Description and Technical Parameters – ST5000-2.4

The ST5000-2.4 terminal is comprised of a 2.4m circular reflector antenna, an antenna positioner, and an antenna control module. The antenna positioner and control module are the same as those used in Harris CapRock's SpaceTrack 4000 series of stabilized antennas. The SpaceTrack 4000 has been previously licensed by the FCC in C-band and Ku-band ESV configurations and has years of proven experience in the field. Thus, the FCC can be assured that ST5000-2.4 will operate as designed to avoid potential interference to adjacent satellites.

SUMMARY OF TECHNICAL PARAMETERS – ST5000-2.4

Characteristic	**C-band**	**Ku-band**
Antenna diameter	2.4m	2.4m
Type of Antenna	Circular reflector	Circular reflector
Peak Power (SSPA)	200 watts	125 watts
Transmit Bandwidth	1 MHz to 72 MHz	1 MHz to 72 MHz
Transmit Gain	38 dBi	43 dBi
EIRP	58.3 dBW	62.2 dBW
Data Rate	20 Mbps Tx / 100 Mbps Rx	20 Mbps Tx / 100 Mbps Rx
Emission Designators	1M00G7D to 20M0G7D	1M00G7D to 20M0G7D
Transmit Polarization	LHCP/RHCP Horizontal/Vertical	Horizontal/Vertical
Transmit Max PSD	21.3 dBW/4kHz	25.2 dBW/4kHZ
Transmit Beamwidth	0.57 degrees	0.3 degrees
Receive G/T	16.4 dB/K	24.5 dB/K
Receive Bandwidth	Up to 72 MHz	Up to 72 MHz
Receive Polarization	LHCP/RHCP Horizontal/Vertical	Horizontal/Vertical
Feed Flange Power	106.2 Watts	74.5 Watts
ERP	409 kW	1.02 MW
Signal Modulation	Up to 32 APSK	Up to 32 APSK

The ST5000-2.4 positioner system is designed to provide stable pointing to GSO satellites during range of motion associated with maritime operations, as well as track predictable NGSO satellite orbit paths under the same maritime operational conditions. Harris CapRock's current test program confirms the terminals ability to successfully track and communicate with O3b satellites, and there have been no reported cases of interference in connection with ST-5000-2.4 operations.

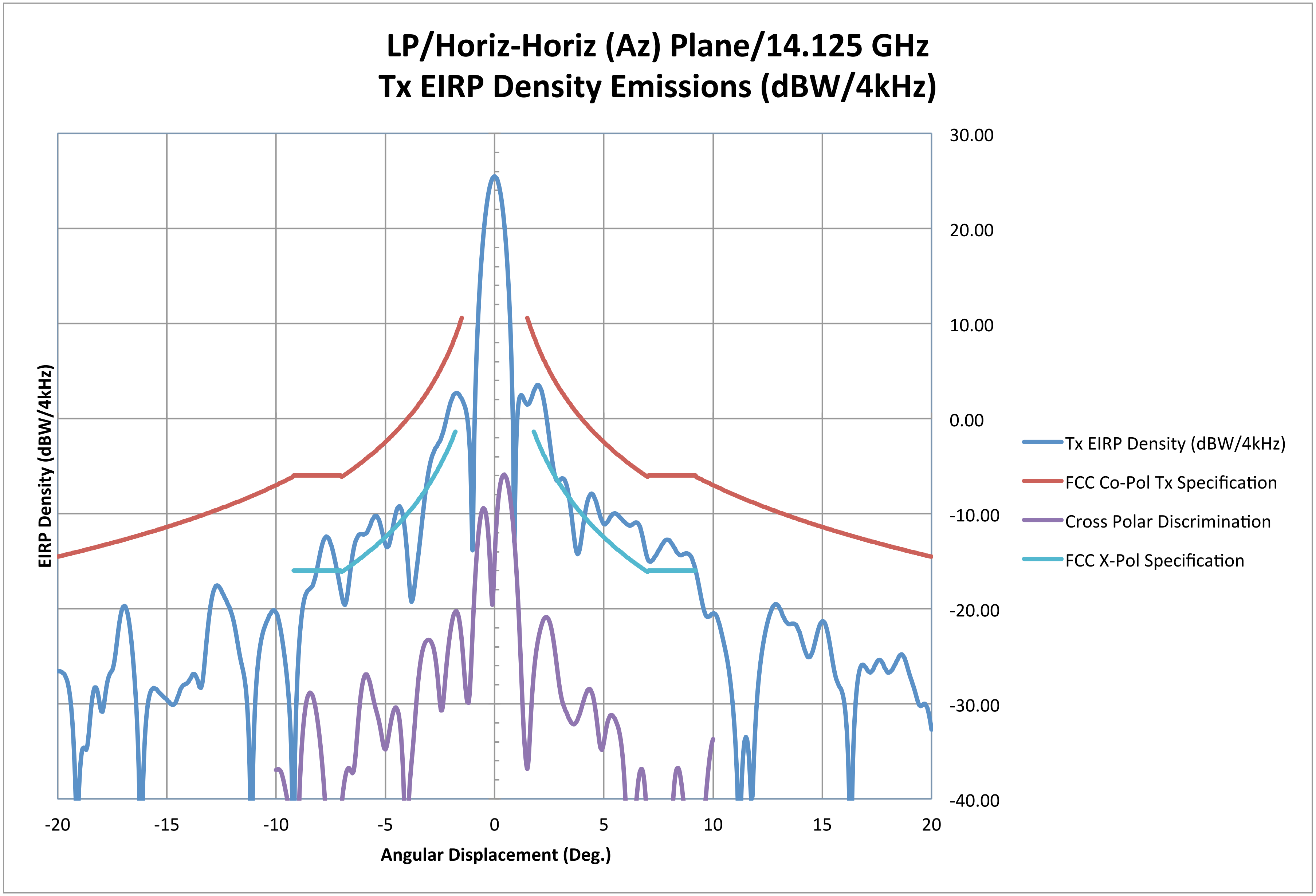
Harris CapRock's ST5000-2.4 terminal is designed to meet the FCC's ESV operational requirements for communication with GSO satellites, which have been extended by analogy to full-motion antennas communicating with the O3b system. These parameters include: (i) maintaining off-axis EIRP to the levels set forth in the applicable FCC mask; (ii) pointing accuracy of 0.2° or better; (iii) automatic cessation of emissions within 100 ms if pointing offset exceeds 0.5°; and (iv) transmissions will not resume until pointing accuracy is within 0.2°. The technical characteristics of the terminal's positioner system are set forth in the follow tables.

ANTENNA MOTION PARAMETERS - ST5000-2.4

Azimuth	Continuous coverage over 360º
Elevation	0 to 90º antenna elevation
Position accuracy	0.2º (auto-disable at 0.5 º offset)
Tracking capability	8º/sec

Additional information regarding the ST5000-2.4 terminal, including antenna performance plots, link budgets, and a radiofrequency hazard assessment are included as attachments hereto.

Annex 1 – Antenna Performance Plots


LP/Horiz-Horiz (Az) Plane/14.125 GHz
Tx EIRP Density Emissions (dBW/4kHz)
EIRP Density (dBW/4kHz)
30.00
20.00
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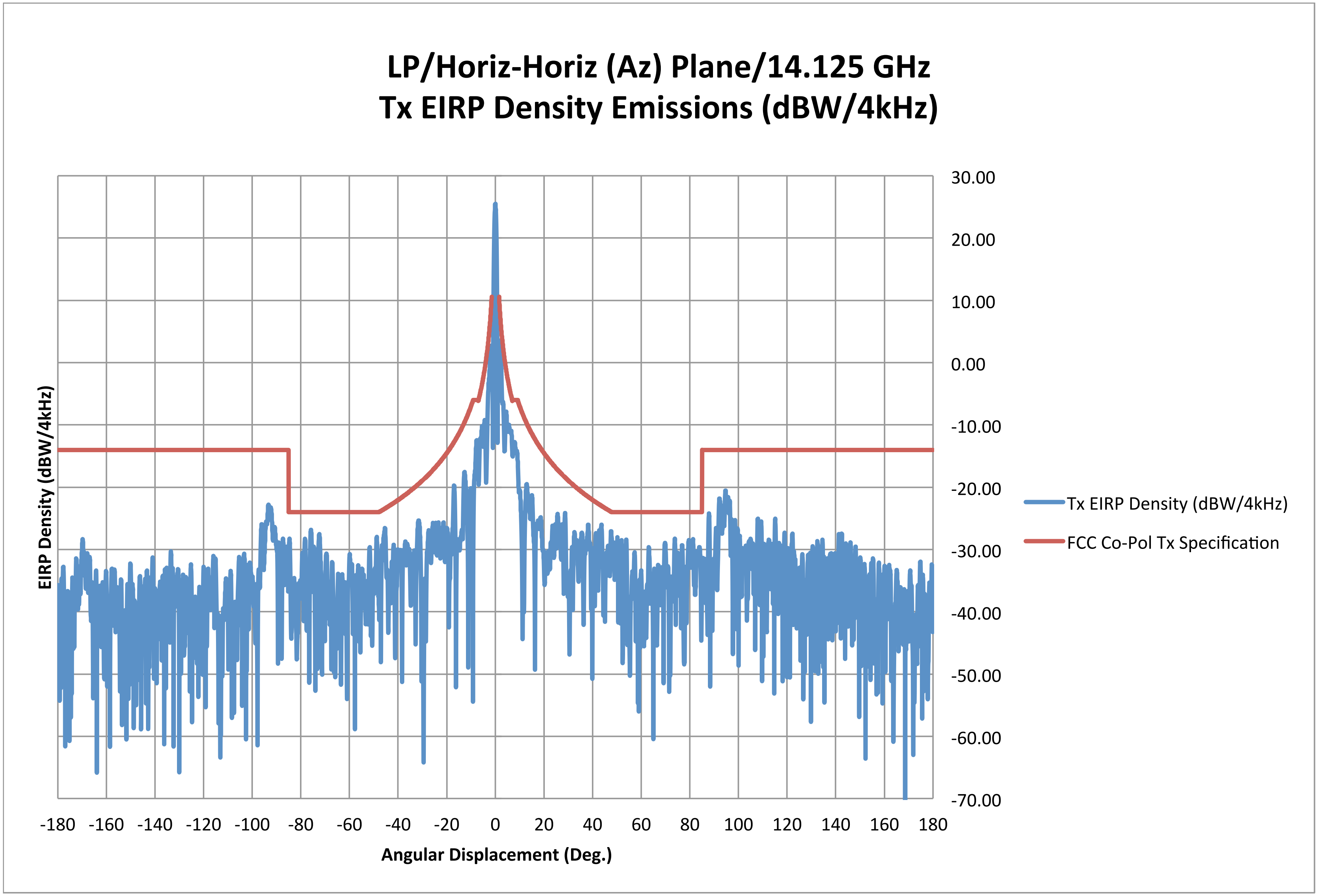
Angular Displacement (Deg.)
Tx EIRP Density (dBW/4kHz)
FCC Co-Pol Tx Specification
Cross Polar Discrimination
FCC X-Pol Specification



LP/Horiz-Horiz (Az) Plane/14.125 GHz
Tx EIRP Density Emissions (dBW/4kHz)
EIRP Density (dBW/4kHz)
Angular Displacement (Deg.)
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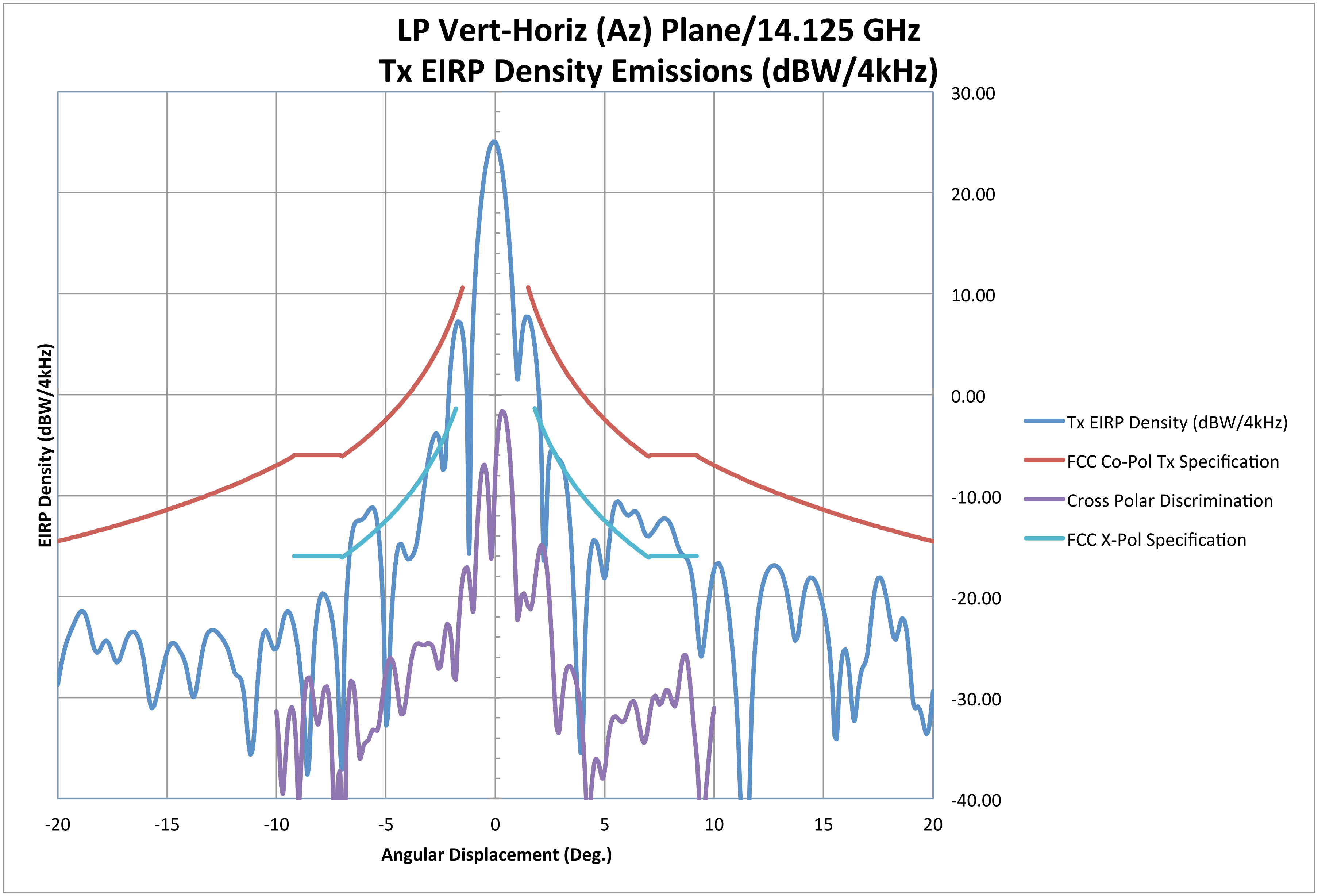
Tx EIRP Density (dBW/4kHz)
FCC Co-Pol Tx Specification



