

GMC Inc.

TEST REPORT

SCOPE OF WORK:

47 CFR FCC Part 15.247 – Radio Spectrum report

Model:

HC700 BT

REPORT NUMBER

201200152TWN-001

ISSUE DATE

Jan. 12, 2021

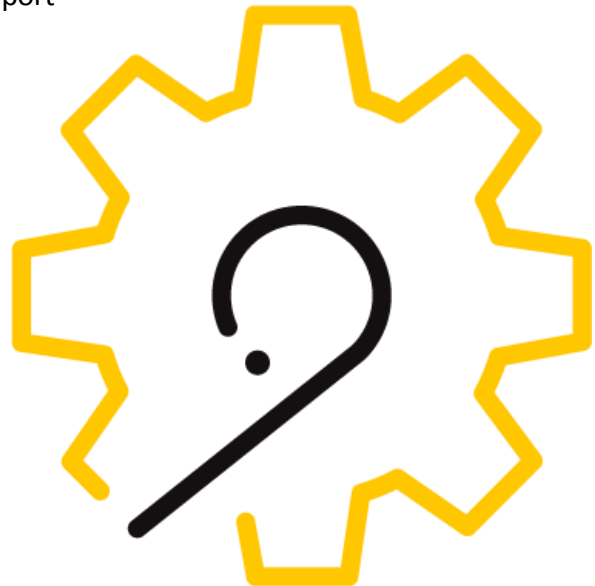
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DOCUMENT CONTROL NUMBER

GFT-OP-10h (28-Nov-2018)

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Radio Spectrum TEST REPORT

Applicant:	GMC Inc. No. 686 Su Chu Rd., Chuzhou, Anhui, China
Product:	Infrared Temple Thermometer
Model No.:	HC700 BT
FCC ID:	2AWWDFH4
Test Method/ Standard:	47 CFR FCC Part 15.247 & ANSI C63.10 2013 KDB 558074 D01 v05r02
Test By:	Intertek Testing Services Taiwan Ltd., Hsinchu Laboratory No. 11, Lane 275, Ko-Nan 1 Street, Chia-Tung Li, Shiang-Shan District, Hsinchu City, Taiwan



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Revision History

Report No.	Issue Date	Revision Summary
201200152TWN-001	Jan. 12, 2021	Original report

Table of Contents

1. General Information	6
1.1 Identification of the EUT	6
1.2 Antenna description	6
1.3 Peripherals equipment	6
1.4 Operation mode	7
2. Minimum 6 dB Bandwidth	8
2.1 Instrument Setting.....	8
2.2 Test Procedure	8
2.3 Test Diagram	8
2.4 Limit	8
2.5 Operating Environment Condition	8
2.6 Test Results	9
3. Maximum Peak Conducted Output Power	11
3.1 Instrument Setting.....	11
3.2 Test Procedure	11
3.3 Test Diagram	11
3.4 Limit	11
3.5 Operating Environment Condition	11
3.6 Test Results	12
4. Power Spectral Density	13
4.1 Instrument Setting.....	13
4.2 Test Procedure	13
4.3 Test Diagram	13
4.4 Limit	13
4.5 Operating Environment Condition	13
4.6 Test Results	14
5. Emissions in Non-Restricted Frequency Bands	16
5.1 Instruments Setting	16
5.2 Test Procedure	16
5.3 Test Diagram	16
5.4 Limit	16
5.5 Operating Environment Condition	17
5.6 Test Results	18
6. Emissions in Restricted Frequency Bands (Radiated emission measurements)	21
6.1 Instrument Setting.....	21
6.2 Test Procedure	21
6.3 Test Diagram	22
6.3.1 Radiated emission below 1GHz using Bilog Antenna	22
6.3.2 Radiated emission above 1GHz using Horn Antenna	22

TEST REPORT

6.4 Limit.....	23
6.5 Operating Environment Condition	23
6.6 Test Result.....	24
7. Emission on Band Edge.....	27
7.1 Instrument Setting.....	27
7.2 Test Procedure	27
7.3 Operating Environment Condition	27
7.4 Test Results	28
8. AC Power Line Conducted Emission	31
Appendix A: Test equipment list.....	32
Appendix B: Measurement Uncertainty	33

Summary of Test Data

Test Requirement	Applicable Rule (Section 15.247)	Result
Minimum 6 dB Bandwidth	15.247(a)(2)	Pass
Maximum Peak Conducted Output Power	15.247(b)(3)	Pass
Power Spectral Density	15.247(e)	Pass
Emissions In Non-Restricted Frequency Bands	15.247(d)	Pass
Emissions In Restricted Frequency Bands (Radiated emission measurements)	15.247(d), 15.205, 15.209	Pass
Emission On The Band Edge	15.247(d), 15.205	Pass
AC Power Line Conducted Emission	15.207	N/A
Antenna Requirement	15.203	Pass

Note: Please note that the test results with statement of conformity, the decision rules which are based on: Safety Testing: the specification, standard or IEC Guide 115.

Other Testing: the specification, standard and not taking into account the measurement uncertainty.

1. General Information

1.1 Identification of the EUT

Product:	Infrared Temple Thermometer
Model No.:	HC700 BT
Operating Frequency:	2402 MHz ~ 2480 MHz
Channel Number:	40 channels
Frequency of Each Channel:	2402+2 k, k=0 ~ 39
Rated Power:	DC 3V
Power Cord:	N/A
Sample receiving date:	Oct. 04, 2019
Sample condition:	Workable
Test Date(s):	Dec. 04, 2019 ~ Dec. 05, 2019

1.2 Antenna description

Antenna Gain : -6.2853 dBi
 Antenna Type : Printed antenna
 Connector Type : Fixed

1.3 Peripherals equipment

Peripherals	Brand	Model No.	Serial No.	Data cable
Battery	Panasonic	LR03TTS/10S-R	N/A	N/A

1.4 Operation mode

The EUT was supplied with DC 3 V from battery.

EUT press the button to select different frequency and modulation.

The signal is maximized through rotation and placement in the two orthogonal axes.



X axis



Y axis



Z axis

After verifying three axes, we found the maximum electromagnetic field was occurred at Z axis. The final test data was executed under this configuration.

