INTERNATIONAL CIVIL AVIATION ORGANIZATION
NORTH AMERICAN, CENTRAL AMERICAN AND CARIBBEAN OFFICE

THIRD MEVA III TASK FORCE MEETING MEETING

MEVA III TF/3

FINAL REPORT

MEXICO CITY, MEXICO, 6 TO 9 OCTOBER 2014

Prepared by the Secretariat October 2014

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HISTORICAL

ii.1 Place and Date of the Meeting

The Third MEVA III Task Force Meeting (MEVA III TF/3) was held at the ICAO NACC Regional Office in Mexico City, Mexico, from 6 to 9 October 2014.

ii.2 Opening Ceremony

Mr. Jorge Fernandez, Deputy Regional Director of the North American, Central American and Caribbean (NACC) Office, on behalf of the ICAO NACC Regional Director, Mrs. Loretta Martin, provided opening remarks, welcomed the participants, highlighted the evaluation process to be conducted by the Task Force and its importance in the design and operation of the MEVA III Network, wished the MEVA III Task Force successful and optimum results, and officially opened the meeting.

ii.3 Officers of the Meeting

Due to the absence of the MEVA TF Rapporteur, Mr. Olivier Delperdange, the Meeting elected Mr. Roger Perez from COCESNA as Chairmen. Mr. Perez acted as Rapporteur of the meeting, assisted by Mr. Julio Siu, ICAO NACC Regional Officer, Communications, Navigation and Surveillance.

ii.4 Working Languages

The working language of the Meeting was English, the working papers, information papers and report were available to participants in said language.

ii.5 Schedule and Working Arrangements

The working hours for the meeting sessions were held from 09:00 to 18:00 hours and the last session was held from 9:00 to 13:30, with adequate breaks.

ii.6 Agenda

Agenda Item 1 Approval of Agenda and Schedule

Agenda Item 2 Follow-up on MEVA III TF Conclusions and Assigned Tasks

Agenda Item 3 Review and Analysis of MEVA III Deliverables and Preparation of the Deliverables for Approval by the MEVA Members

Agenda Item 4 Other Business

ii.7 Attendance

The Meeting was attended by 5 States from the CAR Region, 1 International Organizations and the MEVA III Service Provider, totalling 12 delegates as indicated in the list of participants.

ii.8 Draft Conclusions and Decisions

The Meeting recorded its activities as Draft Conclusions and Decisions as follows:

DRAFT CONCLUSIONS: Activities requiring endorsement by the MEVA TMG

DECISIONS: Internal activities of the MEVA III Task Force

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3/7	DEVELOPMENT OF MEVA III DOCUMENT ON CONSIDERATIONS FOR ADDITIONAL MEVA III CIRCUITS	4-2

ii.9 List of Working and Information Papers and Presentations

Refer to the Meeting web page:
http://www.icao.int/NACC/Pages/meetings-2014-mevaiiitf3.aspx

WORKING PAPERS

Number	Agenda Item	Title	Date	Prepared and Presented by
WP/01	1	Provisional Agenda and Schedule	01/09/14	Secretariat
WP/02	2	Follow-up to MEVA III TF assigned tasks and Conclusions	03/10/14	Task Force Rapporteur
WP/03	3	MEVA III Deliverables and approval Process	29/09/14	MEVA III Task Force Rapporteur
WP/04	3	Evaluation of MEVA III Deliverables	30/09/14	MEVA III Task Force Rapporteur
WP/05	4	Future work of MEVA III TF in support of TMG	02/10/14	MEVA TF Lead

INFORMATION PAPERS

Number	Agenda Item	Title	Date	Prepared and Presented by
IP/01	---	List of Working and Information Papers	03/10/14	Secretariat

LIST OF PARTICIPANTS

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Agenda Item 1 Approval of Agenda and Schedule

1.1 Under WP/01, the Meeting approved the agenda and schedule for the Third MEVA III Task Force Meeting (MEVA III TF/3), presented in the historical part of this report.

1.2 Due to the nature of the work, which included evaluating the proposal from the MEVA III Service provider for the MEVA III Network design and its operational, maintenance and managements matters in accordance with the MEVA III Request for Proposal (RFP) and the latest MEVA-COMSOFT Agreements, the Secretariat instructed the Meeting on the expected information management, thorough analysis of the documentation and management of evaluation discussions.

Agenda Item 2 Follow-up on MEVA III TF Conclusions and Assigned Tasks

2.1 Under WP/02, the Meeting was recalled that during the Twenty seventh Meeting of the MEVA Technical Management Group (MEVA/TMG/27), it was agreed to expand the Terms of Reference (ToRs) of the MEVA III Task Force to include supporting the TMG during the implementation phase of the MEVA III Network, and that during the MEVA/TMG/28 meeting, the TMG Members assigned specific tasks to be carried out by the Task Force.

2.2 The Meeting reviewed the status of outstanding MEVA III TF Conclusions and assigned Tasks from the MEVA III TF/2 report and the teleconferences conducted in 2014. It was concluded that the MEVA III Task Force has completed all the agreed tasks and actions.

2.3 The Meeting reviewed the status of outstanding MEVA TMG Meetings Conclusions, particularly, from the MEVA TMG/28 Meeting, as shown in **Appendix A** to this report.

2.4 In this regard, several agreements were made with Comsoft, which are shown in the results of the evaluation of the System Design Document (SDD) discussed under Agenda Item 3 of this report.

Agenda Item 3 Review and Analysis of MEVA III Deliverables and Preparation of the Deliverables for Approval by the MEVA Members

3.1 The Meeting noted that COMSOFT provided the following documents as part of the SSD proposal (available at the MEVA III Website under ICAO Secure Portal: https://portal.icao.int/MEVA/Pages/MEVA-III-Implementation.aspx):

Name	Date modified	Type	Size
Rack diagrams	08-Oct-14 10:04 PM	File folder	
VSAT-SDD_MEVA III_TRP_V1.1	07-Oct-14 11:58 PM	Adobe Acrobat Document	474 KB
MEVA III_Projectplan_V4.9	02-Oct-14 12:03 PM	Adobe Acrobat Document	268 KB
VSAT-SDD_MEVA III_SDD_System Design Document_V1.0	30-Sep-14 1:29 PM	Adobe Acrobat Document	6,525 KB
VSAT-SDD_MEVA III_SkyWAN System Description_V1.0	30-Sep-14 1:29 PM	Adobe Acrobat Document	575 KB
MEVA III_Network-Overview_v1.7a	29-Sep-14 9:09 AM	Adobe Acrobat Document	571 KB
VSAT-SDD_MEVA III FAT-Procedure_Draft V1.0	27-Sep-14 7:37 AM	Adobe Acrobat Document	597 KB
VSAT-SDD_MEVA III SAT-Procedure Station_Draft V1.0	27-Sep-14 7:37 AM	Adobe Acrobat Document	312 KB
CalculationReport_20140828_101743	27-Sep-14 7:30 AM	Adobe Acrobat Document	13 KB
VSAT-SDD_MEVA III - Cable Plan_V1.0	27-Sep-14 7:30 AM	Adobe Acrobat Document	153 KB
VSAT-SDD_MEVA III_LB_V1.0	27-Sep-14 7:30 AM	Adobe Acrobat Document	323 KB
VSAT-SDD_MEVA III_Glossary_V1.0	27-Sep-14 7:26 AM	Adobe Acrobat Document	390 KB
VSAT-SDD_MEVA III_Security Plan_V1.0	27-Sep-14 7:26 AM	Adobe Acrobat Document	1,016 KB
VSAT-SDD_MEVA III_TSP_V1.2	27-Sep-14 7:26 AM	Adobe Acrobat Document	362 KB
VSAT-SDD_MEVA III-Statistics Template_V1.0	27-Sep-14 7:26 AM	Adobe Acrobat Document	866 KB

3.2 COMSOFT also provided the following MEVA III equipment manuals in soft copy:

Nombre	Tamaño	Tipo	Modificado
..		File folder	
i. SKYWAN 7000 & 2570		File folder	29-Sep-14 4:24 AM
ii. Multiplexer		File folder	29-Sep-14 4:24 AM
iii. Amplifier		File folder	29-Sep-14 4:24 AM
iv. Antenna System		File folder	29-Sep-14 4:24 AM
v. C-Band Redundancy Systems		File folder	29-Sep-14 4:24 AM
vi. Switches		File folder	29-Sep-14 4:24 AM
vii. Radar Filter		File folder	29-Sep-14 4:24 AM
viii. UPS		File folder	29-Sep-14 4:24 AM

3.3 Similarly, COMSOFT submitted the site survey reports of the different MEVA III nodes as follows:

Nombre	Tamaño	Tipo	Modificado
..		File folder	
Aruba		File folder	19-Sep-14 6:06 AM
Atlanta		File folder	19-Sep-14 6:07 AM
Caracas-Venezuela		File folder	29-Sep-14 6:03 AM
COCESNA - Honduras		File folder	19-Sep-14 6:09 AM
Colombia		File folder	19-Sep-14 6:11 AM
Cuba		File folder	19-Sep-14 6:12 AM
Curacao		File folder	19-Sep-14 6:14 AM
Freeport		File folder	19-Sep-14 6:14 AM
George Town		File folder	19-Sep-14 6:14 AM
Kingston		File folder	19-Sep-14 6:15 AM
Merida-Mexico		File folder	19-Sep-14 6:16 AM
Miami		File folder	19-Sep-14 6:18 AM
Nassau		File folder	19-Sep-14 6:19 AM
Panama City		File folder	19-Sep-14 6:19 AM
Port-au-Prince		File folder	19-Sep-14 6:19 AM
San Juan		File folder	19-Sep-14 6:20 AM
Santo Domingo 1		File folder	19-Sep-14 6:20 AM
Santo Domingo 2		File folder	19-Sep-14 8:15 AM
Sint Maarten		File folder	19-Sep-14 6:04 AM

3.4 Following the coordination method, under WP03, the Meeting recalled the expected MEVA III deliverables and their due dates in accordance with the MEVA III RFP and the provided SSD proposal:

Deliverable	**Due date- MEVA III RFP**
Issue Tracking System	MEVA III Network cutover- definition in SDD
Accounting and Billing Records Management System	MEVA III Network cutover
MEVA III Website	Maximum of 30 days after the MEVA III Network Acceptance- definition in SDD
Technical Documentation	• Within 60 days after completion, testing and commissioning of a VSAT site installation the MEVA III Service Provider shall provide the corresponding MEVA Member and the ICAO NACC Office with soft copies of site as-built engineering records, including at least a system block and level diagram, cable and circuit connection/port lists, power and grounding details, and all other details reflecting each installed site configuration. • 30 days before the installation, the MEVA III Service Provider shall provide to each MEVA Member soft copies of the manufacturer's theory of operation and service manual for each equipment used in the MEVA III solution.
Training plan analysis	Part of SDD
Security Plan	Part of SDD
SDD	Within 45 days following the signing of all the corresponding contracts
Implementation Schedule	Part of SDD
Factory Acceptance Test (FAT) procedures	Part of SDD
Transition Plan	Within 45 days following the signing of all the corresponding contracts - part of SDD
Site Acceptance Test (SAT) procedures	Part of SDD

3.5 COMSOFT commented that most of the deliverables are being defined as part of the SDD and provided the checklist *RFP technical requirements and SDD references* for ease of tracking COMSOFT´s compliance with the RFP requirements of these deliverables. In this regard, the Meeting agreed on the following outline of the SDD:

- Chapter 1: Network Design Document
  - Annex: SKYWAN Design Document
- Chapter 2: Network drawings
- Chapter 3: Link Budget
  - Annex: Time Division Multiple Access (TDMA) calculation
- Chapter 4: Drawings of wiring and interconnections
- Chapter 5: Equipment Rack drawings
- Chapter 6: Project Implementation schedule
- Chapter 7: Transition Plan
- Chapter 8: Training Plan
- Chapter 9: Security Plan
- Chapter 10: Reporting
- Chapter 11: Test Documentation (FAT/ SAT/ NAT)
- Chapter 12: MEVA III Website
- Chapter 13: Glossary

3.6 Under WP04, guidance was provided for the conduction of the MEVA III deliverables evaluation in compliance with the MEVA Members mandate and the expected outputs to be provided for approval by the MEVA Members. The Meeting recognized that for this evaluation, the completeness (compared with RFP requirements), consistency of the description and satisfactory explanation of the technical requirements were the key aspects to be reviewed. In this regard, a hard copy compilation of reference documents was prepared for the MEVA III TF participants, whose content was:

- MEVA III RFP document – technical requirement part
- COMSOFT MEVA III Tender Proposal
- MEVA III Evaluation results (MEVA III TF/02 Report)
- MEVA - COMSOFT email exchange
- COMSOFT responses to MEVA questions
- MEVA - COMSOFT teleconferences
- MEVA TMG/27 relevant report parts
- Agreements on training, dial and interface plans and system implementation information

3.7 As part of the evaluation process, the MEVA III TF exchanged email communications with MEVA Members for the clarification of information provided in the proposed SDD (Aruba, Curacao, Dominican Republic, etc.) and agreed on the following:

- Use COMSOFT's RFP technical requirements checklist and SDD references
- Detail the evaluation process and all documentation involved in the MEVA III TF/2
- Provide recommendations of this evaluation, with the aim of having the approval recommendation of the deliverable
- Provide recommendations for the on-going deliverables to be approved later, such as the website, report template etc

3.8 Similarly, the Meeting recalled that the target date for the SDD final approval was agreed for **16 October 14,** as reflected in the minute of the 7th MEVA TF - COMSOFT Teleconference

3.9 The Meeting conducted a thorough evaluation of each of the SDD chapters, identifying additional material to be included, amendments to existing text, rewriting of several texts and other changes important for the system design, as for example:

- Amendments due to the addition of the second switch (CISCO router) in the dual chain configuration
- Voice and data clarifications
- Async-Sync data conversion
- Dual chain/single chain descriptions including the training matters
- Local monitoring information
- Development of MEVA III customized test procedures
- Add in the MEVA III Implementation Plan: the training sessions update, delivery of documentation updates, extend the SDD approval for 24 October 2014, and add the First MEVA III/REDDIG II Interconnection Task Force (TF) Meeting (24-25 May 2015)

3.10 The details of these changes agreed by COMSOFT are shown in **Appendix B** to this report. A summary of all these changes is shown in **Appendix C** to this report**.**

3.11 From the evaluation, the Meeting identified the following actions to be performed by COMSOFT to streamline the SDD update, the implementation activities, schedule future activities and complement the relevant documentation of the project:

- Provision of MEVA III VSAT Frequencies - 24 October 2014
- Comments to the MEVA REDDIG interconnection documents (Working paper 16 TMG/28) – 30 November 2014
- Invitation to FAT (venue, logistics, etc.) - 13 October 2014
- Need for a new local partner in Tegucigalpa/COCESNA: 30 November 2014
- Provision of a hard/soft Copy SDD per site and soft copy of manuals per site: SAT (after approval of full SDD)
- Develop the manual on trouble ticket system web interface: 30 November 2014
- Develop the MEVA III Contingency plan: 30 November 2014
- Develop the MEVA III NOC Operational manual: 30 November
  register VSAT nodes in ITU: to inform MEVA Members when completed
- Provide proposal for accounting and billing records management: 30 October 2014
- List of intended tests for FAT/SAT/NAT, including objective of each test: FAT (24 Oct 2014) ; SAT/NAT (14 Nov 2014)

3.12 Based on the abovementioned, the following draft conclusion was formulated:

DRAFT CONCLUSION
MEVA/TF/3/01 MEVA III SERVICE PROVIDER´S ACTIONS

That the MEVA III Service provider, COMSOFT, timely carry out the agreed actions to streamline the SDD update, the implementation activities, schedule future activities and complement the relevant Project documentation:

a) provision of MEVA III Very Small Aperture Terminal (VSAT) Frequencies - 24 October 2014;

b) comments to the MEVA REDDIG interconnection documents (Working paper 16 TMG-28) – 30 November 2014;

c) invitation to Factory Acceptance Test (FAT) (venue, logistics, etc.) - 13 October 2014;

d) need for a new local partner in Tegucigalpa/COCESNA: 30 November 2014;

e) provision of a hard soft Copy SDD per site and soft copy of manuals per Site Acceptance Test (SAT) (after approval of full SDD);

f) develop the manual on trouble ticket system web interface: 30 November 2014;

g) develop the MEVA III Contingency plan: 30 November 2014;

h) develop the MEVA III NOC operational manual: 30 November 2014;

i) register VSAT nodes in ITU and inform MEVA Members when completed;

j) provide a proposal for accounting and billing records management: 30 October 2014; and

k) list of intended tests for FAT/SAT/NAT, including objective of each test: FAT (24 Oct 2014) ; SAT/NAT (14 Nov 2014)

3.13 Similarly, some actions were identified for the MEVA Members to be conducted:

a) approval of block training dates by **30 October 2014**;

b) send the final comments to the MEVA III website by the end of November 2014 - MEVA III Website implementation by 30 days after NAT; and

c) MEVA II Final Power adjustments by **12 October 2014**

3.14 Based on the abovementioned, the following draft conclusion was formulated:

DRAFT CONCLUSION
MEVA/TF/3/02 MEVA MEMBERS' ACTIONS

That, to streamline the implementation activities, the MEVA Members timely carry out the agreed actions:

a) approval of block training dates by **30 October 2014**;

b) send the final comments to the MEVA III website by the end of November 2014 - MEVA III Website implementation by 30 day after NAT; and

c) make MEVA II Final Power adjustments by **12 October 2014**

3.15 After evaluating the MEVA III equipment manuals vs. the MEVA III inventory, the Meeting concluded that all MEVA III equipment manuals are complete and available in soft copy; however, it commented that COMSOFT will provide the SKYWAN Line Up Manager (LUM) manual and check for a newer version of the antenna system manual. In this regard, the following conclusion was formulated:

DRAFT CONCLUSION
MEVA/TF/3/03 MEVA III EQUIPMENT MANUALS

That, to complete the evaluation of the MEVA III equipment manuals to be provided by the MEVA III Service Provider, COMSOFT provide the SKYWAN LUM manual and check for a more recent version of antenna system manual by **30 October 2014**.

3.16 Considering these changes and for the development of the revised versions of the SDD Chapters, COMSOFT proposed two groups of document deliveries based on the criteria of prioritizing the directly related System Design documents/chapters from the other type of documents/chapters.

Group 1: Documentation directly related with system design, particularly, for equipment ordering and that may affect the schedule of the project:

COMSOFT to send the revised versions by **17 October 2014**, and expect approval by the MEVA Members by **24 October 2014**.

- Chapter 1: Network Design Document and its Annex
- Chapter 2: Network Drawings
- Chapter 4: Wiring and Interconnection Plan
- Chapter 5: Equipment Rack Drawings
- Chapter 6: Project Implementation Schedule (preliminary version related to the installation/test procedures in 2015)

<u>Group 2:</u> Documentation that may be worked out during the shipping and preparation activities of the installations:

COMSOFT to send the revised versions by **24 October 2014** and expect approval by the MEVA Members by:

- Chapter 3: Link Budget (31 October 2014)
- Chapter 7: Transition Plan (31 October 2014)
- Chapter 8: Training Plan (14 November 2014)
- Chapter 9: Security Plan (14 November 2014)
- Chapter 10: Reporting (14 November 2014)
- Chapter 11: Test Documentation (FAT part/30 October)

COMSOFT to send the revised versions by **14 November 2014**, and expect approval by the MEVA Members by 30 November 2014:

- Chapter 11: Test Documentation (SAT/NAT part)
- Chapter 12: MEVA III Website (30 November 2014)
- Chapter 13: Glossary (30 November 2014)

COMSOFT will prepare and deliver: NOC procedures, Contingency Plan, Maintenance procedures, Operational documents by **14 November 2014** for their review and approval at the MEVA TMG/29 Meeting.

3.17 Based on the abovementioned, the following draft conclusion was formulated:

DRAFT CONCLUSION
MEVA/TF/3/04 DELIVERY OF SYSTEM DESIGN DOCUMENTATION UPDATES

That, to promptly update the System Design documentation without affecting the MEVA III implementation dates, the MEVA III Service Provider, COMSOFT, provide these updates as detailed in the Group 1 and 2 of the documentation delivery explained in paragraph 3.16 of this report.

3.18 The MEVA III TF participants, aware that the updates of the System Design documentation shall be done in a timely manner, and that no other face-to-face meeting of the Task Force is scheduled, agreed on conducting the evaluation of these updates led by ICAO and the MEVA III TF Rapporteur through teleconferences and with the assignment of MEVA III TF Members per chapter as follows:

For Group 1:

- Network Design Document and his Annex (United States, COCESNA)
- Network Drawings (Haiti, United States)
- Wiring and Interconnection Plan (Cuba, COCESNA)
- Equipment Rack Drawings (Jamaica)
- Project Implementation Schedule (Mexico, United States)

Teleconference scheduled: 21 October 2014 17 UTC (TBC)

For Group 2:

- Link Budget (United States, COCESNA)
- Transition Plan (Jamaica, United States)
- Training Plan (Cuba, United States)
- Security Plan (Haiti, Mexico)
- Reporting (Cuba, United States)
- Test Documentation (FAT part) (Mexico, COCESNA)

Teleconference scheduled: 28 October 2014 17 UTC (TBC)

- Test Documentation (SAT/NAT part)
- MEVA III Website
- Glossary (30 November 2014)

Teleconference scheduled: 21 November 17 UTC (TBC)

3.19 The teleconferences results shall determine the documentation status for its approval by the MEVA Members and if the update is acceptable, the MEVA Coordinator (ICAO) will proceed requesting the approval to the MEVA Members. Once it is approved by the MEVA Members, COMSOFT shall then be notified.

3.20 Based on the abovementioned, the following decision was formulated:

DECISION
MEVA/TF/3/05 EVALUATION OF SYSTEM DESIGN DOCUMENTATION UPDATES

That, to promptly evaluate the updates of the System Design documentation without affecting the MEVA III implementation dates, the MEVA III TF evaluate these updates as detailed in the Group 1 and 2 of the documentation delivery explained in paragraph 3.18 of this report.

3.21 Regarding the MEVA III implementation schedule, and after a long discussion, the Meeting identified the need for optimizing the activities to ensure port-to-port tests (service oriented tests), reduce the risk of unsatisfactory MEVA III cutover, avoid the 31 March 2015 - MEVA II Service deadline and conduct NAT tests out of peak traffic hours. In this regard, it was requested to extend the SAT/NAT tests to 1 day at least and conduct the MEVA III implementation date by **20 March 2015**. COMSOFT will conduct the necessary analysis and coordination for achieving these requirements and will report an update of the MEVA III implementation Plan by **14 November 2014**. In this regard, the following draft conclusion was formulated:

DRAFT CONCLUSION
MEVA/TF/3/06 OPTIMIZATION OF MEVA III IMPLEMENTATION SCHEDULE

That, to optimize the dates of the MEVA III Implementation to ensure port-to-port tests (service oriented tests), reduce the risk of unsatisfactory MEVA III cutover, avoid the 31 March 2015 - MEVA II Service deadline and conduct NAT tests out of peak traffic hours, the MEVA III Service Provider, COMSOFT, provide a revised MEVA III Implementation Schedule by **14 November 2014**.

3.22 The Meeting provided several initial comments to the MEVA III website, such as UTC time stamping, inclusion of all technical and operation manuals, etc., and in general requesting this website to be equal or better than the existing MEVA II website. The following snap shots of the MEVA II website were provided:

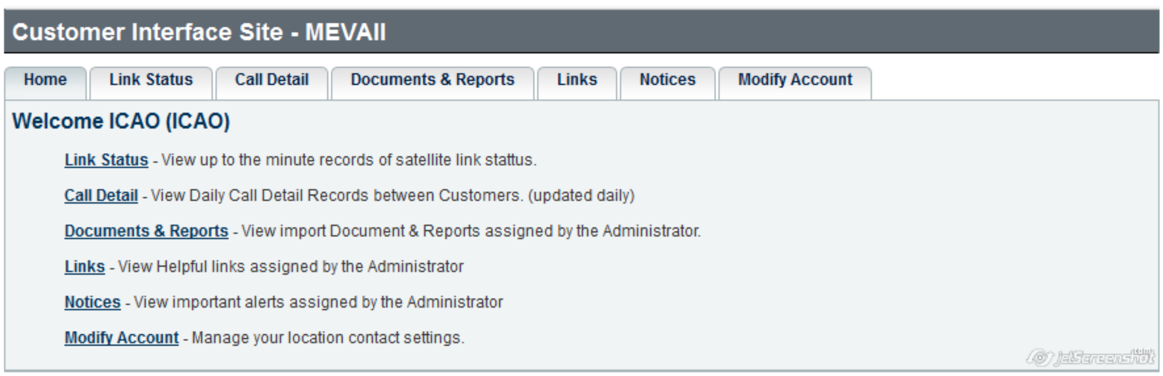


Fig. 1 Home page of MEVA II Website

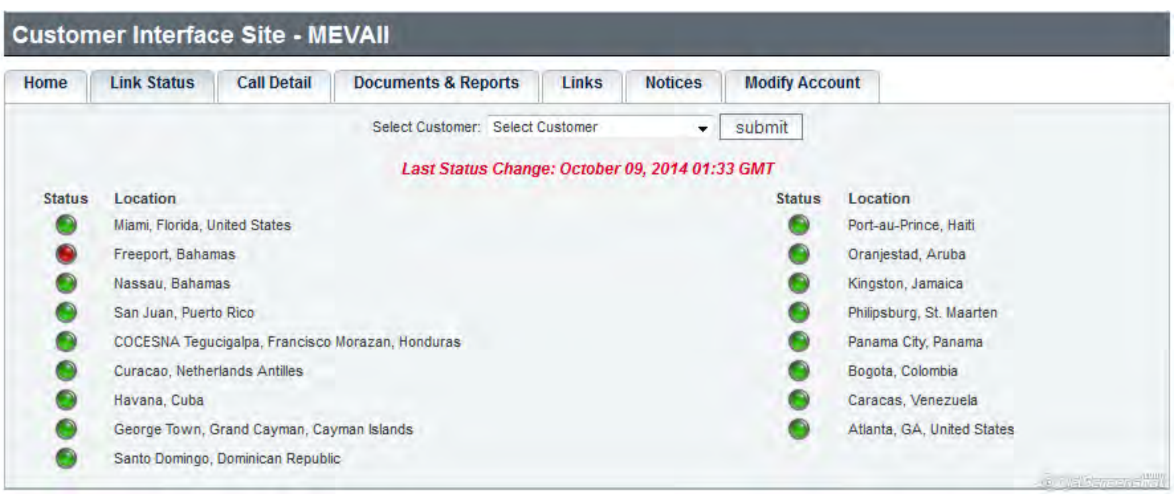
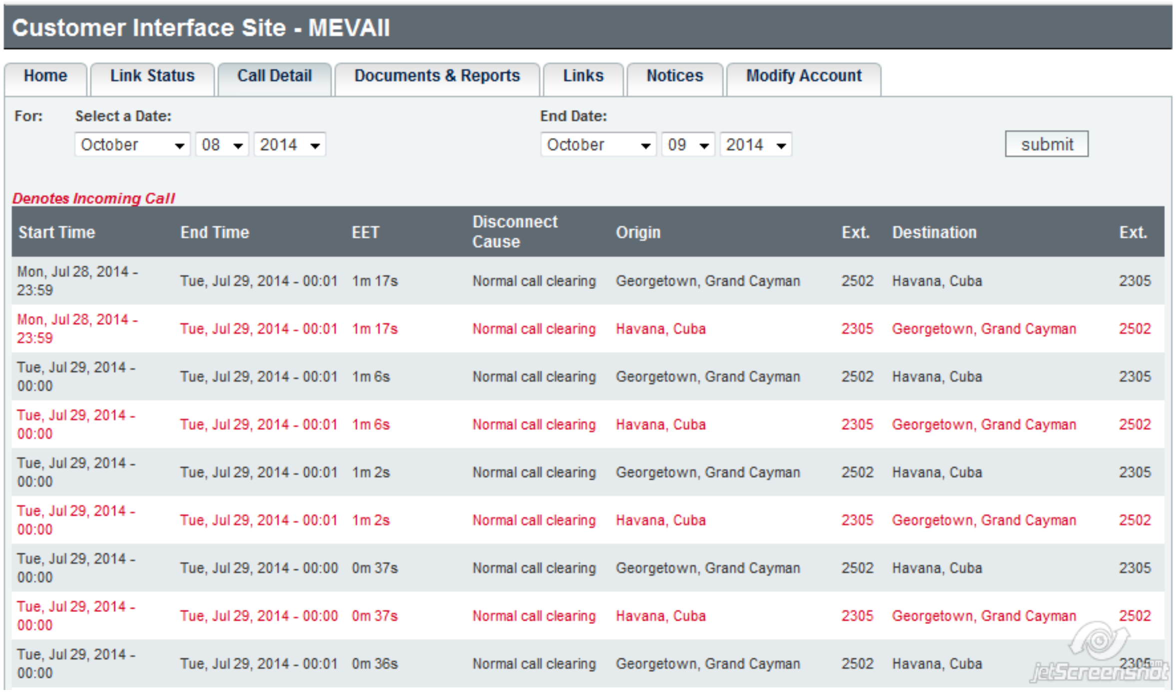


Fig. 2 Network status on MEVA II Website



Start Time	End Time	EET	Disconnect Cause	Origin	Ext.	Destination	Ext.
Mon, Jul 28, 2014 - 23:59	Tue, Jul 29, 2014 - 00:01	1m 17s	Normal call clearing	Georgetown, Grand Cayman	2502	Havana, Cuba	2305
Mon, Jul 28, 2014 - 23:59	Tue, Jul 29, 2014 - 00:01	1m 17s	Normal call clearing	Havana, Cuba	2305	Georgetown, Grand Cayman	2502
Tue, Jul 29, 2014 - 00:00	Tue, Jul 29, 2014 - 00:01	1m 6s	Normal call clearing	Georgetown, Grand Cayman	2502	Havana, Cuba	2305
Tue, Jul 29, 2014 - 00:00	Tue, Jul 29, 2014 - 00:01	1m 6s	Normal call clearing	Havana, Cuba	2305	Georgetown, Grand Cayman	2502
Tue, Jul 29, 2014 - 00:00	Tue, Jul 29, 2014 - 00:01	1m 2s	Normal call clearing	Georgetown, Grand Cayman	2502	Havana, Cuba	2305
Tue, Jul 29, 2014 - 00:00	Tue, Jul 29, 2014 - 00:01	1m 2s	Normal call clearing	Havana, Cuba	2305	Georgetown, Grand Cayman	2502
Tue, Jul 29, 2014 - 00:00	Tue, Jul 29, 2014 - 00:00	0m 37s	Normal call clearing	Georgetown, Grand Cayman	2502	Havana, Cuba	2305
Tue, Jul 29, 2014 - 00:00	Tue, Jul 29, 2014 - 00:00	0m 37s	Normal call clearing	Havana, Cuba	2305	Georgetown, Grand Cayman	2502
Tue, Jul 29, 2014 - 00:00	Tue, Jul 29, 2014 - 00:01	0m 36s	Normal call clearing	Georgetown, Grand Cayman	2502	Havana, Cuba	2305

Fig. 3 Call detailed records from the MEVA II Website

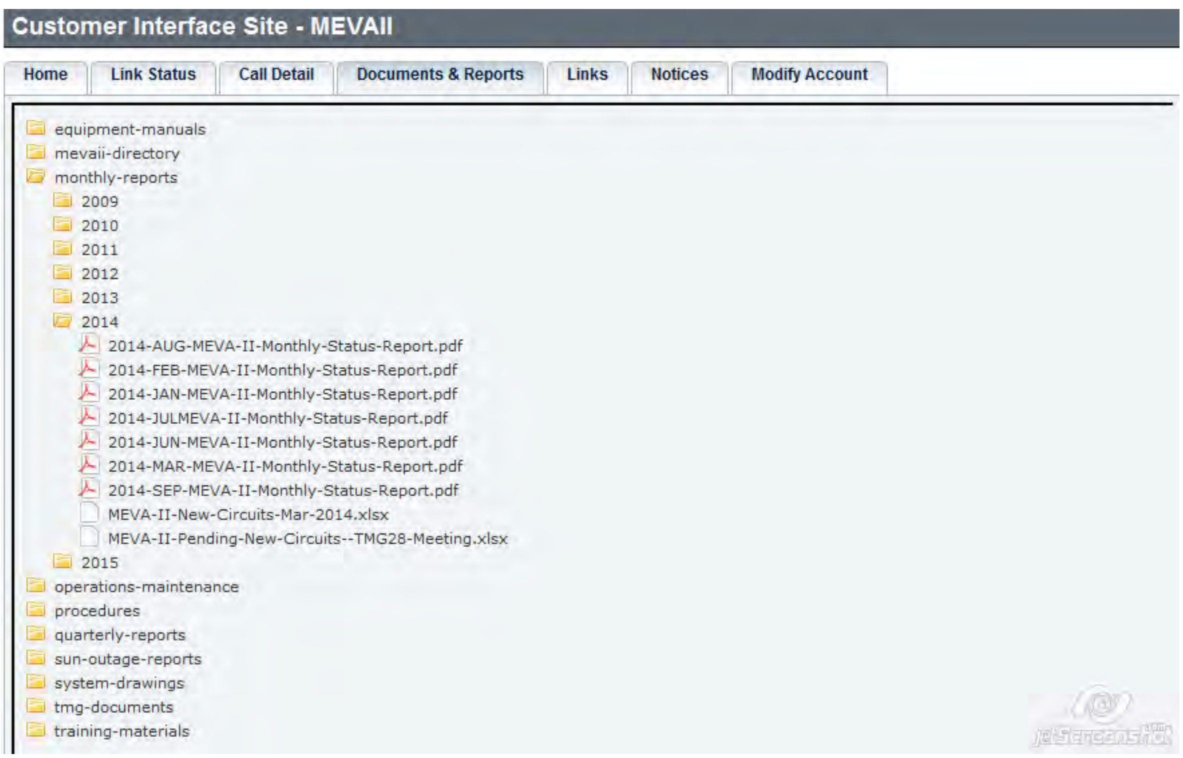


Fig. 4 Documents and Reports from MEVA II Website

3.23 Finally, COMSOFT was provided with samples of MEVA II operational documents, including a sample of the MEVA II monthly report, NOC operational guidance, Maintenance Manual and Contingency Plan for their reference on developing the similar documents for MEVA III and present them to the MEVA/TMG/29 Meeting.

Agenda Item 4 Other Business

MEVA III TF future activities

4.1 Under WP05, the Meeting highlighted the future work of the Task Force in support of the MEVA III implementation, recalling the current MEVA III Task Force Terms of Reference as:

The MEVA III Task Force is responsible for:

a) Develop a MEVA III Project Work Plan and Schedule (WBS)
b) Generate and issue the MEVA III Request for Information (RFI)
c) Support ICAO TCB Office in generate, administer, and issue the MEVA III Request for Proposals (RFP)
d) Review, analyse, and select the qualified RFP proposal
e) Update to MEVA III Document of Agreement (DOA), and other Network administrative.
f) Assist the MEVA Members, in coordination with the MEVA III Service Provider, with the timely and efficient implementation of the MEVA III Network; and
g) Review and inform the MEVA TMG of all deliverable documents required by MEVA III Network implementation.

4.2 It was recalled that the latest MEVA III schedule is version 4.6 as approved by the MEVA Members, and so the corresponding MEVA III TF Work Programme (WBS) is shown in the Attachment to WP/05. The Meeting indicated that the WBS shall be revised based on the upcoming MEVA III Implementation schedule update.

4.3 The Meeting also recognized that several tasks are still valid to be conducted before the start of the network implementation, such as:

a) update to MEVA III Document of Agreement (DoA), if needed, and other Network administrative tasks; and
b) assist the MEVA Members, in coordination with the MEVA III Service Provider, with the MEVA III Network timely and efficient implementation

- Ensure that the following documents are delivered per RFP deadlines
- As-built documentation for all the nodes
- Finalization of the MEVA III Website interface
- Coordination of the post implementation training.

Status of Signature of the MEVA III DOA

4.4 The Meeting reviewed the status of the MEVA III DoA signature, noting that only Cuba and Mexico are still missing to complete the signature. Cuba informed that the signature is ongoing and will be available by the end of October 2014. Mexico indicated that they also are in the process for its signature by the end of October 2014.

Considerations for MEVA Members for Additional MEVA III Circuits

4.5 The Meeting identified the need for making available to the MEVA Members the final clarifications of COMSOFT on additional MEVA III circuits, and therefore, it agreed that a MEVA III document shall be developed to include these clarifications. The clarifications originated from the different MEVA - COMSOFT teleconferences made and following the MEVA III Tender evaluation. An Ad hoc group was formed by the MEVA III TF Rapporteur (Mr. Olivier Delperdange), COCESNA (Mr. Moises Cukier) and Cuba (Mr. Jorge Castellanos). In this regard, the following decision was formulated:

DECISION
MEVA/TF/03/07 DEVELOPMENT OF MEVA III DOCUMENT ON CONSIDERATIONS FOR ADDITIONAL MEVA III CIRCUITS

That, considering the final clarifications made by COMSOFT related with MEVA III additional circuits, and the need to have these clarifications available to the MEVA Members, the MEVA III TF (through its corresponding Ah doc Group) develop by **14 November 2014** a document explaining and including all these clarifications for presentation and approval by the MEVA TMG/29 Meeting.

4.6 The Meeting reviewed the ToRs and the Project RLA/09/801 — *Implementation of Performance Based Air Navigation Systems* for the CAR Region proposal on the *Go-Team* mechanism following Conclusion MEVA TF/2/04 - *MEVA III Technical Implementation activities, Training and Technical Assistance*, item b). The MEVA III TF expressed their full support to the *Go-Team* initiative, recognizing the benefits for the harmonious implementation and transition of the network and the improvements that can be identified with sharing lessons learnt and mutual support between the MEVA Members. The Project informed of a new schedule for these *Go-teams* based on the one scheduled on August 2014:

MEVA III SAT Dates (New schedule- Aug 2014)	Implementation Go-Teams Member-MEVA III:	Mission Dates (effective days)	Remarks
Atlanta/ Mon 05-02-15			
Teleport/ Mon 19-01-15			
Bahamas (Nassau)/ Mon 16-02-15	COCESNA (Team Leader)	15-Feb – 17-Feb	
	Curacao		
	United States		
Cuba/ Mon 16-02-15	ICAO Officer (Team Leader)	15-Feb – 17-Feb	
	Dominican Republic		
	Haiti		
Dominican Republic/ Tue 24-02-15	ICAO Officer (Team Leader)	23-Feb – 25-Feb	
	Curacao		
	Jamaica		
Haiti/ Tue 24-02-15	United States (Team Leader)	23-Feb – 25-Feb	

MEVA III SAT Dates (New schedule- Aug 2014)	**Implementation Go-Teams Member-MEVA III:**	**Mission Dates (effective days)**	**Remarks**
	Cuba		
	Mexico		
Curacao/ Mon 09-03-15	ICAO Officer (Team Leader)	07-Mar – 10-Mar	
	Dominican Republic		
	Jamaica		
COCESNA/ Mon 16-03-15	Curacao (Team Leader)	15-Mar – 17 Mar	
	Dominican Republic		
Jamaica/ Tue 17-03-15	Dominican Republic (Team Leader)	16-Mar – 18 Mar	
	Bahamas		
	Haiti		
Mexico/ Tue 17-03-15	ICAO Officer (Team Leader)	16-Mar – 18 Mar	
	Cuba		
	United States		

4.7 The Meeting recognized that the MEVA III *Go-Team* schedule shall be reviewed based on the optimization of the MEVA III implementation calendar and the training sessions; however, it also recognized the need for starting the mission's coordination. In this regard, it was recommended that the Project RLA/09/801 should have a new revision of this schedule by **17 October 2014** and start the coordination as soon as possible.

4.8 For the MEVA III *Go-team* participation, several CAR Project - MEVA Members informed of their proposed Subject Matter Expert (SME):

- Cuba: Jorge Castellanos
- Jamaica: Alva Myer
- COCESNA: Moisés Cukier

ICAO Position for WRC-2015

4.9 ICAO recalled the Meeting of their commitment to support ICAO position on the upcoming World Radiocommunication Conference (WRC)—2015 with particular focus on Agenda Item 1.1 on the C-band protection, where the regional telecommunication network, as MEVA operates. ICAO informed that from the XXIV Meeting of the Permanent Consultative Committee II: Radio communications held from 29 September to 3October 2014 in Merida, Mexico, a limited support for "No Change" on the 3.6 – 3.8 GHz and 5.850-6.425 GHz was achieved, missing the support of several countries, particularly from the Caribbean.

4.10 ICAO recalled that MEVA Members shall coordinate with the national Spectrum Authority for supporting ICAO for the WRC-2015, as agreed since the MEVA TMG/26 Meeting Conclusion 26/21 transcribed as follows:

CONCLUSION 26/21 ***REVIEW AND AGREEMENT ON ACTIONS TO FOLLOW-UP ON AN-CONF/12 RECOMMENDATION 1/14 AND RECOMMENDATIONS FROM THE REGIONAL PREPARATORY WORKSHOP FOR ITU WRC-15***

That in order to protect the use of the C-band of the MEVA Network, all MEVA Administrations:

a) contact their national radiofrequency spectrum authorities to obtain their support for C-band protection as presented in AN-Conf/12 Recommendation 1/14 - Long-term very small aperture terminal spectrum availability and protection and the Regional Preparatory Workshop for ITU WRC-15 Recommendation: To ensure protection for these WRC-agenda items for the Aeronautical VSAT networks in the CAR/SAM Regions;

b) consider the studies for C-band protection; and

c) report all aeronautical VSAT interference cases to the MEVA TMG, including recording and documenting each case.

APPENDIX A

REVISION OF MEVA/TMG/28 OUTSTANDING CONCLUSIONS RELATED WITH THE MEVA III TF

Conclusion	MEVA III TF action taken	Status
CONCLUSION MEVA TMG/28/08 DEVELOPMENT AND APPROVAL OF RELEVANT MEVA DOCUMENTATION FOR MEVA III *That, in order to ensure the appropriate operations of the MEVA III Network, including its interconnection/integration with the REDDIG Network:* a) *the MEVA III Task Force, Aruba and Curacao, in coordination with COMSOFT, take the necessary actions to maintain or improve the network documentation and references when transitioning to MEVA III and considering the existing MEVA II material* ***by the beginning of the MEVA III site installations;*** b) *COMSOFT present its MEVA III webpage design/template by* ***31 July 2014*** *or within the System Design Documentation (SDD) proposal; and* c) *the MEVA III Task Force, in coordination with COMSOFT, review the existing MEVA II-REDDIG interconnection agreements (MEVA-REDDIG Memorandum of Agreement (MoA) and Integration considerations) for its customization for MEVA III by* ***15 September 2014****.*	a) The Task Force coordinated the Dial and the Interface Plans with all MEVA Members. MEVA II material is being considered as a reference for the MEVA III documentation. b) COMSOFT presented the MEVA III website template on time and the Task Force provided initial comments to the website. c) The Task Force ensured through the Dial and Interface Plans that COMSOFT is aware of the particularities of the MEVA-REDDIG interconnection. It acknowledged that COMSOFT is aware of the particularities of the Aeronautical Fixed Telecommunication Network (AFTN) interconnection (X.25 async to sync) between MEVA III and REDDIG II in Bogota. Conclusions for the agreements with COMSOFR were formulated in this MEVA III TF/3 Meeting on the development and approval of relevant MEVA III documentation. Evaluation of documentation will continue until end of 2014	Valid.
CONCLUSION MEVA TMG/28/11 MEVA III FACTORY ACCEPTANCE TESTS (FATs) *That, in order to allow the possibility for the MEVA Members to participate in the MEVA III FAT:* *a) COMSOFT inform ICAO by* ***29 August 2014*** *about the FAT venue, logistics and details needed for MEVA Members to participate; and* *b) the participating MEVA Members notify the MEVA TMG and ICAO of their interest at least one month prior to the FAT execution.*	COMSOFT has informed ICAO that the FAT will be conducted in Germany, and that MEVA Members are invited to participate on 15 and 16 Dec 2014. A formal letter with the venue and logistic information will be provided by COMSOFT by **10 October 2014**. It was agreed that the MEVA III Coordinator (ICAO) will send out a formal letter to all MEVA Members asking their interest in participating at the FAT following COMSOFT´s formal letter.	To be reported as completed

Conclusion	MEVA III TF action taken	Status
CONCLUSION ***MEVA TMG/28/12 COMSOFT REPRESENTATIVES FOR MEVA III INSTALLATION*** *That, in order to coordinate the necessary security and logistical matters for the node installation of the MEVA III equipment by COMSOFT Local Representatives, COMSOFT will provide by* ***30 October 2014****, the names of the staff and company performing the installation in each MEVA node for the respective MEVA Member approval.*	COMSOFT, in coordination with the MEVA III TF, provided as part of the implementation Plan the names of staff and companies that will take part in the MEVA III implementation. The details can be found in the Implementation Plan. A revision was conducted at the MEVA III TF/3 Meeting identifying the need to propose a new local representative for Honduras.	To be reported as completed
Paragraph 9.4 of the TMG/28 report stipulates: *The Meeting recalled that for the evaluation and processing of the MEVA III deliverables, the MEVA III TF was assigned to apply the Coordination Method defined as follows:* *a) All deliverable proposals from the MEVA III Service Provider shall be submitted to the MEVA III Coordinator/ICAO and MEVA TMG Rapporteur* *b) The MEVA TMG Rapporteur will coordinate with the MEVA III TF Rapporteur on the evaluation and analysis of the proposal, including the exchange of clarifications with the MEVA III Service Provider* *c) The MEVA III TF will develop its evaluation results in a timely manner for submission for approval to MEVA TMG Members by means of email/teleconference communication* *d) If comments or observations by the MEVA Members are made to the evaluation results, the MEVA III TF shall carry out the necessary coordination as in item b) for clarification and, if applicable, an update on the evaluation results* *e) Once approval is granted by the MEVA Members, an approval notification will be submitted to the MEVA III Service Provider for application*	The Task Force followed said method	To be reported as completed

APPENDIX B

VSAT-MEVA III

SDD - System Design Document

V1.0/26.09.2014

CFT Ref.:	**Sealed Tender ST-22501390**
Project No.:	**20141003**
Doc-ID.:	**VSAT-MEVA III_SDD_V1.0**
Customer:	**ICAO MEVA III, Mexico/Canada**

Revision History

Version	Date	Description	Resp.
V1.0	26.09.2014	Initial Version submitted as SDD documentation	

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1 Introduction

(1) The following chapters describes the technical design and network layout in further detail. Not all parameters can be given at time, i.e. MAC addresses of the used units. Some configuration parameters have to be evaluated during the SDD review phase in coordination with MEVA III TMG. Therefore some estimations are preliminary.

1.1 General Design Decisions

(1) COMSOFT's disciplined management and systems engineering heritage executing military and government programs will be applied to this effort.

(2) During the elaboration of the present SDD document the core requirements guided the decisions for the design of the system, the choice of equipment and the specific technical solution.

(3) The technical proposition is based on ND SatCom's SkyWAN® product platform as the most established VSAT portfolio for critical ATC applications. The proposed overall solution is 100% compliant in all details to the Technical Specification with strong focus on the key requirements.

(4) The proposed satellite network consists of a Master Station at FAA Atlanta and a Backup Master Station at Newcom's Teleport Miami, and the remote stations

- Aruba
- Bahamas, Freeport
- Bahamas, Nassau
- COCESNA
- Cuba
- Cayman Islands
- Curaçao
- Colombia
- Caracas, Venezuela
- Dominican Republic
- Haiti
- Jamaica
- Miami (connected terrestrial via Miami Teleport)
- Mexico
- Panama

- Puerto Rico
- Sint Maarten

(5) Both Master Stations replace each other in the function of bandwidth assignment in the case of failure.

(6) The fully meshed SkyWAN® modems support the required any to any connections without topological or other restrictions; all communication between the stations can be accommodated on a single TDMA carrier. The network provides on some stations a redundant chain of indoor and outdoor equipment up to the C-Band antennas.

(7) The SkyWAN® satellite modem offers two transport options over satellite: via IP or FR. Both are used; voice over FR and data connections over IP (in future network development).

1.1.1 Staffing Plan

(1) COMSOFT operates as a line business organization; during the planning stages of a project, the human resources needed to successfully complete the program are identified. Personnel, such as engineers, are assigned who have the experience needed to complete a given task. All of the layouts, such as availability calculations, system design and interconnections to customer systems were developed on previous programs or on internal R&D.

1.2 General Design

(1) During the elaboration of the System Design Document the core requirements mentioned above guided the decisions for the design of the system, the choice of equipment and the specific technical solution.

(2) The technical proposition is based on ND SatCom's SkyWAN® product platform as the most established VSAT portfolio for critical ATC applications. The proposed overall solution is 100% compliant in all details to the Technical Specification with strong focus on the key requirements mentioned in the previous section.

(3) The proposed satellite network consists of a Master Station and a Backup Master Station at the Miami Teleport and in Atlanta, and the remote stations at the other ACC locations in the MEVA Region. Both Master Stations replace each other in the function of bandwidth assignment in the case of failure.

Rewrite (4) The Master Station function is not related to Network Management however, the Teleport and Network Operation Center is the natural place for it also because of the infrastructure in terms of power supply resilience, security and 24/7 equipment access. Similar considerations hold for Atlanta, which is geographically distant enough as not to be affected by the same adverse weather conditions.

(5) The fully meshed SkyWAN® modems support the required any to any connections without topological or other restrictions; all communication between the stations can be accommodated on a single TDMA carrier.

(6) The network provides for the following named stations a non-redundant chain of indoor and outdoor equipment up to the currently used 3.8m C-Band antenna, which will be re-used – except Curacao and Pamana.

- Cuba
- COCESNA
- Mexico
- Sint Maarten
- Jamaica
- Cayman Islands
- Bahamas, Freeport
- Bahamas, Nassau
- Curaçao
- Panama
- Colombia
- Caracas, Venezuela

(7) The network provides for the following named stations a redundant chain of indoor and outdoor equipment up to the currently used 3.8m C-Band antenna, which will be re-used – except Miami and Dominican Republic.

- Aruba
- Dominican Republic
- Atlanta, USA
- Miami, FL
- Haiti
- Puerto Rico

(8) Presently the outdoor units in Atlanta consist of redundant SSPAs and redundant LNBs controlled by an RCU which triggers waveguide switching in case the active element runs into a failure condition. This equipment owned by FAA will be kept and maintained.

(9) C-Band satellite capacity on Intelsat 14 as currently contracted is mandatory ~~and without sensible alternative~~. Therefore the design, the link budget and

corresponding carrier size, transmission parameter and SSPA power are based on this capacity as well as the network migration from the current MEVA II VSAT Network.

2 Detailed Network Component Description

(1) This chapter addresses the main service tasks.

(2) Additionally other documents referenced herein provide further in depth information on standard topics such as the Project Schedule, the Transition Plan and the Training Plan or provide evidence how specific requirements are fulfilled.

(3) Furthermore the Annexes provide technical information on the proposed equipment.

2.1 General Requirements Related to the Technical Specifications Requested

(1) This chapter addresses the general functional requirements of the Technical Specification "Section B" with focus on the following specific technical topics:

- Protocols for future ATN support
- Scalability of the network design
- Equipment support during the useful life
- Availability of the communication system

agregar 2.1.1

(new nodes, new services)

2.1.2 Scalability of the Network Design

(1) Based on the capabilities of the delivered equipment there are no relevant limitations or restrictions for a dynamic development of the MEVA III VSAT Network.

(2) Most of the conceivable changes affecting the connectivity can be achieved by simple reconfiguration of the multiplexers, if necessary the modem configuration needs to be adapted as well. Such reconfigurations can be performed from the Network Operation Center. In case of additional connections beyond the port capacity of the interface cards such expansions may require the provision of additional interface card or multiplexer chassis. In no case there will be a need for additional modem due to the fact that each modem can interface up to 4 multiplexers at 4 serial ports.

(3) The expansion of the network by additional sites does not cause any problem for the existing network, after changing to a new SkyWAN® configuration, which includes the additional station, the new station can become operational in the network. Similarly the increase of data rates on existing or new connections can be accommodated by an according change of the multiplexer configuration and the SkyWAN® TDMA configuration. If such an increase entails the need for additional satellite bandwidth, this may cause some delay until the satellite operator can provide the additional bandwidth. Due to the fact that SkyWAN® modems can

operate on several carriers in non-contingent bandwidth it is very unlikely that the required bandwidth does not become available for a long time.

2.1.3 Equipment Support during the Useful Life

(1) Previous generations of the used equipment have demonstrated the long-life cycle partly being in operation well over 10 years – as becomes visible from expansion and spare orders to the manufacturers. The current IDU 7000 generation of the SkyWAN® Modem and FAD 9220/30 multiplexers benefit from experience driven improvements in the design and more modern electronic components. They even exceed their predecessors in stability as becomes apparent from improved MTBF data in the field.

(2) Both product lines are core products in the portfolio of the respective manufacturer. This ensures the long term support by the manufacturers with regards to

- Software feature development,
- Software maintenance (bug fixing),
- Technical support,
- Repair and return,
- Spare part availability.

2.1.4 Availability of the Communication System

(1) For further reference:

The availability A of a system is defined as A = MTBF / (MTBF + MTTR), where MTBF denotes the mean time between failures of a system or a component and MTTR denotes the mean time to repair a system or component, respectively. Thus, as an example, a requirement of A being > 99.9% corresponds to a maximum total outage (=repair) time of approximately 8 hours and 45 minutes in the average over 1 year.

2.1.4.1 Repair Time for Components

(1) Obviously the critical point in the MEVA III VSAT Network context is the MTTR. If a hardware component in a VSAT station fails this may be due to a non-critical event (of temporary nature) and the component will work again after a reboot or other restoring measures. In the worst case, however, the component is defective and requires repair in the factory and has meanwhile to be replaced by a spare component. Unless all components are duplicated as spares or in hot or cold standby configuration, the repair by replacement may – in a worst case scenario -

take days for transport from a spare stock, custom processing and exchange on site. For any link affected by such an outage with worst case repair time the requirement of 99.9% availability would be violated in the respective rolling 12-month-period. Such rare events could only be avoided by complete 1+1 redundancy for all components employed in the link. Fortunately the mentioned worst case does not happen all the time and does not correspond to the mean time to repair and its bearing on the overall availability. Due to the offered comprehensive support and maintenance concept including the following measures and capabilities:

- annual preventive maintenance of all MEVA III VSAT Network terminals
- 1st level maintenance of MEVA III Member States technical staff (if available) based on the offered OJT
- on-site spare availability of the most critical hardware components
- very fast corrective maintenance within a few hours by local staff at 7 MEVA III Network locations
- fast corrective maintenance within maximum one day for all other MEVA III Network locations due to the strategically located Support Center in Miami
- appropriate spare part stocking and logistics

(2) The applicable MTTR values for the active components as assessed by COMSOFT are significantly lower as can be seen in the table for the relevant availability figures below. table 1

2.1.4.2 Availability of VSAT Terminal Components

(1) For the availability analysis of a system it is common practice to disregard passive fixed in the meaning of not moving and not touched during operation (mainly mechanical) elements such as cables, parabolic antennas, waveguides, connectors etc., since their failure behavior is manageable and the occurrence of failures is negligible as compared to active components. Hence the components to consider in a MEVA III VSAT are:

- Multiplexers including line interface cards
- Modems
- Block-Up Converters in the transmit path
- LNBs in the receive path

(2) The relevant data for the availability analysis for these components are compiled in the following table as provided by the manufacturers:

Hardware	Type	MTBF Hours	Method of Calculation	MTTR Hours	Availability
IDU 7000	SkyWAN® - Satellite Router	287,438	Field Data	24	99.99165%

IDU 2570	SkyWAN® - Satellite Router	259,588	Field Data	24	99.99075%
FAD 9220/30	All (2/3) expansion slots occupied with line cards	80,000	Telecordia Issue 1	8	99.99000%
CPI/CODAN BUC	C-Band Block Up Converter	112,995	Field Data	24	99.97875%
LNB	C-Band Low Noise Block Down Converter	496,000	MIL-HDBK-217F	24	99.99516%

Table 1: MTBF of Major System Components

(3) **Notes:**

- **MTTR Hours:** Assessed for MEVA III VSAT Network as a weighted average over all repair scenarios based on the proposed spare part logistics and reaction times by MEVA III Member States technical staff, local support staff and travelling support staff travelling from Miami.
- **MTBF Hours FAD:** This is an average over various hardware configuration with different line interface cards; in each calculated case all expansion slots are used (which is not the case at all MEVA III Network sites).
- **MTTR Hours FAD:** line card spares stocked on-site.

2.1.4.3 Availability Calculation between Service Delivery Points

(1) In a non-redundant equipment configuration a system is modeled as an interconnection of parts in series, in which the failure of one part causes the failure of the whole system. Hence the availability of the system is calculated as the product of the availability of the individual components.

(2) In the present context the availability of a VSAT station is calculated as product of the availability figures of multiplexer, modem and RF component.

(3) Using the values of Table 1 yields the following results:

1. Availability of the transmitting station starting from the Service Delivery Point (SDP), i.e. the interface of the multiplexer components: 99.95905%
2. Availability of the receiving station starting from the SDP, i.e. the interface of the multiplexer components: 99.97591%
3. Availability of the link over satellite from SDP to SDP: **99.93543%** (>99.9%)

(4) This calculation demonstrates the compliance of the non-redundant design approach with the selected equipment based on the proposed service concept.

(5) The result in 3.) does not so far consider the satellite link itself. The proposed RF equipment provides sufficient transmit power to overcome atmospheric degradations

and achieve a link availability of over 99.99% (disregarding the availability of the satellite itself as discussed). Thus factoring in the satellite link does not change the compliance: the accordingly modified result for 3.) is: 99.92543%. This corresponds to 6 hours and 32 minutes average outage time per annum.

(6) During transition time the amplifiers have to transmit both network carriers, therefore the link availability for this limited time is at least 99,9%.

2.1.4.4 Availability of the MEVA III System

(1) The availability of a complex system like a complete network can be defined in many different ways - starting with specific criteria for unavailability, differentiation in relevance of parts of the system etc. In the specific case of the MEVA III VSAT Network, however, a simplified and natural approach would be to model the system as a multitude of independent connections, provided that there is no single point of failure on system level which would affect all connections. This is not the case for the used system.

(2) Hence the availability of the network would be expressed as the sum over all availabilities of each individual link divided by the total number of links. Since the availability of each connection between SDPs already exceeds 99.9% the same will hold for the average.

2.2 General Network Considerations

(1) The delivered network solution for MEVA III VSAT Network is founded on a number of design decisions, which had to be taken in order to achieve the primary objectives of the new network.

(2) The design criteria and the resulting decisions are discussed below. Thereafter the chapters 2.3 ff presents the network design and the terminal design.

2.2.1 Design Criteria and Decisions

(1) On the investment side the main criteria for the design in general are:

- Optimized cost of ownership
- To comply with or exceed the functional requirements
- To provide an extra high standard of availability of the network
- To support a useful life of at least 10 years

(2) Decisions are taken along the above criteria with the best overall balance.

2.3 Network Layout

(1) According to the above mentioned requirements, COMSOFT is realizing the solution as described hereafter.

(2) The following topics have been investigated and are discussed in the subsequent chapters:

- Selection of the most suitable satellite modem
- Selection of the most suitable interface devices
- Selection of the most suitable networking protocol over satellite

(3) The used technology is a MF-TDMA system that enables all sites to have direct data and voice connections in a meshed environment. The adequate hardware system to provide this solution is SkyWAN®.

2.3.2 Selection of the Appropriate Modem Technology

(1) There are key factors restricting the choice of a suitable modem:

- The capability to provide single hop connectivity for the MEVA III Network traffic topology, which is essentially fully meshed.
- The functional capability with regards to supported protocols and interfaces.
- A COTS TDMA product prepared and supported for a useful life of 10 years and more with proven track records in the industry.

(2) COMSOFT has thoroughly analysed the modem market and came to the conclusion that ND SatCom's SkyWAN® product family is the best answer to the requirements of the technical specification. This decision is not only based on the capabilities of the products but also on the product expertise of COMSOFT and the manufacturer support available for the MEVA III VSAT Network Project due to ND SatCom's commitment and the special benefits COMSOFT has as a Gold Partner of ND SatCom.

(3) SkyWAN® is a very flexible and versatile VSAT system to establish wide area corporate network infrastructures via satellite for enterprises and governmental institutions. A wide variety of end-user business communication applications are supported in a way yet to be matched in the industry. Legacy applications such as HDLC, SNA, X.25, analogue/digital voice can be combined with IP application such as Internet access, Voice over IP or IP Video. Low data rate applications with less than 16 kbit/s and high date rate applications with more than 8 Mbit/s are transferred smoothly and with utmost cost efficiency across the same wide area network infrastructure.

(4) SkyWAN® is a Multi-Carrier (MF-TDMA) VSAT system supporting hub-less communication between remote sites. This means that any station can be reached

via a single satellite hop connection. SkyWAN® provides instant Bandwidth on Demand through its fully dynamic bandwidth allocation scheme. Space segment capacity is automatically assigned to a station requiring transmission capacity with utmost efficiency leaving free capacity for use by the other stations.

(5) The SkyWAN® VSAT platform ensures the best total cost of network ownership for the vast majority of network sizes and topologies. It minimizes both Capital Expenditure (CAPEX) and Operating Expenditure (OPEX). CAPEX is minimized due to a very competitive pricing for network terminals. The SkyWAN® solution has at least 30% advantage in CAPEX cost compared to competing VSAT vendors for networks consisting of some terminals up to 100 of terminals. This major advantage is the result of the superiority of the SkyWAN®'s latest-generation technology. The price comparison has been made in various projects and case studies for straightforward equipment sales, without any implied obligatory services or features restrictions. The low OPEX is achieved by optimizing utilization of satellite capacity. The latter is the most expensive component of most VSAT networks. Satellite bandwidth required for a given traffic model depends on a number of network parameters: e.g. bandwidth allocation, scheduling, algorithm, signaling overhead, modulation, Forward Error Correction (FEC), encapsulation, as well as the performance of the satellite modems (receivers/demodulators). Most VSAT manufacturers claim to support modern modulation and coding techniques, however, they typically do not disclose the overall bandwidth efficiency of the network and of each link. In contrary, the SkyWAN® Satellite Modems were designed to achieve the best utilization of satellite capacity. The designers achieved that goal by relentlessly focusing on the overall end-to-end spectrum efficiency in the network and by using several ground-breaking, innovative design concepts.

2.3.3 Selection of Appropriate Multiplexers

(1) ND SatCom offers Multiplexers as Access Devices (called FAD 9220 and FAD 9230) within their SkyWAN® product portfolio. These devices are equivalent to Memotech's Netperformer Multiplexers with the same number - with the exception that the FADs contain additional software for voice signalling between the multiplexer and the SkyWAN® modem. These multiplexers ideally fulfil all criteria for networks like MEVA III VSAT Network in the sense that they

- support various legacy interfaces and protocols,
- support advanced speech processing features,
- support all relevant and required voice communication interfaces and features including PTT over E&M interfaces,
- provide comprehensive IP Router capabilities,
- are well proven in aeronautical telecommunications,
- provide long-term support for a useful life of 10 years and more.

(2) In short, the multiplexers are the only equipment required to interface with the MEVA III VSAT Network voice and data applications and to process and transfer these to the satellite network.

(3) The only question yet to be discussed in the following chapter is how the multiplexers and modems communicate with each other.

(4) The SkyWAN® FAD product family is the optimal voice and data convergence solution. It has been designed especially to integrate and optimize traffic over a variety of popular WAN infrastructures. It can be used over Satellite or terrestrial Switched/Lease Lines, Frame Relay or IP backbones. Line costs are reduced by bundling various boundaries of traffic onto a single network infrastructure, replacing distinct voice, legacy data and LAN networks.

(5) Also, the SkyWAN® FAD does not only support voice over Packet Networks, but also includes superior LAN and legacy data support as well as data compression. Models are available for branch, regional as well as central sites (HUB).

(6) Some of the key features and advantages of the SkyWAN® FAD include:

- **Reduce Operating Costs:** SkyWAN® FAD uses best in class voice and data bandwidth compression techniques which reduce bandwidth required over the satellite network. This is one of the key benefits of using the SkyWAN® FAD for REDDIG II project.
- **Retain High Quality VHF Voice:** SkyWAN® FAD support voice broadcast signals and use a wide range of voice CODECs to ensure superior voice quality, low bandwidth utilization and as ultralow processing delay.
- **Increase Reliability:** SkyWAN® FAD offers 1+1 system redundancy using a standard SNMP controlled A/B switch. The backup system can take over primary system(s) in the event that a system or bearer interface(s) should fail.
- **Superior Quality of Service:** Mission critical service integrity is guaranteed through SkyWAN® FAD's unique PowerCell (Cell Relay based) throughput bandwidth management feature delivering Quality of Service with fine granularity. PowerCell converts the incoming voice and data traffic (using their own traffic identity and associated QoS (Quality of Service), onto a single variable cell based data stream.
- **Efficient and Reliable PTT Communication:** High quality transmission of Push-To-Talk (PTT), which are used in ATC networks for the ground-to-air (radio) voice communication, requires minimal and constant propagation delay to deliver the voice traffic to the VHF base stations at different remote locations simultaneously. By integrating the PTT interface within the system and using an ultra-low delay codec (LDCD) with an exclusive sampling time of only 0.625ms, we ensure the highest voice quality possible. The SkyWAN® FAD bandwidth management techniques guarantee service integrity and safe transmission of the VHF voice signal. The dynamic jitter buffers also compensate for the satellite link delay variations and enable timely delivery of the VHF voice signal everywhere.

- **Support New Applications and Traffic Growth:** SkyWAN® FAD's solution has the right built-in feature set to address new IP-based applications. Featuring a state of the art IP routing protocol suite (including NAT, virtual routing groups and IP tunnelling), the SkyWAN® FAD platform guarantees data integrity and security.
- **Simplify Network Design:** SkyWAN® FAD combines, over the same backhaul, adapted voice interface transport with signal switching capabilities, which are typically required for internal voice communication, along with point-to-point PPT voice communication and RADAR service transport, which are applications specific to ATC networks.
- **Standard based Network Management:** SkyWAN® FAD's solution supports standards based SNMP protocol for network alarms/events reporting, unit configuration as well as monitoring.

(7) Therefore, SkyWAN® FAD has the ability to interface to any vendor NMS system that offers SNMP support (NewPoint, HP OpenView, What's Up Gold, etc...).

2.3.4 Networking Protocol over Satellite: FR versus IP

(1) The used satellite modem SkyWAN® IDU 7000 offers the option of using IP as well as Frame Relay for transport over satellite. Likewise modem and multiplexer can use FR or IP at the interface between both.

(2) In line with the main criteria of chapter 2.2.1 the reasons for the decision (not to use VoIP and IP in general as only network protocol) are manifold and do not relate to the voice segment only:

- There are no native VoIP sources in MEVA III VSAT Network enforcing the transport of voice in IP packets.
- IP encapsulation, not only for voice, creates substantial overhead[1] and which leads to higher bandwidth consumption.
- The voice quality provided by the SkyWAN® FAD multiplexers is superior to the achievable quality with VoIP.
- The bandwidth allocation for VoFR is deterministic due to a special signaling of the multiplexer to the SkyWAN® FR interface, whereas the bandwidth allocation for VoIP follows indications for Real Time traffic from Ports, IP addresses etc. which includes a residual risk of overbooking and deterioration of the voice link.
- Frame Relay is better suitable to emulate connection oriented data services as required for MEVA III through PVCs.

[1] The reduction of overhead through header compression can result in similar bandwidth consumption as compared to FR, however header compression cannot be employed in any case.

- SkyWAN® modems support Real Time Data Services (PAMA data) on a higher priority as compared to IP Real Time Data.
- The combination of SkyWAN® modems with SkyWAN® FAD Multiplexers using a FR interface connection for voice is a proven solution for critical networks within and outside aeronautical communications.
- For critical networks and critical applications it is important to have full support from the equipment manufacturers[2], which is guaranteed by a long term cooperation and on-going maintenance contracts between all parties involved.

(3) For projects with very long life cycles it is important to have a long-term commitment for the deployed equipment from the respective manufacturer.

2.3.5 Network Application Services

(1) The network design concept for the MEVA III VSAT Network Project has one main objective, to achieve highest reliability and performance – also by avoiding complexity and associated technical risks.

2.3.5.1 Service Advantages with Frame-Relay

(1) Therefore we decided to base the network on ND SatCom's proven standard solution for voice and serial connections within ATC networks, which is based on voice and legacy data over frame relay.

(2) Our decision to choose FR is based on the following considerations regarding the application services:

- **Rapid Call Setup**

  All voice gateways (FAD) in the entire infrastructure will have awareness of all other active FADs and will hold the same MAP table for voice connections. This means that all procedures to establish a voice call will be handled by originating and terminating FAD. Assuming a one way satellite propagation delay of 270 milliseconds, a typical connect sequence between end of dial and ringing will take approx. 600 milliseconds. Contrary to the above, typical VoIP systems are built around a central call management entity which handles all connect request procedures. Typically the originating and terminating VoIP gateways have to independently communicate with the call manager before establishing the call, which leads to 3 information exchange sequences to establish a call. Assuming the delay above, the resulting call setup time will be in the range of more than 1.6 seconds.

- **Data Rate for Radar and other serial Data Applications**

[2] The FADs are produced by Memotec, formerly Verso, and come with a SkyWAN specific software

At a given port speed of 9600 Bit/s and a typical packet size of 48 Bytes/packet the resulting frame rate is 25 fps. The following calculation shall illustrate the difference in WAN bandwidth utilization for transport via IP compared with Frame Relay (results have to be doubled for bidirectional traffic):

IP:

Based on the assumption that TCP is used, the header size is 40 Byte. Together with the payload of 48 Bytes, the frame size is 88 Bytes (Header to Payload Ratio: 0.83). At a frame rate of 25 fps the resulting satellite transmission bandwidth required is 17.600 Bit/s.

Frame Relay:

The total amount of overhead for Frame Relay header and trailer is 4 Byte. Together with the payload of 48 Bytes, the frame size is 52 Bytes (Header to payload ratio: 0.083). At a frame rate of 25 fps the resulting satellite transmission bandwidth required is 10.400 Bit/s. Due to small overhead, the bandwidth usage of Frame Relay is significantly more efficient. In addition the FAD can also be configured to provide unidirectional traffic forwarding if feasible for the application.

- **Redundancy Switching Capabilities of SkyWAN® FAD**

  The redundancy configuration allows a secondary set of FADs to take over all operations of the primary set in case failures. In this setup, the secondary set takes on the "identity" of the primary set, which means that a redundancy switchover in one site is transparent to the other FADs in the infrastructure. Especially for voice communication setups this redundancy configuration does not require the definition of alternate voice call routing to cover outages of a remote unit.

- **Future Proof Voice Call Signalling**

  To be prepared for the future where serial connections might disappear completely from the screen, SkyWAN® FAD has the capabilities to switch voice call signalling from the default mode to VoIP by just changing one global parameter on each unit.

2.3.6 Voice Connections

(1) The SkyWAN® FAD is equipped with voice channels, or ports, for voice/fax/modem transmission.

(2) Each channel has an analogue or digital interface that supports signals from a variety of voice/fax/modem sources using industry-standard signalling methods.

(3) Input interfaces include:

- **E&M:** Ear and Mouth, used between the switching machine's trunk circuit and an associated signalling system.

- **FXS:** Foreign Exchange Channel Unit – Station End, a loop-start signalling method used when connecting to a telephone unit or facsimile machine (POTS line) or a modem or a Key Telephone System (KTS unit).

- **T1/E1:** Digital interfaces that support voice via Channel Associated Signalling (CAS) protocols, like Immediate Start and Wink Start, or via Common Channel Signalling (CCS) protocols like QSIG and ISDN-PRI.

(4) All voice channels use DSP (Digital Signal Processor) for digitization and voice compression facilities. Echo cancellation is provided on all channels, following the CCITT G.165 standard.

(5) Detailed information regarding supported codecs and signalling mechanisms can be found in the provided device documentation.

2.4 Network Architecture

(1) The network equipment for MEVA III VSAT Network, although entirely consisting of off-the-shelf products, is geared towards a useful life of over 10 years as is explained in more detail in chapter 2.1.3. The network architecture is open in the sense that it can be expanded easily ad that it provides standard interfaces and uses standard protocols to communicate to connected external equipment and networks.

(2) The proposed SkyWAN® modems have intrinsic full mesh capability and hence all connections in the MEVA III VSAT Network are establish with a single hop over satellite. The aspects of flexibility and scalability of the network have been discussed in chapter 2.1.2.

(3) The used solution for MEVA III VSAT Network replaces the current components used for the interconnection to REDDIG in Bogotá and Maiquetía one to one and will maintain all current functions. Furthermore also these sites will benefit from the advanced capabilities of the new MEVA III VSAT Network equipment and reduced MRC for satellite capacity. The same applies to maintaining the connection to E/CAR at the San Juan terminal.

2.4.1 Device Naming Convention

(1) Each device name consists of:

- Site Abbreviation/IATA Code: 3 characters of the site name
- Group number: The number for equal device type groups (first group = 1; second group = 2…)
- Name: Name or abbreviation of the device

(2) This naming scheme guarantees that:

- It can be easily identified where a device is connected to
- Sites with only one device type group can be equipped with a second group of devices (example: upgrade of non-redundant sites to redundancy)
- Each device chain can be extended by adding additional devices without mixing the numbers with the other chain

					Chain 1				Chain 2			
No	Country	City	IATA Code	Local ETH	IDU	FAD1	FAD2	FADX	IDU2	FAD1	FAD2	FADX
1	USA	Teleport. Miami	MIT	192.168.101.0/24	MIT1IDU	MIT1FAD1	MIT1FAD2	MIT1FADX	MIT2IDU2	MIT2FAD1	MIT2FAD2	MIT2FADX
2	Aruba	Oranjestad	AUA	192.168.102.0/24	AUA1IDU	AUA1FAD1	AUA1FAD2	AUA1FADX	AUA2IDU2	AUA2FAD1	AUA2FAD2	AUA2FADX
3	Cuba	Havanna	CUB	192.168.103.0/24	CUB1IDU	CUB1FAD1	CUB1FAD2	CUB1FADX				
4	USA	Atlanta	ATL	192.168.104.0/24	ATL1IDU	ATL1FAD1	ATL1FAD2	ATL1FADX	ATL2IDU2	ATL2FAD1	ATL2FAD2	ATL2FADX
5	USA	Miami	MIA	192.168.105.0/24	MIA1IDU	MIA1FAD1	MIA1FAD2	MIA1FADX	MIA2IDU2	MIA2FAD1	MIA2FAD2	MIA2FADX
6	Dom. Rep.	Santo Domingo	DOM	192.168.106.0/24	DOM1IDU	DOM1FAD1	DOM1FAD2	DOM1FADX	DOM2IDU2	DOM2FAD1	DOM2FAD2	DOM2FADX
7	Haiti	Port-au-Prince	HAI	192.168.107.0/24	HAI1IDU	HAI1FAD1	HAI1FAD2	HAI1FADX	HAI2IDU2	HAI2FAD1	HAI2FAD2	HAI2FADX
8	COCESNA		COC	192.168.108.0/24	COC1IDU	COC1FAD1	COC1FAD2	COC1FADX				
9	Mexiko	Mexiko-City	MEX	192.168.109.0/24	MEX1IDU	MEX1FAD1	MEX1FAD2	MEX1FADX				
10	Sint Maarten	Philipsburg	STM	192.168.110.0/24	STM1IDU	STM1FAD1	STM1FAD2	STM1FADX				
11	Jamaika	Kingston	JAM	192.168.111.0/24	JAM1IDU	JAM1FAD1	JAM1FAD2	JAM1FADX				
12	Cayman Islands	George Town	CAI	192.168.112.0/24	CAI1IDU	CAI1FAD1	CAI1FAD2	CAI1FADX				
13	Bahamas	Nassau	NAS	192.168.113.0/24	NAS1IDU	NAS1FAD1	NAS1FAD2	NAS1FADX				
14	Bahamas	Freeport	FPO	192.168.114.0/24	FPO1IDU	FPO1FAD1	FPO1FAD2	FPO1FADX				
15	Curacao	Willemstad	CUR	192.168.115.0/24	CUR1IDU	CUR1FAD1	CUR1FAD2	CUR1FADX				
16	Panama	Panama City	PAN	192.168.116.0/24	PAN1IDU	PAN1FAD1	PAN1FAD2	PAN1FADX				
17	Colombia	Bogta	COL	192.168.117.0/24	COL1IDU	COL1FAD1	COL1FAD2	COL1FADX				
18	Venezuela	Caracas	CCS	192.168.118.0/24	CCS1IDU	CCS1FAD1	CCS1FAD2	CCS1FADX				
19	Puerto Rico	San Juan	PUR	192.168.119.0/24	PUR1IDU	PUR1FAD1	PUR1FAD2	PUR1FADX	PUR2IDU2	PUR2FAD1	PUR2FAD2	PUR2FADX

Table 2: Device Naming Convention

2.4.2 Voice/Data Services

(1) COMSOFT has thoroughly analysed the functional requirements and the traffic and connectivity requirements for the aeronautical voice services in a virtual switched telephone network. The used multiplexer equipment in the interface card configuration for each site will meet all specified requirements.

(2) The Data/Voice interface handover to the customer will be realized for non-redundant equipped sites by using a dedicated connector panel.

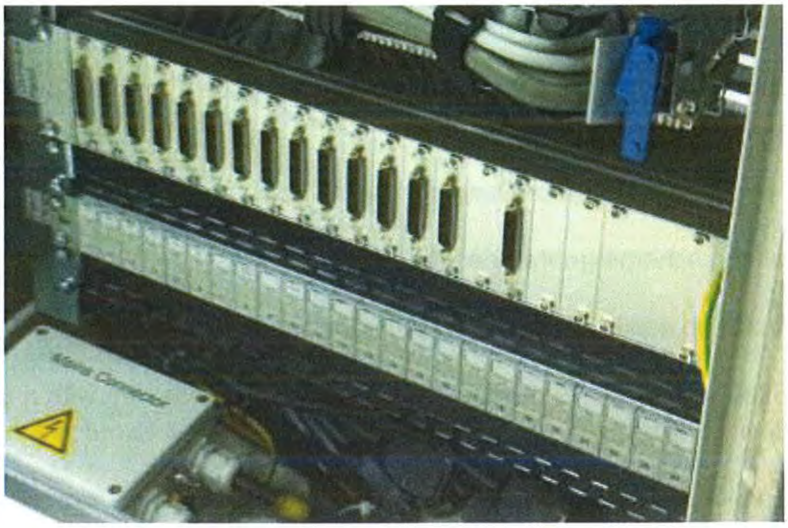


Figure 1: Connector Panel Example

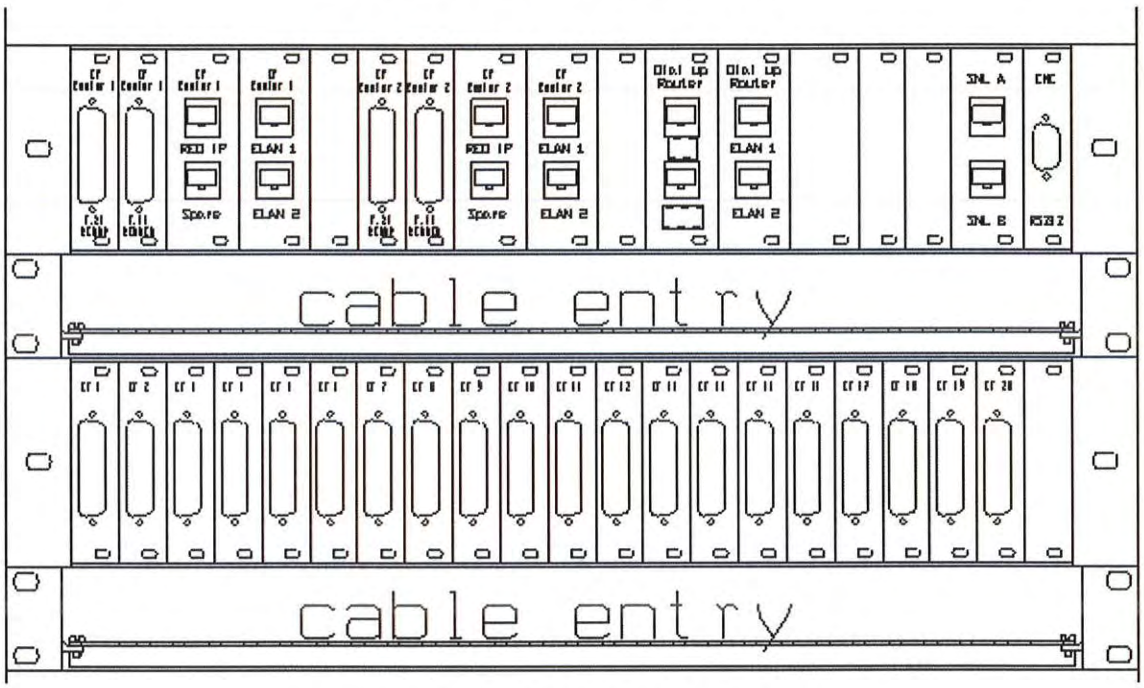


Figure 2: Connector Panel Drawing Example

(3) Likewise at the redundant stations the ports of the redundancy switch will be used.

