MicroSAT
KA Satellite Terminal

MicroSAT KA Radiation Testing
Rev 2.0

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1. Document Properties

1.1 People

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1.2 Distribution

Organization	*Address*	*Contact Name*	*Type*
			Customer

1.3 Change Log

Rev No.	*Date*	*Changes*	*Paragraph*
Rev 1.1	18.02.15	Final Antenna results added	
Rev2.0	20.10.15	Ripple Gain Rx/Tx plots added	

2. Introduction

The purpose of this document is to summarize the testing results of Sky Beam's 248x135mm Ka band antenna.

3. Test Set-up

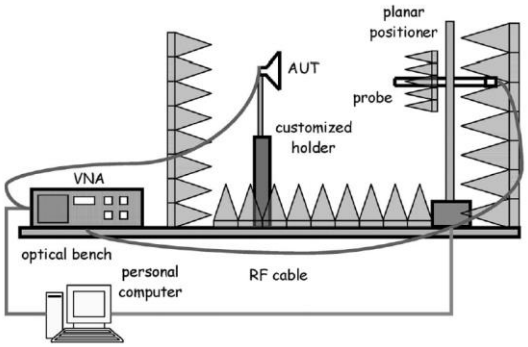
3.1 Overview

A Near-field measurement was used to provide an accurate method to determine the antenna gain, pattern, polarization and beam pointing. The planar near-field technique is an effective method for measuring the performance of large antennas or antennas in which the entire 2D pattern has to be measured. An advantage of the near-field measurements is the possibility to observe the fields on the aperture of the antenna. This allowed a closer and detailed look to obtain further information on the antenna performance.

3.2 Description

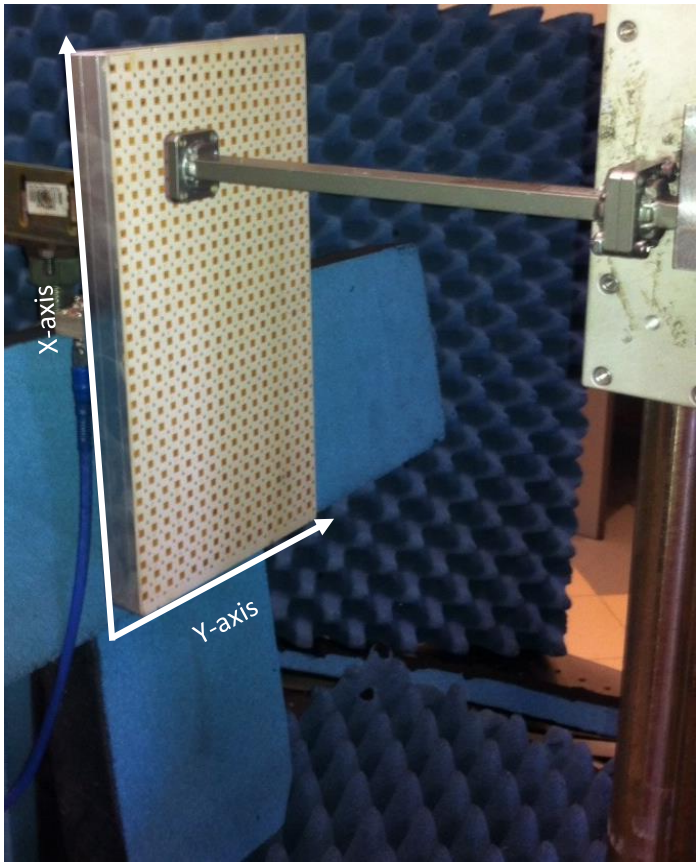
The setup used for the measurements:

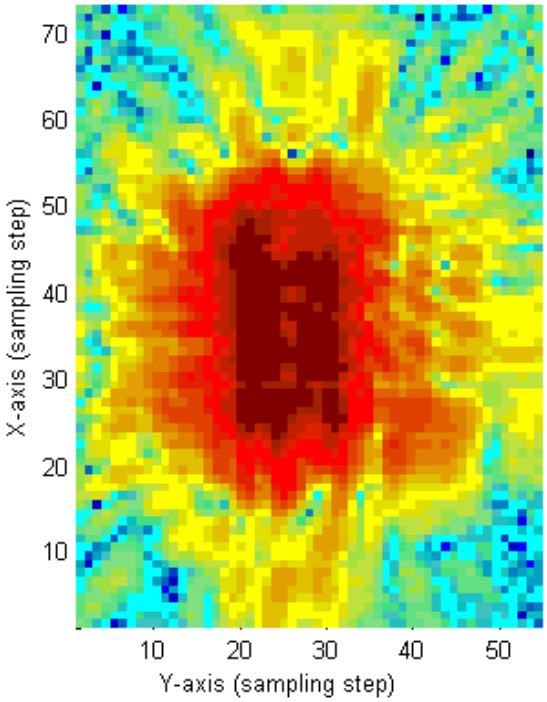
- An electric-field probe (in this case, an open-ended waveguide) is placed in front of the Antenna Under Test (AUT);
- The probe is connected to a Vector Network Analyzer, moved over a planar surface and captures the emissions of the AUT at different points;
- The discrete positions in which the probes samples the near field are arranged in a regular two-dimensional grid with distance between adjacent points of half a wavelength (at the analysis frequency);
- Several hundreds of field samples are collected, and in particular the electric component of the field (E-field) is sampled;
- Since the AUT is designed to operate with circular polarization in both the Rx- and Tx bands, the analysis of the E-field is carried-out sampling both the vertical and Horizontal component of the E-field;
- The data collected processed in order to obtain a full pattern, directivity and gain;
- The analysis is carried out at two frequencies: 20GHz (for RX band) and 30GHz (for TX band).



3.3 Sampling Process

- The antenna is mounted in the planar far-field measurement setup.
- Amplitude distribution of the E-field produced by the antenna at the desired frequency
- The data reported is collected in a spatial range larger than the antenna aperture.





