This attachment contains the following items:

SM-T3.7R SATELLITE COMMUNICATION ANTENNA

SPECIFICATIONS

SUMAN SATELLITE TECHNOLOGY COMPANY

PERFORMANCE SPECIFICATIONS(APERTURE 3.7M)

? R. F SPECIFICATIONS	C-Band RECEIVE	C-Band TRANSMIT	Ku-Band RECEIVE	Ku-Band TRANSMIT
1. Frequency	3.625-4.2GHz *3.4-4.2GHz	5.850-6.425GHz 5.925-6.725GHz	12.25-12.75GHz *10.95-12.75GHz	14.0-14.5GHz
2. Gain at Midband	41.7dB	45.5dB	51.5dB	52.3dB
3. VSWR	1.25:1	1.25:1	1.25:1	1.25:1
4. Beamwidth (-3dB)	1.36°	0.87°	0.44°	0.38°
5. Antenna Noise Temperature				
5° Elevation	40 °K		69 °K	
10° Elevation	29 °K		54 °K	
20° Elevation	26 °K		45 °K	
30° Elevation	21 °K		42 °K	
6. Typical G/T at 20° Elevation, Clear Horizon, 4GHz with 55°K LNA	22.7dB/ °K		29.95dB/ °K (11.85GHz, with 90 °K LNA)	
7. Power Handling Capability		5kW		2kW
8. Feed Interface	CPR-229F	CPR-137G	WR-75F	WR-75G
9. Feed Insertion Loss	0.15dB	0.17dB	0.25dB	0.4dB
10. Cross Polarization Isolation				
On Axis	35dB	35dB	35dB	35dB
Within 1 dB Beamwidth	30dB	30dB	30dB	30dB
11. Port to Port Isolation (Tx-Rx with Filter)	≥85dB		≥85dB	
12. Axial Ratio (Circular Polarization) 2 Port Tx/Rx	1.3	1.09	1.3	1.09
13. Sidelobes				
1st sidelobe	-14dB		-14dB	
100λ/D°≤ θ ≤48°	29- 25Log θ dBi		29- 25Log θ dBi	
* Provided according to User's requirement				

? MECHANICAL SPECIFICATION	? ENVIRONMENTAL SPECIFICATIONS

Intelsat

G/T Calculation (Spectrum Analyzer Direct Method)

ES-CODE: CPE-31 **DATE:** 05/03/2003

SPACECRAFT: 706 307.00deg **ELEVATION:** 16.7

G/T Test (LHCP, RHCP, RX Port 1. RX Port 2):	RX Port 1	Testing Freq.:	
Diameter:	3.7 m.	Beacon or	Mhz
System Temperature(Tant+TLna) (deg.Kelvin):	K	Test Crx:	4114 MHz
Bandwidth Filter(KHz.):	1 KHz		
Correction Factor(0.75 or 1.2):	1.2		

Non-Direct Reading Specan:		Direct Reading Specan:	
Measured CRX Level(C+N)	19.4 dBm	Measured Noise Floor:	84.58 dBm/Hz
Measured Noise Floor Level(N) : OR	dBm	C/No Measured:	65.18 dB/Hz
Measured (C+N)/N:	dB		

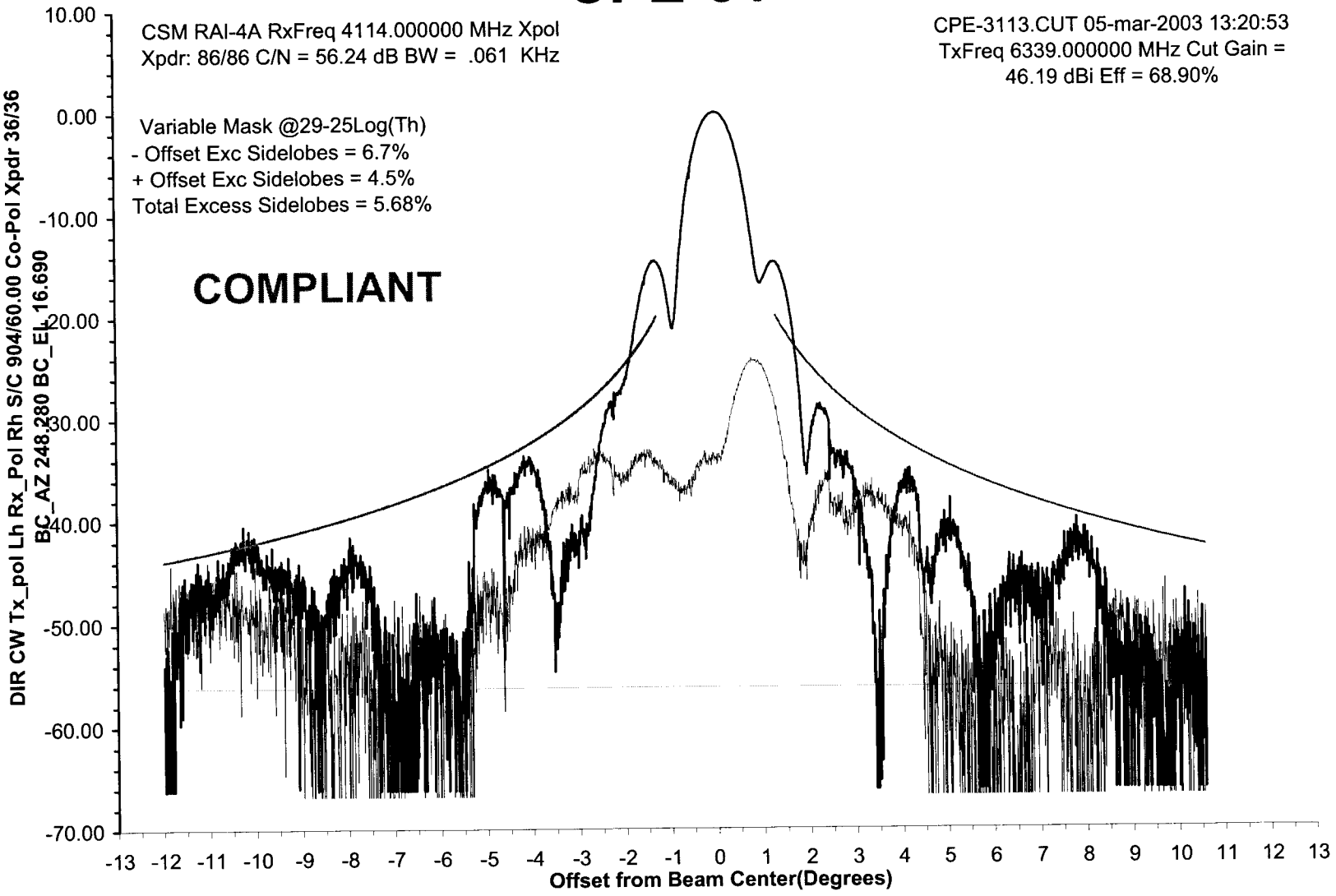
D/L Path Loss	196.4 dB
D/L Aspect Correction	1.91 dB
D/L EIRP at Beam Center	10.4 dBW
Is polarization correction of 3.0 dBW required?(Y/N)	N

Standard Applied: F1
Standard Met: F1

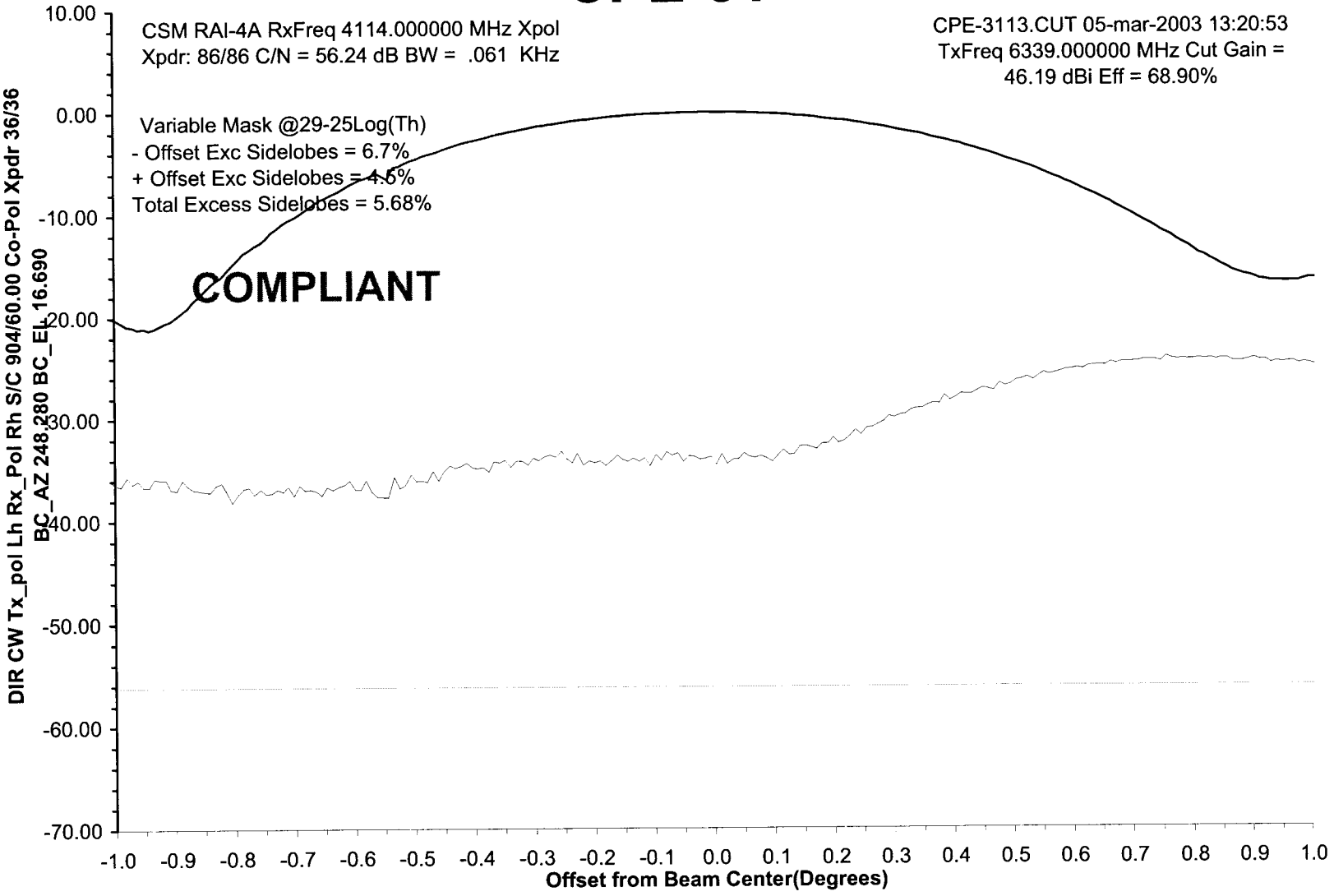
Results:

C/N =	dB/Hz	G/T	24.4900 dB/K
C/No =	65.1800 dB/Hz	@ 4 GHz	24.2459 dB/K
Gain(Rx) =	#NUM! dBi	Efficiency	#NUM! %

