



**FCC 47 CFR PART 15 SUBPART C
INDUSTRY CANADA RSS-247 ISSUE 1**

CERTIFICATION TEST REPORT

FOR

WIRELESS HEADSET

MODEL NUMBER: AF1

FCC ID: A94AF1

IC: 3232A-AF1

REPORT NUMBER: R11201672-E1

ISSUE DATE: 2016-06-15

Prepared for
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Revision History

<u>Ver.</u>	<u>Issue Date</u>	<u>Revisions</u>	<u>Revised By</u>
1	2016-04-20	Initial Issue	Ron Reichard
2	2016-05-23	Added Data Reuse section, added below 30 MHz data, clarified Radiated measurement mode 'V1TR', added statement regarding chamber characterization for below 30 MHz on page 40, Included below 30 MHz limits on page 24.	Jeff Moser
3	2016-06-15	Revised to include non radio differences of AF1 vs. AI1 on page 5	Jeff Moser

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1. DATA REUSE

1.1. INTRODUCTION

The 15.247 FHSS antenna port test results for AF1 are represented by Bose device AI1 test report R11043795-E1 (FCC ID: A94AI1, IC: 3232A-AI1). This report for FCC ID: A94AF1, IC: 3232A-AF1 contains conducted power measurements and full Radiated Emissions measurements.

Bose takes full responsibility that the data as referenced in report R11043795-E1 (FCC ID: A94AI1, IC: 3232A-AI1) represent compliance for this FCC ID.

1.2. DIFFERENCES

Bose devices AI1 and AF1 have identical RF circuit boards, BOM's and antennas (right ear bud); just the enclosures are different and AF1 contains a heart rate sensor that the AI1 does not include (left ear bud). Therefore, AI1 antenna port test results are used in this report to represent how AF1 operates from a conducted perspective. The exception to this is the conducted power measurements made on AF1. Conducted power measurements were made on AF1 to ensure that the output power is aligned between the AF1 and AI1 EUT's.

1.3. TESTING PERFORMED

Testing performed under this Report (R11201672-E1) are Conducted Output power and Radiated Emissions. All other data is referenced to R11043795-E1 (FCC ID: A94AI1, IC: 3232A-AI1).

1.4. REFERENCE DETAIL SECTION

Equipment Class	Reference FCC ID	Type Grant	Grant Date	Reference Application	Report Title
FHSS	FCC ID: A94AI1, IC: 3232A-AI1	New	2016-06-03	AN16T0287/ AN16I6740	R11043795-E1 Section 7 (Antenna Port Results)

2. ATTESTATION OF TEST RESULTS

COMPANY NAME: BOSE CORP.
100 THE MOUNTAIN RD, FRAMINGHAM
MASSACHUSETTS, 01701, USA

EUT DESCRIPTION: Wireless Headset

MODEL: AF1

SERIAL NUMBER: Radiated: AF1_EB78BB, AF1_EB790D
Conducted Power: EB77A3

DATE TESTED: 2016-03-16 to 2016-03-24, 2016-05-05

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	PASS
INDUSTRY CANADA RSS-247 Issue 1	PASS
INDUSTRY CANADA RSS-GEN Issue 4	PASS

UL LLC tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL LLC based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL LLC and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL LLC will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Approved & Released
For UL LLC By:



Jeff Moser
EMC Program Manager
UL – Consumer Technology Division

Prepared By:



Ron Reichard
EMC Project Lead
UL – Consumer Technology Division

3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, ANSI C63.10-2013, RSS-GEN Issue 4, RSS-247 Issue 1.

4. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 12 Laboratory Dr., Research Triangle Park, NC 27709, USA and 2800 Suite B, Perimeter Park Drive, Morrisville, NC 27560.

12 Laboratory Dr., RTP, NC 27709
<input type="checkbox"/> Chamber A
<input type="checkbox"/> Chamber C

2800 Suite B Perimeter Park Dr., Morrisville, NC 27560
<input checked="" type="checkbox"/> Chamber NORTH
<input checked="" type="checkbox"/> Chamber SOUTH

The onsite chambers are covered under Industry Canada company address code 2180C with site numbers 2180C -1 through 2180C-4, respectively.

UL LLC (RTP) is accredited by NVLAP, Laboratory Code 200246-0. The full scope of accreditation can be viewed at <http://www.nist.gov/nvlap/>

5. CALIBRATION AND UNCERTAINTY

5.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

5.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

$$\begin{aligned} \text{Field Strength (dBuV/m)} &= \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \\ &\text{Cable Loss (dB)} - \text{Preamp Gain (dB)} \\ 36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} &= 28.9 \text{ dBuV/m} \end{aligned}$$

5.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER		UNCERTAINTY
Total RF Power, Conducted	+/-	0.45 dB
RF Power Density, Conducted	+/-	1.50 dB
Spurious Emissions, Conducted	+/-	2.94 dB
All Emissions, Radiated up to 40 GHz	+/-	5.36 dB
Temperature	+/-	0.07°C
Humidity	+/-	2.26% RH
DC and Low Frequency Voltages	+/-	1.27%
Conducted Emissions (0.150-30MHz)	+/-	2.37 dB

Uncertainty figures are valid to a confidence level of 95%.

6. EQUIPMENT UNDER TEST

6.1. DESCRIPTION OF EUT

The EUT is a Wireless Headset that contains a Bluetooth transceiver.

The radio module is manufactured by Cambridge Silicon Radio, CSR8670.

6.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak conducted output power as follows:

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2402 - 2480	Basic GFSK	9.18	8.28
2402 - 2480	DQPSK	7.77	5.98
2402 - 2480	Enhanced 8PSK	8.10	6.46

6.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a meander printed etch antenna, with a maximum gain of +0.6 dBi.

6.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was version 0.4.7.158.

The test utility and driver software used during testing was Polycomm, ver. 0.1.5.0 and CSR BlueSuite ver 2.5.8.

6.5. WORST-CASE CONFIGURATION AND MODE

Radiated emissions were performed with the EUT set to transmit at the channel with the highest output power as the worst-case scenario.

The fundamental of the EUT was investigated in three orthogonal orientations X,Y,Z, it was determined that the Y orientation was the worst-case orientation. Therefore, all final radiated testing was performed with the EUT in Y orientation.

For Enhanced Data rate modes, 8DPSK is considered worst-case and only select tests were performed for the DQPSK mode. Additionally, unless noted in the test report, all tests were performed with the DH5 packet size as this was considered worst-case.

6.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop PC (for commissioning the EUT)	Lenovo	20BU-S04K00	PC-0A2UQS	N/A
AC Adapter (for laptop PC)	Lenovo	ADLX65NLC2A	54DE1T	N/A

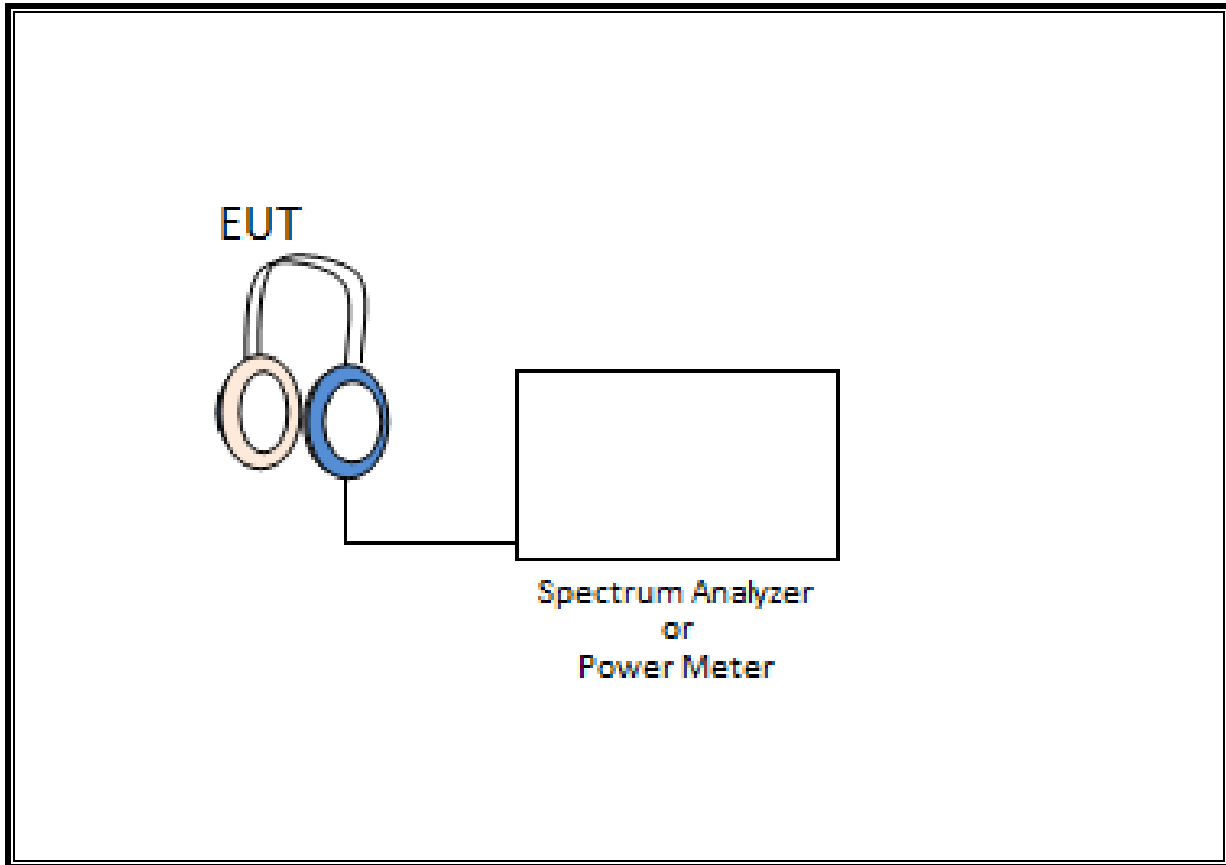
I/O CABLES

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	USB	1	Micro USB	Unshielded	0.33	For USB charging cable.

