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| **World Radiocommunication Conference (WRC-15)Geneva, 2–27 November 2015** |  |
| **INTERNATIONAL TELECOMMUNICATION UNION** |  |
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| PLENARY MEETING | **Document 87-E** |
|  | **19 October 2015** |
|  | **Original: English** |
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| China (People's Republic of), Papua New Guinea, Singapore (Republic of) |
| Proposals for the work of the conference |
| **Regulatory clarification for the operation of ESOMPs under ITU provision No. 5.526 of the radio regulations** |
| Agenda item 9.2 |

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

9.2 on any difficulties or inconsistencies encountered in the application of the Radio Regulations; and

*[Issue : RR5.526 (Sec.3.1.1 of Addendum 2 to Document 4: Report of the Director of the Radiocommunication Bureau)]*

**Introduction**

WARC-92 adopted RR No. 5.526 and few other provisions (Nos.5.527, 5.528 and 5.529) in which earth stations at specified or unspecified points or while in motion could operate with networks which are both in the fixed-satellite service and in the mobile-satellite service.

However, the language used in the footnote is not sufficiently clear to enable the use of Earth Stations On Mobile Platforms (ESOMPs) in a satisfactory manner.

The issue was extensively discussed at ITU-R relevant Study Groups/Working Parties from technical, operational and regulatory aspects.

While there seems to be no difficulties in technical aspects of ESOMPs, there is some ambiguity in the operational and regulatory aspects. ITU-R Study Group 4 prepared two reports to address the various technical and operational aspects of ESOMPs (Report ITU-R S. 2223 and Report ITU-R
S.2357). However, the regulatory aspects were considered as a matter to be decided by a competent WRC.

The issue was reported to the Director of the Radiocommunication Bureau and was subject to a Circular Letter CR/358 clarifying some operational aspects of the matter, including the symbol (new class of earth station UC) to be used when submitting notices (of such type indicated in the Circular Letter) to the BR and in the coordination and notification process. The Director also included in his Report (Addendum 2 to Doc.4), information on the use of the symbol of UC class of stations for the bands subject to No. 5.526 and for which consideration is invited at WRC-15.

**APT View**

In view of the above and taking into account

1. RR Nos. 5.524 and 5.542 for the band 19.7-20.2 GHz and 29.5-30.0 GHz and the requirement to protect terrestrial services;
2. the requirement to protect the fixed-satellite services;
3. the nature of the ESOMP to operate on land, aircraft and vessels, for which there is no established coordination procedure; and
4. the interference management aspects, should the operation of the ESOMPs cause interference.

APT members are of the view that WRC-15 needs, in the light of the various advantages of ESOMPs operations on one hand, and, the ambiguity of text in the footnote and regulatory aspects of the matter, on the other hand, to take necessary action to clarify the situation, enabling administrations and satellite operators to implement and operate the ESOMPs and to provide necessary guidance to membership on how to operate such systems and manage the interference that may be caused to terrestrial and space services.

Clarification is envisaged in the form of a modification to No. 5.526 to harmonise use of the bands 19.7-20.2 GHz and 29.5-30.0 GHz in all three Regions and the removal of the requirement for the network to be both FSS and MSS, as ESOMP intends to operate under FSS.

In this regard, it is necessary to also approve a Resolution, cross referenced in the modified footnotes, to provide details on the use of the ESOMPs together with all operational, technical, if any, as well as procedures to operate them.

The above course of action will facilitate the licensing process for ESOMPs in accordance with Article 18 of the RR, while ensuring that transmission is kept to an acceptable level or ceased completely, should interference occur.

Moreover, any course of action taken to resolve the difficulties encountered in the application of this footnote shall be exclusively restricted or limited to the frequency bands 19.7-20.2 GHz and 29.5-30.0 GHz. Thus it shall in no way be extended to other frequency bands or other footnotes.

In addition, such course of action shall in no way modify the definition of the fixed station or mobile station and fixed and mobile Earth Station as contained in Article 1 of the RR.