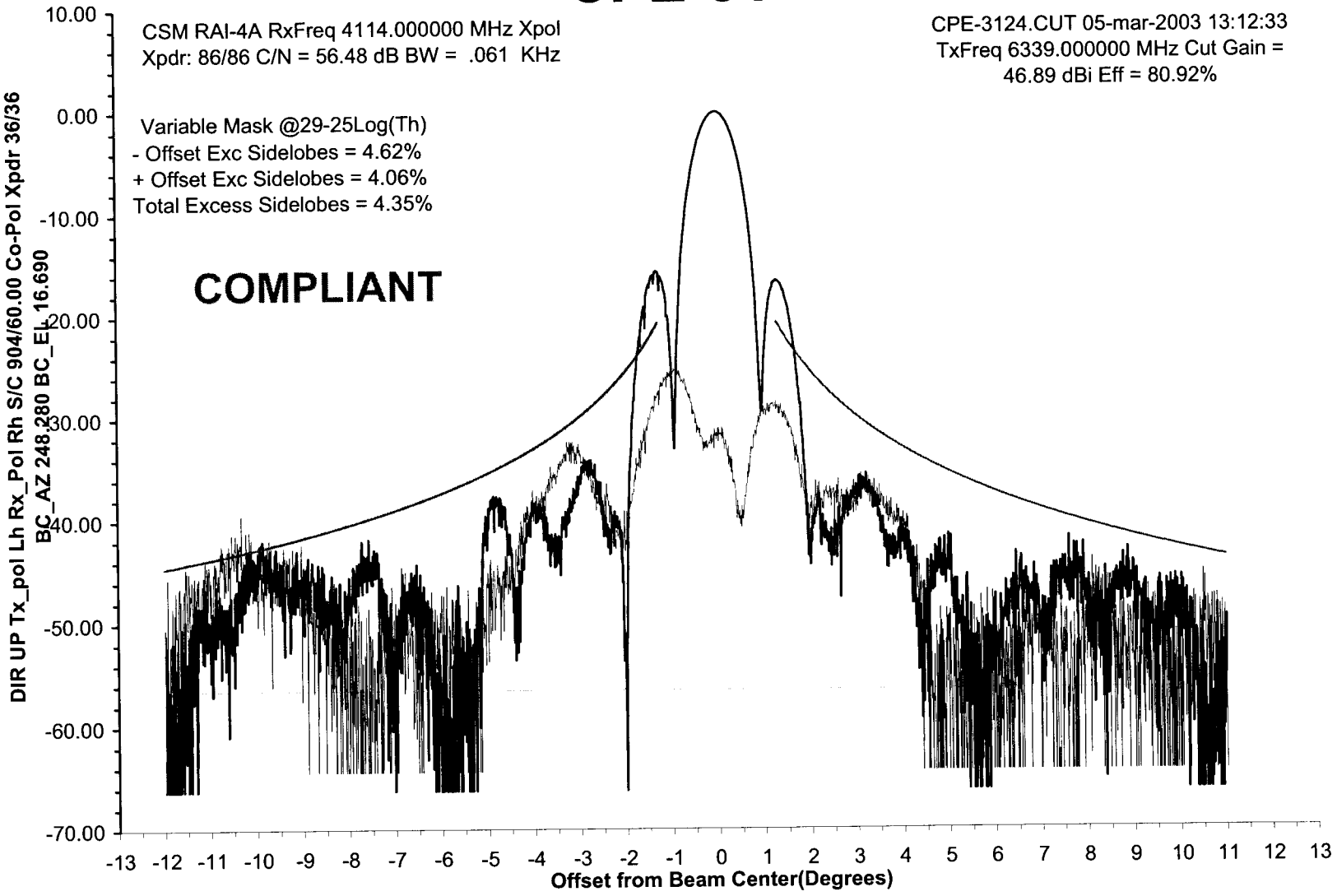
CPE-31


CSM RAI-4A RxFreq 4114.000000 MHz Xpol
Xpdr: 86/86 C/N = 56.24 dB BW = .061 KHz
CPE-3113.CUT 05-mar-2003 13:20:53
TxFreq 6339.000000 MHz Cut Gain =
46.19 dBi Eff = 68.90%
Variable Mask @29-25Log(Th)
- Offset Exc Sidelobes = 6.7%
+ Offset Exc Sidelobes = 4.5%
Total Excess Sidelobes = 5.68%
COMPLIANT
DIR CW Tx_pol Lh Rx_Pol Rh S/C 904/60.00 Co-Pol Xpdr 36/36
BC_AZ 248.280 BC_EL 16.690
10.00
0.00
-10.00
-20.00
-30.00
-40.00
-50.00
-60.00
-70.00
-13 -12 -11 -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9 10 11 12 13
Offset from Beam Center(Degrees)

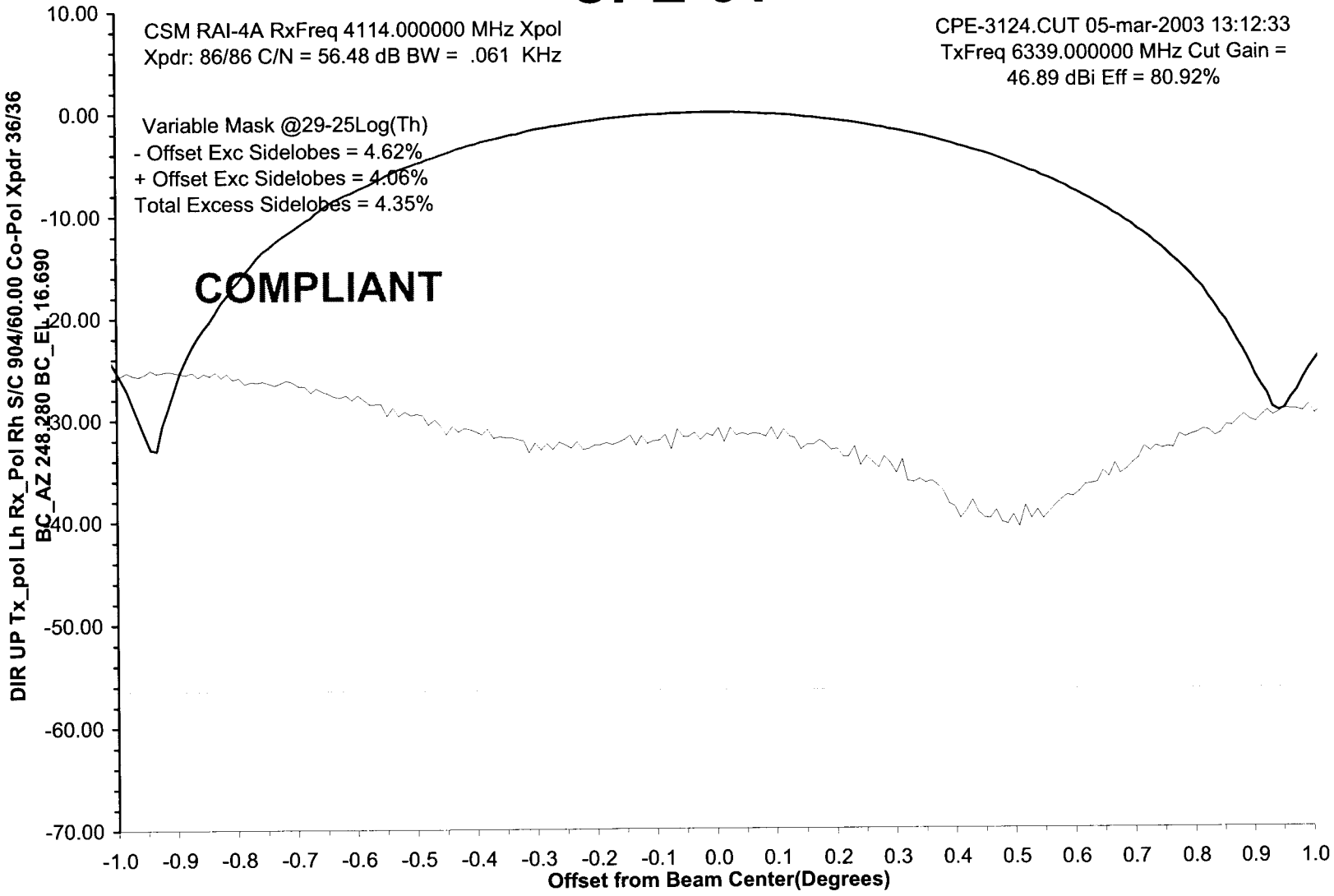
CPE-31


CSM RAI-4A RxFreq 4114.000000 MHz Xpol
Xpdr: 86/86 C/N = 56.24 dB BW = .061 KHz
CPE-3113.CUT 05-mar-2003 13:20:53
TxFreq 6339.000000 MHz Cut Gain =
46.19 dBi Eff = 68.90%
Variable Mask @29-25Log(Th)
- Offset Exc Sidelobes = 6.7%
+ Offset Exc Sidelobes = 4.6%
Total Excess Sidelobes = 5.68%
COMPLIANT
DIR CW Tx_pol Lh Rx_Pol Rh S/C 904/60.00 Co-Pol Xpdr 36/36
BC_AZ 248.280 BC_EL 16.690
10.00
0.00
-10.00
-20.00
-30.00
-40.00
-50.00
-60.00
-70.00
-1.0 -0.9 -0.8 -0.7 -0.6 -0.5 -0.4 -0.3 -0.2 -0.1 0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Offset from Beam Center(Degrees)

CPE-31


CSM RAI-4A RxFreq 4114.000000 MHz Xpol
Xpdr: 86/86 C/N = 56.48 dB BW = .061 KHz
CPE-3124.CUT 05-mar-2003 13:12:33
TxFreq 6339.000000 MHz Cut Gain =
46.89 dBi Eff = 80.92%
Variable Mask @29-25Log(Th)
- Offset Exc Sidelobes = 4.62%
+ Offset Exc Sidelobes = 4.06%
Total Excess Sidelobes = 4.35%
COMPLIANT
DIR UP Tx_pol Lh Rx_Pol Rh S/C 904/60.00 Co-Pol Xpdr 36/36
BC_AZ 248.280 BC_EL 16.690
10.00
0.00
-10.00
-20.00
-30.00
-40.00
-50.00
-60.00
-70.00
-13 -12 -11 -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9 10 11 12 13
Offset from Beam Center(Degrees)

CPE-31


CSM RAI-4A RxFreq 4114.000000 MHz Xpol
Xpdr: 86/86 C/N = 56.48 dB BW = .061 KHz
CPE-3124.CUT 05-mar-2003 13:12:33
TxFreq 6339.000000 MHz Cut Gain =
46.89 dBi Eff = 80.92%
Variable Mask @29-25Log(Th)
- Offset Exc Sidelobes = 4.62%
+ Offset Exc Sidelobes = 4.06%
Total Excess Sidelobes = 4.35%
COMPLIANT
DIR UP Tx_pol Lh Rx_Pol Rh S/C 904/60.00 Co-Pol Xpdr 36/36
BC_AZ 248.280 BC_EL 16.690
10.00
0.00
-10.00
-20.00
-30.00
-40.00
-50.00
-60.00
-70.00
-1.0 -0.9 -0.8 -0.7 -0.6 -0.5 -0.4 -0.3 -0.2 -0.1 0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Offset from Beam Center(Degrees)

Date: 05-Mar-03 13:40:24

Antenna Verif Isolation Contour

EUT Code	CPE-31
CSM Code	RAI -4A
Test Performed On Date/Time (UTC)	05-MAR-2003 12:37:23
Earth Station Switching polarizations	CSM
Satellite/Location (Degrees East)	904 /60.00
Transponder	
Co-pol * (Up/Dn)	36/36
Polarization (Up/Dn)	L/ R
Gain (dB)	155.70
LO Offset (Hz)	44
Gain Check Date / Time (UTC)	05-MAR-2003 12:10:34
Cross-pol ** (Up/Dn)	86/86
Polarization (Up/Dn)	R / L
Gain (dB)	151.49
LO Offset (Hz)	-735
Gain Check Date/Time (UTC)	05-MAR-2003 12:13:55

