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December 3, 2018

VIA ELECTRONIC FILING

Behnam Ghaffari
Experimental Licensing Branch
Office of Engineering and Technology
Federal Communication Commission
445 12th St., SW
Washington, D.C. 20554

**Re: UltiSat, Inc. Call Sign WN9XQQ, File No. 1930-EX-ST-2018;
BB30 Experimental STA Request**

Dear Mr. Ghaffari,

On behalf of UltiSat Inc. (“UltiSat”), we hereby respond to the Commission’s November 29, 2018 correspondence requesting additional information regarding the above-captioned experimental STA request.¹

First, attached as Exhibit 1 is a Radiation Hazard Report for the SkyTech BB30 Ku-band earth station aboard aircraft (“ESAA”) terminal (the “BB30 terminal”).

Second, as noted in the Experimental STA Request, UltiSat proposes that the BB30 communicate with the following satellites: EUTELSAT 117WA (located at 117° W.L.); Sky B-1 (located at 317° E.L.); Intelsat 29e (located at 310° E.L.); SES-1 (located at 101° W.L.); and AMC-21 (located at 125° W.L.), the same satellites included in UltiSat’s other recent experimental STA request for a similar ESAA terminal.² All of these satellites are either U.S.-licensed or on the FCC’s Permitted Space Station List.³

¹ See UltiSat Inc., File No. 1930-EX-ST-2018, Call Sign WN9XQQ (filed Nov. 14, 2018) (“*Experimental STA Request*”); see also Correspondence from Behnam Ghaffari, FCC, to Carlos Nalda, LMI Advisors, File No. 1930-EX-ST-2018, Call Sign WN9XQQ (Nov. 28, 2018).

² See UltiSat, Inc., File No. 0201-EX-ST-2018, Call Sign WM9XHN (granted Mar. 2, 2018) (“*BB45 Experimental STA Grant*”).

³ See *supra* n. 1.

Third, LMI Advisors demonstrates that the BB30 terminal will meet the operational limits in Section 25.227 of the Commission rules⁴ through submission of off-axis EIRP spectral density plots (attached as Exhibit 2) confirming compliance with the off-axis EIRP spectral density mask set forth in Section 25.277(a)(1).⁵ This mask is consistent with the Commission's two-degree spacing rules. In addition, the BB30 terminal has previously operated under experimental authority without interference incident and will operate within the same network as the licensed BB45 ESAA terminal.⁶

Fourth, the BB30 terminal will not communicate with any NGSO satellite system. Thus, the ITU Radio Regulations' equivalent power flux-density limits are not applicable.

Finally, because the BB30 terminal operates in compliance with the two-degree spacing mask set forth in Section 25.277(a)(1), the operations are necessarily consistent with existing and future coordination agreements of operators of the satellite points of communication proposed herein.

Please do not hesitate to contact me with any questions regarding this matter.

Respectfully submitted,



Carlos M. Nalda
Managing Principal
LMI Advisors

⁴ 47 C.F.R. § 25.277(a).

⁵ 47 C.F.R. § 25.277(a)(1). For your convenience, we also have attached gain patterns for the BB30 terminal as Exhibit 3.

⁶ See UltiSat, Inc., File No. SES-LIC-20180726-02089, Call Sign E181298 (granted Nov. 21, 2018) ("*UltiSat BB45 Grant*").

Exhibit 1
Radiation Hazard Report

Radiation Hazard Analysis

BB30Ku – Aircraft Earth Station

This analysis predicts the radiation levels around a proposed earth station complex, comprised of a single panel type antenna. This report is developed in accordance with the prediction methods contained in OET Bulletin No. 65, Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields, Edition 97-01, pp 26-30. The maximum level of non-ionizing radiation to which employees may be exposed is limited to a power density level of 5 milliwatts per square centimeter (5 mW/cm²) averaged over any 6 minute period in a controlled environment and the maximum level of non-ionizing radiation to which the general public is exposed is limited to a power density level of 1 milliwatt per square centimeter (1 mW/cm²) averaged over any 30 minute period in a uncontrolled environment. Note that the worse-case radiation hazards exist along the beam axis. Under normal circumstances, it is highly unlikely that the antenna axis will be aligned with any occupied area since that would represent a blockage to the desired signals, thus rendering the link unusable.

Earth Station Technical Parameter Table

Antenna Aperture Size	0.30m
Antenna Effective Diameter	0.30 m
Antenna Surface Area	0.071 sq. meters
Antenna Isotropic Gain	31.5 dBi
Number of Identical Adjacent Antennas	1
Nominal Antenna Efficiency (ε)	70%
Nominal Frequency	14.25 GHz
Nominal Wavelength (λ)	0.021 meters
Maximum Transmit Power / Carrier	40 Watts
Number of Carriers	1
Total Transmit Power	40.0 Watts
W/G Loss from Transmitter to Feed	2 dB
Total Feed Input Power	25.2 Watts
Radome Losses	1.5 dB
Effective RF Power at radome	17.9 Watts
Near Field Limit	$R_{nf} = D^2/4\lambda = 1.07$ meters
Far Field Limit	$R_{ff} = 0.6 D^2/\lambda = 2.57$ meters
Transition Region	R_{nf} to $R_{ff} = 1.07$ meters to 2.57 meters

In the following sections, the power density in the above regions, as well as other critically important areas will be calculated and evaluated. The calculations are done in the order discussed in OET Bulletin 65.

1.0 At the Antenna Surface

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

$$PD_{as} = 4P/A = \mathbf{142.8} \text{ mW/cm}^2 \text{ (1)}$$

Where: P = total power at feed, milliwatts

A = Total area of reflector, sq. cm

In the normal range of transmit powers for satellite antennas, the power densities at or around the reflector surface is expected to exceed safe levels. This area will not be accessible to the general public.

This antenna will incorporate a radome which has 1.0 dB of loss. The worst case power density at the surface of the radome is shown below:

$$PD_{\text{radome}} = 4P_{\text{rad}}/A = \mathbf{101.1 \text{ mW/cm}^2} \text{ (2)}$$

Where: P_{rad} = total power at feed less radome losses, milliwatts

A = Total area of reflector, sq. cm (this would represent worst case)

Operators and technicians should receive training specifying this area as a high exposure area. Procedures must be established that will assure that all transmitters are rerouted or turned off before access by maintenance personnel to this area is possible.

2.0 On-Axis Near Field Region

The geometrical limits of the radiated power in the near field approximate a cylindrical volume with a diameter equal to that of the antenna. In the near field, the power density is neither uniform nor does its value vary uniformly with distance from the antenna. For the purpose of considering radiation hazard it is assumed that the on-axis flux density is at its maximum value throughout the length of this region. The length of this region, i.e., the distance from the antenna to the end of the near field, is computed as R_{nf} above.

The maximum power density in the near field is given by:

$$PD_{\text{nf}} = (16\epsilon P)/(\pi D^2) = \mathbf{71.3 \text{ mW/cm}^2} \text{ (3)}$$

from 0 to 1.07 meters

Evaluation

Uncontrolled Environment: **Does Not Meet Controlled Limits**

Controlled Environment: **Does Not Meet Uncontrolled Limits**

3.0 On-Axis Transition Region

The transition region is located between the near and far field regions. As stated in Bulletin 65, the power density begins to vary inversely with distance in the transition region. The maximum power density in the transition region will not exceed that calculated for the near field region, and the transition region begins at that value. The maximum value for a given distance within the transition region may be computed for the point of interest according to:

$$PD_{\text{tr}} = (PD_{\text{nf}})(R_{\text{nf}})/R = \text{dependent on } R \text{ (4)}$$

where: PD_{nf} = near field power density

R_{nf} = near field distance

R = distance to point of interest

$$PD_{\text{tr}} = \mathbf{71.26 \text{ mW/cm}^2}$$

For: $1.07 < R < 2.57$ meters

We use Eq (4) to determine the safe on-axis distances required for the two occupancy conditions:

Evaluation

Uncontrolled Environment Safe Operating Distance, (meters), R_{safeu} : 726.9

Controlled Environment Safe Operating Distance, (meters), R_{safec} : 152.7

4.0 On-Axis Far-Field Region

The on-axis power density in the far field region (PD_{ff}) varies inversely with the square of the distance as follows:

$$PD_{ff} = PG/(4\pi R^2) = \text{dependent on } R \text{ (5)}$$

where: P = total power at feed

G = Numeric Antenna gain in the direction of interest relative to isotropic radiator

R = distance to the point of interest

For: $R > R_{ff} = 2.57$ meters

$PD_{ff} = 30.5 \text{ mW/cm}^2$ at R_{ff}

We use Eq (5) to determine the safe on-axis distances required for the two occupancy conditions:

Evaluation

Uncontrolled Environment Safe Operating Distance,(meters), R_{safeu} : See Section 3

Controlled Environment Safe Operating Distance,(meters), R_{safec} : See Section 3

5.0 Off-Axis Levels at the Far Field Limit and Beyond

In the far field region, the power is distributed in a pattern of maxima and minima (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)

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, the off-axis gain reduction may be used to further reduce the power density levels.

For example: At two-degrees off axis at the far-field limit, we can calculate the power density as:

$$G_{off} = 32 - 25\log(2) = 32 - 7.52 \text{ dBi} = 280.2 \text{ numeric}$$

$$PD_{2 \text{ deg off-axis}} = PD_{ff} \times 280.2/G = 6.05 \text{ mW/cm}^2 \text{ (6)}$$

6.0 Off-Axis power density in 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 equivalent on-axis power density in the main beam. Therefore, for regions at least D meters away from the center line of the dish, whether behind, below, or in front under of the antenna's main beam, the power density exposure is at least 20 dB below the main beam level as follows:

$$PD_{\text{nf(off-axis)}} = PD_{\text{nf}} / 100 = \mathbf{0.71} \text{ mW/cm}^2 \text{ at D off axis (7)}$$

See Section 7 for the calculation of the distance vs. elevation angle required to achieve this rule for a given object height.

7.0 Evaluation of Safe Occupancy Area in Front of Antenna

The distance (S) from a vertical axis passing through the dish center to a safe off axis location in front of the antenna can be determined based on the dish diameter rule (Item 6.0). Assuming a flat terrain in front of the antenna, the relationship is:

$$S = (D / \sin \alpha) + (2h - D - 2) / (2 \tan \alpha) \text{ (8)}$$

Where: α = minimum elevation angle of antenna

D = dish diameter in meters

h = maximum height of object to be cleared, meters

For distances equal or greater than determined by equation (8), the radiation hazard will be below safe levels for all but the most powerful stations (> 4 kilowatts RF at the feed).

For	D =	0.3 meters
	h =	2.0 meters, delta between antenna and object >1 m
Then:	α	S
	10	6.6 meters
	15	4.3 meters
	20	3.2 meters
	25	2.5 meters
	30	2.1 meters

8.0 Summary of Results

The earth station site will be protected from uncontrolled access because it will be mounted on the top of an aircraft. The earth station will not be operated when operational or maintenance personnel are in any potential RF hazard area. There will also be proper emission warning signs placed and all operating personnel will be aware of the human exposure levels at and around the earth station.

The applicant agrees to abide by the conditions specified in Condition 18 provided below:

(18) – UltriSat Inc shall take all reasonable and customary measures to ensure that the MET does not create potential for harmful non-ionizing radiation to persons who may be in the vicinity of the MET when it is in operation. At a minimum, permanent warning label(s) shall be affixed to the MET warning of the radiation hazard and including a diagram showing the regions around the MET where the radiation levels could exceed 1.0mW/cm². The operator of the MET shall be responsible for assuring that individuals do not stray into the region around the MET where there is a potential for exceeding the maximum permissible exposure limits required by Section 1.1310 of the Commission's rules 47 C.F.R § 1.1310. This shall be accomplished by means of signs, caution tape, verbal warnings, placement of the MET so as to minimize access to the hazardous region and/or any other appropriate means

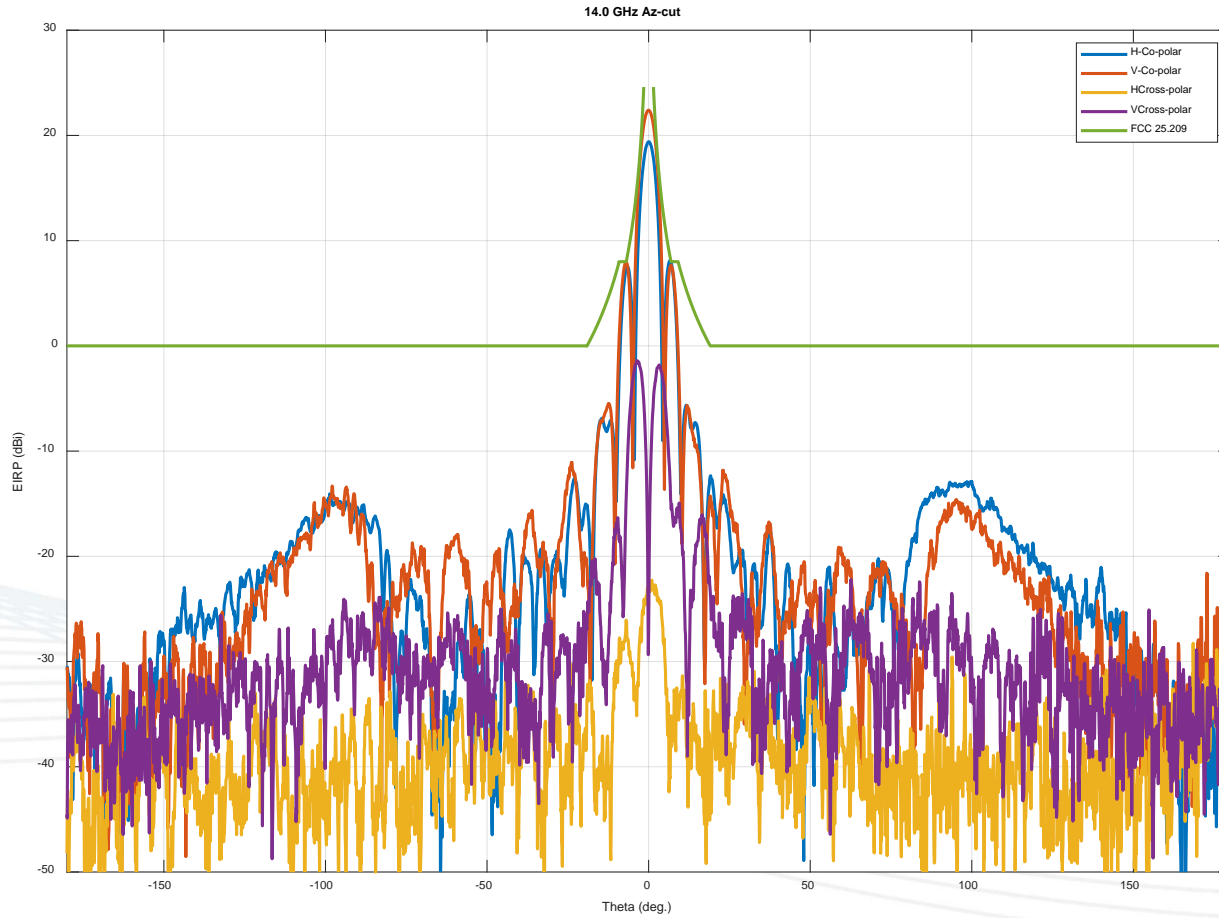
The table below summarizes all of the above calculations.

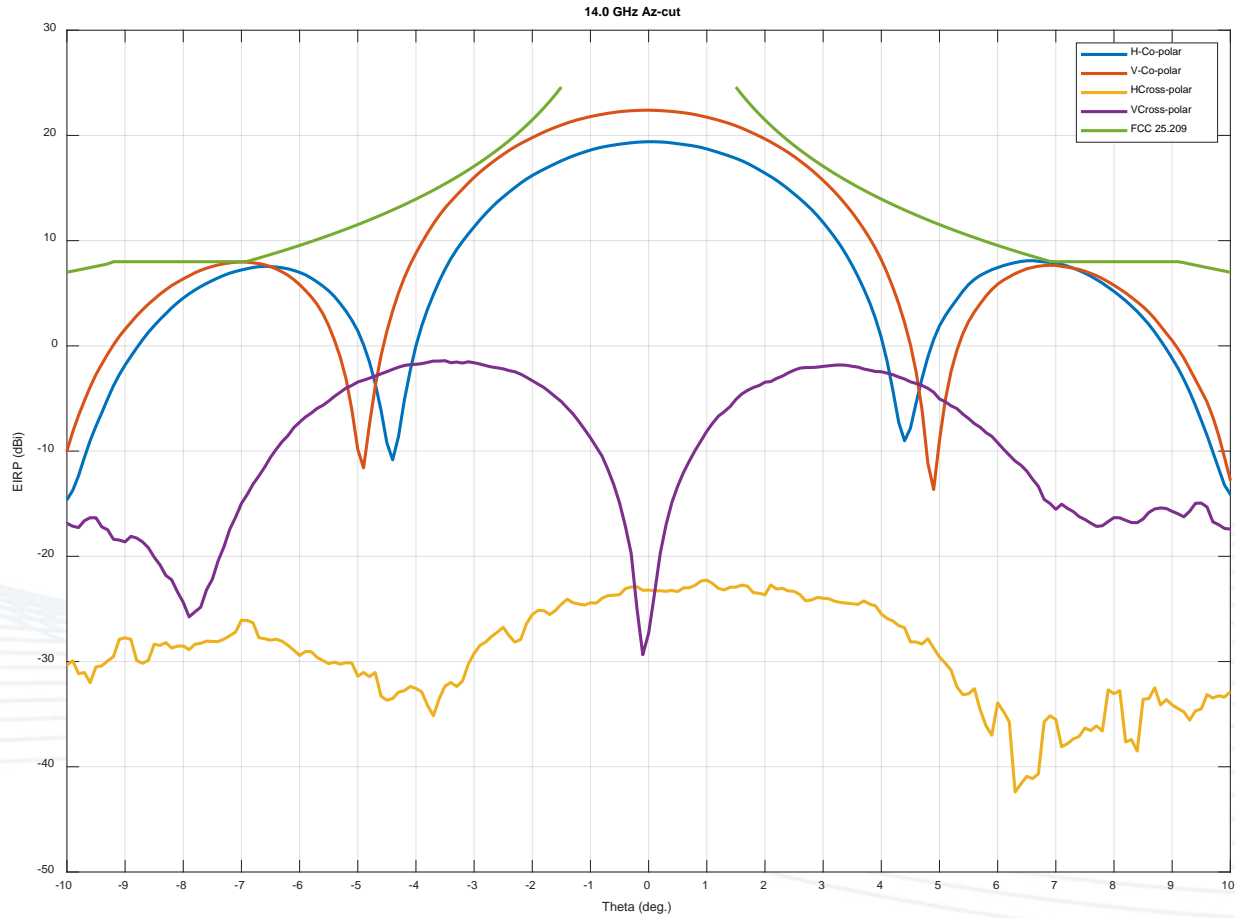
Parameter	Abbreviation	Value	Units	Formula
Antenna Diameter	D	0.3	meters	
Antenna Centerline	h	2	meters	
Antenna Surface Area	S _a	0.071	meter ²	
Antenna Ground Elevation	GE	2	meters	
Frequency of Operation	f	14.25	GHz	
Wavelength	λ	0.02105	meters	
HPA Output Power	P _{HPA}	40	Watts	
HPA to Antenna Loss	L _{Tx}	2	dB	
Radome Loss	L _{rad}	1.5	dB	
Transmit Power at Flange	P _F	25.24	Watts	$16 PHPA / 10^{-\frac{-L_{Tx}}{10}}$
Power After Radome	P _{Rad}	17.87	Watts	$16 PF / 10^{-\frac{-L_{Rad}}{10}}$
Antenna Gain	G _{ES}	31.5	dBi	
Aperture Efficiency	η	0.70		
1. Reflector Calculations				
Antenna Surface Power Density	PD _{As}	1428.20	W/m ²	$16 PF / \pi D^2$
		142.82	mW/cm ²	
Radome Surface Power Density	PD _{Rad}	1011.08	W/m ²	$16 PRad / \pi D^2$
		101.11	mW/cm ²	Does Not meet Controlled Limits
				Does Not meet Uncontrolled Limits
2. On Axis Near Field Calculations				
Extent of Near Field	R _{NF}	1.07	meters	$D^2 / 4\lambda$
Near Field Power Density	P _{DNF}	712.62	W/m ²	$16 PRad / \pi D^2$
		71.26	mW/cm ²	Does Not meet Controlled Limits
				Does Not meet Uncontrolled Limits
3. On Axis Transition Region Calculations				
Extent Of Transition Region, Minimum	R _{TR}	1.07	meters	$D^2 / 4\lambda$
Extent Of Transition Region, Maximum	R _{TR}	2.57	meters	$0.6 D^2 / \lambda$
Worst Case Transition Region Power Density	P _{DTR}	71.26	mW/cm ²	Does Not meet Controlled Limits
				Does Not meet Uncontrolled Limits
Minimum Safe Distance, Uncontrolled Access	R _{SU}	762.69	meters	$P_{DNF} RNF / 1mW/cm^2$
Minimum Safe Distance, Controlled Access	R _{SC}	152.67	meters	$P_{DNF} RNF / 5mW/cm^2$
4. On Axis Far Field Calculations				
Distance to Far Field	R _{FF}	2.57	meters	$0.6 D^2 / \lambda$
On Axis Power Density At Start of Far Field	P _{OFF}	305.26	W/m ²	$G_{ES} PRad / 4 \lambda RFF^2$
		30.53	mW/cm ²	Does Not meet Controlled Limits
				Does Not meet Uncontrolled Limits
5. Off-Axis Far Field Power Density Calculations				
Far Field Power Density at sampl 2° Off-Axis		6.05	mW/cm ²	$P_{OFF} / \left[G @ 2^\circ / G_{ES} \right]$
				Meets Controlled Limits
				Meets Uncontrolled Limits
6. Off-Axis Power Density Calculations for the Near Field and Transitional Regions				
Power Density Off Main Beam Axis at 1 Antenna	P _{DNF-off-axis}	0.71	mW/cm ²	$16 PRad / 100 \pi D_{NF}^2$
Diameter Removed				Meets Controlled Limits
				Meets Uncontrolled Limits
7. Off-Axis Safe Distances From Earth Station				
Minimum Elevation Angle of Antenna	α _{min}	10	Degrees	
Height of Object to be Cleared	h	3	meters	
Height center of antenna is above the ground	G _E	2	meters	
	α	S		
	10°	6.55 m		
	15°	4.33 m		
	20°	3.21 m		
	25°	2.53 m		
	30°	2.07 m		

