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~~I.~~30 April 2002
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~~I.~~Mr. Michael Helm
~~I.~~Director General, Telecommunications Policy Branch
~~I.~~Industry Canada
~~I.~~300 Slater Street
~~I.~~Ottawa, Ontario K1A 0C8
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~~I.~~Dear Mr. Helm:
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~~I.~~Re: *Consultation on Revisions to Spectrum Utilization Policies in the 3-30 GHz Frequency Range*,
~~I.~~<u>Canada Gazette Part I, January 19, 2002, Notice No. DGTP-001-02 (the "Consultation").</u>
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~~I.~~Teledesic (Canada) Inc. and Teledesic LLC (collectively "Teledesic") are grateful for the opportunity to provide comments to Industry Canada on possible revisions to the spectrum utilization policy in the 3-30 GHz frequency range.

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~~I.~~Teledesic supports the Department's proposal to amend its spectrum utilization policies in the Ka-band (17.7-20.2 GHz / 27.5-30 GHz) portion of this frequency range with respect to band segmentation proposals and the concept of "soft partitioning". Furthermore, Teledesic was actively engaged in the discussions that led to the preparation of the Radio Advisory Board of Canada ("RABC") response to the Consultation. In fact, Teledesic views were for the most part reflected in the RABC response, and Teledesic also wishes to express its general concurrence with the views stated as "FSS views" in that document.

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~~I.~~In addition to supporting the RABC response and the "FSS views" contained therein, there are a few areas in which Teledesic would like to expand, which are further elaborated upon in this letter. The following addresses only the Ka-band portion of the frequency spectrum and in many instances focuses on the specific portions of this band (18.8-19.3 GHz / 28.6-29.1 GHz) which were made available for non-GSO FSS use by the ITU during WRC-95 and WRC-97.

These are referred to in this document as the "non-GSO FSS" bands for simplicity, recognizing that they are also available for GSO FSS use on a first-come, first-served coordination process.

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I. Partitioning of the Ka-band Frequency Range

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~~I.~~This proceeding presents the Department with a rare opportunity to achieve several important policy goals while maximizing the deployment of both the FSS and the FS in their respective portions of the Ka-band frequency range. The Department proposed to partition the Ka-band frequency range in a manner described as "soft partitioning". The RABC endorsed this approach, which Teledesic also supports. In addition, the RABC has proposed specific footnotes to implement this novel kind of partitioning which are essential for this process to work. Otherwise, the concept of "soft partitioning" would remain ill-defined and there would be no way to ensure that the bands identified primarily for FSS use would be fully available for such use.

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~~I.~~In summary, Teledesic supports the Department's proposals that emphasis be placed on the FSS for the bands 18.58-18.8 GHz and 18.8-19.3 GHz in the space-to-Earth direction, and the bands 28.35-28.6 GHz, 28.6-29.1 GHz and 29.25-29.5 GHz in the Earth-to-space direction. Teledesic also supports the no change to exclusive FSS in the 19.7-20.2 GHz and 29.5-30 GHz bands as well as the RABC proposed footnotes C[AAA] to C[GGG] in the Ka-band frequency range.

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II. Technical Sharing Studies in the 28 GHz Range

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~~I.~~It is generally accepted that high density deployment of stations in the fixed service, such as LMCS in the 28 GHz band, cannot share the same frequencies in the same geographic area, with the FSS. Conversely, high density, ubiquitous deployment of earth stations in the fixed-satellite service cannot be deployed in the same area as the terrestrial services. This was recognized by Industry Canada as early as 1996 when the Department issued its proposed spectrum licensing rules for LMCS in Canada[1]. At that time, the department recognized that these types of services could not share spectrum to any great extent in the same geographic area and later adopted footnote C47A[2].

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At the last ITU-R WP 4-9S meeting, the working party adopted a similar position in the development of draft CPM text in relation to agenda item 1.25 of the upcoming WRC-03 Conference[3]. Furthermore, the working party also adopted a Preliminary Draft New

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[1] Local Multipoint Communication Systems (LMCS) in the 28 GHz range: Policy, Authorization Procedures and Evaluation Criteria (March 1996)

[2] **C47A (CAN-00)** The band 27.35 – 28.35 GHz is being licensed for local multipoint communication systems (LMCS) in the fixed service, which will be given priority over fixed-satellite service systems sharing this spectrum on a co-primary basis. Fixed-satellite service implementation in this band will be limited to applications which will pose minimal constraints upon the deployment of fixed service systems, such as a small number of large antennas for feeder links.

[3] Document WP 4-9S/TEMP/129 (25 April 2002)

Recommendation[4] ("PDNR") titled "On the sharing between point-to-point and point-to-multipoint FS and transmitting FSS earth station, GSO and non-GSO, in the 27.5-29.5 GHz band" which reflects similar conclusions. For convenience, the text of this PDNR is contained in Attachment 1. However, sharing between high density applications in the FS, such as LMCS, with limited deployment of earth stations, such as gateways, is technically feasible. This is possible because the LMCS service areas can be well defined and are normally restricted to populated centers, so it is possible to coordinate a few specific FSS earth stations that will protect all of the LMCS service areas. On the other hand, in the bands that are primarily identified for FSS use, it is difficult to imagine a realistic terrestrial service or network that would not impose major restrictions and constraints on the ubiquitous nature of the FSS deployment since these will be located anywhere in Canada.

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III. Technical Sharing Studies in the 18 GHz Range

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~~I.~~While the sharing feasibility between FS and FSS in the downlink bands has not been agreed to on a worldwide basis, the sharing in the 18 GHz frequency range between high density, ubiquitous deployment in the FSS and point-to-point links in the FS also poses major constraints on both services. The Department recognized this in the formulation of its proposal for "soft partitioning" in the Ka-band downlink. A study[5] was prepared for the ITU-R WP 4-9S in 1998 that clearly shows the impact of interference from transmitting point-to-point FS stations into FSS receivers in the non-GSO FSS downlink band. This study, reproduced in Attachment 2 to this letter, clearly shows the exclusion areas, where deployment of FSS terminals would not be possible due to potential for unacceptable interference from FS transmitters in the three most important metropolitan areas of Canada: namely, Toronto, Montreal and Vancouver.

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~~I.~~These results indicate that in the absence of significant terrain or building blockage about half of each of these metropolitan areas would be precluded from FSS service due to the *existing* FS deployment at the time the study was conducted. While in these urban areas some blockage will result from man-made structures, these can also cause signal reflections resulting in new interference paths. These two factors tend to cancel each other out. Also, mitigation techniques, such as ATPC on the FS transmitters, can reduce the size of the exclusion areas, but this would be offset by the increased deployment of FS stations. Finally, it was shown in the ITU-R that proposed mitigation techniques for the FSS were either not technically feasible or too onerous for high-density applications.

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Therefore, without some remedial action, the existing and continued deployment of the terrestrial services in the non-GSO FSS downlink band would exclude a large portion of the most lucrative markets for the FSS. This would seriously jeopardize the financial viability of the non-GSO FSS in the Ka-band. Therefore, some form of band segmentation or more than soft partitioning is essential in the 18 GHz frequency range if Canada wants to take advantage of the benefits offered by non-GSO FSS.

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IV. Possible Frequency Plans

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[4] Document WP 4-9S/TEMP/121 (24 April 2002)

[5] Document WP 4-9S/81 (21 September 1998)

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~~I.~~In its Consultation, the Department proposed a soft partitioning band plan for the 18 GHz range (section 5.4 on page 18) and the 28 GHz range (section 5.7 on page 21). These were supported by the RABC and are supported by Teledesic. For the FSS uplink bands in the 28 GHz range, the Department's proposal suffices since there are no existing FS stations deployed above 28.35 GHz, the uppermost frequency in the LMCS band. Therefore, no further action beyond the adoption of the band plan and the subsequent restrictions on the deployment of FS stations per the RABC proposed footnotes C[EEE] and C[GGG] are required.

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~~I.~~For the FSS downlink bands however, the situation is not as clear. The RABC proposed several new footnotes C[AAA], C[BBB] and C[CCC] that will implement the soft-partitioning approach. The issue of existing FS stations in the bands identified primarily for FSS use, under proposed footnote C[BBB], was not explicitly covered in the RABC response. The RABC recognized the need for new channelization plans to accommodate future FS deployment in the 18 GHz band, stating that "To accommodate the type of FS systems that are currently deployed in these bands, the Department is urged to adopt a frequency plan for low and medium capacity systems in the bands 17.8-18.14 GHz and 19.3-19.7 GHz as soon as possible.[6]"

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~~I.~~Attachment 3 to this letter further expands on this idea and proposes alternatives to the Department's suggested band plan as discussed in section 5.4 of the consultation under the heading "17.8-18.58 GHz", where the band 17.8-18.2 GHz is proposed to be paired with 18.2-18.58 GHz.

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V. Restrictions on the Deployment of FS Stations in bands identified for FSS Use

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~~I.~~During the deliberations that led to the formulation of the RABC response, the issue of existing FS stations deployed in bands that are to be designated for prioritized FSS use was discussed. The RABC could not agree on an immediate solution to this issue and proposed that it be dealt with as follows: "With respect to existing licensed FS stations in the band, the Board suggests that Industry Canada undertake a subsequent consultation to deal with the issues of the existing Fixed Service, consistent with the prioritization of FSS use."

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~~I.~~While Teledesic can agree that this issue be treated in a subsequent consultation, it firmly believes that the Department should base its proposals on the precedents that have served Canadians so well in the past. Teledesic would propose that the Department follow the procedures adopted in previous radio station relocations such as in the PCS and the 2 GHz MSS relocations. In the latter case, the Department adopted a process which is both fair to the incumbents and the new entrants. This process[7] would be well suited to the relocation of FS stations in those portions of the 18 GHz band where FSS priority has been established.

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[6] RABC draft response to DGTP-001-02, dated 2004-04-30 (http://www.rabc.ottawa.on.ca/english/broadlist.cfm?type=fixe&doctype=docs)

[7] Amendments to the Microwave Spectrum Utilization Policies in the 1-3 GHz Frequency Range (DGTP-06-99)

~~I.~~This process could be easily adapted to the sharing situation in the 18 GHz band by taking the essential steps and adapting them to the FSS situation, an example of which is reproduced in Attachment 4.

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VI. Conclusion

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~~I.~~This proceeding presents the Department with an excellent opportunity to achieve several important policy goals for the harmonious development of the Fixed-Satellite Service and the Fixed Service in many frequency bands. Adoption of the partitioning proposals as proposed by the Department, and as further refined by the RABC, will achieve important policy goals like rural and remote deployment and the development of new advanced services. This will only be possible in the Ka-band frequency range, however, if the essentially incompatible satellite and terrestrial services are operated on separate spectrum to allow unconstrained deployment of terminals in both services.

