

**UNITED STATES OF AMERICA**  
**PROPOSALS FOR THE WORK OF THE CONFERENCE**

**AGENDA ITEM 1.8:** *to review the provisions relating to earth stations located on board vessels (ESVs), based on studies conducted in accordance with Resolution 909 [COM6/14] (WRC-12)*

**ISSUE:** This agenda item invites the ITU-R to conduct appropriate studies to review the provisions relating to ESVs which operate in the FSS in the uplink bands 5 925-6 425 MHz and 14-14.5 GHz and consider possible modifications to Resolution 902 (WRC-03) in order to reflect current ESV technologies and technical characteristics that are being used or planned to be used, while protecting the other services with allocations in the same frequency bands, in accordance with Resolution 909 (WRC-12).

**BACKGROUND**

Consideration of ESVs in the ITU started in 1997 when WARC-97 placed ESVs on the WRC-2000 agenda (agenda item 1.8) via its Resolution 721. That topic was covered both in the study period 1997-2000 and in the study period 2000-2003. At WRC-03 the ITU-R adopted footnotes 5.457A and 5.457B, in addition to Resolution 902 (WRC-03), which established conditions for ESV operations.

Resolution 902 (WRC-03) contains technical and operational conditions for ESVs such as minimum antenna diameter and maximum transmitted power levels, and establishes 300 km and 125 km as the minimum distances from the low-water mark, as officially recognized by the coastal State, beyond which ESVs can operate without the prior agreement of any administration in the 5 925-6 425 MHz band and 14-14.5 GHz band respectively.

The technical studies used to develop Resolution 902 (WRC-03) were based on the assumptions contained in Recommendations ITU-R S.1587 and ITU-R SF.1650. The former versions of these Recommendations are no longer representatives of all current ESV systems. For example, some of the typical ESVs in the frequency band 5 925-6 425 MHz may operate today with e.i.r.p. density levels that are more than 20 dB lower than those used in Recommendation ITU-R SF.1650. As a consequence, ESV operations at lower power may be geographically restricted by the same constraints derived on the basis of ESV systems with much higher interference potential.

Given the current use of ESV transmissions employing spread spectrum techniques, the assumption of ESV carriers occupying only 2.346 MHz is no longer valid, and therefore the ESV e.i.r.p. levels transmitted toward the horizon should be expressed in terms of e.i.r.p. in the receive bandwidth of the FSRs (assumed as 11.2 MHz for C-band and 14 MHz for Ku-band).

Additionally, the minimum C-band antenna diameter of 2.4 m prescribed in Resolution 902 (WRC-03) is no longer typical of C-band ESVs, and the latest version of Recommendation ITU-R S.1587 already contemplates systems equipped with 1.2 m antenna diameters.

## RESULTS OF UPDATED STUDIES

Recent US studies addressing WRC-15 Agenda Item 1.8 used the same methodology contained in Recommendation ITU-R SF.1650 but assumed ESV antenna diameters of 1.2 m for C-band ESVs and lower values of power density transmitted by the ESVs for both C and Ku bands.

Based on these studies, it was determined that the same level of protection afforded to other services allocated in the frequency bands 5 925-6 425 MHz and 14-14.5 GHz by the WRC-03 ESV related decisions can be ensured if the following protection distances are enforced for C and Ku-bands:

Values for 6 GHz band ESVs

Maximum e.i.r.p. transmitted toward the horizon (dBW in 11.2 MHz)	Minimum distance from low- water mark* (km)
20.8	323
10.8	227
0.8	130
-9.2	64

\* Low-water mark as officially recognized by the coastal State.

Values for 14 GHz band ESVs

Maximum e.i.r.p. transmitted toward the horizon (dBW in 14 MHz)	Minimum distance from low- water mark* (km)
16.3	125
6.3	85
-3.7	29

\* Low-water mark as officially recognized by the coastal State.

All parameters that need to be updated as a result of these studies are captured in Resolution **902 (WRC-03)**, and therefore there is no need to modify text in the main body of the Radio Regulations to satisfy the agenda item. The proposed modifications to Resolution **902 (WRC-03)** are described below.

ESVs transmitting maximum e.i.r.p. spectral density levels such that the required protection distances determined by the new regulatory conditions adopted by WRC-15 are shorter than those determined by WRC-03 may operate in accordance with the regulatory conditions adopted by WRC-15 from the date these regulatory conditions come into force.

ESVs transmitting maximum e.i.r.p. spectral density levels such that the required protection distances determined by the new regulatory conditions adopted by WRC-15 are larger than those determined by WRC-03 will have one year from the date the new regulatory conditions come into force to conform to the new conditions adopted by WRC-15.

Finally, No. **5.509** was suppressed by WRC-07 and therefore the reference to it in Annex 1 to Resolution **902** should be deleted.