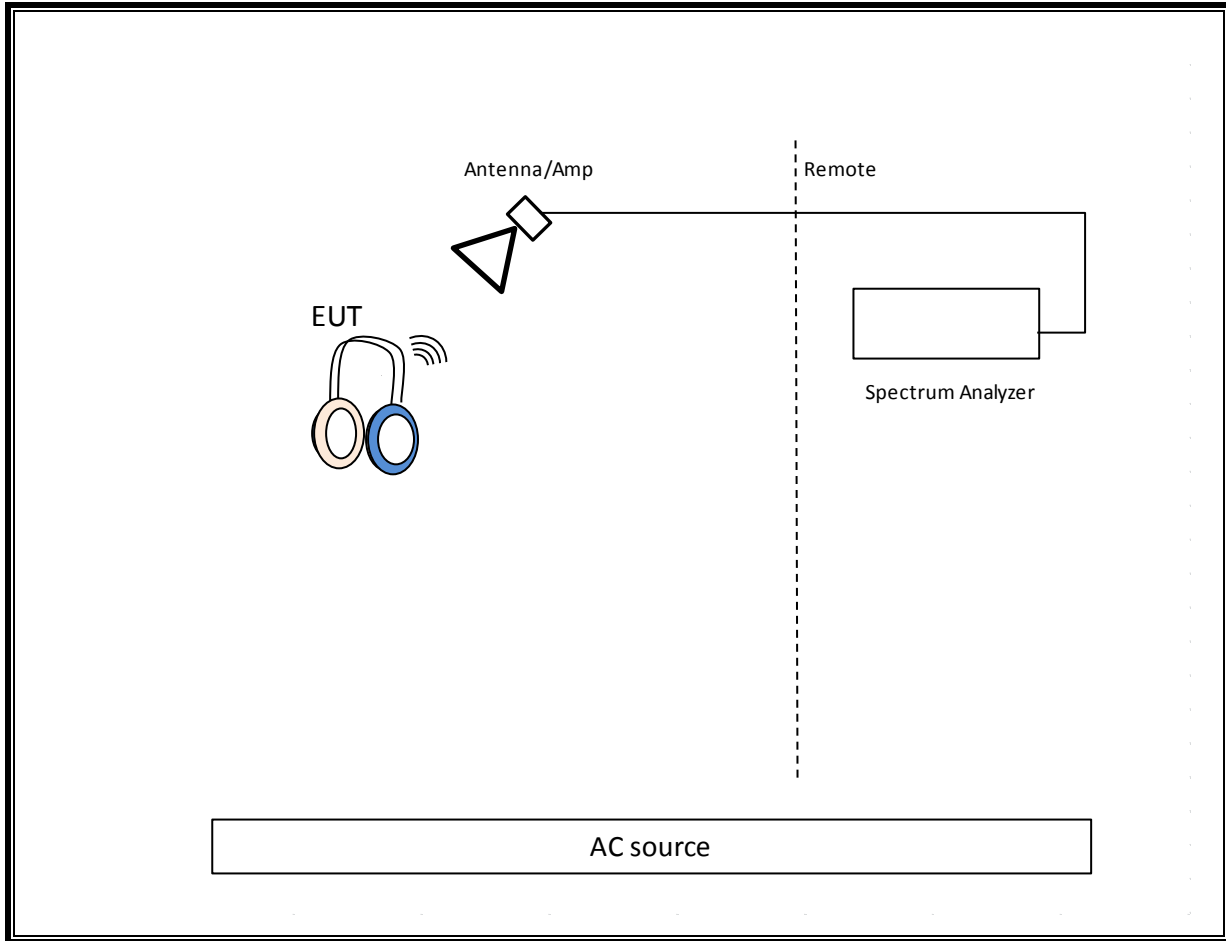
TEST SETUP

The EUT is set up as a stand-alone device during radiated-emissions testing. For convenience, the device is connected to a laptop PC via a USB cable to configure the device for test during antenna-port measurements. Test software exercised the radio portion of the device.

SETUP DIAGRAM FOR CONDUCTED TESTS



SETUP DIAGRAM FOR RADIATED TESTS



7. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Test Equipment Used - Radiated Disturbance Emissions Test Equipment (Morrisville - North Chamber)

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	30-1000 MHz				
AT0073	Hybrid Broadband Antenna	Sunol Sciences Corp.	JB3	2015-06-10	2016-06-30
	1-18 GHz				
AT0078	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2015-10-15	2016-10-31
	Gain-Loss Chains				
N-SAC02	Gain-loss string: 30-1000MHz	Various	Various	2015-06-04	2016-06-30
N-SAC03	Gain-loss string: 1-18GHz	Various	Various	2015-09-29	2016-09-30
	Receiver & Software				
SA0027	Spectrum Analyzer	Agilent	N9030A	2016-02-08	2017-02-08
SOFTEMI	EMI Software	UL	Version 9.5	NA	NA
	Additional Equipment used				
HI0079	Temp/Humid/Pressure Meter	Springfield Precision	PreciseTemp	2015-07-01	2016-07-31

Test Equipment Used - Radiated Disturbance Emissions Test Equipment (Morrisville - South Chamber)

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	0.009-30 MHz				
AT0079	Active Loop Antenna	ETS-Lindgren	6502	2015-12-08	2016-12-31
	30-1000 MHz				
AT0074	Hybrid Broadband Antenna	Sunol Sciences Corp.	JB3	2015-06-10	2016-06-30
	1-18 GHz				
AT0067	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2015-03-12	2016-03-31
	18-40 GHz				
AT0076	Horn Antenna, 18-26.5GHz	ARA	MWH-1826/B	2015-08-27	2016-08-31
AT0077	Horn Antenna, 26-40GHz	ARA	MWH-2640/B	2015-08-27	2016-08-31
	Gain-Loss Chains				
S-SAC01	Gain-loss string: 0.009-30MHz	Various	Various	2015-10-07	2016-10-31
S-SAC02	Gain-loss string: 30-1000MHz	Various	Various	2015-06-09	2016-06-30
S-SAC03	Gain-loss string: 1-18GHz	Various	Various	2015-08-22	2016-08-31
S-SAC04	Gain-loss string: 18-40GHz	Various	Various	2016-02-29	2017-02-28
	Receiver & Software				
SA0018	Spectrum Analyzer	Agilent	N9030A	2015-11-07	2016-11-30
SA0025	Spectrum Analyzer	Agilent	N9030A	2016-03-17	2017-03-31
SOFTEMI	EMI Software	UL	Version 9.5	NA	NA
	Additional Equipment used				
HI0050	Temp/Humid/Pressure Meter	Cole-Parmer	99760-00	2015-07-01	2016-07-31

Note – All testing in this chamber was performed before 2016-03-31, except below 30 MHz testing which was performed on 2016-05-05.

Test Equipment Used - Wireless Conducted Measurement Equipment

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
Conducted Room 2					
PWM003	RF Power Meter	Keysight Technologies	N1911A	2015-06-08	2017-06-08
PWS003	Peak and Avg Power Sensor, 50MHz to 6GHz	Keysight Technologies	E9323A	2015-06-05	2016-06-05
1100502	Temp/Humid Chamber	Cincinnati Sub-Zero	ZPH-8-3.5-SCT/AC	2015-05-13	2016-05-31
HI0079	Temp/Humid/Pressure Meter	Springfield	PreciseTemp	2015-07-1	2016-07-31
MM0168	True RMS Multimeter	Agilent	U1232A	2015-08-17	2016-08-31
T1024	EMPower USB RF Power Sensor, 10MHz to 6GHz	ETS Lindgren	7002-006	2015-10-01	2016-10-01

8. ANTENNA PORT TEST RESULTS

Note - The antenna port test results for AF1 are represented by Bose device AI1 test report R11043795-E1 (FCC ID: A94AI1, IC: 3232A-AI1). Bose devices AI1 and AF1 have identical circuit boards, BOM's and antennas; just the enclosures are different. Therefore, AI1 antenna port test results are used in Report# R11043795-E1 to represent how AF1 operates from a conducted perspective. The exception to this is the conducted power measurements made on AF1. Conducted power measurements were made on AF1 to ensure that the output power is aligned between the AF1 and AI1 EUT's.

8.1. BASIC DATA RATE GFSK MODULATION

8.1.1. OUTPUT POWER

LIMIT

§15.247 (b) (1)

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

RSS-247 5.1 (2)

For frequency hopping systems operating in the band 2400-2483.5 MHz and employing at least 75 hopping channels, the maximum peak conducted output power shall not exceed 1 W; for all other frequency hopping systems in the band, the maximum peak conducted output power shall not exceed 0.125 W.

TEST PROCEDURE

The transmitter output was connected to a power meter equipped with a power sensor capable of measuring peak power. The cable assembly insertion loss of 11.036 dB (including 10 dB pad and 1.036 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

For 75 or more hopping channels

Channel	Frequency (MHz)	Output Power (dBm)	Directional Gain (dBi)	Limit (dBm)	Margin (dB)
Low	2402	6.43	0.60	30	-23.57
Middle	2441	9.18	0.60	30	-20.82
High	2480	7.80	0.60	30	-22.20

8.1.2. AVERAGE POWER

LIMIT

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

The cable assembly insertion loss of 11.036 dB (including 10 dB pad and 1.036 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	6.11
Middle	2441	8.99
High	2480	7.58

8.2. ENHANCED DATA RATE QPSK MODULATION

8.2.1. OUTPUT POWER

LIMIT

§15.247 (b) (1)

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

RSS-247 5.1 (2)

For frequency hopping systems operating in the band 2400-2483.5 MHz and employing at least 75 hopping channels, the maximum peak conducted output power shall not exceed 1 W; for all other frequency hopping systems in the band, the maximum peak conducted output power shall not exceed 0.125 W.

TEST PROCEDURE

The transmitter output was connected to a power meter equipped with a power sensor capable of measuring peak power. The cable assembly insertion loss of 11.036 dB (including 10 dB pad and 1.036 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

Per the A11 report, for DQPSK mode, the channel separation was limited to 2/3 the 20 dB bandwidth. Therefore, the output power was limited to 125 mW. This was based on the channel separation measurements for the 8PSK mode.

Channel	Frequency (MHz)	Output Power (dBm)	Directional Gain (dBi)	Limit (dBm)	Margin (dB)
Low	2402	4.36	0.60	21	-16.64
Middle	2441	7.77	0.60	21	-13.23
High	2480	6.15	0.60	21	-14.85

8.2.2. AVERAGE POWER

LIMIT

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

The cable assembly insertion loss of 11.036 dB (including 10 dB pad and 1.036 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	2.32
Middle	2441	5.89
High	2480	4.21

8.3. ENHANCED DATA RATE 8PSK MODULATION

8.3.1. OUTPUT POWER

LIMIT

§15.247 (b) (1)

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

RSS-247 5.1 (2)

For frequency hopping systems operating in the band 2400-2483.5 MHz and employing at least 75 hopping channels, the maximum peak conducted output power shall not exceed 1 W; for all other frequency hopping systems in the band, the maximum peak conducted output power shall not exceed 0.125 W.

TEST PROCEDURE

The transmitter output was connected to a power meter equipped with a power sensor capable of measuring peak power. The cable assembly insertion loss of 11.036 dB (including 10 dB pad and 1.036 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

For 8PSK mode, the channel separation was limited to 2/3 the 20 dB bandwidth. Therefore, the output power was limited to 125 mW.

