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

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

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TEST REPORT

Application No.:	SZEM1703002506CR
Applicant:	Circus World Displays Ltd.
Address of Applicant:	4080 Montrose Road Niagara Falls, ON Canada, L2H 1J9
Factory:	RDI Technology (Shenzhen) Co., Ltd
Address of Factory:	Building C1, Xintang Industrial Park, East Baishixia, Fuyong, Baoan, Shenzhen, PRC.
Equipment Under Test (EUT):	
EUT Name:	Defender HD Wireless 1080p Receiver
Model No.:	WHDREC
FCC ID:	SMHWHDREC
Trade Mark:	Defender
Standards:	47 CFR Part 15, Subpart C 15.247
Date of Receipt:	2017-03-29
Date of Test:	2017-04-01 to 2017-05-11
Date of Issue:	2017-06-06
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		2017-06-06		Original

Authorized for issue by:				
				
		Bill Chen /Project Engineer		
				
		Eric Fu /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)	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
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 11.9.1.2	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 6.10.4	47 CFR Part 15, Subpart C 15.209 & 15.247(d)	Pass

3 Contents

4 General Information

4.1 Details of E.U.T.

Carrier Frequency	2408MHz~2468MHz
Number of Channels:	16
Modulation Type	FSK
Sample Type:	Fixed production
Antenna Type:	Dipole
Antenna gain:	2dBi
Power supply:	DC input 5V
Test voltage	AC 120V 50Hz
Cable:	USB in cable:100cm Unshielded

Operation Frequency each of channel							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
0	2408MHz	4	2424MHz	8	2440MHz	12	2456MHz
1	2412MHz	5	2428MHz	9	2444MHz	13	2460MHz
2	2416MHz	6	2432MHz	10	2448MHz	14	2464MHz
3	2420MHz	7	2436MHz	11	2452MHz	15	2468MHz

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)	2408MHz
The middle channel (CH8)	2440MHz
The highest channel (CH15)	2468MHz

4.2 Description of Support Units

The EUT has been tested with associated equipment below.

Description	Manufacturer	Model No.
Network set-top box	Customer to provide	N/A

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	2017-05-10	2018-05-10
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

RE in Chamber					
Test Equipment	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal. Date (yyyy-mm-dd)**	**Cal. Due date (yyyy-mm-dd)**
3m Semi-Anechoic Chamber	ETS-LINDGREN	N/A	SEM001-01	2017-05-10	2018-05-10
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
Pre-amplifier (0.1-1300MHz)	Agilent Technologies	8447D	SEM005-01	2017-04-14	2018-04-14

RE in Chamber					
Test Equipment	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal. Date (yyyy-mm-dd)**	**Cal. Due date (yyyy-mm-dd)**
3m Semi-Anechoic Chamber	AUDIX	N/A	SEM001-02	2017-05-10	2018-05-10
EXA Spectrum Analyzer	Agilent Technologies Inc	N9010A	SEM004-09	2016-07-19	2017-07-19
BiConiLog Antenna (26-3000MHz)	ETS-Lindgren	3142C	SEM003-02	2014-11-15	2017-11-15
Amplifier (0.1-1300MHz)	HP	8447D	SEM005-02	2016-10-09	2017-10-09
Horn Antenna (1-18GHz)	Rohde & Schwarz	HF907	SEM003-07	2015-06-14	2018-06-14
Horn Antenna (18-26GHz)	ETS-Lindgren	3160	SEM003-12	2014-11-24	2017-11-24
Horn Antenna(26GHz-40GHz)	A.H.Systems, inc.	SAS-573	SEM003-13	2015-02-12	2018-02-12
Low Noise Amplifier	Black Diamond Series	BDLNA-0118-352810	SEM005-05	2016-10-09	2017-10-09
Band filter	Amindeon	Asi 3314	SEM023-01	N/A	N/A

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

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
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

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

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

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	2017-04-18	2018-04-18

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

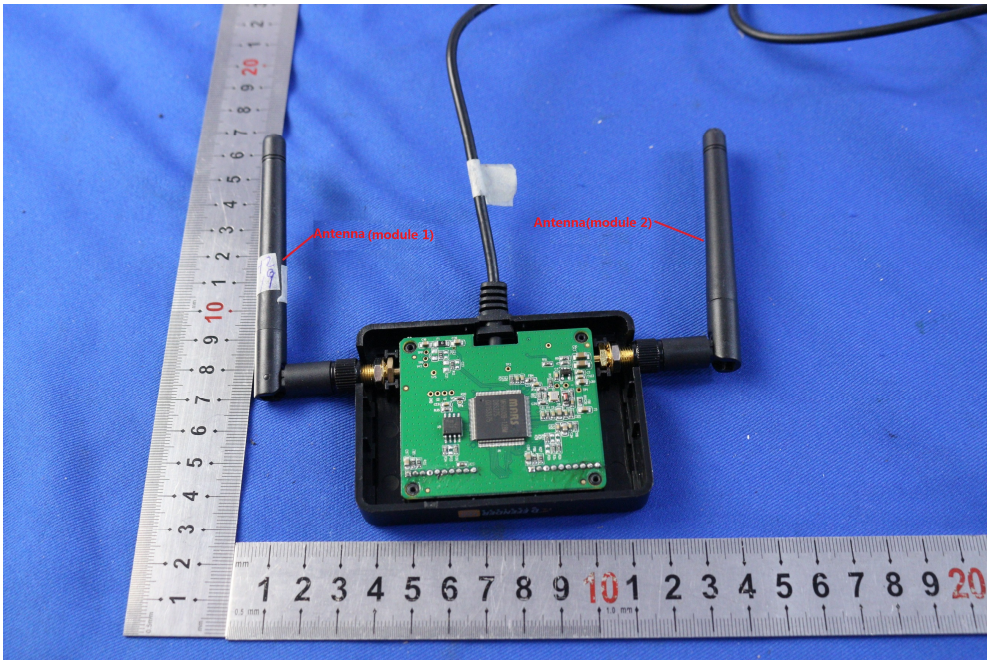
Standard Requirment:

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 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

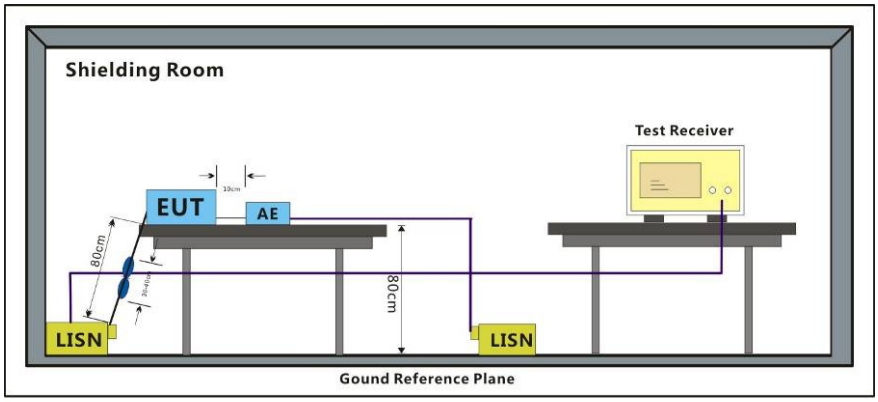
Operating Environment:

Temperature: 25 °C Humidity: 55 % RH Atmospheric Pressure: 1020 mbar

ExploratoryTest Mode: a:TX mode_Keep the EUT in transmitting mode

Final Test Mode: Test channel low/middle and high, the worst case is the high channel.
Only the 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.

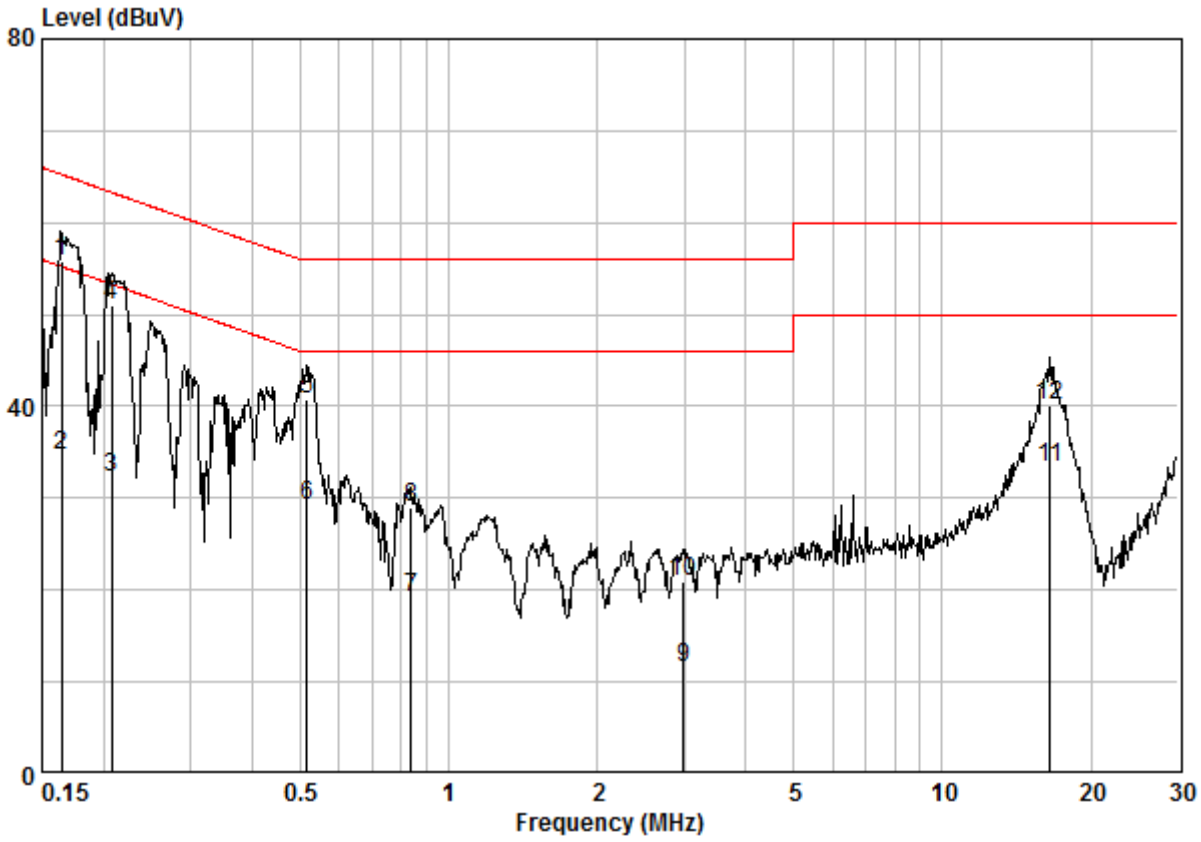
2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50ohm/50μH + 5ohm linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as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