CSM	
Nominal downlink carrier frequency (MHz)	4,114.000
Downlink Frequency Error (kHz)	0.719
Reference C/N (dB)	56.44
Reference C/N bandwidth (Hz)	61
Weather	Clear
EUT	
Antenna Shape	C
Antenna dimensions, Dim1/Dim2*(m)**	3.70/ 3.70
Power at Feed Flange (dBW)	0.00
Azimuth at Beam Center (Deg CCW)	248.30
Elevation at Beam Center (Deg UP)	16.70
Weather	Light Snow
Nominal Uplink test carrier frequency (MHz)	6,339.000

Step	Az-Offset (deg)	El-Offset (deg)	Co-pol (dBW) ****	Cross-pol (dBW)****	Isolation (dB)	Comment
1	0.000	0.000	10.20	-27.61	33.60	
1	0.000	0.000	10.10	-28.45	34.34	
2	0.191	0.000	9.67	-29.57	35.03	
3	0.191	0.183	9.15	-25.38	30.32	
4	0.000	0.183	9.47	-26.14	31.40	
5	-0.191	0.183	9.01	-25.50	30.30	
6	-0.191	0.000	9.85	-23.77	29.41	
7	-0.191	-0.183	8.96	-23.80	28.55	
8	0.000	-0.183	9.65	-27.32	32.76	
9	0.191	-0.183	9.10	-37.47	42.36	TX PORT #1 IS COMPLIANT - APOL

* **Transponder monitored during copol level measurements**
** **Transponder monitored during cross-pol level measurements**
*** **Dim1/Dim2 = Horizontal/Vertical Dimensions**
**** **Level referred to transponder beam center at satellite**

Intelsat

G/T Calculation (Spectrum Analyzer Direct Method)

ES-CODE: *CPE-33* **DATE:** *05/03/2003*

SPACECRAFT: 904 60.00deg **ELEVATION:** 16.7

G/T Test (LHCP, RHCP, RX Port 1. RX Port 2):	RHCP	Testing Freq.:	
Diameter:	3.7 m.	Beacon or	Mhz
System Temperature(Tant+TLna) (deg.Kelvin):	K	Test Crx:	4114 MHz
Bandwidth Filter(KHz.):	1 KHz		
Correction Factor(0.75 or 1.2):	1.2		

Non-Direct Reading Specan:		Direct Reading Specan:	
Measured CRX Level(C+N)	19.9 dBm	Measured Noise Floor:	84.08 dBm/Hz
Measured Noise Floor Level(N) : OR	dBm	C/No Measured:	64.18 dB/Hz
Measured (C+N)/N:	dB		

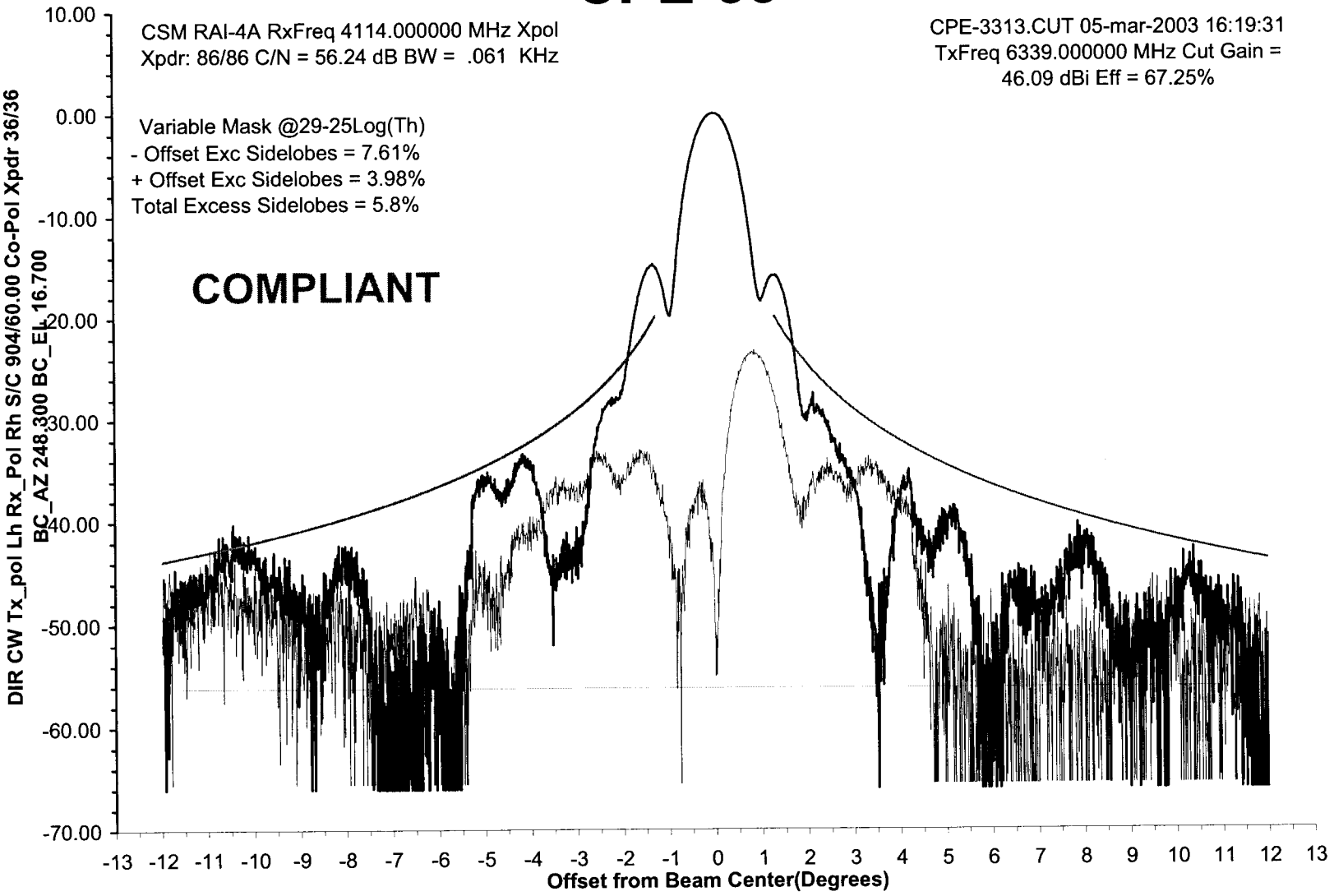
D/L Path Loss	196.4 dB
D/L Aspect Correction	1.91 dB
D/L EIRP at Beam Center	9.8 dBW
Is polarization correction of 3.0 dBW required?(Y/N)	N

Standard Applied: F1
Standard Met: F1

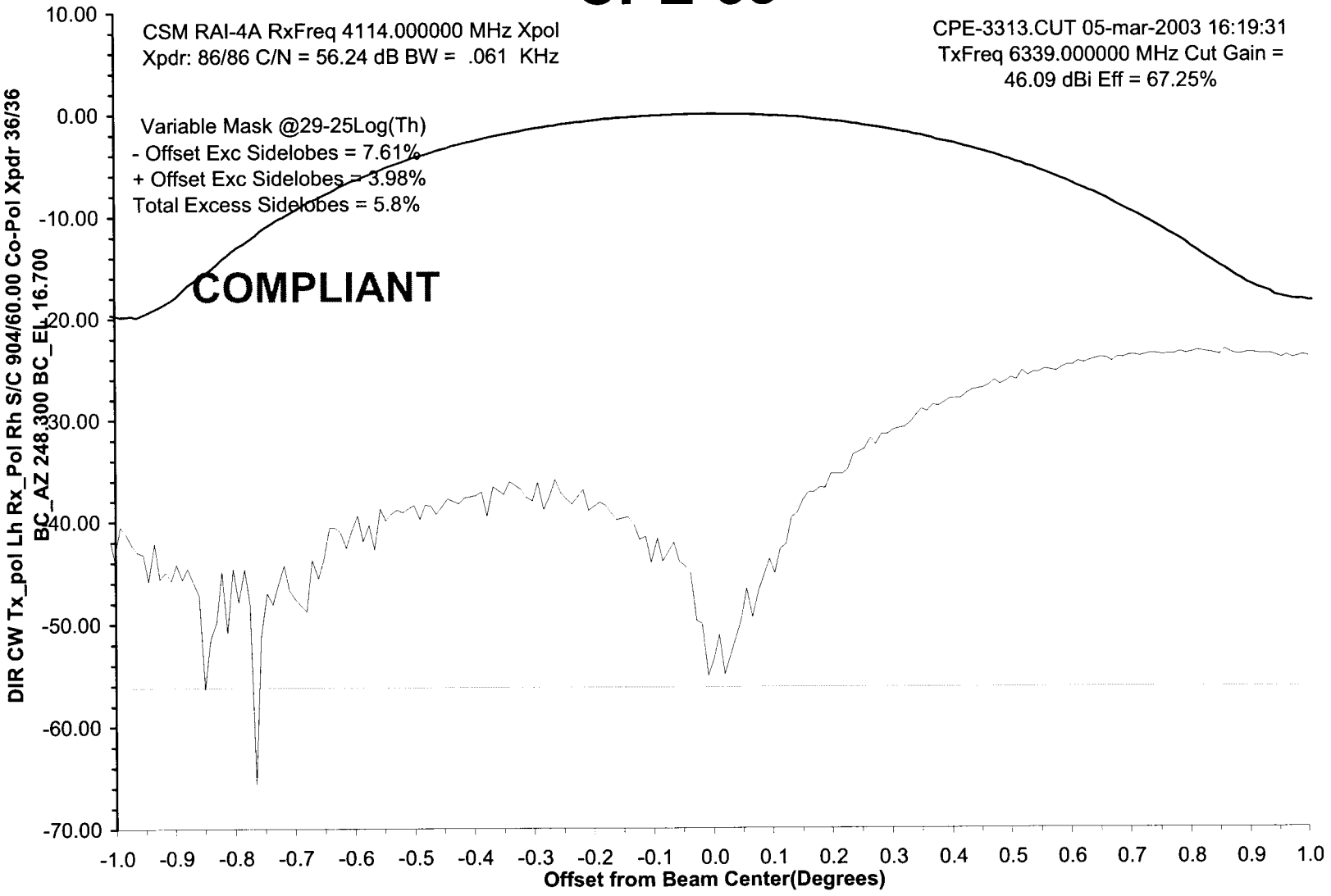
Results:

C/N =	dB/Hz	G/T	24.0900 dB/K
C/No =	64.1800 dB/Hz	@ 4 GHz	23.8459 dB/K
Gain(Rx) =	#NUM! dBi	Efficiency	#NUM! %

