

EMC Test Report

Project Number: 4186592**Report Number:** 4186592EMC03**Revision Level:** 2**Client:** QSR Automations, Inc.**Equipment Under Test:** xCeed**Brand Name:** QSR**Model Number:** DE-4200**FCC ID:** 2AJX7XCEED2**IC ID:** 21998-XCEED2**Applicable Standards:** FCC Part 15 Subpart C, § 15.247

RSS-247, Issue 2, February 2017

ANSI C63.10: 2013

RSS-GEN, Issue 5, April 2018

Report issued on: 21 May 2018**Test Result:** Compliant**Rev. Report issued on:** 14 November 2018**Test Result:** Compliant

Tested by:


Martin Taylor, Project Engineer

Reviewed by:


Jeremy Pickens, Senior EMC Engineer

Remarks: This report details the results of the testing carried out on one sample, the results contained in this test report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.


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Rev. 2 Tested by:


Martin Taylor, Project Engineer

Rev. 2 Reviewed by:


Shawn McGuinness, EMC Engineering Leader

Remarks: This report details the results of the testing carried out on one sample, the results contained in this test report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

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Table of Contents

1	SUMMARY OF TEST RESULTS.....	5
1.1	MODIFICATIONS REQUIRED FOR COMPLIANCE	5
2	GENERAL INFORMATION.....	6
2.1	CLIENT INFORMATION	6
2.2	TEST LABORATORY	6
2.3	GENERAL INFORMATION OF EUT	6
2.4	OPERATING MODES AND CONDITIONS	6
2.5	EUT CONNECTION BLOCK DIAGRAM – CONDUCTED MEASUREMENTS.....	7
2.6	EUT CONNECTION BLOCK DIAGRAM – RADIATED MEASUREMENTS	7
2.7	SYSTEM CONFIGURATIONS	8
2.8	CABLE LIST	8
3	BANDWIDTH	9
3.1	TEST RESULT.....	9
3.2	TEST METHOD.....	9
3.3	TEST SITE	9
3.4	TEST EQUIPMENT	9
3.5	TEST DATA.....	9
4	OUTPUT POWER	11
4.1	TEST RESULT.....	11
4.2	TEST METHOD.....	11
4.3	TEST SITE	11
4.4	TEST EQUIPMENT	11
4.5	TEST DATA.....	12
5	POWER SPECTRAL DENSITY	13
5.1	TEST RESULT.....	13
5.2	TEST METHOD.....	13
5.3	TEST SITE	13
5.4	TEST EQUIPMENT	13
5.5	TEST DATA.....	14
6	CONDUCTED SPURIOUS EMISSIONS / BAND EDGE.....	15
6.1	TEST RESULT.....	15
6.2	TEST METHOD.....	15
6.3	TEST SITE	15
6.4	TEST EQUIPMENT	15
6.5	TEST DATA – DTS BAND EDGE.....	16
6.6	TEST DATA – CONDUCTED SPURIOUS EMISSIONS	17
7	FIELD STRENGTH OF SPURIOUS RADIATION.....	18
7.1	TEST RESULT.....	18
7.2	TEST METHOD.....	18
7.3	TEST SITE	18
7.4	TEST EQUIPMENT	19
7.5	TEST DATA – PEAK PLOTS.....	20
7.6	TEST DATA – TABULAR DATA.....	27
8	RADIATED EMISSIONS AT BAND EDGE / RESTRICTED BAND	28
8.1	TEST RESULT.....	28
8.2	TEST METHOD.....	28

8.3	TEST SITE	28
8.4	TEST EQUIPMENT	28
8.5	TEST DATA – RESTRICTED BAND EDGE	29
9	AC POWERLINE CONDUCTED EMISSIONS.....	30
9.1	TEST RESULT.....	30
9.2	TEST METHOD.....	30
9.3	TEST SITE	30
9.4	TEST EQUIPMENT	30
9.5	TEST DATA.....	31
10	REVISION HISTORY	33

1 Summary of Test Results

Test Description	Test Specification		Test Result
Bandwidth	15.247(d)	RSS-247 S5.2 (1) RSS-GEN S6.6	Compliant
Transmitter Output Power	15.247(b)(3)	RSS-247 S5.4 (4)	Compliant
Power Spectral Density	15.247(e)	RSS-247 S5.2 (2)	Compliant
Conducted Spurious Emissions / Band Edge	15.247(d)	RSS-247 S5.5	Compliant
Radiated Spurious Emissions / Restricted Bands	15.35(b), 15.209	RSS-GEN S6.13 RSS-GEN S8.10	Compliant
Antenna Requirement	15.203	RSS-GEN S8.3	Compliant ⁽¹⁾
AC Powerline Conducted Emissions, Class A	15.107, 15.207	RSS-GEN S8.8	Compliant

(1) The device uses a PCB trace antenna. It is not replaceable by the end user.

1.1 Modifications Required for Compliance

None

2 General Information

2.1 Client Information

Name: QSR Automations, Inc.
Address: 2301 Stanley Gault Pkwy
City, State, Zip, Country: Louisville, KY 40223, USA

2.2 Test Laboratory

Name: SGS North America, Inc.
Address: 620 Old Peachtree Road NW, Suite 100
City, State, Zip, Country: Suwanee, GA 30024, USA

Accrediting Body: A2LA
Type of lab: Testing Laboratory
Certificate Number: 3212.01

2.3 General Information of EUT

Type of Product: xCeed
Model Number: DE-4200
Serial Number: Not labeled

Frequency Range: 2402-2480MHz
Data Modes: Bluetooth Low Energy
Antenna: PCB Trace Antenna (0.4dB)

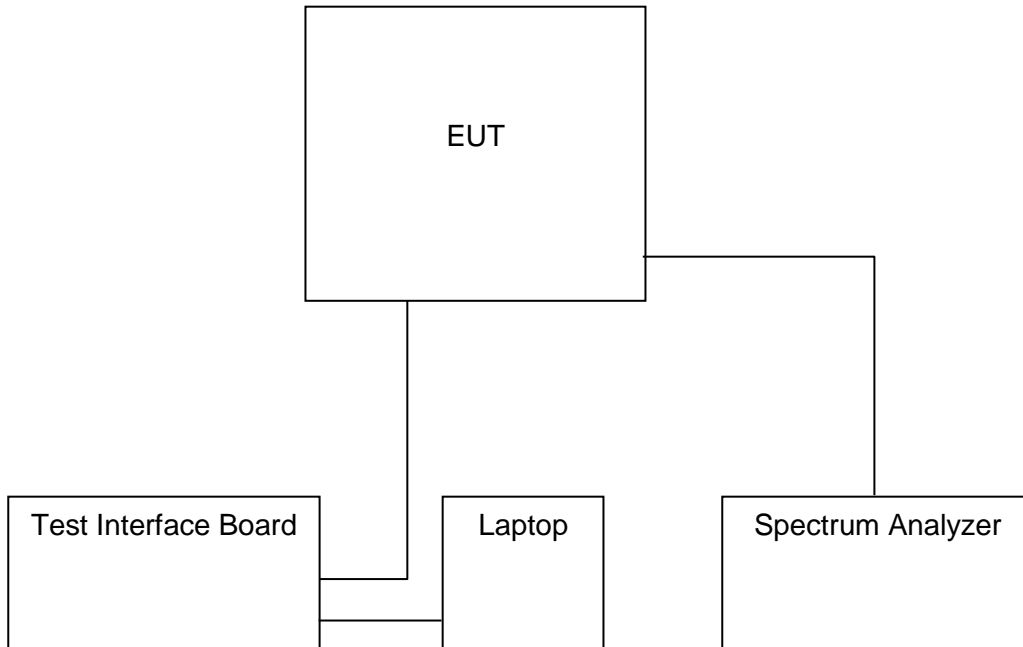
Rated Voltage: 100-240Vac, 50/60Hz
Test Voltage: 120Vac, 60Hz

Radiated Sample Received Date: 04 August 2017
Conducted Sample Received Date: 21 August 2017
Dates of testing: 04 August to 07 September 2017

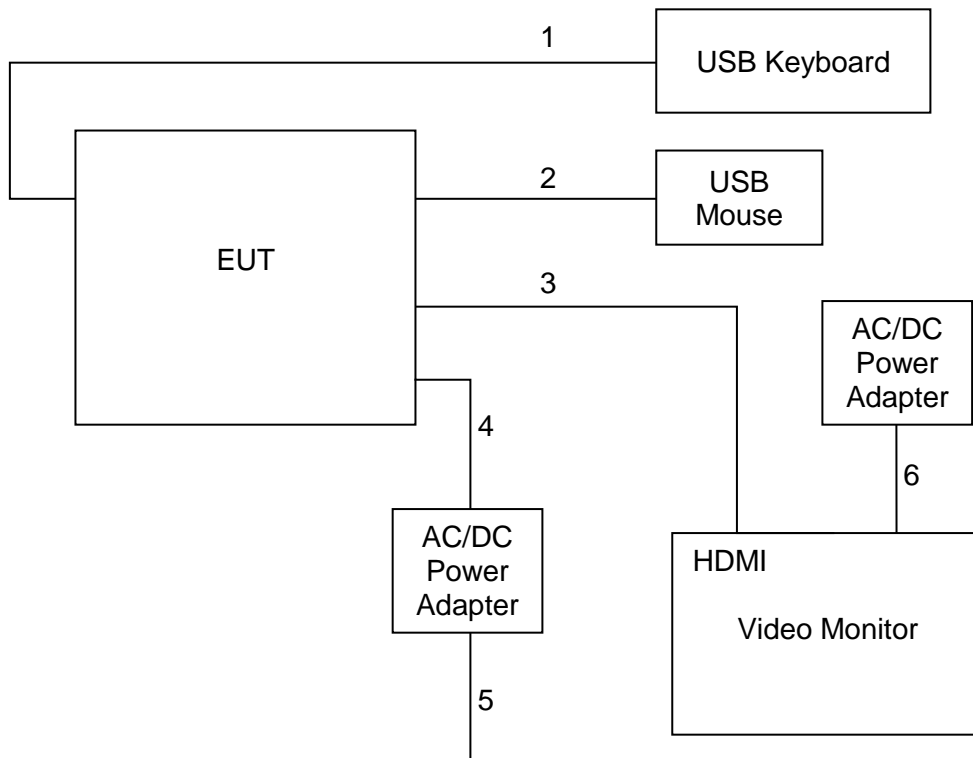
2.4 Operating Modes and Conditions

Continuous traffic was generated using test commands. Where the duty cycle measured below 99% and an RMS detector was employed, corrections of $10 \cdot \log(1/D)$ were applied according to KDB publication 558074 D01 DTS Meas Guidance v03r05.

2.5 EUT Connection Block Diagram – Conducted Measurements



2.6 EUT Connection Block Diagram – Radiated Measurements



2.7 System Configurations

Manufacturer	Description	Model Number	Serial Number
QSR Automations	Media Device (EUT)	DE-4200	Not labeled
Shenzhen Fujia Appliance Co., LTD	AC/DC Power Adapter (for EUT)	FJ-SW20180902000	Not labeled
Inland	USB Keyboard	810697	010110046656
Microsoft	USB Mouse	1080	
LG	Video Monitor	24M37H	506NTTQ9W017
LG	AC/DC Power Adapter (for Video Monitor)	ADS-25FSG-19	HF5LB62768613E714

2.8 Cable List

Cable reference	Port Name	Start	End	Cable Length (m)	Ferrite installed?	Shielded?
1	USB	EUT	USB Keyboard	1.35	No	No
2	USB	EUT	USB Mouse	1.9	Yes	No
3	HDMI	EUT	Video Monitor	1.82	Yes	Yes
4	DC Power	EUT	AC/DC Power Adapter	1.5	No	Yes
5	AC Power	AC/DC Power Adapter	AC Mains	1.5	No	No
6	DC Power	Video Monitor	AC/DC Power Adapter	1.5	No	No

3 Bandwidth

3.1 Test Result

Test Description	Test Specification		Test Result
6 dB bandwidth / 99% OBW	15.247(d)	RSS-247 S5.2 (1) RSS-GEN S6.6	Compliant

3.2 Test Method

The procedures from ANSI C63.10: 2013 clause 11.8 and 558074 D01 DTS Meas Guidance v04 were used to determine the 6 dB bandwidth and 99% OBW.