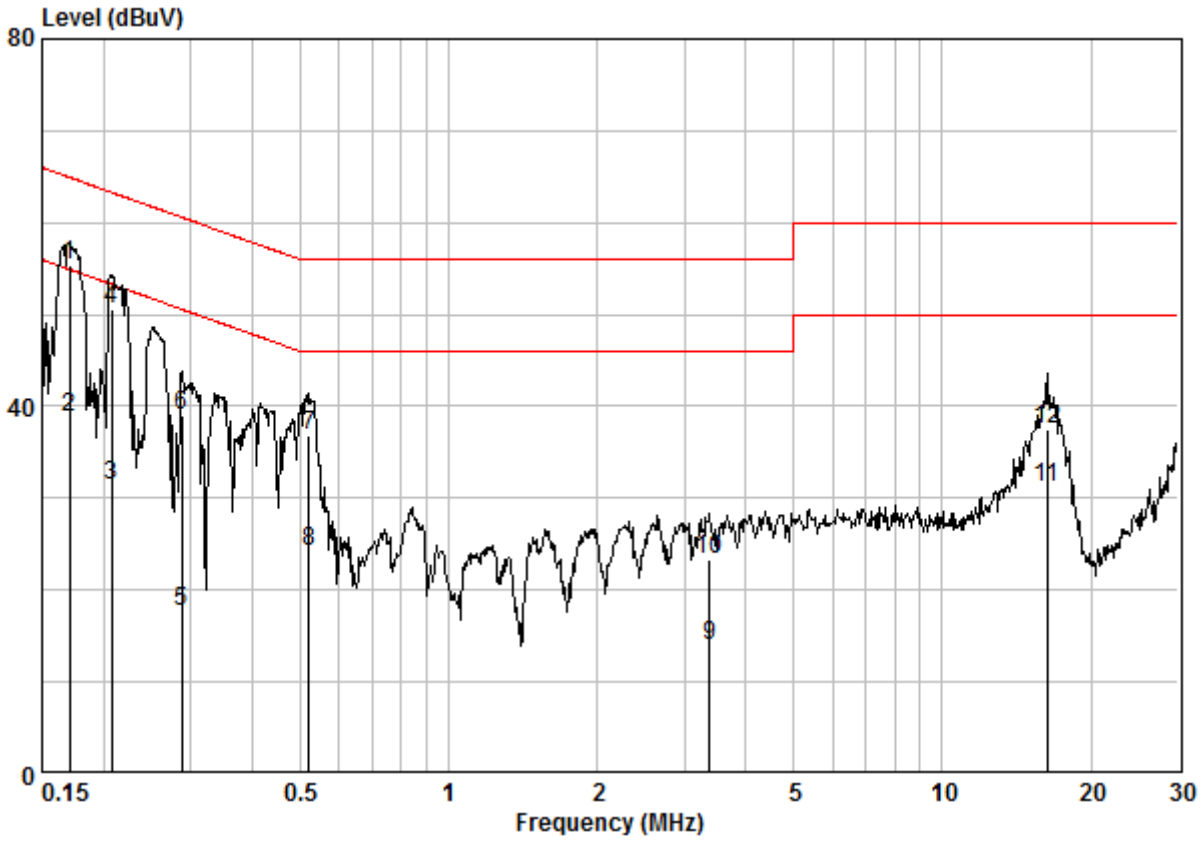
Mode:a; Line:Live Line



Site : Shielding Room
Condition : CE LINE
Job No. : 02506CR
Test Mode : a

		Freq	Cable Loss	LISN Factor	Read Level	Level	Limit Line	Over Limit	Remark
		MHz	dB	dB	dBuV	dBuV	dBuV	dB	
1	@	0.16414	0.02	9.64	46.14	55.80	65.25	-9.45	QP
2		0.16414	0.02	9.64	24.99	34.65	55.25	-20.61	AVERAGE
3		0.20723	0.02	9.64	22.57	32.23	53.32	-21.09	AVERAGE
4		0.20723	0.02	9.64	41.41	51.07	63.32	-12.24	QP
5		0.51550	0.02	9.64	31.04	40.70	56.00	-15.30	QP
6		0.51550	0.02	9.64	19.62	29.28	46.00	-16.72	AVERAGE
7		0.83932	0.03	9.65	9.48	19.16	46.00	-26.84	AVERAGE
8		0.83932	0.03	9.65	19.25	28.92	56.00	-27.08	QP
9		2.993	0.03	9.69	1.79	11.50	46.00	-34.50	AVERAGE
10		2.993	0.03	9.69	11.14	20.86	56.00	-35.14	QP
11		16.573	0.16	10.03	23.25	33.44	50.00	-16.56	AVERAGE
12		16.573	0.16	10.03	29.82	40.02	60.00	-19.98	QP

Mode:a; Line:Neutral Line



Site : Shielding Room
Condition : CE NEUTRAL
Job No. : 02506CR
Test Mode : a

		Freq	Cable Loss	LISN Factor	Read Level	Level	Limit Line	Over Limit	Remark
		MHz	dB	dB	dBuV	dBuV	dBuV	dB	
1	@	0.17034	0.02	9.63	45.72	55.37	64.94	-9.57	QP
2		0.17034	0.02	9.63	29.18	38.83	54.94	-16.12	AVERAGE
3		0.20723	0.02	9.63	21.77	31.42	53.32	-21.90	AVERAGE
4		0.20723	0.02	9.63	40.93	50.58	63.32	-12.73	QP
5		0.28782	0.02	9.63	8.05	17.70	50.59	-32.88	AVERAGE
6		0.28782	0.02	9.63	29.46	39.11	60.59	-21.48	QP
7		0.52099	0.02	9.63	27.22	36.87	56.00	-19.13	QP
8		0.52099	0.02	9.63	14.51	24.16	46.00	-21.84	AVERAGE
9		3.381	0.02	9.68	4.26	13.97	46.00	-32.03	AVERAGE
10		3.381	0.02	9.68	13.72	23.43	56.00	-32.57	QP
11		16.312	0.16	10.04	20.89	31.08	50.00	-18.92	AVERAGE
12		16.312	0.16	10.04	27.21	37.41	60.00	-22.59	QP