LP Vert-Horiz (Az) Plane/14.125 GHz
Tx EIRP Density Emissions (dBW/4kHz)
EIRP Density (dBW/4kHz)
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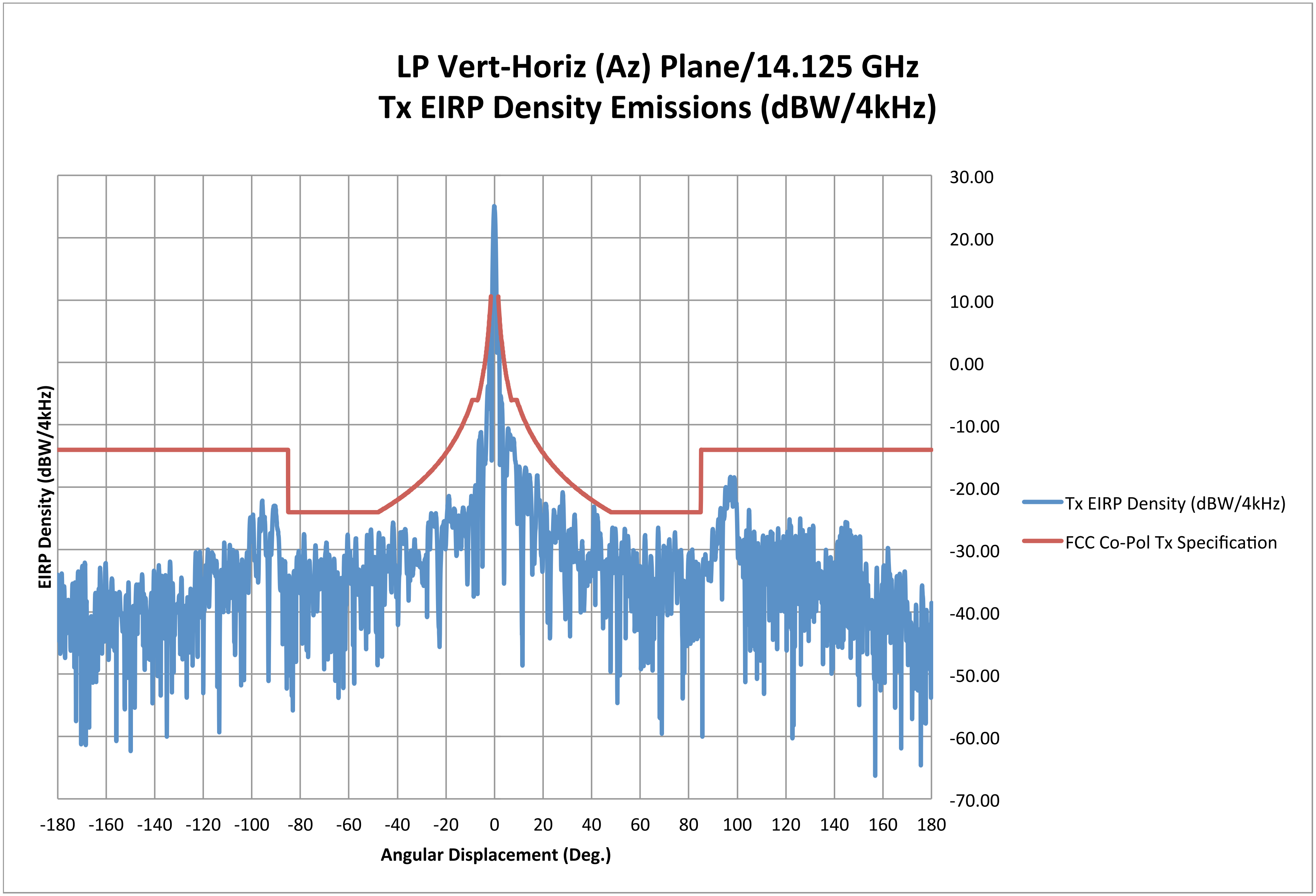
Angular Displacement (Deg.)
Tx EIRP Density (dBW/4kHz)
FCC Co-Pol Tx Specification
Cross Polar Discrimination
FCC X-Pol Specification



LP Vert-Horiz (Az) Plane/14.125 GHz
Tx EIRP Density Emissions (dBW/4kHz)
EIRP Density (dBW/4kHz)
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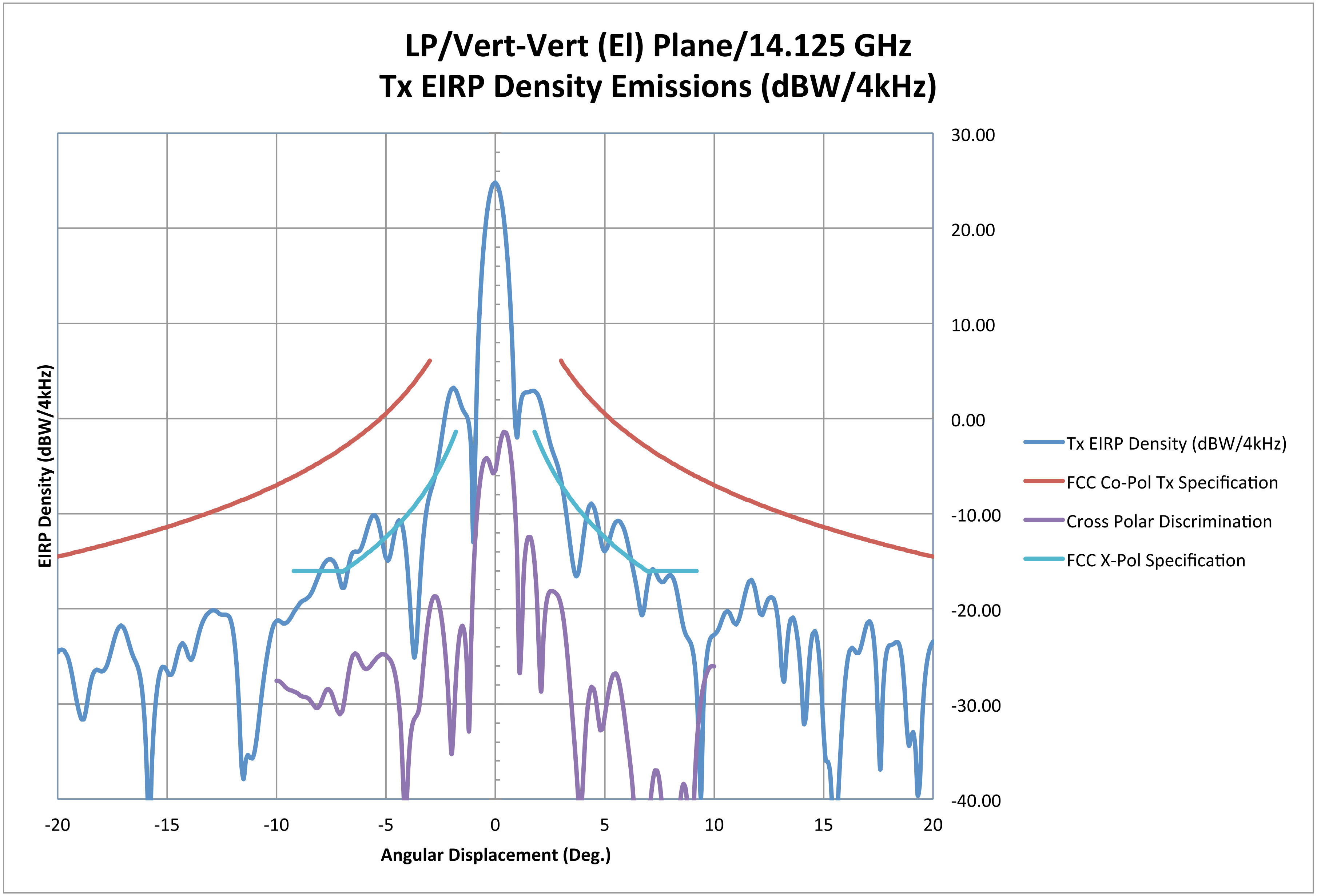
Angular Displacement (Deg.)
Tx EIRP Density (dBW/4kHz)
FCC Co-Pol Tx Specification



LP/Vert-Vert (El) Plane/14.125 GHz
Tx EIRP Density Emissions (dBW/4kHz)
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EIRP Density (dBW/4kHz)
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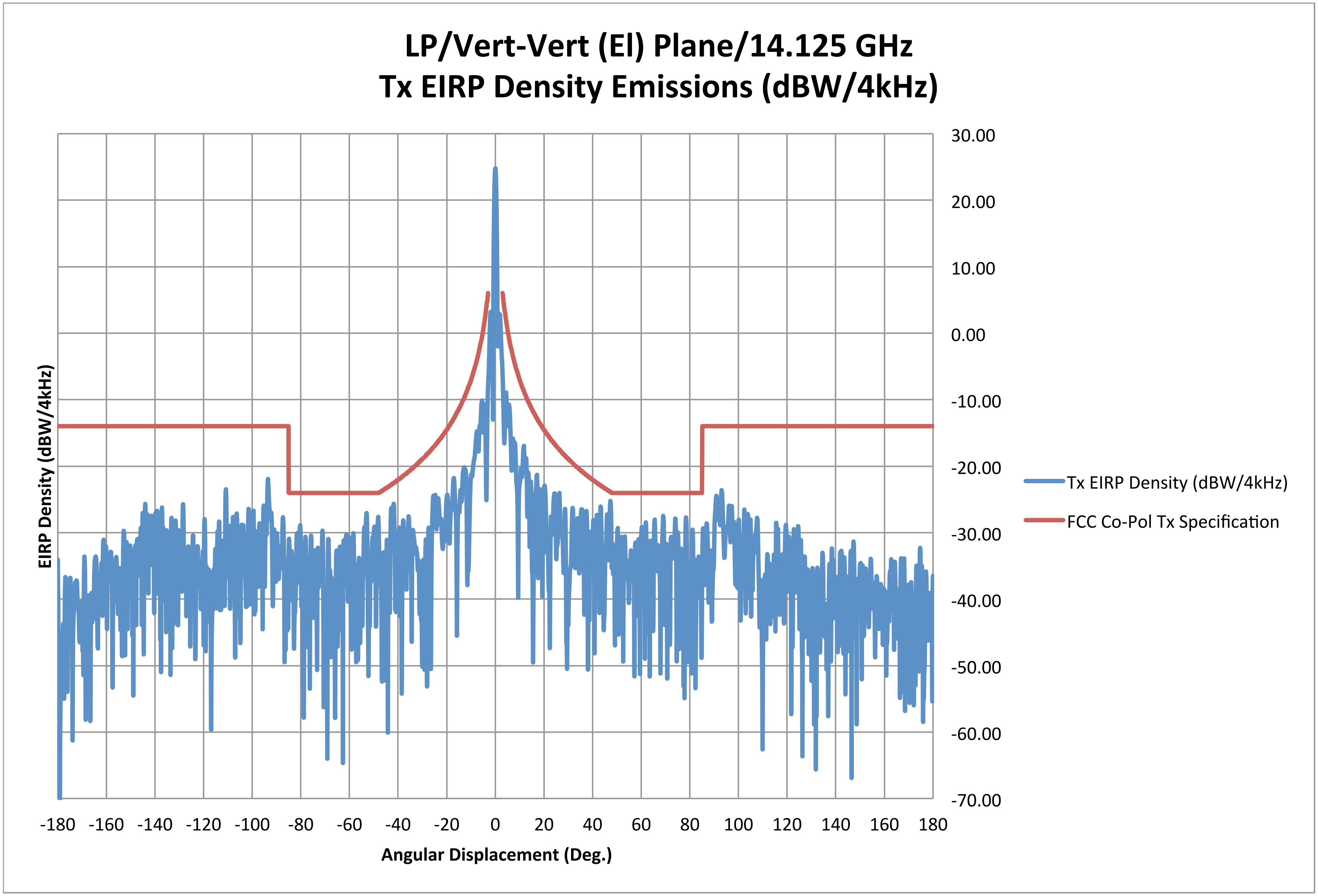
Angular Displacement (Deg.)
Tx EIRP Density (dBW/4kHz)
FCC Co-Pol Tx Specification
Cross Polar Discrimination
FCC X-Pol Specification



LP/Vert-Vert (El) Plane/14.125 GHz
Tx EIRP Density Emissions (dBW/4kHz)
EIRP Density (dBW/4kHz)
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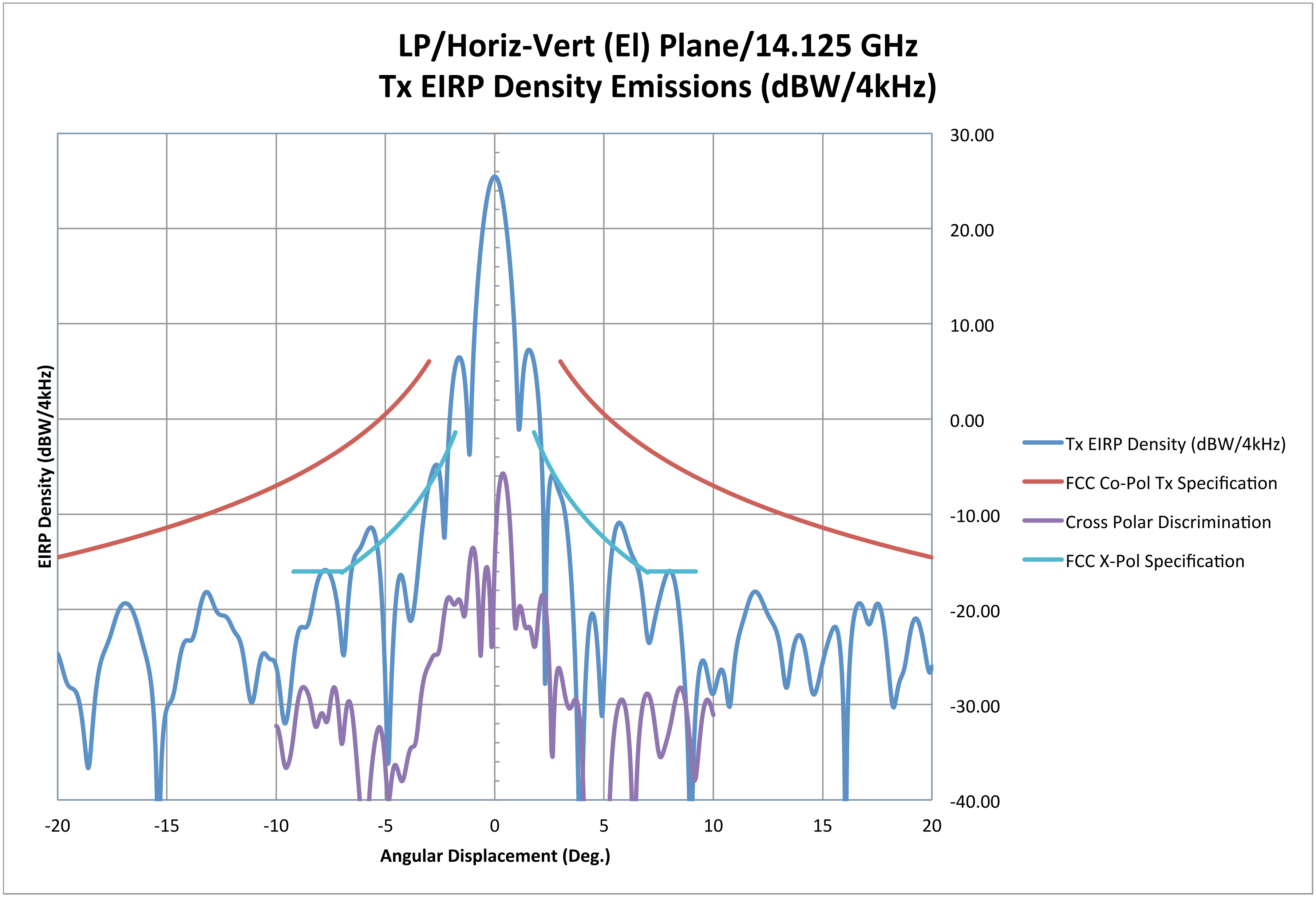
Angular Displacement (Deg.)
Tx EIRP Density (dBW/4kHz)
FCC Co-Pol Tx Specification



