<u>Exhibit A</u>
ST5000-2.4 Technical Information

ST5000-2.4 – Technical Description and Parameters

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

Pointing Accuracy and Automatic Muting. 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. 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 requirements for ESV operations, including: (i) maintaining off-axis EIRP to the levels set forth in the applicable FCC mask (in the case of Ka-band, Section 25.138); (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	Better than 0.2º (auto-disable at 0.5 º offset)
Tracking capability	8º/sec

Harris CapRock has tested the pointing accuracy of the ST5000-2.4 terminal and provided summary results in the ST5000-2.4 Tracking Testing report. (*See* Technical Appendix, Annex 5, "*Tracking Report*") As indicated in the *Tracking Report*, at the tested frequencies the 1 dB contour (i.e., a 1 dB reduction from peak boresite power) represents a 0.19º pointing offset. *See id.* at 4-5. In no case did the pointing offset of the ST5000-2.4 terminal exceed 1 dB (each "box" in the grids in the spectrum analyzer screen shots represents 1 dB). Thus, the tested pointing accuracy of the ST5000-2.4 terminal is better than 0.2º.

Compliant pointing accuracy is expected because the ST5000-2.4 terminal has the same positioner and pointing technology as Harris CapRock's licensed ST4000 series terminals. Similarly, because the ST5000-2.4 terminal employs the same automatic muting technology and functionality as the previously licensed ESV terminals, it complies with the requirement to mute transmissions if pointing offset exceeds 0.5º and will not recommence transmissions until pointing offset is within 0.2º.

Sections 25.221 & 25.222 Off-Axis EIRP Spectral Density Limits. The ST5000-2.4 will operate in accordance with the off-axis EIRP spectral density limits for C-band and Ku-band ESV terminals set forth the Commission's rules.[1] In the Technical Appendix Annex 1, Figures

[1] *See* 47 C.F.R. §§ 25.221 (a)(1)(i) and 25.222(a)(1)(i). The ST5000-2.4 terminal complies with off-axis EIRP spectral density limits in both the azimuth and elevation plane in the C-band and Ku-band.

[2] In the interest of administrative convenience, Harris CapRock has provided EIRP spectral density plots to satisfy Sections 25.221 and 25.222 of the Commission's rules. Harris CapRock has submitted the

1-3 Harris CapRock provides plots demonstrating that the ST5000-2.4 terminal will comply with the FCC Section 25.221 EIRP spectral density limits and the Commission's two-degree spacing policies during C-band operations. Similarly, in Annex 1, Figures 4-6 Harris CapRock provides plots demonstrating that the ST5000-2.4 terminal will comply with the FCC Section 25.222 EIRP spectral density limits and the Commission's two-degree spacing policies during Ku-band operations.[2]

Section 25.209 Gain Envelopes. Harris CapRock acknowledges that the ST5000-2.4 antenna will exceed the Commission's Section 25.209 gain envelopes at C-band and Ku-band at certain off-axis angles.[3] Accordingly, pursuant to Section 25.132(b)(3) of the Commission's rules, Harris CapRock hereby submits range test plots of the antenna gain patterns for each frequency band.

For C-band, Harris CapRock provides the co-polarized and cross-polarization patterns versus the FCC Section 25.209 gain mask in the E and H planes at 5.850 GHz (bottom of band), 6.1375 GHz (middle of band) and 6.4250 GHz (top of band). (*See* Technical Appendix, Annex 2.) For Ku-band, Harris CapRock provides the co-polarized and cross-polarized patterns versus the FCC Section 25.209 gain mask in the E and H planes at 13.75 GHz (bottom of band), 14.125 GHz (middle of band) and 14.50 GHz (top of band). (*See* Technical Appendix, Annex 2.) Accordingly, Harris CapRock complies with Section 25.132(b)(1)'s of the Commission's rules by providing measured gain pattern values at the bottom, middle and top of C-band and Ku band.[4]

Furthermore, in the following appendices, Form 312 and Schedule B, Harris CapRock provides additional operational and technical information relating to the ST5000-2.4 terminal, including the information required under Sections 25.221 and 25.222 of the Commission's rules.

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[2] In the interest of administrative convenience, Harris CapRock has provided EIRP spectral density plots to satisfy Sections 25.221 and 25.222 of the Commission's rules. Harris CapRock has submitted the associated EIRP spectral density tabular data with its recently filed commercial modification application (*see* File No. SES-MOD-20150915-00599 (Call Sign E060157)).

[3] *See* 47. C.F.R. § 25.209.

[4] In the interest of administrative convenience, Harris CapRock has provided gain pattern plots to satisfy Section 25.132(b)(1) of the Commission's rules. To the extent that the Commission wishes to review additional data, Harris CapRock will supply the related gain pattern tabular data for C-band and Ku-band.

Annex 1
Antenna Performance Plots for C-band & Ku-band

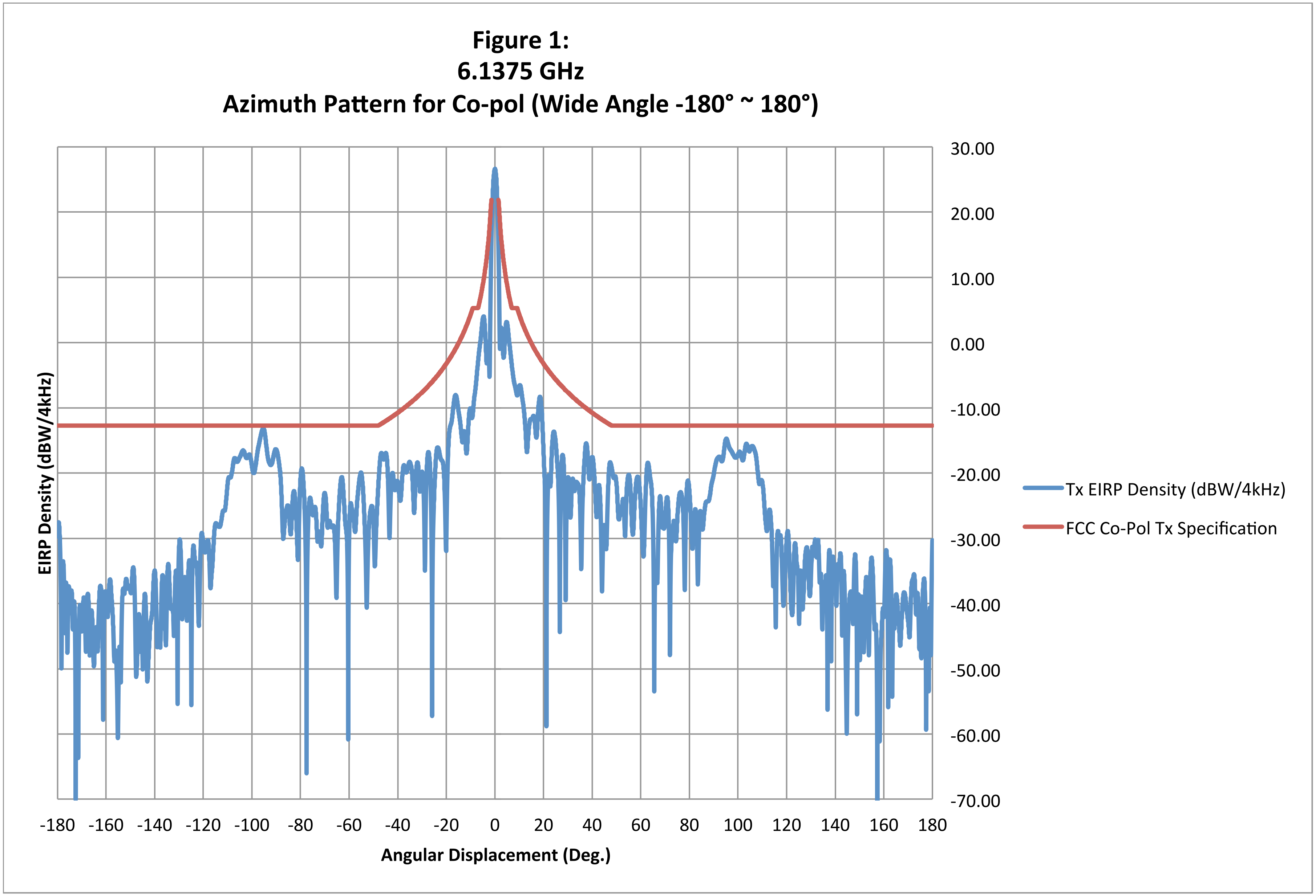


Figure 1:
6.1375 GHz
Azimuth Pattern for Co-pol (Wide Angle -180° ~ 180°)
EIRP Density (dBW/4kHz)
30.00
20.00
10.00
0.00
-10.00
-20.00
-30.00
-40.00
-50.00
-60.00
-70.00
-180 -160 -140 -120 -100 -80 -60 -40 -20 0 20 40 60 80 100 120 140 160 180
Angular Displacement (Deg.)
Tx EIRP Density (dBW/4kHz)
FCC Co-Pol Tx Specification

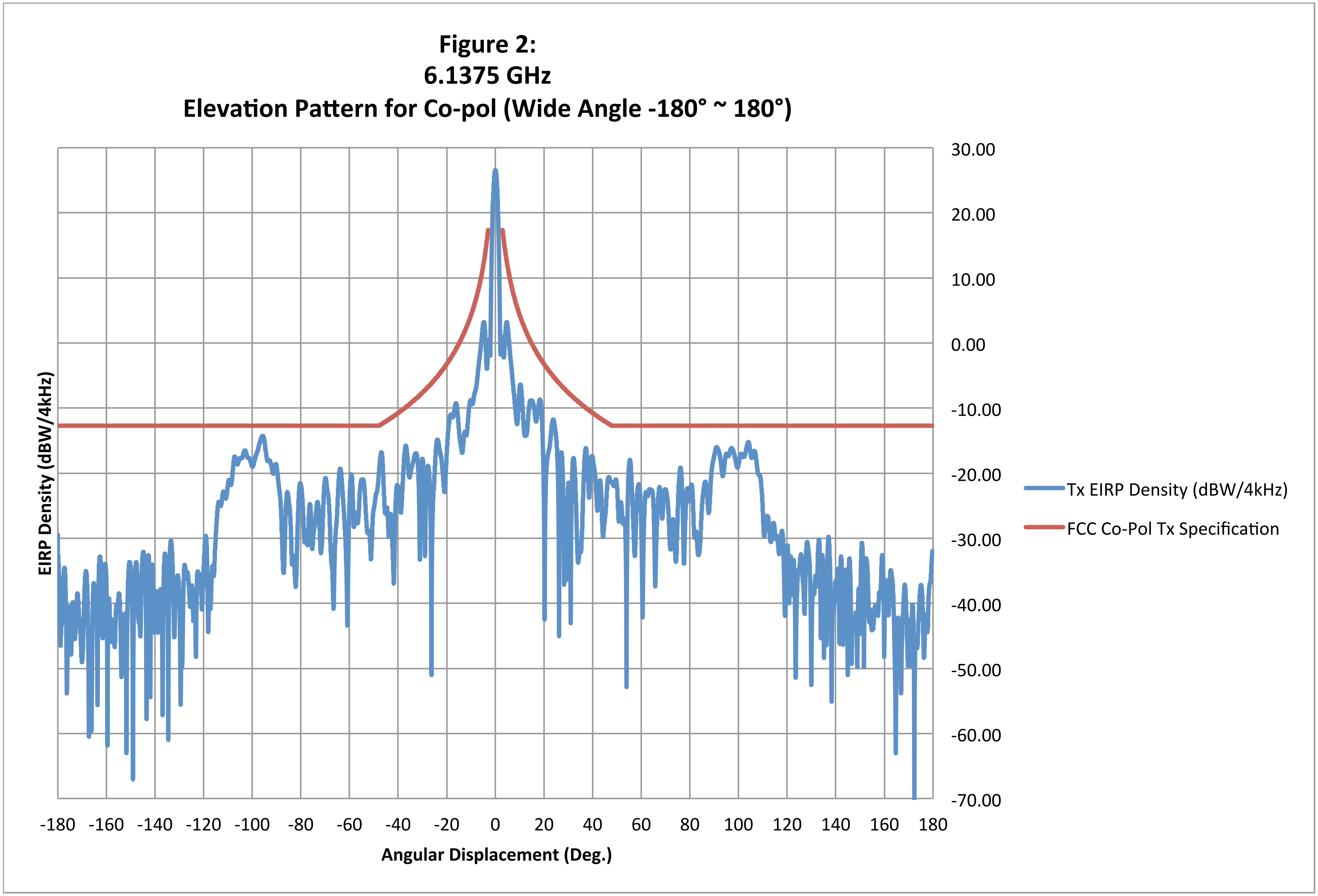


Figure 2:
6.1375 GHz
Elevation Pattern for Co-pol (Wide Angle -180° ~ 180°)
30.00
20.00
10.00
0.00
-10.00
-20.00
-30.00
-40.00
-50.00
-60.00
-70.00
EIRP Density (dBW/4kHz)
-180
-160
-140
-120
-100
-80
-60
-40
-20
0
20
40
60
80
100
120
140
160
180
Angular Displacement (Deg.)
Tx EIRP Density (dBW/4kHz)
FCC Co-Pol Tx Specification

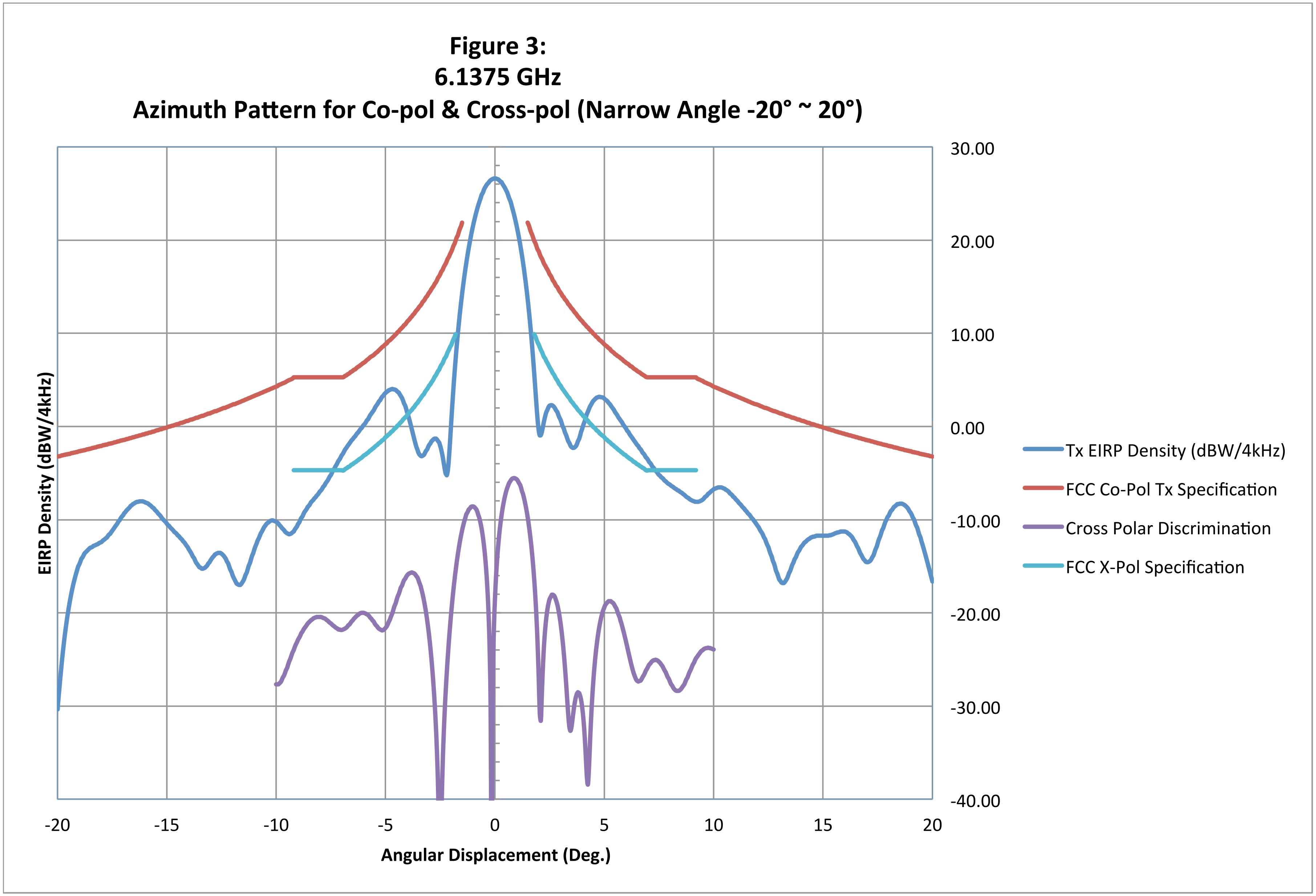


Figure 3:
6.1375 GHz
Azimuth Pattern for Co-pol & Cross-pol (Narrow Angle -20° ~ 20°)
30.00
20.00
10.00
0.00
-10.00
-20.00
-30.00
-40.00
-20
-15
-10
-5
0
5
10
15
20
EIRP Density (dBW/4kHz)
Angular Displacement (Deg.)
Tx EIRP Density (dBW/4kHz)
FCC Co-Pol Tx Specification
Cross Polar Discrimination
FCC X-Pol Specification

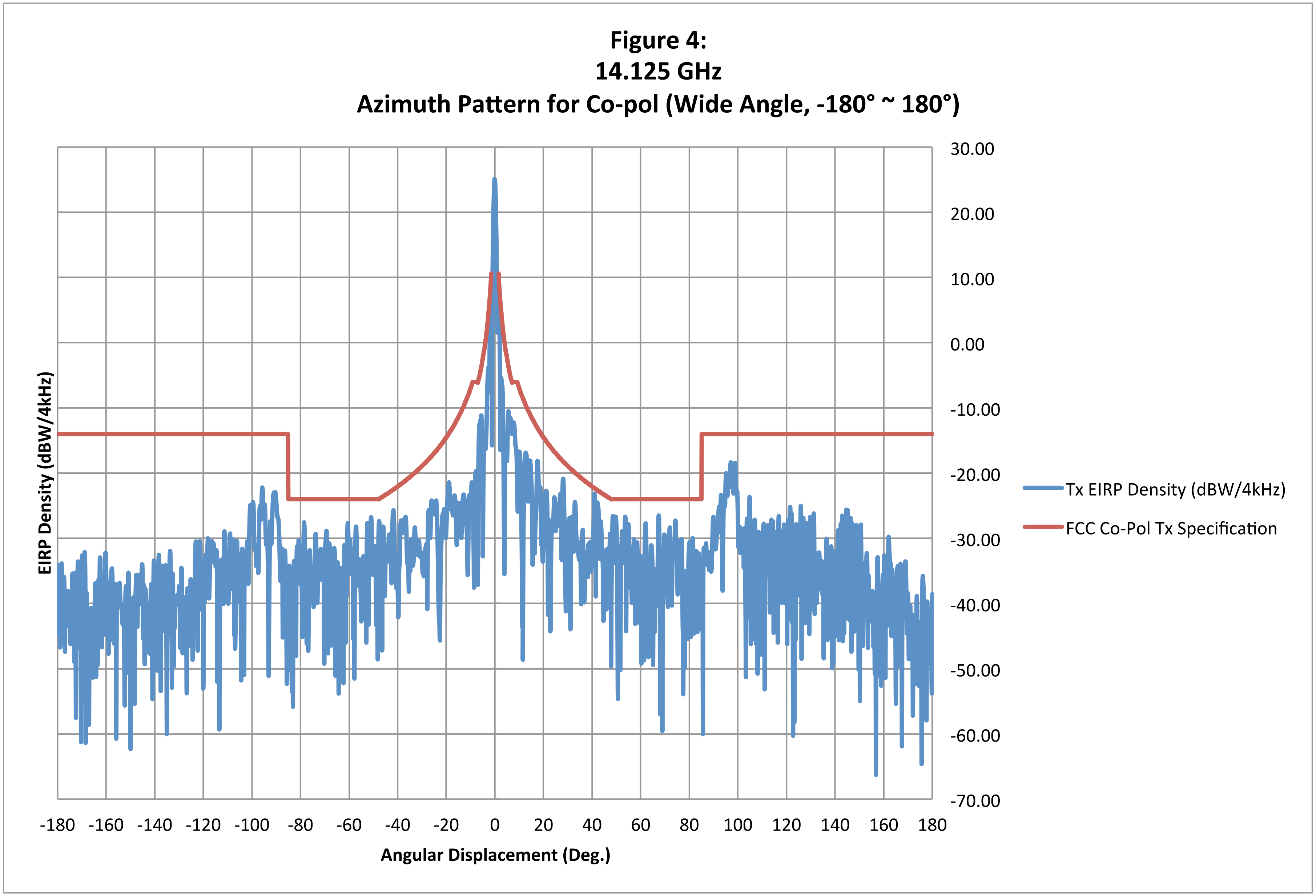


Figure 4:
14.125 GHz
Azimuth Pattern for Co-pol (Wide Angle, -180° ~ 180°)
EIRP Density (dBW/4kHz)
30.00
20.00
10.00
0.00
-10.00
-20.00
-30.00
-40.00
-50.00
-60.00
-70.00
-180 -160 -140 -120 -100 -80 -60 -40 -20 0 20 40 60 80 100 120 140 160 180
Angular Displacement (Deg.)
Tx EIRP Density (dBW/4kHz)
FCC Co-Pol Tx Specification

