SGS-CSTC Standards Technical Services Co., Ltd.
Shenzhen Branch

No. 1 Workshop, M-10, Middle section, Science & Technology Park,
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TEST REPORT

Application No.:	SZEM1702000802CR
Applicant:	BRAGI GMBH
Address of Applicant:	Sendlinger Strasse 7 / Angerblock 2. OG, 80331 München, Germany
Manufacturer:	BRAGI GMBH
Address of Manufacturer:	Sendlinger Strasse 7 / Angerblock 2. OG, 80331 München, Germany
Factory:	VTech (Dongguan) Communications Ltd.
Address of Factory:	Xia Ling Bei Management Zone, Liaobu Town, Dongguan City, Guangdong Province, China
Equipment Under Test (EUT):	
EUT Name:	The Dash Pro
Model No.:	B1002-01R
Trade mark:	Bragi
FCC ID:	2AF5T-B1002R
Standards:	47 CFR Part 15, Subpart C 15.247
Date of Receipt:	2017-02-13
Date of Test:	2017-02-14 to 2017-03-17
Date of Issue:	2017-04-20
Test Result :	**Pass***

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

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Jack Zhang
EMC Laboratory 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.

Revision Record				
Version	**Chapter**	**Date**	**Modifier**	**Remark**
01		2017-04-20		Original

Authorized for issue by:				
Tested By		Hank Yan		2017-04-20
		Hank Yan /Project Engineer		**Date**
Checked By		Eric Fu		2017-04-20
		Eric Fu /Reviewer		**Date**

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)	Pass

Radio Spectrum Matter Part				
Item	**Standard**	**Method**	**Requirement**	**Result**
Conducted Disturbance 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	N/A
Conducted Peak Output Power	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 11.9.1.2	47 CFR Part 15, Subpart C 15.247(b)(3)	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
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 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 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 15.205 & 15.209	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 15.205 & 15.209	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

3 Contents

4 General Information

4.1 Details of E.U.T.

Operation Frequency:	2402MHz~2480MHz
Bluetooth Version:	V4.0 Dual-mode
	This report is for BLE mode
Modulation Type:	GFSK
Number of Channel:	40
Sample Type:	Portable production
Antenna Type:	Integral
Antenna Gain:	-6dBi
Power Supply:	Right headphone: DC 3.7V, 100mAh rechargeable battery Charged by the docking(Charged from Adapter via USB cable)
Cable:	USB charging line: 18.5cm, shielded

Operation Frequency each of channel							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
0	2402MHz	10	2422MHz	20	2442MHz	30	2462MHz
1	2404MHz	11	2424MHz	21	2444MHz	31	2464MHz
2	2406MHz	12	2426MHz	22	2446MHz	32	2466MHz
3	2408MHz	13	2428MHz	23	2448MHz	33	2468MHz
4	2410MHz	14	2430MHz	24	2450MHz	34	2470MHz
5	2412MHz	15	2432MHz	25	2452MHz	35	2472MHz
6	2414MHz	16	2434MHz	26	2454MHz	36	2474MHz
7	2416MHz	17	2436MHz	27	2456MHz	37	2476MHz
8	2418MHz	18	2438MHz	28	2458MHz	38	2478MHz
9	2420MHz	19	2440MHz	29	2460MHz	39	2480MHz

Note:

In section 15.31(m), regards to the operating frequency range over 10 MHz, the lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

Channel	Frequency
The lowest channel (CH0)	2402MHz
The middle channel (CH19)	2440MHz
The highest channel (CH39)	2480MHz

4.2 Description of Support Units

The EUT has been tested independently.

4.3 Measurement Uncertainty

No.	Item	Measurement Uncertainty
1	Radio Frequency	7.25 x 10-8
2	Duty cycle	0.37%
3	Occupied Bandwidth	3%
4	RF conducted power	0.75dB
5	RF power density	2.84dB
6	Conducted Spurious emissions	0.75dB
7	RF Radiated power	4.5dB (below 1GHz)
		4.8dB (above 1GHz)
8	Radiated Spurious emission test	4.5dB (30MHz-1GHz)
		4.8dB (1GHz-18GHz)
9	Temperature test	1℃
10	Humidity test	3%
11	Supply voltages	1.5%
12	Time	3%

4.4 Test Location

All tests were performed at:

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen Branch

No. 1 Workshop, M-10, Middle Section, Science & Technology Park, Shenzhen, Guangdong, China. 518057.

Tel: +86 755 2601 2053 Fax: +86 755 2671 0594

No tests were sub-contracted.

4.5 Test Facility

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

• **CNAS (No. CNAS L2929)**

CNAS has accredited SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch EMC Lab 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. 3816.01)**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 3816.01.

• **VCCI**

The 10m Semi-anechoic chamber and Shielded Room of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-823, R-4188, T-1153 and C-2383 respectively.

• **FCC – Registration No.: 556682**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration No.: 556682.

• **Industry Canada (IC)**

Two 3m Semi-anechoic chambers and the 10m Semi-anechoic chamber of SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch EMC Lab have been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 4620C-1, 4620C-2, 4620C-3.

4.6 Deviation from Standards

None

4.7 Abnormalities from Standard Conditions

None

5 Equipment List

Conducted Disturbance at AC Power Line(150kHz-30MHz)					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
Shielding Room	ZhongYu Electron	GB-88	SEM001-06	2016-05-13	2017-05-13
LISN	Rohde & Schwarz	ENV216	SEM007-01	2016-10-09	2017-10-09
LISN	ETS-LINDGREN	3816/2	SEM007-02	2016-04-25	2017-04-25
8 Line ISN	Fischer Custom Communications Inc.	FCC-TLISN-T8-02	EMC0120	2016-09-28	2017-09-28
4 Line ISN	Fischer Custom Communications Inc.	FCC-TLISN-T4-02	EMC0121	2016-09-28	2017-09-28
2 Line ISN	Fischer Custom	FCC-TLISN-T2-02	EMC0122	2016-09-28	2017-09-28

Conducted Peak Output Power					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
DC Power Supply	ZhaoXin	RXN-305D	SEM011-02	2016-10-09	2017-10-09
Spectrum Analyzer	Rohde & Schwarz	FSP	SEM004-06	2016-10-09	2017-10-09
Power Meter	Rohde & Schwarz	NRVS	SEM014-02	2016-10-09	2017-10-09

Minimum 6dB Bandwidth					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
DC Power Supply	ZhaoXin	RXN-305D	SEM011-02	2016-10-09	2017-10-09
Spectrum Analyzer	Rohde & Schwarz	FSP	SEM004-06	2016-10-09	2017-10-09
Power Meter	Rohde & Schwarz	NRVS	SEM014-02	2016-10-09	2017-10-09

Power Spectrum Density					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
DC Power Supply	ZhaoXin	RXN-305D	SEM011-02	2016-10-09	2017-10-09
Spectrum Analyzer	Rohde & Schwarz	FSP	SEM004-06	2016-10-09	2017-10-09
Power Meter	Rohde & Schwarz	NRVS	SEM014-02	2016-10-09	2017-10-09

Conducted Spurious Emissions					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
DC Power Supply	ZhaoXin	RXN-305D	SEM011-02	2016-10-09	2017-10-09
Spectrum Analyzer	Rohde & Schwarz	FSP	SEM004-06	2016-10-09	2017-10-09
Power Meter	Rohde & Schwarz	NRVS	SEM014-02	2016-10-09	2017-10-09

Conducted Band Edges Measurement					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
DC Power Supply	ZhaoXin	RXN-305D	SEM011-02	2016-10-09	2017-10-09
Spectrum Analyzer	Rohde & Schwarz	FSP	SEM004-06	2016-10-09	2017-10-09
Power Meter	Rohde & Schwarz	NRVS	SEM014-02	2016-10-09	2017-10-09

General used equipment					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
Humidity/ Temperature Indicator	Shanghai Meteorological Industry Factory	ZJ1-2B	SEM002-03	2016-10-12	2017-10-12
Humidity/ Temperature Indicator	Shanghai Meteorological Industry Factory	ZJ1-2B	SEM002-04	2016-10-12	2017-10-12
Humidity/ Temperature Indicator	Mingle	N/A	SEM002-08	2016-10-12	2017-10-12
Barometer	Changchun Meteorological Industry Factory	DYM3	SEM002-01	2016-05-18	2017-05-18

6 Radio Spectrum Technical Requirement

6.1 Antenna Requirement

6.1.1 Test Requirement:

47 CFR Part 15, Subpart C 15.247

6.1.2 Conclusion

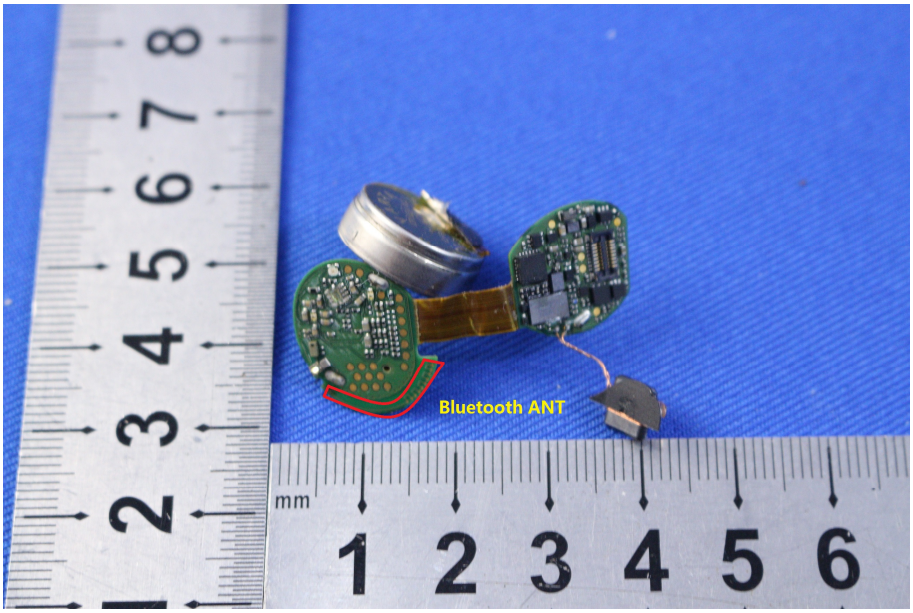
Standard Requirment:

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 integrated on the main PCB and no consideration of replacement. The best case gain of the antenna is -6dBi.

7 Radio Spectrum Matter Test Results

7.1 Conducted Peak Output Power

Test Requirement 47 CFR Part 15, Subpart C 15.247(b)(3)
Test Method: ANSI C63.10 (2013) Section 11.9.1.2
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

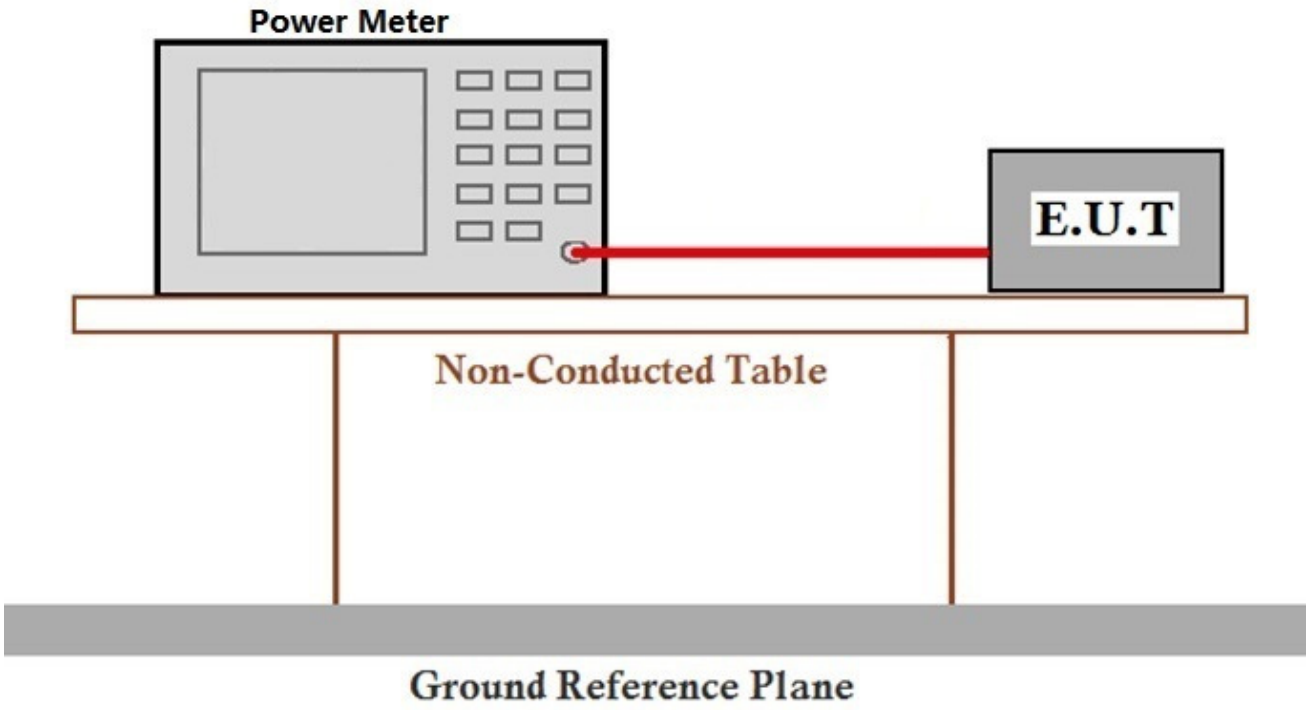
7.1.1 E.U.T. Operation

Operating Environment:

Temperature: 23 °C Humidity: 56 % RH Atmospheric Pressure: 1020 mbar

Test mode Transmitting with GFSK modulation.

