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July 20, 2012

**REDACTED FOR PUBLIC INSPECTION**

**VIA HAND DELIVERY**

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**JUL 20 2012**

Federal Communications Commission  
Office of the Secretary

Ms. Marlene H. Dortch  
Secretary  
Federal Communications Commission  
445 12th Street, SW  
Washington, DC 20554

Re: ViaSat, Inc. Supplemental Submission, File No. SES-LIC-20120427-00404, Call Sign E120075

Dear Ms. Dortch:

By this letter, ViaSat, Inc. (“ViaSat”) supplements the above-referenced application (the “Application”) to provide updated information about international regulatory developments that ViaSat believes should be considered in the International Bureau’s evaluation, and to update the Commission on the current schedule for commercially deploying the earth stations that are the subject of the Application.

The Application seeks authority to operate earth stations mounted on aircraft using the 28.35-29.1 GHz, 29.5-30.0 GHz, 18.3-19.3 GHz and 19.7-20.2 GHz portions of the Ka band, all of which are allocated to the Fixed Satellite Service (among other services). The earth stations will be deployed by a variety of ViaSat’s customers. They are capable of operating while the aircraft are moving, and, in many instances, are expected to be used heavily when the aircraft is parked on the ground (*i.e.*, in a manner similar to a temporary fixed earth station). Notably, these earth stations will operate on the same satellite networks as are currently being used for “traditional,” stationary VSATs (ViaSat-1, WildBlue-1, Anik-F2) and will share the same frequencies as those other VSATs. Moreover, they will operate within the same off-axis EIRP and downlink PDF limits as are set out in Section 25.138 of the Commission’s rules.

As detailed in the Application, the proposed operations are fully consistent with the interference environment that the Commission has established for FSS use of the Ka band, including the Commission’s two-degree-spacing policies. Thus, the Application explains, the proposed operations appropriately could be considered an application of the Fixed Satellite Service (“FSS”). Considering these operations as an application of the FSS is appropriate for at least four reasons:

(i) it would be consistent with the Commission's treatment of earth stations in the FSS portion of the Ku band that are capable of transmitting while in motion;<sup>1</sup>

(ii) it would provide a single regulatory construct for operations that extend across bands that are allocated solely for the FSS (28.35-29.1 GHz and 18.3-19.3 GHz), and also across bands that share both FSS and MSS allocations (29.5-30.0 GHz and 19.7-20.2 GHz);

(iii) it would provide a single regulatory construct for operations that will occur on the same satellite networks and share the same frequencies as stationary VSATs; and

(iv) it would be consistent with the regulatory construct for the Ka band that is developing internationally.

With respect to this last point, ViaSat encourages the Commission to consider recent developments regarding the the operation of earth stations on mobile platforms ("ESOMPs") operating in FSS bands that the European Conference of Postal and Telecommunications Administrations ("CEPT") is taking.

In addition, the draft decision of the CEPT Electronic Communications Committee ("ECC") attached as Exhibit B (i) would provide technical and operational requirements for the operation of ESOMPs on Ka band FSS networks, and (ii) is based upon the draft ECC report, attached as Exhibit C, which explains that treating ESOMPs as an application in the FSS allows operators and regulators to rely on a single, well-established and proven set of rules for authorizing these earth stations.<sup>3</sup> As indicated in the minutes of the FM

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<sup>1</sup> See *Vehicle-Mounted Earth Stations in Certain Frequency Bands Allocated to the Fixed-Satellite Service*, 24 FCC Rcd 10414 ¶¶ 15, 16 (2009) (concluding that vehicle-mounted earth stations are "sufficiently similar in radio frequency characteristics to more traditional networks of FSS earth stations to operate compatibly within the two-degree Ku-band FSS satellite spacing environment" and that VMES should be treated as a mobile application of FSS with primary status); *Satellite Earth Stations on Board Vessels in the 5925-6425 MHz/ 3700-4200 MHz Bands and 14.0-14.5 GHz/11.7-12.2 GHz Bands*, 20 FCC Rcd 674 ¶ 77 (2005) (permitting operation of earth station on board vessels to be considered a recognized application within FSS networks); see also 47 C.F.R. § 2.106, NG181, NG182, NG183, NG187.

<sup>3</sup> Exhibit B, Draft ECC Decision at 2-3; Exhibit C, Draft ECC Report at 9-10.

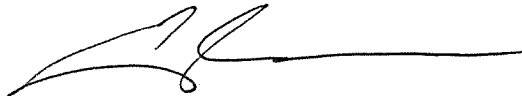
PT44 21<sup>st</sup> meeting (June 13-15, 2012), attached as Exhibit D, the draft ECC report and decision are nearly final.<sup>4</sup>

Therefore, ViaSat respectfully requests that the Commission grant the Application authorizing the operation of the proposed aeronautical terminals as an application of the FSS allocation in the Ka band frequencies. Such treatment is consistent with the Commission's precedent with respect to other mobile terminals in the FSS and the regulatory framework for ESOMPs in the Ka band that is developing internationally. The Application demonstrates that the proposed antennas can operate in a manner that is consistent with the interference environment for fixed terminals across the frequency bands used in the applicable Ka band satellite networks, and thus, adopting single regulatory construct for operations across the entire frequency range requested would provide the simplest and most efficient approach.

Finally, one of ViaSat's customers, JetBlue Airways ("JetBlue"), has scheduled its commercial trials of satellite broadband, using these earth stations, to commence on October 1, 2012. ViaSat respectfully requests expeditious processing of the Application in order to facilitate that commencement of service to the public on October 1, 2012.

If you have any questions regarding this submission, please contact the undersigned.

Respectfully submitted,



John P. Janka  
Elizabeth R. Park

Enclosures

cc: Robert Nelson  
Andrea Kelly  
Paul Blais  
Joseph Hill

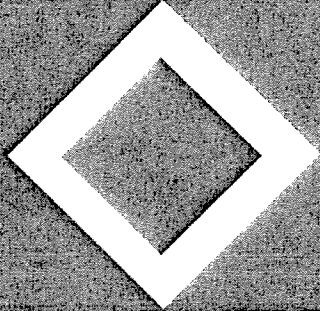
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<sup>4</sup> See Exhibit D, Minutes, FM PT44 21<sup>st</sup> Meeting ¶¶ 43, 51, 52 (June 13-15, 2012).

# **Exhibit A**

**REDACTED**

# **Exhibit B**



# ECC Decision (13)AA

The use, free circulation, and exemption from individual licensing of Earth stations on mobile platforms (ESOMPs) in the frequency bands available for use by uncoordinated FSS Earth stations within the ranges 17.3-20.2 GHz and 27.5-30.0 GHz

Approved DD Month YYYY (Arial 9pt bold)

## EXPLANATORY MEMORANDUM

### 1 INTRODUCTION

This ECC Decision addresses the use of the Earth Stations on Mobile Platforms (ESOMPs) which operate in the frequency ranges 17.3-20.2 GHz (space-to-Earth) and 27.5-30.0 GHz (Earth-to-space). ESOMPs operate in fixed satellite service (FSS) networks and provide broadband communication service to terminals with small directional antennas. The terminals may be mounted on aircraft, ships or land vehicles or may be transportable devices used at temporary halts. ESOMPs on aircraft and ships may operate in national airspace and waters, or may operate in international airspace and waters. This Decision relates only to ESOMPs operating in geostationary satellite networks.

### 2 BACKGROUND

In recent years a number of FSS networks have been launched which operate in the "Ka-band" frequencies (17.0-30.0 GHz). Further networks are under construction and are expected to be launched over the coming few years. Ka-band satellites typically use small spot beams, which leads to increased efficiency of spectrum usage and allows for small user terminal antennas (typically 60cm to 1m in diameter). The increased efficiency allows for broadband communications at lower cost than typical Ku-band systems.

The ECC has adopted several Decisions related to the operation of FSS systems in the Ka-band, in particular ECC/DEC/(05)01, ECC/DEC/(05)08, ECC/DEC/(06)02 and ECC/DEC/(06)03.

Work has been conducted within the ITU-R to examine the issues related to the operation of ESOMPs in Ka-band FSS networks. Report ITU-R S.2223 identifies technical and regulatory issues to be considered in regulations for ESOMPs. In ECC Report 184, CEPT has studied the technical and regulatory requirements related to the operation of ESOMPs and determined technical limits required for ESOMP operations. These technical conditions would ensure that FSS networks and terrestrial services do not suffer from harmful interference from ESOMPs.

Operating on moving platforms, ESOMPs have the potential of causing harmful interference to other satellite networks, due to the possible mispointing of the terminal antenna to the intended satellite. However, advances in technology, particularly the development of stabilised Earth station antennas, have allowed the development of mobile Earth stations with very stable pointing characteristics, capable of maintaining a high degree of pointing accuracy even on rapidly moving platforms. "Closed-loop tracking" and an automatic capability of muting transmission if mispointing towards the intended space station occurs or is about to happen, can ensure that ESOMPs do not represent more risk than typical uncoordinated FSS Earth stations, which are often deployed without satellite-tracking capabilities. Furthermore, it should be ensured that the aggregate interference caused to other satellite networks by ESOMPs would be no higher than the limits agreed in coordination between the relevant satellite networks. To meet these requirements, ESOMPs are required through this Decision to be permanently connected to a Network Control Facility (NCF). When properly managed and controlled by the NCF, the technical characteristics of these mobile Earth stations are then indistinguishable from typical uncoordinated FSS Earth stations in fixed locations from the perspective of inter-satellite network interference.

ECC/DEC/(05)01 designates different parts of the 27.5-29.5 GHz band for the use of fixed service and uncoordinated FSS Earth stations. The intention of this Decision is to provide technical conditions to allow ESOMPs to operate in the parts of the range 27.5-29.5 GHz available for uncoordinated FSS Earth stations and in the band 29.5-30 GHz. Although the frequency arrangements in the range 27.5-29.5 GHz are well harmonised in CEPT through this Decision, there may be cases where a band available for uncoordinated FSS in one country is used for FS systems in a neighbouring country. This could occur, for example, in the band 28.8365-28.9485 GHz, which is designated for uncoordinated FSS earth stations, but is also used for terrestrial services in some CEPT countries.

In the case of land based ESOMPs operating in the bands available for uncoordinated FSS Earth stations, there is no change to the current interference environment since ESOMPs may operate in any location, just



like uncoordinated FSS earth stations. However, in the case of ESOMPs mounted on aircraft regulatory provisions are required, since the geometry of the interference environment is different. An ESOMP mounted on an aircraft and operating in the territory of one country could cause interference to terrestrial systems operating in a neighbouring country even when the separation distance is significantly larger than would be the case for an uncoordinated FSS earth station on land. Consequently, this Decision introduces pfd thresholds for ESOMPs mounted on aircraft that apply in the territory of administrations, which operate terrestrial systems and in the bands used by those terrestrial systems. This constraint may be relaxed with the agreement of the administrations concerned, for example if the terrestrial system characteristics differ from those used in the calculation of the pfd threshold or if the terrestrial systems are deployed only in parts of the country distant from the aircraft route.

In the case of ESOMPs mounted on vessels, the interference environment is also different to that for land based ESOMPs in some respects. In particular, ESOMPs on vessels could operate in international waters (typically beyond 12 nautical miles from the coast). Hence, it is necessary to ensure that terrestrial systems deployed in the band 27.5-29.5 GHz are adequately protected also from ESOMPs on vessels. Consequently, this Decision applies a pfd threshold to ESOMPs on vessels. This threshold applies at the coast of any affected country in any part of the band 27.5-29.5 GHz that is used for terrestrial systems in that country. The pfd constraint may be relaxed with the agreement of the administrations concerned for similar reasons to those for the case of aircraft-mounted ESOMPs.

To comply with the pfd values applicable to ESOMPs on aircraft and vessels, any ESOMP operating in the range 27.5-29.5 GHz must monitor its location and have knowledge of, and control over, other characteristics such as equivalent isotropic radiated power (e.i.r.p.) and antenna pointing direction. This function may be accomplished by the ESOMP Network Control Facility (NCF), which shall have the possibility of reducing, or even set to zero, the terminal e.i.r.p., if needed. This Decision places requirements on the ESOMP NCF to give confidence that the requirements listed in Annex 2 will be met.

As ESOMPs are mobile and could be transported from one country to another, it is desirable to allow for free circulation of terminals, subject to national authorisation requirements. The free circulation of terminals within the CEPT is implemented through this Decision.

