

RF Test Report

Project Number: 4455847**Proposal Number:** 8670**Report Number:** 4455847EMC01**Revision Level:** 1**Client:** Vitls, Inc.**Equipment Under Test:** Vital Signs Monitoring Device**Model Name:** Tego VSS Sensor**Model Number:** VT-F-010**FCC ID:** 2ASYD-VT-F-010**Applicable Standards:** FCC Part 15 Subpart C, § 15.247

RSS-247, Issue 2

RSS-GEN, Issue 5

ANSI C63.10:2013

Report issued on: 10 May 2019**Test Result:** Compliant

Tested by:



Martin Taylor, RF/EMC Engineer

Reviewed by:



Aaron Froehlich, EMC Test 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.

This document is issued by the Company under its General Conditions of Service accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx>. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein.

Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

Table of Contents

1	SUMMARY OF TEST RESULTS	4
1.1	MODIFICATIONS REQUIRED FOR COMPLIANCE	4
2	GENERAL INFORMATION	5
2.1	CLIENT INFORMATION	5
2.2	TEST LABORATORY	5
2.3	GENERAL INFORMATION OF EUT	5
2.4	OPERATING MODES AND CONDITIONS	5
2.5	EUT CONNECTION BLOCK DIAGRAM – CONDUCTED MEASUREMENTS	6
2.6	EUT CONNECTION BLOCK DIAGRAM – RADIATED MEASUREMENTS	6
2.7	SYSTEM CONFIGURATIONS	6
3	BANDWIDTH	7
3.1	TEST RESULT	7
3.2	TEST METHODS	7
3.3	TEST SITE	7
3.4	TEST EQUIPMENT	7
3.5	TEST DATA – DTS BANDWIDTH (6dB)	8
3.6	TEST DATA – 99% OCCUPIED BANDWIDTH	9
4	OUTPUT POWER	10
4.1	TEST RESULT	10
4.2	TEST METHOD	10
4.3	TEST SITE	10
4.4	TEST EQUIPMENT	10
4.5	TEST DATA	10
5	POWER SPECTRAL DENSITY	11
5.1	TEST RESULT	11
5.2	TEST METHOD	11
5.3	TEST SITE	11
5.4	TEST EQUIPMENT	11
5.5	TEST DATA	12
6	CONDUCTED SPURIOUS EMISSIONS / BAND EDGE	13
6.1	TEST RESULT	13
6.2	TEST METHOD	13
6.3	TEST SITE	13
6.4	TEST EQUIPMENT	13
6.5	TEST DATA – DTS BAND EDGE	14
6.6	TEST DATA – CONDUCTED SPURIOUS EMISSIONS	14
7	FIELD STRENGTH OF SPURIOUS RADIATION	15
7.1	TEST RESULT	15
7.2	TEST METHOD	15
7.3	TEST SITE	15
7.4	TEST EQUIPMENT	16
7.5	TEST DATA	18
8	EMISSIONS IN RESTRICTED FREQUENCY BANDS	30
8.1	TEST RESULT	30
8.2	TEST METHOD	30
8.3	TEST SITE	30



8.4	TEST EQUIPMENT	30
8.5	TEST DATA – RESTRICTED BAND EDGE	31
9	MEASUREMENT UNCERTAINTY.....	32
10	REVISION HISTORY	33

1 Summary of Test Results

Test Description	Test Specification		Test Result
Bandwidth	15.247(a)(2)	RSS-247 S5.2 (a) RSS-GEN S6.7	Compliant
Output Power	15.247(b)(3)	RSS-247 S5.4 (d)	Compliant
Power Spectral Density	15.247(e)	RSS-247 S5.2 (b)	Compliant
Conducted Spurious Emissions / Band Edge	15.247(d)	RSS-247 S5.5	Compliant
Field Strength of Spurious Radiation	15.247(d) 15.205, 15.209	RSS-247 S5.5 RSS-GEN S8.9, S8.10	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	15.207	RSS-GEN S8.8	NA ⁽²⁾

(1) Device uses an internal surface-mount antenna which cannot be replaced by the end user.

(2) Device does not connect to the AC Mains.

1.1 Modifications Required for Compliance

None

2 General Information

2.1 Client Information

Name: Vitls, Inc.
Address: 2450 Holcombe Blvd., Ste. X
City, State, Zip, Country: Houston, TX 77021, 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: Vital Signs Monitoring Device
Model Name: Tego VSS Sensor
Model Number: VT-F-010
Serial Number: Not labeled

FCC ID: 2ASYD-VT-F-010

Frequency Range: 2402 – 2480 MHz
Data Modes: Bluetooth Low Energy
Antenna: Internal Surface-Mount Antenna

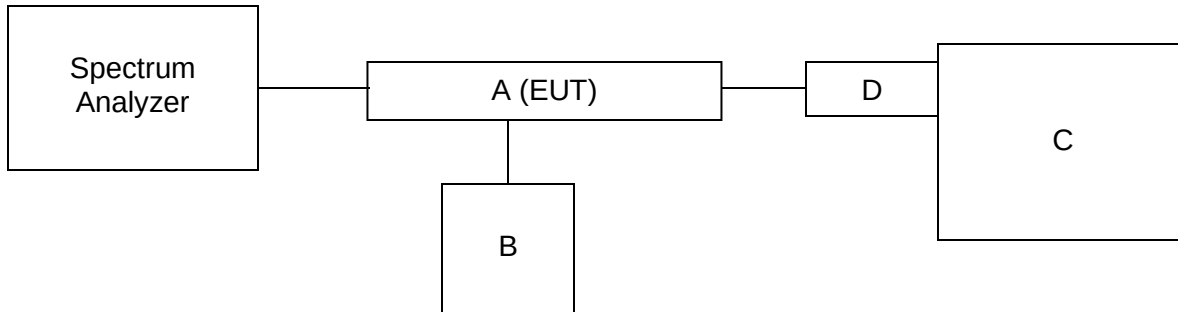
Rated Voltage: 3.7 Vdc
Test Voltage: 3.7 Vdc

Sample Received Date: 15 January 2019
Dates of testing: 28 February to 15 April 2019

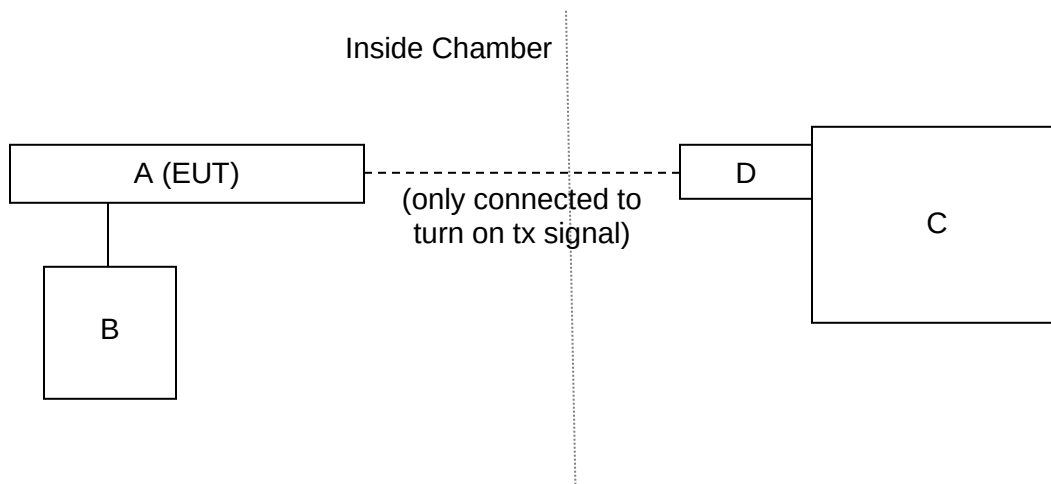
2.4 Operating Modes and Conditions

The EUT was programmed by the manufacturer to transmit on low, mid and high channels in all necessary modulation and modes of operation. Continuous traffic was generated using test commands controlled by software provided by the client.

2.5 EUT Connection Block Diagram – Conducted Measurements



2.6 EUT Connection Block Diagram – Radiated Measurements



2.7 System Configurations

Device Reference	Manufacturer	Description	Model Number	Serial Number
A	Vitls Inc.	Tego VSS Sensor (EUT)	VT-F-010	Not labeled
B	SHLB Co.	3.7V Li-polymer Battery	PL652533	Not labeled
C	Lenovo	Laptop (w/ control SW)	80XV	PF0STB5L
D	(unknown)	USB to TTL Converter	Not labeled	Not labeled

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.

Limit

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

3.3 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 23.4 °C

Relative Humidity: 49.8 %

Atmospheric Pressure: 96.9 kPa

3.4 Test Equipment

Test End Date: 9-Apr-2019

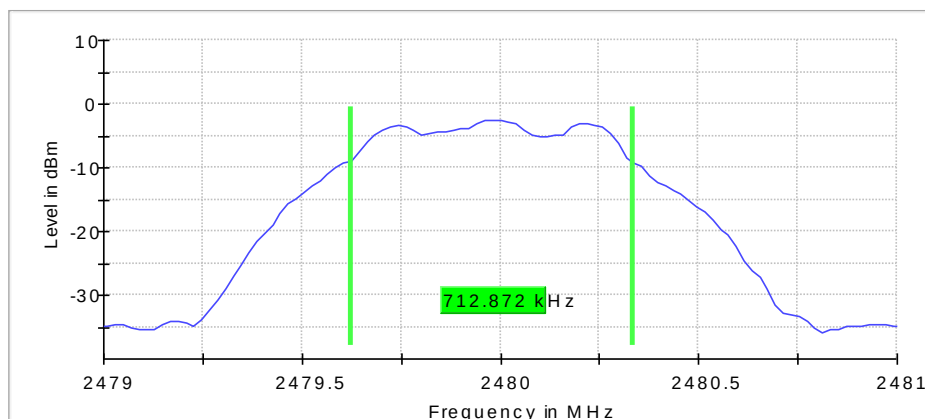
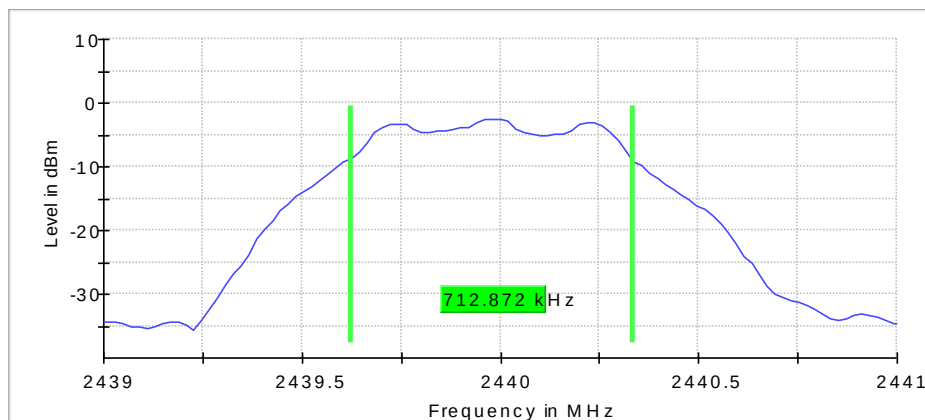
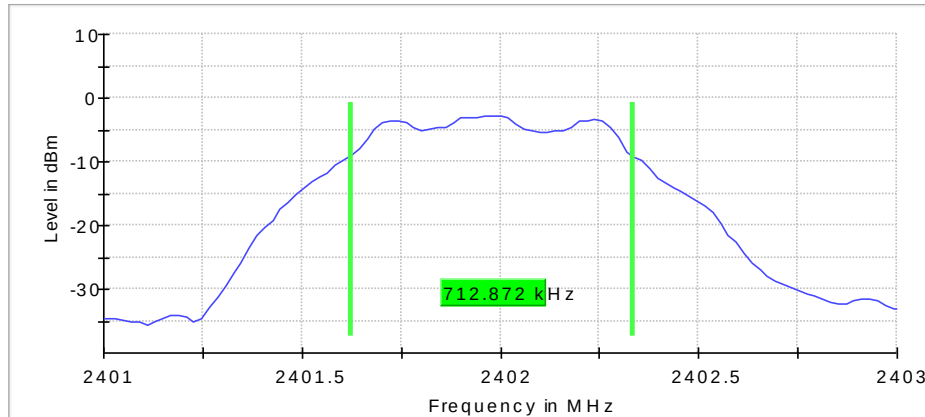
Tester: ASF

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
RF CABLE (TS8997)	141	HUBER & SUHNER	B095585	25-Jul-2019
ATTENUATOR, 10DB (TS8997)	10DB	ROHDE & SCHWARZ	B095591	25-Jul-2019
RF SWITCH (TS8997)	OSP	ROHDE & SCHWARZ	15039	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.

