INTERNATIONAL CIVIL AVIATION ORGANIZATION

WESTERN AND CENTRAL AFRICA OFFICE

Third Meeting of the Central Atlantic FIR Satellite Network (CAFSAT) Management Committee (CNMC/3) (Dakar, Senegal, 15-16 July 2013

Agenda Item 4: interconnection and interoperability of CAFSAT with its neighboring networks (NAFISAT, REDDIG, MEVA)

Preparation of WRC-15: Undertaken Ongoing and Future Actions

(**Presented by the secretariat**)

SUMMARY

The purpose of this paper is to provide the meeting with the actions undertaken in by CNMC members for the protection of the C Band operated by CAFSAT nodes

Reference:

Reports on ACP WG/F Meetings
Final acts of WRC-12
ITU-R Studies 2109; 2199 on C Band sharing

Related ICAO Strategic Objectives: **A:** ***Safety*****; B:** ***Air Navigation Capacity and Efficiency***

Related ASBU Bloc 0 Modules, Performance Improvement Aerias and Applications:
B0-FRTO/PIA3-*PBN En Route Trajectories;*
B0-FICE/PIA2-*AIDC,*
B0-DATM/PIA2-*AIM,*
B0-TBO/PIA4-*Datalink*
B0-AMET/PIA2-*MET*

Action by the meeting see paragraph 3

1. Introduction

1.1 The last CNMC meeting recognized that the preparation of WRC comprises various activities at national, sub / regional and international level and includes various stakeholders such as National Authorities of Regulation of Telecommunication, Civil Aviation Authorities (CAA), Air Navigation Service Providers (ANSPs), Airports Operators and Airlines, regional specialized associations.

1.2 The meeting also noted that key role of CNMC members in the preparation of WRC-15 will be to sensitize their respective CAAs to provide ATU, CITEL and CEPT through their regulators with the concerns of the aviation community what suppose that the position of ICAO is captured understood and shared with these stakeholders.

2. Discussion

2.1 Overview on actions undertaken in preparation to WRC 15

2.1.1 The 28th meeting of the Aeronautical communication Panel Working Group F (ACP WG/F/28) was held in Lima Peru from 11 to 22 March 2013.
This meeting reviewed the outcomes of the 12th Air Navigation Conference (AN-Conf/12) affecting spectrum work such as the finalization of the Spectrum Strategy in Chapter 8 of Radio Frequency Handbook (Doc9718) Vol. 1.The Official ICAO Spectrum Policy and Strategic Objectives contained in the Handbook on Radio Frequency Spectrum Requirements for Civil

Aviation (Doc 9718) were also reviewed as well as the the new draft Part II of the Handbook, in support of the Annex 10 Volume V update.

2.1.2 It may be reminded that the 12th Air Navigation conference formulated Recommendations 1/12; 1/13 and 1/14 addressing issues related to aeronautical frequency spectrum.
In particular **Recommendation 1/13- Potential use of fixed satellite service spectrum allocations to support the safe operation of remotely piloted aircraft systems** calls upon ICAO to support studies conducted by ITU-R to determine what ITU regulatory actions are required to enable use of frequency bands allocated to the Fixed Satellite Service (FSS) for remotely piloted aircraft system command and control (C2) links to ensure consistency with ICAO technical and regulatory requirements for a safety service and CAA, assisted by Air Navigation Service Providers (ANSPs), Airports Operators and Airlines to ensure the participation of civil aviation in the national coordination meetings convened by the Telecommunication Regulator.

2.1.3 **Recommendation 1/14 – Long-term very small aperture terminal spectrum availability and protection** intends to protect the C-Band operated by the Aeronautical VSAT Networks in accordance with Resolution 154 WRC-12.
Recommendation 1:14 reads as follows.

That:

a) ICAO and Member States <u>not support</u> additional international mobile telecommunications spectrum allocations in the fixed satellite service C-band spectrum at the expense of the current or future aeronautical very small aperture terminal networks;

b) ICAO and Member States pursue this matter in the International Telecommunication Union Radio Communication Sector (ITU-R) and during the World Radiocommunication Conference (WRC-15), with a coordinated proposal to promote a solution where the international mobile telecommunications spectrum allocation does not compromise the availability of the aeronautical very small aperture terminal networks.