LP/Horiz-Vert (El) Plane/14.125 GHz
Tx EIRP Density Emissions (dBW/4kHz)
EIRP Density (dBW/4kHz)
Angular Displacement (Deg.)
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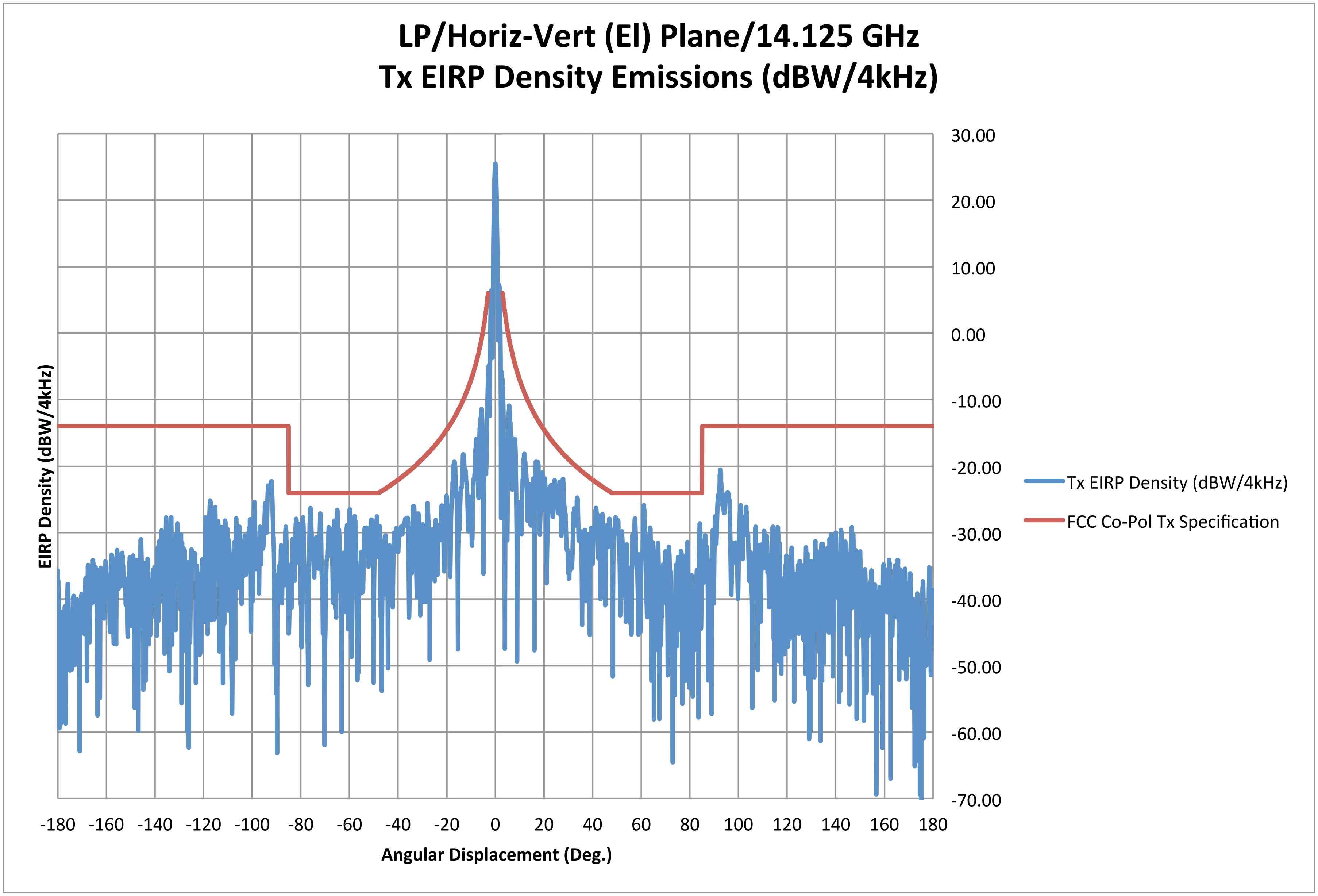
Tx EIRP Density (dBW/4kHz)
FCC Co-Pol Tx Specification
Cross Polar Discrimination
FCC X-Pol Specification



LP/Horiz-Vert (El) Plane/14.125 GHz
Tx EIRP Density Emissions (dBW/4kHz)
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EIRP Density (dBW/4kHz)
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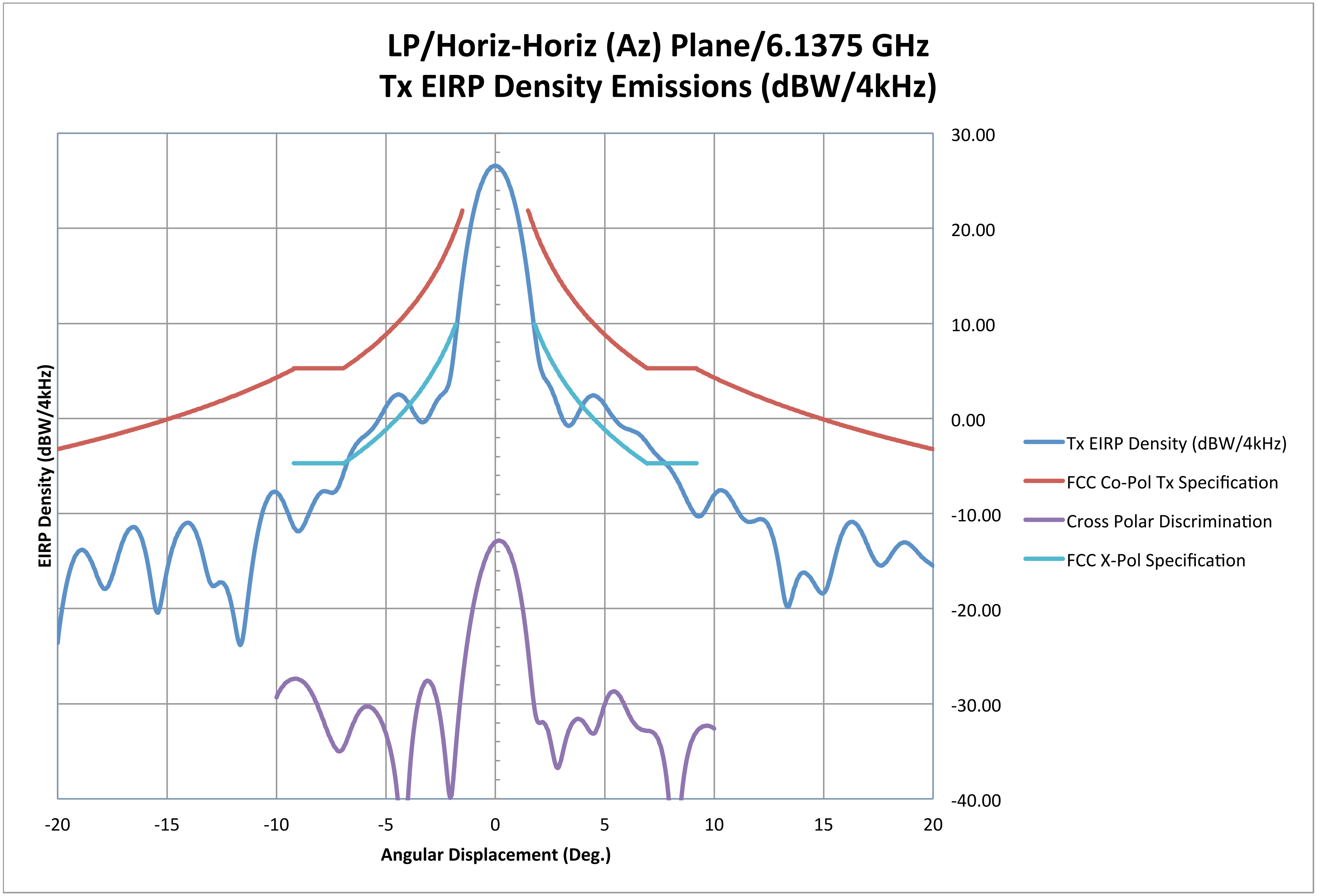
Angular Displacement (Deg.)
Tx EIRP Density (dBW/4kHz)
FCC Co-Pol Tx Specification



LP/Horiz-Horiz (Az) Plane/6.1375 GHz
Tx EIRP Density Emissions (dBW/4kHz)
EIRP Density (dBW/4kHz)
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20.00
10.00
0.00
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-20.00
-30.00
-40.00
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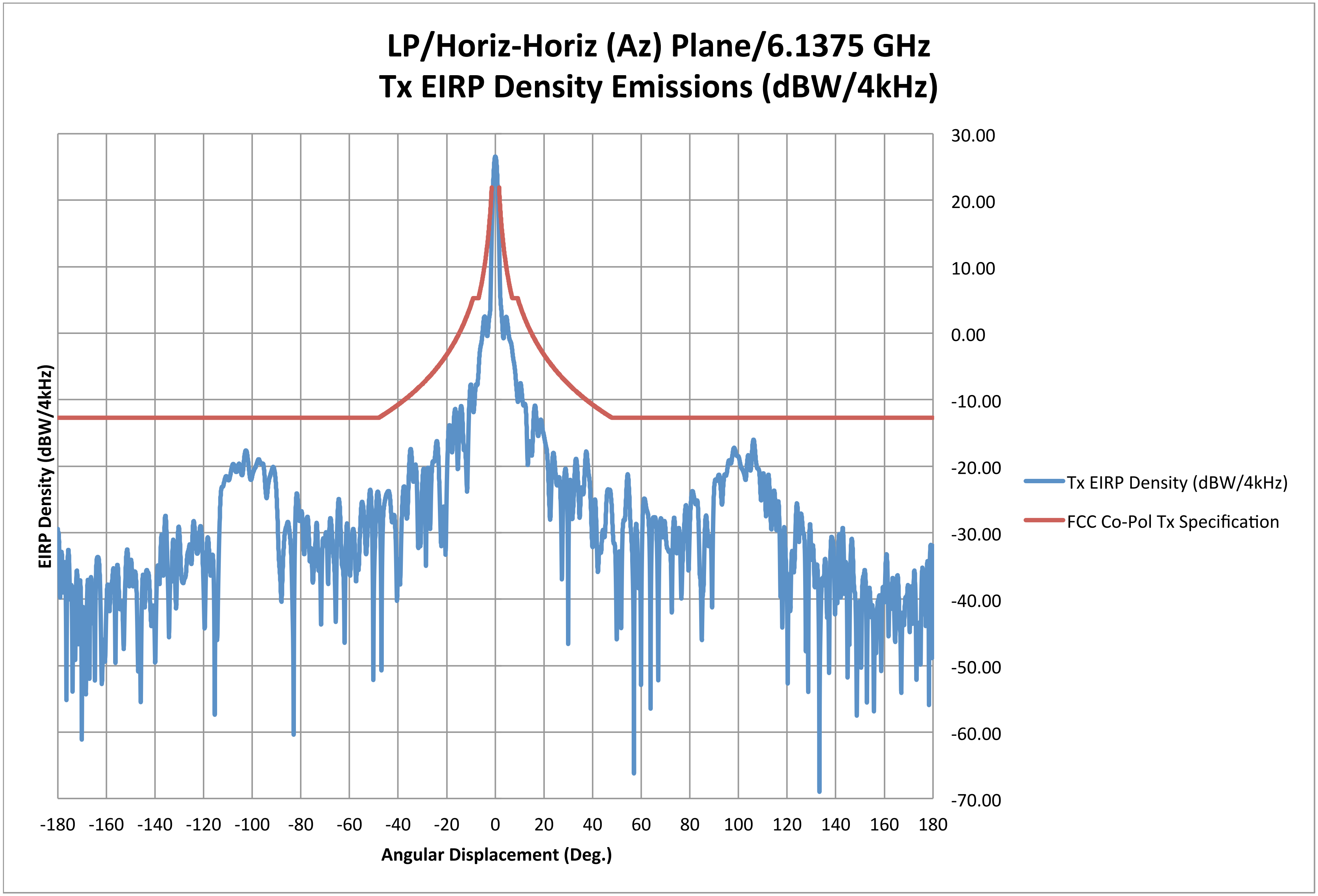
Angular Displacement (Deg.)
Tx EIRP Density (dBW/4kHz)
FCC Co-Pol Tx Specification
Cross Polar Discrimination
FCC X-Pol Specification



LP/Horiz-Horiz (Az) Plane/6.1375 GHz
Tx EIRP Density Emissions (dBW/4kHz)
EIRP Density (dBW/4kHz)
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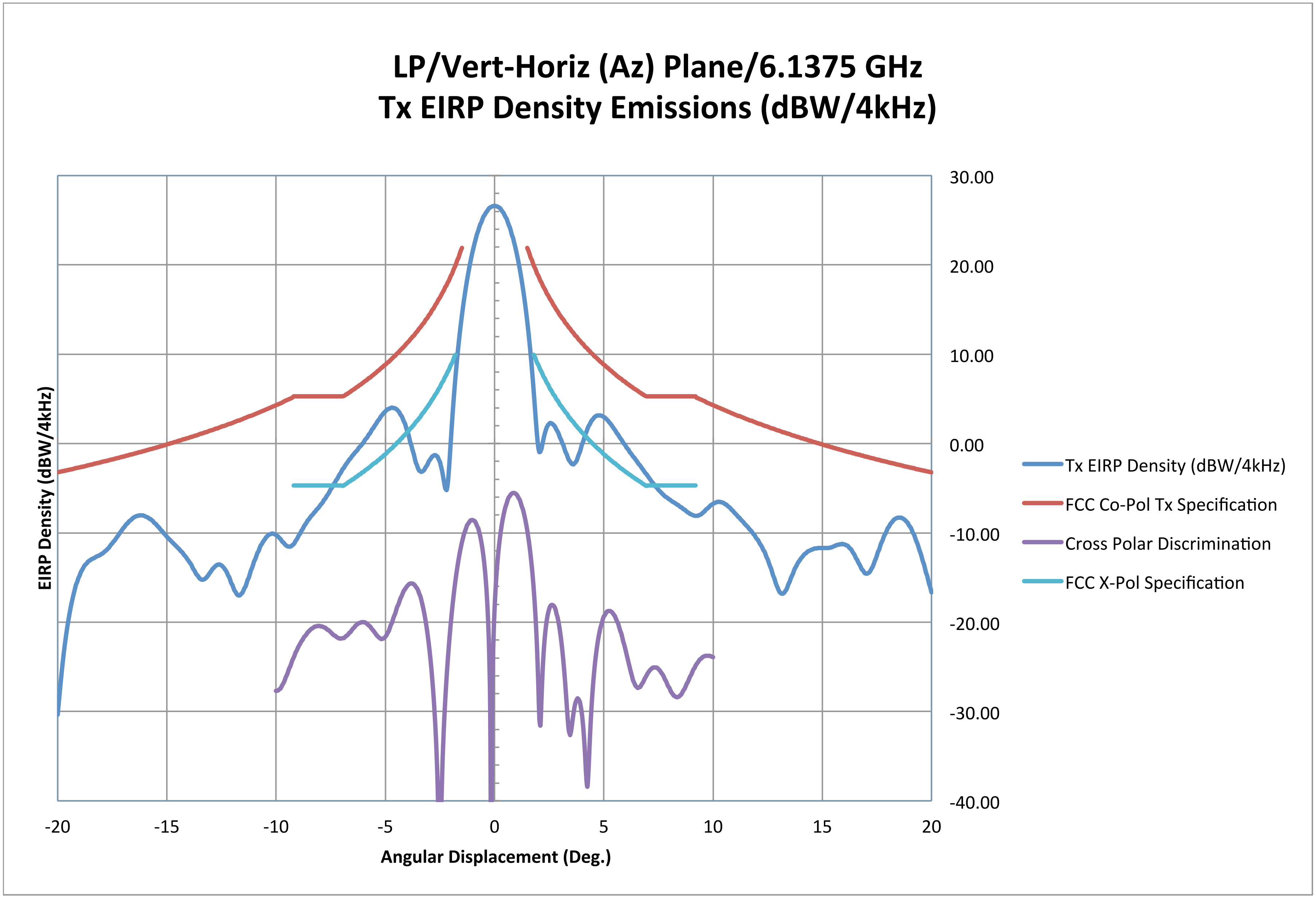
Angular Displacement (Deg.)
Tx EIRP Density (dBW/4kHz)
FCC Co-Pol Tx Specification