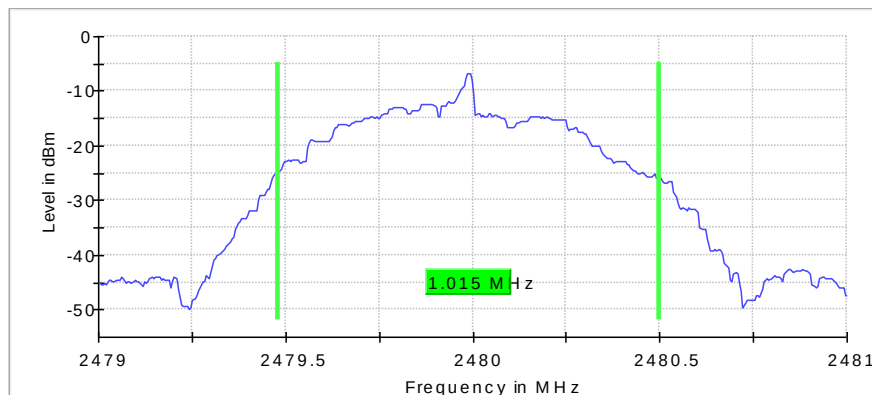
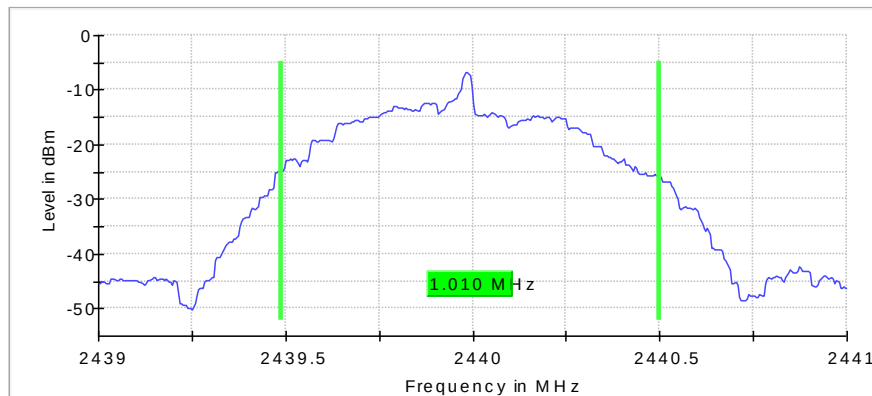
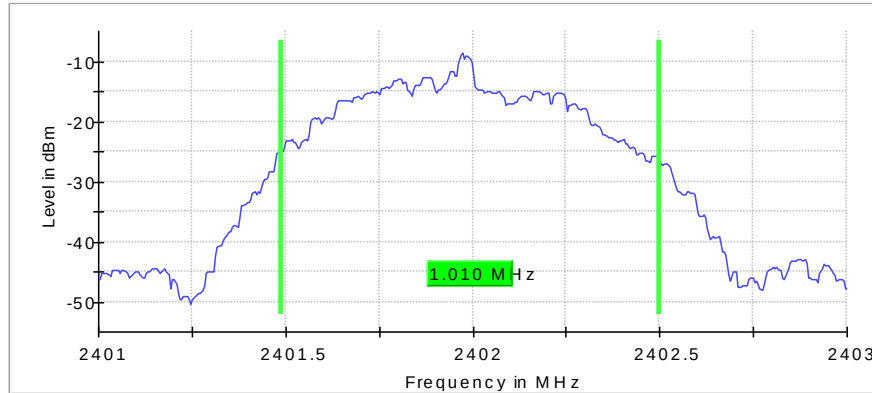
3.5 Test Data – DTS Bandwidth (6dB)

Channel	Frequency (MHz)	6dB Bandwidth (kHz)	Limit Min (kHz)	Result
0	2402	712.9	500	Pass
19	2440	712.9	500	Pass
39	2480	712.9	500	Pass



3.6 Test Data – 99% Occupied Bandwidth

Channel	Frequency (MHz)	99% Bandwidth (kHz)	Result
0	2402	1010	Reported
19	2440	1010	Reported
39	2480	1015	Reported



4 Output Power

4.1 Test Result

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

4.2 Test Method

Fundamental maximum conducted (average) output power measurements were performed using the method described in ANSI C63.10:2013 clause 11.9.2.3.2. This method uses a wideband gated RF power meter with gate parameters adjusted such that the power is measured only when the EUT is transmitting at its maximum power control level. Because the measurement is made only during the ON time of the transmitter, no duty cycle correction factor is required.

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: 23.4 °C

Relative Humidity: 49.8 %

Atmospheric Pressure: 96.9 kPa

4.4 Test Equipment

Test End Date: 9-Apr-2019

Tester: ASF

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
RF CABLE (TS8997)	141	HUBER & SUHNER	B095585	25-Jul-2019
ATTENUATOR, 10DB (TS8997)	10DB	ROHDE & SCHWARZ	B095591	25-Jul-2019
RF SWITCH (TS8997)	OSP	ROHDE & SCHWARZ	15039	15-Dec-2019
SIGNAL ANALYZER (TS8997)	FSV30	ROHDE & SCHWARZ	B085749	1-Nov-2019
POWER METER (TS8997)	OSP-B157	ROHDE & SCHWARZ	15040	15-Dec-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	-3.0	30	Pass
19	2440	-2.8	30	Pass
39	2480	-2.7	30	Pass

5 Power Spectral Density

5.1 Test Result

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

5.2 Test Method

Power spectral density measurements were performed using the procedures from ANSI C63.10: 2013 clause 11.10.

Limit

The maximum limit is 8 dBm / 3 kHz.

5.3 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 23.4 °C

Relative Humidity: 49.8 %

Atmospheric Pressure: 96.9 kPa

5.4 Test Equipment

Test End Date: 9-Apr-2019

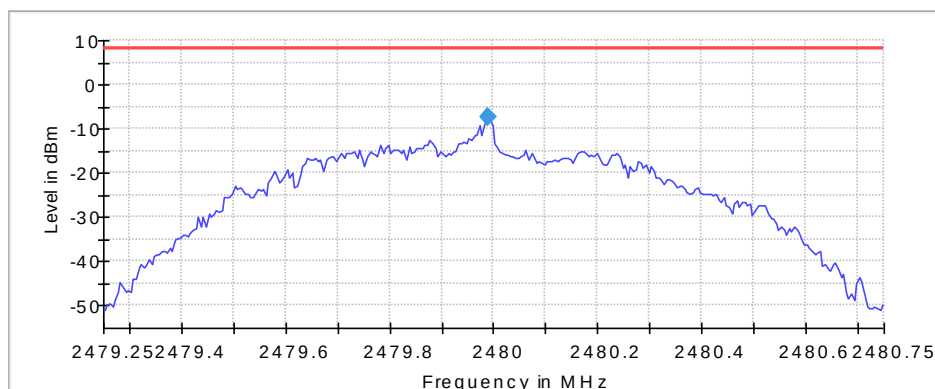
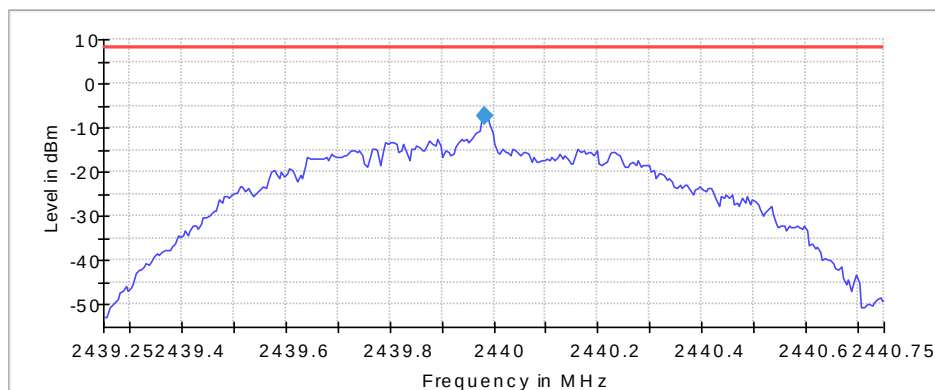
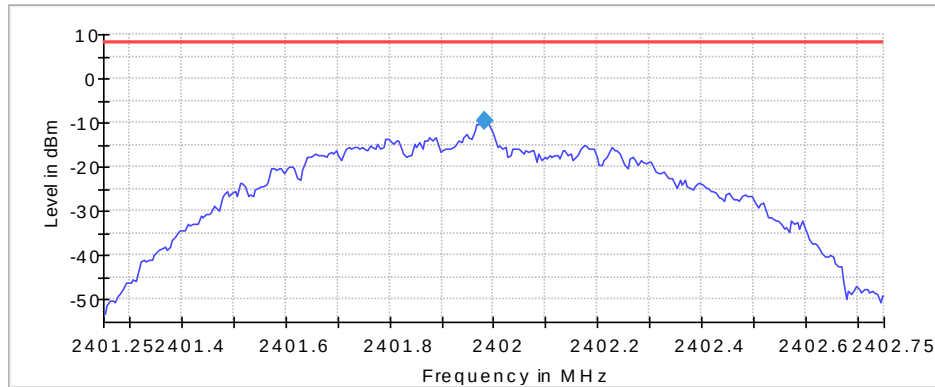
Tester: ASF

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
RF CABLE (TS8997)	141	HUBER & SUHNER	B095585	25-Jul-2019
ATTENUATOR, 10DB (TS8997)	10DB	ROHDE & SCHWARZ	B095591	25-Jul-2019
RF SWITCH (TS8997)	OSP	ROHDE & SCHWARZ	15039	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)	PSD (dBm/3kHz)	Limit Max (dBm/3kHz)	Result
0	2402	-9.64	8	Pass
19	2440	-7.37	8	Pass
39	2480	-7.46	8	Pass



6 Conducted Spurious Emissions / Band Edge

6.1 Test Result

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

6.2 Test Method

Conducted band edge emissions in non-restricted frequency bands were measured using the method defined in ANSI C63.10 clause 11.11.