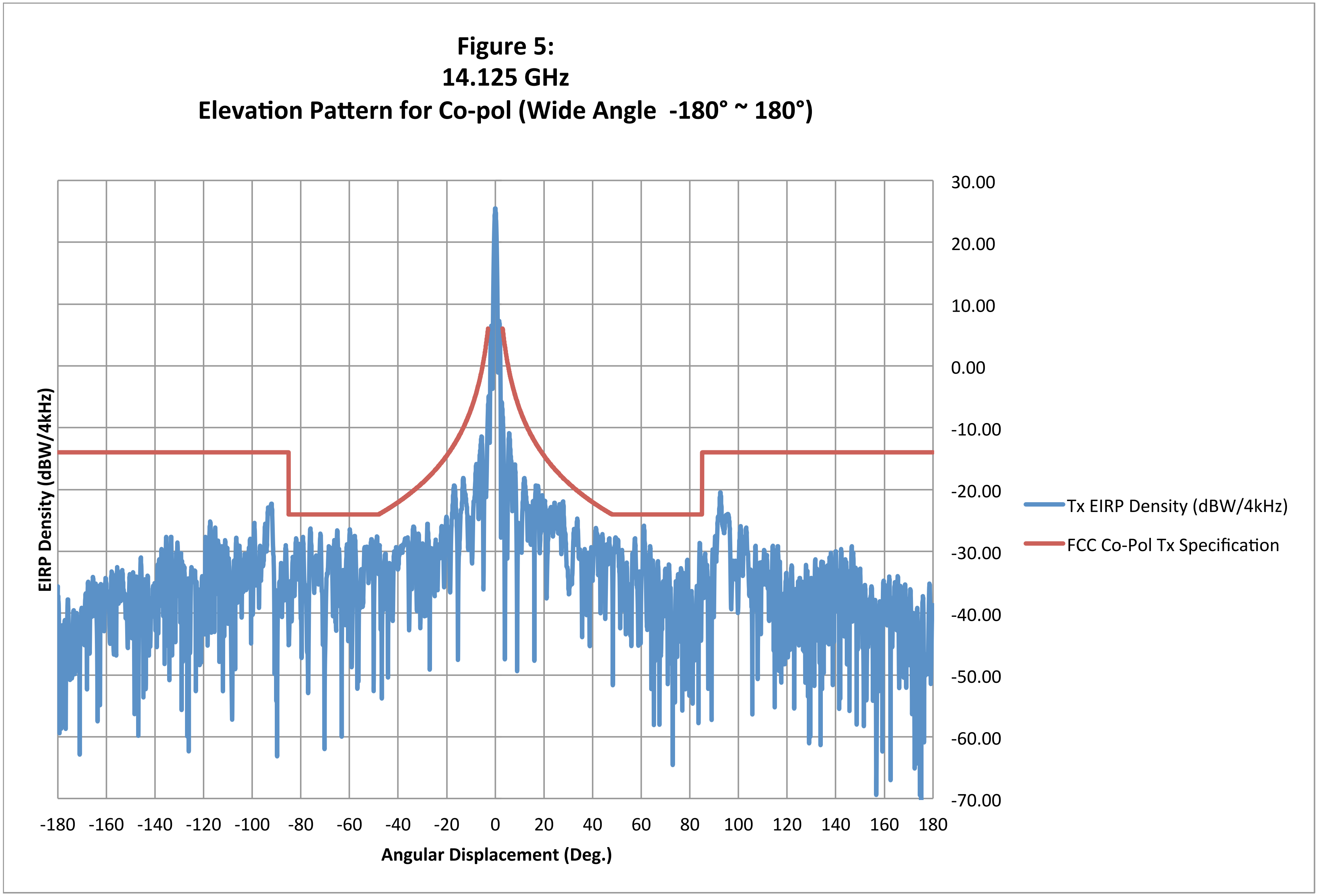


Figure 5:
14.125 GHz
Elevation Pattern for Co-pol (Wide Angle -180° ~ 180°)
EIRP Density (dBW/4kHz)
30.00
20.00
10.00
0.00
-10.00
-20.00
-30.00
-40.00
-50.00
-60.00
-70.00
-180 -160 -140 -120 -100 -80 -60 -40 -20 0 20 40 60 80 100 120 140 160 180
Angular Displacement (Deg.)
Tx EIRP Density (dBW/4kHz)
FCC Co-Pol Tx Specification

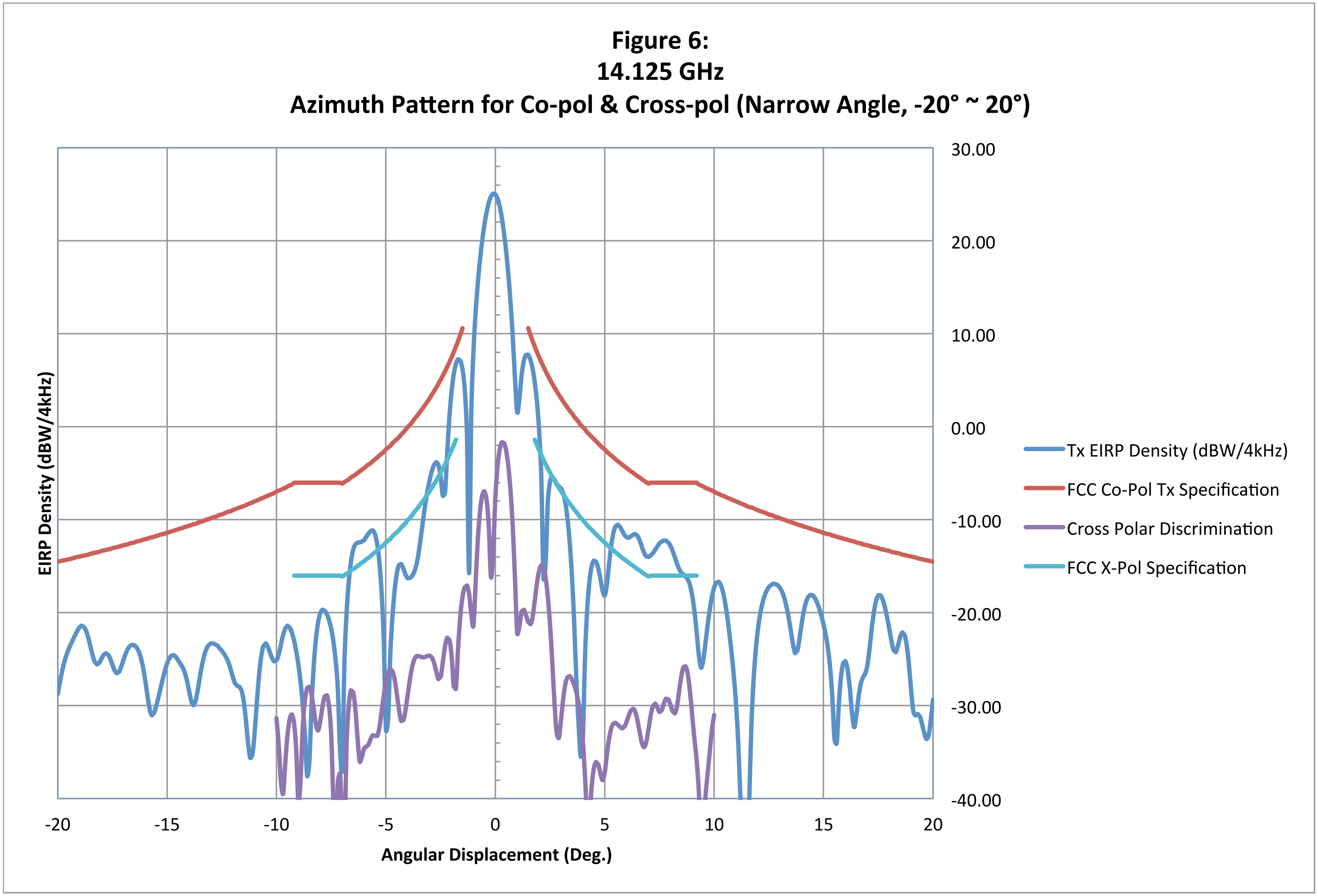
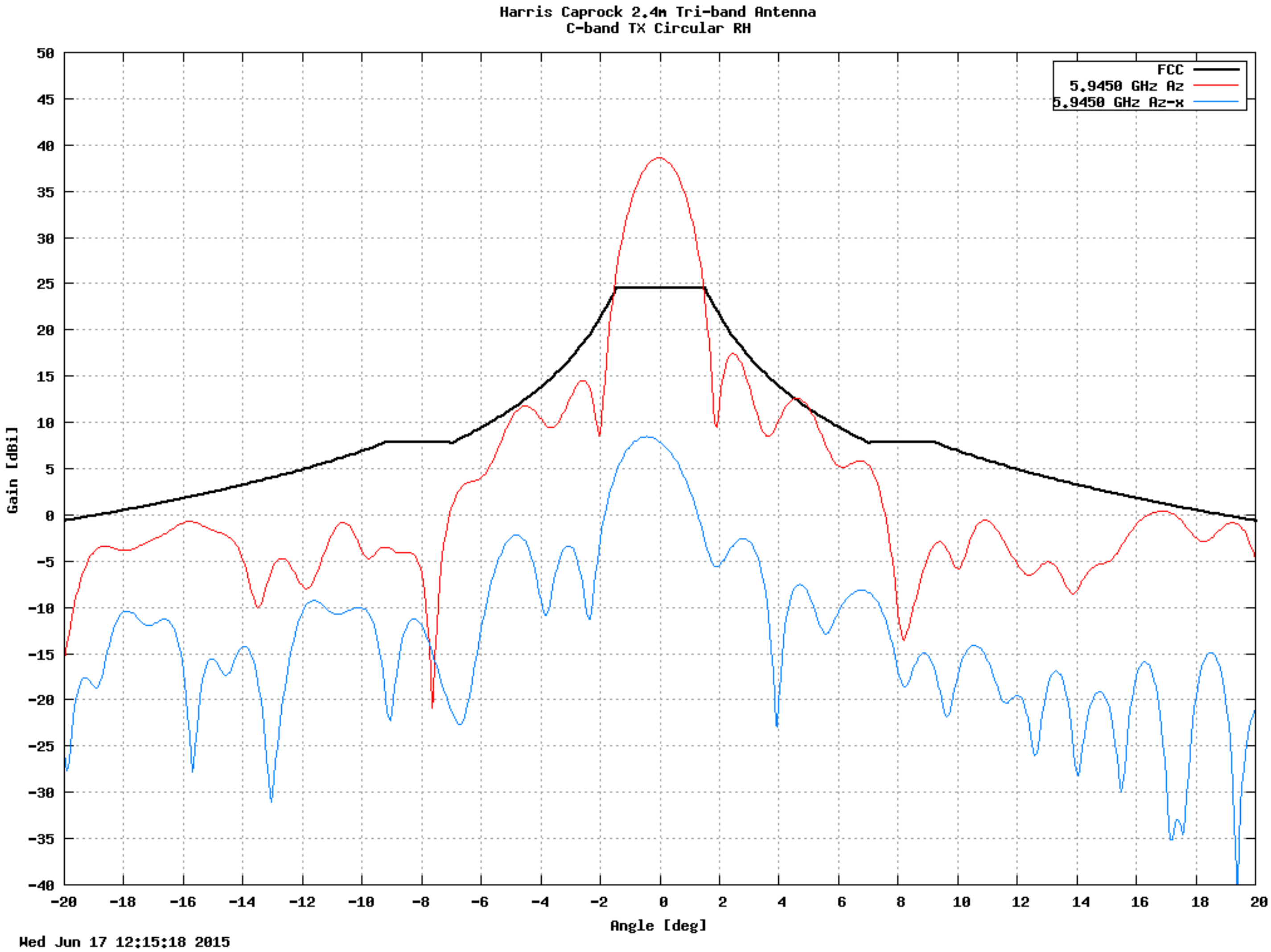


Figure 6:
14.125 GHz
Azimuth Pattern for Co-pol & Cross-pol (Narrow Angle, -20° ~ 20°)
EIRP Density (dBW/4kHz)
30.00
20.00
10.00
0.00
-10.00
-20.00
-30.00
-40.00
-20
-15
-10
-5
0
5
10
15
20
Angular Displacement (Deg.)
Tx EIRP Density (dBW/4kHz)
FCC Co-Pol Tx Specification
Cross Polar Discrimination
FCC X-Pol Specification

Annex 2
Gain Pattern Plots for C-band & Ku-band

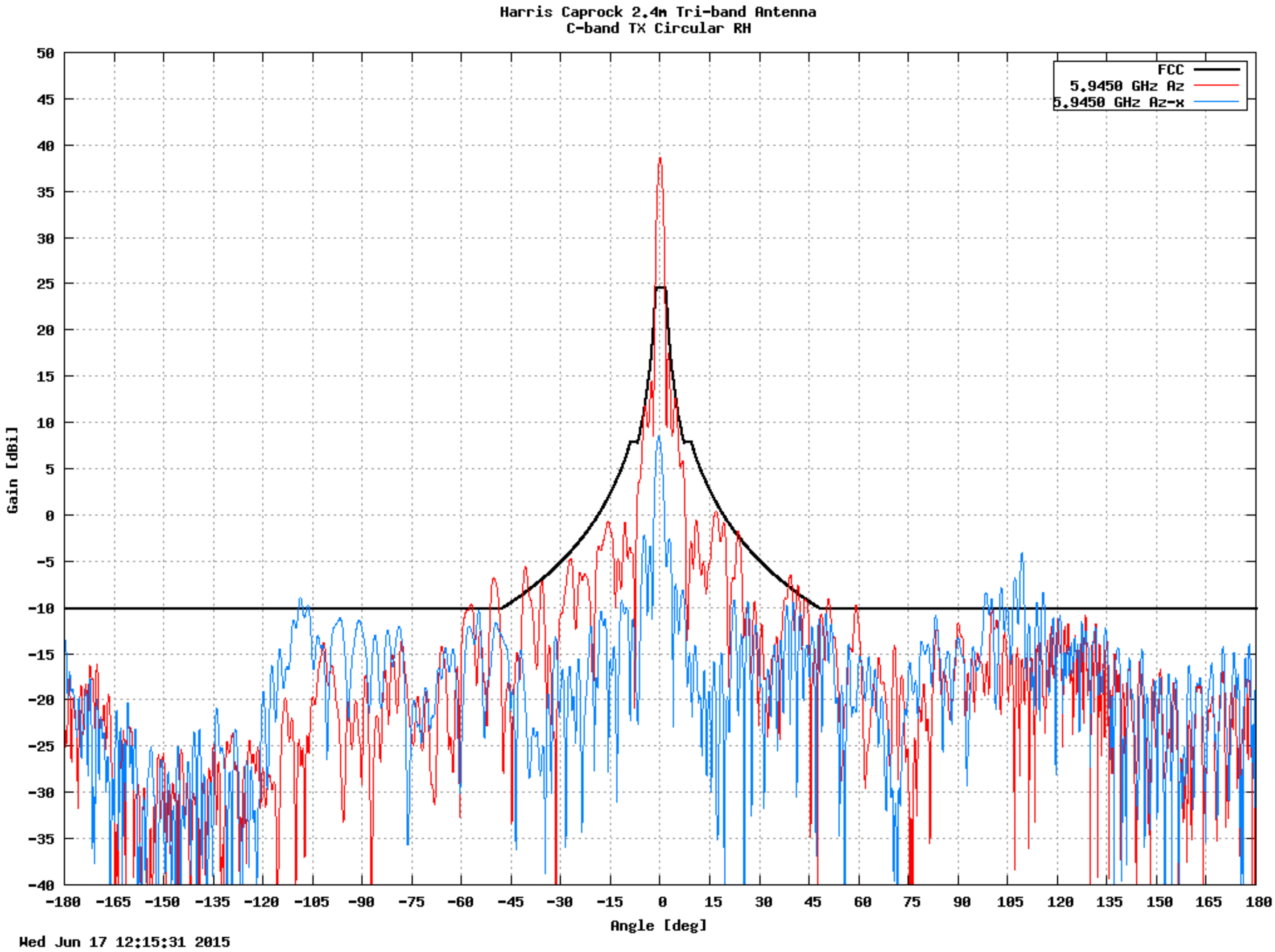
C Band - 5.9450 GHz (Bottom of band)

Figure 1: Azimuth (Narrow)



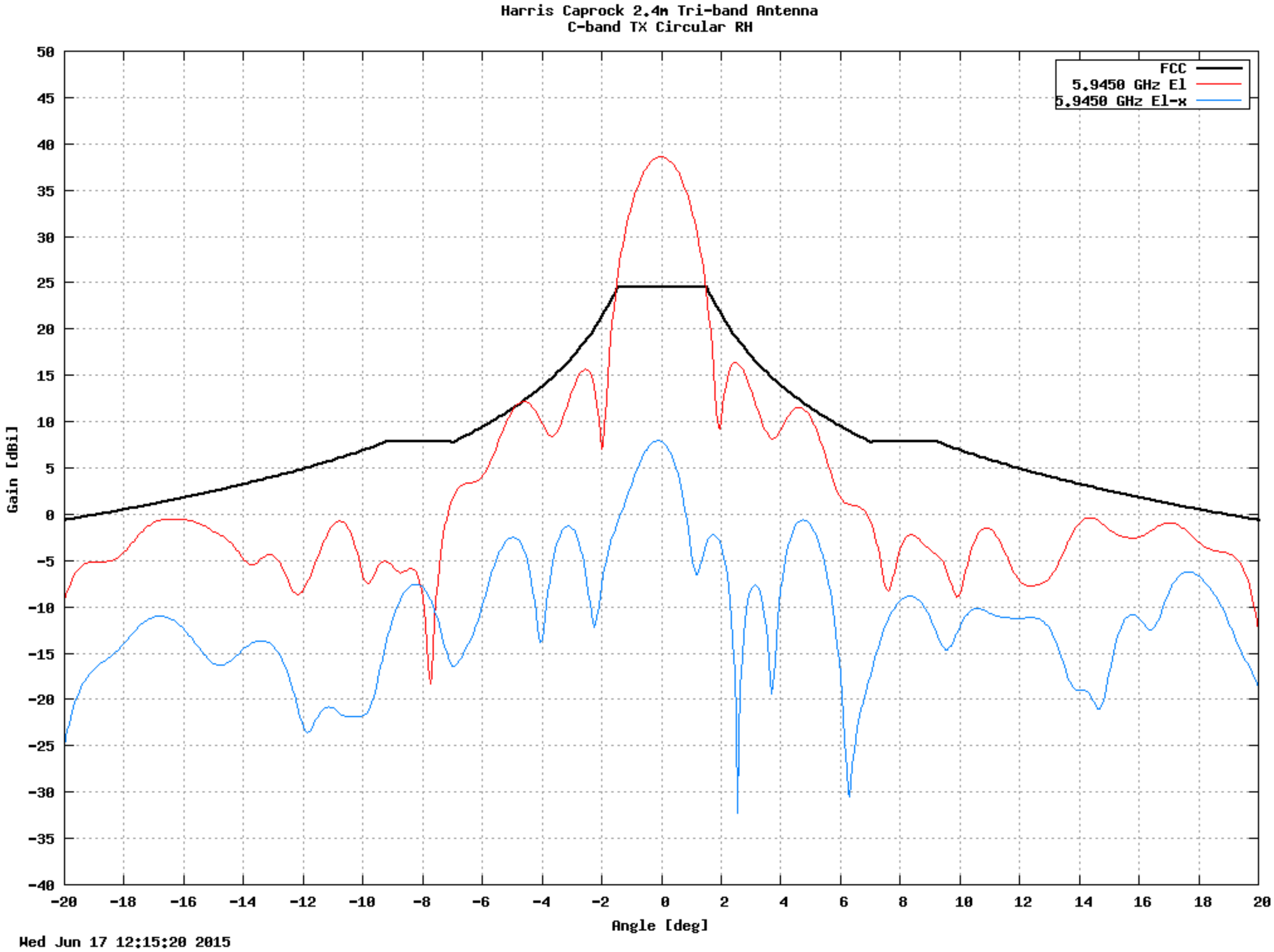
C Band - 5.9450 GHz (Bottom of band)

Azimuth (Wide)



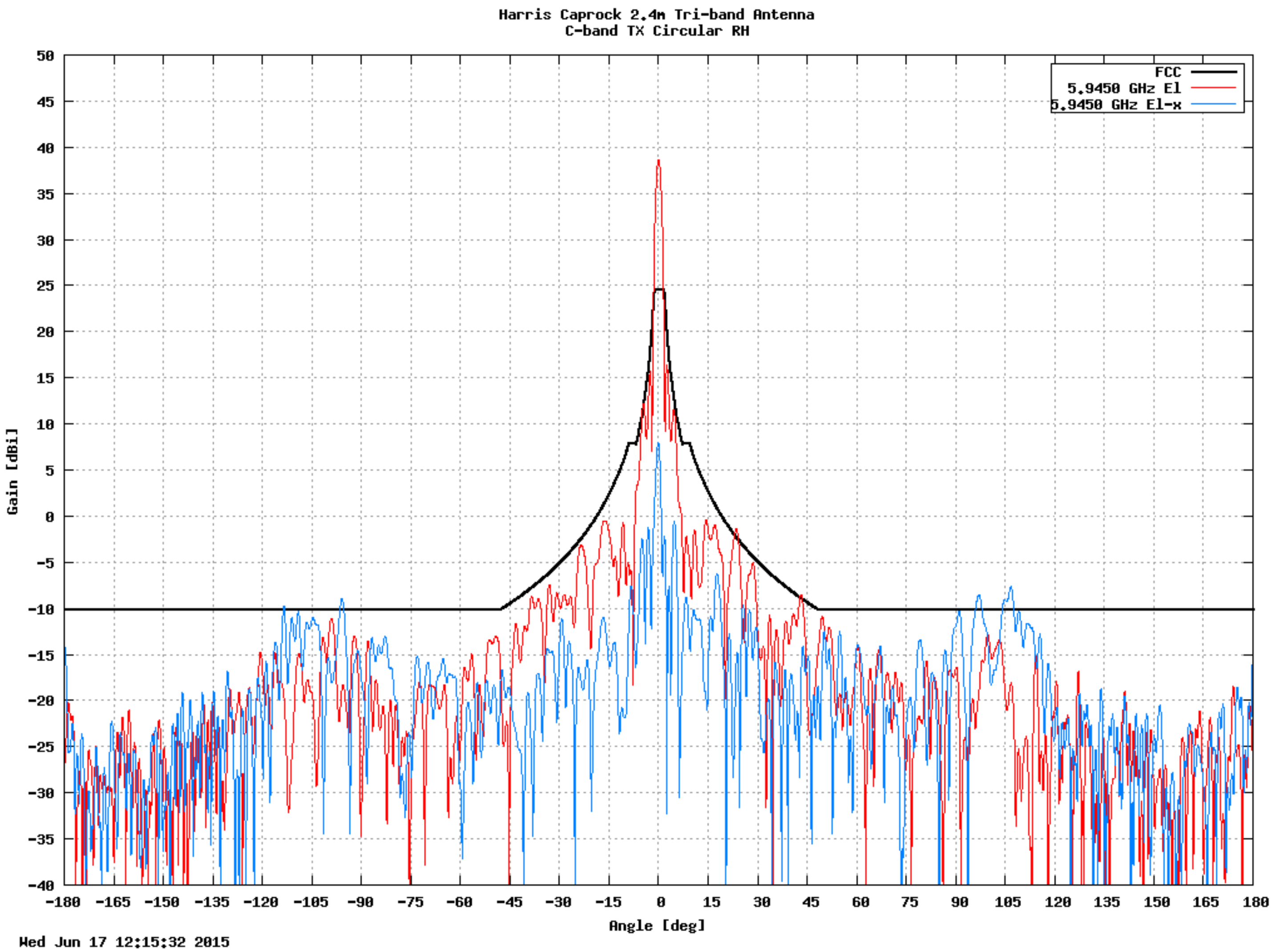
C Band - 5.9450 GHz (Bottom of band)

