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

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

Telephone: +86 (0) 755 2601 2053
Fax: +86 (0) 755 2671 0594
Email: ee.shenzhen@sgs.com

TEST REPORT

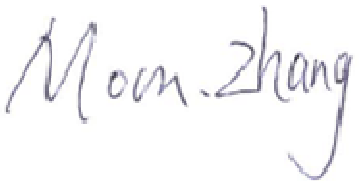
Application No.:	SZEM1703001792CR
Applicant:	ADMOBILIZE LLC
Address of Applicant:	1680 Michigan Avenue Suite 918, Miami Beach, Florida, United States
Manufacturer:	EMBEST TECHNOLOGY CO.,LTD.
Address of Manufacturer:	Tower B 4/F, Shanshui Building, Nanshan Yungu Innovation Industry Park, Liuxian Ave.No.1183, Nanshan District, Shenzhen, Guangdong, China
Factory:	EMBEST TECHNOLOGY CO.,LTD.
Address of Factory:	Tower B 4/F, Shanshui Building, Nanshan Yungu Innovation Industry Park, Liuxian Ave.No.1183, Nanshan District, Shenzhen, Guangdong, China
Equipment Under Test (EUT):	
EUT Name:	MATRIX Creator
Model No.:	MATRIX.C1.US
FCC ID:	2ALM5-MTXC1
Standards:	47 CFR Part 15, Subpart C 15.247
Date of Receipt:	2017-03-15
Date of Test:	2017-03-17 to 2017-04-18
Date of Issue:	2017-04-27
Test Result :	**Pass***

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

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		2017-04-27		Original

Authorized for issue by:				
Tested By				2017-04-18
		Moon Zhang /Project Engineer		**Date**
Checked By				2017-04-27
		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	Pass
Conducted Peak Output Power	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 11.9.1.1	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 6.10.4	47 CFR Part 15, Subpart C 15.209 & 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
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

Page

1 COVER PAGE 1

2 TEST SUMMARY 3

3 CONTENTS 4

4 GENERAL INFORMATION 6

4.1 DETAILS OF E.U.T. 6
4.2 DESCRIPTION OF SUPPORT UNITS 7
4.3 MEASUREMENT UNCERTAINTY 7
4.4 TEST LOCATION 8
4.5 TEST FACILITY 8
4.6 DEVIATION FROM STANDARDS 8
4.7 ABNORMALITIES FROM STANDARD CONDITIONS 8

5 EQUIPMENT LIST 9

6 RADIO SPECTRUM TECHNICAL REQUIREMENT 11

6.1 ANTENNA REQUIREMENT 11
6.1.1 Test Requirement: *11*
6.1.2 Conclusion *11*

7 RADIO SPECTRUM MATTER TEST RESULTS 12

7.1 CONDUCTED DISTURBANCE AT AC POWER LINE(150KHZ-30MHZ) 12
7.1.1 E.U.T. Operation *12*
7.1.2 Test Setup Diagram *12*
7.1.3 Measurement Procedure and Data *13*
7.2 CONDUCTED PEAK OUTPUT POWER 16
7.2.1 E.U.T. Operation *16*
7.2.2 Test Setup Diagram *16*
7.2.3 Measurement Data *16*
7.3 MINIMUM 6DB BANDWIDTH 17
7.3.1 E.U.T. Operation *17*
7.3.2 Test Setup Diagram *17*
7.3.3 Measurement Data *17*
7.4 POWER SPECTRUM DENSITY 18
7.4.1 E.U.T. Operation *18*
7.4.2 Test Setup Diagram *18*
7.4.3 Measurement Data *18*
7.5 CONDUCTED SPURIOUS EMISSIONS 19
7.5.1 E.U.T. Operation *19*
7.5.2 Test Setup Diagram *19*
7.5.3 Measurement Data *19*
7.6 RADIATED SPURIOUS EMISSIONS 20
7.6.1 E.U.T. Operation *21*
7.6.2 Test Setup Diagram *21*
7.6.3 Measurement Procedure and Data *22*
7.7 RADIATED EMISSIONS WHICH FALL IN THE RESTRICTED BANDS 27
7.7.1 E.U.T. Operation *27*
7.7.2 Test Setup Diagram *27*
7.7.3 Measurement Procedure and Data *28*

7.8 CONDUCTED BAND EDGES MEASUREMENT....33
7.8.1 E.U.T. Operation....*33*
7.8.2 Test Setup Diagram....*33*
7.8.3 Measurement Data....*33*

8 PHOTOGRAPHS....34

8.1 CONDUCTED DISTURBANCE AT AC POWER LINE(150KHZ-30MHZ) TEST SETUP....34
8.2 RADIATED SPURIOUS EMISSIONS TEST SETUP....34
8.3 EUT CONSTRUCTIONAL DETAILS....35

9 APPENDIX....36

9.1 APPENDIX 15.247....36

4 General Information

4.1 Details of E.U.T.

Frequency Range:	2405MHz to 2480MHz
Power Class:	< 10mW
Modulation Type:	O-QPSK
Number of Channels:	16
Sample Type:	Mobile device
Antenna Type:	Chip Antenna
Antenna Gain:	1.2dBi
Power supply:	DC 5V

Channel list							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
11	2405MHz	15	2425MHz	19	2445MHz	23	2465MHz
12	2410MHz	16	2430MHz	20	2450MHz	24	2470MHz
13	2415MHz	17	2435MHz	21	2455MHz	25	2475MHz
14	2420MHz	18	2440MHz	22	2460MHz	26	2480MHz

Selected Test Channel	
Channel	Frequency
The lowest channel (CH11)	2405MHz
The middle channel (CH18)	2440MHz
The highest channel (CH26)	2480MHz

4.2 Description of Support Units

Description	Manufacturer	Model No.	Serial No.
Adapter	Apple	A1357 W010A051	REF. No.SEA0500
Micro USB Cable	PHILIPS	SWR2101	REF. No.SEA0700
Raspberry Pi	Raspberry Pi Foundation	Raspberry Pi 3	--

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	2017-04-14	2018-04-14
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

Radiated Emissions					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
3m Semi-Anechoic Chamber	ETS-LINDGREN	N/A	SEM001-01	2016-05-13	2017-05-13
EMI Test Receiver	Agilent Technologies	N9038A	SEM004-05	2016-10-09	2017-10-09
BiConiLog Antenna (26-3000MHz)	ETS-LINDGREN	3142C	SEM003-01	2014-11-01	2017-11-01
Double-ridged horn (1-18GHz)	ETS-LINDGREN	3117	SEM003-11	2015-10-17	2018-10-17
Horn Antenna (18-26GHz)	ETS-LINDGREN	3160	SEM003-12	2014-11-24	2017-11-24

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 15.203

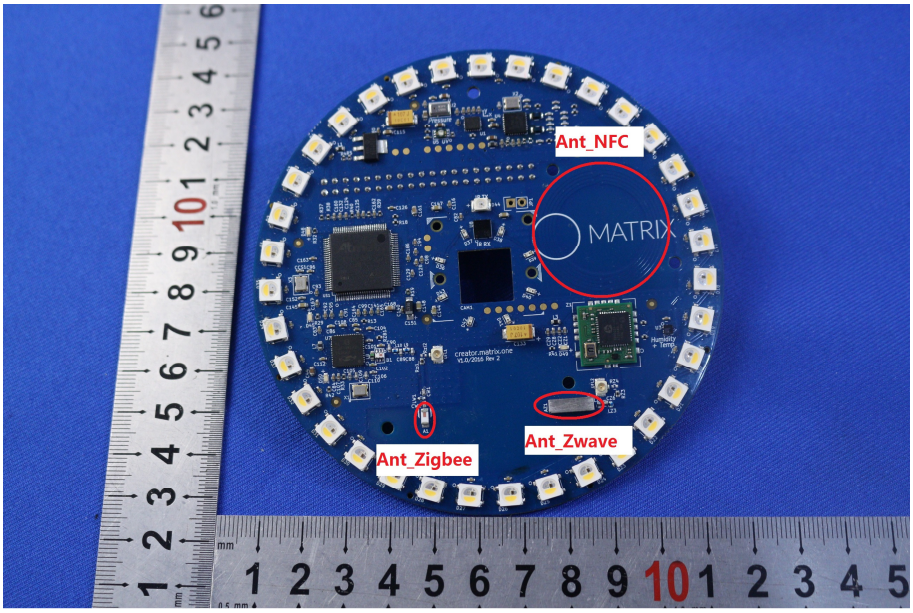
6.1.2 Conclusion

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.

EUT Antenna:

The antenna is integrated on the main PCB and no consideration of replacement. The best case gain of the antenna is 1.2dBi.



7 Radio Spectrum Matter Test Results

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

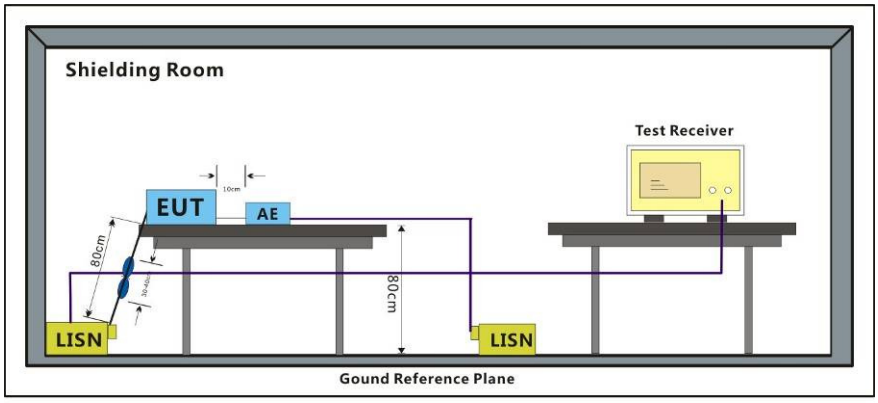
Test Requirement 47 CFR Part 15, Subpart C 15.207
Test Method: ANSI C63.10 (2013) Section 6.2
Limit:

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: 25 °C Humidity: 55 % RH Atmospheric Pressure: 1015 mbar
Test mode: d:TX mode_Keep the EUT in transmitting mode(ZIGBEE)

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.

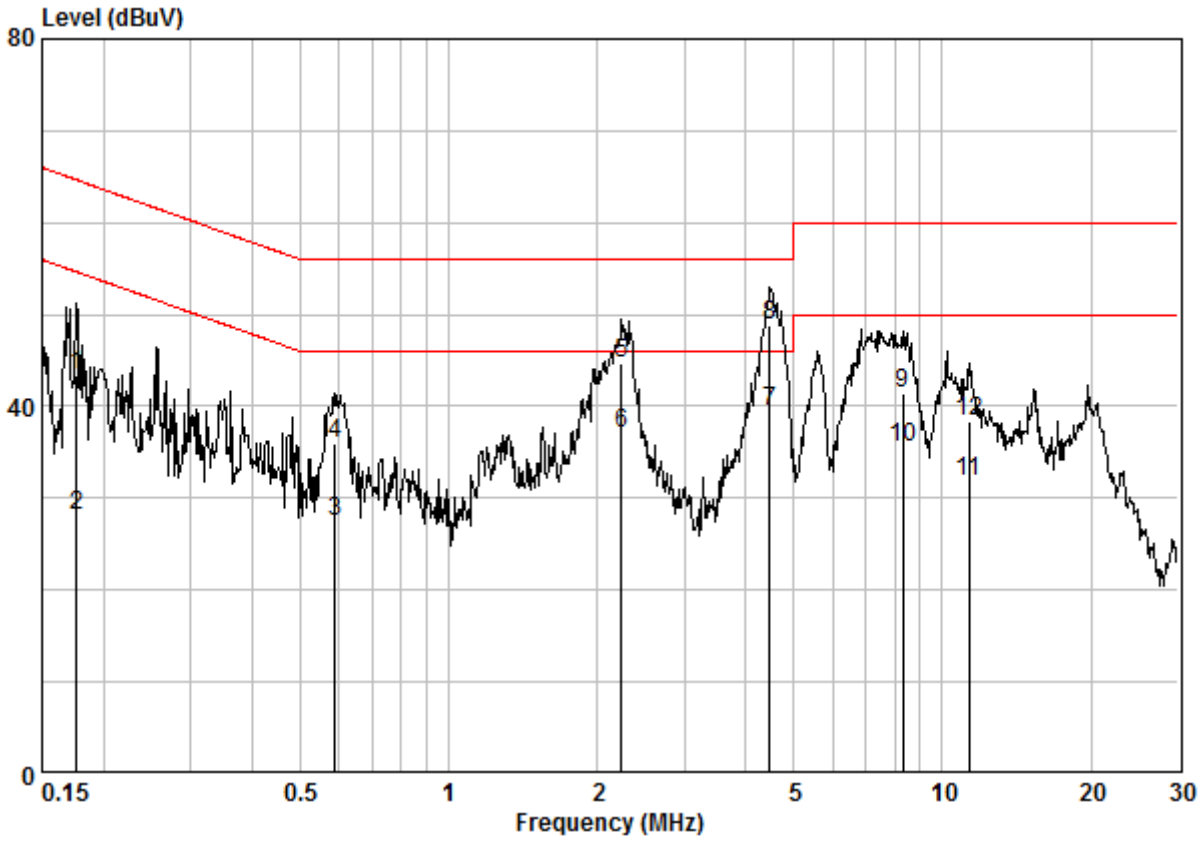
2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50ohm/50μH + 5ohm linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as 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 horizontal 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.

