Table R-A-6 (Rev 1)

SV-Gateway Links

Item		Downlink		Uplink	
		Rain	Clear	Rain	Clear
Range	km	2326.0	2326.0	2326.0	2326.0
Transmitter					
Power	dBW	0.0	-9.7	13.0	-11.8
Antenna Gain	dB	26.9	26.9	56.3	56.3
Circuit Loss	dB	-3.2	-3.2	-1.0	-1.0
Pointing Loss	dB	-0.5	-0.5	-0.3	-0.3
EIRP	dBWi	23.2	13.5	68.0	43.2
System					
Margin	dB	3.2	3.2	2.1	2.1
Space Loss	dB	-185.8	-185.8	-189.1	-189.1
Propagation Loss	dB	-14.2	-1.5	-30.0	-1.5
Polarization Loss	dB	-0.2	-0.2	-0.2	-0.2
Total Prop. Loss	dB	-203.4	-190.7	-221.4	-192.9
Receiver					
Rec. Sig. Strength	dBWi	-180.2	-177.2	-153.4	-149.7
Pointing Loss	dB	-0.2	-0.2	-0.8	-0.8
Antenna Gain	dB	53.2	53.2	30.1	30.1
Received Signal	dBW	-127.2	-124.2	-124.1	-120.4
Ts	K	731.4	731.4	1295.4	1295.4
Noise Density	dBW/Hz	-200.0	-200.0	-197.5	-197.5
Noise Bandwidth	dBHz	64.9	64.9	64.9	64.9
Noise	dBW	-135.1	-135.1	-132.6	-132.6
Link Eb/No	dB	7.9	10.9	8.5	12.2
Eb/Io	dB	25.0	25.0	16.0	16.0
Computed Eb/(No + Io)	dB	7.8	10.7	7.8	10.7
Required Eb/(No + Io)	dB	7.7	7.7	7.7	7.7
Excess Margin	dB	0.1	3.0	0.1	3.0
SPFD at GW	dBW/ m^2/ 1mhz	-134.3	-131.3		

An Examination of IRIDIUM Orbits and Gateway Elevation Angle– Impact on System Availability in the Presence of LMDS Subscriber Transmitters

November 17, 1995

This brief paper summarizes the elevation angles expected at the IRIDIUM gateway from the earth station to the IRIDIUM satellite. This elevation angle is of interest in determining the potential for LMDS subscriber transmitter interference into the IRIDIUM satellite uplink receiver. The law of sines for spherical triangles is the fundamental analytical basis applied herein.

Separation between the earth station and the satellite:

Assumptions:

- Gateway site is at mid-CONUS latitude (40 degrees North)
- Spacing of orbit planes is 31.6 degrees (actually one of six planes is at 22 degrees, so this is worst case)
- Inclination angle is 90 degrees (actual inclination angle is 86.5 degrees, but difference is trivial at assumed latitude)

With these assumptions, the great-circle angular separation of orbit planes is 24.1 degrees at 40 degrees North latitude.

Elevation angle between the earth station and the satellite:

Given the 24.1 degree angular separation between adjacent orbits, we can now examine the worst-case elevation angle between the earth station and the satellite.

Since the separation between satellites in a given orbit plane is about 32.7 degrees (11 satellites per orbit plane), the maximum angular separation between a gateway and satellite when they are co-longitude is one half of 32.7 degrees, or 16.35 degrees. Given this, and the orbit altitude of 780 km for the satellites, the worst case elevation angle to the satellite for co-latitude situations is 13.6 degrees.

For gateway positions between orbits, the worst case (lowest) elevation angle to the satellite occurs on a constant-latitude line halfway between the positions of the two adjacent satellites. For this situation at 40 degrees North latitude, the worst case elevation angle to the satellite is 11.9 degrees.

Further analysis which considers all possible positions of the satellite constellation relative to the gateway shows the following:

Percentage of Time	Elevation Angle (θ) to Nearest Satellite (deg.)
worst 2 %	$11.9 < \theta < 13.6$
10 %	$13.6 < \theta < 15.8$
best 88 %	$\theta > 15.8$

This indicates that the elevation angle to the satellite is never below 11.9 degrees, and is only below 13.6 degrees two percent of the time. Moreover, the elevation angle to the satellite is above 15.8 degrees 88 percent of the time.

Impact on IRIDIUM Availability in the Presence of LMDS Transmitters:

As Motorola has stated, the IRIDIUM system is designed for operation of gateway feeder links at elevation angles of ten degrees or above. Further, Motorola has indicated concern about LMDS transmitters causing degradation of system availability if interference from LMDS consumes IRIDIUM power margins intended for compensation "rain and range." The availability of the IRIDIUM feeder links has not been disclosed. However, it is not necessary to know the availability to consider the impact of gateway operation at minimum elevation angles of 11.9 degrees since we know the system availability is acceptable at elevation angles of 10 degrees.

At an elevation angle of ten degrees, the range to the satellite is 2325 km. The minimum range to the satellite (at zenith) is 780 km. Thus, the power dynamic range of the system consumed by compensation for range to the satellite is 20 log(2325/7680) = 9.5 dB.

Since the total power dynamic range of the uplink transmitter is +12 dBW - (-22.3 dBW) = 34.3 dB (from Motorola system summary table dated 8/5/94), the remaining 24.8 dB after the range compensation value is subtracted is for rain compensation at 10 degrees elevation.

For a slant path through rain at an elevation angle of 11.9 degrees, the length of the path through rain is 84 percent of the length of the path through rain at 10 degrees elevation. Consequently, 16 percent of the power margin is "excess." In other words, with only 0.84 X 24.8 dB = 20.8 dB for needed for rain compensation, operation at 11.9 degrees produces the same gateway link availability as the system has at 10 degrees elevation with 24.8 dB for rain compensation. Thus, 4.0 dB of the system power margin is available for compensation of other link degradation effects. That is, at full power, the link C/(N+I) is 4 dB larger than Motorola requires.

This does not even account for the additional "free-space" margin at the higher elevation angle, which would produce additional margin. Likewise, earth curvature is not considered, which would also produce an additional, although small, margin as the elevation angle increases from 10 degrees to 11.9 degrees. At 40 degrees north elevation, the freezing-point isotherm in the atmosphere is at about 4 km altitude for an assumed 99.99% availability. This isotherm level yields a slant path range through the rain of 19.4 km for the 11.9 degree elevation angle--short enough that earth curvature need not be considered.

Result:

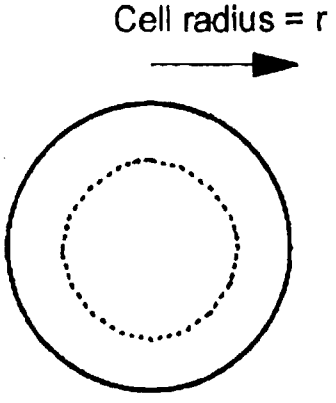
Since the "extra" 4 dB of margin is not needed to compensate for rain loss or range, the interference-to-noise can be as high as + 0.6 dB (as opposed to the -13 dB value cited by Motorola for system operation at a minimum elevation angle of 10 degrees). Viewed another way, when the interference is 0.6 dB higher than the interference (as opposed to 13 dB below the interference level with an I/N of -13 dB), the combined noise and interference would be 4 dB above the -197.5 dBW/Hz noise level in the satellite receiver. Then, with the "extra" 4 dB of margin derived from operating at or above an elevation angle of 11.9 degrees, which is **not needed** for rain or range compensation, the desired operating point for the Motorola satellite receiver is maintained.

Conclusion:

For gateway operation at a mid-CONUS latitude, I/N of +0.6 dB against LMDS interference is sufficient to produce the gateway link availability that Motorola states it needs. This conclusion is based on consideration of gateway elevation angle, levels of potential interference from LMDS, and the availability design of IRIDIUM to get a true picture of LMDS impact on IRIDIUM feeder link operations.

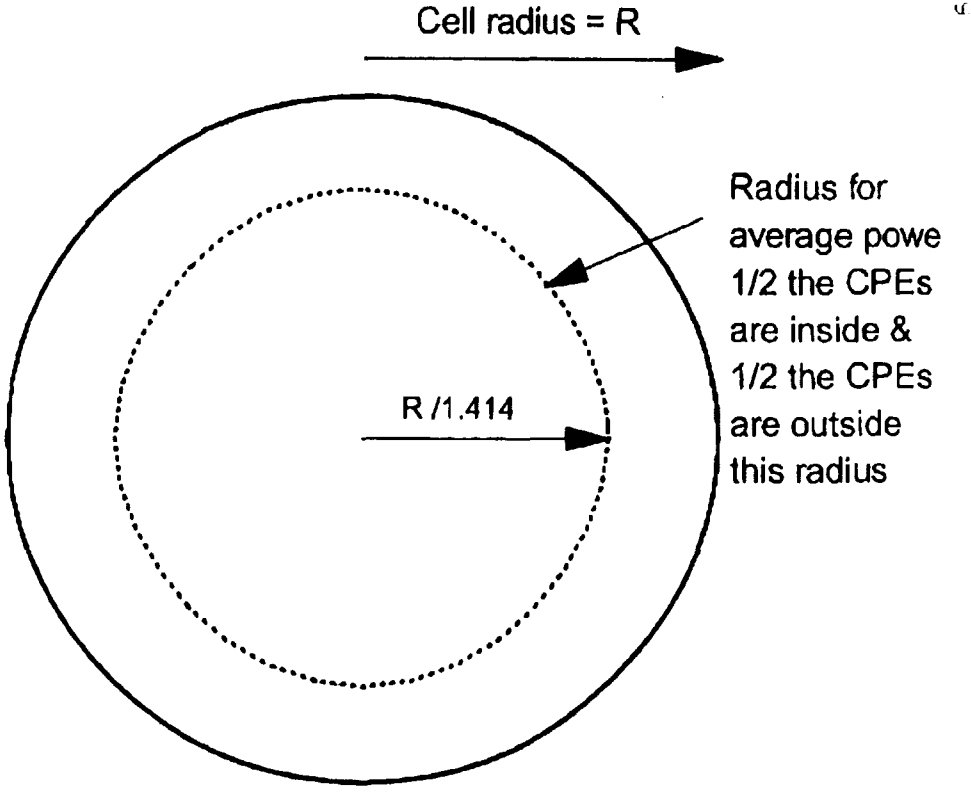
Total power spectral density is dependent only on Maximum EIRP (EIRP at the cell periphery) assuming uniform housing density

