A STUDY OF THE MAGNITUDE OF POTENTIAL INTERFERENCE BETWEEN THE MOBILE SATELLITE SERVICE AND THE FIXED AND/OR MOBILE SERVICE IN THE BANDS 1427-1525 AND 1700-2500 MHz

SHORT TITLE (DOC INTERFERENCE STUDY)

FINAL REPORT

CANADIAN ASTRONAUTICS LIMITED

A STUDY OF THE MAGNITUDE OF POTENTIAL INTERFERENCE BETWEEN THE MOBILE SATELLITE SERVICE AND THE FIXED AND/OR MOBILE SERVICES IN THE BANDS 1427-1525 AND 1700-2500 MHz

SHORT TITLE (DOC INTERFERENCE STUDY)

FINAL REPORT

CONTRACT SERIAL NUMBER 36100-0-5317

CAL-RP-0596-10001

OCTOBER 1990

A STUDY OF THE MAGNITUDE OF POTENTIAL INTERFERENCE BETWEEN THE MOBILE SATELLITE SERVICE AND THE FIXED AND/OR MOBILE SERVICES IN THE BANDS 1427-1525 AND 1700-2500 MHz

TABLE OF CONTENTS

LIST OF ANNEXES

ANNEX	PROGRAM NAME	INTERFERENCE SOURCE	INTERFERED SYSTEM	FREQUENCY BAND
A.1	MSATINTA.BAS	MSAT	TRR	1.530-1.559 GHz
B.1	GRSTPWR1.BAS	TRR	MSAT	1.427-1.525 GHz
B.2	GRSTPWR2.BAS	TRR	MSAT	1.700-1.710 GHz
B.3	GRSTPWR3.BAS	TRR	MSAT	1.710-1.900 GHz
B.4	GRSTPWR4.BAS	TRR	MSAT	1.900-2.290 GHz
B.5	GRSTPWR5.BAS (MCS)	TRR	MSAT	2.290-2.450 GHz
B.6	GRSTPWR6.BAS (Pt-Pt)	TRR	MSAT	2.290-2.450 Ghz
C.1	LANDPWR1.BAS	TRR	MSAT	1.427-1.525 GHz
C.2	LANDPWR2.BAS	TRR	MSAT	1.700-1.710 GHz
C.3	LANDPWR3.BAS	TRR	MSAT	1.710-1.900 GHz
C.4	LANDPWR4.BAS	TRR	MSAT	1.900-2.290 GHz
C.5	LANDPWR5.BAS (MCS)	TRR	MSAT	2.290-2.450 GHz
C.6	LANDPWR6.BAS (Pt-Pt)	TRR	MSAT	2.290-2.450 GHz
D.1	FPLMTSIN.BAS	FPLMTS	MSAT	1.631-1.660 GHz
E.1	FPLMAIR1.BAS	FPLMTS	AMS(R)S	1.545-1.555 GHz
E.2	FPLMAIR2.BAS	FPLMTS	AMS(R)S	1.545-1.555 GHz

EXECUTIVE SUMMARY

The objective of this study was to examine the possibility of frequency sharing between the mobile satellite service and the fixed or mobile services in the frequency bands; 1427-1525 and 1700-2500 MHz. A model was developed based on the proposed MSAT design, current ground terminal specifications and the technical outline of the Future Public Land Mobile Telecommunication System, and the intersystem interference was calculated using computer programs. While the study only included quantitative Canadian data, other information that could impact on system performance was included in a qualitative manner.

The results indicated that there could be significant interference between the services under worst case conditions and that any sharing scenario would have to be subject to fairly stringent regulations on protection from or protection of the geostationary satellite orbit. Also evident was that Canada, because of its geographic location and consequent relatively low look angles to a geostationary satellite, would be limited to deployment of non-interfering terrestrial systems to southern regions.

The only service considered feasible for sharing between the services is the MSAT forward link with the TRR in the bands

1427-1525 MHz and 1900-2450 MHz. The following results from the study summarize the calculations carried out in the text and computer programs used in the report to support this conclusion.

MSAT INTERFERENCE TO THE TRR

FREQUENCY GHz	INTERFERENCE POWER DENSITY dBW/Hz	3.0 dB DEGRAD dB	DEGREES OFF GSO	0.5 dB DEGRAD dB	DEGREES OFF GSO
1.475	-178.6	15.4	5.6	24.5	22.5
1.545	-179.0	15.0	10.3	24.1	40.5
1.705	-178.7	15.4	10.5	24.5	42.0
1.800	-178.6	15.4	8.5	24.5	58.0
2.100	-178.7	15.3	7.0	24.5	15.0
2.400	-178.8	15.2	4.5	24.3	18.0

These bands with a 7 degrees or more offset from the GSO will result in a TRR degradation of not greater than 3 dB and with an offset of at least 22.5 degrees will provide a degradation of at most 0.5 dB. The TRR interference to the MSAT mobile terminal while it is in proximity to a TRR station will naturally affect operation; however, it should be acceptable as the mobile can be expected to move out of the interfering environment relatively rapidly.

1.0 INTRODUCTION

1.1 OBJECTIVE

1.1.1 The objective of this study is to examine the possibility of frequency sharing between the mobile satellite service (MSS) and the fixed or mobile services in the frequency bands; 1427-1525 MHz and 1700-2500 MHz. The MSS or related satellite services are not currently allocated in these bands; however, such allocations may be considered at the World Administrative Radio Conference to be held in 1992 (WARC'92). Specific consideration is given to sharing with the Future Public Land Mobile Telecommunications System (FPLMTS) which is expected to be implemented within the next ten years. The results of the study will be used by the Department of Communications (DOC) in preparing for WARC'92 and as supporting documentation for the Canadian delegation to the Conference.

1.1.2 The criteria for sharing will follow CCIR study papers and reports which also will be used to establish the characteristics and technical parameters for the various services. DOC Canadian requirements for the established services, Standard Radio Systems Plans (SRSP), will be used in the models as inputs to determine if sharing is feasible.

1.2 BACKGROUND

1.2.1 The current allocation to the mobile satellite services in the bands of interest are 1530-1559 MHz in the space-to-earth (downlink) direction and in the band 1626.5-1660.5 MHz in the earth-to-space (uplink) direction. These bands were reviewed at WARC-Mob-87 and changes were made to allocate spectrum to the land mobile satellite service (LMSS) in certain bands, maritime mobile satellite service (MMSS) and aeronautical mobile satellite service (AMS(R)S) in others (see WARC-Mob-87 Final Acts for details). The Canadian spectrum policy in these bands is somewhat different, in that, as specified in SP-1530, the band is allocated to the more general mobile satellite service except for two 3 MHz bands allocated exclusively to the AMS(R)S.

1.2.2 WARC-Mob-87 also generated Resolution 208 of the Radio Regulations which stated additional spectrum should be allocated to the mobile satellite service, or the more specific AMS(R)S, MSS, and LMSS services at a future WARC. The ITU Plenipotentiary decided in June 1989 to hold a WARC in March 1992, and it is expected that the allocation of additional mobile satellite spectrum will be on the agenda.

1.2.3 A previous study "A Study of Intersystem

Interference in the 806-890 MHz Band", reference 1, investigated the possibility of frequency sharing between the mobile satellite service and the terrestrial cellular network. This report detailed the potential interference mechanisms between these services and they will be used as baseline scenarios in this study adjusted as necessary for the different operating frequencies and system parameters.

1.3 SCOPE

1.3.1 The specific bands to be considered for the fixed systems and the DOC technical documentation are:

1427-1525 MHz	SRSP311
1700-1710 MHz	SRSP301.70
1710-1900 MHz	SRSP301.71
1900-2290 MHz	SP301.9
2290-2500 MHz	SRSP302.2

Sharing with the FPLMTS will be based on CCIR Recommendation (Doc. 8/357) and Report M/8 (Doc.8/358) and the mobile satellite (MSAT) technical parameters given in Corrigendum 1 to Document 8/531-E. Mutual interference between LMSS mobiles and terrestrial systems except for the FPLMTS are not included as part of this study and

appropriate protection must be provided.

2.0 EXISTING AND PROPOSED SYSTEMS CHARACTERISTICS

2.1 LINE OF SIGHT RADIO RELAY SYSTEMS

2.1.1 The main radio relay systems' technical characteristics that must be considered in a frequency sharing scenario are the transmitted EIRP, the required signal to noise ratio (S/N), the receive system noise temperature, the antenna pattern, the antenna boresight azimuth and elevation, the system bandwidth and the number of co-channel systems to be considered. Some of the limits of these parameters are given in the SRSP's and others must be estimated from published system performance characteristics (Reference 9), and actual installation and performance information. The required S/N depends on the fade margin allocation and the number of hops in the path. For this study a minimum C/N=20.8 dB will be used which corresponds to a S/N=38.7 dB which will be exceeded for 99.99% of the time for a single hop system with a free space S/N=79.7 dB.

2.1.2 Table 1. gives technical parameters for radio relay systems operating in the bands noted in paragraph 1.3.1 which will be used in subsequent interference calculations. The EIRP values

have been adjusted from the maximum values given in the SRSP's to reflect the DOC's experience with installed systems. The receive antenna gain is based on using a 10 foot (3 metre) antenna with 55% efficiency and 10 dB circuit losses.

TABLE 1. RADIO RELAY SYSTEM CHARACTERISTICS

FREQUENCY MHz	EIRP dBW	NOISE TEMP dB^0K	RX ANT GAIN dB	BW MHz	ANTENNA REFERENCE
1427-1525	35	34.6	20.9	3.5	SRSP-311 FIG.4
1700-1710	35	34.6	22.1	3.5	SRSP-301.70 FIG.2
1710-1900	35	34.6	22.6	.875-7.0	SRSP-301.71 FIG.1
1900-2290	45	34.6	23.9	29.0	SRSP-301.9 FIG.3
2290-2450	45	34.6	24.9	1.5-6.0	SRSP-302.2 FIG.1&2

2.2 FUTURE PUBLIC LAND MOBILE TELECOMMUNICATIONS SYSTEM

2.2.1 The FPLMTS concept has two segments, the vehicular mobile and the indoor/outdoor personal portable units. This study only deals with the personal portable units; however, it is anticipated that similar results will be obtained for the mobile unit or that the results from reference 1 will be still valid. The FPLMTS consists of base stations and a large number of portable stations. These are grouped into cells approximately 25 metres in radius indoors and 100 metres for outdoor cells. Frequencies are reused in accordance with a mutual interference criteria and users may move within cells and from cell to cell while maintaining continuous

communications. The density of base and portable stations may vary from tens of thousands per square kilometre in urban centres to almost zero in rural areas with the ratio of portables to base stations varying between 60:1 in an urban office building to 1:1 in a rural residential area. The preponderance of stations in the urban centres indicates that from an intersystem interference point of view they can be considered to be the main interfering sources. For use in this study a minimum population of 100,000 is used to define an urban or metropolitan area, with a population of 100,000 being considered to be equivalent to one square kilometre of urban traffic.

2.2.2 The FPLMTS typical system parameters are given in Table 2. for the portable segment. An equivalent traffic channel is the expected power level for a single radio carrier and can be considered to be a power level of -25 dBW in a 50 kHz bandwidth. This is expected to produce a busy hour integrated urban power spectral density of -60 dBW/Hz per square kilometre. The range equations are:

$$Lp(r_i)=21+35*\log(r)$$

$$Lp(r_o)=38.5+20*\log(r)$$

Where: $Lp(r_i)$=Indoor path loss in dB

$Lp(r_o)$=Outdoor path loss in dB

r=Range in metres

The maximum path loss is 85 dB for indoors and 81 dB for outdoors operation corresponding to ranges of 67 and 133 metres respectively.

TABLE 2. FPLMTS RADIO PARAMETERS

EIRP/Equivalent Traffic Channel	-25 dBW
Total Bandwidth	60 MHz
Equivalent Traffic Channel Bandwidth	50 kHz
Busy Hour Average Traffic	20000E/sqkm
Integrated Urban Power Density*	-60 dBW/Hz/sqkm
Receiver Noise Figure	5 dB
Required C/(N+I)	13 dB

* 1 sqkm is considered to be equivalent to a population of 100,000.

2.3 THE MSAT MOBILE SATELLITE SYSTEM

2.3.1 The MSAT has evolved to meet the need for reliable mobile communications in all areas of Canada, within the satellite coverage area, for voice and data communication services. In order to provide a regional service with mutual backup capability, Telesat Mobile Incorporated (TMI) and the American Mobile Satellite Consortium, Incorporated (AMSC), are proceeding with joint procurement of similar spacecraft to meet the anticipated North American user demand.

2.3.2 The TMI satellite will be located at 106.5° West Longitude and will provide Canada coverage with four L-Band beams boresighted on:

West	54.4° North Latitude	122.5° West Longitude
West/Central	55.0° North Latitude	103.5° West Longitude
East/Central	52.5° North Latitude	87.8° West Longitude
East	50.0° North Latitude	65.6° West Longitude

Five other beams will give coverage of Alaska and the contiguous US states. A single SHF beam operating in the Ku-Band will provide the link between the fixed earth stations and the satellite. Figure 1 illustrates the four Canadian beams coverage.

2.3.3 The satellite will have nine wideband L-Band linear transponders capable of supporting a total of 860 assignable equivalent voice channels. The L-Band and SHF link budgets are given in Table 3 for a typical (ACSSB) voice channel. The two 4.9 metre spacecraft L-Band antenna give an edge of coverage (EOC) net gain of 31 dB and a 3 dB beamwidth of 2.7 degrees. The satellite EIRP per 5 kHz channel is 32.3 dBW and the mobile terminal has a G/T=-17.5 dB/°K and an EIRP of 16.2 dBW.

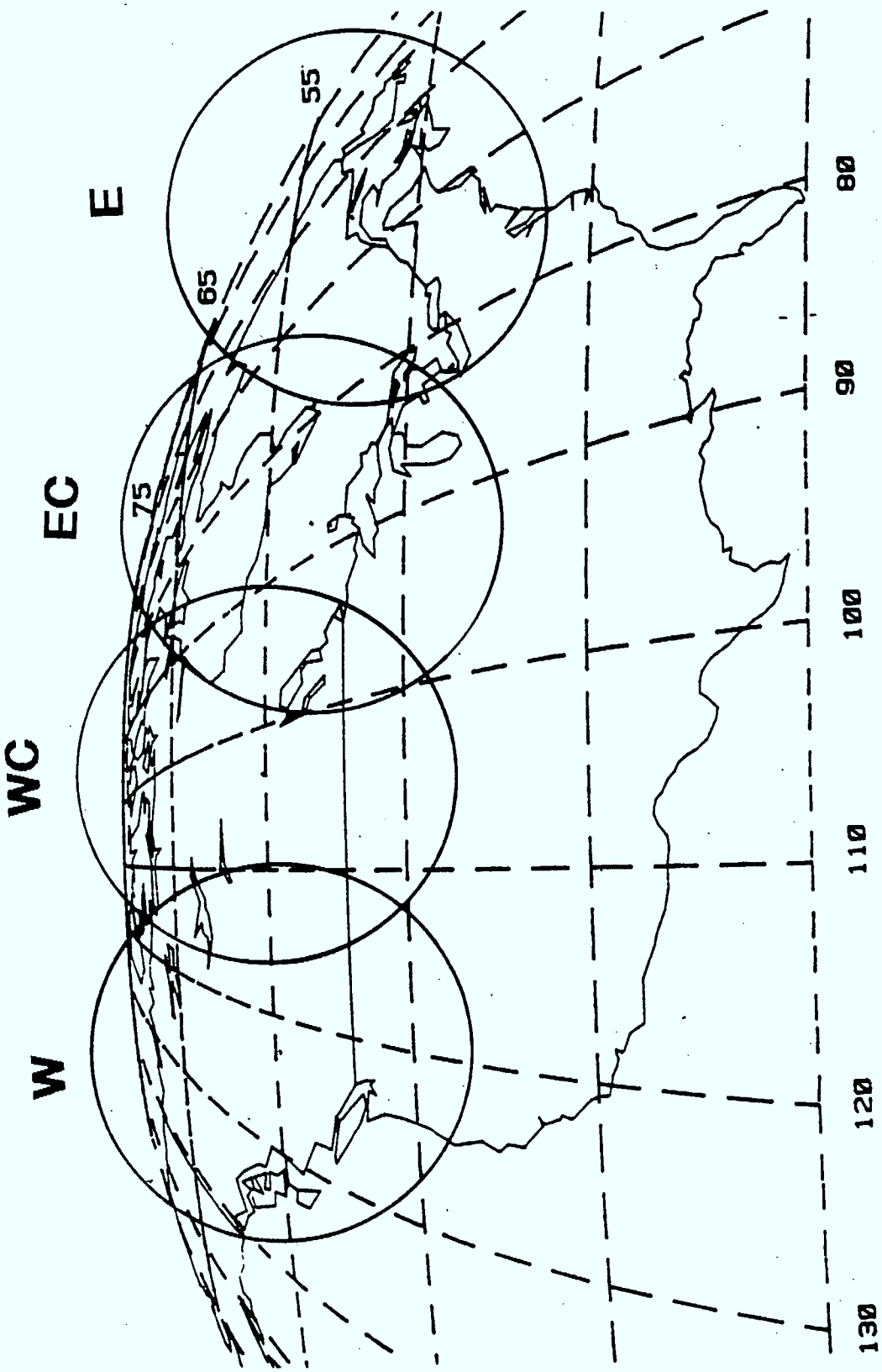

FIGURE 1. MSAT CANADIAN COVERAGE

TABLE 3. MSAT MRS 1.5/1.6 GHz and SHF Link Budgets
ACSSB VOICE (Reference 4)

PARAMETER	UNIT	FORWARD LINK 3.5 M SHF Ant. to Mobile	REVERSE LINK Mobile to 3.5 M SHF Ant.
UPLINK			
Frequency	MHz	13200	1650
Uplink EIRP/Voice Act.Carr	dBW	45.1	16.2
Path Loss	dB	206.8	188.7
Net Antenna Gain EOC	dBi	25.0	31.0
Satellite G/T	dB/K	-3	2.8
System Noise Spectral density	dBW/Hz	-200.6	-200.4
Carrier Power at LNA Input	dBW	-136.7	-141.5
Total IPBO/Transp. (Av.Pwr.)	dB	N/A	12
Req'd Flux Density/Voice Carr	dBW/M^2	-117.8	-146.7
C/N_o Thermal	dB-Hz	63.9	58.9
Voice Bandwidth	kHz	3	3
C/N Thermal	dB	29.2	24.1
DOWNLINK			
Frequency	MHz	1545	11300
Req'd EIRP/Voice Act. Carr.	dBW	32.3	10.6
Req'd Total OPBO	dB	N/A	7
Path Loss	dB	188.1	205.4
Receive Terminal G/T	dB/K	-17.5	25.9
C/N_o Thermal	dB-Hz	55.2	59.7
INTERFERENCE (C/I)			
Intermod & Energy Spread			
Uplink	dB	32	25
Downlink	dB	22	25
Other Sources			
Uplink	dB	32	40
Downlink	dB	40	29
Total Interference	dB	21.2	21.1
Total C/I_o	dB-Hz	55.9	55.9
Total Unfaded $C/(N_o+I_o)$	dB-Hz	52.3	53.1

2.3.4 The interference discrimination from terrestrial sources at the satellite will depend on the off axis angle of the interfering source in relation to the satellite antenna boresight, with the off axis antenna net gain calculated from CCIR Report 558-3. Giving:

$G(\Theta)=G_m-3*(\Theta/\Theta_0)^2$ dBi for $\Theta_0 \leq \Theta \leq a*\Theta_0$

$G(\Theta)=G_m+L_s$ dBi for $a*\Theta_0 < \Theta \leq b*\Theta_0$

$G(\Theta)=G_m+L_s+20-25*\mathrm{Log}(\Theta/\Theta_0)$ dBi for $b*\Theta_0 < \Theta \leq \Theta_1$

$G(\Theta)=0$ dBi for $\Theta_1 < \Theta$

Where: $G(\Theta)$=Gain at the angle (Θ) from the axis in dBi,

Gm=Maximum gain in the main lobe (boresight) in dBi,

Θ_0=1/2 the 3 dB beamwidth in the plane of interest (3 dB below G_m) in degrees,

Θ_1=Value of Θ when $G(\Theta)$ in the third equation above is equal to 0 dBi,

L_s=The required near-in side-lobe level (dB) relative to peak gain,

a,b=The numeric values given below:

L_s in dB	a	b
-20	2.58	6.32
-25	2.88	6.32

-30	3.16	6.32

For MSAT the following values will be used in the computer programs: G_m=34 dBic, $\Theta_{0=}$(1/2)*2.7=1.35 degrees,and L_s=-25 dB. The interference will be assumed to have a Gaussian distribution and to be additive.

2.3.5 The satellite interference to terrestrial systems will depend on the satellite off axis angle to the terrestrial station and the relative orientation of its antenna . Again additive white Gaussian noise will be assumed for the interfering signal. Due to Faraday rotation the satellite to mobile earth terminal path utilizes circular polarization while the terrestrial systems employ linear polarization. This results in a nominal polarization isolation between systems of 3 dB. This value will be included in the link calculations when assessing the intersystem interference.

2.3.6 The power and energy spectral densities will be computed for the desired and interfering sources and the impact on the desired system performance will be assessed. The relative impact on the overall performance of the satellite systems will be graded in accordance with the following levels of degradation (I) in Carrier-to-Total Noise ratio resulting from the interference.

$I \leq 0.1$ dB

$0.1 < I < 3$ dB

$I \geq 3.0$ dB

3.0 POTENTIAL INTER-SYSTEM INTERFERENCE

3.1 SATELLITE/TERRESTRIAL MODEL GEOMETRY

Figure 2 shows the geometry for a geosynchronous satellite located at P=6.6166 earth radii from the centre of the earth and rotating in the plane of the earths equator. A satellite beam is shown boresighted on P(BS) with terrestrial co-ordinates Φ degrees of latitude and BSLONG degrees of longitude. The relative longitude γ, is the sub-satellite longitude (SSLONG) minus BSLONG. Figure 3 expands this view to the Northern hemisphere with the arc R given by:

$$\mathrm{Cos}(R)=\mathrm{Cos}(\Phi)*\mathrm{Cos}(\gamma)$$

The azimuth (360-A), Figure 3, from the boresight location to the

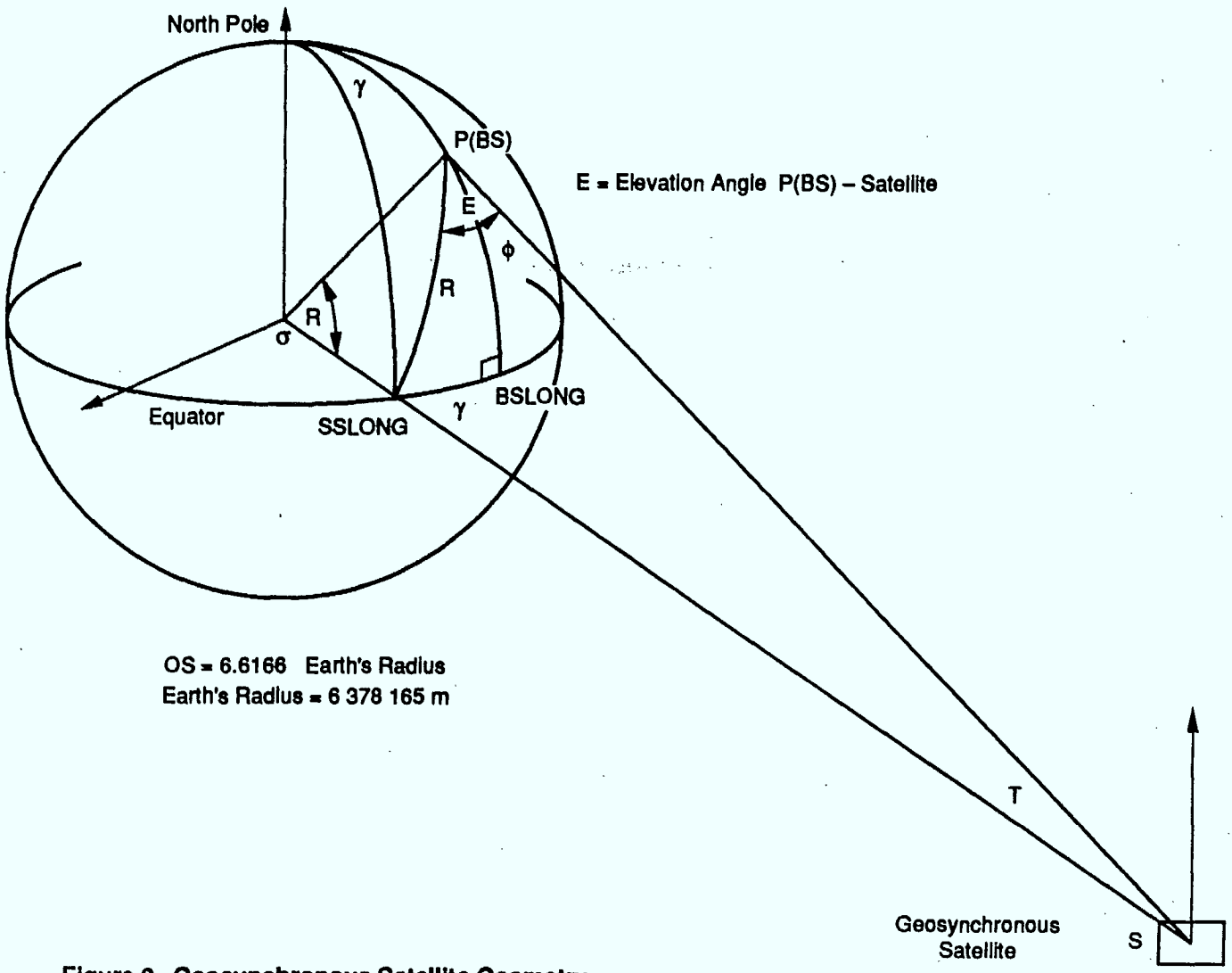

Figure 2 Geosynchronous Satellite Geometry

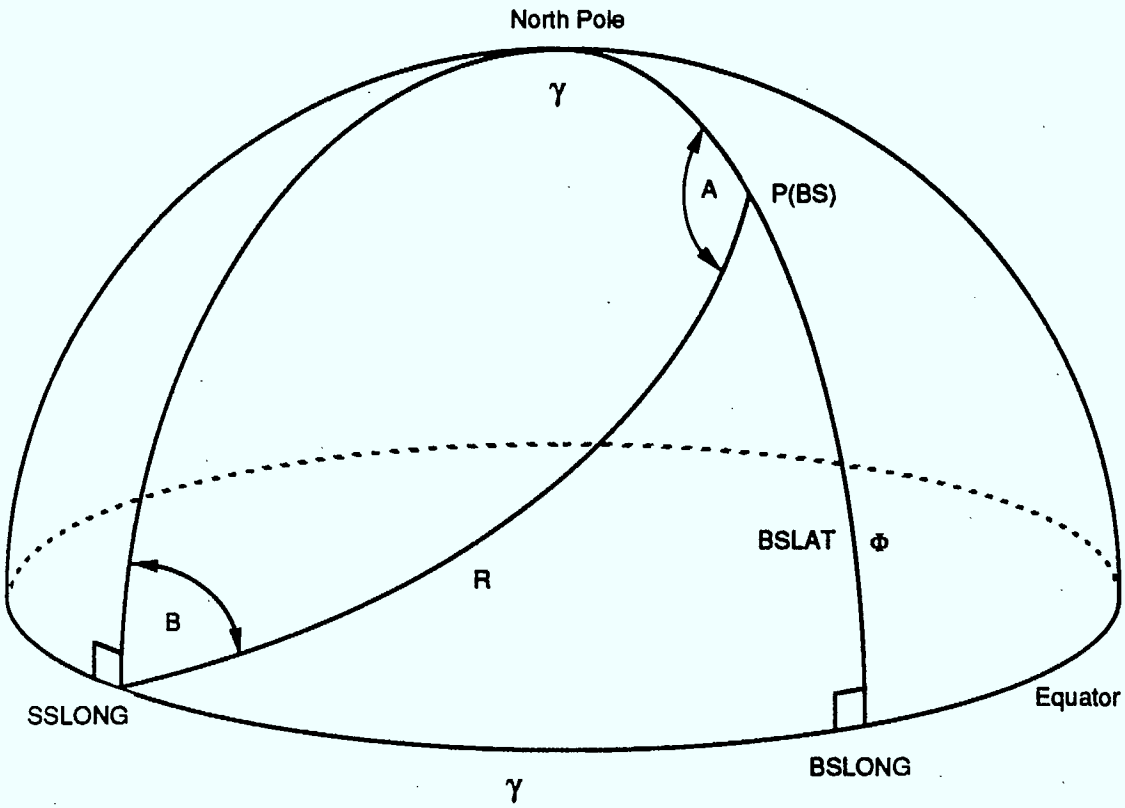

Figure 3 Northern Hemisphere View and Station Coordinates

subsatellite longitude is calculated from:

