EMC Test Report

Project Number:	**4347362**	**Proposal Number:**	**5533**
Report Number:	**4347362EMC01**	**Revision Level:**	**2**

Client: **Enovate Medical, LLC**

Equipment Under Test: **Bluetooth Low Energy Circuit**
Model Number: **P0000457**

FCC ID: **2AQ9D-P0000457**
IC ID: **24335-P0000457**

Applicable Standards: **FCC Part 15 Subpart C, § 15.247**
RSS-247, Issue 2, February 2017
RSS-GEN, Issue 5, March 2019, Amendment 1
ANSI C63.10: 2013

Report issued on: **24 November 2020**
Test Result: **Compliant**

Tested by: _____
Martin Taylor, Project Engineer

Reviewed by: _____
David Schramm, Operations Manager

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.

Table of Contents

1 Summary of Test Results

Test Description	Test Specification		Test Result
Bandwidth	15.247(a)(2)	RSS-247 S5.2 (1) RSS-GEN S6.7	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
Field Strength of Spurious Radiation	15.247(d), 15.209	RSS-247 S5.5	Compliant
Emissions in Restricted Frequency Bands	15.205, 15.209	RSS-GEN S8.9, S8.10	Compliant
Antenna Requirement	15.203	RSS-GEN S6.8	Compliant (1)
AC Powerline Conducted Emissions	15.107, 15.207	RSS-GEN S8.8	Compliant

(1) The device uses an antenna external to the board containing the radio but within the end product which is assembled by the same manufacturer. The antenna connects by means of a reverse polarity SMA connector, and the installation of the antenna is under the control of the device manufacturer.

1.1 *Modifications Required for Compliance*

None

2 General Information

2.1 *Client Information*

Name:	Enovate Medical, LLC
Address:	1152 Park Avenue
City, State, Zip, Country:	Murfreesboro, TN 37129, 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*

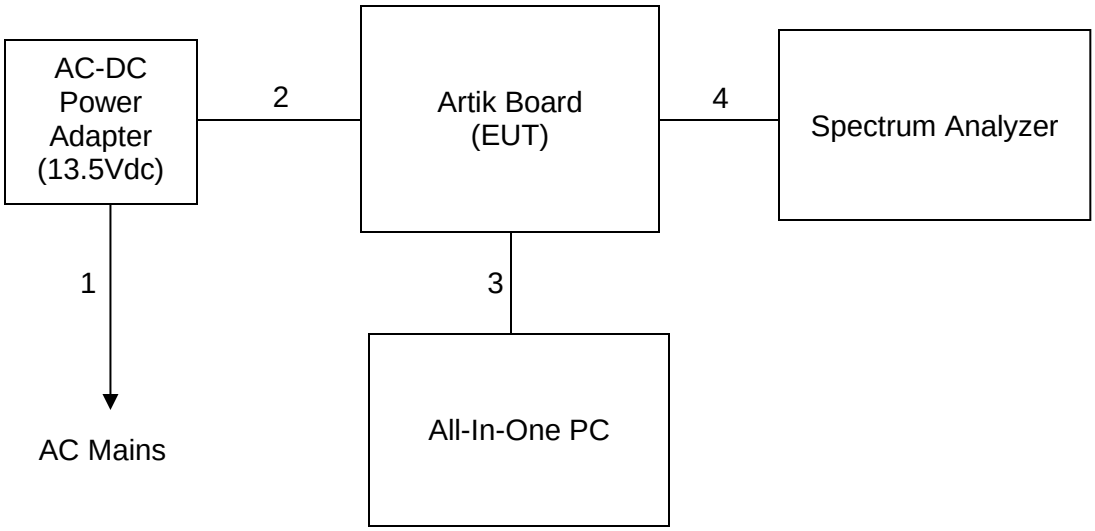
Type of Product (PMN):	Bluetooth Low Energy Circuit
Model Number (HVIN):	P0000457
Firmware Version (FVIN):	SoftDevice 5.0.0
Host Marketing Name (HMN):	Medical Cart
Serial Numbers:	165 (most tests) 971 (AC-CE & 99% OBW)
FCC ID:	2AQ9D-P0000457
IC ID:	24335-P0000457
Frequency Range:	2402-2480MHz
Data Modes:	Bluetooth Low Energy
Antenna:	External Antenna (0.7dBi)
Rated Voltage:	13.5Vdc
Test Voltage:	13.5Vdc
Sample Received Date:	24 July 2018
Dates of testing:	06-11 September 2018 05 November 2020 (99% Occupied Bandwidth) 24 November 2020 (AC Powerline Conducted Emissions)

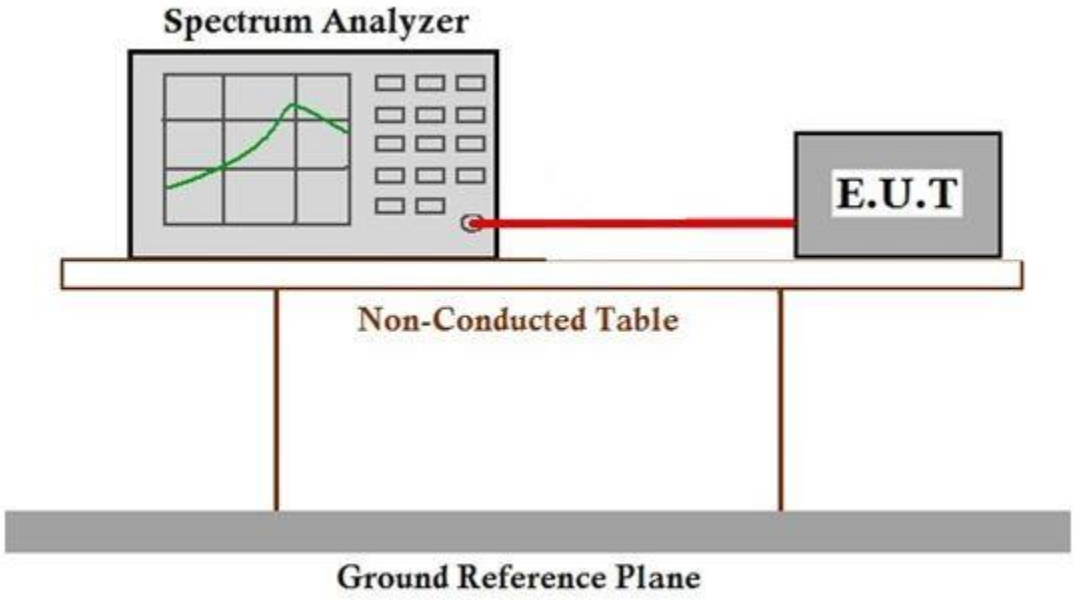
2.4 *Operating Modes and Conditions*

The EUT was running testmode firmware provided by the client to allow continuous traffic to be generated using test commands. A micro-USB cable was connected between the EUT and a PC running a serial terminal program such as PuTTY. A test utility called “minicom” was used to enable commands to be sent to control the Nordic BLE radio. A power setting of 4 was used in conjunction with the high amplifier gain setting. The same modulation and data rate were used as are used in normal operation, but sending continuous PRBS data. Low, middle and high channels were tested as follows:

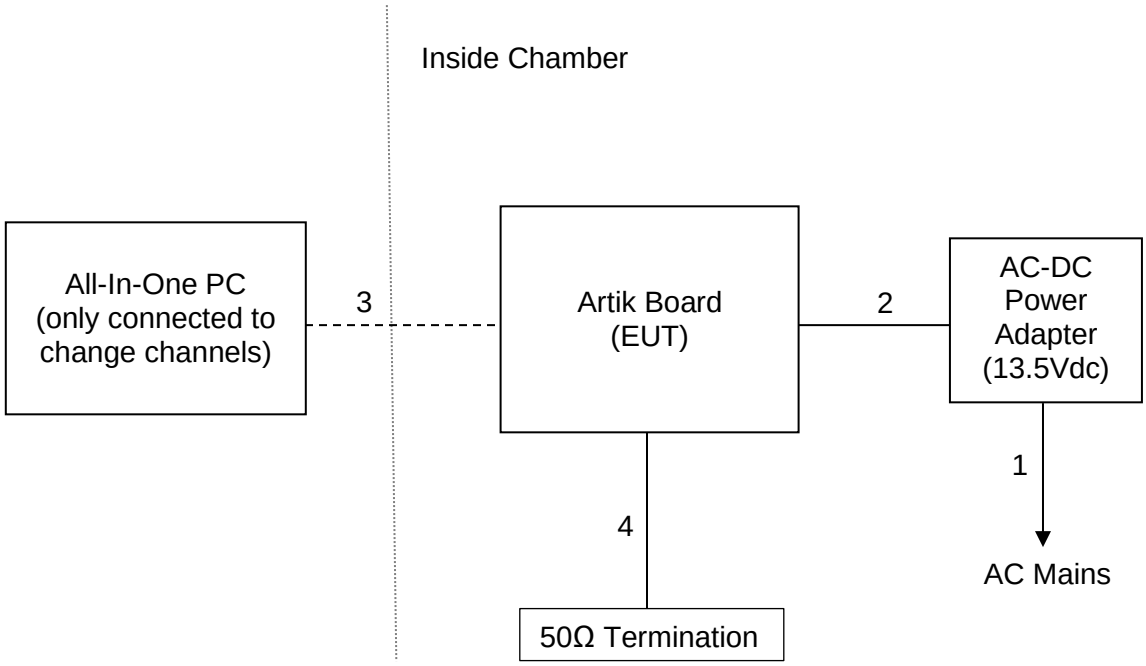
Channel 0 2402MHz
Channel 19 2440MHz
Channel 39 2480MHz

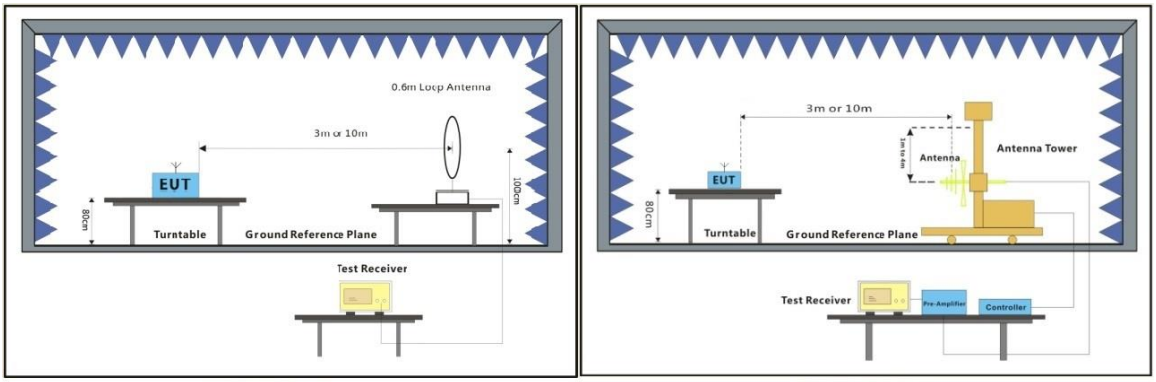
2.5 *EUT Connection Block Diagram – Conducted Measurements*





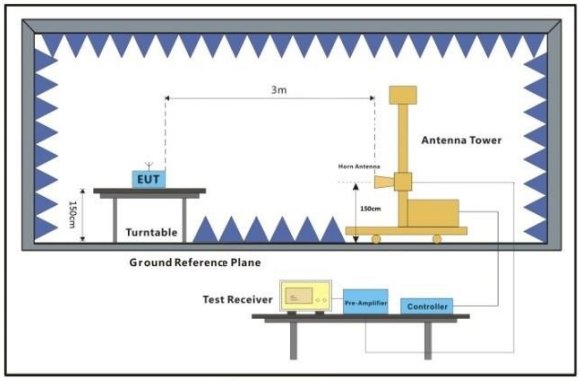
2.6 *EUT Connection Block Diagram – Radiated Measurements*





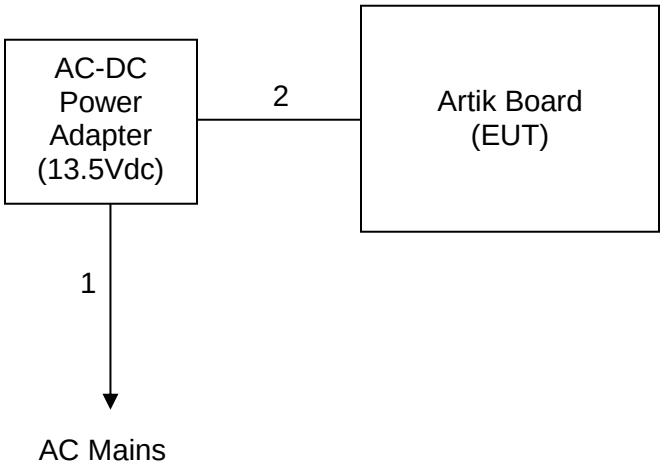
Below 30MHz

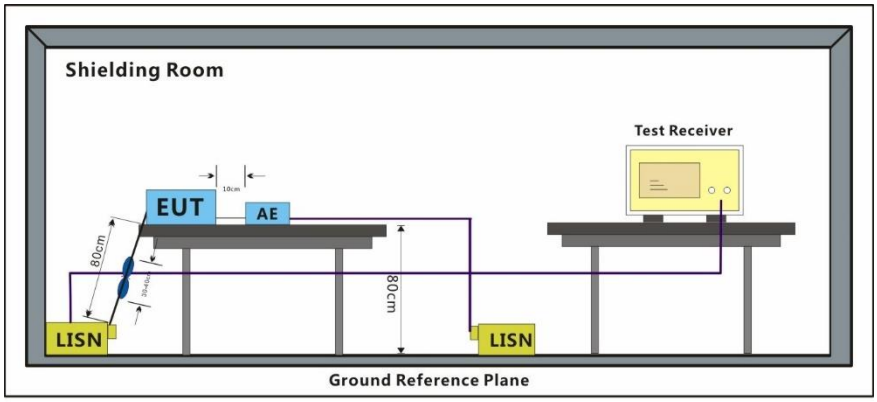
30MHz-1GHz



Above 1GHz

2.7 *EUT Connection Block Diagram – AC Powerline Conducted Emissions*





2.8 *System Configurations*

Manufacturer	Description	Model Number	Serial Number
Enovate Medical, LLC	Artik Board containing BLE Circuit (EUT)	P0000457	165 & 971
Enovate Medical, LLC	All-In-One Computer	HC20-AC-22R6	1004742
PHC Enterprise	AC-DC Power Adapter	SW-132A	Not labeled

2.9 *Cable List*

Cable reference	Port Name	Start	End	Cable Length (m)	Ferrite installed?	Shielded?
1	AC Power	AC-DC Power Adapter	AC Mains	1.80	No	No
2	DC Power	AC-DC Power Adapter	Artik Board (EUT)	1.80	Yes	No
3	Micro USB	Artik Board (EUT)	All-In-One Computer	1.26	No	No
4	Antenna Cable	Artik Board (EUT)	Spectrum Analyzer / 50Ω Termination	0.67 (1)	No	Coax

Note (1): Two RF cables: [17cm U.FL (female) to SMA (female)] + [50cm SMA (male) to SMA (female)] The manufacturer states that this replicates the cables installed between the Artik board and the antenna in the final product.

3 Bandwidth

3.1 *Test Result*

Test Description	Test Specification		Test Result
DTS Bandwidth (6dB)	15.247(a)(2)	RSS-247 S5.2 (a)	Compliant
Occupied Bandwidth (99%)		RSS-GEN S6.7	Reported

3.2 *Test Methods*

The DTS 6dB bandwidth measurements were performed using the procedure from ANSI C63.10 clause 11.8.1, and the 99% occupied bandwidth measurements were performed using the procedure from ANSI C63.10 clause 6.9.3. These procedures are referenced in KDB 558074 D01 15.247 Meas Guidance v05r02.

Limit: The minimum 6dB bandwidth shall be at least 500 kHz.