Small Cell Case



Cell Area = a = $(r/R)^2$ x A
Max EIRP = P
Avg EIRP = P/2 (assuming adaptive pwr control)
PSD/Cell = h x a x P/2
Number of cells to achieve same coverage
as large cell = A/a
Total PSD = h x a x (P/2) x (A/a)
= h x (P/2) x A
where h = housing density in households/sq-km

Large Cell Case

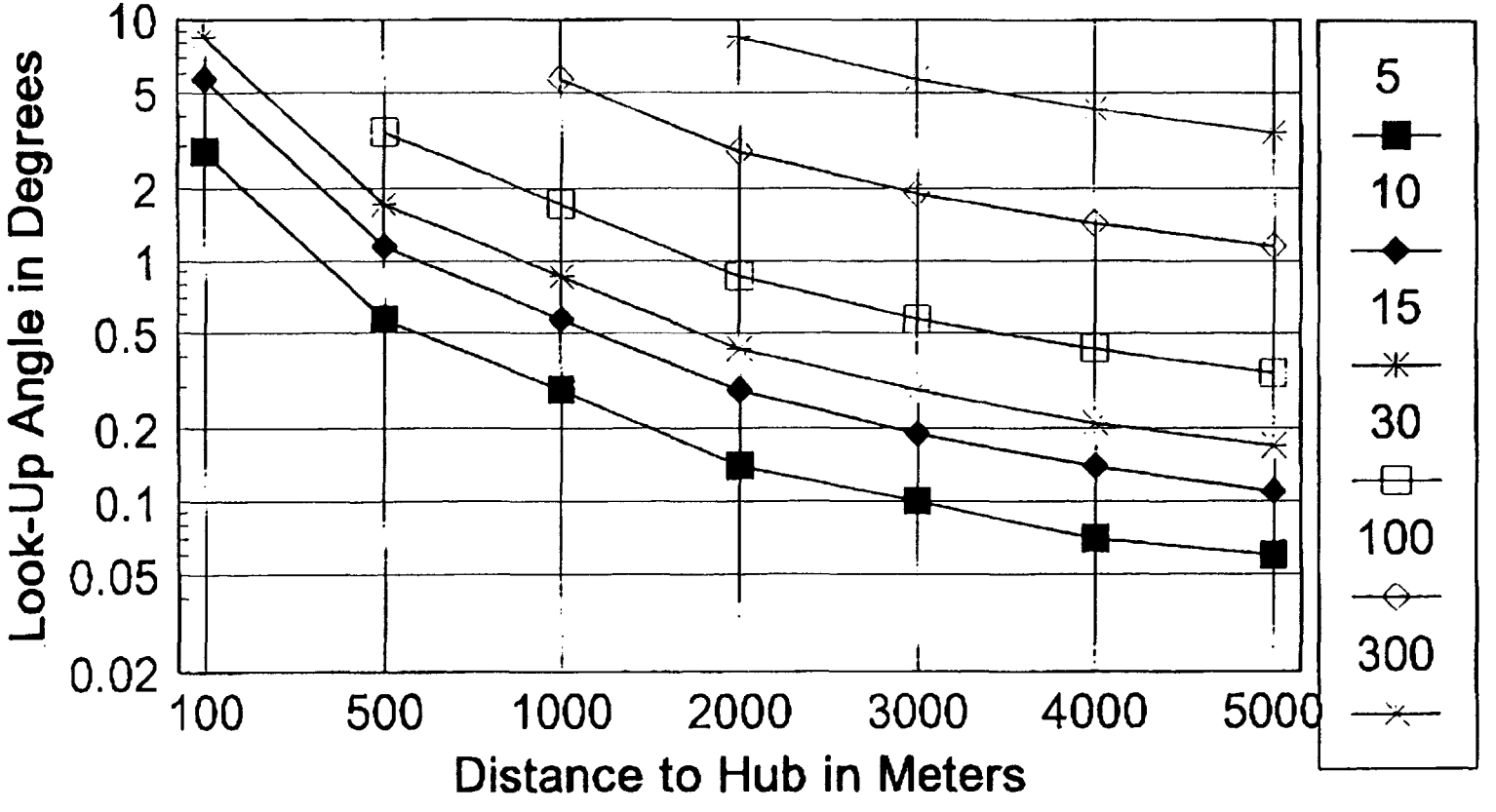


Cell Area = a = A
Max EIRP = P
Avg EIRP = P/2 (assuming adaptive pwr control)
PSD/Cell = h x A x P/2
where h = housing density in households/sq-km

D.Gray/Oct 29, 1995

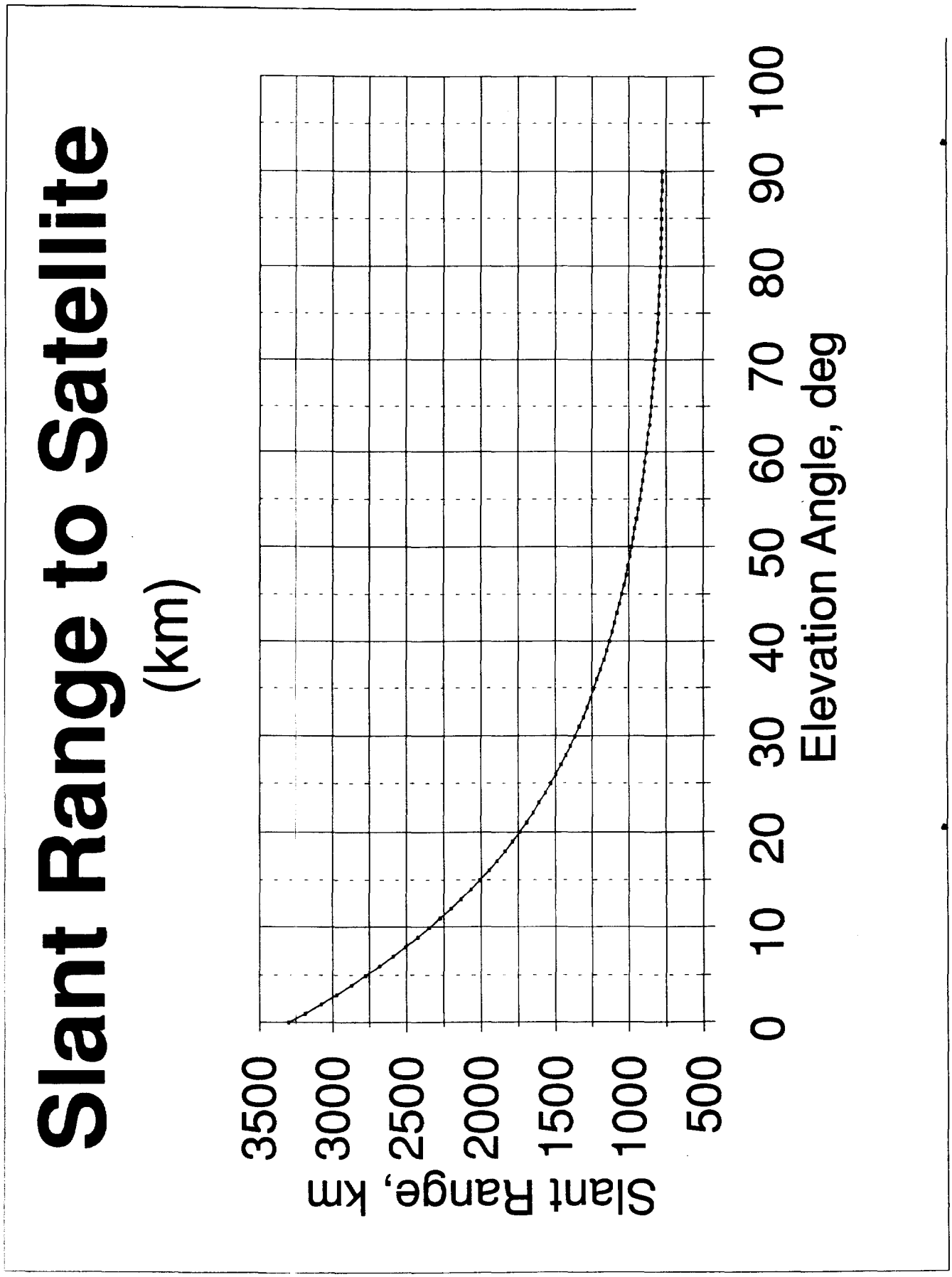
Look-Up Angle vs. Hub Antenna Height

Height in Meters above CPE Antenna



D.Gray/Oct 29, 1995

ATTACHMENT G


Slant Range to Satellite
(km)
Slant Range, km
3500
3000
2500
2000
1500
1000
500
0
10
20
30
40
50
60
70
80
90
100
Elevation Angle, deg