LP/Vert-Horiz (Az) Plane/6.1375 GHz
Tx EIRP Density Emissions (dBW/4kHz)
EIRP Density (dBW/4kHz)
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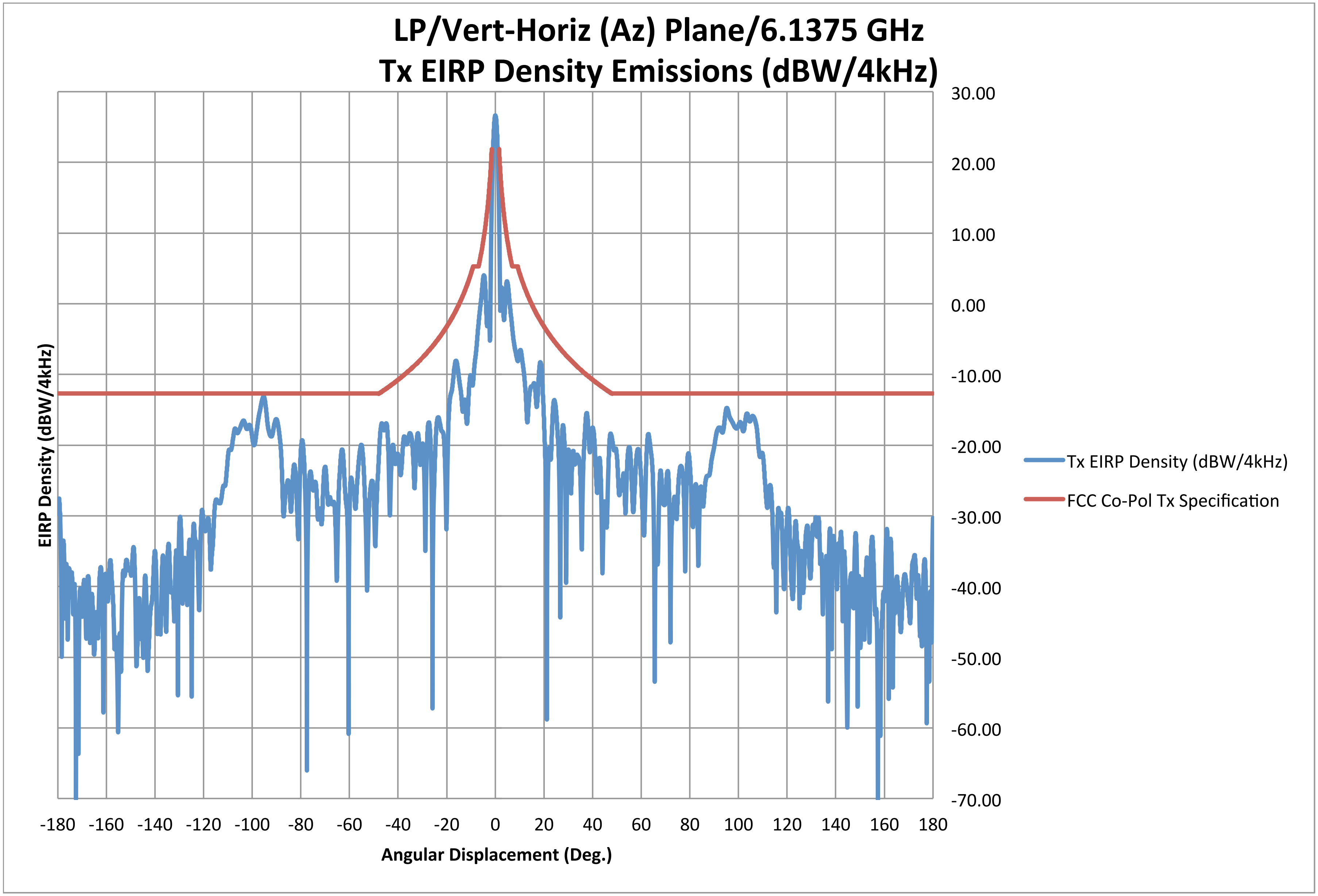
Angular Displacement (Deg.)
Tx EIRP Density (dBW/4kHz)
FCC Co-Pol Tx Specification
Cross Polar Discrimination
FCC X-Pol Specification



LP/Vert-Horiz (Az) Plane/6.1375 GHz
Tx EIRP Density Emissions (dBW/4kHz)
EIRP Density (dBW/4kHz)
Angular Displacement (Deg.)
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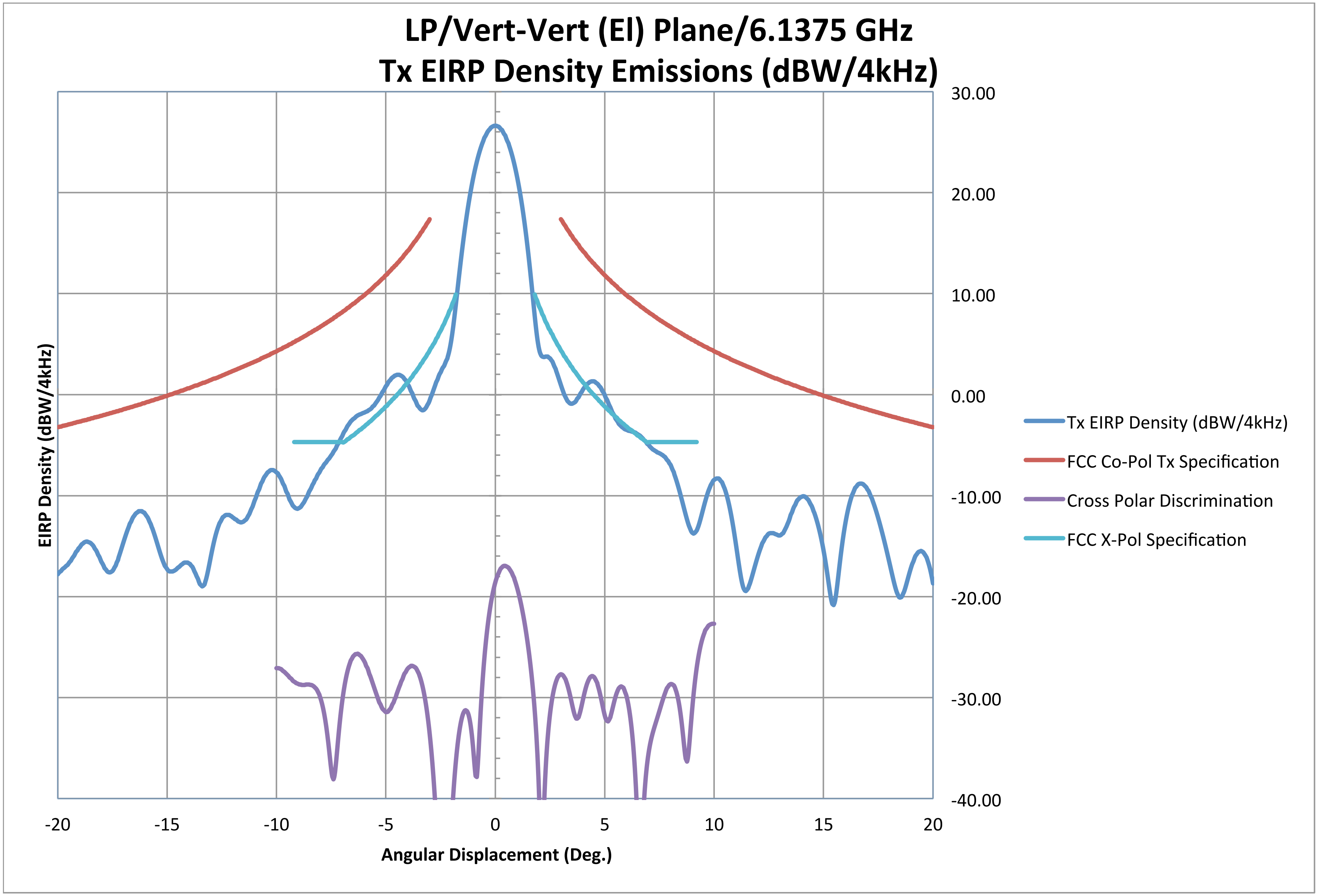
Tx EIRP Density (dBW/4kHz)
FCC Co-Pol Tx Specification


LP/Vert-Vert (El) Plane/6.1375 GHz
Tx EIRP Density Emissions (dBW/4kHz)
EIRP Density (dBW/4kHz)
Angular Displacement (Deg.)
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Tx EIRP Density (dBW/4kHz)
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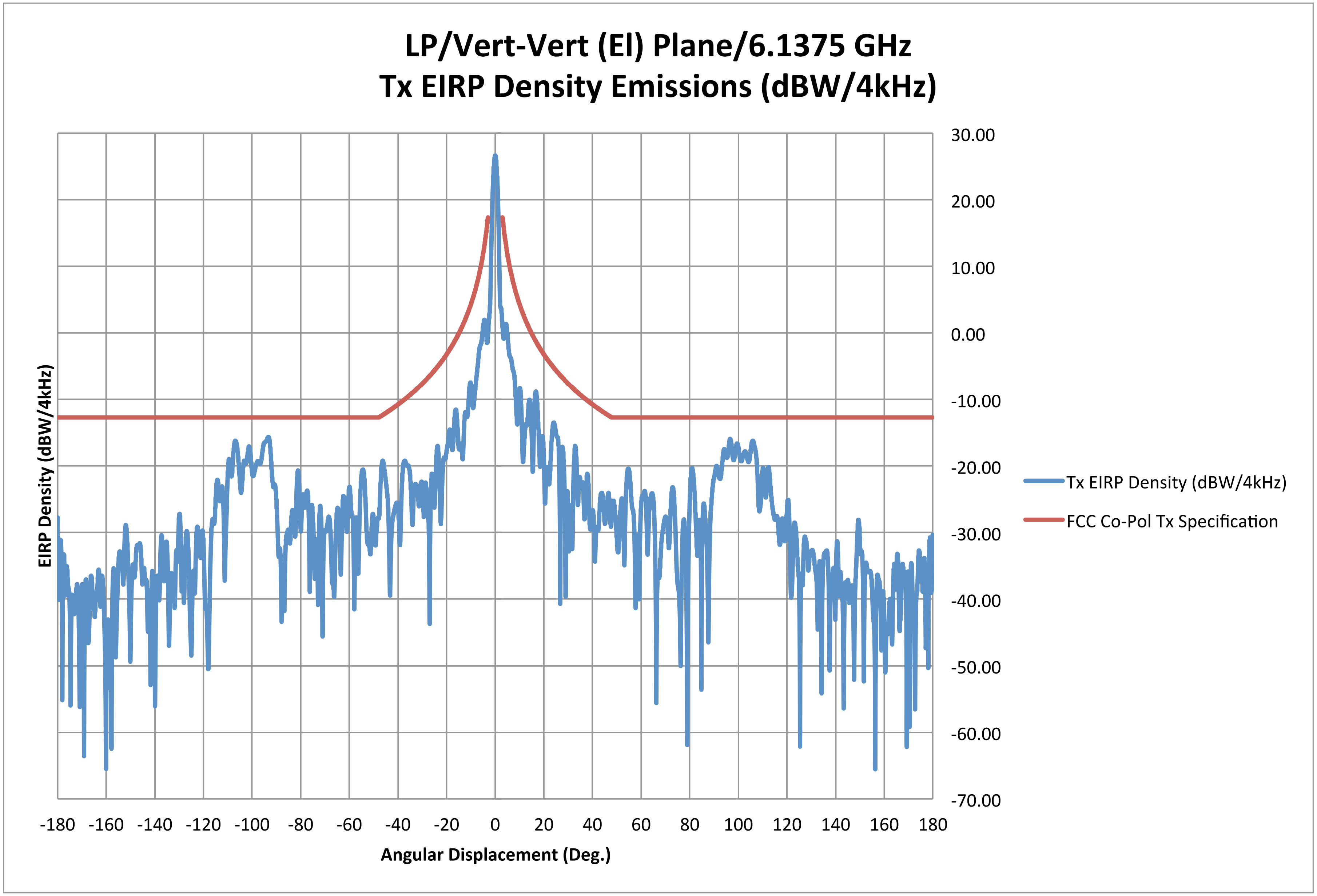
Cross Polar Discrimination
FCC X-Pol Specification


LP/Vert-Vert (El) Plane/6.1375 GHz
Tx EIRP Density Emissions (dBW/4kHz)
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EIRP Density (dBW/4kHz)
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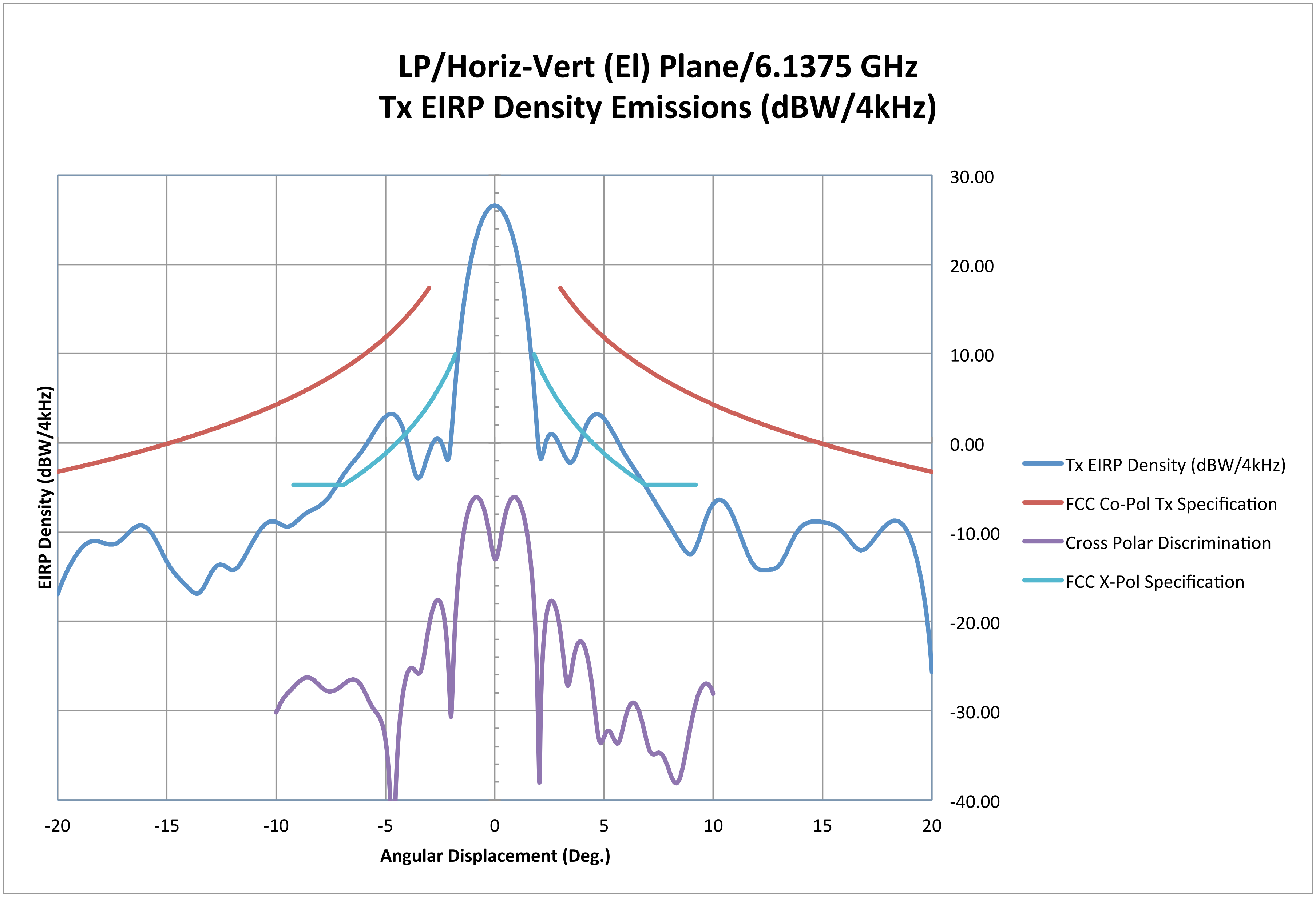
Angular Displacement (Deg.)
Tx EIRP Density (dBW/4kHz)
FCC Co-Pol Tx Specification