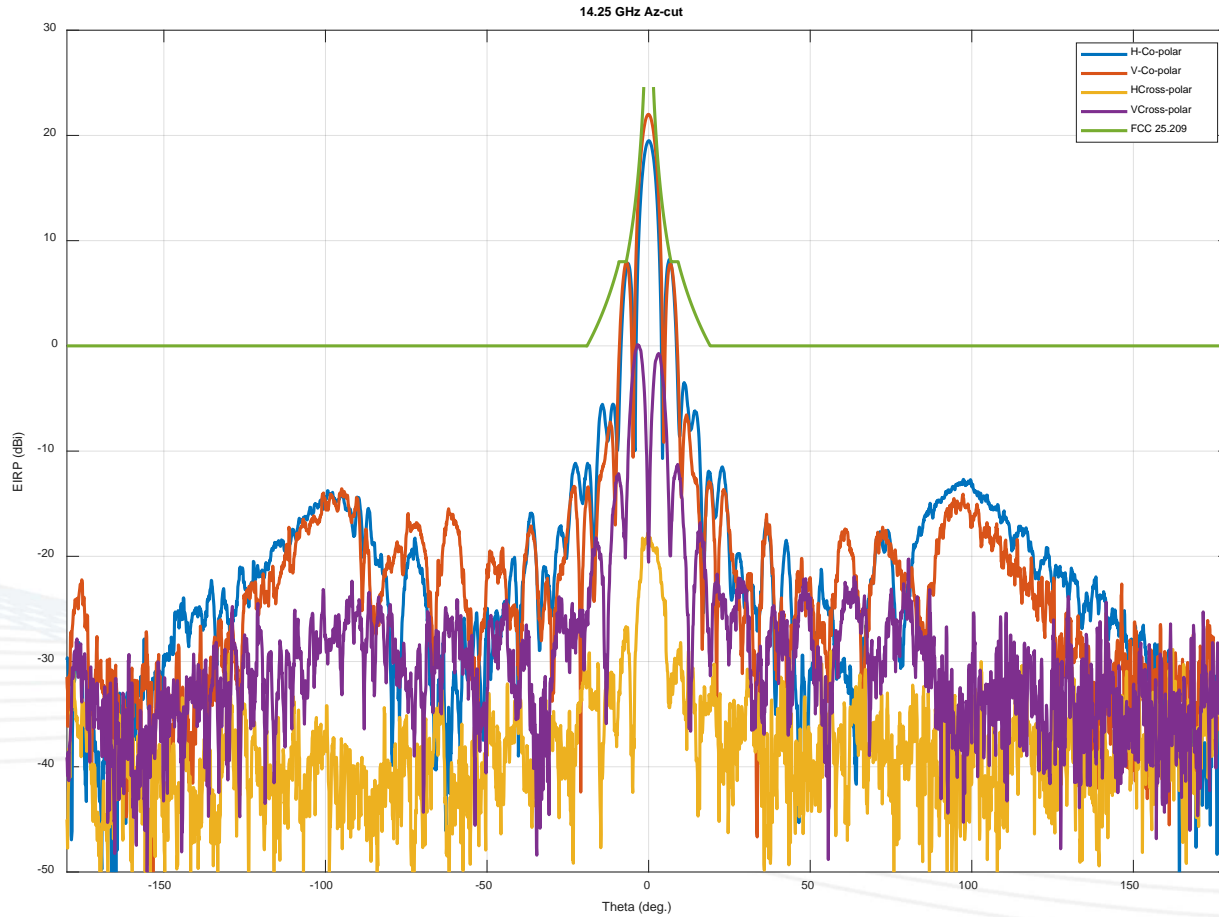
Exhibit 2

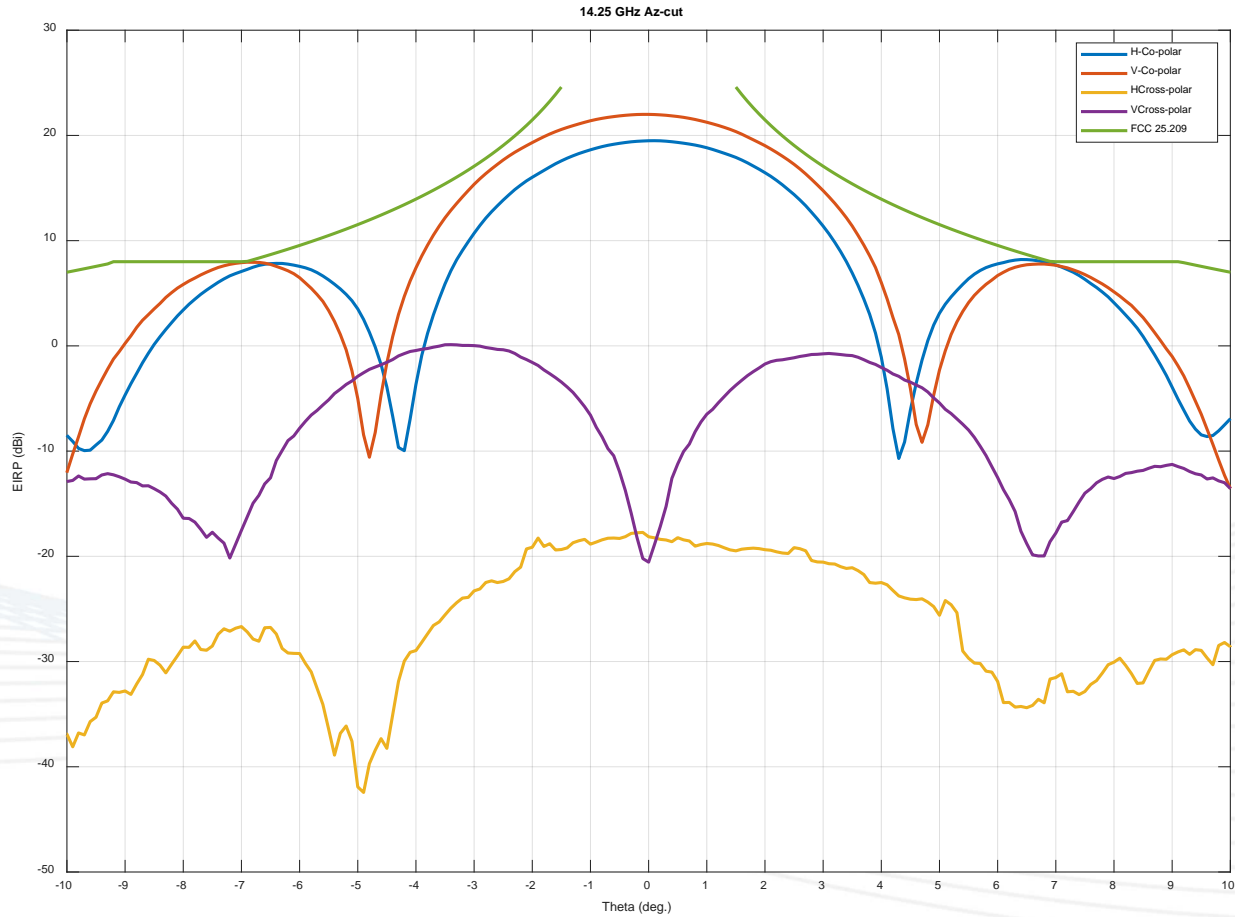
Off-Axis EIRP Spectral Density Plots

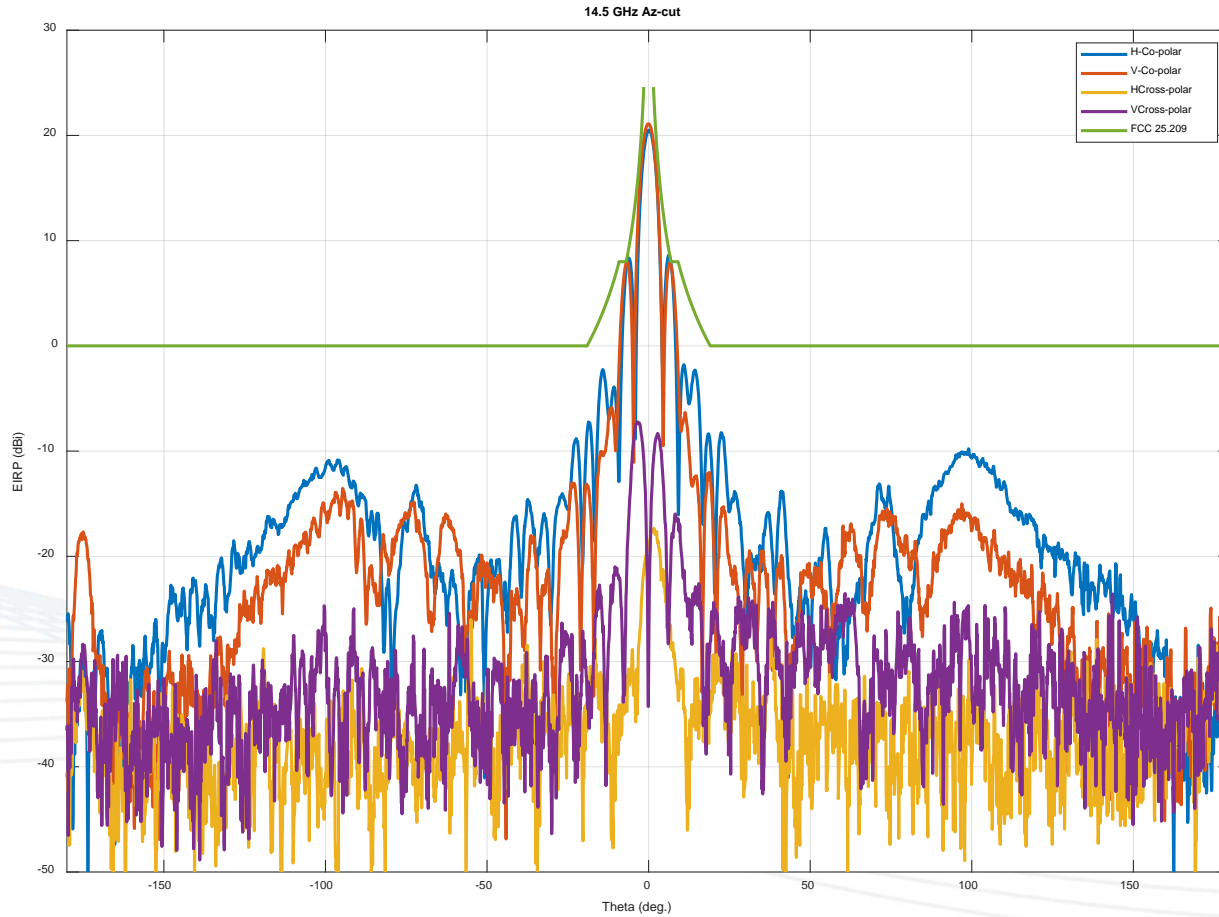
EIRP per FCC 25.209 Tangent to GEO Arc

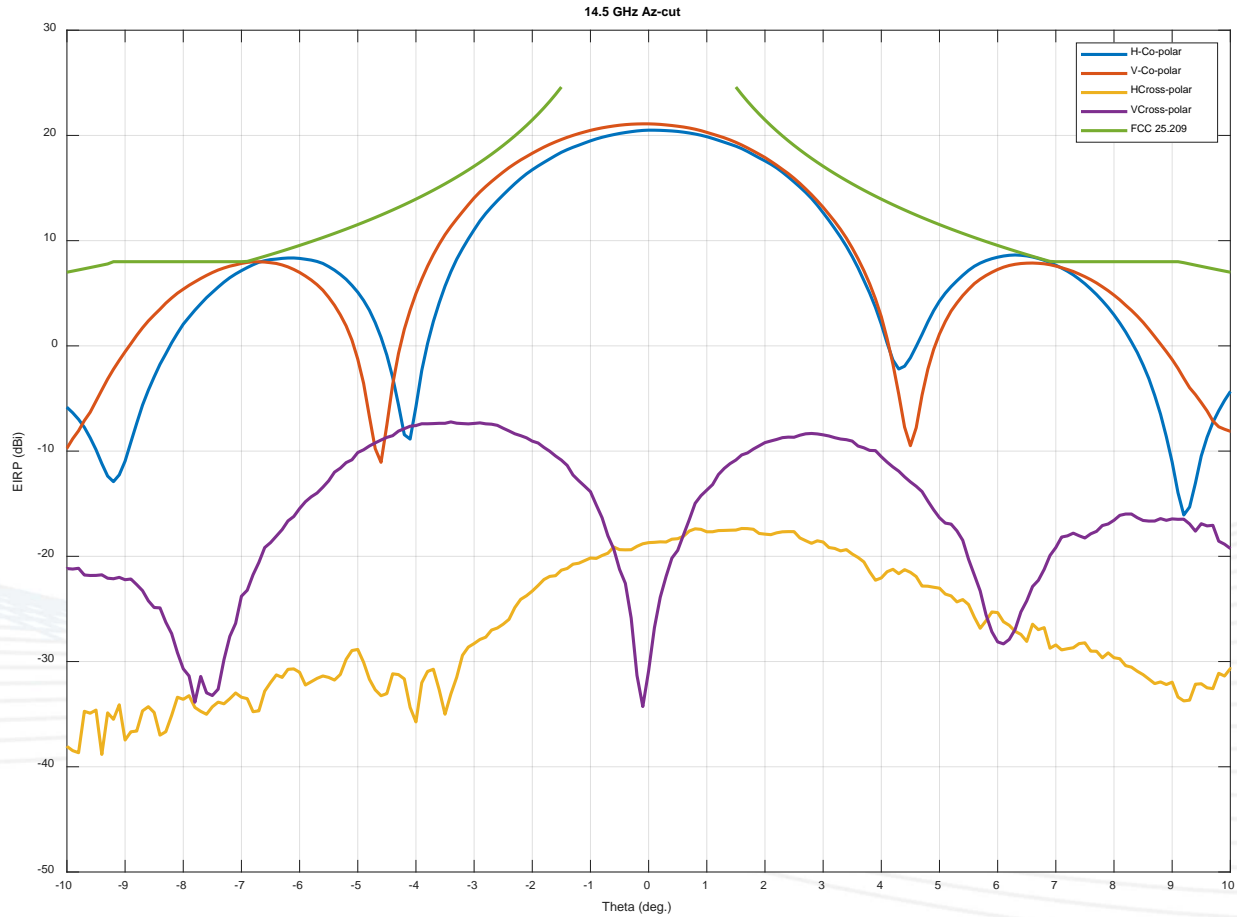




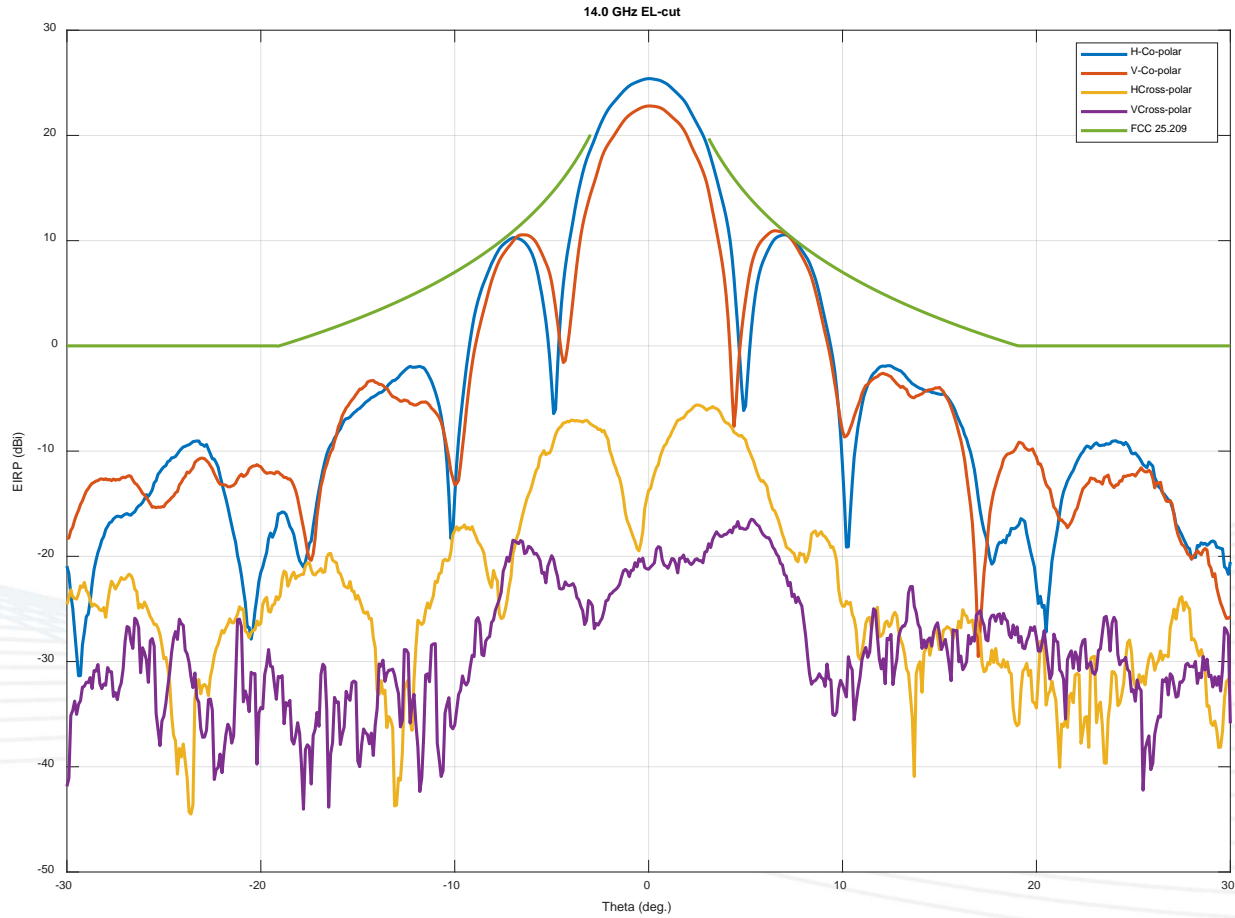


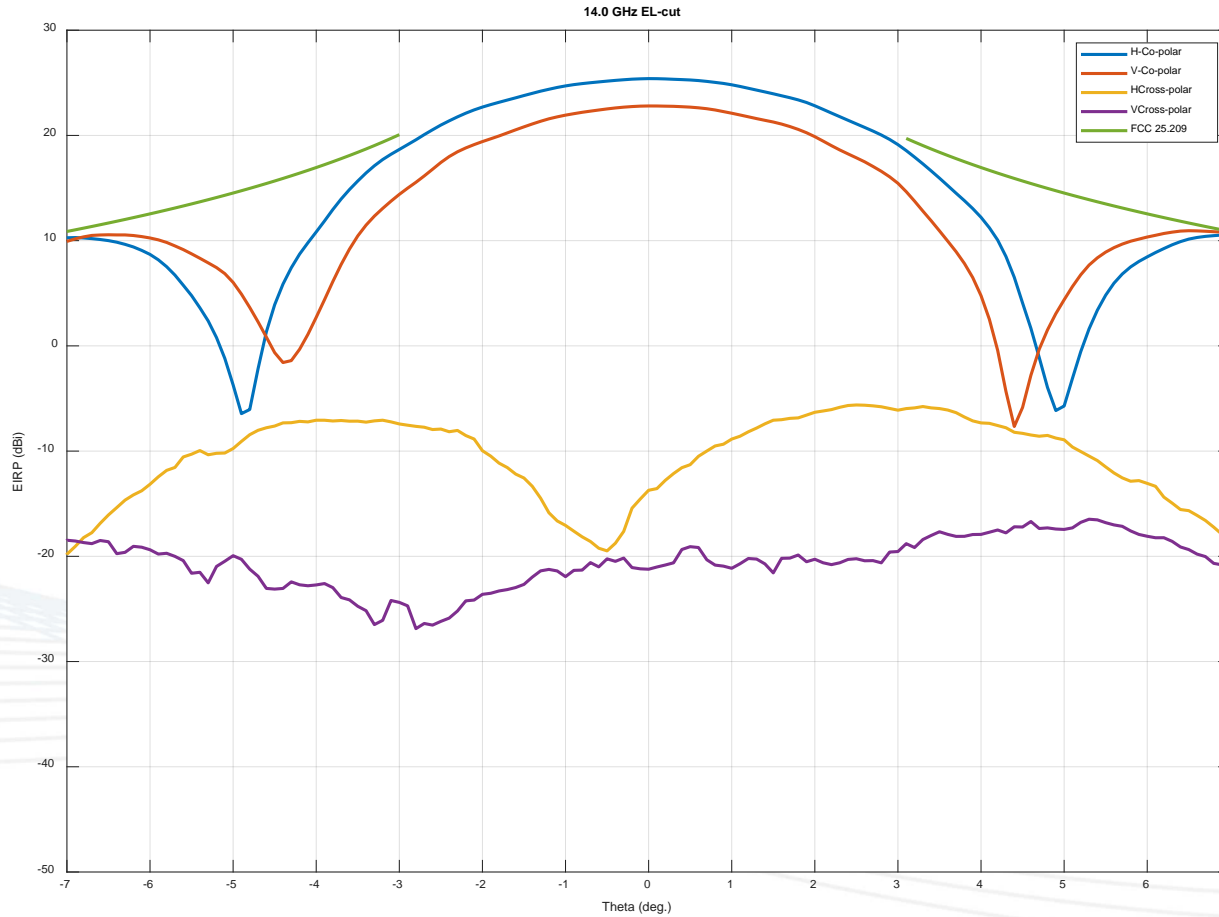


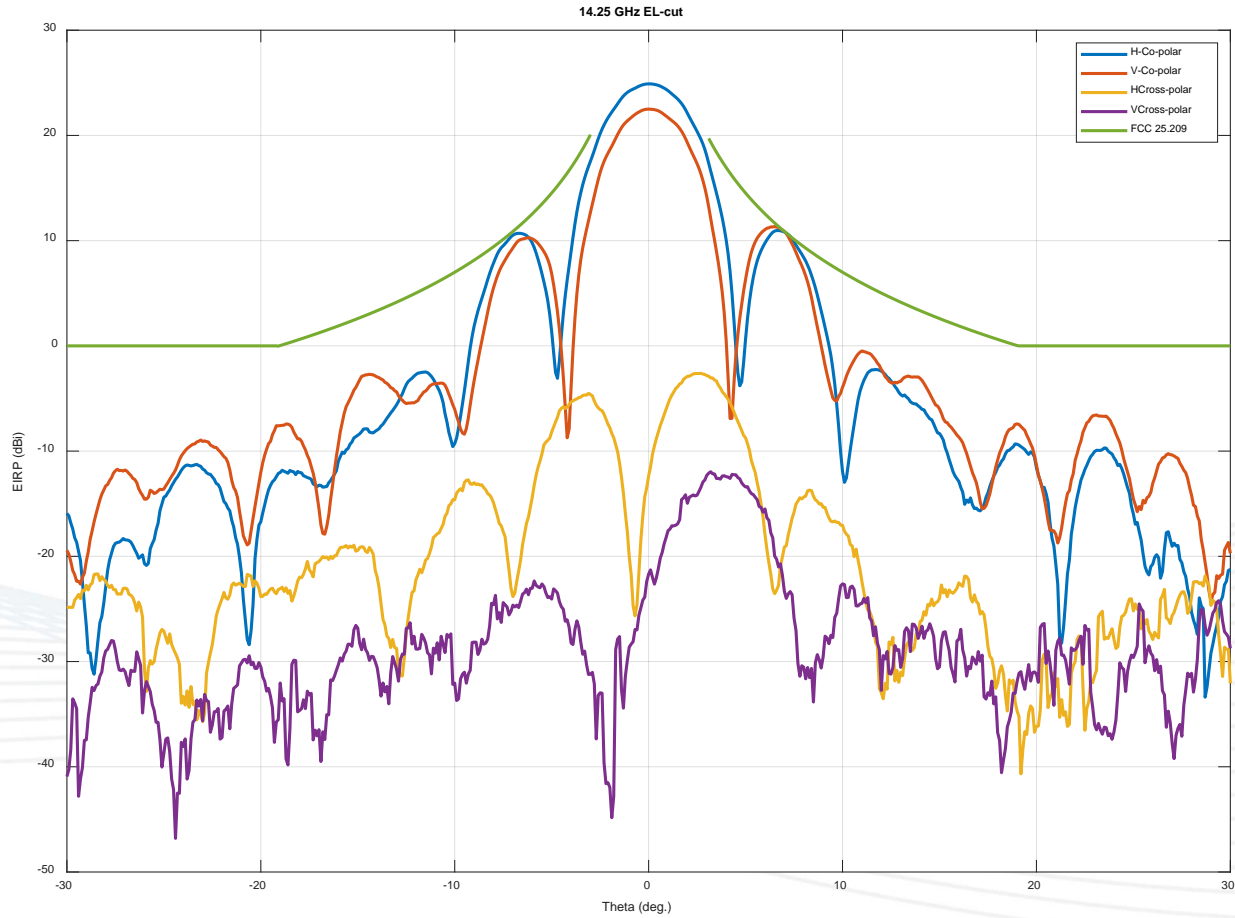


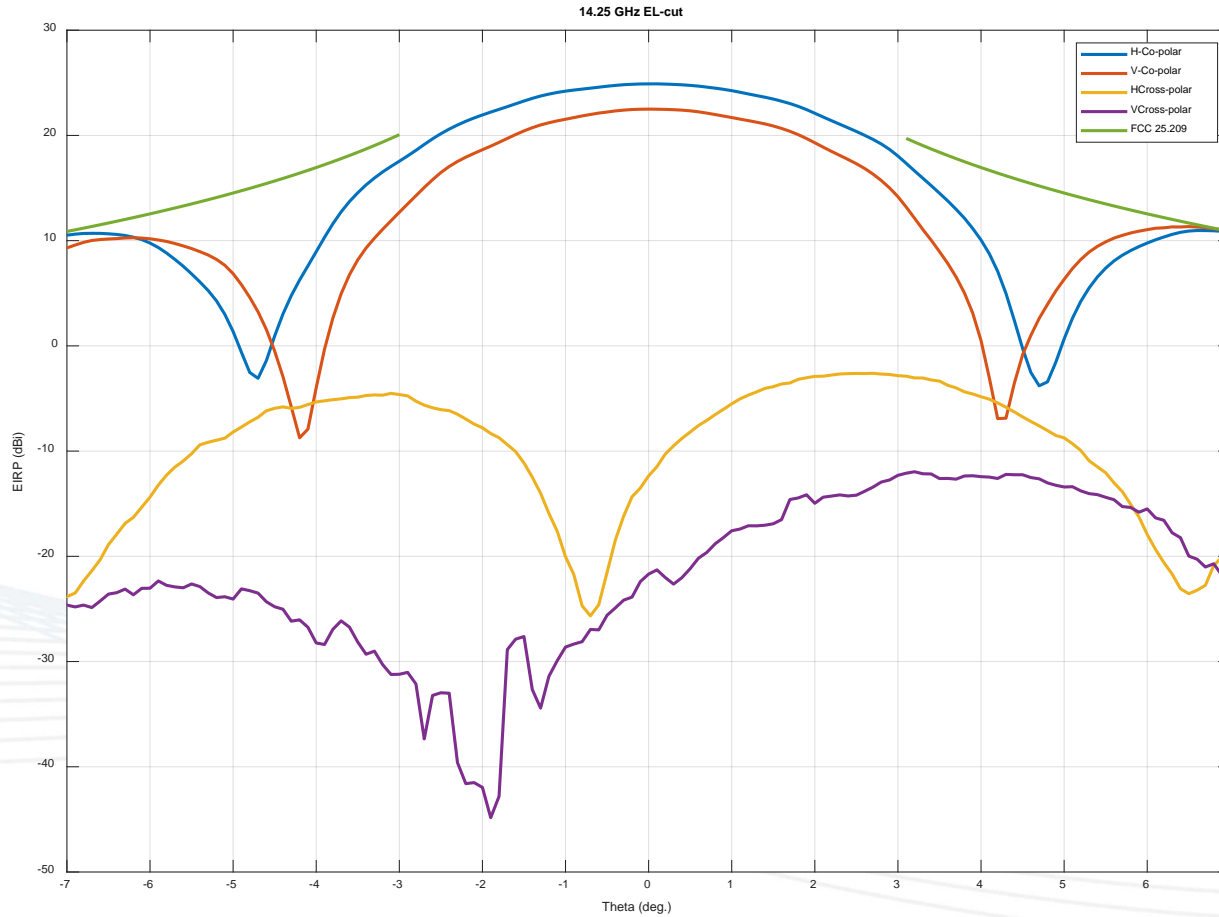


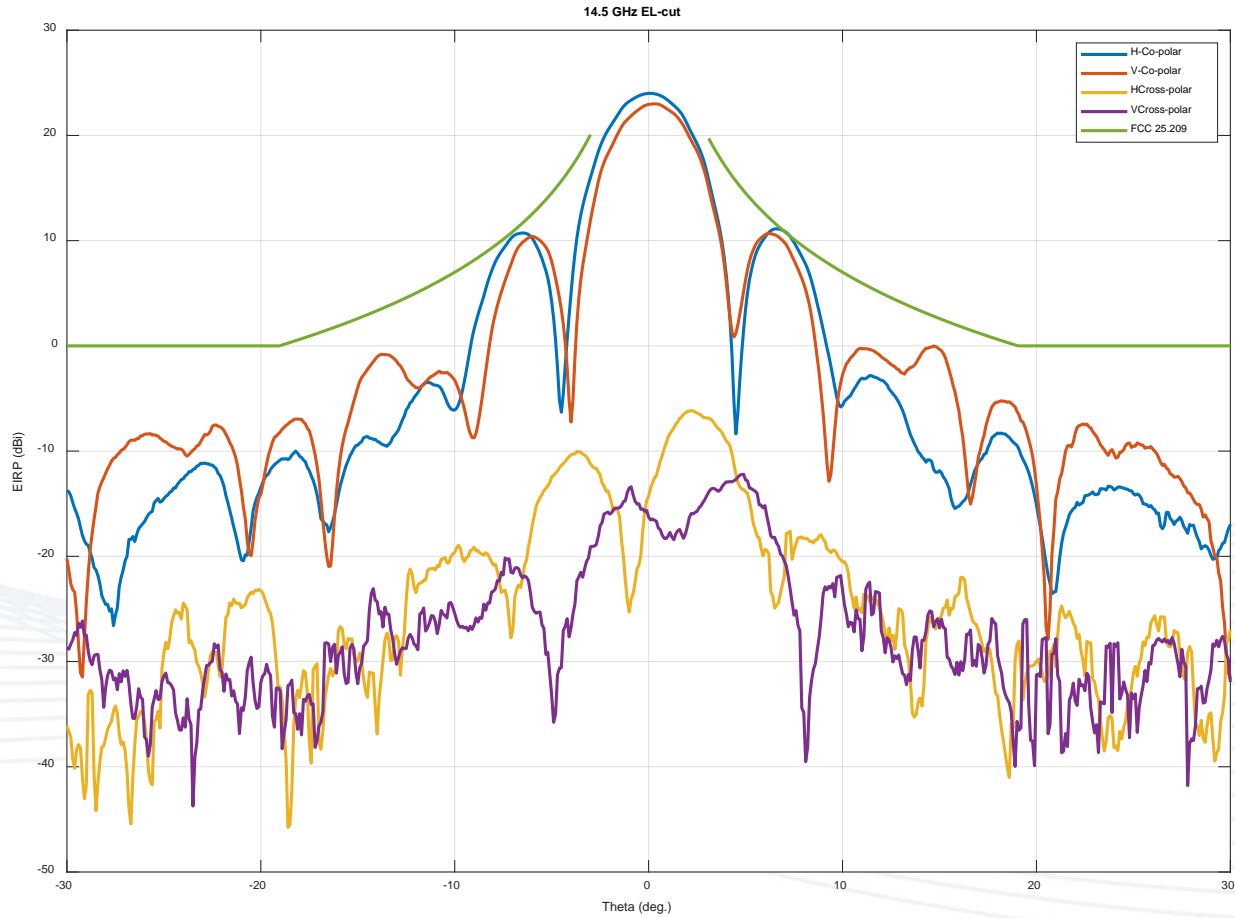
EIRP per FCC 25.209 Perpendicular to GEO Arc











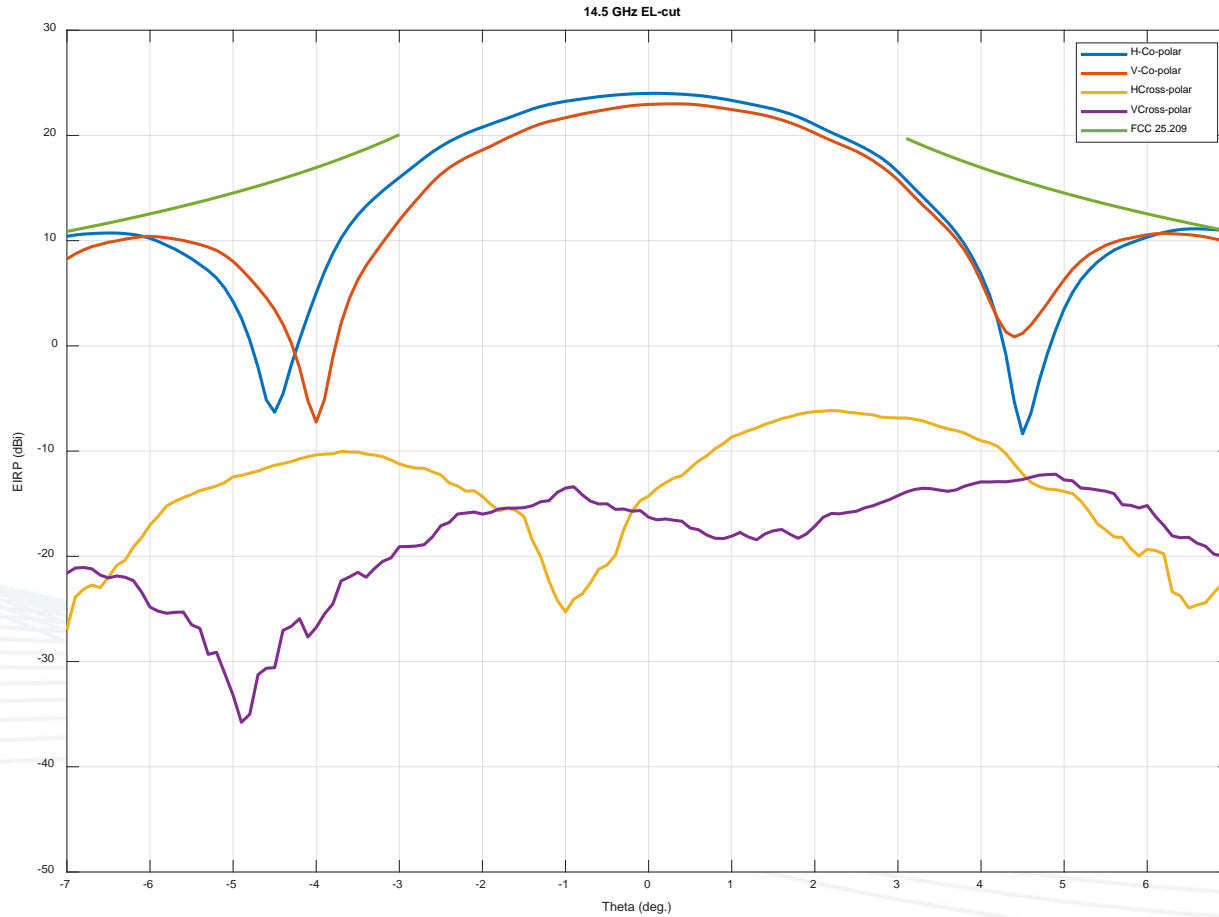


Exhibit 3
Antenna Gain Patterns

Far Field radiation patterns of SkyTech BBIG30Ku antenna.

ID	<i>TRGD03_12/17</i>
Authors	<i>G. Dassano</i>
Date	<i>28/12/2018</i>
Version	<i>2</i>
Classification (*)	<i>CO</i>

Summary:

This report deals with the measurements of the radiation pattern of a sample of the parabolic reflector antenna BBIG30Ku manufactured by SkyTeck, operating in Ku band: The measurements were carried out in November 2017 in the Politecnico di Torino Antenna Laboratory (LACE). Measurements of radiation patterns have been carried out on the two transmission and the two reception antenna ports, for H and V polarizations, at two frequencies bands; in the frequency range 10.95-12.75 GHz (RX) and in the frequency range 13.75-14.5 GHz (TX).

Document history

<i>Version</i>	<i>Date</i>	<i>Description</i>	<i>Authors</i>
1	December 28, 2017	Gain, XPD and patterns in RX and TX band for V and H polarizations (1 st draft)	G. Dassano

Distribution list

<i>Name</i>	<i>Company</i>
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TABLE OF CONTENTS

page 3

<i>1. Introduction</i>	<i>4</i>
<i>2. Measurements facilities description</i>	<i>5</i>
<i>2.1 Gain and pattern measurements</i>	<i>5</i>
<i>3. Measurements procedures</i>	<i>8</i>
<i>3.1 Gain measurement</i>	<i>8</i>
<i>3.2 Radiation pattern measurements</i>	<i>8</i>
<i>3.3 Raster scan measurements</i>	<i>8</i>
<i>4. Pictures of the measurement campaign</i>	<i>9</i>
<i>5. Gain and XPD measurements, TX / RX Bands</i>	<i>10</i>
<i>6. Radiation Pattern Measurements</i>	<i>12</i>
<i>6.1: Radiation patterns in RX band (10.95-12.75 GHz)</i>	<i>12</i>
<i>6.1.1: V-pol, AZ and EL plane plots</i>	<i>12</i>
<i>6.1.2: H-pol, AZ and EL plane plots</i>	<i>17</i>
<i>6.2: Radiation patterns in TX band (13.75-14.5 GHz)</i>	<i>22</i>