(km)R = 6600
(km)h = 780

Elevation Angle, deg	Sat Angle, deg B	Slant Range, km a	Smax/S, dB
0	63.4198	3302.1811	0
1	63.4024	3189.0035	0.30
2	63.3501	3079.8680	0.61
3	63.2633	2974.7804	0.91
4	63.1422	2873.7281	1.21
5	62.9873	2776.6801	1.51
6	62.7992	2683.5889	1.80
7	62.5785	2594.3914	2.10
8	62.3261	2509.0106	2.39
9	62.0429	2427.3575	2.67
10	61.7296	2349.3325	2.96
11	61.3874	2274.8275	3.24
12	61.0173	2203.7275	3.51
13	60.6203	2135.9122	3.78
14	60.1975	2071.2579	4.05
15	59.7501	2009.6387	4.31
16	59.2790	1950.9277	4.57
17	58.7854	1894.9986	4.82
18	58.2703	1841.7260	5.07
19	57.7347	1790.9869	5.31
20	57.1798	1742.6611	5.55
21	56.6064	1696.6314	5.78
22	56.0155	1652.7849	6.01
23	55.4080	1611.0123	6.23
24	54.7848	1571.2091	6.45
25	54.1467	1533.2750	6.66
26	53.4945	1497.1141	6.87
27	52.8289	1462.6354	7.07
28	52.1508	1429.7521	7.27
29	51.4606	1398.3820	7.46
30	50.7592	1368.4473	7.65
31	50.0471	1339.8741	7.83
32	49.3248	1312.5928	8.01
33	48.5930	1286.5376	8.19
34	47.8522	1261.6463	8.36
35	47.1027	1237.8606	8.52
36	46.3451	1215.1251	8.68
37	45.5799	1193.3881	8.84
38	44.8073	1172.6004	8.99
39	44.0279	1152.7160	9.14
40	43.2419	1133.6917	9.29
41	42.4498	1115.4865	9.43
42	41.6517	1098.0621	9.56
43	40.8481	1081.3823	9.70
44	40.0392	1065.4131	9.83
45	39.2253	1050.1224	9.95
46	38.4067	1035.4803	10.07
47	37.5835	1021.4582	10.19
48	36.7561	1008.0294	10.31
49	35.9246	995.1690	10.42
50	35.0892	982.8530	10.53
51	34.2501	971.0593	10.63
52	33.4076	959.7669	10.73
53	32.5618	948.9559	10.83
54	31.7128	938.6078	10.93
55	30.8608	928.7049	11.02
56	30.0060	919.2308	11.11
57	29.1485	910.1698	11.19
58	28.2885	901.5073	11.28
59	27.4260	893.2294	11.36
60	26.5613	885.3232	11.43
61	25.6943	877.7762	11.51
62	24.8253	870.5770	11.58
63	23.9543	863.7148	11.65
64	23.0814	857.1792	11.71
65	22.2068	850.9607	11.78
66	21.3306	845.0501	11.84
67	20.4527	839.4391	11.90
68	19.5734	834.1195	11.95
69	18.6927	829.0840	12.00
70	17.8106	824.3256	12.05
71	16.9273	819.8376	12.10
72	16.0429	815.6140	12.15
73	15.1573	811.6490	12.19
74	14.2708	807.9373	12.23
75	13.3833	804.4740	12.27
76	12.4949	801.2546	12.30
77	11.6057	798.2747	12.33
78	10.7158	795.5305	12.36
79	9.8252	793.0186	12.39
80	8.9339	790.7356	12.42
81	8.0421	788.6786	12.44
82	7.1498	786.8450	12.46
83	6.2570	785.2325	12.48
84	5.3639	783.8391	12.49
85	4.4704	782.6630	12.50
86	3.5767	781.7027	12.52
87	2.6827	780.9571	12.52
88	1.7885	780.4252	12.53
89	0.8943	780.1063	12.53
90	0.0009	780.0000	12.53

Effects of 5% Interference Allocation

The noise temperature for Iridium satellite receiver is stated to be 1295 degrees K. The interference criteria is 5% for single service or 10% for all services (WG2/6). The required Eb/(No+Io) is 7.7 dB. These values together with the information data rate were used to calculate the receiver sensitivity.

Allowable interference based on 5 and 10% noise temperature contribution.

Parameter	Units	No Interference	5% Interference	10% Interference
Noise Temperature	degrees K	1295	1295	1295
Interference (Io)	degrees K	0	65 (-210 dBW)	129 (-207.5 dBW)
Total No+Io	degrees K	1295	1360	1424
10LOG(KT)	dB	-197.5	-197.3	-197.1
Required Eb/(No + Io)	dB	7.7	7.7	7.7
Receiver Sensitivity (Eb)	dBW/Hz	-189.8	-189.6	-189.4

The signal degradation due to 5% added system temperature is 0.2 dB. Figure 1 indicates how increased signal power compensates for increased interference. The bit error rate requirement for Eb/(No+Io)= 7.7 dB is held constant.

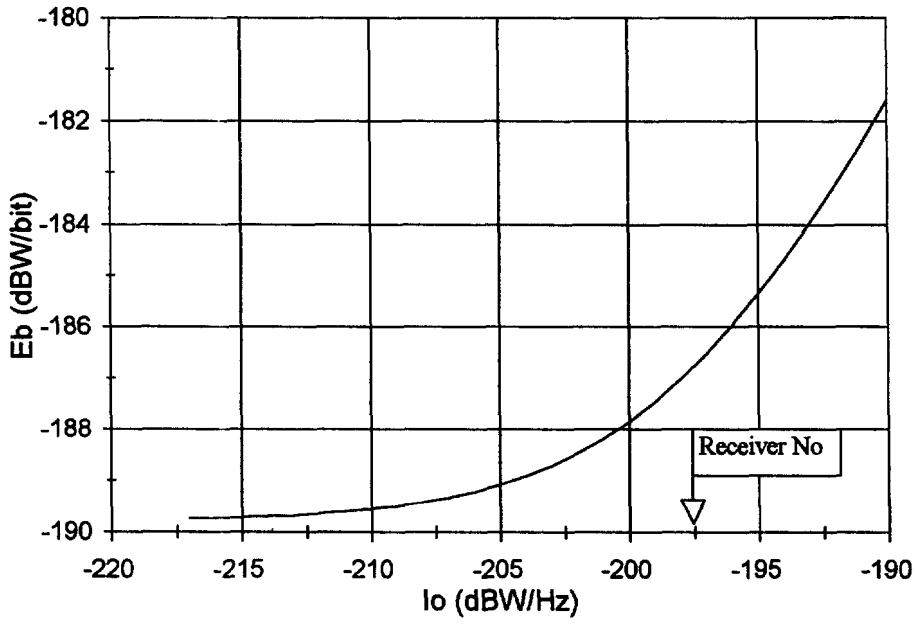


Figure 1 Required Signal Level VS Interference for Eb/(No+Io)=7.7 dB

Summary:

- An interference of -210 dBW/Hz (5% of Ts) results in a 0.2 dB power change.
- An interference of -207 dBW/Hz (10% of Ts) results in 0.4 dB power change.
- An interference of -200 dBW/Hz (10 dB increase in interference) results in 1.7 dB power change.

Conclusions:

- Only 1.7 dB power increase returns satellite to design criteria for interference levels of up to -200 dBW/Hz

- The 30 dB interference problem proposed by Motorola 2 November 1995 does not exist.

Effect of Satellite Power Control at Minimum Range (Overhead)

Aggregrate sidelobe power from LMDS CPE transmissions is small when the satellite is at short range because the satellite footprint size is smaller at higher satellite elevations. At minimum range, the footprint is 75 km x 75 km for an area of 5625 sq-km. Compared to the maximum footprint area of 800,000 sq-km, this represents an area reduction of 0.007 which reduces the number of subscribers accordingly. The equivalent CPE sidelobe energy is reduced -21.5 dB. Satellite power would be reduced from maximum range of 2747 km to 780 km, or -10.9 dB. Therefore, return link sidelobe energy is reduced more than the satellite uplink power is reduced by power control.

Main beam coupling would occur if CPE antenna is mispointed and temporarily aligns with the satellite main beam. At minimum range, the satellite uplink is at minimum power. Table A shows the satellite link with a 3 dB margin at minimum range. An LMDS CPE transmission main beam is compared in the last column. The increase in No+Io is from -197.1 dBW/Hz to -196.4 dBW/Hz, or an increase of 0.7 dB. With a normal margin of 3 dB, this would require 0.2 dB additional uplink power.

Table A

Parameters	Units	Elev 90 deg Iridium Clear	Elev 90 deg LMDS Clear
Frequency	GHz	29.2	29.2
Transmit Power	dBW	-26.8	-14.0
Antenna Gain	dB	56.3	34
Losses	dB	-1.3	
EIRP	dBWi	28.2	20.0
Range	Km	780	780
Space Loss	dB	-179.5	-179.5
Propagation Loss	dB	-0.2	-0.2
Polarization Loss	dB	-0.2	-3
TOTAL LOSS	dB	-179.9	-182.7
Receive Sig Strength	dBW	-151.7	-162.7
Pointing Loss	dB	-0.8	-0.8
Antenna Gain	dB	31.1	31.1
RECEIVED SIG POWER	dBW	-121.4	-132.4
Received Eb (3.125 Mbps)	dBW/bit	-186.3	
Received Io (2.5 MHz)	dBW/Hz		-196.4
Tn	deg K	1295	1295
Io (degrees)	deg K	129	1649
No + Io (Power Density)	dBW/Hz	-197.1	-193.9
Match BW (3.125 Mbps)	dB	64.9	64.9
No+Io IN SV MATCHED BW	dBW/Hz	-132.1	-129.0
Link Eb/(No+Io)	dB	10.7	7.5
Required Eb/(No+Io)	dB	7.7	7.7
SV Margin	dB	3.0	-0.2

Conclusions

- The aggregate sidelobe power from CPE return link transmissions reduce more than the SV power during power control at minimum range.

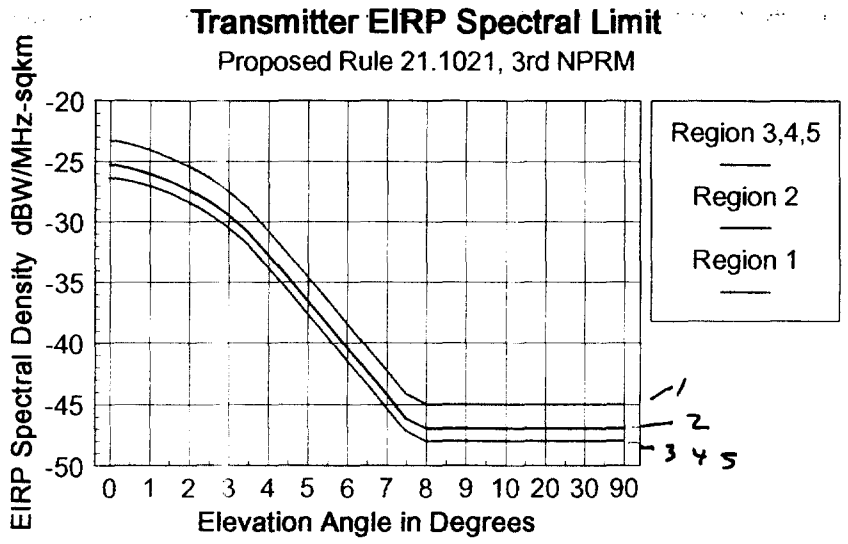
- At 90 degrees elevation, a CPE transmitter with maximum rule power increase that results in main beam coupling only has 0.2 dB Eb/(no+Io) and does not significantly degrade satellite bit error performance, 1E-7 to 2E-7.