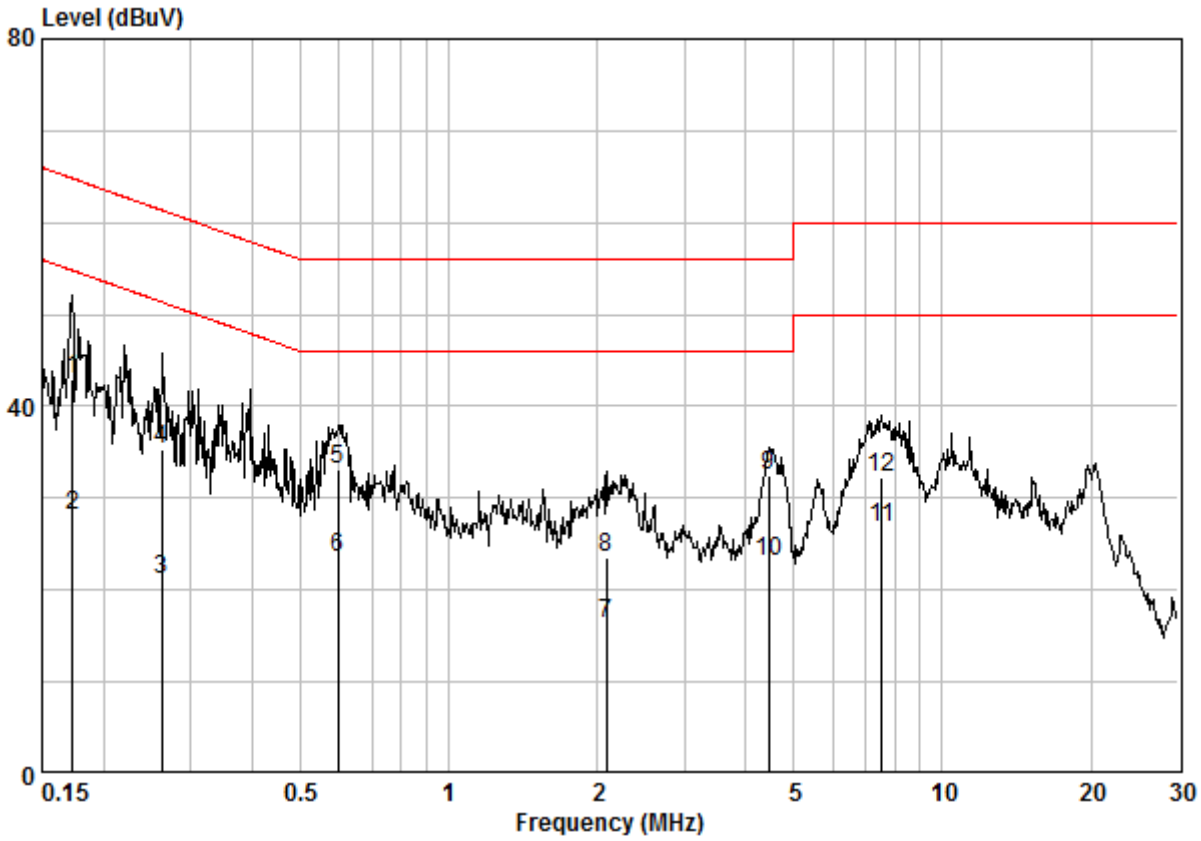
Mode:d; Line:Live Line



Site : Shielding Room
Condition : CE LINE
Job No. : 01792CR
Test Mode : d

		Freq	Cable Loss	LISN Factor	Read Level	Level	Limit Line	Over Limit	Remark
		MHz	dB	dB	dBuV	dBuV	dBuV	dB	
1		0.17584	0.02	9.64	33.73	43.39	64.68	-21.29	QP
2		0.17584	0.02	9.64	18.48	28.14	54.68	-26.54	AVERAGE
3		0.58851	0.02	9.65	17.85	27.52	46.00	-18.48	AVERAGE
4		0.58851	0.02	9.65	26.32	35.99	56.00	-20.01	QP
5		2.237	0.03	9.68	35.07	44.78	56.00	-11.22	QP
6		2.237	0.03	9.68	27.33	37.03	46.00	-8.97	AVERAGE
7	@	4.478	0.02	9.73	29.79	39.53	46.00	-6.47	AVERAGE
8	@	4.478	0.02	9.73	39.05	48.79	56.00	-7.21	QP
9		8.323	0.11	9.82	31.46	41.39	60.00	-18.61	QP
10		8.323	0.11	9.82	25.53	35.46	50.00	-14.54	AVERAGE
11		11.317	0.15	9.88	21.78	31.81	50.00	-18.19	AVERAGE
12		11.317	0.15	9.88	28.28	38.31	60.00	-21.69	QP

Mode:d; Line:Neutral Line



Site : Shielding Room
Condition : CE NEUTRAL
Job No. : 01792CR
Test Mode : d

	Freq	Cable Loss	LISN Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB	dBuV	dBuV	dBuV	dB	
1	0.17307	0.02	9.63	33.25	42.90	64.81	-21.91	QP
2	0.17307	0.02	9.63	18.49	28.14	54.81	-26.67	AVERAGE
3	0.26164	0.02	9.63	11.48	21.13	51.38	-30.25	AVERAGE
4	0.26164	0.02	9.63	25.74	35.39	61.38	-25.99	QP
5	0.59794	0.02	9.63	23.46	33.11	56.00	-22.89	QP
6	0.59794	0.02	9.63	13.85	23.50	46.00	-22.50	AVERAGE
7	2.088	0.03	9.66	6.60	16.29	46.00	-29.71	AVERAGE
8	2.088	0.03	9.66	13.80	23.49	56.00	-32.51	QP
9	4.454	0.02	9.70	22.81	32.53	56.00	-23.47	QP
10	4.454	0.02	9.70	13.31	23.03	46.00	-22.97	AVERAGE
11	7.526	0.09	9.78	17.03	26.91	50.00	-23.09	AVERAGE
12	7.526	0.09	9.78	22.29	32.16	60.00	-27.84	QP

7.2 Conducted Peak Output Power

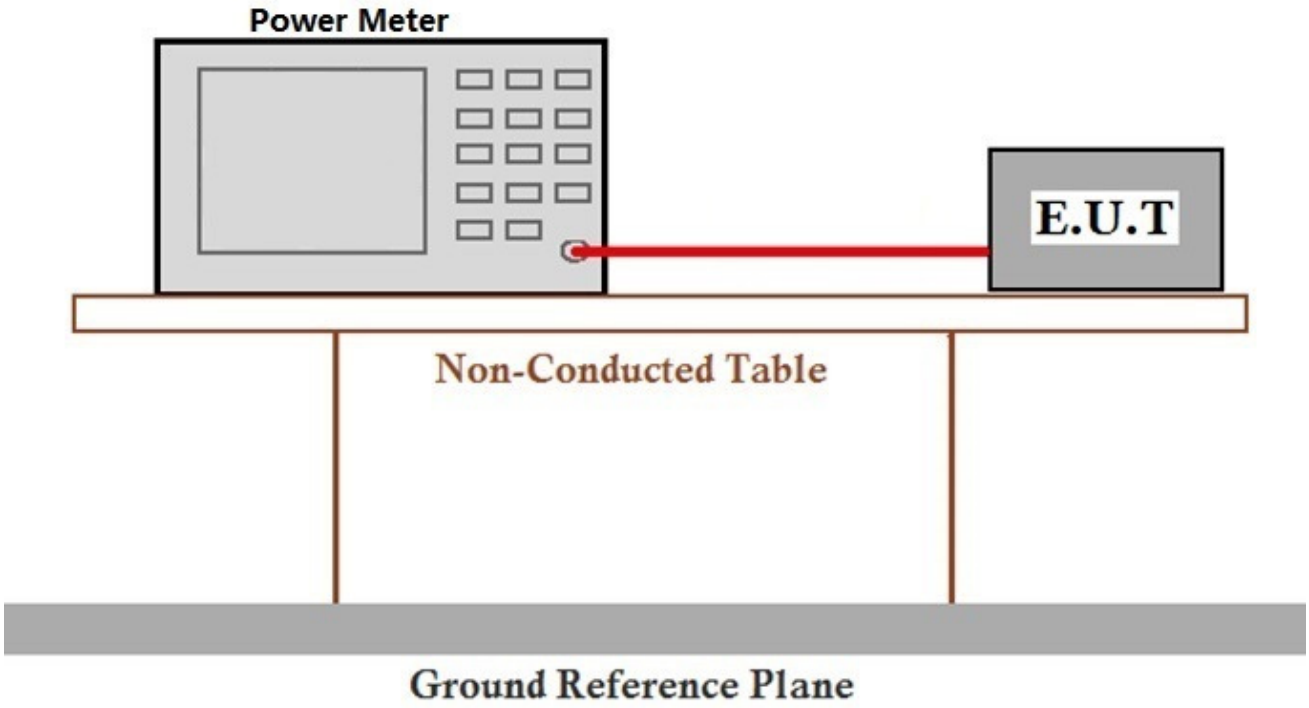
Test Requirement 47 CFR Part 15, Subpart C 15.247(b)(3)
Test Method: ANSI C63.10 (2013) Section 11.9.1.1
Limit:

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

7.2.1 E.U.T. Operation

Operating Environment:
Temperature: 23 °C Humidity: 56 % RH Atmospheric Pressure: 1020 mbar
Test mode: d:TX mode_Keep the EUT in transmitting mode(ZIGBEE)

7.2.2 Test Setup Diagram



7.2.3 Measurement Data

The detailed test data see: Appendix 15.247

7.3 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

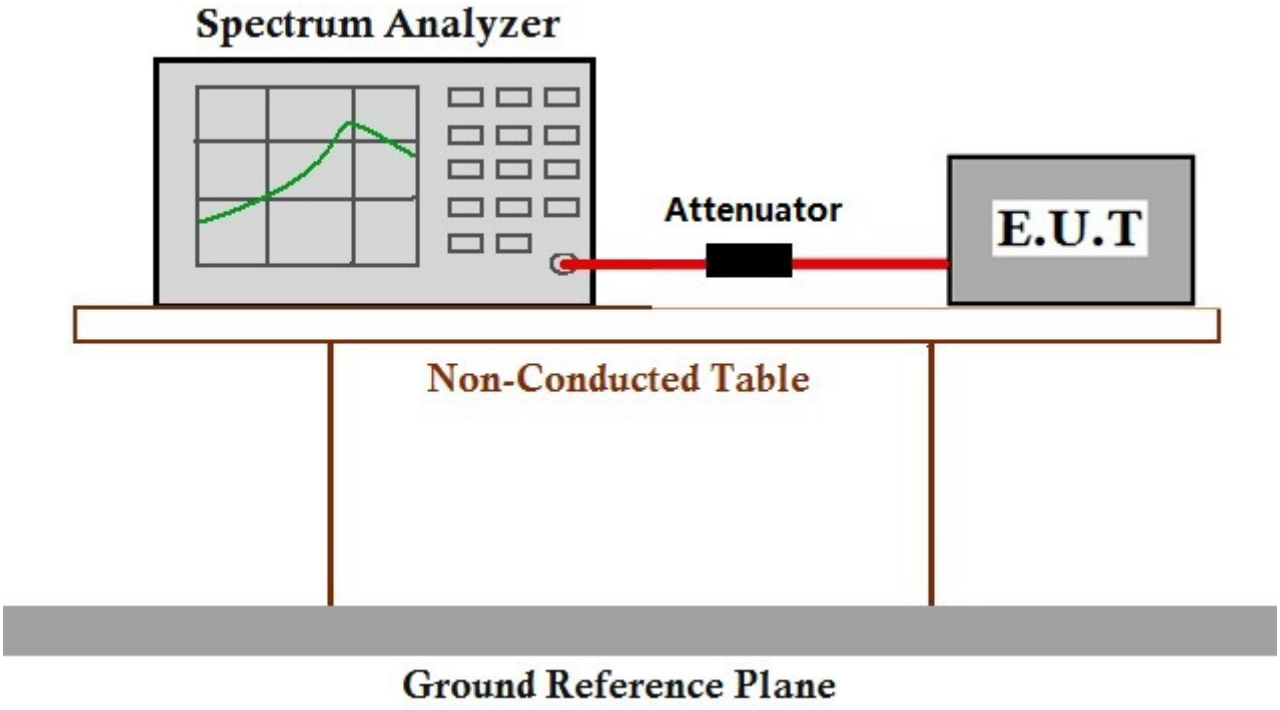
7.3.1 E.U.T. Operation

Operating Environment:

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

Test mode: d:TX mode_Keep the EUT in transmitting mode(ZIGBEE)

7.3.2 Test Setup Diagram



7.3.3 Measurement Data

The detailed test data see: Appendix 15.247

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

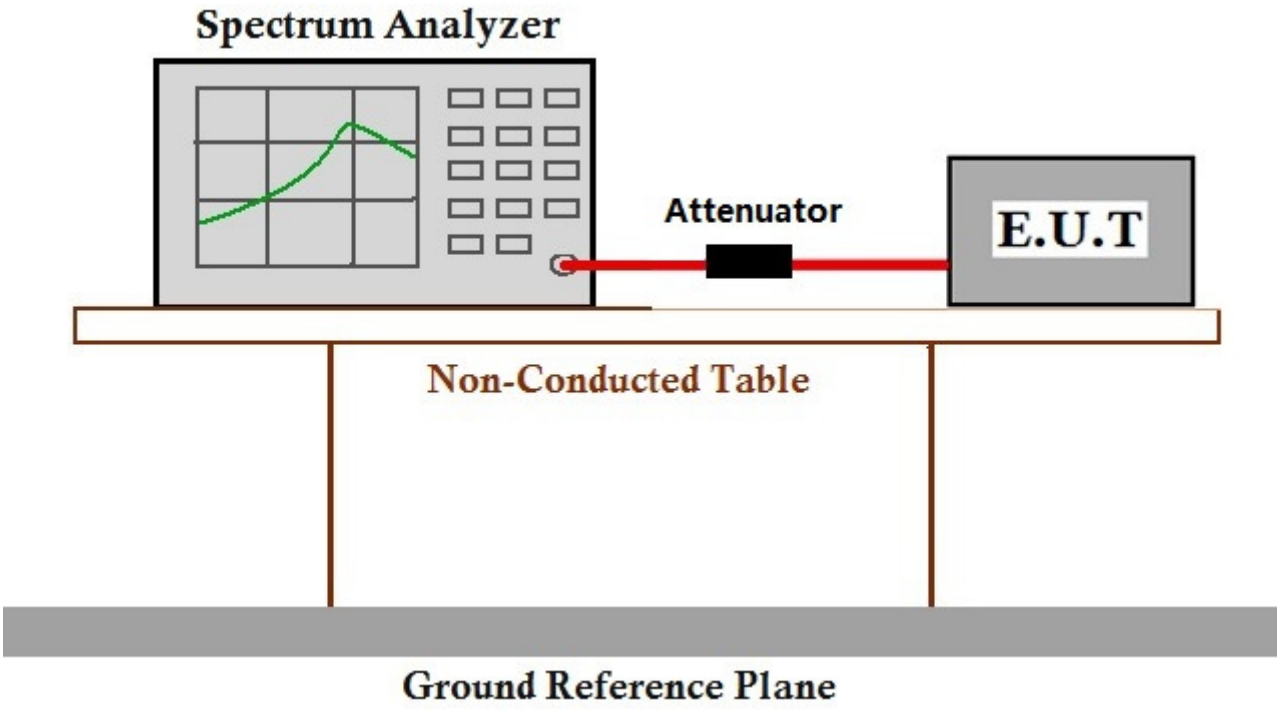
7.4.1 E.U.T. Operation

Operating Environment:

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

Test mode: d:TX mode_Keep the EUT in transmitting mode(ZIGBEE)

7.4.2 Test Setup Diagram



7.4.3 Measurement Data

The detailed test data see: Appendix 15.247

7.5 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.

