

**ELECTROMAGNETIC COMPATIBILITY
TEST REPORT
TO
FCC 47 CFR Part 15 SUBPART C SECTION 15.247
&
INDUSTRY CANADA RSS-210 ISSUE 8**

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Accreditations (ISO 17025):



**Standard Council of Canada: Accredited Laboratory No. 743
International Accreditation Service Inc.: Accredited Laboratory: No. TL-239**

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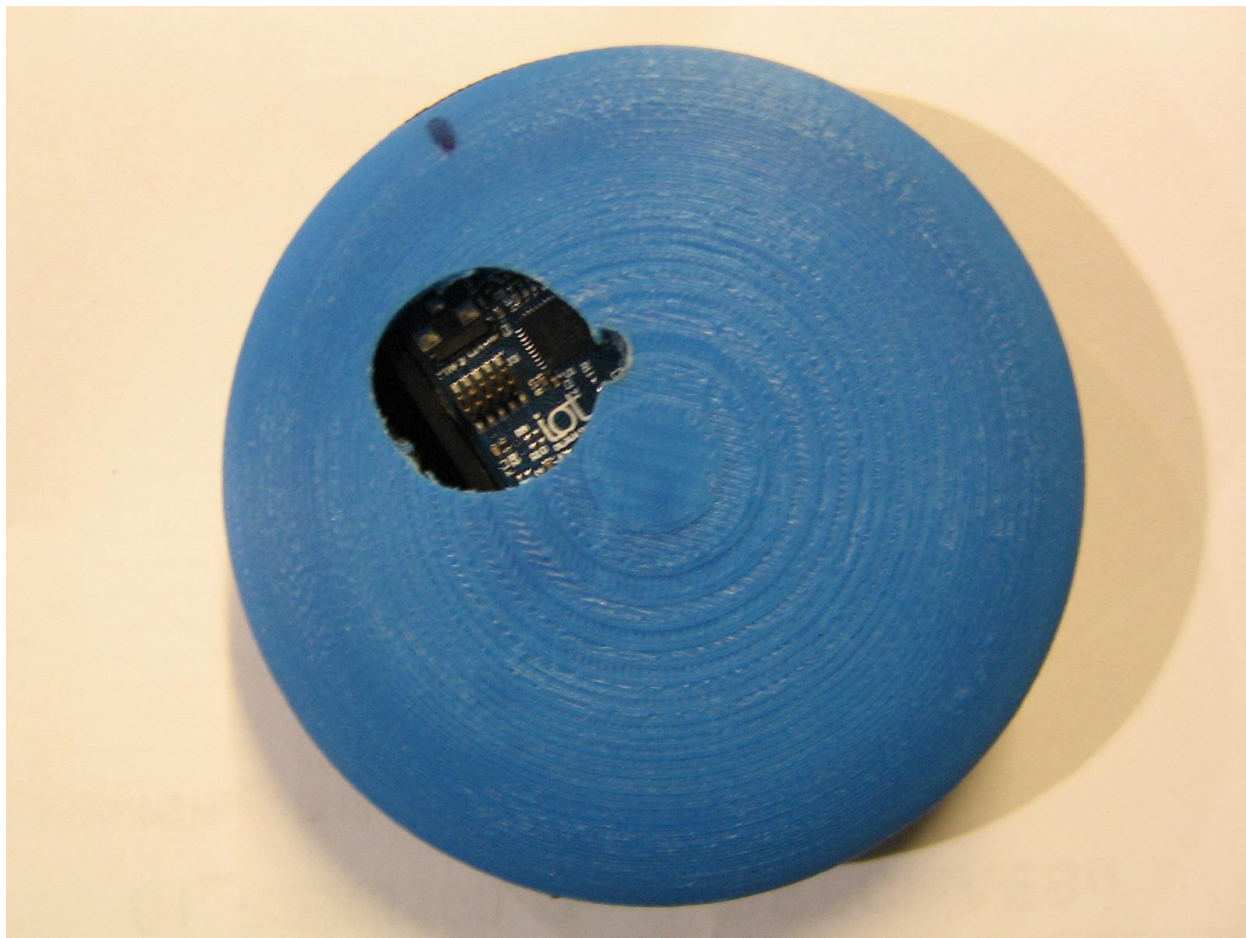
Test Standard: RSS-Gen Issue 4; RSS-210, Issue 8; FCC Part 15.247

Test Item Description: BLE Beacon Module

Trade Mark:



Manufacturer: Finger Food Studios Inc.
Model Number: CORE-100-A1100
IC Certificate number: 12764A-IOTCORE100C
FCC Registration: 2AEAG-IOTCORE100C



BTLE Signul Beacon

Revision History

Date	Report Number	Rev #	Details	Authors Initials
Feb. 11, 2015	E10641-1501	0.0	Draft Test Report	RA
Mar. 2, 2015	E10641-1501	1.0	Final Test Report Issued	AJ
Mar. 3 2015	E10641-1501	1.1	6dB Plots updated	RA
Mar. 17 2015	E10641-1501	2.0	Remove dashes from FCC ID	RA
<p><i>All previous versions of this report have been superseded by the latest dated revision as listed in the above table. Please dispose of all previous electronic and paper printed revisions accordingly.</i></p>				

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Section I. GENERAL TEST INFORMATION

EMC TEST SUMMARY

The following tests demonstrate testimony for the FCC & IC Marks for Transceivers / electromagnetic compatibility testing for this EUT.

Test / Requirement Description	Applicable FCC Rule Parts	Applicable Industry Canada Rule Parts	Results
Antenna requirement	FCC 47 CFR Part 15.203	RSS-Gen Issue 4	Complies
RF Peak Power Output	FCC Part 15.247 (b)(3)	RSS 210 Issue 8 A8.4(4)	Complies
Occupied Bandwidth 6dB Bandwidth	FCC Part 15.247 (b)(3)	RSS 210 Issue 8 A8.2(a)	Complies
Power Spectral Density	FCC Part 15.247 (e)	RSS 210 Issue 8 A8.2(b)	Complies
Out-of-band Emissions (Band edge)	FCC Part 15.247 (d) RSS 210 Issue 8 A8.2(a)	RSS 210 Issue 8 A8.5	Complies
Conducted Spurious Emissions	FCC Part 15.247 (d)	RSS 210 Issue 8 A8.5	Complies
Radiated Spurious Emissions- Transmit Mode	FCC Part 15.247 (d), FCC Part 15.209 (a), FCC Part 15.205	RSS 210 Issue 8 A2.5,A8.5, RSS-Gen Issue3	Complies
Radiated Spurious Emissions - Receive Mode	FCC Part 15.247 (d), FCC Part 15.209 (a), FCC Part 15.205	RSS-210, ICES-003 Issue 5	Complies

Tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC 15.247 & Industry Canada RSS-210. The manufacturer is responsible for the tested product configuration, continued product compliance with these standards listed, and for the appropriate auditing of subsequent products as required. BTLE Signul Beacon (EUT) has Bluetooth low energy transmitter. Bluetooth LE devices do not fulfill the requirements of FHSS and Bluetooth LE devices are classified as system using digital modulation techniques. Hence EUT was tested to comply for FCC 15.247 and RSS-210 as systems using digital modulation techniques operating in 2400 - 2483.5MHz band.



Tested by:
Rajinder Atwal, EMC Engineer



Reviewed By:
Aman Jathaul, EMC Project Manager

PRODUCT DESCRIPTION

Applicant: Finger Food Studios Inc
 #420 - 2755 Lougheed Hwy., Port Coquitlam, BC, Canada, V3B5Y9
 Equipment Under Test: BLE Beacon Module
 Trade Name: IoT Core
 Model: CORE-100-A1100
 Date of Test: January 20, 2015 – January 29, 2015

EUT DESCRIPTION

EUT	BTLE Beacon Module
Functional Description	The device is intended for use as a BLE beacon.
Operational Description	The device transmits BLE advertisement packets that can be received by smartphones and other BLE compatible devices. The unique ID contained in the advertisement packet can be read by receiving devices and actions taken based on the advertisement packet data.
FRN	0024367625
FCC ID	2AEAG-IOT-CORE-100-C
IC	12764A-IOTCORE100C
Manufacturer	Finger Food Studios Inc
Model/Type	BTLE Beacon Module
Serial No.	Test001
Transmitter Type	Bluetooth Low Energy
Frequency Range	2402-2480MHz
Transmit Power	0.002W
Modulation	GFSK
Number of Channels	39
Antenna	Integrated, maximum gain is 3.3 dB
Ratings	3Vdc (2 AA battery)
Software and Firmware	iBeacon 1.4
Received Date	January 06, 2015
Received By	Dave J.
Sample Log	QAI Product Control Log (QM 1305 - Sample Inventory)

ANTENNA DESCRIPTION

Polarization	Linear
Compact Size	25.7 mm x 7.5 mm
RoHS	Compatible
Frequency Range	2300 – 2500 MHz
Linear Max Gain	3.3 dB
Impedance	500 Ω

FACILITIES AND ACCREDITATION

Main Laboratory Headquarters:	Quality Auditing Institute
Headquarters Location/Address:	16 – 211 Schoolhouse Street, Coquitlam, BC, 3K 4X9, Canada
Associated Laboratory:	Quality Auditing Institute (Remote Location)
EMC Laboratory Address:	19473 Fraser Way, Pitt Meadows, BC, V3Y 2V4, Canada
FCC Test Site Registration Number: (3 m /10 m Open Area Test Site [OATS] and 3 m Semi-Anechoic Chamber [SAC]):	226383
Industry Canada Test Site Registration Number (3m SAC):	9543B-1
Standard Council of Canada:	ISO/IEC 17025:2005 Accredited Laboratory No. 743
International Accreditation Service Inc.:	ISO/IEC 17025:2005 Accredited Laboratory: No. TL-239
Tested by:	Rajinder S. Atwal
Reviewed by:	Aman Jathaul

ENVIROMENTAL CONDITIONS: INDOORS

Temperature: 22-28°C R.H.: 39.7 - 54.4%

TESTING METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4:2009, ANSI 63.10:2009, FCC CFR 47 Part 2, FCC CFR 47 Part 15, and RSS-Gen, Issue 4 and RSS-210, Issue 8. The FCC testing was also done using the FCC KDB 558074 D01 DTS Measurement Guidance v03r02 for the BLE transmitters

EUT TESTING CONFIGURATION

EUT was powered using 2 AA batteries and tests were performed at low, middle and high channel for the purpose of compliance. The transmitter was set for continuous operation at fundamental frequencies in modulated modes of operation.

BTLE Beacon Module (EUT) has Bluetooth low energy transmitter. As per FCC Bluetooth LE devices do not fulfill the requirements of FHSS and Bluetooth LE devices are classified as system using digital modulation techniques. Hence EUT was tested to comply for FCC 15.247 and RSS-210 as systems using digital modulation techniques operating in 2400 - 2483.5MHz band.

WORST TEST CASE

Worst-case orientation was determined by rotating the EUT on three axis, during the pre-compliance test and final radiated emissions tests were performed in that orientation. The highest measured output power was at 2450MHz.

GENERAL TEST PROCEDURES

RF Conducted Emissions

The EUT is placed on a test bench connected directly to an EMI Receiver and Spectrum Analyzer. Conducted emissions are measured in the frequency range 9kHz to 25GHz using CISPR Peak, Quasi-Peak and Average detectors. EUT was set up to transmit modulated signal at particular channel at full power.

AC Mains Conducted Emissions

This test was not applicable to this device. EUT operates only with 2 AA batteries.

Radiated Emissions

The EUT is placed on the turntable 0.8m above a ground plane 3m away from a receiving antenna. Height of receiving antenna varied from 1m to 4m, its polarity changes from vertical to horizontal. Turntable rotates 360 degrees. Motion of turntable and receiving antenna allows determining position of maximum emission level. Quasi-peak detector applies for measurements of emissions with frequency range of 30 to 1000MHz. and average/peak detector otherwise.