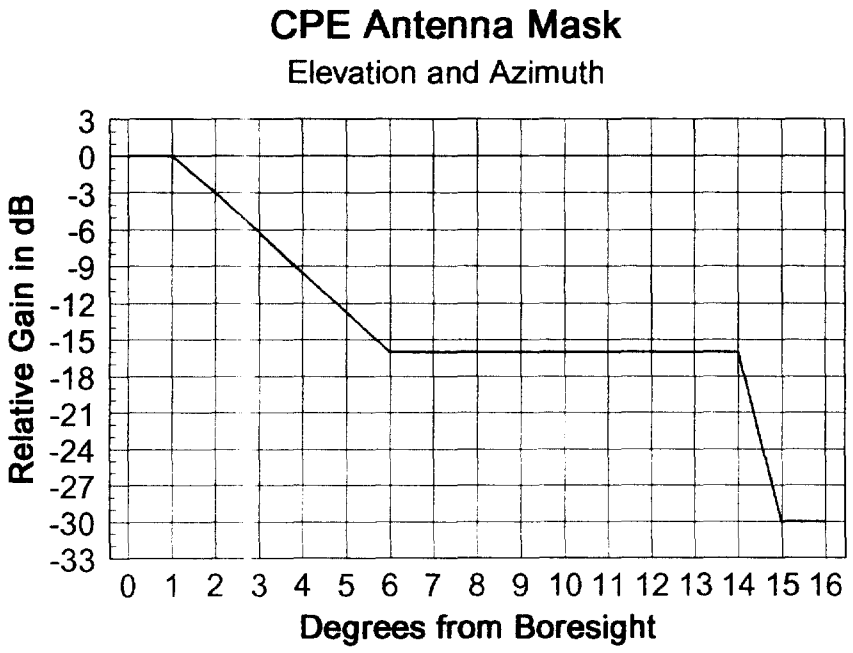
Analysis of CPE Tx's Fit to Proposed Rules, 21.1020 & 21.1021 per 3rd NPRM for 28 GHz using Proposed Rules for CPE Tx's in 150 MHz Band

Doug Gray, Hewlett-Packard Co.

HEWLETT PACKARD

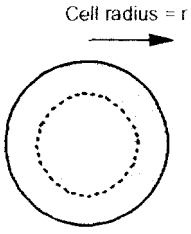
ATTACHMENT K


Transmitter EIRP Spectral Limit
Proposed Rule 21.1021, 3rd NPRM
EIRP Spectral Density dBW/MHz-sqkm
-20
-25
-30
-35
-40
-45
-50
0 1 2 3 4 5 6 7 8 9 10 20 30 90
Elevation Angle in Degrees
Region 3,4,5
Region 2
Region 1
1
2
3 4 5


CPE Antenna Mask
Elevation and Azimuth
Relative Gain in dB
3
0
-3
-6
-9
-12
-15
-18
-21
-24
-27
-30
-33
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
Degrees from Boresight

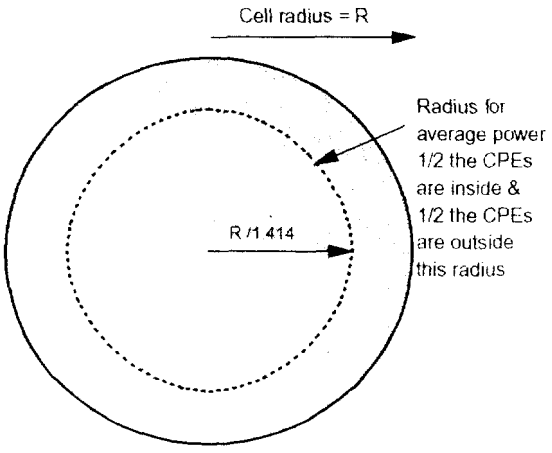
Total power spectral density is dependent only on Maximum EIRP (EIRP at the cell periphery) assuming uniform housing density

Small Cell Case



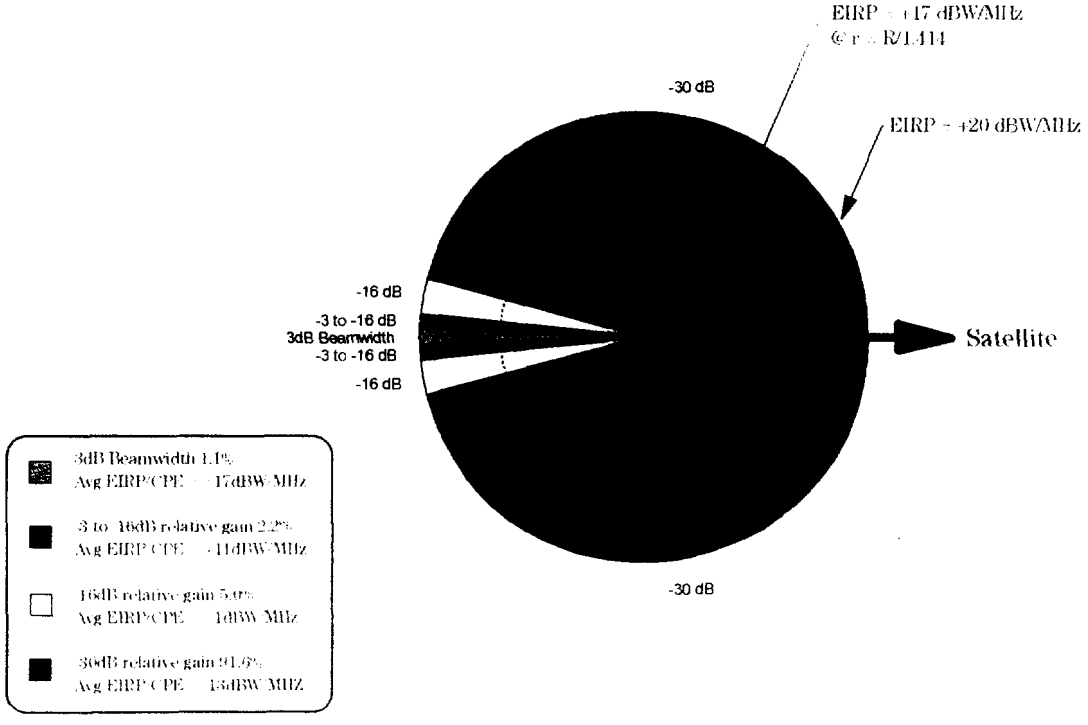
Cell Area = a = $(r/R)^2$ x A
Max EIRP = P
Avg EIRP = P/2 (assuming adaptive pwr control)
PSD/Cell = h x a x P/2
Number of cells to achieve same coverage as large cell = A/a
Total PSD = h x a x (P/2) x (A/a)
= h x (P/2) x A
where h = housing density in households/sq-km

Large Cell Case

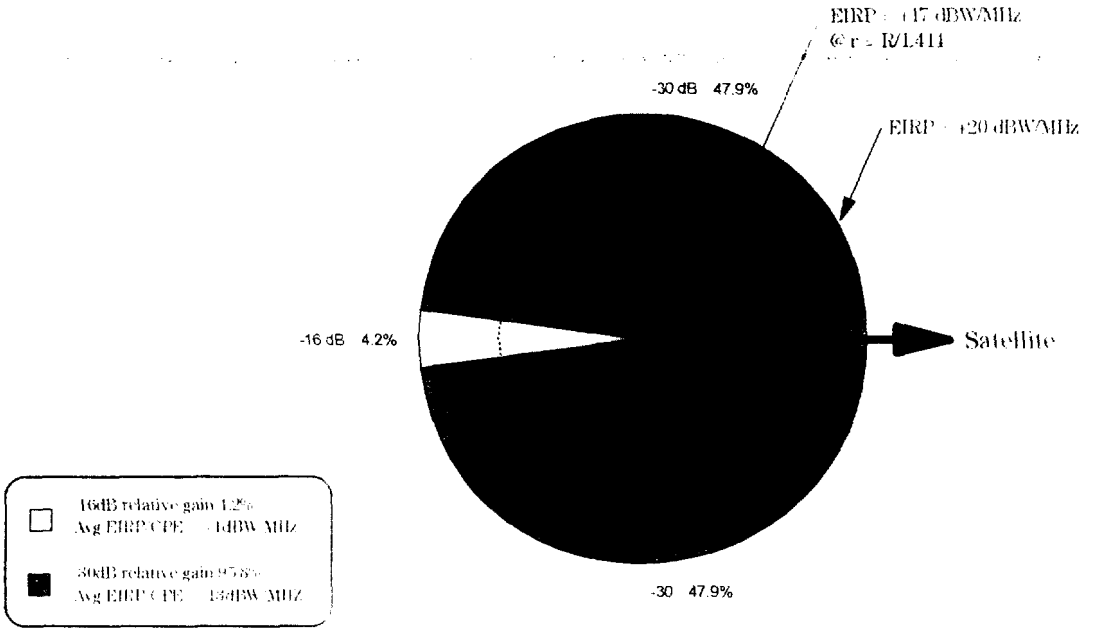


Cell Area = a = A
Max EIRP = P
Avg EIRP = P/2 (assuming adaptive pwr control)
PSD/Cell = h x A x P/2
where h = housing density in households/sq-km

