TEST REPORT

Application No.:	C190123R01
FCC ID:	OCDSD600
Applicant:	Ringway Tech(Jiangsu) Co.,Ltd.
Address of Applicant:	No. 101 Hanjiang West Road, Changzhou,Jiangsu, China
Manufacturer:	Ringway Tech(Jiangsu) Co.,Ltd.
Address of Manufacturer:	No. 101 Hanjiang West Road, Changzhou,Jiangsu, China
Factory:	Ringway Tech(Jiangsu) Co.,Ltd.
Address of Factory:	No. 101 Hanjiang West Road, Changzhou,Jiangsu, China
Equipment Under Test (EUT):	
EUT Name:	ELECTRONIC DRUM
Model No.:	SD600
Brand Name:	N/A
Standard(s) :	47 CFR Part 15, Subpart C 15.247
Date of Receipt:	2019-01-23
Date of Test:	2019-01-28 to 2019-01-29
Date of Issue:	2019-02-25
Test Result:	**Pass***

* In the configuration tested, the EUT complied with the standards specified above.

Jeff Fang

Jeff Fang
EMC Lab Manager

The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards. Any mention of SGS International Electrical Approvals or testing done by SGS International Electrical Approvals in connection with, distribution or use of the product described in this report must be approved by SGS International Electrical Approvals in writing.

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Revision Record			
Version	**Description**	**Date**	**Remark**
00	Original	2019-02-25	/
01	Update	2019-03-05	Revise setup diagram.

Authorized for issue by:				
		James Yan **James Yan / Project Engineer**		
		Jeff fang **Jeff Fang/Reviewer**		

2 Test Summary

Radio Spectrum Technical Requirement				
Item	**Standard**	**Method**	**Requirement**	**Result**
Antenna Requirement	47 CFR Part 15, Subpart C 15.247	N/A	47 CFR Part 15, Subpart C 15.203 & 15.247(c)	Customer Declaration

Radio Spectrum Matter Part				
Item	**Standard**	**Method**	**Requirement**	**Result**
Conducted Emissions at AC Power Line (150kHz-30MHz)	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 6.2	47 CFR Part 15, Subpart C 15.207	Pass
Minimum 6dB Bandwidth	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 11.8.1	47 CFR Part 15, Subpart C 15.247a(2)	Pass
Conducted Peak Output Power	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 11.9.1	47 CFR Part 15, Subpart C 15.247(b)(3)	Pass
Power Spectrum Density	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 11.10.2	47 CFR Part 15, Subpart C 15.247(e)	Pass
Conducted Band Edges Measurement	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 11.13.3.2	47 CFR Part 15, Subpart C 15.247(d)	Pass
Conducted Spurious Emissions	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 11.11	47 CFR Part 15, Subpart C 15.247(d)	Pass
Radiated Emissions which fall in the restricted bands	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 6.10.5	47 CFR Part 15, Subpart C 15.209 & 15.247(d)	Pass
Radiated Spurious Emissions	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 6.4,6.5,6.6	47 CFR Part 15, Subpart C 15.209 & 15.247(d)	Pass

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4 General Information

4.1 Details of E.U.T.

Power supply:	Adapter:
	Model: OH-1048A0900600U4-UL
	Input:100-240V~50/60Hz,250mA
	Output: DC 9V ⎓600mA
Test voltage:	AC 120V 60Hz
Cable:	DC Cable 1.5m for adapter
Antenna Gain	2.5 dBi
Antenna Type	chip Antenna
Channel Spacing	2MHz
Modulation Type	GFSK
Number of Channels	40
Operation Frequency	2402MHz to 2480MHz

4.2 Description of Support Units

Description	Manufacturer	Model No.	Serial No.
/	/	/	/

4.3 Measurement Uncertainty

No.	Item	Measurement Uncertainty
1	RF output power, conducted	±1.291dB
2	Unwanted Emissions, conducted	±2.408dB
3	RF Power density, conducted	±2.374dB
4	Conducted emissions	±2.2485dB
5	All emissions, radiated (Below 1GHz)	±4.5805dB
6	All emissions, radiated (Above 1GHz)	±4.1140dB
7	Temperature	±0.3dB
8	Supply voltages	±0.2%

Note: The measurement uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

4.4 Test Location

All measurement facilities used to collect the measurement data are located at
No.10 Weiye Rd, Innovation park, Eco&Tec, Development Zone, Kunshan City, Jiangsu, China.

No tests were sub-contracted.

4.5 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

- **CNAS (No. CNAS L4354)**

CNAS has accredited Compliance Certification Services (Kunshan) Inc. to ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration Laboratories (CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence in the field of testing.

- **A2LA (Certificate No. 2541.01)**

Compliance Certification Services (Kunshan) Inc. is accredited by the American Association for Laboratory Accreditation (A2LA). Certificate No. 2541.01.

- **FCC –Designation Number: CN1172**

Compliance Certification Services Inc. has been recognized as an accredited testing laboratory.

Designation Number: CN1172. Test Firm Registration Number: 995260.

- **Industry Canada (IC) – IC Assigned Code:** 2324E

The 10m and 3m Semi-anechoic chamber of Compliance Certification Services (Kunshan) Inc. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 2324E-1 for 10m chamber, 2324E-2 for 3m chamber.

- **VCCI (Member No.: 1938)**

The 3m and 10m Semi-anechoic chamber and Shielded Room of Compliance Certification Services (Kunshan) Inc. has been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: R-1600, C-1707, T-1499, G-216 respectively.

4.6 Deviation from Standards

None

5 Equipment List

Conducted Emission at AC Power Line					
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Date**	**Calibration Due**
EMI TEST RECEIVER	R&S	ESCI	100781	2018-2-26	2019-2-25
V (V-LISN)	SCHWARZBECK	NNLK 8129	8129-143	2018-10-28	2019-10-27
TWO-LINE V-NETWORK	R&S	ENV216	101604	2018-10-28	2019-10-27
Pulse LIMITER	R&S	ESH3-Z2	100524	2018-12-26	2019-12-25
Cable	Thermax	Cable-02	14	2018-12-26	2019-12-25
Test Software	EZ-EMC ver.3A1				
Conducted Test					
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Date**	**Calibration Due**
Spectrum Analyzer	RS	FSU26	200789	2018-7-13	2019-7-12
Power meter	Anritsu	ML2495A	1445010	2018-4-26	2019-4-25
Power sensor	Anritsu	MA2411B	1339220	2018-4-26	2019-4-25
Power SPLITTER	Mini-Circuits	ZN2PD-9G	SF078500430	N.C.R	N.C.R
DC Power Supply	AGILENT	E3632A	MY50340053	N.C.R	N.C.R
Cable	N/A	Cable-05	N/A	2018-4-24	2019-4-23
Cable	N/A	Cable-06	N/A	2018-4-24	2019-4-23
6dB Attenuator	N/A	N/A	N/A	2018-4-24	2019-4-23
Temp. / Humidity Gauge	Anymetre	TH603	CCS007	2018-10-30	2019-10-29

Radiated Test					
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Date**	**Calibration Due**
Spectrum Analyzer	R&S	FSV40	101493	2018-12-26	2019-12-25
Spectrum Analyzer	RS	FSU26	200789	2018-7-13	2019-7-12
EMI Test Receiver	R&S	ESCI	101378	2018-12-21	2019-12-20
Amplifier	COM-POWER	PAM-840A	461332	2018-10-28	2019-10-27
Amplifier	COM-POWER	PAM-118A	551044	2018-4-26	2019-4-25
Broad-Band Horn Antenna	SCHWARZBECK	BBHA 9170	9170-515	2018-2-27	2019-2-26
Bilog Antenna	Teseq	CBL6112D	36996	2018-7-7	2019-7-6
Loop Antenna	COM-POWER	AL-130R	10160008	2018-5-8	2019-5-7
Horn-antenna	SCHWARZBECK	9120D	D:266	2018-2-26	2019-2-25
Turn Table	CT	CT123	4165	N.C.R	N.C.R
Antenna Tower	CT	CTERG23	3256	N.C.R	N.C.R
Controller	CT	CT1OO	95637	N.C.R	N.C.R
Cable	REBES MICROWAVE	Cable-93	N/A	2018-10-28	2019-10-27
Cable	REBES MICROWAVE	Cable-94	N/A	2018-10-28	2019-10-27
Cable	REBES MICROWAVE	Cable-95	N/A	2018-10-28	2019-10-27
Cable	N/A	Cable-03	N/A	2018-4-24	2019-4-23
Cable	N/A	Cable-04	N/A	2018-4-24	2019-4-23
2.4G Filter	N/A	N/A	N/A	2018-4-24	2019-4-23
Test Software	EZ-EMC ver.3A1				

6 Radio Spectrum Technical Requirement

6.1 Antenna Requirement

6.1.1 Test Requirement:

47 CFR Part 15, Subpart C 15.203 & 15.247(c)

6.1.2 Conclusion

Standard Requirement:

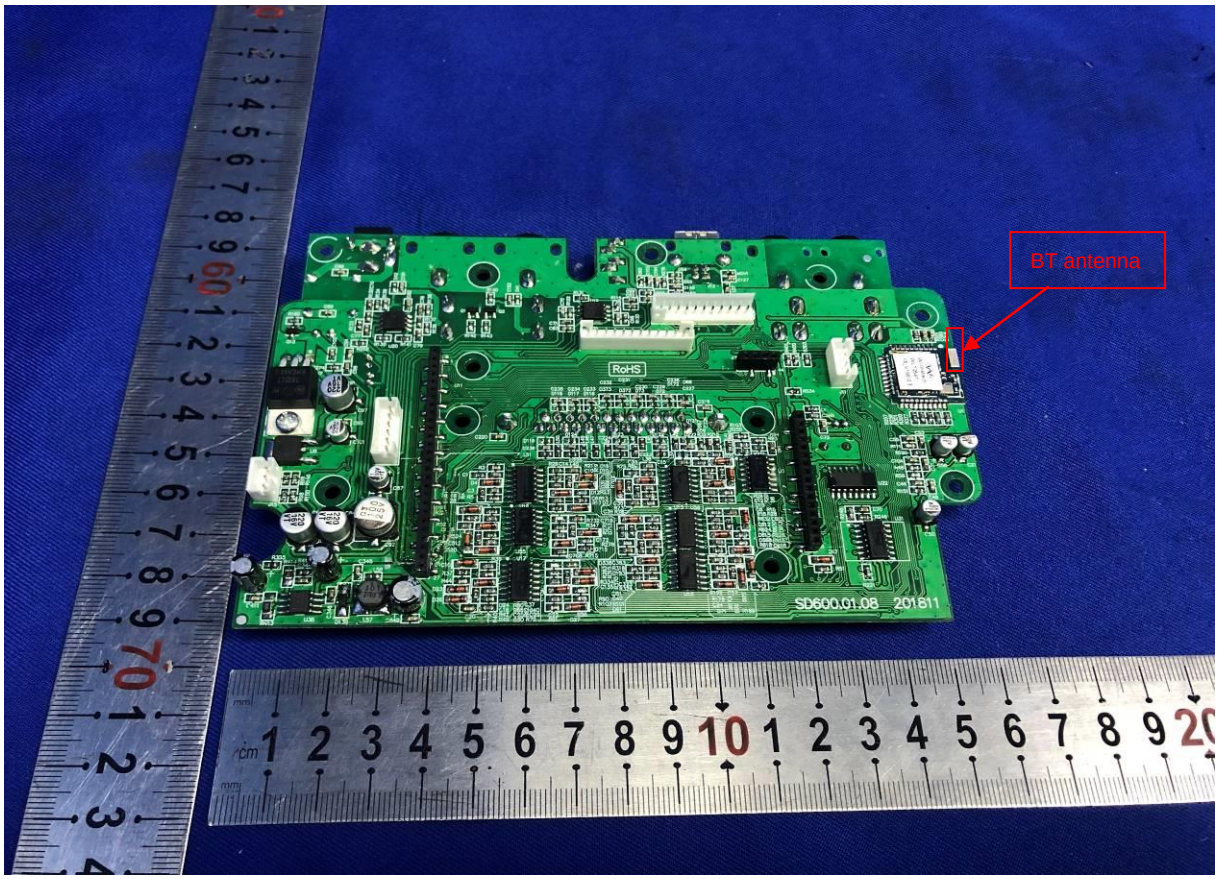
An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

15.247(b) (4) requirement:

The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

EUT Antenna:

The antenna is chip antenna and no consideration of replacement. The best case gain of the antenna is 2.5dBi.


BT antenna
RoHS
SD600.01.08_201811

7 Radio Spectrum Matter Test Results

7.1 Conducted Emissions at AC Power Line (150kHz-30MHz)

Test Requirement 47 CFR Part 15, Subpart C 15.207

Test Method: ANSI C63.10 (2013) Section 6.2

Limit:

Frequency of emission(MHz)	Conducted limit(dBμV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50
*Decreases with the logarithm of the frequency.		

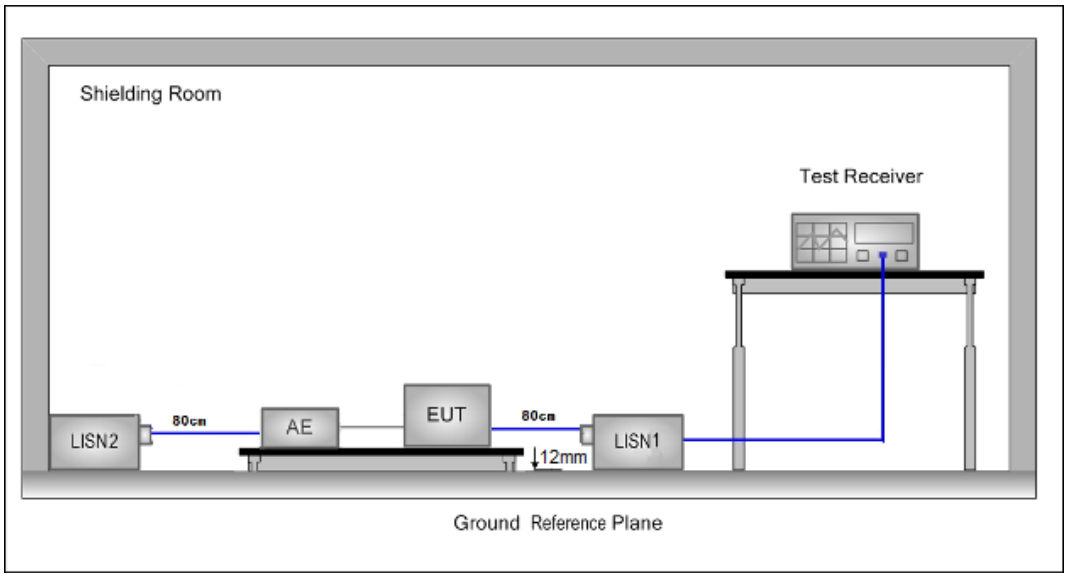
7.1.1 E.U.T. Operation

Operating Environment:

Temperature: 22 °C Humidity: 50 % RH Atmospheric Pressure: 1002 mbar

Test mode a:TX mode_Keep the EUT in continuously transmitting mode. Only the data of worst case is recorded in the report.

7.1.2 Test Setup Diagram



7.1.3 Measurement Procedure and Data

1) The mains terminal disturbance voltage test was conducted in a shielded room.

2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50ohm/50μH + 5ohm linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded.

