Technical Brief
X Band Antenna
AVL Location

August 18, 2019

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20190816m01v01.0_Tech_Brief_AVL_X.band.docx

Prepared by
Intellicom Technologies, Inc.

Approved by: Paul Moller Vice-President, Intellicom Technologies Inc.	

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Revision History

Revision History:	Date	Document Revision Description
V01.0	2019 08 18	Initial Release

2 INTRODUCTION

We are seeking an FCC experimental license for testing, evaluation, and certification of fixed earth stations.

As a commercial entity we are seeking a license to transmit to a satellite within 7.9-8.4 GHz and receive from a satellite within 7.25-7.75 GHz. Transmissions will be coordinated and approved in advance with the satellite operator.

Since the frequency band is assigned for federal use, we anticipate that FCC will need to coordinate with the NTIA via the IRAC Interdepartmental Radio Advisory Committee. The earth stations will be owned, tested, and certified by a commercial entity. Future WGS/ARSTRAT certified earth stations will be manufactured and sold to the US Government for their use. We are including a statement of US government interest and a government point of contact supporting this activity.

The earth station antenna gain and ESD patterns are compliant with **MIL-STD-188-164C** which provides requirements for terminals operated with the WGS satellites**.**

Intellicom Technologies, Inc. is representing AVL in this matter. Please contact the following for additional information, comments, or clarifications:

Paul Moller
Intellicom Technologies, Inc.
480-993-2220
PMoller@ITCcom.net
www.ITCcom.net

3 SYSTEM DESCRIPTION

This section provides a description of the SATCOM system.

3.1 Satellites (Points of Communication)

We are requesting a license to transmit to U.S. licensed space stations.

Satellites include:

- Only with authorization from ARSTRAT
  - WGS3 at 12W, 500 MHz
  - WGS5 at 52.5W, 500 MHz
  - WGS6 at 135W, 500 MHz

3.2 Earth Stations

Location	AvL Technologies 15 North Merrimon Ave Asheville, NC 288804
Coordinates	35°38'24.5"N 82°34'30.9"W
Elevation Range	7 to 38 degrees
Azimuth Range	101 to 246 degrees
Transmit Frequency	7.9 to 8.4 GHz
Receive Frequency	7.25 to 7.75 GHz

Earth Station Attributes

20190329m12v01.3_Terminal_Specs.xlsx

ID	Band	Terminal	Model	Antenna	HPA psat (dBm)	HPA sat (watts)	WG Loss (dB)	Power Into Feed (dBm)	Power Into Feed (watts)	Gtx (dBi)	EIRP (dBW)	ERP (dBW) =EIRP-2.15 dB	ERP kW	Grx (dBi)	G/T (dB/K)	Description
4	X	AVL/Viasat	BAT-600 MMT	60cm	41.1	12.9	0.1	41.0	12.6	32.3	43.3	41.2	13	31.6	9.4	First Article
5	X	AVL	Model 1315	135cm	49.0	79.4	1.4	47.6	57.5	39.0	56.6	54.5	279	38.3	17.2	First Article

Earth Station Pointing Angles		X Band	
20190329m12v01.3_Terminal_Specs.xlsx			
AVL, Asheville			
35.640139N	35°38'24.5"N		
82.575251W	82°34'30.9"N		
		Earth Station Pointing	
Satellites	Location (degrees)	Elevation (degrees)	True Azimuth (degrees)
WGS3 at 12W	12W	7.2	101.6
WGS5 at 52.5W	52.5W	37.8	135.2
WGS6 at 135W	135W	21.7	245.9
	Min	7	101
	Max	38	246

3.3 Emissions

Earth Station Emissions		X Band								
20190329m12v01.3_Terminal_Specs.xlsx		Tx 7.9-8.4 GHz								
AVL, Asheville										
35.640139N	35°38'24.5"N									
82.575251W	82°34'30.9"N									
Terminal	Antenna	HPA psat (dBm)	HPA sat (watts)	Gtx (dBi)	EIRP (dBW)	ERP (dBW) =EIRP-2.15 dB	ERP kW	Modulation	Bit Rate (Mbps)	Emission
AVL/ViasatBAT-600 MMT	60cm	41.1	12.9	32.3	43.3	41.15	13	QPSK, R1/2	2	2M0G7D
AVLModel 1315	135cm	49.0	79.4	39.0	56.6	54.45	279	QPSK, R1/2	10	10M0G7D

Satellite Emissions		X Band							
20190329m12v01.3_Terminal_Specs.xlsx									
AVL, Asheville									
35.640139N	35°38'24.5"N								
82.575251W	82°34'30.9"N								
		Earth Station Pointing			Satellite	Satellite	Satellite	Satellite	Satellite
Satellites	Location (degrees)	Elevation (degrees)	True Azimuth (degrees)	Downlink Frequency (GHz)	Output Power per carrier (dBW)	EIRP (dBW)	ERP (dBW) =EIRP-2.15	ERP (kW)	Emission Designator
WGS3 at 12W	12W	7.2	101.6	7.25-7.75	-4.0	41.0	38.8	7.6	2M0G7D
WGS3 at 12W	12W	7.2	101.6	7.25-7.75	-7.8	37.2	35.0	3.2	10M0G7D
WGS5 at 52.5W	52.5W	37.8	135.2	7.25-7.75	-4.0	41.0	38.8	7.6	2M0G7D
WGS5 at 52.5W	52.5W	37.8	135.2	7.25-7.75	-7.8	37.2	35.0	3.2	10M0G7D
WGS6 at 135W	135W	21.7	245.9	7.25-7.75	-4.0	41.0	38.8	7.6	2M0G7D
WGS6 at 135W	135W	21.7	245.9	7.25-7.75	-7.8	37.2	35.0	3.2	10M0G7D

3.4 Link Budget Estimates

Downlink carrier PSD meets requirements.

Link Budget Estimates	X Band	
20190329m12v01.3_Terminal_Specs.xlsx		
	60 cm	**135 cm**
HPA Power Output (dBW)	11.1	19.0
Coupling + Mispointing Losses (dB)	0.1	1.4
Earth Station Gain (dBi) (8.15 GHz)	32.3	39
Uplink EIRPu (dBW)	**43.3**	**56.6**
Uplink ERPd (dBW) = EIRP-2.15	*41.2*	*54.5*
Path Loss Uplink (dB)	202.9	202.9
Satellite Input (dBW)	-160	-146
Satellite Parameters (Estimated)		
Rx Antenna Beamwidth (Degrees) Narrow Coverage Beam (~400 mi diameter)	*1*	*1*
Sat Grx (dBi) (8.15 GHz) (60% efficient)	*45*	*45*
LNA Gain (dB)	*50*	*50*
Receiver Transfer Gain (dB)	*11*	*-7*
HPA Gain (dB)	*50*	*50*
Tx Antenna Beamwidth (Degrees) Narrow Coverage Beam (~400 mi diameter)	*1*	*1*
Sat Gtx (dBi) (7.5 GHz) (60% efficient)	*45*	*45*
Satellite Transfer Gain (dB)	***201***	***183***

