Before the
Federal Communications Commission
Washington DC 20554

In the Matter of		
Amendment of Part 101 of the Commission's Rules to Increase Spectrum Use Through More Flexible Antenna Rules for the 10.7-11.7 GHz Band		RM-11043

REPLY COMMENTS OF ALCATEL

Alcatel respectfully submits the following reply comments in support of the Petition for Rulemaking (Petition) filed by FiberTower, Inc. in the above-captioned proceeding.[*]

After studying the comments filed in this docket, Alcatel continues to believe that use of two-foot antennas in the 11 GHz band will yield better utilization of the spectrum, easier installation, and cost savings for users of this band.

With its first-round comments, Alcatel submitted a "White Paper Report on Proposed Changes to Small Antenna Standards in the 11 GHz Band" prepared for Alcatel, N.A., Rev. 1, dated August 23, 2004. Attached herewith is an updated version, identified as "Rev. 2.1 dated

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[*] Petition for Rulemaking of FiberTower, Inc., RM-11043 (filed May 26, 2004; date-stamped July 14, 2004). *See* Consumer & Governmental Affairs Bureau, Reference Information Center, Petition for Rulemaking Filed, Report No. 2666 (released July 23, 2004). Alcatel manufactures communications equipment, including microwave radio products, and provides communications solutions to a wide range of commercial and government users.

September 1, 2004." Alcatel asks the Commission to kindly discard the earlier vesion and consider this one in its place.

Respectfully submitted,

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September 7, 2004

White Paper Report

on

Proposed Changes to Small Antenna Standards

in the

11 GHz Band

Prepared by

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for

Alcatel N.A.

Rev. 0 June 24, 2004
Rev. 1 August 20, 2004
Rev. 2.1 September 1, 2004

Comparison Path Studies
for
Small Antenna Standard in 11 GHz Band

BACKGROUND:

FiberTower, Inc. has filed a petition for rulemaking with the FCC to allow the use of two-foot antennas in the 11 GHz band. This white paper report presents the results of comparison path studies for determining the impact of the proposed, optional alternate small antenna standards in the 10.7-11.7 GHz (11 GHz) band with respect to other terrestrial stations and satellite earth stations.

SUMMARY OF RESULTS:

The off-axis gain characteristics of the proposed, alternate Category A (New A) antenna standard in the 11 GHz band are comparable to the current Category A requirement for radiation suppression because of the reduced main beam gain. (Reference Figure 1. and Table 1.) In fact, at many off-axis angles, the New A antenna will perform better (i.e., have less interference impact because of lower off-axis gain) than four-foot and six-foot antennas meeting current Category A specifications. (See Tables 1.2 and 1.3 on page 7.) This is true with respect to interference into terrestrial stations and earth stations because the same basic equation is used to calculate interference levels into both types of stations.

> Off-Axis Gain (dBi) = Main Beam Gain (dBi) – Radiation Suppression* (dB)
> [*as specified in antenna standards table, FCC Rules §101.115]

Separation between microwave paths with different combinations of antennas (i.e., current Category A and New A) is more dependent on the respective transmitter power of each path than on the antenna performance, i.e., off-axis gain. As noted in this report, the off-axis gain characteristics are quite comparable and in some cases actually better for the New A antenna.

The advantages of smaller, 2-foot, antennas (e.g., size, cost, ease of installation) would facilitate the installation of more microwave paths in metropolitan areas using lower power transmitters on shorter paths, thereby resulting in a greater utilization of the 11 GHz microwave spectrum.

METHODOLOGY:

This white paper presents the results of twenty-two (22) different combinations of path length, antenna model, and transmitter power that were used to evaluate the impact of the proposed changes for small antenna standards in the 11 GHz band. The same interference objective of -103 dBm was used in all cases, based on a -69 dBm receiver threshold for 3 DS-3 radios and a T/I ratio of 34 dB. A total of 528 simplified interference calculations were made for these comparison path studies. (See Table 4 on page 10 for a Comparison Chart with the sample results of one path study.)

Four different parallel path length configurations were used for this study:
10 mi. – 10 mi., 5 mi. – 10 mi., 2 mi. – 10 mi., and 2 mi. – 2 mi.

The off-axis angle, θ_1, at Site A (same angle at Site D) was adjusted in 10-degree increments from 10 degrees to 60 degrees. The corresponding off-axis angle, θ_2, at Site B (same angle at Site C) was then calculated for each increment along with the path distance and free space loss between Sites A and D and Sites B and C. (Refer to Figure 2.1 and 2.2, Path Study Configuration.) Interference levels were then calculated and compiled.

An overview table of the 22 path studies lists the minimum off-axis angle that could be used for each path configuration and the resultant separation distance between the parallel paths. (See Table 5 on page 11.) Conclusions stated in this report are based on this data and the antenna off-axis gain tables and graph.

OBSERVATIONS:

The off-axis gain characteristics of the proposed, alternate Category A (New A) antenna standard in the 11 GHz band are comparable to the current Category A requirement for radiation suppression because of the reduced main beam gain. (Reference Figure 1. and Table 1.) In fact, at many off-axis angles, the New A antenna will perform better (i.e., have less interference impact because of lower off-axis gain) than four-foot and six-foot antennas meeting current Category A specifications. (See Tables 1.2 and 1.3 on page 7.)

> Off-Axis Gain (dBi) = Main Beam Gain (dBi) – Radiation Suppression* (dB)
> [*as specified in antenna standards table, FCC Rules §101.115]

The calculation of interference levels into foreign stations (i.e., any station other than the desired receive station) takes into account the off-axis gain of the respective transmit and receive antennas. (Refer to Figures 2.1. and 2.2., Path Study Configurations, and equations 2, 4,6, and 8.)

$I_{CB} = I_{BC}$* when P_C is the same as P_B (reference equations 2 and 8, respectively) and $I_{DA} = I_{AD}$ when P_D is the same as P_A (reference equations 6 and 4, respectively). In each pair of referenced equations all of the terms are equivalent except for the transmitter powers. Therefore, when the transmitter powers are the same (assuming similar rack configurations), the calculated level of interference will be the same in both directions, i.e. I_{CB} (Site C to Site B) will equal I_{BC} (Site B to Site C). (Refer to Figure 4.1, Interference Path Calculations diagram, on page 15.)

**** Key to terms used in the paragraph above and in the following sections of this report:***

For example:

$$C_{AB} = P_A - L_A + G_A - FSL_{AB} + G_B - L_B \qquad \text{Eq. 1}$$

$$I_{CB} = P_C - L_C + G_{C\theta 2} - FSL_{CB} + G_{B\theta 2} - L_B \qquad \text{Eq. 2}$$

where:

C_{AB} = carrier or signal level on the desired path from Site A to Site B in dBm,
P_A = transmitter power level at Site A in dBm,
L_A = line losses at Site A in dB,
G_A = main beam gain of the antenna at Site A in dBi,
FSL_{AB} = free space loss for path between Site A and Site B in dB,
G_B = main beam gain of the antenna at Site B in dBi,
L_B = line losses at Site B in dB,
and
I_{CB} = interference signal level from Site C received at Site B in dBm,
$G_{C\theta 2}$ = off-axis gain (in dBi) of the antenna at Site C at the off-axis angle of θ_2,
$G_{B\theta 2}$ = off-axis gain (in dBi) of the antenna at Site B at the off-axis angle of θ_2.

Calculated interference levels using the New A antenna would be lower at angles between 10-30 degrees and 100-180 degrees away from the main beam, i.e., off-axis, compared to a four-foot antenna with a main beam gain of 40.4 dBi and meeting current Category A specifications, and less than 0.1 dB higher between 5-

10 degrees and 30-100 degrees. Therefore, there is negligible interference impact between 5-10 degrees and 30-100 degrees off-axis from the New A antenna and actually less impact between 10-30 degrees and 100-180 degrees off-axis as compared to a four-foot antenna meeting the current Category A specifications. When compared to a six-foot antenna meeting the current Category A specifications, the New A antenna has lower off-axis gain at all angles which means less interference impact at all angles and even in the main beam of the antenna. (See Table 1.3 on page 7.) As a result, the separation between microwave paths with different combinations of antennas (i.e., current Category A and New A) is more dependent on the respective transmitter power of each path than on the antenna performance, i.e., off-axis gain.

