July 18, 2001

Donald Abelson
Chief of the International Bureau
Federal Communications Commission
445 12th Street SW
Washington, D.C. 20554

Dear Mr. Abelson:

The National Telecommunications and Information Administration on behalf of the Executive Branch Agencies, has approved the release of two Draft Executive Branch (NTIA) proposals considering federal agency inputs toward the development of U.S. Proposals for WRC-2003.

The first proposal addresses WRC-03 agenda item 1.1, which considers the deletion of the United States from footnote **S5.389D** because the applicable dates have passed. This proposal was drafted by Commission's WRC-2003 Advisory Committee and was sent to IRAC's Radio Conference Committee (RCS) for review. The IRAC has reviewed and approved this proposal without change. This proposal is forwarded for consideration to become part of package of U.S. Proposals for WRC-03.

The second draft proposal addresses WRC-03 agenda item 1.8.2. It proposes the definition of out-of-band and spurious domains and the definition of boundaries between these domains as determined by ITU-R Task Group 1/5. This proposal is forwarded for your consideration and review by WRC-2003 Advisory Committee. Karl Nebbia from my staff will contact Julie Garcia and reconcile any differences.

Sincerely,

*(Original Signed by Fred Wentland for)*
William T. Hatch
Associate Administrator
Office of Spectrum Management

Enclosure

**United States of America**

**DRAFT PROPOSALS FOR THE WORK OF THE CONFERENCE**

**Agenda Item 1.1:**  requests from administrations to delete their country footnotes or to have their country name deleted from footnotes, if no longer required, in accordance with Resolution **26 (Rev.WRC-97);**

**Background Information:**  WRC-95 added footnote **S5.389D** to the Table of Allocations in the simplified Radio Regulations adopted by that Conference.  Since the date specified in the footnote has come and gone, the United States is of the view that its name can be deleted from this provision in accordance with Resolution **26 (WRC-97)**.

**Proposal:**

## ARTICLE S5

**Frequency allocations**

**USA/ /1**
**MOD**

**S5.389D**  In Canada ~~and the United States~~ the use of the bands 2 010-2 025 MHz and 2 160-2 170 MHz by the mobile-satellite service shall not commence before 1 January 2000.

**Reasons**:  Footnote is overcome by date and is no longer needed.

————————

## United States of America

## DRAFT PROPOSAL FOR THE WORK OF THE CONFERENCE

**Agenda Item 1.8.1:** consideration of the results of studies regarding the boundary between spurious and out-of-band emissions, with a view to including the boundary in Appendix **S3**;

**Background Information**: The proposal herein amends Article **S1** and Appendix **S3** to take into account the most recent studies identifying the unwanted emissions to which the limits of Appendix **S3** Section II apply. These studies define the out-of-band and spurious domains of an emission and determine the boundary between them.

In developing proposed text for Section II of Appendix **S3** of the *Radio Regulations*, WRC–97, following guidance from Task Group 1/3, used an assumption that all unwanted emissions of a transmitter separated from the center frequency by more than 250% of the necessary bandwidth ($2.5B_n$) would generally be considered spurious emissions, for the purpose of applying spurious emission limits. Realizing, however, that $2.5B_n$ was not an appropriate threshold for all emissions, the WRC included exceptions for certain modulation types, bit rates, transmitter types, and coordination factors.

From 1997 through 2000, Task Group 1/5 continued the studies as to what frequencies the spurious emission limits of Appendix **S3**, Section II should apply. While maintaining the $2.5B_n$ boundary for most systems, the group developed guidance for narrowband and wideband emissions in various frequency ranges to avoid excessive variations in the boundary. The guidance, eventually promulgated in Recommendation ITU–R SM.[BOUNDARY], also addressed exceptions for certain radio systems, radio services, and frequency bands.

Recognizing a conflict in terminology, since no "boundary" exists in the frequency domain between out-of-band and spurious emissions, Task Group 1/5 adopted definitions for the out-of-band and spurious "domains" of an emission that would be disjoint in frequency, and thus have the intended boundary.

