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FEDERAL COMMUNICATIONS COMMISSION
INTERNATIONAL BUREAU

Satellite and Radiocommunication Division

To: Magalie Roman Salas, Secretary

Date: December 3, 1998

From: Kimberly Baum

Re: ET Docket No. 98-206
RM-9147
RM-9245

Please include a copy of the attached documents in the record of the above-mentioned proceeding. Thank you.

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3.2.5 Doc. 4A/TEMP/73(Rev.1)

PRELIMINARY DRAFT MODIFICATION TO RECOMMENDATION ITU-R S.524

EARTH STATION OFF-AXIS e.i.r.p. DENSITY LEVELS*

1.0 Proposed revisions to Rec. S.524 (14 GHz Off-axis e.i.r.p. Density Levels)

Three contributions, two from Australia and one from Japan, were discussed on the subject of off-axis e.i.r.p. density levels for TT&C and communications carriers in the 14 GHz band. The contribution from Japan proposed changes to Recommendation ITU-R S.524 and similar changes to Article S22 of the Radio Regulations.

In the discussions there was agreement that the off-axis e.i.r.p. density levels contained in both section 6 of Article S22 and *recommends* 3 of Recommendation ITU-R S.524-5 may be exceeded by a level to be determined in the case of telecommand and ranging carriers operating in the 14 GHz band with GSO FSS satellites.

For the same links operating in emergency mode, the fact that the above levels may be exceeded was also agreed but there was no agreement on whether or not the level of this exceptional excess had to be quantified.

A new note has been proposed for addition to Recommendation ITU-R S.524 addressing the above concern, see NOTE 19 in the attached proposed modification. Square brackets were included around some of the text where no consensus could be reached. One administration supported the view that levels should be placed on TT&C carriers operating in the emergency mode.

This matter is however subject to further ITU-R studies to determine the levels of excess as given in the proposed note. Japan ~~(Mr. Kono)~~ with the assistance of Australia, Canada and France drafted the Recommendation note and that part of the text in the WP 4A liaison statement to the JTG.

2.0 Proposed revisions to Rec. S.524 (30/20 GHz Off-axis e.i.r.p. Density Levels)

Five contributions were received on off-axis e.i.r.p. density levels for GSO FSS systems operating in the 30/20 GHz band.

Three contributions proposed an e.i.r.p. density level~~limits~~ in the range of 19 -25log φ dBW/40kHz. Two of the contributions, one from Luxembourg and one from France proposed changes to Recs. 524 and 728 respectively, both proposed maximum levels not to be exceeded under any conditions were based upon the technical work which had been undertaken in ETSI. The third contribution from INTELSAT considered the e.i.r.p. density levels under clear sky conditions which were being planned for use with their 30/20 GHz multimedia (Ka) band platform providing high, medium, and low data rate services.

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* Whenever this term applies, it should be taken to reflect eirp spectral density.

One contribution from the UK proposed a lower e.i.r.p. density level of 13-25 log φ , which was based on a review of 47 carrier types and selecting the level which would ensure that no more than half of those carriers would suffer I/N ratios of more than 6% interference from the uplink of a GSO satellite 2.5 degrees away. There were some views the 6% level was a threshold level and might not be appropriate if it was applied as a criteria in the selection of a level~~limit~~.

The contribution from Japan proposed an e.i.r.p. density level of 45-25 log φ under rain fade conditions, i.e. with uplink power control in operation. Under clear sky conditions this eirp density level could meet a level of 32-25 log φ. There were questions on the G/T of the satellite and the level of ΔT/T interference into adjacent satellite systems and the need for such a high off-axis e.i.r.p. density level. Based on some of the discussions the limiting system was an older existing system and the next generation system may have lower levels. In addition there was an indication that a lower e.i.r.p. density level of 19-25 log φ may be possible in the band 27.5-30 GHz for the next generation system. Some flexibility in the implementation date of these new e.i.r.p. density levels might offer a means of taking into account the operation of these existing systems.

~~After some discussion there was no consensus on a final off-axis e.i.r.p. density level however~~ T~~t~~he attached draft revision of Rec. 524 provides an initial attempt in drafting a suitable e.i.r.p. density mask. There was some support for the value of 19 in Recommends 3 provided that some means are found to "grandfather" existing networks. WP 4A members are encouraged to submit further contributions to the next meeting in order finalize the 30/20 GHz portions of this Recommendation. Given below is a summary of the major points that were discussed.

2.1 e.i.r.p. Density Levels for Different Sub-bands

The drafting group considered that portions of the 27.5-30 GHz band may have different off-axis e.i.r.p. density level~~limit~~s. One factor that might have an impact on the definition of maximum off-axis e.i.r.p. density of GSO Earth stations in the band 27.5-30 GHz is the different situations in the frequency bands 27.5-29.5 GHz (shared with terrestrial services) and 29.5-30 GHz (not shared with terrestrial). This factor might be connected to the developments of different FSS applications in some countries in the two different bands. In particular, it is expected that in the upper band satellite networks will deploy ubiquitous small Earth stations. This is not expected to be the case with GSO satellite networks to be operated in the lower portion of the band. It appears that, due to the anticipated use of the band 29.5-30 GHz for applications using small Earth stations, there is urgent need for consideration of the off-axis e.i.r.p. density pattern for such a band.

Although the off-axis e.i.r.p. level for the upper band might be also appropriate for the lower band, further studies are required to define it for the lower band, in order not to constrain existing and future satellite services.

2.2 Power Control/Fixed Levels

There were varied views as to having fixed maximum off-axis e.i.r.p. density levels or clear sky e.i.r.p. density levels. Two of the proposals were based on the standard recently adopted by ETSI and which specified maximum levels as a means of standardizing the verification testing of the earth stations. However, there was a general consensus that the Recommendation should include some provision for

exceeding the level~~limit~~s during rain fade conditions. Text was drafted reflecting the discussions and a note 17 added to the proposed modification of Rec. 524.

2.3 VSAT Recommendation 728

There was a proposal to update Recommendation 728 dealing with VSAT systems. After some discussion it was agreed that Rec. 524 should be revised first as it has a wider application, and then Rec. 728 could be addressed at the next meeting. There was some concern that the exact definition of VSAT type earth stations in the 30/20 GHz bands should be addressed first.

2.4 Applicability of the Off-axis e.i.r.p. Density Values to only GSO FSS Earth stations

There were varied views as to whether the Recommendation ITU-R S.524 should apply to only within the +/- 3 degrees of the GSO plane and only to GSO FSS earth stations. One contribution proposed a draft revision of Recommendation ITU-R S.524-5 to align the recommendation text with the technical bases of the present maximum permissible levels of off-axis e.i.r.p. density. In 1994, the present maximum permissible levels of off-axis e.i.r.p. density were determined and adopted by Working Party 4A, based on information from GSO FSS earth station operations for any direction within 3° of the GSO for the 6 and 14 GHz frequency bands.

One administration indicated that the recommendation should include levels applicable to new antennas in all directions (not just those directions within 3° of the GSO), in order to consider interference into other systems, like NGSO FSS systems. This same view is expressed in two contributions which presented the off-axis e.i.r.p. density specifications for GSO earth stations for any angle with respect to the antenna boresight, as presented in ETSI GSO Ka band standards, which have been agreed by European satellite operators.

The same administration indicated that Recommendation ITU-R S.524-5 should also include maximum permissible levels for NGSO FSS earth stations. However, further studies are necessary to check on this point.

2.5 Exceedance of Side-lobe Levels

There was a proposal ~~from Japan~~ that the off-axis e.i.r.p. density ~~level~~ recommendation should allow a 10 % exceedance of the level, similar to the antenna radiation pattern given in Rec. ITU-R 580. There was agreement with the proposal, and a new note 15 was added to the proposed revision to Recommendation 524. However, further study should be undertaken to confirm that the methodology given in Recommendation ITU-R 732 can be applied to e.i.r.p. density level measurements. Additional studies should also be undertaken to consider the applicability of this 10% exceedance to *recommends* 1 and 2.

2.6 FM/TV

Notes 9, 10, 12, and 13 of Recommendation ITU-R S.524-5 address the usage of FM-TV application in relation to other applications in the 6 and 14 GHz frequency bands. Similar notes or modifications to those existing notes are needed to address the usage of FM-TV application in the 30 GHz frequency band. Some administrations raised the issue of whether or not the FM-TV application should be used in part of the 30 GHz frequency band. However, a general consensus was reached that the question of

which frequency bands should be allocated to which applications is a WRC issue, and thus cannot be resolved within Working Party 4A.

2.7 SNG

A general consensus was reached to address the maximum permissible levels of off-axis e.i.r.p. density ~~off~~of the satellite news gathering (SNG) applications as a new note in the recommends ~~5~~4, of Recommendation ITU-R S.524-5. Further studies are required to determine the maximum permissible levels for this application.

2.8 Satellite G/T

It was noted that the satellite G/T performance of both interfering and victim systems impacts the required earth station off-axis e.i.r.p. levels. Some administrations were of the opinion that further study is required to determine the range of satellite G/T values that may form a basis for the proposal maximum permissible values of off-axis eirp density.

2.9 CDMA

With regard to new NOTE 14, it was recognized that the basic principle was applicable in the case of small spot beams in the 27.5 - 30 GHz band, but that it might not be appropriate to extend the same principle to the lower frequency bands. Therefore, the references to *recommends* 1 and *recommends* 2 were placed in square brackets pending further review at the next meeting of WP 4A.

~~**List of participants contributing to the Drafting of output text from DG 4A1c**~~

~~Mr. Kono (#164): 14 GHz Liaison and Note for Rec. 524~~

~~Mr. N. Takizawa (#159)~~

~~Mr. A. Ashman(#45): TT&C and 14 GHz~~

~~Mr. Greco (#205): Dev.of off-axis e.i.r.p. density levels depending on appl. and band~~

~~Mr. Shewan (#200): Pwr ctrl usage and addl. factor depending on elev.angle~~

~~Mr. Phan (#77): +/- 3deg. applicability of Rec. 524 reasons why changes required/TV~~

~~Mr. F. Boixadera (#222): non restrictive appl. of the Rec to all azimuths and elev. angles~~

~~Mr. R. Barnett ( )~~

~~Mr. Kubic( )~~

~~Mr. Klaeyle ( )~~

~~Ms. Garcia ( )~~

~~Mr. B. Mitani (#210): Footnote on CDMA usage, add footnote based on Rec. 728.~~

ATTACHMENT 1 TO DOC. 4A/TEMP/73(REV.1)

PRELIMINARY PROPOSED DRAFT MODIFICATIONS TO
RECOMMENDATION ITU-R S.524-5

MAXIMUM PERMISSIBLE LEVELS OF OFF-AXIS e.i.r.p. DENSITY ~~IN ANY DIRECTION WITHIN 3° OF THE GSO~~ FROM GSO EARTH STATIONS IN THE FIXED-SATELLITE SERVICE TRANSMITTING IN THE 6, 14 AND ~~14~~ 30 GHz FREQUENCY BANDS*

(Questions ITU-R 48/4 and ITU-R 70/4)

(1978-1982-1986-1990-1992-1994)

The ITU Radiocommunication Assembly,

considering

a) that geostationary satellite networks in the fixed-satellite service (FSS) operate in the same frequency bands;

b) that interference between networks in the FSS contributes to noise in the network;

c) that it is necessary to protect a network in the FSS from interference by other such networks;

d) that it is necessary to specify the maximum permissible levels of off-axis e.i.r.p. density from earth stations, to promote harmonization between geostationary satellite networks;

e) that networks in the FSS may receive interference into the space station receiver;

f) that the use of antennas with the best off-axis performance will lead to the most efficient use of radio-frequency spectrum and the geostationary-satellite orbit (GSO);

g) that progress in the development of reduced side-lobe antennas indicates that improved performance antennas will be widely available in the next few years;

h) that off-axis e.i.r.p. density levels are determined by the side-lobe gain, the transmitter output power level and spectral distribution of that power;

j) that Annex 1 describes the basis on which the limits in this Recommendation were derived,

recommends

1 that GSO networks in the FSS operating in the 6 GHz frequency band be designed in such a manner that at any angle, φ, which is 2.5° or more off the main lobe axis of an earth station antenna, the e.i.r.p. density in any direction within 3° of the GSO should not exceed the following values:

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* Except where providing feeder links to the broadcasting-satellite service in accordance with Appendix 30A of the Radio Regulations (RR).

1.1 for emissions in systems other than those considered in § 1.2 and 1.3 below:

Angle off-axis	*Maximum e.i.r.p. per 4 kHz*
$2.5° \leq \varphi < 48°$	$(35 - 25 \log \varphi)$ dB(W/4 kHz)
$48° \leq \varphi \leq 180°$	–7 dB(W/4 kHz);

1.2 for emissions in voice-activated telephony SCPC/FM systems:

Angle off-axis	*Maximum e.i.r.p. per 40 kHz*
$2.5° \leq \varphi < 48°$	$(42 - 25 \log \varphi)$ dB(W/40 kHz)
$48° \leq \varphi \leq 180°$	0 dB(W/40 kHz);

1.3 for emissions in voice-activated telephony SCPC/PSK systems:

Angle off-axis	*Maximum e.i.r.p. per 40 kHz*
$2.5° \leq \varphi < 48°$	$(45 - 25 \log \varphi)$ dB(W/40 kHz)
$48° \leq \varphi \leq 180°$	3 dB(W/40 kHz);

~~2~~1.4 for new antennas of a~~n~~ GSO earth station using emissions other than those considered in § 1.2 and 1.3, after 1988 the e.i.r.p. density should not exceed the following values:

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

~~3~~2 that earth stations operating in GSO networks in the FSS operating in the 14 GHz frequency band (which are not providing feeder links to the broadcasting-satellite service in accordance with RR Appendix 30A) be designed in such a manner that at any angle, φ, which is 2.5° or more off the main lobe axis of an earth station antenna, the e.i.r.p. density in any direction within 3° of the GSO should not exceed the following values:

Angle off-axis	*Maximum e.i.r.p. per 40 kHz*
$2.5° \leq \varphi \leq 7°$	$(39 - 25 \log \varphi)$ dB(W/40 kHz)
$7° < \varphi \leq 9.2°$	18 dB(W/40 kHz)
$9.2° < \varphi \leq 48°$	$(42 - 25 \log \varphi)$ dB(W/40 kHz)
$48° < \varphi \leq 180°$	0 dB(W/40 kHz);

3 that earth stations operating in networks in the GSO FSS operating in the 27.5 - 30 GHz frequency band be designed in such a manner that at any angle, φ, which is 2[2.5]° or more off the

main lobe axis of an earth station antenna, the e.i.r.p. density [in any direction within 3° of the GSO] should not exceed the following values:

Angle off-axis	Maximum e.i.r.p. per 40 kHz
2[2.5]° ≤ φ ≤ 7°	([19]– 25 log φ) dB(W/40 kHz)
7° < φ ≤ 9.2°	[19-21] dB(W/40 kHz)
9.2° < φ ≤ 48°	([19+3] – 25 log φ) dB(W/40 kHz)
48° < φ ≤ 180°	[-10][19-39]dB(W/40 kHz);

4 that the following Notes should be regarded as part of this Recommendation.

NOTE 1 – Values in § 1.2 above are based on a mean power noise analysis. Possible subjective effects of interference into an SCPC-FM carrier by a very narrow bandwidth emission have not been considered. Further studies are required on this matter.

NOTE 2 – Limits in § 1.2 above apply to normal operation of voice telephony in a 4 kHz baseband.

NOTE 3 – The values contained in § 1.1 above have been derived mainly from an analysis of FM systems used for analogue television or multi-channel telephony. It is not known at the present time whether telecommand and ranging systems operating in the emission band and some types of SCPC system different from those mentioned in § 1.2 and 1.3, comply with these provisions. Studies should be undertaken in order to determine how these systems could comply with the limits above.

NOTE 4 – Enhanced orbit utilization and easier coordination would be attained with lower side-lobe e.i.r.p. values, and therefore, administrations are encouraged to achieve lower values where practicable.

NOTE 5 – Wherever practicable, existing GSO earth stations should comply with the values above.

NOTE 6 – The provisional values contained in § 1.4~~2~~ have been derived from advanced, low side-lobe antenna patterns, taking into account the principles of Note 3. Further studies of GSO earth station antenna performance at angles close to the main beam, and particularly in respect of the validity of 7° as a value up to which it is reasonable to recommend this 3 dB tightening of the off-axis e.i.r.p. density limit, are urgently needed. These studies should also include consideration of the impact of the values in § 1.4~~2~~ on antennas with operating bandwidths greater than 500 MHz.

NOTE 7 – It may be necessary, in frequency planning, to avoid situations where television transmissions in one network use the same frequencies as SCPC telephony transmissions in a network using a nearby satellite.

NOTE 8 – When up-link power control is used and rain fades make it necessary, the limiting values stated in §~~3~~2 may be exceeded for the duration of that period. In rain climates N and P in the case when up-link power control is not used, the limits given in § ~~3~~2 may be exceeded by *y* dB. The value of *y* dB needs to be determined by further studies based on reliable propagation data to establish fade margins with adequate accuracy. Table 2 of Annex 1 provides further guidance on this subject.

NOTE 9 – Administrations operating GSO earth stations in the 14 GHz band are encouraged to reduce the off-axis e.i.r.p. density by increasing the required antenna diameter, employing improved antenna side-lobe performance or, in the case of FM-TV, to use an appropriate form of energy dispersal, if applicable.

NOTE 10 – For FM-TV transmissions, administrations are encouraged to reduce interference to other networks by using either programme material or appropriate test patterns, together with energy dispersal, at all times. Figure 1 of Annex 1 provides an example of typical spectral distribution of a FM-TV carrier modulated by programme material, together with energy dispersal.

NOTE 11 – The use of reduced satellite spacing will require further study of the e.i.r.p. limit for off-axis angles below 2.5°.

NOTE 12 – FM-TV emissions with energy dispersal in the 14 GHz band may exceed the limits in § ~~3~~2 above by up to 3 dB provided the off-axis total e.i.r.p. of the emitted FM-TV carrier does not exceed the following values:

Angle off-axis	*Maximum e.i.r.p.*
$2.5° \leq \varphi \leq 7°$	$(53 - 25 \log \varphi)$ dBW
$7° < \varphi \leq 9.2°$	32 dBW
$9.2° < \varphi \leq 48°$	$(56 - 25 \log \varphi)$ dBW
$48° < \varphi \leq 180°$	14 dBw

NOTE 13 – For FM-TV carriers in the 14 GHz band which operate without energy dispersal, such carriers should be modulated at all times with programme material or appropriate test patterns. In this case, the off-axis total e.i.r.p. of the emitted FM-TV carrier should not exceed the following values:

Angle off-axis	*Maximum e.i.r.p.*
$2.5° \leq \varphi \leq 7°$	$(53 - 25 \log \varphi)$ dBW
$7° < \varphi \leq 9.2°$	32 dBW
$9.2° < \varphi \leq 48°$	$(56 - 25 \log \varphi)$ dBW
$48° < \varphi \leq 180°$	14 dBW

NOTE 14 - For systems in which the earth stations are expected to transmit simultaneously in the same 40 kHz band, e.g. for the systems employing CDMA, the maximum e.i.r.p., values in the [§1] and [§2], §3 above should be decreased by 10 log N(dB), where N is the number of earth stations in the receive satellite beam of the satellite to which these earth stations are communicating and which are expected to transmit simultaneously on the same frequency.

NOTE 15 - Earth station operating in the [30 GHz] band should be designed in such a manner that 90% of their peak off-axis e.i.r.p. density values do not exceed the values given in § 3. The statistical processing of the off-axis eirp density peaks should be dealt with using the method given in Recommendation ITU-R S.732.

NOTE 16 - The off-axis e.i.r.p. density values given in § 3 do not apply to earth stations operating in networks put into operation before [1999].

NOTE 17 - In recommends 3 it is expected that terminals operating in this band will employ operational measures including uplink power control to compensate for uplink fading due to rain. The

values in §3 are nominal values and in the case of systems employing uplink power control, include any additional margins above the minimum clear-sky level necessary for the implementation of uplink power control. During rain faded conditions, the levels in § 3 may be exceeded by earth terminals when implementing uplink power control.

NOTE 18 - FSS earth station terminals which have lower elevation angles to the GSO will require higher e.i.r.p. density levels relative to the same terminals at higher elevation angles to achieve the same power flux-densities at the GSO due to the combined effect of increased distance and atmospheric absorption. Earth terminals with elevation angles of less than 20° may exceed the levels in § 3 by an amount not to exceed:

[f(ε) (dB), where ε = elevation angle]

Further study on the definition of the function f(ε) is required.

NOTE 19 - The levels given in § 2 may be exceeded by telecommand and ranging carriers transmitted to GSO-FSS satellites in both normal and emergency modes of operation. The amount that these levels may be exceeded when operating in normal mode is [X] dB. [Emergency mode operation is exempt from the levels in § 2.] [The amount that these levels may be exceeded when operating in emergency mode is [Y] dB.] The level of excess (i.e. [X] and [Y]) require further studies by ITU-R.

Annex 1 is unchanged.

INTERNATIONAL TELECOMMUNICATION UNION

RADIOCOMMUNICATION STUDY GROUPS

Document 4-9S/TEMP/73-E
2 October 1998
Original: English only

Source: Document 4-9S/67

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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

Working Party 4-9S

PRELIMINARY DRAFT NEW RECOMMENDATION [4-9S/AI]

MAXIMUM ALLOWABLE VALUES OF POWER FLUX-DENSITY PRODUCED AT THE EARTH'S SURFACE BY NON-GEOSTATIONARY SATELLITES IN THE FIXED-SATELLITE SERVICE OPERATING IN THE 10.7 - 12.75 GHz BAND

(Questions ITU-R 237/4 and 206/9)

The ITU Radiocommunication Assembly,

considering

a) that the World Radiocommunication Conference (Geneva, 1997) has allocated the bands 11.7 - 12.5 GHz (in Region 1), 12.2 - 12.7 GHz (in Region 2), and 11.7 - 12.2 GHz (in Region 3) to the fixed-satellite service (space-to-Earth) on a primary basis, limited to non-GSO systems;

b) that the World Radiocommunication Conference (Geneva, 1997) adopted provisional limits on the power flux-density (pfd) produced at the surface of the Earth by non-geostationary satellites in the fixed-satellite service (space-to-Earth) in the band 10.7 - 12.75 GHz;

c) that Resolution 131 (WRC-97) requested the ITU-R to study, as a matter of urgency, the appropriate power flux-density values to be applied to non-geostationary satellite systems in the fixed-satellite service to ensure the protection of the fixed service without unduly constraining the development of either service;

d) that Recommendation ITU-R F.1241 provides the tolerable performance degradations of digital radio-relay systems due to interference resulting from the aggregate of the emissions from systems of other services,

recommends

1 that in the band 10.7 - 12.75 GHz, the maximum power flux-density at the surface of the Earth from any non-geostationary satellite in the fixed-satellite service should not exceed the values given in the following table in any 4 kHz band[1];

[1] The impact of simultaneous constellations on these pfd values hasn't been taken into account and needs further studies.

Frequency band	Limit in dB(W/m^2) for angle of arrival (δ) above the horizontal plane*		
	0° - 5°	5° - 25°	25° - 90°
10.7 - 11.7 GHz	-150	-150 + 0.5 (δ-5)	-140
11.7 - 12.5 GHz (R1) 12.5 - 12.75 GHz (R1 countries listed in Nos. S5.494 and S5.496) 11.7 - 12.7 GHz (R2) 11.7 - 12.2 GHz (R3) 12.2 - 12.5 GHz (R3, No. S5.491) 12.5 - 12.75 GHz (R3)	-148	-148 + 0.5 (δ-5)	-138
* These values are provisional and require further study.			

2 that these values relate to the power flux-density which would be obtained under assumed free-space propagation conditions.

[NOTE 1 - The limits specified in this Recommendation are based on analyses of candidate power flux-density limits that would result in interference below permissible levels and enable satisfactory operation of satellite systems.]

NOTE 2 - The specified power flux-density limits are based on analyses that assumed every satellite in the constellation produced emissions at the maximum levels allowed by the power flux-density limits for all angles of arrival. Analyses taking into account the actual operational characteristics of the NGSO network lead to substantially lower aggregate power flux-density levels produced.

ANNEX 1

Sharing between non-geostationary satellites in the FSS and the fixed service in the 10.7 - 12.75 GHz frequency band

In the framework of Resolution 131 of WRC-97 agenda, this annex addresses sharing between non-geostationary-satellite (NGSO) satellites in the fixed-satellite service (FSS) and stations in the fixed service (FS) in the frequency bands allocated with equal rights to both services between 10.7 GHz and 12.75 GHz.

This annex provides technical material used in determining the adequate pfd limits to protect the fixed service, as presented in *recommends* 1 of this preliminary draft new Recommendation.

1 Characteristics of the NGSO system used in the calculations

The following table gives the characteristics of the NGSO system (F-SATMULTI-1B) which have been used in the simulations:

TABLE 1

Characteristics of the NGSO system

Type of constellation	WALKER 80/20/15
Shape of orbit	Circular
Constellation altitude	1 469 km
Constellation inclination	53°
Number of planes	20
Number of satellite per plane	4
Orbital period	115 min
Phase-shift between the first satellites of adjacent planes	67.5°

2 Characteristics of the stations of the fixed service used in the calculations

The following table gives the characteristics of the digital FS receivers which have been used in the simulations. As explained in another document presented by France to the present 4-9S meeting, these parameters are those which supposed to be the most representative of systems in operation and which should be used for sharing studies in the 11 GHz band.

TABLE 2

Characteristics of FS receivers

Maximum antenna gain (dBi)	49
Noise figure (dB)	5
Connecting losses (dB)	3
Noise floor dB(W/MHz)	-140

3 Use of a simulation for the assessing interference on FS systems in the 10.7 - 12.75 GHz band

A simulation has been done assuming the actual **S21.16** power flux-density mask being radiated by each space station within the NGSO FSS system. It must be noted that this assumption represents a worst-case study for the interference, as far as it assumes that all the visible satellites radiate the maximum pfd level in all the azimuths, and thus that all the beams of all the visible satellites are pointing their beams towards the FS station under consideration, which is unrealistic. Moreover, this assumption does not take into account the real antenna pattern of the satellite antenna.

Atmospheric attenuation has been taken into account in the simulation, as modelled in Document 4-9-11/50 (also Document 4-9S/TEMP/20).

The FS antenna pattern has been modelled according to Recommendation ITU-R F.1245; the simulations has been run considering a typical FS station located at 40° latitude. One simulation has also been run, assuming that the FS station is located 60° latitude.

The statistics of interference levels at the FS receiver have been assessed when applying the -150/ -140 dB(W/m²/4 kHz) power flux-density mask[2] to each NGSO satellite.

The simulation have been run during the NGSO constellation period, for 1 second time step increment.

As justified in another document presented by France to the present 4-9/S meeting, the simulations have been run assuming that the FS antenna is pointing 0° and 0.2° elevation.

The following figures give examples of simulations results:

- **Figure 1** gives the statistics of interference levels at the FS receiver located at 40° latitude. The FS receiver antenna is supposed to point 0° in elevation. Statistics are given assuming different pointing azimuth of the FS receiver antenna: 30°, 90°, 130° and the "worst-case" azimuth (≈ 51.7°, azimuth for which the probability to see a satellite passing in the main-beam of the FS receiver antenna is the highest, given its latitude and pointing elevation).
- **Figure 2** gives the statistics of interference levels at the FS receiver located at 40° latitude. The FS receiver antenna is supposed to point 0.2° in elevation. Statistics are given assuming different pointing azimuth of the FS receiver antenna: 30°, 90°, 130° and the "worst-case" azimuth (≈ 51.7°).

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[2] -150 dB(W/m²/4 kHz) for $0° \leq \delta < 5°$
-150 +0.5(δ-5) dB(W/m²/4 kHz) for $5° \leq \delta < 25°$
-140 dB(W/m²/4 kHz) for $25° \leq \delta < 90°$
where δ is the angle of arrival above the horizontal plane.

- **Figure 3** gives the statistics of interference levels at the FS receiver located at 60° latitude. The FS receiver antenna is supposed to point 0° in elevation and towards the "worst-case" azimuth.

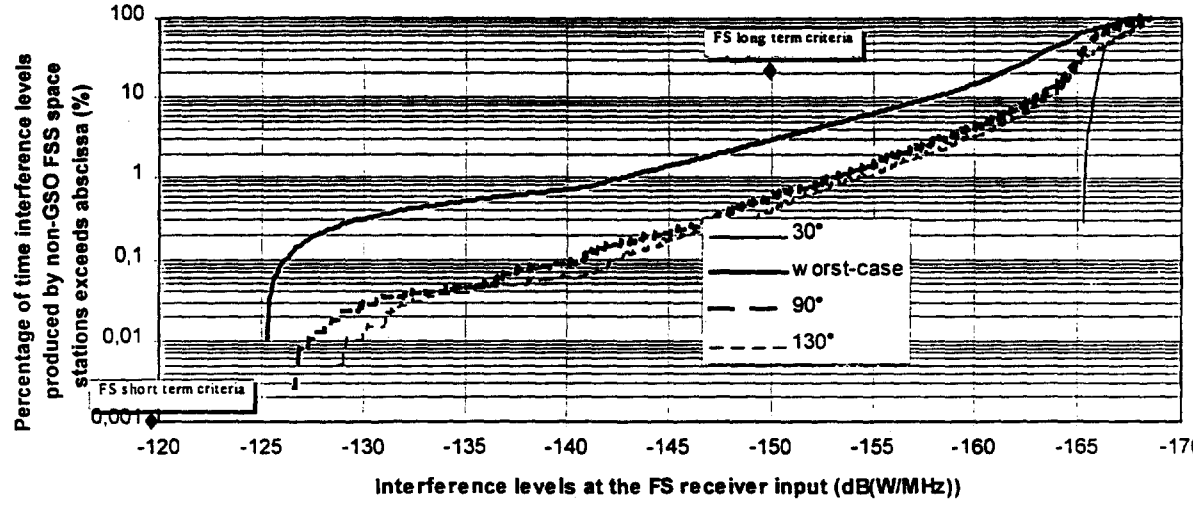

FIGURE 1

Cumulative distribution of interference power at the FS receiver located 40° latitude as a function of the pointing azimuth of the FS receiver antenna
Pointing elevation of the FS receiver antenna: 0°

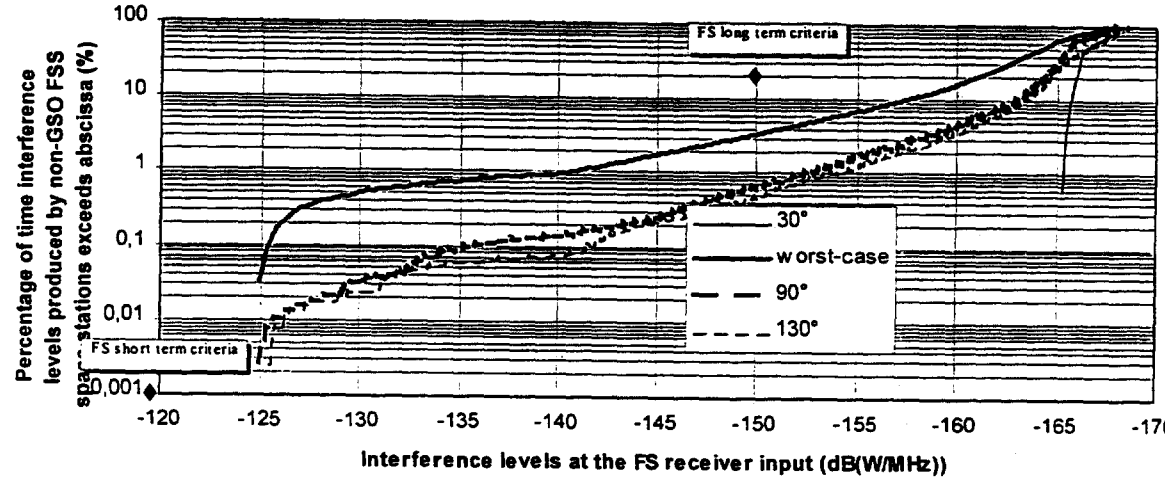

FIGURE 2

Cumulative distribution of interference power at the FS receiver located 40° latitude as a function of the pointing azimuth of the FS receiver antenna
Pointing elevation of the FS receiver antenna: 0.2°

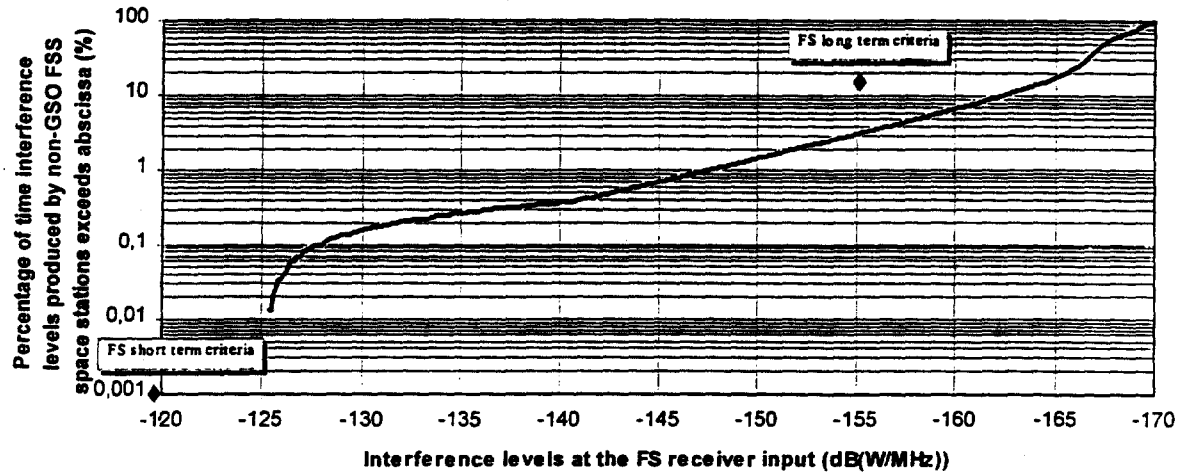

FIGURE 3

Cumulative distribution of interference power at the FS receiver located 60° latitude
Pointing elevation of the FS receiver antenna: 0.2°
Pointing azimuth of the FS receiver antenna: worst-case

4 Conclusion

The above simulations show that, when applying the power flux-density masks as presented in *recommends* 1 of this preliminary draft new Recommendation to all the space stations of a NGSO constellation like F-SATMULTI 1B, for any pointing azimuth of the FS receiver antenna, the FS short-term and long-term interference criteria are met, even in the "worst-case" pointing azimuth, and even for FS receivers located at high latitudes.

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Document 4A/TEMP/72

WORKING DOCUMENT TOWARDS A PRELIMINARY DRAFT NEW RECOMMENDATION

PROTECTION OF FIXED-SATELLITE SERVICE NETWORKS USING SLIGHTLY-INCLINED GEOSTATIONARY-SATELLITE ORBITS FROM ALL OTHER FIXED-SATELLITE SYSTEMS

1 Introduction

WRC-97 adopted provisional power flux-density limits in certain frequency bands that would apply to non-GSO FSS systems to protect GSO FSS networks and GSO BSS networks. Resolution 130 (WRC-97), "Use of Non-Geostationary Systems in the Fixed-Satellite Service in Certain Frequency Bands" and Article S22.2 of the Radio Regulations contain limits corresponding to an interference level caused by one NGSO system in the frequency bands 10.7 - 12.75 GHz, 17.8 - 18.6 GHz, and 19.7 - 20.2 GHz. Annex 2 to Resolution 130 provides a list of studies and related activities which are required to review the regulatory conditions relating to the coexistence of non-GSO and GSO FSS systems. Item 7 of this list includes studies to determine the feasibility of frequency sharing between non-GSO FSS networks using circular orbits and networks using slightly-inclined geostationary orbits and was addressed by WP 4A in October 1998. Although studies have been conducted, further study is required.

2 ITU Radio Regulations

The Radio Regulations do not define "slightly-inclined" geostationary orbits. The operation of satellites in slightly-inclined geostationary orbits is generally not separately addressed in the Regulations. An exception is Article S22.5A of the Radio Regulations, which recognizes the fact of ±5° inclination use by GSOs and imposes an apfd limit on emissions from an NGSO system in the frequency band 6 700 - 7 075 MHz.

Attached as Annex 1 is a proposed preliminary draft new Recommendation, entitled "Protection of fixed-satellite service networks using slightly-inclined geostationary-satellite orbits from all other fixed-satellite systems".

ANNEX 1 TO DOCUMENT 4A/TEMP/72

PROPOSED PRELIMINARY DRAFT NEW RECOMMENDATION

PROTECTION OF FIXED-SATELLITE SERVICE NETWORKS USING SLIGHTLY-INCLINED GEOSTATIONARY-SATELLITE ORBITS FROM ALL OTHER FIXED-SATELLITE SYSTEMS

The ITU Radiocommunication Assembly,

considering

a) that the definition of a geostationary satellite in the Radio Regulations (S1.189) has no indication for a maximum value of the angle of inclination of the orbit of a geostationary satellite;

b) that station-keeping fuel on geostationary space stations constitutes an appreciable portion of in-orbit mass and tends to be the limiting factor of a geostationary space station's life;

c) that north-south station-keeping consumes up to 90% of the total fuel;

d) that, in the absence of north-south station-keeping, the orbit of a geostationary satellite is subject to no more than about 0.9° of orbit change per year, and the inclination will never exceed the natural limit of 15°;

e) that, on the other hand, the absence of north-south station-keeping may require additional equipment at the earth stations, such as angular tracking, polarization tracking and for digital transmissions also, larger size elastic buffers and more complex synchronization methods;

f) that the data required by RR Appendices 3 and 4 (WARC ORB-88) include the effects of using slightly-inclined geostationary-satellite orbits;

g) that the use of an inclined orbit may be designed into the GSO system;

h) that the number of FSS space stations utilizing slightly-inclined orbits is small;

j) that implementation of sharing between NGSO and GSO systems necessitates the use of mitigation techniques which include GSO arc avoidance;

k) that the epfd experienced in the main lobe of GSO earth station antennas is not a function of the inclination angle of the geostationary-satellite orbit;

l) that the off-axis e.i.r.p. of earth stations can be substantially higher in the N-S direction than in the E-W direction,

recommends

1 that an FSS network using the geostationary orbit and intending to operate without north-south station-keeping during part of its in-orbit life but maintaining a inclination not exceeding x^o should be protected from interference from NGSO networks at the same maximum permissible levels of interference as an FSS network using geostationary orbits with zero inclination;

2 that an FSS network using the geostationary orbit and intending to operate without north-south station-keeping during part of its in-orbit life but maintaining a inclination not exceeding x^o should be

afforded equal protection from GSO earth station off-axis e.i.r.p. interference as non-inclined GSO networks;

3 that the maximum permissible levels of interference referred to in *recommends* 1 and 2 be as specified in Recommendation ITU-R S.1323.