Power into downlink antenna (dBW)	-4.0	-7.8
Downlink EIRPd (dBW)	**41.0**	**37.2**
Downlink ERPd (dBW) = EIRP-2.15	*38.8*	*35.0*
Path Loss downlink (dB)	201.9	201.9
Earth Station Input (dBW)	-161	-164.7
Grx (dBi)	31.6	38.3
Carrier power into LNB	-129	-126.4
LNB gain	50	50
Es Receiver input (dBm)	-49	-46
Es G/T (dB/K)	9.4	17
Link C/No		
Uplink C/No (dB/Hz)	102.46	80.79
Downlink C/No (dB/Hz)	103.84	80.19
Total C/No (dB/Hz)	**100.1**	**77.5**
Total Es/No (dB)	**10**	**10**
Downlink Density		
EIRPd (dBW)	41.0	37.2
Path Loss d (dB)	201.9	201.9
G(1m, 7.5) dBi	38.96	38.96
DL Density (dBW/m^2)	-122	-126
Occupied Bandwidth (MHz) (Msymbols/S QPSK)	2	10
DL Density (dBW/m^2/MHz)	-125	-136
DL Density (dBW/m^2/4kHz)	-149	-160
Mil-Std-188-164C, 4.3.2.1 X Band Max PFD (dBW/m^2/4kHz)	-142	-142
FCC 25.208c3, 17.7-19.7, 22.55-23.55 GHz, 25-90 degrees above horizontal plane (dBW/m^2/MHz)	-105	-105
FCC 25.208c3, 17.7-19.7, 22.55-23.55 GHz, 0-5 degrees above horizontal plane (dBW/m^2/MHz)	-115	-115
Minimum Es Elevation Angle (degrees)	7	7
Worst case Satellite to earth beam grazing angle (above horizontal) (degrees) ~ Es -satellite beamwidth	6	6
downlink density meets requirements		

3.5 Points of Contact

Primary Contact:
Ryan Gutierrez
rgutierrez@avltech.com
1 828-250-9950 ext. 3807
Cell: 443-813-3022
AvL Technologies
15 North Merrimon Ave
Asheville, NC 288804

Secondary Contact:
Paul Moller
PMoller@ITCcom.net
Office: 480.993.2220
Cell: 480.226.1493
Intellicom Technologies, Inc

4 Antenna Patterns - AVL Model 1315

4.1 Summary

The antenna is compliant with:

- **Mil-Std-188-164c**

Transmit Gain and Axial Ratio

Antenna Performance

20190517m01v02.0_x60_AntennaPlots.xlsx Model 1315

Direction	Frequency	Frequency (MHz)	LHCP Gain (dBi)	RHCP Gain (dBi)	LHCP Axial Ratio (dB)	RHCP Axial Ratio (dB)
downlink	low	7250	37.3		0.91	
downlink	mid	7500	37.7		0.32	
downlink	high	7750	38.4		0.15	
uplink	low	7900		37.8		0.35
uplink	mid	8150		38.8		0.37
uplink	high	8400		38.7		0.43

3 dB beamwidth in Azimuth is +/-1.1 or 2.2 degrees

Earth Station Transmit ESD Requirements

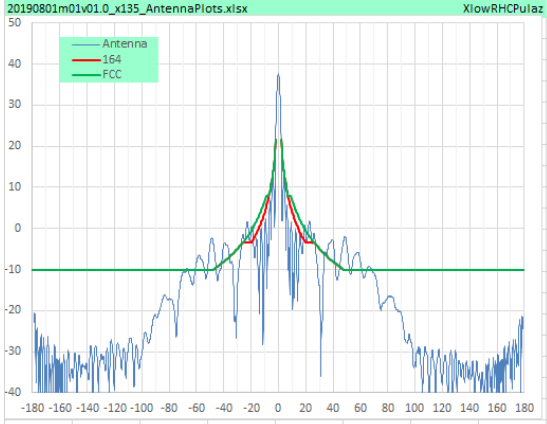
20190801m01v01.0_x135_AntennaPlots.xlsx

Max Linear EIRP	56.6	dBW
Max ESD Feed In	-37.0	dBW/Hz
Max Antenna Gain	38.8	dBi
Max ESD Boresite	1.8	dBW/Hz
Min BW at Max Lin EIRP	305	kHz

Transmissions at max linear must occupy a bandwidth of 305 kHz or greater to ensure compliance with ESD mask requirements.

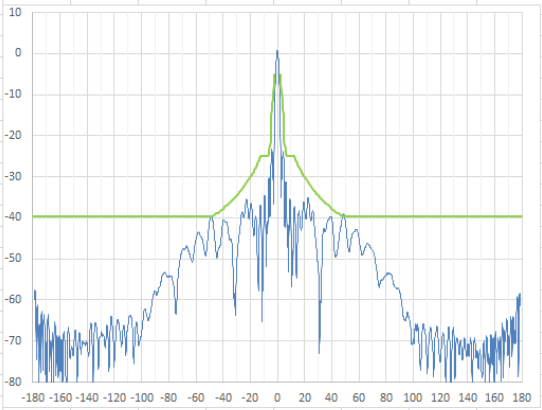
4.2 Tx RHCP Azimuth

Antenna Gain Pattern: Uplink Azimuth RHCP Low
Gain (dBi) vs Azimuth Angle (degrees)
20190801m01v01.0_x135_AntennaPlots.xlsx XlowRHCPulaz



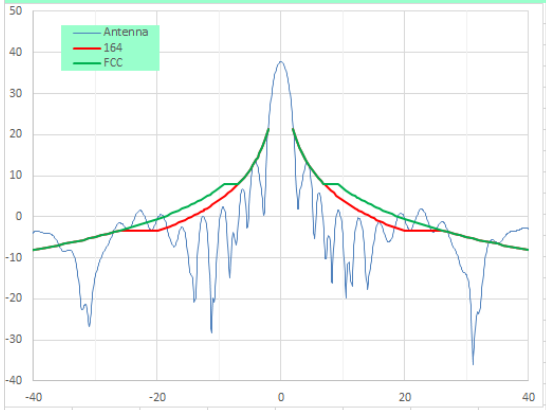
Max Gain	37.8	dBi

Antenna ESD Pattern: Uplink Azimuth RHCP Low
ESD (dBW/Hz) vs Azimuth Angle (degrees)
20190801m01v01.0_x135_AntennaPlots.xlsx XlowRHCPulaz



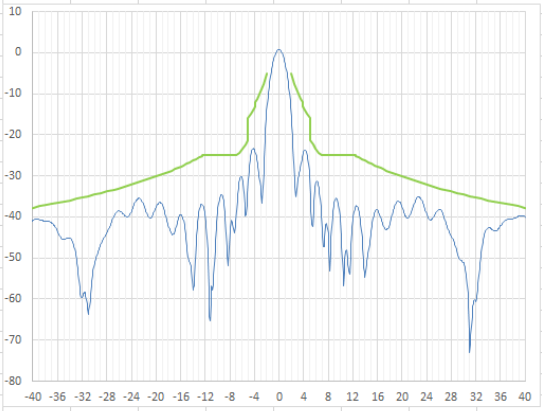
Max PSD	into antenna	-37	dBW/Hz
Max PSD	out of antenna at boresite	0.8	dBW/Hz

Antenna Gain Pattern: Uplink Azimuth RHCP Low
Gain (dBi) vs Azimuth Angle (degrees)
20190801m01v01.0_x135_AntennaPlots.xlsx XlowRHCPulaz



Max Gain	37.8	dBi

Antenna ESD Pattern: Uplink Azimuth RHCP Low
ESD (dBW/Hz) vs Azimuth Angle (degrees)
20190801m01v01.0_x135_AntennaPlots.xlsx XlowRHCPulaz

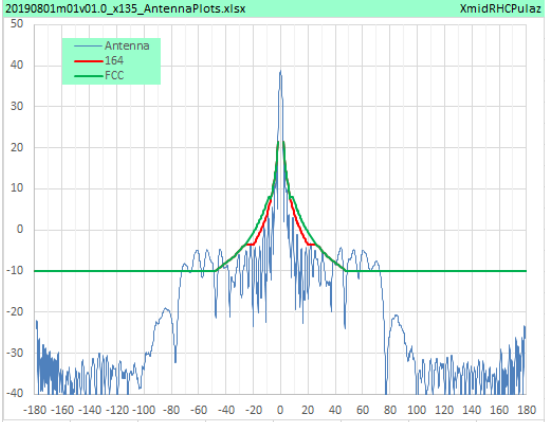


Max PSD	into antenna	-37	dBW/Hz
Max PSD	out of antenna at boresite	0.8	dBW/Hz

Antenna Gain Pattern: Uplink Azimuth RHCP Mid

Gain (dBi) vs Azimuth Angle (degrees)