Channel	Frequency (MHz)	Output Power (dBm)	Directional Gain (dBi)	Limit (dBm)	Margin (dB)
Low	2402	4.81	0.60	21	-16.19
Middle	2441	8.10	0.60	21	-12.90
High	2480	6.56	0.60	21	-14.44

8.3.2. AVERAGE POWER

LIMIT

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

The cable assembly insertion loss of 11.036 dB (including 10 dB pad and 1.036 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	2.32
Middle	2441	5.92
High	2480	4.22

9. RADIATED TEST RESULTS

9.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

IC RSS-GEN Clause 8.9 (Transmitter)

IC RSS-GEN Clause 7.1.2 (Receiver)

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
0.009-0.490	2400/F(kHz) @ 300 m	-
0.490-1.705	24000/F(kHz) @ 30 m	-
1.705 - 30	30 @ 30m	-
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane for below 1GHz measurements and 1.5 m above the ground plane for above 1GHz measurements. The antenna to EUT distance is 3 meters.

For measurements below 1 GHz the resolution bandwidth is set to 120 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements for the 30-1000 MHz range, 9 kHz for peak detection measurements or 9 kHz for quasi-peak detection measurements for the 0.15-30 MHz range and 200 Hz for peak detection measurements or 200 Hz for quasi-peak detection measurements for the 9 to 150 kHz range. Peak detection is used unless otherwise noted as quasi-peak.

For peak measurements above 1 GHz, the resolution bandwidth is set to 1 MHz and the video bandwidth is set to 3 MHz. For average measurements above 1GHz, the resolution bandwidth and video bandwidth are set as described in ANSI C63.10:2013 for the applicable measurement. The particular averaging method used for this test program was by measuring using a Peak detector with the resolution bandwidth set to 1MHz and a reduced video bandwidth, based on $1/T_{on}$ where T_{on} is the transmit on time.

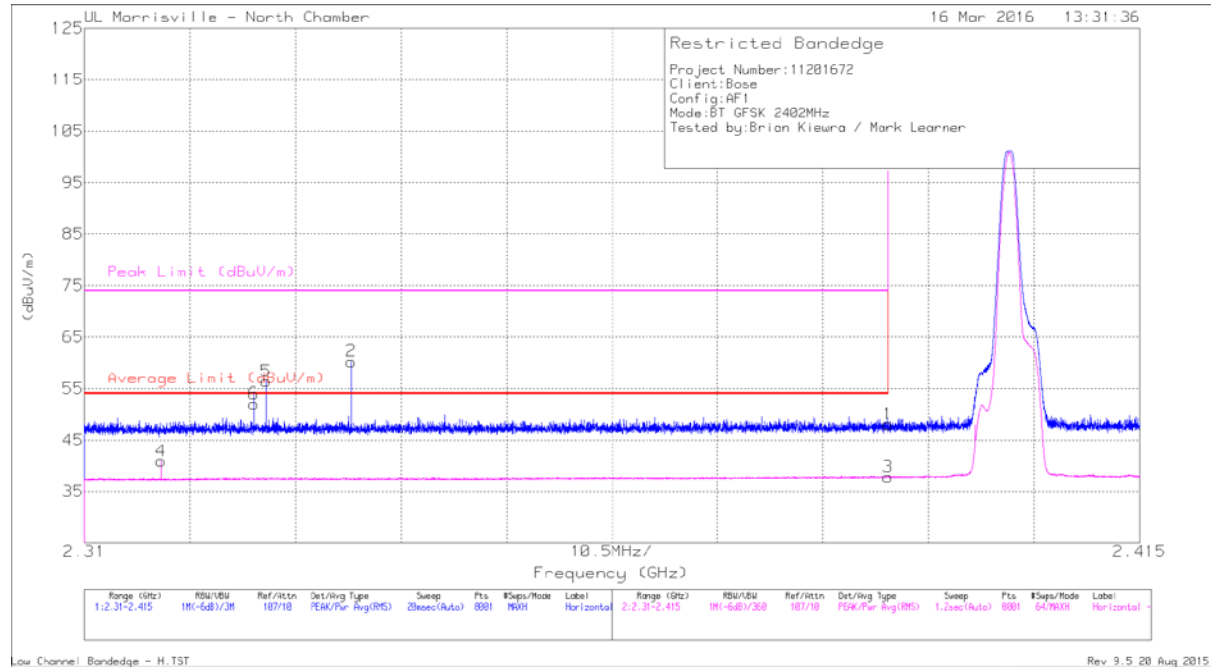
The spectrum from 9 kHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band.

The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

9.2. TRANSMITTER ABOVE 1 GHz

9.2.1. BASIC DATA RATE GFSK MODULATION

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



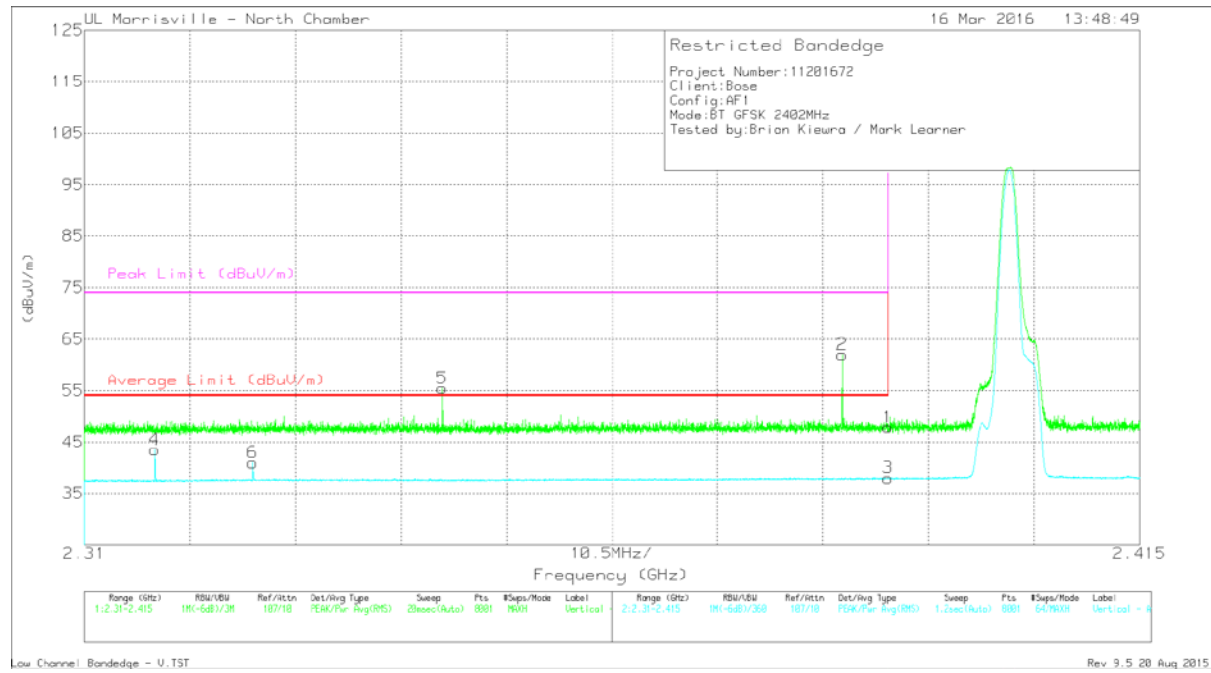
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0078 AF (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	41.29	Pk	31.9	-25.1	48.09	-	-	74	-25.91	299	116	H
2	* 2.337	53.78	Pk	31.7	-25.2	60.28	-	-	74	-13.72	299	116	H
5	* 2.328	49.91	Pk	31.7	-25.2	56.41	-	-	74	-17.59	299	116	H
6	* 2.327	45.56	Pk	31.7	-25.2	52.06	-	-	74	-21.94	299	116	H
3	* 2.39	31.06	V1TR	31.9	-25.1	37.86	54	-16.14	-	-	299	116	H
4	* 2.318	34.5	V1TR	31.7	-25.3	40.9	54	-13.1	-	-	299	116	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

V1TR: VB=1/Ton, where: Ton is packet duration

RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



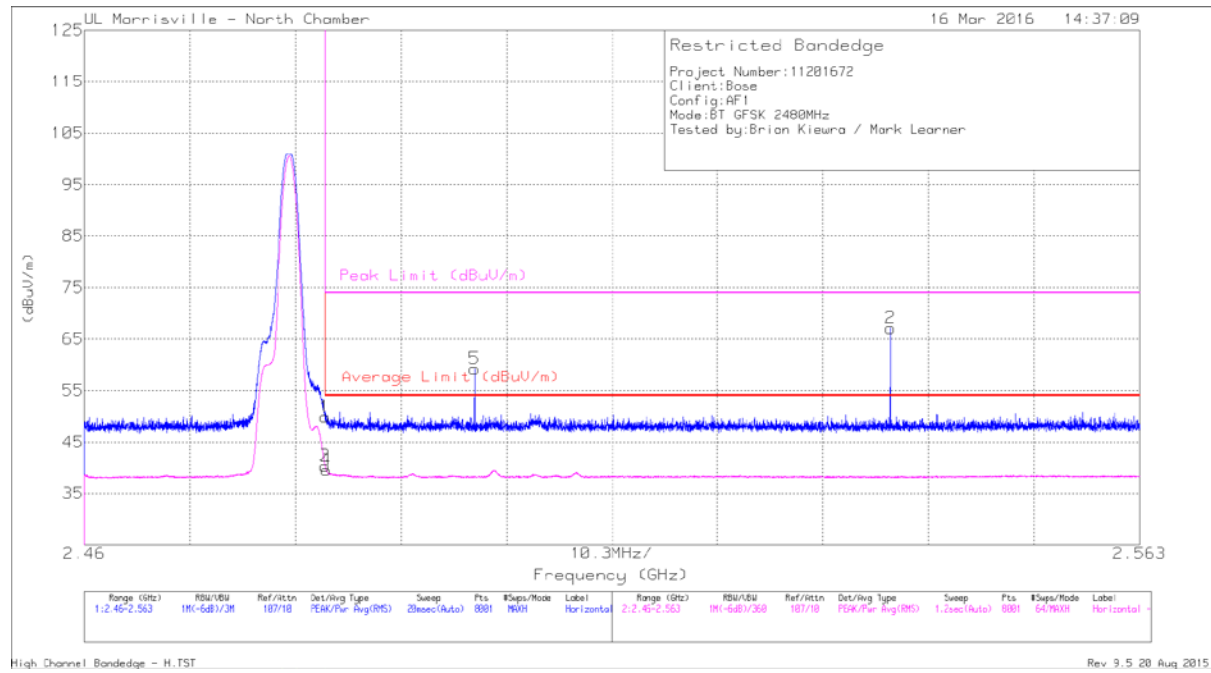
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0078 AF (dB/m)	Amp/Cbl/ Ftr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	41.09	Pk	31.9	-25.1	47.89	-	-	74	-26.11	96	251	V
2	* 2.385	55.18	Pk	31.9	-25.1	61.98	-	-	74	-12.02	96	251	V
5	* 2.346	48.93	Pk	31.8	-25.3	55.43	-	-	74	-18.57	96	251	V
3	* 2.39	31.25	V1TR	31.9	-25.1	38.05	54	-15.95	-	-	96	251	V
4	* 2.317	37.12	V1TR	31.7	-25.3	43.52	54	-10.48	-	-	96	251	V
6	* 2.327	34.5	V1TR	31.7	-25.2	41	54	-13	-	-	96	251	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