3.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions	6dB BW	99% BW
Temperature:	22.8 °C	22.5 °C
Relative Humidity:	53.7 %	40.4 %
Atmospheric Pressure:	98.2 kPa	98.8 kPa

3.4 *Test Equipment*

6dB Bandwidth

Test End Date: 11-Sep-2018 Tester: MT

Equipment	Model	Manufacturer	Asset Number	Cal Date	Cal Due Date
RF CABLE (TS8997)	141	Huber & Suhner	B095585	25-Jul-2018	25-Jul-2019
ATTENUATOR, 10DB (TS8997)	10DB	ROHDE & SCHWARZ	B095591	25-Jul-2018	25-Jul-2019
RF SWITCH (TS8997)	OSP	ROHDE & SCHWARZ	15039	15-Dec-2017	15-Dec-2018
POWER METER (TS8997)	OSP-B157	ROHDE & SCHWARZ	15040	15-Dec-2017	15-Dec-2018
SIGNAL ANALYZER (TS8997)	FSV30	ROHDE & SCHWARZ	B085749	1-Nov-2017	1-Nov-2019

99% Occupied Bandwidth

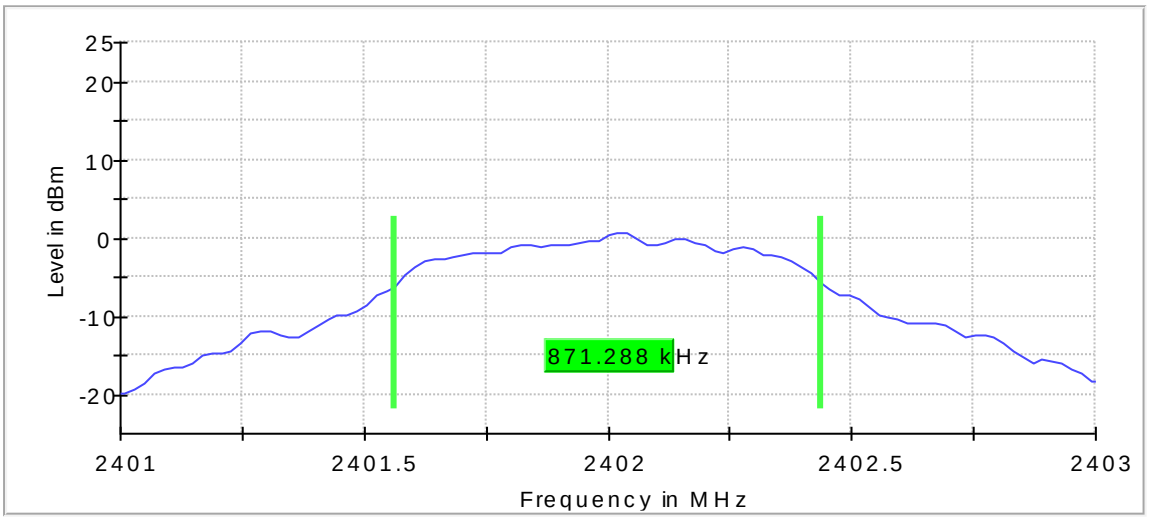
Test End Date: 5-Nov-2020 Tester: MT

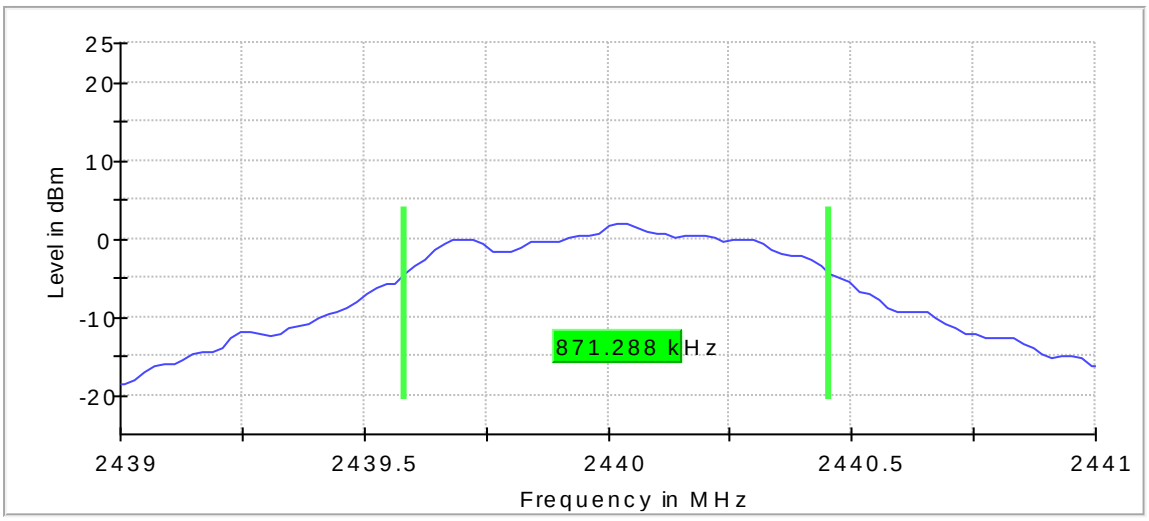
Equipment	Model	Manufacturer	Asset Number	Cal Date	Cal Due Date
RF Cable SMA to SMA, 0.01-40GHz	084-0505-059	TELEDYNE STORM MICROWAVE	20108	6-Mar-2020	6-Mar-2021
SIGNAL ANALYZER (TS8997)	FSV30	ROHDE & SCHWARZ	B085749	27-Dec-2019	27-Dec-2021

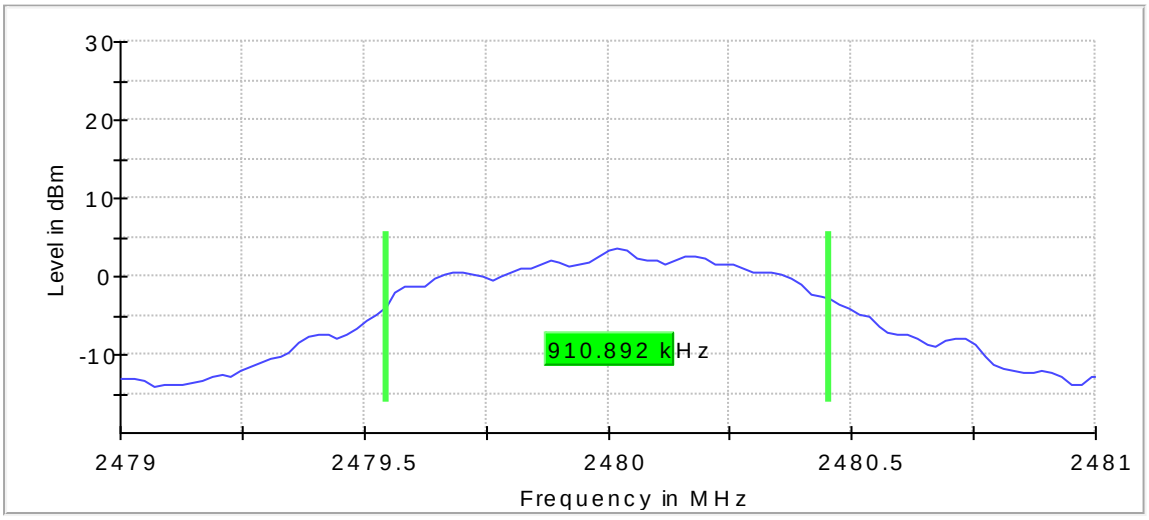
3.5 *Test Data*

Channel	Frequency (MHz)	6dB Bandwidth (kHz)	99% Bandwidth (kHz)	Limit Min for 6dB BW (kHz)	Result
0	2402	871.3	1780	500	Pass
19	2440	871.3	1816	500	Pass
39	2480	910.9	1852	500	Pass

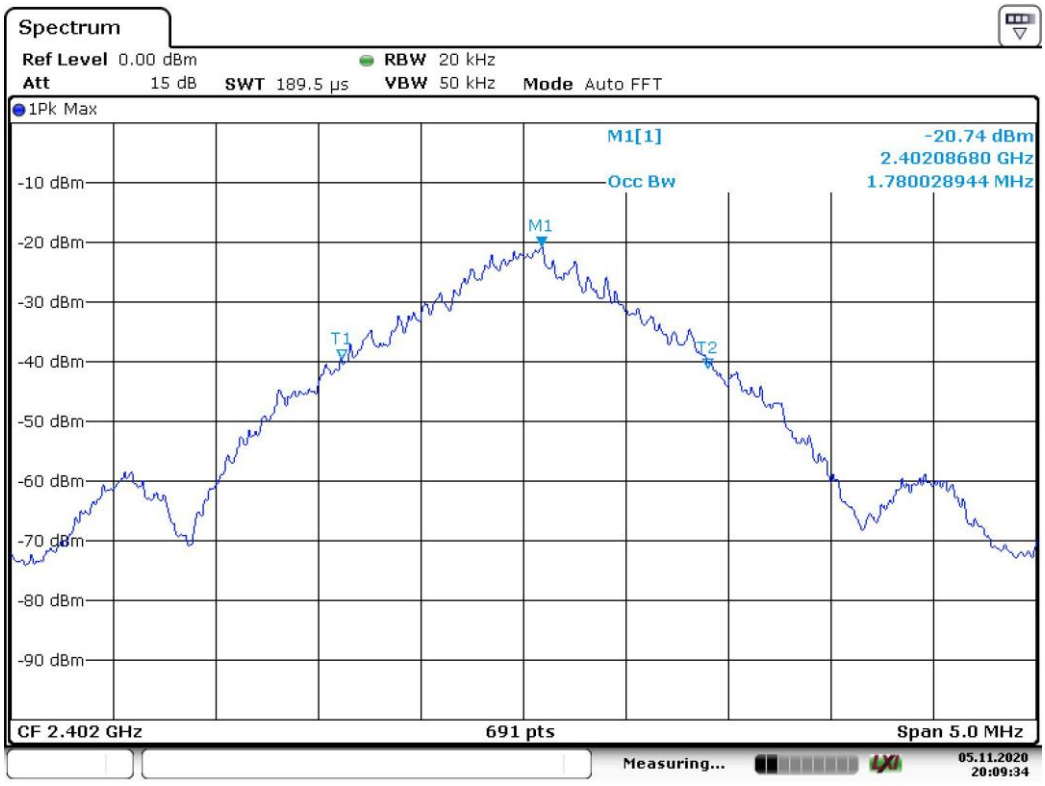
DTS Bandwidth (6dB)



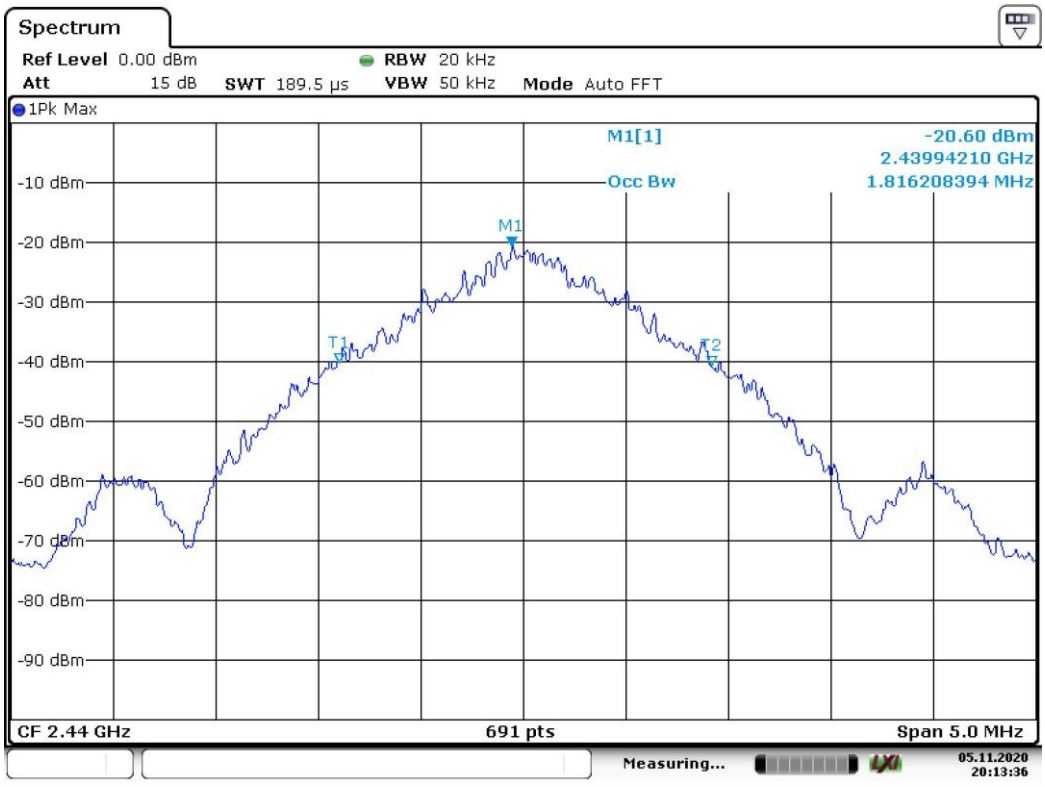




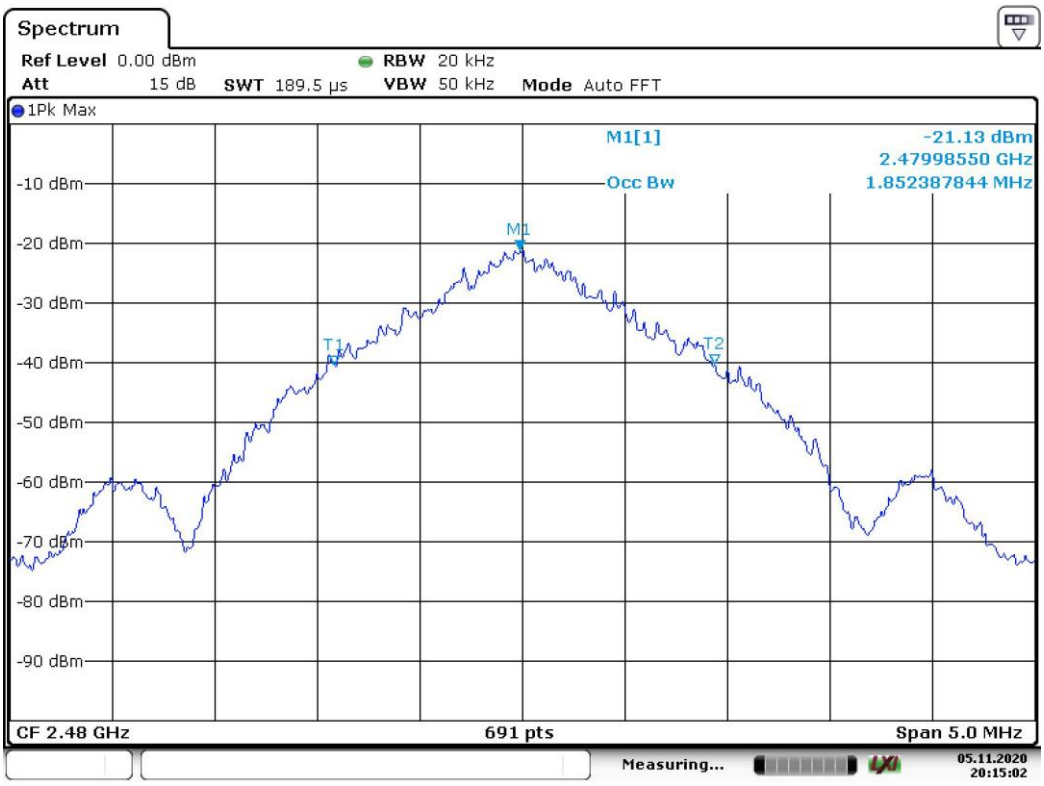
Occupied Bandwidth (99%)
Channel 0



Channel 19



Channel 39


Spectrum
Ref Level 0.00 dBm
RBW 20 kHz
Att 15 dB
SWT 189.5 µs
VBW 50 kHz
Mode Auto FFT
1Pk Max
M1[1]
-21.13 dBm
2.47998550 GHz
Occ Bw
1.852387844 MHz
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
-90 dBm
M1
T1
T2
CF 2.48 GHz
691 pts
Span 5.0 MHz
Measuring...
05.11.2020
20:15:02

4 Output Power

4.1 *Test Result*

Test Description	Test Specification		Test Result
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 Meas Guidance v05r02.

Limit

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:	22.8 °C
Relative Humidity:	53.7 %
Atmospheric Pressure:	98.2 kPa

4.4 *Test Equipment*

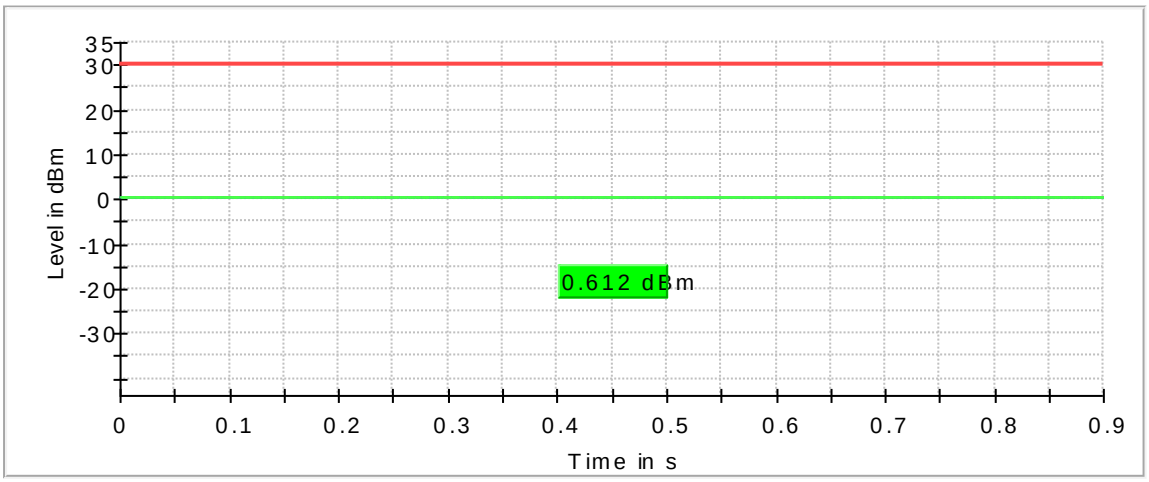
Test End Date: 11-Sep-2018 Tester: MT

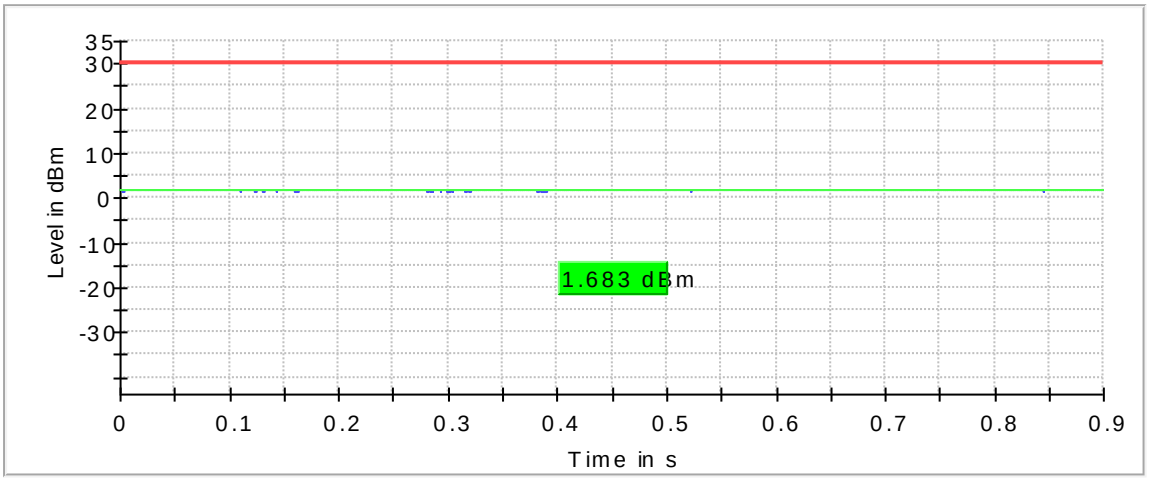
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
RF CABLE	141	HUBER & SUHNER	B095585	25-Jul-2019
ATTENUATOR, 10DB	10DB	ROHDE & SCHWARZ	B095591	25-Jul-2019
RF SWITCH (TS8997)	OSP	ROHDE & SCHWARZ	15039	15-Dec-2019
POWER METER (TS8997)	OSP-B157	ROHDE & SCHWARZ	15040	15-Dec-2019
SIGNAL ANALYZER (TS8997)	FSV30	ROHDE & SCHWARZ	B085749	1-Nov-2019

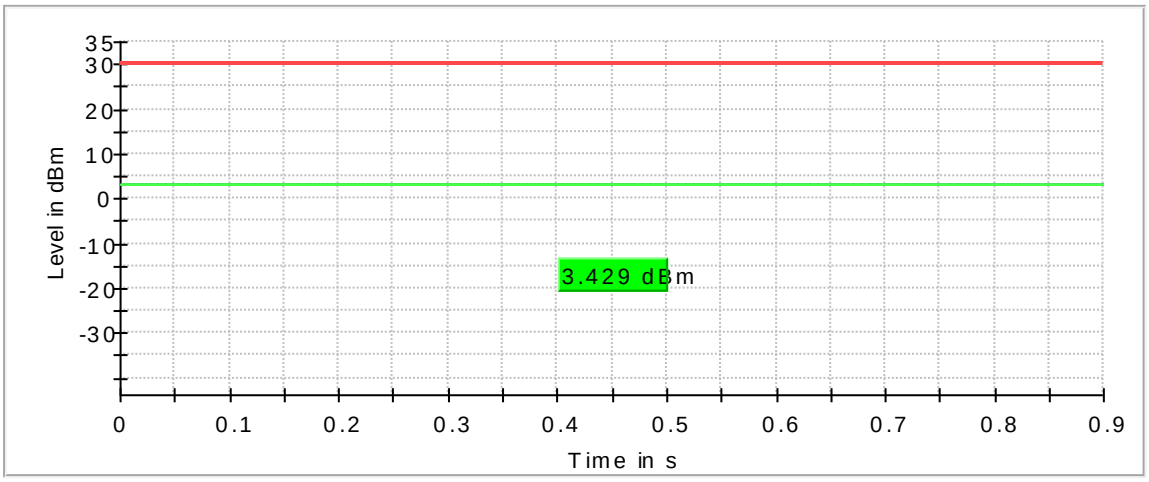
Note: The equipment calibration period is 1 year except for the FSV which is on a 2-year cycle.