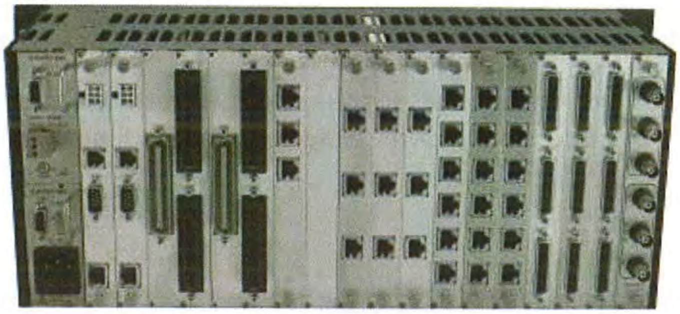


Figure 3: Redundancy Switch Panel Example

(4) All voice interfaces will be provided as RJ-45 jack.

(5) All serial data interfaces will be provided as DB-25 connector female. The only exception is the Dominican Republic where two Winchester Connectors (female) are provided.

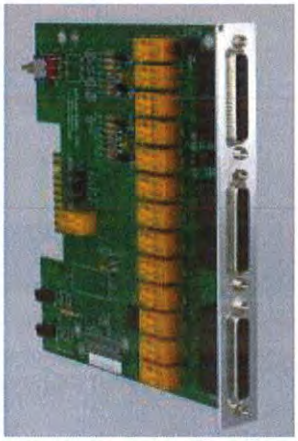


Figure 4: DB-25 Connector Female

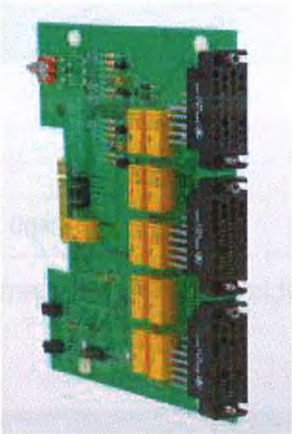


Figure 5: Winchester Connector (Dominican Republic)

2.4.2.1 Voice Services

(1) The 16000 bps for voice circuits in the tables below is for indication. MEVA III voice circuits rate is left to the Tenderer to select provided it complies with Attachment II Section C 12.4

(2) Aruba

Node Origin	Node Dest.	Ext.	Dest Ext.	Service	Data Rate	Interface	Customer Confirmation
Aruba	Miami	2900		SWV	16000	FXS	OK
Aruba	Curacao	2901		SWV	16000	FXS	OK
Aruba	CCS→PRG	2902		SWV	16000	FXS	OK
Aruba	Teleport		2400	SWV	1600	FXS	OK
Aruba	Curacao	ATS Hotline		VSD	16000	E&M	OK
Aruba	Caracas --> Josefa Camejo	end-to-end direct		VSD	16000	E&M	Not confirmed

Table 3: Dial Plan Aruba

(3) Atlanta

Node Origin	Node Dest.	Ext.	Dest Ext.	Service	Data Rate	Interface	Customer Confirmation
Atlanta	Teleport	dial-out	2400	SWV		FXS	OK

Table 4: Dial Plan Atlanta

(4) Bahamas, Freeport

Node Origin	Node Dest.	Ext.	Dest Ext.	Service	Data Rate	Interface	Customer Confirmation
Freeport	Multiple	1010		SWV	16000	FXS	OK
Freeport	Multiple	1001		SWV	16000	FXS	OK
Freeport	Multiple	1002		SWV	16000	FXS	OK
Freeport	Multiple	1003		SWV	16000	FXS	OK
Freeport	Teleport	dial-out	2400	SWV	16000	FXS	OK

Table 5: Dial Plan Bahamas Freeport

(5) Bahamas, Nassau

Node Origin	Node Dest.	Ext.	Dest Ext.	Service	Data Rate	Interface	Customer Confirmation
Nassau	Multiple	2700		SWV	16000	FXS	OK
Nassau	Multiple	2701		SWV	16000	FXS	OK
Nassau	Multiple	2702		SWV	16000	FXS	OK
Nassau	Multiple	2703		SWV	16000	FXS	OK
Nassau	Multiple	2704		SWV	16000	FXS	OK

Node Origin	Node Dest.	Ext.	Dest Ext.	Service	Data Rate	Interface	Customer Confirmation
Nassau	Multiple	2705		SWV	16000	FXS	OK
Nassau	Multiple	2706		SWV	16000	FXS	OK
Nassau	Multiple	2707		SWV	16000	FXS	OK
Nassau	Teleport	dial-out	2400	SWV	16000	FXS	OK
Nassau	Miami	2750	1954	VSD	16000	E&M ~~(29.5.)~~	OK

Table 6: Dial Plan Bahamas Nassau

include description

(6) COCESNA

Node Origin	Node Dest.	Ext.	Dest Ext.	Service	Data Rate	Interface	Customer Confirmation
COCESNA	Multiple	2100		SWV	16000	FXS	OK
COCESNA	Multiple	2102		SWV	16000	FXS	OK
COCESNA	Teleport	dial-out	2400	SWV	16000	FXS	OK
COCESNA	Jamaica	VHF-PTT end-to-end direct		RRS	16000	E&M ~~(PTT)~~ F	OK

Table 7: Dial Plan COCESNA

(7) Cuba

Node Origin	Node Dest.	Ext.	Dest Ext.	Service	Data Rate	Interface	Customer Confirmation
Cuba	Multiple	2300		SWV	16000	E&M	OK
Cuba	Multiple	2301		SWV	16000	E&M	OK
Cuba	Multiple	2302		SWV	16000	E&M	OK
Cuba	Multiple	2303		SWV	16000	E&M	OK
Cuba	Multiple	2304		SWV	16000	E&M	OK
Cuba	Multiple	2305		SWV	16000	E&M	OK
Cuba	Teleport	dial-out	2300 (2400)	SWV	16000	E&M	OK
Cuba	Jamaica	2352	3051	VSD	16000	E&M	OK
Cuba	Jamaica	2353	3052	VSD	16000	E&M	OK
Cuba	Merida	2355	~~1601~~ 1650	VSD	16000	E&M	OK
Cuba	Miami	2350	1951	VSD	16000	E&M	OK
Cuba	Miami	2351	1952	VSD	16000	E&M	OK
Cuba	Miami	2356	1958	VSD	16000	E&M	OK
Cuba	Miami	2354	1957	VSD	16000	E&M	OK

Table 8: Dial Plan Cuba

(8) Cayman Islands

Node Origin	Node Dest.	Ext.	Dest Ext.	Service	Data Rate	Interface	Customer Confirmation
Grand Cayman	Multiple	2500		SWV	16000	FXS	OK
Grand Cayman	Multiple	2501		SWV	16000	FXS	OK
Grand Cayman	Multiple	2502		SWV	16000	FXS	OK
Grand Cayman	Multiple	2503		SWV	16000	FXS	OK
Grand Cayman	Multiple	2504		SWV	16000	FXS	OK
Grand Cayman	Multiple	2505		SWV	16000	FXS	OK
Grand Cayman	Teleport	dial-out	2400	SWV	16000	FXS	OK

Node Origin	Node Dest.	Ext.	Dest Ext.	Service	Data Rate	Interface	Customer Confirmation
Grand Cayman	Jamaica	2550	3050	VSD	16000	E&M ~~(29.05.)~~	OK

Table 9: Dial Plan Cayman Islands

(9) Curaçao

Node Origin	Node Dest.	Ext.	Dest Ext.	Service	Data Rate	Interface	Customer Confirmation
Curacao	Multiple	2200		SWV	16000	FXS	OK
Curacao	Multiple	2201		SWV	16000	FXS	OK
Curacao	Multiple	2202		SWV	16000	FXS	OK
Curacao	Teleport	dial-out	2400	SWV	16000	FXS	OK
Curacao	Aruba	ATS Hotline		VSD	16000	E&M	OK
Curacao	Caracas	ATS Hotline		VSD	16000	E&M	OK
Curacao	Dom Rep.	ATS Hotline		VSD	16000	E&M	OK
Curacao	Jamaica	ATS Hotline		VSD	16000	E&M	OK

Table 10: Dial Plan Curacao

(10) Colombia

Node Origin	Node Dest.	Ext.	Dest Ext.	Service	Data Rate	Interface	Customer Confirmation
Bogota	Multiple	4545		SWV	16000	E1	OK
Bogota	Multiple	4540		SWV	16000	E1	OK
Bogota	Multiple	4531		SWV	16000	E1	OK
Bogota	Multiple	4560		SWV	16000	E1	OK
Bogota	Multiple	4541		SWV	16000	E1	OK
Bogota	Multiple	4542		SWV	16000	E1	OK
Bogota	Multiple	4547		SWV	16000	E1	OK
Bogota	Teleport	dial-out	2400	SWV	16000	E1	OK
Bogota	Curacao	ATS Hotline		VSD	16000	E1	OK
Bogota	Jamaica	ATS Hotline		VSD	16000	E1	OK
Bogota	Panama	ATS Hotline		VSD	16000	E1	OK

Table 11: Dial Plan Colombia

(11) Caracas, Venezuela

Node Origin	Node Dest.	Ext.	Dest Ext.	Service	Data Rate	Interface	Customer Confirmation
Caracas	Multiple	8001		SWV	16000	FXS	OK
Caracas	Multiple	8002		SWV	16000	FXS	OK
Caracas	Multiple	8003		SWV	16000	FXS	OK
Caracas	Teleport	dial-out	2400	SWV	16000	FXS	OK
Caracas	Aruba	ATS Hotline		VSD	16000	FXS	OK
Caracas	Curacao	ATS Hotline		VSD	16000	FXS	OK
Caracas	San Juan	ATS Hotline		VSD	16000	FXS	OK

Table 12: Dial Plan Caracas

(12) Dominican Republic

Node Origin	Node Dest.	Ext.	Dest Ext.	Service	Data Rate	Interface	Customer Confirmation
Dom Rep.	Multiple	2600		SWV	16000	FXS	OK
Dom Rep.	Multiple	2601		SWV	16000	FXS	OK
Dom Rep.	Multiple	2602		SWV	16000	FXS	OK
Dom Rep.	Multiple	2603		SWV	16000	FXS	OK
Dom Rep.	Multiple	2604		SWV	16000	FXS	OK
Dom Rep.	Multiple	2605		SWV	16000	FXS	OK
Dom Rep.	Teleport	dial-out	2400	SWV	16000	FXS	OK
Dom Rep.	Curacao	ATS Hotline		VSD	16000	E&M	OK
Dom Rep.	Haiti	ATS Hotline		VSD	16000	E&M	OK
Dom Rep.	Miami	2650	1656	VSD	16000	E&M	OK
Dom Rep.	San Juan	ATS Hotline		VSD	16000	E&M	OK
Dom Rep.	San Juan	ATS Hotline		VSD	16000	E&M	OK

Table 13: Dial Plan Dominican Republic

(13) Haiti

Node Origin	Node Dest.	Ext.	Dest Ext.	Service	Data Rate	Interface	Customer Confirmation
Haiti	Multiple/Teleport	2800		SWV	16000	FXS	OK
Haiti	Multiple	2801		SWV	16000	FXS	OK
Haiti	Multiple	2802		SWV	16000	FXS	OK
Haiti	Multiple	2803		SWV	16000	FXS	OK
Haiti	Multiple	dial-out	2400	SWV	16000	FXS	OK
Haiti	Dom Rep.	ATS Hotline		VSD	16000	E&M	OK
Haiti	Jamaica	ATS Hotline		VSD	16000	E&M	OK
Haiti	Miami	2850	1950	VSD	16000	E&M	OK

Table 14: Dial Plan Haiti

(14) Jamaica

Node Origin	Node Dest.	Ext.	Dest Ext.	Service	Data Rate	Interface	Customer Confirmation
Jamaica	Multiple	3000		SWV	16000	FXS	OK
Jamaica	Multiple	3001		SWV	16000	FXS	OK
Jamaica	Multiple	3002		SWV	16000	FXS	OK
Jamaica	Multiple	3003		SWV	16000	FXS	OK
Jamaica	Teleport	dial-out	2400	SWV	16000	FXS	OK
Jamaica	Bogota	ATS Hotline		VSD	16000	E&M	OK
Jamaica	Curacao	ATS Hotline		VSD	16000	E&M	OK
Jamaica	Grand Cayman	3050	2550	VSD	16000	E&M	OK
Jamaica	Haiti	ATS Hotline		VSD	16000	E&M	OK
Jamaica	Panama	ATS Hotline		VSD	16000	E&M	OK
Jamaica	Cuba	3051	2352	VSD	16000	E&M	OK
Jamaica	Cuba	3052	2353	VSD	16000	E&M	OK
Jamaica	COCESNA	VHF-PTT end-to-end direct		RRS	16000	E&M (PTT)	OK

Table 15: Dial Plan Jamaica

(15) Miami (connected terrestrial via Miami Teleport)

Node Origin	Node Dest.	Ext.	Dest Ext.	Service	Data Rate	Interface	Customer Confirmation
Miami	Multiple	1900		SWV	16000	FXS	OK
Miami	Multiple	1901		SWV	16000	FXS	OK
Miami	Multiple	1902		SWV	16000	FXS	OK
Miami	Multiple	1903		SWV	16000	FXS	OK
Miami	Multiple	1904		SWV	16000	FXS	OK
Miami	Multiple	1905		SWV	16000	FXS	OK
Miami	Multiple	1906		SWV	16000	FXS	OK
Miami	Multiple	1907		SWV	16000	FXS	OK
Miami	Multiple	1908		SWV	16000	FXS	OK
Miami	Multiple	1909		SWV	16000	FXS	OK
Miami	Multiple	1910		SWV	16000	FXS	OK
Miami	Multiple	1911		SWV	16000	FXS	OK
Miami	Multiple	1912		SWV	16000	FXS	OK
Miami	Multiple	1913		SWV	16000	FXS	OK
Miami	Multiple	1700		SWV	16000	FXS	OK
Miami	Multiple	1701		SWV	16000	FXS	OK
Miami	Multiple	1702		SWV	16000	FXS	OK
Miami	Teleport	dial-out	2400	SWV	16000	FXS	OK
Miami	Cuba	1951	2350	VSD	16000	E&M	OK
Miami	Cuba	1952	2351	VSD	16000	E&M	OK
Miami	Cuba	1958	2356	VSD	16000	E&M	OK
Miami	Cuba	1957	2354	VSD	16000	E&M	OK
Miami	Dom. Rep.	1956	2560	VSD	16000	E&M	OK

Node Origin	Node Dest.	Ext.	Dest Ext.	Service	Data Rate	Interface	Customer Confirmation
Miami	Haiti	1950	2850	VSD	16000	E&M	OK
Miami	Nassau	1954	2750	VSD	16000	E&M	OK
Miami	St. Maarten	1953	3550	VSD	16000	E&M	OK

Table 16: Dial Plan Miami

(16) Mexico

Node Origin	Node Dest.	Ext.	Dest Ext.	Service	Data Rate	Interface	Customer Confirmation
Merida	Multiple	1600		SWV	16000	FXS	OK
Merida	Multiple	1602		SWV	16000	FXS	OK
Merida	Teleport	dial-out	2400	SWV	16000	FXS	OK
Merida	Cuba	~~1601~~	2355	VSD	16000	E&M (29.5.)	OK

Table 17: Dial Plan Mexico

(17) Panama

Node Origin	Node Dest.	Ext.	Dest Ext.	Service	Data Rate	Interface	Customer Confirmation
Panama	Multiple	3901		SWV	16000	FXS	OK
Panama	Multiple	3902		SWV	16000	FXS	OK
Panama	Multiple	3903		SWV	16000	FXS	OK
Panama	Multiple	3904		SWV	16000	FXS	OK
Panama	Multiple	3900		SWV	16000	FXS	OK
Panama	Teleport	dial-out	2400	SWV	16000	FXS	OK
Panama	Bogotá	ATS	Hotline	VSD	16000	E&M	OK
Panama	Jamaica	ATS	Hotline	VSD	16000	E&M	OK

Table 18: Dial Plan Panama

(18) Puerto Rico

Node Origin	Node Dest.	Ext.	Dest Ext.	Service	Data Rate	Interface	Customer Confirmation
San Juan	Multiple	1800		SWV	16000	FXS	OK
San Juan	Multiple	1801		SWV	16000	FXS	OK
San Juan	Multiple	1802		SWV	16000	FXS	OK
San Juan	Multiple	1803		SWV	16000	FXS	OK
San Juan	Multiple	1804		SWV	16000	FXS	OK
San Juan	Multiple	1805		SWV	16000	FXS	OK
San Juan	Multiple	1806		SWV	16000	FXS	OK
San Juan	Multiple	1807		SWV	16000	FXS	OK
San Juan	St. Maarten	ATS	Hotline	~~SWV~~	16000	FXS	OK
San Juan	St. Maarten	ATS	Hotline	~~SWV~~	16000	FXS	OK

Node Origin	Node Dest.	Ext.	Dest Ext.	Service	Data Rate	Interface	Customer Confirmation
San Juan	St. Maarten	ATS	Hotline	SWV	16000	FXS	OK
San Juan	St. Maarten	ATS	Hotline	SWV	16000	FXS	OK
San Juan	Teleport	dial-out	2400	SWV	16000	FXS	OK
San Juan	Dom. Rep.	ATS	Hotline	VSD	16000	E&M	OK
San Juan	Dom. Rep.	ATS	Hotline	VSD	16000	E&M	OK
San Juan	St. Maarten	ATS	Hotline	VSD	16000	E&M	OK
San Juan	Caracas	ATS	Hotline	VSD	16000	E&M	OK

Table 19: Dial Plan Puerto Rico

(19) Sint Maarten 1850 1851 1852 1853 8352 3550 2653 2654

Node Origin	Node Dest.	Ext.	Dest Ext.	Service	Data Rate	Interface	Customer Confirmation
St. Maarten	San Juan (29.05.)	3501		SWV	16000	FXS	OK
St. Maarten	San Juan E/CAR	3502		SWV	16000	FXS	OK/ Anguilla
St. Maarten	" E/CAR	3503		SWV	16000	FXS	OK/ Anguilla
St. Maarten	" E/CAR	3504		SWV	16000	FXS	OK/ Antigua
St. Maarten	" E/CAR	3505		SWV	16000	FXS	OK/ St. Kitts
St. Maarten	Teleport	3500	2400	SWV	16000	FXS	OK
St. Maarten	Teleport	spare	spare	VSD	16000	E&M	OK
St. Maarten	San Juan	ATS	Hotline	VSD	16000	E&M	OK

Table 20: Dial Plan Sint Maarten

add 3500 3550 dial out 1852 Remarks

2.4.2.2 Data Services

(1) Aruba

Node Origin	Node Dest.	Service	Data Rate	Sync/ Async	Interface	Customer Confirmation
Aruba	Atlanta	AFTN	9600	sync	RS232/V.24	OK

Table 21: Data Interfaces Aruba

(2) Atlanta

Node Origin	Node Dest.	Service	Data Rate	Sync/ Async	Interface	Customer Confirmation
Atlanta	Aruba	AFTN	9600	sync	serial, RS232	OK
Atlanta	Jamaica	AFTN	9600	sync	serial, RS232	OK
Atlanta	Nassau	AFTN	9600	sync	serial, RS232	OK
Atlanta	Haiti	AFTN	9600	sync	serial, RS232	OK
Atlanta	COCESNA	AFTN	9600	sync	serial, RS232	OK
Atlanta	Panama	AFTN	9600	sync	serial, RS232	OK

Node Origin	Node Dest.	Service	Data Rate	Sync/ Async	Interface	Customer Confirmation
Atlanta	Cuba	AFTN	9600	sync	serial, RS232	OK
Atlanta	Curacao	AFTN	9600	sync	serial, RS232	OK
Atlanta	St. Maarten	AFTN	9600	sync	serial, RS232	OK
Atlanta	Bogota	AFTN	9600	sync	serial, RS232	OK
Atlanta	Bogota	AFTN	9600	sync	serial, RS232	OK
Atlanta	Caracas	AFTN	9600	sync	serial, RS232	OK
Atlanta	Dom. Rep.	AMHS IP	64000	sync	EIA-530/EIA-422 (sync)	OK
Atlanta	St. Maarten	AMHS IP	64000	sync	EIA-530/EIA-422 (sync)	OK/Hardware only; No service
Atlanta	Curacao	AMHS IP	64000	sync	EIA-530/EIA-422 (sync)	/Hardware only; No service
Atlanta	COCESNA	AMHS IP	64000	sync	EIA-530/EIA-422 (sync)	/Hardware only; No service
Atlanta	Cuba	AMHS IP	64000	sync	EIA-530/EIA-422 (sync)	OK
Atlanta	Jamaica	AMHS IP	64000	sync	EIA-530/EIA-422 (sync)	/Hardware only; No service
Atlanta	Grand Cayman	AFTN	9600	sync	RS232	OK
Atlanta	Grand Cayman	AMHS IP	64000	sync	EIA-530/EIA-422 (sync)	/Hardware only; No service
Atlanta	Aruba	AMHS IP	64000	sync	EIA-530/EIA-422 (sync)	/Hardware only; No service
Atlanta	Nassau	AMHS IP	64000	sync	EIA-530/EIA-422 (sync)	/Hardware only; No service
Atlanta	Haiti	AMHS IP	64000	sync	EIA-530/EIA-422 (sync)	/Hardware only; No service
Atlanta	Panama	AMHS IP	64000	sync	EIA-530/EIA-422 (sync)	/Hardware only; No service
Atlanta	Caracas	AMHS IP	64000	sync	EIA-530/EIA-422 (sync)	/Hardware only; No service

Table 22: Data Interfaces Atlanta

(3) Bahamas, Freeport

Node Origin	Node Dest.	Service	Data Rate	Sync/ Async	Interface	Customer Confirmation
Freeport	Nassau	AFTN	9600	sync	serial, RS232 (V.24)	OK

Table 23: Data Interfaces Bahamas Freeport

(4) Bahamas, Nassau

Node Origin	Node Dest.	Service	Data Rate	Sync/ Async	Interface	Customer Confirmation
Nassau	Atlanta	AFTN	9600	sync	RS232	OK

Node Origin	Node Dest.	Service	Data Rate	Sync/ Async	Interface	Customer Confirmation
Nassau	Freeport	AFTN	9600	sync	RS232	OK

Table 24: Data Interfaces Bahamas Nassau

(5) COCESNA

Node Origin	Node Dest.	Service	Data Rate	Sync/ Async	Interface	Customer Confirmation
COCESNA	Atlanta	AFTN	9600	sync	serial, RS232	OK
COCESNA	Atlanta	AMHS IP	64000	sync	EIA-530/EIA-422 (sync)	OK
COCESNA	Cuba	RADAR	9600	sync	serial, RS232	OK

Table 25: Data Interfaces COCESNA

(6) Cuba

Node Origin	Node Dest.	Service	Data Rate	Sync/ Async	Interface	Customer Confirmation
Cuba	Merida	AFTN	9600	async	serial, V.24	OK
Cuba	Atlanta	AFTN	9600	sync	serial, V.24	OK
Cuba	Atlanta	AMHS IP	64000	sync	V.35	OK
Cuba	COCESNA	RADAR	9600	sync	serial, V.24	OK
Cuba	Jamaica	RADAR	9600	sync	serial, V.24	OK

Table 26: Data Interfaces Cuba

(7) Cayman Islands

Node Origin	Node Dest.	Service	Data Rate	Sync/ Async	Interface	Customer Confirmation
Grand Cayman	Atlanta	AMHS	64000	sync	Ethernet	OK
Grand Cayman	Atlanta	AFTN	9600	sync	RS232	OK

Table 27: Data Interfaces Cayman Islands

(8) Curaçao

Node Origin	Node Dest.	Service	Data Rate	Sync/ Async	Interface	Customer Confirmation
Curacao	Atlanta	AFTN	9600	sync	serial, RS232	OK
Curacao	Atlanta	AMHS IP	64000	async	V.35	OK
Curacao	Caracas	AFTN	2400	async	serial, RS232	OK
Curacao	Dom Rep.	AIDC	16000	sync	serial, RS232	OK
Curacao	Dom Rep.	Radar	9600	sync	serial, RS232	OK

Table 28: Data Interfaces Curacao

(9) Colombia

Node Origin	Node Dest.	Service	Data Rate	Sync/ Async	Interface	Customer Confirmation
Bogota	Panama	AFTN	2400	async	RS232	OK
Bogota	Atlanta	AFTN	9600	async	RS232	OK
Bogota	Atlanta	AFTN	9600	async	RS232	OK

Table 29: Data Interfaces Colombia

(10) Caracas, Venezuela

Node Origin	Node Dest.	Service	Data Rate	Sync/ Async	Interface	Customer Confirmation
Caracas	Atlanta	AFTN	9600	sync	RS232	OK
Caracas	Curacao	AFTN	2400	async	RS232	OK

Table 30: Data Interfaces Caracas

(11) Dominican Republic

Node Origin	Node Dest.	Service	Data Rate	Sync/ Async	Interface	Customer Confirmation
Dom Rep.	Miami	Radar	9600	sync	serial, RS232	OK
Dom Rep.	San Juan	Radar	9600	sync	serial, RS232	OK
Dom Rep.	Curacao	Radar	9600	sync	serial, RS232	OK
Dom Rep.	Curacao	AIDC	16000	sync	serial, RS232	OK
Dom Rep.	Atlanta	AMHS IP	64000	async	V.35	OK

Table 31: Data Interfaces Dominican Republic

(12) Haiti

Node Origin	Node Dest.	Service	Data Rate	Sync/ Async	Interface	Customer Confirmation
Haiti	Atlanta	AFTN	9600	sync	serial, V.24	OK

Table 32: Data Interfaces Haiti

(13) Jamaica

Node Origin	Node Dest.	Service	Data Rate	Sync/ Async	Interface	Customer Confirmation
Jamaica	Cuba	RADAR	9600	sync	serial, RS232	OK
Jamaica	Atlanta	AFTN	9600	sync	serial, RS232	OK
Jamaica	Atlanta	AMHS IP	64000	sync	EIA-530/EIA-422 (sync)	OK

Table 33: Data Interfaces Jamaica

(14) Miami (connected terrestrial via Miami Teleport)

Node Origin	Node Dest.	Service	Data Rate	Sync/ Async	Interface	Customer Confirmation
Miami	Dom. Rep.	RADAR	9600	sync	serial, RS232	OK

Table 34: Data Interfaces Miami

(15) Mexico

Node Origin	Node Dest.	Service	Data Rate	Sync/ Async	Interface	Customer Confirmation
Merida	Cuba	AFTN	9600	async	serial, V.24	OK

Table 35: Data Interfaces Mexico

(16) Panama

Node Origin	Node Dest.	Service	Data Rate	Sync/ Async	Interface	Customer Confirmation
Panama	Bogota	AFTN	2400	async	serial, RS232	OK
Panama	Atlanta	AFTN	9600	sync	serial, RS232	OK

Table 36: Data Interfaces Panama

(17) Puerto Rico

Node Origin	Node Dest.	Service	Data Rate	Sync/ Async	Interface	Customer Confirmation
San Juan	Dom. Rep.	Radar	9600	sync	serial, RS232	OK/Hardware only; No service
San Juan	St. Maarten	Radar	9600	sync	serial, RS232	OK/Hardware only; No service
San Juan	St. Maarten	Radar	9600	sync	serial, RS232	OK/Hardware only; No service

Table 37: Data Interfaces Puerto Rico

(18) Sint Maarten

Node Origin	Node Dest.	Service	Data Rate	Sync/ Async	Interface	Customer Confirmation
St. Maarten	Atlanta	AFTN	9600	sync	serial, RS232	OK
St. Maarten	Atlanta	AMHS IP	64000	async	Ethernet	OK
St. Maarten	San Juan	Radar	9600	sync	serial, RS232	OK
St. Maarten	San Juan	Radar	9600	sync	serial, RS232	OK

Table 38: Data Interfaces Sint Maarten

2.4.2.3 IP Design IDU

Add explanation for diagrams

(1) Teleport Miami

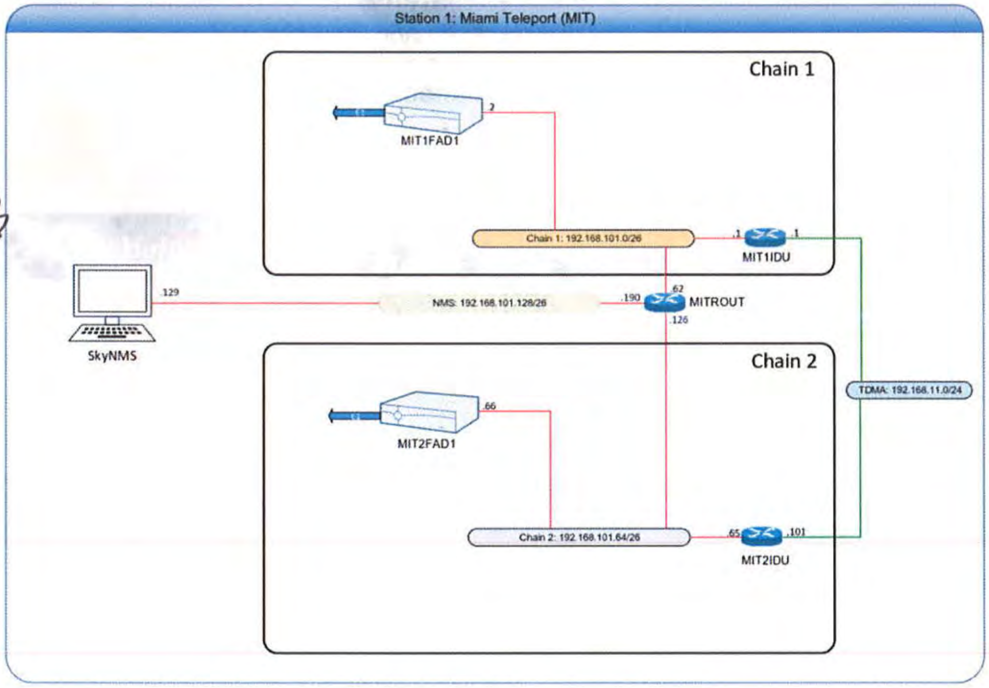


Figure 6: IP Design Teleport Miami

(2) Aruba

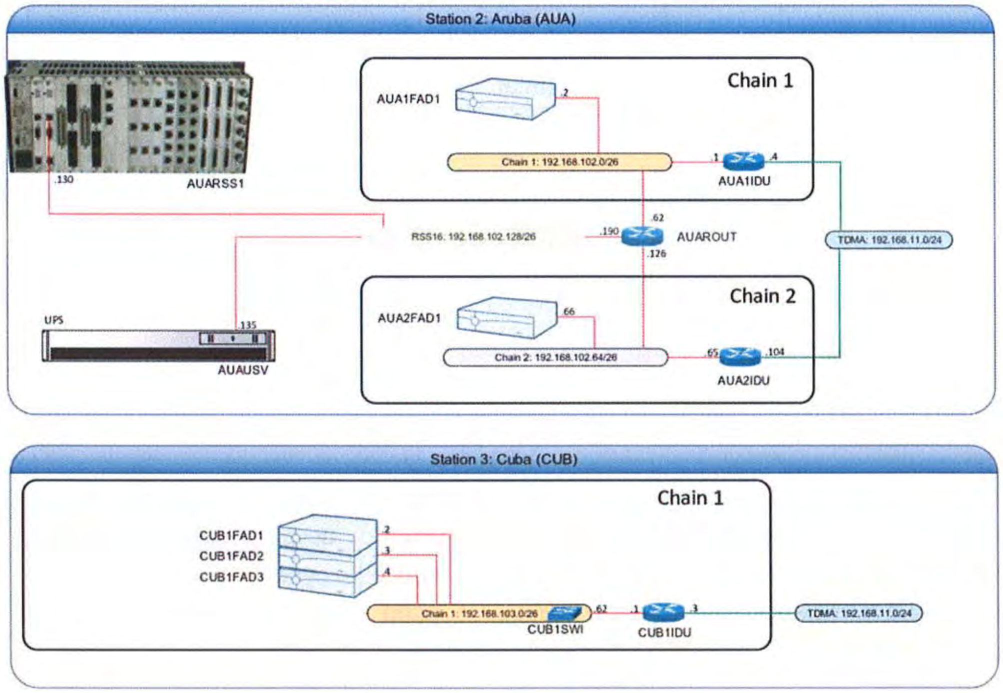


Figure 7: IP Design Aruba

(3) Atlanta

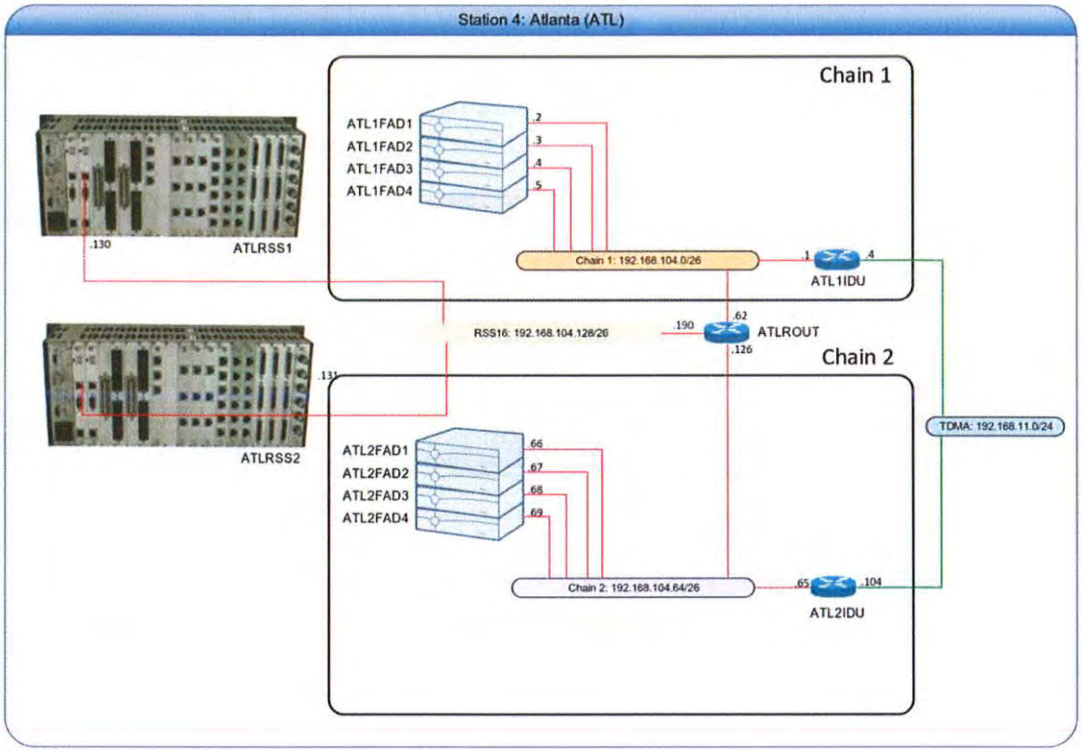


Figure 8: IP Design Atlanta

(4) Bahamas, Freeport

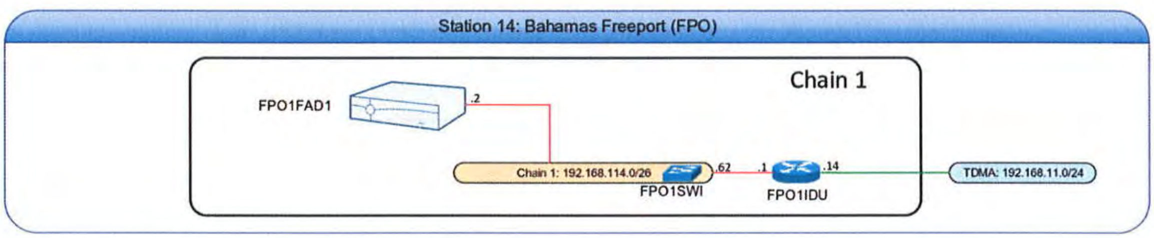


Figure 9: IP Design Bahamas Freeport

(5) Bahamas, Nassau

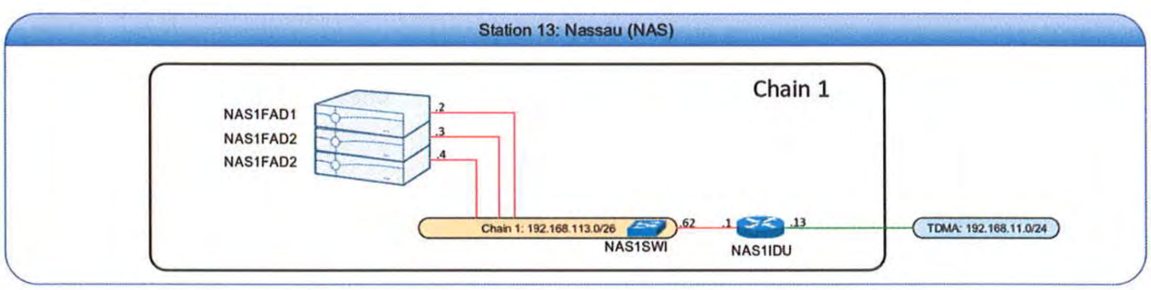


Figure 10: IP Design Bahamas, Nassau

(6) COCESNA

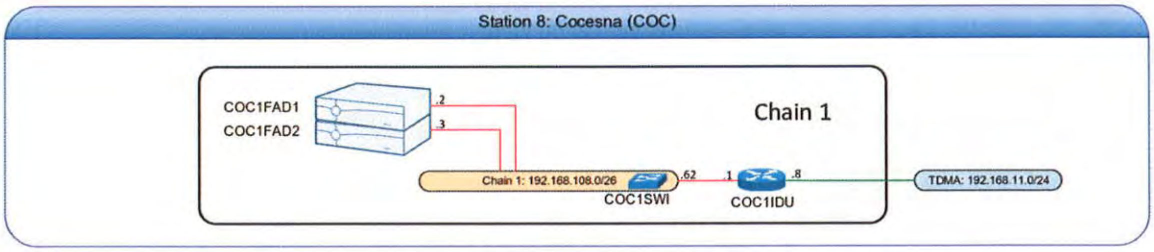


Figure 11: IP Design COCESNA

(7) Cuba

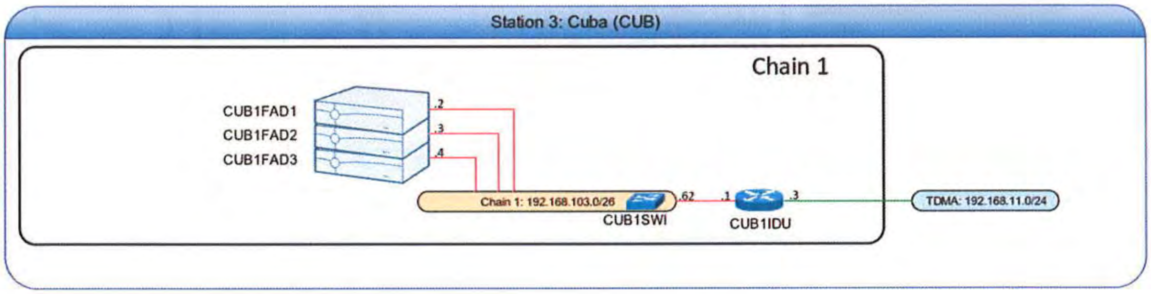


Figure 12: IP Design Cuba

(8) Cayman Islands

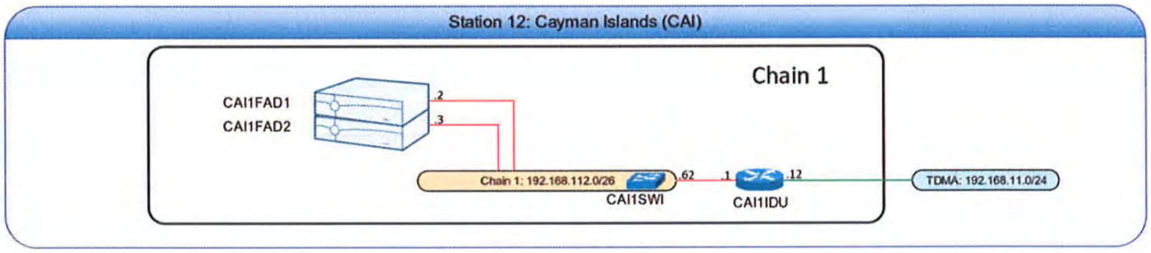


Figure 13: IP Design Cayman Islands

(9) Curaçao

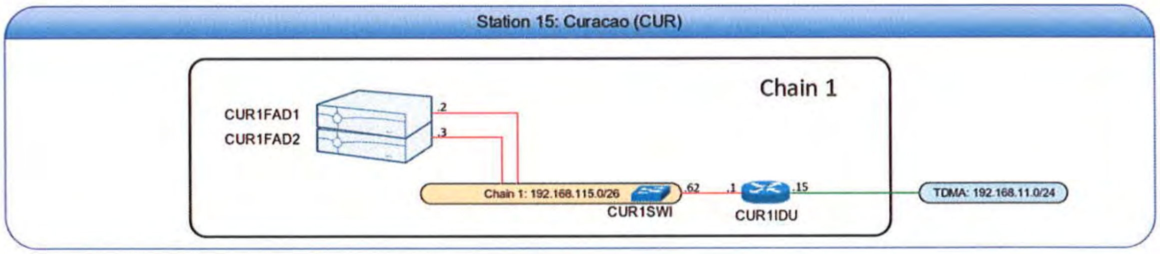


Figure 14: IP Design Curacao

(10) Colombia

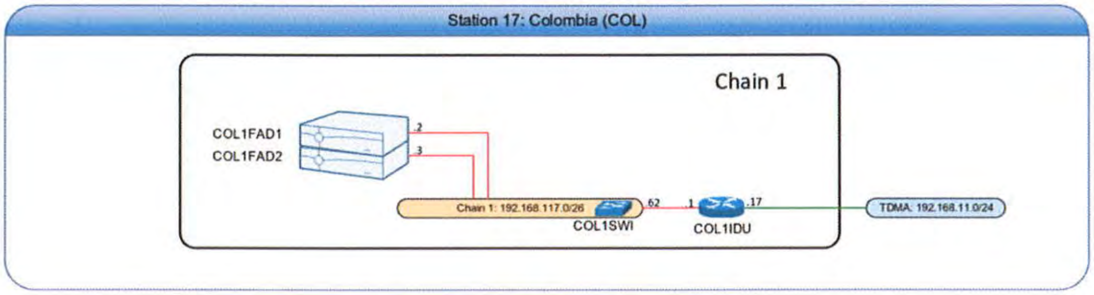


Figure 15: IP Design Colombia

(11) Caracas, Venezuela

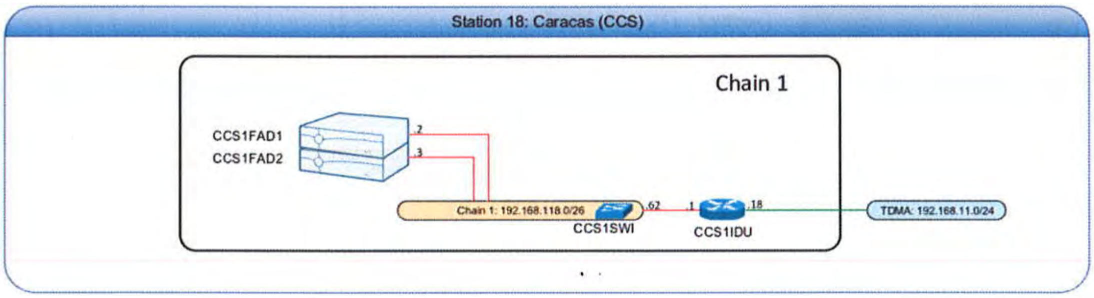


Figure 16: IP Design Caracas

(12) Dominican Republic

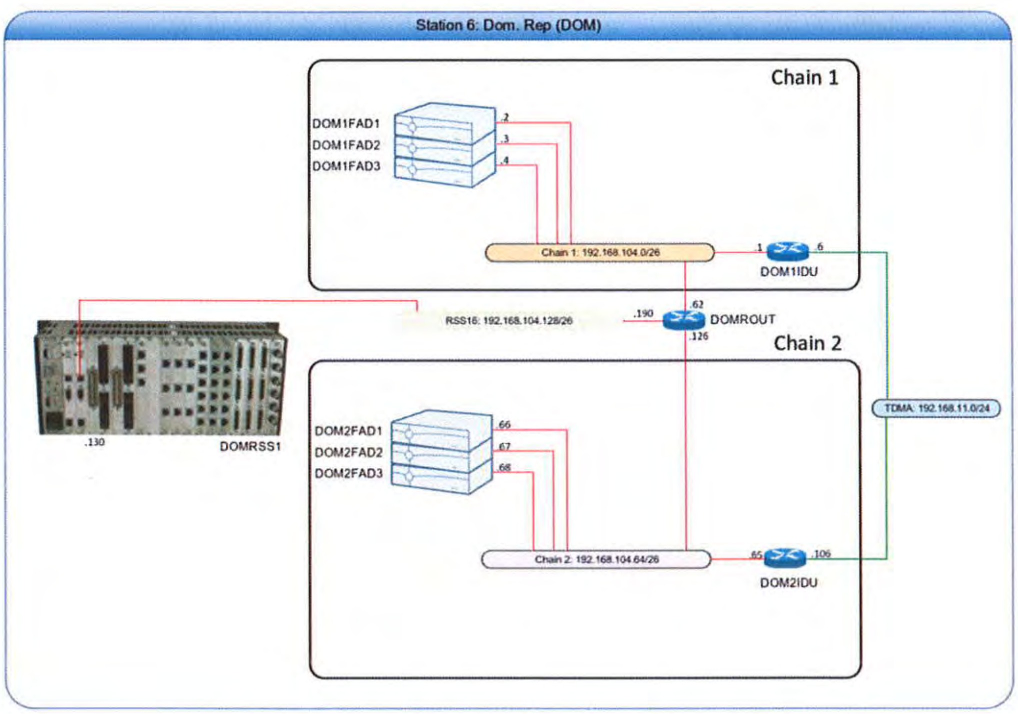


Figure 17: IP Design Dominican Republic

(13) Haiti

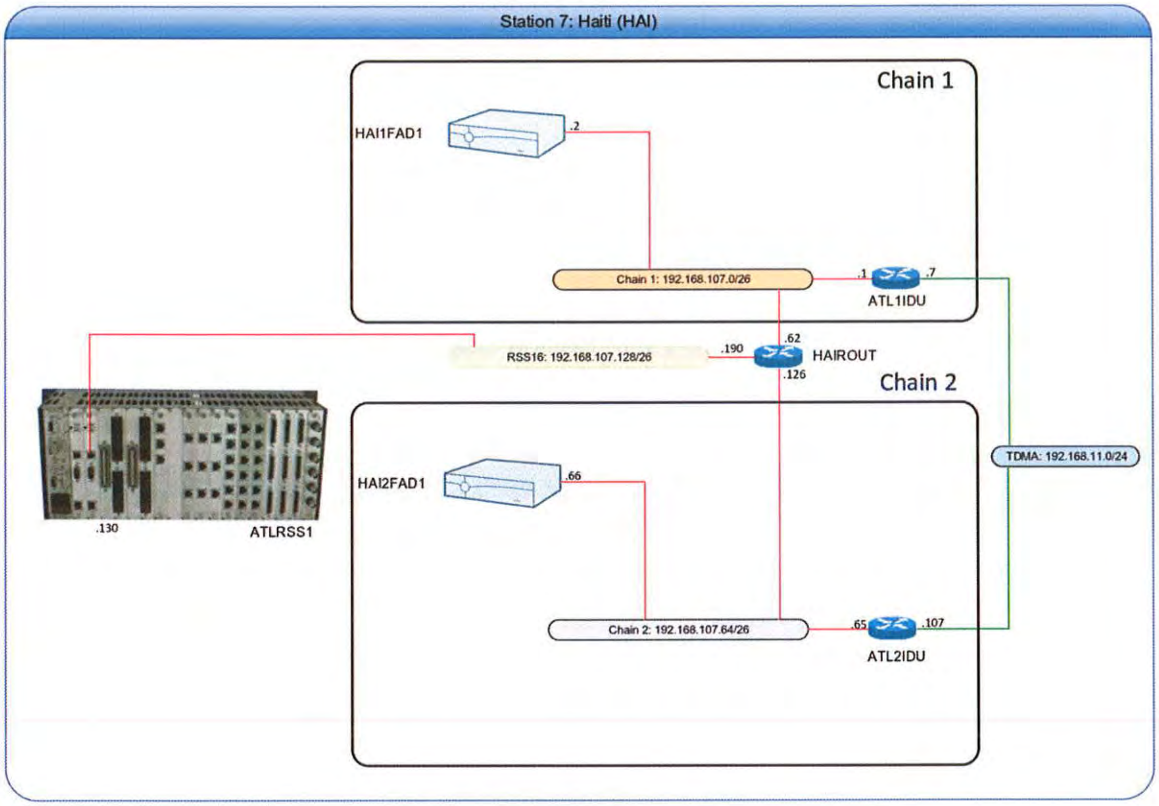


Figure 18: IP Design Haiti

(14) Jamaica

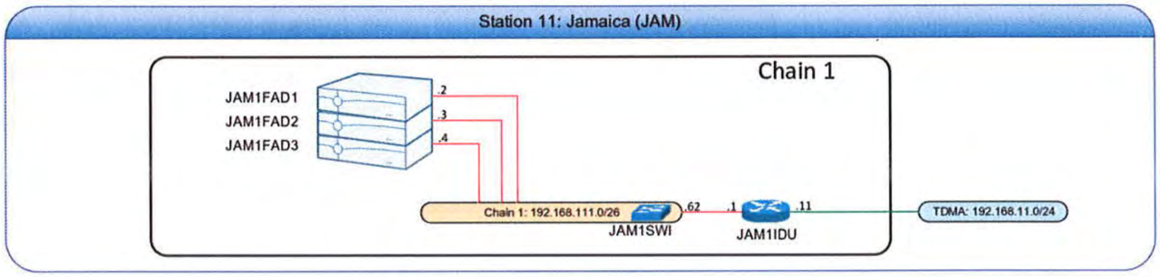


Figure 19: IP Design Jamaica

(15) Miami (connected terrestrial via Miami Teleport)

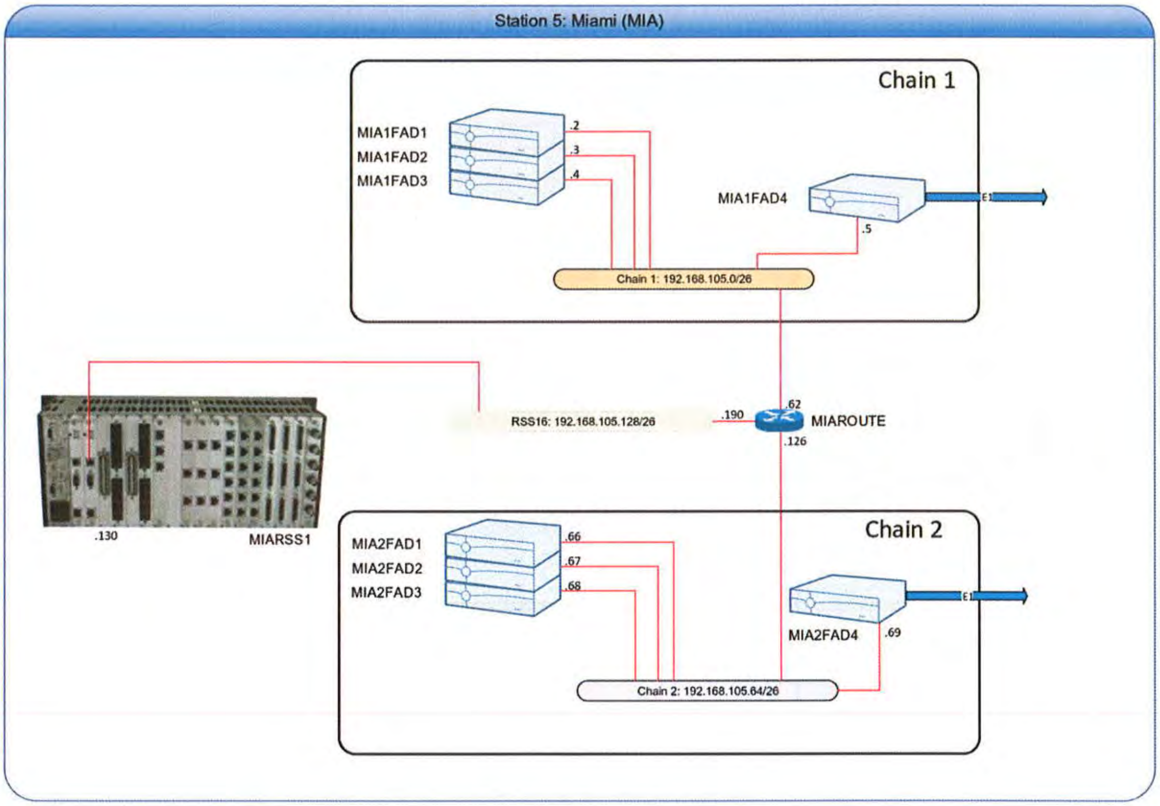


Figure 20: IP Design Miami

(16) Mexico

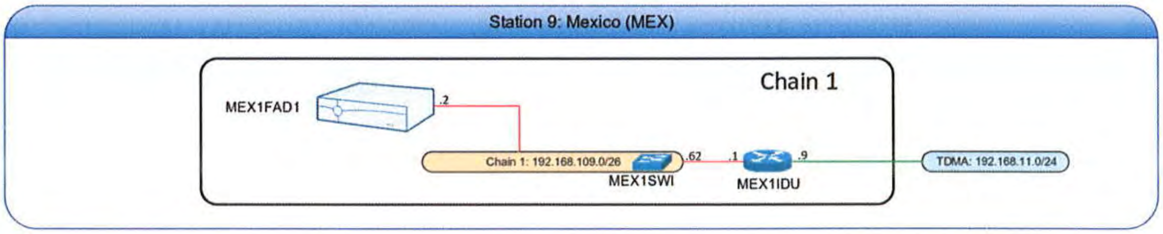


Figure 21: IP Design Mexico

(17) Panama

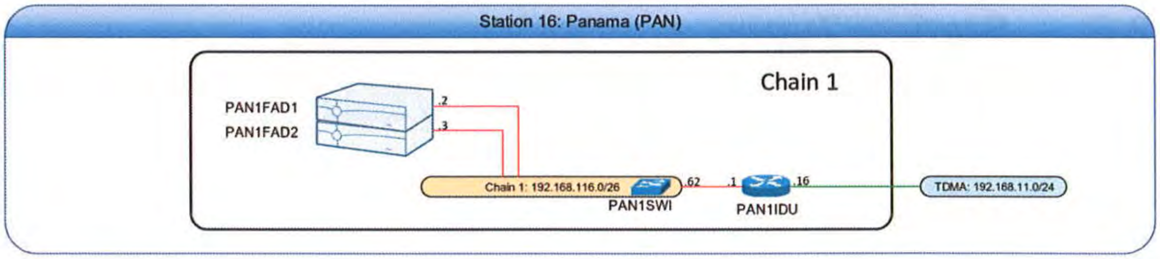


Figure 22: IP Design Panama

(18) Puerto Rico

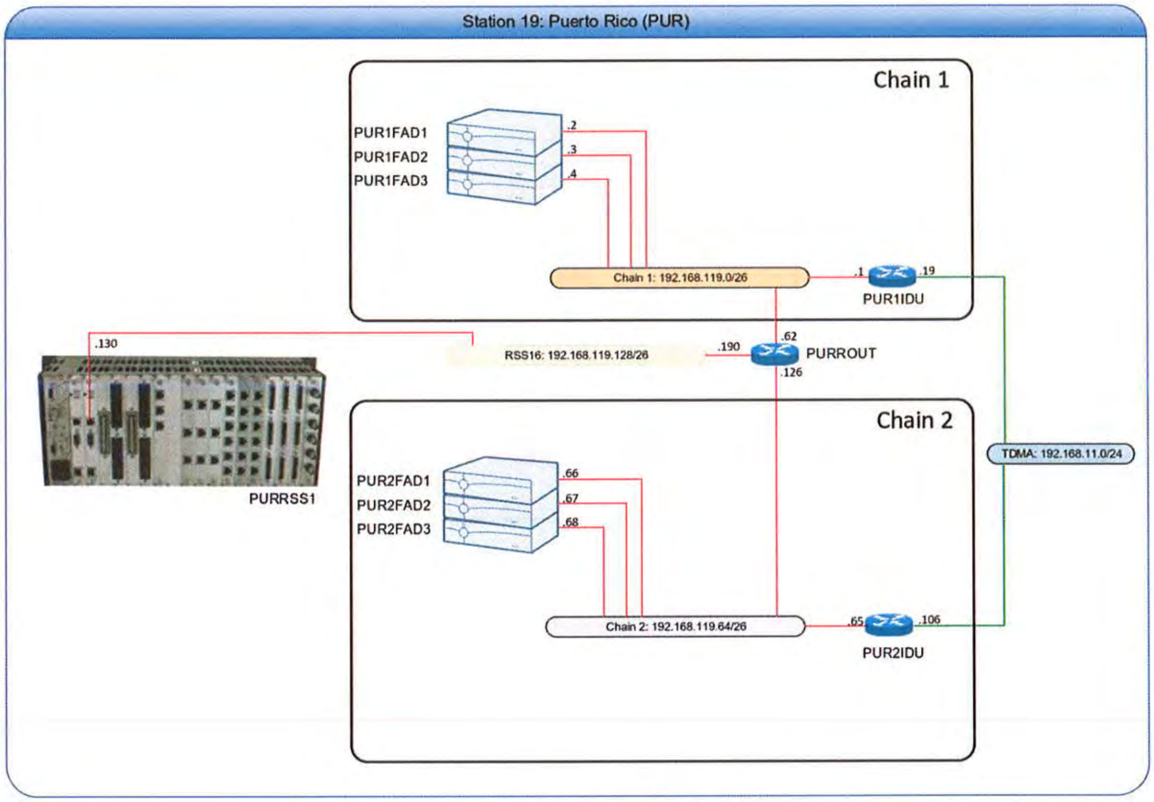


Figure 23: IP Design Puerto Rico

(19) Sint Maarten

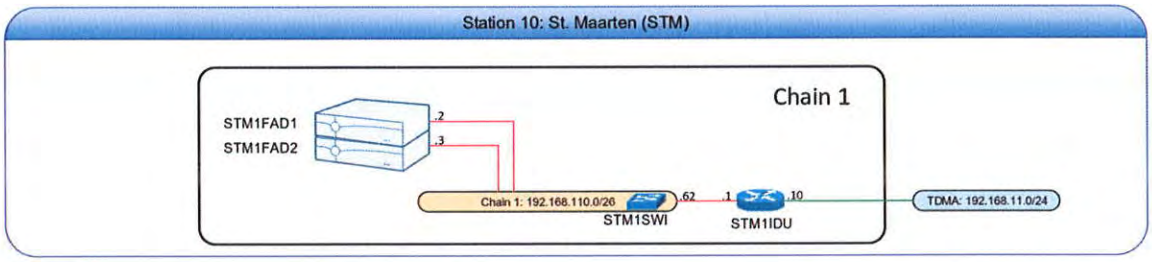


Figure 24: IP Design Sint Maarten

2.5 Station Types

(1) All MEVA III VSAT Network stations are principally consisting of

- FAD baseband equipment
- SkyWAN® modem
- Outdoor RF equipment
- Redundancy Switches (at redundant sites)

- Antenna

(2) The FAD baseband equipment provides connectivity for all required voice and data circuits and comprises one or more FAD multiplexers equipped with the necessary interface cards and, where appropriate, supplemented by FAD 8400 serial port extenders. Serial port extenders are connected to the multiplexer via LAN interfaces, whereas the multiplexers themselves are connected via serial (X.21) ports to the modem using the Frame Relay protocol for reasons explained above.

(3) The SkyWAN® modem offers up to 4 serial ports; depending on the location and the required number of multiplexers to be connected the according number of ports (between 1 and 3) will be activated.

(4) All indoor equipment is housed in professional 19" racks with 15 RUs height. The racks are preassembled in Germany prior to shipping to the respective MEVA III Network location in order to minimize on-site installation time and risk. The rack provides sufficient height to additionally accommodate a UPS for those MEVA III Network locations, where there is no other UPS available yet, as for example in Aruba according to our site survey.

(5) A patch panel provides the cabling interface between the modem and the existing inter-facility link (IFL) cables, which will be re-used.

2.5.1 Master and Backup Master Stations

(1) There are two Master Stations in the network, located at the Teleport in Miami, which hosts the Network Operation Center (NOC), and at the FAA Control Center in Atlanta, respectively. These locations have been selected as they fulfil the criteria:

- Reliable infrastructure, in particular power supply
- 24/7 maintenance available
- sufficient geographical independence not to be impacted simultaneously by the same link affecting phenomena

(2) In Atlanta the existing 3.8 meter antenna will be re-used, as well as the existing redundant RF configuration, which has only recently been procured as new. For the unlikely case, that one RF component therein fails and needs major repair, the complete configuration will be replaced by the corresponding configuration built from CPI amplifier components. These are taken from the spare part stock, which is dimensioned accordingly. The partial redundancy in the Atlanta VSAT node reflects the special importance of Atlanta as the AFTN message switching centre.

(3) The Master Station in the NOC is specifically designed and equipped for the following functions:

- Providing dial-up voice circuits to all MEVA III Network nodes for maintenance coordination.

- Initial testing of application circuits during the Site Acceptance Test after installation of a MEVA III Network station. This temporarily requires according multiplexer equipment taken from the spare part stock.
- Connecting the SkyWAN® NMS to monitor and control the network and its components.

(4) The SkyWAN® NMS is a tailored Network Management System for systems based on the SkyWAN® product family, which is used to setup and configure the system. It additionally provides the necessary software tools to perform trouble shooting, if necessary. Detailed information on the SkyNMS system and its use in the operational phase is provided in chapter 5.1.6 NMS Software "SkyNMS".

(5) After successful initial remote station tests during MEVA III VSAT Network Implementation the Master Station in the NOC will take part in the operational traffic in the sense of passing traffic through a redundant leased line to FAA Miami (apart from the maintenance coordination calls). In that sense it is an active station not only providing the TDMA frame plans as means of bandwidth allocation for the whole network in response to the bandwidth requests from the active stations.

2.5.2 Remote Stations

(1) The main difference for the Remote Stations is that they are equipped with an IDU 2570 modem, which does not have the ability to act as a TDMA control instance.

(2) For all Remote Stations the existing 3.8 (or 3.7) meter antennas will be re-used with the exception of Curacao and Panama, further details below. The existing C-Band RF components will be replaced by components of CODAN/CPI 6700 series amplifier product line, which are mounted to the feed arm with mounting kits in a similar way.

(3) The situation is different for the FAA site in Miami, where the existing 7.3m antenna will not be used further. Miami will be connected to the satellite network using redundant terrestrial T1 connections to get access via the Newcom's Teleport in Miami.

(4) All stations will be equipped with their corresponding voice and universal I/O interfaces needed to cover the needs of the bidding specifications. As baseband devices the FAD 9220, FAD 9230 and FAD 8400 units will be used. The corresponding numbers of multiplexer chassis and voice and data interface cards for each MEVA III Network location are shown in the attached network drawings.

(5) Curacao will not further use the existing antenna. COMSOFT will supply and install a new 3.8m Prodelin antenna with linear feed system based on a Non-Penetrating Mount.

(6) Panama will not further use the existing antenna due to an building relocation. COMSOFT will supply and install a new 3.8m Prodelin antenna with linear feed system based on a King Post Mount at a defined location acknowledged during the site-survey.

(7) Dominican Republic will provide a 3.8m Prodelin antenna with linear feed system on its own. COMSOFT expects the antenna to be ready for use pointed to the Intelsat 14 satellite and accepted by Intelsat (f.e. cross-pole isolation correctly done).

2.6 Key Network Elements

(1) The key system elements of the network solution are

- Satellite Router,
- Multiplexer,
- Antenna,
- Amplifier,

which will be described in the following chapters.

2.6.1 IDU 7000 Satellite Router Series

(1) The SkyWAN® IDU 7000 Satellite Router Series is a MF-TDMA modem, which includes IP Routing and Frame Relay switching capabilities. Each SkyWAN® IDU contains one Ethernet/Fast Ethernet port and up to four operational Frame Relay ports. Frame Relay Access Devices (SkyWAN® FADs or FRADs) are attached to SkyWAN®'s Frame Relay ports in an optimal way and provide a complete range of legacy protocols such as serial line interfaces, HDLC, SDLC as well as analogue and digital voice channels. The modular design provides the possibility to expand, thus gradually developing large networks.

(2) The indoor unit monitors the user interface for upcoming traffic demands, and dynamically assigns the satellite bandwidth accordingly. It uses the ND SatCom patented dynamic bandwidth assignment algorithms.

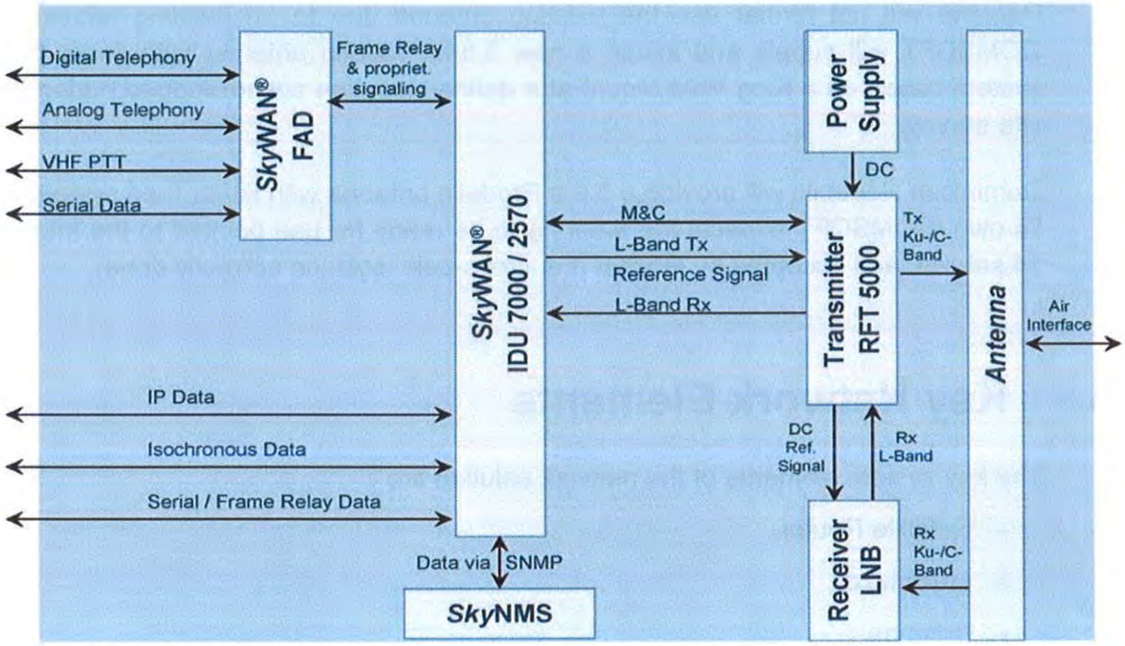


Figure 25: Architecture of Earth Station based on SkyWAN® IDU 7000 / 2570

2.6.1.1 SkyWAN® Application Performance

(1) An optimized application performance in a SkyWAN® network is granted by assigning a suitable Quality of Service (QoS) to each application.

- **Quality of Service Priorities:** SkyWAN® is able to support premium QoS to both, Frame Relay and IP services. Multiple QoS categories are available to transfer different traffic classes in an optimal way. Those traffic classes are prioritized according to the following order:

Priority Status	Description
Priority 1	Frame Relay Real Time
Priority 2	Platinum (Static IP Real Time)
Priority 3	Frame Relay Control
Priority 4	Platinum-Dynamic (Dynamic IP Real Time)
Priority 5	Titanium (IP Control Traffic)
Priority 6	Frame Relay Non-Real Time
Priority 7	Gold TCP-A (high priority IP Non-Real Time for TCP-A services)
Priority 8	Gold (high priority IP Non-Real Time)
Priority 9	Silver (medium priority IP Non-Real Time)
Priority 10	Bronze (low priority IP Non-Real Time)
Priority 11	Default (best effort IP Non-Real Time)

Table 39: Priority Classes

- **IP QoS Classes:** IP data can be classified based on their DSCPs, Source IP Address, Destination IP Address, source UDP/TCP port, destination UDP/TCP port or even wild cards can be used. Thus the network operator can offer various service levels independent of the end-user equipment capabilities which may support DSCP or not. Based on these criteria the IP packets can be handled according to the following data services:

QoS Classes	Description
Platinum	Static bandwidth allocation for IP Real Time applications
Platinum Dynamic	Dynamic bandwidth allocation for IP Real Time applications such as VoIP and IP video
Titanium	For control traffic to be able to manage the stations remote
Gold TCP-A	Non-Real Time IP service with highest priority which will be accelerated with embedded SkyWAN® TCP-A functionality
Gold	Non-Real Time IP service with highest priority for applications such as ERP
Silver	Non-Real Time IP service with medium priority for applications such as File Transfer
Bronze	Non-Real Time IP service with low priority for applications such as E-mail
Default	Non-Real Time IP service with lowest priority for applications such as HTTP access

Table 40: QoS Classes

(2) VoIP is supported with a dedicated service class called Platinum Dynamic. In this service class streaming capacity (bandwidth with no jitter) is automatically allocated in case of an IP call set-up and released at the end of the call.

2.6.1.2 Network Protocols

(1) The used networking equipment for MEVA III, i.e. the SkyWAN® modems and the FAD multiplexers represent the benchmark with regards to bandwidth and cost efficient voice and data transport over satellite. Circuit switching, X.25 and other legacy protocols as well as the IP protocol family (including TCP) are comprehensively supported, whereas the outdated ATM protocol for telecommunication infrastructure backbones is not supported.

(2) The SkyWAN® modems and the FAD multiplexers in the proposed FR operations mode do not add any significant additional delay to the inevitable delay from the signal path to the satellite and back (approximately 250 milliseconds). The processing time within the equipment is well below 100 milliseconds at any time such that a total delay of 350 milliseconds from SDP to SDP will never be exceeded.

(3) By employing Frame Relay as underlying protocol over satellite, SkyWAN® modems and the FAD multiplexers provide natural support of PVCs and SVCs and thus the

basis for other packet and circuit switched protocols. Data speeds and packet sizes are variable in a very wide range on all levels from the access interfaces to the TDMA frame structure.

(4) With regards to protocol support it is important to understand the VSAT network as a closed network, which internally works with specific technologies best adapted to the peculiarity of satellite communications, whereas external protocols are supported at the interface only. The most prominent example for this situation is TCP, which is inevitably very slow over satellite due to the necessary acknowledgements of data windows over a link with long delay. Nonetheless advanced satellite modems like SkyWAN® provide a workaround with local spoofing to achieve high data transfer speed and reproducing TCP at both ends.

(5) Therefore most common protocols are supported either directly by the SkyWAN® modem or by the FAD multiplexer as interface device; in rare cases another external interface device would be necessary.

- All listed IP protocols/features are supported by SkyWAN® with the exception of IPv6 (the extended address room is not usable in the satcom segment), which however is on the road map for the next software releases of the FAD.

Must be relased SW.

- The FAD multiplexer supports VoIP SIP, whereas H.323 did not succeed as VoIP signalling protocol as expected and will not be made available anymore for the FAD.
- SkyWAN® modems support header compression as well as TCP acceleration, details on the capabilities of these features are provided in the attached White Papers.
- RIP is supported by the FAD.
- OSPF is supported by both, the FAD and the SkyWAN® modem.
- BGP-4 can be supported via a 3rd party device.
- IGMP is supported by the FAD.

(6) The serial interfaces and protocol support for synchronous and asynchronous circuits according to a) and b) is provided completely by the FAD and partly also by the modem.

(7) List of supported protocols:

- Network

Type	Description
Network Topology	Mesh, hierarchical, star, point-to-point, satellite point-to-point/multipoint
	Automatic node discovery and rerouting with least cost metric routing

	Automatic load balancing, bandwidth on demand (over leased line), dial back-up, time-of-day connect
QoS	8 classes of service, 16 priority weights, association to 802.1p and DiffServ TOS bits Data
Sync	PPP, BDLC, HDLC, SDLC, X.25, X.25 over Frame Relay annex F/G
Legacy Sync	COP, BSC, VIP, IBM/RJE, Uniscope, Poll/Select, Siemens Nixdorf, JCA, Zengin
Frame Relay	RFC-1490, UNI-DTE, UNI-DCE
Asynchronous	ENQ/ACK, XON/XOFF, transparent

- Telephony

Type	Description
Voice Compression Algorithms (5 Channels per DSP)	ACELP-CN (8 K/6 K), LDCD (16 K), G.711, G.723.1, G.726, G.729 and G.729a
FAX Relay	Group 3 FAX, Super G3 configurable to pass through or fallback to G3, Group 4 FAX and other non-voice bearer ISDN channel at 64 K
Modem Relay	V.32bis demodulation up to 14.4kbps, STU-III secure phone, modem pass through (G.711) for other modems
Network Signalling	Transparent point-to-point and any-to-any switching, including end-to-end QSI G/ISDN
Analogue Telephony Channels	FXS - loop and ground start, forward disconnect, caller ID and local billing tone generation
	FXO - loop start, forward disconnect and caller ID detection
	E&M - immediate and wink start, custom
	Pulse, DTMF and MF tone dialling
	Voice traffic routing with alternates destinations and digits manipulation using local mapping tables, locally switched TDM calls (hairpin)

- LAN

Type	Description
	Two IP address per Ethernet Port
Ethernet Interfaces	Ethernet II and IEEE 802.2, 802.3, SNAP
Standards	IP RIP V1/V2 or Static, OSPF, NAT, IP Multicast IGMP V1/V2 PIM-DM, BootP/DHCP relay, DHCP client, IPX RIP and SAP, LLC2, 802.1p/q prioritization and VLAN, 802.1D Spanning Tree Protocol (STP), MAC Layer
Filter Criteria	Based on protocol, address (source, destination or SAP), TOS bit/DiffServ or custom filtering

- Digital Telephony

Type	Description
ISDN and QSIG T1/E1 PRI and BRI Signalling	Euro ISDN/ETSI, National and Japan
T1 Signalling	robbed bit signalling, CCS transparent, SS7 transport with idle filtering and spoofing
E1 Signalling	CAS, CCS transparent, SS7 transport with idle filtering
Digital CAS Signalling Types	Immediate, Wink, FXO, FXS, FXO ground, FXS ground, E1/R2 (compelled, semi-compelled, DTMF), PLAR, custom (9230 only)
	Mu-law or A-law Coding

2.6.1.3 Clock Management

addition of UTC for timestamping of Alarms/Troubles.

(1) The TDMA architecture of SkyWAN® includes regular exchange of synchronization information in dedicated time slots between the master and remote network stations. This avoids frequency drifts and ensures exact synchronism of time slots at all network nodes.

(2) The SkyWAN® modems use a highly accurate 10MHz internal reference source for the purpose of synchronization and frequency stability. The accuracy is better than 10^{-8} per year over all temperatures, which is more than sufficient for the desired purpose.

(3) It is important to note that the VSAT transport network is a packet switched network, which terminates all external signaling at its interfaces to other networks. This relieves the necessity of absolute synchronism.

2.6.1.4 System Software

(1) The core of the proposed VSAT System for MEVA III VSAT Network lies in the SkyWAN®'s TDMA modem technology. This technology is commercial off-the-shelf and is to a large extent based on system software. This technology is best documented in the attached System Description. There is no firmware involved at that functional level. The VSAT System becomes specific for MEVA III VSAT Network due to a customized configuration as result of the network engineering. The configuration manifests itself in a specific parameter file, which will be update whenever a configuration change becomes necessary.

(2) COMSOFT provides all MEVA III VSAT Network system components with the latest system software for each component, which represents the best available software with regards to bug fixing at the time of delivery.

add sw update plan

(3) The required software licenses are priced and included in the proposed system equipment. All such licenses are unlimited in time.

2.6.1.5 IDU 7000

(1) Basically a SkyWAN® IDU consists of a User Interface Module (UIM) and a Satellite Interface Module (SIM). The SIM of a basic IDU7000 consists of two modules:

- Modulator Board (MOD)
- Demodulator and Satellite Interface Controller Board (SIC/DEMOD).

(2) Two additional cards can be added to the IDU7000 chassis:

- To enhance the receive channel capabilities of the modem a second SIC/DEMOD board can be added.
- To activate the master functionality a Frame Plan Generator Slot Card (FPG Board) has to be used.

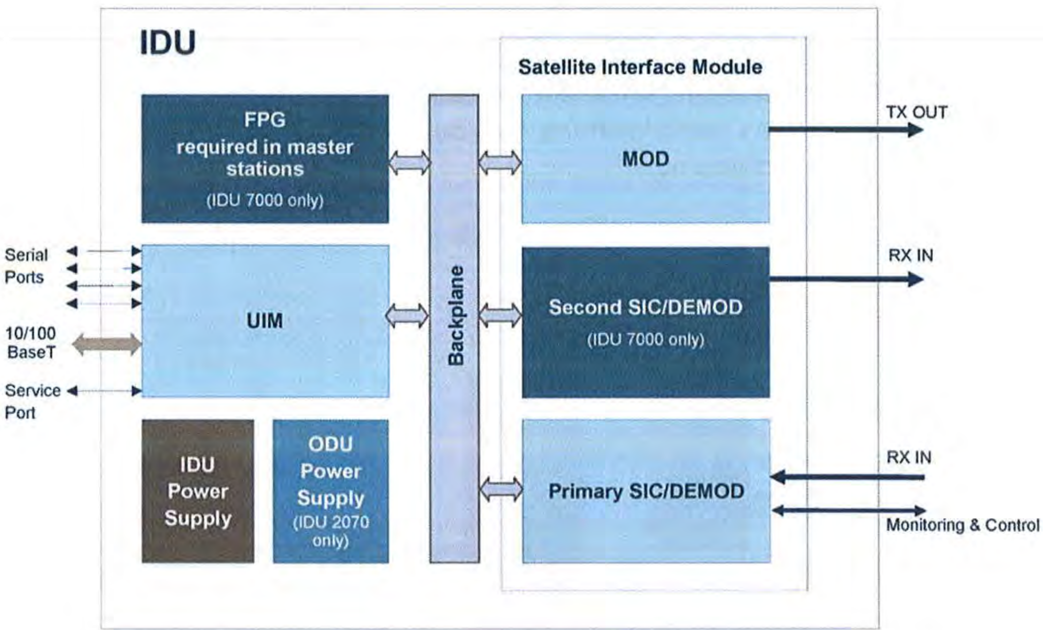


Figure 26: SkyWAN® IDU 7000 / 2570 / 2070 - Hardware Block Diagram

(3) Furthermore a SkyWAN® IDU 7000 has additional spare slots (SIC/ DEMOD 3 and4) for future extensions.