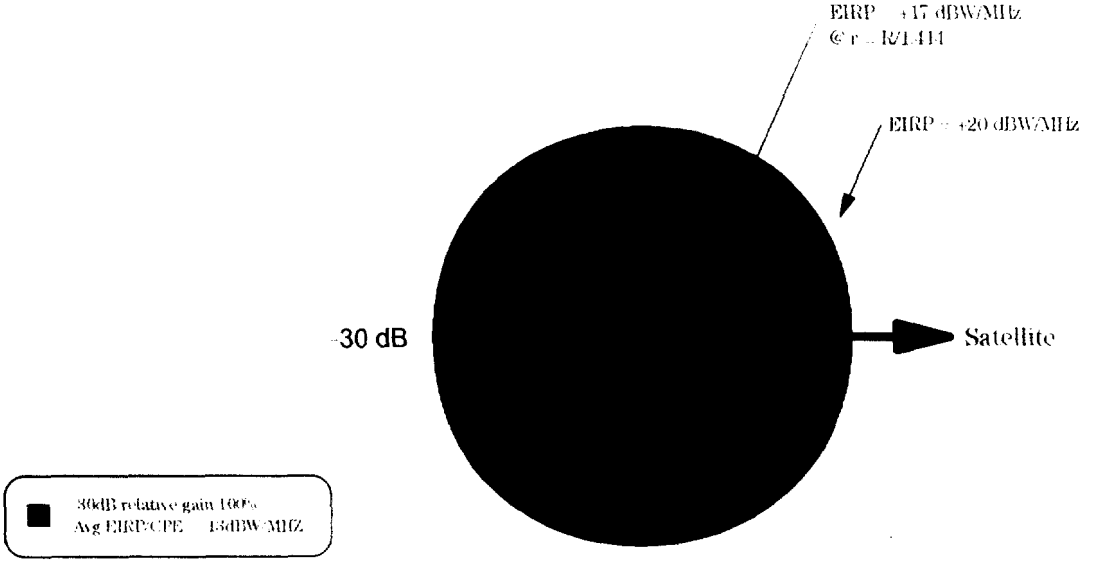
Composite CPE Tx Satellite Interference Potential at 0 Degrees Elevation



Composite CPE Tx Satellite Interference Potential at 6-15 Degrees Elevation



Composite CPE Tx Satellite Interference Potential at 15-90 Degrees Elevation



Calculation of Total EIRP

Equivalent Power per Antenna Sector =

10Log(S) + 10Log(Sector Beamwidth) - 10Log(360) + (Avg EIRP/CPE)

Where S = total number of active subscribers

Demographic Data — 15 Northeast/Mid-Atlantic States

			Column A	Column B	
1	Population	millions	75	75	
2	Surface Area	sq-km	825,700	825,700	
3	Households	millions	25	25	
4	Household Density	HH/sq-km	30	30	
5	Dwelling Units	millions	25	20	Note A.
6	Suitable for LMDS	%	80%	50%	Note B.
7	Take	%	25%	25%	
8	Total Subscribers		5,000,000	2,500,000	
9	Subscribers/MHz	1/150	33,333	16,667	
10	Peak Demand	%	25%		
11	Average Demand	%		10%	Note C.
12	# Active CPEs	@64kbits/s	8,333	1,667	
13	Modulation Efficiency		1	1.5	Note D.
14	Net Active CPEs		533	71	
15	Circuit Efficiency	%	60%	60%	
16	Active CPEs		889	119	
17	Active CPEs/sq-km		0.001077	0.000144	

Column "A" summarizes the numbers used in previous analysis and was generated to represent a "worse" case scenario.

Column "B" represents a more realistic scenario. It would be appropriate to apply a distribution to the final result to account for the effects of non-uniform CPE Tx densities and the effects of varying demand.

Notes:

A. Number of households include those in multiple dwelling units (MDUs), these housholds would not have 1 CPE per houshold. Individual dwelling units are a better indication of the number of possible subscribers.

B. LMDS will not be economically viable in all geographic areas due to the need for line-of-sight or near" line-of-sight conditions. The density of trees, buidings of different heights, mountains, etc. will affect the suitability of a given area. Housing density will also affect the economic viablity of LMDS as a delivery system versus other alternatives. The percent suitable for LMDS will vary from region to region.

C. Peak demand will occur for only short periods of time. Average demand is a better measure for calculating average EIRP.

D. This reflects the use of QPSK modulation which has a typical modulation efficiency of at least 1.5 bits per Hz.

Demographic Data By Region

			Northeast	South	Midwest	West		U.S. Total
1	Population	millions	58.93	78.83	59.83	53.66		251.25
2	Surface Area	sq-km	515,434	2,171,282	1,950,893	4,543,136		9,180,745
3	Households	millions	21.79	28.98	22.12	19.84		92.73
4	Household Density	HH/sq-km	42	13	11	4		10
5	Dwelling Units	millions	17.43	23.18	17.70	15.87		74.18
6	Suitable for LMDS	%	**50%**	**30%**	**70%**	**70%**	←	**53%**
7	Take	%	25%	25%	25%	25%		25%
8	Total Subscribers		2,179,000	1,738,800	3,096,800	2,777,600		9,792,200
9	Subscribers/MHz	1/150	14,527	11,592	20,645	18,517		65,281
10	Average Demand	%	10%	10%	10%	10%		10%
11	# Active CPEs	@64kbits/s	1,453	1,159	2,065	1,852		6,528
12	Modulation Efficiency		1.5	1.5	1.5	1.5		1.5
13	Net Active CPEs		62	49	88	79		279
14	Circuit Efficiency	%	60%	60%	60%	60%		60%
15	Active CPEs		**103**	**82**	**147**	**132**		**464**
16	Active CPEs/sq-km		0.0002	0.000038	0.000075	0.000029		0.000051

Source: 1992 Rand-McNally Commercial Atlas

EIRP per Hub at 0 Degrees Elevation — 15 Northeast/Mid-Atlantic States

Active CPE's S	Equiv. Pwr Ant. Sect 1 dBW/MHz	Equiv. Pwr Ant. Sect 2 dBW/MHz	Equiv. Pwr Ant. Sect 3 dBW/MHz	Equiv. Pwr Ant. Sect 4 dBW/MHz	Tot. Equiv. EIRP dBW/MHz	Total EIRP dBW/MHz	Total EIRP dBW/Hz	Antenna Polariza-tion in dB	Blocking in dB	Area of 15 NE States sq-km	PSAD dBW/MHz/ sq-km	Region 2 EIRP Spec dBW/MHz/ sq-km
119	-2.6	-5.6	-12.0	-13.4	-0.28	20.47	-39.53	-3.00	-3.00	825,700	-44.89	-25
200	-2.6	-5.6	-12.0	-13.4	-0.28	22.73	-37.27	-3.00	-3.00	825,700	-42.44	-25
300	-2.6	-5.6	-12.0	-13.4	-0.28	24.49	-35.51	-3.00	-3.00	825,700	-40.68	-25
400	-2.6	-5.6	-12.0	-13.4	-0.28	25.74	-34.26	-3.00	-3.00	825,700	-39.43	-25
500	-2.6	-5.6	-12.0	-13.4	-0.28	26.71	-33.29	-3.00	-3.00	825,700	-38.46	-25
600	-2.6	-5.6	-12.0	-13.4	-0.28	27.50	-32.50	-3.00	-3.00	825,700	-37.67	-25
700	-2.6	-5.6	-12.0	-13.4	-0.28	28.17	-31.83	-3.00	-3.00	825,700	-37.00	-25
800	-2.6	-5.6	-12.0	-13.4	-0.28	28.75	-31.25	-3.00	-3.00	825,700	-36.42	-25
900	-2.6	-5.6	-12.0	-13.4	-0.28	29.26	-30.74	-3.00	-3.00	825,700	-35.91	-25
1000	-2.6	-5.6	-12.0	-13.4	-0.28	29.72	-30.28	-3.00	-3.00	825,700	-35.45	-25

EIRP per Hub at 7.5 Degrees Elevation

Active CPE's S	Equiv. Pwr Ant. Sect 1 dBW/MHz	Equiv. Pwr Ant. Sect 2 dBW/MHz	Equiv. Pwr Ant. Sect 3 dBW/MHz	Equiv. Pwr Ant. Sect 4 dBW/MHz	Tot. Equiv. EIRP dBW/MHz	Total EIRP dBW/MHz	Total EIRP dBW/Hz	Antenna Polariza-tion in dB	Blocking in dB	Area of 15 NE States sq-km	PSAD dBW/MHz/ sq-km	Region 2 EIRP Spec dBW/MHz/ sq-km
119			-9.8	-13.4	-8.23	12.53	-47.47	-3.00	0.00	825,700	-49.64	-46
200			-9.8	-13.4	-8.23	14.78	-45.22	-3.00	0.00	825,700	-47.39	-46
276			-9.8	-13.4	-8.23	16.17	-43.83	-3.00	0.00	825,700	-46.00	-46
400			-9.8	-13.4	-8.23	17.79	-42.21	-3.00	0.00	825,700	-44.38	-46
500			-9.8	-13.4	-8.23	18.76	-41.24	-3.00	0.00	825,700	-43.41	-46
600			-9.8	-13.4	-8.23	19.55	-40.45	-3.00	0.00	825,700	-42.61	-46
700			-9.8	-13.4	-8.23	20.22	-39.78	-3.00	0.00	825,700	-41.94	-46
800			-9.8	-13.4	-8.23	20.80	-39.20	-3.00	0.00	825,700	-41.36	-46
900			-9.8	-13.4	-8.23	21.31	-38.69	-3.00	0.00	825,700	-40.85	-46
1000			-9.8	-13.4	-8.23	21.77	-38.23	-3.00	0.00	825,700	-40.40	-46