Because the same basic equation is used to calculate interference levels into terrestrial stations and earth stations, the respective off-axis antenna gain components determine the level of interference from a transmit station into a foreign receive station. (Refer to Figure 4.2, Interference Path Calculations diagram, on page 16.) As stated above, the interference impact of the New A antenna is negligible (only 0.1 dB higher) at some off-axis angles as compared to a four-foot antenna meeting the current Category A specifications. At all other angles the New A antenna performs better, i.e., less interference impact, as compared to a four-foot antenna and even a six-foot antenna. (See highlighted areas of Tables 1.2 and 1.3 on page 7.)

The proposed, alternate Category A (New A) antenna standard is basically the same as the current Category B antenna standard except for an improvement of 19 dB in radiation suppression between 100–180 degrees off-axis from the main beam and 2 dB less radiation suppression between 5–10 degrees off-axis. (Refer to Figure 5 on page 17.)

The proposed, alternate Category B (new B) antenna pattern is basically the same as the current Category B antenna pattern except for a 4 dB improvement between 100-140 degrees off-axis and a 9 dB improvement between 140-180 degrees off-axis. The new B pattern proposes a 3 dB relaxation of radiation suppression between 5-10 degrees off-axis. (Refer to Figure 6 on page 18.)

CONCLUSIONS:

Because of the reduced main beam gain, the off-axis gain characteristics of the proposed, optional alternate Category A (New A) antenna in the 11 GHz band are comparable to four-foot and six-foot antennas meeting current Category A specifications. In fact, at many off-axis angles, the New A antenna will perform better, i.e., have less interference impact, than four-foot and six-foot antennas meeting current Category A specifications.

> Off-Axis Gain (dBi) = Main Beam Gain (dBi) – Radiation Suppression (dB)
> [as specified in antenna standards table, FCC Rules §101.115]

As a result, calculated interference levels using the New A antenna will be lower at angles between 10-30 degrees and 100-180 degrees off-axis compared to a four-foot antenna (with a main beam gain of 40.4 dBi) meeting current Category A specifications, and less than 0.1 dB higher between 5-10 degrees and 30-100 degrees.

Short paths with lower power transmitters will be disadvantaged with respect to longer paths using standard power; therefore, larger discrimination angles are needed to meet the threshold interference requirement. Because of the comparable off-axis gain characteristics of the New A standards with respect to the current standards, the impact on path separation is about the same for both antenna standards.

Many 11 GHz links have a low number of RF channels in operation; therefore, interference conflicts can also be prevented by selecting alternate channels to avoid co-channel frequency operation.

The New A antenna is not suitable for one end of a 10-mile path because of insufficient fade margin to combat predicted rainfall outage in the Dallas area and equivalent rainfall regions.

The use of the New A antenna at both ends of a 5-mile path would meet the minimum fade margin requirement for vertical polarization, but not for horizontal polarization in a rainfall region equivalent to that of Dallas, Texas.

Off-Axis Gain Comparison
for
Category A and New Category A Antennas

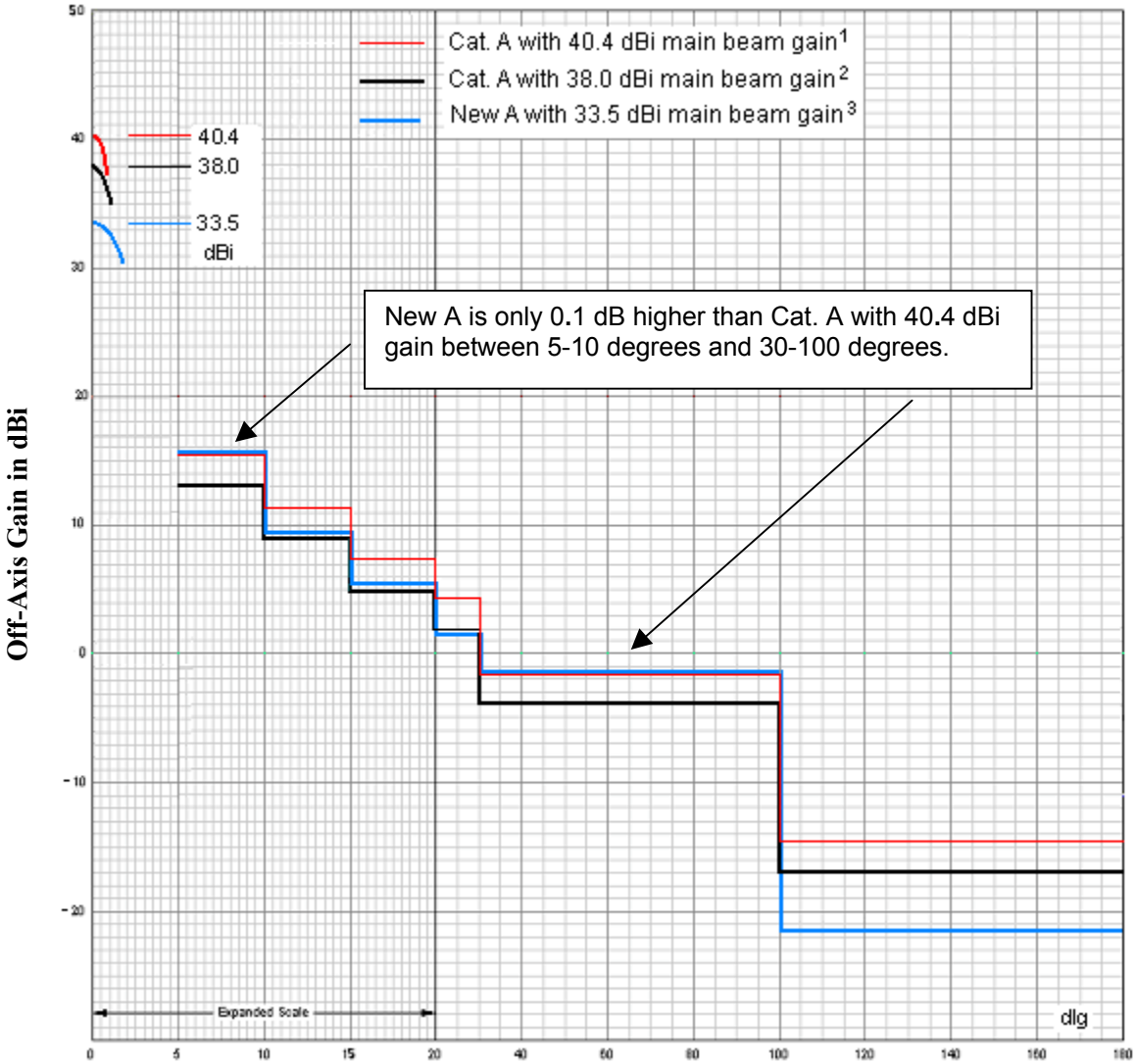

Figure 1. Comparison of Alternate and Current Category A Off-Axis Gain

Note: Off-Axis Gain (dBi) = Main Beam Gain (dBi) – Radiation Suppression (dB)

[1] Actual production models for high-performance antennas have a gain of 40.4 dBi.
[2] Current FCC Cat. A for mw antennas specifies a minimum main beam gain of 38.0 dBi. [as specified in antenna standards table, FCC Rules §101.115]
[3] Proposed Category A for antennas with a minimum main beam gain of 33.5 dBi.