2.2 Participation to the first preparatory meeting of the African Telecommunication Union (ATU)

2.2.1 Based on these Recommendations and in accordance with the mandate and work programme of the APIRG AFI Frequency Management Group, the Secretariat coordinated the participation of AFI CAAs attendance to the first preparatory meeting of the African Telecommunication Union (**ATU**).

2.2.1 The ATU first meeting in preparation to ITU WRC 15 was held in Dakar Senegal, from 18 to 20 March 2013 with as main objectives:

1) Take stock of the WRC-12 preparation, the conference itself, its outcome implementation strategies and key lessons for the development of better strategies for future WRCs commencing with WRC-15;
2) Undertake an overview of the implementation status of WRC-12 outcomes with a view to devising implementation mitigation measures, where necessary;
3) Consider the ITU Work Plan for WRC-15 with a view to providing comments reflecting African views for the kind consideration of ITU;
4) Consider preliminary views on the WRC-15 Agenda Items, in order to commence formulation of preliminary African common positions where possible.

This meeting was followed by two workshops on Mobile telecommunication and Satellite whose aims were to present to the participants the potential contribution of these technologies to the African countries economic growth and the spectrum requirement challenges and stakes.

2.2.2 One Hundred Sixty Eight (**168**) participants from Thirty One (**31**) Member States, the ITU Radiocommunication (BR) and Telecommunication Development (TD) Bureaus, ECOWAS, EACO; Two (**02**) International Regional Telecommunications Organizations (CITEL and CEPT); Seven (**07**) Associate Members and Eleven (**11**) partner organizations attended the meeting.

2.2.3 Amongst these participating States, Six (**06**) States (Cameroon, **Cote d'Ivoire**, **Ghana**, Kenya, **Senegal**, Uganda) delegation included Civil Aviation experts. ASECNA as Rapporteur of the AFI Frequency Management Group (AFI/FMG) and ICAO WACAF attended these meetings.

2.2.4 This meeting was an opportunity to present ICAO views based on the aim and therefore ICAO position on the WRC-15 Agenda Items of **particular importance to civil aviation** (1.1; 1.5; 1.17 and 9.1.5) was presented in detail and ICAO specific views on the other various Agenda Items were recorded under each respective agenda items in particular agenda items 1.4; 1.6; 1.7; 1.10; 1.11; 1.12; 1.16; 4; 8; 9.1.1; 9.1.6 and 10.

2.2.5 The attention of the meeting was drawn on the necessity for a long-term VSAT spectrum availability and protection from interference to be guaranteed across the entire African continent and other parts of the world as recommended by the ICAO 12th Air Navigation Conference held in November 2012 in Montreal.

2.2.6 The presentation by ASECNA highlighted instance of interferences with FM broadcasting stations systems in some countries experienced in some of the adjacent VHF bands (108 to 116 MHz) and affecting both Air Traffic Controller /Pilot voice and data Communications and Aeronautical Radio Navigation Services including critical phase of flight (approach and landing phases) as well.

2.2.7 The C-Band operated by the aeronautical VSAT networks for both Ground/Ground and Air/Ground communication within and across the continent was reported to be interfered by IMT devices in some countries leading to aeronautical service short come. The meeting was reminded on the outcome of ITU studies reported in M.2109 and S.2199 that concluded on the incompatibility of sharing the 3 400 – 4 200 MHz and 4 500 – 4 800 MHz bands between FSS and IMT.

2.2.8 The meeting confirmed that there have been reports of such interferences between the FM sound broadcasting band (87.5 to 108 MHz) and the adjacent aviation band (108 to 136 MHz) in some countries, considered the threat on the C-Band and therefore recommended the following:

That:

a) Air Navigation Service Providers (ANSPs) such as ASECNA and Civil Aviation Authorities (CAAs) are encouraged to inform the Telecommunication Regulators as soon as such interferences occur for urgent and immediate actions;

b) Countries that have experienced such interferences are urged to investigate and share the results with all Administrations through the ATU Secretariat, in order to share experience to facilitate timely intervention by other Administration;

c) ATU members states reinforce their support to the existing and future FSS earth stations in the 3 400-4 200 MHz band used for satellite communications related to safe operation of aircraft and reliable distribution of meteorological information by participating in the studies for possible technical and regulatory measures called upon by Resolution 154 (WRC-12).

2.2.9 A side meeting was organized involving the CAA present at this meeting and satellite industry in order to harmonize views and prepare the next Conference. The idea of the establishment of an **A**frican **U**sers of **S**atellite for **C**ivil **A**viation (**AUSCA**) as shared and receptively applauded.