4 that further study is required to determine the degree of protection afforded to those GSO systems using inclinations greater than x°.

UNITED STATES DEPARTMENT OF COMMERCE
National Telecommunications and
Information Administration
Washington, D.C. 20230

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December 30, 1997

Ms. Regina Keeney
Federal Communications Commission
Chief, International Bureau
2000 M Street, N.W., Suite 800
Washington, D.C. 20554

Dear Ms. Keeney:

I am writing to you in regards to the Petition for Rulemaking requested by DIRECTV Enterprises, Inc., and a letter (see enclosure) recently received from the Office of the Assistant Secretary of Defense. The petition requests the Commission to implement the allocation for the broadcasting-satellite service in the 17.3-17.8 GHz band prior to the effective date of April 1, 2007 (ITU-R footnote S5.517).

NTIA fully supports the position of DOD (see enclosed letter) that the band 17.3-17.8 band can not be used by the broadcasting-satellite service prior to the effective date of April 1, 2007. NTIA and DOD are willing to work with the Commission as we approach the April 1, 2007 date to ensure a smooth transition.

If you have any questions regarding this subject, please call me at (202) 482-1850 or Robert Hinkle at (202) 482-3212.

Sincerely,

Richard D. Parlow
Associate Administrator
Office of Spectrum Management

Enclosure

cc: R. Dyson, OASD
C. Raiford, OASD

OFFICE OF THE ASSISTANT SECRETARY OF DEFENSE
6000 DEFENSE PENTAGON
WASHINGTON, DC 20301-6000

COMMAND, CONTROL, COMMUNICATIONS, AND INTELLIGENCE

December 30, 1997

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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

Mr. Richard Parlow
Associate Administrator
National Telecommunications and
Information Administration, OSM
U.S. Department of Commerce
Washington, DC 20230

Dear Mr. Parlow:

We have reviewed the Petition for Reconsideration of DirecTV Enterprises, Inc. The bands listed are critical to current Department of Defense (DoD) operations. The established international transition date (Footnote S5.517 to the ITU Table of Frequency Allocations that authorizes use of the band 17.3 - 17.8 GHz for the broadcasting satellite service (BSS) in Region 2 effective April 1, 2007) must be maintained to protect the U.S. government's considerable investment in existing services in this band. Hence, we cannot agree with any changes.

As we approach April 1, 2007, the Department is willing to work with NTIA and the FCC to assure that the transition and associated regulatory provisions provide for an effective and compatible operating environment. In our view, this is necessary to ensure a balanced consideration of national security and private sector interests.

Your immediate support concerning this request will be greatly appreciated.

for Richard M. Dyson
Director, Communications

INTERNATIONAL TELECOMMUNICATION UNION

RADIOCOMMUNICATION STUDY GROUPS
JOINT TASK GROUP 4-9-11
TOULOUSE, 2-10 JULY 1998

Revision 1 to
Document 4-9-11/TEMP/28-E
9 July 1998
Original: English only

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JTG 4-9-11 Sub-Group 2

REPORT ON SHARING BETWEEN NON-GSO/FSS AND GSO/BSS

Scope of Sub-Group 2 studies

The Sub-Group 2 has followed the terms of reference approved at the occasion of the first JTG meeting in March 98, which point out:

"To conduct studies and produce draft CPM text, pursuant to the relevant portions of Resolutions 538 and 721 and the BR Administrative Circular CA/48, relating to the sharing between non-GSO/FSS and GSO/BSS systems/associated feeder links".

During the second meeting of the JTG (Toulouse, July 1998), the Sub-Group 2 has been allocated a number of input documents submitted by Administrations and Sector Members in response to the conclusions reached at the first meeting. About 45 delegates have been participated representing the Administrations of: Canada, France, Austria, Australia, Iran, Japan, Portugal, Spain, Switzerland, Sweden, Russia, Luxembourg, Brazil, United Arab Emirates, Lebanon, USA, Intelsat and the assistance of the BR.
For the sake of efficiency, the Subgroup has established a Working group 2 a to deal with GSO BSS characteristics. This working group was created at the very beginning of the JTG meeting and its terms of reference, as approved, are:

"- Compile a list of those GSO BSS links according to the contributions from Administrations in response to CR/92, in addition to the contributions of 10-11S/SRG-2.

- Produce a spreadsheet listing, for each of those links, the parameters of Annex 4 to CR 92."

The Working Group 2A has been chaired by Mr. J. Chartier (France).

In addition to the Working Group, the Sub-Group 2 decided, at the light of the progress made, to create also a Drafting group 2b to deal with the analysis of the different sources of interference which exist into GSO/BSS links. The Drafting group has been chaired by Dr. J. Seseña (Spain) and has been assisted by representatives of France, Canada, Iran, USA, EBU, Intelsat.

Working Group 2A

A separate report (4-9-11/TEMP/27) provides details on the work carried out by this Working Group. In response to its mandate, the list of GSO/BSS links has been produced and a comprehensive number of GSO/BSS carriers have been identified as reference cases to be taken into account when computing interference from non-GSO/FSS into GSO/BSS.

A liaison statement has also been prepared to response to the corresponding one from 10-11S/SRG-2. It is understood that 10-11S may wish to continue related studies on the characterisation of GSO/BSS links as well as detailed analysis on link budgets for GSO/BSS systems. Comments on improved link budgets spread sheet are also provided to 10-11S for their further study. Also, requests for further information on three dimentional radiation patterns of receiving earth stations is made. This liaison statement also includes the report of activities of JTG Sub-Group 2, including a preliminary approach for assessing interference into Appendix S30 assignments within the current regulatory framework, which is one of several possible approaches.

The report from WG 2A describes document 4-9-11/172 from Canada. This document presents measurements that identify asymmetries in the three-dimensional patterns of some 45 cm antennas using off-set feeds. Other working groups within JTG 4-9-11 may wish to review this document as it may impact their work (for example the development of validation software for the BR or in performing simulations).

Drafting Group 2B

Annex 1 describes the work carried out by the Drafting Group 2B, which has progressed significantly on the assessment of interference from several sources into the GSO/BSS links. This report includes a preliminary approach for assessing interference into Appendix **S30** assignments within the regulatory framework. The drafting group reviewed several possible approaches proposed by administrations for the development of interference protection criteria to protect Appendix **S30** Plan assignments and future modifications/additions to this Plan.

Review of pfd limits applicable to GSO/BSS bands

A number of input documents has been studied by Subgroup 2 and its Working and Drafting Groups. The documents allocated to Subgroup 2 were:

* GSO/BSS Sharing: 90 (USA), 93(USA), 102(USA), 115(J), 136(F), 142(F), 145(F), 147(USA), 174(F), 179(USA), 199(E), 205(INT) and Info/8(CAN).

* GSO/BSS characteristics: 68(AUS), 71(INT), 91(USA), 115(J), 139(CAN), 165(10-11S/SR-2), 166(S), 172(CAN), 198(E) and 209(BR).

In addition to the above list of documents, the Sub-Group has borne in mind other documents as reference documents: 85, 95, 107, 110, 124, 126, 133, 150, 152, 153, 176, 186.

A brief summary on the topics covered by each document is herebelow provided:

Doc. 90. It includes a preliminary assessment on the possibilities for sharing between GSO/BSS and non-GSO/FSS (Earth to Space) in the 17.3–17.8 GHz frequency band in Region 2. The Document concludes that there are potential sharing difficulties between non-GSO/FSS gateways and ubiquitous GSO/BSS receive earth stations in the same frequency band depending on the gateway locations relative to BSS earth station locations. The analysis ~~made~~ also points out the difficulties for large numbers of non-GSO/FSS user terminals to share the same frequency band with ubiquitous GSO/BSS receive earth stations, for example, required coordination distance are found to be about 678 km without shielding and about 68 km with shielding. However, further studies are needed to more accurately assess the interference situations between user terminals and GSO/BSS earth stations, including taking into account the statistical nature of the interference.

Doc. 93: This document contains an analysis using one methodology derived from Methodology A in Rec. ITU-R 1323 to identify criteria to ensure that short-term interference events caused by non-GSO/FSS systems will never result in unacceptable loss of signal quality for a GSO/BSS earth station receiver. It also briefly describes the characteristics of heavily coded digital transmission links. Calculations for two sample BSS links indicate that the maximum epfd values needed to protect these links is close to the provisional short term epfd limit. However more analysis are needed to evaluate the impact of rain induced received temperature increase on these results.

Doc. 102: This document investigates the change in BSS system availability due to the introduction of noise-like interference from NGSO FSS systems. The analysis is performed by including a C/I term for the long-term interference contribution in the BSS system link budget. The results indicate that six NGSO FSS systems each operating at the provisional long term epfd limit will induce more than a 20% increase in the unavailability over much of the continental United States. When the interference limits derived in document 179 are used, the availability degradation is substantially reduced.

Doc. 115: This document includes analysis on the impacts that provisional limits would have on some Japanese GSO/BSS systems. The analysis concludes on the need to study the limitations on the number of multiple non-GSO/FSS systems or otherwise to establish limitations on the epfd values to take account for the case of multiple non-GSO systems. It also requests detailed information on specific parameters of the non-GSO/FSS systems to assess the potential interference into GSO/BSS. Some mentions the need for rules to protect GSO/BSS systems after start of operation of the NGSO FSS system are made.

Doc. 136: This document attempts to identify appropriate power limits that could ensure coexistence between non-GSO/FSS systems and the other services and systems in the band 17.3-17.8 GHz. It ~~shows~~ concludes that the limits and sharing criteria that are currently in force in the same or in the adjacent frequency bands and/or in the same or the other Regions would also be adequate to ensure the coexistence of all the services and systems involved. This coexistence would be possible with some limited adjustments to the current regulatory provisions.

Doc. 142: This contribution includes a comprehensive analysis on the possible options that may be used in developing long term criteria for the protection of the GSO/BSS Plans against non-GSO/FSS, GSO/FSS, GSO/BSS and terrestrial services in the cases of inter-regional and/or interservice sharing. The results of the assessments made lead to the conclusion that the most appropriate criterion to protect the GSO/BSS Plans and their future modifications would be a fixed noise increase criterion, adjusted to coincide with the current pfd limits provided by Annexes 1, 3 and 4 of Appendix S30. The adoption of this criterion would lead to some relaxation in the current pfd limits.

Doc. 145: This document assess the impact of the power limits included in Article S22 into the GSO/BSS links provided at the first JTG meeting. The results of these studies need to be updated with the new list of GSO/BSS characteristics as compiled during the second JTG meeting.

Doc. 147: This contribution presents trends in key relevant technologies which should be taken into account when computing interference into GSO/BSS systems. The proposed GSO/BSS system parameters to examine are: earth station and satellite receiver system noise temperatures; satellite antenna beamwidths; earth station antennas; on-board processing; fade compensation; bit error control including adaptive coding, etc.

Doc. 174: This document presents the results obtained in a measurement campaign to assess empirically the impact of a non-GSO/FSS system compliant with the present epfd limits into actual GSO/BSS receptions (Astra 19.2 E, EUTELSAT 13°E and HISPASAT 30°W using commercially available equipment). These tests demonstrated that, for these specific links, the short term epfd limits do not create degradation into a signal presented in a TV screen and no impact was observable on a spectrum analyser. The margins obtained with respect to unavailability thresholds were of 16 dB for digital TV carriers and 11 dB for analog TV carriers.

Doc.178/Info/8: This document addresses the long term and short term epfd values required to protect the planned Canadian GSO/BSS at two orbital positions. The long term criterion used was that the total aggregate long term interference from multiple NGSO FSS systems does not degrade the clear sky margin of the BSS link by more than 0.1 dB, with the aim to protect most receive terminals. The short term criterion used was that the total aggregate short term interference should not result in an outage event, assuming that the interference can use all the clear sky margin of the link. The results of this analysis indicate that the provisional limits, where applicable, would protect most of the BSS links considered, provided that these epfd limits represent the aggregate interference of all the NGSO FSS systems in the band. However, there remain many links, particularly in the long term criterion for small aperture antennas and in the short term criterion, for the larger aperture antenna, where the provisional limits would appear to provide insufficient protection.

Doc. 179: This document presents an expanded protection ratio approach based on protection ratio techniques used in the radio regulations, but differing from these techniques in that it proposes a mechanism to allocate amounts of intra-service and inter-service interference noise within a protection-ratio-determined budget focusing on plan modifications which employ digital transmission techniques. Based on values assumed for certain apportionment of the allowed interference, the contribution proposes specific epfd limits more severe than the provisional ones. It also indicates that protection for future GSO/BSS systems using other modulation constellations as 8-PSK, 16-QAM would not substantially differ from the requirements derived for QPSK.

Doc. 199: This document provides a preliminary assessment on the impact that several pfd limits (including the provisional limits as approved by WRC 97) have on typical HISPASAT parameters. The worst case of degradation leads to 3.4% for 27.5 Mbauds in the uplink and for the downlink a wider range of limits is assessed resulting the worst case for those links located in the edge of the coverage for which the receiving antennas are the biggest ones. In order to bring the concept of limits more useful for the use by GSO/BSS operators, epfd mask should be developed rather than specific cases of percentages of time and receiving antennas.

Doc. 205: This document discusses a proposed approach for deriving long term criteria to protect GSO/BSS against non-GSO/FSS. The rationale used is that the GSO/BSS links should get, at a minimum, the same long term protection from non-GSO/FSS systems as that they receive from GSO/FSS or GSO/BSS operating in the same bands.

Based on this approach, the document proposes that the epfd for the protection of the BSS Plan assignments be derived from the most stringent of the two criteria (inter-regional and intra-regional) in Appendix S30.

List of remaining studies

— Study of the preliminary proposed computing interference approach and review of its validity

— Review of the assumptions for a number of subsequent modifications to the BSS Plans under the trigger value.

review of

— Assumption on the number of simultaneous GSO/FSS and GSO/BSS systems creating interference into a given GSO/BSS system.

— Statistical analysis for each GSO/BSS assignment and its test points, including the list compiled by SWG 2A

— Characterisation of earth station radiation patterns in a three-dimensional profile.

— Further elaboration of alternative methodologies to derive protection criteria.

— Determine additional epfd specification points facilitating sharing between non-GSO/FSS and GSO/BSS across range of antenna sizes an appropriate interpolation method ~~to calculate~~ to facilitate the use of the limits by Administrations.

— Further study of technology trends in order to review the provisional limits.

— Assess the impact of alternative methodologies on the availability of GSO/BSS systems

— Evaluate the impact of non-GSO/FSS interference combined with solar transit events.

We agreed to two separate statements! They are not reflected here.

Julián Seseña
Chairman Sub-Group 2
JTG 4-9-11

ANNEX 1

Drafting Group 2B

PRELIMINARY APPROACH FOR ASSESSING THE INTERFERENCE INTO APPENDIX S30 ASSIGNMENTS WITHIN THE CURRENT REGULATORY FRAMEWORK

In order to assess the allowable interference level from a NGSO FSS system into an assignment in Appendix S30 Plans, it is necessary to first assess the interference level that could be expected into the assignments of Appendix S30 plans from the other systems and services sharing the same frequency band in the same or in another Region. A preliminary assessment using this approach is done in the following way:

1 Interference from the assignments in the same Regional Plan

For each assignment in one of the Regional Plans, the interference generated by the assignments currently included in the same Regional Plan can be taken as the sum of the EPM or OEPM associated to this assignment with the aggregate C/I corresponding to the objective of the corresponding Plan, i.e.:

- 24 dB for Regions 1 and 3 Plan
- 29 dB for Region 2 Plan (assuming a 1 dB degradation by the uplink C/I)

In principle, most of the assignments in the Plan can be expected to have a positive EPM/OEPM. However, the assessment should be done in a statistical way, encompassing all the assignments in the Plan and all their associated test points in order to have a more detailed understanding of the interference situation.

Associated to these C/I objectives, the pfd of the wanted assignment in the Plan for 99% of the worst month may be assumed to be the following:

- - 108 dB(W/m²/27 MHz) in Regions 1 and 3
- - 107 dB(W/m²/24 MHz) in Region 2.

For a zero dB EPM/OEPM, this leads to an aggregate interference level caused by all the assignments currently included in the same Regional Plan corresponding to an interfering epfd level of:

- - 108 – 24 = - 132 dB(W/m²/27 MHz) in Regions 1 and 3
- - 107 – 29 = - 136 dB(W/m²/24 MHz) in Region 2.

2 Interference from the future assignments in the same Regional Plan

The interference from the future assignments that may be entered in the same Regional Plan after successful application of Article 4 procedure may be assumed, initially, to correspond to six times a 0.25 dB degradation in EPM/OEPM.

below zero

For a zero dB EPM/OEPM, this would lead to an aggregate interference level caused by all the assignments of the same Regional Plan corresponding to an interfering epfd level of:

- - 132 + 6 x 0.25 = - 130.5 dB(W/m²/27 MHz) in Regions 1 and 3
- - 136 + 6 x 0.25 = - 134.5 dB(W/m²/24 MHz) in Region 2

3 Interference from the GSO FSS or unplanned GSO BSS in another Region

The interference from the GSO FSS or unplanned GSO BSS (Resolution 34) in another Region after successful application of Article 7 procedure may be assumed, initially, to correspond to:

- Six times the Annex 4 of Appendix **S30** permissible interference for a wanted BSS assignment in Region 1 in the frequency band 12.2-12.5 GHz, caused by GSO FSS in Region 3;
- 2 times the Annex 4 level for a wanted BSS assignment in Region 1 in the frequency band 11.7-12.2 GHz, caused by GSO FSS in Region 2;
- 1 time the Annex 4 level for a wanted BSS assignment in Region 2 in the frequency band 12.5-12.7 GHz, caused by GSO FSS in Region 1 or 3, or by unplanned GSO BSS in Region 3.
- 1 time the Annex 4 level for a wanted BSS assignment in Region 3 in the frequency band 11.7-12.2 GHz caused by GSO FSS in Region 2.

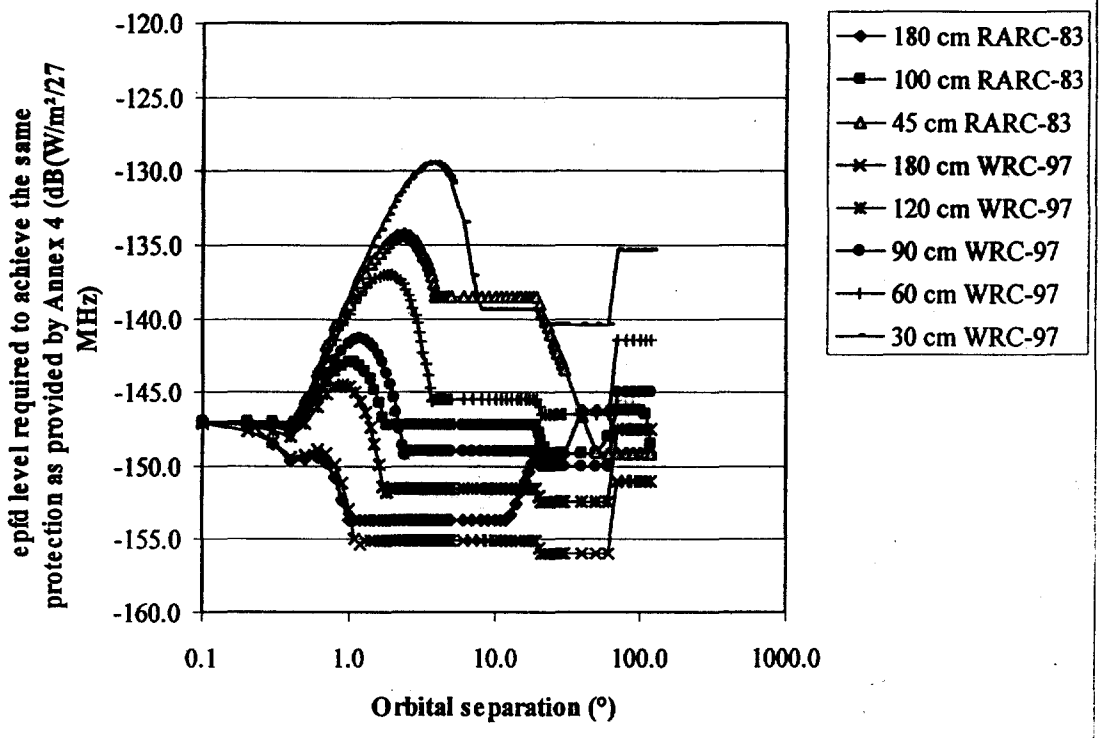
Figure 1 provides the corresponding Annex 4 permissible epfd level, as function of the orbital separation, for various BSS antenna sizes and patterns. It should be noted that, since the Annex 4 pfd mask is based on the original antenna patterns of WARC-77 (Figure 7 of Appendix **S30 (WRC-97)**), the permissible epfd varies considerably with the orbital separation between the wanted BSS space station and the interfering GSO FSS or unplanned BSS space station. Figure 1 is based on the following equations:

$$\text{Epfd}(\theta) = \text{pfd}_{\text{ANNEX 4}}(\theta) - D_R(\varphi)$$

Where:

- Epfd (θ) = the pfd limit that would provide into the main lobe of the receive BSS antenna of interest the same protection as that provided by Annex 4 of Appendix **S30** for the corresponding orbital separation θ.
- $\text{pfd}_{\text{ANNEX 4}}(\theta)$ is the value of pfd provided by Annex 4 of Appendix **S30 S30** for the orbital separation θ.
- $D_R(\varphi)$ is the off-axis discrimination provided by the BSS receive antenna of interest in the direction of the interfering GSO FSS space station located with an orbital separation θ from the wanted GSO BSS space station ($\varphi \approx 1.1\ \theta$) ($\varphi$ is the topocentric angle corresponding to θ).

Figure 1 - epfd level required to achieve the same protection as provided by Annex 4



4 Interference from modifications to another Regional BSS Plan

The interference from assignments in the Plan of another Region may be assumed, initially, to correspond to:

- One time the Annex 1 of Appendix **S30** permissible interference.

Since the Annex 1 of Appendix **S30** permissible interference is given by a pfd mask identical to that of Annex 4 of Appendix **S30,** the difficulties shown in section 3 above also apply in this case to identify what the applicable epfd level might be.

5 Interference from terrestrial services

The interference from terrestrial stations in the same or another Region may be assumed, initially, to correspond to:

- One time the Annex 3 of Appendix **S30** permissible interference.

Since the Annex 1 of Appendix **S30** permissible interference is given by a pfd mask similar to that of Annex 4 of Appendix **S30,** difficulties similar to those shown in section 3 above also apply in this case to identify what the applicable epfd level might be.

It should be noted that this type of interference may not apply in some parts of Region 2, where terrestrial services are not intended to be used.

INTERNATIONAL TELECOMMUNICATION UNION

RADIOCOMMUNICATION STUDY GROUPS

Delayed Contribution
Document 4-9-11/86-E
23 June 1998
Original: English only

Received: 22 June 1998

RECEIVED
DEC - 9 1998
FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

Subject: Resolutions 130 and 538

United States of America

TECHNICAL CHARACTERISTICS OF RADIOLOCATION STATIONS IN THE 17.3-17.7 GHz BANDS TO BE TAKEN INTO ACCOUNT IN ANY SHARING WITH NGSO FSS SYSTEMS

1 Background

At WARC-79, the band 17.3-17.7 GHz was allocated the fixed-satellite service (Earth-to-space). The allocation was limited by RR 869 which states: "The use of the band 17.3-18.1 GHz by the fixed-satellite service (Earth-to-space) is limited to feeder links for the broadcasting-satellite service". The 17.3-17.7 GHz band is covered by Appendix 30/S30A and therefore was limited to satellites on the geostationary-satellite orbit. In the 17.3-17.7 GHz band, the radiolocation service was modified from primary to secondary. Sharing between the GSO FSS and the radiolocation service could be accomplished by the radiolocation service limiting their e.i.r.p. towards the GSO.. Since the e.i.r.p. of a BSS feeder link was expected to be on the order of 80 dBW or more, sharing was expected to be possible if the radiolocation service would limit their e.i.r.p. towards the GSO to approximately 50 dBW. This would allow the radiolocation stations to continue to operate in the band provided they constrain their e.i.r.p. towards the GSO. These radiolocation stations are transmitting e.i.r.p.'s of much greater than 50 dBW away from the GSO.

At WRC-95, S5.516/RR869, was modified as follows: "The use of the band 17.3-18.1 GHz by the fixed-satellite service (Earth-to-space) is limited to feeder links for the broadcasting-satellite service. For use of the band 17.3-17.7 GHz in Region 2 by the feeder links for the broadcast-satellite service in the band 12.2-12.7 GHz, see Article 15A/S11."

Additionally, WRC-95 did not designate the 17.3-17.7 GHz band in Region 2 for use by NGSO FSS satellite systems. Due to the complexity of the use of this band in Region 2, including the radiolocation service, further studies were required to determine if sharing was feasible.

2 Characteristics of Radiolocation Stations

Numerous types of radiolocation stations operate in the band 17.3-17.7 GHz. These stations include ship, ground and airborne equipment. Some of the stations are for the tracking of objects in space. Currently, the only requirement on these stations is the requirement to protect the GSO satellite receivers.

Technical parameters on the radiolocation stations operating in the 17.3-17.7 GHz band are contained in Table 1.

TABLE 1

Type	Function	Platform	EIRP - dBW
1	Ground Mapping	Airborne	80.0
2	Missile Guidance	Airborne	48.4
3	Radar Warning-RX	Ship	n/a
4	Search-RX	Airborne	n/a
5	Ground Mapping	Airborne	80.0
6	Missile Guidance	Airborne	44.8
7	Radar Warning-RX	Ship	n/a
8	Tracking	Ship	81.0
9	Radar Warning	Ground Transportable	n/a
10	Target Acquisition	Airborne	34.0
11	Tracking	Ground Transportable	81.0
12	Ranging	Ground Transportable	100.0
13	SAR-Imagery	Airborne	50.0
14	Space Tracking	Ground	115.7

n/a - not applicable

In addition there are 32 other systems which involve airborne, ship and ground based radars.

3 Sharing between radiolocation stations and NGSO FSS systems

Radiolocation stations, including some which are tracking objects in space, transmitting with an e.i.r.p. of up to 116 dBW are used in this band. NGSO FSS earth station transmitting e.i.r.p.'s would be orders of magnitude less than this value. Sharing was found to be feasible with GSO systems (Earth-to-space) if the radiolocation stations limit their emissions toward the geostationary orbit. However, the radiolocation station emissions toward a NGSO satellite could be 66 dB higher than toward the geostationary orbit. There is a risk to NGSO FSS systems.

INTERNATIONAL TELECOMMUNICATION UNION

RADIOCOMMUNICATION STUDY GROUPS

Delayed Contribution
Document 4-9-11/90-E
23 June 1998
Original: English only

Received: 22 June 1998

Subject: Resolution 538 (WRC-97)

RECEIVED
DEC - 9 1998
FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

United States of America

SHARING BETWEEN BSS AND NON-GSO FSS (EARTH-TO-SPACE) IN THE 17.3 - 17.8 GHz FREQUENCY BAND IN REGION 2

1 Introduction

WRC-97 adopted No. MOD S5.516 provisions to designate usage of non-GSO satellite systems in the fixed-satellite service (Earth-to-space) in the 17.3 - 18.1 GHz frequency band in Regions 1 and 3. Additionally WRC-97 adopted WRC-99 agenda item 1.13.2 recommending regulatory approaches to be considered for other sharing situations. However, WRC-97 did not designate the 17.3 - 17.8 GHz frequency band in Region 2 for use by non-GSO FSS satellite systems. Specifically, Resolution 538 indicates that further studies are needed on sharing between GSO BSS and non-GSO FSS (Earth-to-space) systems in the 17.3 - 17.8 GHz frequency band in Region 2. Further, Resolution 538 states that "coexistence of receive BSS earth stations and large numbers of transmit non-GSO FSS terminals would not be feasible".

This contribution presents study results on sharing between BSS (allocation will come into effect on April 1, 2007) and non-GSO FSS (Earth-to-space) in the 17.3 - 17.8 GHz frequency band in Region 2. Analysed is the interference situation resulting from non-GSO FSS gateway transmissions into BSS receive earth stations.

2 I/N analysis of non-GSO FSS gateway transmissions into BSS earth stations

An interference-to-noise (I/N) analysis from non-GSO FSS gateways into BSS earth stations was performed using preliminary gateway parameters of a non-GSO FSS system operating at 17.3 - 17.8 GHz under clear sky condition. The on-axis elevation angle for the gateway antenna is assumed to be 10°. The BSS required I/N value (-18 dB) is derived from Appendix 30 protection ratio (assuming I/N is similar for 12 GHz and 17 GHz frequency bands), provided that only one gateway will be in the vicinity of a BSS earth station. If more than one gateway (possibly six) is nearby, another I/N value is needed.

TABLE 1

I/N analysis of non-GSO FSS gateway transmissions into BSS earth stations

	Parameter	Units	Case 1: Clear Sky	Case 2: Clear Sky With Shielding
1	Non-GSO FSS gateway 17 GHz uplink e.i.r.p. (on-axis)	dBW	52.1	52.1
2	Off-axis loss	dB	-45.4	-45.4
3	Shielding	dB	0.0	-20.0
4	Bandwidth (22.6 MHz)	dB-Hz	-73.5	-73.5
5	Uplink e.i.r.p. density towards horizon	dB(W/Hz)	-66.8	-86.8
6				
7	BSS earth station system noise temperature	dBK	23.0	23.0
8	Boltzmann's constant	dB(W/K/Hz)	-228.6	-228.6
9	Noise power density (No)	dB(W/Hz)	-205.6	-205.6
10				
11	I/N required	dB	-18.0	-18.0
12				
13	Io max from non-GSO FSS gateway	dB(W/Hz)	-223.6	-223.6
14				
15	BSS earth station receive antenna gain towards non-GSO FSS gateway	dBi	0.0	0.0
16				
17	Isotropic area	dB-m^2	-46.3	-46.3
18				
19	Atmospheric loss (at coordination distance in line 23)	dB	0.0	0.0
20				
21	Required spreading loss	dB/m^2	-110.4	-90.4
22				
23	Coordination distance	km	**93.9**	**9.4**
24		miles	**58.4**	**5.8**
25				
26	Power flux-density at BSS earth station	dB(W/m^2/Hz)	**-177.3**	**-177.3**

Table 1 provides preliminary calculations indicating that the required coordination distance between a non-GSO FSS gateway and a BSS earth station would be approximately 94 km (Case 1) for the on-axis direction. This distance would be prohibitively large to exclude deployment of *ubiquitous* BSS earth stations. Note that this analysis does not consider the time varying nature of the interference and shows only the worst case situation which will occur for small percentages of the time.

Even though it is uncertain whether or not shielding techniques will be employed, a second case was also analysed in which the gateway is assumed to employ some type of shielding that would effectively reduce the gateway's e.i.r.p. density towards the horizon by about 20 dB (Case 2). In this case, the on-axis direction coordination distance reduces to about 9 km, a range that is still large enough to exclude the deployment of *ubiquitous* BSS earth stations.

For comparison purposes, the width of a North American residence is approximately 100 m (residential lot size of 100 m by 100 m) in a suburban area. As a result, a distance of 94 km can span about 940 residences, while a distance of 9 km can span about 90 residences.

The previous paragraph only considers non-GSO FSS gateways pointing in one direction; however, the gateways possibly have to track non-GSO satellites in all azimuth directions. As a result, the on-axis coordination distance becomes the radius of a circular coordination area with the gateway at the centre. Based on this assumption, the coordination area will be about 27 800 km^2 and 250 km^2 without shielding and with shielding, respectively. The area of a North American residence can approximately be 10 000 m^2 or 0.01 km^2 in a suburban area. Therefore, without shielding, the coordination area can cover 2.8 million residences; with shielding, 25 000 residences.

Reverse band operations in the 17.3 - 17.8 GHz frequency band, coming into effect on 1 April 2007, have the same sharing issues between feeder links and BSS receive earth stations; however in this case, the number of feeder link sites is limited. Presently, there are six BSS feeder link sites in the United States. Conceivably, up to four BSS operators in the United States can install eight feeder link sites housing large antennas with low side lobes pointing at one point in the sky. The scenario is drastically different from that in which possibly six non-GSO FSS operators with 180 gateway sites in the United States (30 gateways per operator) housing small non-GSO FSS antennas with large side lobes practically spanning the whole sky. Potentially, 180 gateways can aggregately claim a coordination area of 5 million km^2 without shielding and 45 000 km^2 with shielding. For comparison purposes, 5 million km^2 would cover over half of the land area of the United States (continental US, Alaska, Hawaii, and Puerto Rico) which is about 9.5 million km^2. It becomes potentially infeasible for non-GSO FSS gateways to share a frequency band with BSS earth stations.

Table 2 provides a similar analysis from non-GSO FSS user terminals into BSS earth stations, assuming user terminals can be deployed in the 17.3 - 17.8 GHz frequency band. Because user terminal power densities are much higher than gateway power densities in the horizon direction, the coordination distances are extremely large, 140 000 km without shielding and 14 000 km with shielding. These values indicate that it is impossible for non-GSO FSS user terminals to share with BSS earth stations.

TABLE 2

I/N analysis of non-GSO FSS user terminal transmissions into BSS earth stations

	Parameter	Units	Case 1: Clear Sky	Case 2: Clear Sky With Shielding
1	Non-GSO FSS user terminal 17 GHz uplink e.i.r.p. (on-axis)	dBW	38.1	38.1
2	Off-axis loss	dB	23.1	23.1
3	Shielding	dB	0.0	-20.0
4	Bandwidth (2.93 MHz)	dB-Hz	-64.7	-64.7
5	Uplink e.i.r.p. density towards horizon	dB(W/Hz)	-3.5	-23.5
6				
7	BSS earth station system noise temperature	dBK	23.0	23.0
8	Boltzmann's constant	dB(W/K/Hz)	-228.6	-228.6
9	Noise power density (No)	dB(W/Hz)	-205.6	-205.6
10				
11	I/N required	dB	-18.0	-18.0
12				
13	Io max from non-GSO FSS user terminal	dB(W/Hz)	-223.6	-223.6
14				
15	BSS earth station receive antenna gain towards non-GSO FSS user terminal	dBi	0.0	0.0
16				
17	Isotropic area	dB-m^2	-46.3	-46.3
18				
19	Atmospheric loss (at coordination distance in line 23)	dB	0.0	0.0
20				
21	Required spreading loss	dB/m^2	-173.8	-153.8
22				
23	Coordination distance	km	**138479**	**13848**
24		miles	**86065**	**8607**
25				

26	Power flux- at BSS earth station	dB(W/m^2/Hz)	**-177.3**	**-177.3**

3 Conclusions

Depending on the number of non-GSO FSS gateways/user terminals and their locations relative to BSS earth stations, the above analytical results support WRC-97's decisions that it would be infeasible for a large number of non-GSO FSS gateways/user terminals (Earth-to-space) to share the 17.3 - 17.8 GHz frequency band with ubiquitously deployed BSS earth stations.

As additional data becomes available on non-GSO FSS gateways/user terminals, further studies will be needed to more accurately assess the interference situations between gateways/user terminals and BSS earth stations. When precise non-GSO FSS transmit antenna patterns also become available, studies are needed to determine the coordination area around a non-GSO FSS gateway/user terminal in addition to the coordination distance in the on-axis direction. Further, the statistical nature of the interference needs to be taken into consideration.

Furthermore, availability and implementation of shielding techniques that can effectively reduce gateway e.i.r.p. density towards the horizon by 20 dB have to be confirmed.

INTERNATIONAL TELECOMMUNICATION UNION

RADIOCOMMUNICATION STUDY GROUPS

Delayed Contribution
Document 4-9-11/130-E
24 June 1998
Original: English only

Received: 24 June 1998

RECEIVED
DEC - 9 1998
FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

United States of America

ASSESSMENT OF POTENTIAL INTERFERENCE FROM SKYBRIDGE UPLINKS INTO SPACE-TO-SPACE LINKS OF THE SPACE RESEARCH SERVICE IN THE BAND 13.75 - 14.0 GHz

1 Introduction

One of the bands proposed for SkyBridge uplinks is the 13.75 - 14.0 GHz band. This band is also allocated to the Space Research Service for space-to-space links. The allocation is used to support space-to-space links from data relay satellites to low-Earth orbiters such as the Space Shuttle. Existing space research service geostationary space stations (advanced published prior to 31 January 1992) operate on an equal basis with the fixed-satellite service (RR S5.503). Other restrictions on the fixed-satellite service uplinks are given in S5.502. This document assesses the potential interference to the space-to-space links of the space research service from the SkyBridge uplinks.

2 Characteristics of the SkyBridge System

The characteristics of the SkyBridge system are given in Document JTG 4-9-11/35 (26 February 1998). The relevant characteristics used in this analysis are given in Table 1. It is assumed that the SkyBridge Earth station antennas have a minimum diameter of 4.5 meters in accordance with RR S5.502.