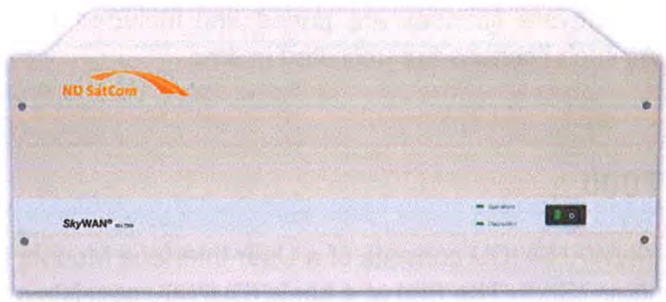


Figure 27: SkyWAN® IDU 7000 Front View

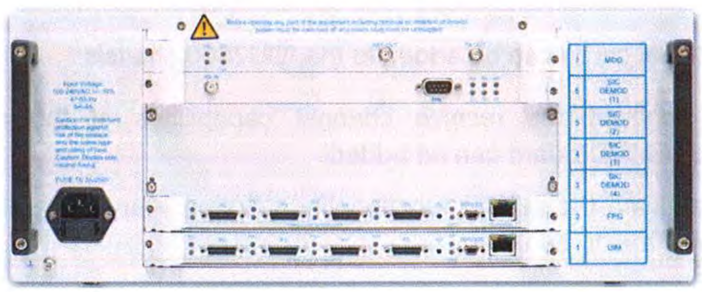


Figure 28: SkyWAN® IDU 7000 Rear View

(4) Thus SkyWAN® IDU 7000 delivers the complete feature and supports the full range of ODU combinations which are available with SkyWAN®. The IDU 7000 is linked to a BUC via the L-band interface, thus supporting broadband applications via satellite in a cost-effective way.

(5) The major components of a SkyWAN® IDU 7000 terminal are described below.

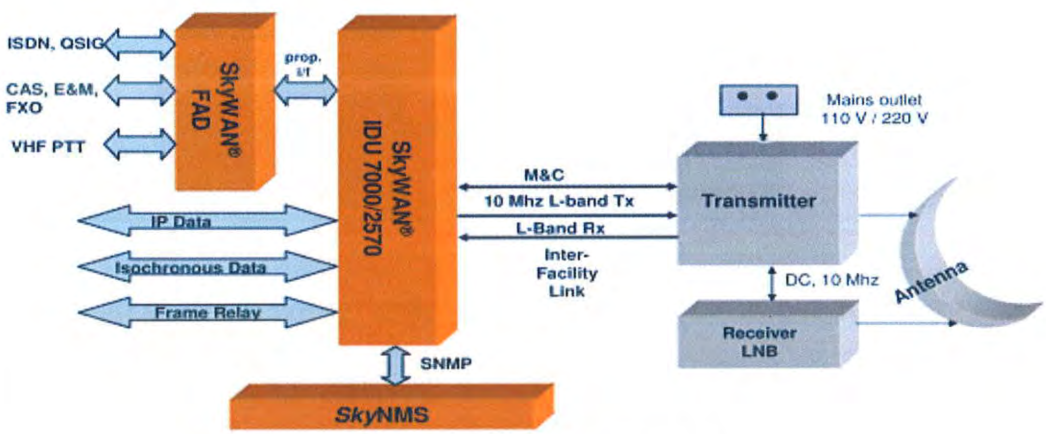


Figure 29: IDU 7000 Terminal Architecture

2.6.1.6 IDU 2570

(1) The 2U SkyWAN® is called 'SkyWAN® IDU 2570'. A SkyWAN® IDU 2570 behaves like a SkyWAN® IDU 7000 with base functionality. It is suitable for a slave station equipped with one demodulator board (SIC/DEMOD), one modulator board (MOD) and one user interface board (UIM).

Figure 30: SkyWAN® IDU 2570 Front View

Figure 31: SkyWAN® IDU 2570 Rear View

2.6.2 Redundancy Concept / Amplifier Solution

(1) Due to changes in manufacturers product range the initial offered redundancy Outdoor Units (ODU) of ND Satcom, COMSOFT will use a solution based on CODAN/CPI products.

(2) The system described in the following chapters is fully supported by the offered SkyWAN system and officially certified and announced by ND Satcom as suitable substitute of the RCU system developed by NDSatcom.

(3) The ODU redundancy consists of three main parts:

- Redundancy Controller
- CODAN amplifier (BUC)

and

- Low Noise Block converter (LNB)

2.6.2.1 Solution Description

(1) The ODU redundancy system from CPI/CODAN is a many years field proven solution.

(2) The following block diagram shows an general overview of involved components.

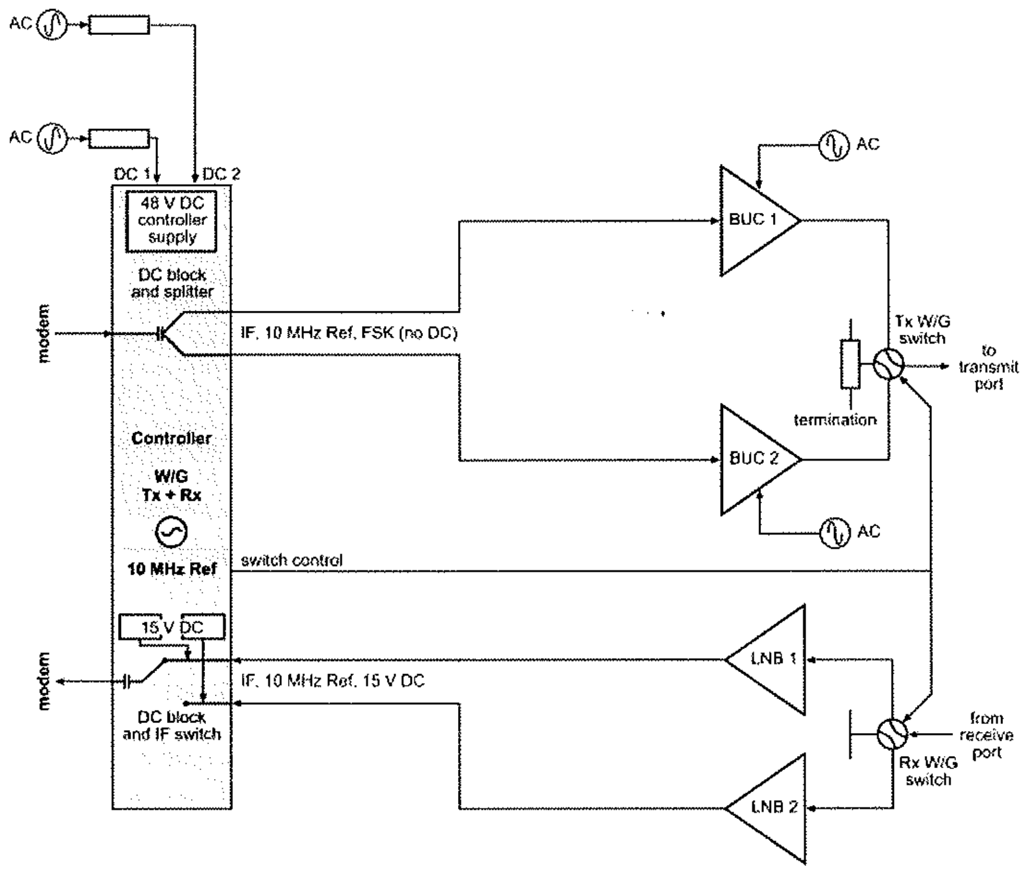


Figure 32: CODAN Redundancy ODU System

(3) To achieve highest reliability levels all BUC and LNB components responsible for network communication are duplicated in every redundant station.

(4) The offered redundancy system is designed to integrate easily with CODAN's range of BUCs which gives the benefit to have a complete solution of components perfectly matched.

(5) Simple in configuration and consisting of two BUCs, the controller, waveguide switches, cabling and LNBs.

(6) The available Warm or Hot Standby operation can be controlled automatically or manual. The manual control allows a time-to-time testing of the systems correct function during maintenance windows.

2.6.2.2 Redundancy Controller

(1) The Codan L-Band IF Transceiver Redundancy Controller 7586L is used to control two L-Band IF transceivers (BUC) in a redundancy system.

(2) For critical applications in which protection of the receive path is also a requirement, the 7586L Tx and Rx option is be used to provide BUC and LNB switching (Tx and Rx).

(3) In the offered configuration, the 7586L operates in stream redundancy mode where a fault detected in either the BUC or LNB in one stream causes switchover to the other BUC and LNB pair.

(4) When a detectable fault occurs in the on-line transceiver, and the off-line transceiver is serviceable, the redundancy controller switches over the two transceivers. The interruption to traffic is typically less than one second.

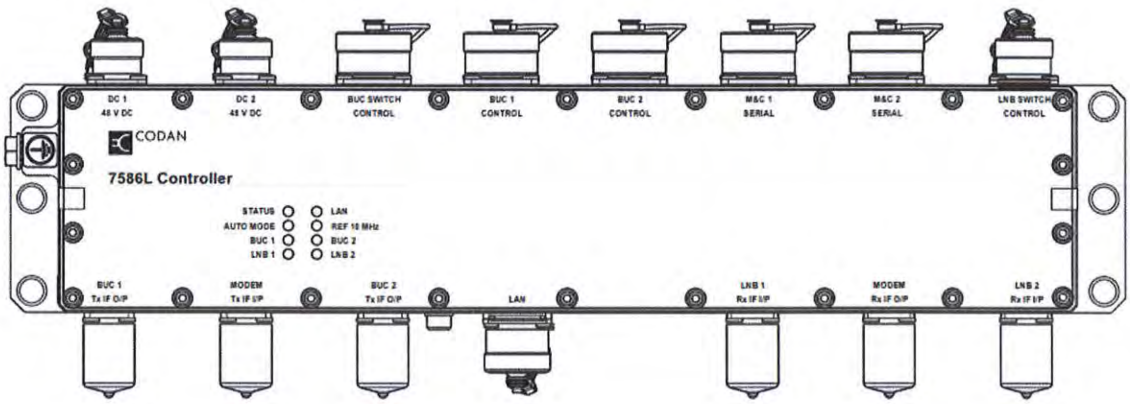


Figure 33: 7586L Controller, Tx + Rx, Tx/Rx

(5) The redundancy controller acts on RF waveguide switches to control active and stand-by path in transmit and receive direction.

Figure 34: WR137 Transmit RF W/G Switch

Figure 35: WR229 Receive RF W/G Switch

(6) The redundancy controller is fully controllable by LAN interface and can be integrated to a network control/monitoring system.

2.6.2.3 CODAN Amplifier

(1) The CPI/CODAN C-Band 6700 series BUCs are purpose-built for satcom-on-the-move customers, while also offering benefits for fixed site and offshore applications.

(2) Rugged & Reliable design of the BUC series provide MTBF figures which exceeds 100,000 hours and offers IP67 rating that provides protection from water or dust storms. The BUCs are sealed to 34 kPA (5 Psi).

(3) The BUCs are designed to be mounted on a wide range of earth station antennae.

(4) The BUC converts transmit L-Band IF signals from the modem to the required RF-Band.

Figure 36: CPI/CODAN C-Band BUCs

2.6.2.4 LNB System

(1) The LNB is a standard SATCOM block down-converter that converts C-Band downlink frequency to L-Band IF. This integrated low noise amplifier and down-converter is in a weather-proof housing for mounting at the antenna feed assembly.

(2) The LNB is phase locked to an external 10 MHz reference which makes this device suited for applications that require excellent frequency stability and low phase noise.

Figure 37: LNB C-Band

2.6.3 Frame-Relay Access Device (SkyWAN® FAD)

(1) The SkyWAN® family of VSAT networking products is complemented by two compact high performance Frame Relay Access Devices of latest technology:

- SkyWAN® FAD 9220 unit is a cost efficient solution for field offices
- SkyWAN® FAD 9230 unit is a powerful solution for branch offices

(2) Both devices provide Frame Relay concentration and switching of packetized voice as well as data from the LAN ports and/or the serial interfaces. Being specifically adapted to the ND SatCom SkyWAN® broadband VSAT system, the combination of both defines the state of the art for voice quality in packetized transmissions over satellite.

Figure 38: SkyWAN® FAD 9220/9230

(3) The SkyWAN® family of Frame Relay Access Devices is complemented by the SkyWAN® FAD 8400, a device which supports serial ports only. The SkyWAN® FAD 8400 enables its users to incrementally scale their network infrastructure as requirements for additional serial ports increase. It can be used stand alone or to extend the three serial ports of the SkyWAN® FAD 9220/9230.

(4) The SkyWAN® FAD 8400 is available in two options:

- 4 serial ports
- 8 serial ports

(5) The number of serial ports can be increased to whatever levels because multiple devices can be chained together over IP. Since the SkyWAN® FAD 8400 is an IP device with multiple connectivity options, it easily integrates into any network infrastructure.

Figure 39: SkyWAN® FAD 8400

(6) Based on Memotec's proven NetPerformer private network platform it allows for maximum network performance in low-bandwidth environments. Supporting both analogue and digital BRI/PRI telephony channels, as well as multiple T1/E1 data interfaces and serial data ports, SkyWAN® FAD is the solution to reduce network infrastructure costs and simplify WAN connections.

(7) It uses a unique technology to packetize and converge voice, data & video traffic onto a single network, and then further compresses it to minimize bandwidth requirements and reduce operating budget. All without sacrificing Quality of Service (QoS) for both voice & data applications!

(8) While supporting both VoIP and VoFR with integral voice routing plans, SkyWAN® FAD allows calls to be placed from anywhere in the ATC network to any other site. Coupled with VSAT technology capable of meshing voice communications, SkyWAN® FAD provides high quality, low bandwidth and single-hop voice communications between any two sites in the network.

(9) The auto-connect mode enables ATC hotlines and emergency communications. It automatically rings the receiving side as soon as the transmitting side handset is picked up.

(10) With this system it is possible to operate a hybrid satellite / terrestrial topology over a single platform, reducing costs and minimizing complexity.

2.6.4 Description of VSAT Antenna

(1) General Dynamics SATCOM Technologies (formerly Prodelin Corporation) is the world's largest manufacturer of Rx/Tx VSAT antennas. Having the broadest product line in the industry including Receive Only, Rx/Tx and Rural Telephony antenna systems.

(2) General Dynamics SATCOM Technologies offers nineteen antenna sizes, 47cm to 4.5M. General Dynamics SATCOM Technologies is the leader in obtaining type certifications and approvals for Intelsat, AsiaSat and Eutelsat.

(3) General Dynamics SATCOM Technologies antennas provide the best quality in the market due to the sophisticated, precision SMC compression molding process technology. General Dynamics SATCOM Technologies provides the best value antenna solution to the market with competitive prices, the highest quality products and superb engineering support.

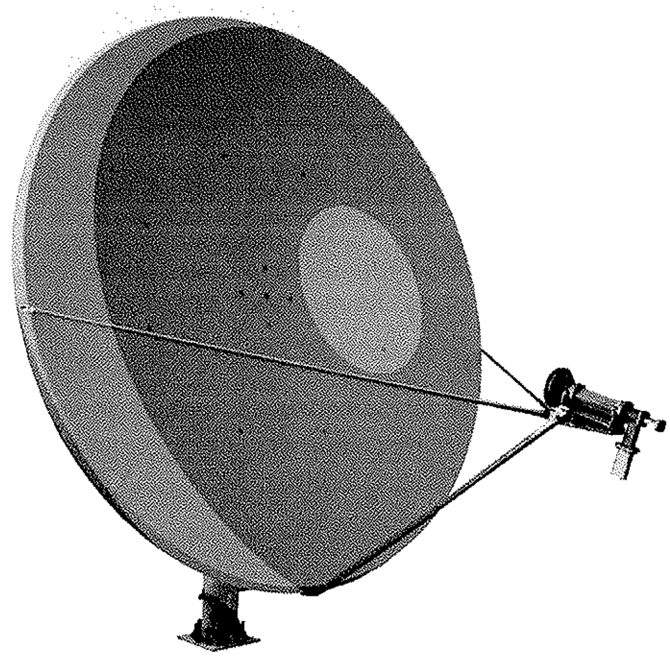


Figure 40: 3,8m 4-piece C-Band Antenna

(4) **Atmospheric Condition:** Salt, Pollutants and Contaminants as Encountered in Coastal and Industrial Area.

2.6.5 Operation in a Noisy Environment

(1) COMSOFT has installed VSAT networks in noisy environment (Radar and aircraft altimeters). Therefore COMSOFT is able to study any interferences for a new VSAT installation. Moreover the modem supplied for this project is equipped with a built-in L-Band filter that suppresses the effects of radar transmitters (developed by NDSatcom specifically for ATC networks).

(2) The specifications of this filter are given below:

- Attenuation 950 – 1750 MHz: < 2 dB
- Peak-to-peak gain flatness 950 – 1750 MHz: < 1 dB
- Peak-to-peak gain flatness in any 12 MHz band: < 0,2 dB
- Attenuation 803 – 813 MHz: > 33 dB
- Return loss 950 – 1750 MHz: > 12 dB, 50 Ohm

- Attenuation 10MHz: < 0,5dB
- Return loss 10 MHz: > 12 dB, 50 Ohm
- DC resistance IN-OUT: < 0,6 Ohm
- DC-Voltage conducted through: < 24 V
- DC current: < 500 mA
- Short circuit protected: Yes

(3) If this filter is not sufficient enough to suppress the interference, COMSOFT will install C-Band filter which will be installed between the antenna feed and the LNB. COMSOFT has successfully installed those filters in Africa where radar signals were disturbing the VSAT station.

Figure 41: Radar Elimination Filter

2.6.6 Uninterruptible Power Supply (UPS) – Aruba and Haiti

(1) The equipment comes with powers supplies with auto adjusting voltage and frequency in the required range.

(2) COMSOFT offers its standard uninterruptible powers supply proven with sensitive electronics in various local power supply environments. The proposed equipment racks provide sufficient spare space to house the UPS as well. The proposed battery sets ensure autonomy for a minimum of 1 hour.

(3) The Uninterruptible Power Supply (UPS) is designed to prevent blackouts, brownouts, sags and surges from reaching customers valuable electronic equipment. The UPS filters out small utility line fluctuations and isolates customer equipment from large disturbances by internally disconnecting from the utility line. The UPS provides continuous power from its internal battery until the utility line returns to safe levels.

Automatic Internal Bypass - Supplies utility power to the connected loads in the event of a UPS overload condition or fault.

Hot-Swappable Batteries - Ensures clean, uninterrupted power to protected equipment while batteries are being replaced.

User-Replaceable Batteries - Increases availability by allowing a trained user to perform upgrades and replacements of the batteries reducing Mean Time to Repair (MTTR).

Automatic Self-Test - Periodic battery self-test ensures early detection of a battery that needs to be replaced.

Frequency and Voltage Regulation - Gives higher application availability by correcting poor frequency and voltage conditions without using the battery.

Generator Compatible - Ensures clean, uninterrupted power to protected equipment when generator power is used.

Figure 42: Uninterruptable Power Supply (UPS)

2.6.7 Measuring Equipment and Tools – Aruba

(1) COMSOFT provides a set of useful (measuring) tools for Aruba for the potential case of repointing the antenna. This set is described in this chapter.

2.6.7.1 Portable Satellite Network Tool Kit

(1) The COMSOFT delivered satellite network tool-kit is compromising of:

- Screwdriver - Slotted 2.5 mm; Slotted 4.0mm; Slotted 5.5mm; Slotted 6.5mm
- Screwdriver - PH 0; PH 1; PH 2
- Hexagon Ball Driver Set – 1.5mm, 2mm, 2.5mm, 3mm, 4mm, 5mm, 6mm, 8mm, 10mm
- Hexagon Ball Driver Set - 3/32", 1/8", 5/32", 3/16", 7/32", 1/4",5/16",3/8"

- Hexagon Ball Driver - 7/64"
- Adjustable Spanner - 6"; 8"; 15"
- Side Cutter-Knipex 140 mm
- 1/4in Drive Metric Socket Set
- 1/2in Sq Drive Socket set
- Inclinometer
- Compass
- Measurement Cable - 2m F-F
- Adapter - N-female to N-female (bullet); N-male to N-male;; N-male to F-female; N-female to F-male; NT Connector
- DC-Block: F-female to F-male 75Ohm 5-5000 MHz
- Tool: Wrench Ncm 100

2.6.7.2 Special Diagnostic/Test Equipment

(1) The SATFINDER Fast S2 is an easy to use instrument to adjust a dish for optimized reception. The SATFINDER is microprocessor-controlled and shows the signal strength of the satellite in its LC display.

(2) Furthermore, the SATFINDER generates an acoustic signal, which increases by a better signal rate, and provides build in spectrum analyser as well as and margin test.

(3) **Key Features**

- SATTUNER with extended band 930-2250 MHz
- Detects and measures all MPEG 4HD signals and High Definition programs
- Automatic quality analysis: FAIL-MARGINAL-PASS
- Rotational encoder and numerical keyboard
- New ultra-bright graphics display
- Automatic and manual memory and Data Logger
- Weighs only 1 kg
- Up to 4 hour battery autonomy
- Battery test function to regenerate/measure battery levels and calibrate the indicator
- Supplied with soft badge for transport, mains adapter and 12 V vehicle adapter

- Free SW upgradeable on-line (USB-2 socket)

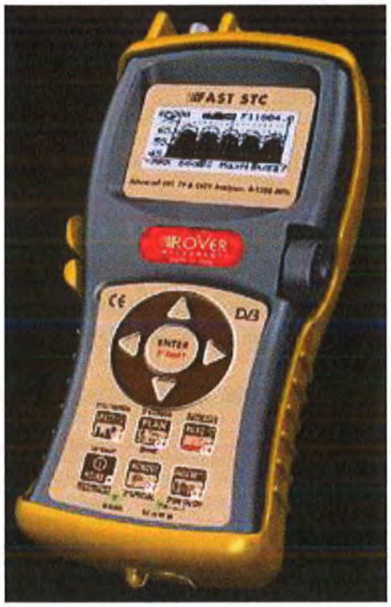


Figure 43: Satfinder Handheld

3 Operating Satellite

(1) Due to the requirement COMSOFT has chosen to use the Intelsat 14 @ 315°E satellite in C-Band, COMSOFT has done required link budget calculations in order to proof concept and system availability at 99,9%.

(2) MEVA II is served by Intelsat 14, a rather new and powerful satellite with good coverage and favourable elevation over the region and last but not least from a leading satellite operator. It is mandatory to continue with this satellite on a transponder of the American Beam with vertical co-polar polarization in order to share a common ODU at the Gateway Stations to the REDDIG network in Bogotá and Maiquetía. COMSOFT has booked the satellite capacity necessary for MEVA III on a transponder using same polarity.

(3) Accordingly the provided MEVA III VSAT Network solution is based on Intelsat IS-14 satellite capacity on this particular transponder of the current lease for MEVA II.

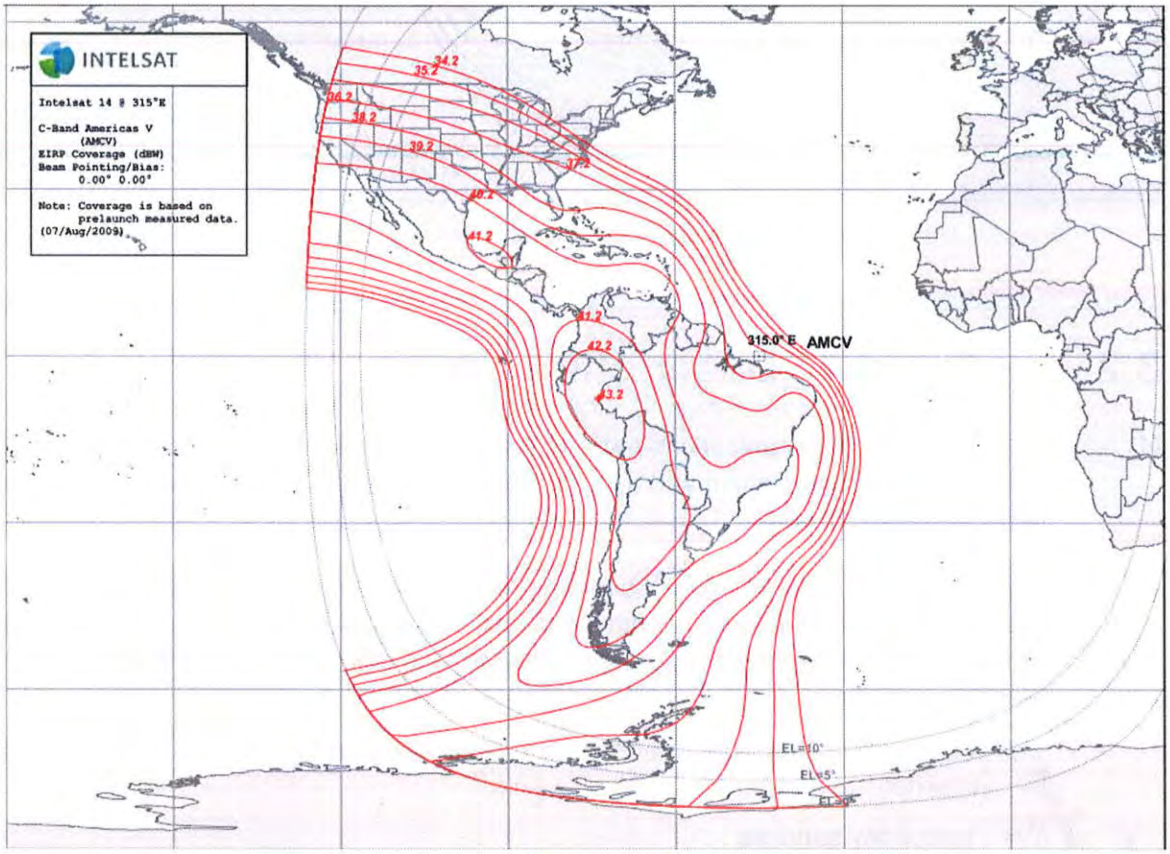


Figure 44: IS-14 C-Band Americas V - EIRP Coverage

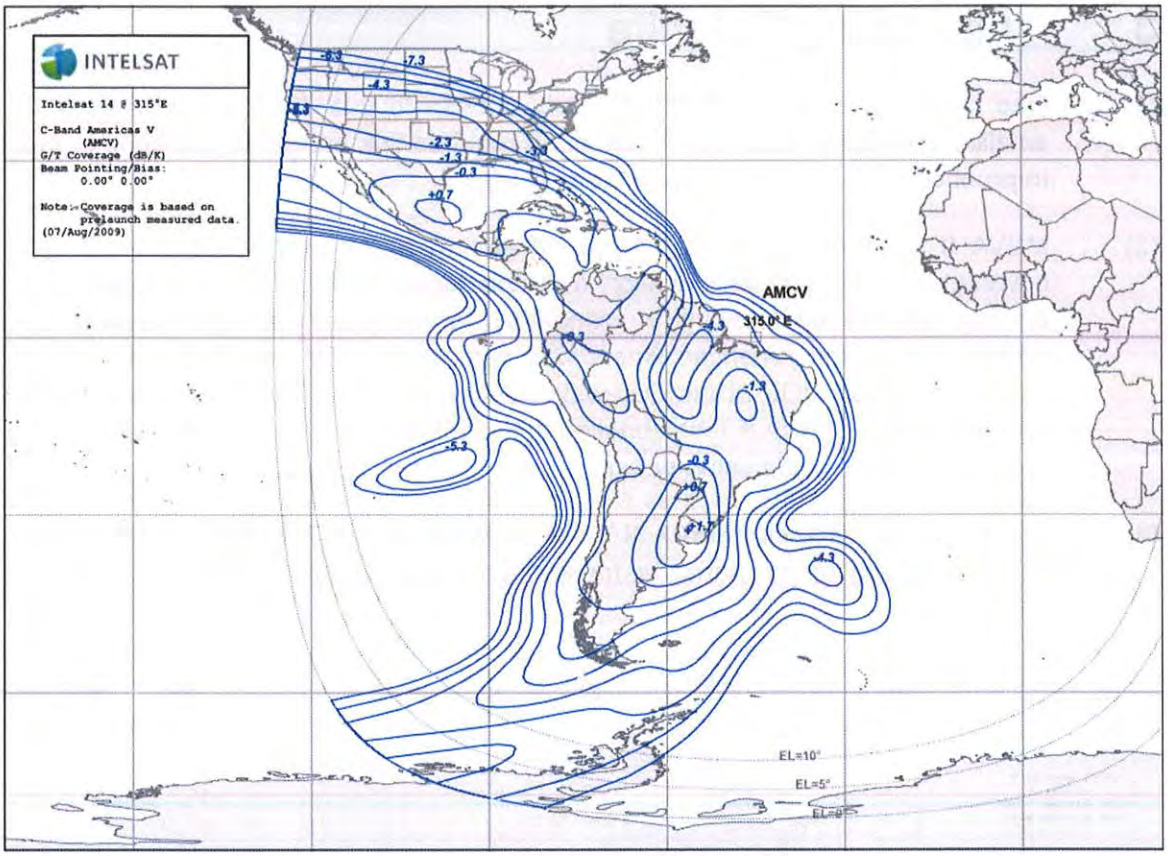


Figure 45: IS-14 C-Band Americas V - G/T Coverage

3.2 Intelsat 14 Description

(1) The Intelsat 14 communications satellite has started its services in November 2009 in the Pacific Ocean Region at 315°E. The satellite has a designed orbital maneuver life-time of over 15 years.

(2) Intelsat 14 offers Pan-American coverage, featuring a high-power C-Band beam and regional Ku-Band beams. With multiple, powerful C-Band and Ku-Band transponders and excellent look angle, Intelsat 14 is able to offer a variety of satcom services, including:

- Very Small Aperture Terminal (VSAT) communications and broadband Internet
- Telephony services
- Data trunking
- Cellular backhaul
- Direct-to-Home (DTH) TV broadcasting
- Video distribution

3.2.1 Intelsat 14 Service Areas

(1) Intelsat 14's antenna beams are optimized for maximum performance over Middle- and South America with access to Europe on a cross-strapped transponder basis. The satellite features steerable beams that enable every beam to be re-pointed toward any area within the visual earth from 315°E.

(2) The frequency bands used in Ku-Band are the FSS and BSS bands. Cross-connect channels between C-Band and Ku-Band enable flexible communication between Americas and Europe.

3.3 Link Budget and Carrier Sizing

(1) The first step in the design of complete satellite communications network is to calculate the total data rate capacity for all simultaneously active traffic. From this – by observing the traffic relations between the stations – a carrier structure can be derived which can accommodate all traffic in terms of volume and connectivity. Finally the necessary number of modulators and demodulators and, by including link budget calculation results, the size of antennas and RF amplifiers can be determined.

Add Ref Ch 3 of link budget

3.3.1 Network Capacity Calculation

(1) Based on the comprehensive information given in the Technical Specification on current and future connections and their characteristics it is in principle a straight forward exercise to calculate the required total data rate capacity of the network including the inevitable TDMA overhead. This applies to the permanent links for critical applications, which need to be always available and cannot be served by a Bandwidth-on-Demand (DAMA) connection. For the synchronous data applications among these, i.e. AFTN, Radar and AIDC, the data rate per connection is predefined and cannot be changed.

(2) For analogue speech transmissions the data rate for the codec can be selected for the best result in terms of voice quality and bandwidth consumption. According to the experience in other aeronautical networks 8kbps Comfort Noise is the best choice resulting in a data rate of 12.6kbps prior to TDMA framing. This data rate is chosen for shout-down (PAMA) as well as for dialled voice connections.

(3) There is also a significant share of links, which do not need to reserve bandwidth permanently and can thus be accommodated in demand assigned bandwidth.

(4) The proposed bandwidth allocation for the corresponding data links is as follows:

- Asynchronous AFTN: 1/3 of the nominal speed per link
- AMHS messages over IP: 1/3 of the nominal speed per link

(5) These generous provisions ensure that all such links could simultaneously carry traffic continuously at 1/3 of the nominal speed or intermittently at nominal speed for 1/3 of the time. It should be also noted that in the SkyWAN® TDMA architecture all terminals can utilize bandwidth reserved for their PAMA transmissions - whenever unused – for the transmission of other traffic. Thus it is inconceivable that there could ever be a bandwidth shortage for the more sporadic message traffic.

(6) The required bandwidth for dialled voice connections results from the specified blocking rate of less than 5% and from the information in the Q&A set 2: 0.833 Erlang, for this type of telephony, respectively 50 calls in the busy hour. Both statements are equivalent if the average call duration is 1 minute. According to the Erlang formula 3 duplex lines are required to accommodate this traffic volume with less than 5% blocking. It is assumed that potential traffic for maintenance coordination between the VSATs and the Network Operation Center may not be counted in the traffic volume quoted above. Therefore the data capacity design provides for 5 duplex channels over satellite.

(7) The chapter presents the calculation of the total capacity (including the share from the connections to the REDDIG and E/CAR network) with the following results:

Required PAMA data rate:	1.128,2 kbps
Required DAMA data rate:	434,3 kbps
Total required data rate:	1.562,5 kbps
TDMA overhead:	312,5 kbps
Information rate over satellite:	1.875,0 kbps

Data Rate	Total by Site	SWV	serial	AFTN synch 9,6kbps	Radar 9,6kbps	AIDC 16,0kbps	Remote Radio link 12,6kbps	PAMA Voice 12,6kbps	AFTN asynch 2,4kbps	AFTN asynch 9,6kbps	AHMS IP 64,0kbps	DAMA Voice 12,6kbps	Traffic Share per site	in %
Atlanta	14 A, 6B		14	13							7	1	275,2kbps	17,62%
Aruba	1A, 2D	4	1	1				2				4	39,2kbps	2,51%
Bahamas, Nassau	3A, 1D	8	4	2				1				9	41,7kbps	2,67%
Bahamas, Freeport	1A	4	1	1								5	15,1kbps	0,97%
Cayman Islands	1A, 1D, 1B	6	1	1				1			1	7	51,2kbps	3,28%
COCESNA	1A, 1B, 2R, 1S	3	2	1	1		1				1	3	56,4kbps	3,61%
Colombia	2A, 1C, 3D	7	3	2				3	1			8	66,6kbps	4,26%
Cuba	1A, 1B, 7D, E, 2R	6	4	1	2			7		1	1	7	149,2kbps	9,55%
Curaçao	1A, 1B, 1C, 4D, 1F, 1R	3	4	1	1	1		4	1		1	4	112,1kbps	7,18%
Dominican Republic	0A, 1B, 7D, 1F, 3R	6	5		3	1		5			1	7	136,8kbps	8,76%
Haïti	1A, 3D	8	1	1				3				5	52,9kbps	3,38%
Jamaica	1A, 1B, 7D, 1S, 2R	4	3	1	1		1	7			1	5	146,8kbps	9,40%
Mexico	1D, 1E	2	1					1		1		3	19,1kbps	1,22%
Panama	1A, 1C, 2D	5	2	1				2	1			6	42,2kbps	2,70%
St Maarten	1A, 1B, 2D	5	1	1	2			2			1	6	81,9kbps	5,24%
US, Puerto Rico	4D, 3R	12	1		3			4				13	93,4kbps	5,98%
US, Miami	8D, 1R	17	1		1			8				18	130,1kbps	8,33%
Venezuela	1A, 1C, 3D	3	2	1				3	1			4	52,6kbps	3,37%
Total by Site				28	14	2	2	53	4	2	14	115	1.562,5kbps	

Table 41: Total Capacity

(8) **Please Note:**

The Link Budgets were calculated with the satellite operator's input data for the satellite segment and are considered preliminary. During the final detailed network design, a second and definite verification has to be done in order to agree on the performance and operating parameters.

(9) A copy of the link budget estimate can be found in the attached document "Link Budget Calculation".

3.3.2 Amplifier Sizing & Link Budget

(1) The calculated data rate capacity for the specified traffic serves as input for the link budget analysis, in fact an information rate of 1950 kbps has been used. It is proposed to accommodate all traffic in a single TDMA carrier. This provides minimized TDMA overhead and optimized DAMA efficiency.

(2) Two different approaches can be used for the link budget calculations:

- For reference and verification purposes with regards to the space segment resource Intelsat provides its LST5 tool, which models all deteriorating effects on the link and in particular the specific intermodulation situation from other transponders and adjacent satellites. It also includes verified pattern dis/advantages in the footprint for major cities globally.
- For TDMA engineering purposes ND SatCom provides a calculation tool with the unique advantage that it allows to analyse all possible connections in a fully meshed scenario at the same time.

(3) For the objectives of this proposal, i.e.

- ensure a satellite link availability of 99.9% as a minimum,
- derive the necessary satellite capacity,
- determine the required transmit power at all MEVA III Network sites

it is sufficient to investigate the worst case scenario, which is in each case a link to Atlanta - the most disadvantaged downlink of all MEVA sites. This has been done for both,

- the transition phase, when carriers of MEVA II and MEVA III are simultaneously transmitted in a transmit power optimized configuration

  and

- the final MEVA III only phase in a bandwidth optimized configuration.

(4) The detailed analysis results are shown in the attached documentation.

(5) The key results are:

- The TDMA carrier can be modulated with 8PSK at a (Turbo PHI) coding rate ¾.
- This modulation and coding combination represents the best bandwidth consumption compromise between bandwidth limited and power limited.
- The power requirement for the SSPAs varies from site to site but does not exceed 40W at any time.

(6) For the equipment selection it is proposed to uniformly equip all locations with 40W SSPAs. This ensures some reserves for higher carrier data rates and deterioration of the satellite transponder over time or a change to another transponder which could be configured for a higher input power.

	Antenna Size (m)	Pattern Advantage Uplink (dB)	Pattern Advantage Downlink (dB)	Transmit Power (W)
Atlanta (USA)	4,6	1,3	1,1	10,5
Bogota Columbia)	3,8	3,8	5,2	5,5
Caracas (Venezuela)	3,8	3,5	4,1	6,3
COCESNA	3,8	5	4,6	5,3
Cuba	3,8	5,6	3	5,4
Dominican Rep	3,8	3,3	3,6	7,6
Haiti	3,8	4,1	3,6	6,4
Kingston (Jamaica)	3,8	4,3	3,7	6,3
Merida (Mexico)	3,8	5,3	4,6	5,3
Panama City	3,8	4,1	4,5	6,3
San Juan (Puerto Rico)	3,8	2,5	3,6	8,6

Table 42: Amplifier Sizing

Ch 8 Training Plan

4 Training

(1) COMSOFT provides training for technical staff of the MEVA III Member States. The details of this training are presented in the attached Training Plan (TRP).

(2) On-the-Job Training for first level maintenance will conducted by COMSOFT´s installation personnel on completion of the installation works and prior to the Site Acceptance Test (SAT) procedures (to be conducted in the presence of the responsible technical staff of the MEVA III Member States).

5 Operation

5.1 Network Management & Control

(1) COMSOFT´s Network Operations Center (NOC) is the place from which system engineers supervise, monitor and maintain a telecommunications network.

(2) COMSOFT provides a network operations center, a room containing visualizations of the networks that are being monitored, workstations at which the detailed status of the network can be seen, and the necessary software to manage the networks. The network operations center is the focal point for network troubleshooting, software distribution and updating, router and domain name management, performance monitoring, and coordination with affiliated networks.

(3) COMSOFT´s NOC is laid out with several rows of desks, all facing a video wall, which typically shows details of highly significant alarms, on-going incidents and general network performance; a corner of the wall is used for showing a weather channel, as this can keep the NOC engineers aware of current events which may have an impact on the network or systems they are responsible for.

(4) COMSOFT will perform systems status, health and performance monitoring and alert the responsible “Technician on Duty” in case of problems. COMSOFT will continuously be responsible for the management of all faults or performance issues on all services provided. This will include a 24-hour monitoring. COMSOFT is further responsible for logging problems with the provided services and will maintain a fault management audit trail of all activities until service restoration. Copies of these logs are made available for customer inspection upon request.

(5) The main tasks of COMSOFT´s NOC are:

- **Network Operation Center:** monitoring, control and administration of satellite-networks, Help-Desk, troubleshooting, activation of maintenance, network statistics
- **Field Service:** configuration, integration and maintenance of VSATs and networks, equipment tests, troubleshooting and analysis of problems
- **Operation of COMSOFT Backbone Network:** monitoring, control and administration of upstream networks, administration of public IPs, analysis of problems, network statistics, technical support
- **Space Segment:** negotiate with satellite providers on satellite capacity, modify and optimize usage of space capacity
- **Facility Management:** monitoring and control of Teleport infrastructure, activation of maintenance

Figure 46: Control Room View-1

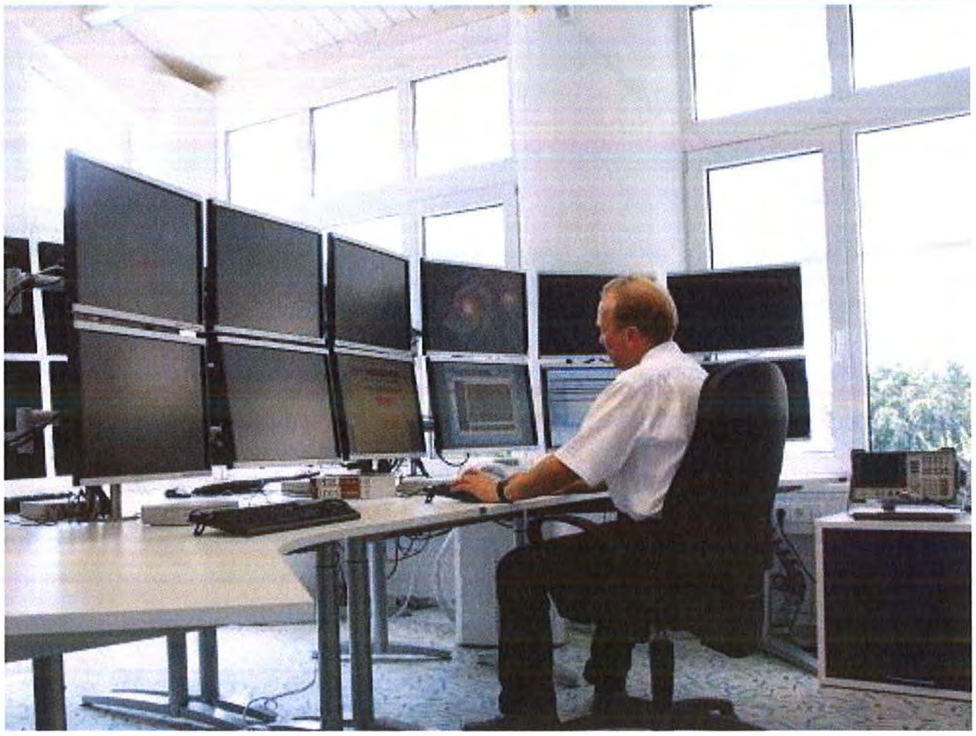


Figure 47: Control Room View-2

(6) Individual desks are assigned to a specific network, technology or area. COMSOFT system engineers using several computer monitors on their desk, with the extra monitors used for monitoring the systems or networks covered from that desk.

add main NOC in Germany

(7) COMSOFT is offering through its regional NOC in Miami a state-of-the-art infrastructure compromising of:

- Three 80kVA Load Balanced UPS units.
- 750 kVA Electric Generator with Automatic Transfer Switch capable of sustaining operations of up to 5 days without re-fuelling.
- Secure controlled access facility and CCTV surveillance.
- Divergent terrestrial network with access to 2 fiber rings from 2 different providers.
- Internet access to 3 different Tier-1 providers.

(8) Both NOC's, the main and the regional ~~local~~ NOC are interconnected using redundant paths in order to keep availability all the time as shown in the following picture:

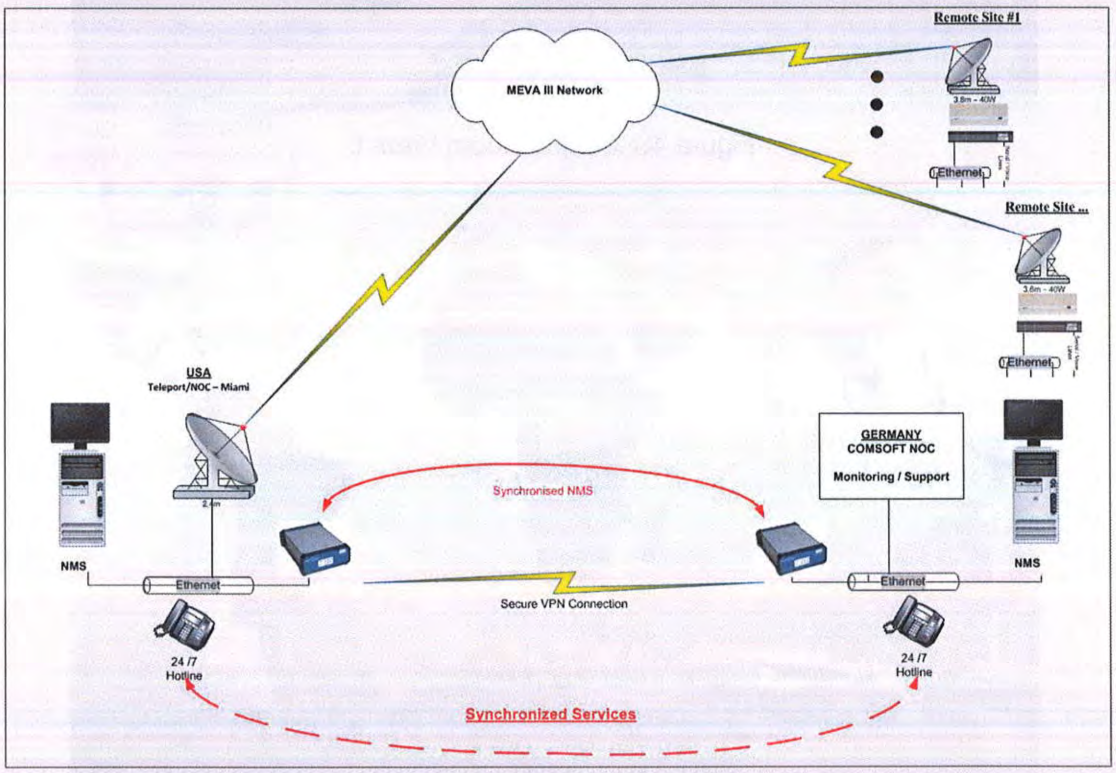


Figure 48: NOC Interconnection

(9) COMSOFT prevent unauthorized remote access connections by using access lists and encrypted interconnections of both NOC's.

(10) The Network Management consists of

- Network Management

- Network Management
- Performance Monitoring
- Alerting

- Trouble Ticketing (TT)
  - Customer Problem Reporting
  - Trouble Ticketing
  - Ticket Tracking
  - Customer FAQ

(11) In order to grant most efficient network troubleshooting to its customers, COMSOFT has established fixed Workflow Procedures as described hereafter.

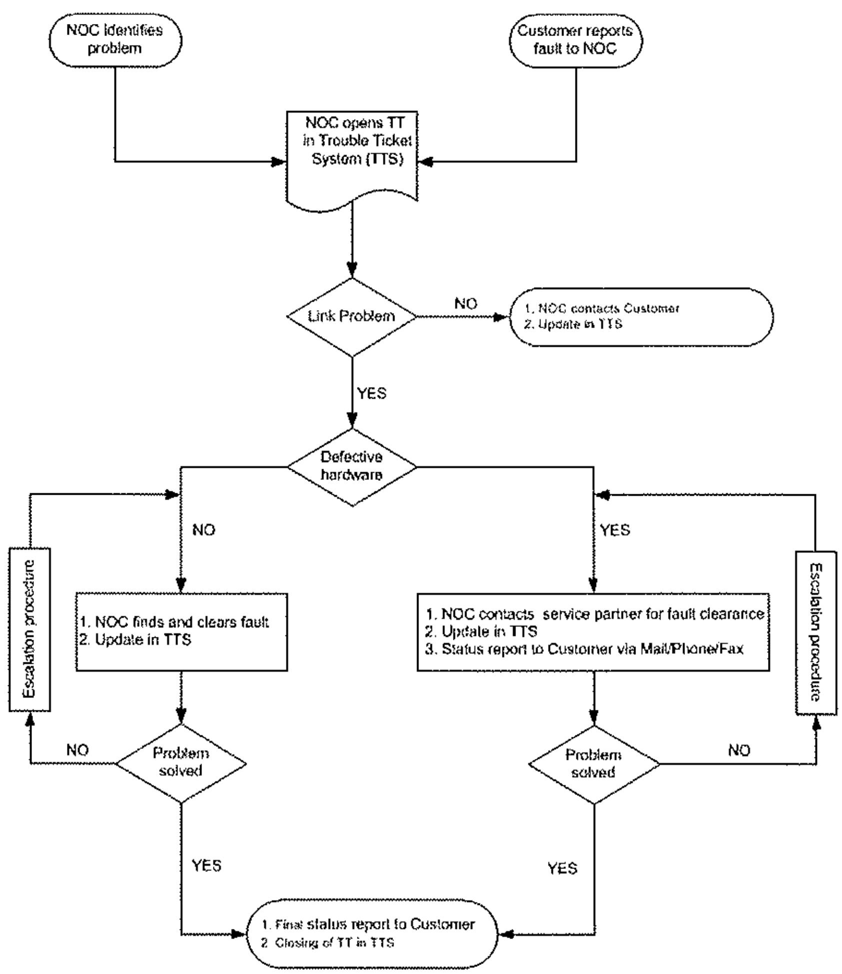


Figure 49: Fault Processing Procedure

5.1.1 Network Control & Monitoring

(1) All MEVA III Network terminals will be constantly monitored and controlled from the NOC in Miami as well sporadically from COMSOFT's Backup NOC in Germany. For this matter SkyWAN® NMS provides comprehensive possibilities to monitor and record the status of the network and its equipment components.

(2) Network and remote VSAT terminal equipment configurations can be defined with the tools of SkyWAN® NMS at the NOC and then automatically be distributed to each of the MEVA III Network terminals in the network via satellite link.

(3) The VSAT Master Station in the Teleport/NOC in Miami is equipped for internal telephony with all MEVA III Network nodes for the purpose of maintenance coordination and end-user support. For this communication the extension 2400 can be used as well as another extension to agree upon. For escalation within COMSOFT service organisation there will be another extension for the use of MEVA III Member States staff.

(4) COMSOFT's NOC in Miami is manned 24 hours on 365 days a year with skilled staff communicating in English and Spanish.

(5) The Miami Teleport, which is proposed to host the MEVA III Network Operation Center, complies to highest commercial standards with regards to resilience of power including autonomous diesel-generators. In no way could potential power issues at the Teleport affect the function of the MEVA III Network:

- firstly because the SkyWAN® network continues to run even without an active Master Station

  and

- secondly, because of automatic switchover to the Backup Master Station for continuation of Frame Plan Generation and according bandwidth allocation.

Local Monitoring from Minutes ACT 4/05

5.1.2 Network Security Management

(1) COMSOFT implements a suite of security measures to protect the network against accidental and malicious harmful acts affecting the correct function of the network. These measures will enforce the situation of MEVA III VSAT Network being a protected, private, closed and professionally managed network.

(2) The NMS for MEVA III VSAT Network will be accommodated in the secured infrastructure of the Miami Teleport. Access control and restriction works on several levels: to the compound, to the building, to the NOC room and to the NMS station, which requires password protected operator login.

Add -> Security Plan CH 9

(3) The NMS is operated in a firewall-protected infrastructure with state-of-the-art countermeasures against virus intrusion. The NMS computer itself is operated offline with in-house connection to the SkyWAN® IDU of the Teleport only.

(4) The access control policy as part of the security plan comprises several elements:

- restricted access to the equipment at MEVA III Member States installation
- a well-defined catalogue of allowed and not allowed actions for technical staff of MEVA III Member States
- access restriction within the Teleport personnel
- access to the NMS Station restricted to the dedicated MEVA III Operators

(5) The SkyWAN® NMS supports comprehensive logging capabilities for system events. COMSOFT will make use of all options for the configuration of monitoring and logging of events, which can help with troubleshooting and tracing security affecting events and actions.

(6) All relevant system information is contained in configuration files defining all system parameters on station and network level. Apart from archiving configuration files at the NOC there will always be the latest configuration file stored in the non-volatile memory of each IDU.

(7) The statements made above with regards to the NMS likewise hold for the SkyWAN® Master Station (equivalent to NCC), which will be deployed in the equipment room of the Teleport. The requirements with regards to security and access control will also be fulfilled for the Backup Master Station to be deployed at the FAA ACC in Atlanta.

(8) Key elements for achieving security to combat threats are to define mechanisms and algorithms associated with security measures such as authentication, access control, and data encryption. COMSOFT is providing telecommunications security by:

- **Physical Security**

  The component of communications security that results from all physical measures necessary to safeguard classified equipment, material, and documents from access thereto or observation thereof by unauthorized persons.

- **Access Control**

  The Access Control security dimension protects against unauthorized use of network resources. Access Control ensures that only authorized personnel or devices are allowed access to network elements, stored information, information flows, services and applications.

5.1.3 Fault Processing

(1) The NOC processes the fault in accordance with the procedure described hereafter, whereas the Customer receives a first status report on possible reasons for the fault and the initiated remedy measures within the response time. Additional status reports on the notified fault are submitted upon agreement with COMSOFT.

(2) After the fault has been remedied the TT is set to status “Problem solved”, Customer is notified accordingly and after the Customer´s consent the TT is closed.

(3) If the Customer cannot be contacted, the TT remains in status “Problem solved” until the Customer has been reached.

- Ticket Handling
  - All the NOC work will be based and registered in the Trouble Ticket System.
  - All requests must reach the NOC via the ticket system, or the NOC will create tickets for requests reaching the NOC via e-mail or phone. The NOC will make sustained efforts to have all customers use the on-line ticket system.
  - The NOC must proceed with any activation, deactivation or modification request received though the ticket system.

5.1.4 Escalations

(1) The deadlines for starting the escalation procedure in case of faults (information inquiries or adjustment requests) are according the following ranking:

Type	Description
Priority 1	Teleport or MEVA III Network location with Service Level Gold Plus cannot be reached
Priority 2	MEVA III Network location with Service Level Gold Plus has restricted service (line is bouncing (instable) / overloaded)
Priority 3	N/A
Priority 4	Information inquiries, requests for adjustments

Need clarification

(2) The **escalation** steps are defined as follows:

- NOC
- Operation Manager
- Head of Business Unit

- Management

(3) In case a fault cannot be solved within the times indicated in the table shown below, shall automatically be escalated accordingly.

	Priority 1 Fault	Priority 2 Fault	Priority 3 Fault	Priority 4 Information inquiries Requests for adjustments
NOC	Immediately	Immediately	Immediately	Immediately
Operational Manager	Immediately	8 hours	24 hours	3 days
Head of Business Unit	2 hours	12 hours	48 hours	./.
Management	8 hours	24 hours	./.	./.

Figure 50: Escalation Procedure

5.1.5 Trouble Ticket System

(1) COMSOFT provided Trouble Ticket System will allow MEVA III Member States to assign tickets to incoming queries and track further communications about them. It is a means of managing incoming inquiries, complaints, support requests, defect reports, and other communications.

5.1.5.1 General Overview

(1) Every ticket generated by the system has persistence or "history" showing what happened to the ticket within its life cycle. The Trouble Ticket System has the ability to merge multiple requests about the same incident, thus making it possible to work on an incident rather than on singular requests.

(2) The Trouble Ticket System is a multiuser system which means that multiple NOC engineers – Americas and German - may work simultaneously on the tickets, reading the incoming messages, bringing them in order, and answering them.

(3) The Trouble Ticket System offers a dashboard-like view on all escalated, reminder, new and open tickets of a specific customer company. All customer users and their individual ticket count are also displayed.

- All tickets from a specific customer company at one glance
- A perfect overview of all customer users and their tickets
- Faster ticket creation with shortcuts
- IPhone App / Android App available
- Multi-Language Support
- Multi-client customer service capability
- WYSIWYG editor for formatting and integrating pictures

5.1.5.2 Personalized Features

(1) This chapter describes outstanding features of the Trouble Ticket System.

- Mobile App
- Language Support
- Web Interface

email systems description

(2) Beneficial of the self-service for the end-user of MEVA III VSAT Network are

- Structured collection and tracking of incidents via customer web front-end,
- Transparent process progress and status of incidents,
- Listing of all incidents in a client‘s organization,
- End-user access to select content from the knowledge base.

5.1.5.2.1 Mobile App Support

(1) The free of cost available app empowers mobile workers to solve business problems even at the time of a journey. With the app COMSOFT is offering MEVA III Member States a 24/7 mobile access without using a desktop. The app is allowing MEVA III Member States to establish new tickets, get information about processing of tickets and actual status. The app is available for Apple based and Android devices.

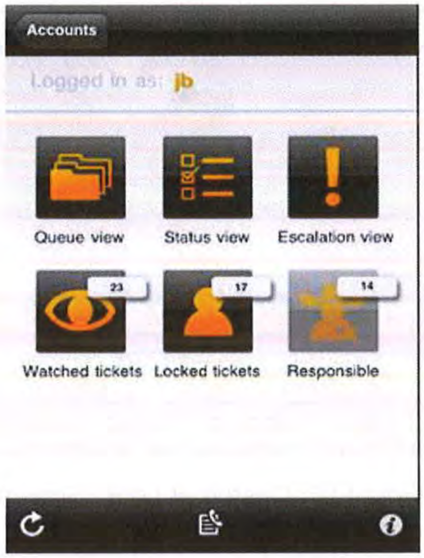


Figure 51: Mobile App

5.1.5.2.2 Language Support

(1) Trouble Ticket System offers multi-language support for its web interface, there are 27 languages available. Each authorized MEVA III Member States / Support Engineer can select his favour and personalize the interface to his flavour.

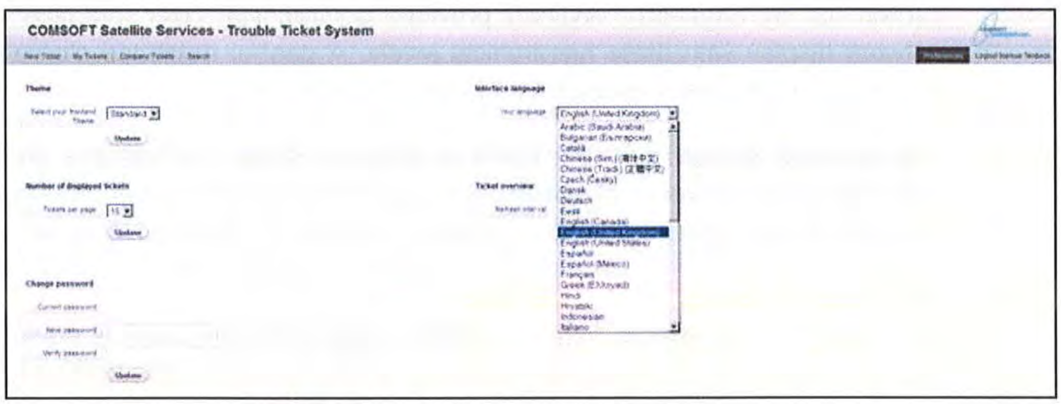


Figure 52: Customer Preferences

5.1.5.2.3 Web Interface

(1) MEVA III Member States will have a separate web interface in the Trouble Ticket System through which they can create new accounts, change their account settings, create and edit tickets, get an overview on tickets that they have created, etc.

(2) Continuing the above example, the customer login screen can be reached by using the URL https://noc.comsoft-sat.com/otrs2 with a web browser (see Figure below).

add reference on Trouble Ticket System web Interface ~~add description of use of web site~~

Figure 53: Customer Login Screen

5.1.6 NMS Software "SkyNMS"

(1) SkyNMS is the SkyWAN® Network Management System (NMS) and resides on a professional Windows XP PC, which is connected via an Ethernet connection to one SkyWAN® station. It is delivered by COMSOFT as a turnkey system, configured for the respective MEVA III VSAT Network. SkyNMS configures and monitors all SkyWAN® stations in the network. Traffic statistics, fault management, software and configuration management, user administration and license key management are carried out by SkyNMS. SkyNMS provides a Graphical User Interface (GUI) for network display with three hierarchical levels. A central database stores all event and alarms to enable diagnostics and alarm management.

(2) The SkyNMS is based on the standard protocol SNMP, an industry standard for communication between a Network Manager (software) and agent processes within the network components, in this case in the stations of a SkyWAN® network.

(3) The NMS is connected to any SkyWAN® station chosen at MEVA III TMG´s discretion. The network is fully operational even when the NMS is down. When a station is switched on, the system software is automatically executed and the agent is activated. A station is automatically included into the network and can stop operation at any time without disturbing the rest of the network. A new station can start operation at any time in a running network.

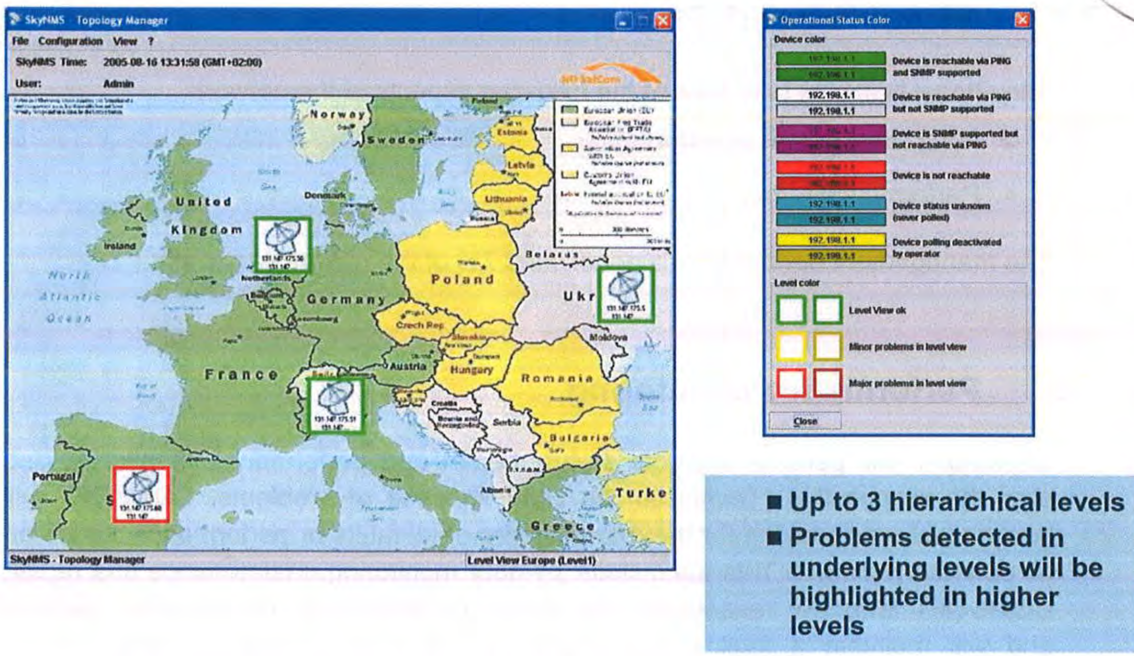


Figure 54: GUI of SkyNMS

(4) SkyNMS provides several main applications.

5.1.7 Global Network Management

(1) COMSOFT's Global Network Management System will allow the operator to have the full control over the network and its components. The operator will not only see what is happening in the network, he will also be able to react immediately to unwanted or unexpected situations.

Figure 55: Global NMS

5.1.7.1 Global Network Status

(1) The Global NMS will take care of the following aspects of the network:

- Fault Recognition and Reporting
- Performance Monitoring

(2) The management bandwidth will not exceed 7% of the overall bandwidth.

5.1.7.2 Performance Monitoring

(1) COMSOFT will perform systems status, health and performance monitoring and alert the responsible "Technician on Duty" in case of problems. COMSOFT will continuously responsible for the management of all faults or performance issues on all services provided. This will include 24-hour monitoring, maintenance and repair. COMSOFT is further responsible for logging problems with the provided services and will maintain a fault management audit trail of all activities until service restoration. Copies of these logs are made available for Customer inspection upon request.

(2) COMSOFT maintains a secure web interface with access rights for access to near real-time information about the status of the installed services and for operations using service/incident trouble tickets. The link tracking software will show:

add MEVA user to have access.

5.1.7.3 Traffic Statistics

(1) Appropriate software like MRTG, Netflow or Cricket will be appointed to keep track on the link volume measurement and number of packets transferred. These software parts are actually in use by COMSOFT to monitor customer links. The created graphs represent the traffic on the monitored network connection. These graphs are embedded into web pages which can be viewed from any modern web-browser via the internet. In addition to a detailed daily view, they will also create visual representations of the traffic seen during the last seven days, the last five weeks and the last twelve months or different intervals as needed.

Web Presentation example, Volume:

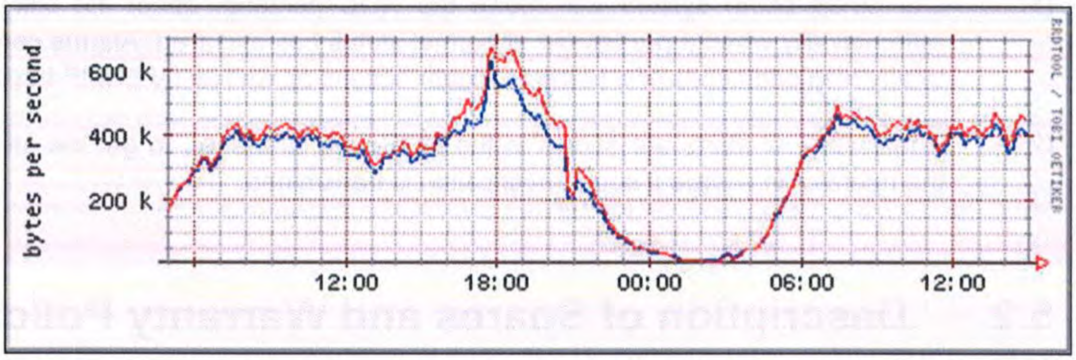


Figure 56: Detailed User Traffic Statistics

5.1.7.4 Ping Statistics

(1) A deluxe latency measurement tool will be used to complete the service information for the link. It can measure, store and display latency, latency distribution and packet loss. It stores the data to maintain a long-term data-store and to draw graphs, giving up to the minute information on the state of each network connection.

Web Presentation example, Latency:

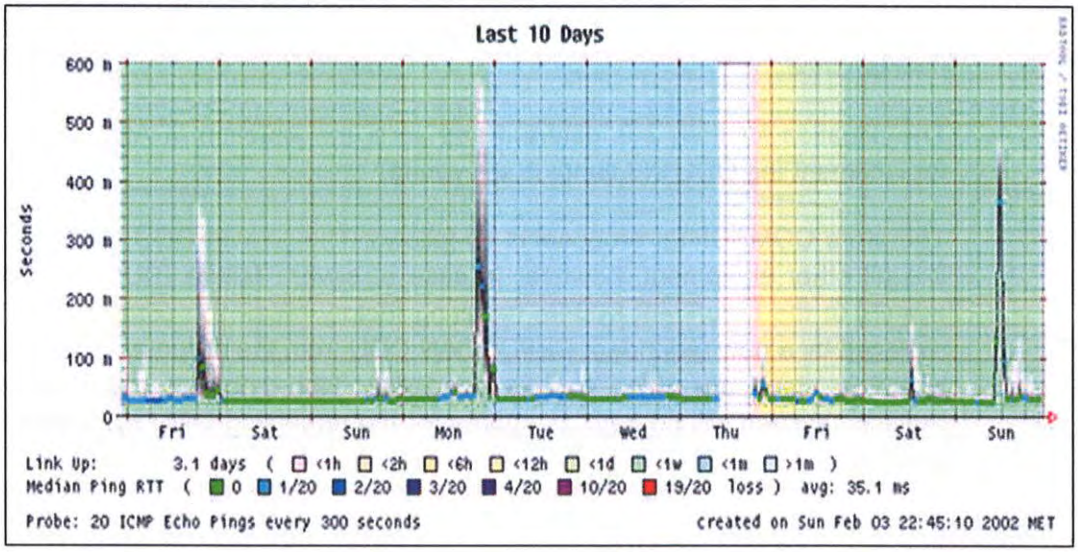


Figure 57: Detailed User Ping Statistic

5.1.7.5 Alerting

(1) Our smart alarm system will inform the NOC personal about the link situation automatically when a predefined abnormal status has occurred. Alarms can be sent to any mail addresses or a pager to trigger actions as well as by SNMP traps.

(2) Additionally all alerts are shown in the NMS web interface. To get the attention of the operator in charge a sound notification is transmitted.

5.2 Description of Spares and Warranty Policies

5.2.1 Equipment Considerations & Maintenance

(1) COMSOFT will replace most MEVA II equipment for technical and/or ownership reasons. What remains for re-use is the following:

- (1) all antenna systems (excl. Dominican Republic, Panama, Caracas, Miami)
- (2) the IDU - ODU cabling
- (3) the redundant RF configuration in Atlanta

(2) With regards to the requested practical plan for maintenance and repair items 1 and 2 do not need much attention other than the proposed annual preventive maintenance.

(3) The situation for item 3 is different and so is the situation in Atlanta: After recent replacement the ODU in Atlanta is still young.

(4) Therefore COMSOFT's proposal is as follows: The Atlanta ODU will be maintained like all other equipment, however in case of severe failure (BUC or Redundancy Switch) in the redundant system requiring factory repair the complete ODU will be replaced by a new redundant CPI/CODAN ODU from the proposed spare part stock, which is sized according to this possibility. Non-defective components of the replaced system will be kept as spares for the remaining ODU system at the other location.

5.2.2 Corrective Maintenance

(1) COMSOFT has investigated the Corrective Maintenance options for all MEVA III Network sites under the aspects of SLA requirements, staff and spare availability and travel times. The respective actions are described in the contracted SLA.

5.2.3 Preventive Maintenance

(1) Preventive Maintenance in the understanding of COMSOFT comprises of two main activities:

- Continuous proactive monitoring of the network and its VSAT equipment in order to uncover potential service quality affecting issues at an early stage.
- Regular ~~scheduled~~ annual site visits of all VSAT stations in order to ensure the optimum mechanical and electrical state of the complete VSAT station and detect any deterioration or potential problem early.

To be modified.

(2) The first part is ~~cost wise~~ covered by the general Service Charges, whereas the second part is offered as annual preventive maintenance site visit. These visits follow a plan, which consists of

- a time schedule stipulated with MEVA III TMG and the Member States

  and

- standardized procedures for the tasks to be executed according to manufacturer routines and the according documentation.

(3) The activities and checkpoints being part of the site visits are the following:

- LNB, BUC and Redundancy Switch Testing
- Cable Inspection - Inspection & Repair
- Re-sealed Connectors
- Electrical Grounding - Inspection & Repair
- Reflector Inspection
- Antenna Pointing – Repoint
- Jack Screw - Greasing
- Pedestal & Support Structure - Inspection, Clean/paint
- Isolation and 1 dB Compression Routines
- Proper Overall Operation and Cleanliness

(4) As part of COMSOFT's continuous care for the MEVA III Network system all documentation with regards to the system, the equipment, the software, the configuration and its implementation (including the as-built documentation) will be updated whenever there have been changes.

Add local Partner description

5.2.4 Spares Provisioning Requirements

(1) ~~COMSOFT's commercial proposal shows a detailed list of equipment and its cost for each VSAT station and the proposed spares necessary to achieve the required~~

Rewrite

availability standard. It should however be noted that the majority of the spares is held in a central pool at the Miami NOC.

(2) COMSOFT has understood the special situation in the region and the challenge to establish spare part logistics, which deliver shortest repair times and minimum cost at the same time. Therefore we are prepared to consider alternative arrangements in discussion with the MEVA III Member States regarding the purchase of local spares, as long as the overall spare part logistics is not negatively affected. The price proposal shows as an example of a complete spare part list for Cuba, which has been selected in this context due to potential delays with equipment transport and on site repair.

(3) As the common pool of spares is stored at the Network Operation Center in Miami, the shipment to any MEVA III Network location can benefit from daily scheduled flights out of Miami Airport. In each case of on-site repair requiring a spare from the pool the NOC will decide on the fastest and most efficient way of spare shipment. This can be

- by courier service

  or

- as checked-in or hand luggage of the traveling field service engineer.

Rewrite.

(4) The decision will in particular take into account local customs procedures.

5.3 Service Management

include warranty policies

5.3.1 General

(1) As COMSOFT is providing an end-to-end-solution to MEVA III TMG, COMSOFT will retain management and financial responsibility for the effective operation and maintenance of the network during the installation phase. COMSOFT project management team will work closely with the Network Operation Centre (NOC) and MEVA III Member States to ensure that problems are handled swiftly and accurately. As such, following the attempted fault resolution via remote access, COMSOFT will inform MEVA III Member States, to dispatch a qualified engineer to repair or replace equipment at the remote terminal.

Add 5.3.2 of proposal maintenance 24 hr time etc

5.3.2 Communication Flow

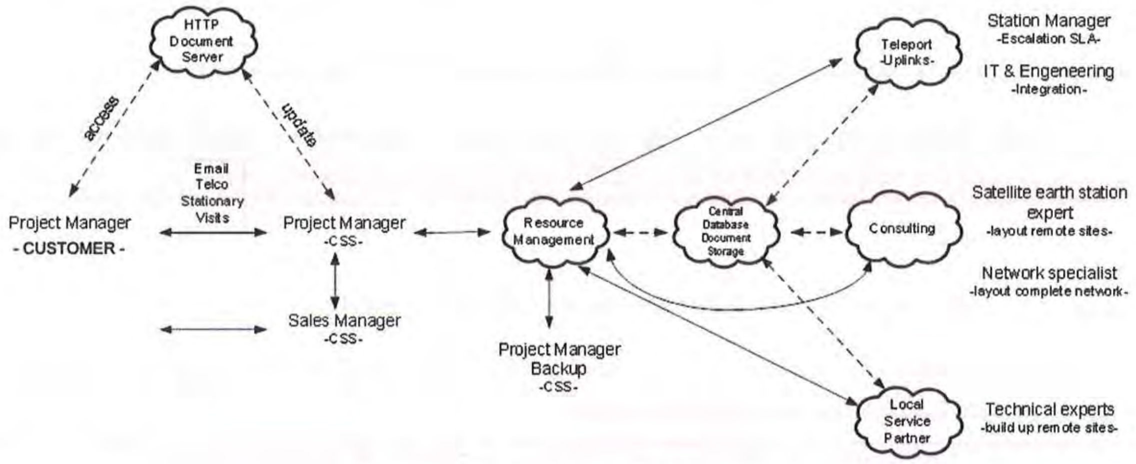


Figure 58: Communication Flow

5.4 Regulatory Issues & VSAT Licenses

(1) To operate a VSAT network in the MEVA III region / countries, usually licenses are required from the relevant authorities.

(2) COMSOFT will undertake all reasonable efforts to obtain the licenses from the regulatory authorities required for the lawful operation of the MEVA III VSAT Network and its earth stations in the respective countries. COMSOFT will bear all costs involved for the acquisition of such license and for related recurring fees as far as the costs are exclusively related to MEVA III TMG.

(3) With regards to the license acquisition process COMSOFT's assessment of the situation is as follows:

- A principal difficulty to attain the license(s) is not to be expected as all sites in operation now are supposed to have been granted the license already.
- COMSOFT's cooperation with NewCom and its VSAT partners ensures the ready availability of the VSAT network operating license for 8 MEVA locations.
- The paperwork related to attain the license for the same earth station under a different network operator or with slightly changed technical parameters is straightforward.
- The process may require the support by the MEVA III Member States as user of the earth station and as owner of the ground. In such case COMSOFT will appreciate the timely help.

(4) From the site surveys conducted by COMSOFT and from the scope of work we are under the impression that there is no need for civil works or changes to the power

supply, which would require an official permit (other than the permission from the owner of the building).

5.5 Site Survey and Standard Installation

(1) All related local field services (e.g. site survey, installation, maintenance), will be under the responsibility of COMSOFT and its regional partner NewCom.

5.5.1 Standard Installation and Commission

(1) All installation work and commissioning of the complete VSAT terminal and network will be carried out in accordance with:

- Regulations and laws in every involved MEVA III Member States
- ICAO standards
- Current safety requirements
- Established and agreed procedures
- The guidelines and instructions given by the manuals of the manufacturer and/or ICAO/MEVA III Member States for the VSAT Terminal and Earth Station Equipment

(2) Standard VSAT implementation will include the following installation as defined in the COMSOFT Service Level Agreement (SLA):

- Outdoor Unit (ODU) – Antenna, BUC, LNB
- Indoor Unit (IDU) – Modem, Multiplexer, (if applied)
- Interface to the Customer equipment, max 50cm cable way
- Remote Control System (if applied)
- IDU/ODU Facility Cable run of 70 meters of less (Belden H126 DB+, or compatible / standard power cable)
- Local Power Connectors, 3 meters for the IDU
- Authorized COMSOFT / NewCom personnel will assist specific MEVA III Member States in the application testing and performing the handover of the service to MEVA III TMG.
- COMSOFT / NewCom will prepare an "Installation and Commissioning Report" certifying the successful completion of the installation and commissioning, signed by the representatives of COMSOFT / NewCom and MEVA III TMG, and submit same MEVA III TMG / ICAO following the commissioning and MEVA III TMG handover.

5.5.2 Wiring & Grounding

(1) The installation through COMSOFT will be done by experienced and certified field engineers according to best industry practice, which includes the required measures for cabling.

(2) All electrical systems, equipment, and metal devices will be connected and grounded as far as compatible with the instructions of the respective manufacturer.

(3) The provided equipment will be grounded as far as intended by the respective equipment manufacturer.

Add Ref. to wiring (CH 4)

5.5.3 Equipment Protection

(1) The equipment proposed by COMSOFT is rugged and proven for the use in harsh environment as far as outdoor equipment is concerned. In conjunction with careful installation it is ensured the system is protected against damages caused by humidity, high and low environmental temperatures, dust, insects, corrosive fumes, salty atmospheres water intrusion and overvoltage induced by lightning.

(2) Environmental Standards

- Operating Temperature: 0° to 50°C / 32° to 113°F
- Storage Temperature: -20º to 65ºC / -4° to 149°F
- Relative Humidity: 0% to 95%, non-condensing
- Altitude: Up to 3000 m above sea level
- Power Supply IDU: Auto sensing 100 – 240 V +/- 10% / input frequency 47 – 63 Hz

5.5.3.2 Transition Plan

(1) COMSOFT has prepared a transition plan with a detailed description of the migration steps from MEVA II to MEVA III and the respective implications. This plan is attached to this SDD Document. The corresponding activities and milestones are also shown in the implementation schedule. (CH 7) (CH 6)

5.5.3.3 Deliverable Reports

(1) COMSOFT keeps a detailed network performance track record in its databases. As a natural, COMSOFT reports monthly the network performance figures.

(2) The detailed report consists of an executive summary, summarizing at a glance the network and site performance and reached SLA figures. By standard the report is split in different sections to address different readers concern

- Executive Summary
- Graphical Study of key performance indicators per site
- Graphical Study of key performance indicators per network
- Non availability reports and solutions
- Lessons learned

→ (CH 10 reporte template)

5.5.4 Acceptance Test

(1) The hand-over of the VSAT system to MEVA III TMG shall take place in accordance to an acceptance test that will be conducted with the current customer equipment. An acceptance protocol will be filled out and signed by the MEVA III TMG representative and the installation team.

5.5.4.1 Factory Acceptance Test (FAT)

(1) COMSOFT will provide Factory Acceptance Test procedures for approval by MEVA III TMG. The procedures will prepared as part of the system engineering works after approval of the SDD and will be in the form of the attached example FAT. All described tests have a clearly defined scenario and a well-defined expected result, such that each test is either passed or not. The objective of the FAT is to test functions of the complete MEVA III Network system in a complete equipment configuration, i.e. with all IDUs and FADS. Therefore the FAT primarily tests the System Engineering for correctness, whereas it (only) provides sufficient evidence for the proper function of the equipment. (It should be noted that a test of such high tech equipment against the manufacturer specification generally is beyond the means of any system integrator like COMSOFT.) The tests will not be limited to typical elementary VSAT test procedures but rather include the establishment of dialled and hotline phone calls and the transfer of AFTN/AHMS messages in COMSOFT's test environment.

(2) The project schedule takes into account that equipment for MEVA III TMG is only shipped after successful FAT. The plan also takes into account that MEVA III TMG may want to attend the FAT. The conduction of the FAT with all prepared procedures will not change, whether it is with or without attendance of the customer.