20190801m01v01.0_x135_AntennaPlots.xlsx XmidRHCPulaz

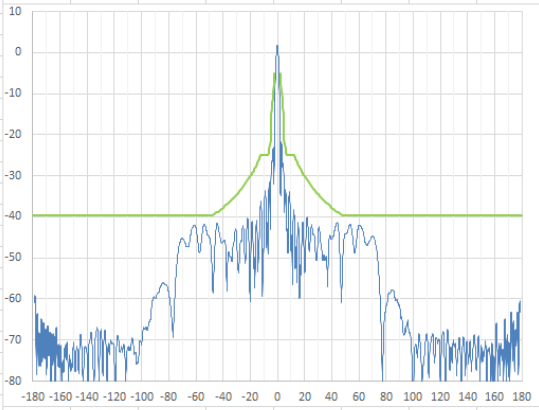


Max Gain	38.8	dBi

Antenna ESD Pattern: Uplink Azimuth RHCP Mid

ESD (dBW/Hz) vs Azimuth Angle (degrees)

20190801m01v01.0_x135_AntennaPlots.xlsx XmidRHCPulaz

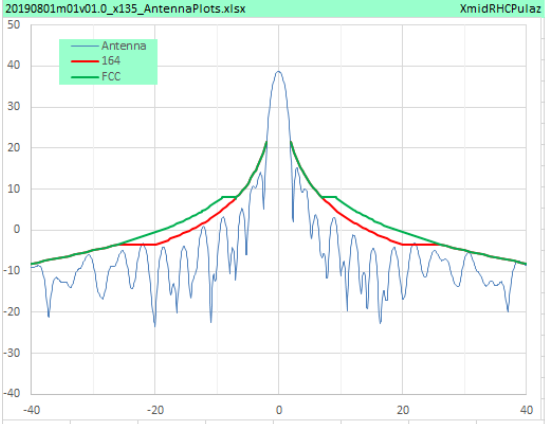


Max PSD	into antenna	-37	dBW/Hz
Max PSD	out of antenna at boresite	1.8	dBW/Hz

Antenna Gain Pattern: Uplink Azimuth RHCP Mid

Gain (dBi) vs Azimuth Angle (degrees)

20190801m01v01.0_x135_AntennaPlots.xlsx XmidRHCPulaz

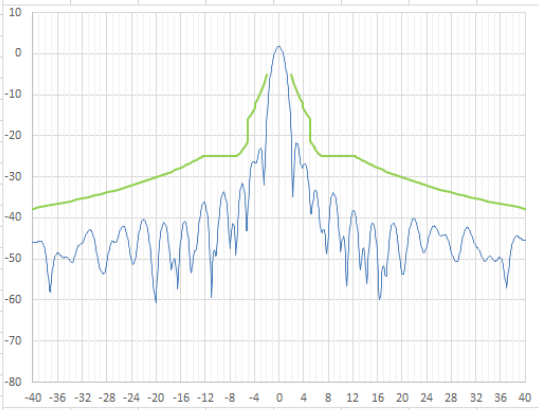


Max Gain	38.8	dBi

Antenna ESD Pattern: Uplink Azimuth RHCP Mid

ESD (dBW/Hz) vs Azimuth Angle (degrees)

20190801m01v01.0_x135_AntennaPlots.xlsx XmidRHCPulaz

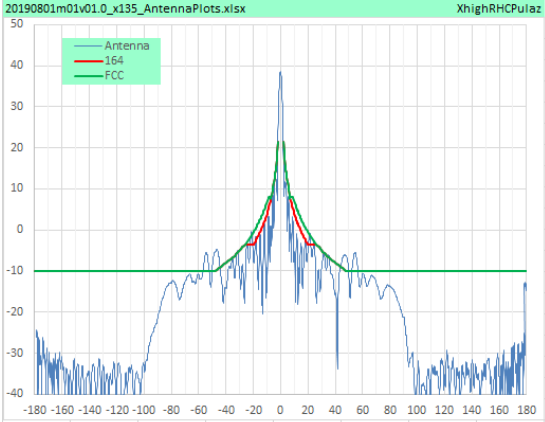


Max PSD	into antenna	-37	dBW/Hz
Max PSD	out of antenna at boresite	1.8	dBW/Hz

Antenna Gain Pattern: Uplink Azimuth RHCP High

Gain (dBi) vs Azimuth Angle (degrees)

20190801m01v01.0_x135_AntennaPlots.xlsx XhighRHCPulaz

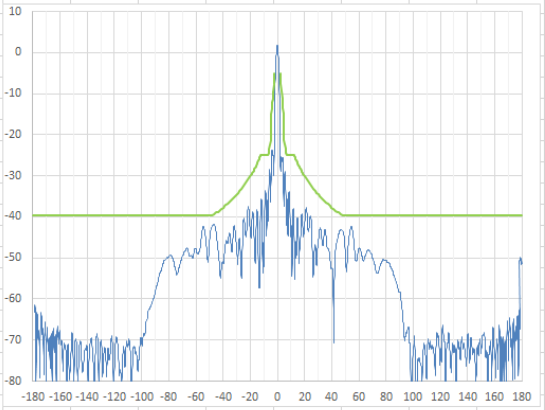


Max Gain	38.7 dBi

Antenna ESD Pattern: Uplink Azimuth RHCP High

ESD (dBW/Hz) vs Azimuth Angle (degrees)

20190801m01v01.0_x135_AntennaPlots.xlsx XhighRHCPulaz

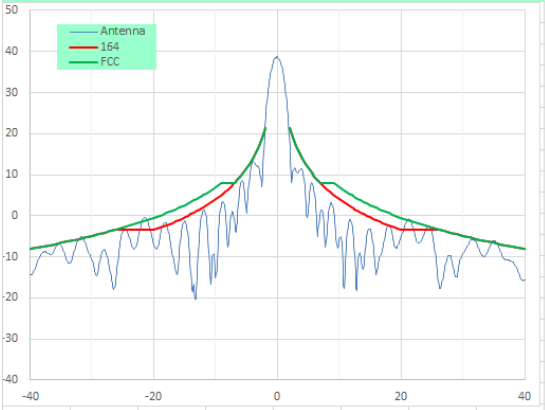


Max PSD	into antenna	-37 dBW/Hz
Max PSD	out of antenna at boresite	1.7 dBW/Hz

Antenna Gain Pattern: Uplink Azimuth RHCP High

Gain (dBi) vs Azimuth Angle (degrees)

20190801m01v01.0_x135_AntennaPlots.xlsx XhighRHCPulaz

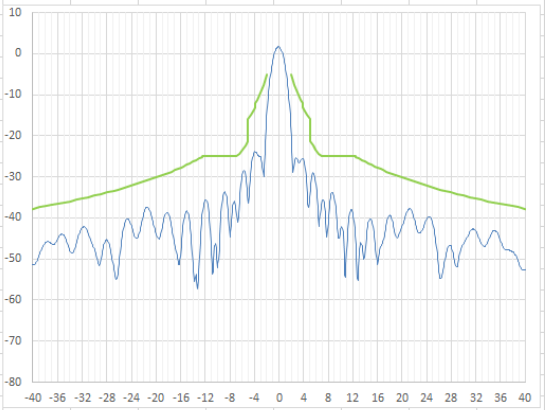


Max Gain	38.7 dBi

Antenna ESD Pattern: Uplink Azimuth RHCP High

ESD (dBW/Hz) vs Azimuth Angle (degrees)