**Proposal:**

**USA/1.8/1**

**MOD**

RESOLUTION 902 (REV. WRC-~~03~~15)

**Provisions relating to earth stations located on board vessels which operate  
in fixed-satellite service networks in the uplink bands  
5 925-6 425 MHz and 14-14.5 GHz**

The World Radiocommunication Conference (Geneva, ~~2003~~2015),

*considering*

- a) that there is a demand for global wideband satellite communication services on vessels;
- b) that the technology exists that enables earth stations on board vessels (ESVs) to use fixed-satellite service (FSS) networks operating in the uplink bands 5 925-6 425 MHz and 14-14.5 GHz;
- c) that ESVs are currently operating through FSS networks in the bands 3 700-4 200 MHz, 5 925-6 425 MHz, 10.7-12.75 GHz and 14-14.5 GHz under No. **4.4**;
- d) that ESVs have the potential to cause unacceptable interference to other services in the bands 5 925-6 425 MHz and 14-14.5 GHz;
- e) that, with respect to the bands considered in this Resolution, global coverage is only available in the band 5 925-6 425 MHz and that only a limited number of geostationary FSS systems can provide such global coverage;
- f) that, without special regulatory provisions, ESVs could place a heavy coordination burden on some administrations, especially those in developing countries;
- g) that, in order to ensure the protection and future growth of other services, ESVs need to operate under certain technical and operational limitations;
- h) that, within ITU-R studies, based on agreed technical assumptions, minimum distances from the low-water mark as officially recognized by the coastal State have been calculated, beyond which an ESV will not have the potential to cause unacceptable interference to other services in the bands 5 925-6 425 MHz and 14-14.5 GHz;
- i) that, in order to limit the interference into other networks in the FSS, it is necessary to establish maximum off-axis e.i.r.p. density limits on ESV emissions;
- j) that establishing a minimum antenna diameter for ESVs has an impact on the number of ESVs that will ultimately be deployed, hence it will reduce interference into the fixed service,

*noting*

- a) that ESVs may be assigned frequencies to operate in FSS networks in the bands 3 700-4 200 MHz, 5 925-6 425 MHz, 10.7-12.75 GHz and 14-14.5 GHz pursuant to No. **4.4** and shall not claim protection from, nor cause interference to, other services having allocations in these bands;
- b) that the regulatory procedures of Article **9** apply for ESVs operating at specified fixed points,

*resolves*

a) that ESVs transmitting in the 5 925-6 425 MHz and 14-14.5 GHz bands shall operate under the regulatory and operational provisions contained in Annex 1 and the technical limitations in Annex 2 of this Resolution;

b) that ESVs transmitting maximum e.i.r.p. spectral density levels such that the required protection distances established in this Resolution are shorter than those contained in Resolution 902 (WRC-03) may operate in accordance with the regulatory conditions established in this Resolution from the date it comes into force;

c) that ESVs transmitting maximum e.i.r.p. spectral density levels such that the required protection distances established in this Resolution are larger than those contained in Resolution 902 (WRC-03) will have one year from the date this Resolution comes into force to conform to the conditions established herein.

*encourages concerned administrations*

to cooperate with administrations which license ESVs while seeking agreement under the above-mentioned provisions, taking into consideration the provisions of Recommendation 37 (WRC-03),

*instructs the Secretary-General*

to bring this Resolution to the attention of the Secretary-General of the International Maritime Organization (IMO).

## ANNEX 1 TO RESOLUTION 902 (REV. WRC-0315)

### **Regulatory and operational provisions for ESVs transmitting in the 5 925-6 425 MHz and 14-14.5 GHz bands**

1 The administration that issues the licence for the use of ESVs in these bands (licensing administration) shall ensure that such stations follow the provisions of this Annex and thus do not present any potential to cause unacceptable interference to the services of other concerned administrations.

2 ESV service providers shall comply with the technical limitations listed in Annex 2 and, when operating within the minimum distances as identified in item 4 below, with the additional limitations agreed by the licensing and other concerned administrations.

3 In the 3 700-4 200 MHz band and 10.7-12.75 GHz range, ESVs in motion shall not claim protection from transmissions of terrestrial services operating in accordance with the Radio Regulations.

4 The minimum distances from the low-water mark as officially recognized by the coastal State beyond which ESVs can operate without the prior agreement of any administration are ~~300 km~~ given in Table 1 for the 5 925-6 425 MHz band and ~~125 km~~ in Table 2 for the 14-14.5 GHz band, taking into account the technical limitations in Annex 2. Any transmissions from ESVs within the minimum distances shall be subject to the prior agreement of the concerned administration(s).

5 The potentially concerned administrations referred to in the previous item 4 are those where fixed or mobile services are allocated on a primary basis in the Table of Frequency Allocations of the Radio Regulations:

Frequency bands	Potentially concerned administrations
5 925-6 425 MHz	All three Regions
14-14.25 GHz	Countries listed in No. <b>5.505</b> , except those listed in No. <b>5.506B</b>
14.25-14.3 GHz	Countries listed in Nos. <b>5.505</b> , <u>and 5.508</u> <del>and 5.509</del> , except those listed in No. <b>5.506B</b>
14.3-14.4 GHz	Regions 1 and 3, except countries listed in No. <b>5.506B</b>

14.4-14.5 GHz	All three Regions, except countries listed in No. <b>5.506B</b>
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6 The ESV system shall include means of identification and mechanisms to immediately cease emissions, whenever the station does not operate in compliance with the provisions of items 2 and 4 above.