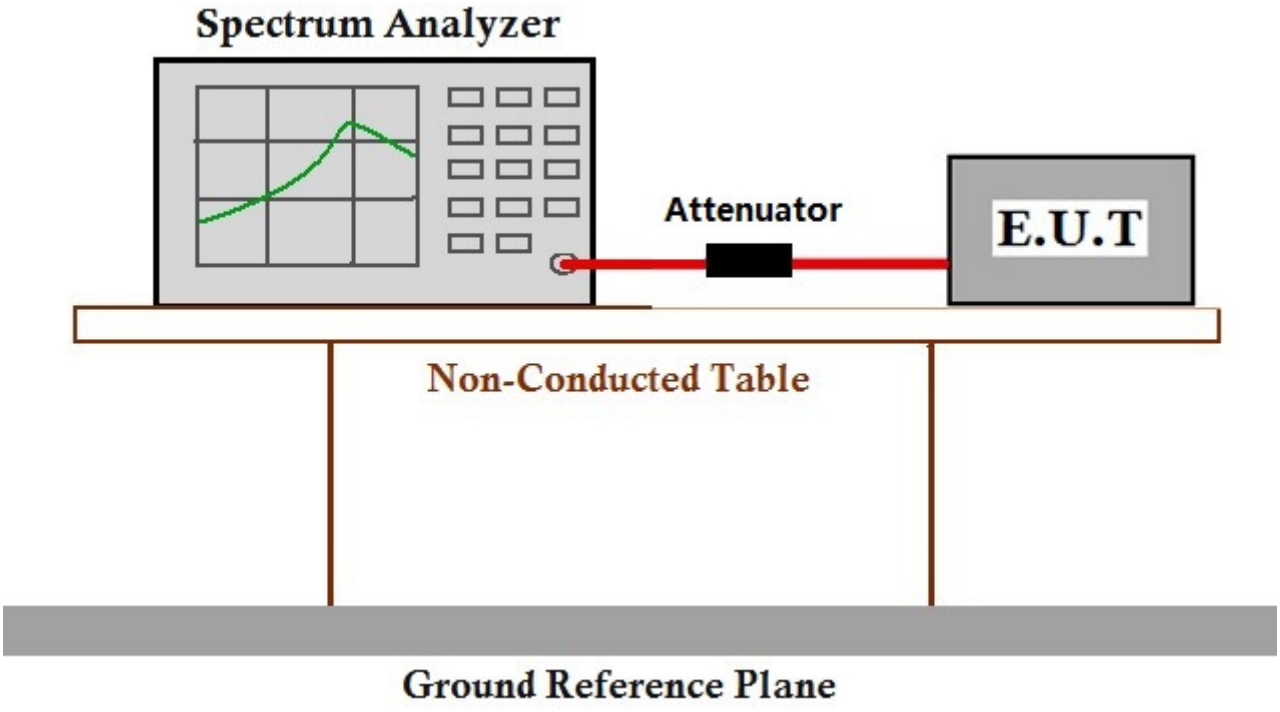
7.5.1 E.U.T. Operation

Operating Environment:

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

Test mode: d:TX mode_Keep the EUT in transmitting mode(ZIGBEE)

7.5.2 Test Setup Diagram



7.5.3 Measurement Data

The detailed test data see: Appendix 15.247

7.6 Radiated Spurious Emissions

Test Requirement 47 CFR Part 15, Subpart C 15.209 & 15.247(d)
Test Method: ANSI C63.10 (2013) Section 6.10.4
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.		

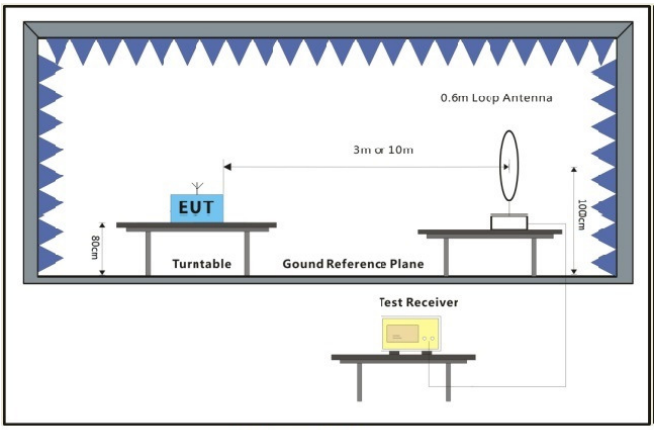
7.6.1 E.U.T. Operation

Operating Environment:

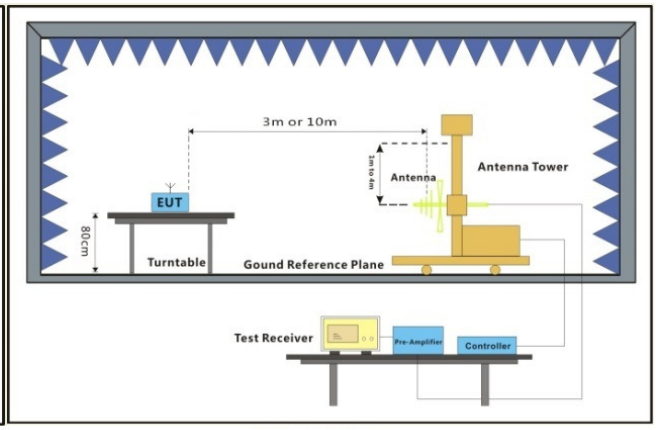
Temperature: 23 °C Humidity: 53 % RH Atmospheric Pressure: 1015 mbar

Test mode: d:TX mode_Keep the EUT in transmitting mode(ZIGBEE)

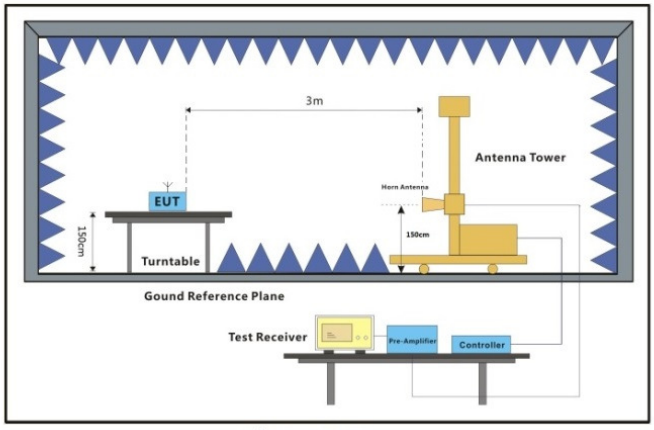
7.6.2 Test Setup Diagram



Below 30MHz



30MHz-1GHz



Above 1GHz

7.6.3 Measurement Procedure and 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.

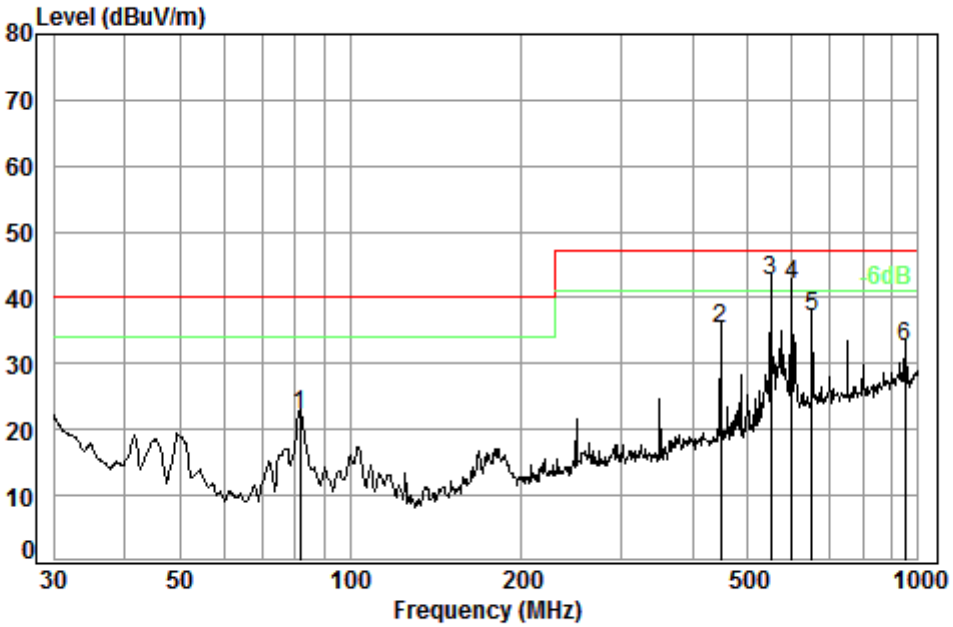
g. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified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

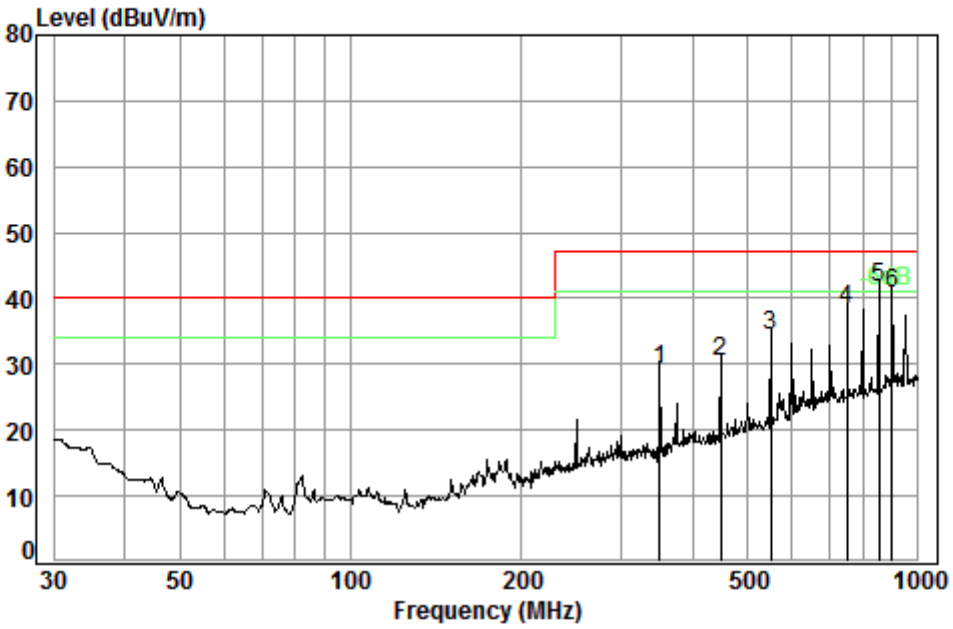
Radiated Emission below 1GHz		
30MHz~1GHz (QP)		
Test mode:	Transmitting mode	Vertical



Condition: 3m VERTICAL
Job No. : 01792CR
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	81.50	1.10	7.85	27.23	40.43	22.15	40.00	-17.85
2	449.56	2.41	16.89	27.44	43.28	35.14	47.00	-11.86
3 pp	549.02	2.65	18.88	27.62	48.55	42.46	47.00	-4.54
4	599.32	2.70	19.78	27.54	47.01	41.95	47.00	-5.05
5	649.66	2.80	20.60	27.47	41.04	36.97	47.00	-10.03
6	948.76	3.65	23.30	26.54	32.24	32.65	47.00	-14.35

Test mode:	Transmitting mode	Horizontal



Condition: 3m HORIZONTAL
Job No. : 01792CR
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	350.48	2.06	13.94	26.79	40.11	29.32	47.00	-17.68
2	449.56	2.41	16.89	27.44	38.67	30.53	47.00	-16.47
3	549.02	2.65	18.88	27.62	40.44	34.35	47.00	-12.65
4	750.11	3.06	21.70	27.35	40.94	38.35	47.00	-8.65
5 pp	851.04	3.41	22.42	27.02	42.81	41.62	47.00	-5.38
6	900.15	3.60	23.20	26.78	40.85	40.87	47.00	-6.13

Transmitter Emission above 1GHz								
Test mode:		O-QPSK	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
1300.858	24.96	4.22	38.07	51.78	43.38	74.00	-30.62	Vertical
3196.094	31.67	6.08	37.92	45.22	45.69	74.00	-28.31	Vertical
4810.000	34.16	7.73	38.40	48.42	52.30	74.00	-21.70	Vertical
7215.000	36.41	9.66	37.10	42.25	51.47	74.00	-22.53	Vertical
9620.000	37.52	11.06	35.09	38.11	52.05	74.00	-21.95	Vertical
15443.410	41.39	15.21	38.41	34.66	53.45	74.00	-20.55	Vertical
1597.181	26.24	4.59	38.04	49.48	42.76	74.00	-31.24	Horizontal
3141.145	31.57	6.04	37.91	44.36	44.72	74.00	-29.28	Horizontal
4810.000	34.16	7.73	38.40	43.97	47.85	74.00	-26.15	Horizontal
7215.000	36.41	9.66	37.10	42.76	51.98	74.00	-22.02	Horizontal
9620.000	37.52	11.06	35.09	38.24	52.18	74.00	-21.82	Horizontal
14660.480	40.69	14.76	38.93	36.05	53.14	74.00	-20.86	Horizontal

Test mode:		O-QPSK	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
1059.511	23.74	3.86	38.09	58.54	48.45	74.00	-25.55	Vertical
3337.710	31.92	6.19	37.93	44.02	44.78	74.00	-29.22	Vertical
4890.000	34.31	7.85	38.44	47.29	51.42	74.00	-22.58	Vertical
7335.000	36.37	9.73	37.01	41.59	50.91	74.00	-23.09	Vertical
9780.000	37.56	11.23	35.01	38.15	52.39	74.00	-21.61	Vertical
14408.430	40.18	14.70	38.96	37.41	53.89	74.00	-20.11	Vertical
1597.181	26.24	4.59	38.04	49.60	42.88	74.00	-31.12	Horizontal
3328.077	31.91	6.18	37.93	44.40	45.15	74.00	-28.85	Horizontal
4890.000	34.31	7.85	38.44	46.17	50.30	74.00	-23.70	Horizontal
7335.000	36.37	9.73	37.01	41.10	50.42	74.00	-23.58	Horizontal
9780.000	37.56	11.23	35.01	37.20	51.44	74.00	-22.56	Horizontal
16504.960	42.70	16.04	37.04	30.64	53.02	74.00	-20.98	Horizontal

Test mode:		O-QPSK		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
1059.511	23.74	3.86	38.09	59.02	48.93	74.00	-25.07	Vertical
3318.471	31.89	6.17	37.93	44.12	44.84	74.00	-29.16	Vertical
4960.000	34.43	7.94	38.48	45.91	50.23	74.00	-23.77	Vertical
7440.000	36.33	9.81	36.91	42.00	51.45	74.00	-22.55	Vertical
9920.000	37.59	11.37	34.94	38.41	52.89	74.00	-21.11	Vertical
15265.880	41.35	15.07	38.61	35.10	53.50	74.00	-20.50	Vertical
1601.804	26.26	4.59	38.04	44.85	38.15	74.00	-35.85	Horizontal
3150.237	31.59	6.05	37.92	44.06	44.44	74.00	-29.56	Horizontal
4960.000	34.43	7.94	38.48	43.08	47.40	74.00	-26.60	Horizontal
7440.000	36.33	9.81	36.91	41.85	51.30	74.00	-22.70	Horizontal
9920.000	37.59	11.37	34.94	38.37	52.85	74.00	-21.15	Horizontal
16891.040	42.78	16.76	36.46	29.57	53.37	74.00	-20.63	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.