2. Minimum 6 dB Bandwidth

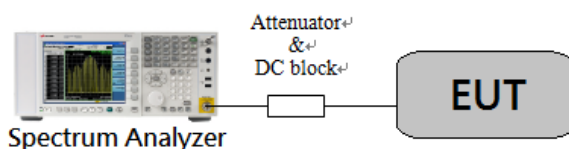
2.1 Instrument Setting

Spectrum Parameter	Setting
Detector	Peak
RBW	100kHz
VBW	$\geq 3 \times \text{RBW}$
Sweep	Auto couple
Trace	Allow the trace to stabilize.
Span	Between two times and five times the occupied bandwidth
Attenuation	Auto

2.2 Test Procedure

Step 1	The transmitter output was connected to the spectrum analyzer.
Step 2	Test was performed accordance with ANSI C63.10.
Step 3	Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission

2.3 Test Diagram



2.4 Limit

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

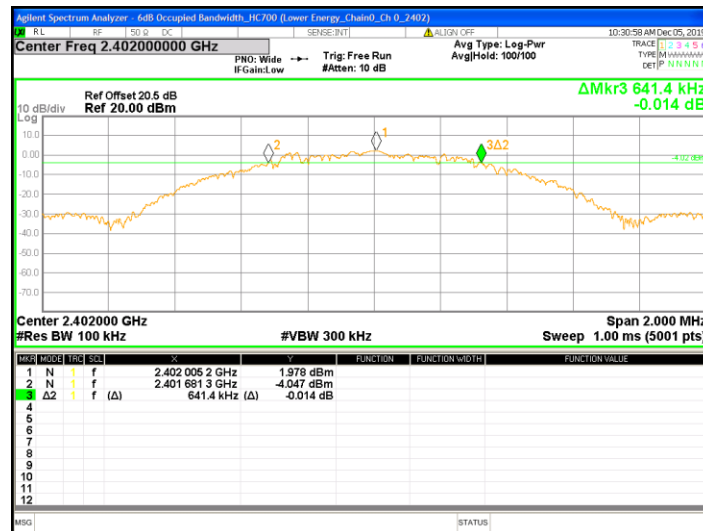
2.5 Operating Environment Condition

Temperature (°C) :	18
Relative Humidity (%) :	59
Test date :	Dec. 05, 2019

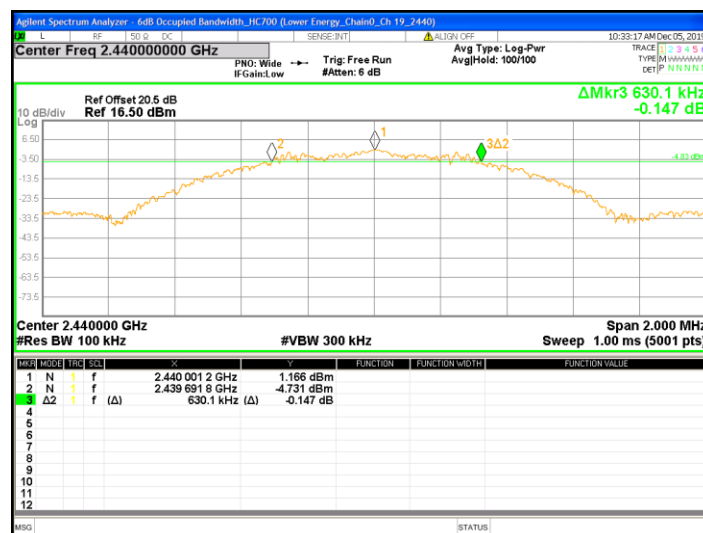
2.6 Test Results

Mode	Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)	Result
BLE	0	2402	0.641	>0.5	Pass
	19	2440	0.630	>0.5	Pass
	39	2480	0.651	>0.5	Pass

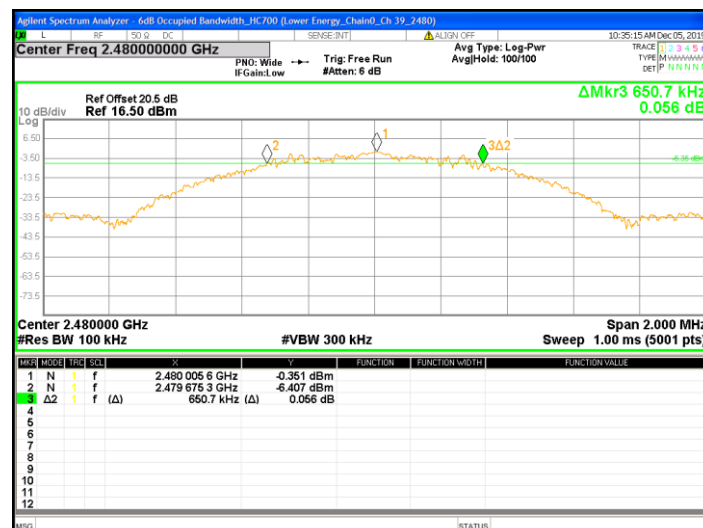
Chain 0: 6dB Bandwidth @ BLE mode Ch 0



Chain 0: 6dB Bandwidth @ BLE mode Ch 19



Chain 0: 6dB Bandwidth @ BLE mode Ch 39



3. Maximum Peak Conducted Output Power

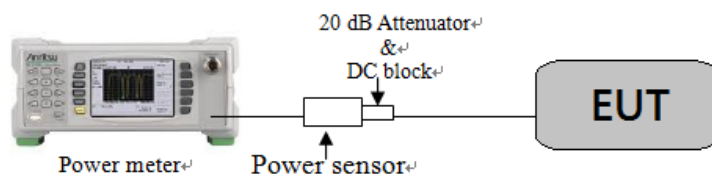
3.1 Instrument Setting

Power Meter Parameter	Setting
Bandwidth	65MHz bandwidth is greater than the EUT emission bandwidth
Detector	Peak & Average

3.2 Test Procedure

The preferred methodology is to use integrated average power measurements, as described in 11.9.2 and 11.13.3 of ANSI C63.10. The peak integrated band power methods of 11.9.1.2 and 11.13.3.2 of ANSI C63.10 are not applicable for FCC compliance testing purposes.

3.3 Test Diagram



3.4 Limit

For systems using digital modulation in the 2400-2483.5 MHz: 1 Watt (30dBm)

3.5 Operating Environment Condition

Temperature (°C) :	18
Relative Humidity (%) :	59
Test date :	Dec. 05, 2019

3.6 Test Results

Mode	Channel	Frequency (MHz)	Output Power (AV) (dBm)	Total Power (AV) (mW)	Maximum power (PK) (dBm)	Maximum power (PK) (mW)	Limit (dBm)	Margin (dB)
BLE	0	2402	1.70	1.48	1.79	1.51	30	-28.21
	19	2440	-0.77	0.84	0.66	1.16	30	-29.34
	39	2480	-0.60	0.87	-0.50	0.89	30	-30.50

4. Power Spectral Density

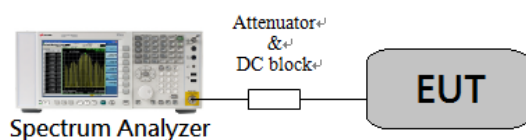
4.1 Instrument Setting

Spectrum Function	Setting
Detector	Peak
RBW	≥ 3 kHz
VBW	$\geq 3 \times$ RBW
Sweep	Auto couple
Trace	Max hold
Span	1.5 times $\times$ 6dB bandwidth
Attenuation	Auto

4.2 Test Procedure

Step 1	Test procedure refer to subclause 11.10 of ANSI C63.10.
Step 2	Using the maximum conducted output power in the fundamental emission demonstrates compliance. The EUT must be configured to transmit continuously at full power over the measurement duration.
Step 3	Use the peak marker function to determine the maximum amplitude level within the RBW.

