CONFIRMATION OF ACCEPTANCE

The attached document is the interim sharing arrangement between the Federal Communications Commission, the National Telecommunications and Information Administration (NTIA) and the Department of Industry (Industry Canada) concerning Local Multipoint Communication systems, the Local Multipoint Distribution Service and certain other services in parts of the 27.35 - 28.35 GHz, 29.1 - 29.25 GHz and 31.0 - 31.3 GHz frequency bands. The Federal Communications Commission, NTIA and Industry Canada intend to implement the attached arrangement, to the extent permissible under their respective domestic laws, pending the amendment of the *Agreement Concerning the Coordination and Use of Radio Frequencies Above Thirty Megacycles per Second, with Annex*, as amended,[1] to incorporate the arrangement's terms.

Donald Abelson Chief, International Bureau Federal Communications Commission	William T. Hatch Associate Administrator Spectrum Management National Telecommunications and Information Administration	Michael Binder Assistant Deputy Minister Spectrum, Information Technologies & Telecommunications Industry Canada
Date: December 1, 2000	Date: December 4, 2000	Date: December 21, 2000

[1] Exchange of Notes at Ottawa, Canada, October 24, 1962. Entered into force October 24, 1962. See USA: T*reaties and Other International Acts Series* (TIAS) 5205; CAN: *Canada Treaty Series* (CTS) 1962 No. 15. *Agreement revision Technical Annex to the Agreement of October 24, 1962* (TIAS 5205/CTS 1962 No. 15) Effected by Exchange of Notes at Ottawa, Canada, June 16 and 24, 1965. Entered into force June 24, 1965. USA: TIAS 5833/CAN: CTS 1962 No. 15, as amended June 24, 1965.

Interim Arrangement Concerning the Sharing between Canada and the United States of America on Local Multipoint Communication Systems, the Local Multipoint Distribution Service and Certain Other Services in Parts of the Frequency Bands 27.35 – 28.35 GHz, 29.1 – 29.25 GHz, and 31.0 – 31.3 GHz

1. Scope

1.1 This interim arrangement (Arrangement) between the Federal Communications Commission (FCC) and the National Telecommunications and Information Administration (NTIA) of the United States of America (U.S.) and the Department of Industry of Canada (Industry Canada), herein referred to as the Agencies, concerns the sharing between Local Multipoint Communication systems (LMCS), the Local Multipoint Distribution Service (LMDS), and certain other services in parts of the 27.35 - 28.35 GHz, 29.1 - 29.25 GHz and 31.0 - 31.3 GHz bands.[1]

1.2 The responsible coordinating agency for the U.S. is NTIA for the 27.35 – 27.5 GHz band and the FCC for all other bands covered by this Arrangement. The responsible coordinating agency for Canada is Industry Canada.

1.3 This Arrangement is subject to review at any time at the request of either Administration.

2. Use of the Bands

2.1 In Canada, the 27.35 - 28.35 GHz (27 GHz) band is designated for LMCS. In the U.S., the 27.35 - 27.5 GHz portion of the band is designated for Federal Government fixed and mobile systems and inter-satellite service and the 27.5 - 28.35 GHz portion is designated for LMDS.

2.2 The 29.1 - 29.25 GHz (29 GHz) band is designated for LMDS in the U.S. and is allocated to fixed and mobile services in Canada.[2] The 31.0 - 31.3 GHz (31 GHz) band is designated for LMDS and fixed point-to-point microwave systems in the U.S. and is allocated to fixed and mobile services in Canada. As of the date of this Arrangement, Canada had not

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[1] This Arrangement applies to both new facilities and facilities in existence prior to the date of this Arrangement.

[2] The 29 GHz band is also designated for Non-Geostationary Orbit Mobile Satellite Service (NGSO MSS) feeder link systems in both the U.S. and Canada. This Arrangement does not apply to coordination with satellite systems in this band.

designated a radio service use for the 29 and 31 GHz bands.[3] This Arrangement does not apply to mobile services in these bands.

3. General Principles

3.1 The 27 GHz, 29 GHz and 31 GHz bands are to be shared on an equal basis along the border and, to the extent possible, the Administrations shall have full use of these frequencies or sub-bands within their respective countries.

3.2 Licensees are expected to take full advantage of interference mitigation techniques such as antenna discrimination, polarization, frequency offset, shielding, site selection, and/or power control to facilitate the coordination of systems.