Elevation (Narrow)



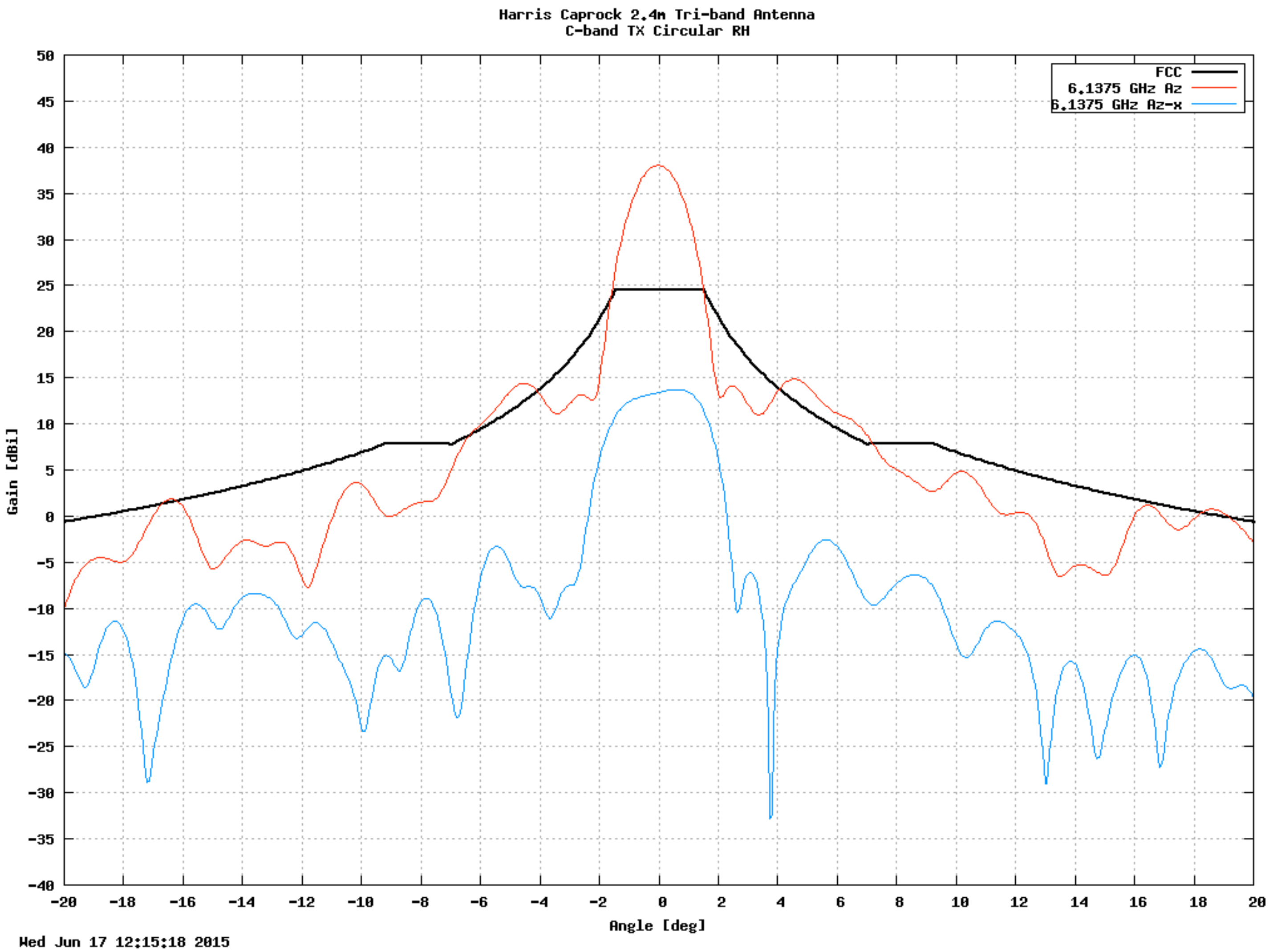
C Band - 5.9450 GHz (Bottom of band)

Elevation (Wide)



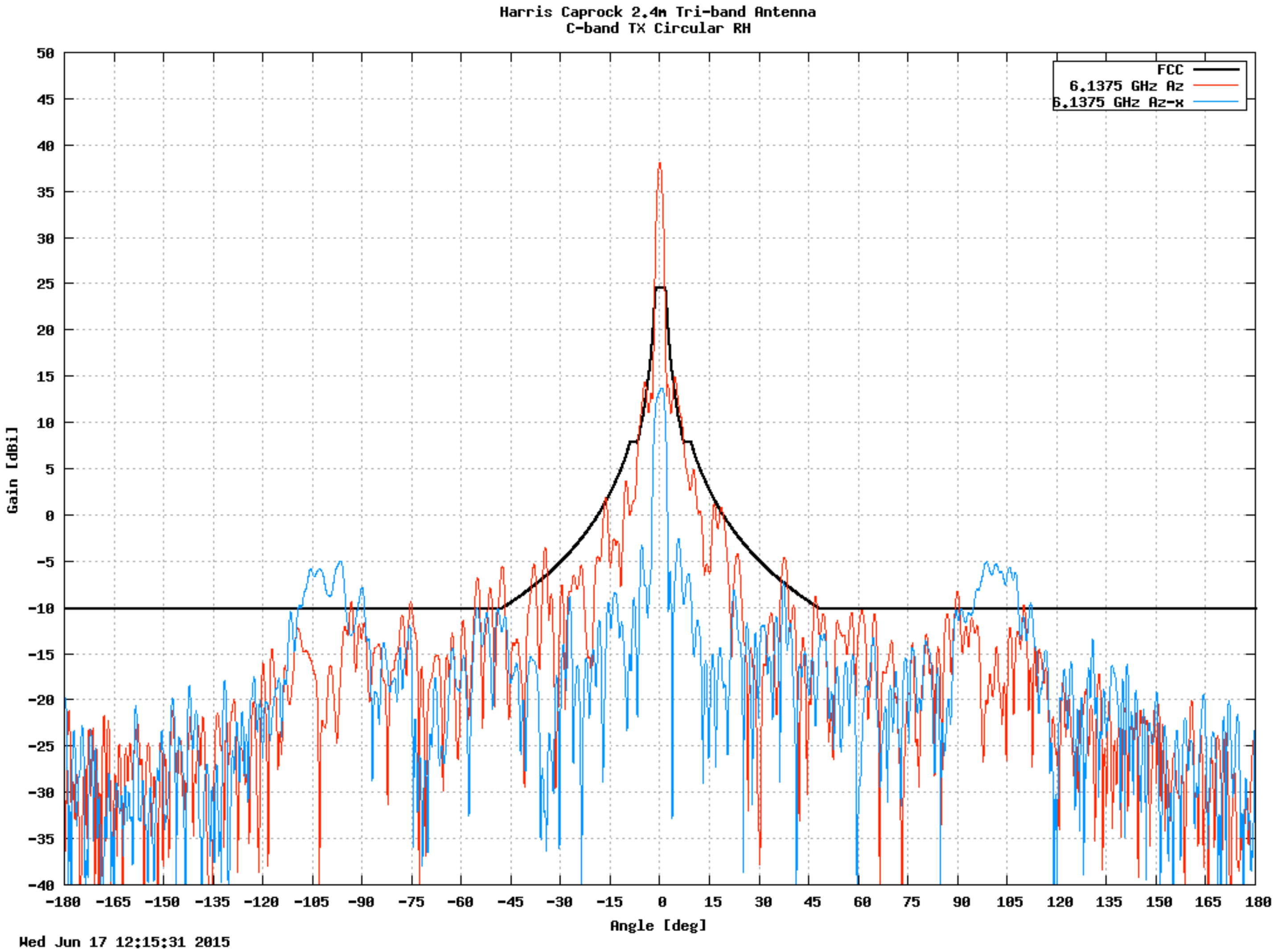
C Band - 6.1375 GHz (Mid-band)

Azimuth (Narrow)



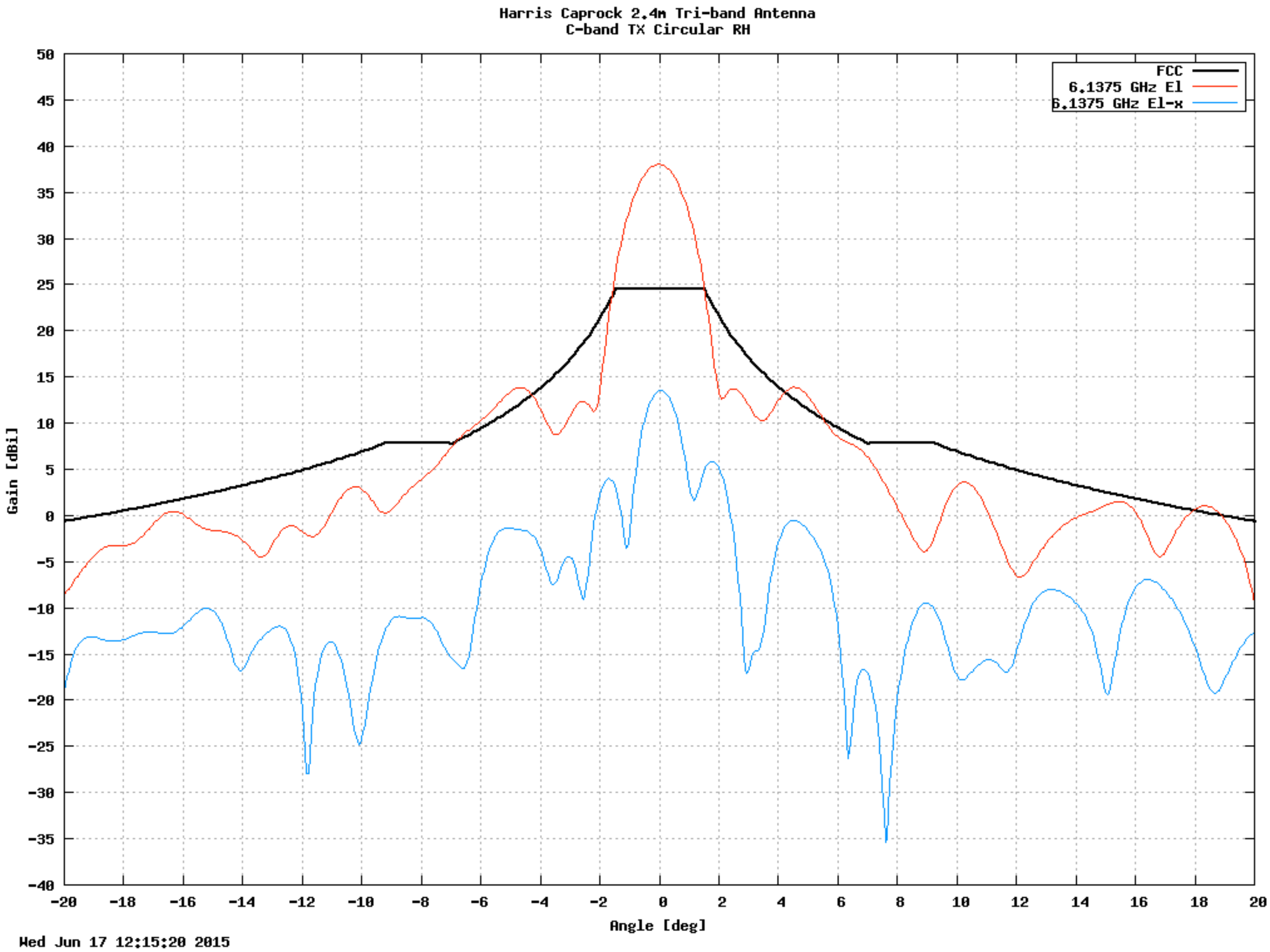
C Band - 6.1375 GHz (Mid-band)

Azimuth (Wide)



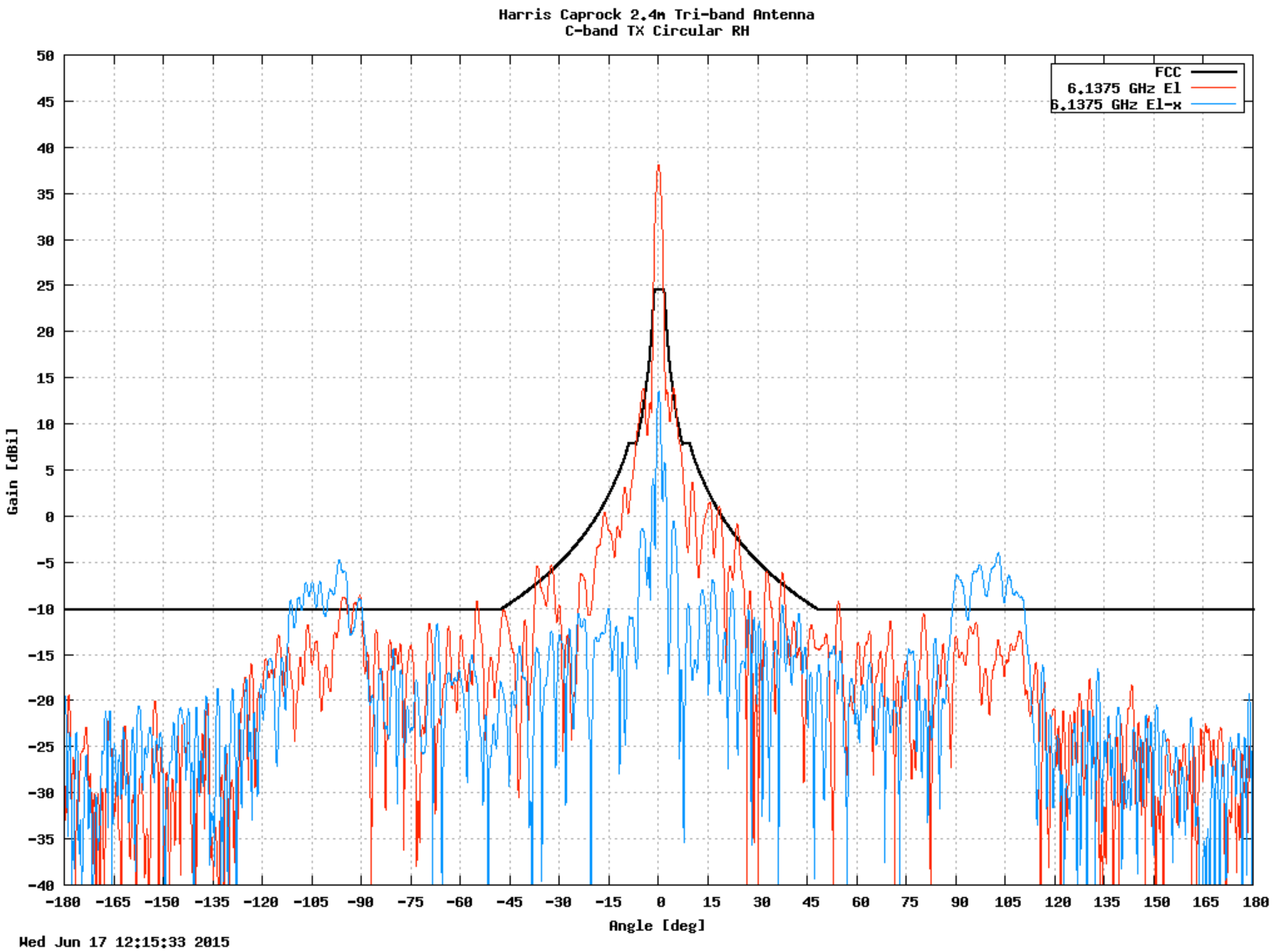
C Band - 6.1375 GHz (Mid-band)

Elevation (Narrow)



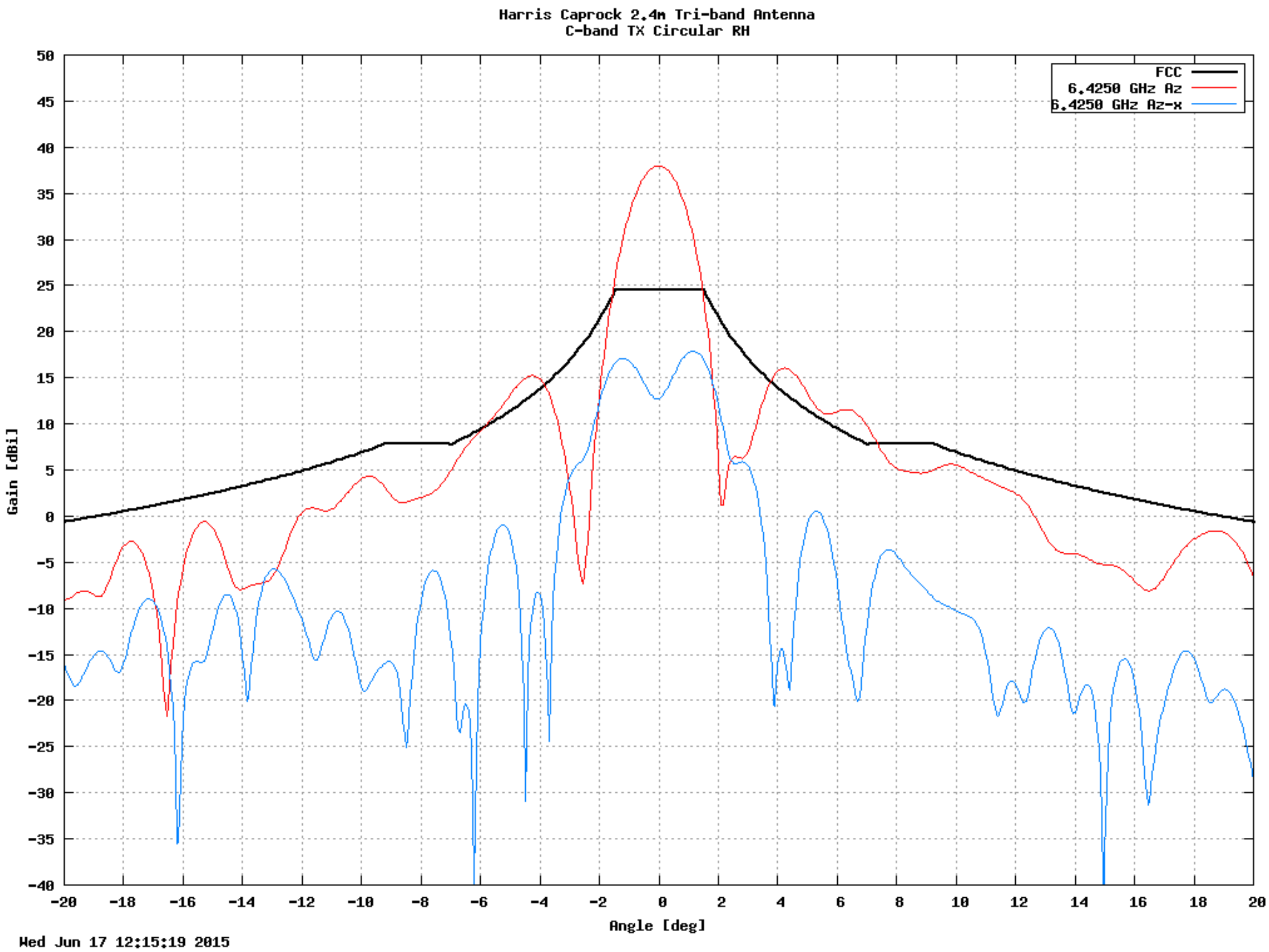
C Band - 6.1375 GHz (Mid-band)

Figure 4: Elevation (Wide)