### 3 REQUIREMENT FOR AN ECC DECISION

ESOMP systems are planned to be launched in Europe in 2013. A Decision is required to ensure that ESOMPs comply with the necessary technical requirements and to provide for the free circulation of terminals.

**ECC DECISION OF [DD MONTH YYYY] ON THE USE, FREE CIRCULATION AND EXEMPTION FROM INDIVIDUAL LICENSING OF EARTH STATIONS ON MOBILE PLATFORMS IN THE FREQUENCY BANDS AVAILABLE FOR USE BY UNCOORDINATED FSS EARTH STATIONS WITHIN THE RANGES 17.3-20.2 GHz AND 27.5-30.0 GHz [(ECC/DEC/(13)AA)]**

"The European Conference of Postal and Telecommunications Administrations, (style: ECC paragraph)

*considering*

- a) that the introduction of new ESOMP systems will enhance broadband communications over wide territories in the CEPT, making them available on platforms such as aircraft, ships and ground vehicles;
- b) that administrations should work towards the exemption of relevant radio equipment from individual licensing based on harmonised criteria detailed in ERC/REC 01-07;
- c) that the band 17.3-17.7 GHz is globally allocated to the FSS (Earth-to-space) on a primary basis in the ITU Radio Regulations, limited to feeder links for the BSS and is subject to ITU Radio Regulations Appendix 30A;
- d) that the 17.7-19.7 GHz band is globally allocated to both the fixed service (FS) and the fixed satellite service (FSS) (space-to-Earth), among others, on a primary basis in the ITU Radio Regulations (ITU RR);
- e) that the 27.5-29.5 GHz band is globally allocated to the fixed service (FS), mobile service (MS), and the fixed satellite service (FSS) (Earth-to-space) on a primary basis in the ITU Radio Regulations (ITU RR);
- f) that the 29.5-30.0 GHz band is globally allocated to the FSS (Earth-to-space) and the 19.7-20.2 GHz band is globally allocated to the FSS (space-to-Earth) on a primary basis in the ITU RR;
- g) that ECC Decision ECC/DEC/(05)01 designates certain frequency bands in the range 27.5-29.5 GHz for the use of uncoordinated FSS Earth stations and certain others for the use of the FS;
- h) that Decision ECC/DEC/(05)01 also designates the band 28.8365-28.9485 GHz for the use of uncoordinated FSS Earth stations, without prejudice to the FS systems licensed in this band in some countries before 18th March 2005;
- i) that not all CEPT administrations have implemented Decision ECC/DEC/(05)01;
- j) that the Office collects information regarding the usage of FS and MS in the CEPT in the frequency bands within the ranges 17.7-19.7 GHz and 27.5-29.5 GHz and that this information is publicly available in the ECO Frequency Information System (EFIS);
- k) that Report ITU-R S.2223 identifies the technical and operational requirements for the operation of ESOMPs in Ka-band FSS networks and that ECC Report [ESOMP] identifies certain technical conditions for ESOMPs to ensure that they do not cause unacceptable interference to other services;
- l) that ECC/DEC/(05)08 decides that certain frequency bands in the range 17.3-30.0 GHz are available for high density applications in the fixed satellite service, including uncoordinated FSS Earth stations;
- m) that ECC/DEC/(05)10 and ECC/DEC/(05)11 have established regulatory requirements allowing the free circulation and use of Aircraft Earth Stations and Earth Stations on Vessels in the 14.0-14.5 GHz band;
- n) that ECC/DEC/(06)02 and ECC/DEC(06)/03 have been developed, providing exemption from individual licensing of LESTs and HESTs in the bands 19.7-20.2 GHz and 29.5-30 GHz;

- o) that some of the technical characteristics of the ESOMP systems are influenced by the co-ordination of the relevant satellite networks;
- p) that the use of ESOMPs on ships and aircraft requires authorisation by the relevant national Administration of the country where the ship or aircraft is registered;
- q) that some administrations may require a frequency authorisation due to specific national requirements, while other administrations may require some form of notification, exemption, or mutual recognition of the licence issued in the country of registration of the terminal;
- r) that when operating in national territory of a CEPT Administration, relevant national regulatory requirements may apply to ESOMPs;
- s) that this Decision shall not impede EEA member countries from fulfilling their obligations according to Community law.
- t) that in EU/EFTA countries the radio equipment that is under the scope of this Decision shall comply with the R&TTE Directive. Conformity with the essential requirements of the R&TTE Directive may be demonstrated by compliance with the applicable harmonised European standard(s) or by using the other conformity assessment procedures set out in the R&TTE Directive.
- u) that the applicable harmonised standard for ESOMPs is ETSI EN 303 978;

#### *DECIDES*

1. that the **purpose of this ECC Decision** is to:
  - a. allow free circulation of ESOMPs operating in geostationary satellite networks in certain frequency bands within the ranges 17.3-20.2 GHz and 27.5-30 GHz;
  - b. apply the technical conditions necessary to ensure harmful interference is not caused by ESOMPs to other services;
2. that **CEPT administrations shall:**
  - a) designate the frequency bands 19.7-20.2 GHz (space-to-Earth) and 29.5-30 GHz (Earth-to-space) for the operation of ESOMPs;
  - b) designate the frequency bands 17.3-19.7 GHz (space-to-Earth), 27.5-27.8285 GHz (Earth-to-space), 28.4445-28.8365 GHz (Earth-to-space), and 29.4525-29.5 GHz (Earth-to-space) for the operation of ESOMPs;
  - c) designate the band 28.8365-28.9485 GHz (Earth-to-space) for the operation of ESOMPs, in those countries that have not authorised terrestrial systems in this band;
  - d) inform the Office, through the ECO Frequency Information System (EFIS), whether frequencies within 28.8365-28.9485 GHz are designated for ESOMP operations, or not, within their territory;
  - e) inform the Office of the necessity for ground based ESOMPs operating in the vicinity of airfields to be coordinated;
  - f) allow free circulation and use of ESOMPs;
  - g) exempt ESOMPs from individual licensing;

3. that, for the purpose of this ECC Decision, the **following technical and operational parameters** apply:
  - a) within the frequency bands 17.3-20.2 GHz and 27.5-30.0 GHz, ESOMPs shall operate only in the frequency bands identified for their use within the territory of operation;
  - b) ESOMPs operating in international waters or international airspace may operate in any frequencies within the range 27.5-30.0 GHz, subject to ensuring protection of terrestrial systems (which may operate within 27.5-29.5 GHz) in the CEPT by compliance with the relevant provisions of this Decision;
  - c) ESOMPs transmitting in the band 29.5-30.0 GHz shall comply with the requirements in Annex 1;
  - d) ESOMPs transmitting in the band 27.5-29.5 GHz shall comply with the requirements in Annexes 1 and 2;
  - e) In countries where coordination in the vicinity of airfields is needed, then Annex 3 shall apply;
  - f) ESOMPs receiving in the band 17.7-19.7 GHz shall not claim protection from interference from fixed stations operating in the same band and in conformity with their national regulations;
  - g) ESOMPs receiving in the band 17.3-17.7 GHz shall not claim protection from BSS feeder links operating in the same band and in conformity with their national regulations;
4. that this Decision **enters into force** on [date: XX Month YYYY];
5. that the preferred **date for implementation** of this Decision shall be [date: XX Month YYYY];
6. that CEPT administrations shall communicate the **national measures** implementing this Decision to the ECC Chairman and the Office when this ECC Decision is nationally implemented."

*Note:*

*Please check the Office documentation database <http://www.ecodocdb.dk> for the up to date position on the implementation of this and other ECC Decisions.*

**ANNEX 1: TECHNICAL AND OPERATIONAL REQUIREMENTS FOR ESOMPS OPERATING IN FREQUENCY BANDS WITHIN THE RANGES 17.3-20.2 GHZ AND 27.5-30 GHz**

ESOMPs operating in bands within the ranges 17.3-20.2 GHz and 27.5-30.0 GHz shall comply with the following technical and operational requirements:

1. This decision applies to ESOMPs operating to a geostationary satellite;
2. ESOMP networks shall operate under the control of a Network Control Facility (NCF);
3. ESOMPs shall be operated in such a manner that the aggregate off-axis e.i.r.p. levels produced by all co-frequency earth stations within such networks are no greater than the levels that have been coordinated for the specific and/or typical earth station(s) pertaining to fixed-satellite service networks where FSS transponders are used;
4. The design, coordination and operation of ESOMPs shall, at least, account for the following factors which could vary the aggregate off-axis e.i.r.p. levels generated by the earth station:
  - a. mispointing of FSS earth station antennas;
  - b. variations in the antenna pattern of earth station antennas;
  - c. variations in the transmit e.i.r.p. from the earth stations;
5. ESOMPs that use close loop tracking of the satellite signal shall employ an algorithm that is resistant to capturing and tracking adjacent satellite signals. ESOMPs shall immediately inhibit transmissions when they detect that unintended satellite tracking has happened or is about to happen;
6. ESOMPs shall be self-monitoring and, should a fault which can cause harmful interference to FSS or terrestrial networks be detected, the ESOMP must automatically mute its transmissions;
7. ESOMPs shall be in conformance with the Harmonised European Standard EN 303 978, "Satellite Earth Stations and Systems (SES); Harmonised EN for Earth Stations on Mobile Platforms (ESOMP) transmitting towards satellites in geostationary orbit in the 27.5 GHz to 30.0 GHz frequency bands covering essential requirements under article 3.2 of the R&TTE Directive", which may also be demonstrated by compliance with equivalent technical specifications (in the sense of art. 3(2) of the R&TTE Directive);
8. The maximum e.i.r.p. of ESOMP equipment shall be limited to a value within the range from 60 to 55 dBW;

## ANNEX 2: ADDITIONAL TECHNICAL AND OPERATIONAL REQUIREMENTS FOR ESOMPS OPERATING IN FREQUENCY BANDS WITHIN THE RANGES 17.3-19.7 GHz AND 27.5-29.5 GHz

ESOMPs operating in the bands within the ranges 17.3-19.7 GHz and 27.5-29.5 GHz must comply with the following technical and operational requirements:

1. When operating in the territory of any administration, the off-axis<sup>1</sup> EIRP spectral density radiated by any ESOMP into the bands 27.8285-28.4445 GHz, 28.8365-28.9485 GHz (where applicable) and 28.9485-29.4525 GHz, shall be limited to -35 dBW/MHz. This limit shall, in any case, be met by ESOMPs on land, on territorial sea or internal waters, at 3 degrees or less above the local horizontal plane;
2. The elevation angle shall be higher than 3 degrees;
3. ESOMPs shall not have their occupied band edges closer than 10 MHz from the edges of the bands identified by administrations for ESOMP operation;
4. For any ESOMP:
  - o operating in the band 28.8365-28.9485 GHz, the pfd threshold values in paragraphs 3a and 3b apply to the territory of any administration which operates FS systems in this band;
  - o operating in the bands 27.8285-28.4445 GHz and 28.9485-29.4525 GHz, the pfd threshold values in paragraphs 3a and 3b apply to the territory of all CEPT administrations.

These values may be exceeded subject to the agreement between the concerned administration and the ESOMP operator:

- 3a. For ESOMPs installed on aircraft the pfd threshold values on the ground are the following:  
[PFD MASK as provided by SE40];
- 3b. For ESOMPs installed on vessels, the pfd threshold value is  $-109 \text{ dBW/m}^2$  in a reference bandwidth of 14 MHz at a height of 20 metres above mean sea level at the low-water mark of the territory of the administrations (referred in paragraph 3 above)<sup>2</sup>;
5. ESOMPs shall have self-monitoring functions and have automatic mechanisms to ensure compliance with the above PFD provisions.
6. National limitations applicable to uncoordinated FSS earth stations to avoid cross-border interference to fixed or mobile services in the same band in an adjacent country shall apply to land based ESOMPs and ESOMPs operating on inland waterways in the same country as the uncoordinated FSS earth stations;
7. Under the control of the NCF, the ESOMPs shall be able to reduce the transmitted e.i.r.p. (or to mute its transmission, if necessary), taking into account its geographical location, to ensure compliance with the pfd thresholds described in paragraphs 4 and 5 above or other agreed limits.

<sup>1</sup>Off-axis refers to angles greater than 7° from the axis of the main beam or to angles greater than the declared minimum elevation angle of the ESOMP, whichever is lower.

<sup>2</sup>The percentage of time that should be used in the propagation model when assessing compliance with this pfd threshold should be 0.007%.