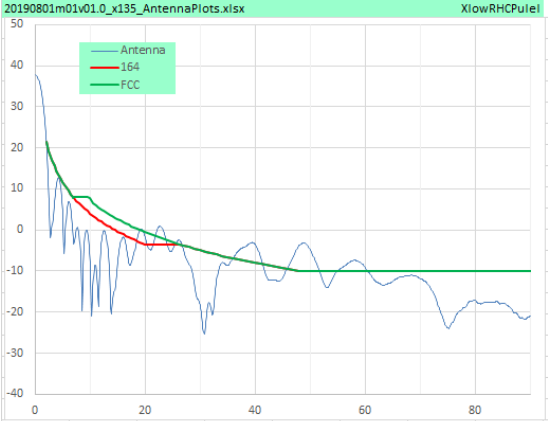
20190801m01v01.0_x135_AntennaPlots.xlsx XhighRHCPulaz



Max PSD	into antenna	-37 dBW/Hz
Max PSD	out of antenna at boresite	1.7 dBW/Hz

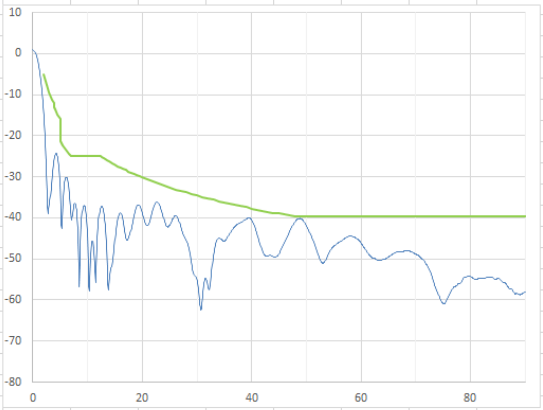
4.3 Tx RHCP Elevation

Antenna Gain Pattern: Uplink Elevation RHCP Low
Gain (dBi) vs Azimuth Angle (degrees)
20190801m01v01.0_x135_AntennaPlots.xlsx XlowRHCPulel



Max Gain	37.9	dBi

Antenna ESD Pattern: Uplink Elevation RHCP Low
ESD (dBW/Hz) vs Azimuth Angle (degrees)
20190801m01v01.0_x135_AntennaPlots.xlsx XlowRHCPulel

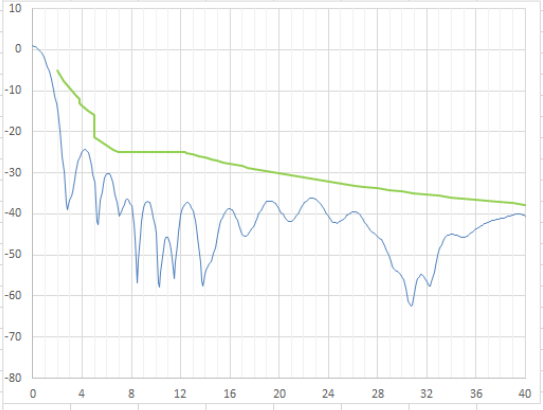


Max PSD	into antenna	-37	dBW/Hz
Max PSD	out of antenna at boresite	0.9	dBW/Hz

Antenna Gain Pattern: Uplink Elevation RHCP Low
Gain (dBi) vs Azimuth Angle (degrees)
20190801m01v01.0_x135_AntennaPlots.xlsx XlowRHCPulel

Max Gain	37.9	dBi

Antenna ESD Pattern: Uplink Elevation RHCP Low
ESD (dBW/Hz) vs Azimuth Angle (degrees)
20190801m01v01.0_x135_AntennaPlots.xlsx XlowRHCPulel

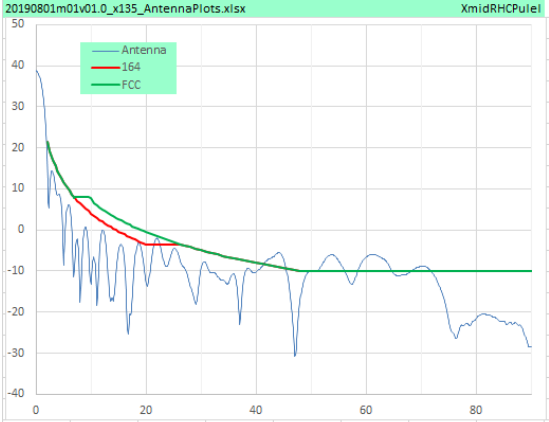


Max PSD	into antenna	-37	dBW/Hz
Max PSD	out of antenna at boresite	0.9	dBW/Hz

Antenna Gain Pattern: Uplink Elevation RHCP Mid

Gain (dBi) vs Azimuth Angle (degrees)

20190801m01v01.0_x135_AntennaPlots.xlsx XmidRHCPulel

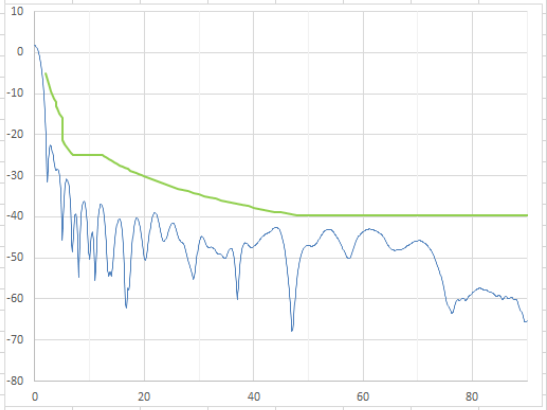


Max Gain	38.8 dBi

Antenna ESD Pattern: Uplink Elevation RHCP Mid

ESD (dBW/Hz) vs Azimuth Angle (degrees)

20190801m01v01.0_x135_AntennaPlots.xlsx XmidRHCPulel

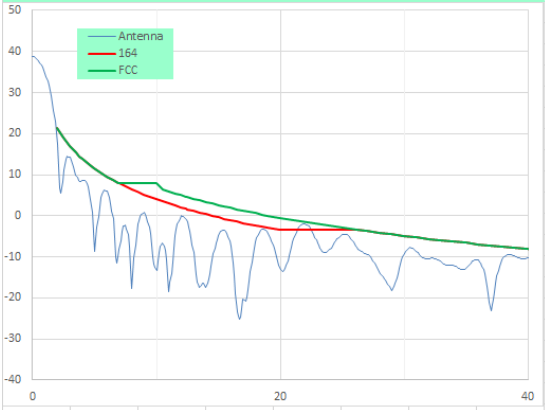


Max PSD	into antenna	-37 dBW/Hz
Max PSD	out of antenna at boresite	1.8 dBW/Hz

Antenna Gain Pattern: Uplink Elevation RHCP Mid

Gain (dBi) vs Azimuth Angle (degrees)

20190801m01v01.0_x135_AntennaPlots.xlsx XmidRHCPulel

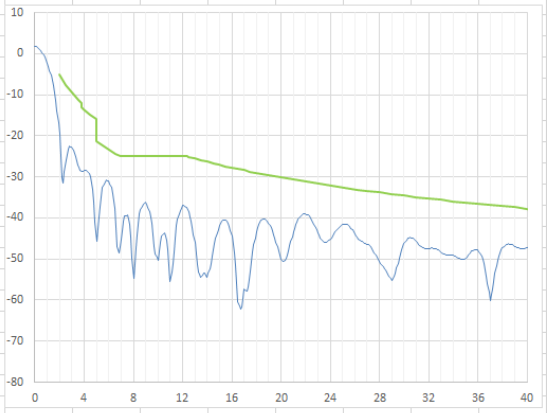


Max Gain	38.8 dBi

Antenna ESD Pattern: Uplink Elevation RHCP Mid

ESD (dBW/Hz) vs Azimuth Angle (degrees)

