

**ELECTROMAGNETIC COMPATIBILITY
TEST REPORT
TO
FCC 47 CFR Part 15 Subpart C 15.247
RSS-247 Issue 1 & RSS-Gen Issue 4**

Report Number:	E10726-1501_OMS3-BLE4
Release Version:	1.0
Date of Issue:	December 29, 2015
Number of Pages:	37
Testing laboratory:	Quality Auditing Institute
Address:	16 – 211 Schoolhouse Street, Coquitlam, BC, V3K 4X9, Canada
Accreditations (ISO 17025):	  <p>Standard Council of Canada: Accredited Laboratory No. 743 International Accreditation Service Inc.: Accredited Laboratory: No. TL-239</p> <p>This report has been completed in accordance with the requirements of ISO/IEC 17025. Test results contained in this report are within QAI Laboratories ISO/IEC 17025 accreditation. QAI Laboratories authorizes the applicant to reproduce this report provided it is reproduced in its entirety and for the use by the company's employees only.</p>
Applicant's name:	OMS3
Address:	545 W Germantown Pike Plymouth Meeting Pa 19462
Phone :	(610) 922-8875 – Charlie, (604) 568-6456 – Sean
Fax:	(610) 537-5178
Test Standard:	FCC 47 CFR Part 15 Subpart C 15.247 RSS-247 Issue 1 & RSS-Gen Issue 4
Equipment under Test (EUT):	LC01
EUT Description:	Bluetooth low Energy Device (LC01)
Manufacturer:	OMS3
Model Number:	LC01
FCC Registration (FRN):	0025012618
FCC ID:	2AGDQLC01
IC:	20975-LC01



LC01 (EUT)

The following tests demonstrate the testimony to "FCC & IC" Mark Electromagnetic compatibility testing for "LC01" manufactured by OMS3

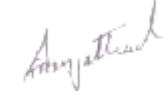
	Test	Standard	Description	Result
Part 1	Antenna requirement	FCC 47 CFR Part 15.203 RSS-Gen Issue4 8.3	Soldered, non-replaceable antenna	Complies
Part 2	Radiated Emissions (Un-intentional)	FCC CFR47 Part 15 Subpart B; RSS Gen issue 4, ICES-003 Issue 5	The emission are measured when the transmitter is not activated.	Complies
Part 3	RF Peak Power Output	FCC Part 15.247 (b)(3) RSS 247 Issue1 5.4 (4)	Maximum peak conducted output power shall not exceed 1 W.	Complies
Part 4	Occupied Bandwidth 6dB Bandwidth	FCC Part 15.247 (a) (2) and RSS 247 Issue1 5.2(1)	The minimum -6 dB bandwidth shall be at least 500 kHz.	Complies
Part 5	99% Occupied Bandwidth	RSS-Gen Issue 4	The Bandwidth to be reported	Complies
Part 6	Power Spectral Density	FCC Part 15.247 (e) and RSS 247 Issue1 5.2(2)	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 7	Out-of-band Emissions (Band Edge)	FCC Part 15.247 (d) and RSS-247 Issue1 5.5	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 8	Radiated Spurious Emissions- Transmit Mode	FCC Part 15 247 (d), 209 (a), 205, RSS-247 Issue 1 5.5 RSS-Gen Issue4 8.10	Radiated emissions requirements as stated in the Standards.	Complies
Part 9	RF Exposure Compliance	FCC KDB447498; CFR 47, Part 1.1307, 1310; Part 2, Subpart J 1091, RSS-102(2.5.1)	Any radio transmitter should not emit higher than the limit	Complies
Part 10	Frequency Stability	FCC Part 15.215(c) & RSS-Gen Issue 4 (8.11)	Frequency Stability measurements were performed at extreme temperature conditions	Complies

Tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with CFR 47 FCC Part 15 Subpart C and Industry Canada RSS-Gen Issue4, RSS-247 Issue1. 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.

This is to certify that the following report is true and correct to the best of our knowledge.



Written by Jack Qin
 RF/EMC Test Engineer/Technical Writer



Reviewed by Aman Jathaul,
 EMC Project Manager

Revision History

Date	Report Number	Rev #	Details	Authors Initials
October 16, 2015	E10726-1501_OMS3-BLE4	0.0	Draft Test Report	JQ
December 17, 2015	E10726-1501_OMS3-LC01	0.1	Draft Test Report	JQ
December 29, 2015	E10726-1501_OMS3-LC01	1.0	Final Test Report	JQ

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.

Table of Contents

Section I:	PRODUCT DESCRIPTION	6
	ANTENNA DESCRIPTION	6
Section II:	General Information	7
	FACILITIES AND ACCREDITATION	7
	ENVIRONMENTAL CONDITIONS: INDOORS	7
	TESTING METHODOLOGY	7
	EUT TESTING CONFIGURATION	7
	WORST TEST CASE	7
	GENERAL TEST PROCEDURES	7
	Test Equipment List	9
Section III:	Test Information	10
	Part 1 - Antenna Requirements	10
	Part 2 - Radiated Emissions Testing (Unintentional Mode)	11
	Part 3 - RF Peak Power Output	12
	Part 4 - Occupied Bandwidth 6dB Bandwidth	13
	Part 5 - 99% Occupied Bandwidth	17
	Part 6 - Power Spectral Density	21
	Part 7 - Out of Band Emissions (Band Edge)	26
	Part 8 - Radiated Spurious Emissions-Transmit Mode	29
	Part 9 - RF Exposure Evaluation	32
	Part 10 - Frequency Stability	33
Appendix A:	photos during the testing	35

Section I: PRODUCT DESCRIPTION

EUT	LC01
Functional Description	<p>The EUT can lock and unlock of any Windows (7,8 or 10) computer automatically. Walk up to your computer, and it will automatically log you in without the need to press a single key. Step away to refill your coffee, and your computer will lock, protecting your work.</p> <p>Each machine on your network can be registered to an Azure Cloud hosted web management console, where you may link keys to local and Active Directory accounts on any computer running the client service.</p>
Manufacturer	OMS3
Model Number	LC01
FCC ID	2AGDQLC01
IC Number	20975-LC01
Frequency Range	2402MHz -2480MHz
Transmit Type	Bluetooth low energy
Transmit Power	-1.04 dBm eirp
Modulation	GFSK
Number of Channels	40
Ratings	+3.6 Vdc, powered by coin cell battery

ANTENNA DESCRIPTION

Description	PCB Antenna/Antenna is integrated in the board
Gain	0dBi

Section II: General Information

FACILITIES AND ACCREDITATION

Main Laboratory Headquarters: Quality Auditing Institute
Headquarters Location/Address: 16 – 211 Schoolhouse Street, Coquitlam, BC, 3K 4X9, Canada
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
FCC Designation Number: CA9543
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

ENVIRONMENTAL 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 C63.10-2009, ANSI C63.10-2013, 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 Meas Guidance v03r03.

EUT TESTING CONFIGURATION

The transmitter was set for continuous operation on various frequencies in modulated modes of operation.

WORST TEST CASE

Worst-case orientation was determined by rotating the EUT on three orthogonal planes, during the pre-compliance test and final radiated emissions tests were performed in that worst orientation.

GENERAL TEST PROCEDURES

RF Conducted Emissions

The EUT is placed on a test bench connected directly to an EMI Receive and Spectrum Analyzer Conducted emissions are measured in the frequency range 10kHz to 25GHz using CISPR Peak, Quasi-Peak and Average detectors.

Radiated Emissions

Below 1000MHz, EUT was 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. Above 1000MHz, EUT was placed 1.5m high from the ground plane on an insulated surface and absorbers were placed on the ground plane as required by the standard. During measurements turntable was also rotated 360 degrees to determine worst case orientation. 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.

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
1.0495-0.505*	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	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	156.52475-156.52525	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	162.0125-167.17	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.

MEASUREMENT UNCERTAINTY

Parameter	Uncertainty
Radio Frequency	±1 x 10-5 MHz
Total RF power, conducted	±1 dB
RF power density, conducted	±2.75 dB
Spurious emissions, conducted	±3 dB
Radiated Emissions	±3 dB
Temperature	±1°C
Humidity	±5 %
DC and low frequency voltages	±3 %

Test 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
Rohde & Schwarz	ESU40	EMI Receiver	100011	2014-11-20	2017-11-20
FCC	FCC-LISN-50-25-2	LISN (150kHz-30MHz)	9927	30-Nov-2012	30-Nov-2015
EMCO	6502	Loop Antenna 10kHz-30MHz	2178	8/21/2014	8/21/2017
Sunol Sciences	JB3	Biconilog Antenna 30MHz-3GHz (Prescan use only)	A120106	28-Oct-2013	28-Oct-2016
ETS Lindgren	3117	Horn Antenna 1GHz-18GHz	00075944	29-Aug-2013	29-Aug-2016
EMCO	3160-09	Horn Antenna 18GHz-26.54GHz	9701-1071	30-Aug-13	30-Aug-16
ETS Lindgren	S201	5 meter Semi-Anechoic Chamber	1030	N/A	N/A
A.H.Systems Inc	PAM-1840VH	Preamplifier	152	14-Jun-2013	14-Jun-2016
A.H.Systems Inc	SAC-40G-2.25	RF cable	396	Conditional use	
A.H.Systems Inc	SAC-40G-0.3	RF cable	395	Conditional use	
ETS Lindgren	7002-006	USB RF Power Sensor	14I00048S NO050	2014-11-20	2017-11-20

Measurement Software List

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

Section III: Test Information

Part 1 - Antenna Requirements

DATE: October 16, 2015

TEST STANDARD: FCC 47 CFR Part 15.203 and RSS-Gen Issue4 8.3

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 device is assembled with a soldered, non-replaceable antenna.

Part 2 - Radiated Emissions Testing (Unintentional Mode)

DATE: October 01, 2015

TEST STANDARD: FCC CFR47 Part 15 Subpart B; RSS Gen issue 4, ICES-003 Issue 5

MINIMUM STANDARD: Except as provided elsewhere in FCC CFR47, Part 15, Subpart C & RSS-247 issue 1, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table

Frequency (MHz)	Field Strength (dB μ V/m) at 3m
30 – 88	40
88 – 216	43.5
216 - 960	46
960 – above	54

Note: In the above emission table, the tighter limit applies at the band edges.