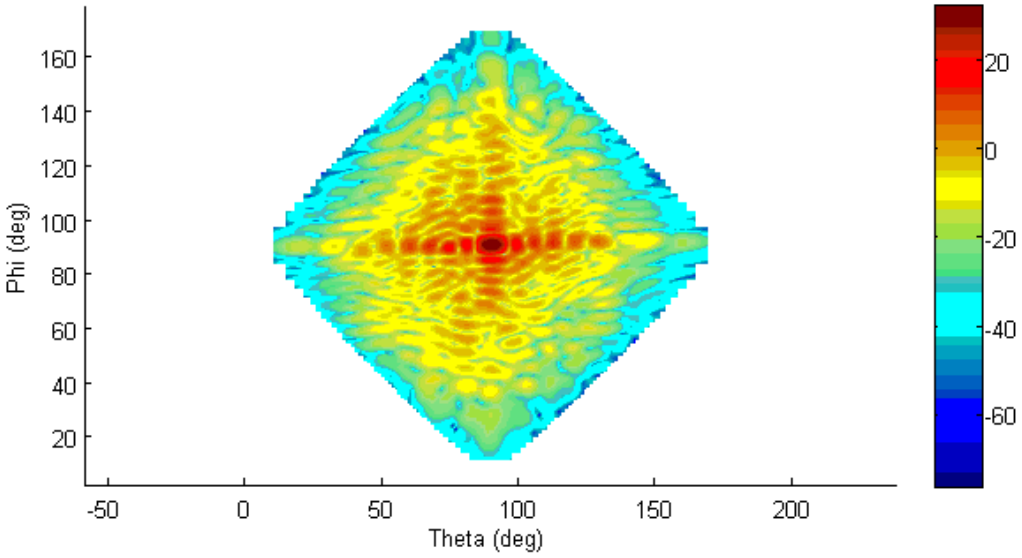
4. Testing Results

4.1 Rx Measurements

4.1.1 Rx Radiation Pattern

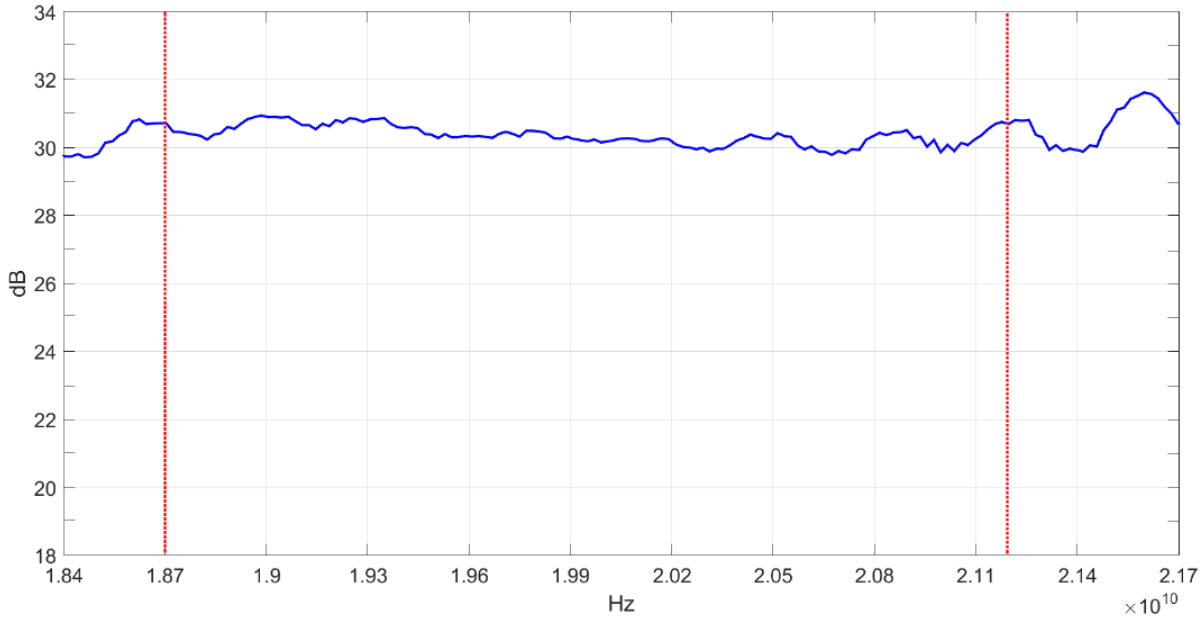
4.1.1.1 Directivity Pattern

Directivity Pattern (RHCP) produced by the antenna at 20GHz. Maximum directivity is 32.5