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: 23.4 °C

Relative Humidity: 49.8 %

Atmospheric Pressure: 96.9 kPa

6.4 Test Equipment

Test End Date: 9-Apr-2019

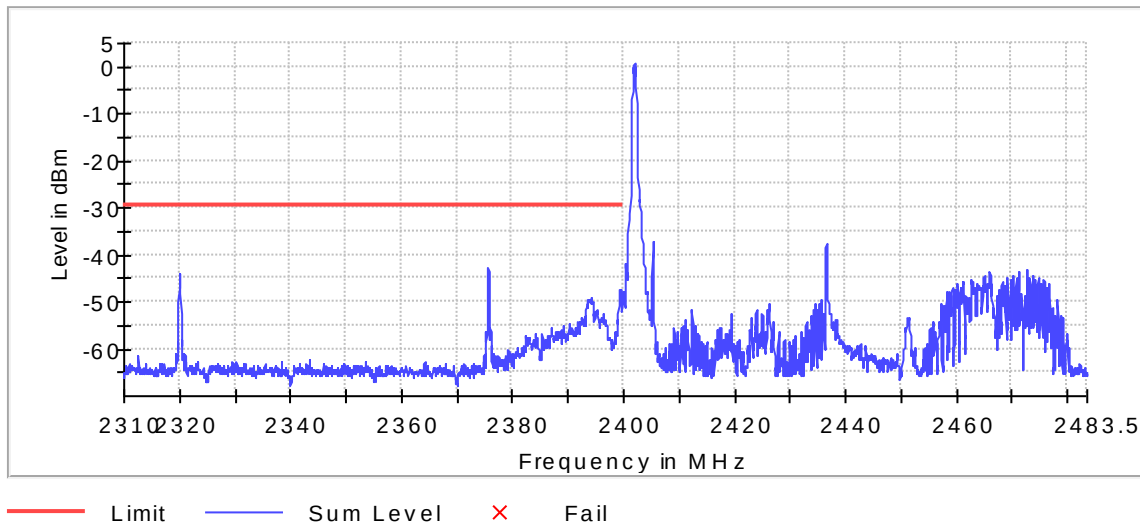
Tester: ASF

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

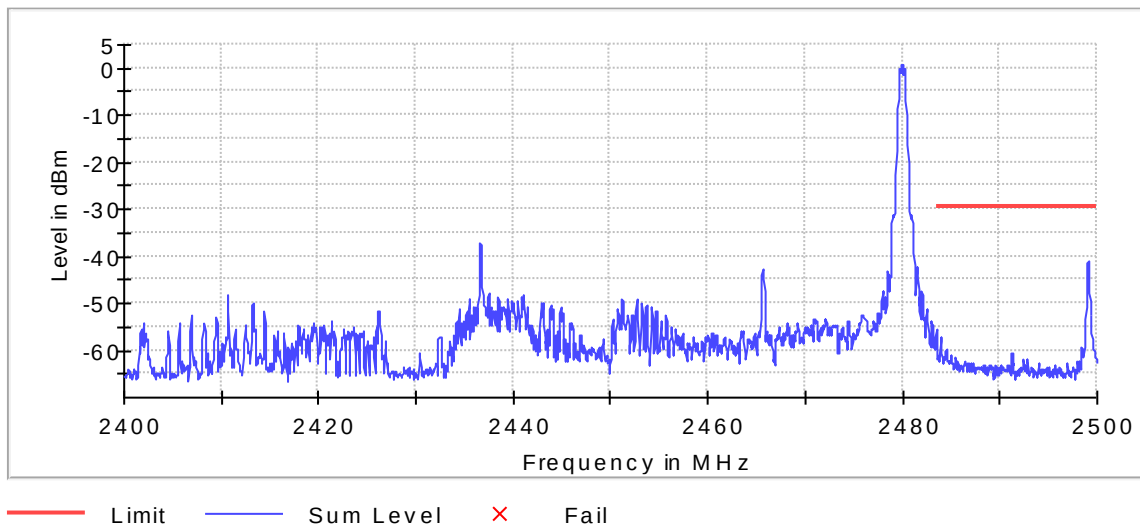
Note: The equipment calibration period is 1 year except for the FSV which is on a 2-year cycle.

6.5 Test Data – DTS Band Edge

BLE - Lower band edge:



BLE - Upper band edge:



6.6 Test Data – Conducted Spurious Emissions

Emissions in the spurious domain were measured in a radiated test setup with the EUT antenna installed. This requirement is covered by the results in section 7 of this report.

7 Field Strength of Spurious Radiation

7.1 Test Result

Test Description	Test Specification		Test Result
Radiated Spurious Emissions	15.247(d) 15.205, 15.209	RSS-247 S5.5 RSS-GEN S8.9, S8.10	Compliant

7.2 Test Method

The radiated measurement methods defined in ANSI C63.10 and KDB 558074 D01 15.247 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 meters

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

Mid Channel Tests

30-1000MHz	1-18GHz	18-26GHz
Enclosure: 3m Chamber	10m Chamber	10m Chamber
Temperature: 21.4 °C	22.7 °C	22.7 °C
Relative Humidity: 48.4 %	48.2 %	52.8 %
Atmospheric Pressure: 97.7 kPa	97.8 kPa	97.6 kPa

Low & High Channel Tests

30-1000MHz	1-18GHz	18-26GHz
Enclosure: 10m Chamber	3m Chamber	3m Chamber
Temperature: 21.3 °C	22.3 °C	21.9 °C
Relative Humidity: 55.7 %	32.5 %	34.0 %
Atmospheric Pressure: 97.8 kPa	98.0 kPa	97.9 kPa

7.4 Test Equipment

Mid Channel Tests

30-1000MHz

Test End Date: 28-Feb-2019

Tester: CO

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
ANTENNA, BILOG	JB6	SUNOL	B079689	30-Oct-2019
RF CABLE	NFS-290-78.7-NFS	FLORIDA RF LABS	B095019	24-Jul-2019
RF CABLE	NMS-290-236.2-NMS	FLORIDA RF LABS	B095020	23-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	24-Jan-2020
EMI TEST RECEIVER	ESU8	ROHDE & SCHWARZ	B085759	17-Aug-2019

1-18GHz

Test End Date: 1-Mar-2019

Tester: MT

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
ANTENNA, DRG HORN (MEDIUM)	3117	ETS LINDGREN	B079691	10-Aug-2019
RF CABLE	SF102	HUBER & SUHNER	B079822	25-Jul-2019
RF CABLE	104PE	HUBER & SUHNER	B079793	24-Jul-2019
LOW NOISE AMPLIFIER	TS-PR18	ROHDE & SCHWARZ	15003	24-Jan-2020
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	B079629	2-Jul-2019

18-26GHz

Test End Date: 1-Mar-2019

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	B079823	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.

Low & High Channel Tests

30-1000MHz

Test End Date: 12-Apr-2019

Tester: MT

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
ANTENNA, BILOG	JB6	SUNOL	B079690	11-Dec-2019
RF CABLE	SF106	HUBER & SUHNER	B079712	24-Jul-2019
RF CABLE	SF106	HUBER & SUHNER	B079713	24-Jul-2019
RF CABLE	SF106	HUBER & SUHNER	B079661	23-Jul-2019
RF CABLE	104PE	HUBER & SUHNER	B079793	24-Jul-2019
LOW NOISE AMPLIFIER	ZKL-2+	MINI-CIRCUITS	B079800	27-Jul-2019
EMI TEST RECEIVER	ESU8	ROHDE & SCHWARZ	B085759	17-Aug-2019

1-18GHz

Test End Date: 15-Apr-2019

Tester: MT

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
ANTENNA, DRG HORN (MEDIUM)	3117	ETS LINDGREN	B079699	2-Jul-2020
RF CABLE	SF102	HUBER & SUHNER	B079822	25-Jul-2019
RF CABLE	SUCOFLEX 100	HUBER & SUHNER	B108523	24-Jul-2019
LOW NOISE AMPLIFIER	TS-PR18	ROHDE & SCHWARZ	15003	24-Jan-2020
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	B079629	2-Jul-2019

18-26GHz

Test End Date: 15-Apr-2019

Tester: MT

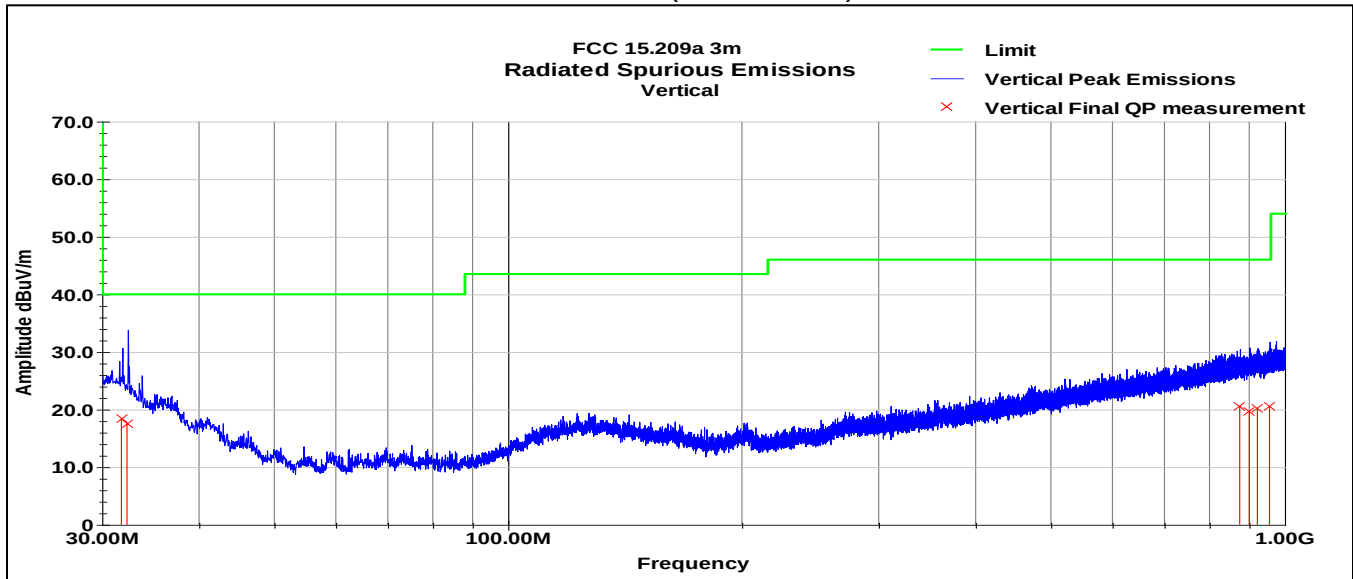
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
ANTENNA, HORN (SMALL)	LB-180400-20-C-KF	A-INFO	15007	30-Mar-2020
RF CABLE	SF102	HUBER & SUHNER	B079822	25-Jul-2019
RF CABLE	SF102	HUBER & SUHNER	B079823	25-Jul-2019
LOW NOISE AMPLIFIER	NSP1840-HG	MITEQ	B087572	27-Jul-2019
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	B079629	2-Jul-2019

Note: The equipment calibration period is 1 year.