3.3 All results of analyses and/or licensee agreements shall be retained by the licensees and be made available to the Agencies upon request.

3.4 If a license is transferred, the sharing agreement(s) (see Section 4) or coordination agreement(s) (see Section 5) developed by the former licensee shall continue to apply with respect to the new licensee until a new agreement is reached.

3.5 The Agencies reserve the right to impose appropriate technical limitations to facilitate reasonable implementation and operation of proposed or existing systems.

4. Coordination in the 27 GHz Band

4.1 27.5 – 28.35 GHz Band - Coordination of LMDS and LMCS systems in the 27.5-28.35 GHz band shall be carried out by the licensees for the respective service areas on both sides of the border, as indicated in Appendix A. This coordination shall be in accordance with Sections 4.3-4.5.

4.2 27.35 – 27.5 GHz Band - For the purposes of coordinating Canadian LMCS systems and U.S. fixed and mobile systems in the band 27.35-27.5 GHz, the NTIA represents the U.S. fixed and mobile use of this band.[4] Coordination of U.S. fixed and mobile stations with Canadian LMCS systems shall be carried out by NTIA, and the appropriate LMCS licensee(s), as indicated in Appendix A, through Industry Canada. This coordination shall be in accordance with Sections 4.3-4.5. In addition, fixed stations operating in Canada and the U.S., and U.S. inter-satellite systems, are subject to the technical limits described in Appendix D.

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[3] This arrangement may be amended if Canada designates the 29 and 31 GHz bands for fixed service.

[4] The service area boundary for fixed and mobile applications operating in the U.S. in this band is defined as the U.S./Canada border.

4.3 Cross Border Sharing Agreements - Licensees on both sides of the border are encouraged to develop sharing agreements that will facilitate reasonable and timely development of LMDS and LMCS.[5] These agreements should allow for the provision of service by each licensee within its licensed service area to the maximum extent possible. If there is a sharing agreement between the licensees, that agreement shall be followed rather than the coordination process set forth in Section 4.4.

4.4 Coordination in the Absence of a Sharing Agreement - If there is no sharing agreement between the licensees, then proposed facilities shall be coordinated on an individual basis according to the process described below.

4.4.1 The following power flux density (pfd) levels from the emissions of each transmitting station shall apply:

4.4.1.a Power flux density A ('pfd A') has a value of -114 dBW/m^2 in any 1 MHz band.

4.4.1.b Power flux density B ('pfd B') has a value of -94 dBW/m^2 in any 1 MHz band.

4.4.1.c Power flux density is calculated at the service area boundary of the neighboring service area(s) on the other side of the border.[6] Power flux density is calculated using accepted engineering practices, taking into account such factors as propagation loss, atmospheric loss, curvature of the Earth, and gain of the antenna in the direction of the service area boundary. The pfd level at the service area boundary shall be the maximum value for elevation points up to 500 meters above local terrain elevation. (See Appendix B for a sample calculation of power flux density at the service area boundary.)

4.4.2 If calculations demonstrate that facilities would generate a power flux density less than or equal to pfd A at the applicable service area boundary(ies), then no coordination is required.

4.4.3 If calculations demonstrate that facilities would generate a power flux density greater than pfd A, but less than or equal to pfd B at the applicable service area boundary(ies), then deployment of facilities is subject to successful coordination

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[5] LMDS and LMCS systems can consist of one or more facilities, which may be implemented at different times. Sharing agreements can facilitate the implementation of such systems by allowing the licensees to establish how they will share in advance.

[6] In cases where both the U.S./Canada border and the neighboring service area lie within a body of water, the power flux density shall be calculated at the shoreline of the neighboring service area.

between the affected licensees in accordance with the following coordination process:[7]

4.4.3.a The licensee must notify the respective licensee(s), by registered mail, of its intention to deploy facilities and include the appropriate information necessary to conduct an interference analysis. If no licensee exists in affected service areas on the other side of the border, deployment may proceed.

4.4.3.b The recipient of the notification must respond within 30 days of receipt to indicate any objection to the deployment. Such objections may be based only on harmful interference to existing systems.[8]

4.4.3.c If there is no objection raised, the deployment may proceed.

4.4.3.d If an objection is raised, the respective licensee(s) must work in collaboration to develop an agreement regarding the proposed facilities before their deployment. It is expected that the time frame to develop such an agreement should not exceed 30 days.