3.3 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 24.9 °C

Relative Humidity: 46.2 %

Atmospheric Pressure: 97.9 kPa

3.4 Test Equipment

Test End Date: 28-Aug-2017

Tester: MT

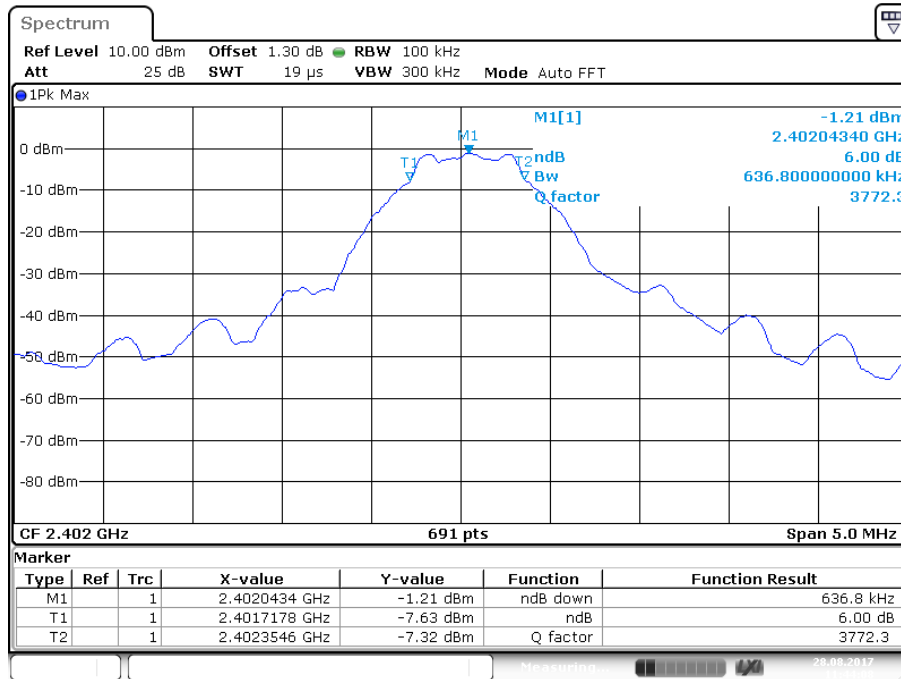
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
SIGNAL ANALYZER	FSV30	ROHDE & SCHWARZ	B085749	8-Oct-2017
RF CABLE	141	HUBER & SUHNER	B095590	26-Jul-2018

Note: The equipment calibration period is 1 year except for the FSV which is on a 2 year cycle.

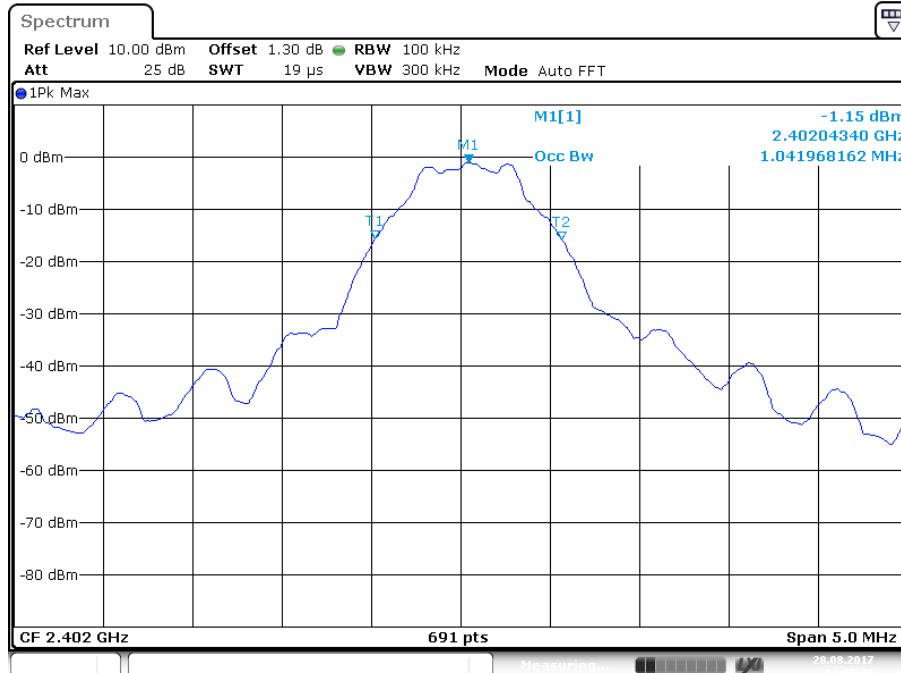
3.5 Test Data

Protocol	Channel	6dB Bandwidth (MHz)	Occupied Bandwidth (99%) (MHz)
BLE	0	0.637	1.042
BLE	19	0.637	1.035
BLE	39	0.637	1.042

Sample Plots:



Date: 28.AUG.2017 11:44:08



Date: 28.AUG.2017 14:08:12

4 Output Power

4.1 Test Result

Test Description	Test Specification		Test Result
Peak Output Power	15.247(b)(3)	RSS-247 S5.4 (4)	Compliant

4.2 Test Method

Fundamental peak power measurements were recorded using the procedures from ANSI C63.10: 2013 clause 11.9 and KDB 558074 D01 Measurement Guidance v04.

Limit

(3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. For using antennas with greater than 6dBi of gain, the limit is reduced in dB by the amount the gain exceeds 6dBi (e.g. for a 7.4dBi antenna, the limit is reduced from 30dBm to 28.6dBm)

4.3 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 24.9 °C

Relative Humidity: 46.2 %

Atmospheric Pressure: 97.9 kPa

4.4 Test Equipment

Test End Date: 28-Aug-2017

Tester: MT

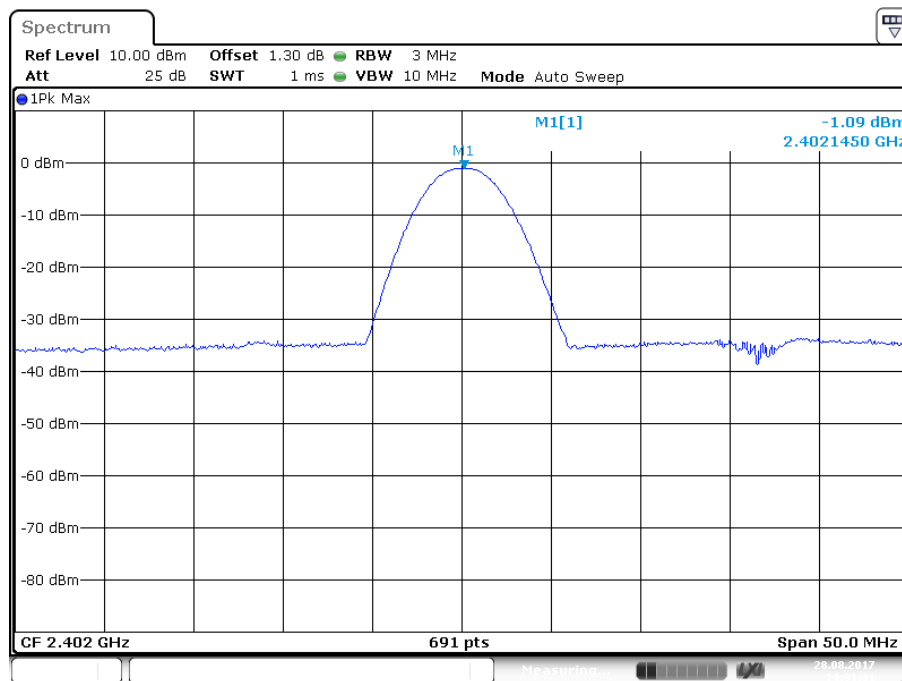
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
SIGNAL ANALYZER	FSV30	ROHDE & SCHWARZ	B085749	8-Oct-2017
RF CABLE	141	HUBER & SUHNER	B095590	26-Jul-2018

Note: The equipment calibration period is 1 year except for the FSV which is on a 2 year cycle.

4.5 Test Data

Protocol	Channel	Peak Power (dBm)	Limit (dBm)	Margin (dB)
BLE	0	-1.09	30	-31.09
BLE	19	-0.84	30	-30.84
BLE	39	-0.74	30	-30.74

Sample Plot:



Date: 28.AUG.2017 14:31:32

5 Power Spectral Density

5.1 Test Result

Test Description	Test Specification		Test Result
Power Spectral Density	15.247(e)	RSS-247 S5.2 (2)	Compliant

5.2 Test Method

Power spectral density measurements were recorded using the procedures from ANSI C63.10: 2013 clause 11.10 and KDB 558074 D01 Measurement Guidance v04.

Limit

The limit is 8 dBm / 3 kHz.

5.3 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 24.9 °C

Relative Humidity: 46.2 %

Atmospheric Pressure: 97.9 kPa

5.4 Test Equipment

Test End Date: 28-Aug-2017

Tester: MT

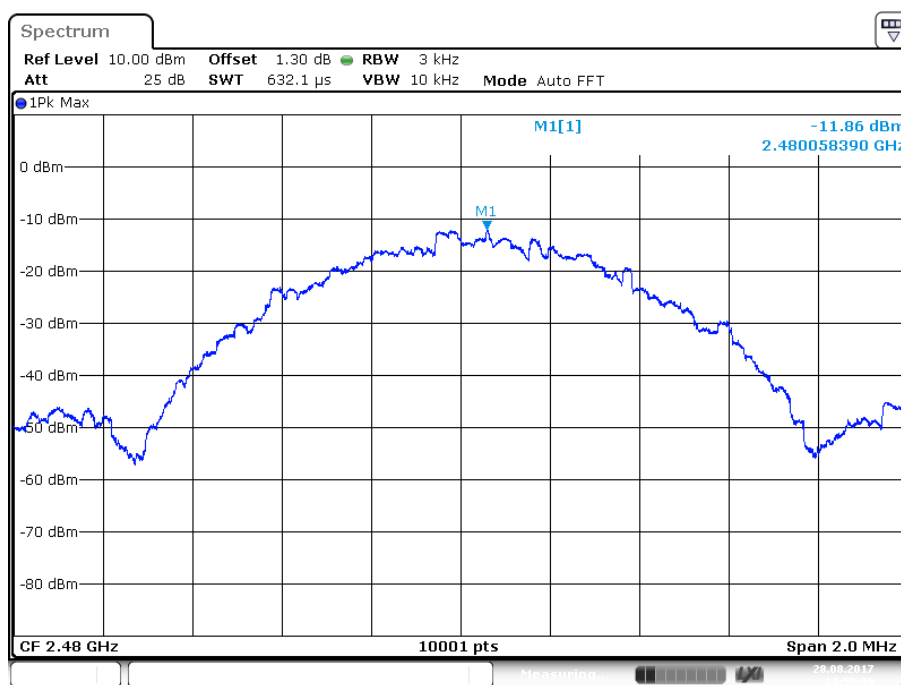
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
SIGNAL ANALYZER	FSV30	ROHDE & SCHWARZ	B085749	8-Oct-2017
RF CABLE	141	HUBER & SUHNER	B095590	26-Jul-2018

Note: The equipment calibration period is 1 year except for the FSV which is on a 2 year cycle.