$$\mathrm{Tan}(A)=-\mathrm{Tan}(\gamma)/\mathrm{Sin}(\Phi)$$

The tilt angle T, the angle OSP(BS) in that plane, is the angle between the boresight and the earth/satellite geocentric and is shown in Figure 2 :

$$\mathrm{Tan}(T)=\mathrm{Sin}(R)/(P-\mathrm{Cos}(R))$$

and the elevation angle E from boresight to the satellite is calculated from:

$$\mathrm{Cos}(E)=P*\mathrm{Sin}(T)$$

with the distance D, in terms of earth radii, from the satellite to the boresight location given by:

$$D^2=P^2-2*P*\mathrm{Cos}(R)+1$$

To form a beam (cone) concentric with the satellite-boresight ray the off boresight angle BW/2 is generated about S.P(BS). The intercept of this projection on the earth's surface gives the coverage pattern for the selected offset. This offset can be

adjusted to give different EIRP's and the isopower contours of the earth's surface can be calculated and plotted. This offset can also be used to calculate the off axis gain for received power calculations. Figure 4 illustrates one point p(x) of this projection and shows the spherical triangle connecting P(BS),P(x) and SSLONG. The spherical triangle ABC on a sphere of one earth's radius generated by the three rays emanating from the satellite to P(BS),P(x) and SSLONG is shown in Figure 5. This view, looking towards the satellite, shows the off-axis arc BC as it is rotated through 360 degrees, $\Psi(n)$,(n=0-360). As the axes of the two spheres are parallel and their centres are connected by SO, it can be shown that the spherical triangle about the satellite ABC is similar to the spherical triangle SSLONG.P(x).P(BS) on the surface of the earth. Solving for the interior angles shown in figure 4 and using the relation that $-\Phi(n)=B-B(x)$ yields the arc length R(x) from SSLONG to the beam edge at P(x) and its direction. These are then translated into coordinates of latitude and longitude using:

$$\mathrm{Sin}(\Phi(x))=\mathrm{Sin}(R(x))*\mathrm{Cos}(B(x))$$

$$\mathrm{Tan}(\gamma(x))=\mathrm{Tan}(R(x))*\mathrm{Sin}(B(x))$$

3.2 INTERFERENCE MODEL

3.2.1 The interfering systems and the interfered system that

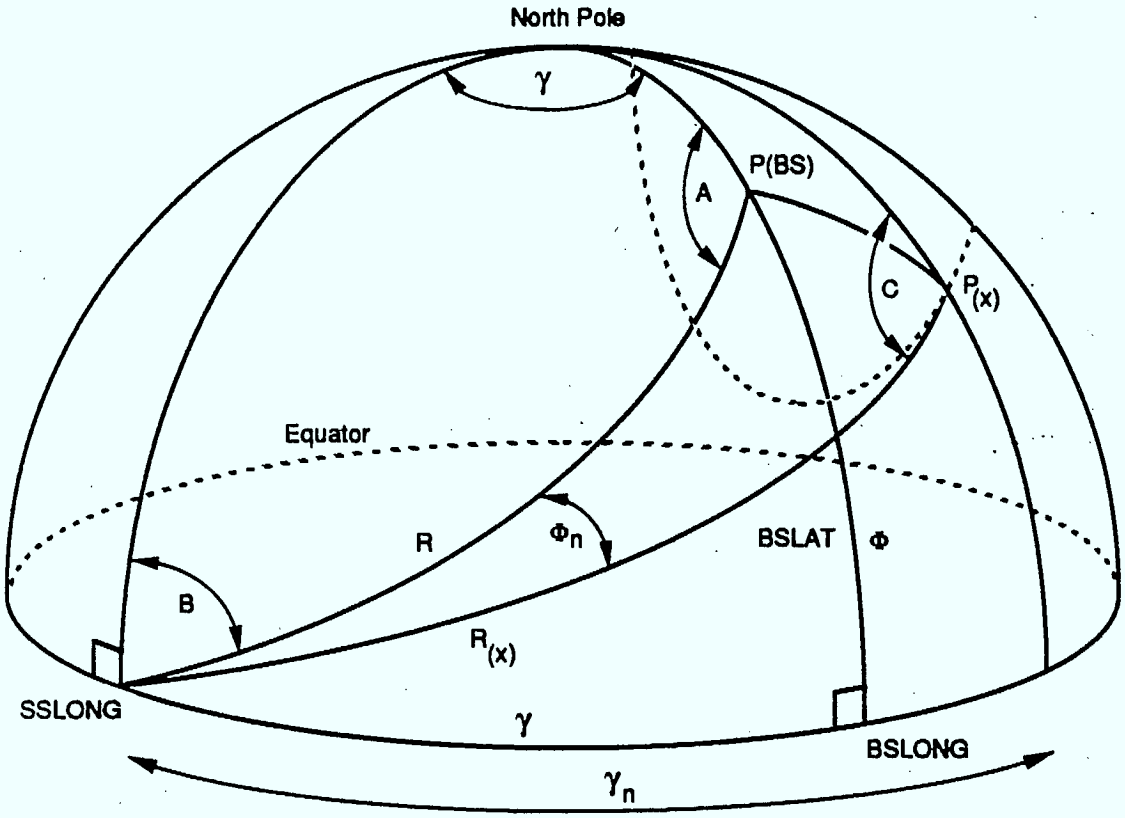

Figure 4 Northern Hemisphere View and Station Coordinates

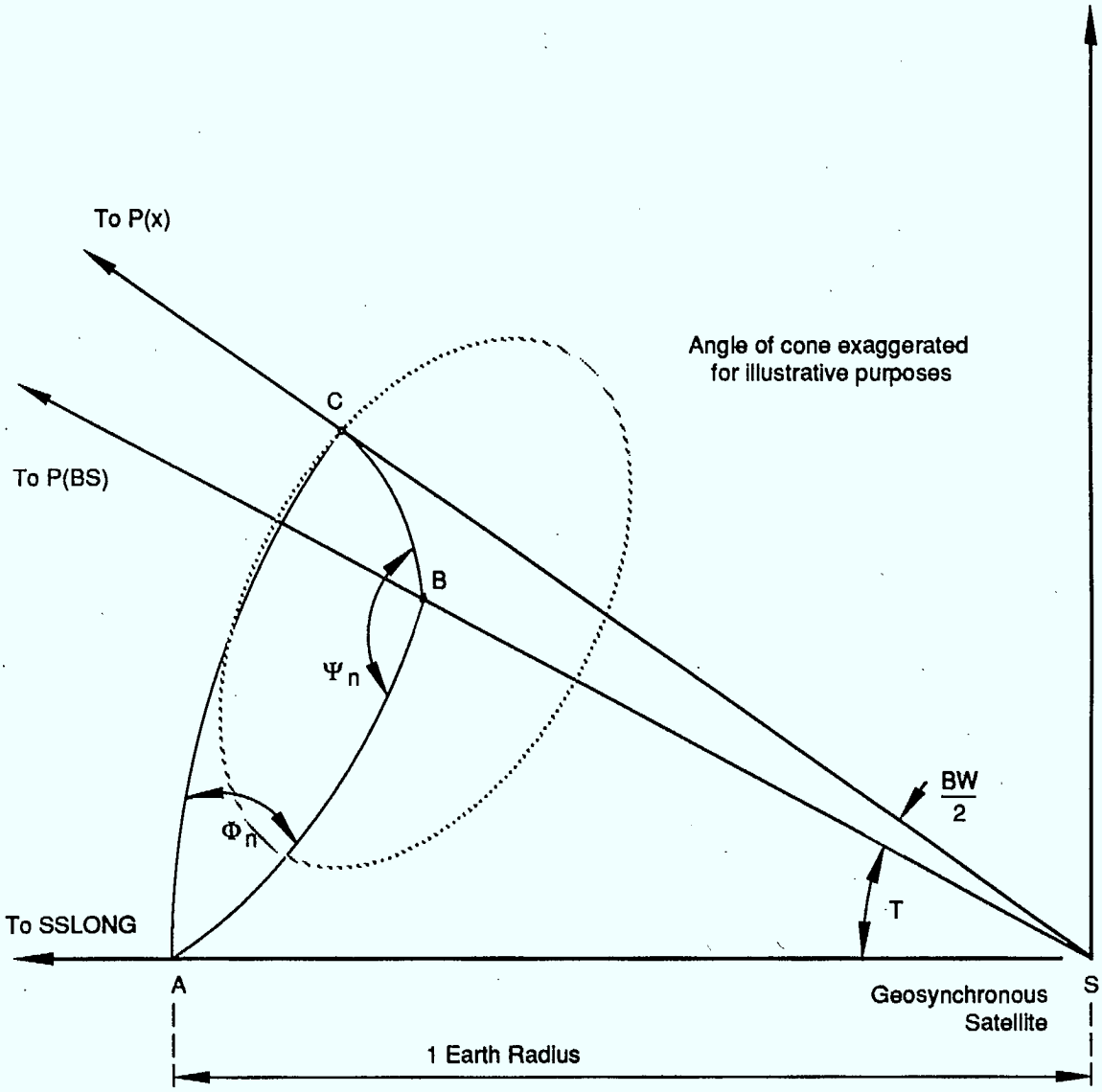

Figure 5 View of Spherical Triangle Looking Towards the Satellite

are considered in this study are shown in Figure 6 with the frequency bands of interest given in Table 4. The desired signal path is shown in full lines and the interfering paths are given in dotted lines. The frequency bands shown for the TRR (paragraph 1.3.1) will be grouped into bands having similar technical characteristics as given in Table 1. The free space pathloss between isotropic radiators for both the desired signal and the interfering source will be given by:

$$PL=20*LOG(4*\Pi*D*F/.3)\ dB$$

For terrestrial systems the pathloss between isotropic radiators that will not be exceeded for 50% of the locations will be given by (Reference 11):

$$PL_{50}=29.7-20*Log(H_t*H_r/(F*D^2))\ dB$$

Where: PL=Free Space Pathloss in dB

PL_{50}=Terrestrial path loss in dB (median)

D=Distance between radiators in Metres

F=Frequency in GHz

H_t=Transmit antenna height in metres

H_r=Receive antenna height in metres

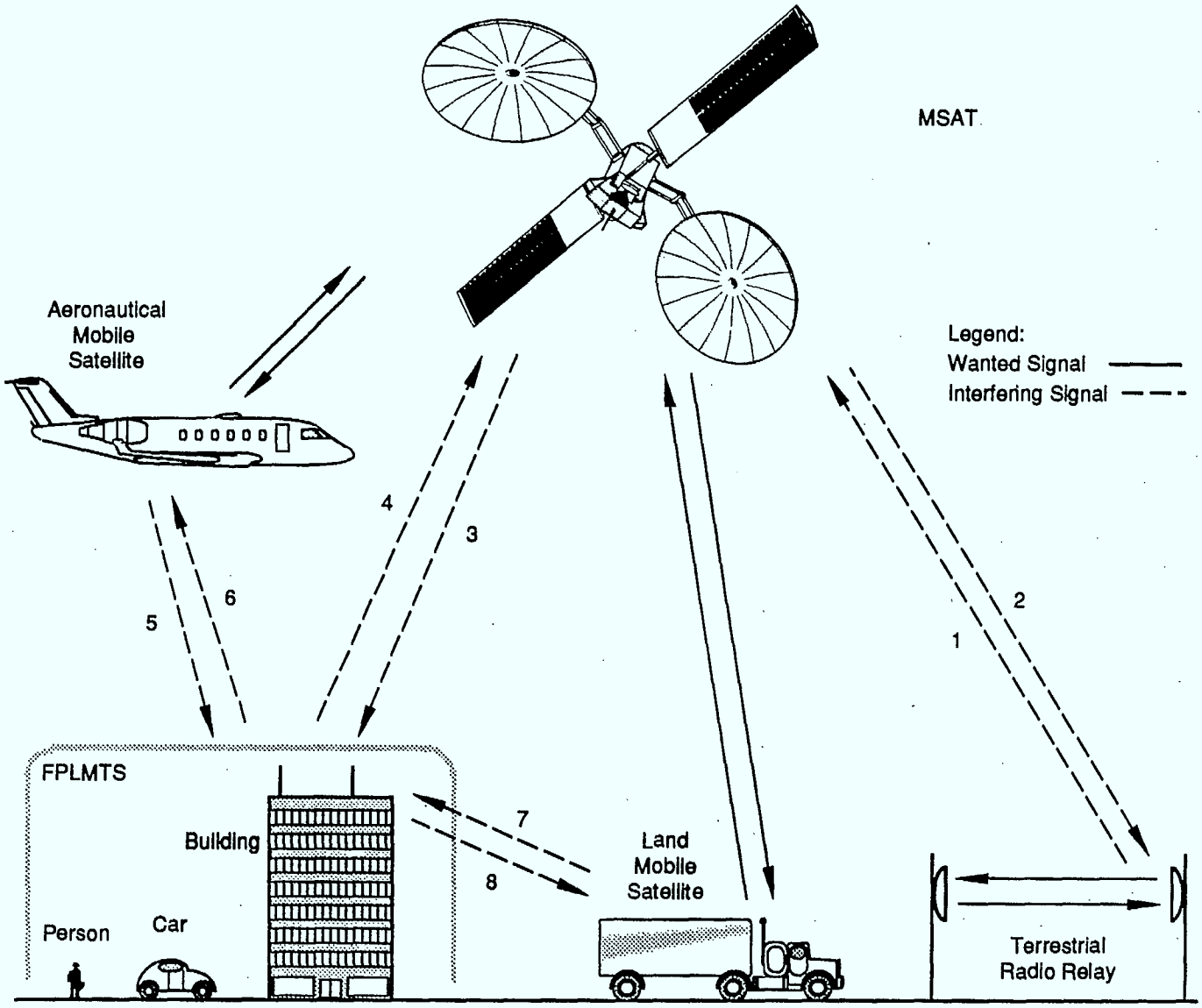

Figure 6 Potential Mutual Interference Paths Between Satellite and Terrestrial Systems

For the satellite path the received carrier-to-noise power spectral density ratio is given by:

$$C/N_o = EIRP - PL + G/T + 228.6$$

Where:

C/N_o=Carrier-to-Noise Spectral Density Ratio in dB-Hz

EIRP=Effective Isotropic Radiated Power in dBW

G/T="System Figure of Merit";Equivalent to net antenna gain in dB minus system noise temperature in dB°K at a specific operating frequency (G-T).

and:

$$C/N_o = C/N + B$$

Where:

C/N=Carrier-to-Noise ratio in dB

B=Bandwidth in dB.Hz

And as the interference is assumed to be additive white Gaussian noise, then:

$$(N_o)_T = I_o + (N_o)_t$$

Where:

$(N_o)_T$=Total noise power spectral density at some point in the system in W/Hz

I_o=Interference power spectral density at the same point in the system in W/Hz

$(N_o)_t$=Thermal noise power spectral density at the same point in the system in W/Hz

or in logarithmic notation:

$$(N_o)T=10*Log(10^(I_o/10)+10^((N_o)_t/10))$$

Then the composite $(C/N_o)_T$ is given by:

$$(C/N_o)_T=-10*Log(10^((-C/I_o)/10)+10^(((-C/N_o)_t)/10))$$

and the decrease in carrier-to-noise power spectral density resulting from the interference power spectral density is given by:

$$\Delta\ C/N_o=(C/N_o)_T-(C/N_o)_t$$

TABLE 4. INTERFERING SYSTEMS

FROM FIG. 1	INTERFERENCE FROM	TO	FREQUENCIES
1	TRR	MSAT	1427-1525 MHz 1700-2450 MHz
2	MSAT	TRR	1427-1525 MHz 1700-2450 MHz
3	FPLMTS	MSAT	1626.5-1660.5 MHz
4	MSAT	FPLMTS	1530-1559 MHz
5	AMS(R)S	FPLMTS	1530-1559 MHz
6	FPLMTS	AMS(R)S	1626.5-1660.5 MHz
7	FPLMTS	LMSS	1626.5-1660.5 MHz
8	LMSS	FPLMTS	1530-1559 MHz

ABBREVIATIONS:
TRR -TERRESTRIAL RADIO RELAY
MSAT -MOBILE SATELLITE SYSTEM
FPLMTS-FUTURE PUBLIC LAND MOBILE TELECOMMUNICATIONS SYSTEM
AMS(R)S -AERONAUTICAL MOBILE SATELLITE SERVICE
LMSS -LAND MOBILE SATELLITE SERVICE

3.3 MODEL DEVELOPMENT

The computer model of the system is based on the previously developed path geometry and interference paths. The programmes have been written in True Basic (Reference 10) and the parameters for any given interference scenario can be adjusted to

reflect technological and regulatory changes. Interference and noise are calculated in terms of power spectral densities and are compared on this basis.

4.0 INTERFERENCE CALCULATIONS

4.1 MSAT INTERFERENCE TO TERRESTRIAL RADIO RELAY

4.1.1 The interference from MSAT to the TRR will be calculated for the MSAT beam in which the TRR operates. Adjacent beams will not operate on the same frequency band and frequency reuse beams will be assumed to have sidelobes that will not cause significant interference. The performance degradation to the terrestrial system will be calculated on a power spectral density basis assuming that the two systems occupy the same spectrum. The terrestrial azimuth to the satellite will be assumed to be the TRR-SSLong angle and the elevation angle to the satellite will determine the TRR antenna discrimination against the satellite signal. Figure 7 shows the TRR/satellite path that will be considered.

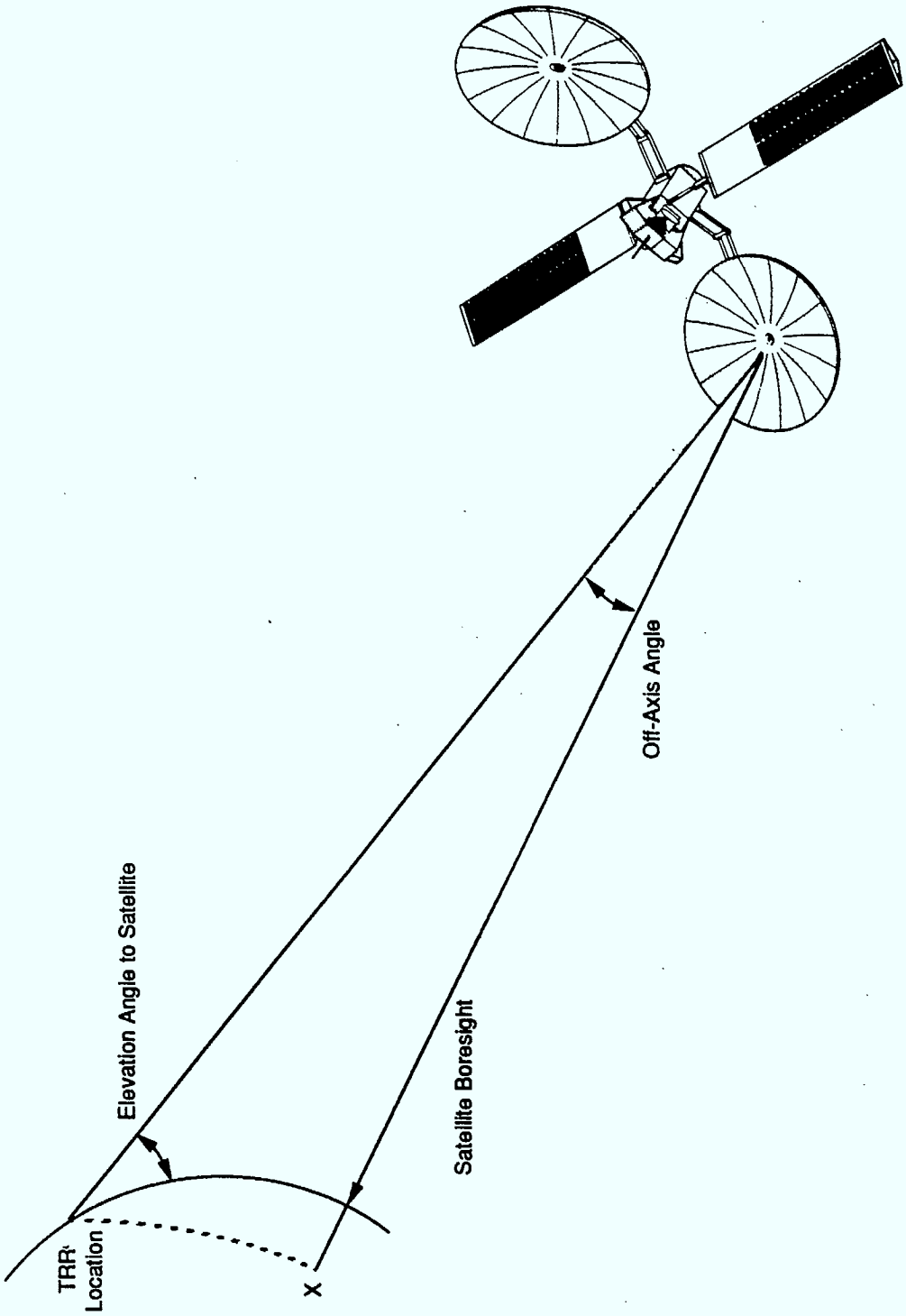

Figure 7 Satellite Beam Boresight and TRR Offsets

4.1.2 The following calculations illustrate the factors that are considered in the computer program (MSATINTA.BAS). The actual values are computed within the program while parametric values are assumed in these sample calculations. The unfaded edge of coverage (EOC) interfering power spectral density from a MSAT beam is given by:

$$I_{so}=EIRP+AF-PL-BW-G_p+G_{TRR}$$

Where: I_{so}=Satellite interfering power spectral density in dBW/Hz

EIRP=Satellite effective isotropic radiated power EOC in dBW

AF=Activity Factor in dB

PL=Path Loss in dB

BW=Channel bandwidth in dB.Hz

G_p=Polarization isolation in dB

G_{TRR}=TRR antenna boresight gain in dB

For the technical parameters given in Tables 1 and 3, an activity factor of 40.0%, a voice channel bandwidth of 5 kHz and a polarization isolation of 3 dB results in:

I_{so}=32.3-188.2-4-37-3+20.9=-179.0 dBW/Hz

The satellite boresight (SBS) value will be 3 dB above this value and will be noted as SBS in the calculations. For a TRR boresighted on the satellite the degradation in C/N_t will be given according to:

N_o=-228.6+34.6=-194 dBW/Hz

N_o+I_{so}=10*Log(10^(-19.4)+10^(-17.9))=-178.9 dBW/Hz

Δ C/N_t=-15.1 dB

SBS I_{so}=-175.9 dBW/Hz

N_o+I_{so}=10*Log(10^(-19.4)+10^(-17.6))=-175.8 dBW/Hz

Δ C/N_t=-18.2 dB

These values represent severe degradation to the performance of the TRR; however, they result from systems boresighted on the geostationary orbit (GSO). A more practical calculation is to consider the elevation angle that will provide at least the minimum antenna discrimination to limit the interference to 3.0 dB, 0.5 dB and 0.1 dB. This gives:

Max $(I_{so})_{3.0}$=10*Log(10^(-19.10)-10^(-19.4))=-194.0 dBW/Hz

Max $(I_{so})_{0.5}$=10*Log(10^(-19.35)-10^(-19.4))=-203.1 dBW/Hz

Max $(I_{so})_{0.1}$=10*Log(10^(-19.39)-10^(-19.4))=-210.3 dBW/Hz

These correspond to a required elevation angle discrimination to the satellite interfering signal of 15.1, 24.2 and 31.5 dB respectively. From SRSP-301.70 the offset is; 10.3, 42 and 123 degrees from the main lobe.

4.1.3 Table 5 summarizes the results from the computer program (MSATINTA.BAS) for the TRR bands giving the angular protection necessary to the GSO to limit the degradation to 3.0 and 0.5 dB.

TABLE 5 MSAT INTERFERENCE TO THE TRR

FREQUENCY GHz	INTERFERENCE POWER DENSITY dBW/Hz	3.0 dB DEGRAD dB	DEGREES OFF GSO	0.5 dB DEGRAD dB	DEGREES OFF GSO
1.475	-178.6	15.4	5.6	24.5	22.5
1.545	-179.0	15.0	10.3	24.1	40.5
1.705	-178.7	15.4	10.5	24.5	42.0
1.800	-178.6	15.4	8.5	24.5	58.0
2.100	-178.7	15.3	7.0	24.5	15.0
2.400	-178.8	15.2	4.5	24.3	18.0

4.2 TERRESTRIAL RADIO RELAY INTERFERENCE TO MSAT

4.2.1 The interference from the TRR on the MSAT system will be calculated for two deployments of TRR terminals. Firstly, a TRR located on the subsatellite meridian of longitude will be moved along the meridian from 81.3° North latitude to the equator and the interference calculated. This will yield the results for a terminal boresighted on the satellite to a terminal with a 90° angle between boresight and the satellite as given by the computer program (LANDPWR1.BAS). The second scenario will be based on deployment of TRR's around the metropolitan areas listed in Table 6. The azimuth of the TRR path will be considered to be the same as the metropolitan area to the sub-satellite longitude (SSLONG) azimuth and the TRR boresight to be horizontal. The metropolitan area to MSAT path will be calculated using the model geometry given in Section 3.1. The computer program (GRSTPWR1-6.BAS) calculates the path parameters and sums the interference for each beam at the satellite giving the effect on satellite link performance.

4.2.2 For the single terminal case interference at the satellite is calculated at the low noise amplifier input, and will include the antenna gain in the direction of the desired signal and interference. The interference and uplink thermal noise will be summed and the impact on the overall C/N_{ot} calculated as follows:

$$(C/N_o)_u = EIRP_u - PL + G/T + 228.6 \text{ dB-Hz}$$

Where: $(C/N_o)_u$=Uplink Carrier-to-Noise Power Spectral Density in dB-Hz.

EIRPu=Effective Isotropic Radiated Power from the Ground Station in dBW.

PL=Path Loss in dB

G/T=Satellite system figure of merit as measured at the transponder low noise amplifier in dB/°K.

Using the values from Table 3 in the above results in:

$$(C/N_o)_u = 16.2 - 188.7 + 2.8 + 228.6 = 58.9 \text{ dB-Hz}$$

Using the 1.7 GHz TRR band and the tangential distance value from earth to the satellite the uplink interference is calculated for a TRR boresighted on the satellite as follows:

D=((6.6166^2-1^2)^.5)*6378=41716 km

PL=20*Log(4*PI*41716*10^3*1.7/.3)

=189.5 dB

$(I_o)_u$=EIRP-10*Log(BW)-PL+G-G_p

=35-65.4-189.5+31-3=-191.9 dBW/Hz

TABLE 6 CANADIAN METROPOLITAN AREAS

METROPOLITAN AREA	LATITUDE DEGREES NORTH	LONGITUDE DEGREES WEST	SIZE (100K)
CALGARY	51.05	114.08	6
EDMONTON	53.55	113.47	5
HALIFAX	44.65	63.60	3
HAMILTON	43.25	79.85	5
KINGSTON	44.23	76.50	1
KITCHENER	43.45	80.48	3
LONDON	42.98	81.23	3
MONCTON	46.10	64.78	1
MONTREAL	45.52	73.57	28
OSHAWA	43.90	78.85	2
OTTAWA	45.33	75.70	7
QUEBEC	46.82	71.33	6
REGINA	50.42	104.65	2
ST JOHN	45.27	66.05	1
ST JOHN'S	47.34	52.43	1
SASKATOON	52.12	106.63	2
THUNDER BAY	48.38	89.00	1
TORONTO	43.65	79.38	30
TROIS RIVIERE	46.35	72.55	1
VANCOUVER	49.27	123.12	13
VICTORIA	48.42	123.37	2
WINDSOR	42.30	83.02	2
WINNIPEG	49.88	97.15	6

yielding:

$$(C/I_o)_u=-141.5-(-191.9)=50.4 \text{ dB-Hz}$$

The reverse link Total unfaded $C/(N_o+I_o)=53.1$ dB-Hz

The impact of the TRR interference is to reduce this to:

$$C/N_T=-10*Log(10^{(-50.4/10)}+10^{(-53.1/10)})=48.5 \text{ dB-Hz}$$

$$\Delta\ C/N=53.1-48.5=4.6 \text{ dB}$$

The required elevation offset to provide a 3.0 dB, 0.5 dB and 0.1 dB degradation is calculated from:

$$(C/I_o)_{3.0}=-10*Log(10^{(-5.01)}-10^{(-5.31)})=53.1 \text{ dB-Hz}$$

$$(C/I_o)_{0.5}=-10*Log(10^{(-5.26)}-10^{(-5.31)})=62.2 \text{ dB-Hz}$$

$$(C/I_o)_{0.1}=-10*Log(10^{(-5.30)}-10^{(-5.31)})=69.4 \text{ dB-Hz}$$

Resulting in maximum uplink interference values of:

$$(I_o)_{3.0}=-141.5-53.1=-194.6 \text{ dBW/Hz}$$

$$(I_o)_{0.5}=-141.5-62.2=-203.7 \text{ dBW/Hz}$$

$$(I_o)_{0.1}=-141.5-69.4=-210.9 \text{ dBW/Hz}$$

Based on the boresight value of -191.9 dBW/Hz gives required offsets of 2.7 dB, 11.8 dB and 19.0 dB. From SRSP-301.70 Figure 2 elevation angles of 3.6°,7.2° and 22.5° are necessary.