Add Reference to CH 11

5.5.4.2 Site Acceptance Test (SAT)

(1) COMSOFT will provide site acceptance test procedures for approval by MEVA III TMG. The procedures will prepared as part of the system engineering works after approval of the SDD and will be in the form of the attached example SAT. All described tests have a clearly defined scenario and a well-defined expected result, such that each test is either passed or not. It is COMSOFT's objective to achieve through the SAT the highest level of confidence that the system will flawlessly work after the switch over of services. Therefore the tests will not be limited to the typical VSAT Site Acceptance Procedures verifying the correct antenna pointing and a ping to the Hub. COMSOFT will rather run a significant subset of procedures from the FAT as far as feasible with the equipment available for and during these tests.

(2) According to the proposed Transition Plan all MEVA III Network terminals will be installed and tested parallel to the operational MEVA II. Each installation of a new MEVA III Network terminal is only completed with successful Site Acceptance Test and no switching of services will be done before all MEVA III Network terminals have been accepted.

NAT Add Reference to Chap 11.

5.5.5 Local Field Service

(1) COMSOFT will cooperate with its regional partner NewCom in order to keep pricing at lowest edge without losing quality for the implementation of the offered VSAT network. Based on this point and the provisioning of a premium quality in equipment and related services, COMSOFT supports with its experience and expertise of its 24/7 Helpdesk Center the site survey, installation and maintenance services.

5.5.6 VSAT Terminal Documentation

(1) COMSOFT provides the documentation for each individual VSAT Terminal. Usually the documentation will consist of:

- A block diagram showing all Equipment, cables and interconnections
- Configuration sheets for the parameters and programming of all electronic hardware (including licenses)
- Installation protocol to be filled out on-site after installation
- Line-up protocol and procedures of the Satellite Operator
- Manuals of hardware /software

5.5.7 Technical Documentation

(1) COMSOFT will provide a complete set of technical documentation for network users as provided by the equipment manufacturers including brochures, data sheets and descriptions to introduce new equipment.

(2) In accordance with the response to Section C § 16.1 COMSOFT will suitable documentation to the MEVA III Member States for their preparation of the installation and familiarizing with the new system. This documentation will be provided as soft copies. However, COMSOFT as being responsible for the flawless operation of the system will generally not provide service manuals covering service activities beyond the topics which are subject of training for users and technical staff.

5.5.8 Maintenance of VSAT Earth Stations

(1) The delivered equipment is generally free of maintenance, keeping an eye on the special location of the remotes stations close to the ocean COMSOFT recommends to check the overall condition of the containers and VSAT equipment on a regular basis. COMSOFT is able to carry out on-site maintenance, but can also assist MEVA III Member States remotely in doing so, to exchange defective parts. Such maintenance work shall include the respective VSAT equipment in order to minimize the cost for maintenance. COMSOFT will provide remote assistance in order to support MEVA III TMG to correct abnormal station operation, maintaining the provision of the data communication link within the guaranteed availability agreed with MEVA III TMG.

6 MEVA Web Page

(1) COMSOFT maintains a secure web interface with access rights for access to near real-time information about the status of the installed services and for operations using service/incident trouble tickets as well as general documentations.

(2) The web page is structured into different sections:

- Home
  - Welcome note and information's on upcoming events
- News
  - FTP server access on documents containing information's on actual events
- Tickets
  - Direct access to the Trouble Ticket System requesting login credentials
- Network Status
  - Provides live information's on the system health requesting login credentials
- Documents
  - Provides access to the monthly reports and network relevant documents as site-survey documentation
- Contact
  - Contact information to get in direct contact with COMSOFT
- Help
  - Provides help on the web page contents and credentials

(3) Please note that JAVA script has to be enabled on local access browsers in order to get full function of the web page.

6.1 Section: Login

(1) The general web page is accessible from the internet using the following address:

(2) http://noc.comsoft-sat.com:7543/

(3) The web page provides a secure login portal in order to prevent unauthorized access from any unwanted 3rd party.

Figure 59: MEVA Web Page Login Screen

(4) The Login credentials were submitted to the MEVA III Member States in separate notices in order to keep security.

6.2 Section: Home

(1) This section is the general start page of the web presence where a short introduction on COMSOFT is given as well as hints on upcoming events related to the MEVA III network.

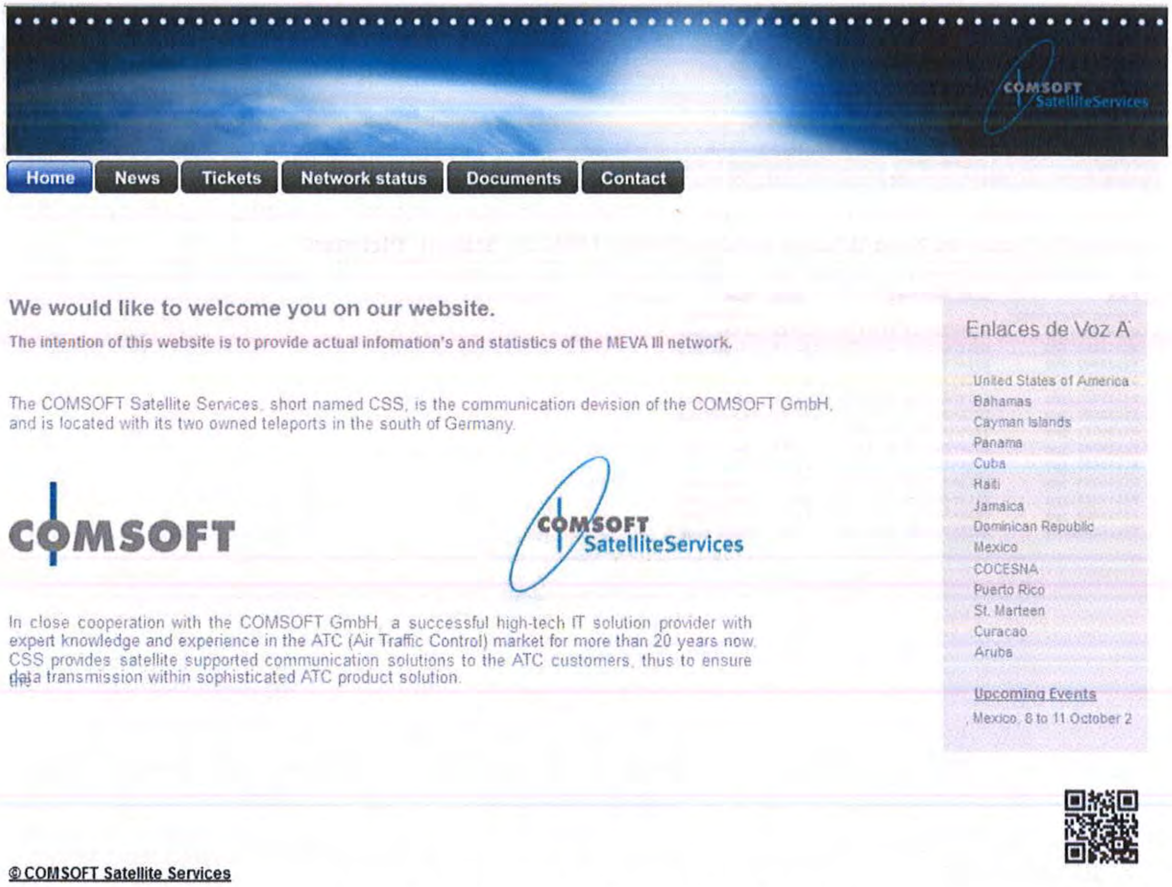


Figure 60: MEVA Web Page Home Screen

6.3 Section: News

(1) This section is presenting actual news on the MEVA III network.

(2) At the time pictures from MEVA III TMG events are available, in addition news an network related tasks or outages due to solar or sun outage are published.

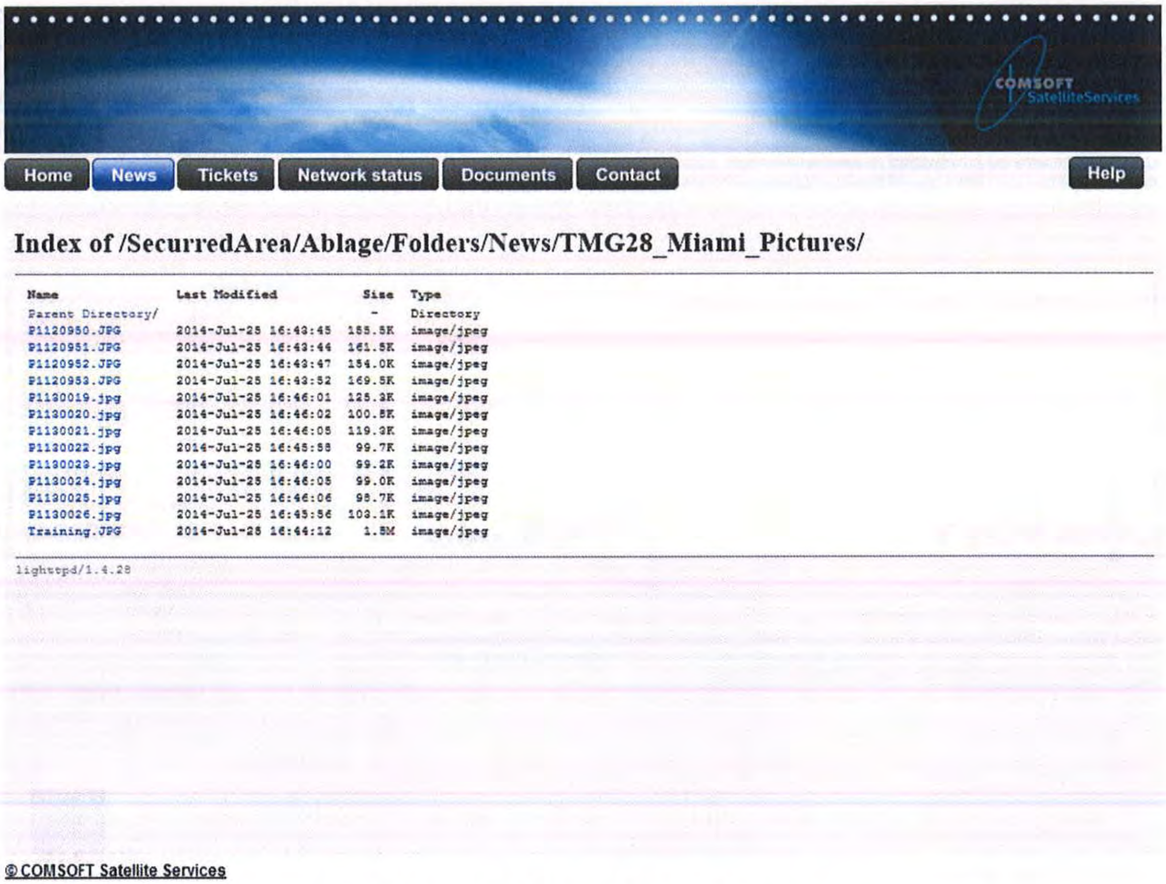


Figure 61: MEVA Web Page News Screen

6.4 Section: Tickets

(1) This section provides direct access to the COMSOFT Trouble Ticket System.

(2) The screen will apply in the local language of the user computer browser.

(3) Login credentials are needed, which are provided by COMSOFT on a separate basis per country.

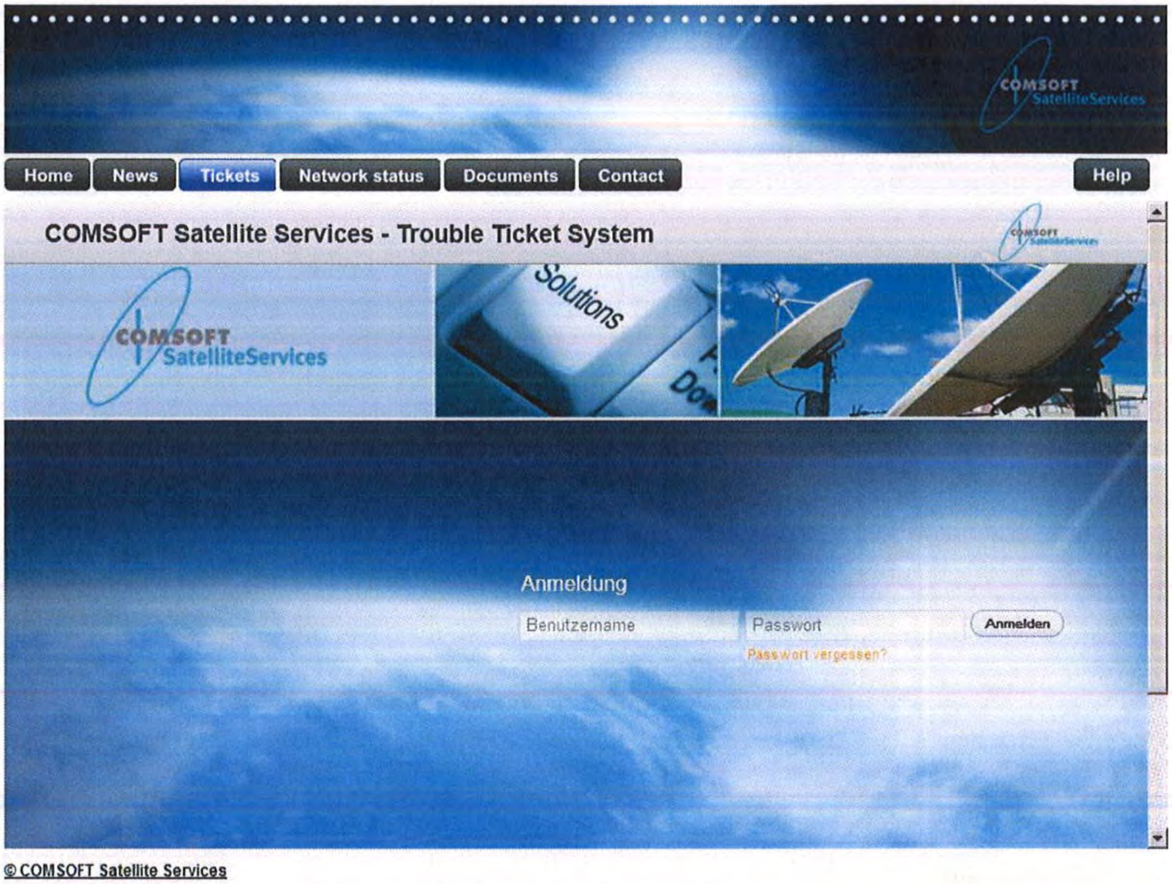


Figure 62: MEVA Web Page Tickets Screen

6.5 Section: Network Status

(1) This section provides a looking glass screen to show the general status per network site.

(2) Meaning of the colours per station:

- Green: OK

  and

- Red: Not OK

Figure 63: MEVA Web Page Network Status Screen

6.6 Section: Documents

(1) This section provides access to network relevant documents.

(2) The documentation will be updated as new versions appear – like monthly reports and others.

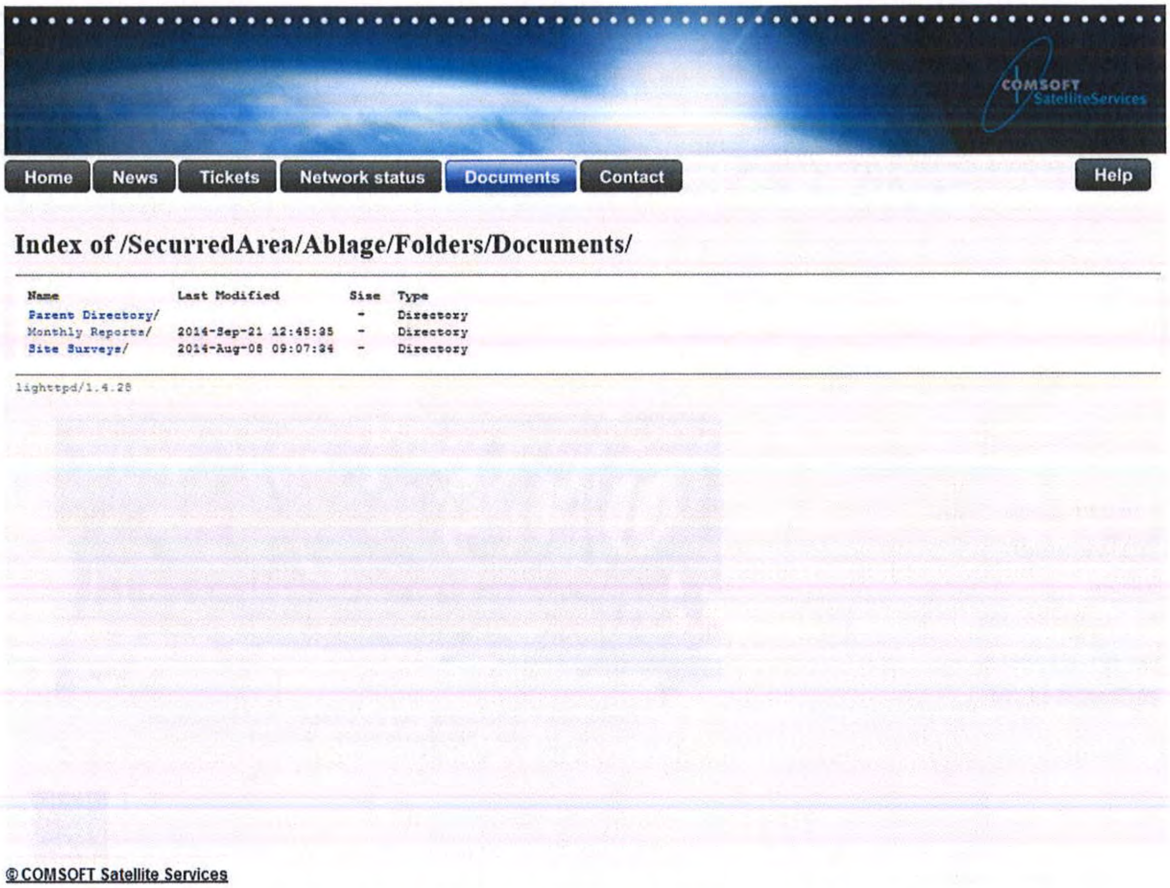


Figure 64: MEVA Web Page Documents Screen

6.7 Section: Contact

(1) This section provides contact information's on reachability of COMSOFT.

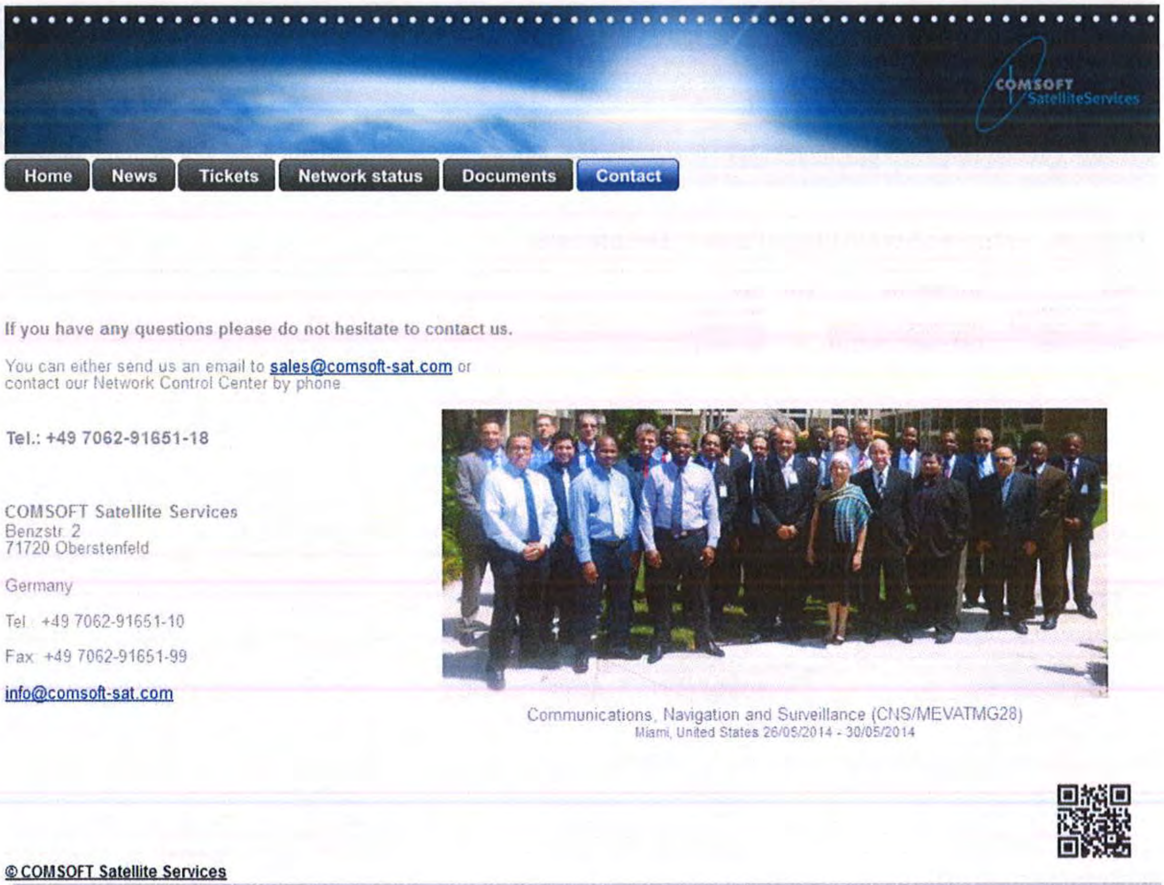
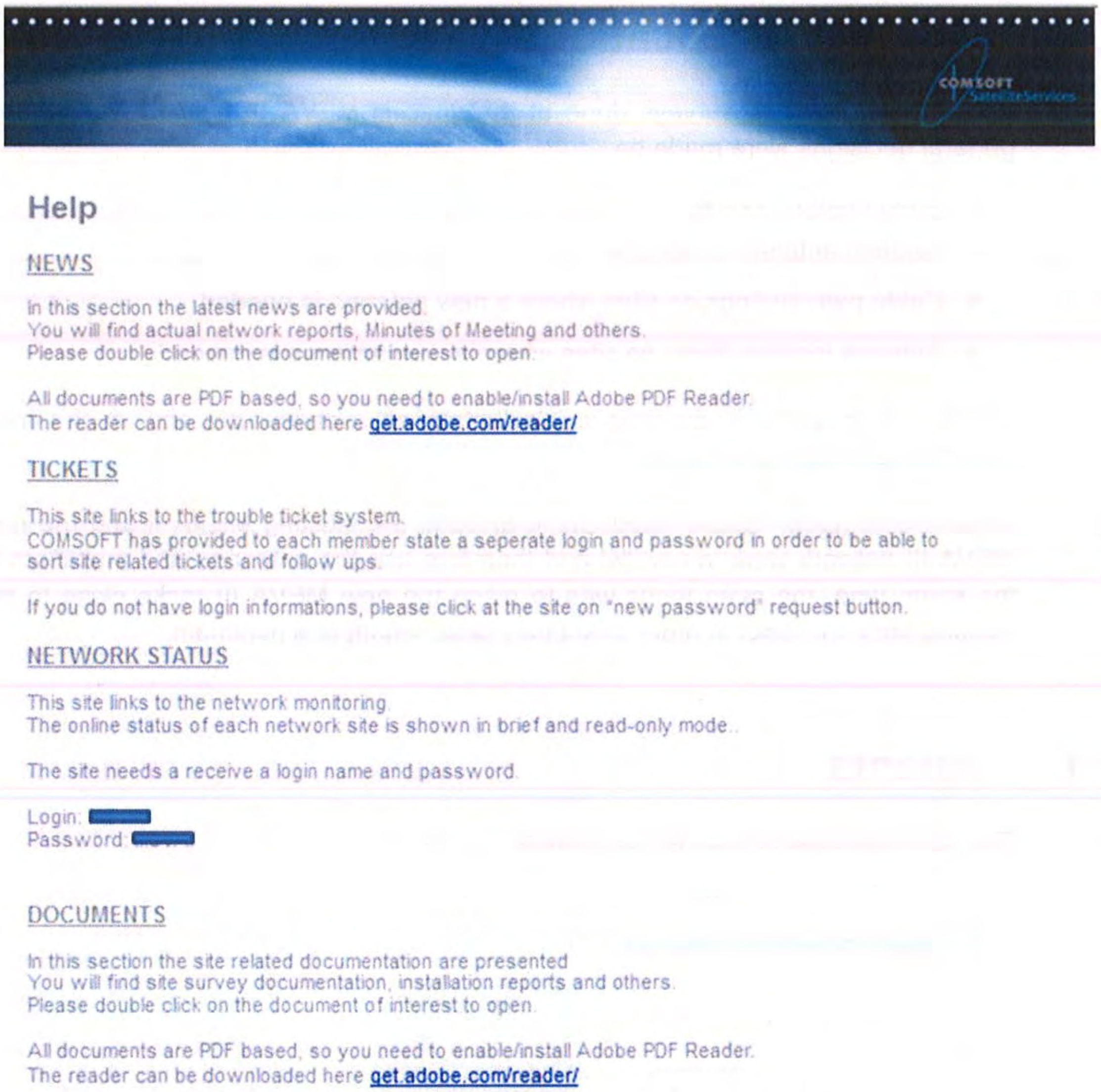


Figure 65: MEVA Web Page Contact Screen

6.8 Section: Help

(1) This section provides contact information's on reachability of COMSOFT.



Help

NEWS

In this section the latest news are provided.
You will find actual network reports, Minutes of Meeting and others.
Please double click on the document of interest to open.

All documents are PDF based, so you need to enable/install Adobe PDF Reader.
The reader can be downloaded here get.adobe.com/reader/

TICKETS

This site links to the trouble ticket system.
COMSOFT has provided to each member state a seperate login and password in order to be able to sort site related tickets and follow ups.

If you do not have login informations, please click at the site on "new password" request button.

NETWORK STATUS

This site links to the network monitoring.
The online status of each network site is shown in brief and read-only mode..

The site needs a receive a login name and password.

Login: [redacted]
Password: [redacted]

DOCUMENTS

In this section the site related documentation are presented
You will find site survey documentation, installation reports and others.
Please double click on the document of interest to open.

All documents are PDF based, so you need to enable/install Adobe PDF Reader.
The reader can be downloaded here get.adobe.com/reader/

Figure 66: MEVA Web Page Help Screen

7 Equipment Locations

(1) According to the site surveys done at the specific MEVA III network sites, some general decisions were made on:

- Equipment locations
- Existing antenna conditions
- Cable path findings on sites where a new antenna is needed
- Antenna location fixing on sites where a new antenna is needed

(2) COMSOFT is giving in the following chapters an overview per site on the most important arrangements done.

(3) Since the migration phase needs to have both, the existing MEVA II and the new MEVA III network work in parallel and therefore use the antennae and amplifiers at the same time, the main focus was to place the new MEVA III racks close to the existing MEVA II racks in order to shorten cable length at a minimum.

7.1 Atlanta

(1) The site is generally designed to provide:

- Dual Chain redundancy
- Usage of existing antenna

(2) The site survey was conducted on July 19th 2013.

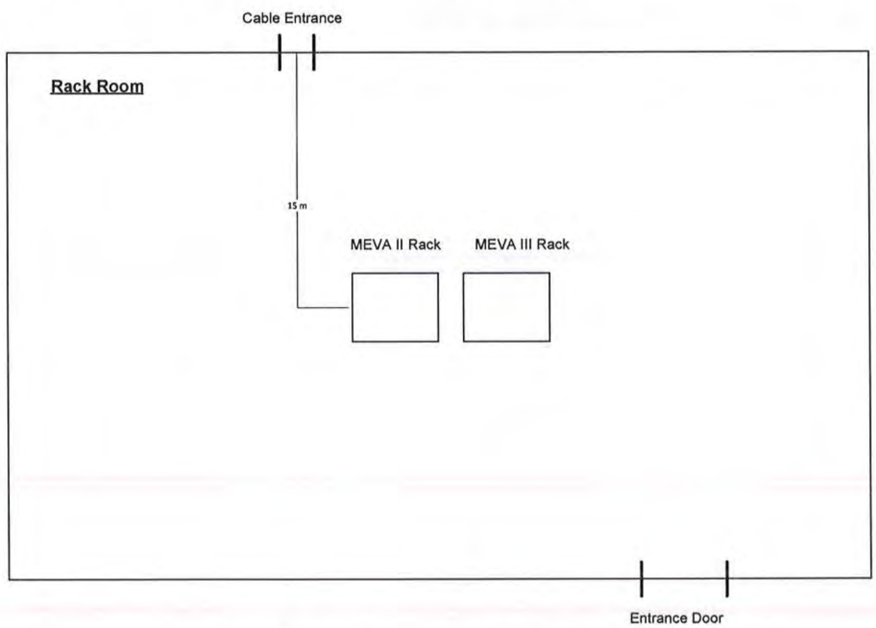


Figure 67: Rack Room Overview Atlanta

(3) The new MEVA III Rack will be installed next to the existing MEVA II Rack.

7.2 Aruba

(1) The site is generally designed to provide:

- Dual Chain redundancy
- Usage of existing antenna
- UPS provisioning

(2) The site survey was conducted on July 30th 2013.

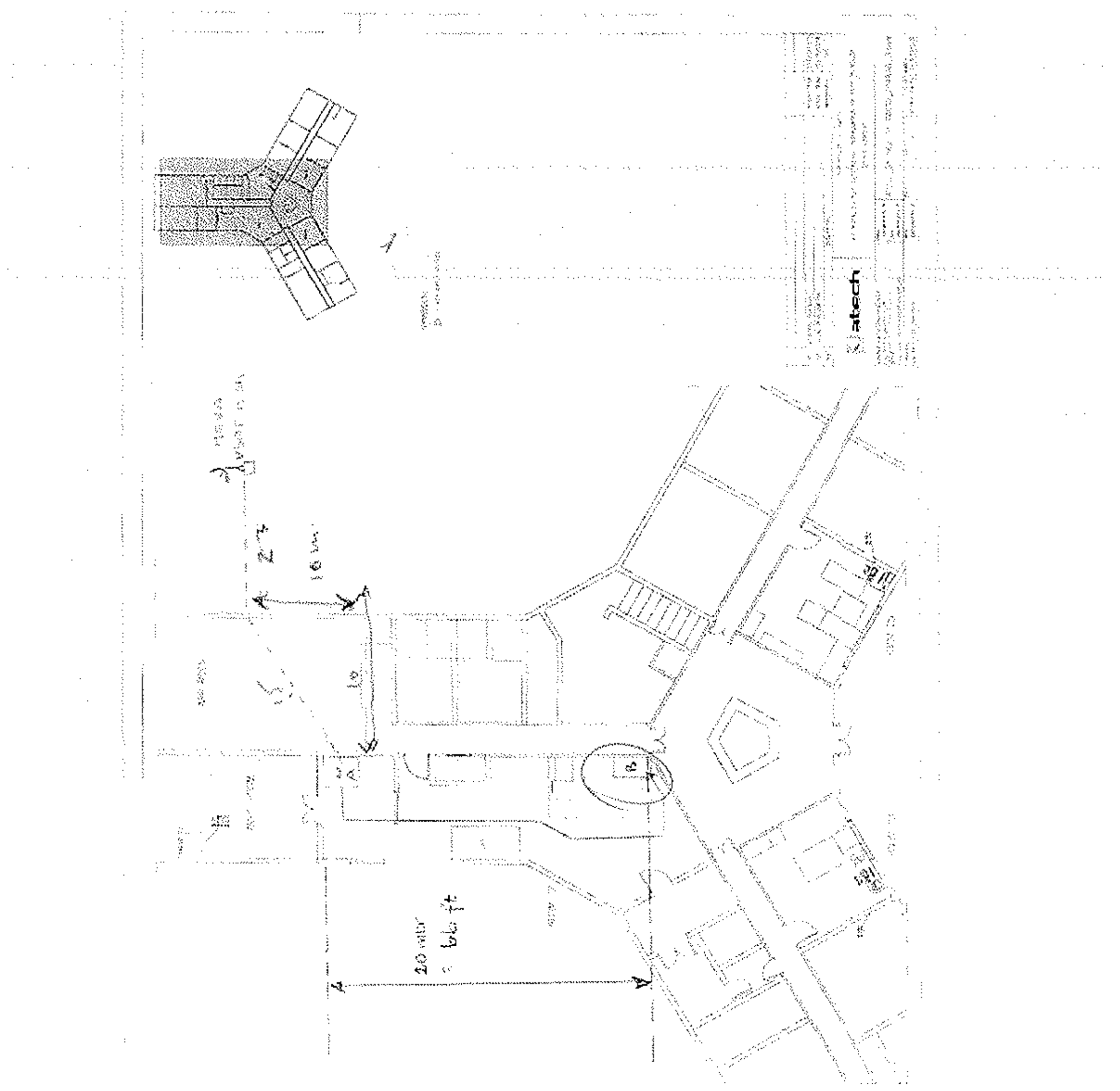


Figure 68: Rack Room Overview Aruba

(3) The new MEVA III Rack will be installed next to the existing MEVA II Rack.

7.3 Bahamas, Freeport

(1) The site is generally designed to provide:

- Single Chain
- Usage of existing antenna

(2) The site survey was conducted on February 20th 2014.

Figure 69: Rack Room Overview Bahamas Freeport

(3) The new MEVA III Rack will be installed next to the existing MEVA II Rack.

7.4 Bahamas, Nassau

(1) The site is generally designed to provide:

- Single Chain
- Usage of existing antenna

(2) The site survey was conducted on February 18th 2014.

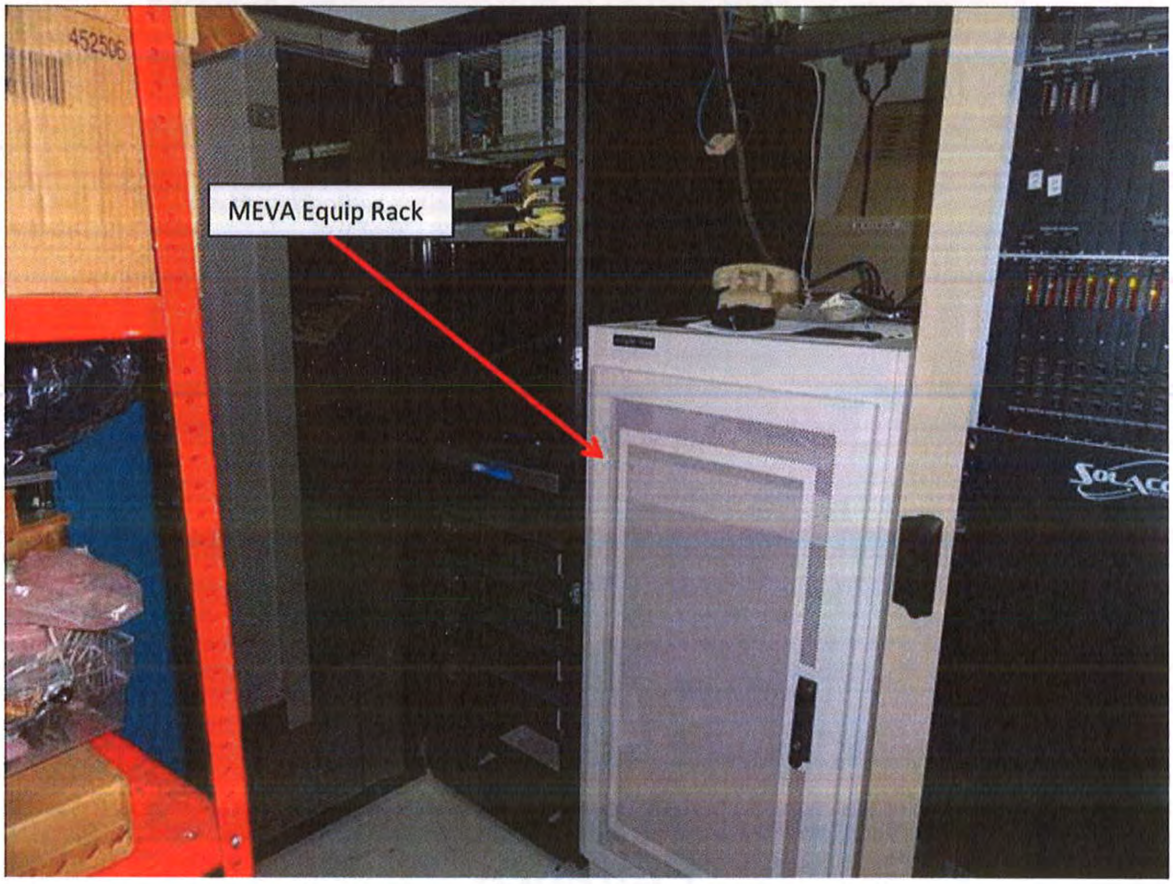


Figure 70: Rack Room Overview Bahamas Nassau

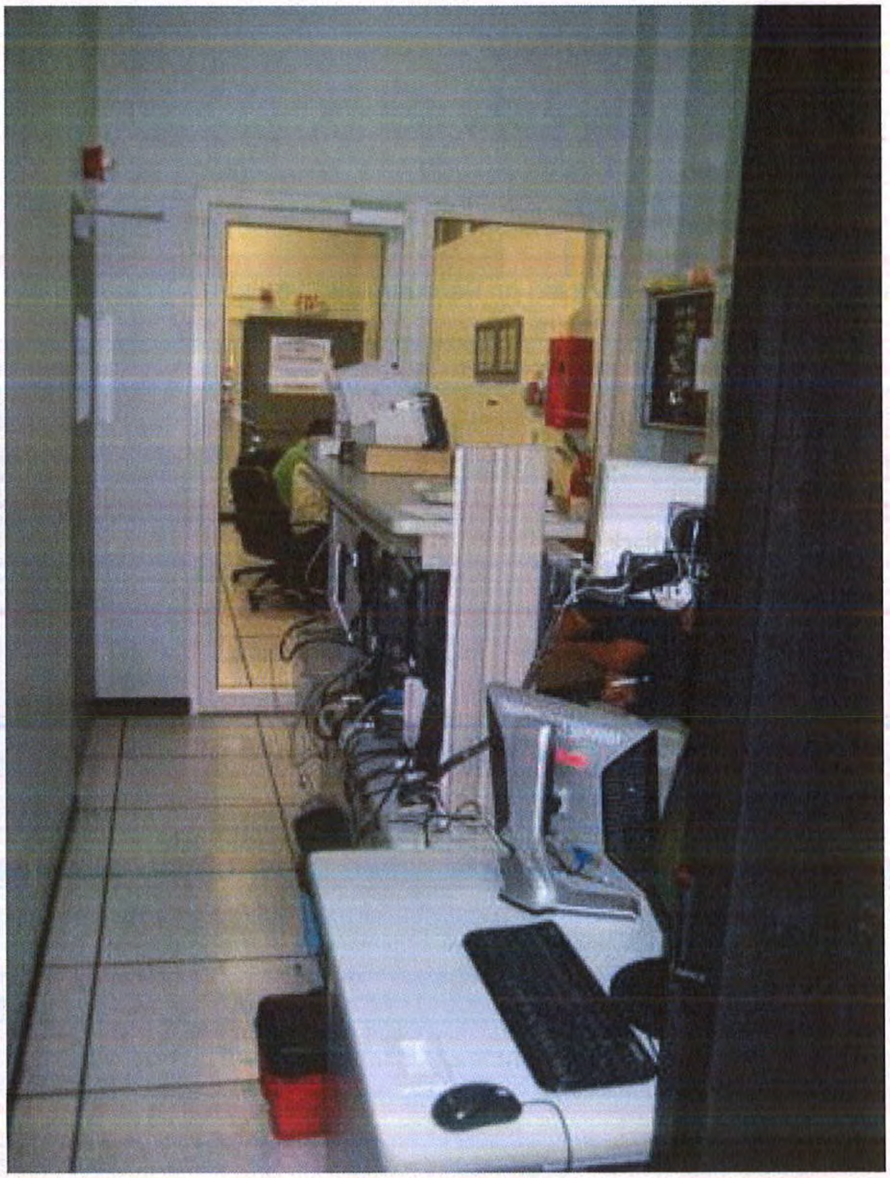
(3) The new MEVA III Rack will be installed next to the existing MEVA II Rack.

7.5 COCESNA

(1) The site is generally designed to provide:

- Single Chain
- Usage of existing antenna

(2) The site survey was conducted on July 30th 2013.



Entrance

Figure 71: Rack Room Overview COCESNA

(3) COCESNA has decided to place the new MEVA III rack in a different room as the existing MEVA II rack. Therefore the cabling for voice and data connections have to be moved by COCESNA to the new location at time of switch over.

7.6 Cuba

(1) The site is generally designed to provide:

- Single Chain
- Usage of existing antenna

(2) The site survey was conducted on July 29th 2013.

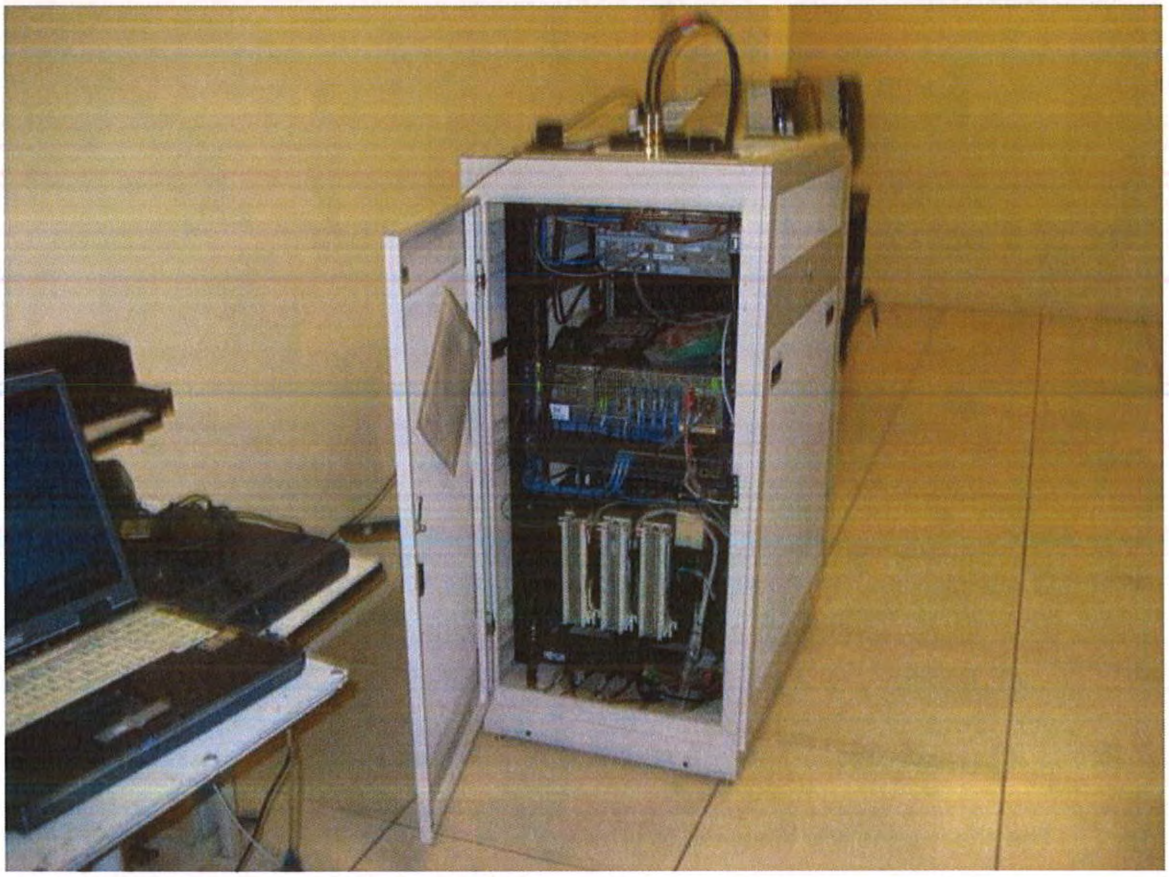


Figure 72: Rack Room Overview Cuba

(3) The new MEVA III Rack will be installed next to the existing MEVA II Rack.

7.7 Cayman Islands

(1) The site is generally designed to provide:

- Single Chain
- Usage of existing antenna

(2) The site survey was conducted on February 21th 2014.

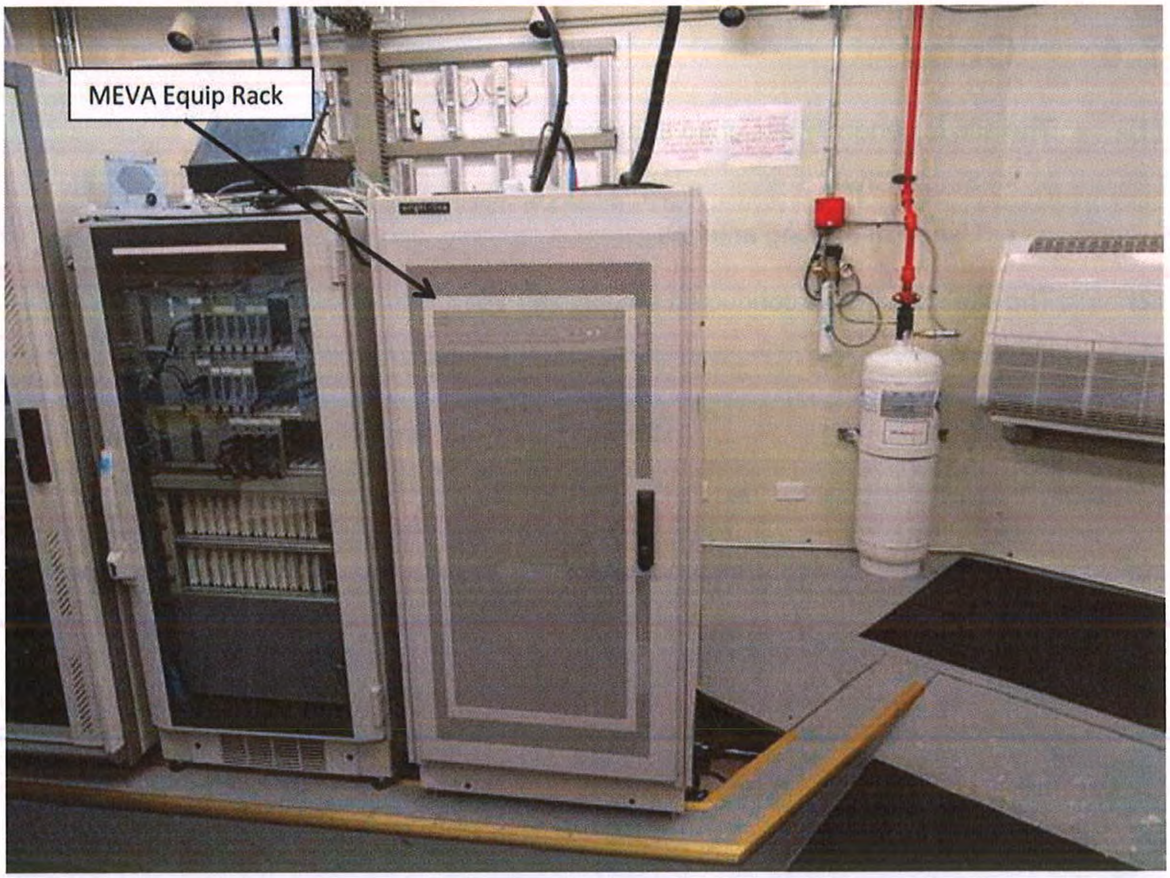


Figure 73: Rack Room Overview Cayman Islands

(3) The new MEVA III Rack will be installed next to the existing MEVA II Rack.

7.8 Curaçao

(1) The site is generally designed to provide:

- Single Chain
- Provision of a new Antenna (King Post Mount)

(2) The site survey was conducted on August 1st 2013.

Figure 74: Rack Room Overview Curacao

(3) The new MEVA III Rack will be installed next to the existing MEVA II Rack.

7.9 Colombia

(1) The site is generally designed to provide:

- Single Chain
- Usage of existing antenna
- Usage of existing amplifier

(2) The site survey was conducted on August 1st 2013.

Figure 75: Rack Room Overview Colombia

(3) The new MEVA III Rack will be installed next to the existing MEVA II Rack.

7.10 Caracas, Venezuela

(1) The site is generally designed to provide:

- Single Chain
- Usage of existing antenna
- Usage of existing amplifier

(2) The site survey was conducted on August 7th 2014.

INAC Computer Room. General View.

MEVA Rack

Figure 76: Rack Room Overview Caracas

(3) The new MEVA III Rack will be installed next to the existing MEVA II Rack.

7.11 Dominican Republic

(1) The site is generally designed to provide:

- Dual Chain redundancy
- Customer installs antenna on its own
- Electrical power supply at the antenna will be supplied by customer

(2) The site survey was conducted on February 24th 2014.

NEW RACK LOCATION

Figure 77: Rack Room Overview Dominican Republic

(3) The new MEVA III Rack will be installed in a new building.

7.12 Haiti

(1) The site is generally designed to provide:

- Dual Chain redundancy
- Usage of existing antenna
- Provisioning of UPS

(2) The site survey was conducted on February 21st 2014.

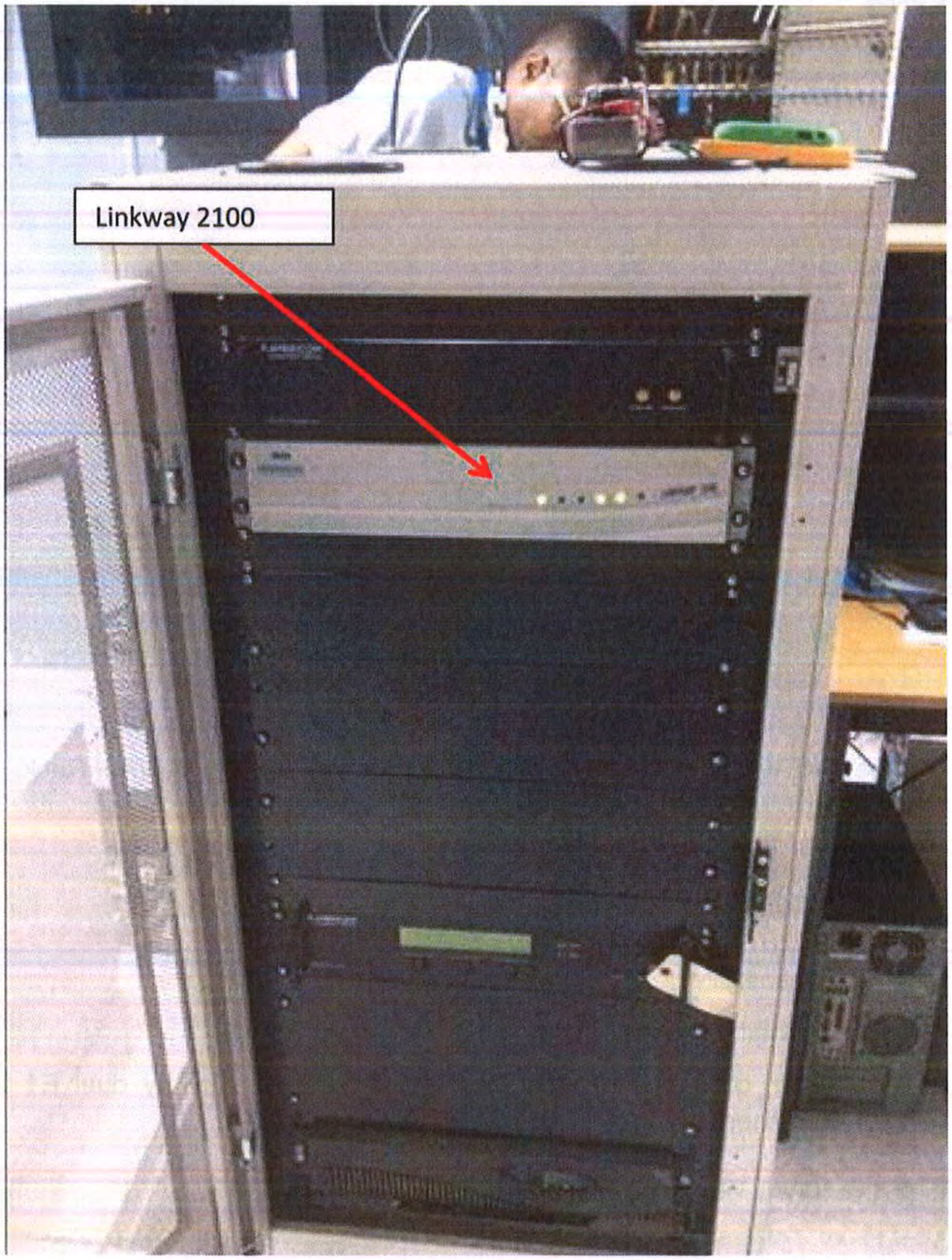


Figure 78: Rack Room Overview Haiti

(3) The new MEVA III Rack will be installed next to the existing MEVA II Rack.

7.13 Jamaica

(1) The site is generally designed to provide:

- Single Chain
- Usage of existing antenna

(2) The site survey was conducted on February 12th 2014.

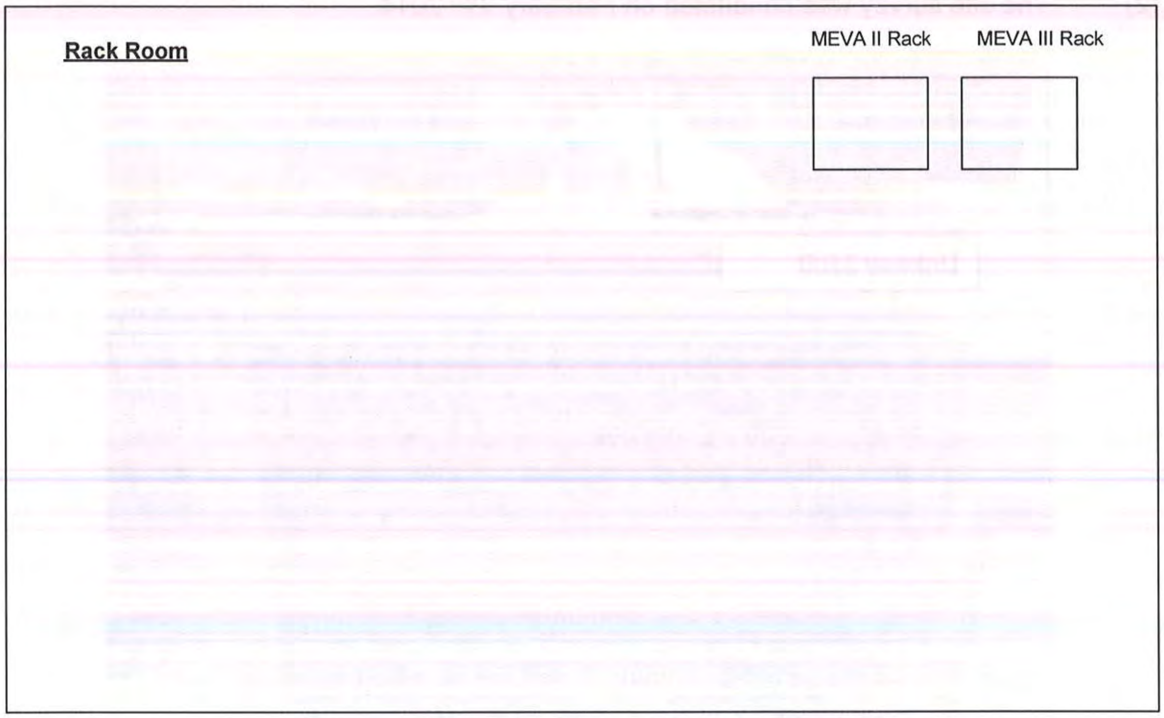


Figure 79: Rack Room Overview Jamaica

(3) The new MEVA III Rack will be installed next to the existing MEVA II Rack.

7.14 Miami

(1) The site is generally designed to provide:

- Dual Chain redundancy
- Network connects through NewCom Teleport Miami by dual E1 terrestrial leased lines

(2) The site survey was conducted on July 18th 2013.

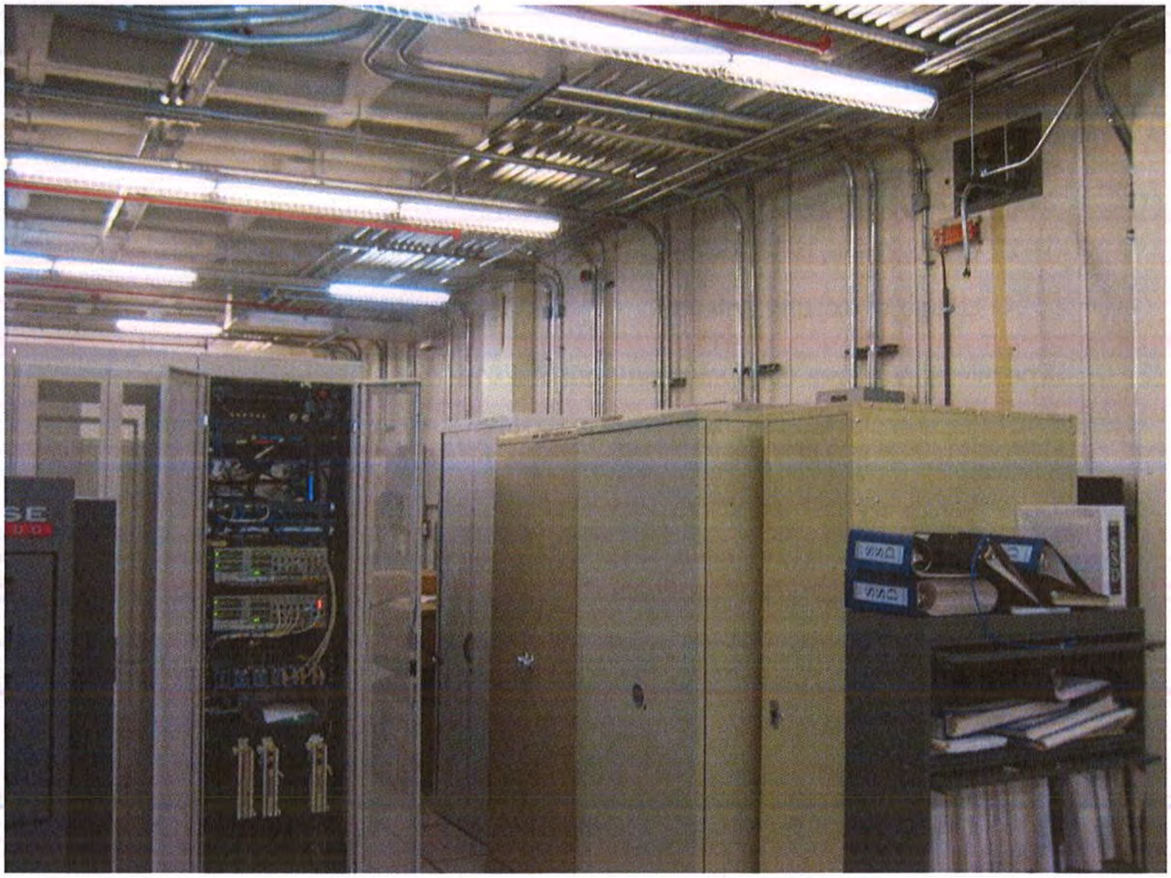


Figure 80: Rack Room Overview Miami

(3) The new MEVA III Rack will be installed next to the existing MEVA II Rack, left hand – empty rack to be removed.

7.15 Mexico

(1) The site is generally designed to provide:

- Single Chain
- Usage of existing antenna

(2) The site survey was conducted on April 5th 2014.

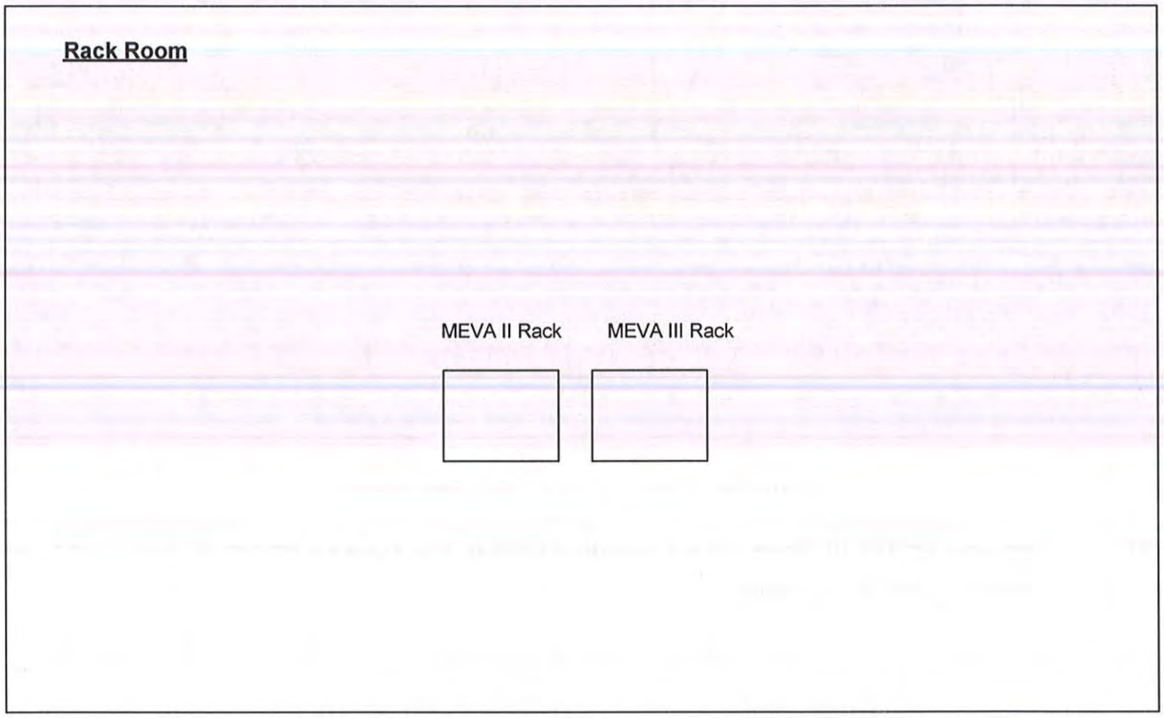


Figure 81: Rack Room Overview Mexico

(3) The new MEVA III Rack will be installed next to the existing MEVA II Rack.

7.16 Panama

(1) The site is generally designed to provide:

- Single Chain
- Provisioning of new antenna (NPMMount)

(2) The site survey was conducted on February 18th 2014.

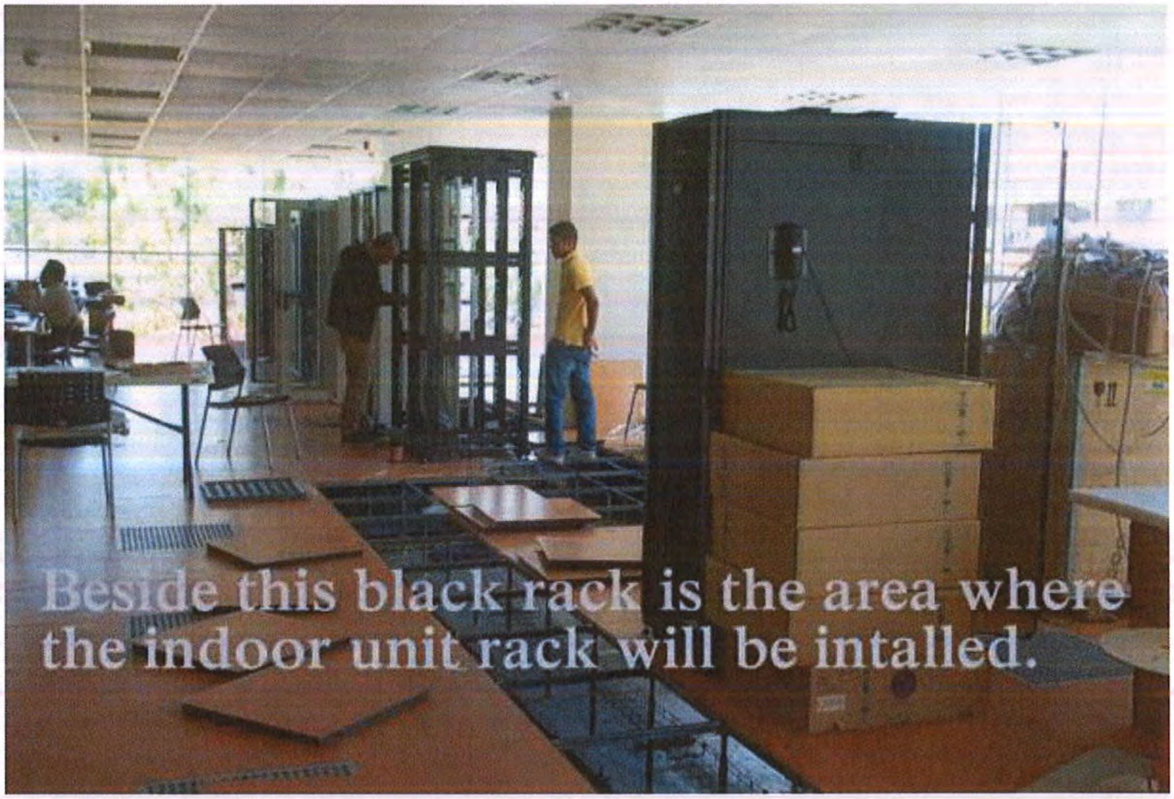


Figure 82: Rack Room Overview Panama

(3) The new MEVA III Rack will be installed in a new room.

7.17 Puerto Rico

(1) The site is generally designed to provide:

- Dual Chain redundancy
- Usage of existing antenna

(2) The site survey was conducted on February 20th 2014.

Figure 83: Rack Room Overview Puerto Rico

(3) The new MEVA III Rack will be installed next to the existing MEVA II Rack.

7.18 Sint Maarten

(1) The site is generally designed to provide:

- Single Chain
- Usage of existing antenna

(2) The site survey was conducted on January 13th 2014.

Figure 84: Rack Room Overview Sint Maarten

(3) The new MEVA III Rack will be installed next to the existing MEVA II Rack.

VSAT-MEVA III

SDD - System Design Document

V1.0/26.09.2014

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V1.0	26.09.2014	Initial Version submitted as SDD documentation	

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1 Introduction

(1) The following chapters describes the technical design and network layout in further detail. Not all parameters can be given at time, i.e. MAC addresses of the used units. Some configuration parameters have to be evaluated during the SDD review phase in coordination with MEVA III TMG. Therefore some estimations are preliminary.

1.1 General Design Decisions

(1) COMSOFT's disciplined management and systems engineering heritage executing military and government programs will be applied to this effort.

(2) During the elaboration of the present SDD document the core requirements guided the decisions for the design of the system, the choice of equipment and the specific technical solution.

(3) The technical proposition is based on ND SatCom's SkyWAN® product platform as the most established VSAT portfolio for critical ATC applications. The proposed overall solution is 100% compliant in all details to the Technical Specification with strong focus on the key requirements.

(4) The proposed satellite network consists of a Master Station at FAA Atlanta and a Backup Master Station at Newcom's Teleport Miami, and the remote stations

- Aruba
- Bahamas, Freeport
- Bahamas, Nassau
- COCESNA
- Cuba
- Cayman Islands
- Curaçao
- Colombia
- Caracas, Venezuela
- Dominican Republic
- Haiti
- Jamaica
- Miami (connected terrestrial via Miami Teleport)
- Mexico
- Panama

- Puerto Rico
- Sint Maarten

(5) Both Master Stations replace each other in the function of bandwidth assignment in the case of failure.

(6) The fully meshed SkyWAN® modems support the required any to any connections without topological or other restrictions; all communication between the stations can be accommodated on a single TDMA carrier. The network provides on some stations a redundant chain of indoor and outdoor equipment up to the C-Band antennas.

(7) The SkyWAN® satellite modem offers two transport options over satellite: via IP or FR. Both are used; voice over FR and data connections over IP (in future network development).

1.1.1 Staffing Plan

(1) COMSOFT operates as a line business organization; during the planning stages of a project, the human resources needed to successfully complete the program are identified. Personnel, such as engineers, are assigned who have the experience needed to complete a given task. All of the layouts, such as availability calculations, system design and interconnections to customer systems were developed on previous programs or on internal R&D.

1.2 General Design

(1) During the elaboration of the System Design Document the core requirements mentioned above guided the decisions for the design of the system, the choice of equipment and the specific technical solution.

(2) The technical proposition is based on ND SatCom's SkyWAN® product platform as the most established VSAT portfolio for critical ATC applications. The proposed overall solution is 100% compliant in all details to the Technical Specification with strong focus on the key requirements mentioned in the previous section.

(3) The proposed satellite network consists of a Master Station and a Backup Master Station at the Miami Teleport and in Atlanta, and the remote stations at the other ACC locations in the MEVA Region. Both Master Stations replace each other in the function of bandwidth assignment in the case of failure.

(4) The Master Station function is not related to Network Management however, the Teleport and Network Operation Center is the natural place for it also because of the infrastructure in terms of power supply resilience, security and 24/7 equipment

access. Similar considerations hold for Atlanta, which is geographically distant enough as not to be affected by the same adverse weather conditions.

(5) The fully meshed SkyWAN® modems support the required any to any connections without topological or other restrictions; all communication between the stations can be accommodated on a single TDMA carrier.

(6) The network provides for the following named stations a non-redundant chain of indoor and outdoor equipment up to the currently used 3.8m C-Band antenna, which will be re-used – except Curacao and Panama.

- Cuba
- COCESNA
- Mexico
- Sint Maarten
- Jamaica
- Cayman Islands
- Bahamas, Freeport
- Bahamas, Nassau
- Curaçao
- Panama
- Colombia
- Caracas, Venezuela

(7) The network provides for the following named stations a redundant chain of indoor and outdoor equipment up to the currently used 3.8m C-Band antenna, which will be re-used – except Miami and Dominican Republic.

- Aruba
- Dominican Republic
- Atlanta, USA
- Miami, FL
- Haiti
- Puerto Rico

(8) Presently the outdoor units in Atlanta consist of redundant SSPAs and redundant LNBs controlled by an RCU which triggers waveguide switching in case the active element runs into a failure condition. This equipment owned by FAA will be kept and maintained.

(9) C-Band satellite capacity on Intelsat 14 as currently contracted is mandatory and without sensible alternative. Therefore the design, the link budget and

corresponding carrier size, transmission parameter and SSPA power are based on this capacity as well as the network migration from the current MEVA II VSAT Network.

2 Detailed Network Component Description

(1) This chapter addresses the main service tasks.

(2) Additionally other documents referenced herein provide further in depth information on standard topics such as the Project Schedule, the Transition Plan and the Training Plan or provide evidence how specific requirements are fulfilled.

(3) Furthermore the Annexes provide technical information on the proposed equipment.

2.1 General Requirements Related to the Technical Specifications Requested

(1) This chapter addresses the general functional requirements of the Technical Specification "Section B" with focus on the following specific technical topics:

- Protocols for future ATN support
- Scalability of the network design
- Equipment support during the useful life
- Availability of the communication system

2.1.2 Scalability of the Network Design

(1) Based on the capabilities of the delivered equipment there are no relevant limitations or restrictions for a dynamic development of the MEVA III VSAT Network.

(2) Most of the conceivable changes affecting the connectivity can be achieved by simple reconfiguration of the multiplexers, if necessary the modem configuration needs to be adapted as well. Such reconfigurations can be performed from the Network Operation Center. In case of additional connections beyond the port capacity of the interface cards such expansions may require the provision of additional interface card or multiplexer chassis. In no case there will be a need for additional modem due to the fact that each modem can interface up to 4 multiplexers at 4 serial ports.

(3) The expansion of the network by additional sites does not cause any problem for the existing network, after changing to a new SkyWAN® configuration, which includes the additional station, the new station can become operational in the network. Similarly the increase of data rates on existing or new connections can be accommodated by an according change of the multiplexer configuration and the SkyWAN® TDMA configuration. If such an increase entails the need for additional satellite bandwidth, this may cause some delay until the satellite operator can provide the additional bandwidth. Due to the fact that SkyWAN® modems can

operate on several carriers in non-contingent bandwidth it is very unlikely that the required bandwidth does not become available for a long time.

2.1.3 Equipment Support during the Useful Life

(1) Previous generations of the used equipment have demonstrated the long-life cycle partly being in operation well over 10 years – as becomes visible from expansion and spare orders to the manufacturers. The current IDU 7000 generation of the SkyWAN® Modem and FAD 9220/30 multiplexers benefit from experience driven improvements in the design and more modern electronic components. They even exceed their predecessors in stability as becomes apparent from improved MTBF data in the field.

(2) Both product lines are core products in the portfolio of the respective manufacturer. This ensures the long term support by the manufacturers with regards to

- Software feature development,
- Software maintenance (bug fixing),
- Technical support,
- Repair and return,
- Spare part availability.

2.1.4 Availability of the Communication System

(1) For further reference:

The availability A of a system is defined as A = MTBF / (MTBF + MTTR), where MTBF denotes the mean time between failures of a system or a component and MTTR denotes the mean time to repair a system or component, respectively. Thus, as an example, a requirement of A being > 99.9% corresponds to a maximum total outage (=repair) time of approximately 8 hours and 45 minutes in the average over 1 year.

2.1.4.1 Repair Time for Components

(1) Obviously the critical point in the MEVA III VSAT Network context is the MTTR. If a hardware component in a VSAT station fails this may be due to a non-critical event (of temporary nature) and the component will work again after a reboot or other restoring measures. In the worst case, however, the component is defective and requires repair in the factory and has meanwhile to be replaced by a spare component. Unless all components are duplicated as spares or in hot or cold standby configuration, the repair by replacement <u>may</u> – in a worst case scenario -

take days for transport from a spare stock, custom processing and exchange on site. For any link affected by such an outage with worst case repair time the requirement of 99.9% availability would be violated in the respective rolling 12-month-period. Such rare events could only be avoided by complete 1+1 redundancy for all components employed in the link. Fortunately the mentioned worst case does not happen all the time and does not correspond to the mean time to repair and its bearing on the overall availability. Due to the offered comprehensive support and maintenance concept including the following measures and capabilities:

- annual preventive maintenance of all MEVA III VSAT Network terminals
- 1st level maintenance of MEVA III Member States technical staff based on the offered OJT
- on-site spare availability of the most critical hardware components
- very fast corrective maintenance within a few hours by local staff at 7 MEVA III Network locations
- fast corrective maintenance within maximum one day for all other MEVA III Network locations due to the strategically located Support Center in Miami
- appropriate spare part stocking and logistics

(2) The applicable MTTR values for the active components as assessed by COMSOFT are significantly lower as can be seen in the table for the relevant availability figures below.

2.1.4.2 Availability of VSAT Terminal Components

(1) For the availability analysis of a system it is common practice to disregard passive fixed in the meaning of not moving and not touched during operation (mainly mechanical) elements such as cables, parabolic antennas, waveguides, connectors etc., since their failure behavior is manageable and the occurrence of failures is negligible as compared to active components. Hence the components to consider in a MEVA III VSAT are:

- Multiplexers including line interface cards
- Modems
- Block-Up Converters in the transmit path
- LNBs in the receive path

(2) The relevant data for the availability analysis for these components are compiled in the following table as provided by the manufacturers:

Hardware	Type	MTBF Hours	Method of Calculation	MTTR Hours	Availability
IDU 7000	SkyWAN® - Satellite Router	287,438	Field Data	24	99.99165%

IDU 2570	SkyWAN® - Satellite Router	259,588	Field Data	24	99.99075%
FAD 9220/30	All (2/3) expansion slots occupied with line cards	80,000	Telecordia Issue 1	8	99.99000%
CPI/CODAN BUC	C-Band Block Up Converter	112,995	Field Data	24	99.97875%
LNB	C-Band Low Noise Block Down Converter	496,000	MIL-HDBK-217F	24	99.99516%

Table 1: MTBF of Major System Components

(3) **Notes:**

- **MTTR Hours:** Assessed for MEVA III VSAT Network as a weighted average over all repair scenarios based on the proposed spare part logistics and reaction times by MEVA III Member States technical staff, local support staff and travelling support staff travelling from Miami.
- **MTBF Hours FAD:** This is an average over various hardware configuration with different line interface cards; in each calculated case all expansion slots are used (which is not the case at all MEVA III Network sites).
- **MTTR Hours FAD:** line card spares stocked on-site.

2.1.4.3 Availability Calculation between Service Delivery Points

(1) In a non-redundant equipment configuration a system is modeled as an interconnection of parts in series, in which the failure of one part causes the failure of the whole system. Hence the availability of the system is calculated as the product of the availability of the individual components.

(2) In the present context the availability of a VSAT station is calculated as product of the availability figures of multiplexer, modem and RF component.

(3) Using the values of Table 1 yields the following results:

1. Availability of the transmitting station starting from the Service Delivery Point (SDP), i.e. the interface of the multiplexer components: 99.95905%
2. Availability of the receiving station starting from the SDP, i.e. the interface of the multiplexer components: 99.97591%
3. Availability of the link over satellite from SDP to SDP: **99.93543%** (>99.9%)

(4) This calculation demonstrates the compliance of the non-redundant design approach with the selected equipment based on the proposed service concept.

(5) The result in 3.) does not so far consider the satellite link itself. The proposed RF equipment provides sufficient transmit power to overcome atmospheric degradations

and achieve a link availability of over 99.99% (disregarding the availability of the satellite itself as discussed). Thus factoring in the satellite link does not change the compliance: the accordingly modified result for 3.) is: 99.92543%. This corresponds to 6 hours and 32 minutes average outage time per annum.

(6) During transition time the amplifiers have to transmit both network carriers, therefore the link availability for this limited time is at least 99,9%.

2.1.4.4 Availability of the MEVA III System

(1) The availability of a complex system like a complete network can be defined in many different ways - starting with specific criteria for unavailability, differentiation in relevance of parts of the system etc. In the specific case of the MEVA III VSAT Network, however, a simplified and natural approach would be to model the system as a multitude of independent connections, provided that there is no single point of failure on system level which would affect all connections. This is not the case for the used system.

(2) Hence the availability of the network would be expressed as the sum over all availabilities of each individual link divided by the total number of links. Since the availability of each connection between SDPs already exceeds 99.9% the same will hold for the average.

2.2 General Network Considerations

(1) The delivered network solution for MEVA III VSAT Network is founded on a number of design decisions, which had to be taken in order to achieve the primary objectives of the new network.

(2) The design criteria and the resulting decisions are discussed below. Thereafter the chapters 2.3 ff presents the network design and the terminal design.

2.2.1 Design Criteria and Decisions

(1) On the investment side the main criteria for the design in general are:

- Optimized cost of ownership
- To comply with or exceed the functional requirements
- To provide an extra high standard of availability of the network
- To support a useful life of at least 10 years

(2) Decisions are taken along the above criteria with the best overall balance.

2.3 Network Layout

(1) According to the above mentioned requirements, COMSOFT is realizing the solution as described hereafter.

(2) The following topics have been investigated and are discussed in the subsequent chapters:

- Selection of the most suitable satellite modem
- Selection of the most suitable interface devices
- Selection of the most suitable networking protocol over satellite

(3) The used technology is a MF-TDMA system that enables all sites to have direct data and voice connections in a meshed environment. The adequate hardware system to provide this solution is SkyWAN®.

2.3.2 Selection of the Appropriate Modem Technology

(1) There are key factors restricting the choice of a suitable modem:

- The capability to provide single hop connectivity for the MEVA III Network traffic topology, which is essentially fully meshed.
- The functional capability with regards to supported protocols and interfaces.
- A COTS TDMA product prepared and supported for a useful life of 10 years and more with proven track records in the industry.

(2) COMSOFT has thoroughly analysed the modem market and came to the conclusion that ND SatCom's SkyWAN® product family is the best answer to the requirements of the technical specification. This decision is not only based on the capabilities of the products but also on the product expertise of COMSOFT and the manufacturer support available for the MEVA III VSAT Network Project due to ND SatCom's commitment and the special benefits COMSOFT has as a Gold Partner of ND SatCom.

(3) SkyWAN® is a very flexible and versatile VSAT system to establish wide area corporate network infrastructures via satellite for enterprises and governmental institutions. A wide variety of end-user business communication applications are supported in a way yet to be matched in the industry. Legacy applications such as HDLC, SNA, X.25, analogue/digital voice can be combined with IP application such as Internet access, Voice over IP or IP Video. Low data rate applications with less than 16 kbit/s and high date rate applications with more than 8 Mbit/s are transferred smoothly and with utmost cost efficiency across the same wide area network infrastructure.

(4) SkyWAN® is a Multi-Carrier (MF-TDMA) VSAT system supporting hub-less communication between remote sites. This means that any station can be reached

via a single satellite hop connection. SkyWAN® provides instant Bandwidth on Demand through its fully dynamic bandwidth allocation scheme. Space segment capacity is automatically assigned to a station requiring transmission capacity with utmost efficiency leaving free capacity for use by the other stations.