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~~I.~~Respectfully submitted,

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~~I.~~Marc Dupuis
~~I.~~Director, Canadian Strategic Relations
~~I.~~Teledesic

INTERNATIONAL TELECOMMUNICATION UNION

RADIOCOMMUNICATION STUDY GROUPS

Document 4-9S/TEMP/121-E
24 April 2002
English only

Source: Document 4-9S/110 (pp. 206-223)

Working Party 4-9S
(Sub-Working Party 4-9S3 DG-C)

PRELIMINARY DRAFT NEW RECOMMENDATION [SAT28GHz-E-S]

On the sharing between point-to-point and point-to-multipoint FS and transmitting FSS earth station, GSO and non-GSO, in the 27.5-29.5 GHz band

(Questions ITU-R 237-2/4 and 206-2/9)

The ITU Radiocommunication Assembly,

considering

a) that the band 27.5-29.5 GHz is allocated to both the fixed service and the fixed-satellite service (Earth-to-space), as well as the mobile service on a primary basis in the Radio Regulations;

b) that the use of the band 28.6-29.1 GHz by FSS systems is subject to **RR 5.523A**;

c) that individual FSS earth stations can be coordinated within the whole band 27.5 - 29.5 GHz;

d) that some FSS systems intend to deploy a small number of large antenna earth stations on a coordinated basis;

e) that high density applications in the FSS (HD-FSS) employ a large number of small ubiquitously deployed user terminals;

f) that conventional method to coordinate such a large number of ubiquitously deployed FSS earth stations may imply a large burden for administrations,

recommends

1 that administrations avoid the deployment of FS receiver stations and large numbers of FSS transmitting earth stations with overlapping frequencies in the same geographical area taking into account the results of studies given in the Annex.

ANNEX

Report on the sharing between point-to-point and point-to-multipoint FS and transmitting FSS earth station, GSO and non-GSO, in the 27.5-29.5 GHz band

1 Introduction

Frequency bands have been allocated and identified for use by GSO and non-GSO FSS systems in the 28 GHz bands shared on a primary basis with the FS. WRC-95/97 facilitated the use of the bands 18.8-19.3 GHz and 28.6-29.1 GHz for non-GSO FSS systems within the FSS allocations. The interference from a GSO and non-GSO FSS earth station transmitting in the band 27.5-29.5 GHz into a FS receiver is studied in this text.

Co-frequency operation of Multipoint Distribution Systems (MDS) (e.g. Local Multipoint Communication/Distribution Systems (LMCS/LMDS)) or Point-to-Point Systems of the Fixed Service (FS) and earth stations of the Fixed Satellite Service (FSS) (Earth to space) in the same geographical area would be difficult and would severely constrain the development of both types of services. Any FS system receivers can suffer long-term and significant short-term interference from FSS uplinks as shown in Figure 1. The severity of this interference is a function of terminal separation, terrain and man-made obstacles, antenna discrimination, FSS Earth Station output power, and FS systems interference allowance.

This report contains the description and results of two studies. One has been updated during the last period to include the effects of diffraction loss in accordance with Recommendation ITU-R P.526 and subsequently updated to reflect the new MDS system characteristics provided in Rec. ITU-R F.758.

Other types of FS and FSS systems operating in the 28 GHz band may require further study.

2 MDS Description

A generic description of an MDS system has been developed using parameters consistent with Recommendation ITU-R F.758-2. The applicability of these parameters in the band 27.5-29.5 GHz has been confirmed by current manufacturers and operators of MDS equipment. The representative RF receiver characteristics used in the deterministic studies are shown in Table 1 for five hub stations and four subscriber stations.

MDS networks are comprised of one or more hub stations serving multiple subscriber stations. Subscribers are assigned to one hub station, based on proximity. Hub stations employ an omni-directional or sectored antenna, while the subscriber stations typically use a much higher-gain dish antenna. Service path links will typically be around 5 Km. Depending on modulation and access methods, a hub station can potentially accommodate a large number of users.

Characteristics of FS links are also provided by the Recommendation ITU-R F.758 and manufacturers have confirmed their validity in the 27.5-29.5 GHz band. Antenna gains are usually higher for FS point-to-point links than for MDS and can reach 46 dBi.

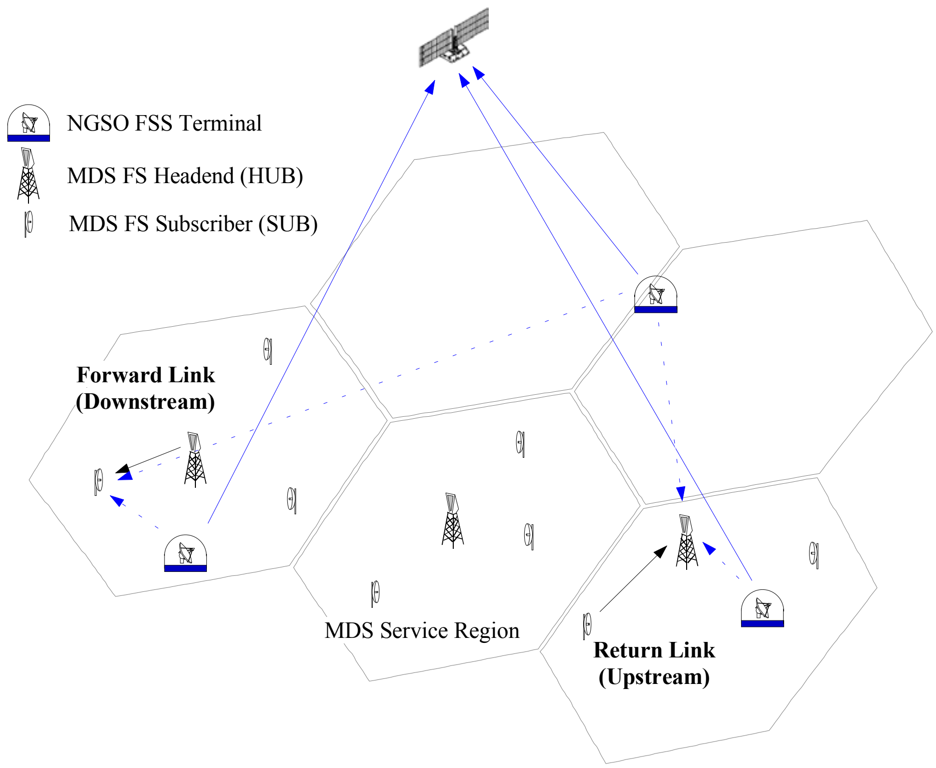

FIGURE 1

FSS/FS Sharing Environment

TABLE 1

Generic MDS System Receiver Description

Parameter	**Hub Systems**				
Hub Receiver	HUB 1	HUB 2	HUB 3	HUB 4	HUB 5
Receive Gain, dBi	20 (90° sect.)	15 (90° x 15°)	15 (90° x 15°)	24 (45° x 3°)	24 (45° x 3°)
IF Bandwidth, MHz	16.4	1.36	2.50	1.36	2.50
Receiver Noise Figure, dB	10	7.5	7.5	7.5	7.5
Noise Power, dBW	-121.8	-135.1	-132.5	-135.1	-132.5
Long-term Interference, dBW	-131.8	-144.3	-141.6	-144.3	-141.6
	Subscriber Systems				
Subscriber Receiver	SUB 1	SUB 2	SUB 3	SUB 4	
Receive Gain, dBi	47	36	36	36	
IF Bandwidth, MHz	16.4	40	1.36	50	
Receiver Noise Figure, dB	8	7	7	7	
Noise Power, dBW	-123.8	-121.0	-135.6	-120.0	
Long-term Interference, dBW	-133.8	-130.1	-144.8	-129.1	

Source: Recommendation ITU-R F.758-2, Tables 16, 17 and 18

3 FSS Uplink Descriptions

Previous studies of coordination distances and required separation distances between FS and FSS earth stations have shown that results are similar whether the FSS earth station is communicating with a GSO or a non-GSO satellite. These studies examine mainly non-GSO FSS earth stations but also GSO FSS earth stations.

3.1 Generic non-GSO FSS Systems

Several different non-GSO FSS systems have been proposed with a variety of uplink characteristics. Table 2 provides an abbreviated summary of several non-GSO uplink parameters useful in assessing potential interference into an MDS receiver. The LEOSAT-1 system specifies a clear-sky transmit power of –0.7 dBW in 3.1 MHz. The far-side lobe for a small 0.3 m antenna would be –3.8 dBi. Reduced distances would results if FSS antennas with improved side lobe performances were to be used. One USAMEO-1 uplink specifies a clear sky power of approximately 11.3 dBW in 2.8 MHz using a 90 cm antenna. Based on Recommendation ITU-R S.465, the far-side lobe level would be −9.6 dBi.

TABLE 2

Several non-GSO FSS System Uplink Parameters

System	Gain dBi	Bandwidth MHz	e.i.r.p. Density dB(W/Hz)
USAMEO-4	41.9	1.445	-21.4
USAMEO-1 65 cm	44.16	0.562	-6.06
USAMEO-1 90 cm	46.98	2.812	-6.25
USAMEO-3 32 cm	38.8	2.628	-26.90
USAMEO-3 52 cm	44.0	13.142	-26.89
USAMEO-2 KSL	55.2	250.0	-17.27
LEOSAT-2 DTH	35.6	4.244	-33.08
LEOSAT-2 LB	48.4	97.421	-31.39
LEOSAT-2 SB	45.9	20.31	-33.28
USAKA-L1 FWD	56.0	22.6	-21.31
USAKA-L1 RTN	39.8	2.93	-26.15
LEOSAT-1 TST	35.2	3.1	-30.41

4 Analysis for non-GSO FSS and P-MP FS systems

Any transmitting FSS earth station can contribute to the short and long-term interference levels of the MDS hub and subscriber stations.

The first study presented below is a deterministic analysis. The second is a statistical analysis.

4.1 Deterministic analysis

Separation distances required to avoid harmful interference between an FSS earth station transmitter and an FS receiver can be calculated using the simplified link equation procedure described in Appendix A to this annex. The calculations assume line-of-sight propagation mechanisms in clear sky conditions and an additional transmission loss due to diffraction over a spherical earth for transhorizon paths. The attenuation due to rain has not been taken into account. Advantages in terrain blockages and additional Fixed Service terminals antenna discrimination (arising from different elevations) were not included in this study because their effects cannot be guarantied in any scenario. Although such effects can result in improvements in the interference, these would tend to be off-set by three other factors that would increase the interference in a detailed analysis: 1) The present analysis makes the conservative assumption of the FSS earth station transmit antenna only interferes via the back-lobes whereas real implementations would sometimes have the earth station antenna pointed closer to the FS receiver main beam but for a short time due to the nature of the FSS system; 2) The present analysis assumes only a single FSS transmit channel is active whereas in reality there might be multiple FSS channels transmitting in the FS receiver passband; and 3) There could be multiple earth stations in the same location operating co-frequency simultaneously with different FSS satellites of the same network and/or multiple networks.

By repeating the separation distance calculation for FS receiver azimuth angles from 0° to 360°, a two-dimensional contour results, known as a "separation zone." These separation zones represent regions around an FS receiver where operation of FSS earth stations may be precluded in order to assure proper operation of the FS receiver.

Potential Interference from non-GSO FSS Systems

For an initial assessment of the interference potential from non-GSO FSS earth stations, the far side lobe (back-lobes) levels are used. This provides the lowest level of unobstructed interference as a function of relative orientation. Although the interference levels may periodically increase depending on the servicing satellite location, interference from the far-side lobe is expected to occur most frequently.

Figure 2 presents an example non-GSO FSS earth station separation zone around an MDS subscriber station (SUB 1) based on the LEOSAT-1 uplink characteristics. The maximum required separation distance (in the main receive beam) ranges from 35 to 50 Km, where the upper value corresponds to both subscriber and earth station antenna heights of 30 m and no terrain and building blockage considered. This clearly represents a worst case scenario but in situations where building and terrain block the interfering signal, these distances are greatly reduced; the far-lobe-to-far-lobe separation is 700 m. This zone is based on interference power overlapping 19% of the SUB 1 receiver bandwidth (= 3.1 MHz/16.4 MHz). Separation distances computed for the four different subscriber stations resulted in the main-beam boundary being between 29 and 47 km, with the maximum occurring with SUB1 (highest receive gain). The backlobe separation distances ranged from 0.7 to 2.0 km, with the maximum occurring for SUB 3 (smallest bandwidth). Table 3 provides a summary of the calculated separation distances for LEOSAT-1 and the various subscriber stations.