4.5 *Test Data*

Channel	Frequency (MHz)	RMS Power (dBm)	Limit Max (dBm)	Result
0	2402	0.61	30	Pass
19	2440	1.68	30	Pass
39	2480	3.43	30	Pass


35
30
20
10
0
-10
-20
-30
Level in dBm
0.612 dBm
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
Time in s
Gated Trace
Overall
Limit


35
30
20
10
0
-10
-20
-30
Level in dBm
1.683 dBm
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
Time in s
Gated Trace
Overall
Limit


35
30
20
10
0
-10
-20
-30
Level in dBm
3.429 dBm
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
Time in s
Gated Trace
Overall
Limit

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 Meas Guidance v05r02.

Limit
The maximum limit is 8 dBm / 3 kHz.

5.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature:	22.8 °C
Relative Humidity:	53.7 %
Atmospheric Pressure:	98.2 kPa

5.4 *Test Equipment*

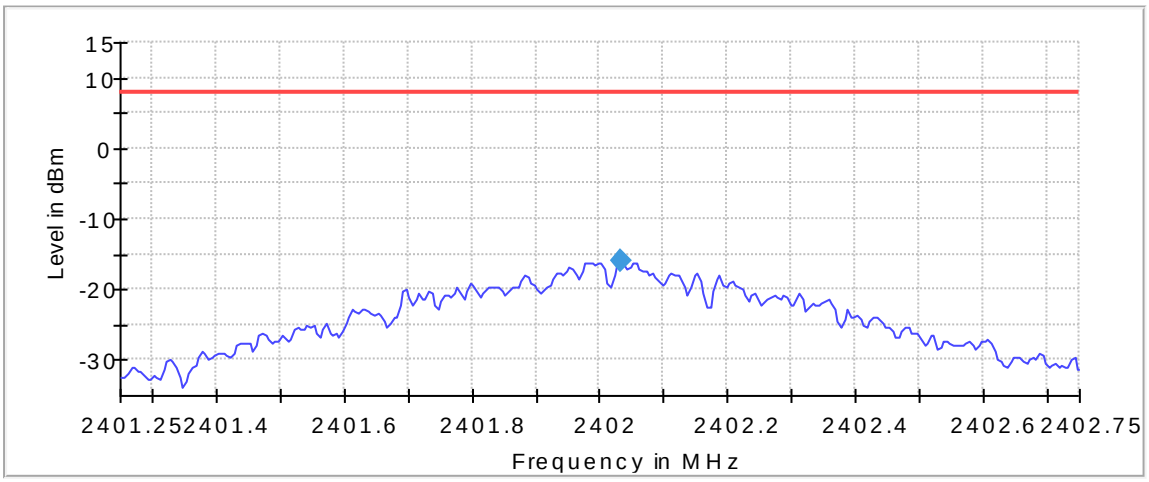
Test End Date: 11-Sep-2018 Tester: MT

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
RF CABLE	141	HUBER & SUHNER	B095585	25-Jul-2019
ATTENUATOR, 10DB	10DB	ROHDE & SCHWARZ	B095591	25-Jul-2019
RF SWITCH (TS8997)	OSP	ROHDE & SCHWARZ	15039	15-Dec-2019
POWER METER (TS8997)	OSP-B157	ROHDE & SCHWARZ	15040	15-Dec-2019
SIGNAL ANALYZER (TS8997)	FSV30	ROHDE & SCHWARZ	B085749	1-Nov-2019

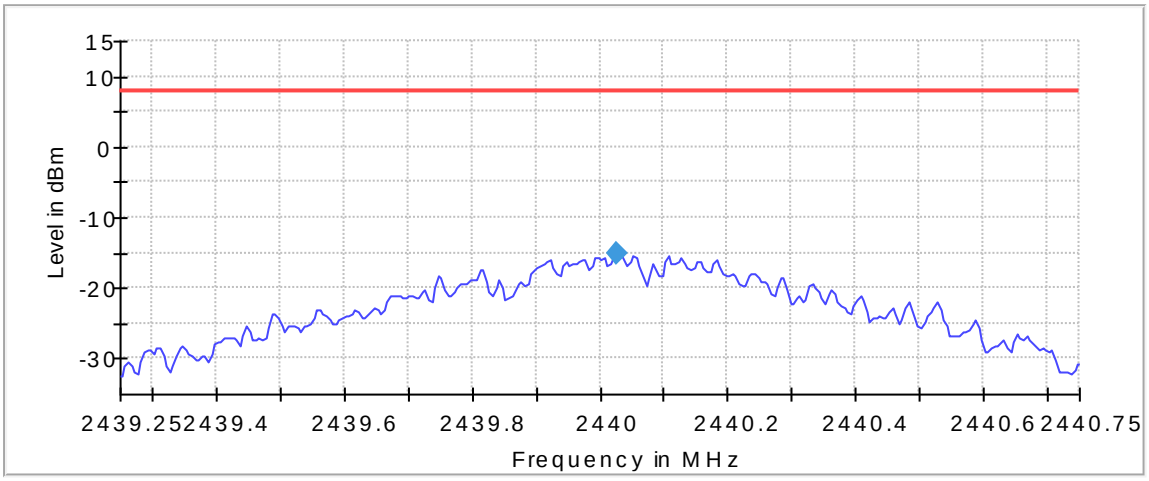
Note: The equipment calibration period is 1 year except for the FSV which is on a 2-year cycle.

5.5 *Test Data*

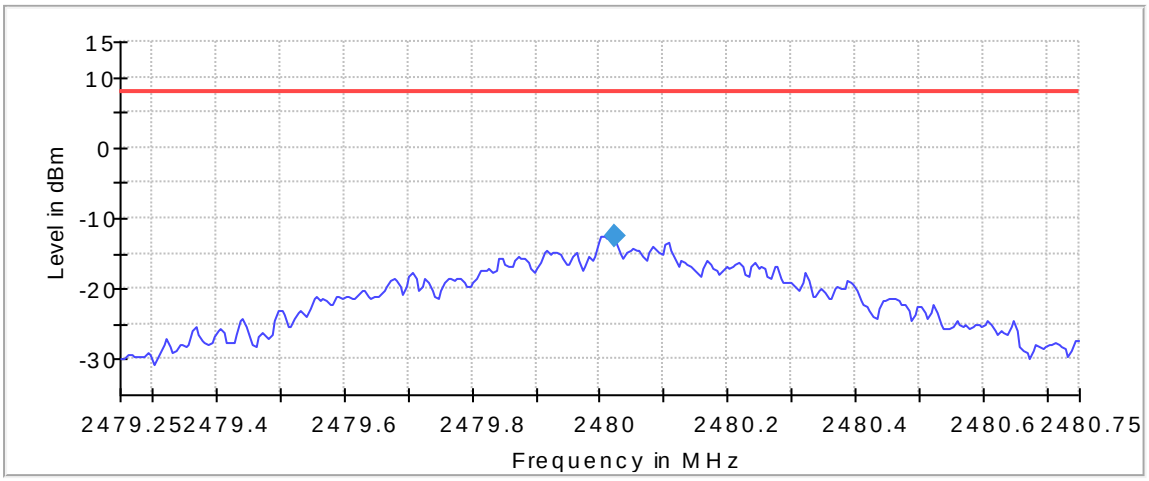
Channel	Frequency (MHz)	Measurement BW (kHz)	PSD (dBm)	Limit Max (dBm)	Result
0	2402	10	-15.8	8	Pass
19	2440	10	-15.0	8	Pass
39	2480	10	-12.6	8	Pass



Limit Sum Level PSD



Limit Sum Level PSD



Limit Sum Level PSD

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 Meas Guidance v05r02.

Limit

Because the maximum conducted average 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 30 dB below the maximum in-band peak level.

6.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature:	22.8 °C
Relative Humidity:	53.7 %
Atmospheric Pressure:	98.2 kPa

6.4 *Test Equipment*

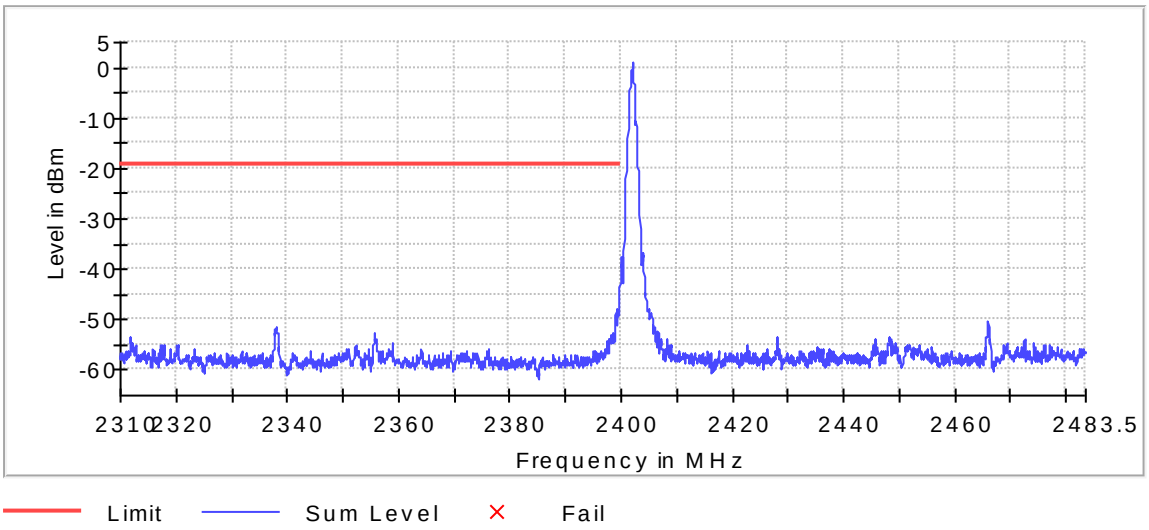
Test End Date: 11-Sep-2018 Tester: MT

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
RF CABLE	141	HUBER & SUHNER	B095585	25-Jul-2019
ATTENUATOR, 10DB	10DB	ROHDE & SCHWARZ	B095591	25-Jul-2019
RF SWITCH (TS8997)	OSP	ROHDE & SCHWARZ	15039	15-Dec-2019
POWER METER (TS8997)	OSP-B157	ROHDE & SCHWARZ	15040	15-Dec-2019
SIGNAL ANALYZER (TS8997)	FSV30	ROHDE & SCHWARZ	B085749	1-Nov-2019

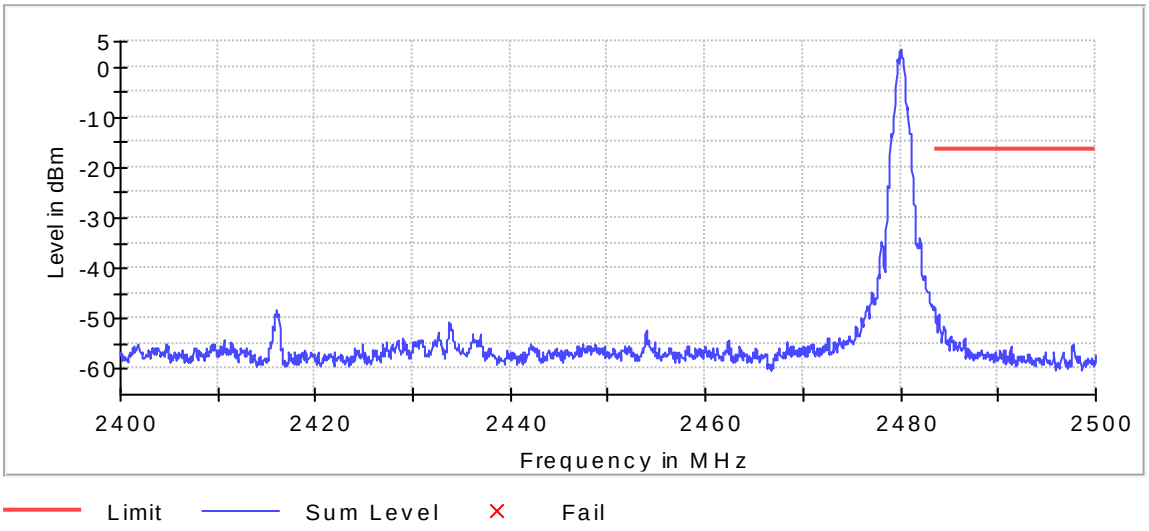
Note: The equipment calibration period is 1 year except for the FSV which is on a 2-year cycle.

6.5 *Test Data – DTS Band Edge*

BLE - Lower band edge:

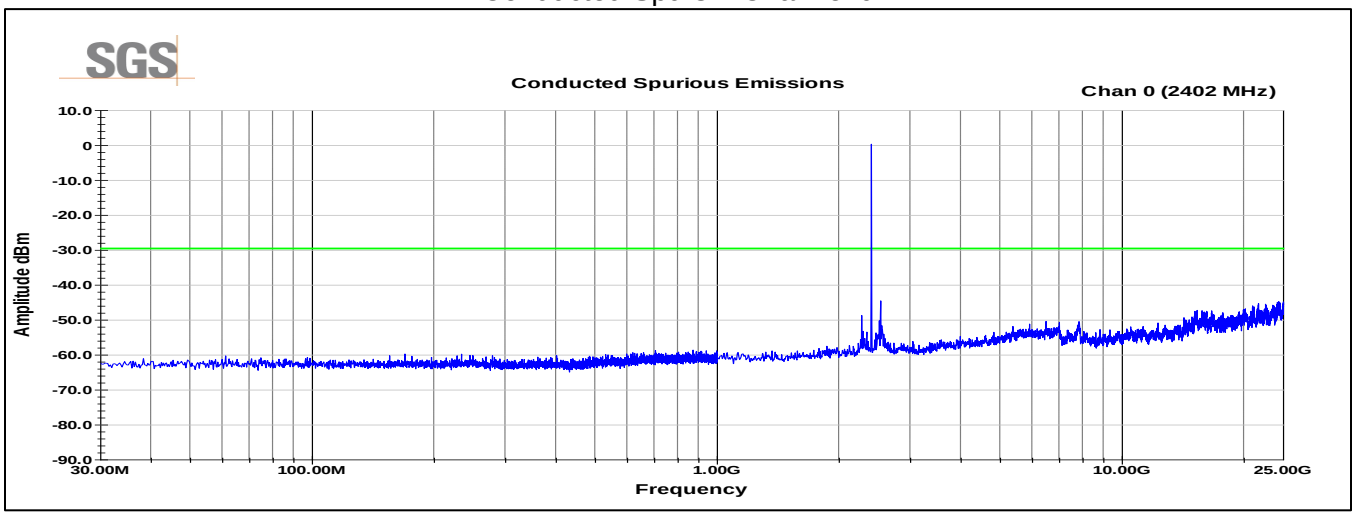


BLE - Upper band edge:

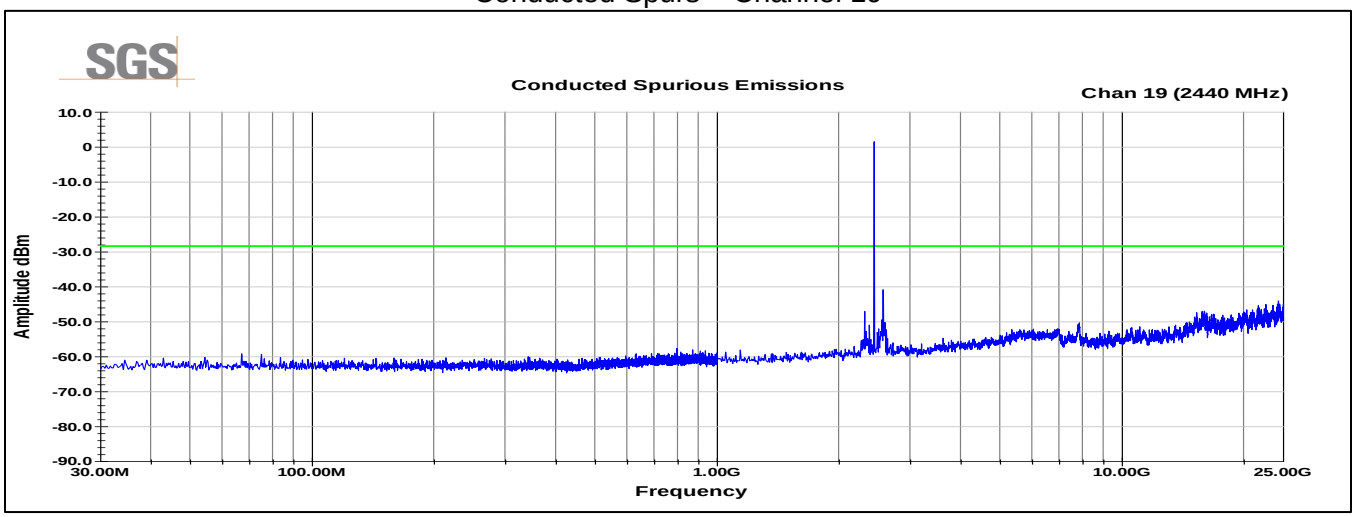


6.6 *Test Data – Conducted Spurious Emissions*

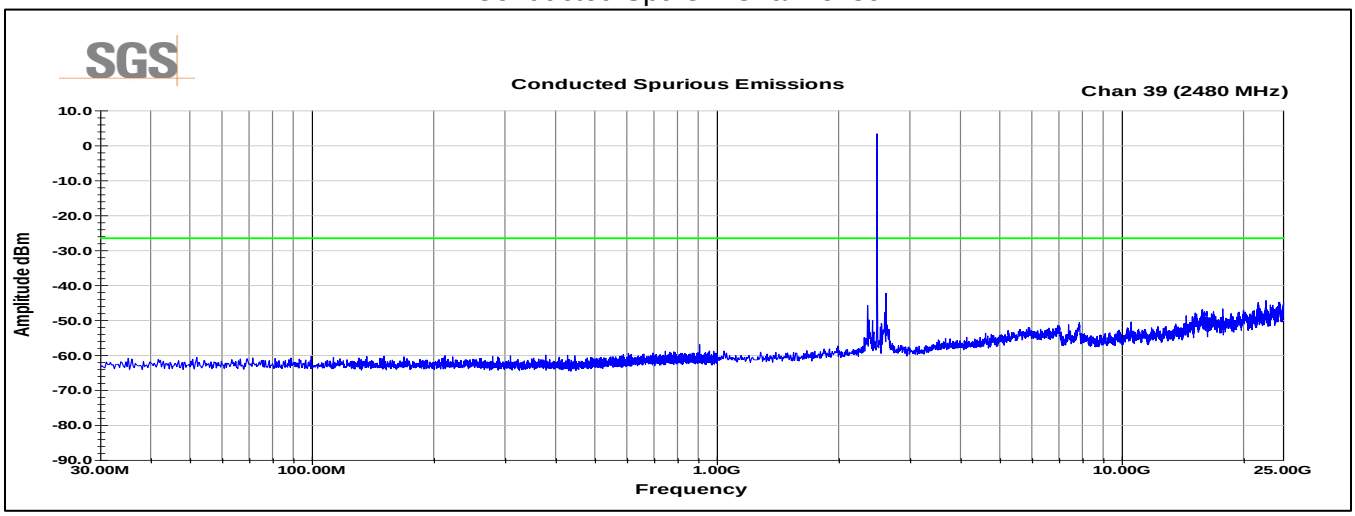
Conducted Spurs – Channel 0



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 and KDB 558074 D01 Meas Guidance v05r02 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*

Absorber Lined Shielded Enclosure (ALSE), Suwanee, GA

Environmental Conditions	30-1000MHz	1-3GHz	3-18GHz	18-26GHz
Enclosure:	10m Chamber	3m Chamber	3m Chamber	3m Chamber
Temperature:	24.0 °C	22.6 °C	22.5 °C	22.3 °C
Relative Humidity:	50.2 %	54.1 %	55.0 %	57.6 %
Atmospheric Pressure:	98.0 kPa	98.0 kPa	98.0 kPa	97.7 kPa

7.4 *Test Equipment*

30-1000MHz

Test End Date: 7-Sep-2018 Tester: PL

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
ANTENNA, BILOG	JB6	SUNOL	B079690	29-Nov-2018
RF CABLE	SF106	HUBER & SUHNER	B079716	23-Jul-2019
RF CABLE	SF106	HUBER & SUHNER	B079713	24-Jul-2019
RF CABLE	SF106	HUBER & SUHNER	B079659	23-Jul-2019
RF CABLE	104PE	HUBER & SUHNER	B079793	24-Jul-2019
LOW NOISE AMPLIFIER	TS-PR18	ROHDE & SCHWARZ	15003	27-Jul-2019
EMI TEST RECEIVER	ESU8	ROHDE & SCHWARZ	B085759	17-Aug-2019

1-3GHz

Test End Date: 7-Sep-2018 Tester: PL

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
ANTENNA, DRG HORN (MEDIUM)	3117	ETS LINDGREN	B079691	10-Aug-2019
RF CABLE	NMS-290-236.2-NMS	FLORIDA RF LABS	B095020	23-Jul-2019
RF CABLE	SUCOFLEX 100	HUBER & SUHNER	B108523	24-Jul-2019
LOW NOISE AMPLIFIER	TS-PR18	ROHDE & SCHWARZ	B094463	6-Mar-2019
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	B079629	2-Jul-2019

3-18GHz

Test End Date: 7-Sep-2018 Tester: PL

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
ANTENNA, DRG HORN (MEDIUM)	3117	ETS LINDGREN	B079691	10-Aug-2019
RF CABLE	NMS-290-236.2-NMS	FLORIDA RF LABS	B095020	23-Jul-2019
RF CABLE	SUCOFLEX 100	HUBER & SUHNER	B108523	24-Jul-2019
LOW NOISE AMPLIFIER	TS-PR18	ROHDE & SCHWARZ	B094463	6-Mar-2019
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	B079629	2-Jul-2019
FILTER, HIGH PASS (>2800MHZ)	HPM50111	MICRO-TRONICS	B085747	26-Jul-2019

18-26GHz

Test End Date: 10-Sep-2018 Tester: MT

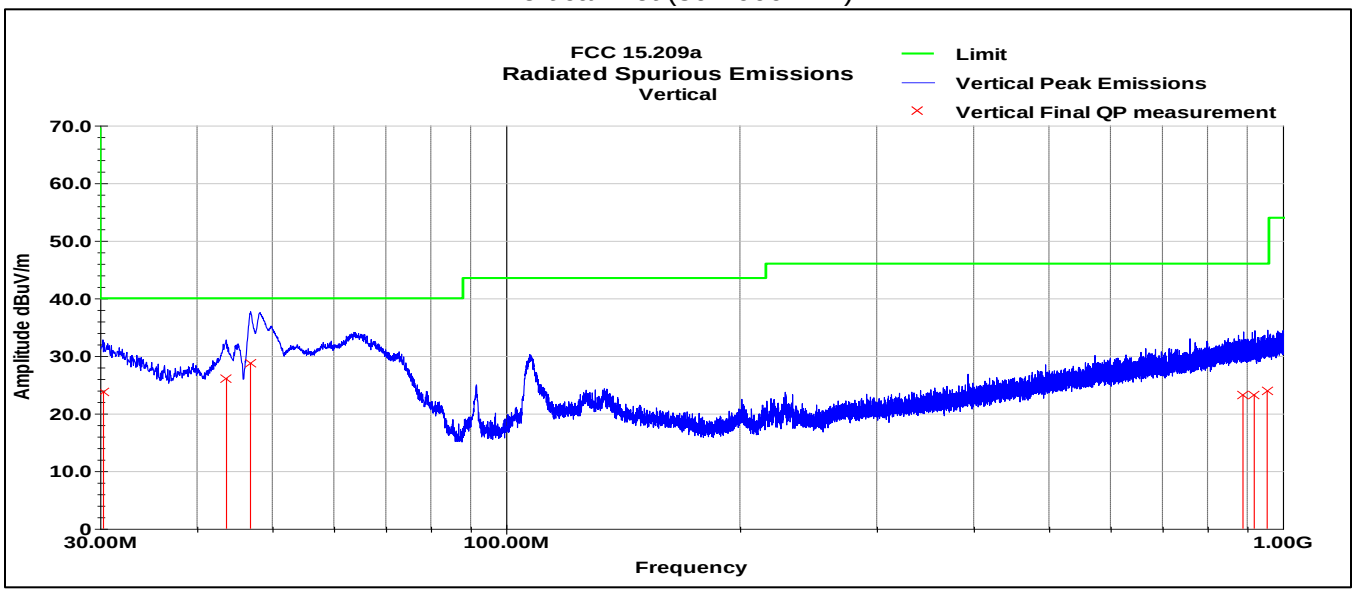
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
ANTENNA, HORN (SMALL)	LB-180400-20-C-KF	A-INFO	15007	30-Mar-2019
RF CABLE	SF102	HUBER & SUHNER	B079822	25-Jul-2019
RF CABLE	SF102	HUBER & SUHNER	B079824	25-Jul-2019
LOW NOISE AMPLIFIER	NSP1840-HG	MITEQ	B087572	27-Jul-2019
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	B079629	2-Jul-2019

Note: The equipment calibration period is 1 year.

7.5 *Test Data – Peak Plots*

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

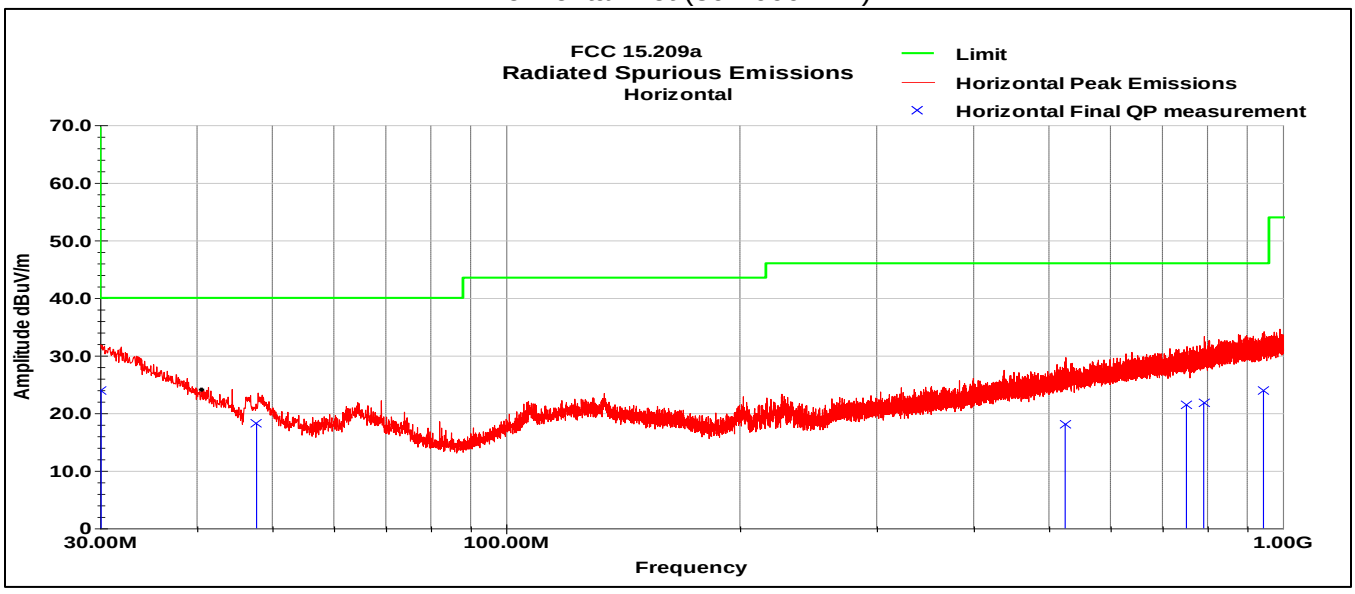
BLE Channel 0
Vertical Plot (30-1000MHz)



BLE Channel 0
Vertical Data (30-1000MHz)

Frequency MHz	Raw QP (dBuV)	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	Loss (dB)	Amp (dB)	QP Value (dBuV/m)	Limit (dBuV/m)	Margin (dB)
30.31	26.3	V	84.0	181.0	22.0	6.5	31.1	23.7	40.0	-16.3
43.65	39.6	V	241.0	250.0	12.1	6.6	32.2	26.1	40.0	-13.9
46.86	44.4	V	231.0	250.0	10.2	6.7	32.4	28.8	40.0	-11.2
888.72	24.6	V	44.0	175.0	22.9	9.3	33.6	23.2	46.0	-22.9
918.89	24.5	V	214.0	175.0	23.1	9.3	33.6	23.3	46.0	-22.7
954.87	24.6	V	138.0	175.0	23.4	9.5	33.6	23.9	46.0	-22.1
QP Value = Level + AF + CL - Amp										
Margin = QP Value - Limit										

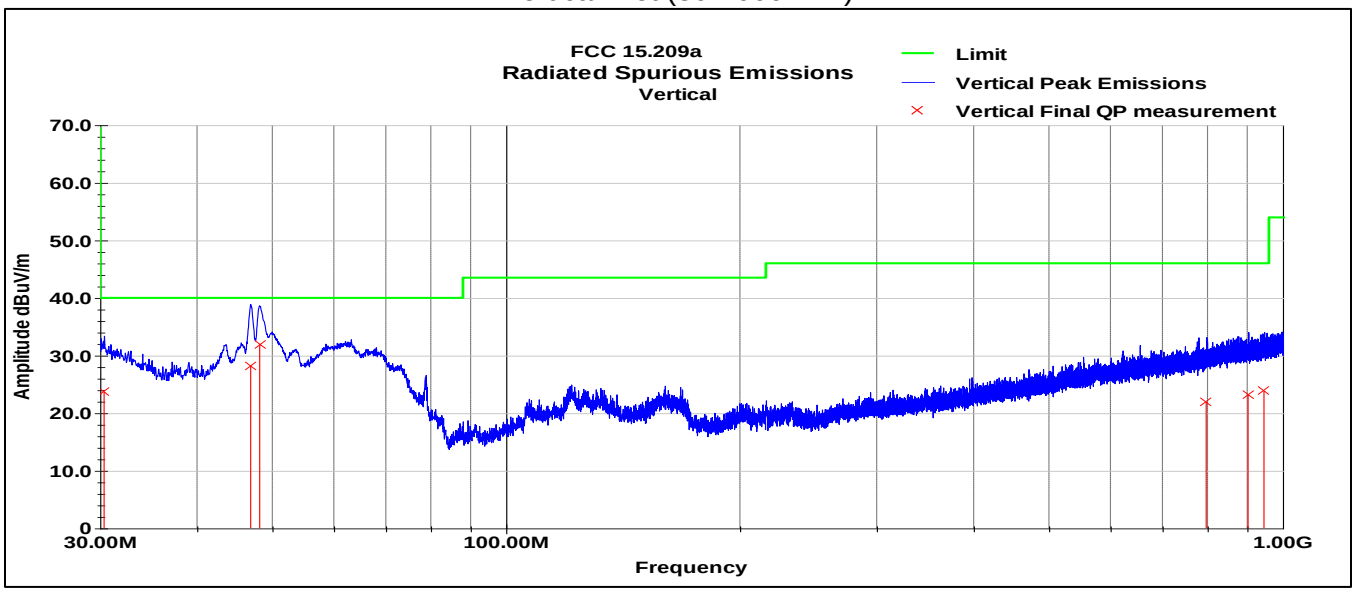
BLE Channel 0
Horizontal Plot (30-1000MHz)



BLE Channel 0
Horizontal Data (30-1000MHz)

Frequency MHz	Raw QP (dBuV)	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	Loss (dB)	Amp (dB)	QP Value (dBuV/m)	Limit (dBuV/m)	Margin (dB)
30.10	26.2	H	327.0	171.0	22.2	6.5	31.1	23.9	40.0	-16.1
47.73	34.3	H	222.0	133.0	9.7	6.7	32.5	18.2	40.0	-21.8
524.58	24.5	H	155.0	224.0	18.6	8.6	33.6	18.1	46.0	-27.9
751.51	24.6	H	330.0	235.0	21.3	9.1	33.6	21.4	46.0	-24.6
790.99	24.5	H	346.0	108.0	21.8	9.1	33.6	21.8	46.0	-24.2
944.40	24.7	H	20.0	248.0	23.4	9.4	33.6	23.9	46.0	-22.1
QP Value = Level + AF + CL - Amp										
Margin = QP Value - Limit										

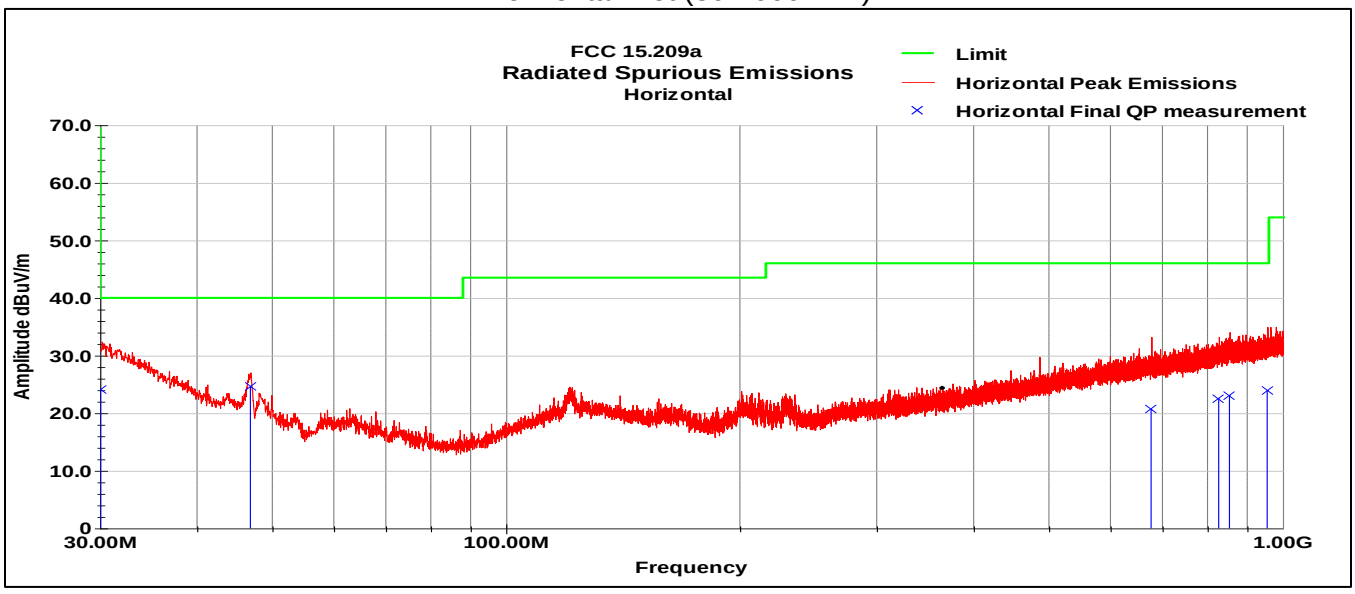
BLE Channel 19
Vertical Plot (30-1000MHz)