EIRP per Hub at 90 Degrees Elevation

Active CPE's S	Equiv. Pwr Ant. Sect 1 dBW/MHz	Equiv. Pwr Ant. Sect 2 dBW/MHz	Equiv. Pwr Ant. Sect 3 dBW/MHz	Equiv. Pwr Ant. Sect 4 dBW/MHz	Tot. Equiv. EIRP dBW/MHz	Total EIRP dBW/MHz	Total EIRP dBW/Hz	Antenna Polariza-tion in dB	Blocking in dB	Area of 15 NE States sq-km	PSAD dBW/MHz/ sq-km	Region 2 EIRP Spec dBW/MHz/ sq-km
119				-13.0	-13.00	7.76	-52.24	-3.00	0.00	825,700	-54.41	-47
200				-13.0	-13.00	10.01	-49.99	-3.00	0.00	825,700	-52.16	-47
300				-13.0	-13.00	11.77	-48.23	-3.00	0.00	825,700	-50.40	-47
400				-13.0	-13.00	13.02	-46.98	-3.00	0.00	825,700	-49.15	-47
500				-13.0	-13.00	13.99	-46.01	-3.00	0.00	825,700	-48.18	-47
656				-13.0	-13.00	15.17	-44.83	-3.00	0.00	825,700	-47.00	-47
700				-13.0	-13.00	15.45	-44.55	-3.00	0.00	825,700	-46.72	-47
800				-13.0	-13.00	16.03	-43.97	-3.00	0.00	825,700	-46.14	-47
900				-13.0	-13.00	16.54	-43.46	-3.00	0.00	825,700	-45.63	-47
1000				-13.0	-13.00	17.00	-43.00	-3.00	0.00	825,700	-45.17	-47

EIRP per Hub at 0 Degrees Elevation — Northeast as defined in Rand-McNally Commercial Atlas

Active CPE's S	Equiv. Pwr Ant. Sect 1 dBW/MHz	Equiv. Pwr Ant. Sect 2 dBW/MHz	Equiv. Pwr Ant. Sect 3 dBW/MHz	Equiv. Pwr Ant. Sect 4 dBW/MHz	Tot. Equiv. EIRP dBW/MHz	Total EIRP dBW/MHz	Total EIRP dBW/Hz	Antenna Polariza-tion in dB	Blocking in dB	Area in sq-km	PSAD dBW/MHz/ sq-km	Region 2 EIRP Spec dBW/MHz/ sq-km
103	-2.6	-5.6	-12.0	-13.4	-0.28	19.85	-40.15	-3.00	-3.00	515,434	-43.28	-25
200	-2.6	-5.6	-12.0	-13.4	-0.28	22.73	-37.27	-3.00	-3.00	515,434	-40.39	-25
300	-2.6	-5.6	-12.0	-13.4	-0.28	24.49	-35.51	-3.00	-3.00	515,434	-38.63	-25
400	-2.6	-5.6	-12.0	-13.4	-0.28	25.74	-34.26	-3.00	-3.00	515,434	-37.38	-25
500	-2.6	-5.6	-12.0	-13.4	-0.28	26.71	-33.29	-3.00	-3.00	515,434	-36.41	-25
600	-2.6	-5.6	-12.0	-13.4	-0.28	27.50	-32.50	-3.00	-3.00	515,434	-35.62	-25
700	-2.6	-5.6	-12.0	-13.4	-0.28	28.17	-31.83	-3.00	-3.00	515,434	-34.95	-25
800	-2.6	-5.6	-12.0	-13.4	-0.28	28.75	-31.25	-3.00	-3.00	515,434	-34.37	-25
900	-2.6	-5.6	-12.0	-13.4	-0.28	29.26	-30.74	-3.00	-3.00	515,434	-33.86	-25
1000	-2.6	-5.6	-12.0	-13.4	-0.28	29.72	-30.28	-3.00	-3.00	515,434	-33.40	-25

EIRP per Hub at 7.5 Degrees Elevation

Active CPE's S	Equiv. Pwr Ant. Sect 1 dBW/MHz	Equiv. Pwr Ant. Sect 2 dBW/MHz	Equiv. Pwr Ant. Sect 3 dBW/MHz	Equiv. Pwr Ant. Sect 4 dBW/MHz	Tot. Equiv. EIRP dBW/MHz	Total EIRP dBW/MHz	Total EIRP dBW/Hz	Antenna Polariza-tion in dB	Blocking in dB	Area in sq-km	PSAD dBW/MHz/ sq-km	Region 2 EIRP Spec dBW/MHz/ sq-km
103			-9.8	-13.4	-8.23	11.90	-48.10	-3.00	0.00	515,434	-48.22	-46
172			-9.8	-13.4	-8.23	14.13	-45.87	-3.00	0.00	515,434	-45.99	-46
300			-9.8	-13.4	-8.23	16.54	-43.46	-3.00	0.00	515,434	-43.58	-46
400			-9.8	-13.4	-8.23	17.79	-42.21	-3.00	0.00	515,434	-42.33	-46
500			-9.8	-13.4	-8.23	18.76	-41.24	-3.00	0.00	515,434	-41.36	-46
600			-9.8	-13.4	-8.23	19.55	-40.45	-3.00	0.00	515,434	-40.57	-46
700			-9.8	-13.4	-8.23	20.22	-39.78	-3.00	0.00	515,434	-39.90	-46
800			-9.8	-13.4	-8.23	20.80	-39.20	-3.00	0.00	515,434	-39.32	-46
900			-9.8	-13.4	-8.23	21.31	-38.69	-3.00	0.00	515,434	-38.81	-46
1000			-9.8	-13.4	-8.23	21.77	-38.23	-3.00	0.00	515,434	-38.35	-46

EIRP per Hub at 90 Degrees Elevation

Active CPE's S	Equiv. Pwr Ant. Sect 1 dBW/MHz	Equiv. Pwr Ant. Sect 2 dBW/MHz	Equiv. Pwr Ant. Sect 3 dBW/MHz	Equiv. Pwr Ant. Sect 4 dBW/MHz	Tot. Equiv. EIRP dBW/MHz	Total EIRP dBW/MHz	Total EIRP dBW/Hz	Antenna Polariza-tion in dB	Blocking in dB	Area in sq-km	PSAD dBW/MHz/ sq-km	Region 2 EIRP Spec dBW/MHz/ sq-km
103				-13.0	-13.00	7.13	-52.87	-3.00	0.00	515,434	-52.99	-47
200				-13.0	-13.00	10.01	-49.99	-3.00	0.00	515,434	-50.11	-47
300				-13.0	-13.00	11.77	-48.23	-3.00	0.00	515,434	-48.35	-47
409				-13.0	-13.00	13.12	-46.88	-3.00	0.00	515,434	-47.00	-47
500				-13.0	-13.00	13.99	-46.01	-3.00	0.00	515,434	-46.13	-47
600				-13.0	-13.00	14.78	-45.22	-3.00	0.00	515,434	-45.34	-47
700				-13.0	-13.00	15.45	-44.55	-3.00	0.00	515,434	-44.67	-47
800				-13.0	-13.00	16.03	-43.97	-3.00	0.00	515,434	-44.09	-47
900				-13.0	-13.00	16.54	-43.46	-3.00	0.00	515,434	-43.58	-47
1000				-13.0	-13.00	17.00	-43.00	-3.00	0.00	515,434	-43.12	-47

EIRP per Hub at 0 Degrees Elevation

South as defined in Rand-McNally Commercial Atlas

Active CPE's S	Equiv. Pwr Ant. Sect 1 dBW/MHz	Equiv. Pwr Ant. Sect 2 dBW/MHz	Equiv. Pwr Ant. Sect 3 dBW/MHz	Equiv. Pwr Ant. Sect 4 dBW/MHz	Tot. Equiv. EIRP dBW/MHz	Total EIRP dBW/MHz	Total EIRP dBW/Hz	Antenna Polariza-tion in dB	Blocking in dB	Area in sq-km	PSAD dBW/MHz/ sq-km	Region 1 EIRP Spec dBW/MHz/ sq-km
82	-2.6	-5.6	-12.0	-13.4	-0.28	18.86	-41.14	-3.00	-3.00	2,171,282	-50.51	-23
200	-2.6	-5.6	-12.0	-13.4	-0.28	22.73	-37.27	-3.00	-3.00	2,171,282	-46.64	-23
300	-2.6	-5.6	-12.0	-13.4	-0.28	24.49	-35.51	-3.00	-3.00	2,171,282	-44.88	-23
400	-2.6	-5.6	-12.0	-13.4	-0.28	25.74	-34.26	-3.00	-3.00	2,171,282	-43.63	-23
500	-2.6	-5.6	-12.0	-13.4	-0.28	26.71	-33.29	-3.00	-3.00	2,171,282	-42.66	-23
600	-2.6	-5.6	-12.0	-13.4	-0.28	27.50	-32.50	-3.00	-3.00	2,171,282	-41.87	-23
700	-2.6	-5.6	-12.0	-13.4	-0.28	28.17	-31.83	-3.00	-3.00	2,171,282	-41.20	-23
800	-2.6	-5.6	-12.0	-13.4	-0.28	28.75	-31.25	-3.00	-3.00	2,171,282	-40.62	-23
900	-2.6	-5.6	-12.0	-13.4	-0.28	29.26	-30.74	-3.00	-3.00	2,171,282	-40.11	-23
1000	-2.6	-5.6	-12.0	-13.4	-0.28	29.72	-30.28	-3.00	-3.00	2,171,282	-39.65	-23

EIRP per Hub at 7.5 Degrees Elevation

Active CPE's S	Equiv. Pwr Ant. Sect 1 dBW/MHz	Equiv. Pwr Ant. Sect 2 dBW/MHz	Equiv. Pwr Ant. Sect 3 dBW/MHz	Equiv. Pwr Ant. Sect 4 dBW/MHz	Tot. Equiv. EIRP dBW/MHz	Total EIRP dBW/MHz	Total EIRP dBW/Hz	Antenna Polariza-tion in dB	Blocking in dB	Area in sq-km	PSAD dBW/MHz/ sq-km	Region 1 EIRP Spec dBW/MHz/ sq-km
82			-9.8	-13.4	-8.23	10.91	-49.09	-3.00	0.00	2,171,282	-56.46	-44
200			-9.8	-13.4	-8.23	14.78	-45.22	-3.00	0.00	2,171,282	-51.56	-44
300			-9.8	-13.4	-8.23	16.54	-43.46	-3.00	0.00	2,171,282	-49.82	-44
400			-9.8	-13.4	-8.23	17.79	-42.21	-3.00	0.00	2,171,282	-48.57	-44
500			-9.8	-13.4	-8.23	18.76	-41.24	-3.00	0.00	2,171,282	-47.60	-44
600			-9.8	-13.4	-8.23	19.55	-40.45	-3.00	0.00	2,171,282	-46.81	-44
700			-9.8	-13.4	-8.23	20.22	-39.78	-3.00	0.00	2,171,282	-46.14	-44
800			-9.8	-13.4	-8.23	20.80	-39.20	-3.00	0.00	2,171,282	-45.56	-44
900			-9.8	-13.4	-8.23	21.31	-38.69	-3.00	0.00	2,171,282	-45.05	-44
1000			-9.8	-13.4	-8.23	21.77	-38.23	-3.00	0.00	2,171,282	-44.59	-44