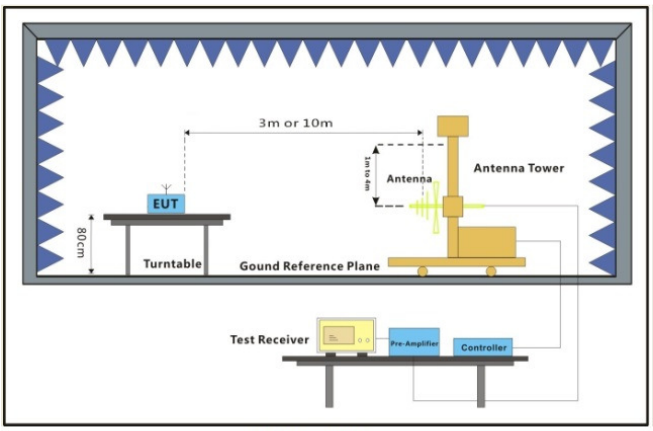
7.7 Radiated Emissions which fall in the restricted bands

Test Requirement 47 CFR Part 15, Subpart C 15.209 & 15.247(d)
Test Method: ANSI C63.10 (2013) Section 6.10.5
Measurement Distance: 3m

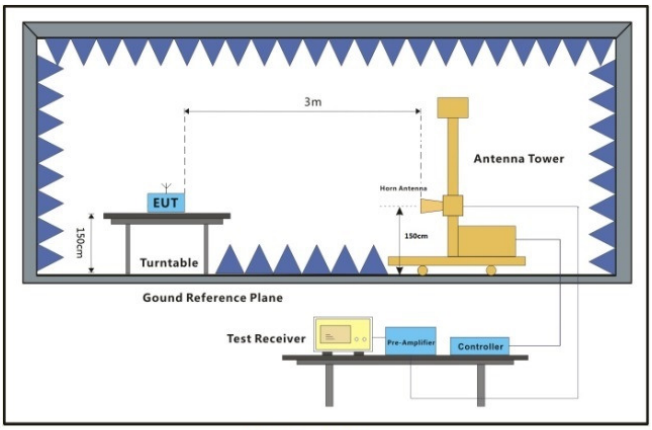
7.7.1 E.U.T. Operation

Operating Environment:
Temperature: 23 °C Humidity: 53 % RH Atmospheric Pressure: 1015 mbar
Test mode: d:TX mode_Keep the EUT in transmitting mode(ZIGBEE)

7.7.2 Test Setup Diagram



30MHz-1GHz



Above 1GHz

7.7.3 Measurement Procedure and 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.

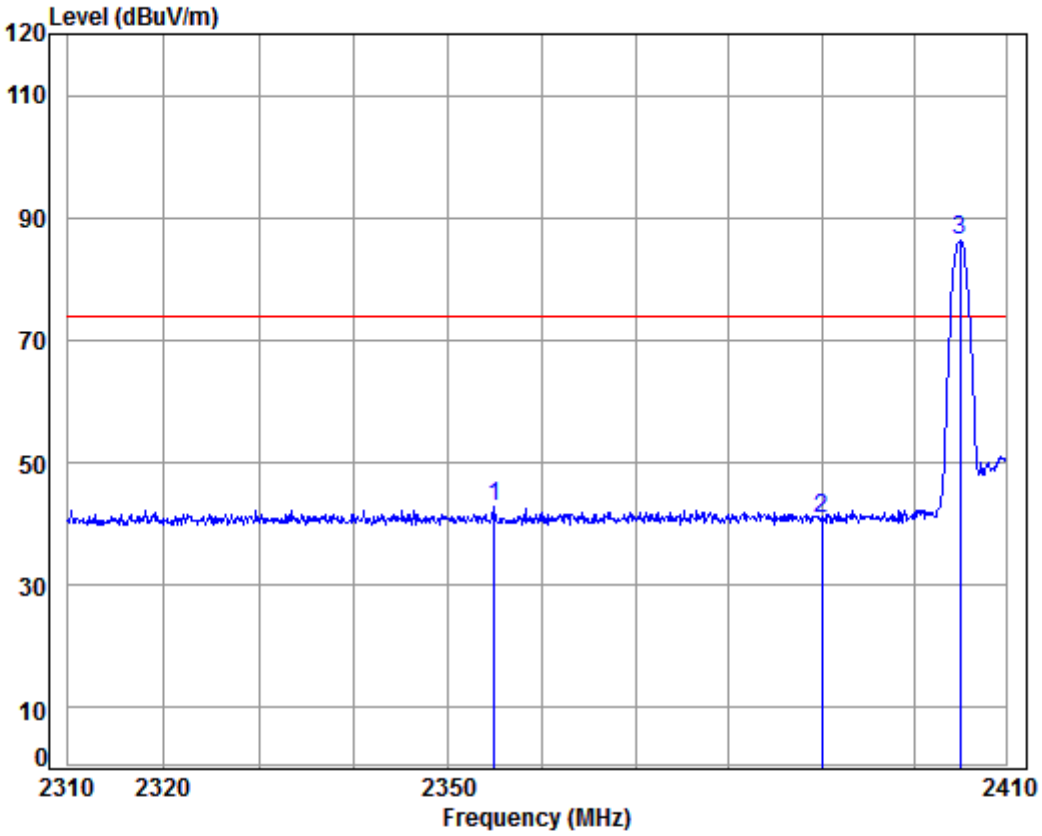
g. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified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

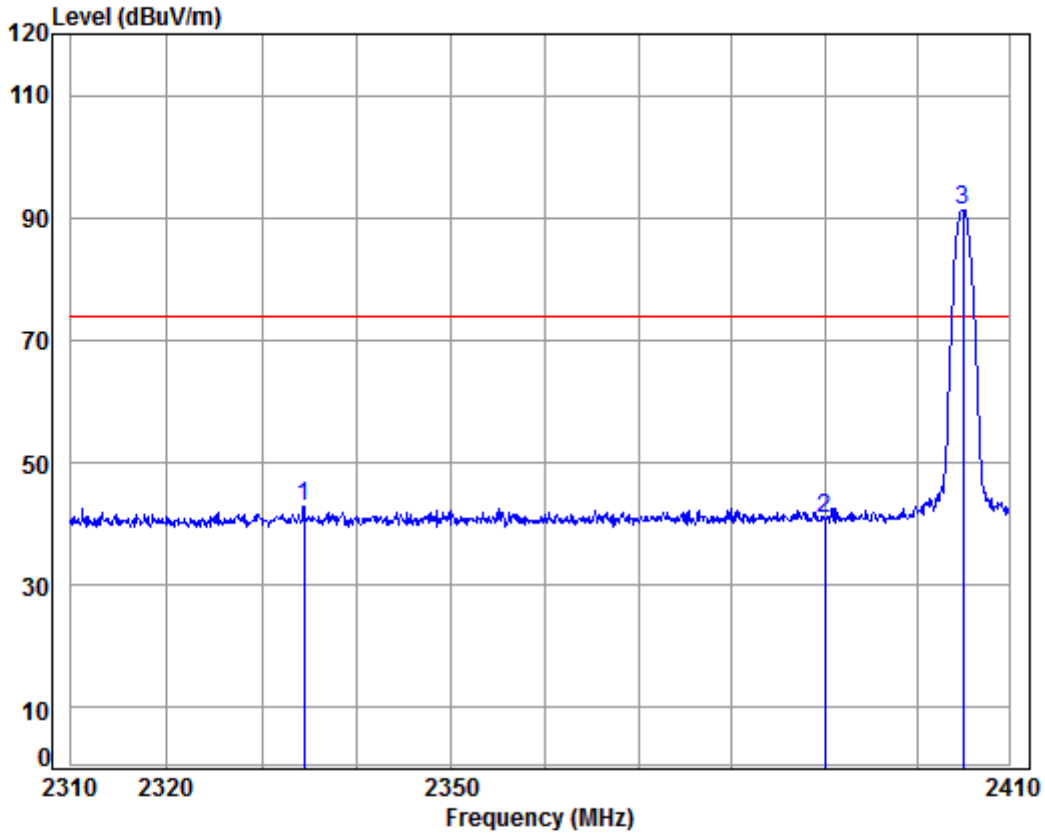
Mode:d; Polarization:Horizontal; Modulation Type:O-QPSK; Channel:Low



Condition: 3m HORIZONTAL
Job No: : 01792CR
Mode: : 2405 Bandedge
: Zigbee

	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	2354.975	5.31	28.97	37.96	46.51	42.83	74.00	-31.17	Peak
2	2390.000	5.34	29.08	37.96	44.53	40.99	74.00	-33.01	Peak
3 pp	2405.001	5.35	29.12	37.96	89.69	86.20	74.00	12.20	Peak

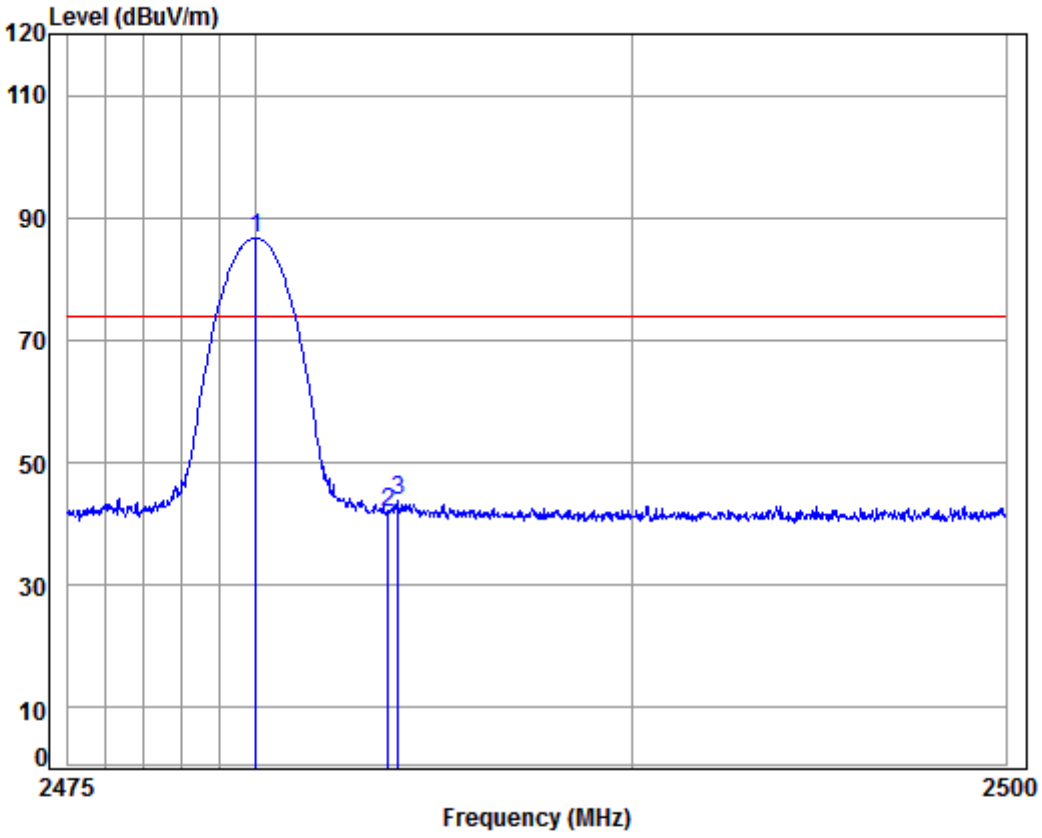
Mode:d; Polarization:Vertical; Modulation Type:O-QPSK; Channel:Low



Condition: 3m VERTICAL
Job No: : 01792CR
Mode: : 2405 Bandedge
: Zigbee

	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	2334.505	5.29	28.91	37.97	46.73	42.96	74.00	-31.04	Peak
2	2390.000	5.34	29.08	37.96	44.33	40.79	74.00	-33.21	Peak
3 pp	2405.001	5.35	29.12	37.96	94.87	91.38	74.00	17.38	Peak

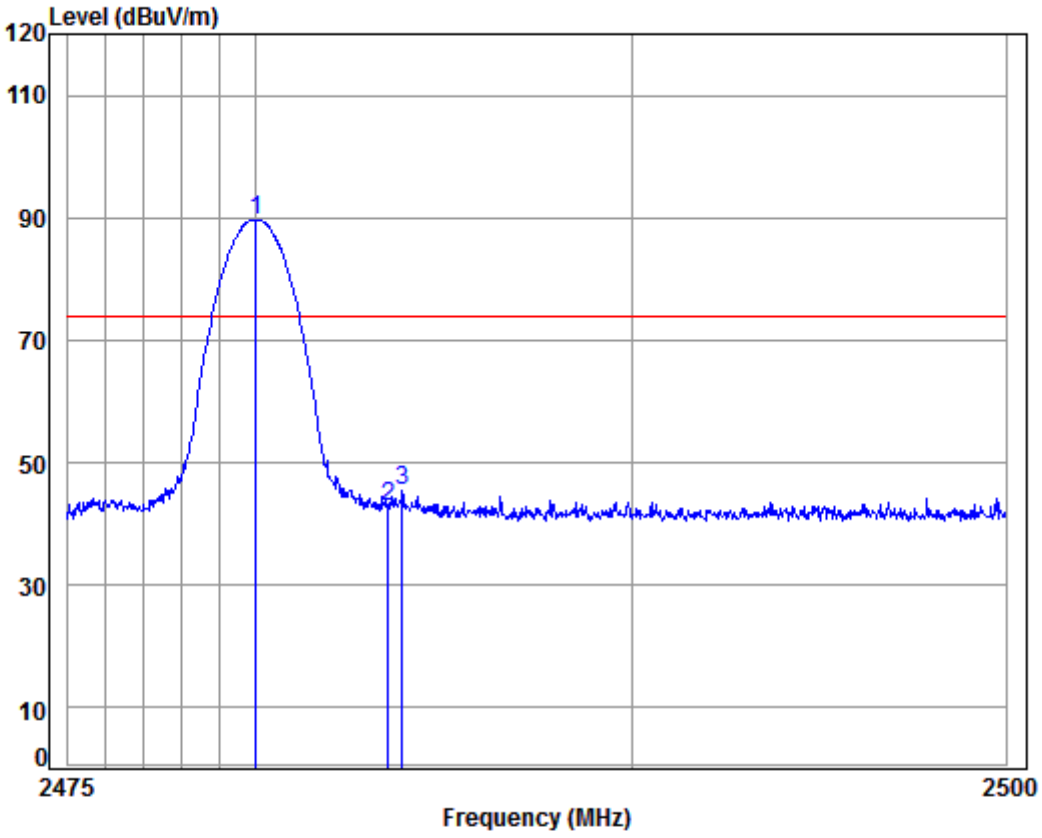
Mode:d; Polarization:Horizontal; Modulation Type:O-QPSK; Channel:High