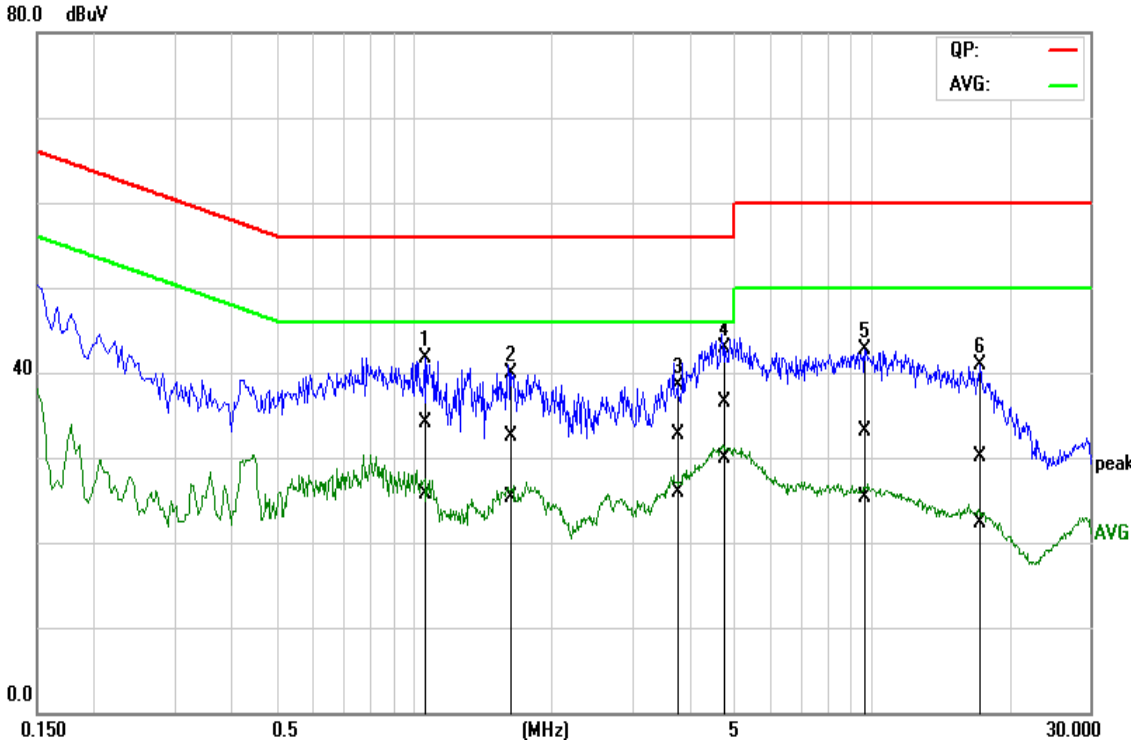
3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the insulating material 12mm above the ground reference plane,

4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2.

5) In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10 on conducted measurement.

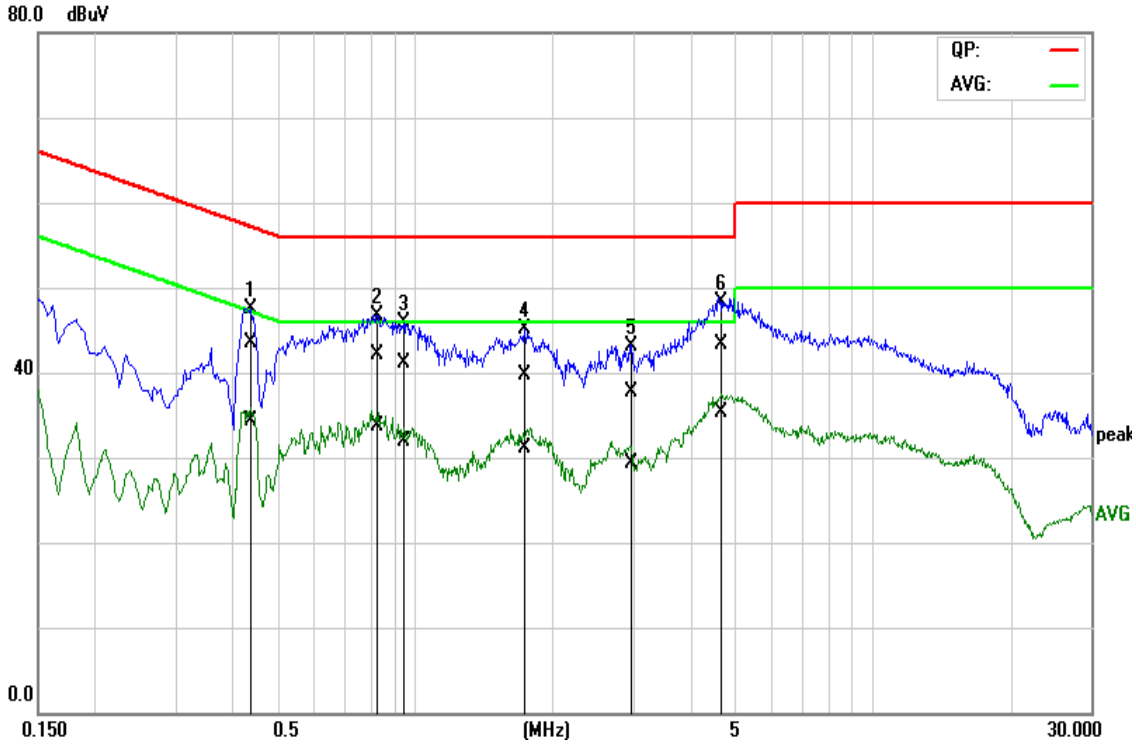
Remark: LISN=Read Level+ Cable Loss+ LISN Factor

Mode a; Line: Live



No.	Frequency	QuasiPeak reading	Average reading	Correction factor	QuasiPeak result	Average result	QuasiPeak limit	Average limit	QuasiPeak margin	Average margin	Remark
	(MHz)	(dBuV)	(dBuV)	(dB)	(dBuV)	(dBuV)	(dBuV)	(dBuV)	(dB)	(dB)	
1	1.0485	14.58	6.18	19.56	34.14	25.74	56.00	46.00	-21.86	-20.26	Pass
2	1.6284	12.95	5.72	19.58	32.53	25.30	56.00	46.00	-23.47	-20.70	Pass
3	3.7447	13.04	6.20	19.65	32.69	25.85	56.00	46.00	-23.31	-20.15	Pass
4*	4.7740	16.85	10.29	19.69	36.54	29.98	56.00	46.00	-19.46	-16.02	Pass
5	9.6647	13.30	5.35	19.87	33.17	25.22	60.00	50.00	-26.83	-24.78	Pass
6	17.1625	10.04	2.24	20.06	30.10	22.30	60.00	50.00	-29.90	-27.70	Pass

Mode a; Line: Neutral



No.	Frequency	QuasiPeak reading	Average reading	Correction factor	QuasiPeak result	Average result	QuasiPeak limit	Average limit	QuasiPeak margin	Average margin	Remark
	(MHz)	(dBuV)	(dBuV)	(dB)	(dBuV)	(dBuV)	(dBuV)	(dBuV)	(dB)	(dB)	
1	0.4351	23.96	14.91	19.48	43.44	34.39	57.15	47.15	-13.71	-12.76	Pass
2	0.8280	22.54	14.16	19.54	42.08	33.70	56.00	46.00	-13.92	-12.30	Pass
3	0.9489	21.56	12.34	19.54	41.10	31.88	56.00	46.00	-14.90	-14.12	Pass
4	1.7175	20.05	11.60	19.57	39.62	31.17	56.00	46.00	-16.38	-14.83	Pass
5	2.9526	18.06	9.64	19.61	37.67	29.25	56.00	46.00	-18.33	-16.75	Pass
6*	4.6563	23.64	15.73	19.67	43.31	35.40	56.00	46.00	-12.69	-10.60	Pass

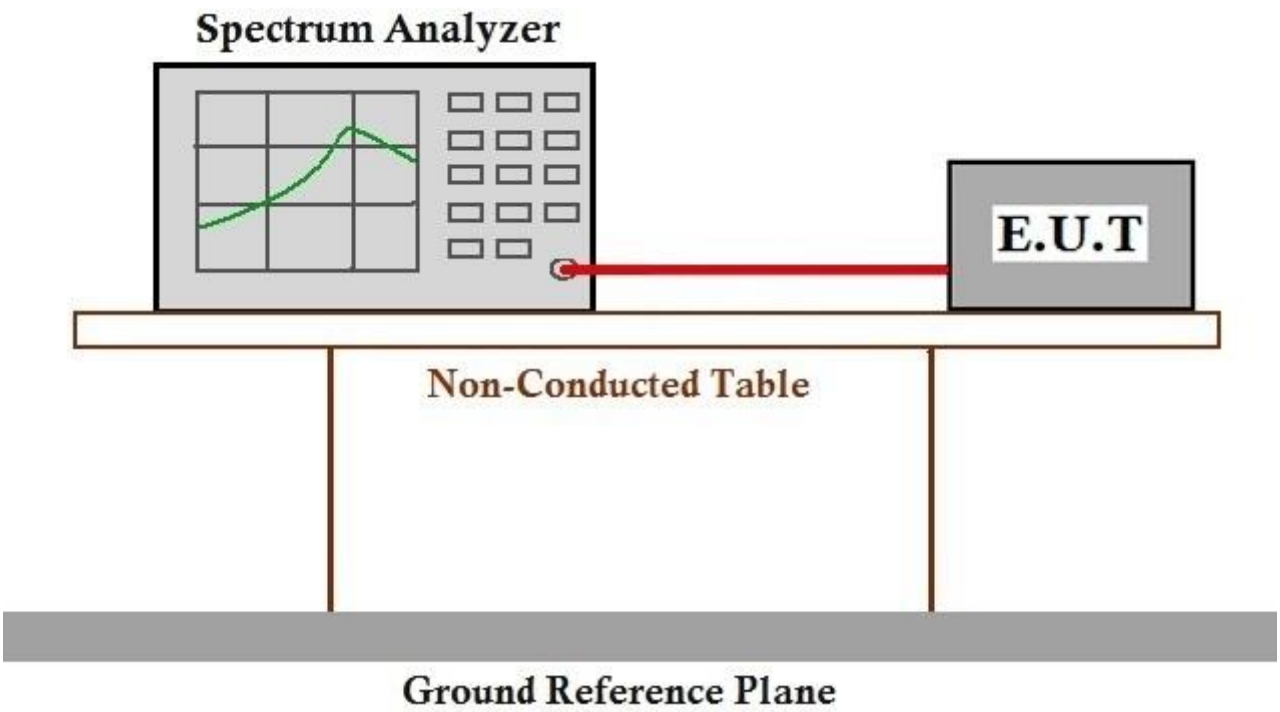
7.2 Minimum 6dB Bandwidth

Test Requirement 47 CFR Part 15, Subpart C 15.247a(2)
Test Method: ANSI C63.10 (2013) Section 11.8.1
Limit: ⩾500 kHz

7.2.1 E.U.T. Operation

Operating Environment:
Temperature: 22 °C Humidity: 50 % RH Atmospheric Pressure: 1002 mbar
Test mode a:TX mode_Keep the EUT in continuously transmitting mode. Only the data of worst case is recorded in the report.

7.2.2 Test Setup Diagram



7.2.3 Measurement Procedure and Data

The detailed test data see: Appendix A for C190123R01

7.3 Conducted Peak Output Power

Test Requirement 47 CFR Part 15, Subpart C 15.247(b)(3)
Test Method: ANSI C63.10 (2013) Section 11.9.1
Limit:

Frequency range(MHz)	Output power of the intentional radiator(watt)
902-928	1 for ≥50 hopping channels
	0.25 for 25≤ hopping channels <50
	1 for digital modulation
2400-2483.5	1 for ≥75 non-overlapping hopping channels
	0.125 for all other frequency hopping systems
	1 for digital modulation
5725-5850	1 for frequency hopping systems and digital modulation

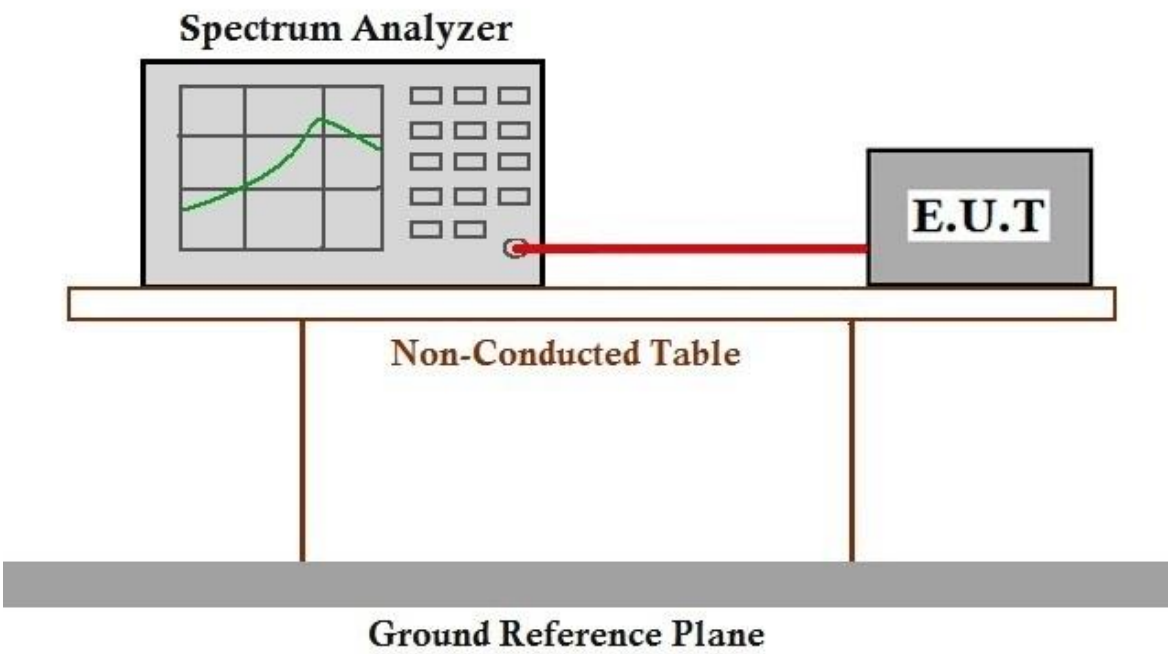
7.3.1 E.U.T. Operation

Operating Environment:

Temperature: 22 °C Humidity: 50 % RH Atmospheric Pressure: 1002 mbar

Test mode a:TX mode_Keep the EUT in continuously transmitting mode. Only the data of worst case is recorded in the report.

7.3.2 Test Setup Diagram



7.3.3 Measurement Procedure and Data

The detailed test data see: Appendix A for C190123R01

7.4 Power Spectrum Density

Test Requirement	47 CFR Part 15, Subpart C 15.247(e)
Test Method:	ANSI C63.10 (2013) Section 11.10.2
Limit:	≤8dBm in any 3 kHz band during any time interval of continuous transmission

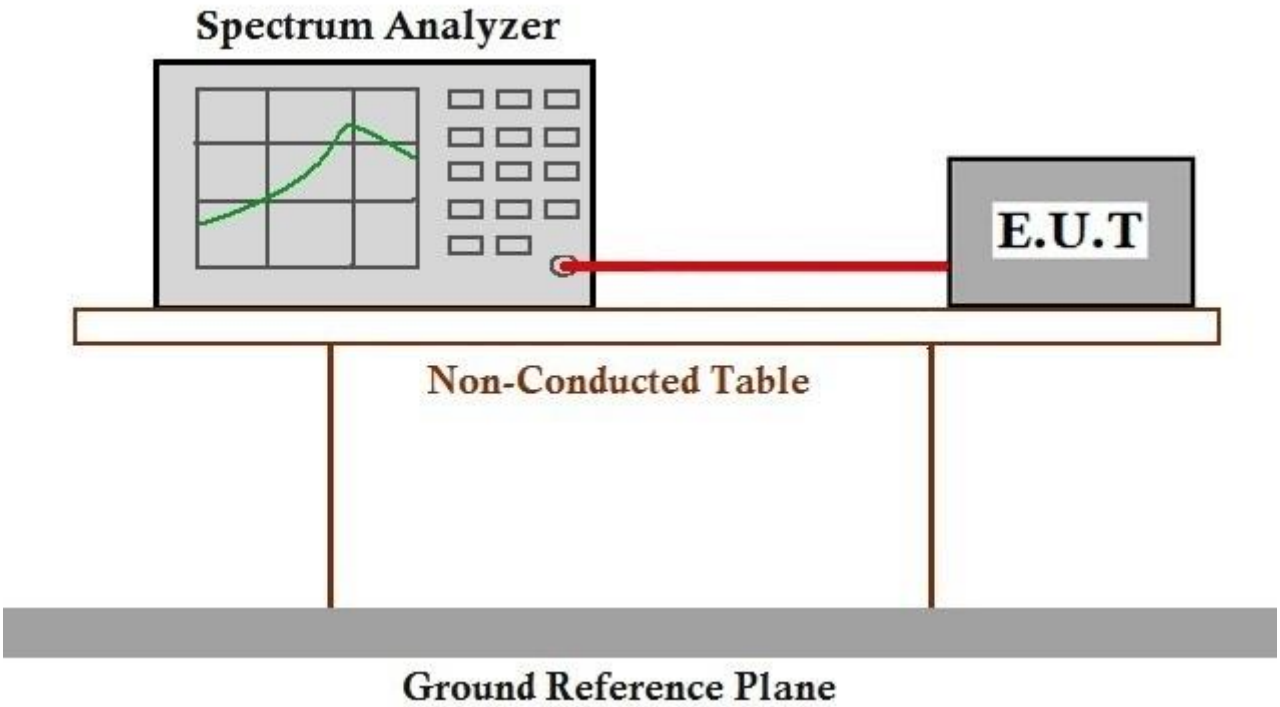
7.4.1 E.U.T. Operation

Operating Environment:

Temperature: 22 °C Humidity: 50 % RH Atmospheric Pressure: 1002 mbar

Test mode a:TX mode_Keep the EUT in continuously transmitting mode. Only the data of worst case is recorded in the report.