4.4.3.e Proposed facilities must be operational within 6 months from the conclusion of coordination, otherwise coordination must be re-initiated pursuant to Section 4.

4.4.4 If calculations demonstrate that facilities would generate a power flux density greater than pfd B at the applicable service area boundary(ies), then deployment of facilities is subject to the consent of the licensee(s) for that (those) service area(s) on the other side of the border.[9] If no licensee exists in the affected service area(s) on the other side of the border, deployment of facilities may proceed. In the event that new licensee(s) are authorized in the affected service area(s), the facilities must be modified in a timely manner to meet the pfd B level, unless an agreement can be reached between the affected parties.

4.5 In the event a satisfactory sharing agreement or a successful coordination between the licensees is not reached, then the respective Administrations shall be informed.

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[7] The pfd B level has been selected on the basis that new systems, on the other side of the border, can be implemented with certain mitigation measures to avoid potential interference. It should be noted that potential interference into existing stations is a possibility, and therefore coordination is required.

[8] Existing systems include (1) systems that are operational prior to the date on which notification is received and (2) systems that have been successfully coordinated within the 6 months preceding that date.

[9] Any pfd value greater than pfd B may present potential interference into both existing, and/or planned systems, therefore successful coordination is required before deployment.

5. Coordination in the 29 GHz and 31 GHz Bands

5.1 Each station of fixed systems in Canada and LMDS or fixed systems in the U.S. generating a pfd signal of less than or equal to –105 dBW/m^2 in any 1 MHz band at the Canada/U.S. border does not require coordination. Stations with emissions exceeding the pfd value of –105 dBW/m^2 in any 1 MHz band at the Canada/U.S. border will require prior coordination before deployment.[10] For the purposes of coordination with Canada, coordination is to be carried out with Industry Canada.[11] For the purposes of coordination with the U.S., coordination is to be carried out with the U.S. licensee(s) in the Basic Trading Area(s) (BTA(s))[12] where the pfd signal exceeds –105 dBW/m^2 in any 1 MHz.

5.2 Power flux density is calculated at the Canada/U.S. border.[13] Power flux density is calculated using accepted engineering practices, taking into account such factors as propagation loss, atmospheric loss, curvature of the Earth, and gain of the antenna in the direction of the Canada/U.S. border. The pfd level at the Canada/U.S. border shall be the maximum value for elevation points up to 500 meters above local terrain elevation. (See Appendix C for a sample calculation of power flux density at the Canada/U.S. border.)

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[10] Licensees on both sides of the border should recognize that the pfd level of –105 dBW/m^2 in any 1 MHz band at the Canada/U.S. border is 10 dB higher than the value given in Section 4 for the 27 GHz band. Operators should take this into consideration in their system design to avoid any interference problems. Emissions of up to the –105 dBW/m^2 in any 1 MHz band at the Canada/U.S. border will not be considered as interference.

[11] For the purposes of coordination with Canada, licensees should contact the Director, Space & International Regulatory Activities, Industry Canada.

[12] *See* Appendix A, note 14.

[13] In cases where both the U.S./Canada border and the neighboring service area lie within a body of water, the power flux density shall be calculated at the shoreline of the neighboring service area.

Appendix A
LMCS and LMDS Service Areas

LMCS is licensed by LMCS service areas and LMDS is licensed by Basic Trading Areas (BTAs).[14] For the purposes of this Arrangement, Tier 3 service areas, instead of LMCS service areas, are used to determine coordination entities in Canada.[15] The following tables show the Tier 3 service areas and BTAs in the 27.5 - 28.35 GHz frequency band that may need to coordinate with each other. The Administrations will provide licensee names and points of contact to allow the licensees to contact the relevant licensee(s) on the other side of the border to initiate coordination in accordance with this Arrangement.[16]

In the 27.35 – 27.5 GHz frequency range, for purposes of this Arrangement, Tables 1A and 1B will be used to determine coordination entities. The point of contact will be NTIA in the U.S. and Industry Canada in Canada.

