



| ICAO

INTERNATIONAL CIVIL AVIATION ORGANIZATION

A UN SPECIALIZED AGENCY

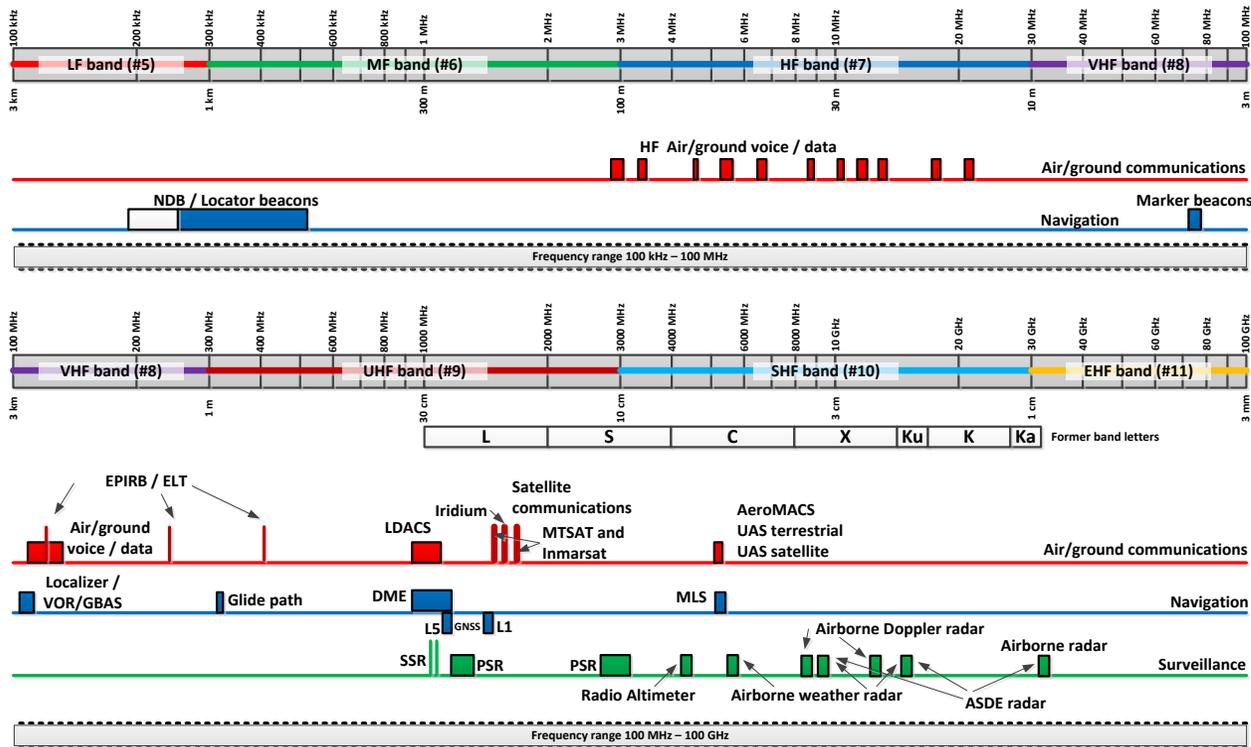


ICAO Doc 9718

Handbook on Radio Frequency Spectrum Requirements for Civil Aviation

Vol. I - ICAO Spectrum Strategy

Vol. II - Frequency Planning



Preparatory Workshop for World Radiocommunication Conference for 2023 (WRC-23)