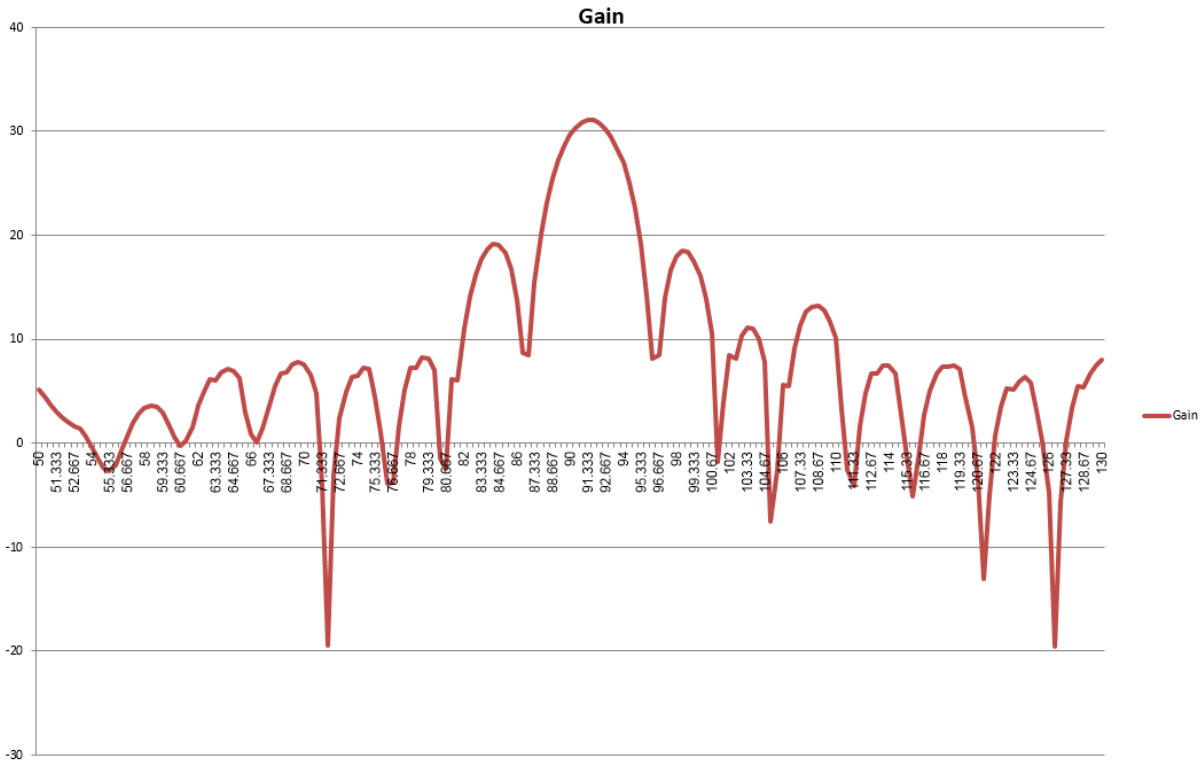


dB

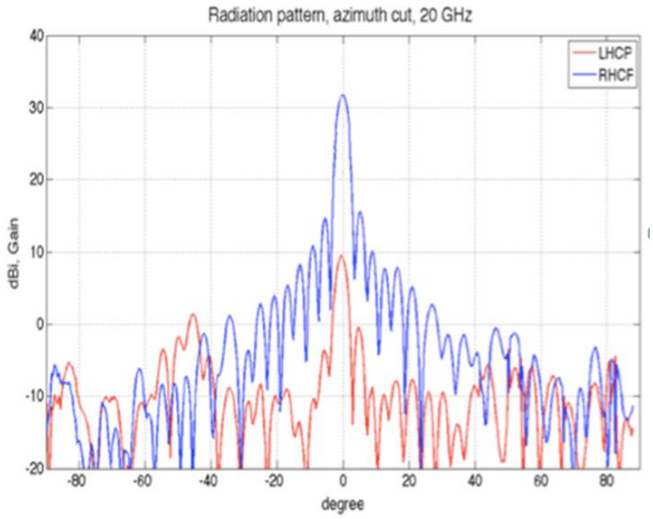
4.1.1.2 Gain variation within Rx frequency