**ANNEX 3: COORDINATION ZONE FOR PROTECTION OF AIRCRAFT FROM ESOMP OPERATING ON THE GROUND IN THE VICINITY OF AN AIRFIELD**

The following requirements are based on ECC Report 66, using a maximum EMC field strength of 20 V/m. The coordination zone comprises the area within the airfield boundary fence in addition to an area surrounding the boundary fence, the width of which depends on the e.i.r.p., see the table below.

**Table 1: Coordination zones**

<b>ES_e.i.r.p. range</b>	34 dBW to 50 dBW	> 50 dBW to 55.3 dBW	>55.3 dBW to 57 dBW	>57 dBW to 60 dBW
<b>ES_latitude</b>	<b>From boundary</b>	<b>From boundary</b>	<b>From boundary</b>	<b>From boundary</b>
>35-70°/N	500 m	1800 m	2300 m	3500 m
30-35°/N	600 m	2000 m	2600 m	3900 m

#### ANNEX 4: LIST OF REFERENCE

This annex contains the list of relevant reference documents.

- [1] ECC/DEC/(05)01 on the use of the band 27.5-29.5 GHz by the Fixed Service and uncoordinated Earth stations of the Fixed-Satellite Service (Earth-to-space);
- [2] ECC/DEC/(05)08 on the availability of frequency bands for high density applications in the Fixed-Satellite Service (space-to-Earth and Earth-to-space);
- [3] ECC/DEC/(06)02 on Exemption from Individual Licensing of Low e.i.r.p. Satellite Terminals (LEST) operating within the frequency bands 10.70–12.75 GHz or 19.70–20.20 GHz space-to-Earth and 14.00–14.25 GHz or 29.50–30.00 GHz Earth-to-Space;
- [4] ECC/DEC/(06)03 on Exemption from Individual Licensing of High e.i.r.p. Satellite Terminals (HEST) with e.i.r.p. above 34 dBW operating within the frequency bands 10.70 - 12.75 GHz or 19.70 - 20.20 GHz space-to-Earth and 14.00-14.25 GHz or 29.50-30.00 GHz Earth-to-space;
- [5] ERC/REC 01-07 on Harmonised regime for exemption from individual licensing for the use of radio spectrum;
- [6] ECC/DEC/(05)10 on the free circulation and use of Earth Stations on board Vessels operating in fixed satellite service networks in the frequency bands 14-14.5 GHz (Earth-to-space), 10.7-11.7 GHz (space-to-Earth) and 12.5-12.75 GHz (space-to-Earth);
- [7] ECC/DEC/(05)11 on the free circulation and use of Aircraft Earth Stations (AES) in the frequency bands 14-14.5 GHz (Earth-to-space), 10.7-11.7GHz (space-to-Earth) and 12.5-12.75 GHz (space-to-Earth);
- [8] ETSI EN 303 978 Satellite Earth Stations and Systems (SES); Harmonised EN for Earth Stations on Mobile Platforms (ESOMP) transmitting towards satellites in geostationary orbit in the 27.5 GHz to 30.0 GHz frequency bands covering essential requirements under article 3.2 of the R&TTE Directive;
- [9] ECC Report 66 on Protection of aircraft from Satellite Earth Stations operating on the ground in the vicinity of airfields.
- [10] Draft ECC Report 184 [ESOMP] [also in public consultation in parallel]



# **Exhibit C**



# ECC Report 184

Draft Report on the use of earth stations on mobile platforms  
operating with GSO satellite networks in the frequency bands 17.3-  
20.2 GHz and 27.5 – 30.0 GHz

**Month Year (Arial 9pt bold)**

(last updated: date) (Arial 9pt)

## 0 EXECUTIVE SUMMARY

Earth Stations On Mobile Platforms (ESOMPs) are planned to be operated in Ka-band FSS networks. This report examines the regulatory and technical issues surrounding such use with reference to similar developments in the C-band and Ku-band where mobile earth stations have operated in FSS networks for many years, under certain technical and regulatory conditions.

With the technical conditions recommended in this Report, ESOMPs may be treated in a similar fashion to uncoordinated FSS earth stations. This report recommends that ESOMPs should be authorised in the Ka-band frequencies already identified by CEPT administrations for the operation of uncoordinated FSS earth stations with the necessary technical conditions to ensure protection of other satellite and terrestrial services.

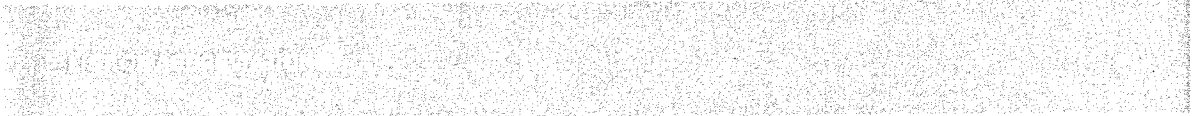
This report identifies certain technical, operational and regulatory requirements to be included in an ECC Decision on Ka-band ESOMPs. Such technical requirements are necessary to ensure, among other things, that ESOMP antennas maintain a high pointing accuracy and do not cause interference to other satellite networks. Furthermore, in some cases - for example where one country has authorised a particular band for uncoordinated FSS earth stations and another has authorised the same band for Fixed Service networks - cross-border interference issues could occur. To address those issues for maritime ESOMPs, a pfd threshold applicable to the coastline of some administrations is necessary. Moreover, to address the same issues for aircraft ESOMPs, a pfd threshold at the ground applicable to the territory of a country operating fixed or mobile systems is needed.

In the downlink FSS bands (17.3-20.2 GHz), ESOMPs would receive the same protection from interference as uncoordinated FSS earth stations. In some instances, this means ESOMPs operate on a non-protected basis.

This report recommends that the new ECC Decision on ESOMPs applies the necessary technical and operational requirements for ESOMPs to ensure no harmful interference is caused to other services and systems. The new ECC Decision should require the exemption of individual licensing for ESOMPs to allow the free circulation of ESOMP terminals.

*[Editorial note: Table of contents to be updated to reflect new section titles and page numbers]*

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Abbreviation	Explanation
AES	Aircraft Earth Station
AMSS	Aeronautical Mobile-Satellite Service
CEPT	European Conference of Postal and Telecommunications Administrations
CPM	Conference Preparatory Meeting (ITU)
ECC	Electronic Communications Committee
ESOMP	Earth Station On Mobile Platform
ESV	Earth Station on board Vessel
ETSI	European Telecommunications Standards Institute
FS	Fixed Service
FSS	Fixed-Satellite Service
GSO	Geostationary Satellite Orbit
G/T	Gain to noise temperature ratio (of a receiving earth station)
HEST	High e.i.r.p. satellite terminals
HDFSS	High-density applications in the fixed-satelliteservice
LEST	Low e.i.r.p. satellite terminals
MS	Mobile Service
MSS	Mobile-Satellite Service
NCMC	Network Control and Monitoring Centre
R&TTE	Radio equipment and telecommunications terminal equipment
VSAT	Very Small Aperture Terminal

## 1 INTRODUCTION

Recently there has been an increase in the use of Fixed Satellite Service networks by earth stations mounted on mobile platforms (ESOMPs) to provide telecommunications services to aircraft, ships, trains and other vehicles using both the C- and Ku-band. As the demand for these systems evolves, service providers are turning to other FSS bands, in particular Ka-band, to meet this growing need.

Advances in satellite antenna technology, particularly the development of stabilized antennas capable of maintaining a high degree of pointing accuracy even on rapidly moving platforms, have already allowed the development of mobile earth stations with very stable pointing characteristics. The pointing accuracy performance of systems currently either in production or under development for use in Ka-band is equal to or better than that currently achieved by Ku-band platforms. These mobile earth stations are designed to operate in the same interference environment and comply with same regulatory constraints as typical uncoordinated FSS earth stations.

WRC-03 adopted technical, operational and regulatory provisions for Aeronautical Mobile Satellite Service (AMSS) systems and Earth Stations on-board Vessels (ESVs) to allow these systems to operate in FSS frequencies in the C- and Ku-bands. Since 2003, numerous networks have been operating successfully under these provisions.

The earth stations on mobile platforms for GSO systems contemplated for the Ka-band are similar to those contemplated in the C- and Ku-bands.

This report examines the requirements for ESOMPs in the Ka-band frequencies, and recommends a regulatory approach which could be adopted by the CEPT. The technical requirements which would need to be included in an appropriate ECC Decision for Ka-band ESOMPs are identified.

This ECC Report covers ESOMPs operating with GSO networks in the Ka-band (17.3-20.2 GHz and 27.5-30 GHz). ESOMPs operating with non-geostationary FSS networks are out of scope of this Report.

## 2 NEED FOR ACCESS BY GSO ESOMPS TO PORTIONS OF THE BANDS 27.5-30.0 GHz AND 17.3-20.2 GHz

ECC Report 152 on the use of the frequency bands 27.5-30.0 GHz and 17.3-20.2 GHz by satellite networks identified a number of reasons, listed below, why some satellite operators and service providers are moving from Ku-band to Ka-band. In fact, some of the reasons, such as the ability to use smaller user terminals, are particularly relevant to the mobile markets served by ESOMPs, where the size and weight of the user antenna are critical considerations.

- Improved spectrum efficiency due to the use of narrow spot beams;
- Better individual coverage and higher gain compared to lower frequency bands;
- Smaller user terminal size due to higher satellite e.i.r.p. and G/T;
- Higher system capacity;
- Greater amount of spectrum available for FSS systems.

Users of ESOMPs on mobile platforms such as aircraft, ships, trains and other vehicles often have no other alternative for broadband access besides satellites. In Europe, for example, while studies are underway to identify spectrum for broadband air-to-ground communications, no such spectrum currently is available to the aeronautical community. Similarly, ships, even those in inland waterways are often beyond the reach of terrestrial wireless networks.

As described in ECC Report 152, Ka-band geostationary FSS systems are now in operation in Europe. The vast majority of these Ka-band FSS systems operate their user-links (i.e. to/from Ka-band LESTs/HESTs) within the 29.5 – 30.0 GHz / 19.7 – 20.2 GHz bands. Ka-band geostationary satellite systems<sup>1</sup> are intended to support the realisation of the EU Digital Agenda 2013 and 2020 objectives for broadband provision to EU customers and so take part to the realisation of EU policy objectives.

There is a significant requirement for additional Ka-band FSS satellite capacity (i.e. Ka-band satellite systems operating in the above 2x500 MHz frequency bands) to be deployed over Europe to support FSS type applications.

### 3 REGULATORY FRAMEWORK FOR ESOMPS

#### 3.1 ITU-R

##### 3.1.1 WRC-03 Decisions on AMSS operating in the 14.0-14.5 GHz band

Extensive work was carried out by ITU-R study groups prior to WRC-03 under Resolution 216 [1] (Rev.WRC-2000), which invited the ITU-R:

"to complete, in time for WRC-03, the technical and operational studies on the feasibility of sharing of the band 14.0-14.5 GHz between the services referred to in considering c) [above] and the aeronautical mobile-satellite service, with the latter service on a secondary basis."

Working Party 4A carried out technical studies which identified several essential requirements that an AMSS system should meet in order to protect FSS. In the case where an AMSS system was implemented within FSS assignments, the ITU-R concluded that the interference levels reaching GSO satellites must at all times be no more than the levels agreed to in coordination. These agreed levels are based on stable antenna platforms with well-defined antenna patterns and aggregate levels that are not to be exceeded. To achieve this goal, the ITU-R identified several requirements that should be placed on AMSS systems to protect FSS:

- Aggregation of off-axis power from multiple aircraft where applicable, for example in systems using spread spectrum multiple access;
- Antenna gain pattern;
- Antenna capture by adjacent satellites;
- Input power to the antenna;
- Antenna mispointing.

These factors formed the basis of a Recommendation on use of this band by AMSS and these were adopted as part of Recommendation ITU-R M.1643 [2]. The CPM Report to WRC-03 concluded that sharing with the FSS was possible in the 14.0-14.5 GHz frequency band, "provided aggregate co-frequency AES emissions in the direction of adjacent satellites are limited to levels that are equal to or less than the levels that have been accepted by other satellite networks."<sup>2</sup>

Because several administrations have implemented Fixed Service (FS) networks in the 14.0-14.5 GHz band, studies were also carried out within former WP-8D to examine the feasibility of sharing between AMSS and the FS. Recommendation ITU-R M.1643 [2] adopted a pfd mask to protect FS networks in the 14.0-14.5 GHz band. In practice, sharing between AMSS and FS networks operating in the 14.0-14.5 GHz band has proven to be more difficult when the services are operating in the same geographic area.