7.1.2 Test Setup Diagram



7.1.3 Measurement Data

The detailed test data see: Appendix 15.247

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

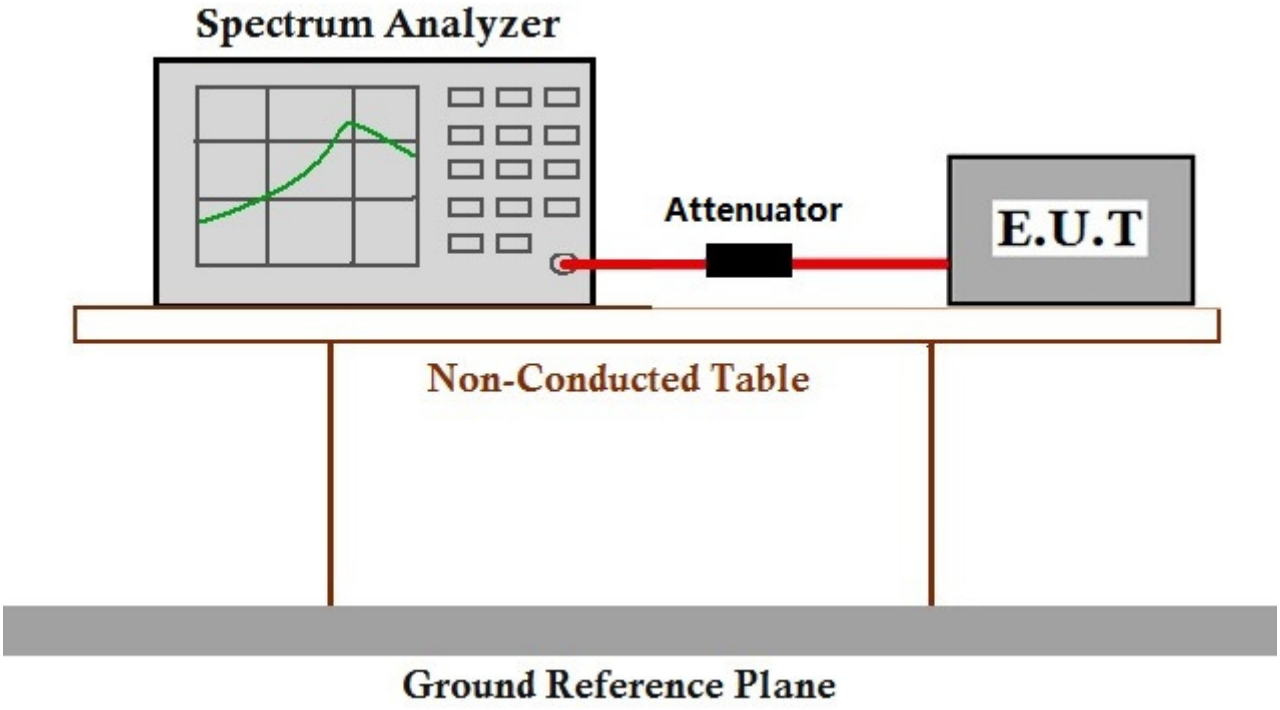
7.2.1 E.U.T. Operation

Operating Environment:

Temperature: 23 °C Humidity: 56 % RH Atmospheric Pressure: 1020 mbar

Test mode Transmitting with GFSK modulation.

7.2.2 Test Setup Diagram



7.2.3 Measurement Data

The detailed test data see: Appendix 15.247

7.3 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

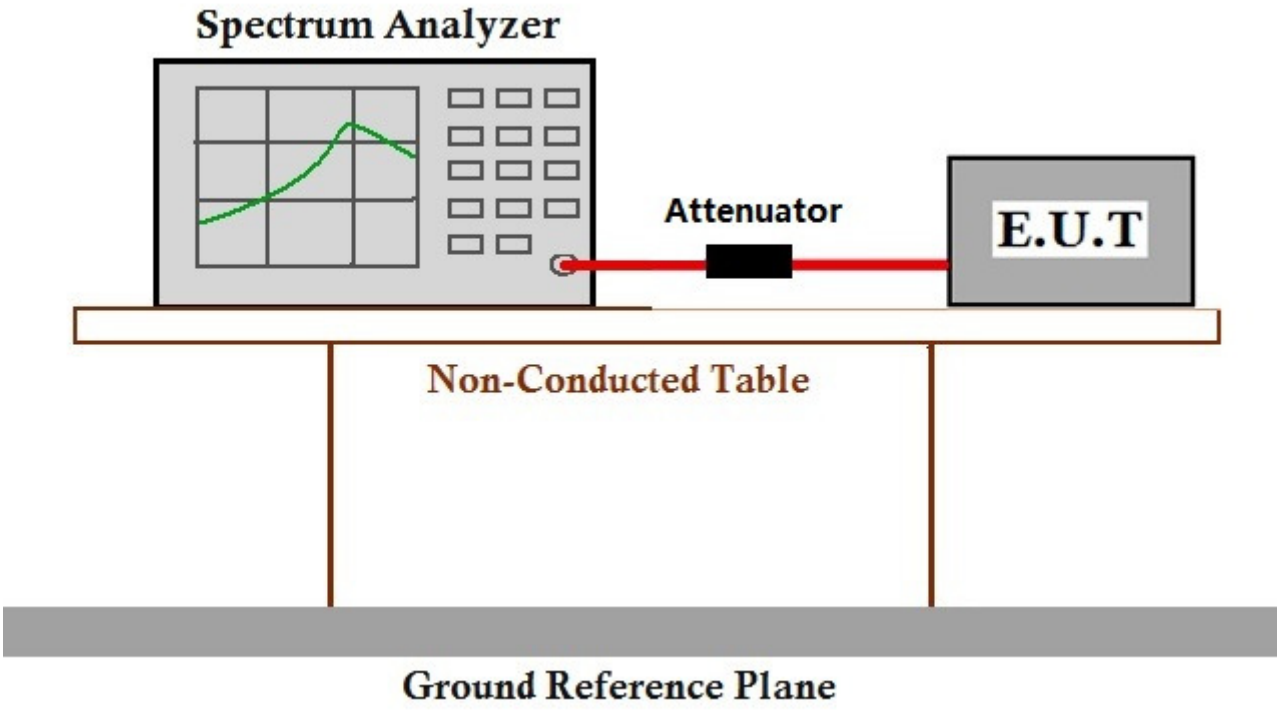
7.3.1 E.U.T. Operation

Operating Environment:

Temperature: 23 °C Humidity: 56 % RH Atmospheric Pressure: 1020 mbar

Test mode Transmitting with GFSK modulation.

7.3.2 Test Setup Diagram



7.3.3 Measurement Data

The detailed test data see: Appendix 15.247

7.4 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 100 kHz bandwidth outside the frequency band in which the spread spectrum 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.

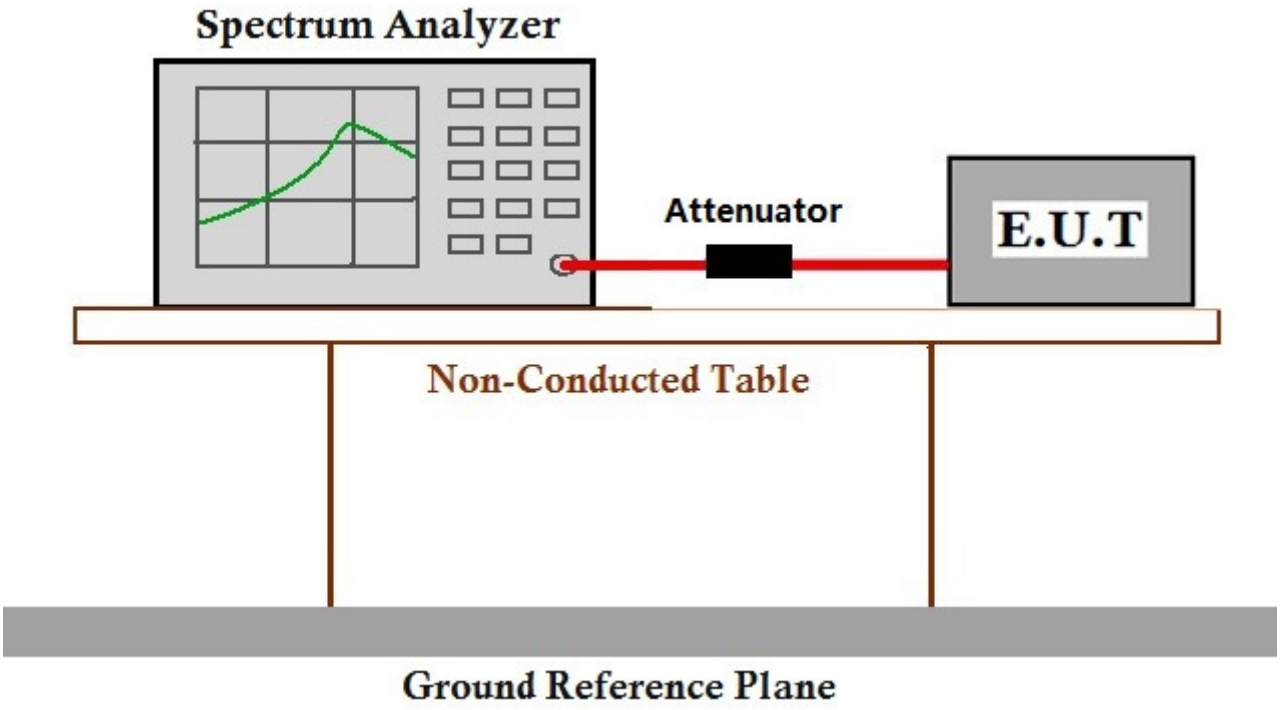
7.4.1 E.U.T. Operation

Operating Environment:

Temperature: 23 °C Humidity: 56 % RH Atmospheric Pressure: 1020 mbar

Test mode Transmitting with GFSK modulation.

7.4.2 Test Setup Diagram



7.4.3 Measurement Data

The detailed test data see: Appendix 15.247

7.5 Radiated Spurious Emissions

Test Requirement 47 CFR Part 15, Subpart C 15.205 & 15.209
Test Method: ANSI C63.10 (2013) Section 6.4,6.5,6.6
Measurement Distance: 3m
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.		

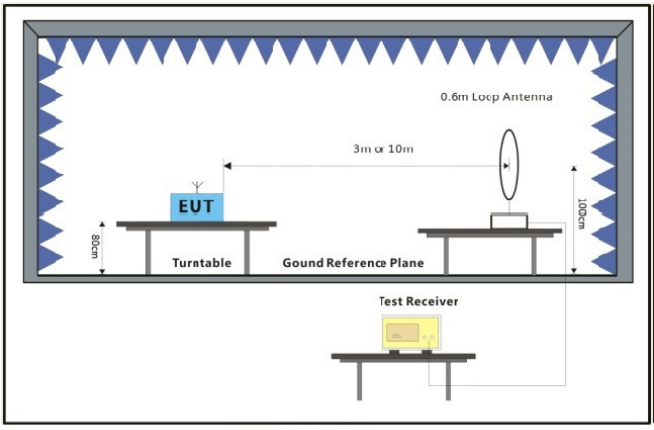
7.5.1 E.U.T. Operation

Operating Environment:

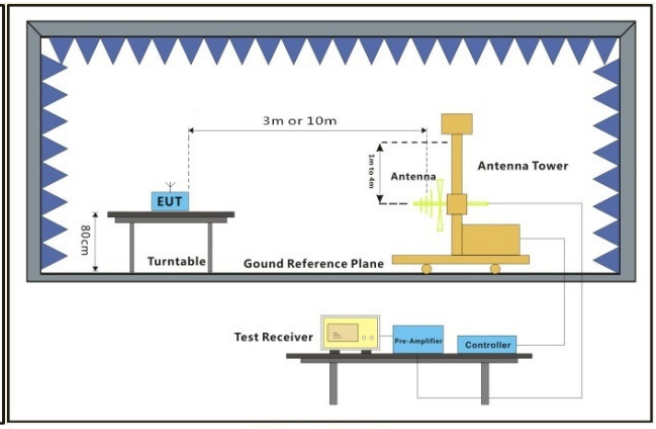
Temperature: 25 °C Humidity: 50 % RH Atmospheric Pressure: 1020 mbar

Test mode Transmitting with GFSK modulation.