**Proposal:**

## CHAPTER  SI

## Article S1

## Terms and definitions

### Section VI  –  Characteristics of emissions and radio equipment

**USA/  /2**
**ADD**

S1.146*bis out-of-band domain* (of an emission):  The frequency range, immediately outside the necessary bandwidth but excluding the *spurious domain*, in which *out-of-band emissions* generally predominate.

Out-of-band *emissions*, defined based on their source, occur in the out-of-band domain and, to a lesser extent, in the spurious domain. Spurious emissions likewise may occur in the out-of-band domain as well as in the spurious domain.

S1.146*ter spurious domain* (of an emission):  The frequency range beyond the *out-of-band domain* in which *spurious emissions* generally predominate.

**Reasons:** Adoption of these two definitions will provide a means to distinguish between frequency ranges within which the emission limits of Appendix S3, Section II either apply or do not apply.

**USA/  /3**
**MOD**

# APPENDIX  S3

## Table of maximum permitted ~~spurious~~ ~~emission~~ power levels for certain unwanted emissions

(See Article **S3**)

**Reasons:**  Section I of this Appendix applies to spurious emissions, while Section II applies to unwanted emissions in the spurious domain. The proposed title encompasses both types of emission limits.

**USA/  /4**
**MOD**

1    The following sections indicate the maximum permitted levels of ~~spurious~~ certain unwanted emissions, in terms of power as indicated in the tables, of ~~any spurious~~ components supplied by a transmitter to the antenna transmission line. Section I, which provides spurious emissions limits, is applicable until 1 January 2012 to transmitters installed on or before 1 January 2003; Section II, which limits emissions in the spurious domain, is applicable to transmitters installed after 1 January 2003 and to all transmitters after 1 January 2012. ~~This Appendix does not cover out-of-band emissions. Out-of-band emissions are dealt with in~~The provisions of No. **S4.5** apply to unwanted emissions not covered in Sections I and II.

2    Spurious and spurious domain emissions (covered by Sections I and II) from any part of the installation, other than the antenna and its transmission line, shall not have an effect greater than would occur if this antenna system were supplied with the maximum permitted power at ~~that spurious emission~~the frequency of that emission.

3    These levels shall not, however, apply to emergency position-indicating radiobeacon (EPIRB) stations, emergency locator transmitters, ships' emergency transmitters, lifeboat transmitters, survival craft stations or maritime transmitters when used in emergency situations.

4    For technical or operational reasons, more stringent levels than those specified may be applied to protect specific services in certain frequency bands. The levels applied to protect these services, such

- for fixed-frequency, non-pulse-coded radar, one divided by the radar pulse length, in seconds (e.g. if the radar pulse length is 1 μs, then the reference bandwidth is 1/1 μs = 1 MHz);

- for fixed-frequency, phase coded pulsed radar, one divided by the phase chip length, in seconds (e.g. if the phase coded chip is 2 μs long, then the reference bandwidth is 1/2 μs = 500 kHz);

- for frequency modulated (FM) or chirped radar, the square root of the quantity obtained by dividing the radar bandwidth in MHz by the pulse length, in seconds (e.g. if the FM is from 1 250 MHz to 1 280 MHz or 30 MHz during the pulse of 10 μs, then the reference bandwidth is $(30 \text{ MHz}/10 \text{ μs})^{1/2} = 1.73 \text{ MHz}$).

For those radar systems for which acceptable methods of measurement do not exist, the lowest practicable power of spurious domain emission should be achieved.

10  The spurious domain emission levels are specified in the following reference bandwidths:

- 1 kHz between 9 kHz and 150 kHz

- 10 kHz between 150 kHz and 30 MHz

- 100 kHz between 30 MHz and 1 GHz

- 1 MHz above 1 GHz.

As a special case, the reference bandwidth of all space service spurious domain emissions should be 4 kHz.

**Reasons:** The provisions of this Section apply to unwanted emissions in the spurious domain, here called "spurious domain emissions," as opposed to the spurious emissions addressed in Section I.