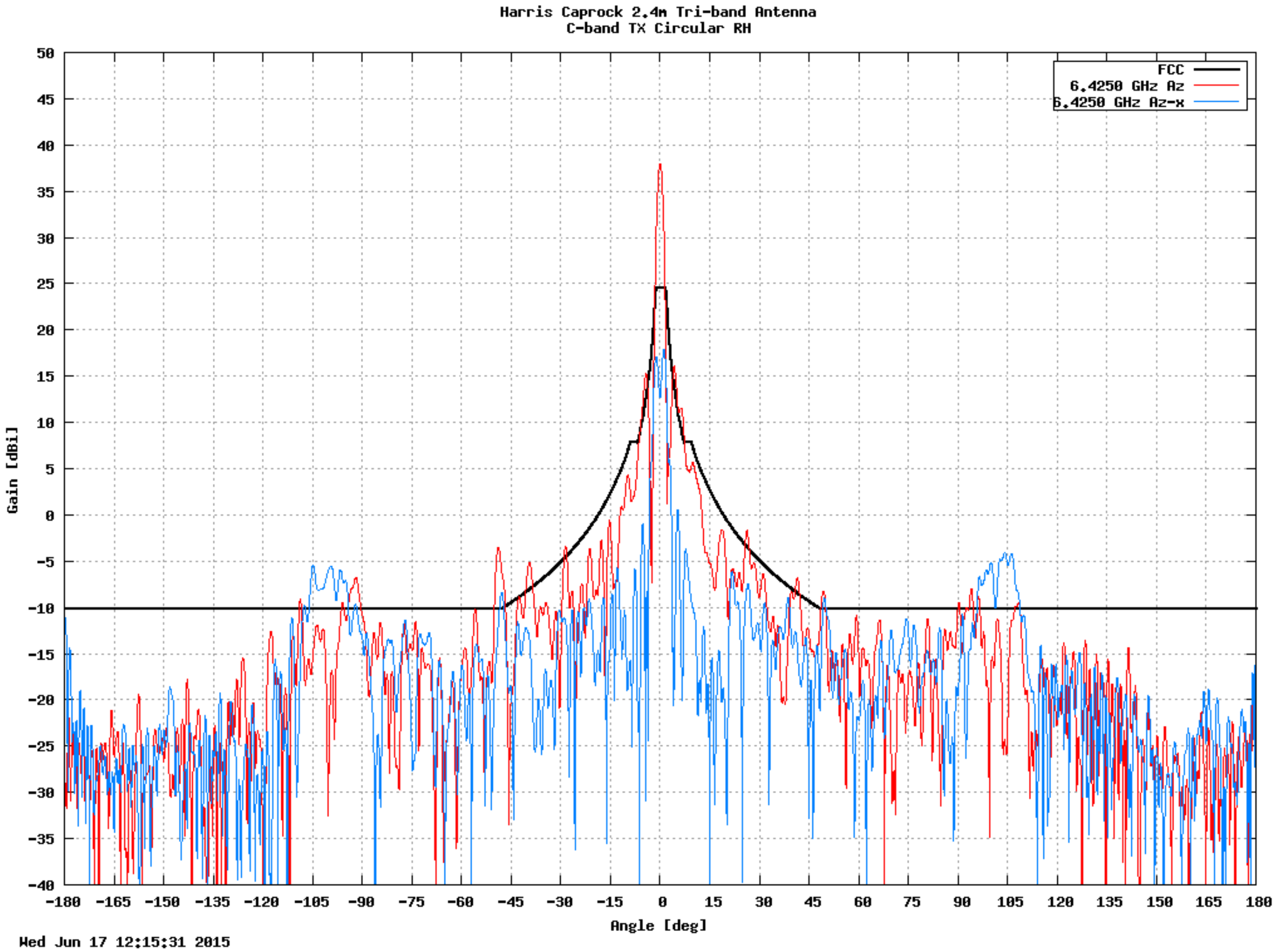
<u>C Band - 6.4250 GHz (Top of band)</u>

Azimuth (Narrow)



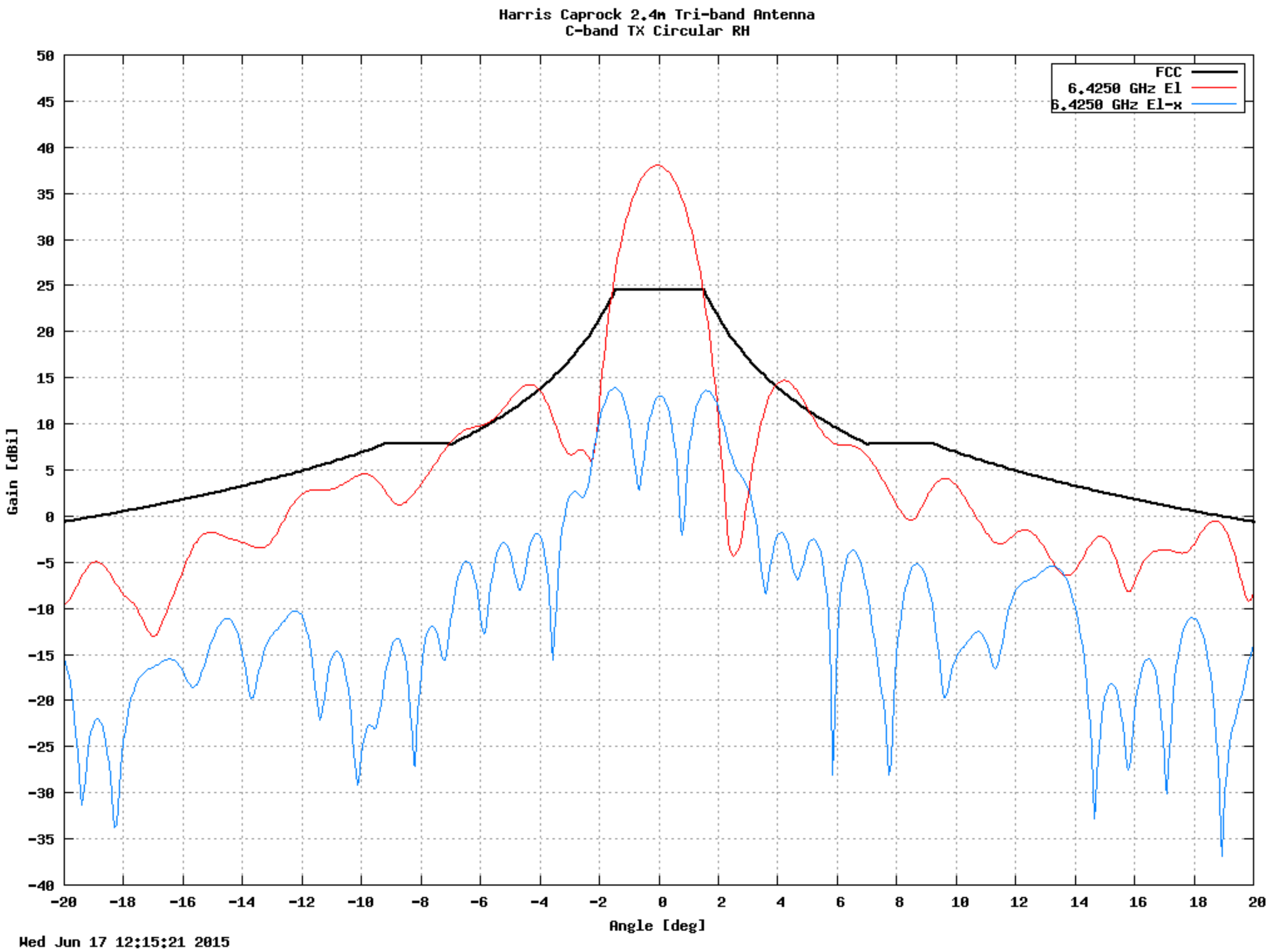
C Band - 6.4250 GHz (Top of band)

Azimuth (Wide)



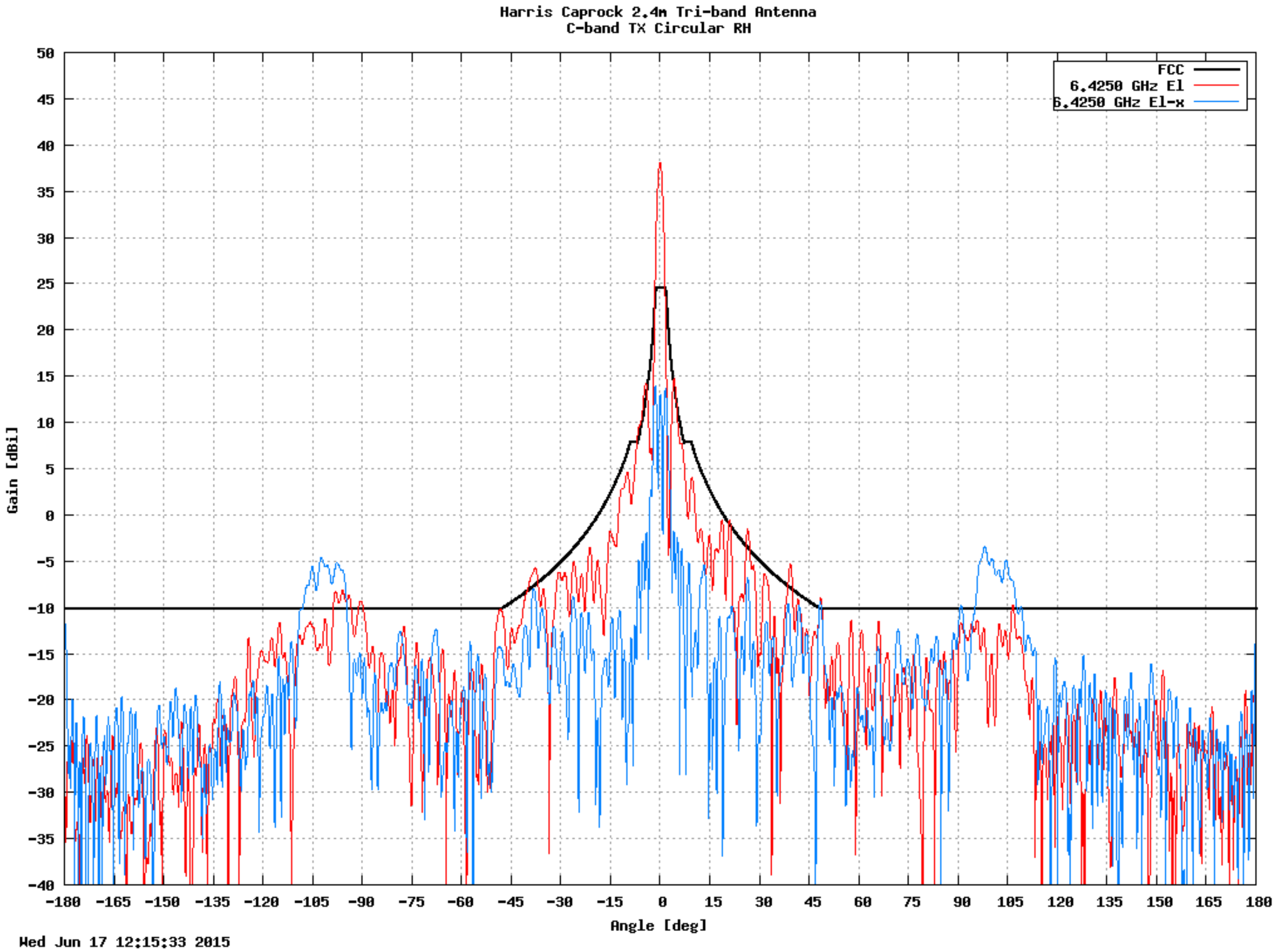
C Band - 6.4250 GHz (Top of band)

Elevation (Narrow)



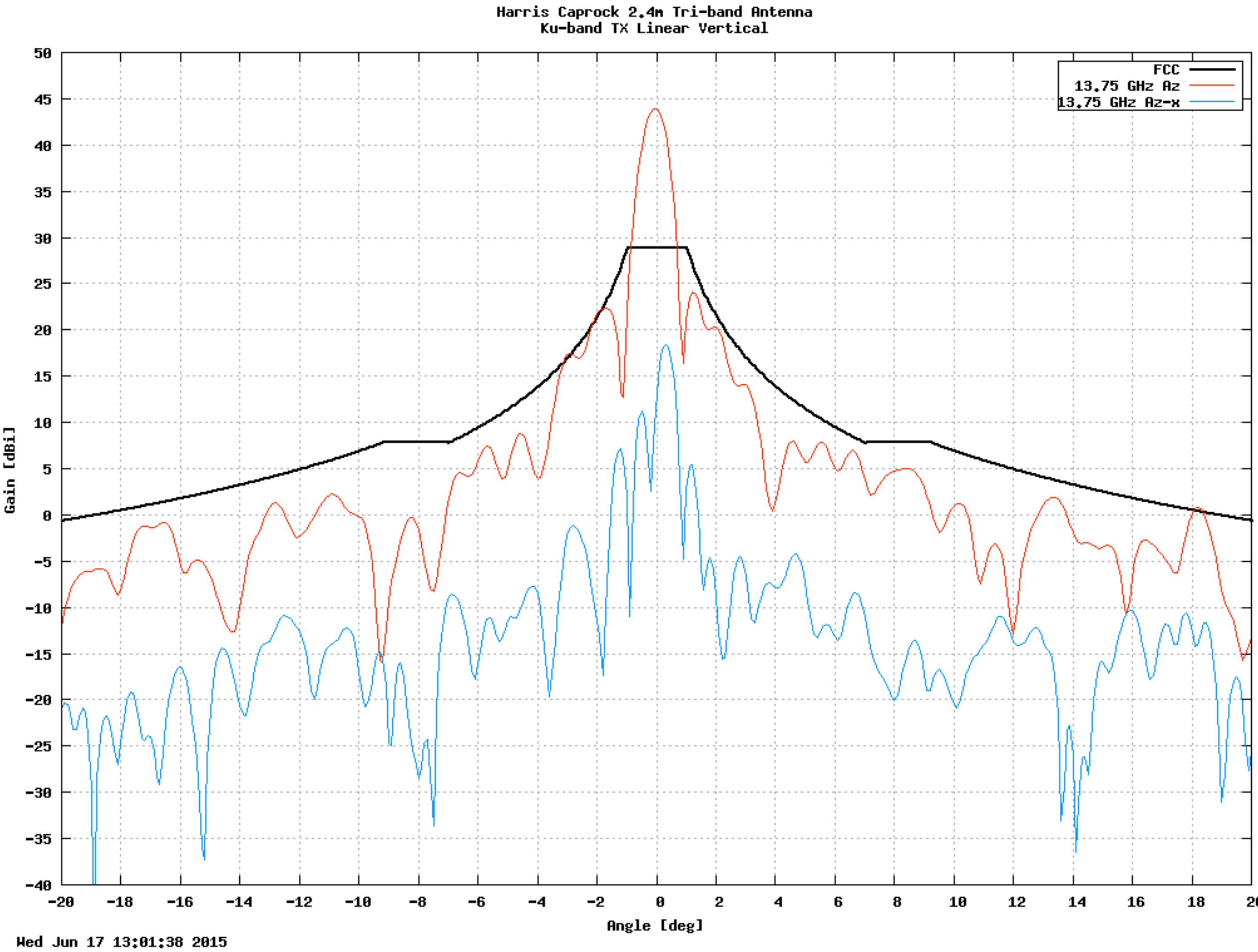
C Band - 6.4250 GHz (Top of band)

Elevation (Wide)



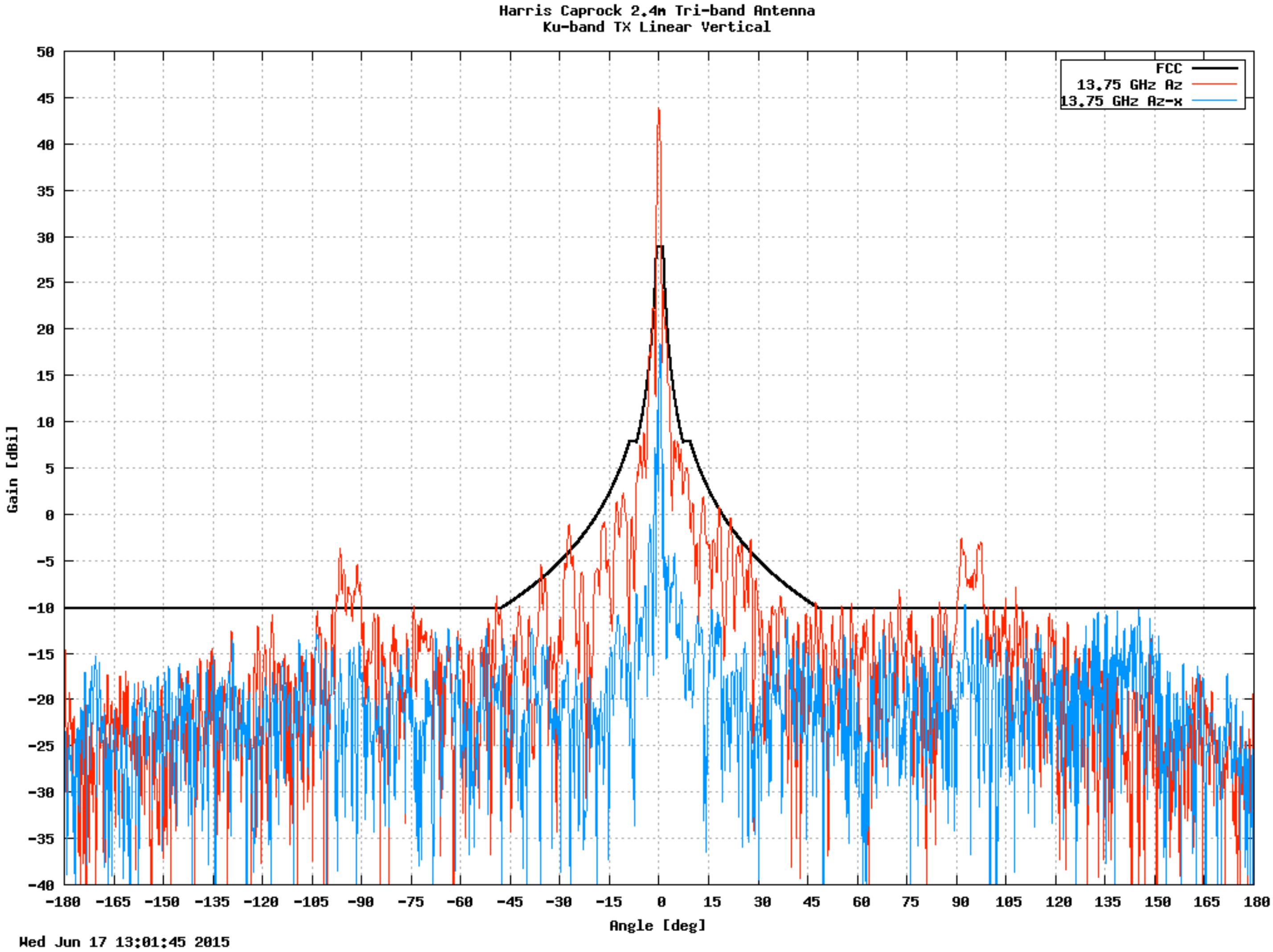
Ku Band - 13.75 GHz (Bottom of band)

Azimuth (Narrow)



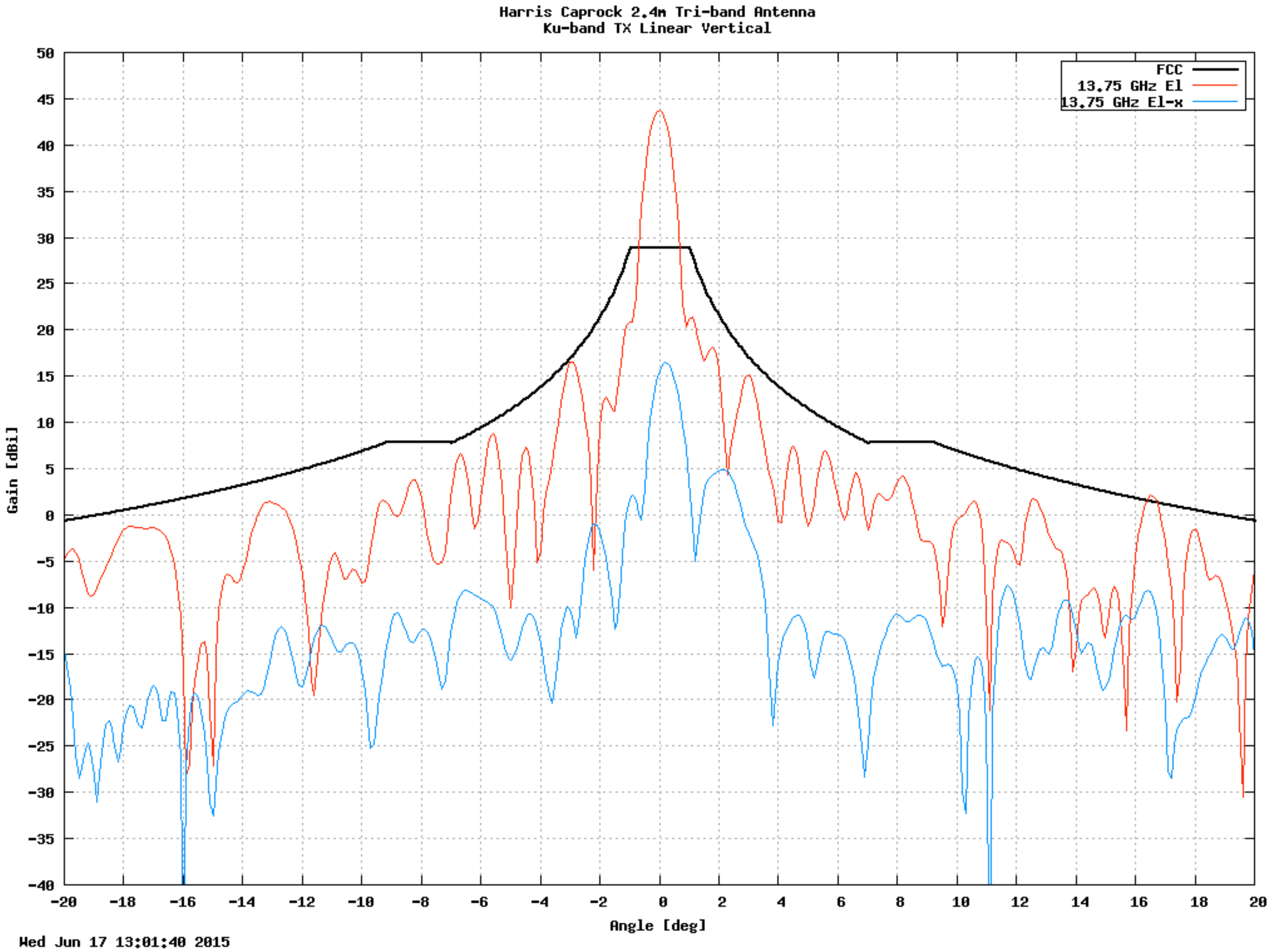
Ku Band - 13.75 GHz (Bottom of band)