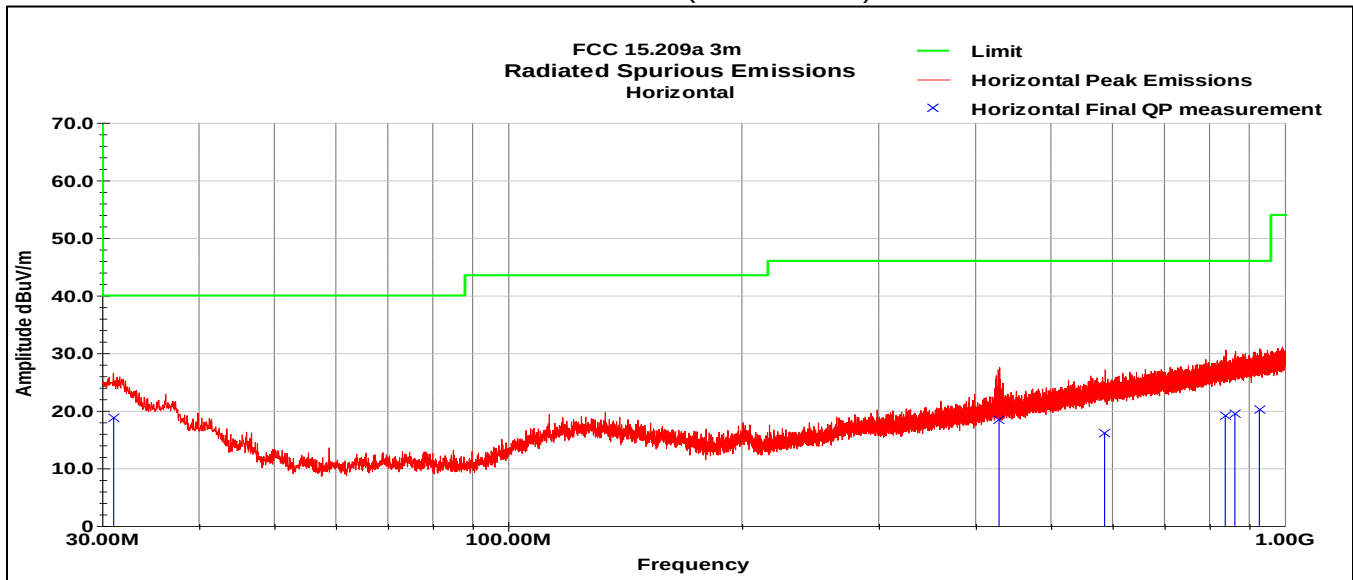
7.5 Test Data

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

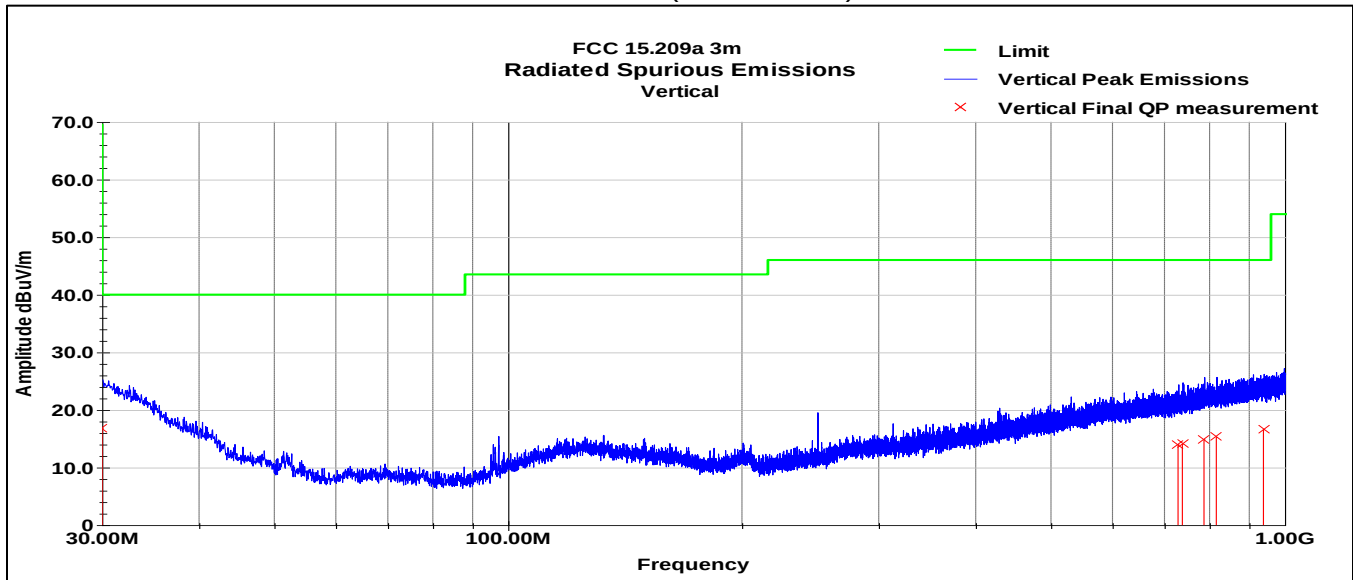
BLE Channel 0
Vertical Plot (30-1000MHz)



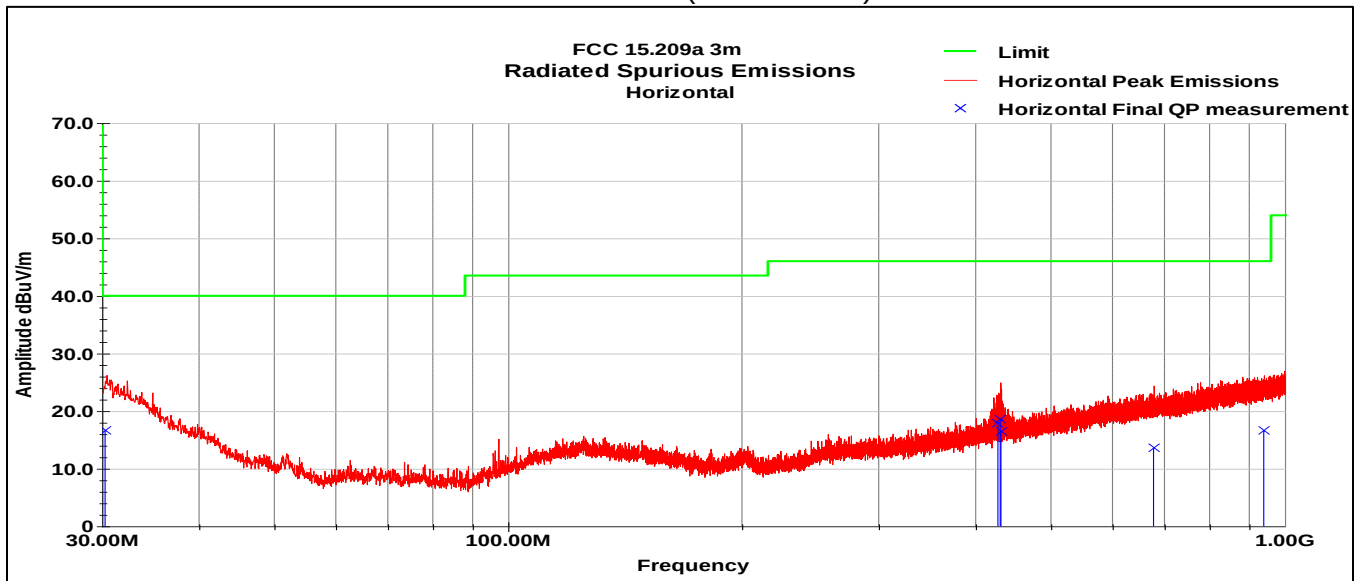
BLE Channel 0
Horizontal Plot (30-1000MHz)



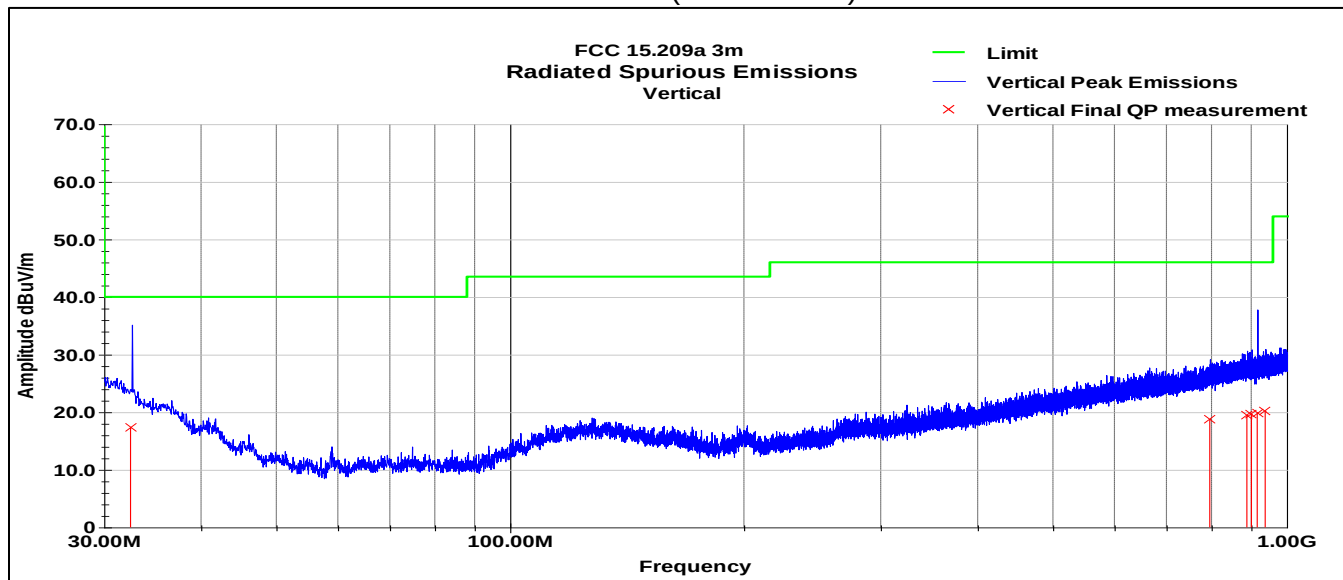
BLE Channel 19 Vertical Plot (30-1000MHz)



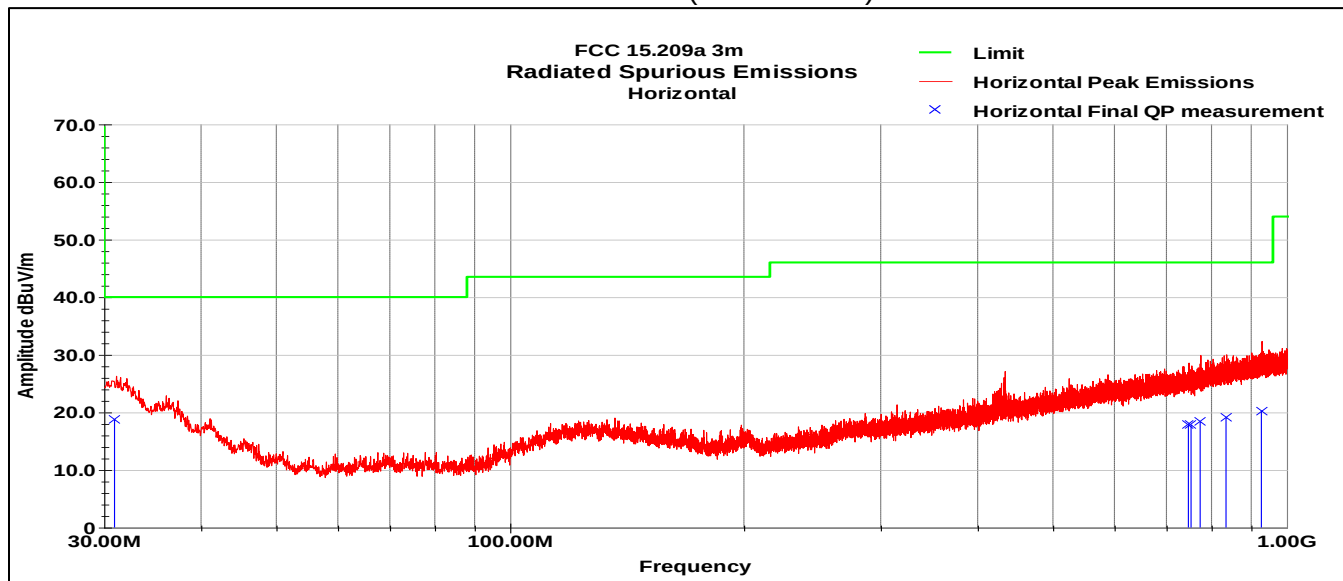
BLE Channel 19 Horizontal Plot (30-1000MHz)