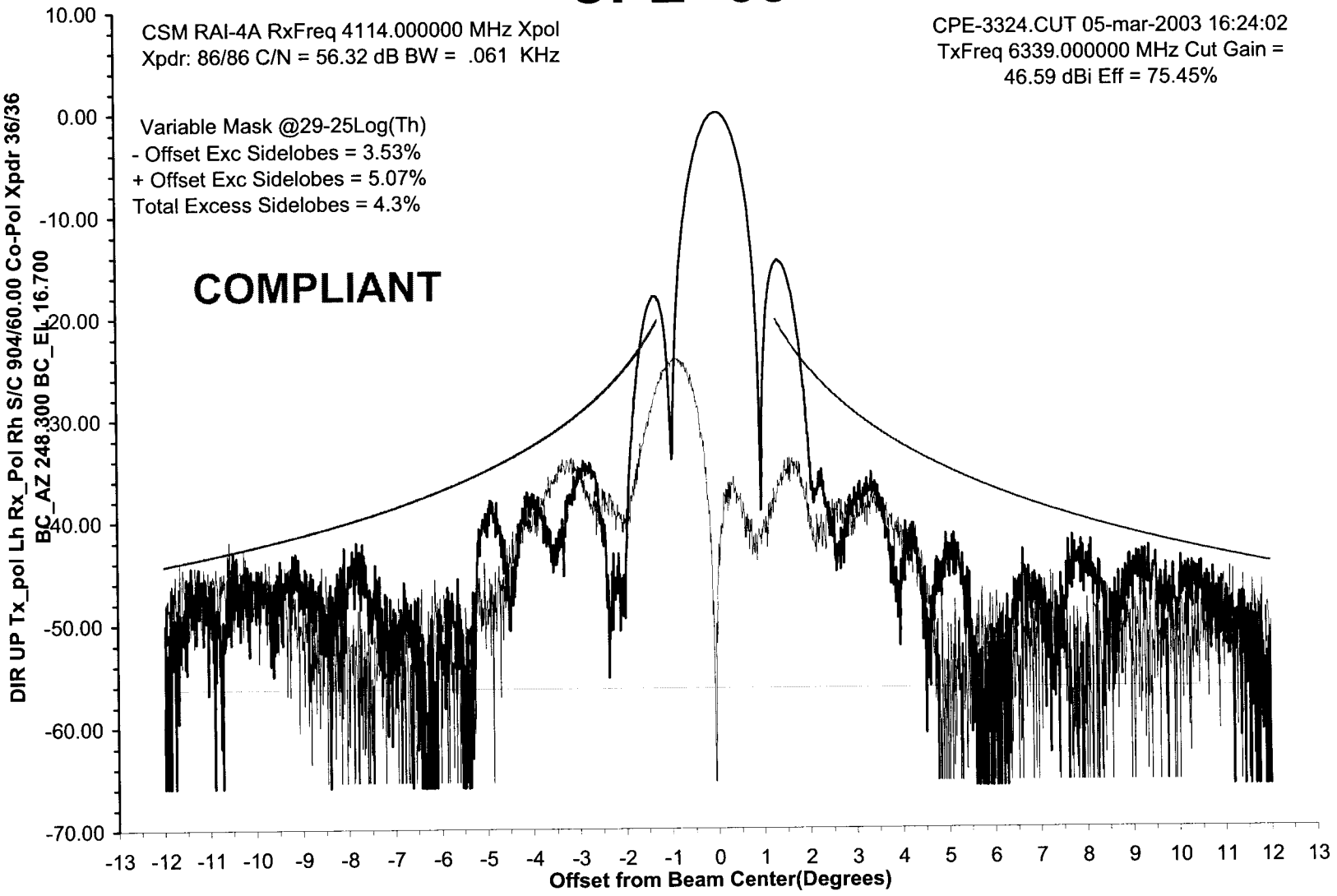
CPE-33


CSM RAI-4A RxFreq 4114.000000 MHz Xpol
Xpdr: 86/86 C/N = 56.24 dB BW = .061 KHz
CPE-3313.CUT 05-mar-2003 16:19:31
TxFreq 6339.000000 MHz Cut Gain =
46.09 dBi Eff = 67.25%
Variable Mask @29-25Log(Th)
- Offset Exc Sidelobes = 7.61%
+ Offset Exc Sidelobes = 3.98%
Total Excess Sidelobes = 5.8%
COMPLIANT
DIR CW Tx_pol Lh Rx_Pol Rh S/C 904/60.00 Co-Pol Xpdr 36/36
BC_AZ 248.300 BC_EL 16.700
10.00
0.00
-10.00
-20.00
-30.00
-40.00
-50.00
-60.00
-70.00
-13 -12 -11 -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9 10 11 12 13
Offset from Beam Center(Degrees)

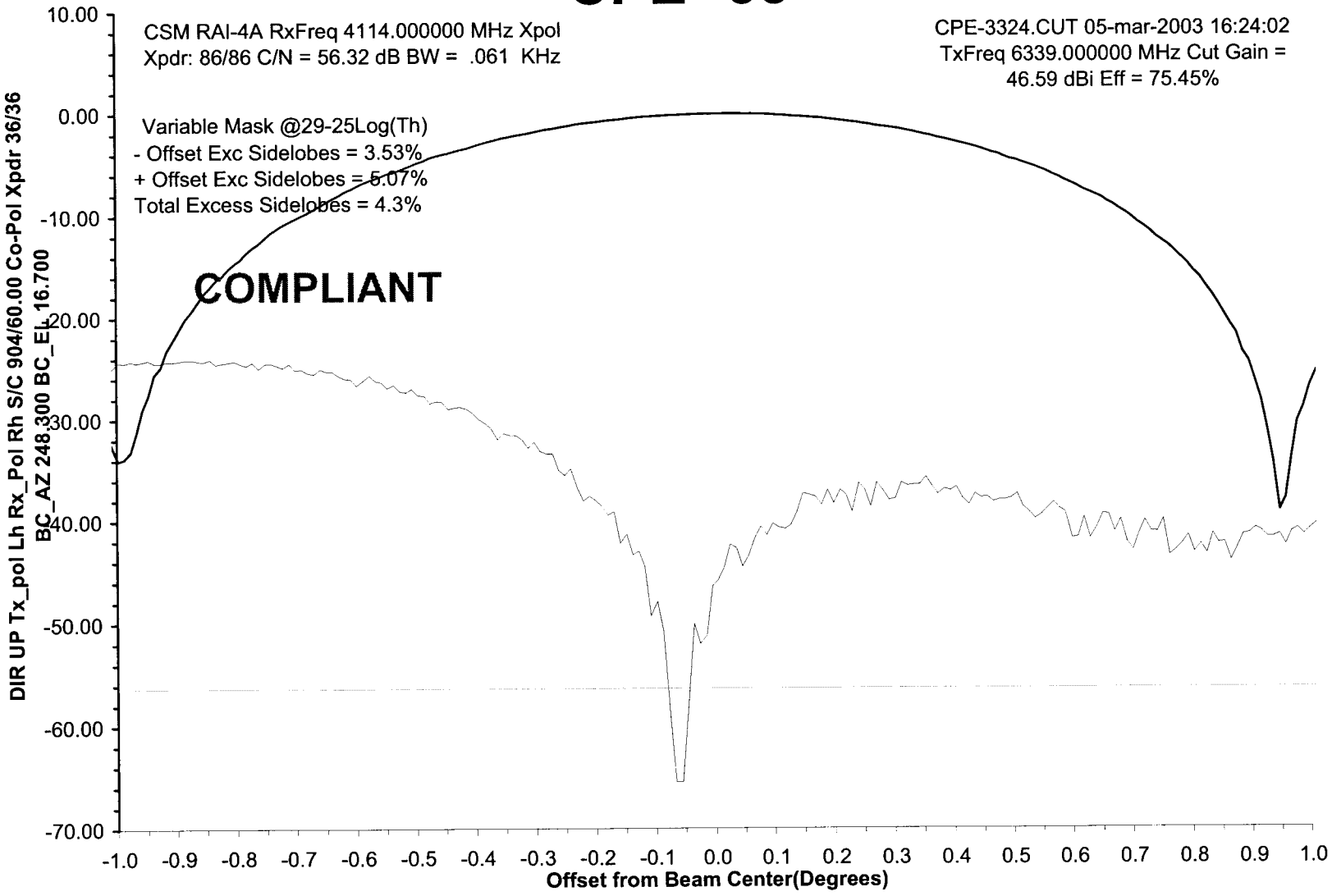
CPE-33


CSM RAI-4A RxFreq 4114.000000 MHz Xpol
Xpdr: 86/86 C/N = 56.24 dB BW = .061 KHz
CPE-3313.CUT 05-mar-2003 16:19:31
TxFreq 6339.000000 MHz Cut Gain =
46.09 dBi Eff = 67.25%
Variable Mask @29-25Log(Th)
- Offset Exc Sidelobes = 7.61%
+ Offset Exc Sidelobes = 3.98%
Total Excess Sidelobes = 5.8%
COMPLIANT
DIR CW Tx_pol Lh Rx_Pol Rh S/C 904/60.00 Co-Pol Xpdr 36/36
BC_AZ 248.300 BC_EL 16.700
10.00
0.00
-10.00
-20.00
-30.00
-40.00
-50.00
-60.00
-70.00
-1.0 -0.9 -0.8 -0.7 -0.6 -0.5 -0.4 -0.3 -0.2 -0.1 0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Offset from Beam Center(Degrees)

CPE--33


CSM RAI-4A RxFreq 4114.000000 MHz Xpol
Xpdr: 86/86 C/N = 56.32 dB BW = .061 KHz
CPE-3324.CUT 05-mar-2003 16:24:02
TxFreq 6339.000000 MHz Cut Gain =
46.59 dBi Eff = 75.45%
Variable Mask @29-25Log(Th)
- Offset Exc Sidelobes = 3.53%
+ Offset Exc Sidelobes = 5.07%
Total Excess Sidelobes = 4.3%
COMPLIANT
DIR UP Tx_pol Lh Rx_Pol Rh S/C 904/60.00 Co-Pol Xpdr 36/36
BC_AZ 248.300 BC_EL 16.700
10.00
0.00
-10.00
-20.00
-30.00
-40.00
-50.00
-60.00
-70.00
-13 -12 -11 -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9 10 11 12 13
Offset from Beam Center(Degrees)

CPE--33


CSM RAI-4A RxFreq 4114.000000 MHz Xpol
Xpdr: 86/86 C/N = 56.32 dB BW = .061 KHz
CPE-3324.CUT 05-mar-2003 16:24:02
TxFreq 6339.000000 MHz Cut Gain =
46.59 dBi Eff = 75.45%
Variable Mask @29-25Log(Th)
- Offset Exc Sidelobes = 3.53%
+ Offset Exc Sidelobes = 5.07%
Total Excess Sidelobes = 4.3%
COMPLIANT
DIR UP Tx_pol Lh Rx_Pol Rh S/C 904/60.00 Co-Pol Xpdr 36/36
BC_AZ 248.300 BC_EL 16.700
10.00
0.00
-10.00
-20.00
-30.00
-40.00
-50.00
-60.00
-70.00
-1.0 -0.9 -0.8 -0.7 -0.6 -0.5 -0.4 -0.3 -0.2 -0.1 0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Offset from Beam Center(Degrees)

Date: 05-Mar-03 16:10:06

Antenna Verif Isolation Contour

EUT Code	CPE-33
CSM Code	RAI -4A
Test Performed On Date/Time (UTC)	05-MAR-2003 15:59:11
Earth Station Switching polarizations	CSM
Satellite/Location (Degrees East)	904 /60.00
Transponder	
Co-pol * (Up/Dn)	36/36
Polarization (Up/Dn)	L/ R
Gain (dB)	155.70
LO Offset (Hz)	44
Gain Check Date / Time (UTC)	05-MAR-2003 12:10:34
Cross-pol ** (Up/Dn)	86/86
Polarization (Up/Dn)	R / L
Gain (dB)	151.49
LO Offset (Hz)	-735
Gain Check Date/Time (UTC)	05-MAR-2003 12:13:55

CSM	
Nominal downlink carrier frequency (MHz)	4,114.000
Downlink Frequency Error (kHz)	0.743
Reference C/N (dB)	56.47
Reference C/N bandwidth (Hz)	61
Weather	Clear
EUT	
Antenna Shape	C
Antenna dimensions, Dim1/Dim2*(m)**	3.70/ 3.70
Power at Feed Flange (dBW)	0.00
Azimuth at Beam Center (Deg CCW)	248.70
Elevation at Beam Center (Deg UP)	16.30
Weather	Light Snow
Nominal Uplink test carrier frequency (MHz)	6,339.000