LP/Horiz-Vert (El) Plane/6.1375 GHz
Tx EIRP Density Emissions (dBW/4kHz)
EIRP Density (dBW/4kHz)
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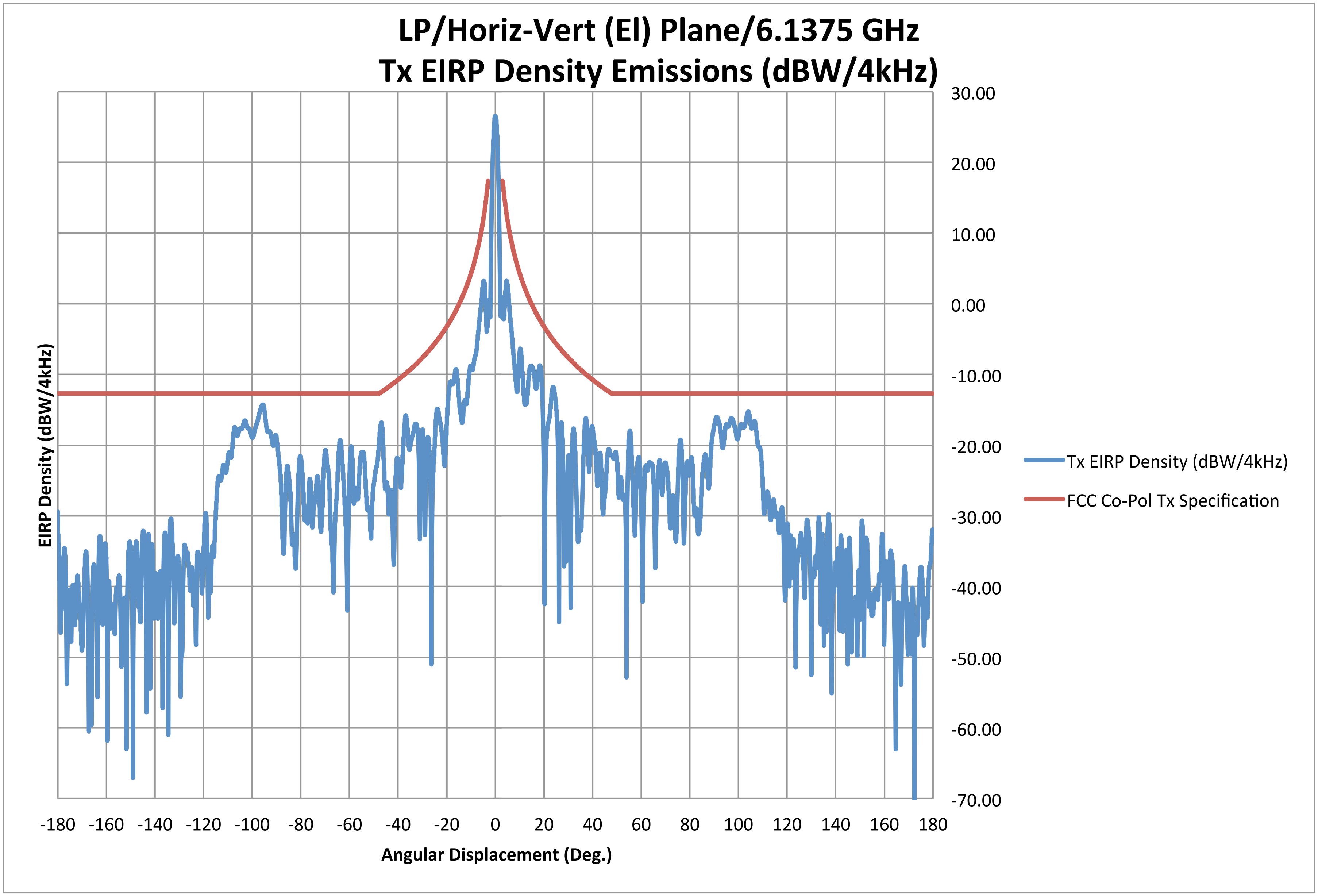
Angular Displacement (Deg.)
Tx EIRP Density (dBW/4kHz)
FCC Co-Pol Tx Specification
Cross Polar Discrimination
FCC X-Pol Specification


LP/Horiz-Vert (El) Plane/6.1375 GHz
Tx EIRP Density Emissions (dBW/4kHz)
EIRP Density (dBW/4kHz)
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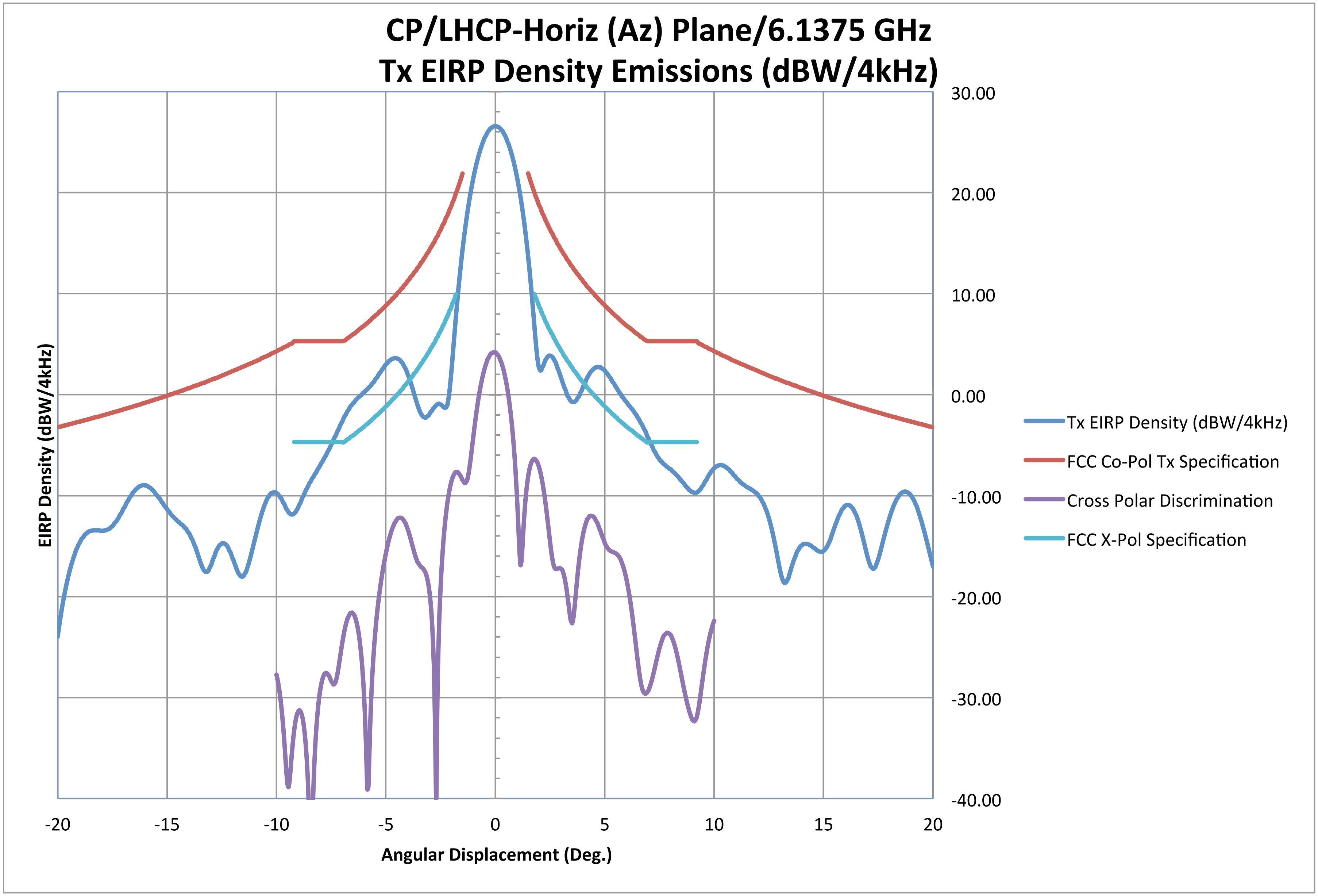
Angular Displacement (Deg.)
Tx EIRP Density (dBW/4kHz)
FCC Co-Pol Tx Specification



CP/LHCP-Horiz (Az) Plane/6.1375 GHz
Tx EIRP Density Emissions (dBW/4kHz)
EIRP Density (dBW/4kHz)
Angular Displacement (Deg.)
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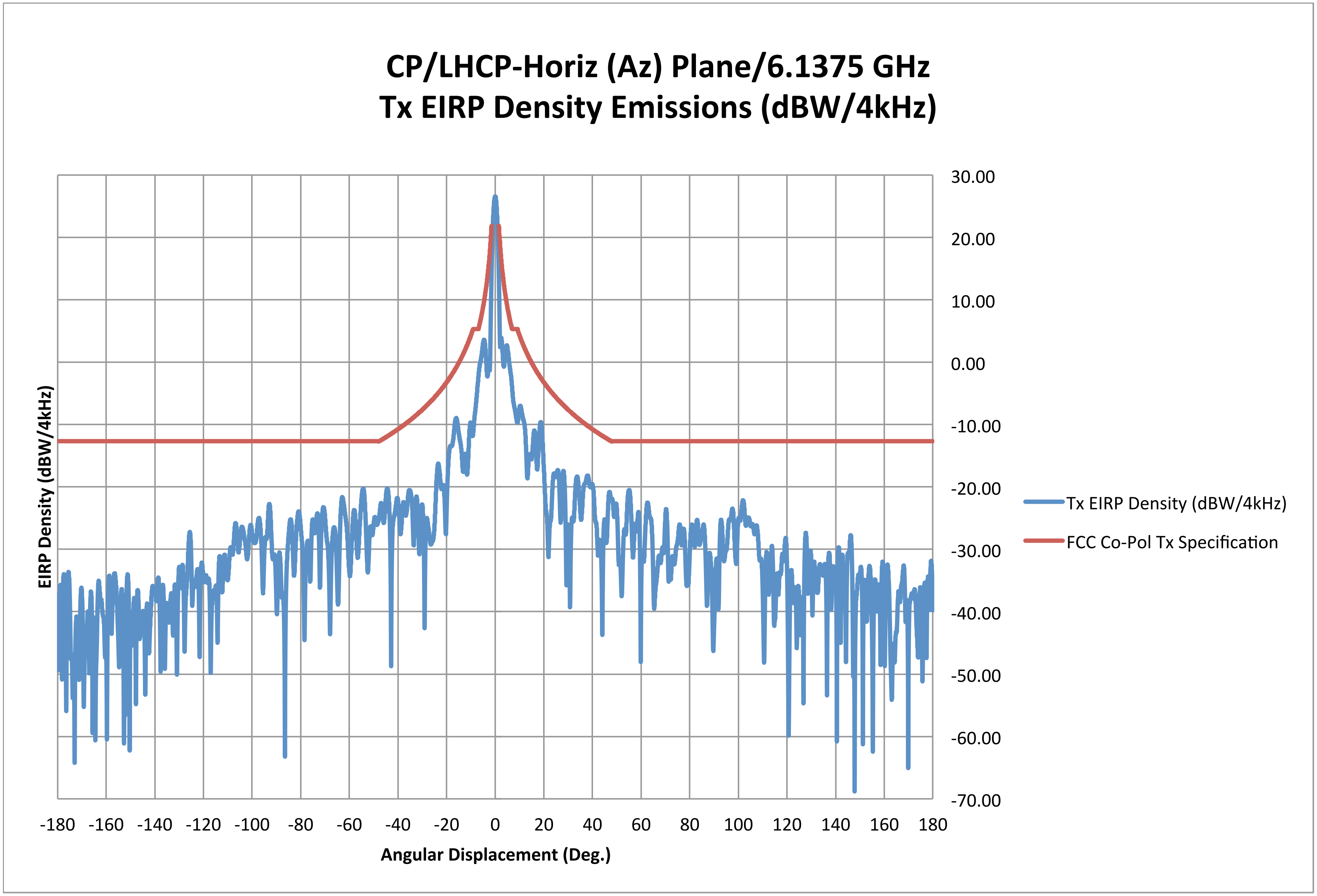
Tx EIRP Density (dBW/4kHz)
FCC Co-Pol Tx Specification
Cross Polar Discrimination
FCC X-Pol Specification


CP/LHCP-Horiz (Az) Plane/6.1375 GHz
Tx EIRP Density Emissions (dBW/4kHz)
EIRP Density (dBW/4kHz)
Angular Displacement (Deg.)
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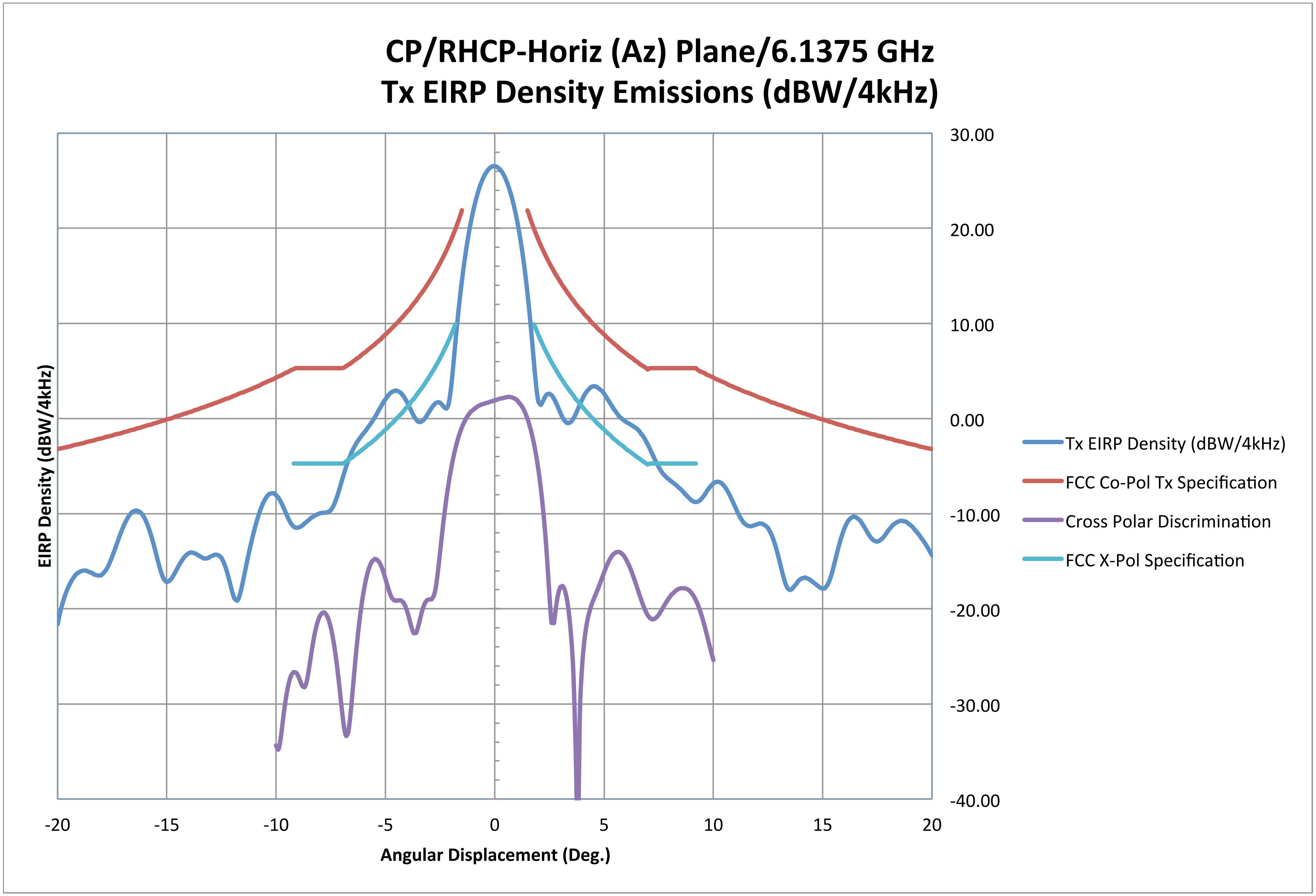
Tx EIRP Density (dBW/4kHz)
FCC Co-Pol Tx Specification