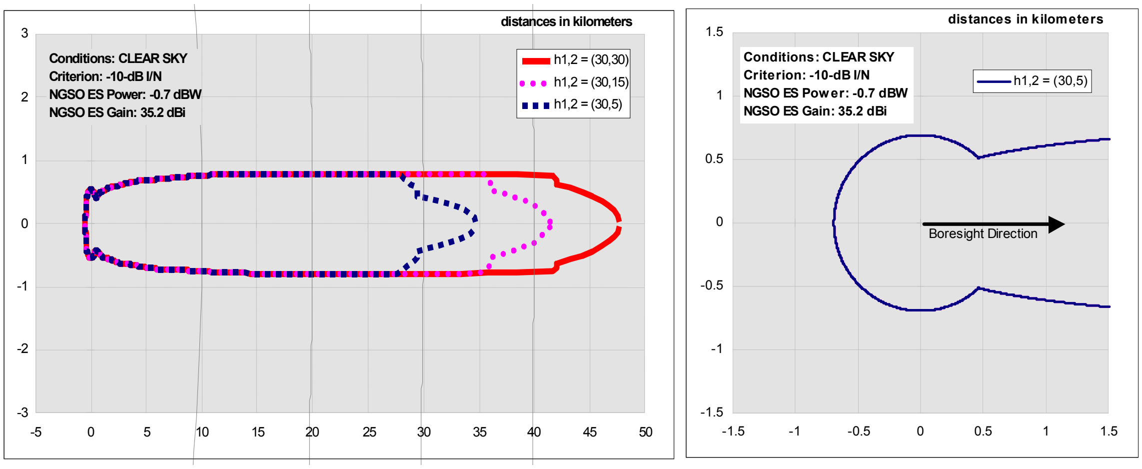

FIGURE 2

Example LEOSAT-1 Separation Zone Around Subscriber Station (SUB 1)

TABLE 3

LEOSAT-1 User Terminal/MDS Subscriber Station Separation Distances

MDS System	Main beam Separation[1]	Backlobe Separation
SUB 1	34.01 – 46.39 km	0.71 km
SUB 2	29.21 – 41.52 km	0.87 km
SUB 3	31.67 – 44.00 km	2.04 km
SUB 4	28.90 – 41.20 km	0.78 km

[1] Range of separations based on station height combinations of (30 m, 5 m) and (30 m, 30 m)

Separation distances computed for the five different hub stations show that the boundary varies with the type of HUB between 15 Km (HUB1) to a distance ranging from 35 to 50 Km (HUB5), where the upper value corresponds to both HUB and earth station antenna heights of 30 m and no terrain and building blockage considered (highest receive gain, similar bandwidth to interference signal). This upper value of 50 Km distance corresponds to the worst case scenario. Table 4 provides a summary of the calculated separation distances between LEOSAT-1 and the various hub stations. Figure 3 shows an example LEOSAT-1 separation zone associated with a hub station (HUB 5). The separation between an FSS terminal far-lobe and the hub station main-lobe is significantly larger than most typical MDS service cells.

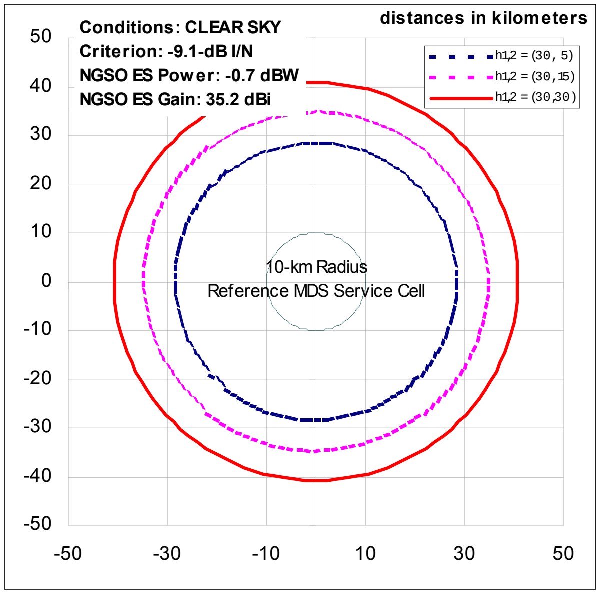

FIGURE 3

Example LEOSAT-1 Separation Zone Around Hub Station (HUB 5)

TABLE 4

LEOSAT-1 User Terminal/MDS Hub Station Separation Distances

MDS System	**Main beam Separation[1]**
HUB 1	14.68 km
HUB 2	15.11 km
HUB 3	19.51 km
HUB 4	27.60 – 34.42 km
HUB 5	28.46 – 40.76 km
1 Range of separations based on station height combinations of (30 m, 5 m) and (30 m, 30 m)	

The example subscriber and hub station separation zones for the USAMEO-1 90 cm earth station are shown in Figures 4 (SUB 1) and 5 (HUB 5), respectively. Separation distances computed for the four subscriber station characteristics showed the main beam boundary ranges from 31 to 49 Km, where the upper value corresponds to SUB1 (highest receive gain) main beam distance when both subscriber and earth station antenna heights of 30 m and no terrain and building blockage considered. Again this clearly represents a worst case scenario but in situations where building and terrain block the interfering signal, these distances are greatly reduced. The backlobe separation distances ranged from 1.4 to 4.4 km, with the maximum occurring SUB 3 (smallest bandwidth).The distances computed for the five hub station characteristics showed the boundary varied between 26 to 43 km, with the maximum occurring with HUB 5 (highest receive gain, similar bandwidth to interference signal) and HUB and earth station antenna heights of 30 m and no terrain and building blockage considered. Tables 5 and 6 present a summary of the calculated separation distances between USAMEO-1 and the various subscriber and hub stations, respectively.

The anticipated number of earth stations is not known, but as shown, just a single earth station is capable of excluding a significant area from MDS service, even if one ignores the area extending beyond the line-of-sight.

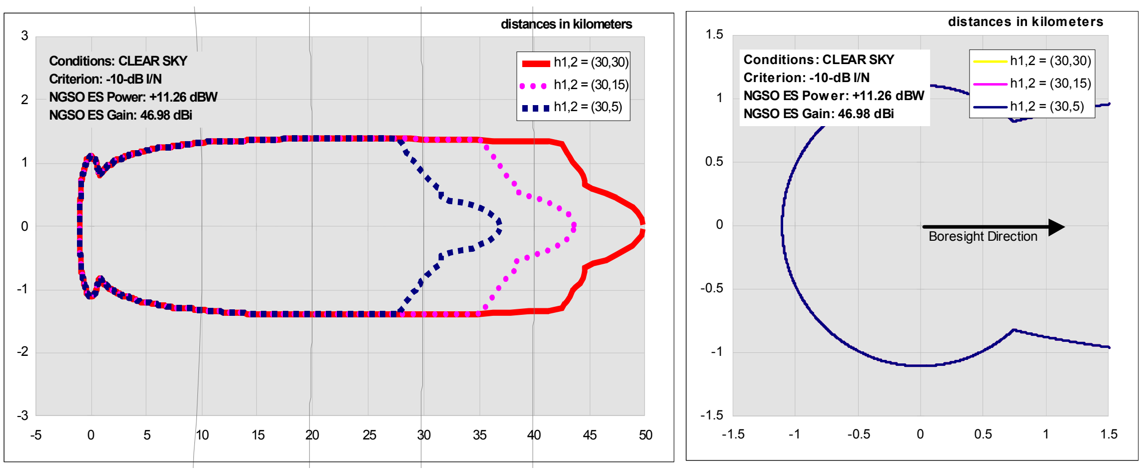

FIGURE 4

Example USAMEO-1 (90 cm) Separation Zone Around Subscriber Station (SUB1)

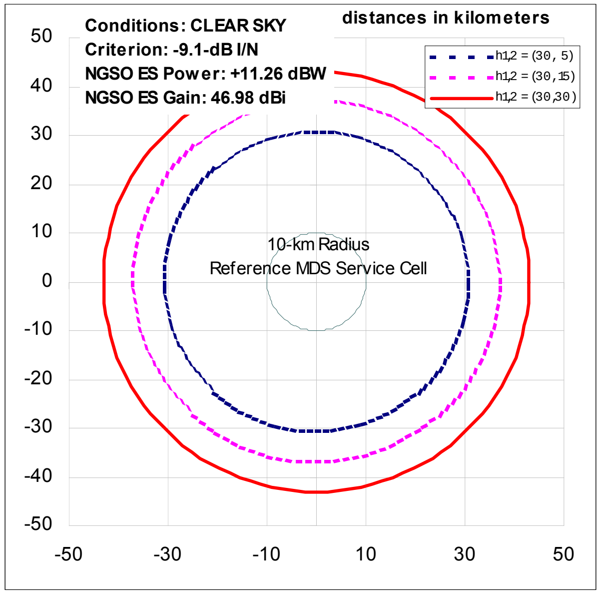

FIGURE 5

Example USAMEO-1 (90 cm) Separation Zone Around Hub Station (HUB 5)

TABLE 5

USAMEO-1 User Terminal/MDS Subscriber Station Separation Distances

MDS System	Main beam Separation[1]	Backlobe Separation
SUB 1	36.00 – 48.40 km	1.42 km
SUB 2	31.19 – 43.52 km	1.73 km
SUB 3	33.92 – 46.29 km	4.41 km
SUB 4	30.87 – 43.21 km	1.55 km
[1] Range of separations based on station height combinations of (30 m, 5 m) and (30 m, 30 m)		

TABLE 6

USAMEO-1 User Terminal/MDS Hub Station Separation Distances

MDS System	Mainbeam Separation1
HUB 1	26.05 km
HUB 2	26.93 – 28.81 km
HUB 3	27.78 – 36.06 km
HUB 4	29.84 – 42.16 km
HUB 5	30.70 – 43.04 km
[1] Range of separations based on station height combinations of (30 m, 5 m) and (30 m, 30 m)	

It should be noted that the distances computed above, are probably not typical of an urban or semi-urban scenarios for which some effect of blocking should be taken into account both for the intra-service (cell to cell) and inter-service sharing.

4.2 Statistical analysis

The study which results are presented below have been run using a tool developed on a statistical methodology based on the Monte Carlo technique. It provides the cumulative effect on each subscriber or base station of a P-MP FS system from all FSS terminals transmitting simultaneously to one non-GSO constellation. The study assumes that each FSS frequency channel is used only once at each simulation step.

One P-MP cell of 3.5 km has been considered and, since it is assumed that the FSS terminals which can potentially interfere the FS receivers in this cell are at a quite small distance from it, the geographical zone under study has been restricted to a 14x14 km square centered on a major city of several millions of inhabitants.

The cell which has been considered contains 74 subscribers and one base station transmitting on 4 sectors of 90° each, each sector uses a bandwidth of 28 MHz with different central frequency than the others.

4.2.1 P-MP FS systems characteristics

Table 7 provides the parameters for the base station. The actual antenna pattern of the hub (Recommendation ITU-R F.1336) and subscriber (Recommendation ITU-R F.1245) antenna was used for the analysis.