4.3 Test Diagram



4.4 Limit

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission

4.5 Operating Environment Condition

Temperature (°C) :	18
Relative Humidity (%) :	59
Test date :	Dec. 05, 2019

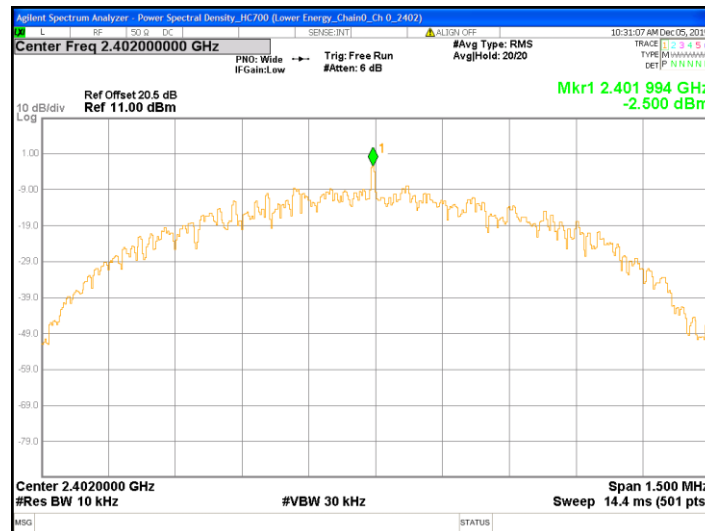
4.6 Test Results

Single TX

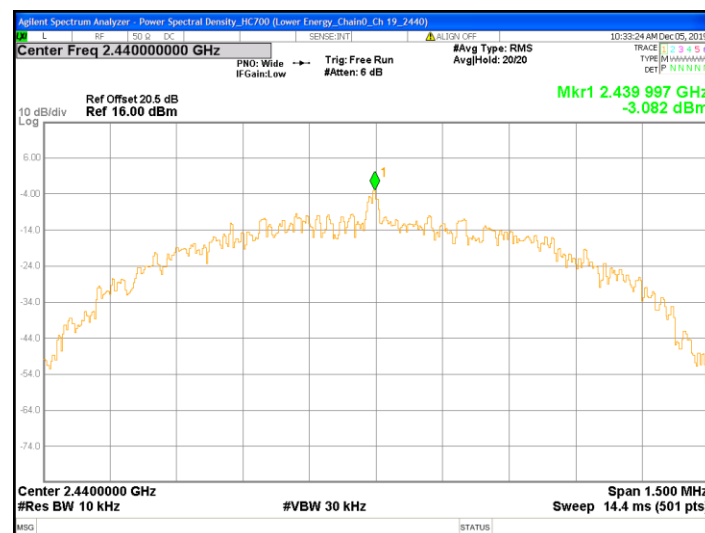
Chain 0

Mode	Channel	Frequency (MHz)	RBW factor	PSD in 10kHz	PSD in 3kHz		Limit (dBm)	Margin (dB)
					(dBm)	(mW)		
BLE	0	2402	5.23	-2.50	-7.73	0.17	8	-15.73
	19	2440	5.23	-3.08	-8.31	0.15	8	-16.31
	39	2480	5.23	-5.89	-11.12	0.08	8	-19.12

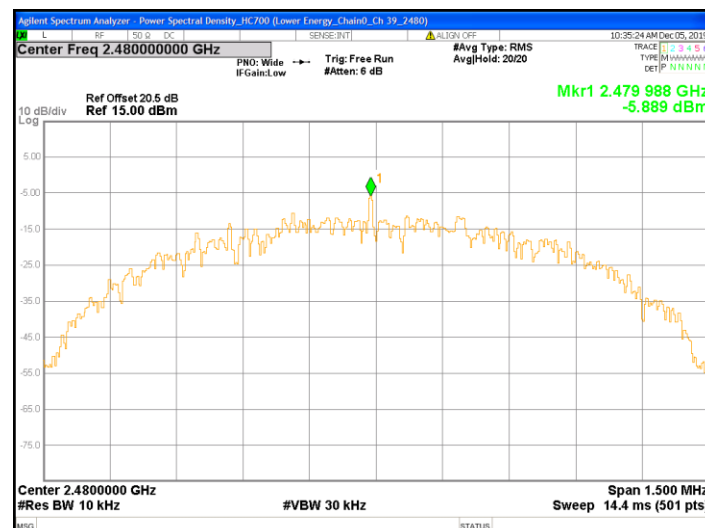
Chain 0: Power Spectral Density @ BLE Mode Ch 0



Chain 0: Power Spectral Density @ BLE Mode Ch 19



Chain 0: Power Spectral Density @ BLE Mode Ch 39



5. Emissions in Non-Restricted Frequency Bands

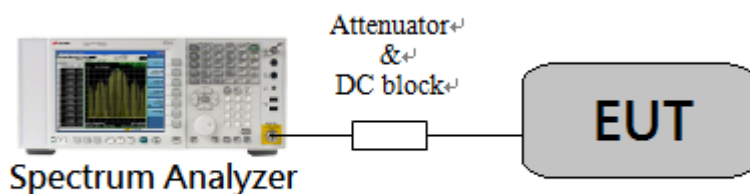
5.1 Instruments Setting

Spectrum Function	Setting (Reference Level)	Setting (Emission Level)
Detector	Peak	Peak
RBW	≥ 100 kHz	≥ 100 kHz
VBW	$\geq 3 \times$ RBW	$\geq 3 \times$ RBW
Sweep	Auto couple	Auto couple
Trace	Max hold	Max hold
Span	≥ 1.5 time 6dB bandwidth	
Attenuation	Auto	Auto

5.2 Test Procedure

- Step 1 The procedure was used in antenna-port conducted and connected to the spectrum analyzer.
- Step 2 Set instrument center frequency to center frequency.
- Step 3 Use the parameter configured in subclause 11.11 of ANSI C63.10 to measure.
- Step 4 Use the peak marker function to determine the maximum amplitude level.