Step	Az-Offset (deg)	El-Offset (deg)	Co-pol (dBW) ****	Cross-pol (dBW)****	Isolation (dB)	Comment
1	0.000	0.000	9.73			
2	0.190	0.000	9.52	-31.54	36.85	
3	0.190	0.183	9.11	-26.30	31.20	
4	0.000	0.183	9.27	-27.44	32.50	
5	-0.190	0.183	8.87	-32.33	36.99	
6	-0.190	0.000	9.27	-25.95	31.01	
7	-0.190	-0.183	8.75	-24.14	28.68	
8	0.000	-0.183	9.05	-25.91	30.75	
9	0.190	-0.183	8.71	-33.25	37.75	TX PORT #1 IS COMPLIANT - BPOL

* **Transponder monitored during copol level measurements**
** **Transponder monitored during cross-pol level measurements**
*** **Dim1/Dim2 = Horizontal/Vertical Dimensions**
**** **Level referred to transponder beam center at satellite**

Intelsat

G/T Calculation (Spectrum Analyzer Direct Method)

ES-CODE: *CPE-32* **DATE:** *05/03/2003*

SPACECRAFT: 904 60.00deg **ELEVATION:** 16.7

G/T Test (LHCP, RHCP, RX Port 1. RX Port 2):	RHCP	Testing Freq.:	
Diameter:	3.7 m.	Beacon or	Mhz
System Temperature(Tant+TLna) (deg.Kelvin):	K	Test Crx:	4114 MHz
Bandwidth Filter(KHz.):	1 KHz		
Correction Factor(0.75 or 1.2):	1.2		

Non-Direct Reading Specan:		Direct Reading Specan:	
Measured CRX Level(C+N)	19.73 dBm	Measured Noise Floor:	84.74 dBm/Hz
Measured Noise Floor Level(N) : OR	dBm	C/No Measured:	65.01 dB/Hz
Measured (C+N)/N:	dB		

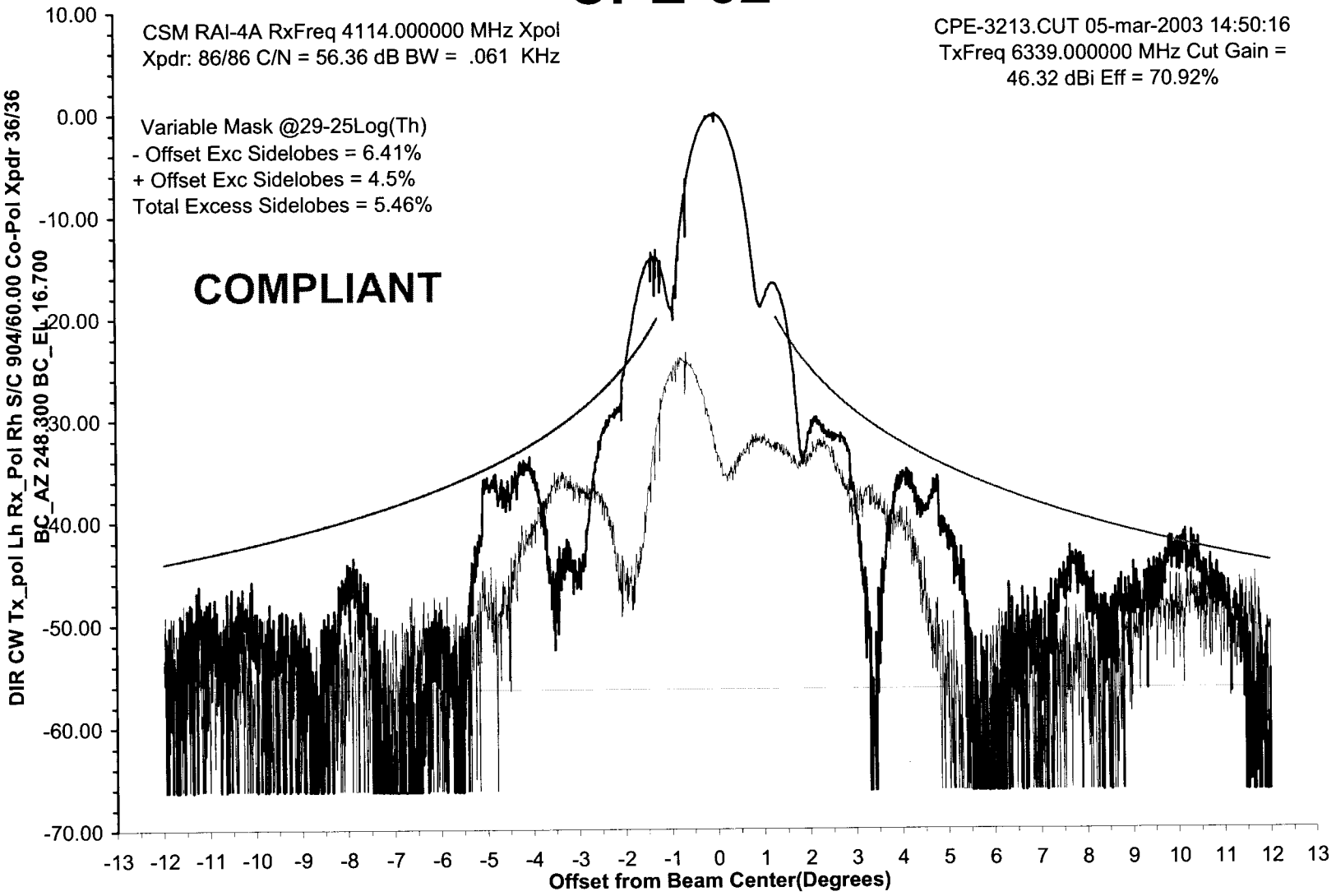
D/L Path Loss	196.4 dB
D/L Aspect Correction	1.1 dB
D/L EIRP at Beam Center	10 dBW
Is polarization correction of 3.0 dBW required?(Y/N)	N

Standard Applied: F1
Standard Met: F1

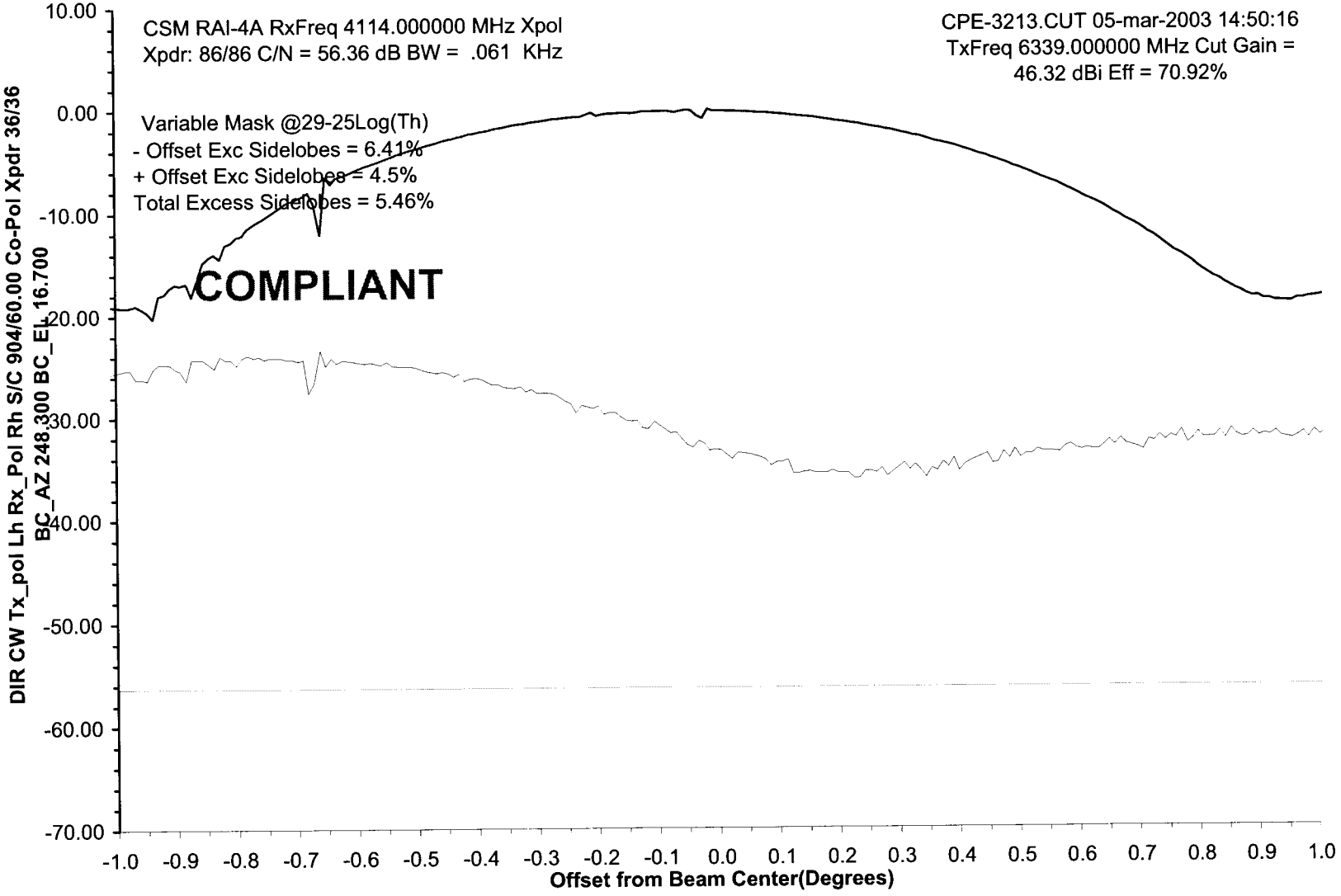
Results:

C/N =	dB/Hz	G/T	23.9100 dB/K
C/No =	65.0100 dB/Hz	@ 4 GHz	23.6659 dB/K
Gain(Rx) =	#NUM! dBi	Efficiency	#NUM! %