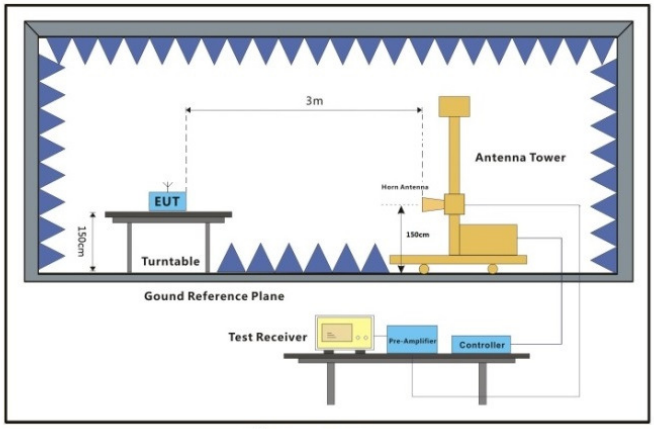
7.5.2 Test Setup Diagram



Below 30MHz



30MHz-1GHz



Above 1GHz

7.5.3 Measurement Data

a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 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 1.5 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.

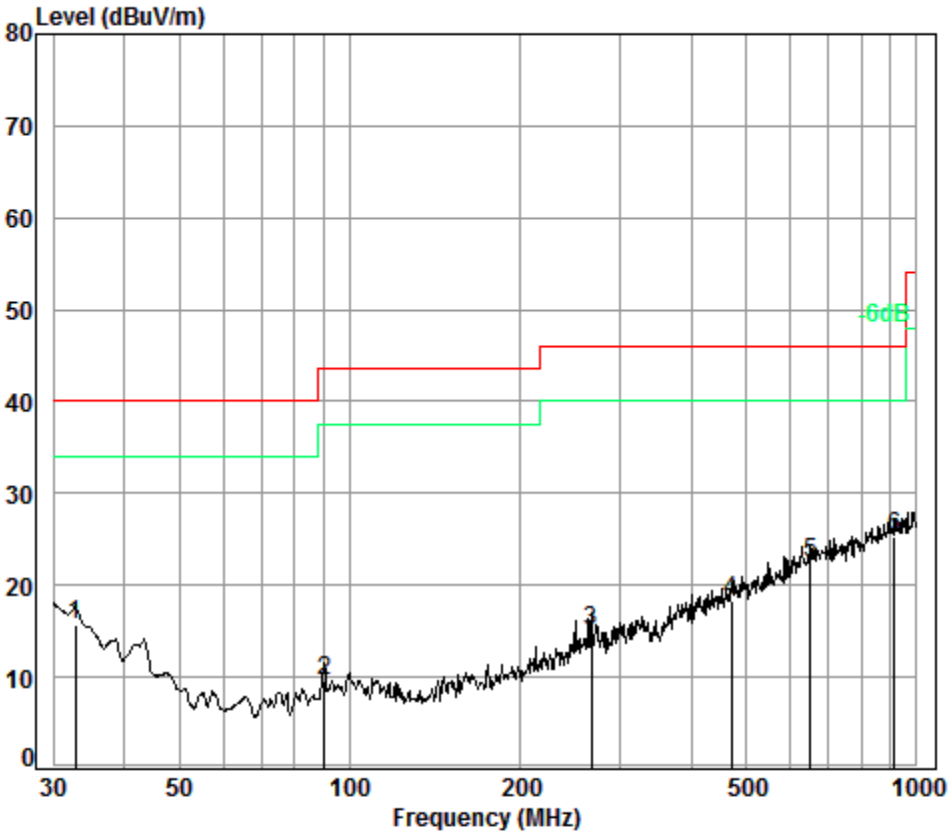
g. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified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

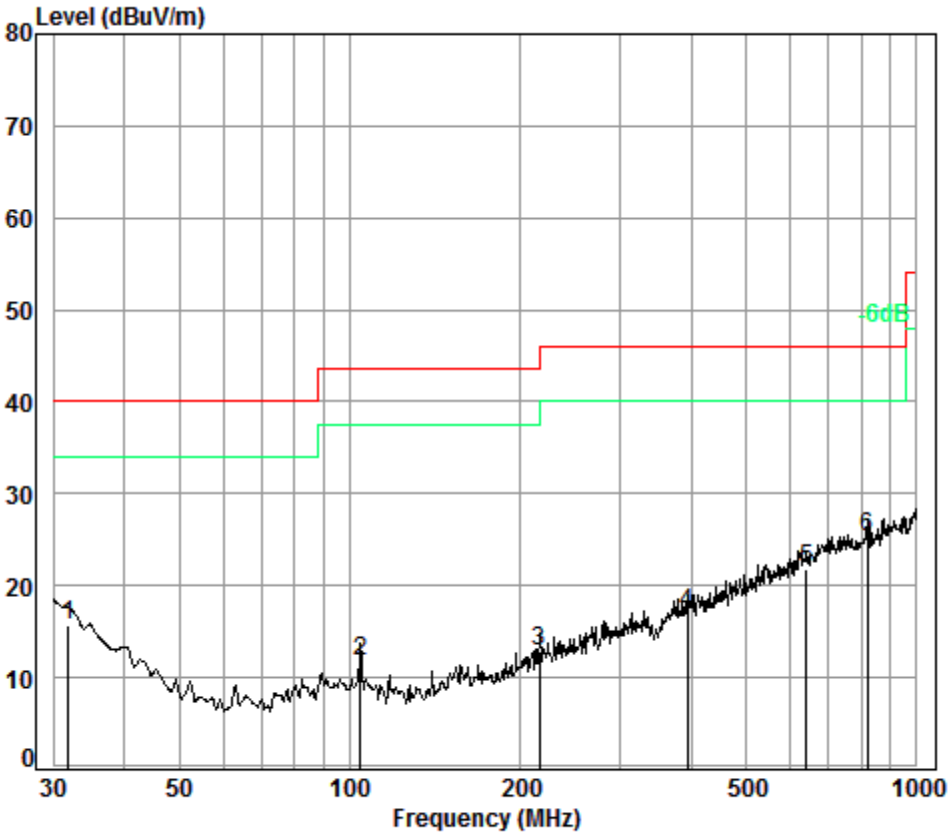
30MHz~1GHz (QP)		
Test mode:	Transmitting	Vertical



Condition: 3m VERTICAL
Job No. : 0802CR
Test mode: TX mode

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1	32.86	0.60	17.10	27.35	25.43	15.78	40.00	-24.22
2	90.22	1.10	8.71	27.21	27.03	9.63	43.50	-33.87
3	266.61	1.75	12.63	26.49	27.17	15.06	46.00	-30.94
4	472.18	2.50	17.70	27.56	25.64	18.28	46.00	-27.72
5	649.66	2.80	20.60	27.47	26.42	22.35	46.00	-23.65
6 pp	912.86	3.61	23.25	26.71	25.18	25.33	46.00	-20.67

Test mode:	Transmitting	Horizontal



Condition: 3m HORIZONTAL
Job No. : 0802CR
Test mode: TX mode

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1	31.95	0.60	17.61	27.35	24.76	15.62	40.00	-24.38
2	104.54	1.21	8.87	27.17	28.92	11.83	43.50	-31.67
3	216.02	1.49	11.03	26.64	26.91	12.79	46.00	-33.21
4	393.47	2.18	16.22	27.09	25.62	16.93	46.00	-29.07
5	638.37	2.78	20.55	27.49	25.99	21.83	46.00	-24.17
6 pp	818.83	3.28	22.33	27.20	26.93	25.34	46.00	-20.66

Transmitter Emission above 1GHz								
Test mode:	GFSK		Test channel:		Lowest	Remark:		Peak
Frequency (MHz)	Cable Loss (dB)	Antenna Factor (dB/m)	Preamp Factor (dB)	Read Level (dBuV)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
1479.955	25.72	4.45	38.06	43.56	36.15	74.00	-37.85	Vertical
3342.042	31.93	6.19	38.39	44.43	44.74	74.00	-29.26	Vertical
4804.000	34.17	7.73	39.03	50.33	53.59	74.00	-20.41	Vertical
7206.000	36.41	9.65	38.18	43.54	51.68	74.00	-22.32	Vertical
9608.000	37.52	11.06	36.99	40.51	52.55	74.00	-21.45	Vertical
12272.340	38.76	12.81	38.58	39.50	53.17	74.00	-20.83	Vertical
1173.943	24.35	4.04	38.02	42.04	32.86	74.00	-41.14	Horizontal
3041.641	31.38	5.96	38.22	43.68	43.82	74.00	-30.18	Horizontal
4804.000	34.17	7.73	39.03	49.15	52.41	74.00	-21.59	Horizontal
7206.000	36.41	9.65	38.18	42.93	51.07	74.00	-22.93	Horizontal
9608.000	37.52	11.06	36.99	40.77	52.81	74.00	-21.19	Horizontal
11633.540	38.24	12.35	37.94	39.70	53.04	74.00	-20.96	Horizontal

Test mode:	GFSK		Test channel:		Middle	Remark:		Peak
Frequency (MHz)	Cable Loss (dB)	Antenna Factor (dB/m)	Preamp Factor (dB)	Read Level (dBuV)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
1655.354	26.49	4.65	38.07	42.58	36.18	74.00	-37.82	Vertical
3151.992	31.59	6.05	38.29	44.50	44.50	74.00	-29.50	Vertical
4880.000	34.30	7.84	39.06	52.56	56.05	74.00	-17.95	Vertical
7319.964	36.37	9.73	38.07	39.93	48.20	74.00	-25.80	Vertical
9759.591	37.55	11.21	36.92	37.94	50.24	74.00	-23.76	Vertical
12717.590	38.86	13.24	39.03	39.53	53.14	74.00	-20.86	Vertical
1273.572	24.83	4.18	38.03	45.05	36.51	74.00	-37.49	Horizontal
2995.538	31.28	5.93	38.20	44.61	44.81	74.00	-29.19	Horizontal
4880.000	34.30	7.84	39.06	46.62	50.11	74.00	-23.89	Horizontal
7320.000	36.37	9.73	38.07	40.38	48.65	74.00	-25.35	Horizontal
9760.000	37.55	11.21	36.92	38.45	50.75	74.00	-23.25	Horizontal
12272.340	38.76	12.81	38.58	38.72	52.39	74.00	-21.61	Horizontal

Test mode:	GFSK	Test channel:	Middle	Remark:	Average

Frequency (MHz)	Cable Loss (dB)	Antenna Factor (dB/m)	Preamp Factor (dB)	Read Level (dBuV)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4880.000	34.30	7.84	39.06	39.51	43.00	54.00	-11.00	Vertical

Test mode:	GFSK	Test channel:	Highest	Remark:	Peak

Frequency (MHz)	Cable Loss (dB)	Antenna Factor (dB/m)	Preamp Factor (dB)	Read Level (dBuV)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
1333.284	25.10	4.26	38.04	44.69	36.51	74.00	-37.49	Vertical
3168.080	31.62	6.06	38.29	43.97	44.01	74.00	-29.99	Vertical
4960.000	34.43	7.94	39.09	47.33	51.04	74.00	-22.96	Vertical
7440.000	36.37	9.73	38.07	44.01	52.28	74.00	-21.72	Vertical
9920.000	37.58	11.35	36.84	40.09	52.64	74.00	-21.36	Vertical
12210.020	38.73	12.71	38.52	39.55	53.17	74.00	-20.83	Vertical
1601.472	26.26	4.59	38.07	42.63	35.90	74.00	-38.10	Horizontal
3308.185	31.87	6.16	38.37	43.00	43.26	74.00	-30.74	Horizontal
4960.000	34.43	7.94	39.09	48.05	51.76	74.00	-22.24	Horizontal
6412.427	35.03	9.01	38.74	45.10	50.72	74.00	-23.28	Horizontal
7440.000	36.33	9.81	37.95	44.18	52.59	74.00	-21.41	Horizontal
9920.000	37.58	11.35	36.84	40.56	53.11	74.00	-20.89	Horizontal

Remark:

1) 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

2) Scan from 9kHz to 25GHz, the disturbance above 13GHz and below 30MHz was very low, and the above harmonics were the highest point could be found when testing, so only the above harmonics had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.