7.4.2 Test Setup Diagram



7.4.3 Measurement Procedure and Data

The detailed test data see: Appendix A for C190123R01

7.5 Conducted Band Edges Measurement

Test Requirement: 47 CFR Part 15, Subpart C 15.247(d)

Test Method: ANSI C63.10 (2013) Section 11.13.3.2

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

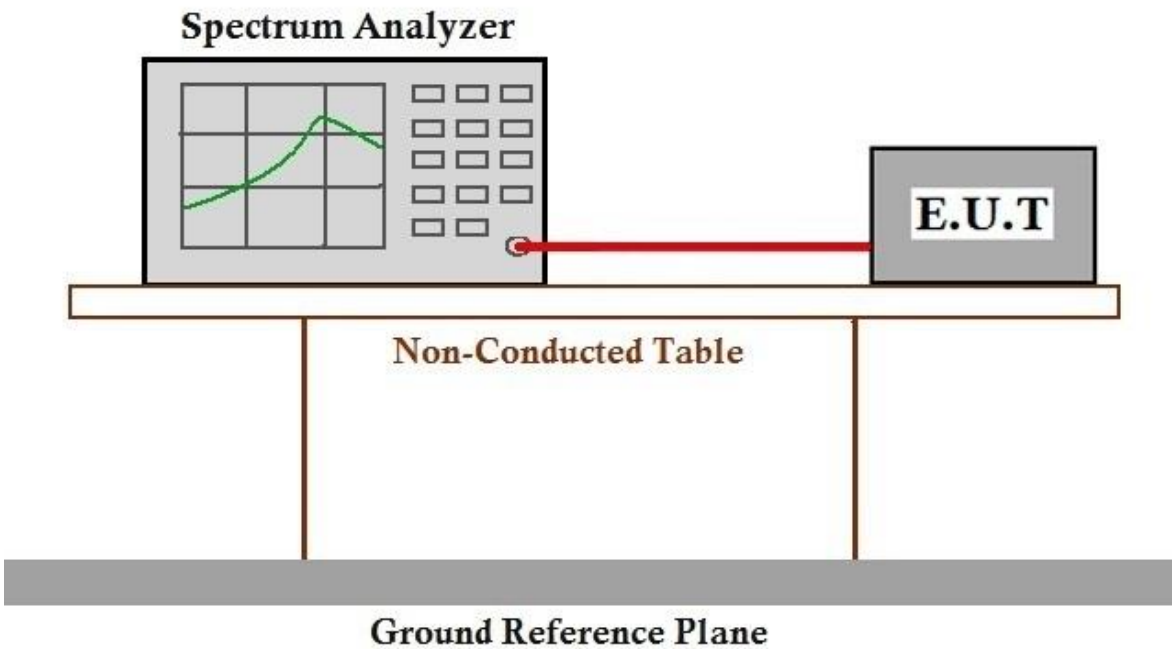
7.5.1 E.U.T. Operation

Operating Environment:

Temperature: 22 °C Humidity: 50 % RH Atmospheric Pressure: 1002 mbar

Test mode: a:TX mode_Keep the EUT in continuously transmitting mode. Only the data of worst case is recorded in the report.

7.5.2 Test Setup Diagram



7.5.3 Measurement Procedure and Data

The detailed test data see: Appendix A for C190123R01

7.6 Conducted Spurious Emissions

Test Requirement: 47 CFR Part 15, Subpart C 15.247(d)

Test Method: ANSI C63.10 (2013) Section 11.11

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

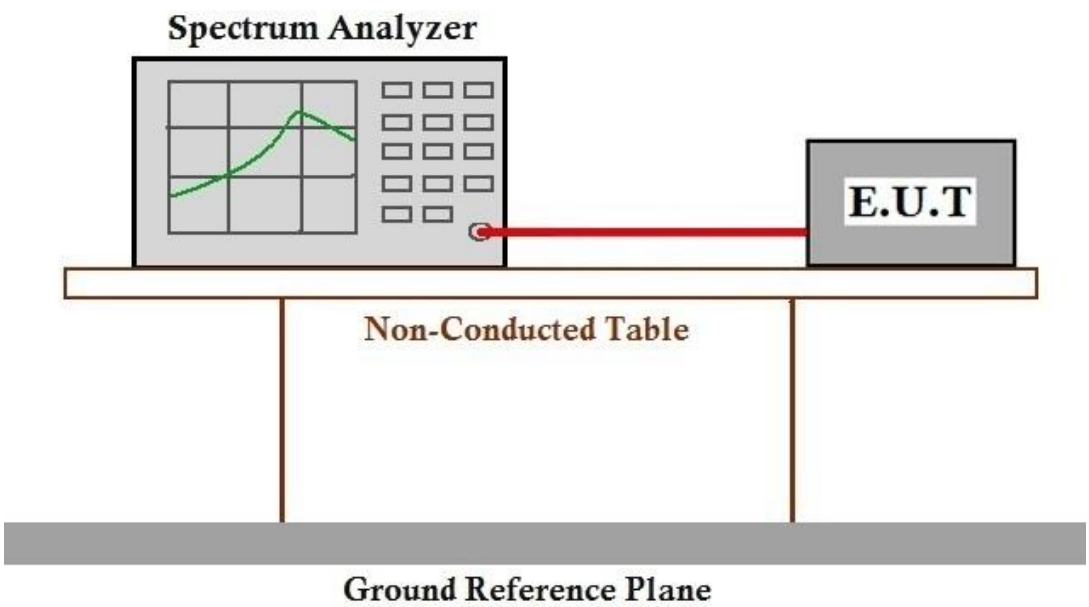
7.6.1 E.U.T. Operation

Operating Environment:

Temperature: 22 °C Humidity: 50 % RH Atmospheric Pressure: 1002 mbar

Test mode: a:TX mode_Keep the EUT in continuously transmitting mode. Only the data of worst case is recorded in the report.

7.6.2 Test Setup Diagram



7.6.3 Measurement Procedure and Data

The detailed test data see: Appendix A for C190123R01

7.7 Radiated Emissions which fall in the restricted bands

Test Requirement 47 CFR Part 15, Subpart C 15.209 & 15.247(d)

Test Method: ANSI C63.10 (2013) Section 6.10.5

Limit:

Frequency(MHz)	Field strength(microvolts/meter)	Measurement distance(meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3
Remark: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90kHz, 110-490kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.		

7.7.1 E.U.T. Operation

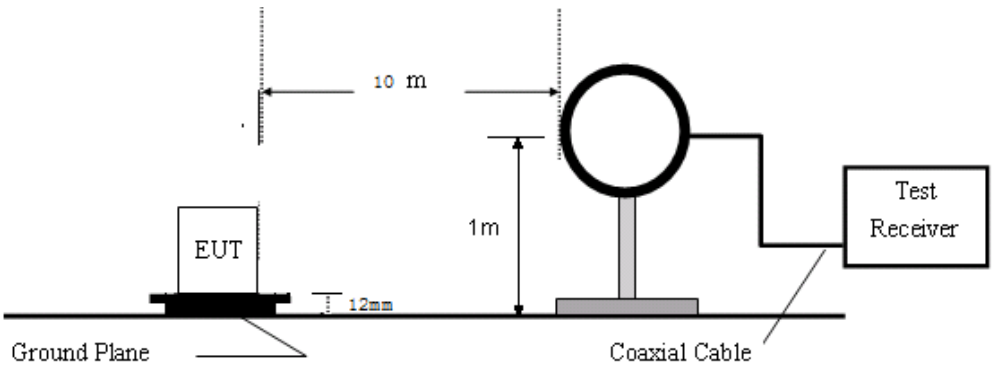
Operating Environment:

Temperature: 25 °C Humidity: 51 % RH Atmospheric Pressure: 1010 mbar

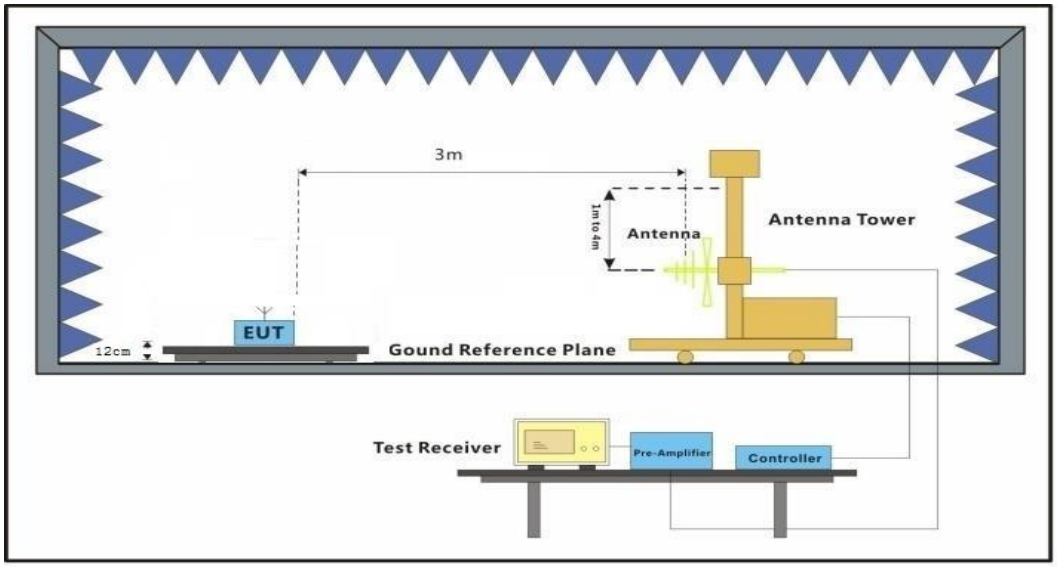
Test mode a: TX mode: Keep the EUT in continuously transmitting mode. Only the data of worst case is recorded in the report.

7.7.2 Test Setup Diagram

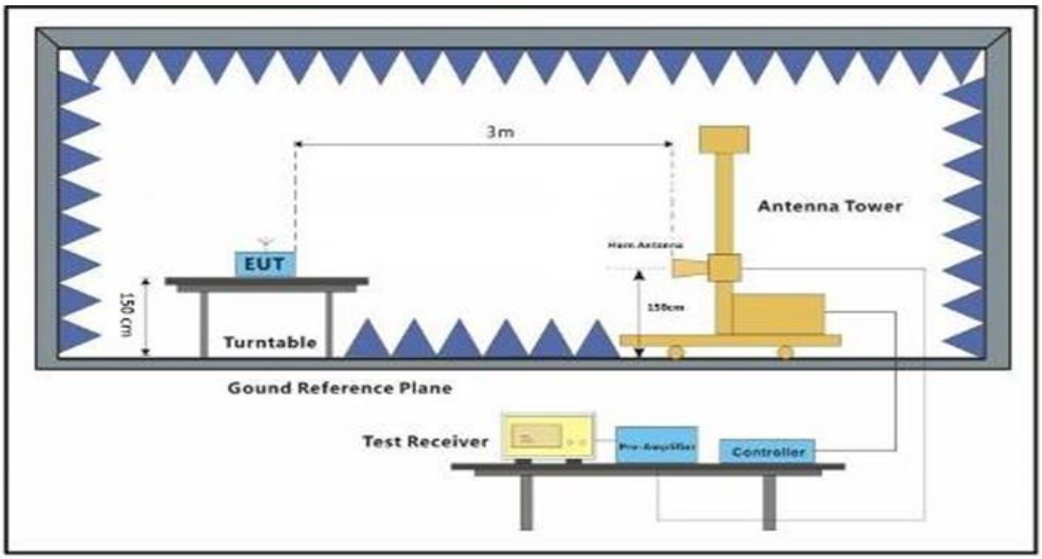
Below 30MHz



Below 1 GHz



Above 1 GHz



7.7.3 Measurement Procedure and Data

a. For below 1GHz, the EUT was placed on the top of insulating material 12mm above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

b. For above 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

c. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

d. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

e. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

g. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

h. Test the EUT in the lowest channel, the middle channel, the Highest channel.

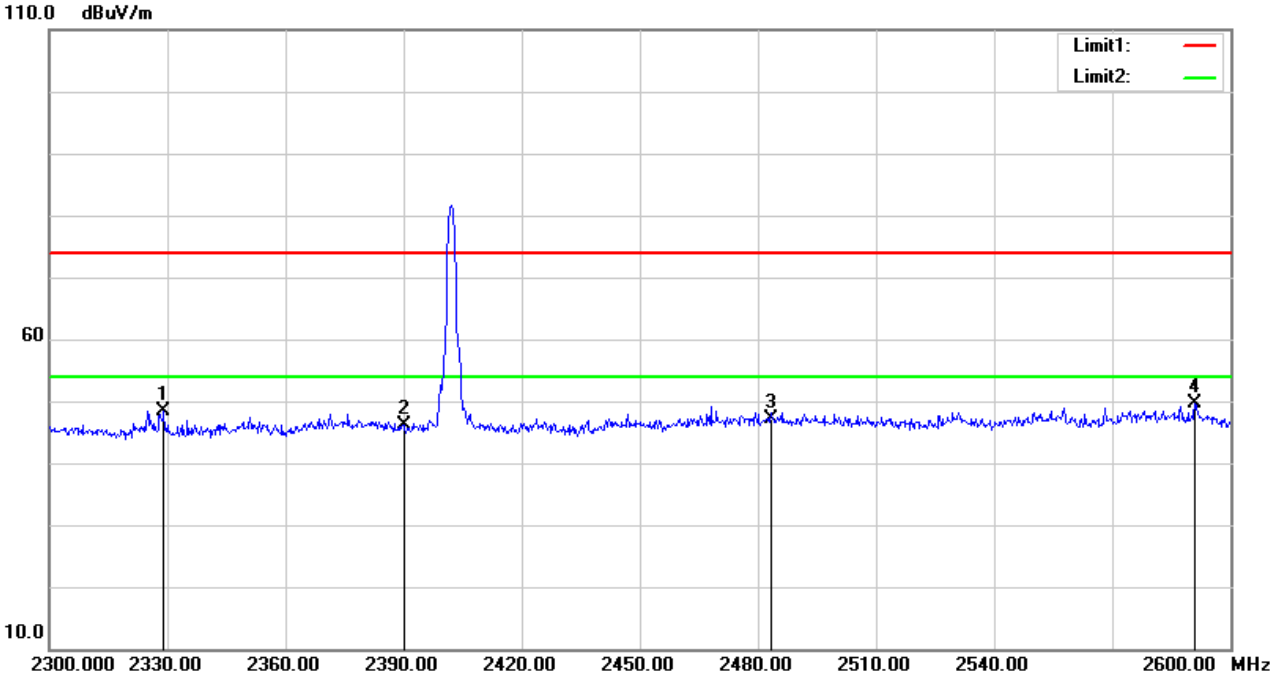
i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.

j. Repeat above procedures until all frequencies measured was complete.