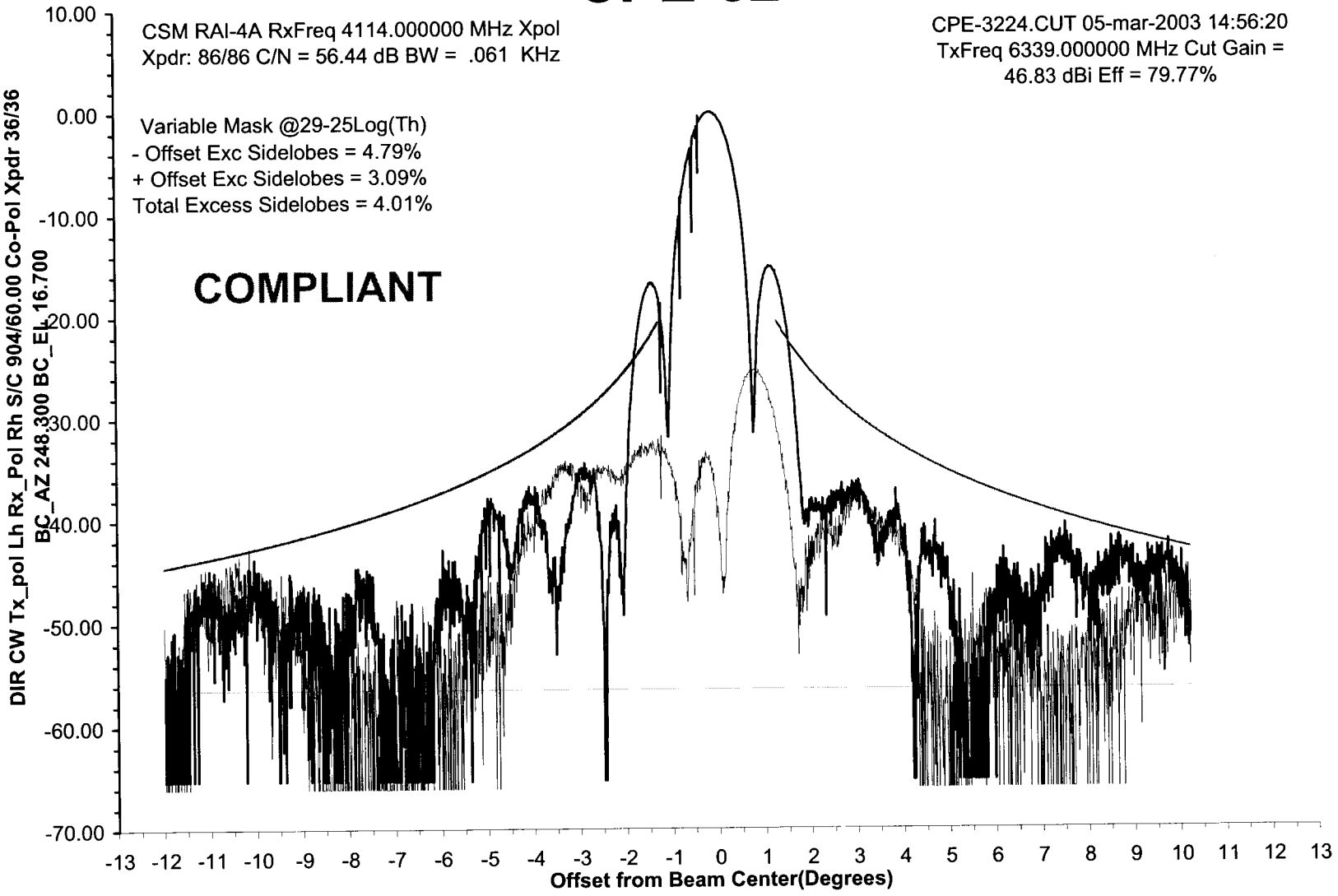
CPE-32


CSM RAI-4A RxFreq 4114.000000 MHz Xpol
Xpdr: 86/86 C/N = 56.36 dB BW = .061 KHz
CPE-3213.CUT 05-mar-2003 14:50:16
TxFreq 6339.000000 MHz Cut Gain =
46.32 dBi Eff = 70.92%
Variable Mask @29-25Log(Th)
- Offset Exc Sidelobes = 6.41%
+ Offset Exc Sidelobes = 4.5%
Total Excess Sidelobes = 5.46%
COMPLIANT
DIR CW Tx_pol Lh Rx_Pol Rh S/C 904/60.00 Co-Pol Xpdr 36/36
BC_AZ 248.300 BC_EL 16.700
10.00
0.00
-10.00
-20.00
-30.00
-40.00
-50.00
-60.00
-70.00
-13 -12 -11 -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9 10 11 12 13
Offset from Beam Center(Degrees)

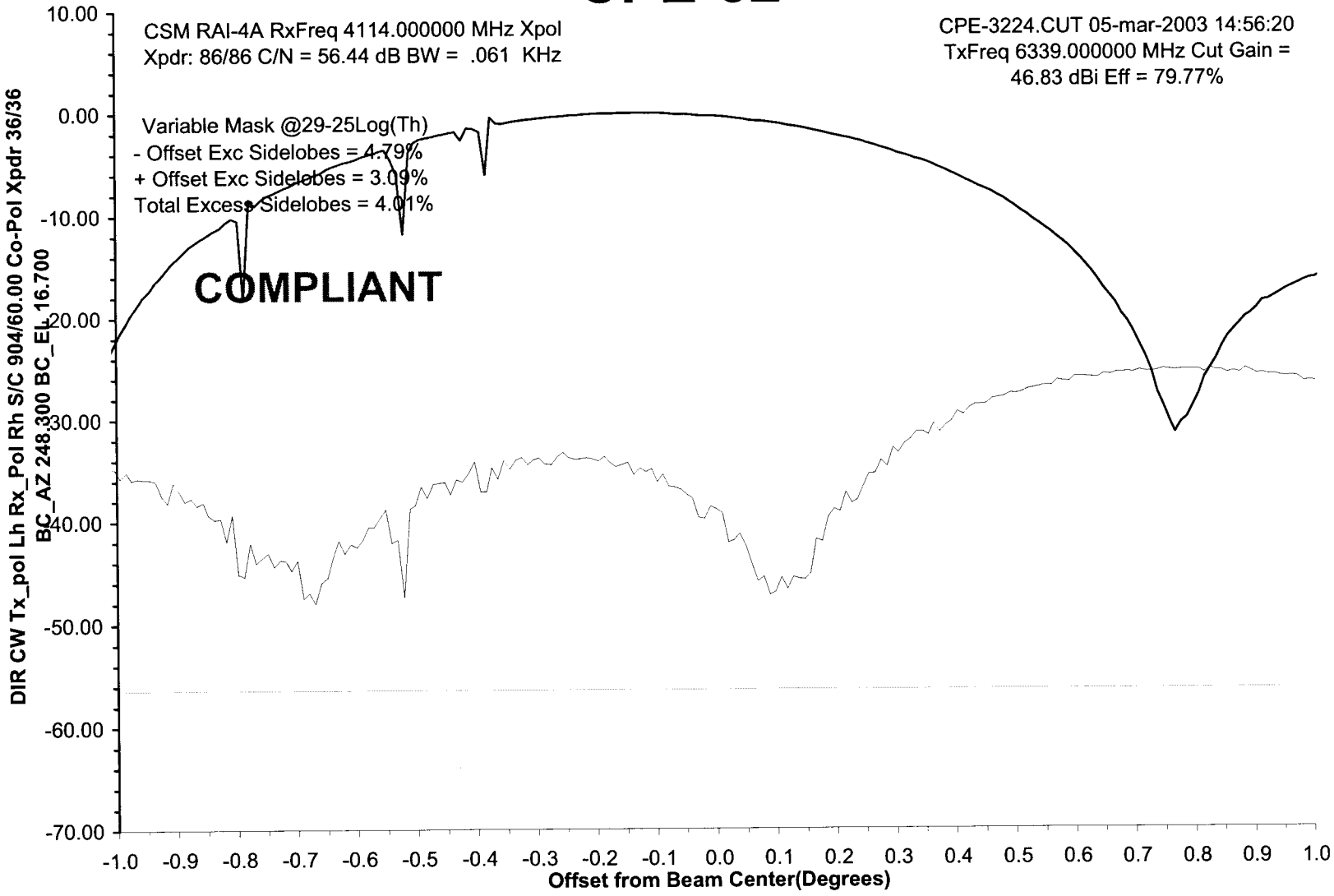
CPE-32


CSM RAI-4A RxFreq 4114.000000 MHz Xpol
Xpdr: 86/86 C/N = 56.36 dB BW = .061 KHz
CPE-3213.CUT 05-mar-2003 14:50:16
TxFreq 6339.000000 MHz Cut Gain =
46.32 dBi Eff = 70.92%
Variable Mask @29-25Log(Th)
- Offset Exc Sidelobes = 6.41%
+ Offset Exc Sidelobes = 4.5%
Total Excess Sidelobes = 5.46%
COMPLIANT
DIR CW Tx_pol Lh Rx_Pol Rh S/C 904/60.00 Co-Pol Xpdr 36/36
BC_AZ 248.300 BC_EL 16.700
10.00
0.00
-10.00
-20.00
-30.00
-40.00
-50.00
-60.00
-70.00
-1.0 -0.9 -0.8 -0.7 -0.6 -0.5 -0.4 -0.3 -0.2 -0.1 0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Offset from Beam Center(Degrees)

CPE-32


CSM RAI-4A RxFreq 4114.000000 MHz Xpol
Xpdr: 86/86 C/N = 56.44 dB BW = .061 KHz
CPE-3224.CUT 05-mar-2003 14:56:20
TxFreq 6339.000000 MHz Cut Gain =
46.83 dBi Eff = 79.77%
Variable Mask @29-25Log(Th)
- Offset Exc Sidelobes = 4.79%
+ Offset Exc Sidelobes = 3.09%
Total Excess Sidelobes = 4.01%
COMPLIANT
DIR CW Tx_pol Lh Rx_Pol Rh S/C 904/60.00 Co-Pol Xpdr 36/36
BC_AZ 248.300 BC_EL 16.700
10.00
0.00
-10.00
-20.00
-30.00
-40.00
-50.00
-60.00
-70.00
-13 -12 -11 -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9 10 11 12 13
Offset from Beam Center(Degrees)

CPE-32


CSM RAI-4A RxFreq 4114.000000 MHz Xpol
Xpdr: 86/86 C/N = 56.44 dB BW = .061 KHz
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COMPLIANT
DIR CW Tx_pol Lh Rx_Pol Rh S/C 904/60.00 Co-Pol Xpdr 36/36
BC_AZ 248.300 BC_EL 16.700
10.00
0.00
-10.00
-20.00
-30.00
-40.00
-50.00
-60.00
-70.00
-1.0 -0.9 -0.8 -0.7 -0.6 -0.5 -0.4 -0.3 -0.2 -0.1 0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Offset from Beam Center(Degrees)

Date: 05-Mar-03 14:43:58

Antenna Verif Isolation Contour

EUT Code	CPE-32
CSM Code	RAI -4A
Test Performed On Date/Time (UTC)	05-MAR-2003 14:31:35
Earth Station Switching polarizations	CSM
Satellite/Location (Degrees East)	904 /60.00
Transponder	
Co-pol * (Up/Dn)	36/36
Polarization (Up/Dn)	L/ R
Gain (dB)	155.70
LO Offset (Hz)	44
Gain Check Date / Time (UTC)	05-MAR-2003 12:10:34
Cross-pol ** (Up/Dn)	86/86
Polarization (Up/Dn)	R / L
Gain (dB)	151.49
LO Offset (Hz)	-735
Gain Check Date/Time (UTC)	05-MAR-2003 12:13:55

CSM	
Nominal downlink carrier frequency (MHz)	4,114.000
Downlink Frequency Error (kHz)	0.718
Reference C/N (dB)	56.48
Reference C/N bandwidth (Hz)	61
Weather	Clear
EUT	
Antenna Shape	C
Antenna dimensions, Dim1/Dim2*(m)**	3.70/ 3.70
Power at Feed Flange (dBW)	0.00
Azimuth at Beam Center (Deg CCW)	248.28
Elevation at Beam Center (Deg UP)	16.69
Weather	Light Snow
Nominal Uplink test carrier frequency (MHz)	6,339.000

Step	Az-Offset (deg)	El-Offset (deg)	Co-pol (dBW) ****	Cross-pol (dBW)****	Isolation (dB)	Comment
1	0.000	0.000	10.04	-24.91	30.74	
2	0.191	0.000	9.58	-20.76	26.13	
3	0.191	0.183	9.31	-21.21	26.31	
4	0.000	0.183	9.75	-22.84	28.38	
5	-0.191	0.183	9.34	-25.52	30.65	
6	-0.191	0.000	9.63	-26.93	32.35	
7	-0.191	-0.183	9.16	-26.53	31.48	
8	0.000	-0.183	9.61	-24.95	30.35	
9	0.191	-0.183	9.34	-22.78	27.91	TX PORT #1 IS COMPLIANT - APOL

* **Transponder monitored during copol level measurements**
** **Transponder monitored during cross-pol level measurements**
*** **Dim1/Dim2 = Horizontal/Vertical Dimensions**
**** **Level referred to transponder beam center at satellite**

RADIATION HAZARD EVALUATION

For

Clear Channel Satellite Services - 3.7M Suman C-Band Antenna

1 Overview

Determining the region around an antenna where radiation hazardous to human health is a consideration of many factors. With a parabolic dish antenna, the region is highly directional and the actual hazardous region is dependent on the antenna elevation angle. The following formulae are used to determine the near and far field regions. These regions are in the main beam of the radiation pattern, which we will assume consists of a conical angle extending +/- 3 degrees from the center axis of the antenna.