3) As shown in this section, 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. So, only the peak measurements were shown in the report.

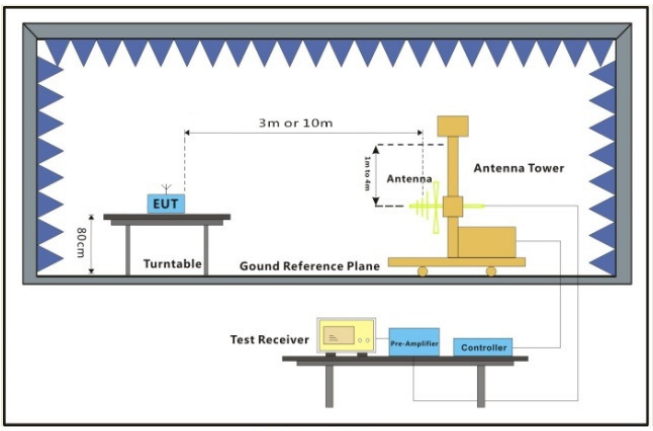
7.6 Radiated Emissions which fall in the restricted bands

Test Requirement 47 CFR Part 15, Subpart C 15.205 & 15.209
Test Method: ANSI C63.10 (2013) Section 6.10.5
Measurement Distance: 3m

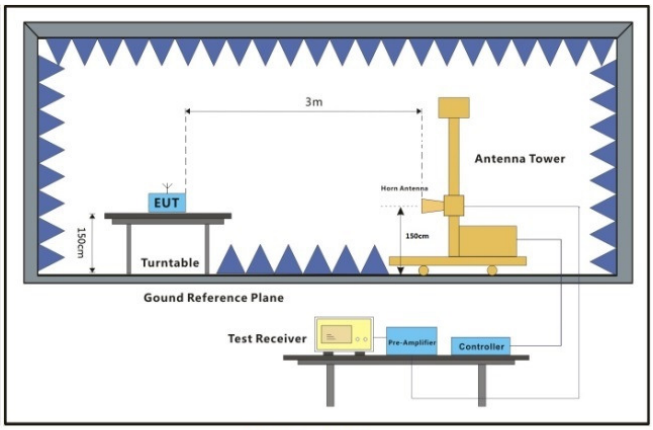
7.6.1 E.U.T. Operation

Operating Environment:
Temperature: 22 °C Humidity: 54 % RH Atmospheric Pressure: 1015 mbar
Test mode Transmitting with GFSK modulation.

7.6.2 Test Setup Diagram



30MHz-1GHz



Above 1GHz

7.6.3 Measurement Data

a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 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 1.5 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.

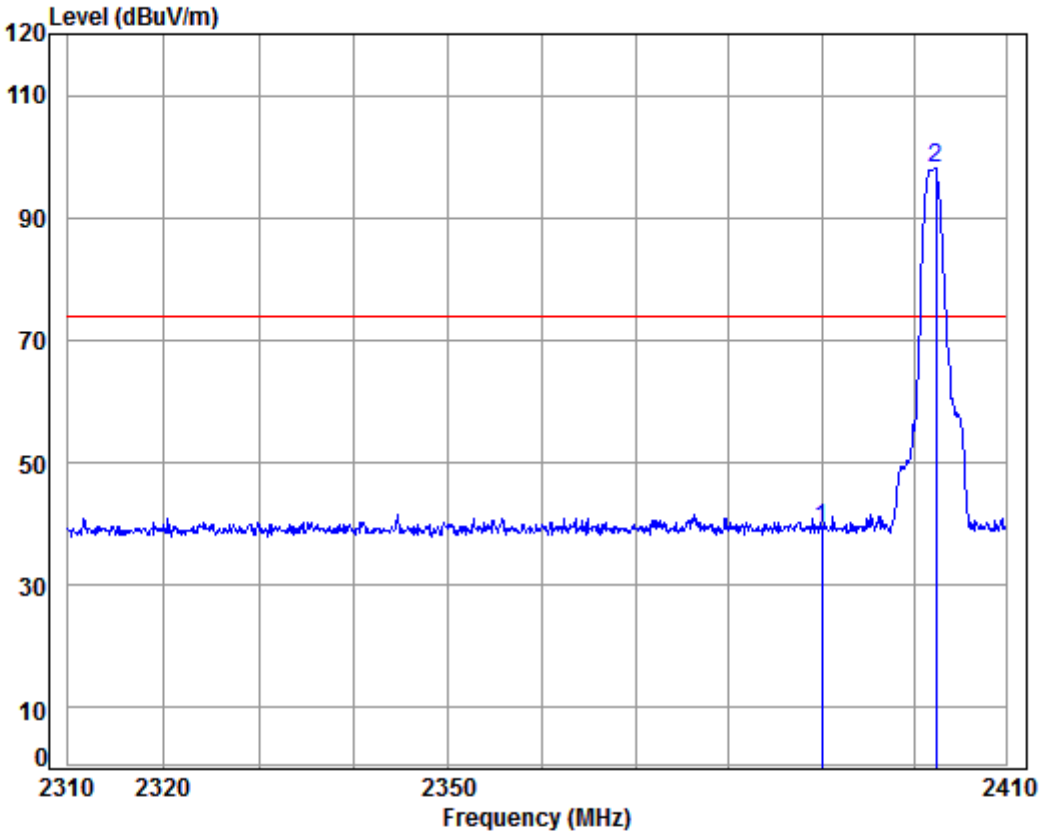
g. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified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

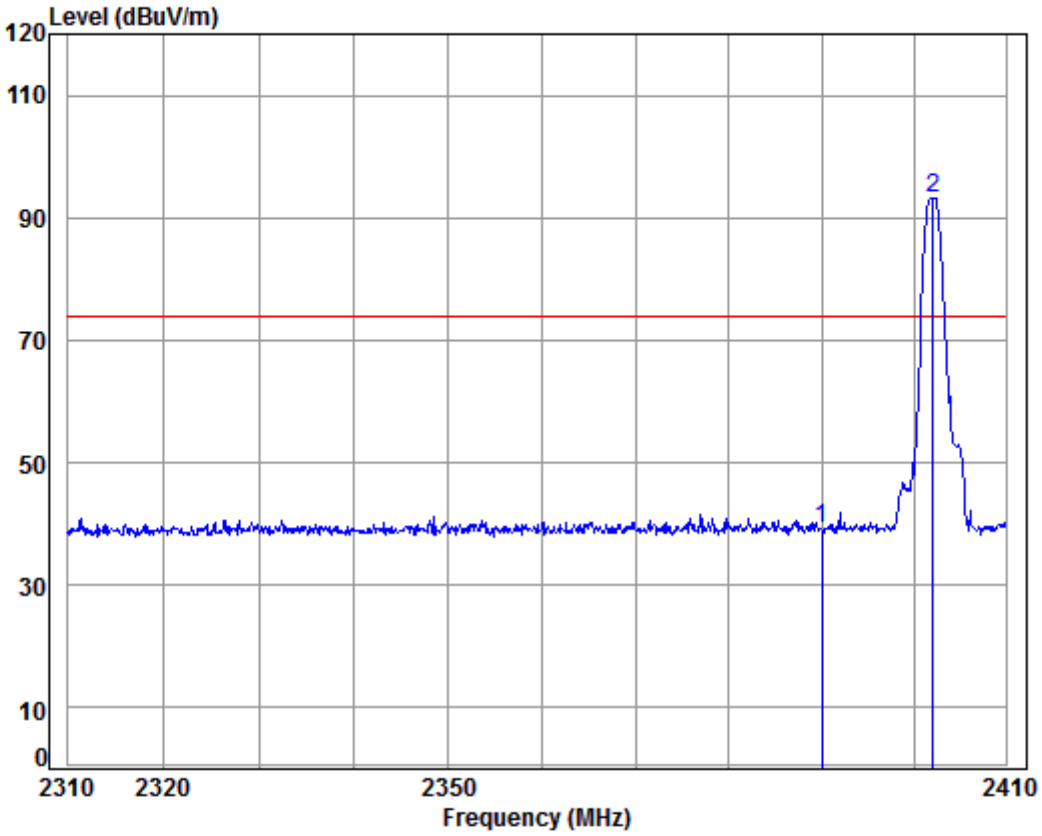
Polarization:Horizontal; Modulation Type:GFSK; ; Channel:Low



Condition: 3m HORIZONTAL
Job No: : 802CR
Mode: : 2402 Band edge
: BLE

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	2390.000	5.34	29.08	38.14	42.84	39.12	74.00	-34.88	
2 pp	2402.352	5.35	29.11	38.15	101.68	97.99	74.00	23.99	

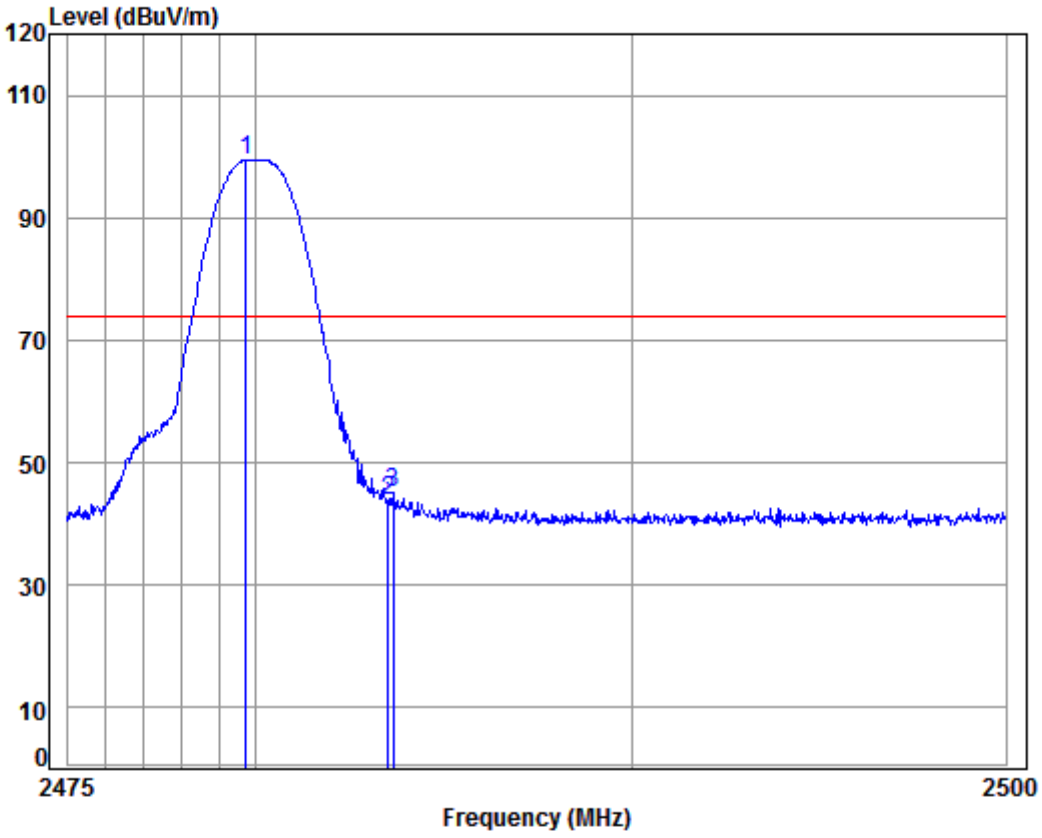
Polarization:Vertical; Modulation Type:GFSK; ; Channel:Low



Condition: 3m VERTICAL
Job No: : 802CR
Mode: : 2402 Band edge
: BLE

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	2390.000	5.34	29.08	38.14	43.05	39.33	74.00	-34.67	
2 pp	2402.047	5.35	29.11	38.15	96.88	93.19	74.00	19.19	

