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FEDERAL COMMUNICATIONS COMMISSION
INTERNATIONAL BUREAU

Satellite and Radiocommunication Division
Satellite Policy Branch

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JAN 29 1996

FEDERAL COMMUNICATIONS COMMISSIO
OFFICE OF SECRETARY

To: Mr. William F. Caton, Acting Secretary

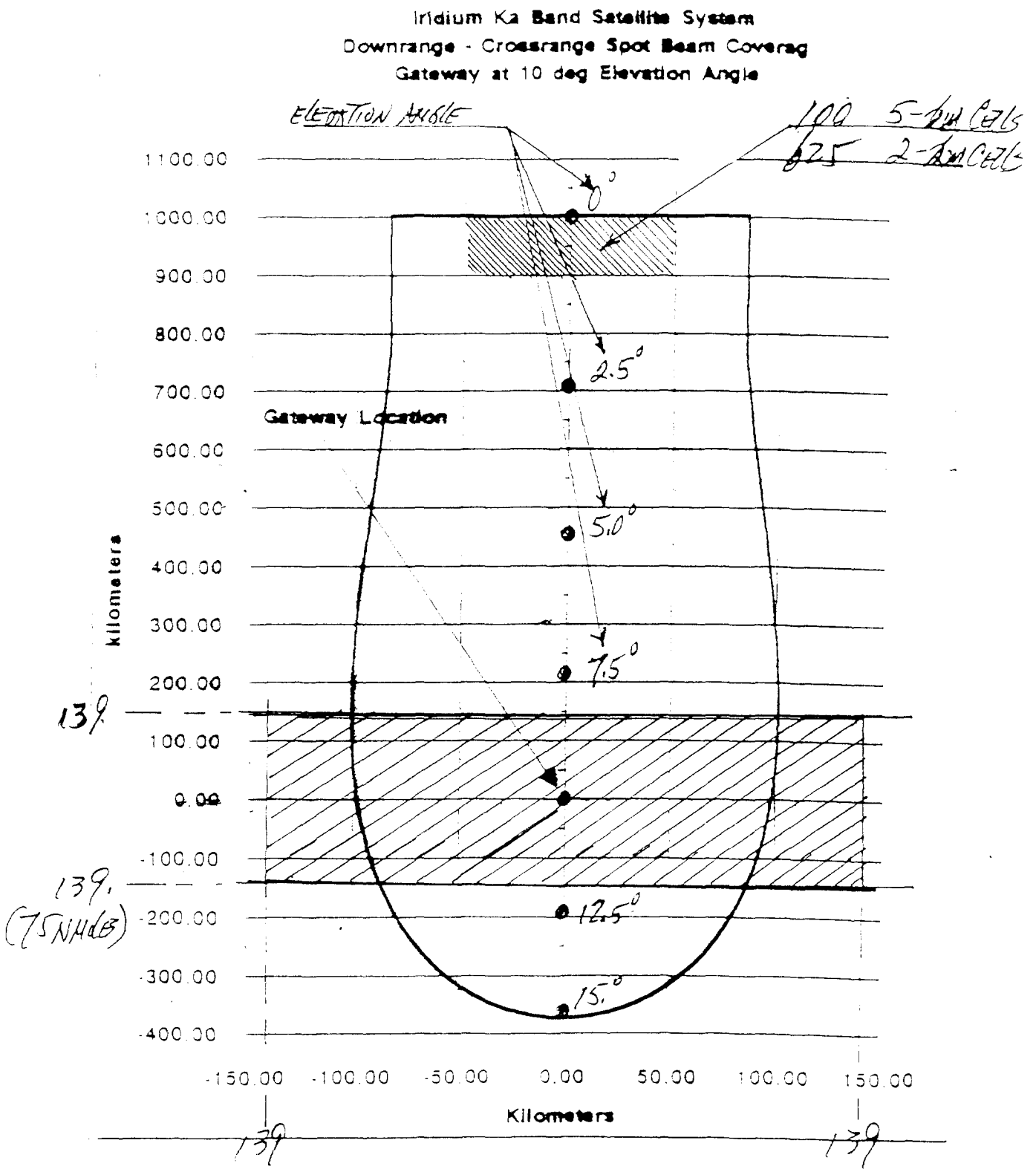
Date: January 29, 1996

From: Karl Kensinger

Re: CC Docket No. 92-297

Please file this memorandum and the attached information in CC Docket No. 92-297 for the information of the parties to the proceeding.