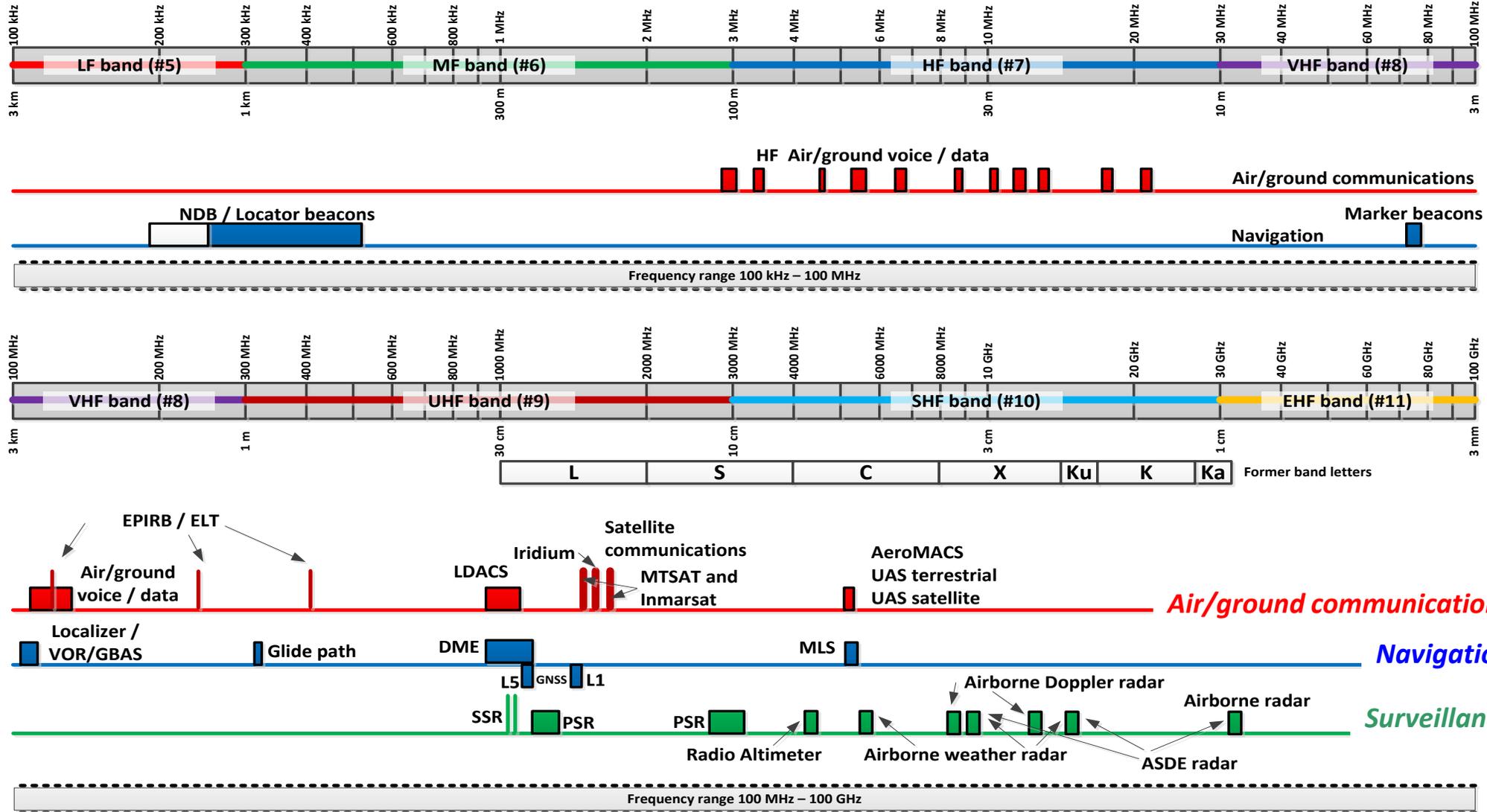
Cairo, Egypt, 28-29 August 2023

Mie Utsunomiya
 CNS Technical officer
 CNS and Spectrum Section(CNSS)
 International Civil Aviation Organization (ICAO)



Notes:
 Drawing not to scale
 Not all Regional or sub-Regional allocations are shown
 Band identification (e.g. VHF) and band # per Radio Regulations
 The satellite communication bands used by MTSAT and Inmarsat are not allocated the Aeronautical Mobile Satellite (R) Service

Over 1 GHz of frequency spectrum in global allocations to aeronautical safety services



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 Band identification (e.g. VHF) and band # per Radio Regulations
 The satellite communication bands used by MTSAT and Inmarsat are not allocated the the Aeronautical Mobile Satellite (R) Service

Overview

- Doc 9718 Volume I
 - Spectrum Strategy and Policies
- Doc 9718 Volume II
 - Frequency Assignment Planning

Doc 9718 and other relevant material can be downloaded, free of charge, from the FSMP website (Documents section) at

<http://www.icao.int/safety/fsmp>

- The latest Edition of Doc 9718 Volume I, second edition + recent updates,
 - is now available on FSMP website...
- Volume II has also recently been updated, second edition 2022

Overall ICAO Spectrum Policy (approved by Council)

- **ICAO Spectrum Strategy**
 - Long term spectrum use of current and future radio systems
- **ICAO Spectrum Policy Statements**
 - Specific actions to assist in meeting the Strategic Objectives
- **ICAO Position for future WRC's**
 - Medium and long term availability of spectrum for aviation

Background material in the Handbook, (Volume I) (1)

- **Role of ICAO**
 - In ITU-R (Study Groups) and in Regional Telecommunication Organizations
 - At ITU World Radiocommunication Conferences
 - In frequency coordination and registration (also ITU)
- **Role of the ITU and Regional Telecommunication Organizations**
 - Develop technical material (ITU-R Study Groups)
 - Amend Radio Regulations (at WRCs)

Doc 9718 Volume I

Spectrum Strategy and Policies

Background material in the Handbook, (Volume I) (2)

- **Policy Statements on frequency allocations and technical details (Chapter 7), including:**
 - Frequency allocations and footnotes in ITU Radio Regulations
 - Information on Aviation use
 - Commentary (specific comments on ITU and ICAO review In frequency coordination and registration (also ITU))
- **Spectrum Strategy (Chapter 8)**
- **ICAO Position for the next WRC (Appendix F)**

Doc 9718 Volume II

Frequency assignment planning

Published for the first time in 2013,

Updated in 2017 and 2022

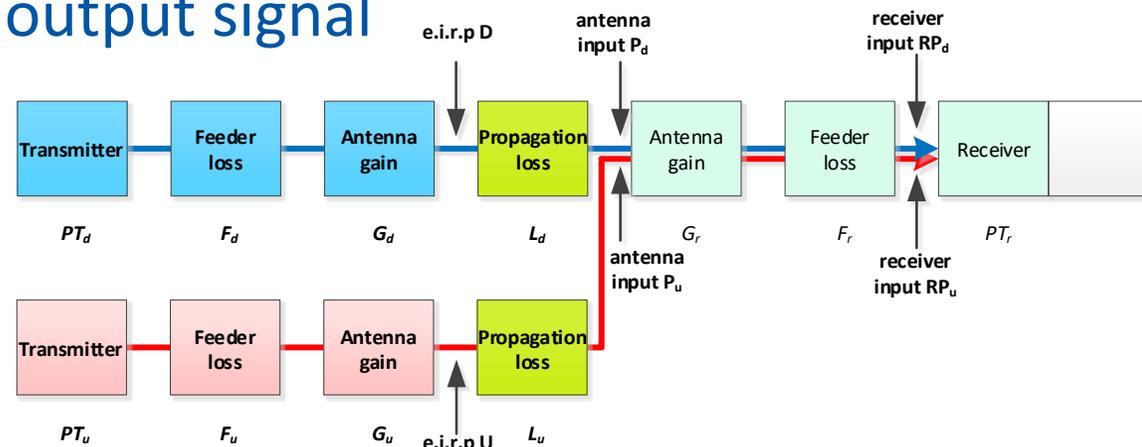
Provides globally harmonized frequency assignment planning criteria and guidance material to support the application of SARPs in Annex 10, Vol. V