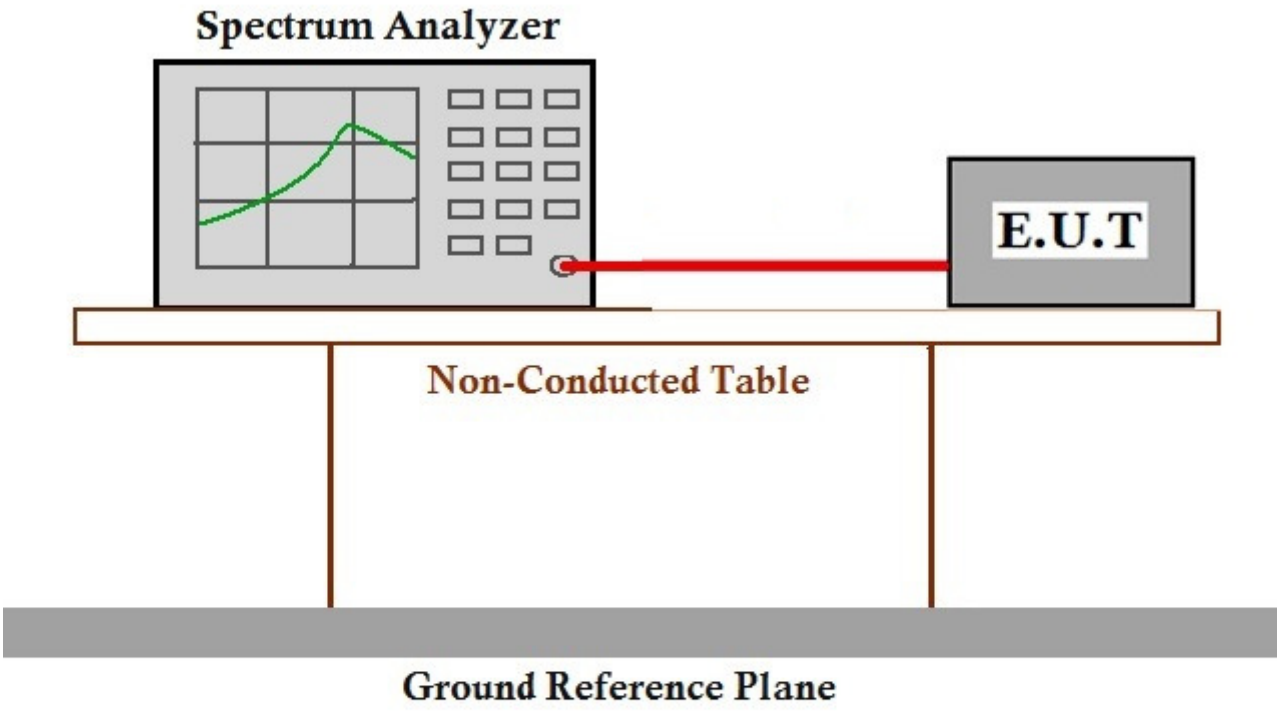
7.2 Minimum 6dB Bandwidth

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 a:TX mode_Keep the EUT in transmitting mode

7.2.2 Test Setup Diagram



7.2.3 Measurement Procedure and Data

The detailed test data see: Appendix 15.247

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 11.9.1.2
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

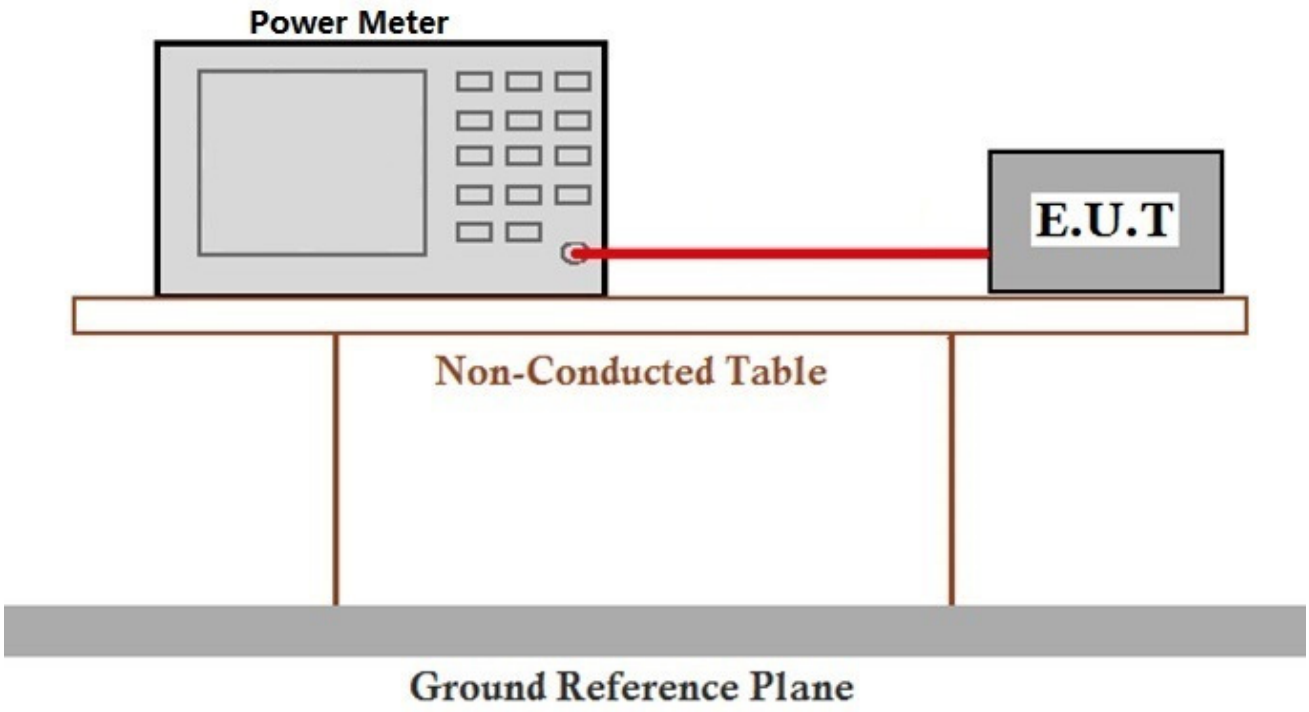
7.3.1 E.U.T. Operation

Operating Environment:

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

Test mode a:TX mode_Keep the EUT in transmitting mode

7.3.2 Test Setup Diagram



7.3.3 Measurement Procedure and 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

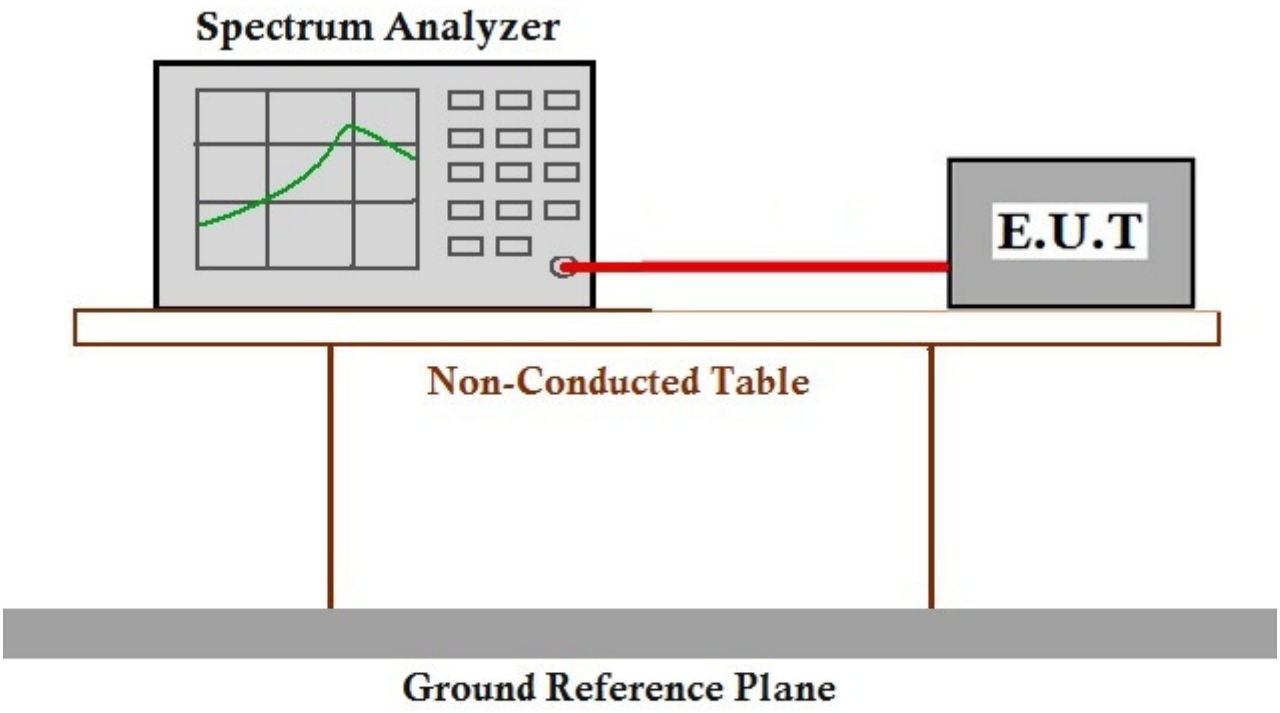
7.4.1 E.U.T. Operation

Operating Environment:

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

Test mode a:TX mode_Keep the EUT in transmitting mode

7.4.2 Test Setup Diagram



7.4.3 Measurement Procedure and Data

The detailed test data see: Appendix 15.247

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 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.