Table 1A

U.S. licensees may need to coordinate with the corresponding Canadian Tier 3 service areas indicated below:

BTA NUMBER	BTA NAME	TIER 3 NUMBER	TIER 3 NAME
14	Anchorage, AK	3-59	Yukon, Northwest Territories & Nunavut/Yukon, Territoires du Nord-Ouest & Nunavut
30	Bangor, ME	3-09	Québec
30	Bangor, ME	3-05	Southern New Brunswick/Nouveau-Brunswick-Sud
30	Bangor, ME	3-06	Western New Brunswick/Nouveau-Brunswick-Ouest
36	Bellingham, WA	3-51	Okanagan/Columbia
36	Bellingham, WA	3-52	Vancouver
36	Bellingham, WA	3-53	Victoria
41	Billings, MT	3-42	Moose Jaw
41	Billings, MT	3-41	Regina
60	Buffalo-Niagara Falls, NY	3-30	London/Woodstock/St. Thomas
60	Buffalo-Niagara Falls, NY	3-25	Toronto
60	Buffalo-Niagara Falls, NY	3-29	Niagara-St. Catharines

[14] BTAs are defined in the Rand McNally 1992 Commercial Atlas & Marketing Guide, 123rd Edition, at pages 38-39, which identifies 487 BTAs based on the 50 States. Further information on U.S. service areas and licensees is available at http://www.fcc.gov/wtb/uls.

[15] The Tier 3 service areas are described in the document, Service Areas for Competitive Licensing (Industry Canada, August 1998). LMCS Service areas are described in the document, Local Multipoint Communication Systems (LMCS) in the 28 GHz Range: Policy, Authorization Procedures and Evaluation Criteria. These service areas and Canadian licensee information are available on the World Wide Web by following the appropriate links at: http://strategis.ic.gc.ca/spectrum.

[16] *See supra* notes 14-15.

63	Burlington, VT	3-12	Trois-Rivières
63	Burlington, VT	3-11	Eastern Townships/Cantons de l'Est
63	Burlington, VT	3-13	Montréal
112	Detroit, MI	3-31	Chatham
112	Detroit, MI	3-32	Windsor/Leamington
112	Detroit, MI	3-33	Strathroy
119	Duluth, MN	3-38	Thunder Bay
136	Fairbanks, AK	3-59	Yukon, Northwest Territories & Nunavut/Yukon, Territoires du Nord-Ouest & Nunavut
166	Grand Forks, ND	3-40	Brandon
166	Grand Forks, ND	3-39	Winnipeg
166	Grand Forks, ND	3-38	Thunder Bay
171	Great Falls, MT	3-42	Moose Jaw
171	Great Falls, MT	3-45	Medicine Hat/Brooks
171	Great Falls, MT	3-46	Lethbridge
215	Jamestown, NY-Warren, PA-Dunkirk, NY	3-30	London/Woodstock/St. Thomas
215	Jamestown, NY-Warren, PA-Dunkirk, NY	3-29	Niagara-St. Catharines
221	Juneau-Ketchikan, AK	3-57	Prince George
221	Juneau-Ketchikan, AK	3-59	Yukon, Northwest Territories & Nunavut/Yukon, Territoires du Nord-Ouest & Nunavut
224	Kalispell, MT	3-46	Lethbridge
224	Kalispell, MT	3-50	Kootenays
251	Lewiston-Auburn, ME	3-11	Eastern Townships/Cantons de l'Est
299	Minot, ND	3-40	Brandon
299	Minot, ND	3-41	Regina
330	Olean, NY-Bradford, PA	3-29	Niagara-St. Catharines
352	Plattsburgh, NY	3-18	Cornwall
352	Plattsburgh, NY	3-11	Eastern Townships/Cantons de l'Est
352	Plattsburgh, NY	3-13	Montréal
356	Port Angeles, WA	3-54	Nanaimo
356	Port Angeles, WA	3-53	Victoria
363	Presque Isle, ME	3-09	Québec
363	Presque Isle, ME	3-06	Western New Brunswick/Nouveau-Brunswick-Ouest
363	Presque Isle, ME	3-08	Bas du fleuve/Gaspésie
379	Rochester, NY	3-29	Niagara-St. Catharines
403	Sandusky, OH	3-32	Windsor/Leamington
409	Sault Ste. Marie, MI	3-35	Sault Ste. Marie
413	Seattle-Tacoma, WA	3-51	Okanagan/Columbia
413	Seattle-Tacoma, WA	3-52	Vancouver
413	Seattle-Tacoma, WA	3-53	Victoria
425	Spokane, WA	3-46	Lethbridge
425	Spokane, WA	3-51	Okanagan/Columbia
425	Spokane, WA	3-50	Kootenays
444	Toledo, OH	3-32	Windsor/Leamington
463	Watertown, NY	3-20	Kingston
463	Watertown, NY	3-21	Belleville