Remark 1: Level= Read Level+ Cable Loss+ Antenna Factor- Preamp Factor

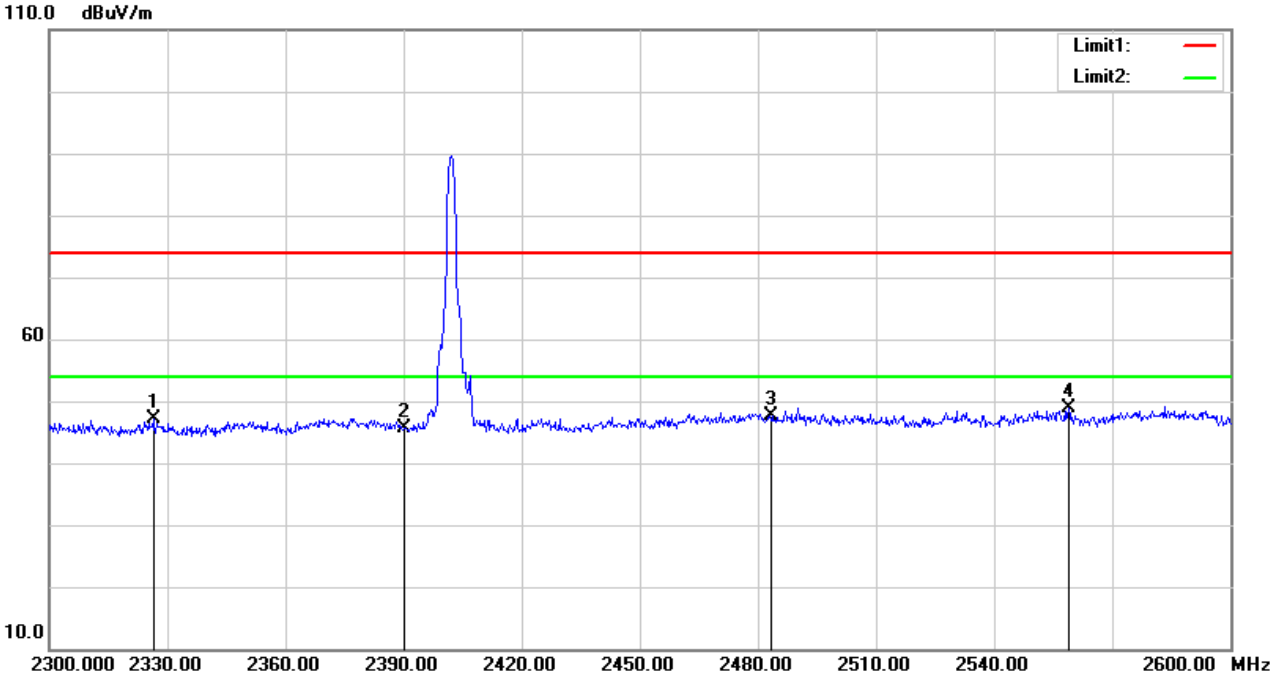
Remark 2: For frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For the emissions whose peak level is lower than the average limit, only the peak measurement is shown in the report.

Mode a; Polarization: Horizontal; Modulation: GFSK; Channel: Low



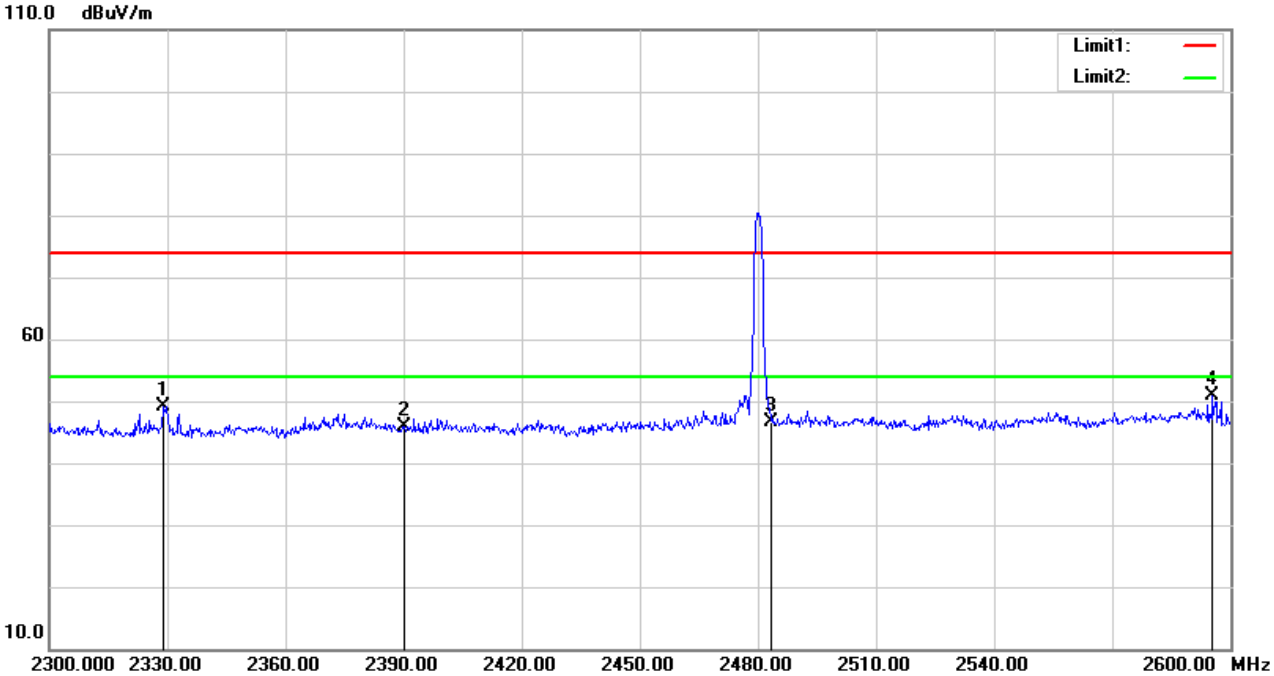
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	2329.100	57.82	-9.34	48.48	74.00	-25.52	100	243	peak
2	2390.000	55.12	-8.95	46.17	74.00	-27.83	100	360	peak
3	2483.500	55.45	-8.35	47.10	74.00	-26.90	100	243	peak
4	2591.000	57.31	-7.79	49.52	74.00	-24.48	100	0	peak

Mode a; Polarization: Vertical; Modulation: GFSK; Channel: Low



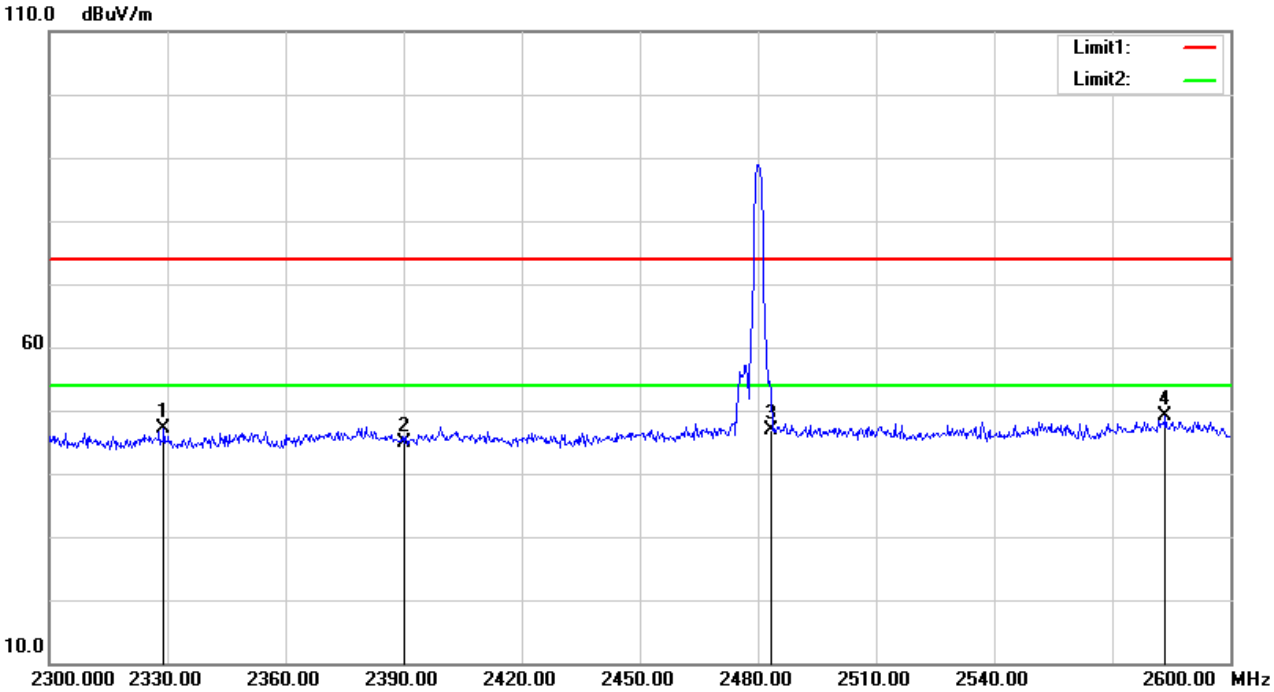
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	2326.400	56.50	-9.35	47.15	74.00	-26.85	100	360	peak
2	2390.000	54.47	-8.95	45.52	74.00	-28.48	200	0	peak
3	2483.500	55.98	-8.35	47.63	74.00	-26.37	200	238	peak
4	2558.900	56.81	-7.95	48.86	74.00	-25.14	100	360	peak

Mode a; Polarization: Horizontal; Modulation: GFSK; Channel: High



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	2328.800	58.54	-9.34	49.20	74.00	-24.80	100	360	peak
2	2390.000	54.81	-8.95	45.86	74.00	-28.14	100	117	peak
3	2483.500	55.07	-8.35	46.72	74.00	-27.28	222	360	peak
4	2595.500	58.72	-7.77	50.95	74.00	-23.05	100	360	peak

Mode a; Polarization: Vertical; Modulation: GFSK; Channel: High



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	2329.100	56.42	-9.34	47.08	74.00	-26.92	100	0	peak
2	2390.000	53.73	-8.95	44.78	74.00	-29.22	200	207	peak
3	2483.500	55.25	-8.35	46.90	74.00	-27.10	200	207	peak
4	2583.500	56.87	-7.83	49.04	74.00	-24.96	200	79	peak

7.8 Radiated Spurious Emissions

Test Requirement 47 CFR Part 15, Subpart C 15.209 & 15.247(d)

Test Method: ANSI C63.10 (2013) Section 6.4,6.5,6.6

Limit:

Frequency(MHz)	Field strength(microvolts/meter)	Measurement distance(meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3
Remark: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90kHz, 110-490kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.		

7.8.1 E.U.T. Operation

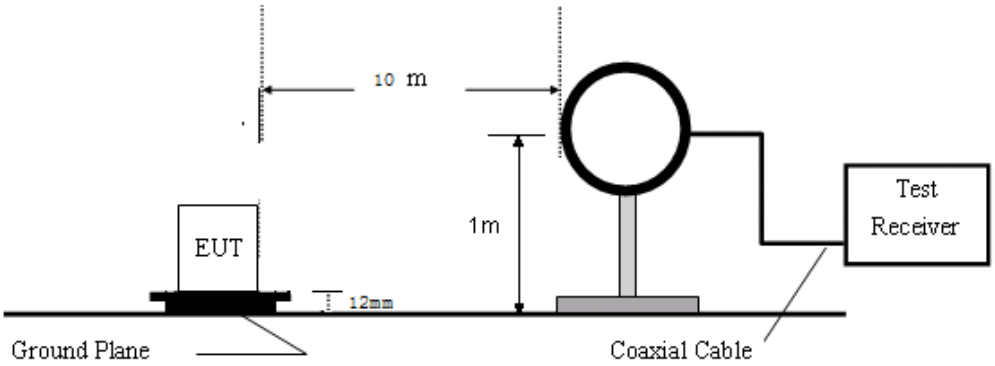
Operating Environment:

Temperature: 25 °C Humidity: 51 % RH Atmospheric Pressure: 1010 mbar

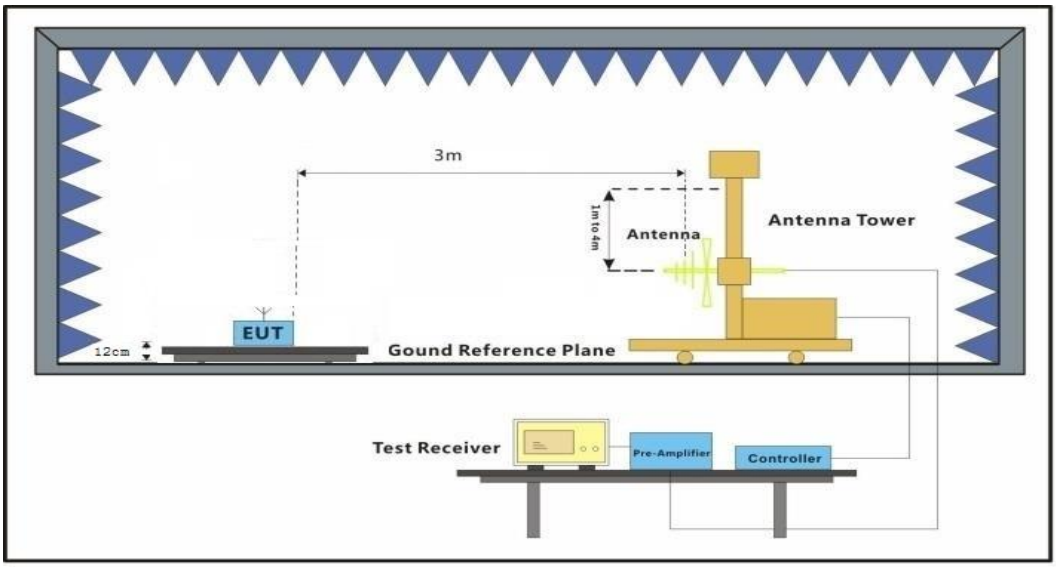
Test mode a:TX mode_Keep the EUT in continuously transmitting mode with all modulation types. All data rates for each modulation type have been tested and found the data rate @ 1Mbps is the worst case of IEEE 802.11b; data rate @ 6Mbps is the worst case of IEEE 802.11g; data rate @ 6.5Mbps is the worst case of IEEE 802.11n(HT20); data rate @ 13.5Mbps is the worst case of IEEE 802.11n(HT40). Only the data of worst case is recorded in the report.

7.8.2 Test Setup Diagram

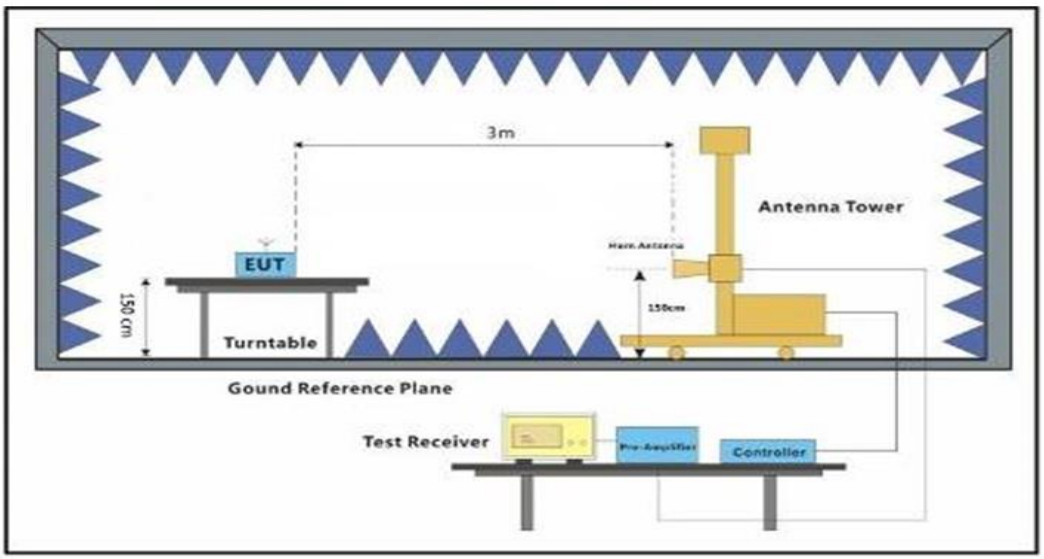
Below 30MHz



Below 1 GHz



Above 1 GHz



7.8.3 Measurement Procedure and Data

a. For below 1GHz, the EUT was placed on the top of insulating material 12mm above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

b. For above 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

c. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

d. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

e. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

g. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

h. Test the EUT in the lowest channel, the middle channel, the Highest channel.

i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.

j. Repeat above procedures until all frequencies measured was complete.

Remark:

1) For emission below 1GHz, through pre-scan found the worst case is the lowest channel. Only the worst case is recorded in the report.

2) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

Final Test Level =Receiver Reading + Antenna Factor + Cable Factor – Preamplifier Factor

3) Scan from 9kHz to 25GHz, the disturbance above 18GHz and below 30MHz was very low. The points marked on above plots are the highest emissions could be found when testing, so only above points had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.

4) For frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For the emissions whose peak level is lower than the average limit, only the peak measurement is shown

BELOW 1G

Mode a; Polarization: Horizontal; Modulation: GFSK; Channel: Low

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	143.4900	20.13	17.33	37.46	43.50	-6.04	200	0	QP
2	191.9900	19.45	16.39	35.84	43.50	-7.66	100	0	QP
3	213.3300	19.87	16.70	36.57	43.50	-6.93	100	0	QP
4	222.0600	21.48	17.01	38.49	46.00	-7.51	100	0	QP
5	239.5200	21.06	17.63	38.69	46.00	-7.31	100	101	QP
6	515.9700	14.85	23.57	38.42	46.00	-7.58	200	47	peak

Mode a; Polarization: Vertical; Modulation: GFSK; Channel: Low

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	143.4900	19.92	17.33	37.25	43.50	-6.25	100	252	QP
2	173.5600	21.85	16.79	38.64	43.50	-4.86	100	32	QP
3	220.2990	25.60	16.95	42.55	46.00	-3.45	100	77	QP
4	229.0770	25.00	17.26	42.26	46.00	-3.74	100	325	QP
5	239.5200	23.60	17.63	41.23	46.00	-4.77	100	56	QP
6	249.2200	22.65	17.98	40.63	46.00	-5.37	100	72	QP

ABOVE 1G

Mode a; Polarization: Horizontal; Modulation: GFSK; Channel: Low

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	1918.000	62.60	-11.46	51.14	74.00	-22.86	100	159	peak
2	12934.000	40.40	12.44	52.84	74.00	-21.16	100	312	peak

Mode a; Polarization: Vertical; Modulation: GFSK; Channel: Low

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	1612.000	53.02	-11.52	41.50	74.00	-32.50	100	123	peak
2	12900.000	40.85	12.39	53.24	74.00	-20.76	100	56	peak

Mode a; Polarization: Horizontal; Modulation: GFSK; Channel: Middle

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	1918.000	63.89	-11.46	52.43	74.00	-21.57	200	31	peak
2	14498.000	40.03	13.02	53.05	74.00	-20.95	200	256	peak

Mode a; Polarization: Vertical; Modulation: GFSK; Channel: Middle

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	9517.000	42.49	8.96	51.45	74.00	-22.55	100	276	peak
2	13886.000	40.62	12.49	53.11	74.00	-20.89	200	133	peak

Mode a; Polarization: Horizontal; Modulation: GFSK; Channel: High

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	1986.000	62.23	-11.45	50.78	74.00	-23.22	100	178	peak
2	12900.000	40.46	12.39	52.85	74.00	-21.15	100	162	peak

Mode a; Polarization: Vertical; Modulation: GFSK; Channel: High

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	9500.000	42.58	9.06	51.64	74.00	-22.36	200	281	peak
2	15229.000	38.86	13.65	52.51	74.00	-21.49	200	0	peak

8 Test Setup Photographs

Refer to the <Test Setup Photos>

9 EUT Constructional Details

Refer to the <External Photos>& <Internal Photos>

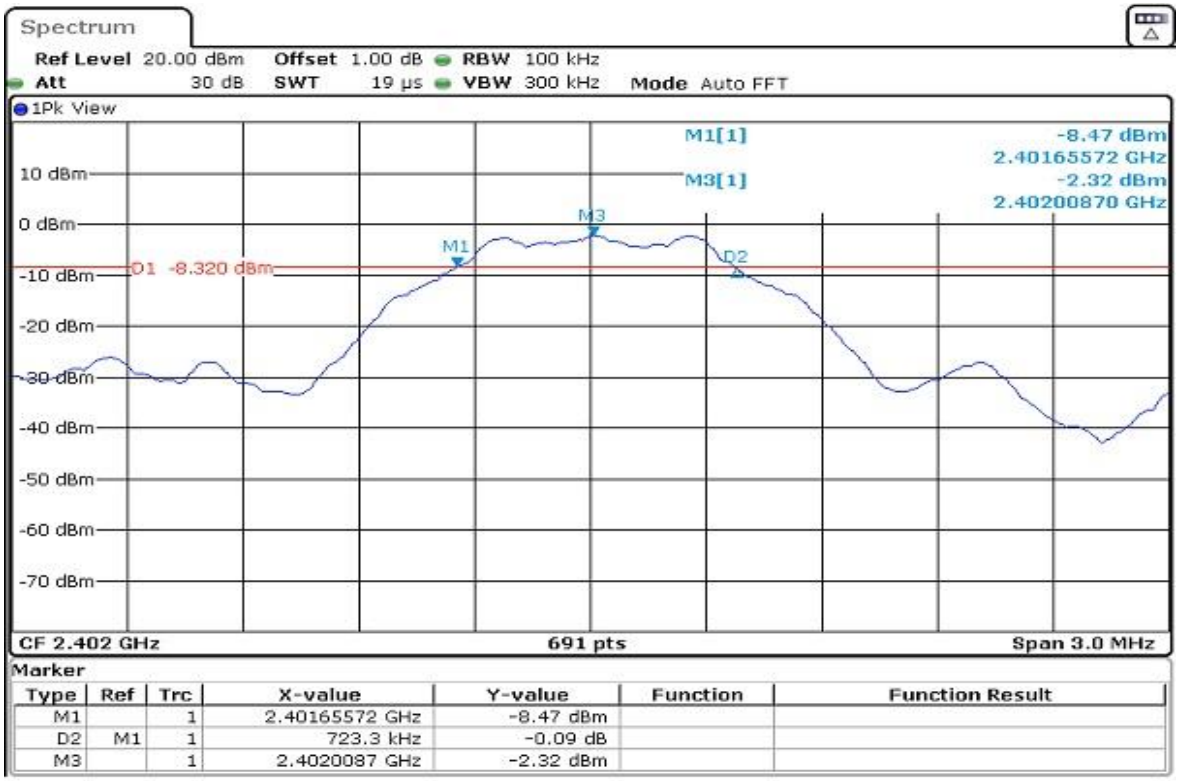
Appendix A for C190123R01

1. 6dB Bandwidth

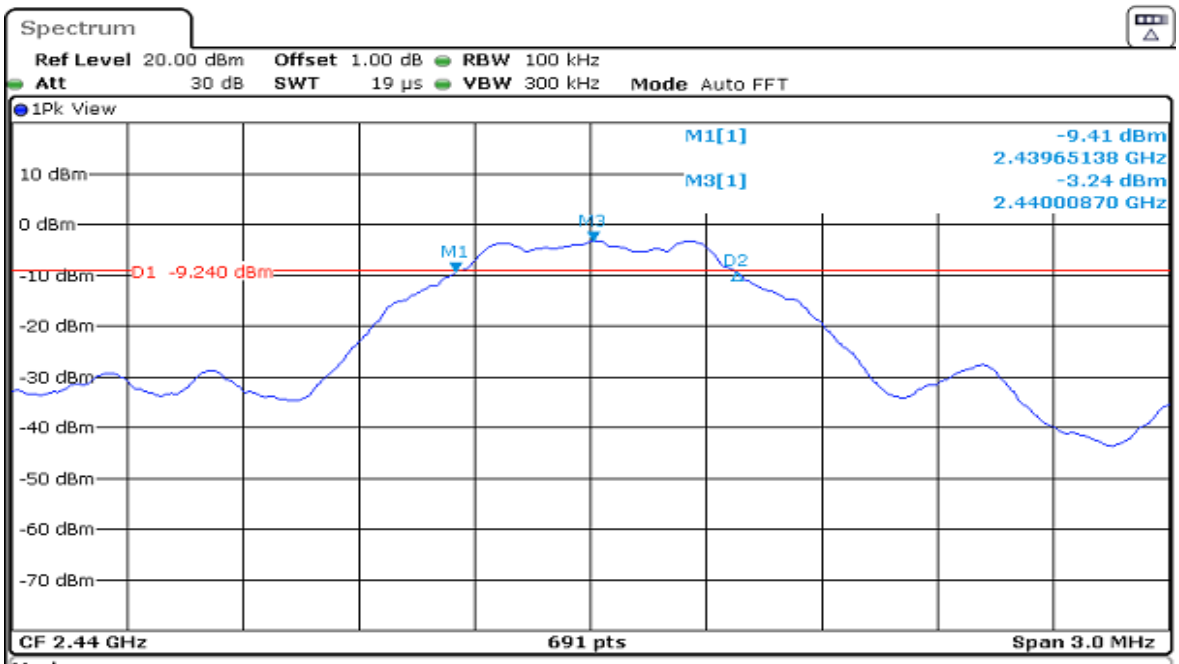
Test mode	Test channel	Freq. [MHz]	EBW[MHz]	Limit[MHz]	Result
BLE	00	2402	0.723	0.5	Pass
BLE	19	2440	0.728	0.5	Pass
BLE	39	2480	0.728	0.5	Pass

Test Plot

Channel 00



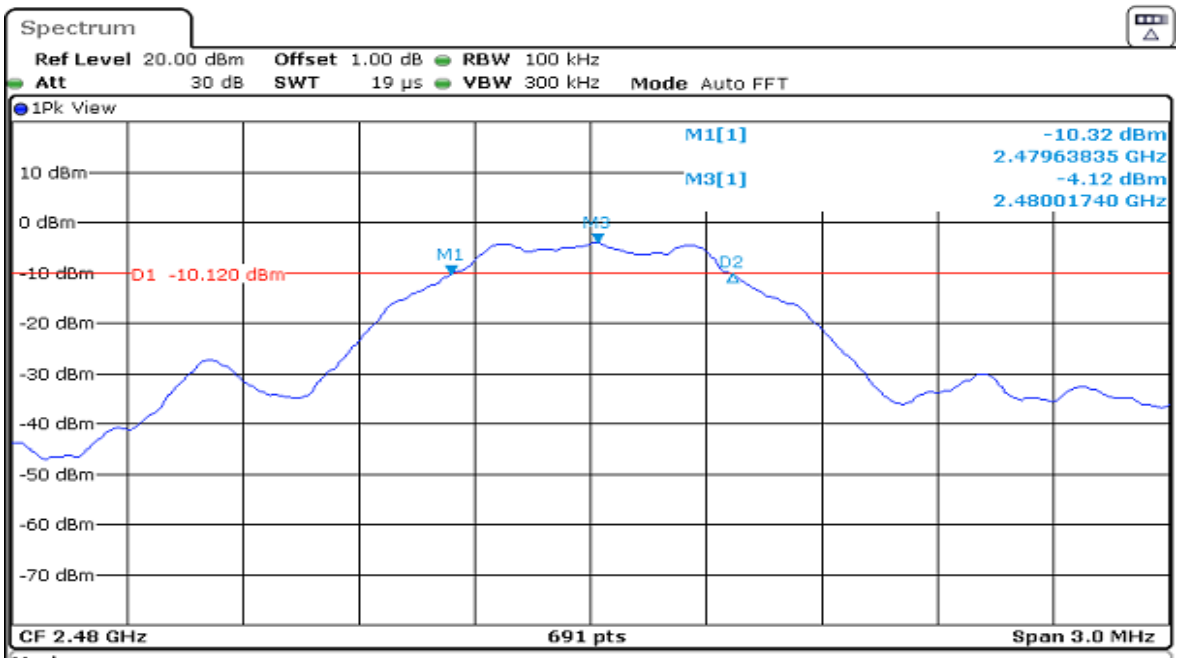
Channel 19



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.43965137 GHz	-9.41 dBm		
D2	M1	1	727.64 kHz	0.12 dB		
M3		1	2.4400087 GHz	-3.24 dBm		

Channel 39



Marker

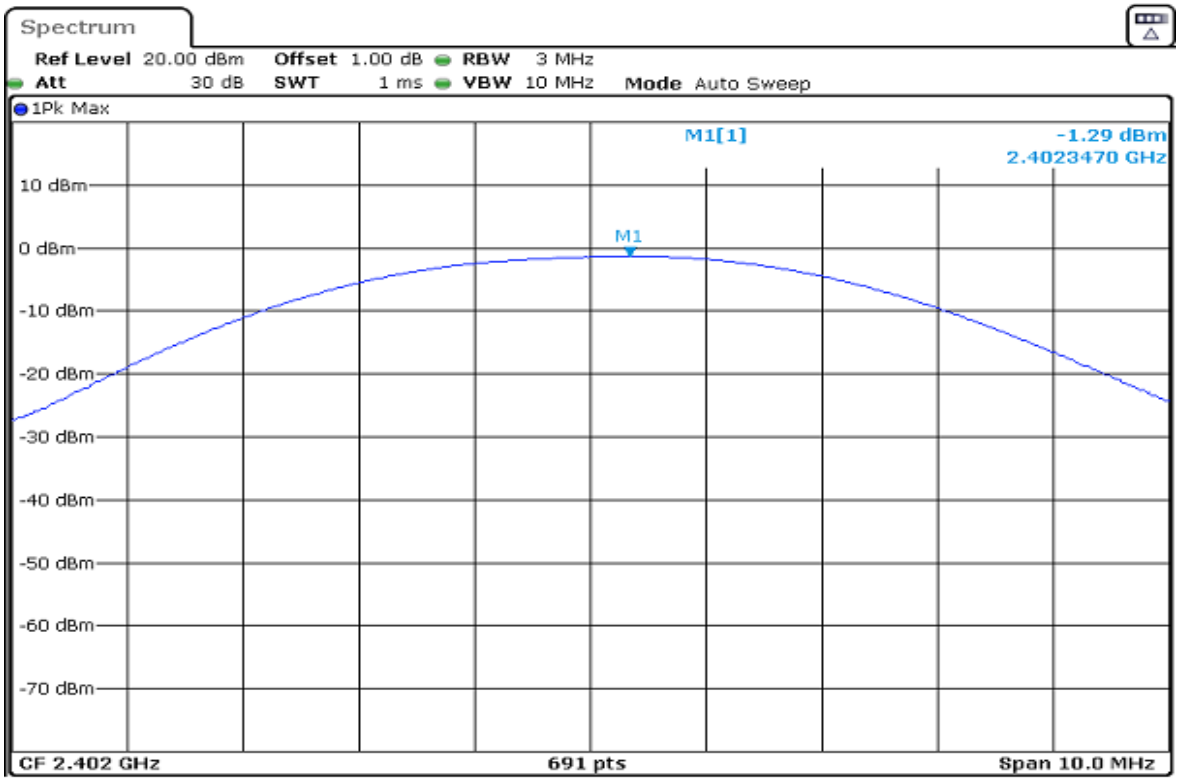
Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.47963835 GHz	-10.32 dBm		
D2	M1	1	727.64 kHz	0.11 dB		
M3		1	2.4800174 GHz	-4.12 dBm		