5.3 Test Diagram



5.4 Limit

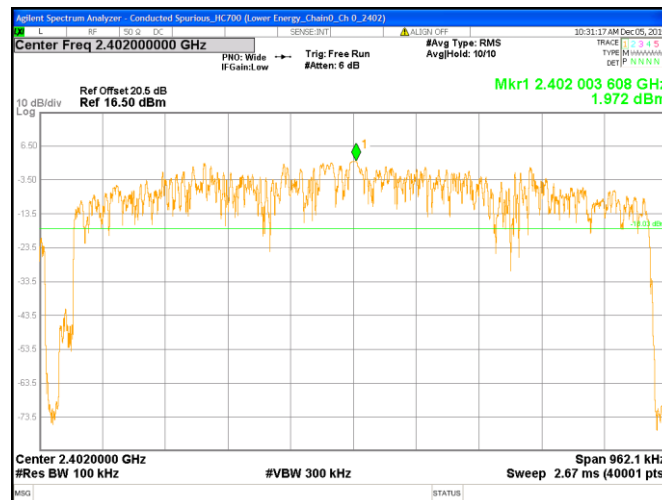
The peak output power measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz

5.5 Operating Environment Condition

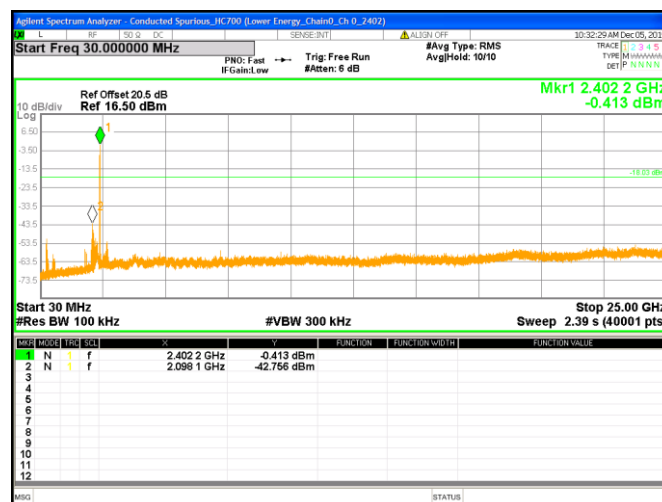
Temperature (°C) :	18
Relative Humidity (%) :	59
Test date :	Dec. 05, 2019

5.6 Test Results

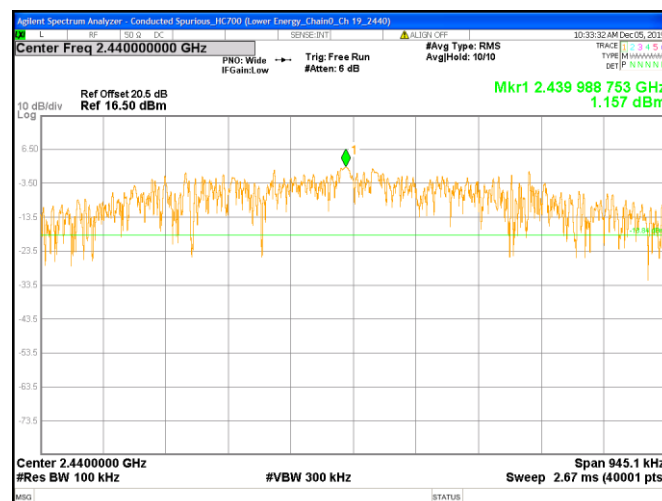
Chain 0: Conducted Spurious @ BLE Mode Ch 0



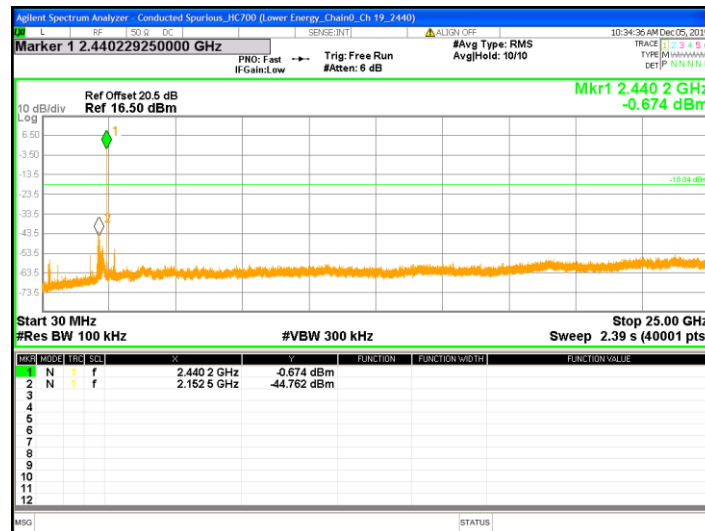
Chain 0: Conducted Spurious @ BLE Mode Ch 0



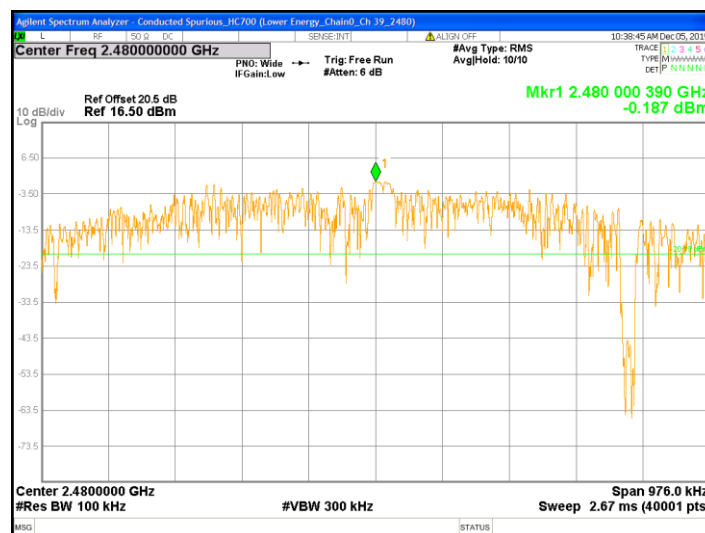
Chain 0: Conducted Spurious @ BLE Mode Ch 19



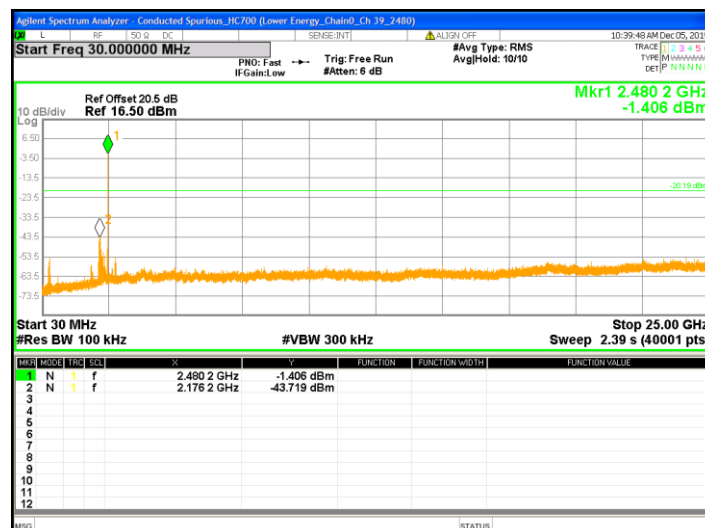
Chain 0: Conducted Spurious @ BLE Mode Ch 19