MEASUREMENT UNCERTAINTY

Radio Frequency	$\pm 1,5 \times 10^{-5}$
Total RF power, conducted.....	± 1 dB
RF power density, conducted.....	± 2.75 dB
Spurious emissions, conducted.....	± 3 dB
All emissions, radiated.....	± 3.5 dB
Temperature.....	$\pm 1^{\circ}\text{C}$
Humidity.....	± 5 %
DC and low frequency voltages.....	± 3 %

Test Equipment List

Semi-Anechoic Chamber Equipment List

Manufacturer	Model	Description	Serial No.	Last Cal	Cal Due Date
ETS Lindgren	2165	Turntable	00043677	N/A	N/A
ETS Lindgren	2125	Mast	00077487	N/A	N/A
Sunol Sciences	JB3	Biconilog Antenna 30MHz-3GHz (Prescan use only)	A120106	28-Oct-2013	28-Oct-2015
Rohde & Schwarz	ESU40	EMI Receiver	100011	20-Mar-2014	20-Mar-2017
ETS Lindgren	3117	Horn Antenna 1GHz-18GHz	00075944	29-Aug-2013	29-Aug-2015
EMCO	6502	Loop Antenna	2178	8/21/2014	8/21/2017
EMCO	3160-09	Horn Antenna 18Ghz-26Ghz	9701-1071	30-Aug-2103	30-Aug-2105
ETS Lindgren	S201	5 meter Semi-Anechoic Chamber	1030	Conditional Use	Conditional Use
AH Systems	PAM118	Amplifier 10KHz-18GHz	189	Conditional Use	Conditional Use
AH Systems	PAM-1840H	Amplifier 18-40GHz	152	14-Jun-2013	14-Jun-2016

Measurement Software List

Manufacturer	Model	Version	Description
Rhode & Schwarz	EMC 32	6.20.0	Emissions Pre-scan Test Software

Section II: Requirements as FCC and Industry Canada

Test Summary:

	Test	Standard	Description	Result
Part 1	Antenna requirement	FCC 47 CFR Part 15.203 RSS-Gen (7.1.2)	Soldered, non-replaceable antenna	Complies
Part 2	RF Peak Power Output	FCC Part 15.247 (b)(3) RSS 210 Issue 8 A8.4(4)	Maximum peak conducted output power shall not exceed 1 W. Except as provided in Section RSS 210 A8.4 (5), the e.i.r.p. shall not exceed 4 W.	Complies
Part 3	Occupied Bandwidth 6dB Bandwidth	FCC Part 15.247 (a)(2) RSS 210 Issue 8 A8.2(a)	The minimum -6 dB bandwidth shall be at least 500 kHz.	Complies
Part 4	Power Spectral Density	FCC Part 15.247 (e) RSS 210 Issue 8 A8.2(b)	The transmitter power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission	Complies
Part 5	Out-of-band Emissions (Band-edge)	FCC Part 15.247 (d) RSS 210 Issue 8 A8.5	In any 100 kHz bandwidth outside the frequency band in which the digitally modulated device is operating, the RF power that is produced shall be at least 20dB.	Complies
Part 6	Conducted Spurious Emissions	FCC Part 15.247 (d) RSS 210 Issue 8 A8.5	In any 100 kHz bandwidth outside the frequency band in which the digitally modulated device is operating, the RF power that is produced shall be at least 20dB.	Complies
Part 7	Radiated Spurious Emissions-Transmit Mode	FCC Part 15.247 (d) FCC Part 15.209 (a) RSS 210 Issue 8 A2.5,A8.5 RSS Gen Issue 3	Radiated emissions requirements as stated in the Standards.	Complies
Part 8	Radiated Spurious Emissions – Unintentional	FCC Part 15.247 (d) FCC Part 15.209 (a) ICES-003 Issue 5	Radiated emissions requirements as stated in the Standards	Complies

Part 1 - Antenna Requirements

DATE: Jan-20-2015

TEST STANDARD: FCC 47 CFR Part 15.203 and IC RSS-Gen Section 7.1.2

APPLICABLE REGULATIONS: - "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 with the provisions of this Section. The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited."... "the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded."

RESULT: This unit meets antenna requirement. Bluetooth antenna was soldered to the circuit board and was not accessible to the end-user.

Part 2 - RF Peak Power Output

DATE: Jan-20-2015

TEST STANDARD: FCC Part 15.247 (b)(3) RSS 210 Issue 8 A8.4(4)

TEST REQUIREMENT: For systems employing digital modulation techniques operating in the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz, the maximum peak conducted output power shall not exceed 1 W. Except as provided in RSS 210 Section A8.4 (5), the e.i.r.p. shall not exceed 4 W.

TEST SETUP: The EUT was tested in our 3 m SAC and was positioned on the center of the turntable and connected to a 3Vdc battery. The transmitter was set for continuous transmission. Measurements were performed on lowest, middle and highest channels in the 2400-2483.5 MHz band The EUT was pre-scanned in 3 different orthogonal orientations and was found to radiate highest when placed flat on the table top as indicated in the test photos.

MEASUREMENT METHOD: As called by the standards above.

DEVICE DESCRIPTIONS: As described in the above EUT description and set up section.

EMISSIONS DATA:

Radiated Output Power Measurements (EIRP Measurements)

Channel	Frequency	EIRP	EIRP Limit (4W)
	(GHz)	(dBm)	(dBm)
Low	2.402	1.07	36.02
Mid	2.450	2.95	36.02
High	2.480	1.4	36.02

RESULTS: Pass: Complies.

Part 3 - Occupied Bandwidth 6dB Bandwidth

DATE: Jan-20-2015

TEST STANDARD: FCC Part 15.247 (a) (2) and RSS 210 Issue 8 A8.2

TEST REQUIREMENT: The minimum -6 dB bandwidth shall be at least 500 kHz.

TEST SETUP: The antenna port of EUT was directly connected to a spectrum analyzer.

MEASUREMENT METHOD: As called by the standards above.

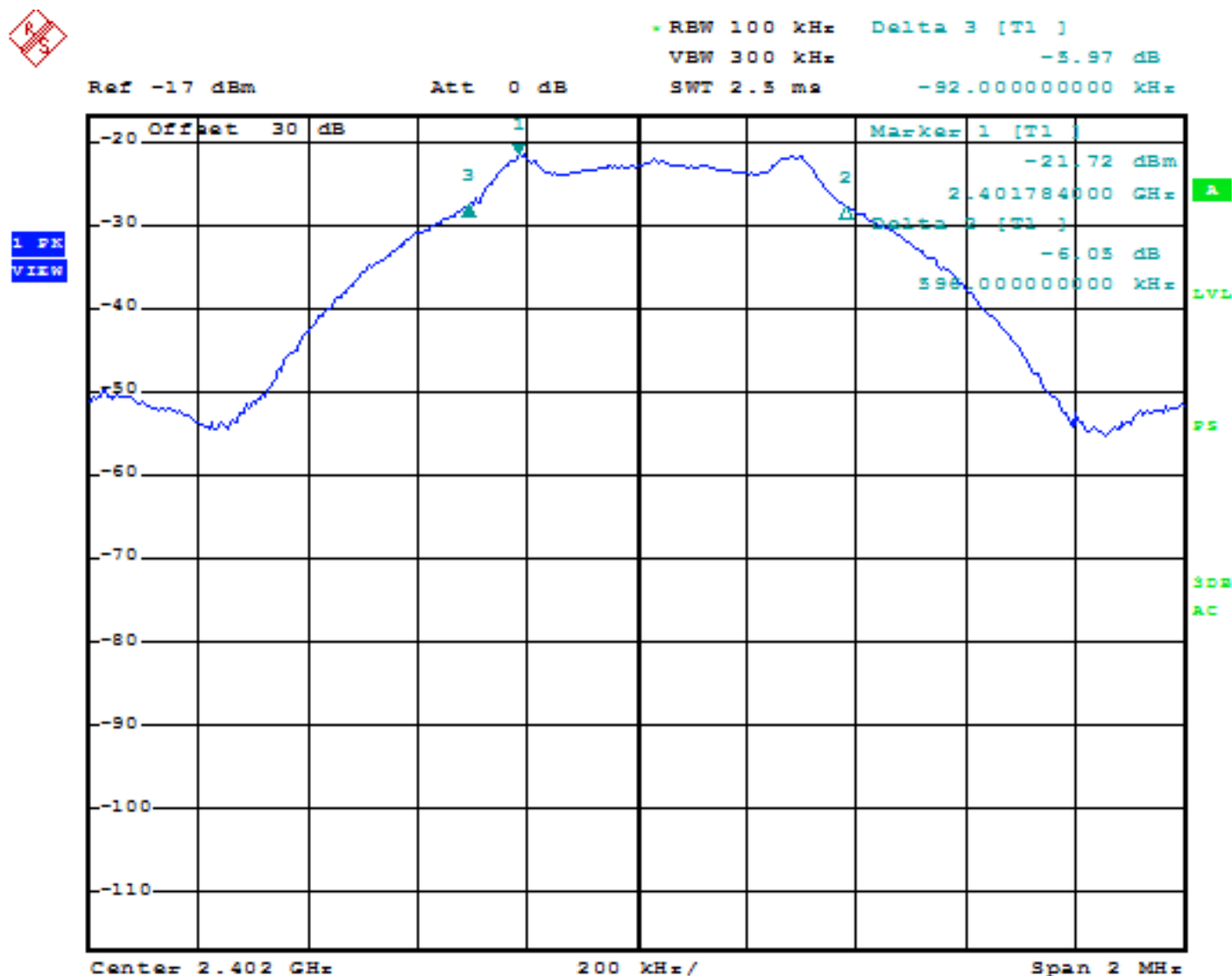
DEVICE DESCRIPTIONS: As described in the above EUT description and set up section.

EMISSIONS DATA:

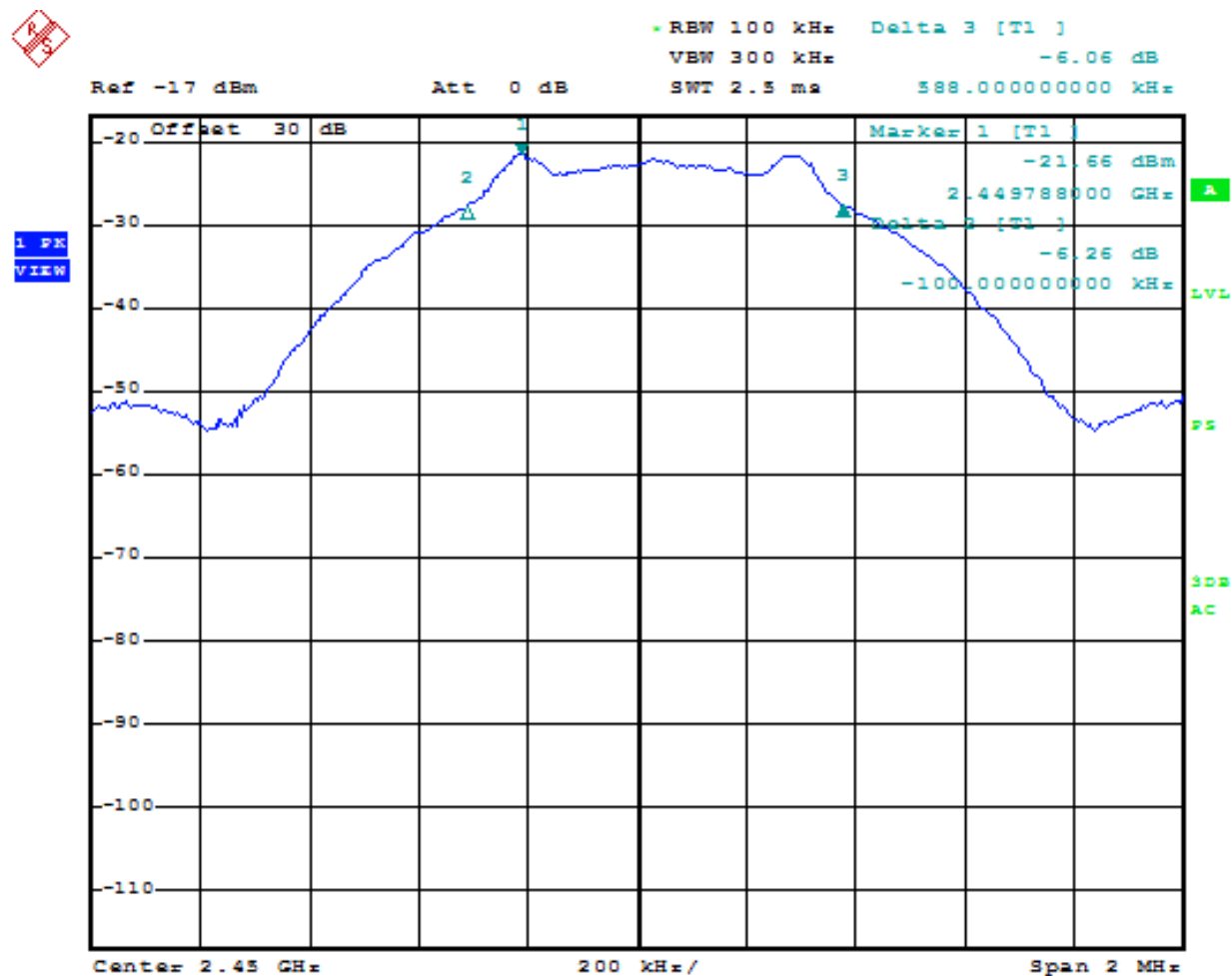
Channel	Frequency (GHz)	6dB Bandwidth (kHz)
Low	2.402	688.00
Mid	2.450	688.00
High	2.480	692.00

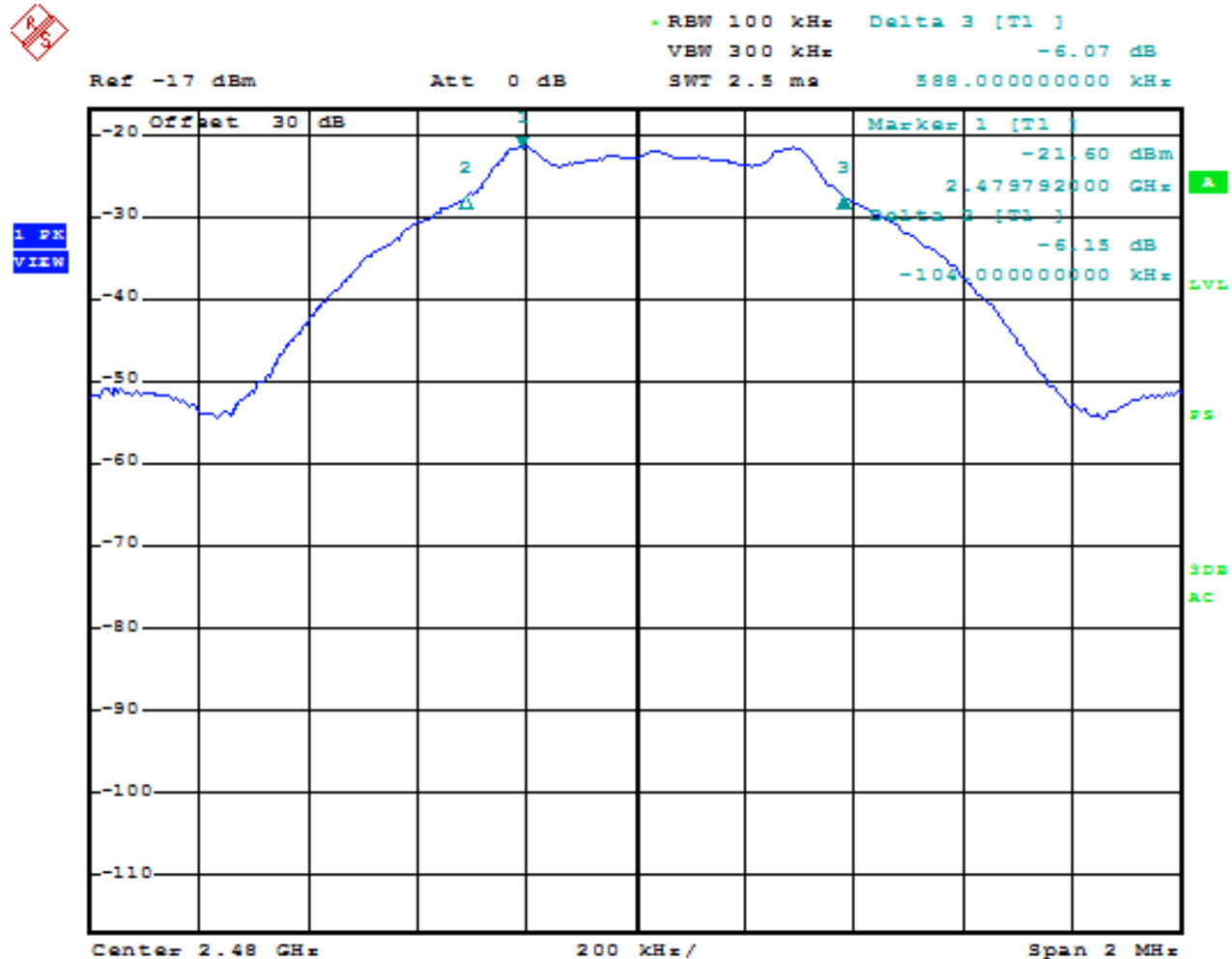
RESULTS: Pass: Complies.

TEST PLOTS – 6dB OCCUPIED BANDWIDTH



PLOT 1 - LOW CHANNEL – 6dB OCCUPIED BANDWIDTH





PLOT 3 - HIGH CHANNEL - 6dB OCCUPIED BANDWIDTH

Part 4 - Power Spectral Density

DATE: Jan-20-2015

TEST STANDARD: FCC Part 15.247 (e) and RSS 210 Issue 8 A 8.2(b)

TEST REQUIREMENT: The transmitter power spectral density conducted from the transmitter to the antenna shall not be greater than 8dBm in any 3 kHz band during any time interval of continuous transmission. The power spectral density was determined using the same method as is used to determine the conducted output power).

TEST SETUP: The antenna port of EUT was directly connected to a spectrum analyzer.

MEASUREMENT METHOD: As called by the standards above.

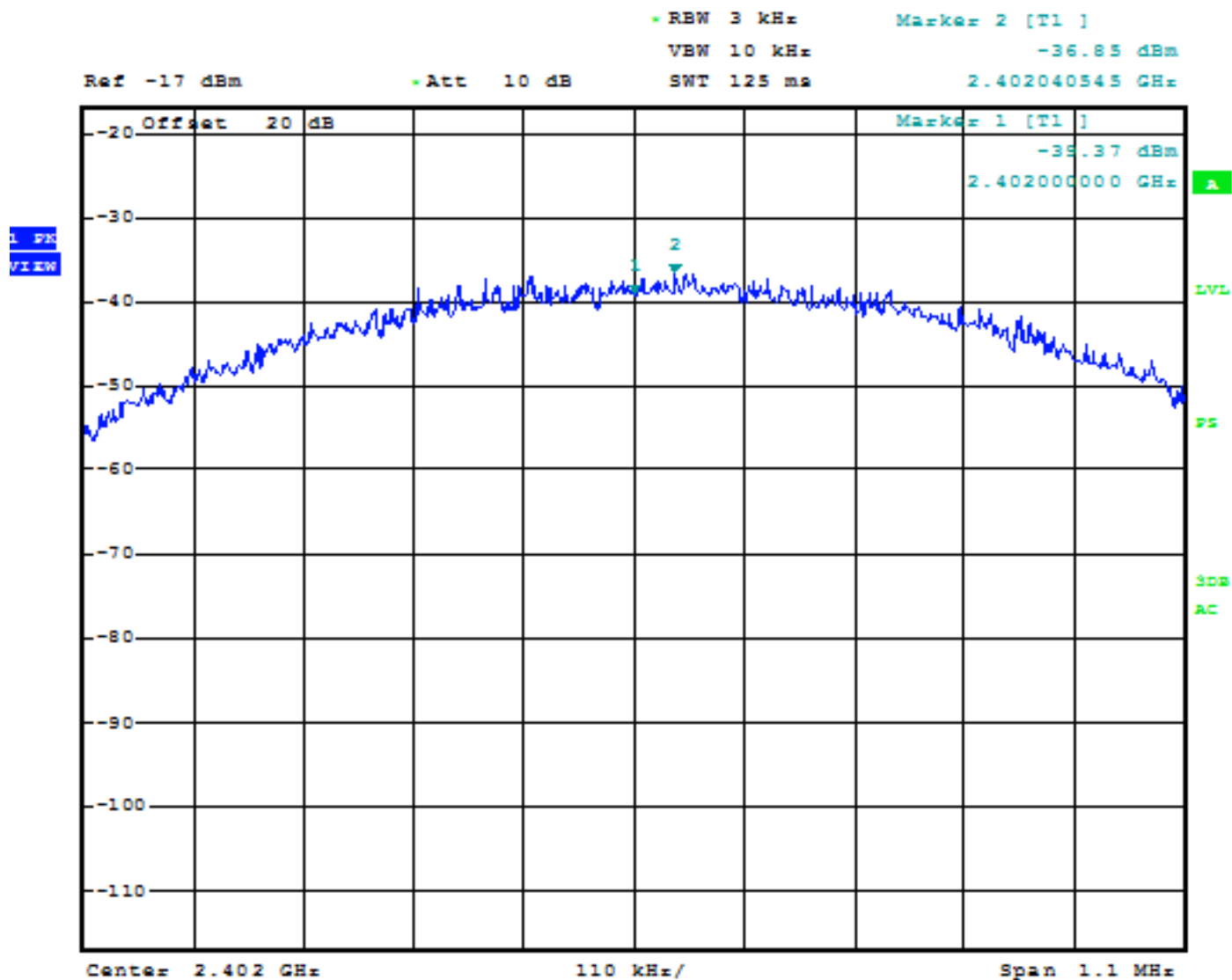
DEVICE DESCRIPTIONS: As described in the above EUT description and set up section.