V1TR: VB=1/Ton, where: Ton is packet duration

RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



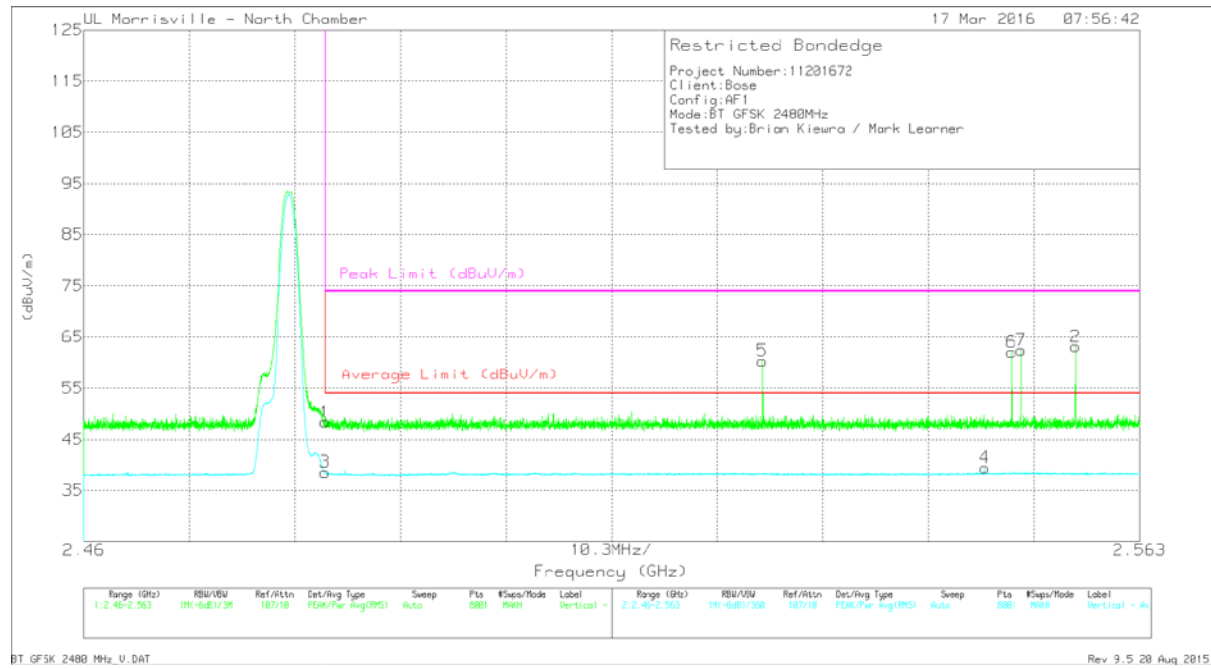
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0078 AF (dB/m)	Amp/Cbl/Ftr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	42.59	Pk	32.2	-24.9	49.89	-	-	74	-24.11	275	128	H
5	* 2.498	51.97	Pk	32.2	-24.9	59.27	-	-	74	-14.73	275	128	H
3	* 2.484	33.05	V1TR	32.2	-24.9	40.35	54	-13.65	-	-	275	128	H
4	* 2.484	32.31	V1TR	32.2	-24.9	39.61	54	-14.39	-	-	275	128	H
2	2.539	59.94	Pk	32.2	-25	67.14	-	-	74	-6.86	275	128	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

V1TR : VB=1/Ton, where: Ton is packet duration

RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0078 AF (dB/m)	Amp/Cbl /Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	41.1	Pk	32.2	-24.9	48.4	-	-	74	-25.6	286	118	V
3	* 2.484	31.3	V1TR	32.2	-24.9	38.6	54	-15.4	-	-	286	118	V
5	2.526	53.04	Pk	32.2	-24.9	60.34	-	-	74	-13.66	286	118	V
4	2.548	32.04	V1TR	32.3	-24.9	39.44	54	-14.56	-	-	286	118	V
6	2.551	54.67	Pk	32.3	-24.9	62.07	-	-	74	-11.93	286	118	V
7	2.551	55.02	Pk	32.3	-24.9	62.42	-	-	74	-11.58	286	118	V
2	2.557	55.74	Pk	32.3	-24.9	63.14	-	-	74	-10.86	286	118	V

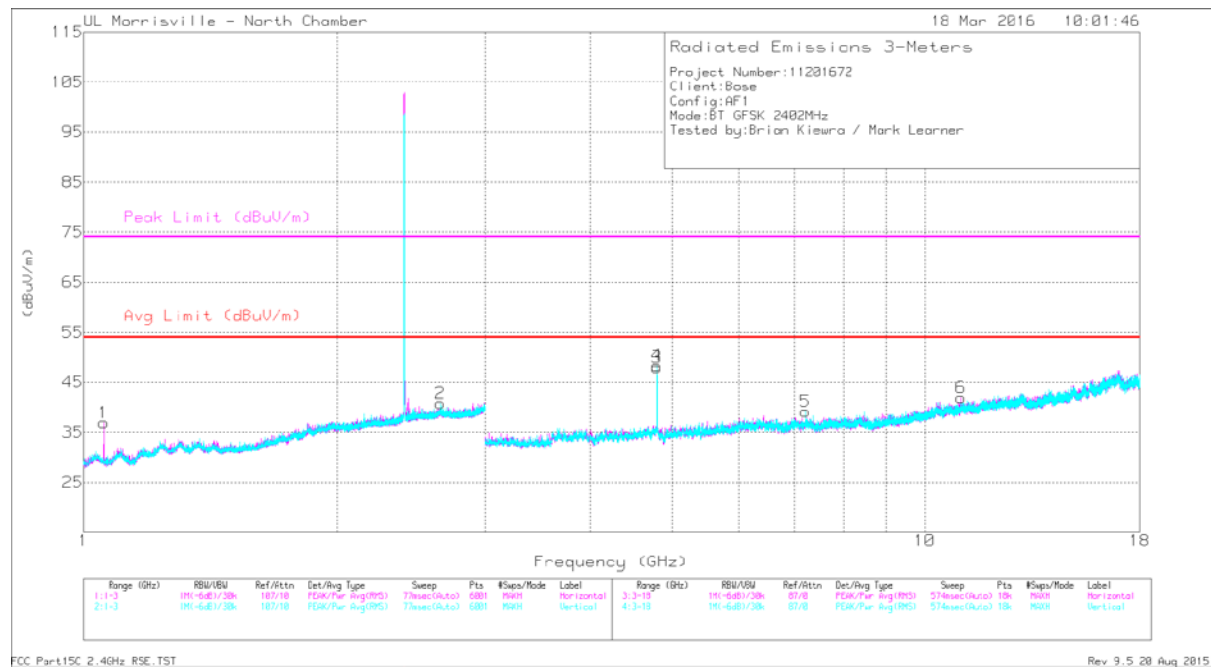
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

V1TR: VB=1/Ton, where: Ton is packet duration

HARMONICS AND SPURIOUS EMISSIONS

Low Channel



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF AT0072 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 1.054	68.14	PK-U	27.7	-27.3	68.54	-	-	74	-5.46	181	286	H
	* 1.055	24.44	V1TR	27.7	-27.3	24.84	54	-29.16	-	-	181	286	H
3	* 4.804	49.76	PK-U	34	-32.3	51.46	-	-	74	-22.54	79	123	H
	* 4.804	45.4	V1TR	34	-32.3	47.1	54	-6.9	-	-	79	123	H
6	* 11.048	35.09	PK-U	37.9	-26.2	46.79	-	-	74	-27.21	253	144	H
	* 11.047	24.03	V1TR	37.9	-26.2	35.73	54	-18.27	-	-	253	144	H
4	* 4.804	49.16	PK-U	34	-32.3	50.86	-	-	74	-23.14	347	105	V
	* 4.804	44.96	V1TR	34	-32.3	46.66	54	-7.34	-	-	347	105	V
2	2.651	32.8	Pk	32.5	-24.5	40.8	-	-	-	-	0-360	199	V
5	7.206	34.44	Pk	35.6	-30.9	39.14	-	-	-	-	0-360	101	V

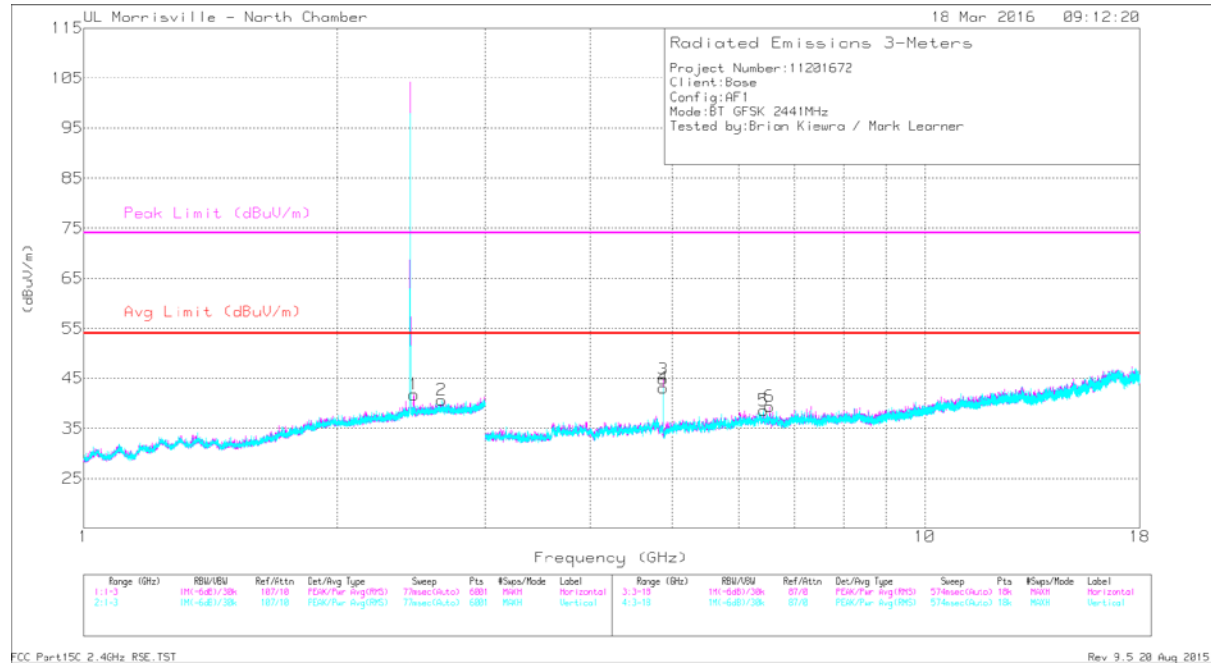
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