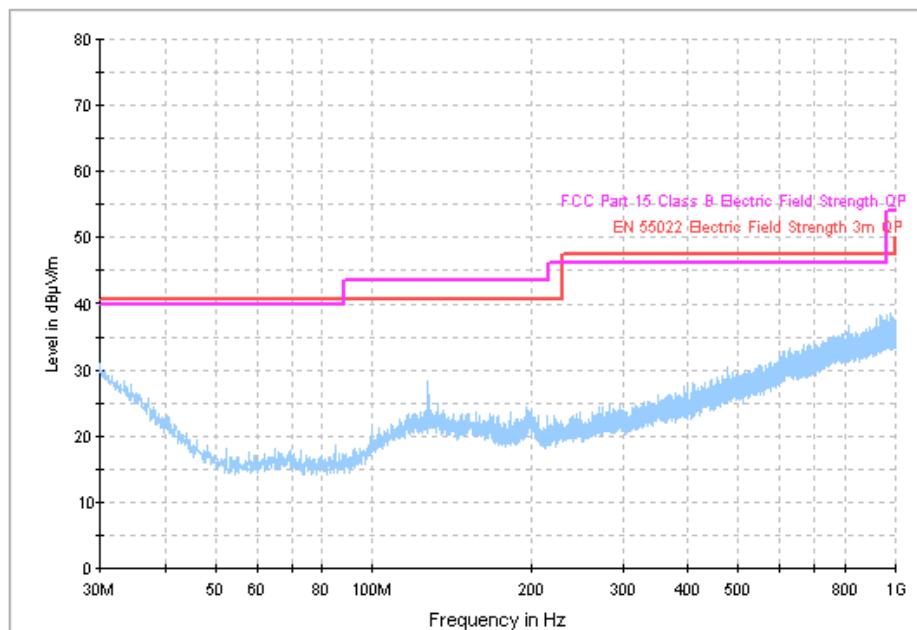
TEST SETUP:

The EUT was placed on a turntable, which is 0.8 m above ground plane. Emissions in both horizontal and vertical polarizations were measured while rotating the EUT on a turntable and moving the receiving antenna from 1m to 4 m high to maximize the emissions signal strength. The equipment was set up in a 3-meter Semi Anechoic Chamber for preliminary measurements and finals were completed in 3m/10m Open Air Test Site at 3 meters.

PERFORMANCE:

Complies with standard.

MEASUREMENT DATA & PLOT:



Note: All radiated emissions were at least 20 dB below the required limit line.

PERFORMANCE:

Complies with standard.

Part 3 - RF Peak Power Output

DATE: October 12, 2015

TEST STANDARD: FCC Part 15.247 (b)(3), RSS 247 Issue1 5.4 (4)

TEST REQUIREMENT: (3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode. Except as provided in RSS 247 Issue1 5.4 (4), the e.i.r.p. shall not exceed 4 W.

MEASUREMENT METHOD: As called by the standards above.

TEST DATA:

Low Channel-0-2402MHz											
Freq.	Peak-Raw	Average-Raw	Ant-Pol	Antenna Height	Angle	Cable Loss	AF	Peak-Corrected	Average Corrected	EIPR	Limit
MHz	dBuV	dBuV		cm	deg	dB	dBm	dBuV/m	dBuV/m	dBm	dBm
2402	55.82	48.67	V	100	101	4.69	32.5	93.01	85.86	-2.25	30
2402	57.03	49.97	H	128	150	4.69	32.5	94.22	87.16	-1.04	30
Mid Channel-19-2440MHz											
Freq.	Peak-Raw	Average-Raw	Ant-Pol	Antenna Height	Angle	Cable Loss	AF	Peak-Corrected	Average Corrected	EIPR	Limit
MHz	dBuV	dBuV		cm	deg	dB	dBm	dBuV/m	dBuV/m	dBm	dBm
2440	56.42	49.4	V	104.8	37.6	4.92	32.58	93.92	86.9	-1.34	30
2440	54.72	47.52	H	173	23.5	4.92	32.58	92.22	85.02	-3.04	30
High Channel-39-2480MHz											
Freq.	Peak-Raw	Average-Raw	Ant-Pol	Antenna Height	Angle	Cable Loss	AF	Peak-Corrected	Average Corrected	EIPR	Limit
MHz	dBuV	dBuV		cm	deg	dB	dBm	dBuV/m	dBuV/m	dBm	dBm
2480	51.75	44.5	V	103	225	5.19	32.66	89.6	82.35	-5.66	30
2480	53.38	46.5	H	128	150	5.19	32.66	91.23	84.35	-4.03	30

RESULTS: Pass: Complies.

Part 4 - Occupied Bandwidth 6dB Bandwidth

DATE: October 08, 2015

TEST STANDARD: FCC Part 15.247 (a) (2) and RSS 247 Issue1 5.2(1)

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.

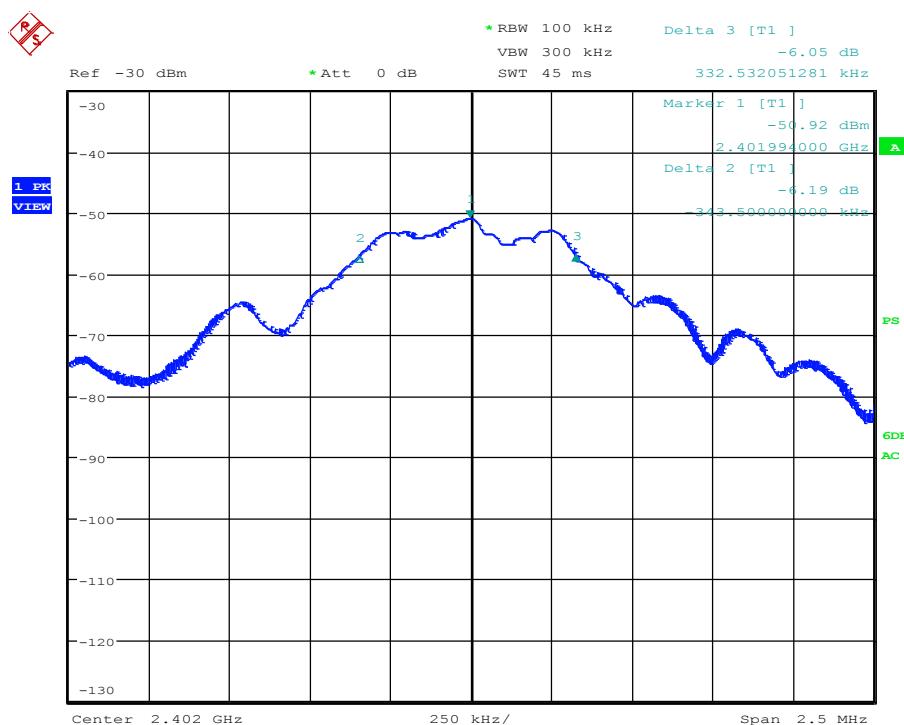
DEVICE DESCRIPTIONS: As described in the above EUT description and set up section.

MEASUREMENT DATA:

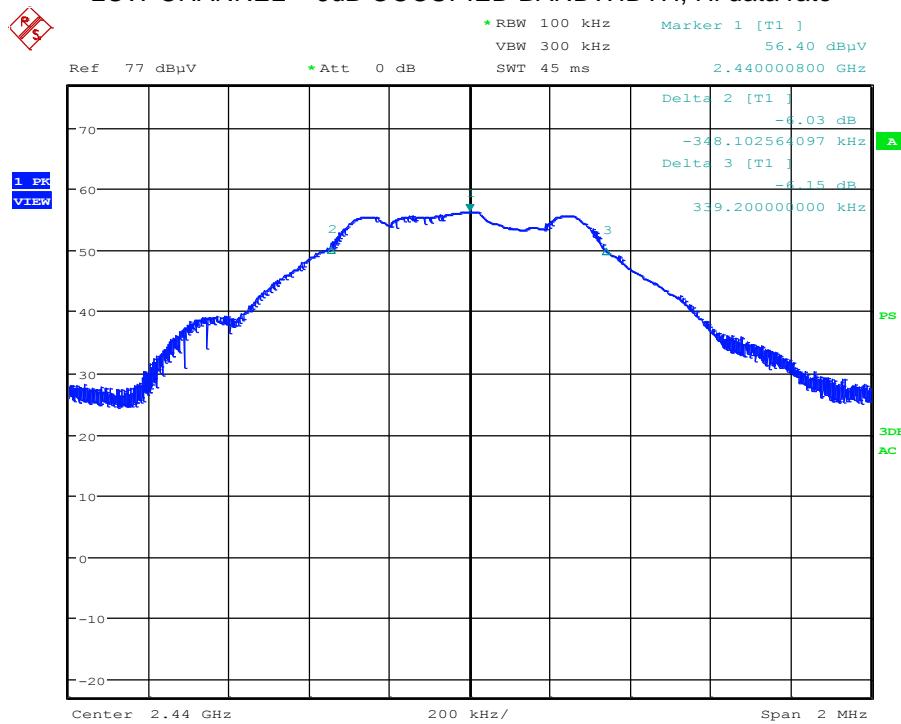
Channel	Frequency (MHz)	6dB Bandwidth at Hi date rate (kHz)	6dB Bandwidth at Low date rate (kHz)
Low	2402	574.3	580.3
Mid	2440	687.3	701.4
High	2480	652.2	672.8

RESULTS: Pass: Complies.