4.2.3 The computer programs (LANDPWR1-6.BAS) are used to compute the interfering power at the satellite for the different TRR bands. Table 7 summarizes these results and shows the offset necessary to the GSO for the three selected interference levels.

TABLE 7 TRR INTERFERENCE TO MSAT

TRR FREQUENCY BAND IN GHz	TERRESTRIAL ANTENNA OFFSET IN DEGREES 0.1 dB DEGRAD	0.5 dB DEGRAD	3.0 dB DEGRAD
1.427-1.525	8.7	5.1	2.7
1.700-1.710	22.5	7.2	3.6
1.710-1.900	9.5	7.0	3.7
1.900-2.290	12.2	6.4	2.6
2.290-2.450 (MCS)	48.3	37.6	12.2
2.290-2.450 (Pt-Pt)	22.4	7.2	3.7

4.2.4

The total interfering power at the satellite from one TRR located at each of the 23 major Canadian metropolitan areas is calculated in the computer programs (GRSTPWR1-6).BAS. The results for each satellite beam and TRR frequency band are shown in Table 8.

TABLE 8 TRR INTERFERENCE TO MSAT FROM CANADIAN METROPOLITAN AREAS

TRR BAND GHz	MSAT BEAM DECREASE IN C/Nt IN dB WEST	WEST/CENT	EAST/CENT	EAST
1.427-1.525	0.077	0.091	0.171	0.322
1.700-1.710	0.353	0.412	0.674	1.019
1.710-1.900	0.338	0.398	0.653	0.889
1.900-2.290	0.086	0.102	0.171	0.241
2.290-2.450 (MCS)	2.478	2.829	4.107	5.323
2.290-2.450 (PT-PT)	0.317	0.369	0.607	0.976

4.3 MSAT-FPLMTS

4.3.1 The potential MSAT interference to the FPLMTS is calculated in a similar fashion to that employed in Section 4.1. The impact of the interference is measured as a range degradation to the FPLMTS user. The calculations are as follows:

EIRP/Voice Activated Carrier	= 32.3	dBW
Voice Activation Factor (0.4)	= -4.0	dB
Voice Channel Bandwidth (5 kHz)	= 37.0	dB.Hz
Pathloss (MSAT-FPLMTS 1545 MHz, 39300 km)	= 188.1	dB
Polarization Isolation	= 3.0	dB
Required $C/(N_o+I_o)$	= 60	dB-Hz

Interfering Power Density at FPLMTS Receiver:

$$I_o=32.3-4.0-188.1-37-3=-199.8 \text{ dBW/Hz}$$

Thermal Noise Spectral Density at FPLMTS Receiver:

N_o=-174-30+5=-199.0 dBW/Hz

N_o+I_o=10^(-19.98)+10^(-19.90)=2.31x10^(-20) W/Hz

=-196.4 dBW/Hz

Effective Change in Pathloss:

Δ PL=-199.0-(-196.4)=-2.6 dB

Lp(R_i)=85=21+35*Log(R_i)

85-2.6=82.4=21+35*Log(R_i)

R_i=56.8 metres

Lp(R_o)=81=38.5+20*Log(R_o)

81-2.4=78.6=38.5+20*Log(R_o)

R_o=101.2 metres

These correspond to a range reduction of 10.2 metres indoors and 31.8 metres outdoors or 15% and 24% respectively.

4.4 FPLMTS INTERFERENCE TO MSAT

4.4.1 The potential uplink interference from the FPLMTS to MSAT is calculated using the system characteristics given in Tables 2 and 3. Twenty three Canadian metropolitan areas are considered to contribute to the interference and their individual power levels are summed at the satellite considering their off- axis angle between the satellite boresight and the metropolitan area.

4.4.2 The individual metropolitan area interference is calculated from the expected Integrated Urban Power Density (IUPD) adjusted for the metropolitan area population that is radiated to the MSAT satellite.

$$I_{fo}=IUPD+10*Log(N)-PL+G_{ob}-G_p$$

Where: I_{fo}=Interference spectral density from a FPLMTS metropolitan area at the MSAT LNA in dBW/Hz.

IUPD=Integrated Urban Power Density in dBW/Hz/Sqkm

N=Sqkm in metropolitan area

G_{ob}=MSAT antenna gain in the direction of the metropolitan area

Using the values given in Table 2 for the FPLMTS and assuming a

metropolitan area population of 2,000,000 and an off axis satellite to metropolitan area angle of 1° results in:

$$I_{fo}=-60+10*Log(20)-188.7+31-3=-207.7 \text{ dBW/Hz}$$

Yielding:

$$C/I_o=-141.5-(-207.7)=66.2 \text{ dB-Hz at the LNA.}$$

$$\Delta\ C/N_t=53.1-(-10*Log(10^{(-5.31)}+10^{(-6.62)}))$$

$$=0.21 \text{ dB}$$

4.4.3 The computed results from the computer program (FPLMTSIN.BAS) for 23 metropolitan areas are given in Table 6 for the four MSAT Canadian beams. The nominal unfaded C/N_{ot} from Table 3 is 53.1 dB-Hz.

TABLE 6. FPLMTS INTERFERENCE TO MSAT

BEAM	C/I_o dB-Hz	C/N_{ot} dB-Hz	DECREASE dB
EAST	59.1	52.1	1.0
EAST/CENTRE	60.4	52.4	0.7
WEST/CENTRE	64.0	52.8	0.3
WEST	64.0	52.8	0.3

4.5 AIRCRAFT INTERFERENCE TO FPLMTS

4.5.1 The potential interference from aircraft operating in the AMS(R)S to the FPLMTS is calculated in a manner similar to Section 4.3. The aircraft EIRP from Table 3 in the direction of the satellite is 16.2 dBW and an aircraft antenna discrimination of 20 dB is assumed in the direction of the FPLMTS metropolitan area plus 3 dB polarization isolation resulting in an interfering EIRP of -6.8 dBW or expressed as an interfering power spectral density of:

$$(I_o)_e=-6.8-10*Log(5000)=-43.8 \text{ dBW/Hz}$$

The path loss for an aircraft flying at an altitude of 10,000 metres is:

$$PL=20*Log(4*PI*10000*1.65/0.3)=116.8 \text{ dB}$$

Therefore the interfering power spectral density at the FPLMTS receiver is:

$$I_o=-43.8-116.8=-160.6 \text{ dBW/Hz}$$

The noise and interference spectral density then is:

$$N_o+I_o=10*Log(10^{(-16.06)}+10^{(-19.90)})=-160.6 \text{ dBW/Hz}$$

corresponding to an effective decrease in available path loss of

$$\Delta\ PL=-160.6-(-199.0)=38.4\ dB.$$

This results in an effective indoor and outdoor range of r_i=5.4 metres and r_o=1.6 metres. Note that the occupied bandwidth of the AMS(R)S signal is only 5 kHz while the FPLMTS channel is 50 kHz.

4.6 FPLMTS INTERFERENCE TO AIRCRAFT

4.6.1 The potential interference to aircraft operating in the AMS(R) from the FPLMTS is calculated in a similar fashion to that used in Section 4.4, except that a single metropolitan interfering source only is considered and the aircraft AMS(R)S receiver is the interfered unit.

4.6.2 The interfering power spectral density at an aircraft flying at an altitude of 10,000 metres above a metropolitan area of 100,000 population is given by:

$$PL=20*Log(4*PI*10000*1.545/0.3)=116.2\ dB$$

$$I_o=-60-116.2-20-3=-199.2\ dBW/Hz$$

$$C/I_o=-145.8-(-199.2)=53.4 \text{ dB-Hz}$$

Resulting in an overall carrier to total noise plus interference ratio of:

$$(C/N_o)_t=-10*Log(10^{(-5.34)}+10^{(-5.23)})=49.8 \text{ dB-Hz}$$

a decrease of 2.5 dB. The program (FPLMAIR1-2.BAS) calculates the degradation to the aircraft terminal for aircraft altitudes of from 100 metres to 20 kms.

4.7 FPLMTS INTERFERENCE TO LMSS

4.7.1 Interference levels of 0.1 dB, 0.5 dB and 3.0 dB will be used as the criteria for the measurement of interference at the LMSS terminal from the FPLMTS. Using the total unfaded value of $(C/N_o)_t$=52.3 dB-Hz from Table 3 for the forward link gives a permissable additional carrier to interference ratio of:

$$(C/I_o)_{0.1}=-10*Log(10^{(-5.22)}-10^{(-5.23)})=68.6 \text{ dB-Hz}$$

$$(C/I_o)_{0.5}=-10*Log(10^{(-5.18)}-10^{(-5.23)})=61.4 \text{ dB-Hz}$$

$$(C/I_o)_{3.0}=-10*Log(10^{(-4.93)}-10^{(-5.23)})=52.3 \text{ dB-Hz}$$

Using the values in Table 3 and a mobile terminal antenna gain of

10 dBic, results in a forward link unfaded carrier level at the LNA of the terminal of:

$$C=32.3-188.1+10=-145.9 \text{ dBW}$$

Permitting an additional I_o at the LNA of:

$$(I_o')_{0.1}=-145.9-68.6=-214.5 \text{ dBW/Hz}$$
$$(I_o')_{0.5}=-145.9-61.4=-207.3 \text{ dBW/Hz}$$
$$(I_o')_{3.0}=-145.9-52.3=-198.2 \text{ dBW/Hz}$$

Using a satellite mobile terminal antenna gain at the horizon of -6 dBic and a polarization isolation of 3 dB results in the following values of interference at the mobile antenna:

$$(I_o)_{0.1}=-214.5+6+3=-205.5 \text{ dBW/Hz}$$
$$(I_o)_{0.5}=-207.3+6+3=-198.3 \text{ dBW/Hz}$$
$$(I_o)_{3.0}=-198.2+3+6=-189.2 \text{ dBW/Hz}$$

and using the terrestrial values for the path loss with a transmit antenna height of 30 metres and a receive antenna height of 3 metres results in:

$$PL_{0.1}=-60-(-205.5)=145.5=29.7-20*Log(3*30/(1.545*D_{0.1}\text{^}2))$$

$$PL_{0.5}=-60-(-198.3)=138.3=29.7-20*Log(3*30/(1.545*D_{0.5}\text{^}2))$$

$$PL_{3.0}=-60-(-189.2)=129.2=29.7-20*Log(3*30/(1.545*D_{3.0}\text{^}2))$$

yielding; $D_{0.1}$=6001 metres, $D_{0.5}$=3960 metres and $D_{3.0}$=2345 metres.

4.8 LMSS INTERFERENCE TO FPLMTS

4.8.1 The distance necessary to provide a path loss equal or greater than that required to limit the degradation in performance of the FPLMTS receiver due to interference from a MSAT terminal by 3 dB will be calculated. From Table 2 this will limit the C/I to 13 dB or :

$$C/I_o=13+10*Log(50000)=60 \text{ dB-Hz}$$

Which using the values from Section 4.3.1 gives a maximum value for interference power spectral density of:

$$I_o=-199.0 \text{ dBW/Hz}$$

The pathloss necessary to limit the interference to the above value is:

$$PL=16.2-10*Log(5000)-(-199.0)=178.2 \text{ dB}$$

which corresponds to a free space distance greater than 12,500 Km.

5.0 SUMMARY OF RESULTS

5.1 INTERFERENCE FROM THE MOBILE SATELLITE SERVICE TO TERRESTRIAL SERVICES

5.1.1 The potential interference from MSAT to the TRR given in Table 5 indicates that considerable caution must be taken when siting terrestrial terminals to ensure that interference from the GSO is avoided. During this study only the proposed Canadian MSAT satellite has been considered and details of the two planned AMSC and operational INMARSAT Atlantic Ocean (AOR) and Pacific Ocean (POR) Region satellites have not been included. These satellites, coupled with the fact that Canadian terminals in general have an elevation angle of less than 35° to the GSO, result in interference in three of the six bands considered of greater than 0.5 dB. All terminals north of sixty can expect at least a 0.5 dB degradation in noise performance due to their elevation angle to the GSO being less than 22°.

5.1.2 The indoor range reduction to the FPLMTS resulting from MSAT interference does not take into account the additional path loss due to shielding by the building structure which should result in little impact on the overall indoor system performance. The

major impact will be on the outdoor terminals which in general will be in a line of sight path to the satellite. This could result in "dead spots" in the coverage at the periphery of the cells.

5.2 INTERFERENCE FROM TERRESTRIAL SERVICES TO THE MOBILE SATELLITE SERVICE

5.2.1 The interference shown in Table 7 results from a single TRR terminal with the necessary antenna offset to meet performance objectives. The actual number of terminals and the technical parameters will determine the sum of the interference and the degree of degradation to the service in any MSAT beam. Table 8 gives the results for a single terminal located at each of the 23 Canadian metropolitan areas. As these areas are clustered in the South with relatively high look angles to the satellite the overall impact is, in general, less than one dB, except for the MCS which, due to its antenna performance, has severe degradation with only one terminal per metropolitan area. The inclusion of the actual number of terminals and the additional interference from the United States should result in at least moderate interference to the MSAT system.

5.2.2 The interference from the FPLMTS to MSAT given in Table 8 indicates moderate interference to MSAT; however, when the United

States metropolitan areas are included, severe interference can be expected in all beams.

5.3 NON SATELLITE INTERSYSTEM INTERFERENCE

5.3.1 An aircraft MSAT terminal, due to its high EIRP in relation to the FPLMTS terminal and line of sight path loss, will seriously degrade the FPLMTS service when over flying the FPLMTS service area. The FPLMTS will degrade the satellite service so severely that it will be inoperable at altitudes below 5000 metres.

5.3.2 The standoff distances calculated in Sections 4.7 and 4.8 indicate that the FPLMTS and LMSS will be significantly affected by each others transmissions. Control of the interference between systems is not feasible as they both react to independent network management facilities.

6.0 CONCLUSIONS

The only service that is considered feasible for sharing between satellite and terrestrial service from a mutual interference consideration is the MSAT forward link with the TRR in the bands 1427-1525 MHz and 1900-2450 MHz. The terrestrial antennas have at least >15 dB rejection of the MSAT downlink at angles

greater than 7° off the GSO, which then would have to become the standard for TRR performance. The terrestrial-terrestrial interference between the TRR stations and the MSAT mobile terminals naturally would establish a zone around the TRR within which the mobile would have to accept the TRR interference.

REFERENCES:

1. A Study of Inter System Interference in the 806-890 MHz Band. CAL Report 81-191 September 1981.

2. The Sync-Sat Calculator. N.C.Ostrander, September 1967.

3. Broadcasting-Satellite Coverage-Geometrical Considerations. C.A.Siocos, IEEE Transactions BC-19, December 1973.

4. CCIR Working Group 8-D, Document 8/531-E, 3 November 1989.

5. Standard Radio System Plan, SRSP-311 Issue 1, Technical Requirements for Fixed Line-of-Sight Radio Systems Operating in the 1427-1525 MHz Band. June 14, 1979.

6 Standard Radio System Plan, SRSP-301.71 Issue 3, Technical Requirements for Line-of-Sight Radio Systems Operating in the Fixes Service in the Band 1710-1900 MHz. 23 July, 1988.

7. Standard Radio System Plan, SRSP-301.9 Issue 2, Technical Requirements for Line-of-Sight Radio Systems Operating in the Fixed Service in the Band 1900-2290 MHz. 9 November, 1985.

8. Standard Radio System Plan, SRSP-302.2 Issue 1 Provisional, Technical Requirements for Line-of-Sight Radio Systems Operating in the Fixed Service in the Band 2290-2450 MHz. 10 March, 1990.

9. Communication Systems Design: Line-of-sight and Tropo-scatter Systems. Philip F. Panter, McGraw-Hill Book Company, 1972.

10. True Basic Reference Manual, Brig Elliot, April 1985.

11. Radio Propagation Above 40 MC over Irregular Terrain. John J. Egli: PROCIRE October 1957.

ANNEX A.1

PROGRAM NAME MSATINTA.BAS
THIS PROGRAM CALCULATES THE INTERFERENCE AT A TRR FROM THE MSAT SATELLITE GIVEN THE SUB SATELLITE LONGITUDE AND THE TRR COORDINATES.

INPUT DATA
SUBSATELLITE LONGITUDE= 106.5 DEGREES WEST
STATION LATITUDE= 65 DEGREES NORTH
STATION LONGITUDE= 106.5 DEGREES WEST
MSAT SATELLITE EIRP/CHANNEL= 32.3 dBW
MSAT CHANNEL BANDWIDTH= 5 KHz
MSAT CHANNEL ACTIVITY FACTOR= 40 %
TERRESTRIAL RADIO RELAY SYSTEM NOISE TEMPERATURE= 34.6 dBK
POLARIZATION ISOLATION= 3 dB

AZIMUTH FROM STATION TO SS POINT= 180 DEGREES
ELEVATION ANGLE STATION TO SATELLITE= 16.6755 DEGREES
DISTANCE STATION TO SATELLITE= 3.99269e+7 METRES

FREQUENCY GHz	TRR ANT GAIN dB	INTERFERENCE DENSITY dB/Hz	REQ ANT OFFSET 3.0 dB	REQ ANT OFFSET 0.5 dB	REQ ANT OFFSET 0.1 dB
1.475	20.9	-178.612	15.4086	24.5237	31.7157
1.545	20.9	-179.015	15.0059	24.121	31.313
1.705	22.1	-178.671	15.35	24.4651	31.6571
1.8	22.6	-178.642	15.379	24.4941	31.6861
2.1	23.9	-178.681	15.3401	24.4552	31.6472
2.4	24.9	-178.84	15.1802	24.2953	31.4873

PROGRAM NAME GRSTPWR1.BAS

THIS PROGRAM CALCULATES THE INTERFERING POWER DENSITY FROM A NUMBER OF EARTH STATIONS OPERATING IN THE 1427-1525 MHz BAND WITH BORESIGHT AZIMUTH POINTING TO THE SUBSATELLITE LONGITUDE OF THE SATELLITE GIVEN THE SUBSATELLITE LONGITUDE AND LOCATION OF THE GROUND STATIONS

ANNEX B.1

INPUT DATA
SUBSATELLITE LONGITUDE= 106.5 DEGREES
SATELLITE ANTENNA BORESIGHT LATITUDE= 54.4 DEGREES
SATELLITE ANTENNA BORESIGHT LONGITUDE= 122.5 DEGREES
SATELLITE ANTENNA BORESIGHT GAIN= 34 dBic
SATELLITE ANTENNA 3 dB BEAMWIDTH= 2.7 DEGREES
REQUIRED NEAR IN SIDELOBE LEVEL (LS) IN dB RELATIVE TO PEAK GAIN
ONLY ALLOWED VALUES ARE -20,-25 OR -30. LS=-25
REVERSE LINK CARRIER POWER AT LNA=-141.5 dBW
MSAT REVERSE LINK C/(No+Io)t= 53.1 dB-Hz
OPERATING FREQUENCY= 1.475 GHz
TERRESTRIAL RADIO RELAY TERMINAL BORESIGHT EIRP= 35 dBW
TERRESTRIAL RADIO RELAY CHANNEL BANDWIDTH= 3.5 MHz
POLARIZATION ISOLATION= 3 dB

METROPOLITAN AREA	LATITUDE DEGREES	LONGITUDE DEGREES	ELEVATION DEGREES	OFF AXIS ANGLE DEGREES	INTERFERING POWER DENSITY IN dBW/Hz
CALGARY	51.05	114.08	31.1117	.760892	-219.979
EDMONTON	53.55	113.47	28.5057	.825763	-218.836
HALIFAX	44.65	63.6	23.4382	6.07692	-236.887
HAMILTON	43.25	79.85	33.3648	4.75623	-241.935
KINGSTON	44.23	76.5	30.9052	5.00166	-241.983
KITCHENER	43.45	80.48	33.4802	4.6666	-241.933
LONDON	42.98	81.23	34.2436	4.62321	-241.918
MONCTON	46.1	64.78	23.1826	5.85981	-236.688
MONTREAL	45.52	73.57	28.3802	5.17827	-240.738
OSHAWA	43.9	78.85	32.325	4.79863	-241.955
OTTAWA	45.33	75.7	29.596	4.98691	-241.686
QUEBEC	46.82	71.33	26.22	5.2565	-239.054
REGINA	50.42	104.65	32.2083	1.73244	-221.898
ST JOHN	45.27	66.05	24.4746	5.82429	-237.694
SASKATOON	52.12	106.63	30.3889	1.50604	-220.727
THUNDER BAY	48.38	89	31.9358	3.4362	-236.399
TORONTO	43.65	79.38	32.7928	4.75413	-241.946
TROIS RIVIERE	46.35	72.55	27.2056	5.189	-239.822
VANCOUVER	49.27	123.12	31.2779	.513736	-219.976
VICTORIA	48.42	123.37	32.0695	.611409	-219.96
WINDSOR	42.3	83.02	35.6648	4.47136	-241.891
WINNIPEG	49.88	97.15	32.128	2.52967	-227.493
ST JOHN'S	47.34	52.43	15.0379	6.53705	-236.32

TOTAL INTERFERING POWER DENSITY AT SATELLITE LNA=-212.087 dBW/Hz
CARRIER-TO-(INTERFERENCE+NOISE) DENSITY= 53.0232 dB-Hz
DECREASE IN C/Nt= 7.67855e-2 dB

PROGRAM NAME GRSTPWR1.BAS

ANNEX B.1

THIS PROGRAM CALCULATES THE INTERFERING POWER DENSITY FROM A NUMBER OF EARTH STATIONS OPERATING IN THE 1427-1525 MHz BAND WITH BORESIGHT AZIMUTH POINTING TO THE SUBSATELLITE LONGITUDE OF THE SATELLITE GIVEN THE SUBSATELLITE LONGITUDE AND LOCATION OF THE GROUND STATIONS

INPUT DATA
SUBSATELLITE LONGITUDE= 106.5 DEGREES
SATELLITE ANTENNA BORESIGHT LATITUDE= 55 DEGREES
SATELLITE ANTENNA BORESIGHT LONGITUDE= 103.5 DEGREES
SATELLITE ANTENNA BORESIGHT GAIN= 34 dBic
SATELLITE ANTENNA 3 dB BEAMWIDTH= 2.7 DEGREES
REQUIRED NEAR IN SIDELOBE LEVEL (LS) IN dB RELATIVE TO PEAK GAIN
ONLY ALLOWED VALUES ARE -20,-25 OR -30. LS=-25
REVERSE LINK CARRIER POWER AT LNA=-141.5 dBW
MSAT REVERSE LINK C/(No+Io)t= 53.1 dB-Hz
OPERATING FREQUENCY= 1.475 GHz
TERRESTRIAL RADIO RELAY TERMINAL BORESIGHT EIRP= 35 dBW
TERRESTRIAL RADIO RELAY CHANNEL BANDWIDTH= 3.5 MHz
POLARIZATION ISOLATION= 3 dB

METROPOLITAN AREA	LATITUDE DEGREES	LONGITUDE DEGREES	ELEVATION DEGREES	OFF AXIS ANGLE DEGREES	INTERFERING POWER DENSITY IN dBW/Hz
CALGARY	51.05	114.08	31.1117	1.11633	-219.979
EDMONTON	53.55	113.47	28.5057	.968426	-218.836
HALIFAX	44.65	63.6	23.4382	4.36963	-236.887
HAMILTON	43.25	79.85	33.3648	3.06734	-232.422
KINGSTON	44.23	76.5	30.9052	3.29655	-234.872
KITCHENER	43.45	80.48	33.4802	2.9821	-231.571
LONDON	42.98	81.23	34.2436	2.9501	-231.244
MONCTON	46.1	64.78	23.1826	4.12755	-236.688
MONTREAL	45.52	73.57	28.3802	3.44968	-235.327
OSHAWA	43.9	78.85	32.325	3.10165	-232.791
OTTAWA	45.33	75.7	29.596	3.26801	-234.266
QUEBEC	46.82	71.33	26.22	3.51859	-234.434
REGINA	50.42	104.65	32.2083	.384794	-219.958
ST JOHN	45.27	66.05	24.4746	4.10966	-237.694
SASKATOON	52.12	106.63	30.3889	.373677	-219.993
THUNDER BAY	48.38	89	31.9358	1.72106	-221.839
TORONTO	43.65	79.38	32.7928	3.06877	-232.448
TROIS RIVIERE	46.35	72.55	27.2056	3.457	-234.495
VANCOUVER	49.27	123.12	31.2779	2.1169	-224.352
VICTORIA	48.42	123.37	32.0695	2.19279	-224.875
WINDSOR	42.3	83.02	35.6648	2.83129	-230.087
WINNIPEG	49.88	97.15	32.128	.834528	-219.959
ST JOHN'S	47.34	52.43	15.0379	4.80828	-236.32

TOTAL INTERFERING POWER DENSITY AT SATELLITE LNA=-211.341 dBW/Hz
CARRIER-TO-(INTERFERENCE+NOISE) DENSITY= 53.009 dB-Hz
DECREASE IN C/Nt= .091013 dB

PROGRAM NAME GRSTPWR1.BAS

ANNEX B.1

THIS PROGRAM CALCULATES THE INTERFERING POWER DENSITY FROM A NUMBER OF EARTH STATIONS OPERATING IN THE 1427-1525 MHz BAND WITH BORESIGHT AZIMUTH POINTING TO THE SUBSATELLITE LONGITUDE OF THE SATELLITE GIVEN THE SUBSATELLITE LONGITUDE AND LOCATION OF THE GROUND STATIONS

INPUT DATA
SUBSATELLITE LONGITUDE= 106.5 DEGREES
SATELLITE ANTENNA BORESIGHT LATITUDE= 52.5 DEGREES
SATELLITE ANTENNA BORESIGHT LONGITUDE= 87.8 DEGREES
SATELLITE ANTENNA BORESIGHT GAIN= 34 dBic
SATELLITE ANTENNA 3 dB BEAMWIDTH= 2.7 DEGREES
REQUIRED NEAR IN SIDELOBE LEVEL (LS) IN dB RELATIVE TO PEAK GAIN
ONLY ALLOWED VALUES ARE -20,-25 OR -30. LS=-25
REVERSE LINK CARRIER POWER AT LNA=-141.5 dBW
MSAT REVERSE LINK C/(No+Io)t= 53.1 dB-Hz
OPERATING FREQUENCY= 1.475 GHz
TERRESTRIAL RADIO RELAY TERMINAL BORESIGHT EIRP= 35 dBW
TERRESTRIAL RADIO RELAY CHANNEL BANDWIDTH= 3.5 MHz
POLARIZATION ISOLATION= 3 dB

METROPOLITAN AREA	LATITUDE DEGREES	LONGITUDE DEGREES	ELEVATION DEGREES	OFF AXIS ANGLE DEGREES	INTERFERING POWER DENSITY IN dBW/Hz
CALGARY	51.05	114.08	31.1117	2.61996	-228.278
EDMONTON	53.55	113.47	28.5057	2.51743	-226.268
HALIFAX	44.65	63.6	23.4382	2.82565	-225.03
HAMILTON	43.25	79.85	33.3648	1.58285	-221.059
KINGSTON	44.23	76.5	30.9052	1.77603	-222.175
KITCHENER	43.45	80.48	33.4802	1.50405	-220.657
LONDON	42.98	81.23	34.2436	1.49055	-220.575
MONCTON	46.1	64.78	23.1826	2.57017	-222.562
MONTREAL	45.52	73.57	28.3802	1.90269	-221.697
OSHAWA	43.9	78.85	32.325	1.60008	-221.17
OTTAWA	45.33	75.7	29.596	1.73184	-221.623
QUEBEC	46.82	71.33	26.22	1.96096	-220.384
REGINA	50.42	104.65	32.2083	1.64573	-221.416
ST JOHN	45.27	66.05	24.4746	2.56256	-223.504
SASKATOON	52.12	106.63	30.3889	1.84916	-222.622
THUNDER BAY	48.38	89	31.9358	.366355	-219.963
TORONTO	43.65	79.38	32.7928	1.57894	-221.05
TROIS RIVIERE	46.35	72.55	27.2056	1.90447	-220.793
VANCOUVER	49.27	123.12	31.2779	3.61038	-238.432
VICTORIA	48.42	123.37	32.0695	3.68187	-239.275
WINDSOR	42.3	83.02	35.6648	1.41966	-220.209
WINNIPEG	49.88	97.15	32.128	.863204	-219.959
ST JOHN'S	47.34	52.43	15.0379	3.25226	-228.731