463	Watertown, NY	3-15	Ottawa
463	Watertown, NY	3-18	Cornwall
463	Watertown, NY	3-19	Brockville
463	Watertown, NY	3-13	Montréal
465	Waterville-Augusta, ME	3-09	Québec
465	Waterville-Augusta, ME	3-11	Eastern Townships/Cantons de l'Est
468	Wenatchee, WA	3-51	Okanagan/Columbia
468	Wenatchee, WA	3-52	Vancouver
476	Williston, ND	3-41	Regina

Table 1B

Canadian licensees may need to coordinate with the corresponding U.S. BTA service areas indicated below:

TIER 3 NUMBER	TIER 3 NAME	BTA Number	BTA NAME
3-05	Southern New Brunswick/Nouveau-Brunswick-Sud	30	Bangor, ME
3-05	Southern New Brunswick/Nouveau-Brunswick-Sud	363	Presque Isle, ME
3-06	Western New Brunswick/Nouveau-Brunswick-Ouest	30	Bangor, ME
3-06	Western New Brunswick/Nouveau-Brunswick-Ouest	363	Presque Isle, ME
3-07	Eastern New Brunswick/Nouveau-Brunswick-Est	363	Presque Isle, ME
3-08	Bas du fleuve/Gaspésie	363	Presque Isle, ME
3-09	Québec	30	Bangor, ME
3-09	Québec	363	Presque Isle, ME
3-09	Québec	465	Waterville-Augusta, ME
3-11	Eastern Townships/Cantons de l'Est	63	Burlington, VT
3-11	Eastern Townships/Cantons de l'Est	251	Lewiston-Auburn, ME
3-11	Eastern Townships/Cantons de l'Est	352	Plattsburgh, NY
3-11	Eastern Townships/Cantons de l'Est	465	Waterville-Augusta, ME
3-12	Trois-Rivières	63	Burlington, VT
3-13	Montréal	63	Burlington, VT
3-13	Montréal	352	Plattsburgh, NY
3-13	Montréal	463	Watertown, NY
3-15	Ottawa	463	Watertown, NY
3-18	Cornwall	352	Plattsburgh, NY
3-18	Cornwall	463	Watertown, NY
3-19	Brockville	463	Watertown, NY
3-20	Kingston	463	Watertown, NY
3-21	Belleville	463	Watertown, NY
3-25	Toronto	60	Buffalo-Niagara Falls, NY
3-29	Niagara-St. Catharines	60	Buffalo-Niagara Falls, NY
3-29	Niagara-St. Catharines	215	Jamestown, NY-Warren, PA-Dunkirk, NY
3-29	Niagara-St. Catharines	330	Olean, NY-Bradford, PA
3-29	Niagara-St. Catharines	379	Rochester, NY
3-30	London/Woodstock/St. Thomas	60	Buffalo-Niagara Falls, NY
3-30	London/Woodstock/St. Thomas	215	Jamestown, NY-Warren, PA-Dunkirk, NY
3-31	Chatham	112	Detroit, MI
3-32	Windsor/Leamington	112	Detroit, MI
3-32	Windsor/Leamington	403	Sandusky, OH
3-32	Windsor/Leamington	444	Toledo, OH
3-33	Strathroy	112	Detroit, MI
3-35	Sault Ste. Marie	409	Sault Ste. Marie, MI
3-38	Thunder Bay	119	Duluth, MN
3-38	Thunder Bay	166	Grand Forks, ND
3-39	Winnipeg	166	Grand Forks, ND
3-40	Brandon	166	Grand Forks, ND
3-40	Brandon	299	Minot, ND
3-41	Regina	41	Billings, MT