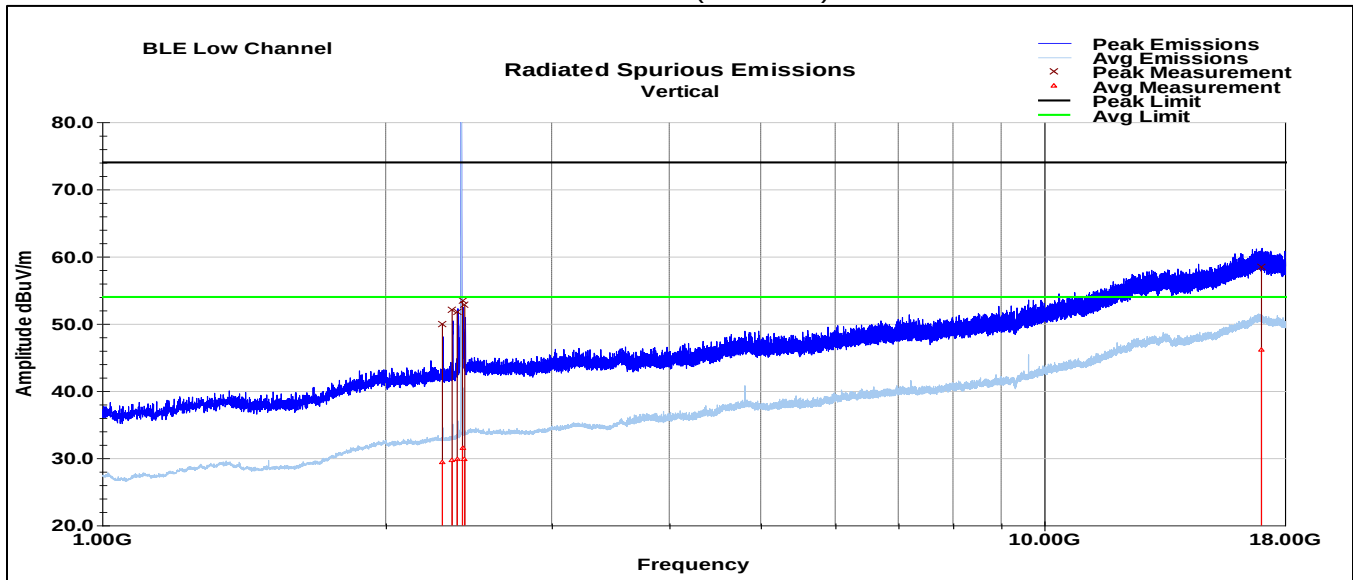
BLE Channel 39 Vertical Plot (30-1000MHz)



BLE Channel 39 Horizontal Plot (30-1000MHz)



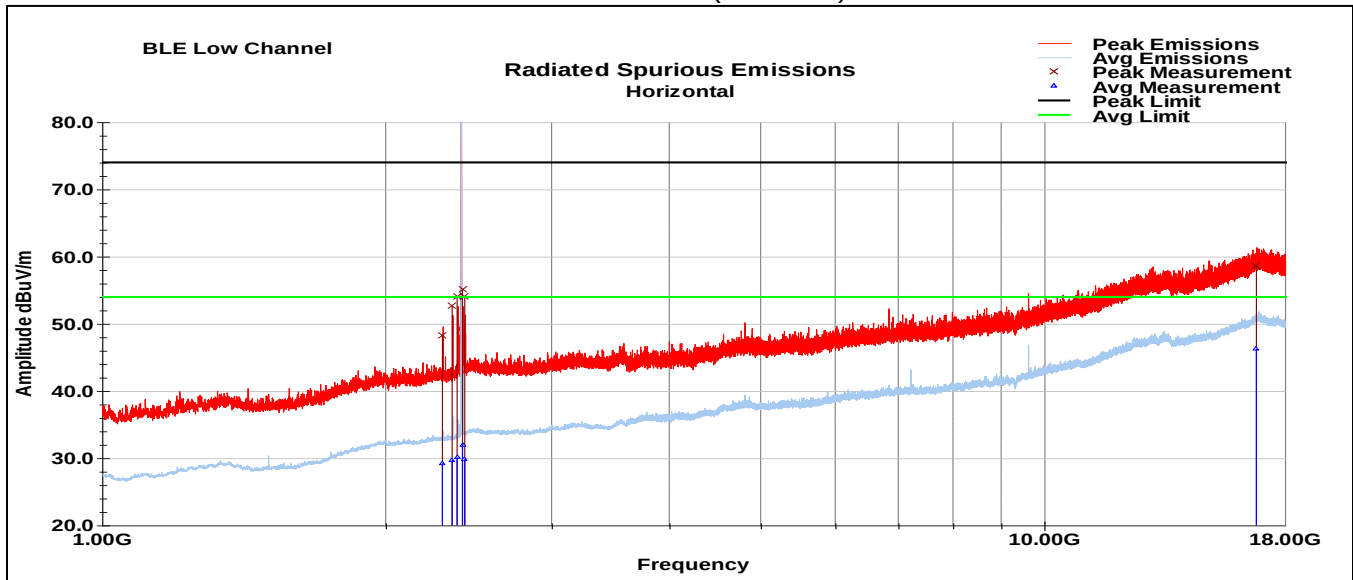
BLE Channel 0 Vertical Plot (1-18GHz)



Vertical Average Data (1-18GHz)

Frequency MHz	Raw Avg dBuV	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	Loss (dB)	Amp (dB)	Final Avg dBuV/m	Limit (dBuV/m)	Margin (dB)
2297.80	29.8	V	244.0	172.0	31.7	2.4	34.5	29.4	54.0	-24.6
2352.80	30.0	V	257.0	121.0	31.7	2.4	34.4	29.7	54.0	-24.3
2382.04	30.0	V	265.0	110.0	31.9	2.4	34.4	29.9	54.0	-24.1
2412.92	31.5	V	262.0	118.0	32.1	2.4	34.4	31.6	54.0	-22.4
2426.28	29.6	V	258.0	146.0	32.2	2.4	34.4	29.8	54.0	-24.1
17002.88	28.6	V	223.0	137.0	41.5	6.9	30.8	46.2	54.0	-7.8
QP Value = Level + AF + CL - Amp										
Margin = QP Value - Limit										

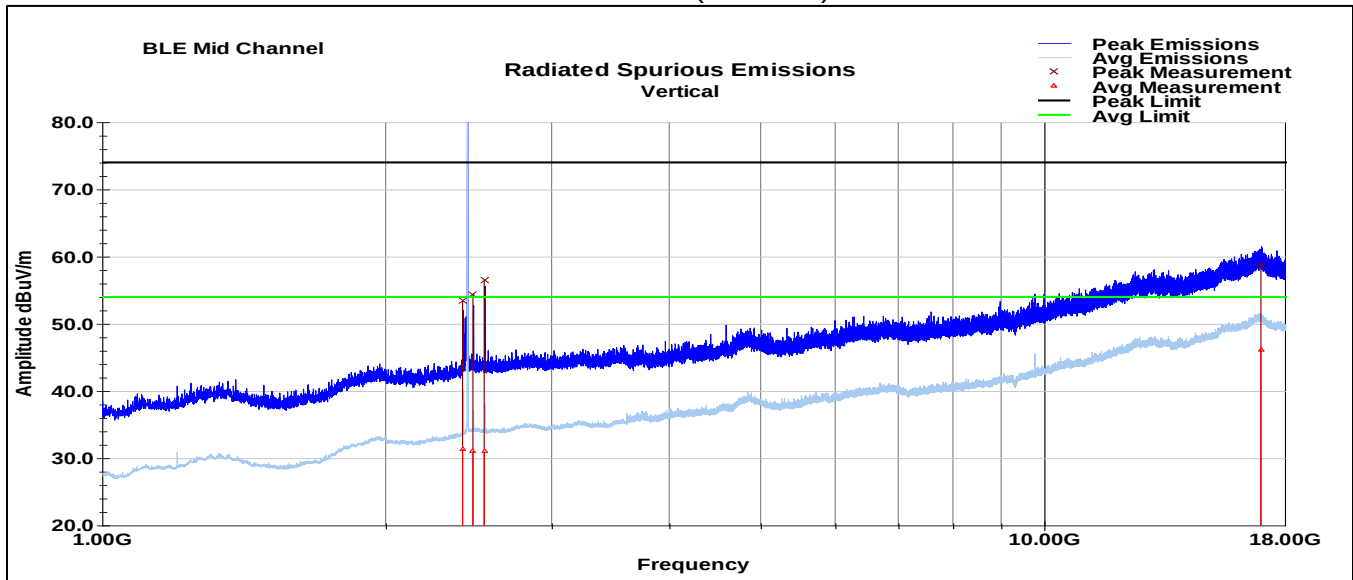
BLE Channel 0 Horizontal Plot (1-18GHz)



Horizontal Average Data (1-18GHz)

Frequency MHz	Raw Avg dBuV	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	Loss (dB)	Amp (dB)	Avg Value dBuV/m	Limit (dBuV/m)	Margin (dB)
2297.68	29.6	H	55.0	186.0	31.7	2.4	34.5	29.2	54.0	-24.7
2352.80	30.0	H	128.0	199.0	31.7	2.4	34.4	29.7	54.0	-24.3
2381.80	30.3	H	126.0	188.0	31.9	2.4	34.4	30.1	54.0	-23.9
2412.80	31.9	H	125.0	208.0	32.1	2.4	34.4	32.0	54.0	-21.9
2426.40	29.6	H	120.0	209.0	32.2	2.4	34.4	29.9	54.0	-24.1
16792.76	28.6	H	329.0	250.0	41.6	6.8	30.8	46.3	54.0	-7.7
QP Value = Level + AF + CL - Amp										
Margin = QP Value - Limit										