2.Conducted Peak Output Power

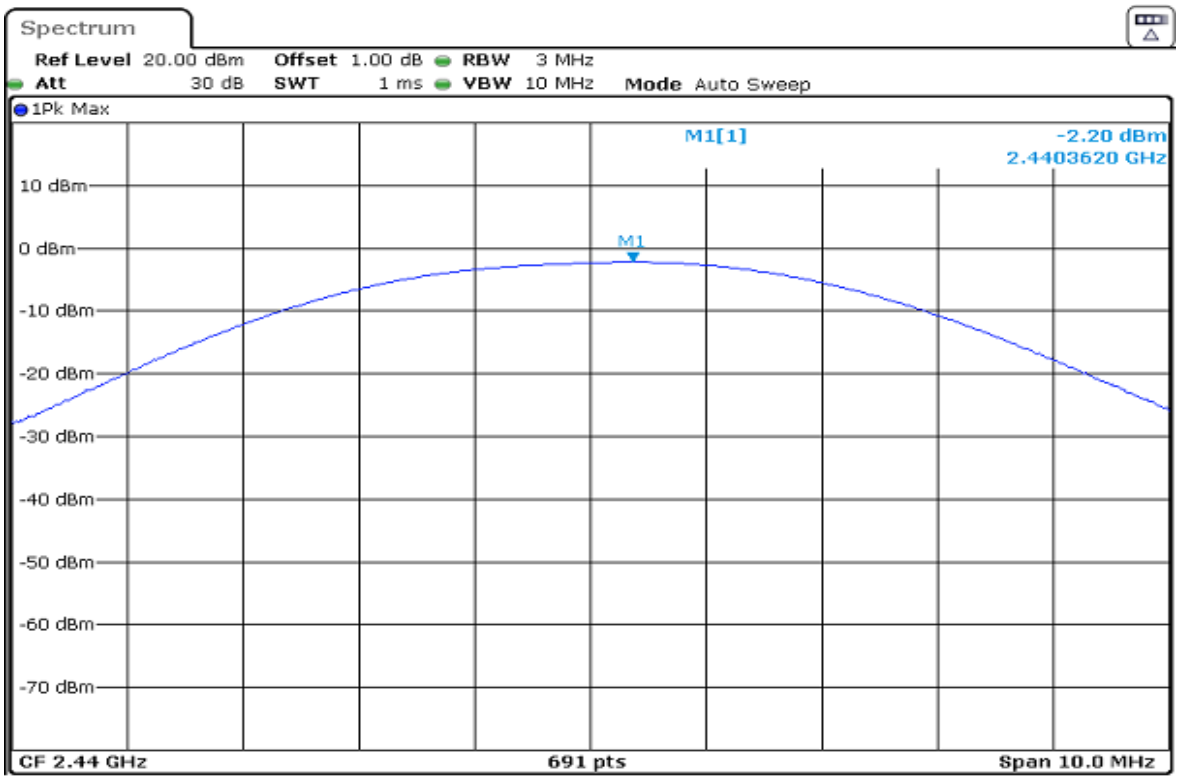
Test mode	Test channel	Freq. [MHz]	Power[dBm]	Limit[dBm]	Result
BLE	00	2402	-1.29	30	Pass
BLE	19	2440	-2.20	30	Pass
BLE	39	2480	-3.01	30	Pass

Test Plot

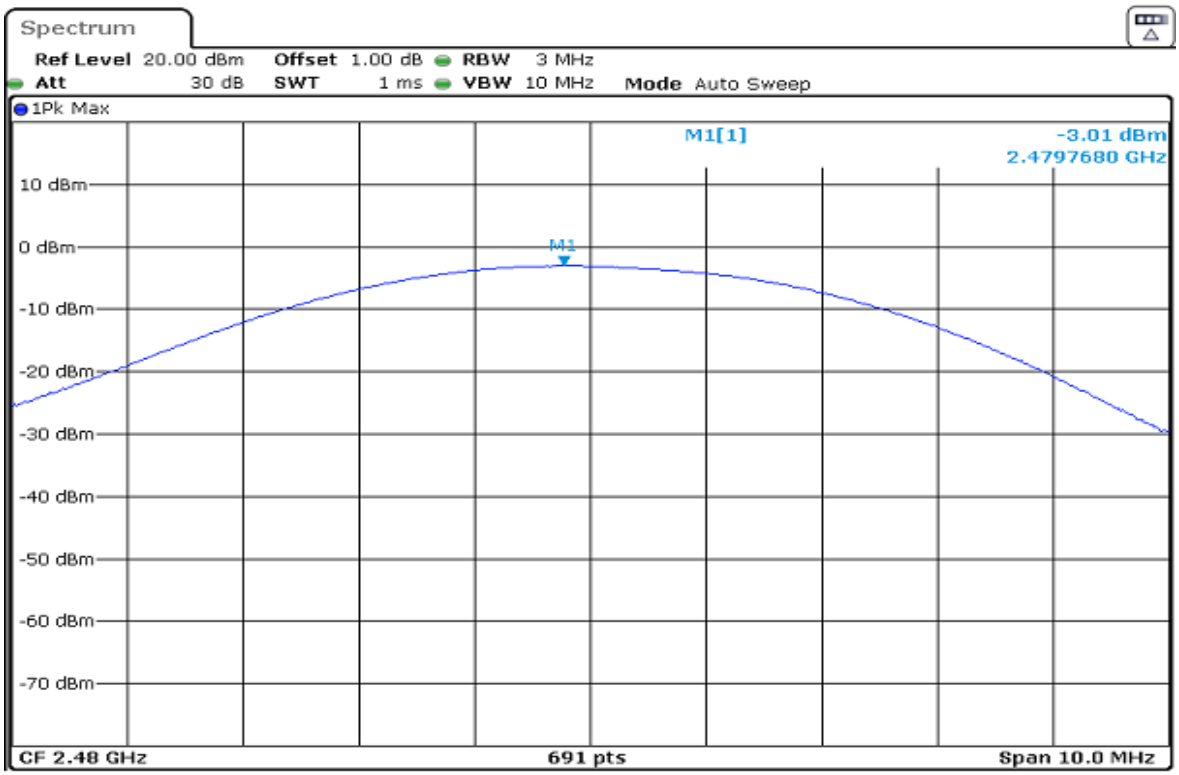
Channel 00



Channel 19



Channel 39

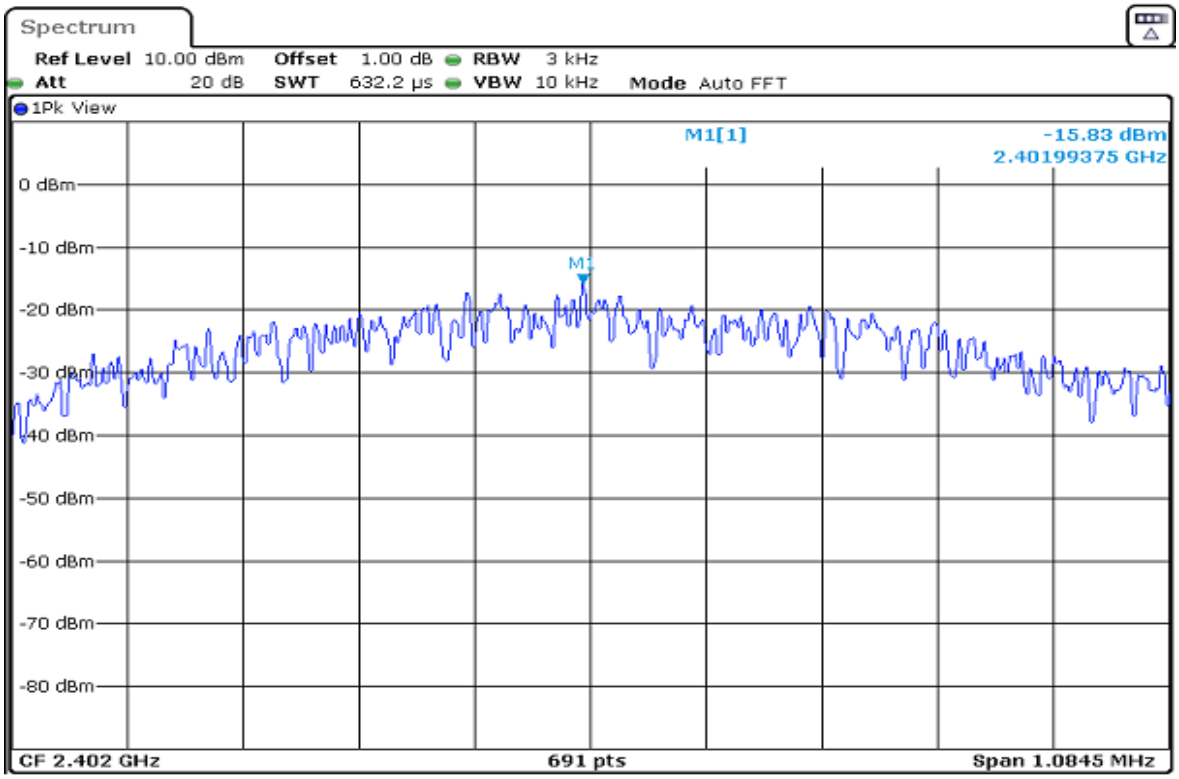


3.Peak Power Spectral Density

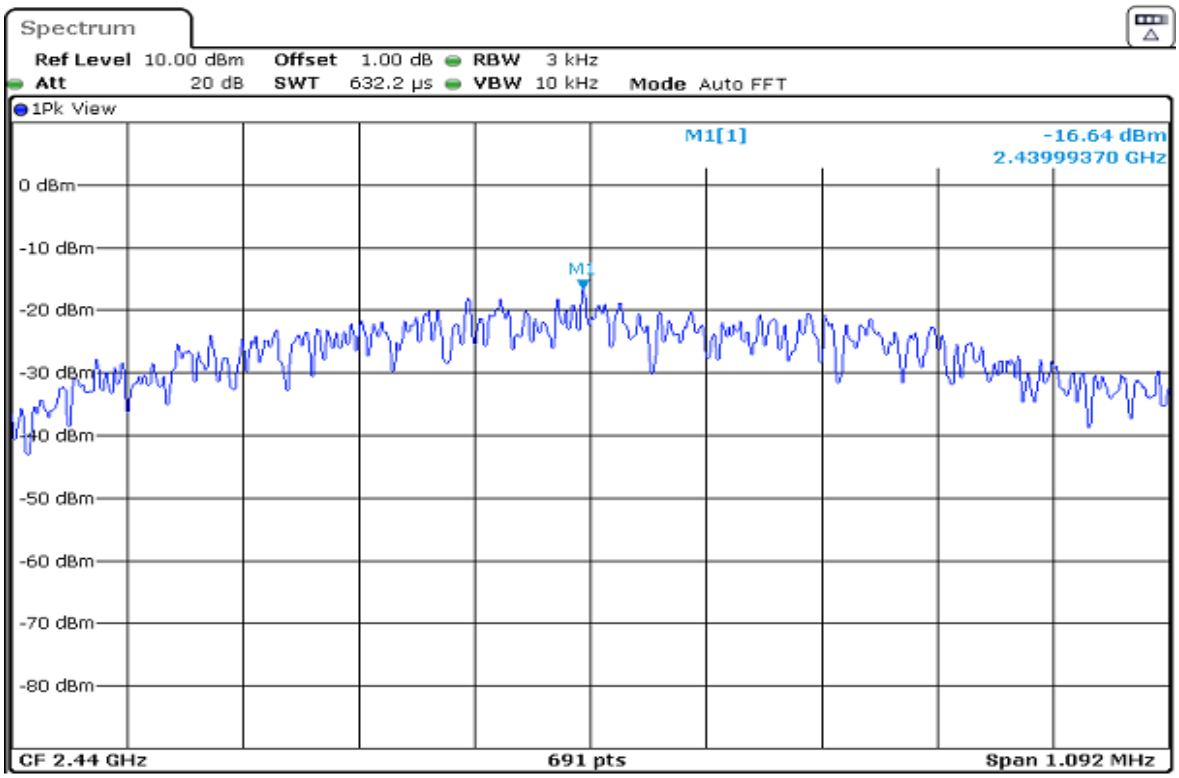
Test mode	Test channel	Freq. [MHz]	PSD[dBm/3KHz]	Limit[dBm/3KHz]	Result
BLE	00	2402	-15.83	8	Pass
BLE	19	2440	-16.64	8	Pass
BLE	39	2480	-17.58	8	Pass