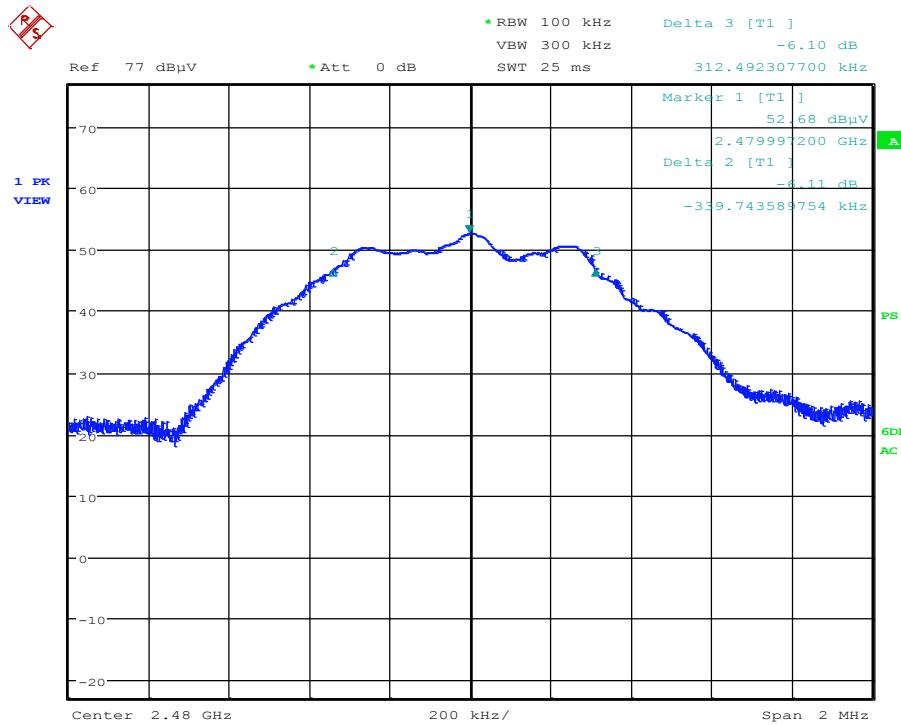
MEASUREMENT PLOT:



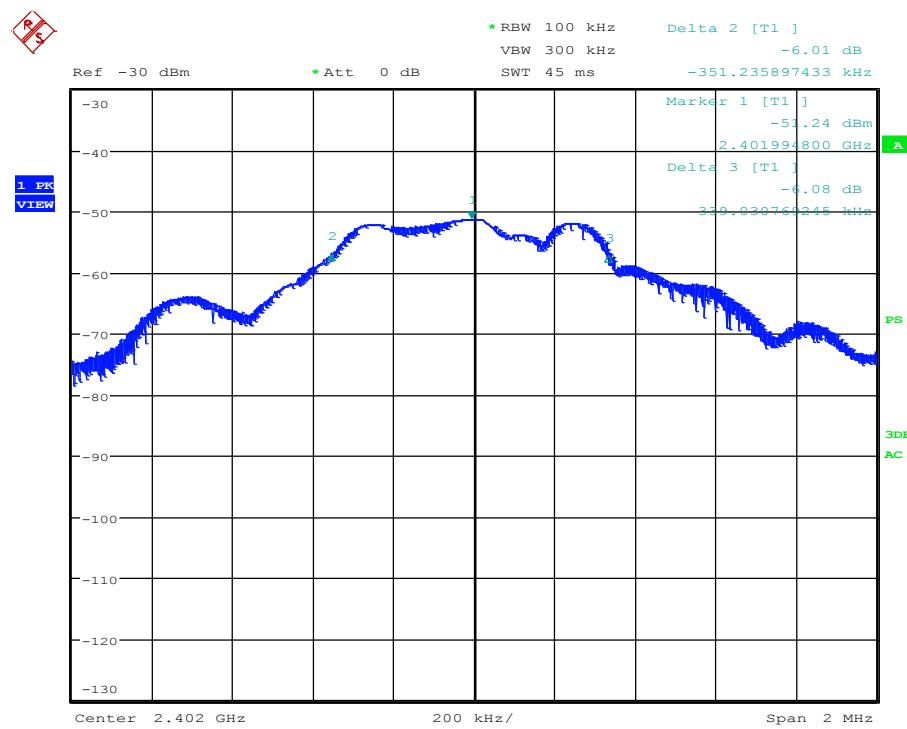
LOW CHANNEL – 6dB OCCUPIED BANDWIDTH, Hi data rate



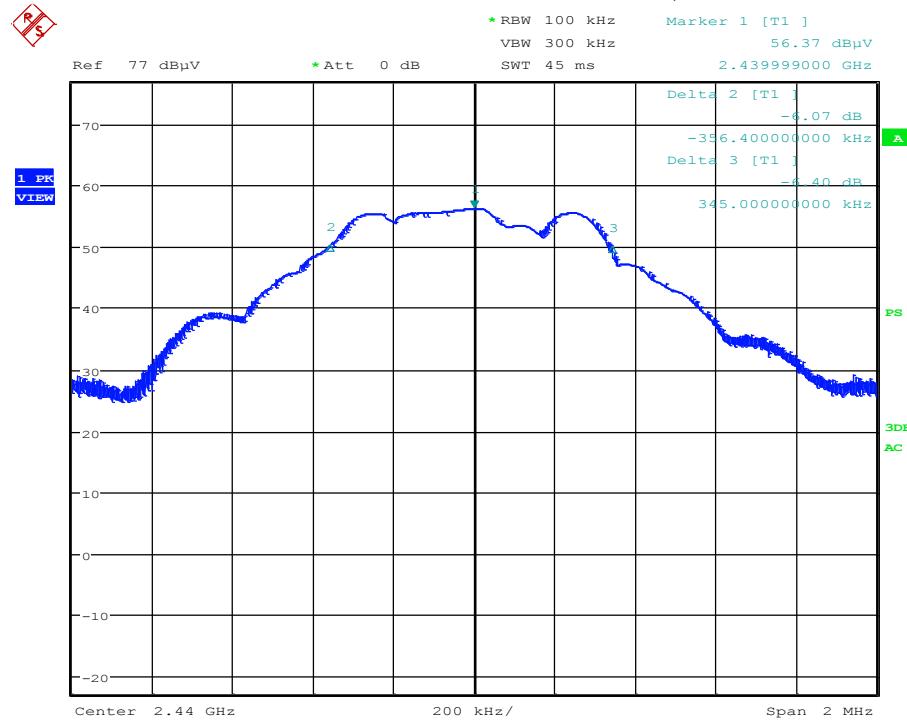
MID CHANNEL – 6dB OCCUPIED BANDWIDTH, Hi data rate



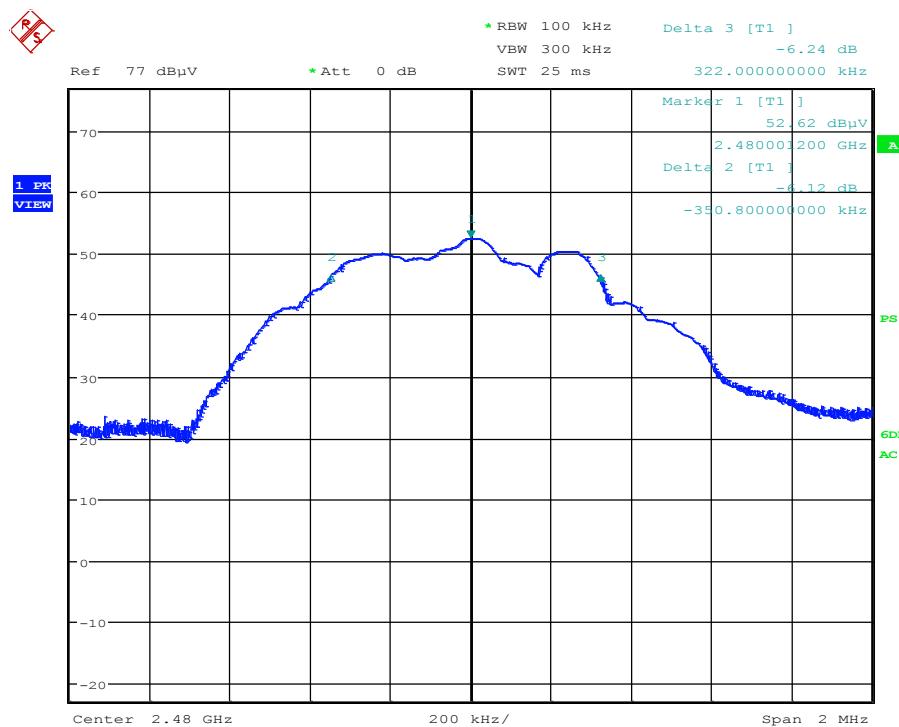
HIGH CHANNEL – 6dB OCCUPIED BANDWIDTH, Hi data rate



LOW CHANNEL – 6dB OCCUPIED BANDWIDTH, Low data rate



MID CHANNEL – 6dB OCCUPIED BANDWIDTH, Low data rate



HIGH CHANNEL – 6dB OCCUPIED BANDWIDTH, Low data rate

Part 5 - 99% Occupied Bandwidth

DATE: October 08, 2015

TEST STANDARD: RSS-Gen Issue 4

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.

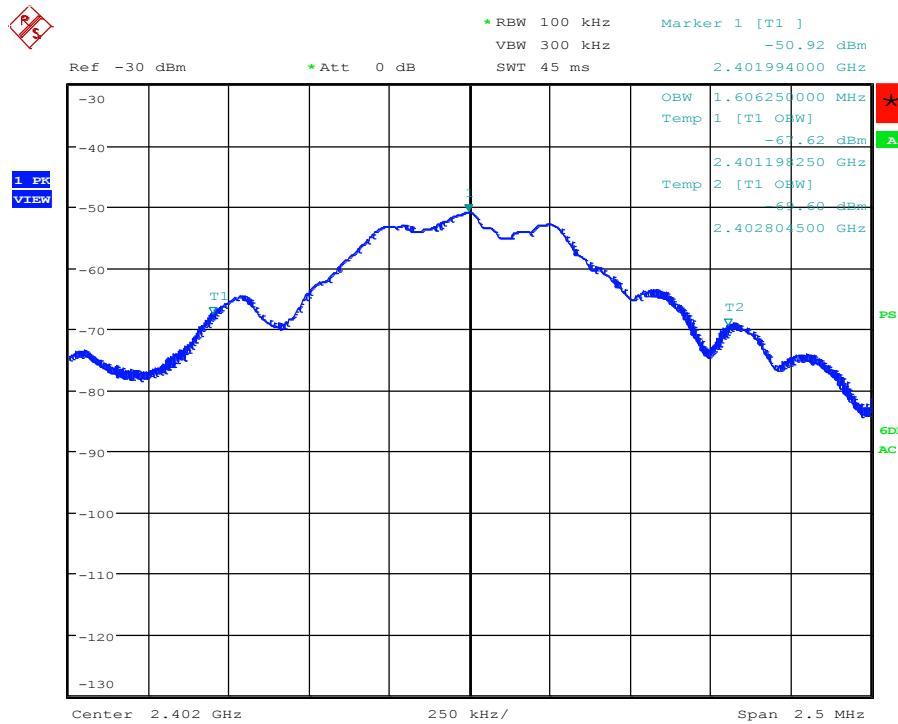
MEASUREMENT DATA:

Channel	Frequency	99% Bandwidth at Hi data rate	99% Bandwidth at Low data rate
	MHz	MHz	MHz
Low	2402	1.61	1.68
Mid	2440	1.13	1.15
High	2480	1.06	1.06