7 Cessation of emissions as referred to in item 6 above shall be implemented in such a way that the corresponding mechanisms cannot be bypassed on board the vessel, except under the provisions of No. **4.9**.

8 ESVs shall be equipped so as to:

- enable the licensing administration under the provisions of Article **18** to verify earth station performance; and
- enable the cessation of ESV emissions immediately upon request by an administration whose services may be affected.

9 Each licence-holder shall provide a point of contact to the administration with which agreements have been reached for the purpose of reporting unacceptable interference caused by the ESV.

10 When ESVs operating beyond the territorial sea but within the minimum distance (as referred to in item 4 above) fail to comply with the terms required by the concerned administration pursuant to items 2 and 4, then that administration may:

- request the ESV to comply with such terms or cease operation immediately; or
- request the licensing administration to require such compliance or immediate cessation of the operation.

**Table 1: Values for 5 925-6 425 MHz band ESVs**

<b><u>Maximum e.i.r.p. transmitted toward the horizon (dBW in 11.2 MHz)</u></b>	<b><u>Minimum distance from low- water mark* (km)</u></b>
<u>20.8</u>	<u>323</u>
<u>10.8</u>	<u>227</u>
<u>0.8</u>	<u>130</u>
<u>-9.2</u>	<u>64</u>

\* Low-water mark as officially recognized by the coastal State.

**Table 2: Values for 14-14.5 GHz band ESVs**

<b><u>Maximum e.i.r.p. transmitted toward the horizon (dBW in 14 MHz)</u></b>	<b><u>Minimum distance from low- water mark* (km)</u></b>
<u>16.3</u>	<u>125</u>
<u>6.3</u>	<u>85</u>
<u>-3.7</u>	<u>29</u>

\* Low-water mark as officially recognized by the coastal State.

**Technical limitations applicable to ESVs transmitting in the bands  
5 925-6 425 MHz and 14-14.5 GHz**

	5 925-6 425 MHz	14-14.5 GHz
Minimum diameter of ESV antenna	<del>2.4</del> 1.2 m	<del>1.2 m</del> <sup>1</sup> 60 cm
Tracking accuracy of ESV antenna	±0.2° (peak)	±0.2° (peak)
Maximum ESV e.i.r.p. spectral density toward the horizon	17 dB(W/MHz)	12.5 dB(W/MHz)
Maximum ESV e.i.r.p. towards the horizon	20.8 dBW	16.3 dBW
Maximum off-axis e.i.r.p. <del>density</del> <sup>2</sup> <del>density</del> <sup>1</sup>	See below	See below

~~While operations within the minimum distances are subject to specific agreement with concerned administrations, licensing administrations may authorize the deployment of smaller antenna sizes down to 0.6 m at 14 GHz provided that the interference to the terrestrial services is no greater than that which would be caused with an antenna size of 1.2 m, taking into account Recommendation ITU R SF.1650. In any case, the use of smaller antenna size shall be in compliance with the tracking accuracy of ESV antenna, maximum ESV e.i.r.p. spectral density toward the horizon, maximum ESV e.i.r.p. towards the horizon and maximum off-axis e.i.r.p. density limits in the Table above and the protection requirements of the FSS intersystem coordination agreements.~~

<sup>21</sup> In any case, the e.i.r.p. off-axis limits shall be compliant with the FSS intersystem coordination agreements that may agree to more stringent off-axis e.i.r.p. levels.

**Off-axis limits**

For earth stations on board vessels operating in the 5 925-6 425 MHz band, at any angle  $\phi$  specified below, off the main-lobe axis of an earth-station antenna, the maximum e.i.r.p. in any direction within 3° of the GSO shall not exceed the following values:

**5 925-6 425 MHz**

<i>Angle off-axis</i>	<i>Maximum e.i.r.p. per 4 kHz band</i>
2.5° ≤ $\phi$ ≤ 7°	(32 – 25 log $\phi$ ) dB(W/4 kHz)
7° < $\phi$ ≤ 9.2°	11 dB(W/4 kHz)
9.2° < $\phi$ ≤ 48°	(35 – 25 log $\phi$ ) dB(W/4 kHz)
48° < $\phi$ ≤ 180°	–7 dB(W/4 kHz)

For ESV operating in the 14-14.5 GHz band, at any angle  $\phi$  specified below, off the main-lobe axis of an earth station antenna, the maximum e.i.r.p. in any direction within 3° of the GSO shall not exceed the following values:

**14.0-14.5 GHz**

<i>Angle off-axis</i>	<i>Maximum e.i.r.p. per 40 kHz band</i>
2° ≤ $\phi$ ≤ 7°	(33 – 25 log $\phi$ ) dB(W/40 kHz)
7° < $\phi$ ≤ 9.2°	12 dB(W/40 kHz)
9.2° < $\phi$ ≤ 48°	(36 – 25 log $\phi$ ) dB(W/40 kHz)
48° < $\phi$ ≤ 180°	–6 dB(W/40 kHz)