Test Plot

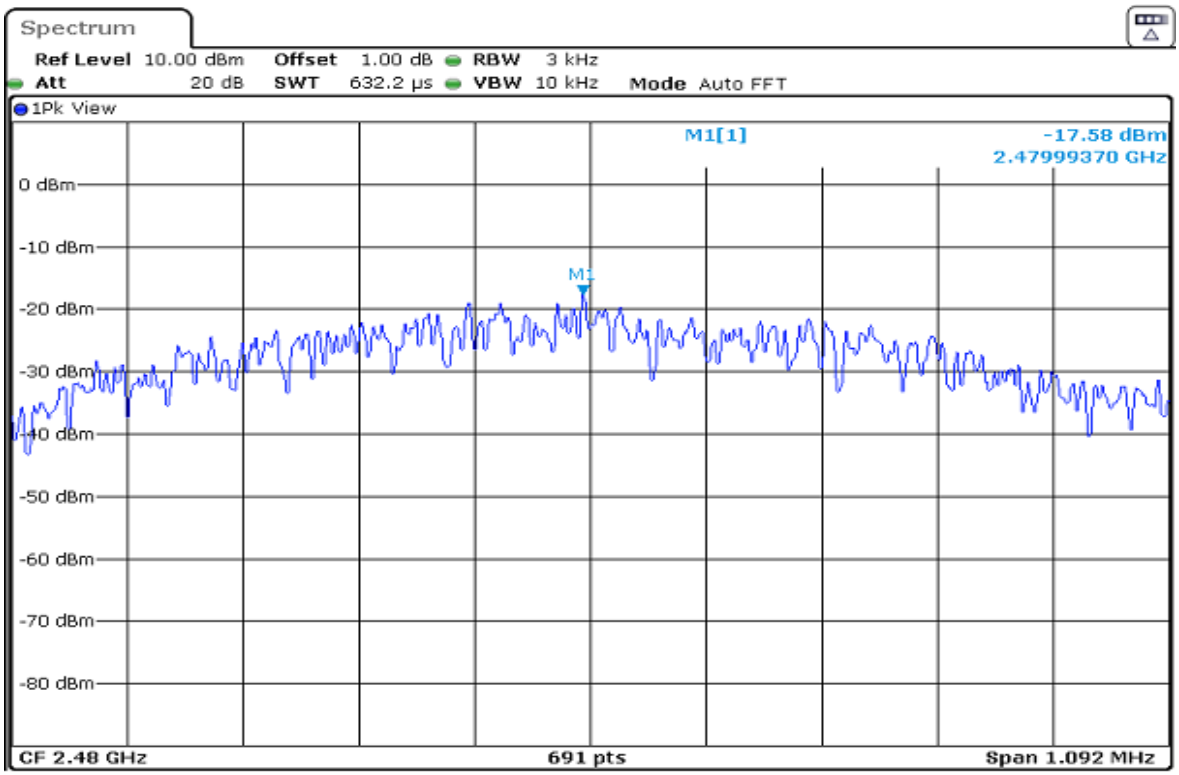
Channel 00



Channel 19

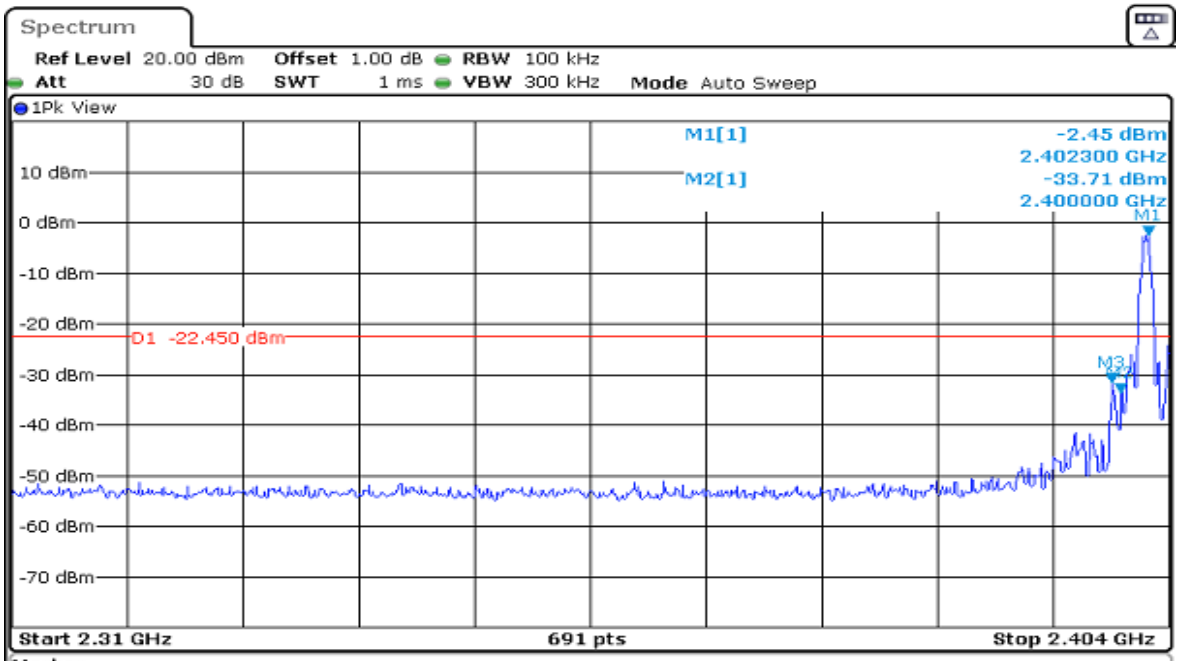


Channel 39



4. Conducted Band Edges

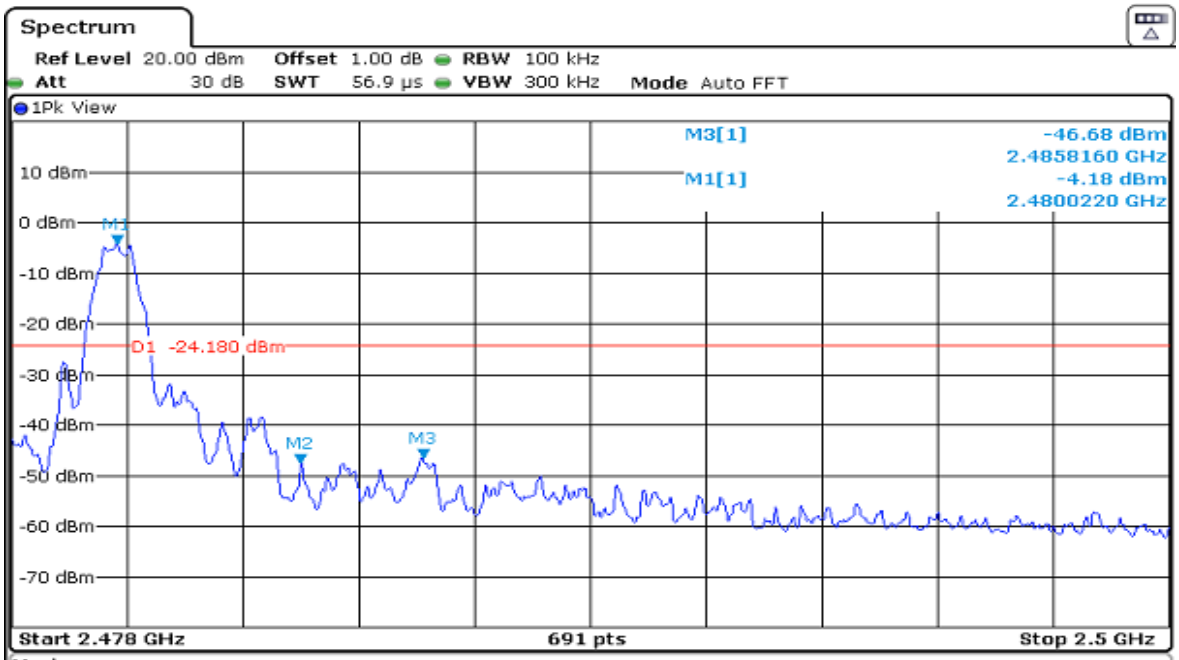
Channel 00



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4023 GHz	-2.45 dBm		
M2		1	2.4 GHz	-33.71 dBm		
M3		1	2.39931 GHz	-31.68 dBm		

Channel 39

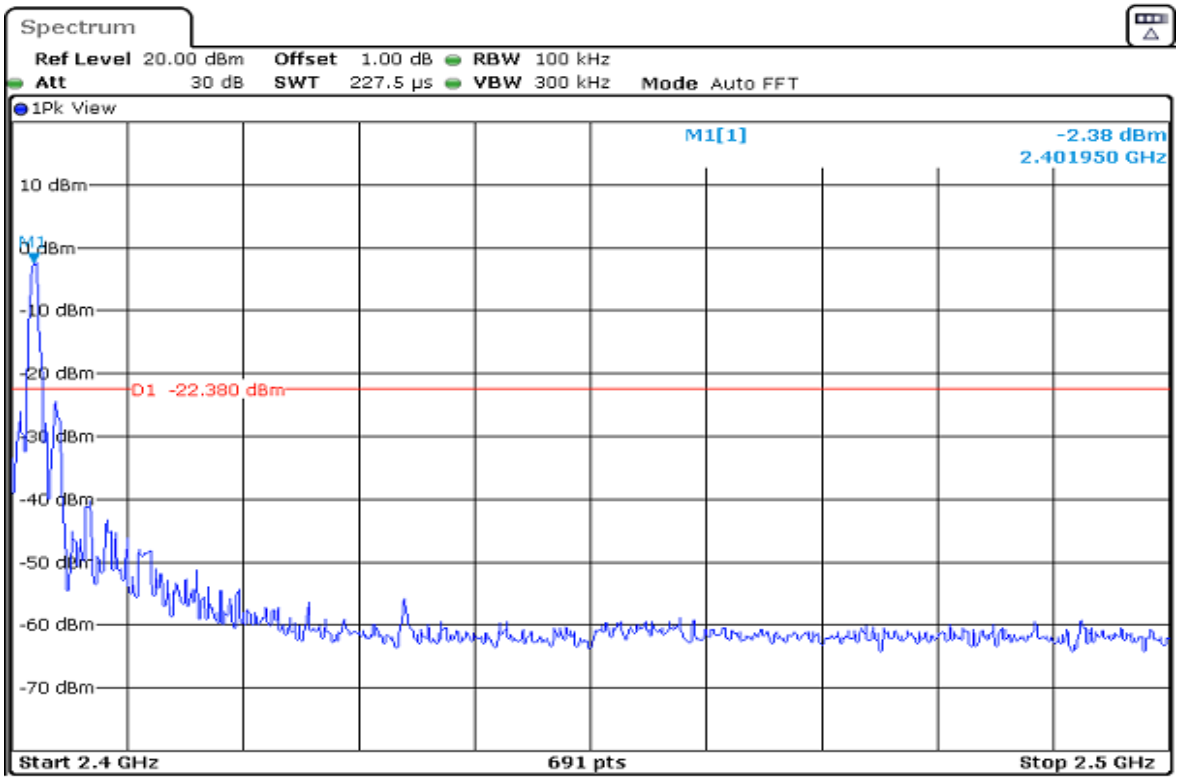


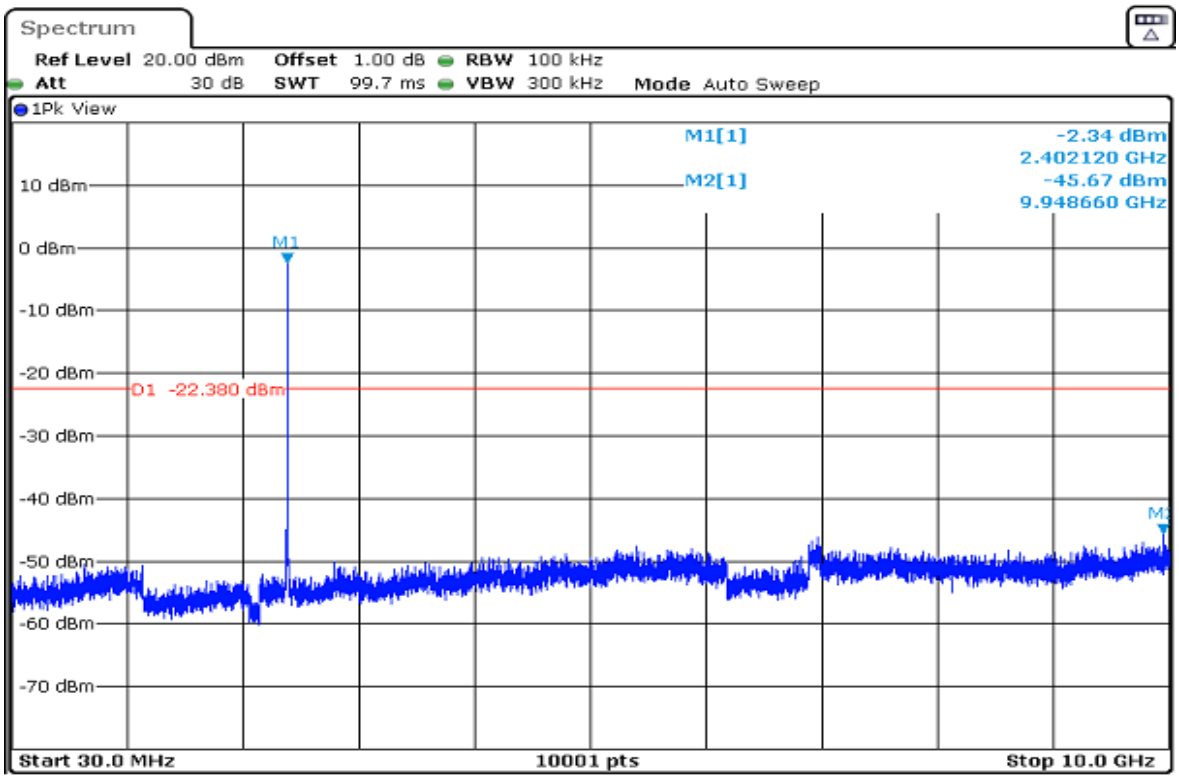
Marker

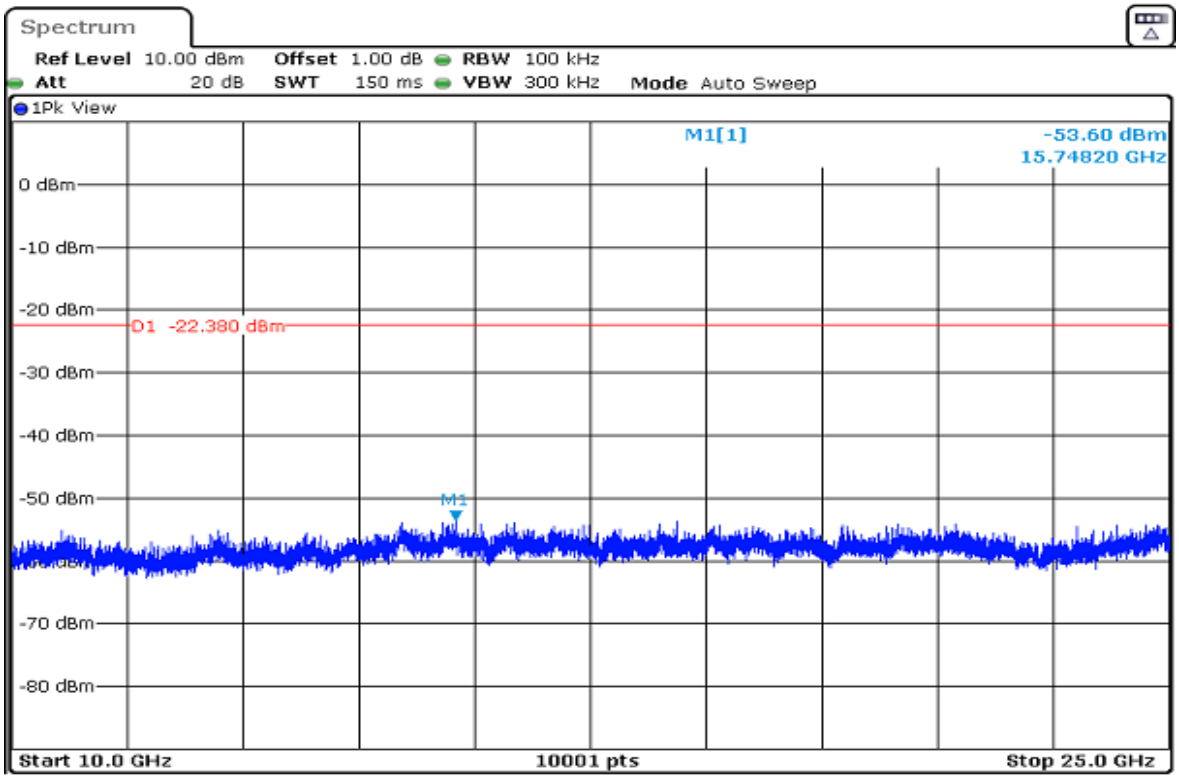
Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.480022 GHz	-4.18 dBm		
M2		1	2.4835 GHz	-47.59 dBm		
M3		1	2.485816 GHz	-46.68 dBm		