TOTAL INTERFERING POWER DENSITY AT SATELLITE LNA=-208.574 dBW/Hz
CARRIER-TO-(INTERFERENCE+NOISE) DENSITY= 52.9295 dB-Hz
DECREASE IN C/Nt= .170542 dB

PROGRAM NAME GRSTPWR1.BAS

ANNEX B.1

THIS PROGRAM CALCULATES THE INTERFERING POWER DENSITY FROM A NUMBER OF EARTH STATIONS OPERATING IN THE 1427-1525 MHz BAND WITH BORESIGHT AZIMUTH POINTING TO THE SUBSATELLITE LONGITUDE OF THE SATELLITE GIVEN THE SUBSATELLITE LONGITUDE AND LOCATION OF THE GROUND STATIONS

INPUT DATA
SUBSATELLITE LONGITUDE= 106.5 DEGREES
SATELLITE ANTENNA BORESIGHT LATITUDE= 50 DEGREES
SATELLITE ANTENNA BORESIGHT LONGITUDE= 65.6 DEGREES
SATELLITE ANTENNA BORESIGHT GAIN= 34 dBic
SATELLITE ANTENNA 3 dB BEAMWIDTH= 2.7 DEGREES
REQUIRED NEAR IN SIDELOBE LEVEL (LS) IN dB RELATIVE TO PEAK GAIN
ONLY ALLOWED VALUES ARE -20,-25 OR -30. LS=-25
REVERSE LINK CARRIER POWER AT LNA=-141.5 dBW
MSAT REVERSE LINK C/(No+Io)t= 53.1 dB-Hz
OPERATING FREQUENCY= 1.475 GHz
TERRESTRIAL RADIO RELAY TERMINAL BORESIGHT EIRP= 35 dBW
TERRESTRIAL RADIO RELAY CHANNEL BANDWIDTH= 3.5 MHz
POLARIZATION ISOLATION= 3 dB

METROPOLITAN AREA	LATITUDE DEGREES	LONGITUDE DEGREES	ELEVATION DEGREES	OFF AXIS ANGLE DEGREES	INTERFERING POWER DENSITY IN dBW/Hz
CALGARY	51.05	114.08	31.1117	4.67511	-241.979
EDMONTON	53.55	113.47	28.5057	4.60171	-240.836
HALIFAX	44.65	63.6	23.4382	.824281	-214.887
HAMILTON	43.25	79.85	33.3648	.967671	-219.935
KINGSTON	44.23	76.5	30.9052	.697293	-219.983
KITCHENER	43.45	80.48	33.4802	1.01765	-219.933
LONDON	42.98	81.23	34.2436	1.08819	-219.918
MONCTON	46.1	64.78	23.1826	.554314	-214.688
MONTREAL	45.52	73.57	28.3802	.481859	-218.738
OSHAWA	43.9	78.85	32.325	.876905	-219.955
OTTAWA	45.33	75.7	29.596	.621154	-219.686
QUEBEC	46.82	71.33	26.22	.325962	-217.054
REGINA	50.42	104.65	32.2083	3.70033	-239.497
ST JOHN	45.27	66.05	24.4746	.58857	-215.694
SASKATOON	52.12	106.63	30.3889	3.91835	-241.993
THUNDER BAY	48.38	89	31.9358	2.00314	-223.568
TORONTO	43.65	79.38	32.7928	.923604	-219.946
TROIS RIVIERE	46.35	72.55	27.2056	.402073	-217.822
VANCOUVER	49.27	123.12	31.2779	5.64017	-241.976
VICTORIA	48.42	123.37	32.0695	5.72595	-241.96
WINDSOR	42.3	83.02	35.6648	1.26386	-219.891
WINNIPEG	49.88	97.15	32.128	2.90368	-230.838
ST JOHN'S	47.34	52.43	15.0379	1.17432	-214.32

TOTAL INTERFERING POWER DENSITY AT SATELLITE LNA=-205.729 dBW/Hz
CARRIER-TO-(INTERFERENCE+NOISE) DENSITY= 52.7774 dB-Hz
DECREASE IN C/Nt= .322623 dB

PROGRAM NAME GRSTPWR2.BAS

ANNEX B.2

THIS PROGRAM CALCULATES THE INTERFERING POWER DENSITY FROM A NUMBER OF EARTH STATIONS OPERATING IN THE 1710-1710 MHz BAND WITH BORESIGHT AZIMUTH POINTING TO THE SUBSATELLITE LONGITUDE OF THE SATELLITE GIVEN THE SUBSATELLITE LONGITUDE AND LOCATION OF THE GROUND STATIONS

INPUT DATA
SUBSATELLITE LONGITUDE= 106.5 DEGREES
SATELLITE ANTENNA BORESIGHT LATITUDE= 54.4 DEGREES
SATELLITE ANTENNA BORESIGHT LONGITUDE= 122.5 DEGREES
SATELLITE ANTENNA BORESIGHT GAIN= 34 dBic
SATELLITE ANTENNA 3 dB BEAMWIDTH= 2.7 DEGREES
REQUIRED NEAR IN SIDELOBE LEVEL (LS) IN dB RELATIVE TO PEAK GAIN
ONLY ALLOWED VALUES ARE -20,-25 OR -30 dB. LS=-25 dB
REVERSE LINK CARRIER POWER AT LNA=-141.5 dBW
MSAT REVERSE LINK C/(No+Io)t= 53.1 dB-Hz
OPERATING FREQUENCY= 1.705 GHz
TERRESTRIAL RADIO RELAY TERMINAL BORESIGHT EIRP= 35 dBW
TERRESTRIAL RADIO RELAY CHANNEL BANDWIDTH= 3.5 MHz
POLARIZATION ISOLATION= 3 dB

METROPOLITAN AREA	LATITUDE DEGREES	LONGITUDE DEGREES	ELEVATION DEGREES	OFF AXIS ANGLE DEGREES	INTERFERING POWER DENSITY IN dBW/Hz
CALGARY	51.05	114.08	31.1117	.760892	-213.018
EDMONTON	53.55	113.47	28.5057	.825763	-212.372
HALIFAX	44.65	63.6	23.4382	6.07692	-233.12
HAMILTON	43.25	79.85	33.3648	4.75623	-235.577
KINGSTON	44.23	76.5	30.9052	5.00166	-234.966
KITCHENER	43.45	80.48	33.4802	4.6666	-235.606
LONDON	42.98	81.23	34.2436	4.62321	-235.796
MONCTON	46.1	64.78	23.1826	5.85981	-233.057
MONTREAL	45.52	73.57	28.3802	5.17827	-234.341
OSHAWA	43.9	78.85	32.325	4.79863	-235.319
OTTAWA	45.33	75.7	29.596	4.98691	-234.642
QUEBEC	46.82	71.33	26.22	5.2565	-233.807
REGINA	50.42	104.65	32.2083	1.73244	-215.23
ST JOHN	45.27	66.05	24.4746	5.82429	-233.376
SASKATOON	52.12	106.63	30.3889	1.50604	-213.572
THUNDER BAY	48.38	89	31.9358	3.4362	-229.658
TORONTO	43.65	79.38	32.7928	4.75413	-235.435
TROIS RIVIERE	46.35	72.55	27.2056	5.189	-234.05
VANCOUVER	49.27	123.12	31.2779	.513736	-213.059
VICTORIA	48.42	123.37	32.0695	.611409	-213.255
WINDSOR	42.3	83.02	35.6648	4.47136	-236.149
WINNIPEG	49.88	97.15	32.128	2.52967	-220.804
ST JOHN'S	47.34	52.43	15.0379	6.53705	-231.579

TOTAL INTERFERING POWER DENSITY AT SATELLITE LNA=-205.324 dBW/Hz
CARRIER-TO-(INTERFERENCE+NOISE) DENSITY= 52.7472 dB-Hz
DECREASE IN C/Nt= .352841 dB

PROGRAM NAME GRSTPWR2.BAS

THIS PROGRAM CALCULATES THE INTERFERING POWER DENSITY FROM A NUMBER OF EARTH STATIONS OPERATING IN THE 1710-1710 MHz BAND WITH BORESIGHT AZIMUTH POINTING TO THE SUBSATELLITE LONGITUDE OF THE SATELLITE GIVEN THE SUBSATELLITE LONGITUDE AND LOCATION OF THE GROUND STATIONS **ANNEX B.2**

INPUT DATA
SUBSATELLITE LONGITUDE= 106.5 DEGREES
SATELLITE ANTENNA BORESIGHT LATITUDE= 55 DEGREES
SATELLITE ANTENNA BORESIGHT LONGITUDE= 103.5 DEGREES
SATELLITE ANTENNA BORESIGHT GAIN= 34 dBic
SATELLITE ANTENNA 3 dB BEAMWIDTH= 2.7 DEGREES
REQUIRED NEAR IN SIDELOBE LEVEL (LS) IN dB RELATIVE TO PEAK GAIN
ONLY ALLOWED VALUES ARE -20,-25 OR -30 dB. LS=-25 dB
REVERSE LINK CARRIER POWER AT LNA=-141.5 dBW
MSAT REVERSE LINK C/(No+Io)t= 53.1 dB-Hz
OPERATING FREQUENCY= 1.705 GHz
TERRESTRIAL RADIO RELAY TERMINAL BORESIGHT EIRP= 35 dBW
TERRESTRIAL RADIO RELAY CHANNEL BANDWIDTH= 3.5 MHz
POLARIZATION ISOLATION= 3 dB

METROPOLITAN AREA	LATITUDE DEGREES	LONGITUDE DEGREES	ELEVATION DEGREES	OFF AXIS ANGLE DEGREES	INTERFERING POWER DENSITY IN dBW/Hz
CALGARY	51.05	114.08	31.1117	1.11633	-213.018
EDMONTON	53.55	113.47	28.5057	.968426	-212.372
HALIFAX	44.65	63.6	23.4382	4.36963	-233.12
HAMILTON	43.25	79.85	33.3648	3.06734	-226.065
KINGSTON	44.23	76.5	30.9052	3.29655	-227.855
KITCHENER	43.45	80.48	33.4802	2.9821	-225.244
LONDON	42.98	81.23	34.2436	2.9501	-225.122
MONCTON	46.1	64.78	23.1826	4.12755	-233.057
MONTREAL	45.52	73.57	28.3802	3.44968	-228.93
OSHAWA	43.9	78.85	32.325	3.10165	-226.155
OTTAWA	45.33	75.7	29.596	3.26801	-227.222
QUEBEC	46.82	71.33	26.22	3.51859	-229.186
REGINA	50.42	104.65	32.2083	.384794	-213.29
ST JOHN	45.27	66.05	24.4746	4.10966	-233.376
SASKATOON	52.12	106.63	30.3889	.373677	-212.838
THUNDER BAY	48.38	89	31.9358	1.72106	-215.098
TORONTO	43.65	79.38	32.7928	3.06877	-225.937
TROIS RIVIERE	46.35	72.55	27.2056	3.457	-228.722
VANCOUVER	49.27	123.12	31.2779	2.1169	-217.435
VICTORIA	48.42	123.37	32.0695	2.19279	-218.17
WINDSOR	42.3	83.02	35.6648	2.83129	-224.345
WINNIPEG	49.88	97.15	32.128	.834528	-213.27
ST JOHN'S	47.34	52.43	15.0379	4.80828	-231.579

TOTAL INTERFERING POWER DENSITY AT SATELLITE LNA=-204.625 dBW/Hz
CARRIER-TO-(INTERFERENCE+NOISE) DENSITY= 52.6884 dB-Hz
DECREASE IN C/Nt= .41164 dB

PROGRAM NAME GRSTPWR2.BAS

THIS PROGRAM CALCULATES THE INTERFERING POWER DENSITY FROM A NUMBER OF EARTH STATIONS OPERATING IN THE 1710-1710 MHz BAND WITH BORESIGHT AZIMUTH POINTING TO THE SUBSATELLITE LONGITUDE OF THE SATELLITE GIVEN THE SUBSATELLITE LONGITUDE AND LOCATION OF THE GROUND STATIONS

ANNEX B.2

INPUT DATA
SUBSATELLITE LONGITUDE= 106.5 DEGREES
SATELLITE ANTENNA BORESIGHT LATITUDE= 52.5 DEGREES
SATELLITE ANTENNA BORESIGHT LONGITUDE= 87.8 DEGREES
SATELLITE ANTENNA BORESIGHT GAIN= 34 dBic
SATELLITE ANTENNA 3 dB BEAMWIDTH= 2.7 DEGREES
REQUIRED NEAR IN SIDELOBE LEVEL (LS) IN dB RELATIVE TO PEAK GAIN
ONLY ALLOWED VALUES ARE -20,-25 OR -30 dB. LS=-25 dB
REVERSE LINK CARRIER POWER AT LNA=-141.5 dBW
MSAT REVERSE LINK C/(No+Io)t= 53.1 dB-Hz
OPERATING FREQUENCY= 1.705 GHz
TERRESTRIAL RADIO RELAY TERMINAL BORESIGHT EIRP= 35 dBW
TERRESTRIAL RADIO RELAY CHANNEL BANDWIDTH= 3.5 MHz
POLARIZATION ISOLATION= 3 dB

METROPOLITAN AREA	LATITUDE DEGREES	LONGITUDE DEGREES	ELEVATION DEGREES	OFF AXIS ANGLE DEGREES	INTERFERING POWER DENSITY IN dBW/Hz
CALGARY	51.05	114.08	31.1117	2.61996	-221.317
EDMONTON	53.55	113.47	28.5057	2.51743	-219.804
HALIFAX	44.65	63.6	23.4382	2.82565	-221.263
HAMILTON	43.25	79.85	33.3648	1.58285	-214.701
KINGSTON	44.23	76.5	30.9052	1.77603	-215.159
KITCHENER	43.45	80.48	33.4802	1.50405	-214.33
LONDON	42.98	81.23	34.2436	1.49055	-214.453
MONCTON	46.1	64.78	23.1826	2.57017	-218.931
MONTREAL	45.52	73.57	28.3802	1.90269	-215.3
OSHAWA	43.9	78.85	32.325	1.60008	-214.533
OTTAWA	45.33	75.7	29.596	1.73184	-214.579
QUEBEC	46.82	71.33	26.22	1.96096	-215.136
REGINA	50.42	104.65	32.2083	1.64573	-214.748
ST JOHN	45.27	66.05	24.4746	2.56256	-219.185
SASKATOON	52.12	106.63	30.3889	1.84916	-215.467
THUNDER BAY	48.38	89	31.9358	.366355	-213.222
TORONTO	43.65	79.38	32.7928	1.57894	-214.539
TROIS RIVIERE	46.35	72.55	27.2056	1.90447	-215.021
VANCOUVER	49.27	123.12	31.2779	3.61038	-231.515
VICTORIA	48.42	123.37	32.0695	3.68187	-232.57
WINDSOR	42.3	83.02	35.6648	1.41966	-214.467
WINNIPEG	49.88	97.15	32.128	.863204	-213.27
ST JOHN'S	47.34	52.43	15.0379	3.25226	-223.99

TOTAL INTERFERING POWER DENSITY AT SATELLITE LNA=-202.352 dBW/Hz
CARRIER-TO-(INTERFERENCE+NOISE) DENSITY= 52.4264 dB-Hz
DECREASE IN C/Nt= .67365 dB

PROGRAM NAME GRSTPWR2.BAS

THIS PROGRAM CALCULATES THE INTERFERING POWER DENSITY FROM A NUMBER OF EARTH STATIONS OPERATING IN THE 1710-1710 MHz BAND WITH BORESIGHT AZIMUTH POINTING TO THE SUBSATELLITE LONGITUDE OF THE SATELLITE GIVEN THE SUBSATELLITE LONGITUDE AND LOCATION OF THE GROUND STATIONS

ANNEX B.2

INPUT DATA
SUBSATELLITE LONGITUDE= 106.5 DEGREES
SATELLITE ANTENNA BORESIGHT LATITUDE= 50 DEGREES
SATELLITE ANTENNA BORESIGHT LONGITUDE= 65.6 DEGREES
SATELLITE ANTENNA BORESIGHT GAIN= 34 dBic
SATELLITE ANTENNA 3 dB BEAMWIDTH= 2.7 DEGREES
REQUIRED NEAR IN SIDELOBE LEVEL (LS) IN dB RELATIVE TO PEAK GAIN
ONLY ALLOWED VALUES ARE -20,-25 OR -30 dB. LS=-25 dB
REVERSE LINK CARRIER POWER AT LNA=-141.5 dBW
MSAT REVERSE LINK C/(No+Io)t= 53.1 dB-Hz
OPERATING FREQUENCY= 1.705 GHz
TERRESTRIAL RADIO RELAY TERMINAL BORESIGHT EIRP= 35 dBW
TERRESTRIAL RADIO RELAY CHANNEL BANDWIDTH= 3.5 MHz
POLARIZATION ISOLATION= 3 dB

METROPOLITAN AREA	LATITUDE DEGREES	LONGITUDE DEGREES	ELEVATION DEGREES	OFF AXIS ANGLE DEGREES	INTERFERING POWER DENSITY IN dBW/Hz
CALGARY	51.05	114.08	31.1117	4.67511	-235.018
EDMONTON	53.55	113.47	28.5057	4.60171	-234.372
HALIFAX	44.65	63.6	23.4382	.824281	-211.12
HAMILTON	43.25	79.85	33.3648	.967671	-213.577
KINGSTON	44.23	76.5	30.9052	.697293	-212.966
KITCHENER	43.45	80.48	33.4802	1.01765	-213.606
LONDON	42.98	81.23	34.2436	1.08819	-213.796
MONCTON	46.1	64.78	23.1826	.554314	-211.057
MONTREAL	45.52	73.57	28.3802	.481859	-212.341
OSHAWA	43.9	78.85	32.325	.876905	-213.319
OTTAWA	45.33	75.7	29.596	.621154	-212.642
QUEBEC	46.82	71.33	26.22	.325962	-211.807
REGINA	50.42	104.65	32.2083	3.70033	-232.829
ST JOHN	45.27	66.05	24.4746	.58857	-211.376
SASKATOON	52.12	106.63	30.3889	3.91835	-234.838
THUNDER BAY	48.38	89	31.9358	2.00314	-216.827
TORONTO	43.65	79.38	32.7928	.923604	-213.435
TROIS RIVIERE	46.35	72.55	27.2056	.402073	-212.05
VANCOUVER	49.27	123.12	31.2779	5.64017	-235.059
VICTORIA	48.42	123.37	32.0695	5.72595	-235.255
WINDSOR	42.3	83.02	35.6648	1.26386	-214.149
WINNIPEG	49.88	97.15	32.128	2.90368	-224.149
ST JOHN'S	47.34	52.43	15.0379	1.17432	-209.579

TOTAL INTERFERING POWER DENSITY AT SATELLITE LNA=-200.378 dBW/Hz
CARRIER-TO-(INTERFERENCE+NOISE) DENSITY= 52.0813 dB-Hz
DECREASE IN C/Nt= 1.01872 dB

PROGRAM NAME GRSTPWR3.BAS

THIS PROGRAM CALCULATES THE INTERFERING POWER DENSITY FROM A NUMBER OF EARTH STATIONS OPERATING IN THE 1710-1900 MHz BAND WITH BORESIGHT AZIMUTH POINTING TO THE SUBSATELLITE LONGITUDE OF THE SATELLITE GIVEN THE SUBSATELLITE LONGITUDE AND LOCATION OF THE GROUND STATIONS

ANNEX B.3

INPUT DATA
SUBSATELLITE LONGITUDE= 106.5 DEGREES
SATELLITE ANTENNA BORESIGHT LATITUDE= 54.4 DEGREES
SATELLITE ANTENNA BORESIGHT LONGITUDE= 122.5 DEGREES
SATELLITE ANTENNA BORESIGHT GAIN= 34 dBic
SATELLITE ANTENNA 3 dB BEAMWIDTH= 2.7 DEGREES
REQUIRED NEAR IN SIDELOBE LEVEL (LS) IN dB RELATIVE TO PEAK GAIN
ONLY ALLOWED VALUES ARE -20,-25 OR -30 dB. LS=-25 dB
REVERSE LINK CARRIER POWER AT LNA=-141.5 dBW
MSAT REVERSE LINK C/(No+Io)t= 53.1 dB-Hz
OPERATING FREQUENCY= 1.8 GHz
TERRESTRIAL RADIO RELAY TERMINAL BORESIGHT EIRP= 35 dBW
TERRESTRIAL RADIO RELAY CHANNEL BANDWIDTH= 3.5 MHz
POLARIZATION ISOLATION= 3 dB

METROPOLITAN AREA	LATITUDE DEGREES	LONGITUDE DEGREES	ELEVATION DEGREES	OFF AXIS ANGLE DEGREES	INTERFERING POWER DENSITY IN dBW/Hz
CALGARY	51.05	114.08	31.1117	.760892	-213.166
EDMONTON	53.55	113.47	28.5057	.825763	-212.928
HALIFAX	44.65	63.6	23.4382	6.07692	-234.471
HAMILTON	43.25	79.85	33.3648	4.75623	-235.372
KINGSTON	44.23	76.5	30.9052	5.00166	-235.147
KITCHENER	43.45	80.48	33.4802	4.6666	-235.382
LONDON	42.98	81.23	34.2436	4.62321	-235.453
MONCTON	46.1	64.78	23.1826	5.85981	-234.448
MONTREAL	45.52	73.57	28.3802	5.17827	-234.917
OSHAWA	43.9	78.85	32.325	4.79863	-235.277
OTTAWA	45.33	75.7	29.596	4.98691	-235.027
QUEBEC	46.82	71.33	26.22	5.2565	-234.721
REGINA	50.42	104.65	32.2083	1.73244	-215.206
ST JOHN	45.27	66.05	24.4746	5.82429	-234.564
SASKATOON	52.12	106.63	30.3889	1.50604	-213.833
THUNDER BAY	48.38	89	31.9358	3.4362	-229.677
TORONTO	43.65	79.38	32.7928	4.75413	-235.319
TROIS RIVIERE	46.35	72.55	27.2056	5.189	-234.81
VANCOUVER	49.27	123.12	31.2779	.513736	-213.181
VICTORIA	48.42	123.37	32.0695	.611409	-213.253
WINDSOR	42.3	83.02	35.6648	4.47136	-235.584
WINNIPEG	49.88	97.15	32.128	2.52967	-220.792
ST JOHN'S	47.34	52.43	15.0379	6.53705	-234.05

TOTAL INTERFERING POWER DENSITY AT SATELLITE LNA=-205.524 dBW/Hz
CARRIER-TO-(INTERFERENCE+NOISE) DENSITY= 52.7624 dB-Hz
DECREASE IN C/Nt= .337601 dB

PROGRAM NAME GRSTPWR3.BAS

THIS PROGRAM CALCULATES THE INTERFERING POWER DENSITY FROM A NUMBER OF EARTH STATIONS OPERATING IN THE 1710-1900 MHz BAND WITH BORESIGHT AZIMUTH POINTING TO THE SUBSATELLITE LONGITUDE OF THE SATELLITE GIVEN THE SUBSATELLITE LONGITUDE AND LOCATION OF THE GROUND STATIONS **ANNEX B.3**

INPUT DATA
SUBSATELLITE LONGITUDE= 106.5 DEGREES
SATELLITE ANTENNA BORESIGHT LATITUDE= 55 DEGREES
SATELLITE ANTENNA BORESIGHT LONGITUDE= 103.5 DEGREES
SATELLITE ANTENNA BORESIGHT GAIN= 34 dBic
SATELLITE ANTENNA 3 dB BEAMWIDTH= 2.7 DEGREES
REQUIRED NEAR IN SIDELOBE LEVEL (LS) IN dB RELATIVE TO PEAK GAIN
ONLY ALLOWED VALUES ARE -20,-25 OR -30 dB. LS=-25 dB
REVERSE LINK CARRIER POWER AT LNA=-141.5 dBW
MSAT REVERSE LINK C/(No+Io)t= 53.1 dB-Hz
OPERATING FREQUENCY= 1.8 GHz
TERRESTRIAL RADIO RELAY TERMINAL BORESIGHT EIRP= 35 dBW
TERRESTRIAL RADIO RELAY CHANNEL BANDWIDTH= 3.5 MHz
POLARIZATION ISOLATION= 3 dB

METROPOLITAN AREA	LATITUDE DEGREES	LONGITUDE DEGREES	ELEVATION DEGREES	OFF AXIS ANGLE DEGREES	INTERFERING POWER DENSITY IN dBW/Hz
CALGARY	51.05	114.08	31.1117	1.11633	-213.166
EDMONTON	53.55	113.47	28.5057	.968426	-212.928
HALIFAX	44.65	63.6	23.4382	4.36963	-234.471
HAMILTON	43.25	79.85	33.3648	3.06734	-225.859
KINGSTON	44.23	76.5	30.9052	3.29655	-228.035
KITCHENER	43.45	80.48	33.4802	2.9821	-225.021
LONDON	42.98	81.23	34.2436	2.9501	-224.779
MONCTON	46.1	64.78	23.1826	4.12755	-234.448
MONTREAL	45.52	73.57	28.3802	3.44968	-229.506
OSHAWA	43.9	78.85	32.325	3.10165	-226.112
OTTAWA	45.33	75.7	29.596	3.26801	-227.607
QUEBEC	46.82	71.33	26.22	3.51859	-230.101
REGINA	50.42	104.65	32.2083	.384794	-213.266
ST JOHN	45.27	66.05	24.4746	4.10966	-234.564
SASKATOON	52.12	106.63	30.3889	.373677	-213.1
THUNDER BAY	48.38	89	31.9358	1.72106	-215.117
TORONTO	43.65	79.38	32.7928	3.06877	-225.821
TROIS RIVIERE	46.35	72.55	27.2056	3.457	-229.483
VANCOUVER	49.27	123.12	31.2779	2.1169	-217.557
VICTORIA	48.42	123.37	32.0695	2.19279	-218.168
WINDSOR	42.3	83.02	35.6648	2.83129	-223.779
WINNIPEG	49.88	97.15	32.128	.834528	-213.258
ST JOHN'S	47.34	52.43	15.0379	4.80828	-234.05

TOTAL INTERFERING POWER DENSITY AT SATELLITE LNA=-204.783 dBW/Hz
CARRIER-TO-(INTERFERENCE+NOISE) DENSITY= 52.7024 dB-Hz
DECREASE IN C/Nt= .397619 dB

PROGRAM NAME GRSTPWR3.BAS

THIS PROGRAM CALCULATES THE INTERFERING POWER DENSITY FROM A NUMBER OF EARTH STATIONS OPERATING IN THE 1710-1900 MHz BAND WITH BORESIGHT AZIMUTH POINTING TO THE SUBSATELLITE LONGITUDE OF THE SATELLITE GIVEN THE SUBSATELLITE LONGITUDE AND LOCATION OF THE GROUND STATIONS

ANNEX B.3

INPUT DATA
SUBSATELLITE LONGITUDE= 106.5 DEGREES
SATELLITE ANTENNA BORESIGHT LATITUDE= 52.5 DEGREES
SATELLITE ANTENNA BORESIGHT LONGITUDE= 87.8 DEGREES
SATELLITE ANTENNA BORESIGHT GAIN= 34 dBic
SATELLITE ANTENNA 3 dB BEAMWIDTH= 2.7 DEGREES
REQUIRED NEAR IN SIDELOBE LEVEL (LS) IN dB RELATIVE TO PEAK GAIN
ONLY ALLOWED VALUES ARE -20,-25 OR -30 dB. LS=-25 dB
REVERSE LINK CARRIER POWER AT LNA=-141.5 dBW
MSAT REVERSE LINK C/(No+Io)t= 53.1 dB-Hz
OPERATING FREQUENCY= 1.8 GHz
TERRESTRIAL RADIO RELAY TERMINAL BORESIGHT EIRP= 35 dBW
TERRESTRIAL RADIO RELAY CHANNEL BANDWIDTH= 3.5 MHz
POLARIZATION ISOLATION= 3 dB