Table 1: Characteristics of the SkyBridge System in the Band 13.75 - 14.0 GHz

Number of Satellites	64 (2 Sub-Constellations with 32 each)
Number of Sub-Constellation Planes	8
Number of Satellites per Plane	4
Inclination Angle of Each Satellite	55 degrees
Orbital Altitude of Each Satellite	1457 km
Plane Spacing at the Equator	45 degrees
Relative Phasing between Satellites in Adjacent Planes	33.75 degrees
Relative Ascending Node Spacing between the Two Sub-Constellations	-10 degrees
Earth Station Transmit Power	8.2 dBW

Earth Station Antenna Maximum Gain	54.0
Noise Bandwidth	22.6 MHz

Maximum EIRP Density	56.4 dBW/6 MHz
Earth Station Reference Antenna Pattern	Appendix 28
Minimum Operational Elevation Angle	10 degrees

3 Characteristics of Space Research Service Space-to-Space Links

The space research service use of this band is by geostationary data relay satellites transmitting to low-Earth orbiting space stations. This analysis uses the Space Shuttle as the low-Earth orbiting satellite. The characteristics for this operation are given in Table 2.

Table 2: Characteristics of Space Research Service in the Band 13.75 - 14.0 GHz

Data Relay Satellite Location	41.0 degrees West
Space Shuttle Characteristics:	
Orbital Altitude	300 km
Orbital Inclination	51.6 degrees
Antenna Maximum Gain	38.5 dBi
Antenna Gain Pattern	See Table 3
Receiver Bandwidth	6.0 MHz
Interference Threshold**	-140.2 dBW/6 MHz
Percent of Time Threshold Can Be Exceeded	0.1%

**Note: The protection criteria and sharing criteria may be found in Recommendation ITU-R SA.1155 and in Annex 3 of Recommendation ITU-R SA. 1071, respectively.

Table 3: Space Shuttle Antenna Gain Pattern

Off-Axis Gain (dB)	Off-Axis Angle, θ (degrees)
$G(\theta) = 38.5 - 3.35 * \theta^2$	$\theta <= 2.25$
$G(\theta) = 28.84 - 20.72 * \log_{10}(\theta)$	$2.25 < \theta <= 48.0$
$G(\theta) = -6.0$	$\theta > 48.0$

4 Analysis Approach and Results

4.1 Static Analysis

The first step in the analysis is to determine the worst case interference from one SkyBridge uplinks into the Space Shuttle receiver. The results of this analysis are given in Table 4. As can be seen from

the table, the interfering signal power received in this worst case coupling is -114.4 dBW/6 MHz. This value exceeds the Space Shuttle receiver interference threshold by 25.8 dB.

Table 4. Worst Case Interference into Space Shuttle Receiver from One SkyBridge Earth Station

Gateway On-Axis EIRP Density (dBW/6 MHz)	56.4
Distance (km)	300.0
Space Loss (dB)	164.8
Space Shuttle Off-Axis Gain (dBi)	-6.0
Interfering Signal Power Received (dBW/6 MHz)	**-114.4**

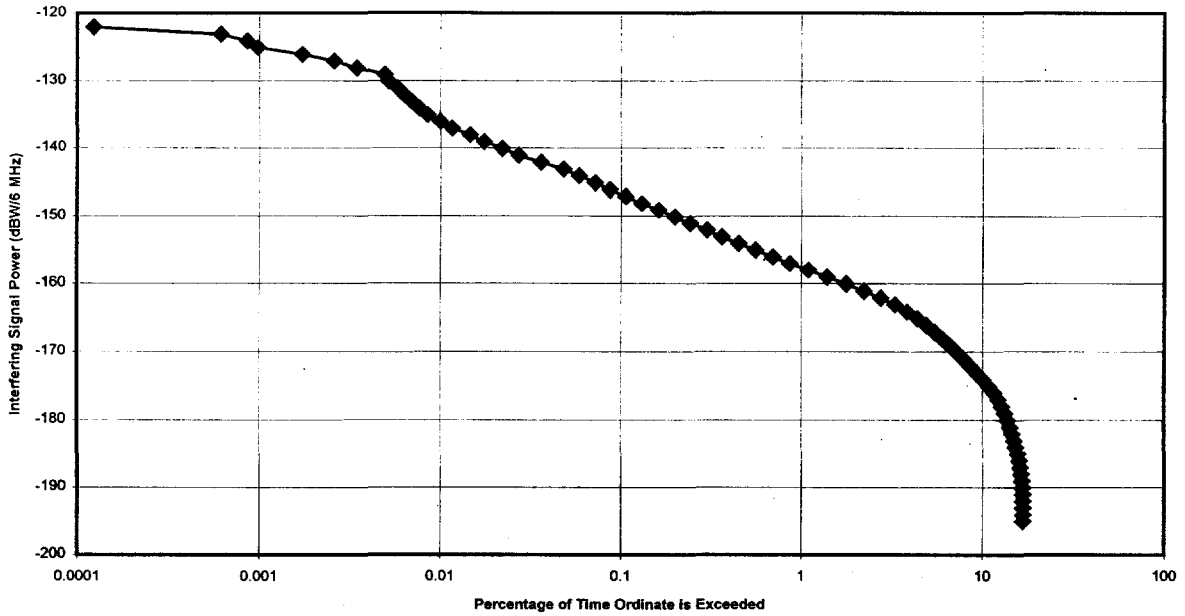
4.2 Dynamic Analysis

The second step of the analysis is to determine the percentage of time that the interference threshold will be exceeded. This analysis assumed that there would be 30 SkyBridge Earth stations located in the United States. Each Earth station is assumed to be able to transmit to any of the SkyBridge satellites that are visible to it. The e.i.r.p. spectral density of each earth station was assumed to be 56.4 dBW/6 MHz. It was also assumed that the SkyBridge Earth stations would cease emissions when the line-of-sight to the SkyBridge satellite is within ± 10 degrees of the geostationary arc. This analysis is perhaps worst-case since it is also assumed that each of the SkyBridge Earth stations is transmitting to every one of the SkyBridge satellites that are visible to it.

The statistics for the interference power spectral density at the input to the receiver of the Space Shuttle from the uplink emissions of the SkyBridge system were determined using a computer simulation program. The simulation assumed co-polar, co-channel frequency operation of the systems and was performed for a period of 100 days. An orbit generator was incremented in 0.1 minute (6 second) intervals. At each interval, the locations of the Space Shuttle and each of the 64 SkyBridge satellites was determined. For each SkyBridge Earth station, it was determined which of the 64 satellites were visible to it and its line-of-sight not within ± 10 degrees of the geostationary arc. The pointing angles of each of the SkyBridge Earth stations toward the Space Shuttle and from the Space Shuttle to each of the Earth stations were determined. From these values, the off-axis gains of each Earth station and the Space Shuttle antenna were calculated using the respective antenna patterns. The cumulative interference power spectral density from all of the SkyBridge Earth stations into the Space Shuttle receiver was then calculated.

The results of the simulation are shown in Figure 1. The results are presented as the received interference power spectral density at the Space Shuttle receiver and as a function of the cumulative percentage of time that a given level is exceeded. The figure shows that the sharing criterion of -140.2 dBW/6 MHz was exceeded for about 0.036% of the time that the Space Shuttle was in view of the data relay satellite and, thus, capable of receiving transmissions.

Figure 1: Interference from SkyBridge Transmissions into Space Shuttle Receiver



5 Summary

The potential interference from SkyBridge uplinks operating in the 13.75 - 14.0 GHz band into space research service space-to-space links was analysed. The band is used by the space research service for transmissions from data relay satellites to low-Earth orbiting satellites, such as the Space Shuttle. The interference at the input to the receiver of the Space Shuttle in a worst-case configuration from the transmissions of one SkyBridge Earth station was calculated and compared to the interference criteria given in Recommendation ITU-R SA.1071 for the space research service links in this band. This level of interference was found to be well above the interference threshold of -140.2 dBW/6 MHz.

A computer simulation was performed to determine the percent of time that the Space Shuttle interference threshold would be exceeded due to the emissions of the SkyBridge system. It was assumed that there were 30 SkyBridge Earth stations located in the United States and each of these was able to transmit to any of the 64 SkyBridge satellites that were visible to it. The e.i.r.p. spectral density of the emissions of each earth station was assumed to be 56.4 dBW/6 MHz. The 10 degree non-operating zone around the geostationary arc for the SkyBridge system was also taken into account. The simulation was performed for a period of 100 days at a time increment of 0.1 minutes (6 seconds). The results of the simulation showed that the emissions of the 30 SkyBridge earth stations caused interference to the Space Shuttle that exceeded the sharing criterion of -140.2 dBW/6 MHz for about 0.036% of the time that the Space Shuttle can receive emissions from a single data relay satellite located at 41 degrees West longitude. These results appear to be compatible with the criteria given in Recommendation ITU-R SA.1071.

RR S5.503 states that the e.i.r.p. density of emissions from any earth station in the fixed-satellite service shall not exceed 71 dBW in any 6 MHz band in the frequency range 13.772 - 13.778 GHz. This

value was developed based on the transmissions from FSS earth stations to geostationary FSS satellites. Interpolation of the results of the simulations performed for this document show that the Space Shuttle interference threshold of -140.2 dBW/6 MHz would be exceeded for about 0.45% of

the time due to the emissions of an NGSO FSS system similar to SkyBridge, but with a much higher EIRP density of 71 dBW/6 MHz. This level of interference is not compatible with the criteria given in Recommendation ITU-R SA.1071. Thus, it appears that a separate, more stringent limit on the e.i.r.p. emissions from an earth station operating in the fixed-satellite service with a NGSO FSS satellite will need to be developed in the frequency range 13.772 - 13.778 GHz. Since the SkyBridge system, with its current parameters, appears to be compatible with the interference criteria for the space research service in this band, it is expected that any modified e.i.r.p. limit would allow for the operation of systems such as SkyBridge. Changes in the SkyBridge system design may call for further study. Further study is necessary to determine the e.i.r.p. limit on NGSO FSS systems operating in this band that will protect the space science services.

The analysis performed here considered only one NGSO FSS system operating in the band 13.75 - 14.0 GHz. Further study is necessary to determine the effects of multiple NGSO FSS systems on the operations of the space science services.

This study only addressed NGSO FSS systems sharing with the space science services in the band 13.75 - 14.0 GHz. Further study regarding NGSO FSS systems sharing with the radiolocation service in the band is necessary.

INTERNATIONAL TELECOMMUNICATION UNION

RADIOCOMMUNICATION STUDY GROUPS

Revision 1 to
Document 10-11S/TEMP/41-E
12 October 1998
Original: English only

Source: Documents 10-11S/80 and 83

RECEIVED

DEC - 9 1998

FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

Joint Working Party 10-11S

PRELIMINARY DRAFT NEW RECOMMENDATION
PROTECTION OF THE BROADCASTING-SATELLITE SERVICE IN THE 12 GHz BAND AND ASSOCIATED FEEDER LINKS IN THE 17 GHz BAND FROM INTERFERENCE CAUSED BY NGSO FSS SYSTEMS
(Questions 85-1/11 and 223/11)

The ITU Radiocommunication Assembly,

considering

a) that the bands 11.7 - 12.5 GHz in Region 1, 12.2 - 12.7 GHz in Region 2 and 11.7 - 12.2 GHz in Region 3 are allocated to the broadcasting-satellite service (BSS);

b) that the BSS in the above bands is subject to the Plans in Appendix S30;

c) that the bands 17.3 - 17.8 GHz in Region 2 and 17.3 - 18.1 GHz in Regions 1 and 3 are allocated to the feeder links of the BSS;

d) that the feeder links to the BSS in the above bands are subject to the Plans in Appendix S30A;

e) that the band 12.5 - 12.75 GHz in Region 3 is also allocated to the BSS;

f) that the band 17.8 - 18.1 GHz in Region 2 is also allocated to the feeder links of the BSS;

g) that WRC-97 allocated the bands 11.7 - 12.5 GHz in Region 1, 12.2 - 12.7 GHz in Region 2, 11.7 - 12.2 GHz and 12.5 - 12.75 GHz in Region 3 to the non-GSO FSS (space-to-Earth) and 17.3 - 17.8 GHz in Regions 1 and 3 and 17.8 - 18.1 GHz in Regions 1, 2 and 3 to the non-GSO FSS (Earth-to-space) subject to the provisions of Resolution 538 (WRC-97);

h) that emissions from the stations of NGSO satellite systems may result in interference to BSS networks and associated feeder links when these networks operate in the same frequency bands;

j) that No. S22.2 of the Radio Regulations states that NGSO satellite systems shall not cause unacceptable interference to GSO satellite systems in the FSS and BSS operating in accordance with these Regulations;

k) that WRC-97 adopted provisional epfd limits to quantify the level of unacceptable NGSO interference and requested ITU-R to review these limits in order to ensure appropriate protection of the Plans and their future modifications;

l) that there exist criteria to protect the BSS networks and associated feeder links from other such networks operating in the same regional plan or in another Regional Plan (Appendix S30, Annex 1 and Appendix S30A, Annex 1);

m) that there exist criteria to protect the BSS networks from FSS networks in another Region (Appendix S30, Annex 4) and to protect the associated feeder links from FSS networks in the same or in another Region (Appendix S30A, Annex 4);

n) that there is a need to define criteria to protect a network in the BSS and associated feeder links from interference caused by NGSO FSS systems;

o) that the harmonious development of NGSO-FSS systems and GSO-BSS and associated feeder link networks requires that the conditions under which the sharing would be feasible should be identified as soon as possible;

p) that the integrity of the Plans in Appendices S30 and S30A and their future modifications is to be ensured,

considering further

a) that the BSS and associated feeder-link system designer should be able to control the overall performance of a network and to provide a quality of service that meets its C/N performance objectives;

b) that to allow an operator to exercise control over the quality of service, there needs to be a limit on the aggregate interference a network must be able to tolerate from emissions of all other networks;

c) that in order to facilitate the introduction of NGSO FSS systems in accordance with the provisions of Article S22, it is necessary to establish sharing criteria that are applicable to individual NSGO FSS systems;

d) that in frequency bands above 10 GHz where very high propagation attenuation may occur for short periods of time, it may be desirable for GSO and NGSOsystems to make use of some form of fade compensation;

e) that in interference situations involving NGSO systems, BSS and associated feedlink networks are potentially exposed to high levels of interference for short periods of time which could affect the performance or availability of these networks;

f) that short-term interference events may cause loss of synchronization or other unstable conditions which may cause a degradation or loss of service for periods longer than the interference events;

g) that in interference situations involving NGSO systems, BSS networks and associated feeder links are potentially exposed to low levels of interference for long periods of time which could degrade the performance or availability of those networks;

h) that the performance and availability of an operating GSO-BSS system and its associated feeder links are degraded by external interfering noise contributions which may be steady state or of a statistical nature;

j) that such degradations may be due to propagation anomalies, other GSO networks and other systems including NGSO-FSS systems that share the same band;

k) that emissions from the earth stations as well as from the space station of a satellite network (GSO-BSS and associated feeder links or NGSO-FSS) in those bands may result in interference to another such network when both networks operate in the same bands;

l) that a methodology is required to allow an accurate assessment of the time varying impact of epfd and apfd limits for NGSO FSS networks on the performance of GSO BSS networks and associated feeder links;

m) that the methodology would facilitate the determination of appropriate epfd and apfd limits that would provide suitable protection of the GSO BSS and associated feeder links;

recommends

1 that for a GSO/BSS network in the 12 GHz band and its associated feeder links in the 17 GHz band, the aggregate inter-network interference caused by the earth and space station emissions of all NGSO-FSS satellite networks operating in the same frequency band, should:

1.1 be responsible for at most 10% of the time allowance(s) for unavailability of the given C/N value(s) as specified in the performance objectives of the desired network, where N is the total noise level of the wanted carrier including all other non-time-varying sources of interference;

1.2 not lead to loss of synchronization in the desired GSO BSS and associated feeder-link network under clear sky conditions;

2 that the equivalent power flux-density (epfd) and aggregate power flux-density (apfd) limits as defined in Article S22 of the Radio Regulations and applicable respectively to NGSO FSS systems to be operated in the 12 GHz bands shared with BSS and in the 17 GHz frequency bands shared with BSS feeder links be derived and specified in such a way:

2.1 that they satisfy the criteria in *recommends* 1.1 and 1.2 above when applied to a set of representative GSO BSS and associated feeder-link system characteristics, as provided in Annex 1 to this Recommendation;

2.2 that the apportionment of the aggregate interference allowance specified in *recommends* 1.1 and 1.2 to derive single entry limits be based on the number of NGSO FSS systems that are anticipated to share the same frequency bands;

2.3 that these limits are specified by ~~piecewise~~ continuous curves of cumulative density function for a range of representative GSO receiving antenna sizes;

Note: Further study is required to ensure that, to the extent possible, these limits be consistent with the protection levels currently afforded to the Plans in Appendices S30 and S30A and their future modifications.

3 that the methodology given in Annex 2, in connection with an appropriate assumed number of NGSO FSS systems, be applied for assessing the impact on the GSO BSS in the 12 GHz band and the associated feeder links in the 17 GHz band of epfd and apfd limits applicable to the NGSO FSS[1].

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[1] NOTE - Other techniques to calculate the impact of NGSO FSS interference on the availability of GSO BSS and associated feeder links are currently under investigation.

ANNEX

(Addendum 2 to Doc. 10-11S/TEMP/41)

This Annex consists of ~~Table 1 of Document~~ 10-11/51, 20 July 1998.

The Table in the Annex will be further revised by 10-11S/SRG-2, and by the meetings of JTG 4-9-11 and ~~by~~ JWP 10-11S.

ANNEX 2

Title

1 Description of the ~~proposed~~ methodology

1.1 Background

The GSO carrier operation is defined by a set of performance requirements (a given C/N or BER for a given percentage of the time). These performance criteria provide, for one or several operating points of the GSO system, with the percentage of time for which the design of the link can tolerate an operational C/N below the required performance. Such an analysis has to be performed taking into account internal and external source of interference non varying in time (such as internal noise, interference from other GSOs) as well as time-varying source of interference (such as rain) (see Figure 1).

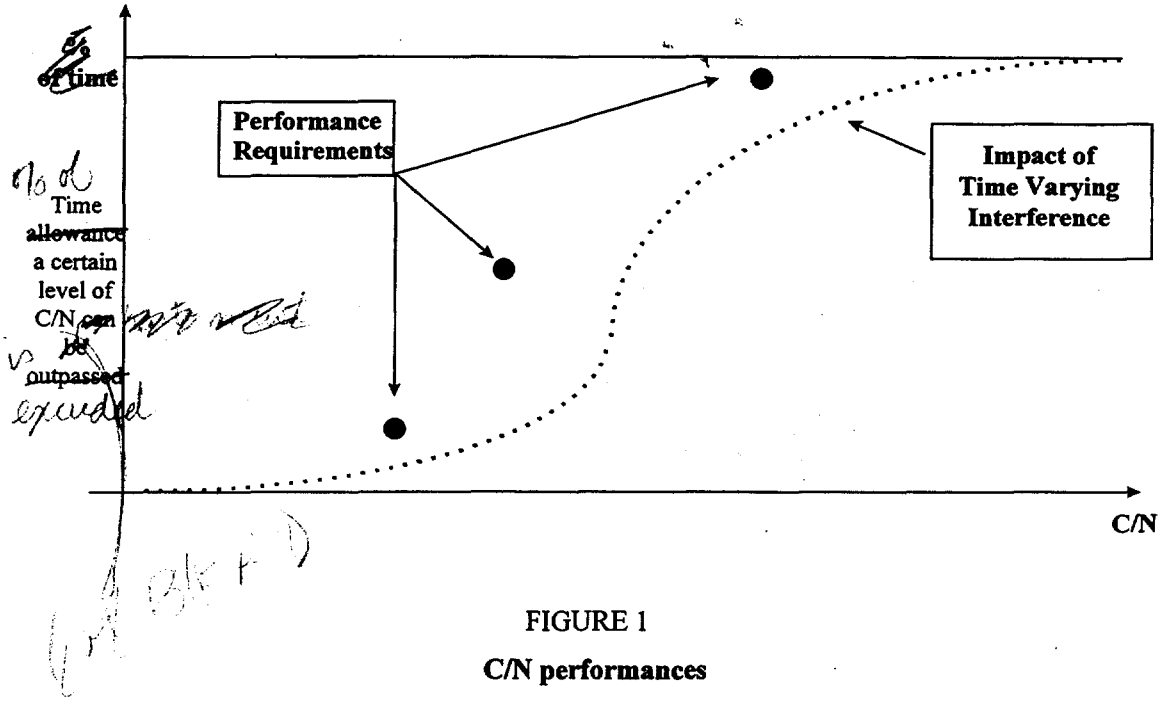


FIGURE 1

C/N performances

1.2 The methodology

Knowing the rain fade degradation statistics and, the apfd and epfd statistics -provisional limits contained in S22 or the actual ones generated by a specific NGSO-FSS network-, the proposed methodology aims at assessing their combined impact on the C/N performances.

Noting that piling worst cases on worst cases leads to overestimate the interference and the time varying nature of some sources of interference, a statistical approach is proposed : convolution of the various statistics, assuming that the various sources of interference are independent. The sources of interference which have been taken into account in this analysis are :

- internal interference to the considered geostationary network (thermal,...);
- external interference from other geostationary networks and/or other systems ;

- attenuation due to rain on the up link and down link and the consequential temperature variations ;
- the interference from the NGSO-FSS system under consideration (for which the distributions of the equivalent power flux-density and the aggregate power flux-density have been computed or measured on the most accurate basis).

As described in Figure 2, the C/N performances is computed two times :

- a first run is performed taking into account all sources of interference, except the interference from the NGSO-FSS system under consideration
- a second run is performed taking into account all sources of interference, including the interference from the NGSO-FSS system under consideration

By comparing the two set of performances, it is then possible to assess the reduction of availability due to the « introduction » of NGSO-FSS. It is also checked that the performance criteria are still met while taking into account the interference from NGSO-FSS.

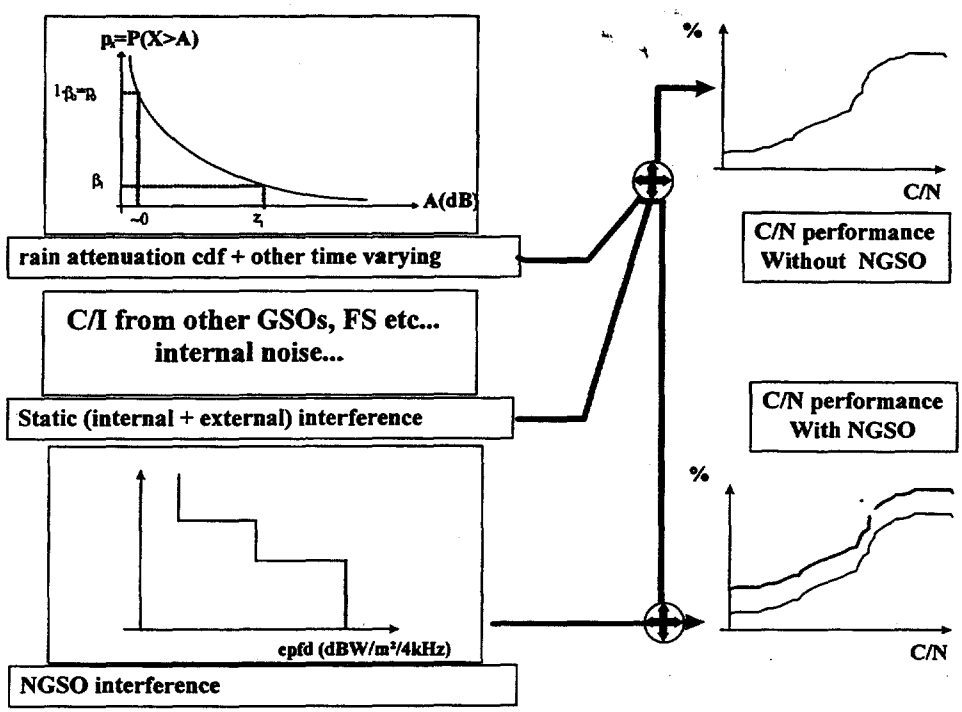


FIGURE 2

Computation of C/N performances

2 Mathematical description of the ~~proposed~~ methodology

2.1 Notations and assumptions

- Upper case notations refer to variables expressed in dB, while lower case notations refers to « linear » variables. Example Given : c (W) vs C (dBW) ;

- GSO network

  ⇒ b (kHz) , is the noise bandwidth of the wanted carrier ;

  ⇒ The characteristics of the Earth-to-Space link and of the desired transmit earth station of the GSO network are known such that the uplink rain attenuation A_u, and its cumulative density function can be computed ;

  ⇒ The characteristics of the Space-to-Earth link and of the desired receive earth station of the GSO network are known such that the downlink rain attenuation A_d, and its cumulative density function can be computed ;

  ⇒ The on-axis antenna gain of the G_r or the GSO receive earth station is known ;

  ⇒ The downlink frequency, f (GHz), of the wanted carrier is known ;

  ⇒ The characteristics of the desired GSO network are known such that the wanted power of the desired carrier of the geostationary network at the input of the demodulator of the receive earth station, c (W) or C (dBW) = $10.\log_{10}(c)$ can be computed : $C = F(A_u,A_d)$

  ⇒ The characteristics of the desired GSO network are known such that the noise power in the noise bandwidth of the desired carrier of the GSO network, at the input of the demodulator of the receive earth station, n (W) or N (dBW) = $10.\log_{10}(n)$, can be computed : $N = G(A_u,A_d)$

  ⇒ The characteristics of the desired GSO network are known such that the link transmission gain, γ or $\Gamma = 10.\log_{10}(\gamma)$ between the output of the geostationary space station receive antenna and the output of the wanted receive earth station can be computed : $\Gamma = H(A_u,A_d)$

- Interferences

  ⇒ $P_u(X) = P(A_u \leq X)$, is the cumulative density function of the uplink rain attenuation, and the corresponding probability function is $P(X \leq A_u < X + dX) = p_u(X).dX$, with $p_u(X) = dP_u(X)/dX$;

  ⇒ $P_d(X) = P(A_d \leq X)$, is the cumulative density function of the downlink rain attenuation, and the corresponding probability function is $P(X \leq A_d < X + dX) = p_d(X).dX$, with $p_d(X) = dP_d(X)/dX$;

  ⇒ The cumulative density function of the thermal noise generated by the conjunction of the Sun, N_s (dBW), or the Moon can be expressed as follows : $P(N_s \leq X) = P_s(X)$. The corresponding probability density function of the noise power generated by the Sun or the Moon can be expressed as: $P(X \leq N_s < X = dX) = p_s(X).dX$, with $p_s(X) = dP_s(X) / dX$

- NGSO-FSS

  ⇒ The NGSO-FSS system is such that the interference power at the geostationary satellite space station receive antenna output, I_u (dBW), or the corresponding aggregate power flux-density A.P.F.D. (dBW/m^2/4kHz), can be considered as being constant ;

  ⇒ The cumulative density function, or c.d.f., of the equivalent power flux-density (EPFD) is known : $P(EPFD \leq X) = P_{epfd}(X)$

- Other

On the downlink, the rain fades will act on both the wanted path (GSO) and on the interfering path (NGSO-FSS)

2.2 Methodology

The methodology is based on the computation of the availability of the GSO network without the power levels generated by the NGSO-FSS system and with these power levels and, on the computation of the difference between availabilities. 8 steps are considered hereafter.

Step 1 :

From the characteristics of the desired earth stations and of the space station, and from the method proposed in the various relevant ITU-R Recommendations :

- Determine the rain attenuation which is exceeded for 0.01% of an average year on the up ink, $A_{u,0.01}$ (dB) : $P(A_u > A_{u,0.01}) = 0.01\%$;
- Determine the rain attenuation which is exceeded for 0.01% of an average year on the down link, $A_{d,0.01}$ (dB) : $P(A_d > A_{d,0.01}) = 0.01\%$;

Note : the algorithms for the CRANE model have been included in the software developped.

Step 2 : From Recommendation ITU-R P.618-5 , determine the cumulative density function (c.d.f.) of the uplink rain fade and of the downlink rain fade :

$$P_{A_u}(X) = P(A_u \le X) = 1 - \frac{10^{11.628\left(-0.546 + \sqrt{0.298 + 0.172\log(0.12 \cdot A_{u,0.01}/X)}\right)}}{100}$$

$$P_{A_d}(X) = P(A_d \le X) = 1 - \frac{10^{11.628\left(-0.546 + \sqrt{0.298 + 0.172\log(0.12 \cdot A_{d,0.01}/X)}\right)}}{100}$$

Step 3 : From Step 2, determine the probability density function (p.d.f.) of the uplink and downlink rain attenuation :

$$p_u(X) = p(X \le A_u \le X + dX) = \frac{dP_{A_u}(X)}{dX} = \frac{1..000008}{100} \times \frac{10^{11.628(-0.546+\sqrt{0.298+0.172\log(\frac{0.12A_{u,0.01}}{X})})}}{X\sqrt{0.298+0.172\log(\frac{0.12A_{u,0.01}}{X})}}$$

and

$$p_d(X) = p(X \le A_d \le X + dX) = \frac{dP_{A_u}(X)}{dX} = \frac{1..000008}{100} \times \frac{10^{11.628(-0.546+\sqrt{0.298+0.172\log(\frac{0.12A_{d,0.01}}{X})})}}{X\sqrt{0.298+0.172\log(\frac{0.12A_{d,0.01}}{X})}}$$

Step 4 : Determine the c.d.f., P_1, of the wanted C/N (i.e. without the interference levels generated by the NGSO-FSS system), from the characteristics of the GSO network and the interference environment :

The total wanted power to noise ratio can be expressed as a function of the up link and the down link rain attenuation as:

$$\left(\frac{C}{N}\right)(A_u, A_d) = F(A_u, A_d) - 10 \cdot \log_{10}\left[10^{G(A_u, A_d)/10} + 10^{(N_s - A_d)/10}\right]$$

Therefore :

$$P_1\left(\frac{C}{N} \le X\right) = 1 - P_1\left(\frac{C}{N} > X\right)$$

thus

$$P_1\left(\frac{C}{N} \le X\right) = 1 - \int_0^{A_{u,1}} p_u(U) \cdot \left\{ \int_0^{A_{d,1}(U)} p_d(V) \cdot P_S\left(10 \cdot \log_{10}\left[10^{(F(U,V)-X)/10} - 10^{G(U,V)/10}\right] + V\right) dV \right\} dU$$

where :

- $A_{u,1}$, is such that : $F(A_{u,1},0) - G(A_{u,1},0) = X$ (i.e. $C/N \cong X$, because of rain fade only on the uplink path, no rain fade on the downlink and no interference due to the extra terrestrial bodies) ;
- $A_{d,1}(U)$, is such that : $F(U, A_{d,1}) - G(U, A_{d,1}) = X$ (i.e. $C/N = X$ because of rain fade only on the uplink path and on the downlink path, and no interference due to the Sun).

Step 5 : Determine the p.d.f. of the epfd and the apfd generated by the NGSO-FSS system :

The interference power I, dBW due to the non-geostationary system(s), can then be expressed as :

$$I(A_u, A_d) = 10 \cdot \log_{10}\left[10^{(I_{wp} + H(A_u, A_d))/10} + 10^{(epfd + K_1 - A_d)/10}\right]$$

where :

- $K_1 = 10.\log_{10}(b/4) + G_r + 10.\log_{10}(\lambda^2/[4.\pi])$, is a constant in dBm^2;
- $\lambda = c/f$, is the wavelength (m).

Step 6 : Determine the c.d.f. P_2 of the noise plus interference power ratio, C/(N+I), i.e. including the presence of the NGSO-FSS system.

The total wanted power to noise plus interference ratio can be expressed as a function of the uplink and the downlink rain attenuation as:

$$\left(\frac{C}{N+I}\right)(A_u, A_d) = F(A_u, A_d) - 10 \cdot \log_{10}\left[10^{G(A_u, A_d)/10} + 10^{(N_s - A_d)/10} + 10^{(I_u + \Gamma(A_u, A_d))/10} + 10^{(epfd + K_1 - A_d)/10}\right]$$

Therefore :

$$P_2\left(\frac{C}{N+I} \le X\right) = 1 - P_2\left(\frac{C}{N+I} > X\right)$$

thus

$$P_2\left(\frac{C}{N} \le X\right) = 1 - \int_0^{A_{u,1}} p_u(U) \cdot \left\{ \int_0^{A_{d,1}(U)} p_d(V) \cdot \left[\int_{-\infty}^{N_{s,1}(U,V)} p_s(N) \cdot P_{epfd}(epfd(U,V,N)) \cdot dN \right] dV \right\} dU$$

where :

- $N_{s,1}(U,V) = 10 \cdot \log_{10}\left[10^{(F(U,V)-X)/10} - 10^{G(U,V)/10}\right] + V$, is the extra-terrestrial noise power which, for uplink fade U and downlink fade V, and with no interference from the NGSo-FSS system(s), would imply C/(N+I) = X.
- $epfd(U,V,N) = 10 \cdot \log_{10}\left[10^{(F(U,V)-X)/10} - 10^{G(U,V)/10} - 10^{(N-V)/10} - 10^{(I_e+H(U,V))/10}\right] - K_1 + V$, is the epfd such that C/N+I = X, knowing the uplink and downlink rain attenuation (U and V), and the extra terrestrial bodies interference power (N).

Step 7: Determine the reduction of availability between the situation without the NGSO-FSS system, and with the NGSO-FSS system :

$$\Delta(X) = \left[1 - P_1(X)\right] - \left[1 - P_2(X)\right] = P_2(X) - P_1(X)$$

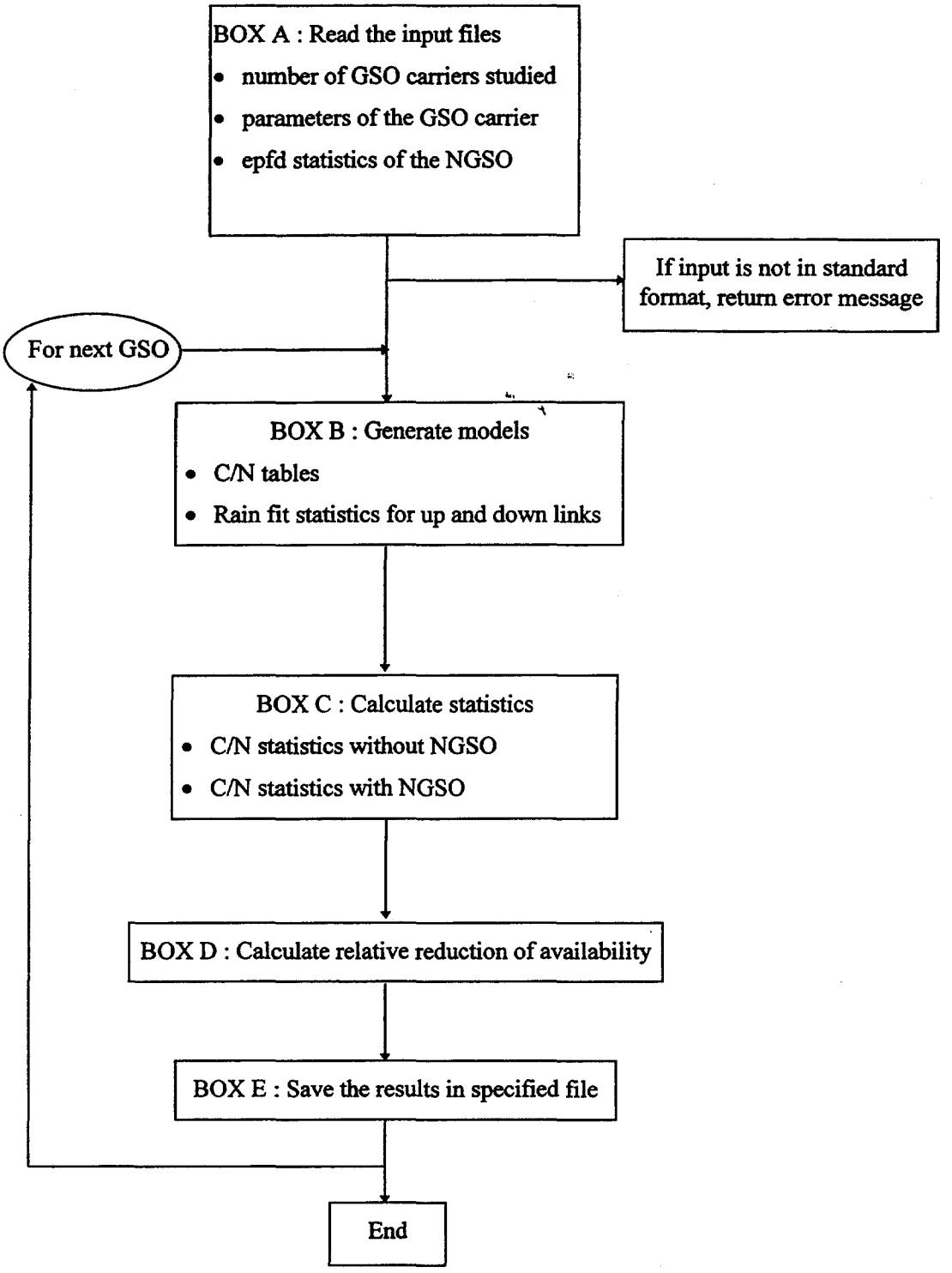
Step 8 : Determine the relative reduction of availability due to the introduction of the NGSO-FSS system, $R_v(X)$ (%) :

$$R_v(X) = 100 \cdot \frac{\Delta(X)}{1 - P_1(X)} = 100 \cdot \frac{P_2(X) - P_1(X)}{1 - P_1(X)} = 100 \cdot \frac{P_2(X) - 1 + 1 - P_1(X)}{1 - P_1(X)} = 100 \cdot \left[1 - \frac{1 - P_2(X)}{1 - P_1(X)}\right]$$

3 Flow chart of the ~~proposed~~ methodology

The following section provides a simplified algorithm that may be used to implement the methodology.