<sup>1</sup>Such as Avanti's HYLAS-1 and Eutelsat's KA-SAT satellite systems.

<sup>2</sup>Report to the 2003 World Radiocommunication Conference (WRC-03) at 2.4.2.

### 3.1.2 WRC-03 Decisions on ESVs operating at C-Band and Ku-Band

In the case of earth Stations on board Vessels, WP-4-9S was the lead working party for studies. Unlike AMSS, ESVs were treated from the start as operating in the FSS. The CPM report to WRC-03 concluded that ESVs could protect other FSS networks so long as they complied with the off-axis e.i.r.p. limits given in Recommendation ITU-R S.524 [3]. WRC-03 added a new footnote in Article 5 to clarify that ESVs be considered as operating in the FSS:

**“5.457A** In the bands 5 925-6 425 MHz and 14.0-14.5 GHz, earth stations located on board vessels may communicate with space stations of the fixed-satellite service. Such use shall be in accordance with Resolution 902 [5] (WRC-03).”

WRC-03 adopted Resolution 902 [5] (WRC-03), which included technical and operational constraints to avoid interference from ESVs into terrestrial networks.

Resolution 902 [5] is likely to be revised at WRC-15 under AI 1.8 of WRC-15 and Resolution COM 6/14 [4] of WRC-12. There is no linkage of the Resolution 902 [5] to the Ka Band and hence, no impact is expected on the ESOMP harmonisation measure within the CEPT.

### 3.1.3 WRC-03 Decisions on HDFSS

WRC-03 adopted Resolution 143 [6] (Rev.WRC-07) “Guidelines for the implementation of high-density applications in the Fixed-Satellite Service in frequency bands identified for these applications”. As described by Resolution 143 [6] (Rev.WRC-07), “HDFSS are characterized by flexible, rapid and ubiquitous deployment of large numbers of cost-optimized earth stations employing small antennas and having common technical characteristics.”

Resolution 143 [6] (Rev.WRC-07) recognizes “that co-frequency sharing between transmitting HDFSS earth stations and terrestrial services is difficult in the same geographical area” and that administrations implementing HDFSS should take into account “that HDFSS deployment will be simplified in bands that are not shared with terrestrial services.”

WRC-03 adopted a footnote which identified bands for use by HDFSS:

**“5.516B** the following bands are identified for use by high-density applications in the fixed-satellite service:

17.3-17.7 GHz (space-to-Earth) in Region 1,  
 18.3-19.3 GHz (space-to-Earth) in Region 2,  
 19.7-20.2 GHz (space-to-Earth) in all Regions,  
 39.5-40 GHz (space-to-Earth) in Region 1,  
 40-40.5 GHz (space-to-Earth) in all Regions,  
 40.5-42 GHz (space-to-Earth) in Region 2,  
 47.5-47.9 GHz (space-to-Earth) in Region 1,  
 48.2-48.54 GHz (space-to-Earth) in Region 1,  
 49.44-50.2 GHz (space-to-Earth) in Region 1,

and

27.5-27.82 GHz (Earth-to-space) in Region 1,  
 28.35-28.45 GHz (Earth-to-space) in Region 2,  
 28.45-28.94 GHz (Earth-to-space) in all Regions,  
 28.94-29.1 GHz (Earth-to-space) in Region 2 and 3,  
 29.25-29.46 GHz (Earth-to-space) in Region 2,  
 29.46-30 GHz (Earth-to-space) in all Regions,  
 48.2-50.2 GHz (Earth-to-space) in Region 2.



This identification does not preclude the use of these bands by other Fixed-Satellite Service applications or by other services to which these bands are allocated on a co-primary basis and does not establish priority in these Radio Regulations among users of the bands. Administrations should take this into account when considering regulatory provisions in relation to these bands. See Resolution 143 [6] (Rev.WRC-07)."

### 3.1.4 Study Group 4 Work on Ka-band ESOMPs

ITU-R SG-4 at its meeting on 29–30 Sep 2011 in Geneva adopted a draft new Report ITU-R S.2223 [7]. This Report identifies the technical and operational requirements for the operation of ESOMPs in Ka-band FSS networks.

## 3.2 CEPT

### 3.2.1 CEPT Regulatory Framework for HDFSS

As a result of the WRC-03 identification of bands for HDFSS, the ECC/DEC/(00)09 [8] was replaced by ECC/DEC/(05)01 [9] which implements a band plan in the 27.5-29.5 GHz that segmented the band between FS and FSS. In addition, the ECC adopted ECC/DEC/(05)08 [10] which makes available for HDFSS deployment subject to market demand the following bands:

- 17.3-17.7 GHz and 19.7-20.2 GHz bands (space-to-Earth);
- 29.5-30.0 GHz band (Earth-to-space).

ECC/DEC(06)02 [11] and ECC/DEC(06)03 [12] were also developed, providing exemption from individual licensing of Low e.i.r.p. Satellite Terminals (LESTs) and High e.i.r.p. Satellite Terminals (HESTs). The exemption requires the terminals to have an e.i.r.p. not exceeding 34 dBW for LESTs and 50-60 dBW for HESTs.

The LEST and HEST Decisions do not contain specific off-axis e.i.r.p. limits. Instead, they require compliance with ETSI EN 301 459 [16] or ETSI EN 301 428 [17] or equivalent technical specifications. These standards contain requirements and test methods for ensuring compliance with the off-axis e.i.r.p. limits contained in Recommendation ITU-R S.524 [3].

By a Decision taken on 18 March 2005 (ECC/DEC/(05)01 [9]), the CEPT administrations, in conjunction with industry, decided to "segment" the frequency band 27.5-29.5 GHz between FS and FSS (uncoordinated FSS earth stations). The frequency bands 27.5-27.8285 GHz, 28.4445-28.8365 GHz and 29.4525-29.5 GHz are designated for the use of uncoordinated FSS earth stations (including transportable terminals). This represents 768 MHz for uncoordinated FSS earth stations: one block of 328.5 MHz, one block of 392 MHz and one block of 47.5 MHz.

The band 17.3-17.7 GHz is globally allocated to the FSS (Earth-to-space) on a primary basis in the ITU Radio Regulations, limited to feeder links for the BSS and is subject to ITU Radio Regulations Appendix 30A [18]. Regarding the potential impact from BSS feeder links (Earth-to-space) into FSS ESOMP (space-to-Earth), when for example an aircraft mounted ESOMP flies through a BSS feeder link beam, ESOMP shall not claim protection from BSS feeder links and shall not put any constraints on BSS feeder links (reference is made to ITU footnote 5.516A). This is reflected in Decides 4 of ECC/DEC/(05)08 [10] for HDFSS.

The frequency band 28.8365-28.9485 GHz is designated for the use of uncoordinated FSS earth stations without prejudice to the FS systems licensed in this band in some countries before the date of adoption of this Decision. This represents an additional 112 MHz within which no new FS stations can be deployed except in countries which make use of Decides 2) and 4) of ECC/DEC/(05)01 [9].

As of February 2012, this Decision has been declared as having been implemented by 23 CEPT administrations (4 *Not Implemented*, 5 *Implementation Under Study*, 16 *No Information*). Given the transnational nature of satellite services, these satellite systems cannot be deployed in CEPT unless a major part of the CEPT administrations implement ECC/DEC/(05)01 [9].

### 3.2.2 CEPT Regulatory Framework for AESs and ESVs

Under established international law, national sovereignty over radio spectrum resources extends above the national territory up to the limits of the atmosphere. Any aeronautical earth station operating over the territory of a country must therefore be duly authorised by that country. Under maritime law, national sovereignty extends out 12 nautical miles from the low-water mark of the coast. Similarly, any earth stations on vessels operating in territorial waters must also be duly authorised.

Three ECC Decisions were adopted following WRC-03 to allow for the free circulation of Aircraft Earth Stations and ESVs. ECC/DEC/(05)09 [13] and ECC/DEC/(05)10 [14] were adopted for C- and Ku-bands ESVs while ECC/DEC/(05)11 [15] was adopted for Ku-band Aircraft Earth Stations (AESs).

All three ECC Decisions adopted technical, operational and regulatory requirements that ensured that the ESVs and AESs had the same interference characteristics as a typical uncoordinated FSS earth station. Since the adoption of these ECC Decisions, hundreds of ESVs and AESs have operated successfully in European waters and airspace. Similar conditions could be adopted and applied to the terminals operating on mobile platforms in the parts of the Ka-band identified for uncoordinated FSS operations.

### 3.2.3 Applicability of Previous Frameworks to ESOMPs in Ka-band

The previous frameworks adopted for AESs and ESVs in C- and Ka-band only apply to GSO FSS.

ESOMPs for GSO systems operating in the Ka-band present a sharing environment similar to that found in the 14.0-14.5 GHz band for AMSS, ESV and VSAT networks. Each of these types of networks is characterized by large numbers of small, technically identical earth stations which are not coordinated on an individual basis.

Earth stations on mobile platforms are also similar to AMSS, ESV and VSAT networks in that sharing between such earth stations and co-frequency FS networks which are located in the same geographic area is difficult for the three types of earth stations because they could be located anywhere within the operational area of such an FS network.

Technical, operational and regulatory requirements have been adopted within the ITU-R to ensure that the ESVs and AESs operating between 14.0 GHz and 14.5 GHz have the same interference characteristics as typical FSS earth stations. Regulators have ensured that Ku-band ESVs and AESs operate only in bands which have no use or limited use by terrestrial services. Since the adoption of these regulations, hundreds of AESs and ESVs have operated successfully worldwide on aircraft and ships.

Taking into account the success of the previous ECC Decisions, a similar regulatory framework could be adopted in the Ka-band. The suggested Ka-band frequencies within which ESOMPs may operate are those identified for uncoordinated FSS earth stations, such as those identified in ECC/DEC/(05)01 [9] and ECC/DEC(05)08 [10], thereby limiting potential interference to terrestrial services only to some instances of cross-border interference. Any technical requirements needed to prevent the risk of unacceptable interference to other services should be developed to ensure that ESOMPs operating in the Ka-band frequencies identified for uncoordinated FSS operations have the equivalent interference characteristics as typical uncoordinated FSS earth stations and do not cause unacceptable interference to any terrestrial services operating in the same bands.

Any regulatory framework adopted in these bands to accommodate ESOMPs should also ensure that it does not prejudice the use of these bands by other FSS and terrestrial applications.

## 4 CONSIDERATIONS ABOUT THE OPERATION OF ESOMPS IN FSS NETWORKS

In considering what regulatory provisions should be adopted for ESOMPs, several options were available. One option was to treat ESOMPs as an application in the Mobile Satellite Service (MSS), which would need a new MSS allocation in the FSS band(s). Another was to change the definition of FSS to include service to mobile platforms. A third option, which has been finally endorsed, was to treat ESOMPs as an application in the FSS. ESOMPs represent one of many examples of service convergence that CEPT administrations are confronting. In the past, any earth station that moved while transmitting was considered to be part of the

Mobile Satellite Service (MSS). Historically, there were significant technical differences between the MSS and FSS. MSS antennas were often non-directional, making co-frequency sharing with other MSS systems difficult. MSS systems operated in distinct bands that were much lower in frequency than FSS systems. Changes in technology have allowed ESOMPs to operate in bands allocated to the FSS.

The issue of convergence is a serious matter for CEPT administrations to consider since it is raised both in satellite and terrestrial services. The approach adopted by the ECC for ESOMPs should be neutral to both existing and new users. The ECC should also strive to the extent possible to adopt a consistent approach both for satellite and terrestrial services.

