Radiocommunication Study Groups

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TECHNICAL AND REGULATORY MEASURES TO ENSURE A LONG-TERM SPECTRUM AVAILABILITY AND PROTECTION FOR VERY SMALL APERTURE TERMINAL OPERATED BY AERONAUTICAL NETWORKS

1. INTRODUCTION

The provision of air navigation services in the ICAO **Af**rica-**I**ndian Ocean (**AFI**) Region relies basically on the aeronautical VSAT networks, operating in the C-band 3400-4200MHz for downlink–Space to Earth and 5625-6425MHz for Uplink-Earth to Space. Currently, aeronautical VSAT networks support the exchange of safety-critical information related the planning, coordination, management, guidance and monitoring of flight operations.

The ITU-R WRC- 07 and WRC-12 adopted Recommendation 724 and Resolution 154 respectively, which call for regulatory and technical measures to protect the continuous operation of C-band for Civil Aviation use in some countries of ITU Region 1, including the AFI Region.

2. Downlink

FSS systems are used in the bands **3 400–4 200 MHz and 4 500–4 800 MHz** for transmission of aeronautical and meteorological information, related to the air navigation safety (see Resolution 154 of WRC-12 and WRC -15 Agenda Item 9.1.5). FSS systems in the latter band are also used for feeder links to support AMS(R)S systems. ITU-R Report M.2109 contains sharing studies between IMT and FSS in the bands 3 400–4 200 MHz and 4 500–4 800 MHz and ITU-R Report S.2199 contains studies on compatibility of broadband wireless access systems and FSS networks in the 3 400 – 4 200 MHz band. Both studies show a potential for interference from IMT and broadband wireless access stations into FSS Earth stations at distances of up to several hundred km. Such large separation distances would impose substantial constraints on both mobile and satellite deployments. The studies also show that interference can occur when IMT systems are operated in the adjacent band.

In ITU Region 1, many African countries (e.g Burkina Faso, Mali, South Africa) have reported interferences suffered from IMTs in the operation of their aeronautical VSAT ground stations, which can impede the development and implementation of the technologies identified by ICAO to enhance safety, capacity and efficiency of the current and future aviation systems. Appendix A to this working paper provides an illustration of such interference experienced in Ouagadougou, Burkina Faso (AFISNET VSAT Network).

The same problems are experienced in ITU Region 2 with the regional aeronautical VSAT network. **Appendix B** to this working paper provides an illustration of such interference experienced in Lima, Peru (REDDIG VSAT Network). Region 3 can also be affected when implementing similar aeronautical VSAT networks, considering that 3.4–4.2 GHz is the preferred frequency band for aeronautical communications in tropical regions such as Central/Southern America and Asia Pacific Regions.

3. Uplink

FSS systems are used in the band 5850–6425 MHz for the transmission of aeronautical and meteorological information related to the air navigation safety, including the aeronautical mobile service, and should be protected from new additional allocations, together with the 3400-4200 MHz band.

4. Studies objectives

To seek for possible technical and regulatory measures to ensure protection of VSATs used for the transmission of aeronautical and meteorological information in the 3.4–4.2 GHz frequency band against interferences from other services operating in the band, and of any other involved frequency bands as necessary.

Appendix A

Interference caused to Ouagadougou Earth Station (Burkina Faso) by WIMAX

Spectrum Analysis of the intermediate frequency (IF) 141.9125 MHz

<u>Figure 1: Spectrum analysis with IMT signal – 28 February 2013</u>

Appendix A

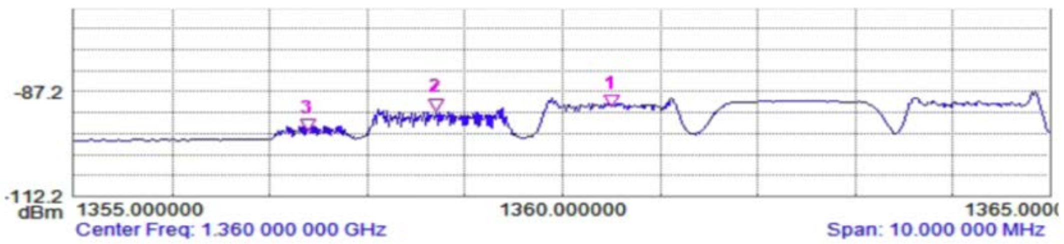
<u>Figure 2: Spectrum analysis without IMT signal - 08 March 2013</u>

Appendix B

Interference caused to Lima Earth Station (Peru) by WIMAX from 31 August to 07 September 2012

Carrier	Symbol rate (Msym/s)	L-band Freq (kHz)	L.O. (GHz)	RF Freq (kHz)
1	1.25	1,360,504	5.15	3,789,496
2	1.25	1,358,752	5.15	3,791,248
3	0.625	1,357,438	5.15	3,792,562

Figure 1 : Spectrum Analysis of carriers 1, 2 and 3 (Reception) – 14 September 2012