This idea was explained in detail to the satellite symposium during which with two short presentations ICAO outlined the key role of satellite technology for the provision of aeronautical Communication Navigation and Surveillance services within and across the continent.

2.3 **Contribution to the work of ITU Radiocommunication Study Groups (Working Party 4A)**

2.3.1 The issue related to the protection of the C-Band will be discussed under WRC 15 **Agenda Item 9.1.5**: ***Fixed Satellite Service (FSS) systems used for aeronautical purposes***

ICAO in liaise with AFI/FMG Rapporteur has developed the contribution as attached in Appendix to this working Paper. This contribution needs to be introduced by ITU member state for consideration by the next session of the study Group on September 2013.

2.3.2 The last session of Working Party 4A was attended by the Secretary of the Navigation Systems Panels (NSP). This session developed a draft CPM text on WRC-15 Agenda **Item 9.1.5** WRC-15 (AFI VSAT), which reflects ICAO inputs which could be used by States as the basis to make their proposals to the Conference (November 2015). The outcome of Working Party 4A is attached at Appendix to this Working Paper.

The future action should aim to avoid that the text gets downgraded or weakened in the CPM meeting because of the real risk of strong opposition by the IMT Community.

3 Action by the meeting

The meeting is invited to:

a) Take note of the information given above

b) Implement the Recommendations of ICAO 12th Air Navigation Conference pertaining to the protection of C Band

c) Encourage Sates/Organizations to participate in the preparatory activities for WRC-15;

d) Promote ICAO position for WRC-15 to conduct the Collaborative Decision Making (CDM) with the stakeholders involved in the usage of aeronautical spectrum;

e) Consider the above stakes and challenges on the FSS spectrum band when conducting the re-engineering exercise of CAFSAT

Appendix

Regions ITU

Source: Document 4A/TEMP/249

Subject: WRC-15 agenda item 9.1, issue 9.1.5
Resolution **154 (WRC-12)**

Annex 12 to
Document 4A/591-E
25 July 2014
English only

Annex 12 to Working Party 4A Chairman's Report

DRAFT CPM TEXT ON WRC-15 AGENDA ITEM 9.1, ISSUE 9.1.5

AGENDA ITEM 9.1

9 to consider and approve the Report of the Director of the Radiocommunication Bureau, in accordance with Article 7 of the Convention:

9.1 on the activities of the Radiocommunication Sector since WRC-12;

5/9.1.5 Resolution 154 (WRC-12)

Consideration of technical and regulatory actions in order to support existing and future operation of fixed-satellite service earth stations within the band 3 400-4 200 MHz, as an aid to the safe operation of aircraft and reliable distribution of meteorological information in some countries in Region 1

(**WP 4A** (technical and regulatory aspects), **SC** (regulatory and procedural aspects) / -)

5/9.1.5/1 Executive summary

Resolution **154 (WRC-12)** invites the ITU-R to study possible technical and regulatory measures in some countries in Region 1 to support the existing and future fixed-satellite service (FSS) earth stations in the 3 400-4 200 MHz band used for satellite communications related to safe operations of aircraft and reliable distribution of meteorological information, considering that where an adequate terrestrial communication infrastructure is not available, FSS earth stations are the only viable option to augment the communication infrastructure in order to satisfy the overall communications infrastructure requirement of the International Civil Aviation Organization (ICAO) and to ensure distribution of meteorological information under the auspices of the World Meteorological Organization (WMO).

5/9.1.5/2 Background

The efficient provision of air navigation services requires the implementation and operation of ground communications infrastructure with high availability, reliability and integrity. In some countries in Africa, the difficulty of fulfilling these requirements, given the extent of the airspace and weakness in terrestrial communication infrastructure, has led to the extensive deployment of an aeronautical communication infrastructure based on very small aperture terminal (VSAT) systems operating in the FSS. The frequency band of operation is the 3 400-4 200 MHz band (with

the standard C-band frequency range being 3 700-4 200 MHz and the extended C-band frequency range being 3 400-3 700 MHz), which, due to more pronounced rain attenuation at higher frequency bands, is the most viable option for satellite links with high availability in tropical regions. This infrastructure currently spans the entire region and is crucial to ensure the continued growth of traffic while maintaining safe operation of aircraft. The same band is also used for the distribution of meteorological data via satellites under the auspices of the WMO.