**USA/ /7**
**MOD**

11 ~~For the purpose of setting limits,~~ The emission limits of this section apply to all emissions, including harmonic emissions, intermodulation products, frequency conversion products and parasitic emissions, at frequencies in the spurious domain (see Figure 1). The upper and lower parts of the spurious domain extend outward from a boundary determined using Annex I. ~~which fall at frequencies separated from the centre frequency of the emission by ±250%, or more, of the necessary bandwidth of the emission will generally be considered as spurious emissions. However, this frequency separation may be dependent on the type of modulation used, the maximum bit rate in the case of digital modulation, the type of transmitter and frequency coordination factors. For example, in the case of digital (including digital broadcasting) modulation systems, broadband systems, pulsed modulation systems and narrow-band high power transmitters, the frequency separation may need to differ from the ±250% factor. For multichannel or multicarrier transmitters/transponders, where several carriers may be transmitted simultaneously from a final output amplifier or an active antenna, the centre frequency of the emission is taken to be the centre of the −3 dB bandwidth of the transmitter or transponder and the necessary bandwidth is taken to be the transmitter or transponder bandwidth.~~

**Reasons:** Since the boundary between the out-of-band and spurious domains is determined using Annex I, the information is no longer needed here.

**USA/ /8**
**ADD**

<p align="center" style="color:magenta"><u>FIGURE 1</u></p>

<div align="center">

| spurious domain | out-of-band domain | necessary bandwidth | out-of-band domain | spurious domain |
</div>

**Frequency of the Emission**
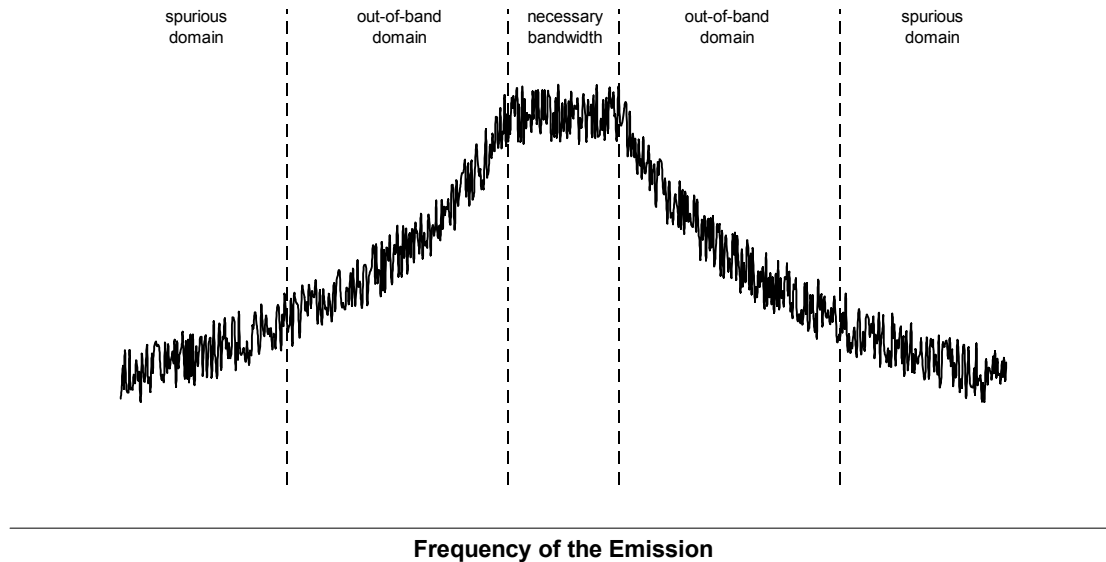
**Out-of-band and spurious domains**

**Reasons:** The figure illustrates the text description of the locations of the out-of-band and spurious domains from the previous paragraph.

**USA/ /9**
**SUP**

11*bis*

**Reasons:** The information used to determine the boundary between the out-of-band and spurious domains is now found in Annex I.

**USA/ /10**
**MOD**

11*ter*    For the case of a single satellite operating with more than one transponder in the same service area, and when considering the limits for spurious <u>domain</u> emissions as indicated in § 11 of this Appendix, spurious <u>domain</u> emissions from one transponder may fall on a frequency at which a second, companion transponder is transmitting. In these situations, the level of spurious <u>domain</u>

emissions from the first transponder is well exceeded by the fundamental or out-of-band domain emissions of the second transponder. Therefore, the limits of this Appendix should not apply to those ~~spurious~~ emissions of a satellite that fall within either the necessary bandwidth or the out-of-band ~~region~~ domain of another transponder on the same satellite, in the same service area (see Fig. ~~1~~2).