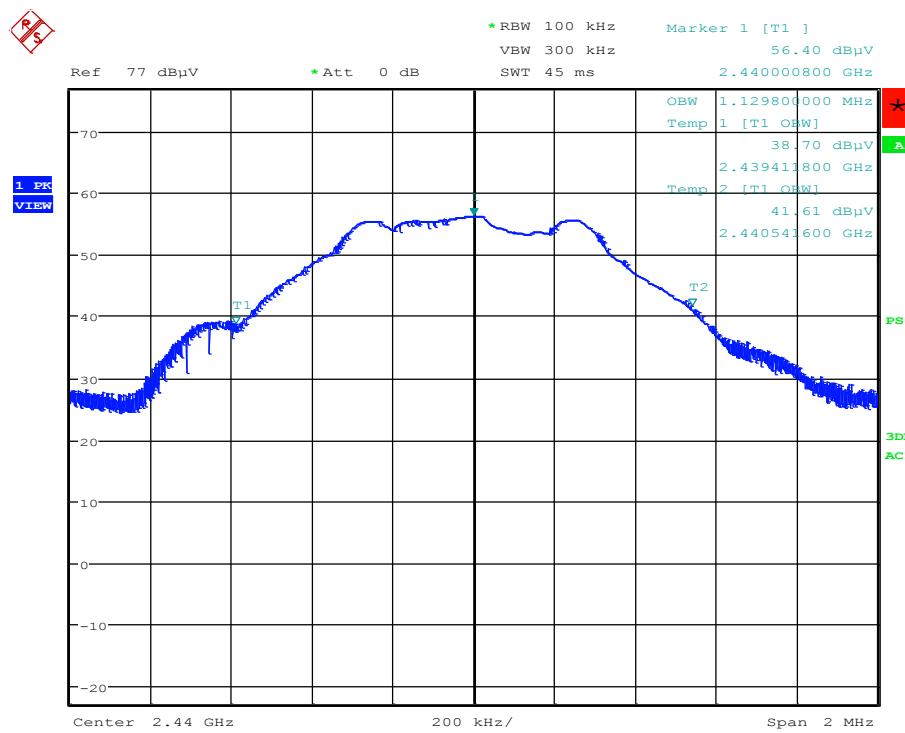
OBSERVATIONS: The EUT performed as expected.

PERFORMANCE: Complies

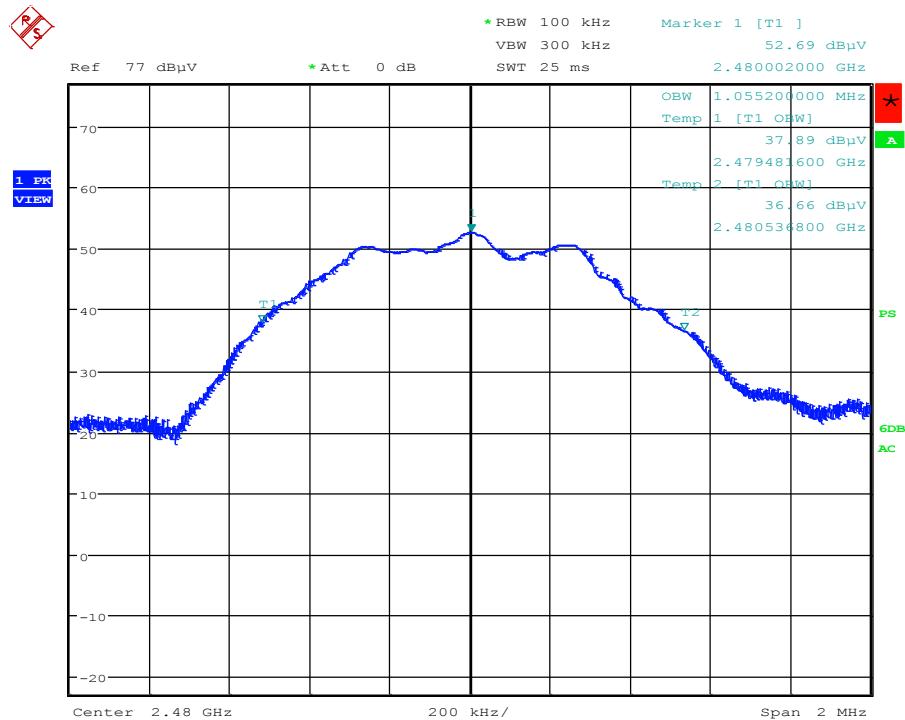
MEASUREMENT PLOT:



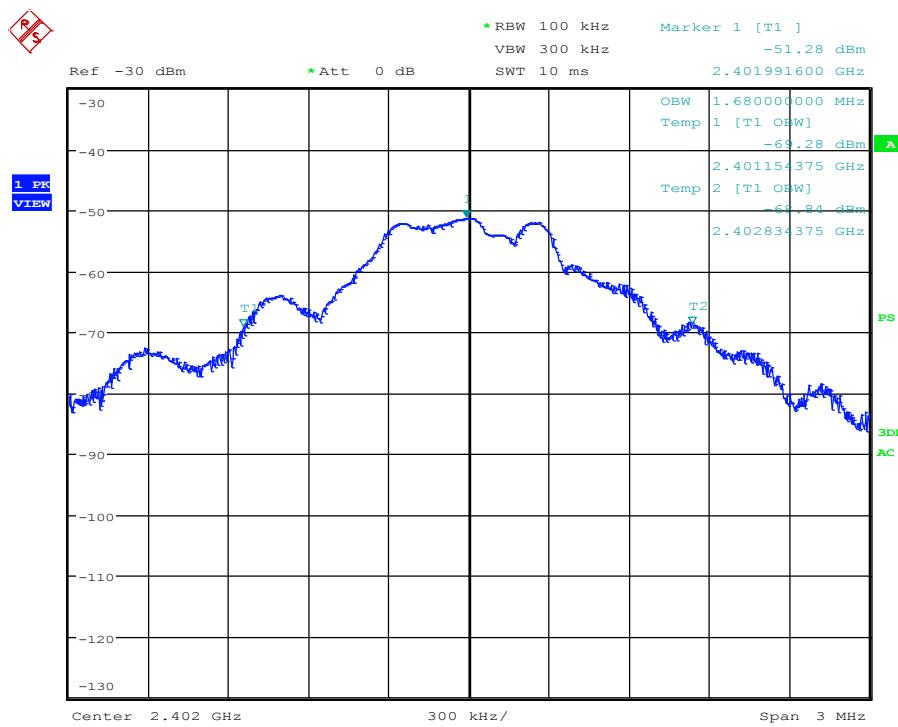
LOW CHANNEL – 99% OCCUPIED BANDWIDTH, Hi data rate



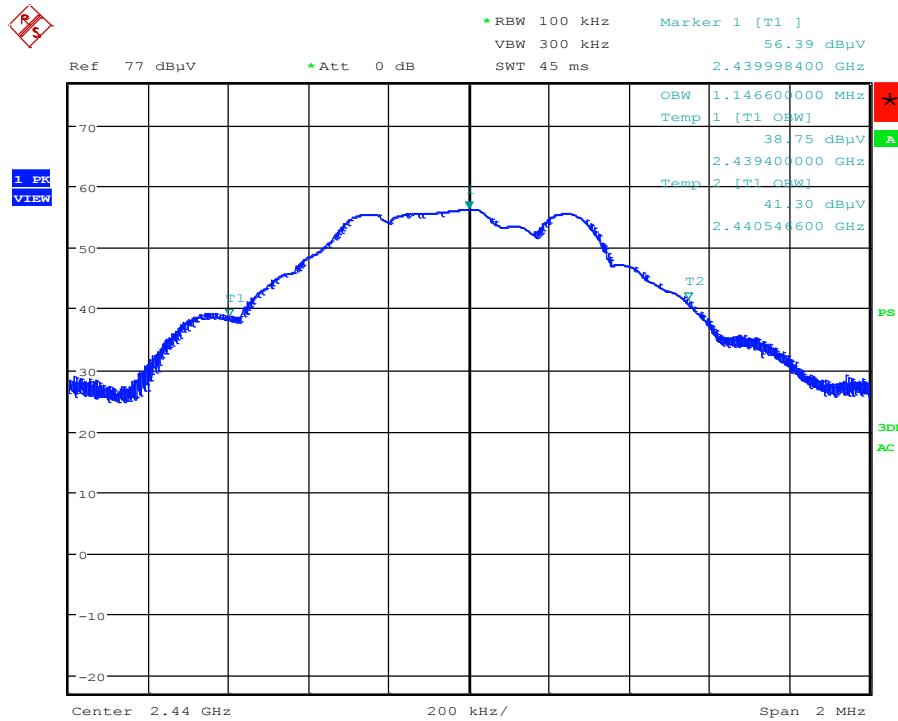
MIDDLE CHANNEL – 99% OCCUPIED BANDWIDTH, Hi data rate



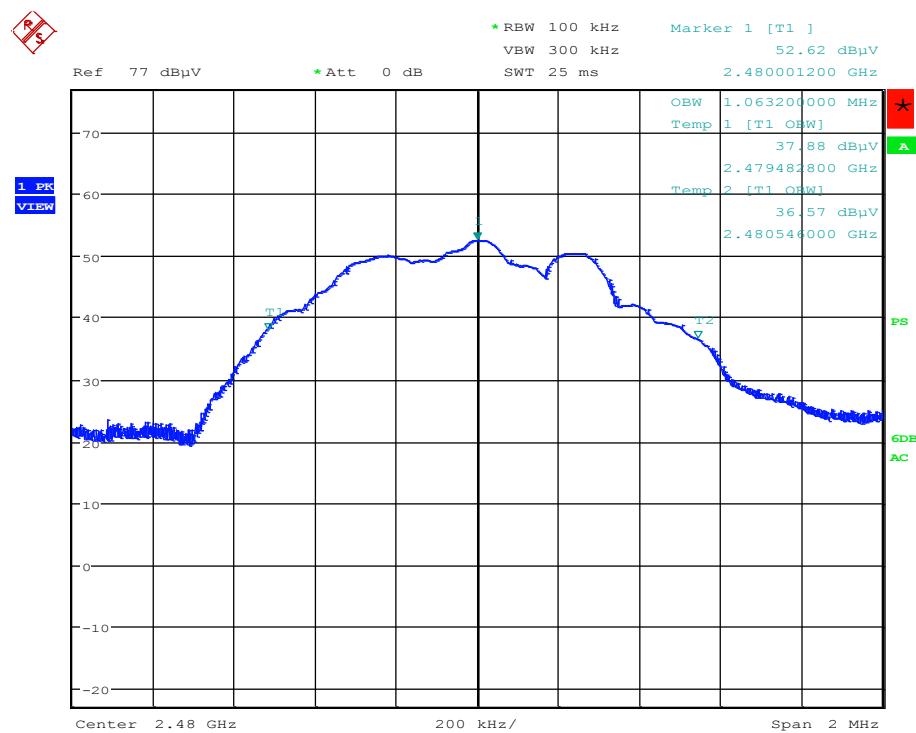
HIGH CHANNEL – 99% OCCUPIED BANDWIDTH, Hi data rate



LOW CHANNEL – 99% OCCUPIED BANDWIDTH, Low data rate



MIDDLE CHANNEL – 99% OCCUPIED BANDWIDTH, Low data rate



HIGH CHANNEL – 99% OCCUPIED BANDWIDTH, Low data rate

Part 6 - Power Spectral Density

DATE: October 08, 2015

TEST STANDARD: FCC Part 15.247 (e) and RSS 247 Issue1 5.2(2)

TEST METHOD: As called by the standards above

MINIMUM STANDARD: 8 dBm in any 3 kHz band

TEST SETUP: The EUT was connected to the DUT in conducted mode likewise for output power measurements.