EMISSIONS DATA:

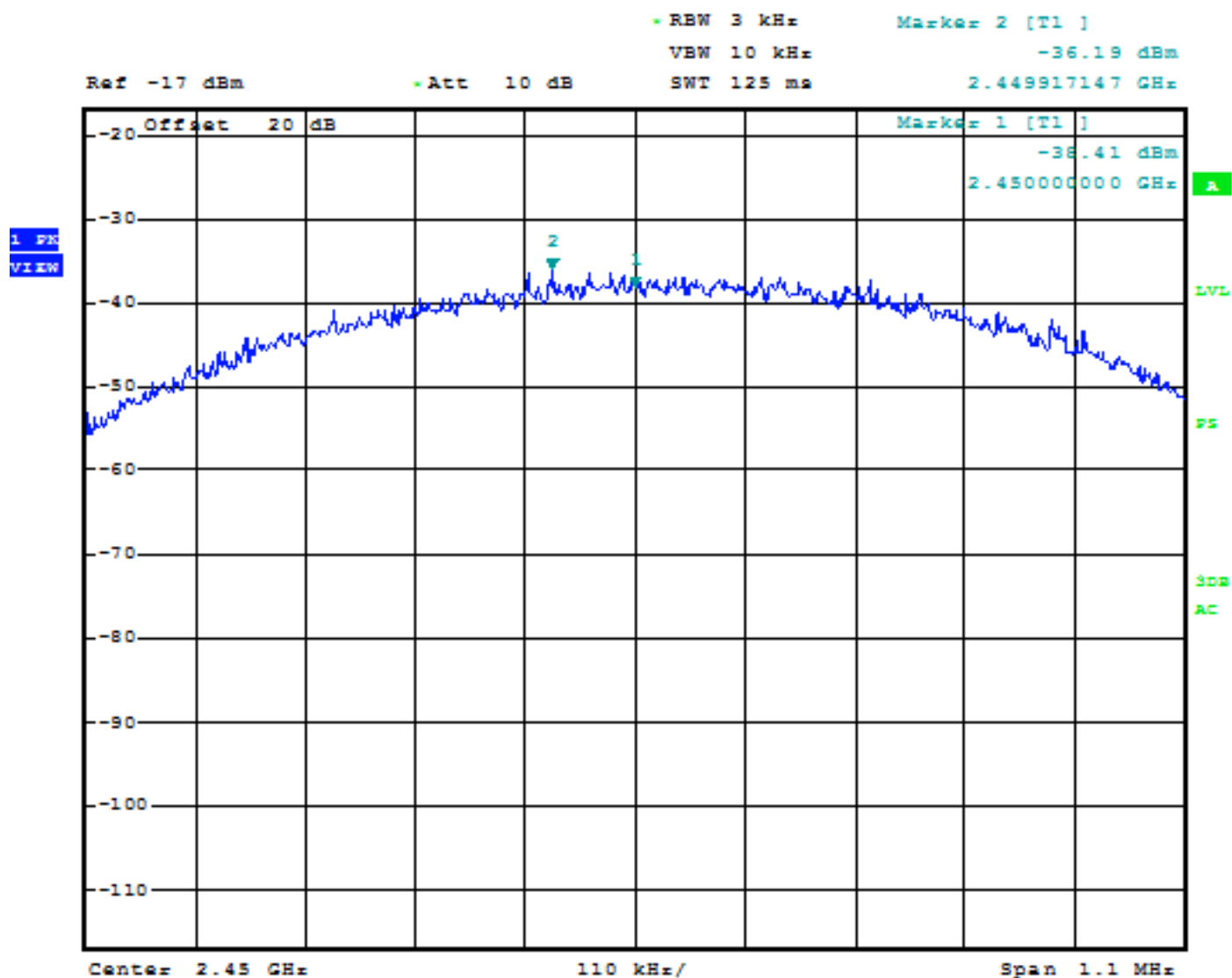
Channel	Frequency	Un-Corrected PSD	Correction Factor	Corrected PSD	Limit	Margin	Results
	(GHz)	(dBm)	(dB)	(dBm)	(dBm)	(dB)	Pass/Fail
Low	2.402	-56.85	20	-36.85	8	28.85	Pass
Mid	2.450	-56.19	20	-36.19	8	28.19	Pass
High	2.480	-55.50	20	-35.50	8	27.5	Pass

RESULTS: PASS: Complies.

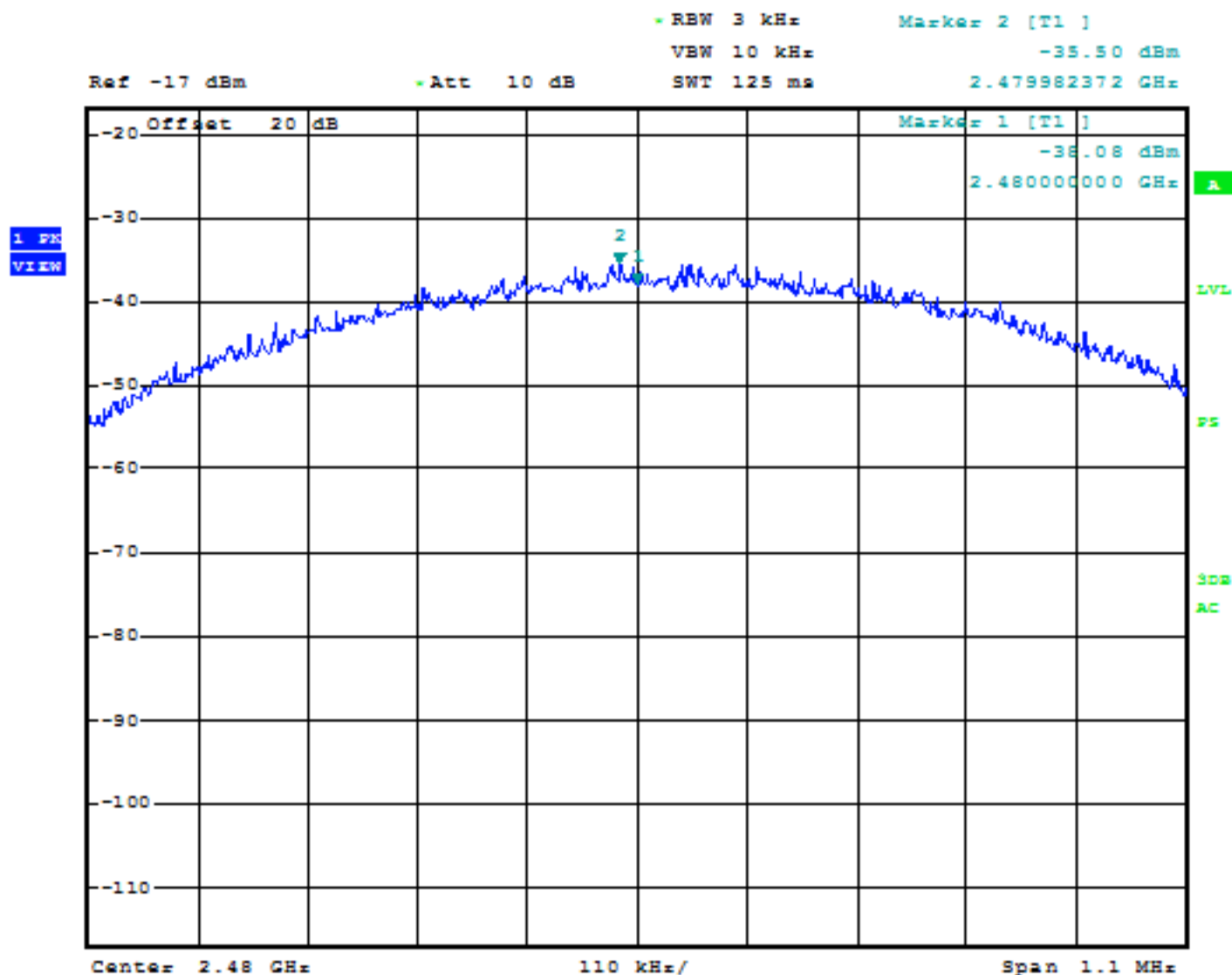
TEST PLOTS - POWER SPECTRAL DENSITY



PLOT 4 – LOW CHANNEL - POWER SPECTRAL DENSITY



PLOT 5 – MID CHANNEL - POWER SPECTRAL DENSITY



PLOT 6 – HIGH CHANNEL - POWER SPECTRAL DENSITY

Part 5 - Out of Band Emissions (Band Edge)

DATE: Jan-20-2015

TEST STANDARD: FCC Part 15.247 (d) and RSS 210 Issue 8 A8.5

TEST REQUIREMENTS:

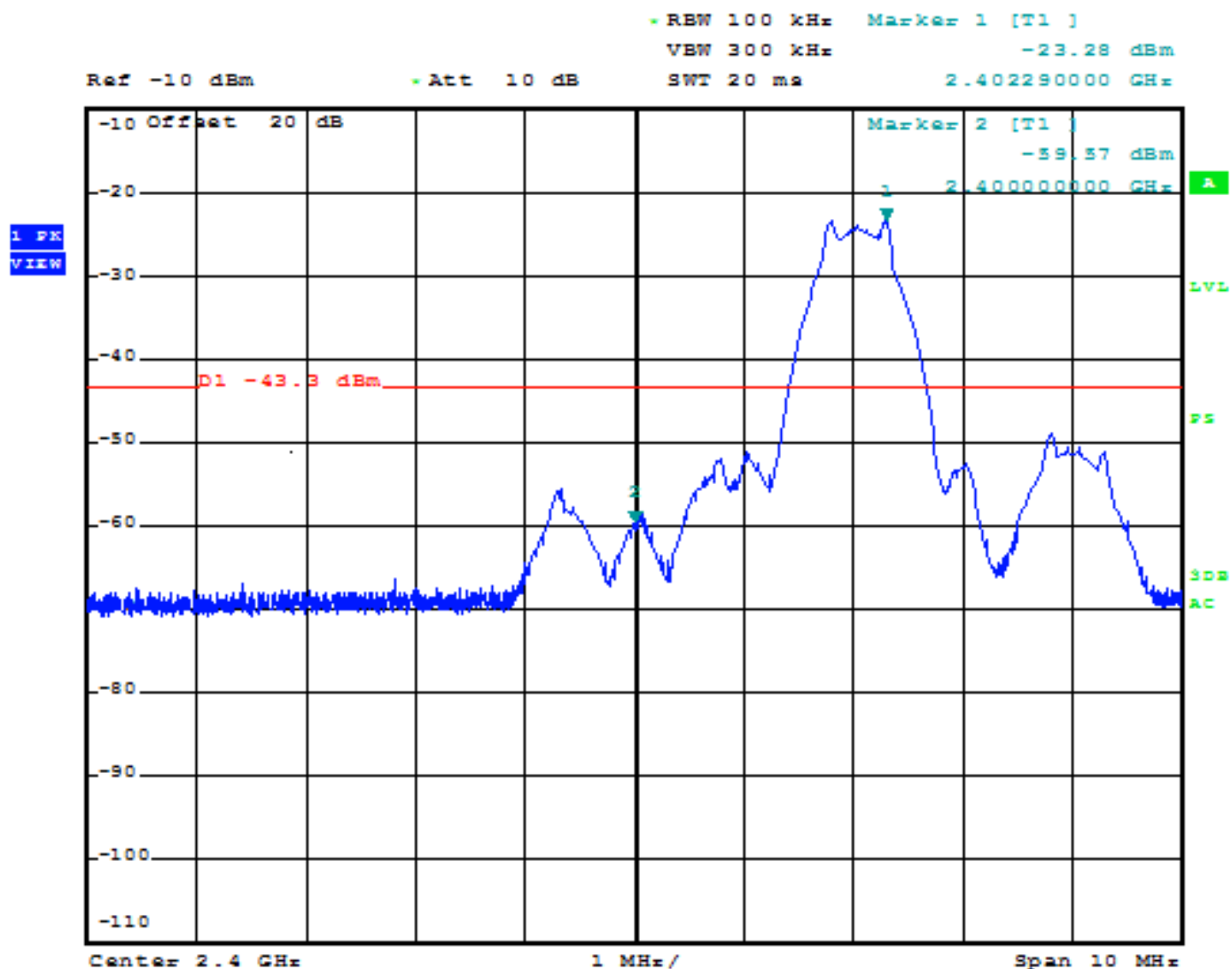
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section A8.4 (4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

MEASUREMENT METHOD: As called by the standards above.