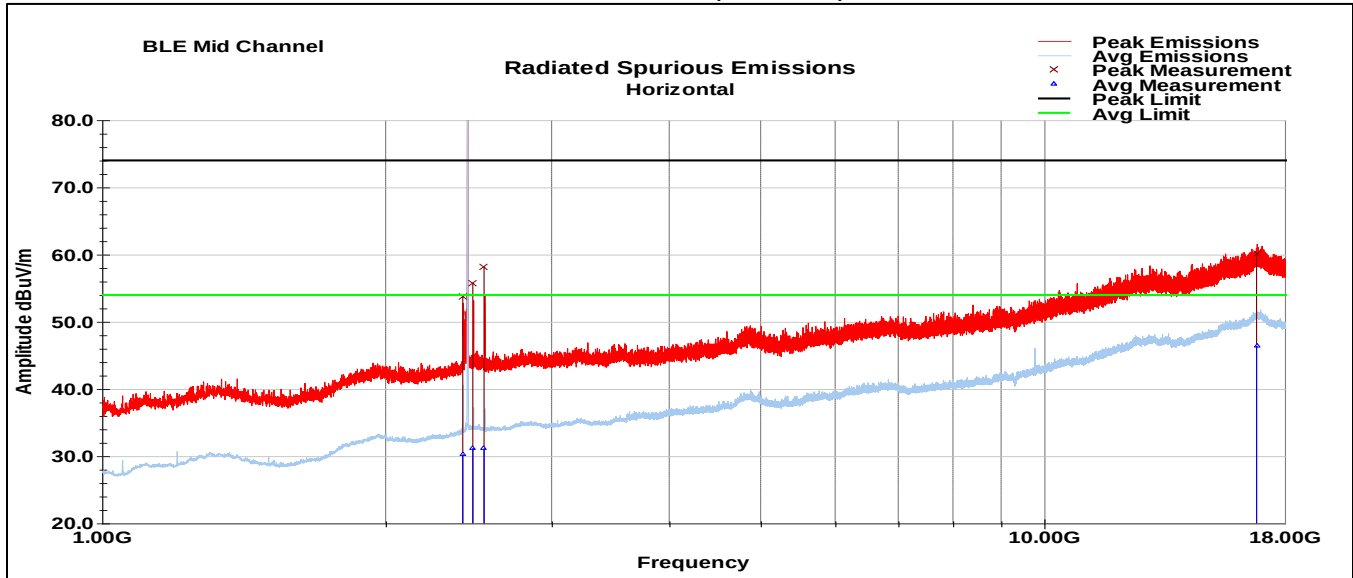
BLE Channel 19 Vertical Plot (1-18GHz)



Vertical Average Data (1-18GHz)

Frequency MHz	Raw Avg dBuV	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	Loss (dB)	Amp (dB)	Final Avg dBuV/m	Limit (dBuV/m)	Margin (dB)
2413.68	31.1	V	235.0	239.0	32.2	2.5	34.4	31.3	54.0	-22.6
2475.16	30.4	V	237.0	221.0	32.5	2.5	34.4	31.1	54.0	-22.9
2544.20	30.4	V	238.0	234.0	32.5	2.6	34.5	31.0	54.0	-23.0
16983.76	28.3	V	182.0	236.0	41.6	7.0	30.8	46.2	54.0	-7.8
QP Value = Level + AF + CL - Amp										
Margin = QP Value - Limit										

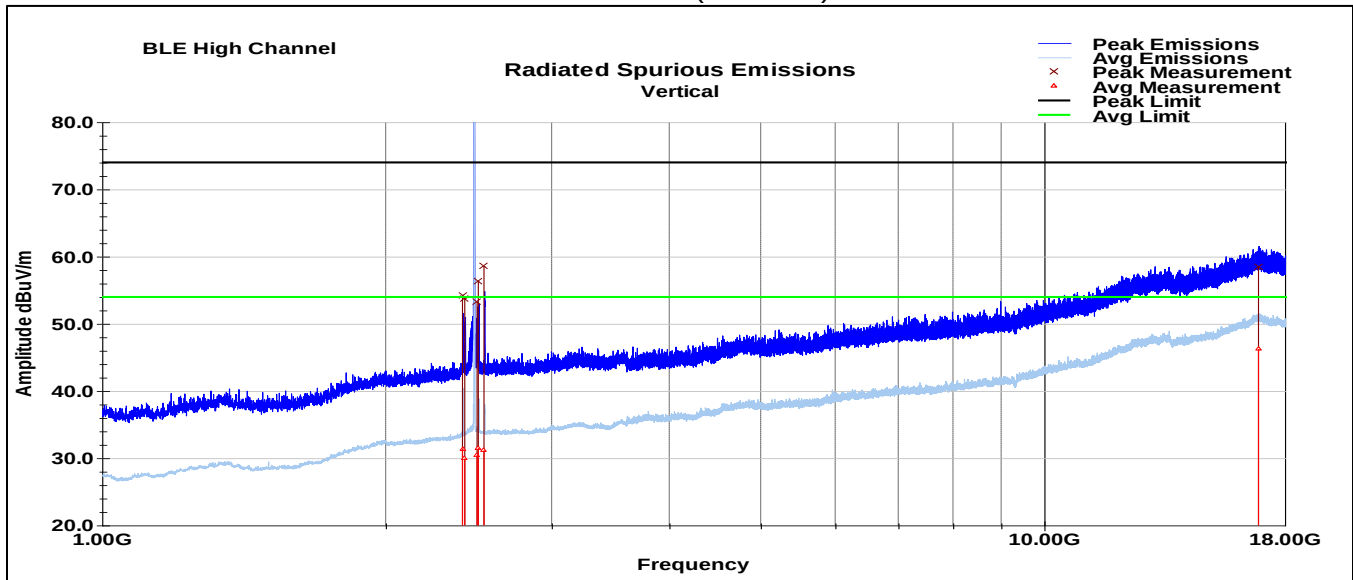
BLE Channel 19 Horizontal Plot (1-18GHz)



Horizontal Average Data (1-18GHz)

Frequency MHz	Raw Avg dBuV	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	Loss (dB)	Amp (dB)	Avg Value dBuV/m	Limit (dBuV/m)	Margin (dB)
2414.88	30.0	H	132.0	228.0	32.2	2.5	34.4	30.2	54.0	-23.7
2475.04	30.5	H	131.0	222.0	32.5	2.5	34.4	31.2	54.0	-22.8
2544.16	30.6	H	127.0	234.0	32.5	2.6	34.5	31.2	54.0	-22.8
16804.12	28.5	H	296.0	214.0	41.8	6.9	30.8	46.4	54.0	-7.6
QP Value = Level + AF + CL - Amp										
Margin = QP Value - Limit										

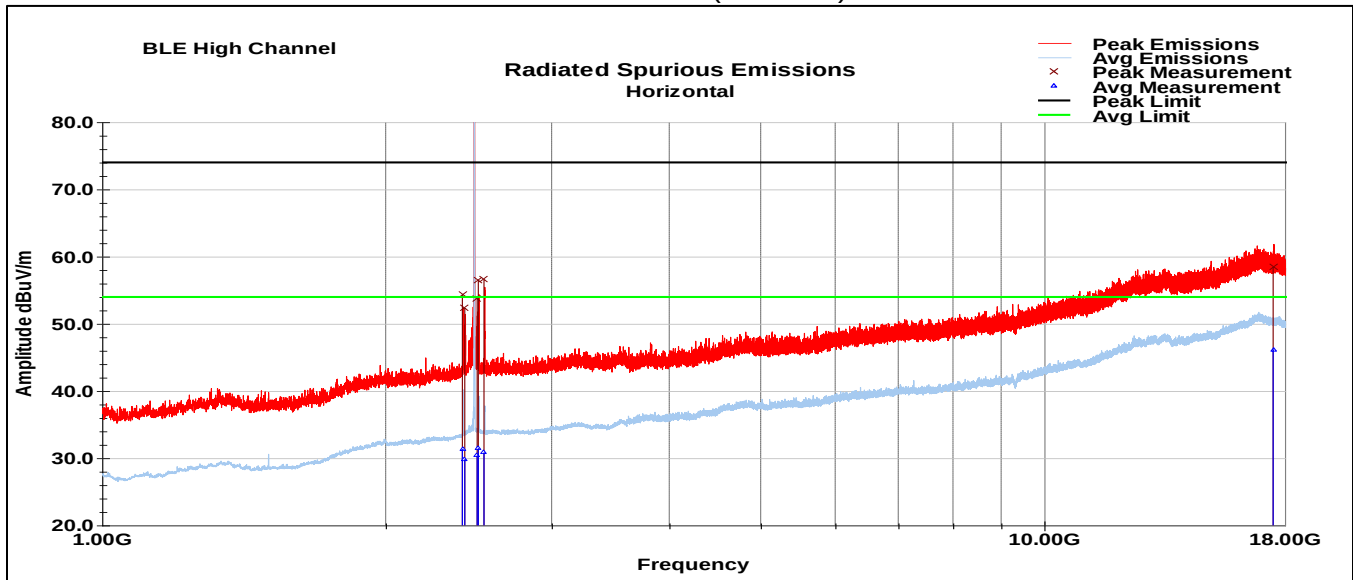
BLE Channel 39 Vertical Plot (1-18GHz)



Vertical Average Data (1-18GHz)

Frequency MHz	Raw Avg dBuV	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	Loss (dB)	Amp (dB)	Final Avg dBuV/m	Limit (dBuV/m)	Margin (dB)
2412.80	31.3	V	241.0	169.0	32.1	2.4	34.4	31.4	54.0	-22.6
2426.28	29.7	V	243.0	204.0	32.2	2.4	34.4	29.9	54.0	-24.0
2500.76	29.9	V	253.0	209.0	32.5	2.5	34.4	30.5	54.0	-23.5
2507.92	31.0	V	252.0	215.0	32.4	2.5	34.4	31.5	54.0	-22.5
2543.52	30.8	V	261.0	231.0	32.3	2.5	34.5	31.1	54.0	-22.8
16878.84	28.7	V	241.0	191.0	41.6	6.8	30.8	46.2	54.0	-7.7
QP Value = Level + AF + CL - Amp										
Margin = QP Value - Limit										

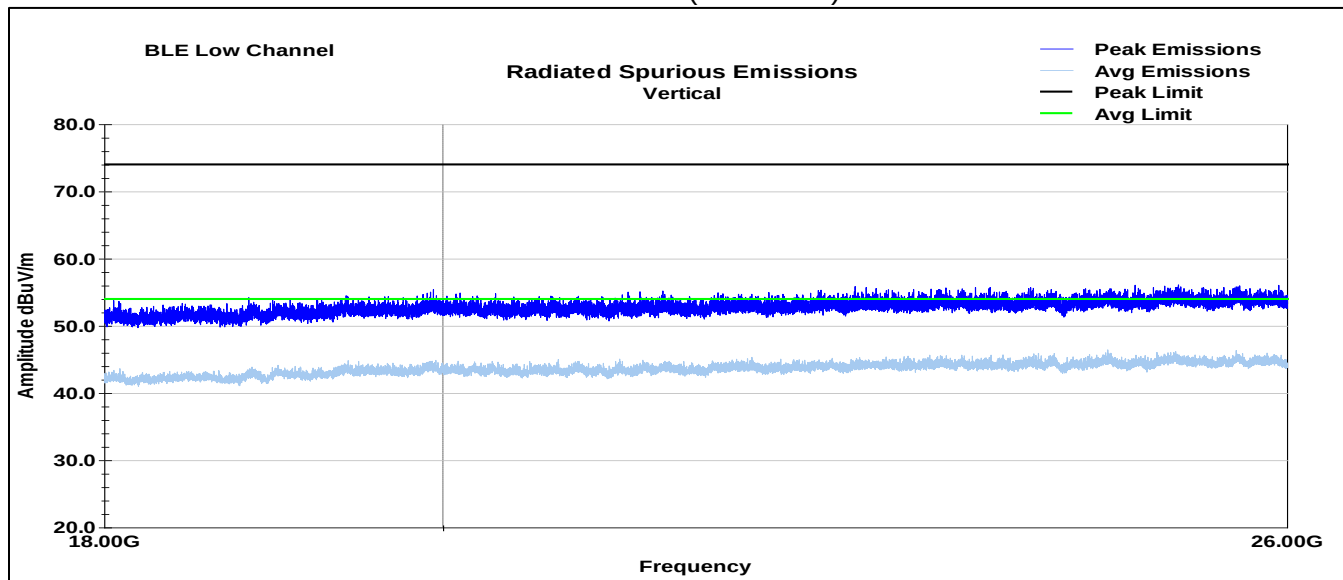
BLE Channel 39 Horizontal Plot (1-18GHz)