11 GHz Small Antenna Standards

Comparison of Off-Axis Gain and EIRP

Table 1

Off-axis angle	Table 1.1 Proposed Category A Radiation Suppression (Sm. Antenna) (dB)	Table 1.1 Off-axis Antenna Gain* "New A" (dBi)	Table 1.1 EIRP** +24 dBm into Antenna dBm	Table 1.2 Current Category A Radiation Suppression (dB)	Table 1.2 Off-axis Antenna Gain* 4-ft Dish (dBi)	Table 1.2 EIRP** +24 dBm into Antenna dBm	Table 1.2 New A vs. 4-ft dish Δ EIRP Δ Gain (dB)	Table 1.3 Current Category A Radiation Suppression (dB)	Table 1.3 Off-axis Antenna Gain* 6-ft Dish (dBi)	Table 1.3 EIRP** +24 dBm into Antenna dBm	Table 1.3 New A vs. 6-ft dish Δ EIRP Δ Gain (dB)
0°	0	**33.5**	+57.5	0	**40.4**	+64.4	**-6.9**	0	**44.0**	+68	**-10.5**
							(note 1)				(note 1)
5° - 10°	18	**+15.5**	+39.5	25	**+15.4**	+39.4	**0.1**	25	**+19**	+43	**-3.5**
10° - 15°	24	**+9.5**	+33.5	29	**+11.4**	+35.4	**-1.9**	29	**+15**	+39	**-5.5**
15° - 20°	28	**+5.5**	+29.5	33	**+7.4**	+31.4	**-1.9**	33	**+11**	+35	**-5.5**
20° - 30°	32	**+1.5**	+25.5	36	**+4.4**	+28.4	**-2.9**	36	**+8**	+32	**-6.5**
30° - 100°	35	**-1.5**	+22.5	42	**-1.6**	+22.4	**0.1**	42	**+2**	+26	**-3.5**
100° - 140°	55	**-21.5**	+2.5	55	**-14.6**	+9.4	**-6.9**	55	**-11**	+13	**-10.5**
140° - 180°	55	**-21.5**	+2.5	55	**-14.6**	+9.4	**-6.9**	55	**-11**	+13	**-10.5**

* Off-axis Gain = Main Beam Gain - Radiation Suppression

** EIRP = Ptx - Line Loss + Gant

** EIRP = +27 dBm - 3 dB + Gant

Maximum allowable EIRP = +55 dBW (+85 dBm)

2-mile path EIRP Limit = 55-(40*LOG10(3.1/2 47.4 dBW

or 77.4 dBm

Note 1: Negative values indicate New A antenna has lower gain and EIRP for respective off-axis angle

Positive values indicate New A antenna has higher gain and EIRP for respective off-axis angle

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Comparison of Off-Axis Gain

Table 2

Table 2.1

Current Category A Radiation Suppression (dB)	Off-axis Antenna Gain* Cat. A Min. (dBi)	EIRP w/+24 dBm (27 -3 dB)** dBm	New A Δ Gain (dB)
0	**38**	+62	
25	**+13**	+37	**2.5**
29	**+9**	+33	**0.5**
33	**+5**	+29	**0.5**
36	**+2**	+26	**-0.5**
42	**-4**	+20	**2.5**
55	**-17**	+7	**-4.5**
55	**-17**	+7	**-4.5**

Table 2.2

Off-axis angle	Proposed Category A Radiation Suppression (dB)	Off-axis Antenna Gain* "New A" (dBi)	EIRP w/+24 dBm (27 - 3 dB)** dBm	EIRP w/+12 dBm (Short) (Link) dBm
0°	0	**33.5**	+57.5	+45.5
5° - 10°	18	**+15.5**	+39.5	+27.5
10° - 15°	24	**+9.5**	+33.5	+21.5
15° - 20°	28	**+5.5**	+29.5	+17.5
20° - 30°	32	**+1.5**	+25.5	+13.5
30° - 100°	35	**-1.5**	+22.5	+10.5
100° - 140°	55	**-21.5**	+2.5	-9.5
140° - 180°	55	**-21.5**	+2.5	-9.5

Table 2.3

(Cat. A)	Typical 4-ft Dish (dBi)	EIRP w/+24 dBm (dBm)	New A Δ Gain (dB)
0	**40.4**	+64.4	
25	**+15.4**	+39.4	**0.1**
29	**+11.4**	+35.4	**-1.9**
33	**+7.4**	+31.4	**-1.9**
36	**+4.4**	+28.4	**-2.9**
42	**-1.6**	+22.4	**0.1**
55	**-14.6**	+9.4	**-6.9**
55	**-14.6**	+9.4	**-6.9**

Table 2.4

Off-axis angle	(Cat. A)	Typical 6-ft Dish (dBi)	EIRP w/+24 dBm (dBm)	New A Δ Gain (dB)
0°	0	**44.0**	+68	
5° - 10°	25	**+19**	+43	**-3.5**
10° - 15°	29	**+15**	+39	**-5.5**
15° - 20°	33	**+11**	+35	**-5.5**
20° - 30°	36	**+8**	+32	**-6.5**
30° - 100°	42	**+2**	+26	**-3.5**
100° - 140°	55	**-11**	+13	**-10.5**
140° - 180°	55	**-11**	+13	**-10.5**

Table 2.5

Off-axis angle		HP4-107 (dBi)	EIRP w/+24 dBm (dBm)	New A Δ Gain (dB)
0°	0	**40.4**	+64.4	
	Actual	(dBi)	(dBm)	(dB)
5° - 10°	25	+15.4	+39.4	0.1
10° - 15°	30	+10.4	+34.4	-0.9
15° - 20°	33	+7.4	+31.4	-1.9
20° - 30°	36	+4.4	+28.4	-2.9
30° - 55°	42	-1.6	+22.4	0.1
60° - 65°	45	-4.6	+19.4	3.1
70° - 75°	54	-13.6	+10.4	12.1
76° - 90°	57	-16.6	+7.4	15.1
95° - 180°	61	-20.6	+3.4	-0.9

Table 2.6

Off-axis angle		HP6-107 (dBi)	EIRP w/+24 dBm (dBm)	New A Δ Gain (dB)
0°	0	**44.0**	+68	
	Actual	(dBi)	(dBm)	(dB)
5°	30	+14	+38	1.5
6° - 9°	32.5	+11.5	+35.5	4
9.5° - 15°	36	+8	+32	1.5
20° - 30°	42	+2	+26	-0.5
50°	46	-2	+22	0.5
99°	69	-25	-1	23.5
102° - 180°	70	-26	-2	4.5

Table 2.7

Off-axis angle		HP8-107 (dBi)	EIRP w/+24 dBm (dBm)	New A Δ Gain (dB)
0°	0	**46.4**	+70.4	
	Actual	(dBi)	(dBm)	(dB)
5°	30	+16.4	+40.4	**-0.9**
5.5° - 7°	31	+15.4	+39.4	**0.1**
7.5° - 9°	33	+13.4	+37.4	**2.1**
10.5°	37	+9.4	+33.4	**0.1**
15°	38	+8.4	+32.4	**-2.9**
25°	47	-0.6	+23.4	**2.1**
40°	48	-1.6	+22.4	**0.1**
60°	53	-6.6	+17.4	**5.1**
98°	71	-24.6	-0.6	**23.1**
100° - 180°	72	-25.6	-1.6	**4.1**

* Off-axis Gain = Main Beam Gain - Radiation Suppression

** EIRP = Ptx - Line Loss + Gant

** EIRP = +27 dBm - 3 dB + Gant

Maximum allowable EIRP = +55 dBW (+85 dBm)