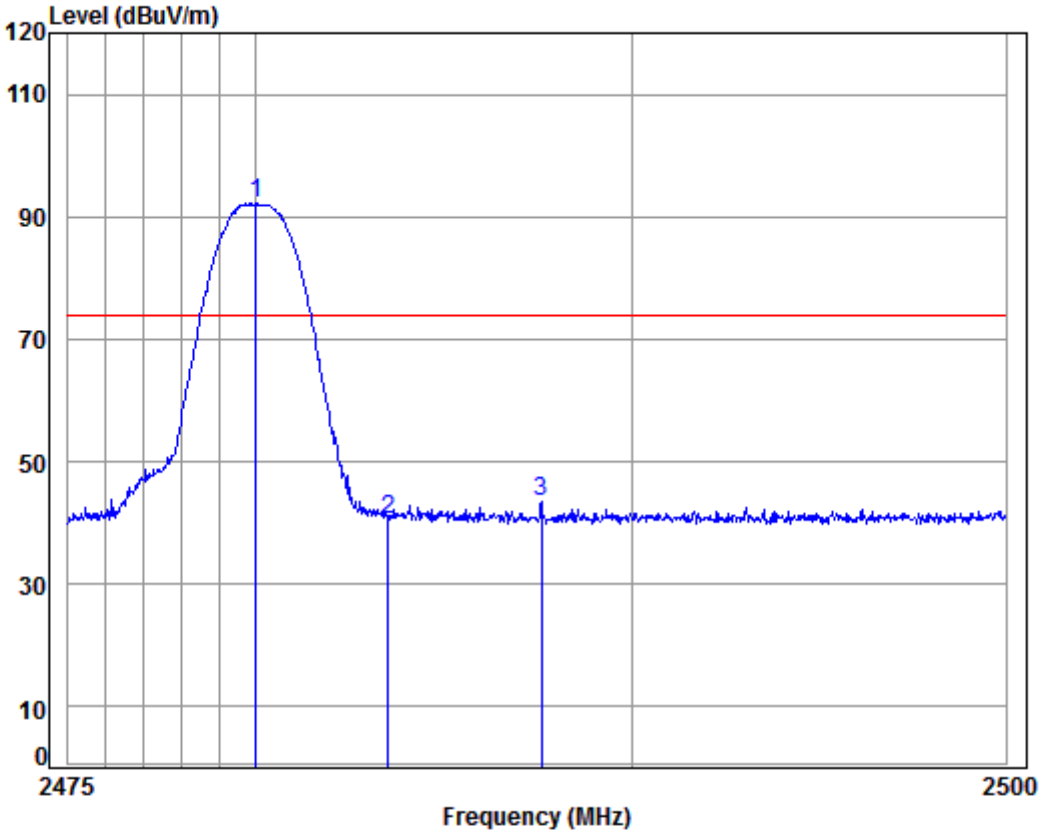
Polarization:Horizontal; Modulation Type:GFSK; ; Channel:High



Condition: 3m HORIZONTAL
Job No: : 802CR
Mode: : 2480 Band edge
: BLE

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1 pp	2479.731	5.41	29.34	38.15	102.85	99.45	74.00	25.45	
2	2483.500	5.41	29.35	38.15	47.11	43.72	74.00	-30.28	
3	2483.646	5.41	29.35	38.15	48.45	45.06	74.00	-28.94	

Polarization:Vertical; Modulation Type:GFSK; ; Channel:High



Condition: 3m VERTICAL
Job No: : 802CR
Mode: : 2480 Band edge
: BLE

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1 pp	2479.980	5.41	29.34	38.15	95.46	92.06	74.00	18.06	
2	2483.500	5.41	29.35	38.15	43.96	40.57	74.00	-33.43	
3	2487.594	5.41	29.36	38.15	46.71	43.33	74.00	-30.67	

7.7 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

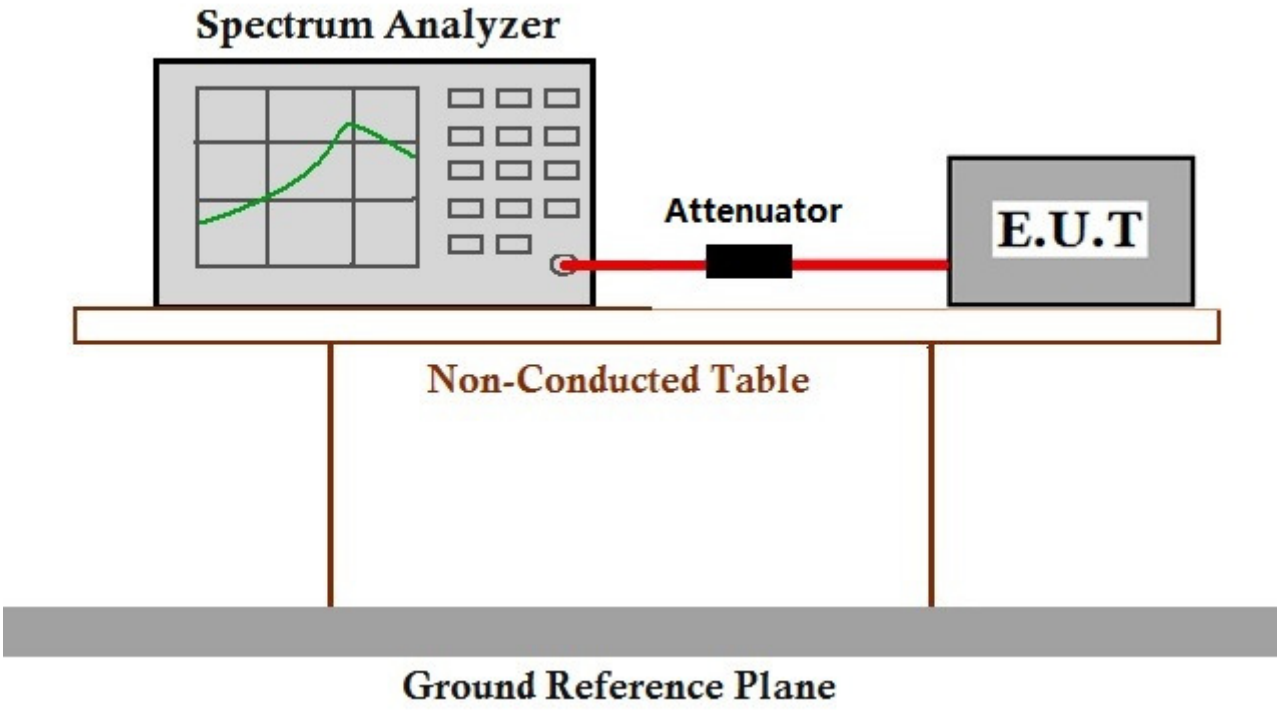
7.7.1 E.U.T. Operation

Operating Environment:

Temperature: 23 °C Humidity: 56 % RH Atmospheric Pressure: 1020 mbar

Test mode Transmitting with GFSK modulation.

7.7.2 Test Setup Diagram

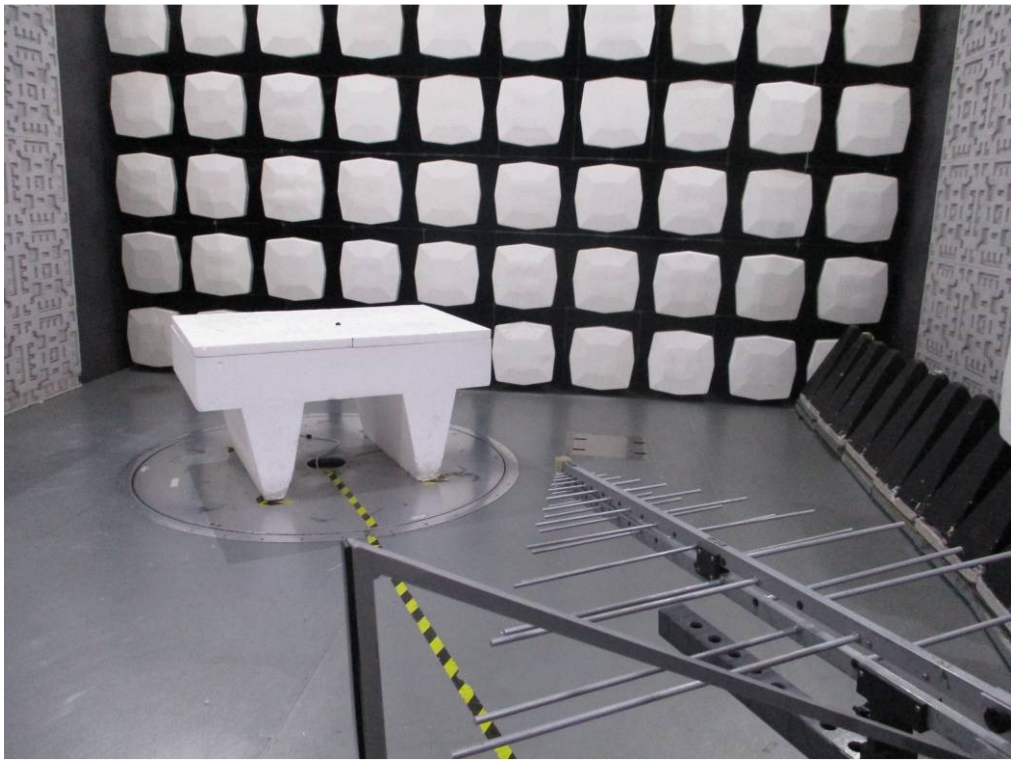


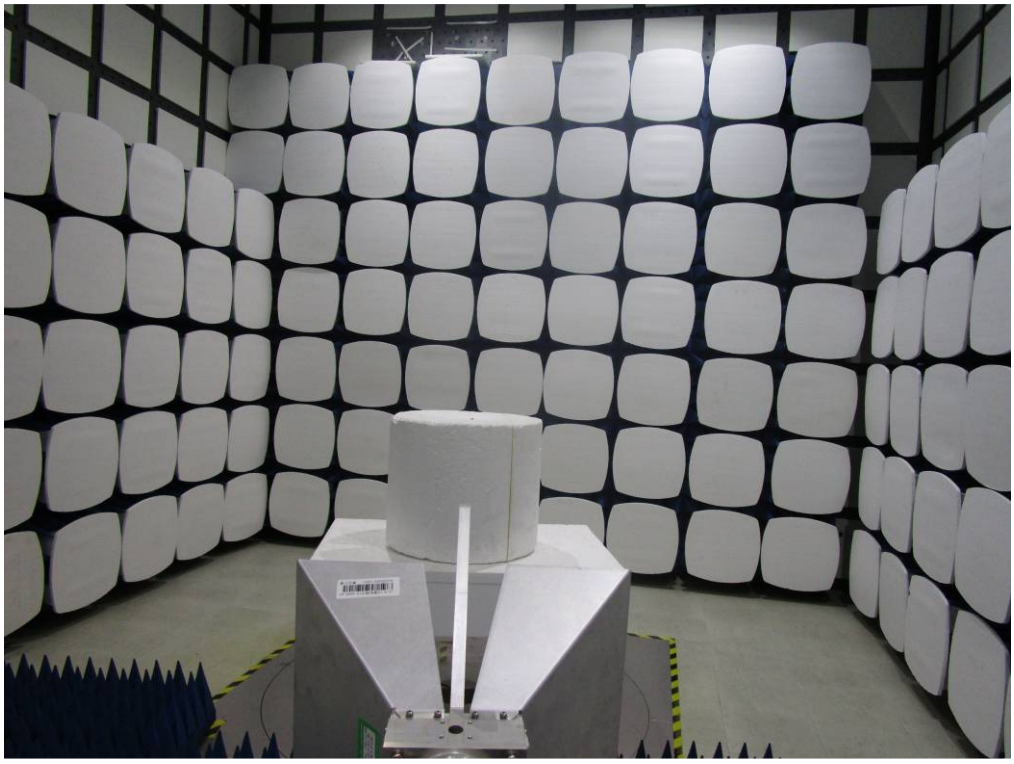
7.7.3 Measurement Data

The detailed test data see: Appendix 15.247

8 Photographs

8.1 Radiated Spurious Emissions Test Setup





8.2 EUT Constructional Details

Refer to Appendix A - Photographs of EUT Constructional Details for SZEM1702000802CR.