Regarding the service classification of ESOMPs, several considerations should be taken into account:

- ESOMPs are assumed to be designed and operated in compliance with the existing rules for FSS. No rules (such as off-axis e.i.r.p. limits) exist for MSS in bands above 17 GHz, making implementation as MSS problematic;
- Requiring compliance with existing FSS rules provides FSS operators with certainty that existing systems will be protected;
- While MSS allocations exist in the bands above 17 GHz, the majority of these are secondary allocations or reserved for non-civilian applications. In Region 1 / Europe 2x100 MHz of co-primary spectrum for MSS is available at 29.9-30.0 GHz / 20.1-20.2 GHz. These allocations are not considered adequate by ESOMP system operators for four reasons:
  - 1) if ESOMP networks were required to operate only in the 2x100 MHz allocated to the MSS on a co-primary basis with the FSS, the result would in any case be that they should coordinate with existing and future FSS networks, leading to the same technical constraints as if they were treated as FSS. Hence, there is no benefit to other services or systems by operating ESOMPs in a smaller frequency band;
  - 2) the key-feature of the systems that are planned to be launched soon is that they will be capable of offering to European citizens travelling on mobile platforms connectivity and network performance similar to those they can experience with terrestrial wired and wireless solutions, where data rates of up to 100 Mbit/s are planned. If only 2x100 MHz were available, allowing for the need to assign different frequencies in adjacent beams, only a few 10s of MHz could be made available in each beam, shared among multiple users within it. To allow data rates comparable to terrestrial systems in a satellite system, with sufficient users to support the business case for a satellite network, at least 2x500 MHz of available spectrum, would be required.
  - 3) The capital and operating costs of an ESOMP network operating in 2x100 MHz would be similar to those for an ESOMP network operating in, for example, 2x500 MHz. However the capacity of the system (in terms of number of users of comparable data requirements) is increased five-fold. Hence, the cost of the service to end users is significantly lowered if the system can operate in a larger frequency band, benefiting both the operator and the end users.
  - 4) All systems currently planning to provide ESOMP services in Europe would be capable of operating at least in 2x500 MHz spectrum.
- Treating ESOMPs as FSS provides ESOMP operators and regulators with a well-established and proven set of rules for authorizing these earth stations.
- GSO ESOMPs must comply with same off-axis e.i.r.p. limits as typical uncoordinated FSS earth stations
- In many planned networks, ESOMPs will operate on the same networks and frequencies as stationary earth stations. If ESOMPs are classified as MSS and stationary earth stations are classified as FSS, there may be situations where terminals using the same network and frequencies must comply with different rules simply because one type is in motion and the other is not.

Therefore, so long as GSO ESOMPs on an aggregate basis per GSO network are designed and operated in compliance with the same requirements (such as off-axis e.i.r.p. limits) placed on uncoordinated FSS earth stations, no sharing issues exist between ESOMPs and other FSS networks. Within the CEPT framework,

this means that ESOMPs may be treated as typical uncoordinated FSS earth stations and operate in bands available to them.

## 5 TECHNICAL CONSIDERATIONS ON ESOMPS

### 5.1 SHARING WITH FS - DIFFERENCE BETWEEN TYPICAL UNCOORDINATED FSS EARTH STATIONS AND ESOMPS

As a general consideration, it should be noticed that the work done within both the ITU-R and CEPT has shown that co-frequency sharing between uncoordinated FSS earth stations and terrestrial networks in the same geographic area is difficult to accomplish. The same conclusion holds true for ESOMPs. Since implementation of ESOMPs is only contemplated in bands where uncoordinated FSS earth stations are allowed, however, ESOMPs should not represent any increased interference risk to FS or Mobile Service (MS) networks beyond that presented by uncoordinated FSS earth stations. If administrations conclude that implementation of uncoordinated FSS earth stations is permissible in a band, introduction of GSO ESOMPs in the same band should not raise any additional interference concern to FS or MS networks.

There is the possibility that neighbouring countries could implement different allocations in the 27.5-29.5 GHz and 17.3-19.7 GHz bands either to uncoordinated FSS or to FS applications. The aim of this section is therefore to address any sharing issue that could arise from such a scenario.

#### 5.1.1 ESOMPS INSTALLED ON LAND PLATFORMS

ESOMPs installed on land platforms do not differ substantially from typical uncoordinated stationary FSS stations. It should be noticed that Recommendation ITU-R SF.1707 [20] already provides methods and means to facilitate the implementation of large numbers of earth stations operating in the Fixed-Satellite Service (FSS) in areas where terrestrial services are also deployed. This Recommendation could therefore be considered a basis for coordination procedures between neighbouring administrations implementing different allocations in this band.

Section 7 of this document provides an overview of a possible approach for resolving cross-border coordination requirements.

#### 5.1.2 ESOMPS INSTALLED ON MARITIME PLATFORMS

ESOMPs on vessels or other mobile maritime platforms have the potential to cause interference to any FS or MS applications deployed in parts of the band 27.5-29.5 GHz. FS or MS systems operating near the coast could receive interference from a maritime ESOMP, which could be operating in the territorial waters of another administration, or in non-territorial waters (i.e. beyond 12nm from the low-water mark of the concerned administration).

A pfd threshold combined with a suitable mandatory automatic mechanism to regulate the ESOMP power, at a given position, could be developed that would apply to the coast of a country and would provide adequate protection to FS or MS systems deployed. The pfd threshold could be exceeded only if the concerned administration agreed. The ESOMP would be able to take into account its actual antenna gain pattern, its pointing and transmitter power to comply with the pfd threshold.

It is recommended to use a pfd threshold at the coastline, taking the same method and assumptions as in Recommendation ITU-R SF.1650 dealing with ESV in the bands 5 925-6 425 MHz and 14-14.5 GHz.

In the case of ESOMPs operating in the band 27.5-29.5 GHz, this pfd threshold is  $-109$  dBW/m<sup>2</sup> expressed in a reference bandwidth of 14 MHz at a height of 20 m above sea level. In addition, the percentage of time that should be used in the propagation model when assessing compliance with this pfd threshold should be 0.007%.

The actual frequency ranges used by administrations for FS applications would need to be identified and made available to the operators of maritime ESOMPs so that any pfd restrictions are applied only on the necessary frequencies.

### 5.1.3 AIRCRAFT-MOUNTED ESOMPS

ESOMPs installed on aircrafts should be treated differently, because of the particular geometrical scenario in which they operate. Actually, since the earth station is normally not operating on the ground, but at a higher altitude<sup>3</sup>, the same cross-border sharing considerations as for other types of earth stations cannot be applied to aircraft-mounted terminals.

[There are currently ongoing studies addressing this matter and provisional results seem to indicate that in the worst case scenario, and when considering FS stations with characteristics reflecting real deployed networks, aircraft-mounted ESOMPs operating at an altitude higher than a certain limit do not cause and do not suffer from any harmful interference, either when the aircraft is flying near or over a country which has allowed the deployment of FS networks operating in the same band.

[Another study [ref] suggested that there was the potential for interference into the FS which could be significantly above the threshold for harmful interference]

It should also be noticed that when the ESOMP terminal is operating with the maximum allowed e.i.r.p., the provisional pfd threshold is met down to a certain aircraft altitude, well below that of the cruise phase of a typical flight; therefore, the provisional results suggest that interference may occur only during the take-off and landing phases of a flight.

A possible cross-border coordination approach covering this type of ESOMPs is then discussed in Section 7 of this document.]

*[Comment: this section will need to be revised to reflect the conclusions of the studies in SE40 on aircraft-mounted ESOMPs]*

Comment [YUN1]: Text will be replaced with the final findings from SE40.

## 5.2 ETSI STANDARDS

Under the R&TTE Directive, all radio equipment placed on the market in the EU must meet the essential requirements defined in the Directive. In most cases, the requirements are met by compliance with the relevant ETSI harmonised standard. Compliance with ETSI standards is also an essential element of the licensing regimes in CEPT countries.

The specific ETSI standard with which ESOMPs must comply with will need to be developed and be noted in any ECC Decision adopted for ESOMPs. ETSI has been tasked with developing a new standard (draft ETSI EN 303 978 [21]) for ESOMPs operating in the bands between 17.3-20.2 GHz and 27.5- 30 GHz.

## 5.3 OTHER TECHNICAL REQUIREMENTS FOR KA-BAND ESOMPS

To address potential interference with other co-frequency GSO FSS networks, ESOMPs should comply with the same constraints, such as off-axis e.i.r.p. limits, as other FSS earth stations. Such limits would be determined by both the inter-system satellite coordination agreements and the limits in the ETSI standard. In considering aggregate interference levels, it should be noted that there is no evidence that FSS systems supporting ESOMPs will have more spot beams or better frequency reuse than other FSS systems, so by applying existing FSS rules at least the same level of protection will be provided to neighbouring satellite networks as is currently the case. These requirements will ensure that such earth stations are essentially equivalent to stationary FSS earth stations from the perspective of potential uplink interference to other satellite networks.

<sup>3</sup> In the case where administrations may also choose to allow operation of aircraft mounted ESOMPs on the ground at airports, the cross-border sharing issues would be the same as with other earth stations.

The level of protection provided to ESOMPs from other satellite networks will be determined through coordination among the concerned administrations/satellite operators following the same rules and processes as those applicable to all FSS networks. ESOMP terminals will be protected to the same extent as FSS earth stations included in the inter-system coordination. As there are no limitations on antenna sizes or patterns in these bands for FSS today, there is also no need to define any such additional requirements for ESOMPs.

Realising that earth stations on mobile platforms operate in a dynamic environment, it is important to address this aspect in specifying an essential set of technical and operational requirements. The design, coordination and operation of earth stations on mobile platforms should be such that, in addition to the static requirements discussed above, the interference levels generated by such earth stations account for the following factors:

- Mispointing of the earth station antenna. Where applicable, this includes, at least, motion-induced antenna pointing errors, effects caused by bias and latency of their pointing systems, tracking error of open or closed loop tracking systems, misalignment between transmit and receive apertures for systems that use separate apertures, and misalignment between transmit and receive feeds for systems that use combined apertures
- Variations in the antenna pattern of the earth station antenna. Where applicable, this includes, at least, effects caused by manufacturing tolerances, ageing of the antenna and environmental effects. Networks using certain types of antennas, such as phased arrays, should account for variation in antenna pattern with scan angles (elevation and azimuth). Networks using phased arrays should also account for element phase error, amplitude error and failure rate.
- Variations in the transmit e.i.r.p. from the earth station. Where applicable, this includes, at least, effects caused by measurement error, control error and latency for closed loop power control systems, and motion-induced antenna pointing errors.

Earth stations on mobile platforms that use closed loop tracking of the satellite signal need to employ an algorithm that is resistant to capturing and tracking adjacent satellite signals. Such earth stations must be designed and operated such that they immediately inhibit transmission when they detect that unintended satellite tracking has occurred or is about to occur. Such earth stations must also immediately inhibit transmission when their mispointing would result in off-axis e.i.r.p. levels in the direction of neighbouring satellite networks above those of other specific and/or typical FSS earth stations operating in compliance with Recommendation ITU-R S.524 [3] or with any other limits coordinated with neighbouring satellite networks. These earth stations also need to be self-monitoring and, should harmful interference to FSS networks be detected, must automatically mute any transmissions.

In addition to these autonomous capabilities, earth stations on mobile platforms will need to be subject to the monitoring and control by a Network Control and Monitoring Center (NCMC) or equivalent facility and these earth stations should be able to receive at least "enable transmission" and "disable transmission" commands from the NCMC. It will need to be possible for the NCMC to monitor the operation of the earth station to determine if it is malfunctioning.

Earth stations affixed to mobile platforms that comply with these requirements will not create unacceptable levels of interference to other FSS systems and terminals operating in the same bands or sub-bands. It is assumed that any ESOMP operating in the territory of a CEPT administration will have to comply with any relevant CEPT requirements, e.g. a new ECC Decision. Any use of non-compliant equipment would be unlawful and subject to national enforcement provisions and sanctions.

The level of protection provided to ESOMPs from other satellite networks will be determined through coordination among the concerned administrations/satellite operators following the same rules and processes as those applicable to all FSS networks. ESOMP terminals will be protected to the same extent as FSS earth stations included in the inter-system coordination. As there are no limitations on antenna sizes or on the patterns in these bands for FSS today, there is no need to define such requirements for ESOMPs.

When considering the level of protection provided to other satellite networks from ESOMPs, technical requirements should adequately be defined in order to avoid that poorly pointed or poorly controlled Ka-band terminals (whether fixed or mobile) would cause unacceptable interference to adjacent Ka-band GEO FSS satellites and so prejudice the provision of Ka-band FSS services to European customers. Furthermore, the use of low-gain antennae and their potential impact on other satellite networks should not

be an issue, since any terminal, in order to be able to operate, shall be compliant with the relevant Harmonised ETSI Standard which will include an off-axis e.i.r.p. limit and the other Recommendations and coordination requirements applicable to FSS networks.