BLE Channel 19
Vertical Data (30-1000MHz)

Frequency MHz	Raw QP (dBuV)	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	Loss (dB)	Amp (dB)	QP Value (dBuV/m)	Limit (dBuV/m)	Margin (dB)
30.37	26.3	V	271.0	250.0	22.0	6.5	31.1	23.7	40.0	-16.3
46.90	43.8	V	194.0	250.0	10.1	6.7	32.4	28.2	40.0	-11.8
48.16	48.2	V	210.0	250.0	9.5	6.7	32.5	31.9	40.0	-8.1
796.86	24.5	V	222.0	250.0	22.0	9.1	33.6	21.9	46.0	-24.1
902.35	24.5	V	196.0	250.0	23.0	9.3	33.6	23.2	46.0	-22.9
945.95	24.6	V	142.0	250.0	23.4	9.5	33.6	23.9	46.0	-22.2
QP Value = Level + AF + CL - Amp										
Margin = QP Value - Limit										

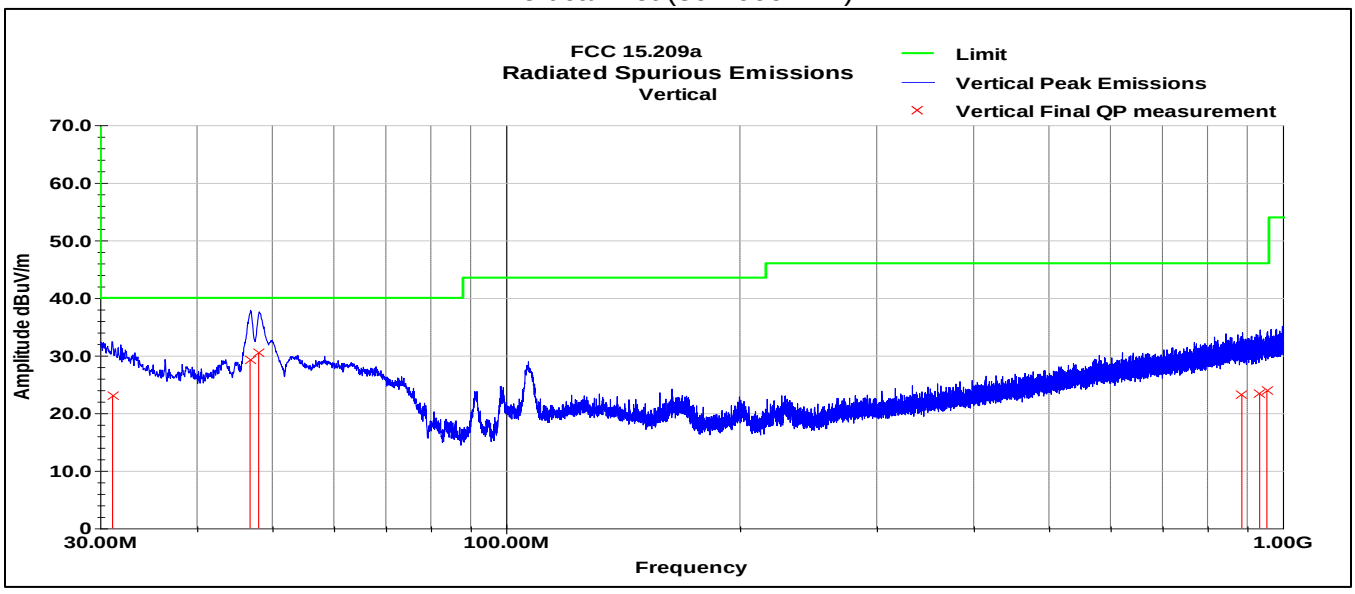
BLE Channel 19
Horizontal Plot (30-1000MHz)



BLE Channel 19
Horizontal Data (30-1000MHz)

Frequency MHz	Raw QP (dBuV)	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	Loss (dB)	Amp (dB)	QP Value (dBuV/m)	Limit (dBuV/m)	Margin (dB)
30.03	26.3	H	10.0	169.0	22.3	6.5	31.1	24.0	40.0	-16.0
46.86	40.2	H	237.0	114.0	10.2	6.7	32.4	24.6	40.0	-15.4
676.87	24.5	H	335.0	175.0	20.8	8.9	33.5	20.7	46.0	-25.4
827.13	24.5	H	185.0	148.0	22.4	9.2	33.6	22.5	46.0	-23.5
853.90	24.6	H	196.0	179.0	22.8	9.3	33.6	23.1	46.0	-22.9
954.92	24.7	H	245.0	100.0	23.4	9.5	33.6	24.0	46.0	-22.0
QP Value = Level + AF + CL - Amp										
Margin = QP Value - Limit										

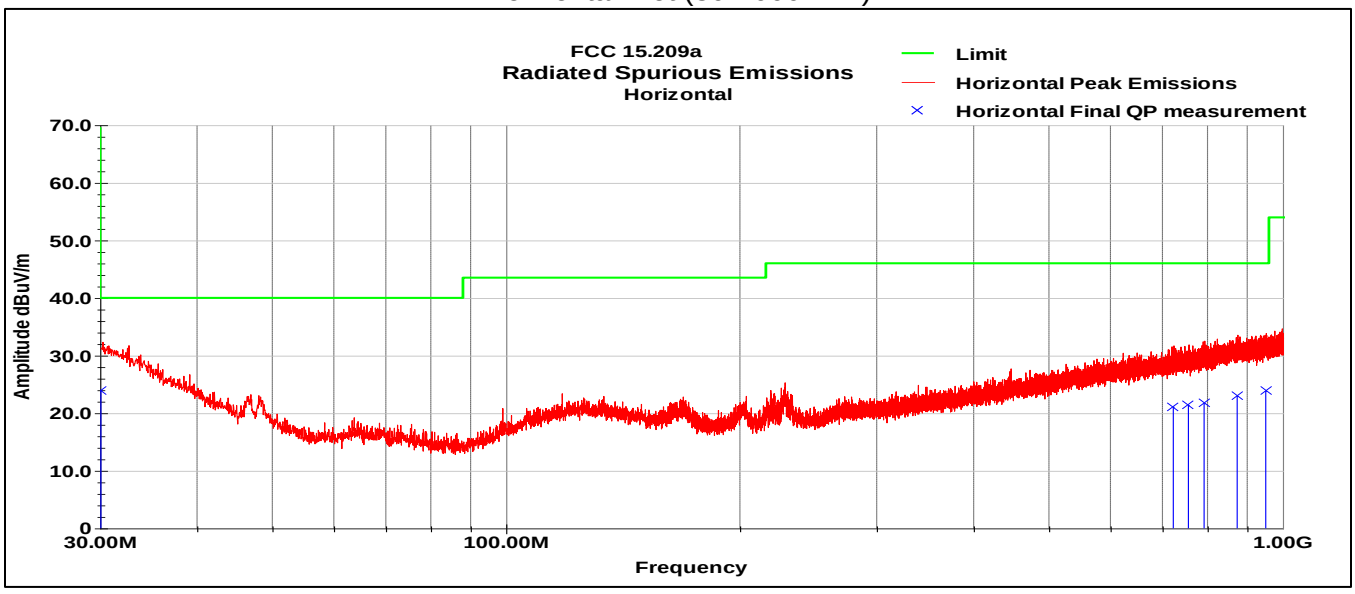
BLE Channel 39
Vertical Plot (30-1000MHz)



BLE Channel 39
Vertical Data (30-1000MHz)

Frequency MHz	Raw QP (dBuV)	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	Loss (dB)	Amp (dB)	QP Value (dBuV/m)	Limit (dBuV/m)	Margin (dB)
31.14	26.3	V	51.0	250.0	21.4	6.5	31.2	23.0	40.0	-17.0
46.81	44.8	V	167.0	250.0	10.2	6.7	32.4	29.3	40.0	-10.7
48.02	46.7	V	63.0	250.0	9.6	6.7	32.5	30.4	40.0	-9.6
885.86	24.6	V	130.0	175.0	22.9	9.3	33.6	23.2	46.0	-22.9
933.67	24.5	V	318.0	215.0	23.1	9.4	33.6	23.4	46.0	-22.6
954.15	24.5	V	233.0	250.0	23.4	9.5	33.6	23.8	46.0	-22.2
QP Value = Level + AF + CL - Amp										
Margin = QP Value - Limit										

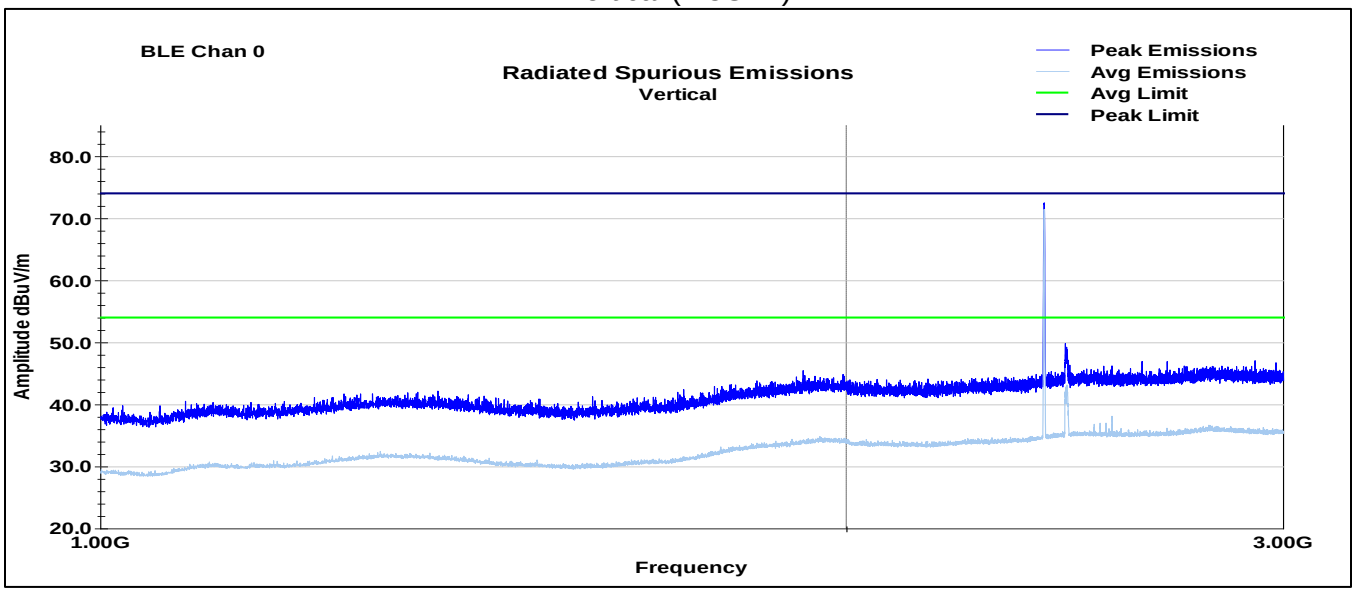
BLE Channel 39
Horizontal Plot (30-1000MHz)



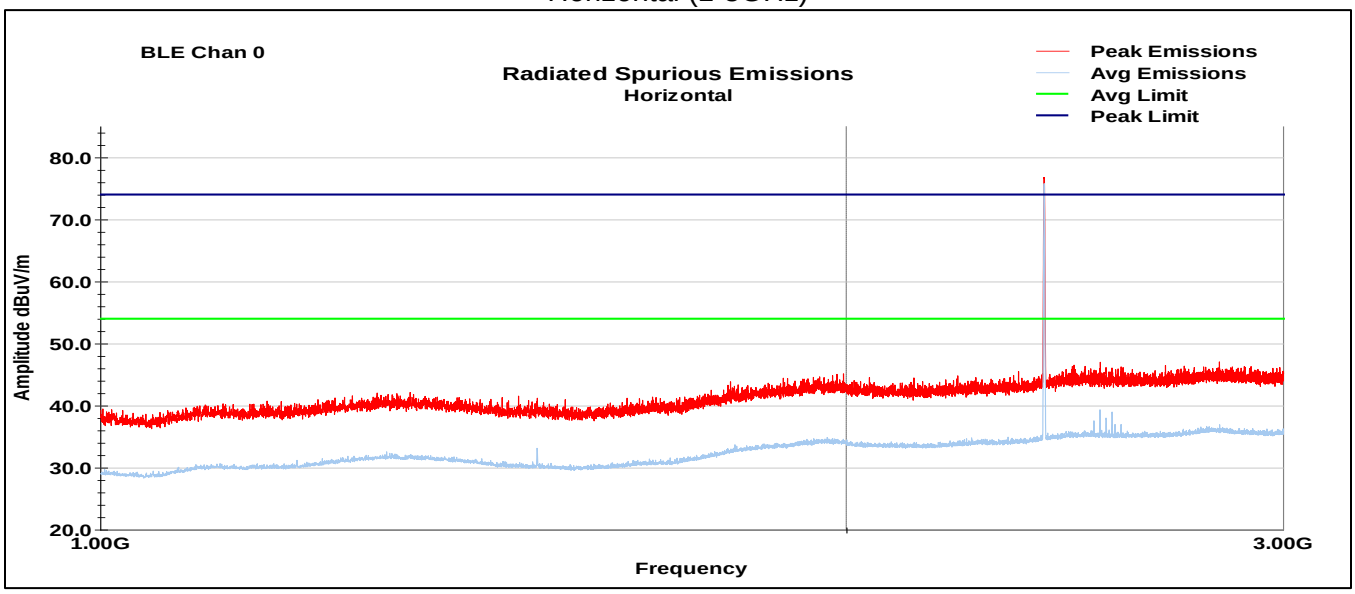
BLE Channel 39
Horizontal Data (30-1000MHz)

Frequency MHz	Raw QP (dBuV)	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	Loss (dB)	Amp (dB)	QP Value (dBuV/m)	Limit (dBuV/m)	Margin (dB)
30.07	26.3	H	243.0	239.0	22.2	6.5	31.1	24.0	40.0	-16.0
722.90	24.5	H	295.0	100.0	21.2	9.0	33.6	21.1	46.0	-24.9
755.93	24.5	H	49.0	151.0	21.3	9.1	33.6	21.4	46.0	-24.6
792.16	24.4	H	308.0	113.0	21.8	9.1	33.6	21.7	46.0	-24.3
873.64	24.5	H	175.0	161.0	22.8	9.3	33.6	23.0	46.0	-23.0
950.71	24.6	H	241.0	248.0	23.4	9.5	33.6	23.9	46.0	-22.1
QP Value = Level + AF + CL - Amp										
Margin = QP Value - Limit										

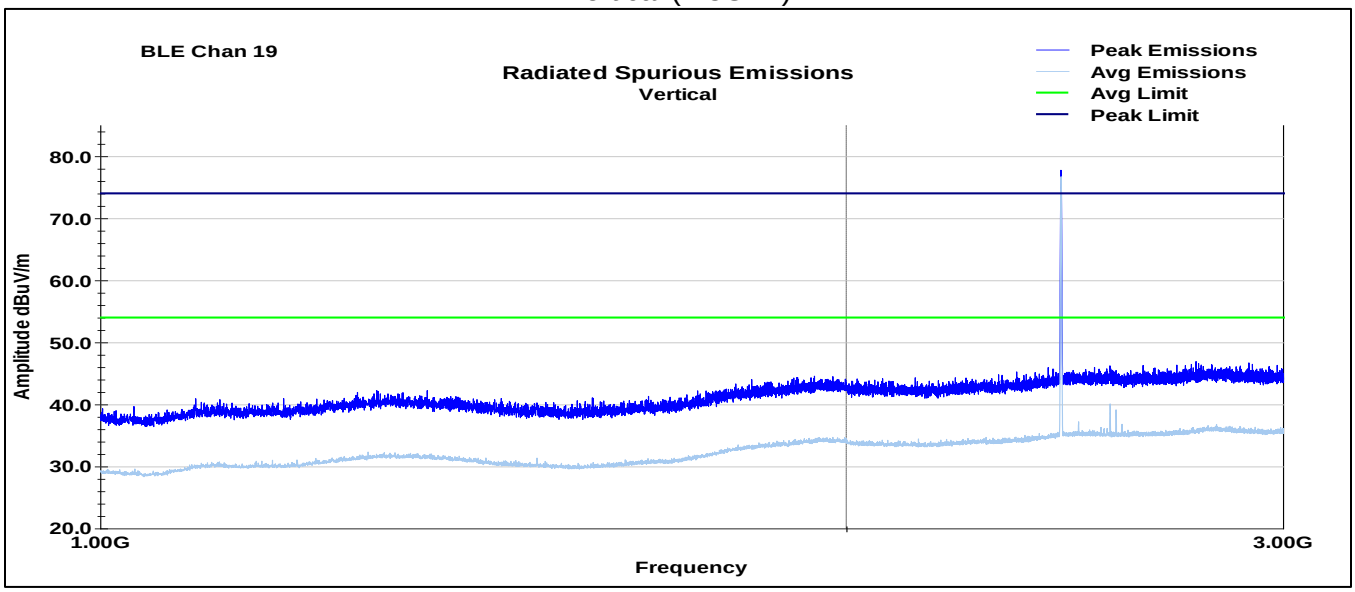
BLE Channel 0
Vertical (1-3GHz)