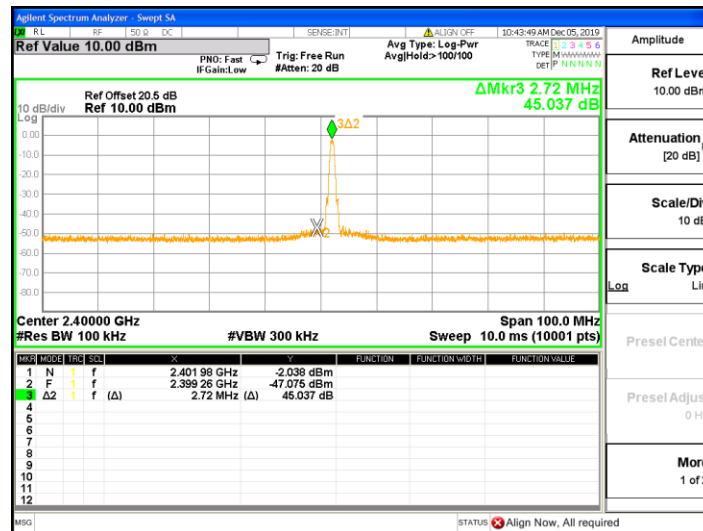
Chain 0: Conducted Spurious @ BLE Mode Ch 39



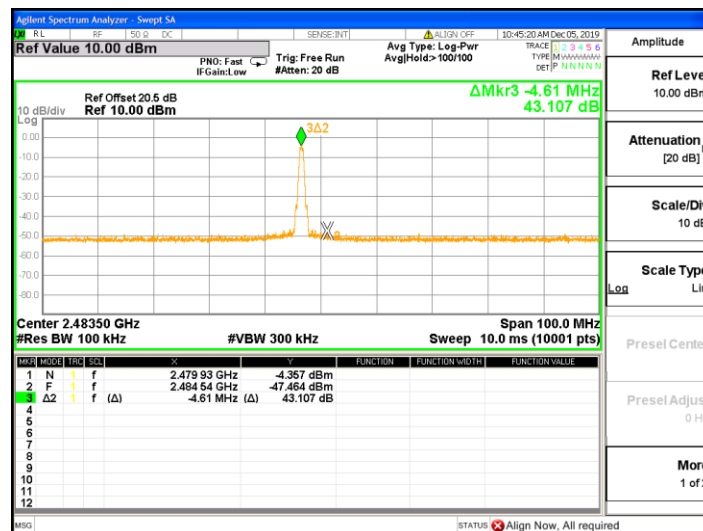
Chain 0: Conducted Spurious @ BLE Mode Ch 39



Chain 0: Authorized Band Bandedge @ BLE Mode Ch0



Chain 0: Authorized Band Bandedge @ BLE Mode Ch39



6. Emissions in Restricted Frequency Bands (Radiated emission measurements)

6.1 Instrument Setting

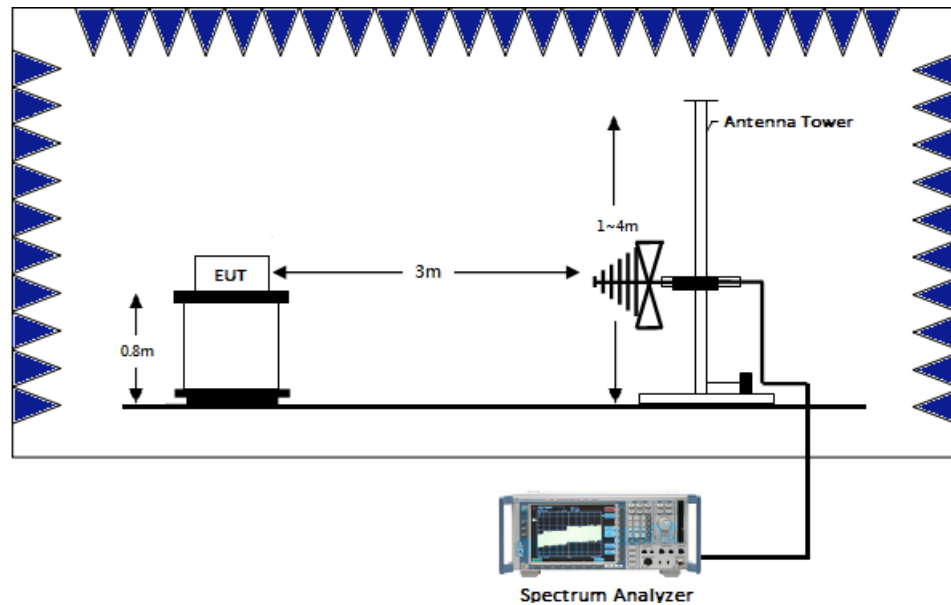
Receiver Function	Setting (Below 1GHz)	Setting (Above 1GHz)
Detector	QP	Peak and Average
RBW	9-150 kHz ; 200-300 Hz 0.15-30 MHz; 9-10 kHz 30-1000 MHz; 100-120 kHz	1MHz
VBW	$\geq 3 \times \text{RBW}$	3MHz
Sweep	Auto couple	Auto couple
Start Frequency	9 kHz	1GHz
Stop Frequency	1 GHz	Tenth harmonic
Attenuation	Auto	Auto