20190801m01v01.0_x135_AntennaPlots.xlsx XmidRHCPulel

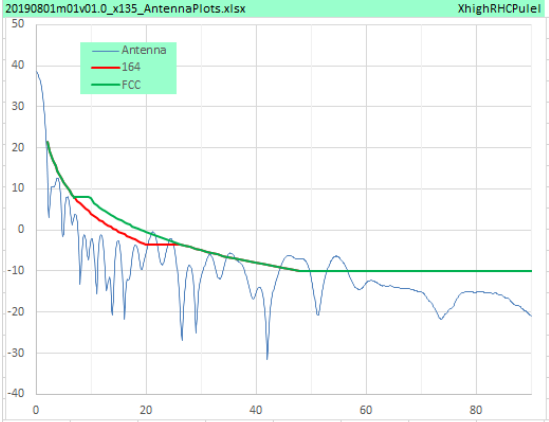


Max PSD	into antenna	-37 dBW/Hz
Max PSD	out of antenna at boresite	1.8 dBW/Hz

Antenna Gain Pattern: Uplink Elevation RHCP High

Gain (dBi) vs Azimuth Angle (degrees)

20190801m01v01.0_x135_AntennaPlots.xlsx XhighRHCPulel

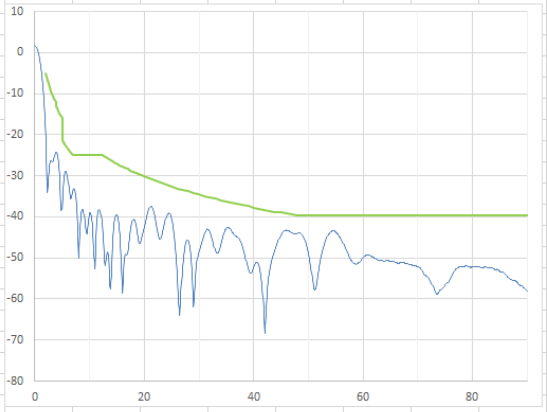


Max Gain	38.7	dBi

Antenna ESD Pattern: Uplink Elevation RHCP High

ESD (dBW/Hz) vs Azimuth Angle (degrees)

20190801m01v01.0_x135_AntennaPlots.xlsx XhighRHCPulel

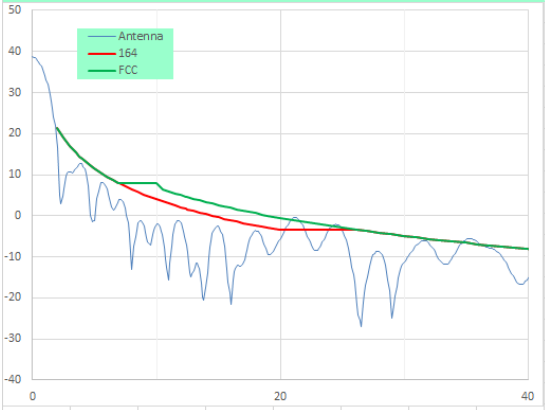


Max PSD	into antenna	-37	dBW/Hz
Max PSD	out of antenna at boresite	1.7	dBW/Hz

Antenna Gain Pattern: Uplink Elevation RHCP High

Gain (dBi) vs Azimuth Angle (degrees)

20190801m01v01.0_x135_AntennaPlots.xlsx XhighRHCPulel

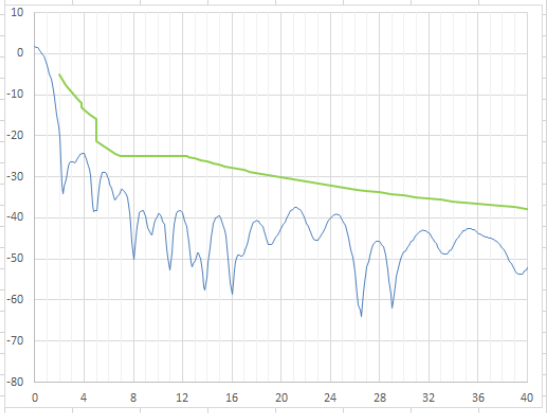


Max Gain	38.7	dBi

Antenna ESD Pattern: Uplink Elevation RHCP High

ESD (dBW/Hz) vs Azimuth Angle (degrees)

20190801m01v01.0_x135_AntennaPlots.xlsx XhighRHCPulel



Max PSD	into antenna	-37	dBW/Hz
Max PSD	out of antenna at boresite	1.7	dBW/Hz

5 Antenna Patterns - AVL/Viasat BAT-600

5.1 Summary

The antenna is compliant with:

- **Mil-Std-188-164c**

Transmit Gain and Axial Ratio

Antenna Performance

20190517m01v02.0_x60_AntennaPlots.xlsx BAT-600 MMT

Direction	Frequency	Frequency (MHz)	LHCP Gain (dBi)	RHCP Gain (dBi)	LHCP Axial Ratio (dB)	RHCP Axial Ratio (dB)
downlink	low	7250	31.0		0.17	
downlink	mid	7500	31.6		0.17	
downlink	high	7750	31.9		0.17	
uplink	low	7900		32.3		0.27
uplink	mid	8150		32.3		0.45
uplink	high	8400		32.3		0.21

3 dB beamwidth in Azimuth is +/-3.0 or 6.0 degrees

Earth Station Transmit ESD Requirements

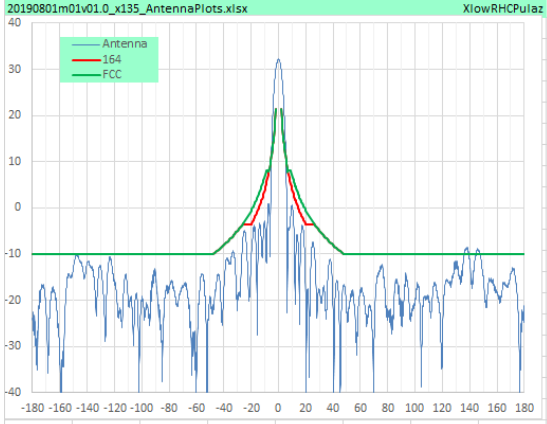
20190517m01v02.0_x60_AntennaPlots.xlsx

Max Linear EIRP	43.4	dBW
Max ESD Feed In	-38.0	dBW/Hz
Max Antenna Gain	32.3	dBi
Max ESD Boresite	-5.7	dBW/Hz
Min BW at Max Lin EIRP	80	kHz

Transmissions at max linear must occupy a bandwidth of 80 kHz or greater to ensure compliance with ESD mask requirements.