9 Appendix

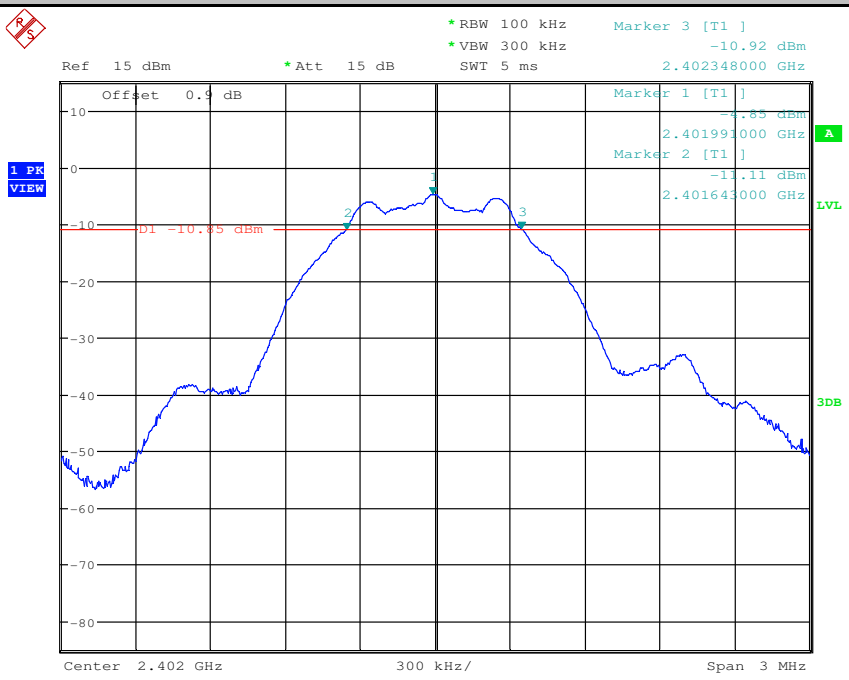
9.1 Appendix 15.247

1.6dB Bandwidth

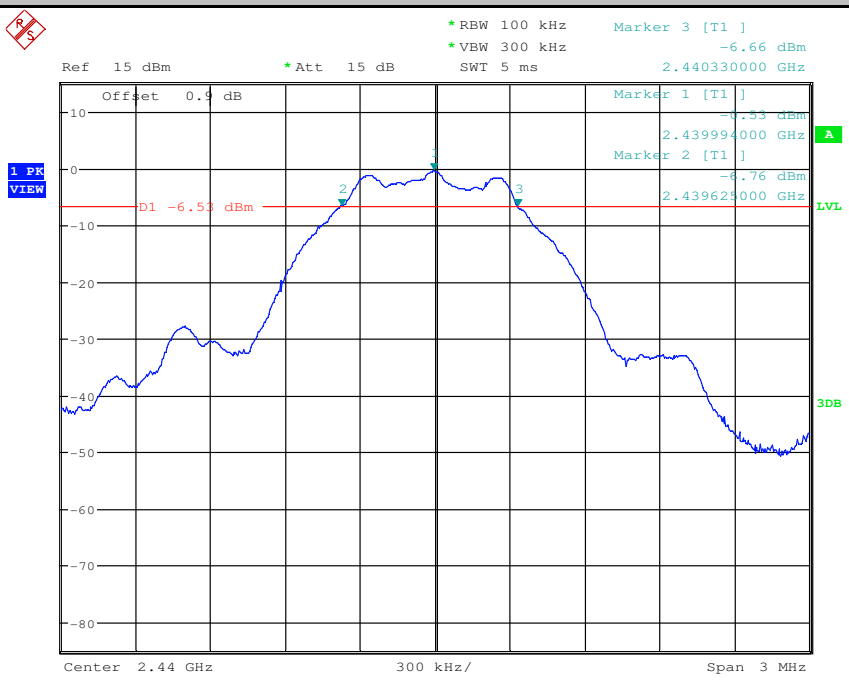
Test Mode	Test Channel	EBW[MHz]	Limit [MHz]	Verdict
BLE	2402	0.705	>=0.5	PASS
BLE	2440	0.705	>=0.5	PASS
BLE	2480	0.702	>=0.5	PASS

TEST PLOT

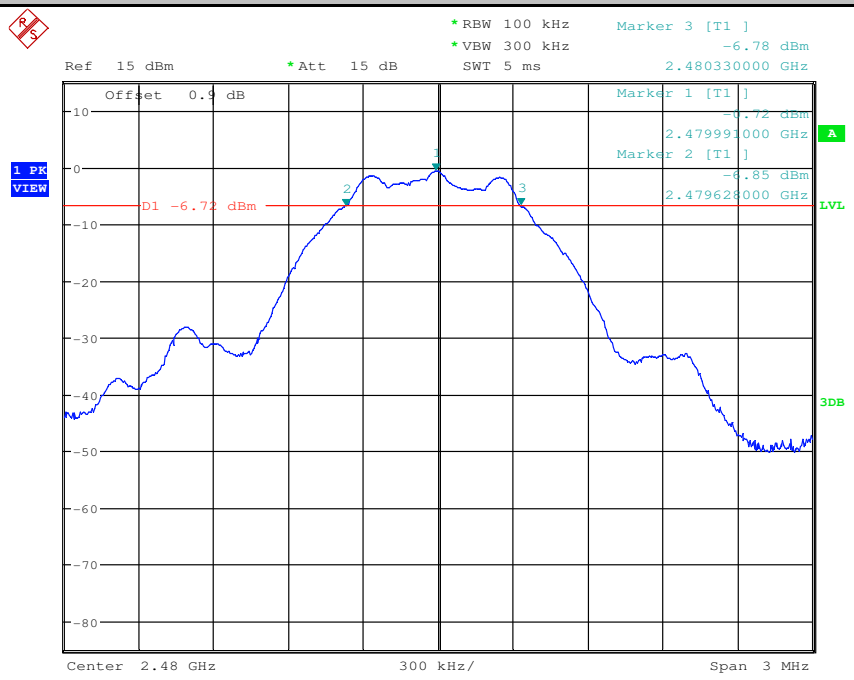
6dB Bandwidth_BLE_2402



6dB Bandwidth_BLE_2440



6dB Bandwidth_BLE_2480

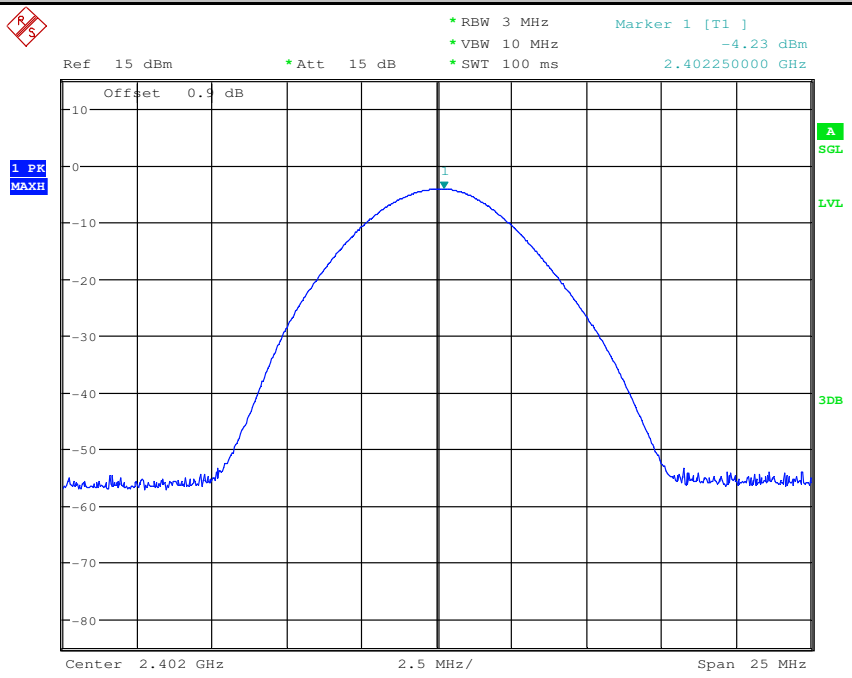


2.Maximum peak conducted output power

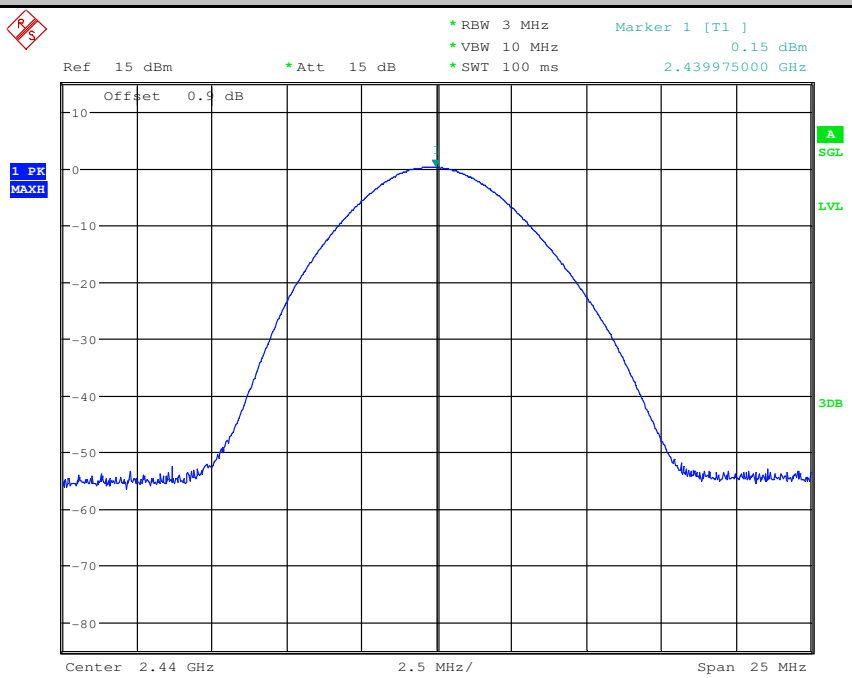
Test Mode	Test Channel	Power[dBm]	Limit[dBm]	Verdict
BLE	2402	-4.23	<30	PASS
BLE	2440	0.15	<30	PASS
BLE	2480	-0.05	<30	PASS

TEST PLOT

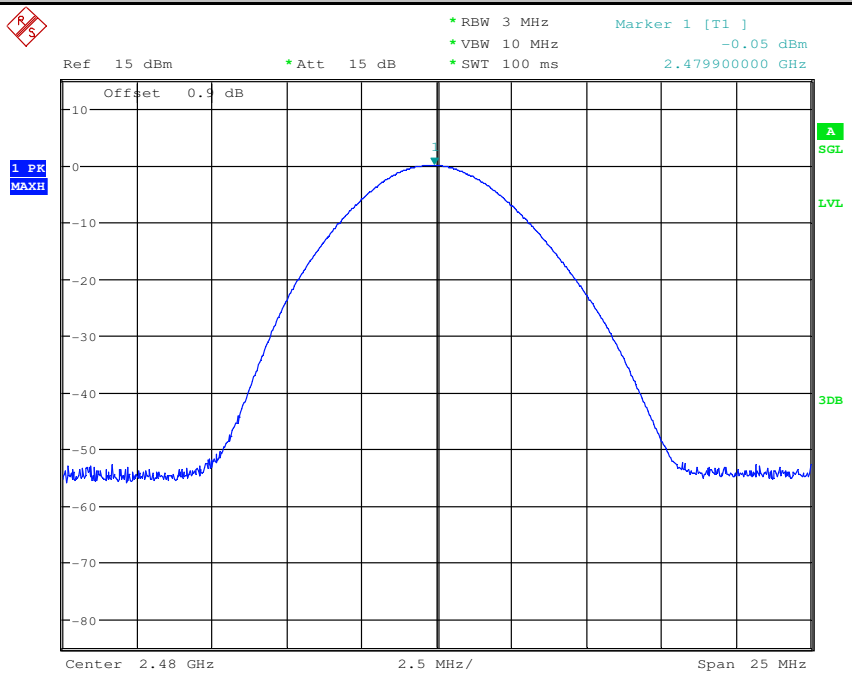
Maximum peak conducted output power_BLE_2402