5.5 Test Data

Protocol	Channel	Peak PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
BLE	0	-12.68	8	-20.68
BLE	19	-12.39	8	-20.39
BLE	39	-11.86	8	-19.86

Sample Plot:



Date: 28.AUG.2017 14:59:10

6 Conducted Spurious Emissions / Band Edge

6.1 Test Result

Test Description	Test Specification		Test Result
Conducted Spurious Emissions	15.247(d)	RSS-247 S5.5	Compliant

6.2 Test Method

Spurious emissions in non-restricted frequency bands were recorded using the methods defined in ANSI C63.10: 2013 clause 11.11 and KDB 558074 D01 Measurement Guidance v04.

Lowest, middle, and highest channels were investigated.

Because the maximum conducted peak output power was used to determine compliance with the output power limits, the limit in any 100 kHz band outside of the authorized band is 20 dB below the maximum in-band peak level.

6.3 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 24.9 °C

Relative Humidity: 46.2 %

Atmospheric Pressure: 97.9 kPa

6.4 Test Equipment

Test End Date: 28-Aug-2017

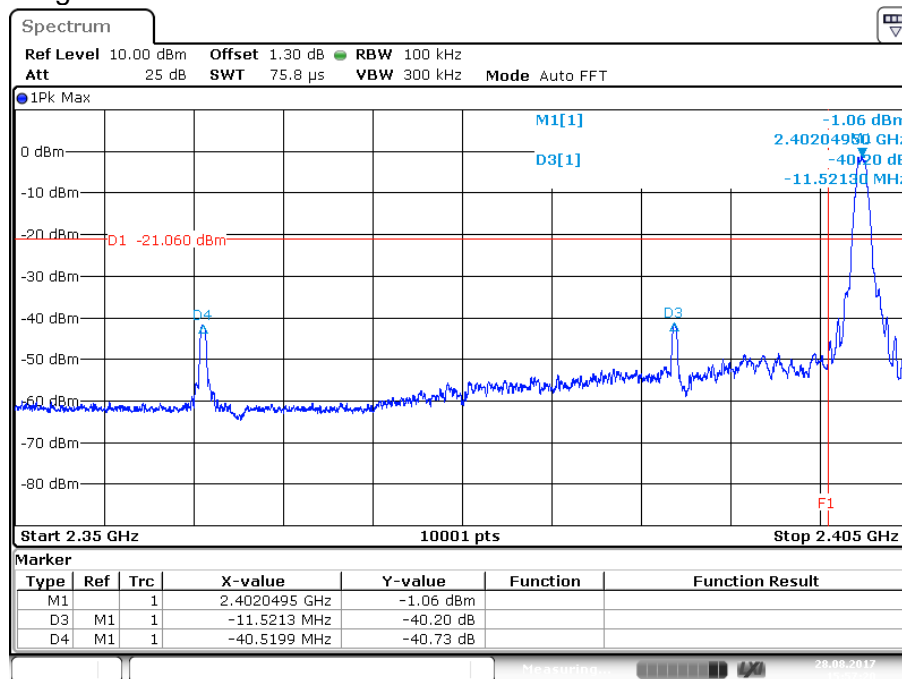
Tester: MT

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
SIGNAL ANALYZER	FSV30	ROHDE & SCHWARZ	B085749	8-Oct-2017
RF CABLE	141	HUBER & SUHNER	B095590	26-Jul-2018

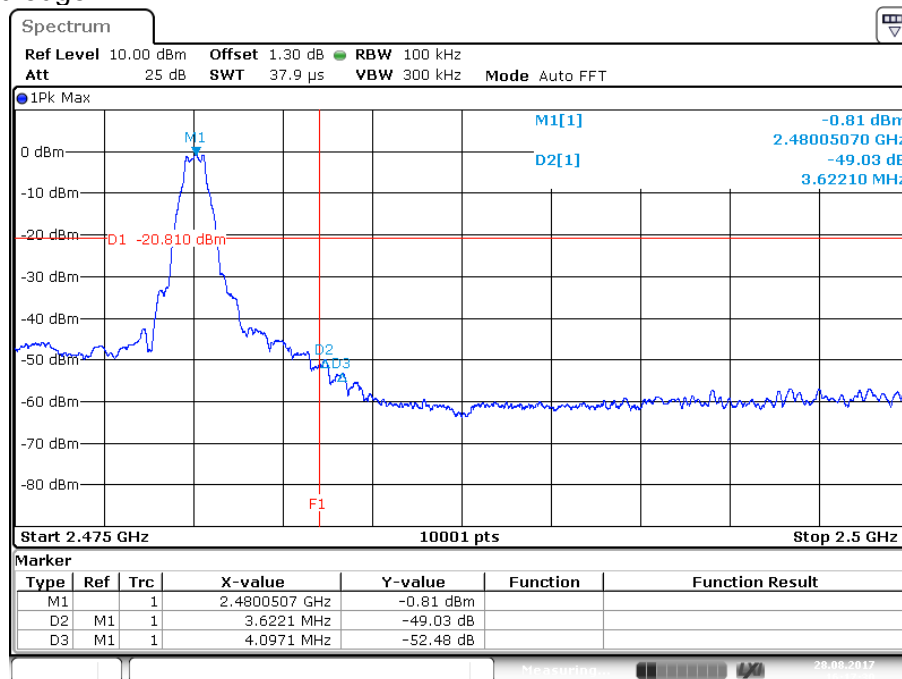
Note: The equipment calibration period is 1 year except for the FSV which is on a 2 year cycle.

6.5 Test Data – DTS Band Edge

BLE - Lower band edge:

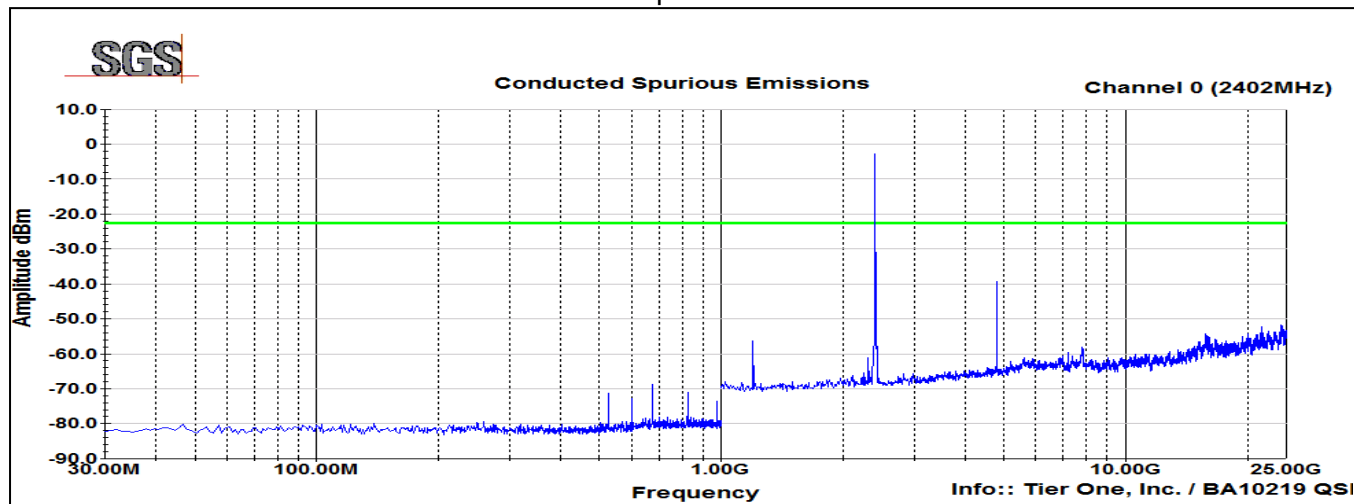


BLE - Upper band edge:

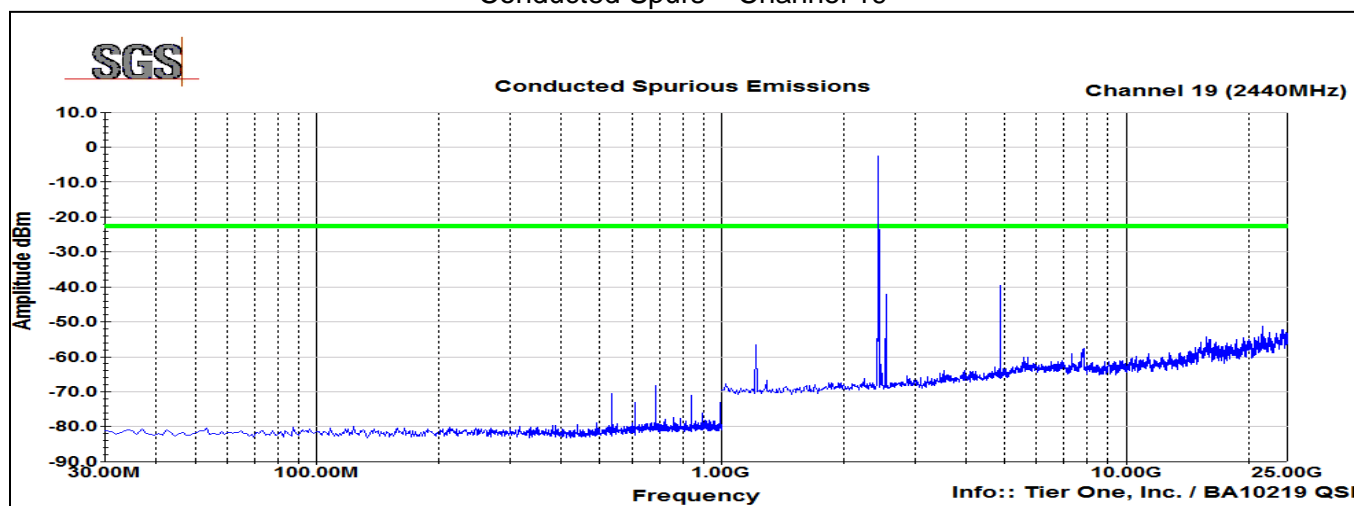


6.6 Test Data – Conducted Spurious Emissions

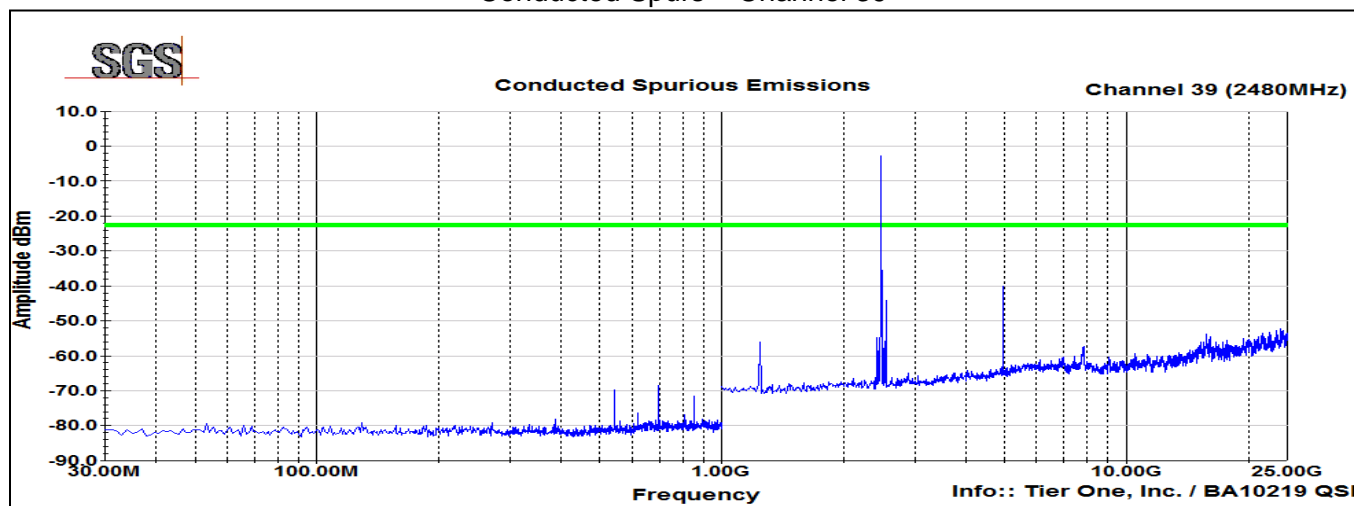
Conducted Spurs – Channel 0



Conducted Spurs – Channel 19



Conducted Spurs – Channel 39



7 Field Strength of Spurious Radiation

7.1 Test Result

Test Description	Test Specification		Test Result
Spurious Emissions	15.247 (d) and 15.209	RSS-247 S5.5	Compliant

