COMPLIANCE WORLDWIDE INC.
TEST REPORT 179-19R5

In Accordance with the Requirements of

Federal Communications Commission 47 CFR Part 15.250, Subpart C
Wideband Systems within the band 5925 to 7250 MHz

ISED RSS-220, Issue 1 (March 2009) + Amendment 1 (July 2018)
Devices Using Ultra-Wideband (UWB) Technology

Issued to

Argon Electronics, Ltd
16 Ribocon Way, Progress Park
Luton, England LU4 9UR

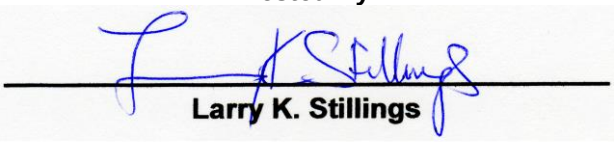
For the

RadSim UWB Module
Model: ARG411M01

FCC ID: 2ATN7-ARG411M01
IC: 25152-ARG411M01

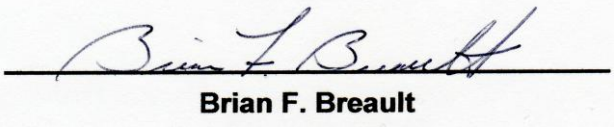
Report Issued on May 31, 2019
Revision R5 Issued on November 19, 2019

Tested By



Larry K. Stillings

Reviewed By



Brian F. Breault

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1. Scope

This test report certifies that the Argon Electronics RadSim UWB Module as tested, meets the FCC Part 15.250, Subpart C and ISED RSS-220 requirements. The scope of this test report is limited to the test sample provided by the client, only in as much as that sample represents other production units. If any significant changes are made to the unit, the changes shall be evaluated and a retest may be required. Revision R1 updates the RF Exposure by removing simultaneous operation and updating the distance for the UWB radio. Revision R2 changes RF Exposure using the SAR exemption criteria. Revision R3 updates the RF Exposure to account for low duty cycle. Revision R4 corrects typo in RF Exposure, and adds exemption for the Bluetooth radio module. Revision R5 updates RF Exposure by taking conducted power measurements per TCB Workshop RF Exposure Policy Updates, dated November 13, 2019.

2. Product Details

2.1. Manufacturer:	Argon Electronics, Ltd.
2.2. Model Number:	RadSim UWB Module ARG411M01
2.3. Serial Number:	Pre Production
2.4. Description:	The ARG411M01 is a modular device that relies on ultra-wideband (UWB) pulses and time-stamp information to capture real-time location and movement data. The ARG411M01 also includes a 2.4GHz radio transceiver for long-range communication and communication with other devices.
2.5. Power Source:	3.3 VDC
2.6. Hardware Revision:	N/A
2.7. Software Revision:	N/A
2.8. Modulation Type:	Pulse Modulation, Frequency Hopping
2.9. Operating Frequency:	6.49 GHz Center Frequency Nominal (Channel 5 – 500 MHz BW)
2.10. EMC Modifications:	None

3. Product Configuration

3.1 Operational Characteristics & Software

Hardware Setup:

Connect the RadSim UWB Module to a laptop via a serial to USB interface adapter. Using the built in firmware configure packet length, and PRFs for the EUT. The Radsim was tested in two modes consisting of 1023 packet lengths, with 16M and 64M PRFs at a 6.8 Mbps data rate.

3.2. Cables

Cable Type	Length	Shield	From	To
Power Cable	2M	No	EUT	3.3 VDC Power Supply
Serial to USB Adapter	10M	Yes	EUT	Laptop
u.fl to SMB or Antenna	0.1M	Yes	EUT	Antenna

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3. Product Configuration (cont.)

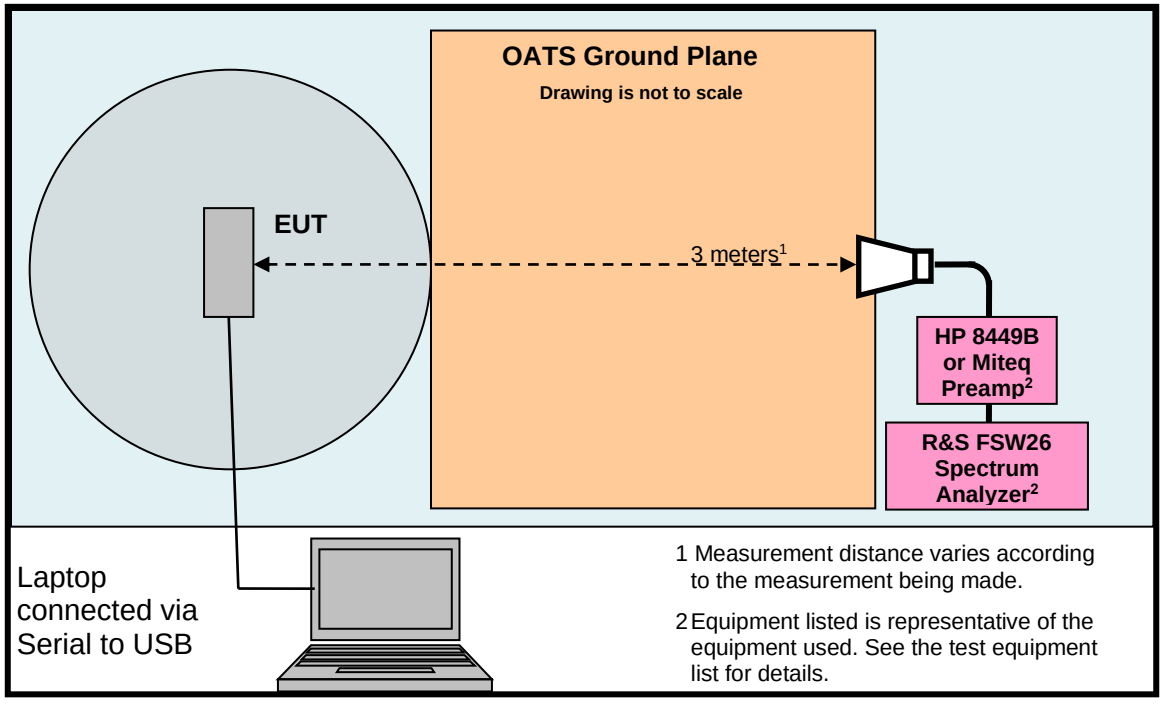
3.3. EUT Hardware

Manufacturer	Model/Part # / Options	Serial Number	Input Volts	Freq (Hz)	Description/Function
Argon Electronics	ARG411M01	Pre Production	3.3	DC	RadSim UWB Module
Argon Electronics	MDO-ANT-C5UWB30	V1.1.0			Directional Antenna
Argon Electronics	MAN				Argon Antenna
Taoglas	FXUWB01.07.0100C				Taoglas Antenna
Laird Technologies	BL654 Module		3.3	DC	FCC ID: SQGBL654 IC: 3147A-BL654

3.4. Support Equipment

Manufacturer	Model/Part #	Serial Number	Description
Dell	Inspirion E1505	5573349937	Laptop for Configuration
Acopian	B3.3G700M	None	Linear DC Power Supply

3.5. Test Setup Diagram



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4. Measurements Parameters

4.1. Measurement Equipment Used to Perform Test

Device	Manufacturer	Model No.	Serial No.	Cal Due	Interval
EMI Receiver 9 kHz to 7 GHz	Rohde & Schwarz	ESR7	101156	9/10/2020	2 Years
Spectrum Analyzer 9 kHz to 40 GHz	Rohde & Schwarz	FSV40	100899	9/10/2020	2 Years
Spectrum Analyzer 10 Hz to 40 GHz	Rohde & Schwarz	FSVR40	100909	5/3/2020	3 Years
Spectrum Analyzer 3 Hz to 26.5 GHz	Rohde & Schwarz	FSW26	102044	9/13/2020	2 Years
Bilog Antenna 30 to 2000 MHz	Com-Power	AC-220	25509	2/13/2022	3 Years
Loop Antenna 9 kHz to 30 MHz	EMCO	6512	9309-1139	10/26/2019	3 Years
Preamplifier 100 MHz to 7 GHz	Miteq	AFS3-00100200-10-15P-4	988773	4/17/2020	2 Years
Preamplifier 100 MHz to 18 GHz	Miteq	AMF-7D-00101800-30-10P	1953081	4/16/2020	2 Years
Preamplifier 2 to 12 GHz	JCA	JCA48-4111B1	7087S	4/17/2020	2 Years
Preamplifier 1 to 26.5 GHz	Hewlett Packard	8449B	3008A01323	9/11/2020	2 Years
Preamplifier 18 to 40 GHz	Miteq	JSD42-21004200-40-5P	649199/649219	11/1/2019	1 Year
Horn Antenna 1 to 18 GHz	ETS-Lindgren	3117	00143292	3/21/2022	3 Years
Horn Antenna 18-40 GHz	Com Power	AH-840	101032	10/9/2020	2 Years
High Pass Filter 8 to 18 GHz	Micro-Tronics	HPM50107	G036	7/20/2019	1 Year
2.4 GHz Band Pass Filter	Micro-Tronics	BRM50702	150	1/23/2019	1 Year
Barometer	Control Company	4195	Cal ID# 236	4/3/2020	2 Years

[1] ESR7 Firmware revision: V3.36, SP2 Date installed: 11/02/2017 Previous V3.36, installed 05/16/2017.
[2] FSV40 Firmware revision: V2.30 SP4, Date installed: 05/04/2016 Previous V2.30 SP1, installed 10/22/2014.
[3] FSVR40 Firmware revision: V2.23 SP1, Date installed: 08/19/2016 Previous V2.23, installed 10/20/2014.
[4] FSW26 Firmware revision: V2.80, Date installed: 10/28/2017 Previous V2.61, installed 04/04/2017.

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4. Measurements Parameters (continued)

4.2. Measurement & Equipment Setup

Test Dates:	4/25/2019, 4/26/2019, 4/29/2019, 5/7/2019, 5/8/2019, 5/9/2019, 8/22/2019, 11/19/2019
Test Engineers:	Brian Breault, Larry Stillings
Normal Site Temperature (15 - 35°C):	21.6
Relative Humidity (20 -75%RH):	35
Frequency Range:	10 kHz to 40 GHz
Measurement Distance:	3 Meters
EMI Receiver IF Bandwidth:	200 Hz – 10 kHz to 150 kHz 9 kHz – 10 to 30 MHz 120 kHz - 30 MHz to 1 GHz 1 MHz - Above 1 GHz
EMI Receiver Avg Bandwidth:	300 Hz – 10 kHz to 150 kHz 30 kHz – 10 to 30 MHz 300 kHz - 30 MHz to 1 GHz 3 MHz - Above 1 GHz
Detector Function:	Peak, Quasi-Peak, RMS & CISPR Average

4.3. Measurement Procedure

Test measurements were made in accordance FCC Parts 15.209, 15.250 Subpart C and ISED RSS-220, Issue 1 & A1.

The test methods used to generate the data is this test report is in accordance with ANSI C63.10:2013, American National Standard for Testing Unlicensed Wireless Devices.

4.4. Measurement Uncertainty

The following uncertainties are expressed for an expansion/coverage factor of K=2.

RF Frequency (out of band)	$\pm$ 1x10^{-8}
Radiated Emission of Transmitter to 100 GHz	$\pm$ 4.55 dB
Radiated Emission of Receiver	$\pm$ 4.55 dB
Temperature	$\pm$ 0.91^{o} C
Humidity	$\pm$ 5%

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5. Measurements Summary

Test Requirement	FCC Rule Requirement	ISED Rule Requirement	Test Report Section	Result	Comment
Antenna Requirement	15.203	RSS-220 5.1 (b)	6.1	Compliant	
Operational Requirements	15.250 (a)	RSS-220	6.2	Compliant	
Wideband Bandwidth	15.250 (b)	RSS-220 2 RSS-220 5.1	6.3	Compliant	
Spurious Radiated Emissions	15.250 (d) (1) 15.209	RSS-220 3.4	6.4	Compliant	
Radiated Emissions in GPS Bands	15.250 (d) (2)	RSS-220 5.3.1 (e)	6.5	Compliant	
RMS Power in a 1 MHz Bandwidth	15.250 (d) (1)	RSS-220 5.3.1 (d)	6.6	Compliant	
Peak Emissions in a 50 MHz Bandwidth	15.250 (d) (3)	RSS-220 5.3.1 (g)	6.7	Compliant	
Conducted Emissions	15.207	RSS-GEN	6.8	Compliant	
99% Emission Bandwidth	N/A	RSS-GEN 6.7	6.9	Compliant	
Radio Frequency Exposure	FCC OET Bulletin 65 1.1307 (b) (1)	RSS-102, Issue 5	6.10	Compliant	

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6. Measurement Data

6.1. Antenna Requirement (15.203, RSS-220 5.1 (b))

Requirement: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply

Result: Three different antennas are utilized by the device under test and use an on board u.fl connector to connect to the antennas.

6.2. Operational Requirements of the Device under Test (15.250 (a), RSS-220)

Requirement: The -10 dB bandwidth of a device operating under the provisions of this section must be contained within the 5925 to 7250 MHz band under all conditions of operation including the effects from stepped frequency, frequency hopping or other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage.

Result: Compliant

6.2.1 Frequency Stability over Temperature

Marker	Temp °C	Measured Frequency	-10 dB Band Edges		15.250 Frequency Band		Result
		(MHz)	Lower	Upper	F_{MIN} (MHz)	F_{MAX} (MHz)	
-	OATS	6439.1	6194.3	6754.7	5925	7250	Compliant
-	Ambient	6449.2	6057.9	6840.5	5925	7250	Compliant
1	-20	6450.7	6039.1	6862.2	5925	7250	Compliant
2	-10	6458.6	6059.3	6857.9	5925	7250	Compliant
3	0	6464.4	6079.6	6849.2	5925	7250	Compliant
4	+10	6463.6	6085.4	6841.8	5925	7250	Compliant
5	+20	6464.4	6085.4	6843.4	5925	7250	Compliant
6	+30	6465.9	6098.5	6833.3	5925	7250	Compliant
7	+40	6468.0	6097.0	6839.1	5925	7250	Compliant
8	+50	6475.4	6138.8	6812.0	5925	7250	Compliant

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6. Measurement Data (continued)

6.3. Wideband Bandwidth (15.250 (b), RSS-220 2, 5.1)

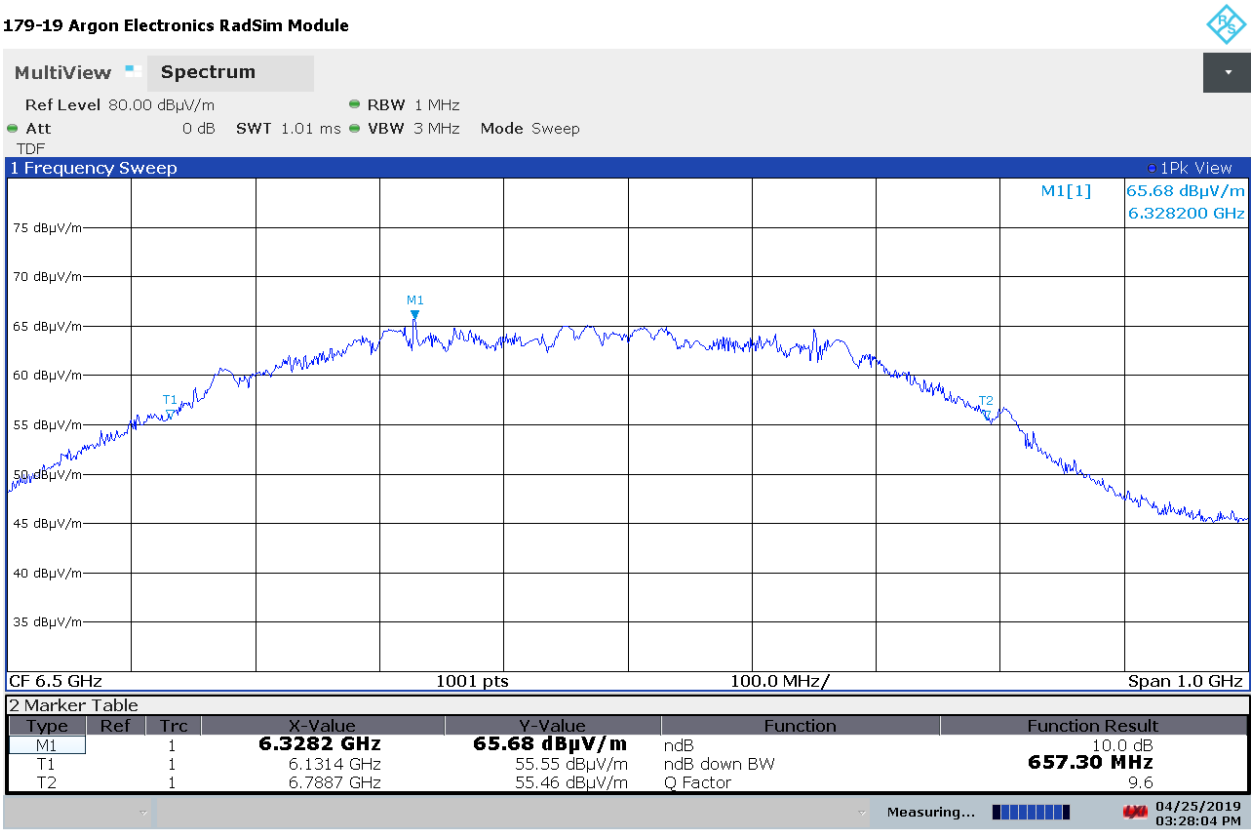
Requirement: The -10 dB bandwidth of the fundamental emission shall be at least 50 MHz.

Result: Compliant

6.3.1. Measurement Data – Values in GHz

f_M	The highest emission peak	6.3282
f_L	10 dB below the highest peak	6.1314
f_H	10 dB above the highest peak	6.7887
Bandwidth	Calculated: (f_H - f_L)	0.6573

6.3.2. Measurement Plot of 10 dB frequencies (16M PRF Directional Antenna)



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6. Measurement Data (continued)

6.3. Wideband Bandwidth (15.250 (b), RSS-220 2, 5.1 continued)

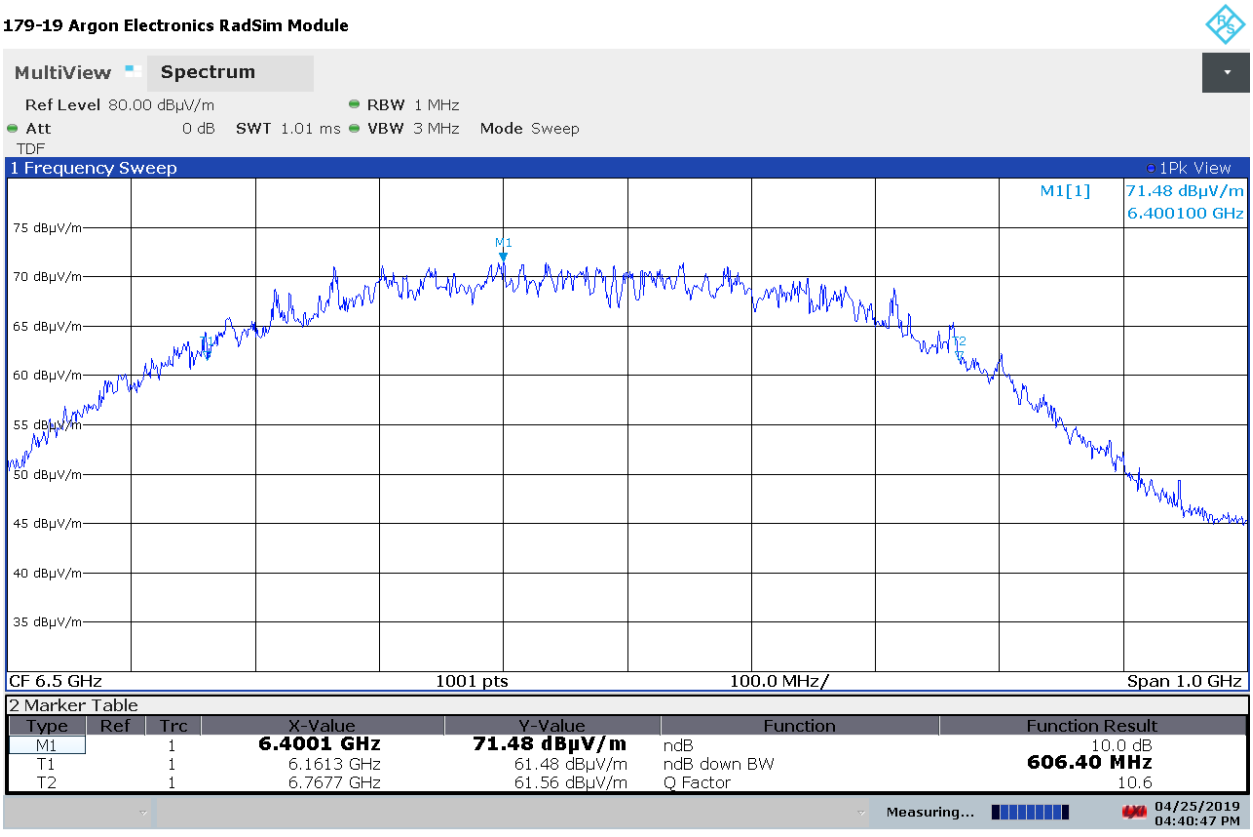
Requirement: The -10 dB bandwidth of the fundamental emission shall be at least 50 MHz.

Result: Compliant

6.3.3. Measurement Data – Values in GHz

f_M	The highest emission peak	6.4001
f_L	10 dB below the highest peak	6.1613
f_H	10 dB above the highest peak	6.7677
Bandwidth	Calculated: (f_H - f_L)	0.6064

6.3.4. Measurement Plot of 10 dB frequencies (64M PRF Directional Antenna)



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6. Measurement Data (continued)

6.3. Wideband Bandwidth (15.250 (b), RSS-220 2, 5.1 continued)

Requirement: The -10 dB bandwidth of the fundamental emission shall be at least 50 MHz.

Result: Compliant

6.3.5. Measurement Data – Values in GHz

f_M	The highest emission peak	6.3631
f_L	10 dB below the highest peak	6.2313
f_H	10 dB above the highest peak	6.7438
Bandwidth	Calculated: (f_H - f_L)	0.5125

6.3.6. Measurement Plot of 10 dB frequencies (16M PRF Argon Antenna)

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6. Measurement Data (continued)

6.3. Wideband Bandwidth (15.250 (b), RSS-220 2, 5.1 continued)

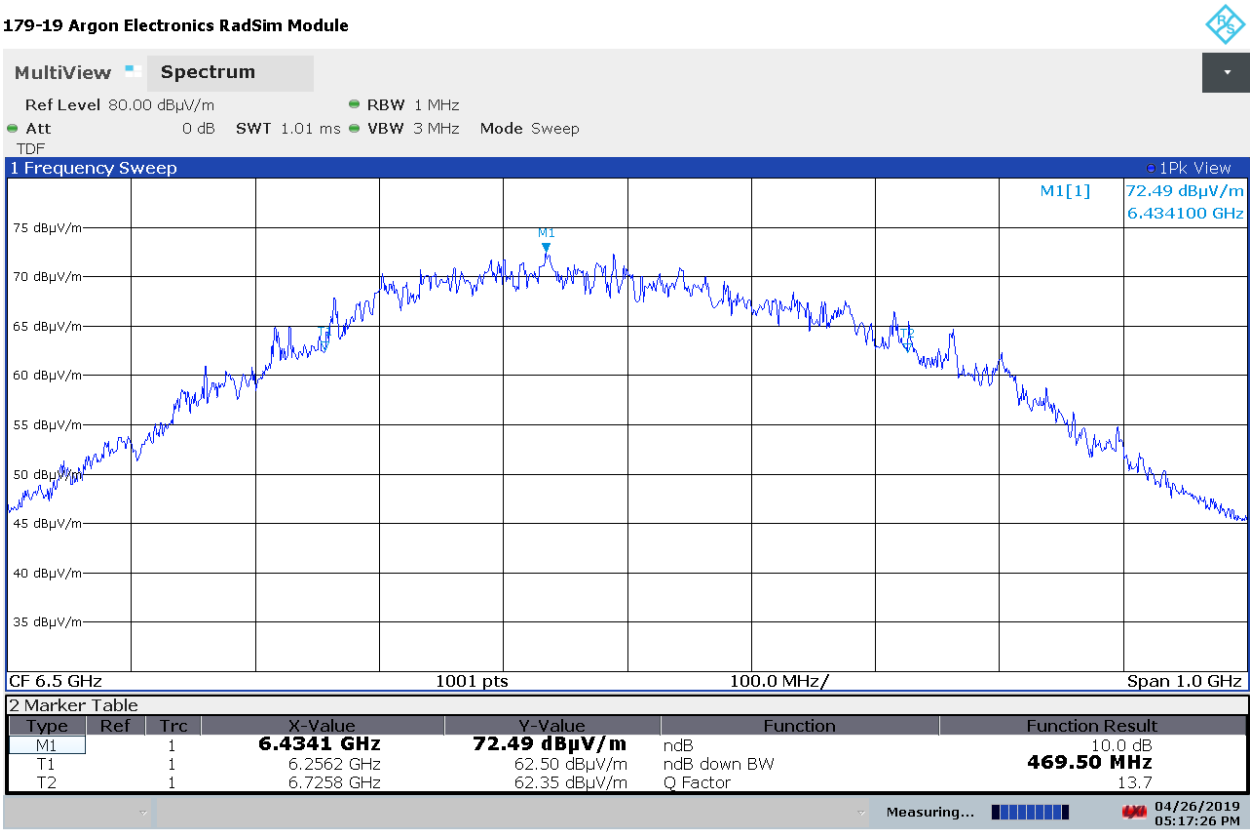
Requirement: The -10 dB bandwidth of the fundamental emission shall be at least 50 MHz.