EMISSIONS DATA:

Frequency (MHz)	Out of band Emissions Level (dBc)	Limit	Results
2402	-36.32	>20dBc	Pass
2480	-47.9	>20dBc	Pass

RESULTS: Pass: Complies



PLOT 7: OUT OF BAND EMISSIONS LOW CHANNEL



Part 6 - Radiated Spurious Emissions-Transmit Mode

DATE: Jan-20-2015

TEST STANDARD: FCC Part 15.247 (d), FCC Part 15.209 (a), FCC Part 15.205, IC RSS-210 Annex 2 Section (A2.2)(b), RSS-Gen Section (7.2.5)

TEST VOLTAGE: 3Vdc

TEST CONDITIONS: Indoor

MINIMUM STANDARD: Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 20 dB below the level of the fundamental or to the general field strength limits listed in RSS-Gen, whichever is less stringent.

In measuring unwanted emissions, the spectrum shall be investigated from 30 MHz or the lowest radio frequency signal generated in the equipment, whichever is lower, without going below 9 kHz, up to at least the frequency ... if the equipment operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

Unwanted emissions falling into restricted bands of shall comply with the limits specified below

Frequency (MHz)	Field Strength	
	uV/m @ 3-m	Calculated dB μ V/m at 3m
30 – 88	100	40.0
88 - 216	150	43.5
216 - 960	200	46.0
960 - 1000	500	54.0

FCC PART 15.205-RESTRICTED BANDS OF OPERATION

- (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
1 0.495-0.505*	16.69475-	608-614	5.35-5.46
2.1735-2.1905	16.80425-	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	(2)
13.36-13.41			

* - note FCC-specific .

Canada-specific frequency ranges - 3.020-3.026, 5.677-5.683, 121.94-123.0, 149.9-150.05, 162.0125-167.17, 167.72 -173.2, 1300-1427, 2483.5 -2500, 3500-3600,

(2) Above 38.6 GHz

- (b) Except as provided in paragraphs (d) and (e) of this section, the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in § 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in § 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in § 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in § 15.35 apply to these measurements.

RESTRICTED FREQUENCY BANDS (RSS-GEN)

MHz
0.090-0.110
2.1735-2.1905
3.020-3.026
4.125-4.128
4.17725-4.17775
4.20725-4.20775
5.677-5.683
6.215-6.218
6.26775-6.26825
6.31175-6.31225
8.291-8.294
8.362-8.366
8.37625-8.38675
8.41425-8.41475
12.29-12.293
12.51975-12.52025
12.57675-12.57725
13.36-13.41
16.42-16.423
16.69475-16.69525
16.80425-16.80475
25.5-25.67
37.5-38.25
73-74.6
74.8-75.2
108-138
156.52475-156.52525
156.7-156.9

MHz
240-285
322-335.4
399.9-410
608-614
960-1427
1435-1626.5
1645.5-1646.5
1660-1710
1718.8-1722.2
2200-2300
2310-2390
2655-2900
3260-3267
3332-3339
3345.8-3358
3500-4400
4500-5150
5350-5460
7250-7750
8025-8500

GHz
9.0-9.2
9.3-9.5
10.6-12.7
13.25-13.4
14.47-14.5
15.35-16.2
17.7-21.4
22.01-23.12
23.6-24.0
31.2-31.8
36.43-36.5
Above 38.6

Note: Certain frequency bands listed in Table 3 and in bands above 38.6 GHz are designated for licence-exempt applications. These frequency bands and the requirements that apply to the devices are set out in the 200- and 300- series RSSs, such as RSS-210 and RSS-310, which contain the requirements that apply to licence-exempt radio apparatus.

TEST SETUP:

The EUT was tested in our 3 m SAC and was positioned on the center of the turntable and connected to a 3Vdc battery. The transmitter was set for continuous transmission. The lowest, middle and highest channels in the 2400-2483.5 MHz band were measured for all radiated emissions 10kHz to 18 GHz. The EUT was pre-scanned in 3 different orthogonal orientations and was found to radiate highest when placed flat on the table top as indicated in the test photos.

MEASUREMENT METHOD:

Measurements were made using spectrum analyser and receiver, 200Hz RBW average detector for the frequency range 9-150KHz; 9kHz RBW average detector for the Frequency range 150kHz to 30MHz; 120kHz RBW quasi-peak detector using the appropriate antennas, amplifiers and filters.

The measurement results are obtained as described below:

$$E \text{ [dB}\mu\text{V/m]} = \text{Un-Corrected Value} + \text{ATOT}$$

Where ATOT is total correction factor including cable loss, antenna factor and preamplifier gain (ATOT = LCABLES + AF - AMP).

DEVICE DESCRIPTIONS: As described in the above EUT description and setup section.

EMISSIONS DATA:

Note: Emissions were measured up to 10th harmonic, but were well below 20db of the limits

Radiated Spurious Emissions – Low Channel

Frequency	MxPeak Meas'd	AvePeak Meas'd	Corr. Factor	Antenna height	Polarity	Turntable position	MaxPeak Corrctd	AvePeak Corrctd	Avg Limit	Peak Limit
(MHz)	(dBμV/m)	(dBμV/m)	(db)	(cm)	V/H	(deg)	(dBμV/m)	(dBμV/m)	(dBμV/m)	(dBμV/m)
4806	35.38	31.89	10.2	100	V	324	45.98	42.09	54	74
7205.5	28.87	19.95	16.7	152.5	V	247	45.57	36.65	54	74

Radiated Spurious Emissions – Middle Channel

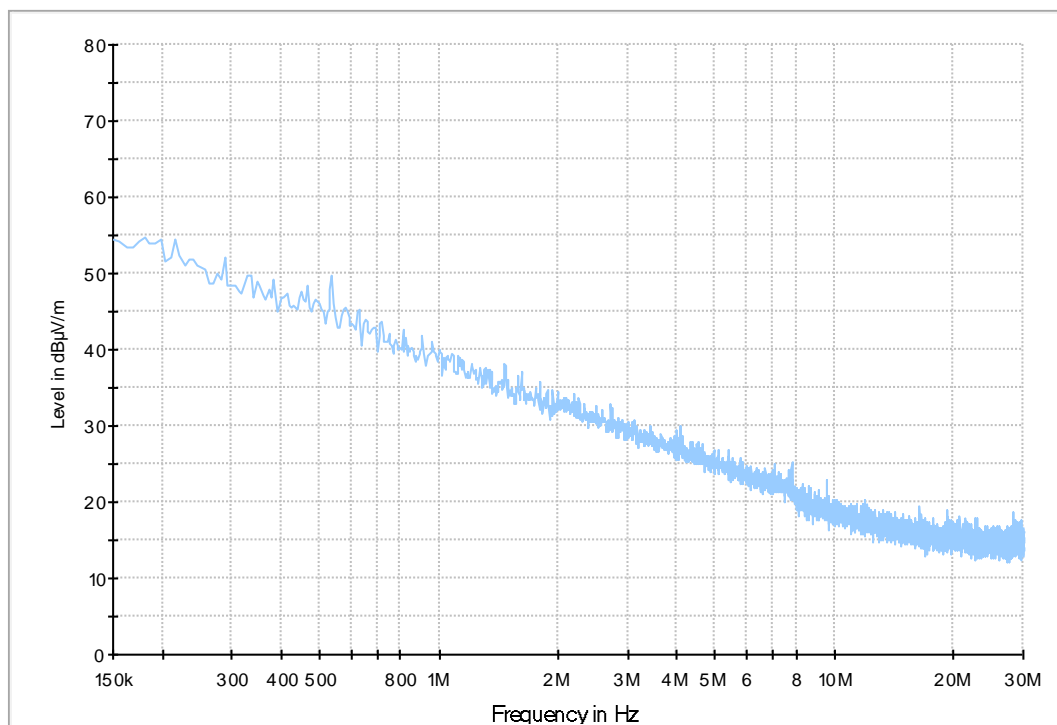
Frequency	MxPeak Meas'd	AvePeak Meas'd	Corr. Factor	Antenna height	Polarity	Turntable position	MaxPeak Corrctd	AvePeak Corrctd	Avg Limit	Peak Limit
(MHz)	(dBμV/m)	(dBμV/m)	(db)	(cm)		(deg)	(dBμV/m)	(dBμV/m)	(dBμV/m)	(dBμV/m)
4898	35.3	31.89	10	100	V	282.9	46.7	41.89	54	74
7350.7	32.35	23.15	16.6	123.9	V	121.7	48.95	39.75	54	74

Radiated Spurious Emissions – High Channel

Frequency	MxPeak Meas'd	AvePeak Meas'd	Corr. Factor	Antenna height	Polarity	Turntable position	MaxPeak Corrctd	AvePeak Corrctd	Avg Limit	Peak Limit
(MHz)	(dBμV/m)	(dBμV/m)	(db)	(cm)		(deg)	(dBμV/m)	(dBμV/m)	(dBμV/m)	(dBμV/m)
4958.1	34.28	29.9	10.8	100	V	317.5	44.88	40.7	54	74
7439.5	31.53	23.78	17.4	126.5	V	126.3	48.93	48.9	54	74