7.2 Test Method

The measurement methods defined in ANSI C63.10: 2013 were used.

Lowest, middle, and highest channels were investigated – the device was commanded to continuously transmit on channels 0, 19, and 39.

Test distance:

9k to 30 MHz – Near field prescan to determine if there were any emissions.

30 to 1000 MHz - The EUT to measurement antenna distance was 3 meters

1 to 18 GHz - The EUT to measurement antenna distance was 3 meters

18 to 26 GHz - The EUT to measurement antenna distance was 3 meter

Limits within restricted bands of operation:

Frequency	Limits ⁽¹⁾		Peak Limits dBuV/m
	Microvolts/m	dBuV/m	
30 - 88 MHz	100	40 ⁽²⁾	--
88 - 216 MHz	150	43.5 ⁽²⁾	--
216 - 960 MHz	200	46 ⁽²⁾	--
960 - 1000 MHz	500	54 ⁽²⁾	--
1 - 40 GHz	500	54 ⁽³⁾	74

(1) These limits are applicable to emissions outside of the intentional transmit frequency band.

(2) Quasi-peak limit

(3) Average limit

7.3 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 23.0 – 24.7 °C

Relative Humidity: 49.2 – 57.0 %

Atmospheric Pressure: 97.3 – 97.8 kPa

7.4 Test Equipment

30MHz to 1GHz

Test End Date: 5-Sep-2017

Tester: MT

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
ANTENNA, BILOG	JB6	SUNOL	B079689	8-Sep-2017
RF CABLE	SF106	HUBER & SUHNER	B079712	24-Jul-2018
RF CABLE	NFS-290-78.7-NFS	FLORIDA RF LABS	B095019	24-Jul-2018
RF CABLE	NMS-290-236.2-NMS	FLORIDA RF LABS	B095020	24-Jul-2018
RF CABLE	SUCOFLEX 100	HUBER & SUHNER	B108523	24-Jul-2018
LOW NOISE AMPLIFIER	TS-PR18	ROHDE & SCHWARZ	B094463	22-Feb-2018
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	B079629	25-Apr-2018

Note: The equipment calibration period is 1 year.

1 to 18GHz

Test End Date: 5-Sep-2017

Tester: MT

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
ANTENNA, DRG HORN (MEDIUM)	3117	ETS LINDGREN	B079691	27-Jul-2018
RF CABLE	SF106	HUBER & SUHNER	B079712	24-Jul-2018
RF CABLE	SUCOFLEX 100	HUBER & SUHNER	B108523	24-Jul-2018
LOW NOISE AMPLIFIER	TS-PR18	ROHDE & SCHWARZ	B094463	22-Feb-2018
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	B079629	25-Apr-2018

Note: The equipment calibration period is 1 year.

18 to 26GHz

Test End Date: 5-Sep-2017

Tester: MT

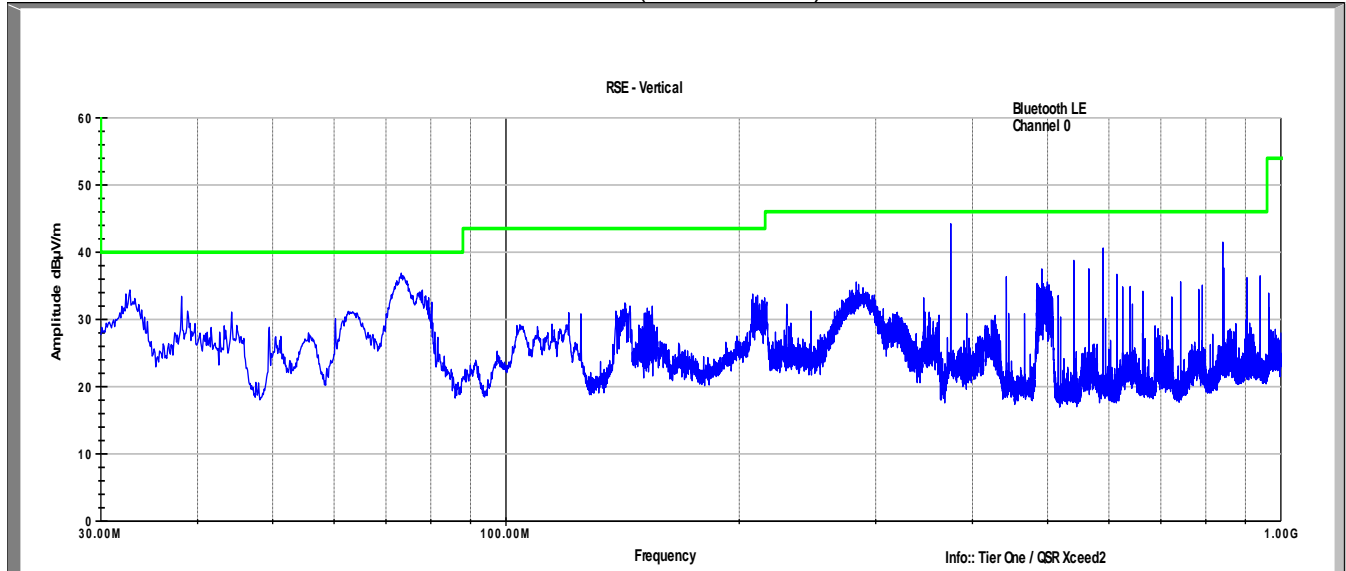
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
HORN(SMALL)	LB-180400-20-C-KF	A-INFO	15007	21-Mar-2018
RF CABLE	SF102	HUBER & SUHNER	B079822	27-Jul-2018
RF CABLE	SF102	HUBER & SUHNER	B079823	26-Jul-2018
LOW NOISE AMPLIFIER	NSP1840-HG	MITEQ	B087572	28-Jul-2018
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	B079629	25-Apr-2018

Note: The equipment calibration period is 1 year.

7.5 Test Data – Peak Plots

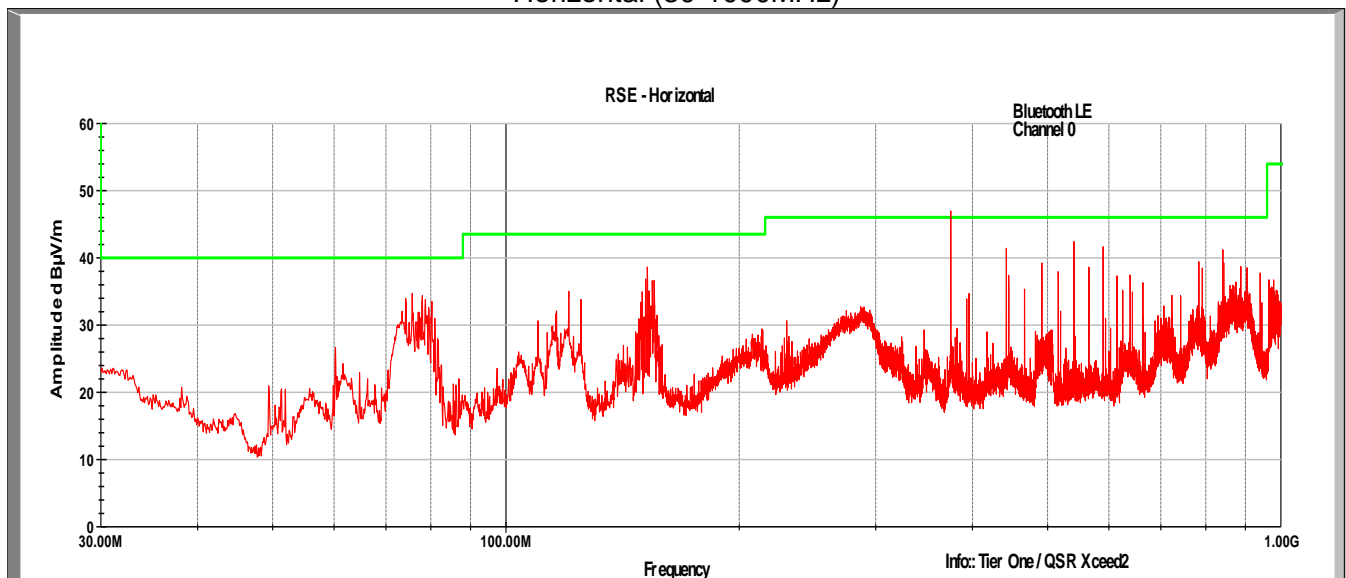
No emissions were detected in the range 9kHz to 30MHz.

BLE Channel 0
Vertical (30-1000MHz)



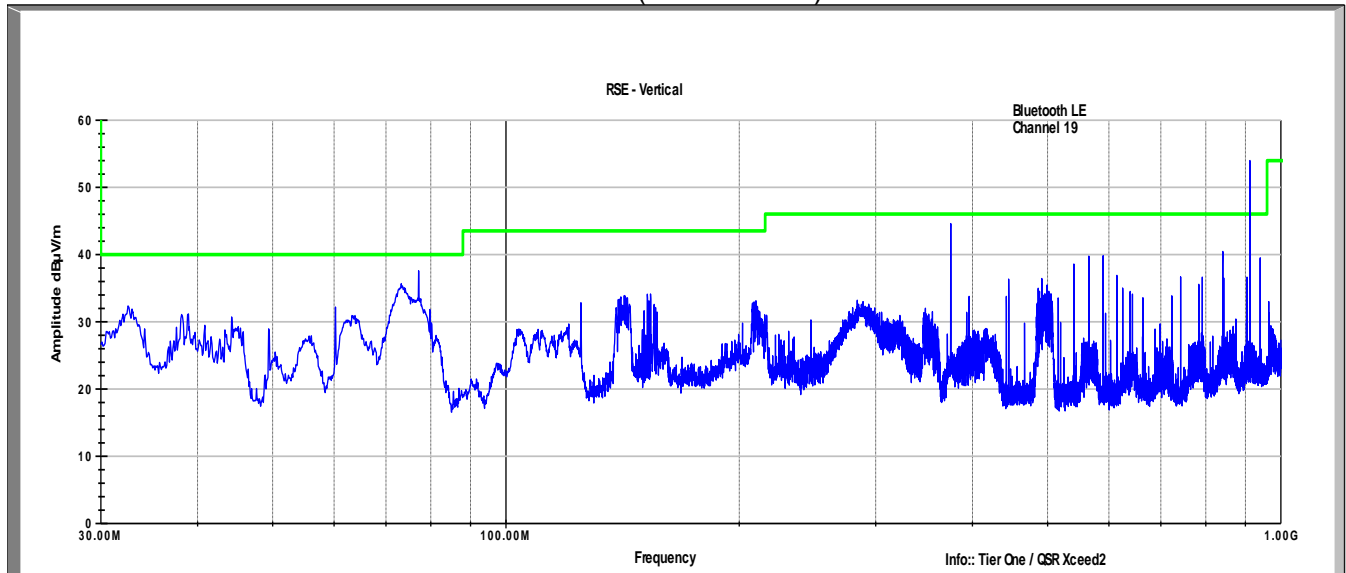
Peaks in this frequency range were unrelated to the transmitter portion of the device. These were evaluated and measured under FCC Part 15, Subpart B.