Result: Compliant

6.3.7. Measurement Data – Values in GHz

f_M	The highest emission peak	6.4341
f_L	10 dB below the highest peak	6.2562
f_H	10 dB above the highest peak	6.7258
Bandwidth	Calculated: (f_H - f_L)	0.4695

6.3.8. Measurement Plot of 10 dB frequencies (64M PRF Argon Antenna)



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6. Measurement Data (continued)

6.3. Wideband Bandwidth (15.250 (b), RSS-220 2, 5.1 continued)

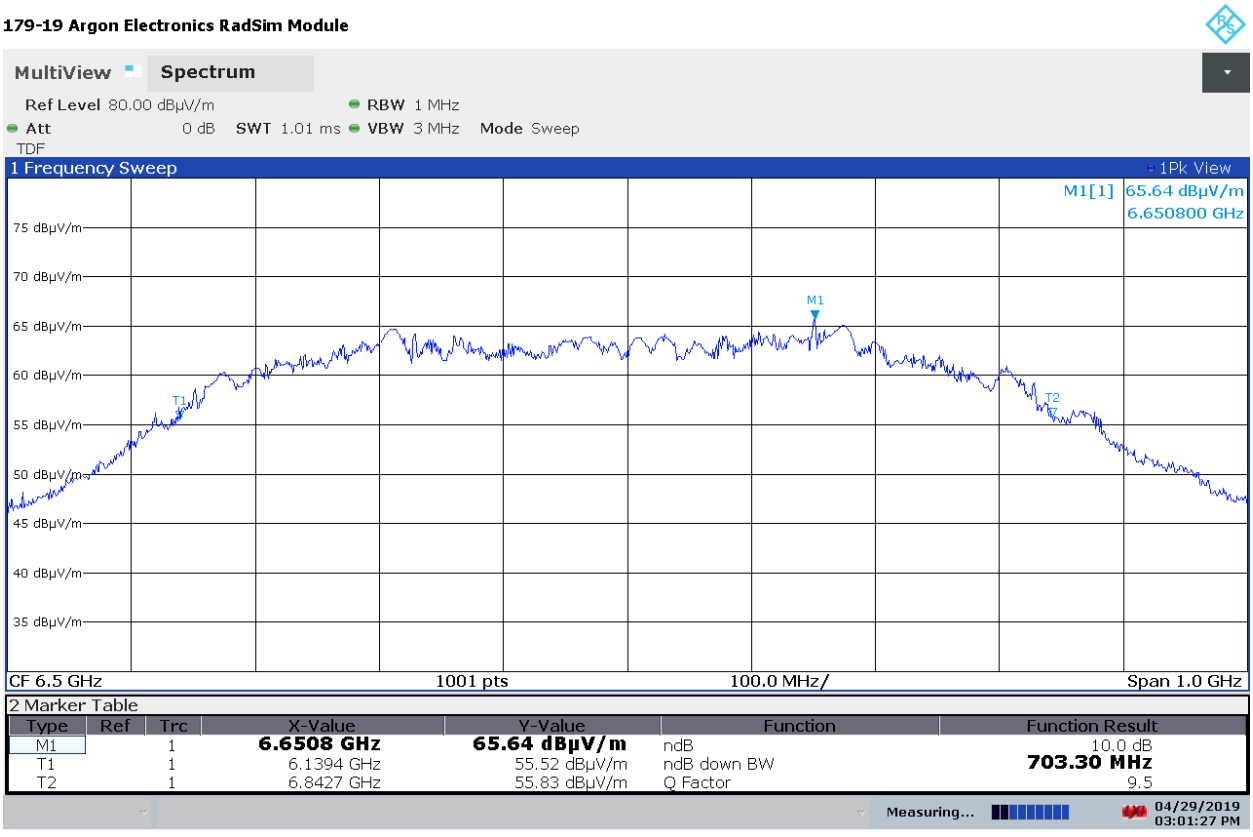
Requirement: The -10 dB bandwidth of the fundamental emission shall be at least 50 MHz.

Result: Compliant

6.3.9. Measurement Data – Values in GHz

f_M	The highest emission peak	6.6508
f_L	10 dB below the highest peak	6.1394
f_H	10 dB above the highest peak	6.8427
Bandwidth	Calculated: (f_H - f_L)	0.7033

6.3.10. Measurement Plot of 10 dB frequencies (16M PRF Taoglas Antenna)



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6. Measurement Data (continued)

6.3. Wideband Bandwidth (15.250 (b), RSS-220 2, 5.1 continued)

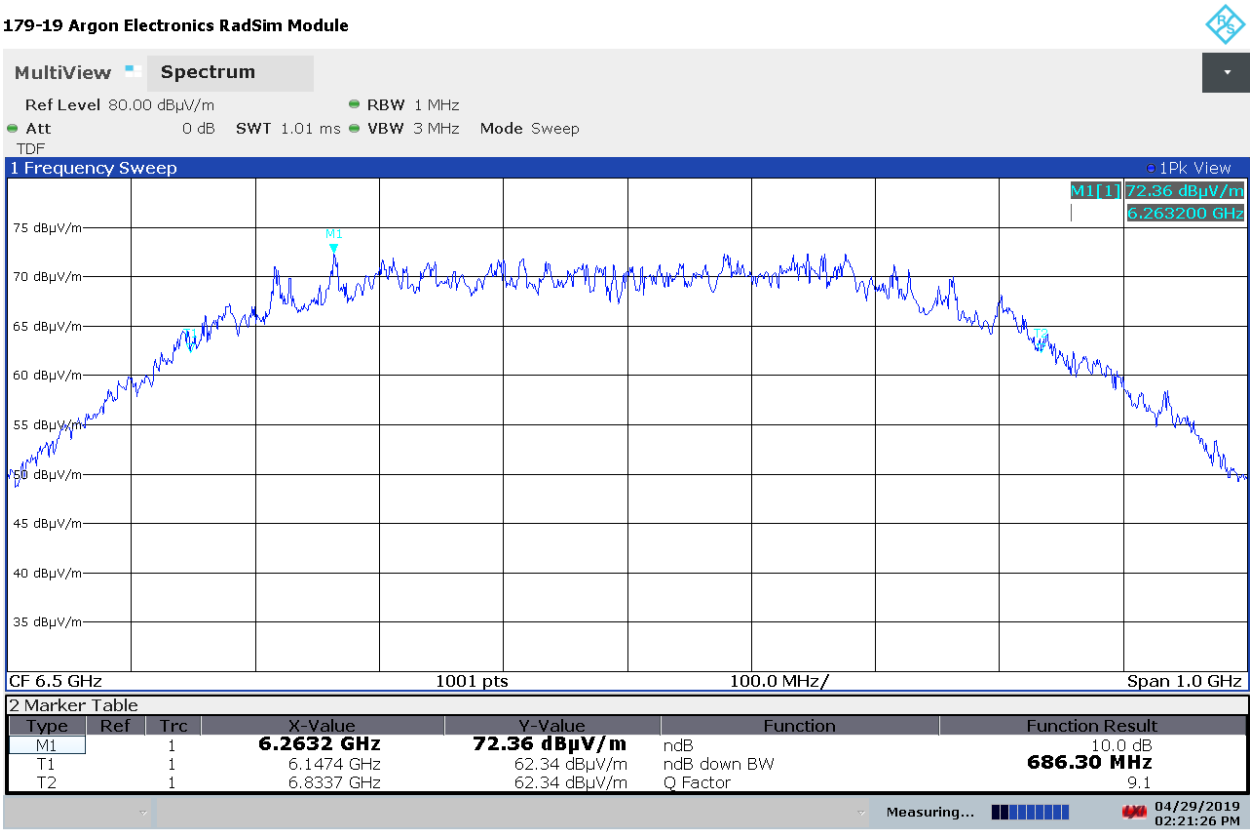
Requirement: The -10 dB bandwidth of the fundamental emission shall be at least 50 MHz.

Result: Compliant

6.3.11. Measurement Data – Values in GHz

f_M	The highest emission peak	6.2632
f_L	10 dB below the highest peak	6.1474
f_H	10 dB above the highest peak	6.8337
Bandwidth	Calculated: (f_H - f_L)	0.6863

6.3.12. Measurement Plot of 10 dB frequencies (64M PRF Taoglas Antenna)



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6. Measurement Data (continued)

6.4. Spurious Radiated Emissions (15.250 (d) (1), 15.209, RSS-220 3.4)

Requirement: The radiated emissions at or below 960 MHz from a device operating under the provisions of this section shall not exceed the emission levels in Section 15.209. The radiated emissions above 960 MHz from a device operating under the provisions of this section shall not exceed the following average limits when measured using a resolution bandwidth of 1 MHz:

Frequency (MHz)	EIRP (dBm)	EIRP at 3 Meters (dBµV/m)
960 - 1610	-75.3	19.9
1610 - 1990	-63.3	31.9
1990 - 3100	-61.3	33.9
3100 – 5925	-51.3	43.9
5925 – 7250	-41.3	53.9
7250 – 10,600	-51.3	43.9
Above 10,600	-61.3	33.9

Spurious Radiated Emissions (RSS-220 5.3.1 (d))

Requirement: The radiated emissions at or below 960 MHz from a device shall not exceed the limits in Section 3.4. The radiated emissions above 960 MHz from a device shall not exceed the following average limits when measured using a resolution bandwidth of 1 MHz:

Frequency (MHz)	EIRP (dBm)	EIRP at 3 Meters (dBµV/m)
960 - 1610	-75.3	19.9
1610 – 4750	-70.0	25.2
4750 – 10,600	-41.3	53.9
Above 10,600	-61.3	33.9

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6. Measurement Data (continued)

6.4. Spurious Radiated Emissions (15.250 (d) (1), 15.209, RSS-220 3.4 continued)

Radiated Emissions Field Strength Limits at 3 Meters (Section 15.250 (d),15.209)

Frequency (MHz)	Field Strength (µV/m)	Field Strength (dBµV/m)
0.009 to 0.490	2,400/F	128.5 to 93.8
0.490 to 1.705	24,000/F	73.8 to 63
1.705 - 30	30	69.5
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
960 - 40,000	500	54

Test Notes: Refer to Section 4.1 for the test equipment used.

Frequency Range:	10 kHz to 40 GHz
Measurement Distance:	3 Meters
EMI Receiver IF Bandwidth:	200 Hz – 10 kHz to 150 kHz 9 kHz – 150 kHz to 30 MHz 120 kHz - 30 MHz to 1 GHz 1 MHz - Above 1 GHz
EMI Receiver Avg Bandwidth (minimum):	300 Hz – 10 kHz to 150 kHz 30 kHz – 150 kHz to 30 MHz 300 kHz - 30 MHz to 1 GHz 3 MHz - Above 1 GHz
Detector Function:	Peak, Quasi-Peak & Average

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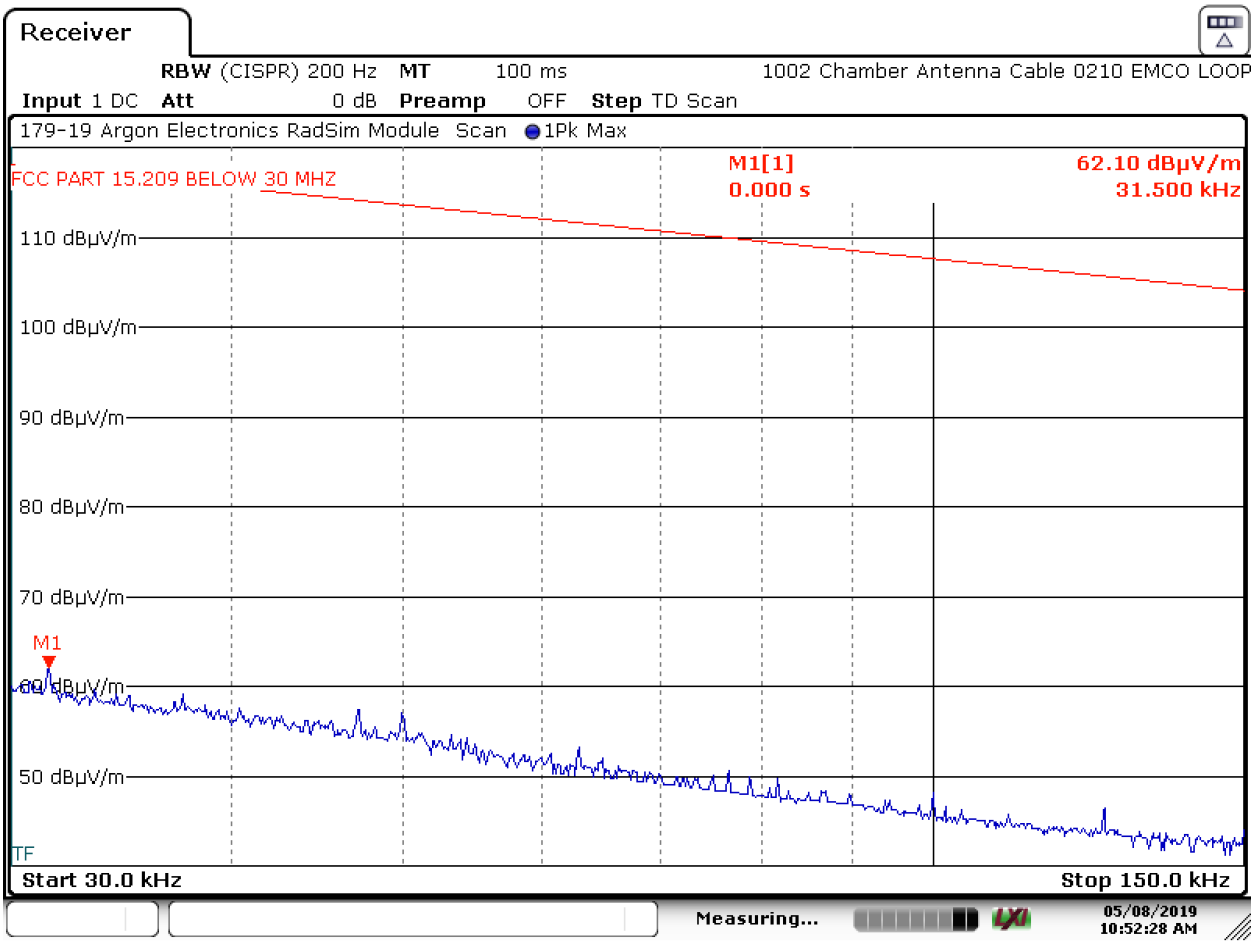
6. Measurement Data (continued)

6.4. Spurious Radiated Emissions (15.250 (d) (5), 15.209, RSS-220 3.4 continued)

6.4.1. 30 kHz to 960 MHz, measured at 3 Meters

The device was prescreened in our 3 Meter Semi-Anechoic Chamber. There were no measurable emissions below 960 MHz on our 3 Meter OATS.

6.4.1.1 Parallel Measurement Antenna – 30 to 150 kHz (Directional 16M PRF)



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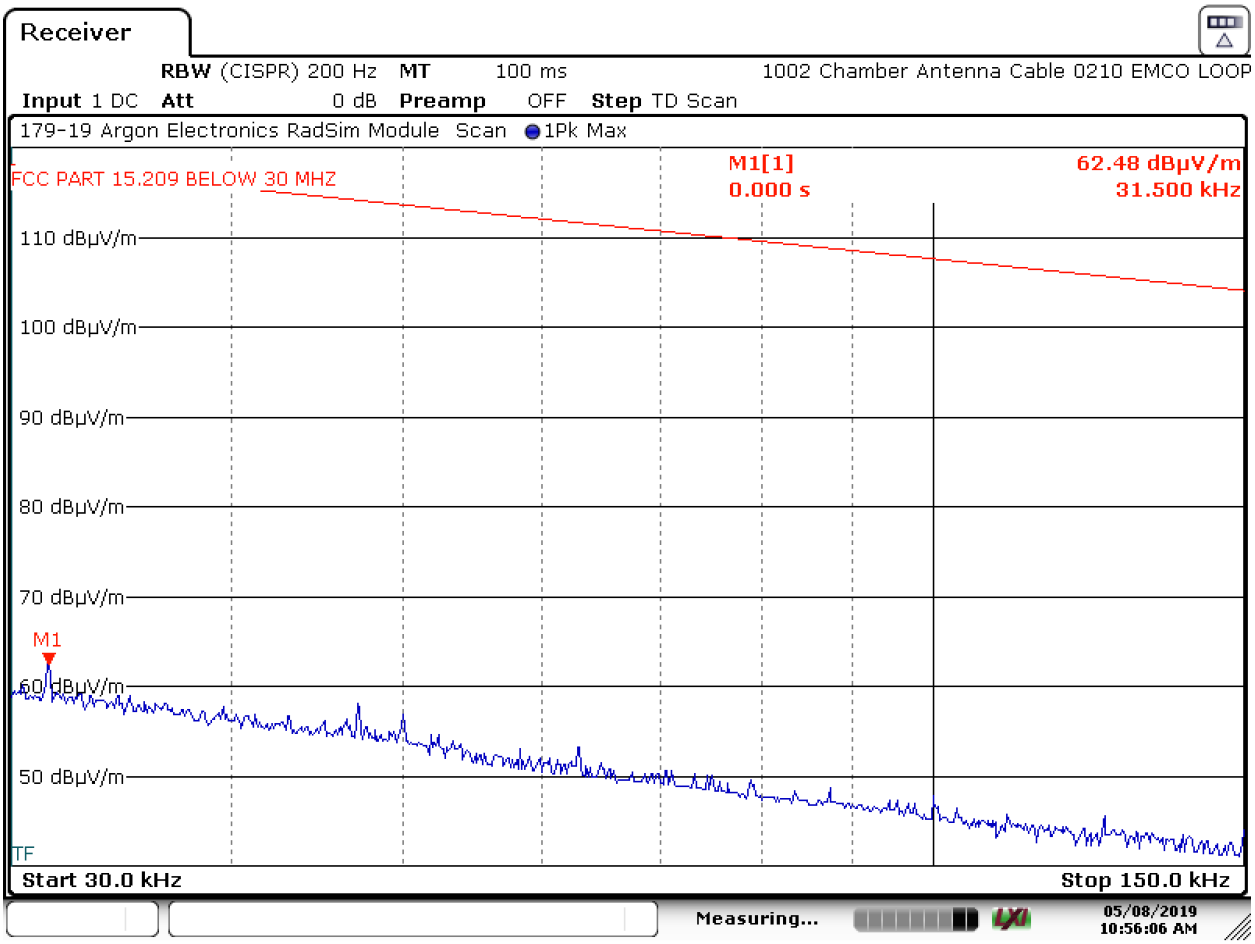
6. Measurement Data (continued)

6.4. Spurious Radiated Emissions (15.250 (d) (5), 15.209, RSS-220 3.4 continued)

6.4.1. 30 kHz to 960 MHz, measured at 3 Meters

The device was prescreened in our 3 Meter Semi-Anechoic Chamber. There were no measurable emissions below 960 MHz on our 3 Meter OATS.

6.4.1.2 Perpendicular Measurement Antenna – 30 to 150 kHz (Directional 16M PRF)



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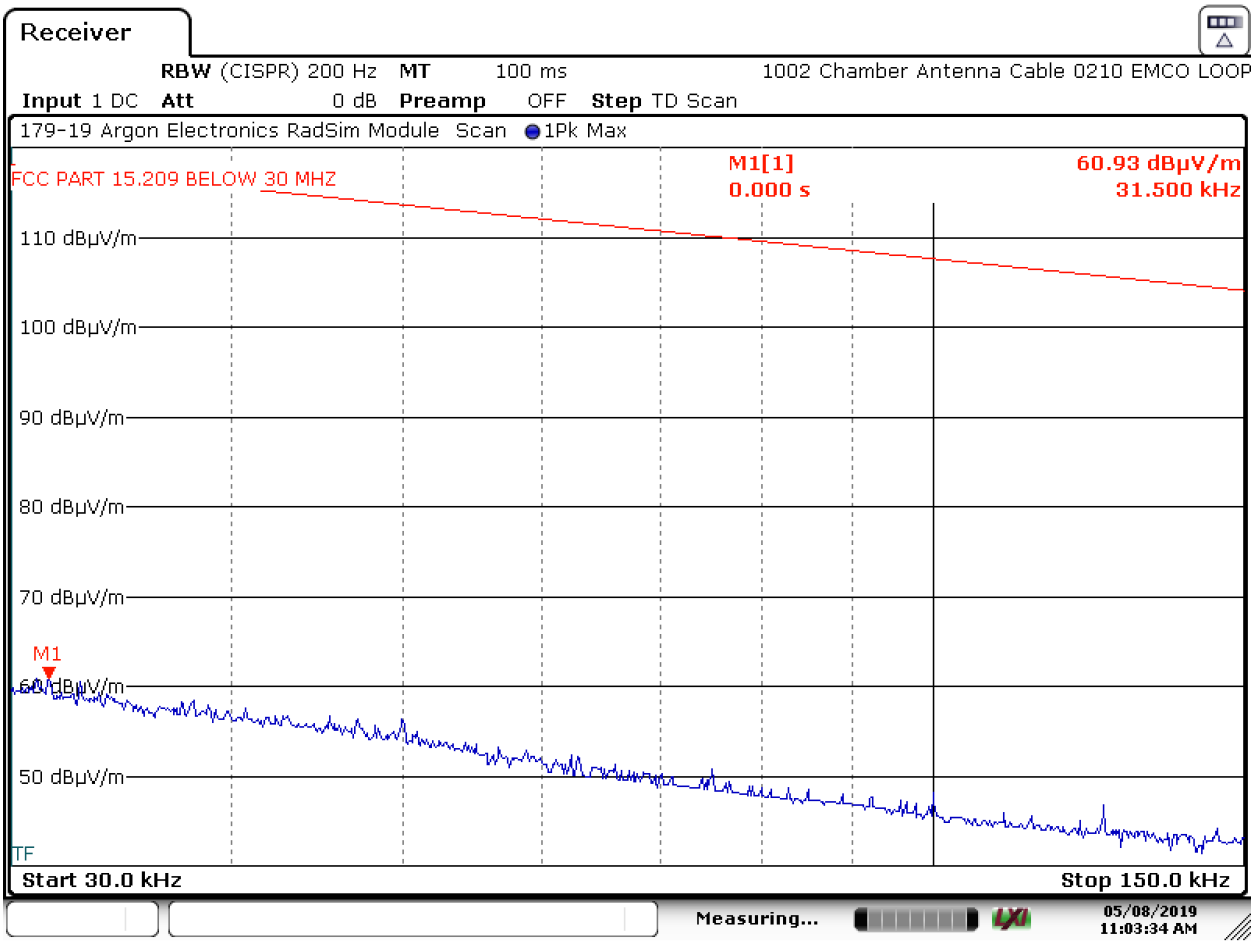
6. Measurement Data (continued)

6.4. Spurious Radiated Emissions (15.250 (d) (5), 15.209, RSS-220 3.4 continued)

6.4.1. 30 kHz to 960 MHz, measured at 3 Meters

The device was prescreened in our 3 Meter Semi-Anechoic Chamber. There were no measurable emissions below 960 MHz on our 3 Meter OATS.

6.4.1.3 Ground Parallel Measurement Antenna – 30 to 150 kHz (Directional 16M PRF)



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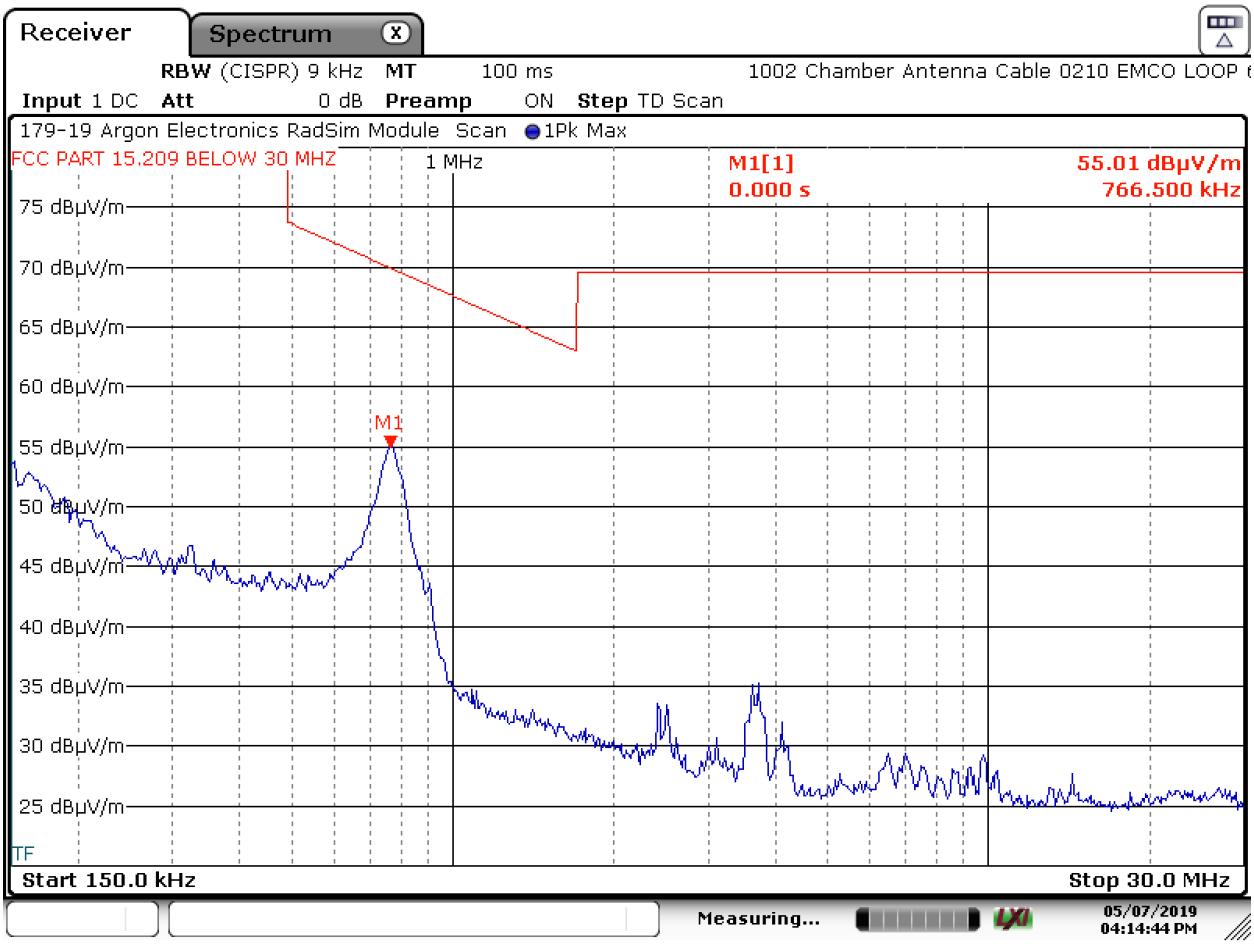
6. Measurement Data (continued)

6.4. Spurious Radiated Emissions (15.250 (d) (5), 15.209, RSS-220 3.4 continued)

6.4.1. 30 kHz to 960 MHz, measured at 3 Meters

The device was prescreened in our 3 Meter Semi-Anechoic Chamber. There were no measurable emissions below 960 MHz on our 3 Meter OATS.