WRC-07 allocated the frequency band 3 400-3 600 MHz to the mobile, except aeronautical mobile, service on a primary basis in 81 countries in Region 1, subject to regulatory and technical restrictions (see RR No. **5.430A**). The deployment of mobile service systems in the vicinity of airports has led to an increased number of cases of interference into the FSS (VSAT) receivers. Consequently, some additional measures are needed to improve the protection of the FSS links supporting aeronautical and meteorological communications. Depending on whether the interference cases are between two stations in the same country (domestic case) or between two stations in neighbouring countries (cross-border case), the consideration of such measures is either a national spectrum-regulatory matter, or an issue of international spectrum regulation between countries.

WRC-12 adopted Resolution **154 (WRC-12)**, and invited the ITU-R to study possible technical and regulatory measures in some countries in Region 1 to support the existing and future FSS earth stations in the 3 400-4 200 MHz band used for satellite communications related to safe operations of aircraft and reliable distribution of meteorological information referred to in *considering c)*.

Regional coordination was carried out between African Civil Aviation Authorities, air navigation service providers (ANSPs) and the African Telecommunication Union (ATU) in preparation for WRC-15. As a result, the first ATU preparatory meeting to ITU WRC-15 held in Dakar (Senegal), from 18 to 20 March 2013 recommended ATU Member States to "reinforce their support to the existing and future FSS earth stations in the 3 400-4 200 MHz band used for satellite communications related to safe operation of aircraft and reliable distribution of meteorological information by participating in the studies for possible technical and regulatory measures called upon by ITU Resolution 154 (WRC-12)."

5/9.1.5/3 Summary of technical and operational studies, including a list of relevant ITU-R Recommendations

Report ITU-R M.2109 contains sharing studies between IMT-Advanced systems and geostationary satellite networks in the FSS in the 3 400-4 200 and 4 500-4 800 MHz frequency bands.

Report ITU-R S.2199 contains studies on compatibility of broadband wireless access systems and FSS networks in the 3 400-4 200 MHz band.

Recommendation ITU-R SF.1486 contains a sharing methodology between fixed wireless access systems in the fixed service and VSATs in the FSS in the 3 400-3 700 MHz band.

Recommendation ITU-R S.1856 contains methodologies for determining whether an IMT station at a given location operating in the band 3 400-3 600 MHz would transmit without exceeding the power flux-density limits in RR Nos. **5.430A**, **5.432A**, **5.432B** and **5.433A**.

These studies show a potential for interference from IMT and broadband wireless access stations into FSS earth stations at distances of up to several hundred kilometers. 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 frequency band.

5/9.1.5/4 Regulatory and procedural considerations

Resolution **154 (WRC-12)** could be modified, calling for relevant administrations in Region 1 to use special care in the coordination, assignment, and management of frequencies taking into consideration the potential impact on FSS earth stations used for satellite communications related to safe operation of aircraft and reliable distribution of meteorological information in the band 3 400-4 200 MHz.

In parallel to the modification of Resolution **154 (WRC-12)**, consideration may be given to modifying RR No. **5.430A** to include a reference to the modified Resolution.

An example of modification of Resolution **154 (WRC-12)** follows.

MOD

RESOLUTION 154 (REV.WRC-~~12~~15)

~~Consideration of t~~Technical and regulatory actions in order to support existing and future operation of fixed-satellite service earth stations within the band 3 400-4 200 MHz, as an aid to the safe operation of aircraft and reliable distribution of meteorological information in some countries in Region 1

The World Radiocommunication Conference (Geneva, ~~2012~~2015),

considering

a) that the band 3 400-4 200 MHz is allocated worldwide to the fixed-satellite service (FSS) in the space-to-Earth direction and to the fixed service on a primary basis;

b) that the band 3 400-3 600 MHz is allocated on a primary basis to the mobile, except aeronautical mobile, service in the countries in Region 1 specified in No. **5.430A** and identified for International Mobile Telecommunications (IMT) in those countries;

c) that in Region 1 the allocation to the mobile, except aeronautical mobile, service in the band 3 400-3 600 MHz is subject to the technical and regulatory limitations listed in No. **5.430A**, aimed at ensuring compatibility with co-primary services of neighbouring countries;

d) that a number of developing countries rely, to a great extent, on FSS systems using very small aperture terminals (VSAT) in the band 3 400-4 200 MHz for provision of communications related to safe operation of aircraft and reliable distribution of meteorological information;