The attachments are calculations and analysis by the staff of the International Bureau's Satellite Policy Basis. These materials formed a basis for the tentative draft staff recommendation attached to a separate submission to the record in this proceeding. See Memorandum from Jennifer Gilsenan to William Caton, dated January 29, 1996. References in the attached materials are to materials in previous ex parte filings in this proceeding. Several of the attachments are photocopied reproductions of exhibits to earlier filings in this proceeding, with handwritten remarks and additions.



K&M Company POLY-PAD
Torrance, CA 90503 #PV119E

Margin Relative to the Satellite Receiving System Noise Floor[1] (dB)
due to a single CPE at -40 dBW/Hz

Relative Margin[2] (dB) without Atmospheric Attenuations

Elevation to the satellite	CPE antenna off-axis angle relative to the satellite				
	0°[3]	2.5°	5°	10°	20°
0.0°	-4.3 dB	-10.3	-19.3	-22.3	-34.3
2.5°	-3.6	-9.6	-18.6	-21.6	-33.6
5.0°	-2.9	-8.9	-17.9	-20.9	-32.9
7.5°	-2.1	-8.1	-17.1	-20.1	-32.1
10°	-1.4	-7.4	-16.4	-19.4	-31.4
12°	-0.8	-6.8	-15.8	-18.8	-30.8
20°	1.2	-4.8			
30°	3.2	-2.8			
45°	5.5	-0.5			

Note 1. The satellite system noise floor is -197.5 dBW/Hz.
Note 2. A negative margin indicates that the interference is below the satellite system noise level and a positive margin indicates that the interference is above the noise level.
Note 3. This column is for the condition that the CPE antenna points correctly towards the hub antenna and is "in-line" with the satellite (i.e., the CPE, the hub antenna and the satellite form a straight line.)

Relative Margin with Atmospheric Attenuations[4]

Elevation to the satellite	CPE antenna off-axis angle				
	0°[3]	2.5°	5°	10°	20°
0.0°	-34.3	-40.3	-49.3	-52.3	-64.3
2.5°	-23.6	-29.6	-48.6	-41.6	-53.6
5.0°	-13.3	-19.3	-28.3	-31.3	-43.3
7.5°	-9.0	-15.0	-24.0	-27.0	-39.0
10°	-6.6	-12.6	-21.6	-24.6	-36.6
12°	-5.2	-11.2	-20.2	-23.2	-35.2
20°	-1.5	-7.5			
30°	1.4	-4.6			
45°	4.2	-1.8			

Note 4: Based on T. Klandrud's analysis (12/1/95) with cosecant extrapolation at 2.5° and assumed 30 dB atmospheric attenuation at 0° elevation. The analysis is based on a climatic zone "D3" region (e.g., the Atlanta area).

Relative Margin and the Effect of Distance and Hub antenna Height

Elevation angle to the satellite	Relative Margin (dB) at Sat. Receiver	**20Log(d/D)[5](dB) / Distance to the Hub[6] (m)**					
		Hub antenna height (m) above CPE					
		5m	10m	15m	30m	100m	300m
0.0°	-34.3	---	---	---	---	---	---
2.5°	-23.6	-24.8/115	-18.8/229	-15.3/343	-9.3/687	-/2290	-/6871
5.0°	-13.3	**-30.9[7]/57[8]**	-24.9/114	-21.3/171	-15.3/343	-4.8/1143	-/3429
7.5°	-9.0	-34.4/38	-28.3/76	-24.8/114	-18.8/228	-8.3/760	-/2279
10°	-6.6	-37.0/28	-30.8/57	-27.3/85	-21.3/170	-10.8/567	-1.3/1701
12°	-5.2	-38.2/24	-32.4/47	-28.8/71	-22.8/141	-12.4/470	-2.8/1411
20°	-1.5	-42.6/14	-36.6/28	-33.2/41	-27.2/82	-16.7/275	-7.2/824
30°	1.4	-45.8/9	-40.1/17	-36.5/26	-30.5/52	-20.0/173	-10.5/519
45°	4.2	-49.0/5	-43.0/10	-39.5/15	-33.5/30	-23.0/100	-13.5/300

Note 5 The maximum Hub-to-CPE range (D) is assumed to be 2 km.

Note 6. The horizontal distance between the CPE and the Hub. At this horizontal distance, the CPE look-up angle towards the Hub antenna qual to the elevation angle towards the satellite.

Note 7. Additional reduction in the interference power level due to the distance correction factor, e.g., $20*\mathrm{Log}(\mathrm{sqr}((5^2 + 57^2)/2000) = -30.9$ dB

Note 8. "57" is the horizontal distance in meter between the CPE and the Hub to produce a look-up angle equal to 5.0 degrees towards the Hub antenna.