TABLE 7

Parameters of a P-MP FS base station

Transmit bit rate	Mbit/s	33
Receive bandwidth	MHz	7
Thermal noise (KTBF)	dBm	-98
Antenna gain	dBi	15
Antenna height		4 m above the roof

The parameters of the subscriber terminals, which activity rate is assumed to be 1, are given in Table 8:

TABLE 8

Parameters of the FS subscriber station

Transmit bit rate	Mbit/s	2
Receive bandwidth	MHz	28
Thermal noise (KTBF)	dBm	-91
Antenna gain	dBi	35
Antenna height		1 m above the roof

The simulations have been run using an I/N calculation, with the following assumed FS interference protection criteria (assuming a typical clear sky fade margin in the order of 10 dB):

– I/N = -10 dB not to be exceeded for more than 20% of the time,

– I/N = 9 dB not to be exceeded for more than 0.001% of time.

4.2.2 Non-GSO FSS user terminals characteristics

The FSS user terminals characteristics considered are those of one non-GSO FSS system operating in the 28.6-29.1 GHz. However, these characteristics depend much more of the system than of the exact frequency band in the 28 GHz range. As a consequence, the FSS user terminals characteristics given in Table 9 are considered valid, for the technology used by the considered system, in the whole 27.5-29.5 GHz band but may not be valid for other systems.

TABLE 9

Parameters of the non-GSO FSS user terminal

Bit rate	Mbit/s	2
Bandwidth	MHz	3.1
Transmit power (clear sky)	dBW	0.4
ATPC range [1]	DB	10.7
Antenna gain	dBi	35
Antenna height		1 m above the roof

[1] At each step of simulation, the ATPC effect is applied according to the rain distribution as defined in the Recommendation ITU-R P.618.

4.2.3 Methodology

Around 1 900 user terminals have been randomly sited in the considered 14x14 km^2 area achieving a penetration ratio up to 20 terminals/km^2 for the built-up area, representative of a dense urban zone.

The activity ratio of these terminals has been randomly chosen at each step of the simulation between 5 and 10% which is a maximum since on the whole LEOSAT-1 cell (118 x 118 km) it leads to a occupation of the total bandwidth (500 MHz) of around 90%. Note that these activity ratios would be increased by the number of co-frequency NGSO FSS systems operating in the band, which will be few in numbers.

Figure 6 illustrates the analysed scenario.

At each step of the simulation, the frequency used by each active user terminal has been randomly chosen in the total bandwidth considered.

Finally, at each step of the simulation the elevation and azimuth of the user terminals have been defined according to real geometric characteristics of the constellation and assuming that each user terminal tracks the closest satellite. On this basis, the two following sequences have been defined which gives for each simulation case around 4 000 samples:

– for the simulations with subscribers: 58 seconds centred on a worst-case elevation angle (i.e. 40°);

– for the simulations with base station: 1 000 seconds.

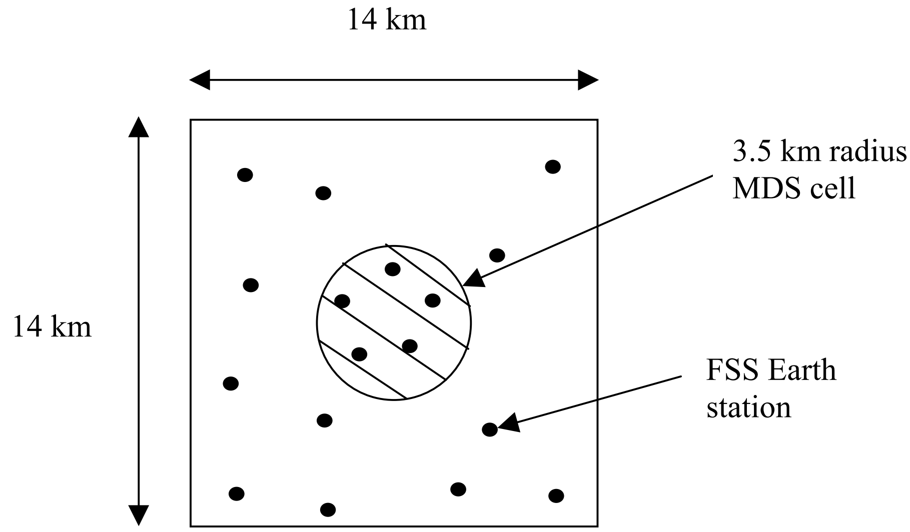

FIGURE 6

4.2.4 Results of the simulations

Figure 7 gives the results of the interference simulations for all the considered subscribers and shows that according to the assumed short term interference criteria the sharing is not possible in the same area. Note that these results would show even higher levels of interference if more than one NGSO constellation was taken into account, however these will be few in numbers.

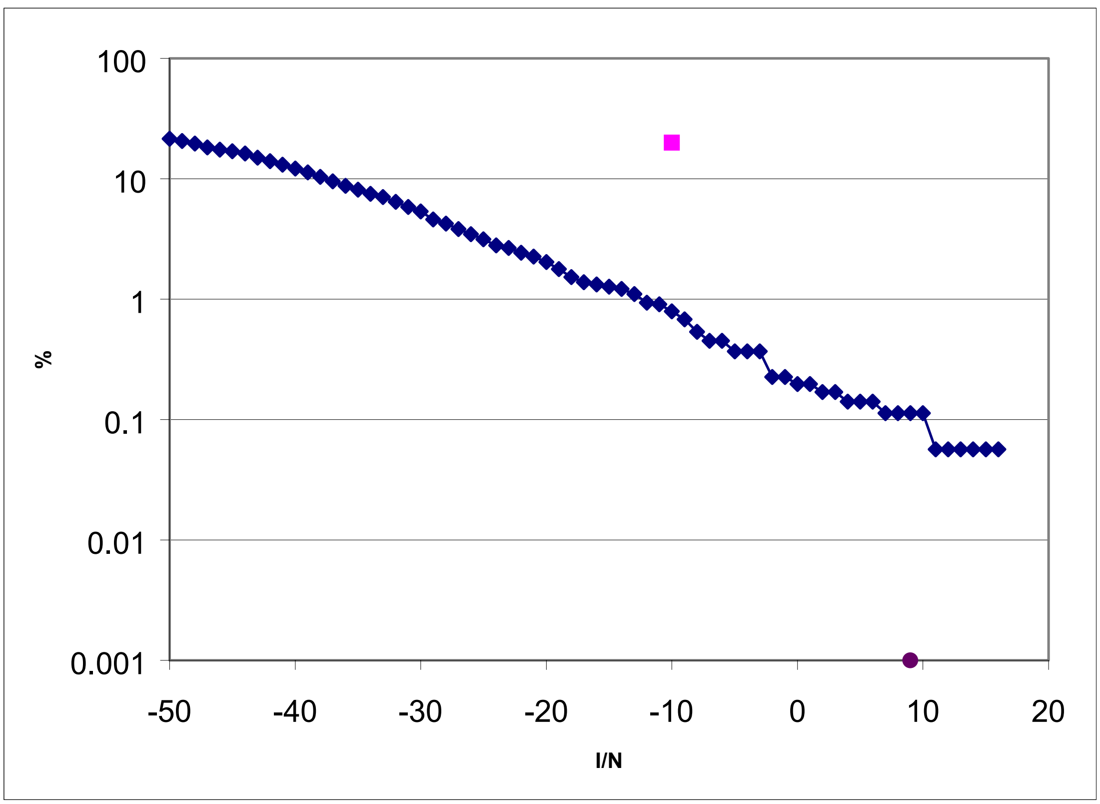

FIGURE 7

Non-GSO FSS terminal versus P-MP FS terminal

Figure 8 below gives the results of the interference simulations for the base station. It shows that the distribution just fits the assumed short term interference criteria but with a higher percentage level. Thus, the conclusion on the feasibility of sharing is not that obvious. The difference of results relatively to FS P-MP subscriber terminals is due to the different maximum antenna gain (35 dBi for subscriber terminals *vs* 15 dBi for base stations). Note that these results would show higher levels of interference if more than one NGSO constellation was taken into account, however these will be few in numbers.

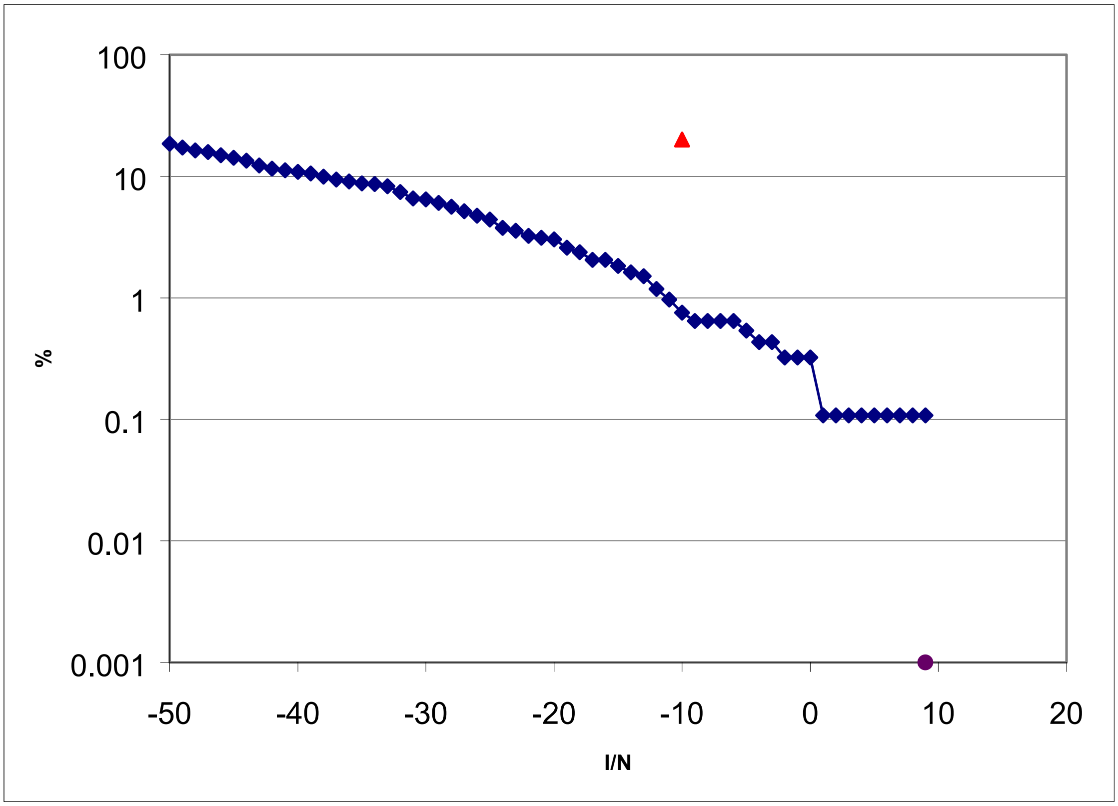

FIGURE 8

Non-GSO FSS terminal versus P-MP base station

5 Analysis for GSO FSS and P-MP FS systems

As previously mentioned, results of simulations are similar whether the FSS earth station is communicating with a GSO or a non-GSO satellite. These studies examines mainly non-GSO FSS earth stations but also GSO FSS earth stations.

5.1 Methodology and characteristics

The methodology (taking into account the fact that GSO FSS system antennas are fixed) and the P-MP FS system considered for the statistical study of the interference scenario between GSO FSS user terminals and P-MP FS systems are the same as in Section 4.2.

The characteristics of the GSO FSS system are given in Table 10 below.

TABLE 10

Characteristics of the GSO FSS system

Satellite position	2° E
Elevation of the terminal earth stations	About 33°
Transmitting channel bandwidth	5 MHz
Terminal earth station nominal power	10 dBW
Terminal earth station antenna gain	49.1 dBi
Antenna height	1 m above roof

5.2 Results of the calculation of the interference of the GSO FSS user terminals towards FS

As shown in Figure 9 below, the assumed short term criteria is not met for the scenario considered where the FSS GSO subscriber terminal interferes with the FS P-MP base station.