CP/RHCP-Horiz (Az) Plane/6.1375 GHz
Tx EIRP Density Emissions (dBW/4kHz)
EIRP Density (dBW/4kHz)
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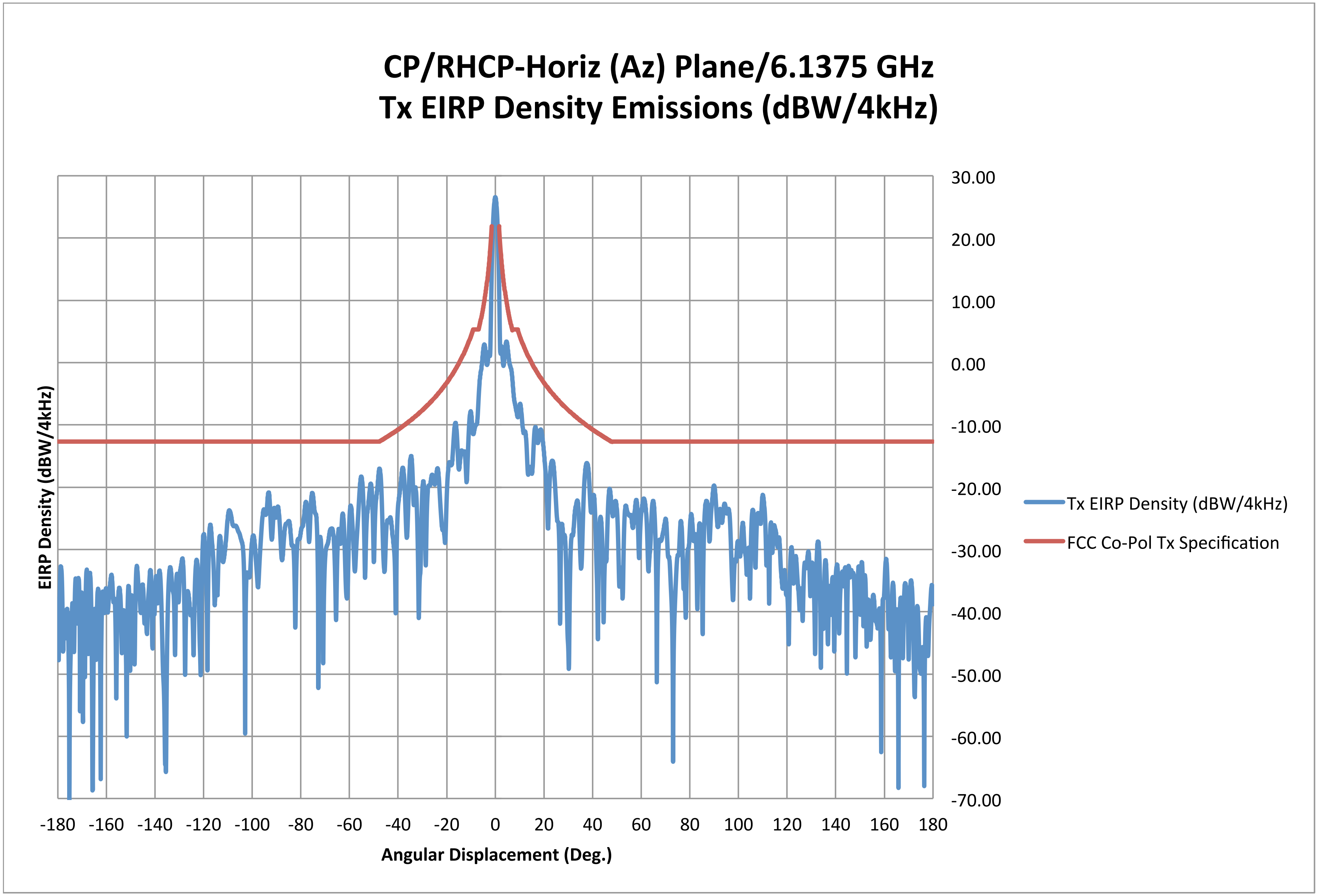
Angular Displacement (Deg.)
Tx EIRP Density (dBW/4kHz)
FCC Co-Pol Tx Specification
Cross Polar Discrimination
FCC X-Pol Specification


CP/RHCP-Horiz (Az) Plane/6.1375 GHz
Tx EIRP Density Emissions (dBW/4kHz)
EIRP Density (dBW/4kHz)
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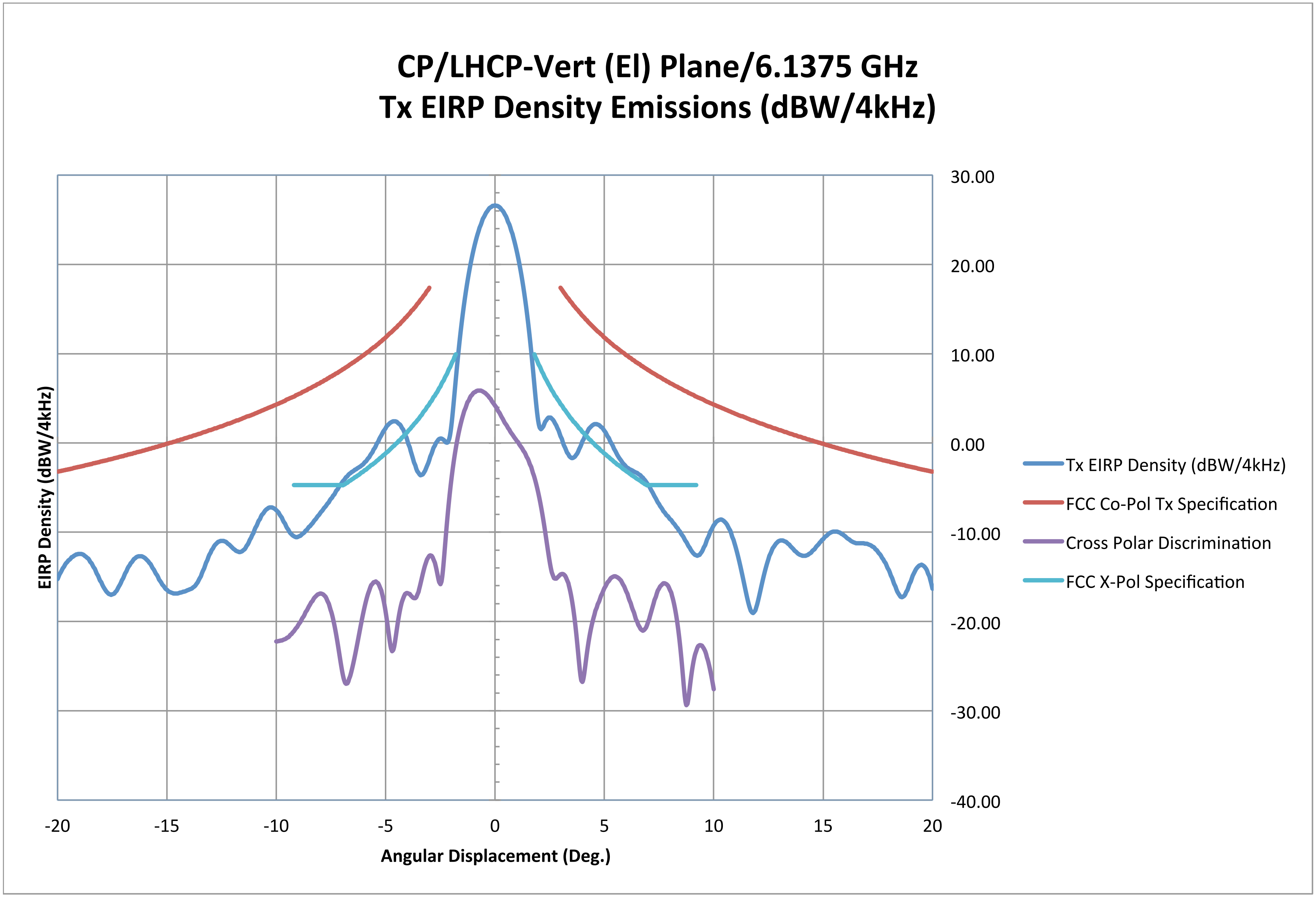
Angular Displacement (Deg.)
Tx EIRP Density (dBW/4kHz)
FCC Co-Pol Tx Specification


CP/LHCP-Vert (El) Plane/6.1375 GHz
Tx EIRP Density Emissions (dBW/4kHz)
EIRP Density (dBW/4kHz)
Angular Displacement (Deg.)
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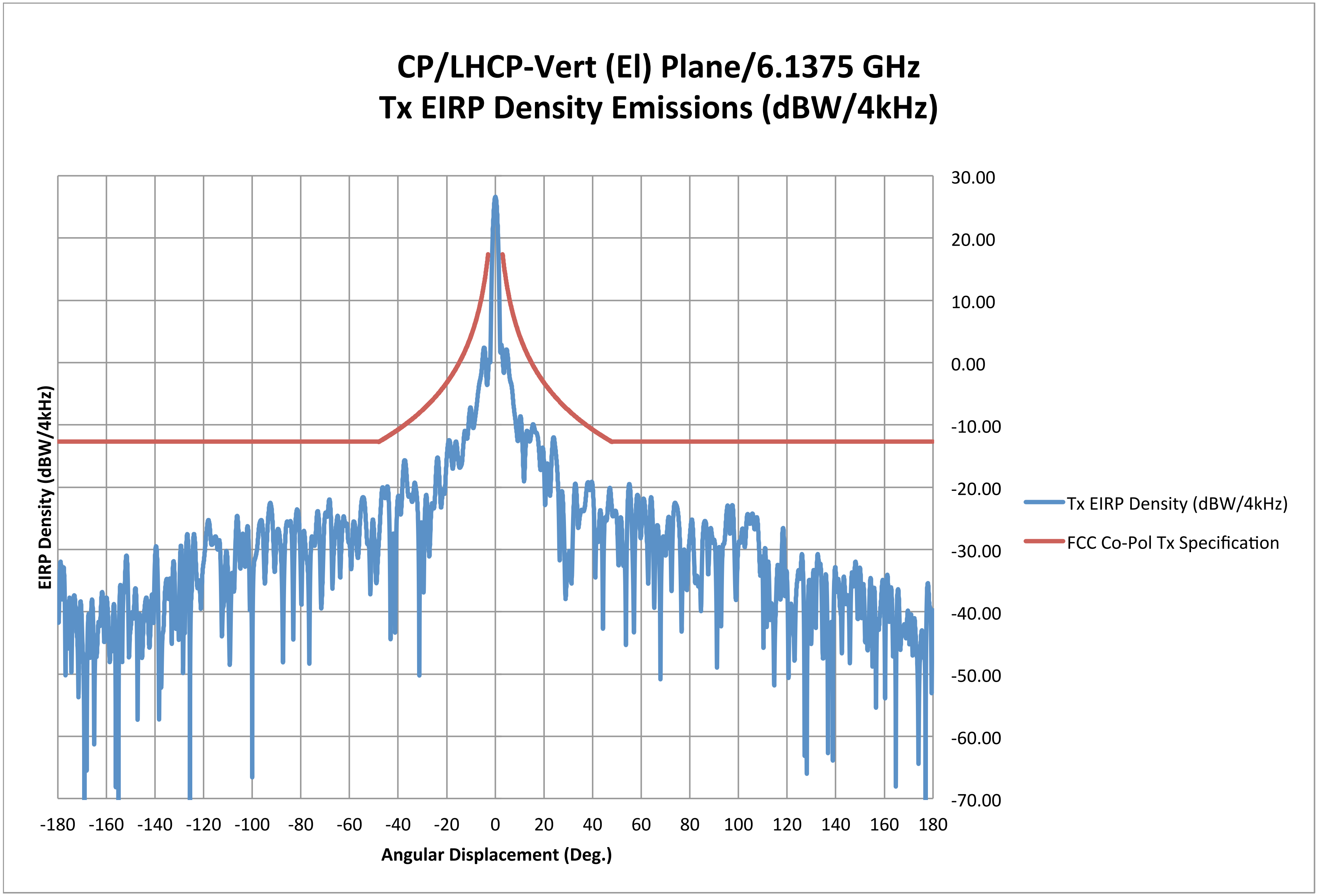
Tx EIRP Density (dBW/4kHz)
FCC Co-Pol Tx Specification
Cross Polar Discrimination
FCC X-Pol Specification



CP/LHCP-Vert (El) Plane/6.1375 GHz
Tx EIRP Density Emissions (dBW/4kHz)
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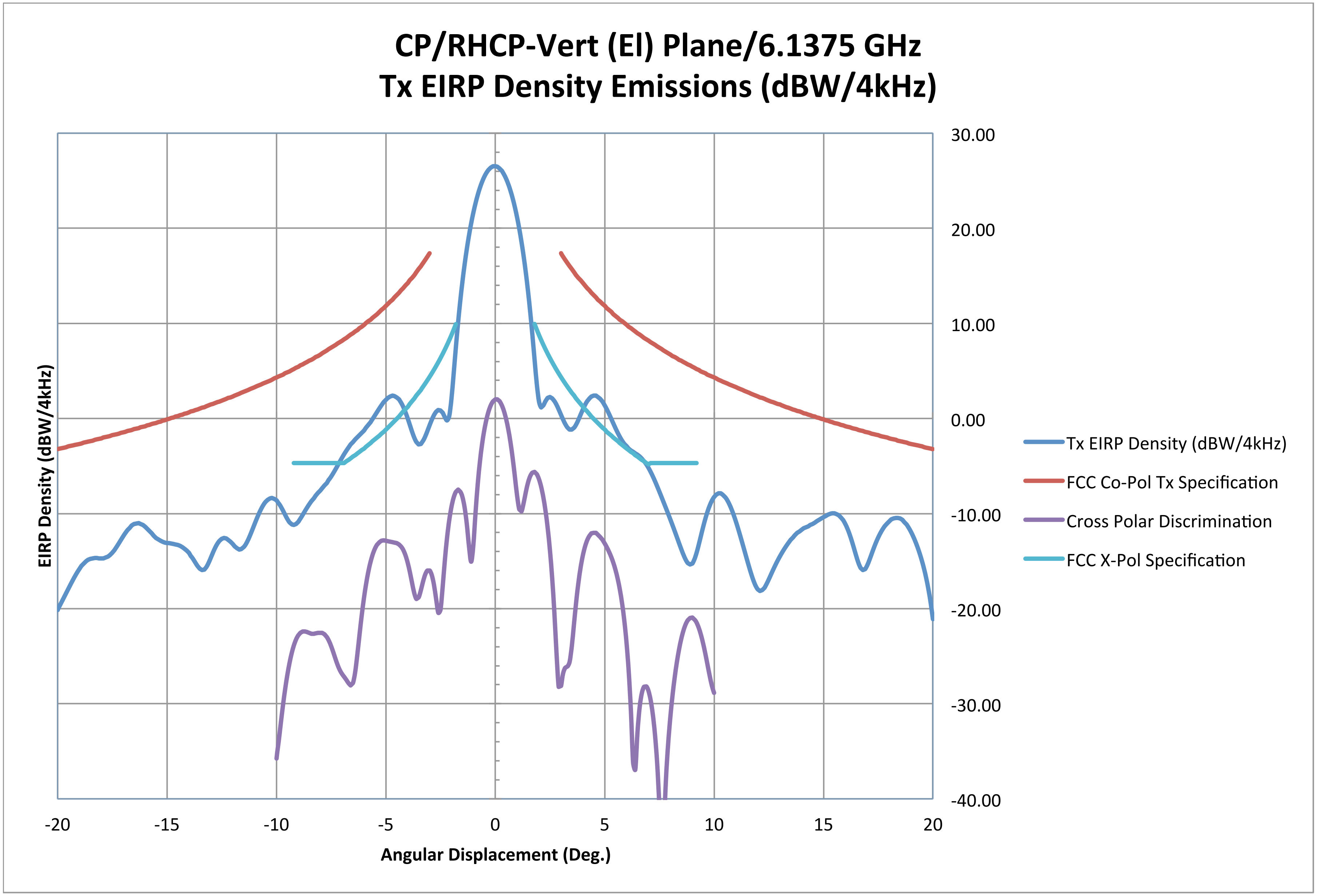
-70.00
EIRP Density (dBW/4kHz)
-180 -160 -140 -120 -100 -80 -60 -40 -20 0 20 40 60 80 100 120 140 160 180
Angular Displacement (Deg.)
Tx EIRP Density (dBW/4kHz)
FCC Co-Pol Tx Specification