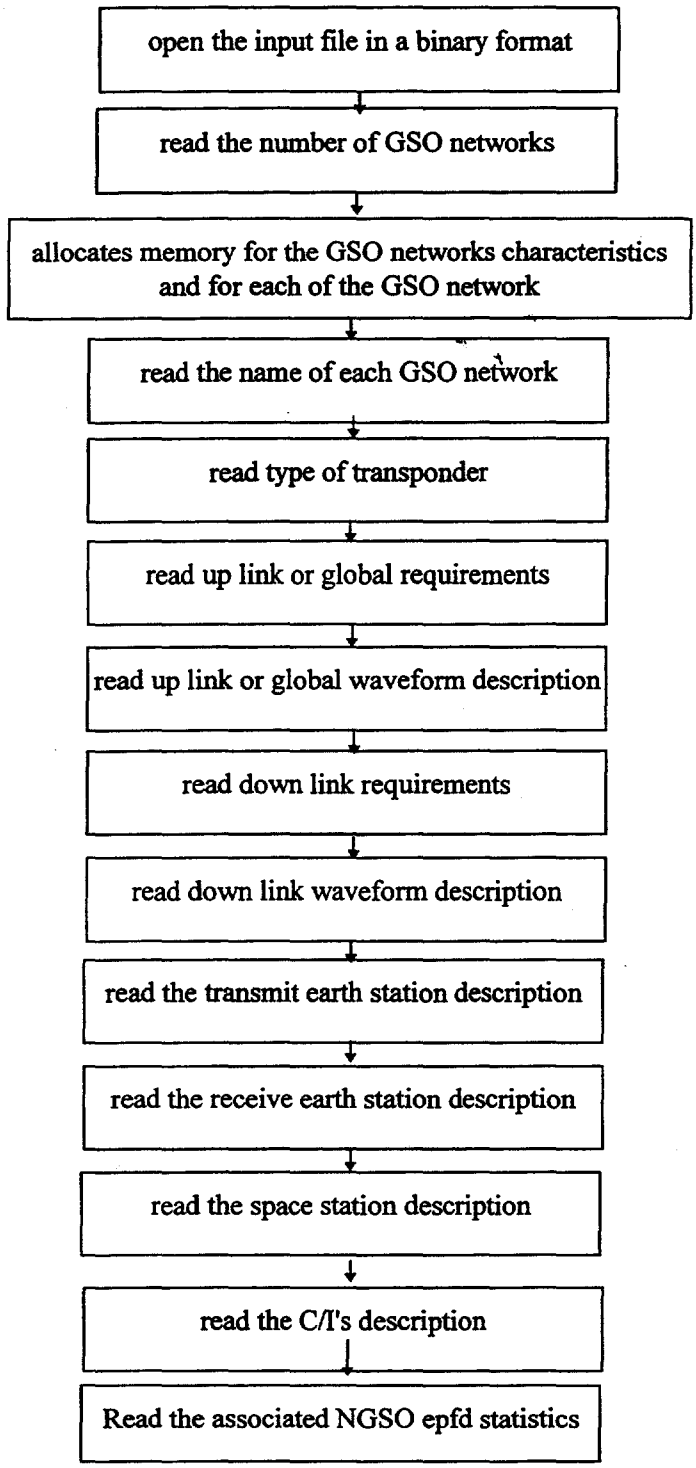
3.1 General algorithm


BOX A : Read the input files
• number of GSO carriers studied
• parameters of the GSO carrier
• epfd statistics of the NGSO
If input is not in standard format, return error message
For next GSO
BOX B : Generate models
• C/N tables
• Rain fit statistics for up and down links
BOX C : Calculate statistics
• C/N statistics without NGSO
• C/N statistics with NGSO
BOX D : Calculate relative reduction of availability
BOX E : Save the results in specified file
End

Description of the different boxes

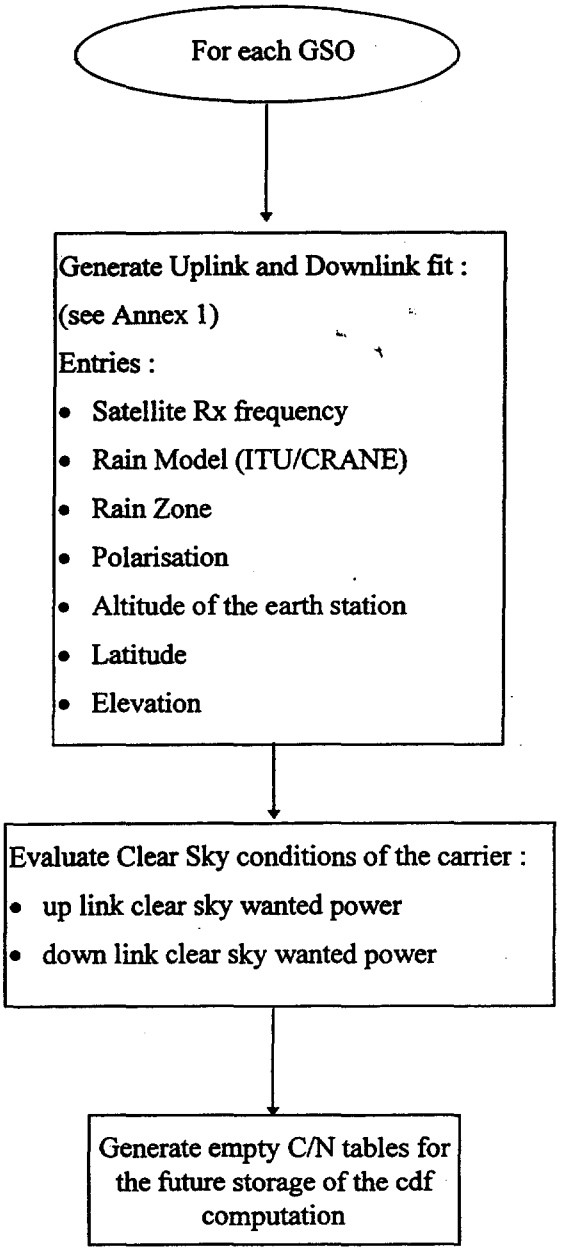
3.1.1 box A : read inputs files

This first part of the software reads and stores the different GSO carrier parameters and the different NGSO epfd files.

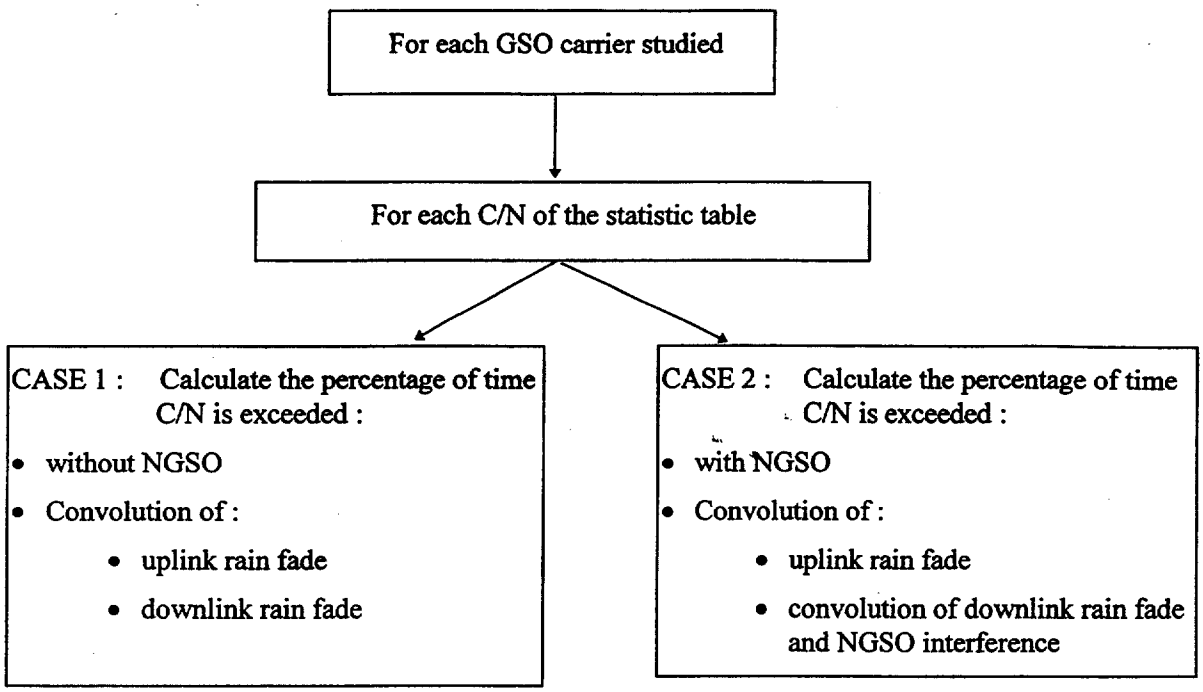


3.1.2 Box B : generate models

The aim of this sub-program is to generate all the models that will be further used to generate the C/N statistics. In particular, an approximation is calculated for the rain attenuations. The description of the methodology used to calculate the rain fit is described in Annex 3.



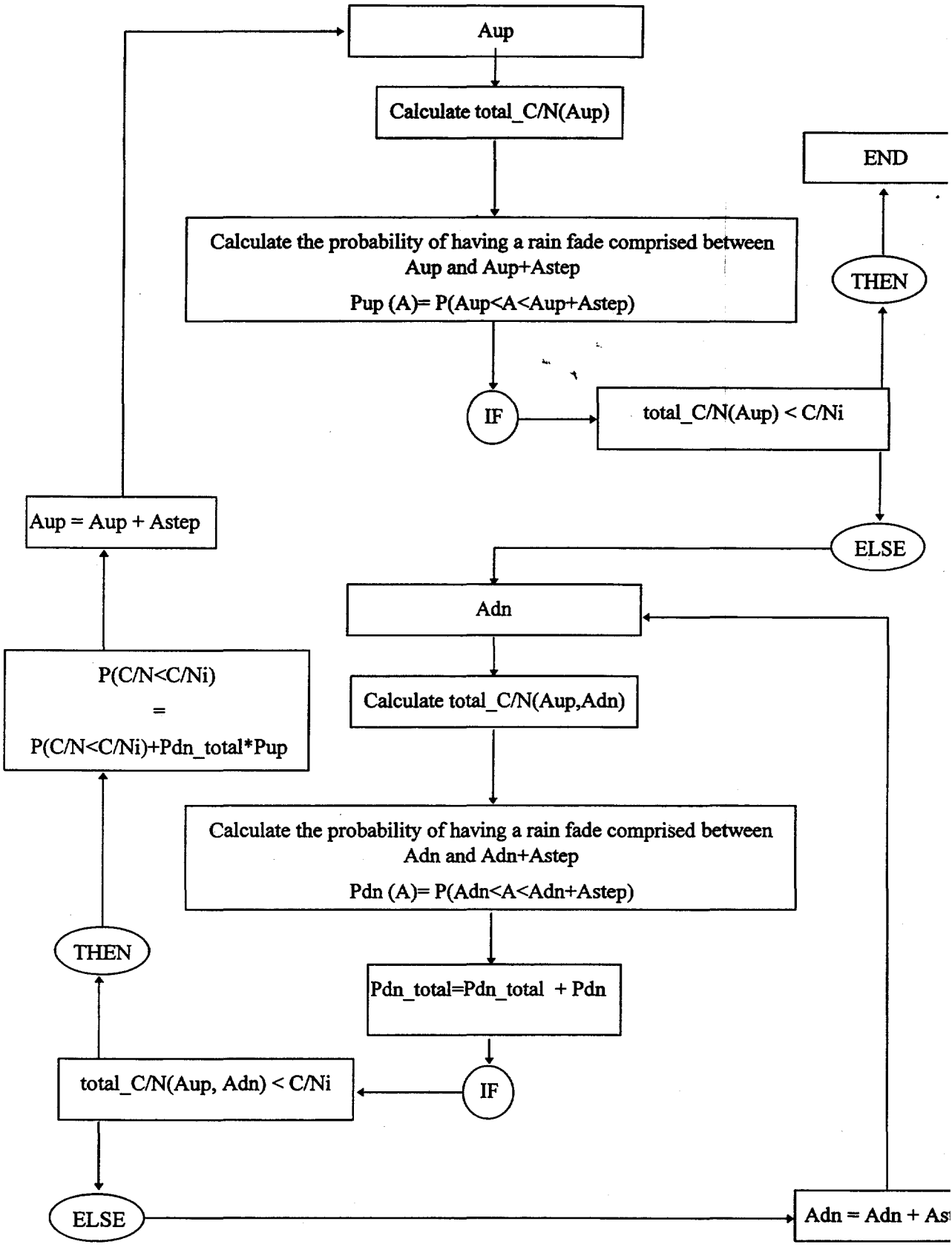
3.1.3 Box C : calculation of the C/N+I statistics



⇒ <u>Case 1 : Cumulative Density Function of total C/N without NGSO</u>

For each tested C/N of the C/N statistic table , with the following notations :

- total_C/N(Aup) : Total C/N of the carrier with an uplink rain attenuation of Aup and no downlink attenuation ;
- total_C/N(Aup,Adn) : Total C/N of the carrier with an uplink rain attenuation of Aup and a downlink rain attenuation of Adn ;
- C/Ni : C/N for which the associated percentage of time is being calculated ;
- Astep : calculation step for the rain attenuation ;

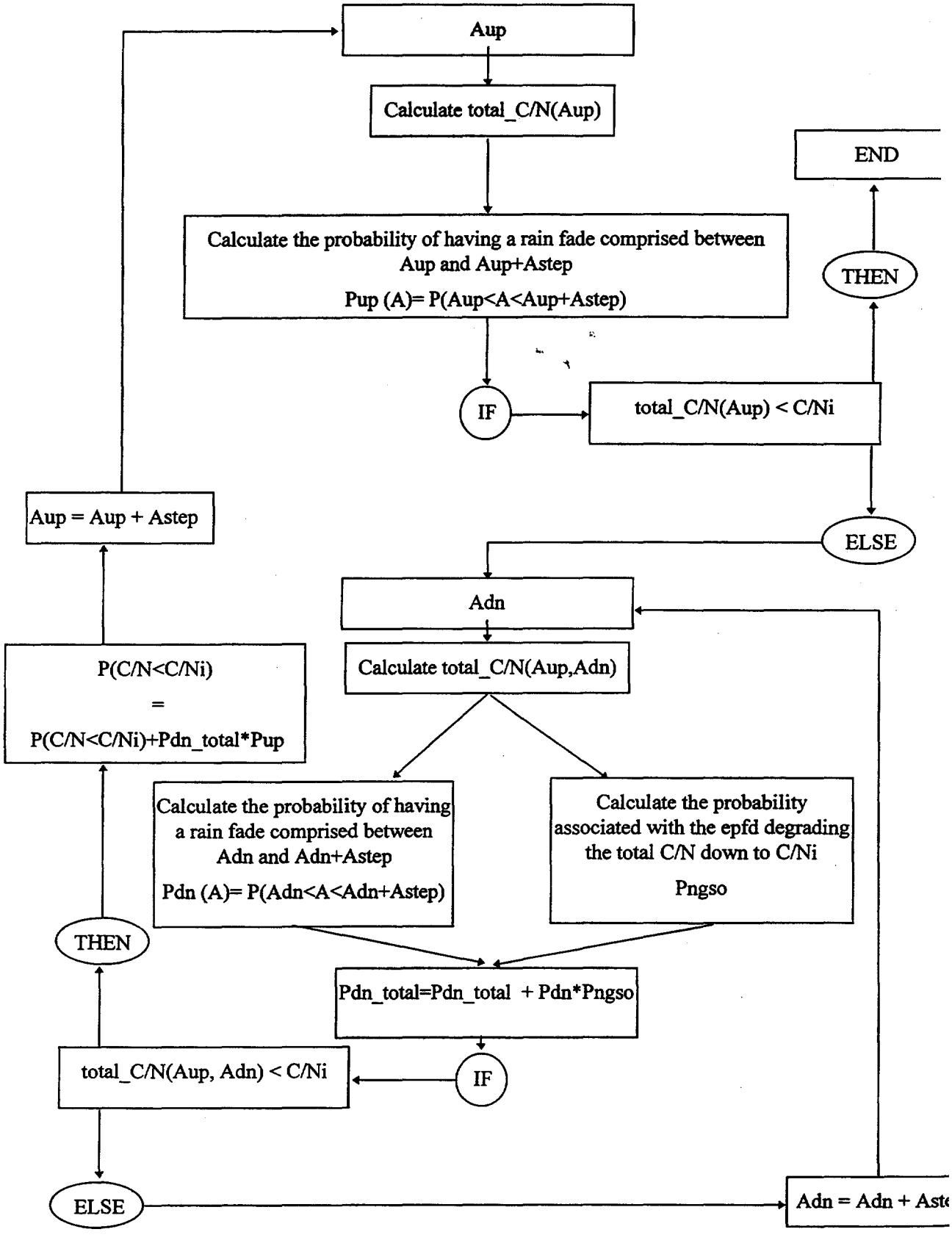

Aup
Calculate total_C/N(Aup)
END
Calculate the probability of having a rain fade comprised between Aup and Aup+Astep
Pup (A)= P(Aup<A<Aup+Astep)
THEN
IF
total_C/N(Aup) < C/Ni
Aup = Aup + Astep
ELSE
Adn
P(C/N<C/Ni)
=
P(C/N<C/Ni)+Pdn_total*Pup
Calculate total_C/N(Aup,Adn)
Calculate the probability of having a rain fade comprised between Adn and Adn+Astep
Pdn (A)= P(Adn<A<Adn+Astep)
THEN
Pdn_total=Pdn_total + Pdn
total_C/N(Aup, Adn) < C/Ni
IF
ELSE
Adn = Adn + As

⇒ Case 2 : Cumulative Density Function of total C/N with NGSO

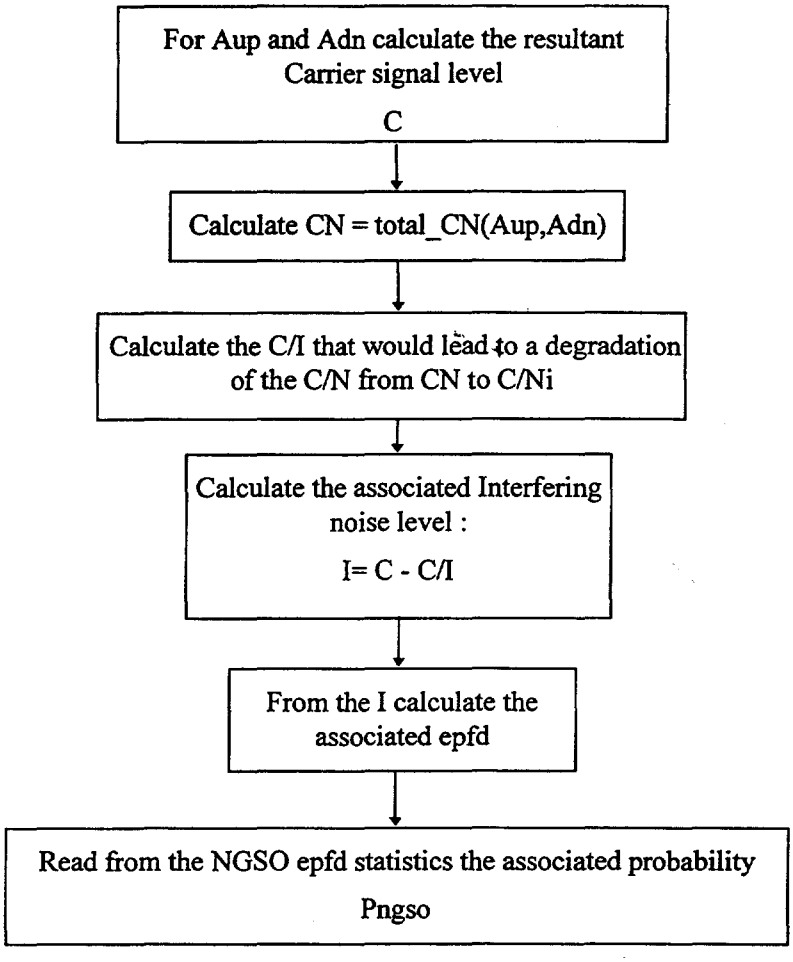
For each tested C/N of the C/N statistic table , with the following notations :

- total_C/N(Aup) : Total C/N of the carrier with an uplink rain attenuation of Aup and no downlink attenuation ;
- total_C/N(Aup,Adn) : Total C/N of the carrier with an uplink rain attenuation of Aup and a downlink rain attenuation of Adn ;
- C/Ni : C/N for which the associated percentage of time is being calculated ;
- Astep : calculation step for the rain attenuation ;

The algorithm used is the following :


Aup
Calculate total_C/N(Aup)
END
Calculate the probability of having a rain fade comprised between Aup and Aup+Astep
Pup (A)= P(Aup<A<Aup+Astep)
THEN
IF
total_C/N(Aup) < C/Ni
Aup = Aup + Astep
ELSE
Adn
Calculate total_C/N(Aup,Adn)
P(C/N<C/Ni)
=
P(C/N<C/Ni)+Pdn_total*Pup
Calculate the probability of having a rain fade comprised between Adn and Adn+Astep
Pdn (A)= P(Adn<A<Adn+Astep)
Calculate the probability associated with the epfd degrading the total C/N down to C/Ni
Pngso
THEN
Pdn_total=Pdn_total + Pdn*Pngso
total_C/N(Aup, Adn) < C/Ni
IF
ELSE
Adn = Adn + Aste

The following algorithm details the calculation of Pngso with the same notations:



1.4 Box D : Calculation of the relative reduction of availability

This part of the software determines the relative reduction of availability due to the introduction of the non-geostationary system(s), $R_v(X)$ (%) :

$$R_v(X) = 100 \cdot \frac{\Delta(X)}{1-P_1(X)} = 100 \cdot \frac{P_2(X)-P_1(X)}{1-P_1(X)} = 100 \cdot \frac{P_2(X)-1+1-P_1(X)}{1-P_1(X)} = 100 \cdot \left[1-\frac{1-P_2(X)}{1-P_1(X)}\right]$$

Where P1 is the probability associated with a level of C/N without NGSO and P2 with NGSO.

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RADIOCOMMUNICATION STUDY GROUPS

Addendum 2 to Document 10-11S/TEMP/41-E
12 October 1998
Original: English only

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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

Working Party 10-11S

PRELIMINARY DRAFT NEW RECOMMENDATION
PROTECTION OF THE BROADCASTING SATELLITE SERVICE IN THE 12 GHZ BAND AND ASSOCIATED FEEDER LINKS IN THE 17 GHZ BAND FROM INTERFERENCE CAUSED BY NGSO FSS SYSTEMS

Attached please find Annex 1 to above mentioned document.

Annex 1 : BSS system characteristics

System Characteristics	Units	Ref WARC-77 Regions 1 & 3 individual	Ref WARC-77 Regions 1 & 3 community	Ref WRC-97 Region 1 & 3	Ref RARC-83 Region 2	Ref WRC-97 Region 1 & 3	Ref WRC-97 Region 1 & 3	Ref WRC-97 Region 1 & 3	Ref WRC-97 Region 1 & 3	Ref WRC-97 Region 1 & 3	Ref WRC-97 Region 1 & 3	Ref WRC-97 Region 1 & 3
System Characteristics												
Frequency	GHz	12.000	12.000	12.000	12.350	12.200	12.200	12.200	12.200	12.200	12.200	12.200
Availability objective	%											
Receiver noise Bandwidth	MHz	27.0	27.0	27.0	24.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0
Modulation type		FM	FM	FM	FM	FM	FM	FM	FM	FM	FM	FM
Polarization (angle as defined in Annex 2 of APS30 in case of linear polarization)		CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR
C/I due to frequency re-use (polarization discrimination)	dB											
C/I due to other GSO BSS networks	dB	30.0	30.0	23.0	28.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0
C/I due to GSO FSS networks	dB	30.0	30.0	23.0	28.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0
Clear sky feeder link C/N+I	dB					25.6	26.8	26.2	25.0	26.7	25.2	26.7
C/N+I required at operating threshold	dB	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
Clear sky C/N+I margin above operating threshold (1)	dB											
Total Clear sky C/N+I margin above operating threshold (1)	dB					6.8	8.2	7.7	7.0	8.0	7.2	8.1
C/N+I total link for 99.7% of the time	dB					15.3	16.7	15.8	14.8	15.9	14.8	15.7
C/N+I margin above operating threshold for 99.7% of the time	dB											
Space station characteristics												
Longitude	°					-25.0	74.0	-19.0	62.0	5.0	152.0	5.0
Satellite e.i.r.p. in the direction of the earth station	dBW	61.0	53.0	56.0	57.0	55.8	58.9	57.6	56.2	58.3	56.6	58.8
Earth station characteristics												
Receive antenna diameter	cm	90.0	180.0	60.0	100.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0
On-axis antenna gain at receiver input	dBi	37.0	44.5	35.7	40.2							
On-axis antenna gain at antenna output	dBi					35.9	35.9	35.9	35.9	35.9	35.9	35.9
Off-axis antenna gain characteristics		Fig7 An3 Ap30	Fig7 An3 Ap30	Ig7bis An3 Ap30	Fig8 An3 Ap30	BO1213	BO1213	BO1213	BO1213	BO1213	BO1213	BO1213
Clear sky receive system noise temperature at receiver input	K	1000.0	700.0	155.0	300.0							
Clear sky receive system noise temperature at antenna output	K					120.0	120.0	120.0	120.0	120.0	120.0	120.0
Total pointing loss	dB	1.0	2.0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Latitude	°					23.0	45.0	-28.4	36.3	55.3	-34.9	58.0
Longitude	°					12.0	98.0	20.0	90.0	15.1	140.9	7.6
Altitude	km					0.1	0.1	0.1	0.1	0.1	0.1	0.1
Rain climatic zone						A	B	C	D	E	F	G
Elevation angle	°					40.7	32.9	36.1	38.6	26.3	47.8	24.0
Propagation characteristics												
Rain attenuation for 99.7% of the time	dB	1.2	1.2	1.2	1.2	0.3	0.4	0.6	0.8	0.8	1.0	1.2
Noise increase due to rain for 99.7 % of the time	dB	0.3	0.4	1.5	0.9	0.7	0.9	1.2	1.4	1.5	1.7	1.9
Rain attenuation for availability percentage of time	dB	5.5	5.3	4.9	8.9	5.0	7.5	6.5	5.3	6.9	5.8	7.3
Feeder link earth station characteristics												
Frequency	GHz	17.7	17.7	17.7	17.7	17.7	17.7	14.7	17.7	17.7	17.7	17.7
Maximum uplink power control						2.1	1.7	2.8	10.0	4.8	5.7	6.8
Minimum feeder link earth station eirp	dBW	82.0	82.0	82.0	82.0	84.0	89.0	82.0	84.0	84.0	87.0	84.0
Latitude	°					24.0	43.2	-28.3	48.0	55.7	-34.8	60.1
Longitude	°					11.0	96.0	20.0	118.0	12.5	138.6	10.8
Altitude	km					0.1	0.1	0.1	0.1	0.1	0.1	0.1
Rain climatic zone						A	A	C	F	E	F	G
Elevation angle	°					41.1	35.4	36.2	13.5	26.2	47.1	21.6
Rain attenuation for 99.97% of the time	dB					2.1	1.7	2.8	11.4	4.8	5.7	6.8
Rain attenuation for availability percentage of time	dB											
Characteristics of the space station receiver												
Satellite receive noise temperature	K	1500.0	1500.0	1500.0	1500.0	1000.0	1000.0	1000.0	1000.0	1000.0	1000.0	1000.0
Satellite receive antenna gain in the direction of the feeder link station	dB	35.0	35.0	35.0	35.0	32.4	35.7	35.4	31.1	40.5	28.0	40.8
Automatic gain control setting						YES	YES	YES	YES	YES	YES	YES
Polarization (angle as defined in Annex 2 of APS30A in case of linear polarization)		CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL
C/I due to frequency re-use (polarization discrimination)	dB											
C/I due to other GSO BSS networks	dB	30.0	30.0	30.0	30.0							
C/I from other assignments in the Plan	dB					30.0	30.0	30.0	30.0	30.0	30.0	30.0
C/I from other GSO FSS systems	dB	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0

(1) Administrations are strongly encouraged to use the spreadsheet provided with this Table in order to calculate this margin

Footnote 1: For US-GSO D5, rain effects are not relevant.

Footnote 2: See the antenna gain pattern mask in attachment 1 to document 4-9-11/165 Corr.1

Footnote 3: See "test results template" in Figure 4 of ITU Document 4-9-11/172-E, 25 June 1998.

Annex 1 : BSS system characteristics

System Characteristics	Units	Ref WRC-97 Region 1 & 3	Ref WRC-97 Region 1 & 3	Ref WRC-97 Region 1 & 3	Ref WRC-97 Region 1 & 3	Ref WRC-97 Region 1 & 3	Ref WRC-97 Region 1 & 3	Ref WRC-97 Region 1 & 3	Ref WRC-97 Region 1 & 3	USA US-GSO 1(a)	USA US-GSO 1(b)	USA US-GSO 2(a)
System Characteristics												
Frequency	GHz	12.200	12.200	12.200	12.200	12.200	12.200	12.200	12.200	12.700	12.700	12.700
Availability objective	%									99.92	99.94	99.99
Receiver noise Bandwidth	MHz	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	24.0	24.0	24.0
Modulation type		FM	FM	FM	FM	FM	FM	FM	FM	QPSK	QPSK	QPSK
Polarization (angle as defined in Annex 2 of APS30 in case of linear polarization)		CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR
C/I due to frequency re-use (polarization discrimination)	dB											
C/I due to other GSO BSS networks	dB	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	20.7	23.7	20.7
C/I due to GSO FSS networks	dB	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	99.0	99.0	99.0
Clear sky feeder link C/N+I	dB	26.9	26.4	26.5	26.6	26.3	26.8	24.7	26.4	24.2	24.2	24.2
C/N+I required at operating threshold	dB	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	5.0	7.6	5.1
Clear sky C/N+I margin above operating threshold (1)	dB									3.6	4.0	8.8
Total Clear sky C/N+I margin above operating threshold (1)	dB	8.2	7.2	7.9	8.9	9.1	8.0	6.8	7.6			
C/N+I total link for 99.7% of the time	dB	15.6	13.7	14.5	15.6	16.2	11.8	6.7	9.9			
C/N+I margin above operating threshold for 99.7% of the time	dB									1.5	1.9	6.9
Space station characteristics												
Longitude	°	-33.5	-1.0	5.0	-19.0	110.0	68.0	80.2	-13.0	101W	101W	101W
Satellite e.i.r.p. in the direction of the earth station	dBW	59.0	56.2	58.1	61.3	62.3	57.9	55.6	56.8	48.0	51.0	48.0
Earth station characteristics												
Receive antenna diameter	cm	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	45.0	45.0	90.0
On-axis antenna gain at receiver input	dBi									34.0	34.0	40.0
On-axis antenna gain at antenna output	dBi	35.9	35.9	35.9	35.9	35.9	35.9	35.9	35.9			
Off-axis antenna gain characteristics		BO1213	BO1213	BO1213	BO1213	BO1213	BO1213	BO1213	BO1213	App 30, An. 5	App 30, An. 5	App 30, An. 5
Clear sky receive system noise temperature at receiver input	K									125.0	125.0	125.0
Clear sky receive system noise temperature at antenna output	K	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0			
Total pointing loss	dB	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Latitude	°	54.4	-9.0	36.0	41.2	34.7	23.0	5.5	4.8	47.6	47.6	47.6
Longitude	°	-7.3	33.0	36.0	9.5	129.3	91.6	95.3	8.5	122.3W	122.3W	122.3W
Altitude	km	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1			
Rain climatic zone		H	J	K	L	M	N	P	Q	D	D	D
Elevation angle	°	23.5	49.3	37.0	34.2	44.7	52.2	71.2	64.2	31.5	31.5	31.5
Propagation characteristics												
Rain attenuation for 99.7% of the time	dB	1.4	1.6	1.9	2.7	2.7	4.3	7.2	5.3	0.8	0.8	0.8
Noise increase due to rain for 99.7 % of the time	dB	2.2	2.5	2.7	3.3	3.3	4.0	4.7	4.3	1.4	1.4	1.4
Rain attenuation for availability percentage of time	dB	7.4	5.5	6.9	9.7	10.8	6.9	5.2	6.1	1.5	1.8	5.4
Feeder link earth station characteristics												
Frequency	GHz	17.7	14.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7
Maximum uplink power control		7.9	6.7	10.0	10.0	10.0	10.0	10.0	10.0			
Minimum feeder link earth station eirp	dBW	84.0	82.0	84.0	84.0	87.0	84.0	84.0	84.0	78.0	78.0	78.0
Latitude	°	54.4	-9.0	36.0	41.2	34.7	23.0	4.4	4.8	39.7	39.7	39.7
Longitude	°	-7.3	33.0	32.8	9.5	129.3	91.6	118.0	8.5	105.0	105.0	105.0
Altitude	km	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1			
Rain climatic zone		H	J	K	L	M	N	P	Q	E	E	E
Elevation angle	°	23.5	49.3	38.9	34.2	44.7	52.2	45.9	64.2	43.8	43.8	43.8
Rain attenuation for 99.97% of the time	dB	7.9	6.7	10.6	14.5	14.7	22.4	35.5	27.0	3.0	3.0	3.0
Rain attenuation for availability percentage of time	dB											
Characteristics of the space station receiver												
Satellite receive noise temperature	K	1000.0	1000.0	1000.0	1000.0	1000.0	1000.0	1000.0	1000.0	616.6	616.6	616.6
Satellite receive antenna gain in the direction of the feeder link station	dB	47.2	36.5	37.4	38.0	32.9	41.3	29.6	36.5	32.2	32.2	32.2
Automatic gain control setting		YES	YES	YES	YES	YES	YES	YES	YES			
Polarization (angle as defined in Annex 2 of APS30A in case of linear polarization)		CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL
C/I due to frequency re-use (polarization discrimination)	dB											
C/I due to other GSO BSS networks	dB									30.0	30.0	30.0
C/I from other assignments in the Plan	dB	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0			
C/I from other GSO FSS systems	dB	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0

(1) Administrations are strongly encouraged to use the spreadsheet provided with this Table in order to calculate

Footnote 1: For US-GSO D5, rain effects are not relevant.

Footnote 2: See the antenna gain pattern mask in attachment 1 to document 4-9-11/165 Corr.1

Footnote 3: See "test results template" in Figure 4 of ITU Document 4-9-11/172-E, 25 June 1998.

Annex 1 : BSS system characteristics

System Characteristics	Units	USA US-GSO 2(b)	USA US-GSO 4	USA US-GSO 5(a)	USA US-GSO 5(b)	USA US-GSO 5(c)	USA US-GSO 5(d)	USA US-GSO 5(e)	USA US-GSO 5(f)	USA US-GSO 6	USA US-GSO D1(a)	USA US-GSO D1(b)
System Characteristics												
Frequency	GHz	12.700	12.700	12.700	12.700	12.700	12.700	12.700	12.700	12.700	12.700	12.700
Availability objective	%	99.99	TBS	99.90	99.90	TBS	99.70	99.70	99.60	99.80	99.80	99.83
Receiver noise Bandwidth	MHz	24.0	24.0	26.0	26.0	26.0	26.0	26.0	26.0	24.0	24.0	24.0
Modulation type		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK
Polarization (angle as defined in Annex 2 of APS30 in case of linear polarization)		CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR
C/I due to frequency re-use (polarization discrimination)	dB											
C/I due to other GSO BSS networks	dB	23.7	11.5	11.4	14.1	TBS	TBS	TBS	TBS	15.5	20.7	23.7
C/I due to GSO FSS networks	dB	99.0	99.0	99.0	99.0	99.0	99.0	99.0	99.0	99.0	99.0	99.0
Clear sky feeder link C/N+I	dB	24.2	23.5	TBS	TBS	24.8	24.8	24.8	24.8	24.2	24.2	24.2
C/N+I required at operating threshold	dB	7.6	TBS	8.4	8.4	8.4	8.4	8.4	8.4	8.4	5.0	7.6
Clear sky C/N+I margin above operating threshold (1)	dB	9.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.8	9.2
Total Clear sky C/N+I margin above operating threshold (1)	dB											
C/N+I total link for 99.7% of the time	dB											
C/N+I margin above operating threshold for 99.7% of the time	dB	7.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	1.6
Space station characteristics												
Longitude	°	101W									101W	101W
Satellite e.i.r.p. in the direction of the earth station	dBW	51.0	47.6	47.5	50.2	54.9	37.4	41.4	37.4	51.5	53.9	56.9
Earth station characteristics												
Receive antenna diameter	cm	90.0	45.0	45.0	45.0	60.0	180.0	180.0	240.0	26.0	45.0	45.0
On-axis antenna gain at receiver input	dBi	40.0	TBS	33.9	33.9	36.4	45.9	45.9	48.4	28.7	34.0	34.0
On-axis antenna gain at antenna output	dBi											
Off-axis antenna gain characteristics		App 30, An. 5	measured	measured	measured	measured	measured	measured	measured	measured	App 30, An. 5	App 30, An. 5
Clear sky receive system noise temperature at receiver input	K	125.0		125.0	125.0	125.0	125.0	125.0	125.0	100.0	125.0	125.0
Clear sky receive system noise temperature at antenna output	K											
Total pointing loss	dB	0.5	0.5	0.5	0.5	0.5	TBS	TBS	TBS	TBS	0.5	0.5
Latitude	°	47.6									27.9	27.9
Longitude	°	122.3W									82.5W	82.5W
Altitude	km											
Rain climatic zone		D									N	N
Elevation angle	°	31.5									51.5	51.5
Propagation characteristics												
Rain attenuation for 99.7% of the time	dB	0.8	TBS	TBS	TBS	TBS	TBS	TBS	TBS	TBS	4.5	4.5
Noise increase due to rain for 99.7 % of the time	dB	1.4	TBS	TBS	TBS	TBS	TBS	TBS	TBS	TBS	4.0	4.0
Rain attenuation for availability percentage of time	dB	5.9	TBS	TBS	TBS	TBS	TBS	TBS	TBS	TBS	5.5	5.8
Feeder link earth station characteristics												
Frequency	GHz	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7
Maximum uplink power control												
Minimum feeder link earth station eirp	dBW	78.0	76.6	TBS	TBS	78.0	78.0	78.0	78.0	78.0	78.0	78.0
Latitude	°	39.7									39.7	39.7
Longitude	°	105.0									105.0	105.0
Altitude	km											
Rain climatic zone		E									E	E
Elevation angle	°	43.8									43.8	43.8
Rain attenuation for 99.97% of the time	dB	3.0									3.0	3.0
Rain attenuation for availability percentage of time	dB											
Characteristics of the space station receiver												
Satellite receive noise temperature	K	616.6	716.0	590.0	590.0	590.0	590.0	590.0	590.0	616.6	616.6	616.6
Satellite receive antenna gain in the direction of the feeder link station	dB	32.2	32.8	33.8	33.8	33.8	33.8	33.8	33.8	32.2	32.2	32.2
Automatic gain control setting												
Polarization (angle as defined in Annex 2 of APS30A in case of linear polarization)		CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL
C/I due to frequency re-use (polarization discrimination)	dB											
C/I due to other GSO BSS networks	dB	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
C/I from other assignments in the Plan	dB											
C/I from other GSO FSS systems	dB	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0

(1) Administrations are strongly encouraged to use the spreadsheet provided with this Table in order to calculate

Footnote 1: For US-GSO D5, rain effects are not relevant.