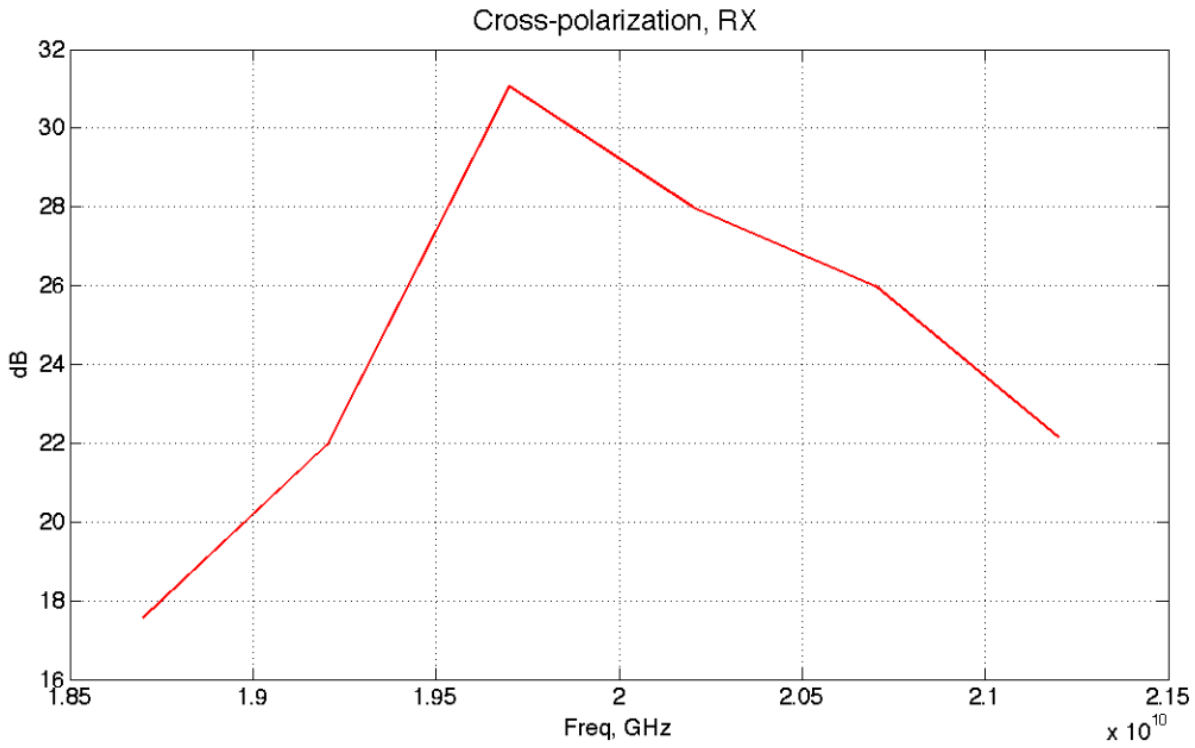
4.1.1.3 Azimuth Pattern (RHCP), 20GHz



RX



4.1.2 Rx Cross Polarization



4.2 Rx Summary

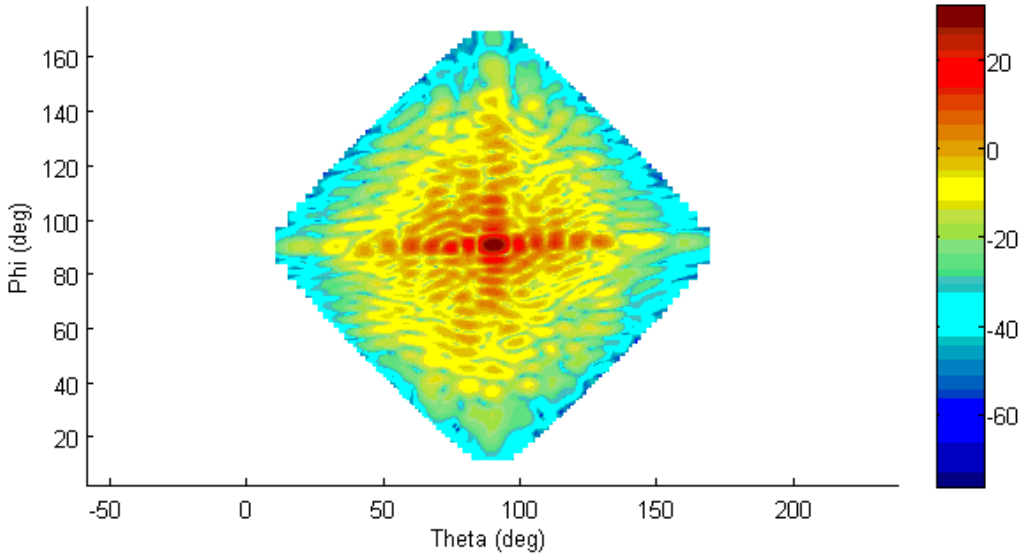
- The measured directivity is 32.5dB.
- Measurements show a maximum level of cross-polarization (LHCP) of -16dB worst case in lower side (18.5 GHz), corresponding to 3dB of Axial Ratio.
- The Side Lobe Level (SLL) is -15dB.
- Isolation is >50dB
- The measured co-pol gain is 31.4dBi. This, assuming a directivity of 32.5dB and considering the mismatching loss (equal to 0.85dB) gives the loss inside the antenna, equal to 0.25dB.
- As a consequence, the G/T of the antenna system (considering an LNA with Noise figure of 1.3dB, and a sky noise of 30°K) has an estimated value of 7.6dB. It has to be pointed out that the modalities in which the measurements are taken suggest some caution, because an error of 0.5 dB is easily obtainable.