2-mile path EIRP Limit = 55-(40*LOG10(3.1/2)) = 47.4 dBW

or 77.4 dBm

dlg 08/24/04

11 Small Antenna Standards

Comparison of Off-Axis Gain

for

Interference Path Study Configurations

Table 3

Table 3.1

	Main Beam Antenna Gain (dBi)			
	38	**40.4**		**33.5**
Category A Current Off-Axis Suppression	Category A Current Off-Axis Gain (dBi)	Category A Current Off-Axis Gain (dBi)	Category A Proposed Off-Axis Suppression	Category A Proposed Off-Axis Gain (dBi)
29	+9	+11.4	24	+9.5
36	+2	+4.4	32	+1.5
42	-4	-1.6	35	-1.5
42	-4	-1.6	35	-1.5
42	-4	-1.6	35	-1.5
42	-4	-1.6	35	-1.5
29	+9	+11.4	24	+9.5
36	+2	+4.4	32	+1.5
42	-4	-1.6	35	-1.5
42	-4	-1.6	35	-1.5
42	-4	-1.6	35	-1.5
42	-4	-1.6	35	-1.5

<< 0° >>
Off-Axis Angle
θ_1
10°
20°
30°
40°
50°
60°
θ_2
10.0°
20.0°
30.0°
40.0°
50.0°
60.0°

Table 3.2

	Main Beam Antenna Gain (dBi)				
	40.4		**44.0**		**46.4**
HP4-107 Actual Off-Axis Suppression	HP4-107 Actual Off-Axis Gain (dBi)	HP6-107 Actual Off-Axis Suppression	HP6-107 Actual Off-Axis Gain (dBi)	HP8-107 Actual Off-Axis Suppression	HP8-107 Actual Off-Axis Gain (dBi)
30	+10.4	36	+8	35.7	+10.7
36	+4.4	42	+2	45.5	+0.9
42	-1.6	42	+2	47.5	-1.1
42	-1.6	44	0	48	-1.6
43	-2.6	46	-2	50.5	-4.1
45	-4.6	50	-6	53	-6.6
30	+10.4	36	+8	35.7	+10.7
36	+4.4	42	+2	45.5	+0.9
42	-1.6	42	+2	47.5	-1.1
42	-1.6	44	0	48	-1.6
43	-2.6	46	-2	50.5	-4.1
45	-4.6	50	-6	53	-6.6

Case #	COMPARISON CHART FOR SMALL ANTENNAS IN 11 GHz BAND							
	SAMPLE RESULTS FOR INTERFERENCE PATH STUDY							
				Table 4				
		D1					**D2**	
		Length A-B in miles	Free Space Loss (dB)				Length C-D in miles	Free Space Loss (dB)
		2	123.6				10	137.6
	θ_1			**D3**		**θ_2**		
	Angle BAD, CDA (Deg)	Length AD, DA (Mi)	Free Space Loss (dB)	Separation B-D (Mi.)		Angle ABC, DCB (Deg)	Length BC, CB (Mi)	Free Space Loss (dB)
	10	2.0	123.7	0.4		2.02	10.0	137.6
	20	2.1	124.1	0.7		4.2	10.0	137.6
	30	2.3	124.9	1.2		6.6	10.1	137.6
	40	2.6	125.9	1.7		9.5	10.1	137.7
	50	3.1	127.4	2.4		13.4	10.3	137.8
	60	4.0	129.6	3.5		19.1	10.6	138.1
13	HP4 (AB) and HP6 (CD)							
	P_{TX} (dBm) >	15 : 27			15 : 27		Fade Margin in dB	
	C_{AB}	-33.8	Off-axis angle	C_{BA}	-33.8		35.2	
	I_{CB}	-70.2	2.02 : 10	I_{DA}	-84.3			
	I_{CB}	-84.2	4.2 : 20	I_{DA}	-96.7			
	I_{CB}	-90.7	6.6 : 30	I_{DA}	-103.5			
	I_{CB}	-96.3	9.5 : 40	I_{DA}	-106.5			
	I_{CB}	-98.4	13.4 : 50	I_{DA}	-111.0			
	I_{CB}	-107.1	19.1 : 60	I_{DA}	-119.2			
		for P_A, P_B = 15 and P_C, P_D = 27						
							Fade Margin in dB	
	C_{CD}	-28.6	Off-axis angle	C_{DC}	-28.6		40.4	
	I_{AD}	-96.3	10 : 2.02	I_{BC}	-82.2			
	I_{AD}	-108.7	20 : 4.2	I_{BC}	-96.2			
	I_{AD}	-115.5	30 : 6.6	I_{BC}	-102.7			
	I_{AD}	-118.5	40 : 9.5	I_{BC}	-108.3			
	I_{AD}	-123.0	50 : 13.4	I_{BC}	-110.4			
	I_{AD}	-131.2	60 : 19.1	I_{BC}	-119.1			
	Note:	Shaded areas indicates interference threshold cases for range of off-axis angles.						

Case #		OVERVIEW OF SMALL ANTENNA PATH STUDIES					
			Table 5				
	D1 = 10 mi.	(Min. F.M. = 35 - 40 dB)		**D2 = 10 mi.**	(Min. F.M. = 35 - 40 dB)		
	ANTENNA TYPE		**XTMR**	**FADE**	**θ1, θ2**	**D3**	**FOREIGN**
	Sites	Sites	**POWER**	**MARGIN**	Off-axis	Separation	**RSL**
	A - B	C - D	A-B : C-D	A-B : C-D	Angles	Distance	(dBm)
1	**HP6-HP6**	**HP6-HP6**	**27 : 27**	**40.4 : 40.4**	**16 : 16**	**2.9 mi.**	**-103.7**
2	**HP8-HP8**	**HP8-HP8**	**23 : 23**	**41.2 : 41.2**	**12.5:12.5**	**2.2 mi.**	**-103.2**
(3)	HP4-HP4	HP4-HP4	27 : 27	33.2 : 33.2	20 : 20.0	3.6 mi.	-108.3
(4)	New A-New A	HP4-HP4	27 : 27	19.4 : 33.2	15 : 15	2.7 mi.	-104.0
(5)	New A-New A	HP6-HP6	27 : 23	19.4 : 36.4	15 : 15	2.7 mi.	-103.4
(6)	HP6-New A	HP6-HP6	27 : 27	29.9 : 40.4	16 : 16	2.9 mi.	-103.7
(7)	HP8-New A	HP6-HP6	27 : 27	32.3 : 40.4	16 : 16	2.9 mi.	-103.4
	D1 = 5 mi.	(Min. F.M. = 24 - 28 dB)		**D2 = 10 mi.**	(Min. F.M. = 35 - 40 dB)		
	ANTENNA TYPE		**XTMR**	**FADE**	**θ1, θ2**	**D3**	**FOREIGN**
	Sites	Sites	**POWER**	**MARGIN**	Off-axis	Separation	**RSL**
	A - B	C - D	A-B : C-D	A-B : C-D	Angles	Distance	(dBm)
(8)	New A-New A	HP4-HP4	27 : 27	25.4 : 33.2	15.5 : 29	2.8	-104.0
9	New A-New A	HP6-HP6	27 : 23	25.4 : 36.4	15.5 : 29	2.8	-103.9
10	**HP4-HP4**	**HP6-HP6**	**23 : 27**	**35.2 : 40.4**	**16.1 : 30**	**2.9**	**-102.5**
(11)	HP4-New A	HP4-HP4	23 : 27	28.3 : 33.2	15.0 : 28.2	2.7	-103.6
12	HP4-New A	HP6-HP6	23 : 27	28.3 : 40.4	15 : 28.2	2.7	-103.4
	D1 = 2 mi.	(Min. F.M. = 15 dB)		**D2 = 10 mi.**	(Min. F.M. = 35 - 40 dB)		
	ANTENNA TYPE		**XTMR**	**FADE**	**θ1, θ2**	**D3**	**FOREIGN**
	Sites	Sites	**POWER**	**MARGIN**	Off-axis	Separation	**RSL**
	A - B	C - D	A-B : C-D	A-B : C-D	Angles	Distance	(dBm)
13	**HP4-HP4**	**HP6-HP6**	**15 : 27**	**35.2 : 40.4**	**16.5 : 56**	**3**	**-103.6**
14	HP4-HP4	HP6-HP6	15 : 23	35.2 : 36.4	13.9 : 51	2.5	-103.2
(15)	New A-New A	HP4-HP4	15 : 27	21.4 : 33.2	15 : 53.2	2.7	-104.0
(16)	New A-New A	HP4-HP4	23 : 27	29.4 : 33.2	15 : 53.2	2.7	-104.0
17	New A-New A	HP6-HP6	15 : 27	21.4 : 40.4	15 : 53.2	2.7	-103.4
18	New A-New A	HP6-HP6	15 : 23	21.4 : 36.4	10.2 : 42	1.8	-103.2
19	New A-New A	HP6-HP6	23 : 23	29.4 : 36.4	10.2 : 42	1.8	-103.2
	D1 = 2 mi.	(Min. F.M. = 15 dB)		**D2 = 2 mi.**	(Min. F.M. = 15 dB)		
	ANTENNA TYPE		**XTMR**	**FADE**	**θ1, θ2**	**D3**	**FOREIGN**
	Sites	Sites	**POWER**	**MARGIN**	Off-axis	Separation	**RSL**
	A - B	C - D	A-B : C-D	A-B : C-D	Angles	Distance	(dBm)
20	New A-New A	HP4-HP4	15 : 15	21.4 : 35.2	20.0 : 20	0.7	-109.2
21	New A-New A	New A-New A	15 : 15	21.4 : 21.4	15 : 15	0.5	-103.9
22	**HP4-HP4**	**HP4-HP4**	**15 : 15**	**35.2 : 35.2**	**20.0 : 20**	**0.7**	**-106.3**
Key							
#	**Bold # and font indicates control case study.**						
#	Regular font indicates viable path with New A antenna at one or more sites.						
(#)	Indicates case not meeting minimum fade margin requirement on one or both paths.						