METHOD OF MEASUREMENT: Measurements were made using a spectrum analyser with 3 kHz resolution bandwidth and peak detector. PSD was measured using radiated substitution method.

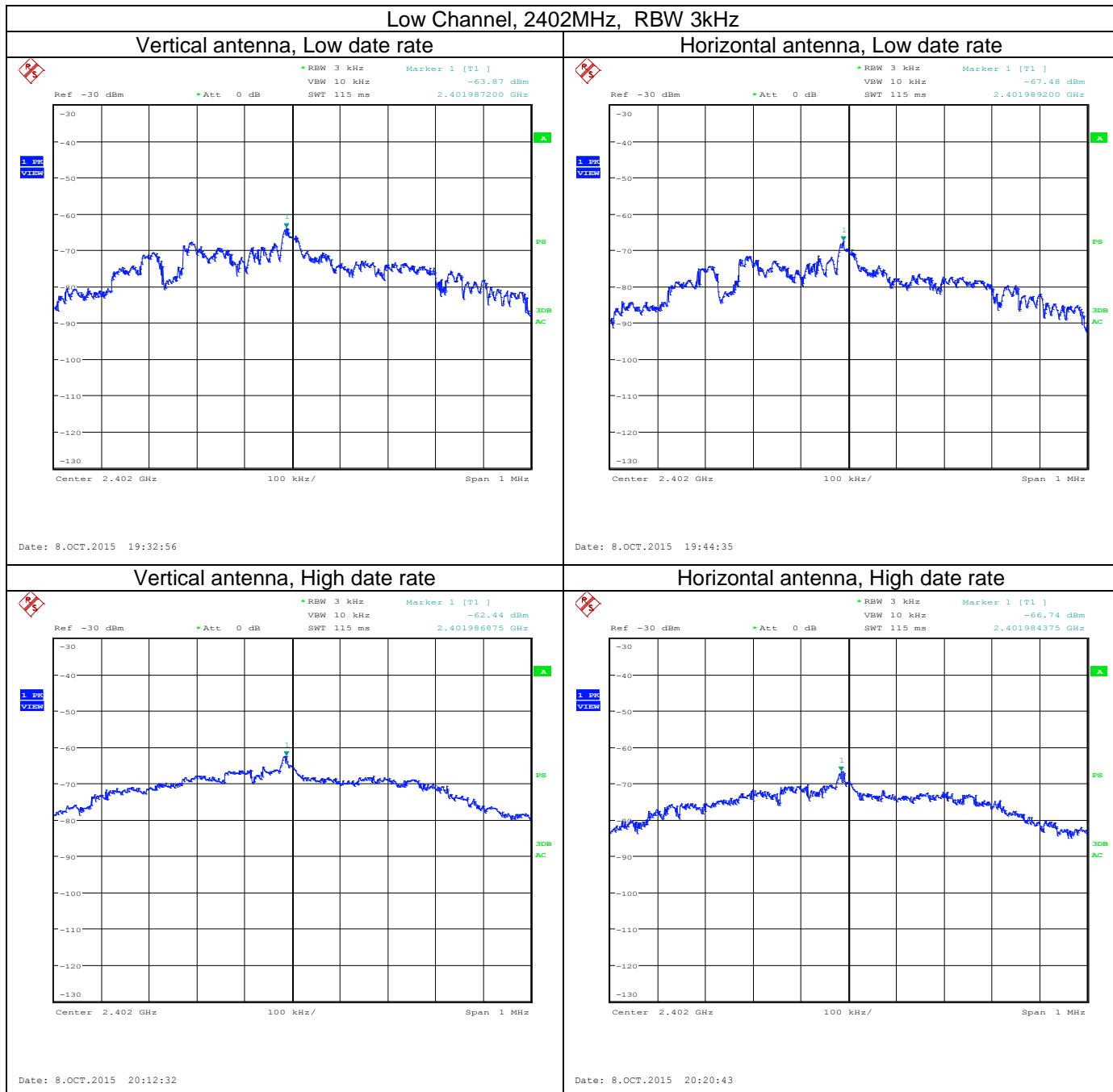
PERFORMANCE: Complies with Standard

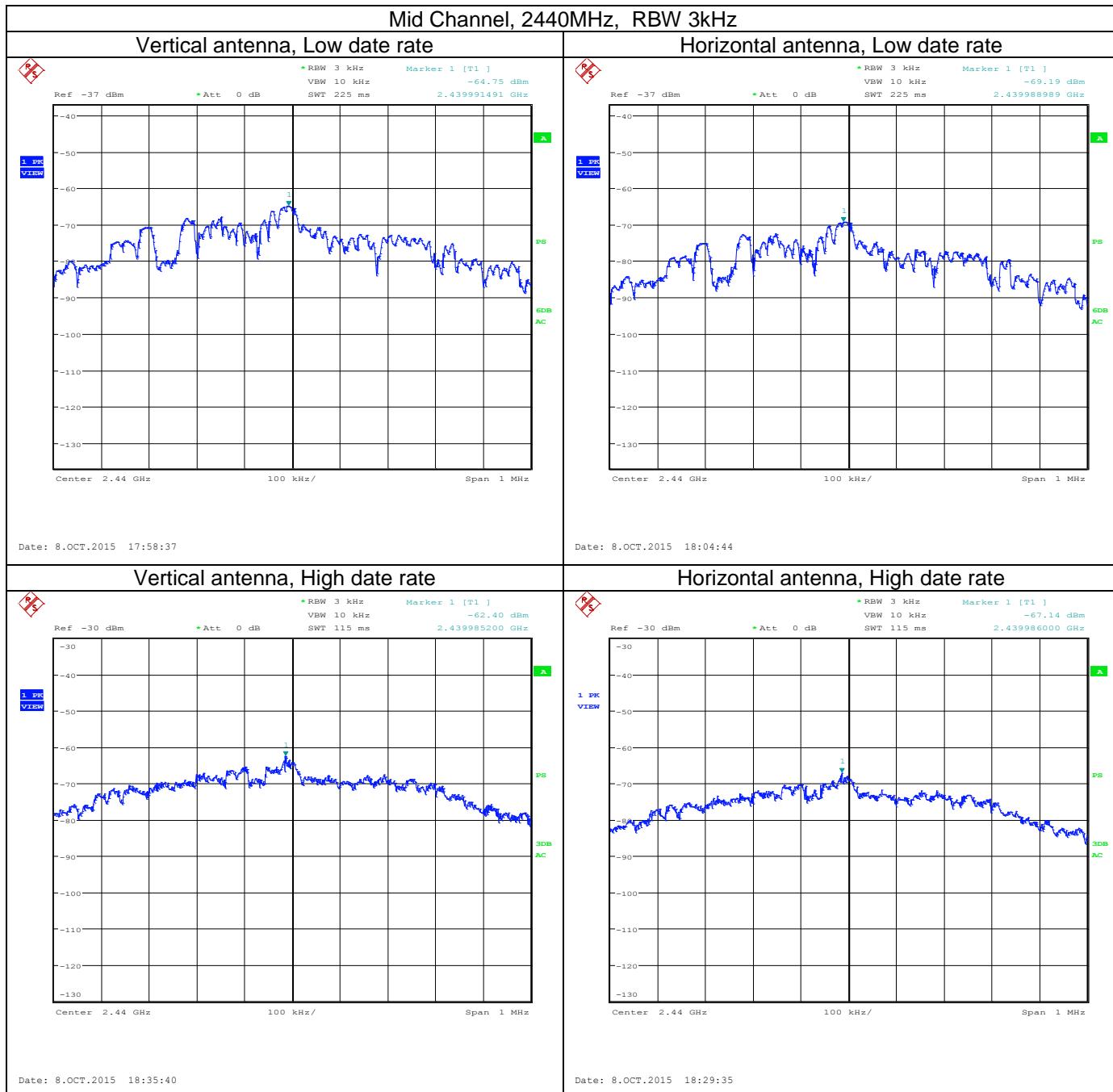
MEASUREMENT DATA & PLOT:

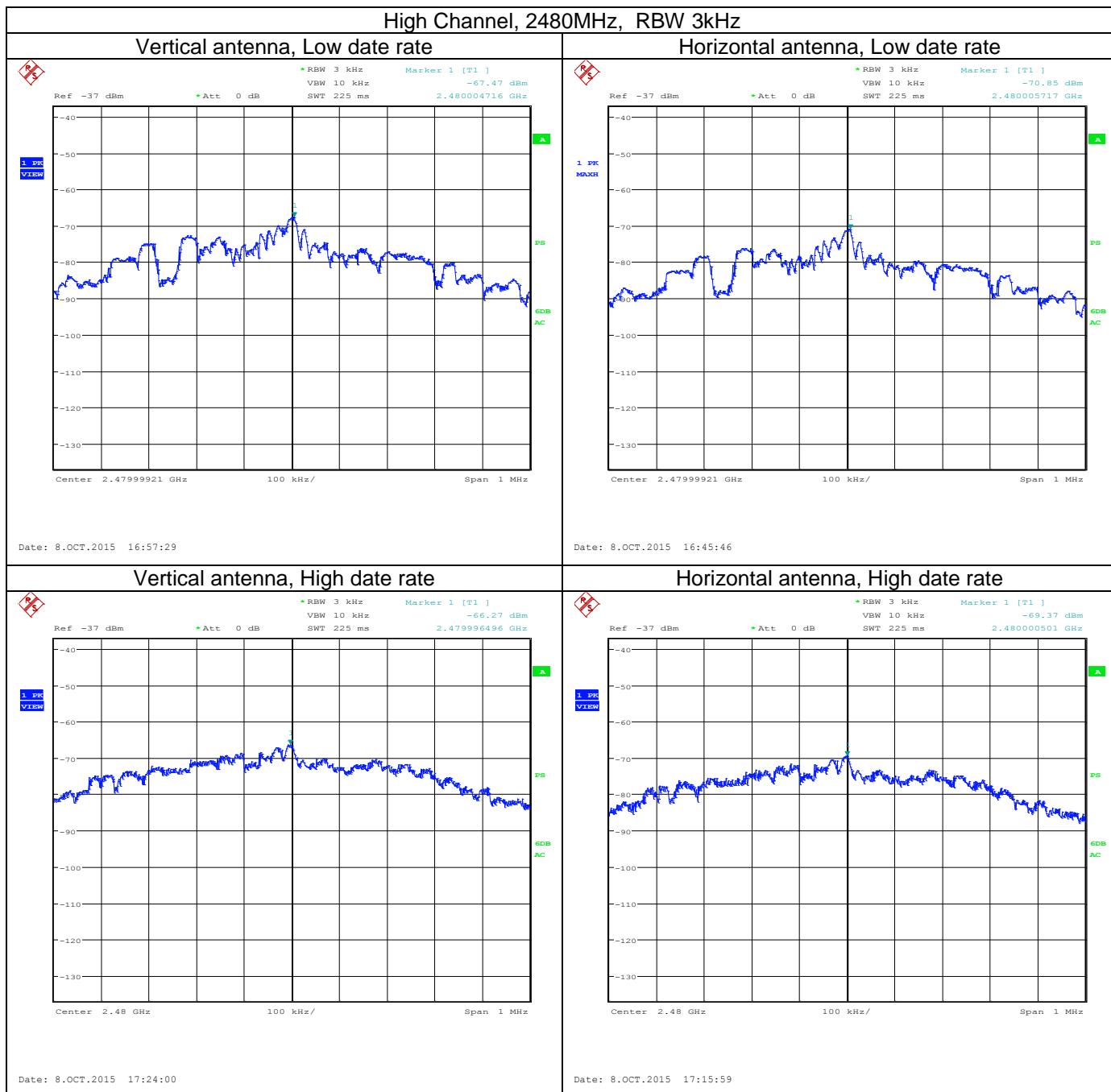
Low Channel, 2402MHz, RBW 3kHz										
Freq.	Peak-Raw	Ant-Pol	Antenna Height	Angle	Cable Loss	Antenna factor	Peak-Corrected	PSD	Limit	Data rate
(MHz)	(dBuV)	(V/H)	(cm)	(deg)	(dB)	(dBm)	(dBuV)	(dBm)	(dBm)	
2402	43.13	V	100	212	4.69	32.5	-26.68	-14.94	8	Low
2402	39.52	H	100	110	4.69	32.5	-30.29	-18.55	8	Low
2402	40.56	V	100	226	4.69	32.5	-29.25	-17.51	8	Hi
2402	40.26	H	126	108	4.69	32.5	-29.55	-17.81	8	Hi

Mid Channel, 2440MHz, RBW 3kHz										
Freq.	Peak-Raw	Ant-Pol	Antenna Height	Angle	Cable Loss	Antenna factor	Peak-Corrected	PSD	Limit	Data rate
(MHz)	(dBuV)	(V/H)	(cm)	(deg)	(dB)	(dBm)	(dBuV)	(dBm)	(dBm)	
2440	42.25	V	104.6	34.6	4.92	32.58	-27.25	-15.51	8	Low
2440	37.81	H	100	288	4.92	32.58	-31.69	-19.95	8	Low
2440	44.6	V	102	35	4.92	32.58	-24.9	-13.16	8	Hi
2440	39.86	H	100	285	4.92	32.58	-29.64	-17.9	8	Hi

High Channel, 2480MHz, RBW 3kHz										
Freq.	Peak-Raw	Ant-Pol	Antenna Height	Angle	Cable Loss	Antenna factor	Peak-Corrected	PSD	Limit	Data rate
(MHz)	(dBuV)	(V/H)	(cm)	(deg)	(dB)	(dBm)	(dBuV)	(dBm)	(dBm)	
2480	39.53	V	100	58	5.19	32.66	-29.62	-17.88	8	Low
2480	36.15	H	123	115	5.19	32.66	-33	-21.26	8	Low
2480	40.73	V	101	37	5.19	32.66	-28.42	-16.68	8	Hi
2480	37.63	H	101	110	5.19	32.66	-31.52	-19.78	8	Hi







Part 7 - Out of Band Emissions (Band Edge)

DATE: October 08, 2015

TEST STANDARD: FCC Part 15.247 (d) and RSS-247 Issue1 5.5

TEST REQUIREMENTS:

FCC Part 15.247 (d):

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator 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 the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

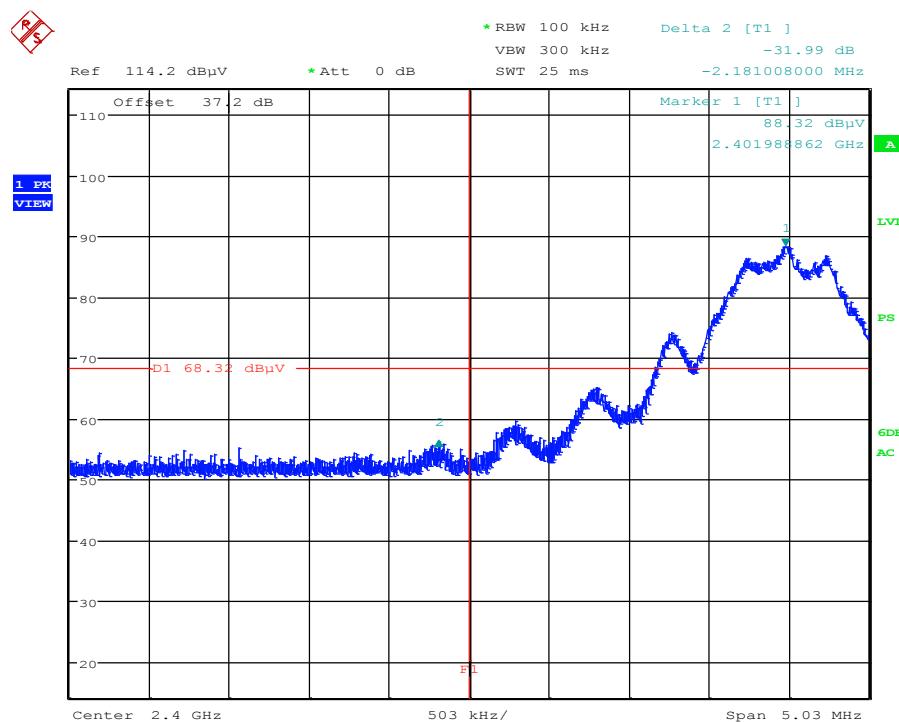
RSS-247 Issue1 5.5:

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 5.4(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.

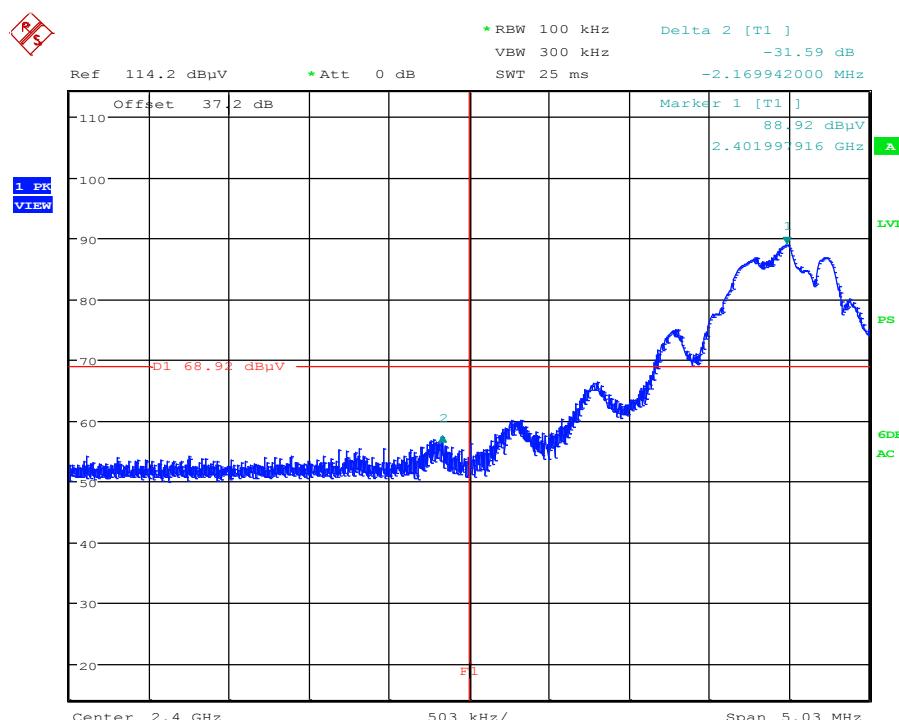
MEASUREMENT METHOD: As called by the standards above.