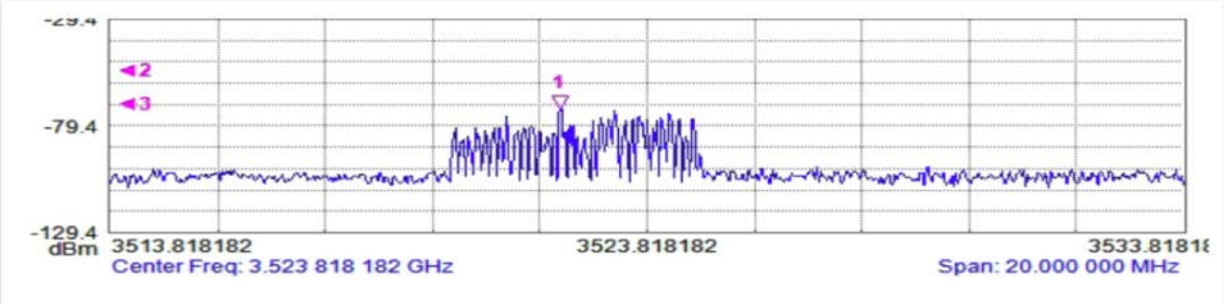
Mkr	Ref	Delta	Ref Freq	Ref Amp	Delta Freq	Delta Amp
1	☐	☐	1.360 5 GHz	-90.88 dBm	--	--
2	☐	☐	1.358 7 GHz	-91.84 dBm	--	--
3	☐	☐	1.357 4 GHz	-96.70 dBm	--	--
4	☐	☐	--	--	--	--
5	☐	☐	--	--	--	--

Measurement Parameters

		Start Frequency	1.355 000 000 GHz
Trace Mode	Normal	Stop Frequency	1.365 000 000 GHz
Preamp	OFF	Frequency Span	10.000 000 MHz
Min Sweep Time	0.668 S	Reference Level	-62.184 dBm
Reference Level Offset	0 dB	Scale	5.0 dB/div
Input Attenuation	0.0 dB	Serial Number	931151
RBW	100.0 kHz	Base Ver.	V2.01
VBW	30.0 Hz	App Ver.	V3.17
Detection	Peak	Date	9/14/2012 3:51:23 PM
Center Frequency	1.360 000 000 GHz	Device Name	ana105a

Appendix B

Figure 2 : Spectrum Analysis of Frequency Band 3.513 – 3.533 GHz with WIMAX signal – 06 September 2012



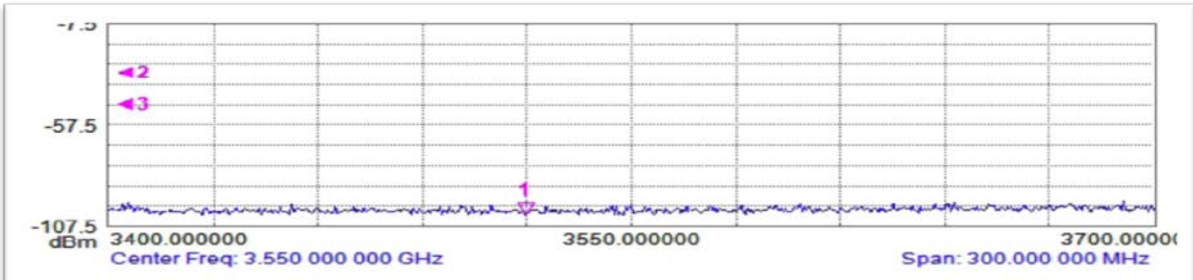
Mkr	Ref	Delta	Ref Freq	Ref Amp	Delta Freq	Delta Amp
1	☐	☐	3.522 2 GHz	-71.14 dBm	--	--
2	☐	☐	2.685 3 GHz	-100.37 dBm	--	--
3	☐	☐	2.427 9 GHz	-102.01 dBm	--	--
4	☐	☐	--	--	--	--
5	☐	☐	--	--	--	--
6	☐	☐	--	--	--	--

Measurement Parameters

		Start Frequency	3.513 818 182 GHz
Trace Mode	Normal	Stop Frequency	3.533 818 182 GHz
Preamp	OFF	Frequency Span	20.000 000 MHz
Min Sweep Time	0.668 S	Reference Level	-29.412 dBm
Reference Level Offset	0 dB	Scale	10.0 dB/div
Input Attenuation	0.0 dB	Serial Number	931151
RBW	10.0 kHz	Base Ver.	V2.01
VBW	3.0 kHz	App Ver.	V3.17
Detection	Peak	Date	9/6/2012 4:05:05 PM
Center Frequency	3.523 818 182 GHz	Device Name	ana105a

Appendix B

Figure 3 : Spectrum Analysis of Frequency Band 3.4 – 3.7 GHz without WIMAX signal – 06 September 2012



Mkr	Ref	Delta	Ref Freq	Ref Amp	Delta Freq	Delta Amp
1	☐	☐	3.519 7 GHz	-101.60 dBm	--	--
2	☐	☐	2.685 3 GHz	-65.30 dBm	--	--
3	☐	☐	2.427 9 GHz	-82.20 dBm	--	--
4	☐	☐	--	--	--	--
5	☐	☐	--	--	--	--
6	☐	☐	--	--	--	--

Measurement Parameters

		Start Frequency	3.400 000 000 GHz
Trace Mode	Normal	Stop Frequency	3.700 000 000 GHz
Preamp	OFF	Frequency Span	300.000 000 MHz
Min Sweep Time	0.668 S	Reference Level	-7.512 dBm
Reference Level Offset	0 dB	Scale	10.0 dB/div
Input Attenuation	0.0 dB	Serial Number	931151
RBW	10.0 kHz	Base Ver.	V2.01
VBW	3.0 kHz	App Ver.	V3.17
Detection	Peak	Date	9/6/2012 9:34:37 AM
Center Frequency	3.550 000 000 GHz	Device Name	ana105a