6.2 Test Procedure

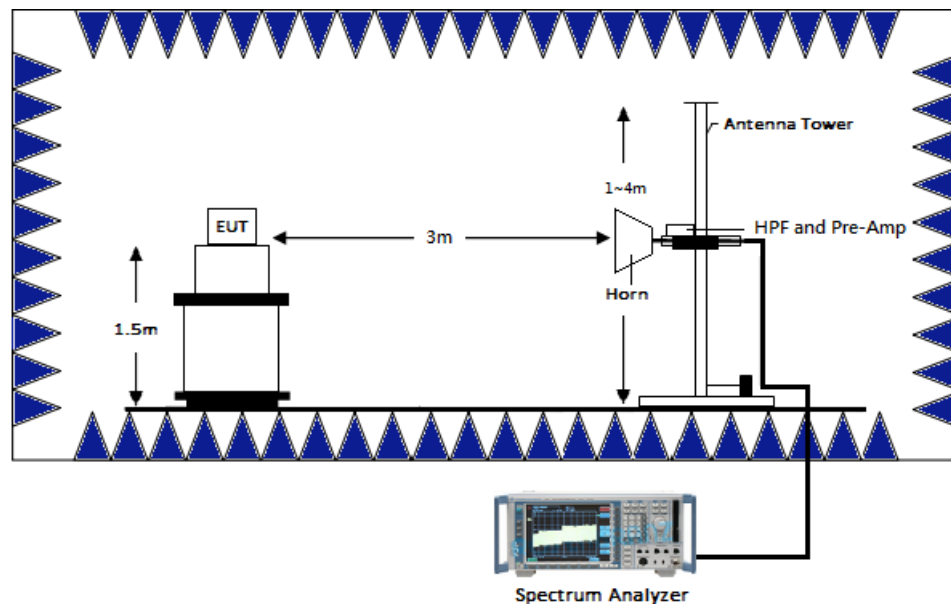
Step 1	Configure the EUT according to ANSI C63.10:2013. The EUT was placed on the top of the turntable 0.8 meter (below 1GHz) and 1.5 meter (above 1GHz) above ground. The center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
Step 2	Power on the EUT and all the companion devices. The turntable was rotated by 360 degree to find the position of the maximum emission level.
Step 3	The height of the receiving antenna was varied between one meter and four meters above ground to find the maximum emission field strength of the both horizontal and vertical polarization.
Step 4	If find the frequencies above the limit or below within 3dB, the antenna tower was scan (from 1m to 4m) and then the turntable was rotated to find the maximum reading.
Step 5	Set the test-receiver system to peak or CISPR quasi-peak detector with specified bandwidth under maximum hold mode.
Step 6	For emissions above 1GHz, use 1MHz VBW and 3MHz RBW for reading in spectrum analyzer. Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response.
Step 7	If the emissions level of the EUT in peak mode was 3dB lower than the average limit specified then testing will be stopped and peak values of the EUT will be reported. Otherwise, the emissions which do not have 3dB margin will be measured using the quasi-peak method for below 1GHz.
Step 8	For testing above 1GHz, The emissions level of the EUT in peak mode was lower than average limit, then testing will be stopped and peak values of the EUT will be reported, otherwise, the emission will be measured in average mode again and reported.
Step 9	In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be quasi-peak measured by receiver.

6.3 Test Diagram

6.3.1 Radiated emission below 1GHz using Bilog Antenna



6.3.2 Radiated emission above 1GHz using Horn Antenna



6.4 Limit

Frequency(MHz)	Field Strength(uV/m)	Measurement distance(m)
0.009~0.490	2400/F(kHz)	300
0.490~1.705	24000/F(kHz)	30
1.705~30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Remark:

1. In the above table, the tighter limit applies at the band edges.
2. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system

6.5 Operating Environment Condition

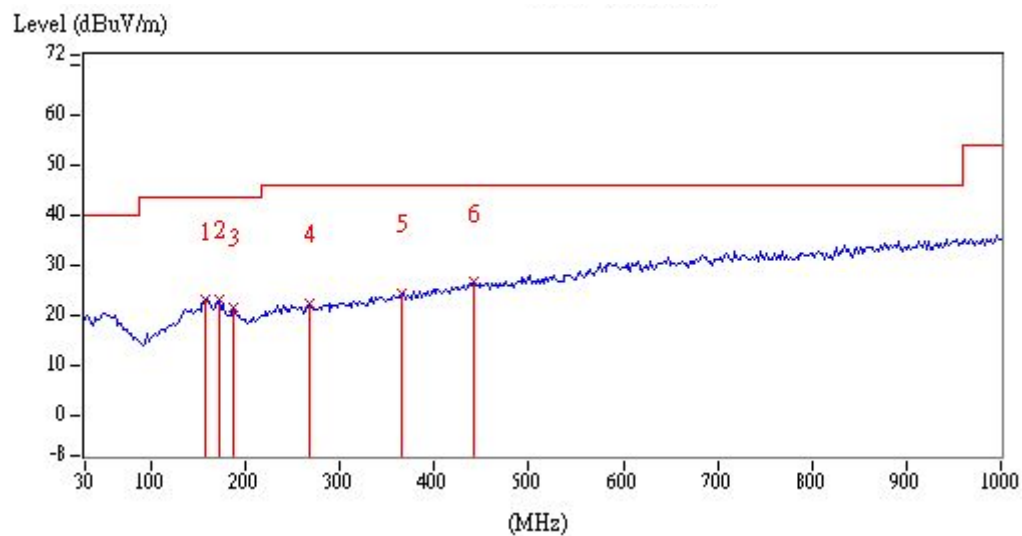
Temperature (°C) :	24
Relative Humidity (%) :	58
Test date :	Dec. 04, 2019

6.6 Test Result

6.6.1 Measurement results: frequencies below 1 GHz

The test was performed on EUT under continuously transmitting mode. The worst case occurred at Channel 0.

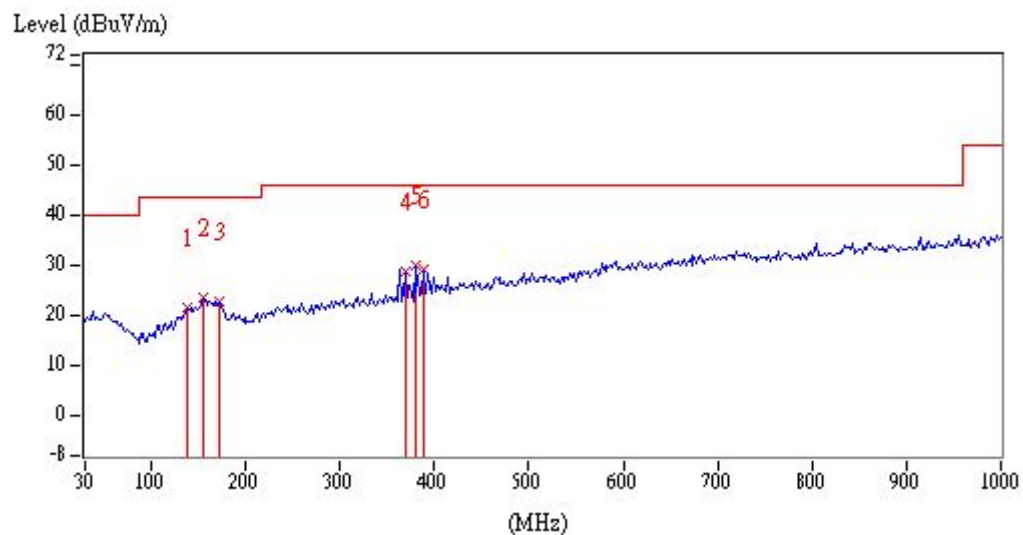
Ant Polarity	Frequency (MHz)	Detector	Factor (dB/m)	Reading (dBμV)	Corrected Reading (dBμV/m)	Limit @ 3m (dBμV/m)	Margin (dB)
Vertical	158.04	QP	20.55	2.49	23.04	43.50	-20.46
Vertical	171.62	QP	20.04	3.17	23.21	43.50	-20.29
Vertical	187.14	QP	18.39	3.40	21.79	43.50	-21.71
Vertical	268.62	QP	20.96	1.54	22.50	46.00	-23.50
Vertical	365.62	QP	23.34	1.20	24.54	46.00	-21.46
Vertical	441.28	QP	25.35	1.29	26.64	46.00	-19.36