Azimuth (Wide)



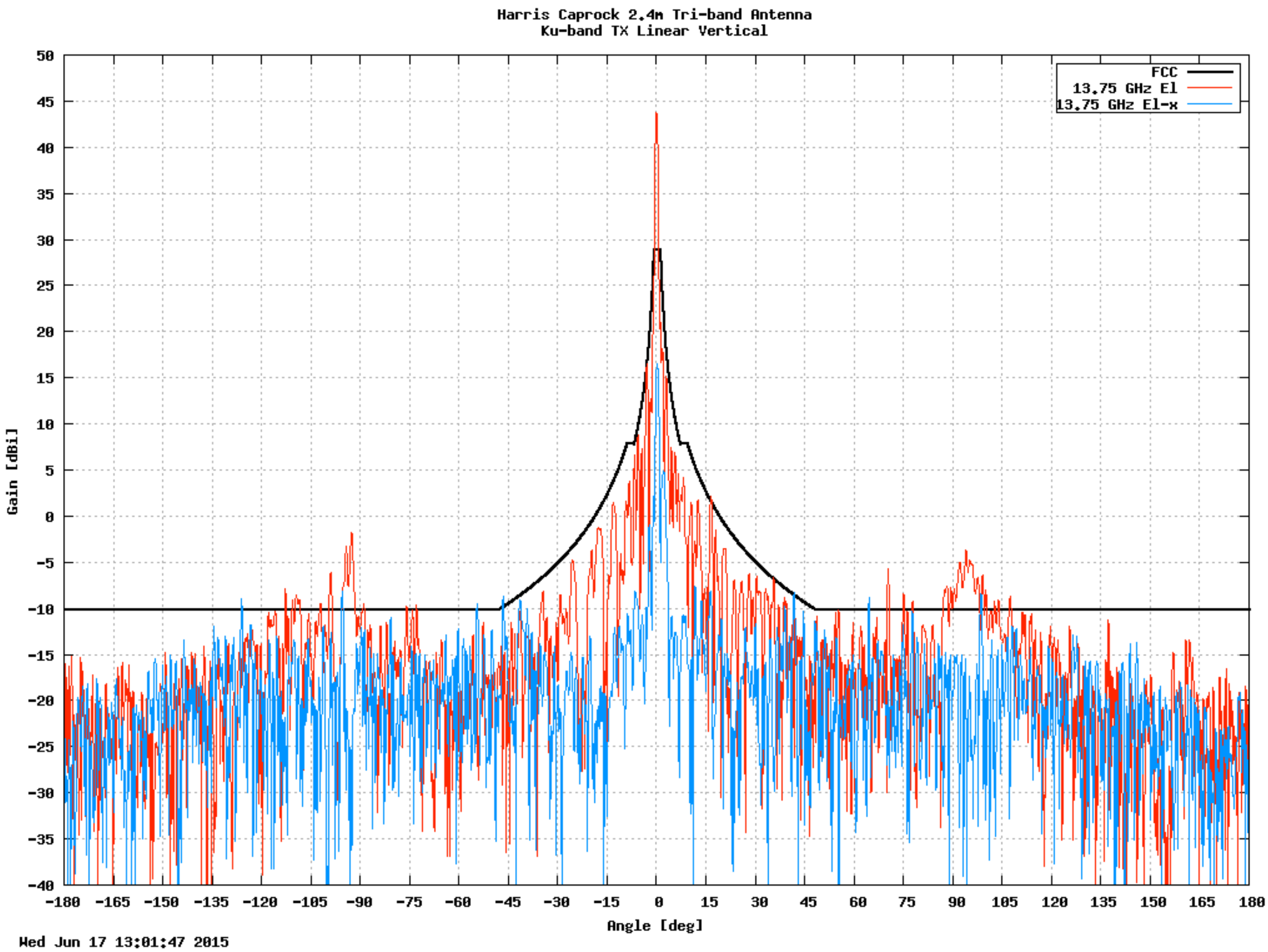
Ku Band - 13.75 GHz (Bottom of band)

Elevation (Narrow)



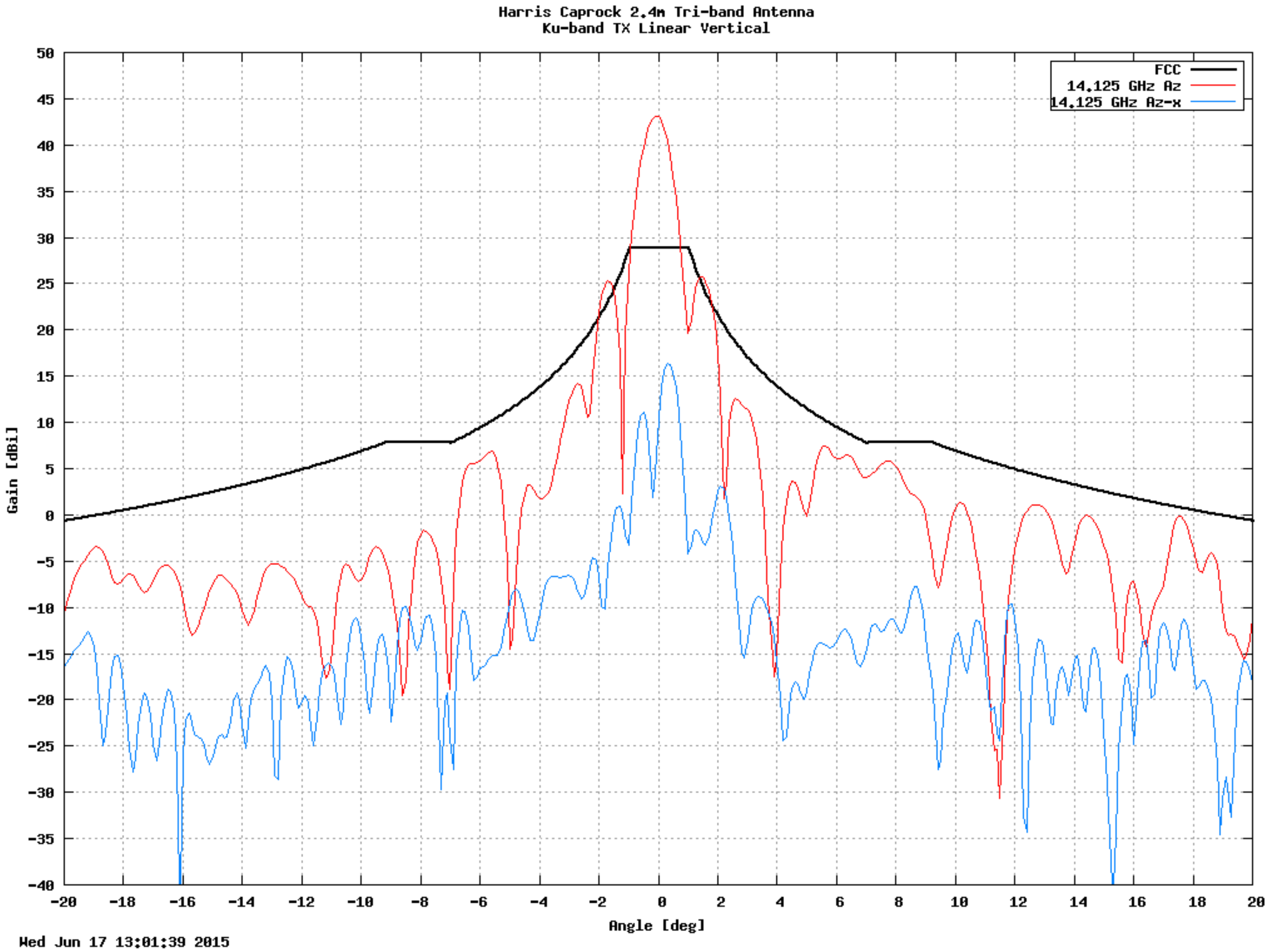
Ku Band - 13.75 GHz (Bottom of band)

Elevation (Wide)



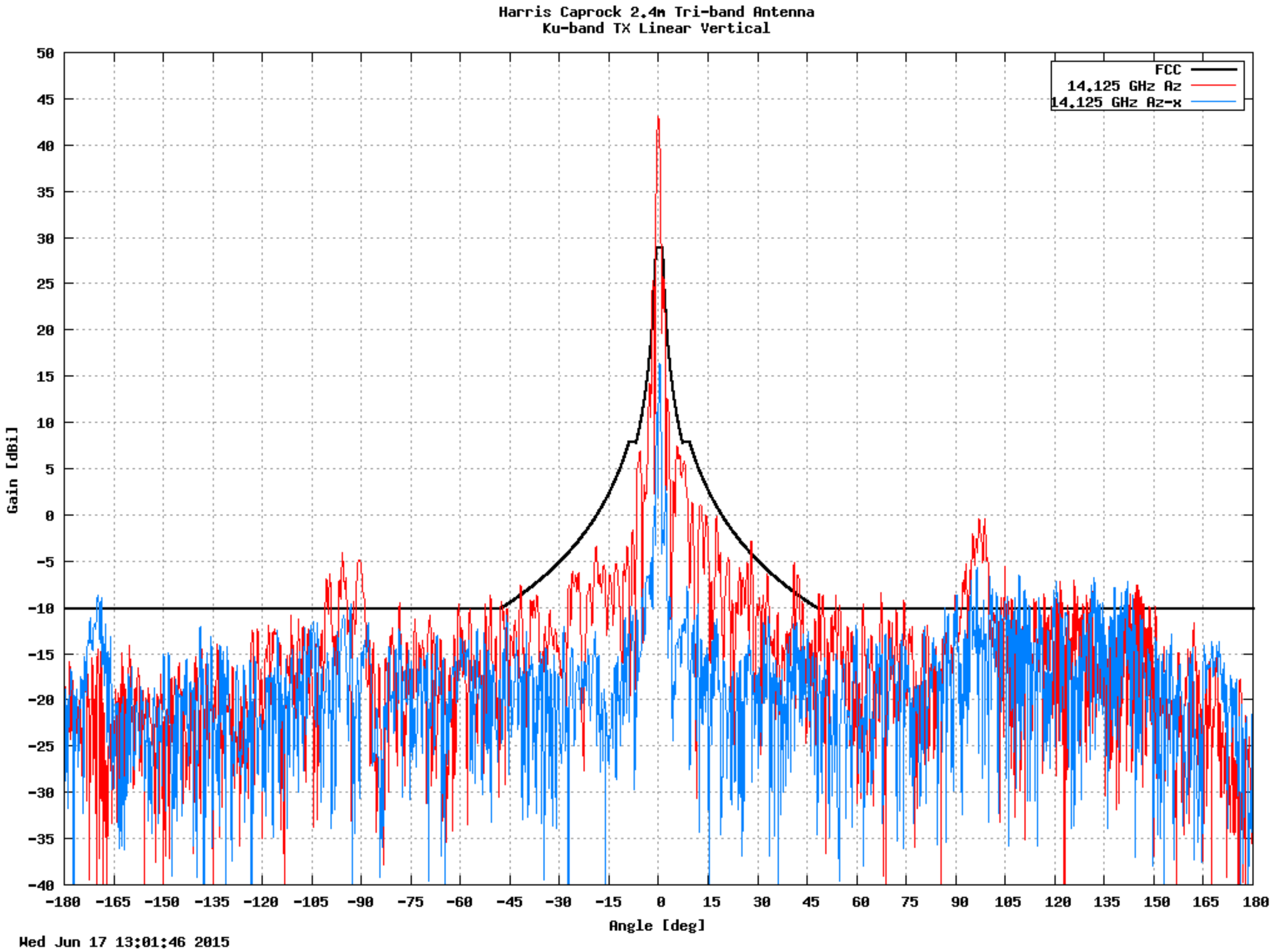
Ku Band - 14.125 GHz (Mid-band)

Azimuth (Narrow)



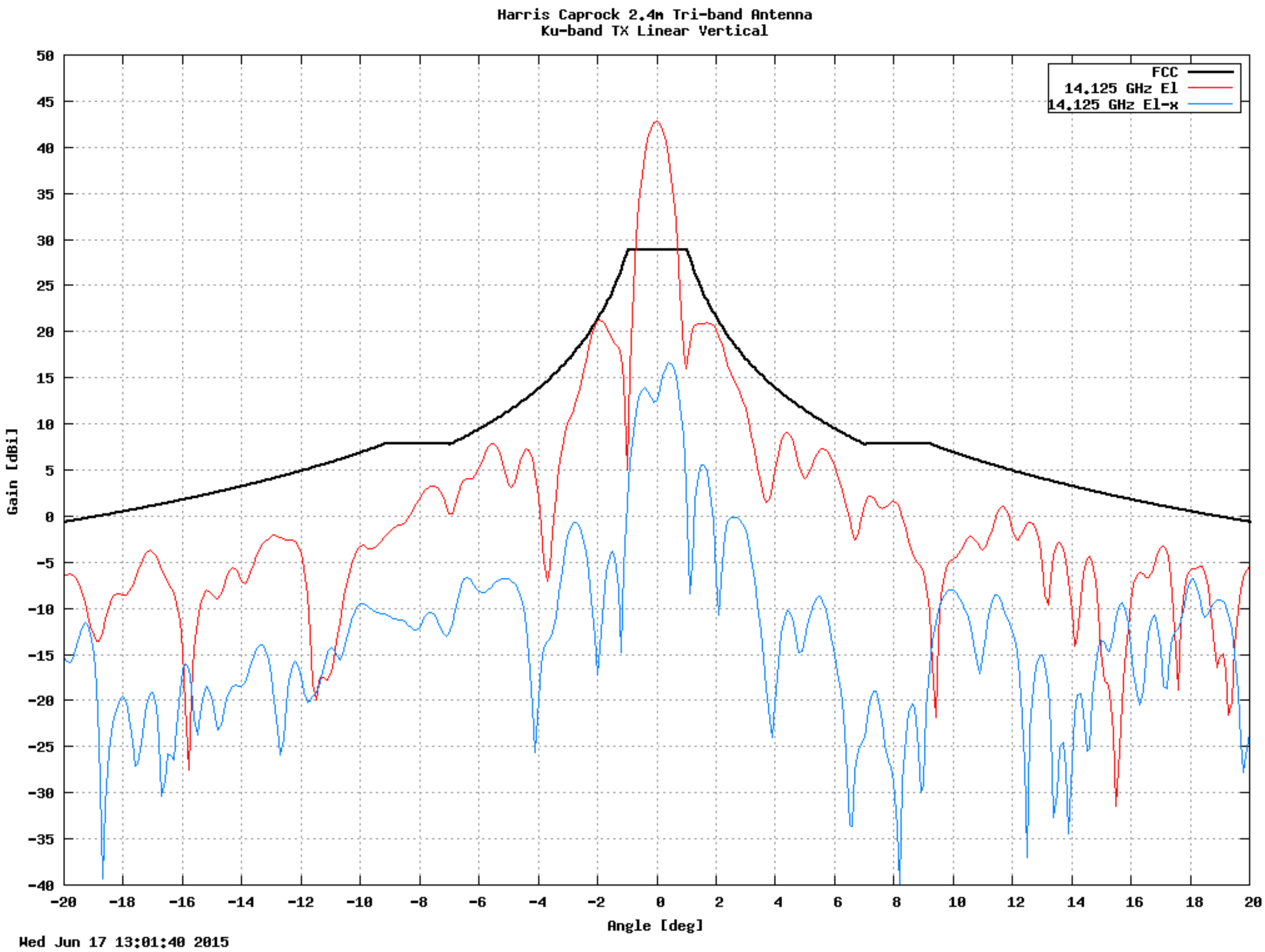
Ku Band - 14.125 GHz (Mid-band)

Azimuth (Wide)



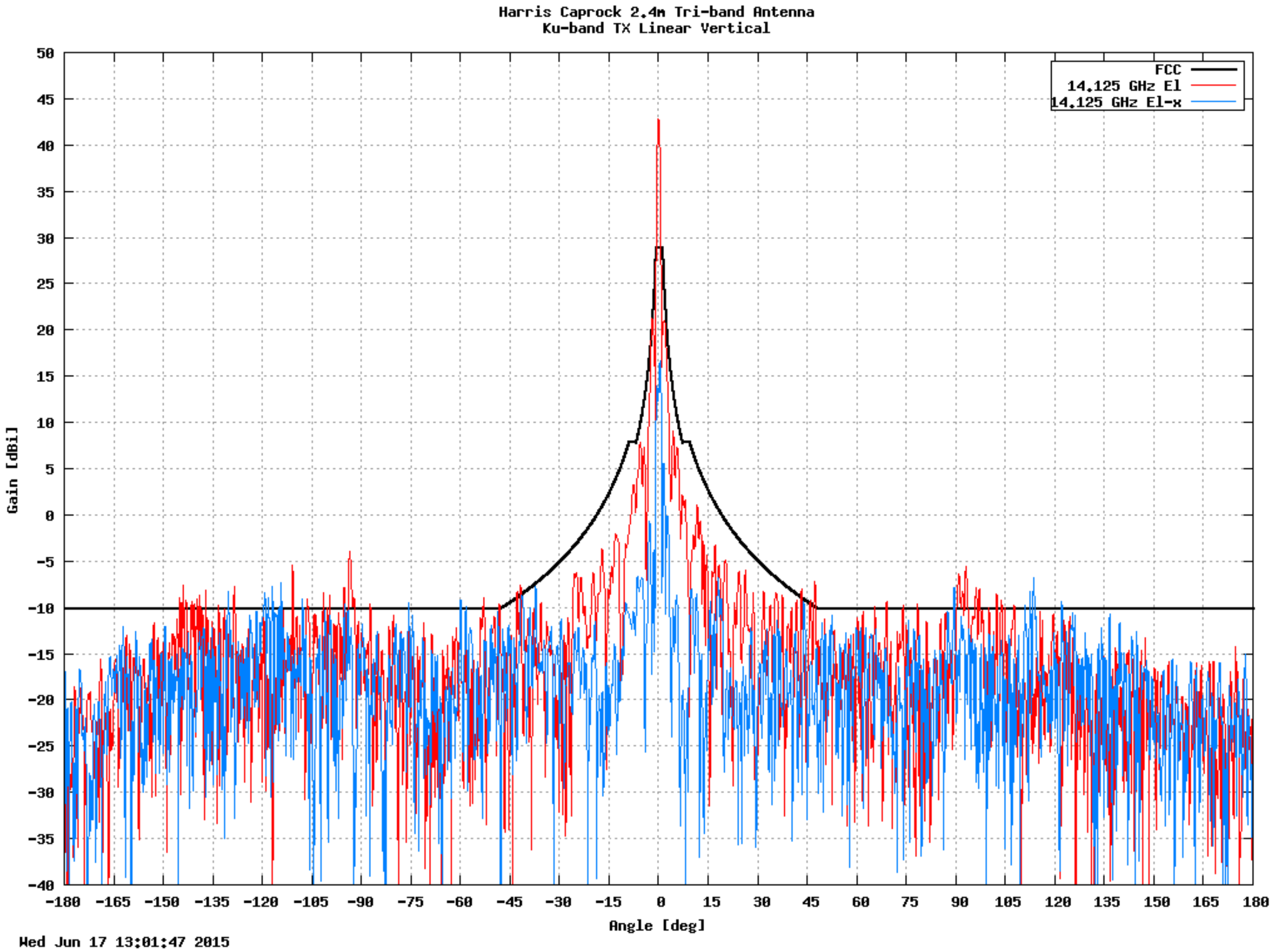
Ku Band - 14.125 GHz (Mid-band)

Elevation (Narrow)



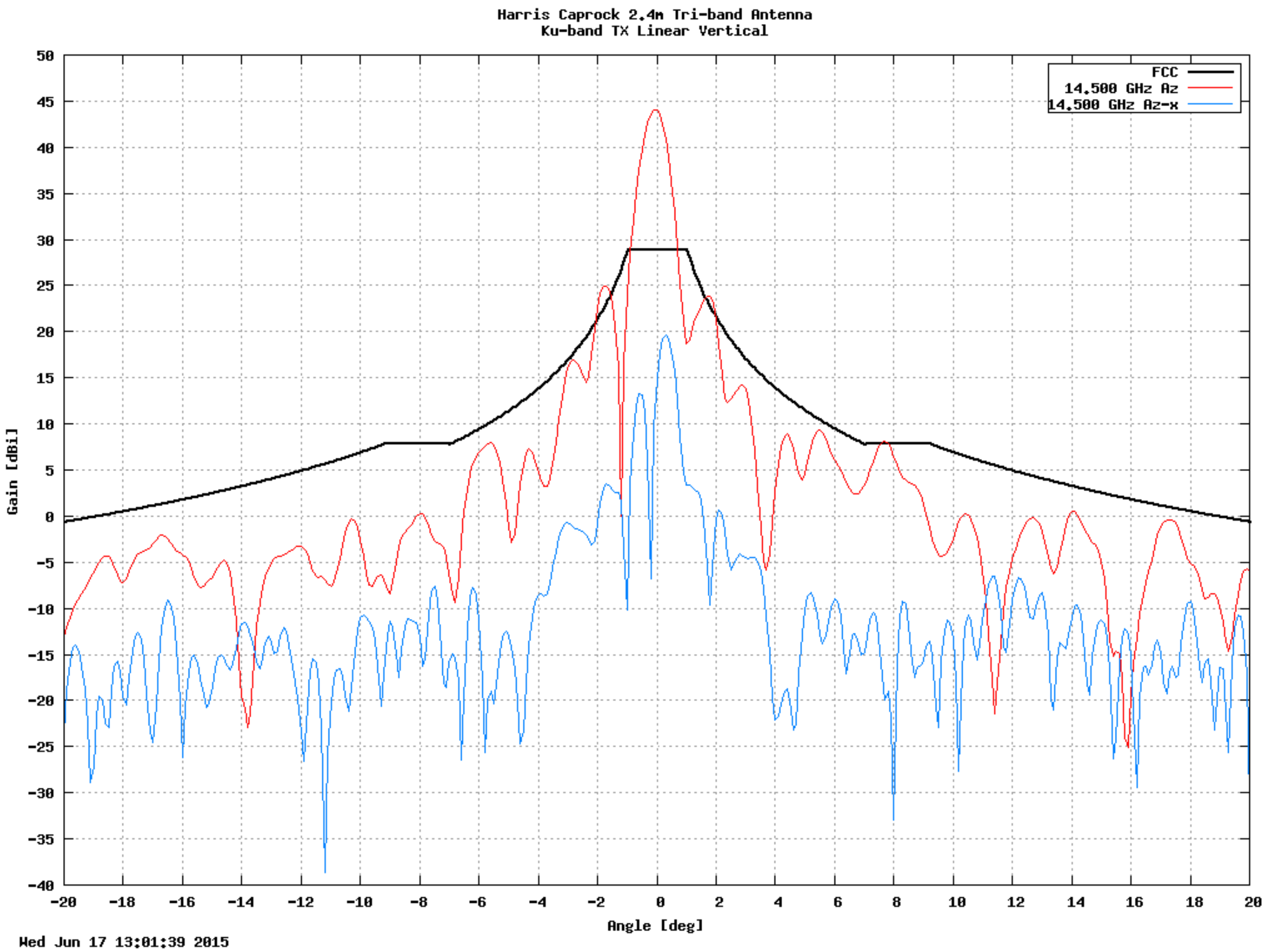
Ku Band - 14.125 GHz (Mid-band)