(5) The SkyWAN® VSAT platform ensures the best total cost of network ownership for the vast majority of network sizes and topologies. It minimizes both Capital Expenditure (CAPEX) and Operating Expenditure (OPEX). CAPEX is minimized due to a very competitive pricing for network terminals. The SkyWAN® solution has at least 30% advantage in CAPEX cost compared to competing VSAT vendors for networks consisting of some terminals up to 100 of terminals. This major advantage is the result of the superiority of the SkyWAN®'s latest-generation technology. The price comparison has been made in various projects and case studies for straightforward equipment sales, without any implied obligatory services or features restrictions. The low OPEX is achieved by optimizing utilization of satellite capacity. The latter is the most expensive component of most VSAT networks. Satellite bandwidth required for a given traffic model depends on a number of network parameters: e.g. bandwidth allocation, scheduling, algorithm, signaling overhead, modulation, Forward Error Correction (FEC), encapsulation, as well as the performance of the satellite modems (receivers/demodulators). Most VSAT manufacturers claim to support modern modulation and coding techniques, however, they typically do not disclose the overall bandwidth efficiency of the network and of each link. In contrary, the SkyWAN® Satellite Modems were designed to achieve the best utilization of satellite capacity. The designers achieved that goal by relentlessly focusing on the overall end-to-end spectrum efficiency in the network and by using several ground-breaking, innovative design concepts.

2.3.3 Selection of Appropriate Multiplexers

(1) ND SatCom offers Multiplexers as Access Devices (called FAD 9220 and FAD 9230) within their SkyWAN® product portfolio. These devices are equivalent to Memotech's Netperformer Multiplexers with the same number - with the exception that the FADs contain additional software for voice signalling between the multiplexer and the SkyWAN® modem. These multiplexers ideally fulfil all criteria for networks like MEVA III VSAT Network in the sense that they

- support various legacy interfaces and protocols,
- support advanced speech processing features,
- support all relevant and required voice communication interfaces and features including PTT over E&M interfaces,
- provide comprehensive IP Router capabilities,
- are well proven in aeronautical telecommunications,
- provide long-term support for a useful life of 10 years and more.

(2) In short, the multiplexers are the only equipment required to interface with the MEVA III VSAT Network voice and data applications and to process and transfer these to the satellite network.

(3) The only question yet to be discussed in the following chapter is how the multiplexers and modems communicate with each other.

(4) The SkyWAN® FAD product family is the optimal voice and data convergence solution. It has been designed especially to integrate and optimize traffic over a variety of popular WAN infrastructures. It can be used over Satellite or terrestrial Switched/Lease Lines, Frame Relay or IP backbones. Line costs are reduced by bundling various boundaries of traffic onto a single network infrastructure, replacing distinct voice, legacy data and LAN networks.

(5) Also, the SkyWAN® FAD does not only support voice over Packet Networks, but also includes superior LAN and legacy data support as well as data compression. Models are available for branch, regional as well as central sites (HUB).

(6) Some of the key features and advantages of the SkyWAN® FAD include:

- **Reduce Operating Costs:** SkyWAN® FAD uses best in class voice and data bandwidth compression techniques which reduce bandwidth required over the satellite network. This is one of the key benefits of using the SkyWAN® FAD for REDDIG II project.
- **Retain High Quality VHF Voice:** SkyWAN® FAD support voice broadcast signals and use a wide range of voice CODECs to ensure superior voice quality, low bandwidth utilization and as ultralow processing delay.
- **Increase Reliability:** SkyWAN® FAD offers 1+1 system redundancy using a standard SNMP controlled A/B switch. The backup system can take over primary system(s) in the event that a system or bearer interface(s) should fail.
- **Superior Quality of Service:** Mission critical service integrity is guaranteed through SkyWAN® FAD’s unique PowerCell (Cell Relay based) throughput bandwidth management feature delivering Quality of Service with fine granularity. PowerCell converts the incoming voice and data traffic (using their own traffic identity and associated QoS (Quality of Service), onto a single variable cell based data stream.
- **Efficient and Reliable PTT Communication:** High quality transmission of Push-To-Talk (PTT), which are used in ATC networks for the ground-to-air (radio) voice communication, requires minimal and constant propagation delay to deliver the voice traffic to the VHF base stations at different remote locations simultaneously. By integrating the PTT interface within the system and using an ultra-low delay codec (LDCD) with an exclusive sampling time of only 0.625ms, we ensure the highest voice quality possible. The SkyWAN® FAD bandwidth management techniques guarantee service integrity and safe transmission of the VHF voice signal. The dynamic jitter buffers also compensate for the satellite link delay variations and enable timely delivery of the VHF voice signal everywhere.

- **Support New Applications and Traffic Growth:** SkyWAN® FAD‘s solution has the right built-in feature set to address new IP-based applications. Featuring a state of the art IP routing protocol suite (including NAT, virtual routing groups and IP tunnelling), the SkyWAN® FAD platform guarantees data integrity and security.
- **Simplify Network Design:** SkyWAN® FAD combines, over the same backhaul, adapted voice interface transport with signal switching capabilities, which are typically required for internal voice communication, along with point-to-point PPT voice communication and RADAR service transport, which are applications specific to ATC networks.
- **Standard based Network Management:** SkyWAN® FAD‘s solution supports standards based SNMP protocol for network alarms/events reporting, unit configuration as well as monitoring.

(7) Therefore, SkyWAN® FAD has the ability to interface to any vendor NMS system that offers SNMP support (NewPoint, HP OpenView, What’s Up Gold, etc…).

2.3.4 Networking Protocol over Satellite: FR versus IP

(1) The used satellite modem SkyWAN® IDU 7000 offers the option of using IP as well as Frame Relay for transport over satellite. Likewise modem and multiplexer can use FR or IP at the interface between both.

(2) In line with the main criteria of chapter 2.2.1 the reasons for the decision (not to use VoIP and IP in general as only network protocol) are manifold and do not relate to the voice segment only:

- There are no native VoIP sources in MEVA III VSAT Network enforcing the transport of voice in IP packets.
- IP encapsulation, not only for voice, creates substantial overhead[1] and which leads to higher bandwidth consumption.
- The voice quality provided by the SkyWAN® FAD multiplexers is superior to the achievable quality with VoIP.
- The bandwidth allocation for VoFR is deterministic due to a special signaling of the multiplexer to the SkyWAN® FR interface, whereas the bandwidth allocation for VoIP follows indications for Real Time traffic from Ports, IP addresses etc. which includes a residual risk of overbooking and deterioration of the voice link.
- Frame Relay is better suitable to emulate connection oriented data services as required for MEVA III through PVCs.

[1] The reduction of overhead through header compression can result in similar bandwidth consumption as compared to FR, however header compression cannot be employed in any case.

- SkyWAN® modems support Real Time Data Services (PAMA data) on a higher priority as compared to IP Real Time Data.
- The combination of SkyWAN® modems with SkyWAN® FAD Multiplexers using a FR interface connection for voice is a proven solution for critical networks within and outside aeronautical communications.
- For critical networks and critical applications it is important to have full support from the equipment manufacturers[2], which is guaranteed by a long term cooperation and on-going maintenance contracts between all parties involved.

(3) For projects with very long life cycles it is important to have a long-term commitment for the deployed equipment from the respective manufacturer.

2.3.5 Network Application Services

(1) The network design concept for the MEVA III VSAT Network Project has one main objective, to achieve highest reliability and performance – also by avoiding complexity and associated technical risks.

2.3.5.1 Service Advantages with Frame-Relay

(1) Therefore we decided to base the network on ND SatCom's proven standard solution for voice and serial connections within ATC networks, which is based on voice and legacy data over frame relay.

(2) Our decision to choose FR is based on the following considerations regarding the application services:

- **Rapid Call Setup**

  All voice gateways (FAD) in the entire infrastructure will have awareness of all other active FADs and will hold the same MAP table for voice connections. This means that all procedures to establish a voice call will be handled by originating and terminating FAD. Assuming a one way satellite propagation delay of 270 milliseconds, a typical connect sequence between end of dial and ringing will take approx. 600 milliseconds. Contrary to the above, typical VoIP systems are built around a central call management entity which handles all connect request procedures. Typically the originating and terminating VoIP gateways have to independently communicate with the call manager before establishing the call, which leads to 3 information exchange sequences to establish a call. Assuming the delay above, the resulting call setup time will be in the range of more than 1.6 seconds.

- **Data Rate for Radar and other serial Data Applications**

[2] The FADs are produced by Memotec, formerly Verso, and come with a SkyWAN specific software

At a given port speed of 9600 Bit/s and a typical packet size of 48 Bytes/packet the resulting frame rate is 25 fps. The following calculation shall illustrate the difference in WAN bandwidth utilization for transport via IP compared with Frame Relay (results have to be doubled for bidirectional traffic):

IP:

Based on the assumption that TCP is used, the header size is 40 Byte. Together with the payload of 48 Bytes, the frame size is 88 Bytes (Header to Payload Ratio: 0.83). At a frame rate of 25 fps the resulting satellite transmission bandwidth required is 17.600 Bit/s.

Frame Relay:

The total amount of overhead for Frame Relay header and trailer is 4 Byte. Together with the payload of 48 Bytes, the frame size is 52 Bytes (Header to payload ratio: 0.083). At a frame rate of 25 fps the resulting satellite transmission bandwidth required is 10.400 Bit/s. Due to small overhead, the bandwidth usage of Frame Relay is significantly more efficient. In addition the FAD can also be configured to provide unidirectional traffic forwarding if feasible for the application.

- **Redundancy Switching Capabilities of SkyWAN® FAD**

  The redundancy configuration allows a secondary set of FADs to take over all operations of the primary set in case failures. In this setup, the secondary set takes on the “identity” of the primary set, which means that a redundancy switchover in one site is transparent to the other FADs in the infrastructure. Especially for voice communication setups this redundancy configuration does not require the definition of alternate voice call routing to cover outages of a remote unit.

- **Future Proof Voice Call Signalling**

  To be prepared for the future where serial connections might disappear completely from the screen, SkyWAN® FAD has the capabilities to switch voice call signalling from the default mode to VoIP by just changing one global parameter on each unit.

2.3.6 Voice Connections

(1) The SkyWAN® FAD is equipped with voice channels, or ports, for voice/fax/modem transmission.

(2) Each channel has an analogue or digital interface that supports signals from a variety of voice/fax/modem sources using industry-standard signalling methods.

(3) Input interfaces include:

- **E&M:** Ear and Mouth, used between the switching machine's trunk circuit and an associated signalling system.
- **FXS:** Foreign Exchange Channel Unit – Station End, a loop-start signalling method used when connecting to a telephone unit or facsimile machine (POTS line) or a modem or a Key Telephone System (KTS unit).
- **T1/E1:** Digital interfaces that support voice via Channel Associated Signalling (CAS) protocols, like Immediate Start and Wink Start, or via Common Channel Signalling (CCS) protocols like QSIG and ISDN-PRI.

(4) All voice channels use DSP (Digital Signal Processor) for digitization and voice compression facilities. Echo cancellation is provided on all channels, following the CCITT G.165 standard.

(5) Detailed information regarding supported codecs and signalling mechanisms can be found in the provided device documentation.

2.4 Network Architecture

(1) The network equipment for MEVA III VSAT Network, although entirely consisting of off-the-shelf products, is geared towards a useful life of over 10 years as is explained in more detail in chapter 2.1.3. The network architecture is open in the sense that it can be expanded easily ad that it provides standard interfaces and uses standard protocols to communicate to connected external equipment and networks.

(2) The proposed SkyWAN® modems have intrinsic full mesh capability and hence all connections in the MEVA III VSAT Network are establish with a single hop over satellite. The aspects of flexibility and scalability of the network have been discussed in chapter 2.1.2.

(3) The used solution for MEVA III VSAT Network replaces the current components used for the interconnection to REDDIG in Bogotá and Maiquetía one to one and will maintain all current functions. Furthermore also these sites will benefit from the advanced capabilities of the new MEVA III VSAT Network equipment and reduced MRC for satellite capacity. The same applies to maintaining the connection to E/CAR at the San Juan terminal.

2.4.1 Device Naming Convention

(1) Each device name consists of:

- Site Abbreviation/IATA Code: 3 characters of the site name
- Group number: The number for equal device type groups (first group = 1; second group = 2…)
- Name: Name or abbreviation of the device

(2) This naming scheme guarantees that:

- It can be easily identified where a device is connected to
- Sites with only one device type group can be equipped with a second group of devices (example: upgrade of non-redundant sites to redundancy)
- Each device chain can be extended by adding additional devices without mixing the numbers with the other chain

					Chain 1				Chain 2			
No	Country	City	IATA Code	Local ETH	IDU	FAD1	FAD2	FADX	IDU2	FAD1	FAD2	FADX
1	USA	Teleport. Miami	MIT	192.168.101.0/24	MIT1IDU	MIT1FAD1	MIT1FAD2	MIT1FADX	MIT2IDU2	MIT2FAD1	MIT2FAD2	MIT2FADX
2	Aruba	Oranjestad	AUA	192.168.102.0/24	AUA1IDU	AUA1FAD1	AUA1FAD2	AUA1FADX	AUA2IDU2	AUA2FAD1	AUA2FAD2	AUA2FADX
3	Cuba	Havanna	CUB	192.168.103.0/24	CUB1IDU	CUB1FAD1	CUB1FAD2	CUB1FADX				
4	USA	Atlanta	ATL	192.168.104.0/24	ATL1IDU	ATL1FAD1	ATL1FAD2	ATL1FADX	ATL2IDU2	ATL2FAD1	ATL2FAD2	ATL2FADX
5	USA	Miami	MIA	192.168.105.0/24	MIA1IDU	MIA1FAD1	MIA1FAD2	MIA1FADX	MIA2IDU2	MIA2FAD1	MIA2FAD2	MIA2FADX
6	Dom. Rep.	Santo Domingo	DOM	192.168.106.0/24	DOM1IDU	DOM1FAD1	DOM1FAD2	DOM1FADX	DOM2IDU2	DOM2FAD1	DOM2FAD2	DOM2FADX
7	Haiti	Port-au-Prince	HAI	192.168.107.0/24	HAI1IDU	HAI1FAD1	HAI1FAD2	HAI1FADX	HAI2IDU2	HAI2FAD1	HAI2FAD2	HAI2FADX
8	COCESNA		COC	192.168.108.0/24	COC1IDU	COC1FAD1	COC1FAD2	COC1FADX				
9	Mexiko	Mexiko-City	MEX	192.168.109.0/24	MEX1IDU	MEX1FAD1	MEX1FAD2	MEX1FADX				
10	Sint Maarten	Philipsburg	STM	192.168.110.0/24	STM1IDU	STM1FAD1	STM1FAD2	STM1FADX				
11	Jamaika	Kingston	JAM	192.168.111.0/24	JAM1IDU	JAM1FAD1	JAM1FAD2	JAM1FADX				
12	Cayman Islands	George Town	CAI	192.168.112.0/24	CAI1IDU	CAI1FAD1	CAI1FAD2	CAI1FADX				
13	Bahamas	Nassau	NAS	192.168.113.0/24	NAS1IDU	NAS1FAD1	NAS1FAD2	NAS1FADX				
14	Bahamas	Freeport	FPO	192.168.114.0/24	FPO1IDU	FPO1FAD1	FPO1FAD2	FPO1FADX				
15	Curacao	Willemstad	CUR	192.168.115.0/24	CUR1IDU	CUR1FAD1	CUR1FAD2	CUR1FADX				
16	Panama	Panama City	PAN	192.168.116.0/24	PAN1IDU	PAN1FAD1	PAN1FAD2	PAN1FADX				
17	Colombia	Bogta	COL	192.168.117.0/24	COL1IDU	COL1FAD1	COL1FAD2	COL1FADX				
18	Venezuela	Caracas	CCS	192.168.118.0/24	CCS1IDU	CCS1FAD1	CCS1FAD2	CCS1FADX				
19	Puerto Rico	San Juan	PUR	192.168.119.0/24	PUR1IDU	PUR1FAD1	PUR1FAD2	PUR1FADX	PUR2IDU2	PUR2FAD1	PUR2FAD2	PUR2FADX

Table 2: Device Naming Convention

2.4.2 Voice/Data Services

(1) COMSOFT has thoroughly analysed the functional requirements and the traffic and connectivity requirements for the aeronautical voice services in a virtual switched telephone network. The used multiplexer equipment in the interface card configuration for each site will meet all specified requirements.

(2) The Data/Voice interface handover to the customer will be realized for non-redundant equipped sites by using a dedicated connector panel.

Figure 1: Connector Panel Example

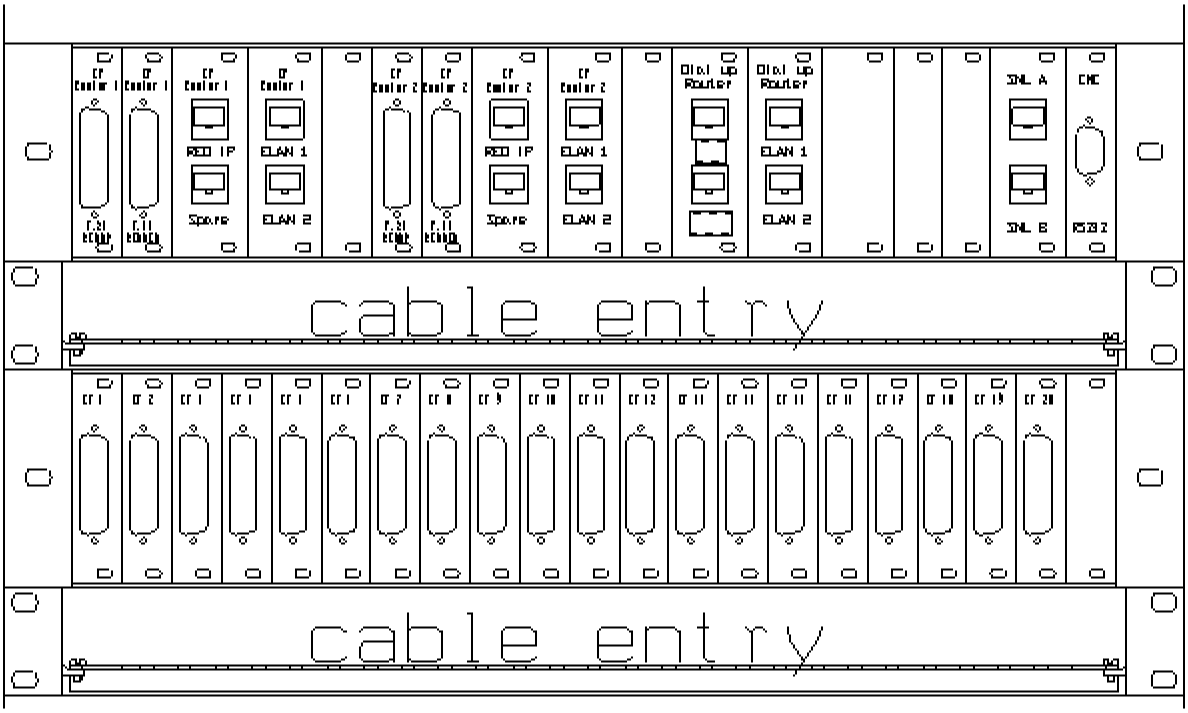


Figure 2: Connector Panel Drawing Example

(3) Likewise at the redundant stations the ports of the redundancy switch will be used.

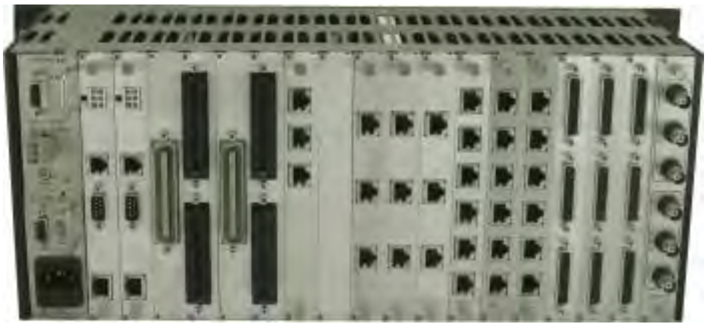


Figure 3: Redundancy Switch Panel Example

(4) All voice interfaces will be provided as RJ-45 jack.

(5) All serial data interfaces will be provided as DB-25 connector female. The only exception is the Dominican Republic where two Winchester Connectors (female) are provided.

Figure 4: DB-25 Connector Female

Figure 5: Winchester Connector (Dominican Republic)

2.4.2.1 Voice Services

(1) The 16000 bps for voice circuits in the tables below is for indication. MEVA III voice circuits rate is left to the Tenderer to select provided it complies with Attachment II Section C 12.4

(2) Aruba

Node Origin	Node Dest.	Ext.	Dest Ext.	Service	Data Rate	Interface	Customer Confirmation
Aruba	Miami	2900		SWV	16000	FXS	OK
Aruba	Curacao	2901		SWV	16000	FXS	OK
Aruba	CCS→PRG	2902		SWV	16000	FXS	OK
Aruba	Teleport		2400	SWV	1600	FXS	OK
Aruba	Curacao	ATS Hotline		VSD	16000	E&M	OK
Aruba	Caracas --> Josefa Camejo	end-to-end direct		VSD	16000	E&M	Not confirmed

Table 3: Dial Plan Aruba

(3) Atlanta

Node Origin	Node Dest.	Ext.	Dest Ext.	Service	Data Rate	Interface	Customer Confirmation
Atlanta	Teleport	dial-out	2400	SWV	[illegible]	FXS	OK

Table 4: Dial Plan Atlanta

(4) Bahamas, Freeport

Node Origin	Node Dest.	Ext.	Dest Ext.	Service	Data Rate	Interface	Customer Confirmation
Freeport	Multiple	1010		SWV	16000	FXS	OK
Freeport	Multiple	1001		SWV	16000	FXS	OK
Freeport	Multiple	1002		SWV	16000	FXS	OK
Freeport	Multiple	1003		SWV	16000	FXS	OK
Freeport	Teleport	[illegible]	2400	SWV	16000	FXS	OK

Table 5: Dial Plan Bahamas Freeport

(5) Bahamas, Nassau

Node Origin	Node Dest.	Ext.	Dest Ext.	Service	Data Rate	Interface	Customer Confirmation
Nassau	Multiple	2700		SWV	16000	FXS	OK
Nassau	Multiple	2701		SWV	16000	FXS	OK
Nassau	Multiple	2702		SWV	16000	FXS	OK
Nassau	Multiple	2703		SWV	16000	FXS	OK
Nassau	Multiple	2704		SWV	16000	FXS	OK

Node Origin	Node Dest.	Ext.	Dest Ext.	Service	Data Rate	Interface	Customer Confirmation
Nassau	Multiple	2705		SWV	16000	FXS	OK
Nassau	Multiple	2706		SWV	16000	FXS	OK
Nassau	Multiple	2707		SWV	16000	FXS	OK
Nassau	Teleport	dial-out	2400	SWV	16000	FXS	OK
Nassau	Miami	2750	1954	VSD	16000	E&M (29.5.)	OK

Table 6: Dial Plan Bahamas Nassau

(6) COCESNA

Node Origin	Node Dest.	Ext.	Dest Ext.	Service	Data Rate	Interface	Customer Confirmation
COCESNA	Multiple	2100		SWV	16000	FXS	OK
COCESNA	Multiple	2102		SWV	16000	FXS	OK
COCESNA	Teleport	dial-out	2400	SWV	16000	FXS	OK
COCESNA	Jamaica	VHF-PTT end-to-end direct		RRS	16000	E&M (PTT)	OK

Table 7: Dial Plan COCESNA

(7) Cuba

Node Origin	Node Dest.	Ext.	Dest Ext.	Service	Data Rate	Interface	Customer Confirmation
Cuba	Multiple	2300		SWV	16000	E&M	OK
Cuba	Multiple	2301		SWV	16000	E&M	OK
Cuba	Multiple	2302		SWV	16000	E&M	OK
Cuba	Multiple	2303		SWV	16000	E&M	OK
Cuba	Multiple	2304		SWV	16000	E&M	OK
Cuba	Multiple	2305		SWV	16000	E&M	OK
Cuba	Teleport	dial-out	[illegible]	SWV	16000	E&M	OK
Cuba	Jamaica	2352	3051	VSD	16000	E&M	OK
Cuba	Jamaica	2353	3052	VSD	16000	E&M	OK
Cuba	Merida	2355	1601	VSD	16000	E&M	OK
Cuba	Miami	2350	1951	VSD	16000	E&M	OK
Cuba	Miami	2351	1952	VSD	16000	E&M	OK
Cuba	Miami	2356	1958	VSD	16000	E&M	OK
Cuba	Miami	2354	1957	VSD	16000	E&M	OK

Table 8: Dial Plan Cuba

(8) Cayman Islands

Node Origin	Node Dest.	Ext.	Dest Ext.	Service	Data Rate	Interface	Customer Confirmation
Grand Cayman	Multiple	2500		SWV	16000	FXS	OK
Grand Cayman	Multiple	2501		SWV	16000	FXS	OK
Grand Cayman	Multiple	2502		SWV	16000	FXS	OK
Grand Cayman	Multiple	2503		SWV	16000	FXS	OK
Grand Cayman	Multiple	2504		SWV	16000	FXS	OK
Grand Cayman	Multiple	2505		SWV	16000	FXS	OK
Grand Cayman	Teleport	dial-out	2400	SWV	16000	FXS	OK

Node Origin	Node Dest.	Ext.	Dest Ext.	Service	Data Rate	Interface	Customer Confirmation
Grand Cayman	Jamaica	2550	3050	VSD	16000	E&M (29.05.)	OK

Table 9: Dial Plan Cayman Islands

(9) Curaçao

Node Origin	Node Dest.	Ext.	Dest Ext.	Service	Data Rate	Interface	Customer Confirmation
Curacao	Multiple	2200		SWV	16000	FXS	OK
Curacao	Multiple	2201		SWV	16000	FXS	OK
Curacao	Multiple	2202		SWV	16000	FXS	OK
Curacao	Teleport	dial-out	2400	SWV	16000	FXS	OK
Curacao	Aruba	ATS Hotline		VSD	16000	E&M	OK
Curacao	Caracas	ATS Hotline		VSD	16000	E&M	OK
Curacao	Dom Rep.	ATS Hotline		VSD	16000	E&M	OK
Curacao	Jamaica	ATS Hotline		VSD	16000	E&M	OK

Table 10: Dial Plan Curacao

(10) Colombia

Node Origin	Node Dest.	Ext.	Dest Ext.	Service	Data Rate	Interface	Customer Confirmation
Bogota	Multiple	4545		SWV	16000	E1	OK
Bogota	Multiple	4540		SWV	16000	E1	OK
Bogota	Multiple	4531		SWV	16000	E1	OK
Bogota	Multiple	4560		SWV	16000	E1	OK
Bogota	Multiple	4541		SWV	16000	E1	OK
Bogota	Multiple	4542		SWV	16000	E1	OK
Bogota	Multiple	4547		SWV	16000	E1	OK
Bogota	Teleport	dial-out	2400	SWV	16000	E1	OK
Bogota	Curacao	ATS Hotline		VSD	16000	E1	OK
Bogota	Jamaica	ATS Hotline		VSD	16000	E1	OK
Bogota	Panama	ATS Hotline		VSD	16000	E1	OK

Table 11: Dial Plan Colombia

(11) Caracas, Venezuela

Node Origin	Node Dest.	Ext.	Dest Ext.	Service	Data Rate	Interface	Customer Confirmation
Caracas	Multiple	8001		SWV	16000	FXS	OK
Caracas	Multiple	8002		SWV	16000	FXS	OK
Caracas	Multiple	8003		SWV	16000	FXS	OK
Caracas	Teleport	dial-out	2400	SWV	16000	FXS	OK
Caracas	Aruba	ATS Hotline		VSD	16000	FXS	OK
Caracas	Curacao	ATS Hotline		VSD	16000	FXS	OK
Caracas	San Juan	ATS Hotline		VSD	16000	FXS	OK

Table 12: Dial Plan Caracas

(12) Dominican Republic

Node Origin	Node Dest.	Ext.	Dest Ext.	Service	Data Rate	Interface	Customer Confirmation
Dom Rep.	Multiple	2600		SWV	16000	FXS	OK
Dom Rep.	Multiple	2601		SWV	16000	FXS	OK
Dom Rep.	Multiple	2602		SWV	16000	FXS	OK
Dom Rep.	Multiple	2603		SWV	16000	FXS	OK
Dom Rep.	Multiple	2604		SWV	16000	FXS	OK
Dom Rep.	Multiple	2605		SWV	16000	FXS	OK
Dom Rep.	Teleport	dial-out	2400	SWV	16000	FXS	OK
Dom Rep.	Curacao	ATS Hotline		VSD	16000	E&M	OK
Dom Rep.	Haiti	ATS Hotline		VSD	16000	E&M	OK
Dom Rep.	Miami	2650	1656	VSD	16000	E&M	OK
Dom Rep.	San Juan	ATS Hotline		VSD	16000	E&M	OK
Dom Rep.	San Juan	ATS Hotline		VSD	16000	E&M	OK

Table 13: Dial Plan Dominican Republic

(13) Haiti

Node Origin	Node Dest.	Ext.	Dest Ext.	Service	Data Rate	Interface	Customer Confirmation
Haiti	Multiple/Teleport	2800		SWV	16000	FXS	OK
Haiti	Multiple	2801		SWV	16000	FXS	OK
Haiti	Multiple	2802		SWV	16000	FXS	OK
Haiti	Multiple	2803		SWV	16000	FXS	OK
Haiti	Multiple	dial-out	2400	SWV	16000	FXS	OK
Haiti	Dom Rep.	ATS Hotline		VSD	16000	E&M	OK
Haiti	Jamaica	ATS Hotline		VSD	16000	E&M	OK
Haiti	Miami	2850	1950	VSD	16000	E&M	OK

Table 14: Dial Plan Haiti

(14) Jamaica

Node Origin	Node Dest.	Ext.	Dest Ext.	Service	Data Rate	Interface	Customer Confirmation
Jamaica	Multiple	3000		SWV	16000	FXS	OK
Jamaica	Multiple	3001		SWV	16000	FXS	OK
Jamaica	Multiple	3002		SWV	16000	FXS	OK
Jamaica	Multiple	3003		SWV	16000	FXS	OK
Jamaica	Teleport	dial-out	2400	SWV	16000	FXS	OK
Jamaica	Bogota	ATS Hotline		VSD	16000	E&M	OK
Jamaica	Curacao	ATS Hotline		VSD	16000	E&M	OK
Jamaica	Grand Cayman	3050	2550	VSD	16000	E&M	OK
Jamaica	Haiti	ATS Hotline		VSD	16000	E&M	OK
Jamaica	Panama	ATS Hotline		VSD	16000	E&M	OK
Jamaica	Cuba	3051	2352	VSD	16000	E&M	OK
Jamaica	Cuba	3052	2353	VSD	16000	E&M	OK
Jamaica	COCESNA	VHF-PTT end-to-end direct		RRS	16000	E&M (PTT)	OK

Table 15: Dial Plan Jamaica

(15) Miami (connected terrestrial via Miami Teleport)

Node Origin	Node Dest.	Ext.	Dest Ext.	Service	Data Rate	Interface	Customer Confirmation
Miami	Multiple	1900		SWV	16000	FXS	OK
Miami	Multiple	1901		SWV	16000	FXS	OK
Miami	Multiple	1902		SWV	16000	FXS	OK
Miami	Multiple	1903		SWV	16000	FXS	OK
Miami	Multiple	1904		SWV	16000	FXS	OK
Miami	Multiple	1905		SWV	16000	FXS	OK
Miami	Multiple	1906		SWV	16000	FXS	OK
Miami	Multiple	1907		SWV	16000	FXS	OK
Miami	Multiple	1908		SWV	16000	FXS	OK
Miami	Multiple	1909		SWV	16000	FXS	OK
Miami	Multiple	1910		SWV	16000	FXS	OK
Miami	Multiple	1911		SWV	16000	FXS	OK
Miami	Multiple	1912		SWV	16000	FXS	OK
Miami	Multiple	1913		SWV	16000	FXS	OK
Miami	Multiple	1700		SWV	16000	FXS	OK
Miami	Multiple	1701		SWV	16000	FXS	OK
Miami	Multiple	1702		SWV	16000	FXS	OK
Miami	Teleport	dial-out	2400	SWV	16000	FXS	OK
Miami	Cuba	1951	2350	VSD	16000	E&M	OK
Miami	Cuba	1952	2351	VSD	16000	E&M	OK
Miami	Cuba	1958	2356	VSD	16000	E&M	OK
Miami	Cuba	1957	2354	VSD	16000	E&M	OK
Miami	Dom. Rep.	1956	2560	VSD	16000	E&M	OK

Node Origin	Node Dest.	Ext.	Dest Ext.	Service	Data Rate	Interface	Customer Confirmation
Miami	Haiti	1950	2850	VSD	16000	E&M	OK
Miami	Nassau	1954	2750	VSD	16000	E&M	OK
Miami	St. Maarten	1953	3550	VSD	16000	E&M	OK

Table 16: Dial Plan Miami

(16) Mexico

Node Origin	Node Dest.	Ext.	Dest Ext.	Service	Data Rate	Interface	Customer Confirmation
Merida	Multiple	1600		SWV	16000	FXS	OK
Merida	Multiple	1602		SWV	16000	FXS	OK
Merida	Teleport	dial-out	2400	SWV	16000	FXS	OK
Merida	Cuba	1601	2355	VSD	16000	E&M (29.5.)	OK

Table 17: Dial Plan Mexico

(17) Panama

Node Origin	Node Dest.	Ext.	Dest Ext.	Service	Data Rate	Interface	Customer Confirmation
Panama	Multiple	3901		SWV	16000	FXS	OK
Panama	Multiple	3902		SWV	16000	FXS	OK
Panama	Multiple	3903		SWV	16000	FXS	OK
Panama	Multiple	3904		SWV	16000	FXS	OK
Panama	Multiple	3900		SWV	16000	FXS	OK
Panama	Teleport	dial-out	2400	SWV	16000	FXS	OK
Panama	Bogotá	ATS Hotline		VSD	16000	E&M	OK
Panama	Jamaica	ATS Hotline		VSD	16000	E&M	OK

Table 18: Dial Plan Panama

(18) Puerto Rico

Node Origin	Node Dest.	Ext.	Dest Ext.	Service	Data Rate	Interface	Customer Confirmation
San Juan	Multiple	1800		SWV	16000	FXS	OK
San Juan	Multiple	1801		SWV	16000	FXS	OK
San Juan	Multiple	1802		SWV	16000	FXS	OK
San Juan	Multiple	1803		SWV	16000	FXS	OK
San Juan	Multiple	1804		SWV	16000	FXS	OK
San Juan	Multiple	1805		SWV	16000	FXS	OK
San Juan	Multiple	1806		SWV	16000	FXS	OK
San Juan	Multiple	1807		SWV	16000	FXS	OK
San Juan	St. Maarten	ATS Hotline		SWV	16000	FXS	OK
San Juan	St. Maarten	ATS Hotline		SWV	16000	FXS	OK

Node Origin	Node Dest.	Ext.	Dest Ext.	Service	Data Rate	Interface	Customer Confirmation
San Juan	St. Maarten	ATS Hotline		SWV	16000	FXS	OK
San Juan	St. Maarten	ATS Hotline		SWV	16000	FXS	OK
San Juan	Teleport	dial-out	2400	SWV	16000	FXS	OK
San Juan	Dom. Rep.	ATS Hotline		VSD	16000	E&M	OK
San Juan	Dom. Rep.	ATS Hotline		VSD	16000	E&M	OK
San Juan	St. Maarten	ATS Hotline		VSD	16000	E&M	OK
San Juan	Caracas	ATS Hotline		VSD	16000	E&M	OK

Table 19: Dial Plan Puerto Rico

(19) Sint Maarten

Node Origin	Node Dest.	Ext.	Dest Ext.	Service	Data Rate	Interface	Customer Confirmation
St. Maarten	San Juan (29.05.)	3501		SWV	16000	FXS	OK
St. Maarten	E/CAR	3502		SWV	16000	FXS	OK/ Anguilla
St. Maarten	E/CAR	3503		SWV	16000	FXS	OK/ Anguilla
St. Maarten	E/CAR	3504		SWV	16000	FXS	OK/ Antigua
St. Maarten	E/CAR	3505		SWV	16000	FXS	OK/ St. Kitts
St. Maarten	Teleport	3500	2400	SWV	16000	FXS	OK
St. Maarten	Teleport	spare	spare	VSD	16000	E&M	OK
St. Maarten	San Juan	ATS Hotline		VSD	16000	E&M	OK

Table 20: Dial Plan Sint Maarten

2.4.2.2 Data Services

(1) Aruba

Node Origin	Node Dest.	Service	Data Rate	Sync/ Async	Interface	Customer Confirmation
Aruba	Atlanta	AFTN	9600	sync	RS232/V.24	OK

Table 21: Data Interfaces Aruba

(2) Atlanta

Node Origin	Node Dest.	Service	Data Rate	Sync/ Async	Interface	Customer Confirmation
Atlanta	Aruba	AFTN	9600	sync	serial, RS232	OK
Atlanta	Jamaica	AFTN	9600	sync	serial, RS232	OK
Atlanta	Nassau	AFTN	9600	sync	serial, RS232	OK
Atlanta	Haiti	AFTN	9600	sync	serial, RS232	OK
Atlanta	COCESNA	AFTN	9600	sync	serial, RS232	OK
Atlanta	Panama	AFTN	9600	sync	serial, RS232	OK

Node Origin	Node Dest.	Service	Data Rate	Sync/ Async	Interface	Customer Confirmation
Atlanta	Cuba	AFTN	9600	sync	serial, RS232	OK
Atlanta	Curacao	AFTN	9600	sync	serial, RS232	OK
Atlanta	St. Maarten	AFTN	9600	sync	serial, RS232	OK
Atlanta	Bogota	AFTN	9600	sync	serial, RS232	OK
Atlanta	Bogot	AFTN	9600	sync	serial, RS232	OK
Atlanta	Caracas	AFTN	9600	sync	serial, RS232	OK
Atlanta	Dom. Rep.	AMHS IP	64000	sync	EIA-530/EIA-422 (sync)	OK
Atlanta	St. Maarten	AMHS IP	64000	sync	EIA-530/EIA-422 (sync)	OK/Hardware only; No service
Atlanta	Curacao	AMHS IP	64000	sync	EIA-530/EIA-422 (sync)	/Hardware only; No service
Atlanta	COCESNA	AMHS IP	64000	sync	EIA-530/EIA-422 (sync)	/Hardware only; No service
Atlanta	Cuba	AMHS IP	64000	sync	EIA-530/EIA-422 (sync)	OK
Atlanta	Jamaica	AMHS IP	64000	sync	EIA-530/EIA-422 (sync)	/Hardware only; No service
Atlanta	Grand Cayman	AFTN	9600	sync	RS232	OK
Atlanta	Grand Cayman	AMHS IP	64000	sync	EIA-530/EIA-422 (sync)	/Hardware only; No service
Atlanta	Aruba	AMHS IP	64000	sync	EIA-530/EIA-422 (sync)	/Hardware only; No service
Atlanta	Nassau	AMHS IP	64000	sync	EIA-530/EIA-422 (sync)	/Hardware only; No service
Atlanta	Haiti	AMHS IP	64000	sync	EIA-530/EIA-422 (sync)	/Hardware only; No service
Atlanta	Panama	AMHS IP	64000	sync	EIA-530/EIA-422 (sync)	/Hardware only; No service
Atlanta	Caracas	AMHS IP	64000	sync	EIA-530/EIA-422 (sync)	/Hardware only; No service

Table 22: Data Interfaces Atlanta

(3) Bahamas, Freeport

Node Origin	Node Dest.	Service	Data Rate	Sync/ Async	Interface	Customer Confirmation
Freeport	Nassau	AFTN	9600	sync	serial, RS232 (V.24)	OK

Table 23: Data Interfaces Bahamas Freeport

(4) Bahamas, Nassau

Node Origin	Node Dest.	Service	Data Rate	Sync/ Async	Interface	Customer Confirmation
Nassau	Atlanta	AFTN	9600	sync	RS232	OK

Node Origin	Node Dest.	Service	Data Rate	Sync/ Async	Interface	Customer Confirmation
Nassau	Freeport	AFTN	9600	sync	RS232	OK

Table 24: Data Interfaces Bahamas Nassau

(5) COCESNA

Node Origin	Node Dest.	Service	Data Rate	Sync/ Async	Interface	Customer Confirmation
COCESNA	Atlanta	AFTN	9600	sync	serial, RS232	OK
COCESNA	Atlanta	AMHS IP	64000	sync	EIA-530/EIA-422 (sync)	OK
COCESNA	Cuba	RADAR	9600	sync	serial, RS232	OK

Table 25: Data Interfaces COCESNA

(6) Cuba

Node Origin	Node Dest.	Service	Data Rate	Sync/ Async	Interface	Customer Confirmation
Cuba	Merida	AFTN	9600	async	serial, V.24	OK
Cuba	Atlanta	AFTN	9600	sync	serial, V.24	OK
Cuba	Atlanta	AMHS IP	64000	sync	V.35	OK
Cuba	COCESNA	RADAR	9600	sync	serial, V.24	OK
Cuba	Jamaica	RADAR	9600	sync	serial, V.24	OK

Table 26: Data Interfaces Cuba

(7) Cayman Islands

Node Origin	Node Dest.	Service	Data Rate	Sync/ Async	Interface	Customer Confirmation
Grand Cayman	Atlanta	AMHS	64000	sync	Ethernet	OK
Grand Cayman	Atlanta	AFTN	9600	sync	RS232	OK

Table 27: Data Interfaces Cayman Islands

(8) Curaçao

Node Origin	Node Dest.	Service	Data Rate	Sync/ Async	Interface	Customer Confirmation
Curacao	Atlanta	AFTN	9600	sync	serial, RS232	OK
Curacao	Atlanta	AMHS IP	64000	async	V.35	OK
Curacao	Caracas	AFTN	2400	async	serial, RS232	OK
Curacao	Dom Rep.	AIDC	16000	sync	serial, RS232	OK
Curacao	Dom Rep.	Radar	9600	sync	serial, RS232	OK

Table 28: Data Interfaces Curacao

(9) Colombia

Node Origin	Node Dest.	Service	Data Rate	Sync/ Async	Interface	Customer Confirmation
Bogota	Panama	AFTN	2400	async	RS232	OK
Bogota	Atlanta	AFTN	9600	async	RS232	OK
Bogota	Atlanta	AFTN	9600	async	RS232	OK

Table 29: Data Interfaces Colombia

(10) Caracas, Venezuela

Node Origin	Node Dest.	Service	Data Rate	Sync/ Async	Interface	Customer Confirmation
Caracas	Atlanta	AFTN	9600	sync	RS232	OK
Caracas	Curacao	AFTN	2400	async	RS232	OK

Table 30: Data Interfaces Caracas

(11) Dominican Republic

Node Origin	Node Dest.	Service	Data Rate	Sync/ Async	Interface	Customer Confirmation
Dom Rep.	Miami	Radar	9600	sync	serial, RS232	OK
Dom Rep.	San Juan	Radar	9600	sync	serial, RS232	OK
Dom Rep.	Curacao	Radar	9600	sync	serial, RS232	OK
Dom Rep.	Curacao	AIDC	16000	sync	serial, RS232	OK
Dom Rep.	Atlanta	AMHS IP	64000	async	V.35	OK

Table 31: Data Interfaces Dominican Republic

(12) Haiti

Node Origin	Node Dest.	Service	Data Rate	Sync/ Async	Interface	Customer Confirmation
Haiti	Atlanta	AFTN	9600	sync	serial, V.24	OK

Table 32: Data Interfaces Haiti

(13) Jamaica

Node Origin	Node Dest.	Service	Data Rate	Sync/ Async	Interface	Customer Confirmation
Jamaica	Cuba	RADAR	9600	sync	serial, RS232	OK
Jamaica	Atlanta	AFTN	9600	sync	serial, RS232	OK
Jamaica	Atlanta	AMHS IP	64000	sync	EIA-530/EIA-422 (sync)	OK

Table 33: Data Interfaces Jamaica

(14) Miami (connected terrestrial via Miami Teleport)

Node Origin	Node Dest.	Service	Data Rate	Sync/ Async	Interface	Customer Confirmation
Miami	Dom. Rep.	RADAR	9600	sync	serial, RS232	OK

Table 34: Data Interfaces Miami

(15) Mexico

Node Origin	Node Dest.	Service	Data Rate	Sync/ Async	Interface	Customer Confirmation
Merida	Cuba	AFTN	9600	async	serial, V.24	OK

Table 35: Data Interfaces Mexico

(16) Panama

Node Origin	Node Dest.	Service	Data Rate	Sync/ Async	Interface	Customer Confirmation
Panama	Bogota	AFTN	2400	async	serial, RS232	OK
Panama	Atlanta	AFTN	9600	sync	serial, RS232	OK

Table 36: Data Interfaces Panama

(17) Puerto Rico

Node Origin	Node Dest.	Service	Data Rate	Sync/ Async	Interface	Customer Confirmation
San Juan	Dom. Rep.	Radar	9600	sync	serial, RS232	OK/Hardware only; No service
San Juan	St. Maarten	Radar	9600	sync	serial, RS232	OK/Hardware only; No service
San Juan	St. Maarten	Radar	9600	sync	serial, RS232	OK/Hardware only; No service

Table 37: Data Interfaces Puerto Rico

(18) Sint Maarten

Node Origin	Node Dest.	Service	Data Rate	Sync/ Async	Interface	Customer Confirmation
St. Maarten	Atlanta	AFTN	9600	sync	serial, RS232	OK
St. Maarten	Atlanta	AMHS IP	64000	async	Ethernet	OK
St. Maarten	San Juan	Radar	9600	sync	serial, RS232	OK
St. Maarten	San Juan	Radar	9600	sync	serial, RS232	OK

Table 38: Data Interfaces Sint Maarten

2.4.2.3 IP Design IDU

(1) Teleport Miami

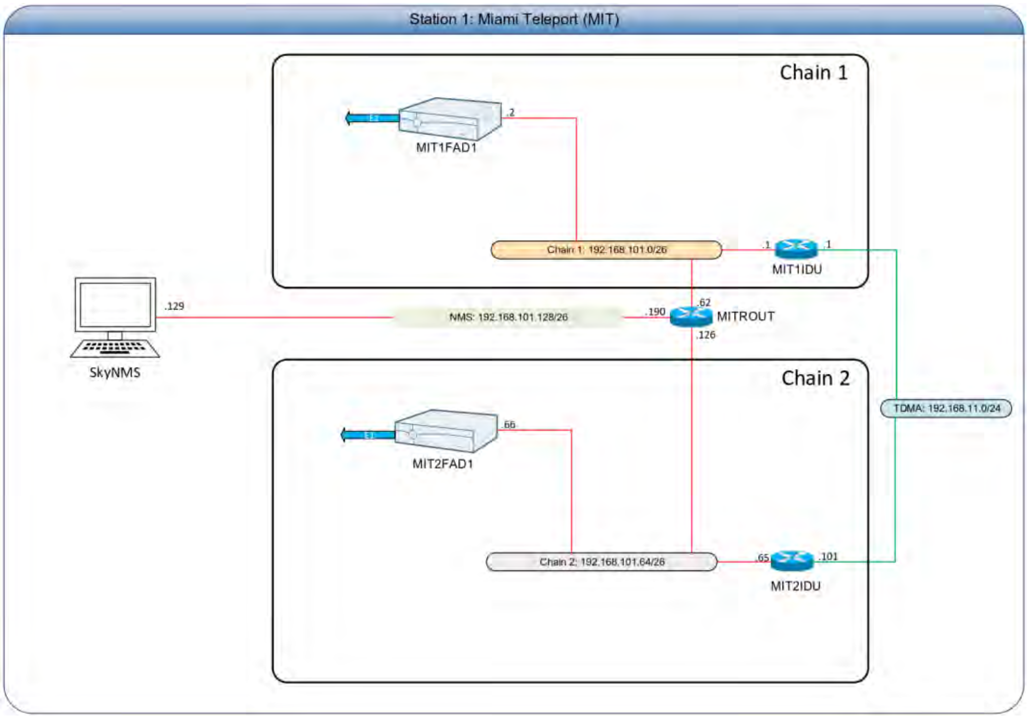


Figure 6: IP Design Teleport Miami

(2) Aruba

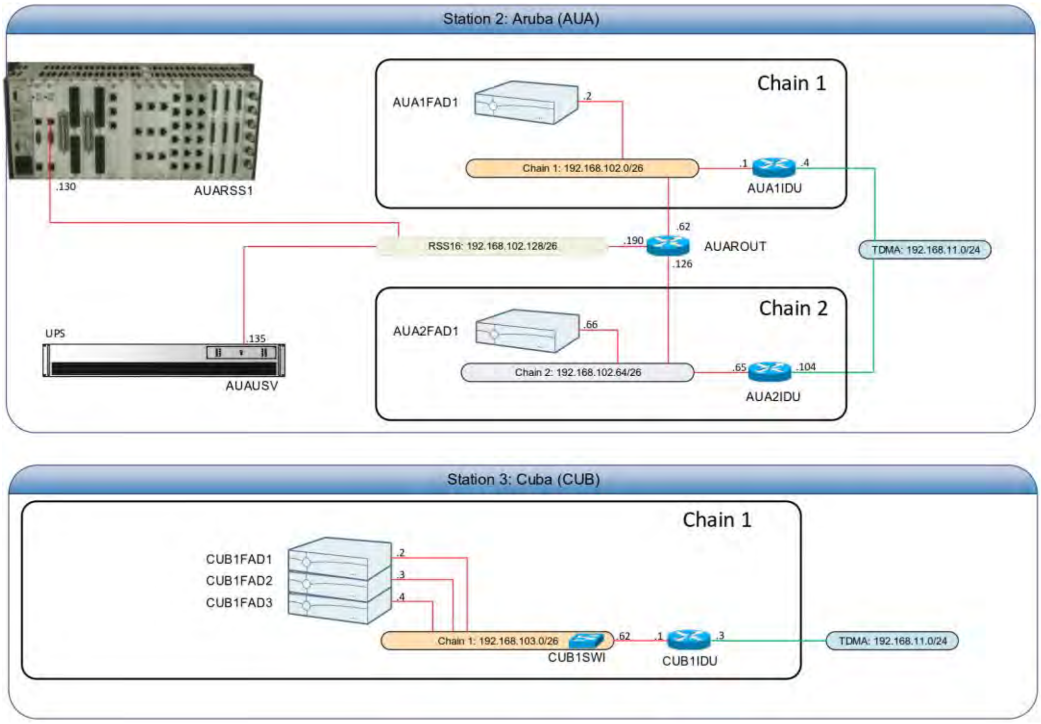


Figure 7: IP Design Aruba

(3) Atlanta

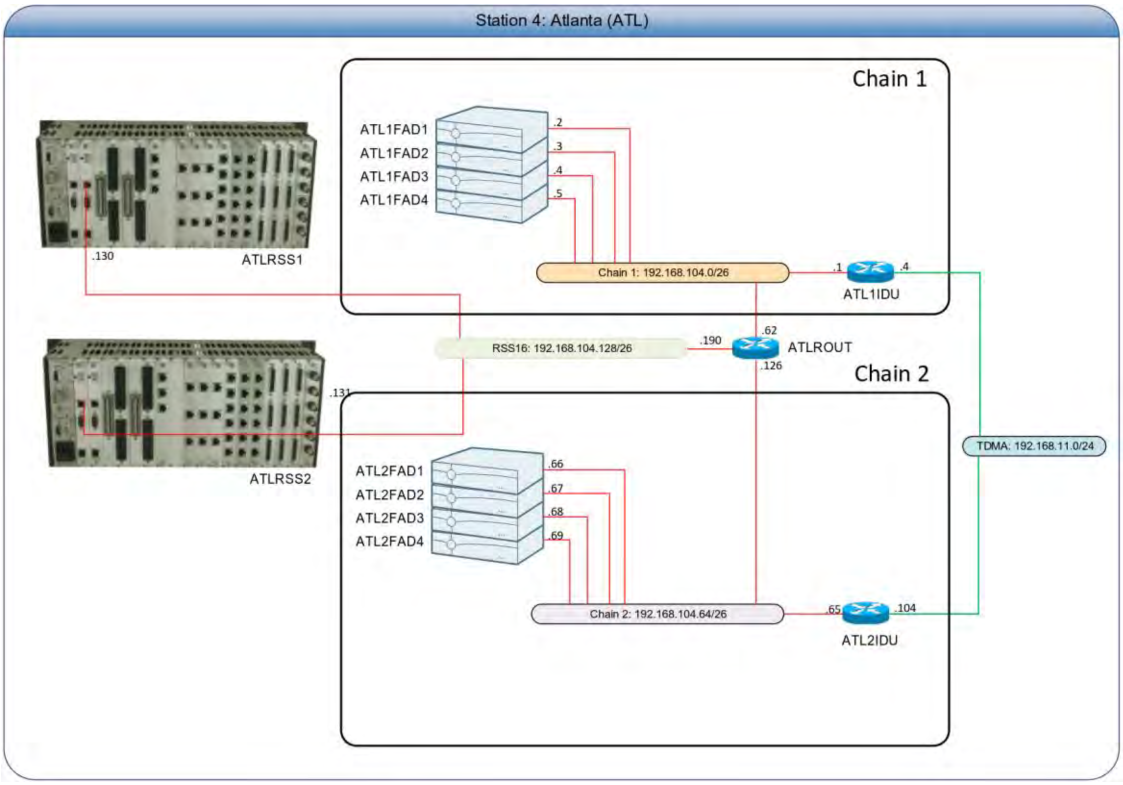


Figure 8: IP Design Atlanta

(4) Bahamas, Freeport

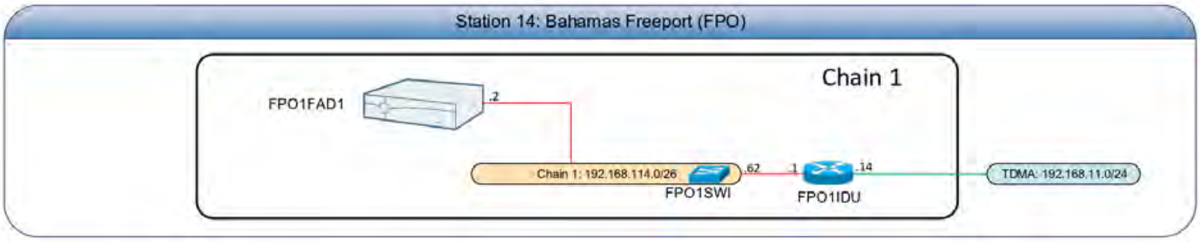


Figure 9: IP Design Bahamas Freeport

(5) Bahamas, Nassau

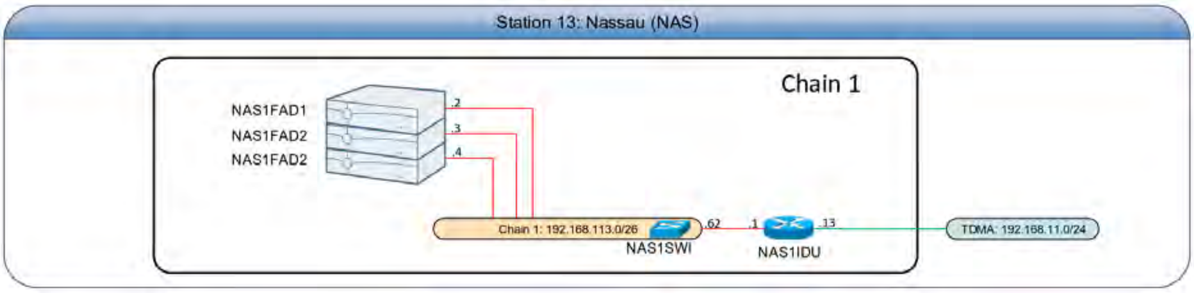


Figure 10: IP Design Bahamas, Nassau

(6) COCESNA

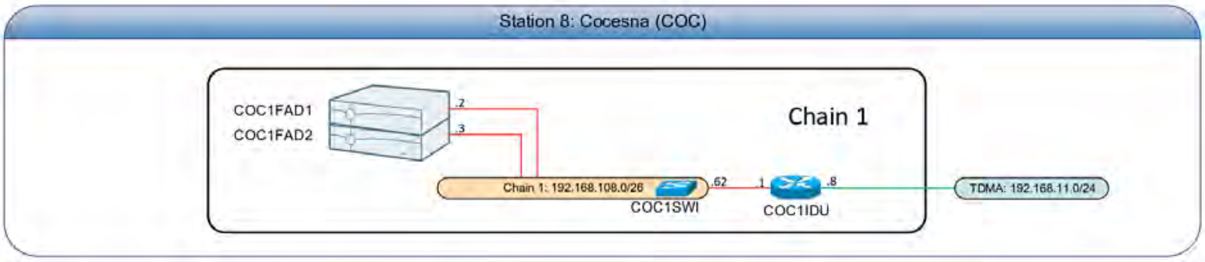


Figure 11: IP Design COCESNA

(7) Cuba

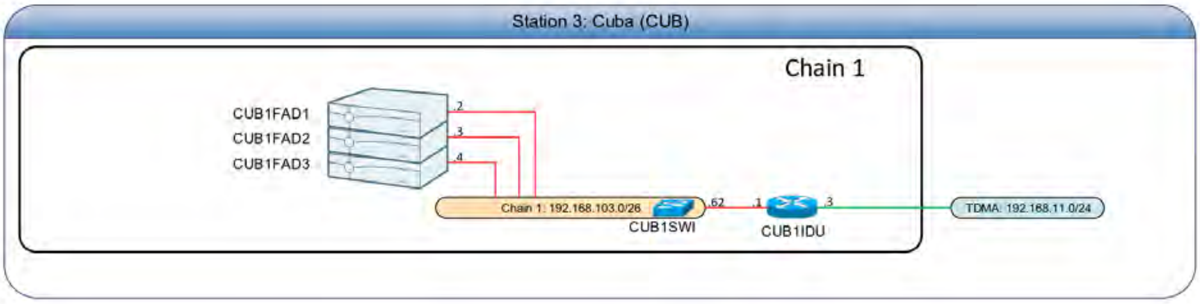


Figure 12: IP Design Cuba

(8) Cayman Islands

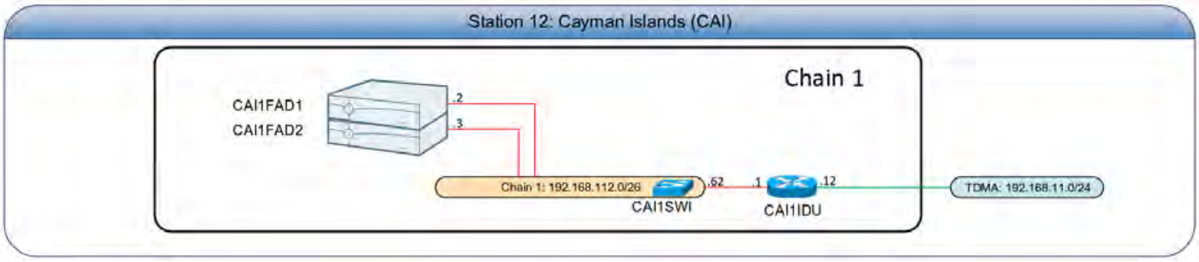


Figure 13: IP Design Cayman Islands

(9) Curaçao

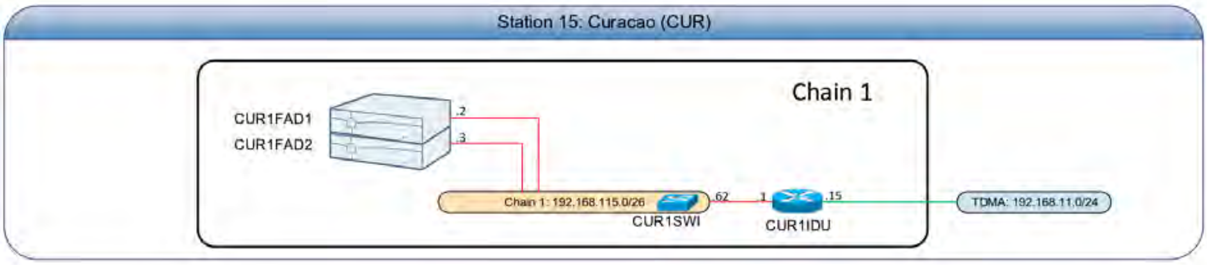


Figure 14: IP Design Curacao

(10) Colombia

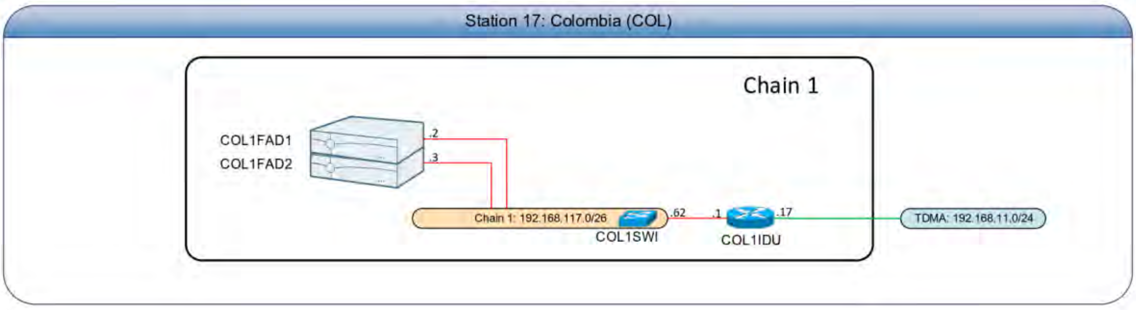


Figure 15: IP Design Colombia

(11) Caracas, Venezuela

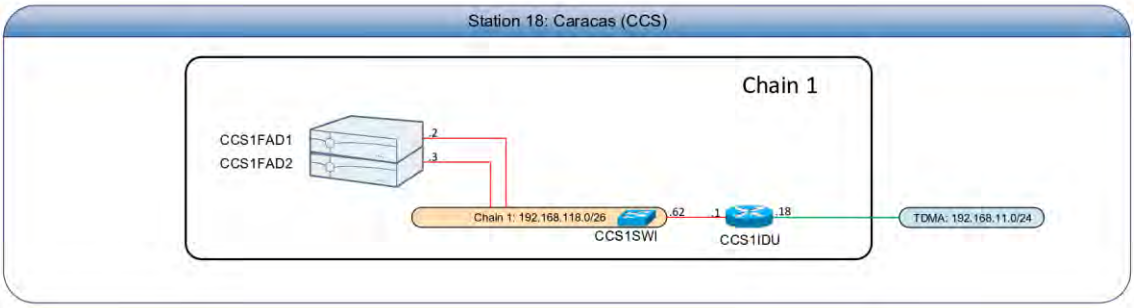


Figure 16: IP Design Caracas

(12) Dominican Republic

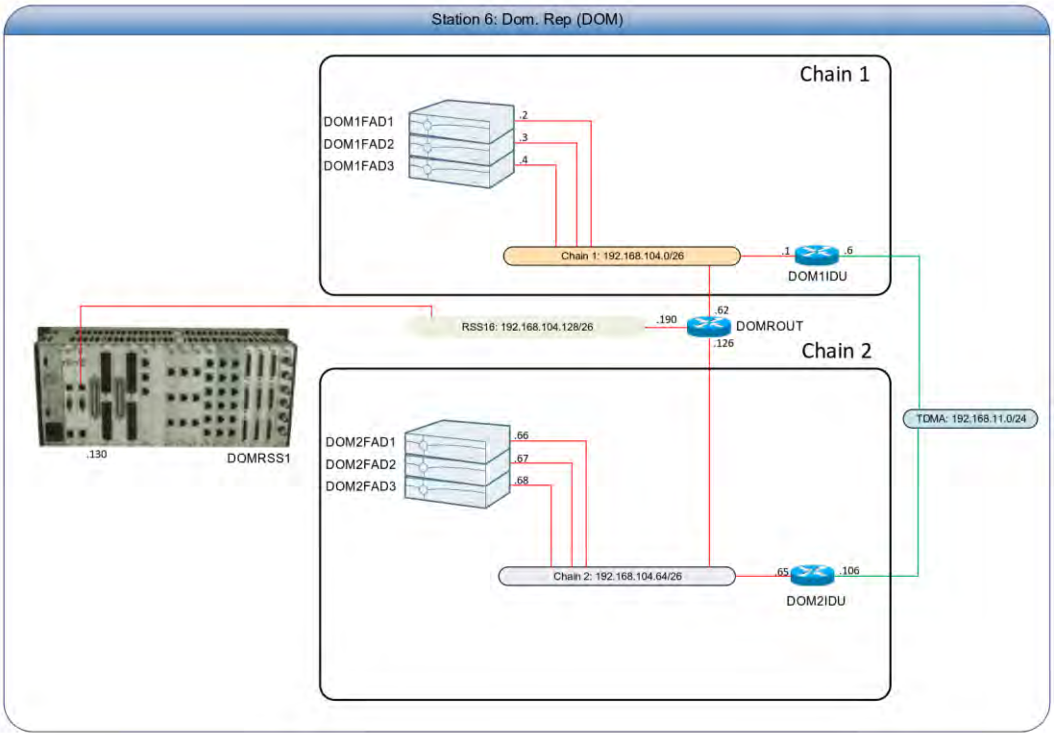


Figure 17: IP Design Dominican Republic

(13) Haiti

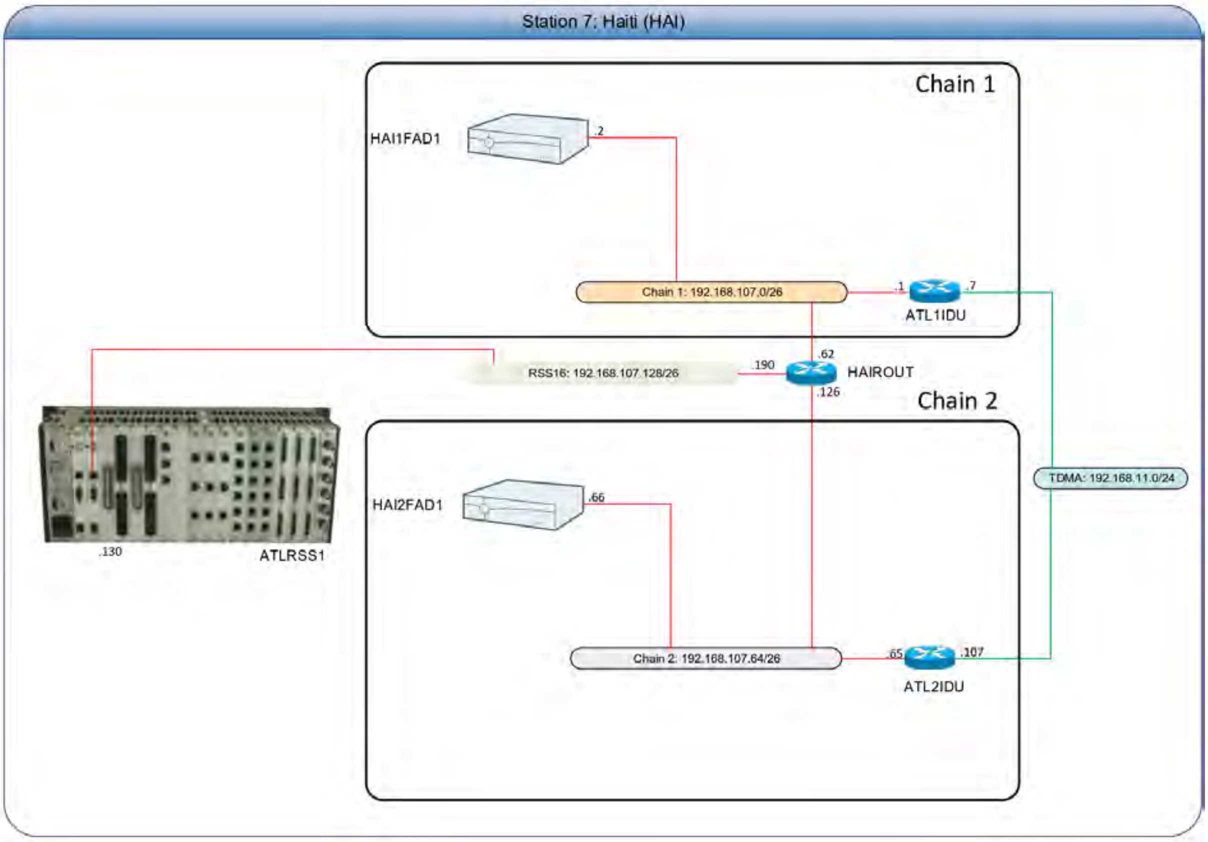


Figure 18: IP Design Haiti

(14) Jamaica

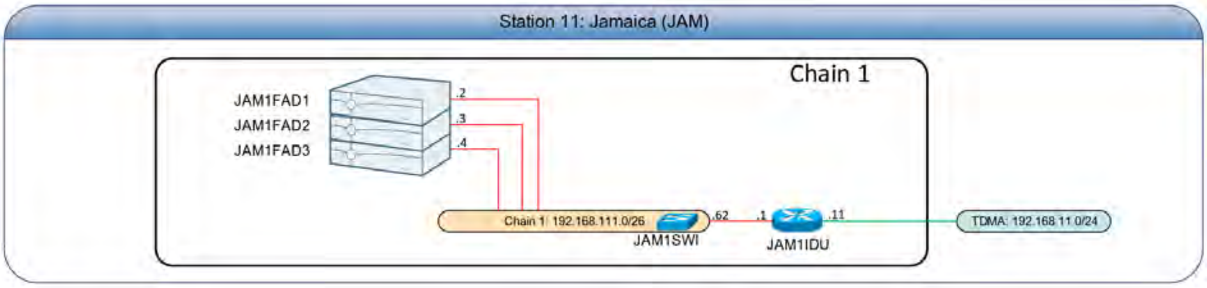


Figure 19: IP Design Jamaica

(15) Miami (connected terrestrial via Miami Teleport)

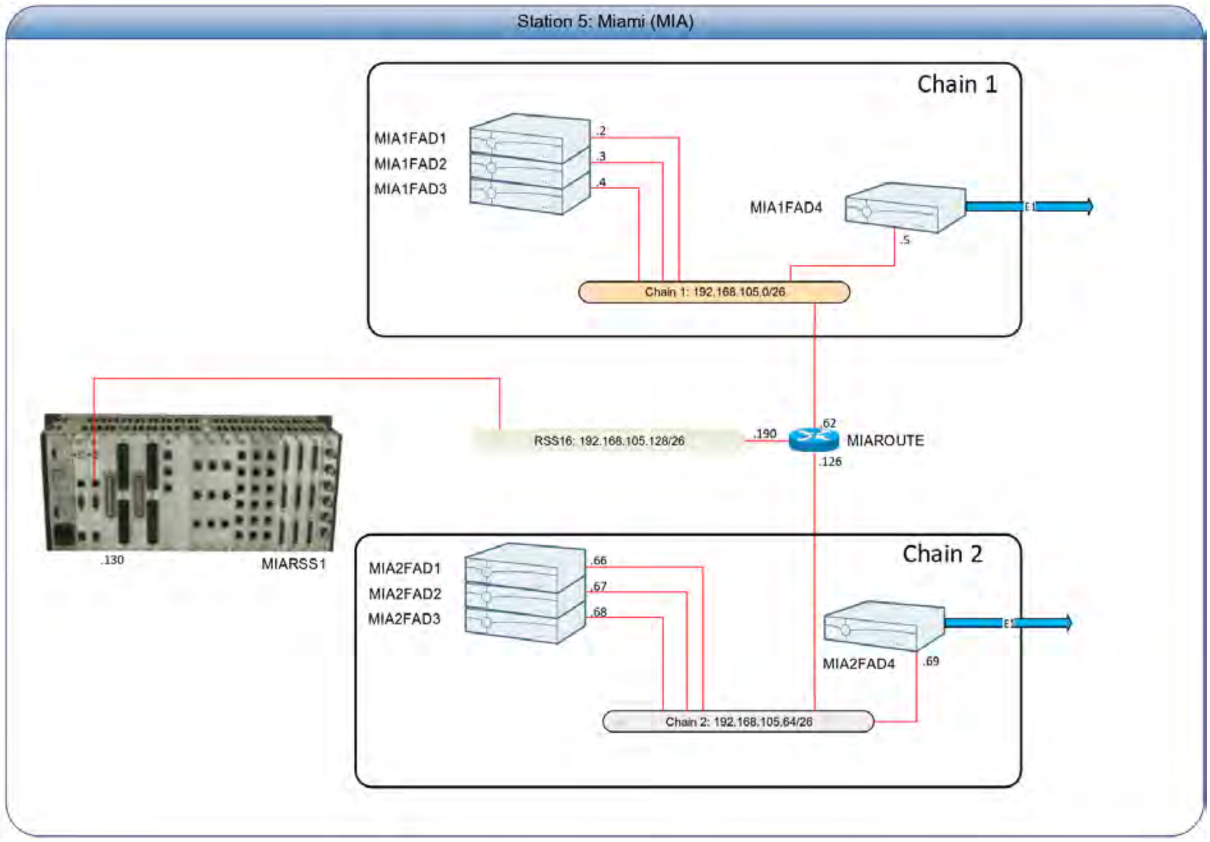


Figure 20: IP Design Miami

(16) Mexico

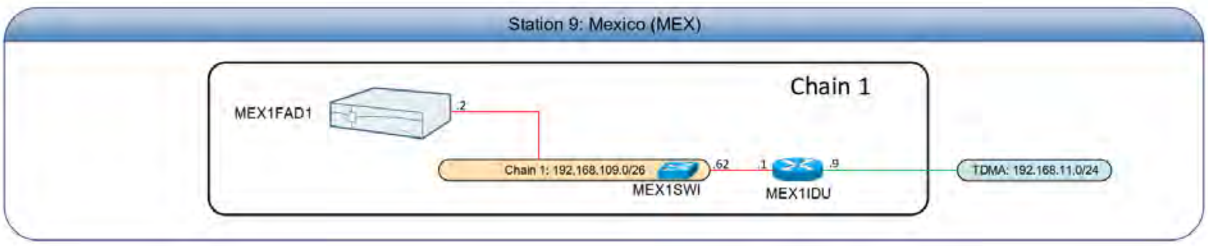


Figure 21: IP Design Mexico

(17) Panama

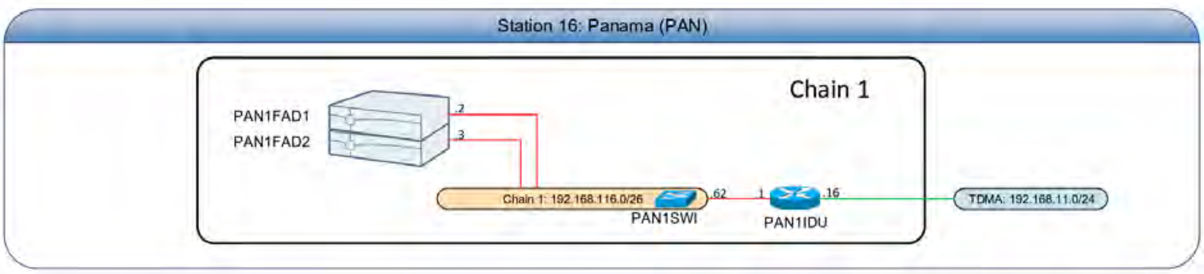


Figure 22: IP Design Panama

(18) Puerto Rico

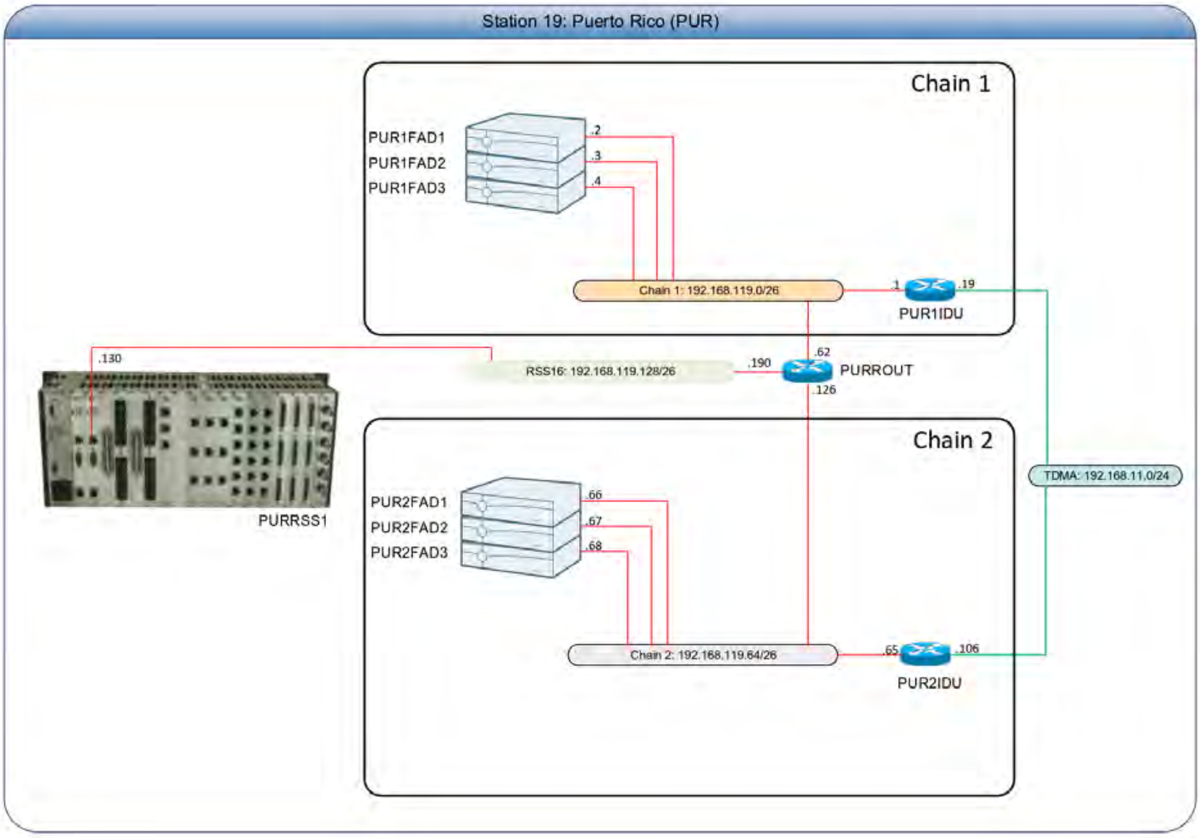


Figure 23: IP Design Puerto Rico

(19) Sint Maarten

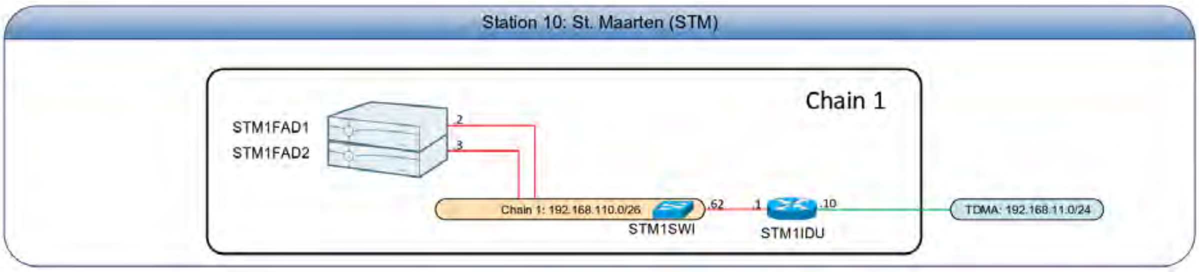


Figure 24: IP Design Sint Maarten

2.5 Station Types

(1) All MEVA III VSAT Network stations are principally consisting of

- FAD baseband equipment
- SkyWAN® modem
- Outdoor RF equipment
- Redundancy Switches (at redundant sites)

- Antenna

(2) The FAD baseband equipment provides connectivity for all required voice and data circuits and comprises one or more FAD multiplexers equipped with the necessary interface cards and, where appropriate, supplemented by FAD 8400 serial port extenders. Serial port extenders are connected to the multiplexer via LAN interfaces, whereas the multiplexers themselves are connected via serial (X.21) ports to the modem using the Frame Relay protocol for reasons explained above.