6.4.1.4 Parallel Measurement Antenna – 150 kHz to 30 MHz (Directional 16M PRF)



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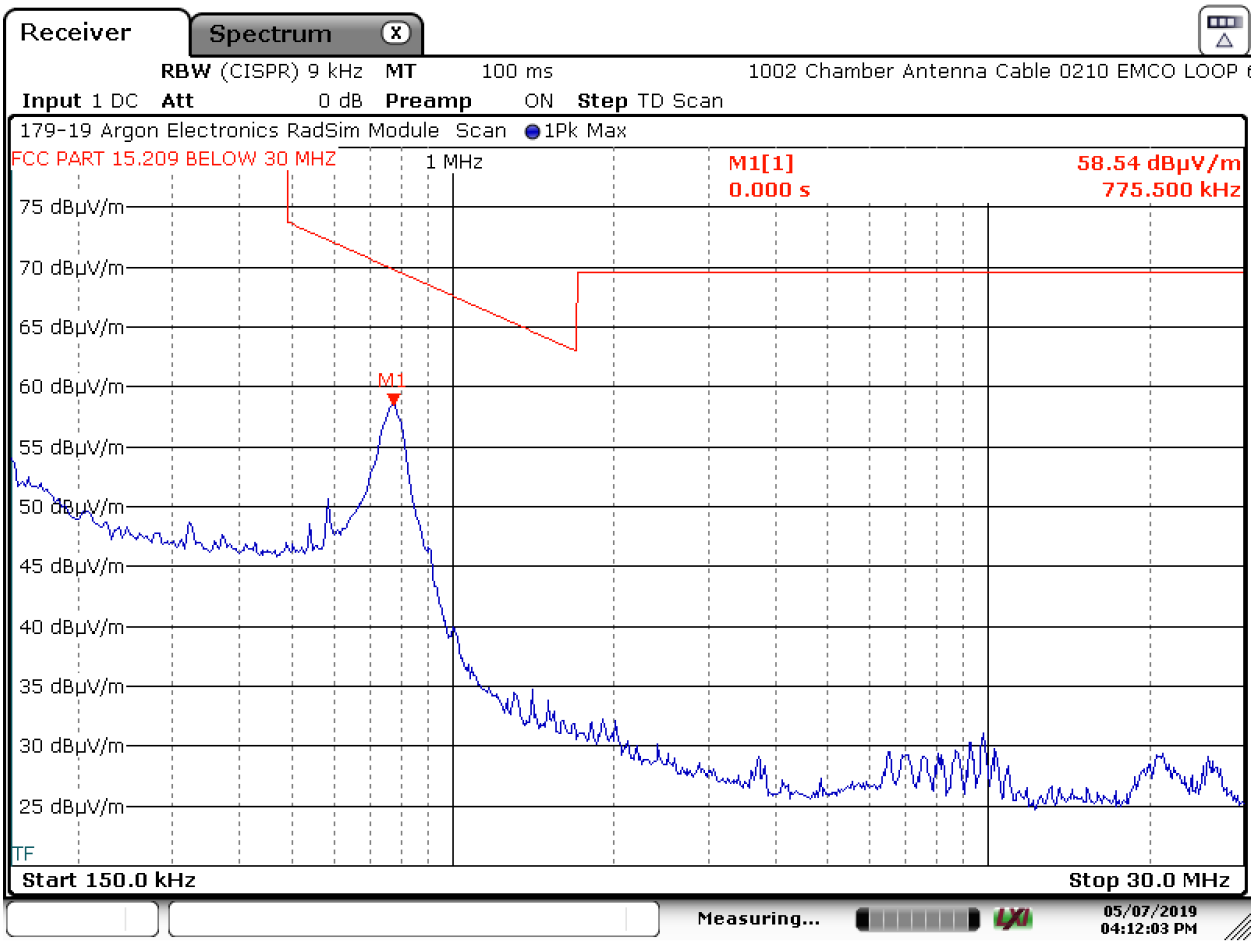
6. Measurement Data (continued)

6.4. Spurious Radiated Emissions (15.250 (d) (5), 15.209, RSS-220 3.4 continued)

6.4.1. 30 kHz to 960 MHz, measured at 3 Meters

The device was prescreened in our 3 Meter Semi-Anechoic Chamber. There were no measurable emissions below 960 MHz on our 3 Meter OATS.

6.4.1.5 Perpendicular Measurement Antenna – 150 kHz to 30 MHz (Directional 16M PRF)



Date: 7.MAY.2019 16:12:02

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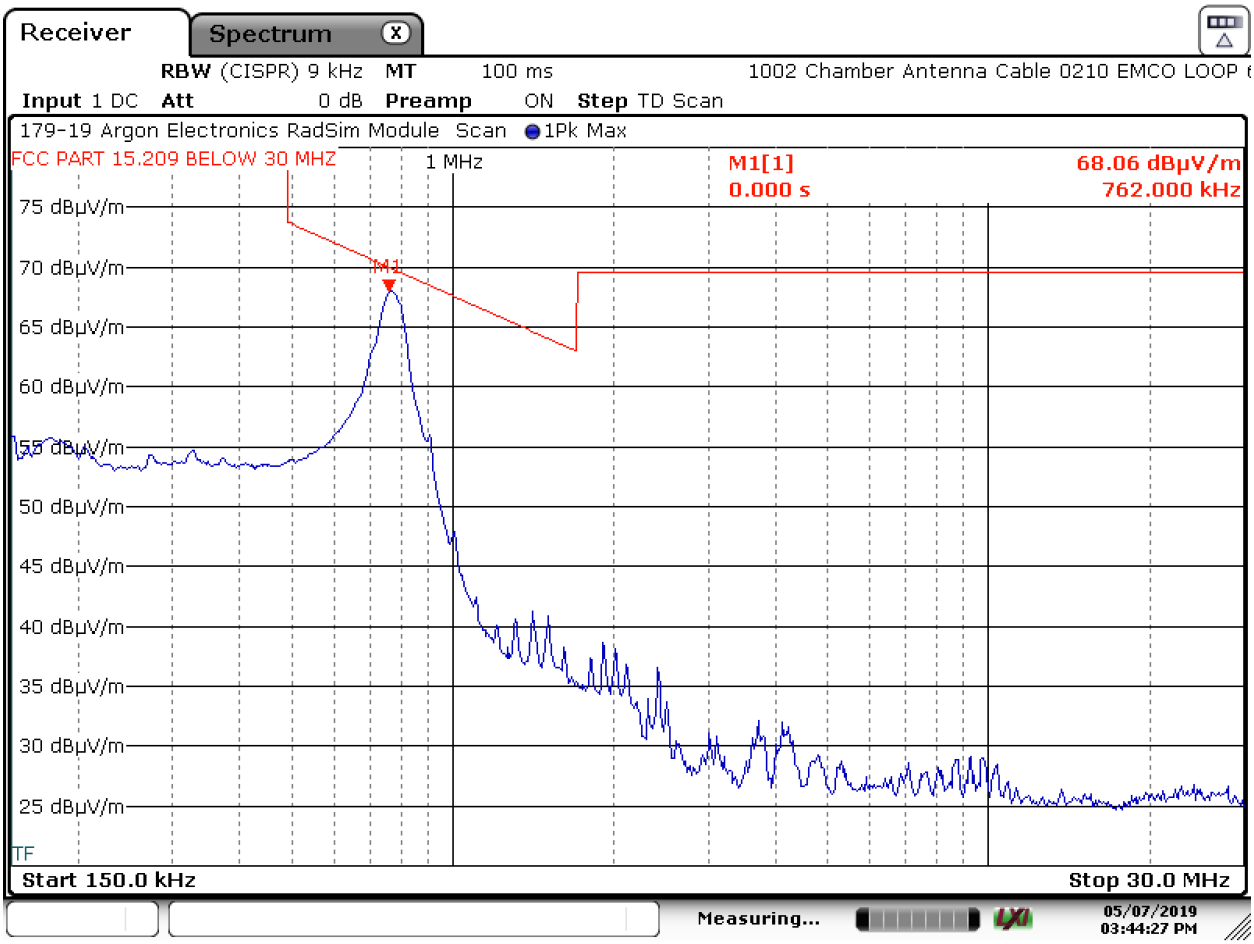
6. Measurement Data (continued)

6.4. Spurious Radiated Emissions (15.250 (d) (5), 15.209, RSS-220 3.4 continued)

6.4.1. 30 kHz to 960 MHz, measured at 3 Meters

The device was prescreened in our 3 Meter Semi-Anechoic Chamber. There were no measurable emissions below 960 MHz on our 3 Meter OATS.

6.4.1.6 Ground Parallel Measurement Antenna – 150 kHz to 30 MHz (Directional 16M PRF)



Date: 7.MAY.2019 15:44:26

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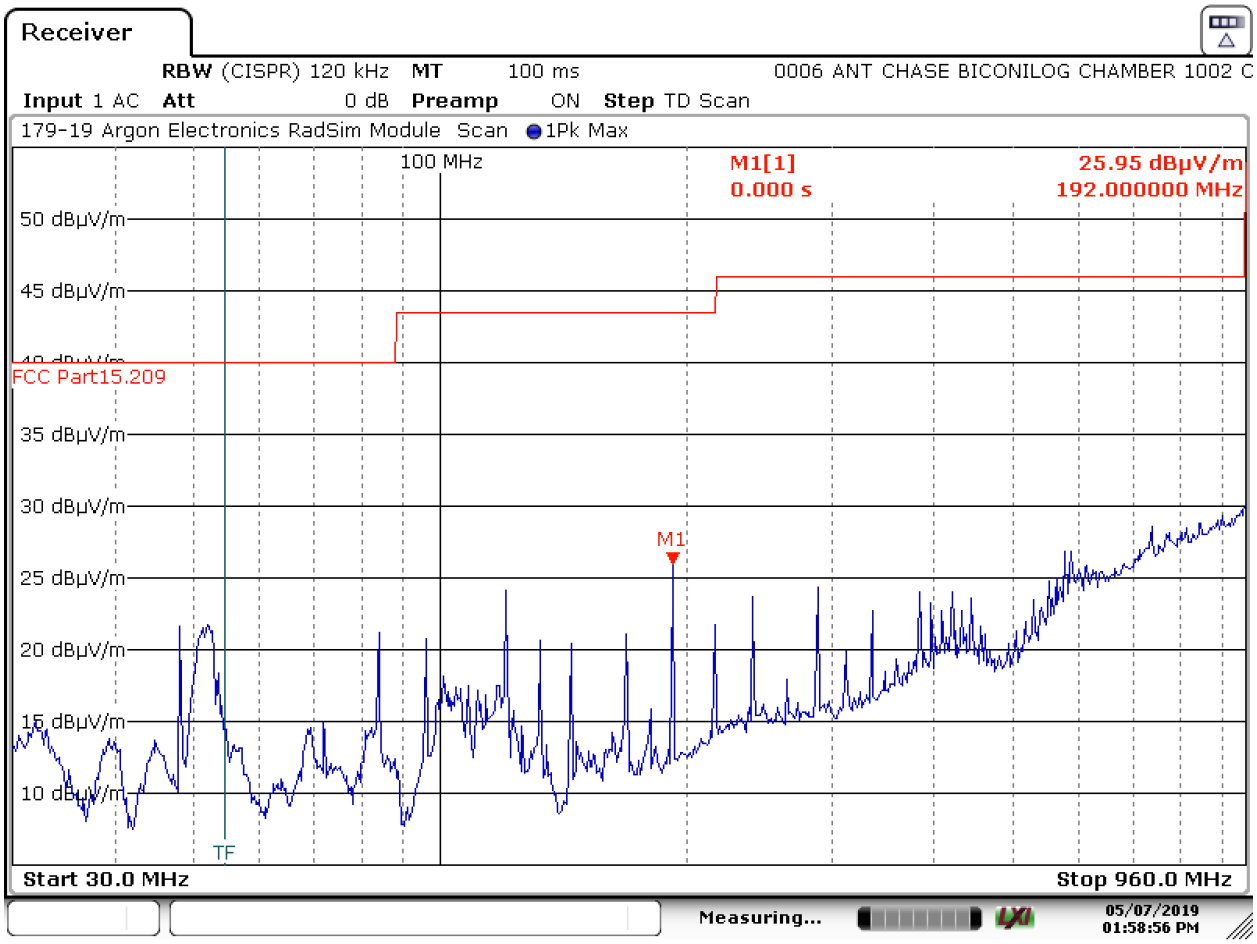
6. Measurement Data (continued)

6.4. Spurious Radiated Emissions (15.250 (d) (5), 15.209, RSS-220 3.4 continued)

6.4.1. 30 kHz to 960 MHz, measured at 3 Meters

The device was prescreened in our 3 Meter Semi-Anechoic Chamber. There were no emissions within 6 dB of the limits below 960 MHz on our 3 Meter OATS.

6.4.1.7 Horizontal Polarity – 30 to 960 MHz (Directional 16M PRF)



Date: 7.MAY.2019 13:58:55

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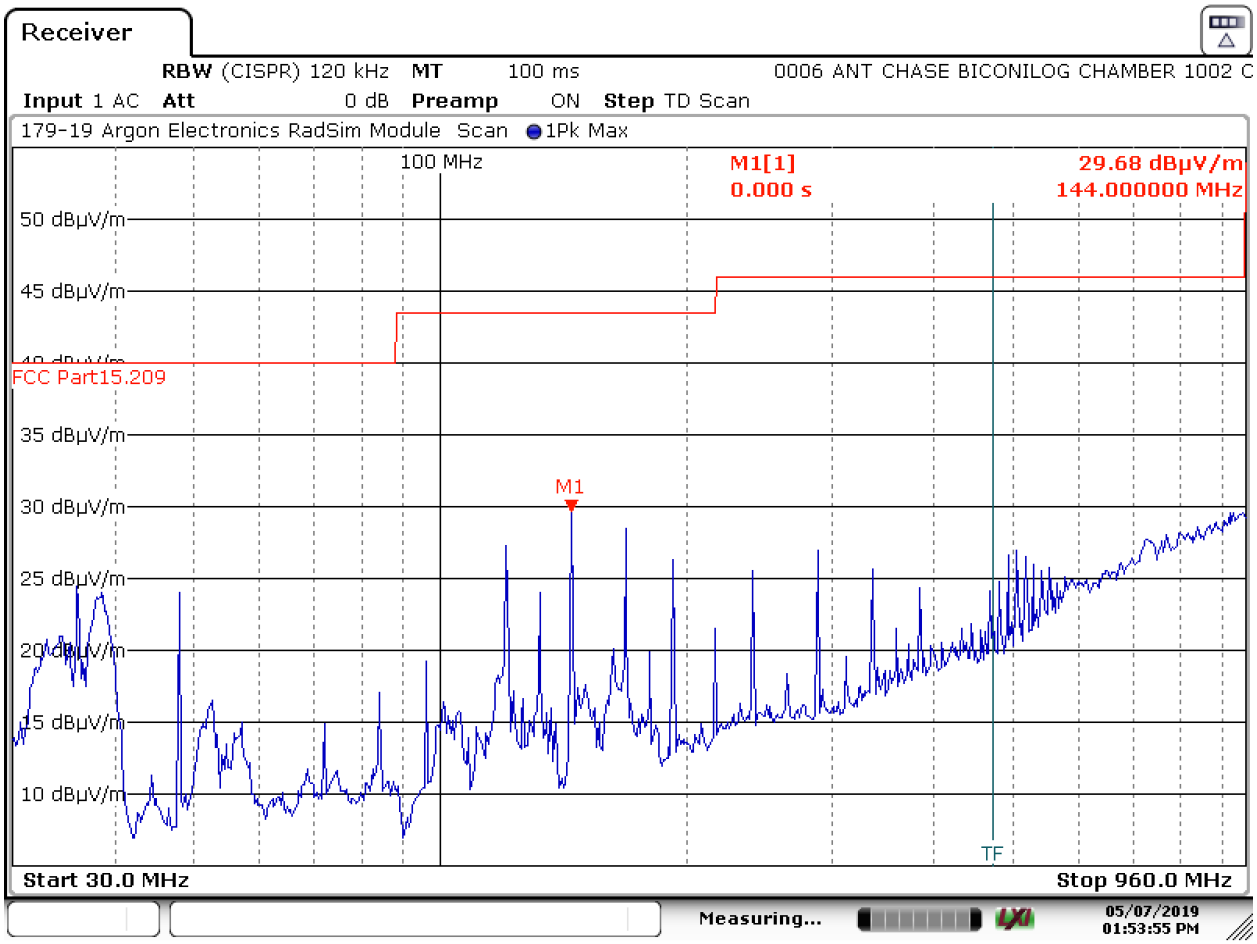
6. Measurement Data (continued)

6.4. Spurious Radiated Emissions (15.250 (d) (5), 15.209, RSS-220 3.4 continued)

6.4.1. 30 kHz to 960 MHz, measured at 3 Meters

The device was prescreened in our 3 Meter Semi-Anechoic Chamber. There were no measurable emissions below 960 MHz on our 3 Meter OATS.

6.4.1.8 Vertical Polarity – 30 to 960 MHz (Directional 16M PRF)



Date: 7.MAY.2019 13:53:56

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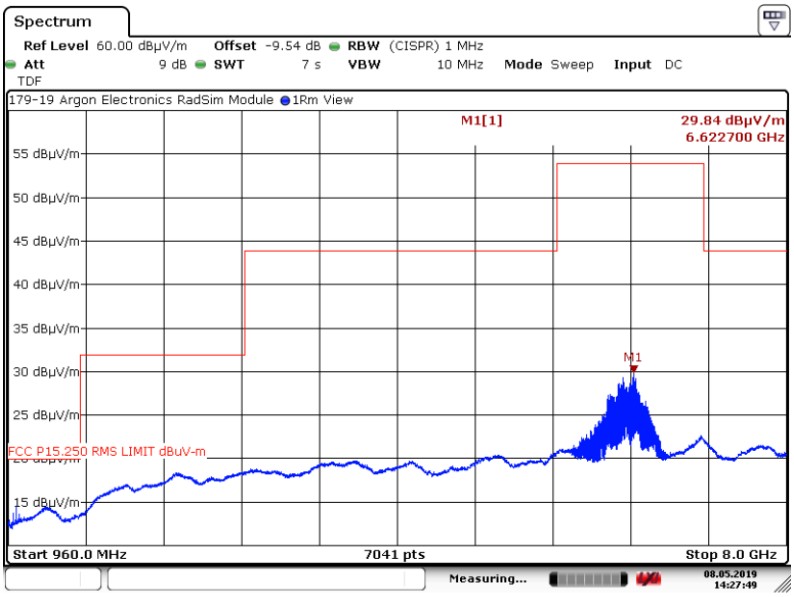
6. Measurement Data (continued)

6.4. Spurious Radiated Emissions (15.250 (d) (1), RSS-220 5.3.1(d))

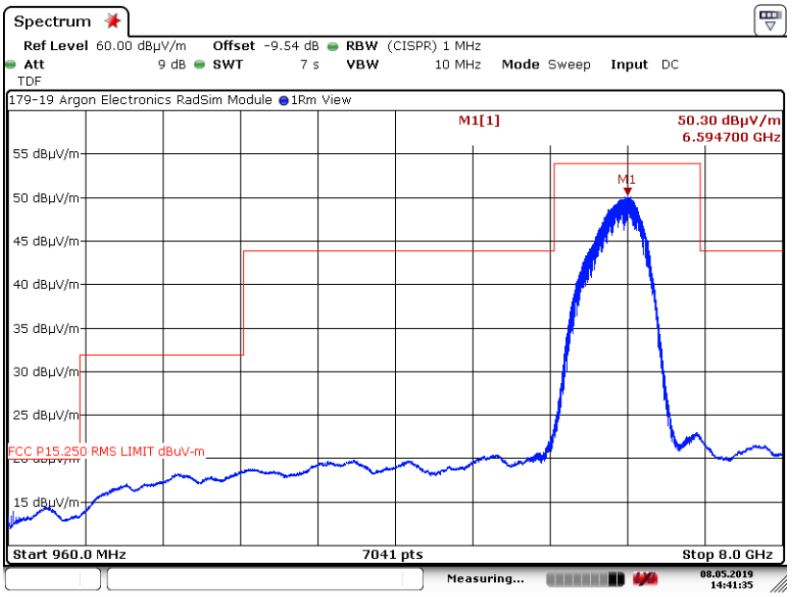
6.4.2. 960 MHz to 8 GHz Horizontal at 1 Meter (Directional 16M PRF)



13V - Baseline

Date: 8.MAY.2019 14:27:49

6.4.3. 960 MHz to 8 GHz Vertical at 1 Meter (Directional 16M PRF)



13V - Baseline

Date: 8.MAY.2019 14:41:35

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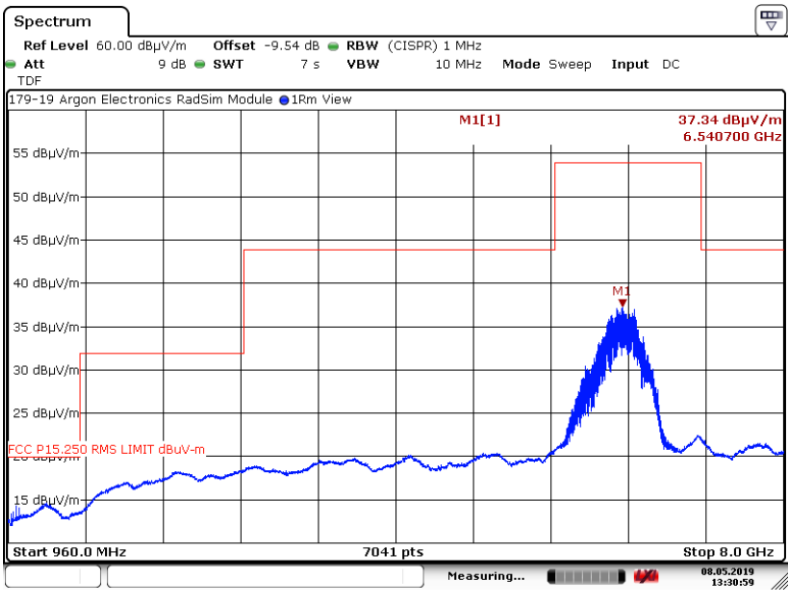
6. Measurement Data (continued)

6.4. Spurious Radiated Emissions (15.250 (d) (1), RSS-220 5.3.1 (d) continued)

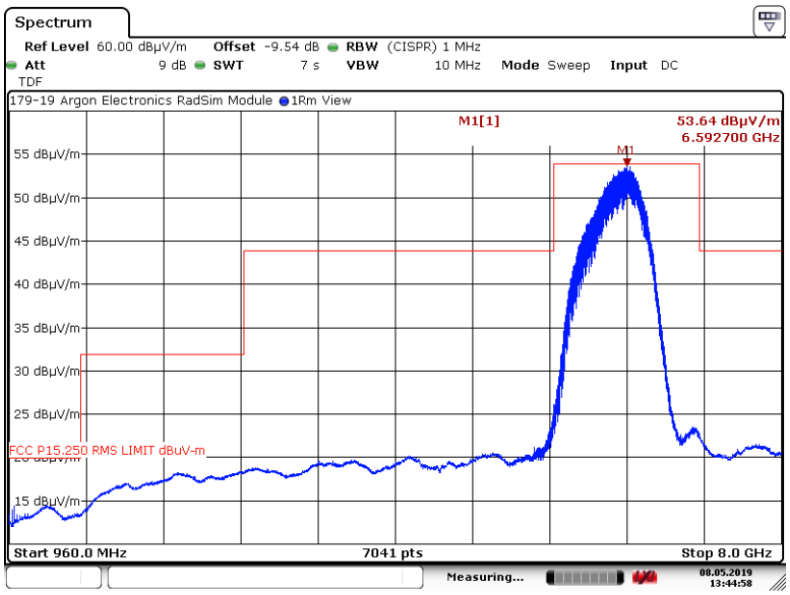
6.4.4. 960 MHz to 8 GHz Horizontal at 1 Meter (Directional 64M PRF)



13V - Baseline

Date: 8.MAY.2019 13:30:58

6.4.5. 960 MHz to 8 GHz Vertical at 1 Meter (Directional 64M PRF)



13V - Baseline

Date: 8.MAY.2019 13:44:58

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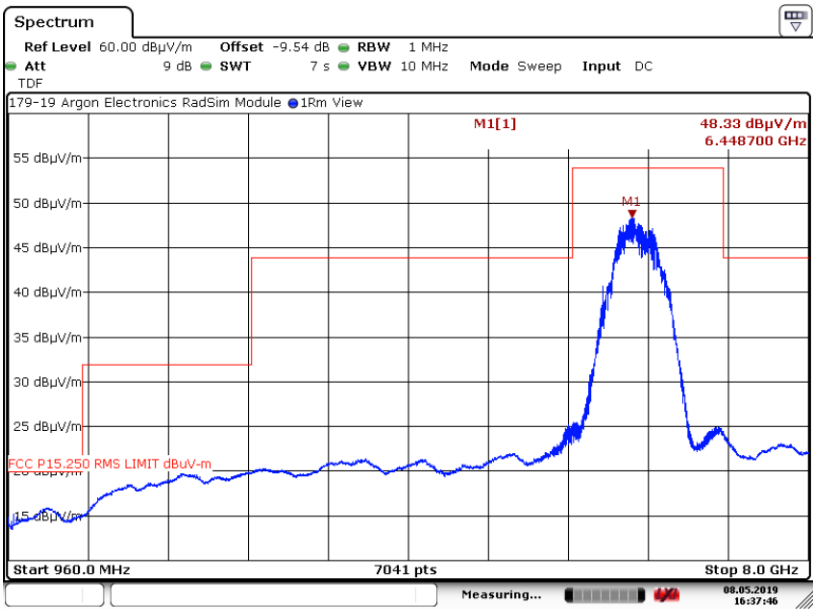
6. Measurement Data (continued)