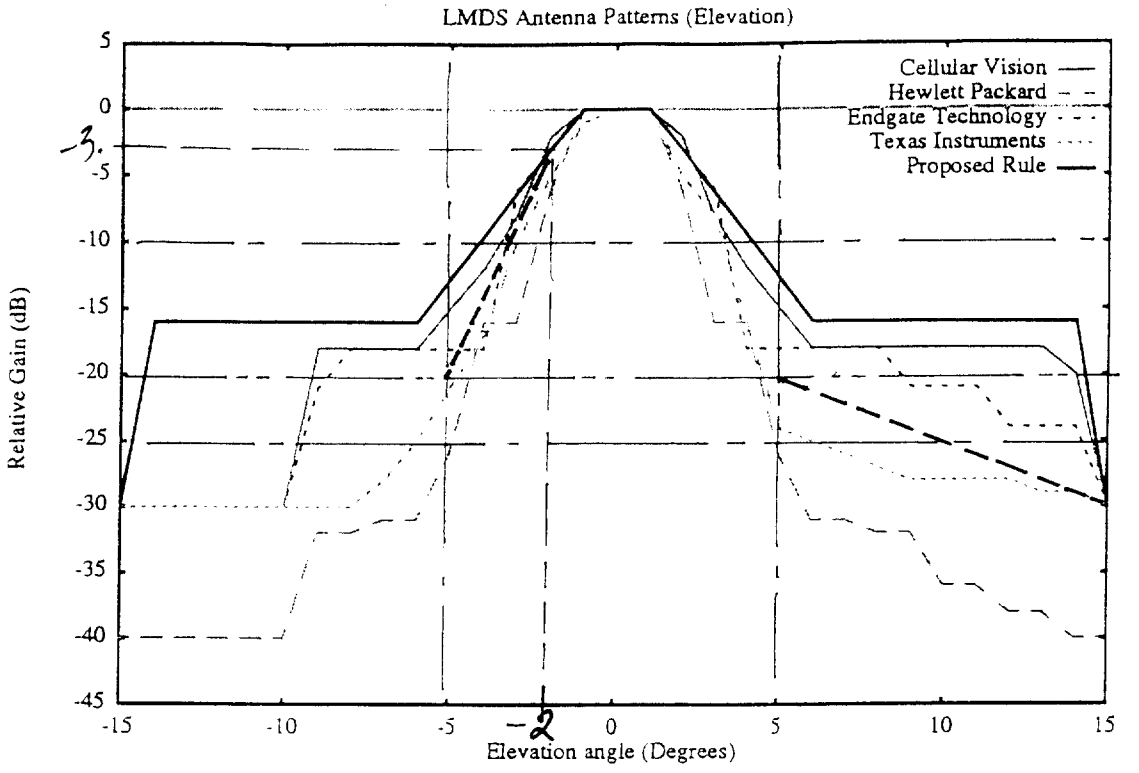


Figure 4. LMDS CPE elevation antenna patterns.