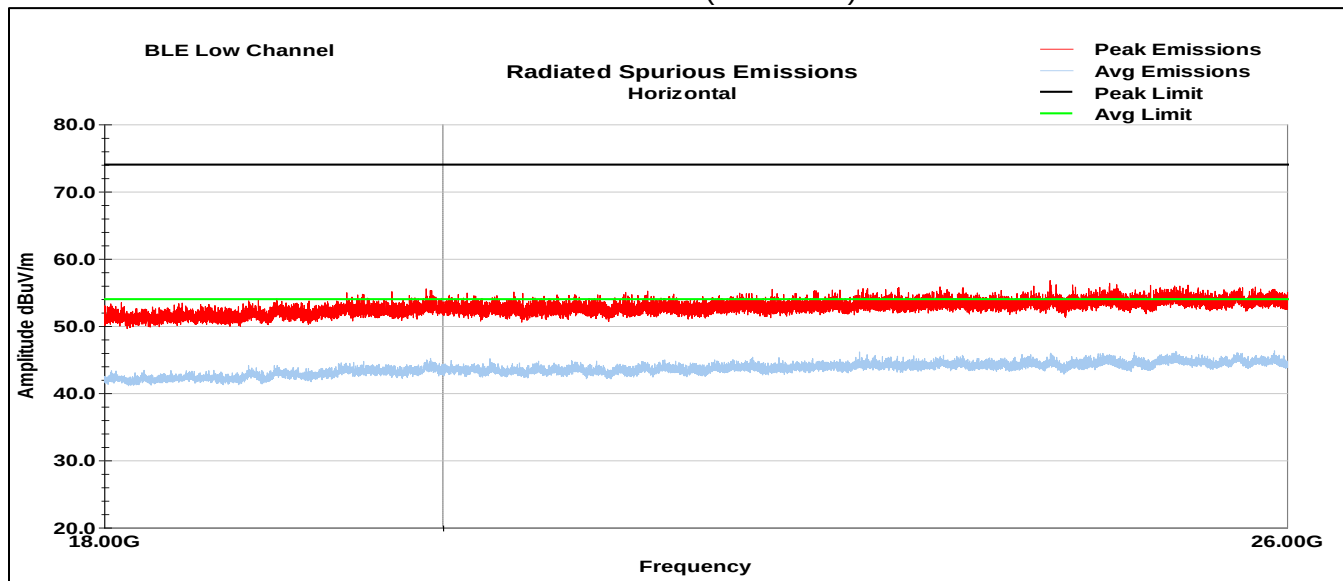
Horizontal Average Data (1-18GHz)

Frequency MHz	Raw Avg dBuV	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	Loss (dB)	Amp (dB)	Avg Value dBuV/m	Limit (dBuV/m)	Margin (dB)
2412.44	31.2	H	136.0	208.0	32.1	2.4	34.4	31.3	54.0	-22.6
2426.28	29.6	H	132.0	197.0	32.2	2.4	34.4	29.8	54.0	-24.1
2501.20	29.9	H	112.0	225.0	32.5	2.5	34.4	30.4	54.0	-23.6
2507.92	31.0	H	125.0	199.0	32.4	2.5	34.4	31.5	54.0	-22.5
2543.44	30.5	H	123.0	178.0	32.3	2.5	34.5	30.8	54.0	-23.1
17496.92	29.2	H	124.0	172.0	41.1	6.9	31.1	46.2	54.0	-7.8
QP Value = Level + AF + CL - Amp										
Margin = QP Value - Limit										

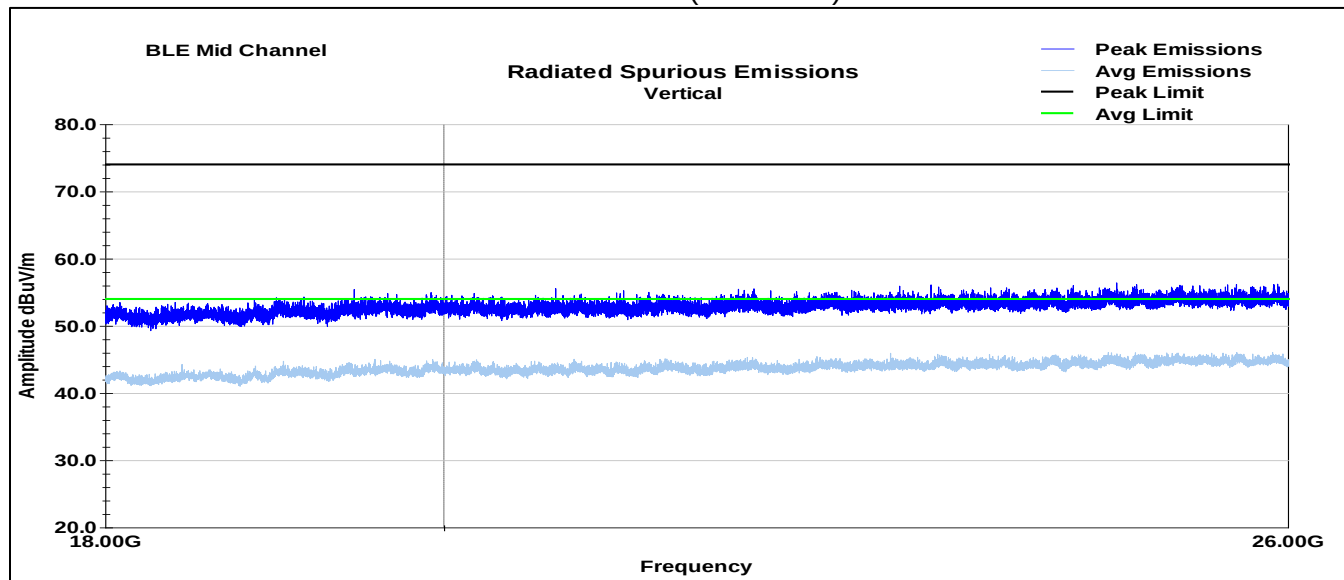
BLE Channel 0
Vertical Plot (18-26GHz)



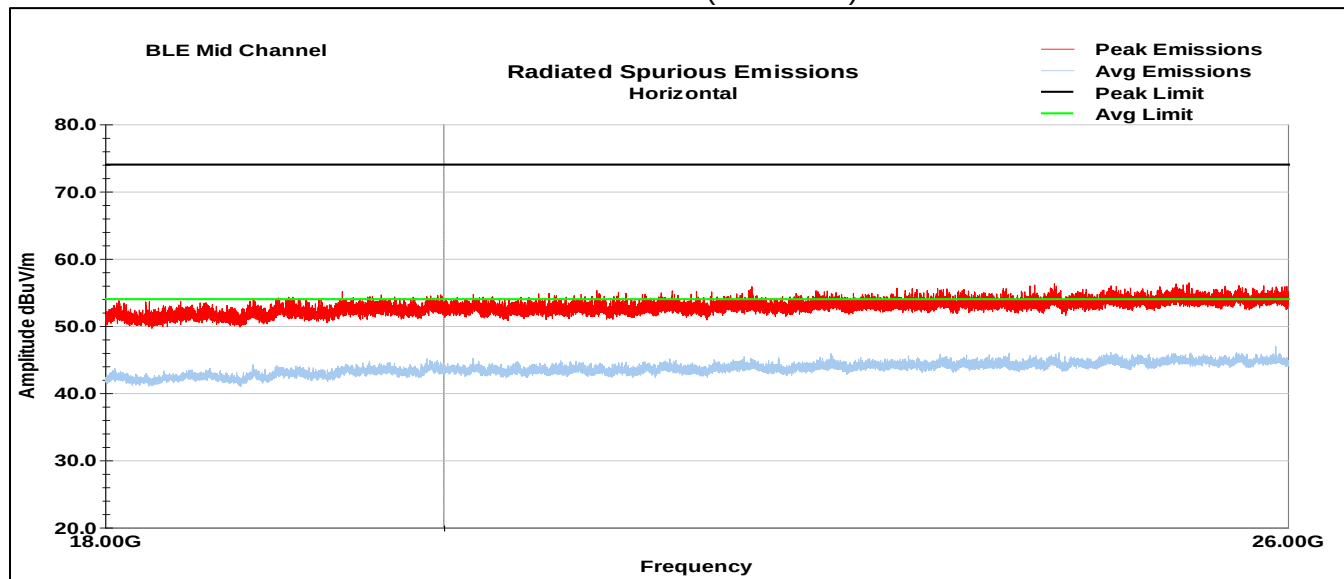
BLE Channel 0
Horizontal Plot (18-26GHz)



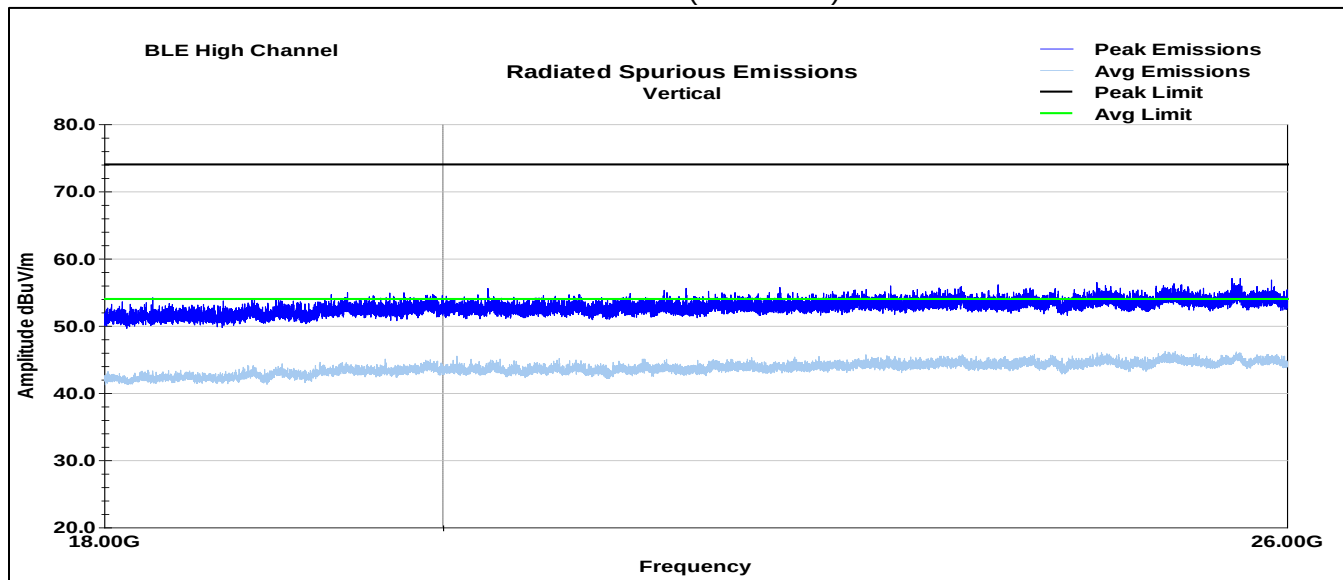
BLE Channel 19
Vertical Plot (18-26GHz)