(3) The SkyWAN® modem offers up to 4 serial ports; depending on the location and the required number of multiplexers to be connected the according number of ports (between 1 and 3) will be activated.

(4) All indoor equipment is housed in professional 19” racks with 15 RUs height. The racks are preassembled in Germany prior to shipping to the respective MEVA III Network location in order to minimize on-site installation time and risk. The rack provides sufficient height to additionally accommodate a UPS for those MEVA III Network locations, where there is no other UPS available yet, as for example in Aruba according to our site survey.

(5) A patch panel provides the cabling interface between the modem and the existing inter-facility link (IFL) cables, which will be re-used.

2.5.1 Master and Backup Master Stations

(1) There are two Master Stations in the network, located at the Teleport in Miami, which hosts the Network Operation Center (NOC), and at the FAA Control Center in Atlanta, respectively. These locations have been selected as they fulfil the criteria:

- Reliable infrastructure, in particular power supply
- 24/7 maintenance available
- sufficient geographical independence not to be impacted simultaneously by the same link affecting phenomena

(2) In Atlanta the existing 3.8 meter antenna will be re-used, as well as the existing redundant RF configuration, which has only recently been procured as new. For the unlikely case, that one RF component therein fails and needs major repair, the complete configuration will be replaced by the corresponding configuration built from CPI amplifier components. These are taken from the spare part stock, which is dimensioned accordingly. The partial redundancy in the Atlanta VSAT node reflects the special importance of Atlanta as the AFTN message switching centre.

(3) The Master Station in the NOC is specifically designed and equipped for the following functions:

- Providing dial-up voice circuits to all MEVA III Network nodes for maintenance coordination.

- Initial testing of application circuits during the Site Acceptance Test after installation of a MEVA III Network station. This temporarily requires according multiplexer equipment taken from the spare part stock.
- Connecting the SkyWAN® NMS to monitor and control the network and its components.

(4) The SkyWAN® NMS is a tailored Network Management System for systems based on the SkyWAN® product family, which is used to setup and configure the system. It additionally provides the necessary software tools to perform trouble shooting, if necessary. Detailed information on the SkyNMS system and its use in the operational phase is provided in chapter 5.1.6 NMS Software “SkyNMS”.

(5) After successful initial remote station tests during MEVA III VSAT Network Implementation the Master Station in the NOC will take part in the operational traffic in the sense of passing traffic through a redundant leased line to FAA Miami (apart from the maintenance coordination calls). In that sense it is an active station not only providing the TDMA frame plans as means of bandwidth allocation for the whole network in response to the bandwidth requests from the active stations.

2.5.2 Remote Stations

(1) The main difference for the Remote Stations is that they are equipped with an IDU 2570 modem, which does not have the ability to act as a TDMA control instance.

(2) For all Remote Stations the existing 3.8 (or 3.7) meter antennas will be re-used with the exception of Curacao and Panama, further details below. The existing C-Band RF components will be replaced by components of CODAN/CPI 6700 series amplifier product line, which are mounted to the feed arm with mounting kits in a similar way.

(3) The situation is different for the FAA site in Miami, where the existing 7.3m antenna will not be used further. Miami will be connected to the satellite network using redundant terrestrial T1 connections to get access via the Newcom’s Teleport in Miami.

(4) All stations will be equipped with their corresponding voice and universal I/O interfaces needed to cover the needs of the bidding specifications. As baseband devices the FAD 9220, FAD 9230 and FAD 8400 units will be used. The corresponding numbers of multiplexer chassis and voice and data interface cards for each MEVA III Network location are shown in the attached network drawings.

(5) Curacao will not further use the existing antenna. COMSOFT will supply and install a new 3.8m Prodelin antenna with linear feed system based on a Non-Penetrating Mount.

(6) Panama will not further use the existing antenna due to an building relocation. COMSOFT will supply and install a new 3.8m Prodelin antenna with linear feed system based on a King Post Mount at a defined location acknowledged during the site-survey.

(7) Dominican Republic will provide a 3.8m Prodelin antenna with linear feed system on its own. COMSOFT expects the antenna to be ready for use pointed to the Intelsat 14 satellite and accepted by Intelsat (f.e. cross-pole isolation correctly done).

2.6 Key Network Elements

(1) The key system elements of the network solution are

- Satellite Router,
- Multiplexer,
- Antenna,
- Amplifier,

which will be described in the following chapters.

2.6.1 IDU 7000 Satellite Router Series

(1) The SkyWAN® IDU 7000 Satellite Router Series is a MF-TDMA modem, which includes IP Routing and Frame Relay switching capabilities. Each SkyWAN® IDU contains one Ethernet/Fast Ethernet port and up to four operational Frame Relay ports. Frame Relay Access Devices (SkyWAN® FADs or FRADs) are attached to SkyWAN®'s Frame Relay ports in an optimal way and provide a complete range of legacy protocols such as serial line interfaces, HDLC, SDLC as well as analogue and digital voice channels. The modular design provides the possibility to expand, thus gradually developing large networks.

(2) The indoor unit monitors the user interface for upcoming traffic demands, and dynamically assigns the satellite bandwidth accordingly. It uses the ND SatCom patented dynamic bandwidth assignment algorithms.

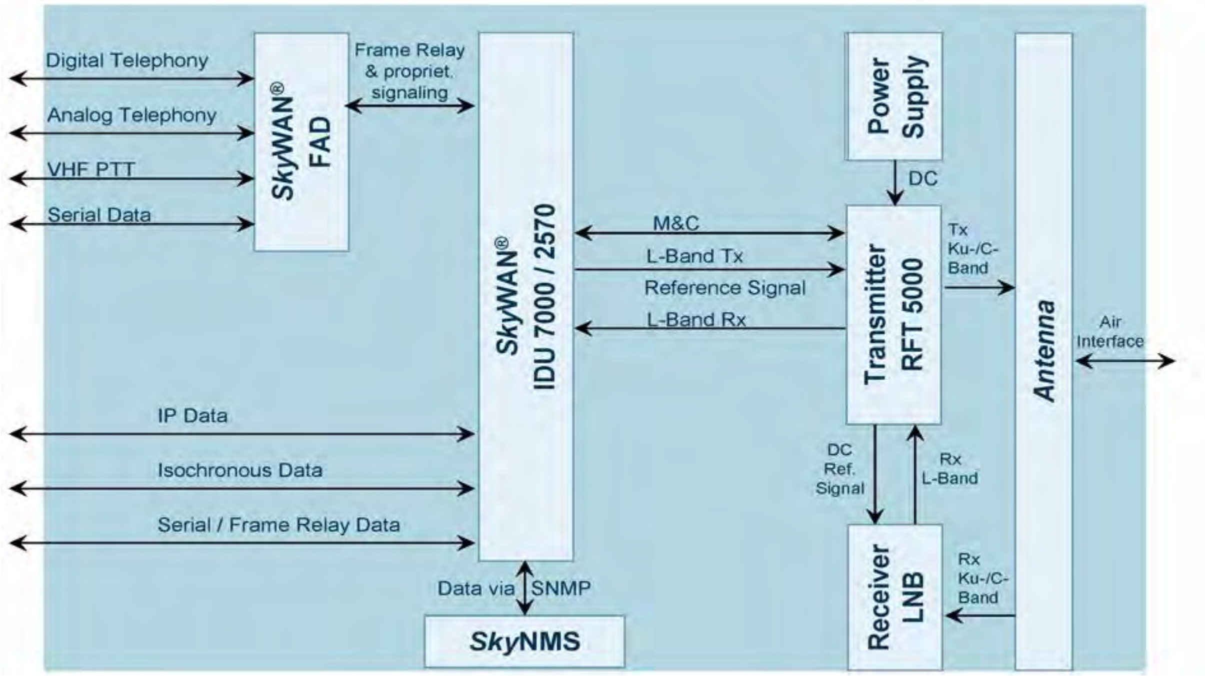


Figure 25: Architecture of Earth Station based on SkyWAN® IDU 7000 / 2570

2.6.1.1 SkyWAN® Application Performance

(1) An optimized application performance in a SkyWAN® network is granted by assigning a suitable Quality of Service (QoS) to each application.

- **Quality of Service Priorities:** SkyWAN® is able to support premium QoS to both, Frame Relay and IP services. Multiple QoS categories are available to transfer different traffic classes in an optimal way. Those traffic classes are prioritized according to the following order:

Priority Status	Description
Priority 1	Frame Relay Real Time
Priority 2	Platinum (Static IP Real Time)
Priority 3	Frame Relay Control
Priority 4	Platinum-Dynamic (Dynamic IP Real Time)
Priority 5	Titanium (IP Control Traffic)
Priority 6	Frame Relay Non-Real Time
Priority 7	Gold TCP-A (high priority IP Non-Real Time for TCP-A services)
Priority 8	Gold (high priority IP Non-Real Time)
Priority 9	Silver (medium priority IP Non-Real Time)
Priority 10	Bronze (low priority IP Non-Real Time)
Priority 11	Default (best effort IP Non-Real Time)

Table 39: Priority Classes

- **IP QoS Classes:** IP data can be classified based on their DSCPs, Source IP Address, Destination IP Address, source UDP/TCP port, destination UDP/TCP port or even wild cards can be used. Thus the network operator can offer various service levels independent of the end-user equipment capabilities which may support DSCP or not. Based on these criteria the IP packets can be handled according to the following data services:

QoS Classes	Description
Platinum	Static bandwidth allocation for IP Real Time applications
Platinum Dynamic	Dynamic bandwidth allocation for IP Real Time applications such as VoIP and IP video
Titanium	For control traffic to be able to manage the stations remote
Gold TCP-A	Non-Real Time IP service with highest priority which will be accelerated with embedded SkyWAN® TCP-A functionality
Gold	Non-Real Time IP service with highest priority for applications such as ERP
Silver	Non-Real Time IP service with medium priority for applications such as File Transfer
Bronze	Non-Real Time IP service with low priority for applications such as E-mail
Default	Non-Real Time IP service with lowest priority for applications such as HTTP access

Table 40: QoS Classes

(2) VoIP is supported with a dedicated service class called Platinum Dynamic. In this service class streaming capacity (bandwidth with no jitter) is automatically allocated in case of an IP call set-up and released at the end of the call.

2.6.1.2 Network Protocols

(1) The used networking equipment for MEVA III, i.e. the SkyWAN® modems and the FAD multiplexers represent the benchmark with regards to bandwidth and cost efficient voice and data transport over satellite. Circuit switching, X.25 and other legacy protocols as well as the IP protocol family (including TCP) are comprehensively supported, whereas the outdated ATM protocol for telecommunication infrastructure backbones is not supported.

(2) The SkyWAN® modems and the FAD multiplexers in the proposed FR operations mode do not add any significant additional delay to the inevitable delay from the signal path to the satellite and back (approximately 250 milliseconds). The processing time within the equipment is well below 100 milliseconds at any time such that a total delay of 350 milliseconds from SDP to SDP will never be exceeded.

(3) By employing Frame Relay as underlying protocol over satellite, SkyWAN® modems and the FAD multiplexers provide natural support of PVCs and SVCs and thus the

basis for other packet and circuit switched protocols. Data speeds and packet sizes are variable in a very wide range on all levels from the access interfaces to the TDMA frame structure.

(4) With regards to protocol support it is important to understand the VSAT network as a closed network, which internally works with specific technologies best adapted to the peculiarity of satellite communications, whereas external protocols are supported at the interface only. The most prominent example for this situation is TCP, which is inevitably very slow over satellite due to the necessary acknowledgements of data windows over a link with long delay. Nonetheless advanced satellite modems like SkyWAN® provide a workaround with local spoofing to achieve high data transfer speed and reproducing TCP at both ends.

(5) Therefore most common protocols are supported either directly by the SkyWAN® modem or by the FAD multiplexer as interface device; in rare cases another external interface device would be necessary.

- All listed IP protocols/features are supported by SkyWAN® with the exception of IPv6 (the extended address room is not usable in the satcom segment), which however is on the road map for the next software releases of the FAD.
- The FAD multiplexer supports VoIP SIP, whereas H.323 did not succeed as VoIP signalling protocol as expected and will not be made available anymore for the FAD.
- SkyWAN® modems support header compression as well as TCP acceleration, details on the capabilities of these features are provided in the attached White Papers.
- RIP is supported by the FAD.
- OSPF is supported by both, the FAD and the SkyWAN® modem.
- BGP-4 can be supported via a 3rd party device.
- IGMP is supported by the FAD.

(6) The serial interfaces and protocol support for synchronous and asynchronous circuits according to a) and b) is provided completely by the FAD and partly also by the modem.

(7) List of supported protocols:

- Network

Type	Description
Network Topology	Mesh, hierarchical, star, point-to-point, satellite point-to-point/multipoint
	Automatic node discovery and rerouting with least cost metric routing

	Automatic load balancing, bandwidth on demand (over leased line), dial back-up, time-of-day connect
QoS	8 classes of service, 16 priority weights, association to 802.1p and DiffServ TOS bits Data
Sync	PPP, BDLC, HDLC, SDLC, X.25, X.25 over Frame Relay annex F/G
Legacy Sync	COP, BSC, VIP, IBM/RJE, Uniscope, Poll/Select, Siemens Nixdorf, JCA, Zengin
Frame Relay	RFC-1490, UNI-DTE, UNI-DCE
Asynchronous	ENQ/ACK, XON/XOFF, transparent

- Telephony

Type	Description
Voice Compression Algorithms (5 Channels per DSP)	ACELP-CN (8 K/6 K), LDCD (16 K), G.711, G.723.1, G.726, G.729 and G.729a
FAX Relay	Group 3 FAX, Super G3 configurable to pass through or fallback to G3, Group 4 FAX and other non-voice bearer ISDN channel at 64 K
Modem Relay	V.32bis demodulation up to 14.4kbps, STU-III secure phone, modem pass through (G.711) for other modems
Network Signalling	Transparent point-to-point and any-to-any switching, including end-to-end QSI G/ISDN
Analogue Telephony Channels	FXS - loop and ground start, forward disconnect, caller ID and local billing tone generation
	FXO - loop start, forward disconnect and caller ID detection
	E&M - immediate and wink start, custom
	Pulse, DTMF and MF tone dialling
	Voice traffic routing with alternates destinations and digits manipulation using local mapping tables, locally switched TDM calls (hairpin)

- LAN

Type	Description
	Two IP address per Ethernet Port
Ethernet Interfaces	Ethernet II and IEEE 802.2, 802.3, SNAP
Standards	IP RIP V1/V2 or Static, OSPF, NAT, IP Multicast IGMP V1/V2 PIM-DM, BootP/DHCP relay, DHCP client, IPX RIP and SAP, LLC2, 802.1p/q prioritization and VLAN, 802.1D Spanning Tree Protocol (STP), MAC Layer
Filter Criteria	Based on protocol, address (source, destination or SAP), TOS bit/DiffServ or custom filtering

- Digital Telephony

Type	Description
ISDN and QSIG T1/E1 PRI and BRI Signalling	Euro ISDN/ETSI, National and Japan
T1 Signalling	robbed bit signalling, CCS transparent, SS7 transport with idle filtering and spoofing
E1 Signalling	CAS, CCS transparent, SS7 transport with idle filtering
Digital CAS Signalling Types	Immediate, Wink, FXO, FXS, FXO ground, FXS ground, E1/R2 (compelled, semi-compelled, DTMF), PLAR, custom (9230 only)
	Mu-law or A-law Coding

2.6.1.3 Clock Management

(1) The TDMA architecture of SkyWAN® includes regular exchange of synchronization information in dedicated time slots between the master and remote network stations. This avoids frequency drifts and ensures exact synchronism of time slots at all network nodes.

(2) The SkyWAN® modems use a highly accurate 10MHz internal reference source for the purpose of synchronization and frequency stability. The accuracy is better than 10^{-8} per year over all temperatures, which is more than sufficient for the desired purpose.

(3) It is important to note that the VSAT transport network is a packet switched network, which terminates all external signaling at its interfaces to other networks. This relieves the necessity of absolute synchronism.

2.6.1.4 System Software

(1) The core of the proposed VSAT System for MEVA III VSAT Network lies in the SkyWAN®'s TDMA modem technology. This technology is commercial off-the-shelf and is to a large extent based on system software. This technology is best documented in the attached System Description. There is no firmware involved at that functional level. The VSAT System becomes specific for MEVA III VSAT Network due to a customized configuration as result of the network engineering. The configuration manifests itself in a specific parameter file, which will be update whenever a configuration change becomes necessary.

(2) COMSOFT provides all MEVA III VSAT Network system components with the latest system software for each component, which represents the best available software with regards to bug fixing at the time of delivery.

(3) The required software licenses are priced and included in the proposed system equipment. All such licenses are unlimited in time.

2.6.1.5 IDU 7000

(1) Basically a SkyWAN® IDU consists of a User Interface Module (UIM) and a Satellite Interface Module (SIM). The SIM of a basic IDU7000 consists of two modules:

- Modulator Board (MOD)
- Demodulator and Satellite Interface Controller Board (SIC/DEMOD).

(2) Two additional cards can be added to the IDU7000 chassis:

- To enhance the receive channel capabilities of the modem a second SIC/DEMOD board can be added.
- To activate the master functionality a Frame Plan Generator Slot Card (FPG Board) has to be used.

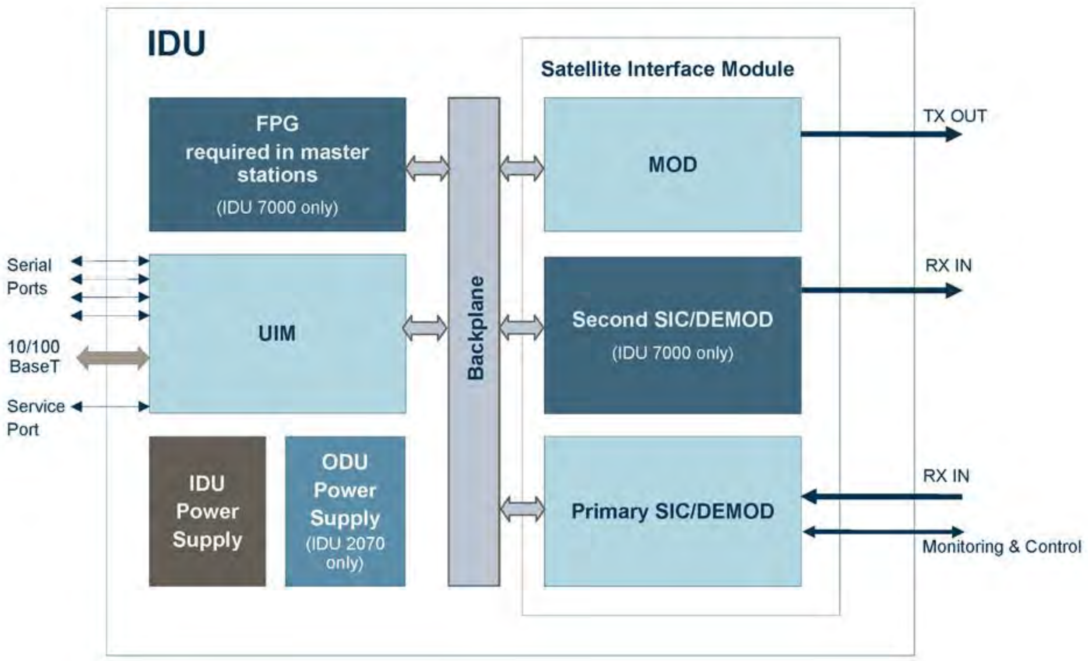


Figure 26: SkyWAN® IDU 7000 / 2570 / 2070 - Hardware Block Diagram

(3) Furthermore a SkyWAN® IDU 7000 has additional spare slots (SIC/ DEMOD 3 and4) for future extensions.

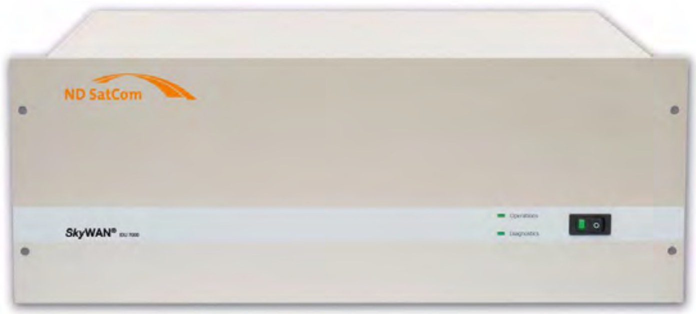


Figure 27: SkyWAN® IDU 7000 Front View

Figure 28: SkyWAN® IDU 7000 Rear View

(4) Thus SkyWAN® IDU 7000 delivers the complete feature and supports the full range of ODU combinations which are available with SkyWAN®. The IDU 7000 is linked to a BUC via the L-band interface, thus supporting broadband applications via satellite in a cost-effective way.

(5) The major components of a SkyWAN® IDU 7000 terminal are described below.

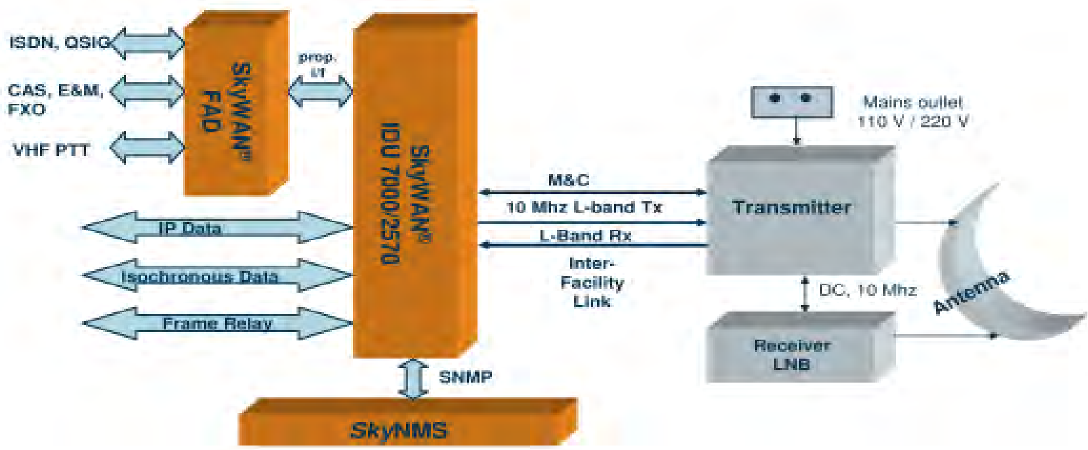


Figure 29: IDU 7000 Terminal Architecture

2.6.1.6 IDU 2570

(1) The 2U SkyWAN® is called 'SkyWAN® IDU 2570'. A SkyWAN® IDU 2570 behaves like a SkyWAN® IDU 7000 with base functionality. It is suitable for a slave station equipped with one demodulator board (SIC/DEMOD), one modulator board (MOD) and one user interface board (UIM).

Figure 30: SkyWAN® IDU 2570 Front View

Figure 31: SkyWAN® IDU 2570 Rear View

2.6.2 Redundancy Concept / Amplifier Solution

(1) Due to changes in manufacturers product range the initial offered redundancy Outdoor Units (ODU) of ND Satcom, COMSOFT will use a solution based on CODAN/CPI products.

(2) The system described in the following chapters is fully supported by the offered SkyWAN system and officially certified and announced by ND Satcom as suitable substitute of the RCU system developed by NDSatcom.

(3) The ODU redundancy consists of three main parts:

- Redundancy Controller
- CODAN amplifier (BUC)

and

- Low Noise Block converter (LNB)

2.6.2.1 Solution Description

(1) The ODU redundancy system from CPI/CODAN is a many years field proven solution.

(2) The following block diagram shows an general overview of involved components.

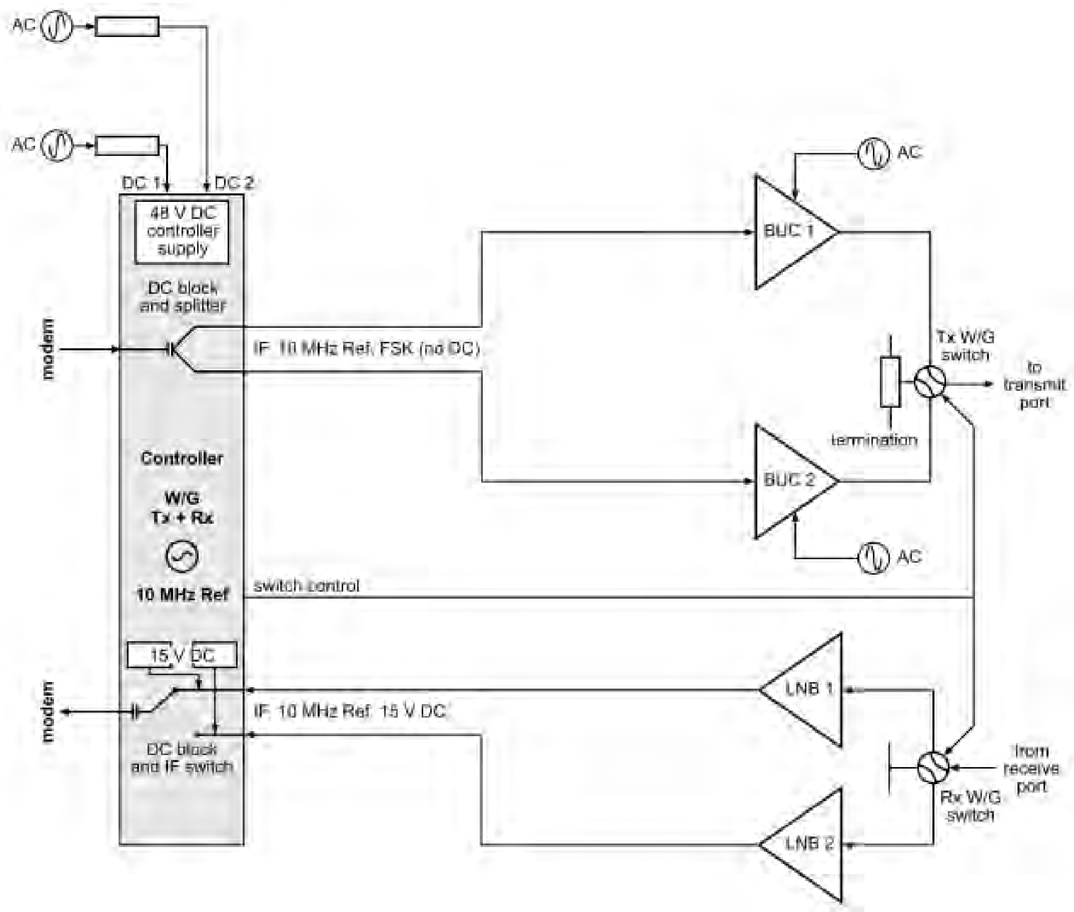


Figure 32: CODAN Redundancy ODU System

(3) To achieve highest reliability levels all BUC and LNB components responsible for network communication are duplicated in every redundant station.

(4) The offered redundancy system is designed to integrate easily with CODAN's range of BUCs which gives the benefit to have a complete solution of components perfectly matched.

(5) Simple in configuration and consisting of two BUCs, the controller, waveguide switches, cabling and LNBs.

(6) The available Warm or Hot Standby operation can be controlled automatically or manual. The manual control allows a time-to-time testing of the systems correct function during maintenance windows.

2.6.2.2 Redundancy Controller

(1) The Codan L-Band IF Transceiver Redundancy Controller 7586L is used to control two L-Band IF transceivers (BUC) in a redundancy system.

(2) For critical applications in which protection of the receive path is also a requirement, the 7586L Tx and Rx option is be used to provide BUC and LNB switching (Tx and Rx).

(3) In the offered configuration, the 7586L operates in stream redundancy mode where a fault detected in either the BUC or LNB in one stream causes switchover to the other BUC and LNB pair.

(4) When a detectable fault occurs in the on-line transceiver, and the off-line transceiver is serviceable, the redundancy controller switches over the two transceivers. The interruption to traffic is typically less than one second.

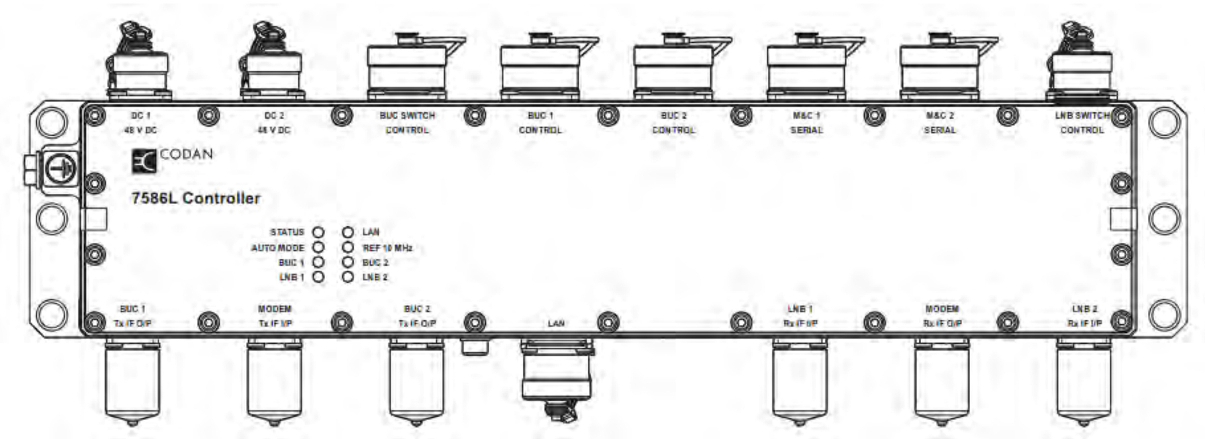


Figure 33: 7586L Controller, Tx + Rx, Tx/Rx

(5) The redundancy controller acts on RF waveguide switches to control active and stand-by path in transmit and receive direction.

Figure 34: WR137 Transmit RF W/G Switch

Figure 35: WR229 Receive RF W/G Switch

(6) The redundancy controller is fully controllable by LAN interface and can be integrated to a network control/monitoring system.

2.6.2.3 CODAN Amplifier

(1) The CPI/CODAN C-Band 6700 series BUCs are purpose-built for satcom-on-the-move customers, while also offering benefits for fixed site and offshore applications.

(2) Rugged & Reliable design of the BUC series provide MTBF figures which exceeds 100,000 hours and offers IP67 rating that provides protection from water or dust storms. The BUCs are sealed to 34 kPA (5 Psi).

(3) The BUCs are designed to be mounted on a wide range of earth station antennae.

(4) The BUC converts transmit L-Band IF signals from the modem to the required RF-Band.

Figure 36: CPI/CODAN C-Band BUCs

2.6.2.4 LNB System

(1) The LNB is a standard SATCOM block down-converter that converts C-Band downlink frequency to L-Band IF. This integrated low noise amplifier and down-converter is in a weather-proof housing for mounting at the antenna feed assembly.

(2) The LNB is phase locked to an external 10 MHz reference which makes this device suited for applications that require excellent frequency stability and low phase noise.

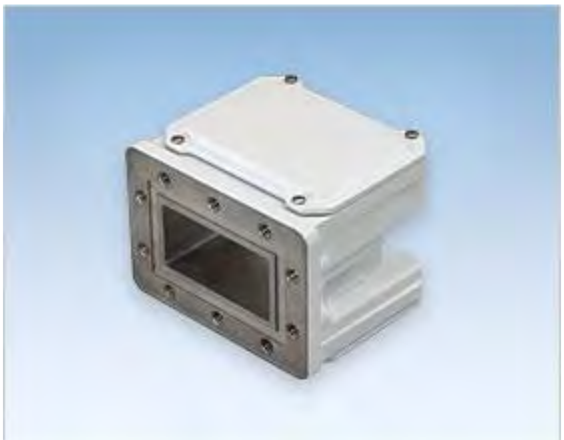


Figure 37: LNB C-Band

2.6.3 Frame-Relay Access Device (SkyWAN® FAD)

(1) The SkyWAN® family of VSAT networking products is complemented by two compact high performance Frame Relay Access Devices of latest technology:

- SkyWAN® FAD 9220 unit is a cost efficient solution for field offices
- SkyWAN® FAD 9230 unit is a powerful solution for branch offices

(2) Both devices provide Frame Relay concentration and switching of packetized voice as well as data from the LAN ports and/or the serial interfaces. Being specifically adapted to the ND SatCom SkyWAN® broadband VSAT system, the combination of both defines the state of the art for voice quality in packetized transmissions over satellite.

Figure 38: SkyWAN® FAD 9220/9230

(3) The SkyWAN® family of Frame Relay Access Devices is complemented by the SkyWAN® FAD 8400, a device which supports serial ports only. The SkyWAN® FAD 8400 enables its users to incrementally scale their network infrastructure as requirements for additional serial ports increase. It can be used stand alone or to extend the three serial ports of the SkyWAN® FAD 9220/9230.

(4) The SkyWAN® FAD 8400 is available in two options:

- 4 serial ports
- 8 serial ports

(5) The number of serial ports can be increased to whatever levels because multiple devices can be chained together over IP. Since the SkyWAN® FAD 8400 is an IP device with multiple connectivity options, it easily integrates into any network infrastructure.

Figure 39: SkyWAN® FAD 8400

(6) Based on Memotec's proven NetPerformer private network platform it allows for maximum network performance in low-bandwidth environments. Supporting both analogue and digital BRI/PRI telephony channels, as well as multiple T1/E1 data interfaces and serial data ports, SkyWAN® FAD is the solution to reduce network infrastructure costs and simplify WAN connections.

(7) It uses a unique technology to packetize and converge voice, data & video traffic onto a single network, and then further compresses it to minimize bandwidth requirements and reduce operating budget. All without sacrificing Quality of Service (QoS) for both voice & data applications!

(8) While supporting both VoIP and VoFR with integral voice routing plans, SkyWAN® FAD allows calls to be placed from anywhere in the ATC network to any other site. Coupled with VSAT technology capable of meshing voice communications, SkyWAN® FAD provides high quality, low bandwidth and single-hop voice communications between any two sites in the network.

(9) The auto-connect mode enables ATC hotlines and emergency communications. It automatically rings the receiving side as soon as the transmitting side handset is picked up.

(10) With this system it is possible to operate a hybrid satellite / terrestrial topology over a single platform, reducing costs and minimizing complexity.

2.6.4 Description of VSAT Antenna

(1) General Dynamics SATCOM Technologies (formerly Prodelin Corporation) is the world's largest manufacturer of Rx/Tx VSAT antennas. Having the broadest product line in the industry including Receive Only, Rx/Tx and Rural Telephony antenna systems.

(2) General Dynamics SATCOM Technologies offers nineteen antenna sizes, 47cm to 4.5M. General Dynamics SATCOM Technologies is the leader in obtaining type certifications and approvals for Intelsat, AsiaSat and Eutelsat.

(3) General Dynamics SATCOM Technologies antennas provide the best quality in the market due to the sophisticated, precision SMC compression molding process technology. General Dynamics SATCOM Technologies provides the best value antenna solution to the market with competitive prices, the highest quality products and superb engineering support.

Figure 40: 3,8m 4-piece C-Band Antenna

(4) **Atmospheric Condition:** Salt, Pollutants and Contaminants as Encountered in Coastal and Industrial Area.

2.6.5 Operation in a Noisy Environment

(1) COMSOFT has installed VSAT networks in noisy environment (Radar and aircraft altimeters). Therefore COMSOFT is able to study any interferences for a new VSAT installation. Moreover the modem supplied for this project is equipped with a built-in L-Band filter that suppresses the effects of radar transmitters (developed by NDSatcom specifically for ATC networks).

(2) The specifications of this filter are given below:

- Attenuation 950 – 1750 MHz: < 2 dB
- Peak-to-peak gain flatness 950 – 1750 MHz: < 1 dB
- Peak-to-peak gain flatness in any 12 MHz band: < 0,2 dB
- Attenuation 803 – 813 MHz: > 33 dB
- Return loss 950 – 1750 MHz: > 12 dB, 50 Ohm

- Attenuation 10MHz: < 0,5dB
- Return loss 10 MHz: > 12 dB, 50 Ohm
- DC resistance IN-OUT: < 0,6 Ohm
- DC-Voltage conducted through: < 24 V
- DC current: < 500 mA
- Short circuit protected: Yes

(3) If this filter is not sufficient enough to suppress the interference, COMSOFT will install C-Band filter which will be installed between the antenna feed and the LNB. COMSOFT has successfully installed those filters in Africa where radar signals were disturbing the VSAT station.

Figure 41: Radar Elimination Filter

2.6.6 Uninterruptible Power Supply (UPS) – Aruba and Haiti

(1) The equipment comes with powers supplies with auto adjusting voltage and frequency in the required range.

(2) COMSOFT offers its standard uninterruptible powers supply proven with sensitive electronics in various local power supply environments. The proposed equipment racks provide sufficient spare space to house the UPS as well. The proposed battery sets ensure autonomy for a minimum of 1 hour.

(3) The Uninterruptible Power Supply (UPS) is designed to prevent blackouts, brownouts, sags and surges from reaching customers valuable electronic equipment. The UPS filters out small utility line fluctuations and isolates customer equipment from large disturbances by internally disconnecting from the utility line. The UPS provides continuous power from its internal battery until the utility line returns to safe levels.

Automatic Internal Bypass - Supplies utility power to the connected loads in the event of a UPS overload condition or fault.

Hot-Swappable Batteries - Ensures clean, uninterrupted power to protected equipment while batteries are being replaced.

User-Replaceable Batteries - Increases availability by allowing a trained user to perform upgrades and replacements of the batteries reducing Mean Time to Repair (MTTR).

Automatic Self-Test - Periodic battery self-test ensures early detection of a battery that needs to be replaced.

Frequency and Voltage Regulation - Gives higher application availability by correcting poor frequency and voltage conditions without using the battery.

Generator Compatible - Ensures clean, uninterrupted power to protected equipment when generator power is used.

Figure 42: Uninterruptable Power Supply (UPS)

2.6.7 Measuring Equipment and Tools – Aruba

(1) COMSOFT provides a set of useful (measuring) tools for Aruba for the potential case of repointing the antenna. This set is described in this chapter.

2.6.7.1 Portable Satellite Network Tool Kit

(1) The COMSOFT delivered satellite network tool-kit is compromising of:

- Screwdriver - Slotted 2.5 mm; Slotted 4.0mm; Slotted 5.5mm; Slotted 6.5mm
- Screwdriver - PH 0; PH 1; PH 2
- Hexagon Ball Driver Set – 1.5mm, 2mm, 2.5mm, 3mm, 4mm, 5mm, 6mm, 8mm, 10mm
- Hexagon Ball Driver Set - 3/32", 1/8", 5/32", 3/16", 7/32", 1/4",5/16",3/8"

- Hexagon Ball Driver - 7/64"
- Adjustable Spanner - 6"; 8"; 15"
- Side Cutter-Knipex 140 mm
- 1/4in Drive Metric Socket Set
- 1/2in Sq Drive Socket set
- Inclinometer
- Compass
- Measurement Cable - 2m F-F
- Adapter - N-female to N-female (bullet); N-male to N-male;; N-male to F-female; N-female to F-male; NT Connector
- DC-Block: F-female to F-male 75Ohm 5-5000 MHz
- Tool: Wrench Ncm 100

2.6.7.2 Special Diagnostic Test Equipment

(1) The SATFINDER Fast S2 is an easy to use instrument to adjust a dish for optimized reception. The SATFINDER is microprocessor-controlled and shows the signal strength of the satellite in its LC display.

(2) Furthermore, the SATFINDER generates an acoustic signal, which increases by a better signal rate, and provides build in spectrum analyser as well as and margin test.

(3) **Key Features**

- SATTUNER with extended band 930-2250 MHz
- Detects and measures all MPEG 4HD signals and High Definition programs
- Automatic quality analysis: FAIL-MARGINAL-PASS
- Rotational encoder and numerical keyboard
- New ultra-bright graphics display
- Automatic and manual memory and Data Logger
- Weighs only 1 kg
- Up to 4 hour battery autonomy
- Battery test function to regenerate/measure battery levels and calibrate the indicator
- Supplied with soft badge for transport, mains adapter and 12 V vehicle adapter

- Free SW upgradeable on-line (USB-2 socket)

Figure 43: Satfinder Handheld

3 Operating Satellite

(1) Due to the requirement COMSOFT has chosen to use the Intelsat 14 @ 315°E satellite in C-Band, COMSOFT has done required link budget calculations in order to proof concept and system availability at 99,9%.

(2) MEVA II is served by Intelsat 14, a rather new and powerful satellite with good coverage and favourable elevation over the region and last but not least from a leading satellite operator. It is mandatory to continue with this satellite on a transponder of the American Beam with vertical co-polar polarization in order to share a common ODU at the Gateway Stations to the REDDIG network in Bogotá and Maiquetía. COMSOFT has booked the satellite capacity necessary for MEVA III on a transponder using same polarity.

(3) Accordingly the provided MEVA III VSAT Network solution is based on Intelsat IS-14 satellite capacity on this particular transponder of the current lease for MEVA II.

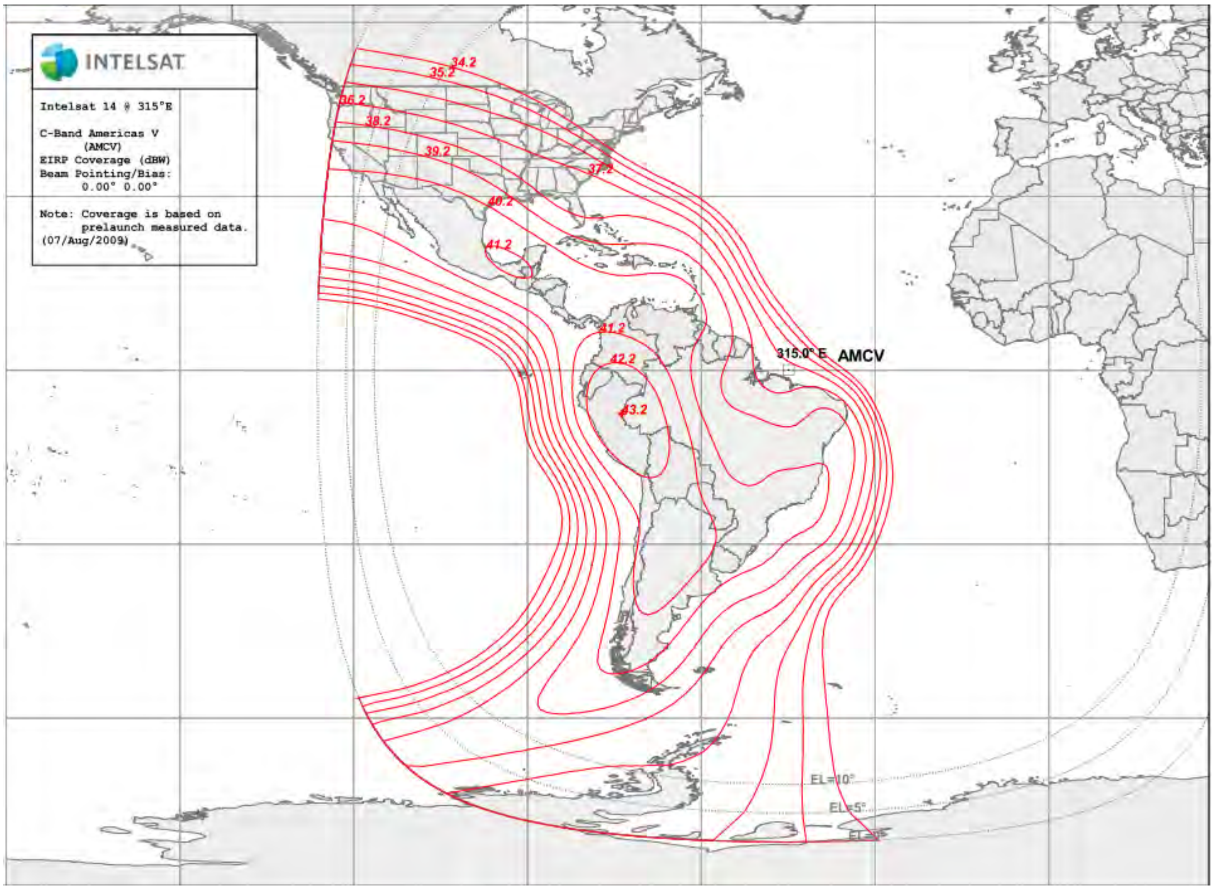


Figure 44: IS-14 C-Band Americas V - EIRP Coverage

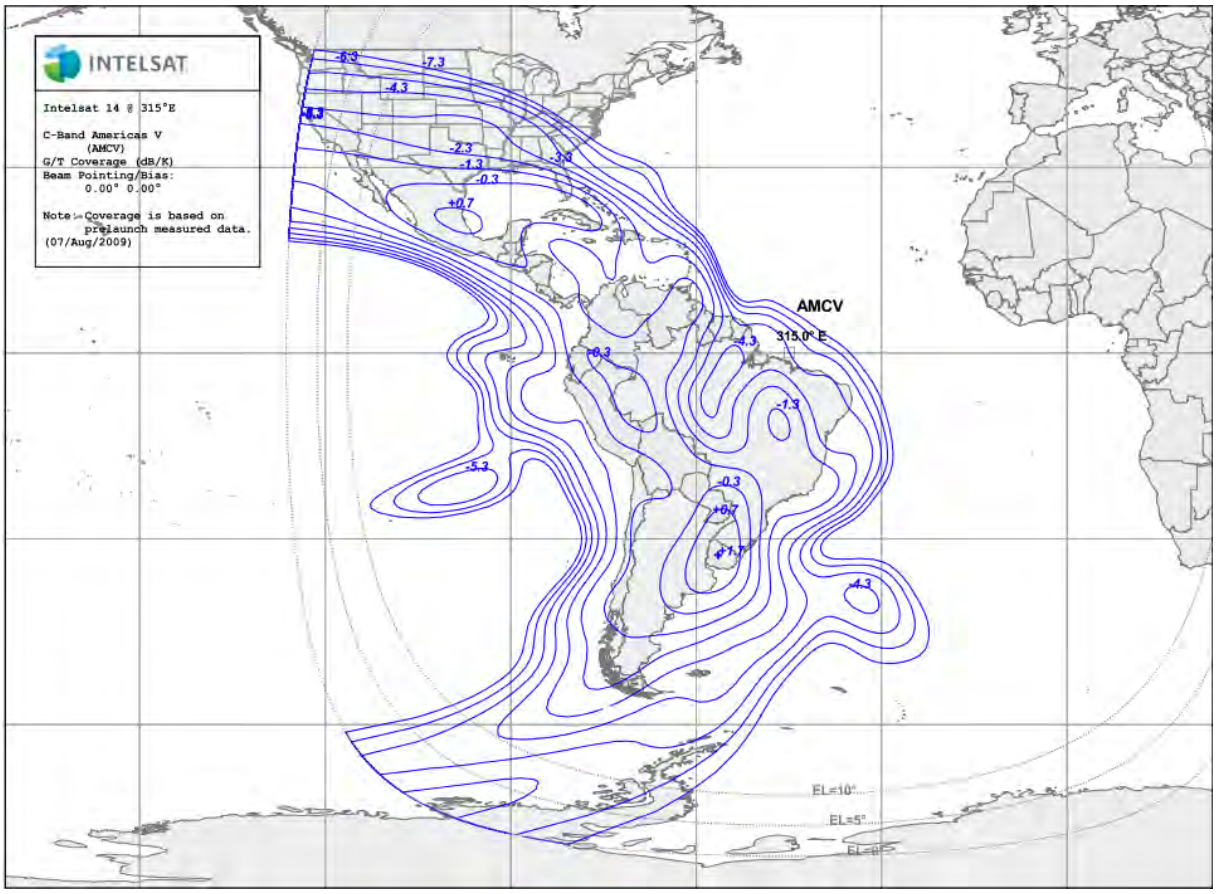


Figure 45: IS-14 C-Band Americas V - G/T Coverage

3.2 Intelsat 14 Description

(1) The Intelsat 14 communications satellite has started its services in November 2009 in the Pacific Ocean Region at 315°E. The satellite has a designed orbital maneuver life-time of over 15 years.

(2) Intelsat 14 offers Pan-American coverage, featuring a high-power C-Band beam and regional Ku-Band beams. With multiple, powerful C-Band and Ku-Band transponders and excellent look angle, Intelsat 14 is able to offer a variety of satcom services, including:

- Very Small Aperture Terminal (VSAT) communications and broadband Internet
- Telephony services
- Data trunking
- Cellular backhaul
- Direct-to-Home (DTH) TV broadcasting
- Video distribution

3.2.1 Intelsat 14 Service Areas

(1) Intelsat 14's antenna beams are optimized for maximum performance over Middle- and South America with access to Europe on a cross-strapped transponder basis. The satellite features steerable beams that enable every beam to be re-pointed toward any area within the visual earth from 315°E.

(2) The frequency bands used in Ku-Band are the FSS and BSS bands. Cross-connect channels between C-Band and Ku-Band enable flexible communication between Americas and Europe.

3.3 Link Budget and Carrier Sizing

(1) The first step in the design of complete satellite communications network is to calculate the total data rate capacity for all simultaneously active traffic. From this – by observing the traffic relations between the stations – a carrier structure can be derived which can accommodate all traffic in terms of volume and connectivity. Finally the necessary number of modulators and demodulators and, by including link budget calculation results, the size of antennas and RF amplifiers can be determined.

3.3.1 Network Capacity Calculation

(1) Based on the comprehensive information given in the Technical Specification on current and future connections and their characteristics it is in principle a straight forward exercise to calculate the required total data rate capacity of the network including the inevitable TDMA overhead. This applies to the permanent links for critical applications, which need to be always available and cannot be served by a Bandwidth-on-Demand (DAMA) connection. For the synchronous data applications among these, i.e. AFTN, Radar and AIDC, the data rate per connection is predefined and cannot be changed.

(2) For analogue speech transmissions the data rate for the codec can be selected for the best result in terms of voice quality and bandwidth consumption. According to the experience in other aeronautical networks 8kbps Comfort Noise is the best choice resulting in a data rate of 12.6kbps prior to TDMA framing. This data rate is chosen for shout-down (PAMA) as well as for dialled voice connections.

(3) There is also a significant share of links, which do not need to reserve bandwidth permanently and can thus be accommodated in demand assigned bandwidth.

(4) The proposed bandwidth allocation for the corresponding data links is as follows:

- Asynchronous AFTN: 1/3 of the nominal speed per link
- AMHS messages over IP: 1/3 of the nominal speed per link

(5) These generous provisions ensure that all such links could simultaneously carry traffic continuously at 1/3 of the nominal speed or intermittently at nominal speed for 1/3 of the time. It should be also noted that in the SkyWAN® TDMA architecture all terminals can utilize bandwidth reserved for their PAMA transmissions - whenever unused – for the transmission of other traffic. Thus it is inconceivable that there could ever be a bandwidth shortage for the more sporadic message traffic.

(6) The required bandwidth for dialled voice connections results from the specified blocking rate of less than 5% and from the information in the Q&A set 2: 0.833 Erlang, for this type of telephony, respectively 50 calls in the busy hour. Both statements are equivalent if the average call duration is 1 minute. According to the Erlang formula 3 duplex lines are required to accommodate this traffic volume with less than 5% blocking. It is assumed that potential traffic for maintenance coordination between the VSATs and the Network Operation Center may not be counted in the traffic volume quoted above. Therefore the data capacity design provides for 5 duplex channels over satellite.

(7) The chapter presents the calculation of the total capacity (including the share from the connections to the REDDIG and E/CAR network) with the following results:

Required PAMA data rate:	1.128,2 kbps
Required DAMA data rate:	434,3 kbps
Total required data rate:	1.562,5 kbps
TDMA overhead:	312,5 kbps
Information rate over satellite:	1.875,0 kbps

Data Rate	Total by Site	SWV	serial	AFTN synch 9,6kbps	Radar 9,6kbps	AIDC 16,0kbps	Remote Radio link 12,6kbps	PAMA Voice 12,6kbps	AFTN asynch 2,4kbps	AFTN asynch 9,6kbps	AHMS IP 64,0kbps	DAMA Voice 12,6kbps	Traffic Share per site	in %
Atlanta	14 A, 6B		14	13							7	1	275,2kbps	17,62%
Aruba	1A, 2D	4	1	1				2				4	39,2kbps	2,51%
Bahamas, Nassau	3A, 1D	8	4	2				1				9	41,7kbps	2,67%
Bahamas, Freeport	1A	4	1	1								5	15,1kbps	0,97%
Cayman Islands	1A, 1D, 1B	6	1	1				1			1	7	51,2kbps	3,28%
COCESNA	1A, 1B, 2R, 1S	3	2	1	1		1				1	3	56,4kbps	3,61%
Colombia	2A, 1C, 3D	7	3	2				3	1			8	66,6kbps	4,26%
Cuba	1A, 1B, 7D, E, 2R	6	4	1	2			7		1	1	7	149,2kbps	9,55%
Curaçao	1A, 1B, 1C, 4D, 1F, 1R	3	4	1	1	1		4	1		1	4	112,1kbps	7,18%
Dominican Republic	0A, 1B, 7D, 1F, 3R	6	5		3	1		5			1	7	136,8kbps	8,76%
Haïti	1A, 3D	8	1	1				3				5	52,9kbps	3,38%
Jamaica	1A, 1B, 7D, 1S, 2R	4	3	1	1		1	7			1	5	146,8kbps	9,40%
Mexico	1D, 1E	2	1					1		1		3	19,1kbps	1,22%
Panama	1A, 1C, 2D	5	2	1				2	1			6	42,2kbps	2,70%
St Maarten	1A, 1B, 2D	5	1	1	2			2			1	6	81,9kbps	5,24%
US, Puerto Rico	4D, 3R	12	1		3			4				13	93,4kbps	5,98%
US, Miami	8D, 1R	17	1		1			8				18	130,1kbps	8,33%
Venezuela	1A, 1C, 3D	3	2	1				3	1			4	52,6kbps	3,37%
Total by Site				28	14	2	2	53	4	2	14	115	1.562,5kbps	

Table 41: Total Capacity

(8) **Please Note:**

The Link Budgets were calculated with the satellite operator's input data for the satellite segment and are considered preliminary. During the final detailed network design, a second and definite verification has to be done in order to agree on the performance and operating parameters.

(9) A copy of the link budget estimate can be found in the attached document "Link Budget Calculation".

3.3.2 Amplifier Sizing & Link Budget

(1) The calculated data rate capacity for the specified traffic serves as input for the link budget analysis, in fact an information rate of 1950 kbps has been used. It is proposed to accommodate all traffic in a single TDMA carrier. This provides minimized TDMA overhead and optimized DAMA efficiency.

(2) Two different approaches can be used for the link budget calculations:

- For reference and verification purposes with regards to the space segment resource Intelsat provides its LST5 tool, which models all deteriorating effects on the link and in particular the specific intermodulation situation from other transponders and adjacent satellites. It also includes verified pattern dis/advantages in the footprint for major cities globally.
- For TDMA engineering purposes ND SatCom provides a calculation tool with the unique advantage that it allows to analyse all possible connections in a fully meshed scenario at the same time.

(3) For the objectives of this proposal, i.e.

- ensure a satellite link availability of 99.9% as a minimum,
- derive the necessary satellite capacity,
- determine the required transmit power at all MEVA III Network sites

it is sufficient to investigate the worst case scenario, which is in each case a link to Atlanta - the most disadvantaged downlink of all MEVA sites. This has been done for both,

- the transition phase, when carriers of MEVA II and MEVA III are simultaneously transmitted in a transmit power optimized configuration

  and

- the final MEVA III only phase in a bandwidth optimized configuration.

(4) The detailed analysis results are shown in the attached documentation.

(5) The key results are:

- The TDMA carrier can be modulated with 8PSK at a (Turbo PHI) coding rate ¾.
- This modulation and coding combination represents the best bandwidth consumption compromise between bandwidth limited and power limited.
- The power requirement for the SSPAs varies from site to site but does not exceed 40W at any time.

(6) For the equipment selection it is proposed to uniformly equip all locations with 40W SSPAs. This ensures some reserves for higher carrier data rates and deterioration of the satellite transponder over time or a change to another transponder which could be configured for a higher input power.

	Antenna Size (m)	Pattern Advantage Uplink (dB)	Pattern Advantage Downlink (dB)	Transmit Power (W)
Atlanta (USA)	4,6	1,3	1,1	10,5
Bogota Columbia)	3,8	3,8	5,2	5,5
Caracas (Venezuela)	3,8	[illegible],5	4,1	6,3
COCESNA	3,8	5	4,6	5,3
Cuba	3,8	5,6	3	5,4
Dominican Rep	3,8	3,3	3,6	7,6
Haiti	3,8	4,1	3,6	6,4
Kingston (Jamaica)	3,8	4,3	3,7	6,3
Merida (Mexico)	3,8	5,3	4,6	5,3
Panama City	3,8	4,1	4,5	6,3
San Juan (Puerto Rico)	3,8	2,5	3,6	8,6

Table 42: Amplifier Sizing

4 Training

(1) COMSOFT provides training for technical staff of the MEVA III Member States. The details of this training are presented in the attached Training Plan (TRP).

(2) On-the-Job Training for first level maintenance will conducted by COMSOFT´s installation personnel on completion of the installation works and prior to the Site Acceptance Test (SAT) procedures (to be conducted in the presence of the responsible technical staff of the MEVA III Member States).

5 Operation

5.1 Network Management & Control

(1) COMSOFT´s Network Operations Center (NOC) is the place from which system engineers supervise, monitor and maintain a telecommunications network.

(2) COMSOFT provides a network operations center, a room containing visualizations of the networks that are being monitored, workstations at which the detailed status of the network can be seen, and the necessary software to manage the networks. The network operations center is the focal point for network troubleshooting, software distribution and updating, router and domain name management, performance monitoring, and coordination with affiliated networks.

(3) COMSOFT´s NOC is laid out with several rows of desks, all facing a video wall, which typically shows details of highly significant alarms, on-going incidents and general network performance; a corner of the wall is used for showing a weather channel, as this can keep the NOC engineers aware of current events which may have an impact on the network or systems they are responsible for.

(4) COMSOFT will perform systems status, health and performance monitoring and alert the responsible “Technician on Duty” in case of problems. COMSOFT will continuously be responsible for the management of all faults or performance issues on all services provided. This will include a 24-hour monitoring. COMSOFT is further responsible for logging problems with the provided services and will maintain a fault management audit trail of all activities until service restoration. Copies of these logs are made available for customer inspection upon request.

(5) The main tasks of COMSOFT´s NOC are:

- **Network Operation Center:** monitoring, control and administration of satellite-networks, Help-Desk, troubleshooting, activation of maintenance, network statistics
- **Field Service:** configuration, integration and maintenance of VSATs and networks, equipment tests, troubleshooting and analysis of problems
- **Operation of COMSOFT Backbone Network:** monitoring, control and administration of upstream networks, administration of public IPs, analysis of problems, network statistics, technical support
- **Space Segment:** negotiate with satellite providers on satellite capacity, modify and optimize usage of space capacity
- **Facility Management:** monitoring and control of Teleport infrastructure, activation of maintenance

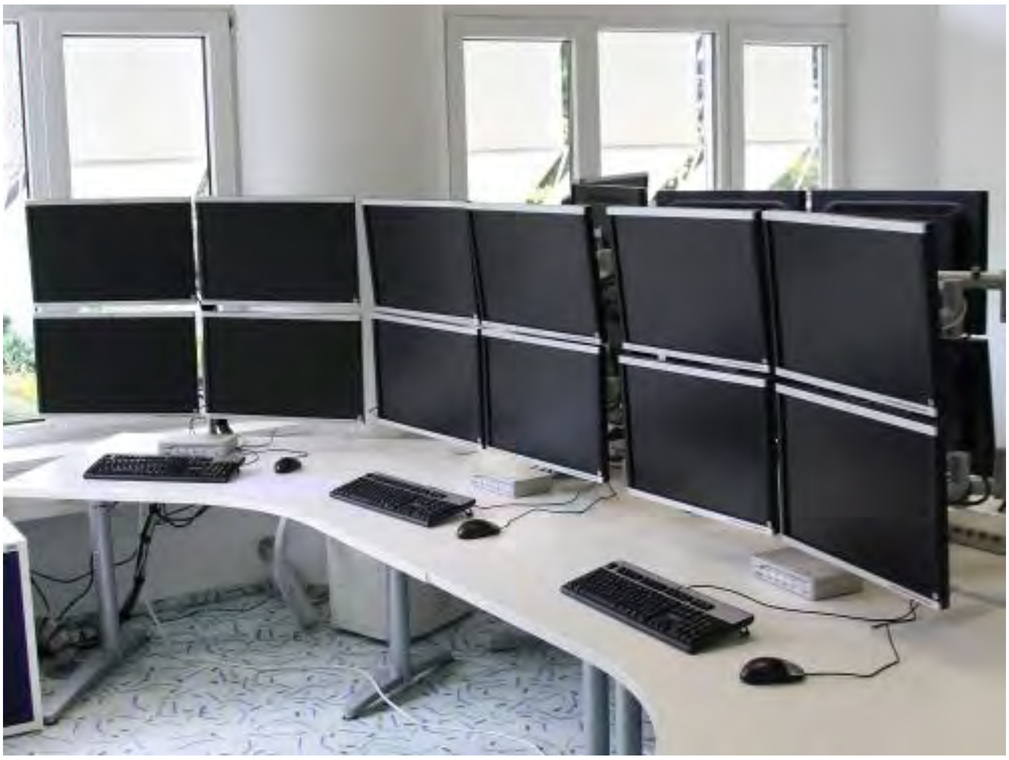


Figure 46: Control Room View-1

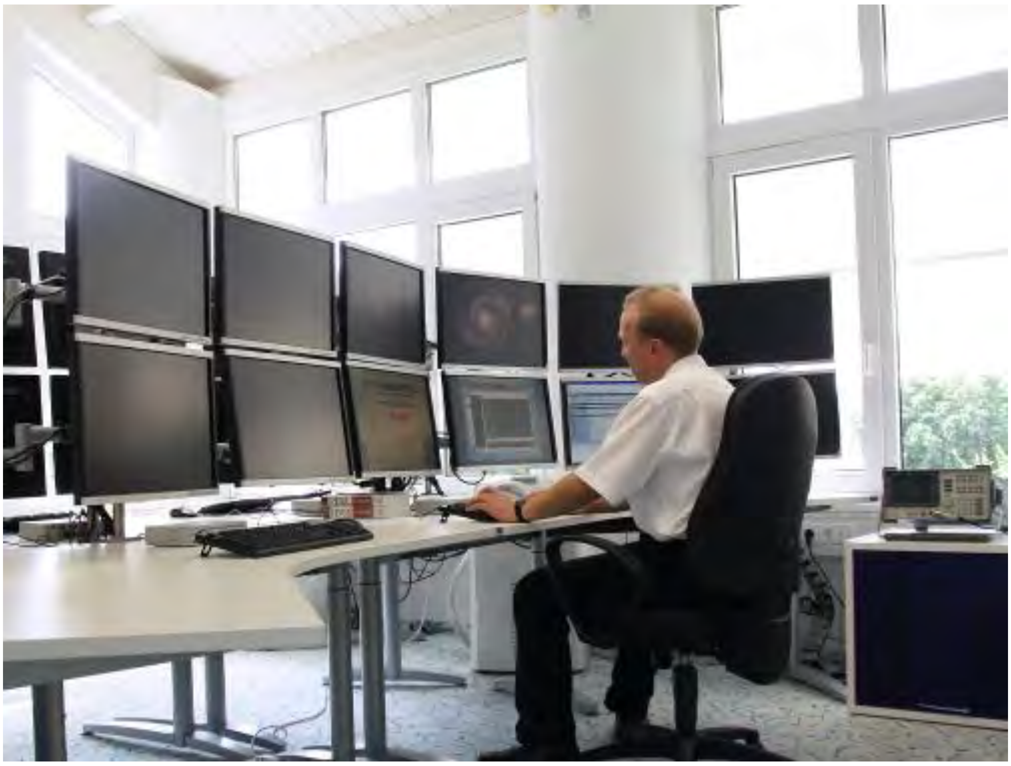


Figure 47: Control Room View-2

(6) Individual desks are assigned to a specific network, technology or area. COMSOFT system engineers using several computer monitors on their desk, with the extra monitors used for monitoring the systems or networks covered from that desk.

(7) COMSOFT is offering through its regional NOC in Miami a state-of-the-art infrastructure compromising of:

- Three 80kVA Load Balanced UPS units.
- 750 kVA Electric Generator with Automatic Transfer Switch capable of sustaining operations of up to 5 days without re-fuelling.
- Secure controlled access facility and CCTV surveillance.
- Divergent terrestrial network with access to 2 fiber rings from 2 different providers.
- Internet access to 3 different Tier-1 providers.

(8) Both NOC's, the main and the regional local NOC are interconnected using redundant paths in order to keep availability all the time as shown in the following picture:

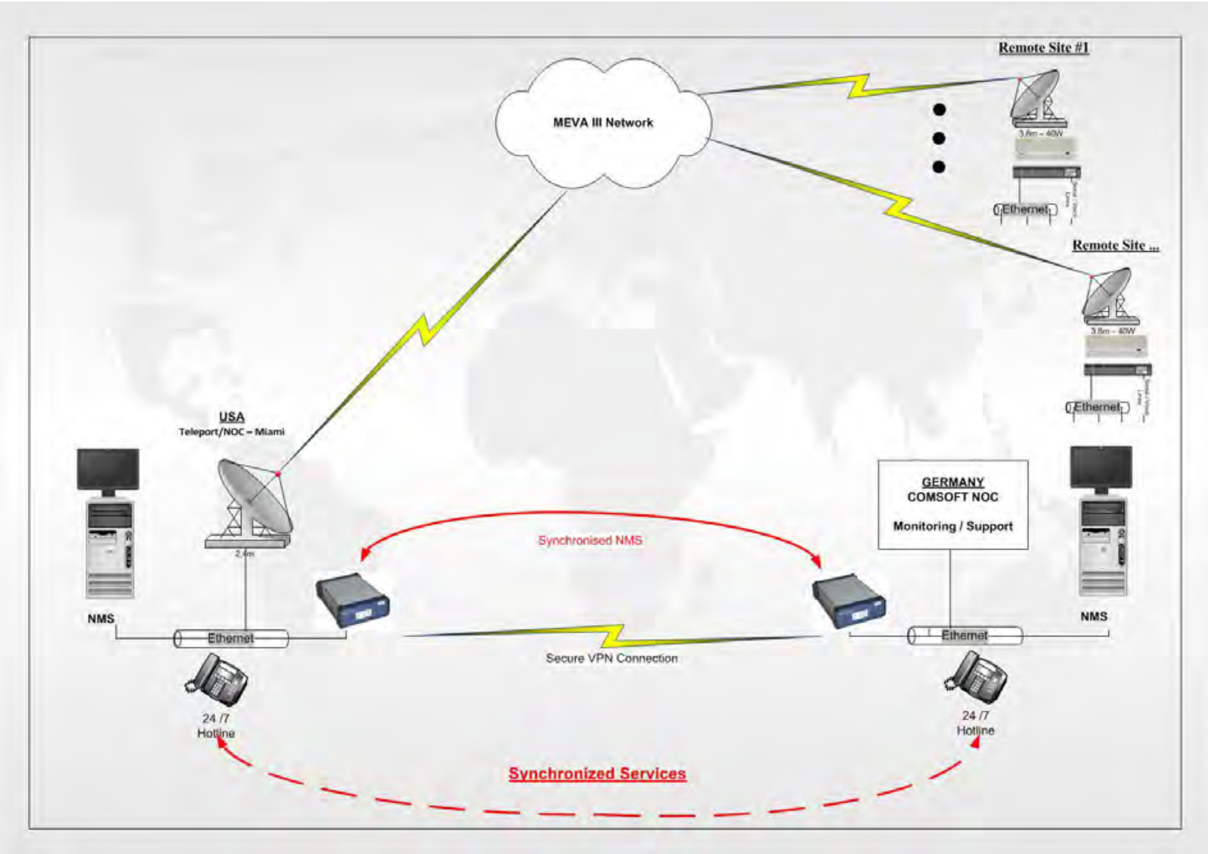


Figure 48: NOC Interconnection

(9) COMSOFT prevent unauthorized remote access connections by using access lists and encrypted interconnections of both NOC's.

(10) The Network Management consists of

- Network Management

    - Network Management
    - Performance Monitoring
    - Alerting
- Trouble Ticketing (TT)
    - Customer Problem Reporting
    - Trouble Ticketing
    - Ticket Tracking
    - Customer FAQ

(11) In order to grant most efficient network troubleshooting to its customers, COMSOFT has established fixed Workflow Procedures as described hereafter.

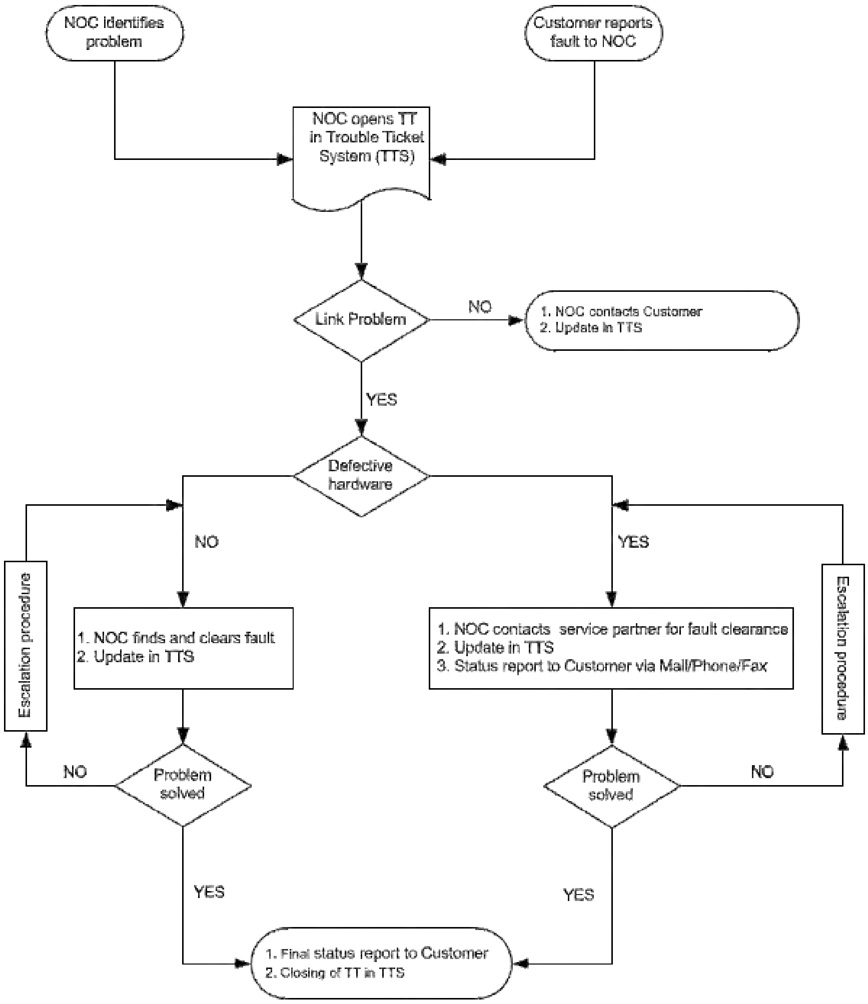


Figure 49: Fault Processing Procedure

5.1.1 Network Control & Monitoring

(1) All MEVA III Network terminals will be constantly monitored and controlled from the NOC in Miami as well sporadically from COMSOFT's Backup NOC in Germany. For this matter SkyWAN® NMS provides comprehensive possibilities to monitor and record the status of the network and its equipment components.

(2) Network and remote VSAT terminal equipment configurations can be defined with the tools of SkyWAN® NMS at the NOC and then automatically be distributed to each of the MEVA III Network terminals in the network via satellite link.

(3) The VSAT Master Station in the Teleport/NOC in Miami is equipped for internal telephony with all MEVA III Network nodes for the purpose of maintenance coordination and end-user support. For this communication the extension 2400 can be used as well as another extension to agree upon. For escalation within COMSOFT service organisation there will be another extension for the use of MEVA III Member States staff.

(4) COMSOFT's NOC in Miami is manned 24 hours on 365 days a year with skilled staff communicating in English and Spanish.

(5) The Miami Teleport, which is proposed to host the MEVA III Network Operation Center, complies to highest commercial standards with regards to resilience of power including autonomous diesel-generators. In no way could potential power issues at the Teleport affect the function of the MEVA III Network:

- firstly because the SkyWAN® network continues to run even without an active Master Station

  and

- secondly, because of automatic switchover to the Backup Master Station for continuation of Frame Plan Generation and according bandwidth allocation.

5.1.2 Network Security Management

(1) COMSOFT implements a suite of security measures to protect the network against accidental and malicious harmful acts affecting the correct function of the network. These measures will enforce the situation of MEVA III VSAT Network being a protected, private, closed and professionally managed network.

(2) The NMS for MEVA III VSAT Network will be accommodated in the secured infrastructure of the Miami Teleport. Access control and restriction works on several levels: to the compound, to the building, to the NOC room and to the NMS station, which requires password protected operator login.

(3) The NMS is operated in a firewall-protected infrastructure with state-of-the-art countermeasures against virus intrusion. The NMS computer itself is operated offline with in-house connection to the SkyWAN® IDU of the Teleport only.

(4) The access control policy as part of the security plan comprises several elements:

- restricted access to the equipment at MEVA III Member States installation
- a well-defined catalogue of allowed and not allowed actions for technical staff of MEVA III Member States
- access restriction within the Teleport personnel
- access to the NMS Station restricted to the dedicated MEVA III Operators

(5) The SkyWAN® NMS supports comprehensive logging capabilities for system events. COMSOFT will make use of all options for the configuration of monitoring and logging of events, which can help with troubleshooting and tracing security affecting events and actions.

(6) All relevant system information is contained in configuration files defining all system parameters on station and network level. Apart from archiving configuration files at the NOC there will always be the latest configuration file stored in the non-volatile memory of each IDU.

(7) The statements made above with regards to the NMS likewise hold for the SkyWAN® Master Station (equivalent to NCC), which will be deployed in the equipment room of the Teleport. The requirements with regards to security and access control will also be fulfilled for the Backup Master Station to be deployed at the FAA ACC in Atlanta.

(8) Key elements for achieving security to combat threats are to define mechanisms and algorithms associated with security measures such as authentication, access control, and data encryption. COMSOFT is providing telecommunications security by:

- **Physical Security**

  The component of communications security that results from all physical measures necessary to safeguard classified equipment, material, and documents from access thereto or observation thereof by unauthorized persons.

- **Access Control**

  The Access Control security dimension protects against unauthorized use of network resources. Access Control ensures that only authorized personnel or devices are allowed access to network elements, stored information, information flows, services and applications.

5.1.3 Fault Processing

(1) The NOC processes the fault in accordance with the procedure described hereafter, whereas the Customer receives a first status report on possible reasons for the fault and the initiated remedy measures within the response time. Additional status reports on the notified fault are submitted upon agreement with COMSOFT.

(2) After the fault has been remedied the TT is set to status “Problem solved”, Customer is notified accordingly and after the Customer´s consent the TT is closed.

(3) If the Customer cannot be contacted, the TT remains in status “Problem solved” until the Customer has been reached.

- Ticket Handling
  - All the NOC work will be based and registered in the Trouble Ticket System.
  - All requests must reach the NOC via the ticket system, or the NOC will create tickets for requests reaching the NOC via e-mail or phone. The NOC will make sustained efforts to have all customers use the on-line ticket system.
  - The NOC must proceed with any activation, deactivation or modification request received though the ticket system.

5.1.4 Escalations

(1) The deadlines for starting the escalation procedure in case of faults (information inquiries or adjustment requests) are according the following ranking:

Type	Description
Priority 1	Teleport or MEVA III Network location with Service Level Gold Plus cannot be reached
Priority 2	MEVA III Network location with Service Level Gold Plus has restricted service (line is bouncing (instable) / overloaded)
Priority 3	N/A
Priority 4	Information inquiries, requests for adjustments

(2) The **escalation** steps are defined as follows:

- NOC
- Operation Manager
- Head of Business Unit

- Management

(3) In case a fault cannot be solved within the times indicated in the table shown below, shall automatically be escalated accordingly.

	Priority 1 Fault	Priority 2 Fault	Priority 3 Fault	Priority 4 Information inquiries Requests for adjustments
NOC	Immediately	Immediately	Immediately	Immediately
Operational Manager	Immediately	8 hours	24 hours	3 days
Head of Business Unit	2 hours	12 hours	48 hours	./.
Management	8 hours	24 hours	./.	./.

Figure 50: Escalation Procedure

5.1.5 Trouble Ticket System

(1) COMSOFT provided Trouble Ticket System will allow MEVA III Member States to assign tickets to incoming queries and track further communications about them. It is a means of managing incoming inquiries, complaints, support requests, defect reports, and other communications.

5.1.5.1 General Overview

(1) Every ticket generated by the system has persistence or "history" showing what happened to the ticket within its life cycle. The Trouble Ticket System has the ability to merge multiple requests about the same incident, thus making it possible to work on an incident rather than on singular requests.

(2) The Trouble Ticket System is a multiuser system which means that multiple NOC engineers – Americas and German - may work simultaneously on the tickets, reading the incoming messages, bringing them in order, and answering them.

(3) The Trouble Ticket System offers a dashboard-like view on all escalated, reminder, new and open tickets of a specific customer company. All customer users and their individual ticket count are also displayed.

- All tickets from a specific customer company at one glance
- A perfect overview of all customer users and their tickets
- Faster ticket creation with shortcuts
- IPhone App / Android App available
- Multi-Language Support
- Multi-client customer service capability
- WYSIWYG editor for formatting and integrating pictures

5.1.5.2 Personalized Features

(1) This chapter describes outstanding features of the Trouble Ticket System.

- Mobile App
- Language Support
- Web Interface

(2) Beneficial of the self-service for the end-user of MEVA III VSAT Network are

- Structured collection and tracking of incidents via customer web front-end,
- Transparent process progress and status of incidents,
- Listing of all incidents in a client‘s organization,
- End-user access to select content from the knowledge base.

5.1.5.2.1 Mobile App Support

(1) The free of cost available app empowers mobile workers to solve business problems even at the time of a journey. With the app COMSOFT is offering MEVA III Member States a 24/7 mobile access without using a desktop. The app is allowing MEVA III Member States to establish new tickets, get information about processing of tickets and actual status. The app is available for Apple based and Android devices.

Figure 51: Mobile App

5.1.5.2.2 Language Support

(1) Trouble Ticket System offers multi-language support for its web interface, there are 27 languages available. Each authorized MEVA III Member States / Support Engineer can select his favour and personalize the interface to his flavour.

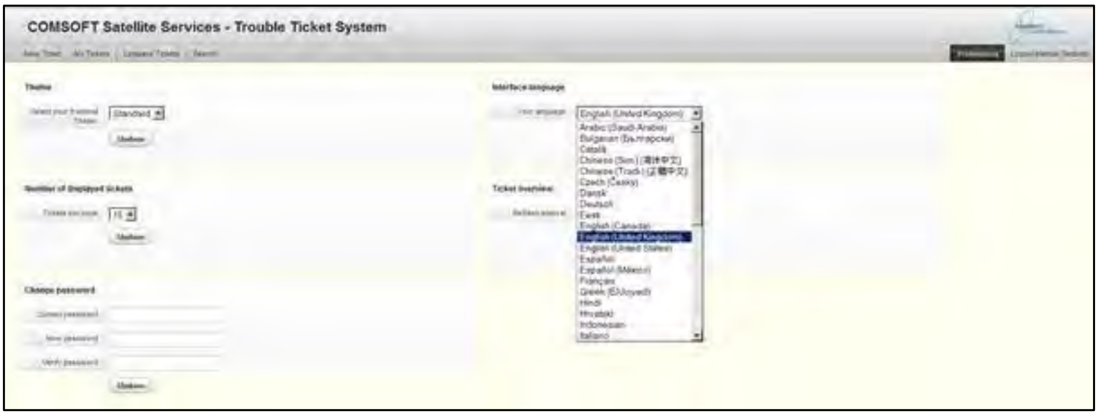


Figure 52: Customer Preferences

5.1.5.2.3 Web Interface

(1) MEVA III Member States will have a separate web interface in the Trouble Ticket System through which they can create new accounts, change their account settings, create and edit tickets, get an overview on tickets that they have created, etc.