<i>6.2.1: V-pol, AZ and EL plane plots</i>	<i>22</i>
<i>6.2.2: H-pol, AZ and EL plane plots</i>	<i>30</i>

1. INTRODUCTION

In this document are reported the results of the tests (carried out on November 2017) on a 30cm parabolic reflector antenna for Ku band satellite communication, indicated as **BBIG30Ku**, manufactured by SkyTech. The antenna has a circular aperture with a diameter of 30 cm.

For this antenna the results shown in this report are:

In the RX and TX bands: the frequency swept maximum gain for the co-polarization on axis, and the XPD factor evaluated on axis.

The radiation pattern cuts (co- and cross-polarization) in the principal (Azimuth and Elevation) planes:

- *in RX band, in the angular range $\pm 180^\circ$ for AZ and $\pm 30^\circ$ for EL planes, and both polarizations ports (H and V), at 3 frequencies: 10.95, 11.85 and 12.75 GHz;*
- *in TX band, in the angular range $\pm 180^\circ$ for AZ and $\pm 30^\circ$ for EL planes, and both polarizations ports (H and V), at 4 frequencies, 250MHz spaced, from 13.75 to 14.5 GHz;*

All the measurements were carried out in LACE's outdoor far field test range, with a distance SRC-AUT of 150 m.

2. MEASUREMENTS FACILITIES DESCRIPTION

2.1 Gain and pattern measurements

The measurements have been performed in the outdoor test range of the Laboratory (see fig.1).

The present test range, who has replaced the old one used since the early '60es for pioneering works on space antennas, has been supplied from MI Technologies (formerly Scientific Atlanta) and installed in February 2008.

In this test range the Antenna Under Test (AUT), used as receiver, and the Source (SRC) are placed on the roof of two different buildings, the Department of Electronics and Telecommunications and the Department of Control and Computer Engineering. The two buildings are far apart (more than 150 m) without obstacles in between, and the height of both AUT and SRC is 30 m above the ground; the range is schematically shown in fig.1 (plan and elevation). It is also possible to use a SRC at a slightly lower level, to reduce the scattering from the back of the range.

Due to the elevated range, there are many Fresnel zones without obstacles. The effects of the reflection on the ground can be removed by a time windowing, with some directivity of the source and also considering that the incidence angle on the ground is near to the Brewster angle.