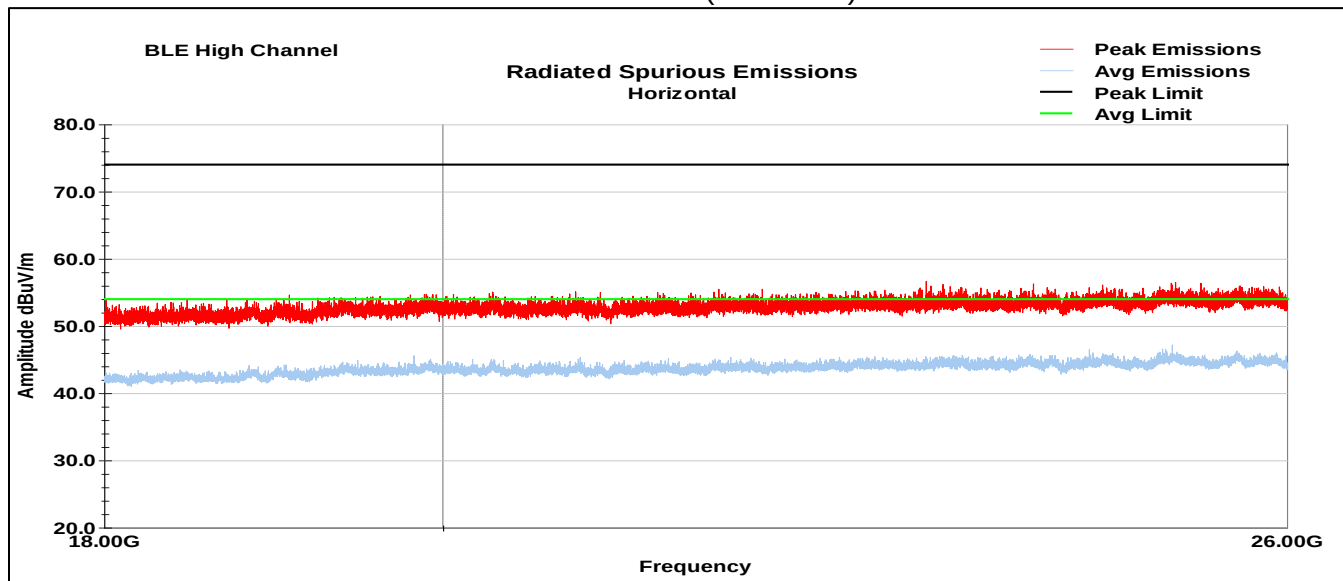
BLE Channel 19
Horizontal Plot (18-26GHz)



BLE Channel 39
Vertical Plot (18-26GHz)



BLE Channel 39
Horizontal Plot (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 11.12.2. The measurements were converted to a radiated field strength equivalent using the equations defined in that section. Both peak and average measurements were performed at the antenna port.

Offset Calculations:

A reference level offset was applied to the spectrum analyzer so that conducted measurements in dBμV represent field strength measurements in dBμV/m.

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

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

Where:

D = 3m	Distance
CL = 11.0 dB	Cable Loss
DC = 1.34 dB (73.5%)	Duty Cycle Correction Factor [10Log(1/Duty Cycle)]
AG = 3.3 dB	Antenna Gain [2 dB is the minimum allowed by the test method]

$$\text{Offset} = 3.94 \text{ dB}$$

8.3 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature:	23.4 °C
Relative Humidity:	49.8 %
Atmospheric Pressure:	96.9 kPa

8.4 Test Equipment

Test End Date: 9-Apr-2019

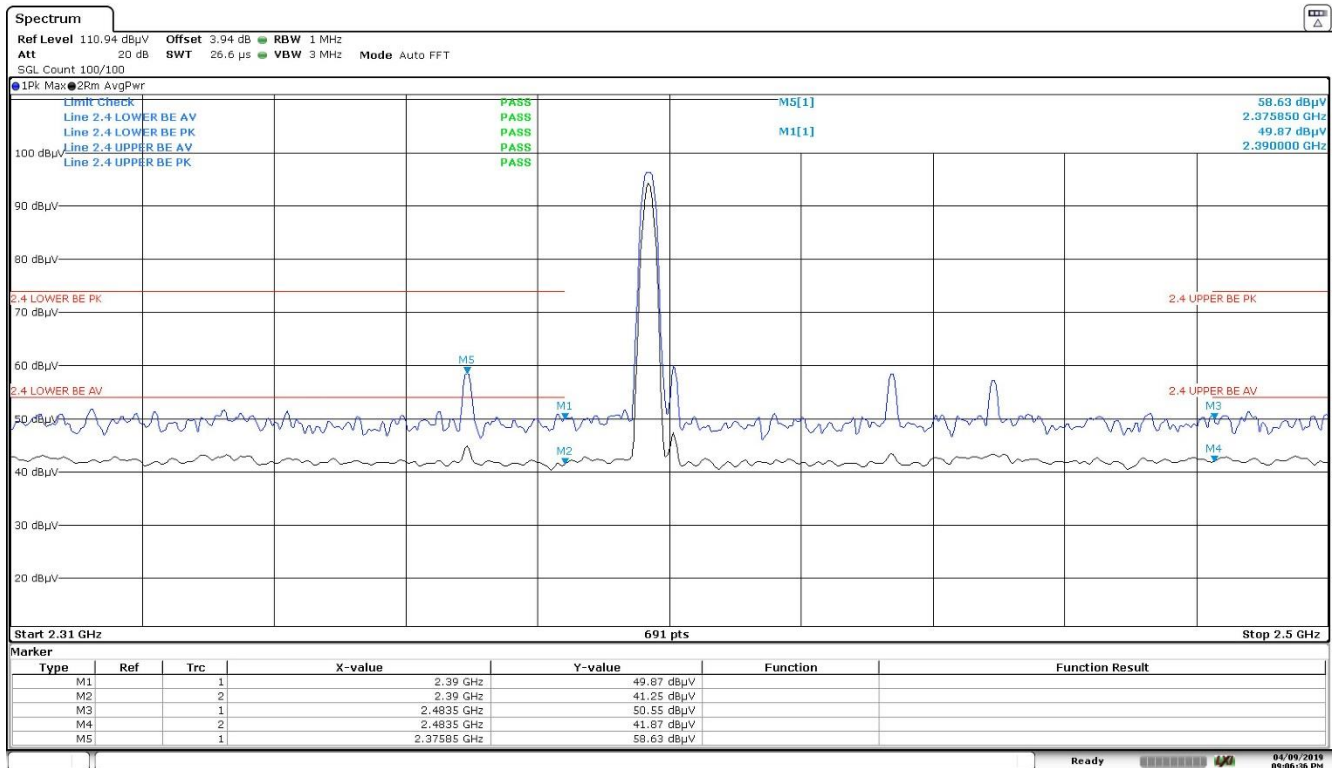
Tester: ASF

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

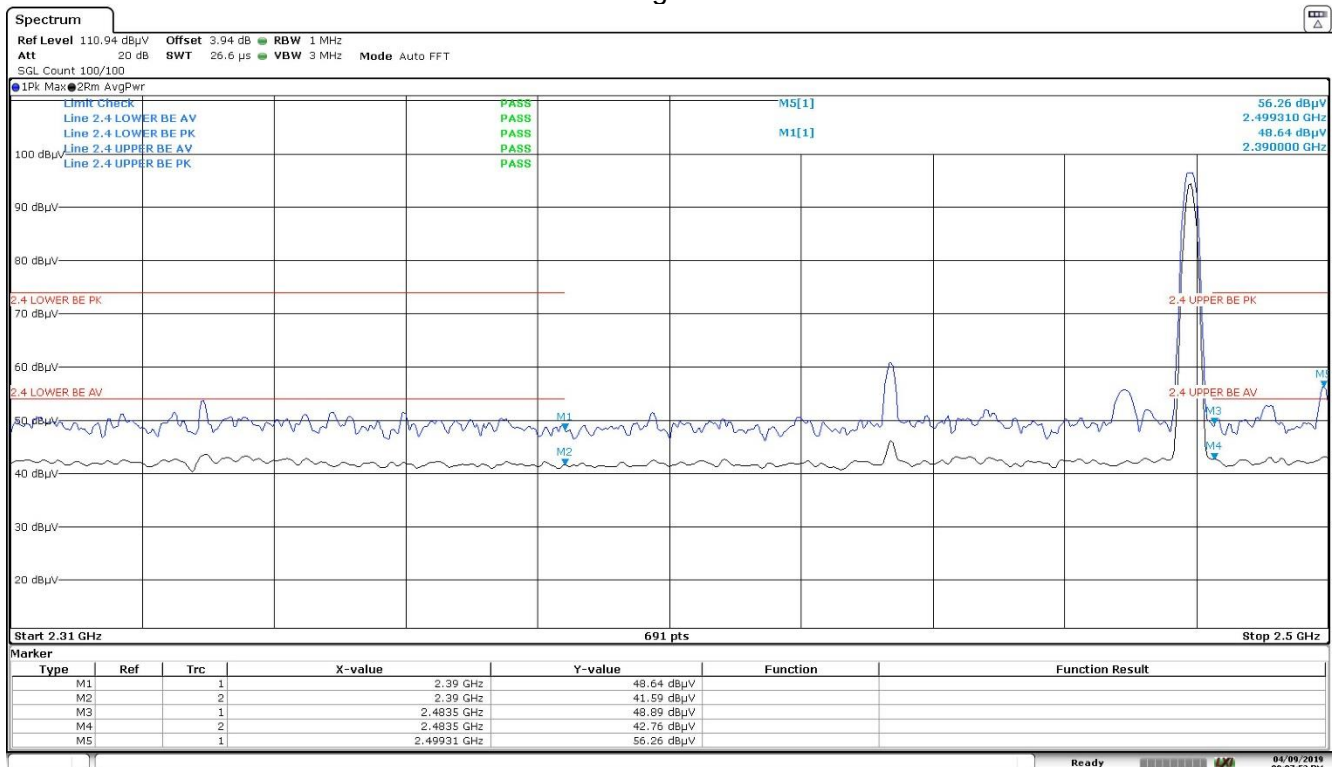
Note: The equipment calibration period is 1 year except for the FSV30 which is on a 2-year cycle.

8.5 Test Data – Restricted Band Edge

BLE – Low Channel



BLE – High Channel



9 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)).

Parameter	Expanded Uncertainty for Normal k factor equal to 2	
	Required	Laboratory Actual
Radio Frequency	$\pm 1 \times 10^{-5}$	$\pm 9.8 \times 10^{-8}$
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	$\pm 1^{\circ}\text{C}$	$\pm 0.5^{\circ}\text{C}$
humidity	± 5 %	$\pm 3.5\%$
DC and low frequency voltages	± 3 %	$\pm 0.4\%$
Conducted disturbance at mains port using AMN	± 3.4 dB	± 2.5 dB

10 Revision History

Revision Level	Description of changes	Revision Date
0	Initial release	22 April 2019
1	Updated KDB reference to latest version in section 7.2	10 May 2019