- Developed in conjunction with the revisions to Annex 10, Vol. V
- Developed by FSMP (previously ACP Working Group F) and NSP
- **Implementation through Regional Air Navigation Agreement by PIRG**
- Frequency Assignment Planning criteria is used by the ICAO Frequency Assignment Planning software: **Frequency Finder (FF)**

Chapter 1 (1) General methodology

General methodology for compatibility analysis

- General model for compatibility assessment
- Based on:
 - Protection of desired signal at receiver input
 - Not to exceed maximum permissible distortion of receiver output signal



Doc 9718 Volume II

Frequency assignment planning

Chapter 1 (2) General methodology

Propagation model

- Based on free space propagation
(Re. Recommendation ITU-R P.525-4)

Propagation model does not accommodate certain phenomena which are difficult to predict such as

- Changes in the refractive index of the atmosphere
- Ducting

ITU has developed propagation curves for aeronautical communication and navigation systems
(Recommendation ITU-R P.528-5)

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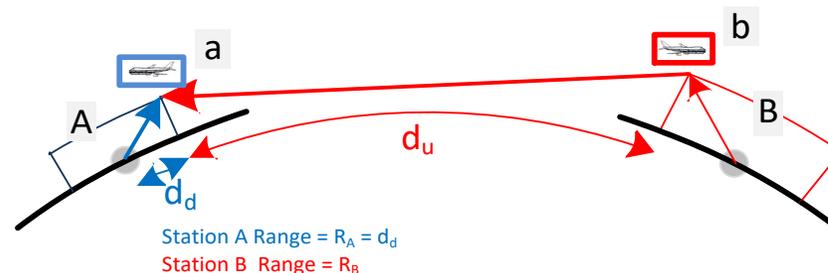
Frequency assignment planning

Chapter 2 (1)

Frequency assignment planning criteria for VHF air-ground communication systems

Interference model (co-frequency separation)

- Conforms to the general methodology in Chapter 1
- Model for establishing separation distances to prevent air-to-air interference:



- Minimum separation between stations A and B: **Range A + Radio horizon A + Radio Horizon B + Range B**

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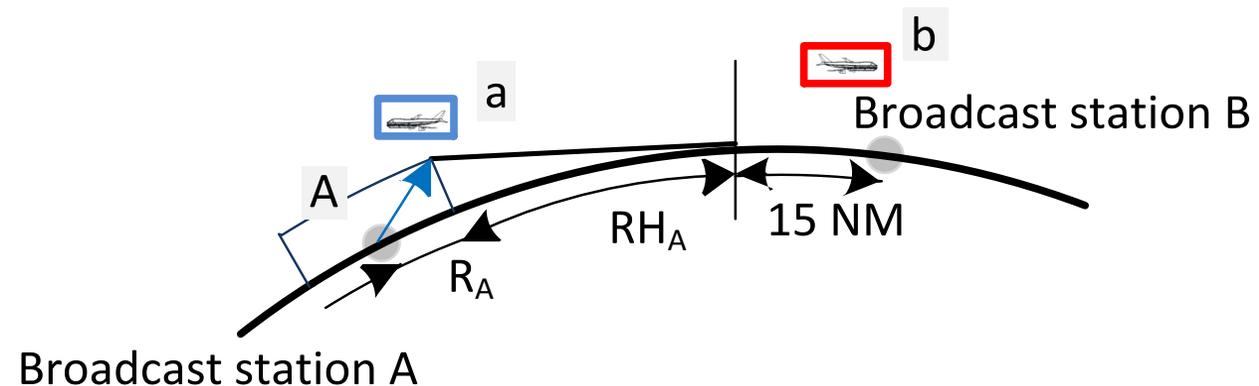
Frequency assignment planning

Chapter 2 (2)

Frequency assignment planning criteria for VHF air-ground communication systems

Interference model (co-frequency)

- Aeronautical broadcast stations (ATIS, VOLMET)
 - Do not involve aircraft transmission
 - Separation distances are less



Frequency assignment planning

Chapter 2 (3)

Frequency assignment planning criteria for VHF air-ground communication systems

Frequency separation and channelling

- 25 kHz and 8.33 kHz channel spacing.
- Special consideration for mixed environment where both are applied

Designated Operational Coverage (DOC)

- Table of uniform values for DOC
- Complies with common values used in most Regions
- Area services ACC-FIS – are in many cases not specified

Frequency assignment planning

Chapter 2 (4)

Frequency assignment planning criteria for VHF air-ground communication systems

Calculation of separation distances

- Methodology for establishing separation distances
- Air/ground communications
- Aeronautical broadcast communications
- Aerodrome surface communications

For each of these types the Handbook clarifies the principles and methods used when the separation distances were established. A summary of the results (25kHz channel spacing) is on the next slide

Frequency assignment planning

Chapter 2 (5)