Elevation (Wide)



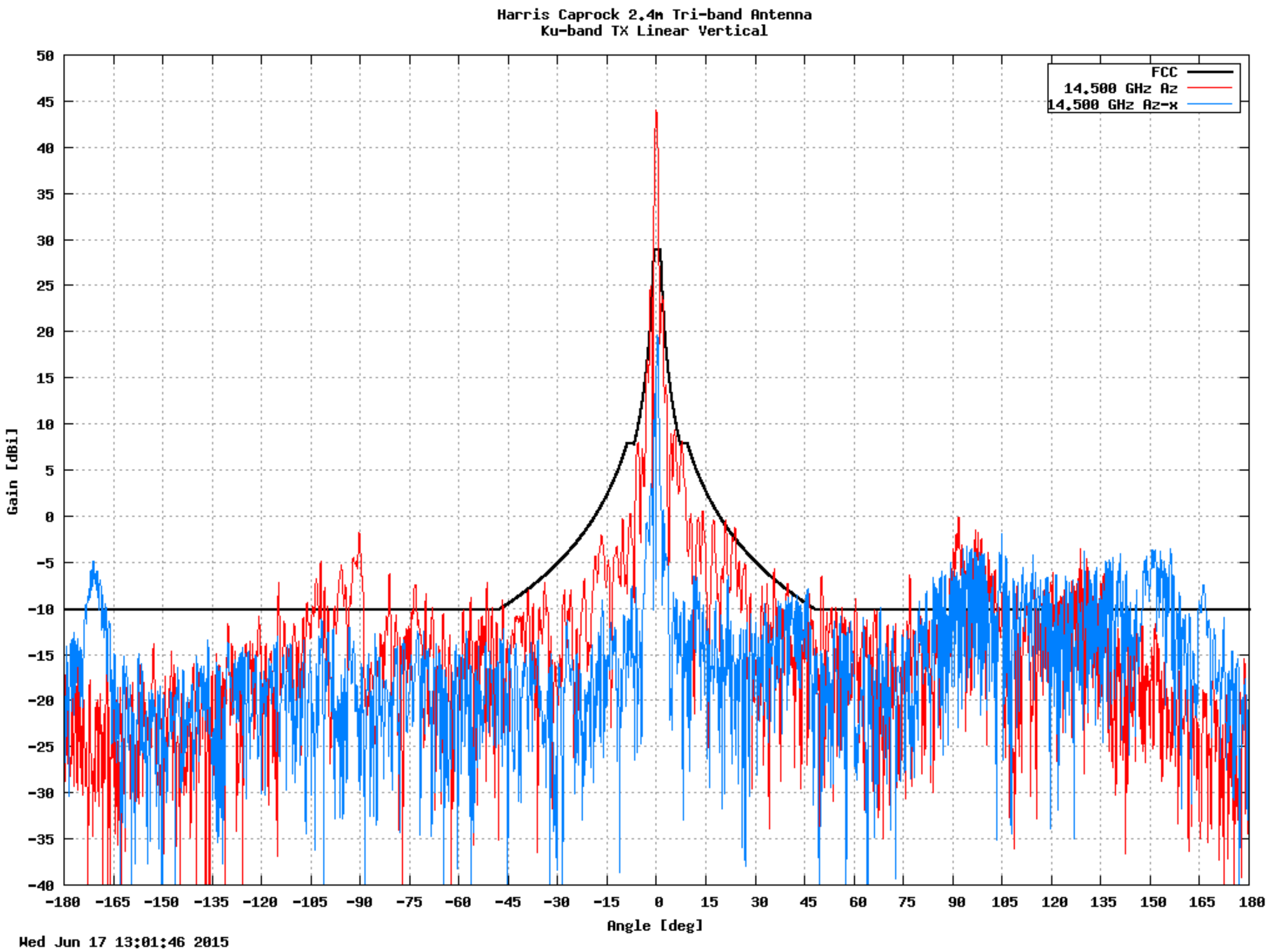
Ku Band - 14.500 GHz (Top of band)

Azimuth (Narrow)



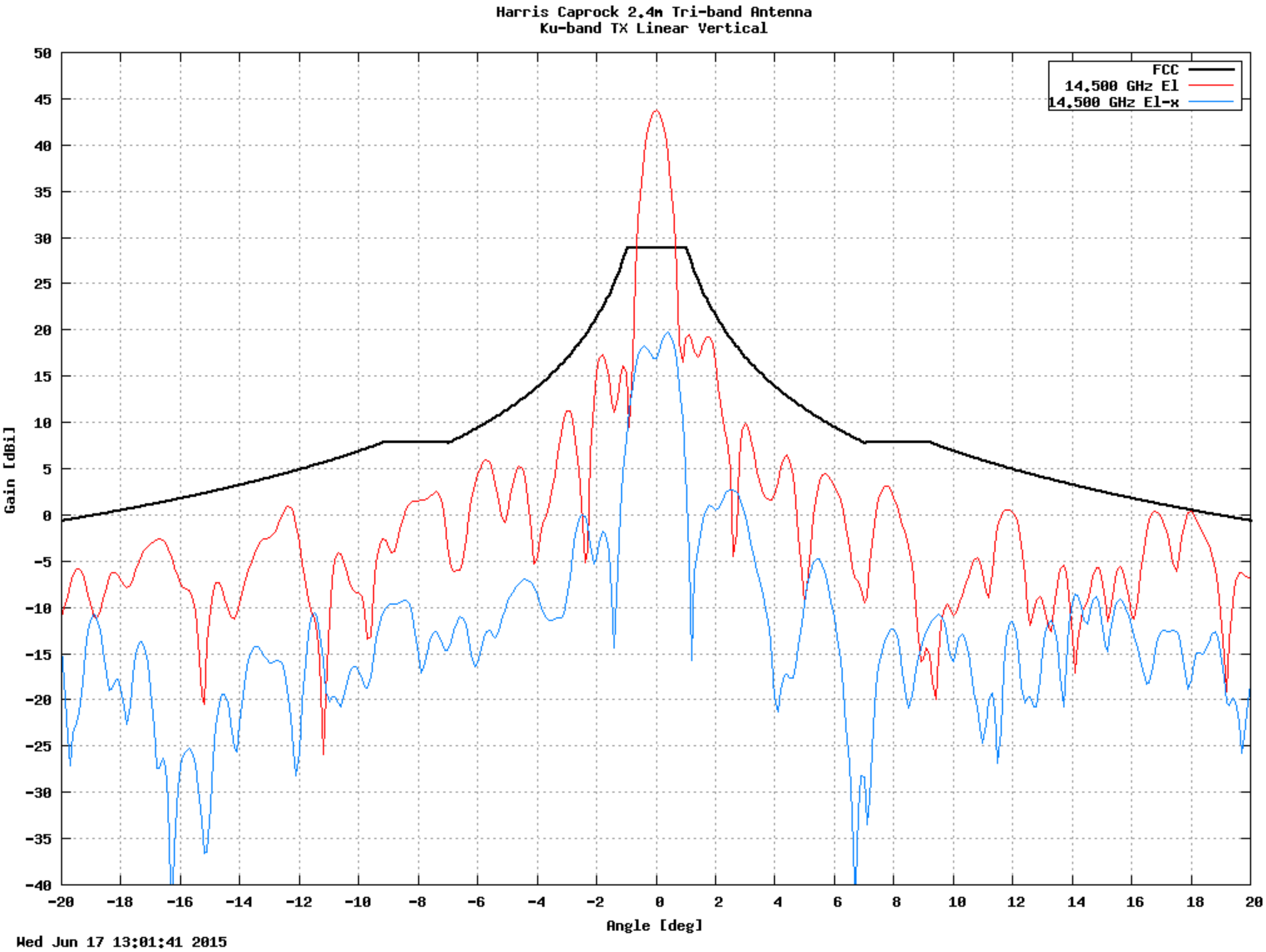
Ku Band - 14.500 GHz (Top of band)

Azimuth (Wide)



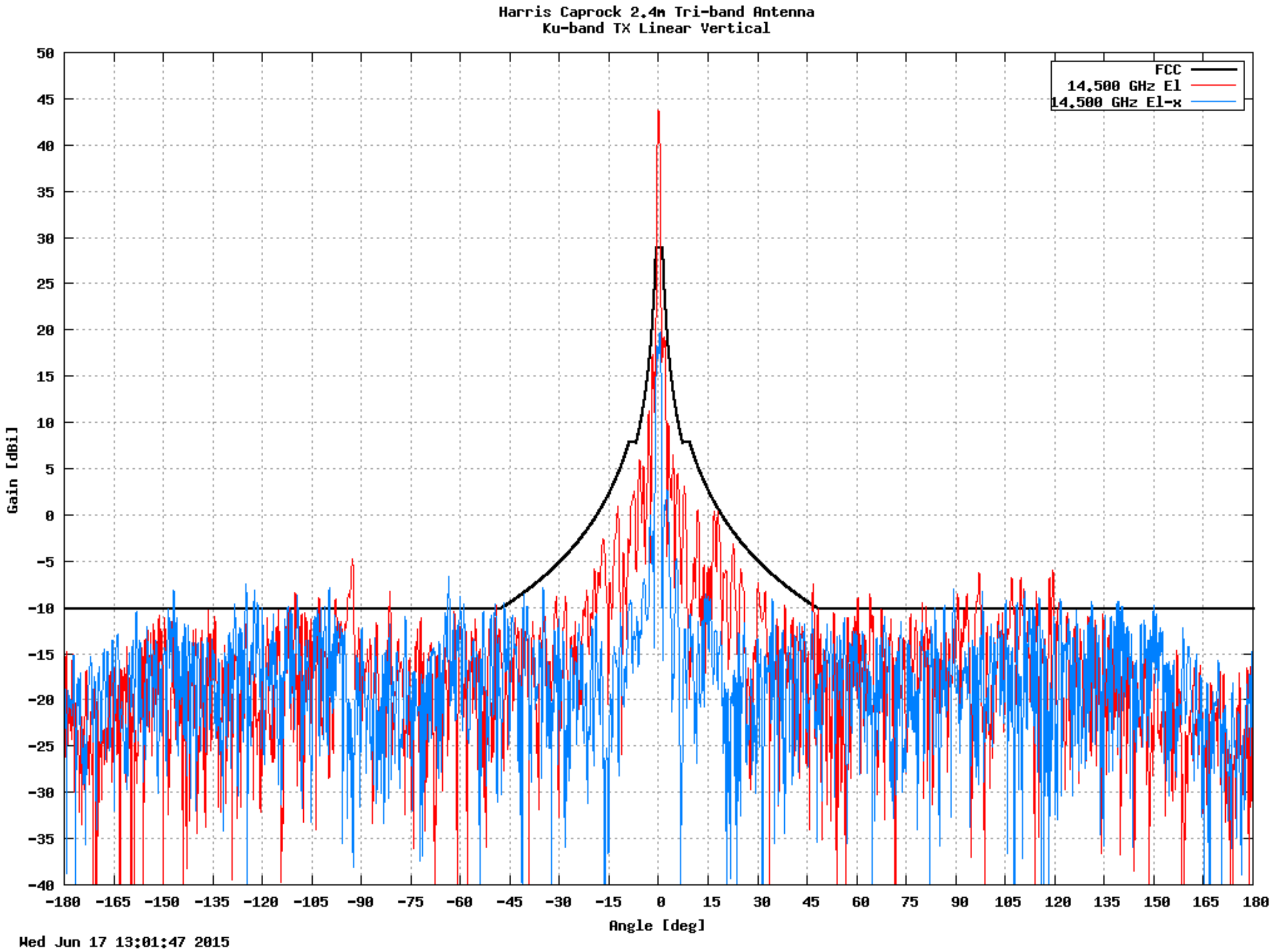
Ku Band - 14.500 GHz (Top of band)

Elevation (Narrow)



Ku Band - 14.500 GHz (Top of band)

Elevation (Wide)



Annex 3
Radiation Hazard Studies for C-band & Ku-band

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.

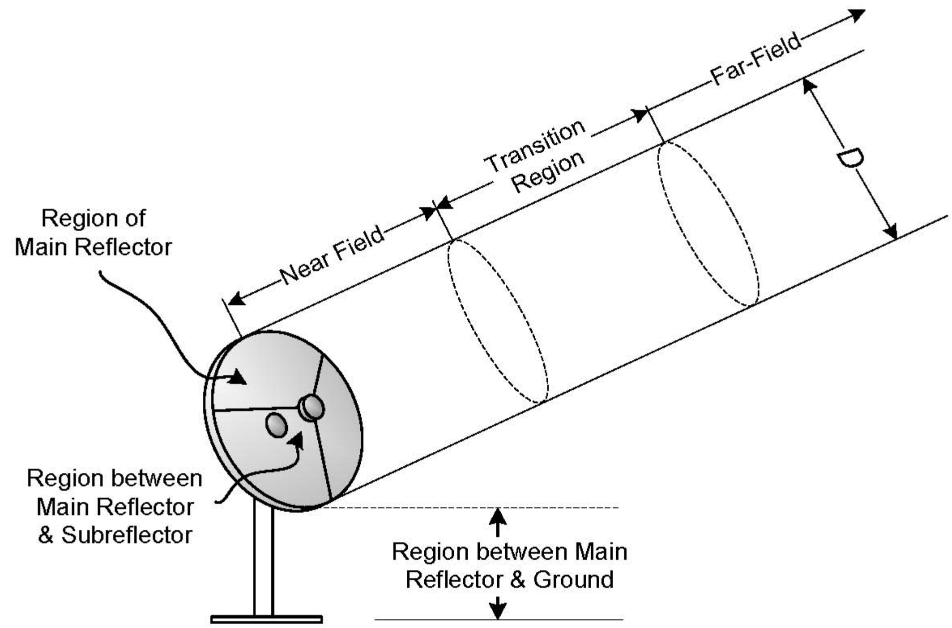


Figure 1. EM Fields as a Function of Distance

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.

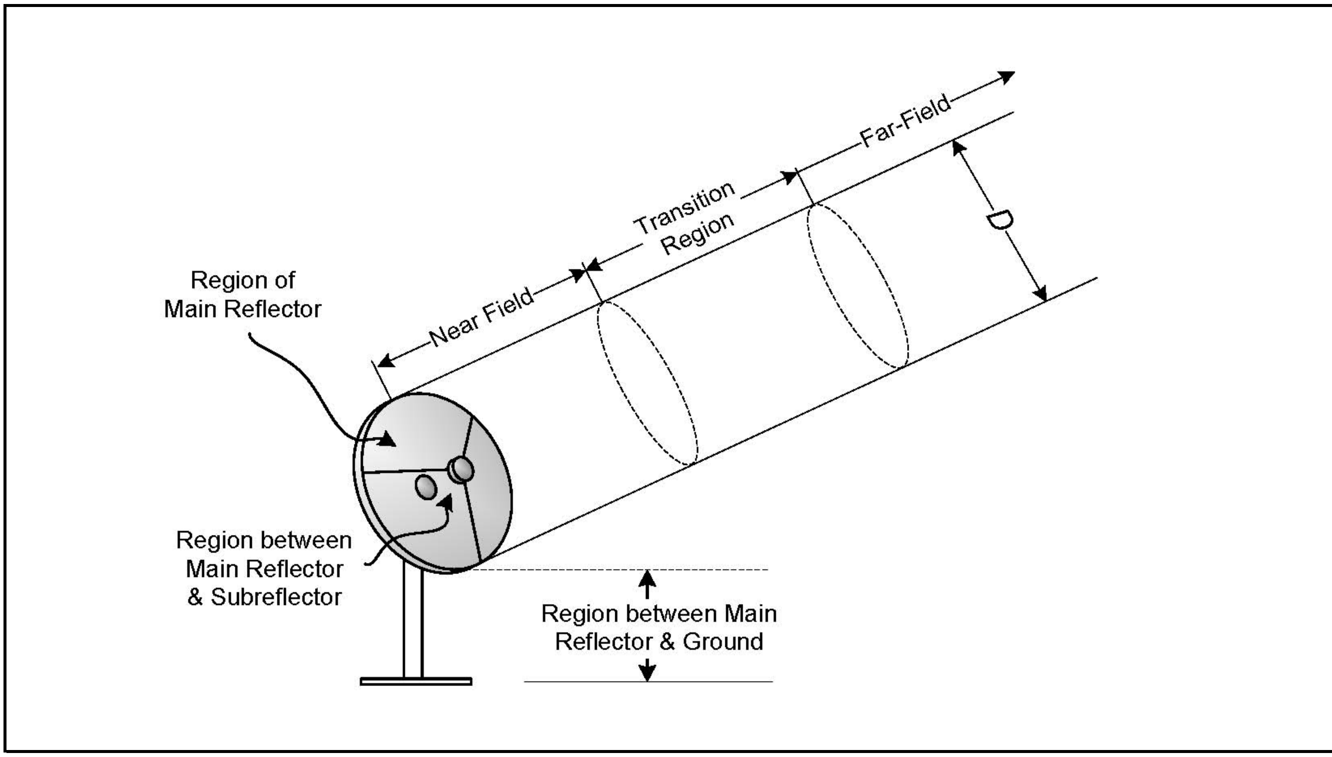


Figure 1. EM Fields as a Function of Distance

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.

<u>Annex 4</u>
Tracking Report

Tracking Testing

Reference: *4E0248*
Revision: *01*
Produced: *Feb 2015*

Revision History

Revision	*Date*	*Description*	*Prepared by*
01	*7/8/15*	*First Draft*	*D McCoig*

Document Control

Author	*Reviewer*	*Approver*
D McCoig		*A Lucas*

Health, Safety and Environment

Our dedication to employee safety is fundamental to the culture of our organization. We protect our employees by minimizing workplace risk and above all promoting a positive work ethos. We're dedicated to conducting business as responsible corporate citizens and are committed to business practices that support a sustainable global environment. Harris CapRock fulfils this commitment globally through compliance with applicable laws and regulations of the countries in which we operate.

We strive to:

- Improve the efficiency of our operations and processes
- Instruct and encourage employees to work in a safe, healthy and environmentally responsible manner
- Engage Harris CapRock supply chain partners to support our sustainability objectives through similar practices
- Enhance our customers' experience with our products and services by improving their eco-efficiency, while maintaining our high standards of quality, reliability and performance

Management Commitment

Paramount to our operation here at Harris CapRock is the health, safety and well-being of all our staff, contractors and clients. We aim for a no injury working environment and strive to demonstrate that "zero harm" is an achievable objective in all parts of our organization.

"At Harris CapRock, protecting the health and safety of our workforce, business partners and general public is our highest priority. We are fostering an increasingly proactive and vigilant HSE culture that is unwilling to accept any harm to people and our environment. If we cannot do business safely, we will not do business – no exceptions." ***President, Harris CapRock Communications***

Table of Contents

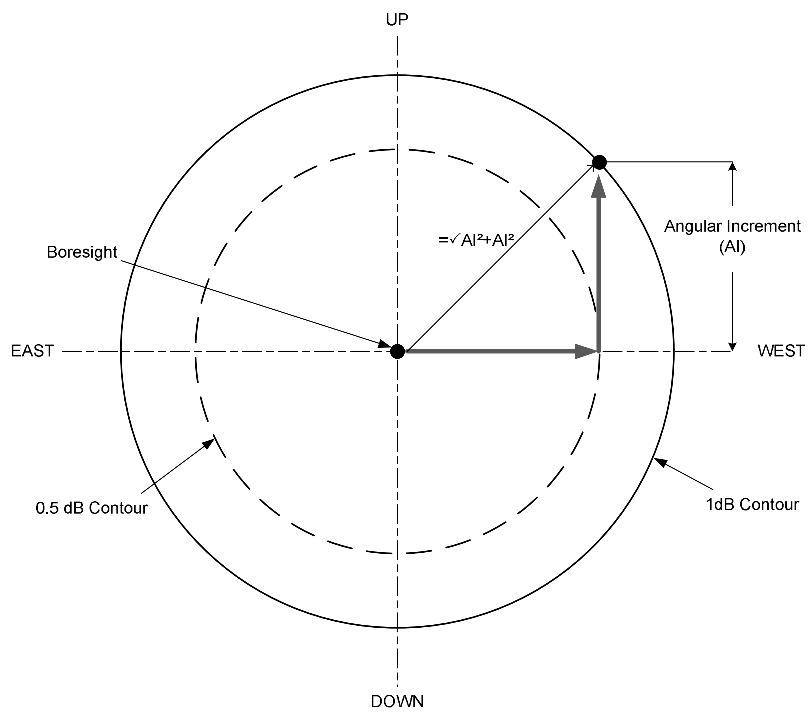
1 Overview

The motion tests were performed on a 6 axis motion table to verify the performance of the ST5024 system under motion at Ku band. The motion table was set up with motion parameters that mimic the expected range of motions that the Antenna will encounter during service on the various target vessels. The test data is derived from DOD-STD-1399(NAVY) sections 5.2.1.2 Loading factors, tables II, III and IV.