4.3 Tx Measurements

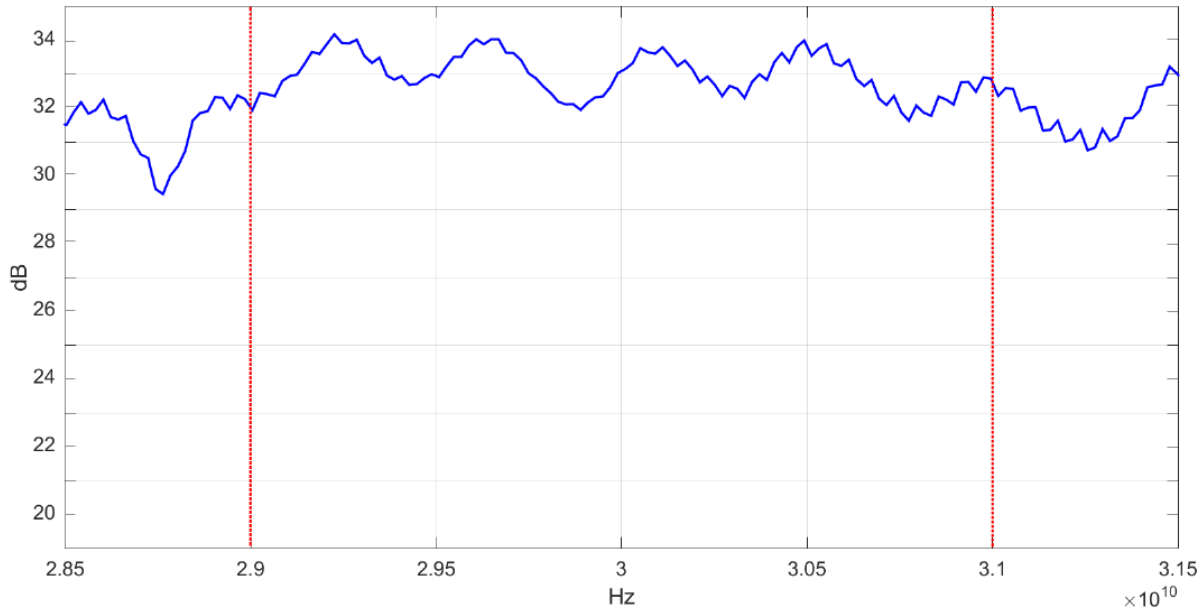
4.3.1 Tx Radiation Pattern

4.3.1.1 Directivity Radiation Pattern

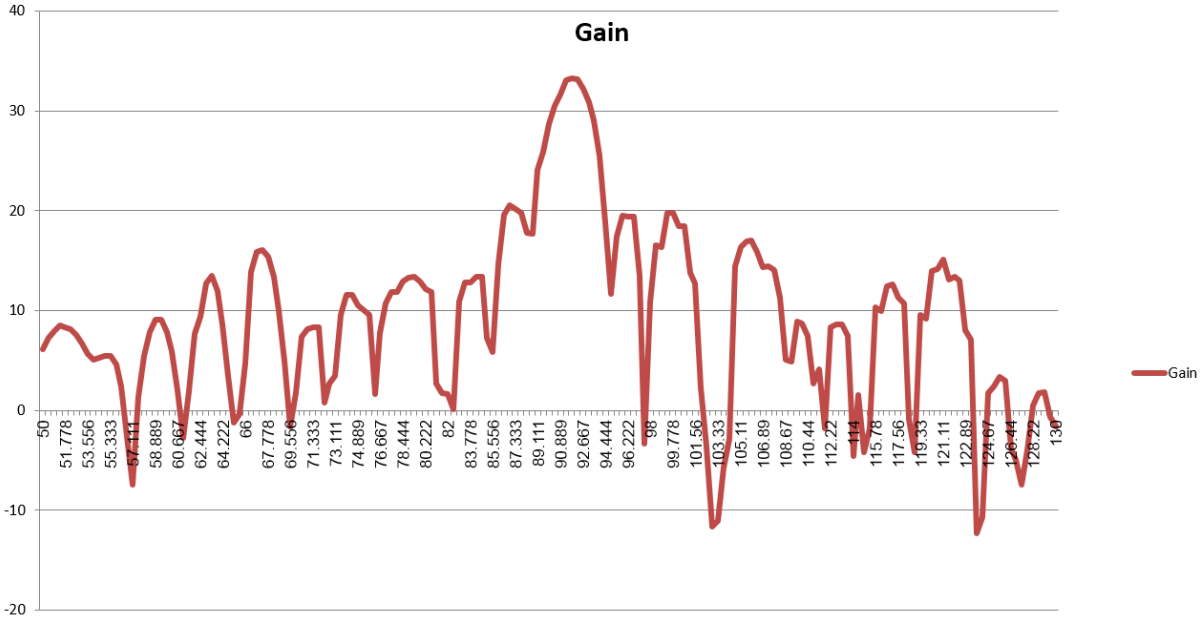
The 2D Directivity Pattern of the antenna. Maximum directivity at 30GHz is 35 dB