Path Study Configuration (1 of 2)
Small Antenna Comparison
11 GHz Band

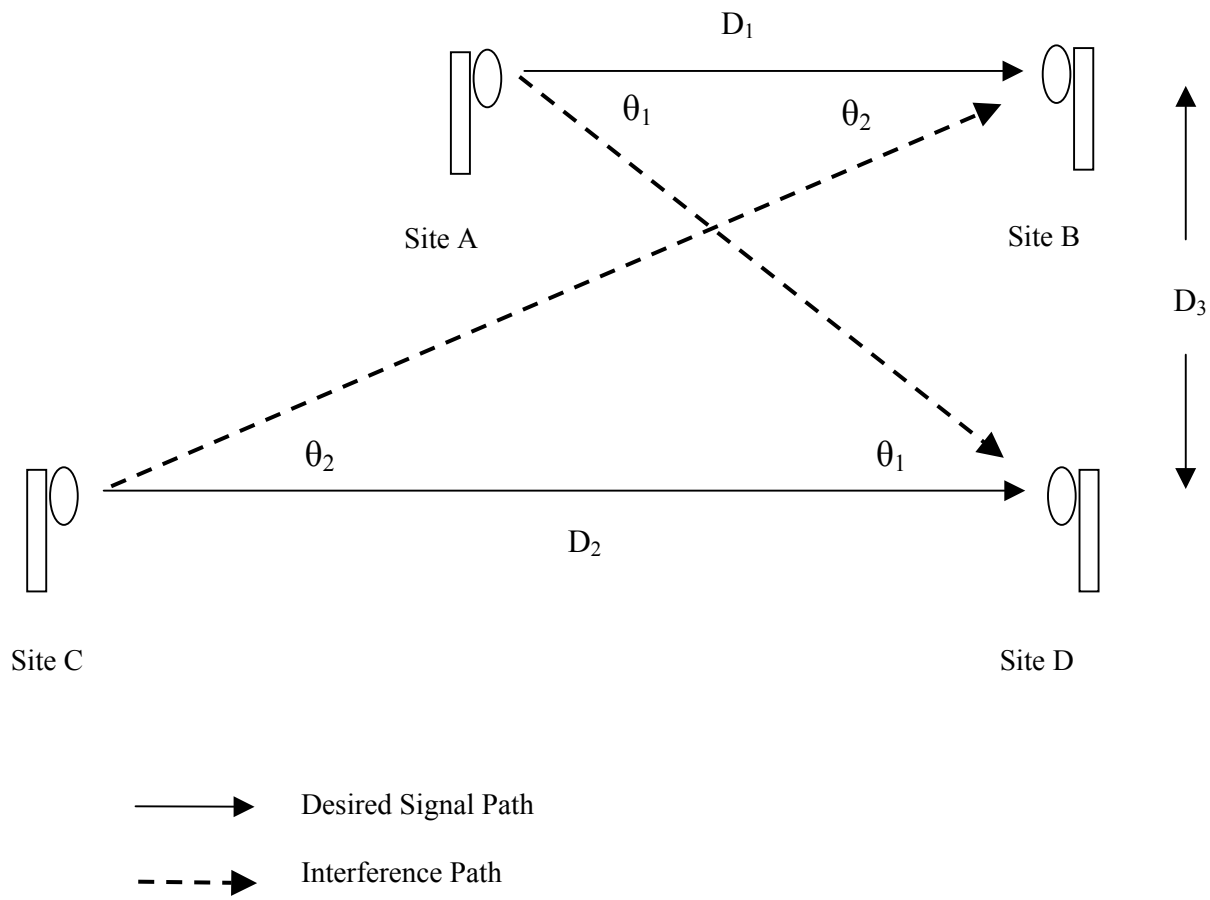

Figure 2.1 Path Study Configuration for I_{AD} and I_{CB}

$$C_{AB} = P_A - L_A + G_A - FSL_{AB} + G_B - L_B \qquad \text{Eq. 1}$$

$$I_{CB} = P_C - L_C + G_{C\theta 2} - FSL_{CB} + G_{B\theta 2} - L_B \qquad \text{Eq. 2}$$

$$C_{CD} = P_C - L_C + G_C - FSL_{CD} + G_D - L_D \qquad \text{Eq. 3}$$

$$I_{AD} = P_A - L_A + G_{A\theta 1} - FSL_{AD} + G_{D\theta 1} - L_D \qquad \text{Eq. 4}$$

Path Study Configuration (2 of 2)