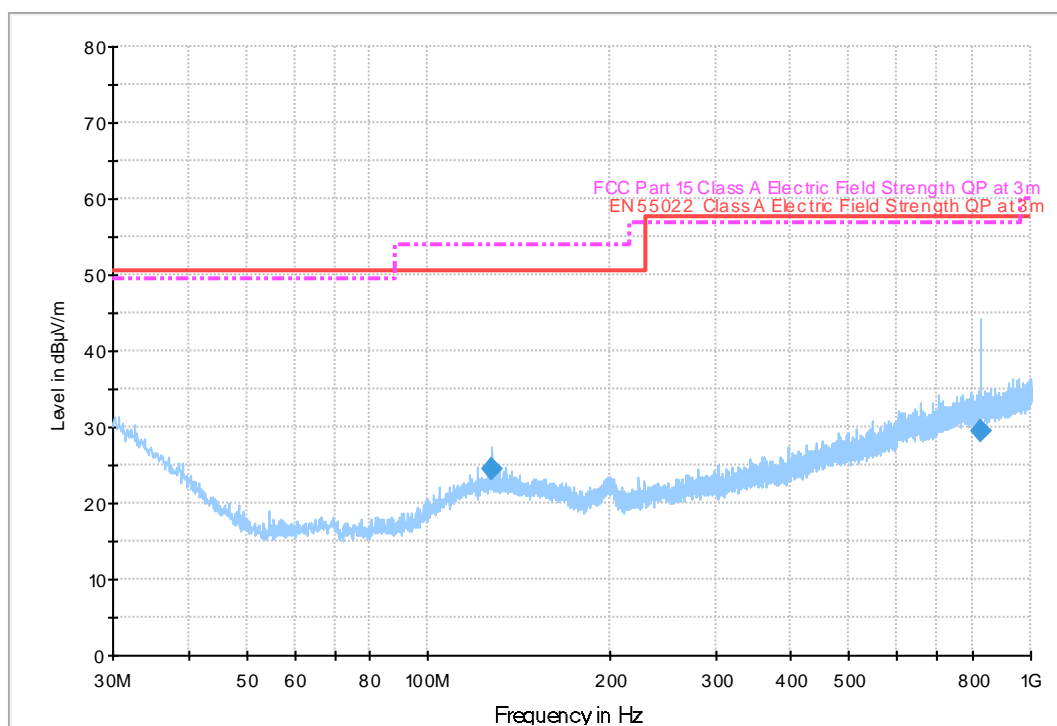
RESULTS: Pass: Complies

TEST PLOTS: RADIATED SPURIOUS EMISSIONS TRANSMIT MODE



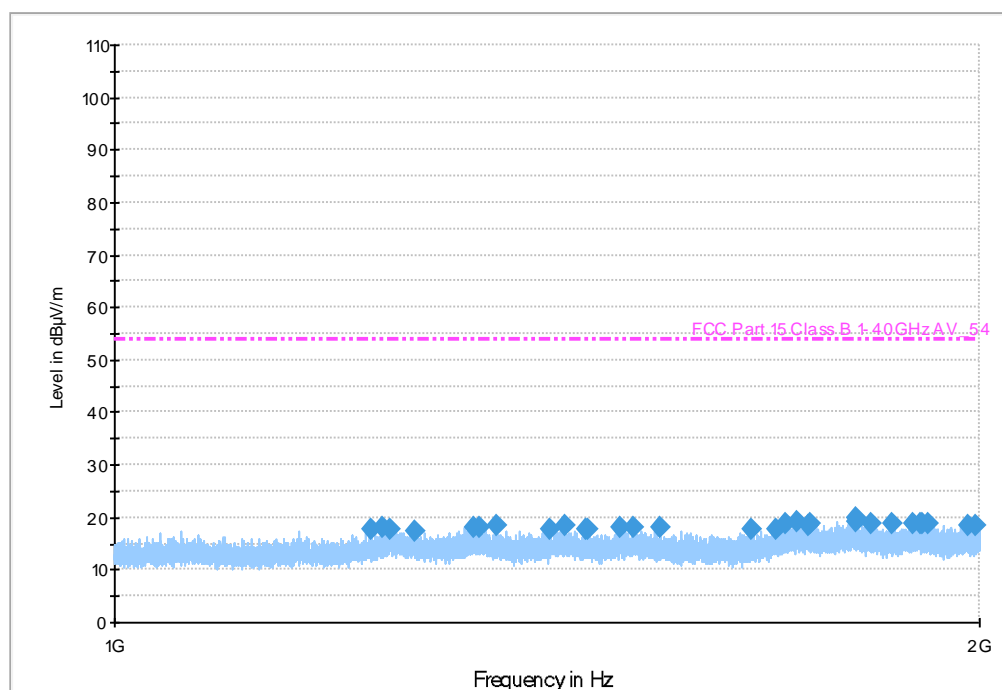
PLOT 9: Radiated Spurious Emissions Plot: 150k-30MHz

*Emissions were measured below 30MHz but no emissions were found that were 20dB below the permissible limits.

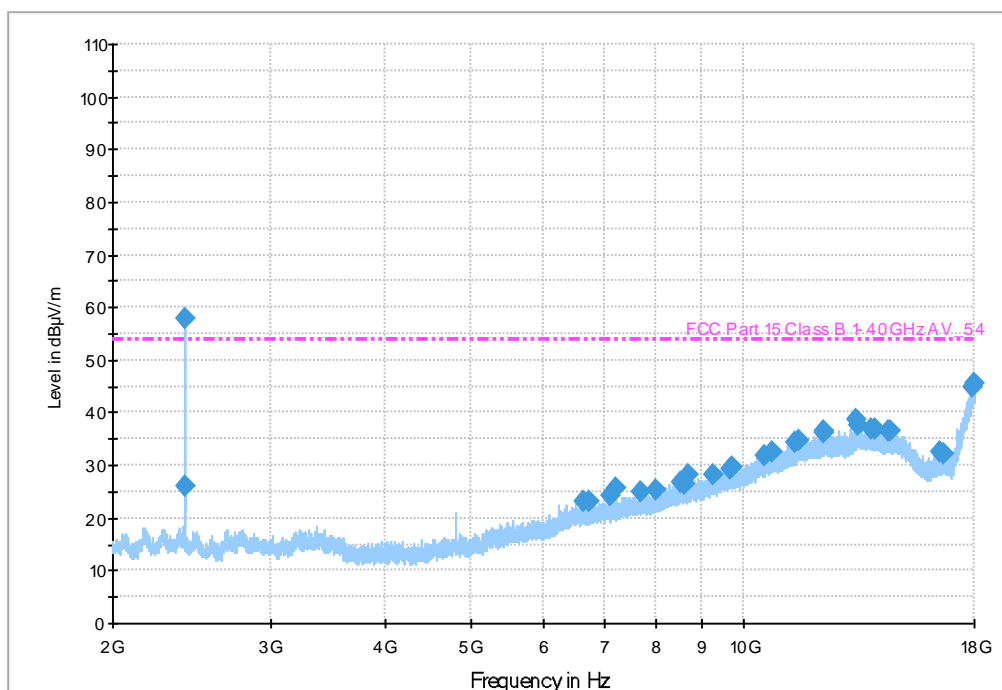


PLOT 10: Radiated Spurious Emissions Plot: 30MHz – 1GHz, Low Channel
(For Reference Only)

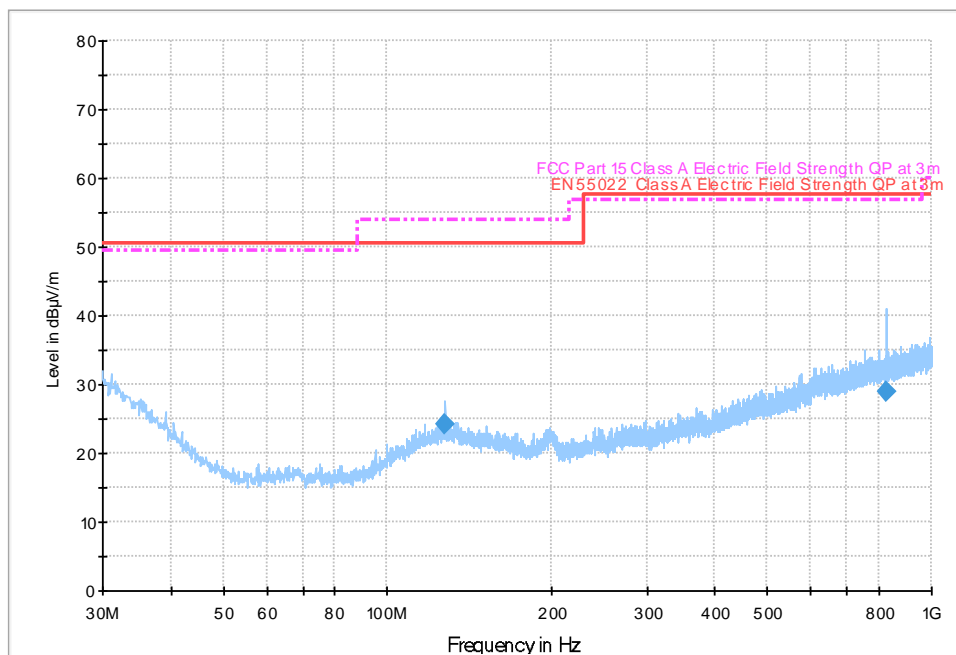
Note: Emissions measured from 30-1000MHz were at least 20dB below the permissible limits. Frequency signal marked in the above plot were ambient signals.



PLOT 11: Radiated Spurious Emissions Plot: 1GHz – 2GHz, Low Channel
(For Reference Only)

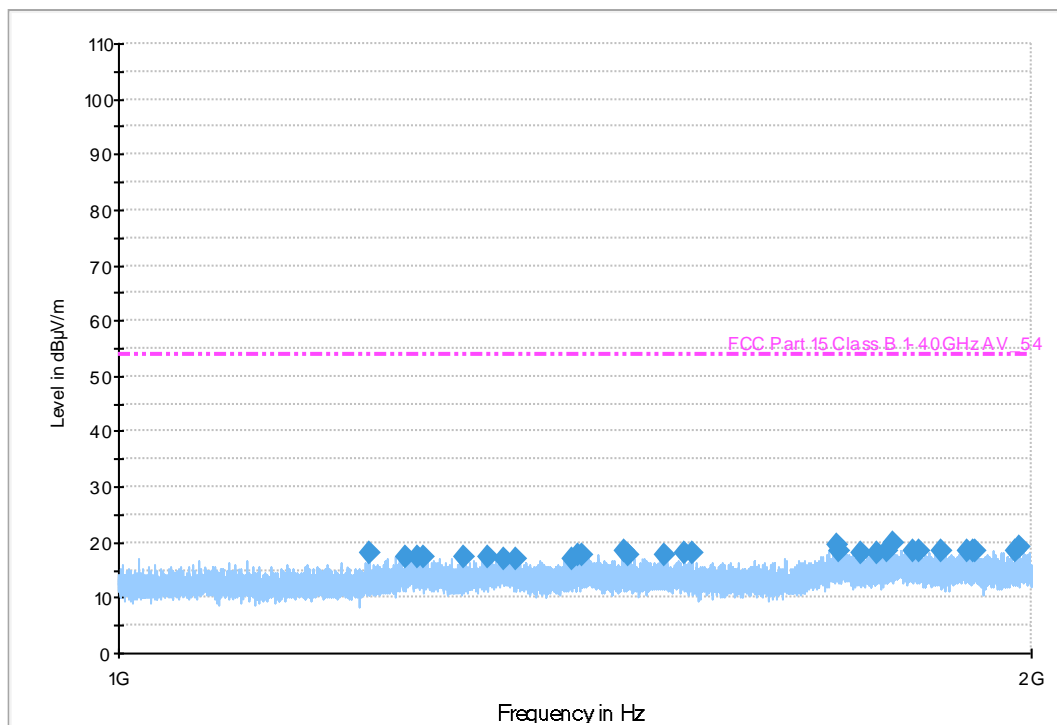


PLOT 12: Radiated Spurious Emissions Plot: 2GHz – 18GHz, Low Channel
Note: 2.402GHz is fundamental frequency
(For Reference Only)

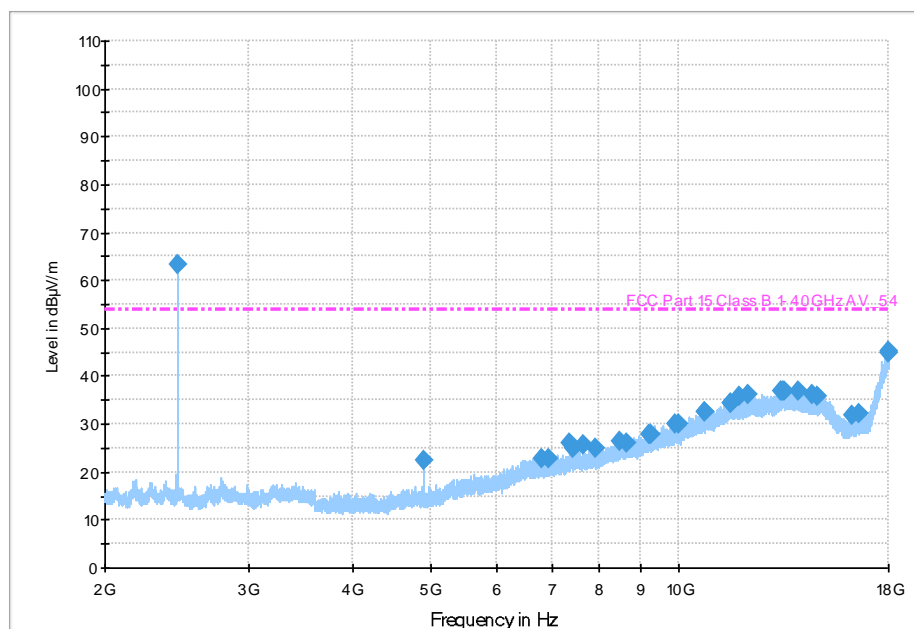


PLOT 13: Radiated Spurious Emissions Plot: 30MHz – 1GHz, Mid Channel
(For Reference Only)

Note: Emissions measured from 30-1000MHz were at least 20dB below the permissible limits. Frequency signal marked in the above plot were ambient signals.