In view of the above, some APT Members are submitting this multi-country proposal to WRC-15 for an amendment to No.5.526 and other associated footnotes relating to the operation of ESOMPs, which points towards a new WRC Resolution. That Resolution contains various aspects of ESOMPs as mentioned in bullet points 1-4 above.

**Proposal**

A modification to the RR is proposed, to clarify the regulatory provisions surrounding the use of ESOMPs in these frequency bands, and to extend the provisions to the bands 29.5 - 30.0 GHz and 19.7 - 20.2 GHz to all three Regions consistently. The proposed changes include technical, operational and regulatory provisions in a Resolution incorporated by reference in No. 5.526. Such provisions are based on the content of Report ITU-R S.2357 on ESOMPs and shall ensure that ESOMPs operating with FSS satellites would not cause harmful interference to existing and future services sharing the same bands.

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. 2.1)

MOD CHN/PNG/SNG/87/1

18.4-22 GHz

|  |
| --- |
| Allocation to services |
| Region 1 | Region 2 | Region 3 |
| 19.7-20.1FIXED-SATELLITE(space-to-Earth) 5.484A 5.516BMobile-satellite (space-to-Earth) | 19.7-20.1FIXED-SATELLITE(space-to-Earth) 5.484A 5.516BMOBILE-SATELLITE(space-to-Earth) | 19.7-20.1FIXED-SATELLITE(space-to-Earth) 5.484A 5.516BMobile-satellite (space-to-Earth) |
| 5.524 ADD 5.526 | 5.524 5.525 MOD 5.526 5.527 5.528 MOD 5.529 | 5.524 ADD 5.526 |
| 20.1-20.2FIXED-SATELLITE (space-to-Earth) 5.484A 5.516B MOBILE-SATELLITE (space-to-Earth) 5.524 5.525 MOD 5.526 5.527 5.528 |

MOD CHN/PNG/SNG/87/2

24.75-29.9 GHz

|  |
| --- |
| Allocation to services |
| Region 1 | Region 2 | Region 3 |
| 29.5-29.9FIXED-SATELLITE(Earth-to-space) 5.484A 5.516B 5.539Earth exploration-satellite(Earth-to-space) 5.541Mobile-satellite (Earth-to-space) | 29.5-29.9FIXED-SATELLITE(Earth-to-space) 5.484A 5.516B 5.539MOBILE-SATELLITE(Earth-to-space)Earth exploration-satellite(Earth-to-space) 5.541 | 29.5-29.9FIXED-SATELLITE(Earth-to-space) 5.484A 5.516B 5.539Earth exploration-satellite(Earth-to-space) 5.541Mobile-satellite (Earth-to-space)  |
| 5.540 5.542 ADD 5.526 | 5.525 MOD 5.526 5.527 MOD 5.529 5.540  | 5.540 5.542 ADD 5.526 |

MOD CHN/PNG/SNG/87/3

29.9-34.2 GHz

|  |
| --- |
| Allocation to services |
| Region 1 | Region 2 | Region 3 |
| 29.9-30 FIXED-SATELLITE (Earth-to-space) 5.484A 5.516B 5.539 MOBILE-SATELLITE (Earth-to-space) Earth exploration-satellite (Earth-to-space) 5.541 5.543 5.525 MOD 5.526 5.527 5.538 5.540 5.542 |

MOD CHN/PNG/SNG/87/4

5.526 In the bands 19.7-20.2 GHz and 29.5-30 GHz, networks which are in the fixed-satellite service may include links between earth stations at specified or unspecified points or while in motion, through one or more satellites for point-to-point and point-to-multipoint communications. Such use shall be in accordance with Resolution [87-A92] (WRC-15).

MOD CHN/PNG/SNG/87/5

5.529 The use of the bands 19.7-20.1 GHz and 29.5-29.9 GHz by the mobile-satellite service in Region 2 is limited to satellite networks which are both in the fixed-satellite service and in the mobile-satellite service.