Maximum peak conducted output power_BLE_2440



Maximum peak conducted output power_BLE_2480

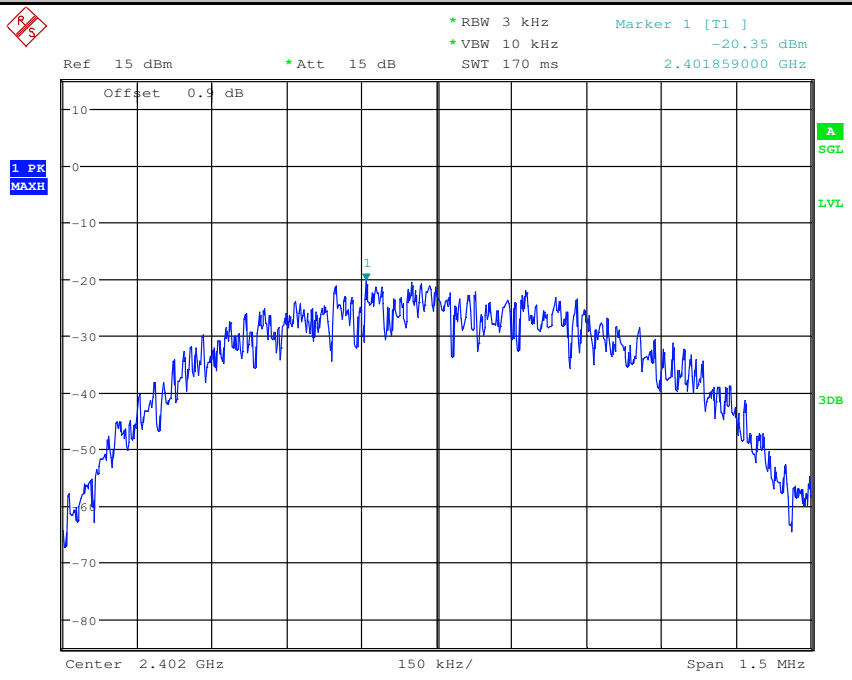


3.Maximum Peak power spectral density

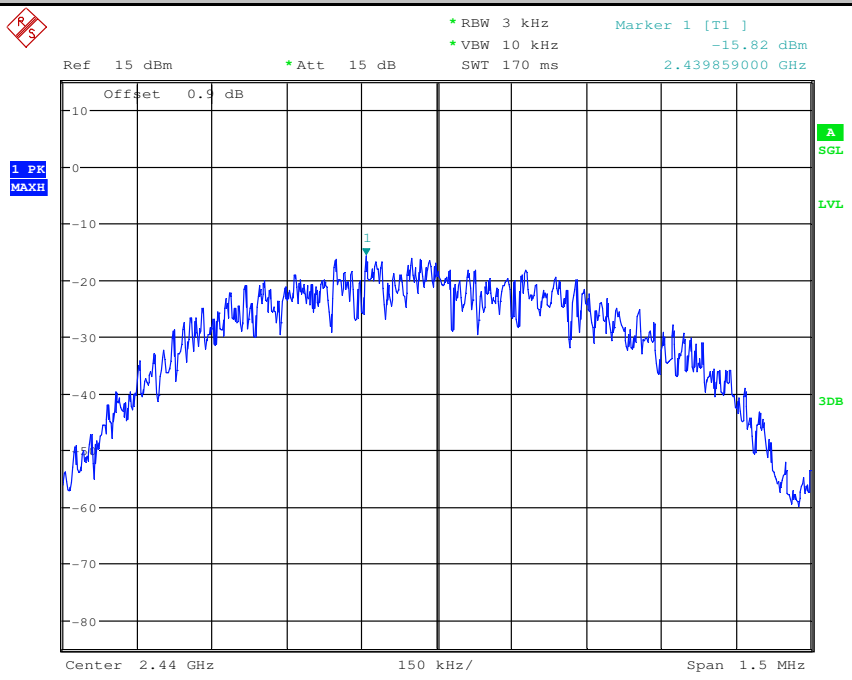
Test Mode	Test Channel	PSD[dBm/3kHz]	Limit[dBm/3kHz]	Verdict
BLE	2402	-20.35	<8.00	PASS
BLE	2440	-15.82	<8.00	PASS
BLE	2480	-16.16	<8.00	PASS

TEST PLOT

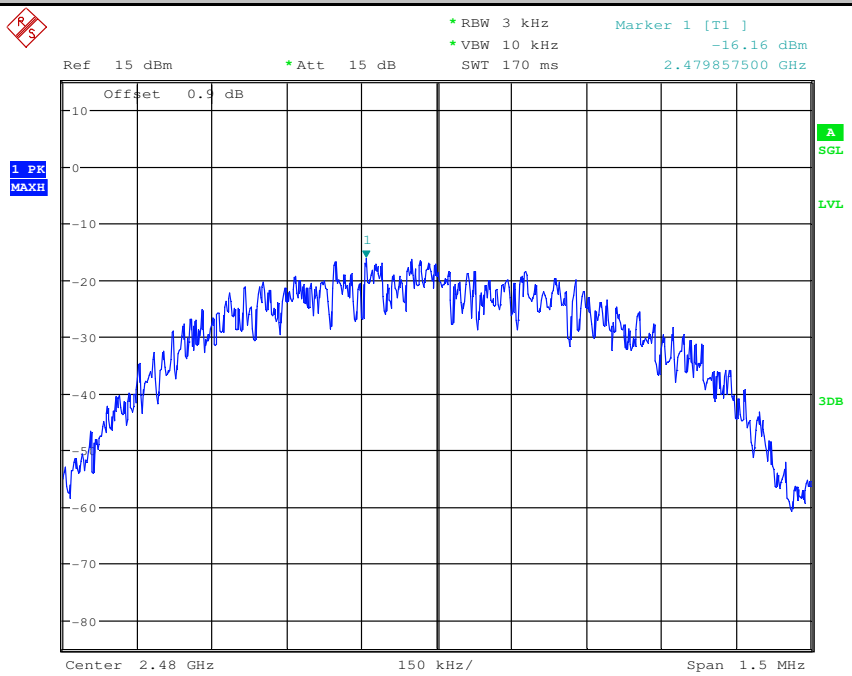
Maximum Peak power spectral density_BLE_2402



Maximum Peak power spectral density_BLE_2440



Maximum Peak power spectral density_BLE_2480

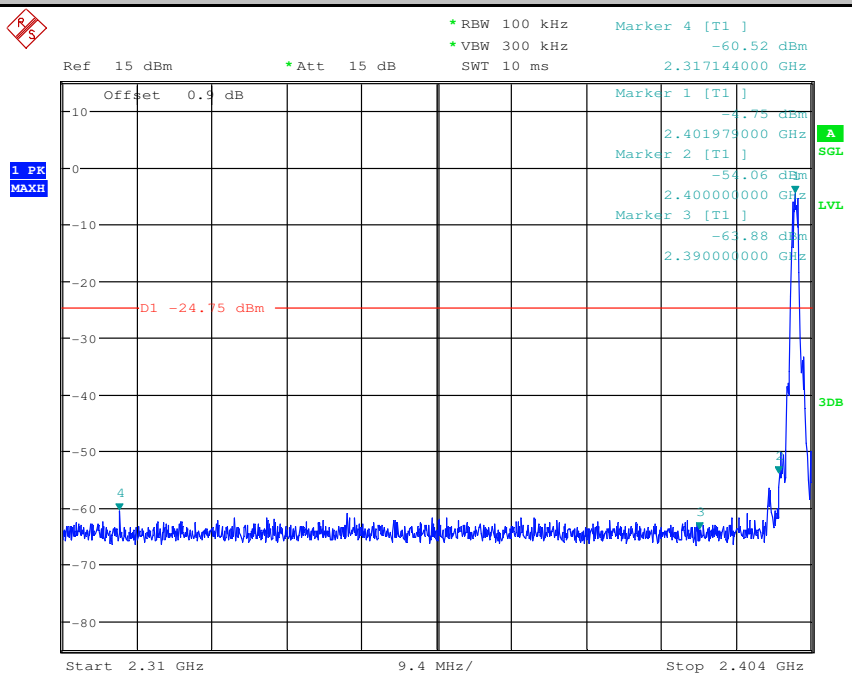


4.Band-edge for RF Conducted Emissions

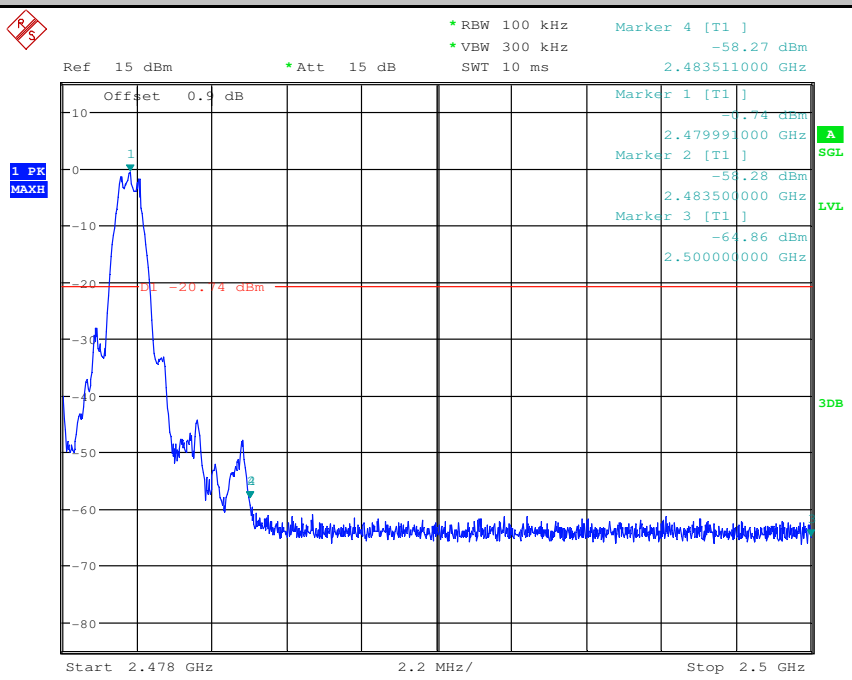
Test Mode	Test Channel	Carrier Power[dBm]	Max. Spurious Level [dBm]	Limit [dBm]	Verdict
BLE	2402	-4.750	-60.516	<-24.75	PASS
BLE	2480	-0.740	-58.271	<-20.74	PASS

TEST PLOT

Band-edge for RF Conducted Emissions_BLE_2402_Hopping Off

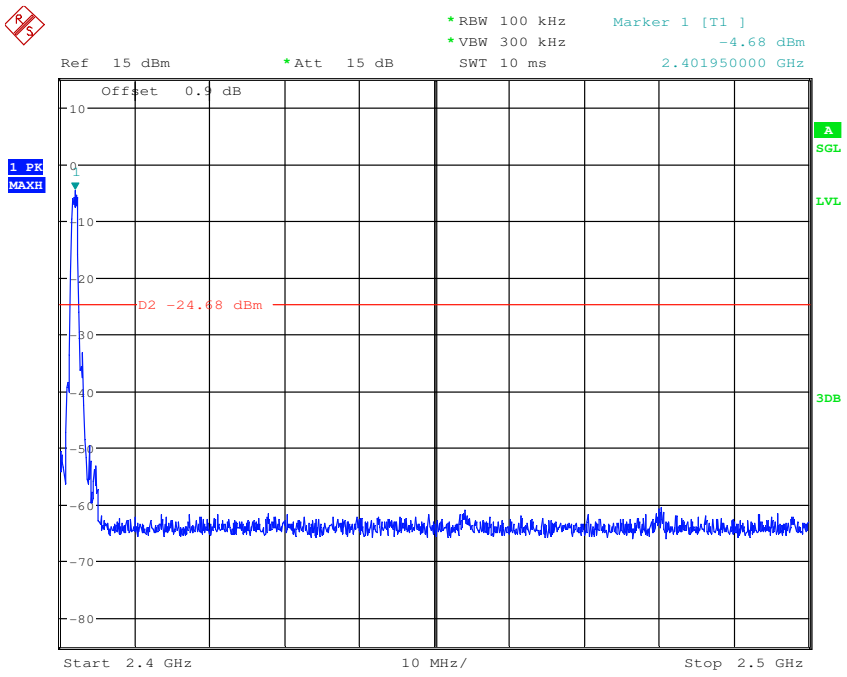
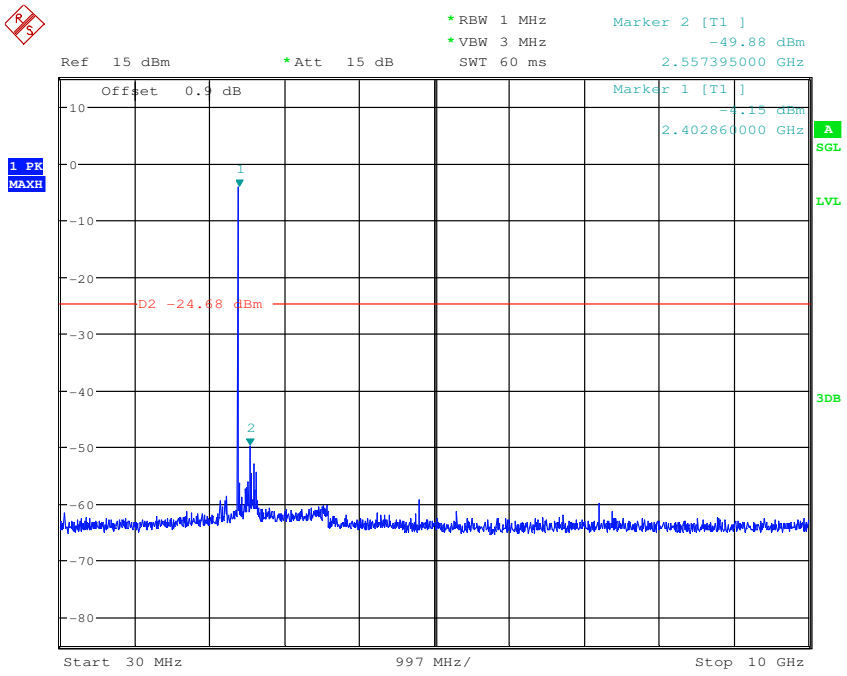