Footnote 2: See the antenna gain pattern mask in attachment 1 to document 4-9-11/165 Corr.1

Footnote 3: See "test results template" in Figure 4 of ITU Document 4-9-11/172-E, 25 June 1998.

Annex 1 : BSS system characteristics

System Characteristics	Units	USA US-GSO D2(a)	USA US-GSO D2(b)	USA US-GSO D3(a)	USA US-GSO D3(b)	USA US-GSO D4	USA US-GSO D5(a)	USA US-GSO D5(b)	USA US-GSO D6(a)	USA US-GSO D6(b)	USA US-GSO D7(a)	USA US-GSO D7(b)
System Characteristics												
Frequency	GHz	12.700	12.700	12.700	12.700	12.700	12.700	12.700	12.700	12.700	12.700	12.700
Availability objective	%	99.91	99.92	99.80	99.84	99.90	Footnote 1	Footnote 1	99.96	99.97	99.92	99.94
Receiver noise Bandwidth	MHz	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
Modulation type		QPSK	QPSK	QPSK	QPSK	8PSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK
Polarization (angle as defined in Annex 2 of APS30 in case of linear polarization)		CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR
C/I due to frequency re-use (polarization discrimination)	dB											
C/I due to other GSO BSS networks	dB	20.7	23.7	20.7	23.7	20.0	20.7	23.7	20.7	23.7	20.7	23.7
C/I due to GSO FSS networks	dB	99.0	99.0	99.0	99.0	99.0	99.0	99.0	99.0	99.0	99.0	99.0
Clear sky feeder link C/N+I	dB	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2
C/N+I required at operating threshold	dB	5.0	7.6	5.0	7.6	11.0	5.0	7.6	5.0	7.6	5.0	7.6
Clear sky C/N+I margin above operating threshold (1)	dB	6.7	7.1	4.6	5.0	2.8	0.5	0.9	5.4	5.8	3.6	4.0
Total Clear sky C/N+I margin above operating threshold (1)	dB											
C/N+I total link for 99.7% of the time	dB											
C/N+I margin above operating threshold for 99.7% of the time	dB	2.4	2.8	0.7	1.1	1.0	0.5	0.9	2.7	3.1	1.5	1.9
Space station characteristics												
Longitude	°	101W	101W	101W	101W	101W	101W	101W	101W	101W	101W	101W
Satellite e.i.r.p. in the direction of the earth station	dBW	51.4	54.4	49.1	52.1	54.1	48.0	51.0	48.0	51.0	48.0	51.0
Earth station characteristics												
Receive antenna diameter	cm	45.0	45.0	45.0	45.0	45.0	measured	measured	45.0	45.0	45.0	45.0
On-axis antenna gain at receiver input	dBi	34.0	34.0	34.0	34.0	34.0	30.0	30.0	34.0	34.0	34.0	34.0
On-axis antenna gain at antenna output	dBi											
Off-axis antenna gain characteristics		App 30, An. 5	App 30, An. 5	App 30, An. 5	App 30, An. 5	App 30, An. 5	Footnote 2	Footnote 2	App 30, An. 5	App 30, An. 5	Footnote 3	Footnote 3
Clear sky receive system noise temperature at receiver input	K	125.0	125.0	125.0	125.0	125.0	110.0	110.0	80.0	80.0	125.0	125.0
Clear sky receive system noise temperature at antenna output	K											
Total pointing loss	dB	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Latitude	°	40.7	40.7	45.0	45.0	47.6	47.6	47.6	47.6	47.6	47.6	47.6
Longitude	°	74W	74W	93.3W	93.3W	122.3W	122.3W	122.3W	122.3W	122.3W	122.3W	122.3W
Altitude	km											
Rain climatic zone		K	K	K	K	D	D	D	D	D	D	D
Elevation angle	°	35.4	35.4	37.6	37.6	31.5	Variable	Variable	31.5	31.5	31.5	31.5
Propagation characteristics												
Rain attenuation for 99.7% of the time	dB	2.0	2.0	1.7	1.7	0.8	0.0	0.0	0.8	0.8	0.8	0.8
Noise increase due to rain for 99.7 % of the time	dB	2.7	2.7	2.5	2.5	1.4	0.0	0.0	2.1	2.1	1.4	1.4
Rain attenuation for availability percentage of time	dB	3.6	3.9	2.1	2.4	1.3	0.0	0.0	2.0	2.3	1.5	1.8
Feeder link earth station characteristics												
Frequency	GHz	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7
Maximum uplink power control												
Minimum feeder link earth station eirp	dBW	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0
Latitude	°	39.7	39.7	39.7	39.7	39.7	39.7	39.7	39.7	39.7	39.7	39.7
Longitude	°	105.0	105.0	105.0	105.0	105.0	105.0	105.0	105.0	105.0	105.0	105.0
Altitude	km											
Rain climatic zone		E	E	E	E	E	E	E	E	E	E	E
Elevation angle	°	43.8	43.8	43.8	43.8	43.8	43.8	43.8	43.8	43.8	43.8	43.8
Rain attenuation for 99.97% of the time	dB	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Rain attenuation for availability percentage of time	dB											
Characteristics of the space station receiver												
Satellite receive noise temperature	K	616.6	616.6	616.6	616.6	616.6	616.6	616.6	616.6	616.6	616.6	616.6
Satellite receive antenna gain in the direction of the feeder link station	dB	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2
Automatic gain control setting												
Polarization (angle as defined in Annex 2 of APS30A in case of linear polarization)		CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL
C/I due to frequency re-use (polarization discrimination)	dB											
C/I due to other GSO BSS networks	dB	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
C/I from other assignments in the Plan	dB											
C/I from other GSO FSS systems	dB	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0

(1) Administrations are strongly encouraged to use the spreadsheet provided with this Table in order to calculate

Footnote 1: For US-GSO D5, rain effects are not relevant.

Footnote 2: See the antenna gain pattern mask in attachment 1 to document 4-9-11/165 Corr.1

Footnote 3: See "test results template" in Figure 4 of ITU Document 4-9-11/172-E, 25 June 1998.

Annex 1 : BSS system characteristics

System Characteristics	Units	USA US-GSO D8(a)	USA US-GSO D8(b)	USA US-GSO D9(a)	USA US-GSO D9(b)	USA US-GSO D10(a)	USA US-GSO D10(b)	USA US-GSO D11	USA US-GSO D12(a)	USA US-GSO D12(b)	Australia OPTUS	France RADIOSAT-3 Analog / TP 1
System Characteristics												
Frequency	GHz	12.700	12.700	12.700	12.700	12.700	12.700	12.700	12.700	12.700	12.000	12.200
Availability objective	%	99.80	99.83	99.91	99.92	99.80	99.84	99.90	99.96	99.97	99.90	99.98
Receiver noise Bandwidth	MHz	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	33.0	27.0
Modulation type		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	8PSK	QPSK	QPSK	QPSK	FM
Polarization (angle as defined in Annex 2 of APS30 in case of linear polarization)		CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	L (45°/135°)	L (22°/112°)
C/I due to frequency re-use (polarization discrimination)	dB										30.0	
C/I due to other GSO BSS networks	dB	20.7	23.7	20.7	23.7	20.7	23.7	20.0	20.7	23.7	17.0	23.0
C/I due to GSO FSS networks	dB	99.0	99.0	99.0	99.0	99.0	99.0	99.0	99.0	99.0	30.0	23.0
Clear sky feeder link C/N+I	dB	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	27.0	26.3
C/N+I required at operating threshold	dB	5.0	7.6	5.0	7.6	5.0	7.6	11.0	5.0	7.6	5.9	9.0
Clear sky C/N+I margin above operating threshold (1)	dB	8.8	9.2	6.7	7.1	4.6	5.0	2.8	5.4	5.8	4.0	
Total Clear sky C/N+I margin above operating threshold (1)	dB											6.3
C/N+I total link for 99.7% of the time	dB											13.8
C/N+I margin above operating threshold for 99.7% of the time	dB	1.2	1.6	2.4	2.8	0.7	1.1	1.0	2.7	3.1	0.0	
Space station characteristics												
Longitude	°	101W	101W	101W	101W	101W	101W	101W	101W	101W	152E	-7.0
Satellite e.i.r.p. in the direction of the earth station	dBW	53.9	56.9	51.4	54.4	49.1	52.1	54.1	48.0	51.0	53.0	54.8
Earth station characteristics												
Receive antenna diameter	cm	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	60.0	60.0
On-axis antenna gain at receiver input	dBi	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	36.0	
On-axis antenna gain at antenna output	dBi											35.9
Off-axis antenna gain characteristics		Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Fig7 An3 Ap30	BO1213
Clear sky receive system noise temperature at receiver input	K	125.0	125.0	125.0	125.0	125.0	125.0	125.0	80.0	80.0	130.0	
Clear sky receive system noise temperature at antenna output	K											120.0
Total pointing loss	dB	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Latitude	°	27.9	27.9	40.7	40.7	45.0	45.0	47.6	47.6	47.6		51.2
Longitude	°	82.5W	82.5W	74W	74W	93.3W	93.3W	122.3W	122.3W	122.3W		2.5
Altitude	km											0.1
Rain climatic zone		N	N	K	K	K	K	D	D	D		E
Elevation angle	°	51.5	51.5	35.4	35.4	37.6	37.6	31.5	31.5	31.5		30.7
Propagation characteristics												
Rain attenuation for 99.7% of the time	dB	4.5	4.5	2.0	2.0	1.7	1.7	0.8	0.8	0.8	1.3	0.8
Noise increase due to rain for 99.7 % of the time	dB	4.0	4.0	2.7	2.7	2.5	2.5	1.4	2.1	2.1	1.9	1.5
Rain attenuation for availability percentage of time	dB	5.5	5.8	3.6	3.9	2.1	2.4	1.3	2.0	2.3	4.7	4.2
Feeder link earth station characteristics												
Frequency	GHz	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7
Maximum uplink power control												7.1
Minimum feeder link earth station eirp	dBW	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0	84.0	77.0
Latitude	°	39.7	39.7	39.7	39.7	39.7	39.7	39.7	39.7	39.7	33.9	48.2
Longitude	°	105.0	105.0	105.0	105.0	105.0	105.0	105.0	105.0	105.0	151.2	3.9
Altitude	km										0.01	0.1
Rain climatic zone		E	E	E	E	E	E	E	E	E	F	H
Elevation angle	°	43.8	43.8	43.8	43.8	43.8	43.8	43.8	43.8	43.8	50.0	33.6
Rain attenuation for 99.97% of the time	dB	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		7.1
Rain attenuation for availability percentage of time	dB											
Characteristics of the space station receiver												
Satellite receive noise temperature	K	616.6	616.6	616.6	616.6	616.6	616.6	616.6	616.6	616.6	900.0	600.0
Satellite receive antenna gain in the direction of the feeder link station	dB	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	36.0	41.0
Automatic gain control setting												YES
Polarization (angle as defined in Annex 2 of APS30A in case of linear polarization)		CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	L (135°/45°)	CR/CL
C/I due to frequency re-use (polarization discrimination)	dB										30.0	
C/I due to other GSO BSS networks	dB	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	
C/I from other assignments in the Plan	dB											30.0
C/I from other GSO FSS systems	dB	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0

(1) Administrations are strongly encouraged to use the spreadsheet provided with this Table in order to calculate

Footnote 1: For US-GSO D5, rain effects are not relevant.

Footnote 2: See the antenna gain pattern mask in attachment 1 to document 4-9-11/165 Corr.1

Footnote 3: See "test results template" in Figure 4 of ITU Document 4-9-11/172-E, 25 June 1998.

Annex 1 : BSS system characteristics

System Characteristics	Units	France RADIOSAT-3 Analog / TP 2	France RADIOSAT-3 Analog / TP 3	France RADIOSAT-3 Analog / TP 4	France RADIOSAT-3 Digital / TP 1	France RADIOSAT-3 Digital / TP 2	France RADIOSAT-3 Digital / TP 3	France RADIOSAT-3 Digital / TP 4	France RADIOSAT-5C Digital / TP 1	France RADIOSAT-5C Digital / TP 2	France RADIOSAT-5C Digital / TP 3	France RADIOSAT-5C Digital / TP 4
System Characteristics												
Frequency	GHz	12.200	12.200	12.200	12.200	12.200	12.200	12.200	12.200	12.200	12.200	12.200
Availability objective	%	99.97	99.84	99.96	99.98	99.97	99.89	99.97	99.98	99.97	99.92	99.85
Receiver noise Bandwidth	MHz	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0
Modulation type		FM	FM	FM	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK
Polarization (angle as defined in Annex 2 of APS30 in case of linear polarization)		L (22°/112°)	L (22°/112°)	L (22°/112°)	L (22°/112°)	L (22°/112°)	L (22°/112°)	L (22°/112°)	L (22°/112°)	L (22°/112°)	L (22°/112°)	L (22°/112°)
C/I due to frequency re-use (polarization discrimination)	dB											
C/I due to other GSO BSS networks	dB	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0
C/I due to GSO FSS networks	dB	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0
Clear sky feeder link C/N+I	dB	26.3	26.5	26.3	26.3	26.3	26.3	26.3	26.5	25.6	25.6	25.6
C/N+I required at operating threshold	dB	9.0	9.0	9.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Clear sky C/N+I margin above operating threshold (1)	dB											
Total Clear sky C/N+I margin above operating threshold (1)	dB	6.2	5.7	6.7	7.3	7.2	6.7	7.7	5.7	7.1	7.2	5.4
C/N+I total link for 99.7% of the time	dB	13.0	10.4	13.0	13.8	13.0	10.4	13.0	11.9	12.8	11.1	9.4
C/N+I margin above operating threshold for 99.7% of the time	dB											
Space station characteristics												
Longitude	°	-7.0	-7.0	-7.0	-7.0	-7.0	-7.0	-7.0	-7.0	-7.0	-7.0	-7.0
Satellite e.i.r.p. in the direction of the earth station	dBW	54.7	53.7	55.4	54.8	54.7	53.7	55.4	52.3	54.5	54.6	52.2
Earth station characteristics												
Receive antenna diameter	cm	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0
On-axis antenna gain at receiver input	dBi											
On-axis antenna gain at antenna output	dBi	35.9	35.9	35.9	35.9	35.9	35.9	35.9	35.9	35.9	35.9	35.9
Off-axis antenna gain characteristics		BO1213	BO1213	BO1213	BO1213	BO1213	BO1213	BO1213	BO1213	BO1213	BO1213	BO1213
Clear sky receive system noise temperature at receiver input	K											
Clear sky receive system noise temperature at antenna output	K	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0
Total pointing loss	dB	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Latitude	°	49.1	41.2	42.5	51.2	49.1	41.2	42.5	48.2	47.4	41.2	42.5
Longitude	°	8.1	9.5	3.0	2.5	8.1	9.5	3.0	-4.3	6.5	9.1	32.5
Altitude	km	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Rain climatic zone		H	L	K	E	H	L	K	E	H	L	K
Elevation angle	°	31.8	39.5	39.9	30.7	31.8	39.5	39.9	34.6	34.0	39.6	26.9
Propagation characteristics												
Rain attenuation for 99.7% of the time	dB	1.3	2.5	1.7	0.8	1.3	2.5	1.7	0.8	1.2	2.5	2.1
Noise increase due to rain for 99.7 % of the time	dB	2.1	3.1	2.5	1.5	2.1	3.1	2.5	1.5	2.0	3.1	2.9
Rain attenuation for availability percentage of time	dB	4.1	3.5	4.8	5.0	4.9	4.3	5.6	3.2	4.8	4.9	3.0
Feeder link earth station characteristics												
Frequency	GHz	17.7	14.7	17.7	17.7	17.7	17.7	17.7	14.7	17.7	17.7	17.7
Maximum uplink power control		7.1	5.1	7.1	7.1	7.1	7.1	7.1	5.1	7.1	7.1	7.1
Minimum feeder link earth station eirp	dBW	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0
Latitude	°	48.2	48.2	48.2	48.2	48.2	48.2	48.2	48.2	48.2	48.2	48.2
Longitude	°	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9
Altitude	km	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Rain climatic zone		H	H	H	H	H	H	H	H	H	H	H
Elevation angle	°	33.6	33.6	33.6	33.6	33.6	33.6	33.6	33.6	33.6	33.6	33.6
Rain attenuation for 99.97% of the time	dB	7.1	5.1	7.1	7.1	7.1	7.1	7.1	5.1	7.1	7.1	7.1
Rain attenuation for availability percentage of time	dB											
Characteristics of the space station receiver												
Satellite receive noise temperature	K	600.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0
Satellite receive antenna gain in the direction of the feeder link station	dB	41.0	41.0	41.0	41.0	41.0	41.0	41.0	41.0	37.3	37.3	37.3
Automatic gain control setting		YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Polarization (angle as defined in Annex 2 of APS30A in case of linear polarization)		CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL
C/I due to frequency re-use (polarization discrimination)	dB											
C/I due to other GSO BSS networks	dB											
C/I from other assignments in the Plan	dB	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
C/I from other GSO FSS systems	dB	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0

(1) Administrations are strongly encouraged to use the spreadsheet provided with this Table in order to calculate

Footnote 1: For US-GSO D5, rain effects are not relevant.

Footnote 2: See the antenna gain pattern mask in attachment 1 to document 4-9-11/165 Corr.1

Footnote 3: See "test results template" in Figure 4 of ITU Document 4-9-11/172-E, 25 June 1998.

Annex 1 : BSS system characteristics

System Characteristics	Units	Japan Analogue	Japan Digital	Japan Analogue	Japan Digital	Japan Analogue	Japan Digital	Norway NOR-1	Norway NOR-2	Norway NOR-3	Norway NOR-4	Norway NOR-5
System Characteristics												
Frequency	GHz	11.996	11.996	11.996	11.996	11.996	11.996	12.100	12.100	12.100	12.100	12.100
Availability objective	%	99.96	99.92	99.92	99.81	99.96	99.85	99.7	99.7	99.7	99.9	99.8
Receiver noise Bandwidth	MHz	27.0	28.86	27.0	28.86	27.0	28.86	33	33	33	33	33
Modulation type		FM	8PSK	FM	8PSK	FM	8PSK	QPSK 7/8	QPSK 7/8	QPSK 7/8	QPSK 7/8	QPSK 7/8
Polarization (angle as defined in Annex 2 of APS30 in case of linear polarization)		CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	L (0°/90°)	L (0°/90°)	L (0°/90°)	L (0°/90°)
C/I due to frequency re-use (polarization discrimination)	dB											
C/I due to other GSO BSS networks	dB	31.0	24.0	31.0	24.0	31.0	24.0	24.0	24.0	24.0	24.0	24.0
C/I due to GSO FSS networks	dB	29.5	29.2	25.7	25.4	23.3	23.0	99.0	99.0	99.0	99.0	99.0
Clear sky feeder link C/N+I	dB	37.0	29.6	37.0	29.6	37.0	29.6	25.2	25.2	25.2	25.2	25.2
C/N+I required at operating threshold	dB	9.0	11.0	9.0	11.0	9.0	11.0	7.5	7.5	7.5	7.5	7.5
Clear sky C/N+I margin above operating threshold (1)	dB							3.2	3.3	3.3	9.1	4.8
Total Clear sky C/N+I margin above operating threshold (1)	dB	10.6	7.0	9.0	5.8	6.7	3.9					
C/N+I total link for 99.7% of the time	dB	14.7	19.9	12.6	12.1	12.6	12.0	7.6	7.7	7.7	13.6	8.4
C/N+I margin above operating threshold for 99.7% of the time	dB											
Space station characteristics												
Longitude	°	110.0	110.0	110.0	110.0	110.0	110.0	-1.0	-1.0	-1.0	-1.0	-1.0
Satellite e.i.r.p. in the direction of the earth station	dBW	60.0	60.0	56.0	56.0	54.0	54.0	59.0	50.0	46.0	50.0	37.0
Earth station characteristics												
Receive antenna diameter	cm	45.0	45.0	60.0	60.0	60.0	60.0	20.0	55.0	85.0	120.0	300.0
On-axis antenna gain at receiver input	dBi							26.0	35.1	38.9	41.6	49.2
On-axis antenna gain at antenna output	dBi	33.22	33.22	35.72	35.72	35.72	35.72					
Off-axis antenna gain characteristics		BO.1213	BO.1213	BO.1213	BO.1213	BO.1213	BO.1213	465-3	BO1213	BO1213	BO1213	BO1213
Clear sky receive system noise temperature at receiver input	K							120	120	120	120	120
Clear sky receive system noise temperature at antenna output	K	120.0	120.0	120.0	120.0	120.0	120.0					
Total pointing loss	dB	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Latitude	°	34.7	34.7	26.2	26.2	45.3	45.3	60.0	60.0	52.0	60.0	38.0
Longitude	°	135.2	135.2	127.7	127.7	141.4	141.4	11.0	11.0	-8.0	11.0	-5.0
Altitude	km	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Rain climatic zone		Osaka	Osaka	Naha	Naha	Wakkanai	Wakkanai	G	G	H	G	K
Elevation angle	°	41.6	41.6	53.6	53.6	29.3	29.3	20.0	20.0	30.0	20.0	45.0
Propagation characteristics												
Rain attenuation for 99.7% of the time	dB	2.44	2.44	2.86	2.86	1.43	1.43	1.2	1.2	1.2	1.2	1.6
Noise increase due to rain for 99.7 % of the time	dB	3.1	3.1	3.4	3.4	2.2	2.2	1.9	1.9	1.9	1.9	2.4
Rain attenuation for availability percentage of time	dB	6.8	4.7	5.6	3.7	3.7	2.1	1.2	1.2	1.2	1.9	2.0
Feeder link earth station characteristics												
Frequency	GHz	17.6	17.6	17.6	17.6	17.6	17.6	17.7	17.7	17.7	17.7	17.7
Maximum uplink power control		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Minimum feeder link earth station eirp	dBW	84.0	84.0	84.0	84.0	84.0	84.0	74.0	74.0	74.0	74.0	74.0
Latitude	°	35.7	35.7	35.7	35.7	35.7	35.7	60.0	60.0	60.0	60.0	60.0
Longitude	°	139.7	139.7	139.7	139.7	139.7	139.7	11.0	11.0	11.0	11.0	11.0
Altitude	km	0.1	0.1	0.1	0.1	0.1	0.1	0	0	0	0	0
Rain climatic zone		Tokyo	Tokyo	Tokyo	Tokyo	Tokyo	Tokyo	G	G	G	G	G
Elevation angle	°	38.0	38.0	38.0	38.0	38.0	38.0	20.0	20.0	20.0	20.0	20.0
Rain attenuation for 99.97% of the time	dB	13.1	13.1	13.1	13.1	13.1	13.1	6.6	6.6	6.6	6.6	6.6
Rain attenuation for availability percentage of time	dB							6.6	6.6	6.6	6.6	6.6
Characteristics of the space station receiver												
Satellite receive noise temperature	K	900.0	900.0	900.0	900.0	900.0	900.0	530.0	530.0	530.0	530.0	530.0
Satellite receive antenna gain in the direction of the feeder link station	dB	42.0	42.0	42.0	42.0	42.0	42.0	35.0	35.0	35.0	35.0	35.0
Automatic gain control setting		NO	NO	NO	NO	NO	NO	YES	YES	YES	YES	YES
Polarization (angle as defined in Annex 2 of APS30A in case of linear polarization)		CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	L (90°/0°)	L (90°/0°)	L (90°/0°)	L (90°/0°)
C/I due to frequency re-use (polarization discrimination)	dB											
C/I due to other GSO BSS networks	dB											
C/I from other assignments in the Plan	dB	40.0	30.0	40.0	30.0	40.0	30.0	40.0	40.0	40.0	40.0	40.0
C/I from other GSO FSS systems	dB	46.1	45.9	46.1	45.9	46.1	45.9	99.0	99.0	99.0	99.0	99.0

(1) Administrations are strongly encouraged to use the spreadsheet provided with this Table in order to calculate

Footnote 1: For US-GSO D5, rain effects are not relevant.

Footnote 2: See the antenna gain pattern mask in attachment 1 to document 4-9-11/165 Corr.1

Footnote 3: See "test results template" in Figure 4 of ITU Document 4-9-11/172-E, 25 June 1998.

Annex 1 : BSS system characteristics

System Characteristics	Units	Norway NOR-6	Norway NOR-7	Norway NOR-8	Norway NOR-9	Norway NOR-10	Norway NOR-11	Norway NOR-12	Norway NOR-13	Norway NOR-14	Norway NOR-15	Canada CAN-1	Canada CAN-2
System Characteristics													
Frequency	GHz	12.100	12.100	12.100	12.100	12.100	12.100	12.100	12.100	12.100	12.100	12.500	12.500
Availability objective	%	99.7	99.7	99.7	99.9	99.8	99.7	99.7	99.7	99.9	99.8		
Receiver noise Bandwidth	MHz	33	33	33	33	33	27	27	27	27	27	24.0	24.0
Modulation type		QPSK 7/8	QPSK 7/8	QPSK 7/8	QPSK 7/8	QPSK 7/8	FM	FM	FM	FM	FM	QPSK	QPSK
Polarization (angle as defined in Annex 2 of APS30 in case of linear polarization)		CL/CR	L (0°/90°)	L (0°/90°)	L (0°/90°)	L (0°/90°)	CL/CR	L (0°/90°)	L (0°/90°)	L (0°/90°)	L (0°/90°)	CL/CR	CL/CR
C/I due to frequency re-use (polarization discrimination)	dB												
C/I due to other GSO BSS networks	dB	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.9	24.1
C/I due to GSO FSS networks	dB	99.0	99.0	99.0	99.0	99.0	99.0	99.0	99.0	99.0	99.0	50.0	50.0
Clear sky feeder link C/N+I	dB	22.5	22.5	22.5	22.5	22.5	23.3	23.3	23.3	23.3	23.3	50.0	50.0
C/N+I required at operating threshold	dB	7.5	7.5	7.5	7.5	7.5	9.0	9.0	9.0	18.0	11.0	6.6	6.6
Clear sky C/N+I margin above operating threshold (1)	dB	3.2	3.3	3.3	9.1	4.8	3.3	3.3	3.1	3.2	5.2		
Total Clear sky C/N+I margin above operating threshold (1)	dB											3.6	0.8
C/N+I total link for 99.7% of the time	dB	7.6	7.7	7.6	13.4	8.3	9.2	9.2	9.0	17.9	12.3	10.0	6.6
C/N+I margin above operating threshold for 99.7% of the time	dB												
Space station characteristics													
Longitude	°	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-82.0	-82.0
Satellite e.i.r.p. in the direction of the earth station	dBW	59.0	50.0	46.0	50.0	37.0	59.0	50.0	46.0	50.0	37.0	38.8	47.5
Earth station characteristics													
Receive antenna diameter	cm	20.0	55.0	85.0	120.0	300.0	22.0	60.0	90.0	240.0	450.0	180.0	45.0
On-axis antenna gain at receiver input	dBi	26.0	35.1	38.9	41.6	49.2	26.9	35.9	39.4	47.6	52.7		
On-axis antenna gain at antenna output	dBi											45.5	33.5
Off-axis antenna gain characteristics		465-3	BO1213	BO1213	BO1213	BO1213	465-3	BO1213	BO1213	BO1213	BO1213	Footnote 3	Footnote 3
Clear sky receive system noise temperature at receiver input	K	120	120	120	120	120	120	120	120	120	120		
Clear sky receive system noise temperature at antenna output	K											145.9	134.6
Total pointing loss	dB	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Latitude	°	60.0	60.0	52.0	60.0	38.0	60.0	60.0	52.0	60.0	38.0	66.5	50.0
Longitude	°	11.0	11.0	-8.0	11.0	-5.0	11.0	11.0	-8.0	11.0	-5.0	-86.5	-123.1
Altitude	km	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rain climatic zone		G	G	H	G	K	G	G	H	G	K	A	B1
Elevation angle	°	20.0	20.0	30.0	20.0	45.0	20.0	20.0	30.0	20.0	45.0	15.0	20.9
Propagation characteristics													
Rain attenuation for 99.7% of the time	dB	1.2	1.2	1.2	1.2	1.6	1.2	1.2	1.2	1.2	1.6	0.1	0.3
Noise increase due to rain for 99.7 % of the time	dB	1.9	1.9	1.9	1.9	2.4	1.9	1.9	1.9	1.9	2.4	0.1	0.5
Rain attenuation for availability percentage of time	dB	1.2	1.2	1.2	1.9	2.0	1.2	1.2	1.2	1.9	2.0	1.6	0.3
Feeder link earth station characteristics													
Frequency	GHz	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7
Maximum uplink power control		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Not available	Not available
Minimum feeder link earth station eirp	dBW	81.0	81.0	81.0	81.0	81.0	81.0	81.0	81.0	81.0	81.0	Not available	Not available
Latitude	°	52.0	52.0	52.0	52.0	52.0	52.0	52.0	52.0	52.0	52.0	Not available	Not available
Longitude	°	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	Not available	Not available
Altitude	km	0	0	0	0	0	0	0	0	0	0	Not available	Not available
Rain climatic zone		F	F	F	F	F	F	F	F	F	F	Not available	Not available
Elevation angle	°	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	Not available	Not available
Rain attenuation for 99.97% of the time	dB	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	Not available	Not available
Rain attenuation for availability percentage of time	dB	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	Not available	Not available
Characteristics of the space station receiver													
Satellite receive noise temperature	K	530.0	530.0	530.0	530.0	530.0	530.0	530.0	530.0	530.0	530.0	Not available	Not available
Satellite receive antenna gain in the direction of the feeder link station	dB	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	Not available	Not available
Automatic gain control setting		YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	Not available	Not available
Polarization (angle as defined in Annex 2 of APS30A in case of linear polarization)		CR/CL	L (90°/0°)	L (90°/0°)	L (90°/0°)	L (90°/0°)	CR/CL	L (90°/0°)	L (90°/0°)	L (90°/0°)	L (90°/0°)	CR/CL	CR/CL
C/I due to frequency re-use (polarization discrimination)	dB												
C/I due to other GSO BSS networks	dB											Not available	Not available
C/I from other assignments in the Plan	dB	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	Not available	Not available
C/I from other GSO FSS systems	dB	99.0	99.0	99.0	99.0	99.0	99.0	99.0	99.0	99.0	99.0	Not available	Not available

(1) Administrations are strongly encouraged to use the spreadsheet provided with this Table in order to calculate

Footnote 1: For US-GSO D5, rain effects are not relevant.

Footnote 2: See the antenna gain pattern mask in attachment 1 to document 4-9-11/165 Corr.1

Footnote 3: See "test results template" in Figure 4 of ITU Document 4-9-11/172-E, 25 June 1998.

Annex 1 : BSS system characteristics

System Characteristics	Units	Canada CAN-3	Canada CAN-4	Canada CAN-5	Canada CAN-6	Canada CAN-7	Canada CAN-8	Canada CAN-9	Canada CAN-10	Canada CAN-11	Canada CAN-12
System Characteristics											
Frequency	GHz	12.500	12.500	12.500	12.500	12.500	12.500	12.500	12.500	12.500	12.500
Availability objective	%										
Receiver noise Bandwidth	MHz	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
Modulation type		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK
Polarization (angle as defined in Annex 2 of APS30 in case of linear polarization)		CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR
C/I due to frequency re-use (polarization discrimination)	dB										
C/I due to other GSO BSS networks	dB	22.6	21.9	21.9	17.5	22.2	23.4	18.7	22.2	20.6	15.4
C/I due to GSO FSS networks	dB	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0
Clear sky feeder link C/N+I	dB	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0
C/N+I required at operating threshold	dB	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6
Clear sky C/N+I margin above operating threshold (1)	dB										
Total Clear sky C/N+I margin above operating threshold (1)	dB	2.8	3.1	1.3	5.4	3.3	2.3	1.4	1.4	1.7	5.2
C/N+I total link for 99.7% of the time	dB	6.8	6.9	6.9	7.2	7.2	7.1	7.0	7.0	7.2	7.6
C/N+I margin above operating threshold for 99.7% of the time	dB										
Space station characteristics											
Longitude	°	-82.0	-82.0	-82.0	-82.0	-82.0	-82.0	-82.0	-82.0	-82.0	-82.0
Satellite e.i.r.p. in the direction of the earth station	dBW	48.8	49.1	44.9	48.0	49.4	48.4	45.1	45.0	47.9	47.2
Earth station characteristics											
Receive antenna diameter	cm	45.0	45.0	60.0	75.0	45.0	45.0	60.0	60.0	45.0	90.0
On-axis antenna gain at receiver input	dBi										
On-axis antenna gain at antenna output	dBi	33.5	33.5	36.0	37.9	33.5	33.5	36.0	36.0	33.5	39.5
Off-axis antenna gain characteristics		Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3
Clear sky receive system noise temperature at receiver input	K										
Clear sky receive system noise temperature at antenna output	K	123.4	123.4	123.4	123.4	123.4	123.4	123.4	123.4	123.4	123.4
Total pointing loss	dB	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Latitude	°	42.3	39.6	39.7	29.5	40.7	45.5	31.8	40.8	36.1	25.5
Longitude	°	-83.0	-75.1	-105.0	-95.3	-74.0	-73.6	-106.5	-111.9	-115.1	-80.2
Altitude	km	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rain climatic zone		D2	D2	B	E	D2	D1	F	F	F	E
Elevation angle	°	41.2	43.6	38.2	52.7	42.2	37.0	44.5	33.8	35.5	60.2
Propagation characteristics											
Rain attenuation for 99.7% of the time	dB	1.0	1.1	0.4	2.6	1.1	0.6	0.4	0.3	0.4	2.7
Noise increase due to rain for 99.7 % of the time	dB	1.7	1.8	0.7	3.1	1.8	1.2	0.7	0.7	0.8	3.2
Rain attenuation for availability percentage of time	dB	1.1	1.2	0.5	3.1	1.4	0.9	0.5	0.5	0.6	3.4
Feeder link earth station characteristics											
Frequency	GHz	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7
Maximum uplink power control		Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Minimum feeder link earth station eirp	dBW	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Latitude	°	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Longitude	°	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Altitude	km	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Rain climatic zone		Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Elevation angle	°	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Rain attenuation for 99.97% of the time	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Rain attenuation for availability percentage of time	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Characteristics of the space station receiver											
Satellite receive noise temperature	K	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Satellite receive antenna gain in the direction of the feeder link station	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Automatic gain control setting		Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Polarization (angle as defined in Annex 2 of APS30A in case of linear polarization)		CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL
C/I due to frequency re-use (polarization discrimination)	dB										
C/I due to other GSO BSS networks	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
C/I from other assignments in the Plan	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
C/I from other GSO FSS systems	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available

(1) Administrations are strongly encouraged to use the spreadsheet provided with this Table in order to calculate

Footnote 1: For US-GSO D5, rain effects are not relevant.

Footnote 2: See the antenna gain pattern mask in attachment 1 to document 4-9-11/165 Corr.1

Footnote 3: See "test results template" in Figure 4 of ITU Document 4-9-11/172-E, 25 June 1998.