ADD CHN/PNG/SNG/87/6

Draft New Resolution [87-A92] (WRC-15)

Use of the frequency bands 19.7-20.2 GHz and 29.5-30.0 GHz by earth stations in motion communicating with geostationary space stations in the fixed-satellite service

The World Radiocommunication Conference (Geneva, 2015),

considering

a) that the bands 19.7-20.2 GHz and 29.5-30.0 GHz are globally allocated on a primary basis to the FSS and that there are a large number of geostationary FSS satellite networks operating in these frequency bands;

b) that there is an increasing need for mobile communications, including global broadband satellite services, and that some of this need can be met by allowing earth stations in motion on platforms (such as ships, aircraft and land vehicles) to communicate with space stations of the FSS operating in the frequency bands 19.7-20.2 GHz and 29.5-30.0 GHz;

c) that satellite technology has advanced to the stage where it is now feasible to operate earth stations in motion while still maintaining a very high degree of pointing stability and accuracy, and that in this respect they can be considered as having similar performance to fixed satellite earth stations;

d) that facilitating the use of earth stations on moving platforms (ESOMPS) as elements of FSS networks would increase the utility of those networks and enhance the efficient use of scarce spectrum and orbital resources;

e) that it is desirable to formulate a regulatory solution that facilitates ESOMPS as elements of the FSS in a manner that avoids resorting to the provision of No. **4.4** in order to better manage the potential for unacceptable interference;

f) that administrations are already able to indicate their intention to operate ESOMPS as elements of FSS networks by including a reference to a dedicated class of station in filing information submitted to the Radiocommunication Bureau;

g) that specific measures need to be applied to ensure that the use of ESOMPS as elements of FSS networks will not lead to unacceptable interference into the Fixed and Fixed Satellite Services operating in conformity with the Radio Regulations;

h) that some administrations have already deployed, and plan to expand their use of ESOMPS with operational and future geostationary FSS networks;

i) that ITU-R has studied certain aspects of the technical and operational use of earth stations in motion and that the result of these studies is contained in ITU-R Reports,

recognizing

a) that earth stations in motion operating in accordance with No. **5.526** are not to be used for safety of life applications;

b) that the adoption of special regulatory measures to facilitate the operation of ESOMPS as elements of the FSS under specific technical and operational conditions is in no way intended to impact on the provisions contained in Article 1 for the Radio Regulations related to the definition of services;

c) that the adoption of these measures to facilitate ESOMPS is specifically limited to the 19.7-20.2 GHz and 29.5-30.0 GHz band;

d) that the adoption of these measures will facilitate the licensing process for ESOMPs in accordance with Article 18 of the Radio Regulations, while ensuring that transmission is kept to an acceptable level or ceased completely, should interference occur,

considering

a) that some administrations have addressed this matter nationally or regionally by adopting technical and operational criteria for the operation of these earth stations;

b) that a consistent approach to deployment of these earth stations will support this important and growing global communication requirements on an equal basis in all three Regions,

resolves

1 that administrations authorizing earth stations in motion operating in accordance with No. **5.526** shall not claim more protection and/or produce more interference than other earth stations in the same FSS networks, *inter alia* taking into account the *recognizings;*

2 that administrations authorizing earth stations in motion communicating with FSS networks in the band 29.5-30.0 GHz shall require such earth stations to:

a. comply with the off-axis e.i.r.p. density levels given in Annex 1 or other levels mutually agreed with other satellite network operators and their administrations;

b. employ techniques that allow the tracking of the wanted satellite and that are resistant to capturing and tracking adjacent satellites;

c. immediately reduce or cease transmission when their antenna mispointing would result in exceeding the levels referred to in *resolves 2a*;

d. be subject to permanent monitoring and control by a Network Control and Monitoring Center (NCMC) or equivalent facility and that these earth stations be capable to receive and act upon at least “enable transmission” and “disable transmission” commands from the NCMC;

3 that administrations authorizing earth stations in motion require the operators to provide a point of contact for the purpose of tracing any suspected cases of interference from Earth stations in motion;

4 that in the event of a report of unacceptable interference being caused to services in the same band, the ESOMP operator shall take immediate action to cease the cause of such interference.