A range of roll periods are produced which reflect the uncertainty in the metacentric heights of the vessels. The worst case, (shortest), period was chosen for each test.

The results show the tracking performance in relations to the signal level received on a scale where each division on the spectrum analyser represents 1dB.

The principle in monitoring the tracking performance to be within +/- 1dB is the direct relationship between the signal level and the angular pointing accuracy with regard to bore sight and the 1dB contour as explained bellow:-



The angular increment (AI) for circular aperture antennas (as is the case with the ST5024) is represented by the following expression

$$AI = \frac{3.978}{d \cdot f}$$

where:	d:	Antenna diameter	[m]
	f:	Frequency	[GHz]

(Ref.: CCIR Handbook on Satellite Communications).

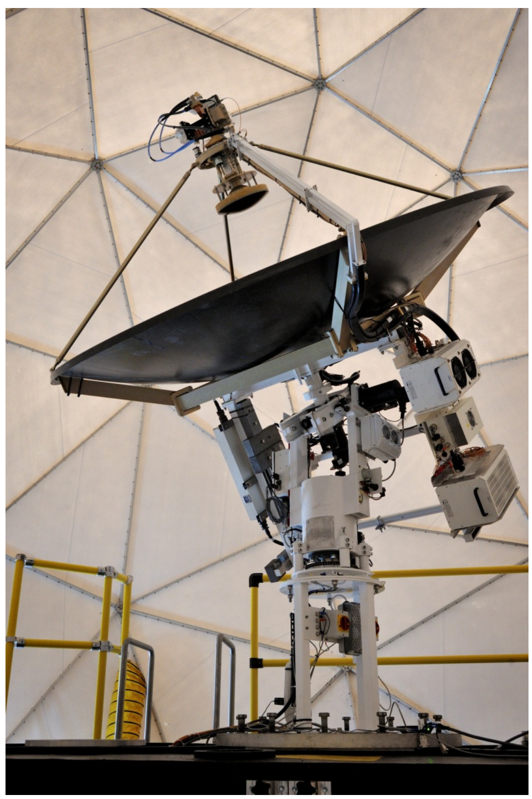
Therefore in the case of the antenna under test the d = 2.4m and f = 12GHz

$$AI = 0.138°$$

Which in turn makes the angle to the 1dB contour = ✓AI^2+AI^2 which equals 0.19°.

Therefore tracking within the 1dB division as shown on the spectrum analyser represents pointing accuracy better than 0.19°

The motion testing was performed at the GCSD R2 facility in Melbourne, FL. The tests were performed at Ku band on Intelsat GC3 95W Ku tracking an advanced VSAT network. The system was equipped with a 100W Ku LPOD, 200W C LPOD, 40W Ka CPI, E.2.



System on Motion Table

2 Motion tests results

2.1 Cross Polarisation Results:

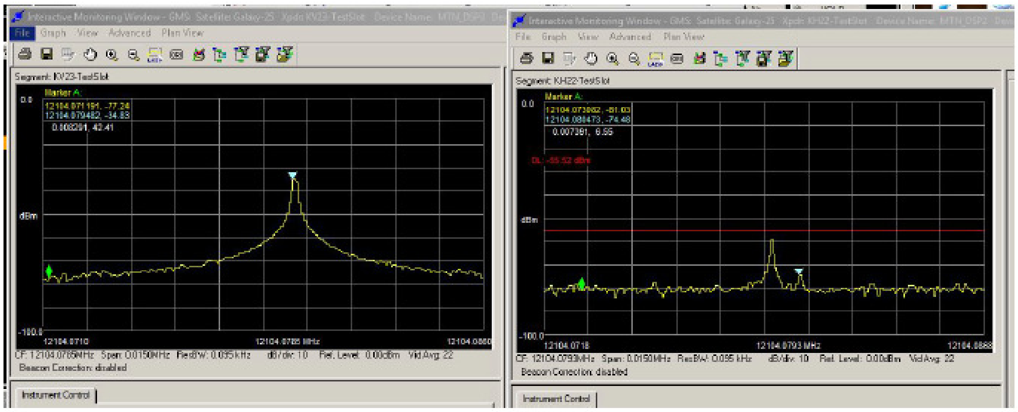
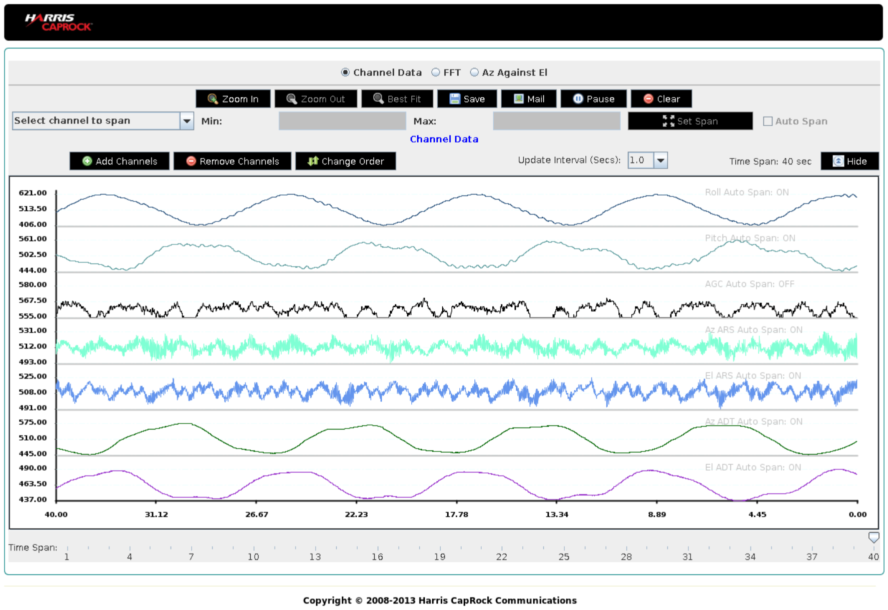


Figure E.1: Ku band cross pole isolation NOC data

2.2 Sea state 4 - 100m guided missile boat



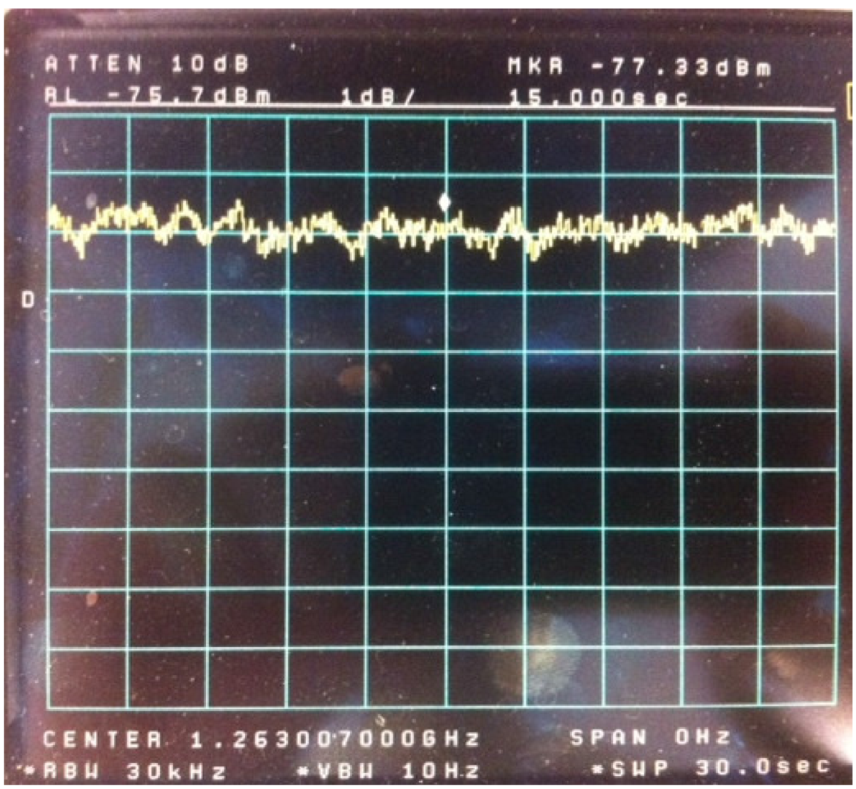


Figure E.3: 1/2 sea state 4, 17° Roll / 11 second period, 9.5° Pitch / 9 second period

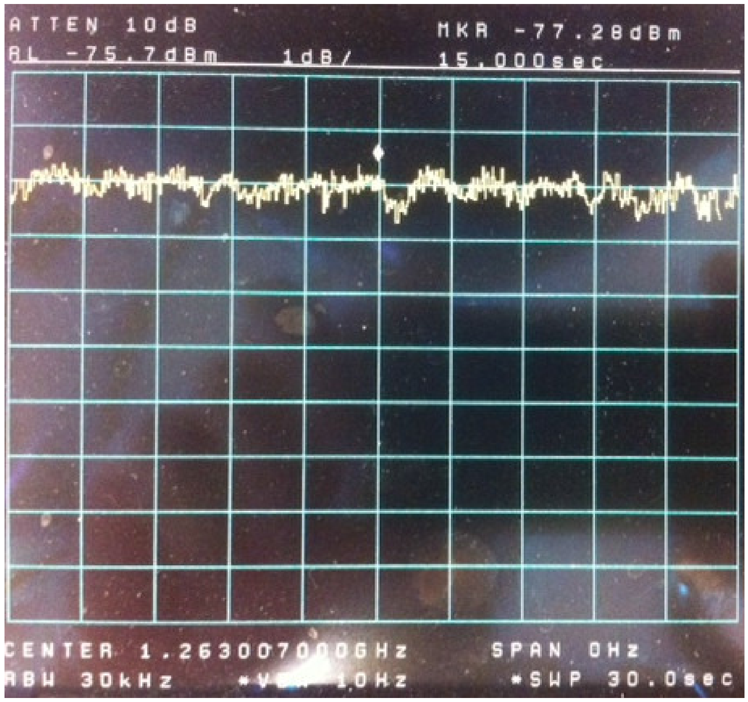


Figure E.4: Sea state 4, 17° Roll / 11 second period, 9.5° Pitch / 9 second period

2.3 Sea state 6 - 100m guided missile boat

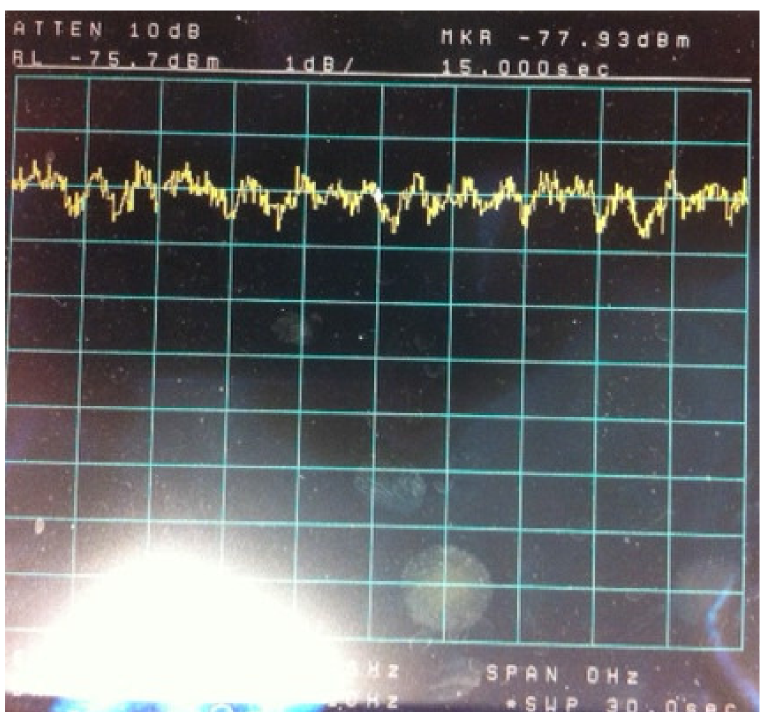


Figure E.5: Sea state 6, 41° Roll / 9 second period, 22° Pitch / 9 second period

2.4 Sea state 4 - 74m Supply Vessel, excessive pitch

The table can be seen to oscillate around the set point due to the high frequency biased tuning applied to the PLC. This provided a challenging, juddering, type motion for the system to track through.

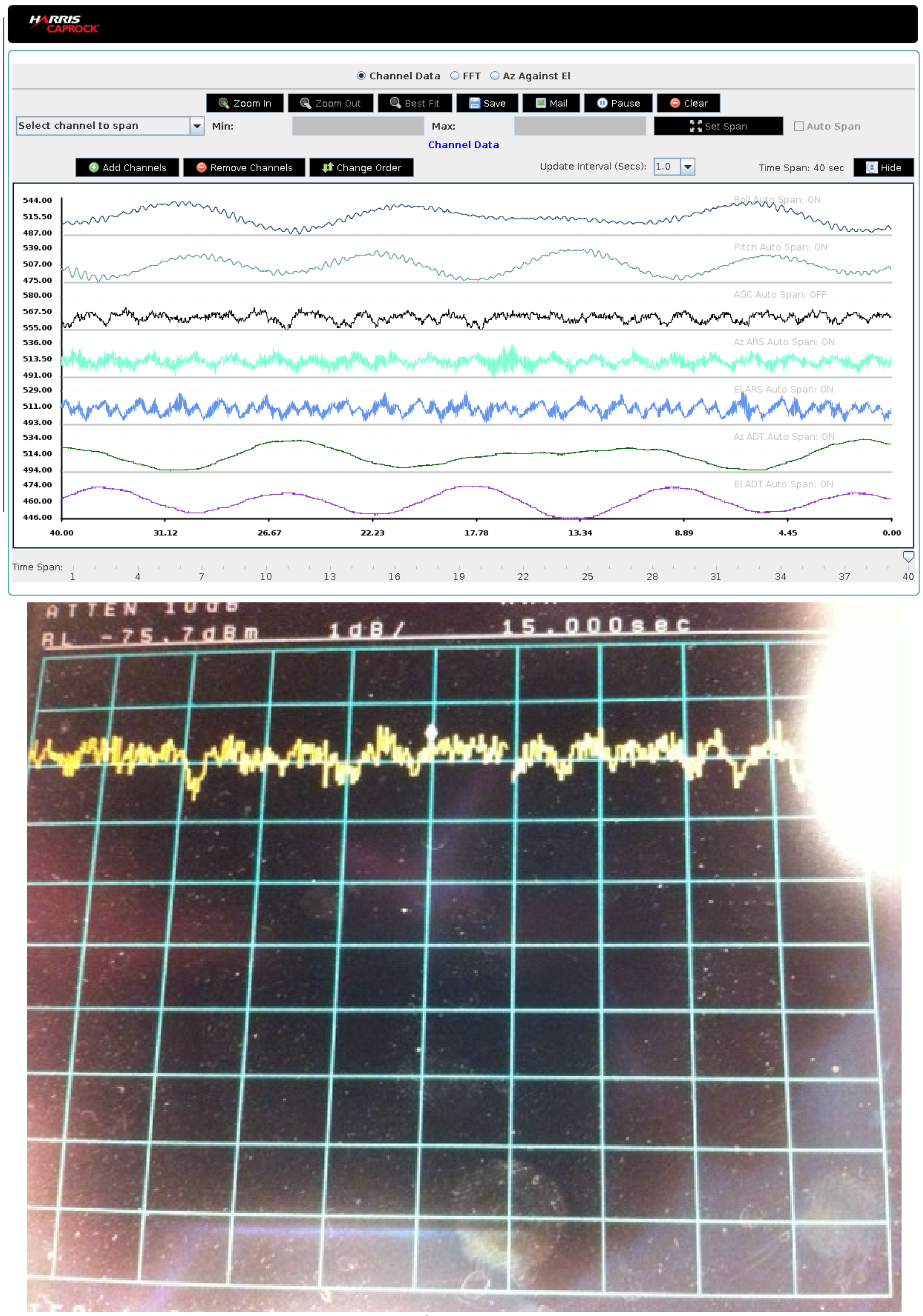
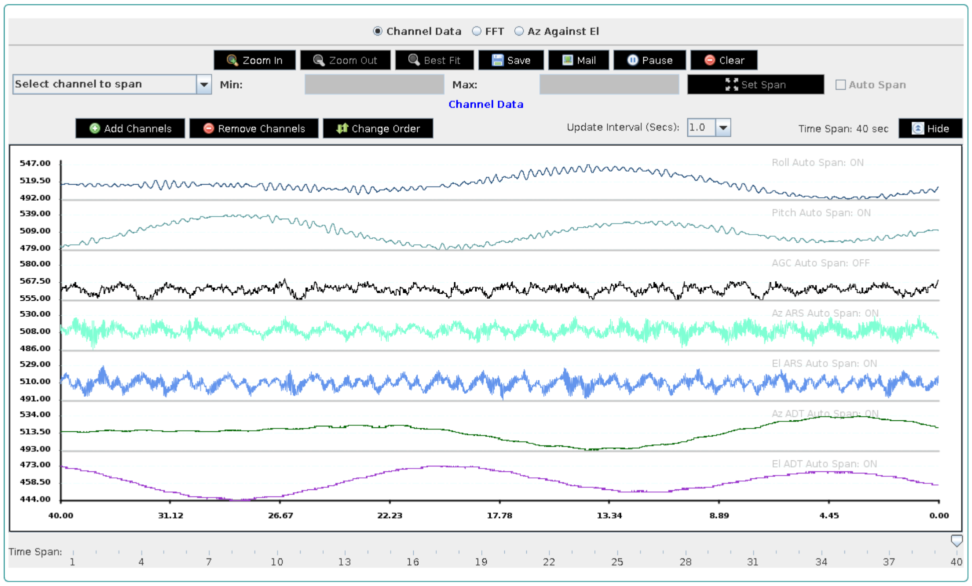


Figure E.7: Undefined sea state, PLC input 0.03/15, 0.05/10. 4.6° Roll / 9 second period, 5.21° Pitch / 14 second period

2.5 Sea state 4 - 360m Cruise Liner, excessive pitch

The table can be seen to oscillate around the set point due to the high frequency biased tuning applied to the PLC. This provided a challenging, juddering, type motion for the system to track through. The table did not appear to perform the motion correctly with regard to period.



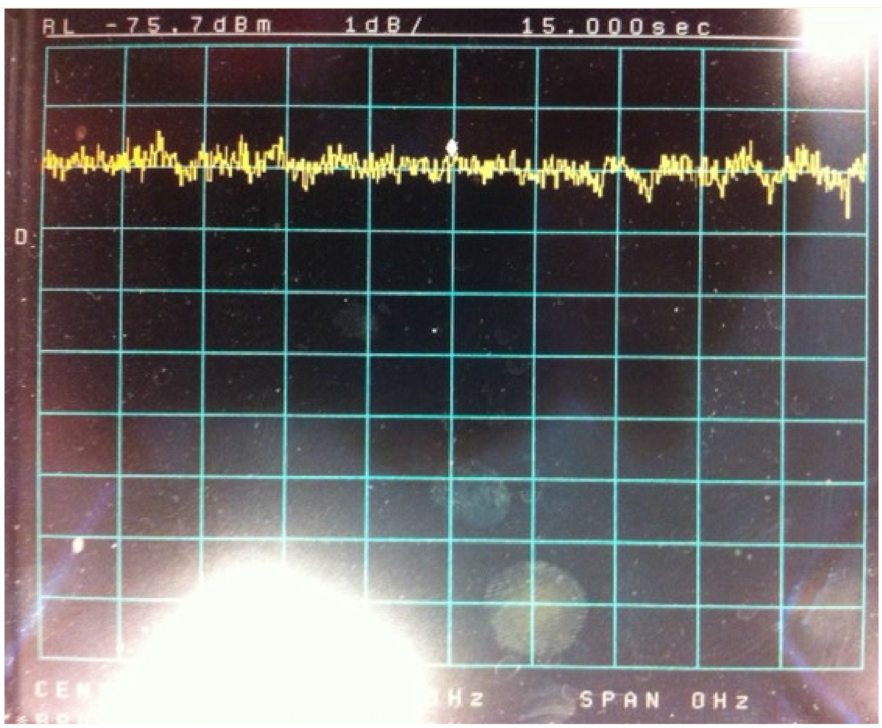
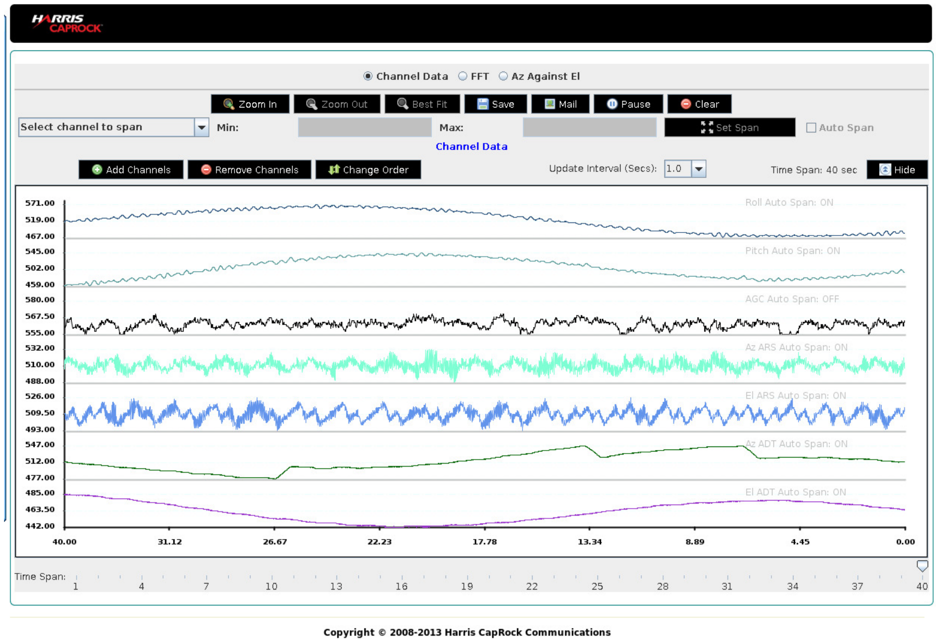


Figure E.8: Undefined sea state, PLC input 0.03/30, 0.05/20. 4.6° Roll / 18 second period, 5.21° Pitch / 28 second period

2.6 Sea state 5 - 360m Cruise Liner, excessive roll period, excessive pitch

The table can be seen to oscillate around the set point due to the high frequency biased tuning applied to the PLC. This provided a challenging, juddering, type motion for the system to track through. The table did not appear to perform the motion correctly with regard to period.