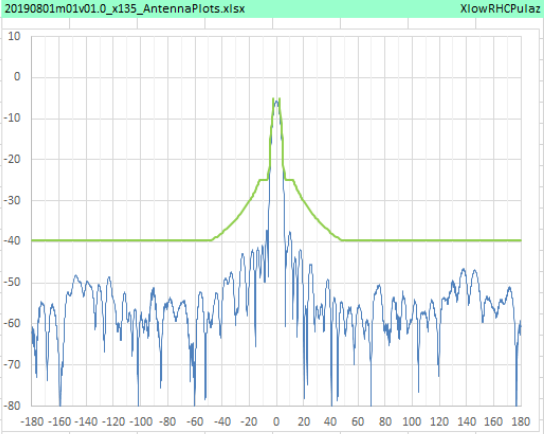
5.2 Tx RHCP Azimuth

Antenna Gain Pattern: Uplink Azimuth RHCP Low
Gain (dBi) vs Azimuth Angle (degrees)
20190801m01v01.0_x135_AntennaPlots.xlsx XlowRHCPulaz



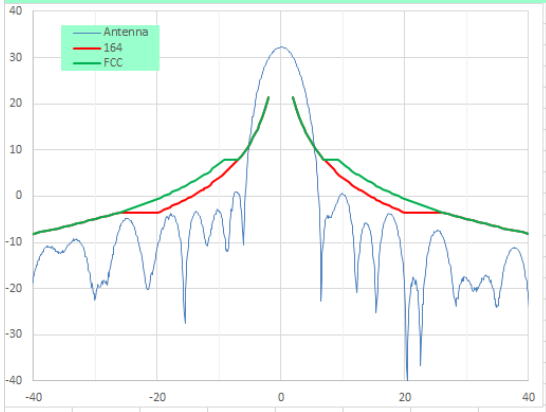
Max Gain	32.3	dBi

Antenna ESD Pattern: Uplink Azimuth RHCP Low
ESD (dBW/Hz) vs Azimuth Angle (degrees)
20190801m01v01.0_x135_AntennaPlots.xlsx XlowRHCPulaz



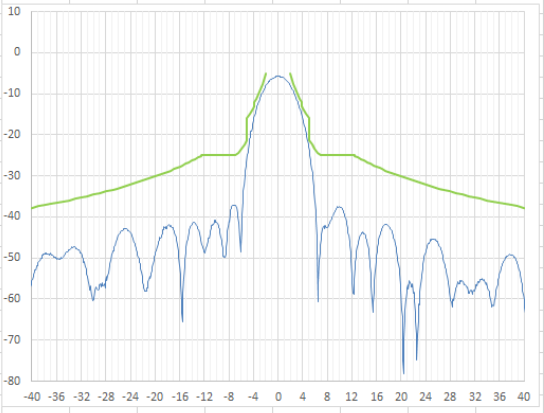
Max PSD	into antenna	-38	dBW/Hz
Max PSD	out of antenna at boresite	-5.7	dBW/Hz

Antenna Gain Pattern: Uplink Azimuth RHCP Low
Gain (dBi) vs Azimuth Angle (degrees)
20190801m01v01.0_x135_AntennaPlots.xlsx XlowRHCPulaz



Max Gain	32.3	dBi

Antenna ESD Pattern: Uplink Azimuth RHCP Low
ESD (dBW/Hz) vs Azimuth Angle (degrees)
20190801m01v01.0_x135_AntennaPlots.xlsx XlowRHCPulaz

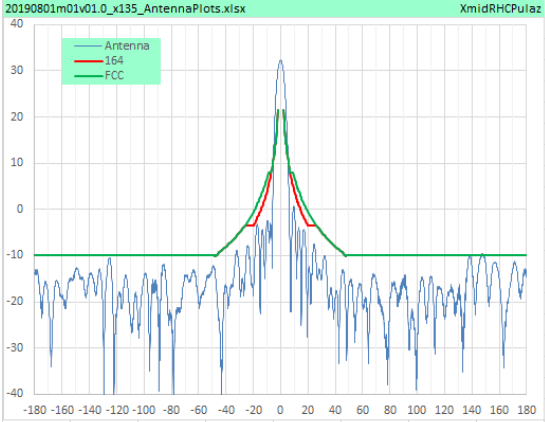


Max PSD	into antenna	-38	dBW/Hz
Max PSD	out of antenna at boresite	-5.7	dBW/Hz

Antenna Gain Pattern: Uplink Azimuth RHCP Mid

Gain (dBi) vs Azimuth Angle (degrees)

20190801m01v01.0_x135_AntennaPlots.xlsx XmidRHCPulaz

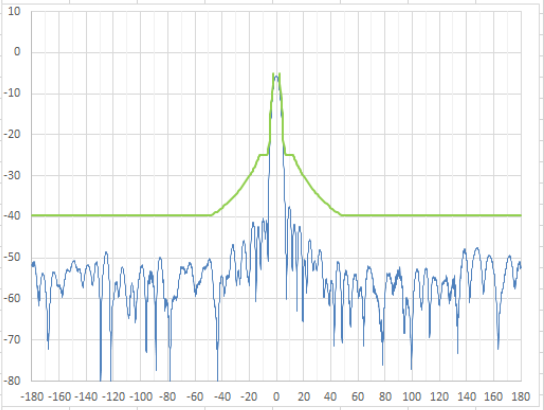


Max Gain	32.3	dBi

Antenna ESD Pattern: Uplink Azimuth RHCP Mid

ESD (dBW/Hz) vs Azimuth Angle (degrees)

20190801m01v01.0_x135_AntennaPlots.xlsx XmidRHCPulaz

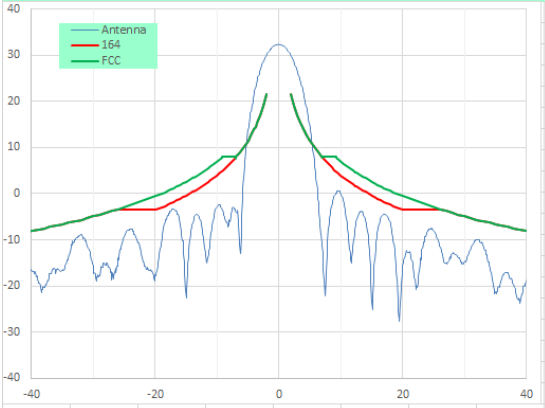


Max PSD	into antenna	-38	dBW/Hz
Max PSD	out of antenna at boresite	-5.7	dBW/Hz

Antenna Gain Pattern: Uplink Azimuth RHCP Mid

Gain (dBi) vs Azimuth Angle (degrees)

20190801m01v01.0_x135_AntennaPlots.xlsx XmidRHCPulaz

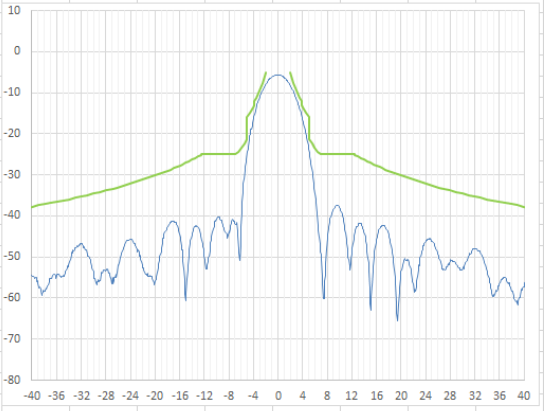


Max Gain	32.3	dBi

Antenna ESD Pattern: Uplink Azimuth RHCP Mid

ESD (dBW/Hz) vs Azimuth Angle (degrees)

20190801m01v01.0_x135_AntennaPlots.xlsx XmidRHCPulaz

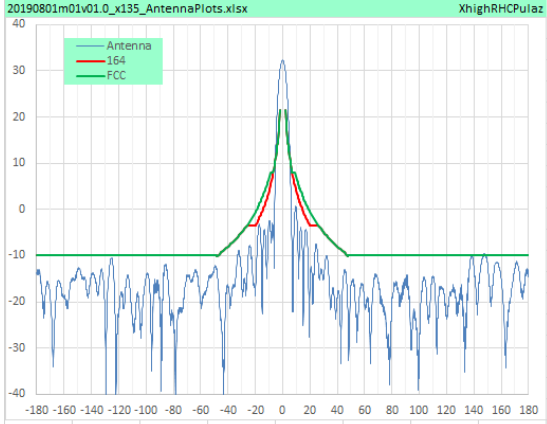


Max PSD	into antenna	-38	dBW/Hz
Max PSD	out of antenna at boresite	-5.7	dBW/Hz

Antenna Gain Pattern: Uplink Azimuth RHCP High

Gain (dBi) vs Azimuth Angle (degrees)