Frequency assignment planning criteria for VHF air-ground communication systems

		VICTIM											
	Service	TWR 25/4000	AFIS 25/4000	AS Surface	APP-U 150/450	APP- I 75/250	APP-L 50/120	ACC-U Area/450	ACC-L Area/250	FIS-U Area/450	FIS- L Area/250	VOLMET 260/450	ATIS 200/450
INTERFER	TWR	156	156		338	273	212	338	273	338	273	338	338
	AFIS	156	156		338	273	212	338	273	338	273	338	338
	AS (Note 2)			25									
	APP-U	338	338		520	455	394	520	455	520	455	520	520
	APP-I	273	273		455	390	329	325	390	455	390	455	455
	APP-L	212	212		394	329	268	394	329	394	329	394	394
	ACC-U (Note 1)	338	338		520	455	394	520	455	520	455	520	520
	ACC-L (Note 1)	273	273		455	390	329	455	390	455	390	455	455
	FIS-U (Note 1)	338	338		520	455	394	520	455	520	455	520	520
	FIS-L (Note 1)	273	273		455	390	329	455	390	455	390	455	455
	VOLMET	338	338		520	455	394	520	455	520	455	15	15
	ATIS	338	338		520	455	394	520	455	520	455	15	15

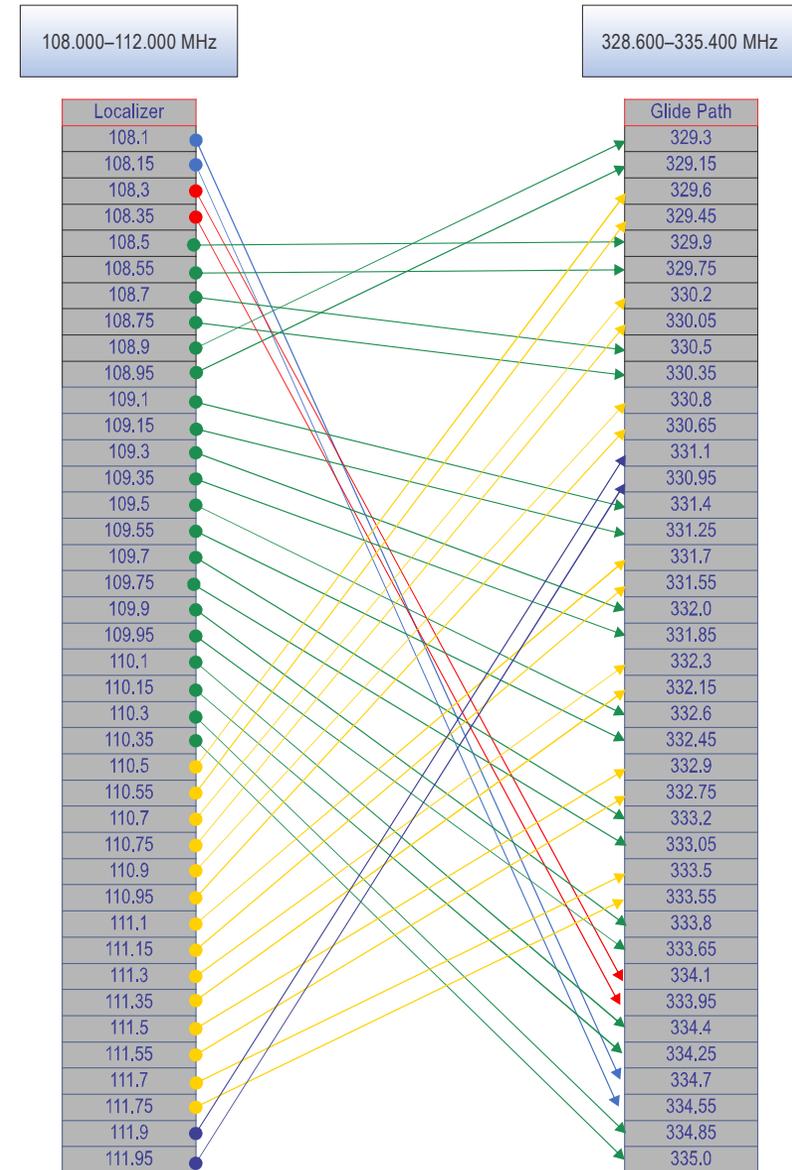
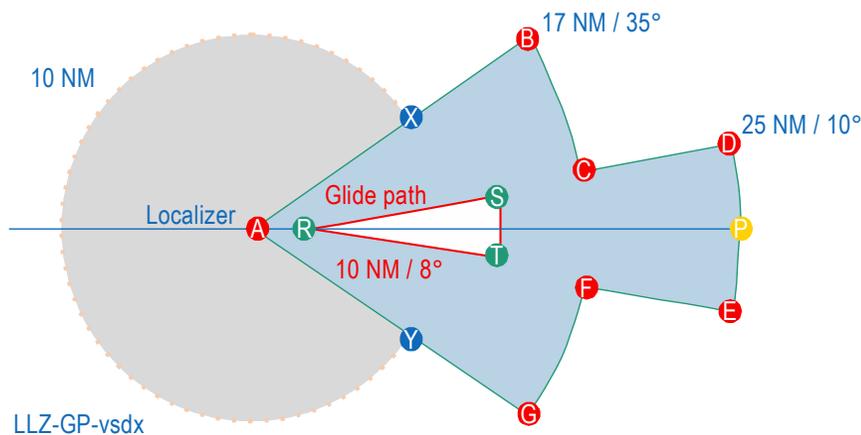
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Frequency assignment planning

Chapter 3 - Instrument Landing System (ILS)

Methodology and examples for calculation of separation distances for:

- Localisers (108-112 MHz)
- Glidepath (328.6-335.4 MHz)
- Localisers versus VOR and GBAS VDB