Annex 1

Off Axis e.i.r.p. density levels for earth station in motion communicating with geostationary space stations in the fixed-satellite
service operating in the band 29.5-30.0 GHz

This Annex provides a set of off-axis e.i.r.p. levels for earth stations in motion operating in the band 29.5-30.0 GHz. However, as stated in *resolves 2a*, other levels may be mutually agreed between satellite operators and administrations.

Earth stations in motion communicating with geostationary space stations in the fixed‑satellite service transmitting in the band 29.5-30.0 GHz should be designed in such a manner that at any angle[[1]](#footnote-1), θ, which is 2° or more from the vector from the earth station antenna to the wanted satellite (see Figure 1 below for the reference geometry of an earth station in motion compared to an earth station at a fixed location), the e.i.r.p. density in any direction within 3° of the geostationary satellite orbit, should not exceed the following values:

|  |  |
| --- | --- |
| Angle θ | Maximum e.i.r.p. per 40 kHz |
| 2°≤ θ≤7° | (19 – 25 log θ) dB(W/40 kHz) |
| 7°< θ≤9.2° | –2 dB(W/40 kHz) |
| 9.2°< θ≤48° | (22 – 25 log θ) dB(W/40 kHz) |
| 48°< θ≤180° | –10 dB(W/40 kHz) |

NOTE 1 – The values above should be maximal values under clear-sky conditions. In case of networks employing uplink power control, these levels should include any additional margins above the minimum clear-sky level necessary for the implementation of uplink power control. When uplink power control is used and rain fades makes it necessary, the levels stated above may be exceeded for the duration of that period. When uplink power control is not used and the e.i.r.p. density levels given above are not met, different values could be used in compliance with the values agreed to through bilateral coordination of geostationary FSS satellite networks.

NOTE 2 – The e.i.r.p. density levels for angles of θ less than 2° may be determined from geostationary FSS coordination agreements taking into account the specific parameters of the two geostationary FSS satellite networks.

NOTE 3 – For geostationary space stations in the fixed-satellite service with which the earth stations in motion are expected to transmit simultaneously in the same 40 kHz band, e.g., employing code division multiple access (CDMA), the maximum e.i.r.p. density values should be decreased by 10 log(N) dB, where N is the number of earth stations in motion that are in the receive satellite beam of the satellite with which these earth stations are communicating and that are expected to transmit simultaneously on the same frequency.

NOTE 4 – Earth stations in motion operating in the band 29.5-30.0 GHz that have lower elevation angles to the geostationary satellite orbit will require higher e.i.r.p. levels relative to the same terminals at higher elevation angles to achieve the same power flux-densities (pfd) at the geostationary satellite orbit due to the combined effect of increased distance and atmospheric absorption. Earth stations with low elevation angles may exceed the above levels by the following amount:

|  |  |
| --- | --- |
| Elevation angle to GSO (ε) | Increase in e.i.r.p. spectral density (dB) |
| ε<5° | 2.5 |
| 5°≤ε≤30° | 3– 0.1 ε |

Figure 1 below illustrates the definition of angle θ[[2]](#footnote-2).

FIGURE 1:

Definition of angle θ



where:

 a represents the earth station in motion;

 b represents the boresight of the antenna;

 c represents the geostationary orbit (GSO);

 d represents the vector from the earth station in motion to the wanted satellite;

 φ represents the angle between the boresight of the antenna and a point P on the GSO arc;

 ϑ represents the angle between the vector d and point P on the GSO arc;

 P represents a generic point on the GSO arc which angles ϑ and φ are referred to.

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1. It should be noted that the definition of angle θ is different to that of angle φ contained in Recommendation ITU-R S.524-9. The angle θ is introduced to address possible mispointing from earth stations in motion, which is not a consideration in Recommendation ITU-R S.524-9. [↑](#footnote-ref-1)
2. In Figure 1 proportions are illustrative and not to scale. [↑](#footnote-ref-2)