Condition: 3m HORIZONTAL
Job No: : 01792CR
Mode: : 2480 Bandedge
: Zigbee

	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	37.95	89.86	86.66	74.00	12.66	Peak
2	2483.500	5.41	29.35	37.95	45.02	41.83	74.00	-32.17	Peak
3	2483.771	5.41	29.35	37.95	46.91	43.72	74.00	-30.28	Peak

Mode:d; Polarization:Vertical; Modulation Type:O-QPSK; Channel:High



Condition: 3m VERTICAL
Job No: : 01792CR
Mode: : 2480 Bandedge
: Zigbee

	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	37.95	92.93	89.73	74.00	15.73	Peak
2	2483.500	5.41	29.35	37.95	46.00	42.81	74.00	-31.19	Peak
3	2483.871	5.41	29.35	37.95	48.75	45.56	74.00	-28.44	Peak

7.8 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

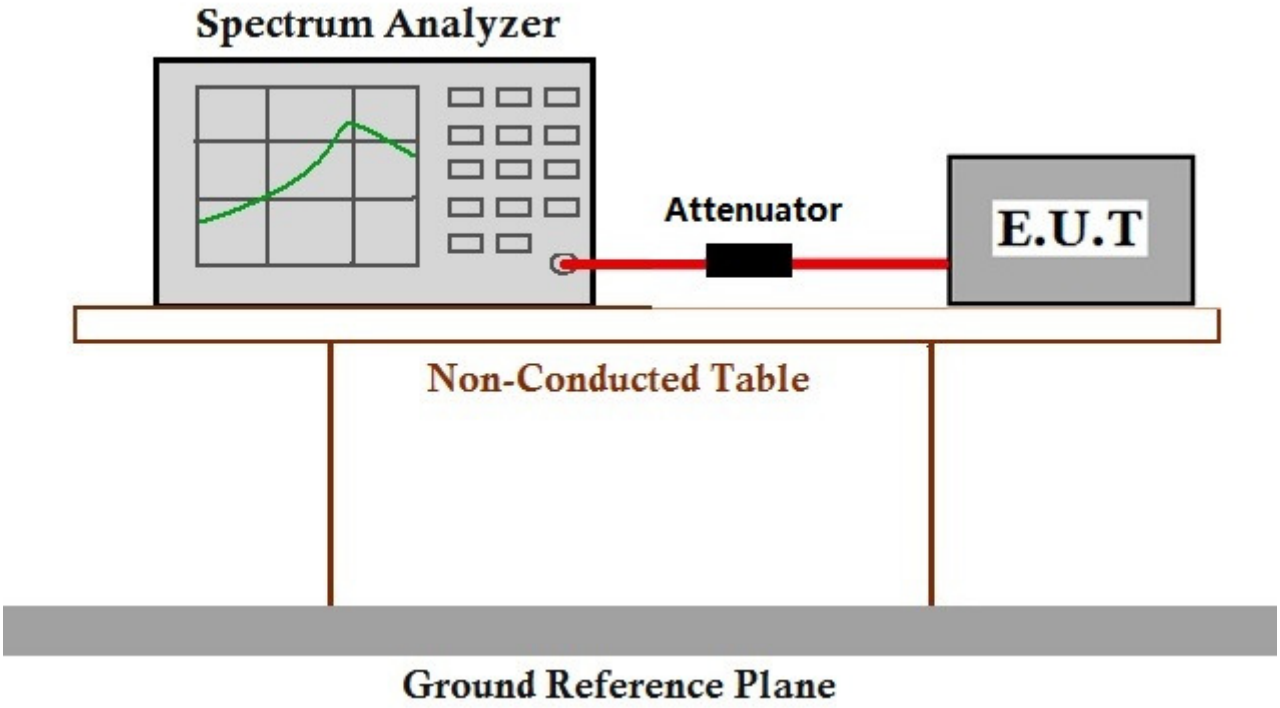
7.8.1 E.U.T. Operation

Operating Environment:

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

Test mode: d:TX mode_Keep the EUT in transmitting mode(ZIGBEE)

7.8.2 Test Setup Diagram

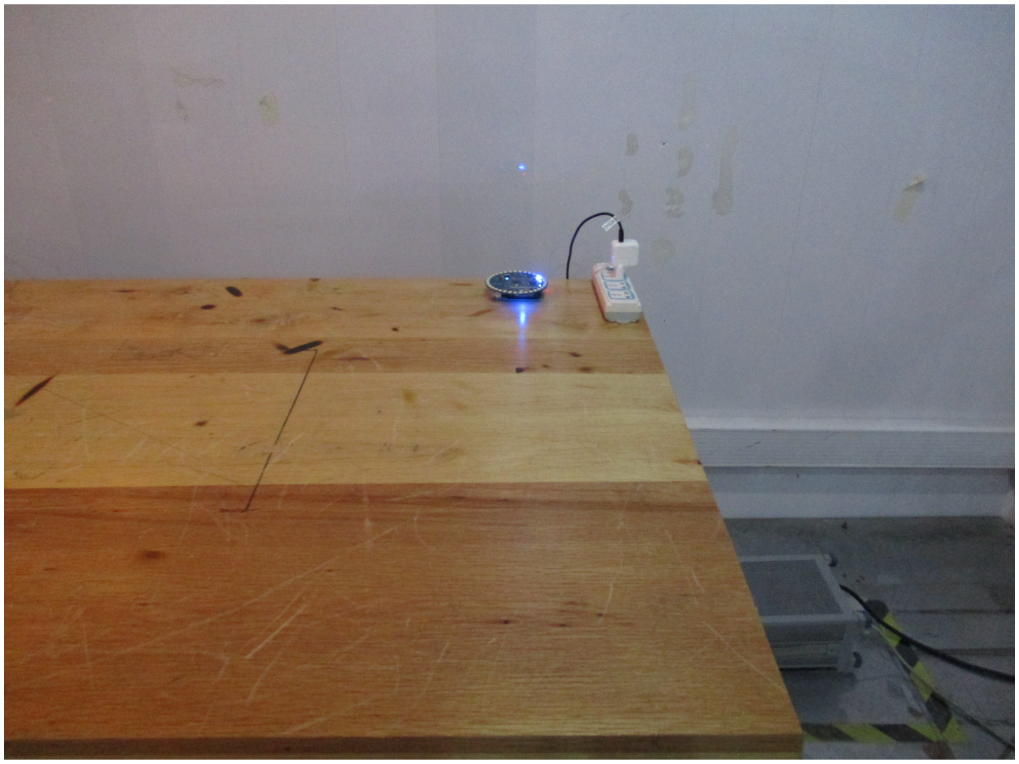


7.8.3 Measurement Data

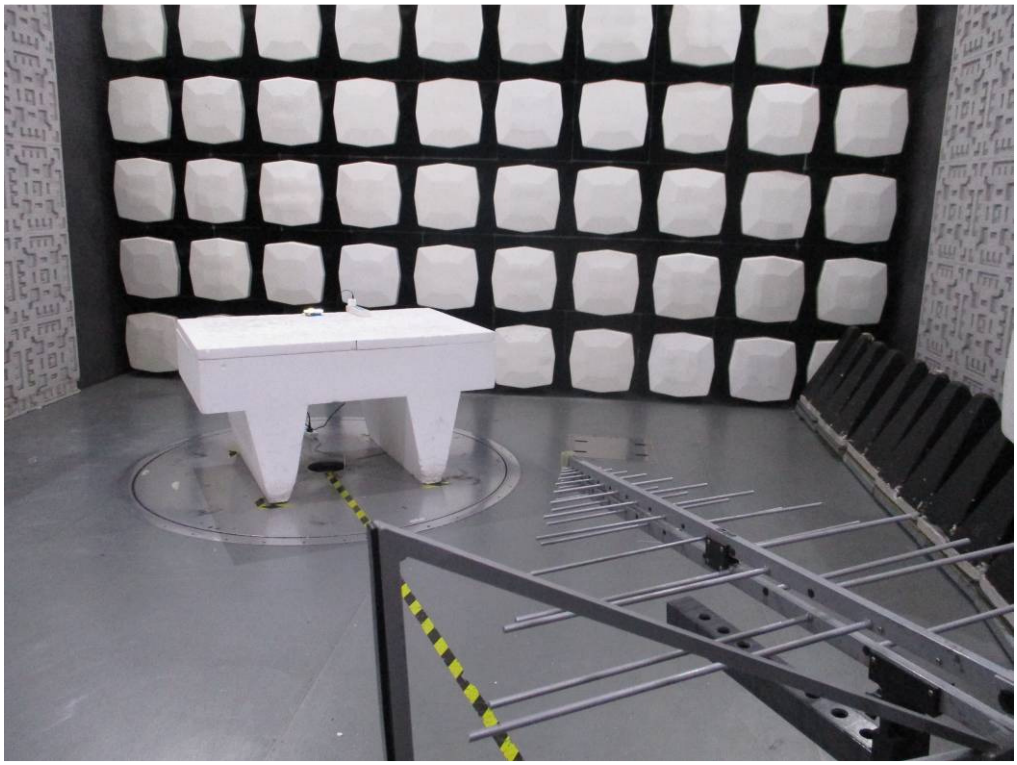
The detailed test data see: Appendix 15.247

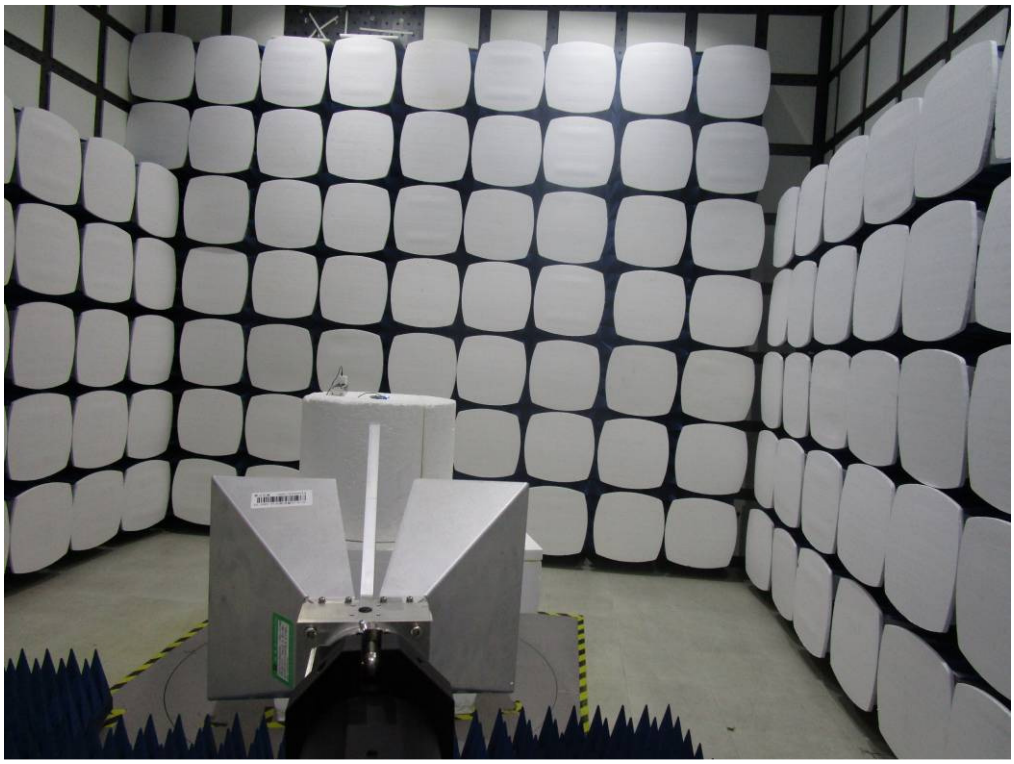
8 Photographs

8.1 Conducted Disturbance at AC Power Line(150kHz-30MHz) Test Setup



8.2 Radiated Spurious Emissions Test Setup





8.3 EUT Constructional Details

Refer to Appendix A - Photographs of EUT Constructional Details for SZEM1703001792CR.