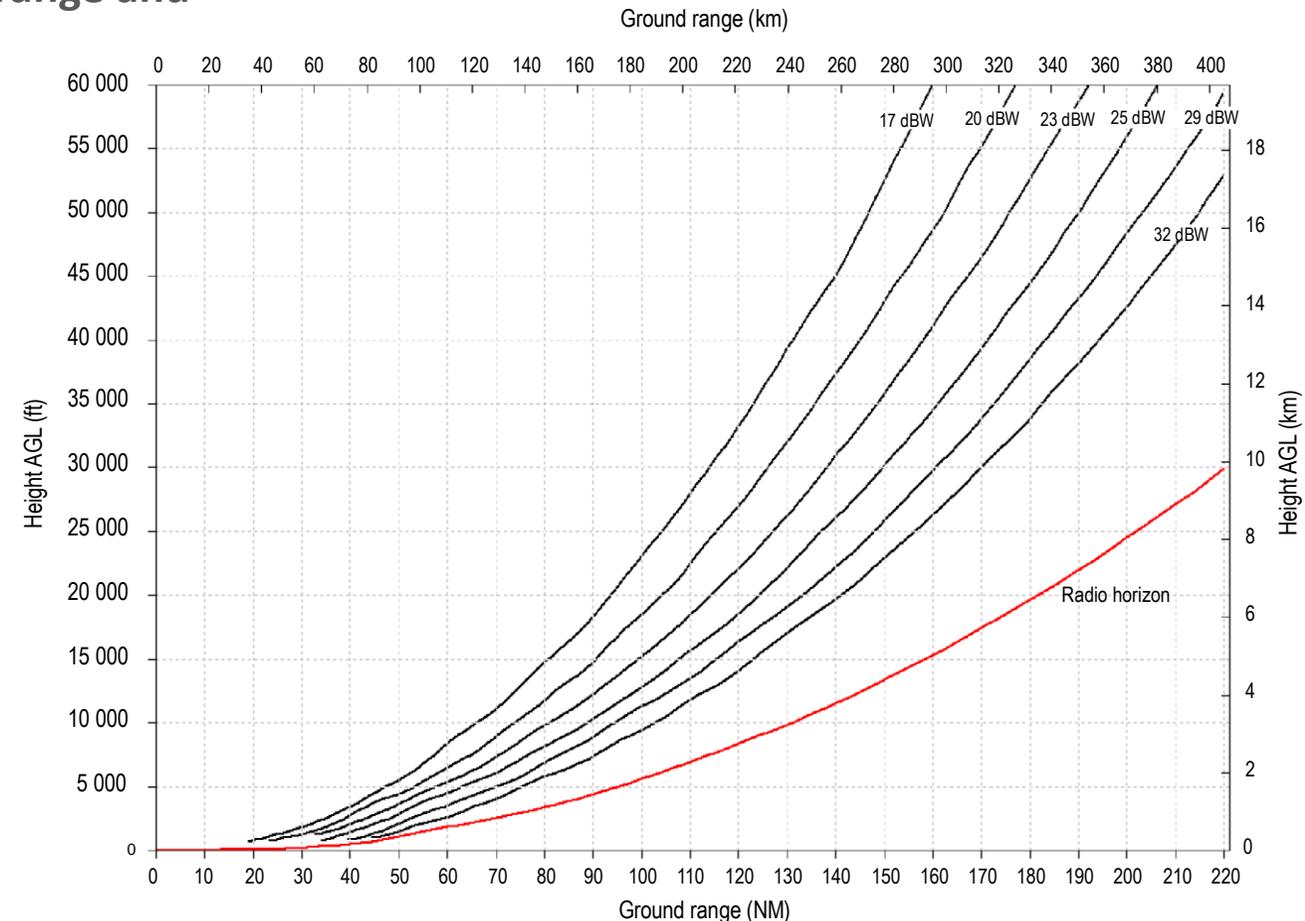
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Frequency assignment planning

Chapter 4 – VHF Omnidirectional Range (VOR)

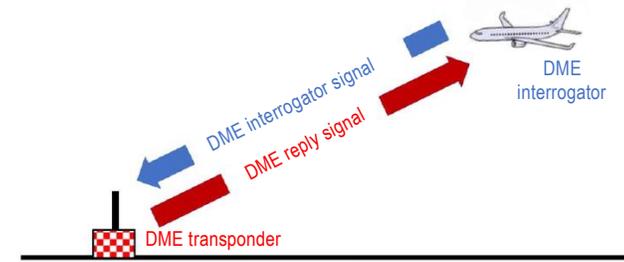
Methodology and examples for calculation of range and separation distances for:

- VOR (108-117.975 MHz)
 - ✓ Associated with DME
 - ✓ Operating in the band 108 – 112 MHz
- VOR versus Localizers
- VOR versus GBAS