20190801m01v01.0_x135_AntennaPlots.xlsx XhighRHCPulaz

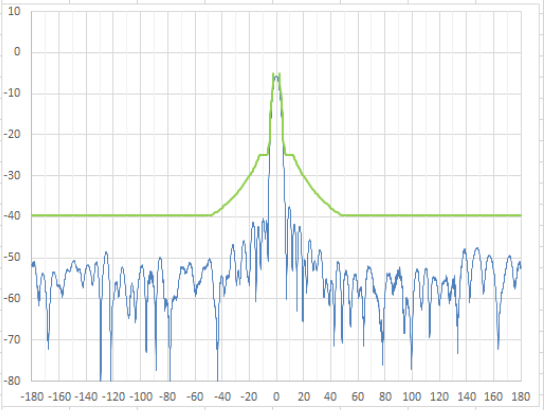


Max Gain	32.3	dBi

Antenna ESD Pattern: Uplink Azimuth RHCP High

ESD (dBW/Hz) vs Azimuth Angle (degrees)

20190801m01v01.0_x135_AntennaPlots.xlsx XhighRHCPulaz

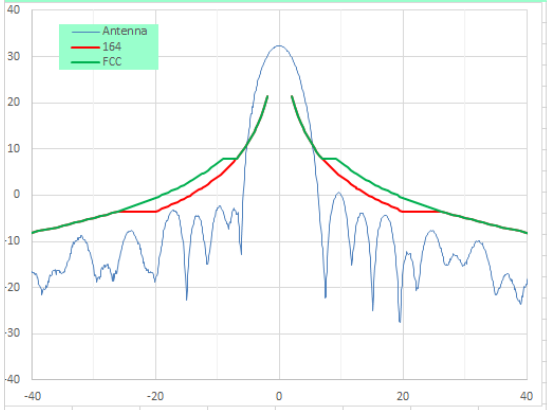


Max PSD	into antenna	-38	dBW/Hz
Max PSD	out of antenna at boresite	-5.7	dBW/Hz

Antenna Gain Pattern: Uplink Azimuth RHCP High

Gain (dBi) vs Azimuth Angle (degrees)

20190801m01v01.0_x135_AntennaPlots.xlsx XhighRHCPulaz

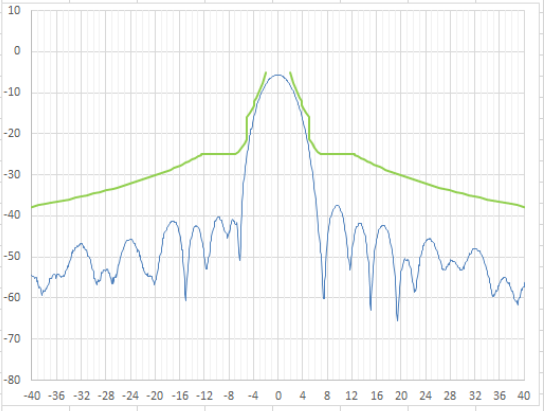


Max Gain	32.3	dBi

Antenna ESD Pattern: Uplink Azimuth RHCP High

ESD (dBW/Hz) vs Azimuth Angle (degrees)

20190801m01v01.0_x135_AntennaPlots.xlsx XhighRHCPulaz



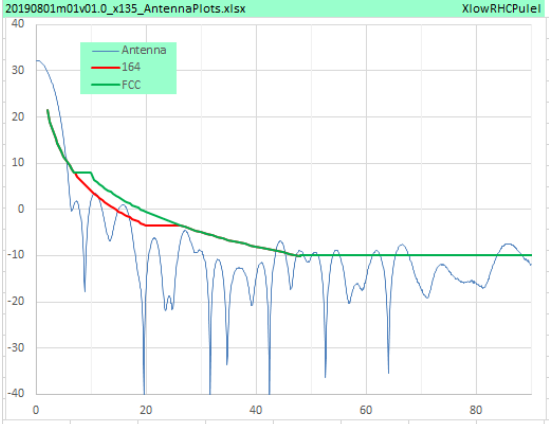
Max PSD	into antenna	-38	dBW/Hz
Max PSD	out of antenna at boresite	-5.7	dBW/Hz

5.3 Tx RHCP Elevation

Antenna Gain Pattern: Uplink Elevation RHCP Low

Gain (dBi) vs Azimuth Angle (degrees)

20190801m01v01.0_x135_AntennaPlots.xlsx XlowRHCPulel

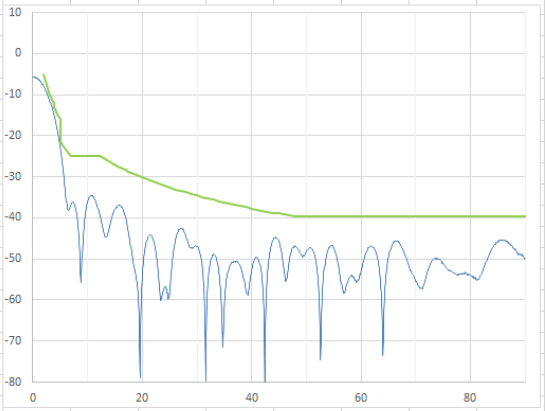


Max Gain	32.3	dBi

Antenna ESD Pattern: Uplink Elevation RHCP Low

ESD (dBW/Hz) vs Azimuth Angle (degrees)

20190801m01v01.0_x135_AntennaPlots.xlsx XlowRHCPulel

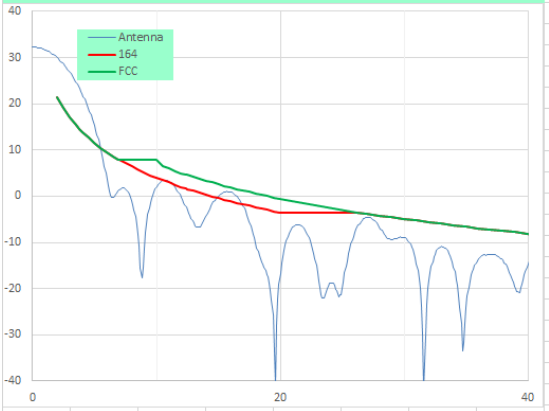


Max PSD	into antenna	-38	dBW/Hz
Max PSD	out of antenna at boresite	-5.7	dBW/Hz

Antenna Gain Pattern: Uplink Elevation RHCP Low

Gain (dBi) vs Azimuth Angle (degrees)

20190801m01v01.0_x135_AntennaPlots.xlsx XlowRHCPulel

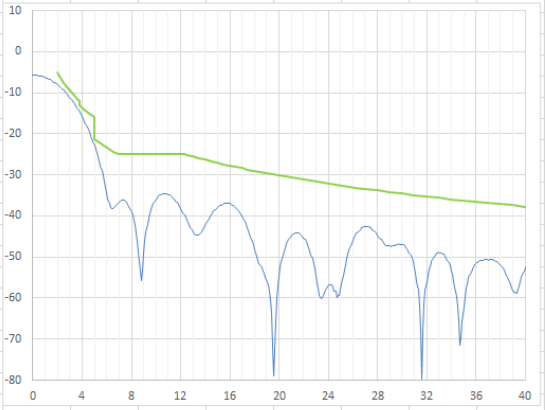


Max Gain	32.3	dBi

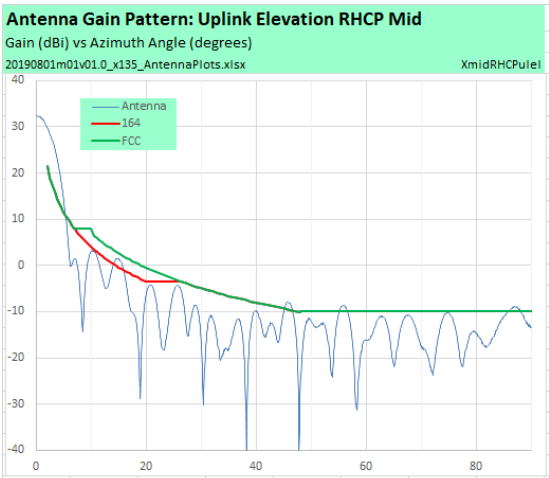
Antenna ESD Pattern: Uplink Elevation RHCP Low