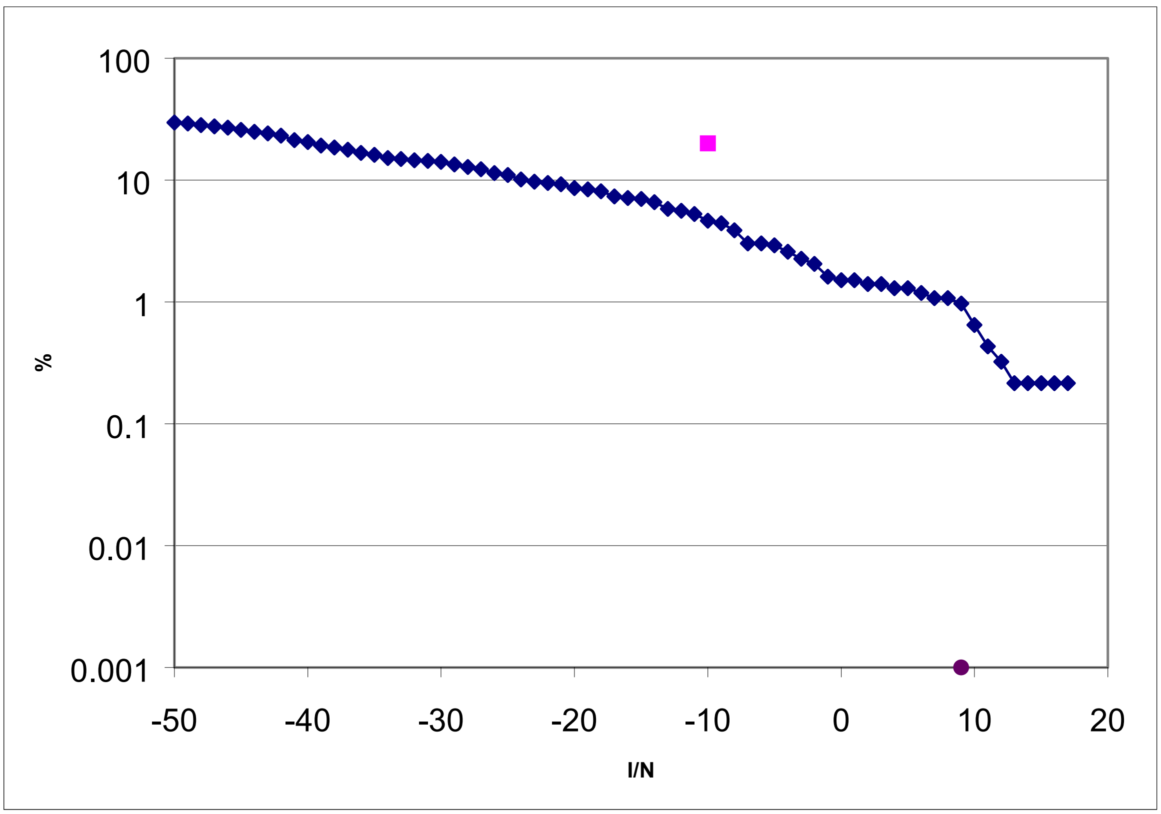

FIGURE 9

GSO FSS terminal vs P-MP FS base station

As shown in Figure 10 below, the assumed short term criteria is not met for the scenario considered where the GSO FSS subscriber terminal interferes with the P-MP FS subscriber terminal.

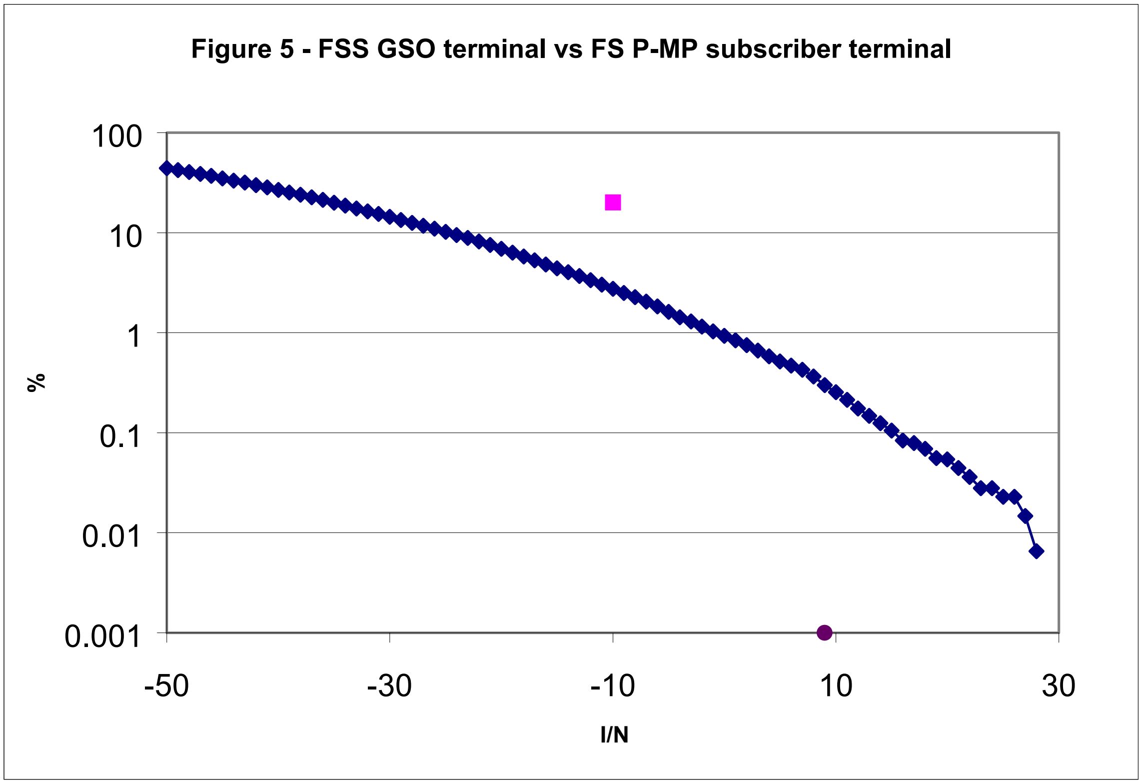

FIGURE 10

GSO FSS terminal vs P-MP FS subscriber terminal

6 Consideration of P-P FS systems

Whereas there is already information about the deployment of FS P-MP systems in the 28 GHz band, the data currently available regarding the FS P-P systems in this band are still quite limited. However, the information received about FS P-MP systems in this range in the area of Paris indicates that the antenna elevation angles of the FS P-P systems are very close to those of the FS P-MP systems. Typical characteristics of FS P-P links at 26 GHz are given below:

TABLE 11

Parameters of the P-P FS stations

Bandwidth	MHz	28
Receiver thermal noise (KTBF)	dBm	-95
Antenna gain	dBi	42 to 48

The comparison with the FS P-MP characteristics shows that the risk of interference in the FS P-P case is expected to be higher than with P-MP systems.

7 Conclusion

Large separation distances are required between unobstructed non-GSO FSS earth stations and MDS hub stations relative to the size of the MDS service cell. In effect, a non-GSO FSS earth station located in an MDS service cell and in view of the hub antenna can easily exceed the 10% interference allowance of the MDS receiver from the far-side lobe alone. Non-GSO FSS earth stations may also interfere into MDS subscriber stations from across multiple service cells if insufficient discrimination is provided from the subscriber high-gain antenna.

The deterministic analysis assuming only one non-GSO FSS earth station transmitting on a single channel and based on a free space loss calculation (plus gas attenuation and diffraction loss) concluded that sharing is not possible. In addition, there could be other non-GSO FSS earth stations transmitting simultaneously in one or more other channels within the FS receiver pass-band of a given MDS receiver (hub or subscriber). If any of these other non-GSO transmissions also fall within the MDS receiver bandwidth, the resulting separation zones could be larger than those given in section 4.1. The statistical analysis confirmed that sharing is not possible, especially because the interference short term criteria could not be met. More precisely, these results show that co-frequency sharing between FS subscriber stations and FSS earth stations in the 28 GHz band is not possible in the same geographical area. Even though the co-frequency sharing between FS base stations and FSS earth stations in the 28 GHz band was also shown not to be possible, the sharing situation depends on the FS networks considered and might be possible in some cases.

MDS systems operating with ATPC could have significantly lower clear sky fade margin, thereby making these systems more susceptible to short term interference. Only the statistical analysis took into account the effect of rain and of terrain and man-made blocking which can explain that the results are less severe than those obtained through the deterministic analysis.

Neither the deterministic nor the statistical analyses took into account the scenario of multiple FSS user terminals simultaneously transmitting co-frequency to different satellites. When such a scenario occurs, it would only make the interference situation worse, however the number of NGSO systems will be few.

These results of both deterministic and statistical studies support the conclusion that it would not be feasible to operate high-density applications of FS such as MDS hub and subscriber terminals in the same portions of the 28 GHz band as ubiquitously deployed non-GSO FSS or GSO FSS earth stations. Since it is the intention of FSS operators to deploy HDFSS user terminals in the 28 GHz range, the above conclusion should be taken into consideration when discussing the appropriate regulatory provisions to facilitate the introduction of such FSS terminals in this band.

APPENDIX A (TO ANNEX OF PDNR [SAT28GHz-E-S])

The separation zone geometry associated with FS/FSS co-frequency operation can be calculated using standard link equations. The boundary is based on an aggregate long-term interference allowance of 10% of the receiver system noise. The interference power in dBW is calculated using the following equation:

$$I = (P_{Tx})_{FSS} - (L_F)_{FSS} + (G_{Tx}(\varphi))_{FSS} - L(d) + (G_{Rx}(\phi))_{FS} - BW_{cor}$$

where

$(P_{Tx})_{FSS}$	FSS transmitter power	(dBW)
$(L_F)_{FSS}$	FSS transmitter loss	(dB)
$(G_{Tx}(\varphi))_{FSS}$	FSS gain in the direction of the FS terminal (ITU-R S.465)	(dBi)
φ	Angle between FSS transmit boresight and FS receiver	(deg)
L(d)	Signal loss associated with path distance, $L_{FSL} + L_{atm} + L_{diff}$	(dB)
L_{FSL}	Free space loss, $\approx 92.44 + 20 \times \log_{10}(d \times f)$	(dB)
d	FS and FSS terminal separation	(km)
f	frequency	(GHz)
L_{atm}	atmospheric loss, $\gamma_a \times d$, (ITU-R P.676)	(dB)
γ_a	specific attenuation, ($\approx$ 0.095 dB/km for 7.2 g/m^3, 20°C, 28.85 GHz)	(dB/km)
L_{diff}	diffraction loss over a spherical earth (ITU-R P.526)	(dB)
$(G_{Rx}(\phi))_{FS}$	FS gain in the direction of the FSS transmitter (ITU-R F.699-4)	(dBi)
ϕ	Angle between FS receive boresight and FSS transmitter	(deg)
BW_{cor}	Overlap bandwidth correction, higher of 0.0 or $10 \times \log10 \dfrac{(BW_{rx})_{EES}}{(BW_{RX})_{FS}}$	(dB)

Recommendation ITU-R F.699 specifies the reference radiation pattern for radio-relay system antennas operating in the range from about 1 to 70 GHz. For most typical FS antennas, the ratio D/λ is less than 100, however, there are some FS stations in use that employ larger antennas, which trigger the tighter sidelobe specification to be used. For hub stations using sectored or omni-directional antennas, Recommendation ITU-R F.699 may be inappropriate. Therefore, this study has modelled the hub receive antenna as four 90°-sectored antennas with gain constant as a function of azimuth. (NOTE - Recommendation ITU-R F.1336 describes point-to-multipoint antenna patterns for the 1-3 GHz frequency range.) The S.465 reference radiation pattern applies to earth stations operating in the Fixed-Satellite Service. The equations are identical to those presented in Recommendation ITU-R F.699.