TEST REPORT

Ant Polarity	Frequency (MHz)	Detector	Factor (dB/m)	Reading (dBμV)	Corrected Reading (dBμV/m)	Limit @ 3m (dBμV/m)	Margin (dB)
Horizontal	138.64	QP	19.83	1.78	21.61	43.50	-21.89
Horizontal	156.10	QP	20.53	3.08	23.61	43.50	-19.89
Horizontal	171.62	QP	20.04	2.80	22.84	43.50	-20.66
Horizontal	369.50	QP	23.44	5.55	28.99	46.00	-17.01
Horizontal	379.20	QP	23.69	6.38	30.07	46.00	-15.93
Horizontal	388.90	QP	23.94	5.43	29.37	46.00	-16.63

Remark: Corr. Factor = Antenna Factor + Cable Loss



TEST REPORT

6.6.2 Measurement results: frequency above 1GHz to 25GHz

Chain0

Mode	Frequency (MHz)	Spectrum Analyzer Detector	Ant. Pol. (H/V)	Correction Factor (dB/m)	Reading (dBμV)	Corrected Reading (dBμV/m)	Limit @ 3 m (dBμV/m)	Margin (dB)
BLE , Ch0	4804	PK	V	7.32	44.02	51.34	74.00	-22.66
	4804	PK	H	7.32	43.37	50.69	74.00	-23.31
BLE , Ch19	4880	PK	V	7.49	34.13	41.62	74.00	-32.38
	4880	PK	H	7.49	34.69	42.18	74.00	-31.82
BLE , Ch39	4960	PK	V	7.66	36.74	44.40	74.00	-29.60
	4960	PK	H	7.66	40.15	47.81	74.00	-26.19

Remark: Correction Factor = Antenna Factor + Cable Loss + High Pass Filter Loss - Pre_Amplifier Gain

7. Emission on Band Edge

7.1 Instrument Setting

Spectrum Function	Setting
Detector	Peak and Average
RBW	1MHz
VBW	3MHz
Sweep	Auto couple
Restrict bands	2310 MHz ~ 2390 MHz 2483.5 MHz ~ 2500 MHz
Attenuation	Auto

7.2 Test Procedure

The test procedure is the same as Emissions in Restricted Frequency Bands (Radiated emission measurements).

7.3 Operating Environment Condition

Temperature (°C) :	24
Relative Humidity (%) :	58
Test date :	Dec. 04, 2019

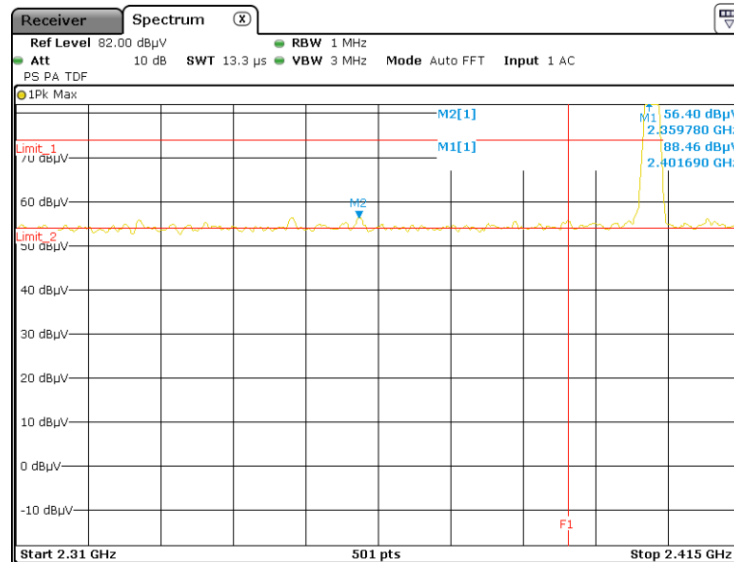
TEST REPORT

7.4 Test Results

Mode	Frequency (MHz)	Spectrum Analyzer Detector	Ant. Pol. (H/V)	Correction Factor (dB/m)	Reading (dBμV)	Corrected Reading (dBμV/m)	Limit @ 3 m (dBμV/m)	Margin (dB)	Restricted band (MHz)
BLE	2359.78	PK	V	34.44	21.96	56.40	74	-17.60	2310~2390
	2385.97	AV	V	34.55	9.48	44.03	54	-9.97	
	2494.49	PK	V	34.97	21.47	56.44	74	-17.56	2483.5~2500
	2494.49	AV	V	34.97	9.64	44.61	54	-9.39	

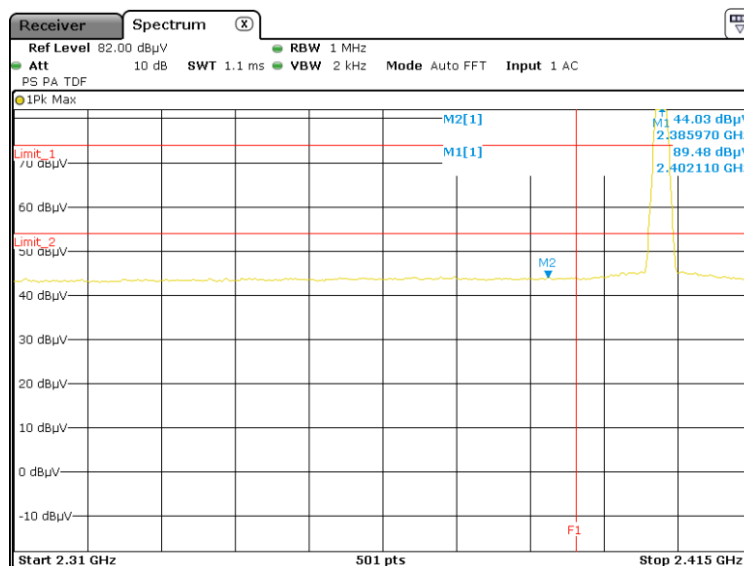
Remark: Correction Factor = Antenna Factor + Cable Loss