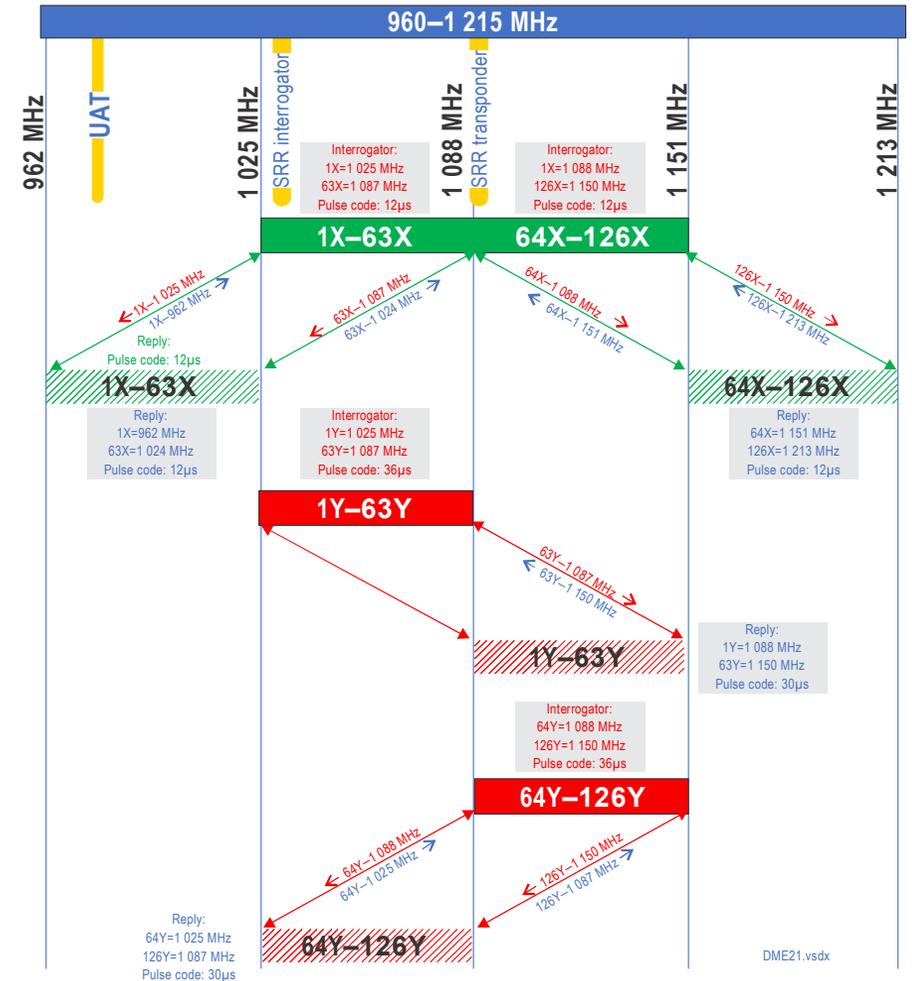
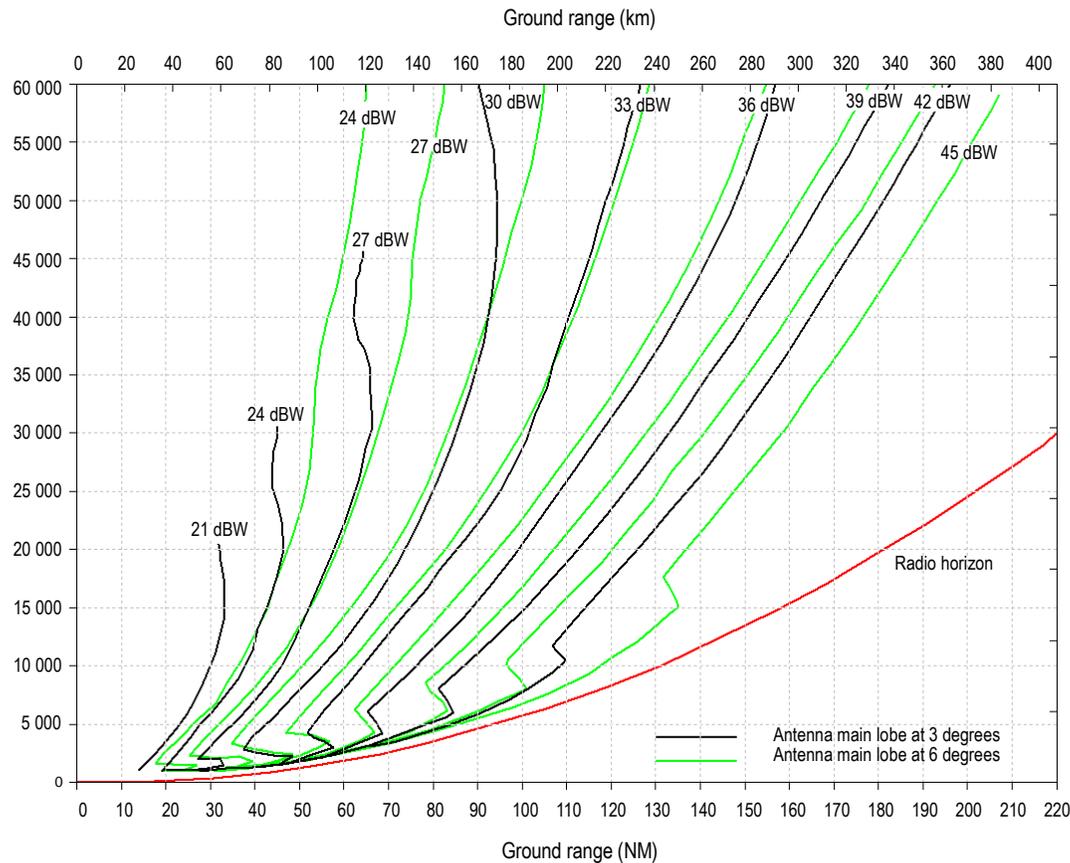
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Frequency assignment planning