9 Appendix

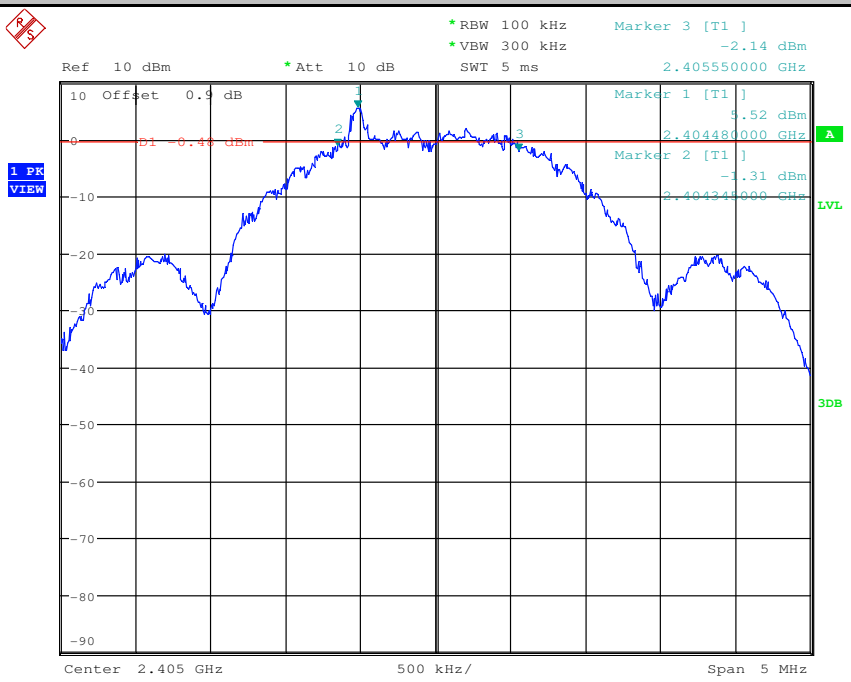
9.1 Appendix 15.247

1.6dB Bandwidth

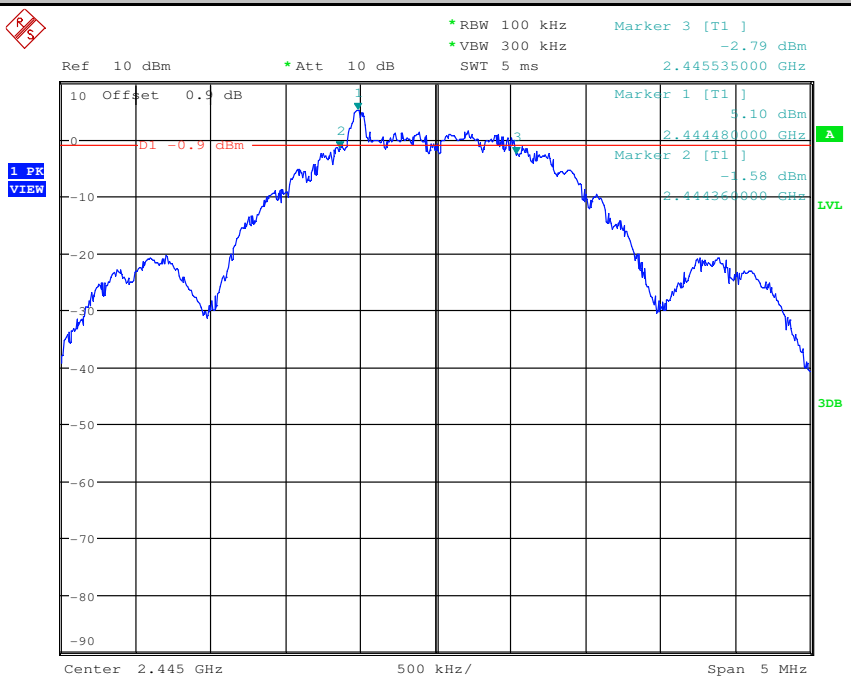
Test Mode	Test Channel	EBW[MHz]	Limit[MHz]	Verdict
ZIGBEE	2405	1.205	>=0.5	PASS
ZIGBEE	2445	1.175	>=0.5	PASS
ZIGBEE	2480	1.215	>=0.5	PASS

TEST PLOT

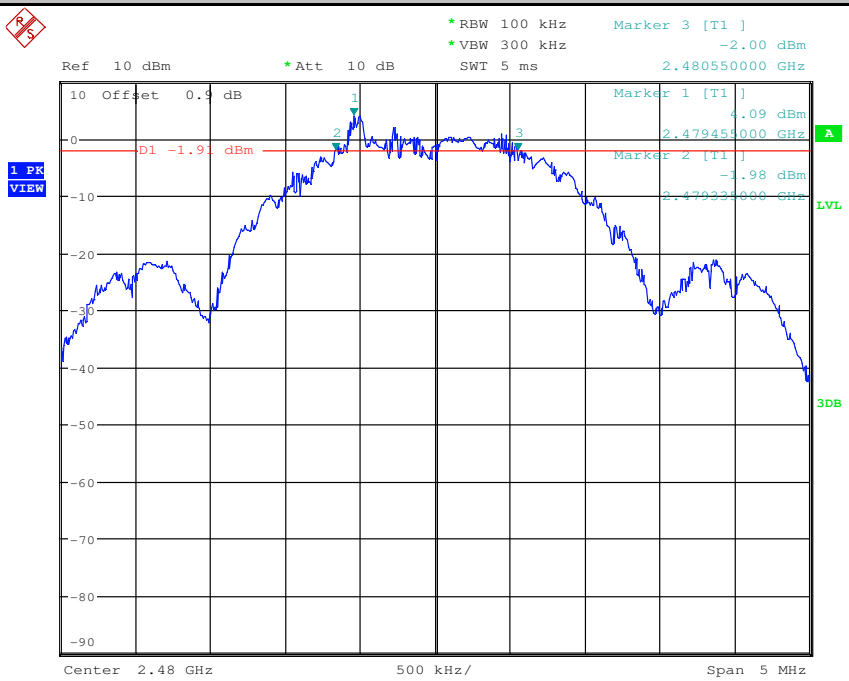
6dB Bandwidth_ZIGBEE_2405



6dB Bandwidth_ZIGBEE_2445



6dB Bandwidth_ZIGBEE_2480

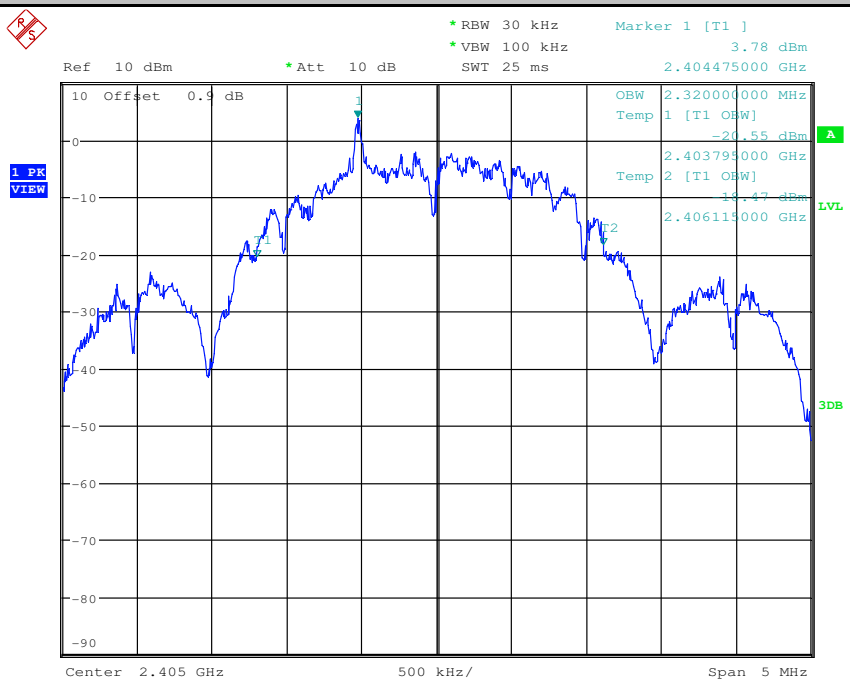


2.Occupied Bandwidth

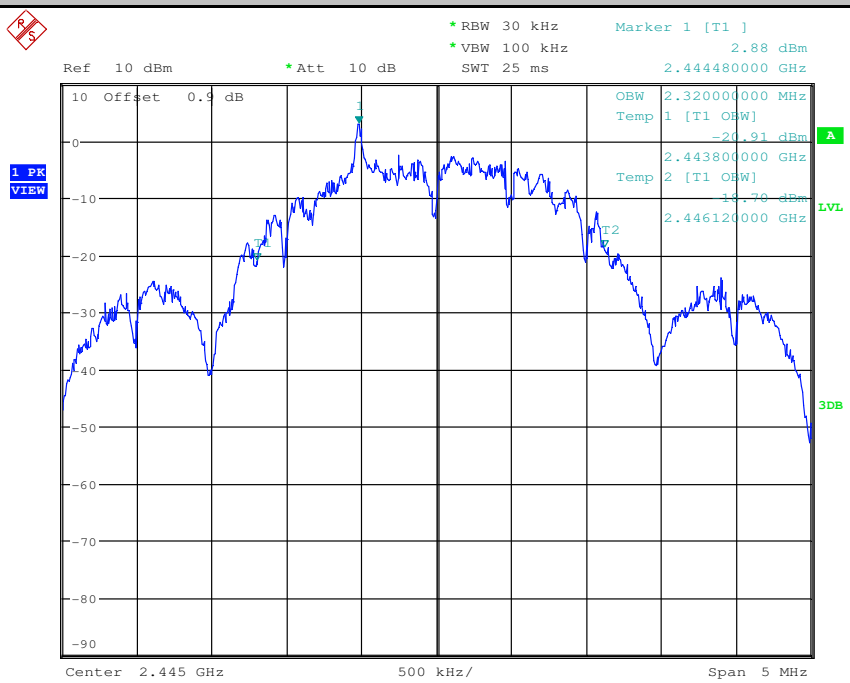
Test Mode	Test Channel	OBW[MHz]	Limit[MHz]	Verdict
ZIGBEE	2405	2.320	---	PASS
ZIGBEE	2445	2.320	---	PASS
ZIGBEE	2480	2.315	---	PASS

TEST PLOT

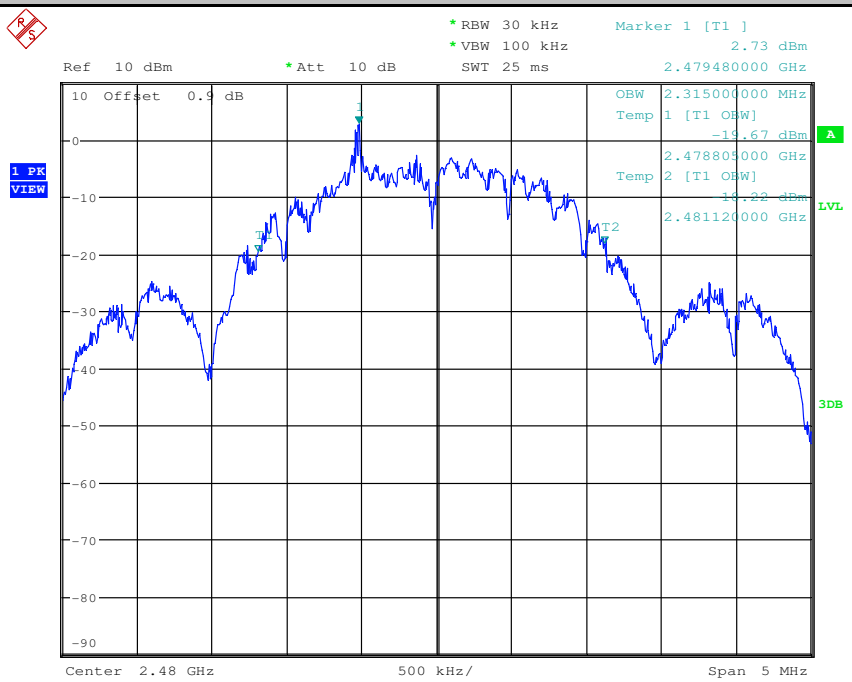
Occupied Bandwidth_ZIGBEE_2405



Occupied Bandwidth_ZIGBEE_2445



Occupied Bandwidth_ZIGBEE_2480

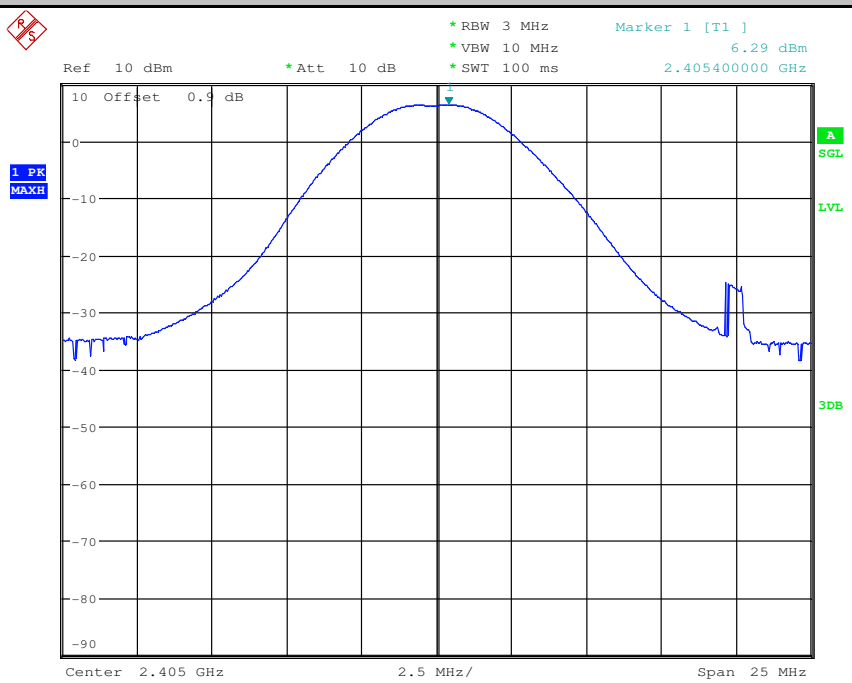


3.Maximum peak conducted output power

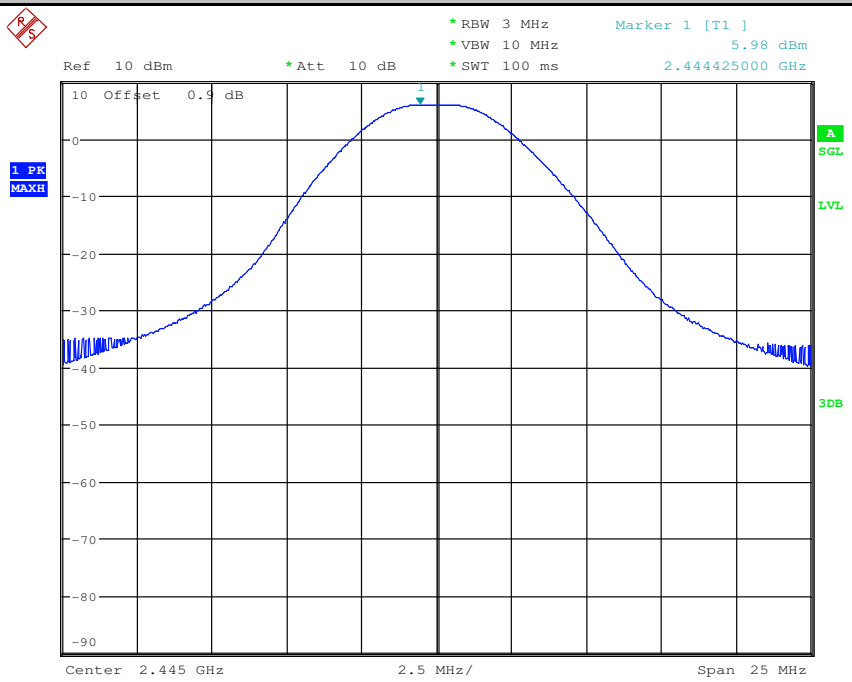
Test Mode	Test Channel	Power[dBm]	Limit[dBm]	Verdict
ZIGBEE	2405	6.29	<30	PASS
ZIGBEE	2445	5.98	<30	PASS
ZIGBEE	2480	5.48	<30	PASS