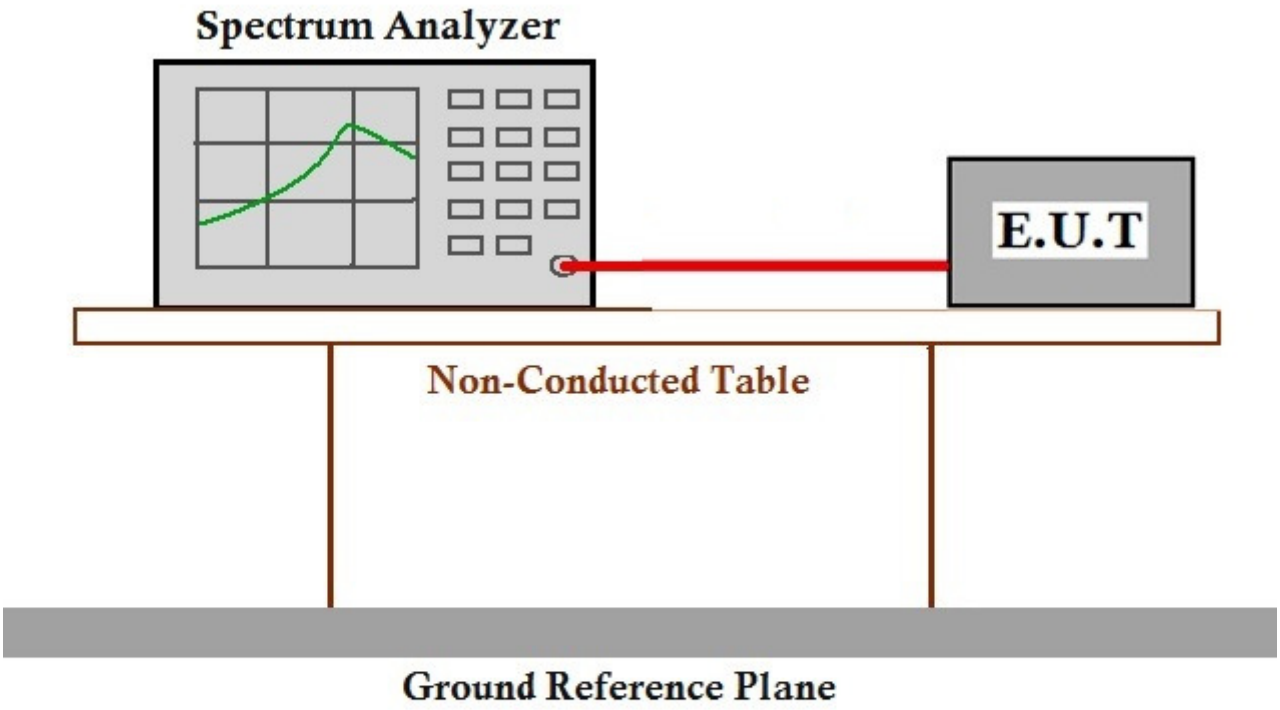
7.5.1 E.U.T. Operation

Operating Environment:

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

Test mode a:TX mode_Keep the EUT in transmitting mode

7.5.2 Test Setup Diagram



7.5.3 Measurement Procedure and Data

The detailed test data see: Appendix 15.247

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 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.

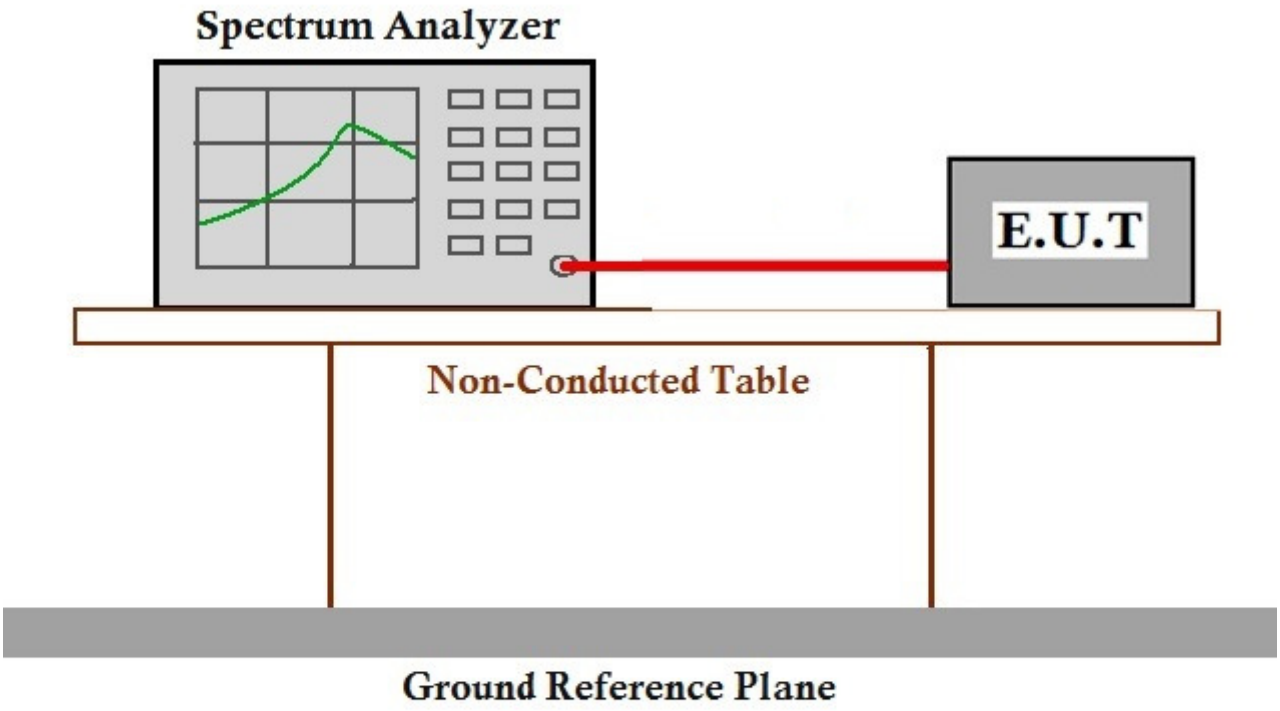
7.6.1 E.U.T. Operation

Operating Environment:

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

Test mode a:TX mode_Keep the EUT in transmitting mode

7.6.2 Test Setup Diagram



7.6.3 Measurement Procedure and Data

The detailed test data see: Appendix 15.247

7.7 Radiated Emissions which fall in the restricted bands

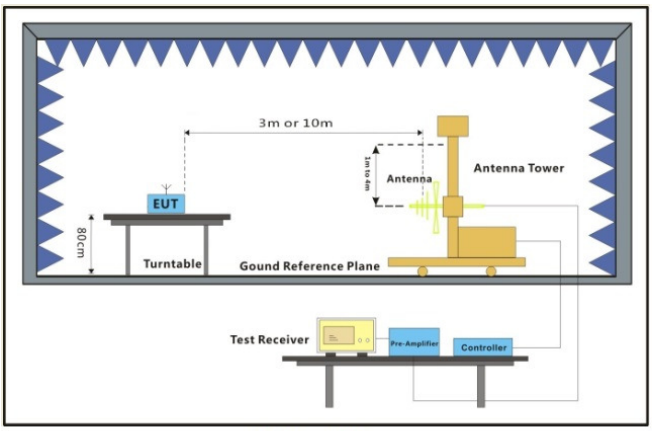
Test Requirement 47 CFR Part 15, Subpart C 15.209 & 15.247(d)
Test Method: ANSI C63.10 (2013) Section 6.10.5
Measurement Distance: 3m
Limit:

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.		