3-41	Regina	299	Minot, ND
3-41	Regina	476	Williston, ND
3-42	Moose Jaw	41	Billings, MT
3-42	Moose Jaw	171	Great Falls, MT
3-45	Medicine Hat/Brooks	171	Great Falls, MT
3-46	Lethbridge	171	Great Falls, MT
3-46	Lethbridge	224	Kalispell, MT
3-50	Kootenays	224	Kalispell, MT
3-50	Kootenays	425	Spokane, WA
3-51	Okanagan/Columbia	36	Bellingham, WA
3-51	Okanagan/Columbia	425	Spokane, WA
3-51	Okanagan/Columbia	468	Wenatchee, WA
3-52	Vancouver	36	Bellingham, WA
3-52	Vancouver	413	Seattle-Tacoma, WA
3-52	Vancouver	468	Wenatchee, WA
3-53	Victoria	36	Bellingham, WA
3-53	Victoria	356	Port Angeles, WA
3-53	Victoria	413	Seattle-Tacoma, WA
3-54	Nanaimo	356	Port Angeles, WA
3-57	Prince George	221	Juneau-Ketchikan, AK
3-59	Yukon, Northwest Territories & Nunavut/Yukon, Territoires du Nord-Ouest & Nunavut	14	Anchorage, AK
3-59	Yukon, Northwest Territories & Nunavut/Yukon, Territoires du Nord-Ouest & Nunavut	136	Fairbanks, AK
3-59	Yukon, Northwest Territories & Nunavut/Yukon, Territoires du Nord-Ouest & Nunavut	221	Juneau-Ketchikan, AK

Appendix B
Sample Calculation for the 27 GHz Band

The following example is provided to illustrate how the pfd level at the service area boundary can be determined[17]:

Proposed station parameters:

Parameter	Symbol	Value
Hub transmitter power into the antenna	P_T	-12 dBW
Channel bandwidth	B	40 MHz
Transmitter antenna height above ground	H_T	100 meter
Transmitter antenna gain (Maximum gain towards the service area boundary at any elevation point 0-500 m above local terrain)	G_T	21 dBi
Centre frequency of channel	F	28150 MHz
Distance from hub transmitter to the boundary of service area Y	D	10km

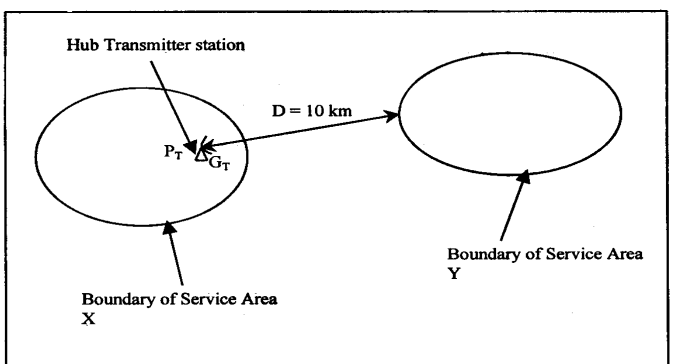

Figure 1: Graphical representation of the proposed situation

[17] It should be noted that the example calculation assumes line of sight conditions due to the short path length and the height of the transmitting antenna. In other cases, where the distance is larger and/or the transmitting antenna height is small, line-of-sight conditions may not exist. In these cases, an appropriate propagation model that takes the non-line-of-sight situation into account should be used.

The spectral power density in dBW/MHz received by an isotropic antenna ($P_{\text{at the boundary of Service Area Y}}$) at the boundary of service area Y may be calculated using free space propagation, and taking into account such factor as atmospheric losses as follows:

$$P_{\text{at the boundary of Service Area Y}} = P_T' + G_T - 20 \log F_{MHz} - 20 \log D_{km} - 32.4 - L_a$$
$$= (-28 + 21 - 20\log(28150) - 20 \log(10) - 32.4 - 0.1\text{x}10) \text{ dBW/MHz}$$
$$= (-28 + 21 - 89 - 20 - 32.4 - 1) \text{ dBW/MHz}$$
$$= -149.4 \text{ dBW/MHz}$$

where:

$P_T' = P_T - 10 \log B_{MHz}$
$= -12 - 10 \log(40)$
$= -28$ dBW/MHz

$G_T = 21$ dBi

$F_{MHz} = 28150$

$D_{km} = 10$

$L_a =$ atmospheric losses
$= 0.1$ dB/km

Then, the power flux density in dBW/m^2 in 1 MHz (pfd) may be calculated as follows:

$$\text{pfd} = P_{\text{at the boundary of Service Area Y}} - 10 \log A_r$$
$$= (-149.4 - 10 \log(9.038 \text{ x } 10^{-6})) \text{ dBW/m}^2 \text{ in 1 MHz}$$
$$= (-149.4 - (-50.4)) \text{ dBW/m}^2 \text{ in 1 MHz}$$
$$= -99 \text{ dBW/m}^2 \text{ in 1 MHz}$$

where: Ar = area of an isotropic receiving antenna

$= \lambda^2/(4\pi)$

$= c^2/(4\pi F_{Hz}^2)$

$= (3\text{x}10^8)^2 / (4\pi \text{ x } (28.15\text{x}10^9)^2)$

$= 9.038 \text{ x } 10^{-6} \text{m}^2$

Appendix C
Sample Calculation for the 29 GHz and 31 GHz Bands

The following example is provided to illustrate how the pfd level at the Canada/U.S. border can be determined[18]:

Proposed station parameters:

Parameter	Symbol	Value
Hub transmitter power into the antenna	P_T	-12 dBW
Channel bandwidth	B	40 MHz
Transmitter antenna height above ground	H_T	100 meter
Transmitter antenna gain (Maximum gain towards the U.S./Canada border at any elevation point 0-500 m above local terrain)	G_T	21 dBi
Centre frequency of channel	F	29150 MHz
Distance from hub transmitter to the Canada/U.S. border	D	10 km

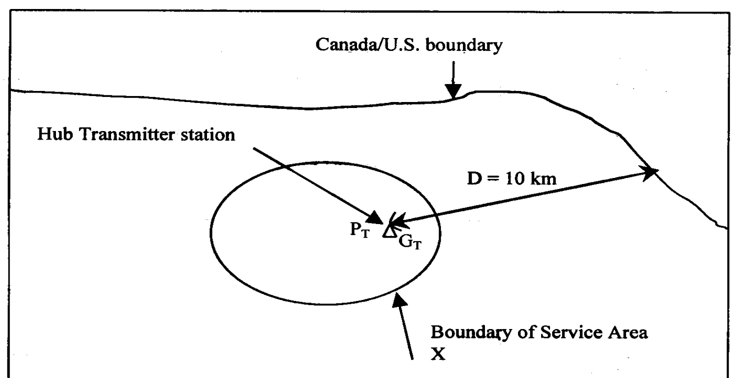

Figure 1: Graphical representation of the proposed situation

[18] It should be noted that the example calculation assumes line of sight conditions due to the short path length and the height of the transmitting antenna. In other cases, where the distance is larger and/or the transmitting antenna height is small, line-of-sight conditions may not exist. In these cases, an appropriate propagation model that takes the non-line-of-sight situation into account should be used.

The spectral power density in dBW/MHz received by an isotropic antenna ($P_{\text{at the U.S./Canada border}}$) at the U.S. Canada border may be calculated using free space propagation, and taking into account such factor as atmospheric losses as follows:

$$
\begin{aligned}
P_{\text{at the U.S/Canada border}} &= P_T' + G_T - 20\log F_{MHz} - 20\log D_{km} - 32.4 - L_a \\
&= (-28 + 21 - 20\log(29150) - 20\log(10) - 32.4 - 0.1\text{x}10)\ \text{dBW/MHz} \\
&= (-28 + 21 - 89.3 - 20 - 32.4 - 1)\ \text{dBW/MHz} \\
&= -149.7\ \text{dBW/MHz}
\end{aligned}
$$

where:

$$
\begin{aligned}
P_T' &= P_T - 10\log B_{MHz} \\
&= -12 - 10\log(40) \\
&= -28\ \text{dBW/MHz} \\
G_T &= 21\ \text{dBi} \\
F_{MHz} &= 29150 \\
D_{km} &= 10 \\
L_a &= \text{atmospheric losses} \\
&= 0.1\ \text{dB/km}
\end{aligned}
$$

Then, the power flux density in dBW/m^2 in 1 MHz (pfd) may be calculated as follows:

$$
\begin{aligned}
\text{pfd} &= P_{\text{at the U.S./Canada border}} - 10\log A_r \\
&= (-149.7 - 10\log(8.429 \text{ x } 10^{-6}))\ \text{dBW/m}^2 \text{ in 1 MHz} \\
&= (-149.7 - (-50.7))\ \text{dBW/m}^2 \text{ in 1 MHz} \\
&= -99\ \text{dBW/m}^2 \text{ in 1 MHz}
\end{aligned}
$$

where:

$$
\begin{aligned}
Ar &= \text{area of an isotropic receiving antenna} \\
&= \lambda^2/(4\pi) \\
&= c^2/(4\pi F_{Hz}^2) \\
&= (3\text{x}10^8)^2 / (4\pi \text{ x } (29.15\text{x}10^9)^2) \\
&= 8.429 \text{ x } 10^{-6} m^2
\end{aligned}
$$

Appendix D

The following technical limits have been developed in the ITU-R with the objective to provide adequate protection to the inter-satellite service from emissions from the fixed service in the band 27.35-27.5 GHz:

Stations of the inter-satellite service will operate in accordance with the provisions of Section V of Article S21 of the ITU Radio Regulations.