FIGURE ~~1~~2

**Example of the applicability of spurious domain emission limits
to a satellite transponder**
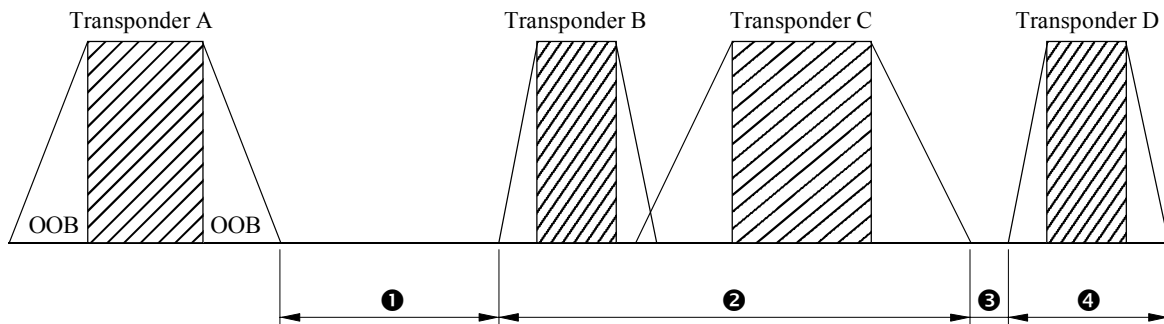


Transponders A, B, C and D are operating on the same satellite in the same service area. Transponder A is not required to meet spurious domain emission limits in frequency ranges ❷ and ❹, but is required to meet them in frequency ranges ❶ and ❸.

## 12  Examples of applying 43 + 10 log ($P$) to calculate attenuation requirements

Where specified in relation to mean power, spurious domain emissions are to be at least $x$ dB below the total mean power $P$, i.e. $-x$ dBc. The power $P$ (W) is to be measured in a bandwidth wide enough to include the total mean power. The spurious domain emissions are to be measured in the reference bandwidths given in the Recommendation. The measurement of the spurious domain emission power is independent of the value of necessary bandwidth. Because the absolute emission power limit, derived from 43 + 10 log ($P$), can become too stringent for high-power transmitters, alternative relative powers are also provided in Table II.

*Example 1*

A land mobile transmitter, with any value of necessary bandwidth, must meet a spurious domain emission attenuation of 43 + 10 log ($P$), or 70 dBc, whichever is less stringent. To measure spurious domain emissions in the frequency range between 30 MHz and 1 GHz, Recommendation ITU-R SM.329-~~7~~8 *recommends* 4.1 indicates the use of a reference bandwidth of 100 kHz. For other frequency ranges, the measurement must use the appropriate reference bandwidths given in *recommends* 4.1.

With a measured total mean power of 10 W:

−  Attenuation relative to total mean power = 43 + 10 log (10) = 53 dBc.

- The 53 dBc value is less stringent than the 70 dBc, so the 53 dBc value is used.

- Therefore: Spurious domain emissions must not exceed 53 dBc in a 100 kHz bandwidth, or converting to an absolute level, ~~spurious emissions~~ they must not exceed 10 dBW − 53 dBc = −43 dBW in a 100 kHz reference bandwidth.

With a measured total mean power of 1 000 W:

- Attenuation relative to total mean power = 43 + 10 log (1 000) = 73 dBc.

- The 73 dBc value is more stringent than the 70 dBc limit, so the 70 dBc value is used.

- Therefore: Spurious domain emissions must not exceed 70 dBc in a 100 kHz bandwidth, or converting to an absolute level, ~~spurious emissions~~ they must not exceed 30 dBW − 70 dBc = −40 dBW in a 100 kHz reference bandwidth.

*Example 2*

A space service transmitter with any value of necessary bandwidth must meet a spurious domain emission attenuation of 43 + 10 log ($P$), or 60 dBc, whichever is less stringent. To measure spurious domain emissions at any frequency, Note 10 to Table II indicates using a reference bandwidth of 4 kHz.