Small Antenna Comparison
11 GHz Band

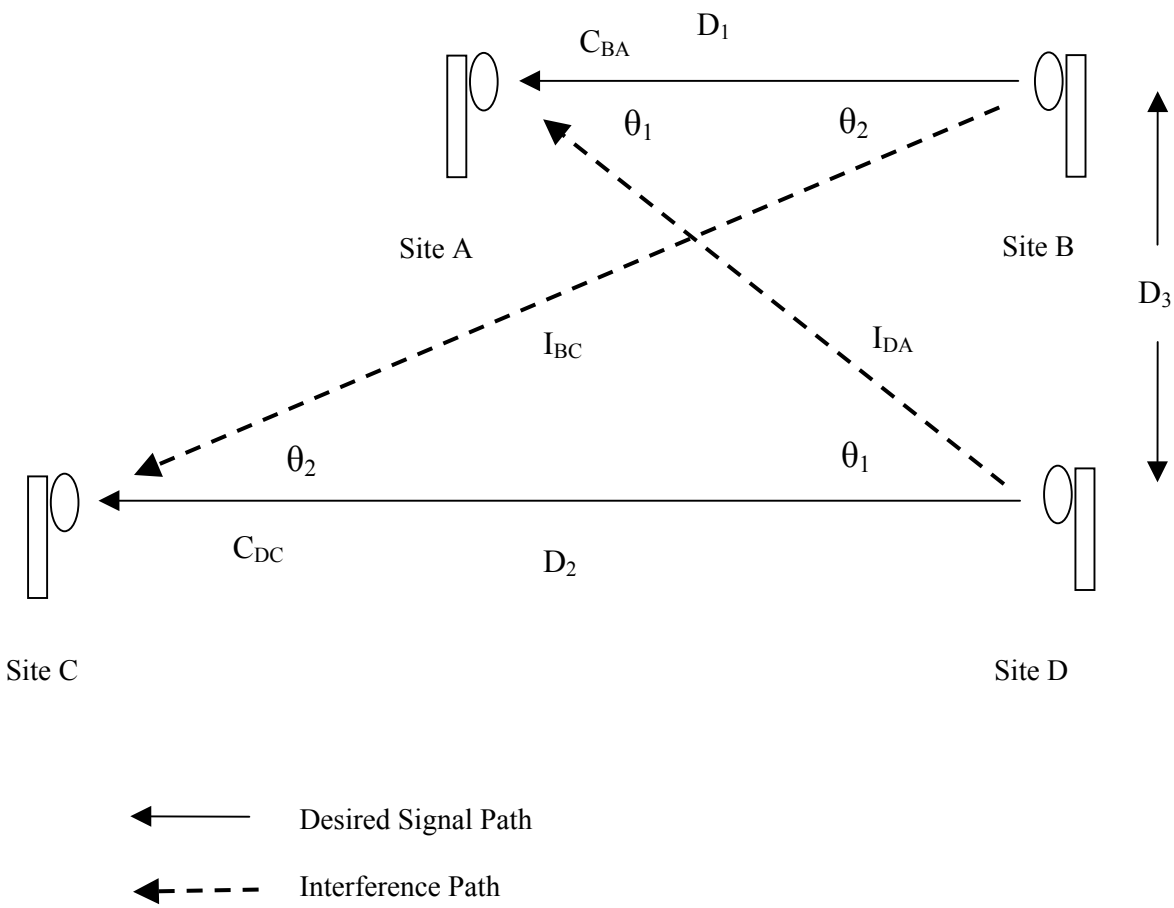

Figure 2.2 Path Study Configuration for I_{DA} and I_{BC}

$$C_{BA} = P_B - L_B + G_B - FSL_{BA} + G_A - L_A \qquad \text{Eq. 5}$$

$$I_{DA} = P_D - L_D + G_{D\theta 1} - FSL_{DA} + G_{A\theta 1} - L_A \qquad \text{Eq. 6}$$

$$C_{DC} = P_D - L_D + G_D - FSL_{DC} + G_C - L_C \qquad \text{Eq. 7}$$

$$I_{BC} = P_B - L_B + G_{B\theta 2} - FSL_{BC} + G_{C\theta 2} - L_C \qquad \text{Eq. 8}$$

Small Antenna Comparison
11 GHz Band

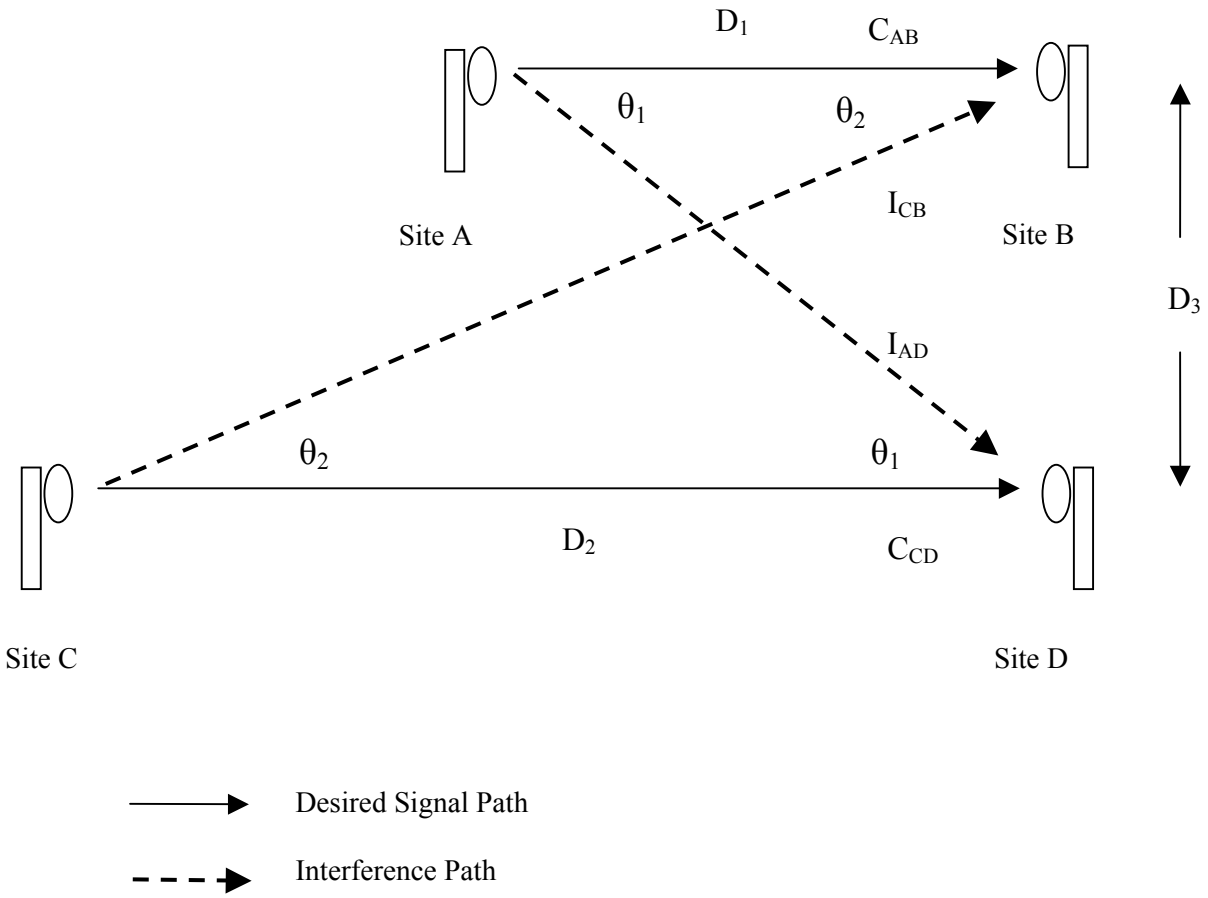

Figure 3. Example of Path Geometry

Table of Off-Axis Angles for Parallel Terrestrial Paths
5 Mi. **:** 10 Mi. Path Configuration

Off-Axis Angle θ_1 : θ_2
10° : 5.04°
20° : 10.3°
30° : 16.1°
40° : 22.8°
50° : 30.8°
60° : 40.9°