The analysis contained herein predicts the radiation levels around the proposed antenna. The calculations contained in this report are in accordance with FCC guidelines as contained in CFR 47 Part 1.1310 and OET Bulletin 65. The maximum level of non-ionizing radiation to which the general public is exposed is defined for controlled and uncontrolled environments as follows:

Environment	Exposure Limit Power	Exposure Limit Duration
Controlled - (applicable to system operators and technicians in the service area of the antenna):	**5 mW/cm^2**	**6 Minutes**
Uncontrolled - (applicable to general public in proximity of the antenna):	**1 mW/cm^2**	**30 Minutes**

2.1 Earth Station Technical Parameters - Input Data

1A	Antenna Diameter - Standard Parabola	3.7	meters
1B	Antenna Diameter - Elliptical Reflector		meters
1B1	Major Axis Diameter		meters
1B2	Minor Axis Diameter		meters
2	G = Antenna Isotropic Gain	45.5	dBi
3	h = Nominal Antenna Efficiency	66	Percent
4	Nominal Frequency	6	GHz
5	Maximum Transmit Power Amplifier Size	150	Watts
6	Number of Carriers	2	each
7	W/G Loss from Transmitter to Feed	0.5	dB
8	Multicarrier Fixed Backoff	3	dB
9	Desired Object Clearance Height	3	meters

2.2 Earth Station Technical Parameters - Calculated Data

10	A = Antenna Surface Area	10.75	sq meters		
10A	Standard Parabolic Reflector	10.75210086	sq meters		
10B	Elliptical Reflector	0.00	sq meters		
11	D = Effective Antenna Diameter	3.7	meters		
12	Total Transmit Power	300	Watts		
13	P = Total Feed Input Power (watts)	67.00	Watts		
14	E = Maximum E/S EIRP - Calculated	63.76	dBW		
15	λ = Wavelength (= c/f in m/GHz)	0.0500	m/GHz		
16	p = Pi	3.14159			
17	R_{nf} = Near Field Limit ($D^2/4\lambda$)	68	meters	223	feet
18	R_{ff} = Far Field Limit (R_{ff}=0.6D2/λ)	164	meters	538	feet
19	R_{nf} to R_{ff} = Transition Region	68 to 164	meters	223 to 538	feet

3 Power Density at the Antenna Surface

The power density at the reflector surface is expected to exceed the safe limits. The reflector is not accessible to the public and will not present a hazard. Terminal operators and technicians receive training identifying the area as presenting high exposure levels. Procedures are incorporated requiring that transmitters are not operating when access to the reflector surface is required.

The power density at the antenna reflector surface can be calculated by the expression:

$PD_{REFL} = 4P/A =$ **2.49 mW/cm^2**

Where: P = Total power at the feed, milliwatts
A = Total area of reflector, sq cm

Evaluation:

Controlled Environment (less than 5 mW/cm^2 in 6 minutes): **SAFE**

Uncontrolled environment (less than 1 mW/cm^2 in 30 minutes): **Mitigation Required**

4 On-Axis Power Density in the Near Field Region

The Radiating Near Field Region for a parabolic, circular reflector, is defined as extending from the reflector to a distance equal to the diameter squared divided by twice the wavelength. This distance is referred to as the Rayleigh distance. In this region the power is nearly all contained within a cylinder of radius 0.5D. As a safety measure the highest possible power density is applied to the whole of this region.

The power density in the Near Field Region of the antenna can be calculated by the expression:

$16*P*h/\pi*D^2 =$ **1.65 mW/cm^2**

Where: P = Total power at the feed, milliwatts
h = Nominal antenna efficiency
D = Effective antenna diameter, meters

Evaluation:

Controlled Environment (less than 5 mW/cm^2 in 6 minutes): **SAFE**

Uncontrolled environment (less than 1 mW/cm^2 in 30 minutes): **Mitigation Required**

5 On-Axis Power Density in the Transition Region

The transition region is located between the Near Field and Far Field regions. The power density begins to vary inversely with distance from the antenna in the transition region. The maximum power density in this region will not exceed the power density calculated for the Near Field region. Once again the power density figures are for the On-Axis and contained with a cylinder extending within +/- 1 degree of beam center. Where the antennas are normally operated at an elevation angle typically greater than 10°, the actual safe distance in front of the antenna may be found in paragraph 10. The formula for the calculation is used to evaluate the power density at any given distance in the transition as expressed below:

The power density in the On-Axis Transition Region can be calculated by the expression:

$PD_t=(PD_{nf})(R_{nf}/R$

Where: PD_{nf} = The Near Field power density, mW/cm^2
R_{nf} = Near Field maximum distance, meters
R = Distance to point of interest

For: 68 < R < 164 meters

Evaluation:

Controlled Environment Safe Operating Distance, meters: **22 meters**

Uncontrolled environment Safe Operating Distance, meters: **112 meters**

6 On-Axis Power Density in the Far Field Region

The On-Axis power density in the far field region (PD_{ff}) varies inversely with the square of the distance. The calculation is performed below:

The Power Density at the start of the Far Field region can be calculated by the expression:

$E-10\log(4\pi R^2)$	8.47 dBW/m^2
$\text{antilog}((E-10\log(4\pi R^2))/10)/10$	**0.70 mW/cm^2**

Evaluation:

Controlled Environment (less than 5 $mW/cm^{2\ in}$ 6 minutes):	**SAFE**
Uncontrolled environment (less than 1 mW/cm^2 in 30 minutes):	**SAFE**

7 Off-Axis Power Density Levels at the Far Field Limit and Beyond

In the far field region, the power is distributed in a pattern of sidelobes as a function of the off-axis angle between the antenna center line and the point of interest. Off-axis power density in the far field can be estimated using the antenna radiation patterns prescribed for the antenna in use. Usually this will correspond to the antenna gain pattern envelope defined by the FCC or the ITU, which takes the form of:

$G_{off} = 32 - 25\log(\theta)$

for θ from 1 to 48 degrees; -10 dBi from 48 to 180 degrees

(Applicable for commonly used satellite transmit antennas)

For example: At one (1) degree off axis At the far-field limit, we can calculate the power density as:

$G_{off} = 32 - 25\log(1) = 32 - 0$ dBi =	1585 numeric
$PD_{1\ deg\ off\text{-}axis} = PD_{ff} \times 1585/G$	**0.0314 mW/cm^2**

Evaluation:

Considering that satellite antenna beams are aimed skyward, power density in the far field will usually not be a problem except at low look angles. In these cases, off axis gain reduction techniques may be used to further reduce the power density levels.

8 Off-Axis Power Density Levels at the Near Field and Transitional Regions

According to Bulletin 65, off-axis calculations in the near field may be performed as follows: assuming that the point of interest is at least one antenna diameter removed from the center of the main beam, the power density at that point is at least a factor of 100 (20 dB) less than the value calculated for the near field main beam power density. This may be calculated as follows:

$PD_{nf(off\text{-}axis)} = PD_{nf}/100 =$	**0.0165 mW/cm^2**

9 Region Between the Feed Horn and Reflector/Sub-Reflector

Transmissions from the feed horn are directed toward the main reflector or the sub-reflector depending on the type of antenna (prime focus, Gregorian or Cassegrain). The transmission is confined within a conical shape defined by the feed horn. The energy between the feedhorn and the reflector/sub-reflector is assumed to be in excess of any limit for permissible exposure. This region is not accessible to the general public, and operators and technicians should be suitable trained and procedures in place to preclude access to this region during active transmission.

10 Evaluation of Safe Occupancy Area in Front of the Antenna

The distance (L) from a vertical axis passing through the dish center to a safe off-axis point in front of the antenna can be determined based on the dish diameter. Assuming a flat terrain and a point on the horizontal plane with the center point of the antenna, the relationship is determined by the following formula:

$$L = (D/\sin a) + (2h - D - 2)/(2 \tan a)$$

Where: a = minimum elevation angle of antenna

D = Dish diameter in meters

h = Maximum height of object to be cleared, meters

For distances equal to or greater than determined by the equation above, the radiation hazard will be below safe levels

For:	D =	3.7	meters
	h=	3	meters

Safe distance for the following elevation angles (a):

a - Elevation Angle (degrees)	**L - Safe Distance**	
10	**22.16**	**meters**
15	**14.86**	**meters**
20	**11.23**	**meters**
25	**9.08**	**meters**
30	**7.66**	**meters**
40	**5.93**	**meters**
50	**4.96**	**meters**

11 Mitigation Analysis

Mitigation of accessibility to hazardous regions may take several forms depending on the antenna application and location. In instances such as mobile applications, the antenna may be located such that the hazardous region is not accessible during operation. An example may be in a mobile configuration where the antenna is located on top of a vehicle during operation. In other fixed installation instances the hazardous area may be fenced off to prevent access. In areas where only operators and technicians have access, training in safeguards and proper markings of hazardous areas may be sufficient. This analysis tool is designed to identify the hazardous exposure regions around an operating antenna system in accordance with the defined power density limits in CFR 47, part 1.1310 and OET bulletin 65.

FREQUENCY COORDINATION AND INTERFERENCE ANALYSIS REPORT

Prepared for
Clear Channel Satellite Services
ENGLEWOOD, CO
(3.7 Meter)
Satellite Earth Station

Prepared By:
COMSEARCH
19700 Janelia Farm Boulevard
Ashburn, VA 20147
October 10, 2011

TABLE OF CONTENTS

1. CONCLUSIONS

An interference study considering all existing, proposed and prior coordinated microwave facilities within the coordination contours of the proposed earth station demonstrates that this site will operate satisfactorily with the common carrier microwave environment. Further, there will be no restrictions of its operation due to interference considerations.

2. SUMMARY OF RESULTS

A number of great circle interference cases were identified during the interference study of the proposed earth station. Each of the cases, which exceeded the interference objective on a line-of-sight basis, was profiled and the propagation losses estimated using NBS TN101 (Revised) techniques. The losses were found to be sufficient to reduce the signal levels to acceptable magnitudes in every case.

The following companies reported potential great circle interference conflicts that did not meet the objectives on a line-of-sight basis. When over-the-horizon losses are considered on the interfering paths, sufficient blockage exists to negate harmful interference from occurring with the proposed transmit-receive earth station.

Company

New Cingular Wireless PCS LLC -Colorado
State of Colorado
Tri State Generation & Transmission
Great Western Communications, LLC

No other carriers reported potential interference cases.

3. SUPPLEMENTAL SHOWING

Pursuant to Part 25.203(c) of the FCC Rules and Regulations, the satellite earth station proposed in this application was coordinated by Comsearch using computer techniques and in accordance with Part 25 of the FCC Rules and Regulations.

Coordination data for this earth station was sent to the below listed carriers with a letter dated 09/08/2011.