The generic MDS FS terminal has a receiver noise of –121.8 dBW (assuming a 16.4 MHz receiver bandwidth and 10-dB receiver noise figure). Assuming a 10% interference allowance, the FSS transmitter interference should not exceed –131.8 dBW into the FS receiver.

The diffraction loss model was used to better account for the transhorizon path losses. The model is strongly dependent on frequency, path length, equivalent Earth's radius (9 348 km used), and station antenna heights. The model is valid only for paths beyond the horizon. Figure A-1 shows the distances where the model provides useful results for various combinations of (interferer and desired) antenna heights.

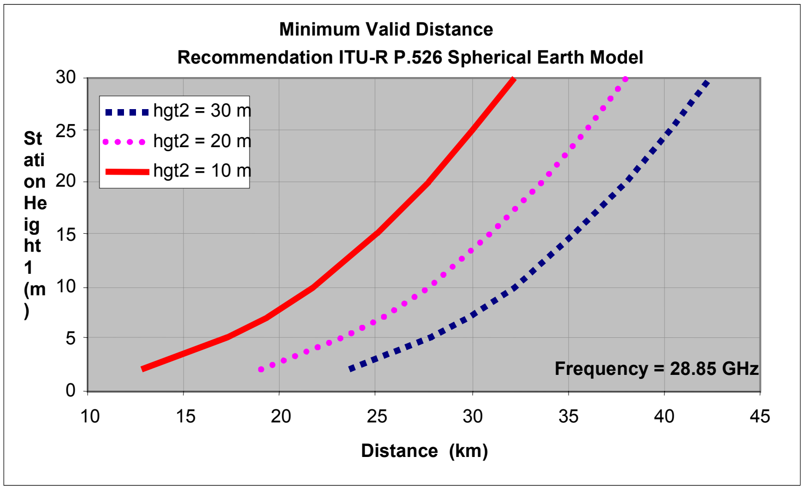

FIGURE A-1

Path Distances for Zero Spherical Earth Diffraction Loss (Recommendation ITU-R P.526

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INTERNATIONAL TELECOMMUNICATION UNION

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INTERFERENCE FROM FIXED SERVICE TRANSMITTERS INTO NGSO FIXED-SATELLITE EARTH STATION RECEIVERS AT 18.8 - 19.3 GHz

1. Introduction

This contribution presents the analysis results for the band 18.8-19.3 GHz to determine the area around FS transmitters, called exclusion zones in this paper, in which it would not be possible to locate a NGSO FSS receive earth station without the latter receiving unacceptable levels of interference. The purpose is to determine whether earth terminal siting difficulties can be anticipated during the introduction phase of NGSO FSS systems in the paired bands 18.8-19.3 GHz (space-to-Earth) and 28.6-29.1 GHz (Earth-to-space).

The calculations are performed using a database of FS parameters obtained from the Industry Canada licensing database, called the Technical and Administrative Frequency List (TAFL). The receive characteristics of typical NGSO FSS user earth stations were assumed for the victim site. The model assumes that there is no terrain or man-made obstacles within the line-of-sight around each FS site and is based on the use of a free-space loss plus atmospheric absorption propagation model.

2. Models and Assumptions

The user terminal receiver parameters assumed for the NGSO FSS network are shown in Table 1. In the 18.8-19.3 GHz band, NGSO FSS systems typically operate at high elevation angles to minimize the effects of atmospheric and rain attenuation and to reduce the probability of signal blockage. Since the interfering path of the FS transmission typically arrives at low elevation angles, this analysis assumes the interference is received via the far sidelobes of earth station antenna. Although the minimal operational elevation angle of the NGSO FSS earth station may go below 48°, when also taking into account the varying azimuth direction to the satellite, the dwell time and percentage of time that a typical user terminal operates both in the general direction of the FS site and below that elevation angle are small. Therefore, the minimum gain of the NGSO FSS receive terminal, corresponding to angles greater than 48°, is used for the calculations.

TABLE 1

NGSO FSS Earth Station Receiver Parameters

Receive Antenna	0.3m
Receive Gain	34.1 dBi
Antenna Pattern	AP 29 (D/λ = 19)
Gain towards horizon	-2.8 dBi
Receive Noise Temperature	288 K
Receive System Noise (500 MHz)	-117 dBW

The FS parameters are taken from the Industry Canada licensing database (TAFL) which can be obtained electronically on their web site (www.spectrum.ic.gc.ca). Table 2 provides a sample of three FS sites operating within the 18.8-19.3 GHz band using different antenna sizes. This is not, of course, an exhaustive list but it does provide a representation of the database's contents.

TABLE 2

Sample Parameters for FS Transmitters Used in Canada

Transmit Antenna Size (m)	1.8	1.2	0.6
Transmit Gain (dBi)	48.5	44.9	38.9
Carrier Bandwidth (MHz)	10	5, 10, 20	5, 10
Transmit Power (dBW)	-15 to –5	-20 to -1	-17 to -6
Transmit losses (dB)	0 to 23	0 to 35	0 to 16
EIRP (dBW)	20 to 40	20 to 38	10 to 31

The calculations were performed using the simple interference-to-noise (I/N) equation. Because the NGSO FSS earth terminals receive wideband carriers, as compared to the 5 to 20 MHz which are typical of the FS transmitters, the entire interference power is assumed to fall within the earth station's receive pass-band. In general, the interference-to-noise (I/N) ratio is computed as:

$$I/N = EIRP_{FS}(\theta) - FSL - Aa + Grx_v(\varphi) - N_v$$

Where,

$EIRP_{FS}(\theta)$ EIRP of the interfering transmitting FS towards the victim NGSO FSS receive terminal (dBW);

θ	angle off-boresight at the transmitting interfering FS towards the victim NGSO FSS receiver (degrees);
FSL	free-space loss between the transmit FS site and the victim NGSO FSS receiver (in dB), which is given as FSL = 92.5 + 20 log (distance) + 20 log (frequency);
Aa	atmospheric absorption, given as 0.08 * distance (per Rec. ITU-R P.676);
Grx_v (φ)	receive gain of the victim NGSO FSS receive antenna towards the interference source (-2.8 dBi), the minimum earth station gain from Appendix 29;
N_v	noise level of the victim NGSO FSS receiver, expressed as N = -228.6 + 10 log (noise temperature) + 10 log (BW_v) (dBW);
BW_v	bandwidth of the victim carrier (MHz).

The interference is computed for each FS transmitter in the database and for all azimuths around each of these transmitters. The results are then superimposed graphically on maps of some major metropolitan areas in Canada. Table 3 provides sample calculations, in the worst direction, for the three example FS antenna sizes given in Table 2. Because the minimum earth station gain is used and that the calculations are not dependent on anomalous propagation conditions, a long term I/N criterion corresponding to 6% of the thermal noise level (I/N = -12.2 dB) has been used. This criterion may require further study to take into account the effects of multiple FS transmitters simultaneously interfering into an NGSO FSS user terminal across the full 500 MHz receive bandwidth.

TABLE 3

Sample Calculations

Transmit Antenna Size (m)	1.8	1.2	0.6
Transmit Gain (dBi)	48.5	44.9	38.9
EIRP (dBW)	30	28	22
Required Loss for I/N = -12.2 dB	156.4	154.4	148.4
Required distance (km)	51.4	43.8	25.9

The distances in Table 3 are based on typical transmit EIRP values for the three representative antenna sizes, assuming that the victim NGSO FSS receive terminal is located directly in the main beam of the transmitting FS site. It is noted that the Recommendation ITU-R F.699 pattern, for larger antennas, has a gain of –10 dBi for angles greater than 48°, and this is used for calculating the interference caused by the backlobes of the FS transmitter. For example, in cases where the transmit power is –10 dBW into the antenna, this results in a required distance of about 260 meters when the NGSO FSS receiver is on the far sidelobes of the FS transmitter.

3. Results

The results of the simple interference budgets provided in the previous section show that the exclusion zone caused by the FS transmitters would be very long in the main direction of transmission, in the order of 40 to 80 km typically, but would be small in other directions well away from the FS main beam. Figure 1 shows a histogram of the exclusion distance, in the main direction of transmission, for all sites in the database.

By performing such calculations in all directions around each FS site in a given area and then plotting the results on a map, it is possible to see the aggregate effect of multiple transmitters in terms of loss of possible service area for the NGSO FSS receive terminals. This has been performed for three metropolitan areas of Canada, where FS deployment is highest.

Figure 2 provides the FS exclusion zones for the Montreal area (around 45.5°N, 73.6°W). Figures 3 and 4 provide similar diagrams for Toronto (43.8°N, 79.4°W) and Vancouver (49.2°N, 122°W), respectively. In all cases, it can be seen that there is a significant area in each city where NGSO FSS terminal siting would be very difficult or perhaps even impossible. In fact, calculating the area of the exclusion zone within a 40-km diameter circle as shown in the Figures, yields areas of 35.7%, 48.5% and 47.4% that would be unavailable for NGSO FSS terminals in the three cases studied in the absence of some blocking.