With a measured total mean power of 20 W:

- Attenuation relative to total mean power = 43 + 10 log (20) = 56 dBc.

- The 56 dBc value is less stringent than the 60 dBc limit, so the 56 dBc value is used.

- Therefore: Spurious domain emissions must not exceed 56 dBc in a 4 kHz reference bandwidth, or converting to an absolute level, ~~spurious emissions~~ they must not exceed 13 dBW − 56 dBc = −43 dBW in a 4 kHz reference bandwidth.

TABLE  II

**Attenuation values used to calculate maximum permitted spurious domain emission
power levels for use with radio equipment**

| Service category in accordance with Article S1, or equipment type [15] | Attenuation (dB) below the power supplied to the antenna transmission line |
|---|---|
| All services except those services quoted below: | 43 + 10 log (*P*), or 70 dBc, whichever is less stringent |
| Space services (earth stations) [10, 16] | 43 + 10 log (*P*), or 60 dBc, whichever is less stringent |
| Space services (space stations) [10, 17] | 43 + 10 log (*P*), or 60 dBc, whichever is less stringent |
| Radiodetermination [14] | 43 + 10 log (*PEP*), or 60 dB, whichever is less stringent |
| Broadcast television [11] | 46 + 10 log (*P*), or 60 dBc, whichever is less stringent, without exceeding the absolute mean power level of 1 mW for VHF stations or 12 mW for UHF stations. However, greater attenuation may be necessary on a case by case basis. |
| Broadcast FM | 46 + 10 log (*P*), or 70 dBc, whichever is less stringent; the absolute mean power level of 1 mW should not be exceeded |
| Broadcasting at MF/HF | 50 dBc; the absolute mean power level of 50 mW should not be exceeded |
| SSB from mobile stations [12] | 43 dB below *PEP* |
| Amateur services operating below 30 MHz (including those using SSB) [16] | 43 + 10 log (*PEP*), or 50 dB, whichever is less stringent |
| Services operating below 30 MHz, except space, radiodetermination, broadcast, those using SSB from mobile stations, and amateur [12] | 43 + 10 log (*X*), or 60 dBc, whichever is less stringent, where *X* = *PEP* for SSB modulation, and *X* = *P* for other modulation |
| Low-power device radio equipment [13] | 56 + 10 log (*P*), or 40 dBc, whichever is less stringent |
| Emergency transmitters [18] | No limit |

TABLE II (*end*)

*P*: mean power in watts supplied to the antenna transmission line, in accordance with No. **S1.158**. When burst transmission is used, the mean power *P* and the mean power of any spurious domain emissions are measured using power averaging over the burst duration.

*PEP*: peak envelope power in watts supplied to the antenna transmission line, in accordance with No. **S1.157**.

dBc: decibels relative to the unmodulated carrier power of the emission. In the cases which do not have a carrier, for example in some digital modulation schemes where the carrier is not accessible for measurement, the reference level equivalent to dBc is decibels relative to the mean power *P*.

[10] Spurious domain emission limits for all space services are stated in a 4 kHz reference bandwidth.

[11] For analogue television transmissions, the mean power level is defined with a specified video signal modulation. This video signal has to be chosen in such a way that the maximum mean power level (e.g. at the video signal blanking level for negatively modulated television systems) is supplied to the antenna transmission line.

[12] All classes of emission using SSB are included in the category "SSB".

[13] Low-power radio devices having a maximum output power of less than 100 mW and intended for short-range communication or control purposes; such equipment is in general exempt from individual licensing.

[14] For radiodetermination systems (radar as defined by No. **S1.100**), spurious domain emission attenuation (dB) shall be determined for radiated emission levels, and not at the antenna transmission line. The measurement methods for determining the radiated spurious domain emission levels from radar systems should be guided by Recommendation ITU-R M.1177.

[15] In some cases of digital modulation (including digital broadcasting), broadband systems, pulsed modulation and narrow-band high-power transmitters for all categories of services, there may be difficulties in meeting limits close to $\pm 250\%$ of the necessary bandwidth.