5. Conducted Spurious Emission

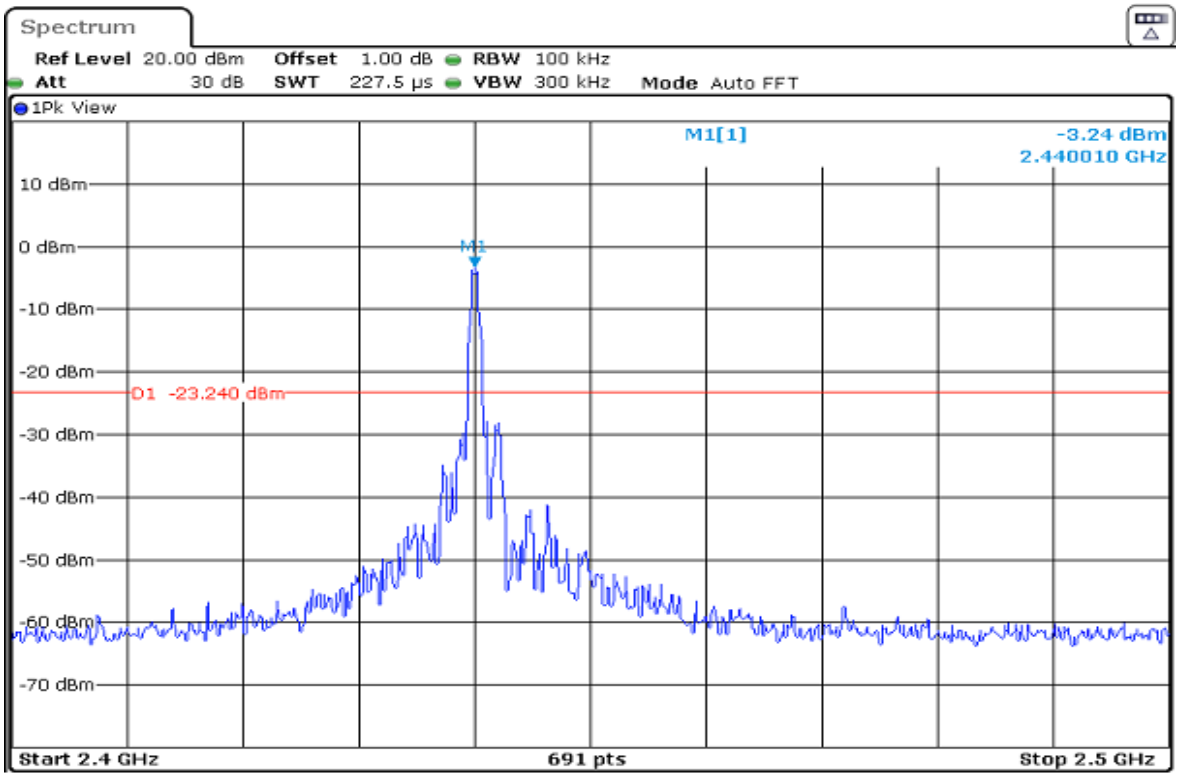
Channel 00

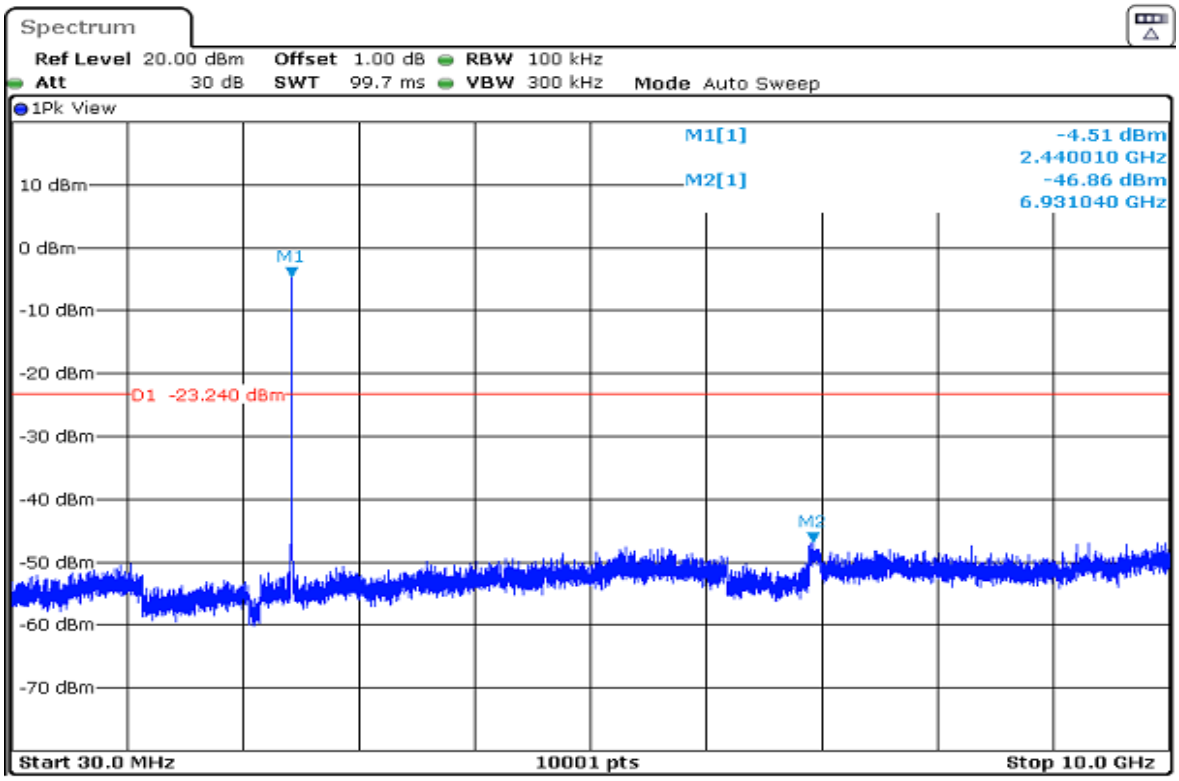


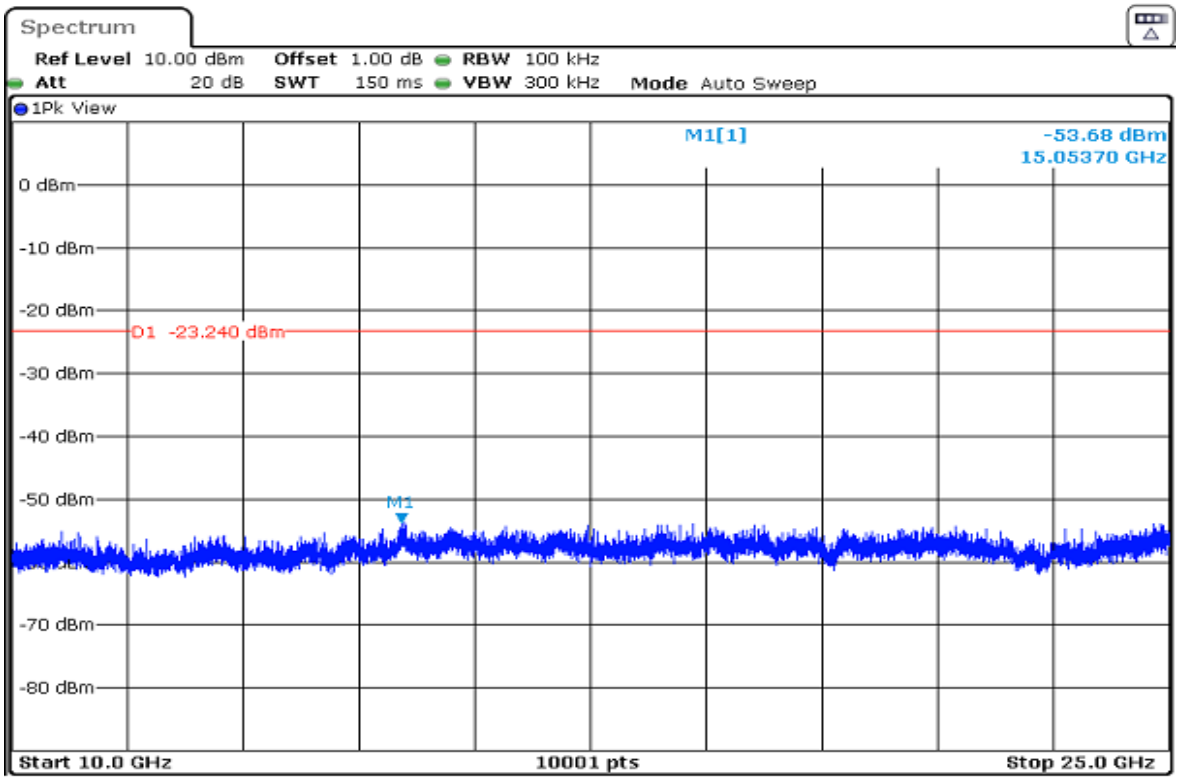



Spectrum
Ref Level 10.00 dBm Offset 1.00 dB RBW 100 kHz
Att 20 dB SWT 150 ms VBW 300 kHz Mode Auto Sweep
1Pk View
M1[1] -53.60 dBm
15.74820 GHz
0 dBm
-10 dBm
-20 dBm
D1 -22.380 dBm
-30 dBm
-40 dBm
-50 dBm
M1
-70 dBm
-80 dBm
Start 10.0 GHz
10001 pts
Stop 25.0 GHz

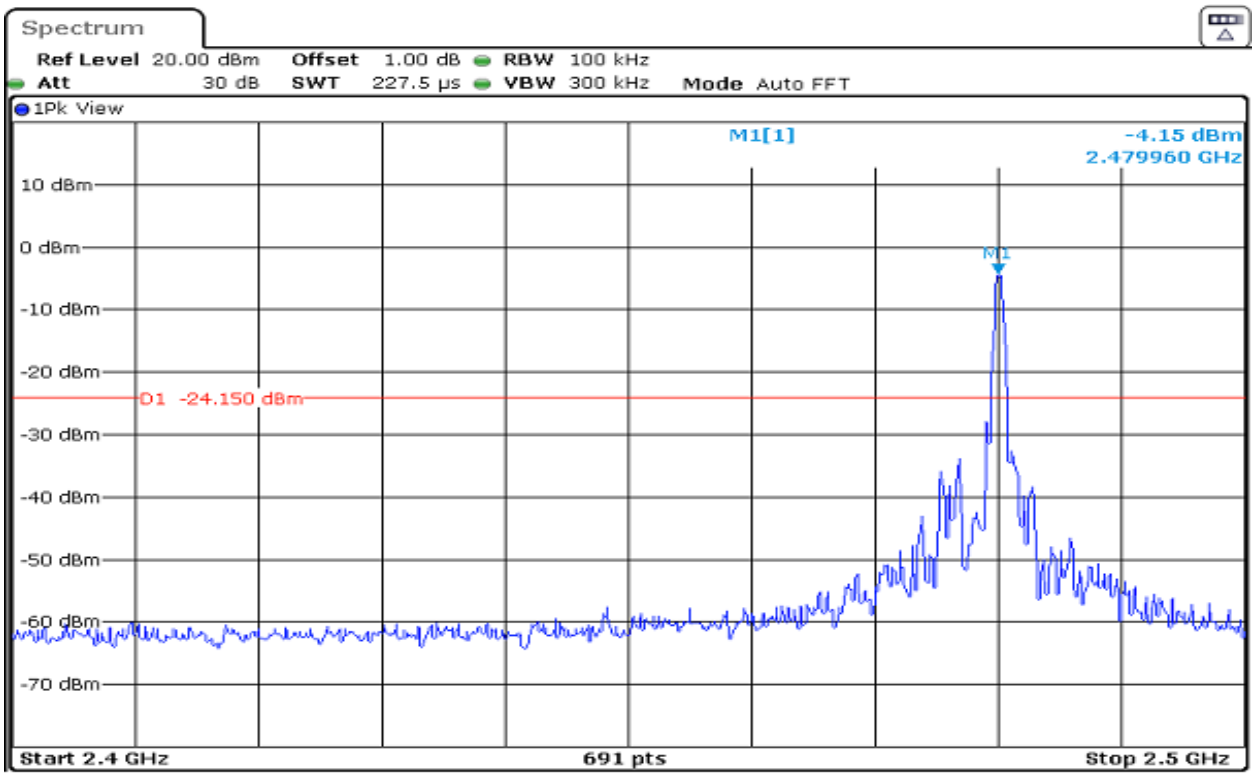
Channel 19

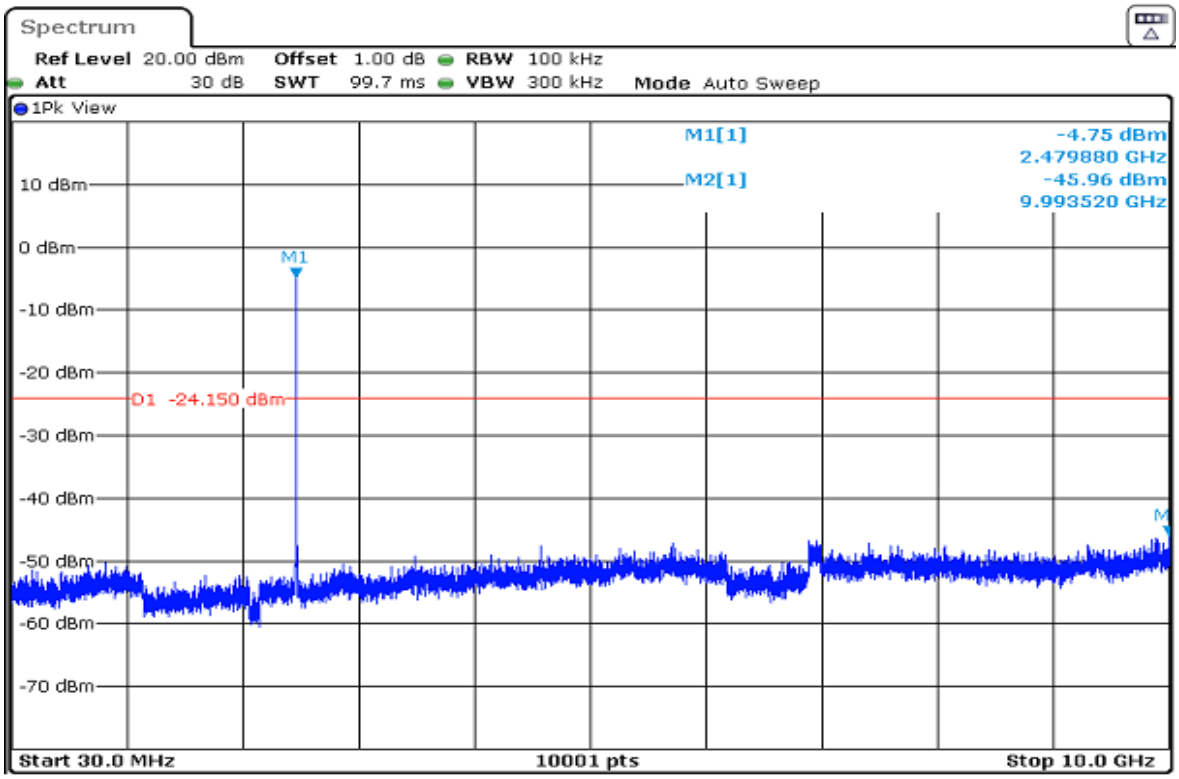

Spectrum
Ref Level 20.00 dBm Offset 1.00 dB RBW 100 kHz
Att 30 dB SWT 227.5 µs VBW 300 kHz Mode Auto FFT
1Pk View
M1[1] -3.24 dBm
2.440010 GHz
10 dBm
0 dBm
M1
-10 dBm
-20 dBm
D1 -23.240 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
Start 2.4 GHz
691 pts
Stop 2.5 GHz

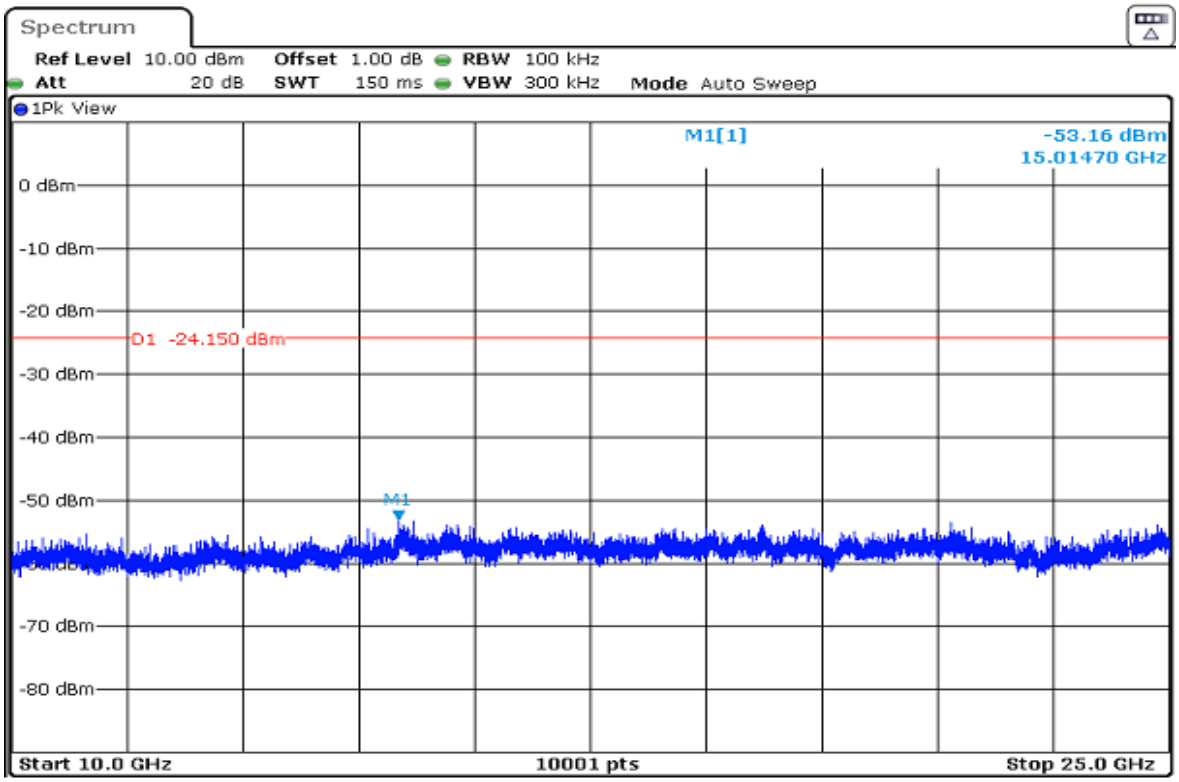

Spectrum
Ref Level 20.00 dBm Offset 1.00 dB RBW 100 kHz
Att 30 dB SWT 99.7 ms VBW 300 kHz Mode Auto Sweep
1Pk View
M1[1] -4.51 dBm
2.440010 GHz
M2[1] -46.86 dBm
6.931040 GHz
10 dBm
0 dBm
-10 dBm
-20 dBm
D1 -23.240 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
M1
M2
Start 30.0 MHz
10001 pts
Stop 10.0 GHz


Spectrum
Ref Level 10.00 dBm Offset 1.00 dB RBW 100 kHz
Att 20 dB SWT 150 ms VBW 300 kHz Mode Auto Sweep
1Pk View
M1[1] -53.68 dBm
15.05370 GHz
0 dBm
-10 dBm
-20 dBm
D1 -23.240 dBm
-30 dBm
-40 dBm
-50 dBm
-70 dBm
-80 dBm
M1
Start 10.0 GHz
10001 pts
Stop 25.0 GHz

Channel 39


Spectrum
Ref Level 20.00 dBm Offset 1.00 dB RBW 100 kHz
Att 30 dB SWT 227.5 µs VBW 300 kHz Mode Auto FFT
1Pk View
M1[1] -4.15 dBm
2.479960 GHz
10 dBm
0 dBm
-10 dBm
-20 dBm
D1 -24.150 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
Start 2.4 GHz
691 pts
Stop 2.5 GHz


Spectrum
Ref Level 20.00 dBm Offset 1.00 dB RBW 100 kHz
Att 30 dB SWT 99.7 ms VBW 300 kHz Mode Auto Sweep
1Pk View
M1[1] -4.75 dBm
2.479880 GHz
M2[1] -45.96 dBm
9.993520 GHz
10 dBm
0 dBm
-10 dBm
-20 dBm
D1 -24.150 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
Start 30.0 MHz
10001 pts
Stop 10.0 GHz



- End of the Report -