Chapter 5 – Distance Measuring Equipment (DME), 960 – 1215 MHz

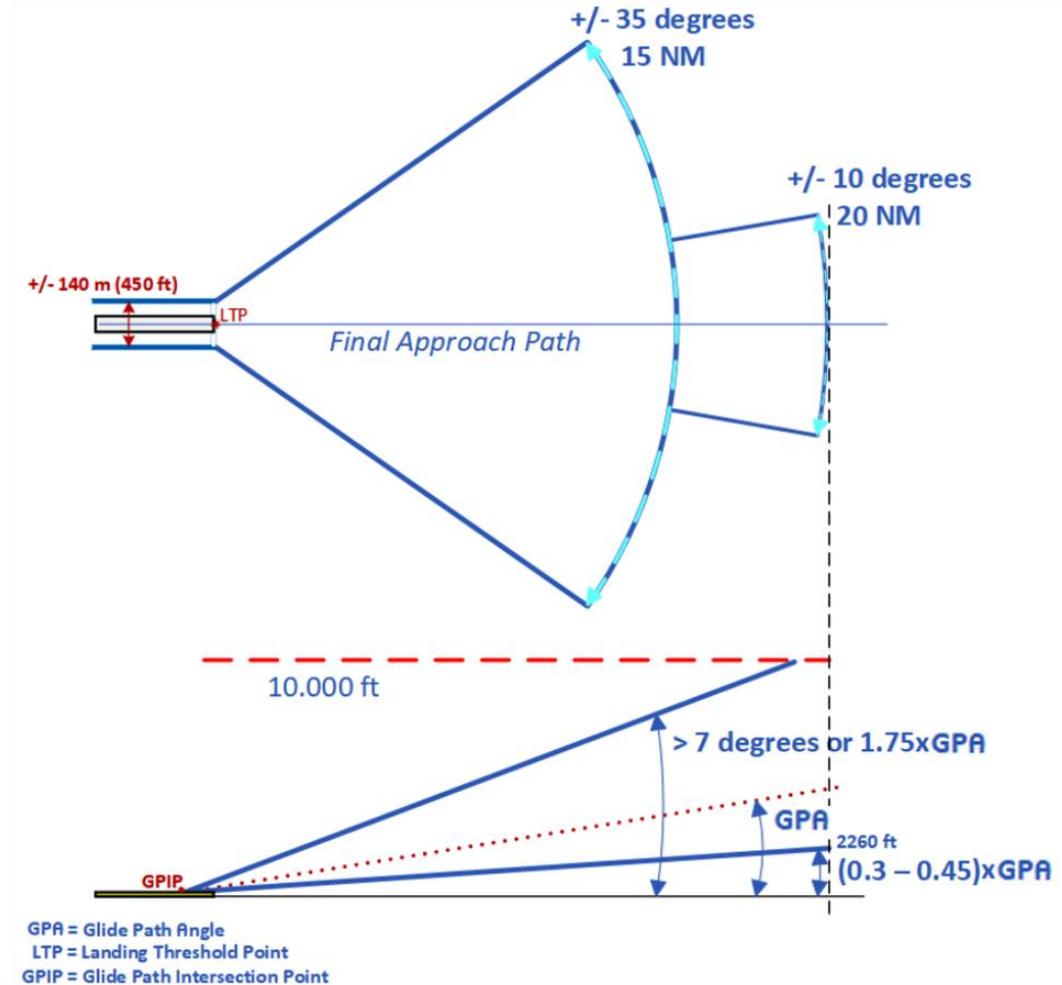
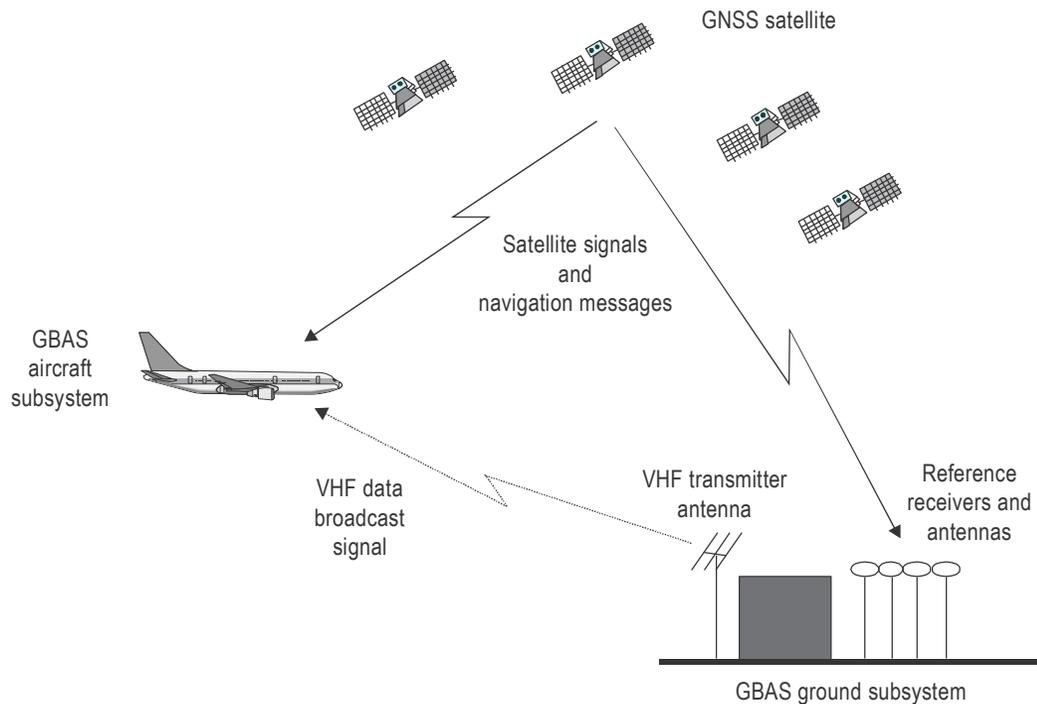
Methodology and examples for calculation of operational coverage and separation distances



Frequency assignment planning

Chapter 6 – Ground Based Augmentation System (GBAS),
108 – 117.975 MHz

Methodology and examples for calculation of operational coverage and separation distances



ICAO Coordination and Assignment procedures for VHF aeronautical mobile (route) services (AM(R)S) (117.975-137 MHz)

Aeronautical Service	Frequency	Systems
Navigation	108–117.975 MHz	ILS localizer, VOR, GBAS
Communications	117.975–137 MHz	Air-ground and air-air communications (VHF voice and data)