METROPOLITAN AREA	LATITUDE DEGREES	LONGITUDE DEGREES	ELEVATION DEGREES	OFF AXIS ANGLE DEGREES	INTERFERING POWER DENSITY IN dBW/Hz
CALGARY	51.05	114.08	31.1117	2.61996	-221.465
EDMONTON	53.55	113.47	28.5057	2.51743	-220.36
HALIFAX	44.65	63.6	23.4382	2.82565	-222.613
HAMILTON	43.25	79.85	33.3648	1.58285	-214.496
KINGSTON	44.23	76.5	30.9052	1.77603	-215.339
KITCHENER	43.45	80.48	33.4802	1.50405	-214.106
LONDON	42.98	81.23	34.2436	1.49055	-214.11
MONCTON	46.1	64.78	23.1826	2.57017	-220.321
MONTREAL	45.52	73.57	28.3802	1.90269	-215.876
OSHAWA	43.9	78.85	32.325	1.60008	-214.491
OTTAWA	45.33	75.7	29.596	1.73184	-214.964
QUEBEC	46.82	71.33	26.22	1.96096	-216.051
REGINA	50.42	104.65	32.2083	1.64573	-214.724
ST JOHN	45.27	66.05	24.4746	2.56256	-220.373
SASKATOON	52.12	106.63	30.3889	1.84916	-215.728
THUNDER BAY	48.38	89	31.9358	.366355	-213.241
TORONTO	43.65	79.38	32.7928	1.57894	-214.423
TROIS RIVIERE	46.35	72.55	27.2056	1.90447	-215.781
VANCOUVER	49.27	123.12	31.2779	3.61038	-231.637
VICTORIA	48.42	123.37	32.0695	3.68187	-232.568
WINDSOR	42.3	83.02	35.6648	1.41966	-213.901
WINNIPEG	49.88	97.15	32.128	.863204	-213.258
ST JOHN'S	47.34	52.43	15.0379	3.25226	-226.461

TOTAL INTERFERING POWER DENSITY AT SATELLITE LNA=-202.498 dBW/Hz
CARRIER-TO-(INTERFERENCE+NOISE) DENSITY= 52.4469 dB-Hz
DECREASE IN C/Nt= .653077 dB

PROGRAM NAME GRSTPWR3.BAS

THIS PROGRAM CALCULATES THE INTERFERING POWER DENSITY FROM A NUMBER OF EARTH STATIONS OPERATING IN THE 1710-1900 MHz BAND WITH BORESIGHT AZIMUTH POINTING TO THE SUBSATELLITE LONGITUDE OF THE SATELLITE GIVEN THE SUBSATELLITE LONGITUDE AND LOCATION OF THE GROUND STATIONS **ANNEX B.3**

INPUT DATA
SUBSATELLITE LONGITUDE= 106.5 DEGREES
SATELLITE ANTENNA BORESIGHT LATITUDE= 50 DEGREES
SATELLITE ANTENNA BORESIGHT LONGITUDE= 65.6 DEGREES
SATELLITE ANTENNA BORESIGHT GAIN= 34 dBic
SATELLITE ANTENNA 3 dB BEAMWIDTH= 2.7 DEGREES
REQUIRED NEAR IN SIDELOBE LEVEL (LS) IN dB RELATIVE TO PEAK GAIN
ONLY ALLOWED VALUES ARE -20,-25 OR -30 dB. LS=-25 dB
REVERSE LINK CARRIER POWER AT LNA=-141.5 dBW
MSAT REVERSE LINK C/(No+Io)t= 53.1 dB-Hz
OPERATING FREQUENCY= 1.8 GHz
TERRESTRIAL RADIO RELAY TERMINAL BORESIGHT EIRP= 35 dBW
TERRESTRIAL RADIO RELAY CHANNEL BANDWIDTH= 3.5 MHz
POLARIZATION ISOLATION= 3 dB

METROPOLITAN AREA	LATITUDE DEGREES	LONGITUDE DEGREES	ELEVATION DEGREES	OFF AXIS ANGLE DEGREES	INTERFERING POWER DENSITY IN dBW/Hz
CALGARY	51.05	114.08	31.1117	4.67511	-235.166
EDMONTON	53.55	113.47	28.5057	4.60171	-234.928
HALIFAX	44.65	63.6	23.4382	.824281	-212.471
HAMILTON	43.25	79.85	33.3648	.967671	-213.372
KINGSTON	44.23	76.5	30.9052	.697293	-213.147
KITCHENER	43.45	80.48	33.4802	1.01765	-213.382
LONDON	42.98	81.23	34.2436	1.08819	-213.453
MONCTON	46.1	64.78	23.1826	.554314	-212.448
MONTREAL	45.52	73.57	28.3802	.481859	-212.917
OSHAWA	43.9	78.85	32.325	.876905	-213.277
OTTAWA	45.33	75.7	29.596	.621154	-213.027
QUEBEC	46.82	71.33	26.22	.325962	-212.721
REGINA	50.42	104.65	32.2083	3.70033	-232.805
ST JOHN	45.27	66.05	24.4746	.58857	-212.564
SASKATOON	52.12	106.63	30.3889	3.91835	-235.1
THUNDER BAY	48.38	89	31.9358	2.00314	-216.846
TORONTO	43.65	79.38	32.7928	.923604	-213.319
TROIS RIVIERE	46.35	72.55	27.2056	.402073	-212.81
VANCOUVER	49.27	123.12	31.2779	5.64017	-235.181
VICTORIA	48.42	123.37	32.0695	5.72595	-235.253
WINDSOR	42.3	83.02	35.6648	1.26386	-213.584
WINNIPEG	49.88	97.15	32.128	2.90368	-224.137
ST JOHN'S	47.34	52.43	15.0379	1.17432	-212.05

TOTAL INTERFERING POWER DENSITY AT SATELLITE LNA=-201.037 dBW/Hz
CARRIER-TO-(INTERFERENCE+NOISE) DENSITY= 52.2111 dB-Hz
DECREASE IN C/Nt= .888889 dB

PROGRAM NAME GRSTPWR4.BAS

THIS PROGRAM CALCULATES THE INTERFERING POWER DENSITY FROM A NUMBER OF EARTH STATIONS OPERATING IN THE 1900-2290 MHz BAND WITH BORESIGHT AZIMUTH POINTING TO THE SUBSATELLITE LONGITUDE OF THE SATELLITE GIVEN THE SUBSATELLITE LONGITUDE AND LOCATION OF THE GROUND STATIONS

ANNEX B.4

INPUT DATA
SUBSATELLITE LONGITUDE= 106.5 DEGREES
SATELLITE ANTENNA BORESIGHT LATITUDE= 54.4 DEGREES
SATELLITE ANTENNA BORESIGHT LONGITUDE= 122.5 DEGREES
SATELLITE ANTENNA BORESIGHT GAIN= 34 dBic
SATELLITE ANTENNA 3 dB BEAMWIDTH= 2.7 DEGREES
REQUIRED NEAR IN SIDELOBE LEVEL (LS) IN dB RELATIVE TO PEAK GAIN
ONLY ALLOWED VALUES ARE -20,-25 OR -30 dB. LS=-25 dB
REVERSE LINK CARRIER POWER AT LNA=-141.5 dBW
MSAT REVERSE LINK C/(No+Io)t= 53.1 dB-Hz
OPERATING FREQUENCY= 2.1 GHz
TERRESTRIAL RADIO RELAY TERMINAL BORESIGHT EIRP= 45 dBW
TERRESTRIAL RADIO RELAY CHANNEL BANDWIDTH= 29 MHz
POLARIZATION ISOLATION= 3 dB

METROPOLITAN AREA	LATITUDE DEGREES	LONGITUDE DEGREES	ELEVATION DEGREES	OFF AXIS ANGLE DEGREES	INTERFERING POWER DENSITY IN dBW/Hz
CALGARY	51.05	114.08	31.1117	.760892	-219.22
EDMONTON	53.55	113.47	28.5057	.825763	-218.951
HALIFAX	44.65	63.6	23.4382	6.07692	-240.43
HAMILTON	43.25	79.85	33.3648	4.75623	-241.454
KINGSTON	44.23	76.5	30.9052	5.00166	-241.199
KITCHENER	43.45	80.48	33.4802	4.6666	-241.466
LONDON	42.98	81.23	34.2436	4.62321	-241.546
MONCTON	46.1	64.78	23.1826	5.85981	-240.404
MONTREAL	45.52	73.57	28.3802	5.17827	-240.938
OSHAWA	43.9	78.85	32.325	4.79863	-241.346
OTTAWA	45.33	75.7	29.596	4.98691	-241.063
QUEBEC	46.82	71.33	26.22	5.2565	-240.715
REGINA	50.42	104.65	32.2083	1.73244	-221.274
ST JOHN	45.27	66.05	24.4746	5.82429	-240.536
SASKATOON	52.12	106.63	30.3889	1.50604	-219.879
THUNDER BAY	48.38	89	31.9358	3.4362	-235.742
TORONTO	43.65	79.38	32.7928	4.75413	-241.395
TROIS RIVIERE	46.35	72.55	27.2056	5.189	-240.817
VANCOUVER	49.27	123.12	31.2779	.513736	-219.237
VICTORIA	48.42	123.37	32.0695	.611409	-219.319
WINDSOR	42.3	83.02	35.6648	4.47136	-241.694
WINNIPEG	49.88	97.15	32.128	2.52967	-226.859
ST JOHN'S	47.34	52.43	15.0379	6.53705	-239.577

TOTAL INTERFERING POWER DENSITY AT SATELLITE LNA=-211.574 dBW/Hz
CARRIER-TO-(INTERFERENCE+NOISE) DENSITY= 53.0137 dB-Hz
DECREASE IN C/Nt= 8.63049e-2 dB

PROGRAM NAME GRSTPWR4.BAS

THIS PROGRAM CALCULATES THE INTERFERING POWER DENSITY FROM A NUMBER OF EARTH STATIONS OPERATING IN THE 1900-2290 MHz BAND WITH BORESIGHT AZIMUTH POINTING TO THE SUBSATELLITE LONGITUDE OF THE SATELLITE GIVEN THE SUBSATELLITE LONGITUDE AND LOCATION OF THE GROUND STATIONS **ANNEX B.4**

INPUT DATA
SUBSATELLITE LONGITUDE= 106.5 DEGREES
SATELLITE ANTENNA BORESIGHT LATITUDE= 55 DEGREES
SATELLITE ANTENNA BORESIGHT LONGITUDE= 103.5 DEGREES
SATELLITE ANTENNA BORESIGHT GAIN= 34 dBic
SATELLITE ANTENNA 3 dB BEAMWIDTH= 2.7 DEGREES
REQUIRED NEAR IN SIDELOBE LEVEL (LS) IN dB RELATIVE TO PEAK GAIN
ONLY ALLOWED VALUES ARE -20,-25 OR -30 dB. LS=-25 dB
REVERSE LINK CARRIER POWER AT LNA=-141.5 dBW
MSAT REVERSE LINK C/(No+Io)t= 53.1 dB-Hz
OPERATING FREQUENCY= 2.1 GHz
TERRESTRIAL RADIO RELAY TERMINAL BORESIGHT EIRP= 45 dBW
TERRESTRIAL RADIO RELAY CHANNEL BANDWIDTH= 29 MHz
POLARIZATION ISOLATION= 3 dB

METROPOLITAN AREA	LATITUDE DEGREES	LONGITUDE DEGREES	ELEVATION DEGREES	OFF AXIS ANGLE DEGREES	INTERFERING POWER DENSITY IN dBW/Hz
CALGARY	51.05	114.08	31.1117	1.11633	-219.22
EDMONTON	53.55	113.47	28.5057	.968426	-218.951
HALIFAX	44.65	63.6	23.4382	4.36963	-240.43
HAMILTON	43.25	79.85	33.3648	3.06734	-231.942
KINGSTON	44.23	76.5	30.9052	3.29655	-234.087
KITCHENER	43.45	80.48	33.4802	2.9821	-231.105
LONDON	42.98	81.23	34.2436	2.9501	-230.872
MONCTON	46.1	64.78	23.1826	4.12755	-240.404
MONTREAL	45.52	73.57	28.3802	3.44968	-235.527
OSHAWA	43.9	78.85	32.325	3.10165	-232.182
OTTAWA	45.33	75.7	29.596	3.26801	-233.643
QUEBEC	46.82	71.33	26.22	3.51859	-236.095
REGINA	50.42	104.65	32.2083	.384794	-219.334
ST JOHN	45.27	66.05	24.4746	4.10966	-240.536
SASKATOON	52.12	106.63	30.3889	.373677	-219.145
THUNDER BAY	48.38	89	31.9358	1.72106	-221.181
TORONTO	43.65	79.38	32.7928	3.06877	-231.896
TROIS RIVIERE	46.35	72.55	27.2056	3.457	-235.489
VANCOUVER	49.27	123.12	31.2779	2.1169	-223.614
VICTORIA	48.42	123.37	32.0695	2.19279	-224.234
WINDSOR	42.3	83.02	35.6648	2.83129	-229.89
WINNIPEG	49.88	97.15	32.128	.834528	-219.326
ST JOHN'S	47.34	52.43	15.0379	4.80828	-239.577

TOTAL INTERFERING POWER DENSITY AT SATELLITE LNA=-210.837 dBW/Hz
CARRIER-TO-(INTERFERENCE+NOISE) DENSITY= 52.9979 dB-Hz
DECREASE IN C/Nt= .102095 dB

PROGRAM NAME GRSTPWR4.BAS

THIS PROGRAM CALCULATES THE INTERFERING POWER DENSITY FROM A NUMBER OF EARTH STATIONS OPERATING IN THE 1900-2290 MHz BAND WITH BORESIGHT AZIMUTH POINTING TO THE SUBSATELLITE LONGITUDE OF THE SATELLITE GIVEN THE SUBSATELLITE LONGITUDE AND LOCATION OF THE GROUND STATIONS

ANNEX B.4

INPUT DATA
SUBSATELLITE LONGITUDE= 106.5 DEGREES
SATELLITE ANTENNA BORESIGHT LATITUDE= 52.5 DEGREES
SATELLITE ANTENNA BORESIGHT LONGITUDE= 87.8 DEGREES
SATELLITE ANTENNA BORESIGHT GAIN= 34 dBic
SATELLITE ANTENNA 3 dB BEAMWIDTH= 2.7 DEGREES
REQUIRED NEAR IN SIDELOBE LEVEL (LS) IN dB RELATIVE TO PEAK GAIN
ONLY ALLOWED VALUES ARE -20,-25 OR -30 dB. LS=-25 dB
REVERSE LINK CARRIER POWER AT LNA=-141.5 dBW
MSAT REVERSE LINK C/(No+Io)t= 53.1 dB-Hz
OPERATING FREQUENCY= 2.1 GHz
TERRESTRIAL RADIO RELAY TERMINAL BORESIGHT EIRP= 45 dBW
TERRESTRIAL RADIO RELAY CHANNEL BANDWIDTH= 29 MHz
POLARIZATION ISOLATION= 3 dB

METROPOLITAN AREA	LATITUDE DEGREES	LONGITUDE DEGREES	ELEVATION DEGREES	OFF AXIS ANGLE DEGREES	INTERFERING POWER DENSITY IN dBW/Hz
CALGARY	51.05	114.08	31.1117	2.61996	-227.519
EDMONTON	53.55	113.47	28.5057	2.51743	-226.383
HALIFAX	44.65	63.6	23.4382	2.82565	-228.573
HAMILTON	43.25	79.85	33.3648	1.58285	-220.578
KINGSTON	44.23	76.5	30.9052	1.77603	-221.391
KITCHENER	43.45	80.48	33.4802	1.50405	-220.19
LONDON	42.98	81.23	34.2436	1.49055	-220.203
MONCTON	46.1	64.78	23.1826	2.57017	-226.278
MONTREAL	45.52	73.57	28.3802	1.90269	-221.897
OSHAWA	43.9	78.85	32.325	1.60008	-220.56
OTTAWA	45.33	75.7	29.596	1.73184	-221.
QUEBEC	46.82	71.33	26.22	1.96096	-222.045
REGINA	50.42	104.65	32.2083	1.64573	-220.792
ST JOHN	45.27	66.05	24.4746	2.56256	-226.346
SASKATOON	52.12	106.63	30.3889	1.84916	-221.774
THUNDER BAY	48.38	89	31.9358	.366355	-219.306
TORONTO	43.65	79.38	32.7928	1.57894	-220.498
TROIS RIVIERE	46.35	72.55	27.2056	1.90447	-221.787
VANCOUVER	49.27	123.12	31.2779	3.61038	-237.694
VICTORIA	48.42	123.37	32.0695	3.68187	-238.634
WINDSOR	42.3	83.02	35.6648	1.41966	-220.012
WINNIPEG	49.88	97.15	32.128	.863204	-219.326
ST JOHN'S	47.34	52.43	15.0379	3.25226	-231.988

TOTAL INTERFERING POWER DENSITY AT SATELLITE LNA=-208.553 dBW/Hz
CARRIER-TO-(INTERFERENCE+NOISE) DENSITY= 52.9286 dB-Hz
DECREASE IN C/Nt= .171364 dB

PROGRAM NAME GRSTPWR4.BAS

ANNEX B.4

THIS PROGRAM CALCULATES THE INTERFERING POWER DENSITY FROM A NUMBER OF EARTH STATIONS OPERATING IN THE 1900-2290 MHz BAND WITH BORESIGHT AZIMUTH POINTING TO THE SUBSATELLITE LONGITUDE OF THE SATELLITE GIVEN THE SUBSATELLITE LONGITUDE AND LOCATION OF THE GROUND STATIONS

INPUT DATA
SUBSATELLITE LONGITUDE= 106.5 DEGREES
SATELLITE ANTENNA BORESIGHT LATITUDE= 50 DEGREES
SATELLITE ANTENNA BORESIGHT LONGITUDE= 65.6 DEGREES
SATELLITE ANTENNA BORESIGHT GAIN= 34 dBic
SATELLITE ANTENNA 3 dB BEAMWIDTH= 2.7 DEGREES
REQUIRED NEAR IN SIDELOBE LEVEL (LS) IN dB RELATIVE TO PEAK GAIN
ONLY ALLOWED VALUES ARE -20,-25 OR -30 dB. LS=-25 dB
REVERSE LINK CARRIER POWER AT LNA=-141.5 dBW
MSAT REVERSE LINK C/(No+Io)t= 53.1 dB-Hz
OPERATING FREQUENCY= 2.1 GHz
TERRESTRIAL RADIO RELAY TERMINAL BORESIGHT EIRP= 45 dBW
TERRESTRIAL RADIO RELAY CHANNEL BANDWIDTH= 29 MHz
POLARIZATION ISOLATION= 3 dB

METROPOLITAN AREA	LATITUDE DEGREES	LONGITUDE DEGREES	ELEVATION DEGREES	OFF AXIS ANGLE DEGREES	INTERFERING POWER DENSITY IN dBW/Hz
CALGARY	51.05	114.08	31.1117	4.67511	-241.22
EDMONTON	53.55	113.47	28.5057	4.60171	-240.951
HALIFAX	44.65	63.6	23.4382	.824281	-218.43
HAMILTON	43.25	79.85	33.3648	.967671	-219.454
KINGSTON	44.23	76.5	30.9052	.697293	-219.199
KITCHENER	43.45	80.48	33.4802	1.01765	-219.466
LONDON	42.98	81.23	34.2436	1.08819	-219.546
MONCTON	46.1	64.78	23.1826	.554314	-218.404
MONTREAL	45.52	73.57	28.3802	.481859	-218.938
OSHAWA	43.9	78.85	32.325	.876905	-219.346
OTTAWA	45.33	75.7	29.596	.621154	-219.063
QUEBEC	46.82	71.33	26.22	.325962	-218.715
REGINA	50.42	104.65	32.2083	3.70033	-238.873
ST JOHN	45.27	66.05	24.4746	.58857	-218.536
SASKATOON	52.12	106.63	30.3889	3.91835	-241.145
THUNDER BAY	48.38	89	31.9358	2.00314	-222.911
TORONTO	43.65	79.38	32.7928	.923604	-219.395
TROIS RIVIERE	46.35	72.55	27.2056	.402073	-218.817
VANCOUVER	49.27	123.12	31.2779	5.64017	-241.237
VICTORIA	48.42	123.37	32.0695	5.72595	-241.319
WINDSOR	42.3	83.02	35.6648	1.26386	-219.694
WINNIPEG	49.88	97.15	32.128	2.90368	-230.204
ST JOHN'S	47.34	52.43	15.0379	1.17432	-217.577

TOTAL INTERFERING POWER DENSITY AT SATELLITE LNA=-207.028 dBW/Hz
CARRIER-TO-(INTERFERENCE+NOISE) DENSITY= 52.8585 dB-Hz
DECREASE IN C/Nt= .241455 dB

PROGRAM NAME GRSTPWR5.BAS

THIS PROGRAM CALCULATES THE INTERFERING POWER DENSITY FROM A NUMBER OF EARTH STATIONS OPERATING MCS IN THE 2290-2450 MHz BAND WITH BORESIGHT AZIMUTH POINTING TO THE SUBSATELLITE LONGITUDE OF THE SATELLITE GIVEN THE SUBSATELLITE LONGITUDE AND LOCATION OF THE GROUND STATIONS

ANNEX B.5

INPUT DATA
SUBSATELLITE LONGITUDE= 106.5 DEGREES
SATELLITE ANTENNA BORESIGHT LATITUDE= 54.4 DEGREES
SATELLITE ANTENNA BORESIGHT LONGITUDE= 122.5 DEGREES
SATELLITE ANTENNA BORESIGHT GAIN= 34 dBic
SATELLITE ANTENNA 3 dB BEAMWIDTH= 2.7 DEGREES
REQUIRED NEAR IN SIDELOBE LEVEL (LS) IN dB RELATIVE TO PEAK GAIN
ONLY ALLOWED VALUES ARE -20,-25 OR -30 dB. LS=-25 dB
REVERSE LINK CARRIER POWER AT LNA=-141.5 dBW
MSAT REVERSE LINK C/(No+Io)t= 53.1 dB-Hz
OPERATING FREQUENCY= 2.35 GHz
TERRESTRIAL RADIO RELAY TERMINAL BORESIGHT EIRP= 45 dBW
TERRESTRIAL RADIO RELAY CHANNEL BANDWIDTH= 6 MHz
POLARIZATION ISOLATION= 3 dB

METROPOLITAN AREA	LATITUDE DEGREES	LONGITUDE DEGREES	ELEVATION DEGREES	OFF AXIS ANGLE DEGREES	INTERFERING POWER DENSITY IN dBW/Hz
CALGARY	51.05	114.08	31.1117	.760892	-203.365
EDMONTON	53.55	113.47	28.5057	.825763	-203.418
HALIFAX	44.65	63.6	23.4382	6.07692	-225.523
HAMILTON	43.25	79.85	33.3648	4.75623	-225.321
KINGSTON	44.23	76.5	30.9052	5.00166	-225.37
KITCHENER	43.45	80.48	33.4802	4.6666	-225.319
LONDON	42.98	81.23	34.2436	4.62321	-225.305
MONCTON	46.1	64.78	23.1826	5.85981	-225.528
MONTREAL	45.52	73.57	28.3802	5.17827	-225.42
OSHAWA	43.9	78.85	32.325	4.79863	-225.342
OTTAWA	45.33	75.7	29.596	4.98691	-225.396
QUEBEC	46.82	71.33	26.22	5.2565	-225.465
REGINA	50.42	104.65	32.2083	1.73244	-205.284
ST JOHN	45.27	66.05	24.4746	5.82429	-225.501
SASKATOON	52.12	106.63	30.3889	1.50604	-204.113
THUNDER BAY	48.38	89	31.9358	3.4362	-219.785
TORONTO	43.65	79.38	32.7928	4.75413	-225.332
TROIS RIVIERE	46.35	72.55	27.2056	5.189	-225.444
VANCOUVER	49.27	123.12	31.2779	.513736	-203.362
VICTORIA	48.42	123.37	32.0695	.611409	-203.347
WINDSOR	42.3	83.02	35.6648	4.47136	-225.278
WINNIPEG	49.88	97.15	32.128	2.52967	-210.879
ST JOHN'S	47.34	52.43	15.0379	6.53705	-219.752

TOTAL INTERFERING POWER DENSITY AT SATELLITE LNA=-195.74 dBW/Hz
CARRIER-TO-(INTERFERENCE+NOISE) DENSITY= 50.6223 dB-Hz
DECREASE IN C/Nt= 2.47772 dB

PROGRAM NAME GRSTPWR5.BAS

THIS PROGRAM CALCULATES THE INTERFERING POWER DENSITY FROM A NUMBER OF EARTH STATIONS OPERATING MCS IN THE 2290-2450 MHz BAND WITH BORESIGHT AZIMUTH POINTING TO THE SUBSATELLITE LONGITUDE OF THE SATELLITE GIVEN THE SUBSATELLITE LONGITUDE AND LOCATION OF THE GROUND STATIONS

ANNEX B.5

INPUT DATA
SUBSATELLITE LONGITUDE= 106.5 DEGREES
SATELLITE ANTENNA BORESIGHT LATITUDE= 55 DEGREES
SATELLITE ANTENNA BORESIGHT LONGITUDE= 103.5 DEGREES
SATELLITE ANTENNA BORESIGHT GAIN= 34 dBic
SATELLITE ANTENNA 3 dB BEAMWIDTH= 2.7 DEGREES
REQUIRED NEAR IN SIDELOBE LEVEL (LS) IN dB RELATIVE TO PEAK GAIN
ONLY ALLOWED VALUES ARE -20,-25 OR -30 dB. LS=-25 dB
REVERSE LINK CARRIER POWER AT LNA=-141.5 dBW
MSAT REVERSE LINK C/(No+Io)t= 53.1 dB-Hz
OPERATING FREQUENCY= 2.35 GHz
TERRESTRIAL RADIO RELAY TERMINAL BORESIGHT EIRP= 45 dBW
TERRESTRIAL RADIO RELAY CHANNEL BANDWIDTH= 6 MHz
POLARIZATION ISOLATION= 3 dB

METROPOLITAN AREA	LATITUDE DEGREES	LONGITUDE DEGREES	ELEVATION DEGREES	OFF AXIS ANGLE DEGREES	INTERFERING POWER DENSITY IN dBW/Hz
CALGARY	51.05	114.08	31.1117	1.11633	-203.365
EDMONTON	53.55	113.47	28.5057	.968426	-203.418
HALIFAX	44.65	63.6	23.4382	4.36963	-225.523
HAMILTON	43.25	79.85	33.3648	3.06734	-215.809
KINGSTON	44.23	76.5	30.9052	3.29655	-218.258
KITCHENER	43.45	80.48	33.4802	2.9821	-214.958
LONDON	42.98	81.23	34.2436	2.9501	-214.631
MONCTON	46.1	64.78	23.1826	4.12755	-225.528
MONTREAL	45.52	73.57	28.3802	3.44968	-220.009
OSHAWA	43.9	78.85	32.325	3.10165	-216.177
OTTAWA	45.33	75.7	29.596	3.26801	-217.976
QUEBEC	46.82	71.33	26.22	3.51859	-220.844
REGINA	50.42	104.65	32.2083	.384794	-203.344
ST JOHN	45.27	66.05	24.4746	4.10966	-225.501
SASKATOON	52.12	106.63	30.3889	.373677	-203.38
THUNDER BAY	48.38	89	31.9358	1.72106	-205.225
TORONTO	43.65	79.38	32.7928	3.06877	-215.834
TROIS RIVIERE	46.35	72.55	27.2056	3.457	-220.116
VANCOUVER	49.27	123.12	31.2779	2.1169	-207.739
VICTORIA	48.42	123.37	32.0695	2.19279	-208.262
WINDSOR	42.3	83.02	35.6648	2.83129	-213.473
WINNIPEG	49.88	97.15	32.128	.834528	-203.345
ST JOHN'S	47.34	52.43	15.0379	4.80828	-219.752

TOTAL INTERFERING POWER DENSITY AT SATELLITE LNA=-194.97 dBW/Hz
CARRIER-TO-(INTERFERENCE+NOISE) DENSITY= 50.2706 dB-Hz
DECREASE IN C/Nt= 2.82944 dB

PROGRAM NAME GRSTPWR5.BAS

THIS PROGRAM CALCULATES THE INTERFERING POWER DENSITY FROM A NUMBER OF EARTH STATIONS OPERATING MCS IN THE 2290-2450 MHz BAND WITH BORESIGHT AZIMUTH POINTING TO THE SUBSATELLITE LONGITUDE OF THE SATELLITE GIVEN THE SUBSATELLITE LONGITUDE AND LOCATION OF THE GROUND STATIONS **ANNEX B.5**

INPUT DATA
SUBSATELLITE LONGITUDE= 106.5 DEGREES
SATELLITE ANTENNA BORESIGHT LATITUDE= 52.5 DEGREES
SATELLITE ANTENNA BORESIGHT LONGITUDE= 87.8 DEGREES
SATELLITE ANTENNA BORESIGHT GAIN= 34 dBic
SATELLITE ANTENNA 3 dB BEAMWIDTH= 2.7 DEGREES
REQUIRED NEAR IN SIDELOBE LEVEL (LS) IN dB RELATIVE TO PEAK GAIN
ONLY ALLOWED VALUES ARE -20,-25 OR -30 dB. LS=-25 dB
REVERSE LINK CARRIER POWER AT LNA=-141.5 dBW
MSAT REVERSE LINK C/(No+Io)t= 53.1 dB-Hz
OPERATING FREQUENCY= 2.35 GHz
TERRESTRIAL RADIO RELAY TERMINAL BORESIGHT EIRP= 45 dBW
TERRESTRIAL RADIO RELAY CHANNEL BANDWIDTH= 6 MHz
POLARIZATION ISOLATION= 3 dB