EIRP per Hub at 90 Degrees Elevation

Active CPE's S	Equiv. Pwr Ant. Sect 1 dBW/MHz	Equiv. Pwr Ant. Sect 2 dBW/MHz	Equiv. Pwr Ant. Sect 3 dBW/MHz	Equiv. Pwr Ant. Sect 4 dBW/MHz	Tot. Equiv. EIRP dBW/MHz	Total EIRP dBW/MHz	Total EIRP dBW/Hz	Antenna Polariza-tion in dB	Blocking in dB	Area in sq-km	PSAD dBW/MHz/ sq-km	Region 1 EIRP Spec dBW/MHz/ sq-km
82				-13.0	-13.00	6.14	-53.86	-3.00	0.00	2,171,282	-60.23	-45
206				-13.0	-13.00	10.14	-49.86	-3.00	0.00	2,171,282	-56.23	-45
300				-13.0	-13.00	11.77	-48.23	-3.00	0.00	2,171,282	-54.60	-45
400				-13.0	-13.00	13.02	-46.98	-3.00	0.00	2,171,282	-53.35	-45
500				-13.0	-13.00	13.99	-46.01	-3.00	0.00	2,171,282	-52.38	-45
600				-13.0	-13.00	14.78	-45.22	-3.00	0.00	2,171,282	-51.59	-45
700				-13.0	-13.00	15.45	-44.55	-3.00	0.00	2,171,282	-50.92	-45
800				-13.0	-13.00	16.03	-43.97	-3.00	0.00	2,171,282	-50.34	-45
900				-13.0	-13.00	16.54	-43.46	-3.00	0.00	2,171,282	-49.82	-45
1000				-13.0	-13.00	17.00	-43.00	-3.00	0.00	2,171,282	-49.37	-45

EIRP per Hub at 0 Degrees Elevation

Midwest as defined in Rand-McNally Commercial Atlas

Active CPE's S	Equiv. Pwr Ant. Sect 1 dBW/MHz	Equiv. Pwr Ant. Sect 2 dBW/MHz	Equiv. Pwr Ant. Sect 3 dBW/MHz	Equiv. Pwr Ant. Sect 4 dBW/MHz	Tot. Equiv. EIRP dBW/MHz	Total EIRP dBW/MHz	Total EIRP dBW/Hz	Antenna Polariza-tion in dB	Blocking in dB	Area in sq-km	PSAD dBW/MHz/ sq-km	Region 2 EIRP Spec dBW/MHz/ sq-km
100	-2.6	-5.6	-12.0	-13.4	-0.28	19.72	-40.28	-3.00	-3.00	1,950,893	-49.18	-25
147	-2.6	-5.6	-12.0	-13.4	-0.28	21.39	-38.61	-3.00	-3.00	1,950,893	-47.51	-25
300	-2.6	-5.6	-12.0	-13.4	-0.28	24.49	-35.51	-3.00	-3.00	1,950,893	-44.41	-25
400	-2.6	-5.6	-12.0	-13.4	-0.28	25.74	-34.26	-3.00	-3.00	1,950,893	-43.16	-25
500	-2.6	-5.6	-12.0	-13.4	-0.28	26.71	-33.29	-3.00	-3.00	1,950,893	-42.19	-25
600	-2.6	-5.6	-12.0	-13.4	-0.28	27.50	-32.50	-3.00	-3.00	1,950,893	-41.40	-25
700	-2.6	-5.6	-12.0	-13.4	-0.28	28.17	-31.83	-3.00	-3.00	1,950,893	-40.73	-25
800	-2.6	-5.6	-12.0	-13.4	-0.28	28.75	-31.25	-3.00	-3.00	1,950,893	-40.15	-25
900	-2.6	-5.6	-12.0	-13.4	-0.28	29.26	-30.74	-3.00	-3.00	1,950,893	-39.64	-25
1000	-2.6	-5.6	-12.0	-13.4	-0.28	29.72	-30.28	-3.00	-3.00	1,950,893	-39.18	-25

EIRP per Hub at 7.5 Degrees Elevation

Active CPE's S	Equiv. Pwr Ant. Sect 1 dBW/MHz	Equiv. Pwr Ant. Sect 2 dBW/MHz	Equiv. Pwr Ant. Sect 3 dBW/MHz	Equiv. Pwr Ant. Sect 4 dBW/MHz	Tot. Equiv. EIRP dBW/MHz	Total EIRP dBW/MHz	Total EIRP dBW/Hz	Antenna Polariza-tion in dB	Blocking in dB	Area in sq-km	PSAD dBW/MHz/ sq-km	Region 2 EIRP Spec dBW/MHz/ sq-km
100			-9.8	-13.4	-8.23	11.77	-48.23	-3.00	0.00	1,950,893	-54.13	-46
147			-9.8	-13.4	-8.23	13.45	-46.55	-3.00	0.00	1,950,893	-52.46	-46
300			-9.8	-13.4	-8.23	16.54	-43.46	-3.00	0.00	1,950,893	-49.36	-46
400			-9.8	-13.4	-8.23	17.79	-42.21	-3.00	0.00	1,950,893	-48.11	-46
500			-9.8	-13.4	-8.23	18.76	-41.24	-3.00	0.00	1,950,893	-47.14	-46
600			-9.8	-13.4	-8.23	19.55	-40.45	-3.00	0.00	1,950,893	-46.35	-46
650			-9.8	-13.4	-8.23	19.90	-40.10	-3.00	0.00	1,950,893	-46.00	-46
800			-9.8	-13.4	-8.23	20.80	-39.20	-3.00	0.00	1,950,893	-45.10	-46
900			-9.8	-13.4	-8.23	21.31	-38.69	-3.00	0.00	1,950,893	-44.59	-46
1000			-9.8	-13.4	-8.23	21.77	-38.23	-3.00	0.00	1,950,893	-44.13	-46

EIRP per Hub at 90 Degrees Elevation

Active CPE's S	Equiv. Pwr Ant. Sect 1 dBW/MHz	Equiv. Pwr Ant. Sect 2 dBW/MHz	Equiv. Pwr Ant. Sect 3 dBW/MHz	Equiv. Pwr Ant. Sect 4 dBW/MHz	Tot. Equiv. EIRP dBW/MHz	Total EIRP dBW/MHz	Total EIRP dBW/Hz	Antenna Polariza-tion in dB	Blocking in dB	Area in sq-km	PSAD dBW/MHz/ sq-km	Region 2 EIRP Spec dBW/MHz/ sq-km
100				-13.0	-13.00	7.00	-53.00	-3.00	0.00	1,950,893	-58.90	-47
147				-13.0	-13.00	8.67	-51.33	-3.00	0.00	1,950,893	-57.23	-47
300				-13.0	-13.00	11.77	-48.23	-3.00	0.00	1,950,893	-54.13	-47
400				-13.0	-13.00	13.02	-46.98	-3.00	0.00	1,950,893	-52.88	-47
500				-13.0	-13.00	13.99	-46.01	-3.00	0.00	1,950,893	-51.91	-47
600				-13.0	-13.00	14.78	-45.22	-3.00	0.00	1,950,893	-51.12	-47
700				-13.0	-13.00	15.45	-44.55	-3.00	0.00	1,950,893	-50.45	-47
800				-13.0	-13.00	16.03	-43.97	-3.00	0.00	1,950,893	-49.87	-47
900				-13.0	-13.00	16.54	-43.46	-3.00	0.00	1,950,893	-49.36	-47
1000				-13.0	-13.00	17.00	-43.00	-3.00	0.00	1,950,893	-48.90	-47

EIRP per Hub at 0 Degrees Elevation

West as defined in Rand-McNally Commercial Atlas

Active CPE's S	Equiv. Pwr Ant. Sect 1 dBW/MHz	Equiv. Pwr Ant. Sect 2 dBW/MHz	Equiv. Pwr Ant. Sect 3 dBW/MHz	Equiv. Pwr Ant. Sect 4 dBW/MHz	Tot. Equiv. EIRP dBW/MHz	Total EIRP dBW/MHz	Total EIRP dBW/Hz	Antenna Polariza-tion in dB	Blocking in dB	Area in sq-km	PSAD dBW/MHz/ sq-km	Reg. 3,4,5 EIRP Spec dBW/MHz/ sq-km
100	-2.6	-5.6	-12.0	-13.4	-0.28	19.72	-40.28	-3.00	-3.00	4,543,136	-52.86	-26
132	-2.6	-5.6	-12.0	-13.4	-0.28	20.92	-39.08	-3.00	-3.00	4,543,136	-51.65	-26
300	-2.6	-5.6	-12.0	-13.4	-0.28	24.49	-35.51	-3.00	-3.00	4,543,136	-48.08	-26
400	-2.6	-5.6	-12.0	-13.4	-0.28	25.74	-34.26	-3.00	-3.00	4,543,136	-46.83	-26
500	-2.6	-5.6	-12.0	-13.4	-0.28	26.71	-33.29	-3.00	-3.00	4,543,136	-45.87	-26
600	-2.6	-5.6	-12.0	-13.4	-0.28	27.50	-32.50	-3.00	-3.00	4,543,136	-45.07	-26
700	-2.6	-5.6	-12.0	-13.4	-0.28	28.17	-31.83	-3.00	-3.00	4,543,136	-44.40	-26
800	-2.6	-5.6	-12.0	-13.4	-0.28	28.75	-31.25	-3.00	-3.00	4,543,136	-43.82	-26
900	-2.6	-5.6	-12.0	-13.4	-0.28	29.26	-30.74	-3.00	-3.00	4,543,136	-43.31	-26
1000	-2.6	-5.6	-12.0	-13.4	-0.28	29.72	-30.28	-3.00	-3.00	4,543,136	-42.86	-26