RESULTS: Pass: Complies

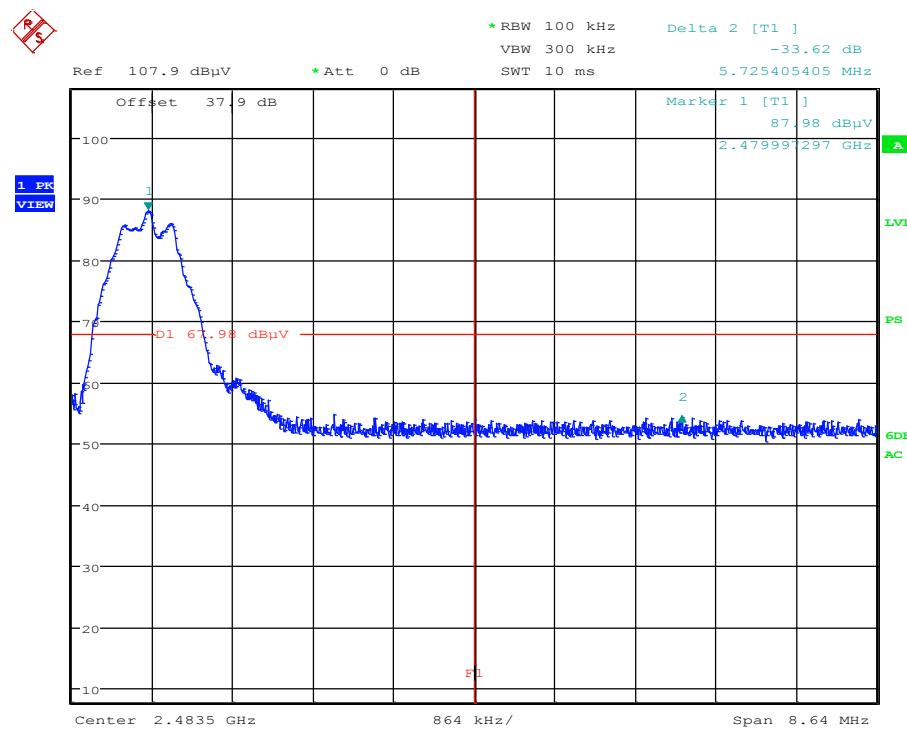
MEASUREMENT DATA & PLOT:



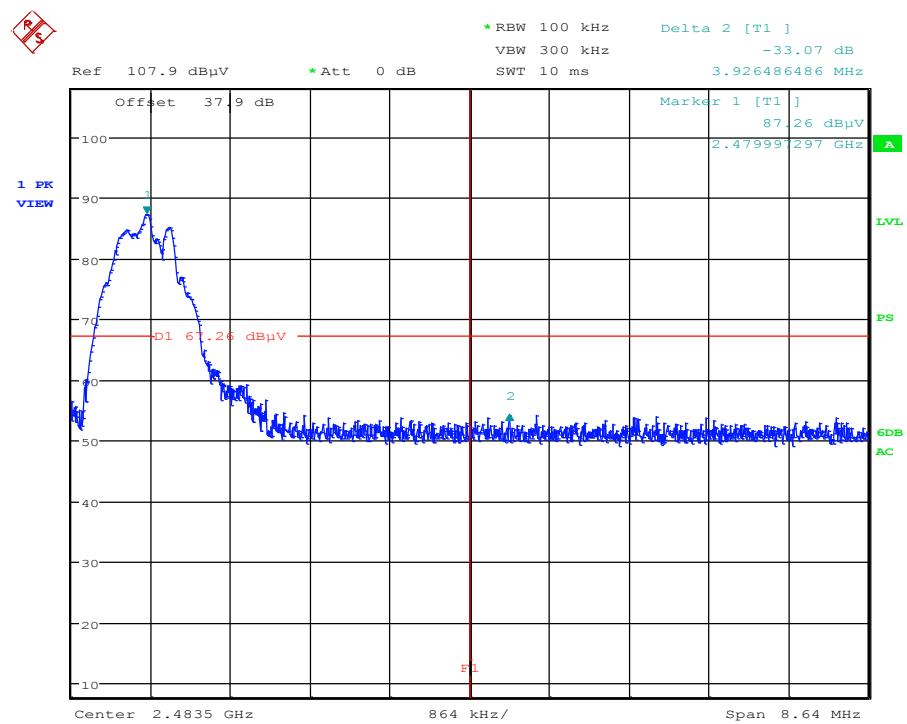
OUT OF BAND EMISSIONS - LOW CHANNEL, High data rate



OUT OF BAND EMISSIONS - LOW CHANNEL, Low data rate



OUT OF BAND EMISSIONS - HIGH CHANNEL, High data rate



OUT OF BAND EMISSIONS - HIGH CHANNEL, Low data rate

Part 8 - Radiated Spurious Emissions-Transmit Mode

DATE: October 01, 2015

TEST STANDARD: FCC Part 15.247 (d), FCC Part 15.209 (a), FCC Part 15.205, RSS-Gen Issue4 8.10, RSS-247 Issue 1 5.5

MINIMUM STANDARD: FCC Part 15.209 a):

Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength	Distance
	uV/m	m
0.009-0.49	2400/F(kHz)	300
0.49-1.705	24000/F(kHz)	30
1.705 - 30	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

FCC Part 15.247 (d):

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator 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 the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

FCC Part 15.205 (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*	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	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	156.52475-156.52525	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	162.0125-167.17	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	Above 38.6 GHz
13.36-13.41			

RSS-Gen Issue4 8.10:

Fundamental components of modulation of licence-exempt radio apparatus shall not fall within the restricted bands of the below table

MHz	MHz	GHz
0.090-0.110	240-285	9.0-9.2
2.1735-2.1905	322-335.4	9.3-9.5
3.020-3.026	399.9-410	10.6-12.7
4.125-4.128	608-614	13.25-13.4
4.17725-4.17775	960-1427	14.47-14.5
4.20725-4.20775	1435-1626.5	15.35-16.2
5.677-5.683	1645.5-1646.5	17.7-21.4
6.215-6.218	1660-1710	22.01-23.12
6.26775-6.26825	1718.8-1722.2	23.6-24.0
6.31175-6.31225	2200-2300	31.2-31.8
8.291-8.294	2310-2390	36.43-36.5
8.362-8.366	2655-2900	Above 38.6
8.37625-8.38675	3260-3267	
8.41425-8.41475	3332-3339	
12.29-12.293	3345.8-3358	
12.51975-12.52025	3500-4400	
12.57675-12.57725	4500-5150	
13.36-13.41	5350-5460	
16.42-16.423	7250-7750	
16.69475-16.69525	8025-8500	
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		

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.

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

RSS-247 Issue 1 5.5:

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 5.4(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.

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 10 kHz to 25 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).

PERFORMANCE:

Complies with Standard

EMISSIONS DATA:

1. Radiated Emissions test was performed from 9 kHz-25GHz
2. All emissions below 1GHz were more than 20dB lower than the limit line.
3. Except the emissions reported below, all emissions above 1GHz were more than 20dB lower than the limit.

Freq.	Peak-Raw	Average-Raw	Pol.	Antenna Height	Angle	Loss	Antenna factor	Peak-Corr.	Average-Corr.	Peak Limit	Average Limit
MHz	dBuV	dBuV	V/H	cm	deg	dB	dB/m	dBuV/m	dBuV/m	dBuV/m	dBuV/m
High Channel											
4960	46.08	35.54	H	100	310	-23.87	34.1	56.31	45.77	74	54
4960	43.01	30.4	V	101	148	-23.87	34.1	53.24	40.63	74	54
7439.99	31.5	22.8	H	146	58	-18.67	35.58	48.41	39.71	74	54
7439.99	31.85	21	V	123	148	-18.67	35.58	48.76	37.91	74	54
Middle Channel											
4880	45.1	34.7	H	100	133	-24.09	34.1	55.11	44.71	74	54
4880	43.7	33.4	V	100	133	-24.09	34.1	53.71	43.41	74	54
7319.99	32	22.4	H	138	68	-19.42	35.53	48.11	38.51	74	54
7319.99	32.2	23.1	V	133	126	-19.42	35.53	48.31	39.21	74	54
Low Channel											
4804	45.96	35.3	H	110	105	-24.91	34.1	55.15	44.49	74	54
4804	43.1	33.2	V	100	360	-24.91	34.1	52.29	42.39	74	54
7206	31.86	22.8	H	125	310	-20.19	34.1	45.77	36.71	74	54
7206	31.6	21.9	V	100	58	-20.19	34.1	45.51	35.81	74	54

Part 9 - RF Exposure Evaluation

DATE: October 23, 2015

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

TABLE 1 - POWER DENSITY LIMITS

RF EXPOSURE EVALUATION DISTANCE CALCULATION

From the above Table, 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.

Max EIRP	Max EIRP	Power Density Limit	Safe distance
dBm	mW	mW/cm ²	cm
-1.04	0.79	1	0.25

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

Where: d = Distance to the center of radiation of the antenna (cm) for the allowable

S = Allowable Power density Limit (mW/cm²)

EIRP = Equivalent isotropically radiated power (mW)

As shown above, the minimum distance where the MPE limit is reached is 0.25 cm from the EUT. The EUT is safe for touching with a hand when it transmits signal, if the space between the case surface and the antenna is taken into account.

Part 10 - Frequency Stability

DATE: October 13, 2015

TEST STANDARD: FCC Part 15.215(c) and RSS-Gen Issue 4 (8.11)

MINIMUM STANDARD: RSS-Gen Issue 4 (8.11):

Transmitter frequency stability for licence-exempt radio apparatus shall be measured in accordance with Section 6.11. For licence-exempt radio apparatus, the frequency stability shall be measured at temperatures of -20°C (-4°F), +20°C (+68°F) and +50°C (+122°F) instead of at the temperatures specified in Section 6.11.