(2) Continuing the above example, the customer login screen can be reached by using the URL https://noc.comsoft-sat.com/otrs2 with a web browser (see Figure below).

Figure 53: Customer Login Screen

5.1.6 NMS Software “SkyNMS”

(1) SkyNMS is the SkyWAN® Network Management System (NMS) and resides on a professional Windows XP PC, which is connected via an Ethernet connection to one SkyWAN® station. It is delivered by COMSOFT as a turnkey system, configured for the respective MEVA III VSAT Network. SkyNMS configures and monitors all SkyWAN® stations in the network. Traffic statistics, fault management, software and configuration management, user administration and license key management are carried out by SkyNMS. SkyNMS provides a Graphical User Interface (GUI) for network display with three hierarchical levels. A central database stores all event and alarms to enable diagnostics and alarm management.

(2) The SkyNMS is based on the standard protocol SNMP, an industry standard for communication between a Network Manager (software) and agent processes within the network components, in this case in the stations of a SkyWAN® network.

(3) The NMS is connected to any SkyWAN® station chosen at MEVA III TMG´s discretion. The network is fully operational even when the NMS is down. When a station is switched on, the system software is automatically executed and the agent is activated. A station is automatically included into the network and can stop operation at any time without disturbing the rest of the network. A new station can start operation at any time in a running network.

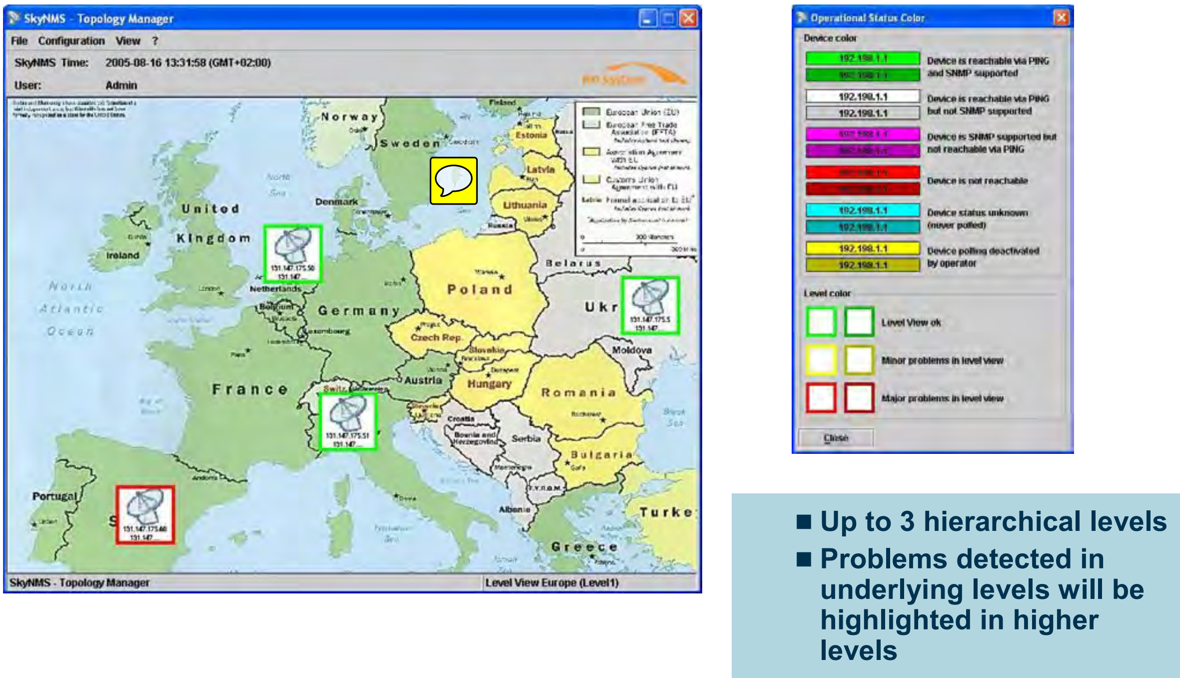


Figure 54: GUI of SkyNMS

(4) SkyNMS provides several main applications.

5.1.7 Global Network Management

(1) COMSOFT's Global Network Management System will allow the operator to have the full control over the network and its components. The operator will not only see what is happening in the network, he will also be able to react immediately to unwanted or unexpected situations.

Figure 55: Global NMS

5.1.7.1 Global Network Status

(1) The Global NMS will take care of the following aspects of the network:

- Fault Recognition and Reporting
- Performance Monitoring

(2) The management bandwidth will not exceed 7% of the overall bandwidth.

5.1.7.2 Performance Monitoring

(1) COMSOFT will perform systems status, health and performance monitoring and alert the responsible “Technician on Duty” in case of problems. COMSOFT will continuously responsible for the management of all faults or performance issues on all services provided. This will include 24-hour monitoring, maintenance and repair. COMSOFT is further responsible for logging problems with the provided services and will maintain a fault management audit trail of all activities until service restoration. Copies of these logs are made available for Customer inspection upon request.

(2) COMSOFT maintains a secure web interface with access rights for access to near real-time information about the status of the installed services and for operations using service/incident trouble tickets. The link tracking software will show:

5.1.7.3 Traffic Statistics

(1) Appropriate software like MRTG, Netflow or Cricket will be appointed to keep track on the link volume measurement and number of packets transferred. These software parts are actually in use by COMSOFT to monitor customer links. The created graphs represent the traffic on the monitored network connection. These graphs are embedded into web pages which can be viewed from any modern web-browser via the internet. In addition to a detailed daily view, they will also create visual representations of the traffic seen during the last seven days, the last five weeks and the last twelve months or different intervals as needed.

Web Presentation example, Volume:

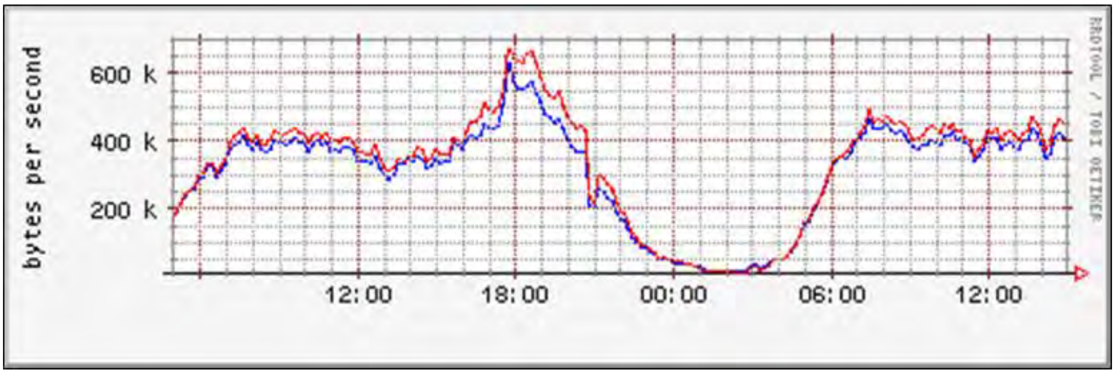


Figure 56: Detailed User Traffic Statistics

5.1.7.4 Ping Statistics

(1) A deluxe latency measurement tool will be used to complete the service information for the link. It can measure, store and display latency, latency distribution and packet loss. It stores the data to maintain a long-term data-store and to draw graphs, giving up to the minute information on the state of each network connection.

Web Presentation example, Latency:

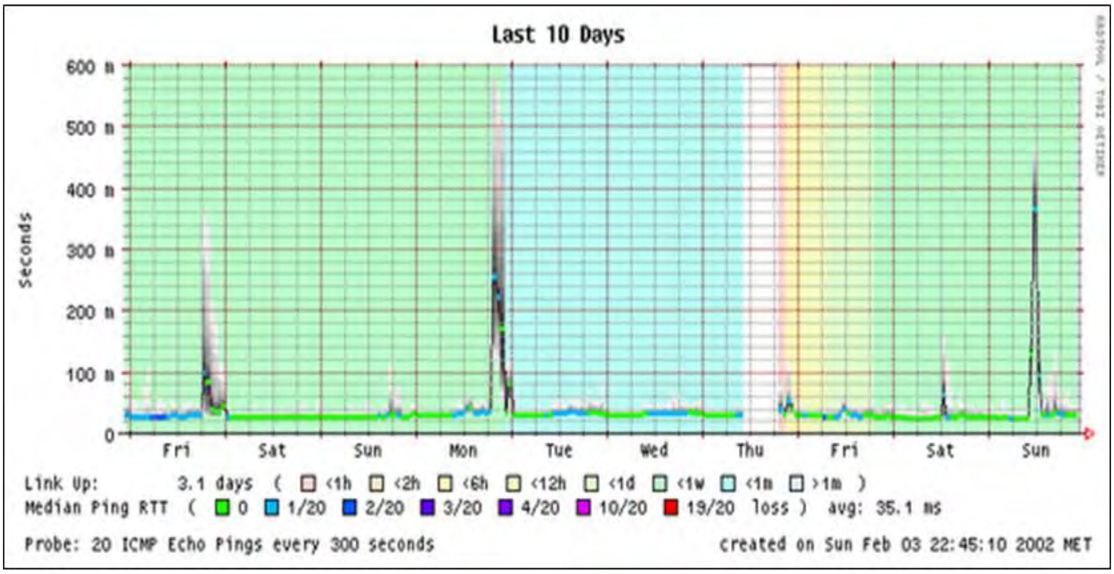


Figure 57: Detailed User Ping Statistic

5.1.7.5 Alerting

(1) Our smart alarm system will inform the NOC personal about the link situation automatically when a predefined abnormal status has occurred. Alarms can be sent to any mail addresses or a pager to trigger actions as well as by SNMP traps.

(2) Additionally all alerts are shown in the NMS web interface. To get the attention of the operator in charge a sound notification is transmitted.

5.2 Description of Spares and Warranty Policies

5.2.1 Equipment Considerations & Maintenance

(1) COMSOFT will replace most MEVA II equipment for technical and/or ownership reasons. What remains for re-use is the following:

- (1) all antenna systems (excl. Dominican Republic, Panama, Caracas, Miami)
- (2) the IDU - ODU cabling
- (3) the redundant RF configuration in Atlanta

(2) With regards to the requested practical plan for maintenance and repair items 1 and 2 do not need much attention other than the proposed annual preventive maintenance.

(3) The situation for item 3 is different and so is the situation in Atlanta: After recent replacement the ODU in Atlanta is still young.

(4) Therefore COMSOFT's proposal is as follows: The Atlanta ODU will be maintained like all other equipment, however in case of severe failure (BUC or Redundancy Switch) in the redundant system requiring factory repair the complete ODU will be replaced by a new redundant CPI/CODAN ODU from the proposed spare part stock, which is sized according to this possibility. Non-defective components of the replaced system will be kept as spares for the remaining ODU system at the other location.

5.2.2 Corrective Maintenance

(1) COMSOFT has investigated the Corrective Maintenance options for all MEVA III Network sites under the aspects of SLA requirements, staff and spare availability and travel times. The respective actions are described in the contracted SLA.

5.2.3 Preventive Maintenance

(1) Preventive Maintenance in the understanding of COMSOFT comprises of two main activities:

- Continuous proactive monitoring of the network and its VSAT equipment in order to uncover potential service quality affecting issues at an early stage.
- Regular scheduled site visits of all VSAT stations in order to ensure the optimum mechanical and electrical state of the complete VSAT station and detect any deterioration or potential problem early.

(2) The first part is cost wise covered by the general Service Charges, whereas the second part is offered as annual preventive maintenance site visit. These visits follow a plan, which consists of

- a time schedule stipulated with MEVA III TMG and the Member States

  and

- standardized procedures for the tasks to be executed according to manufacturer routines and the according documentation.

(3) The activities and checkpoints being part of the site visits are the following:

- LNB, BUC and Redundancy Switch Testing
- Cable Inspection - Inspection & Repair
- Re-sealed Connectors
- Electrical Grounding - Inspection & Repair
- Reflector Inspection
- Antenna Pointing – Repoint
- Jack Screw - Greasing
- Pedestal & Support Structure - Inspection, Clean/paint
- Isolation and 1 dB Compression Routines
- Proper Overall Operation and Cleanliness

(4) As part of COMSOFT's continuous care for the MEVA III Network system all documentation with regards to the system, the equipment, the software, the configuration and its implementation (including the as-built documentation) will be updated whenever there have been changes.

5.2.4 Spares Provisioning Requirements

(1) COMSOFT's commercial proposal shows a detailed list of equipment and its cost for each VSAT station and the proposed spares necessary to achieve the required

availability standard. It should however be noted that the majority of the spares is held in a central pool at the Miami NOC.

(2) COMSOFT has understood the special situation in the region and the challenge to establish spare part logistics, which deliver shortest repair times and minimum cost at the same time. Therefore we are prepared to consider alternative arrangements in discussion with the MEVA III Member States regarding the purchase of local spares, as long as the overall spare part logistics is not negatively affected. The price proposal shows as an example of a complete spare part list for Cuba, which has been selected in this context due to potential delays with equipment transport and on site repair.

(3) As the common pool of spares is stored at the Network Operation Center in Miami, the shipment to any MEVA III Network location can benefit from daily scheduled flights out of Miami Airport. In each case of on-site repair requiring a spare from the pool the NOC will decide on the fastest and most efficient way of spare shipment. This can be

- by courier service

  or

- as checked-in or hand luggage of the traveling field service engineer.

(4) The decision will in particular take into account local customs procedures.

5.3 Service Management

5.3.1 General

(1) As COMSOFT is providing an end-to-end-solution to MEVA III TMG, COMSOFT will retain management and financial responsibility for the effective operation and maintenance of the network during the installation phase. COMSOFT project management team will work closely with the Network Operation Centre (NOC) and MEVA III Member States to ensure that problems are handled swiftly and accurately. As such, following the attempted fault resolution via remote access, COMSOFT will inform MEVA III Member States, to dispatch a qualified engineer to repair or replace equipment at the remote terminal.

5.3.2 Communication Flow

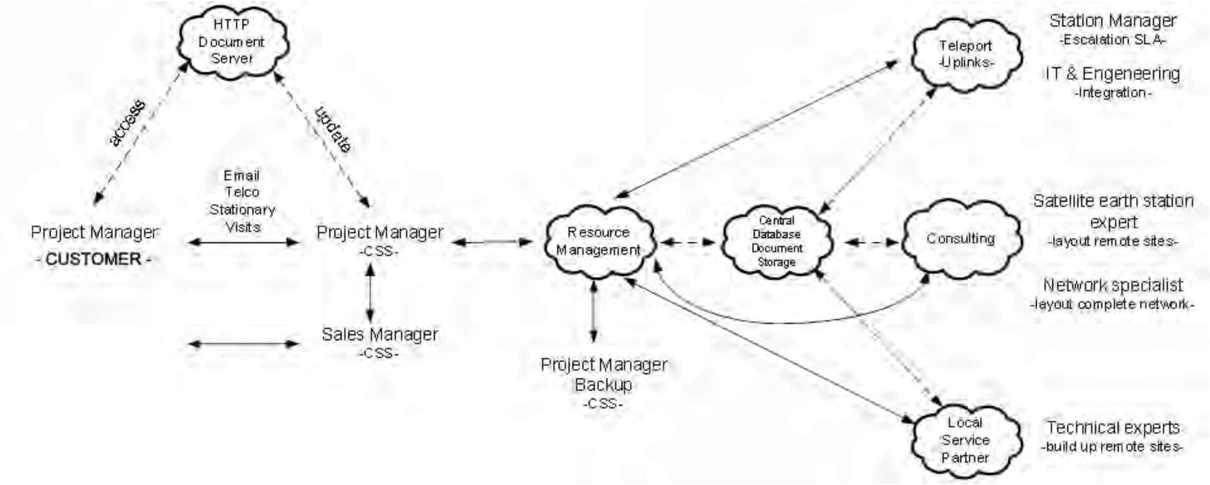


Figure 58: Communication Flow

5.4 Regulatory Issues & VSAT Licenses

(1) To operate a VSAT network in the MEVA III region / countries, usually licenses are required from the relevant authorities.

(2) COMSOFT will undertake all reasonable efforts to obtain the licenses from the regulatory authorities required for the lawful operation of the MEVA III VSAT Network and its earth stations in the respective countries. COMSOFT will bear all costs involved for the acquisition of such license and for related recurring fees as far as the costs are exclusively related to MEVA III TMG.

(3) With regards to the license acquisition process COMSOFT's assessment of the situation is as follows:

- A principal difficulty to attain the license(s) is not to be expected as all sites in operation now are supposed to have been granted the license already.
- COMSOFT's cooperation with NewCom and its VSAT partners ensures the ready availability of the VSAT network operating license for 8 MEVA locations.
- The paperwork related to attain the license for the same earth station under a different network operator or with slightly changed technical parameters is straightforward.
- The process may require the support by the MEVA III Member States as user of the earth station and as owner of the ground. In such case COMSOFT will appreciate the timely help.

(4) From the site surveys conducted by COMSOFT and from the scope of work we are under the impression that there is no need for civil works or changes to the power

supply, which would require an official permit (other than the permission from the owner of the building).

5.5 Site Survey and Standard Installation

(1) All related local field services (e.g. site survey, installation, maintenance), will be under the responsibility of COMSOFT and its regional partner NewCom.

5.5.1 Standard Installation and Commission

(1) All installation work and commissioning of the complete VSAT terminal and network will be carried out in accordance with:

- Regulations and laws in every involved MEVA III Member States
- ICAO standards
- Current safety requirements
- Established and agreed procedures
- The guidelines and instructions given by the manuals of the manufacturer and/or ICAO/MEVA III Member States for the VSAT Terminal and Earth Station Equipment

(2) Standard VSAT implementation will include the following installation as defined in the COMSOFT Service Level Agreement (SLA):

- Outdoor Unit (ODU) – Antenna, BUC, LNB
- Indoor Unit (IDU) – Modem, Multiplexer, (if applied)
- Interface to the Customer equipment, max 50cm cable way
- Remote Control System (if applied)
- IDU/ODU Facility Cable run of 70 meters of less (Belden H126 DB+, or compatible / standard power cable)
- Local Power Connectors, 3 meters for the IDU
- Authorized COMSOFT / NewCom personnel will assist specific MEVA III Member States in the application testing and performing the handover of the service to MEVA III TMG.
- COMSOFT / NewCom will prepare an “Installation and Commissioning Report” certifying the successful completion of the installation and commissioning, signed by the representatives of COMSOFT / NewCom and MEVA III TMG, and submit same MEVA III TMG / ICAO following the commissioning and MEVA III TMG handover.

5.5.2 Wiring & Grounding

(1) The installation through COMSOFT will be done by experienced and certified field engineers according to best industry practice, which includes the required measures for cabling.

(2) All electrical systems, equipment, and metal devices will be connected and grounded as far as compatible with the instructions of the respective manufacturer.

(3) The provided equipment will be grounded as far as intended by the respective equipment manufacturer.

5.5.3 Equipment Protection

(1) The equipment proposed by COMSOFT is rugged and proven for the use in harsh environment as far as outdoor equipment is concerned. In conjunction with careful installation it is ensured the system is protected against damages caused by humidity, high and low environmental temperatures, dust, insects, corrosive fumes, salty atmospheres water intrusion and overvoltage induced by lightning.

(2) Environmental Standards

- Operating Temperature: 0° to 50°C / 32° to 113°F
- Storage Temperature: -20º to 65ºC / -4° to 149°F
- Relative Humidity: 0% to 95%, non-condensing
- Altitude: Up to 3000 m above sea level
- Power Supply IDU: Auto sensing 100 – 240 V +/- 10% / input frequency 47 – 63 Hz

5.5.3.2 Transition Plan

(1) COMSOFT has prepared a transition plan with a detailed description of the migration steps from MEVA II to MEVA III and the respective implications. This plan is attached to this SDD Document. The corresponding activities and milestones are also shown in the implementation schedule.

5.5.3.3 Deliverable Reports

(1) COMSOFT keeps a detailed network performance track record in its databases. As a natural, COMSOFT reports monthly the network performance figures.

(2) The detailed report consists of an executive summary, summarizing at a glance the network and site performance and reached SLA figures. By standard the report is split in different sections to address different readers concern

- Executive Summary
- Graphical Study of key performance indicators per site
- Graphical Study of key performance indicators per network
- Non availability reports and solutions
- Lessons learned

5.5.4 Acceptance Test

(1) The hand-over of the VSAT system to MEVA III TMG shall take place in accordance to an acceptance test that will be conducted with the current customer equipment. An acceptance protocol will be filled out and signed by the MEVA III TMG representative and the installation team.

5.5.4.1 Factory Acceptance Test (FAT)

(1) COMSOFT will provide Factory Acceptance Test procedures for approval by MEVA III TMG. The procedures will prepared as part of the system engineering works after approval of the SDD and will be in the form of the attached example FAT. All described tests have a clearly defined scenario and a well-defined expected result, such that each test is either passed or not. The objective of the FAT is to test functions of the complete MEVA III Network system in a complete equipment configuration, i.e. with all IDUs and FADS. Therefore the FAT primarily tests the System Engineering for correctness, whereas it (only) provides sufficient evidence for the proper function of the equipment. (It should be noted that a test of such high tech equipment against the manufacturer specification generally is beyond the means of any system integrator like COMSOFT.) The tests will not be limited to typical elementary VSAT test procedures but rather include the establishment of dialled and hotline phone calls and the transfer of AFTN/AHMS messages in COMSOFT's test environment.

(2) The project schedule takes into account that equipment for MEVA III TMG is only shipped after successful FAT. The plan also takes into account that MEVA III TMG may want to attend the FAT. The conduction of the FAT with all prepared procedures will not change, whether it is with or without attendance of the customer.

5.5.4.2 Site Acceptance Test (SAT)

(1) COMSOFT will provide site acceptance test procedures for approval by MEVA III TMG. The procedures will prepared as part of the system engineering works after approval of the SDD and will be in the form of the attached example SAT. All described tests have a clearly defined scenario and a well-defined expected result, such that each test is either passed or not. It is COMSOFT's objective to achieve through the SAT the highest level of confidence that the system will flawlessly work after the switch over of services. Therefore the tests will not be limited to the typical VSAT Site Acceptance Procedures verifying the correct antenna pointing and a ping to the Hub. COMSOFT will rather run a significant subset of procedures from the FAT as far as feasible with the equipment available for and during these tests.

(2) According to the proposed Transition Plan all MEVA III Network terminals will be installed and tested parallel to the operational MEVA II. Each installation of a new MEVA III Network terminal is only completed with successful Site Acceptance Test and no switching of services will be done before all MEVA III Network terminals have been accepted.

5.5.5 Local Field Service

(1) COMSOFT will cooperate with its regional partner NewCom in order to keep pricing at lowest edge without losing quality for the implementation of the offered VSAT network. Based on this point and the provisioning of a premium quality in equipment and related services, COMSOFT supports with its experience and expertise of its 24/7 Helpdesk Center the site survey, installation and maintenance services.

5.5.6 VSAT Terminal Documentation

(1) COMSOFT provides the documentation for each individual VSAT Terminal. Usually the documentation will consist of:

- A block diagram showing all Equipment, cables and interconnections
- Configuration sheets for the parameters and programming of all electronic hardware
- Installation protocol to be filled out on-site after installation
- Line-up protocol and procedures of the Satellite Operator
- Manuals of hardware

5.5.7 Technical Documentation

(1) COMSOFT will provide a complete set of technical documentation for network users as provided by the equipment manufacturers including brochures, data sheets and descriptions to introduce new equipment.

(2) In accordance with the response to Section C § 16.1 COMSOFT will suitable documentation to the MEVA III Member States for their preparation of the installation and familiarizing with the new system. This documentation will be provided as soft copies. However, COMSOFT as being responsible for the flawless operation of the system will generally not provide service manuals covering service activities beyond the topics which are subject of training for users and technical staff.

5.5.8 Maintenance of VSAT Earth Stations

(1) The delivered equipment is generally free of maintenance, keeping an eye on the special location of the remotes stations close to the ocean COMSOFT recommends to check the overall condition of the containers and VSAT equipment on a regular basis. COMSOFT is able to carry out on-site maintenance, but can also assist MEVA III Member States remotely in doing so, to exchange defective parts. Such maintenance work shall include the respective VSAT equipment in order to minimize the cost for maintenance. COMSOFT will provide remote assistance in order to support MEVA III TMG to correct abnormal station operation, maintaining the provision of the data communication link within the guaranteed availability agreed with MEVA III TMG.

6 MEVA Web Page

(1) COMSOFT maintains a secure web interface with access rights for access to near real-time information about the status of the installed services and for operations using service/incident trouble tickets as well as general documentations.

(2) The web page is structured into different sections:

- Home
  - Welcome note and information's on upcoming events
- News
  - FTP server access on documents containing information's on actual events
- Tickets
  - Direct access to the Trouble Ticket System requesting login credentials
- Network Status
  - Provides live information's on the system health requesting login credentials
- Documents
  - Provides access to the monthly reports and network relevant documents as site-survey documentation
- Contact
  - Contact information to get in direct contact with COMSOFT
- Help
  - Provides help on the web page contents and credentials

(3) Please note that JAVA script has to be enabled on local access browsers in order to get full function of the web page.

6.1 Section: Login

(1) The general web page is accessible from the internet using the following address:

(2) http://noc.comsoft-sat.com:7543/

(3) The web page provides a secure login portal in order to prevent unauthorized access from any unwanted 3rd party.

Figure 59: MEVA Web Page Login Screen

(4) The Login credentials were submitted to the MEVA III Member States in separate notices in order to keep security.

6.2 Section: Home

(1) This section is the general start page of the web presence where a short introduction on COMSOFT is given as well as hints on upcoming events related to the MEVA III network.

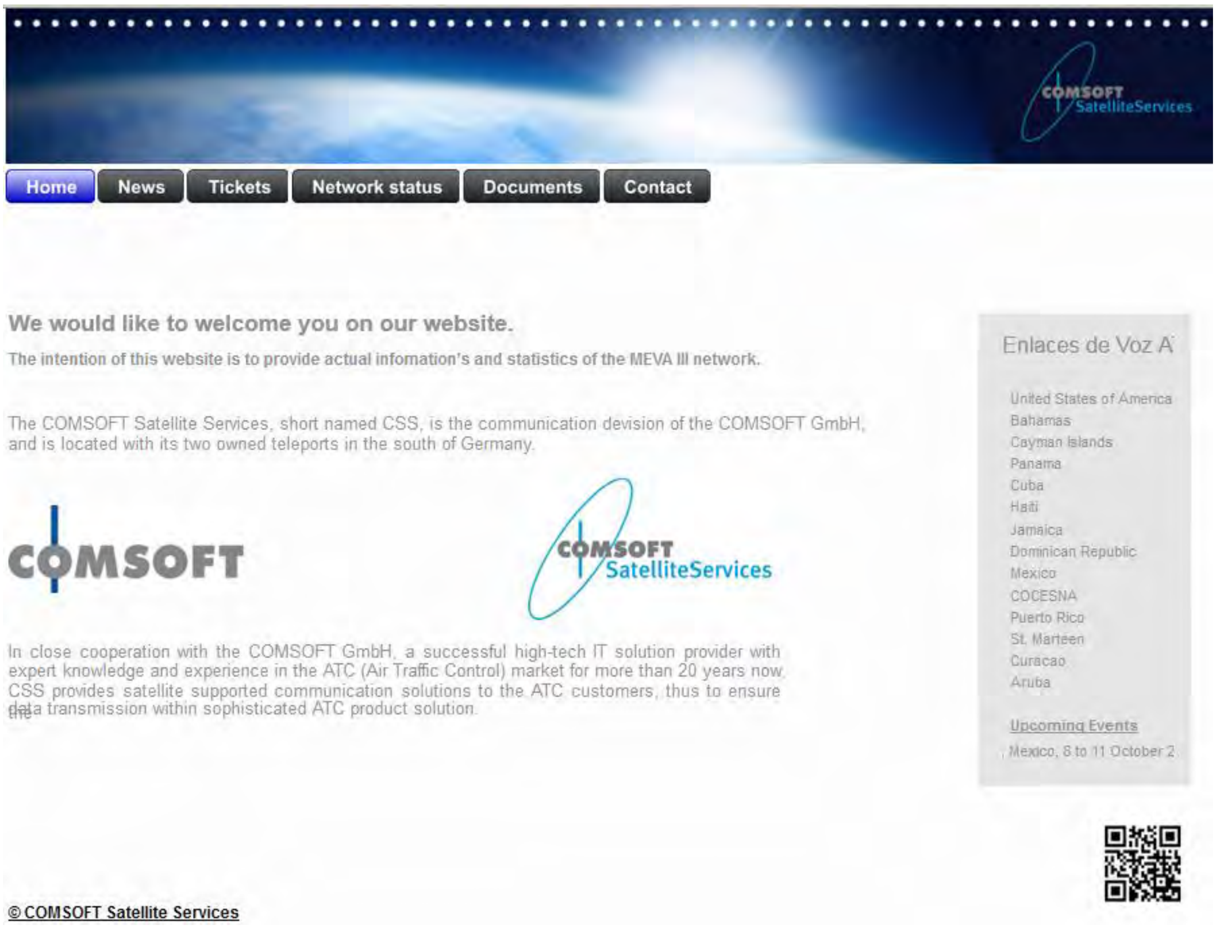


Figure 60: MEVA Web Page Home Screen

6.3 Section: News

(1) This section is presenting actual news on the MEVA III network.

(2) At the time pictures from MEVA III TMG events are available, in addition news an network related tasks or outages due to solar or sun outage are published.

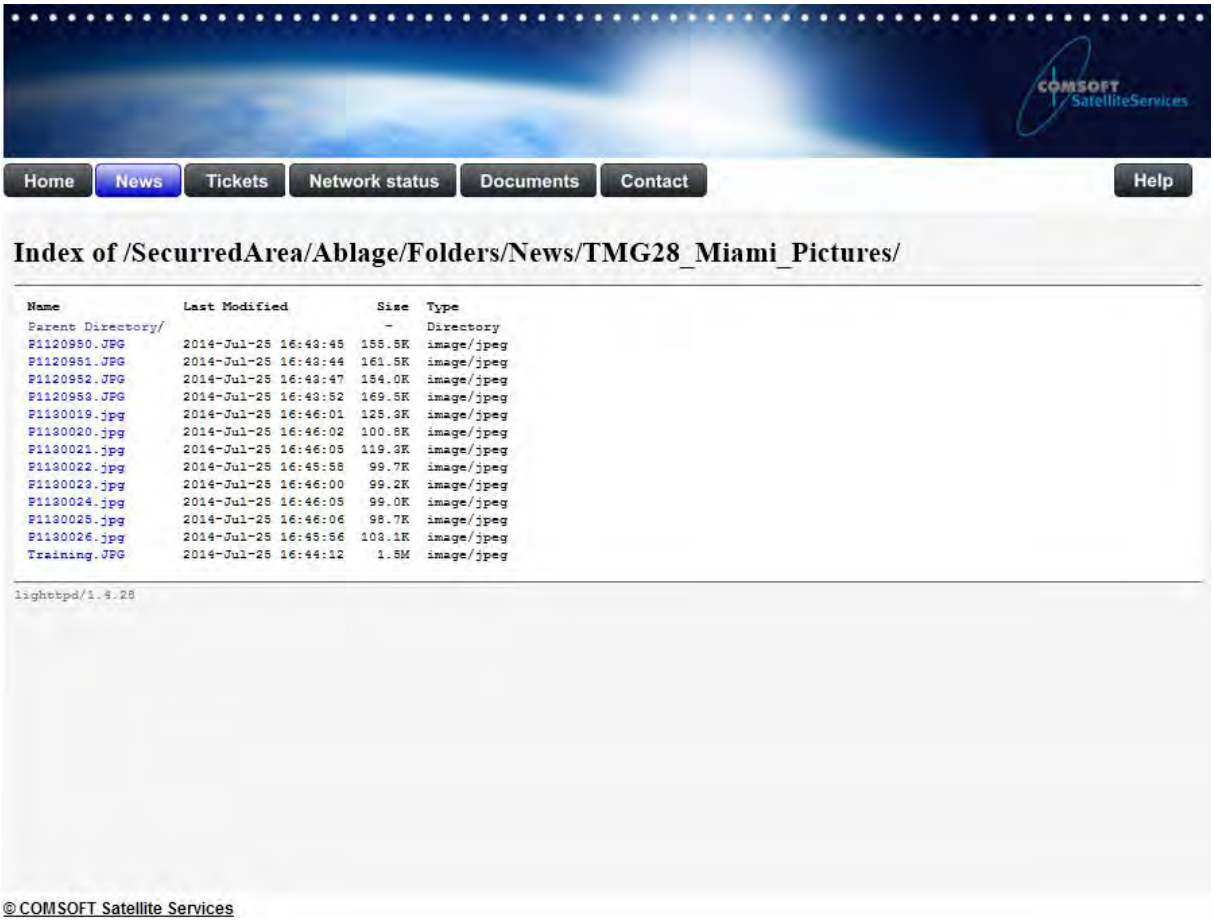


Figure 61: MEVA Web Page News Screen

6.4 Section: Tickets

(1) This section provides direct access to the COMSOFT Trouble Ticket System.

(2) The screen will apply in the local language of the user computer browser.

(3) Login credentials are needed, which are provided by COMSOFT on a separate basis per country.

Figure 62: MEVA Web Page Tickets Screen

6.5 Section: Network Status

(1) This section provides a looking glass screen to show the general status per network site.

(2) Meaning of the colours per station:

- Green: OK

  and

- Red: Not OK

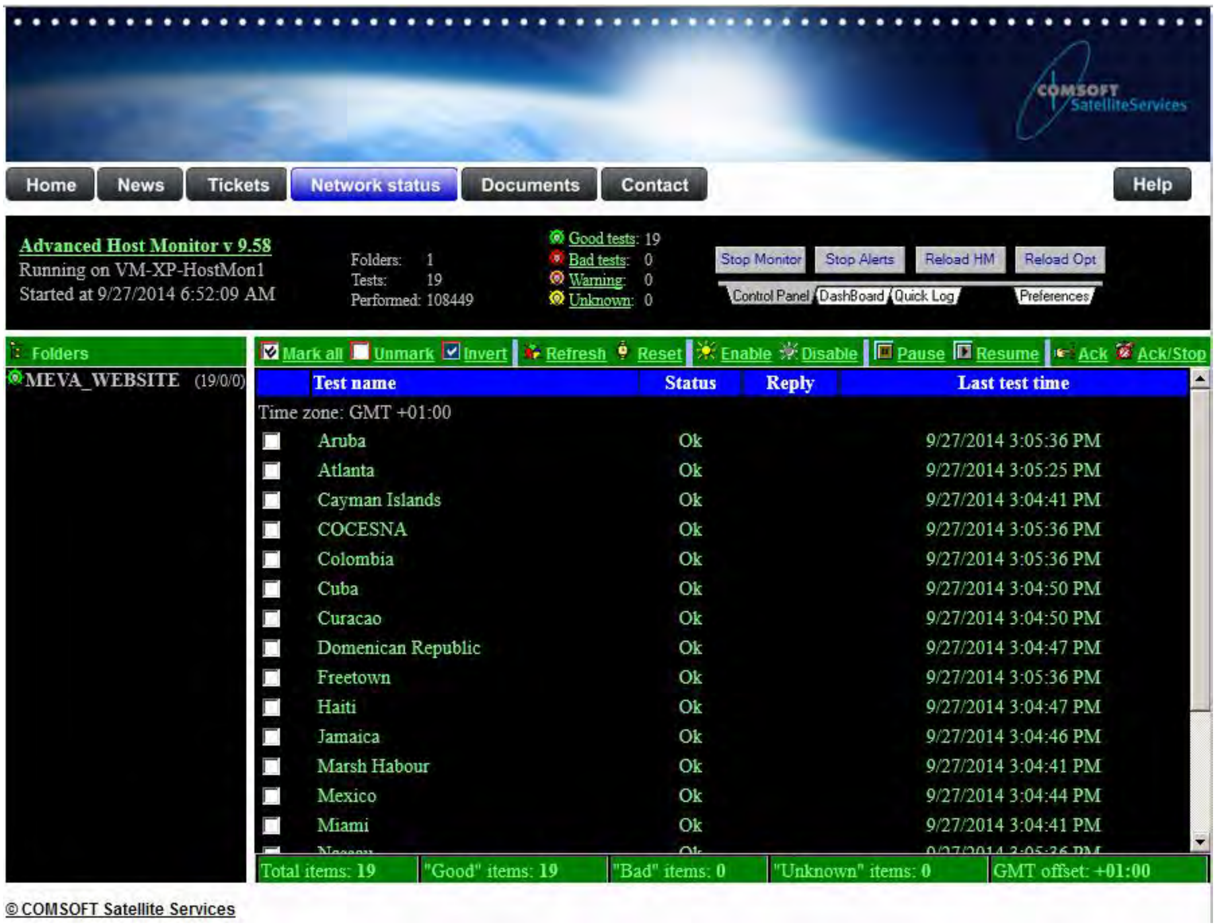


Figure 63: MEVA Web Page Network Status Screen

6.6 Section: Documents

(1) This section provides access to network relevant documents.

(2) The documentation will be updated as new versions appear – like monthly reports and others.

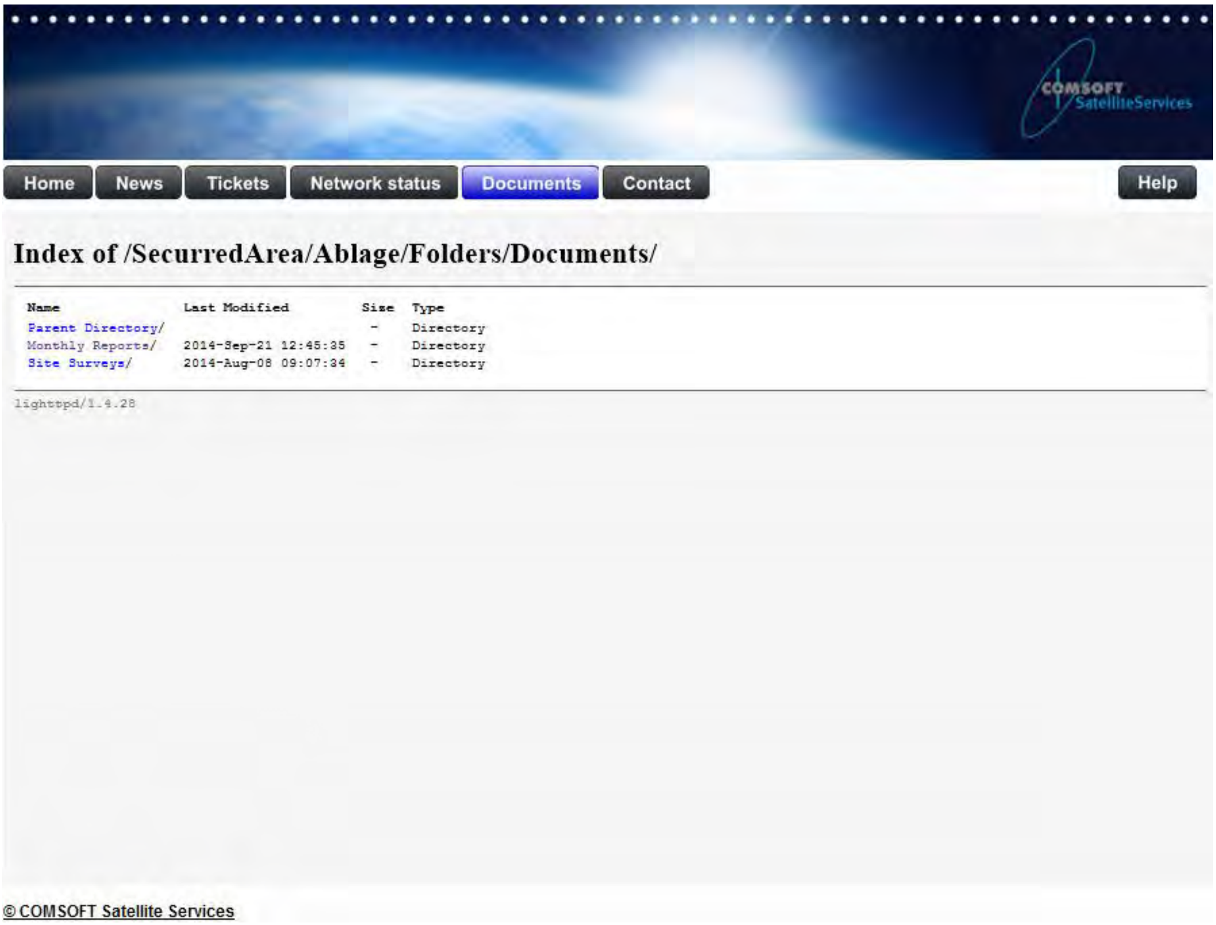


Figure 64: MEVA Web Page Documents Screen

6.7 Section: Contact

(1) This section provides contact information's on reachability of COMSOFT.

Figure 65: MEVA Web Page Contact Screen

6.8 Section: Help

(1) This section provides contact information’s on reachability of COMSOFT.

Help

NEWS

In this section the latest news are provided.
You will find actual network reports, Minutes of Meeting and others.
Please double click on the document of interest to open.

All documents are PDF based, so you need to enable/install Adobe PDF Reader.
The reader can be downloaded here get.adobe.com/reader/

TICKETS

This site links to the trouble ticket system.
COMSOFT has provided to each member state a seperate login and password in order to be able to sort site related tickets and follow ups.

If you do not have login informations, please click at the site on "new password" request button.

NETWORK STATUS

This site links to the network monitoring.
The online status of each network site is shown in brief and read-only mode..

The site needs a receive a login name and password.

Login: [redacted]
Password: [redacted]

DOCUMENTS

In this section the site related documentation are presented
You will find site survey documentation, installation reports and others.
Please double click on the document of interest to open.

All documents are PDF based, so you need to enable/install Adobe PDF Reader.
The reader can be downloaded here get.adobe.com/reader/

Figure 66: MEVA Web Page Help Screen

7 Equipment Locations

(1) According to the site surveys done at the specific MEVA III network sites, some general decisions were made on:

- Equipment locations
- Existing antenna conditions
- Cable path findings on sites where a new antenna is needed
- Antenna location fixing on sites where a new antenna is needed

(2) COMSOFT is giving in the following chapters an overview per site on the most important arrangements done.

(3) Since the migration phase needs to have both, the existing MEVA II and the new MEVA III network work in parallel and therefore use the antennae and amplifiers at the same time, the main focus was to place the new MEVA III racks close to the existing MEVA II racks in order to shorten cable length at a minimum.

7.1 Atlanta

(1) The site is generally designed to provide:

- Dual Chain redundancy
- Usage of existing antenna

(2) The site survey was conducted on July 19th 2013.

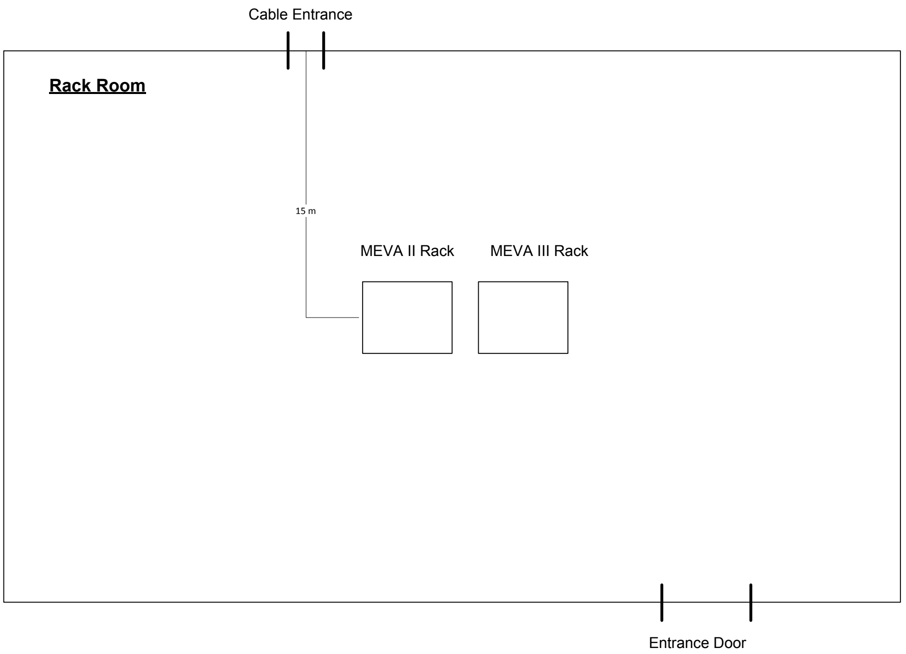


Figure 67: Rack Room Overview Atlanta

(3) The new MEVA III Rack will be installed next to the existing MEVA II Rack.

7.2 Aruba

(1) The site is generally designed to provide:

- Dual Chain redundancy
- Usage of existing antenna
- UPS provisioning

(2) The site survey was conducted on July 30th 2013.

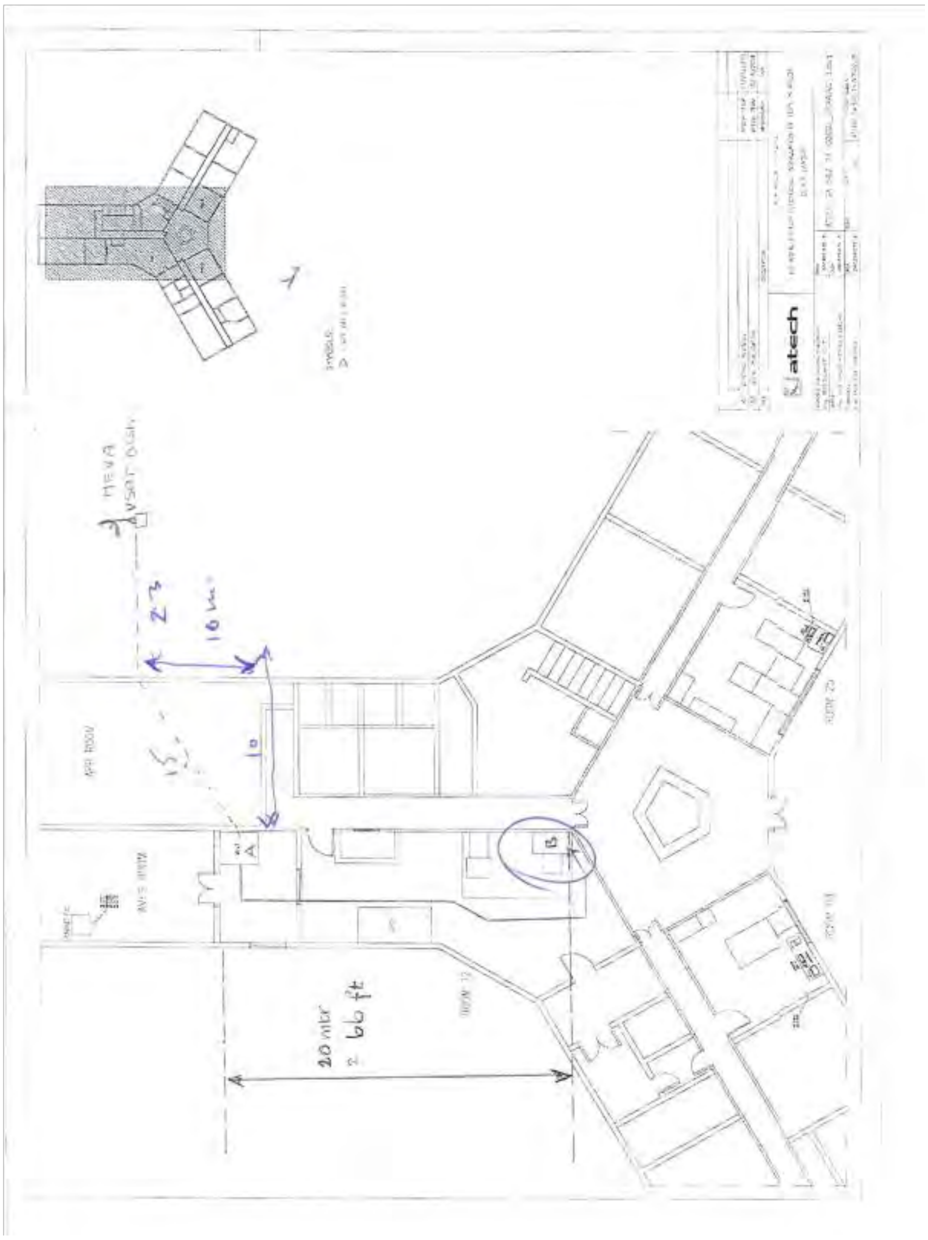


Figure 68: Rack Room Overview Aruba

(3) The new MEVA III Rack will be installed next to the existing MEVA II Rack.

7.3 Bahamas, Freeport

(1) The site is generally designed to provide:

- Single Chain
- Usage of existing antenna

(2) The site survey was conducted on February 20th 2014.

Figure 69: Rack Room Overview Bahamas Freeport

(3) The new MEVA III Rack will be installed next to the existing MEVA II Rack.

7.4 Bahamas, Nassau

(1) The site is generally designed to provide:

- Single Chain
- Usage of existing antenna

(2) The site survey was conducted on February 18th 2014.

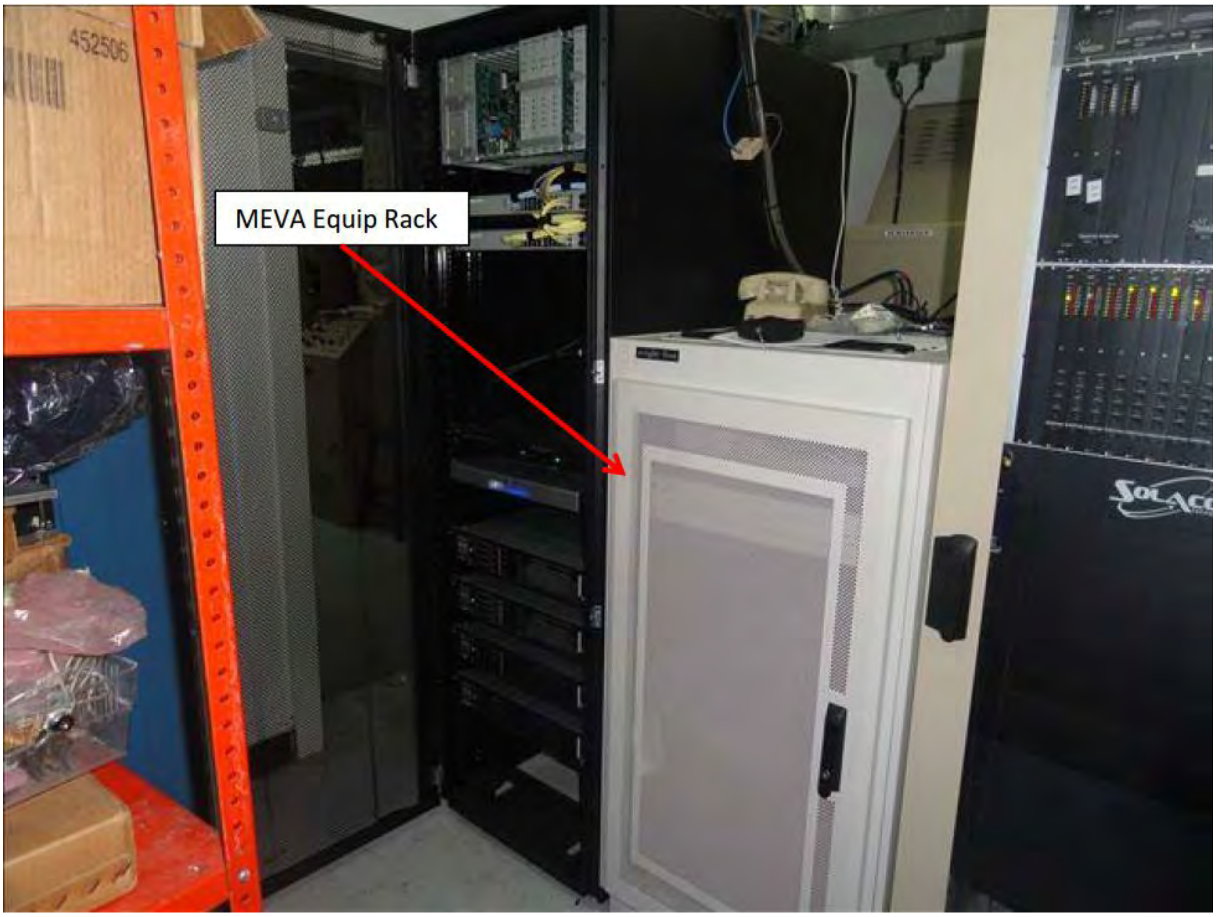


Figure 70: Rack Room Overview Bahamas Nassau

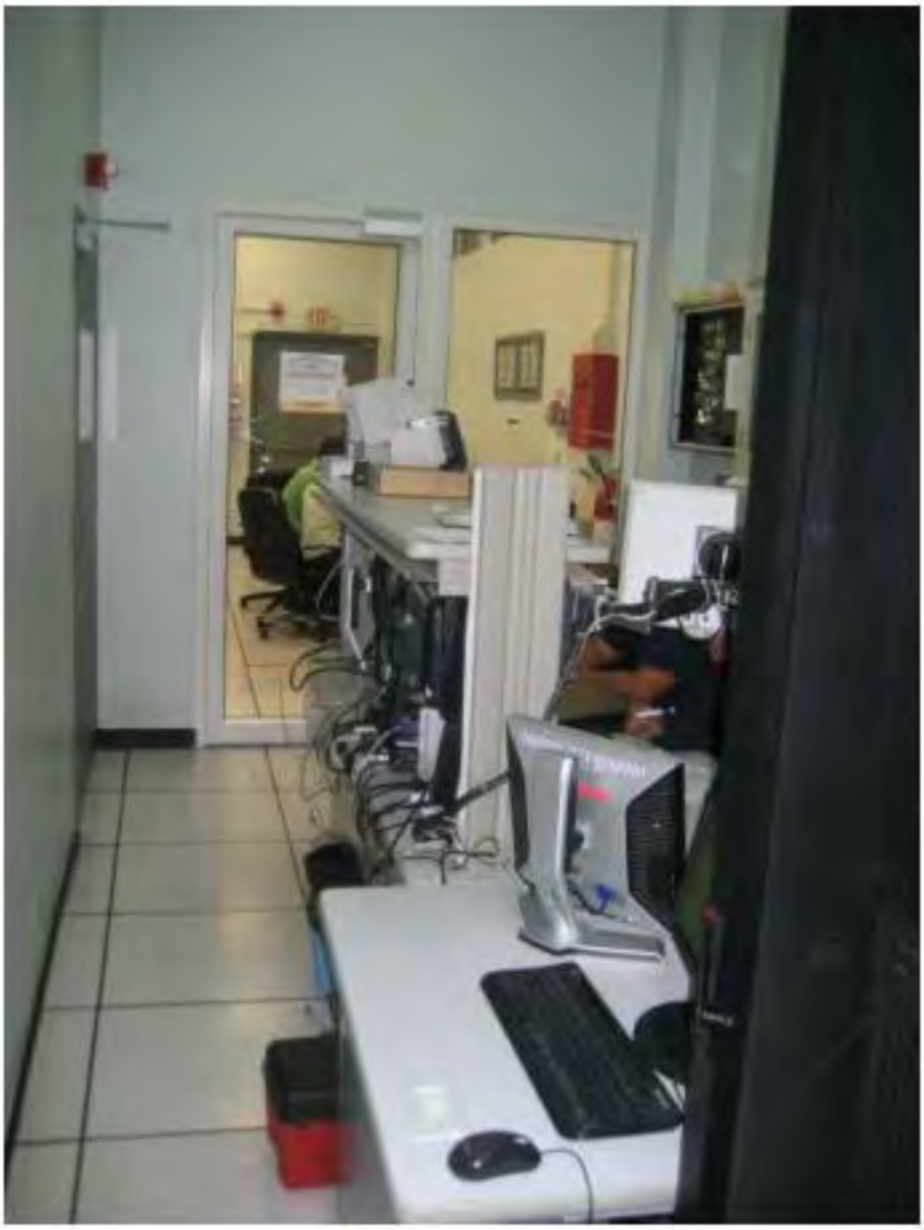
(3) The new MEVA III Rack will be installed next to the existing MEVA II Rack.

7.5 COCESNA

(1) The site is generally designed to provide:

- Single Chain
- Usage of existing antenna

(2) The site survey was conducted on July 30th 2013.



Entrance

Figure 71: Rack Room Overview COCESNA

(3) COCESNA has decided to place the new MEVA III rack in a different room as the existing MEVA II rack. Therefore the cabling for voice and data connections have to be moved by COCESNA to the new location at time of switch over.

7.6 Cuba

(1) The site is generally designed to provide:

- Single Chain
- Usage of existing antenna

(2) The site survey was conducted on July 29th 2013.

Figure 72: Rack Room Overview Cuba

(3) The new MEVA III Rack will be installed next to the existing MEVA II Rack.

7.7 Cayman Islands

(1) The site is generally designed to provide:

- Single Chain
- Usage of existing antenna

(2) The site survey was conducted on February 21th 2014.

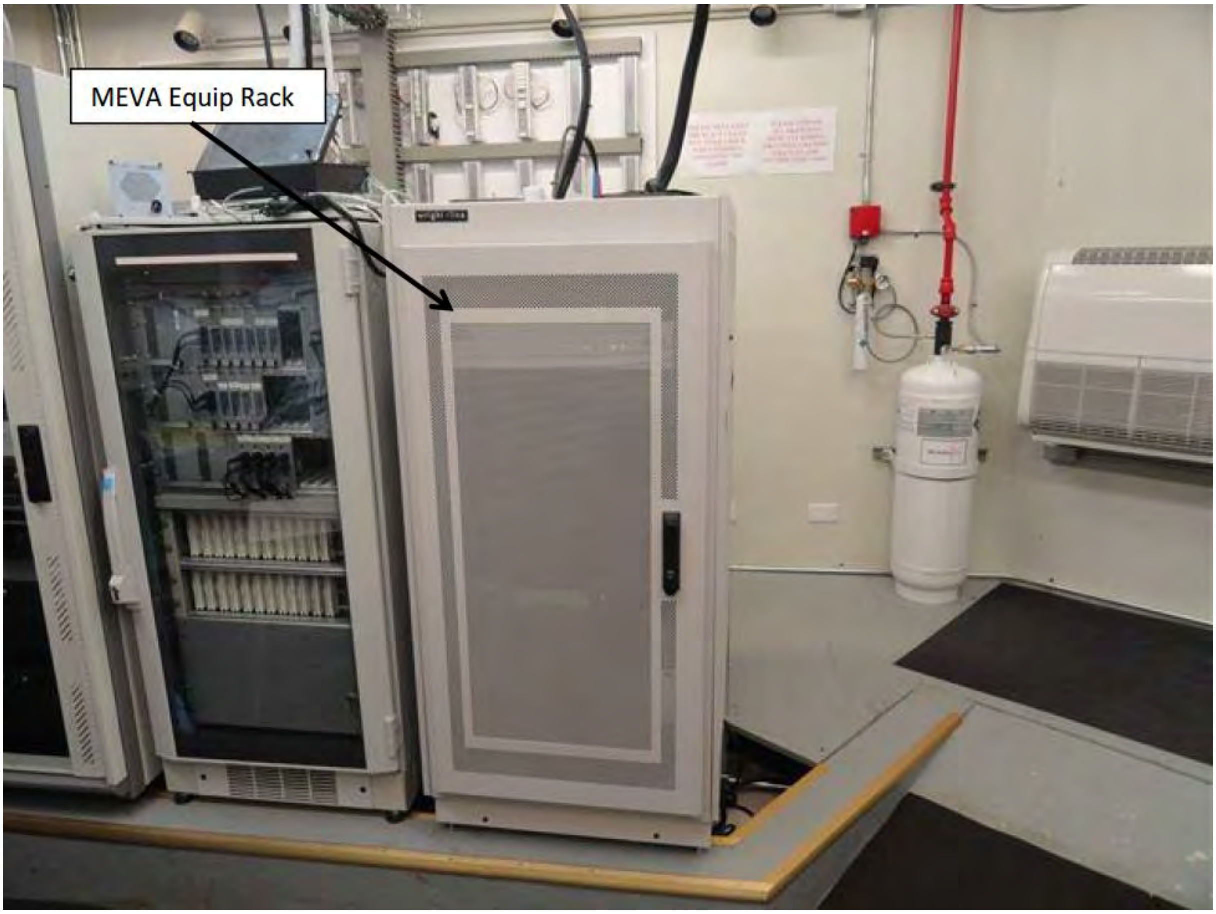


Figure 73: Rack Room Overview Cayman Islands

(3) The new MEVA III Rack will be installed next to the existing MEVA II Rack.

7.8 Curaçao

(1) The site is generally designed to provide:

- Single Chain
- Provision of a new Antenna (King Post Mount)

(2) The site survey was conducted on August 1st 2013.

Figure 74: Rack Room Overview Curacao

(3) The new MEVA III Rack will be installed next to the existing MEVA II Rack.

7.9 Colombia

(1) The site is generally designed to provide:

- Single Chain
- Usage of existing antenna
- Usage of existing amplifier

(2) The site survey was conducted on August 1st 2013.

Figure 75: Rack Room Overview Colombia

(3) The new MEVA III Rack will be installed next to the existing MEVA II Rack.

7.10 Caracas, Venezuela

(1) The site is generally designed to provide:

- Single Chain
- Usage of existing antenna
- Usage of existing amplifier

(2) The site survey was conducted on August 7th 2014.

INAC Computer Room. General View.

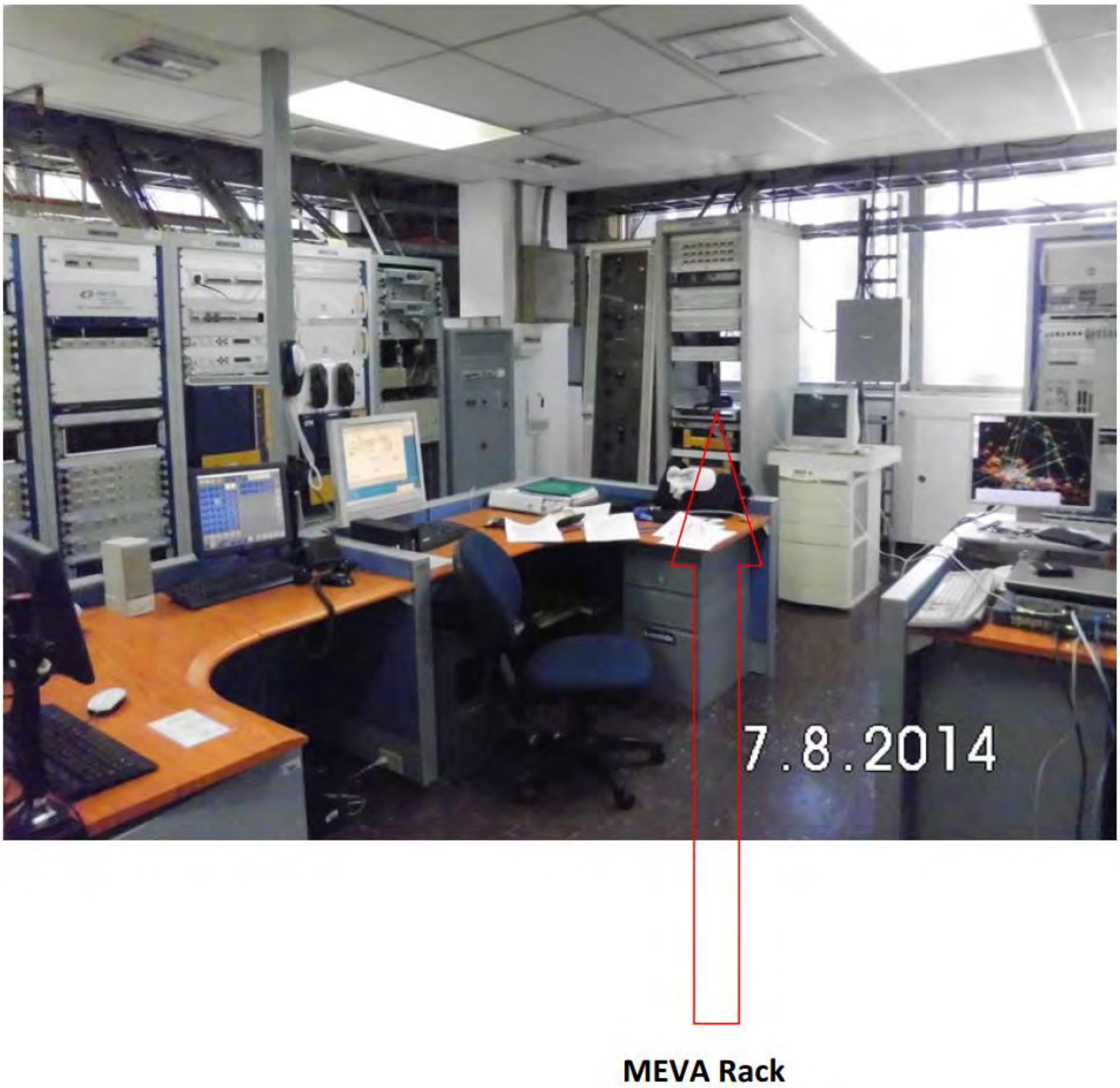


Figure 76: Rack Room Overview Caracas

(3) The new MEVA III Rack will be installed next to the existing MEVA II Rack.

7.11 Dominican Republic

(1) The site is generally designed to provide:

- Dual Chain redundancy
- Customer installs antenna on its own
- Electrical power supply at the antenna will be supplied by customer

(2) The site survey was conducted on February 24th 2014.

NEW RACK LOCATION

Figure 77: Rack Room Overview Dominican Republic

(3) The new MEVA III Rack will be installed in a new building.

7.12 Haiti

(1) The site is generally designed to provide:

- Dual Chain redundancy
- Usage of existing antenna
- Provisioning of UPS

(2) The site survey was conducted on February 21st 2014.

Figure 78: Rack Room Overview Haiti

(3) The new MEVA III Rack will be installed next to the existing MEVA II Rack.

7.13 Jamaica

(1) The site is generally designed to provide:

- Single Chain
- Usage of existing antenna

(2) The site survey was conducted on February 12th 2014.

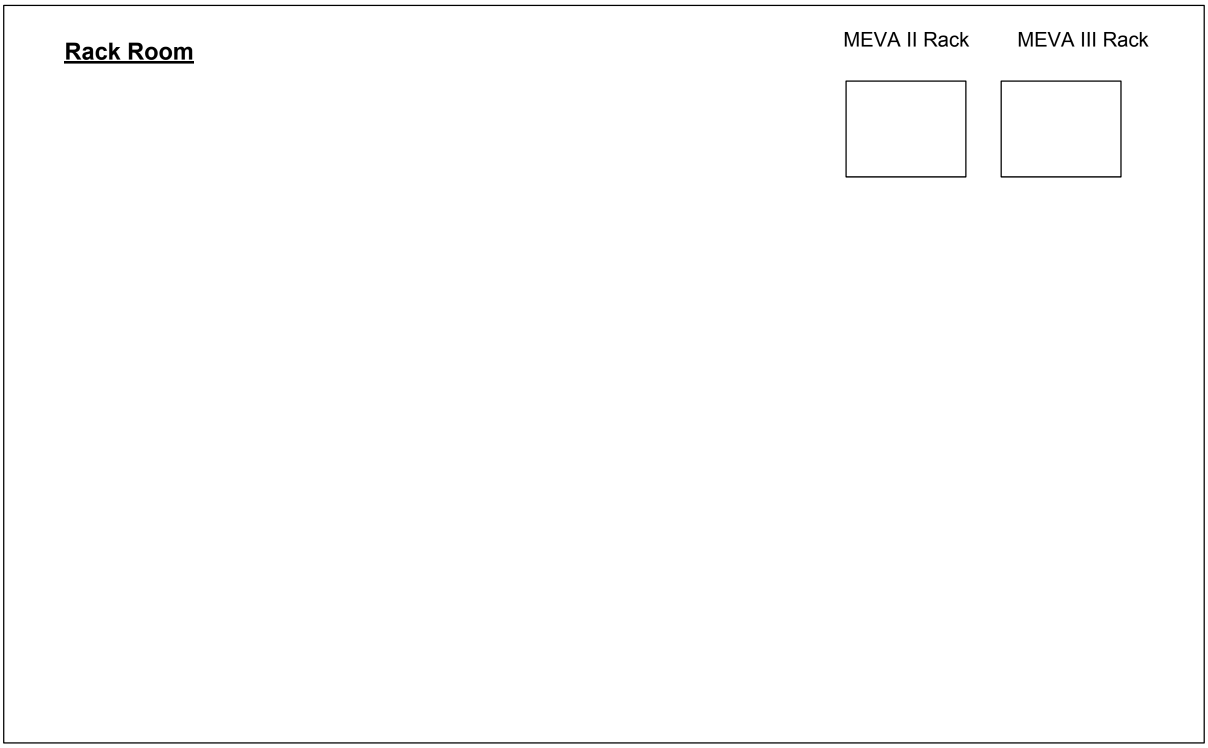


Figure 79: Rack Room Overview Jamaica

(3) The new MEVA III Rack will be installed next to the existing MEVA II Rack.

7.14 Miami

(1) The site is generally designed to provide:

- Dual Chain redundancy
- Network connects through NewCom Teleport Miami by dual E1 terrestrial leased lines

(2) The site survey was conducted on July 18th 2013.

Figure 80: Rack Room Overview Miami

(3) The new MEVA III Rack will be installed next to the existing MEVA II Rack, left hand – empty rack to be removed.

7.15 Mexico

(1) The site is generally designed to provide:

- Single Chain
- Usage of existing antenna

(2) The site survey was conducted on April 5th 2014.

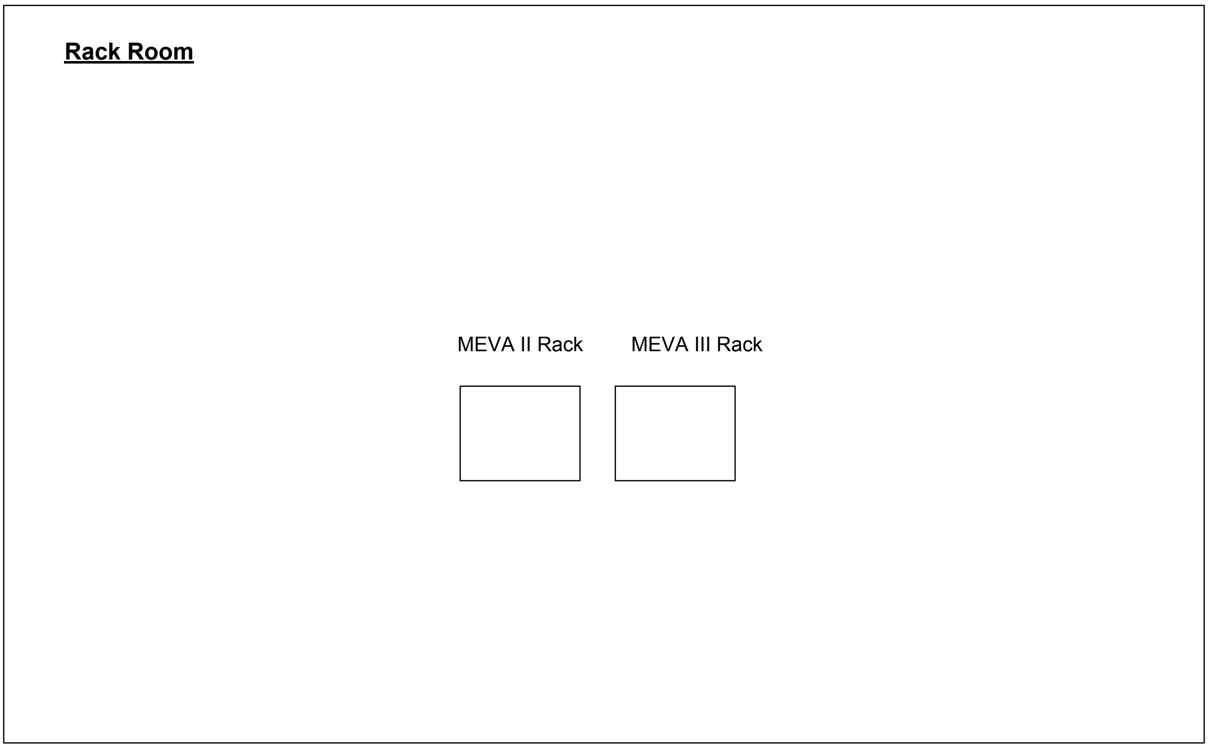


Figure 81: Rack Room Overview Mexico

(3) The new MEVA III Rack will be installed next to the existing MEVA II Rack.

7.16 Panama

(1) The site is generally designed to provide:

- Single Chain
- Provisioning of new antenna (NPMMount)

(2) The site survey was conducted on February 18th 2014.

Figure 82: Rack Room Overview Panama

(3) The new MEVA III Rack will be installed in a new room.

7.17 Puerto Rico

(1) The site is generally designed to provide:

- Dual Chain redundancy
- Usage of existing antenna

(2) The site survey was conducted on February 20th 2014.

Figure 83: Rack Room Overview Puerto Rico

(3) The new MEVA III Rack will be installed next to the existing MEVA II Rack.

7.18 Sint Maarten

(1) The site is generally designed to provide:

- Single Chain
- Usage of existing antenna

(2) The site survey was conducted on January 13th 2014.

Figure 84: Rack Room Overview Sint Maarten

(3) The new MEVA III Rack will be installed next to the existing MEVA II Rack.

VSAT-MEVA III

SDD - Training Plan

V1.0/26.09.2014

CFT Ref.:	**Sealed Tender ST-22501390**
Project No.:	**20141003**
Doc-ID.:	**VSAT-MEVA III_TRP_V1.0**
Customer:	**ICAO MEVA III, Mexico/Canada**

Revision History

Version	Date	Description
V1.0	26.09.2014	Initial Version submitted as SDD document

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Contents

List of Tables

1 COMSOFT Training Concept

(1) The correct and efficient use of COMSOFT provided VSAT systems requires detailed knowledge of the provided technology and its hardware elements. In order to facilitate the qualification of MEVA III Member States internal staff, COMSOFT has established a training concept based on the experience gathered during former trainings. This document provides information on all available training courses for the MEVA III VSAT network.

(2) The training courses will be performed by highly experienced COMSOFT VSAT experts that are also involved in the development and implementation of the MEVA III network.

(3) This document describes in detail the proposed training plan for MEVA III Member States personnel on the VSAT network. The training as suggested will ensure that operating and technical staff are able to operate and maintain the system satisfactorily and in a safe way.

1.1 Types of Training

(1) According to the training requirements there are three basic types of training to be held:

- the technical training ~~for technical staff~~ related to first level maintenance;
- the high level training ~~for operators;~~
- the restoration training related to transponder and satellite changes.

(2) COMSOFT offers several courses to cover the individual requirements of each identified group of system users.

(3) For the MEVA III Member State's needs, the following courses will be held:

Course ID	Course Name / Location	Course Duration (Training Days)	Max. No. of Participants/Course
I.	On-the-Job Training (OJT)	**1**	
O-1	Station Commissioning for Basic		6 (of the specific Member State)
O-2	Maintenance & Failure Localisation at Station Level (incl. interaction with NOC)		6 (of the specific Member State)
O-3	Interfacing of attached local Sub-Systems and Standard Test Procedures for SAT		6 (of the specific Member State)
II.	High Level Training	**4**	
T-1	Fundamentals of SkyWAN Networking		Up to 6 (from 1 or several Member States)
T-2	Basic Maintenance & Failure Localisation at Station and Network Level		Up to6 (from 1 or several Member States)
III.	Restoration Training	**1**	
S-1	Professional Training related to Restoration Procedures for Transponder and Satellite Changes		Up to 6 (from 1 or several Member States)

Table 1: Overview Training Course

(4) Training Course I (On-the-Job Training) will be conducted indoors and at the antenna of the VSAT node in the respective MEVA Member States and after the installation at each site.

(5) Training Course II (High Level Training) and Course III (Restoration Training) will be conducted at the COMSOFT premises in Miami (FL).

1.2 Training Concept / Schedule

(1) The syllabus for the High Level Training also covers special topics related to redundant Dual Chain Configurations. In order to have a homogeneous audience

and undivided attention COMSOFT recommends to have training groups with participants from countries that will have Dual Chain Redundancy separate from those without redundancy.

(2) In this case and in accordance to have a smooth and perfect operational start of the MEVA III VSAT Network, COMSOFT elaborates a special training concept / schedule which split the training into two (02) blocks.

1.2.1 Training Block #1

High-Level / Restoration Training – Block #1				
Start Date	**End Date**	**Site Configuration**	**Member State**	**No. of Participants**
Training Group #1				**6**
26.01.2015	30.01.2015	Single Chain	Cuba Bahamas (Freeport) Bahamas (Nassau) Cayman Islands	3 1 1 1
Training Group #2				**5**
02.02.2015	06.02.2015	Dual Chain	FAA Atlanta FAA Miami Mexico	2 2 1
Training Group #3				**6**
09.02.2015	13.02.2015	Dual Chain	Haiti Aruba COCESNA	3 2 1
Training Group #4				**5**
16.02.2015	20.02.2015	Dual Chain	Dominican Republic	5
Training Group #5				**6**
23.02.2015	27.02.2015	Single Chain	Jamaica Curacao Panama St. Maarten	3 1 1 1

1.2.2 Training Block #2

High-Level / Restoration Training – Block #2				
Start Date	**End Date**	**Site Configuration**	**Member State**	**No. of Participants**
Training Group #1				**5**
06.04.2015	10.04.2015	Single Chain	Cuba Cayman Islands	3 2
Training Group #2				**4**
13.04.2015	17.04.2015	Dual Chain	FAA Atlanta FAA Miami	2 2
Training Group #3				**6**
20.04.2015	24.04.2015	Dual Chain	Haiti Aruba	3 3
Training Group #4				**5**
27.04.2015	01.05.2015	Dual Chain	Dominican Republic	5
Training Group #5				**5**
04.05.2015	08.05.2015	Single Chain	Jamaica Curacao St. Maarten	3 1 1

1.3 Training Objectives

(1) The goals of the training are:

- to ensure the competent and efficient operation of the delivered system,
- to enable the MEVA III Member States personnel to maintain the VSAT system within their specific responsibility at any time,
- to enable the MEVA III Member States personnel to perform planned and corrective maintenance as well as to rectify faults to restore the system to full functionality in cooperation with and under the guidance of COMSOFT's Network Operation Center,
- to enable the MEVA III Member States personnel to perform detailed restoration procedures for transponder and satellite changes.

adjust to reflect responsibility

1.4 Document Overview

- Chapter 2 provides some general information on COMSOFT training.
- Chapter 3 provides an overview of the courses. (Please refer to section 3.2 for the details of the courses.)
- Chapter 4 explains the prerequisites for the courses.
- Chapter 5 deals with progress monitoring.

2 General

(1) For all courses proposed by COMSOFT, the following statements shall apply:

(2) All courses will be held in English language. Training documentation and other material employed for the courses will be in English language.

(3) Each participant will receive a complete set of course material for the course she/he attends.

(4) Courses are supposed to take place during usual business hours (see section 3.1.2. for a proposed day schedule). However, COMSOFT is flexible if special circumstances require another training schedule.

(5) The trainees are expected to be off duty as long as they participate in a training course, in order to give them enough time to duly prepare and revise the lessons.

(6) As far as possible, training will be carried out on the original equipment to be used for the operational work later. Thus the trainees get familiar with the new system at an early stage.

(7) Besides theoretical parts, training will include practical examples to provide practical experience on the equipment for the participants. Theoretical, practical and on-the-job training contents will vary and cover all aspects of the system installed at the customer's site.

(8) The emphasis of all courses is on the practical part. Practical details and procedures enable the technical and operational staff to install, maintain and operate the system ~~by themselves later.~~

(9) Test procedures will be part of the training. A focal point here will be how to gain and interpret diagnostic data in order to guarantee the good health state of the system.

(10) The courses will address all functionalities of the system and enable the participants to fully and independently operate and maintain the system. COMSOFT will show all flexibility to meet any specific requirements should they arise.