Company
AT&T COMMUNICATIONS OF MOUNTAIN STATES
AT&T CORP
Adcom 911
AirLife Denver
BASIN ELECTRIC POWER COOPERATIVE
BNSF Railway Company
Boulder, County of
CBS Communications Services
CBS Television Stations
City of Colorado Springs
Colorado Interstate Gas Company
Colorado Springs Utilities
ENTRAVISION HOLDINGS, LLC
FONES WEST DIGITAL SYSTEMS INC.
Gray Television Licensee, Inc. (KKTV)
Great Western Communications, LLC
Intermountain Rural Electric Association
International Communications Group, Inc.
Larimer County Sheriff's Department
METROPOLITAN AREA NETWORKS, INC.
MHO Networks
Multimedia Holdings Corporation
NE Colorado Cellular, Inc.
New Cingular Wireless PCS LLC -Colorado
Open Range Communications
Platte River Power Authority
QWEST CORPORATION
SANGRE DE CRISTO COMMUNICATIONS, INC.
Sprint Communications Company, LP
State of Colorado
Tri State Generation & Transmission
UNITED POWER
Verizon Wireless - Mountain Region
XCEL ENERGY SERVICES INC

4. EARTH STATION COORDINATION DATA

This section presents the data pertinent to frequency coordination of the proposed earth station that was circulated to all carriers within its coordination contours.

COMSEARCH

Earth Station Data Sheet

19700 Janelia Farm Boulevard, Ashburn, VA 20147
(703)726-5500 http://www.comsearch.com

Date:	10/10/2011
Job Number:	110908COMSGE01

Administrative Information

Status	ENGINEER PROPOSAL
Call Sign	
Licensee Code	CLCSAT
Licensee Name	Clear Channel Satellite Services

Site Information — ENGLEWOOD, CO

Venue Name	
Latitude (NAD 83)	39° 34' 47.0" N
Longitude (NAD 83)	104° 51' 35.0" W
Climate Zone	A
Rain Zone	2
Ground Elevation (AMSL)	1751.0 m / 5744.8 ft

Link Information

Satellite Type	Geostationary
Mode	TR - Transmit-Receive
Modulation	Digital
Satellite Arc	60° W to 143° West Longitude
Azimuth Range	122.6° to 230.9°
Corresponding Elevation Angles	25.3° / 29.8°
Antenna Centerline (AGL)	2.44 m / 8.0 ft

Antenna Information		Receive - FCC32		Transmit - FCC32	
Manufacturer		Suman		Suman	
Model		SMT3.7R		SMT3.7R	
Gain / Diameter		41.7 dBi / 3.7 m		45.5 dBi / 3.7 m	
3-dB / 15-dB Beamwidth		1.40° / 2.70°		0.90° / 1.70°	
Max Available RF Power	(dBW/4 kHz)			-17.2	
	(dBW/MHz)			6.8	
Maximum EIRP	(dBW/4 kHz)			28.3	
	(dBW/MHz)			52.3	
Interference Objectives:	Long Term	-156.0 dBW/MHz	20%	-154.0 dBW/4 kHz	20%
	Short Term	-146.0 dBW/MHz	0.01%	-131.0 dBW/4 kHz	0.0025%

Frequency Information	Receive 4.0 GHz	Transmit 6.1 GHz
Emission / Frequency Range (MHz)	11M1G1E - 22M5G7W / 3700.0 - 4200.0	11M1G1E - 22M5G7W / 5925.0 - 6425.0
Max Great Circle Coordination Distance	285.3 km / 177.2 mi	124.3 km / 77.3 mi
Precipitation Scatter Contour Radius	495.1 km / 307.6 mi	100.0 km / 62.1 mi

COMSEARCH

Earth Station Data Sheet

19700 Janelia Farm Boulevard, Ashburn, VA 20147
(703)726-5500 http://www.comsearch.com

Coordination Values	**ENGLEWOOD, CO**			
Licensee Name	Clear Channel Satellite Services			
Latitude (NAD 83)	39° 34' 47.0" N			
Longitude (NAD 83)	104° 51' 35.0" W			
Ground Elevation (AMSL)	1751.0 m / 5744.8 ft			
Antenna Centerline (AGL)	2.44 m / 8.0 ft			
Antenna Model	Suman 3.7 Meter			
Antenna Mode	Receive 4.0 GHz		Transmit 6.1 GHz	
Interference Objectives: Long Term	-156.0 dBW/MHz	20%	-154.0 dBW/4 kHz	20%
Short Term	-146.0 dBW/MHz	0.01%	-131.0 dBW/4 kHz	0.0025%
Max Available RF Power			-17.2 (dBW/4 kHz)	

			Receive 4.0 GHz		Transmit 6.1 GHz	
Azimuth (°)	Horizon Elevation (°)	Antenna Discrimination (°)	Horizon Gain (dBi)	Coordination Distance (km)	Horizon Gain (dBi)	Coordination Distance (km)
0	0.00	119.19	-10.00	285.28	-10.00	124.34
5	0.00	114.80	-10.00	285.28	-10.00	124.34
10	0.00	110.37	-10.00	285.28	-10.00	124.34
15	0.00	105.90	-10.00	285.28	-10.00	124.34
20	0.00	101.41	-10.00	285.28	-10.00	124.34
25	0.00	96.90	-10.00	285.28	-10.00	124.34
30	0.00	92.38	-10.00	285.28	-10.00	124.34
35	0.00	87.86	-10.00	285.28	-10.00	124.34
40	0.23	83.33	-10.00	281.81	-10.00	122.09
45	0.59	78.78	-10.00	244.09	-10.00	100.00
50	1.37	74.16	-10.00	209.16	-10.00	100.00
55	1.71	69.58	-10.00	202.35	-10.00	100.00
60	1.83	65.05	-10.00	199.07	-10.00	100.00
65	2.10	60.51	-10.00	192.18	-10.00	100.00
70	2.16	56.06	-10.00	190.96	-10.00	100.00
75	2.22	51.67	-10.00	189.41	-10.00	100.00
80	2.24	47.38	-9.89	189.63	-9.89	100.00
85	2.17	43.24	-8.90	195.86	-8.90	100.00
90	2.08	39.27	-7.85	202.67	-7.85	100.00
95	2.19	35.40	-6.72	205.49	-6.72	100.00
100	2.38	31.75	-5.54	204.76	-5.54	100.00
105	2.06	28.84	-4.50	217.05	-4.50	100.00
110	2.07	26.23	-3.47	222.36	-3.47	100.00
115	2.14	24.27	-2.63	225.34	-2.63	100.00
120	2.20	23.19	-2.13	226.73	-2.13	100.00
125	2.28	23.09	-2.08	225.01	-2.08	100.00
130	1.98	24.35	-2.66	229.34	-2.66	100.00
135	1.79	26.36	-3.52	230.25	-3.52	100.00
140	1.48	29.14	-4.61	233.93	-4.61	100.00
145	1.50	31.98	-5.62	227.59	-5.62	100.00
150	1.44	34.66	-6.50	224.69	-6.50	100.00
155	1.35	37.07	-7.23	223.57	-7.23	100.00
160	1.09	39.31	-7.86	228.52	-7.86	100.00
165	0.86	41.15	-8.36	236.95	-8.36	100.00
170	1.02	42.20	-8.63	226.73	-8.63	100.00
175	1.12	42.83	-8.79	222.67	-8.79	100.00
180	0.96	43.23	-8.90	228.01	-8.90	100.00
185	0.95	43.00	-8.84	228.84	-8.84	100.00

COMSEARCH

Earth Station Data Sheet

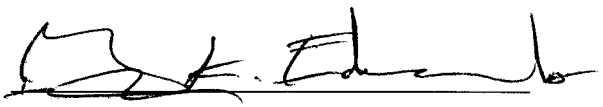
19700 Janelia Farm Boulevard, Ashburn, VA 20147
(703)726-5500 http://www.comsearch.com

Coordination Values	**ENGLEWOOD, CO**			
Licensee Name	Clear Channel Satellite Services			
Latitude (NAD 83)	39° 34' 47.0" N			
Longitude (NAD 83)	104° 51' 35.0" W			
Ground Elevation (AMSL)	1751.0 m / 5744.8 ft			
Antenna Centerline (AGL)	2.44 m / 8.0 ft			
Antenna Model	Suman 3.7 Meter			
Antenna Mode	Receive 4.0 GHz		Transmit 6.1 GHz	
Interference Objectives: Long Term	-156.0 dBW/MHz	20%	-154.0 dBW/4 kHz	20%
Short Term	-146.0 dBW/MHz	0.01%	-131.0 dBW/4 kHz	0.0025%
Max Available RF Power			-17.2 (dBW/4 kHz)	

			Receive 4.0 GHz		Transmit 6.1 GHz	
Azimuth (°)	Horizon Elevation (°)	Antenna Discrimination (°)	Horizon Gain (dBi)	Coordination Distance (km)	Horizon Gain (dBi)	Coordination Distance (km)
190	1.29	41.93	-8.56	218.52	-8.56	100.00
195	1.35	40.69	-8.24	218.35	-8.24	100.00
200	1.42	39.01	-7.78	218.51	-7.78	100.00
205	1.48	36.96	-7.19	219.73	-7.19	100.00
210	1.61	34.52	-6.45	219.72	-6.45	100.00
215	1.75	31.91	-5.60	219.96	-5.60	100.00
220	1.76	29.91	-4.90	223.64	-4.90	100.00
225	1.77	28.58	-4.40	226.03	-4.40	100.00
230	1.64	28.15	-4.24	231.06	-4.24	100.00
235	1.65	28.39	-4.33	230.13	-4.33	100.00
240	1.79	29.30	-4.67	223.87	-4.67	100.00
245	1.87	30.99	-5.28	218.18	-5.28	100.00
250	1.80	33.41	-6.10	215.99	-6.10	100.00
255	1.74	36.29	-7.00	213.22	-7.00	100.00
260	1.76	39.49	-7.91	208.03	-7.91	100.00
265	1.74	43.01	-8.84	204.49	-8.84	100.00
270	1.71	46.75	-9.74	203.51	-9.74	100.00
275	1.30	50.82	-10.00	211.11	-10.00	100.00
280	1.22	54.86	-10.00	213.66	-10.00	100.00
285	1.27	58.95	-10.00	212.24	-10.00	100.00
290	1.32	63.12	-10.00	210.67	-10.00	100.00
295	1.23	67.40	-10.00	213.43	-10.00	100.00
300	1.14	71.72	-10.00	216.07	-10.00	100.00
305	1.11	76.05	-10.00	216.89	-10.00	100.00
310	0.98	80.42	-10.00	221.28	-10.00	100.00
315	0.84	84.80	-10.00	229.07	-10.00	100.00
320	0.73	89.18	-10.00	235.34	-10.00	100.00
325	0.59	93.54	-10.00	244.02	-10.00	100.00
330	0.30	97.88	-10.00	272.97	-10.00	116.28
335	0.37	102.22	-10.00	265.03	-10.00	110.95
340	0.00	106.47	-10.00	285.28	-10.00	124.34
345	0.00	110.72	-10.00	285.28	-10.00	124.34
350	0.00	114.94	-10.00	285.28	-10.00	124.34
355	0.00	119.09	-10.00	285.28	-10.00	124.34

5. CERTIFICATION

I HEREBY CERTIFY THAT I AM THE TECHNICALLY QUALIFIED PERSON RESPONSIBLE FOR THE PREPARATION OF THE FREQUENCY COORDINATION DATA CONTAINED IN THIS APPLICATION, THAT I AM FAMILIAR WITH PARTS 101 AND 25 OF THE FCC RULES AND REGULATIONS, THAT I HAVE EITHER PREPARED OR REVIEWED THE FREQUENCY COORDINATION DATA SUBMITTED WITH THIS APPLICATION, AND THAT IT IS COMPLETE AND CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF.

BY: _ 

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DATED: October 10, 2011