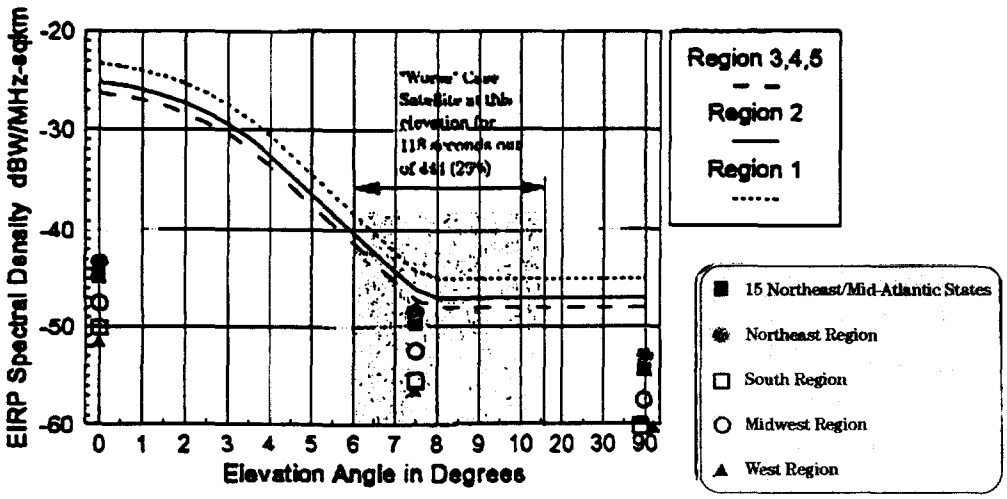
EIRP per Hub at 7.5 Degrees Elevation

Active CPE's S	Equiv. Pwr Ant. Sect 1 dBW/MHz	Equiv. Pwr Ant. Sect 2 dBW/MHz	Equiv. Pwr Ant. Sect 3 dBW/MHz	Equiv. Pwr Ant. Sect 4 dBW/MHz	Tot. Equiv. EIRP dBW/MHz	Total EIRP dBW/MHz	Total EIRP dBW/Hz	Antenna Polariza-tion in dB	Blocking in dB	Area in sq-km	PSAD dBW/MHz/ sq-km	Reg. 3,4,5 EIRP Spec dBW/MHz/ sq-km
100			-9.8	-13.4	-8.23	11.77	-48.23	-3.00	0.00	4,543,136	-57.80	-47
132			-9.8	-13.4	-8.23	12.98	-47.02	-3.00	0.00	4,543,136	-56.60	-47
300			-9.8	-13.4	-8.23	16.54	-43.46	-3.00	0.00	4,543,136	-53.03	-47
400			-9.8	-13.4	-8.23	17.79	-42.21	-3.00	0.00	4,543,136	-51.78	-47
500			-9.8	-13.4	-8.23	18.76	-41.24	-3.00	0.00	4,543,136	-50.81	-47
600			-9.8	-13.4	-8.23	19.55	-40.45	-3.00	0.00	4,543,136	-50.02	-47
700			-9.8	-13.4	-8.23	20.22	-39.78	-3.00	0.00	4,543,136	-49.35	-47
800			-9.8	-13.4	-8.23	20.80	-39.20	-3.00	0.00	4,543,136	-48.77	-47
900			-9.8	-13.4	-8.23	21.31	-38.69	-3.00	0.00	4,543,136	-48.26	-47
1000			-9.8	-13.4	-8.23	21.77	-38.23	-3.00	0.00	4,543,136	-47.80	-47

EIRP per Hub at 90 Degrees Elevation

Active CPE's S	Equiv. Pwr Ant. Sect 1 dBW/MHz	Equiv. Pwr Ant. Sect 2 dBW/MHz	Equiv. Pwr Ant. Sect 3 dBW/MHz	Equiv. Pwr Ant. Sect 4 dBW/MHz	Tot. Equiv. EIRP dBW/MHz	Total EIRP dBW/MHz	Total EIRP dBW/Hz	Antenna Polariza-tion in dB	Blocking in dB	Area in sq-km	PSAD dBW/MHz/ sq-km	Reg. 3,4,5 EIRP Spec dBW/MHz/ sq-km
100				-13.0	-13.00	7.00	-53.00	-3.00	0.00	4,543,136	-62.57	-48
132				-13.0	-13.00	8.21	-51.79	-3.00	0.00	4,543,136	-61.37	-48
300				-13.0	-13.00	11.77	-48.23	-3.00	0.00	4,543,136	-57.80	-48
400				-13.0	-13.00	13.02	-46.98	-3.00	0.00	4,543,136	-56.55	-48
500				-13.0	-13.00	13.99	-46.01	-3.00	0.00	4,543,136	-55.58	-48
600				-13.0	-13.00	14.78	-45.22	-3.00	0.00	4,543,136	-54.79	-48
700				-13.0	-13.00	15.45	-44.55	-3.00	0.00	4,543,136	-54.12	-48
800				-13.0	-13.00	16.03	-43.97	-3.00	0.00	4,543,136	-53.54	-48
900				-13.0	-13.00	16.54	-43.46	-3.00	0.00	4,543,136	-53.03	-48
1000				-13.0	-13.00	17.00	-43.00	-3.00	0.00	4,543,136	-52.57	-48

Transmitter EIRP Spectral Limit as per Proposed Rule 21.1020 & 21.1021, 3rd NPRM with Projected EIRP Levels for U.S. Regions



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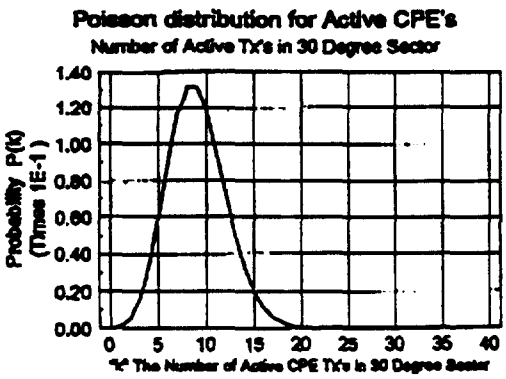
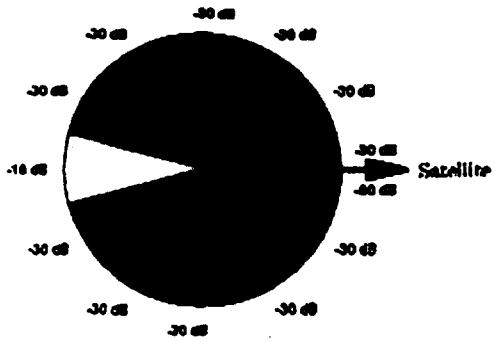
Composite CPE Tx Satellite Interference Potential at 6-15 Degrees Elevation





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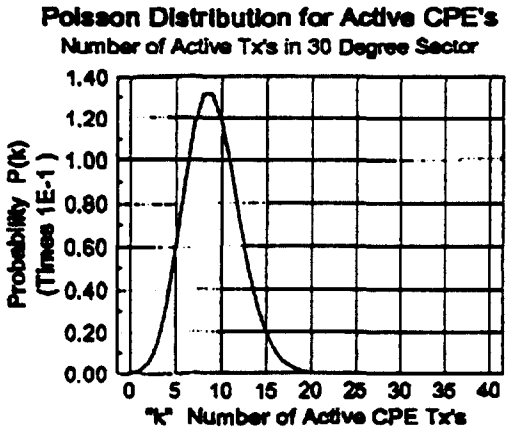
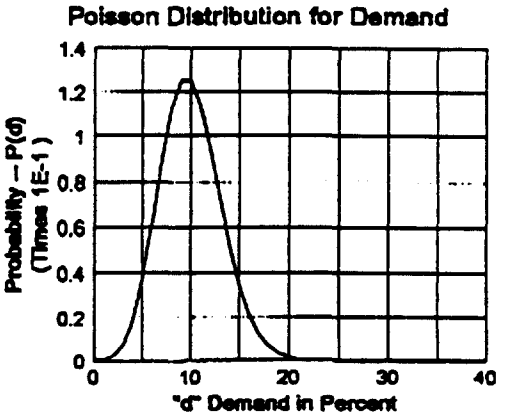
Probability Distribution for Demand and Active CPE Tx's in 30 Degree Sector





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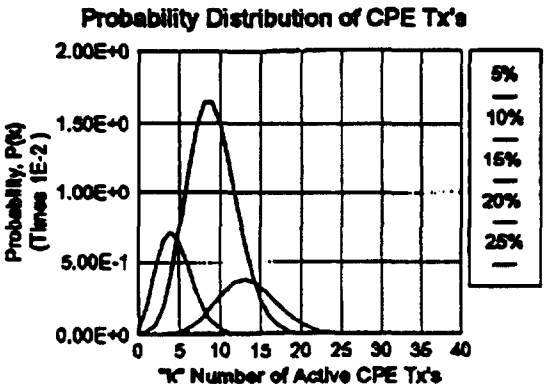
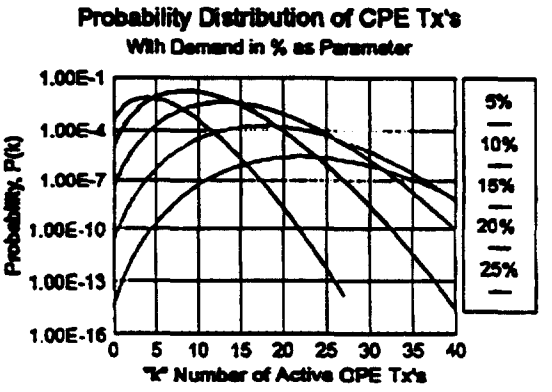
Joint Probability Distribution for Demand and Active CPE Tx's in 30 Degree Sector





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