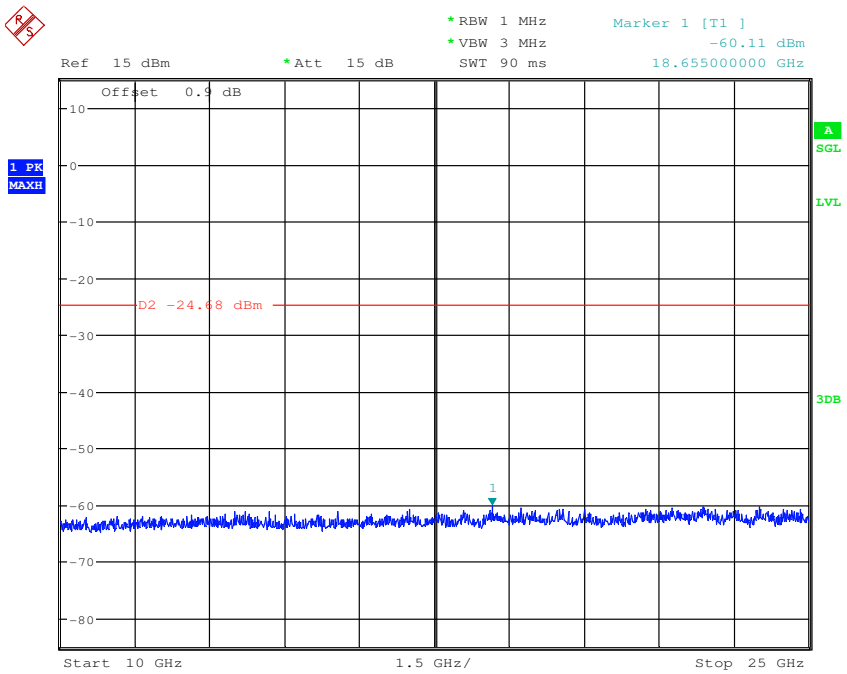
Band-edge for RF Conducted Emissions_BLE_2480_Hopping Off

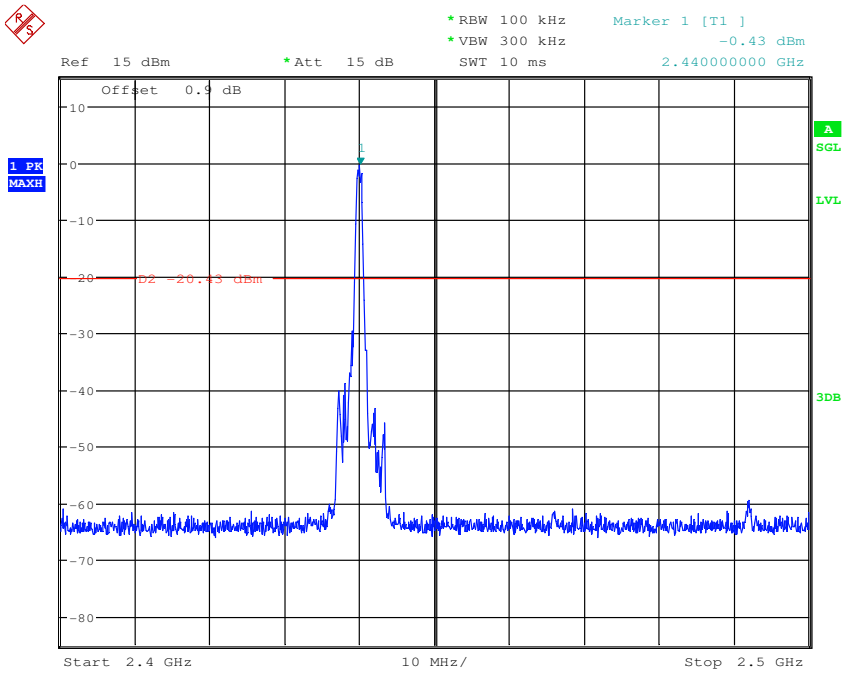


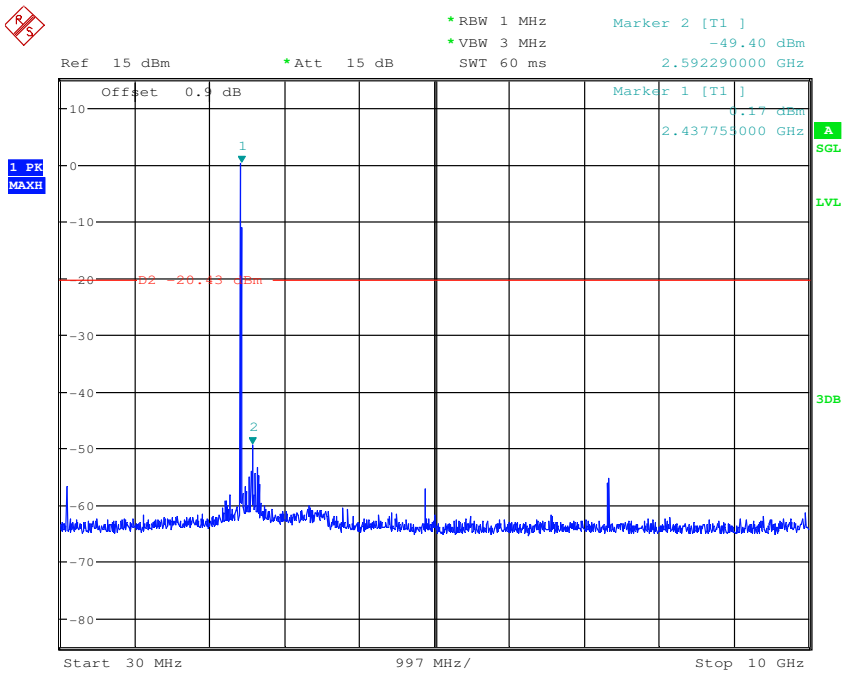
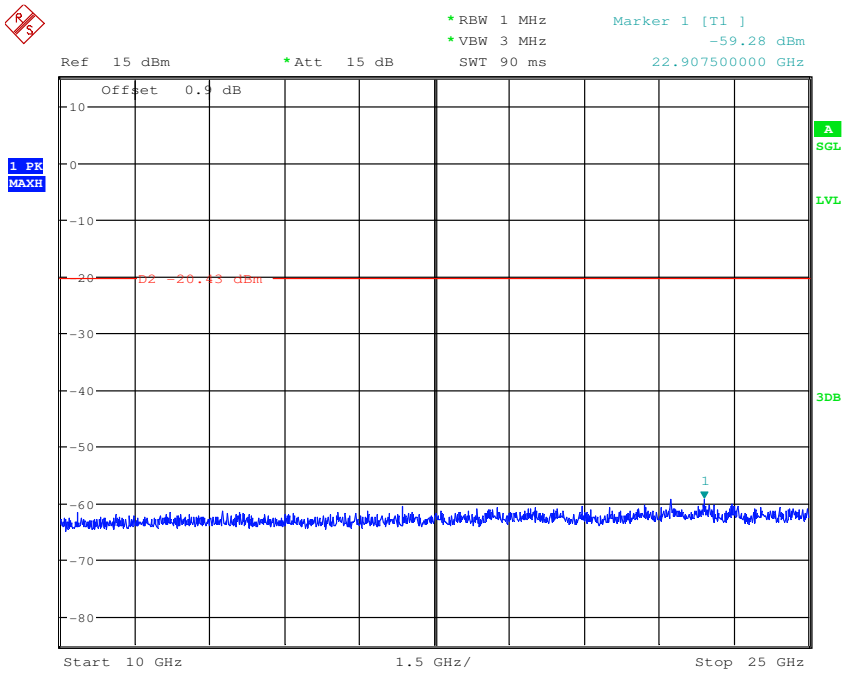
5.RF Conducted Spurious Emissions

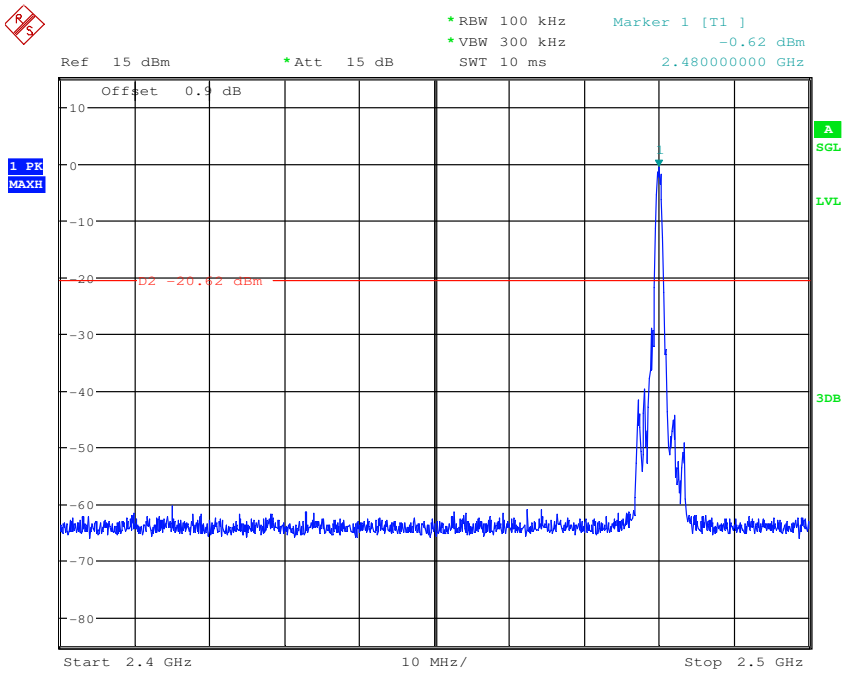
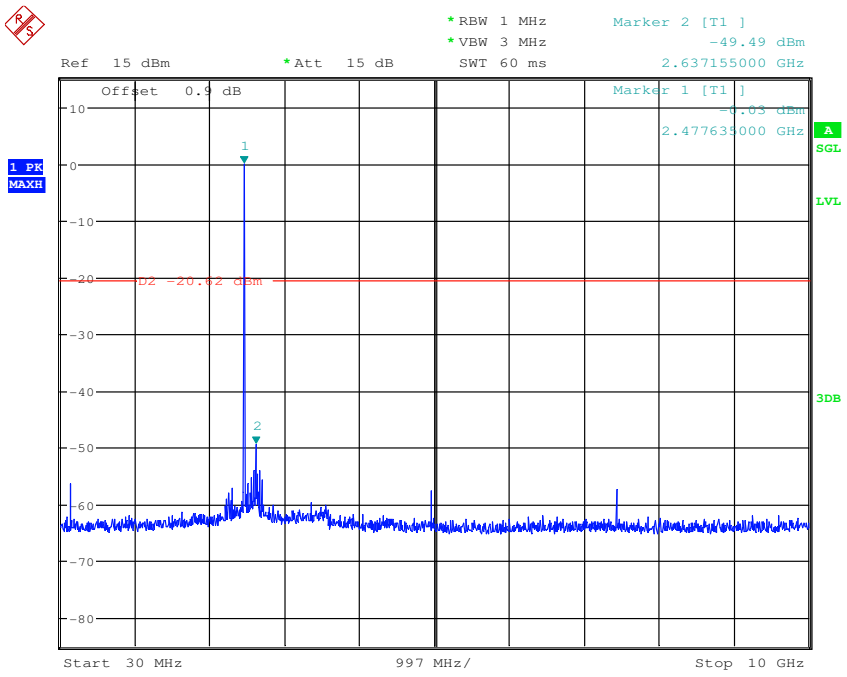
Test Mode	Test Channel	StartFre [MHz]	StopFre [MHz]	RBW [kHz]	VBW [kHz]	Pref[dBm]	Max. Level [dBm]	Limit [dBm]	Verdict
BLE	2402	30	10000	1000	3000	-4.68	-49.880	<-24.68	PASS
BLE	2402	10000	25000	1000	3000	-4.68	-60.110	<-24.68	PASS
BLE	2440	30	10000	1000	3000	-0.43	-49.400	<-20.43	PASS
BLE	2440	10000	25000	1000	3000	-0.43	-59.280	<-20.43	PASS
BLE	2480	30	10000	1000	3000	-0.62	-49.490	<-20.62	PASS
BLE	2480	10000	25000	1000	3000	-0.62	-59.420	<-20.62	PASS

TEST PLOT	
RF Conducted Spurious Emissions_BLE_2402	
Pref	
CSE_1	

CSE_2	

RF Conducted Spurious Emissions_BLE_2440	
Pref	

CSE_1	
CSE_2	

RF Conducted Spurious Emissions_BLE_2480	
Pref	
CSE_1	

CSE_2