BLE Channel 0
Horizontal (30-1000MHz)



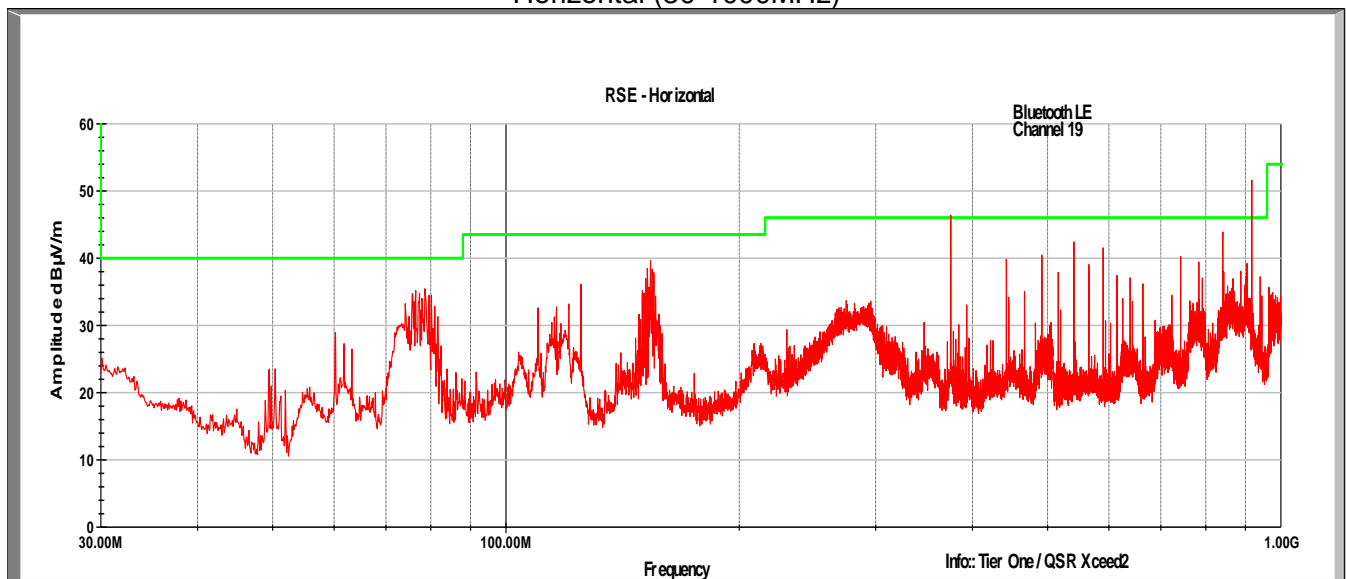
Peaks in this frequency range were unrelated to the transmitter portion of the device. These were evaluated and measured under FCC Part 15, Subpart B.

BLE Channel 19 Vertical (30-1000MHz)



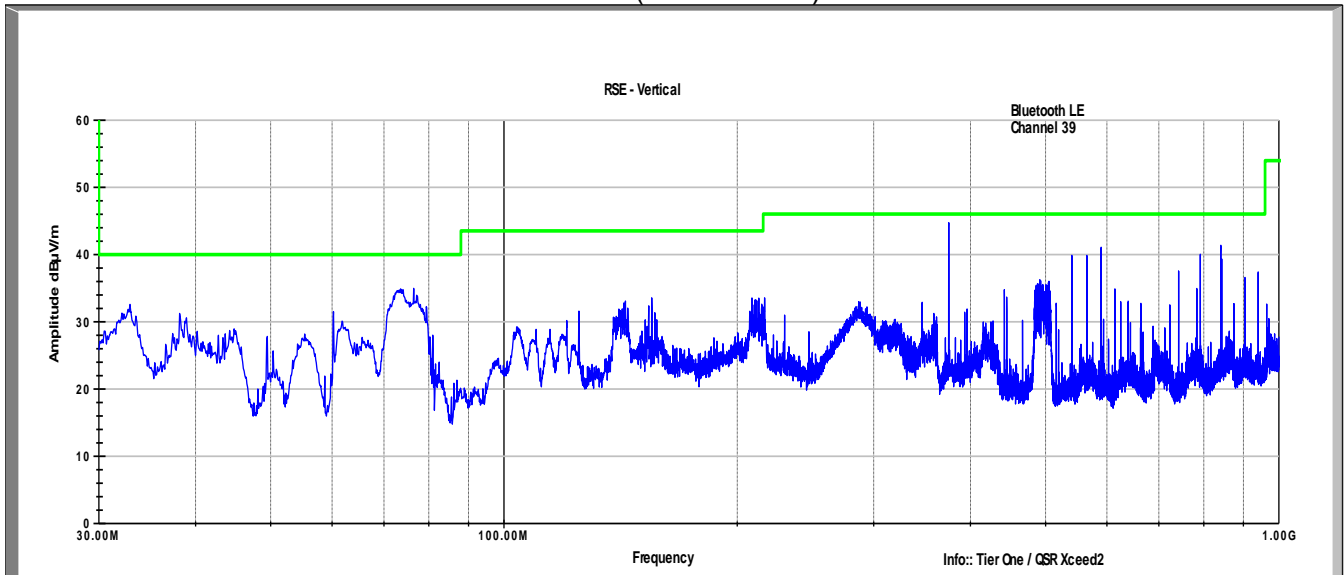
Peaks in this frequency range were unrelated to the transmitter portion of the device. These were evaluated and measured under FCC Part 15, Subpart B.

BLE Channel 19 Horizontal (30-1000MHz)



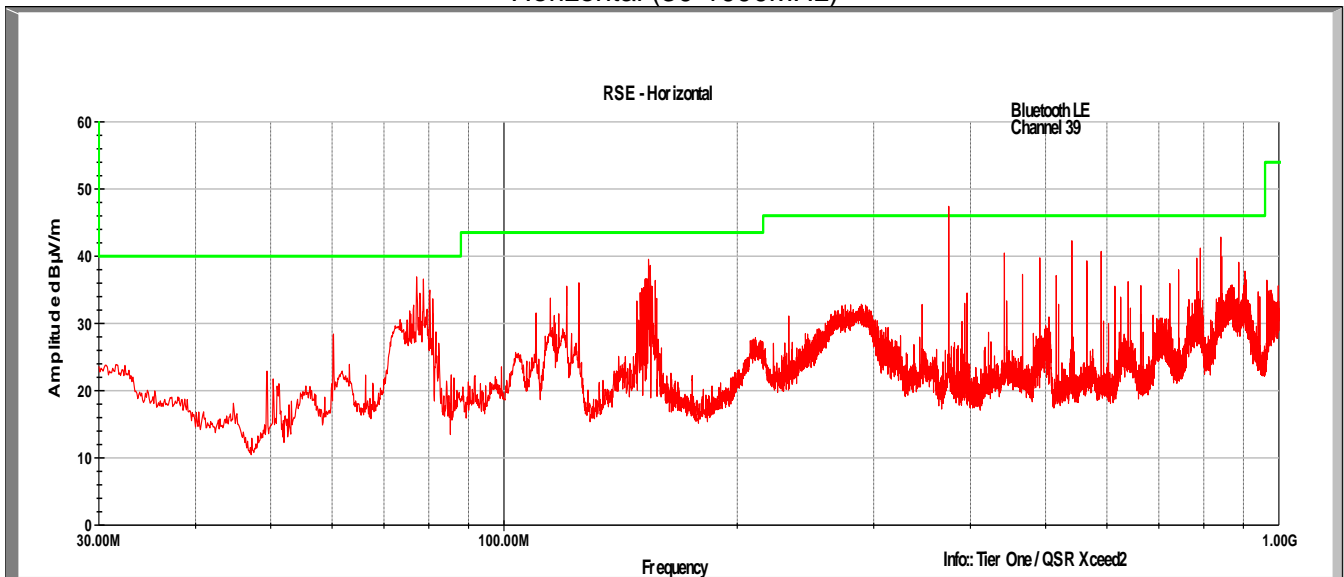
Peaks in this frequency range were unrelated to the transmitter portion of the device. These were evaluated and measured under FCC Part 15, Subpart B.

BLE Channel 39 Vertical (30-1000MHz)



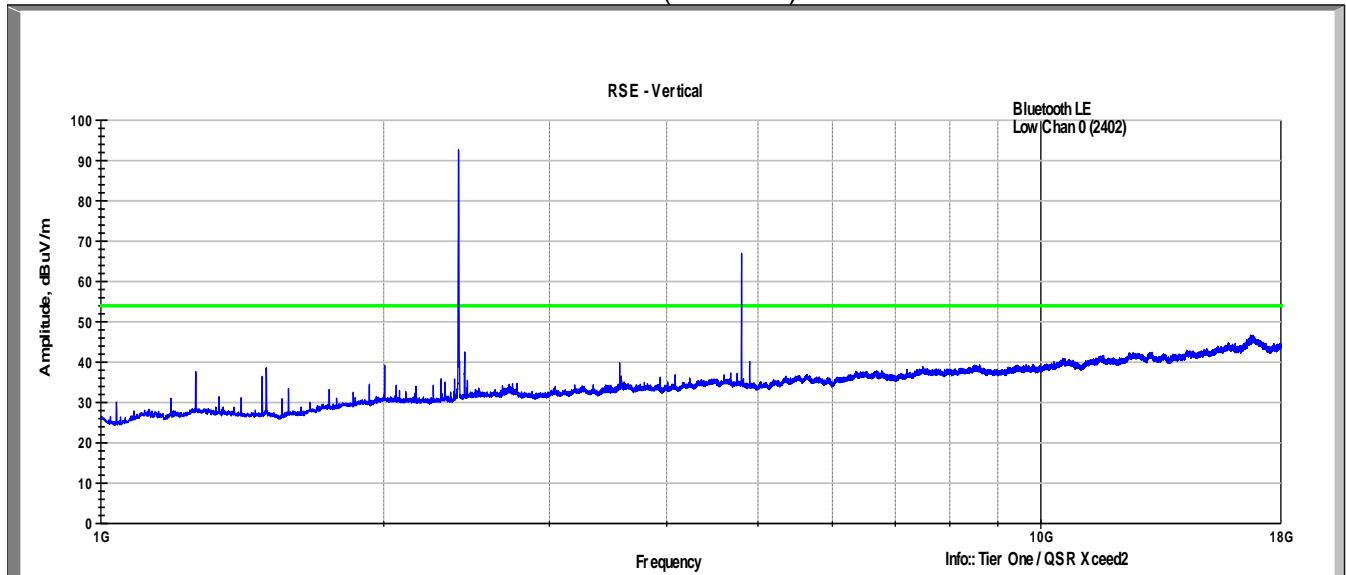
Peaks in this frequency range were unrelated to the transmitter portion of the device. These were evaluated and measured under FCC Part 15, Subpart B.