PK-U: Maximum Peak

V1TR: VB=1/Ton, where: Ton is packet duration

Mid Channel



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF AT0072 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* 2.662	37.54	PK-U	32.5	-24.4	45.64	-	-	74	-28.36	8	196	V
	* 2.664	25.41	V1TR	32.5	-24.4	33.51	54	-20.49	-	-	8	196	V
3	* 4.882	46.92	PK-U	34.1	-32.3	48.72	-	-	74	-25.28	247	107	H
	* 4.882	41.65	V1TR	34.1	-32.3	43.45	54	-10.55	-	-	247	107	H
4	* 4.882	44.91	PK-U	34.1	-32.4	46.61	-	-	74	-27.39	170	101	V
	* 4.882	39.02	V1TR	34.1	-32.4	40.72	54	-13.28	-	-	170	101	V
1	2.469	34.16	Pk	32.3	-24.7	41.76	-	-	-	-	0-360	102	H
5	6.434	34.39	Pk	35.4	-31.2	38.59	-	-	-	-	0-360	199	V
6	6.531	35.87	Pk	35.5	-32	39.37	-	-	-	-	0-360	101	H

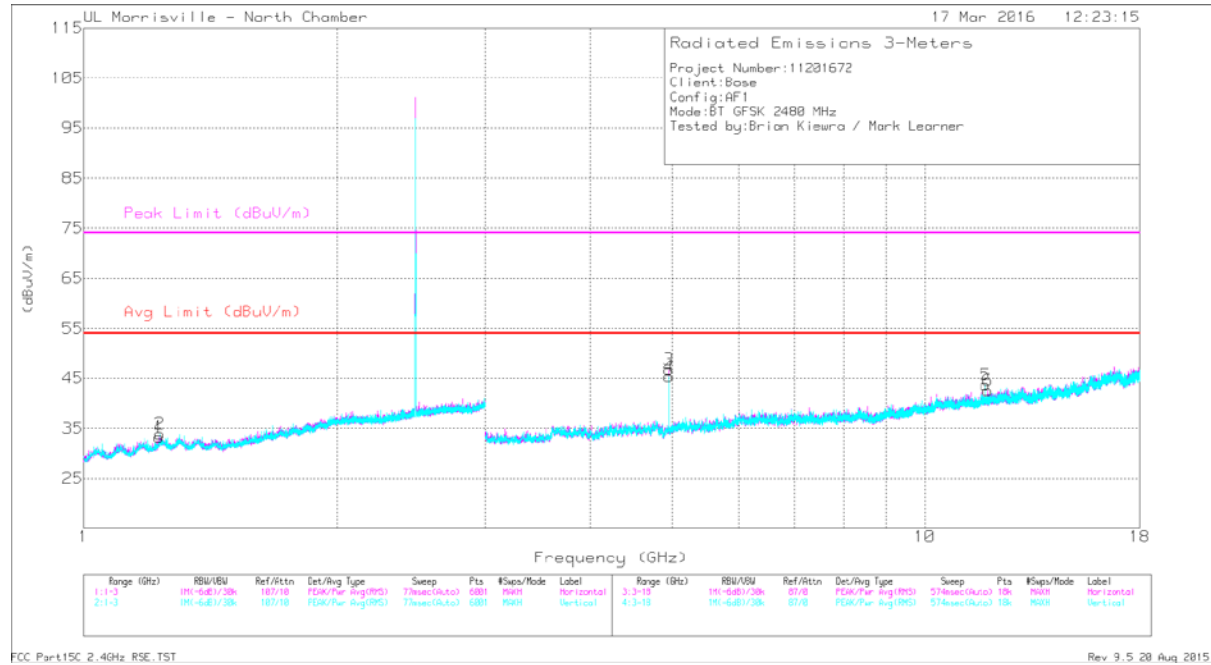
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

PK-U: Maximum Peak

V1TR: VB=1/Ton, where: Ton is packet duration

High Channel

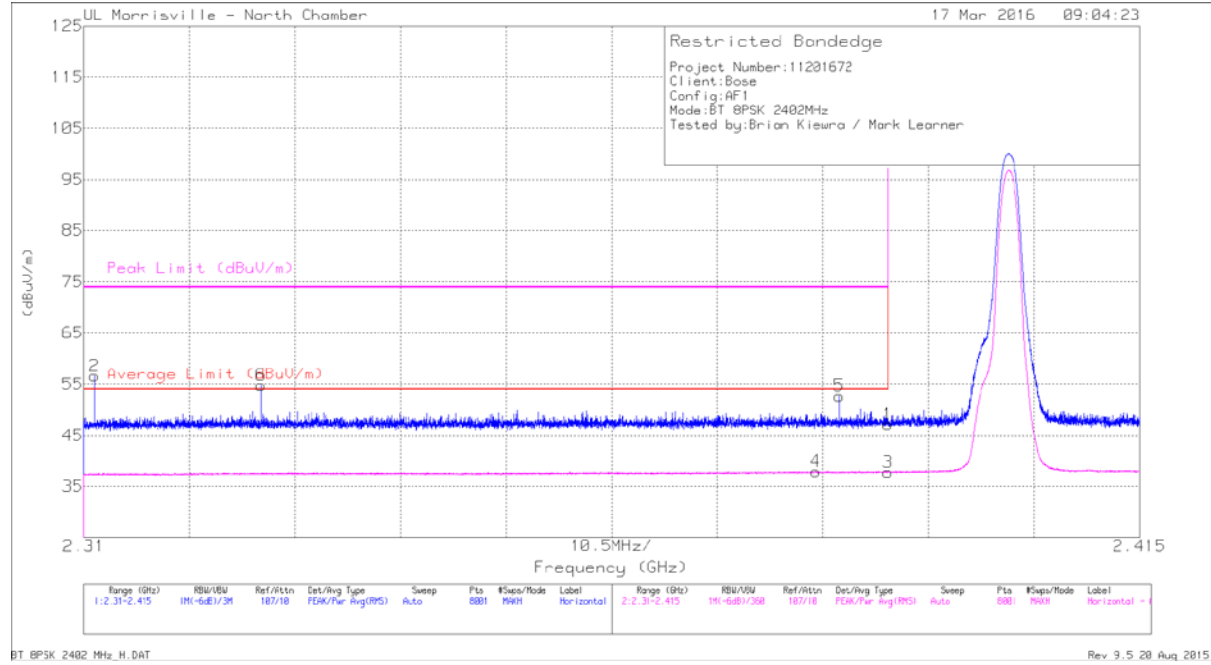


Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0078 AF (dB/m)	Amp/Cbl/ Fitr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 1.23	54.42	PK-U	29.1	-26.2	57.32	-	-	74	-16.68	34	390	H
	* 1.231	24.86	V1TR	29.1	-26.2	27.76	54	-26.24	-	-	34	390	H
3	* 4.96	48.66	PK-U	34.1	-33.2	49.56	-	-	74	-24.44	255	101	H
	* 4.96	44.09	V1TR	34.1	-33.2	44.99	54	-9.01	-	-	255	101	H
6	* 11.891	35.66	PK-U	38.8	-27.2	47.26	-	-	74	-26.74	175	105	H
	* 11.891	24.61	V1TR	38.8	-27.2	36.21	54	-17.79	-	-	175	105	H
2	* 1.231	68.13	PK-U	29.1	-26.2	71.03	-	-	74	-2.97	37	136	V
	* 1.232	24.77	V1TR	29.1	-26.2	27.67	54	-26.33	-	-	37	136	V
4	* 4.961	41.05	PK-U	34.1	-33.2	41.95	-	-	74	-32.05	4	121	V
	* 4.958	29.25	V1TR	34	-33.2	30.05	54	-23.95	-	-	4	121	V
5	* 11.805	36.24	PK-U	38.7	-26.7	48.24	-	-	74	-25.76	310	317	V
	* 11.803	24.48	V1TR	38.7	-26.8	36.38	54	-17.62	-	-	310	317	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
 Pk - Peak detector
 PK-U: Maximum Peak
 V1TR: VB=1/Ton, where: Ton is packet duration

9.2.2. ENHANCED DATA RATE 8PSK MODULATION

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



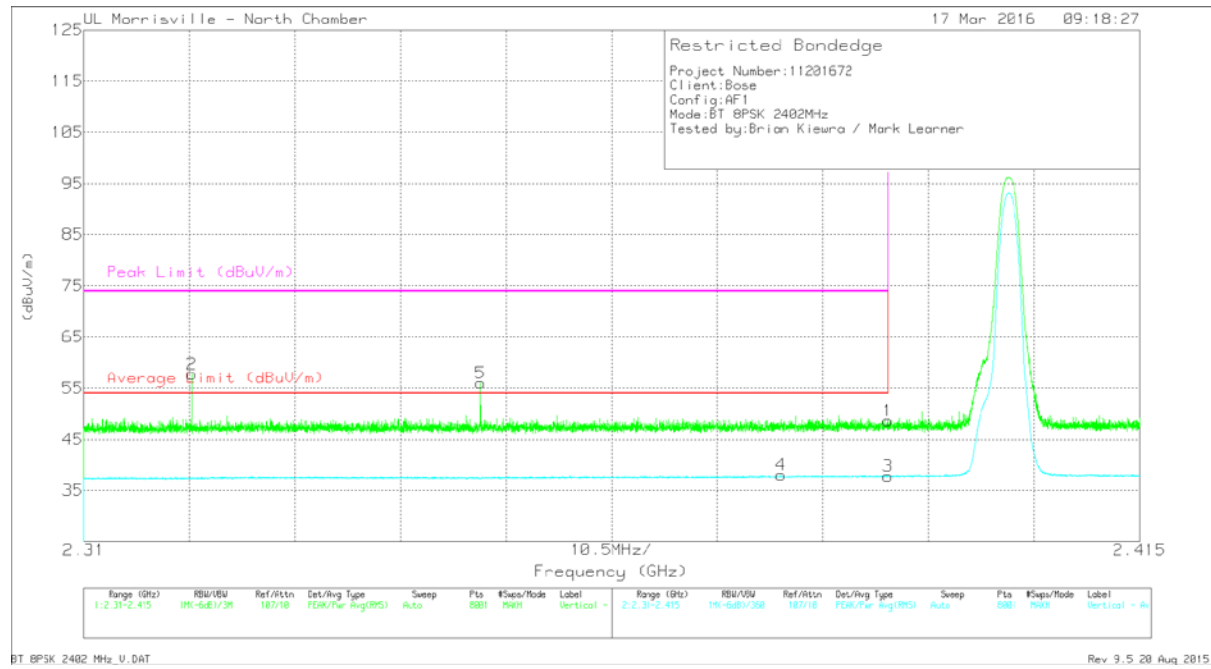
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0078 AF (dB/m)	Amp/Cbl /Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	40.31	Pk	31.9	-25.1	47.11	-	-	74	-26.89	336	192	H
2	* 2.311	50.19	Pk	31.7	-25.3	56.59	-	-	74	-17.41	336	192	H
5	* 2.385	45.92	Pk	31.9	-25.1	52.72	-	-	74	-21.28	336	192	H
6	* 2.328	48.32	Pk	31.7	-25.2	54.82	-	-	74	-19.18	336	192	H
3	* 2.39	31	V1TR	31.9	-25.1	37.8	54	-16.2	-	-	336	192	H
4	* 2.383	31.16	V1TR	31.9	-25.1	37.96	54	-16.04	-	-	336	192	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