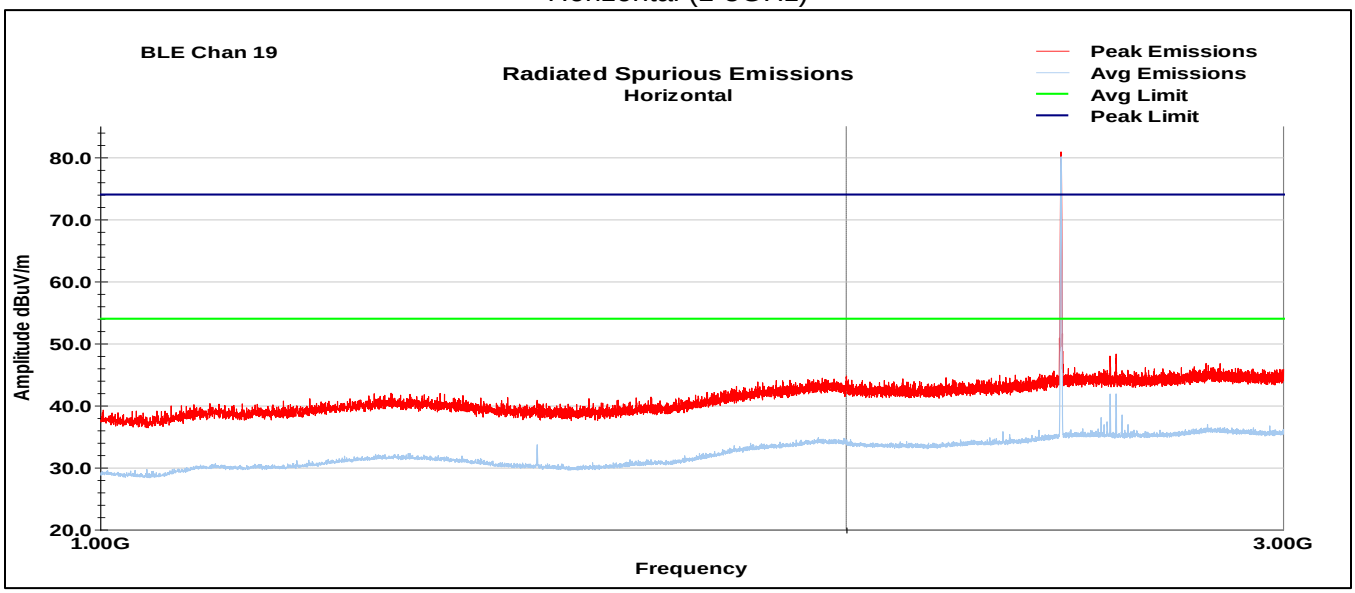
BLE Channel 0
Horizontal (1-3GHz)



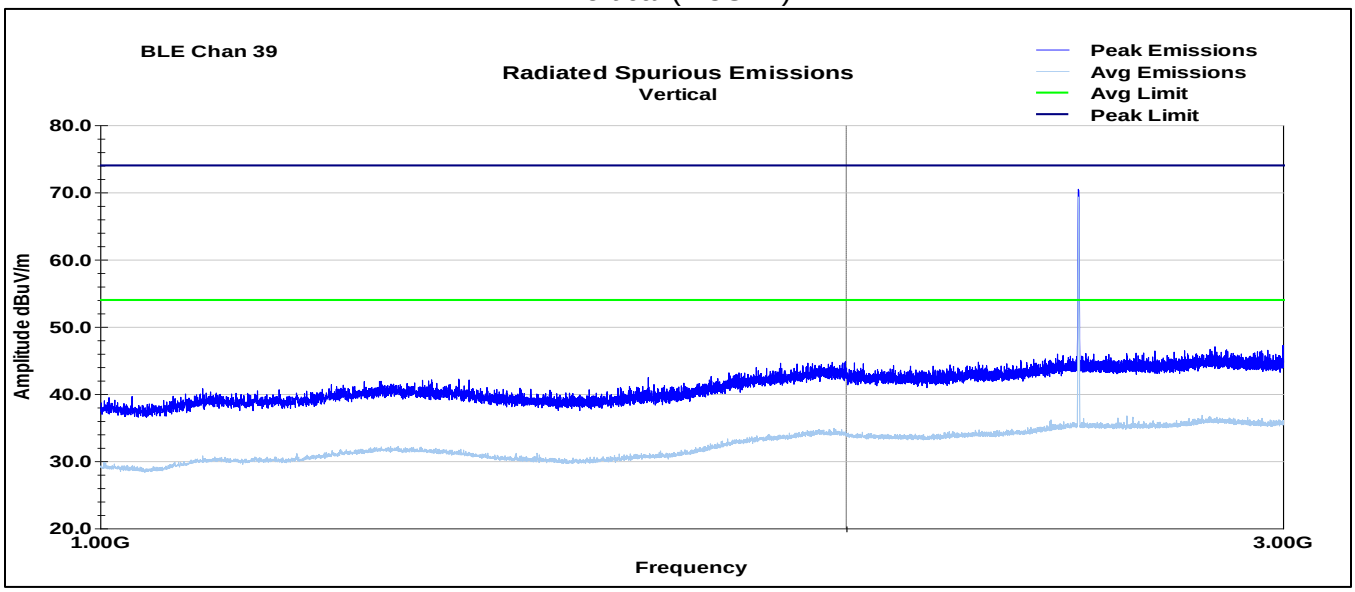
BLE Channel 19
Vertical (1-3GHz)



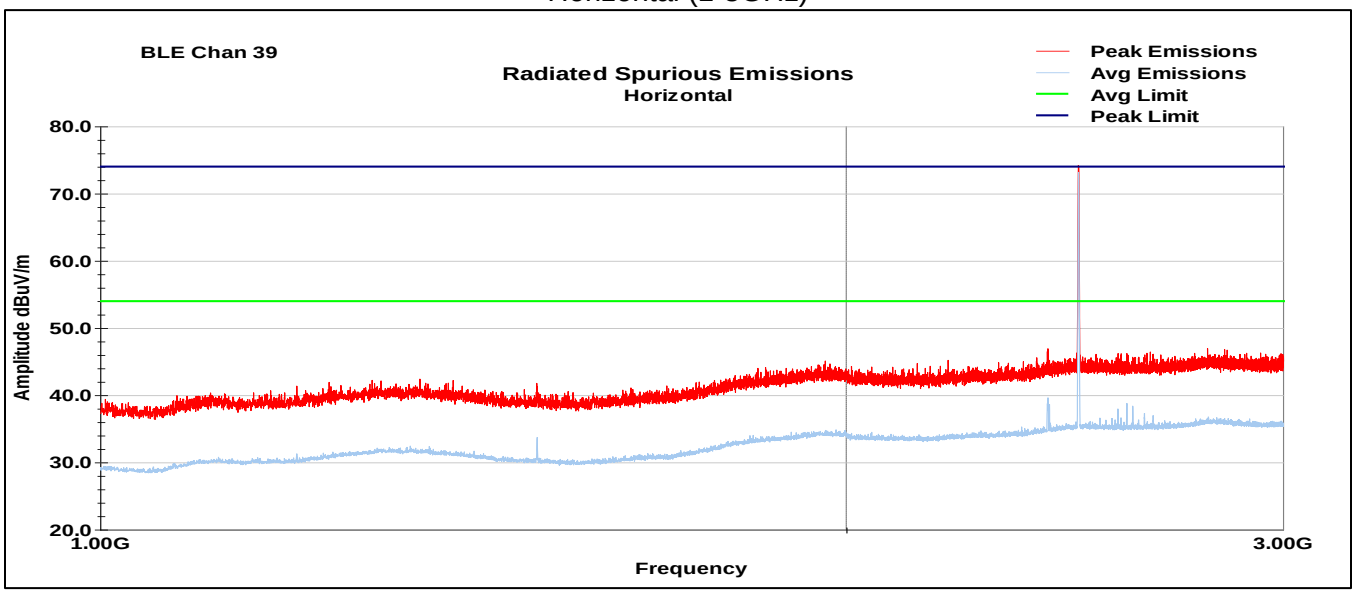
BLE Channel 19
Horizontal (1-3GHz)



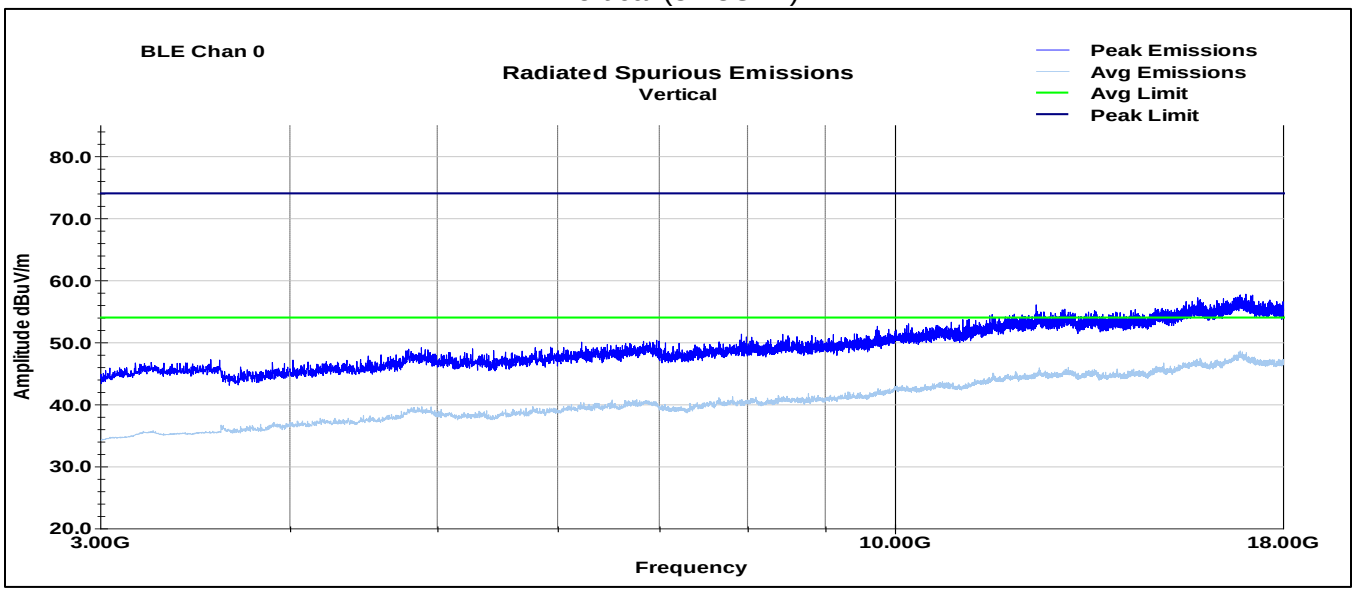
BLE Channel 39
Vertical (1-3GHz)



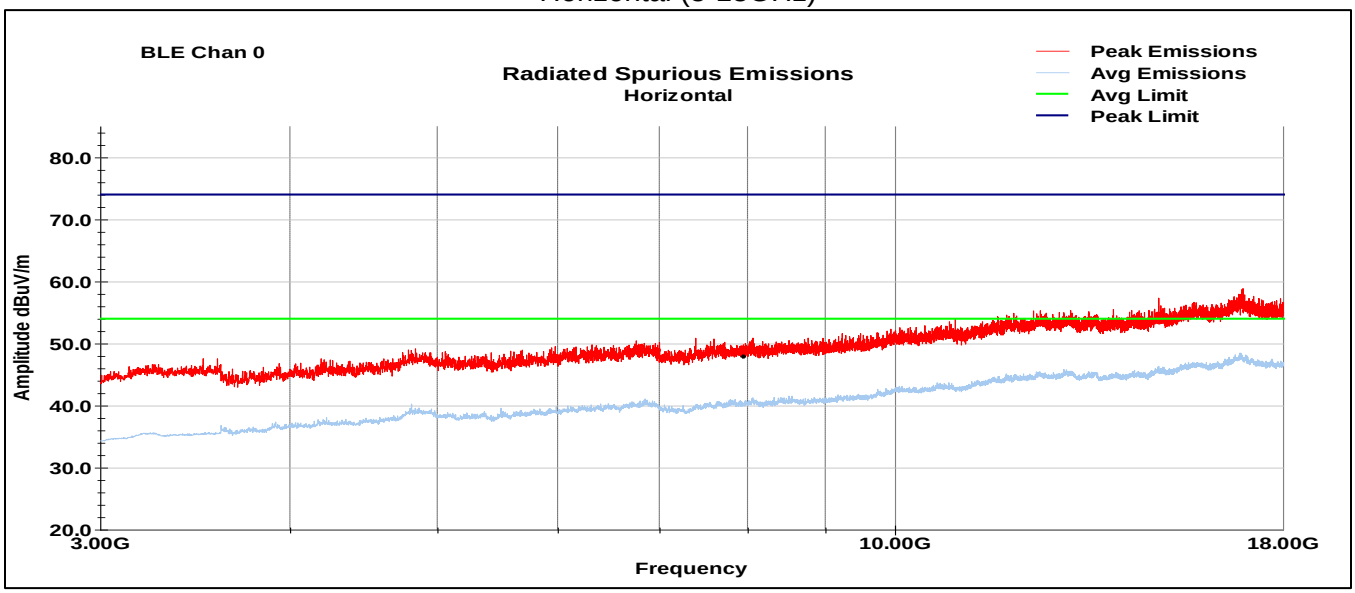
BLE Channel 39
Horizontal (1-3GHz)



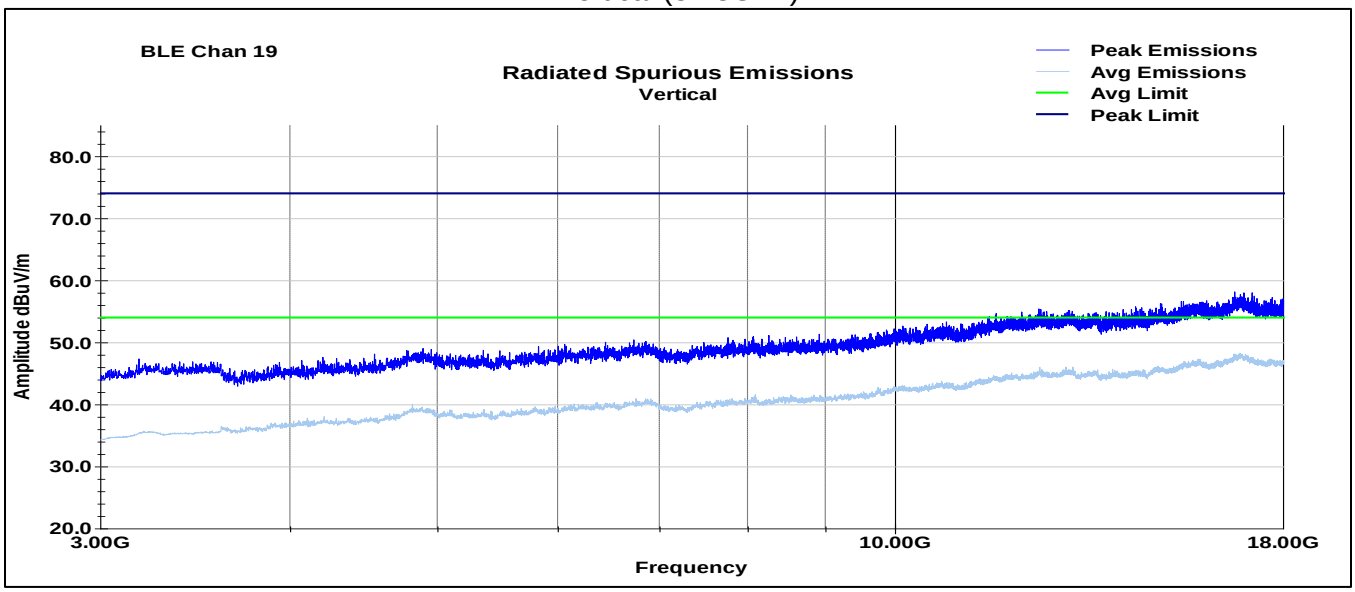
BLE Channel 0
Vertical (3-18GHz)



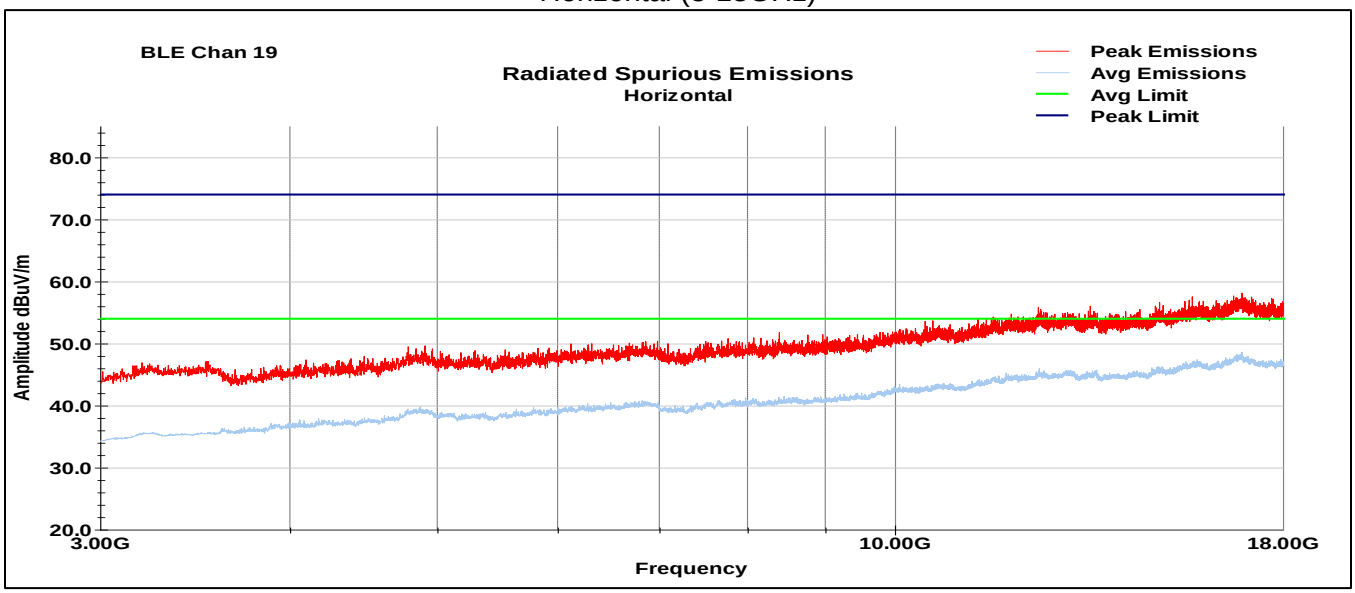
BLE Channel 0
Horizontal (3-18GHz)