BLE Channel 39 Horizontal (30-1000MHz)

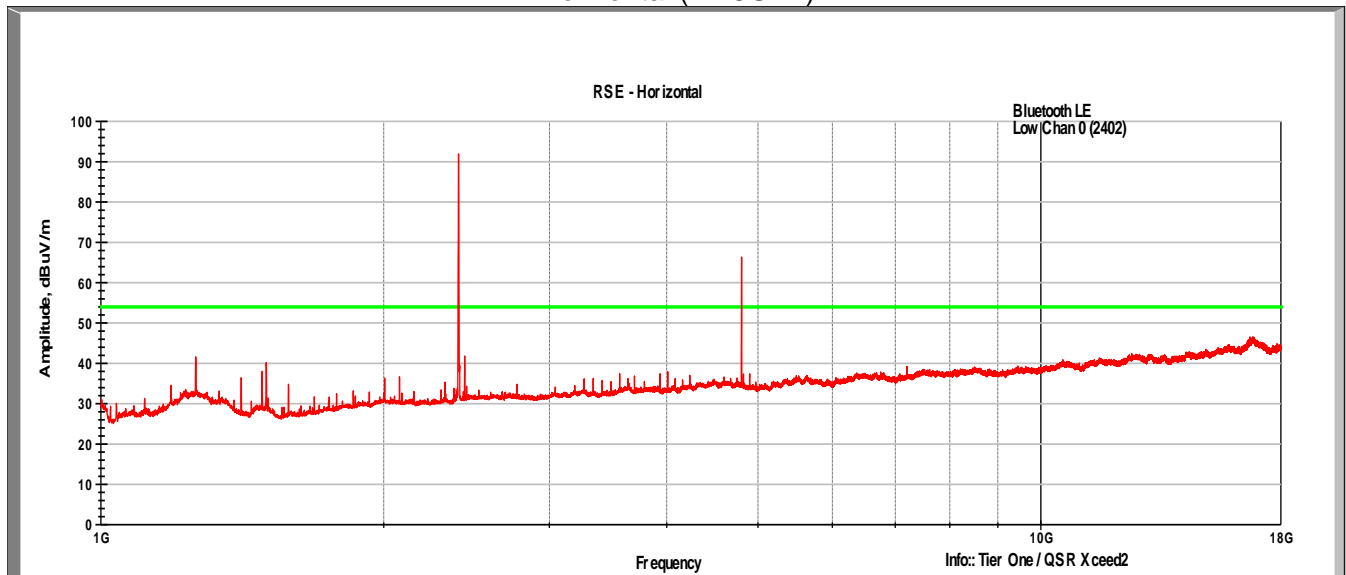


Peaks in this frequency range were unrelated to the transmitter portion of the device. These were evaluated and measured under FCC Part 15, Subpart B.

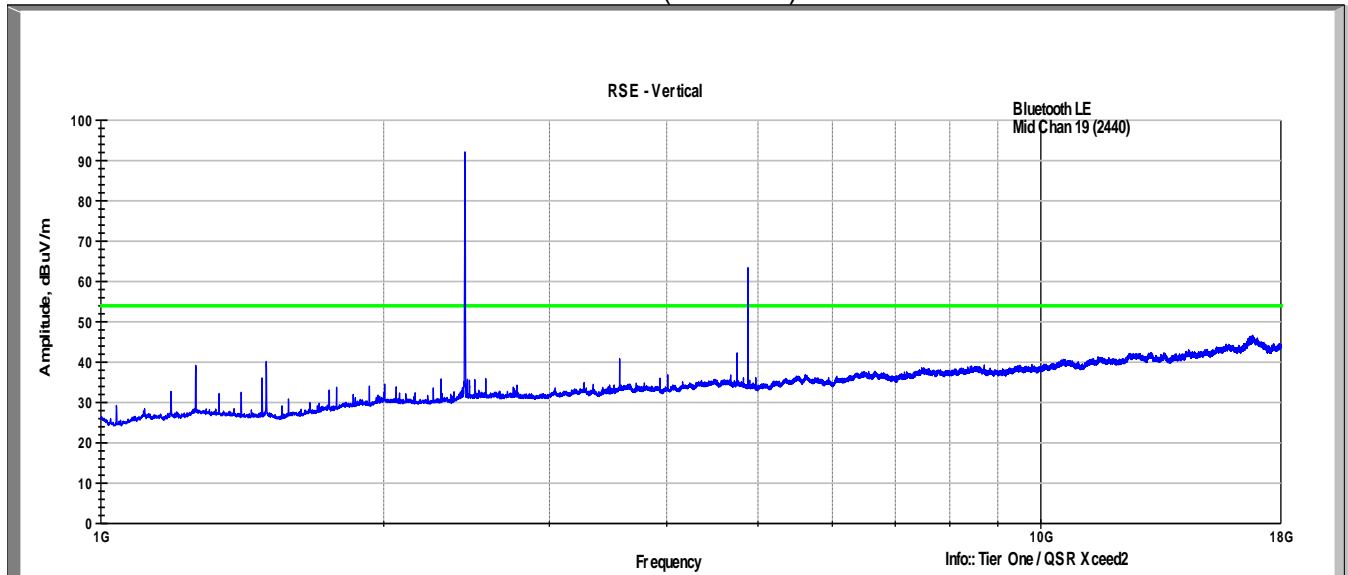
BLE Channel 0 Vertical (1-18GHz)



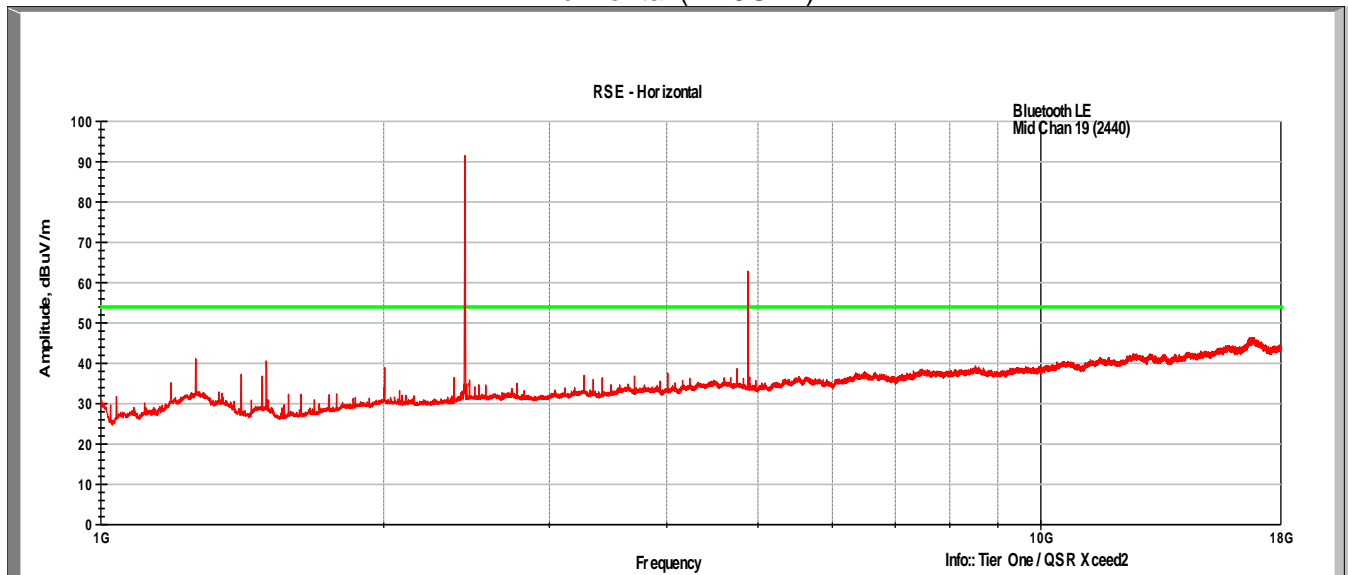
BLE Channel 0 Horizontal (1-18GHz)



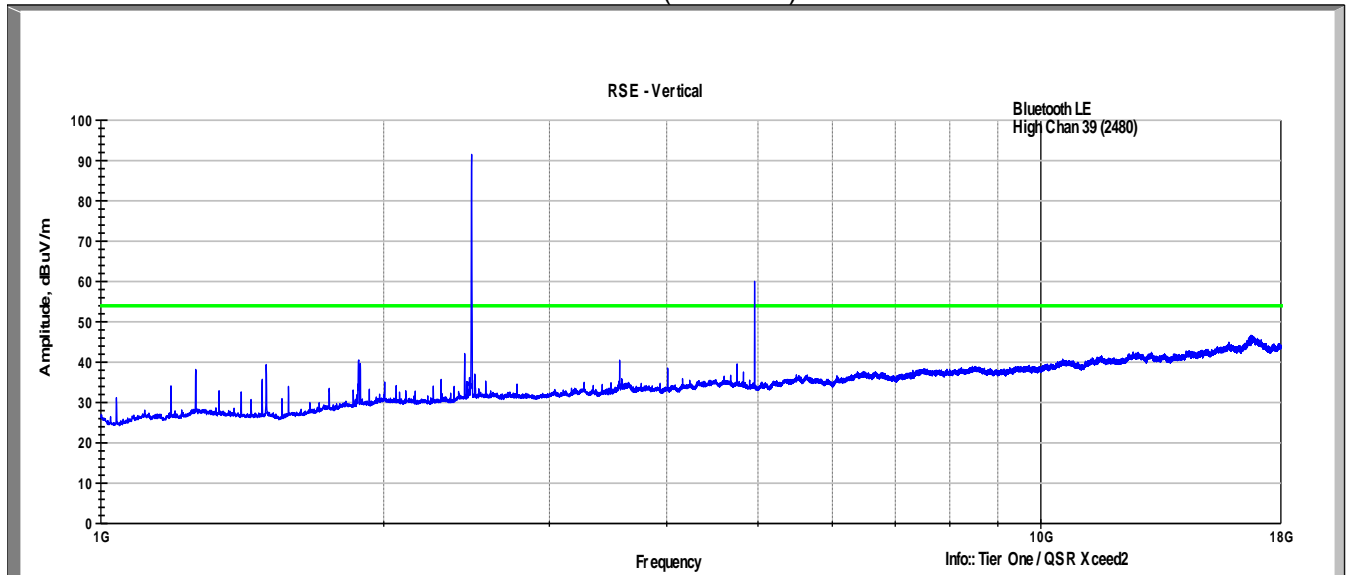
BLE Channel 19 Vertical (1-18GHz)