V1TR: VB=1/Ton, where: Ton is packet duration

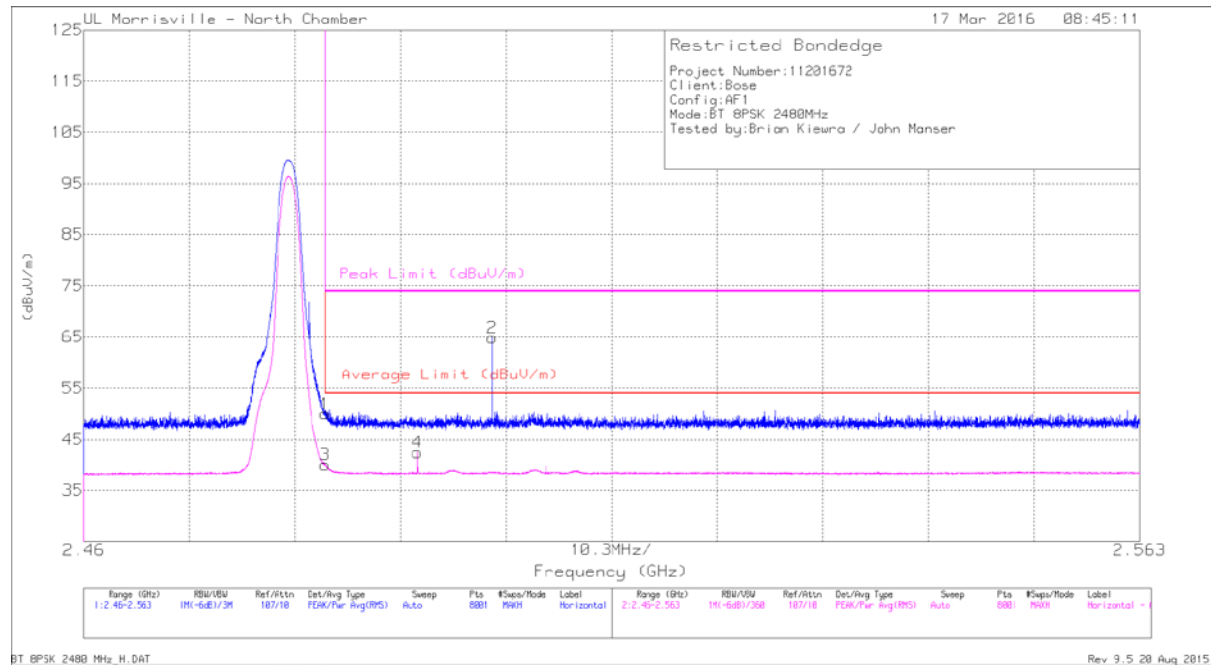
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0078 AF (dB/m)	Amp/Cbl/ Ftr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	41.79	Pk	31.9	-25.1	48.59	-	-	74	-25.41	327	199	V
2	* 2.321	51.34	Pk	31.7	-25.3	57.74	-	-	74	-16.26	327	199	V
5	* 2.349	49.52	Pk	31.8	-25.3	56.02	-	-	74	-17.98	327	199	V
3	* 2.39	31.02	V1TR	31.9	-25.1	37.82	54	-16.18	-	-	327	199	V
4	* 2.379	31.23	V1TR	31.9	-25.1	38.03	54	-15.97	-	-	327	199	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
 Pk - Peak detector
 V1TR: VB=1/Ton, where: Ton is packet duration

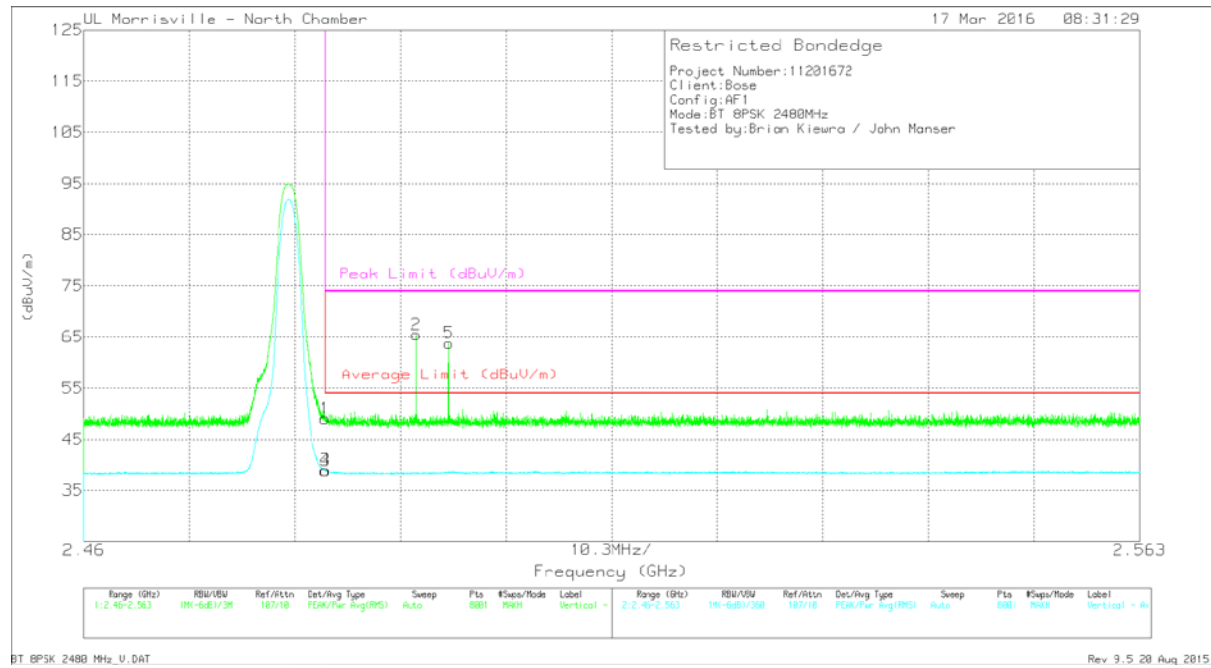
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0078 AF (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	42.68	Pk	32.2	-24.9	49.98	-	-	74	-24.02	337	205	H
2	* 2.5	57.57	Pk	32.2	-24.9	64.87	-	-	74	-9.13	337	205	H
3	* 2.484	32.68	V1TR	32.2	-24.9	39.98	54	-14.02	-	-	337	205	H
4	* 2.493	35.13	V1TR	32.2	-24.9	42.43	54	-11.57	-	-	337	205	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
 Pk - Peak detector
 V1TR: VB=1/Ton, where: Ton is packet duration

RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)

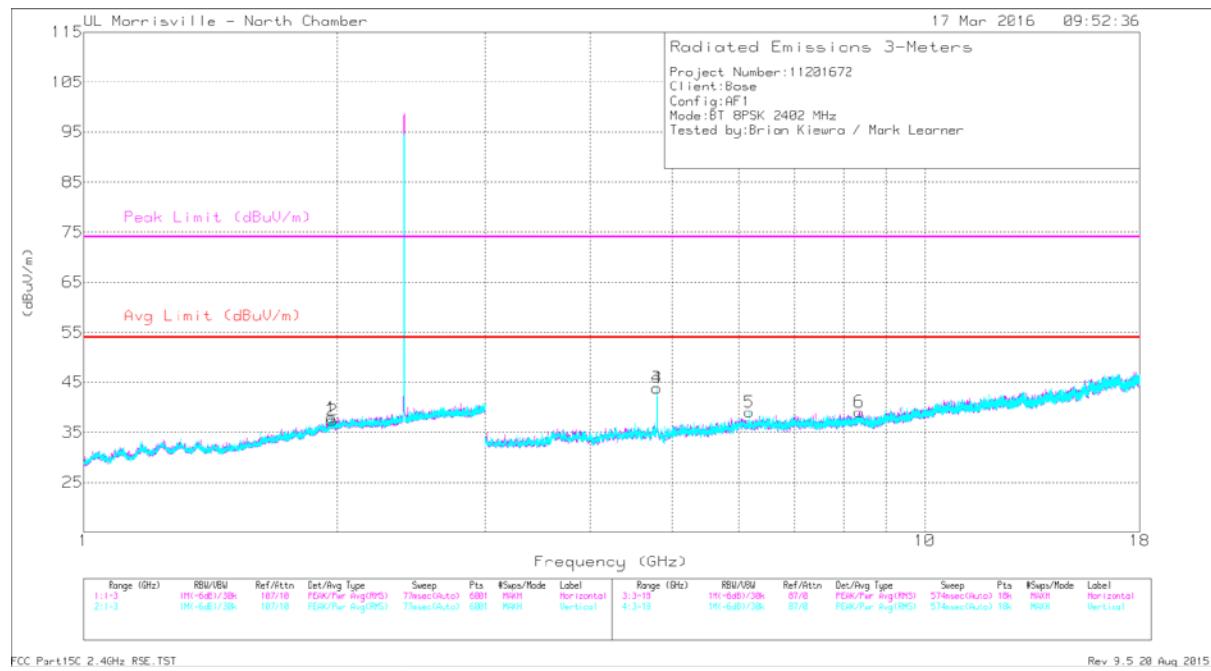


Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0078 AF (dB/m)	Amp/Cbl/Fitr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	41.76	Pk	32.2	-24.9	49.06	-	-	74	-24.94	19	372	V
2	* 2.492	58.19	Pk	32.2	-24.9	65.49	-	-	74	-8.51	19	372	V
5	* 2.496	56.5	Pk	32.2	-24.9	63.8	-	-	74	-10.2	19	372	V
3	* 2.484	31.65	V1TR	32.2	-24.9	38.95	54	-15.05	-	-	19	372	V
4	* 2.484	31.66	V1TR	32.2	-24.9	38.96	54	-15.04	-	-	19	372	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
 Pk - Peak detector
 V1TR: VB=1/Ton, where: Ton is packet duration