ESD (dBW/Hz) vs Azimuth Angle (degrees)

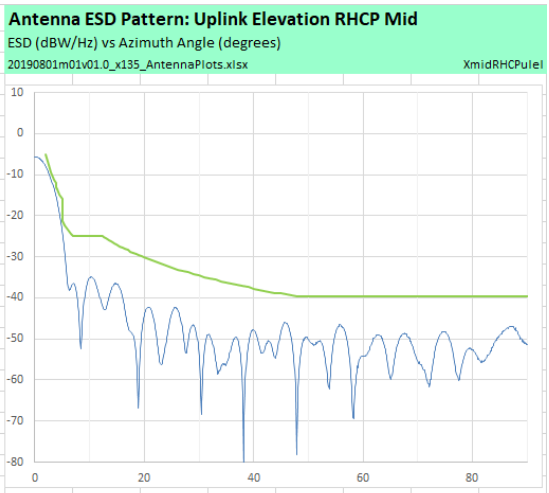
20190801m01v01.0_x135_AntennaPlots.xlsx XlowRHCPulel



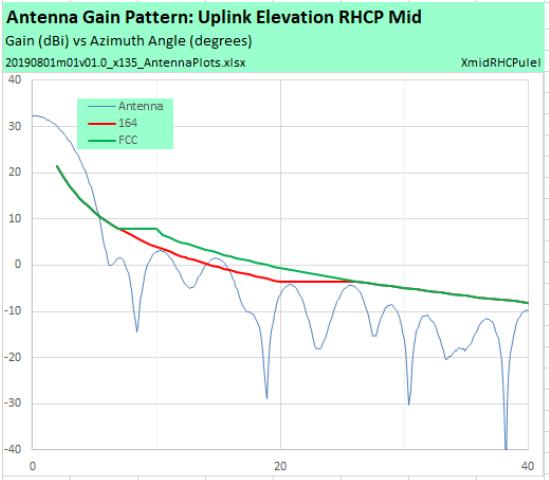
Max PSD	into antenna	-38	dBW/Hz
Max PSD	out of antenna at boresite	-5.7	dBW/Hz



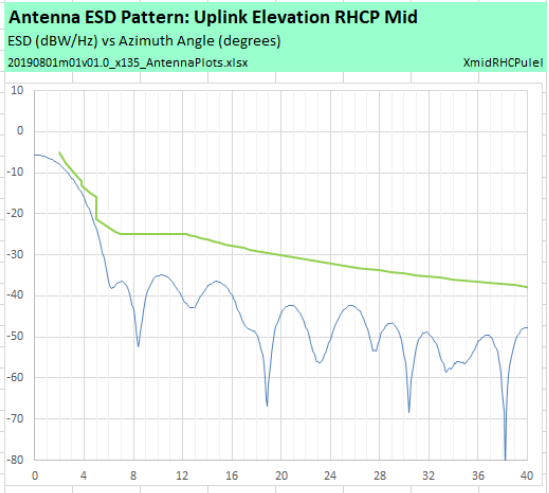
Max Gain	32.3	dBi



Max PSD	into antenna	-38	dBW/Hz
Max PSD	out of antenna at boresite	-5.7	dBW/Hz



Max Gain	32.3	dBi

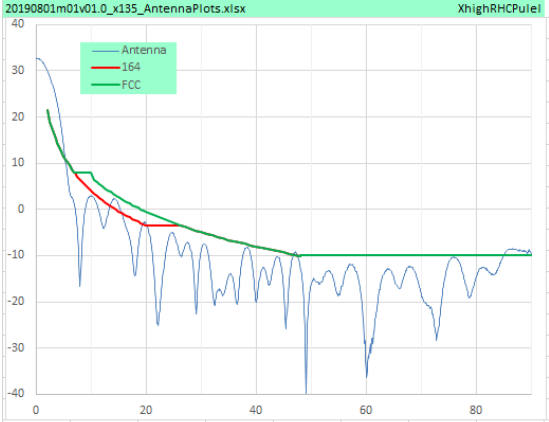


Max PSD	into antenna	-38	dBW/Hz
Max PSD	out of antenna at boresite	-5.7	dBW/Hz

Antenna Gain Pattern: Uplink Elevation RHCP High

Gain (dBi) vs Azimuth Angle (degrees)

20190801m01v01.0_x135_AntennaPlots.xlsx XhighRHCPulel

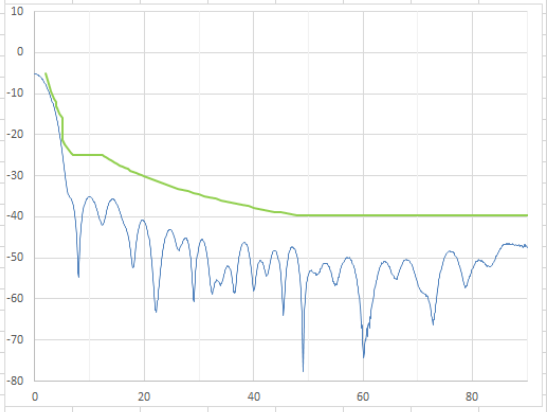


Max Gain	32.8	dBi

Antenna ESD Pattern: Uplink Elevation RHCP High

ESD (dBW/Hz) vs Azimuth Angle (degrees)

20190801m01v01.0_x135_AntennaPlots.xlsx XhighRHCPulel



Max PSD	into antenna	-38	dBW/Hz
Max PSD	out of antenna at boresite	-5.2	dBW/Hz

Antenna Gain Pattern: Uplink Elevation RHCP High

Gain (dBi) vs Azimuth Angle (degrees)

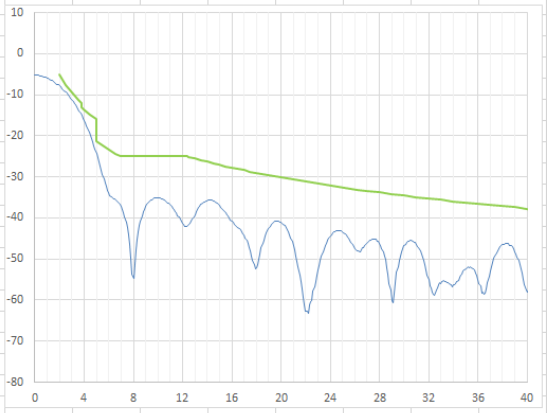
20190801m01v01.0_x135_AntennaPlots.xlsx XhighRHCPulel

Max Gain	32.8	dBi

Antenna ESD Pattern: Uplink Elevation RHCP High

ESD (dBW/Hz) vs Azimuth Angle (degrees)

20190801m01v01.0_x135_AntennaPlots.xlsx XhighRHCPulel



Max PSD	into antenna	-38	dBW/Hz
Max PSD	out of antenna at boresite	-5.2	dBW/Hz