6.4. Spurious Radiated Emissions (15.250 (d) (1), RSS-220 5.3.1 (d) continued)

6.4.6. 960 MHz to 8 GHz Horizontal at 1 Meter (Argon 16M PRF)



Date: 8.MAY.2019 16:37:46

6.4.7. 960 MHz to 8 GHz Vertical at 1 Meter (Argon 16M PRF)

Date: 8.MAY.2019 16:43:23

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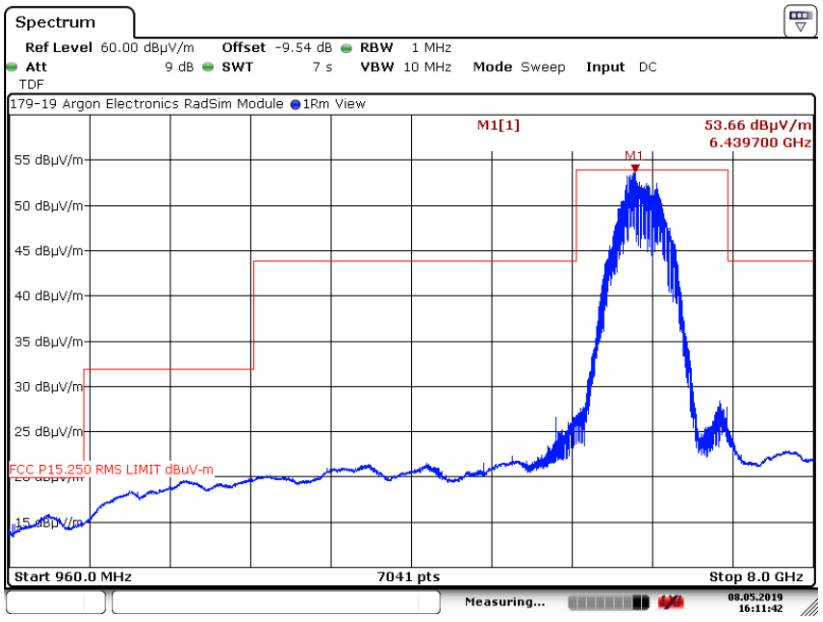
6. Measurement Data (continued)

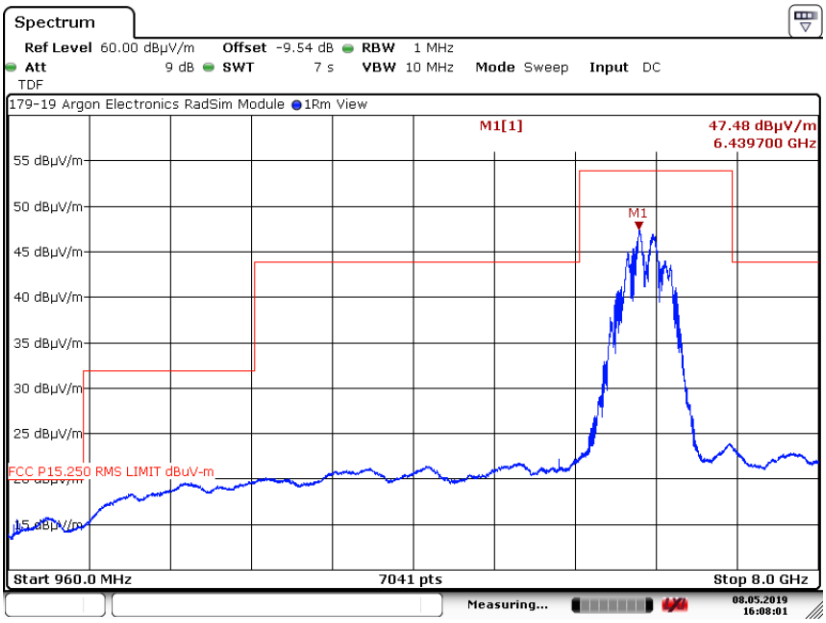
6.4. Spurious Radiated Emissions (15.250 (d) (1), RSS-220 5.3.1 (d) continued)

6.4.7. 960 MHz to 8 GHz Horizontal at 1 Meter (Argon 64M PRF)



Date: 8.MAY.2019 16:11:42

6.4.8. 960 MHz to 8 GHz Vertical at 1 Meter (Argon 64M PRF)



Date: 8.MAY.2019 16:08:01

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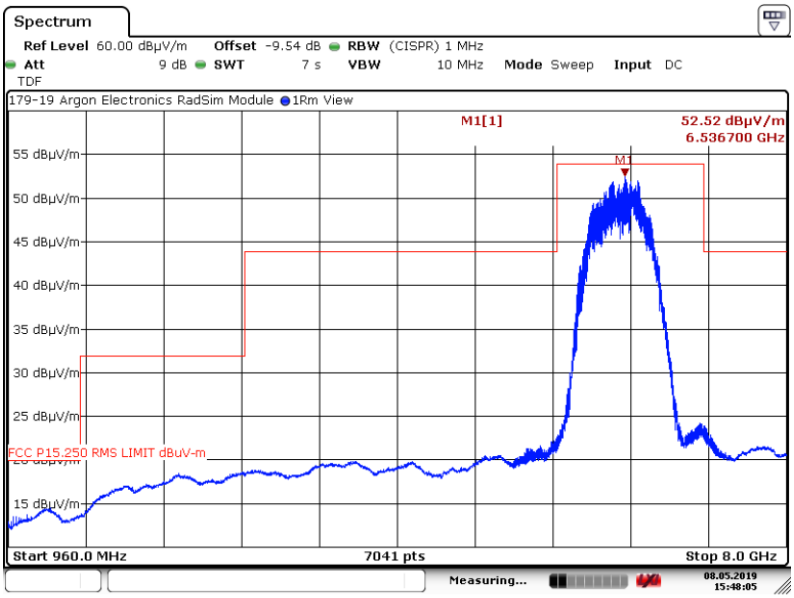
6. Measurement Data (continued)

6.4. Spurious Radiated Emissions (15.250 (d) (1), RSS-220 5.3.1 (d) continued)

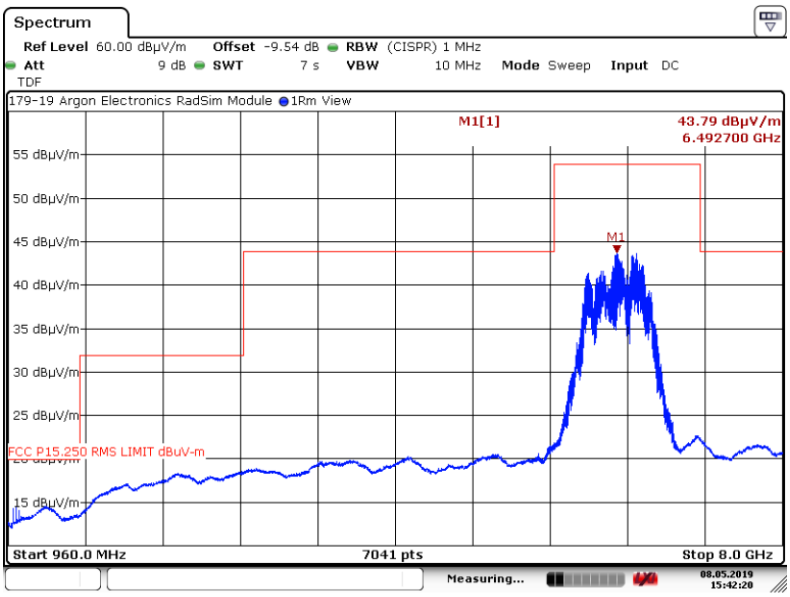
6.4.9. 960 MHz to 8 GHz Horizontal at 1 Meter (Taoglas 16M PRF)



13V - Baseline

Date: 8.MAY.2019 15:48:05

6.4.10. 960 MHz to 8 GHz Vertical at 1 Meter (Taoglas 16M PRF)



13V - Baseline

Date: 8.MAY.2019 15:42:19

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6. Measurement Data (continued)

6.4. Spurious Radiated Emissions (15.250 (d) (1), RSS-220 5.3.1 (d) continued)

6.4.11. 960 MHz to 8 GHz Horizontal at 1 Meter (Taoglas 64M PRF)

13V - Baseline
Date: 8.MAY.2019 15:08:59

6.4.12. 960 MHz to 8 GHz Vertical at 1 Meter (Taoglas 64M PRF)

13V - Baseline
Date: 8.MAY.2019 15:14:22

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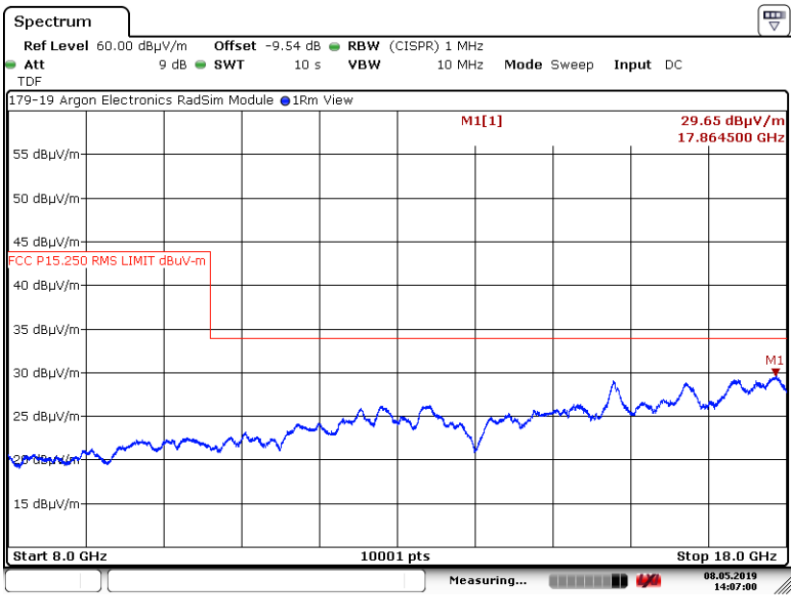
6. Measurement Data (continued)

6.4. Spurious Radiated Emissions (15.250 (d) (1), RSS-220 5.3.1 (d) continued)

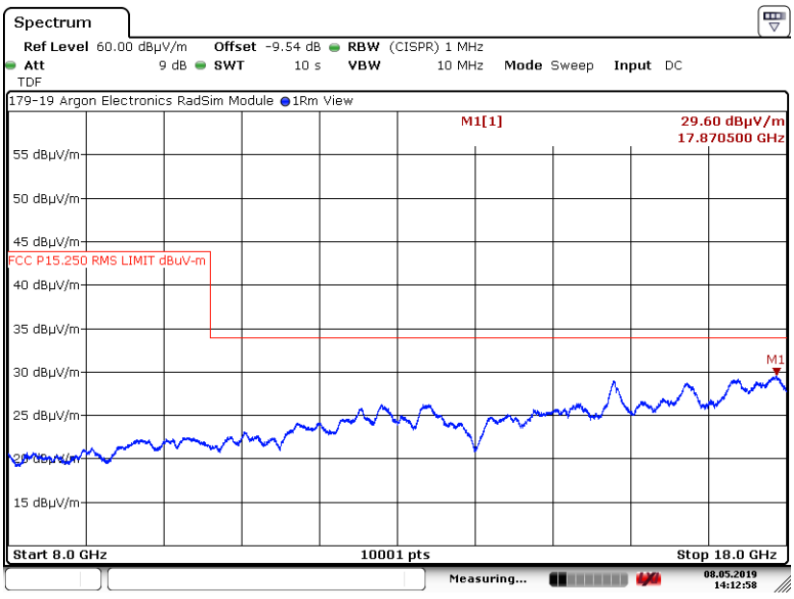
6.4.13. 8 to 18 GHz Horizontal at 1 Meter (Directional 16M PRF)



13V - Baseline

Date: 8.MAY.2019 14:07:00

6.4.14. 8 to 18 GHz Vertical at 1 Meter (Directional 16M PRF)



13V - Baseline

Date: 8.MAY.2019 14:12:58

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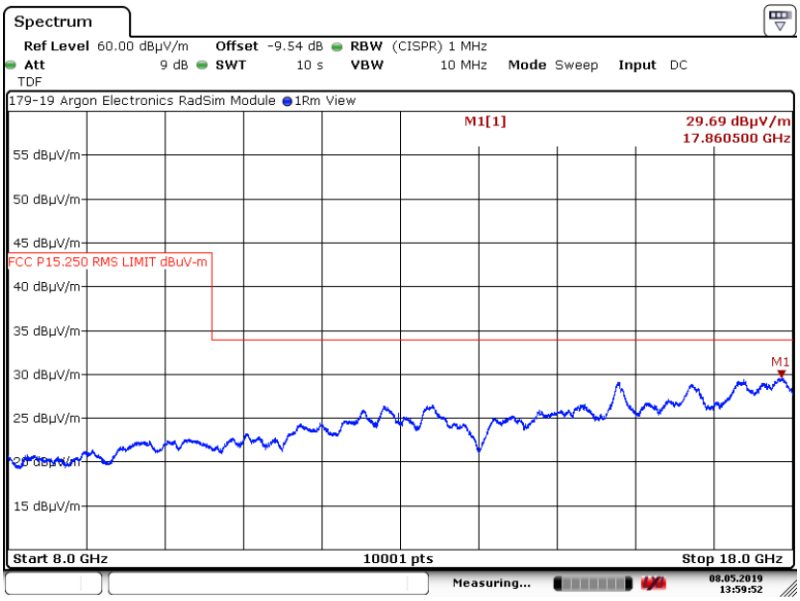
6. Measurement Data (continued)

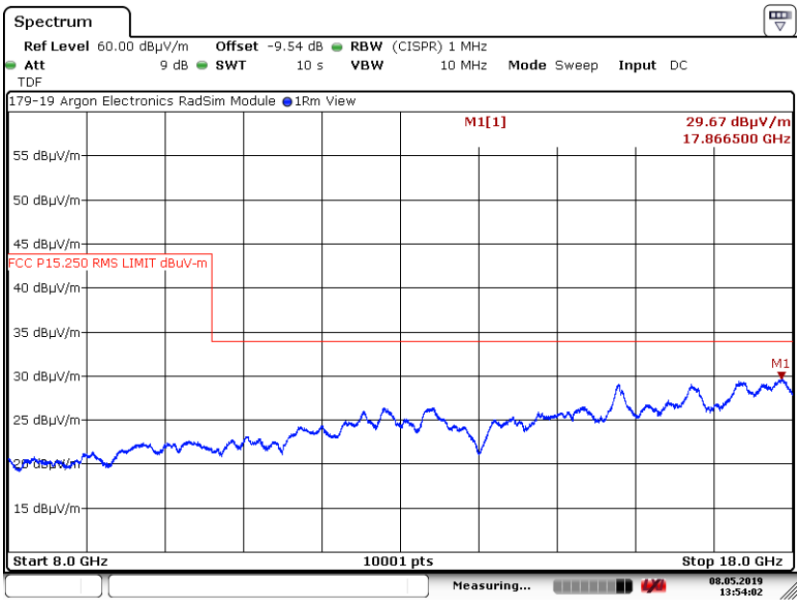
6.4. Spurious Radiated Emissions (15.250 (d) (1), RSS-220 5.3.1 (d) continued)

6.4.15. 8 to 18 GHz Horizontal at 1 Meter (Directional 64M PRF)



13V - Baseline
Date: 8.MAY.2019 13:59:51

6.4.16. 8 to 18 GHz Vertical at 1 Meter (Directional 64M PRF)



13V - Baseline
Date: 8.MAY.2019 13:54:02

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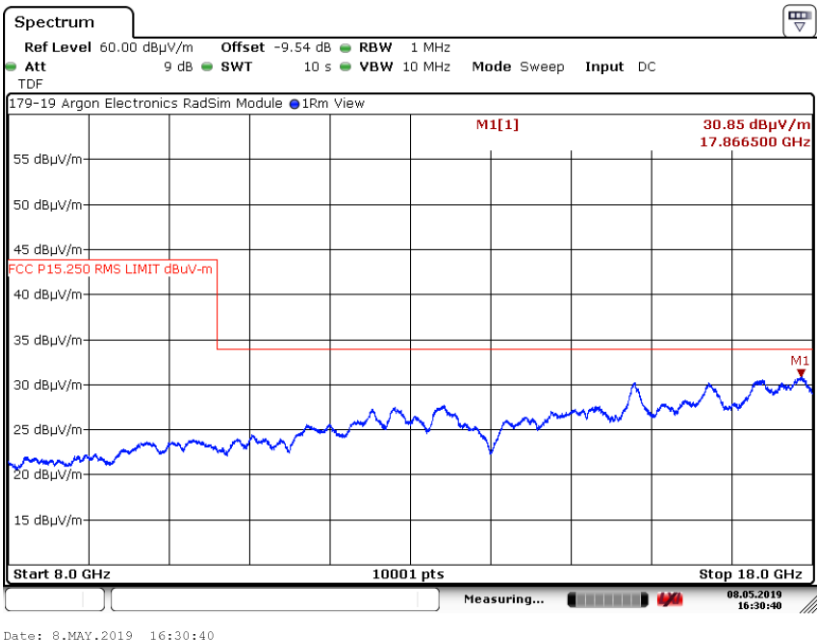
6. Measurement Data (continued)

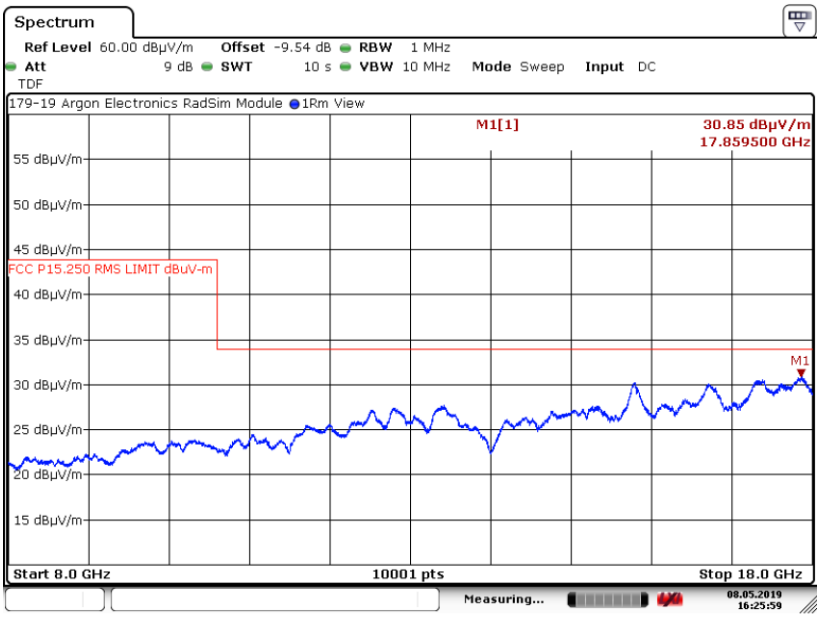
6.4. Spurious Radiated Emissions (15.250 (d) (1), RSS-220 5.3.1 (d) continued)

6.4.17. 8 to 18 GHz Horizontal at 1 Meter (Argon 16M PRF)



Date: 8.MAY.2019 16:30:40

6.4.18. 8 to 18 GHz Vertical at 1 Meter (Argon 16M PRF)



Date: 8.MAY.2019 16:25:59

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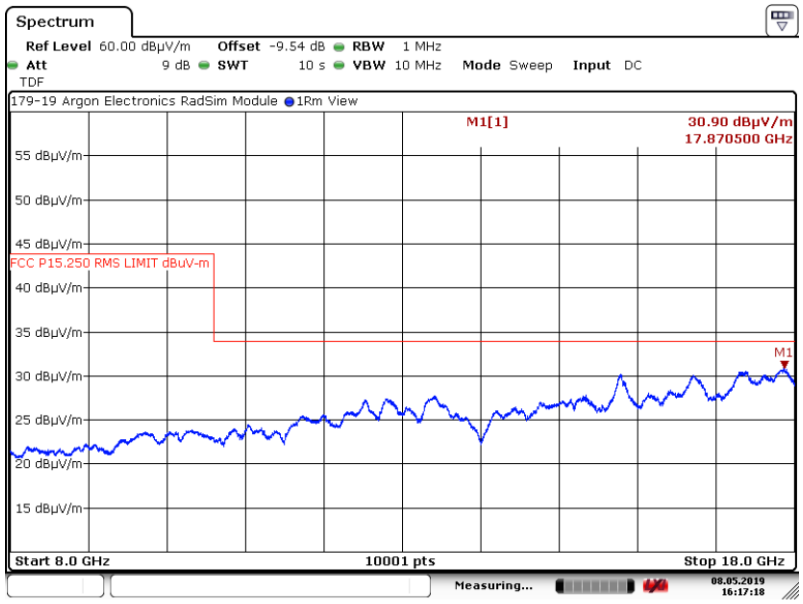
6. Measurement Data (continued)

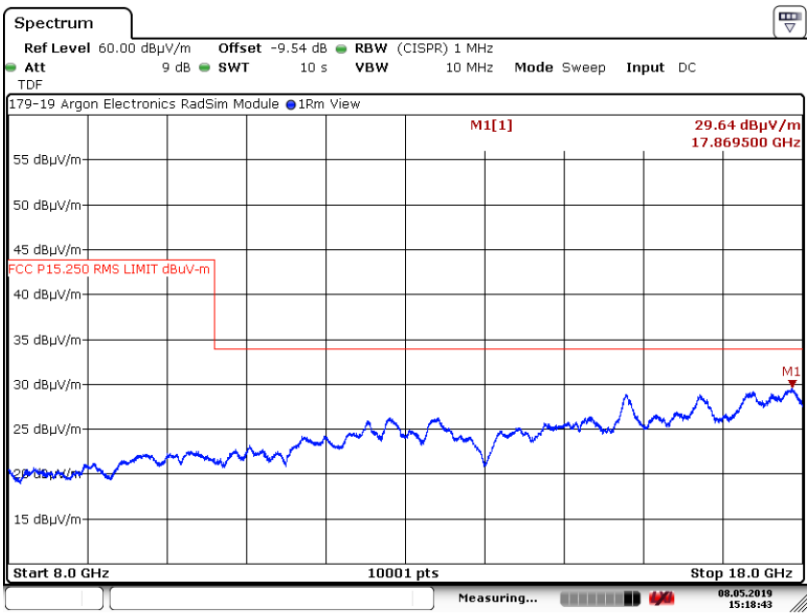
6.4. Spurious Radiated Emissions (15.250 (d) (1), RSS-220 5.3.1 (d) continued)

6.4.19. 8 to 18 GHz Horizontal at 1 Meter (Argon 64M PRF)



Date: 8.MAY.2019 16:17:18

6.4.20. 8 to 18 GHz Vertical at 1 Meter (Argon 64M PRF)



13V - Baseline

Date: 8.MAY.2019 15:18:43

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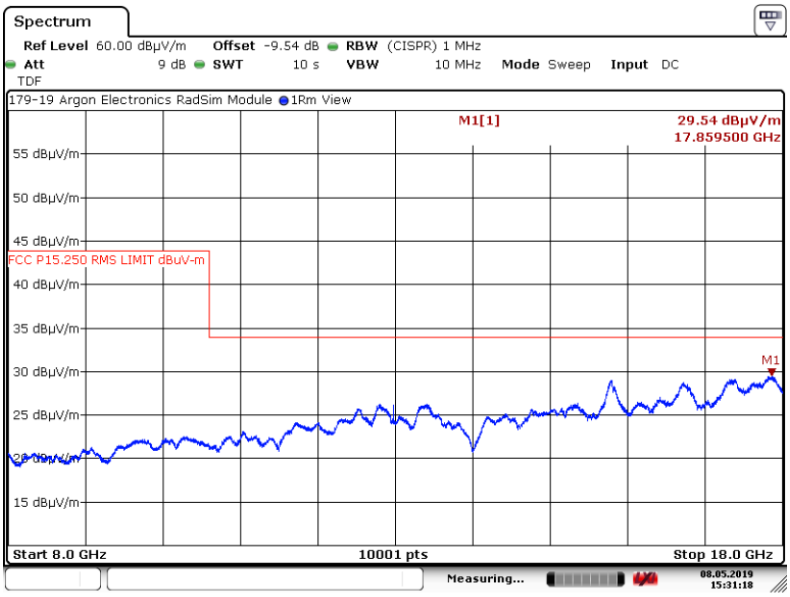
6. Measurement Data (continued)

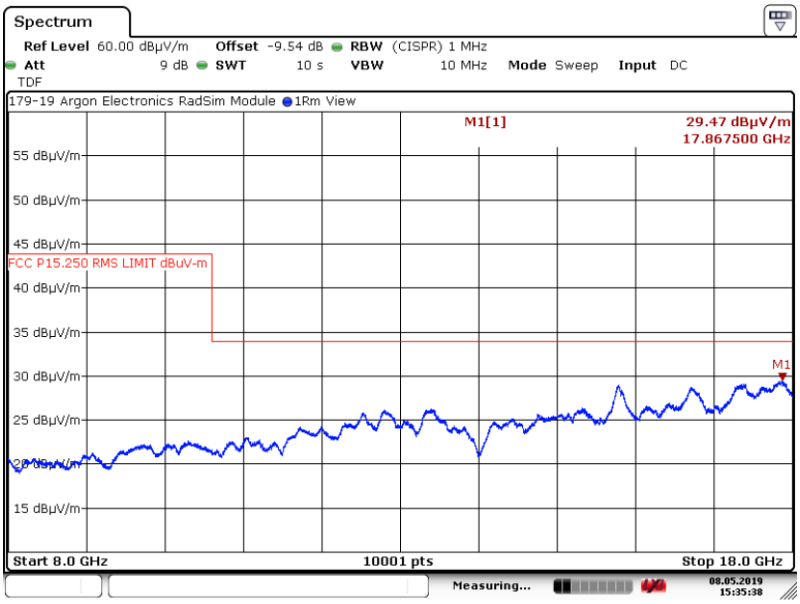
6.4. Spurious Radiated Emissions (15.250 (d) (1), RSS-220 5.3.1 (d) continued)