Interference Path Calculations

Small Antenna Comparison
11 GHz Band

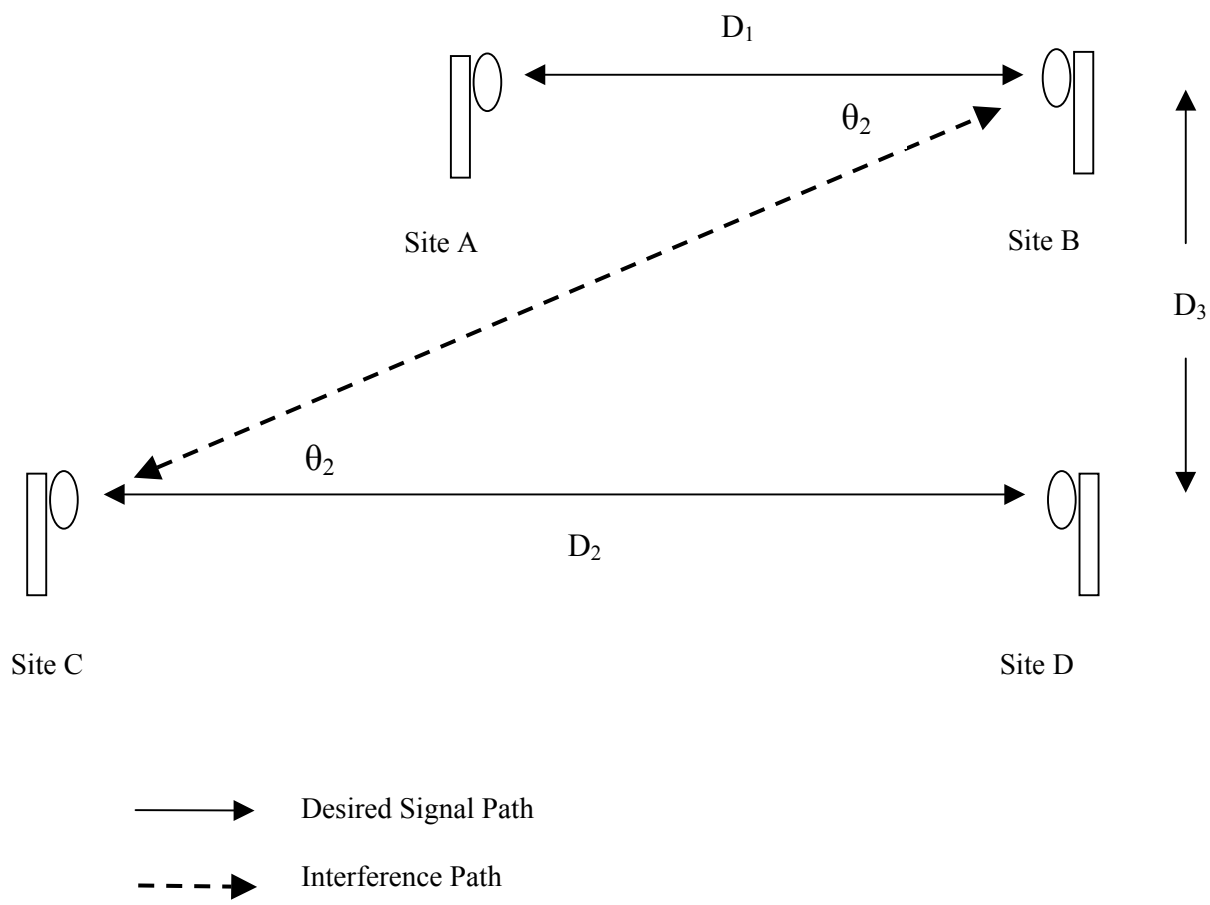

Figure 4.1 Interference Path Calculations for Mutual Interference Case

$$I_{CB} = P_C - L_C + G_{C\theta 2} - FSL_{CB} + G_{B\theta 2} - L_B \qquad \text{Eq. 2}$$

$$I_{BC} = P_B - L_B + G_{B\theta 2} - FSL_{BC} + G_{C\theta 2} - L_C \qquad \text{Eq. 8}$$

Note: The above equations apply whether Site C is a terrestrial station or an earth station. (See also Figure 4.2) The respective off-axis antenna gains are used to calculate the level of interference into the foreign station.

Interference Path Calculations
Small Antenna Comparison
11 GHz Band

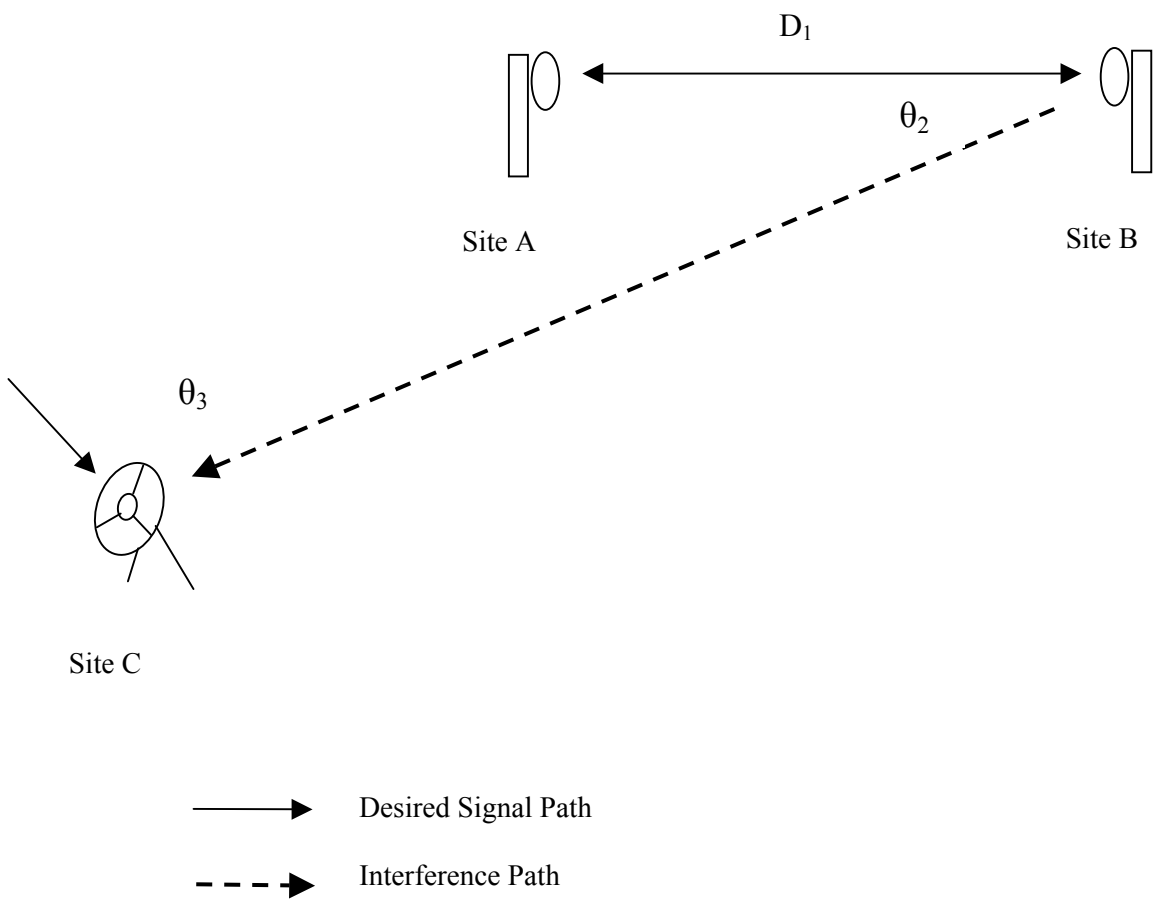

Figure 4.2 Interference Path Calculation for Earth Station Interference Case

$$I_{BC} = P_B - L_B + G_{B\theta 2} - FSL_{BC} + G_{C\theta 3} - L_C \qquad \text{Eq. 8}$$

Note: The above equation applys whether Site C is a terrestrial station or an earth station. The respective off-axis antenna gains are used to calculate the level of interference into the foreign station. The off-axis antenna gain for the earth station is designated as $G_{C\theta 3}$.