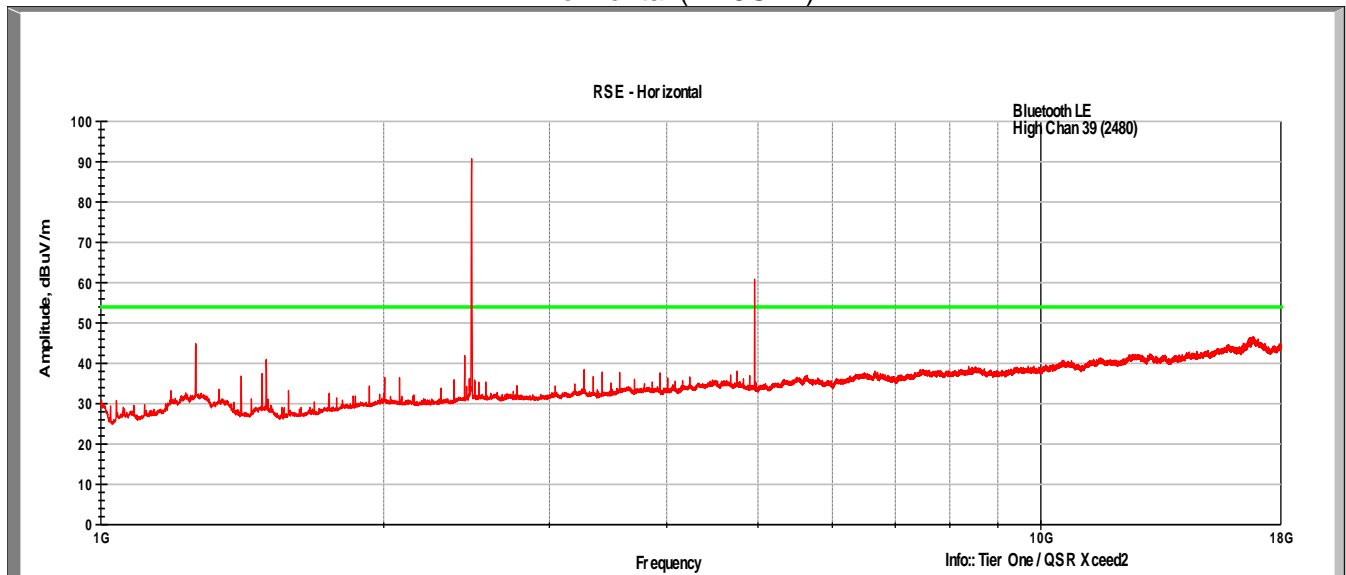
BLE Channel 19 Horizontal (1-18GHz)



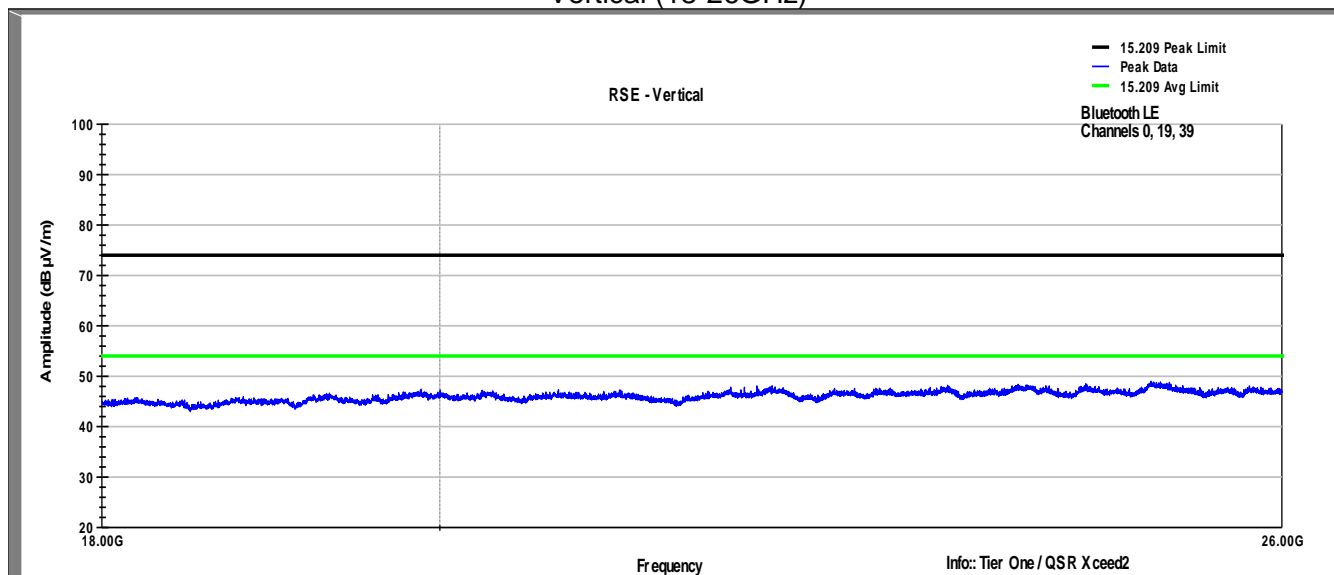
BLE Channel 39 Vertical (1-18GHz)



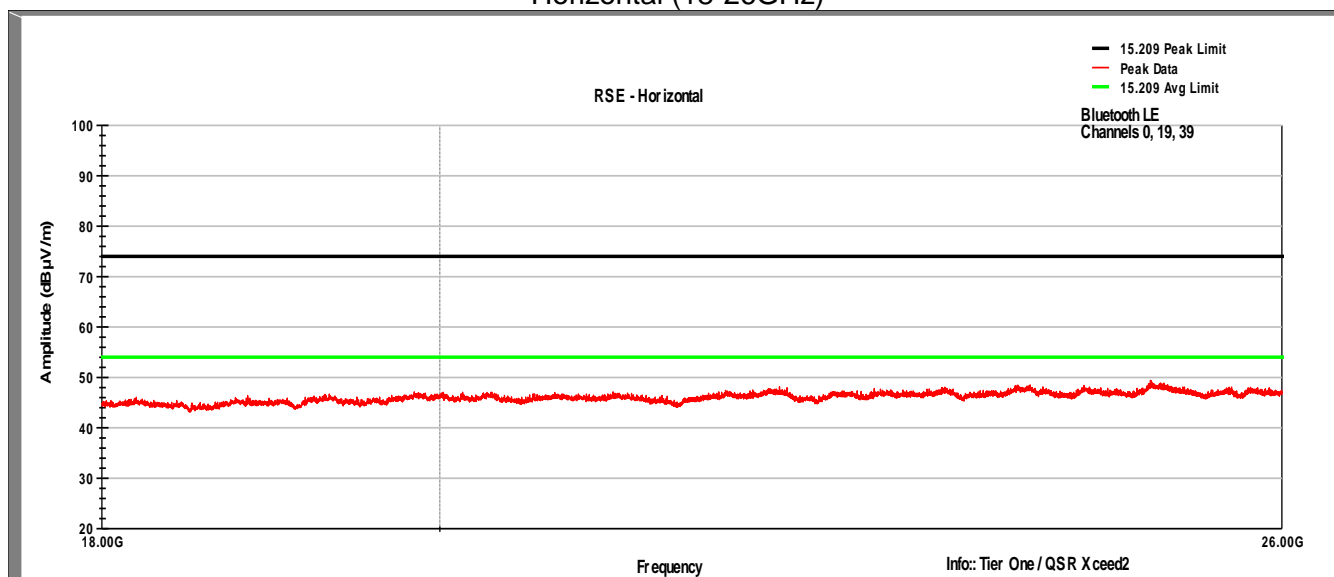
BLE Channel 39 Horizontal (1-18GHz)



BLE Channels 0, 19, 39 Vertical (18-26GHz)



BLE Channels 0, 19, 39 Horizontal (18-26GHz)



7.6 Test Data – Tabular Data

Frequency MHz	Raw Meas (dBuV/m)	Polarity (V/H)	Correction (dB)	Corr Value dBuV/m	Limit (dBuV/m)	Margin (dB)
Channel 0 (2402MHz)						
4804.00	67.0	V	-28.6	38.4	54.0	-15.6
4804.00	66.3	H	-28.6	37.7	54.0	-16.3
Channel 19 (2440MHz)						
4880.00	63.4	V	-28.6	34.8	54.0	-19.2
4880.00	62.8	H	-28.6	34.2	54.0	-19.8
Channel 39 (2480MHz)						
4960.00	60.0	V	-28.6	31.4	54.0	-22.6
4960.00	60.8	H	-28.6	32.2	54.0	-21.8

Note: Correction is for Duty Cycle which was measured to be less than 0.138% in normal Bluetooth LE operation.

8 Radiated Emissions at Band Edge / Restricted Band

8.1 Test Result

Test Description	Test Specification		Test Result
Spurious Emissions	15.205 / 15.209	RSS-GEN S8.9 / 8.10	Compliant

8.2 Test Method

Field strength measurements were performed at the restricted band edges of 2390MHz and 2483.5MHz for each modulation. Measurements were made using the conducted methods defined in Section 12 of FCC publication D01 DTS Meas Guidance v03r05.

Offset Calculations:

Offset calculations so that conducted measurements on the spectrum analyzer in dBμV represent field strength measurements in dBμV/m.

$$\text{Offset} = -20\log(D) + 104.8 - 107 + \text{CL} + \text{DC} + \text{AG}$$

$$\text{Offset}_{3m} = -11.7 + \text{CL} + \text{DC} + \text{AG}$$

D = 3m	Distance
CL = 0.9 dB	Cable Loss
DC = 0.16 dB (96.4%)	Duty Cycle Correction Factor
AG = 2 dB*	Antenna Gain

$$\text{Offset} = -8.7 \text{ dB}$$

* The actual antenna gain was calculated to be 0.4dBi. 2 dB correction is the minimum allowed by the test method.

8.3 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature:	24.0 °C
Relative Humidity:	42.0 %
Atmospheric Pressure:	98.0 kPa