METROPOLITAN AREA	LATITUDE DEGREES	LONGITUDE DEGREES	ELEVATION DEGREES	OFF AXIS ANGLE DEGREES	INTERFERING POWER DENSITY IN dBW/Hz
CALGARY	51.05	114.08	31.1117	2.61996	-211.664
EDMONTON	53.55	113.47	28.5057	2.51743	-210.85
HALIFAX	44.65	63.6	23.4382	2.82565	-213.666
HAMILTON	43.25	79.85	33.3648	1.58285	-204.446
KINGSTON	44.23	76.5	30.9052	1.77603	-205.562
KITCHENER	43.45	80.48	33.4802	1.50405	-204.043
LONDON	42.98	81.23	34.2436	1.49055	-203.962
MONCTON	46.1	64.78	23.1826	2.57017	-211.402
MONTREAL	45.52	73.57	28.3802	1.90269	-206.379
OSHAWA	43.9	78.85	32.325	1.60008	-204.556
OTTAWA	45.33	75.7	29.596	1.73184	-205.333
QUEBEC	46.82	71.33	26.22	1.96096	-206.794
REGINA	50.42	104.65	32.2083	1.64573	-204.802
ST JOHN	45.27	66.05	24.4746	2.56256	-211.311
SASKATOON	52.12	106.63	30.3889	1.84916	-206.008
THUNDER BAY	48.38	89	31.9358	.366355	-203.349
TORONTO	43.65	79.38	32.7928	1.57894	-204.436
TROIS RIVIERE	46.35	72.55	27.2056	1.90447	-206.415
VANCOUVER	49.27	123.12	31.2779	3.61038	-221.819
VICTORIA	48.42	123.37	32.0695	3.68187	-222.661
WINDSOR	42.3	83.02	35.6648	1.41966	-203.595
WINNIPEG	49.88	97.15	32.128	.863204	-203.345
ST JOHN'S	47.34	52.43	15.0379	3.25226	-212.163

TOTAL INTERFERING POWER DENSITY AT SATELLITE LNA=-192.628 dBW/Hz
CARRIER-TO-(INTERFERENCE+NOISE) DENSITY= 48.9926 dB-Hz
DECREASE IN C/Nt= 4.10743 dB

PROGRAM NAME GRSTPWR5.BAS

THIS PROGRAM CALCULATES THE INTERFERING POWER DENSITY FROM A NUMBER OF EARTH STATIONS OPERATING MCS IN THE 2290-2450 MHz BAND WITH BORESIGHT AZIMUTH POINTING TO THE SUBSATELLITE LONGITUDE OF THE SATELLITE GIVEN THE SUBSATELLITE LONGITUDE AND LOCATION OF THE GROUND STATIONS **ANNEX B.5**

INPUT DATA
SUBSATELLITE LONGITUDE= 106.5 DEGREES
SATELLITE ANTENNA BORESIGHT LATITUDE= 50 DEGREES
SATELLITE ANTENNA BORESIGHT LONGITUDE= 65.6 DEGREES
SATELLITE ANTENNA BORESIGHT GAIN= 34 dBic
SATELLITE ANTENNA 3 dB BEAMWIDTH= 2.7 DEGREES
REQUIRED NEAR IN SIDELOBE LEVEL (LS) IN dB RELATIVE TO PEAK GAIN
ONLY ALLOWED VALUES ARE -20,-25 OR -30 dB. LS=-25 dB
REVERSE LINK CARRIER POWER AT LNA=-141.5 dBW
MSAT REVERSE LINK C/(No+Io)t= 53.1 dB-Hz
OPERATING FREQUENCY= 2.35 GHz
TERRESTRIAL RADIO RELAY TERMINAL BORESIGHT EIRP= 45 dBW
TERRESTRIAL RADIO RELAY CHANNEL BANDWIDTH= 6 MHz
POLARIZATION ISOLATION= 3 dB

METROPOLITAN AREA	LATITUDE DEGREES	LONGITUDE DEGREES	ELEVATION DEGREES	OFF AXIS ANGLE DEGREES	INTERFERING POWER DENSITY IN dBW/Hz
CALGARY	51.05	114.08	31.1117	4.67511	-225.365
EDMONTON	53.55	113.47	28.5057	4.60171	-225.418
HALIFAX	44.65	63.6	23.4382	.824281	-203.523
HAMILTON	43.25	79.85	33.3648	.967671	-203.321
KINGSTON	44.23	76.5	30.9052	.697293	-203.37
KITCHENER	43.45	80.48	33.4802	1.01765	-203.319
LONDON	42.98	81.23	34.2436	1.08819	-203.305
MONCTON	46.1	64.78	23.1826	.554314	-203.528
MONTREAL	45.52	73.57	28.3802	.481859	-203.42
OSHAWA	43.9	78.85	32.325	.876905	-203.342
OTTAWA	45.33	75.7	29.596	.621154	-203.396
QUEBEC	46.82	71.33	26.22	.325962	-203.465
REGINA	50.42	104.65	32.2083	3.70033	-222.883
ST JOHN	45.27	66.05	24.4746	.58857	-203.501
SASKATOON	52.12	106.63	30.3889	3.91835	-225.38
THUNDER BAY	48.38	89	31.9358	2.00314	-206.954
TORONTO	43.65	79.38	32.7928	.923604	-203.332
TROIS RIVIERE	46.35	72.55	27.2056	.402073	-203.444
VANCOUVER	49.27	123.12	31.2779	5.64017	-225.362
VICTORIA	48.42	123.37	32.0695	5.72595	-225.347
WINDSOR	42.3	83.02	35.6648	1.26386	-203.278
WINNIPEG	49.88	97.15	32.128	2.90368	-214.224
ST JOHN'S	47.34	52.43	15.0379	1.17432	-197.752

TOTAL INTERFERING POWER DENSITY AT SATELLITE LNA=-190.787 dBW/Hz
CARRIER-TO-(INTERFERENCE+NOISE) DENSITY= 47.7772 dB-Hz
DECREASE IN C/Nt= 5.3228 dB

PROGRAM NAME GRSTPWR6.BAS

THIS PROGRAM CALCULATES THE INTERFERING POWER DENSITY FROM A NUMBER OF EARTH STATIONS OPERATING POINT-TO-POINT IN THE 2290-2450 MHz BAND WITH BORESIGHT AZIMUTH POINTING TO THE SUBSATELLITE LONGITUDE OF THE SATELLITE GIVEN THE SUBSATELLITE LONGITUDE AND LOCATION OF THE GROUND STATIONS **ANNEX B.6**

INPUT DATA
SUBSATELLITE LONGITUDE= 106.5 DEGREES
SATELLITE ANTENNA BORESIGHT LATITUDE= 54.4 DEGREES
SATELLITE ANTENNA BORESIGHT LONGITUDE= 122.5 DEGREES
SATELLITE ANTENNA BORESIGHT GAIN= 34 dBic
SATELLITE ANTENNA 3 dB BEAMWIDTH= 2.7 DEGREES
REQUIRED NEAR IN SIDELOBE LEVEL (LS) IN dB RELATIVE TO PEAK GAIN
ONLY ALLOWED VALUES ARE -20,-25 OR -30 dB. LS=-25 dB
REVERSE LINK CARRIER POWER AT LNA=-141.5 dBW
MSAT REVERSE LINK C/(No+Io)t= 53.1 dB-Hz
OPERATING FREQUENCY= 2.35 GHz
TERRESTRIAL RADIO RELAY TERMINAL BORESIGHT EIRP= 45 dBW
TERRESTRIAL RADIO RELAY CHANNEL BANDWIDTH= 6 MHz
POLARIZATION ISOLATION= 3 dB

METROPOLITAN AREA	LATITUDE DEGREES	LONGITUDE DEGREES	ELEVATION DEGREES	OFF AXIS ANGLE DEGREES	INTERFERING POWER DENSITY IN dBW/Hz
CALGARY	51.05	114.08	31.1117	.760892	-213.521
EDMONTON	53.55	113.47	28.5057	.825763	-212.74
HALIFAX	44.65	63.6	23.4382	6.07692	-233.223
HAMILTON	43.25	79.85	33.3648	4.75623	-236.198
KINGSTON	44.23	76.5	30.9052	5.00166	-235.459
KITCHENER	43.45	80.48	33.4802	4.6666	-236.233
LONDON	42.98	81.23	34.2436	4.62321	-236.463
MONCTON	46.1	64.78	23.1826	5.85981	-233.147
MONTREAL	45.52	73.57	28.3802	5.17827	-234.702
OSHAWA	43.9	78.85	32.325	4.79863	-235.886
OTTAWA	45.33	75.7	29.596	4.98691	-235.066
QUEBEC	46.82	71.33	26.22	5.2565	-234.055
REGINA	50.42	104.65	32.2083	1.73244	-215.791
ST JOHN	45.27	66.05	24.4746	5.82429	-233.533
SASKATOON	52.12	106.63	30.3889	1.50604	-214.038
THUNDER BAY	48.38	89	31.9358	3.4362	-230.205
TORONTO	43.65	79.38	32.7928	4.75413	-236.026
TROIS RIVIERE-	46.35	72.55	27.2056	5.189	-234.35
VANCOUVER	49.27	123.12	31.2779	.513736	-213.571
VICTORIA	48.42	123.37	32.0695	.611409	-213.809
WINDSOR	42.3	83.02	35.6648	4.47136	-236.89
WINNIPEG	49.88	97.15	32.128	2.52967	-221.36
ST JOHN'S	47.34	52.43	15.0379	6.53705	-230.719

TOTAL INTERFERING POWER DENSITY AT SATELLITE LNA=-205.806 dBW/Hz
CARRIER-TO-(INTERFERENCE+NOISE) DENSITY= 52.7829 dB-Hz
DECREASE IN C/Nt= .317126 dB

PROGRAM NAME GRSTPWR6.BAS

THIS PROGRAM CALCULATES THE INTERFERING POWER DENSITY FROM A NUMBER OF EARTH STATIONS OPERATING POINT-TO-POINT IN THE 2290-2450 MHz BAND WITH BORESIGHT AZIMUTH POINTING TO THE SUBSATELLITE LONGITUDE OF THE SATELLITE GIVEN THE SUBSATELLITE LONGITUDE AND LOCATION OF THE GROUND STATIONS

ANNEX B.6

INPUT DATA
SUBSATELLITE LONGITUDE= 106.5 DEGREES
SATELLITE ANTENNA BORESIGHT LATITUDE= 55 DEGREES
SATELLITE ANTENNA BORESIGHT LONGITUDE= 103.5 DEGREES
SATELLITE ANTENNA BORESIGHT GAIN= 34 dBic
SATELLITE ANTENNA 3 dB BEAMWIDTH= 2.7 DEGREES
REQUIRED NEAR IN SIDELOBE LEVEL (LS) IN dB RELATIVE TO PEAK GAIN
ONLY ALLOWED VALUES ARE -20,-25 OR -30 dB. LS=-25 dB
REVERSE LINK CARRIER POWER AT LNA=-141.5 dBW
MSAT REVERSE LINK C/(No+Io)t= 53.1 dB-Hz
OPERATING FREQUENCY= 2.35 GHz
TERRESTRIAL RADIO RELAY TERMINAL BORESIGHT EIRP= 45 dBW
TERRESTRIAL RADIO RELAY CHANNEL BANDWIDTH= 6 MHz
POLARIZATION ISOLATION= 3 dB

METROPOLITAN AREA	LATITUDE DEGREES	LONGITUDE DEGREES	ELEVATION DEGREES	OFF AXIS ANGLE DEGREES	INTERFERING POWER DENSITY IN dBW/Hz
CALGARY	51.05	114.08	31.1117	1.11633	-213.521
EDMONTON	53.55	113.47	28.5057	.968426	-212.74
HALIFAX	44.65	63.6	23.4382	4.36963	-233.223
HAMILTON	43.25	79.85	33.3648	3.06734	-226.686
KINGSTON	44.23	76.5	30.9052	3.29655	-228.348
KITCHENER	43.45	80.48	33.4802	2.9821	-225.871
LONDON	42.98	81.23	34.2436	2.9501	-225.789
MONCTON	46.1	64.78	23.1826	4.12755	-233.147
MONTREAL	45.52	73.57	28.3802	3.44968	-229.291
OSHAWA	43.9	78.85	32.325	3.10165	-226.721
OTTAWA	45.33	75.7	29.596	3.26801	-227.646
QUEBEC	46.82	71.33	26.22	3.51859	-229.434
REGINA	50.42	104.65	32.2083	.384794	-213.851
ST JOHN	45.27	66.05	24.4746	4.10966	-233.533
SASKATOON	52.12	106.63	30.3889	.373677	-213.304
THUNDER BAY	48.38	89	31.9358	1.72106	-215.644
TORONTO	43.65	79.38	32.7928	3.06877	-226.528
TROIS RIVIERE	46.35	72.55	27.2056	3.457	-229.022
VANCOUVER	49.27	123.12	31.2779	2.1169	-217.948
VICTORIA	48.42	123.37	32.0695	2.19279	-218.724
WINDSOR	42.3	83.02	35.6648	2.83129	-225.086
WINNIPEG	49.88	97.15	32.128	.834528	-213.826
ST JOHN'S	47.34	52.43	15.0379	4.80828	-230.719

TOTAL INTERFERING POWER DENSITY AT SATELLITE LNA=-205.12 dBW/Hz
CARRIER-TO-(INTERFERENCE+NOISE) DENSITY= 52.7309 dB-Hz
DECREASE IN C/Nt= .369109 dB

PROGRAM NAME GRSTPWR6.BAS

THIS PROGRAM CALCULATES THE INTERFERING POWER DENSITY FROM A NUMBER OF EARTH STATIONS OPERATING POINT-TO-POINT IN THE 2290-2450 MHz BAND WITH BORESIGHT AZIMUTH POINTING TO THE SUBSATELLITE LONGITUDE OF THE SATELLITE GIVEN THE SUBSATELLITE LONGITUDE AND LOCATION OF THE GROUND STATIONS **ANNEX B.6**

INPUT DATA
SUBSATELLITE LONGITUDE= 106.5 DEGREES
SATELLITE ANTENNA BORESIGHT LATITUDE= 52.5 DEGREES
SATELLITE ANTENNA BORESIGHT LONGITUDE= 87.8 DEGREES
SATELLITE ANTENNA BORESIGHT GAIN= 34 dBic
SATELLITE ANTENNA 3 dB BEAMWIDTH= 2.7 DEGREES
REQUIRED NEAR IN SIDELOBE LEVEL (LS) IN dB RELATIVE TO PEAK GAIN
ONLY ALLOWED VALUES ARE -20,-25 OR -30 dB. LS=-25 dB
REVERSE LINK CARRIER POWER AT LNA=-141.5 dBW
MSAT REVERSE LINK C/(No+Io)t= 53.1 dB-Hz
OPERATING FREQUENCY= 2.35 GHz
TERRESTRIAL RADIO RELAY TERMINAL BORESIGHT EIRP= 45 dBW
TERRESTRIAL RADIO RELAY CHANNEL BANDWIDTH= 6 MHz
POLARIZATION ISOLATION= 3 dB

METROPOLITAN AREA	LATITUDE DEGREES	LONGITUDE DEGREES	ELEVATION DEGREES	OFF AXIS ANGLE DEGREES	INTERFERING POWER DENSITY IN dBW/Hz
CALGARY	51.05	114.08	31.1117	2.61996	-221.82
EDMONTON	53.55	113.47	28.5057	2.51743	-220.172
HALIFAX	44.65	63.6	23.4382	2.82565	-221.366
HAMILTON	43.25	79.85	33.3648	1.58285	-215.322
KINGSTON	44.23	76.5	30.9052	1.77603	-215.651
KITCHENER	43.45	80.48	33.4802	1.50405	-214.957
LONDON	42.98	81.23	34.2436	1.49055	-215.12
MONCTON	46.1	64.78	23.1826	2.57017	-219.021
MONTREAL	45.52	73.57	28.3802	1.90269	-215.661
OSHAWA	43.9	78.85	32.325	1.60008	-215.1
OTTAWA	45.33	75.7	29.596	1.73184	-215.003
QUEBEC	46.82	71.33	26.22	1.96096	-215.385
REGINA	50.42	104.65	32.2083	1.64573	-215.309
ST JOHN	45.27	66.05	24.4746	2.56256	-219.342
SASKATOON	52.12	106.63	30.3889	1.84916	-215.933
THUNDER BAY	48.38	89	31.9358	.366355	-213.769
TORONTO	43.65	79.38	32.7928	1.57894	-215.13
TROIS RIVIERE	46.35	72.55	27.2056	1.90447	-215.32
VANCOUVER	49.27	123.12	31.2779	3.61038	-232.028
VICTORIA	48.42	123.37	32.0695	3.68187	-233.123
WINDSOR	42.3	83.02	35.6648	1.41966	-215.208
WINNIPEG	49.88	97.15	32.128	.863204	-213.826
ST JOHN'S	47.34	52.43	15.0379	3.25226	-223.13

TOTAL INTERFERING POWER DENSITY AT SATELLITE LNA=-202.839 dBW/Hz
CARRIER-TO-(INTERFERENCE+NOISE) DENSITY= 52.493 dB-Hz
DECREASE IN C/Nt= .606983 dB

PROGRAM NAME GRSTPWR6.BAS

THIS PROGRAM CALCULATES THE INTERFERING POWER DENSITY FROM A NUMBER OF EARTH STATIONS OPERATING POINT-TO-POINT IN THE 2290-2450 MHz BAND WITH BORESIGHT AZIMUTH POINTING TO THE SUBSATELLITE LONGITUDE OF THE SATELLITE GIVEN THE SUBSATELLITE LONGITUDE AND LOCATION OF THE GROUND STATIONS

ANNEX B.6

INPUT DATA
SUBSATELLITE LONGITUDE= 106.5 DEGREES
SATELLITE ANTENNA BORESIGHT LATITUDE= 50 DEGREES
SATELLITE ANTENNA BORESIGHT LONGITUDE= 65.6 DEGREES
SATELLITE ANTENNA BORESIGHT GAIN= 34 dBic
SATELLITE ANTENNA 3 dB BEAMWIDTH= 2.7 DEGREES
REQUIRED NEAR IN SIDELOBE LEVEL (LS) IN dB RELATIVE TO PEAK GAIN
ONLY ALLOWED VALUES ARE -20,-25 OR -30 dB. LS=-25 dB
REVERSE LINK CARRIER POWER AT LNA=-141.5 dBW
MSAT REVERSE LINK C/(No+Io)t= 53.1 dB-Hz
OPERATING FREQUENCY= 2.35 GHz
TERRESTRIAL RADIO RELAY TERMINAL BORESIGHT EIRP= 45 dBW
TERRESTRIAL RADIO RELAY CHANNEL BANDWIDTH= 6 MHz
POLARIZATION ISOLATION= 3 dB

METROPOLITAN AREA	LATITUDE DEGREES	LONGITUDE DEGREES	ELEVATION DEGREES	OFF AXIS ANGLE DEGREES	INTERFERING POWER DENSITY IN dBW/Hz
CALGARY	51.05	114.08	31.1117	4.67511	-235.521
EDMONTON	53.55	113.47	28.5057	4.60171	-234.74
HALIFAX	44.65	63.6	23.4382	.824281	-211.223
HAMILTON	43.25	79.85	33.3648	.967671	-214.198
KINGSTON	44.23	76.5	30.9052	.697293	-213.459
KITCHENER	43.45	80.48	33.4802	1.01765	-214.233
LONDON	42.98	81.23	34.2436	1.08819	-214.463
MONCTON	46.1	64.78	23.1826	.554314	-211.147
MONTREAL	45.52	73.57	28.3802	.481859	-212.702
OSHAWA	43.9	78.85	32.325	.876905	-213.886
OTTAWA	45.33	75.7	29.596	.621154	-213.066
QUEBEC	46.82	71.33	26.22	.325962	-212.055
REGINA	50.42	104.65	32.2083	3.70033	-233.39
ST JOHN	45.27	66.05	24.4746	.58857	-211.533
SASKATOON	52.12	106.63	30.3889	3.91835	-235.304
THUNDER BAY	48.38	89	31.9358	2.00314	-217.374
TORONTO	43.65	79.38	32.7928	.923604	-214.026
TROIS RIVIERE	46.35	72.55	27.2056	.402073	-212.35
VANCOUVER	49.27	123.12	31.2779	5.64017	-235.571
VICTORIA	48.42	123.37	32.0695	5.72595	-235.809
WINDSOR	42.3	83.02	35.6648	1.26386	-214.89
WINNIPEG	49.88	97.15	32.128	2.90368	-224.705
ST JOHN'S	47.34	52.43	15.0379	1.17432	-208.719

TOTAL INTERFERING POWER DENSITY AT SATELLITE LNA=-200.587 dBW/Hz
CARRIER-TO-(INTERFERENCE+NOISE) DENSITY= 52.1242 dB-Hz
DECREASE IN C/Nt= .975763 dB

ANNEX C.1

PROGRAM LANDPWR1.BAS

THIS PROGRAM CALCULATES THE INTERFERING POWER AT THE SATELLITE GIVEN THE SUBSATELLITE LONGITUDE, BEAM COORDINATES AND LOCATION OF THE GROUND TERMINALS OPERATING IN THE 1427-1525 MHZ BAND.

INPUT DATA
SUBSATELLITE LONGITUDE= 106.5 DEGREES WEST
SATELLITE ANTENNA BORESIGHT LATITUDE= 65 DEGREES NORTH
SATELLITE ANTENNA BORESIGHT LONGITUDE= 106.5 DEGREES WEST
SATELLITE ANTENNA BORESIGHT GAIN= 34 dBic
SATELLITE ANTENNA 3 dB BEAMWIDTH= 2.7 DEGREES
REQUIRED NEAR IN SIDELOBE LEVEL (LS) IN dB RELATIVE TO PEAK GAIN
ONLY ALLOWED VALUES ARE -20,-25 OR -30. LS=-25
INPUT OPERATING FREQUENCY= 1.475 GHz
INPUT TERRESTRIAL RADIO RELAY BORESIGHT POWER= 35 dBW
POLARIZATION ISOLATION= 3 dB
TERRESTRIAL RADIO RELAY CHANNEL BANDWIDTH= 3.5 MHz
L BAND UNFADED UPLINK CARRIER POWER AT SATELLITE LNA=-141.5 dBW
REVERSE LINK UNFADED C/(No+Io)= 53.1 dB-Hz

BORESIGHT DATA
AZIMUTH FROM BS TO SSPOINT= 0 DEGREEES
ELEVATION ANGLE BS TO SATELLITE= 16.6755 DEGREES
DISTANCE BS TO SATELLITE= 3.99269e+7 METRES
PATHLOSS IN dB= 187.843

TERRESTRIAL RADIO RELAY/SATELLITE DATA

TRR LOCATION LATITUDE DEGREES	LONGITUDE DEGREES	ELEVATION DEGREES	OFF AXIS ANGLE	INTERFERENCE dBW/Hz	CNT DELTA dB
81	106.5	.307415	.368088	-190.657	5.41441
80	106.5	1.30958	.365934	-190.634	5.43097
79	106.5	2.31444	.361076	-193.573	3.55436
78	106.5	3.32201	.353502	-197.213	1.89739
77	106.5	4.33232	.343193	-200.864	.921578
76	106.5	5.34538	.330129	-204.524	.420886
75	106.5	6.36122	.314292	-208.195	.185782
74	106.5	7.37985	.295665	-210.494	.110371
73	106.5	8.40128	.27423	-210.471	.110961
72	106.5	9.42554	.249974	-212.149	7.56952e-2
71	106.5	10.4526	.222879	-214.424	4.49953e-2
70	106.5	11.4826	.192933	-214.4	4.52374e-2

ANNEX C.1

LATITUDE DEGREES	LONGITUDE DEGREES	ELEVATION DEGREES	OFF AXIS ANGLE	INTERFERENCE dBW/Hz	CNT DELTA dB
69	106.5	12.5154	.160121	-214.377	4.54805e-2
68	106.5	13.5511	.124432	-214.353	4.57247e-2
67	106.5	14.5897	8.58545e-2	-214.33	4.59697e-2
66	106.5	15.6311	4.43761e-2	-214.307	4.62155e-2
64	106.5	17.7228	4.72922e-2	-214.26	4.67092e-2
63	106.5	18.773	.097516	-214.237	4.69569e-2
62	106.5	19.8262	.150666	-214.214	.047205
61	106.5	20.8823	.206747	-214.191	4.74534e-2
60	106.5	21.9413	.265764	-214.169	4.77019e-2
59	106.5	23.0032	.327718	-214.548	4.37267e-2
58	106.5	24.0681	.39261	-215.378	3.61571e-2
57	106.5	25.136	.460439	-216.21	2.98763e-2
56	106.5	26.2067	.531202	-217.044	2.46694e-2
55	106.5	27.2804	.604896	-217.881	2.03562e-2
54	106.5	28.357	.681515	-218.72	.016786
53	106.5	29.4366	.761053	-219.562	.013833
52	106.5	30.519	.843501	-219.991	1.25335e-2
51	106.5	31.6044	.928849	-219.969	1.25956e-2
50	106.5	32.6926	1.01709	-219.948	1.26574e-2
49	106.5	33.7837	1.1082	-219.927	1.27189e-2
48	106.5	34.8777	1.20217	-219.906	.01278
47	106.5	35.9745	1.29899	-219.885	1.28408e-2
46	106.5	37.0742	1.39863	-220.085	1.22648e-2
45	106.5	38.1767	1.50107	-220.554	1.10113e-2
44	106.5	39.2819	1.6063	-221.072	9.77386e-3
43	106.5	40.3899	1.71428	-221.643	8.57164e-3
42	106.5	41.5006	1.825	-222.269	7.42252e-3
41	106.5	42.6141	1.93843	-222.952	6.34229e-3
40	106.5	43.7302	2.05453	-223.697	5.34396e-3
39	106.5	44.849	2.17327	-224.504	4.43728e-3
38	106.5	45.9703	2.29462	-225.379	3.62845e-3
37	106.5	47.0943	2.41855	-226.322	2.92005e-3
36	106.5	48.2208	2.54502	-227.338	2.31121e-3
35	106.5	49.3498	2.67398	-228.429	1.79798e-3

ANNEX C.1

LATITUDE DEGREES	LONGITUDE DEGREES	ELEVATION DEGREES	OFF AXIS ANGLE	INTERFERENCE dBW/Hz	CNT DELTA dB
34	106.5	50.4812	2.8054	-229.598	1.37387e-3
33	106.5	51.6151	2.93924	-230.847	1.0305e-3
32	106.5	52.7513	3.07544	-232.179	7.5825e-4
31	106.5	53.8899	3.21397	-233.598	5.46982e-4
30	106.5	55.0308	3.35477	-235.105	3.86603e-4
29	106.5	56.1738	3.49778	-236.703	2.67567e-4
28	106.5	57.3191	3.64297	-238.396	1.81226e-4
27	106.5	58.4664	3.79027	-240.184	1.20058e-4
26	106.5	59.6158	3.93963	-241.522	8.8217e-5
25	106.5	60.7673	4.09099	-241.509	8.84845e-5
24	106.5	61.9206	4.24428	-241.496	8.87437e-5
23	106.5	63.0759	4.39945	-241.484	8.89945e-5
22	106.5	64.2329	4.55643	-241.472	8.92364e-5
21	106.5	65.3917	4.71516	-241.461	8.94694e-5
20	106.5	66.5522	4.87557	-241.45	8.96931e-5
19	106.5	67.7143	5.03759	-241.44	8.99074e-5
18	106.5	68.878	5.20115	-241.43	9.01121e-5
17	106.5	70.0431	5.36618	-241.421	9.03069e-5
16	106.5	71.2097	5.5326	-241.412	9.04917e-5
15	106.5	72.3775	5.70034	-241.403	9.06662e-5
14	106.5	73.5466	5.86933	-241.395	9.08304e-5
13	106.5	74.7169	6.03948	-241.388	9.0984e-5
12	106.5	75.8882	6.21072	-241.381	9.11268e-5
11	106.5	77.0606	6.38298	-241.375	9.12588e-5
10	106.5	78.2339	6.55616	-241.369	9.13798e-5
9	106.5	79.4081	6.73018	-241.364	9.14897e-5
8	106.5	80.583	6.90497	-241.359	9.15883e-5
7	106.5	81.7586	7.08045	-241.355	9.16755e-5
6	106.5	82.9349	7.25652	-241.352	9.17513e-5
5	106.5	84.1116	7.4331	-241.349	9.18156e-5
4	106.5	85.2887	7.61011	-241.346	9.18683e-5
3	106.5	86.4663	7.78747	-241.344	9.19093e-5
2	106.5	87.644	7.96508	-241.343	9.19387e-5
1	106.5	88.822	8.14286	-241.342	9.19563e-5
0	106.5	90.	8.32072	-241.342	9.19622e-5

ANNEX C.2

PROGRAM LANDPWR2.BAS

THIS PROGRAM CALCULATES THE POWER AT THE SATELLITE GIVEN THE SUBSATELLITE LONGITUDE, BEAM COORDINATES AND LOCATION OF THE GROUND TERMINALS OPERATING IN THE BAND 1700-1710 MHZ BAND.