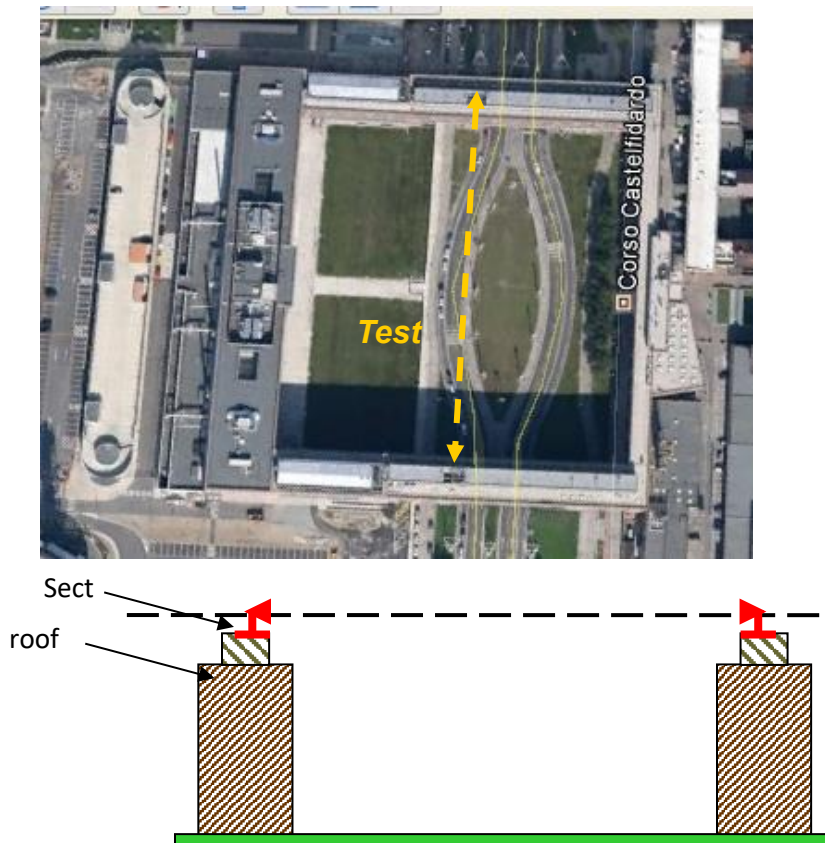


Fig.1: Plan view and vertical section of the outdoor test range

The design frequency interval is 100 MHz-50 GHz (the upgrade from 20 to 40 GHz has been added in 2011; from 40 to 50 GHz in 2015). The distance between SRC and AUT allows to test antennas up to 0.7m diameter at 40 GHz; at lower frequencies the maximum size in meters is given by $D \cong 4.7/f^{0.5}$, where f is the frequency in GHz. Corrections procedures are also available should the distance be less than $2D^2/\lambda$.

The dynamic range is around 90 dB (depending on the frequency). The receiver can handle up to 16 measurements channels, with external switching system, and 1 reference channel measured simultaneously with each signal channel, with 100 dB isolation Channel to Channel (110 dB . Reference Channel to Signal Channel). The accuracy in amplitude (Logarithmic mode) is ± 0.05 dB/10 dB over the full dynamic range (excluding effects of temperature, cross-talk and noise) and ± 0.4 °/10 dB in phase over full dynamic range; the noise figure is 17 dB at 0.1 to 18 GHz. The most recent calibration of the whole system has been in June 2014.

The positioning system of the AUT is a 3-axis system (roll over azimuth over elevation), consisting of: MI53150 Az/El and MI6111 rotary positioner (see fig.2, left). The Az/El accuracies are respectively 0.03° and 0.05° with max load 1136 kg and bending moment 3390 N·m; the roll accuracy is 0.05° with max load 455 kg and bending moment 678 N·m. As a practical guideline, the system can measure antennas up to 2m in size and to 70 kg in weight: actual limits depend however on the shape of the antenna. This positioning system allows to take pattern cuts as well as raster scan of the pattern, and to measure circular and linear polarization.. Examples of measured radiation patterns are shown in fig. 3. The full system cabling diagram is shown in fig. 4.

As source antennas standard gain horns are used. Measurement accuracy for secondary lobe is estimated in about in ± 1 dB; for gain in about ± 0.5 dB



Fig.2: Outdoor test range: the AUT mount (left) and the upper SRC mount (right).

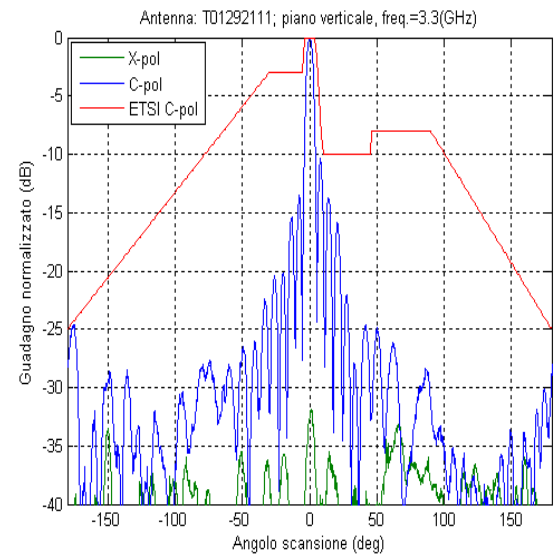
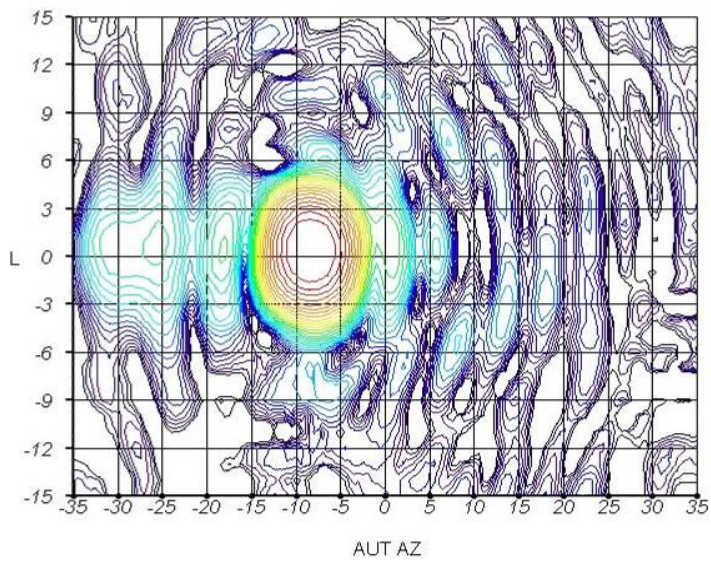


Fig.3: Examples of radiation patterns measured in the Outdoor Test Range.

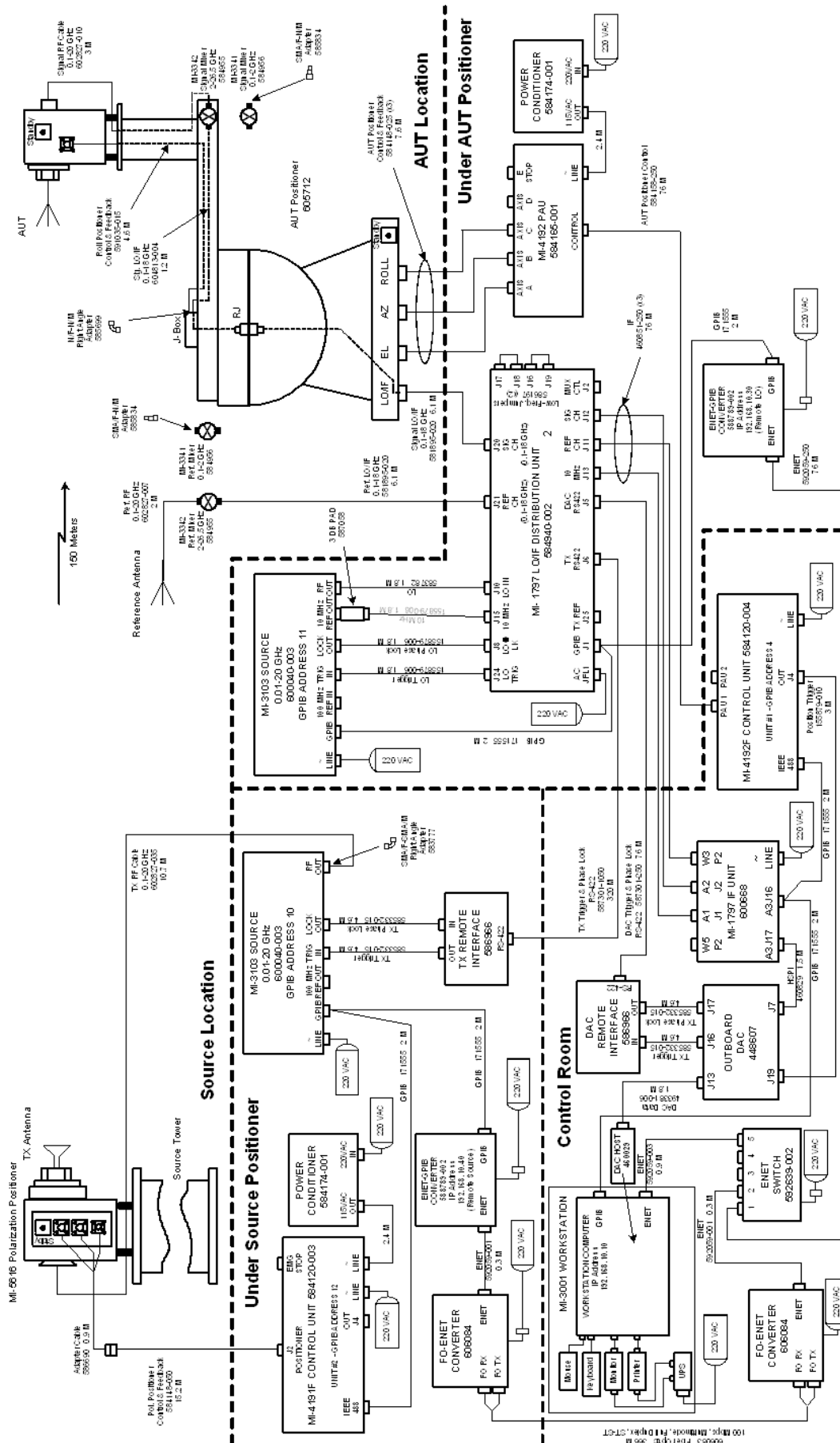


Fig.4: The full system cabling diagram.

3. MEASUREMENTS PROCEDURES

3.1 Gain measurement

The standard procedure for this type of measurement is the “substitution method”. The Antenna Under Test (AUT) operates in reception. The maximum signal level received (at all ports) from the AUT, pointed with the maximum to the source antenna, is measured, with a frequency sweep in the required frequency band. Then the AUT is replaced by a Standard Gain Horn antenna (SGH) with known gain, with the maximum to the source antenna, and again the maximum signal level received from is recorded. The Gain of the AUT is derived from the simple formula (in dB)

$$G_{AUT} = G_{SGH} + (P_{rAUT} - P_{rSGH})$$

The gain vs frequency is plotted in Cartesian plot, in dB scale.

3.2. Radiation pattern measurements

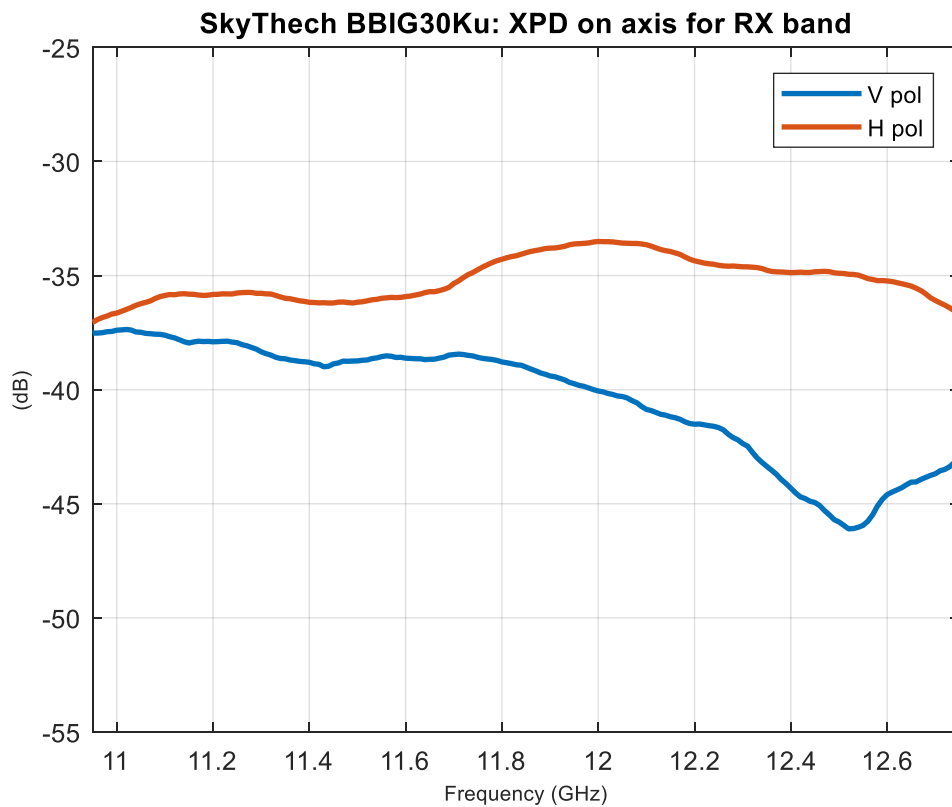
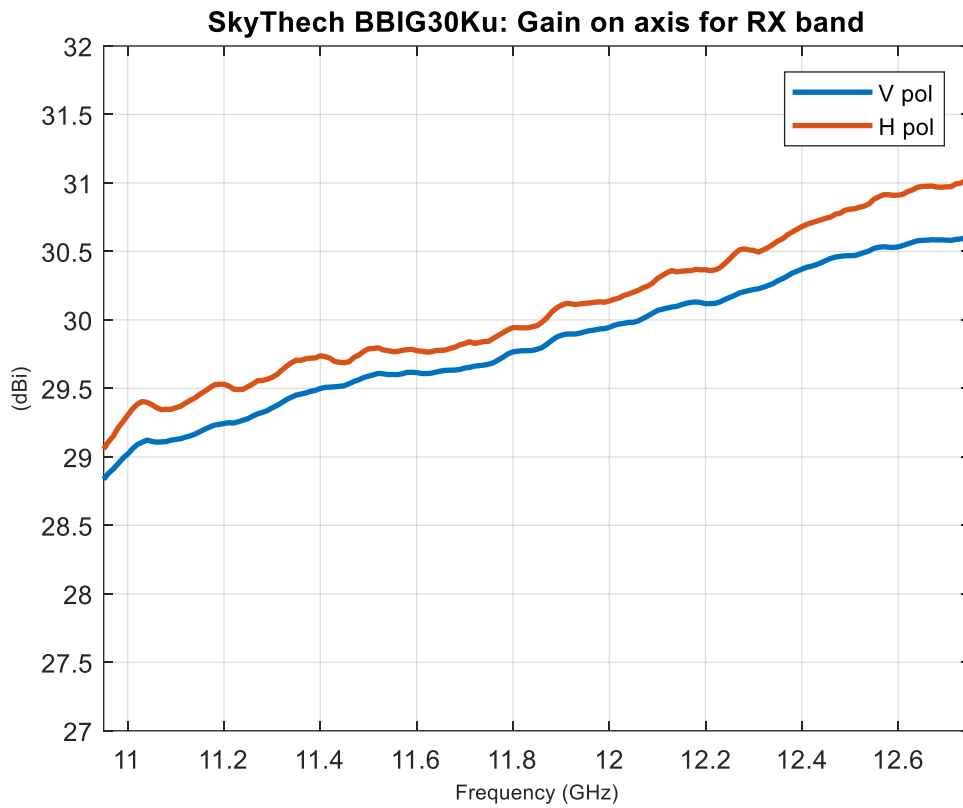
Since the patterns are required in various phi-cuts (azimuth, elevation) as well as in a raster scan around the main beam, the standard procedure is to measure, at discrete frequencies, the received power from the AUT from each port, when transmitting from the source three different linear polarizations (V and H). The radiation patterns are plotted in dB scale, in the desired angular range.

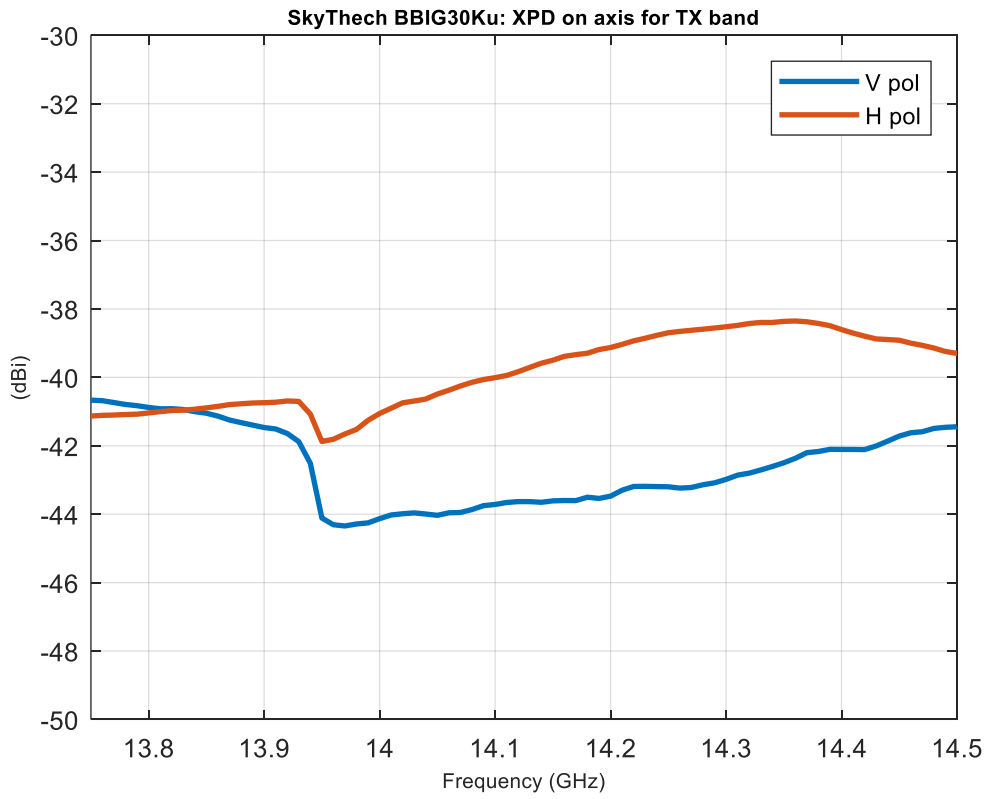
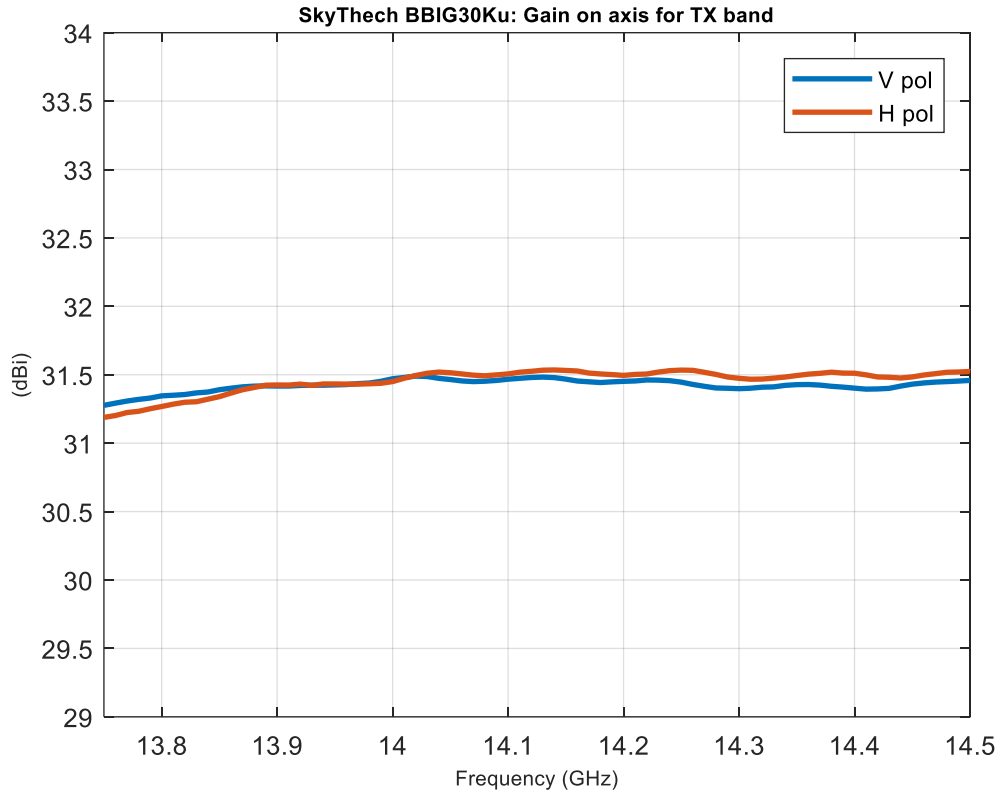
4. Pictures of the measurement campaign.



Fig.5: Antenna BBIG30Ku tested.