8.4 Test Equipment

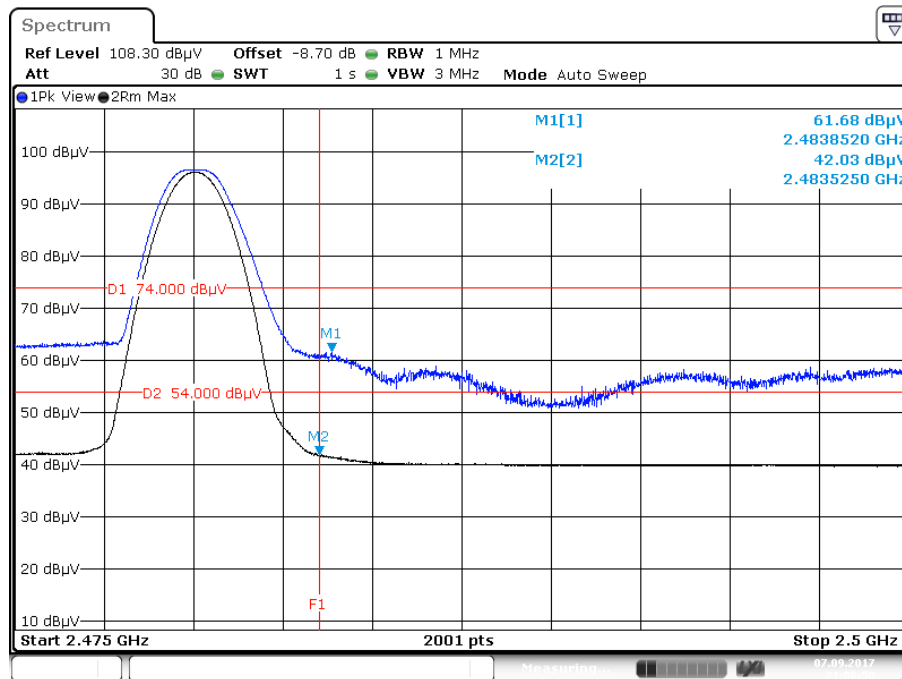
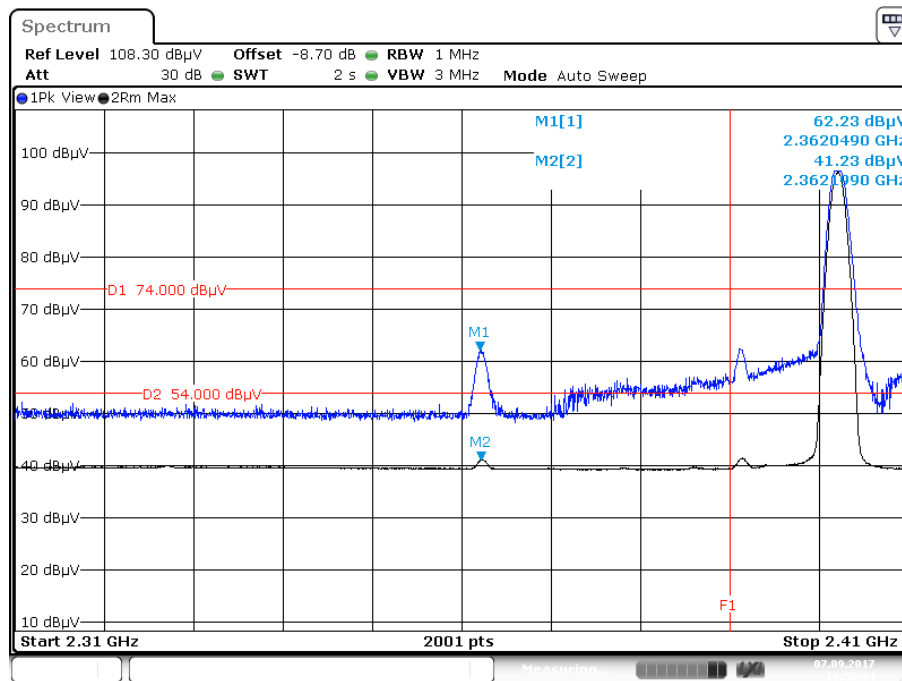
Test End Date: 7-Sep-2017

Tester: MT

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
SIGNAL ANALYZER	FSV30	ROHDE & SCHWARZ	B085749	8-Oct-2017
RF CABLE	1134	GORE	B094785	26-Jul-2018

Note: The equipment calibration period is 1 year except for the FSV30 which is on a 2-year cycle.

8.5 Test Data – Restricted Band Edge



9 AC Powerline Conducted Emissions

9.1 Test Result

Test Description	Test Specification		Test Result
Conducted Emissions, Class A	15.107 / 15.207	RSS-GEN S8.8	Compliant

9.2 Test Method

With the receiver's resolution bandwidth set to 9 kHz the initial preliminary exploratory scans were performed over the measuring frequency range (0.15MHz to 30MHz) using a max hold mode incorporating a Peak detector and Average detector and using the TILE! software. The final test data was measured using a Quasi-Peak detector and Average detector and compared against the limits indicated in the table below.

Frequency Range	Class A Limits (dBuV)	Class B Limits (dBuV)
0.15 to 0.5 MHz	Avg 66 QP 79	Avg 56 to 46 QP 66 to 56
0.5 to 5 MHz	Avg 60 QP 73	Avg 46 Pk 56
5 to 30 MHz	Avg 60 QP 73	Avg 50 Pk 60

9.3 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 23.3 °C

Relative Humidity: 44.9 %

Atmospheric Pressure: 97.7 kPa

9.4 Test Equipment

Test End Date: 4-Aug-2017

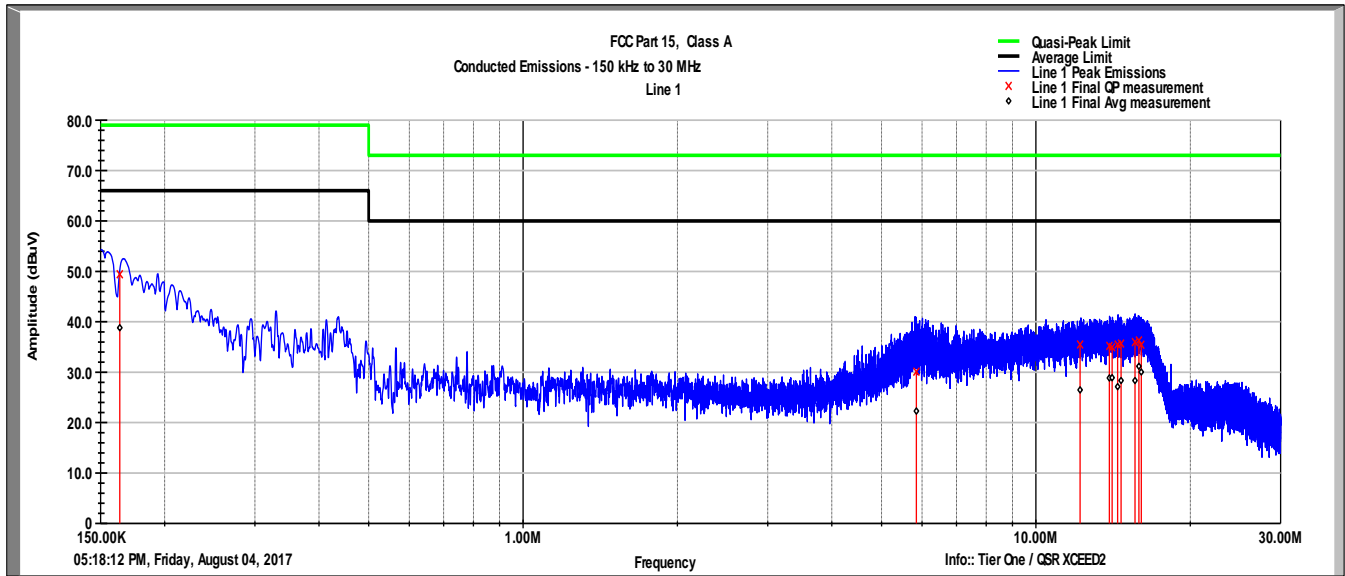
Tester: MT

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
LINE IMPEDANCE STABILIZATION NETWORK	NNB 51	TESEQ	B087573	16-Nov-2017
RF CABLE	SF106	HUBER & SUHNER	B079660	25-Jul-2018
EMI TEST RECEIVER	ESU8	ROHDE & SCHWARZ	B085759	25-Jul-2018

Note: The calibration period equipment is 1 year.

9.5 Test Data

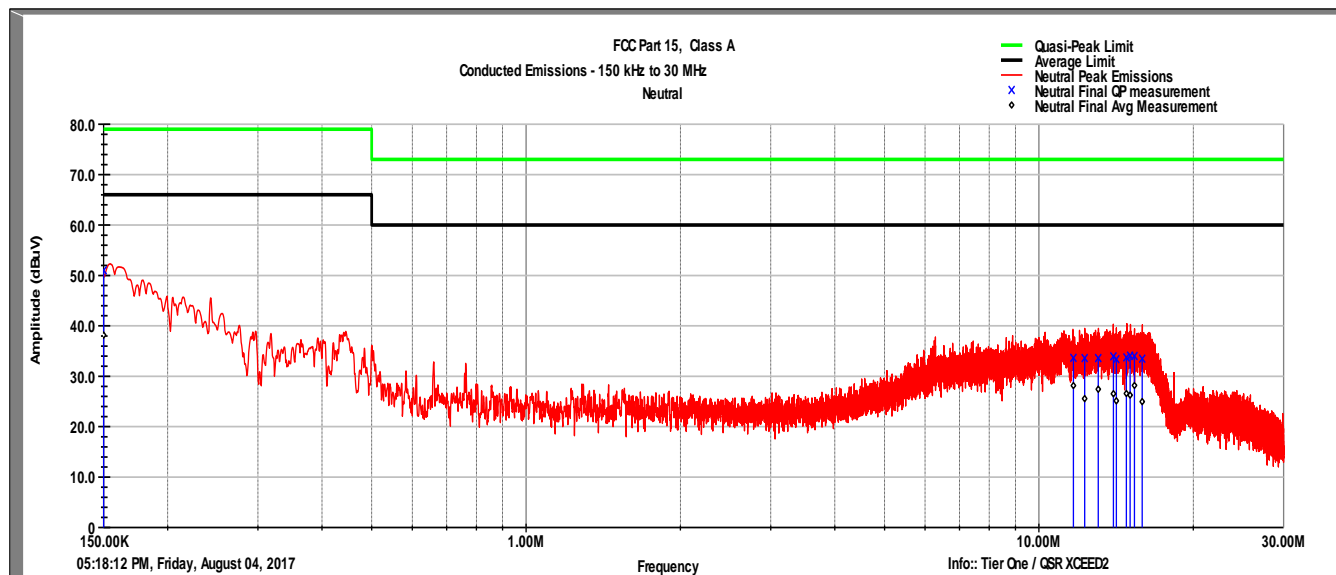
Line 1 Conducted Emissions Plot



Line 1 Conducted Emissions Data

Frequency MHz	QP Value dBuV	QP Limit dBuV	QP Margin dB	Avg Value dBuV	Avg Limit dBuV	Avg Margin dB
0.164	49.4	79.0	-29.6	38.8	66.0	-27.2
5.848	30.1	73.0	-42.9	22.3	60.0	-37.7
12.198	35.5	73.0	-37.5	26.5	60.0	-33.5
13.910	35.2	73.0	-37.8	28.8	60.0	-31.2
14.079	34.9	73.0	-38.1	28.9	60.0	-31.1
14.433	35.5	73.0	-37.5	27.1	60.0	-32.9
14.656	35.7	73.0	-37.3	28.3	60.0	-31.7
15.603	36.0	73.0	-37.0	28.3	60.0	-31.7
15.882	36.3	73.0	-36.7	31.1	60.0	-28.9
16.050	35.4	73.0	-37.6	30.0	60.0	-30.0

Neutral Conducted Emissions Plot



Neutral Conducted Emissions Data

Frequency MHz	QP Value dBuV	QP Limit dBuV	QP Margin dB	Avg Value dBuV	Avg Limit dBuV	Avg Margin dB
0.150	51.0	79.0	-28.0	38.1	66.0	-27.9
11.674	33.6	73.0	-39.4	28.1	60.0	-31.9
12.283	33.6	73.0	-39.4	25.6	60.0	-34.4
13.054	33.6	73.0	-39.4	27.4	60.0	-32.6
13.974	34.0	73.0	-39.0	26.5	60.0	-33.5
14.159	33.4	73.0	-39.6	25.1	60.0	-34.9
14.817	33.7	73.0	-39.3	26.6	60.0	-33.4
15.063	34.1	73.0	-38.9	26.3	60.0	-33.7
15.359	34.0	73.0	-39.0	28.2	60.0	-31.8
15.902	33.5	73.0	-39.5	25.0	60.0	-35.0

10 Revision History

Revision Level	Description of changes	Revision Date
0	Initial release	08 September 2017
1	Updated Model Name to xCeed, Model Number to DE-4200, and Brand Name to QSR per client's request.	21 May 2018
2	<ul style="list-style-type: none"> - Corrected FCC ID and IC ID on page 1. - Referenced latest issues of RSS standards on page 1. - Added antenna requirement to Summary on page 4. - Corrected PSD units on pages 12 and 13. - Corrected antenna gain on page 27 to match that on page 5. 	13 November 2018