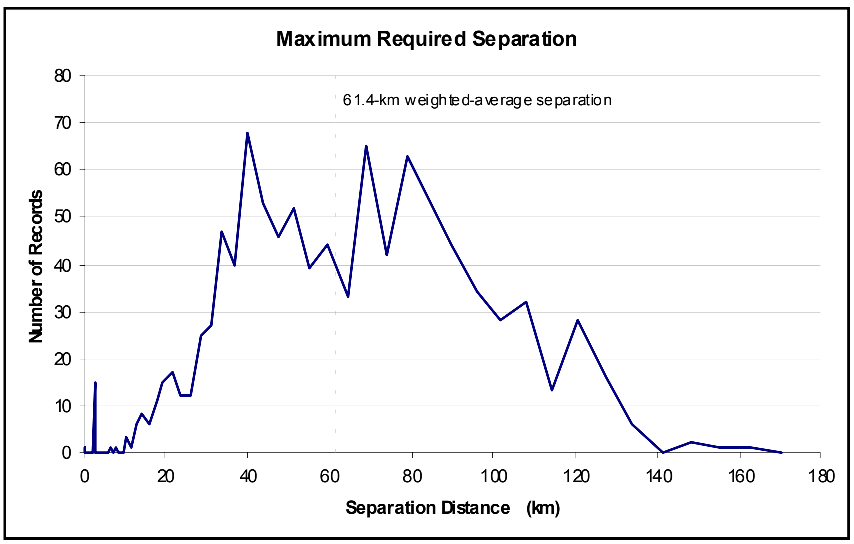

FIGURE 1

Worst-Case Exclusion Zone for all Sites

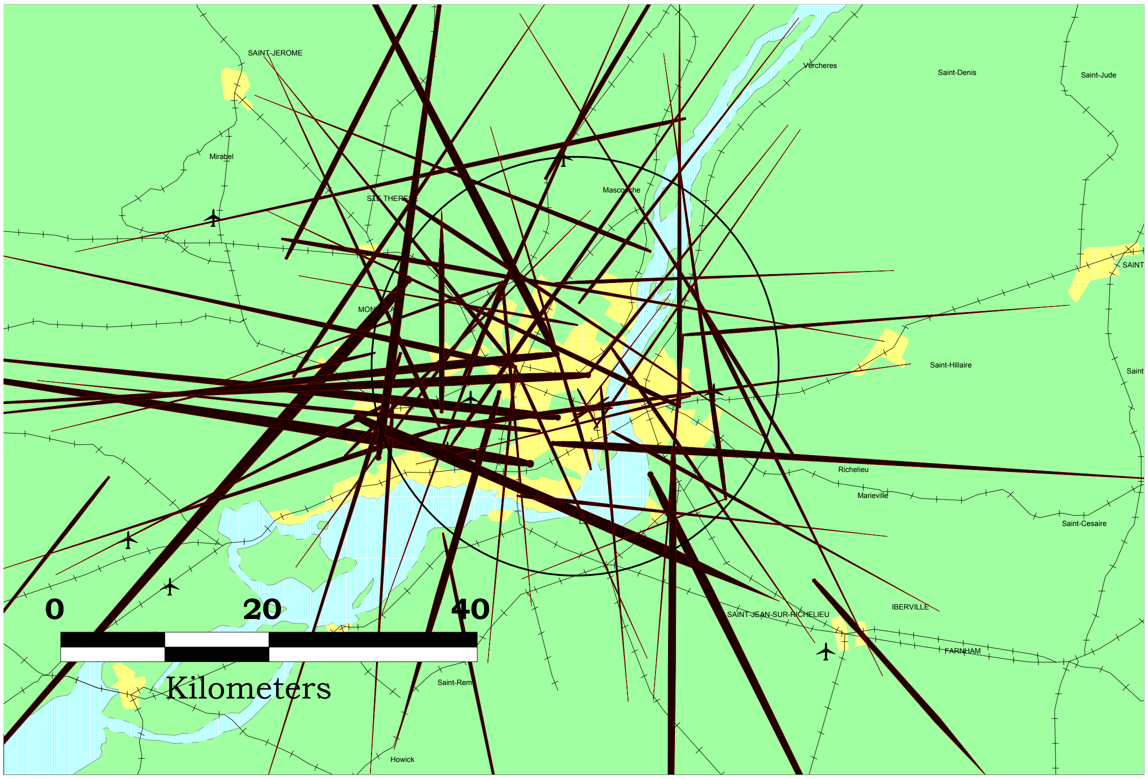

FIGURE 2
FS Exclusion Zones Around Montreal

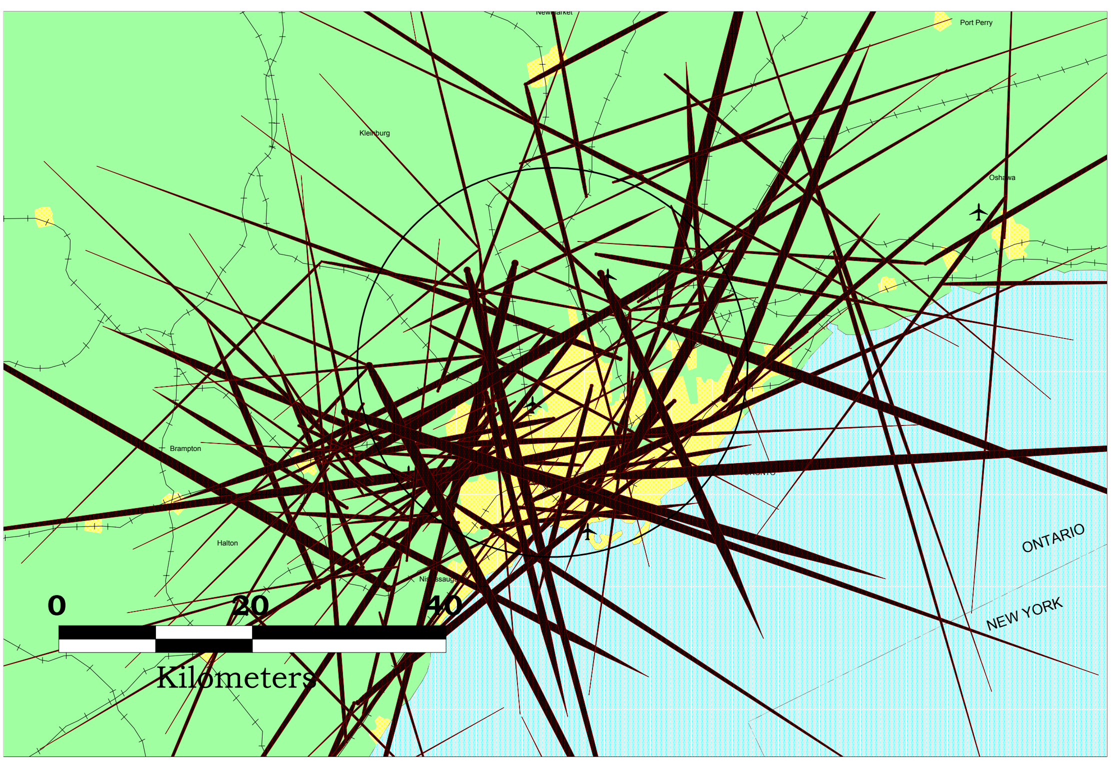

FIGURE 3
FS Exclusion Zones Around Toronto

4. Conclusion

This study provides examples of exclusion zones around FS transmitters that represent the area in which NGSO FSS user terminals would suffer excessive levels of interference in the absence of some blockage. Results presented for three metropolitan areas of Canada show that even under the current deployment of FS stations there are already significant areas within each of the three cities where NGSO FSS terminal deployment could be difficult or even impossible. Within the three urban areas studied, there is between 36% to 49% of the total area that could be excluded to the NGSO FSS due to FS interference. It is understood that in some cases, the actual exclusion zones will be reduced due to natural or man-made blockage, but it does serve to illustrate the potential severity of interference from FS transmitters into NGSO FSS user terminals within a given geographic area. The excluded areas will increase as the FS continues to grow.

Implementing a global NGSO FSS network requires several years of planning, construction and deployment. By contrast, once an allocation is given and equipment is manufactured, deploying an FS network can be started immediately. In practice, the FS deployment begins much more quickly than is possible for the FSS system. Even if networks in both services were authorized at the same time, there will be substantial FS deployment by the time a NGSO FSS system is in place. As demonstrated above, in many areas the use of the FS is already substantial. Unless certain steps are taken to limit the further growth of the FS in bands where large deployment of NGSO FSS terminals is desired, significant areas might not be available to the NGSO FSS. For satellite networks using only few large terminals, this might not be a problem, because it is always possible to coordinate with the FS or find locations that provide suitable blockage to operate the earth station. However, in services currently envisaged for the NGSO FSS using the 18.8-19.3 GHz band, using small low-cost, ubiquitously deployed terminals, a significant portion of the users might be precluded.

In summary, the following points are retained:

- ubiquitous deployment of either or both services (FS and FSS) in the same geographical area is not practicable;
- administrations should take this into account in the planning of their domestic spectrum decisions; and
- early decisions are required by administrations on the use of spectrum in these bands to facilitate the planning of networks in either service.

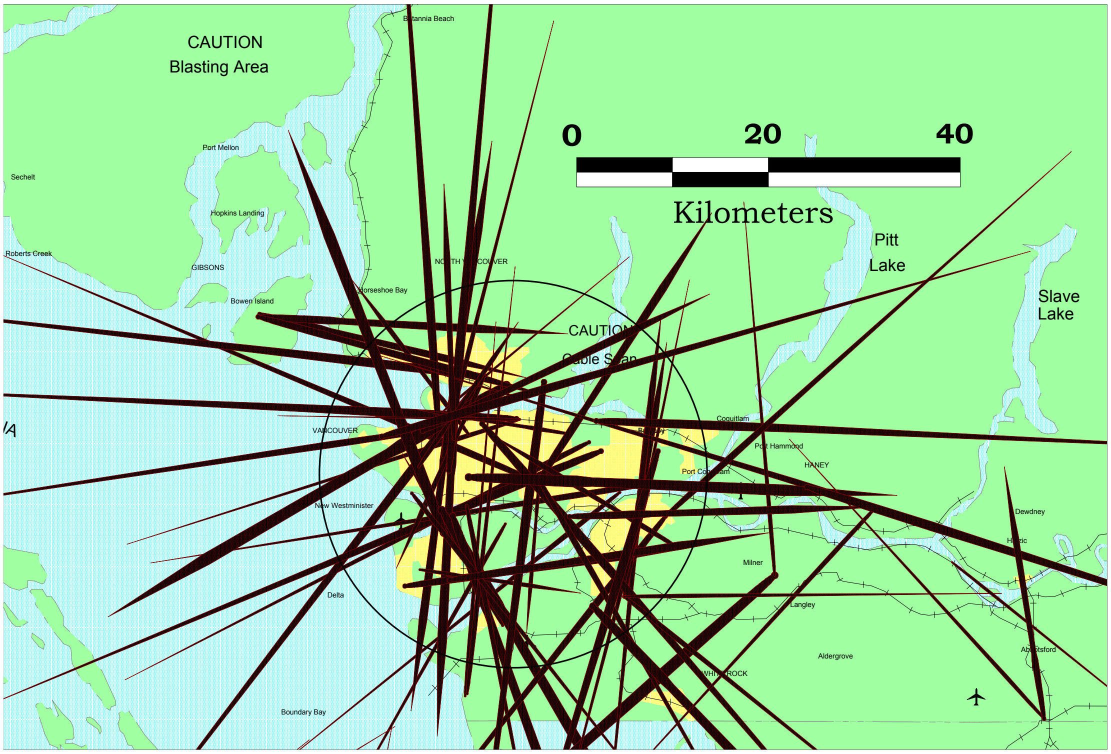

FIGURE 4

FS Exclusion Zones Around Vancouver

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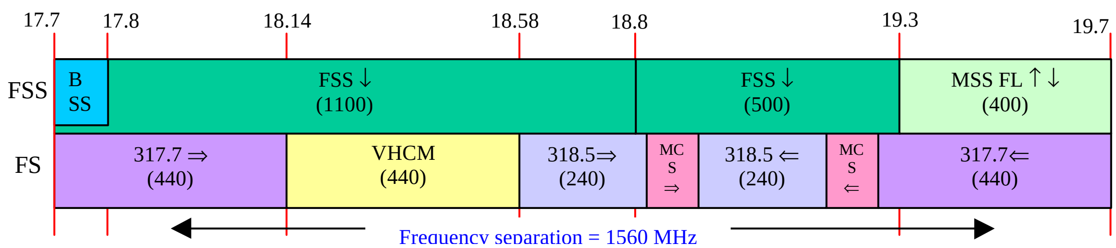
Attachment 3 – Alternative FS Band Plans in the 17.7-19.7 GHz Range

The following diagram illustrates the current Canadian allocations within the range 17.7-19.7 GHz between space services (mostly FSS) and terrestrial services (FS). The entire band is currently available to the FSS on a shared basis with the FS. The FS employs four different channelization schemes: SRSP 317.7 (440+440 MHz), the draft SRSP 318.14 (MCS/VHCM), SRSP 318.5 (240+240 MHz) and SRSP 318.8 (MCS; 100+100 MHz). It is a well known fact that the MCS spectrum in SRSP 318.8 was originally intended for indoor wireless applications and this use has not materialized to any large extent. Also, the lower 100 MHz of the SRSP 317.7 has not been utilized due to potential sharing difficulties with the feederlinks to the BSS and the new BSS allocation in the band 17.3-17.7 GHz.