6.4.21. 8 to 18 GHz Horizontal at 1 Meter (Taoglas 16M PRF)



13V - Baseline
Date: 8.MAY.2019 15:31:18

6.4.22. 8 to 18 GHz Vertical at 1 Meter (Taoglas 16M PRF)



13V - Baseline
Date: 8.MAY.2019 15:35:38

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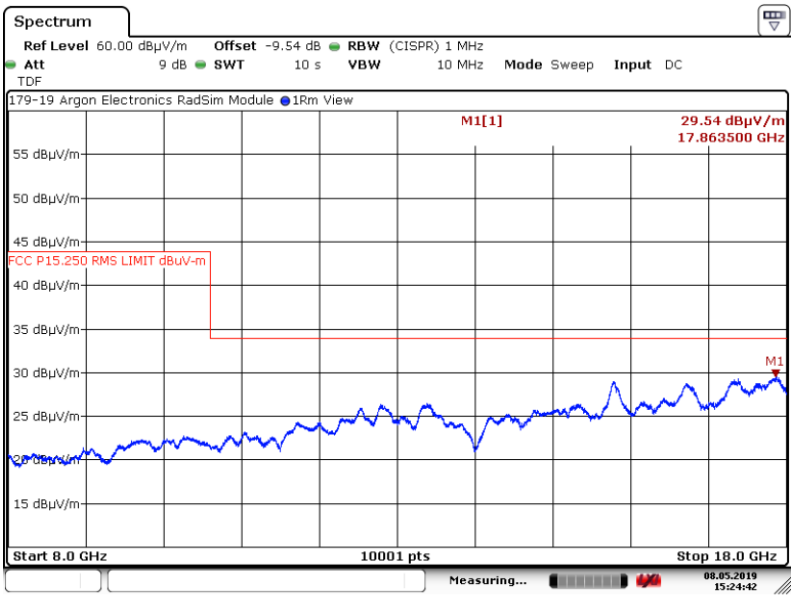
6. Measurement Data (continued)

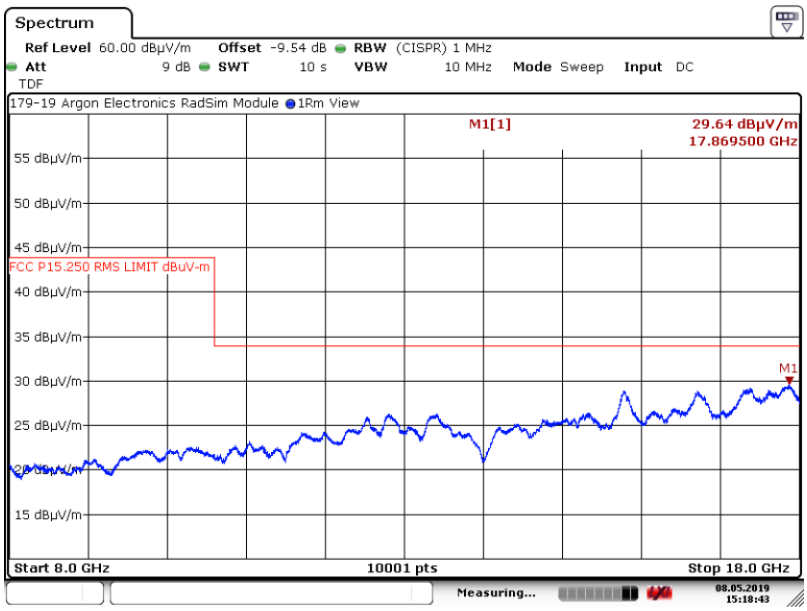
6.4. Spurious Radiated Emissions (15.250 (d) (1), RSS-220 5.3.1 (d) continued)

6.4.23. 8 to 18 GHz Horizontal at 1 Meter (Taoglas 64M PRF)



13V - Baseline
Date: 8.MAY.2019 15:24:43

6.4.24. 8 to 18 GHz Vertical at 1 Meter (Argon 64M PRF)



13V - Baseline
Date: 8.MAY.2019 15:18:43

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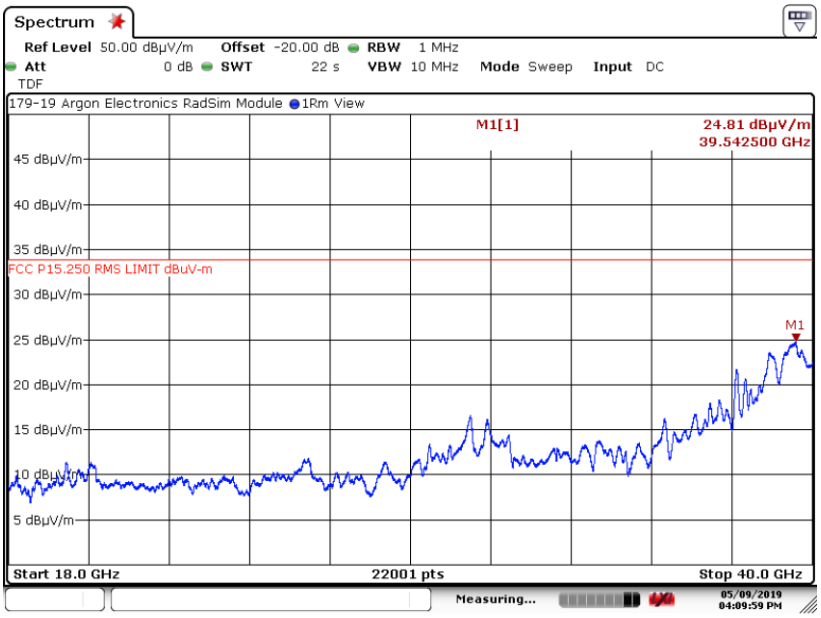
6. Measurement Data (continued)

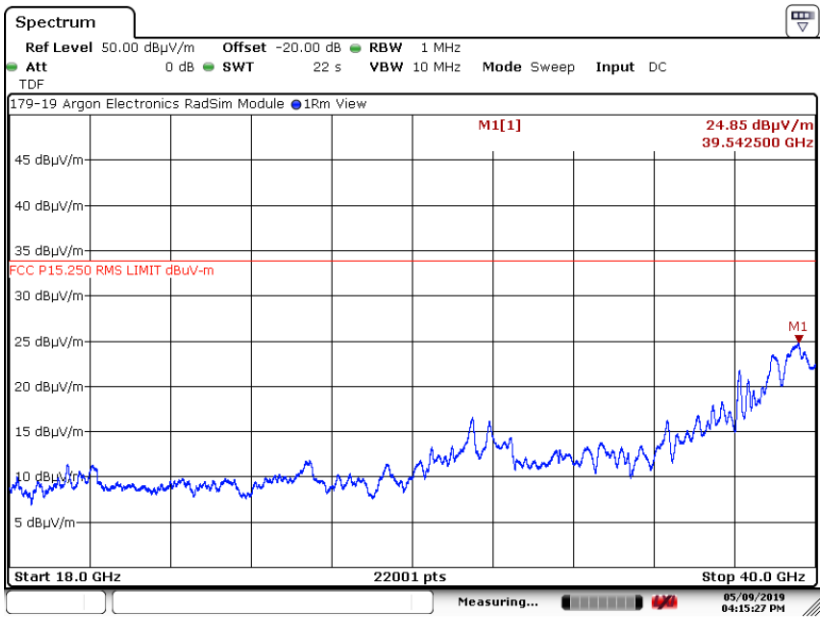
6.4. Spurious Radiated Emissions (15.250 (d) (1), RSS-220 5.3.1 (d) continued)

6.4.25. 18 to 40 GHz Horizontal at 0.3 Meter (Directional 16M PRF)



Date: 9.MAY.2019 16:09:58

6.4.26. 18 to 40 GHz Vertical at 0.3 Meter (Directional 16M PRF)



Date: 9.MAY.2019 16:15:27

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6. Measurement Data (continued)

6.5. Spurious Radiated Emissions in GPS Bands (15.250 (d) (2), RSS-220 5.3.1 (e))

Requirement: In addition to the radiated emission limits specified in the table in paragraph (d) of this section, UWB transmitters operating under the provisions of this section shall not exceed the following average limits when measured using a resolution bandwidth of no less than 1 kHz:

Frequency (MHz)	EIRP (dBm)	EIRP at 3 Meters (dBµV/m)
1164 - 1240	-85.3	9.9
1559 - 1610	-85.3	9.9

6.5.1. Measurement & Equipment Setup

EMI Receiver IF Bandwidth:	1 kHz
EMI Receiver Avg Bandwidth:	10 kHz
Detector Function:	RMS

6.5.2. Test Procedure

Test measurements were made in accordance with ANSI C63.10:2013, American National Standard for Testing Unlicensed Wireless Devices.

6.5.3. 1164 to 1240 MHz & 1559 to 1610 MHz

There were no broadband emissions related to the UWB transmitter. Measured signals were narrowband and related to the microprocessor / clocks and do not fall under the requirements of this section. At 3 Meters the -85.3 dBm limit is converted to a field strength limit of 9.9 dBuV/m using a distance correction factor of 95.2.

A distance correction factor of -9.54 dB was entered into the analyzer as an offset since the measurements were made at 1 meter.

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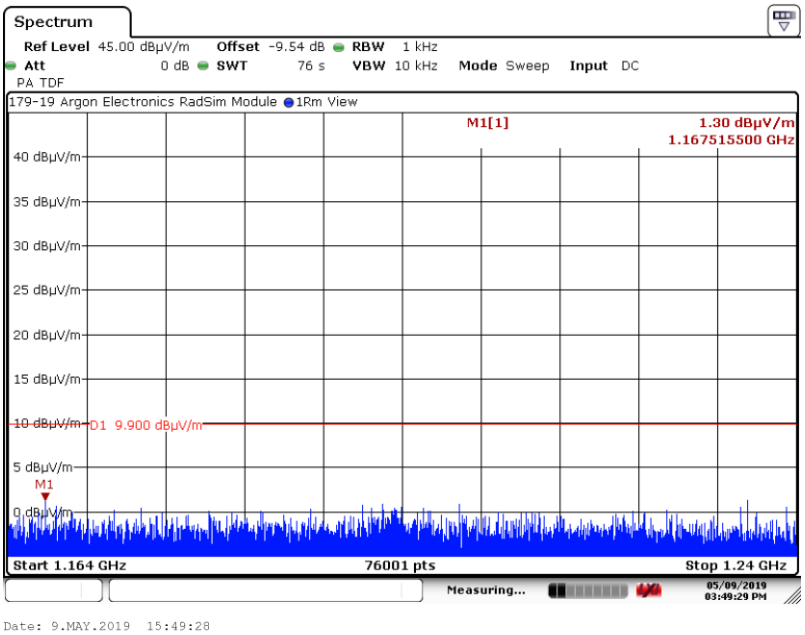
6. Measurement Data (continued)

6.5. Spurious Radiated Emissions in GPS Bands (15.250 (d) (2), RSS-220 5.3.1 (e))

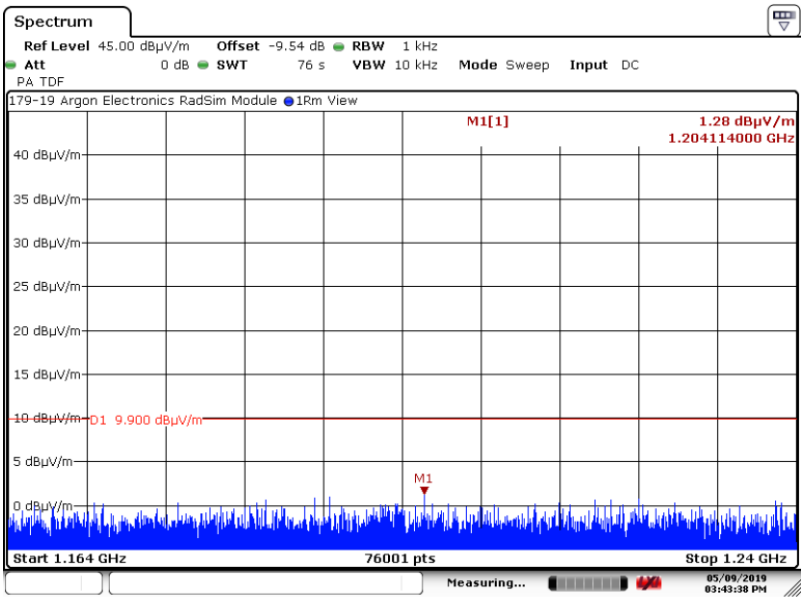
6.5.2 1164 to 1240 MHz Band

6.5.2.1 Horizontal Measurement Polarity 1164 to 1240 MHz



Date: 9.MAY.2019 15:49:28

6.5.2.2 Vertical Measurement Polarity 1164 to 1240 MHz



Date: 9.MAY.2019 15:43:38

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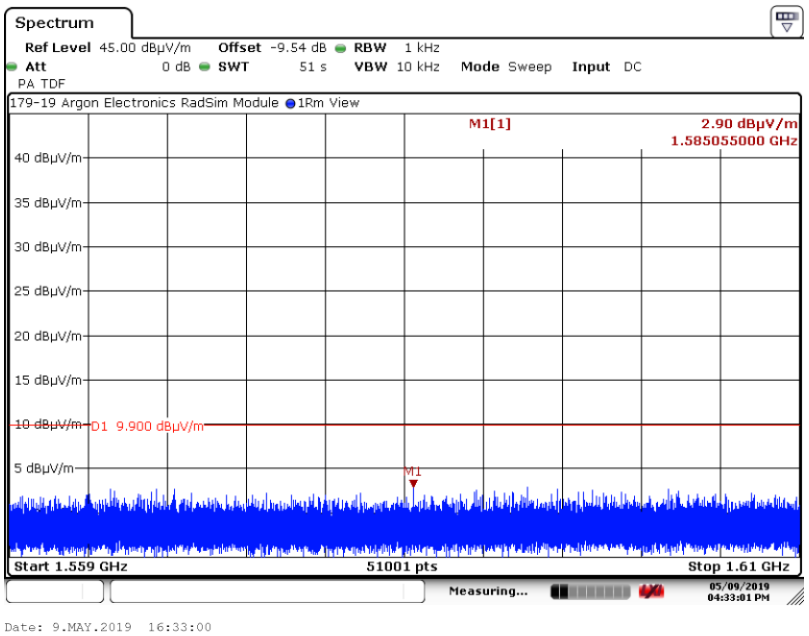
6. Measurement Data (continued)

6.5. Spurious Radiated Emissions in GPS Bands (15.250 (d) (2), RSS-220 5.3.1 (e))

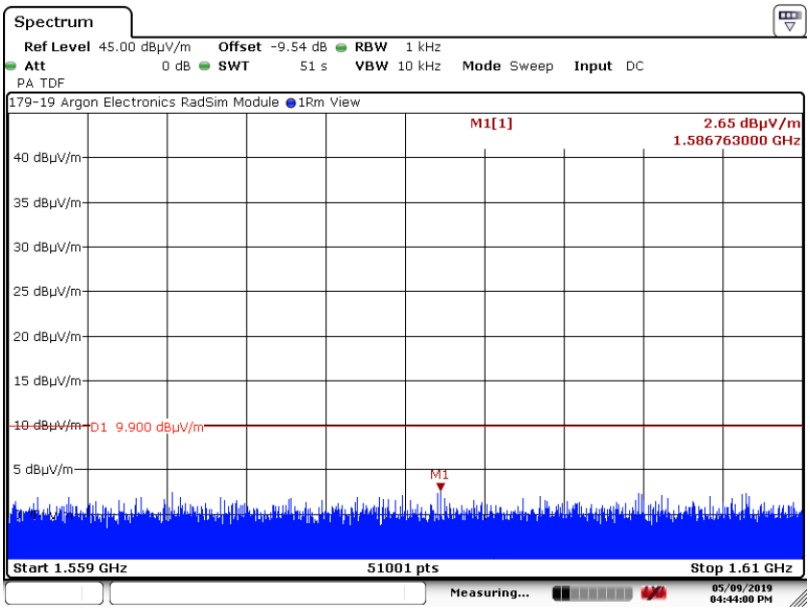
6.5.3 1559 to 1610 MHz Band

6.5.3.1 Horizontal Measurement Polarity 1559 to 1610 MHz



Date: 9.MAY.2019 16:33:00

6.5.3.2 Vertical Measurement Polarity 1559 to 1610 MHz



Date: 9.MAY.2019 16:43:59

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6. Measurement Data (continued)

6.6. RMS Power in a 1 MHz Bandwidth (15.250 (d) (1), RSS-220 5.3.1 (d))

Requirement: The radiated emissions above 960 MHz from a device operating under the provisions of this section shall not exceed the following average limits when measured using a resolution bandwidth of 1 MHz:

The RMS average measurement is based on the use of a spectrum analyzer with a resolution bandwidth of 1 MHz, an RMS detector, and a 1 millisecond or less averaging time.

The EIRP in terms of dBm, can be converted to a field strength, in dBµV/m at 3 Meters by adding 95.2.

Frequency (MHz)	EIRP (dBm)	EIRP at 3 Meters (dBµV/m)
5925 - 7250	-41.3	53.9

Frequency Range:	6 to 7 GHz
Measurement Distance:	3 Meters
EMI Receiver IF Bandwidth:	1 MHz
EMI Receiver Avg Bandwidth	10 MHz
Detector Function:	RMS 1 mS Average

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6. Measurement Data (continued)

6.6. RMS Power in a 1 MHz Bandwidth (15.250 (d) (1), RSS-220 5.3.1 (d))

Requirement: The limit for operation in the 5925 to 7250 MHz band is -41.3 dBm EIRP.

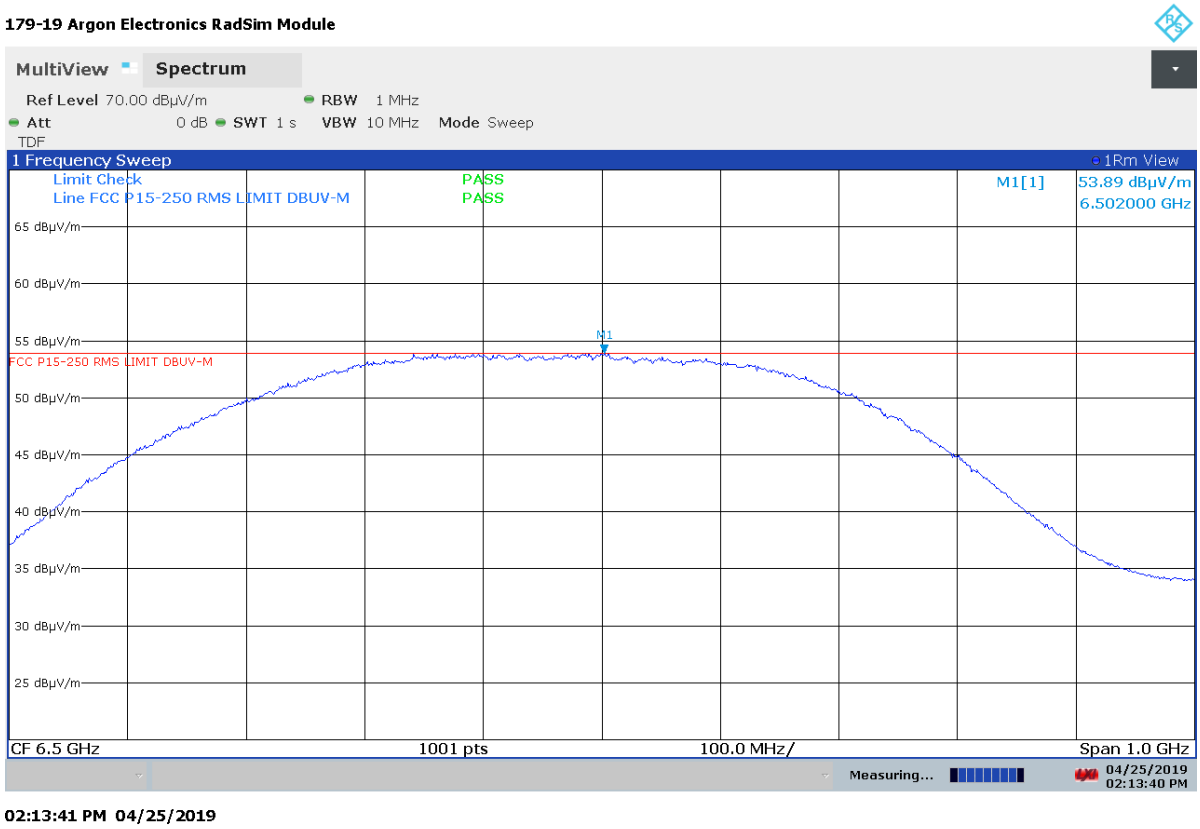
Frequency (GHz)	Amplitude[1]	Limit	Margin	Ant Polarity	Ant Height	Turntable Azimuth	Result
	(dBµV/m)	(dBµV/m)	(dB)	H/V	cm	Deg	
6.502	53.89	53.90	-0.01	V	135	1	Compliant

Notes: [1] Antenna Factor (AF), Cable Factor (CF) and External Preamplifier Gain (PAG) have been entered into the analyzer as transducer factors.

Equation (22) from ANSI C63.10-2013, EIRP = E_{meas} + 20 log (d_{meas}) – 104.7; d_{meas} = 3
EIRP (dBm) = E_{meas} (dBµV/m) – 95.2

Frequency (GHz)	Amplitude[1] (dBm)	Limit (dBm)	Margin	Ant Polarity	Ant Height	Turntable Azimuth	Result
	EIRP	EIRP	(dB)	H/V	cm	Deg	
6.502	-41.31	-41.30	-0.01	V	135	1	Compliant

6.6.1. Plot of RMS Power at 3 Meters (Directional 16M PRF)



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6. Measurement Data (continued)

6.6. RMS Power in a 1 MHz Bandwidth (15.250 (d) (1), RSS-220 5.3.1 (d))

Requirement: The limit for operation in the 5925 to 7250 MHz band is -41.3 dBm EIRP.

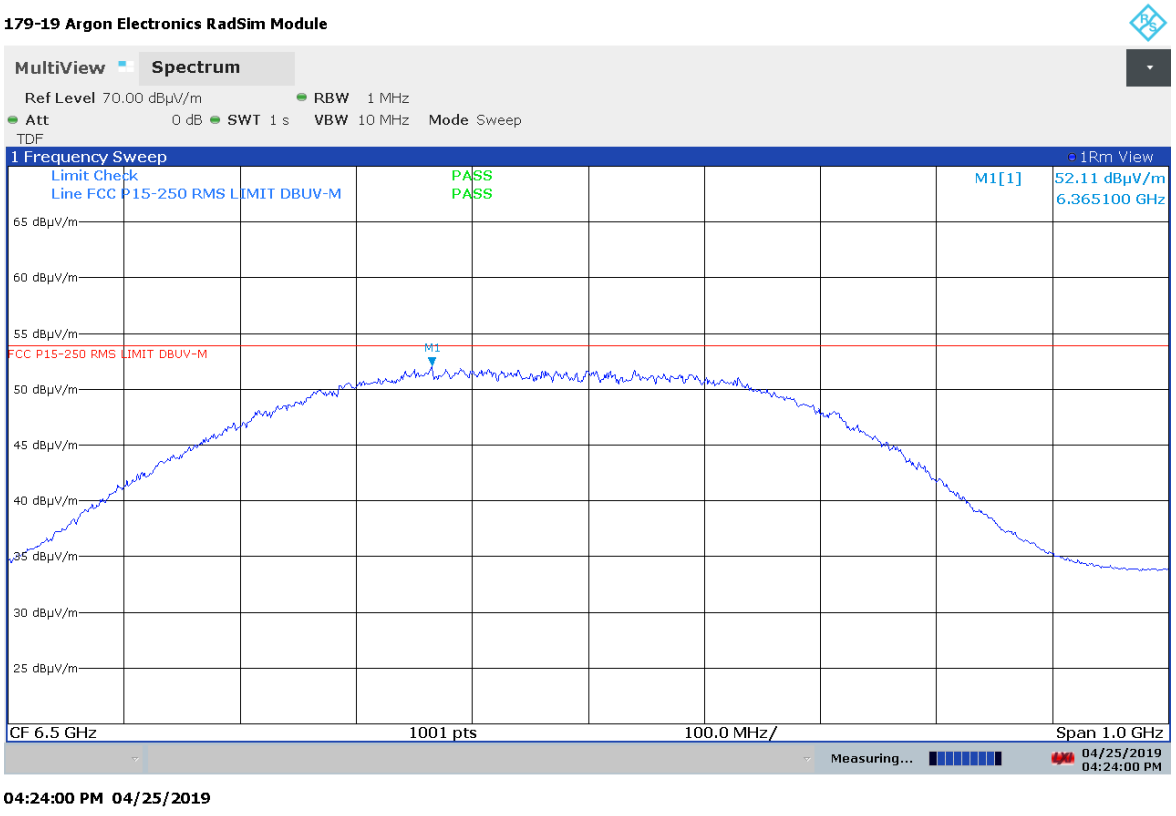
Frequency (GHz)	Amplitude[1]	Limit	Margin	Ant Polarity	Ant Height	Turntable Azimuth	Result
	(dBµV/m)	(dBµV/m)	(dB)	H/V	cm	Deg	
6.3651	52.11	53.90	-1.79	V	135	1	Compliant

Notes: [1] Antenna Factor (AF), Cable Factor (CF) and External Preamplifier Gain (PAG) have been entered into the analyzer as transducer factors.