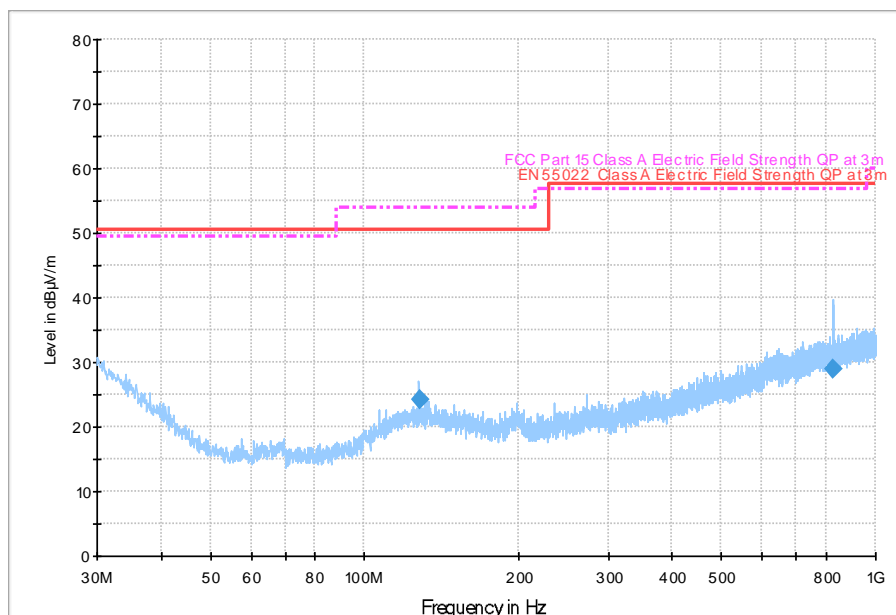


PLOT 14: Radiated Spurious Emissions Plot: 1GHz – 2GHz, Mid Channel
(For Reference Only)



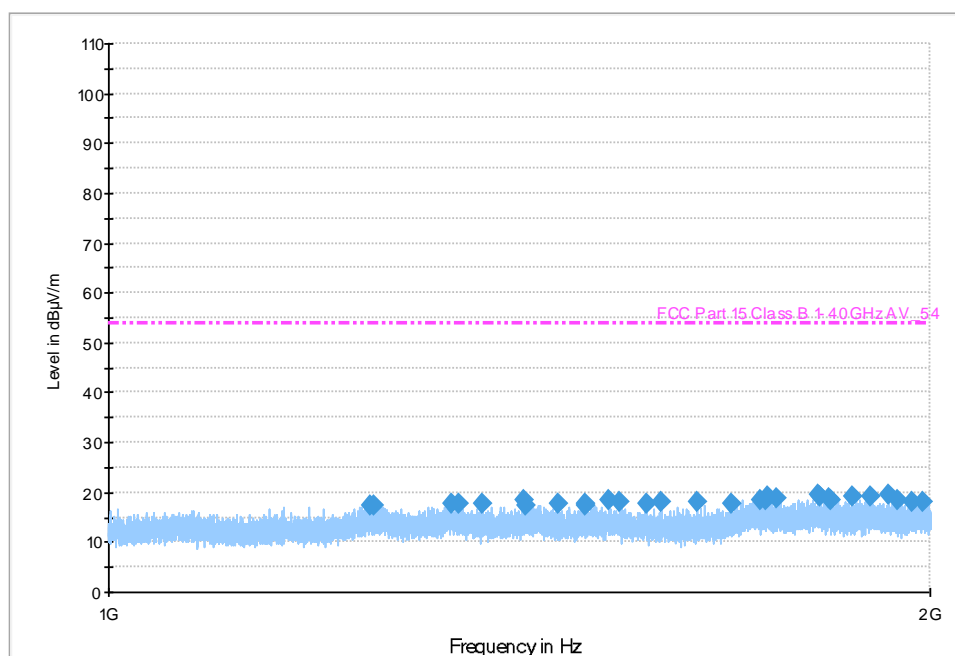
PLOT 15: Radiated Spurious Emissions Plot: 2GHz – 18GHz, Mid Channel
Note: 2.450GHz is fundamental frequency

(For Reference Only)

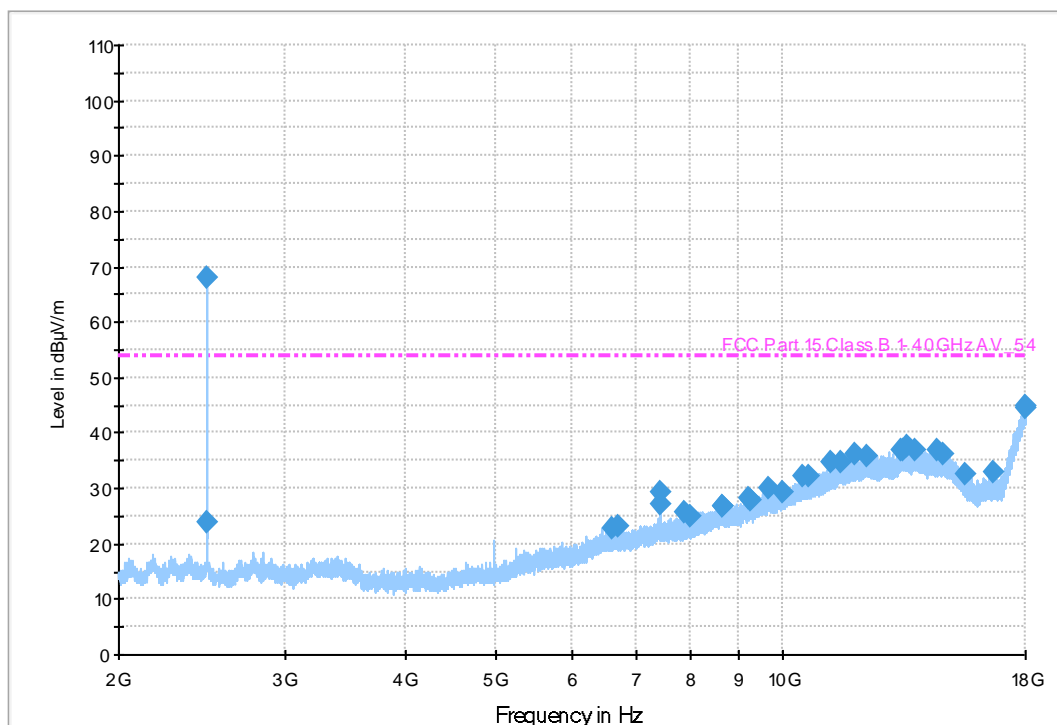


PLOT 16: Radiated Spurious Emissions Plot: 30MHz – 1GHz, Hi Channel
(For Reference Only)

Note: Emissions measured from 30-1000MHz were at least 20dB below the permissible limits. Frequency signal marked in the above plot were ambient signals.



PLOT 17: Radiated Spurious Emissions Plot: 1GHz – 2GHz, Hi Channel
(For Reference Only)



PLOT 18: Radiated Spurious Emissions Plot: 2GHz – 18GHz, Hi Channel
Note: 2.480GHz is fundamental frequency
(For Reference Only)

Part 7 - Radiated Spurious Emissions - Unintentional

DATE: Jan-20-2015

TEST STANDARD: FCC Part 15.247 (d), FCC Part 15.209 (a) and ICES-003 Issue 5

TEST VOLTAGE: 3Vdc

TEST CONDITIONS: Indoor

MINIMUM STANDARD: Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 20 dB below the level of the fundamental or to the general field strength limits listed in RSS-Gen, whichever is less stringent.

In measuring unwanted emissions, the spectrum shall be investigated from 30 MHz or the lowest radio frequency signal generated in the equipment, whichever is lower, without going below 9 kHz, up to at least the frequency ... if the equipment operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

Unwanted emissions falling into restricted bands of shall comply with the limits specified below

Frequency (MHz)	Field Strength	
	uV/m @ 3-m	Calculated dB μ V/m at 3m
30 – 88	100	40.0
88 - 216	150	43.5
216 - 960	200	46.0
960 - 1000	500	54.0

TEST SETUP: The EUT was tested in our 3 m SAC and was positioned on the center of the turntable and connected to a 3Vdc battery. The transmitter was set for continuous transmission. The lowest, middle and highest channels in the 2400-2483.5 MHz band were measured for all radiated emissions 10kHz to 18 GHz. The EUT was pre-scanned in 3 different orthogonal orientations and was found to radiate highest when placed flat on the table top as indicated in the test photos.

MEASUREMENT METHOD: Measurements were made using spectrum analyser and receiver, 200Hz RBW average detector for the frequency range 9-150KHz; 9kHz RBW average detector for the Frequency range 150kHz to 30MHz; 120kHz RBW quasi-peak detector using the appropriate antennas, amplifiers and filters.

The measurement results are obtained as described below:

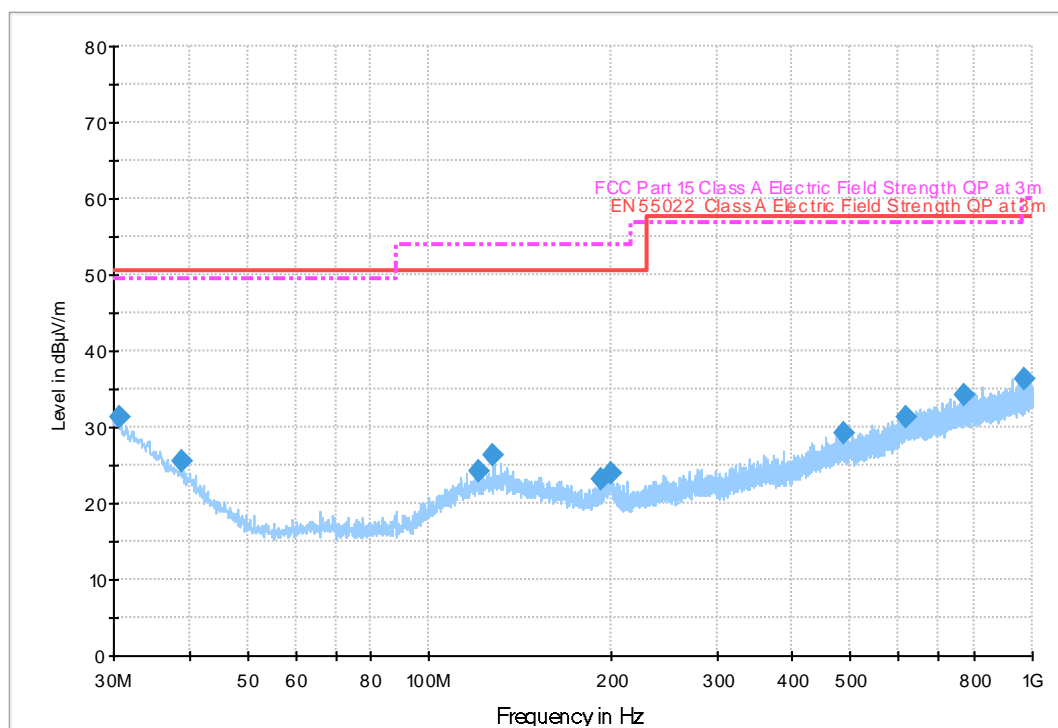
E [dB μ V/m] = Un-Corrected Value + ATOT

Where ATOT is total correction factor including cable loss, antenna factor and preamplifier gain (ATOT = LCABLES + AF - AMP).

DEVICE DESCRIPTIONS: As described in the above EUT description and setup section.

RESULTS: Pass: Complies.

EMISSIONS DATA:



PLOT 19: Radiated Spurious Emissions Plot: Unintentional, 30MHz – 1GHz

Note: Emissions measured from 30-1000MHz were at least 20dB below the permissible limits. Frequency signal marked in the above plot were ambient signals.

Part 8 - 99% Bandwidth

DATE: Jan-29-2015

TEST STANDARD: RSS-Gen Issue 4 clause (6.6)

TEST SETUP: The antenna port of EUT was directly connected to a spectrum analyzer.