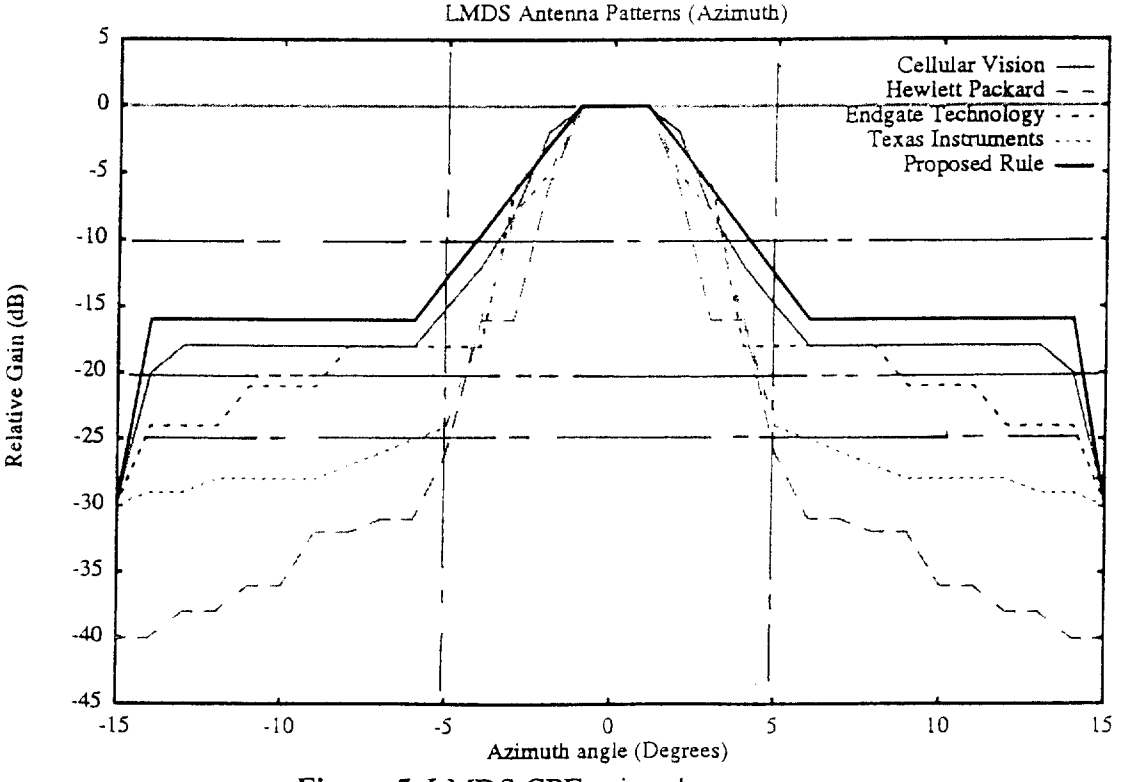
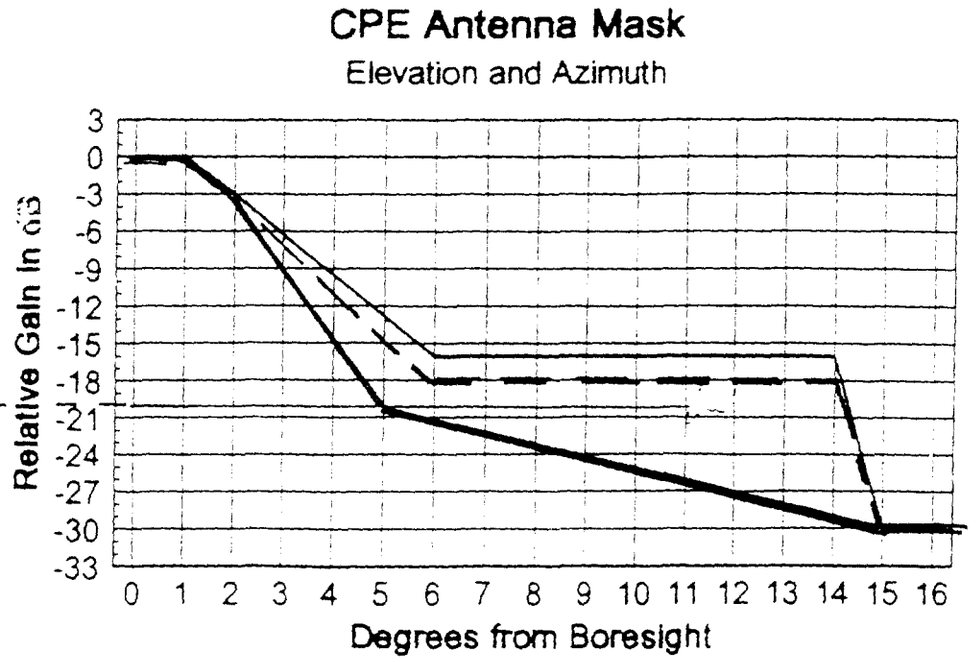


Figure 5. LMDS CPE azimuth antenna patterns.

Proposed CPE Tx Antenna Mask



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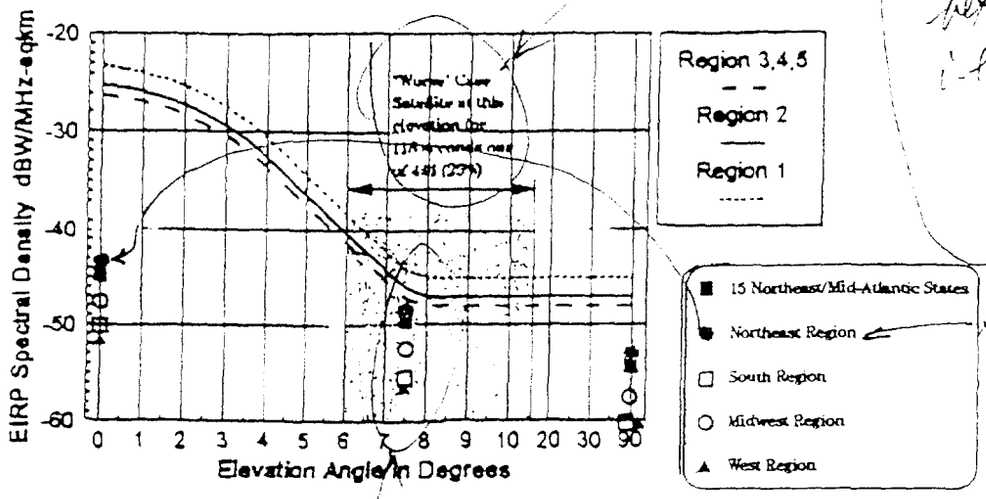
Transmitter EIRP Spectral Limit as per Proposed Rule 21.1020 & 21.1021, 3rd NPRM with Projected EIRP Levels for U.S. Regions