5. Gain and XPD measurements , TX / RX Bands.

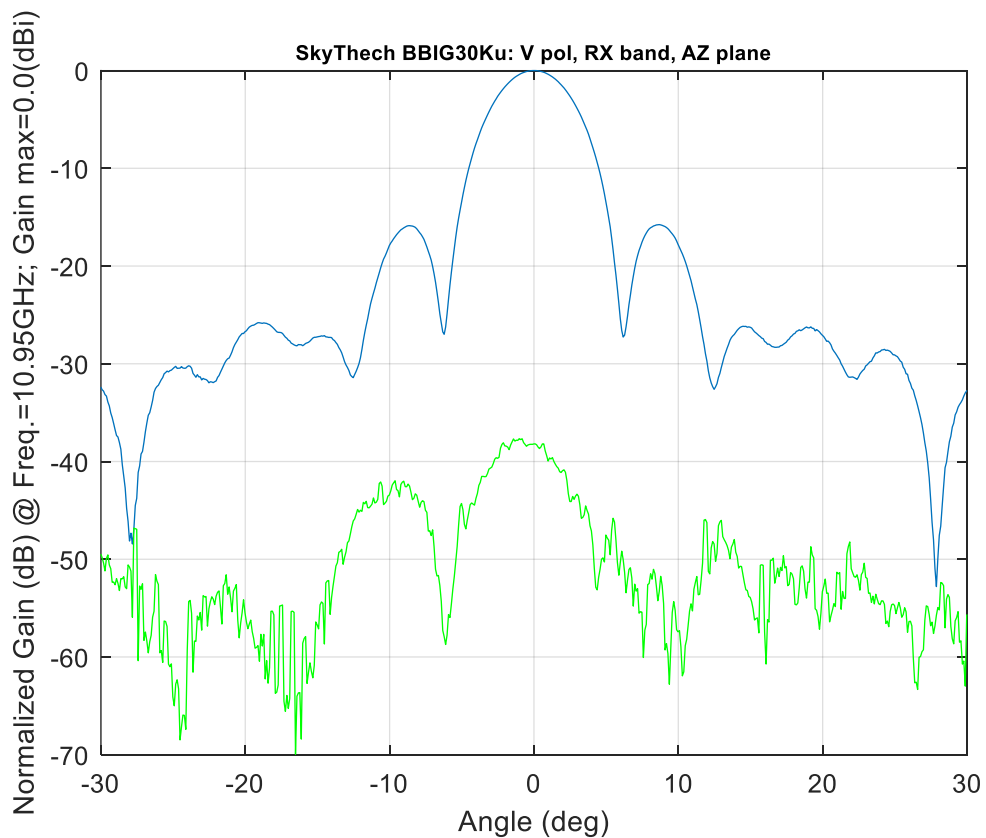
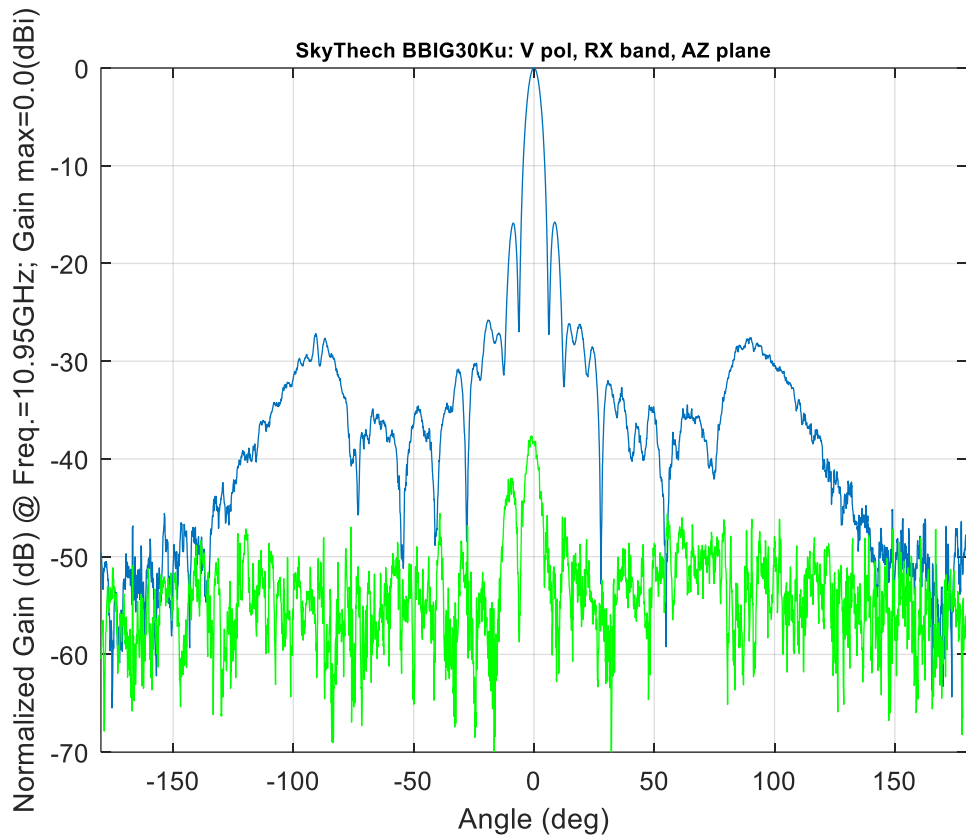


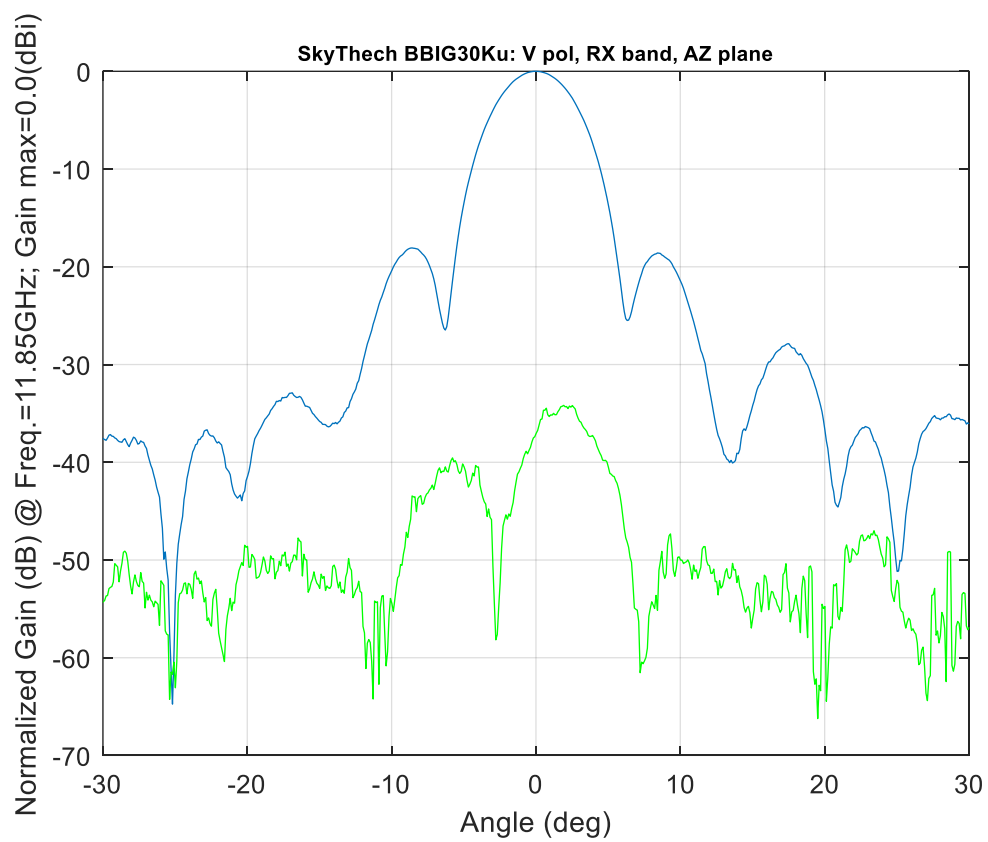
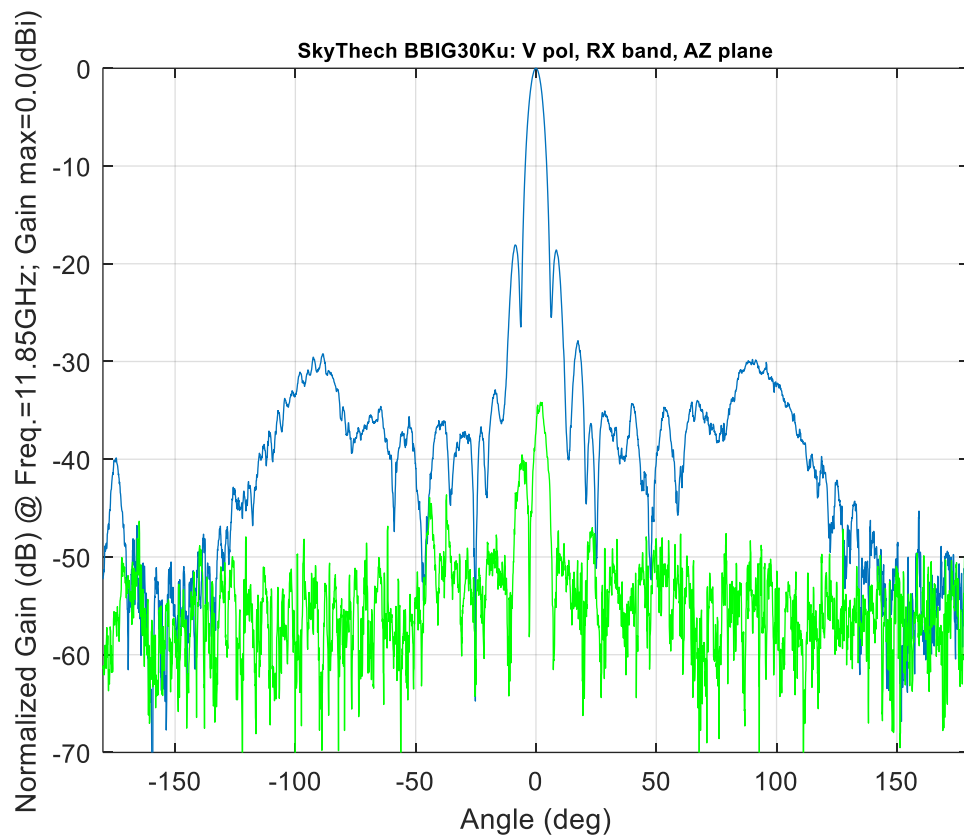


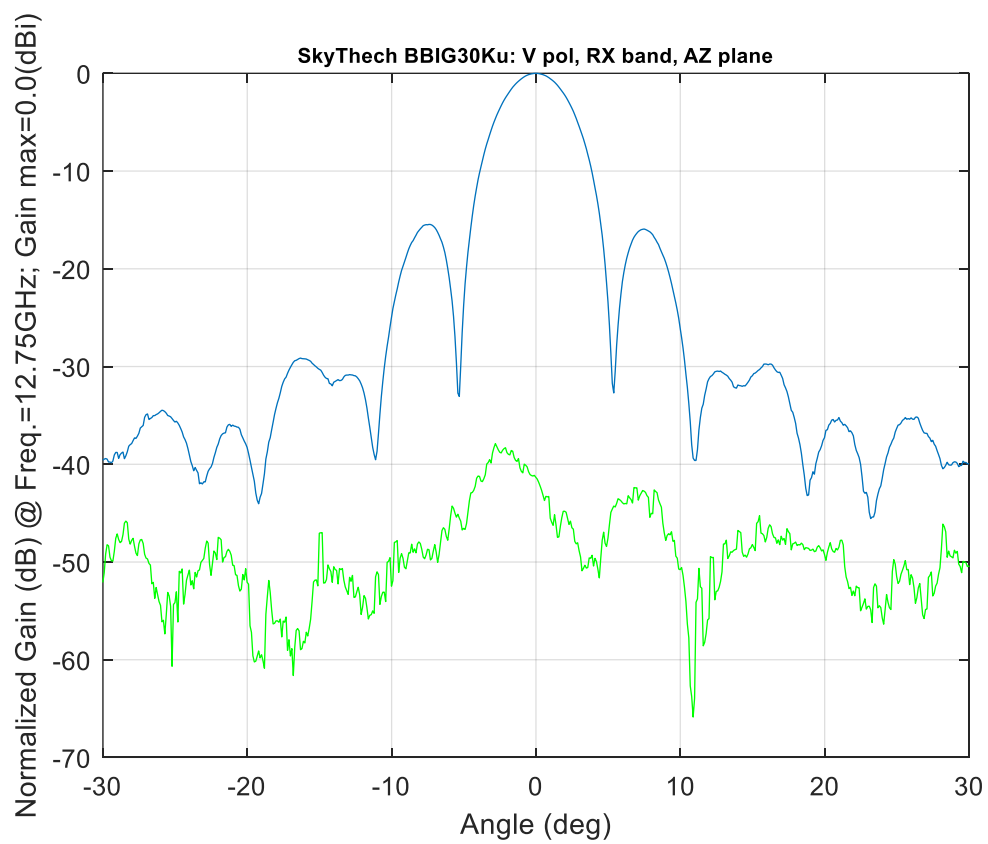
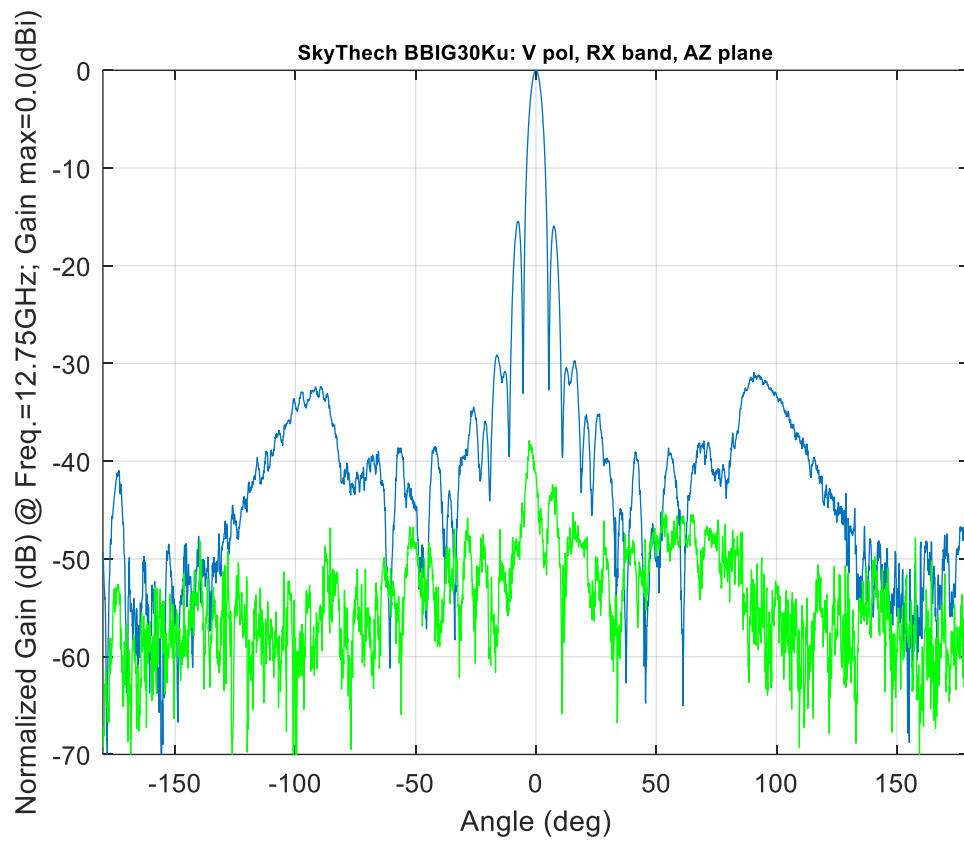
6. Radiation Pattern Measurements.

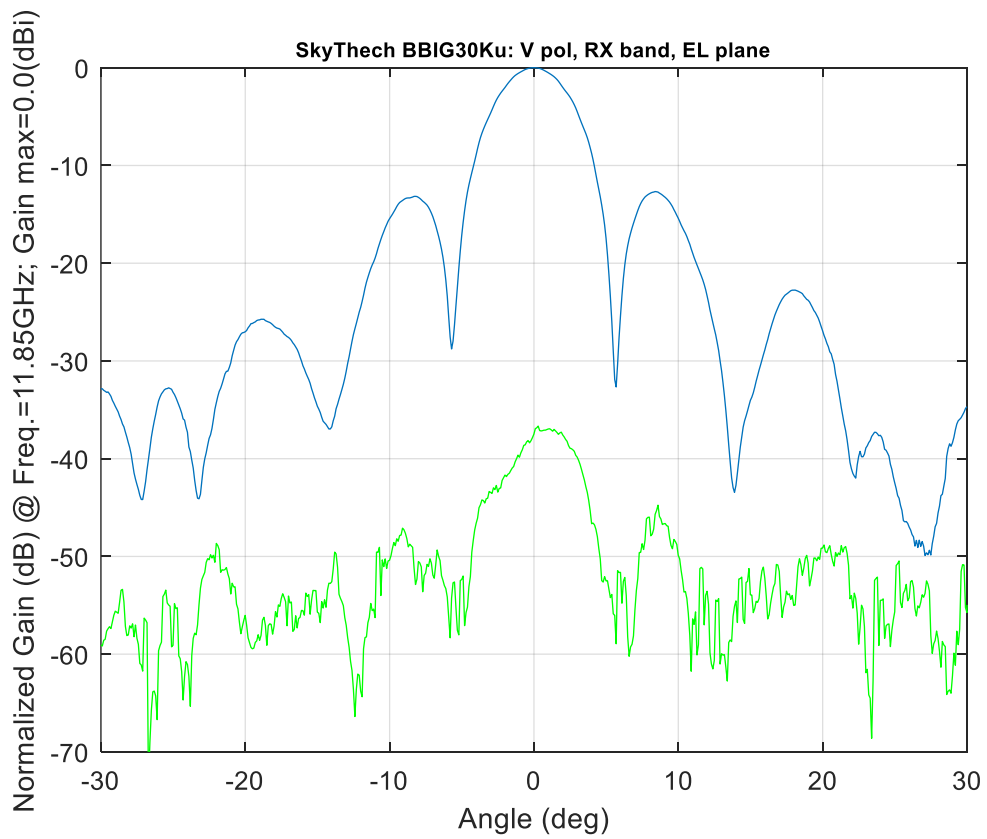
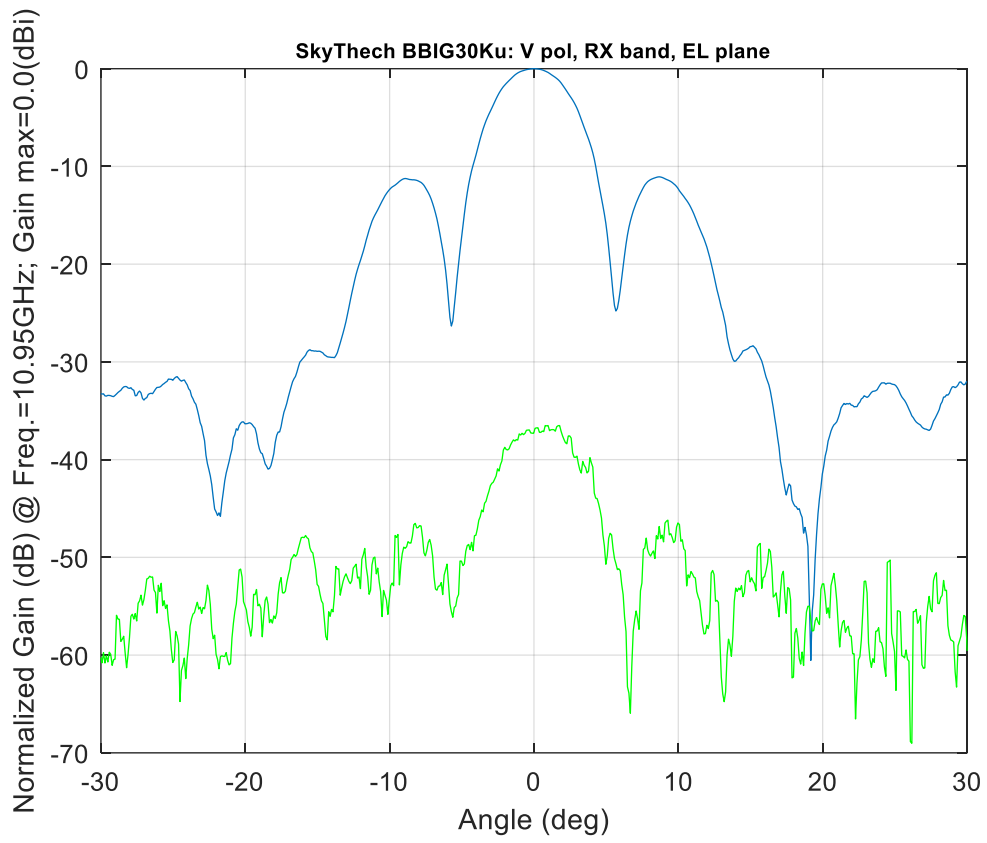
6.1: Radiation patterns in RX band (10.95-12.75 GHz).