[16] Earth stations in the amateur-satellite service operating below 30 MHz are in the service category "Amateur services operating below 30 MHz (including those using SSB)".

[17] Space stations in the space research service intended for operation in deep space as defined by No. **S1.177** are exempt from spurious domain emission limits.

[18] Emergency position-indicating radio beacon, emergency locator transmitters, personal location beacons, search and rescue transponders, ship emergency, lifeboat and survival craft transmitters and emergency land, aeronautical or maritime transmitters.

**Reasons:** These revisions again reflect the change in terminology from "spurious emissions" to "spurious domain emissions."

**USA/ /11**
**ADD**

<p align="center"><span style="color:magenta">ANNEX I</span></p>

<p align="center"><span style="color:magenta">**Determination of the boundary between the out-of-band and spurious domains**</span></p>

1    Except as provided below, the boundary between the out-of-band and spurious domains occurs at frequencies that are separated from the centre frequency of the emission by the values shown in Table 1. For most systems, the centre frequency of the emission is the centre of the necessary bandwidth. For multichannel or multicarrier transmitters/transponders, where several carriers may be transmitted simultaneously from a final output amplifier or an active antenna, the centre frequency of the emission is taken to be the centre of the 3 dB bandwidth of the transmitter or transponder and the transmitter or transponder bandwidth is used in place of the necessary bandwidth for determining the boundary. Some systems specify unwanted emissions relative to channel bandwidth, or channel spacing. These may be used as a substitute for the necessary bandwidth in Table 1, provided they are found in ITU–R Recommendations.

<p align="center">TABLE 1</p>

<p align="center">**Values for frequency separation between the centre frequency<br>and the boundary of the spurious domain**</p>

| Frequency range | Narrow-band case | | Normal separation | Wideband case | |
|---|---|---|---|---|---|
| | for $B_n <$ | Separation | | for $B_n >$ | Separation |
| $9 \text{ kHz} < f_c < 150 \text{ kHz}$ | 250 Hz | 625 Hz | $2.5\, B_n$ | 10 kHz | $1.5\, B_n + 10 \text{ kHz}$ |
| $150 \text{ kHz} < f_c < 30 \text{ MHz}$ | 4 kHz | 10 kHz | $2.5\, B_n$ | 100 kHz | $1.5\, B_n + 100 \text{ kHz}$ |
| $30 \text{ MHz} < f_c < 1 \text{ GHz}$ | 25 kHz | 62.5 kHz | $2.5\, B_n$ | 10 MHz | $1.5\, B_n + 10 \text{ MHz}$ |
| $1 \text{ GHz} < f_c < 3 \text{ GHz}$ | 100 kHz | 250 kHz | $2.5\, B_n$ | 50 MHz | $1.5\, B_n + 50 \text{ MHz}$ |
| $3 \text{ GHz} < f_c < 10 \text{ GHz}$ | 100 kHz | 250 kHz | $2.5\, B_n$ | 100 MHz | $1.5\, B_n + 100 \text{ MHz}$ |
| $10 \text{ GHz} < f_c < 15 \text{ GHz}$ | 300 kHz | 750 kHz | $2.5\, B_n$ | 250 MHz | $1.5\, B_n + 250 \text{ MHz}$ |
| $15 \text{ GHz} < f_c < 26 \text{ GHz}$ | 500 kHz | 1.25 MHz | $2.5\, B_n$ | 500 MHz | $1.5\, B_n + 500 \text{ MHz}$ |
| $f_c > 26 \text{ GHz}$ | 1 MHz | 2.5 MHz | $2.5\, B_n$ | 500 MHz | $1.5\, B_n + 500 \text{ MHz}$ |

NOTE—In Table 1, $f_c$ is the centre frequency of the emission and $B_n$ is the necessary bandwidth. If the assigned frequency band of the emissions extends across two frequency ranges, then the values corresponding to the higher frequency range shall be used for determining the boundary.

*Example 1*: The necessary bandwidth of an emission at 26 MHz is 1.8 kHz. Since $2.5 B_n$ is only 4.5 kHz, the minimum separation applies. The spurious domain begins 10 kHz each side of the centre of the necessary bandwidth.