Annex 1 : BSS system characteristics

System Characteristics	Units	Canada CAN-13	Canada CAN-14	Canada CAN-15	Canada CAN-16	Canada CAN-17	Canada CAN-18	Canada CAN-19	Canada CAN-20	Canada CAN-21	Canada CAN-22
System Characteristics											
Frequency	GHz	12.500	12.500	12.500	12.500	12.500	12.500	12.500	12.500	12.500	12.500
Availability objective	%										
Receiver noise Bandwidth	MHz	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
Modulation type		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK
Polarization (angle as defined in Annex 2 of APS30 in case of linear polarization)		CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR
C/I due to frequency re-use (polarization discrimination)	dB										
C/I due to other GSO BSS networks	dB	23.4	23.0	17.8	24.9	24.7	21.1	19.0	23.7	24.8	24.7
C/I due to GSO FSS networks	dB	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0
Clear sky feeder link C/N+I	dB	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0
C/N+I required at operating threshold	dB	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6
Clear sky C/N+I margin above operating threshold (1)	dB										
Total Clear sky C/N+I margin above operating threshold (1)	dB	2.6	2.8	5.8	1.2	1.9	3.1	5.2	3.8	1.6	1.7
C/N+I total link for 99.7% of the time	dB	7.5	7.6	7.7	7.6	7.6	7.8	8.0	8.1	8.0	8.0
C/N+I margin above operating threshold for 99.7% of the time	dB										
Space station characteristics											
Longitude	°	-82.0	-82.0	-82.0	-82.0	-82.0	-82.0	-82.0	-82.0	-82.0	-82.0
Satellite e.i.r.p. in the direction of the earth station	dBW	48.7	48.8	46.9	40.6	44.8	47.0	47.4	47.6	46.2	45.9
Earth station characteristics											
Receive antenna diameter	cm	45.0	45.0	90.0	120.0	75.0	60.0	75.0	60.0	60.0	60.0
On-axis antenna gain at receiver input	dBi										
On-axis antenna gain at antenna output	dBi	33.5	33.5	39.5	42.0	37.9	36.0	37.9	36.0	36.0	36.0
Off-axis antenna gain characteristics		Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3
Clear sky receive system noise temperature at receiver input	K										
Clear sky receive system noise temperature at antenna output	K	123.4	123.4	123.4	168.3	145.9	123.4	123.4	123.4	145.9	134.6
Total pointing loss	dB	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Latitude	°	45.4	43.7	30.0	69.1	58.4	37.5	32.5	47.6	60.0	59.6
Longitude	°	-75.7	-79.4	-90.1	-115.1	-134.8	-122.2	-96.5	-52.7	-111.9	-108.6
Altitude	km	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rain climatic zone		D1	D1	E	A	B1	C	D3	D1	A	A
Elevation angle	°	37.3	39.6	54.0	8.8	9.9	29.7	49.0	28.4	17.4	18.7
Propagation characteristics											
Rain attenuation for 99.7% of the time	dB	0.6	0.6	2.6	0.1	0.3	0.7	1.8	0.9	0.1	0.1
Noise increase due to rain for 99.7 % of the time	dB	1.2	1.2	3.1	0.1	0.6	1.3	2.5	1.5	0.2	0.2
Rain attenuation for availability percentage of time	dB	1.0	1.0	3.4	0.5	0.8	1.3	2.7	1.6	0.6	0.6
Feeder link earth station characteristics											
Frequency	GHz	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7
Maximum uplink power control		Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Minimum feeder link earth station eirp	dBW	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Latitude	°	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Longitude	°	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Altitude	km	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Rain climatic zone		Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Elevation angle	°	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Rain attenuation for 99.97% of the time	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Rain attenuation for availability percentage of time	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Characteristics of the space station receiver											
Satellite receive noise temperature	K	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Satellite receive antenna gain in the direction of the feeder link station	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Automatic gain control setting		Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Polarization (angle as defined in Annex 2 of APS30A in case of linear polarization)		CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL
C/I due to frequency re-use (polarization discrimination)	dB										
C/I due to other GSO BSS networks	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
C/I from other assignments in the Plan	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
C/I from other GSO FSS systems	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available

(1) Administrations are strongly encouraged to use the spreadsheet provided with this Table in order to calculate

Footnote 1: For US-GSO D5, rain effects are not relevant.

Footnote 2: See the antenna gain pattern mask in attachment 1 to document 4-9-11/165 Corr.1

Footnote 3: See "test results template" in Figure 4 of ITU Document 4-9-11/172-E, 25 June 1998.

Annex 1 : BSS system characteristics

System Characteristics	Units	Canada CAN-23	Canada CAN-24	Canada CAN-25	Canada CAN-26	Canada CAN-27	Canada CAN-28	Canada CAN-29	Canada CAN-30	Canada CAN-31	Canada CAN-32
System Characteristics											
Frequency	GHz	12.500	12.500	12.500	12.500	12.500	12.500	12.500	12.500	12.500	12.500
Availability objective	%										
Receiver noise Bandwidth	MHz	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
Modulation type		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK
Polarization (angle as defined in Annex 2 of APS30 in case of linear polarization)		CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR
C/I due to frequency re-use (polarization discrimination)	dB										
C/I due to other GSO BSS networks	dB	24.9	23.2	22.5	19.7	24.6	23.7	24.7	19.4	24.2	22.8
C/I due to GSO FSS networks	dB	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0
Clear sky feeder link C/N+I	dB	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0
C/N+I required at operating threshold	dB	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6
Clear sky C/N+I margin above operating threshold (1)	dB										
Total Clear sky C/N+I margin above operating threshold (1)	dB	1.8	3.8	4.4	3.0	2.2	3.5	2.2	3.1	2.7	4.8
C/N+I total link for 99.7% of the time	dB	8.1	8.4	8.5	8.5	8.6	8.6	8.6	8.6	8.7	9.0
C/N+I margin above operating threshold for 99.7% of the time	dB										
Space station characteristics											
Longitude	°	-82.0	-82.0	-82.0	-82.0	-82.0	-82.0	-82.0	-82.0	-82.0	-82.0
Satellite e.i.r.p. in the direction of the earth station	dBW	36.9	47.5	48.0	46.9	44.4	47.7	44.5	46.9	46.9	48.5
Earth station characteristics											
Receive antenna diameter	cm	180.0	60.0	60.0	60.0	75.0	60.0	75.0	60.0	60.0	60.0
On-axis antenna gain at receiver input	dBi										
On-axis antenna gain at antenna output	dBi	45.5	36.0	36.0	36.0	37.9	36.0	37.9	36.0	36.0	36.0
Off-axis antenna gain characteristics		Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3
Clear sky receive system noise temperature at receiver input	K										
Clear sky receive system noise temperature at antenna output	K	145.9	123.4	123.4	123.4	134.6	134.6	134.6	123.4	134.6	123.4
Total pointing loss	dB	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Latitude	°	63.8	44.7	41.9	34.1	56.0	47.4	58.8	33.3	51.1	42.8
Longitude	°	-68.5	-63.6	-87.6	-118.2	-87.7	-122.2	-94.2	-112.0	-114.1	-83.1
Altitude	km	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rain climatic zone		A	D1	D2	F	A	C	A	F	B1	D2
Elevation angle	°	17.2	35.4	41.3	34.9	26.0	23.2	22.4	39.7	24.3	40.6
Propagation characteristics											
Rain attenuation for 99.7% of the time	dB	0.1	0.8	1.0	0.4	0.1	0.6	0.1	0.4	0.2	1.0
Noise increase due to rain for 99.7 % of the time	dB	0.2	1.4	1.7	0.9	0.2	1.0	0.1	0.8	0.5	1.7
Rain attenuation for availability percentage of time	dB	0.7	1.6	1.9	1.3	0.9	1.5	0.9	1.3	1.1	2.2
Feeder link earth station characteristics											
Frequency	GHz	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7
Maximum uplink power control		Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Minimum feeder link earth station eirp	dBW	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Latitude	°	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Longitude	°	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Altitude	km	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Rain climatic zone		Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Elevation angle	°	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Rain attenuation for 99.97% of the time	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Rain attenuation for availability percentage of time	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Characteristics of the space station receiver											
Satellite receive noise temperature	K	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Satellite receive antenna gain in the direction of the feeder link station	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Automatic gain control setting		Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Polarization (angle as defined in Annex 2 of APS30A in case of linear polarization)		CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL
C/I due to frequency re-use (polarization discrimination)	dB										
C/I due to other GSO BSS networks	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
C/I from other assignments in the Plan	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
C/I from other GSO FSS systems	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available

(1) Administrations are strongly encouraged to use the spreadsheet provided with this Table in order to calculate

Footnote 1: For US-GSO D5, rain effects are not relevant.

Footnote 2: See the antenna gain pattern mask in attachment 1 to document 4-9-11/165 Corr.1

Footnote 3: See "test results template" in Figure 4 of ITU Document 4-9-11/172-E, 25 June 1998.

Annex 1 : BSS system characteristics

System Characteristics	Units	Canada CAN-33	Canada CAN-34	Canada CAN-35	Canada CAN-36	Canada CAN-37	Canada CAN-38	Canada CAN-39	Canada CAN-40	Canada CAN-41	Canada CAN-42
System Characteristics											
Frequency	GHz	12.500	12.500	12.500	12.500	12.500	12.500	12.500	12.500	12.500	12.500
Availability objective	%										
Receiver noise Bandwidth	MHz	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
Modulation type		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK
Polarization (angle as defined in Annex 2 of APS30 in case of linear polarization)		CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR
C/I due to frequency re-use (polarization discrimination)	dB										
C/I due to other GSO BSS networks	dB	24.4	22.6	19.5	24.2	24.1	23.3	21.5	24.1	24.9	24.8
C/I due to GSO FSS networks	dB	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0
Clear sky feeder link C/N+I	dB	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0
C/N+I required at operating threshold	dB	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6
Clear sky C/N+I margin above operating threshold (1)	dB										
Total Clear sky C/N+I margin above operating threshold (1)	dB	2.8	5.2	6.2	3.2	3.3	4.1	5.2	3.9	2.7	2.9
C/N+I total link for 99.7% of the time	dB	8.8	9.1	9.1	9.0	8.9	9.0	9.1	9.1	9.0	9.2
C/N+I margin above operating threshold for 99.7% of the time	dB										
Space station characteristics											
Longitude	°	-82.0	-82.0	-82.0	-82.0	-82.0	-82.0	-82.0	-82.0	-82.0	-82.0
Satellite e.i.r.p. in the direction of the earth station	dBW	47.0	48.9	50.4	45.4	47.0	47.7	49.0	47.6	42.3	45.7
Earth station characteristics											
Receive antenna diameter	cm	60.0	60.0	60.0	75.0	60.0	60.0	60.0	60.0	120.0	75.0
On-axis antenna gain at receiver input	dBi										
On-axis antenna gain at antenna output	dBi	36.0	36.0	36.0	37.9	36.0	36.0	36.0	36.0	42.0	37.9
Off-axis antenna gain characteristics		Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3
Clear sky receive system noise temperature at receiver input	K										
Clear sky receive system noise temperature at antenna output	K	134.6	123.4	123.4	134.6	123.4	123.4	123.4	123.4	168.3	145.9
Total pointing loss	dB	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Latitude	°	53.6	42.2	33.5	51.5	50.4	45.0	38.5	49.9	68.3	60.2
Longitude	°	-113.5	-71.1	-84.2	-78.7	-104.7	-93.2	-77.0	-97.2	-133.7	-123.5
Altitude	km	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rain climatic zone		B1	D2	D3	B2	B2	D1	D2	D1	A	A
Elevation angle	°	22.4	40.0	51.0	31.0	28.4	37.0	45.1	31.0	4.6	13.4
Propagation characteristics											
Rain attenuation for 99.7% of the time	dB	0.2	1.1	1.8	0.3	0.3	0.6	1.1	0.5	0.1	0.1
Noise increase due to rain for 99.7 % of the time	dB	0.4	1.8	2.5	0.6	0.7	1.1	1.8	1.0	0.2	0.2
Rain attenuation for availability percentage of time	dB	1.1	2.4	3.4	1.4	1.3	1.8	2.5	1.6	1.3	1.2
Feeder link earth station characteristics											
Frequency	GHz	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7
Maximum uplink power control		Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Minimum feeder link earth station eirp	dBW	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Latitude	°	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Longitude	°	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Altitude	km	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Rain climatic zone		Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Elevation angle	°	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Rain attenuation for 99.97% of the time	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Rain attenuation for availability percentage of time	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Characteristics of the space station receiver											
Satellite receive noise temperature	K	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Satellite receive antenna gain in the direction of the feeder link station	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Automatic gain control setting		Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Polarization (angle as defined in Annex 2 of APS30A in case of linear polarization)		CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL
C/I due to frequency re-use (polarization discrimination)	dB										
C/I due to other GSO BSS networks	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
C/I from other assignments in the Plan	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
C/I from other GSO FSS systems	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available

(1) Administrations are strongly encouraged to use the spreadsheet provided with this Table in order to calculate

Footnote 1: For US-GSO D5, rain effects are not relevant.

Footnote 2: See the antenna gain pattern mask in attachment 1 to document 4-9-11/165 Corr.1

Footnote 3: See "test results template" in Figure 4 of ITU Document 4-9-11/172-E, 25 June 1998.

Annex 1 : BSS system characteristics

System Characteristics	Units	Canada CAN-43	Canada CAN-44	Canada CAN-45	Canada CAN-46	Canada CAN-47	Canada CAN-48	Canada CAN-49	Canada CAN-50	Canada CAN-51	Canada CAN-52
System Characteristics											
Frequency	GHz	12.500	12.500	12.500	12.500	12.500	12.500	12.500	12.500	12.500	12.500
Availability objective	%										
Receiver noise Bandwidth	MHz	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
Modulation type		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK
Polarization (angle as defined in Annex 2 of APS30 in case of linear polarization)		CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR
C/I due to frequency re-use (polarization discrimination)	dB										
C/I due to other GSO BSS networks	dB	24.4	24.9	24.1	22.6	21.9	21.9	17.5	22.2	23.4	18.7
C/I due to GSO FSS networks	dB	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0
Clear sky feeder link C/N+I	dB	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0
C/N+I required at operating threshold	dB	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6
Clear sky C/N+I margin above operating threshold (1)	dB										
Total Clear sky C/N+I margin above operating threshold (1)	dB	3.6	3.6	0.9	2.8	3.0	1.4	5.4	3.3	2.3	1.5
C/N+I total link for 99.7% of the time	dB	9.5	10.0	6.7	6.8	6.8	6.9	7.2	7.1	7.1	7.1
C/N+I margin above operating threshold for 99.7% of the time	dB										
Space station characteristics											
Longitude	°	-82.0	-91.0	-91.0	-91.0	-91.0	-91.0	-91.0	-91.0	-91.0	-91.0
Satellite e.i.r.p. in the direction of the earth station	dBW	47.7	38.8	47.5	48.8	49.1	44.9	48.0	49.4	48.4	45.1
Earth station characteristics											
Receive antenna diameter	cm	60.0	180.0	45.0	45.0	45.0	60.0	75.0	45.0	45.0	60.0
On-axis antenna gain at receiver input	dBi										
On-axis antenna gain at antenna output	dBi	36.0	45.5	33.5	33.5	33.5	36.0	37.9	33.5	33.5	36.0
Off-axis antenna gain characteristics		Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3
Clear sky receive system noise temperature at receiver input	K										
Clear sky receive system noise temperature at antenna output	K	134.6	145.9	134.6	123.4	123.4	123.4	123.4	123.4	123.4	123.4
Total pointing loss	dB	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Latitude	°	53.0	66.5	50.0	42.3	39.6	39.7	29.5	40.7	45.5	31.8
Longitude	°	-66.9	-86.5	-123.1	-83.0	-75.1	-105.0	-95.3	-74.0	-73.6	-106.5
Altitude	km	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rain climatic zone		B1	A	B1	D2	D2	B	E	D2	D1	F
Elevation angle	°	27.9	15.0	25.1	40.5	41.3	41.8	55.3	39.8	34.8	49.4
Propagation characteristics											
Rain attenuation for 99.7% of the time	dB	0.2	0.1	0.3	1.0	1.1	0.4	2.6	1.1	0.6	0.4
Noise increase due to rain for 99.7 % of the time	dB	0.4	0.1	0.5	1.7	1.8	0.7	3.1	1.8	1.2	0.7
Rain attenuation for availability percentage of time	dB	1.5	1.6	0.3	1.1	1.2	0.5	3.1	1.4	0.9	0.5
Feeder link earth station characteristics											
Frequency	GHz	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7
Maximum uplink power control		Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Minimum feeder link earth station eirp	dBW	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Latitude	°	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Longitude	°	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Altitude	km	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Rain climatic zone		Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Elevation angle	°	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Rain attenuation for 99.97% of the time	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Rain attenuation for availability percentage of time	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Characteristics of the space station receiver											
Satellite receive noise temperature	K	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Satellite receive antenna gain in the direction of the feeder link station	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Automatic gain control setting		Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Polarization (angle as defined in Annex 2 of APS30A in case of linear polarization)		CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL
C/I due to frequency re-use (polarization discrimination)	dB										
C/I due to other GSO BSS networks	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
C/I from other assignments in the Plan	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
C/I from other GSO FSS systems	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available

(1) Administrations are strongly encouraged to use the spreadsheet provided with this Table in order to calculate

Footnote 1: For US-GSO D5, rain effects are not relevant.

Footnote 2: See the antenna gain pattern mask in attachment 1 to document 4-9-11/165 Corr.1

Footnote 3: See "test results template" in Figure 4 of ITU Document 4-9-11/172-E, 25 June 1998.

Annex 1 : BSS system characteristics

System Characteristics	Units	Canada CAN-53	Canada CAN-54	Canada CAN-55	Canada CAN-56	Canada CAN-57	Canada CAN-58	Canada CAN-59	Canada CAN-60	Canada CAN-61	Canada CAN-62
System Characteristics											
Frequency	GHz	12.500	12.500	12.500	12.500	12.500	12.500	12.500	12.500	12.500	12.500
Availability objective	%										
Receiver noise Bandwidth	MHz	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
Modulation type		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK
Polarization (angle as defined in Annex 2 of APS30 in case of linear polarization)		CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR
C/I due to frequency re-use (polarization discrimination)	dB										
C/I due to other GSO BSS networks	dB	22.2	20.6	15.4	23.4	23.0	17.8	24.9	24.7	21.1	19.0
C/I due to GSO FSS networks	dB	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0
Clear sky feeder link C/N+I	dB	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0
C/N+I required at operating threshold	dB	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6
Clear sky C/N+I margin above operating threshold (1)	dB										
Total Clear sky C/N+I margin above operating threshold (1)	dB	1.5	1.8	5.2	2.6	2.7	5.8	1.2	2.0	3.2	5.2
C/N+I total link for 99.7% of the time	dB	7.1	7.3	7.6	7.5	7.5	7.7	7.6	7.7	7.9	8.1
C/N+I margin above operating threshold for 99.7% of the time	dB										
Space station characteristics											
Longitude	°	-91.0	-91.0	-91.0	-91.0	-91.0	-91.0	-91.0	-91.0	-91.0	-91.0
Satellite e.i.r.p. in the direction of the earth station	dBW	45.0	47.9	47.2	48.7	48.8	46.9	40.6	44.8	47.0	47.4
Earth station characteristics											
Receive antenna diameter	cm	60.0	45.0	90.0	45.0	45.0	90.0	120.0	75.0	60.0	75.0
On-axis antenna gain at receiver input	dBi										
On-axis antenna gain at antenna output	dBi	36.0	33.5	39.5	33.5	33.5	39.5	42.0	37.9	36.0	37.9
Off-axis antenna gain characteristics		Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3
Clear sky receive system noise temperature at receiver input	K										
Clear sky receive system noise temperature at antenna output	K	123.4	123.4	123.4	123.4	123.4	123.4	168.3	145.9	123.4	123.4
Total pointing loss	dB	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Latitude	°	40.8	36.1	25.5	45.4	43.7	30.0	69.1	58.4	37.5	32.5
Longitude	°	-111.9	-115.1	-80.2	-75.7	-79.4	-90.1	-115.1	-134.8	-122.2	-96.5
Altitude	km	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rain climatic zone		F	F	E	D1	D1	E	A	B1	C	D3
Elevation angle	°	38.2	41.0	57.9	35.5	38.3	55.1	10.4	13.8	35.7	51.7
Propagation characteristics											
Rain attenuation for 99.7% of the time	dB	0.3	0.4	2.7	0.6	0.6	2.6	0.1	0.3	0.7	1.8
Noise increase due to rain for 99.7 % of the time	dB	0.7	0.8	3.2	1.2	1.2	3.1	0.1	0.6	1.3	2.5
Rain attenuation for availability percentage of time	dB	0.5	0.6	3.4	1.0	1.0	3.4	0.5	0.8	1.3	2.7
Feeder link earth station characteristics											
Frequency	GHz	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7
Maximum uplink power control		Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Minimum feeder link earth station eirp	dBW	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Latitude	°	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Longitude	°	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Altitude	km	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Rain climatic zone		Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Elevation angle	°	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Rain attenuation for 99.97% of the time	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Rain attenuation for availability percentage of time	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Characteristics of the space station receiver											
Satellite receive noise temperature	K	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Satellite receive antenna gain in the direction of the feeder link station	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Automatic gain control setting		Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Polarization (angle as defined in Annex 2 of APS30A in case of linear polarization)		CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL
C/I due to frequency re-use (polarization discrimination)	dB										
C/I due to other GSO BSS networks	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
C/I from other assignments in the Plan	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
C/I from other GSO FSS systems	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available

(1) Administrations are strongly encouraged to use the spreadsheet provided with this Table in order to calculate

Footnote 1: For US-GSO D5, rain effects are not relevant.

Footnote 2: See the antenna gain pattern mask in attachment 1 to document 4-9-11/165 Corr.1

Footnote 3: See "test results template" in Figure 4 of ITU Document 4-9-11/172-E, 25 June 1998.

Annex 1 : BSS system characteristics

System Characteristics	Units	Canada CAN-63	Canada CAN-64	Canada CAN-65	Canada CAN-66	Canada CAN-67	Canada CAN-68	Canada CAN-69	Canada CAN-70	Canada CAN-71	Canada CAN-72
System Characteristics											
Frequency	GHz	12.500	12.500	12.500	12.500	12.500	12.500	12.500	12.500	12.500	12.500
Availability objective	%										
Receiver noise Bandwidth	MHz	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
Modulation type		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK
Polarization (angle as defined in Annex 2 of APS30 in case of linear polarization)		CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR
C/I due to frequency re-use (polarization discrimination)	dB										
C/I due to other GSO BSS networks	dB	23.7	24.8	24.7	24.9	23.2	22.5	19.7	24.6	23.7	24.7
C/I due to GSO FSS networks	dB	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0
Clear sky feeder link C/N+I	dB	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0
C/N+I required at operating threshold	dB	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6
Clear sky C/N+I margin above operating threshold (1)	dB										
Total Clear sky C/N+I margin above operating threshold (1)	dB	3.7	1.6	1.7	1.7	3.8	4.4	3.1	2.2	3.5	2.2
C/N+I total link for 99.7% of the time	dB	8.1	8.0	8.1	8.1	8.3	8.5	8.6	8.6	8.7	8.6
C/N+I margin above operating threshold for 99.7% of the time	dB										
Space station characteristics											
Longitude	°	-91.0	-91.0	-91.0	-91.0	-91.0	-91.0	-91.0	-91.0	-91.0	-91.0
Satellite e.i.r.p. in the direction of the earth station	dBW	47.6	46.2	45.9	36.9	47.5	48.0	46.9	44.4	47.7	44.5
Earth station characteristics											
Receive antenna diameter	cm	60.0	60.0	60.0	180.0	60.0	60.0	60.0	75.0	60.0	75.0
On-axis antenna gain at receiver input	dBi										
On-axis antenna gain at antenna output	dBi	36.0	36.0	36.0	45.5	36.0	36.0	36.0	37.9	36.0	37.9
Off-axis antenna gain characteristics		Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3
Clear sky receive system noise temperature at receiver input	K										
Clear sky receive system noise temperature at antenna output	K	123.4	145.9	134.6	145.9	123.4	123.4	123.4	134.6	134.6	134.6
Total pointing loss	dB	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Latitude	°	47.6	60.0	59.6	63.8	44.7	41.9	34.1	56.0	47.4	58.8
Longitude	°	-52.7	-111.9	-108.6	-68.5	-63.6	-87.6	-118.2	-87.7	-122.2	-94.2
Altitude	km	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rain climatic zone		D1	A	A	A	D1	D2	F	A	C	A
Elevation angle	°	24.0	19.7	20.7	15.8	31.8	41.5	40.9	26.1	27.7	23.2
Propagation characteristics											
Rain attenuation for 99.7% of the time	dB	0.9	0.1	0.1	0.1	0.8	1.0	0.4	0.1	0.6	0.1
Noise increase due to rain for 99.7 % of the time	dB	1.5	0.2	0.2	0.2	1.4	1.7	0.9	0.2	1.0	0.1
Rain attenuation for availability percentage of time	dB	1.5	0.6	0.6	0.7	1.6	1.9	1.3	0.9	1.5	0.9
Feeder link earth station characteristics											
Frequency	GHz	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7
Maximum uplink power control		Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Minimum feeder link earth station eirp	dBW	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Latitude	°	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Longitude	°	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Altitude	km	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Rain climatic zone		Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Elevation angle	°	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Rain attenuation for 99.97% of the time	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Rain attenuation for availability percentage of time	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Characteristics of the space station receiver											
Satellite receive noise temperature	K	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Satellite receive antenna gain in the direction of the feeder link station	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Automatic gain control setting		Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Polarization (angle as defined in Annex 2 of APS30A in case of linear polarization)		CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL
C/I due to frequency re-use (polarization discrimination)	dB										
C/I due to other GSO BSS networks	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
C/I from other assignments in the Plan	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
C/I from other GSO FSS systems	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available

(1) Administrations are strongly encouraged to use the spreadsheet provided with this Table in order to calculate

Footnote 1: For US-GSO D5, rain effects are not relevant.

Footnote 2: See the antenna gain pattern mask in attachment 1 to document 4-9-11/165 Corr.1

Footnote 3: See "test results template" in Figure 4 of ITU Document 4-9-11/172-E, 25 June 1998.

Annex 1 : BSS system characteristics

System Characteristics	Units	Canada CAN-73	Canada CAN-74	Canada CAN-75	Canada CAN-76	Canada CAN-77	Canada CAN-78	Canada CAN-79	Canada CAN-80	Canada CAN-81	Canada CAN-82
System Characteristics											
Frequency	GHz	12.500	12.500	12.500	12.500	12.500	12.500	12.500	12.500	12.500	12.500
Availability objective	%										
Receiver noise Bandwidth	MHz	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
Modulation type		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK
Polarization (angle as defined in Annex 2 of APS30 in case of linear polarization)		CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR
C/I due to frequency re-use (polarization discrimination)	dB										
C/I due to other GSO BSS networks	dB	19.4	24.2	22.8	24.4	22.6	19.5	24.2	24.1	23.3	21.5
C/I due to GSO FSS networks	dB	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0
Clear sky feeder link C/N+I	dB	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0
C/N+I required at operating threshold	dB	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6
Clear sky C/N+I margin above operating threshold (1)	dB										
Total Clear sky C/N+I margin above operating threshold (1)	dB	3.1	2.8	4.8	2.9	5.1	6.2	3.2	3.3	4.1	5.2
C/N+I total link for 99.7% of the time	dB	8.7	8.7	9.0	8.8	9.0	9.1	9.0	9.0	9.0	9.1
C/N+I margin above operating threshold for 99.7% of the time	dB										
Space station characteristics											
Longitude	°	-91.0	-91.0	-91.0	-91.0	-91.0	-91.0	-91.0	-91.0	-91.0	-91.0
Satellite e.i.r.p. in the direction of the earth station	dBW	46.9	46.9	48.5	47.0	48.9	50.4	45.4	47.0	47.7	49.0
Earth station characteristics											
Receive antenna diameter	cm	60.0	60.0	60.0	60.0	60.0	60.0	75.0	60.0	60.0	60.0
On-axis antenna gain at receiver input	dBi										
On-axis antenna gain at antenna output	dBi	36.0	36.0	36.0	36.0	36.0	36.0	37.9	36.0	36.0	36.0
Off-axis antenna gain characteristics		Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3
Clear sky receive system noise temperature at receiver input	K										
Clear sky receive system noise temperature at antenna output	K	123.4	134.6	123.4	134.6	123.4	123.4	134.6	123.4	123.4	123.4
Total pointing loss	dB	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Latitude	°	33.3	51.1	42.8	53.6	42.2	33.5	51.5	50.4	45.0	38.5
Longitude	°	-112.0	-114.1	-83.1	-113.5	-71.1	-84.2	-78.7	-104.7	-93.2	-77.0
Altitude	km	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rain climatic zone		F	B1	D2	B1	D2	D3	B1	B2	D1	D2
Elevation angle	°	45.2	27.6	39.9	25.4	37.2	50.4	29.9	30.8	38.1	43.1
Propagation characteristics											
Rain attenuation for 99.7% of the time	dB	0.4	0.2	1.0	0.2	1.1	1.8	0.3	0.3	0.6	1.1
Noise increase due to rain for 99.7 % of the time	dB	0.8	0.5	1.7	0.4	1.8	2.5	0.6	0.7	1.1	1.8
Rain attenuation for availability percentage of time	dB	1.3	1.1	2.2	1.1	2.4	3.4	1.4	1.3	1.8	2.5
Feeder link earth station characteristics											
Frequency	GHz	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7
Maximum uplink power control		Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Minimum feeder link earth station eirp	dBW	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Latitude	°	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Longitude	°	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Altitude	km	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Rain climatic zone		Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Elevation angle	°	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Rain attenuation for 99.97% of the time	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Rain attenuation for availability percentage of time	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Characteristics of the space station receiver											
Satellite receive noise temperature	K	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Satellite receive antenna gain in the direction of the feeder link station	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Automatic gain control setting		Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Polarization (angle as defined in Annex 2 of APS30A in case of linear polarization)		CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL
C/I due to frequency re-use (polarization discrimination)	dB										
C/I due to other GSO BSS networks	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
C/I from other assignments in the Plan	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
C/I from other GSO FSS systems	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available

(1) Administrations are strongly encouraged to use the spreadsheet provided with this Table in order to calculate

Footnote 1: For US-GSO D5, rain effects are not relevant.

Footnote 2: See the antenna gain pattern mask in attachment 1 to document 4-9-11/165 Corr.1

Footnote 3: See "test results template" in Figure 4 of ITU Document 4-9-11/172-E, 25 June 1998.

Annex 1 : BSS system characteristics

System Characteristics	Units	Canada CAN-83	Canada CAN-84	Canada CAN-85	Canada CAN-86	Canada CAN-87	Canada CAN-88	Canada CAN-89	Canada CAN-90	Canada CAN-91	Canada CAN-92
System Characteristics											
Frequency	GHz	12.500	12.500	12.500	12.500	12.500	12.500	12.500	12.500	12.500	12.500
Availability objective	%										
Receiver noise Bandwidth	MHz	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
Modulation type		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK
Polarization (angle as defined in Annex 2 of APS30 in case of linear polarization)		CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR
C/I due to frequency re-use (polarization discrimination)	dB										
C/I due to other GSO BSS networks	dB	24.1	24.9	24.8	24.4	14.0	14.0	14.0	14.0	14.0	14.0
C/I due to GSO FSS networks	dB	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0
Clear sky feeder link C/N+I	dB	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0
C/N+I required at operating threshold	dB	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6
Clear sky C/N+I margin above operating threshold (1)	dB										
Total Clear sky C/N+I margin above operating threshold (1)	dB	3.9	2.8	2.9	3.5	3.7	3.7	3.7	3.7	3.7	3.7
C/N+I total link for 99.7% of the time	dB	9.1	9.0	9.2	9.5	7.2	8.1	9.5	6.6	7.7	9.0
C/N+I margin above operating threshold for 99.7% of the time	dB										
Space station characteristics											
Longitude	°	-91.0	-91.0	-91.0	-91.0	-72.5	-72.5	-72.5	-72.5	-72.5	-72.5
Satellite e.i.r.p. in the direction of the earth station	dBW	47.6	42.3	45.7	47.7	53.4	54.4	54.8	53.1	51.4	53.3
Earth station characteristics											
Receive antenna diameter	cm	60.0	120.0	75.0	60.0	45.0	45.0	45.0	45.0	45.0	45.0
On-axis antenna gain at receiver input	dBi										
On-axis antenna gain at antenna output	dBi	36.0	42.0	37.9	36.0	33.6	33.6	33.6	33.6	33.6	33.6
Off-axis antenna gain characteristics		Footnote 3	Footnote 3	Footnote 3	Footnote 3	AP30 Annex 5	AP30 Annex 5	AP30 Annex 5	AP30 Annex 5	AP30 Annex 5	AP30 Annex 5
Clear sky receive system noise temperature at receiver input	K										
Clear sky receive system noise temperature at antenna output	K	123.4	168.3	145.9	134.6	120.0	120.0	120.0	120.0	120.0	120.0
Total pointing loss	dB	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Latitude	°	49.9	68.3	60.2	53.0	30.5	36.7	41.0	29.5	32.8	48.4
Longitude	°	-97.2	-133.7	-123.5	-66.9	-84.3	-76.0	-73.9	-98.5	-117.1	-123.4
Altitude	km	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rain climatic zone		D1	A	A	B1	M	M	K	M	E	D
Elevation angle	°	32.5	7.2	16.4	25.5	52.2	47.2	42.6	45.4	29.1	16.4
Propagation characteristics											
Rain attenuation for 99.7% of the time	dB	0.5	0.1	0.1	0.2	2.9	2.8	1.8	3.1	1.2	1.2
Noise increase due to rain for 99.7 % of the time	dB	1.0	0.2	0.2	0.4	3.4	3.3	2.6	3.5	2.0	2.0
Rain attenuation for availability percentage of time	dB	1.6	1.3	1.3	1.5	3.4	4.1	4.3	3.1	2.0	2.9
Feeder link earth station characteristics											
Frequency	GHz	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7
Maximum uplink power control		Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Minimum feeder link earth station eirp	dBW	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Latitude	°	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Longitude	°	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Altitude	km	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Rain climatic zone		Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Elevation angle	°	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Rain attenuation for 99.97% of the time	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Rain attenuation for availability percentage of time	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Characteristics of the space station receiver											
Satellite receive noise temperature	K	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Satellite receive antenna gain in the direction of the feeder link station	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Automatic gain control setting		Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Polarization (angle as defined in Annex 2 of APS30A in case of linear polarization)		CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL
C/I due to frequency re-use (polarization discrimination)	dB										
C/I due to other GSO BSS networks	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
C/I from other assignments in the Plan	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
C/I from other GSO FSS systems	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available

(1) Administrations are strongly encouraged to use the spreadsheet provided with this Table in order to calculate

Footnote 1: For US-GSO D5, rain effects are not relevant.

Footnote 2: See the antenna gain pattern mask in attachment 1 to document 4-9-11/165 Corr.1

Footnote 3: See "test results template" in Figure 4 of ITU Document 4-9-11/172-E, 25 June 1998.

Annex 1 : BSS system characteristics

System Characteristics	Units	Canada CAN-93	Canada CAN-94	Canada CAN-95	Canada CAN-96	Canada CAN-97	Canada CAN-98	Canada CAN-99	Canada CAN-100	Canada CAN-101	Canada CAN-102
System Characteristics											
Frequency	GHz	12.500	12.500	12.500	12.500	12.500	12.500	12.500	12.500	12.500	12.500
Availability objective	%										
Receiver noise Bandwidth	MHz	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
Modulation type		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK
Polarization (angle as defined in Annex 2 of APS30 in case of linear polarization)		CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR
C/I due to frequency re-use (polarization discrimination)	dB										
C/I due to other GSO BSS networks	dB	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0
C/I due to GSO FSS networks	dB	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0
Clear sky feeder link C/N+I	dB	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0
C/N+I required at operating threshold	dB	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6
Clear sky C/N+I margin above operating threshold (1)	dB										
Total Clear sky C/N+I margin above operating threshold (1)	dB	3.7	3.7	3.7	3.7	3.7	3.0	3.0	3.0	3.0	3.0
C/N+I total link for 99.7% of the time	dB	7.4	9.0	9.8	8.7	9.8	12.7	13.0	11.5	10.4	9.4
C/N+I margin above operating threshold for 99.7% of the time	dB										
Space station characteristics											
Longitude	°	-72.5	-72.5	-72.5	-72.5	-72.5	-138.0	-138.0	-138.0	-138.0	-138.0
Satellite e.i.r.p. in the direction of the earth station	dBW	52.3	52.7	55.3	52.6	53.7	59.9	61.1	59.8	59.3	58.8
Earth station characteristics											
Receive antenna diameter	cm	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0
On-axis antenna gain at receiver input	dBi										
On-axis antenna gain at antenna output	dBi	33.6	33.6	33.6	33.6	33.6	33.6	33.6	33.6	33.6	33.6
Off-axis antenna gain characteristics		AP30 Annex 5	AP30 Annex 5	AP30 Annex 5	AP30 Annex 5	AP30 Annex 5	Ap30 Annex 5	Ap30 Annex 5	Ap30 Annex 5	Ap30 Annex 5	Ap30 Annex 5
Clear sky receive system noise temperature at receiver input	K										
Clear sky receive system noise temperature at antenna output	K	120.0	121.0	122.0	123.0	124.0	120.0	120.0	120.0	120.0	120.0
Total pointing loss	dB	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Latitude	°	60.6	62.4	43.7	47.6	53.6	60.6	49.3	49.9	43.7	45.5
Longitude	°	-135.0	-114.4	-79.4	-52.7	-113.5	-135.0	-123.1	-97.1	-79.4	-73.6
Altitude	km	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rain climatic zone		C	C	K	F	C	C	D	K	K	K
Elevation angle	°	4.4	11.7	39.1	32.0	18.4	21.3	31.7	21.0	13.7	9.0
Propagation characteristics											
Rain attenuation for 99.7% of the time	dB	1.6	0.9	1.8	1.2	0.8	0.6	0.7	2.3	3.3	4.0
Noise increase due to rain for 99.7 % of the time	dB	2.4	1.6	2.5	2.0	1.4	1.1	1.4	3.0	3.6	3.9
Rain attenuation for availability percentage of time	dB	2.2	2.5	4.6	2.7	3.2	8.2	9.5	8.1	7.5	7.0
Feeder link earth station characteristics											
Frequency	GHz	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7
Maximum uplink power control		Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Minimum feeder link earth station eirp	dBW	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Latitude	°	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Longitude	°	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Altitude	km	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Rain climatic zone		Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Elevation angle	°	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Rain attenuation for 99.97% of the time	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Rain attenuation for availability percentage of time	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Characteristics of the space station receiver											
Satellite receive noise temperature	K	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Satellite receive antenna gain in the direction of the feeder link station	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Automatic gain control setting		Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Polarization (angle as defined in Annex 2 of APS30A in case of linear polarization)		CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL
C/I due to frequency re-use (polarization discrimination)	dB										
C/I due to other GSO BSS networks	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
C/I from other assignments in the Plan	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
C/I from other GSO FSS systems	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available

(1) Administrations are strongly encouraged to use the spreadsheet provided with this Table in order to calculate

Footnote 1: For US-GSO D5, rain effects are not relevant.