CP/RHCP-Vert (El) Plane/6.1375 GHz
Tx EIRP Density Emissions (dBW/4kHz)
EIRP Density (dBW/4kHz)
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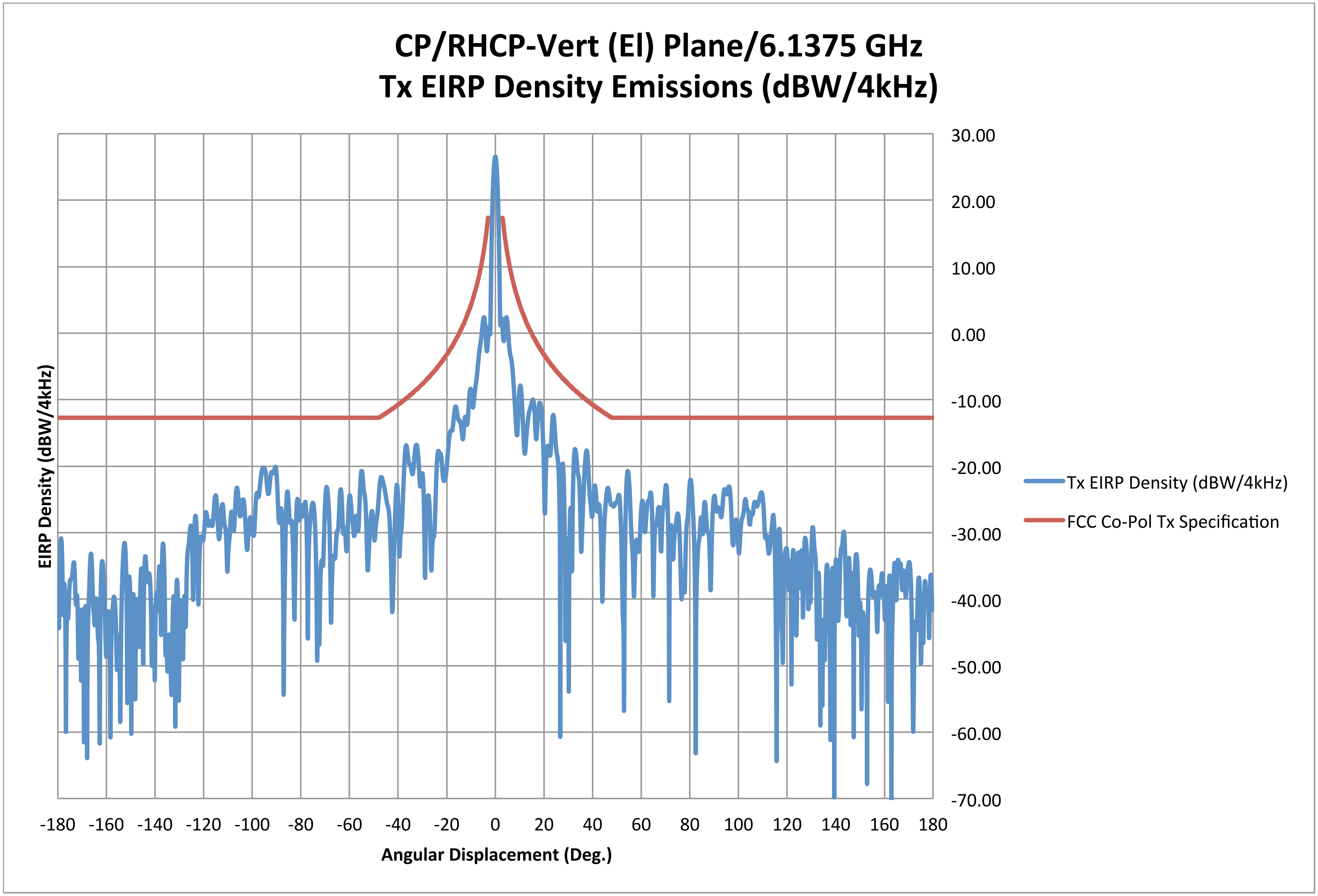
Angular Displacement (Deg.)
Tx EIRP Density (dBW/4kHz)
FCC Co-Pol Tx Specification
Cross Polar Discrimination
FCC X-Pol Specification


CP/RHCP-Vert (El) Plane/6.1375 GHz
Tx EIRP Density Emissions (dBW/4kHz)
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-30.00
-40.00
-50.00
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-70.00
-180 -160 -140 -120 -100 -80 -60 -40 -20 0 20 40 60 80 100 120 140 160 180
Angular Displacement (Deg.)
EIRP Density (dBW/4kHz)
Tx EIRP Density (dBW/4kHz)
FCC Co-Pol Tx Specification

Annex 2 – Link Budgets

Carrier Analysis

				2	7760					
	Antenna Model	ST5000 Ku					Imported values			
	Frequency	14250.00	MHz				Entered values			
E41	Antenna Gain (no radome)	43.50	dBi				Calculated values			
	Max HPA power	55.00								
	Elevation Angle	40.1	°							
	Azimuth Angle	124.5	°							
	Satellite Longitude	115.00	W							
	Data Rate	15800	Kbps							
	FEC	1.000								
	Modulation (BPSK = 1, QPSK = 2, 8PSK = 4, 16PSK = 8)	2							9	
	Spacing Factor	1.00								
	Uplink EIRP	60.20	dBW							
	Gain towards the horizon (frequency coord.)	-10.00	dB							
	Earth Station Latitute	28.00	1.00		51.00	North	28.03	Theta	0.755	
	Earth Station Longitude	80	35.00		56.00	West	80.60		55.54	

					+2dB	+6dB	+9dB	+12dB
				X1	X2	X4	X8	X16
	EIRP	dBW		60.20	62.20	65.2	68.2	71.2
	Occupied BW	KHz		7900.0	15800	31600	63200	126400
	Power density at flange	dBW/4KHz		-16.26	-17.27	-17.28	-17.29	-17.30
	Power density at flange	dBW/Hz		-52.26	-53.27	-53.28	-53.29	-53.30
E38	*Total Input Power at Antenna Flange*	W		46.77	74.13	147.91	295.12	588.84
E49	*Maximum EIRP Density per Carrier*	dBW/4KHz		27.244	26.23	26.22	26.21	26.20
E48	*Maximum EIRP per Carrier*	dBW		60.20	62.20	65.20	68.20	71.20
E60	*Max. EIRP Density towards the Horizon (from elev. Angle)*	dBW/4KHz		-24.34	-25.35	-25.36	-25.37	-25.38
E60	*Max. EIRP Density towards the Horizon (if freq. coord.)*	dBW/4KHz		-26.26	-27.27	-27.28	-27.29	-27.30

E40 Total EIRP for all Carriers (at max HPA) **60.90** dBW

ST5000 C-Band Link Budget Analysis

Carrier Analysis

				2.5	9700				
	Antenna Model	ST5000 C							
	Frequency	6175.00	MHz						
E41	Antenna Gain (no radome)	38.00	dBi						
	Max HPA power	55.00							
	Elevation Angle	56.0	°						
	Azimuth Angle	162.6	°						
	Satellite Longitude	89.00	W						
	Data Rate	1250	Kbps						
	FEC	0.500							
	Modulation (BPSK = 1, QPSK = 2, 8PSK = 4, 16PSK = 8)	8							9
	Spacing Factor	1.60							
	Uplink EIRP	55.30	dBW						
	Gain towards the horizon (frequency coord.)	-10.00	dB						
	Earth Station Latitute	28.00	1.00		51.00	North	28.03	Theta	0.509
	Earth Station Longitude	80	35.00		56.00	West	80.60		17.45

(light blue)	Imported values
(dark blue)	Entered values
(yellow)	Calculated values

			+3dB	+6dB	+9dB	+12dB
		X1	X2	X4	X8	X16
EIRP	dBW	55.30	58.3	61.3	64.3	67.3
Occupied BW	KHz	500.0	1000	2000	4000	8000

	Power density at flange	dBW/4KHz	-3.67	-3.68	-3.69	-3.70	-3.71
	Power density at flange	dBW/Hz	-39.67	-39.68	-39.69	-39.70	-39.71
E38	*Total Input Power at Antenna Flange*	W	53.70	107.15	213.80	426.58	851.14
E49	*Maximum EIRP Density per Carrier*	dBW/4KHz	34.331	34.32	34.31	34.30	34.29
E48	*Maximum EIRP per Carrier*	dBW	55.30	58.30	61.30	64.30	67.30
E60	*Max. EIRP Density towards the Horizon (from elev. Angle)*	dBW/4KHz	-15.37	-15.38	-15.39	-15.40	-15.41
E60	*Max. EIRP Density towards the Horizon (if freq. coord.)*	dBW/4KHz	-13.67	-13.68	-13.69	-13.70	-13.71

E40 Total EIRP for all Carriers (at max HPA) **55.40** dBW

- The Maximum Power Input to the Antenna to pass the Rad Hazard Analysis is 55W.
- The desired EIRP(58.3dBW) that you submit to me exceeds the safe Total Input Power at the antenna flange, using the half transmit bandwidth of the desired one (500Khz instead of 1Mhz) we can safely use this antenna at 55.3 dBW at 1250 Kbps (0.5Mbps).

- In Red Color is the desired analysis at 58.3dBW EIRP with probes to be unreliable, suggested EIRP (55.30 dBW) usage analysis is in Green.

Annex 3 – Radiation Hazard Study

Radiation Hazard Study

ST5000 C

This study analyzes the potential Radio Frequency (RF) human exposure levels caused by the Electro Magnetic (EM) fields of the above-captioned antenna. The mathematical analysis performed below complies with the methods described in the Federal Communications Commission Office of Engineering and Technology Bulletin No. 65 (1985 rev. 1997) R&O 96-326.

Maximum Permisible Exposure

There are two separate levels of exposure limits. The first applies to persons in the general population who are in an uncontrolled environment. The second applies to trained personnel in a controlled environment. According to 47 C.F.R. § 1.1310, the Maximum Permissible Exposure (MPE) limits for frequencies above 1.5 GHz are as follows:

- General Population / Uncontrolled Exposure 1.0 mW/cm2
- Occupational / Controlled Exposure 5.0 mW/cm2

The purpose of this study is to determine the power flux density levels for the earth station under study as compared with the MPE limits. This comparison is done in each of the following regions:

1. Far-field region
2. Near-field region
3. Transition region
4. The region between the feed and the antenna surface
5. The main reflector region
6. The region between the antenna edge and the ground

Input Parameters

The following input parameters were used in the calculations:

Parameter	Value	Unit	Symbol
Atenna Diameter:	2.4	m	D
Antenna Transmit Gain:	38.00	dBi	G
Trasmit Frequency:	6175	MHz	f
Feed Flange Diameter:	10.00	cm	d
Power Input to the Antenna:	55.00	W	P

Calculated Parameters

The following values were calculated using the above input parameters and the corresponding formulas.

Parameter	Value	Unit	Symbol	Formula
Antenna Surface Area:	4.52	m^2	A	$\pi D^2/4$
Area of Feed Flange:	78.54	cm^2	a	$\pi d^2/4$
Antenna Efficiency:	0.26		η	$G\lambda^2/(\pi^2 D^2)$
Gain Factor:	6309.57		g	$10^{G/10}$
Wavelength:	0.0486	m	λ	$300/f$

Behavior of EM Fields as a Function of Distance

The behavior of the characteristics of EM fields varies depending on the distance from the radiating antenna. These characteristics are analyzed in three primary regions: the near-field region, the far-field region and the transition region. Of interest also are the region between the antenna main reflector and the subreflector, the region of the main reflector area and the region between the main reflector and ground.

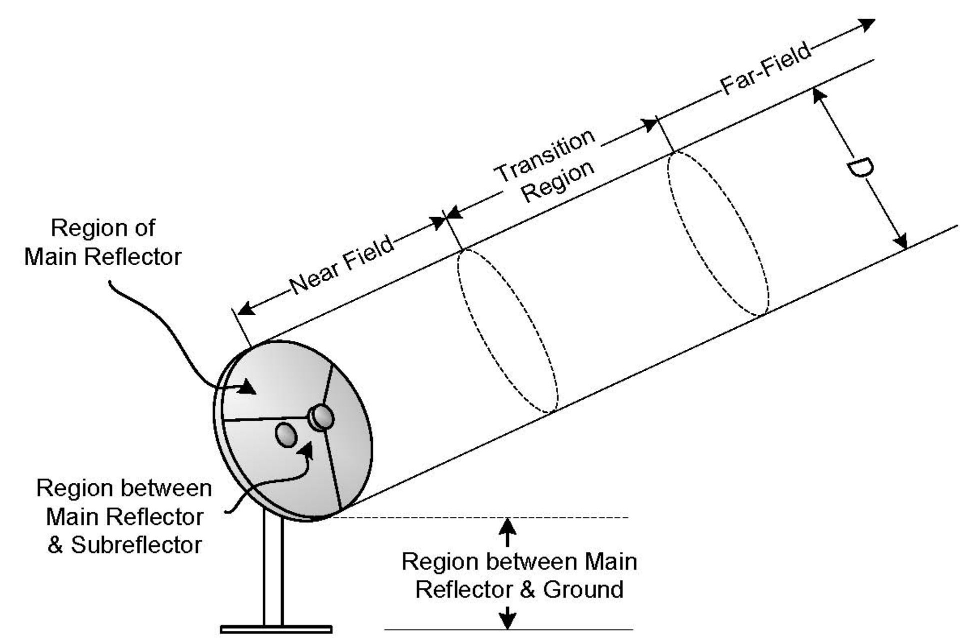

Figure 1. EM Fields as a Function of Distance

For parabolic aperture antennas with circular cross sections, such as the antenna under study, the near-field, far-field and transition region distances are calculated as follows:

Parameter	Value	Unit	Formula
Near Field Distance:	29.640	m	$R_{nf} = D^2/(4\lambda)$
Distance to Far Field:	71.136	m	Rff = 0.60D2/(λ)
Distance of Trasition Region	29.640	m	Rt = Rnf

The distance in the transition region is between the near and far fields. Thus, Rnf ≤ Rt ≤ Rff . However, the power density in the transition region will not exceed the power density in the near-field. Therefore, for purposes of the present analysis, the distance of the transition region can equate the distance to the near-field.

Power Flux Density Calculations

The power flux density is considered to be at a maximum through the entire length of the near-field. This region is contained within a cylindrical volume with a diameter, D, equal to the diameter of the antenna. In the transition region and the far-field, the power density decreases inversely with the square of the distance. The following equations are used to calculate power density in these regions.

Parameter	Value	Unit	Symbol	Formula
Power Density in the Near-Field	1.274	mW/cm^2	S_{nf}	$16.0\ \eta\ P/(\pi D^2)$
Power Density in the Far-Field	0.546	mW/cm^2	S_{ff}	$GP/(4\pi R_{ff}^2)$
Power Density in the Trans. Region	1.274	mW/cm^2	S_t	$S_{nf} R_{nf} / (R_t)$

The region between the main reflector and the subreflector is confined within a conical shape defined by the feed assembly. The most common feed assemblies are waveguide flanges. This energy is determined as follows:

Parameter	Value	Unit	Symbol	Formula
Power Density at the Feed Flange	2801.1	mW/cm^2	S_{fa}	$4P / a$

The power density in the main reflector is determined similarly to the power density at the feed flange; except that the area of the reflector is used.

Parameter	Value	Unit	Symbol	Formula
Power Density at Main Reflector	4.863	mW/cm^2	$S_{surface}$	$4P / A$

The power density between the reflector and ground, assuming uniform illumination of the reflector surface, is calculated as follows:

Parameter	Value	Unit	Symbol	Formula
Power Density between Reflector and Ground	1.216	mW/cm^2	S_g	P / A

Table 1 summarizes the calculated power flux density values for each region. In a controlled environment, the only regions that exceed FCC limitations are shown below. These regions are only accessible by trained technicians who, as a matter of procedure, turn off transmit power before performing any work in these areas.

Power Densities	**mW/cm2**	**Controlled Environment (5 mW/cm2)**
Far Field Calculation	0.546	Satisfies FCC Requirements
Near Field Calculation	1.274	Satisfies FCC Requirements
Transition Region	1.274	Satisfies FCC Requirements
Region between Main and Subreflector	2801.1	Exceeds Limitations
Main Reflector Region	4.863	Satisfies FCC Requirements
Region between Main Reflector and Ground	1.216	Satisfies FCC Requirements

Table 1. Power Flux Density for Each Region

In conclusion, the results show that the antenna, in a controlled environment, and under the proper mitigation procedures, meets the guidelines specified in 47 C.F.R. § 1.1310.

Radiation Hazard Study

ST5000 Ku

This study analyzes the potential Radio Frequency (RF) human exposure levels caused by the Electro Magnetic (EM) fields of the above-captioned antenna. The mathematical analysis performed below complies with the methods described in the Federal Communications Commission Office of Engineering and Technology Bulletin No. 65 (1985 rev. 1997) R&O 96-326.