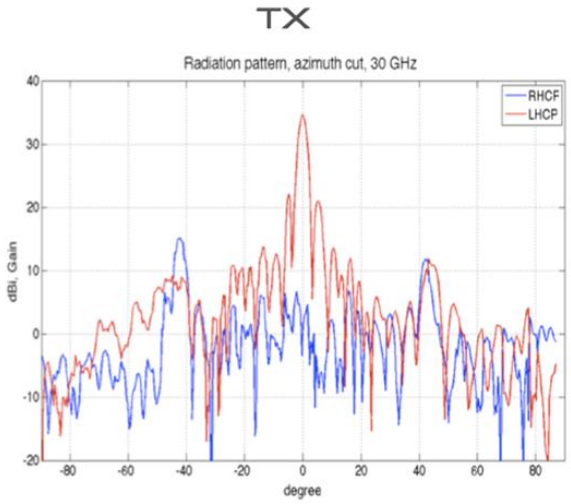


4.3.1.2 Gain variation within TX frequency

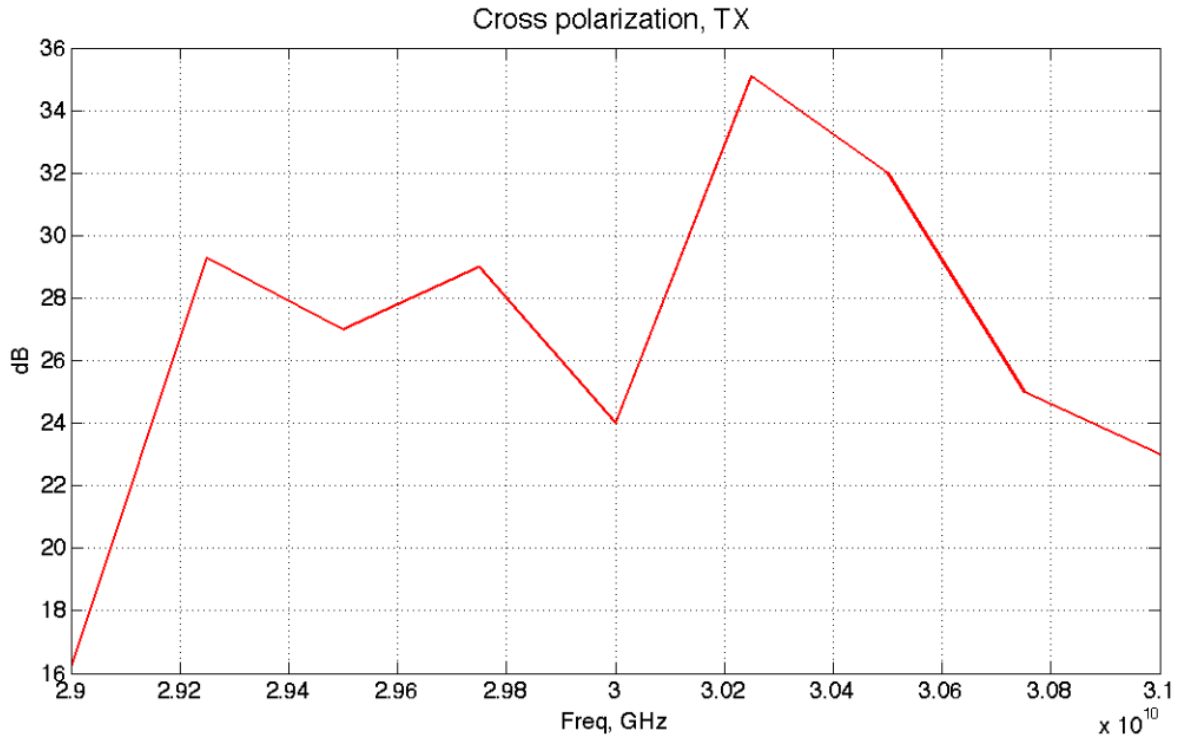


4.3.1.3 Azimuth Tx Pattern (LHCP), 30GHz





4.3.2 Tx Cross Polarization



4.4 Tx Summary

- The measured directivity is 35 dB.
- The phase difference between the V-pol and H-pol components of the LHCP radiated average value of 100°, that is close to ideality (90°).
- Measurements show a maximum level of cross-polarization (RHCP) of -16dB worst case at lower frequency (29 GHz), corresponding to an axial ratio of 4.3dB.
- The 3dB beam width in the two cuts is: 4.3° (Elevation-cut) and 2.7° (Azimuth-cut). The measured gain is 33.8dB
- Isolation is >50dB

5. Final Measured Specifications

5.1 Electrical

Parameter		Measured Value	Comments
Gain	RX	31.4 dB	+/- 0.5 dB Tolerance Error
	TX	33.8 dB	+/- 0.5 dB Tolerance Error
G/T	RX	7.8 dB/K	+/- 0.5 dB/K error
Beam Width	AZ	2.7°	
	EL	4.3°	
Isolation	RX	65 dB	
	TX	50 dB	