Equation (22) from ANSI C63.10-2013, EIRP = E_{meas} + 20 log (d_{meas}) – 104.7; d_{meas} = 3
EIRP (dBm) = E_{meas} (dBµV/m) – 95.2

Frequency (GHz)	Amplitude[1] (dBm)	Limit (dBm)	Margin	Ant Polarity	Ant Height	Turntable Azimuth	Result
	EIRP	EIRP	(dB)	H/V	cm	Deg	
6.3651	-43.09	-41.30	-1.79	V	135	1	Compliant

6.6.2. Plot of RMS Power at 3 Meters (Directional 64M PRF)



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6. Measurement Data (continued)

6.6. RMS Power in a 1 MHz Bandwidth (15.250 (d) (1), RSS-220 5.3.1 (d))

Requirement: The limit for operation in the 5925 to 7250 MHz band is -41.3 dBm EIRP.

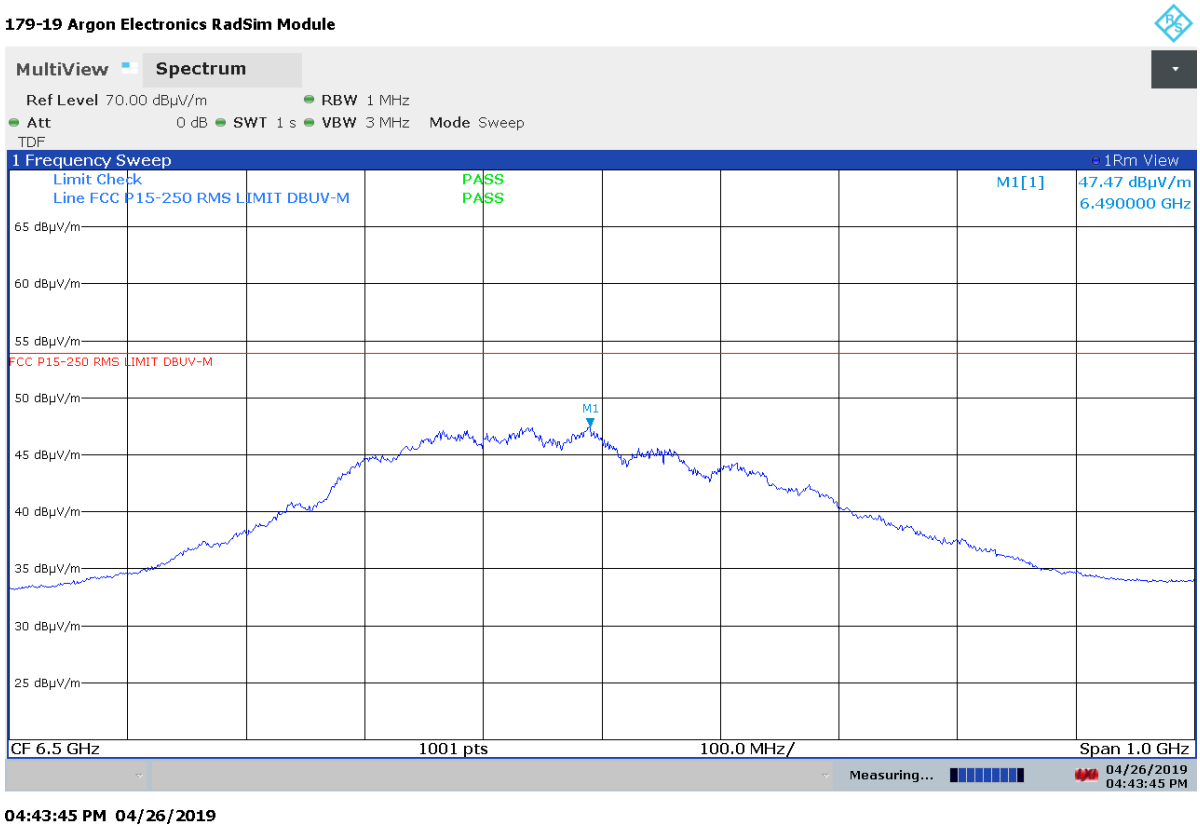
Frequency (GHz)	Amplitude[1]	Limit	Margin	Ant Polarity	Ant Height	Turntable Azimuth	Result
	(dBµV/m)	(dBµV/m)	(dB)	H/V	cm	Deg	
6.490	47.47	53.90	-6.43	H	100	307	Compliant

Notes: [1] Antenna Factor (AF), Cable Factor (CF) and External Preamplifier Gain (PAG) have been entered into the analyzer as transducer factors.

Equation (22) from ANSI C63.10-2013, EIRP = E_{meas} + 20 log (d_{meas}) – 104.7; d_{meas} = 3
EIRP (dBm) = E_{meas} (dBµV/m) – 95.2

Frequency (GHz)	Amplitude[1] (dBm)	Limit (dBm)	Margin	Ant Polarity	Ant Height	Turntable Azimuth	Result
	EIRP	EIRP	(dB)	H/V	cm	Deg	
6.490	-47.73	-41.30	-6.43	H	100	307	Compliant

6.6.3. Plot of RMS Power at 3 Meters (Argon 16M PRF)



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6. Measurement Data (continued)

6.6. RMS Power in a 1 MHz Bandwidth (15.250 (d) (1), RSS-220 5.3.1 (d))

Requirement: The limit for operation in the 5925 to 7250 MHz band is -41.3 dBm EIRP.

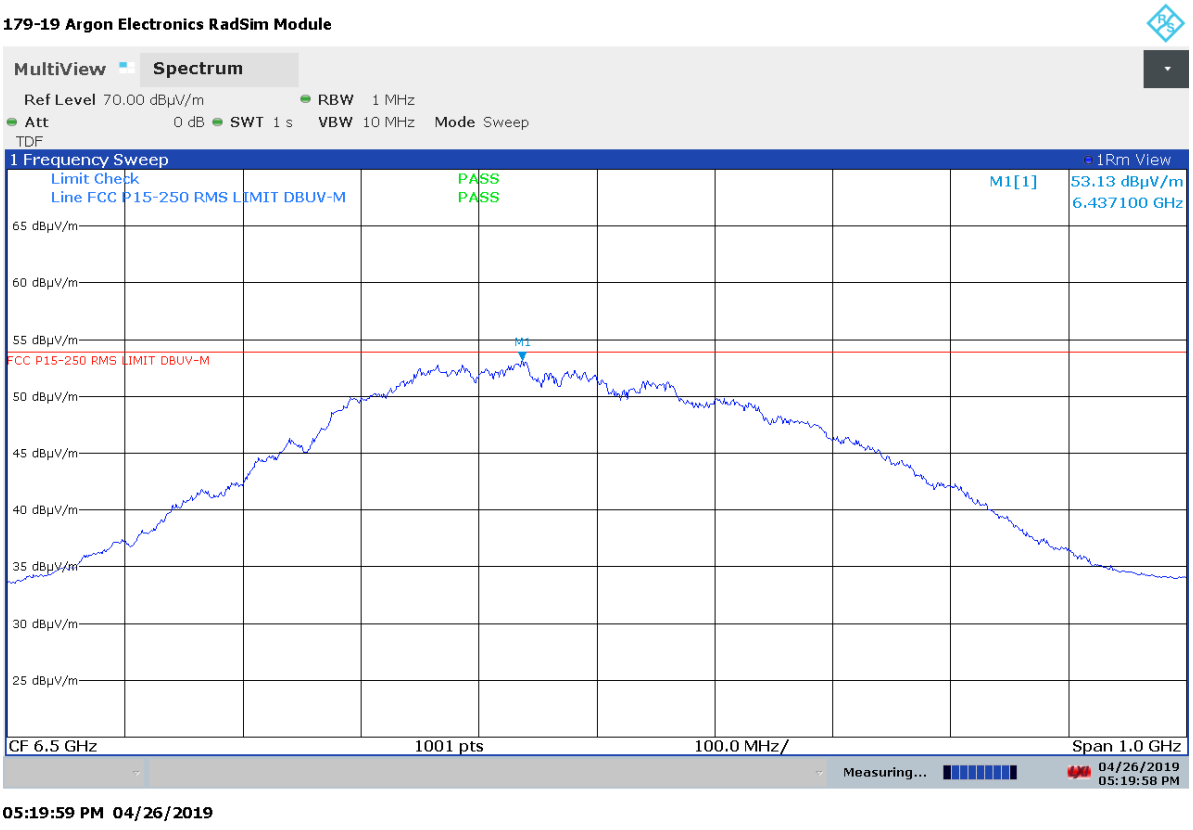
Frequency (GHz)	Amplitude[1]	Limit	Margin	Ant Polarity	Ant Height	Turntable Azimuth	Result
	(dBµV/m)	(dBµV/m)	(dB)	H/V	cm	Deg	
6.4371	53.13	53.90	-0.77	H	100	307	Compliant

Notes: [1] Antenna Factor (AF), Cable Factor (CF) and External Preamplifier Gain (PAG) have been entered into the analyzer as transducer factors.

Equation (22) from ANSI C63.10-2013, EIRP = E_{meas} + 20 log (d_{meas}) – 104.7; d_{meas} = 3
EIRP (dBm) = E_{meas} (dBµV/m) – 95.2

Frequency (GHz)	Amplitude[1] (dBm)	Limit (dBm)	Margin	Ant Polarity	Ant Height	Turntable Azimuth	Result
	EIRP	EIRP	(dB)	H/V	cm	Deg	
6.4371	-42.07	-41.30	-0.77	H	100	307	Compliant

6.6.4. Plot of RMS Power at 3 Meters (Argon 64M PRF)



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6. Measurement Data (continued)

6.6. RMS Power in a 1 MHz Bandwidth (15.250 (d) (1), RSS-220 5.3.1 (d))

Requirement: The limit for operation in the 5925 to 7250 MHz band is -41.3 dBm EIRP.

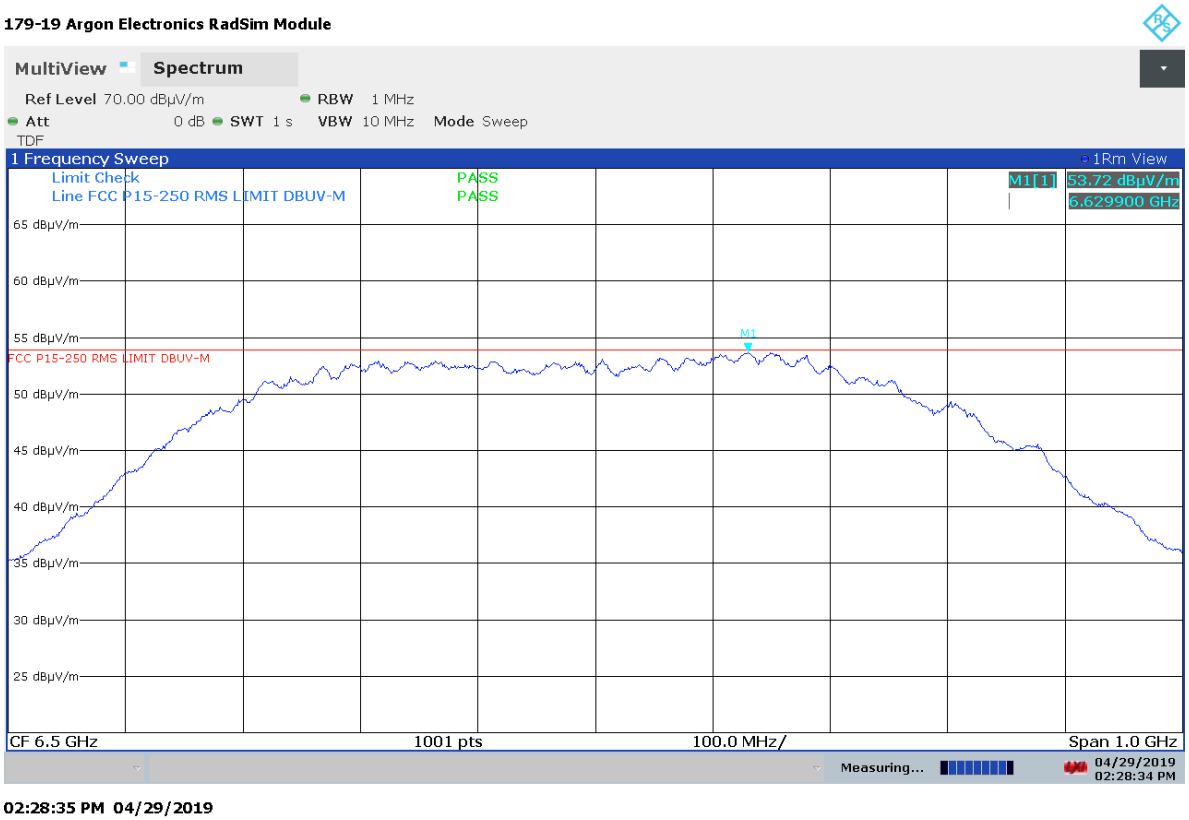
Frequency (GHz)	Amplitude[1]	Limit	Margin	Ant Polarity	Ant Height	Turntable Azimuth	Result
	(dBµV/m)	(dBµV/m)	(dB)	H/V	cm	Deg	
6.6299	53.72	53.90	-0.18	H	116	204	Compliant

Notes: [1] Antenna Factor (AF), Cable Factor (CF) and External Preamplifier Gain (PAG) have been entered into the analyzer as transducer factors.

Equation (22) from ANSI C63.10-2013, EIRP = E_{meas} + 20 log (d_{meas}) – 104.7; d_{meas} = 3
EIRP (dBm) = E_{meas} (dBµV/m) – 95.2

Frequency (GHz)	Amplitude[1] (dBm)	Limit (dBm)	Margin	Ant Polarity	Ant Height	Turntable Azimuth	Result
	EIRP	EIRP	(dB)	H/V	cm	Deg	
6.6299	-41.48	-41.30	-0.18	H	116	204	Compliant

6.6.5. Plot of RMS Power at 3 Meters (Taoglas 16M PRF)



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6. Measurement Data (continued)

6.6. RMS Power in a 1 MHz Bandwidth (15.250 (d) (1), RSS-220 5.3.1 (d))

Requirement: The limit for operation in the 5925 to 7250 MHz band is -41.3 dBm EIRP.

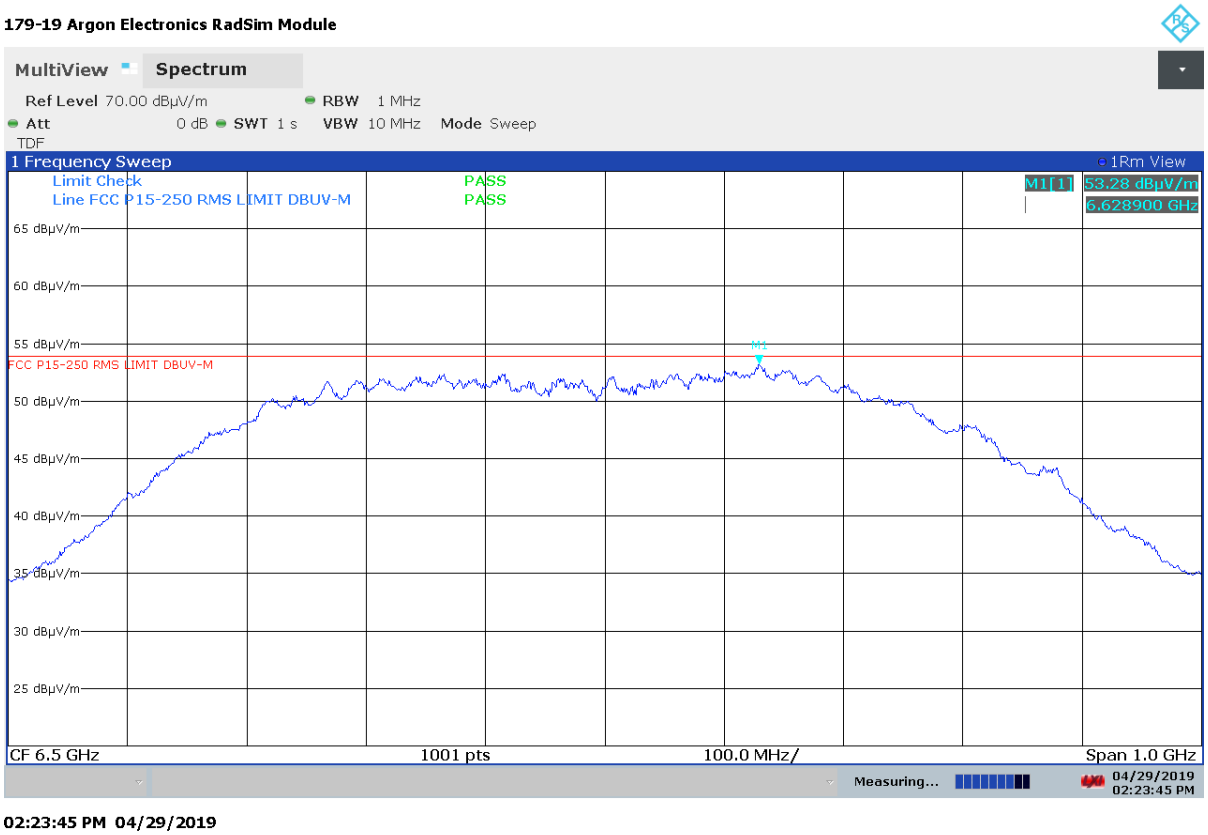
Frequency (GHz)	Amplitude[1]	Limit	Margin	Ant Polarity	Ant Height	Turntable Azimuth	Result
	(dBµV/m)	(dBµV/m)	(dB)	H/V	cm	Deg	
6.6289	53.28	53.90	-0.62	H	116	204	Compliant

Notes: [1] Antenna Factor (AF), Cable Factor (CF) and External Preamplifier Gain (PAG) have been entered into the analyzer as transducer factors.

Equation (22) from ANSI C63.10-2013, EIRP = E_{meas} + 20 log (d_{meas}) – 104.7; d_{meas} = 3
EIRP (dBm) = E_{meas} (dBµV/m) – 95.2

Frequency (GHz)	Amplitude[1] (dBm)	Limit (dBm)	Margin	Ant Polarity	Ant Height	Turntable Azimuth	Result
	EIRP	EIRP	(dB)	H/V	cm	Deg	
6.6289	-41.92	-41.30	-0.62	H	116	204	Compliant

6.6.6. Plot of RMS Power at 3 Meters (Argon 64M PRF)



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6. Measurement Data (continued)

6.7. Peak Emissions in a 50 MHz Bandwidth (15.250 (d) (3), RSS-220 5.3.1 (g))

Requirement: There is a limit on the peak level of the emissions contained within a 50 MHz bandwidth centered on the frequency at which the highest radiated emission occurs, f_M. That limit is 0 dBm EIRP.

The EIRP in terms of dBm, can be converted to a field strength, in dBµV/m at 3 Meters by adding 95.2.

Frequency (MHz)	EIRP (dBm)	EIRP at 3 Meters (dBµV/m)
5925 - 7250	0	95.2

Frequency Range:	6 to 7 GHz
Measurement Distance:	3 Meters
EMI Receiver IF Bandwidth:	50 MHz
EMI Receiver Avg Bandwidth	80 MHz
Detector Function:	Peak, Max Held

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6. Measurement Data (continued)

6.7. Peak Emissions in a 50 MHz Bandwidth (15.250 (d) (3), RSS-220 5.3.1 (g))

Requirement: There is a limit on the peak level of the emissions contained within a 50 MHz bandwidth centered on the frequency at which the highest radiated emission occurs, f_M. That limit is 0 dBm EIRP.

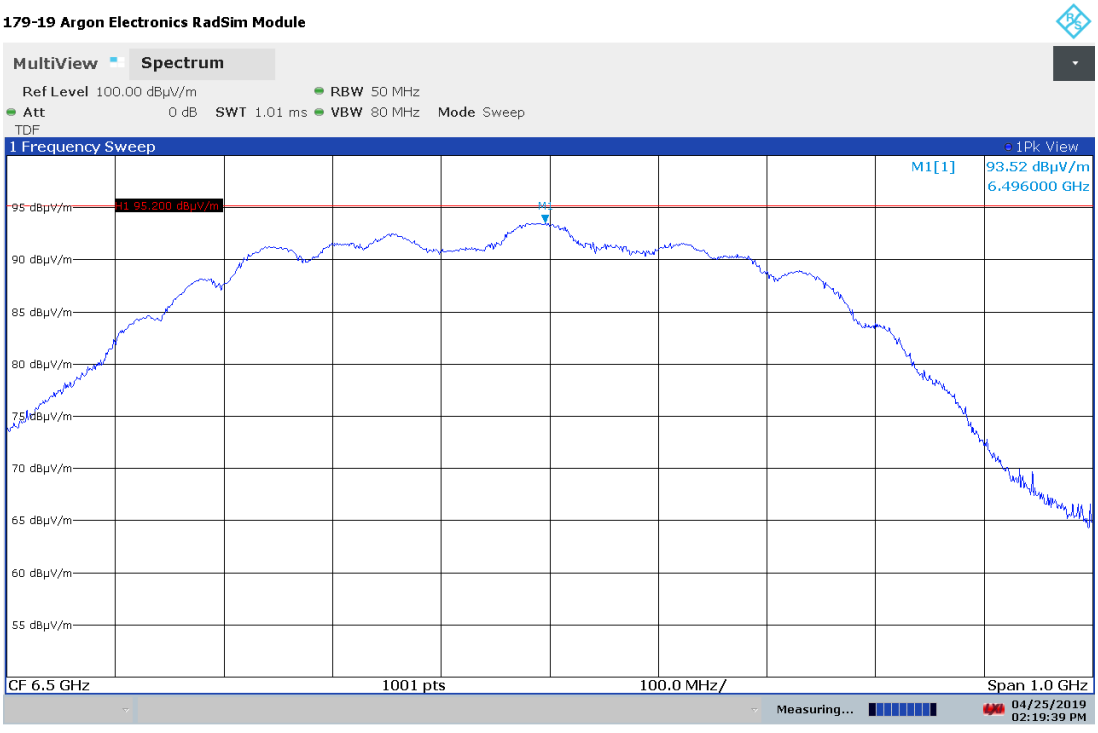
Frequency (GHz)	Amplitude[1]	Limit	Margin	Ant Polarity	Ant Height	Turntable Azimuth	Result
	(dBµV/m)	(dBµV/m)	(dB)	H/V	cm	Deg	
6.496	93.52	95.20	-1.68	V	135	1	Compliant

Notes: [1] Antenna Factor (AF), Cable Factor (CF) and External Preamplifier Gain (PAG) have been entered into the analyzer as transducer factors.

Equation (22) from ANSI C63.10-2013, EIRP = E_{meas} + 20 log (d_{meas}) – 104.7; d_{meas} = 3
EIRP (dBm) = E_{meas} (dBµV/m) – 95.2

Frequency (GHz)	Amplitude[1] (dBm)	Limit (dBm)	Margin	Ant Polarity	Ant Height	Turntable Azimuth	Result
	EIRP	EIRP	(dB)	H/V	cm	Deg	
6.496	-1.68	0.00	-1.68	H	135	1	Compliant

6.7.1 Plot of Peak Power at 3 Meters (Directional 16M PRF)



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6. Measurement Data (continued)

6.7. Peak Emissions in a 50 MHz Bandwidth (15.250 (d) (3), RSS-220 5.3.1 (g))

Requirement: There is a limit on the peak level of the emissions contained within a 50 MHz bandwidth centered on the frequency at which the highest radiated emission occurs, f_M. That limit is 0 dBm EIRP.

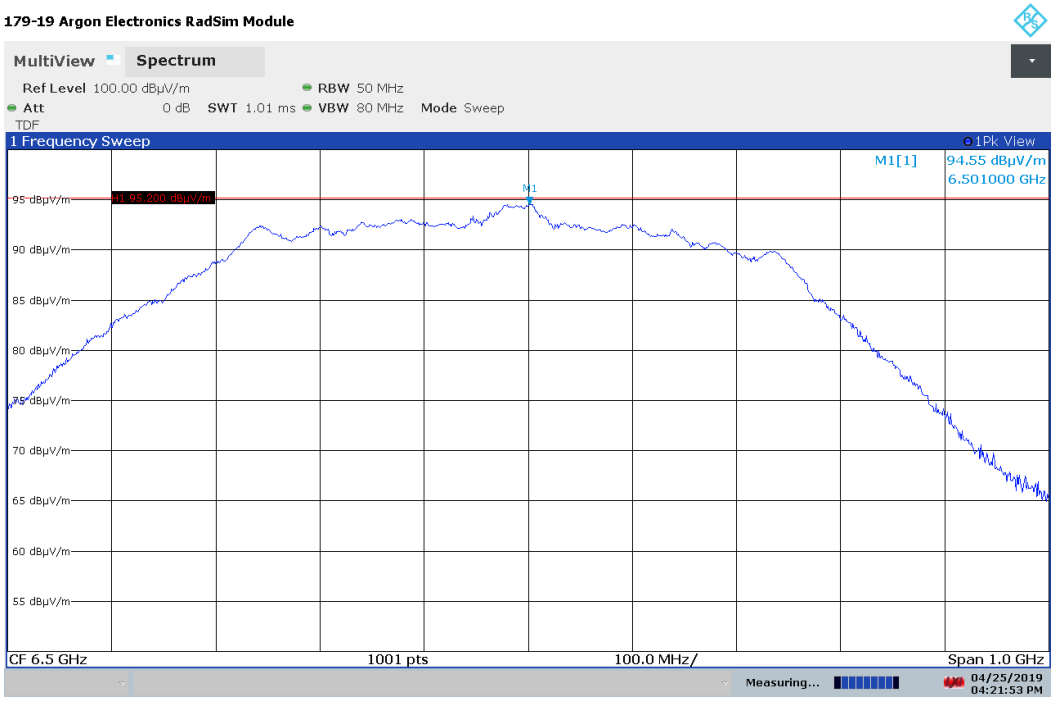
Frequency (GHz)	Amplitude[1]	Limit	Margin	Ant Polarity	Ant Height	Turntable Azimuth	Result
	(dBµV/m)	(dBµV/m)	(dB)	H/V	cm	Deg	
6.501	94.55	95.20	-0.65	V	135	1	Compliant

Notes: [1] Antenna Factor (AF), Cable Factor (CF) and External Preamplifier Gain (PAG) have been entered into the analyzer as transducer factors.