Maximum Permisible Exposure

There are two separate levels of exposure limits. The first applies to persons in the general population who are in an uncontrolled environment. The second applies to trained personnel in a controlled environment. According to 47 C.F.R. § 1.1310, the Maximum Permissible Exposure (MPE) limits for frequencies above 1.5 GHz are as follows:

- General Population / Uncontrolled Exposure 1.0 mW/cm2
- Occupational / Controlled Exposure 5.0 mW/cm2

The purpose of this study is to determine the power flux density levels for the earth station under study as compared with the MPE limits. This comparison is done in each of the following regions:

1. Far-field region
2. Near-field region
3. Transition region
4. The region between the feed and the antenna surface
5. The main reflector region
6. The region between the antenna edge and the ground

Input Parameters

The following input parameters were used in the calculations:

Parameter	Value	Unit	Symbol
Atenna Diameter:	2.4	m	D
Antenna Transmit Gain:	43.50	dBi	G
Trasmit Frequency:	14250	MHz	f
Feed Flange Diameter:	10.00	cm	d
Power Input to the Antenna:	55.00	W	P

Calculated Parameters

The following values were calculated using the above input parameters and the corresponding formulas.

Parameter	Value	Unit	Symbol	Formula
Antenna Surface Area:	4.52	m^2	A	$\pi D^2/4$
Area of Feed Flange:	78.54	cm^2	a	$\pi d^2/4$
Antenna Efficiency:	0.17		η	$G\lambda^2/(\pi^2 D^2)$
Gain Factor:	22387.21		g	$10^{G/10}$
Wavelength:	0.0211	m	λ	$300/f$

Behavior of EM Fields as a Function of Distance
The behavior of the characteristics of EM fields varies depending on the distance from the radiating antenna. These characteristics are analyzed in three primary regions: the near-field region, the far-field region and the transition region. Of interest also are the region between the antenna main reflector and the subreflector, the region of the main reflector area and the region between the main reflector and ground.

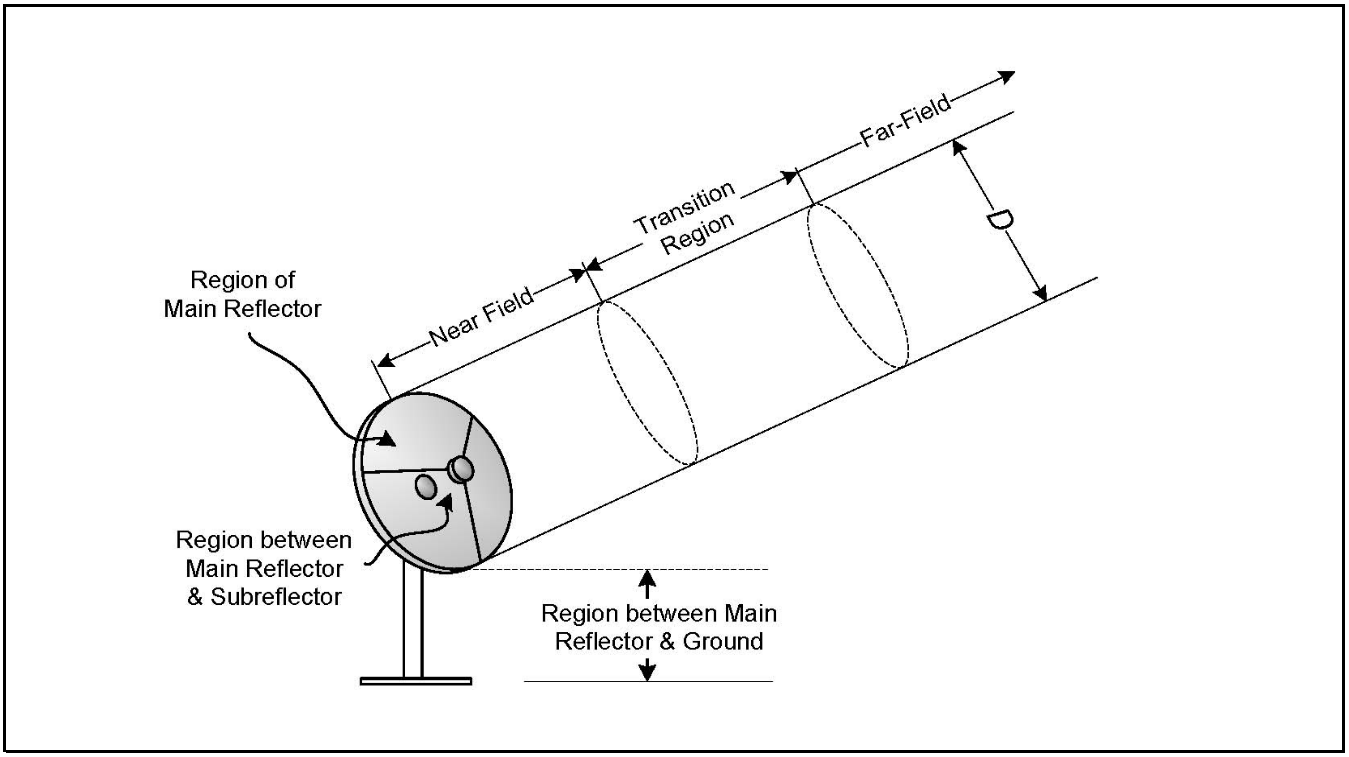

Figure 1. EM Fields as a Function of Distance

For parabolic aperture antennas with circular cross sections, such as the antenna under study, the near-field, far-field and transition region distances are calculated as follows:

Parameter	Value	Unit	Formula
Near Field Distance:	68.400	m	$R_{nf} = D^2/(4\lambda)$
Distance to Far Field:	164.160	m	Rff = 0.60D2/(λ)
Distance of Trasition Region	68.400	m	Rt = Rnf

The distance in the transition region is between the near and far fields. Thus, Rnf ≤ Rt ≤ Rff . However, the power density in the transition region will not exceed the power density in the near-field. Therefore, for purposes of the present analysis, the distance of the transition region can equate the distance to the near-field.

Power Flux Density Calculations
The power flux density is considered to be at a maximum through the entire length of the near-field. This region is contained within a cylindrical volume with a diameter, D, equal to the diameter of the antenna. In the transition region and the far-field, the power density decreases inversely with the square of the distance. The following equations are used to calculate power density in these regions.

Parameter	Value	Unit	Symbol	Formula
Power Density in the Near-Field	0.849	mW/cm^2	S_{nf}	$16.0\ \eta\ P/(\pi D^2)$
Power Density in the Far-Field	0.364	mW/cm^2	S_{ff}	$GP/(4\pi R_{ff}^2)$
Power Density in the Trans. Region	0.849	mW/cm^2	S_t	$S_{nf} R_{nf} / (R_t)$

The region between the main reflector and the subreflector is confined within a conical shape defined by the feed assembly. The most common feed assemblies are waveguide flanges. This energy is determined as follows:

Parameter	Value	Unit	Symbol	Formula
Power Density at the Feed Flange	2801.1	mW/cm^2	S_{fa}	$4P / a$

The power density in the main reflector is determined similarly to the power density at the feed flange; except that the area of the reflector is used.

Parameter	Value	Unit	Symbol	Formula
Power Density at Main Reflector	4.863	mW/cm^2	$S_{surface}$	$4P / A$

The power density between the reflector and ground, assuming uniform illumination of the reflector surface, is calculated as follows:

Parameter	Value	Unit	Symbol	Formula
Power Density between Reflector and Ground	1.216	mW/cm^2	S_g	P / A

Table 1 summarizes the calculated power flux density values for each region. In a controlled environment, the only regions that exceed FCC limitations are shown below. These regions are only accessible by trained technicians who, as a matter of procedure, turn off transmit power before performing any work in these areas.

Power Densities	**mW/cm2**	**Controlled Environment (5 mW/cm2)**
Far Field Calculation	0.364	Satisfies FCC Requirements
Near Field Calculation	0.849	Satisfies FCC Requirements
Transition Region	0.849	Satisfies FCC Requirements
Region between Main and Subreflector	2801.1	Exceeds Limitations
Main Reflector Region	4.863	Satisfies FCC Requirements
Region between Main Reflector and Ground	1.216	Satisfies FCC Requirements

Table 1. Power Flux Density for Each Region

In conclusion, the results show that the antenna, in a controlled environment, and under the proper mitigation procedures, meets the guidelines specified in 47 C.F.R. § 1.1310.

Annex 4 – C-band Coordination Report, Port Canaveral, Florida

COMSEARCH

Earth Station Data Sheet

19700 Janelia Farm Boulevard, Ashburn, VA 20147
(703)726-5662 http://www.comsearch.com

COMSEARCH
A CommScope Company

July 17, 2015

Re: Harris CapRock Communications
PORT CANAVERAL, FL
Temporary Transmit-Only Earth Station
Operation Dates: 07/20/2015 - 01/20/2016
Job Number: 150717COMSGE11

Dear Frequency Coordinator:

On behalf of Harris CapRock Communications, we are forwarding the attached coordination data for a Temporary Transmit-Only Earth Station to be located at the site referenced above.

This earth station will transmit only on the satellite(s) and frequency or frequencies as described in the attached data. Please do not report cases involving 4 GHz facilities or problems involving non-active paths or frequencies outside the specified range.

If there are any questions concerning this coordination notice, please contact Comsearch.

Sincerely,

COMSEARCH

Gary K. Edwards
Senior Manager
gedwards@comsearch.com

Enclosure(s)

COMSEARCH

Earth Station Data Sheet

19700 Janelia Farm Boulevard, Ashburn, VA 20147
(703)726-5662 http://www.comsearch.com

Date:	07/17/2015
Job Number:	150717COMSGE11

Administrative Information	
Status	TEMPORARY (Operation from 07/20/2015 to 01/20/2016)
Call Sign	TEMP01
Licensee Code	SPACLK
Licensee Name	Harris CapRock Communications

Site Information	**PORT CANAVERAL, FL**
Venue Name	
Latitude (NAD 83)	28° 24' 31.8" N
Longitude (NAD 83)	80° 36' 37.9" W
Climate Zone	B
Rain Zone	1
Ground Elevation (AMSL)	0.0 m / 0.0 ft

Link Information	
Satellite Type	Geostationary
Mode	TO - Transmit-Only
Modulation	Digital
Satellite Arc	29.5° W to 129° West Longitude
Azimuth Range	111.0° to 247.1°
Corresponding Elevation Angles	25.7° / 28.1°
Antenna Centerline (AGL)	3.66 m / 12.0 ft

Antenna Information		**Transmit - FCC32**
Antenna Model		Harris 2.4 Meter
Gain / Diameter		38.0 dBi / 2.4 m
3-dB / 15-dB Beamwidth		1.00° / 2.00°
Max Available RF Power	(dBW/4 kHz)	-18.7
	(dBW/MHz)	5.3
Maximum EIRP	(dBW/4 kHz)	19.3
	(dBW/MHz)	43.3
Interference Objectives:	Long Term	-154.0 dBW/4 kHz 20%
	Short Term	-131.0 dBW/4 kHz 0.0025%

Frequency Information	**Transmit 6.1 GHz**
Emission / Frequency Range (MHz)	1M00G7D - 20M0G7D / 5925.0 - 6425.0
Max Great Circle Coordination Distance	154.3 km / 95.9 mi
Precipitation Scatter Contour Radius	100.0 km / 62.1 mi

COMSEARCH

Earth Station Data Sheet

19700 Janelia Farm Boulevard, Ashburn, VA 20147
(703)726-5662 http://www.comsearch.com

Coordination Values	**PORT CANAVERAL, FL**		
Licensee Name	Harris CapRock Communications		
Latitude (NAD 83)	28° 24' 31.8" N		
Longitude (NAD 83)	80° 36' 37.9" W		
Ground Elevation (AMSL)	0.0 m / 0.0 ft		
Antenna Centerline (AGL)	3.66 m / 12.0 ft		
Antenna Model	Harris 2.4 Meter		
Antenna Mode		Transmit 6.1 GHz	
Interference Objectives: Long Term		-154.0 dBW/4 kHz	20%
Short Term		-131.0 dBW/4 kHz	0.0025%
Max Available RF Power	-18.7 (dBW/4 kHz)		

			Transmit 6.1 GHz	
Azimuth (°)	Horizon Elevation (°)	Antenna Discrimination (°)	Horizon Gain (dBi)	Coordination Distance (km)
0	0.00	108.84	-10.00	129.28
5	0.00	104.38	-10.00	129.28
10	0.00	99.90	-10.00	129.28
15	0.00	95.40	-10.00	129.28
20	0.00	90.90	-10.00	129.28
25	0.00	86.39	-10.00	129.28
30	0.00	81.89	-10.00	129.28
35	0.00	77.40	-10.00	129.28
40	0.00	72.94	-10.00	129.28
45	0.00	68.49	-10.00	129.28
50	0.00	64.09	-10.00	129.28
55	0.00	59.74	-10.00	129.28
60	0.00	55.45	-10.00	129.28
65	0.00	51.24	-10.00	129.28
70	0.00	47.14	-9.84	129.81
75	0.22	43.08	-8.86	130.83
80	0.00	39.42	-7.89	136.39
85	0.00	35.90	-6.88	140.05
90	0.00	32.72	-5.87	143.85
95	0.00	29.97	-4.92	147.57
100	0.00	27.79	-4.10	150.76
105	0.00	26.33	-3.51	153.20
110	0.00	25.70	-3.25	154.30
115	0.00	25.98	-3.36	153.82
120	0.00	27.12	-3.83	151.86
125	0.00	29.03	-4.57	148.84
130	0.00	31.56	-5.48	145.36
135	0.00	34.59	-6.47	141.56
140	0.00	37.99	-7.49	137.83
145	0.00	41.62	-8.48	134.34
150	0.00	45.09	-9.35	131.40
155	0.00	48.29	-10.00	129.28
160	0.00	51.13	-10.00	129.28
165	0.00	53.50	-10.00	129.28
170	0.00	55.32	-10.00	129.28
175	0.00	56.46	-10.00	129.28
180	0.00	56.85	-10.00	129.28
185	0.00	56.46	-10.00	129.28

COMSEARCH

Earth Station Data Sheet

19700 Janelia Farm Boulevard, Ashburn, VA 20147
(703)726-5662 http://www.comsearch.com

Coordination Values	**PORT CANAVERAL, FL**		
Licensee Name	Harris CapRock Communications		
Latitude (NAD 83)	28° 24' 31.8" N		
Longitude (NAD 83)	80° 36' 37.9" W		
Ground Elevation (AMSL)	0.0 m / 0.0 ft		
Antenna Centerline (AGL)	3.66 m / 12.0 ft		
Antenna Model	Harris 2.4 Meter		
Antenna Mode		Transmit 6.1 GHz	
Interference Objectives: Long Term		-154.0 dBW/4 kHz	20%
Short Term		-131.0 dBW/4 kHz	0.0025%
Max Available RF Power	-18.7 (dBW/4 kHz)		

			Transmit 6.1 GHz	
Azimuth (°)	Horizon Elevation (°)	Antenna Discrimination (°)	Horizon Gain (dBi)	Coordination Distance (km)
190	0.00	55.32	-10.00	129.28
195	0.00	53.50	-10.00	129.28
200	0.00	51.13	-10.00	129.28
205	0.00	48.29	-10.00	129.28
210	0.00	45.09	-9.35	131.39
215	0.00	41.62	-8.48	134.34
220	0.00	38.23	-7.56	137.58
225	0.00	35.16	-6.65	140.90
230	0.00	32.50	-5.80	144.13
235	0.00	30.37	-5.06	147.00
240	0.00	28.88	-4.52	149.06
245	0.00	28.14	-4.23	150.20
250	0.00	28.21	-4.26	150.10
255	0.00	29.08	-4.59	148.76
260	0.00	30.68	-5.17	146.57
265	0.00	32.90	-5.93	143.62
270	0.00	35.63	-6.80	140.36
275	0.00	38.76	-7.71	137.04
280	0.00	42.20	-8.63	133.82
285	0.00	45.88	-9.54	130.78
290	0.00	49.74	-10.00	129.28
295	0.00	53.74	-10.00	129.28
300	0.00	57.85	-10.00	129.28
305	0.00	62.05	-10.00	129.28
310	0.00	66.31	-10.00	129.28
315	0.00	70.62	-10.00	129.28
320	0.00	74.97	-10.00	129.28
325	0.00	79.35	-10.00	129.28
330	0.00	83.75	-10.00	129.28
335	0.00	88.16	-10.00	129.28
340	0.00	92.57	-10.00	129.28
345	0.00	96.97	-10.00	129.28
350	0.00	101.37	-10.00	129.28
355	0.00	105.74	-10.00	129.28