113 sec. out of 444 sec (25%) to transit between 6° and 15° i.e. 25% of the satellite pass is within 6°-15°

the worst case

Worst case (lowest margin)

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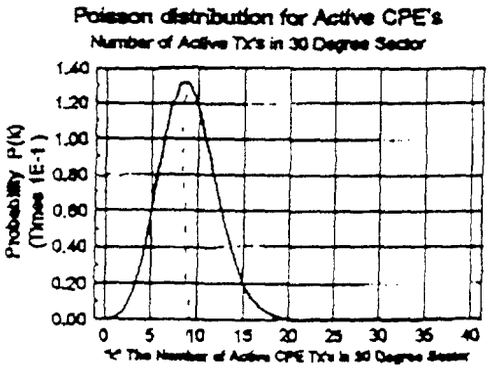
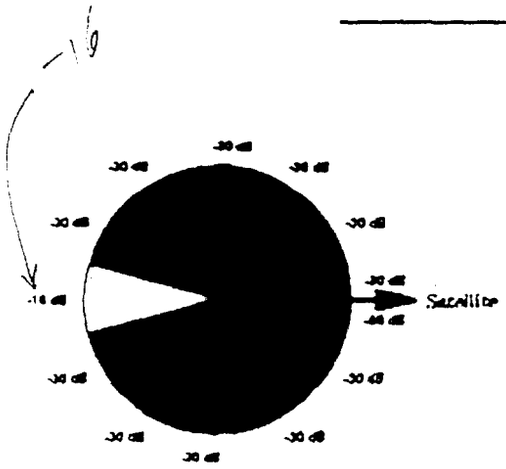
Composite CPE Tx Satellite Interference Potential at 6-15 Degrees Elevation





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LMDS system parameters that were used for the four different LMDS systems in the analysis program are listed below.

Table Three: Typical LMDS System Parameters

Parameter	TI	HP	EG	CV
Transmitter Power per RF channel (dBW)	-17	-19.6	-13	-23
Modulation Type	QPSK	QPSK	4FSK	QPSK
Bandwidth of RF channel (MHz)	2.5	1.0	24	1.0
Antenna Gain (dBi)	34	35	39	31
EIRP density (dBW/Hz)	-47	-44.6	-47.8	-52
Minimum hub-CPE range (Km)	0.1	0.1	0.1	0.1
Maximum hub-CPE range (Km)	5	2	2.2	5
Tower height (meters)	30	15	20	30
Hub spacing in HPBW (Km)	17	17	17	17
Hub spacing out of HPBW (Km)	68	68	68	68
Maximum look angle for 50% blocking (Deg)	5	5	5	5

CPE Antenna pattern envelope is specific for each LMDS supplier
(Frequency reuse is included in the hub spacing density for a reuse factor of 4)

As noted above, LMDS system specific parameters are included. A common hub spacing is used for each LMDS system. This is equivalent to CPE spacing for simultaneous transmissions based on a frequency reuse factor of 4. Adjustments are made in the results for variations to these parameters for each LMDS system.

Analysis Results

Outputs resulting from the program are listed below. Adjustments are made for different frequency reuse and hub densities for each LMDS system. The number of simultaneous hub receiving frequencies is equivalent to the number of CPEs transmitting simultaneously.

Table Four: Statistical Analysis Results

Data Output and Adjustments	TI	HP	EG	CV
CPEs in SV HPBW (frequency reuse 4x)	896	896	896	896
CPEs outside the SV HPBW	3940	3940	3940	3940
C/I for CPEs within the SV HPBW (dB)	36.0	41.4	35.1	37.1
C/I for all CPEs as an aggregate (dB)	35.4	40.2	34.6	36.7
Frequency reuse adjustment (dB)	-	-	-7.0 (4/20)	-
Concentration factor (dB)		1.7 (6/4)		
Resulting Total Aggregate C/I (dB)	35.4	41.9	27.6	36.7