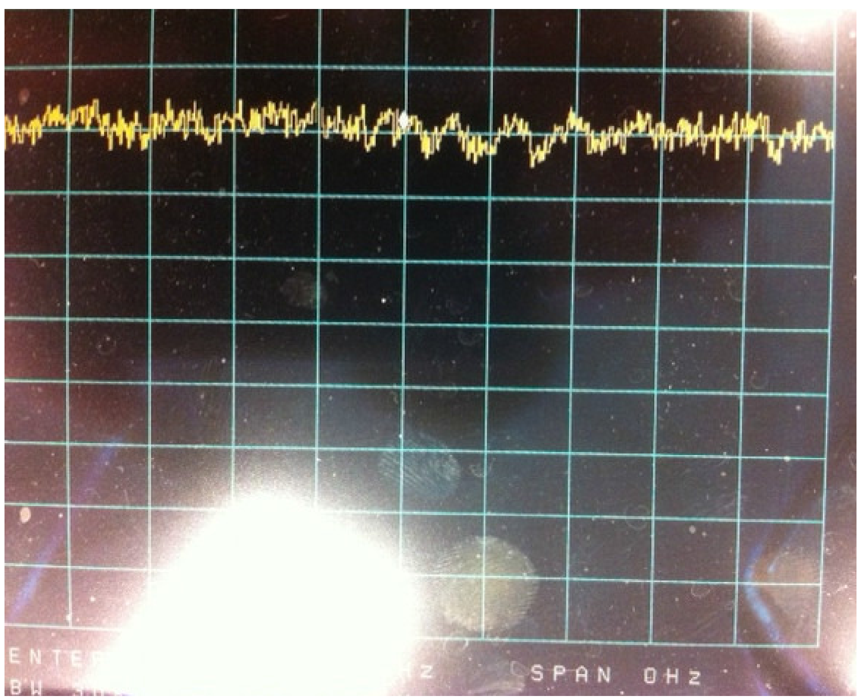
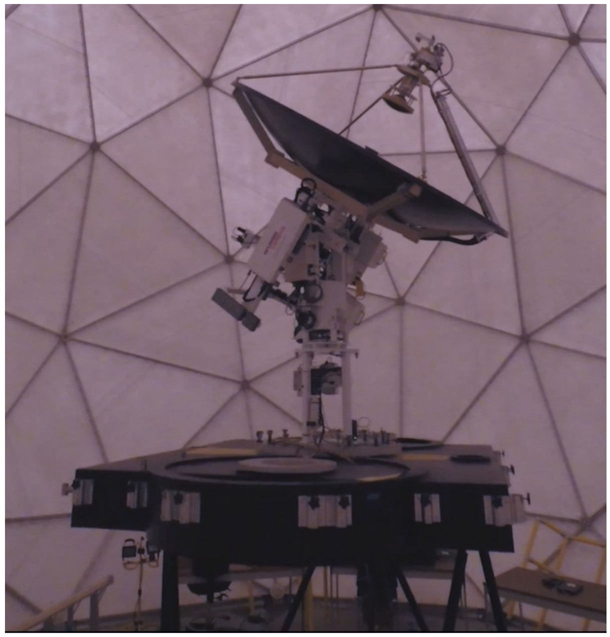
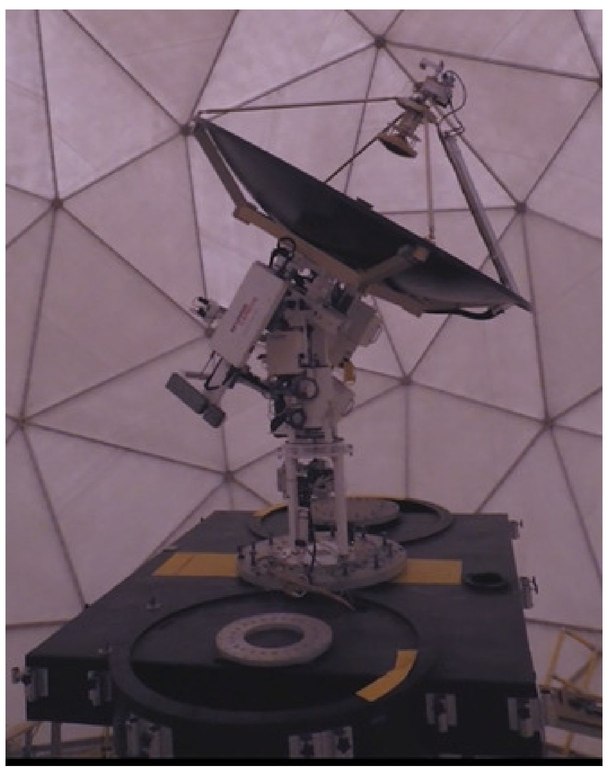


Figure E.9: Undefined sea state, PLC input 0.1/60, 0.1/40. 8.4° Roll / 40 second period, 7° Pitch / 40 second period

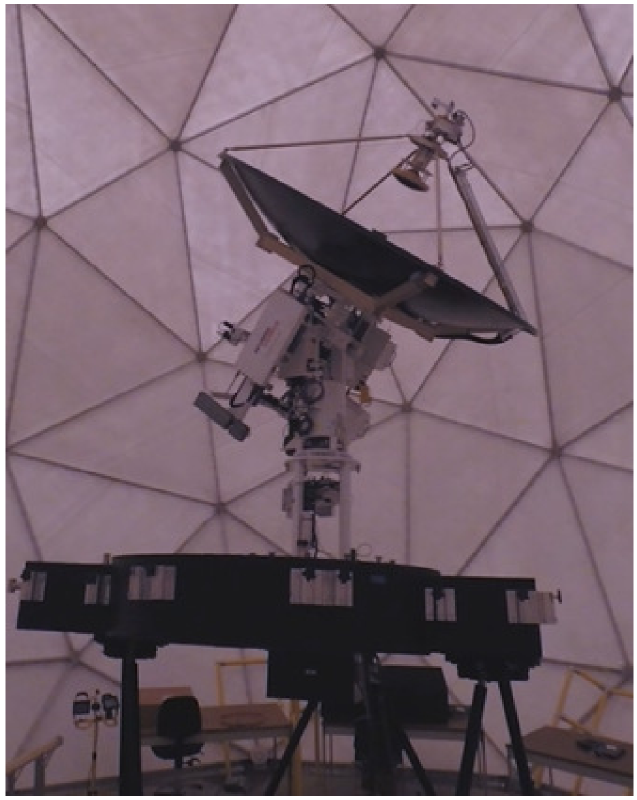
3.1 Motion Table Photographs – Sea State 4



Start (mid) position



Bow Pitch Up



Bow Pitch Down

4.0 Conclusion

As can be seen from the motion testing results the system is able to maintain the 1dB tracking under the various sea states tested.

In each case the system performed well within the 1dB limit and therefore had a pointing accuracy of better than the 0.2° requirement.

Annex 5
FCC Declarations of Conformity

HARRIS CAPROCK COMMUNICATIONS

1025 West NASA Boulevard
Melbourne, FL USA 32919

www.harriscaprock.com

FCC Declaration of Conformity

1. Harris CapRock Corporation ("Harris CapRock") designs, develops and manufactures marine stabilized antenna systems for satellite communications at sea. These products are then used by our customers as part of their C-band Earth Station on Vessel ("ESV") networks.

2. Section 25.221 of the Commission's rules, 47 C.F.R. § 25.221, defines the provisions for blanket licensing of ESV antennas operating in the C-band. This declaration covers the requirements for meeting § 25.221(a)(1) by the demonstrations outlined in paragraphs (b)(1)(i) and (b)(1)(iii). The requirements for meeting § 25.221(a)(3)-(a)(13) are left to the applicant. The paragraph numbers in this declaration refer to the 2009 version of FCC 47 C.F.R. § 25.221.

3. Harris CapRock hereby declares that the antennas listed below will meet the off-axis EIRP spectral density requirements of § 25.221(a)(1)(i) with an N value of 1, when the following Input Power spectral density limitations are met:

   - 2.4 Meter C-Band, Model ST5000 is limited to: -2.7 dBW/4kHz

4. Harris CapRock hereby declares that the antenna referenced in paragraph 3 above, will maintain a stabilization pointing accuracy of better than 0.2 degrees under specified ship motion conditions, thus meeting the requirements of § 25.221(a)(1)(ii)(A). The Input Power spectral density limits for this antenna have been adjusted to meet the requirements of § 25.221(a)(1)(ii)(B).

5. Harris CapRock hereby declares that the antenna referenced in paragraph 3 above, will automatically cease transmission within 100 milliseconds if the pointing error should exceed 0.5 degrees and will not resume transmission until the error drops below 0.2 degrees, thus meeting the requirements of § 25.221(a)(1)(iii).

6. Harris CapRock maintains all relevant test data, which is available upon request, to verify these declarations.

By: [signature]

Name: ANDREW LUCAS

Title: CTO

Harris CapRock Corporation

Date: 28th AUGUST 2015

HARRIS CAPROCK COMMUNICATIONS

1025 West NASA Boulevard
Melbourne, FL USA 32919

www.harriscaprock.com

FCC Declaration of Conformity

1. Harris CapRock designs, develops and manufactures marine stabilized antenna systems for satellite communications at sea. These products are then used by our customers as part of their Ku-band Earth Station on Vessel ("ESV") networks.

2. Section 25.222 of the Commission's rules, 47 C.F.R. § 25.222, defines the provisions for blanket licensing of ESV antennas operating in the Ku-band. This declaration covers the requirements for meeting § 25.222(a)(1) by the demonstrations outlined in paragraphs (b)(1)(i) and (b)(1)(iii). The requirements for meeting § 25.222(a)(3)-(a)(7) are left to the applicant. The paragraph numbers in this declaration refer to the 2009 version of FCC 47 C.F.R. § 25.222.

3. Harris CapRock hereby declares that the antennas listed below will meet the off-axis EIRP spectral density requirements of § 25.222(a)(1)(i) with an N value of 1, when the following Input Power spectral density limitations are met:
   - 2.4 Meter Ku-Band, Model ST5000 is limited to: -14.0 dBW/4kHz

4. Harris CapRock hereby declares that the antenna referenced in paragraph 3 above, will maintain a stabilization pointing accuracy of better than 0.2 degrees under specified ship motion conditions, thus meeting the requirements of § 25.222(a)(1)(ii)(A). The Input Power spectral density limits for this antenna have been adjusted to meet the requirements of § 25.222(a)(1)(ii)(B).

5. Harris CapRock hereby declares that the antenna referenced in paragraph 3 above, will automatically cease transmission within 100 milliseconds if the pointing error should exceed 0.5 degrees and will not resume transmission until the error drops below 0.2 degrees, thus meeting the requirements of § 25.222(a)(1)(iii).

6. Harris CapRock maintains all relevant test data, which is available upon request, to verify these declarations.

By: ____________

Name: ANDREW LUCAS

Title: CTO

Harris CapRock Corporation

Date: 28th August 2015

Exhibit B
Preliminary C-band Frequency Coordination Analysis & Area of Operations

COORDINATION DATA

Company	Harris Caprocks Corp	
Site Name, State	San Juan, Puerto Rico	
Call Sign	Temporary ESV	
Latitude (NAD83) Main Port (B5)	18.4622	N
Longitude (NAD83) Main Port (B5)	66.1102	W
Elevation AMSL (ft/m)	0	
Transmit Frequency Range (MHz)	6389.118 - 6402.313	
	6115.422 - 6123.141	
	6150 - 6164.050	
Range of Satellite Orbital Long. (deg W)	30	34.5
Range of Azimuths from North (deg)	113.5	117.2
Antenna Centerline (ft/m)	51.0	15.5
Antenna Elevation Angles (deg)	43.8	48.1
Antenna Diameter (m)	2.4	
Equipment Parameters at Center Freq (GHz)		6.18
Antenna Gain, Main Beam (dBi)		41.7
15 DB Half Beamwidth (deg)		1.18
3 DB Half Beamwidth (deg)		0.66
Receive Antenna Type		
Transmit Antenna Type		FCC32
Max Transmitter Power (dbW/4KHz)		-18
Max EIRP Main Beam (dbW/4KHz)		51.5
Modulation / Emission Designator		3M50G7D
		2M14G7D
		5M44G7D
Coordination Parameters		
6 GHz Max Interference Power Long Term (dBW/4kHz) (20%)	-154	
6 GHz Max Interference Power Short Term (dBW/4kHz) (.0025%)	-131	
6 GHz Max Interference Power In Motion (dBW/4kHz) (1%)	-145	

BREAK POINT LIST

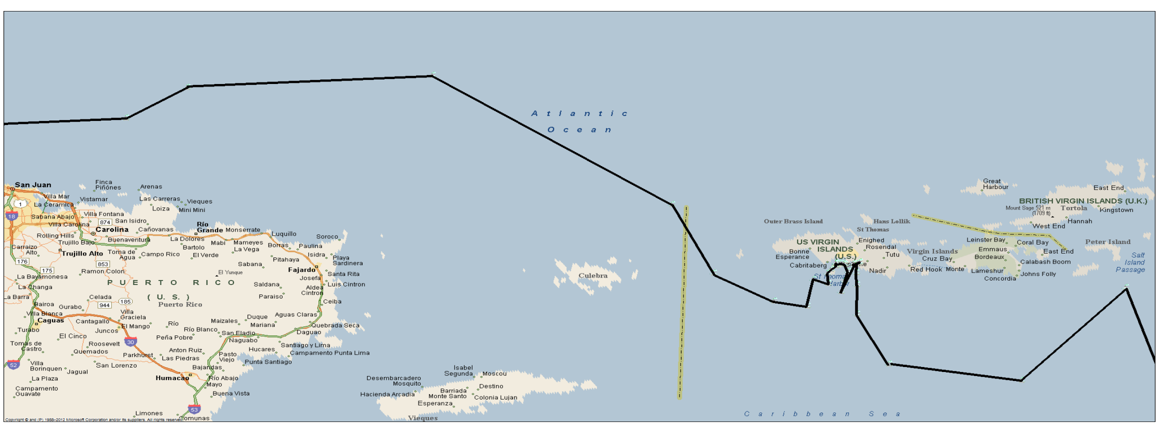
Name	Latitude	Longitude
SH1	19.97478	-67.05431
SH2	18.753333	-66.583333
SH3	18.803333	-66.5
SH4	18.666667	-66.316667
SH9	18.4695	-66.128333
SH29	18.4555	-66.114167
SH30	18.45	-66.1095
SH23	18.461167	-66.105667
SH26	18.4595	-66.098833
SH25	18.459167	-66.096167
SH24	18.4605	-66.100333
SH22	18.461333	-66.106667
SH21	18.462833	-66.109667
SH27	18.46	-66.1085
SH20	18.459167	-66.1105
SH19-P	18.4622	-66.1102
SH18	18.4625	-66.110333
SH17	18.4625	-66.113667
SH16	18.460167	-66.112333
SH28	18.458167	-66.111167
SH15	18.460167	-66.113667
SH14	18.462333	-66.114
SH13	18.457333	-66.114667
SH12	18.4575	-66.118
SH11	18.463	-66.124667
SH10	18.466667	-66.127333
SH9	18.4695	-66.128333
SH8	18.483333	-66.128
SH7	18.516667	-66.126667
SH6	18.555	-66.083333
SH5	18.565	-65.916667
ST1	18.615	-65.833333
ST2	18.635	-65.5
ST3	18.426667	-65.175
ST4	18.316667	-65.118333
ST5	18.271667	-65.036667
ST6	18.263333	-64.991667
ST7	18.306167	-64.983333
ST8	18.3	-64.963333
ST9	18.316667	-64.964333
ST10	18.322167	-64.959667
ST11	18.327833	-64.953
ST12	18.331167	-64.952833
ST13	18.331833	-64.952833
ST14-P	18.332	-64.953
ST15	18.332667	-64.952833
ST16	18.331833	-64.950333
ST17	18.332333	-64.946333
ST18	18.331333	-64.942167
ST19	18.330167	-64.9405

ST20	18.3195	-64.936333
ST21	18.303667	-64.941
ST22	18.286333	-64.946167
ST23	18.328	-64.928667
ST24	18.331167	-64.929333
ST25	18.3315	-64.927833
ST26-P	18.3343	-64.9205
ST27	18.334	-64.9205
ST28	18.332833	-64.922833
ST29	18.331333	-64.924667
ST30	18.316667	-64.925333
ST31	18.297167	-64.924667
ST32	18.25	-64.925
ST33	18.17	-64.881667
ST34	18.143333	-64.701667
ST35	18.291667	-64.56
ST36	18.113333	-64.5
ST37	17.985	-64.5

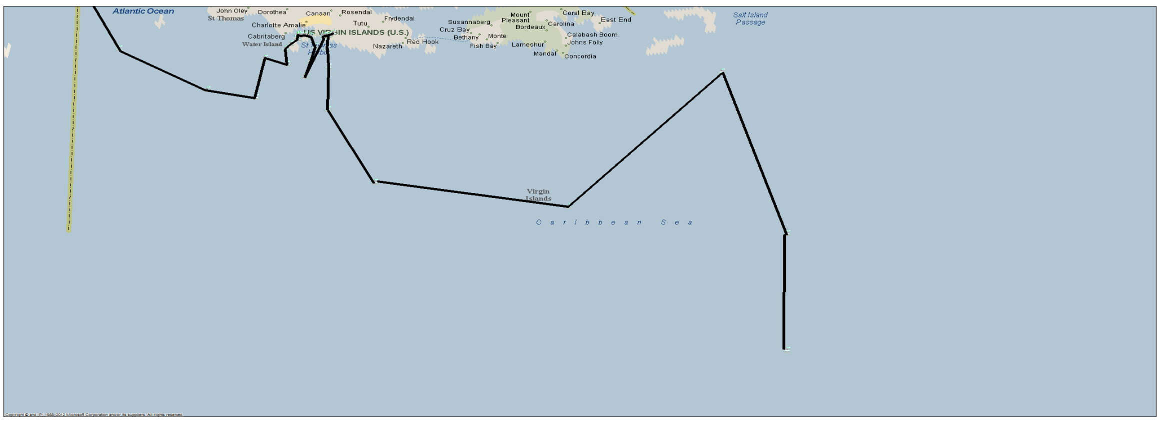
Affected U.S.-Licensed Fixed Service Operators

- Puerto Rico Commonwealth
- Puerto Rico Telephone Company, Inc.
- Broadband Telecommunications Network
- AT&T Mobility Puerto Rico
- Choice Communications, LLC
- T-Mobile Puerto Rico LLC
- Neptuno Media
- AT&T Mobility Virgin Islands, Inc.
- PR Wireless, Inc.
- Sprintcom, Inc.
- Sprintcom, Inc. Puerto Rico
- PREPA Networks, LLC.
- Critical Hub Networks, Inc.
- Puerto Rico Commonwealth of State Police
- ALL AMERICAN CABLE AND RADIO INC
- Puerto Rico Electric Power Authority
- Virgin Islands Telephone Corporation
- Aeronet Wireless Broadband Corp.
- Broadband VI, LLC
- Iniciativa Tecnologica Centro Oriental
- Evertec, Inc.
- Osnet Wireless Corporation
- University of the Virgin Islands
- System Development Integration, LLC

Area of Operations




West Cay
Kalkun Cay
Savanna Island
John Oley
Zambee
Bonne Esperance
Santa Maria Estate
Dorothea
Resolution
Misgen
Lovenlund
Thatch Cay
Rata Cay
Hadley Cay
U S V I R G I N I S L A N D S
(U. S.)
Mafolie
Canaan
Rosendal
Mandahl
Frydendal
Solberg
Louisenhoj
Perseverance Bay
Fortuna Bay
Brewers Bay
Contant
Fort Christian
Estate Thomas
St Thomas
Donoe
Tutu
Anna's Retreat
Pearson Gardens
Frenchtown
Cabritaberg
Cyril E King Field Airport
Raphune
Hoffman
St Thomas
Mariendal
Virgin Islands National Park
St John
Cruz Bay
Enighed
Contant
Bethany
Great Cruz Bay
Water Island
Turtledove Cay
Saba Island
Nadir
Benner
Nazareth
Great Bay
Cowpet Bay
Great St James Island
Little St James Island
Bovoni Cay
Caribbean Sea
Buck Island
Capella Island


Atlantic Ocean
John Oley
Dorothea
Canaan
Rosendal
St Thomas
Charlotte Amalie
Tutu
Frydendal
Cabritaberg
Water Island
US VIRGIN ISLANDS (U.S.)
Nazareth
Red Hook
Susannaberg
Cruz Bay
Bethany
Mount Pleasant
Bordeaux
Monte
Fish Bay
Lameshur
Mandal
Coral Bay
Carolina
East End
Calabash Boom
Johns Folly
Concordia
Salt Island Passage
Virgin Islands
Caribbean Sea