INPUT DATA
SUBSATELLITE LONGITUDE= 106.5 DEGREES WEST
SATELLITE ANTENNA BORESIGHT LATITUDE= 65 DEGREES NORTH
SATELLITE ANTENNA BORESIGHT LONGITUDE= 106.5 DEGREES WEST
SATELLITE ANTENNA BORESIGHT GAIN= 34 dBic
SATELLITE ANTENNA 3 dB BEAMWIDTH= 2.7 DEGREES
REQUIRED NEAR IN SIDELOBE LEVEL (LS) IN dB RELATIVE TO PEAK GAIN
ONLY ALLOWED VALUES ARE -20,-25 OR -30. LS=-25
OPERATING FREQUENCY= 1.705 GHz
TERRESTRIAL RADIO RELAY BORESIGHT POWER= 35 dBW
TERRESTRIAL RADIO RELAY CHANNEL BANDWIDTH= 3.5 MHz
L BAND UNFADED UPLINK CARRIER POWER AT SATELLITE LNA=-141.5 dBW
REVERSE LINK UNFADED C/(No+Io)= 53.1 dB-Hz
POLARIZATION ISOLATION= 3 dB

BORESIGHT DATA
AZIMUTH FROM BORESIGHT TO SSPOINT= 0 DEGREEES
ELEVATION ANGLE BORESIGHT TO SATELLITE= 16.6755 DEGREES
DISTANCE BORESIGHT TO SATELLITE= 3.99269e+7 METRES
PATHLOSS IN dB= 189.102

TERRESTRIAL RADIO RELAY/SATELLITE DATA

TRR LOCATION LATITUDE DEGREES	LONGITUDE DEGREES	ELEVATION DEGREES	OFF AXIS ANGLE	INTERFERENCE dBW/Hz	CNT DELTA dB
81	106.5	.307415	.368088	-192.055	4.4666
80	106.5	1.30958	.365934	-192.509	4.18047
79	106.5	2.31444	.361076	-193.152	3.79408
78	106.5	3.32201	.353502	-194.104	3.26533
77	106.5	4.33232	.343193	-195.527	2.57159
76	106.5	5.34538	.330129	-197.629	1.7546
75	106.5	6.36122	.314292	-200.667	.959797
74	106.5	7.37985	.295665	-204.945	.383678
73	106.5	8.40128	.27423	-205.729	.322579
72	106.5	9.42554	.249974	-205.706	.324262
71	106.5	10.4526	.222879	-207.493	.217559
70	106.5	11.4826	.192933	-209.659	.133416

ANNEX C.2

LATITUDE DEGREES	LONGITUDE DEGREES	ELEVATION DEGREES	OFF AXIS ANGLE	INTERFERENCE dBW/Hz	CNT DELTA dB
69	106.5	12.5154	.160121	-209.635	.134126
68	106.5	13.5511	.124432	-209.612	.134839
67	106.5	14.5897	8.58545e-2	-209.589	.135554
66	106.5	15.6311	4.43761e-2	-209.565	.136271
64	106.5	17.7228	4.72922e-2	-209.713	.131798
63	106.5	18.773	.097516	-209.971	.124298
62	106.5	19.8262	.150666	-210.23	.117196
61	106.5	20.8823	.206747	-210.49	.110472
60	106.5	21.9413	.265764	-210.751	.104109
59	106.5	23.0032	.327718	-211.013	9.80877e-2
58	106.5	24.0681	.39261	-211.275	9.23922e-2
57	106.5	25.136	.460439	-211.539	8.70059e-2
56	106.5	26.2067	.531202	-211.803	8.19134e-2
55	106.5	27.2804	.604896	-212.069	7.70999e-2
54	106.5	28.357	.681515	-212.335	7.25513e-2
53	106.5	29.4366	.761053	-212.602	6.82541e-2
52	106.5	30.519	.843501	-212.871	6.41955e-2
51	106.5	31.6044	.928849	-213.14	6.03633e-2
50	106.5	32.6926	1.01709	-213.41	5.67458e-2
49	106.5	33.7837	1.1082	-213.681	5.33318e-2
48	106.5	34.8777	1.20217	-213.953	5.01107e-2
47	106.5	35.9745	1.29899	-214.227	4.70725e-2
46	106.5	37.0742	1.39863	-214.721	4.20343e-2
45	106.5	38.1767	1.50107	-215.485	.03528
44	106.5	39.2819	1.6063	-216.299	2.92678e-2
43	106.5	40.3899	1.71428	-217.167	2.39835e-2
42	106.5	41.5006	1.825	-218.09	1.94008e-2
41	106.5	42.6141	1.93843	-219.072	1.54822e-2
40	106.5	43.7302	2.05453	-220.115	1.21806e-2
39	106.5	44.849	2.17327	-221.223	9.44164e-3
38	106.5	45.9703	2.29462	-222.137	7.64989e-3
37	106.5	47.0943	2.41855	-223.081	6.15692e-3
36	106.5	48.2208	2.54502	-224.097	4.87356e-3
35	106.5	49.3498	2.67398	-225.188	3.79158e-3

ANNEX C.2

LATITUDE DEGREES	LONGITUDE DEGREES	ELEVATION DEGREES	OFF AXIS ANGLE	INTERFERENCE dBW/Hz	CNT DELTA dB
34	106.5	50.4812	2.8054	-226.356	2.89738e-3
33	106.5	51.6151	2.93924	-227.606	2.17333e-3
32	106.5	52.7513	3.07544	-228.938	1.59921e-3
31	106.5	53.8899	3.21397	-230.356	1.15366e-3
30	106.5	55.0308	3.35477	-231.864	8.15417e-4
29	106.5	56.1738	3.49778	-233.462	5.64355e-4
28	106.5	57.3191	3.64297	-235.154	3.8225e-4
27	106.5	58.4664	3.79027	-236.942	2.53233e-4
26	106.5	59.6158	3.93963	-238.281	1.86073e-4
25	106.5	60.7673	4.09099	-238.268	1.86638e-4
24	106.5	61.9206	4.24428	-238.255	1.87184e-4
23	106.5	63.0759	4.39945	-238.243	1.87713e-4
22	106.5	64.2329	4.55643	-238.231	1.88224e-4
21	106.5	65.3917	4.71516	-238.22	1.88715e-4
20	106.5	66.5522	4.87557	-238.209	1.89187e-4
19	106.5	67.7143	5.03759	-238.198	1.89639e-4
18	106.5	68.878	5.20115	-238.189	1.9007e-4
17	106.5	70.0431	5.36618	-238.179	1.90481e-4
16	106.5	71.2097	5.5326	-238.17	1.90871e-4
15	106.5	72.3775	5.70034	-238.162	1.91239e-4
14	106.5	73.5466	5.86933	-238.154	1.91586e-4
13	106.5	74.7169	6.03948	-238.147	1.9191e-4
12	106.5	75.8882	6.21072	-238.14	1.92211e-4
11	106.5	77.0606	6.38298	-238.134	1.92489e-4
10	106.5	78.2339	6.55616	-238.128	1.92744e-4
9	106.5	79.4081	6.73018	-238.123	1.92976e-4
8	106.5	80.583	6.90497	-238.118	1.93184e-4
7	106.5	81.7586	7.08045	-238.114	1.93368e-4
6	106.5	82.9349	7.25652	-238.11	1.93528e-4
5	106.5	84.1116	7.4331	-238.107	1.93664e-4
4	106.5	85.2887	7.61011	-238.105	1.93775e-4
3	106.5	86.4663	7.78747	-238.103	1.93861e-4
2	106.5	87.644	7.96508	-238.101	1.93923e-4
1	106.5	88.822	8.14286	-238.101	1.9396e-4
0	106.5	90.	8.32072	-238.1	1.93973e-4

PROGRAM LANDPWR3.BAS

ANNEX C.3

THIS PROGRAM CALCULATES THE INTERFERRING POWER AT THE SATELLITE GIVEN THE SUBSATELLITE LONGITUDE, BEAM COORDINATES AND LOCATION OF THE TERRESTRIAL TERMINAL OPERATING IN THE BAND 1710-1900 MHz.

INPUT DATA

SUBSATELLITE LONGITUDE= 106.5 DEGREES WEST
SATELLITE ANTENNA BORESIGHT LATITUDE= 65 DEGREES NORTH
SATELLITE ANTENNA BORESIGHT LONGITUDE= 106.5 DEGREES WEST
SATELLITE ANTENNA BORESIGHT GAIN= 34 dBic
SATELLITE ANTENNA 3 dB BEAMWIDTH= 2.7 DEGREES
REQUIRED NEAR IN SIDELOBE LEVEL (LS) IN dB RELATIVE TO PEAK GAIN
ONLY ALLOWED VALUES ARE -20,-25 OR -30. LS=-25
OPERATING FREQUENCY= 1.8 GHz
REVERSE LINK CARRIER POWER AT LNA=-141.5 dBW
REVERSE LINK TOTAL UNFADED C/(No+Io)= 53.1 dB-Hz
GROUND STATION BORESIGHT POWER= 35 dBW
TERRESTRIAL RADIO RELAY CHANNEL BANDWIDTH= 3.5 MHz
POLARIZATION ISOLATIION= 3 dB

BORESIGHT DATA

AZIMUTH FROM BS TO SSPOINT= 0 DEGREES
ELEVATION ANGLE BS TO SATELLITE= 16.6755 DEGREES
DISTANCE BS TO SATELLITE= 3.99269e+7 METRES
PATHLOSS IN dB= 189.573

TERRESTRIAL RADIO RELAY/SATELLITE DATA

TRR LOCATION LATITUDE DEGREES	LONGITUDE DEGREES	ELEVATION DEGREES	OFF AXIS ANGLE	INTERFERENCE dBW/Hz	C/Nt DELTA dB
81	106.5	.307415	.368088	-192.387	4.25623
80	106.5	1.30958	.365934	-192.364	4.27076
79	106.5	2.31444	.361076	-192.341	4.28534
78	106.5	3.32201	.353502	-193.237	3.74491
77	106.5	4.33232	.343193	-196.1	2.32454
76	106.5	5.34538	.330129	-198.972	1.3528
75	106.5	6.36122	.314292	-201.851	.749415
74	106.5	7.37985	.295665	-204.737	.401609
73	106.5	8.40128	.27423	-207.632	.210844
72	106.5	9.42554	.249974	-210.535	.109337
71	106.5	10.4526	.222879	-212.153	.075626
70	106.5	11.4826	.192933	-212.13	7.60314e-2

ANNEX C.3

LATITUDE DEGREES	LONGITUDE DEGREES	ELEVATION DEGREES	OFF AXIS ANGLE	INTERFERENCE dBW/Hz	C/Nt DELTA dB
69	106.5	12.5154	.160121	-212.106	7.64387e-2
68	106.5	13.5511	.124432	-212.083	7.68475e-2
67	106.5	14.5897	8.58545e-2	-212.06	7.72578e-2
66	106.5	15.6311	4.43761e-2	-212.036	7.76695e-2
64	106.5	17.7228	4.72922e-2	-211.99	7.84962e-2
63	106.5	18.773	.097516	-212.053	7.73792e-2
62	106.5	19.8262	.150666	-212.147	7.57366e-2
61	106.5	20.8823	.206747	-212.241	7.41215e-2
60	106.5	21.9413	.265764	-212.336	7.25335e-2
59	106.5	23.0032	.327718	-212.431	7.09722e-2
58	106.5	24.0681	.39261	-212.527	6.94371e-2
57	106.5	25.136	.460439	-212.623	6.79279e-2
56	106.5	26.2067	.531202	-212.72	6.64442e-2
55	106.5	27.2804	.604896	-212.817	6.49856e-2
54	106.5	28.357	.681515	-212.915	6.35518e-2
53	106.5	29.4366	.761053	-213.013	6.21425e-2
52	106.5	30.519	.843501	-213.111	6.07572e-2
51	106.5	31.6044	.928849	-213.211	5.93956e-2
50	106.5	32.6926	1.01709	-213.31	5.80575e-2
49	106.5	33.7837	1.1082	-213.41	5.67425e-2
48	106.5	34.8777	1.20217	-213.511	5.54503e-2
47	106.5	35.9745	1.29899	-213.612	5.41807e-2
46	106.5	37.0742	1.39863	-213.934	5.03336e-2
45	106.5	38.1767	1.50107	-214.525	4.39586e-2
44	106.5	39.2819	1.6063	-215.167	3.79516e-2
43	106.5	40.3899	1.71428	-215.86	3.23695e-2
42	106.5	41.5006	1.825	-216.609	2.72571e-2
41	106.5	42.6141	1.93843	-217.417	2.26454e-2
40	106.5	43.7302	2.05453	-218.285	1.85503e-2
39	106.5	44.849	2.17327	-219.217	1.49729e-2
38	106.5	45.9703	2.29462	-220.216	1.19005e-2
37	106.5	47.0943	2.41855	-221.285	9.30764e-3
36	106.5	48.2208	2.54502	-222.426	7.15895e-3
35	106.5	49.3498	2.67398	-223.642	5.41143e-3

ANNEX C.3

LATITUDE DEGREES	LONGITUDE DEGREES	ELEVATION DEGREES	OFF AXIS ANGLE	INTERFERENCE dBW/Hz	C/Nt DELTA dB
34	106.5	50.4812	2.8054	-224.936	4.01746e-3
33	106.5	51.6151	2.93924	-226.311	2.92746e-3
32	106.5	52.7513	3.07544	-227.77	2.09247e-3
31	106.5	53.8899	3.21397	-229.315	1.46619e-3
30	106.5	55.0308	3.35477	-230.949	1.00652e-3
29	106.5	56.1738	3.49778	-232.675	6.76546e-4
28	106.5	57.3191	3.64297	-234.494	4.4501e-4
27	106.5	58.4664	3.79027	-236.41	2.86283e-4
26	106.5	59.6158	3.93963	-237.876	2.04263e-4
25	106.5	60.7673	4.09099	-237.991	1.98935e-4
24	106.5	61.9206	4.24428	-238.106	1.93716e-4
23	106.5	63.0759	4.39945	-238.222	1.88606e-4
22	106.5	64.2329	4.55643	-238.339	1.83603e-4
21	106.5	65.3917	4.71516	-238.456	1.78704e-4
20	106.5	66.5522	4.87557	-238.574	1.73911e-4
19	106.5	67.7143	5.03759	-238.693	1.69219e-4
18	106.5	68.878	5.20115	-238.813	1.6463e-4
17	106.5	70.0431	5.36618	-238.933	1.6014e-4
16	106.5	71.2097	5.5326	-239.053	1.5575e-4
15	106.5	72.3775	5.70034	-239.175	1.51457e-4
14	106.5	73.5466	5.86933	-239.297	1.4726e-4
13	106.5	74.7169	6.03948	-239.42	1.43158e-4
12	106.5	75.8882	6.21072	-239.543	1.39149e-4
11	106.5	77.0606	6.38298	-239.667	1.35233e-4
10	106.5	78.2339	6.55616	-239.792	1.31408e-4
9	106.5	79.4081	6.73018	-239.917	1.27673e-4
8	106.5	80.583	6.90497	-240.043	1.24026e-4
7	106.5	81.7586	7.08045	-240.169	1.20465e-4
6	106.5	82.9349	7.25652	-240.296	1.16991e-4
5	106.5	84.1116	7.4331	-240.424	1.13601e-4
4	106.5	85.2887	7.61011	-240.552	1.10294e-4
3	106.5	86.4663	7.78747	-240.681	1.07069e-4
2	106.5	87.644	7.96508	-240.811	1.03924e-4
1	106.5	88.822	8.14286	-240.941	1.00858e-4
0	106.5	90.	8.32072	-241.071	9.78697e-5

ANNEX C.4

PROGRAM LANDPWR4.BAS

THIS PROGRAM CALCULATES THE INTERFERRING POWER AT THE SATELLITE GIVEN THE SUBSATELLITE LONGITUDE, BEAM COORDINATES AND LOCATION OF THE TERRESTRIALTERMINALS OPERATING IN THE BAND 1900-2290 MHZ.

INPUT DATA
SUBSATELLITE LONGITUDE= 106.5 DEGREES WEST
SATELLITE ANTENNA BORESIGHT LATITUDE= 65 DEGREES NORTH
SATELLITE ANTENNA BORESIGHT LONGITUDE= 106.5 DEGREES WEST
SATELLITE ANTENNA BORESIGHT GAIN= 34 dBic
SATELLITE ANTENNA 3 dB BEAMWIDTH= 2.7 DEGREES
REQUIRED NEAR IN SIDELOBE LEVEL (LS) IN dB RELATIVE TO PEAK GAIN
ONLY ALLOWED VALUES ARE -20,-25 OR -30. LS=-25
INPUT OPERATING FREQUENCY IN GHZ= 2.1
INPUT TERRESTRIAL RADIO RELAY BORESIGHT POWER IN dBW= 45
TERRESTRIAL RADIO RELAY CHANNEL BANDWIDTH= 29 MHz
L BAND UNFADED UPLINK CARRIER POWER AT SATELLITE LNA =-141.5 dBW
REVERSE LINK UNFADED C/(No+Io)= 53.1 dB-Hz
POLARIZATION ISOLATION= 3 dB

BORESIGHT DATA
AZIMUTH FROM BORESIGHT TO SSPOINT= 0 DEGREEES
ELEVATION ANGLE BORESIGHT TO SATELLITE= 16.6755 DEGREES
DISTANCE BORESIGHT TO SATELLITE= 3.99269e+7 METRES
PATHLOSS IN dB= 190.911

TERRESTRIAL RADIO RELAY/SATELLITE DATA

TRR LOCATION LATITUDE DEGREES	LONGITUDE DEGREES	ELEVATION DEGREES	OFF AXIS ANGLE	INTERFERENCE dBW/Hz	CNT DELTA dB
81	106.5	.307415	.368088	-192.909	3.93742
80	106.5	1.30958	.365934	-192.886	3.95128
79	106.5	2.31444	.361076	-193.806	3.42538
78	106.5	3.32201	.353502	-196.805	2.04608
77	106.5	4.33232	.343193	-199.813	1.14307
76	106.5	5.34538	.330129	-202.829	.608316
75	106.5	6.36122	.314292	-205.853	.313837
74	106.5	7.37985	.295665	-208.885	.158955
73	106.5	8.40128	.27423	-210.722	.104784
72	106.5	9.42554	.249974	-210.699	.105345
71	106.5	10.4526	.222879	-210.676	.105908
70	106.5	11.4826	.192933	-210.652	.106474

ANNEX C.4

LATITUDE DEGREES	LONGITUDE DEGREES	ELEVATION DEGREES	OFF AXIS ANGLE	INTERFERENCE dBW/Hz	CNT DELTA dB
69	106.5	12.5154	.160121	-211.831	8.13923e-2
68	106.5	13.5511	.124432	-214.224	4.70954e-2
67	106.5	14.5897	8.58545e-2	-216.624	2.71629e-2
66	106.5	15.6311	4.43761e-2	-217.637	2.15302e-2
64	106.5	17.7228	4.72922e-2	-217.848	2.05076e-2
63	106.5	18.773	.097516	-217.955	2.00117e-2
62	106.5	19.8262	.150666	-218.062	1.95257e-2
61	106.5	20.8823	.206747	-218.169	1.90495e-2
60	106.5	21.9413	.265764	-218.277	1.85829e-2
59	106.5	23.0032	.327718	-218.386	1.81258e-2
58	106.5	24.0681	.39261	-218.495	1.76779e-2
57	106.5	25.136	.460439	-218.604	1.72392e-2
56	106.5	26.2067	.531202	-218.714	1.68093e-2
55	106.5	27.2804	.604896	-218.824	1.63883e-2
54	106.5	28.357	.681515	-218.935	1.59758e-2
53	106.5	29.4366	.761053	-219.047	1.55719e-2
52	106.5	30.519	.843501	-219.159	1.51762e-2
51	106.5	31.6044	.928849	-219.271	1.47888e-2
50	106.5	32.6926	1.01709	-219.384	1.44093e-2
49	106.5	33.7837	1.1082	-219.498	1.40378e-2
48	106.5	34.8777	1.20217	-219.612	1.36741e-2
47	106.5	35.9745	1.29899	-219.727	.013318
46	106.5	37.0742	1.39863	-220.062	1.23297e-2
45	106.5	38.1767	1.50107	-220.667	1.07285e-2
44	106.5	39.2819	1.6063	-221.322	9.22853e-3
43	106.5	40.3899	1.71428	-222.029	7.8426e-3
42	106.5	41.5006	1.825	-222.792	6.58023e-3
41	106.5	42.6141	1.93843	-223.613	5.44743e-3
40	106.5	43.7302	2.05453	-224.495	4.44662e-3
39	106.5	44.849	2.17327	-225.441	3.57659e-3
38	106.5	45.9703	2.29462	-226.454	2.83287e-3
37	106.5	47.0943	2.41855	-227.537	2.20808e-3
36	106.5	48.2208	2.54502	-228.691	1.69259e-3
35	106.5	49.3498	2.67398	-229.922	1.27513e-3

ANNEX C.4

LATITUDE DEGREES	LONGITUDE DEGREES	ELEVATION DEGREES	OFF AXIS ANGLE	INTERFERENCE dBW/Hz	CNT DELTA dB
34	106.5	50.4812	2.8054	-231.23	9.43504e-4
33	106.5	51.6151	2.93924	-232.619	6.85238e-4
32	106.5	52.7513	3.07544	-234.092	4.88175e-4
31	106.5	53.8899	3.21397	-235.651	3.40939e-4
30	106.5	55.0308	3.35477	-237.299	2.33282e-4
29	106.5	56.1738	3.49778	-239.038	1.56291e-4
28	106.5	57.3191	3.64297	-240.872	1.02467e-4
27	106.5	58.4664	3.79027	-242.802	6.5703e-5
26	106.5	59.6158	3.93963	-244.282	4.67255e-5
25	106.5	60.7673	4.09099	-244.411	4.5358e-5
24	106.5	61.9206	4.24428	-244.541	4.40236e-5
23	106.5	63.0759	4.39945	-244.671	4.27217e-5
22	106.5	64.2329	4.55643	-244.802	4.14517e-5
21	106.5	65.3917	4.71516	-244.934	4.02132e-5
20	106.5	66.5522	4.87557	-245.066	3.90055e-5
19	106.5	67.7143	5.03759	-245.2	3.78282e-5
18	106.5	68.878	5.20115	-245.333	3.66806e-5
17	106.5	70.0431	5.36618	-245.468	3.55623e-5
16	106.5	71.2097	5.5326	-245.603	3.44728e-5
15	106.5	72.3775	5.70034	-245.739	3.34114e-5
14	106.5	73.5466	5.86933	-245.875	3.23778e-5
13	106.5	74.7169	6.03948	-246.012	3.13713e-5
12	106.5	75.8882	6.21072	-246.15	3.03915e-5
11	106.5	77.0606	6.38298	-246.289	2.94379e-5
10	106.5	78.2339	6.55616	-246.428	2.851e-5
9	106.5	79.4081	6.73018	-246.568	2.76072e-5
8	106.5	80.583	6.90497	-246.708	2.67291e-5
7	106.5	81.7586	7.08045	-246.849	2.58752e-5
6	106.5	82.9349	7.25652	-246.991	2.5045e-5
5	106.5	84.1116	7.4331	-247.133	2.42381e-5
4	106.5	85.2887	7.61011	-247.276	2.34538e-5
3	106.5	86.4663	7.78747	-247.419	2.26919e-5
2	106.5	87.644	7.96508	-247.563	2.19517e-5
1	106.5	88.822	8.14286	-247.708	2.12329e-5
0	106.5	90.	8.32072	-247.853	2.05349e-5

ANNEX C.5

PROGRAM LANDPWR5.BAS

THIS PROGRAM CALCULATES THE INTERFERRING POWER AT THE SATELLITE GIVEN THE SUBSATELLITE LONGITUDE, BEAM COORDINATES AND LOCATION OF THE GROUND TERMINALS OPERATING MULTIPOINT COMMUNICATION SYSTEMS IN THE BAND 2290-2450 MHZ.

INPUT DATA
SUBSATELLITE LONGITUDE= 106.5 DEGREES WEST
SATELLITE ANTENNA BORESIGHT LATITUDE= 65 DEGREES NORTH
SATELLITE ANTENNA BORESIGHT LONGITUDE= 106.5 DEGREES WEST
SATELLITE ANTENNA BORESIGHT GAIN= 34 dBic
SATELLITE ANTENNA 3 dB BEAMWIDTH= 2.7 DEGREES
REQUIRED NEAR IN SIDELOBE LEVEL (LS) IN dB RELATIVE TO PEAK GAIN
ONLY ALLOWED VALUES ARE -20,-25 OR -30. LS=-25
OPERATING FREQUENCY= 2.35 GHz
CARRIER POWER AT SATELLITE LNA INPUT=-141.5 dBW
REVERSE LINK TOTAL UNFADED C/(No+Io)= 53.1 dB-Hz
GROUND STATION BORESIGHT POWER= 45 dBW
TERRESTRIAL RADIO RELAY CHANNEL BANDWIDTH= 6 MHz
POLARIZATION ISOLATION= 3 dB

BORESIGHT DATA
TILT ANGLE FROM SSLONG TO BORESIGHT= 8.32449 DEGREES
AZIMUTH FROM SSPOINT TO EARTH STATION= 0 DEGREEES
ELEVATION ANGLE BS TO SATELLITE= 16.6755 DEGREES
DISTANCE BS TO SATELLITE= 3.99269e+7 METRES
PATHLOSS IN dB= 191.888

TRR LOCATION LATITUDE DEGREES	LONGITUDE DEGREES	ELEVATION DEGREES	OFF AXIS ANGLE	INTERFERENCE dBW/Hz	CNT DELTA dB
81	106.5	.307415	.368088	-187.112	8.20055
80	106.5	1.30958	.365934	-187.312	8.03186
79	106.5	2.31444	.361076	-187.512	7.86392
78	106.5	3.32201	.353502	-187.712	7.69678
77	106.5	4.33232	.343193	-187.913	7.53048
76	106.5	5.34538	.330129	-188.41	7.12553
75	106.5	6.36122	.314292	-188.967	6.68218
74	106.5	7.37985	.295665	-189.526	6.24967
73	106.5	8.40128	.27423	-190.316	5.66077
72	106.5	9.42554	.249974	-191.463	4.85634
71	106.5	10.4526	.222879	-192.613	4.11645
70	106.5	11.4826	.192933	-193.767	3.44692

ANNEX C.5

LATITUDE DEGREES	LONGITUDE DEGREES	ELEVATION DEGREES	OFF AXIS ANGLE	INTERFERENCE dBW/Hz	CNT DELTA dB
69	106.5	12.5154	.160121	-194.924	2.8515
68	106.5	13.5511	.124432	-196.084	2.33142
67	106.5	14.5897	8.58545e-2	-197.248	1.88524
66	106.5	15.6311	4.43761e-2	-198.451	1.49849
64	106.5	17.7228	4.72922e-2	-200.914	.911953
63	106.5	18.773	.097516	-202.151	.703106
62	106.5	19.8262	.150666	-203.392	.538715
61	106.5	20.8823	.206747	-203.578	.51746
60	106.5	21.9413	.265764	-203.555	.520029
59	106.5	23.0032	.327718	-203.532	.522597
58	106.5	24.0681	.39261	-203.51	.525164
57	106.5	25.136	.460439	-203.487	.527728
56	106.5	26.2067	.531202	-203.465	.530287
55	106.5	27.2804	.604896	-203.443	.532841
54	106.5	28.357	.681515	-203.421	.535389
53	106.5	29.4366	.761053	-203.399	.537928
52	106.5	30.519	.843501	-203.377	.540458
51	106.5	31.6044	.928849	-203.356	.542978
50	106.5	32.6926	1.01709	-203.334	.545484
49	106.5	33.7837	1.1082	-203.313	.547978
48	106.5	34.8777	1.20217	-203.292	.550456
47	106.5	35.9745	1.29899	-203.272	.552917
46	106.5	37.0742	1.39863	-203.471	.529533
45	106.5	38.1767	1.50107	-203.94	.478217
44	106.5	39.2819	1.6063	-204.459	.426969
43	106.5	40.3899	1.71428	-205.029	.376609
42	106.5	41.5006	1.825	-205.655	.327935
41	106.5	42.6141	1.93843	-206.339	.281688
40	106.5	43.7302	2.05453	-207.083	.238515
39	106.5	44.849	2.17327	-207.891	.198938
38	106.5	45.9703	2.29462	-208.765	.163333
37	106.5	47.0943	2.41855	-209.709	.131913
36	106.5	48.2208	2.54502	-210.725	.10473
35	106.5	49.3498	2.67398	-211.815	8.16863e-2

ANNEX C.5

LATITUDE DEGREES	LONGITUDE DEGREES	ELEVATION DEGREES	OFF AXIS ANGLE	INTERFERENCE dBW/Hz	CNT DELTA dB
34	106.5	50.4812	2.8054	-212.984	6.25531e-2
33	106.5	51.6151	2.93924	-214.233	4.70015e-2
32	106.5	52.7513	3.07544	-215.566	3.46324e-2
31	106.5	53.8899	3.21397	-216.984	2.50101e-2
30	106.5	55.0308	3.35477	-218.491	1.76915e-2
29	106.5	56.1738	3.49778	-220.09	1.22518e-2
28	106.5	57.3191	3.64297	-221.782	8.30198e-3
27	106.5	58.4664	3.79027	-223.57	5.5016e-3
26	106.5	59.6158	3.93963	-224.909	4.04317e-3
25	106.5	60.7673	4.09099	-224.895	4.05543e-3
24	106.5	61.9206	4.24428	-224.883	4.0673e-3
23	106.5	63.0759	4.39945	-224.87	4.07879e-3
22	106.5	64.2329	4.55643	-224.859	4.08987e-3
21	106.5	65.3917	4.71516	-224.965	3.99112e-3
20	106.5	66.5522	4.87557	-225.302	.003693
19	106.5	67.7143	5.03759	-225.64	3.41638e-3
18	106.5	68.878	5.20115	-225.98	3.15978e-3
17	106.5	70.0431	5.36618	-226.32	2.92182e-3
16	106.5	71.2097	5.5326	-226.661	2.7012e-3
15	106.5	72.3775	5.70034	-227.003	2.49671e-3
14	106.5	73.5466	5.86933	-227.346	2.30723e-3
13	106.5	74.7169	6.03948	-227.69	2.13169e-3
12	106.5	75.8882	6.21072	-227.768	2.0937e-3
11	106.5	77.0606	6.38298	-227.761	2.09673e-3
10	106.5	78.2339	6.55616	-227.756	2.09951e-3
9	106.5	79.4081	6.73018	-227.75	2.10203e-3
8	106.5	80.583	6.90497	-227.746	2.1043e-3
7	106.5	81.7586	7.08045	-227.742	2.1063e-3
6	106.5	82.9349	7.25652	-227.738	2.10804e-3
5	106.5	84.1116	7.4331	-227.735	2.10952e-3
4	106.5	85.2887	7.61011	-227.732	2.11073e-3
3	106.5	86.4663	7.78747	-227.731	2.11167e-3
2	106.5	87.644	7.96508	-227.729	2.11235e-3
1	106.5	88.822	8.14286	-227.728	2.11275e-3
0	106.5	90.	8.32072	-227.728	2.11288e-3

ANNEX C.6

PROGRAM LANDPWR6.BAS

THIS PROGRAM CALCULATES THE INTERFERRING POWER AT THE SATELLITE GIVEN THE SUBSATELLITE LONGITUDE, BEAM COORDINATES AND LOCATION OF THE GROUND TERMINALS OPERATING POINT-TO-POINT SYSTEMS IN THE BAND 2290-2450 MHZ.