MEASUREMENT METHOD: As called by the standards above.

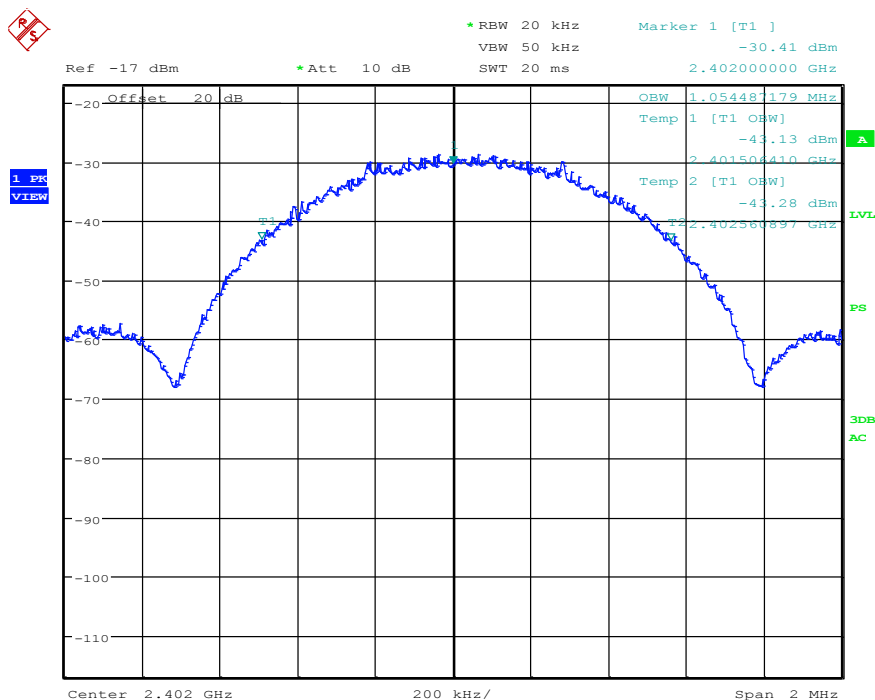
DEVICE DESCRIPTIONS: As described in the above EUT description and set up section.

EMISSIONS DATA:

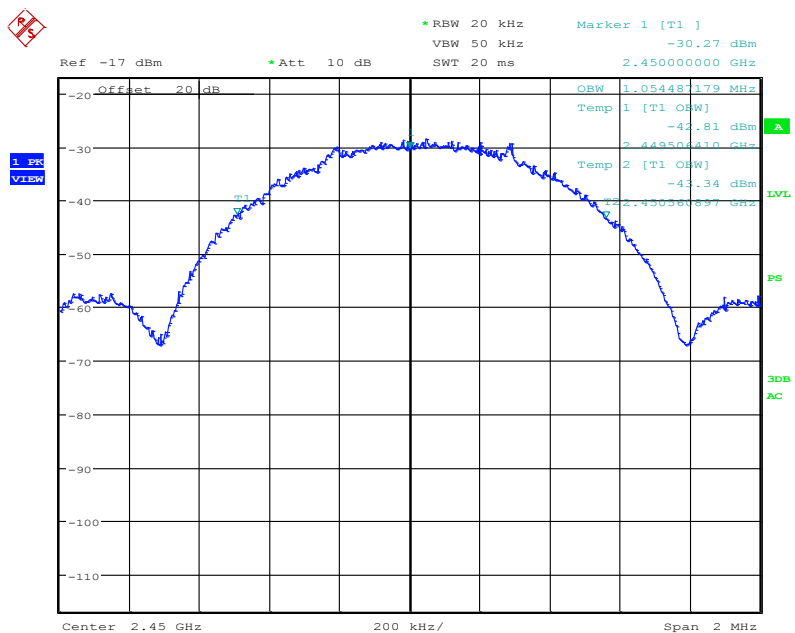
Channel	Frequency (GHz)	99% Bandwidth (MHz)
Low	2.402	1.054
Mid	2.450	1.054
High	2.480	1.051

RESULTS: Pass: Complies.

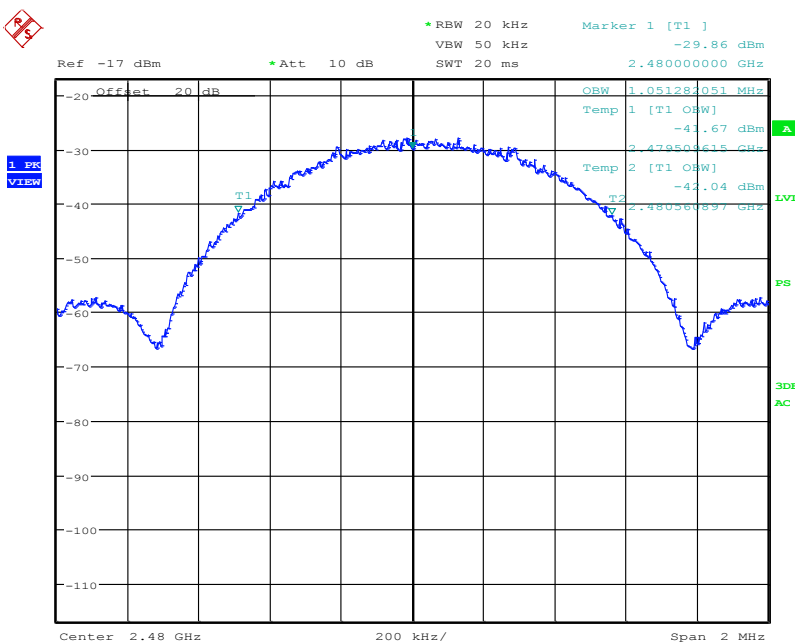
Test Plots – 99% Bandwidth



99% Bandwidth Low Channel



99% Bandwidth Middle Channel



99% Bandwidth High Channel

Part 9 - RF Exposure Evaluation

FCC 1.1310 states the criteria listed in the table below shall be used to evaluate the environmental impact of human exposure to radiofrequency (RF) radiation as specified in Section 1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of Section 2.1093. Further information on evaluating compliance with these limits can be found in the FCC's OST/OET Bulletin Number 65, "Evaluating Compliance with FCC-Specified Guidelines for Human Exposure to Radiofrequency Radiation".

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Average Time (s)
(A) Limits for Occupational/Control Exposures				
300-1500	-	-	F/300	6
1500-100,000	-	-	5	6
(B) Limits for General Population/Uncontrolled Exposures				
300-1500	-	-	F/1500	6
1500-100,000	-	-	1	30

1.1 EUT OPERATING CONDITION

- The antenna used for this product is a Chip antenna and is designed for a Peak antenna gain of 3.3 dB (peak)
- Highest measured EIRP = **2.95 dBm**
- From Table 1, the Maximum Power Density safe exposure level for General Population Uncontrolled
- Exposure of 30 Seconds for the frequency range of 2.4 to 2.4835GHz is 1mW/cm²

EIRP (dBm)	Max EIRP (mW)	Power Density Limit Allowed (mW/cm ²)	Safe distance (cm)
2.95	1.97	1	0.396

1.2 RF EXPOSURE EVALUATION DISTANCE CALCULATION

$$d = \sqrt{\frac{EIRP}{4\pi S}}$$

where:

d = Distance to the center of radiation of the antenna (cm) for the allowable Power Density

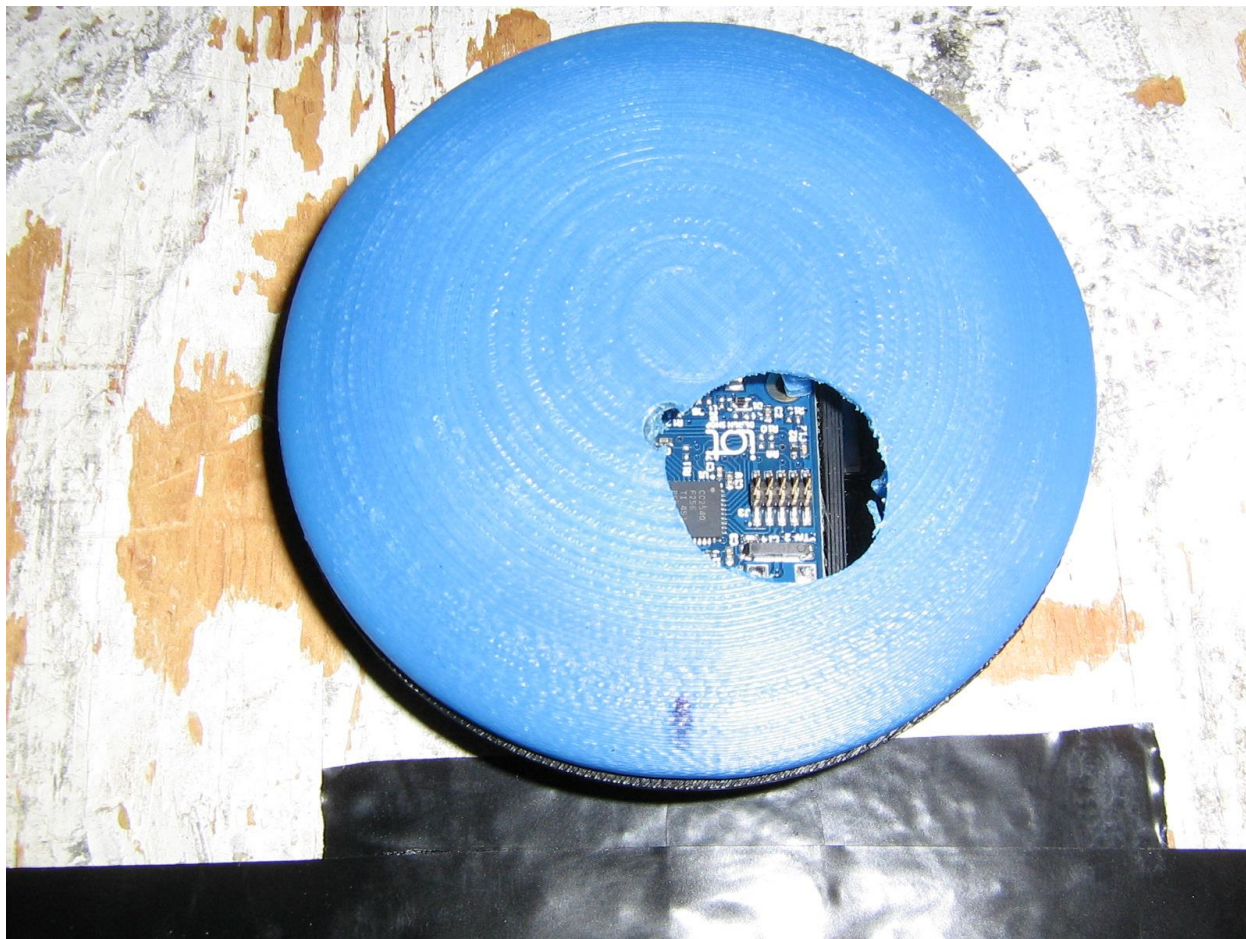
S = Allowable Power density Limit (mW/cm²)

EIRP = Equivalent isotropically radiated power (mW) = 10 [TX Power (dBm) + Ant Gain (dBi)/10]

As shown above, the minimum distance where the MPE limit is reached is **0.4 cm** from the EUT with the 3.3 dB antenna.

It is recommended that the unit is positioned so that the typical distance from the antenna to the end user is 0.4cm or greater.

Appendix A: EUT photos during the testing



Radiated Emissions Setup in Semi-Anechoic Chamber



Radiated Emissions Test-Setup 30MHz-1GHz



Radiated Emissions Test-Setup above 1GHz



Radiated Emissions Test-Setup below 30MHz