Chain 0: Restricted Band Bandedge @ BLE Mode Ch0 PK



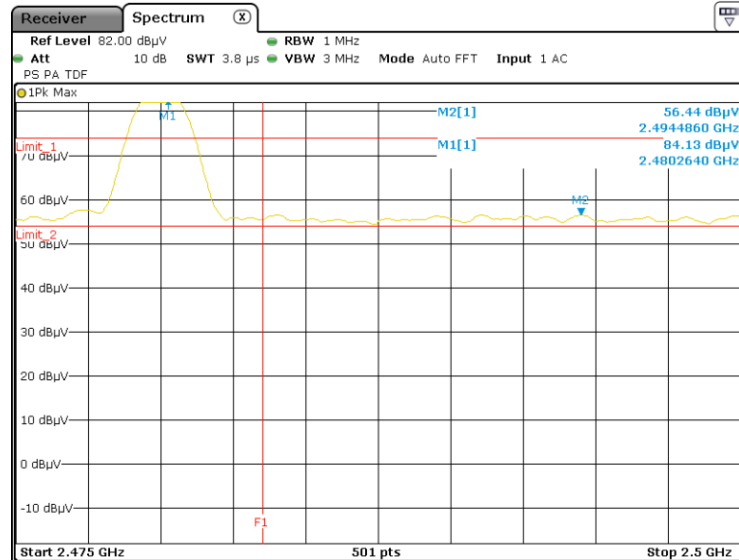
Date: 4.DEC.2019 10:05:32

Chain 0: Restricted Band Bandedge @ BLE Mode Ch0 AV



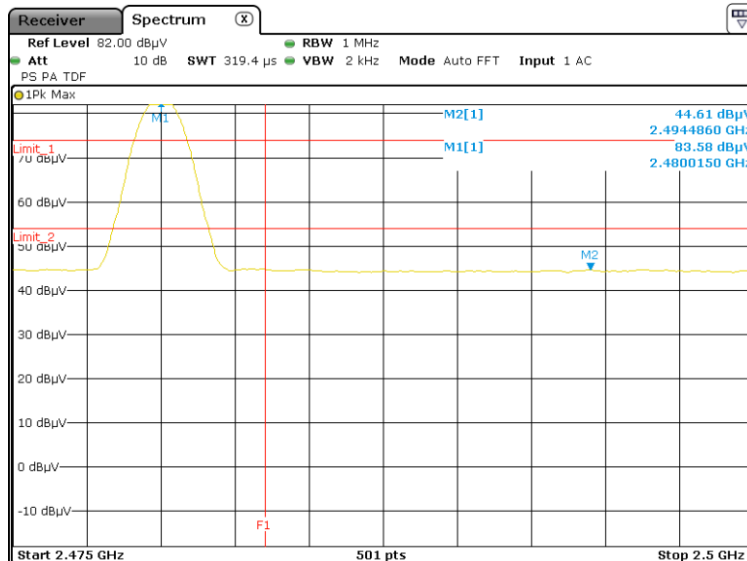
Date: 4.DEC.2019 10:12:20

Chain 0: Restricted Band Bandedge @ BLE Mode Ch39 PK



Date: 4.DEC.2019 10:20:14

Chain 0: Restricted Band Bandedge @ BLE Mode Ch39 AV



Date: 4.DEC.2019 10:21:28

8. AC Power Line Conducted Emission

Since the EUT is not connected to AC source, therefore, the test can be waived.

TEST REPORT

Appendix A: Test equipment list

Test Equipment/ Test site	Brand	Model No.	Serial No.	Calibration Date	Next Calibration Date
EMI Test Receiver	Rohde & Schwarz	ESR-7	101232	2019/01/30	2020/01/29
EMI Test Receiver	R&S	ESU40	100381	2019/06/05	2020/06/03
Spectrum Analyzer	R&S	FSP30	100137	2019/08/29	2020/08/27
Signal Analyzer	Agilent	N9030A	MY51380492	2019/08/21	2020/08/19
Active Loop Antenna	SCHWARZBECK MESS-ELEKTRONIC	FMZB1519	1519-067	2019/04/19	2020/04/17
Broadband Antenna	SHWARZBECK	VULB 9168	9168-172	2019/06/05	2020/06/03
Horn Antenna	SHWARZBECK	BBHA 9120 D	9120D-456	2019/02/01	2020/01/31
Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170159	2017/09/04	2020/09/02
Pre-Amplifier	SCHWARZBECK	BBV9718	9718-004	2019/10/16	2020/10/14
Power Meter	Anritsu	ML2495A	0844001	2019/10/23	2020/10/21
Power Sensor	Anritsu	MA2411B	0738452	2019/10/23	2020/10/21
966-2(A) Cable	SUHNER	SMA / EX 100	N/A	2019/08/19	2020/08/17
966-2(B) Cable	SUHNER	SUCOFLEX 104P	CB0005	2019/08/19	2020/08/17
RF Cable	SUHNER	SUCOFLEX 102	CB0006	2019/05/02	2020/04/30
Hight Pass Filter	Reactel	7HS-3G/18G-S11	N/A	2019/05/30	2020/05/28
966-2_3m Semi-Anechoic Chamber	966_2	CEM-966_2	N/A	2019/02/23	2020/02/22

Note: No Calibration Required (NCR)

Appendix B: Measurement Uncertainty

This uncertainty represents an expanded uncertainty expressed at approximately the 95 % confidence level using a coverage factor of $k=2$.

Item	Uncertainty
Vertically polarized radiated disturbances from 30MHz~1GHz in a semi-anechoic chamber at a distance of 3m	4.90 dB
Horizontally polarized radiated disturbances from 30MHz~1GHz in a semi-anechoic chamber at a distance of 3m	4.89 dB
Vertically polarized Radiated disturbances from 1GHz~18GHz in a semi-anechoic chamber at a distance of 3m	4.29 dB
Horizontally polarized Radiated disturbances from 1GHz~18GHz in a semi-anechoic chamber at a distance of 3m	4.29 dB
Vertically polarized Radiated disturbances from 18GHz~26.5GHz in a semi-anechoic chamber at a distance of 1m	2.45 dB
Horizontally polarized Radiated disturbances from 18GHz~26.5GHz in a semi-anechoic chamber at a distance of 1m	2.45 dB
Vertically polarized Radiated disturbances from 26.5GHz~40GHz in a semi-anechoic chamber at a distance of 1m	2.45 dB
Horizontally polarized Radiated disturbances from 26.5GHz~40GHz in a semi-anechoic chamber at a distance of 1m	2.45 dB
Radiated disturbances from 9kHz~30MHz in a semi-anechoic chamber at a distance of 3m	3.32 dB
Emission on the Band Edge Test	4.29 dB
Minimum Emission Bandwidth	7.69 %
Maximum Conducted Output Power	1.15 dB
Power Spectral Density	1.15 dB
AC Power Line Conducted Emission	2.52 dB