TEST PLOT

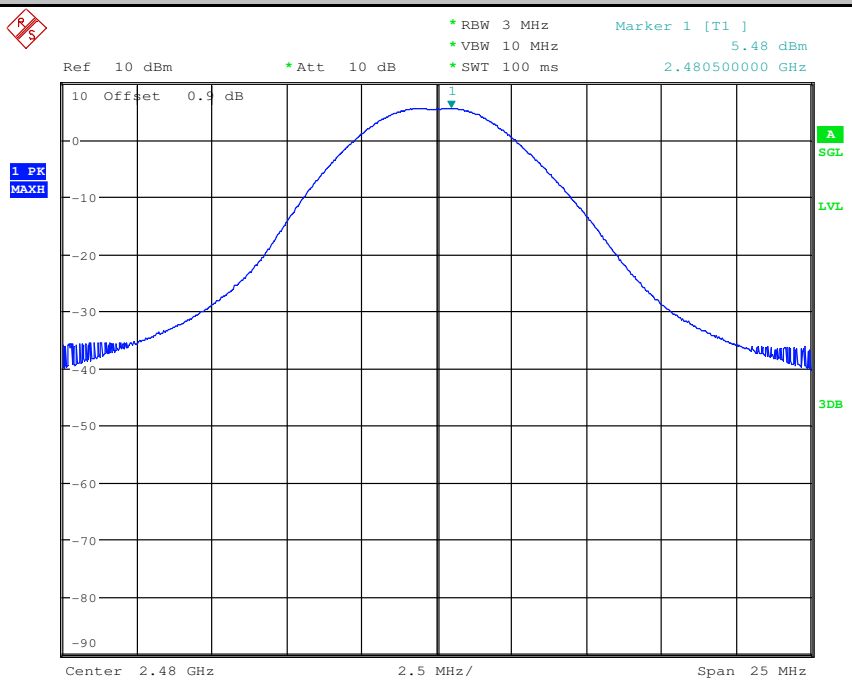
Maximum peak conducted output power_ZIGBEE_2405



Maximum peak conducted output power_ZIGBEE_2445



Maximum peak conducted output power_ZIGBEE_2480

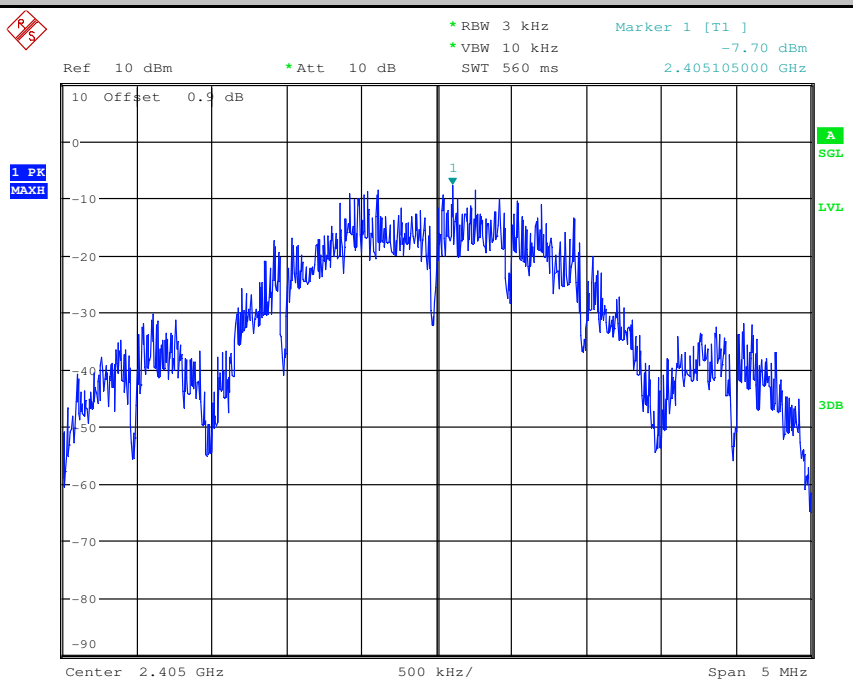


4.Maximum Peak power spectral density

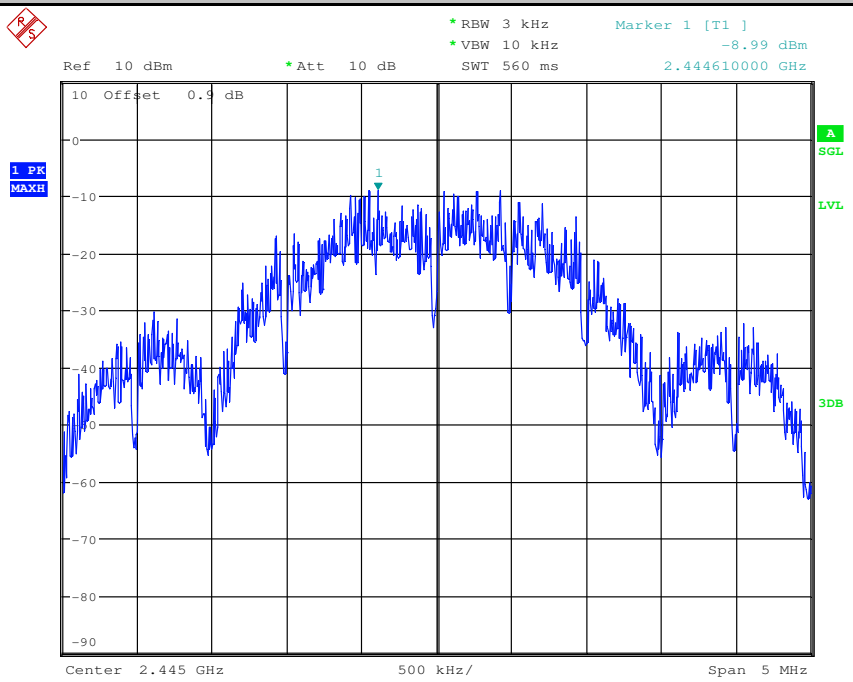
Test Mode	Test Channel	PSD[dBm/3kHz]	Limit[dBm/3kHz]	Verdict
ZIGBEE	2405	-7.7	<8.00	PASS
ZIGBEE	2445	-8.99	<8.00	PASS
ZIGBEE	2480	-8.55	<8.00	PASS

TEST PLOT

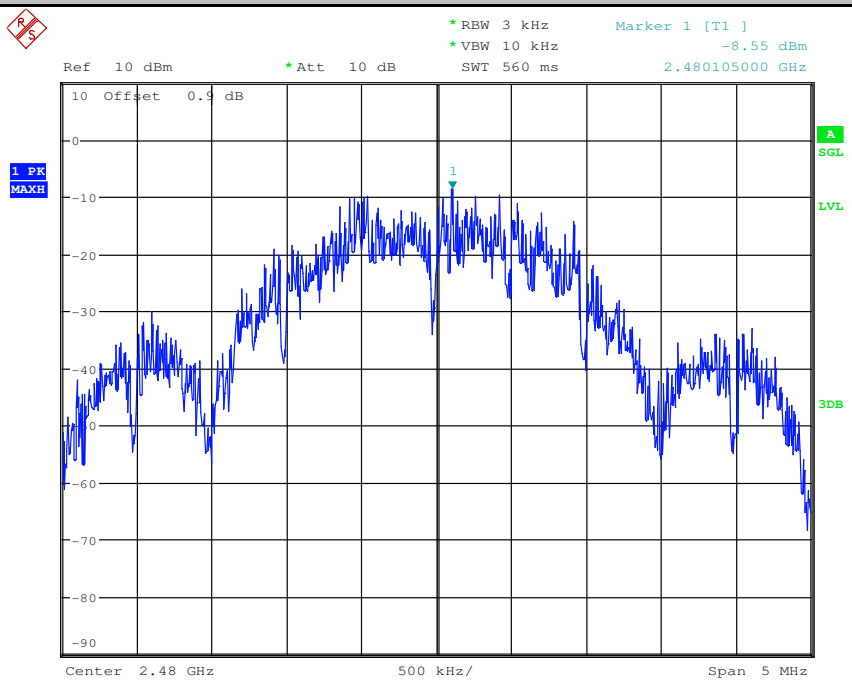
Maximum Peak power spectral density_ZIGBEE_2405



Maximum Peak power spectral density_ZIGBEE_2445



Maximum Peak power spectral density_ZIGBEE_2480

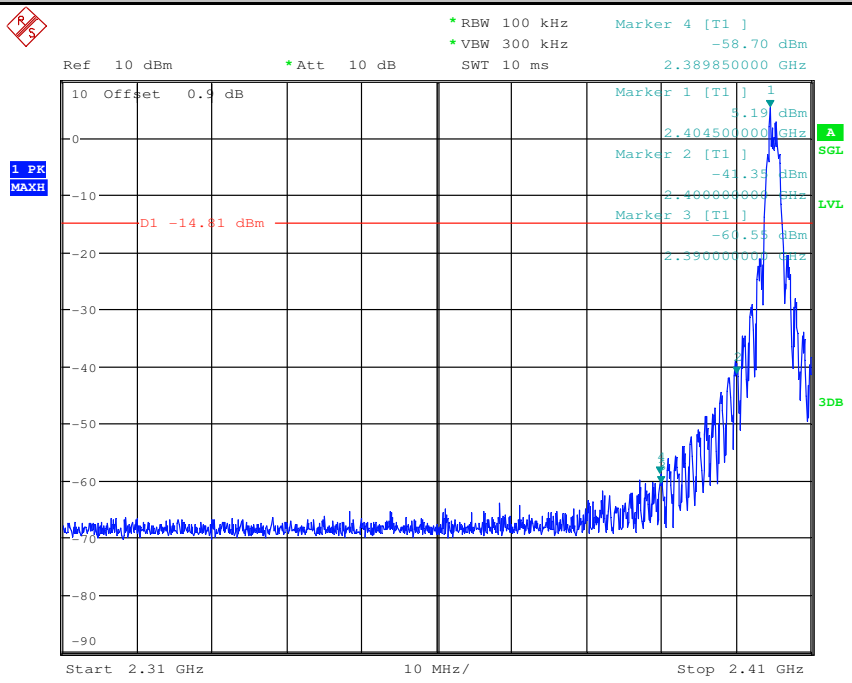


5.Band-edge for RF Conducted Emissions

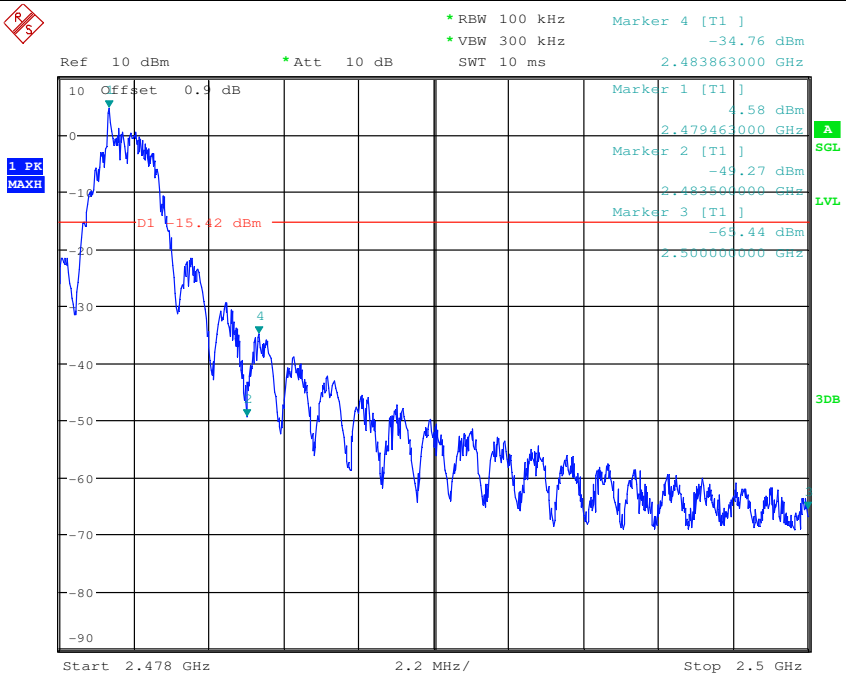
Test Mode	Test Channel	Carrier Power[dBm]	Max. Spurious Level [dBm]	Limit [dBm]	Verdict
ZIGBEE	2405	5.190	-58.702	<-14.81	PASS
ZIGBEE	2480	4.580	-34.763	<-15.42	PASS