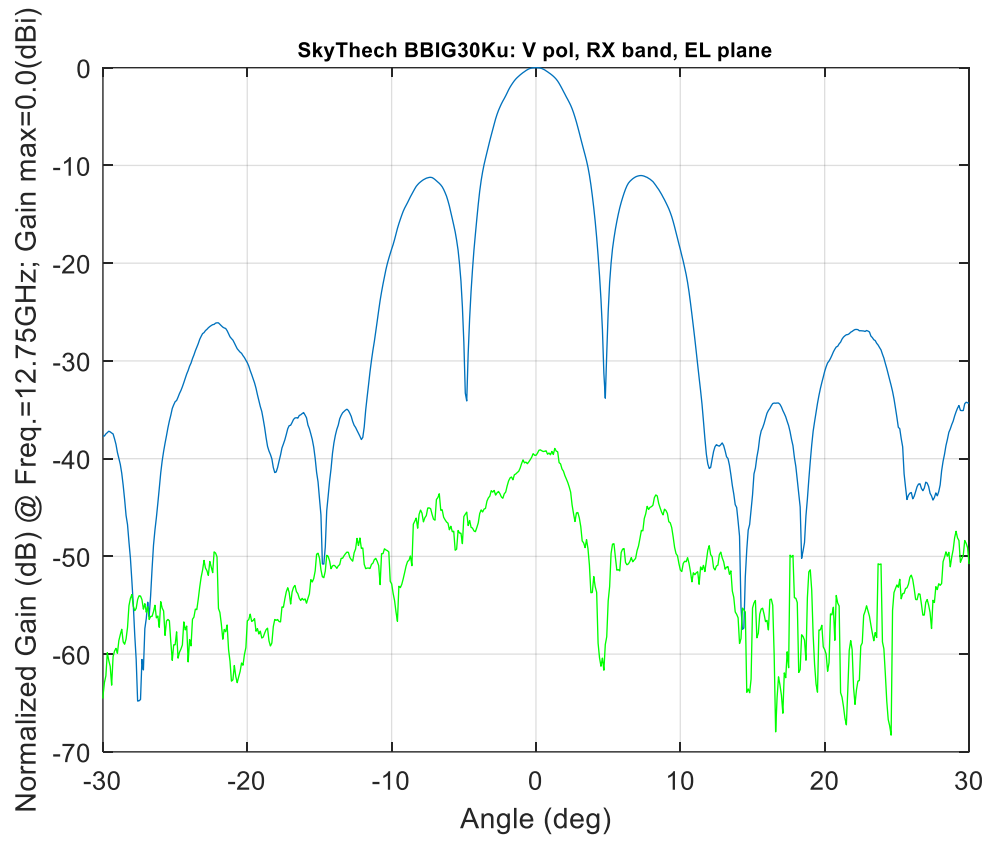
6.1.1: V-pol, AZ and EL plane plots.



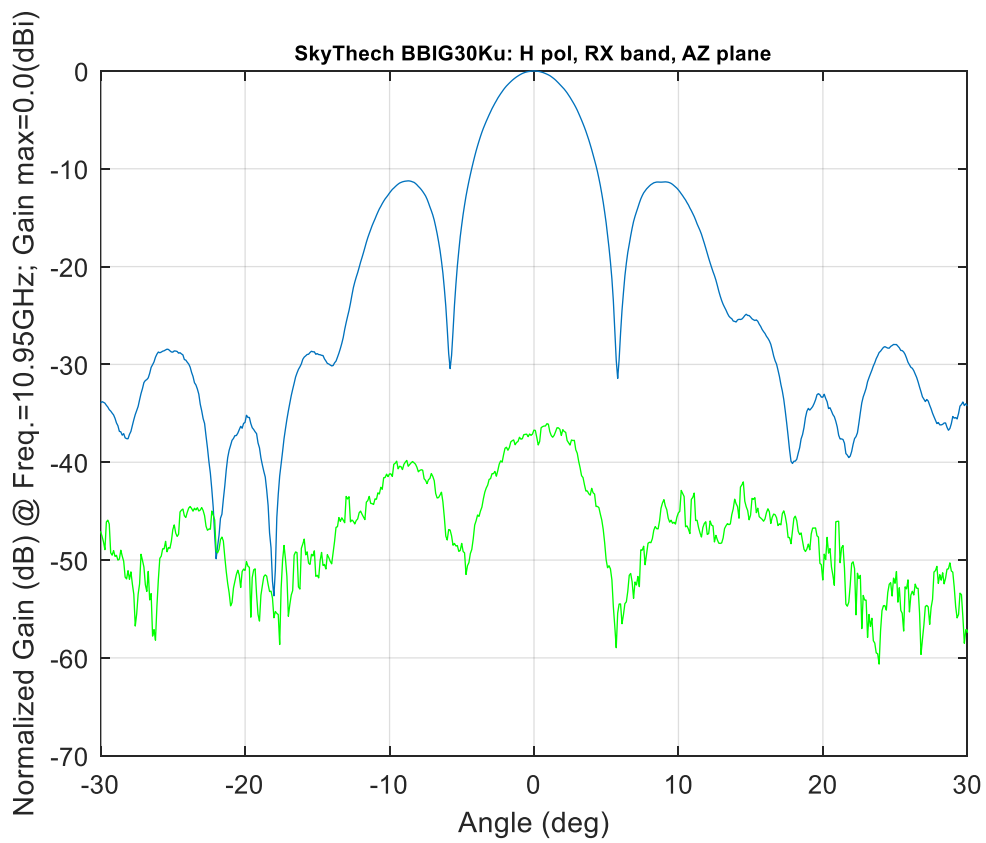
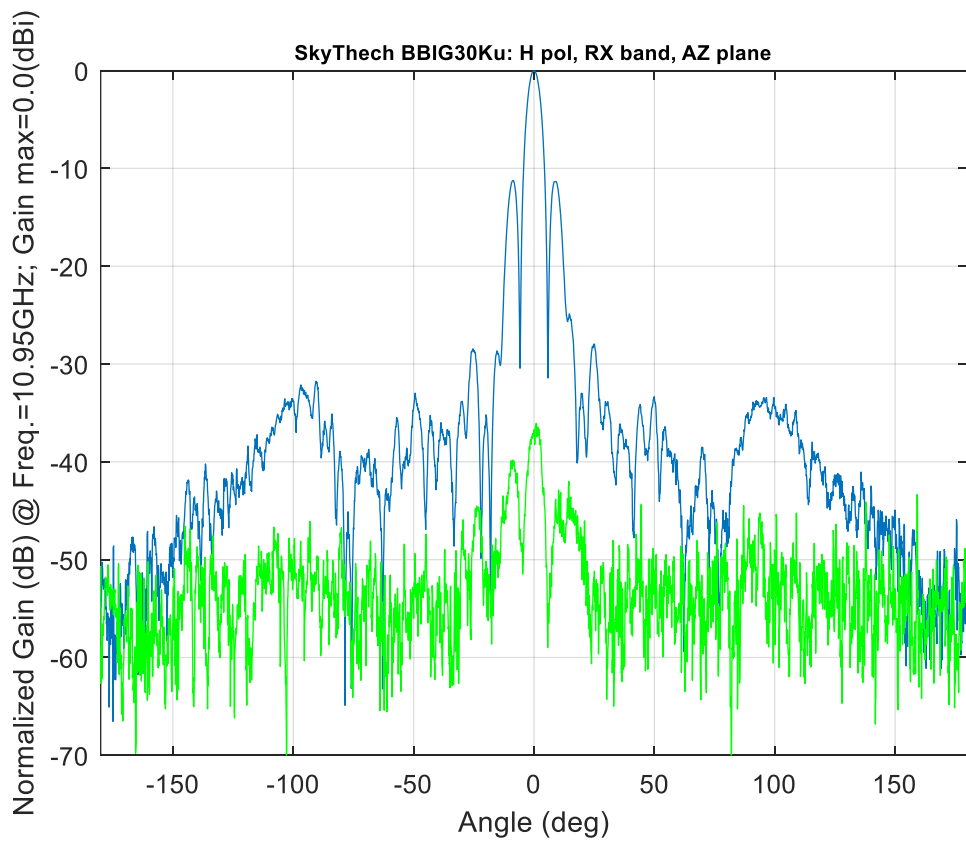


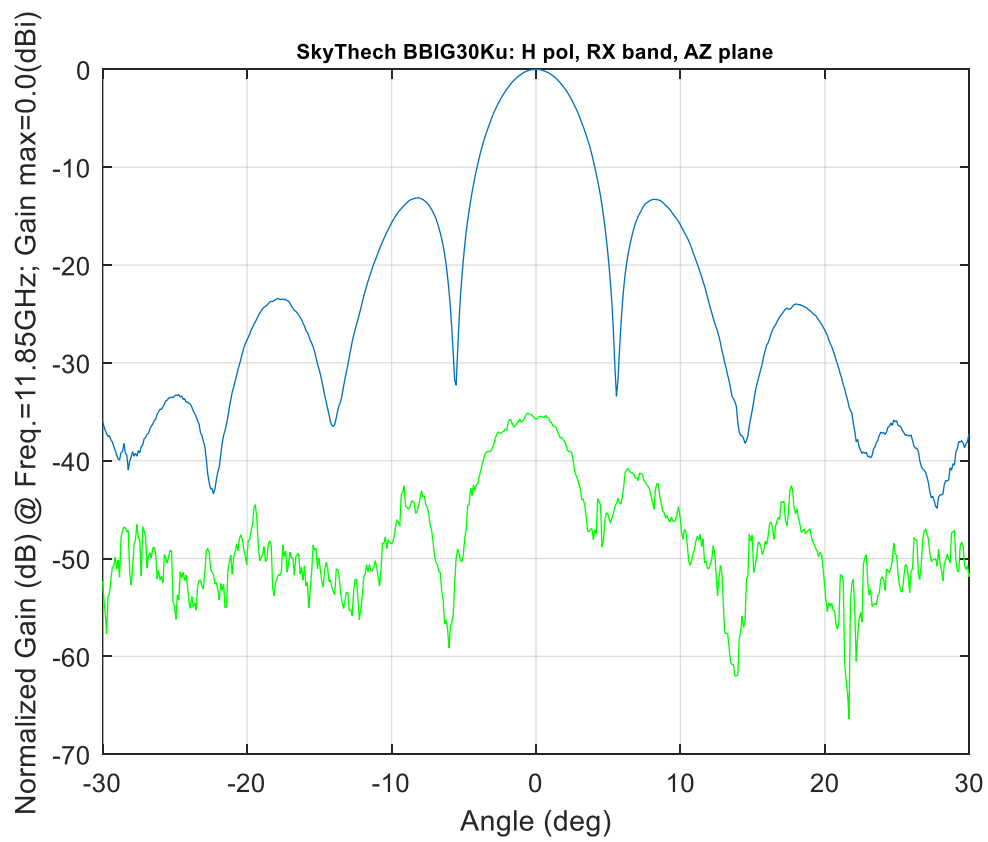
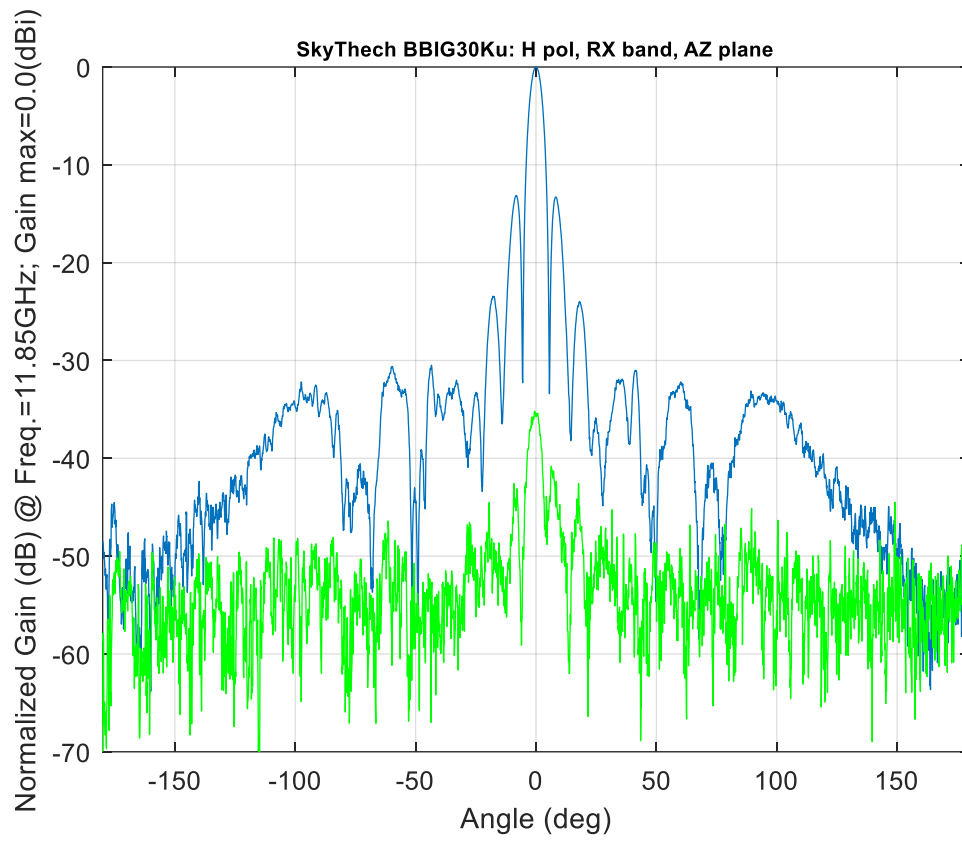


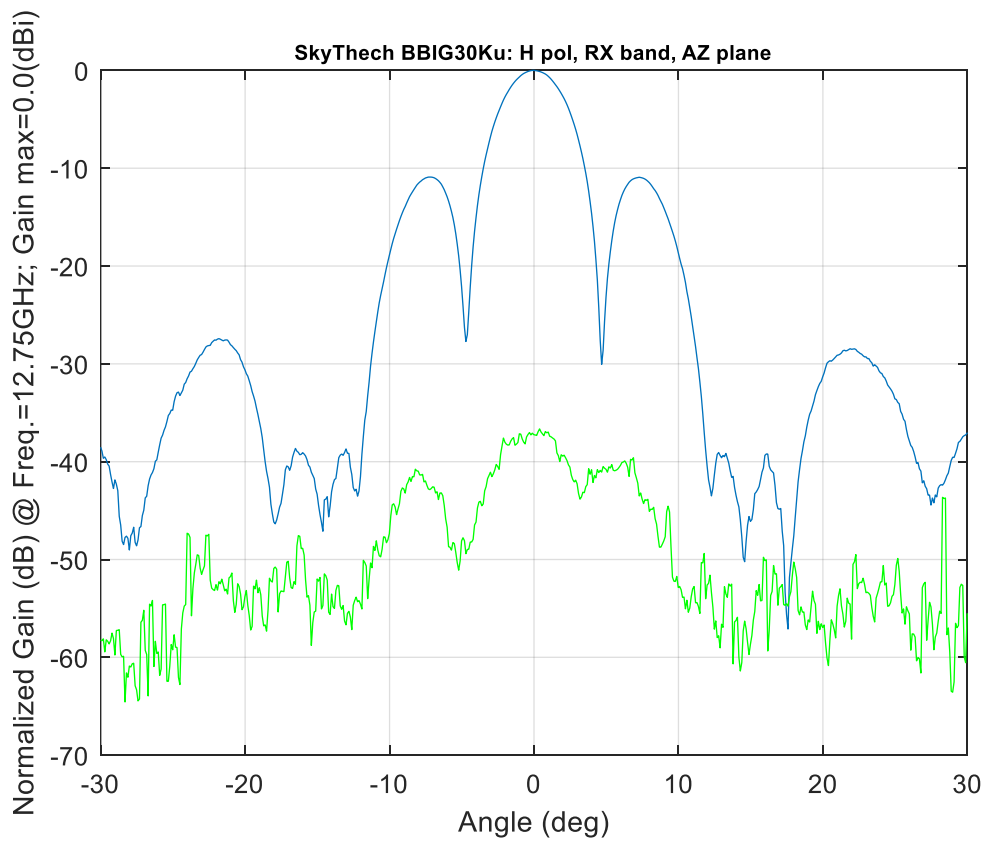
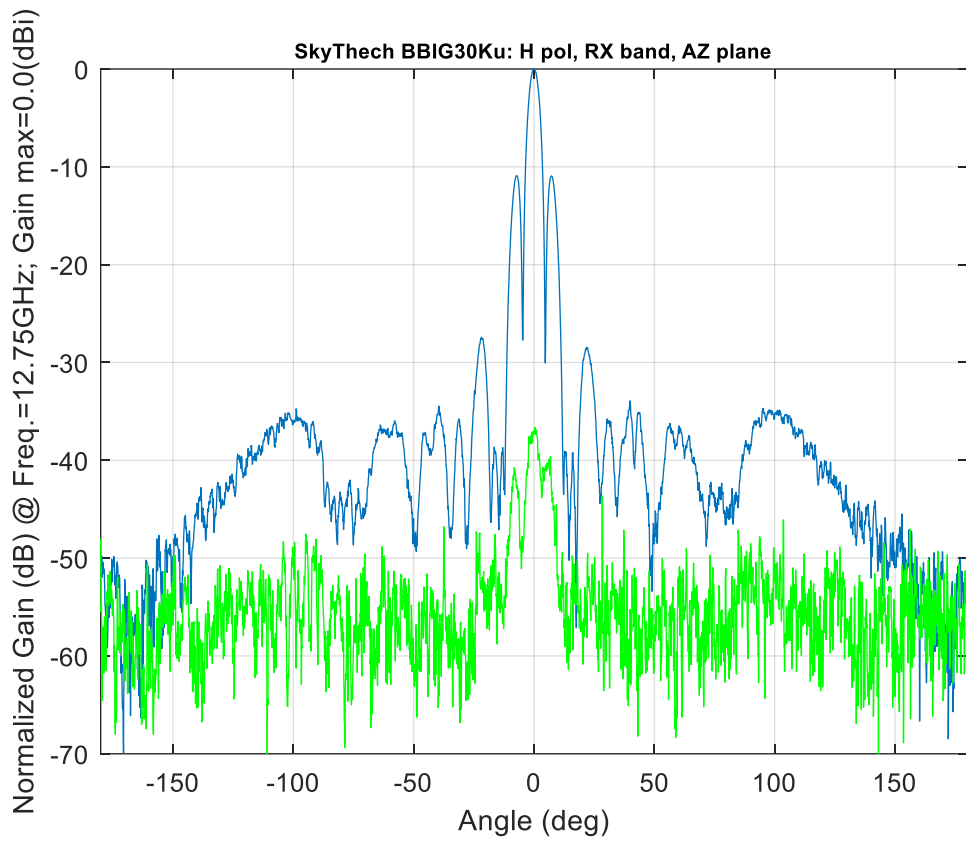


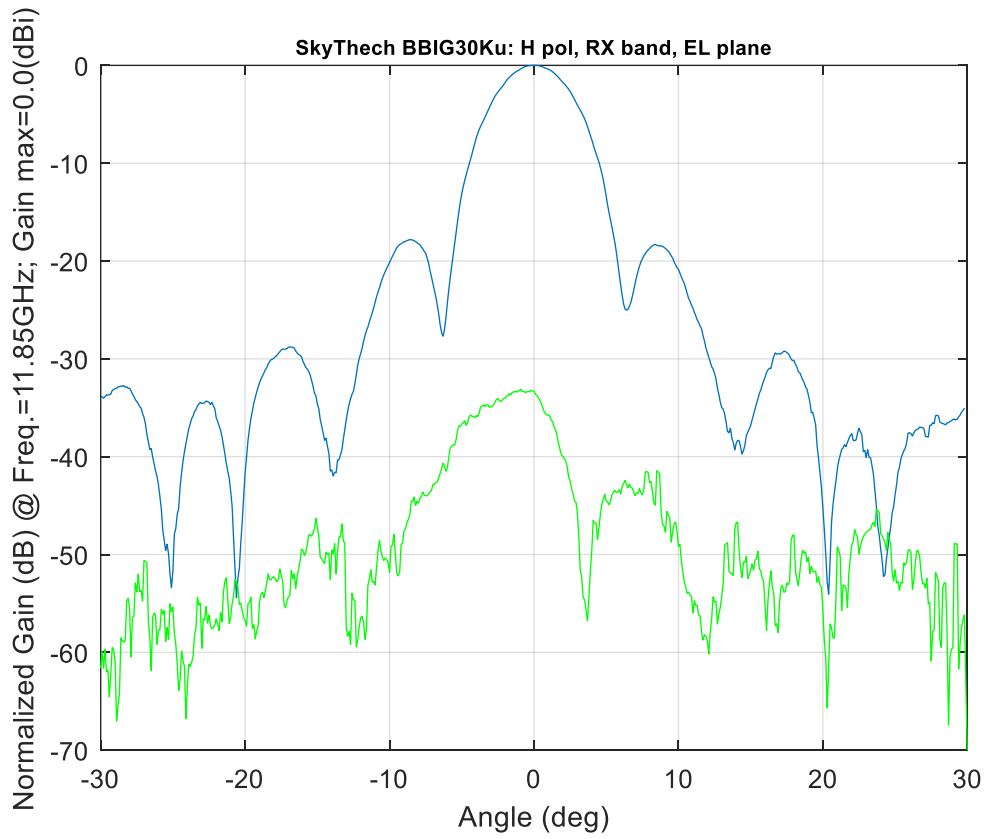
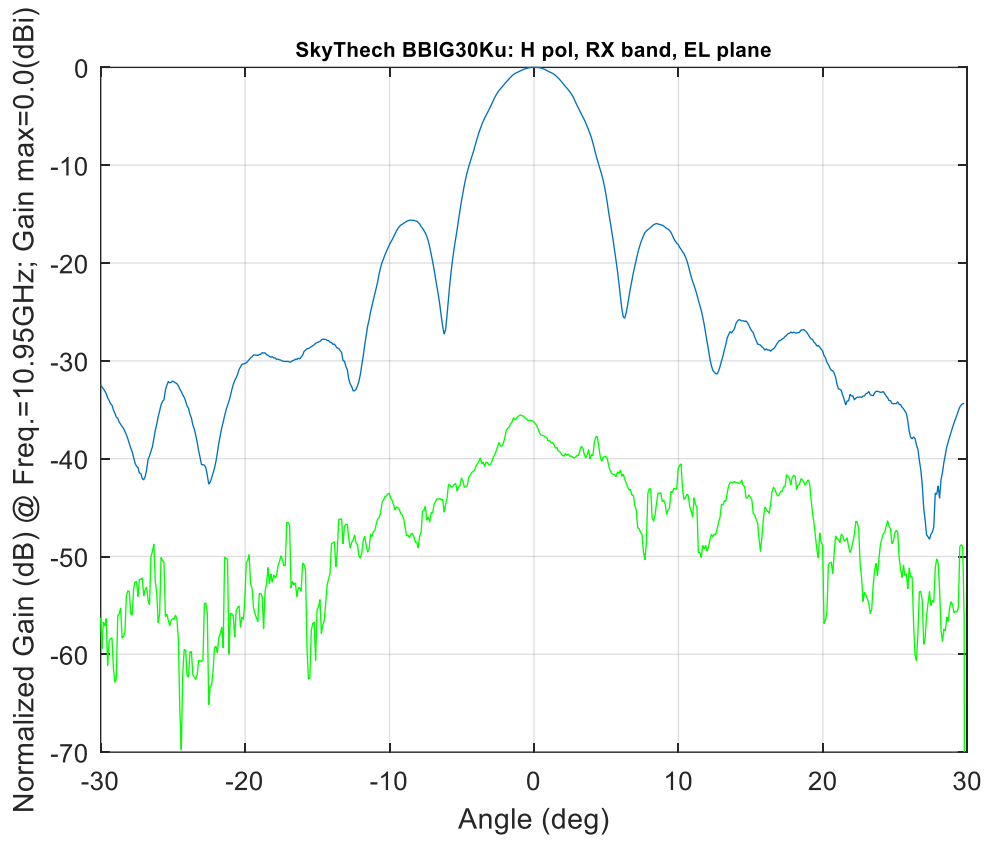