~~*a*~~*e)* that, in some cases ~~remote and rural areas often still lack a terrestrial communication infrastructure that meets the evolving requirements of modern civil aviation;~~

~~*b) that the cost of providing and maintaining such an infrastructure could be expensive, particularly in remote regions;*~~

~~*c)*~~ where an adequate terrestrial communication infrastructure is not available, ~~fixed-satellite service (FSS) earth stations~~VSAT networks referred to in *considering d)* above are the only viable option to ~~augment the communication infrastructure in order to satisfy the overall communications infrastructure~~ meet the safety requirements of the International Civil Aviation Organization (ICAO) and to ensure distribution of meteorological information under the auspices of the World Meteorological Organization (WMO);

f) that the relevant ITU-R studies showed a potential for interference from fixed wireless access and IMT stations into FSS receiving earth stations at distances from tens of kilometres up to hundreds kilometres, depending on the parameters and deployment of stations of these services;

g) that WRC-12 recognized these sharing difficulties and decided to study technical and regulatory measures to support the FSS earth stations referred to in *considering e)* above,

~~*d)* that the use of FSS earth stations deployed in some countries in Region 1 for aeronautical communications has the potential to significantly enhance communications between air traffic control centres as well as with remote aeronautical stations,~~

noting

~~*a)* that the FSS is not a safety service;~~

~~*b)* that, by its Resolution **20 (Rev.WRC-03)**, WRC resolved to instruct the Secretary-General "to encourage ICAO to continue its assistance to developing countries which are endeavouring to improve their aeronautical telecommunications ...";~~

~~*c)* Recommendation ITU-R SF.1486 on sharing methodology between fixed wireless access systems in the fixed service (FS) and very small aperture terminals (VSATs) in the FSS in the 3 400-3 700 MHz band;~~

~~*d)* Report ITU-R S.2199 on studies on compatibility of broadband wireless access systems and FSS networks in the 3 400-4 200 MHz band;~~

~~*e)* Report ITU-R M.2109 on sharing studies between International Mobile Telecommunications-Advanced (IMT-Advanced) systems and geostationary-satellite networks in the fixed-satellite service in the 3 400-4 200 MHz and 4 500-4 800 MHz frequency bands,~~

a) that by the date of WRC-15 several cases of harmful interference to FSS VSATs used for aeronautical safety communications from fixed wireless access or IMT stations of the same administration were reported;

b) that these reported cases of interference revealed some national difficulties in the coordination of frequencies between the respective national telecommunication regulators responsible for licensing fixed wireless access or IMT systems and national aviation authorities responsible for the management of frequencies for aeronautical purposes, including assignments for VSATs;

c) that in many countries FSS VSAT earth stations are not subject to individual licencing and not registered as specific stations in national frequency databases and in the ITU Master International Frequency Register (MIFR) due to considerable administrative work;

d) that the knowledge of the location and operational frequencies of VSAT stations used for communications related to the safe operation of aircraft and/or distribution of meteorological information is critically important for ensuring compatibility with applications of other services,

recognizing

a) that ITU-R conducted comprehensive studies of compatibility between FSS on the one hand and the fixed wireless access systems and IMT applications on the other hand in the band 3 400-4 200 MHz and summarized the results of the studies in Recommendation ITU-R SF.1486 as well as Reports ITU-R S.2199 and ITU-R M.2109;

b) that the Recommendation and Reports identified in *recognizing a)* offer a set of mitigation techniques that could be employed for international coordination and at a national level and to facilitate coexistence of FSS, fixed and mobile services systems;

c) that Recommendation ITU-R S.1856 contains methodologies for verification of the power flux-density (pfd) limit set forth in No. **5.430A**,

resolves

1 that administrations shall ensure the compliance of the IMT stations subject to No. **5.430A** with the pfd limit set forth therein and apply the relevant coordination procedures before bringing these applications in use;

2 to urge administrations, when planning and licencing fixed point-to-point, fixed wireless access, and IMT systems in bands referred to in *considering b)* above, to take into account the protection needs of existing and planned FSS VSAT earth stations by coordinating the deployment of the systems mentioned above with the respective aviation and meteorological authorities at a national level;

3 to invite administrations, taking into account the number of earth stations involved for this particular type of usage, to consider the possibility of licencing FSS VSAT earth stations used for communications related to the safe operation of aircraft and/or distribution of meteorological information on an individual basis and registering them in the MIFR as specific earth stations;