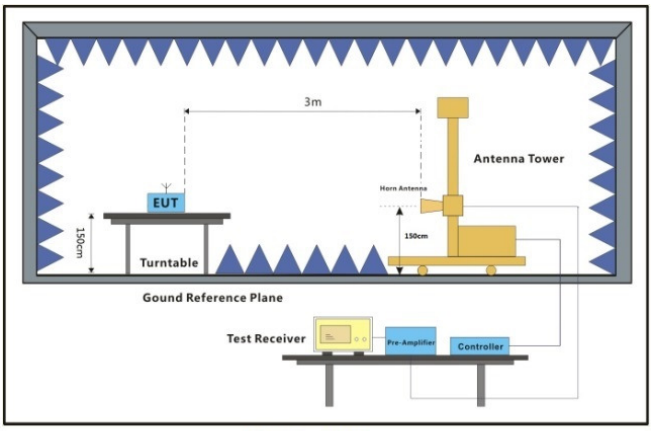
7.7.1 E.U.T. Operation

Operating Environment:
Temperature: 24 °C Humidity: 58 % RH Atmospheric Pressure: 1020 mbar
Test mode a:TX mode_Keep the EUT in transmitting mode

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 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.

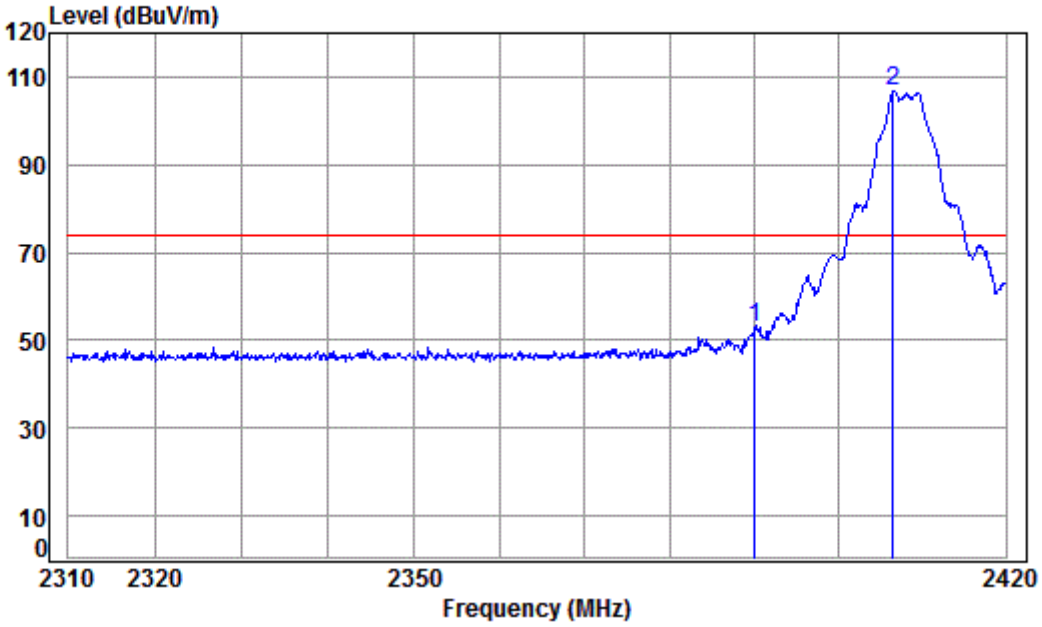
g. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified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

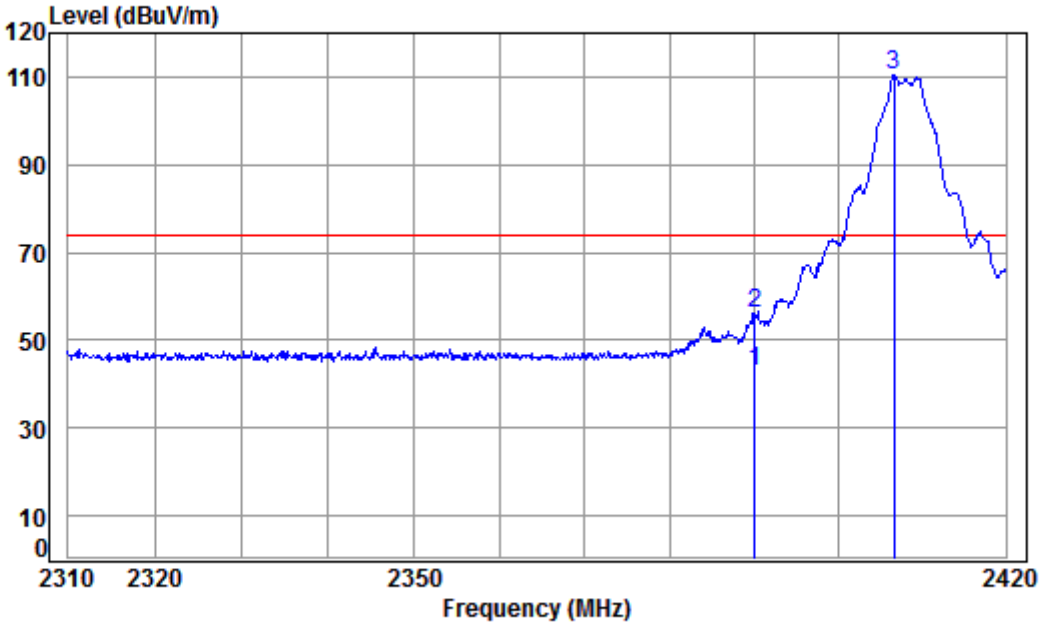
Mode:a; Polarization:Horizontal; Channel:Low



Condition: 3m HORIZONTAL
Job No: : 02506CR
Mode: : 2408 Band edge

	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	37.96	56.53	52.99	74.00	-21.01	peak
2 pp	2406.528	5.35	29.13	37.96	110.28	106.80	74.00	32.80	peak