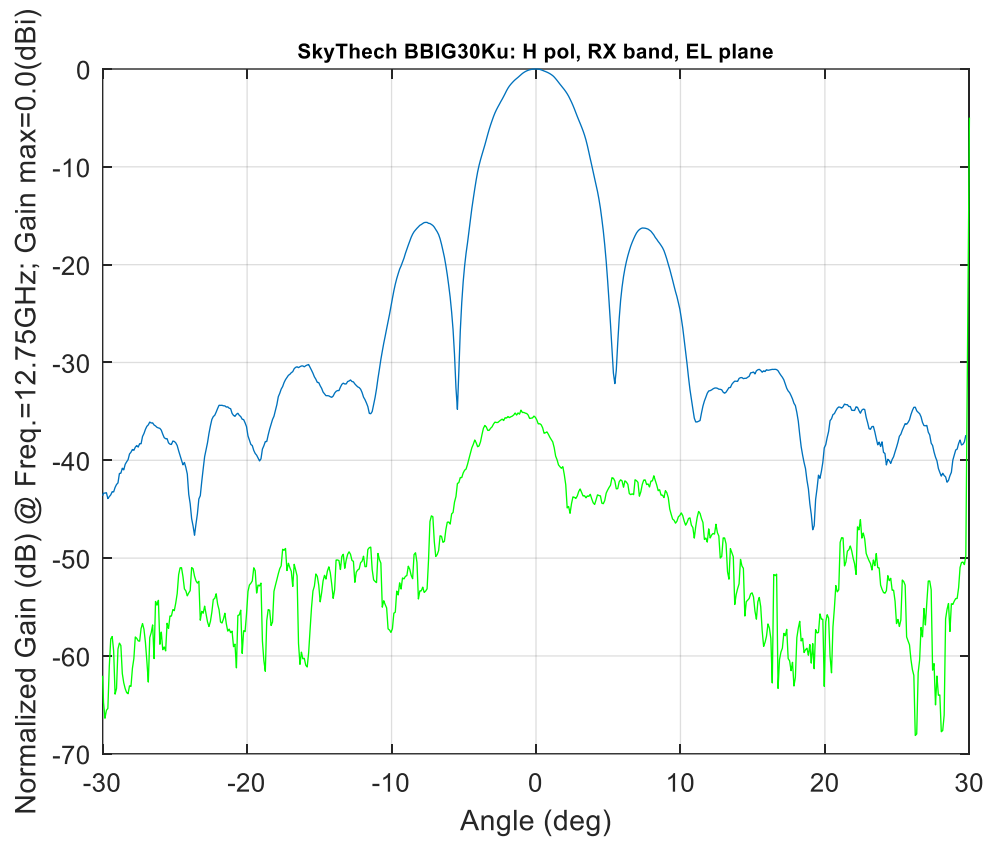
6.1.2: H-pol, AZ and EL plane plots.





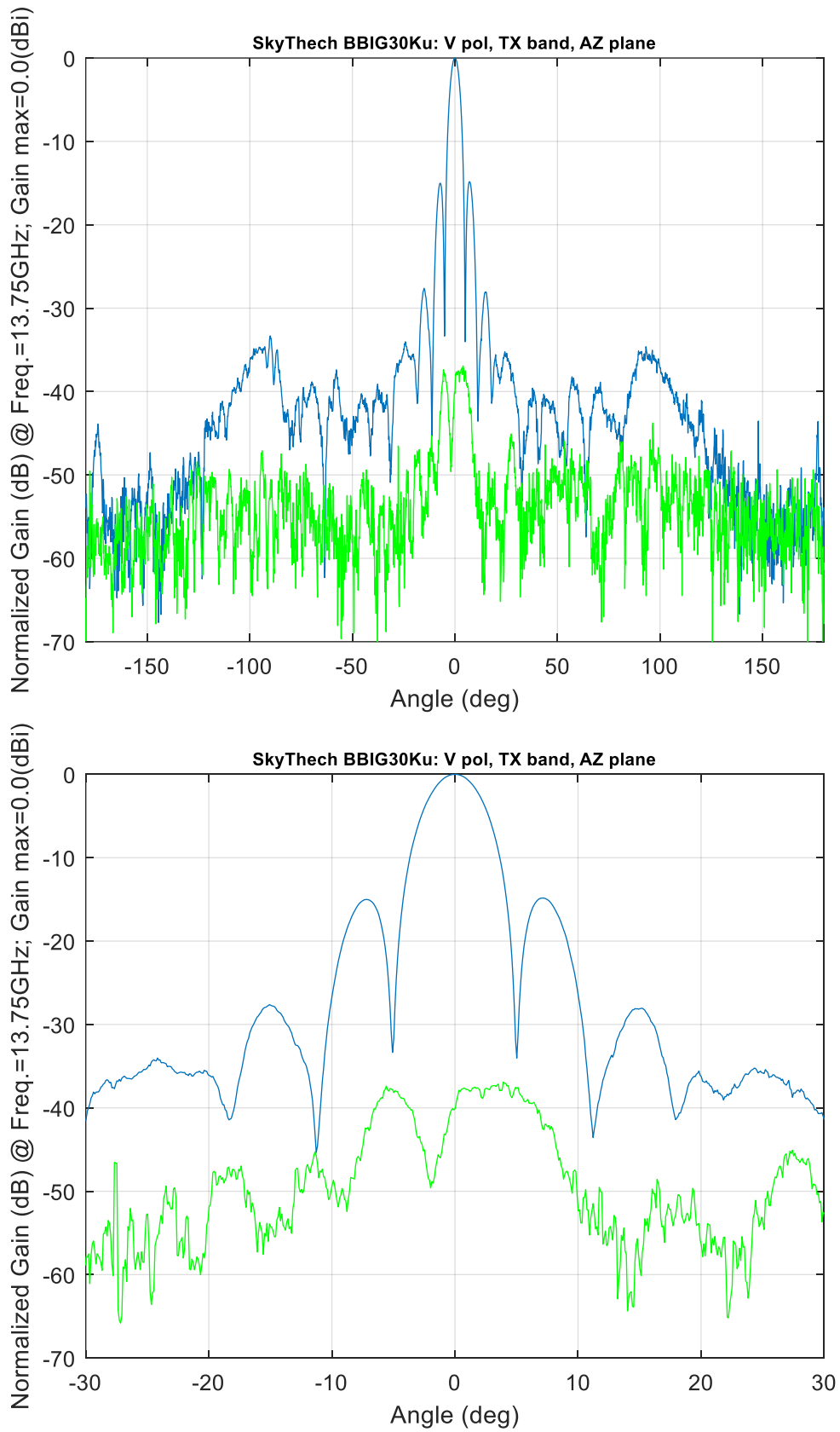


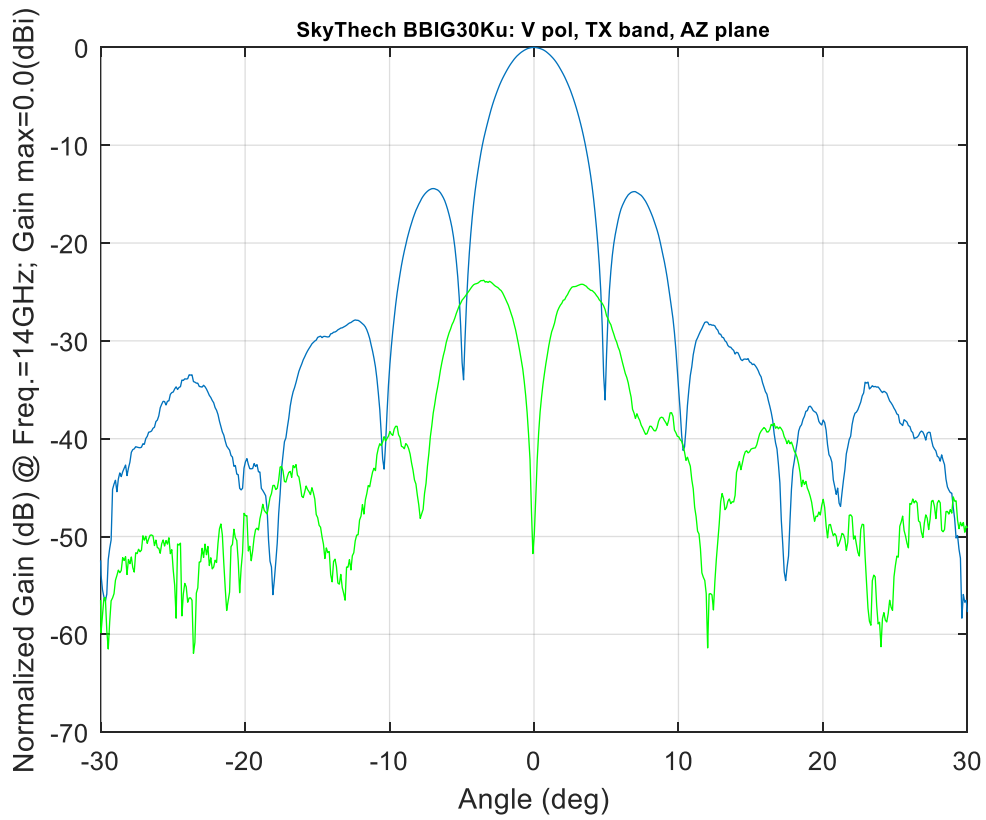
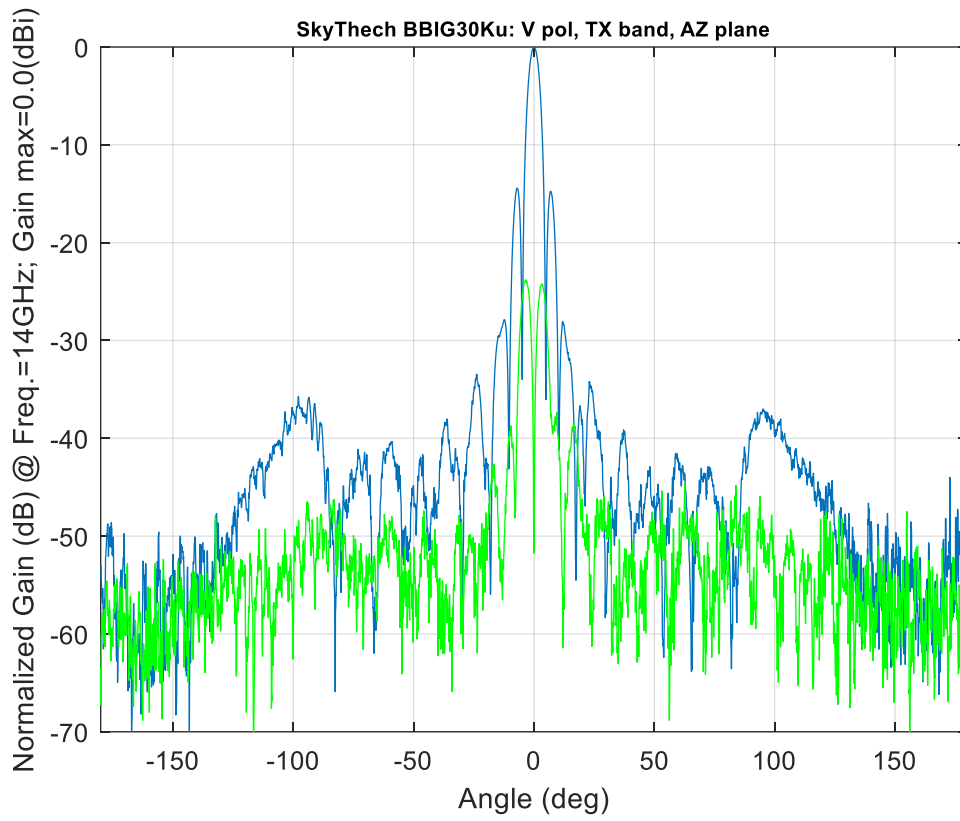


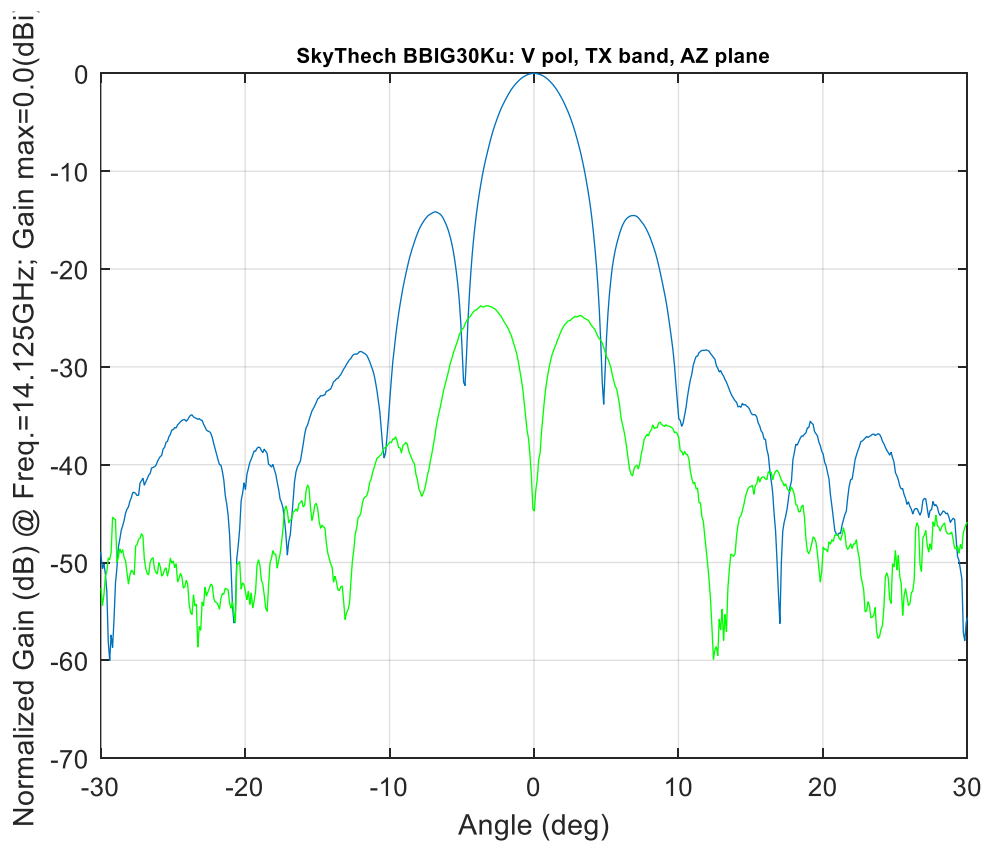
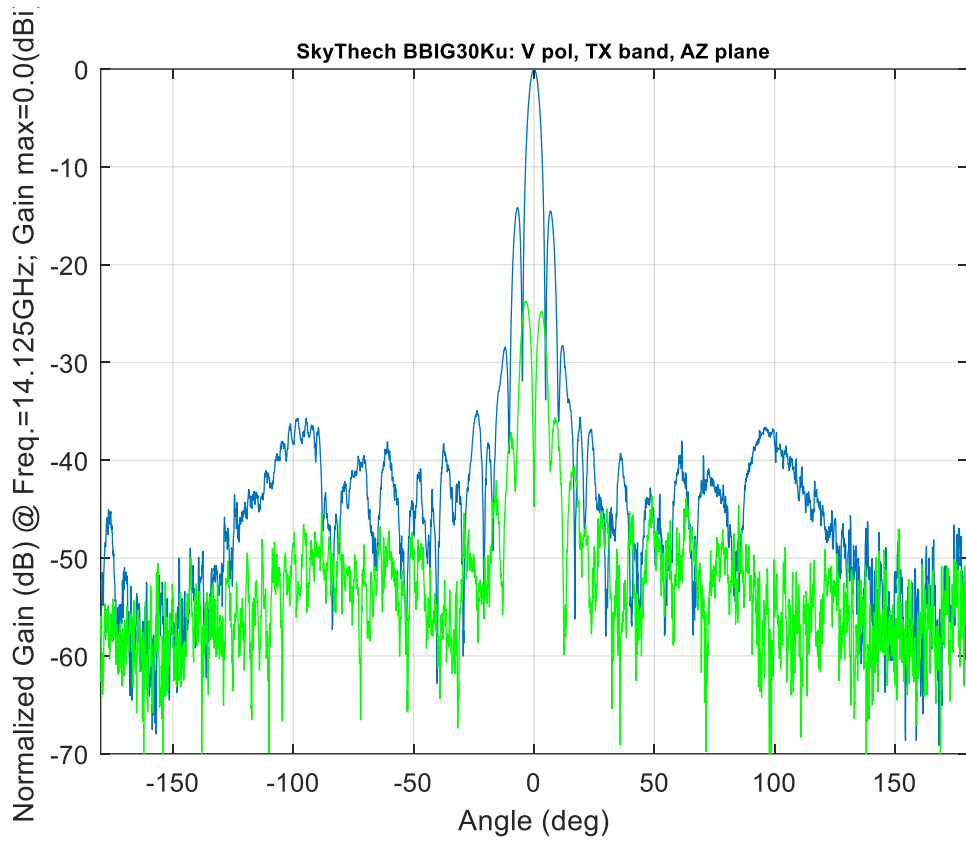


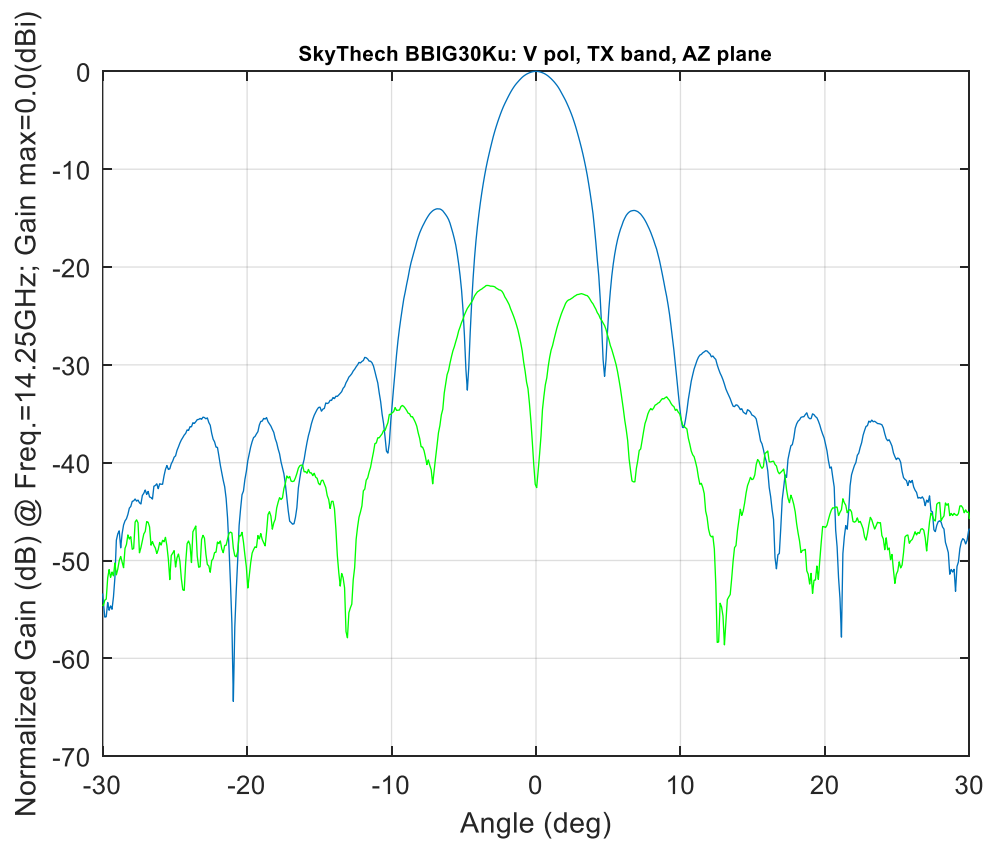
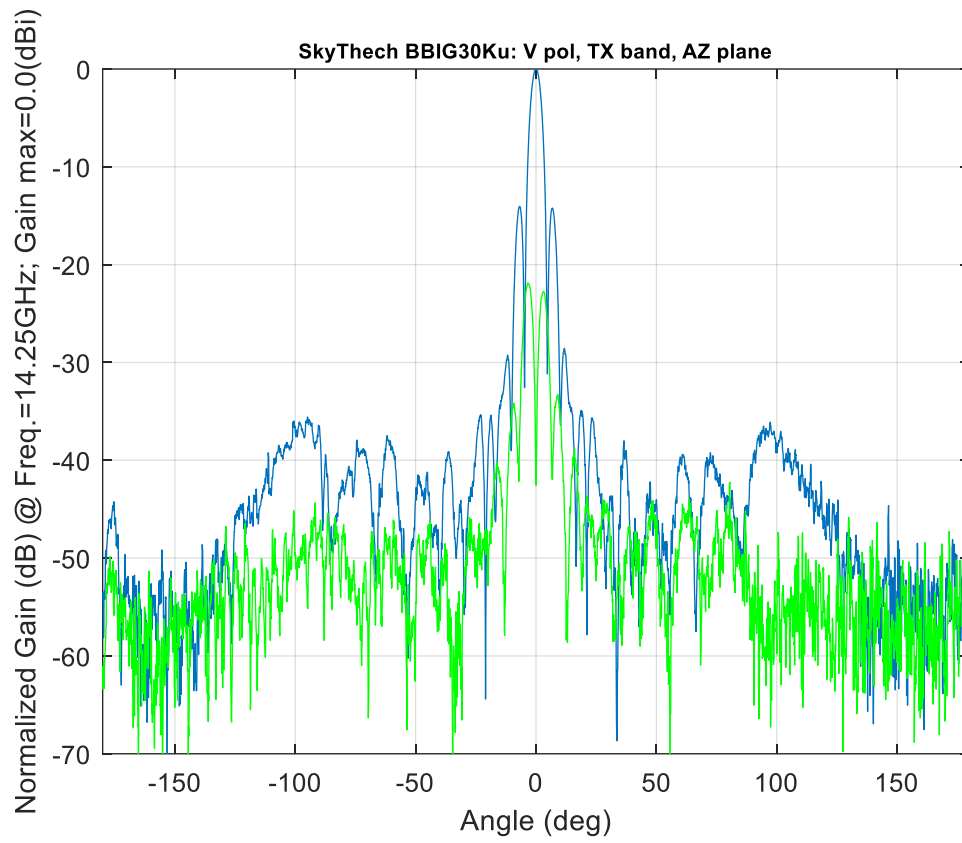
6.2: Radiation patterns in TX band (13.75-14.5 GHz).