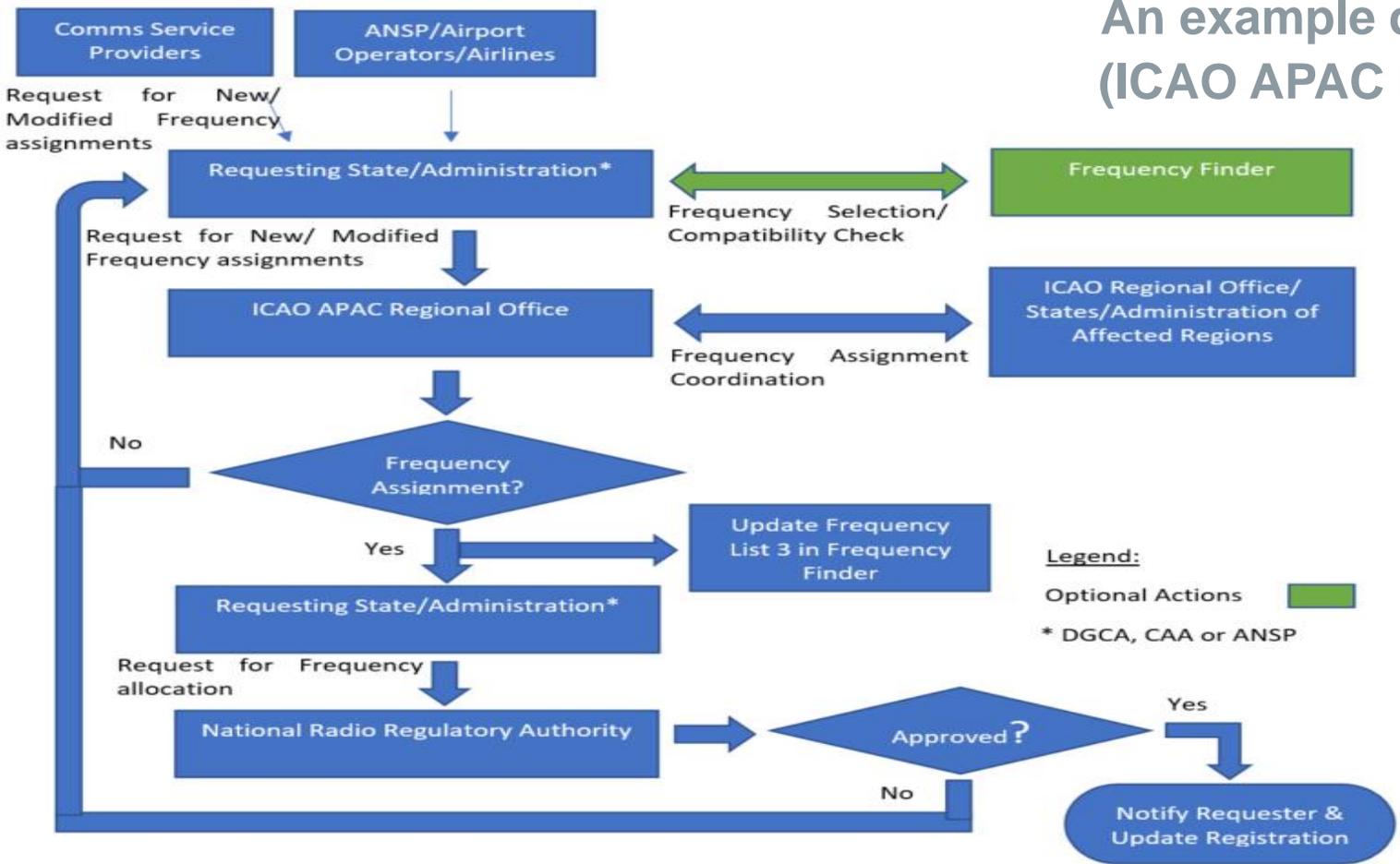
ICAO Coordination and Assignment procedures for VHF aeronautical mobile (route) services (AM(R)S) (117.975-137 MHz)

- ICAO Regional Offices continue to maintain its frequency selection and coordination role (especially inter-regional coordination role), which includes the maintenance and promulgation of Frequency List No. 3 (Aeronautical Communication facilities in the VHF Frequency Bands from 117.975 to 137 MHz).
- The latest information is available for States (DGCA, CAAs and ANSPs) on each Regional office's website or the website through Frequency Finder (frequency management tool developed and managed by ICAO)
- To facilitate the final coordination performed by the Regional Office, States/Administrations are encouraged to use the ICAO's Frequency Finder to select their proposed frequencies and perform compatibility checks before submitting their requests to the Regional Office.
- Upon receipt of the requests, the Regional Office will use the Frequency Finder to perform similar compatibility checks and frequency selection, if required. When a proposed/selected frequency may affect other air navigation regions, the Regional Office will coordinate with the respective Regional Offices or States of the affected regions.

Note.- Frequency Finder is the ICAO aeronautical radio frequency management tool for VHF COM and NAV frequency assignments.

ICAO Coordination and Assignment procedures for VHF aeronautical mobile (route) services (AM(R)S) (117.975-137 MHz)

An example diagram (ICAO APAC Region)



Doc 9718 Volume II

Frequency assignment planning

Future work

- The 2022 update added material on radionavigation systems (ILS, VOR, DME and GBAS), as developed with the help of NSP. Editorial update of this material is planned in the near future
- Future work will concentrate on refining the existing criteria and adding criteria for systems such as LDACS
- The Handbook and other relevant material can be downloaded from the FSMP website (Repository section) at <http://www.icao.int/safety/fsmp>



Thank You!