If the frequency stability of the licence-exempt radio apparatus is not specified in the applicable standard (RSS), measurement of the frequency stability is not required provided that the occupied bandwidth of the licence-exempt radio apparatus lies entirely outside the restricted bands and the prohibited TV bands of 54-72 MHz, 76-88 MHz, 174-216 MHz, 470-608 MHz and 614-806 MHz

FCC (15.215(c) :

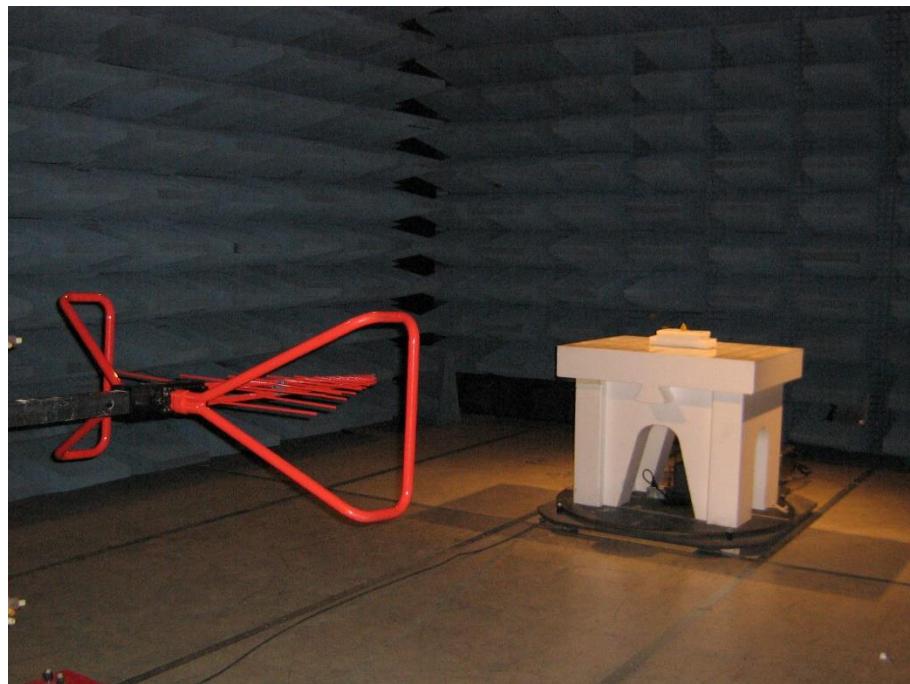
The 20dB bandwidth must remain within the designated frequency band over the expected variations in temperature and voltage range

TEST SETUP: The EUT was bench tested and in our temperature chamber. The EUT voltage and temperature range was specified by the manufacturer. The transmitter was set for Carrier Wave (CW) mode and the lowest, middle and highest channel frequency was measured at each temperature setting. Measurements were made using a Spectrum Analyzer with 100Hz RBW, 300Hz VBW and average detector.

Measurement Data:

Temp DegC	Channel	Voltage	Frequency GHz	Freq Shift Hz	PPM	Uncorrected Peak Power dBm
20	Low	3.6	2.402000494	292	0.1	-39.3
		3	2.402000202	0	0.0	-39.2
		1.8	2.401999162	-1040	-0.4	-39.4
	Mid	3.6	2.440000884	686	0.3	-45.9
		3	2.440000198	0	0.0	-45.8
		1.8	2.439999174	-1024	-0.4	-45.1
	High	3.6	2.480000718	432	0.2	-50.9
		3	2.480000286	0	0.0	-50.6
		1.8	2.479999198	-1088	-0.4	-50.5
30	Low	3.6	2.401992012	-8190	-3.4	-40.0
		3	2.40199154	-8662	-3.6	-38.9
		1.8	2.401990502	-9700	-4.0	-39.0
	Mid	3.6	2.43999171	-8488	-3.5	-46.5
		3	2.439991458	-8740	-3.6	-46.5
		1.8	2.43999129	-8908	-3.7	-49.3
	High	3.6	2.479992396	-7890	-3.2	-51.2
		3	2.479991472	-8814	-3.6	-51.1
		1.8	2.479990406	-9880	-4.0	-50.9
40	Low	3.6	2.40198315	-17052	-7.1	-39.8
		3	2.401982758	-17444	-7.3	-39.8
		1.8	2.401981754	-18448	-7.7	-39.8
	Mid	3.6	2.439982738	-17460	-7.2	-44.0
		3	2.43998237	-17828	-7.3	-44.3
		1.8	2.439981368	-18830	-7.7	-43.9
	High	3.6	2.479983444	-16842	-6.8	-51.4
		3	2.479982262	-18024	-7.3	-51.3
		1.8	2.479982028	-18258	-7.4	-50.6
50	Low	3.6	2.401975676	-24526	-10.2	-39.6
		3	2.401975222	-24980	-10.4	-39.6
		1.8	2.401974292	-25910	-10.8	-39.5
	Mid	3.6	2.439975498	-24700	-10.1	-43.6
		3	2.439974902	-25296	-10.4	-43.3
		2.2	2.43997505	-25148	-10.3	-44.1
	High	3.6	2.47997489	-25396	-10.2	-49.1
		3	2.47997445	-25836	-10.4	-49.1
		1.8	2.47997313	-27156	-10.9	-49.0
60	Low	3.6	2.401971262	-28940	-12.0	-39.9
		3	2.401970852	-29350	-12.2	-40.0

		1.8	2.401968038	-32164	-13.4	-39.8	
Mid	3.6	2.439970862	-29336	-12.0	-44.0		
		3	2.439970484	-29714	-12.2	-44.3	
	1.8	2.43996922	-30978	-12.7	-43.6		
	High	3.6	2.47997054	-29746	-12.0	-53.6	
70		3	2.47996996	-30326	-12.2	-53.4	
		1.8	2.479968392	-31894	-12.9	-53.5	
Low	3.6	2.401970326	-29876	-12.4	-39.4		
	3	2.401969732	-30470	-12.7	-39.4		
	1.8	2.401968084	-32118	-13.4	-39.7		
Mid	3.6	2.439969476	-30722	-12.6	-44.6		
	3	2.439969026	-31172	-12.8	-44.4		
	1.8	2.43996738	-32818	-13.4	-44.8		
High	3.6	2.479968868	-31418	-12.7	-54.3		
	3	2.479968332	-31954	-12.9	-54.6		
	1.8	2.479966622	-33664	-13.6	-54.8		
75	Low	3.6	2.40197023	-29972	-12.5	-40.7	
		3	2.401969814	-30388	-12.7	-40.8	
		1.8	2.401968324	-31878	-13.3	-41.0	
	Mid	3.6	2.439970114	-30084	-12.3	-45.1	
		3	2.439969762	-30436	-12.5	-45.6	
		1.8	2.439968172	-32026	-13.1	-45.2	
	High	3.6	2.479970068	-30218	-12.2	-56.3	
		3	2.479969636	-30650	-12.4	-56.3	
		1.8	2.479967878	-32408	-13.1	-56.1	
10	Low	3.6	2.40200727	7068	2.9	-40.6	
		3	2.402006918	6716	2.8	-40.3	
		1.8	2.402005994	5792	2.4	-40.4	
	Mid	3.6	2.440007828	7630	3.1	-47.7	
		3	2.440007354	7156	2.9	-47.8	
		1.8	2.440006266	6068	2.5	-47.3	
	High	3.6	2.480008008	7722	3.1	-50.4	
		3	2.480007326	7040	2.8	-53.0	
		1.8	2.480006254	5968	2.4	-50.7	
0	Low	3.6	2.40201256	12358	5.1	-39.2	
		3	2.402012072	11870	4.9	-39.2	
		1.8	2.402010878	10676	4.4	-39.3	
	Mid	3.6	2.440012816	12618	5.2	-44.8	
		3	2.440012346	12148	5.0	-44.8	
		1.8	2.440011074	10876	4.5	-44.9	
	High	3.6	2.480013078	12792	5.2	-52.0	
		3	2.480012598	12312	5.0	-51.7	
		1.8	2.480011168	10882	4.4	-51.3	
-10	Low	3.6	2.402014058	13856	5.8	-39.0	
		3	2.402013562	13360	5.6	-39.5	
		1.8	2.402011938	11736	4.9	-39.1	
	Mid	3.6	2.440014286	14088	5.8	-45.7	
		3	2.440013744	13546	5.6	-44.5	
		1.8	2.440012126	11928	4.9	-45.2	
	High	3.6	2.480014496	14210	5.7	-51.9	
		3	2.480013976	13690	5.5	-52.0	
		1.8	2.480012296	12010	4.8	-51.9	
-20	Low	3.6	2.402010726	10524	4.4	-39.5	
		3	2.402009894	9692	4.0	-39.5	
		1.8	2.402007798	7596	3.2	-39.4	
	Mid	3.6	2.440010928	10730	4.4	-45.3	
		3	2.440010152	9954	4.1	-45.6	
		1.8	2.440007932	7734	3.2	-45.3	
	High	3.6	2.480010778	10492	4.2	-52.1	
		3	2.480010274	9988	4.0	-52.2	
		1.8	2.480008388	8102	3.3	-52.1	
-30	Low	3.6	2.402001628	1426	0.6	-39.5	
		3	2.402000472	270	0.1	-39.5	
		1.8	2.40199809	-2112	-0.9	-38.9	
	Mid	3.6	2.440000492	294	0.1	-45.8	
		3	2.440000372	174	0.1	-45.3	
		1.8	2.439997894	-2304	-0.9	-46.7	
	High	3.6	2.480001092	806	0.3	-52.4	
		3	2.480000524	238	0.1	-52.4	
		1.8	2.479997948	-2338	-0.9	-52.0	

Appendix A: photos during the testing

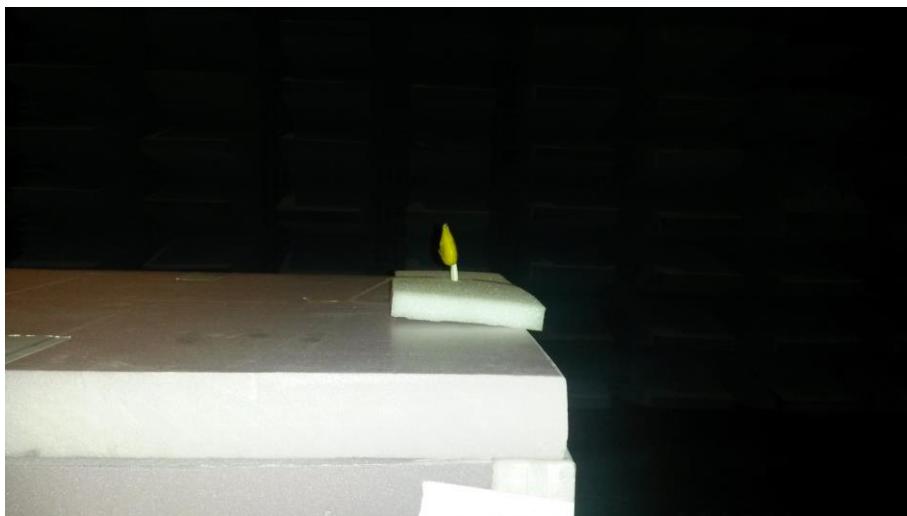
Radiated Emissions Setup in Semi-Anechoic Chamber, 30MHz-1GHz



Radiated Emissions Setup in Semi-Anechoic Chamber, 30MHz-1GHz



Radiated Emissions Setup in Semi-Anechoic Chamber, 1GHz-18GHz



Radiated Emissions Setup in Semi-Anechoic Chamber, 1GHz-18GHz