INPUT DATA
SUBSATELLITE LONGITUDE= 106.5 DEGREES WEST
SATELLITE ANTENNA BORESIGHT LATITUDE= 65 DEGREES NORTH
SATELLITE ANTENNA BORESIGHT LONGITUDE= 106.5 DEGREES WEST
SATELLITE ANTENNA BORESIGHT GAIN= 34 dBic
SATELLITE ANTENNA 3 dB BEAMWIDTH= 2.7 DEGREES
NEAR IN SIDELOBE LEVEL (LS) IN dB RELATIVE TO PEAK GAIN
ONLY ALLOWED VALUES ARE -20,-25 OR -30. LS=-25
OPERATING FREQUENCY= 2.35 GHz
CARRIER POWER AT SATELLITE LNA INPUT=-141.5 dBW
REVERSE LINK TOTAL UNFADED C/(No+Io)= 53.1 dB-Hz
GROUND STATION BORESIGHT POWER= 45 dB
TERRESTRIAL RADIO RELAY CHANNEL BANDWIDTH= 6 MHz
POLARIZATION ISOLATION= 3 dB

BORESIGHT DATA
TILT ANGLE FROM SSLONG TO BORESIGHT= 8.32449 DEGREES
AZIMUTH FROM SSPOINT TO EARTH STATION= 0 DEGREEES
ELEVATION ANGLE BS TO SATELLITE= 16.6755 DEGREES
DISTANCE BS TO SATELLITE= 3.99269e+7 METRES
PATHLOSS IN dB= 191.888

TRR LOCATION

LATITUDE DEGREES	LONGITUDE DEGREES	ELEVATION DEGREES	OFF AXIS ANGLE	INTERFERENCE dBW/Hz	CNT DELTA dB
81	106.5	.307415	.368088	-187.044	8.2586
80	106.5	1.30958	.365934	-187.021	8.27836
79	106.5	2.31444	.361076	-186.997	8.29819
78	106.5	3.32201	.353502	-190.194	5.74957
77	106.5	4.33232	.343193	-200.274	1.04071
76	106.5	5.34538	.330129	-202.491	.654025
75	106.5	6.36122	.314292	-203.145	.568328
74	106.5	7.37985	.295665	-203.8	.493033
73	106.5	8.40128	.27423	-204.458	.427053
72	106.5	9.42554	.249974	-205.117	.369378
71	106.5	10.4526	.222879	-205.778	.319073
70	106.5	11.4826	.192933	-206.442	.275286

ANNEX C.6

LATITUDE DEGREES	LONGITUDE DEGREES	ELEVATION DEGREES	OFF AXIS ANGLE	INTERFERENCE dBW/Hz	CNT DELTA dB
69	106.5	12.5154	.160121	-207.107	.237242
68	106.5	13.5511	.124432	-207.774	.204243
67	106.5	14.5897	8.58545e-2	-208.443	.175663
66	106.5	15.6311	4.43761e-2	-208.895	.158604
64	106.5	17.7228	4.72922e-2	-209.518	.137743
63	106.5	18.773	.097516	-209.831	.128306
62	106.5	19.8262	.150666	-210.145	.119478
61	106.5	20.8823	.206747	-210.46	.111225
60	106.5	21.9413	.265764	-210.776	.10351
59	106.5	23.0032	.327718	-211.093	9.63012e-2
58	106.5	24.0681	.39261	-211.411	8.95677e-2
57	106.5	25.136	.460439	-211.731	8.32803e-2
56	106.5	26.2067	.531202	-212.051	7.74112e-2
55	106.5	27.2804	.604896	-212.372	7.19345e-2
54	106.5	28.357	.681515	-212.695	6.68256e-2
53	106.5	29.4366	.761053	-213.019	6.20613e-2
52	106.5	30.519	.843501	-213.343	5.76199e-2
51	106.5	31.6044	.928849	-213.669	5.34806e-2
50	106.5	32.6926	1.01709	-213.996	4.96243e-2
49	106.5	33.7837	1.1082	-214.324	4.60327e-2
48	106.5	34.8777	1.20217	-214.653	4.26887e-2
47	106.5	35.9745	1.29899	-214.984	3.95762e-2
46	106.5	37.0742	1.39863	-215.535	3.48754e-2
45	106.5	38.1767	1.50107	-216.357	.028884
44	106.5	39.2819	1.6063	-217.229	2.36438e-2
43	106.5	40.3899	1.71428	-218.029	1.96731e-2
42	106.5	41.5006	1.825	-218.655	1.70387e-2
41	106.5	42.6141	1.93843	-219.339	1.45613e-2
40	106.5	43.7302	2.05453	-220.083	.012271
39	106.5	44.849	2.17327	-220.891	1.01905e-2
38	106.5	45.9703	2.29462	-221.765	8.33395e-3
37	106.5	47.0943	2.41855	-222.709	6.70758e-3
36	106.5	48.2208	2.54502	-223.725	5.30951e-3
35	106.5	49.3498	2.67398	-224.815	4.13079e-3

ANNEX C.6

LATITUDE DEGREES	LONGITUDE DEGREES	ELEVATION DEGREES	OFF AXIS ANGLE	INTERFERENCE dBW/Hz	CNT DELTA dB
34	106.5	50.4812	2.8054	-225.984	3.15662e-3
33	106.5	51.6151	2.93924	-227.233	2.3678e-3
32	106.5	52.7513	3.07544	-228.566	1.74232e-3
31	106.5	53.8899	3.21397	-229.984	1.25691e-3
30	106.5	55.0308	3.35477	-231.491	8.88394e-4
29	106.5	56.1738	3.49778	-233.09	6.14865e-4
28	106.5	57.3191	3.64297	-234.782	4.16462e-4
27	106.5	58.4664	3.79027	-236.57	2.75899e-4
26	106.5	59.6158	3.93963	-237.909	2.02728e-4
25	106.5	60.7673	4.09099	-237.895	2.03343e-4
24	106.5	61.9206	4.24428	-237.883	2.03938e-4
23	106.5	63.0759	4.39945	-237.87	2.04514e-4
22	106.5	64.2329	4.55643	-237.859	2.0507e-4
21	106.5	65.3917	4.71516	-237.847	2.05606e-4
20	106.5	66.5522	4.87557	-237.837	2.0612e-4
19	106.5	67.7143	5.03759	-237.826	2.06612e-4
18	106.5	68.878	5.20115	-237.816	2.07083e-4
17	106.5	70.0431	5.36618	-237.807	2.0753e-4
16	106.5	71.2097	5.5326	-237.798	2.07955e-4
15	106.5	72.3775	5.70034	-237.79	2.08356e-4
14	106.5	73.5466	5.86933	-237.782	2.08733e-4
13	106.5	74.7169	6.03948	-237.774	2.09086e-4
12	106.5	75.8882	6.21072	-237.768	2.09415e-4
11	106.5	77.0606	6.38298	-237.761	2.09718e-4
10	106.5	78.2339	6.55616	-237.756	2.09996e-4
9	106.5	79.4081	6.73018	-237.75	2.10248e-4
8	106.5	80.583	6.90497	-237.746	2.10475e-4
7	106.5	81.7586	7.08045	-237.742	2.10676e-4
6	106.5	82.9349	7.25652	-237.738	2.1085e-4
5	106.5	84.1116	7.4331	-237.735	2.10997e-4
4	106.5	85.2887	7.61011	-237.732	2.11119e-4
3	106.5	86.4663	7.78747	-237.731	2.11213e-4
2	106.5	87.644	7.96508	-237.729	2.1128e-4
1	106.5	88.822	8.14286	-237.728	2.11321e-4
0	106.5	90.	8.32072	-237.728	2.11334e-4

PROGRAM NAME FPLMTSIN.BAS

ANNEX D.1

THIS PROGRAM CALCULATES THE INTERFERING POWER FROM THE PROPOSED FPLMTS TO THE MSAT SATELLITE GIVEN THE SUBSATELLITE LONGITUDE, BEAM COORDINATES AND LOCATION OF THE HIGH DENSITY METROPOLITAN AREAS.

INPUT DATA

SUBSATELLITE LONGITUDE= 106.5
SATELLITE ANTENNA BORESIGHT LATITUDE= 54.4
SATELLITE ANTENNA BORESIGHT LONGITUDE= 122.5
SATELLITE ANTENNA BORESIGHT GAIN= 34 dBic
SATELLITE ANTENNA 3 dB BEAMWIDTH= 2.7 DEGREES
REQUIRED NEAR IN SIDELOBE LEVEL (LS) IN dB RELATIVE TO PEAK GAIN
ONLY ALLOWED VALUES ARE -20,-25 OR -30 dB. LS=-25 dB
OPERATING FREQUENCY= 1.65 GHz
UNFADED SATELLITE UPLINK CARRIER POWER AT LNA=-141.5 dBW
POLARIZATION ISOLATION= 3 dB
REVERSE LINK TOTAL UNFADED C/(No+Io)= 53.1 dB-Hz

METROPOLITAN AREA	LATITUDE DEGREES	LONGITUDE DEGREES	SIZE 100K	OFF AXIS ANGLE	POWER dBW/Hz
CALGARY	51.05	114.08	6	.760892	-212.731
EDMONTON	53.55	113.47	5	.825763	-213.575
HALIFAX	44.65	63.6	3	6.07692	-237.899
HAMILTON	43.25	79.85	5	4.75623	-235.479
KINGSTON	44.23	76.5	1	5.00166	-242.516
KITCHENER	43.45	80.48	3	4.6666	-237.695
LONDON	42.98	81.23	3	4.62321	-237.68
MONCTON	46.1	64.78	1	5.85981	-242.675
MONTREAL	45.52	73.57	28	5.17827	-228.095
OSHAWA	43.9	78.85	2	4.79863	-239.478
OTTAWA	45.33	75.7	7	4.98691	-234.091
QUEBEC	46.82	71.33	6	5.2565	-234.83
REGINA	50.42	104.65	2	1.73244	-219.421
ST JOHN	45.27	66.05	1	5.82429	-242.648
SASKATOON	52.12	106.63	2	1.50604	-218.25
THUNDER BAY	48.38	89	1	3.4362	-236.932
TORONTO	43.65	79.38	30	4.75413	-227.708
TROIS RIVIERE	46.35	72.55	1	5.189	-242.591
VANCOUVER	49.27	123.12	13	.513736	-209.37
VICTORIA	48.42	123.37	2	.611409	-217.483
WINDSOR	42.3	83.02	2	4.47136	-239.414
WINNIPEG	49.88	97.15	6	2.52967	-220.244
ST JOHN'S	47.34	52.43	1	6.53705	-242.853

TOTAL INTERFERING POWER AT SATELLITE=-205.654 dBW/Hz
UPLINK C/Io= 64.1543 dB-Hz
NEW C/(No+Io)= 52.772 dB-Hz
DECREASE IN (C/No)t= .327983 dB

PROGRAM NAME FPLMTSIN.BAS

ANNEX D.1

THIS PROGRAM CALCULATES THE INTERFERING POWER FROM THE PROPOSED FPLMTS TO THE MSAT SATELLITE GIVEN THE SUBSATELLITE LONGITUDE, BEAM COORDINATES AND LOCATION OF THE HIGH DENSITY METROPOLITAN AREAS.

INPUT DATA

SUBSATELLITE LONGITUDE= 106.5
SATELLITE ANTENNA BORESIGHT LATITUDE= 55
SATELLITE ANTENNA BORESIGHT LONGITUDE= 103.5
SATELLITE ANTENNA BORESIGHT GAIN= 34 dBic
SATELLITE ANTENNA 3 dB BEAMWIDTH= 2.7 DEGREES
REQUIRED NEAR IN SIDELOBE LEVEL (LS) IN dB RELATIVE TO PEAK GAIN
ONLY ALLOWED VALUES ARE -20,-25 OR -30 dB. LS=-25 dB
OPERATING FREQUENCY= 1.65 GHz
UNFADED SATELLITE UPLINK CARRIER POWER AT LNA=-141.5 dBW
POLARIZATION ISOLATION= 3 dB
REVERSE LINK TOTAL UNFADED C/(No+Io)= 53.1 dB-Hz

METROPOLITAN AREA	LATITUDE DEGREES	LONGITUDE DEGREES	SIZE 100K	OFF AXIS ANGLE	POWER dBW/Hz
CALGARY	51.05	114.08	6	1.11633	-212.731
EDMONTON	53.55	113.47	5	.968426	-213.575
HALIFAX	44.65	63.6	3	4.36963	-237.899
HAMILTON	43.25	79.85	5	3.06734	-225.966
KINGSTON	44.23	76.5	1	3.29655	-235.405
KITCHENER	43.45	80.48	3	2.9821	-227.333
LONDON	42.98	81.23	3	2.9501	-227.006
MONCTON	46.1	64.78	1	4.12755	-242.675
MONTREAL	45.52	73.57	28	3.44968	-222.684
OSHAWA	43.9	78.85	2	3.10165	-230.314
OTTAWA	45.33	75.7	7	3.26801	-226.672
QUEBEC	46.82	71.33	6	3.51859	-230.209
REGINA	50.42	104.65	2	.384794	-217.48
ST JOHN	45.27	66.05	1	4.10966	-242.648
SASKATOON	52.12	106.63	2	.373677	-217.516
THUNDER BAY	48.38	89	1	1.72106	-222.372
TORONTO	43.65	79.38	30	3.06877	-218.21
TROIS RIVIERE	46.35	72.55	1	3.457	-237.263
VANCOUVER	49.27	123.12	13	2.1169	-213.746
VICTORIA	48.42	123.37	2	2.19279	-222.398
WINDSOR	42.3	83.02	2	2.83129	-227.61
WINNIPEG	49.88	97.15	6	.834528	-212.711
ST JOHN'S	47.34	52.43	1	4.80828	-242.853

TOTAL INTERFERING POWER AT SATELLITE=-205.629 dBW/Hz
UPLINK C/Io= 64.1294 dB-Hz
NEW C/(No+Io)= 52.7702 dB-Hz
DECREASE IN (C/No)t= .329803 dB

PROGRAM NAME FPLMTSIN.BAS

ANNEX D.1

THIS PROGRAM CALCULATES THE INTERFERING POWER FROM THE PROPOSED FPLMTS TO THE MSAT SATELLITE GIVEN THE SUBSATELLITE LONGITUDE, BEAM COORDINATES AND LOCATION OF THE HIGH DENSITY METROPOLITAN AREAS.

INPUT DATA

SUBSATELLITE LONGITUDE= 106.5
SATELLITE ANTENNA BORESIGHT LATITUDE= 52.5
SATELLITE ANTENNA BORESIGHT LONGITUDE= 87.8
SATELLITE ANTENNA BORESIGHT GAIN= 34 dBic
SATELLITE ANTENNA 3 dB BEAMWIDTH= 2.7 DEGREES
REQUIRED NEAR IN SIDELOBE LEVEL (LS) IN dB RELATIVE TO PEAK GAIN
ONLY ALLOWED VALUES ARE -20,-25 OR -30 dB. LS=-25 dB
OPERATING FREQUENCY= 1.65 GHz
UNFADED SATELLITE UPLINK CARRIER POWER AT LNA=-141.5 dBW
POLARIZATION ISOLATION= 3 dB
REVERSE LINK TOTAL UNFADED C/(No+Io)= 53.1 dB-Hz

METROPOLITAN AREA	LATITUDE DEGREES	LONGITUDE DEGREES	SIZE 100K	OFF AXIS ANGLE	POWER dBW/Hz
CALGARY	51.05	114.08	6	2.61996	-221.03
EDMONTON	53.55	113.47	5	2.51743	-221.007
HALIFAX	44.65	63.6	3	2.82565	-226.041
HAMILTON	43.25	79.85	5	1.58285	-214.603
KINGSTON	44.23	76.5	1	1.77603	-222.709
KITCHENER	43.45	80.48	3	1.50405	-216.419
LONDON	42.98	81.23	3	1.49055	-216.337
MONCTON	46.1	64.78	1	2.57017	-228.549
MONTREAL	45.52	73.57	28	1.90269	-209.055
OSHAWA	43.9	78.85	2	1.60008	-218.693
OTTAWA	45.33	75.7	7	1.73184	-214.029
QUEBEC	46.82	71.33	6	1.96096	-216.16
REGINA	50.42	104.65	2	1.64573	-218.939
ST JOHN	45.27	66.05	1	2.56256	-228.457
SASKATOON	52.12	106.63	2	1.84916	-220.145
THUNDER BAY	48.38	89	1	.366355	-220.496
TORONTO	43.65	79.38	30	1.57894	-206.812
TROIS RIVIERE	46.35	72.55	1	1.90447	-223.561
VANCOUVER	49.27	123.12	13	3.61038	-227.826
VICTORIA	48.42	123.37	2	3.68187	-236.798
WINDSOR	42.3	83.02	2	1.41966	-217.732
WINNIPEG	49.88	97.15	6	.863204	-212.711
ST JOHN'S	47.34	52.43	1	3.25226	-235.264

TOTAL INTERFERING POWER AT SATELLITE=-202.038 dBW/Hz
UPLINK C/Io= 60.5377 dB-Hz
NEW C/(No+Io)= 52.3797 dB-Hz
DECREASE IN (C/No)t= .720277 dB

PROGRAM NAME FPLMTSIN.BAS

THIS PROGRAM CALCULATES THE INTERFERING POWER FROM THE PROPOSED FPLMTS TO THE MSAT SATELLITE GIVEN THE SUBSATELLITE LONGITUDE, BEAM COORDINATES AND LOCATION OF THE HIGH DENSITY METROPOLITAN AREAS.

ANNEX D.1

INPUT DATA

SUBSATELLITE LONGITUDE= 106.5
SATELLITE ANTENNA BORESIGHT LATITUDE= 50
SATELLITE ANTENNA BORESIGHT LONGITUDE= 65.6
SATELLITE ANTENNA BORESIGHT GAIN= 34 dBic
SATELLITE ANTENNA 3 dB BEAMWIDTH= 2.7 DEGREES
REQUIRED NEAR IN SIDELOBE LEVEL (LS) IN dB RELATIVE TO PEAK GAIN
ONLY ALLOWED VALUES ARE -20,-25 OR -30 dB. LS=-25 dB
OPERATING FREQUENCY= 1.65 GHz
UNFADED SATELLITE UPLINK CARRIER POWER AT LNA=-141.5 dBW
POLARIZATION ISOLATION= 3 dB
REVERSE LINK TOTAL UNFADED C/(No+Io)= 53.1 dB-Hz

METROPOLITAN AREA	LATITUDE DEGREES	LONGITUDE DEGREES	SIZE 100K	OFF AXIS ANGLE	POWER dBW/Hz
CALGARY	51.05	114.08	6	4.67511	-234.731
EDMONTON	53.55	113.47	5	4.60171	-235.575
HALIFAX	44.65	63.6	3	.824281	-215.899
HAMILTON	43.25	79.85	5	.967671	-213.479
KINGSTON	44.23	76.5	1	.697293	-220.516
KITCHENER	43.45	80.48	3	1.01765	-215.695
LONDON	42.98	81.23	3	1.08819	-215.68
MONCTON	46.1	64.78	1	.554314	-220.675
MONTREAL	45.52	73.57	28	.481859	-206.095
OSHAWA	43.9	78.85	2	.876905	-217.478
OTTAWA	45.33	75.7	7	.621154	-212.091
QUEBEC	46.82	71.33	6	.325962	-212.83
REGINA	50.42	104.65	2	3.70033	-237.019
ST JOHN	45.27	66.05	1	.58857	-220.648
SASKATOON	52.12	106.63	2	3.91835	-239.516
THUNDER BAY	48.38	89	1	2.00314	-224.101
TORONTO	43.65	79.38	30	.923604	-205.708
TROIS RIVIERE	46.35	72.55	1	.402073	-220.591
VANCOUVER	49.27	123.12	13	5.64017	-231.37
VICTORIA	48.42	123.37	2	5.72595	-239.483
WINDSOR	42.3	83.02	2	1.26386	-217.414
WINNIPEG	49.88	97.15	6	2.90368	-223.59
ST JOHN'S	47.34	52.43	1	1.17432	-220.853

TOTAL INTERFERING POWER AT SATELLITE=-200.747 dBW/Hz
UPLINK C/Io= 59.2473 dB-Hz
NEW C/(No+Io)= 52.156 dB-Hz
DECREASE IN (C/No)t= .944045 dB

ANNEX E.1

PROGRAM NAME FPLMAIR1.BAS

THE PURPOSE OF THIS PROGRAM IS TO CALCULATE THE INTERFERENCE AT AN AIRCRAFT TERMINAL FROM THE FLMPTS FOR DIFFERENT AIRCRAFT ALTITUDES. SATELLITE LINK PARAMETERS ARE AS GIVEN IN 8/531-E

SATELLITE FORWARD LINK

UPLINK EIRP/CHANNEL IN dBW= 45.1
UPLINK Ku BAND PATHLOSS IN dB= 206.8
UPLINK SYSTEM NOISE TEMPERATURE IN dBK= 28
UPLINK THERMAL NOISE IN dBK/Hz=-200.6
UPLINK C/No dB-Hz= 63.9
SATELLITE C/Io dB-Hz= 55.9
EIRP PER CHANNEL IN dBW= 32.3
L-BAND DOWNLINK PATHLOSS IN dB= 188.1
MOBILE ANTENNA GAIN IN dBic= 10
MOBILE TERMINAL SYSTEM NOISE IN dBK= 27.5
UNFADED DOWLINK IN dB-Hz C/No= 55.3
DOWNLINK THERMAL NOISE IN dBK/Hz=-201.1

UNFADED AND WITHOUT TERRESTRIAL INTERFERENCE

(C/No)u dB-Hz	C/Io dB-Hz	(C/No)d dB-Hz	(C/No)t dB-Hz
63.9	55.9	55.3	52.2702

METAREA SIZE IN SQUARE KILOMETRES= 1
AIRCRAFT ANTENNA METAREA REJECTION= 20 dB
POLARIZATION ISOLATION= 3 dB

AIRCRAFT ALTITUDE METRES	INTERFERING SIGNAL dBW/Hz	CARRIER TO TOTAL (NOISE +INTERFERENCE) RATIO IN dB-Hz	DEGRADATION IN C/Nt dB-Hz
1000	-179.22	33.3641	18.9061
2000	-185.241	39.2203	13.0499
3000	-188.763	42.4811	9.78908
4000	-191.262	44.639	7.63117
5000	-193.2	46.175	6.09524
6000	-194.783	47.3127	4.95751
7000	-196.122	48.1776	4.09255
8000	-197.282	48.848	3.42218
9000	-198.305	49.3758	2.89439
10000	-199.22	49.797	2.47319
11000	-200.048	50.1372	2.13295
12000	-200.804	50.4151	1.85506
13000	-201.499	50.6444	1.62578
14000	-202.143	50.8354	1.43483
15000	-202.742	50.9958	1.27441
16000	-203.303	51.1316	1.13857
17000	-203.829	51.2475	1.02267
18000	-204.326	51.3471	.923107
19000	-204.795	51.4332	.837027
20000	-205.241	51.508	.762157

ANNEX E.2

PROGRAM NAME FPLMAIR2.BAS

THE PURPOSE OF THIS PROGRAM IS TO CALCULATE THE INTERFERENCE AT AN AIRCRAFT TERMINAL FROM THE FLMPTS FOR DIFFERENT AIRCRAFT ALTITUDES. SATELLITE LINK PARAMETERS ARE AS GIVEN IN 8/531-E

SATELLITE FORWARD LINK

UPLINK EIRP/CHANNEL IN dBW= 45.1
UPLINK Ku BAND PATHLOSS IN dB= 206.8
UPLINK SYSTEM NOISE TEMPERATURE IN dBK= 28
UPLINK THERMAL NOISE IN dBK/Hz=-200.6
UPLINK C/No dB-Hz= 63.9
SATELLITE C/Io dB-Hz= 55.9
EIRP PER CHANNEL IN dBW= 32.3
L-BAND DOWNLINK PATHLOSS IN dB= 188.1
MOBILE ANTENNA GAIN IN dBic= 10
MOBILE TERMINAL SYSTEM NOISE IN dBK= 27.5
UNFADED DOWLINK IN dB-Hz C/No= 55.3
DOWNLINK THERMAL NOISE IN dBK/Hz=-201.1

UNFADED AND WITHOUT TERRESTRIAL INTERFERENCE

(C/No)u dB-Hz	C/Io dB-Hz	(C/No)d dB-Hz	(C/No)t dB-Hz
63.9	55.9	55.3	52.2702

METAREA SIZE IN SQUARE KILOMETRES= 1
AIRCRAFT ANTENNA METAREA REJECTION IN dB = 20
POLARIZATION ISOLATION= 3 dB

AIRCRAFT ALTITUDE METRES	INTERFERING SIGNAL dBW/Hz	CARRIER TO TOTAL (NOISE +INTERFERENCE) RATIO IN dB-Hz	DEGRADATION IN C/Nt dB-Hz
100	-159.22	13.4198	38.8504
200	-165.241	19.4387	32.8315
300	-168.763	22.9577	29.3125
400	-171.262	25.4525	26.8177
500	-173.2	27.3856	24.8846
600	-174.783	28.963	23.3072
700	-176.122	30.2947	21.9755
800	-177.282	31.4461	20.8241
900	-178.305	32.4596	19.8106
1000	-179.22	33.3641	18.9061

A STUDY OF THE MAGNITUDE OF POTENTIAL INTERFERENCE BETWEEN THE MOBILE SATELLITE SERVICE AND THE FIXED AND/OR MOBILE SERVICES IN THE BANDS...