TEST PLOT

Band-edge for RF Conducted Emissions_ZIGBEE_2405_Hopping Off

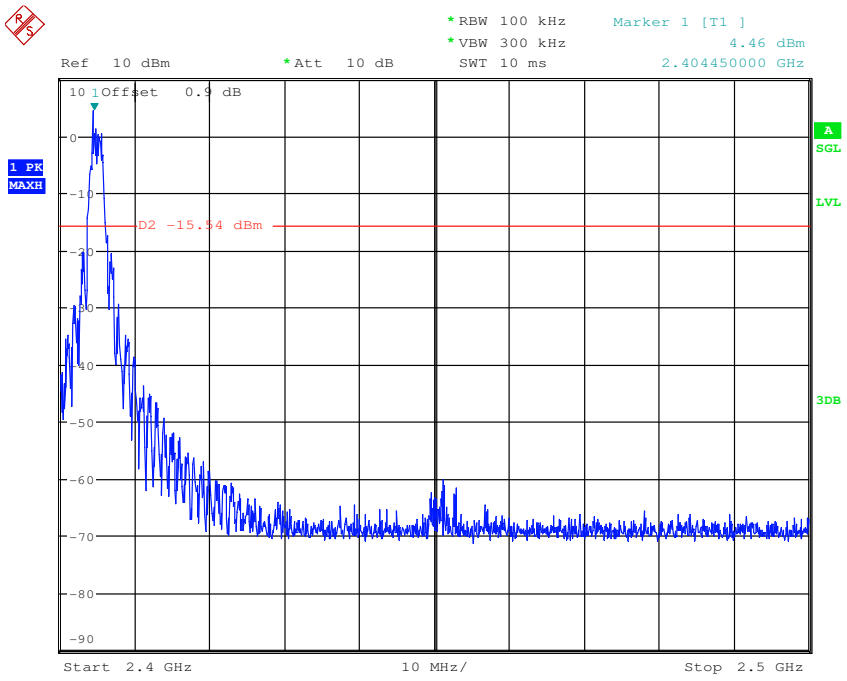
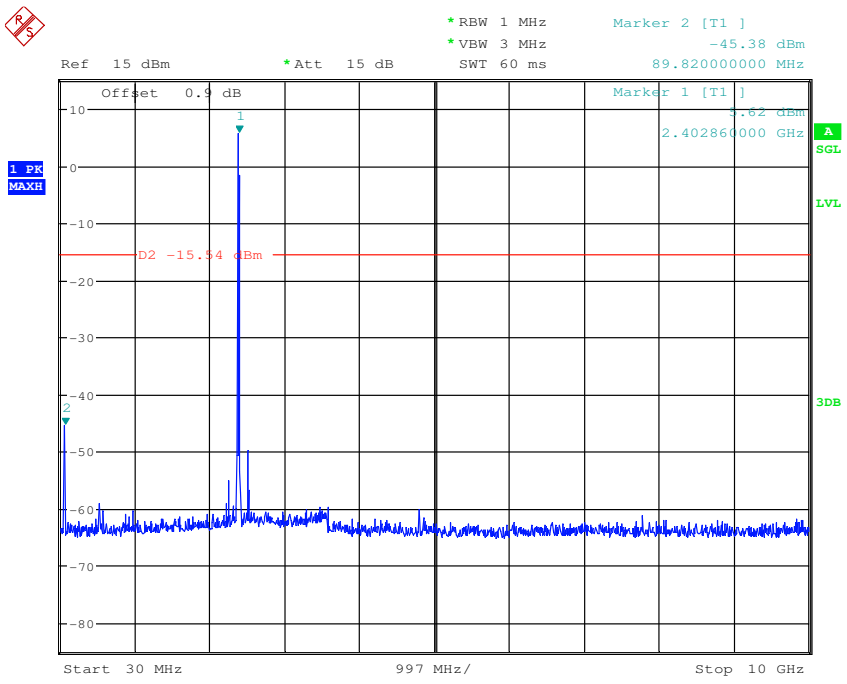


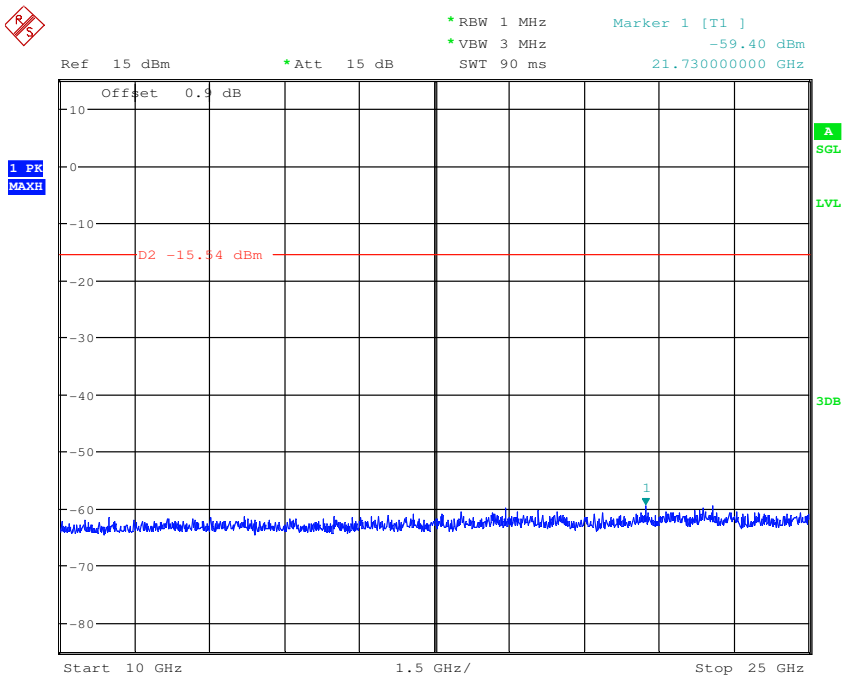
Band-edge for RF Conducted Emissions_ZIGBEE_2480_Hopping Off

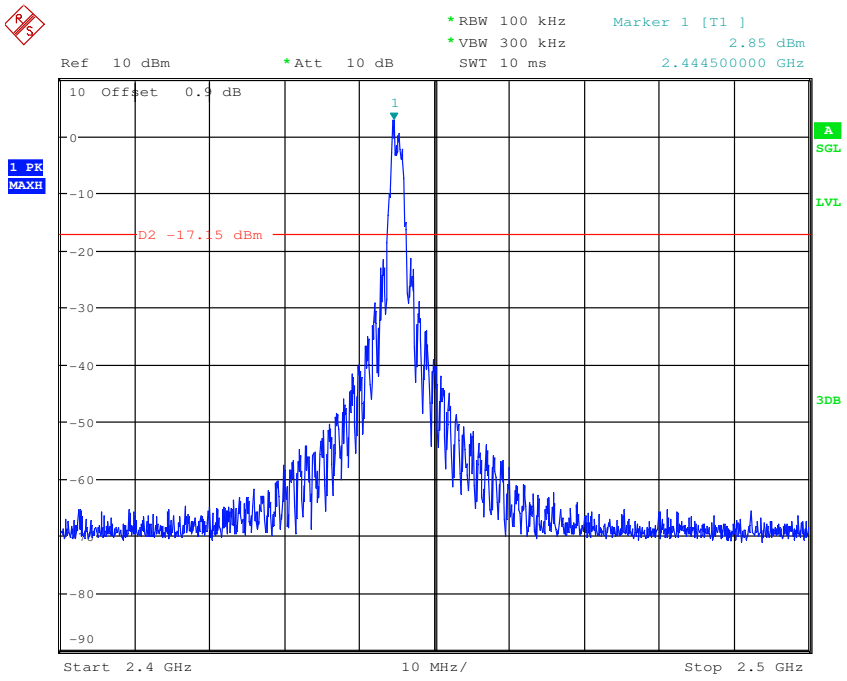
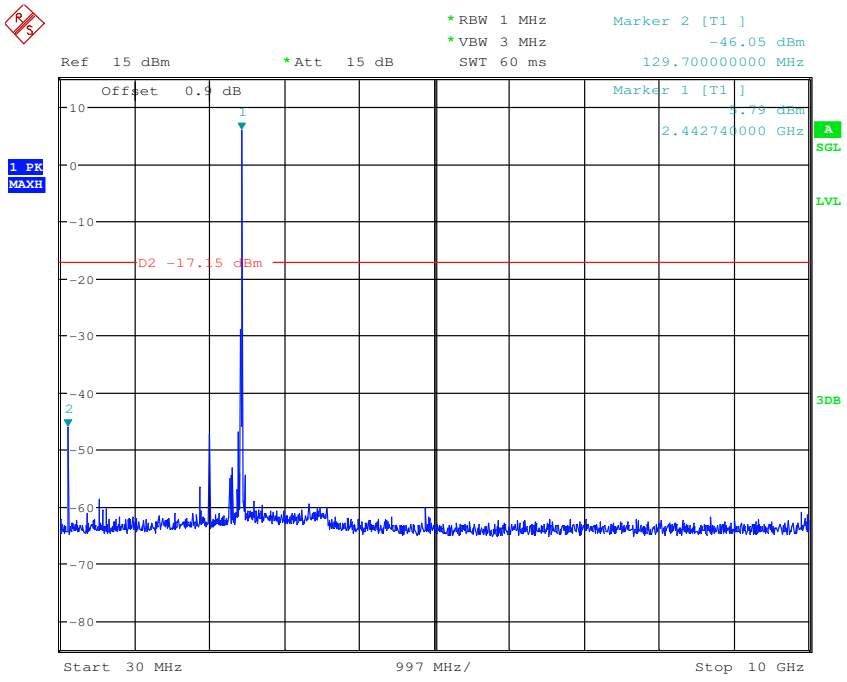


6.RF Conducted Spurious Emissions

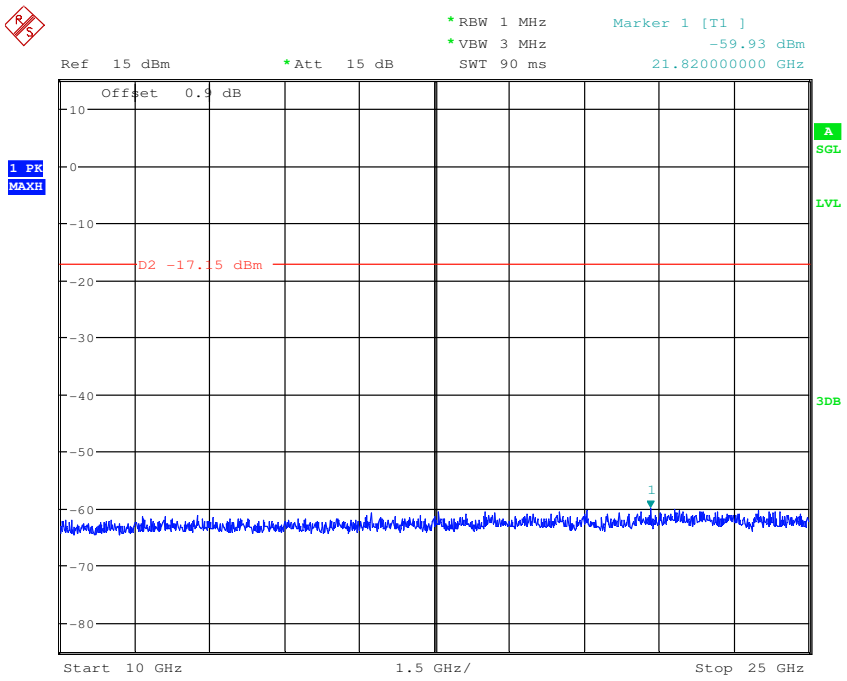
Test Mode	Test Channel	StartFre [MHz]	StopFre [MHz]	RBW [kHz]	VBW [kHz]	Pref[dBm]	Max. Level [dBm]	Limit [dBm]	Verdict
ZIGBEE	2405	30	10000	1000	3000	4.46	-45.380	<-15.54	PASS
ZIGBEE	2405	10000	25000	1000	3000	4.46	-59.400	<-15.54	PASS
ZIGBEE	2445	30	10000	1000	3000	2.85	-46.050	<-17.15	PASS
ZIGBEE	2445	10000	25000	1000	3000	2.85	-59.930	<-17.15	PASS
ZIGBEE	2480	30	10000	1000	3000	1.99	-46.520	<-18.01	PASS
ZIGBEE	2480	10000	25000	1000	3000	1.99	-59.710	<-18.01	PASS

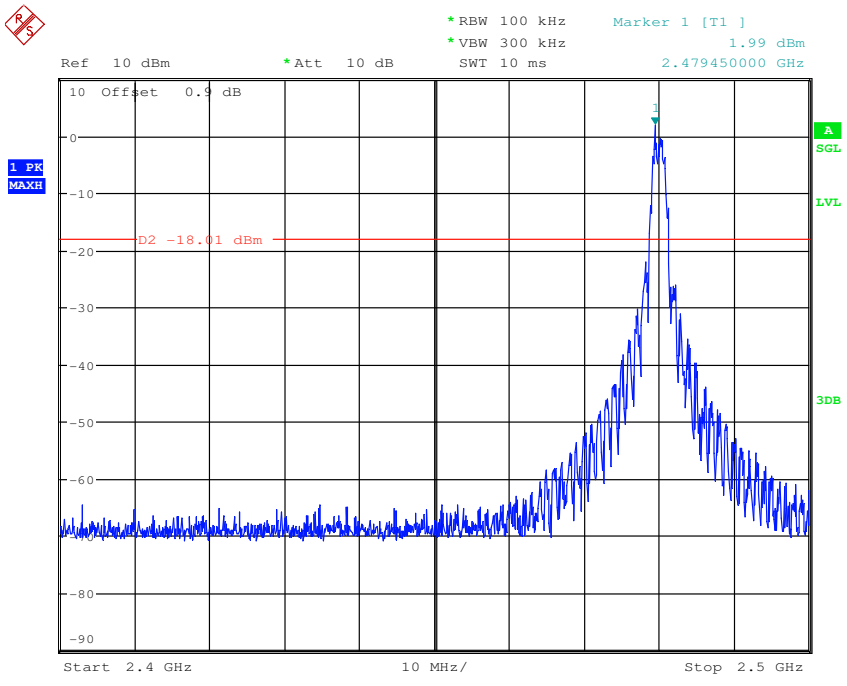
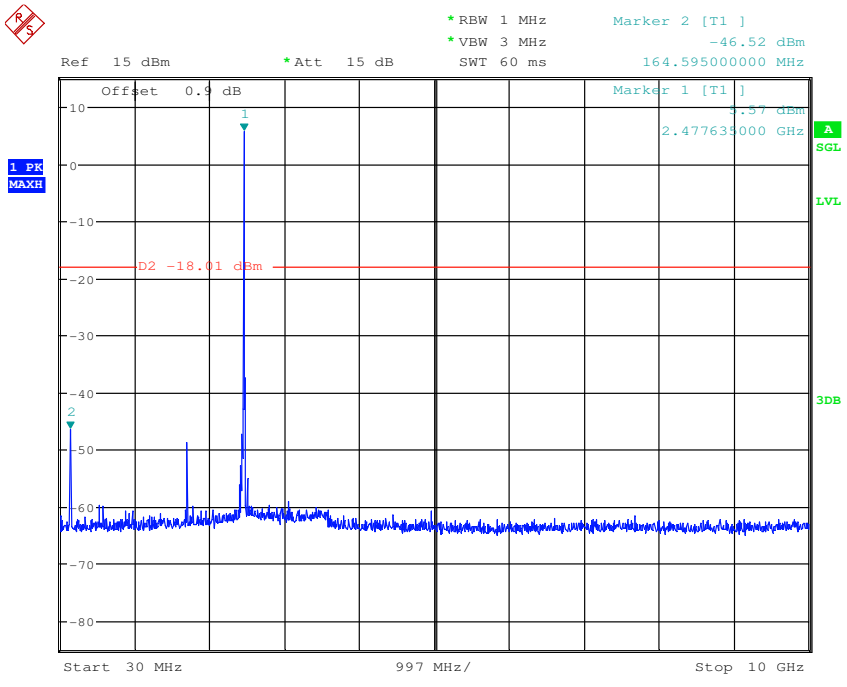
TEST PLOT	
RF Conducted Spurious Emissions_ZIGBEE_2405	
Pref	
CSE_1	

CSE_2	

RF Conducted Spurious Emissions_ZIGBEE_2445	
Pref	
CSE_1	

CSE_2



RF Conducted Spurious Emissions_ZIGBEE_2480	
Pref	
CSE_1	

CSE_2