HARMONICS AND SPURIOUS EMISSIONS

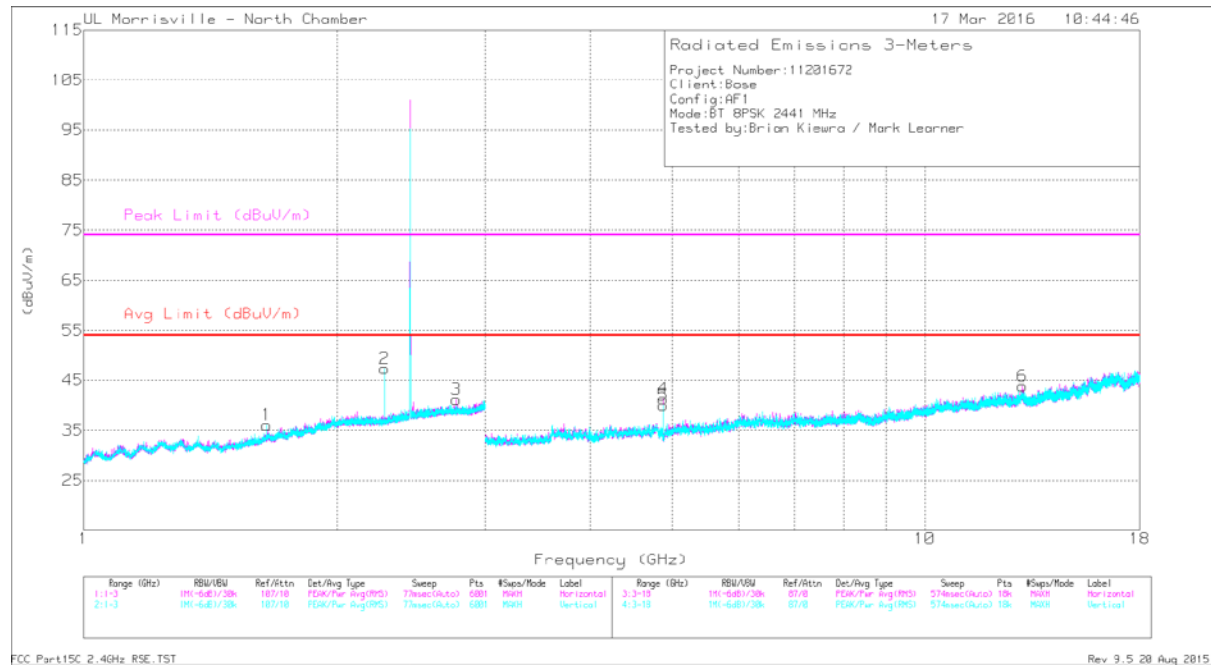
Low Channel



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0078 AF (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
3	* 4.804	46.9	PK-U	33.9	-32.3	48.5	-	-	74	-25.5	82	146	H
	* 4.804	38.18	V1TR	33.9	-32.3	39.78	54	-14.22	-	-	82	146	H
6	* 8.359	38.6	PK-U	36	-29.5	45.1	-	-	74	-28.9	102	267	H
	* 8.358	26.63	V1TR	36	-29.5	33.13	54	-20.87	-	-	102	267	H
4	* 4.804	46.32	PK-U	33.9	-32.3	47.92	-	-	74	-26.08	352	135	V
	* 4.804	37.55	V1TR	33.9	-32.3	39.15	54	-14.85	-	-	352	135	V
2	1.974	30.41	Pk	31.7	-24.7	37.41	-	-	-	-	0-360	200	H
1	1.968	31.03	Pk	31.7	-24.8	37.93	-	-	-	-	0-360	101	V
5	6.186	36.27	Pk	35.4	-32.6	39.07	-	-	-	-	0-360	101	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
 Pk - Peak detector
 PK-U: Maximum Peak
 V1TR: VB=1/Ton, where: Ton is packet duration

Mid Channel



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0078 AF (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
3	* 2.774	36.68	PK-U	32.5	-24.2	44.98	-	-	74	-29.02	260	397	H
	* 2.773	25.26	V1TR	32.5	-24.2	33.56	54	-20.44	-	-	260	397	H
2	* 2.277	36.73	PK-U	31.6	-24.8	43.53	-	-	74	-30.47	173	276	V
	* 2.277	24.81	V1TR	31.6	-24.8	31.61	54	-22.39	-	-	173	276	V
4	* 4.882	45.07	PK-U	34	-32.4	46.67	-	-	74	-27.33	250	107	H
	* 4.882	37.38	V1TR	34	-32.4	38.98	54	-15.02	-	-	250	107	H
5	* 4.882	43.66	PK-U	34	-32.3	45.36	-	-	74	-28.64	354	112	V
	* 4.882	35.09	V1TR	34	-32.4	36.69	54	-17.31	-	-	354	112	V
6	13.069	31.22	Pk	39.2	-26.6	43.82	-	-	-	-	0-360	200	H
1	1.648	31.69	Pk	29.2	-24.8	36.09	-	-	-	-	0-360	101	V

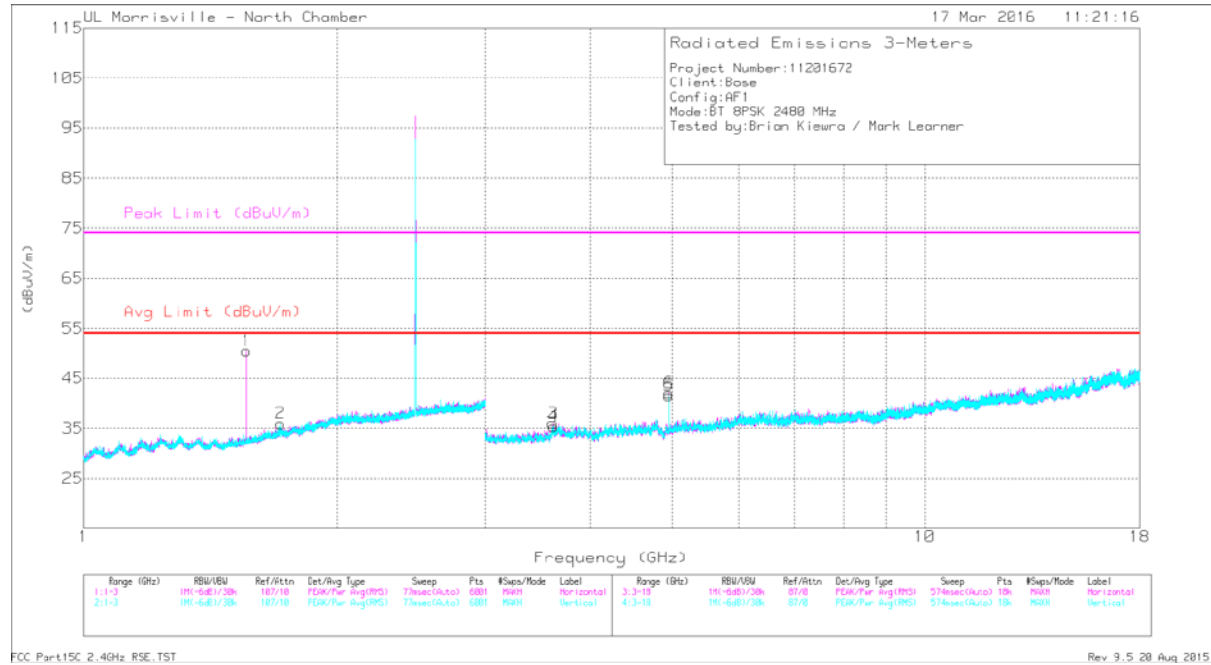
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

PK-U: Maximum Peak

V1TR: VB=1/Ton, where: Ton is packet duration

High Channel



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0078 AF (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 1.562	35.81	PK-U	28.5	-25	39.31	-	-	74	-34.69	133	312	H
	* 1.56	24.12	V1TR	28.5	-25	27.62	54	-26.38	-	-	133	312	H
3	* 3.611	40.78	PK-U	33	-32.2	41.58	-	-	74	-32.42	280	163	H
	* 3.613	29.2	V1TR	33	-32.1	30.1	54	-23.9	-	-	280	163	H
6	* 4.96	45.87	PK-U	34.1	-33.2	46.77	-	-	74	-27.23	271	112	H
	* 4.96	37.91	V1TR	34.1	-33.2	38.81	54	-15.19	-	-	271	112	H
4	* 3.621	40.69	PK-U	33	-32.2	41.49	-	-	74	-32.51	123	383	V
	* 3.621	29.36	V1TR	33	-32.2	30.16	54	-23.84	-	-	123	383	V
5	* 4.96	45.83	PK-U	34.1	-33.2	46.73	-	-	74	-27.27	8	111	V
	* 4.96	37.18	V1TR	34.1	-33.2	38.08	54	-15.92	-	-	8	111	V
2	1.713	30.97	Pk	29.7	-24.7	35.97	-	-	-	-	0-360	200	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