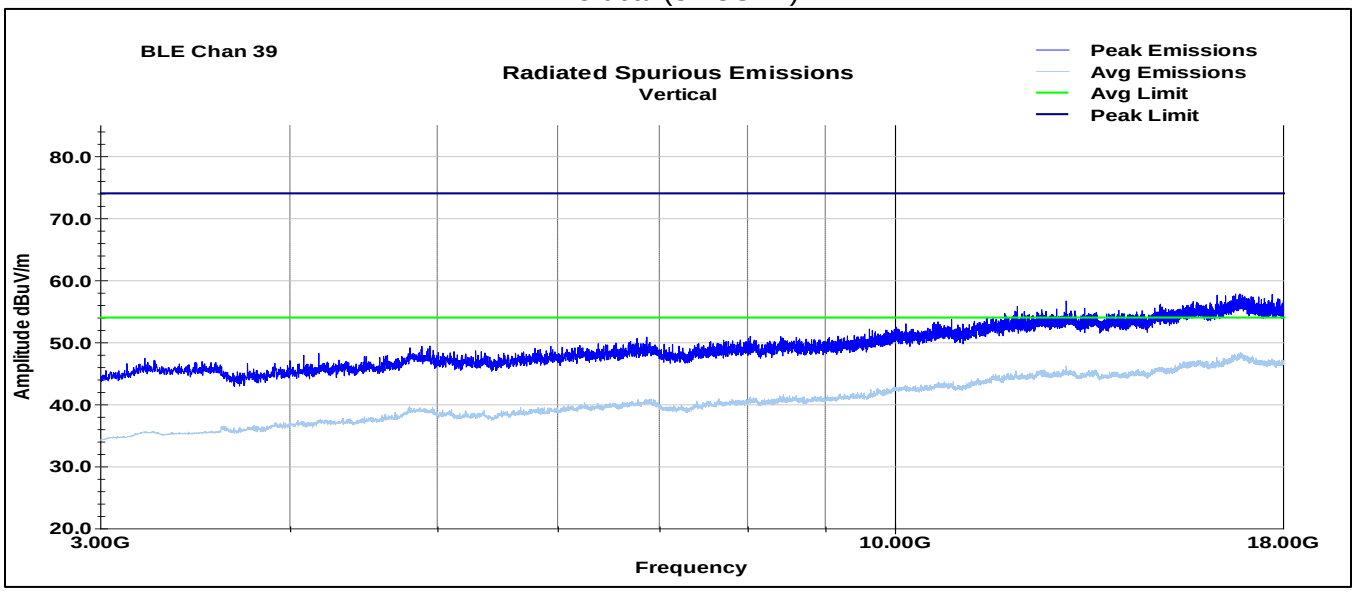
BLE Channel 19
Vertical (3-18GHz)



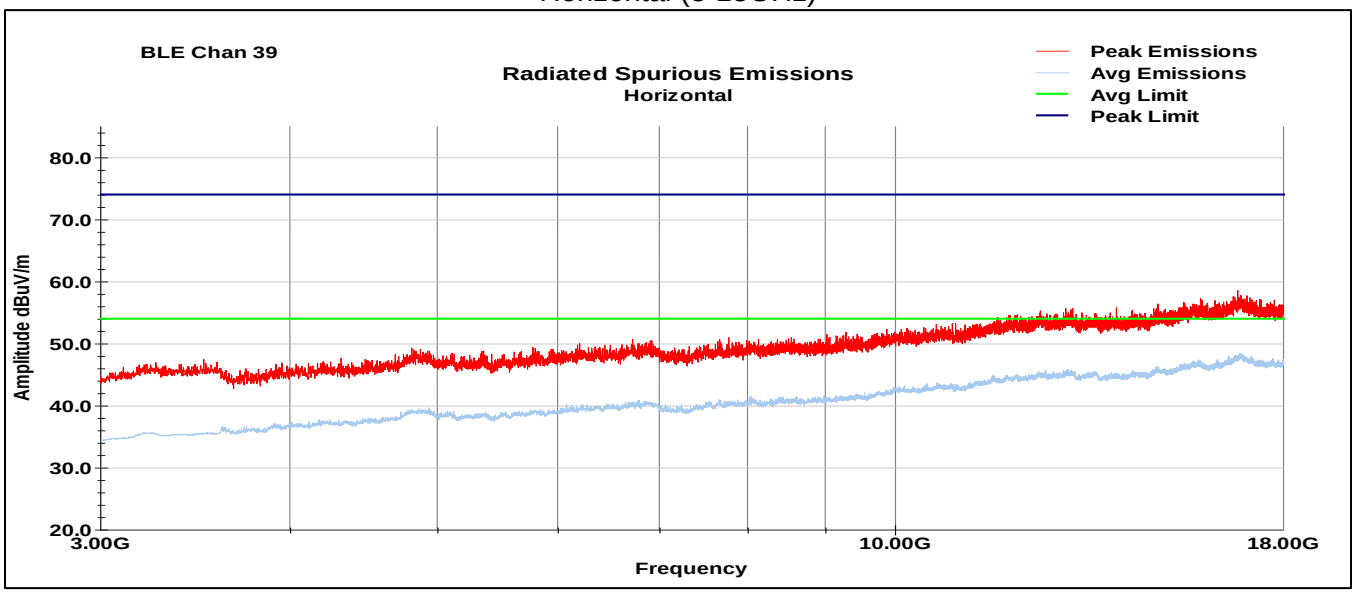
BLE Channel 19
Horizontal (3-18GHz)



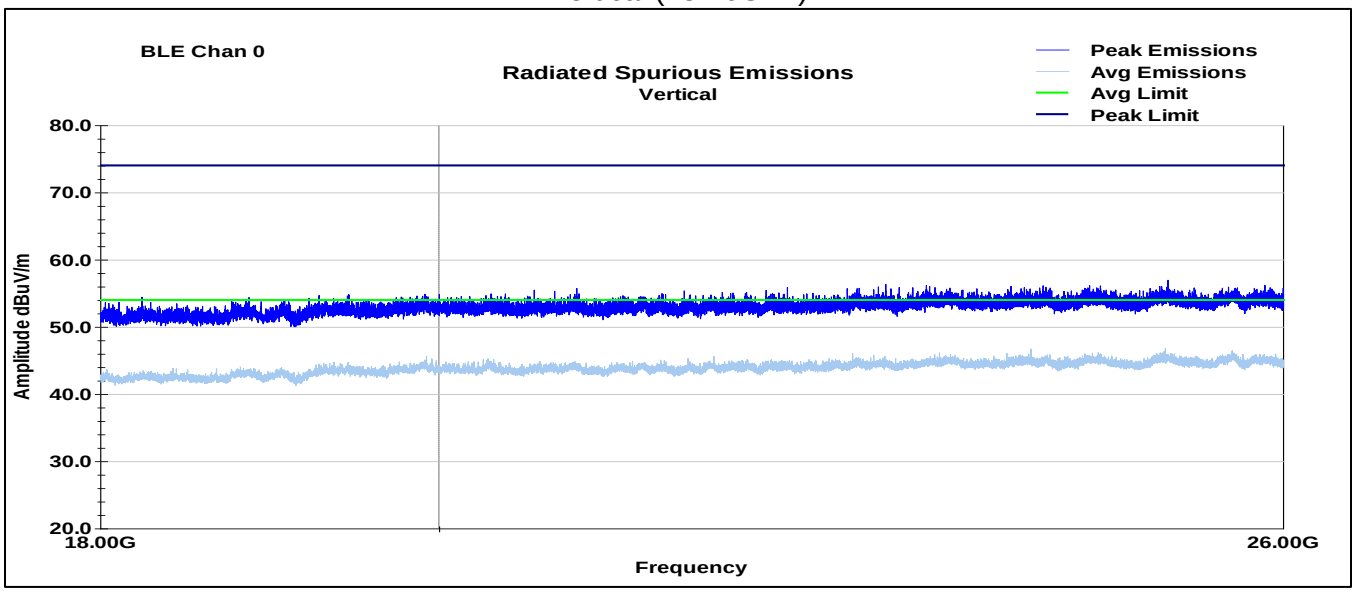
BLE Channel 39
Vertical (3-18GHz)



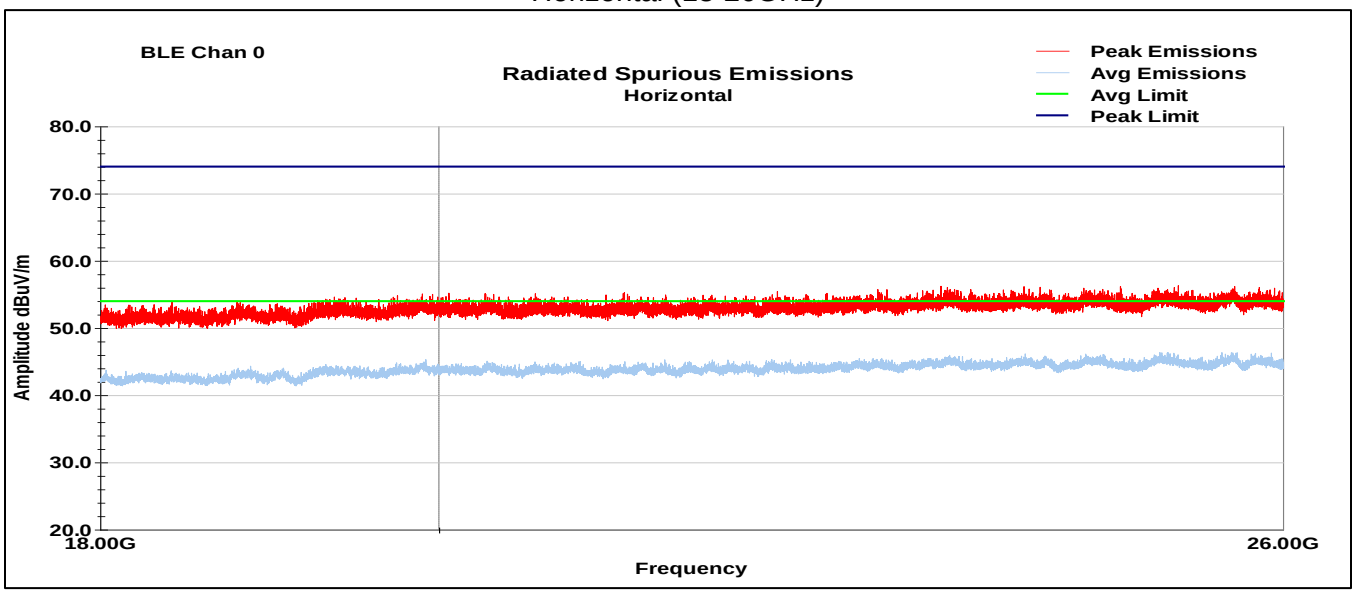
BLE Channel 39
Horizontal (3-18GHz)



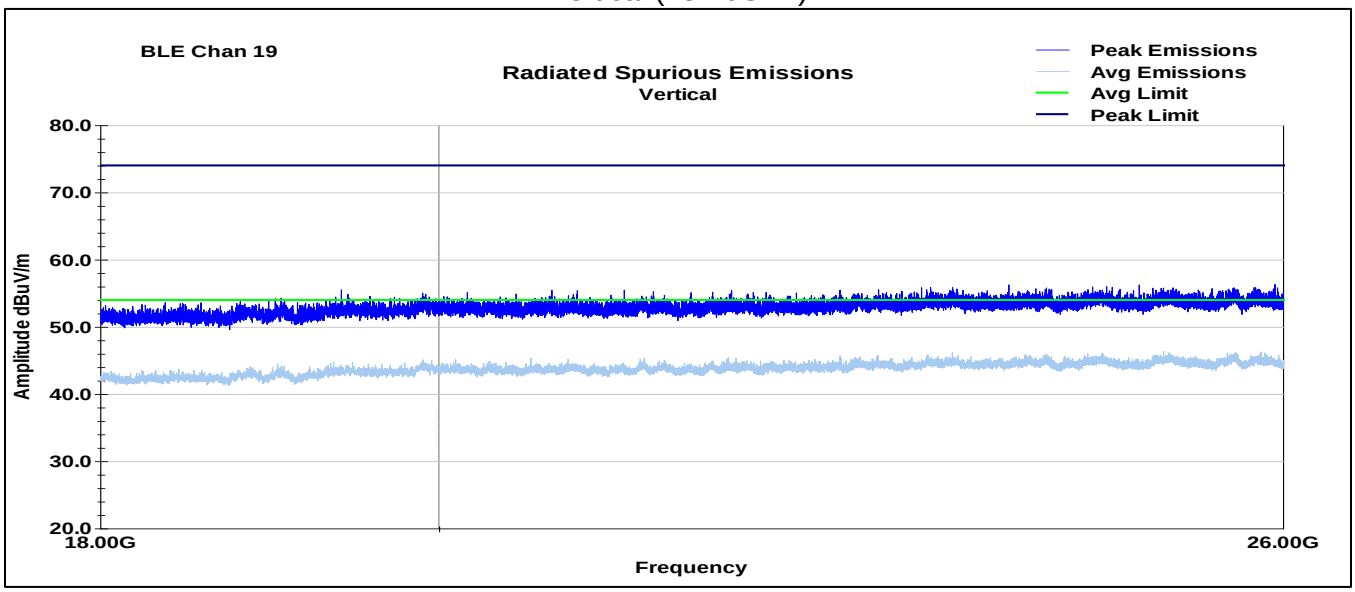
BLE Channel 0
Vertical (18-26GHz)



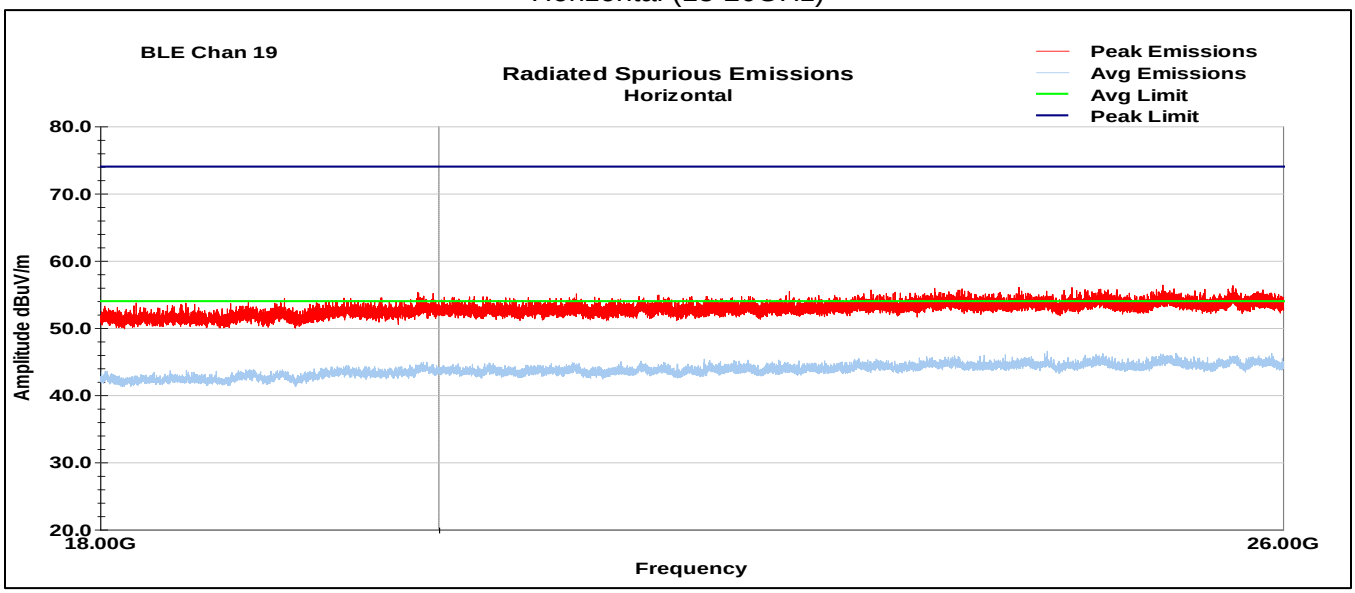
BLE Channel 0
Horizontal (18-26GHz)



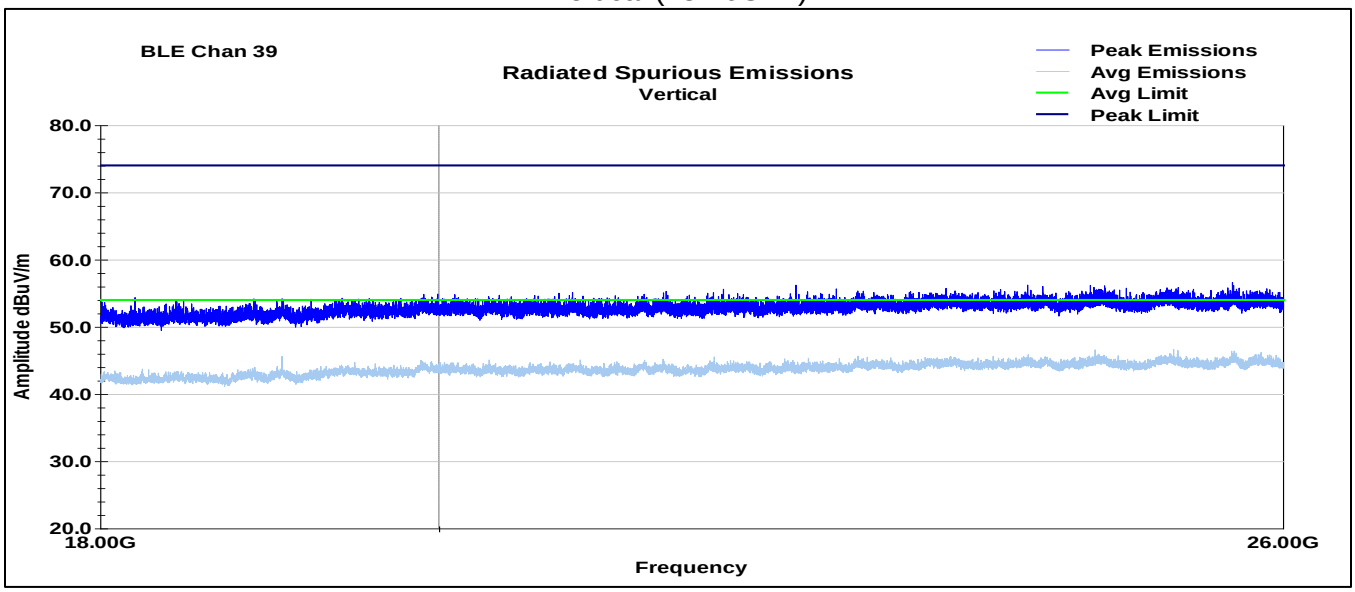
BLE Channel 19
Vertical (18-26GHz)