**6 REGULATORY FRAMEWORK NEEDED TO TREAT AND OPERATE ESOMPS AS FSS IN THE BANDS 27.5-30.0 GHz AND 17.3-20.2 GHz**

Under the recommended approach, a new ECC Decision would be developed to authorise the use of ESOMPs in the Ka-band frequencies, without any change to the Radio Regulations. The Decision would provide a framework for ESOMPs to operate in FSS networks and would establish technical and regulatory requirements. While, for ESOMPs terminals installed on land, authorisation is managed by the single administrations, in the case of ESOMPs on maritime platforms, a process based on mutual recognition of licences and free circulation may be considered. When they are operated under certain technical conditions, the same regime could also apply to ESOMPs installed on aeronautical platforms. Figure 1 outlines the process through which a new ECC Decision (and ETSI Standard) could be used for authorising ESOMPs to operate in those parts of the Ka-band allocated to uncoordinated FSS earth Stations.

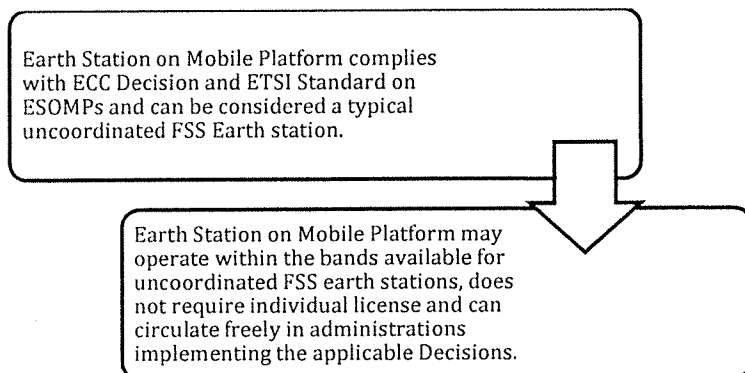


Figure 1: Proposed treatment of ESOMPs in CEPT

The prior ECC Decisions on AESs and ESVs (ref, ECC/DEC/(05)09 [13], ECC/DEC/(05)10 [14] and ECC/DEC/(05)11) [15] as well as the ITU-R Resolutions and Recommendations on which they are based, provide a basis for developing the requirements for inclusion in such a new Decision. The following table summarises the requirements from these Decisions, Resolutions and Recommendations that may be used for developing criteria for determining whether a mobile platform communicating with an FSS network may be treated as a typical uncoordinated FSS earth station.

Table 1: Requirements for C-band and Ku-band ESOMPs to be considered for inclusion in new Regulations on Ka-band ESOMPs

Requirement	Source
[The network] must operate under the control of a network control facility.	Recommendation ITU-R M.1643 [2]
[The network] should be coordinated and operated in such a manner that the aggregate off-axis e.i.r.p. levels produced by all co-frequency [Earth stations] within the network are no greater than the interference levels that have been published and coordinated for the specific and/or typical Earth station(s) pertaining to the FSS networks where FSS transponders are used.	Recommendation ITU-R M.1643 [2] Resolution 902 [5]  Recommendation ITU-R S.524 [3]
The design, coordination and operation of the Earth stations should take into account:	
- Antenna mispointing	Recommendation ITU-R M.1643 [2]
- Variations in antenna pattern of the Earth station	Recommendation ITU-R M.1643 [2]
- Variations in the transmit e.i.r.p. from the Earth station	Recommendation ITU-R M.1643 [2]
[Earth stations] that use close loop tracking of the satellite signal need to employ an algorithm that is resistant to capturing and tracking adjacent satellite signals. [Earth stations] must immediately inhibit transmissions when they detect that unintended satellite tracking has happened or is about to happen.	Recommendation ITU-R M.1643 [2]
The [Earth station] should be self-monitoring and, should a fault which can cause harmful interference to FSS networks be detected, the [Earth station] must automatically mute its transmissions.	Recommendation ITU-R M.1643; [2] Resolution 902 [5]

Some of the above requirements are expected to be contained in the ETSI standard for Ka-band ESOMPs. Other requirements may need to be included in the ECC Decision.

Instead of defining distinct decisions for aeronautical and maritime earth stations operating in the Ka-band, more general provisions would be developed defining the conditions under which these earth stations could be treated as ESOMPs, operating under the same conditions as typical uncoordinated FSS earth stations. Maritime and aeronautical ESOMPs would then be required to follow similar regulatory requirements to those applicable to typical uncoordinated FSS Earth stations operating in the band in order to achieve free circulation for aero and maritime terminals and licence exemption or general authorisation for land based terminals.

This approach provides a more simplified and consistent regulatory treatment of such terminals since it requires them to comply with the same type of requirements as the fixed FSS terminals they are designed to emulate.



## 7 CROSS-BORDER COORDINATION

*[to be reviewed on the basis of the SE40 studies]*

The implementation of ESOMPs in the frequency bands 27.5-30.0 GHz and 17.3-20.2 GHz will be limited to the portions of these bands in which uncoordinated FSS earth stations are allowed. The Ka-band frequencies identified for uncoordinated FSS earth stations have been harmonised throughout CEPT by ECC Decisions ECC/DEC/(05)01 [9] and ECC/DEC/(05)08 [10]. Hence, in the general case, the bands available for ESOMPs will be common throughout Europe, and there would be no cross-border interference issues. However in some cases, for example on the borders of CEPT, a band identified for uncoordinated FSS earth stations by one administration, could be used for terrestrial services by a neighbouring administration.

The issue of potential cross-border interference caused by the use of uncoordinated FSS Earth stations in one country into FS stations in a neighbouring country has been addressed by Recommendation ITU-R SF.1707 [20] which, among other things, provides an example, based on worst case assumptions, of how to develop a single transmit and a single receive coordination distance for consideration as a mean to ease bilateral agreements for a given geographical area. Also, Recommendation ITU-R SF.1719 [22] has examined interference using more typical assumptions and indicates that far smaller separation distances are applicable in most practical cases.

When assessing the interference generated by aircraft-mounted ESOMPs, the studies mentioned in [Section 6.2.2] of this document indicate that the potential area where any FS stations might be impacted is when the aircraft is below a certain altitude, which would typically be only within the vicinity of airports for take-off and landing. The use of the proposed pfd mask would allow administrations to authorise the operation of aircraft-mounted ESOMPs in bands for which neighbouring countries might operate terrestrial services.

In any case, it should be noted that the possibility of interference between FS stations and aircraft-mounted ESOMPs in the bands 27.5-29.5 GHz and 17.3-19.7 GHz, beyond that posed by stationary uncoordinated FSS earth stations, can be considered highly unlikely since it can occur only if the following circumstances are present simultaneously:

1. FS stations in one country are deployed near the border of a neighbouring country that allows aircraft-mounted ESOMPs;
2. The FS stations are not already limited by existing uncoordinated FSS earth stations deployed in the neighbouring country;
3. The FS stations are deployed near an airport located in the neighbouring country;
4. The neighbouring country allows aircraft-mounted ESOMPs to operate below a minimum altitude;
5. The FS stations are pointing North (aircraft-mounted ESOMPs operating in Europe will never point towards the North, so there will never be a case of main beam to main beam interference from an aircraft-mounted ESOMP into a South-pointing FS station).

If all these conditions exist, administrations could still define a protection area around airports in order to protect FS stations in neighbouring countries.

## 8 CONCLUSIONS

Ka-band FSS networks capable of providing ESOMP services in Europe are already in operation and operators are planning to introduce ESOMP services in Europe in the near future.

This report has examined possible regulatory approaches to allow the CEPT administrations to authorise ESOMPs to operate in FSS networks in the Ka-band. It is recommended that a new ECC Decision be developed, with the following elements:

- Authorising the use of ESOMPs operating in FSS networks in the Ka-band frequencies designated by administrations for uncoordinated FSS earth stations.
- Establishing the technical and operational requirements for ESOMPs to avoid causing interference to other services and systems.

- To establish the free circulation of ESOMPs, subject to national licensing requirements.

Taking into account that ESOMPs networks are planned to be launched in a short time frame, it is in the interest of operators, users and the CEPT regulators to have an agreed framework in place to harmonize their operations as soon as possible.

ANNEX 1: LIST OF REFERENCE

- [1] Resolution 216 (Rev.WRC-2000)
- [2] Recommendation ITU-R M.1643
- [3] Recommendation ITU-R S.524
- [4] Resolution COM 6/14 of WRC-12
- [5] Resolution 902 (WRC-03) Provisions relating to earth stations located on board vessels which operate in Fixed-Satellite Service networks in the uplink bands 5925-6425 MHz and 14.0-14.45 GHz
- [6] Resolution 143 (Rev.WRC-07) Guidelines for the implementation of high-density applications in the Fixed-Satellite Service in frequency bands identified for these applications
- [7] Report ITU-R S.2223
- [8] ECC/DEC/(00)09 on harmonised frequencies, technical characteristics and exemption from individual licensing of Short Range Devices used for Movement Detection and Alert operating in the frequency band 2400 - 2483.5 MHz
- [9] ECC/DEC/(05)01 on the use of the band 27.5-29.5 GHz by the Fixed Service and uncoordinated Earth stations of the Fixed-Satellite Service (Earth-to-space)
- [10] ECC/DEC/(05)08 on the availability of frequency bands for high density applications in the Fixed-Satellite Service (space-to-Earth and Earth-to-space)
- [11] ECC/DEC(06)02 on Exemption from Individual Licensing of Low e.i.r.p. Satellite Terminals (LEST) operating within the frequency bands 10.70–12.75 GHz or 19.70–20.20 GHz space-to-Earth and 14.00–14.25 GHz or 29.50–30.00 GHz Earth-to-Space
- [12] ECC/DEC(06)03 on Exemption from Individual Licensing of High e.i.r.p. Satellite Terminals (HEST) with e.i.r.p. above 34 dBW operating within the frequency bands 10.70 - 12.75 GHz or 19.70 - 20.20 GHz space-to-Earth and 14.00 - 14.25 GHz or 29.50 - 30.00 GHz Earth-to-space
- [13] ECC/DEC/(05)09 on the free circulation and use of Earth Stations on board Vessels operating in Fixed Satellite Service networks in the frequency bands 5 925-6 425 MHz (Earth-to-space) and 3 700-4 200 MHz (space-to-Earth)
- [14] ECC/DEC/(05)10 on the free circulation and use of Earth Stations on board Vessels operating in Fixed Satellite Service networks in the frequency bands 14-14.5 GHz (Earth-to-space), 10.7-11.7 GHz (space-to-Earth) and 12.5-12.75 GHz (space-to-Earth)
- [15] ECC/DEC/(05)11 on the free circulation and use of Aircraft Earth Stations (AES) in the frequency bands 14-14.5 GHz (Earth-to-space), 10.7-11.7GHz (space-to-Earth) and 12.5-12.75 GHz (space-to-Earth)
- [16] ETSI EN 301 459 Harmonised EN for Satellite Interactive Terminals (SIT) and Satellite User Terminals (SUT) transmitting towards satellites in geostationary orbit in the 29,5 GHz to 30,0 GHz frequency bands covering essential requirements
- [17] ETSI EN 301 428 Harmonised EN for Very Small Aperture Terminal (VSAT); Transmit-only, transmit/receive or receive-only satellite earth stations operating in the 11/12/14 GHz frequency bands covering essential requirements
- [18] ITU Radio Regulations Appendix 30A xxxxx
- [19] ITU footnote 5.516A In the band 17.3-17.7 GHz, earth stations of the Fixed-Satellite Service (space-to-Earth) in Region 1 shall not claim protection from the broadcasting-satellite service feeder-link earth stations operating under Appendix 30A, nor put any limitations or restrictions on the locations of the broadcasting-satellite service feeder-link earth stations anywhere within the service area of the feeder link. (WRC-03)
- [20] Recommendation ITU-R SF.1707
- [21] draft ETSI EN 303 978
- [22] Recommendation ITU-R SF.1719

# **Exhibit D**

## Minutes

### FM PT44 21<sup>st</sup> meeting

Venue: Helsinki, Finland

13-15 June 2012

#### 1. Opening of the meeting

- (1) The Chairman (Mr Azzarelli (UK)), opened the 21<sup>st</sup> meeting of the project team, welcomed the FM44 participants and thanked the Finnish administration for inviting the meeting. The meeting was attended by 30 participants, including representatives from 10 Administrations, Industry and the ECO.
- (2) Mr Pikkarainen from Ficora welcomed the project team to Helsinki and gave some details about the practical arrangements. Also, he provided some news on some changes happening in FICORA due to the closure of the TV license fees department.
- (3) The participants introduced themselves. Later, Mr. Weber also informed the meeting that since Transfinite are not part of any delegation and as they are not an ETSI member, they should have requested the Chairman for an invitation to attend the meeting and for permission to input a document. The meeting participants did not oppose for Transfinite to be in the meeting and the UK delegation offered for them to be on their delegation if they wished so. Mr. Pahl accepted to participate as part of the UK delegation.
- (4) A list of participants is provided in Annex 1bis.