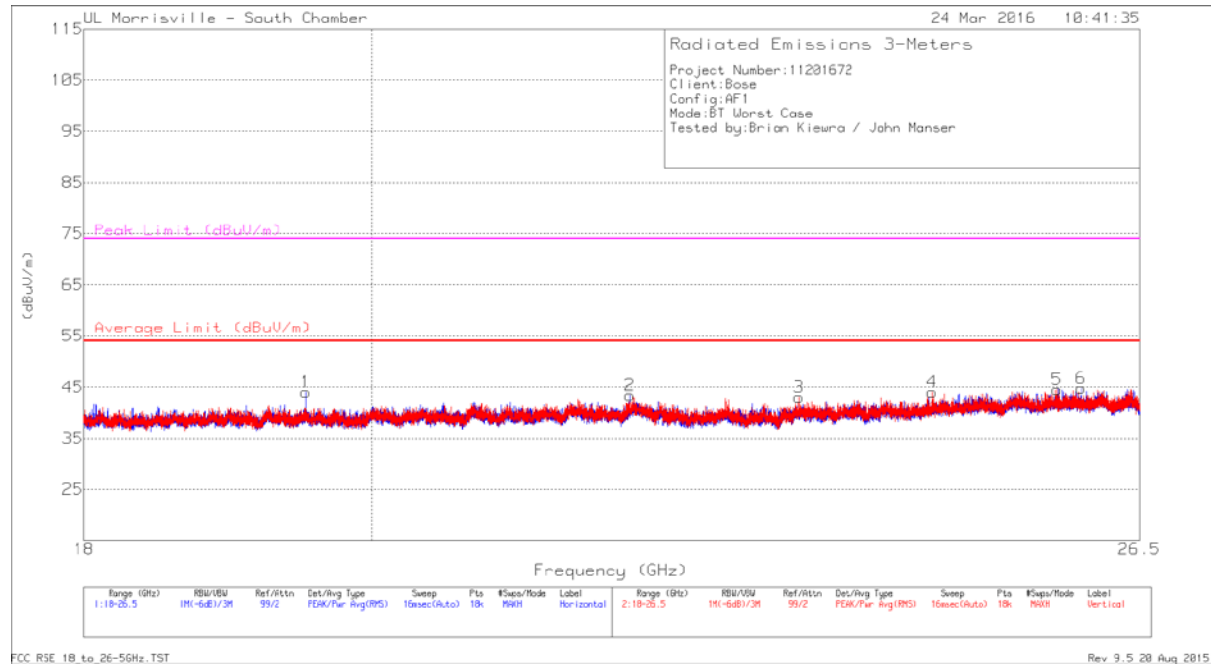
Pk - Peak detector

PK-U: Maximum Peak

V1TR: VB=1/Ton, where: Ton is packet duration

9.3. WORST-CASE 18-26GHz

SPURIOUS EMISSIONS 18-26GHz (WORST-CASE CONFIGURATION)



Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF AT0076 (dB/m)	Amp/Cbl (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 19.524	53.77	PK-U	32.9	-40.4	0	46.27	54	-7.73	74	-27.73	63	110	H
2	21.986	49.54	Pk	33.8	-39.9	0	43.44	54	-10.56	74	-30.56	0-360	102	H
3	23.39	47.81	Pk	34.4	-39.2	0	43.01	54	-10.99	74	-30.99	0-360	102	V
4	24.563	48.1	Pk	34.5	-38.6	0	44	54	-10	74	-30	0-360	151	V
5	25.711	47.39	Pk	35	-37.9	0	44.49	54	-9.51	74	-29.51	0-360	299	V
6	25.936	47.88	Pk	34.6	-37.7	0	44.78	54	-9.22	74	-29.22	0-360	149	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

PK-U: Maximum Peak

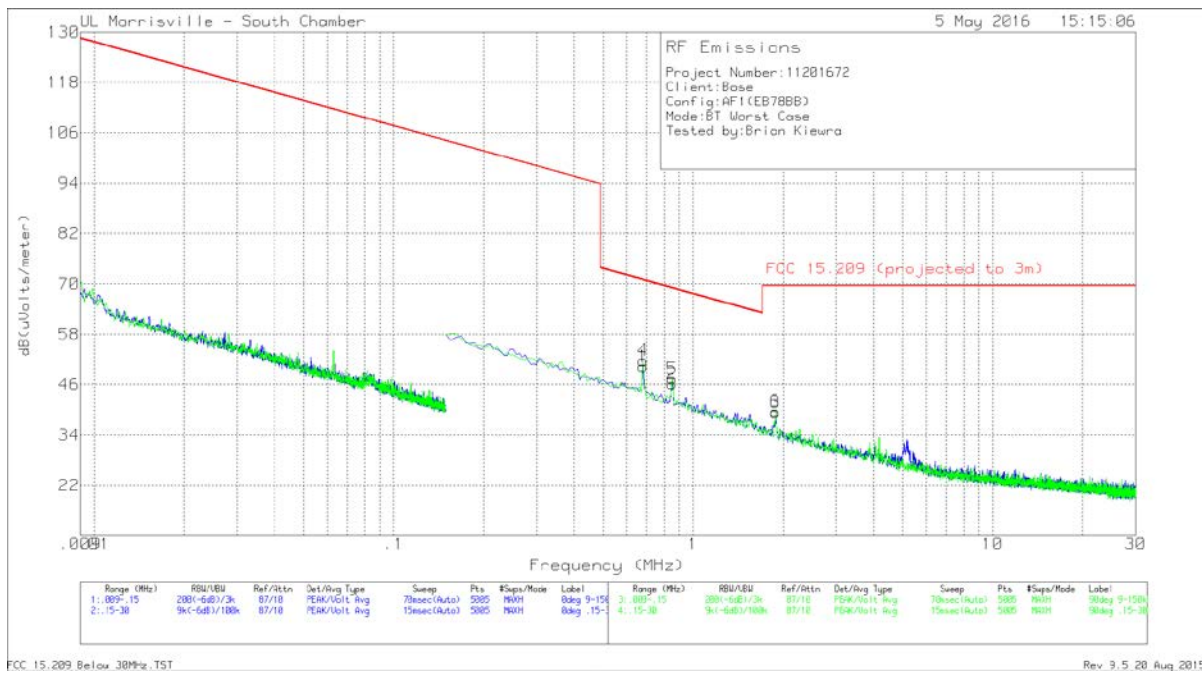
V1TR: VB=1/Ton, where: Ton is packet duration

9.4. WORST-CASE BELOW 1 GHz

SPURIOUS EMISSIONS 9kHz-30 MHz (WORST-CASE CONFIGURATION)

Note: All measurements were made at a test distance of 3 m. The limits in the plots and tabular data are the FCC/IC limits extrapolated from the specification distance (300 m from 9-490 kHz and 30 m from 490 kHz – 30 MHz) to the measurement distance to clearly show the relative levels of fundamental and spurious emissions and demonstrate compliance with the requirement that the level of any spurious emissions be below the level of the intentionally transmitted signal. The extrapolation factor for the limits were 40*Log (specification distance / test distance).

The anechoic chamber has been properly calibrated so that the measurement results correspond to what would be obtained from an open field sites.

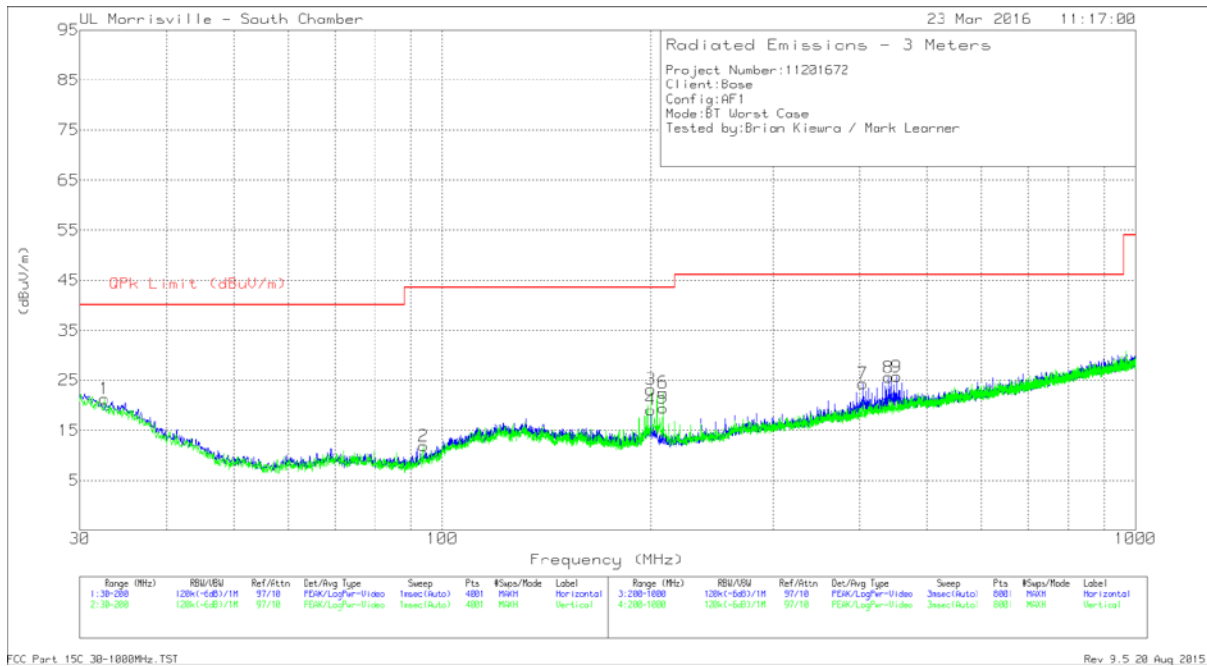


Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0079 AF (dB/m)	Cbl (dB)	Corrected Reading dB(uVolts/meter)	FCC 15.209 (projected to 3m)	Margin (dB)	Azimuth (Degs)
1	.68089	38.35	Pk	11.9	.1	50.35	70.94	-20.59	0-360
4	.68089	39.75	Pk	11.9	.1	51.75	70.94	-19.19	0-360
2	.84791	34.16	Pk	11.9	.1	46.16	69.04	-22.88	0-360
5	.84791	35.43	Pk	11.9	.1	47.43	69.04	-21.61	0-360
3	1.88582	27.08	Pk	12.1	.2	39.38	69.54	-30.16	0-360
6	1.88582	27.36	Pk	12.1	.2	39.66	69.54	-29.88	0-360

Pk - Peak detector

FCC 15.209 Below 30MHz.TST
 Rev 9.5.20 Aug 2015

SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION)



Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF AT0074 (dB/m)	Port 0 Factors	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
7	* 403.9894	28.97	Qp	20.4	-29.2	20.17	46.02	-25.85	330	207	H
1	32.5075	28.94	Pk	24.2	-31.8	21.34	40	-18.66	0-360	102	V
2	93.8775	30.26	Pk	12.6	-31	11.86	43.52	-31.66	0-360	102	V
3	200	35.95	Pk	17.5	-30.3	23.15	43.52	-20.37	0-360	102	V
4	200	31.91	Pk	17.5	-30.3	19.11	43.52	-24.41	0-360	102	H
5	208	34.19	Pk	15.4	-30.2	19.39	43.52	-24.13	0-360	102	H
6	208	37.29	Pk	15.4	-30.2	22.49	43.52	-21.03	0-360	102	V
8	440	33.69	Pk	21	-29.1	25.59	46.02	-20.43	0-360	199	H
9	452	33.51	Pk	21.2	-29	25.71	46.02	-20.31	0-360	199	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
 Pk - Peak detector
 Qp - Quasi-Peak detector