Footnote 2: See the antenna gain pattern mask in attachment 1 to document 4-9-11/165 Corr.1

Footnote 3: See "test results template" in Figure 4 of ITU Document 4-9-11/172-E, 25 June 1998.

Annex 1 : BSS system characteristics

System Characteristics	Units	Canada CAN-103	Canada CAN-104	Canada CAN-105	Canada CAN-106	Canada CAN-107	Canada CAN-108	Canada CAN-109	Canada CAN-110	Canada CAN-110	Canada CAN-111
System Characteristics											
Frequency	GHz	12.500	12.500	12.500	12.500	12.500	12.500	12.500	12.500	12.500	12.500
Availability objective	%										
Receiver noise Bandwidth	MHz	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
Modulation type		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK
Polarization (angle as defined in Annex 2 of APS30 in case of linear polarization)		CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR
C/I due to frequency re-use (polarization discrimination)	dB										
C/I due to other GSO BSS networks	dB	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	17.6	17.6
C/I due to GSO FSS networks	dB	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0
Clear sky feeder link C/N+I	dB	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0
C/N+I required at operating threshold	dB	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6
Clear sky C/N+I margin above operating threshold (1)	dB										
Total Clear sky C/N+I margin above operating threshold (1)	dB	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	1.0	1.0
C/N+I total link for 99.7% of the time	dB	9.9	8.6	11.3	10.6	12.9	10.3	9.6	7.3	6.7	7.4
C/N+I margin above operating threshold for 99.7% of the time	dB										
Space station characteristics											
Longitude	°	-138.0	-138.0	-138.0	-138.0	-138.0	-138.0	-138.0	-138.0	-129.0	-129.0
Satellite e.i.r.p. in the direction of the earth station	dBW	59.4	59.4	60.2	59.7	60.5	60.2	59.9	49.4	54.5	55.3
Earth station characteristics											
Receive antenna diameter	cm	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	90.0	90.0
On-axis antenna gain at receiver input	dBi										
On-axis antenna gain at antenna output	dBi	33.6	33.6	33.6	33.6	33.6	33.6	33.6	33.6	39.6	39.6
Off-axis antenna gain characteristics		Ap30 Annex 5	Ap30 Annex 5	Ap30 Annex 5	Ap30 Annex 5	Ap30 Annex 5	Ap30 Annex 5	Ap30 Annex 5	Ap30 Annex 5	AP30 Annex 5	AP30 Annex 5
Clear sky receive system noise temperature at receiver input	K										
Clear sky receive system noise temperature at antenna output	K	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0
Total pointing loss	dB	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Latitude	°	41.0	28.0	41.8	27.7	37.8	33.8	35.8	21.6	28.0	30.5
Longitude	°	-73.9	-82.5	-87.7	-97.3	-122.5	-84.3	-78.7	-157.8	-82.5	-84.3
Altitude	km	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rain climatic zone		K	N	K	M	D	M	M	D	M	M
Elevation angle	°	10.7	21.9	20.3	35.0	43.3	21.4	16.1	56.2	29.9	30.3
Propagation characteristics											
Rain attenuation for 99.7% of the time	dB	3.8	5.5	2.7	3.5	0.8	4.2	4.6	0.8	9.3	9.3
Noise increase due to rain for 99.7 % of the time	dB	3.8	4.4	3.3	3.7	1.4	4.0	4.1	1.5	5.0	5.0
Rain attenuation for availability percentage of time	dB	7.5	7.7	8.4	8.2	9.1	8.4	8.0	1.2	9.4	10.1
Feeder link earth station characteristics											
Frequency	GHz	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7
Maximum uplink power control		Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Minimum feeder link earth station eirp	dBW	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Latitude	°	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Longitude	°	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Altitude	km	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Rain climatic zone		Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Elevation angle	°	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Rain attenuation for 99.97% of the time	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Rain attenuation for availability percentage of time	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Characteristics of the space station receiver											
Satellite receive noise temperature	K	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Satellite receive antenna gain in the direction of the feeder link station	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Automatic gain control setting		Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Polarization (angle as defined in Annex 2 of APS30A in case of linear polarization)		CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL
C/I due to frequency re-use (polarization discrimination)	dB										
C/I due to other GSO BSS networks	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
C/I from other assignments in the Plan	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
C/I from other GSO FSS systems	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available

(1) Administrations are strongly encouraged to use the spreadsheet provided with this Table in order to calculate

Footnote 1: For US-GSO D5, rain effects are not relevant.

Footnote 2: See the antenna gain pattern mask in attachment 1 to document 4-9-11/165 Corr.1

Footnote 3: See "test results template" in Figure 4 of ITU Document 4-9-11/172-E, 25 June 1998.

Annex 1 : BSS system characteristics

System Characteristics	Units	Canada CAN-112	Canada CAN-113	Canada CAN-114	Canada CAN-115	Canada CAN-116	Canada CAN-117	Canada CAN-118	Canada CAN-119	Canada CAN-120	Canada CAN-121
System Characteristics											
Frequency	GHz	12.500	12.500	12.500	12.500	12.500	12.500	12.500	12.500	12.500	12.500
Availability objective	%										
Receiver noise Bandwidth	MHz	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
Modulation type		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK
Polarization (angle as defined in Annex 2 of APS30 in case of linear polarization)		CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR
C/I due to frequency re-use (polarization discrimination)	dB										
C/I due to other GSO BSS networks	dB	18.3	14.0	17.0	18.2	19.8	18.9	17.5	18.1	19.0	19.1
C/I due to GSO FSS networks	dB	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0
Clear sky feeder link C/N+I	dB	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0
C/N+I required at operating threshold	dB	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6
Clear sky C/N+I margin above operating threshold (1)	dB										
Total Clear sky C/N+I margin above operating threshold (1)	dB	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
C/N+I total link for 99.7% of the time	dB	9.1	7.8	8.0	8.6	8.5	9.0	8.1	7.7	10.0	6.9
C/N+I margin above operating threshold for 99.7% of the time	dB										
Space station characteristics											
Longitude	°	-129.0	-129.0	-129.0	-129.0	-129.0	-129.0	-129.0	-129.0	-129.0	-129.0
Satellite e.i.r.p. in the direction of the earth station	dBW	55.1	55.2	55.1	56.6	55.0	55.6	55.7	55.1	56.7	54.3
Earth station characteristics											
Receive antenna diameter	cm	90.0	120.0	60.0	45.0	45.0	45.0	75.0	75.0	45.0	75.0
On-axis antenna gain at receiver input	dBi										
On-axis antenna gain at antenna output	dBi	39.6	42.1	36.1	33.6	33.6	33.6	38.0	38.0	33.6	38.0
Off-axis antenna gain characteristics		AP30 Annex 5	AP30 Annex 5	AP30 Annex 5	AP30 Annex 5	AP30 Annex 5	AP30 Annex 5	AP30 Annex 5	AP30 Annex 5	AP30 Annex 5	AP30 Annex 5
Clear sky receive system noise temperature at receiver input	K										
Clear sky receive system noise temperature at antenna output	K	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0
Total pointing loss	dB	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Latitude	°	41.0	27.7	32.8	48.4	60.6	62.4	43.7	45.5	53.6	44.7
Longitude	°	-73.9	-97.3	-117.1	-123.4	-135.0	-114.4	-79.4	-73.6	-113.5	-63.7
Altitude	km	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rain climatic zone		K	M	E	D	C	C	K	K	C	K
Elevation angle	°	17.3	42.5	49.7	34.2	21.1	18.4	19.8	15.1	27.2	8.7
Propagation characteristics											
Rain attenuation for 99.7% of the time	dB	7.2	10.6	5.7	4.3	3.2	3.2	7.3	7.2	3.2	7.2
Noise increase due to rain for 99.7 % of the time	dB	4.7	5.1	4.4	4.0	3.6	3.5	4.7	4.7	3.6	4.7
Rain attenuation for availability percentage of time	dB	9.7	12.1	7.0	6.0	4.6	5.0	8.8	8.2	6.1	7.4
Feeder link earth station characteristics											
Frequency	GHz	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7
Maximum uplink power control		Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Minimum feeder link earth station eirp	dBW	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Latitude	°	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Longitude	°	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Altitude	km	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Rain climatic zone		Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Elevation angle	°	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Rain attenuation for 99.97% of the time	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Rain attenuation for availability percentage of time	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Characteristics of the space station receiver											
Satellite receive noise temperature	K	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Satellite receive antenna gain in the direction of the feeder link station	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Automatic gain control setting		Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Polarization (angle as defined in Annex 2 of APS30A in case of linear polarization)		CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL
C/I due to frequency re-use (polarization discrimination)	dB										
C/I due to other GSO BSS networks	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
C/I from other assignments in the Plan	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
C/I from other GSO FSS systems	dB	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available

(1) Administrations are strongly encouraged to use the spreadsheet provided with this Table in order to calculate

Footnote 1: For US-GSO D5, rain effects are not relevant.

Footnote 2: See the antenna gain pattern mask in attachment 1 to document 4-9-11/165 Corr.1

Footnote 3: See "test results template" in Figure 4 of ITU Document 4-9-11/172-E, 25 June 1998.

Annex 1 : BSS system characteristics

BSS characteristics	Units	Intelsat INT (INAE33)	Intelsat INT (INDAK310)	Intelsat INT (INQUE310)	Intelsat INT (SAS310)	Intelsat INT (IEAU1377)	Intelsat INT (INT1D33)	Intelsat INT (INTSA33)	Intelsat INT (INTME33)	Intelsat INT (INJA157)	Intelsat INT (INT3D33)	Intelsat INT (IMEX310)	Intelsat INT (IBIN1377)
System Characteristics													
Frequency	GHz	12.000	12.000	12.100	12.100	12.100	12.100	12.100	12.100	12.100	12.100	12.100	12.100
Availability objective	%												
Receiver noise Bandwidth	MHz	27	24	24	24	27	27	27	27	27	27	24	27
Modulation type		FM	FM	FM	FM	FM	FM	FM	FM	FM	FM	FM	FM
Polarization (angle as defined in Annex 2 of APS30 in case of linear polarization)													
C/I due to frequency re-use (polarization discrimination)	dB												
C/I due to other GSO BSS networks	dB	27	31	31	27	27	27	27	27	27	27	31	27
C/I due to GSO FSS networks	dB	27.0	31.0	31.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	31.0	27.0
Clear sky feeder link C/N+I	dB	26.1	29.2	28.9	28.5	24.7	27.2	25.3	27.0	28.6	27.2	29.3	28.0
C/N+I required at operating threshold	dB	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0
Clear sky C/N+I margin above operating threshold (1)	dB	0.3	0.9	1.2	1.0	0.2	0.1	0.4	0.3	2.7	0.2	3.9	2.4
Total Clear sky C/N+I margin above operating threshold (1)	dB												
C/N+I total link for 99.7% of the time	dB												
C/N+I margin above operating threshold for 99.7% of the time	dB												
Space station characteristics													
Longitude	°	33	-50	-50	-50	137.7	33	33	33	157	33	-50	137.7
Satellite e.i.r.p. in the direction of the earth station	dBW	52	52	52	52	52	52	52	52	55	52	55	55
Earth station characteristics													
Receive antenna diameter	cm	60	100	100	100	60	60	60	60	60	60	100	60
On-axis antenna gain at receiver input	dBi												
On-axis antenna gain at antenna output	dBi	35.72	40.16	40.23	40.23	35.79	35.79	35.79	35.79	35.79	35.79	40.23	35.79
Off-axis antenna gain characteristics		BO1213	BO1213	BO1213	BO1213	BO1213	BO1213	BO1213	BO1213	BO1213	BO1213	BO1213	BO1213
Clear sky receive system noise temperature at receiver input	K												
Clear sky receive system noise temperature at antenna output	K	120	300	300	300	120	120	120	120	120	120	300	120
Total pointing loss	dB	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Latitude	°	23.0	41.0	57.0	-45.0	-35.0	35.6	-18.0	35.1	35.1	40.8	16.0	8.0
Longitude	°	12.0	-113.0	-64.0	-75.0	140.0	-0.7	28.0	33.2	126.3	9.5	-101.0	77.7
Altitude	km	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Rain climatic zone		A	B	C	D	F	E	J	K	K	L	N	N
Elevation angle	°	54.2	11.5	24.0	32.5	49.3	35.5	68.1	49.2	37.9	37.0	29.7	21.6
Propagation characteristics													
Rain attenuation for 99.7% of the time	dB	0.27	0.90	0.53	0.58	0.94	0.96	1.45	1.66	1.91	2.55	4.90	5.40
Noise increase due to rain for 99.7 % of the time	dB	0.6	0.7	0.5	0.5	1.7	1.7	2.3	2.5	2.7	3.2	2.2	4.3
Rain attenuation for availability percentage of time	dB												
Feeder link earth station characteristics													
Frequency	GHz	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7
Maximum uplink power control		10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Minimum feeder link earth station eirp	dBW	85.0	87.4	87.4	87.4	85.0	85.0	85.0	85.0	85.0	85.0	87.4	85.0
Latitude	°	23.0	41.0	57.0	-45.0	-35.0	35.6	-18.0	35.1	35.1	40.8	16.0	8.0
Longitude	°	12.0	-113.0	-64.0	-75.0	140.0	-0.7	28.0	33.2	126.3	9.5	-101.0	77.7
Altitude	km	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Rain climatic zone		A	B	C	D	F	E	J	K	K	L	N	N
Elevation angle	°	54.2	11.5	24.0	32.5	49.3	35.5	68.1	49.2	37.9	37.0	29.7	21.6
Rain attenuation for 99.97% of the time	dB												
Rain attenuation for availability percentage of time	dB												
Characteristics of the space station receiver													
Satellite receive noise temperature	K	900.0	900.0	900.0	900.0	900.0	900.0	900.0	900.0	900.0	900.0	900.0	900.0
Satellite receive antenna gain in the direction of the feeder link station	dB	27.9	34.6	32.6	31.0	25.8	30.3	26.4	29.5	33.9	30.3	34.3	32.5
Automatic gain control setting		YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Polarization (angle as defined in Annex 2 of APS30A in case of linear polarization)													
C/I due to frequency re-use (polarization discrimination)	dB												
C/I due to other GSO BSS networks	dB												
C/I from other assignments in the Plan	dB	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0
C/I from other GSO FSS systems	dB	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0

(1) Administrations are strongly encouraged to use the spreadsheet provided with this Table in order to calculate this margin

Footnote 1: For US-GSO D5, rain effects are not relevant.

Footnote 2: See the antenna gain pattern mask in attachment 1 to document 4-9-11/165 Corr.1

Footnote 3: See "test results template" in Figure 4 of ITU Document 4-9-11/172-E, 25 June 1998.

Annex 1 : BSS system characteristics

BSS characteristics	Units	Intelsat INT(I1MCSA310)	Intelsat INT(I2SE1377)	Intelsat INT(I1MCA33)	Intelsat INT (INAE33)	Intelsat INT (INDAK310)	Intelsat INT (INQUE310)	Intelsat INT (SAS310)	Intelsat INT (IEAU1377)	Intelsat INT (INT1D33)	Intelsat INT (INTSA33)	Intelsat INT (INTME33)	Intelsat INT (INJA157)
System Characteristics													
Frequency	GHz	12.350	12.000	12.000	12.000	12.000	12.100	12.100	12.100	12.100	12.100	12.100	12.100
Availability objective	%												
Receiver noise Bandwidth	MHz	24	27	27	33	24	24	24	33	33	33	33	27
Modulation type		FM	FM	FM	digital TV	digital TV	digital TV	digital TV	digital TV	digital TV	digital TV	digital TV	digital TV
Polarization (angle as defined in Annex 2 of APS30 in case of linear polarization)													
C/I due to frequency re-use (polarization discrimination)	dB												
C/I due to other GSO BSS networks	dB	31	27	27	27	31	31	27	27	27	27	27	27
C/I due to GSO FSS networks	dB	31.0	27.0	27.0	27.0	31.0	31.0	27.0	27.0	27.0	27.0	27.0	27.0
Clear sky feeder link C/N+I	dB	26.5	25.1	25.9	25.6	29.2	28.9	28.5	24.1	26.8	24.7	26.5	28.6
C/N+I required at operating threshold	dB	14.0	14.0	14.0	13.0	14.0	14.0	14.0	13.0	13.0	13.0	13.0	13.0
Clear sky C/N+I margin above operating threshold (1)	dB	4.1	2.6	2.7	0.6	0.9	1.2	1.0	0.4	0.4	0.6	0.6	3.7
Total Clear sky C/N+I margin above operating threshold (1)	dB												
C/N+I total link for 99.7% of the time	dB												
C/N+I margin above operating threshold for 99.7% of the time	dB												
Space station characteristics													
Longitude	°	-50	137.7	33	33	-50	-50	-50	137.7	33	33	33	157
Satellite e.i.r.p. in the direction of the earth station	dBW	55	55	55	52	52	52	52	52	52	52	52	55
Earth station characteristics													
Receive antenna diameter	cm	100	60	60	60	100	100	100	60	60	60	60	60
On-axis antenna gain at receiver input	dBi												
On-axis antenna gain at antenna output	dBi	40.41	35.72	35.72	35.72	40.16	40.23	40.23	35.79	35.79	35.79	35.79	35.79
Off-axis antenna gain characteristics			BO1213	BO1213	BO1213	BO1213	BO1213	BO1213	BO1213	BO1213	BO1213	BO1213	BO1213
Clear sky receive system noise temperature at receiver input	K												
Clear sky receive system noise temperature at antenna output	K	300	120	120	120	300	300	300	120	120	120	120	120
Total pointing loss	dB	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Latitude	°	-11.0	8.0	2.0	23.0	41.0	57.0	-45.0	-35.0	35.6	-18.0	35.1	35.1
Longitude	°	-53.0	124.0	10.0	12.0	-113.0	-64.0	-75.0	140.0	-0.7	28.0	33.2	126.3
Altitude	km	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Rain climatic zone		P	P	Q	A	B	C	D	F	E	J	K	K
Elevation angle	°	76.6	71.4	63.0	54.2	11.5	24.0	32.5	49.3	35.5	68.1	49.2	37.9
Propagation characteristics													
Rain attenuation for 99.7% of the time	dB	7.21	7.03	5.18	0.27	0.90	0.53	0.58	0.94	0.96	1.45	1.66	1.91
Noise increase due to rain for 99.7 % of the time	dB	2.5	4.7	4.3	0.6	0.7	0.5	0.5	1.7	1.7	2.3	2.5	2.7
Rain attenuation for availability percentage of time	dB												
Feeder link earth station characteristics													
Frequency	GHz	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7
Maximum uplink power control		10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Minimum feeder link earth station eirp	dBW	87.4	85.0	85.0	85.0	87.4	87.4	87.4	85.0	85.0	85.0	85.0	85.0
Latitude	°	-11.0	8.0	2.0	23.0	41.0	57.0	-45.0	-35.0	35.6	-18.0	35.1	35.1
Longitude	°	-53.0	124.0	10.0	12.0	-113.0	-64.0	-75.0	140.0	-0.7	28.0	33.2	126.3
Altitude	km	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Rain climatic zone		P	P	Q	A	B	C	D	F	E	J	K	K
Elevation angle	°	76.6	71.4	63.0	54.2	11.5	24.0	32.5	49.3	35.5	68.1	49.2	37.9
Rain attenuation for 99.97% of the time	dB												
Rain attenuation for availability percentage of time	dB												
Characteristics of the space station receiver													
Satellite receive noise temperature	K	900.0	900.0	900.0	900.0	900.0	900.0	900.0	900.0	900.0	900.0	900.0	900.0
Satellite receive antenna gain in the direction of the feeder link station	dB	25.5	26.0	27.4	27.9	34.6	32.6	31.0	25.8	30.3	26.4	29.5	33.9
Automatic gain control setting		YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Polarization (angle as defined in Annex 2 of APS30A in case of linear polarization)													
C/I due to frequency re-use (polarization discrimination)	dB												
C/I due to other GSO BSS networks	dB												
C/I from other assignments in the Plan	dB	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0
C/I from other GSO FSS systems	dB	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0

(1) Administrations are strongly encouraged to use the spreadsheet provided with this Table in order to calculate

Footnote 1: For US-GSO D5, rain effects are not relevant.

Footnote 2: See the antenna gain pattern mask in attachment 1 to document 4-9-11/165 Corr.1

Footnote 3: See "test results template" in Figure 4 of ITU Document 4-9-11/172-E, 25 June 1998.

Annex 1 : BSS system characteristics

BSS characteristics	Units	Intelsat INT (INT3D33)	Intelsat INT (IMEX310)	Intelsat INT (IBIN1377)	Intelsat INT (I1MCSA310)	Intelsat INT. (I2SE1377)	Intelsat INT (I1MCA33)	Sweden S 1	Sweden S 2	Sweden S 3	Sweden S 4	Sweden S 5	Sweden S 6
System Characteristics													
Frequency	GHz	12.100	12.100	12.100	12.350	12.000	12.000	12.100	12.100	12.100	12.100	12.100	12.100
Availability objective	%							99.9	99.9	99.9	99.9	99.9	99.9
Receiver noise Bandwidth	MHz	33	24	33	33	33	33	27	27	27	27	33	33
Modulation type		digital TV	digital TV	digital TV	digital TV	digital TV	digital TV	FM	FM	FM	FM	QPSK	QPSK
Polarization (angle as defined in Annex 2 of APS30 in case of linear polarization)								L (0°/90°)	L (0°/90°)	L (0°/90°)	L (0°/90°)	L (0°/90°)	L (0°/90°)
C/I due to frequency re-use (polarization discrimination)	dB												
C/I due to other GSO BSS networks	dB	27	31	27	31	27	27	23	23	23	23	23	23
C/I due to GSO FSS networks	dB	27.0	31.0	27.0	31.0	27.0	27.0	55.82	53.50	39.91	49.81	54.95	52.62
Clear sky feeder link C/N+I	dB	26.8	29.3	27.7	25.7	24.4	25.3	27.9	27.9	27.9	27.9	27.5	27.5
C/N+I required at operating threshold	dB	13.0	14.0	13.0	14.0	13.0	13.0	11.0	11.0	11.0	11.0	7.9	7.9
Clear sky C/N+I margin above operating threshold (1)	dB	0.4	3.9	2.7	2.9	2.9	3.0						
Total Clear sky C/N+I margin above operating threshold (1)	dB							5.1	3.7	4.9	3.4	7.5	6.0
C/N+I total link for 99.7% of the time	dB							14.0	11.5	11.0	11.5	13.3	10.7
C/N+I margin above operating threshold for 99.7% of the time	dB												
Space station characteristics													
Longitude	°	33	-50	137.7	-50	137.7	33	5	5	5	5	5	5
Satellite e.i.r.p. in the direction of the earth station	dBW	52	55	55	55	55	55	55	53	41	49	55	53
Earth station characteristics													
Receive antenna diameter	cm	60	100	60	100	60	60	60	60	300	90	60	60
On-axis antenna gain at receiver input	dBi												
On-axis antenna gain at antenna output	dBi	35.79	40.23	35.79	40.41	35.72	35.72	35.79	35.79	49.77	39.31	35.79	35.79
Off-axis antenna gain characteristics		BO1213	BO1213	BO1213		BO1213	BO1213	BO1213	BO1213	BO1213	BO1213	BO1213	BO1213
Clear sky receive system noise temperature at receiver input	K												
Clear sky receive system noise temperature at antenna output	K	120	300	120	300	120	120	120	120	120	120	120	120
Total pointing loss	dB	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Latitude	°	40.8	16.0	8.0	-11.0	8.0	2.0	66.0	60.0	64.0	49.6	66.0	60.0
Longitude	°	9.5	-101.0	77.7	-53.0	124.0	10.0	18.0	5.0	-51.0	22.2	18.0	5.0
Altitude	km	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Rain climatic zone		L	N	N	P	P	Q	E	J	G	H	E	J
Elevation angle	°	37.0	29.7	21.6	76.6	71.4	63.0	14.9	21.9	5.5	30.8	14.9	21.9
Propagation characteristics													
Rain attenuation for 99.7% of the time	dB	2.55	4.90	5.40	7.21	7.03	5.18	0.93	1.41	2.63	1.28	0.93	1.41
Noise increase due to rain for 99.7 % of the time	dB	3.2	2.2	4.3	2.5	4.7	4.3	1.7	2.2	3.2	2.1	1.7	2.2
Rain attenuation for availability percentage of time	dB							2.8	1.7	2.6	1.5	4.4	3.1
Feeder link earth station characteristics													
Frequency	GHz	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7
Maximum uplink power control		10.0	10.0	10.0	10.0	10.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0
Minimum feeder link earth station eirp	dBW	85.0	87.4	85.0	87.4	85.0	85.0	72.0	72.0	72.0	72.0	72.0	72.0
Latitude	°	40.8	16.0	8.0	-11.0	8.0	2.0	59.0	59.0	59.0	59.0	59.0	59.0
Longitude	°	9.5	-101.0	77.7	-53.0	124.0	10.0	18.0	18.0	18.0	18.0	18.0	18.0
Altitude	km	0.1	0.1	0.1	0.1	0.1	0.1	0	0	0	0	0	0
Rain climatic zone		L	N	N	P	P	Q	E	E	E	E	E	E
Elevation angle	°	37.0	29.7	21.6	76.6	71.4	63.0	22.1	22.1	22.1	22.1	22.1	22.1
Rain attenuation for 99.97% of the time	dB							5.2	5.2	5.2	5.2	5.2	5.2
Rain attenuation for availability percentage of time	dB												
Characteristics of the space station receiver													
Satellite receive noise temperature	K	900.0	900.0	900.0	900.0	900.0	900.0	460.0	460.0	460.0	460.0	460.0	460.0
Satellite receive antenna gain in the direction of the feeder link station	dB	30.3	34.3	32.5	25.5	26.0	27.4	42.0	42.0	42.0	42.0	42.0	42.0
Automatic gain control setting		YES	YES	YES	YES	YES	YES	ALC	ALC	ALC	ALC	ALC	ALC
Polarization (angle as defined in Annex 2 of APS30A in case of linear polarization)								L (90°/0°)	L (90°/0°)	L (90°/0°)	L (90°/0°)	L (90°/0°)	L (90°/0°)
C/I due to frequency re-use (polarization discrimination)	dB												
C/I due to other GSO BSS networks	dB							30.0	30.0	30.0	30.0	30.0	30.0
C/I from other assignments in the Plan	dB	33.0	33.0	33.0	33.0	33.0	33.0						
C/I from other GSO FSS systems	dB	33.0	33.0	33.0	33.0	33.0	33.0	99.0	99.0	99.0	99.0	99.0	99.0

(1) Administrations are strongly encouraged to use the spreadsheet provided with this Table in order to calculate

Footnote 1: For US-GSO D5, rain effects are not relevant.

Footnote 2: See the antenna gain pattern mask in attachment 1 to document 4-9-11/165 Corr.1

Footnote 3: See "test results template" in Figure 4 of ITU Document 4-9-11/172-E, 25 June 1998.

Annex 1 : BSS system characteristics

BSS characteristics	Units	Sweden S 7	Sweden S 8	Sweden S 9	Sweden S 10	Sweden S 11	Sweden S 12	Sweden S 13	Sweden S 14	Thailand THAICOM-BSS 1	Thailand THAICOM-BSS 1	Thailand THAICOM-BSS 1
System Characteristics												
Frequency	GHz	12.100	12.100	12.100	12.100	12.100	12.100	12.100	12.100	12.200	12.200	12.200
Availability objective	%	99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9			
Receiver noise Bandwidth	MHz	33	33	27	27	27	33	33	33	27	27	33
Modulation type		QPSK	QPSK	FM	FM	FM	QPSK	QPSK	QPSK	FM	FM	Digital
Polarization (angle as defined in Annex 2 of APS30 in case of linear polarization)		L (0°/90°)	L (0°/90°)	L (0°/90°)	L (0°/90°)	L (0°/90°)	L (0°/90°)	L (0°/90°)	L (0°/90°)			
C/I due to frequency re-use (polarization discrimination)	dB											
C/I due to other GSO BSS networks	dB	23	23	22	22	22	22	22	22	30	30	30
C/I due to GSO FSS networks	dB	39.03	48.94	49.35	51.03	46.78	48.48	50.16	45.91	30.0	30.0	30.0
Clear sky feeder link C/N+I	dB	27.5	27.5	27.5	27.4	27.4	27.1	27.0	27.0	25.9	26.2	25.7
C/N+I required at operating threshold	dB	7.9	7.9	11.0	11.0	11.0	7.9	7.9	7.9	12.0	12.0	12.0
Clear sky C/N+I margin above operating threshold (1)	dB											
Total Clear sky C/N+I margin above operating threshold (1)	dB	7.3	4.4	3.4	2.8	3.1	5.6	4.6	5.4	7.6	7.7	7.1
C/N+I total link for 99.7% of the time	dB	10.2	9.2	10.4	11.3	11.3	9.4	9.9	10.4	10.7	10.7	9.9
C/N+I margin above operating threshold for 99.7% of the time	dB											
Space station characteristics												
Longitude	°	5	5	5	5	5	5	5	5	83	83	83
Satellite e.i.r.p. in the direction of the earth station	dBW	41	49	49	50	46	49	50	46	56	56	56
Earth station characteristics												
Receive antenna diameter	cm	300	75	90	75	125	90	75	125	90	90	90
On-axis antenna gain at receiver input	dBi											
On-axis antenna gain at antenna output	dBi	49.77	37.73	39.31	37.73	42.17	39.10	37.03	42.10	39.39	39.39	39.39
Off-axis antenna gain characteristics		BO1213	BO1213	BO1213	BO1213	BO1213	BO1213	BO1213	BO1213	Annex3 Sec.3.7.3	Annex3 Sec.3.7.3	Annex3 Sec.3.7.3
Clear sky receive system noise temperature at receiver input	K											
Clear sky receive system noise temperature at antenna output	K	120	120	120	120	120	120	120	120	155	155	155
Total pointing loss	dB	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.3	0.3	0.3
Latitude	°	64.0	49.6	35.0	51.5	52.0	35.0	51.5	52.0	13.8	13.8	13.8
Longitude	°	-51.0	22.2	33.4	0.0	-10.0	33.4	0.0	-10.0	100.6	100.6	100.6
Altitude	km	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1
Rain climatic zone		G	H	K	F	H	K	F	H	P	P	P
Elevation angle	°	5.5	30.8	39.4	30.9	28.9	39.4	30.9	28.9	64.0	64.0	64.0
Propagation characteristics												
Rain attenuation for 99.7% of the time	dB	2.63	1.28	1.91	1.06	1.27	1.91	1.06	1.27	7.05	7.05	7.05
Noise increase due to rain for 99.7 % of the time	dB	3.2	2.1	2.7	1.8	2.1	2.7	1.8	2.1	4.0	4.0	4.0
Rain attenuation for availability percentage of time	dB	4.2	2.0	1.6	1.2	1.4	2.9	2.1	2.7	5.9	5.9	5.2
Feeder link earth station characteristics												
Frequency	GHz	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	14.7	17.7
Maximum uplink power control		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0	10.0	10.0
Minimum feeder link earth station eirp	dBW	72.0	72.0	76.0	76.0	76.0	76.0	76.0	76.0	84.0	84.0	84.0
Latitude	°	59.0	59.0	35.0	51.5	51.5	35.0	51.5	51.5	14.1	14.1	14.1
Longitude	°	18.0	18.0	33.4	0.0	0.0	33.4	0.0	0.0	100.4	100.4	100.4
Altitude	km	0	0	0	0	0	0	0	0	0.1	0.1	0.1
Rain climatic zone		E	E	K	F	F	K	F	F	N	N	N
Elevation angle	°	22.1	22.1	39.4	30.9	30.9	39.4	30.9	30.9	63.9	63.9	63.9
Rain attenuation for 99.97% of the time	dB	5.2	5.2	10.9	6.3	6.3	10.9	6.3	6.3	22.3	16.9	22.3
Rain attenuation for availability percentage of time	dB											
Characteristics of the space station receiver												
Satellite receive noise temperature	K	460.0	460.0	460.0	460.0	460.0	460.0	460.0	460.0	1800.0	1800.0	1800.0
Satellite receive antenna gain in the direction of the feeder link station	dB	42.0	42.0	36.6	36.6	36.6	36.6	36.6	36.6	35.5	35.5	35.5
Automatic gain control setting		ALC	ALC	ALC	ALC	ALC	ALC	ALC	ALC	YES	YES	YES
Polarization (angle as defined in Annex 2 of APS30A in case of linear polarization)		L (90°/0°)	L (90°/0°)	L (90°/0°)	L (90°/0°)	L (90°/0°)	L (90°/0°)	L (90°/0°)	L (90°/0°)			
C/I due to frequency re-use (polarization discrimination)	dB											
C/I due to other GSO BSS networks	dB	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0			
C/I from other assignments in the Plan	dB									30.0	30.0	30.0
C/I from other GSO FSS systems	dB	99.0	99.0	99.0	99.0	99.0	99.0	99.0	99.0	30.0	30.0	30.0

(1) Administrations are strongly encouraged to use the spreadsheet provided with this Table in order to calculate

Footnote 1: For US-GSO D5, rain effects are not relevant.

Footnote 2: See the antenna gain pattern mask in attachment 1 to document 4-9-11/165 Corr.1

Footnote 3: See "test results template" in Figure 4 of ITU Document 4-9-11/172-E, 25 June 1998.

Annex 1 : BSS system characteristics

BSS characteristics	Units	Thailand THAICOM-BSS 1	Thailand THAICOM-BSS1	Thailand THAICOM-BSS2	Thailand THAICOM-BSS2	Thailand THAICOM-BSS2	Thailand THAICOM-BSS3	Thailand THAICOM-BSS3	Thailand THAICOM-BSS3	Thailand THAICOM-BSS3	Thailand THAICOM-BSS4	Thailand THAICOM-BSS4
System Characteristics												
Frequency	GHz	12.200	12.200	12.200	12.200	12.200	12.200	12.200	12.200	12.200	12.200	12.200
Availability objective	%											
Receiver noise Bandwidth	MHz	33	27	27	33	33	27	27	33	33	27	27
Modulation type		Digital	FM	FM	Digital	Digital	FM	FM	Digital	Digital	FM	FM
Polarization (angle as defined in Annex 2 of APS30 in case of linear polarization)												
C/I due to frequency re-use (polarization discrimination)	dB											
C/I due to other GSO BSS networks	dB	30	30	30	30	30	30	30	30	30	30	30
C/I due to GSO FSS networks	dB	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
Clear sky feeder link C/N+I	dB	26.1	25.9	26.2	25.7	26.1	25.9	26.2	25.7	26.1	25.9	26.2
C/N+I required at operating threshold	dB	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
Clear sky C/N+I margin above operating threshold (1)	dB											
Total Clear sky C/N+I margin above operating threshold (1)	dB	7.1	7.6	7.7	7.0	7.1	7.6	7.7	7.0	7.1	7.6	7.7
C/N+I total link for 99.7% of the time	dB	9.9	10.7	10.7	9.9	9.9	10.7	10.7	9.9	9.9	10.7	10.7
C/N+I margin above operating threshold for 99.7% of the time	dB											
Space station characteristics												
Longitude	°	83	78.5	78.5	78.5	78.5	120	120	120	120	124	124
Satellite e.i.r.p. in the direction of the earth station	dBW	56	56	56	56	56	56	56	56	56	56	56
Earth station characteristics												
Receive antenna diameter	cm	90	90	90	90	90	90	90	90	90	90	90
On-axis antenna gain at receiver input	dBi											
On-axis antenna gain at antenna output	dBi	39.39	39.39	39.39	39.39	39.39	39.39	39.39	39.39	39.39	39.39	39.39
Off-axis antenna gain characteristics		Annex3 Sec.3.7.3	Annex3 Sec.3.7.3	Annex3 Sec.3.7.3	Annex3 Sec.3.7.3	Annex3 Sec.3.7.3	Annex3 Sec.3.7.3	Annex3 Sec.3.7.3	Annex3 Sec.3.7.3	Annex3 Sec.3.7.3	Annex3 Sec.3.7.3	Annex3 Sec.3.7.3
Clear sky receive system noise temperature at receiver input	K											
Clear sky receive system noise temperature at antenna output	K	155	155	155	155	155	155	155	155	155	155	155
Total pointing loss	dB	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Latitude	°	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8
Longitude	°	100.6	100.6	100.6	100.6	100.6	100.6	100.6	100.6	100.6	100.6	100.6
Altitude	km	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Rain climatic zone		P	P	P	P	P	P	P	P	P	P	P
Elevation angle	°	64.0	59.8	59.8	59.8	59.8	62.3	62.3	62.3	62.3	58.5	58.5
Propagation characteristics												
Rain attenuation for 99.7% of the time	dB	7.05	7.01	7.01	7.01	7.01	7.03	7.03	7.03	7.03	7.01	7.01
Noise increase due to rain for 99.7 % of the time	dB	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Rain attenuation for availability percentage of time	dB	5.2	5.8	5.9	5.1	5.1	5.9	5.9	5.2	5.2	5.8	5.8
Feeder link earth station characteristics												
Frequency	GHz	14.7	17.7	14.7	17.7	14.7	17.7	14.7	17.7	14.7	17.7	14.7
Maximum uplink power control		10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Minimum feeder link earth station eirp	dBW	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0
Latitude	°	14.1	14.1	14.1	14.1	14.1	14.1	14.1	14.1	14.1	14.1	14.1
Longitude	°	100.4	100.4	100.4	100.4	100.4	100.4	100.4	100.4	100.4	100.4	100.4
Altitude	km	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Rain climatic zone		N	N	N	N	N	N	N	N	N	N	N
Elevation angle	°	63.9	59.8	59.8	59.8	59.8	62.0	62.0	62.0	62.0	58.2	58.2
Rain attenuation for 99.97% of the time	dB	16.9	22.2	16.8	22.2	16.8	22.2	16.8	22.2	16.8	22.2	16.8
Rain attenuation for availability percentage of time	dB											
Characteristics of the space station receiver												
Satellite receive noise temperature	K	1800.0	1800.0	1800.0	1800.0	1800.0	1800.0	1800.0	1800.0	1800.0	1800.0	1800.0
Satellite receive antenna gain in the direction of the feeder link station	dB	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5
Automatic gain control setting		YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Polarization (angle as defined in Annex 2 of APS30A in case of linear polarization)												
C/I due to frequency re-use (polarization discrimination)	dB											
C/I due to other GSO BSS networks	dB											
C/I from other assignments in the Plan	dB	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
C/I from other GSO FSS systems	dB	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0

(1) Administrations are strongly encouraged to use the spreadsheet provided with this Table in order to calculate

Footnote 1: For US-GSO D5, rain effects are not relevant.