(11) After successful completion of the training, each participant will receive a certificate of training for each course he/she attended. To receive a certificate a regular attendance is required. The attendance is verified by attendance lists.

(12) It is not permitted to film or to record the training sessions.

(13) No liability can be assumed by COMSOFT for any interruption of training as a result of circumstances beyond its control. All measures will, however, be taken to minimise the consequences.

(14) The prices for the training courses and the scope of training services offered can be found in the commercial part of this offer.

3 Course Descriptions

3.1 General

(1) The following chapter describes the courses, their duration and prerequisites, and gives an example of a daily training schedule.

(dual/single chain)

3.1.1 Estimated Training Volume

(1) The table 1 in chapter 1.1 lists the training courses and their duration in days.

(2) In order to keep a course efficient, no more than 6 (six) trainees should participate in a course at each MEVA Member State/Site or in the Miami training facility.

3.1.2 Course Timetable

(1) A training week normally consists of 5 training days. The training week starts on Monday morning and finishes on Friday afternoon. This schedule can be adapted if necessary.

(2) COMSOFT is flexible to adapt the start/end of the training and the time of the breaks according to the wishes of the customer. In any case, the overall time for the lesson/practice is always 8 training hours (1hr = 45 minutes) per training day.

(3) The participants of the courses are expected to prepare and revise the lessons. The trainers will give specific tasks after each lesson. This can either be as written homework or as exercises. Each training day starts with a short revision of the topics from the previous lessons. This revision can be made as a written test as well.

(4) The following table provides a sample training day schedule:

Daily Time Schedule		
Start	**End**	**Activity**
09.00 a.m.	10.30 a.m.	Revision/Lesson/Practice
10.30 a.m.	10.45 a.m.	Break
10.45 a.m.	12.15 p.m.	Lesson/Practice
12.15 p.m.	01.00 p.m.	Lunch
01.00 p.m.	02.30 p.m.	Lesson/Practice
02.30 p.m.	02.45 p.m.	Break
02.45 p.m.	04.15 p.m.	Lesson/Practice

Table 2: Training Day Schedule

3.2 Courses in Detail

(1) The following tables show course details per course with a description of contents, course duration and objective. Please note that the exact contents of the courses can only be defined once the design of the system has been agreed upon. Then the TRP can be adapted accordingly.

3.2.1 On-the-Job Training (OJT)

3.2.1.1 Station Commissioning (O-1)

(1) The Station Commissioning course provides the following contents:

Subject	Description
Contents	**Installation of Hardware** • SkyWAN® System Components (Components & Assembly Overview) • Antenna Pointing (Passive Pointing; Refined Adjustments; Antenna Pointing Practice) **Line-Up** • Required Information for proper Line-Up • Procedure (Perform Tests; final adjustments; Cross-Pol & Power-Settings; Contact Satellite Provider) **Initial Operation** • Basic Pitfalls & Troubleshooting
Objective	The trainee will be able to do basic trouble shooting in conjunction with NOC.

Subject	Description
	• Outdoor Equipment Installation Overview • Set Up of Indoor Unit Hardware • Run Station Specific Functional Tests • Control relevant Parameters for proper Operation
Location	MEVA Member State / Site
No. of trainees	Up to 6 (six) participants
Pre-requisites	See chapter 4
Remarks	This course will be conducted on-site between SAT and system commissioning. If both parties agree the course could be conducted as well between installation / integration and SAT.

Table 3: Station Commissioning Course

Contain add SW applications + Local Monitoring

3.2.1.2 Maintenance & Failure Localisation at Station Level (O-2)

(1) The Hardware Maintenance course provides the following contents:

Subject	Description
Contents	**Station Acceptance Test** • Run basic test procedures • Advanced troubleshooting at station level
Objective	The trainee will be able to do basic trouble shooting in conjunction with NOC. • Prove antenna pointing • Run Station Acceptance Test (SAT) • Control & adjust relevant parameters for proper operation
Location	MEVA Member State / Site
No. of trainees	Up to 6 (six) participants
Pre-requisites	See chapter 4
Remarks	This course will be conducted on-site between SAT and system commissioning. If both parties agree the course could be conducted as well between installation / integration and SAT.

Table 4: Hardware Maintenance Course

3.2.1.3 Interfacing of attached local Sub-Systems (O-3)

(1) The Interfacing of Attached Local Sub-Systems course provides the following contents:

Subject	Description
Contents	**Configuration Sections & relevant Parameters** • Check relevant connections • Proof proper function of system
Objective	The trainee will be able to do basic trouble shooting in conjunction with NOC.
Location	MEVA Member State / Site
No. of trainees	Up to 6 (six) participants
Pre-requisites	See chapter 4
Remarks	This course will be conducted on-site between SAT and system commissioning. If both parties agree the course could be conducted as well between installation / integration and SAT.

Table 5: Interfacing of Attached Local Sub-Systems Course

3.2.2 High Level Training

3.2.2.1 Fundamentals of SkyWAN Networking - Course (T-1)

(1) The SkyWAN Network Commissioning Course provides the following contents:

Subject	Description
Contents	**Introduction into SkyWAN® Technology** • Essential SkyWAN® Properties (SkyWAN® Solution Benefits; Networking Features; Satellite Link Features: Master/Slave Concept, Master/Backup Master, MF-TDMA, Topologies & Populations; Control of Transmit Parameters; Data Transport; Modules & Elements: SkyWAN® IDU, SkyWAN® System Components) • SkyWAN® IDU Access (Access Protocols; Applications) **Network Configuration and Installation** • Satellite Link (Configuration of Station; Network & Master/Backup Master) • Connectivity for Network Management (Interface IP-Addressing; Static Routes)

Subject	Description
	Introduction into SkyNMS • Monitoring System Parameters (Essential Parameters; Telnet Screens) • Reconfiguration Cases (Fully Meshed to Star; New Frequencies; 2nd Demod)
Objective	The trainee will be able to understand the SkyWAN® network design, its installations and configurations as delivered as a basis for Network Maintenance, i.e. • identifying and localizing failures • resolving issues jointly with the NOC
Location	Miami (FL)
No. of trainees	Up to 6 (six) participants
Pre-requisites	See chapter 4
Remarks	This course will be conducted at COMSOFT´s Training Facilities in Miami (FL).

Table 6: SkyWAN Network Commissioning Course

3.2.2.2 Basic Maintenance & Failure Localisation at Network and Station Level - Course (T-2)

(1) The Basic Maintenance & Failure Localization at Network Level Course provides the following contents:

Subject	Description
Contents	**Factory Acceptance Test** • Review of the test procedures **Network Acceptance Test** • Review of test procedures • Troubleshooting approaches • Station & network redundancy (MST | Backup) **Site Acceptance Test** • Test procedures **Coordination Procedures with the NOC** • Trouble tickets • Web access • Report analysis • Hardware repair activities

Subject	Description
Objective	The trainee will be able to assess the proper execution of station and network functions. She/he will be able to execute all foreseen local • monitoring • maintenance and • repair support functions for the Network Operation Center
Location	Miami (FL)
No. of trainees	Up to 6 (six) participants
Pre-requisites	See chapter 4
Remarks	This course will be conducted at COMSOFT´s Training Facilities in Miami (FL).

Table 7: Basic Maintenance & Failure Localization at Network Level Course

3.2.3 Restoration Training

3.2.3.1 Professional Training related to Satellite Administration

(1) The Professional Training related to Satellite Administration Course provides the following contents:

Subject	Description
Contents:	**Safety @ Work** **Installation** • Site Survey and Planning • Installation Outdoors and Indoors **Satellite Information** • Satellite Information Sources • Beacon Signal • Transponder Plot **Pointing** • Introduction (Concept Clarification; Azimuth, Elevation & Polarization Offset Adjustment; GEO Arc). • Passive Pointing Basics (Coarse Adjustment; Refined Adjustment: Optimization Procedures with Spectrum Analyzer). **Introduction to Line-Up Procedure** • Contact a Satellite Provider • Perform Tests and final adjustments

Subject	Description
	• Basic Tests
Objective	The trainee will be able to restoration a SkyWAN® network after a satellite or transponder change. • Perform necessary measurement procedures • Monitor & control relevant parameters for proper network operation
Location	Miami (FL)
No. of trainees	Up to 6 (six) participants
Pre-requisites	See chapter 4
Remarks	This course will be conducted at COMSOFT´s Training Facilities in Germany or Miami (FL).

Table 8: Professional Training related to Satellite Administration Course

4 Prerequisites

(1) This chapter lists the required background knowledge of the trainees participating in the training, as well as the requirements regarding the training location.

(2) The trainees shall acquire all required background knowledge **before** any specific course starts. COMSOFT considers these qualifications as necessary for the appropriate category of staff before the course starts.

(3) The required levels of knowledge are as follows:

Level	Qualification
Basic	Participant is able to fulfil a task with reference to documentation and under supervision, or has comparable knowledge
Good	Participant is able to fulfil a task independently, with little supporting reference to documentation, or has comparable knowledge
Excellent	Participant is able to fulfil a task independently and on his or her own, with little to no need for reference to documentation, or has comparable knowledge.

(4) Since courses and training documentation are in English, fluency in spoken and written English is necessary for all courses.

(5) The MEVA III TMG shall select the trainees and present to COMSOFT the complete list of course participants, including their full names, at least 4 weeks before the start date of the relevant course to allow for a thorough preparation of the training.

4.1 On-the-Job Training

(1) The required background knowledge for the Technical Training is:

- Good knowledge of microprocessor systems and workstations (CPU, RAM, interfaces, etc.)
- Good knowledge of GUIs (i.e. controlling a graphical based system with the PC mouse)
- Basic knowledge of Windows Operating System
- Basic knowledge of software management and software configuration (loading of software)
- LAN basics (hardware, Ethernet 802.2/802.3 topologies)
- WAN basics (hardware, asynchronous V.24, synchronous X.25)
- Good knowledge in analogue voice standard procedures
- Good knowledge of serial interface mechanism

4.2 High Level Training

(1) The required background knowledge for the Operation & Maintenance Training is:

- Basic knowledge of microprocessor systems and workstations (CPU, RAM, interfaces, etc.)
- Good knowledge of GUIs (i.e. controlling a graphical based system with the PC mouse)
- Basic knowledge of Windows Operating System
- Good knowledge in NMS standard procedures
- Good knowledge of satellite communications and IP

4.3 Restoration Training

(1) The required background knowledge for the Operational Training is:

- Good knowledge in Satellite Communication
- GVF level 1
- General good English language skills

4.4 Training Location

(1) The training shall take place in a separate class room wherever and whenever possible to minimise disturbance.

(2) A maximum of two participants shall be working with one terminal at any time.

(3) A sufficient number of terminals shall be available in the class room.

(4) Physical access shall be possible to all system components throughout the courses.

(5) It shall be possible to connect extra equipment (e.g. message sources, network simulation, etc.) from the class room to the new system.

(6) COMSOFT will provide soft drinks, coffee/tea and biscuits during the scheduled breaks free of charge for the trainees for all trainings.

(7) The following equipment would be appreciated at the training site, but is not compulsory: computer video beamer, flip chart or whiteboard with appropriate colour pens

5 Progress Monitoring

(1) Throughout the course, the trainer monitors the progress of the participants in order to be able to respond to individual problems immediately. This is achieved, for example, by close supervision of theoretical and practical exercises.

(2) After each course, the participants are requested to fill in a questionnaire that will be used to evaluate and document the course's quality.

feedback to MEVA

6 Development of TRP

(1) In COMSOFT experience the development of the final Training Plan is a process which will have various phases. This present TRP is clearly the draft version and a starting point. Early on in the project, preferably during a combined Site Visit / Project Meeting, COMSOFT will clarify the exact working procedures and needs of each of the envisaged training groups.

(2) From the clear understanding of their respective needs, the next version will have a more precise mirroring of the trainees' working processes in the syllabus.

(3) Reviews of each new version of the TRP will make sure that input from the customers is included and proposals have been discussed and properly addressed to. Once the contents of each course have been defined, work on the certification process will begin. A description of the certification process will show in which way the training will assure that the trainees are enabled to do their respective tasks upon completion of their trainings.

VSAT-MEVA III

SDD - Training Plan

V1.1/08.10.2014

CFT Ref.:	**Sealed Tender ST-22501390**
Project No.:	**20141003**
Doc-ID.:	**VSAT-MEVA III_TRP_V1.1**
Customer:	**ICAO MEVA Members**

Revision History

Version	Date	Description
V1.0	26.09.2014	Initial Version submitted as SDD document
V1.1	08.10.2014	Revised Version on SDD Change Requests

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Contents

List of Tables

1 COMSOFT Training Concept

(1) The correct and efficient use of COMSOFT provided VSAT systems requires detailed knowledge of the provided technology and its hardware elements. In order to facilitate the qualification of MEVA III Member States internal staff, COMSOFT has established a training concept based on the experience gathered during former trainings. This document provides information on all available training courses for the MEVA III VSAT network.

(2) The training courses will be performed by highly experienced COMSOFT VSAT experts that are also involved in the development and implementation of the MEVA III network.

(3) This document describes in detail the proposed training plan for MEVA III Member States personnel on the VSAT network. The training as suggested will ensure that operating and technical staff are able to operate and maintain the system satisfactorily and in a safe way.

1.1 Types of Training

(1) According to the training requirements there are three basic types of training to be held for the technical staff:

- the technical training (OJT) related to first level maintenance;
- the high level training;
- the restoration training related to transponder and satellite changes.

(2) COMSOFT offers several courses to cover the individual requirements of each identified group of system users.

(3) For the MEVA III Member State's needs, the following courses will be held:

Course ID	Course Name / Location	Course Duration (Training Days)	Max. No. of Participants/Course
I.	On-the-Job Training (OJT)	**1**	
O-1	Station Commissioning for Basic		6 (of the specific Member State)
O-2	Maintenance & Failure Localisation at Station Level (incl. interaction with NOC)		6 (of the specific Member State)
O-3	Interfacing of attached local Sub-Systems and Standard Test Procedures for SAT		6 (of the specific Member State)
II.	High Level Training	**4**	
T-1	Fundamentals of SkyWAN Networking		Up to 6 (from 1 or several Member States)
T-2	Basic Maintenance & Failure Localisation at Station and Network Level		Up to6 (from 1 or several Member States)
III.	Restoration Training	**1**	
S-1	Professional Training related to Restoration Procedures for Transponder and Satellite Changes		Up to 6 (from 1 or several Member States)

Table 1: Overview Training Course

(4) Training Course I (On-the-Job Training) will be conducted indoors and at the antenna of the VSAT node in the respective MEVA Member States and after the installation at each site.

(5) Training Course II (High Level Training) and Course III (Restoration Training) will be conducted at the COMSOFT premises in Miami (FL).

1.2 Training Concept / Schedule

(1) The syllabus for the High Level Training also covers special topics related to redundant Dual Chain Configurations. In order to have a homogeneous audience

and undivided attention COMSOFT recommends to have training groups with participants from countries that will have Dual Chain Redundancy separate from those without redundancy.

(2) In this case and in accordance to have a smooth and perfect operational start of the MEVA III VSAT Network, COMSOFT elaborates a special training concept / schedule which split the training into two (02) blocks.

1.2.1 Training Block #1

High-Level / Restoration Training – Block #1				
Start Date	**End Date**	**Site Configuration**	**Member State**	**No. of Participants**
Training Group #1				**6**
26.01.2015	30.01.2015	Single Chain	Bahamas (Freeport) Bahamas (Nassau) Cayman Islands Mexico	1 1 3 1
Training Group #2				**4**
02.02.2015	06.02.2015	Dual Chain	FAA FAA	2 2
Training Group #3				**6**
09.02.2015	13.02.2015	Dual Chain	Haiti Aruba COCESNA	3 2 1
Training Group #4				**5**
16.02.2015	20.02.2015	Dual Chain	Dominican Republic	5
Training Group #5				**6**
23.02.2015	27.02.2015	Single Chain	Jamaica Curacao Panama St. Maarten	3 1 1 1

1.2.2 Training Block #2

High-Level / Restoration Training – Block #2				
Start Date	**End Date**	**Site Configuration**	**Member State**	**No. of Participants**
Training Group #1				**6**
06.04.2015	10.04.2015	Single Chain	Cuba	6
Training Group #2				**4**
13.04.2015	17.04.2015	Dual Chain	FAA FAA	2 2
Training Group #3				**6**
20.04.2015	24.04.2015	Dual Chain	Haiti Aruba	3 3
Training Group #4				**5**
27.04.2015	01.05.2015	Dual Chain	Dominican Republic	5
Training Group #5				**5**
04.05.2015	08.05.2015	Single Chain	Jamaica Curacao St. Maarten	3 1 1

1.3 Training Objectives

(1) The goals of the training are:

- to ensure the competent and efficient operation of the delivered system,
- to enable the MEVA III Member States personnel to maintain the VSAT system within their specific responsibility at any time,
- to enable the MEVA III Member States personnel to perform planned and corrective maintenance as well as to rectify faults to restore the system to full functionality in cooperation with and under the guidance of COMSOFT's Network Operation Center,
- to enable the MEVA III Member States personnel to perform detailed restoration procedures for transponder and satellite changes.

1.4 Document Overview

- Chapter 2 provides some general information on COMSOFT training.
- Chapter 3 provides an overview of the courses. (Please refer to section 3.2 for the details of the courses.)
- Chapter 4 explains the prerequisites for the courses.
- Chapter 5 deals with progress monitoring.

2 General

For all courses proposed by COMSOFT, the following statements shall apply:

(1) All courses will be held in English language. Training documentation and other material employed for the courses will be in English language.

(2) Each participant will receive a complete set of course material for the course she/he attends.

(3) Courses are supposed to take place during usual business hours (see section 3.1.2. for a proposed day schedule). However, COMSOFT is flexible if special circumstances require another training schedule.

(4) The trainees are expected to be off duty as long as they participate in a training course, in order to give them enough time to duly prepare and revise the lessons.

(5) As far as possible, training will be carried out on the original equipment to be used for the operational work later. Thus the trainees get familiar with the new system at an early stage.

(6) Besides theoretical parts, training will include practical examples to provide practical experience on the equipment for the participants. Theoretical, practical and on-the-job training contents will vary and cover all aspects of the system installed at the customer's site.

(7) The emphasis of all courses is on the practical part. Practical details and procedures enable the technical and operational staff to install, maintain and operate the system by themselves later.

(8) Test procedures will be part of the training. A focal point here will be how to gain and interpret diagnostic data in order to guarantee the good health state of the system.

(9) The courses will address all functionalities of the system and enable the participants to fully and independently operate and maintain the system. COMSOFT will show all flexibility to meet any specific requirements should they arise.

(10) After successful completion of the training, each participant will receive a certificate of training for each course he/she attended. To receive a certificate a regular attendance is required. The attendance is verified by attendance lists.

(11) It is not permitted to film or to record the training sessions.

(12) No liability can be assumed by COMSOFT for any interruption of training as a result of circumstances beyond its control. All measures will, however, be taken to minimise the consequences.

3 Course Descriptions

3.1 General

(1) The following chapter describes the courses, their duration and prerequisites, and gives an example of a daily training schedule.

3.1.1 Estimated Training Volume

(1) The table 1 in chapter 1.1 lists the training courses and their duration in days.

(2) In order to keep a course efficient, no more than 6 (six) trainees should participate in a course at each MEVA Member State/Site or in the Miami training facility.

3.1.2 Course Timetable

(1) A training week normally consists of 5 training days. The training week starts on Monday morning and finishes on Friday afternoon. This schedule can be adapted if necessary.

(2) COMSOFT is flexible to adapt the start/end of the training and the time of the breaks according to the wishes of the customer. In any case, the overall time for the lesson/practice is always 8 training hours (1hr = 45 minutes) per training day.

(3) The participants of the courses are expected to prepare and revise the lessons. The trainers will give specific tasks after each lesson. This can either be as written homework or as exercises. Each training day starts with a short revision of the topics from the previous lessons. This revision can be made as a written test as well.

(4) The following table provides a sample training day schedule:

Daily Time Schedule		
Start	**End**	**Activity**
09.00 a.m.	10.30 a.m.	Revision/Lesson/Practice
10.30 a.m.	10.45 a.m.	Break
10.45 a.m.	12.15 p.m.	Lesson/Practice
12.15 p.m.	01.00 p.m.	Lunch
01.00 p.m.	02.30 p.m.	Lesson/Practice
02.30 p.m.	02.45 p.m.	Break
02.45 p.m.	04.15 p.m.	Lesson/Practice

Table 2: Training Day Schedule

3.2 Courses in Detail

(1) The following tables show course details per course with a description of contents, course duration and objective. Please note that the exact contents of the courses can only be defined once the design of the system has been agreed upon. Then the TRP can be adapted accordingly.

3.2.1 On-the-Job Training (OJT)

3.2.1.1 Station Commissioning (O-1)

(1) The Station Commissioning course provides the following contents:

Subject	Description
Contents	**Installation of Hardware** • SkyWAN® System Components (Components & Assembly Overview) • Antenna Pointing (Passive Pointing; Refined Adjustments; Antenna Pointing Practice) **Line-Up** • Required Information for proper Line-Up • Procedure (Perform Tests; final adjustments; Cross-Pol & Power-Settings; Contact Satellite Provider) **Initial Operation** • Basic Pitfalls & Troubleshooting
Objective	The trainee will be able to do basic trouble shooting in conjunction with NOC.

Subject	Description
	• Outdoor Equipment Installation Overview • Set Up of Indoor Unit Hardware • Run Station Specific Functional Tests • Control relevant Parameters for proper Operation
Location	MEVA Member State / Site
No. of trainees	Up to 6 (six) participants
Pre-requisites	See chapter 4
Remarks	This course will be conducted on-site between SAT and system commissioning. If both parties agree the course could be conducted as well between installation / integration and SAT.

Table 3: Station Commissioning Course

3.2.1.2 Maintenance & Failure Localisation at Station Level (O-2)

(1) The Hardware Maintenance course provides the following contents:

Subject	Description
Contents	**Station Acceptance Test** • Run basic test procedures • Advanced troubleshooting at station level
Objective	The trainee will be able to do basic trouble shooting in conjunction with NOC. • Prove antenna pointing • Run Station Acceptance Test (SAT) • Control & adjust relevant parameters for proper operation
Location	MEVA Member State / Site
No. of trainees	Up to 6 (six) participants
Pre-requisites	See chapter 4
Remarks	This course will be conducted on-site between SAT and system commissioning. If both parties agree the course could be conducted as well between installation / integration and SAT.

Table 4: Hardware Maintenance Course

3.2.1.3 Interfacing of attached local Sub-Systems (O-3)

(1) The Interfacing of Attached Local Sub-Systems course provides the following contents:

Subject	Description
Contents	**Configuration Sections & relevant Parameters** • Check relevant connections • Proof proper function of system
Objective	The trainee will be able to do basic trouble shooting in conjunction with NOC.
Location	MEVA Member State / Site
No. of trainees	Up to 6 (six) participants
Pre-requisites	See chapter 4
Remarks	This course will be conducted on-site between SAT and system commissioning. If both parties agree the course could be conducted as well between installation / integration and SAT.

Table 5: Interfacing of Attached Local Sub-Systems Course

3.2.2 High Level Training

3.2.2.1 Fundamentals of SkyWAN Networking - Course (T-1)

(1) The SkyWAN Network Commissioning Course provides the following contents:

Subject	Description
Contents	**Introduction into SkyWAN® Technology** • Essential SkyWAN® Properties (SkyWAN® Solution Benefits; Networking Features; Satellite Link Features: Master/Slave Concept, Master/Backup Master, MF-TDMA, Topologies & Populations; Control of Transmit Parameters; Data Transport; Modules & Elements: SkyWAN® IDU, SkyWAN® System Components) • SkyWAN® IDU Access (Access Protocols; Applications) **Network Configuration and Installation** • Satellite Link (Configuration of Station; Network & Master/Backup Master) • Connectivity for Network Management (Interface IP-Addressing; Static Routes)

Subject	Description
	Introduction into SkyNMS • Monitoring System Parameters (Essential Parameters; Telnet Screens) • Reconfiguration Cases (Fully Meshed to Star; New Frequencies; 2nd Demod)
Objective	The trainee will be able to understand the SkyWAN® network design, its installations and configurations as delivered as a basis for Network Maintenance, i.e. • identifying and localizing failures • resolving issues jointly with the NOC
Location	Miami (FL)
No. of trainees	Up to 6 (six) participants
Pre-requisites	See chapter 4
Remarks	This course will be conducted at COMSOFT´s Training Facilities in Miami (FL).

Table 6: SkyWAN Network Commissioning Course

3.2.2.2 Basic Maintenance & Failure Localisation at Network and Station Level - Course (T-2)

(1) The Basic Maintenance & Failure Localization at Network Level Course provides the following contents:

Subject	Description
Contents	**Factory Acceptance Test** • Review of the test procedures **Network Acceptance Test** • Review of test procedures • Troubleshooting approaches • Station & network redundancy **Site Acceptance Test** • Test procedures **Coordination Procedures with the NOC** • Trouble tickets • Web access • Report analysis • Hardware repair activities

Subject	Description
Objective	The trainee will be able to assess the proper execution of station and network functions. She/he will be able to execute all foreseen local • monitoring • maintenance and • repair support functions for the Network Operation Center
Location	Miami (FL)
No. of trainees	Up to 6 (six) participants
Pre-requisites	See chapter 4
Remarks	This course will be conducted at COMSOFT´s Training Facilities in Miami (FL).

Table 7: Basic Maintenance & Failure Localization at Network Level Course

3.2.3 Restoration Training

3.2.3.1 Professional Training related to Satellite Administration

(1) The Professional Training related to Satellite Administration Course provides the following contents:

Subject	Description
Contents:	**Safety @ Work** **Installation** • Site Survey and Planning • Installation Outdoors and Indoors **Satellite Information** • Satellite Information Sources • Beacon Signal • Transponder Plot **Pointing** • Introduction (Concept Clarification; Azimuth, Elevation & Polarization Offset Adjustment; GEO Arc). • Passive Pointing Basics (Coarse Adjustment; Refined Adjustment: Optimization Procedures with Spectrum Analyzer). **Introduction to Line-Up Procedure** • Contact a Satellite Provider • Perform Tests and final adjustments

Subject	Description
	• Basic Tests
Objective	The trainee will be able to restoration a SkyWAN® network after a satellite or transponder change. • Perform necessary measurement procedures • Monitor & control relevant parameters for proper network operation
Location	Miami (FL)
No. of trainees	Up to 6 (six) participants
Pre-requisites	See chapter 4
Remarks	This course will be conducted at COMSOFT´s Training Facilities in Germany or Miami (FL).

Table 8: Professional Training related to Satellite Administration Course

4 Prerequisites

(1) This chapter lists the required background knowledge of the trainees participating in the training, as well as the requirements regarding the training location.

(2) The trainees shall acquire all required background knowledge **before** any specific course starts. COMSOFT considers these qualifications as necessary for the appropriate category of staff before the course starts.

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(5) The MEVA III TMG shall select the trainees and present to COMSOFT the complete list of course participants, including their full names, at least 4 weeks before the start date of the relevant course to allow for a thorough preparation of the training.

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- Good knowledge of microprocessor systems and workstations (CPU, RAM, interfaces, etc.)
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- Basic knowledge of software management and software configuration (loading of software)
- LAN basics (hardware, Ethernet 802.2/802.3 topologies)
- WAN basics (hardware, asynchronous V.24, synchronous X.25)
- Good knowledge in analogue voice standard procedures
- Good knowledge of serial interface mechanism

4.2 High Level Training

(1) The required background knowledge for the Operation & Maintenance Training is:

- Basic knowledge of microprocessor systems and workstations (CPU, RAM, interfaces, etc.)
- Good knowledge of GUIs (i.e. controlling a graphical based system with the PC mouse)
- Basic knowledge of Windows Operating System
- Good knowledge in NMS standard procedures
- Good knowledge of satellite communications and IP

4.3 Restoration Training

(1) The required background knowledge for the Operational Training is:

- Good knowledge in Satellite Communication
- GVF level 1
- General good English language skills

4.4 Training Location

(1) The training shall take place in a separate class room wherever and whenever possible to minimise disturbance.

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(1) Throughout the course, the trainer monitors the progress of the participants in order to be able to respond to individual problems immediately. This is achieved, for example, by close supervision of theoretical and practical exercises.

(2) After each course, the participants are requested to fill in a questionnaire that will be used to evaluate and document the course's quality.

VSAT-MEVA III

SDD - Transition Plan

V1.2/26.09.2014

CFT Ref.:	**Sealed Tender ST-22501390**
Project No.:	**20141003**
Doc-ID.:	**VSAT-MEVA III_TSP_V1.2**
Customer:	**ICAO MEVA III, Mexico/Canada**

Revision History

Version	Date	Description	Resp.
V1.2	26.09.2014	Initial Version submitted as SDD document	

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Contents

List of Figures

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1 Introduction

(1) During the 28th MEVA TMG meeting held in Miami, FL the migration phase was discussed in further details.

(2) Since a migration of an operational satellite communications network to a new or upgraded network with different equipment or a different satellite is always a challenging task because of the implicit requirement of minimum service interruption.

(3) Based on the input of several MEVA Member States COMSOFT has slightly adapted the migration plan presented during the tender phase.

(4) Within this document COMSOFT will present the options for a smooth transition along the criteria:

- Minimum service interruption
- Minimum risk
- Minimum expenses for extra equipment exclusively used in the transition phase
- Speedy process

(5) As result, the proposed migration process from this analysis is outlined in the next section with the main objectives:

- to determine the required equipment (under the additional aspect of a seamless transition);
- to derive a realistic time schedule

  and

- to address what is involved in the migration process for all parties involved.

(6) It is important to understand that the fast success of the migration process depends very much on the good cooperation between incumbent Service Provider, MEVA III TMG/Member States and the integrator of the new network. In this context COMSOFT assumes that the current Service Provider has the same obligation to support the transition as successful tenderer for MEVA III according to Section B 4.9.

2 Migration Concept

(1) The ideal prerequisite for a smooth network transition is the simultaneous presence of both networks, which allows testing the new network sufficiently without affecting the operational services in the old network. This can be achieved exactly due to the following measures.

2.1 Satellite Capacity

(1) COMSOFT has an agreement with Intelsat in place for capacity on exactly the same transponder being used for MEVA II presently and for REDDIG. Therefore it is indeed feasible to simultaneously transmit current carriers from the Linkway 2100 Modem and the SkyWAN carrier.

(2) As of today there are restrictions in using both carriers – the new SkyWAN and the existing Linkway.

(3) During the 28th MEVA Member States meeting obstacles occurred in defining the actual used power of the amplifiers at site. The existing service provider (SES) was not able to provide figures on power usage, but mentioned that on some sites power usage is above calculated link budget parameters.

(4) MEVA III TMG is obliged to ensure that SES meets the related BUC power consumption figures at date of MEVA III network implementation.

(5) All mentioned power usage assumptions at SES remote sites as stated in Figure 1: Calculation on max. Power Need per Site during Migration Phase are therefore estimations.

2.1.2 Critical Facts

(1) To grant a smooth network migration some key elements have to be resolved upfront:

- SES has to re-align sites to compensate power consumption of existing amplifiers to meet link budget figures.

RISK:

(2) Sites which over consumes related output power at the amplifiers cannot provide sufficient margin to transmit both network carriers at the same time. Migration is therefore not possible

- COMSOFT has entered into a contract with SES in order to agree on stations equipment dismantling responsibilities. COMSOFT will dismantle related equipment without need of participation of SES technicians locally.

RISK:

(3) COMSOFT cannot take liability for any damage caused on SES owned equipment or unexpected outages when changing existing amplifiers against new ones offered.

Note: In any way there will be a short outage on the related site, when amplifiers are exchanged.

2.2 Satellite Transponder

(1) The satellite transponder has superior performance and requires comparatively little uplink power per carrier. Based on the Intelsat Link Budget Tool LST5, the required RF power for this scenario has been calculated for this transponder for all MEVA III locations, for which Intelsat provides pattern advantage data in the footprint of the C-Band America Beam of Intelsat 14.

(2) The footprint of this beam shows that all other MEVA III Network sites have significantly better pattern advantages than Atlanta, which represents the worst case.

(3) The results presented in the table below show that the existing 40W BUCs have sufficient power margin for this scenario provided that the new carrier is operated with low modulation and coding.

(4) The calculation is done for the worst case, i.e. the TDMA carrier to be received in Atlanta, which is furthest off the center of the footprint. This also includes the necessary multi carrier back-off to avoid intermodulation when transmitting simultaneously a Linkway 2100 carrier (symbol rate of 1.25 MBaud) and the SkyWAN carrier per site.

2.3 Racks

(1) In reflection of the fact that the ownership of current MEVA II equipment racks is not clear throughout, COMSOFT provides new racks for the MEVA III equipment at all sites. Thus it is also ensured that there is no mechanical or electrical dependence or interference with potential harm to the running MEVA II service during the installation of the MEVA III network equipment.

(2) Hence the new MEVA III equipment can be installed station by station. After completion of the installation at each site it will be tested with test links to the Teleport Miami, FL by running typical aeronautical (voice and data) applications. These test scenarios will be proposed in the SAT Plan as part of the System Design Document (SDD).

(3) After passing these tests successfully the sites will be approved by the respective Technical Manager of the MEVA Member State as accepted (SAT). As soon as **all** MEVA III Network sites have become ready for operation in this way, the active services can be switched over in a coordinated manner in parallel - from MEVA II to MEVA III. At the end of this process all MEVA II carriers will be idle and can be shut down. Finally all MEVA II indoor equipment can be decommissioned.

(4) It should be mentioned that the proposed procedure does not require temporary equipment or software configurations for the purpose of the transition - neither on the MEVA II nor MEVA III side – therefore no and associated risk of reconfigurations is expected; the new network starts in its final operational configuration and the multiplexers and Linkway modems remain in its current configuration.

(5) There is only one change necessary after completion of the migration:

(6) The low modulation & coding utilized during the transition is chosen to minimize the extra transmit power for the additional SkyWAN carrier and to remain within the limits of available transmit power. This is at the expense of extra bandwidth, which needs to be leased temporarily during the transition phase. After MEVA II Network has been switched off, the MEVA III Network (operated by SkyWAN) can be operated with optimized satellite bandwidth and the extra bandwidth can be returned to Intelsat. This change between different modulation & coding (from QPSK, FEC=1/2) does not involve any risk and can be achieved through a short shut down of the network with subsequent reboot with the new parameters (8PSK, FEC=3/4).

	Antenna Size (m)	Pattern Advantage Uplink (dB)	Pattern Advantage Downlink (dB9	Transmit Power for Downlink to Atlanta (worst case) (W)				Assumed Transmit Power for REDDIG Carrier (Worst Case) (W)	Transmit Power combined incl. back-off (W)
				SkyWAN 8PSK FEC3/4	SkyWAN 8PSK FEC 2/3	SkyWAN QPSK FEC 1/2	Linkway QPSK FEC 3/4		
Atlanta (USA)	3,8	1,3	1,1	16,6	10,9	5	11,6		**33,2**
Bogota Columbia)	3,7	3,8	5,2	9	6,7	2,7	6,3	5	**35**
Caracas (Venezuela)	*3,8*	3,5	4,1	8,9	6,5	2,7	6,2	5	**34,8**
COCESNA	3,8	5	4,6	7,4	5,4	2,2	5,1		**14,6**
Cuba	3,8	5,6	3	6,3	4,6	1,9	4,4		**12,6**
Dominican Rep	*3,8*	3,3	3,6	9,9	7,3	2,9	6,9		**19,6**
Haiti	*3,8*	4,1	3,6	8,3	6,1	2,5	5,8		**16,6**
Kingston (Jamaica)	*3,8*	4,3	3,7	8,2	6	2,4	5,7		**16,2**
Merida (Mexico)	*3,8*	5,3	4,6	7,2	5,3	2,1	5		**14,2**
Miami, Teleport (USA)	3,8	5,2	2,1	5,8	5,4	2,6	-		**8,8**
Panama City	*3,8*	4,1	4,5	9	6,5	2,6	6,2		**17,6**
San Juan (Puerto Rico)	*3,8*	2,5	3,6	11,3	8,5	3,4	7,9		**22,6**

Figure 1: Calculation on max. Power Need per Site during Migration Phase

3 Detailed Description of the Migration Steps

(1) Installation of MEVA III Network and the transition from MEVA II Network will take place in following stages:

<u>Stage 01:</u> Approval by MEVA III TMG of the Transition Plan presented with the SDD.

<u>Stage 02:</u> Installation of the Master Station in the Teleport Miami, FL includes a test configuration for the simulation of aeronautical voice and data applications as part of the SAT. On completion the SkyWAN carrier is on air and the satcom network is ready for inclusion of operational MEVA III terminals.

<u>Stage 03:</u> Installation of the Backup Master Station in Atlanta.

<u>Stage 04:</u> A few minutes interruption at the Atlanta terminal is necessary to introduce

- an L-Band combiner indoors to combine the carriers of an old and new modem on the transmit IFL cable

and

- an L-Band splitter indoors to feed the receive signal from the IFL cable to both modems.

<u>Stage 05:</u> In the subsequent, SAT for Atlanta application tests as agreed and approved by MEVA III TMG, between Atlanta and the Teleport, will be conducted and site acceptance will be achieved.

<u>Stage 06:</u> Corresponding to steps (3) – (5), another MEVA III Network si[illegible].e. the first “remote site” in terms of the terminal/network node functions, will be installed and subjected to the SAT.

<u>Stage 07:</u> Within the 3-site network configuration the switching between Master and Backup Master can be tested.

<u>Stage 08:</u> In repetition of step (6), all other MEVA III Network sites will be installed by the installation teams, where several teams working in parallel to minimize the migration period with operational costs for 2 networks and subsequently subjected to the SAT.

<u>Stage 09:</u> Now, all MEVA III Network sites are ready for switch-over in active services. The technical staff of the MEVA Member States have during the On-the-Job Training been instructed on the available interfaces and the connectors. Thus the active connections can now be transferred, one by one or in parallel, from MEVA II Network to MEVA

III Network in coordination between technical staff of both affected sites by reconnecting to the MEVA III multiplexer interfaces. This process is accompanied by COMSOFT´s Helpdesk Support for the technicians at both sites - Miami and Atlanta.

Stage 10: After transfer of all active services to MEVA III Network the Linkway 2100 carriers will be idle and can be shut down. Thereafter all MEVA II indoor equipment can be decommissioned.

Stage 11: The transition will be concluded with an adjustment of the modulation and coding to its final values. This involves a brief shut down of the network followed by a reboot with the new parameters.

3.1 Detailed Time Schedule Breakdown of the Migration Steps

(1) The proposed time schedule for the transition is outlined in the overall Project Schedule Plan (PSP).

(2) The following essence is related only to the relevant site installation schedules (incl. SAT and OJT).

- **Aruba**
  - Start of Installation: 19 Feb '15
  - End of Installation: 02 Mar '15
- **Cuba**
  - Start of Installation: 10 Feb '15
  - End of Installation: 18 Feb '15
- **Dominican Republic**
  - Start of Installation: 23 Feb '15
  - End of Installation: 04 Mar '15
- **Atlanta, USA**
  - Start of Installation: 11 Feb '15
  - End of Installation: 23 Feb '15

- **Miami, FL**
  - Start of Installation: 19 Feb '15
  - End of Installation: 05 Mar '15
- **Miami Teleport, FL**
  - Start of Installation: 08 Jan '15
  - End of Installation: 19 Jan '15
- **Haiti**
  - Start of Installation: 17 Feb '15
  - End of Installation: 24 Feb '15
- **COCESNA**
  - Start of Installation: 10 Mar '15
  - End of Installation: 16 Mar '15
- **Mexico**
  - Start of Installation: 10 Mar '15
  - End of Installation: 17 Mar '15
- **Sint Maarten**
  - Start of Installation: 24 Feb '15
  - End of Installation: 02 Mar '15
- **Jamaica**
  - Start of Installation: 11 Mar '15
  - End of Installation: 17 Mar '15
- **Cayman Islands**
  - Start of Installation: 03 Mar '15
  - End of Installation: 09 Mar '15

- **Bahamas, Freeport**
    - Start of Installation: 10 Feb '15
    - End of Installation: 16 Feb '15
- **Bahamas, Nassau**
    - Start of Installation: 10 Feb '15
    - End of Installation: 18 Feb '15
- **Curaçao**
    - Start of Installation: 24 Feb '15
    - End of Installation: 11 Mar '15
- **Panama**
    - Start of Installation: 10 Mar '15
    - End of Installation: 16 Mar '15
- **Colombia**
    - Start of Installation: 03 Mar '15
    - End of Installation: 11 Mar '15
- **Caracas, Venezuela**
    - Start of Installation: 09 Mar '15
    - End of Installation: 17 Mar '15
- **Puerto Rico**
    - Start of Installation: 10 Mar '15
    - End of Installation: 17 Mar '15

(3) Phase II

- **Switch over of active connections**
  - Start: 18 Mar '15
  - End: 24 Mar '15
- **Shut-down of MEVA II network**
  - 25 Mar '15
- **Switch to final modulation & coding of MEVA III network**
  - 26 Mar '15

VSAT-MEVA III

SDD - Security Plan

V1.0/26.09.2014

CFT Ref.:	**Sealed Tender ST-22501390**
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Revision History

Version	Date	Description
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1 COMSOFT Security Management

(1) Networks are subject to attacks from malicious sources. Attacks can be from two categories: "Passive" when a network intruder intercepts data traveling through the network, and "Active" in which an intruder initiates commands to disrupt the network's normal operation.

(2) Types of attacks include:

(3) Passive

- Network
- Wiretapping
- Port scanner
- Idle scan

(4) Active

- Denial-of-service attack
- Spoofing
- Man in the middle
- ARP poisoning
- Smurf attack
- Buffer overflow
- Heap overflow
- Format string attack
- SQL injection
- Cyber attack

(5) COMSOFT will implement a suite of security measures to protect the network against accidental and malicious harmful acts affecting the correct function of the network. These measures will enforce the situation of MEVA III VSAT Network being a protected, private, closed and professionally managed network.

1.1 Data Security in SkyWAN Networks

(1) SkyWAN is a unique networking product designed to provide highest bandwidth efficiency for voice, data and video in corporate networks over satellite. The following sections discuss the security of communications in SkyWAN networks with respect to data integrity, confidentiality of the information and vulnerability towards communications monitoring.

1.1.2 Introduction

(1) It is a common perception of satellite communications that it cannot provide sufficient data security during transmission. Signals transmitted between the satellite and the earth stations are unprotected and can be received in an area as broad as the footprint of the satellite.

(2) This obvious vulnerability leads to the conclusion that only the highest degree of encryption can ensure security against unauthorized interception of the transmitted information.

(3) On the other hand recent progress in digital communications technology and sophisticated bandwidth saving satellite access schemes have led to a great variety of satellite communications technologies, which all behave differently with respect to the possibility of unauthorized access to the transmitted information.

(4) The next section reveals the specific technologies employed in SkyWAN in order to allow a fact based judgement of potential security risks involved.

1.1.3 SkyWAN Technology

(1) The SkyWAN system employs the latest state-of-the-art technologies of digital transmissions in order to achieve the versatility and efficiency of communications in corporate networking.

(2) Thus the working principles of SkyWAN differ in many ways from conventional satellite communications.

1.1.3.2 Physical Layer

(1) In SkyWAN networks the information payload is transmitted over carriers which are produced by a burst modem.

(2) Each carrier contains a QPSK or 8-PSK modulated signal with selectable Forward Error Correction (FEC = ½, ¾, 7/8 and others).

(3) The modem has been developed by ND SatCom and produces a unique signal characteristics with respect to sequence, duration and separation of bursts. Due to this proprietary behaviour it is not possible to decode or generate the carrier signal with any other modem available on the market.

(4) In addition to this the structure of the bursts differs from SkyWAN network to SkyWAN network depending on data rate and other burst internal parameters customized for each network.

(5) Larger and/or high capacity SkyWAN networks are realized as multi carrier networks. User data traffic is simultaneously transmitted on all carrier frequency bands, therefore complete monitoring of communications requires as many SkyWAN demodulators as there are carrier frequencies.

1.1.3.3 Data Link and Network Layer

(1) Access to the space segment and exchange of information between SkyWAN network nodes happens in a completely proprietary way, which defines the construction of bursts including duration and content of slots, frames and data payload within slots.

(2) This construction is specific for each single SkyWAN network and accordingly the decoding of bursts received with a SkyWAN modem is only possible with the knowledge of the specific parameter set of the respective network.

(3) The assignment of TDMA time slot is totally dynamic and based on demand. Therefore there is no transparent or repetitive pattern and the originator of a burst and its information can only be identified by complete decoding of the burst contents. Each SkyWAN network node is registered in the network with its unique address.

(4) Transmitting and receiving is only possible for legitimate stations, because all communication activities require identification with the network address. Transmit requests of unknown addresses are rejected and there is no data sent to non-registered network nodes.

1.1.3.4 Transport and Application Layer

(1) Data received by a SkyWAN station are extracted from the data container within the TDMA burst; these data are handed over on the central board and processed further

in the SkyWAN inherent Frame Relay Switch or in the Ethernet Bridge depending on the addressing.

(2) Only data addressed to the node under consideration will become available at the Frame Relay or Ethernet ports.

(3) Therefore there is no access to other data than those destined for the SkyWAN station under consideration.

1.1.4 Thread Analysis

(1) Based on the explanations of the previous section the possible ways to intrude into a SkyWAN network are discussed.

(2) The necessary prerequisites and the effort involved for a potential intruder are discussed in relation to the possible gain of information.

1.1.4.2 Data Integrity

(1) There is no way for unauthorized parties to change, modify, suppress or add data during transmission over a SkyWAN network, simply because for non-registered earth stations it is not possible to transmit.

(2) The attempt of a duplicated legitimate SkyWAN earth station will be discovered immediately from the conflict which it will necessarily cause.

(3) The network operator has the possibility to exclude this station (both) from the network.

(4) Certainly it is possible to generally prevent a SkyWAN network from proper working through jamming on the carrier frequencies of the SkyWAN network. Such an obvious offence would in fact disable any kind of satellite communications, but, unless in war times, this does not seem very likely.

(5) On the other hand, the multi carrier capability of SkyWAN in conjunction with the broadband capability of the SkyWAN modem, which covers nearly the complete C-Band or Ku-Band, make it easier to escape from jamming attacks.

1.1.4.3 Data Confidentiality

(1) From the explanations in chapter 1.1.3.2 it is obvious that a potential intruder needs to purchase a SkyWAN station in order to demodulate the transmitted signals.

(2) To be able to structure and decode the transported data flow he also needs to know all network specific parameters.

(3) To finally get access to any information the foreign station needs a legitimate identity, which can only be the identity of another already existing station in the network - we can speak of a "cloned" station.

(4) This station cannot transmit, the attempt to transmit would cause conflicts which will lead to the discovery of the illegitimate "clone" station.

(5) The evaluation of received information requires proper synchronization, which cannot be taken granted for all times, because the round trip time will be different from the original station.

(6) The automatic RTT adaptation would require the "clone" to transmit, which would lead to its discovery.

(7) The cloned station can only get access to information addressed to the original station, getting access to data addressed to other stations (only on the same carrier) would require extreme efforts in hardware and software modifications of proprietary SkyWAN system architecture.

(8) Nonetheless even the limited information available at the clone is encoded through different protocol layers of the user application and Frame Relay (or Ethernet respectively).

1.1.4.4 Vulnerability towards Communications Monitoring

(1) Communications activities of satellite earth stations are less easy to detect and localize and analyse compared to HF and VHF radio communications.

(2) The transmitted signal is radiated in a very narrow angle (typically 1 degree) in direction to the satellite. Due to the very focused radiation there is no noticeable energy travelling along the earth surface, which could be detected and evaluated in some distance.

(3) Therefore communications monitoring relies on the monitoring of the activities at the satellite. There is no information to gain in the case of SkyWAN: originators of transmissions cannot be identified without complete decoding of the contents of data in each and every TDMA burst.

(4) It has been explained before that only "cloned" SkyWAN nodes would be able to do so, with all its limitations: only on one carrier, only information for one station, no information about other network nodes.

1.1.5 Conclusion

(1) The detailed discussion in the previous sections has shown, that the barriers for an intruder into SkyWAN networks are extremely high.

(2) The possible information gain is very low in comparison to the required effort and the risk of failure and being discovered.

(3) The result of a fair comparison between the various confidentiality risks would show that it is much easier for a potential intruder to get the information otherwise, e.g. by intercepting data on terrestrial or other radio links or approaching personnel of the institution.

1.2 Equipment Access Security

(1) Key elements for achieving security to combat threats are to define mechanisms and algorithms associated with security measures such as authentication, access control, and data encryption. COMSOFT is providing telecommunications security by:

- Physical Security

  The component of communications security that results from all physical measures necessary to safeguard classified equipment, material, and documents from access thereto or observation thereof by unauthorized persons.

- Access Control

  The Access Control security dimension protects against unauthorized use of network resources. Access Control ensures that only authorized personnel or devices are allowed access to network elements, stored information, information flows, services and applications.

2 Hardware Security Management

(1) COMSOFT is using network hardware which is secured against third party access by offering manifold methods for protection.

(2) The following chapters will give a detailed overview of the used equipment capabilities and how COMSOFT will take advantage of them.

2.1 SkyWAN Modem

(1) COMSOFT has described in above chapters how to prevent from external access to the SkyWAN network.

(2) The following chapters addresses the security efforts on possible unwanted local access.

2.1.1 General

(1) The SKYWAN IDU provides two ports to get direct access to a single station. The first port is the service port by using Point-to-Point Protocol (PPP) to establish the link between the station and management PC and the second is the Ethernet port.

(2) The management access point for node management is enabled at the service port and if the default configuration is used also on the Ethernet port.

2.1.2 Local Access over the Service Port

(1) The access is established at the service port by means of a local "null modem". A specific EIA-232 cable connects the "null modem" to the service port of the SkyWAN node.

(2) The service port of the SkyWAN node uses the Point-to-Point (PPP) connection. A PPP link always has a local IP address and a remote IP address. The PPP link is a logical subnet accessible from the management PC and the SkyWAN node.

(3) The SkyWAN node acts as a PPP server assigning the IP address 192.168.1.1 to its service port and the IP address 192.168.1.2 to the connected client.

(4) To avoid unauthorized access, the PPP access is protected via dedicated user names and passwords. Usernames depend on the run mode of the SkyWAN node. The following table lists the default user names and passwords for PPP access.

	Operational Mode	Diagnostic Mode
PPP Username	ppp_user	operator
PPP Password	ppp_password	go4skywan

Figure 1: Default Values for PPP Access

TO

(5) **In order keep security, COMSOFT changes these standard passwords into customer and network unique ones.**

2.1.3 Local Access over Ethernet Port

(1) This IP interface provides the connectivity to the SkyWAN satellite network as well as to a LAN connected to the SkyWAN node.

(2) The RJ-45 connector e.g. with a regular patch cable can be used to connect a management PC.

(3) The locally connected management PC can access the SkyWAN node in operational or in diagnostic mode.

(4) The default IP address of the Ethernet interface is 192.168.192.101 for a master station and 192.168.192.201 for a slave station.

2.1.4 Remote Access over the Service Port (Dial-In)

(1) The service port of a SkyWAN node can be accessed with a telephone line modem.

(2) A specific EIA-232 cable (W60) connects the modem to the service port of the SkyWAN node. The telephone line modem to be used on the SkyWAN IDU site must be a specific modem (U.S.Robotics Mod-5630B) supporting worldwide PSTN networks.

(3) This modem will be installed at each network station.

2.1.5 Remote Access over the Satellite Port (SatMgmt)

(1) A SkyWAN satellite network is designed to be managed from central point via a Network Management System (NMS) like SkyNMS, which uses the IP based application layer protocols File Transfer Protocol (FTP) and Simple Network Management Protocol (SNMP).

(2) This means that a SkyWAN node needs an enabled management access point for noted management on the SatMgmt interface in order to be managed by SKYNMS.

2.2 FAD Multiplexer

(1) The multiplexer (NetPerformer) provides an internal Web Server which is part of the base unit software and that uses the HTTP protocol to serve content to any Web browser accessing the unit via standard Web addressing (http://ipaddress/).

(2) This Web Server provides a user-friendly interface for configuring and monitoring NetPerformer devices by any standard Web browser, such as:

- Internet Explorer©
- Firefox©
- Chrome©

(3) Also, the Web interface can be linked to any standard NMS platform that supports device links to a Web browser.

2.2.1 HTTP Mode Parameter

(1) Enables or disables the NetPerformer unit Web Interface Server access from any IP address.

(2) When disabled, no access to the unit is possible and when enabled the Web Server Interface access is possible. In that case follow-up parameters are available to control which IP addresses can have web access to the unit via HTTP.

2.2.2 Restricting HTTP Access

(1) Access to the NetPerformer Web Server Interface via an HTTP connection can be restricted to up to 5 IP addresses, or disabled altogether using the HTTP mode parameter as explained in the previous section.

(2) COMSOFT only allows the IP address of the NMS system to access the multiplexer.

(3) By standard COMSOFT changes all default password on the multiplexer.

3 Software Security Management

3.1 SkyNMS Network Management

(1) SkyNMS is a SNMP and FTP based umbrella network management system which allows network wide views to components, configurations, parameter values and logging.

(2) The SkyNMS software package is installed on a Microsoft Windows PC which is connected to a SkyWAN IDU over the Ethernet.

(3) SkyNMS consists of the following components.

- The SkyNMS Console, which is the SkyNMS core application.
- The central relational PostgreSQL database.

(4) The SkyWAN IDU Line-up Manager to bring a SkyWAN IDU initially in operational status, used mainly for station commissioning.

3.1.1 SkyNMS Login Security

(1) After the start of the SkyWAN NMS Framework, the user is prompted to login with a valid username and password.

Figure 2: Login Dialog

(2) The username and password have to be entered into corresponding text boxes, below the 'Login' section heading.

(3) By clicking on the 'Login' button, the user will be logged-in, if the entered username and password are valid. After three unsuccessful attempts, the SkyWAN NMS Framework is **closed automatically**.

(4) The expiration date of a SKYWAN NMS User is checked during login.

3.1.2 User Administrator

(1) The main tasks of the SkyNMS User Administrator are show, add, modify, delete, import and export users within the SkyNMS.

(2) Additionally components and user rights can be assigned to users. Further- more user passwords can be reset.

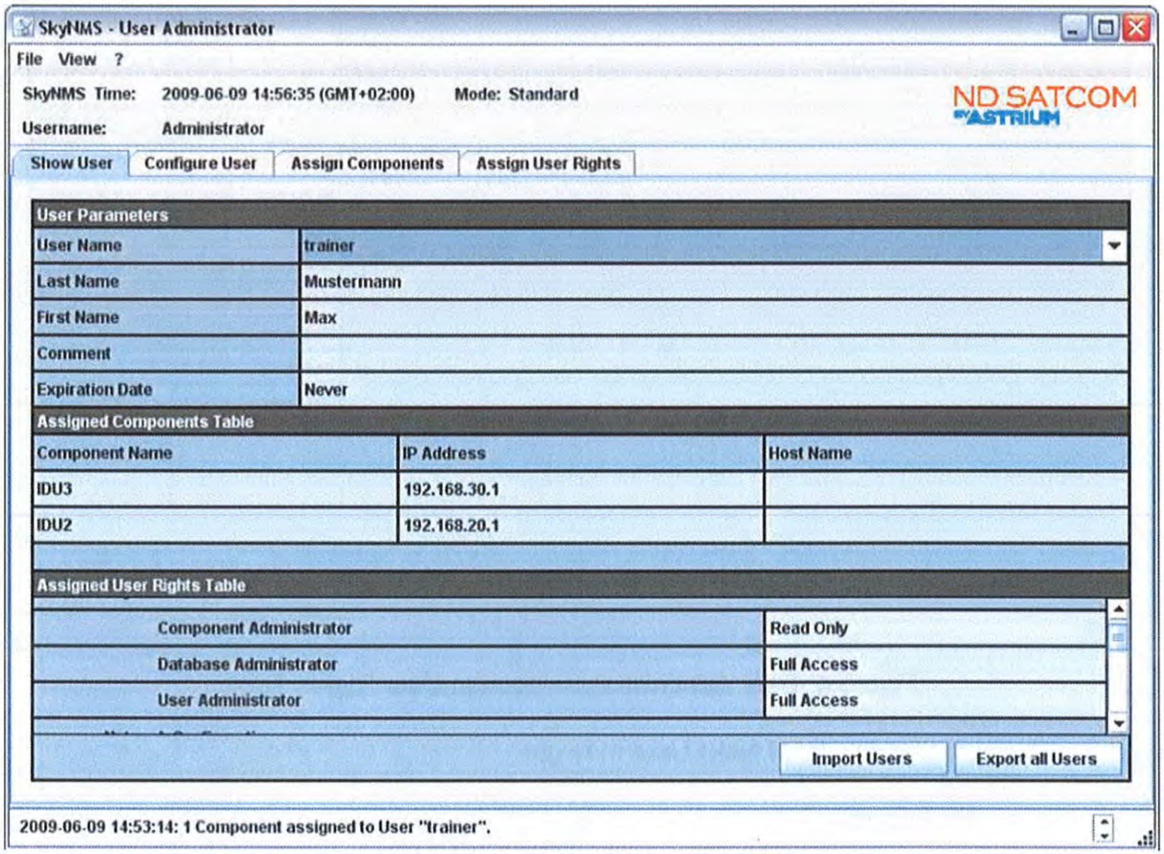

Figure 3: SkyNMS User Administrator

(3) COMSOFT is administrating this tool in order to grant access only to allowed staff and disable access from unwanted third party users.

Add Local Monitoring Security Matters

3.1.2.1 Assign User Rights

(1) The 'Assign User Rights' panel provides the function to assign or un-assign application rights to a SkyWAN NMS User.

(2) Initially no application rights are assigned to a SkyWAN NMS User.

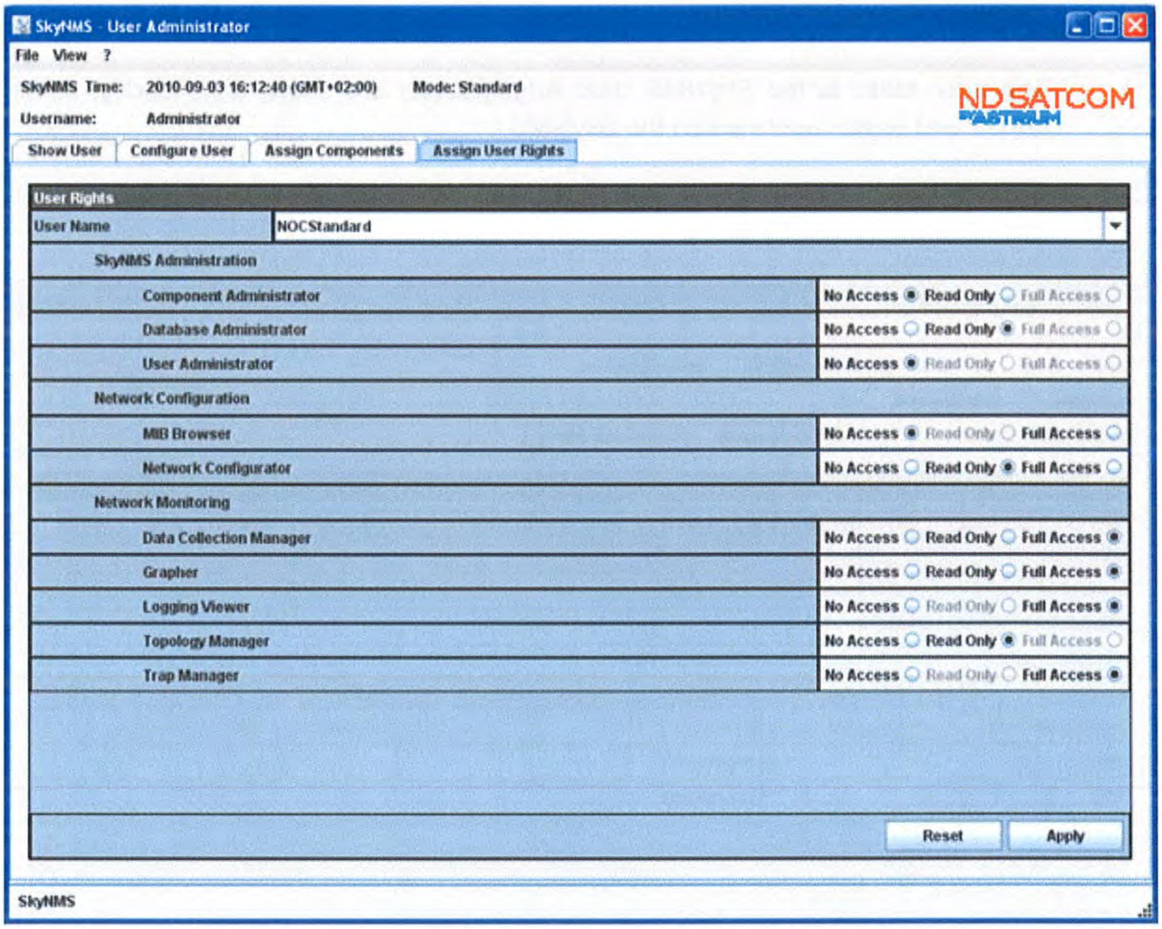

Figure 4: User Administrator – Assign User Rights Tab

(3) The selected SkyWAN NMS User may get

- No Access,
- Read Only or
- Full Access to a SkyWAN NMS Framework application.

(4) By clicking on the 'Apply' button, the application rights are assigned to the selected SkyWAN NMS User and saved in the SkyWAN NMS Database.

(5) The 'Reset' button is used to reset all application right assignments to the default value.

3.1.3 Logging Viewer

(1) The main tasks of the SkyNMS Logging Viewer are

- show SkyNMS logbook entries
    - Errors or unexpected states,
    - Login and logout, successful and unsuccessful,
    - Account creation/modification, permissions, or configuration changes,
    - Administrative Activities,
    - Start-up/Shutdown of System/Services/processes, and
    - Access to privileged functions (e.g., setting auditable event and intrusion detection devices).
- acknowledge logbook entries by the user,
- filter the logbook entries in order to manipulate the amount of shown logbook entries,
- delete selected logbook entries,
- export logbook entries to the file system and
- show exported logbook entries.

(2) Whereas logbook entries can be

- system messages, logged by all SkyNMS applications,
- thresholds, recognized by the Event Handler or
- traps, incoming from arbitrary network components.

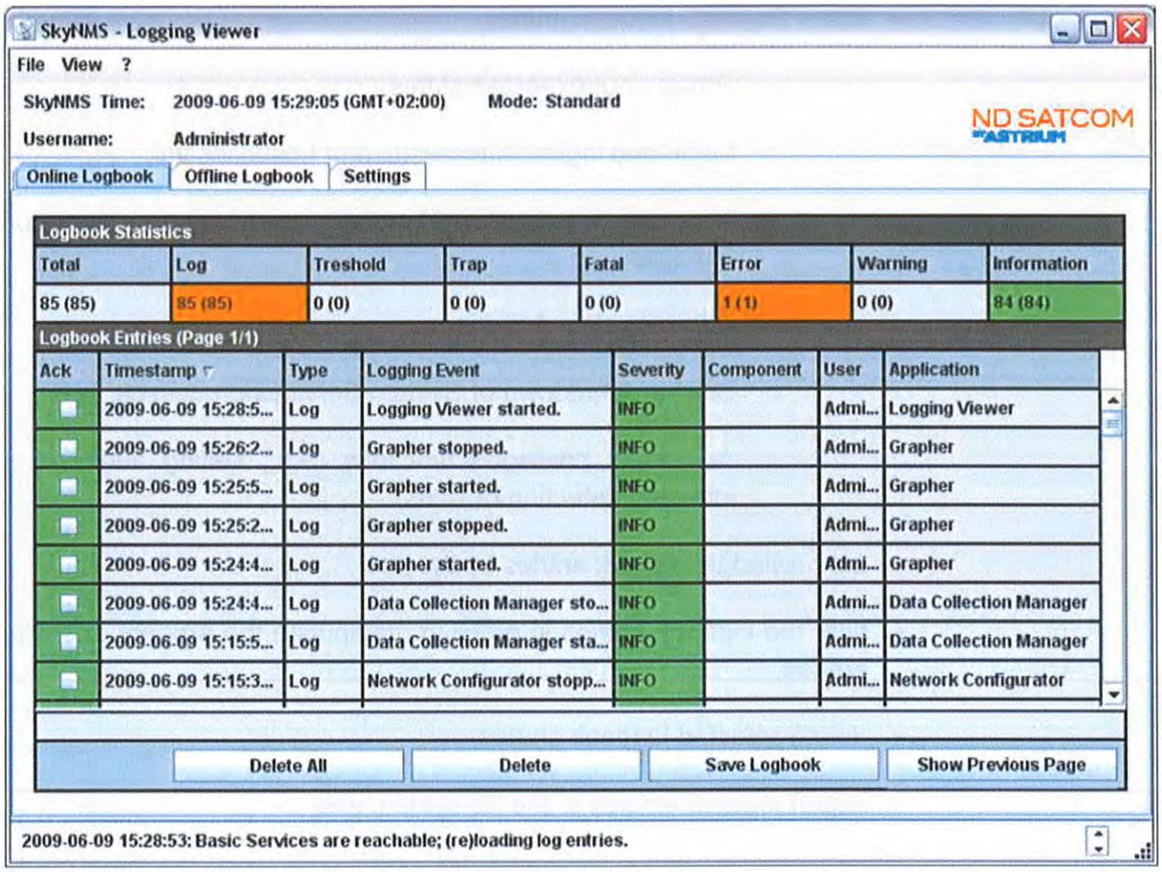

Figure 5: SkyNMS Logging Viewer

(3) Through the logging viewer, COMSOFT will be directly informed on suspect system behaviour, changes or system messages.

(4) Remote access connections are monitored within the logging viewer as well.

(5) Effective safeguards will be taken immediately as they are needed.

3.1.4 Conclusion

(1) Various management security properties are mentioned and described in previously chapters.

(2) The following list highlights the relevant management security characteristics.

- A dedicated IP network is automatically configured for IP management traffic. IP user and management traffic are conveyed over different IP networks.
- The management access for node or network management can be secured per station and is authenticated via its IP address.

- Authentication and registration of stations is controlled by the active master station via unchangeable station IDs.

(3) Additional management security can be configured by activating the configuration check code (CCC). It ensures that unauthorized changes of local configurations are detected and automatically cleaned up.

3.1.4.1 Configuration Check Code

(1) The Configuration Check Code (CCC) is a control value calculated from configurable SkyWAN IDU parameters on both SkyNMS and each SkyWAN IDU.

(2) These control values are compared regularly in a defined time interval to make sure that the configurations defined on the SkyNMS are equal to the used configurations on the SkyWAN IDUs.

(3) Changes done by other tools like Line Up Manager, MIB-Browser or Telnet may be blocked or lead to a mismatch of the configuration defined on the SkyNMS.

(4) If the CCC differs from the CCC as calculated by the SkyNMS, it may be configured to take the following actions:

- generate log message and/or
- upload the configuration file deposited at SkyNMS via FTP and reboot SkyWAN IDU with this original configuration file.

3.2 Virus Protection

(1) The NMS system is located at the Newcom Teleport in Miami.

(2) The operating system is Linux "Debian" based where a virtual Windows installation is serving the SkyNMS software.

(3) **Linux:**

(4) The ~~Linix~~ Linux operating system is protected by ClamAV which is an open source (GPL) anti-virus engine used in a variety of situations including

- email scanning,
- web scanning, and
- end point security.

(5) It provides a number of utilities including a flexible and scalable multi-threaded daemon, a command line scanner and an advanced tool for automatic database updates.

(6) COMSOFT is using "freshclam" which is the automatic database update tool for Clam AntiVirus.

(7) It can work in two modes:

- interactive - on demand from command line
- daemon - silently in the background (used)

(8) Freshclam is an advanced tool: it supports scripted updates (instead of transferring the whole CVD file at each update it only transfers the differences between the latest and the current database via a special script), database version checks through DNS, proxy servers (with authentication), digital signatures and various error scenarios.

(9) **Windows:**

(10) The windows machines are protected by Microsoft Forefront Enpoint Protection.

(11) Under the hood of Endpoint Protection is its award-winning protection engine that is updated regularly. The engine is backed by a team of antimalware researchers from the Microsoft Malware Protection Center, providing responses to the latest malware threats 24 hours a day.

(12) This used version of Endpoint Protection includes the following features and enhancements to better help protect computers from threats:

- Network Inspection System.
    - This feature enhances real-time protection by inspecting network traffic to help proactively block exploitation of known network-based vulnerabilities.
- New and improved protection engine.
    - The updated engine offers enhanced detection and cleanup capabilities with better performance.

3.2.1 Remote Dial-In

(1) COMSOFT is offering through its regional NOC in Miami a state-of-the-art infrastructure compromising of:

- Three 80 kVA Load Balanced UPS units.
- 750 kVA Electric Generator with Automatic Transfer Switch capable of sustaining operations of up to 5 days without re-fuelling.
- Secure controlled access facility and CCTV surveillance.
    - Access is only granted to NCC operations ~~stuff~~ staff and authorized visitors.
- Divergent terrestrial network with access to 2 fiber rings from 2 different providers.
- Internet access to 3 different Tier-1 providers.

(2) Both NOC's, the main and the regional ~~local~~ NOC are interconnected using redundant paths in order to keep availability all the time as shown in the following picture:

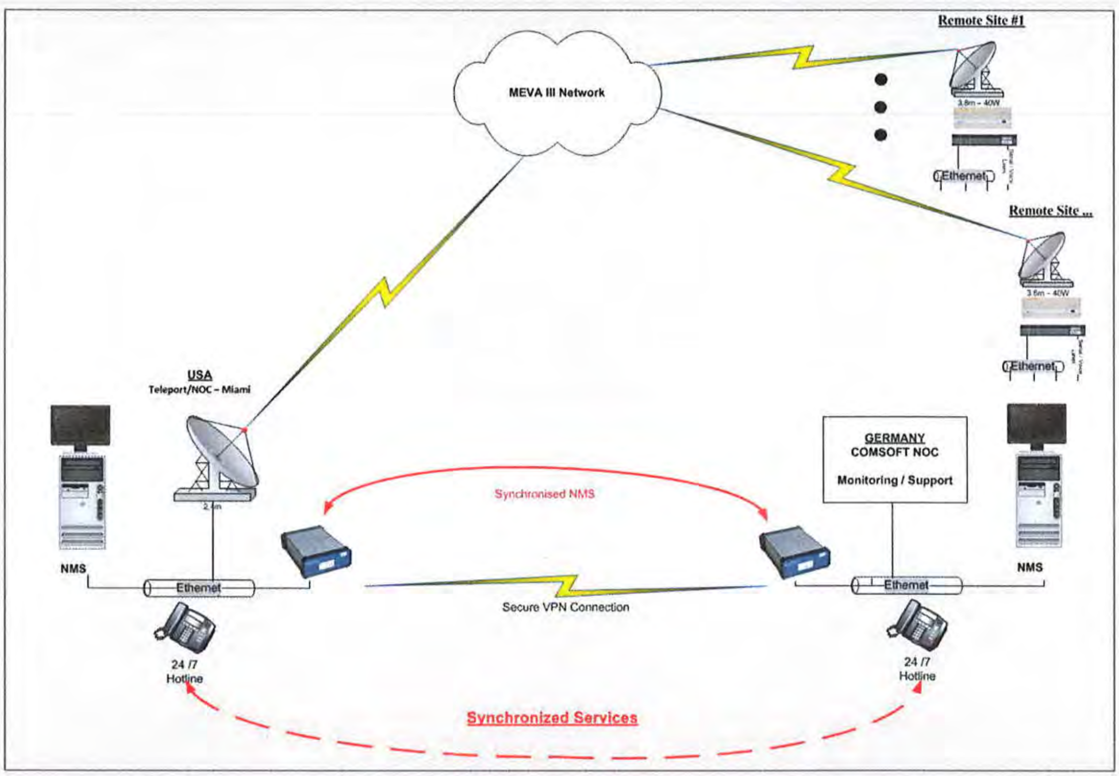

Figure 6: VPN Connection Overview

(3) COMSOFT prevent unauthorized remote access connections by using access lists and encrypted interconnections of both NOC's.

4 Access Control Policy

(1) The access control policy as part of the security plan comprises several elements:

- restricted access to the equipment at MEVA III installation
- a well-defined catalogue of allowed and not allowed actions for technical staff of MEVA III.
- access restriction within the COMSOFT NOC personnel
- access to the NMS Station restricted to dedicated Operators

5 IT Structure and Management

5.1 Hardware and Network

(1) The IT structure (network, server, workstations) and hardware configurations are documented by form sheets and diagrams. These documents are maintained by the operations department.

(2) The minimal configurations and requirements regarding hardware are validated continuously. New hardware purchases are approved by the Director of Operations.

(3) Requirements regarding hard- and software are documented by the according form sheets.

(4) Data processing input and output equipment are checked and validated regarding quantity and quality and replaced if needed.

(5) The installation of hardware equipment, the dismantlement/removal or installation/setup/repair of workstations/servers are only performed by authorized staff.

5.2 Software (Programs)

(1) The NMS for MEVA III VSAT Network will be accommodated in the secured infrastructure of the Miami Teleport.

(2) Access control and restriction works on several levels: to the compound, to the building, to the NOC room and to the NMS station, which requires password protected operator login.

(3) Software will be installed/configured from/by authorized staff.

(4) The usage of illegal and not authorized software is strictly prohibited. The IT equipment and software are solely to be used for official business purposes.

(5) The core elements of the standard software installation are agreed and validated by the Director of Operations.

5.3 Backup

(1) COMSOFT uses data systems of varying importance, from a staff notebook to mission critical internal server systems that are used exclusively by the company's

staff but also to mission critical systems that are also used and accessed by external customers, as for example the help desk software.

5.3.1 Staff Workstations and Notebooks

(1) In principal the company uses the approach that all employees individually archive and backup their data on either recordable CDs or DVDs, external mobile hard disks or USB memory sticks. Business critical data has to be stored on the appropriate company file servers at all times as well.

5.3.2 Helpdesk and Monitoring Systems

(1) The availability of the functionality of the helpdesk and monitoring systems is of high business importance. However, the currently stored data in those systems is only of secondary importance. In case of a disaster, it is of higher priority to regain the functionality of these systems rather than recovering the previously collected data. Thus either meticulously filled in configuration sheets or archived configuration files are sufficient as backups. As an additional fail-safe measure those servers use a RAID 1 or RAID 5 hard disk configuration so that the failure of one storage medium does not disrupt the entire system.

Define File Server Location

5.3.3 E-Mails

(1) Following the corporate standard, emails have to remain on the mail server for at least thirty (30) days before they may be deleted. The staff is supposed to archive the emails on local storage files using the archive and backup features of the used email client software.

5.3.4 File Servers

(1) The main network shares on the file servers are fully archived every week day to external hard disks.

5.3.5 Administrative Passwords

(1) Administrative passwords are stored in a sealed folder in the company's safe.

5.4 Data and Virus Protection

(1) All Internet access from and to the internal network, including email, and external media containing data to be used in the internal LAN are automatically checked by an antivirus software package that is part of the default software installation.

(2) Access from the outside to the internal LAN is protected by firewalls and malicious software filters. Remote access to LAN resources is possible through an encrypted Virtual Private Network ~~encryption~~ only.

(3) The antivirus signature files of the antivirus software are updated automatically on all servers and on all desktops/laptops. This ensures an appropriate level of security.

(4) Furthermore patching of software vulnerabilities of the operating systems and some core software on desktops and laptops is achieved by the operating system's automated software update mechanism. Updating of the servers, firewalls and other protection systems are performed by the Operations department.

5.5 Storage of Data Media

(1) Installable software and the required license keys are located in a special area of the staff file server. Authorized staff can install the required software from there in compliance with the software licenses and the business requirements.

APPENDIX C
AGREED CHANGES TO MEVA III SYSTEM DESIGN DOCUMENTATION

The Meeting reviewed the System Design Document and found several improvements and changes to be made on the document:

- Document organization as explained in the Meeting report
- Chapter 1, inclusion of Async to Sync data conversion
- Change costumer in all templates to show MEVA members and include MEVA members terms in the glossary
- Introduction (1) to be updated
- Merge 1.1 and 1.2 to avoid duplications; eliminate 1.1.1
- Rewrite/revise paragraph 1.2 (4), 1.2 (8), 2.3.5.1 (2) last three bullets, 5.2.1 (3), 5.2.3 (2), 5.2.4 (2), 5.2.4 (4)
- In 1.2 (9) delete "without sensible alternative"
- Add missing 2.1 sections (protocol for future ATN support)
- Replace "used" for "existing".
- 2.1.2 (1) add "new nodes, new services"
- 2.1.3 (1) replace "used equipment" for "Skywan".
- 2.1.4 remove bold letters and delete "(=repair)"
- 2.1.4.1 (1) second bullet, add "if available"
- Add references to existing tables and chapters
- 2.3.4 add information on TCP/IP implementation as indicated in the proposal
- 2.3.4 (3) to be deleted
- 2.3.6 add type of voice compression
- Add new section (2.3.7) on data connection information
- Under 2.4, add information on interconnection details (MEVA - REDDIG / MEVA – E/CAR) using agreed responses (MEVA COMSOFT Teleconferences)
- 2.4.2.1 include all changes to the voice circuits and description of voice numbering convention. Add text explaining Erlang B call blocking probability (RFP requirement 12.6 and 12.7)
- 2.4.2.2 change "customer confirmation" to "remarks"
- 2.4.2.3 add explanation on diagrams
- 2.5.2 (5) to be deleted
- 2.6.1.2 (5) first bullet FAD SW version must support IPV6
- 2.6.1.3 add text for time stamping of alarms/Trouble Ticket as text for the required accuracy of the reference clock to be at least 1 part in 1011 per year
- 2.6.1.4 add text for SW updated plan
- 3.2 add Intelsat service contrat non preemptible
- 3.3 add reference to chapter 3 of link budget
- 4 add reference to chapter 8
- 5.1 add description of main NOC in Germany
- Chapter 5, power socket to be American Type
- 5.1.1 add text on local monitoring (as agreed by the MEVA COMSOFT teleconference)

- 5.1.2 add references to chapter 9
- 5.1.4 need clarification on escalation procedure and steps
- 5.1.5.2 add email options for trouble ticket system
- 5.1.5.2.3 add references to the manual on trouble ticket system web interface, add reference to chapter 10
- 5.1.7 (1) add “NOC” to the term operator
- 5.1.7.2 (2) add text for MEVA user access to secure WEB
- 5.1.7.5 (2) add “NOC” to the term operator
- 5.2.1 (1) to be updated by COMSOFT
- 5.2.2 add local partner description
- 5.2.3 add local partner description
- 5.2.3 second bullet add “anual”
- 5.2.4 (1) delete first sentence
- 5.2.4 add text on guarantee policies (equipment guarantee, purchases)
- 5.3 add text on maintenance services (5.3.2 of proposal)
- 5.4 to be updated by COMSOFT
- 5.5.2 add reference to chapter 4. Also add text on labelling in the installation as indicated in the proposal
- 5.5.3.2 add references to chapters 6 and 7
- 5.5.3.3 add references to chapter 10
- 5.5.4 (1) to be deleted
- 5.5.4 add text on NAT
- 5.5.4.1 add references to chapter 11
- 5.5.4.2 add references to chapter 11
- 5.5.6 (1) add “including licenses” and manual Software
- 5.5.7 add text for deliverables as build diagrams (60 days)
- 5.5.8 to be moved to maintenance section
- Section 6 (website) to be moved as chapter 12
- Amendments due to second redundant switch (CISCO 3850) in the dual chain configuration (Aruba, Dominican Republic, Atlanta, Miami, Haiti and Puerto Rico)
- Amended Chapter 8: Training Plan: changes on FAA participants, new training weeks, single/dual chain etc.
- Amended Chapter 9: Security with identified wording changes, local monitoring security matters, etc.
- Develop Chapter 10 on all reporting matters (web trouble tickets, new revised monthly report template, blocked voice call attempts, etc.)
- Develop MEVA III customized FAT/SAT/NAT procedures (Chapter 11) including improvement to scenario/ testbed description and service oriented tests
- Ch 2, add description on data circuits latency performance (RFP requirement 4.2/4.3 of Attachment C)
- Update Ch 7: transition Plan with power adjustment information, etc.
- MEVA TF took note of Chapter 2, Chapter 3, Chapter 4, Chapter 5