Andrew Model PL4-107 Microwave Dish Antenna Pattern
with
FCC Category B and Proposed Category A

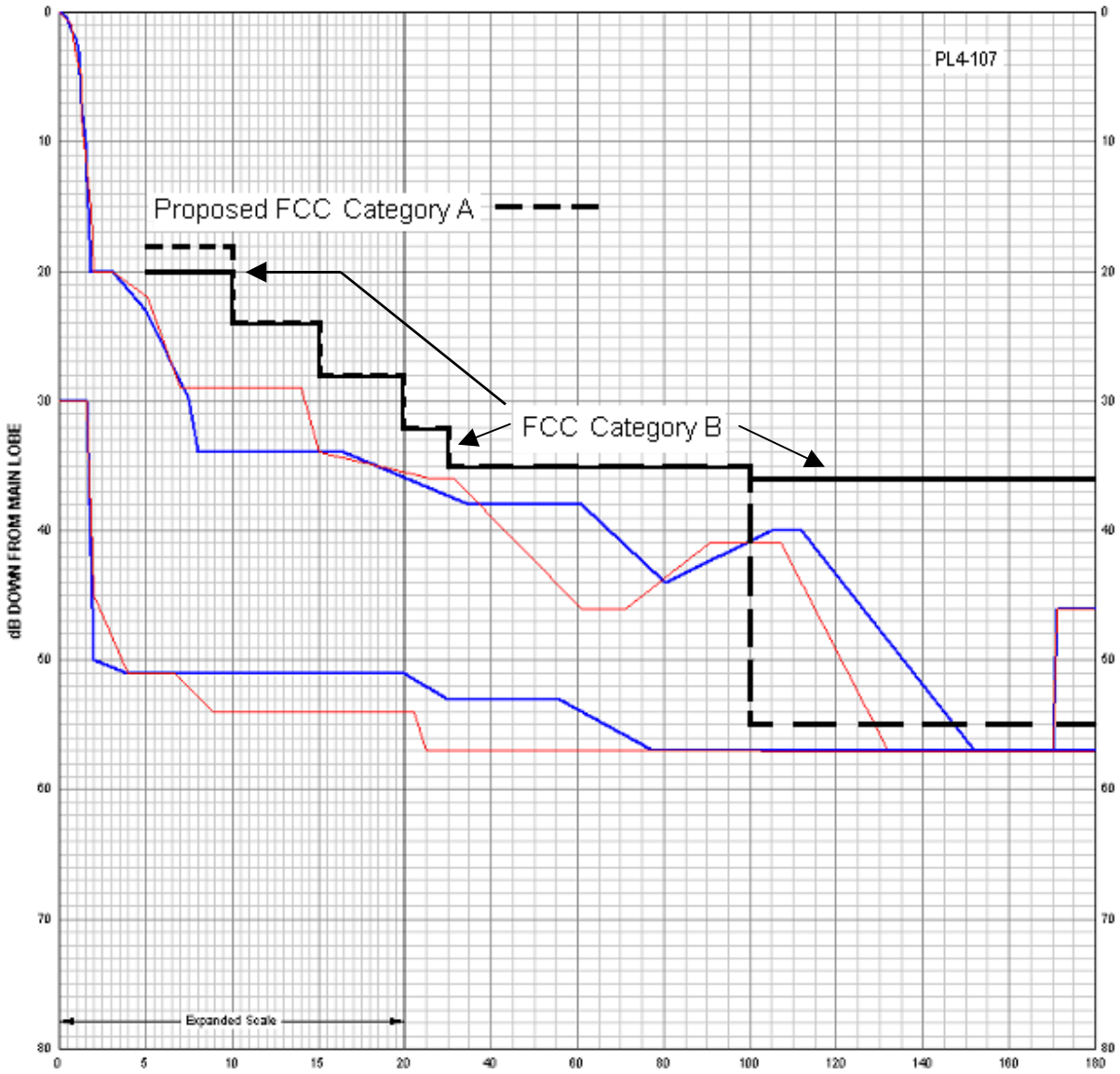

Figure 5. Proposed Alternate Category A Radiation Suppression

Andrew Model PL4-107 Microwave Dish Antenna Pattern
with
FCC Category B and Proposed Category B

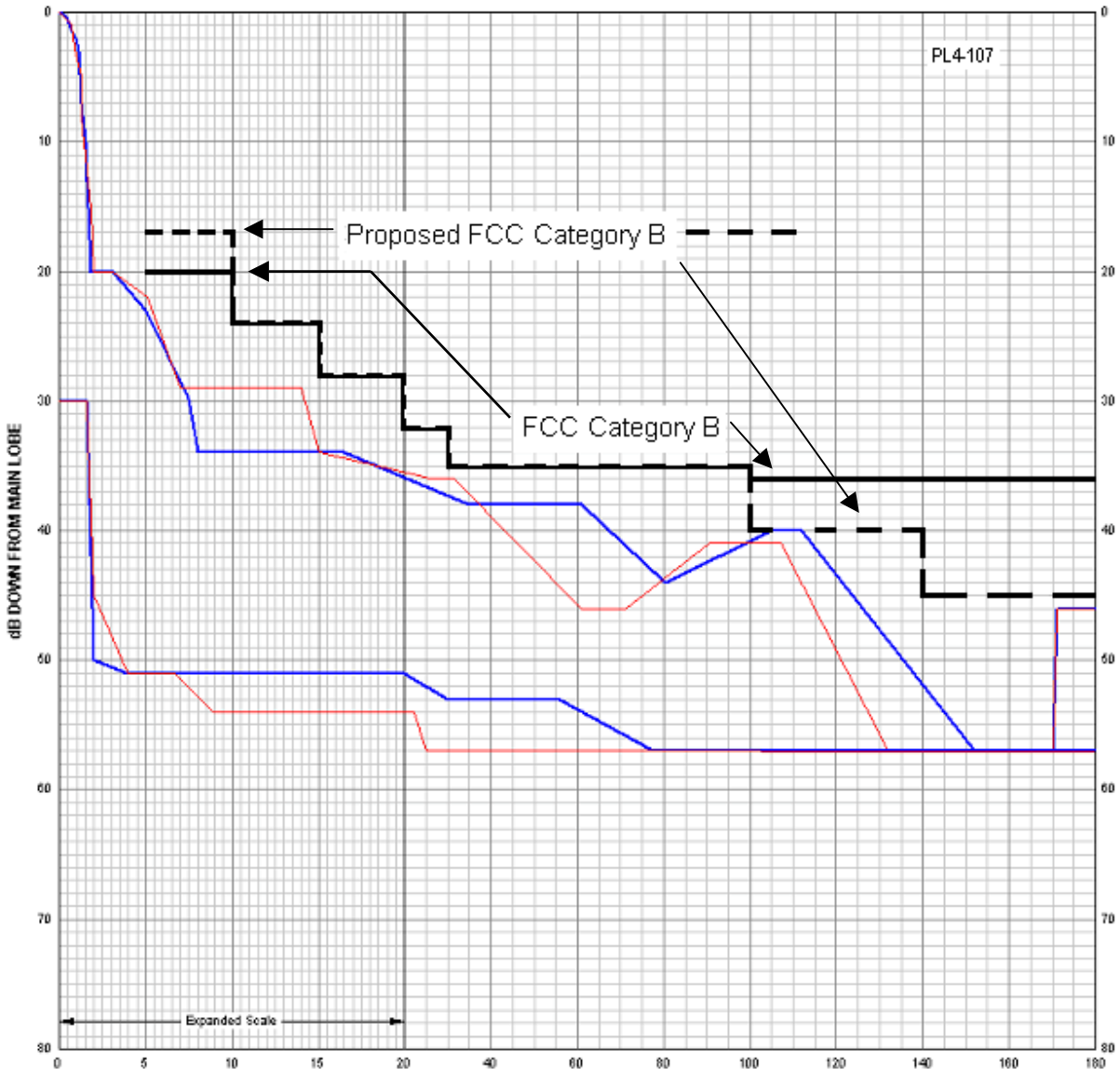

Figure 6. Proposed Alternate Category B Radiation Suppression

CERTIFICATE OF SERVICE

I, Deborah N. Lunt, a secretary with the law firm of Fletcher, Heald & Hildreth, PLC, state that true copies of the foregoing Reply Comments of Alcatel have been served by first class mail, postage prepaid, this 7th day of September, 2004, to the people listed on the attached Service List.

Deborah N. Lunt

*Denotes those served by hand delivery.

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