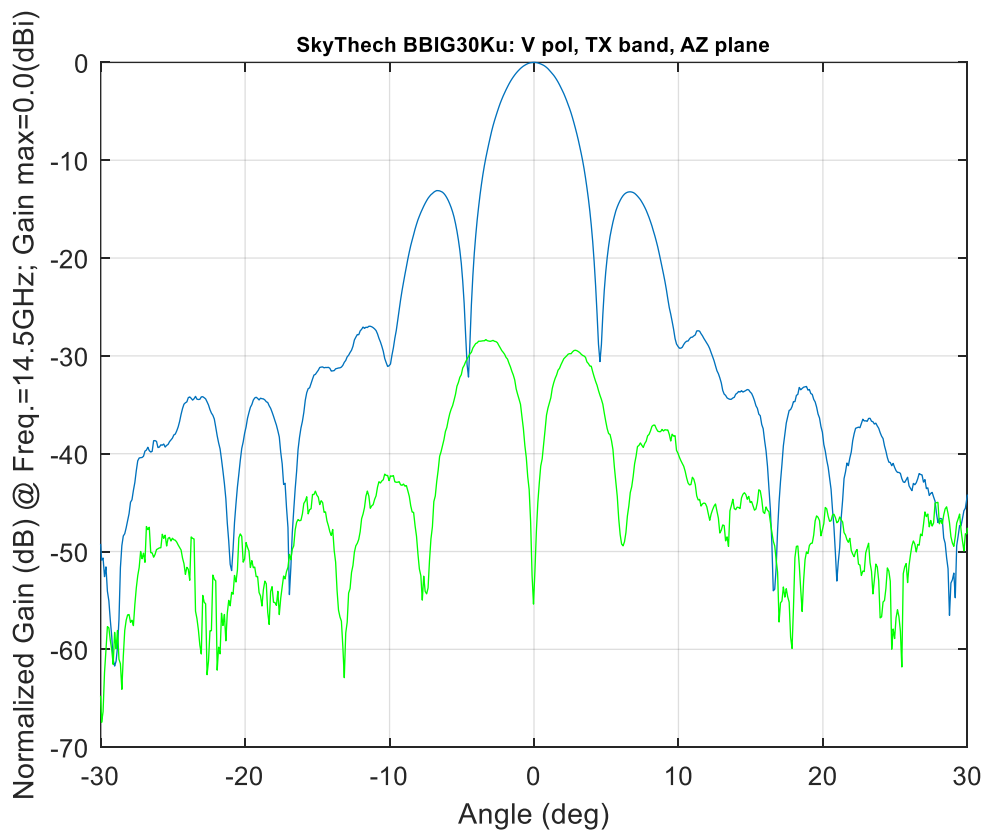
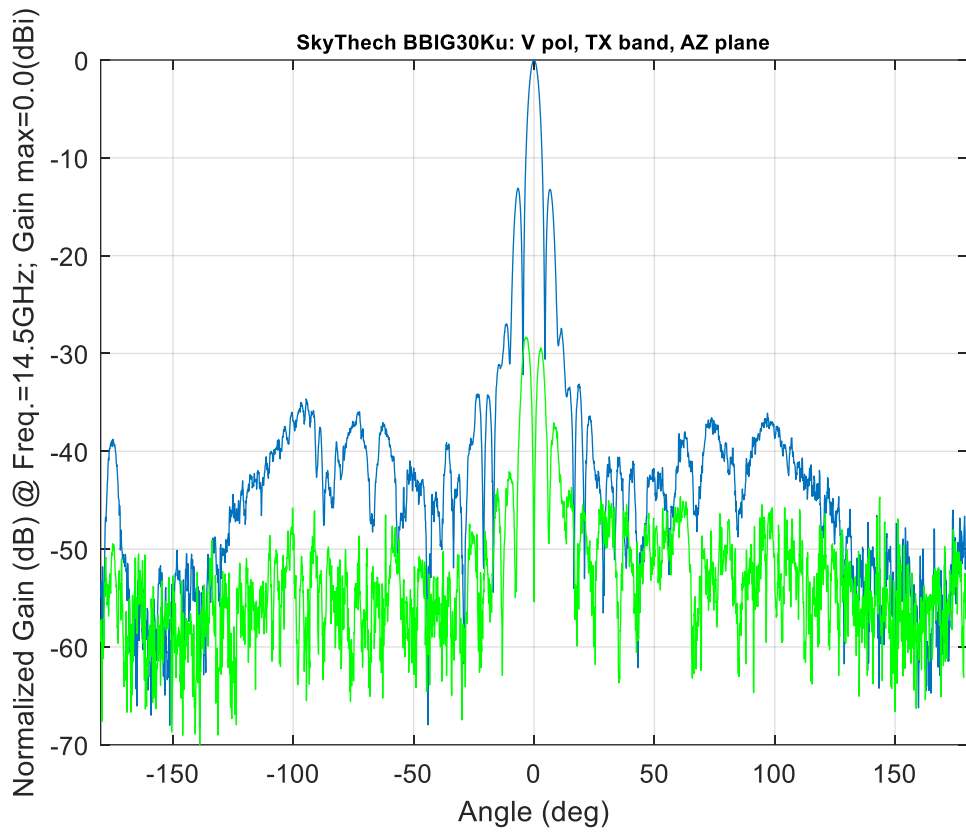
6.2.1: V-pol, AZ and EL plane plots.

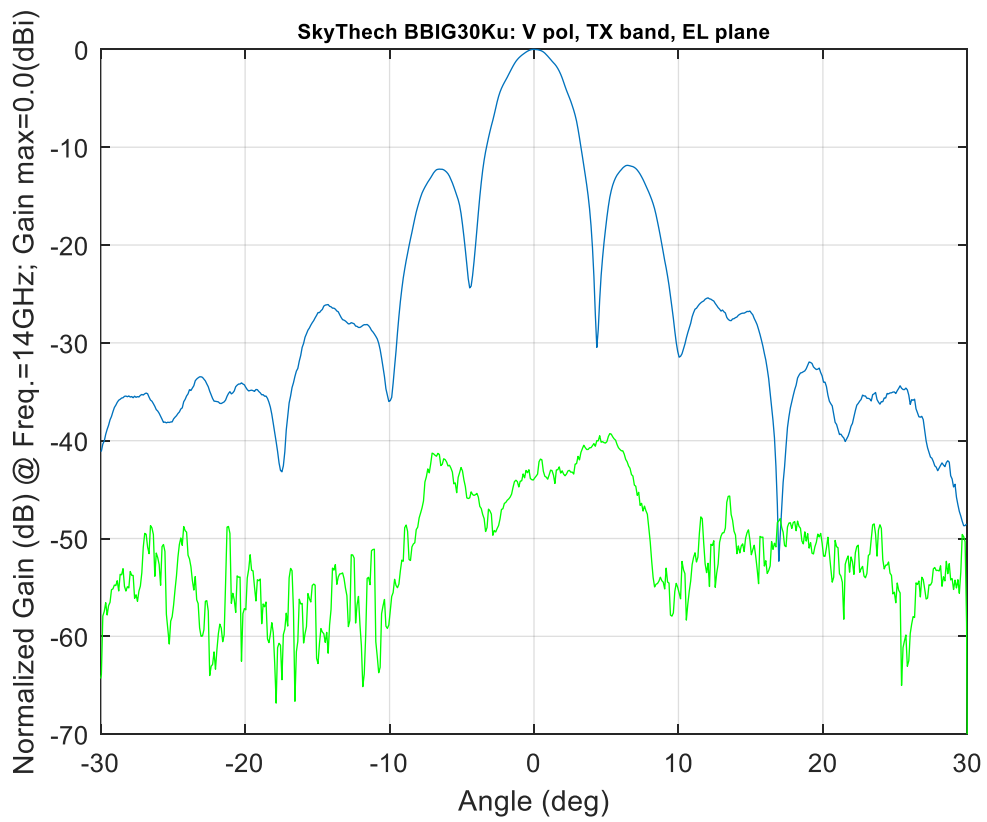
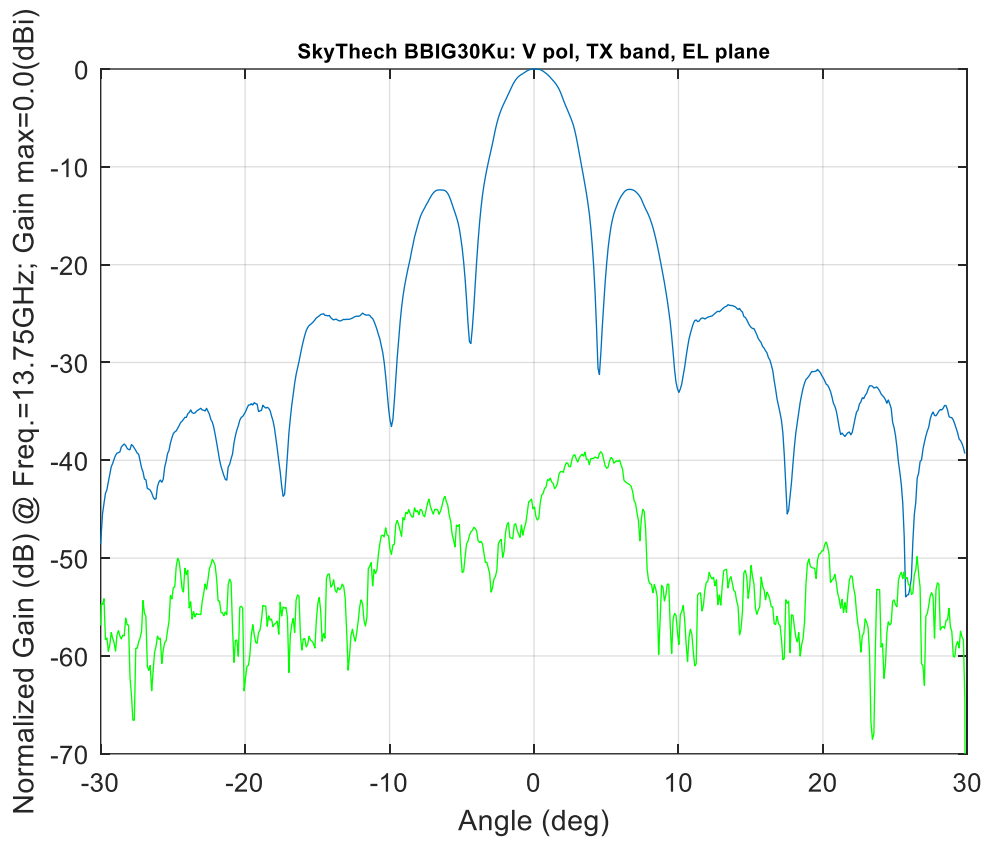


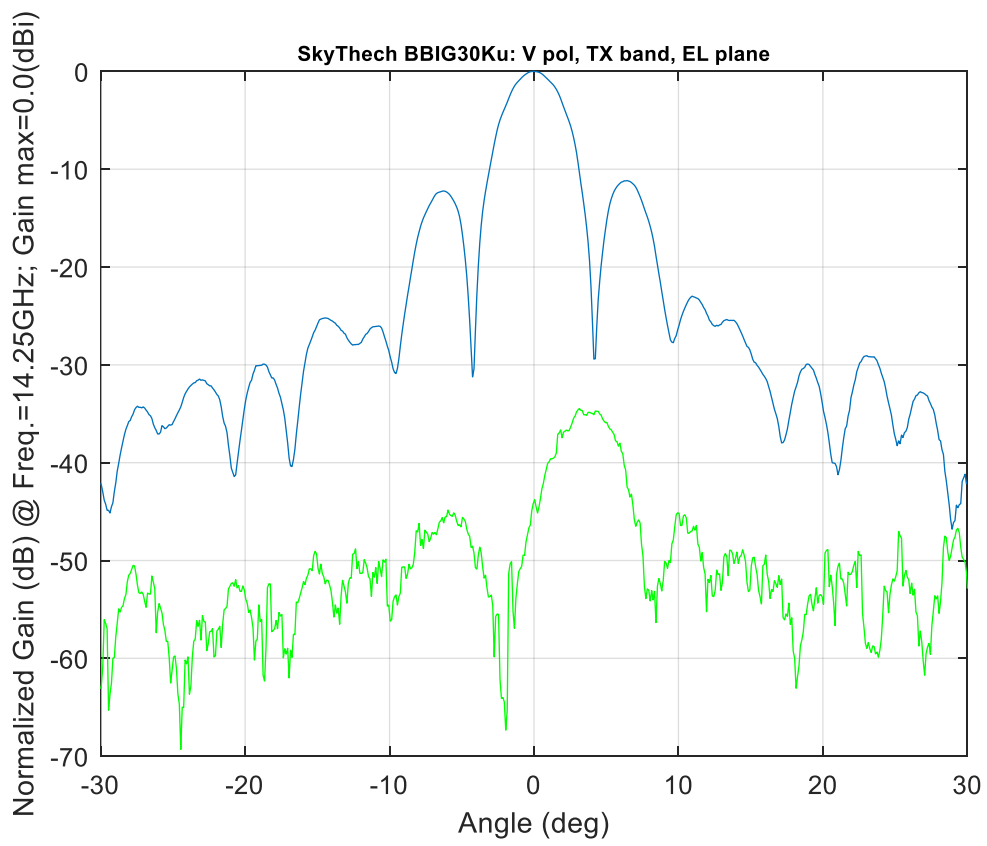
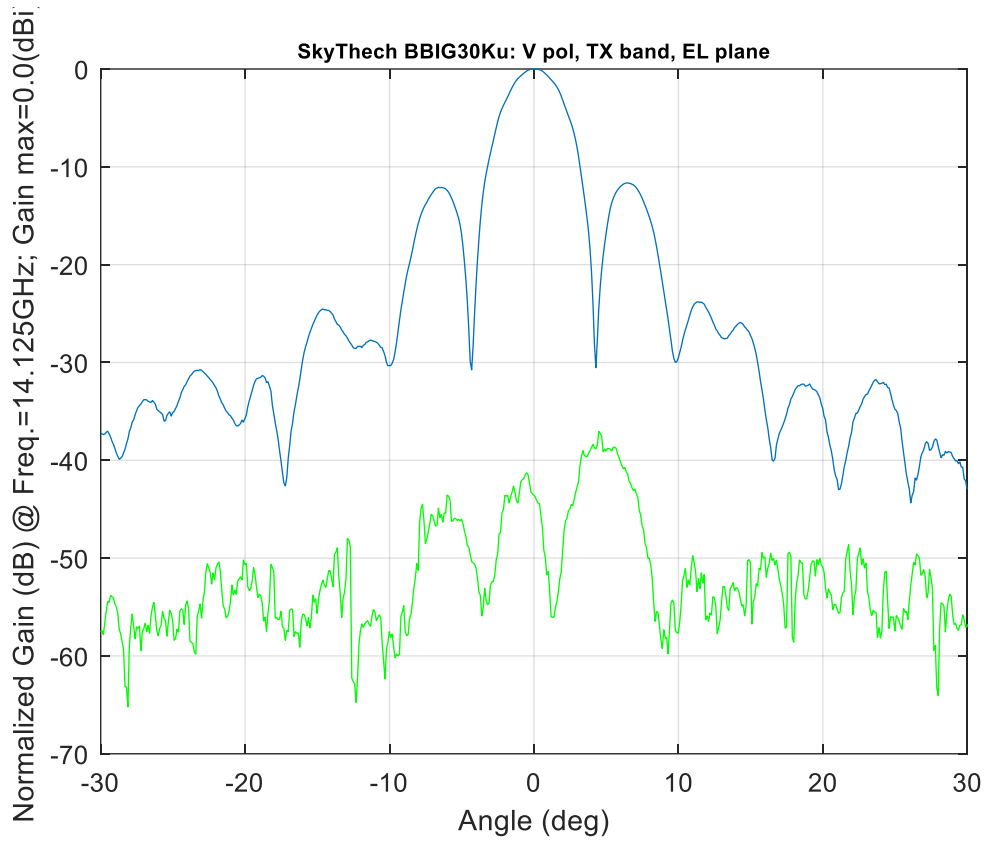


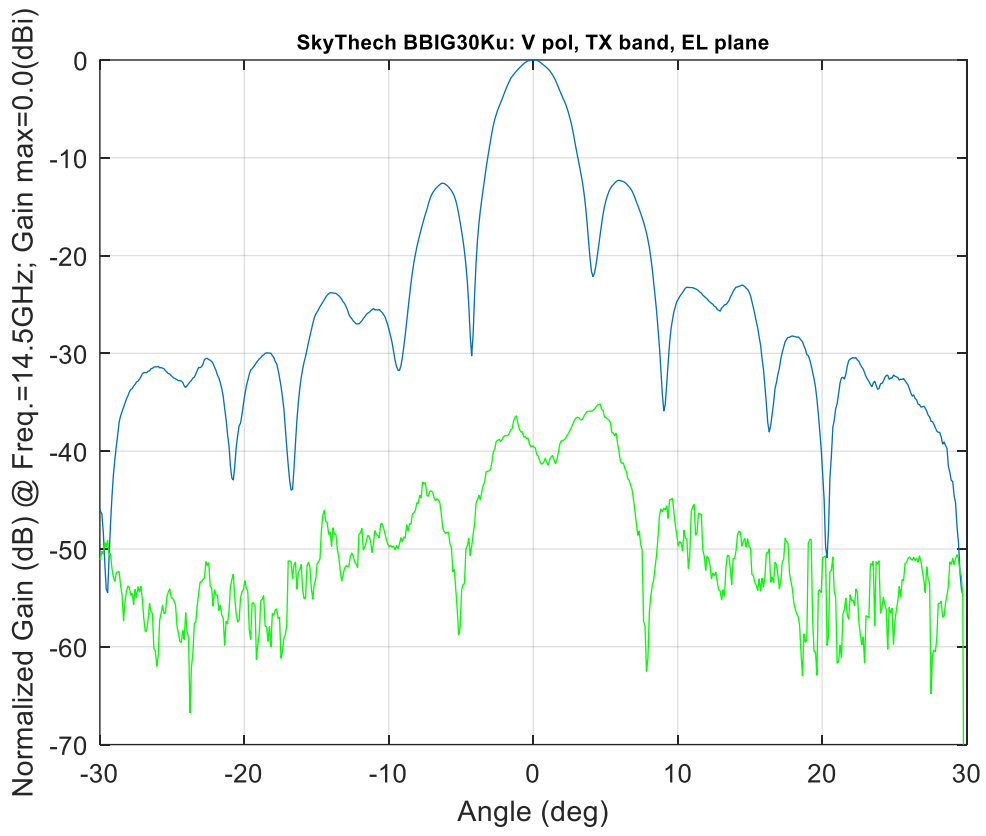












6.2.2: H-pol, AZ and EL plane plots.