Equation (22) from ANSI C63.10-2013, EIRP = E_{meas} + 20 log (d_{meas}) – 104.7; d_{meas} = 3
EIRP (dBm) = E_{meas} (dBµV/m) – 95.2

Frequency (GHz)	Amplitude[1] (dBm)	Limit (dBm)	Margin	Ant Polarity	Ant Height	Turntable Azimuth	Result
	EIRP	EIRP	(dB)	H/V	cm	Deg	
6.501	-0.65	0.00	-0.65	V	135	1	Compliant

6.7.2 Plot of Peak Power at 3 Meters (Directional 64M PRF)



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6. Measurement Data (continued)

6.7. Peak Emissions in a 50 MHz Bandwidth (15.250 (d) (3), RSS-220 5.3.1 (g))

Requirement: There is a limit on the peak level of the emissions contained within a 50 MHz bandwidth centered on the frequency at which the highest radiated emission occurs, f_M. That limit is 0 dBm EIRP.

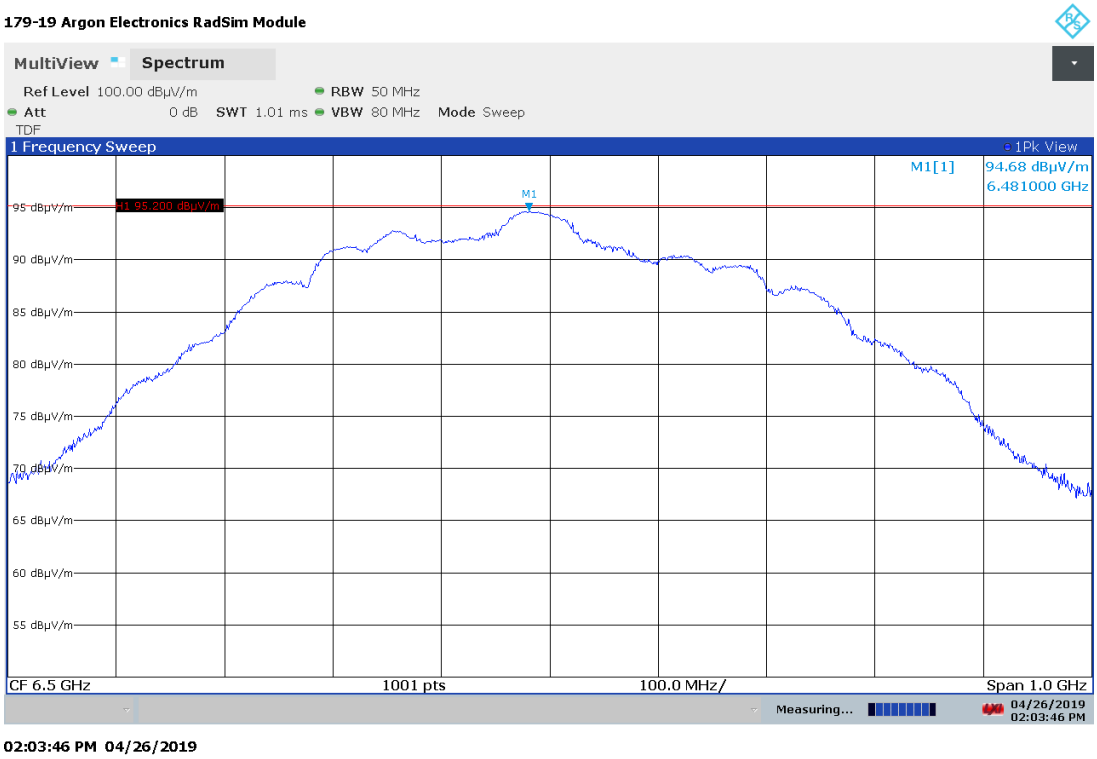
Frequency (GHz)	Amplitude[1]	Limit	Margin	Ant Polarity	Ant Height	Turntable Azimuth	Result
	(dBµV/m)	(dBµV/m)	(dB)	H/V	cm	Deg	
6.481	94.68	95.20	-0.52	H	100	307	Compliant

Notes: [1] Antenna Factor (AF), Cable Factor (CF) and External Preamplifier Gain (PAG) have been entered into the analyzer as transducer factors.

Equation (22) from ANSI C63.10-2013, EIRP = E_{meas} + 20 log (d_{meas}) – 104.7; d_{meas} = 3
EIRP (dBm) = E_{meas} (dBµV/m) – 95.2

Frequency (GHz)	Amplitude[1] (dBm)	Limit (dBm)	Margin	Ant Polarity	Ant Height	Turntable Azimuth	Result
	EIRP	EIRP	(dB)	H/V	cm	Deg	
6.481	-0.52	0.00	-0.52	H	100	307	Compliant

6.7.3 Plot of Peak Power at 3 Meters (Argon 16M PRF)



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6. Measurement Data (continued)

6.7. Peak Emissions in a 50 MHz Bandwidth (15.250 (d) (3), RSS-220 5.3.1 (g))

Requirement: There is a limit on the peak level of the emissions contained within a 50 MHz bandwidth centered on the frequency at which the highest radiated emission occurs, f_M. That limit is 0 dBm EIRP.

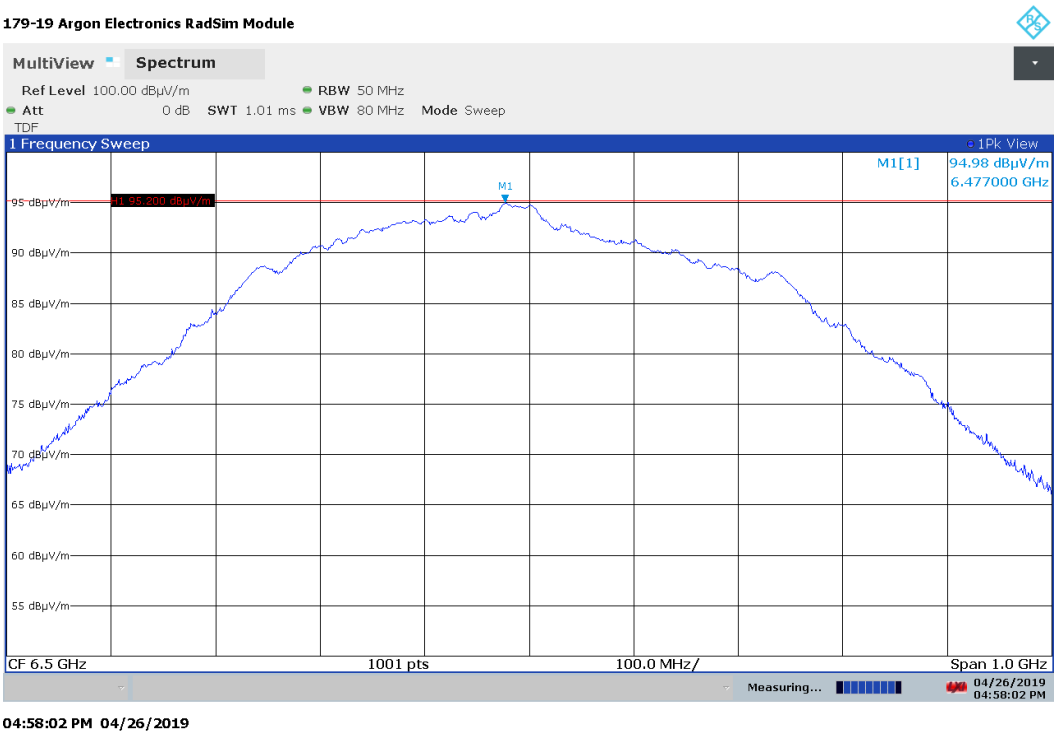
Frequency (GHz)	Amplitude[1]	Limit	Margin	Ant Polarity	Ant Height	Turntable Azimuth	Result
	(dBµV/m)	(dBµV/m)	(dB)	H/V	cm	Deg	
6.477	94.98	95.20	-0.22	H	100	307	Compliant

Notes: [1] Antenna Factor (AF), Cable Factor (CF) and External Preamplifier Gain (PAG) have been entered into the analyzer as transducer factors.

Equation (22) from ANSI C63.10-2013, EIRP = E_{meas} + 20 log (d_{meas}) – 104.7; d_{meas} = 3
EIRP (dBm) = E_{meas} (dBµV/m) – 95.2

Frequency (GHz)	Amplitude[1] (dBm)	Limit (dBm)	Margin	Ant Polarity	Ant Height	Turntable Azimuth	Result
	EIRP	EIRP	(dB)	H/V	cm	Deg	
6.477	-0.22	0.00	-0.22	H	100	307	Compliant

6.7.4 Plot of Peak Power at 3 Meters (Argon 64M PRF)



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6. Measurement Data (continued)

6.7. Peak Emissions in a 50 MHz Bandwidth (15.250 (d) (3), RSS-220 5.3.1 (g))

Requirement: There is a limit on the peak level of the emissions contained within a 50 MHz bandwidth centered on the frequency at which the highest radiated emission occurs, f_M. That limit is 0 dBm EIRP.

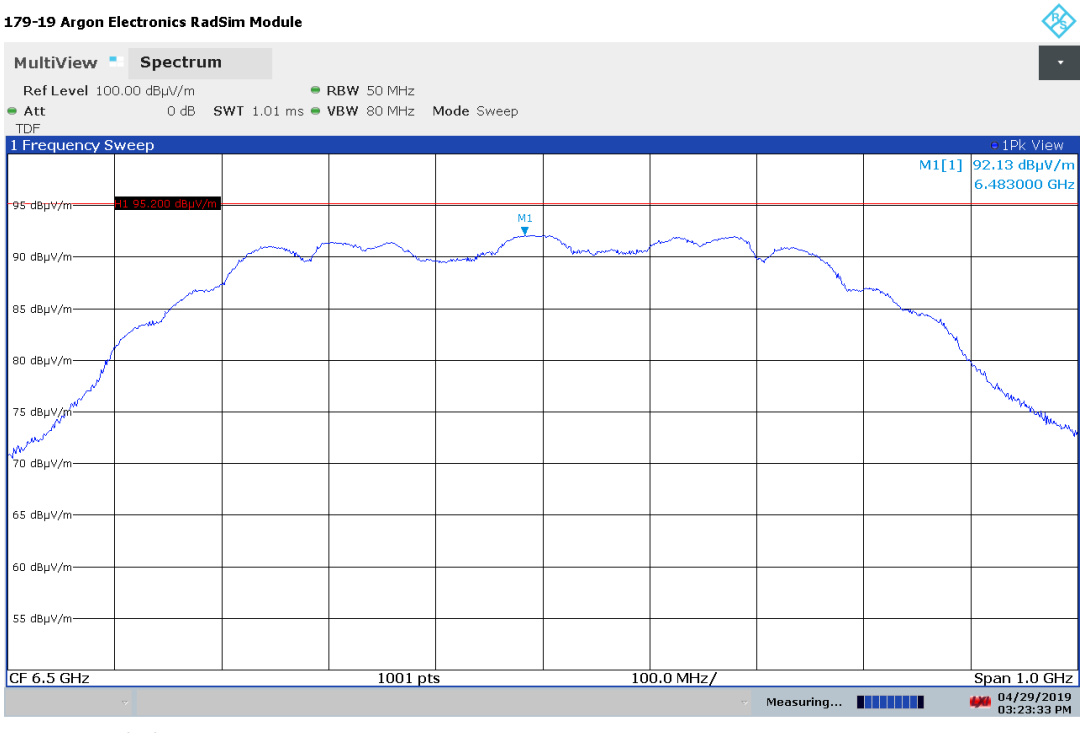
Frequency (GHz)	Amplitude[1]	Limit	Margin	Ant Polarity	Ant Height	Turntable Azimuth	Result
	(dBµV/m)	(dBµV/m)	(dB)	H/V	cm	Deg	
6.483	92.13	95.20	-3.07	H	116	204	Compliant

Notes: [1] Antenna Factor (AF), Cable Factor (CF) and External Preamplifier Gain (PAG) have been entered into the analyzer as transducer factors.

Equation (22) from ANSI C63.10-2013, EIRP = E_{meas} + 20 log (d_{meas}) – 104.7; d_{meas} = 3
EIRP (dBm) = E_{meas} (dBµV/m) – 95.2

Frequency (GHz)	Amplitude[1] (dBm)	Limit (dBm)	Margin	Ant Polarity	Ant Height	Turntable Azimuth	Result
	EIRP	EIRP	(dB)	H/V	cm	Deg	
6.483	-3.07	0.00	-3.07	H	116	204	Compliant

6.7.5 Plot of Peak Power at 3 Meters (Taoglas 16M PRF)



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6. Measurement Data (continued)

6.7. Peak Emissions in a 50 MHz Bandwidth (15.250 (d) (3), RSS-220 5.3.1 (g))

Requirement: There is a limit on the peak level of the emissions contained within a 50 MHz bandwidth centered on the frequency at which the highest radiated emission occurs, f_M. That limit is 0 dBm EIRP.

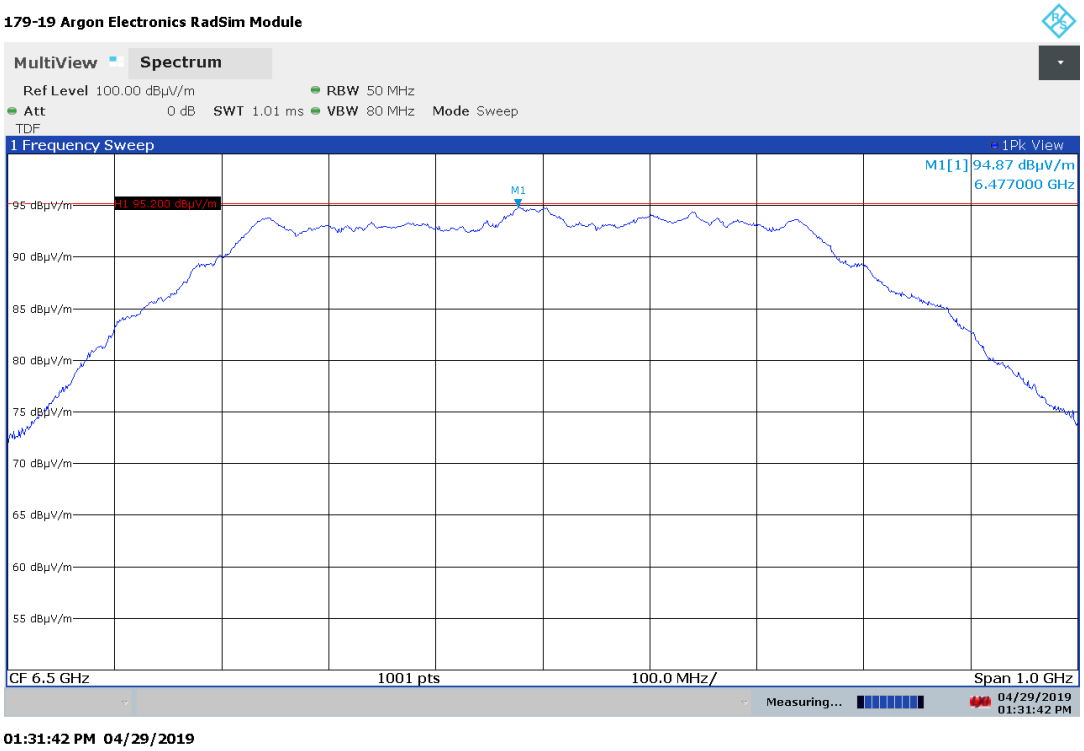
Frequency (GHz)	Amplitude[1]	Limit	Margin	Ant Polarity	Ant Height	Turntable Azimuth	Result
	(dBµV/m)	(dBµV/m)	(dB)	H/V	cm	Deg	
6.477	94.87	95.20	-0.33	H	116	204	Compliant

Notes: [1] Antenna Factor (AF), Cable Factor (CF) and External Preamplifier Gain (PAG) have been entered into the analyzer as transducer factors.

Equation (22) from ANSI C63.10-2013, EIRP = E_{meas} + 20 log (d_{meas}) – 104.7; d_{meas} = 3
EIRP (dBm) = E_{meas} (dBµV/m) – 95.2

Frequency (GHz)	Amplitude[1] (dBm)	Limit (dBm)	Margin	Ant Polarity	Ant Height	Turntable Azimuth	Result
	EIRP	EIRP	(dB)	H/V	cm	Deg	
6.477	-0.33	0.00	-0.33	H	116	204	Compliant

6.7.6 Plot of Peak Power at 3 Meters (Taoglas 64M PRF)



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6. Measurement Data (continued)

6.8 Conducted Emissions Test Setup

6.8.1. Regulatory Limit: FCC Part 15.207, RSS-Gen

Frequency Range (MHz)	Limits (dBµV)	
	Quasi-Peak	Average
0.15 to 0.50	66 to 56*	56 to 46*
0.50 to 5.0	56	46
5.0 to 30.0	60	50
* Decreases with the logarithm of the frequency.		

6.8.2 Measurement Equipment and Software Used to Perform Test

Device	Manufacturer	Model No.	Serial No.	Cal Due
EMI Receiver 9 kHz to 7 GHz	Rohde & Schwarz	ESR7	101156	9/10/2020
LISN	EMCO	3825/2	9109-1860	9/10/2019
Manufacturer	**Software Description**		**Title/Model #**	**Rev.**
Compliance Worldwide	Test Report Generation Software		Test Report Generator	1.0

6.8.3. Measurement & Equipment Setup

Test Date:	N/A
Test Engineer:	N/A
Site Temperature (°C):	22.2
Relative Humidity (%RH):	45.3
Frequency Range:	0.15 MHz to 30 MHz
EMI Receiver IF Bandwidth:	9 kHz
EMI Receiver Avg Bandwidth:	30 kHz
Detector Functions:	Peak, Quasi-Peak. & Average

6.8.4. Test Procedure

Test measurements were made in accordance with ANSI C63.4-2014, Standard Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronics Equipment in the Range of 9 kHz to 40 GHz.

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6. Measurement Data (continued)

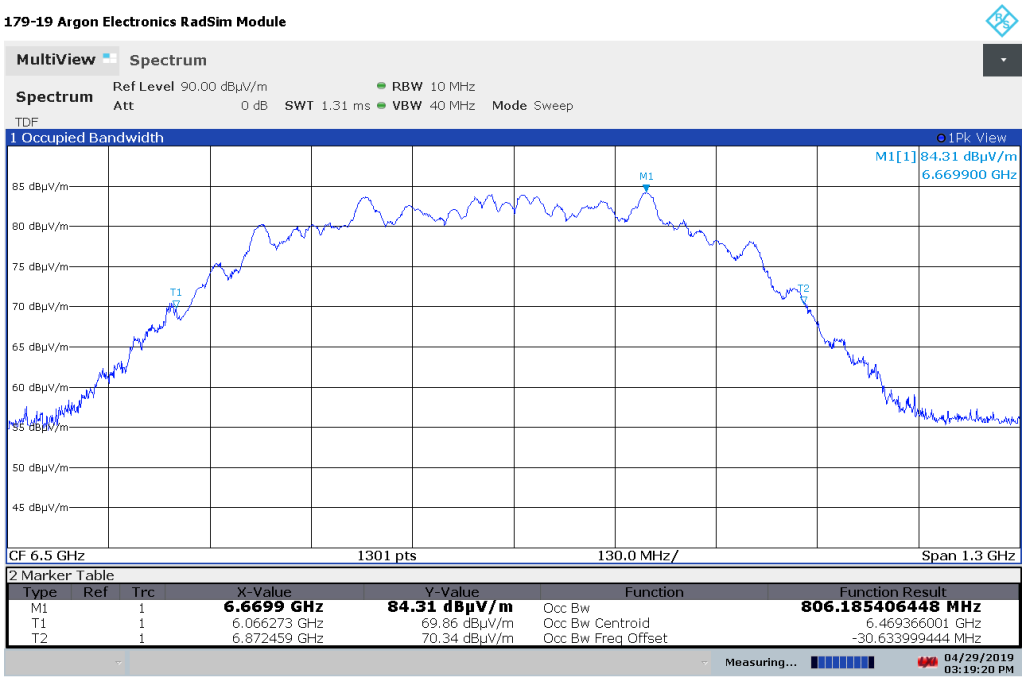
6.9. 99% Emission Bandwidth (RSS-GEN 6.7)

Requirement: The occupied bandwidth shall be reported for all equipment in addition to the specified bandwidth required in the applicable RSSs RSS-Gen, Section 6.7.

Test Note: The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the actual occupied / x dB bandwidth and the video bandwidth (VBW) shall not be smaller than three times the RBW value. Video averaging is not permitted.

The detector of the spectrum analyzer shall be set to “Sample”. However, a peak, or peak hold, may be used in place of the sampling detector since this usually produces a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold (or “Max Hold”) may be necessary to determine the occupied / x dB bandwidth if the device is not transmitting continuously.

6.9.1 Plot of 99% Emission Bandwidth (Directional, 16M PRF)



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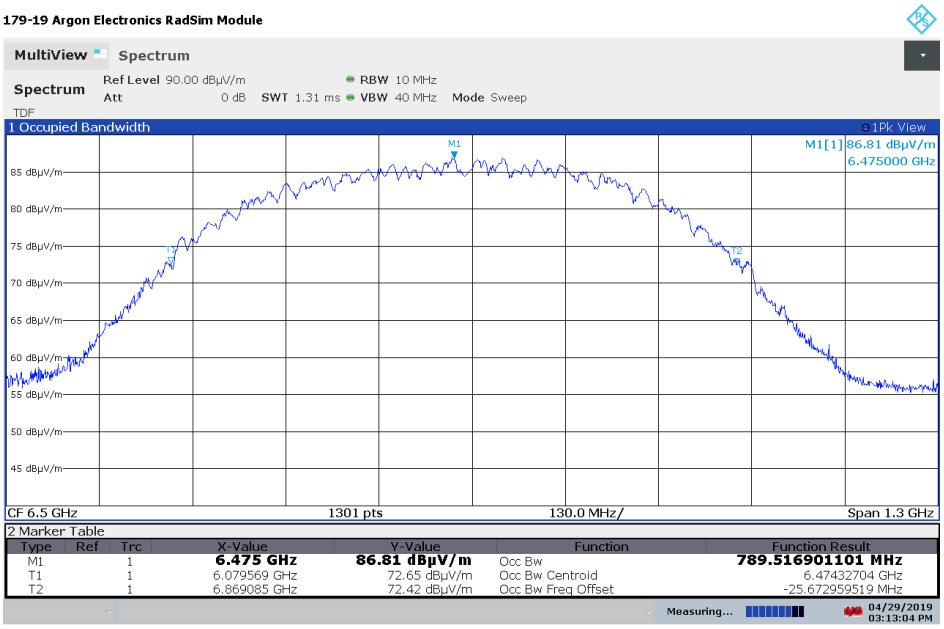
6. Measurement Data (continued)

6.9. 99% Emission Bandwidth (RSS-GEN 6.7 continued)

6.9.2 Plot of 99% Emission Bandwidth (Directional, 64M PRF)



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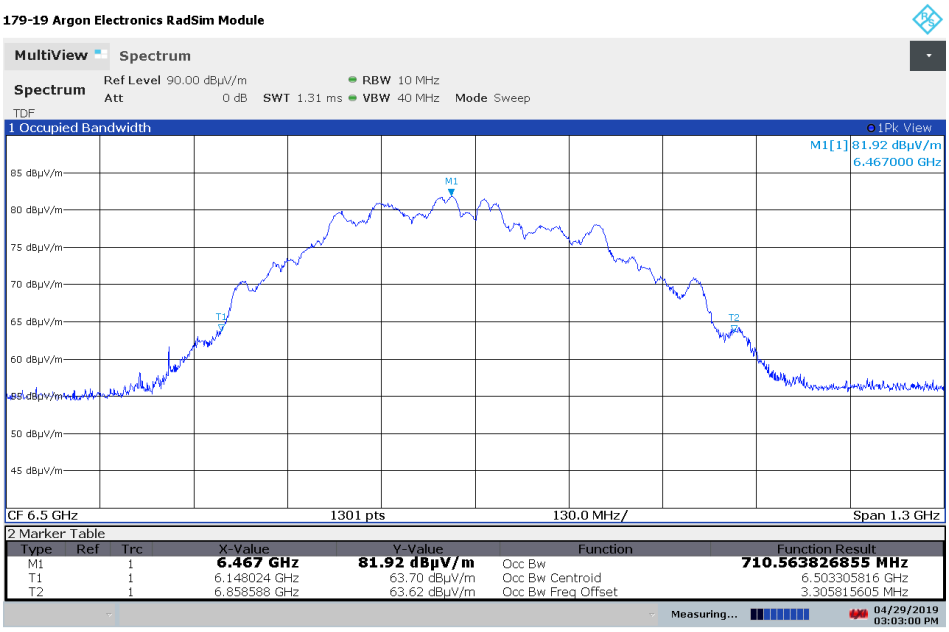
6.9.3 Plot of 99% Emission Bandwidth (Argon, 16M PRF)