Footnote 2: See the antenna gain pattern mask in attachment 1 to document 4-9-11/165 Corr.1

Footnote 3: See "test results template" in Figure 4 of ITU Document 4-9-11/172-E, 25 June 1998.

Annex 1 : BSS system characteristics

BSS characteristics	Units	Thailand THAICOM-BSS4	Thailand THAICOM-BSS4	Malaysia Measat-bss78.5	Malaysia Measat-bss78.5	Malaysia Measat-bss78.5	Malaysia Measat-bss78.5	Malaysia Measat-bss86	Malaysia Measat-bss86	Malaysia Measat-bss86	Malaysia Measat-bss86	Malaysia Measat-bss91.5
System Characteristics												
Frequency	GHz	12.200	12.200	12.200	12.200	12.200	12.200	12.200	12.200	12.200	12.200	12.200
Availability objective	%											
Receiver noise Bandwidth	MHz	33	33	27	27	33	33	27	27	36	36	27
Modulation type		Digital	Digital	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK
Polarization (angle as defined in Annex 2 of APS30 in case of linear polarization)												
C/I due to frequency re-use (polarization discrimination)	dB											
C/I due to other GSO BSS networks	dB	30	30	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
C/I due to GSO FSS networks	dB	30.0	30.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Clear sky feeder link C/N+I	dB	25.7	25.7	27.2	25.6	26.3	24.7	27.2	25.6	27.8	24.3	27.2
C/N+I required at operating threshold	dB	12.0	12.0	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6
Clear sky C/N+I margin above operating threshold (1)	dB											
Total Clear sky C/N+I margin above operating threshold (1)	dB	7.0	7.0	9.7	9.5	8.9	8.6	9.8	9.5	8.8	8.3	9.8
C/N+I total link for 99.7% of the time	dB	9.9	9.9									
C/N+I margin above operating threshold for 99.7% of the time	dB											
Space station characteristics												
Longitude	°	124	124	78.5E	78.5E	78.5E	78.5E	86E	86E	86E	86E	91.5E
Satellite e.i.r.p. in the direction of the earth station	dBW	56	56	55.1	55.1	55.1	55.1	55	55	55	55	55
Earth station characteristics												
Receive antenna diameter	cm	90	90	60	60	60	60	60	60	60	60	60
On-axis antenna gain at receiver input	dBi											
On-axis antenna gain at antenna output	dBi	39.39	39.39	36.3	36.3	36.3	36.3	36.3	36.3	36.3	36.3	36.3
Off-axis antenna gain characteristics		Annex3 Sec.3.7.3	Annex3 Sec.3.7.3	Fig7 An3 Ap30	Fig7 An3 Ap30	Fig7 An3 Ap30	Fig7 An3 Ap30	Fig7 An3 Ap30	Fig7 An3 Ap30	Fig7 An3 Ap30	Fig7 An3 Ap30	Fig7 An3 Ap30
Clear sky receive system noise temperature at receiver input	K											
Clear sky receive system noise temperature at antenna output	K	155	155	130	130	130	130	130	130	130	130	130
Total pointing loss	dB	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Latitude	°	13.8	13.8	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1
Longitude	°	100.6	100.6	-101.4	-101.4	-101.4	-101.4	-101.4	-101.4	-101.4	-101.4	-101.4
Altitude	km	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Rain climatic zone		P	P	P	P	P	P	P	P	P	P	P
Elevation angle	°	58.5	58.5	62.9	62.9	62.9	62.9	77.8	77.8	77.8	77.8	77.8
Propagation characteristics												
Rain attenuation for 99.7% of the time	dB	7.01	7.01	5.00	5.00	5.00	5.00	4.93	4.93	4.93	4.93	4.96
Noise increase due to rain for 99.7 % of the time	dB	4.0	4.0									
Rain attenuation for availability percentage of time	dB	5.1	5.1									
Feeder link earth station characteristics												
Frequency	GHz	17.7	17.7	14.7	17.7	14.7	17.7	14.7	17.7	14.7	17.7	14.7
Maximum uplink power control		10.0	10.0									
Minimum feeder link earth station eirp	dBW	84.0	84.0	69.5	67.8	69.5	67.8	69.4	67.7	69.4	67.7	69.4
Latitude	°	14.1	14.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1
Longitude	°	100.4	100.4	-101.4	-101.4	-101.4	-101.4	-101.4	-101.4	-101.4	-101.4	-101.4
Altitude	km	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Rain climatic zone		N	N	P	P	P	P	P	P	P	P	P
Elevation angle	°	58.2	58.2	62.9	62.9	62.9	62.9	77.8	77.8	77.8	77.8	77.8
Rain attenuation for 99.97% of the time	dB	22.2	22.2	18.97	24.85	18.97	24.85	18.7	24.4	18.7	24.4	18.8
Rain attenuation for availability percentage of time	dB											
Characteristics of the space station receiver												
Satellite receive noise temperature	K	1800.0	1800.0	600.0	800.0	600.0	800.0	600.0	800.0	600.0	800.0	600.0
Satellite receive antenna gain in the direction of the feeder link station	dB	35.5	35.5	41.4	43.0	41.4	43.0	41.4	43.0	41.4	43.0	41.4
Automatic gain control setting		YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Polarization (angle as defined in Annex 2 of APS30A in case of linear polarization)												
C/I due to frequency re-use (polarization discrimination)	dB											
C/I due to other GSO BSS networks	dB											
C/I from other assignments in the Plan	dB	30.0	30.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
C/I from other GSO FSS systems	dB	30.0	30.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

(1) Administrations are strongly encouraged to use the spreadsheet provided with this Table in order to calculate

Footnote 1: For US-GSO D5, rain effects are not relevant.

Footnote 2: See the antenna gain pattern mask in attachment 1 to document 4-9-11/165 Corr.1

Footnote 3: See "test results template" in Figure 4 of ITU Document 4-9-11/172-E, 25 June 1998.

Annex 1 : BSS system characteristics

BSS characteristics	Units	Malaysia Measat-bss91.5	Malaysia Measat-bss91.5	Malaysia Measat-bss91.5	Spain E-12900	Spain E-12900	Spain E-12900	Spain HISPASAT-2	Spain HISPASAT-2	Spain HISPASAT-2	Spain CNR	Spain CNR
System Characteristics												
Frequency	GHz	12.200	12.200	12.200	12.2	12.2	12.2	12.2	12.2	12.2	12.2	12.2
Availability objective	%				99.7	99.7	99.7	99.7	99.7	99.7	99.7	99.7
Receiver noise Bandwidth	MHz	27	33	33	27	27	27	27	27	27	27	27
Modulation type		QPSK	QPSK	QPSK	FM	FM	FM	FM	FM	FM	FM	FM
Polarization (angle as defined in Annex 2 of APS30 in case of linear polarization)								CL/CR	CL/CR	CL/CR		
C/I due to frequency re-use (polarization discrimination)	dB											
C/I due to other GSO BSS networks	dB	N/A	N/A	N/A	23	23	23	23	23	23	23	23
C/I due to GSO FSS networks	dB	N/A	N/A	N/A	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Clear sky feeder link C/N+I	dB	25.6	26.3	24.7	29.58	29.58	29.58	29.06	29.06	29.06	29.83	29.83
C/N+I required at operating threshold	dB	7.6	7.6	7.6	9.22	14.4	16.4	9.22	14.4	16.4	8.07	13.37
Clear sky C/N+I margin above operating threshold (1)	dB				3.0	2.8	1.8	3.0	2.8	1.8	3.0	3.0
Total Clear sky C/N+I margin above operating threshold (1)	dB	9.5	9.0	8.7								
C/N+I total link for 99.7% of the time	dB											
C/N+I margin above operating threshold for 99.7% of the time	dB											
Space station characteristics												
Longitude	°	91.5E	91.5E	91.5E	-30	-30	-30	-30	-30	-30	-30	-30
Satellite e.i.r.p. in the direction of the earth station	dBW	55	55	55	56	56	56	56	56	56	54.8	54.8
Earth station characteristics												
Receive antenna diameter	cm	60	60	60	30	50	90	30	50	90	30	50
On-axis antenna gain at receiver input	dBi											
On-axis antenna gain at antenna output	dBi	36.3	36.3	36.3	30.0	35.0	39.5	30.0	35.0	39.5	30.0	35.0
Off-axis antenna gain characteristics		Fig7 An3 Ap30	Fig7 An3 Ap30	Fig7 An3 Ap30	BO1213	BO1213	BO1213	BO1213	BO1213	BO1213	BO1213	BO1213
Clear sky receive system noise temperature at receiver input	K											
Clear sky receive system noise temperature at antenna output	K	130	130	130	123	123	180	123	123	180	123	123
Total pointing loss	dB	0.3	0.3	0.3	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Latitude	°	3.1	3.1	3.1	40.42	40.42	40.42	40.42	40.42	40.42	27.6	27.6
Longitude	°	-101.4	-101.4	-101.4	-3.7	-3.7	-3.7	-3.7	-3.7	-3.7	-18	-18
Altitude	km	0.1	0.1	0.1	0.655	0.655	0.655	0.655	0.655	0.655	0.655	0.655
Rain climatic zone		P	P	P	H	H	H	H	H	H	H	H
Elevation angle	°	77.8	77.8	77.8								
Propagation characteristics												
Rain attenuation for 99.7% of the time	dB	4.96	4.96	4.96	1.29	1.29	1.29	1.29	1.29	1.29	1.29	1.29
Noise increase due to rain for 99.7 % of the time	dB											
Rain attenuation for availability percentage of time	dB											
Feeder link earth station characteristics												
Frequency	GHz	17.7	14.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7
Maximum uplink power control					NA	NA	NA	NA	NA	NA	NA	NA
Minimum feeder link earth station eirp	dBW	67.6	69.4	67.6	84	84	84	84	84	84	84	84
Latitude	°	3.1	3.1	3.1	40.42	40.42	40.42	40.42	40.42	40.42	40.42	40.42
Longitude	°	-101.4	-101.4	-101.4	-3.7	-3.7	-3.7	-3.7	-3.7	-3.7	-3.7	-3.7
Altitude	km	0.1	0.1	0.1	0.655	0.655	0.655	0.655	0.655	0.655	0.655	0.655
Rain climatic zone		P	P	P	H	H	H	H	H	H	H	H
Elevation angle	°	77.8	77.8	77.8								
Rain attenuation for 99.97% of the time	dB	24.6	18.8	24.6	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25
Rain attenuation for availability percentage of time	dB											
Characteristics of the space station receiver												
Satellite receive noise temperature	K	800.0	600.0	800.0	900	900	900	900	900	900	900	900
Satellite receive antenna gain in the direction of the feeder link station	dB	43.0	41.4	43.0	40.66	40.66	40.66	39.8	39.8	39.8	44.79	44.79
Automatic gain control setting		YES	YES	YES	15	15	15	15	15	15	15	15
Polarization (angle as defined in Annex 2 of APS30A in case of linear polarization)								CR/CL	CR/CL	CR/CL		
C/I due to frequency re-use (polarization discrimination)	dB											
C/I due to other GSO BSS networks	dB											
C/I from other assignments in the Plan	dB	N/A	N/A	N/A	30	30	30	30	30	30	30	30
C/I from other GSO FSS systems	dB	N/A	N/A	N/A	100	100	100	100	100	100	100	100

(1) Administrations are strongly encouraged to use the spreadsheet provided with this Table in order to calculate

Footnote 1: For US-GSO D5, rain effects are not relevant.

Footnote 2: See the antenna gain pattern mask in attachment 1 to document 4-9-11/165 Corr.1

Footnote 3: See "test results template" in Figure 4 of ITU Document 4-9-11/172-E, 25 June 1998.

Annex 1 : BSS system characteristics

BSS characteristics	Units	Spain CNR	Spain E-12900	Spain E-12900	Spain E-12900	Spain E-12900	Spain HISPASAT-2	Spain HISPASAT-2	Spain HISPASAT-2	Spain HISPASAT-2	Spain CNR	Spain CNR
System Characteristics												
Frequency	GHz	12.2	12.2	12.2	12.2	12.2	12.2	12.2	12.2	12.2	12.2	12.2
Availability objective	%	99.7	99.7	99.7	99.7	99.7	99.7	99.7	99.7	99.7	99.7	99.7
Receiver noise Bandwidth	MHz	27	33	33	33	33	33	33	33	33	33	33
Modulation type		FM	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK
Polarization (angle as defined in Annex 2 of APS30 in case of linear polarization)							CL/CR	CL/CR	CL/CR	CL/CR		
C/I due to frequency re-use (polarization discrimination)	dB											
C/I due to other GSO BSS networks	dB	23	30	30	30	30	30	30	30	30	30	30
C/I due to GSO FSS networks	dB	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Clear sky feeder link C/N+I	dB	29.83	29.50	29.50	29.50	29.50	28.90	28.90	28.90	28.90	29.81	29.81
C/N+I required at operating threshold	dB	15.49	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1
Clear sky C/N+I margin above operating threshold (1)	dB	2.0	4.5	6.4	9.7	10.9	4.5	6.4	9.7	10.9	3.3	5.3
Total Clear sky C/N+I margin above operating threshold (1)	dB											
C/N+I total link for 99.7% of the time	dB											
C/N+I margin above operating threshold for 99.7% of the time	dB											
Space station characteristics												
Longitude	°	-30	-30	-30	-30	-30	-30	-30	-30	-30	-30	-30
Satellite e.i.r.p. in the direction of the earth station	dBW	54.8	56	56	56	56	56	56	56	56	54.8	54.8
Earth station characteristics												
Receive antenna diameter	cm	90	30	40	60	90	30	40	60	90	30	40
On-axis antenna gain at receiver input	dBi											
On-axis antenna gain at antenna output	dBi	39.5	30.0	33.2	36.0	39.0	30.0	33.2	36.0	39.0	30.0	33.2
Off-axis antenna gain characteristics		BO1213	BO1213	BO1213	BO1213	BO1213	BO1213	BO1213	BO1213	BO1213	BO1213	BO1213
Clear sky receive system noise temperature at receiver input	K											
Clear sky receive system noise temperature at antenna output	K	180	123	123	123	202.7	123	123	123	202.7	180	123
Total pointing loss	dB	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Latitude	°	27.6	40.42	40.42	40.42	40.42	40.42	40.42	40.42	40.42	28	28
Longitude	°	-18	-3.7	-3.7	-3.7	-3.7	-3.7	-3.7	-3.7	-3.7	-15	-15
Altitude	km	0.655	0.655	0.655	0.655	0.655	0.655	0.655	0.655	0.655	0.655	0.655
Rain climatic zone		H	H	H	H	H	H	H	H	H	H	H
Elevation angle	°											
Propagation characteristics												
Rain attenuation for 99.7% of the time	dB	1.29	1.29	1.29	1.29	1.29	1.29	1.29	1.29	1.29	1.29	1.29
Noise increase due to rain for 99.7 % of the time	dB											
Rain attenuation for availability percentage of time	dB											
Feeder link earth station characteristics												
Frequency	GHz	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7
Maximum uplink power control		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Minimum feeder link earth station eirp	dBW	84	84	84	84	84	84	84	84	84	84	84
Latitude	°	40.42	40.42	40.42	40.42	40.42	40.42	40.42	40.42	40.42	27.6	40.42
Longitude	°	-3.7	-3.7	-3.7	-3.7	-3.7	-3.7	-3.7	-3.7	-3.7	-18	-3.7
Altitude	km	0.655	0.655	0.655	0.655	0.655	0.655	0.655	0.655	0.655	0.655	0.655
Rain climatic zone		H	H	H	H	H	H	H	H	H	H	H
Elevation angle	°											
Rain attenuation for 99.97% of the time	dB	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25
Rain attenuation for availability percentage of time	dB											
Characteristics of the space station receiver												
Satellite receive noise temperature	K	900	900	900	900	900	900	900	900	900	900	900
Satellite receive antenna gain in the direction of the feeder link station	dB	44.79	40.66	40.66	40.66	40.66	39.8	39.8	39.8	39.8	44.79	44.79
Automatic gain control setting		15	15	15	15	15	15	15	15	15	15	15
Polarization (angle as defined in Annex 2 of APS30A in case of linear polarization)							CR/CL	CR/CL	CR/CL	CR/CL		
C/I due to frequency re-use (polarization discrimination)	dB											
C/I due to other GSO BSS networks	dB											
C/I from other assignments in the Plan	dB	30	30	30	30	30	30	30	30	30	30	30
C/I from other GSO FSS systems	dB	100	100	100	100	100	100	100	100	100	100	100

(1) Administrations are strongly encouraged to use the spreadsheet provided with this Table in order to calculate

Footnote 1: For US-GSO D5, rain effects are not relevant.

Footnote 2: See the antenna gain pattern mask in attachment 1 to document 4-9-11/165 Corr.1

Footnote 3: See "test results template" in Figure 4 of ITU Document 4-9-11/172-E, 25 June 1998.

Annex 1 : BSS system characteristics

BSS characteristics	Units	Spain CNR	Spain CNR	Spain HISPASAT-1	Spain HISPASAT-1	Spain HISPASAT-1	Spain HISPASAT-1	Spain HISPASAT-1	Spain HISPASAT-1	Spain HISPASAT-1	Spain HISPASAT-1	Spain HISPASAT-1
System Characteristics												
Frequency	GHz	12.2	12.2	12.2	12.2	12.2	12.2	12.2	12.2	12.2	12.2	12.2
Availability objective	%	99.7	99.7	99.7	99.7	99.7	99.7	99.7	99.7	99.7	99.9	99.9
Receiver noise Bandwidth	MHz	33	33	33	33	33	33	33	33	33	33	33
Modulation type		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK
Polarization (angle as defined in Annex 2 of APS30 in case of linear polarization)				CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR
C/I due to frequency re-use (polarization discrimination)	dB											
C/I due to other GSO BSS networks	dB	30	30	30	30	30	30	30	30	30	30	30
C/I due to GSO FSS networks	dB	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Clear sky feeder link C/N+I	dB	29.81	29.81	29.41	29.41	29.41	29.41	29.41	29.41	29.41	29.41	29.41
C/N+I required at operating threshold	dB	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1
Clear sky C/N+I margin above operating threshold (1)	dB	8.8	10.0	2.9	2.9	2.9	2.2	2.7	2.7	2.0	4.2	4.2
Total Clear sky C/N+I margin above operating threshold (1)	dB											
C/N+I total link for 99.7% of the time	dB											
C/N+I margin above operating threshold for 99.7% of the time	dB											
Space station characteristics												
Longitude	°	-30	-30	-30	-30	-30	-30	-30	-30	-30	-30	-30
Satellite e.i.r.p. in the direction of the earth station	dBW	54.8	58.8	54.3	51.1	48.3	46.03	45.05	41.1	37.39	55.6	52.6
Earth station characteristics												
Receive antenna diameter	cm	60	90	30	40	60	90	120	180	240	40	60
On-axis antenna gain at receiver input	dBi											
On-axis antenna gain at antenna output	dBi	36.0	39.0	30.0	33.2	36.0	39.0	41.0	44.5	48.0	33.2	36.0
Off-axis antenna gain characteristics		BO1213	BO1213	BO1213	BO1213	BO1213	BO1213	BO1213	BO1213	BO1213	BO1213	BO1213
Clear sky receive system noise temperature at receiver input	K											
Clear sky receive system noise temperature at antenna output	K	123	202	123	123	123	201	201	201	201	123	123
Total pointing loss	dB	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Latitude	°	28	28	40.42	40.42	40.42	40.42	40.42	40.42	40.42	40.42	40.42
Longitude	°	-15	-15	-3.7	-3.7	-3.7	-3.7	-3.7	-3.7	-3.7	-3.7	-3.7
Altitude	km	0.655	0.655	0.655	0.655	0.655	0.655	0.655	0.655	0.655	0.655	0.655
Rain climatic zone		H	H	H	H	H	H	H	H	H	H	H
Elevation angle	°											
Propagation characteristics												
Rain attenuation for 99.7% of the time	dB	1.29	1.29	1.29	1.29	1.29	1.29	1.29	1.29	1.29	1.29	1.29
Noise increase due to rain for 99.7 % of the time	dB											
Rain attenuation for availability percentage of time	dB											
Feeder link earth station characteristics												
Frequency	GHz	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7
Maximum uplink power control		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Minimum feeder link earth station eirp	dBW	84	84	84	84	84	84	84	84	84	84	84
Latitude	°	40.42	40.42	40.42	40.42	40.42	40.42	40.42	40.42	40.42	40.42	40.42
Longitude	°	-3.7	-3.7	-3.7	-3.7	-3.7	-3.7	-3.7	-3.7	-3.7	-3.7	-3.7
Altitude	km	0.655	0.655	0.655	0.655	0.655	0.655	0.655	0.655	0.655	0.655	0.655
Rain climatic zone		H	H	H	H	H	H	H	H	H	H	H
Elevation angle	°											
Rain attenuation for 99.97% of the time	dB	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25
Rain attenuation for availability percentage of time	dB											
Characteristics of the space station receiver												
Satellite receive noise temperature	K	900	900	900	900	900	900	900	900	900	900	900
Satellite receive antenna gain in the direction of the feeder link station	dB	44.79	44.79	39.8	39.8	39.8	39.8	39.8	39.8	39.8	39.8	39.8
Automatic gain control setting		15	15	15	15	15	15	15	15	15	15	15
Polarization (angle as defined in Annex 2 of APS30A in case of linear polarization)				CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL
C/I due to frequency re-use (polarization discrimination)	dB											
C/I due to other GSO BSS networks	dB											
C/I from other assignments in the Plan	dB	30	30	30	30	30	30	30	30	30	30	30
C/I from other GSO FSS systems	dB	100	100	100	100	100	100	100	100	100	100	100

(1) Administrations are strongly encouraged to use the spreadsheet provided with this Table in order to calculate

Footnote 1: For US-GSO D5, rain effects are not relevant.

Footnote 2: See the antenna gain pattern mask in attachment 1 to document 4-9-11/165 Corr.1

Footnote 3: See "test results template" in Figure 4 of ITU Document 4-9-11/172-E, 25 June 1998.

Annex 1 : BSS system characteristics

BSS characteristics	Units	Spain HISPASAT-1	Spain HISPASAT-1	Spain HISPASAT-1	Spain HISPASAT-1	Spain HISPASAT-1	Spain HISPASAT-1	Spain HISPASAT-1	Spain HISPASAT-1	Spain HISPASAT-1	Spain HISPASAT-1	Spain HSA MOD
System Characteristics												
Frequency	GHz	12.2	12.2	12.2	12.2	12.2	12.2	12.2	12.2	12.2	12.2	12.2
Availability objective	%	99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.7
Receiver noise Bandwidth	MHz	33	33	33	33	33	33	33	33	33	33	33
Modulation type		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK
Polarization (angle as defined in Annex 2 of APS30 in case of linear polarization)		CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	CL/CR	Linear
C/I due to frequency re-use (polarization discrimination)	dB											
C/I due to other GSO BSS networks	dB	30	30	30	30	30	30	30	30	30	30	30
C/I due to GSO FSS networks	dB	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Clear sky feeder link C/N+I	dB	29.41	29.41	29.41	29.41	29.41	29.41	29.41	29.41	29.41	29.41	24.34
C/N+I required at operating threshold	dB	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1
Clear sky C/N+I margin above operating threshold (1)	dB	3.5	3.5	3.5	3.5	4.2	4.2	3.5	3.5	3.5	3.5	2.9
Total Clear sky C/N+I margin above operating threshold (1)	dB											
C/N+I total link for 99.7% of the time	dB											
C/N+I margin above operating threshold for 99.7% of the time	dB											
Space station characteristics												
Longitude	°	-30	-30	-30	-30	-30	-30	-30	-30	-30	-30	-30
Satellite e.i.r.p. in the direction of the earth station	dBW	50.42	49.6	46.1	41.65	57.6	54.6	52.4	51.6	48.1	43.65	54.3
Earth station characteristics												
Receive antenna diameter	cm	90	120	180	240	40	60	90	120	180	240	30
On-axis antenna gain at receiver input	dBi											
On-axis antenna gain at antenna output	dBi	39.0	41.0	44.5	48.0	33.2	36.0	39.0	41.0	44.5	48.0	30.0
Off-axis antenna gain characteristics		BO1213	BO1213	BO1213	BO1213	BO1213	BO1213	BO1213	BO1213	BO1213	BO1213	BO1213
Clear sky receive system noise temperature at receiver input	K											
Clear sky receive system noise temperature at antenna output	K	201	201	201	201	123	123	201	201	201	201	123
Total pointing loss	dB	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Latitude	°	40.42	40.42	40.42	40.42	40.42	40.42	40.42	40.42	40.42	40.42	40.42
Longitude	°	-3.7	-3.7	-3.7	-3.7	-3.7	-3.7	-3.7	-3.7	-3.7	-3.7	-3.7
Altitude	km	0.655	0.655	0.655	0.655	0.655	0.655	0.655	0.655	0.655	0.655	0.655
Rain climatic zone		H	H	H	H	H	H	H	H	H	H	H
Elevation angle	°											
Propagation characteristics												
Rain attenuation for 99.7% of the time	dB	1.29	1.29	1.29	1.29	1.29	1.29	1.29	1.29	1.29	1.29	1.29
Noise increase due to rain for 99.7 % of the time	dB											
Rain attenuation for availability percentage of time	dB											
Feeder link earth station characteristics												
Frequency	GHz	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7
Maximum uplink power control		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Minimum feeder link earth station eirp	dBW	84	84	84	84	84	84	84	84	84	84	84
Latitude	°	40.42	40.42	40.42	40.42	40.42	40.42	40.42	40.42	40.42	40.42	40.42
Longitude	°	-3.7	-3.7	-3.7	-3.7	-3.7	-3.7	-3.7	-3.7	-3.7	-3.7	-3.7
Altitude	km	0.655	0.655	0.655	0.655	0.655	0.655	0.655	0.655	0.655	0.655	0.655
Rain climatic zone		H	H	H	H	H	H	H	H	H	H	H
Elevation angle	°											
Rain attenuation for 99.97% of the time	dB	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25
Rain attenuation for availability percentage of time	dB											
Characteristics of the space station receiver												
Satellite receive noise temperature	K	900	900	900	900	900	900	900	900	900	900	900
Satellite receive antenna gain in the direction of the feeder link station	dB	39.8	39.8	39.8	39.8	39.8	39.8	39.8	39.8	39.8	39.8	38.5
Automatic gain control setting		15	15	15	15	15	15	15	15	15	15	15
Polarization (angle as defined in Annex 2 of APS30A in case of linear polarization)		CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	CR/CL	Linear
C/I due to frequency re-use (polarization discrimination)	dB											
C/I due to other GSO BSS networks	dB											
C/I from other assignments in the Plan	dB	30	30	30	30	30	30	30	30	30	30	30
C/I from other GSO FSS systems	dB	100	100	100	100	100	100	100	100	100	100	100

(1) Administrations are strongly encouraged to use the spreadsheet provided with this Table in order to calculate

Footnote 1: For US-GSO D5, rain effects are not relevant.

Footnote 2: See the antenna gain pattern mask in attachment 1 to document 4-9-11/165 Corr.1

Footnote 3: See "test results template" in Figure 4 of ITU Document 4-9-11/172-E, 25 June 1998.

Annex 1 : BSS system characteristics

BSS characteristics	Units	Spain HSA MOD	Spain HSA MOD	Spain HSA MOD	Spain HSA MOD	Spain HSA MOD	Spain HSA MOD	Spain HSA MOD	Spain HSA MOD	Spain HSA MOD	Spain HSA MOD	Spain HSA MOD
System Characteristics												
Frequency	GHz	12.2	12.2	12.2	12.2	12.2	12.2	12.2	12.2	12.2	12.2	12.2
Availability objective	%	99.7	99.7	99.7	99.7	99.7	99.7	99.9	99.9	99.9	99.9	99.9
Receiver noise Bandwidth	MHz	33	33	33	33	33	33	33	33	33	33	33
Modulation type		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK
Polarization (angle as defined in Annex 2 of APS30 in case of linear polarization)		Linear	Linear	Linear	Linear	Linear	Linear	Linear	Linear	Linear	Linear	Linear
C/I due to frequency re-use (polarization discrimination)	dB											
C/I due to other GSO BSS networks	dB	30	30	30	30	30	30	30	30	30	30	30
C/I due to GSO FSS networks	dB	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Clear sky feeder link C/N+I	dB	24.34	24.34	24.34	24.34	24.34	24.34	24.34	24.34	24.34	24.34	24.34
C/N+I required at operating threshold	dB	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1
Clear sky C/N+I margin above operating threshold (1)	dB	3.0	3.0	2.3	2.3	2.4	2.4	4.3	3.9	3.6	3.7	3.7
Total Clear sky C/N+I margin above operating threshold (1)	dB											
C/N+I total link for 99.7% of the time	dB											
C/N+I margin above operating threshold for 99.7% of the time	dB											
Space station characteristics												
Longitude	°	-30	-30	-30	-30	-30	-30	-30	-30	-30	-30	-30
Satellite e.i.r.p. in the direction of the earth station	dBW	51.4	48.4	46.04	44.5	40.87	37.4	53.4	51.3	49.4	45.6	42.1
Earth station characteristics												
Receive antenna diameter	cm	40	60	90	120	180	240	60	90	120	180	240
On-axis antenna gain at receiver input	dBi											
On-axis antenna gain at antenna output	dBi	33.2	36.0	39.0	41.0	44.5	48.0	36.0	39.0	41.0	44.5	48.0
Off-axis antenna gain characteristics		BO1213	BO1213	BO1213	BO1213	BO1213	BO1213	BO1213	BO1213	BO1213	BO1213	BO1213
Clear sky receive system noise temperature at receiver input	K											
Clear sky receive system noise temperature at antenna output	K	123	123	201	201	201	201	123	201	201	201	201
Total pointing loss	dB	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Latitude	°	40.42	40.42	40.42	40.42	40.42	40.42	40.42	40.42	40.42	40.42	40.42
Longitude	°	-3.7	-3.7	-3.7	-3.7	-3.7	-3.7	-3.7	-3.7	-3.7	-3.7	-3.7
Altitude	km	0.655	0.655	0.655	0.655	0.655	0.655	0.655	0.655	0.655	0.655	0.655
Rain climatic zone		H	H	H	H	H	H	H	H	H	H	H
Elevation angle	°											
Propagation characteristics												
Rain attenuation for 99.7% of the time	dB	1.29	1.29	1.29	1.29	1.29	1.29	1.29	1.29	1.29	1.29	1.29
Noise increase due to rain for 99.7 % of the time	dB											
Rain attenuation for availability percentage of time	dB											
Feeder link earth station characteristics												
Frequency	GHz	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7
Maximum uplink power control		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Minimum feeder link earth station eirp	dBW	84	84	84	84	84	84	84	84	84	84	84
Latitude	°	40.42	40.42	40.42	40.42	40.42	40.42	40.42	40.42	40.42	40.42	40.42
Longitude	°	-3.7	-3.7	-3.7	-3.7	-3.7	-3.7	-3.7	-3.7	-3.7	-3.7	-3.7
Altitude	km	0.655	0.655	0.655	0.655	0.655	0.655	0.655	0.655	0.655	0.655	0.655
Rain climatic zone		H	H	H	H	H	H	H	H	H	H	H
Elevation angle	°											
Rain attenuation for 99.97% of the time	dB	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25
Rain attenuation for availability percentage of time	dB											
Characteristics of the space station receiver												
Satellite receive noise temperature	K	900	900	900	900	900	900	900	900	900	900	900
Satellite receive antenna gain in the direction of the feeder link station	dB	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5
Automatic gain control setting		15	15	15	15	15	15	15	15	15	15	15
Polarization (angle as defined in Annex 2 of APS30A in case of linear polarization)		Linear	Linear	Linear	Linear	Linear	Linear	Linear	Linear	Linear	Linear	Linear
C/I due to frequency re-use (polarization discrimination)	dB											
C/I due to other GSO BSS networks	dB											
C/I from other assignments in the Plan	dB	30	30	30	30	30	30	30	30	30	30	30
C/I from other GSO FSS systems	dB	100	100	100	100	100	100	100	100	100	100	100

(1) Administrations are strongly encouraged to use the spreadsheet provided with this Table in order to calculate

Footnote 1: For US-GSO D5, rain effects are not relevant.

Footnote 2: See the antenna gain pattern mask in attachment 1 to document 4-9-11/165 Corr.1

Footnote 3: See "test results template" in Figure 4 of ITU Document 4-9-11/172-E, 25 June 1998.

BSS characteristics	Units	Spain	Spain	Spain	Spain	Spain
		HSA MOD	HSA MOD	HSA MOD	HSA MOD	HSA MOD
System Characteristics						
Frequency	GHz	12.2	12.2	12.2	12.2	12.2
Availability objective	%	99.9	99.9	99.9	99.9	99.9
Receiver noise Bandwidth	MHz	33	33	33	33	33
Modulation type		QPSK	QPSK	QPSK	QPSK	QPSK
Polarization (angle as defined in Annex 2 of APS30 in case of linear polarization)		Linear	Linear	Linear	Linear	Linear
C/I due to frequency re-use (polarization discrimination)	dB					
C/I due to other GSO BSS networks	dB	30	30	30	30	30
C/I due to GSO FSS networks	dB	100.0	100.0	100.0	100.0	100.0
Clear sky feeder link C/N+I	dB	24.34	24.34	24.34	24.34	24.34
C/N+I required at operating threshold	dB	6.1	6.1	6.1	6.1	6.1
Clear sky C/N+I margin above operating threshold (1)	dB	4.3	3.9	3.6	3.7	3.7
Total Clear sky C/N+I margin above operating threshold (1)	dB					
C/N+I total link for 99.7% of the time	dB					
C/N+I margin above operating threshold for 99.7% of the time	dB					
Space station characteristics						
Longitude	°	-30	-30	-30	-30	-30
Satellite e.i.r.p. in the direction of the earth station	dBW	55.4	53.3	51.4	47.6	44.1
Earth station characteristics						
Receive antenna diameter	cm	60	90	120	180	240
On-axis antenna gain at receiver input	dBi					
On-axis antenna gain at antenna output	dBi	36.0	39.0	41.0	44.5	48.0
Off-axis antenna gain characteristics		BO1213	BO1213	BO1213	BO1213	BO1213
Clear sky receive system noise temperature at receiver input	K					
Clear sky receive system noise temperature at antenna output	K	123	201	201	201	201
Total pointing loss	dB	0.5	0.5	0.5	0.5	0.5
Latitude	°	40.42	40.42	40.42	40.42	40.42
Longitude	°	-3.7	-3.7	-3.7	-3.7	-3.7
Altitude	km	0.655	0.655	0.655	0.655	0.655
Rain climatic zone		H	H	H	H	H
Elevation angle	°					
Propagation characteristics						
Rain attenuation for 99.7% of the time	dB	1.29	1.29	1.29	1.29	1.29
Noise increase due to rain for 99.7 % of the time	dB					
Rain attenuation for availability percentage of time	dB					
Feeder link earth station characteristics						
Frequency	GHz	17.7	17.7	17.7	17.7	17.7
Maximum uplink power control		NA	NA	NA	NA	NA
Minimum feeder link earth station eirp	dBW	84	84	84	84	84
Latitude	°	40.42	40.42	40.42	40.42	40.42
Longitude	°	-3.7	-3.7	-3.7	-3.7	-3.7
Altitude	km	0.655	0.655	0.655	0.655	0.655
Rain climatic zone		H	H	H	H	H
Elevation angle	°					
Rain attenuation for 99.97% of the time	dB	6.25	6.25	6.25	6.25	6.25
Rain attenuation for availability percentage of time	dB					
Characteristics of the space station receiver						
Satellite receive noise temperature	K	900	900	900	900	900
Satellite receive antenna gain in the direction of the feeder link station	dB	38.5	38.5	38.5	38.5	38.5
Automatic gain control setting		15	15	15	15	15
Polarization (angle as defined in Annex 2 of APS30A in case of linear polarization)		Linear	Linear	Linear	Linear	Linear
C/I due to frequency re-use (polarization discrimination)	dB					
C/I due to other GSO BSS networks	dB					
C/I from other assignments in the Plan	dB	30	30	30	30	30
C/I from other GSO FSS systems	dB	100	100	100	100	100

(1) Administrations are strongly encouraged to use the spreadsheet provided with this Table in order to calculate

Footnote 1: For US-GSO D5, rain effects are not relevant.

Footnote 2: See the antenna gain pattern mask in attachment 1 to document 4-9-11/165 Corr.1

Footnote 3: See "test results template" in Figure 4 of ITU Document 4-9-11/172-E, 25 June 1998.