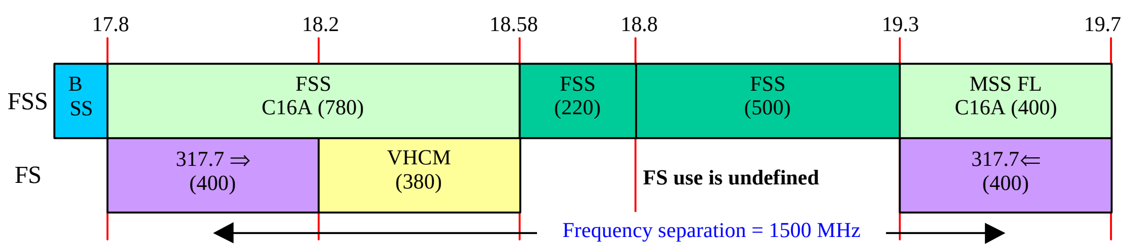
There is general agreement within the RABC that the bands 18.58-18.8 GHz and 18.8-19.3 GHz can be prioritized for FSS use. Teledesic concurs with this proposal.

Current Situation



On page 19 of the Consultation (DGTP-001-02), the Department suggests that a possible structure for fixed services would be to pair 17.8-18.2 GHz with 19.3-19.7 GHz leaving 18.2-18.58 GHz for MCS applications (VHCM) and providing 400+400 MHz for the point-to-point LC/MC/HC FS networks.

Taking into account the restrictions that would be placed on the FS deployment in the band 18.58-19.3 GHz, the following band plan would result. While not explicitly mentioned, it is understood that the intent of the Department was to allow deployment of FSS in the FS-priority bands subject to Canadian footnote C16A.

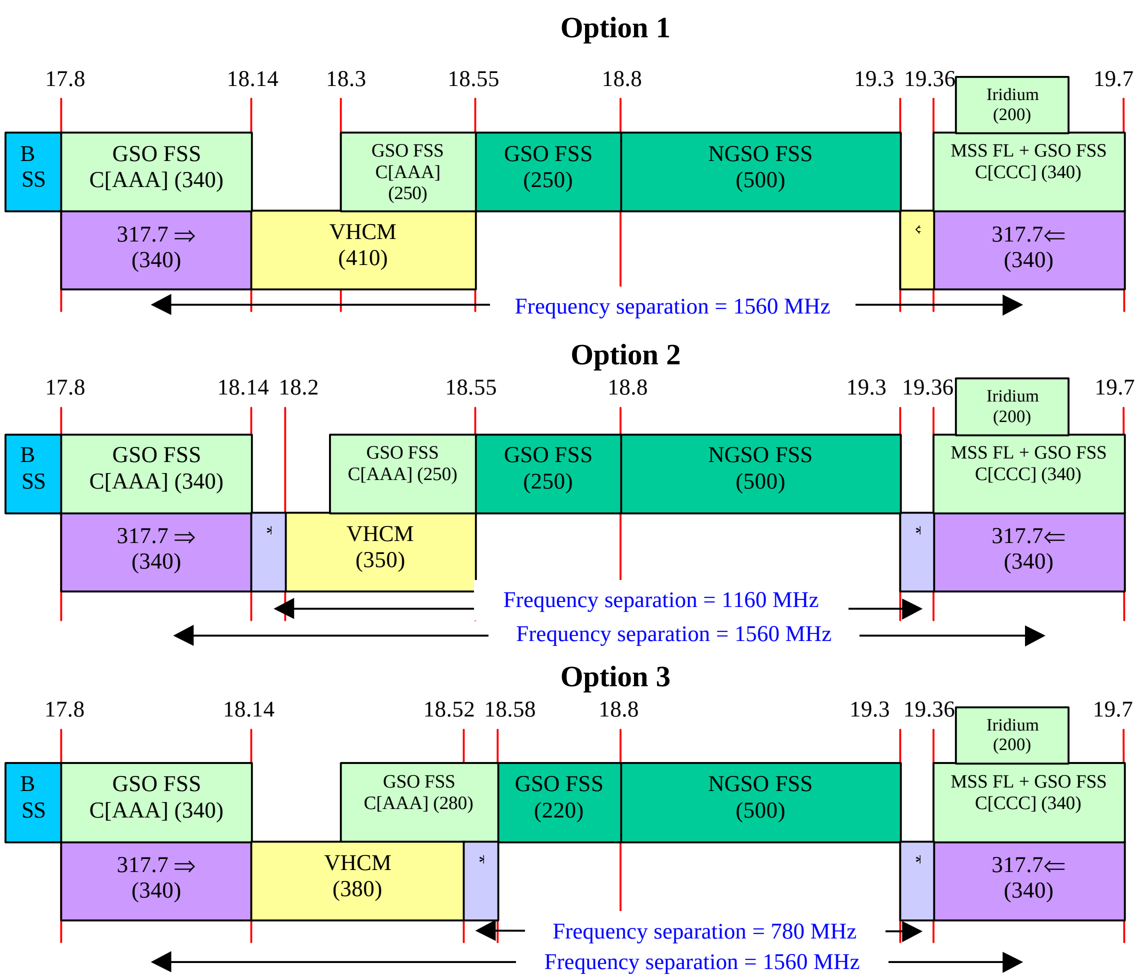


This proposal has the advantage of providing 400+400 MHz of FS bandwidth under a modified SRSP 317.7 plan.

The proposed plan by Industry Canada has the following drawbacks:

- It changes the current go-return spacing of the SRSP 317.7 channelization plan from 1560 MHz to 1500 MHz. This means that existing FS networks would not be compatible (in terms of spacing) with the new equipment.
- It reduces the VHCM spectrum from its current 440 MHz to 380 MHz.

The following figure illustrates three possible alternatives for the FS channelization plans after implementation of the "soft segmentation" option.



* denotes a possible 60+60 MHz new pairing to replace SRSP 318.5

The examples above have in common that they also show the soft-partitioning between non-GSO FSS and GSO FSS, i.e., in the band 18.8-19.3 GHz the GSO FSS would coordinate against non-GSO FSS, whereas in the rest of this band, the non-GSO FSS would need to meet EPFD limits and not seek protection from GSO FSS.

Also, the band 19.3-19.7 GHz can be shared between limited deployment of GSO FSS earth stations, subject to a new footnote C[CCC] as proposed by the RABC, and MSS feederlinks. Considering that the only currently operational MSS system employing feederlinks in this range (Iridium) only uses the 19.4-19.6 GHz band, the lower part of this band (19.3-19.36 GHz) could be used to provide new FS channels without any coordination with the FSS, as depicted in the above frequency plans.

The above alternatives have the following advantages and disadvantages.

Option	Advantages	Disadvantages
1	• Maintains SRSP 317.7 spacing • Provides 410 MHz VHCM plus an additional 60 MHz in return channels • Increases GSO FSS priority spectrum to 250 MHz	• Results in 340+340 MHz SRSP 317.7 spectrum (same as current when considering BSS restrictions on lower 100 MHz) • No replacement for SRSP 318.5
2	• Maintains SRSP 317.7 spacing • Provides 60+60 MHz replacement for SRSP 318.5 • Increases GSO FSS priority spectrum to 250 MHz	• Results in 340+340 MHz SRSP 317.7 spectrum (same as current when considering BSS restrictions on lower 100 MHz) • Reduces VHCM to 350 MHz
3	• Maintains SRSP 317.7 spacing • Provides 60+60 MHz replacement for SRSP 318.5	• Results in 340+340 MHz SRSP 317.7 spectrum (same as current when considering BSS restrictions on lower 100 MHz) • Reduces VHCM to 380 MHz • Provides only 220 MHz GSO FSS priority band

Option 1 could be a preferred option if the cable companies can make use of the return channels to carry User Internet traffic back to the head ends. It provides the GSO FSS with 250 MHz of priority spectrum from the currently planned 220 MHz.

Option 2 is also a preferred option from the FSS point of view since it increases the GSO FSS priority band near 18.5 GHz to 250 MHz from the currently planned 220 MHz. It also provides spectrum to replace the SRSP 318.5 bands.

Option 3 is a good option from the conventional FS perspective as there is some replacement spectrum provided as a relief for the SRSP 318.5 band, while maintaining as much VHCM spectrum as per the Department’s proposal.

Attachment 4 – Sample Relocation Policy for the 18 GHz FSS Bands

This following process is a possible relocation policy that could be adopted in the 18 GHz bands that would be identified primarily for FSS use over the FS. It is largely based on a relocation policy which was adopted in SP1-3 GHz for the 2 GHz MSS bands and adapted to the sharing situation in the 18 GHz band by replacing "MSS" with "FSS" and changing the dates as appropriate. For example, considering the state of development of FSS broadband services in the Ka-band, the earliest date of displacement for the FS in the 18 GHz band as discussed in step 2 below could be 1 January 2005. This would give over 2 years to the incumbents, and would allow for a smooth transition to the new regime where FSS would have priority of use.

1. The Department will issue formal notifications for the displacement of specific frequency assignments of fixed stations to make spectrum available on a country-wide basis, based on sufficient evidence from an approved FSS service provider that such displacements are critical in meeting their service requirements, including:
- a thorough justification that the commercial in-service date is viable;
- justification of the spectrum requirement;
- a technical assessment of affected fixed stations; and
- justification that the spectrum will be accommodated on an (ITU) regional basis.

2. The earliest mandatory date for fixed frequency assignments that may be subject to displacement will be January 1, 2005. A minimum notification period of two years will be afforded to fixed station incumbents. Earlier displacement to the formal notification date may be achieved through mutually acceptable arrangements between FSS operator(s) and the affected fixed station operator(s).

3. The displacement of frequency assignments of fixed stations and the date indicated in the notification will be based on the amount of spectrum necessary for the implementation of a particular FSS system and the projected traffic for the Canadian market. The FSS operator(s) will ensure that such displacements, including dates and access to the Canadian and North American markets, are critical to meet the FSS service dates. The Department will consider the extent to which regional and global FSS systems have been assigned spectrum for the North American market by other administrations as an indication of the service date of these systems.

4. The Department may enter into an arrangement for the assignment of the fixed-satellite systems with other administrations according to technology or system operational characteristics in these allocations so as to improve the access to these bands to more FSS systems. Such an

arrangement would likely be derived on a multinational basis in the near future.

5. In the event an FSS operator identifies a need to defer a notified displacement date due to delays in implementing an FSS service, an amendment to the notice of displacement must be issued at least one (1) year prior to the displacement date in effect or earlier.

6. The FS operators will cease operation of the identified frequency assignments on or before the displacement date indicated in the served notification.

7. The FSS operator shall not commence service prior to the displacement date indicated in the served notification unless a mutually acceptable arrangement has been made beforehand, unless such operation is on a no-protection basis.

8. Industry Canada will retain oversight of the displacement process and will assist, where necessary, affected fixed operators in identifying new replacement frequency assignments.

9. Industry Canada will develop procedures based on the policy provisions in this document for the displacement of fixed service stations in the near future, and will incorporate them in the Department’s fixed-satellite service licence application procedure.

10. The operation of FSS service along the Canada-U.S. border will depend on the status of FS operation on either side of the border and on whether the frequency bands (in part or in whole) have been cleared for FSS service.

A significant and/or unjustified delay in the use of released frequency spectrum by FSS licensees, after the displacement date, will be viewed by Industry Canada as a serious breach of service commitment, particularly if fixed stations were displaced prematurely.

Industry Canada will monitor the effectiveness of the spectrum policy provisions related to the displacement of fixed systems. Changes to these provisions may be made to ensure that the continued availability of spectrum for FSS services is accomplished in the most efficient manner.