4 to encourage administrations to employ the appropriate mitigation techniques described in the ITU-R publications referred to in *recognizing a)* above;

5 to invite administrations to ensure that the application of these technical and regulatory measures to the FSS and mobile service does not limit the use of the band 3 400-4 200 MHz by other existing and planned systems and services in other countries,

~~*resolves to invite ITU-R*~~

~~to study possible technical and regulatory measures in some countries in Region 1 to support the existing and future FSS earth stations in the 3 400-4 200 MHz band used for satellite communications related to safe operation of aircraft and reliable distribution of meteorological information referred to in *considering c)*,~~

~~*invites*~~

~~all members of the Radiocommunication Sector, ICAO and WMO to contribute to these studies,~~

~~*instructs the Director of the Radiocommunication Bureau*~~

~~to include the results of these studies in his Report to WRC-15 for the purposes of considering adequate actions in response to *resolves to invite ITU-R* above,~~

instructs the Secretary-General

to bring this Resolution to the attention of ICAO and WMO.

Radiocommunication Study Groups

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Subject: **Fixed Satellite Service (FSS) systems used for aeronautical purposes – WRC-15 Agenda Item 9.1.5**

Source

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

Figure 1: Spectrum analysis with IMT signal – 28 February 2013

Appendix A

Figure 2: Spectrum analysis without IMT signal - 08 March 2013

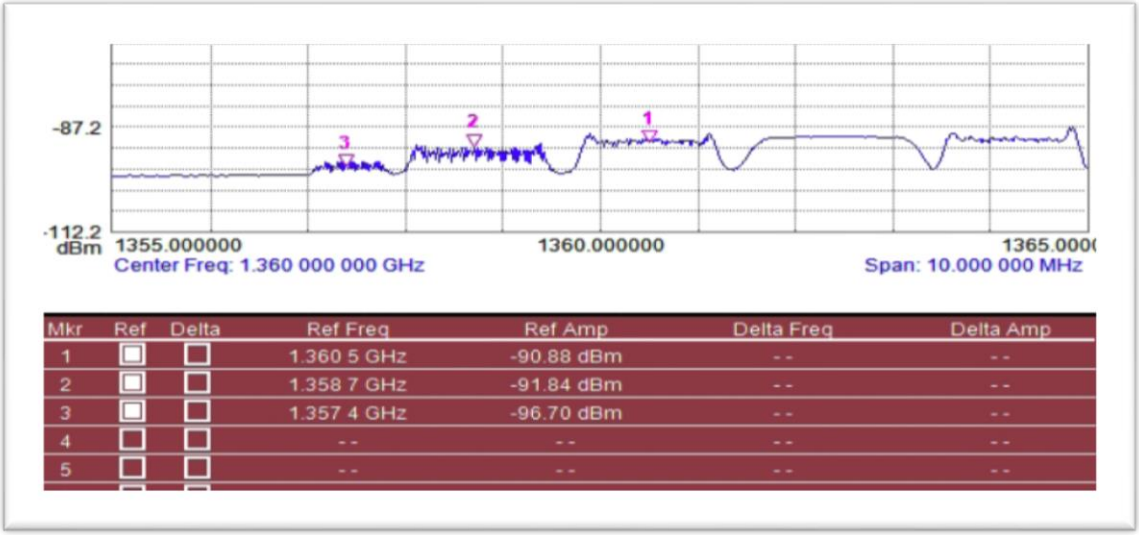
Appendix B

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



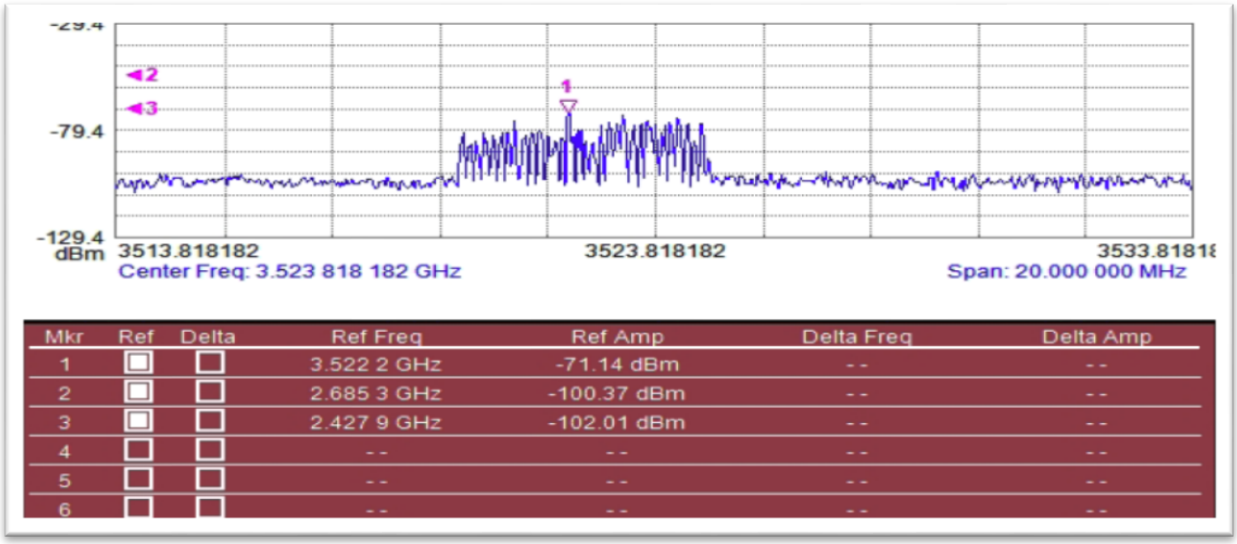
Mkr	Ref	Delta	Ref Freq	Ref Amp	Delta Freq	Delta Amp
1	☐	☐	1.360 5 GHz	-90.88 dBm	--	--
2	☐	☐	1.358 7 GHz	-91.84 dBm	--	--
3	☐	☐	1.357 4 GHz	-96.70 dBm	--	--
4	☐	☐	--	--	--	--
5	☐	☐	--	--	--	--

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



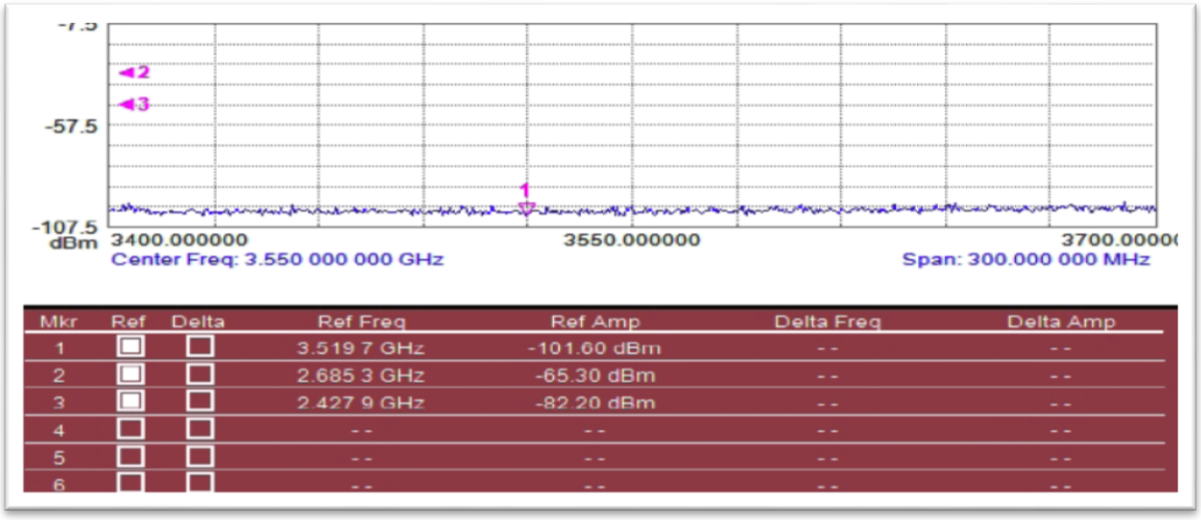
Mkr	Ref	Delta	Ref Freq	Ref Amp	Delta Freq	Delta Amp
1	☐	☐	3.522 2 GHz	-71.14 dBm	- -	- -
2	☐	☐	2.685 3 GHz	-100.37 dBm	- -	- -
3	☐	☐	2.427 9 GHz	-102.01 dBm	- -	- -
4	☐	☐	- -	- -	- -	- -
5	☐	☐	- -	- -	- -	- -
6	☐	☐	- -	- -	- -	- -

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