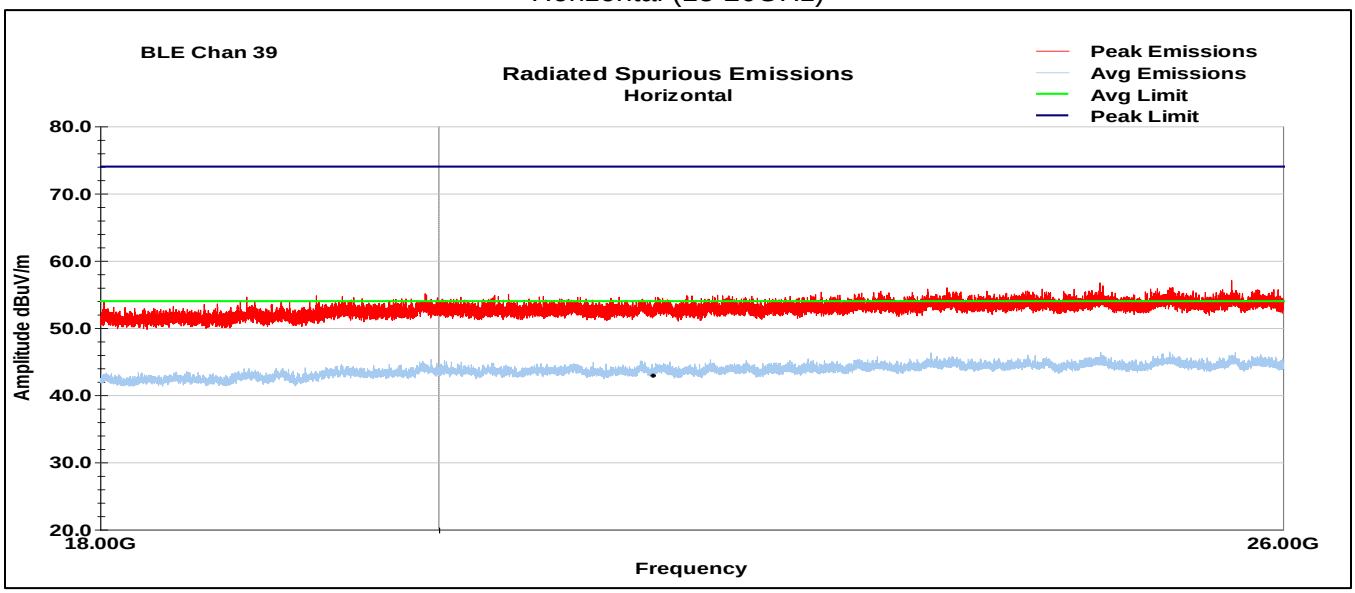
BLE Channel 19
Horizontal (18-26GHz)



BLE Channel 39
Vertical (18-26GHz)



BLE Channel 39
Horizontal (18-26GHz)



8 Emissions in Restricted Frequency Bands

8.1 *Test Result*

Test Description	Test Specification		Test Result
Emissions in Restricted Frequency Bands	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. Measurements were made using the conducted methods defined in ANSI C63.10: 2013 clause 11.12.

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

Offset = -20Log(D) + 104.8 - 107 + CL + DC + AG
$Offset_{3m}$ = -11.7 + CL + DC + AG

D = 3m	Distance
CL = 0.0 dB	Cable Loss
DC = 0.41 dB (91.0%)	Duty Cycle Correction Factor
AG = 2 dB*	Antenna Gain

Offset = -9.3 dB

* The actual antenna gain is 0.7 dBi according to the datasheet. 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:	54.0 %
Atmospheric Pressure:	98.2 kPa

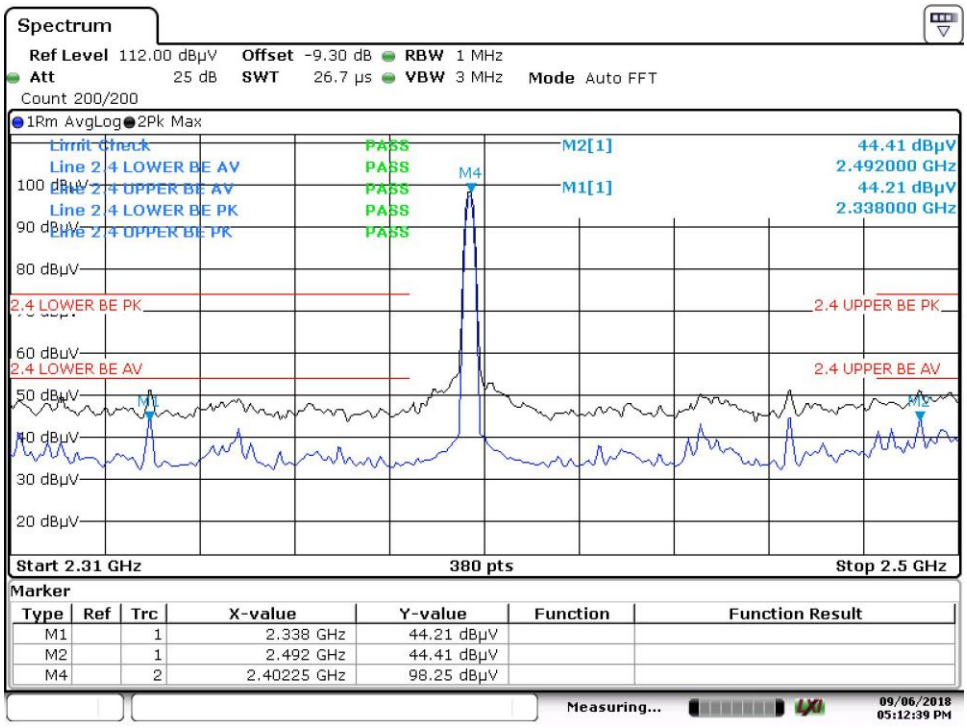
8.4 *Test Equipment*

Test End Date: 6-Sep-2018 Tester: MT

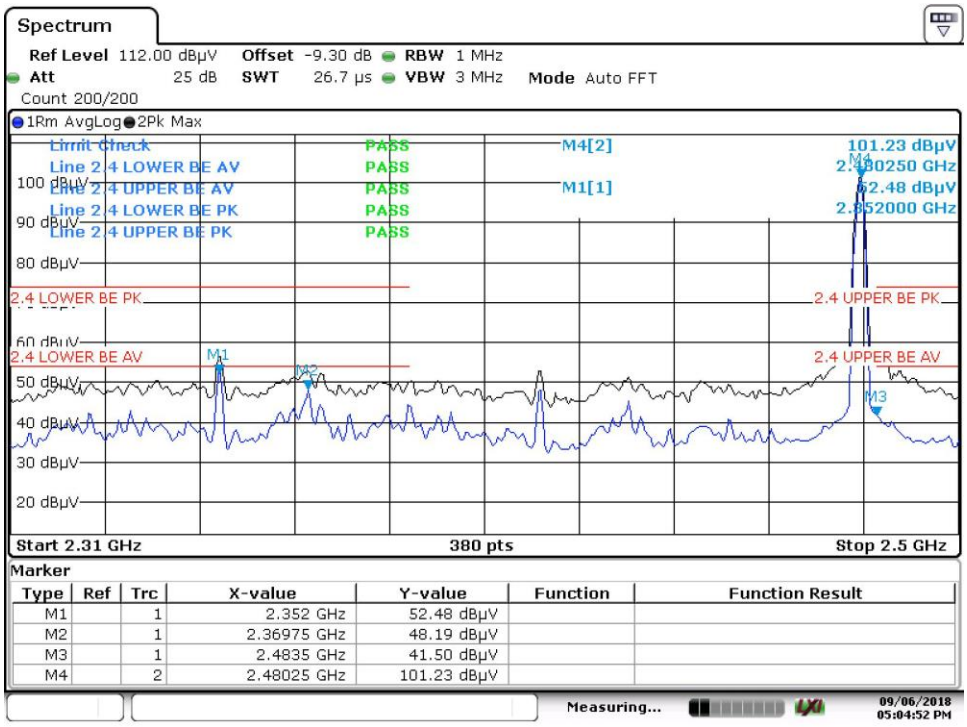
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
SIGNAL ANALYZER (TS8997)	FSV30	ROHDE & SCHWARZ	B085749	1-Nov-2019

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*



Date: 6.SEP.2018 17:12:40



Date: 6.SEP.2018 17:04:52

9 AC Powerline Conducted Emissions

9.1 *Test Result*

Test Description	Basic Standards	Test Result
AC Powerline Conducted Emissions, Class B	ANSI C63.4 ANSI C63.10	Compliant

9.2 *Test Method*

With the receiver's resolution bandwidth was set to 9 kHz, exploratory scans were performed over the measuring frequency range (0.15 MHz to 30 MHz) 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 50 Pk 60

9.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature:	23 °C
Relative Humidity:	30 %
Atmospheric Pressure:	98 kPa

9.4 *Test Equipment*

Test End Date: 24-Nov-2020 Tester: PV

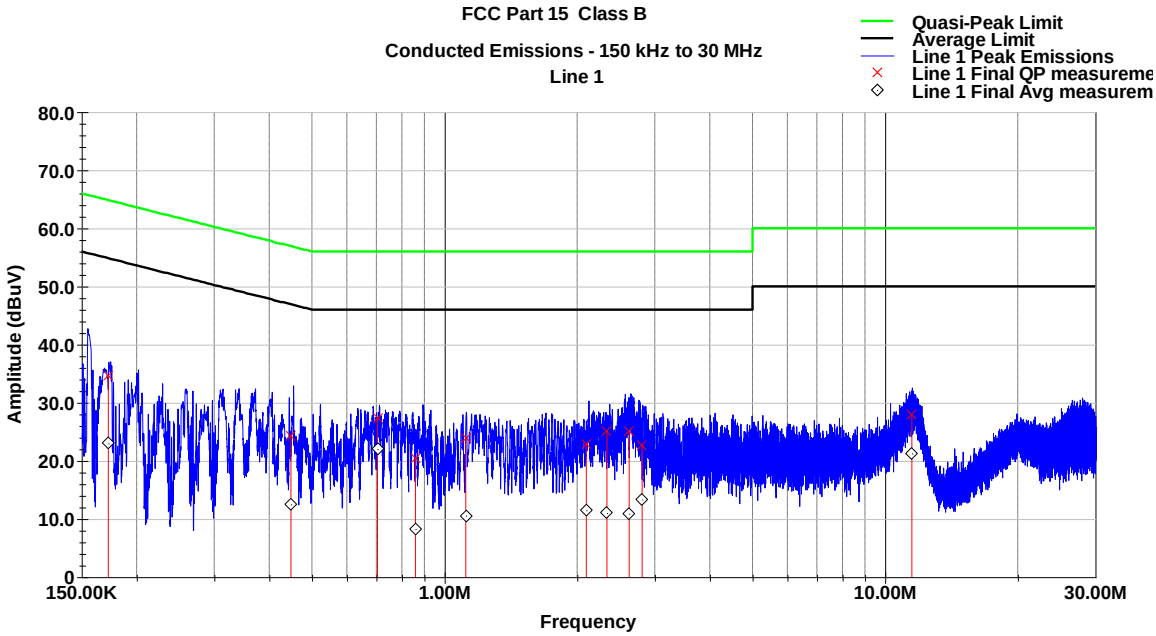
Equipment	Model	Manufacturer	Asset Number	Cal Date	Cal Due Date
EMI TEST RECEIVER	ESU8	ROHDE & SCHWARZ	B085759	7-May-2020	7-May-2021
RF CABLE	UC-N-MM-78	MAURY MICROWAVE	17017	3-Sep-2020	3-Sep-2021
LINE IMPEDANCE STABILIZATION NETWORK	NNB 51	TESEQ	B085882	9-Apr-2020	9-Apr-2021

Note: The equipment calibration period is 1 year.

Software:
"Conducted Emissions" TILE! profile dated Nov 2018

9.5 *Test Data*

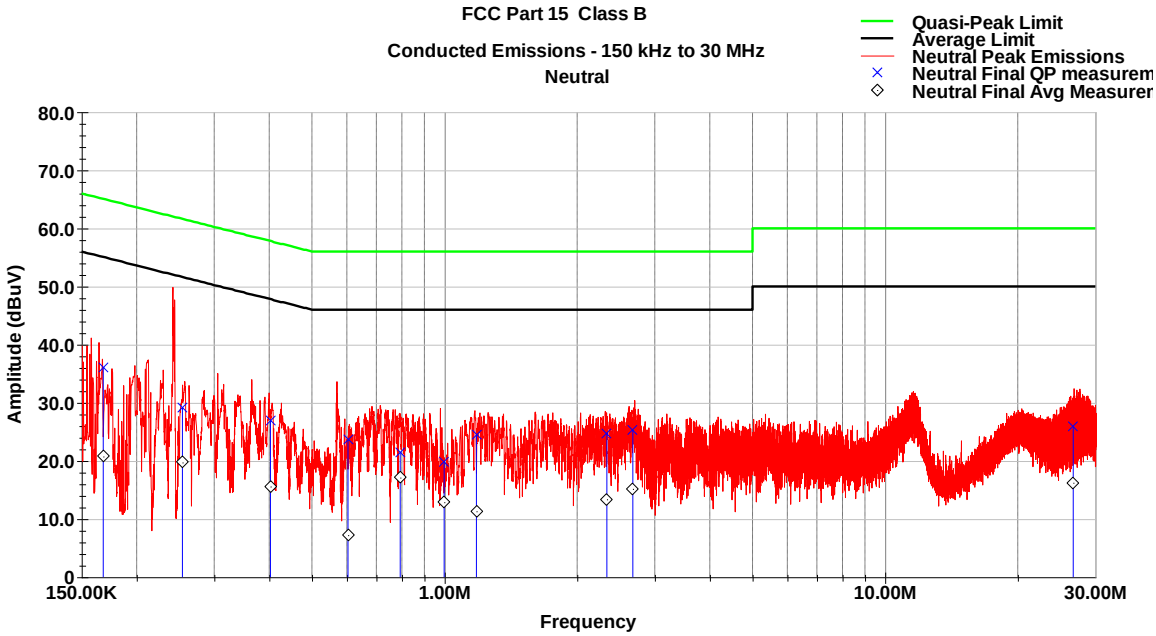
Line 1 Conducted Emissions Plot – 120 Vac 60 Hz



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
0.172	34.6	64.8	-30.2	23.0	54.8	-31.8
0.448	24.2	56.9	-32.7	12.5	46.9	-34.4
0.704	27.3	56.0	-28.7	22.0	46.0	-24.0
0.859	20.4	56.0	-35.6	8.3	46.0	-37.7
1.117	24.0	56.0	-32.0	10.6	46.0	-35.4
2.097	22.8	56.0	-33.2	11.5	46.0	-34.5
2.337	25.1	56.0	-30.9	11.0	46.0	-35.0
2.624	25.2	56.0	-30.8	10.9	46.0	-35.1
2.808	22.6	56.0	-33.4	13.4	46.0	-32.6
11.501	27.9	60.0	-32.1	21.3	50.0	-28.7

Neutral Conducted Emissions Plot – 120 Vac 60 Hz



Neutral Conducted Emissions Data

Frequency MHz	QP Value dBuV	QP Limit dBuV	QP Margin dB	Avg Value dBuV	Avg Limit dBuV	Avg Margin dB
0.168	36.1	65.1	-29.0	20.8	55.1	-34.3
0.254	29.2	61.6	-32.5	19.7	51.6	-31.9
0.403	26.9	57.8	-30.9	15.6	47.8	-32.2
0.604	23.7	56.0	-32.3	7.2	46.0	-38.8
0.793	21.5	56.0	-34.5	17.1	46.0	-28.9
0.998	19.8	56.0	-36.2	12.9	46.0	-33.1
1.181	24.4	56.0	-31.6	11.3	46.0	-34.7
2.336	24.8	56.0	-31.2	13.4	46.0	-32.6
2.675	25.3	56.0	-30.7	15.2	46.0	-30.8
26.724	25.9	60.0	-34.1	16.2	50.0	-33.8

10 Measurement Uncertainty

The measurement uncertainty figures are calculated in accordance with TR 100 028-1 [2] and correspond to an expansion factor (coverage factor) k = 2 (which provides confidence levels of 95.45 % in the case where the distributions characterizing the actual measurement uncertainties are normal (Gaussian)).

	Expanded Uncertainty for Normal k factor equal to 2	
Parameter	Required	Laboratory Actual
Radio Frequency	±1 x 10-5	±9.8 x 10-8
total RF power, conducted	±1.5 dB	±1.2 dB
RF power density, conducted	±3 dB	±0.7 dB
spurious emissions, conducted	±3 dB	±2.1 dB
all emissions, radiated	±6 dB	±4.8 dB
temperature	±1°C	±0.5°C
humidity	±5 %	±3.5%
DC and low frequency voltages	±3 %	±0.4%
Conducted disturbance at mains port using AMN	± 3.4 dB	± 2.5 dB

11 Revision History

Revision Level	Description of changes	Revision Date
Draft	--	25 September 2018
0	Initial release	21 October 2020
1	- Corrected references to RSS-GEN clauses, updated AC Powerline Conducted Emissions results and added antenna connection information (Note 1) in section 1 - Updated EUT S/N's and test dates in section 2.3 - Updated information about EUT F/W, test program used and radio configuration and settings used in section 2.4 - Added test setup diagrams in sections 2.5 and 2.6 - Added EUT Connection Diagrams for AC Powerline Conducted Emissions test in new section 2.7 - Added Encore 1.5 Medical Cart (Host) in section 2.8 - Added 99% Occupied Bandwidth test results in section 3 - Added AC Powerline Conducted Emissions test in new section 9 - Updated references to KDB publication 558074 D01 DTS Meas Guidance to latest revision v05r02 (many sections)	17 November 2020
2	- Updated test date for AC Powerline Conducted Emissions test in section 2.3 - Updated EUT Connection Diagram for AC Powerline Conducted Emissions test in section 2.7 (replaced Medical Cart host with AC-DC Power Adapter) - Removed Encore 1.5 Medical Cart (Host) in section 2.8 - Updated AC Powerline Conducted Emissions test results in section 9 due to re-testing to Class B limits using AC-DC Power Adapter instead of complete Medical Cart host	24 November 2020