1. Transmitters of a hub station in a point-to-multipoint network:

    1.1 The equivalent isotropic radiated power (e.i.r.p) spectral density for each transmitter of a hub station in a point-to-multipoint network will not exceed the following values in any 1 MHz band for the elevation angle θ above the local horizontal plane[19]:

+14 dB	dBW	for $0° \leq \theta \leq 5°$
$+14-10\log(\theta/5)$	dBW	for $5° < \theta \leq 90°$

    1.2 In the direction toward the geostationary (GSO) Data Relay Satellite (DRS) orbit locations of, 41°W, 46°W, 171°W, and 174°W[20], the e.i.r.p. spectral density[21] of the emissions of a hub station shall not exceed +8dBW/MHz if the elevation angle above the local horizontal plane[22] is between 0° and 20°.

    1.3 In the case of a hub-station employing single frequency operation in which the same frequency is used for both transmission and reception on a time division basis, the e.i.r.p. spectral density limit in 1.2 can be relaxed by $7 \log (1/\eta)$ dB, where η ($0< \eta <1$) is the proportion of time when a hub-station is emitting transmitting signals. However, this relaxation should not exceed 3 dB even for a small η.

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[19] At elevation angles below the local horizontal plane no e.i.r.p. limitations, other than those specified in Article S21 of the ITU Radio Regulations apply.

[20] In the event that additional orbit locations are identified in applicable ITU-R Recommendations, this arrangement may be modified to include those orbit locations.

[21] The e.i.r.p. spectral density radiated towards a geostationary DRS location shall be calculated as the product of the transmitted power spectral density and the gain of the omnidirectional or sectoral antenna in the direction of the DRS. In the absence of a radiation pattern for the hub-station antenna, the reference radiation pattern of Recommendation ITU-R F.1336 should be used. The calculation should take into account the effects of atmospheric refraction and the local horizon. A method for calculating the separation angles is given in Annex 2 to Recommendation ITU-R F.[PMP26GHz].

[22] At elevation angles below the local horizontal plane no e.i.r.p. limitations, other than those specified in Article S21 of the ITU Radio Regulations apply.

1.4 The hub station of a point-to-multipoint network may use Automatic Transmit Power Control (ATPC) to increase its transmitted power during rain faded condition, by an amount not exceeding the precipitation attenuation such that its e.i.r.p. spectral density in the direction of any GSO DRS orbit locations referenced above does not exceed +17 dBW in any 1 MHz band.

2. Transmitter of a subscriber station in a point-to-multipoint network, or transmitters of point-to-point fixed stations:

For the GSO DRS orbit locations referenced above:

2.1 As far as practicable, the e.i.r.p. spectral density of such a fixed service (FS) station in the direction of the above locations should not exceed +24dBW in any 1 MHz band.

2.2 During conditions when precipitation attenuation is experienced between the FS transmitting and receiving stations, the transmitting station may use ATPC to increase its transmitted power, by an amount not exceeding the precipitation attenuation such that its e.i.r.p. spectral density in the direction of the GSO locations referenced above does not exceed +33 dBW in any 1 MHz band.

2.3 When the atmospheric attenuation towards the GSO locations referenced above, calculated using the procedures in Annex 1 of Recommendation ITU-R P.676, taking into account the elevation angle towards these orbit locations, the altitude of the FS transmitting antenna and local information of average water vapor content in the driest month and of other meteorological parameters (see Annex 3 to Recommendation ITU-R F. 1249), exceeds 3 dB, this excess may be applied as an increase of the e.i.r.p. spectral density of the subscriber or point-to-point station.

2.4 When the Fresnel zones on the path from such a transmitting subscriber station or point-to-point station in the direction of the above orbit locations are completely or partially blocked, the e.i.r.p. density in this direction may be increased by an amount calculated using the methods of Recommendation ITU-R P.526 (see Annex 4 to Recommendation ITU-R F.1249) taking due account of atmospheric refraction on this path (see Recommendation ITU-R F.1333).