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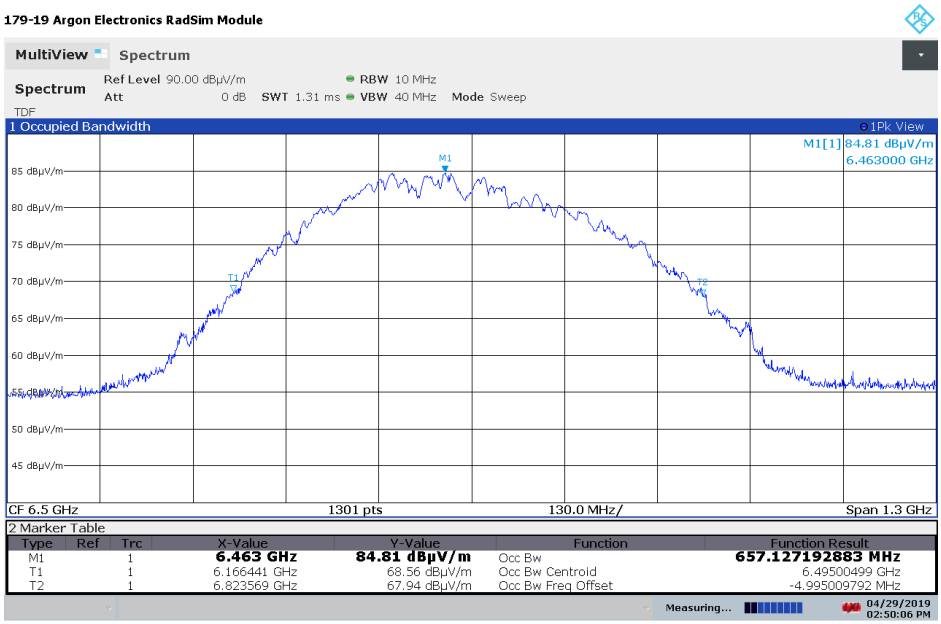
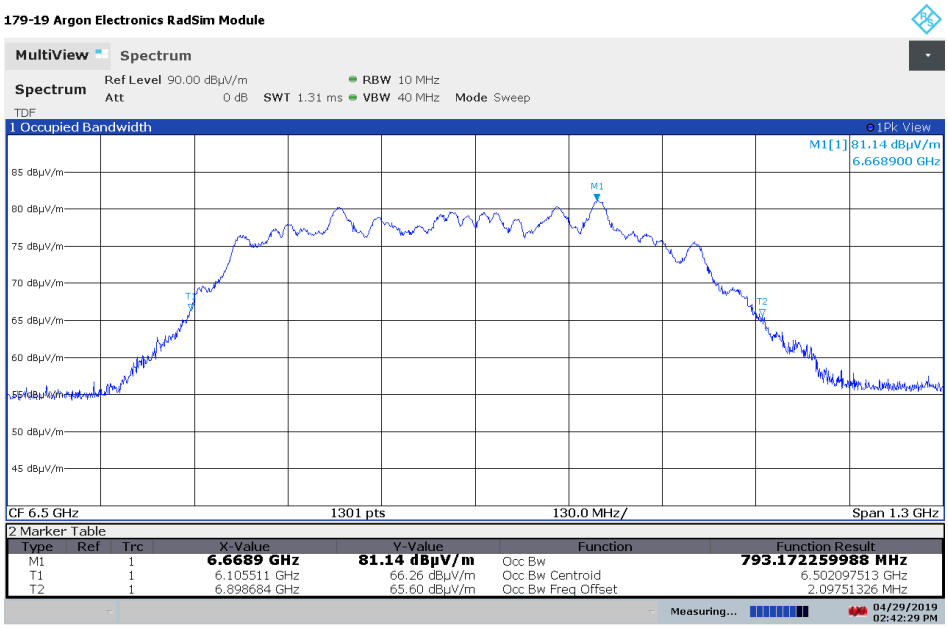
6. Measurement Data (continued)

6.9. 99% Emission Bandwidth (RSS-GEN 6.7 continued)

6.9.4 Plot of 99% Emission Bandwidth (Argon, 64M PRF)



6.9.5 Plot of 99% Emission Bandwidth (Taoglas, 16M PRF)



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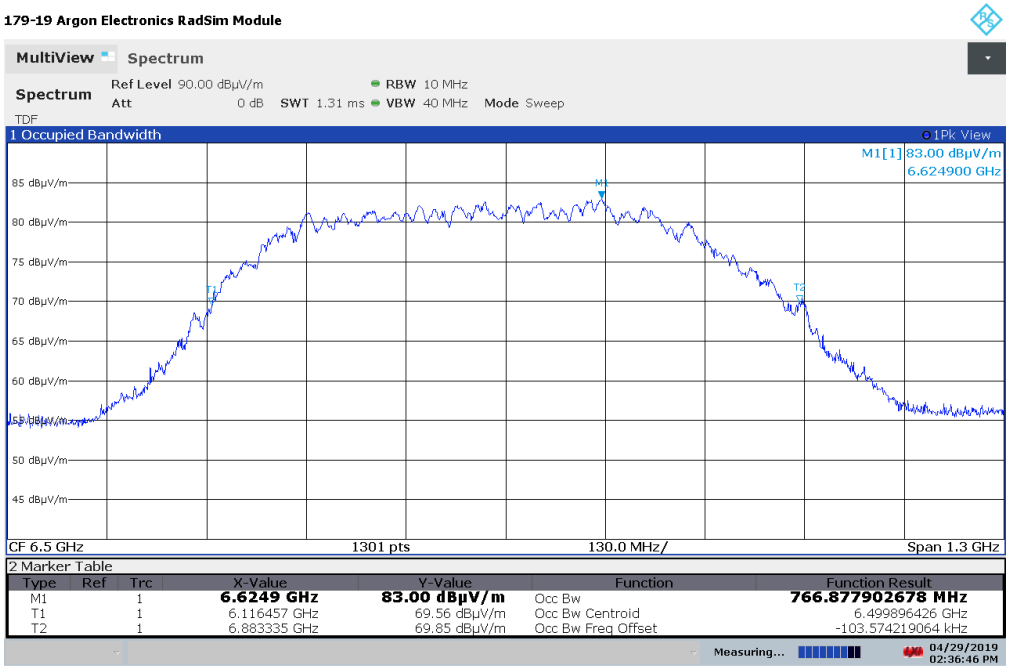
6. Measurement Data (continued)

6.9. 99% Emission Bandwidth (RSS-GEN 6.7 continued)

6.9.6 Plot of 99% Emission Bandwidth (Taoglas, 64M PRF)



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6. Measurement Data (continued)

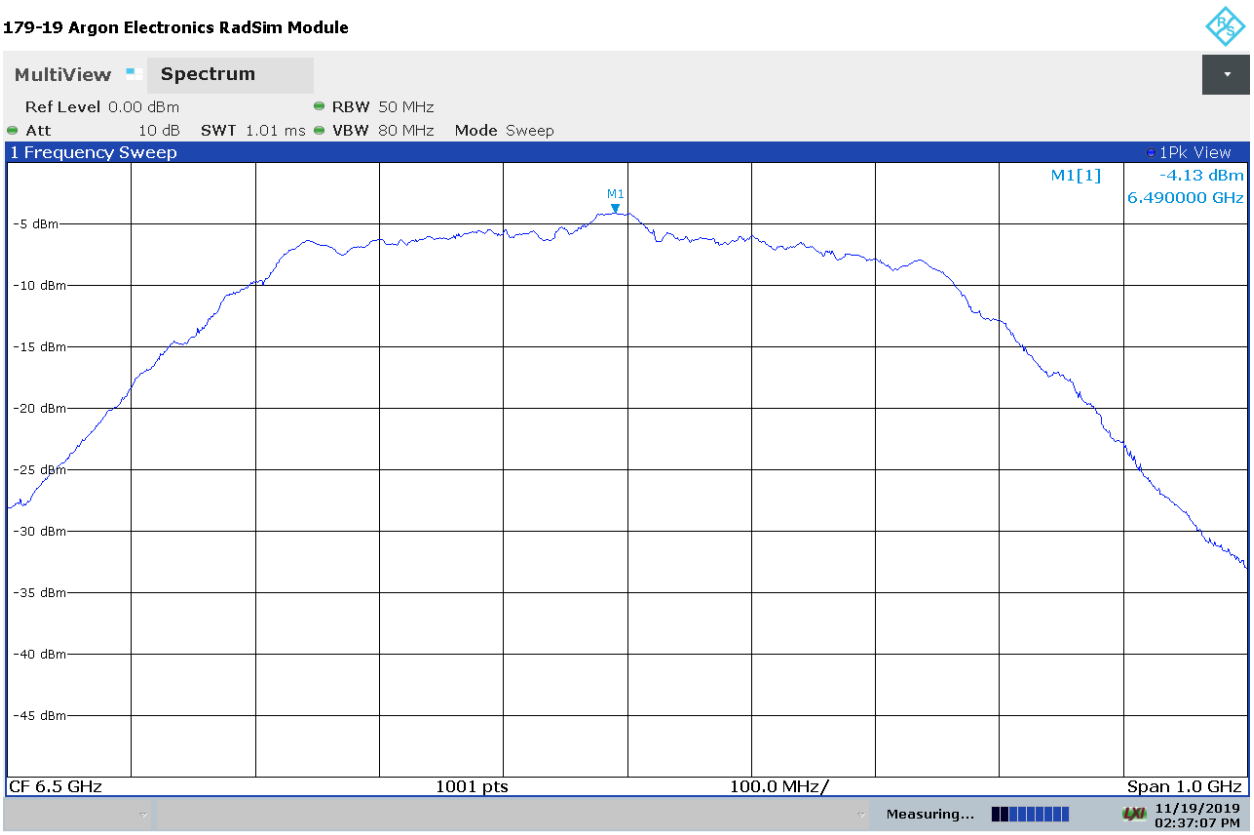
6.10. Public Exposure to Radio Frequency Energy Levels (1.1310)

6.10.1 RF Exposure for devices that operate above 6 GHz (continued)

Requirement: TCB Workshop November 2019 RF Exposure Policy Updates dated November 13, 2019, specifically slide 11.

Test exclusion based on 1 mW may be used now with the portable device f> 6GHz FCC MPE power density limits. Maximum time-averaged conducted power irrespective of distance from the body.

Worst Case conducted peak power for the Taoglas Antenna at 64M PRF = **-4.13 dBm**



Time averaged power is 8.45 dB lower or -12.58 dBm or 0.055 milliwats.

Result: Device is compliant with the Test Exclusion requirement of 1 mW.

The BLE Module and UWB radios do not operate simultaneously.

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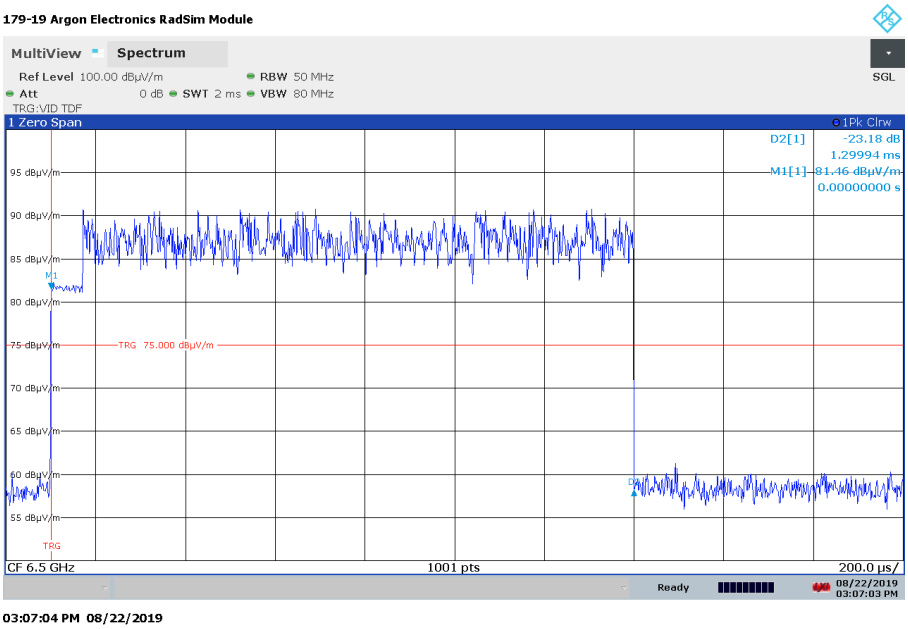
6. Measurement Data (continued)

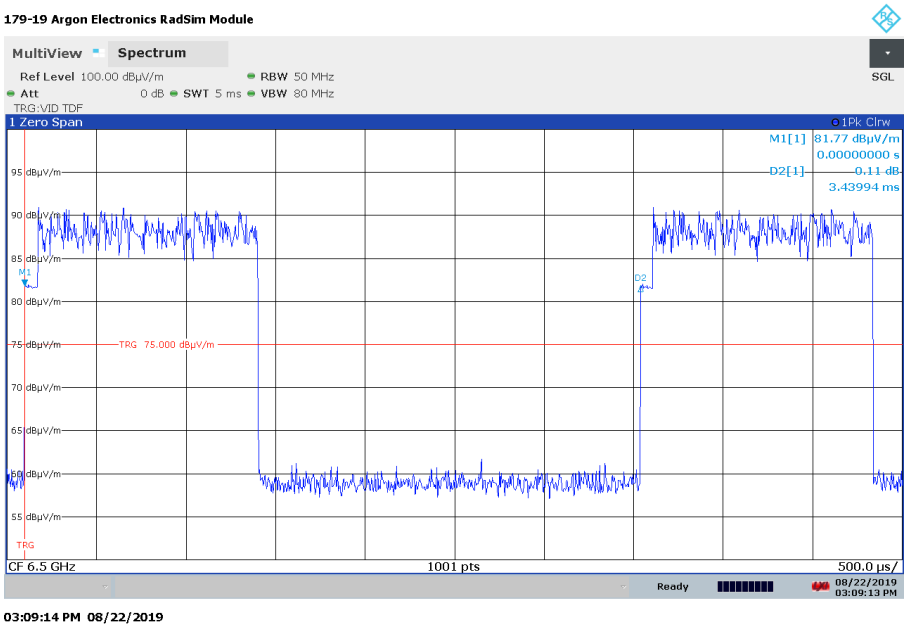
6.10. Public Exposure to Radio Frequency Energy Levels (1.1310, RSS-102)

6.10.1 RF Exposure for devices that operate above 6 GHz (continued)

Worst Case Duty Cycle of the device Burst Length = ~ 1.3 mS



Repetition Time = ~ 3.44 mS



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6. Measurement Data (continued)

6.10. Public Exposure to Radio Frequency Energy Levels (RSS-102)

6.10.1 RF Exposure for devices that operate above 6 GHz (continued)

Requirements: All transmitters are exempt from routine SAR and RF exposure evaluations provided that they comply with the requirements of sections 2.5.1 or 2.5.2.

Section 2.5.1: SAR evaluation is required if the separation distance between the user and/or bystander and the antenna and/or radiating element of the device is less than or equal to 20 cm, except when the device operates at or below the applicable output power level (adjusted for tune-up tolerance) for the specified separation distance defined in Table 1. The limit at 5800 MHz is 1 mW at a distance of ≤ 5mm.

Section 2.5.2: RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates as follows: at or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 5 W (adjusted for tune-up tolerance).

Center Frequency (GHz)	DUT Peak Output Power (dBm)	DUT Peak Output Power	ISED 2.5.1 Limit	DUT Peak Output Power	ISED 2.5.2 Limit
		(milliWatts EIRP)	(milliWatts)	(Watts EIRP)	(Watts)
	(1)	(2)	(3)	(4)	(5)
6.496	-1.68	0.679	1	0.000679	5
6.501	-0.65	0.861	1	0.000861	5
6.481	-0.52	0.887	1	0.000887	5
6.477	-0.22	0.951	1	0.000951	5
6.483	-3.07	0.493	1	0.000493	5
6.477	-0.33	0.927	1	0.000927	5

$$PD = \frac{OP + AG}{(4 \times \pi \times d^2)}$$

1. Section 6.8 of this test report. Measured Peak Power at 3 Meters
2. Converted dBm (E.I.R.P) measured in Section 6.8 to milliwatts
3. Reference ISED RSS-102 Section 2.5.1 Limit at 5800 MHz
4. Converted dBm (E.I.R.P) measured in Section 6.8 to Watts
5. Reference ISED RSS-102 Section 2.5.2 Limit above 6 GHz

Note: This is the peak power of the device in a 50 MHz bandwidth the time averaged power of the device is significantly lower. **20 * LOG (1.3 mS / 3.44 mS) = -8.45 dB**

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6. Measurement Data (continued)

6.10. Public Exposure to Radio Frequency Energy Levels (RSS-102)

6.10.1 RF Exposure for devices that operate above 6 GHz (continued)

Time Averaged Power

Center Frequency (GHz)	DUT Peak Output Power (dBm)	DUT Peak Output Power	ISED 2.5.1 Limit	DUT Peak Output Power	ISED 2.5.2 Limit
		(milliWatts EIRP)	(milliWatts)	(Watts EIRP)	(Watts)
	(1)	(2)	(3)	(4)	(5)
6.496	-10.13	0.097	1	0.000097	5
6.501	-9.10	0.123	1	0.000123	5
6.481	-9.00	0.126	1	0.000126	5
6.477	-8.67	0.136	1	0.000136	5
6.483	-11.55	0.070	1	0.000070	5
6.477	-8.78	0.132	1	0.000132	5

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7. Test Site Description

Compliance Worldwide is located at 357 Main Street in Sandown, New Hampshire. The test sites at Compliance Worldwide are used for conducted and radiated emissions testing in accordance with the Federal Communications Commission (FCC) and Industry Canada standards. Through our American Association for Laboratory Accreditation (A2LA) ISO Guide 17025 Accreditation our test sites are designated with the FCC (designation number **US1091**), Industry Canada (file number **IC 3023A-1)** and VCCI (Member number 3168) under registration number A-0274.

Compliance Worldwide is also designated as a Phase 1 CAB under APEC-MRA (US0132) for Australia/New Zealand AS/NZS CISPR 22, Chinese-Taipei (Taiwan) BSMI CNS 13438 and Korea (RRA) KN 11, KN 13, KN 14-1, KN 22, KN 32, KN 61000-6-3, KN 61000-6-4.

The radiated emissions test site is a 3 and 10 meter enclosed open area test site (OATS). Personnel, support equipment and test equipment are located in the basement beneath the OATS ground plane.

The conducted emissions site is part of a 16' x 20' x 12' ferrite tile chamber and uses one of the walls for the vertical ground plane. A second conducted emissions site is also located in the basement of the OATS site with a 2.3 x 2.5 meter ground plane and a 2.4 x 2.4 meter vertical wall.

The radiated emissions test site for measurements above 1GHz is a 3 Meter open area test site (OATS) with a 3.6 by 3.6 meter anechoic absorber floor patch to achieve a quasi-free space measurement environment per ANSI C63.4/C63.10 and CISPR 16-1-4 standards.

The sites are designed to test products or systems 1.5 meters W x 1.5 meters L x 2.0 meters H, floor standing or table top.

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8. Test Images

8.1. Spurious and Harmonic Emissions – 30 kHz to 1 GHz Front

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8. Test Images

8.2. Spurious and Harmonic Emissions – 30 kHz to 30 MHz Rear

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8. Test Images

8.3. Spurious and Harmonic Emissions – 30 MHz to 1 GHz Rear

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8. Test Images

8.4. Spurious and Harmonic Emissions – 1 to 18 GHz Front

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8. Test Images

8.5. Spurious and Harmonic Emissions – 1 to 18 GHz Rear

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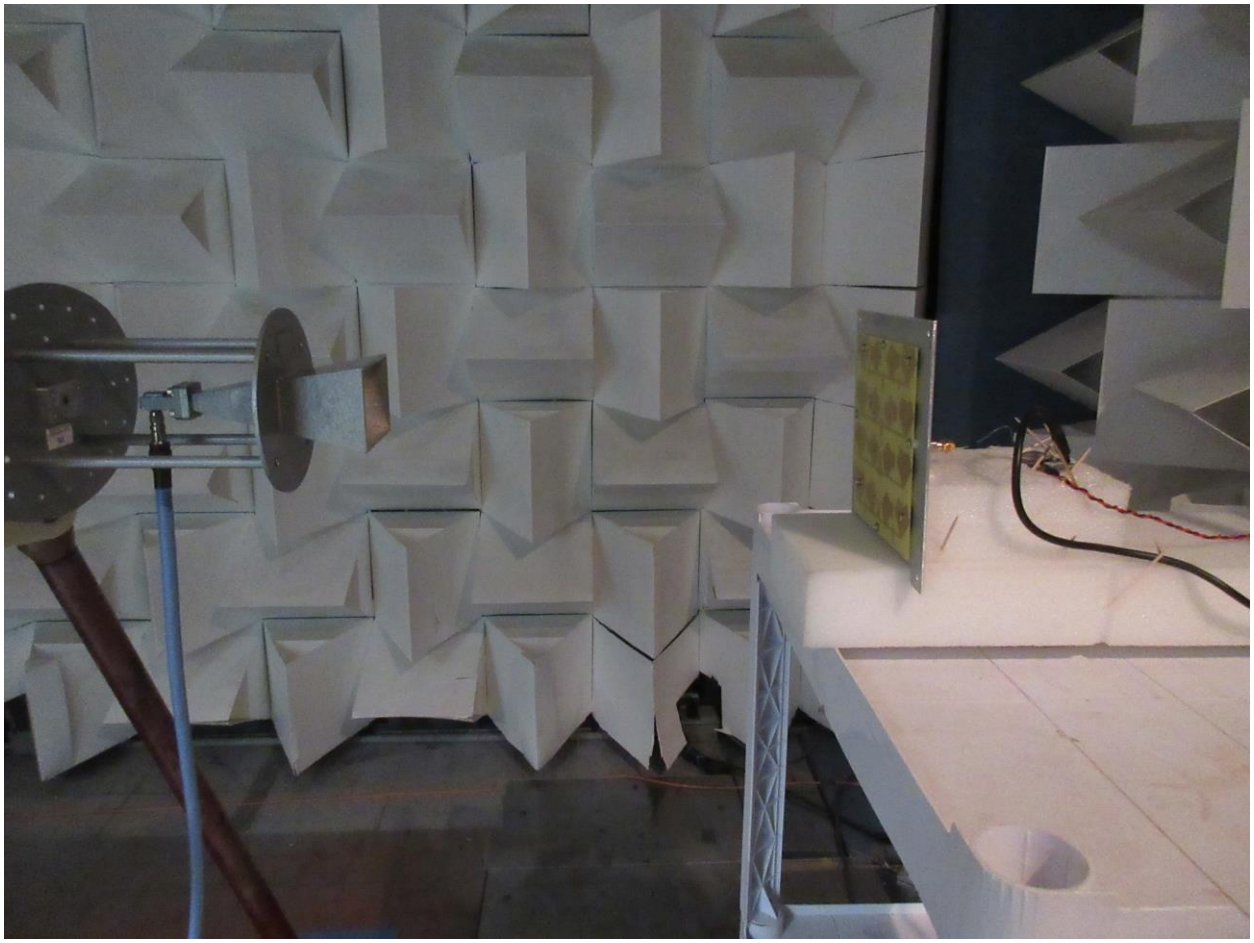
8. Test Images

8.6. Spurious and Harmonic Emissions – 18 to 40 GHz Side



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8. Test Images

8.7. Frequency Stability (Setup)

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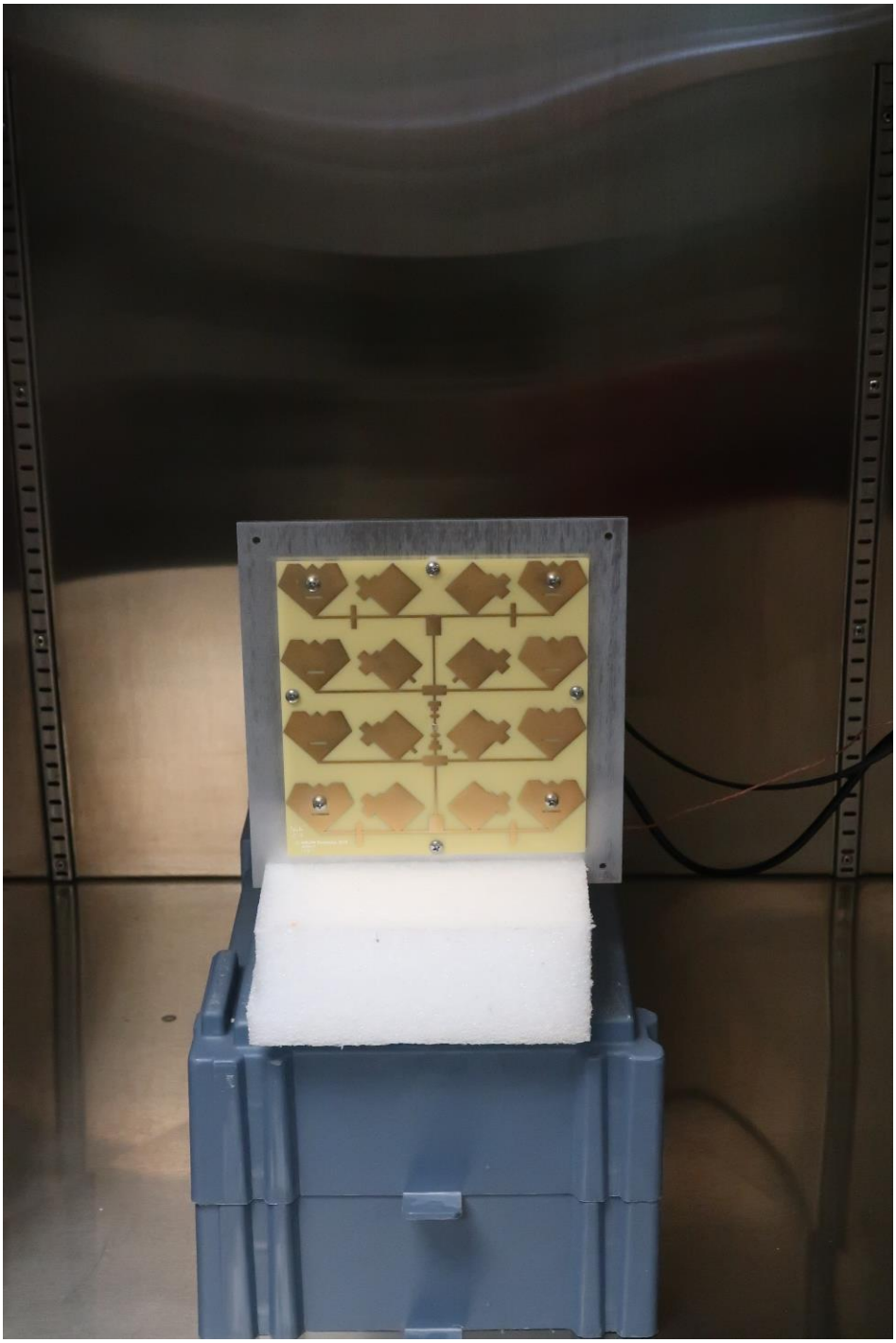
8. Test Images

8.8. Frequency Stability (Setup)



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