#### 2. Adoption of the agenda

- (5) The draft Agenda was available as document **FM44(12)019r2** which was to be uploaded once approved by the meeting.
- (6) The Chairman mentioned that he received one late document from Transfinite, **FM44(12)INFO006R1**, which will be introduced in AI 6.3 (ESOMPs). This was later withdrawn.
- (7) The Chairman also introduced the time schedule of the meeting which was also agreed.
- (8) **FM44 then approved the Agenda** and was uploaded as **FM44(12)019r3** with the modifications agreed in the meeting. The Agenda is provided in **Annex 1**.
- (9) A list of contributions submitted to the meeting is given in **Annex 2**.
- (10) A list of output contributions are given in **Annex 3**.

#### 3. Consideration of relevant parts of the 74<sup>th</sup> WG FM Report

- (11) The Chairman provided an extract of the WGFM minutes in document **FM44(12)020**, and presented relevant parts of the document of interest to the FM44. The Chairman highlighted the following:

- **ECC/DEC/(12)AA:** With the adoption of ECC/DEC/(12)AA by the ECC (June 2012), and the consequential provision of withdrawing ECC Decisions (07)04 and (07)05, FM44 will have no ERC/ECC Decision to review in 2012;
- **For the ESOMPs:**
  - For the **ECC Report on ESOMPs(FM44(12)14 Annex 6)** WGFM made no comments;
  - For the **ECC Decision on ESOMPs (FM44(12)14 Annex 7)**, where discussions were raised (i) on applicable frequencies in the Decides, (ii) Decides 2, (iii) some of the wording in its Annex 1. For this WGFM provided guidelines to FM44, through their output document **FM(12)084 Annex 8**, as to progress the work. This was considered and the meeting instructed the drafting group to consider this document.
  - WG FM noted that for the **harmonised ETSI standard on ESOMPs**, a LS was sent by FM44 to TC-ERM for TC-SES to consider deletion of the reference to the band 21.4-22 GHz;
- **Decision (09)02** was approved for public consultation (ending 25 June 2012);
- **GNSS repeaters and pseudolites:**
  - WGFM noted the remarks made by FM44 that the Draft ECC Report on Pseudolites might be available for approval at the FM meeting in September 2012.
- **Chairmanship of FM44**, decision taken at WGFM to elect Dr.Azzarelli (UK) and it also thanked Dr. Deschamps(F) for his work in FM44;
- **ESV:** WGFM noted Document **FM44(12)INFO002** which provides the LS from WGFM to CPG (and CPG-PTB). This was proposed by the last (20<sup>th</sup>) FM44 meeting, asking if the preparation work for A.I 1.8 of WRC-15 would have an impact on FM44 further work on this issue. **The FM44 Chairman stated that as he is attending PTB he will make sure that the LS will be addressed.**

#### 4. Consideration of relevant parts of the 31<sup>st</sup> ECC Meeting Report

(12) The Chairman provided an extract of the 31<sup>st</sup> ECC meeting minutes relevant to satellite issues in document **FM44(12)025**, and presented relevant parts of the document of interest to the FM44. The Chairman highlighted the following:

- **Chairmen of ECC/CPG:** FM44 noted the changes in chairmanship for ECC and election of chairman for CPG;
- **Observers:** FM44 noted the issues with regards to observers and changes to the RoP as well as references. Specifically, it was noted that:

*"The ECC confirmed that chairmen have the discretion to include or not include statements from observers in the minutes of their meetings."*

- **Section 4.4 on ECO Bulletin (ECC(12)16R1):**Mr.Papin (Luxembourg) raised a concern of where the text on the FCC investigation on 2 GHz MSS bands comes

from as it is inaccurate/misleading and what relevance this had within Europe. Comments from Luxembourg were that the ECO bulletin should only provide factual information and that the 2 GHz MSS band is subject to a specific regulatory framework within the European Union. Mr. Weber (Office) commented that the ECO bulletin did not say at all "MSS spectrum may become vacant" as stated in the ECC minutes but only tries to describe a tendency that was also reported in a recent EC workshop on spectrum inventory and is also planned to be discussed at the ECC/FCC Officials meeting. ECO may consider to provide a clarification in the next ECO bulletin. Mr Papin expressed the view that the information currently available within the EC workshop on spectrum inventory would require correction for several frequency bands.

Mr. Deedman (Inmarsat) also supported the concerned raised by Luxembourg, adding that he disagreed with the suggestion in the bulletin that the growth in mobile satellite applications in Ku-band and Ka-band could lead to reduced need for MSS spectrum in L-band and S-band.

## 5. Outdoor GNSS Pseudolites

- (13) Mr Pikkarainen (Finland) introduced document **FM(12)024**, proposing to continue to finalise work on the ECC Decision on Pseudolites.
- (14) Mr. Nitschke (Germany) introduced INFO003, providing information on Eurocontrol documents (from the last ASFCG meeting) and ICAO on the matter of GNSS interference, in particular GPS jammers, GNSS repeaters and GNSS Pseudolites, commenting that these organisations, with also EC (Galileo) and NATO may have not been involved in SE40 work.
- (15) Mr. Harding (UK) stated that at least the EC (Galileo) was involved in the SE40 work.
- (16) Mr. Weber (ECO) stated that NATO attends WGFM and they can make comments directly at WGFM. He then went to say that when the document goes to public consultation, **the Office can send the document to ICAO, Eurocontrol and the EC who are most likely interested so that they can provide comment.**
- (17) A drafting group was formed to do this work and provided a comprehensive document at Plenary.
- (18) **The group approved this document at Plenary (the Office will perform the required editorial checks) and it is provided in Annex 4 (TEMP3rev1).**
- (19) As in regard to a Draft Recommendation, Mr. Pikkarainen proposed that FM44 continues work for developing a Draft Recommendation on Pseudolites and this was endorsed by all the (10) Administrations present at Plenary. This will be reported to WGFM, the Office stated that based on the overwhelming support by the Administrations in FM44 the work can start at any time. **A Work Item has been initiated by the Office.**
- (20) The group thanked Mr. Pikkarainen (Finland) for his efforts in dealing with this document in his drafting group.

## 6. Ka Band

- (21) There are four work items on the Ka band with four correspondence groups, i.e.:  
**CG#1:** Uncoordinated FSS Earth stations in the 17.3-17.7 GHz, coordinator Mr Bloch;

**CG#2:** Use of the 28.8365-28.9485 GHz band by FSS and FS, coordinator Mr Papin;

**CG#3:** ESOMP operating in the 17.3-30 GHz range; coordinator Mr. Christiansen;

**CG#4:** Uncoordinated FSS Earth stations in the 17.7-19.7 GHz, coordinator Mr Combelles.

(22) Document **INFO005** from VTT/Elektrobit was introduced. This is a study on interference between FSS/FS in the Ka-band, showing areas of interference and concluding that this may be used to improve the sharing of the bands.

(23) **Several participants found that this study is relevant to the Ka-band issues and that it should be liaised to SE40** as his group will be working on an ECC report for the band 17.7-19.7 GHz. Mr. Bloch (France) commented that the study results are in line with results of the French study in SE40 earlier in the week for the band 17.3-17.7 GHz. Mr. Bloch was tasked to prepare a **LS to SE40 which was approved in Plenary and appears in Annex 5 (Temp5)**.

#### **6.1 Uncoordinated FSS Earth stations in the band 17.3-17.7 GHz**

(24) An LS (FM44(12)028) was received from SE40 on the compatibility between transmit gateways for the BSS and uncoordinated receive earth stations in the band 17.3-17.7 GHz. Mr. Guerin (SE40 Chairman) introduced the LS from SE40 on this issue (**FM44(12)028**), which studies two receive antenna diameters (80cm and 120 cm) for HDFSS use and which concluded:

*"... taking into account the relatively small number of BSS transmit feeder link gateways located in Europe at fixed locations as evidenced in your LS and the expected limited areas (up to few tens of kilometres) around them where receive uncoordinated Earth stations would be subject to harmful interference, the use of the band 17.3-17.7 GHz should be generally available for European administrations for uncoordinated Earth stations."*

(25) Mr. Akperov (Sweden), asked if the antenna diameters are representative in this band. Mr. Hunter (VIASAT) stated that they deploy antennas of 75cm diameter (120cm for edge of coverage services). It was agreed that this information validates the assumptions on antenna diameter taken in the compatibility study.

(26) A drafting group, chaired by Mr. Bloch (France) was set up to work on ECC/DEC/(05)08. This drafting group met to develop modifications to ECC/DEC/(05)08 with the aim to:

- o make available for HDFSS all 3 bands mentioned in Decides 1 (namely 17.3-17.7 GHz, 19.7-20.2 GHz and 29.5-30 GHz);
- o allow free circulation and licence exemption for uncoordinated Earth stations operating in these 3 bands;
- o make reference to the relatively low number of BSS gateways and to the limited interference zone reported by SE40 in a new Considering;
- o update the background section of the Decision.

(27) The draft modified ECC/DEC/(05)08 was finally approved by the Plenary meeting with minor addenda as it appears in **Annex 6(Temp2rev1)**. It will be submitted for approval to WGFM during its 24-28 September 2012 meeting.



## 6.2 FSS/FS use of the band 28.8365-28.9485 GHz

- (28) FM44 considered input document **FM44(12)022**, which was previously circulated within the CG#2, summarizing the status of the work on this work item and proposing a draft revision of ECC/DEC(05)01. The meeting agreed and a drafting group chaired Mr. Papin (Luxembourg) was created to finalise **Draft ECC/DEC(05)01**.
- (29) Mr. Papin explained that the proposed modifications to ECC/DEC(05)01 are intended to achieve the following objectives:
- Provide better visibility and certainty to the FSS for the use of the band 28.8365-28.9485 GHz within countries of CEPT that do not use FS and/or countries of CEPT that are expected to cease FS use by 1st January 2020, taking into account the results of the CEPT questionnaire on the FS use in this band;
  - Allow exemption from individual licensing and free circulation of uncoordinated FSS Earth stations in the bands 27.5-27.8285 GHz, 28.4445-28.8365 GHz and 29.4525-29.5 GHz, as well as in the band 28.8365-28.9485 GHz where appropriate;
  - Insert in new annexes to ECC/DEC(05)01 technical and operational requirements for uncoordinated FSS Earth stations, on the same model as ECC/DEC(06)03 ("HEST" Decision).
- (30) In doing this, the drafting group and FM44 have taken into account the instructions given by the 30<sup>th</sup> meeting of the ECC, (see **FM44(12)005**), whereby:
- "Agreed that the ECC/DEC/(05)01 on "the use of the band 27.5 - 29.5 GHz by the Fixed Service and uncoordinated Earth stations of the Fixed-Satellite Service (Earth-to-space)" be revised as proposed by WGFM taking into account that the revision should keep the high harmonisation level of this frequency band and the implementation status of the Decision."*
- (31) The UK commented that there are still 8 Administrations, including the UK, using the band for terrestrial systems and suggested to split the Decision in two parts for Administrations to choose from (i.e. partial implementation). UK added that this could allow more administrations to sign and implement the Decision. Mr. Weber (from the Office) commented that the Decision could be implemented partially and there was no need to have different/separate parts in it since the existing system provides for the option "yes, partly" for the implementation status.
- (32) Mr. Bloch (F) stated that free circulation is not in the proposed text and could be inserted in the Decides section. Mr. Weber (from the Office) commented that if equipment is under the control of a network then this requirement could be added to the new ECC/DEC(12)01, which is an overarching decision, by including the frequency bands in its list. Since it was noted that the Earth stations are not necessarily part of a network, it was felt that the introduction of free circulation was necessary in the modified Decision.
- (33) Mr. Laatu (Finland) raised the issue of cross border interference to countries that may not sign up to the Decision. After some lengthy discussions it was decided to add a new considering (also to be introduced in the ESOMPs section);
- (34) **A revised draft ECC/DEC(05)01 was approved at this meeting, as reflected in Annex 7 (TEMP1rev3), for submission to WGFM for approval in September 2012.**

- (35) The Administration of Austria expressed its concerns about having any date in Decides 2 of Decision (05)01.
- (36) Mr. Papin thanked all participants in the drafting group for their contributions and the good progress achieved.