*Example 2*: The necessary bandwidth of an emission at 8 GHz is 200 MHz. Since the wideband case applies for $B_n > 100$ MHz at that frequency, the spurious domain begins 400 MHz each side of the centre of the necessary bandwidth. Using the general separation formula, the out-of-band domain would have extended to $2.5 \times 200$ MHz = 500 MHz either side of the centre frequency.

2    Tables 2 and 3 show exceptions to Table 1 for narrow-band and wideband cases, respectively, applicable to particular systems or services and frequency bands.

TABLE 2

**Narrow-band variations for systems or services and frequency bands**

| System or service | Frequency range | Narrow-band case | |
|---|---|---|---|
| | | **for $B_n <$** | **Separation** |
| FS | 14 kHz - 1.5 MHz | 20 kHz[1] | 50 kHz |
| FS | 1.5-30 MHz | 80 kHz[2] | 200 kHz |

[1]   This is based on an assumption that the maximum value of the necessary bandwidth is about 3 kHz for the frequency range 14 kHz - 1.5 MHz. The value of 50 kHz separation is extremely large as compared with the necessary bandwidth. It is because unwanted emissions of high power transmitters under modulated conditions have to be below the spurious limit (70 dBc) at the boundary between the out-of-band and spurious domains.

[2]   This is based on an assumption that the maximum value of the necessary bandwidth is about 12 kHz for the frequency range 1.5-30 MHz. The value of 200 kHz separation is extremely large as compared with the necessary bandwidth. It is because unwanted emissions of high power transmitters under modulated conditions have to be below the spurious limit (70 dBc) at the boundary between the out-of-band and spurious domains. Also, if future systems in the fixed service operating in this frequency range require a necessary bandwidth larger than 12 kHz, it may become necessary to review the 200 kHz separation. It should be noted that for medium or low power transmitters (e.g. below 1 kW), a smaller value may be appropriate as the minimum separation. This matter requires further study.

TABLE 3

**Wideband variations for systems or services and frequency bands**

| System or service | Frequency range | Wideband case | |
|---|---|---|---|
| | | **for $B_n >$** | **Separation** |
| FS | 14-150 kHz | 20 kHz | $1.5\,B_n + 20$ kHz |
| FSS | 3.4-4.2 GHz | 250 MHz | $1.5\,B_n + 250$ MHz |
| FSS | 5.725-6.725 GHz | 500 MHz | $1.5\,B_n + 500$ MHz |
| FSS | 7.25-7.75 GHz and 7.9-8.4 GHz | 250 MHz | $1.5\,B_n + 250$ MHz |
| FSS | 10.7-12.75 GHz | 500 MHz | $1.5\,B_n + 500$ MHz |
| BSS | 11.7-12.75 GHz | 500 MHz | $1.5\,B_n + 500$ MHz |
| FSS | 12.75-13.25 GHz | 500 MHz | $1.5\,B_n + 500$ MHz |
| FSS | 13.75-14.8 GHz | 500 MHz | $1.5\,B_n + 500$ MHz |

3    For primary radar stations, the boundary between the out-of-band and spurious domains is the frequency at which the out-of-band limits specified in applicable ITU–R Recommendations are equal

to the spurious limit defined in Table II of Appendix **S3**. Further studies need to be conducted within the ITU–R to determine the appropriate spurious domain boundary for these systems.

**Reasons:** Annex I is added for the following reasons;

- Section II of this Appendix states that the emission limits apply to unwanted emissions in the spurious domain. This Annex is needed to determine the boundary between the out-of-band and spurious domains, and thus the frequencies to which the emission limits of Section II apply.

- Table 1, taken from Recommendation ITU–R SM.[BOUNDARY], shows the normal boundary of $2.5B_n$, along with the narrowband and wideband exception. The information in the Recommendation, along with the text of existing paragraphs 11 and 11*bis*, have been included, though they have been shortened to bring them in line with the form of other Appendices.

- Tables 2 and 3 are also taken from Recommendation ITU–R SM. [BOUNDARY].

- Studies regarding the frequencies to which the Section II limits for primary radar apply will not be completed in time for WRC–2003. This text is similar to that of Annex 8, § 5 of Recommendation ITU–R SM.[OOB].

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