### 6.3 ESOMP

- (37) Transfinite asked for their input document **INFO006rev1** to be withdrawn, as they had already clarified their views at SE40 this week and also by the introduction of Annex 8 of the FM Report (**provided in FM44(12)020rev1**).

#### ETSI HS for ESOMPs

- (38) Document **FM44(12)021** is a LS from TC-ERM in response to the LS sent to TC-SES at the last meeting, which requested TC-SES to delete references to the band 21.4-22 GHz from the ESOMPs draft Harmonised Standard EN 303 978, as this has not been studied in the SE40 and FM44. The response from TC-SES is that:

“

- The title of Table 1 has been changed from "Frequency bands designated for ESOMP" to "Frequency bands"
- The text concerning the 21.4-22 GHz band has been changed to inform that the implementation of this BSS receive band by ESOMP is optional.

”

- (39) It was discussed that as this frequency range is used for receive only equipment for BSS, within the EU framework there are no provisions that any receive equipment would need an authorisation and as such also the RTTE Directive will not be contravened (although the Directive also applies to all radio receivers such as broadcast receiving equipment nowadays, unless specific receivers are explicitly taken out from it) if the band is retained in the HS for ESOMPs. It was also discussed that the frequency band under concern is in the “informative” section of the HS and as such it is not mandatory.
- (40) The participants of the meeting were happy with the proposal from TC-ERM and **concluded that this matter can come to a close.**
- (41) The Dutch Administration, who on principle basis, did not agree with this and requested the following note in the meeting minutes:

"The Netherlands explained to have difficulties with the approach to accept the usage of the band 21.4 – 22 GHz as an option in the EN303978 standard. This is mainly an issue of basic principles that the Netherlands administration is of the opinion that before inclusion of this frequency band as an option in the ESOMP EN303978, the same procedure should apply as conducted for the 17 GHz and 28 GHz frequency bands."

#### SE40 PFD Mask

- (42) The LS from SE40 (**FM44(12)027**) was introduced by Mr. Guerin (Chairman of SE40) who stated that the meeting could not agree to a PFD mask for the aeronautical ESOMPs. It was stated that there was a lot of support to propose a compromise using the Art. 21 Table 21.4 PFD mask, but because the UK could not come to a view at the moment, the meeting this week decided to postpone a decision to an SE40 Ad-Hoc web-meeting on the 20<sup>th</sup> July 2012.

- (43) Because of this the group agreed to have a meeting of FM44 on ESOMPs on 24 August 2012 limited to finalising the ESOMP Decision and Report by incorporating the AERO PFD mask.

#### **Draft ECC Decision on ESOMPs**

- (44) A drafting group was tasked to work on the draft ECC ESOMP Decision. For this the group considered the UK contribution **FM44(12)023rev1** and Annex 8 of the FM meeting (**FM44(12)020rev1**).
- (45) The Drafting group chaired by Mr. Azzarelli (UK), had lengthy discussions. These included several issues raised by the UK, Finland and others, such as (i) notification by Operators to the ECO, (ii) Decides 5 on non-mandatory issues (iii), the Annexes and (iv) New Considering such as on cross border-coordination.
- (46) For the notification issue the drafting group considered the UK contribution (FM44(12)23rev1) and the proposal to maintain the Decides 2. Also Annex 8 of the FM meeting FM44(12)20rev1 was recalled to try to find a compromise solution. Several Administrations (F, D, NO and NL) objected to the inclusion of such text in the Decision as it is not enforceable to ESOMP operators and as such the data in the ECO database would not be meaningful at all. Russia also supported this view.
- (47) The DG Chairman looked at finding another solution by placing text of notification (originally in Decided 2) into Annex 2. However, this text with (also that of Annex 4) was placed in square brackets after lengthy discussions, for consideration at Plenary.
- (48) The plenary considered this text. Again strong opposition by several Administrations resulted to the deletion of any reference to notification to the ECO by satellite operators. UK provided the following statement for the chairman's report:
- "UK certainly saw merit in the ECO notification for a number of reasons, as outlined during the discussion in the drafting group, and would like to reserve its position on the issue."
- (49) Decides 5 was also considered by the DG, this was related to (i) relaxation of PFD threshold and (ii) operation of ESOMPs near airfields. After some discussion this Decides 5 was deleted and its text was moved, where appropriate, in Annex 2 and other parts of the document.
- (50) The DG also discussed matters related to airfield coordination zones and new text was accepted by all.
- (51) The plenary discussed the document and after some modifications approved the document as final for considerations by the next WGFM, except for the Annex 2 where the PFD mask would have to be placed once approved by SE40. The document is provided in Annex 8 (TEMP4rev2) and will be considered by the next Ad-Hoc FM44 meeting, provisionally planned for 24 August 2012.
- (52) The groups also considered that since WGFM did not have comments for the Report on ESOMPs, see Annex 9 (copied from Annex 6 of FM44(12)005), then the report will be considered at the next Ad-Hoc meeting for final approval by FM44. This will require finalisation of the SE40 studies and thus the Correspondence Group #3 could have its finalisation after the 20 July and before the 24 August when the FM44 Ad-Hoc meeting meets.

#### **6.4 17.7-19.7 GHz band**

- (53) Laurent Combelles, as coordinator on this issue, reported that no activity occurred within the correspondence group since the last meeting, and hence the correspondence group working document attached to chairman report of the last meeting of FM44 (**FM44(12)18 Annex9**) is the basis for the future work of the correspondence group, between now and the next meeting.
- (54) He also reported the outcome of discussions within SE40 with respect to the liaison statement that FM44 sent to SE40 at the last meeting (**FM44(12)18 Annex8**). SE40 identified specific studies that could be undertaken to respond to the FM44 request, and requests the endorsement of WGSE to develop a Report on this issue.
- (55) With respect to the studies to be undertaken by SE40, Laurent Combelles indicated that these will require FS deployment data over study areas representative of such deployment in CEPT (e.g. FS assignment database extracts), the goal being to determine the spectrum actually usable by an unprotected FSS receive earth station in area where FS is deployed. This would take into account in particular the location, azimuth, e.i.r.p., assigned frequency and occupied bandwidth by the various FS transmitters in the area considered. Administrations interested in those studies are invited to provide such information.

#### **7. Work programme**

- (56) This meeting has finalised one New Draft Decisions (Annex 8), two Draft Revised Decisions (Annex 6 and Annex 7) and onenew Draft Report (Annex 4). Also a New Draft Report on ESOMPs (Annex 9) will be finalised at the next Ad-Hoc FM44 meeting planned for the end of August 2012.  
**Mr. Weber will finalise these editorially before the next meeting of WGFM.**
- (57) **The group approved, see item (17) above, a new work item on the development of a new Recommendation on Pseudolites to be submitted to the next WGFM.**

#### **8. Public consultation on ECC/DEC/(09)02**

- (58) Mr. Weber informed the group that the revised ECC/DEC(09)02 is under public consultation which will end on 25<sup>th</sup> June 2012.
- (59) The chairman informed that he received emails from Mr. Smith (CRAF) and Mr. Thompson (Iridium) about this matter, stating that comments from the public consultation will be dealt with sooner or later.
- (60) **The group discussed and agreed that in view of possible comments made during the public consultation, an Ad-Hoc web-meeting will take place in early July 2012 to consider any such comments. Mr. Weber will notify the group of these comments and a meeting will be set up soon after.**

#### **9. Any other business**

- (61) None.

#### **10. Future meeting(s)**

- (62) **A potential Ad-Hoc web-meeting early July to consider comments from the public consultation (ending 25 June 2012) of revised Decision (09)02.**

- (63) The next FM44 meeting (22<sup>nd</sup>) will be a meeting in Copenhagen on the 24<sup>th</sup> of August 2012, from 9am to 4pm, to finalise the new Decision on ESOMPs (Annex 8) and the new Report on ESOMPs (Annex 9).
- (64) The 23<sup>rd</sup> FM44 meeting will take place from 12-15 December 2012, Pisa, Italy, for which the deadline for document submission will be 5pm on 5<sup>th</sup> December 2012. Documents not submitted in due time will not be considered at this meeting.

#### **11. Approval of the minutes of the meeting**

- (65) The Chairman did not have time to provide the minutes FM44(11)029 (and related Annexes) before the end of the meeting. It was agreed that these will be circulated and approved by correspondence within the next week.

#### **12. Closure of the meeting**

- (66) The Chairman expressed thanks to delegates for their participation in the meeting and to the Finnish Administration for the invitation and preparations of the meeting. He wished all the participants a safe trip back home.

#### **List of Annexes**

- Annex 1: Approved Agenda of 21<sup>st</sup> FM44 Meeting
- Annex 2: List of contributions to the 21<sup>st</sup> FM44 Meeting
- Annex 3: List of output documents
- Annex 4: New Report (No. 183) on Outdoor Pseudolites (TEMP3rev1)
- Annex 5: LS to SE40 on FS/FSS studies at Ka-band (TEMP5)
- Annex 6: Revision to ECC/DEC(05)08 (TEMP2rev1)
- Annex 7: Revision to ECC/DEC(05)01 (TEMP1rev3)
- Annex 8: New Decision on ESOMPs (TEMP4rev2)
- Annex 9: New Report (No. 184) on ESOMPs (from Annex 6 FM44(12)005)

**Approved Agenda**  
**FM44 – 21<sup>st</sup> meeting**  
**13-15 June 2012**

Items	Document
1. Opening of the meeting	
2. Adoption of the agenda	019r3
3. Consideration of relevant parts of 74 <sup>th</sup> FM report a. Extract of minutes b. LS from FM to CPG	020 INFO002
4. ECC a. Consideration of relevant parts of 31 <sup>st</sup> ECC report b. Review of ERC/ECC Decisions and Recommendations	025 (none)
5. GNSS outdoor Pseudolites	024 INFO003
6.. Ka band a. Studies (ESA/cognitive radio)	INFO005
6.1 17.3-17.7 GHz band a. LS from SE40	028
6.2 FSS/FS use of the band 28.8365-28.9485 GHz	022
6.3 ESOMP a. ETSI ERM b. Draft Decision c. LS from SE40	021 023r1, INFO006R1 027
6.4 17.7-19.7 GHz band	No inputs
7. (empty)	
8. Public consultation on ... - (09)02	No inputs
9. (empty)	
10. Work Programme a. ECO updates) b. ITU-R (WP4A, 4C) c. Work items	INFO004 026, 026Add1
11. Any Other Business	
12. Future meeting(s)	
13. Approval of the minutes of the meeting	
14. Closure of the meeting	

**List of Input Documents**  
**FM44 – 21<sup>st</sup> meeting**  
**13-15 June 2012**

Document number	Title	Agenda item	Source
FM44(12)019r3	Draft Agenda	2	Chairman
FM44(12)20	Extract of FM meeting minutes	3	Chairman
FM44(12)21	LS from TC-SES on ESOMPs HS	6.3	ETSI TC-ERM
FM44(12)22	Report of Rapporteur on Correspondence Group #2	6.2	CG#2
FM44(12)23r1	Revisions to New Decision on ESOMPs	6.3	UK
FM44(12)24	Working document towards ECC report on Outdoor PLs	5	Finland
FM44(12)25	Extract of ECC meeting minutes	4	Chairman
FM44(12)26	Summary of ITU-R WP4A and WP4C meetings	10.b	Chairman
FM44(12)27	LS from SE40 on ESOMPs pfd mask	6.3	SE40
FM44(12)28	LS from SE40 on 17.3-17.7 GHz sharing.	6.1	SE40
INFO002	LS from FM to CPG on AI 1.8 and ESV notifications	3.b	WGFM
INFO003	Protection of GNSS from Interference	5	Germany
INFO004	ECO assistance information	10.a	Office
INFO005	Note on FSS/FS Interference Simulations on Ka-band	6	VTT, Elektrobit
INFO006r1	Withdrawn		Transfinite

**List of Output Documents  
FM44 – 21st meeting  
13-15 June 2012**

<b>Document number</b>	<b>Title</b>
FM44(21)029	Draft Minutes of 21 <sup>st</sup> FM44 Meeting
Temp1Rev3	Annex 7: Revised Dec(05)01
Temp2Rev1	Annex 6: Revised Dec(05)08
Temp3Rev1	Annex 4: New Report on Outdoor Pseudolites
Temp4Rev2	Annex 8: New Decision on ESOMPs
Temp5	Annex 5: LS to SE40 and cc to WGSE.
FM44(12)005, Annex 6	Annex 9: New Report on ESOMPs