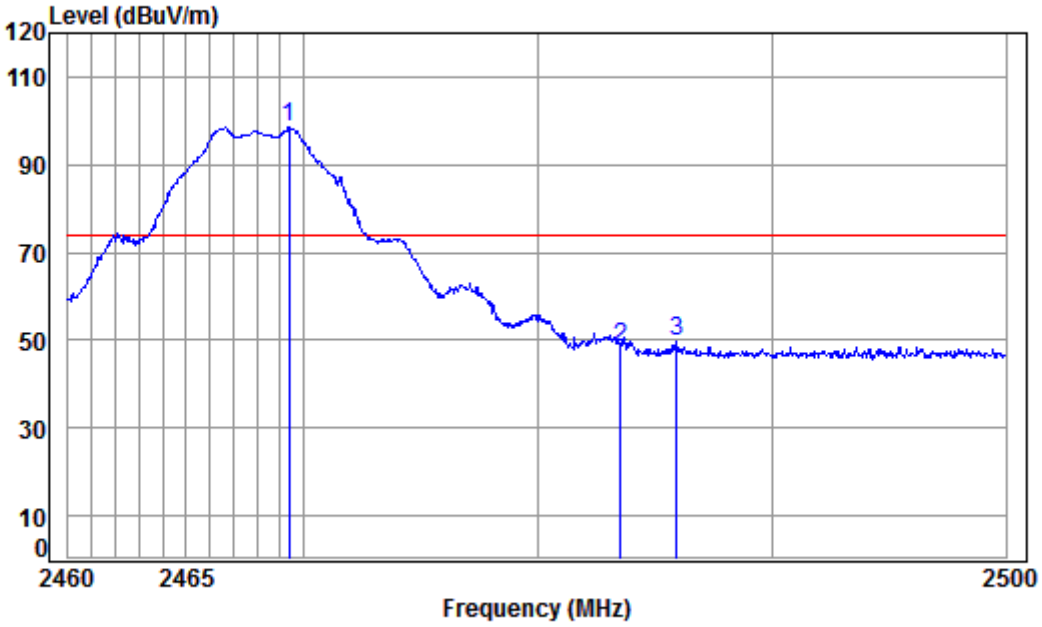
Mode:a; Polarization:Vertical; Channel:Low



Condition: 3m VERTICAL
Job No: : 02506CR
Mode: : 2408 Band edge

	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	av 2390.000	5.34	29.08	37.96	46.20	42.66	54.00	-11.34	Average
2	2390.000	5.34	29.08	37.96	59.84	56.30	74.00	-17.70	Peak
3	pp 2406.640	5.35	29.13	37.96	113.86	110.38	74.00	36.38	Peak

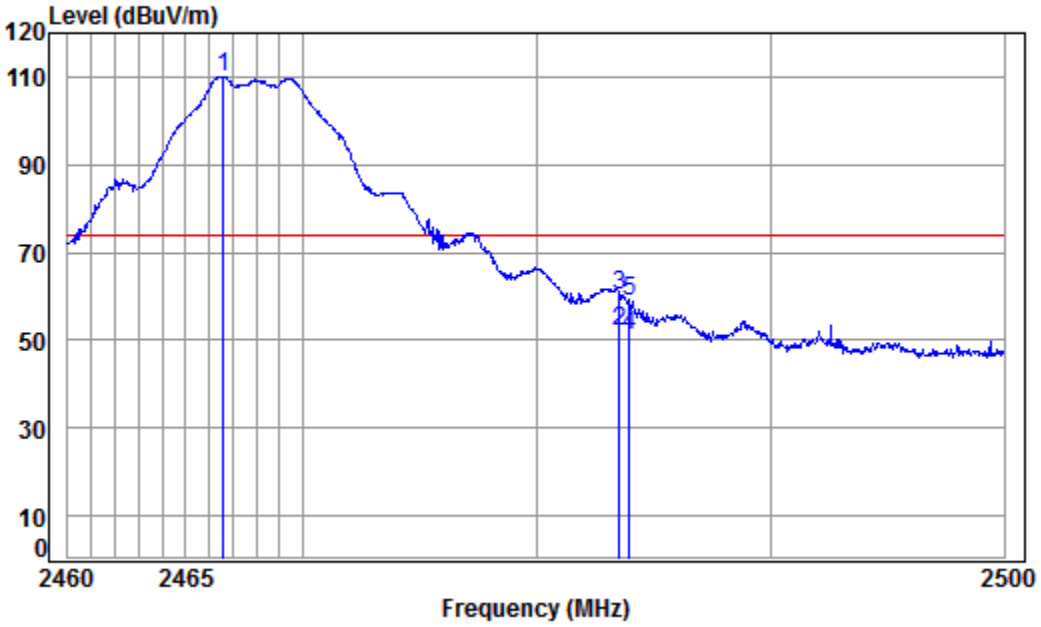
Mode:a; Polarization:Horizontal; Channel:High



Condition: 3m HORIZONTAL
Job No: : 02506CR
Mode: : 2468 Band edge

	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	2469.382	5.40	29.31	37.95	101.70	98.46	74.00	24.46	peak
2	2483.500	5.41	29.35	37.95	51.70	48.51	74.00	-25.49	peak
3	2485.886	5.41	29.36	37.95	52.85	49.67	74.00	-24.33	Peak

Mode:a; Polarization:Vertical; Channel:High



Condition: 3m VERTICAL
Job No: : 02506CR
Mode: : 2468 Band edge

		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	2466.595	5.40	29.30	37.95	113.25	110.00	74.00	36.00	peak
2	av	2483.500	5.41	29.35	37.95	55.13	51.94	54.00	-2.06	Average
3		2483.500	5.41	29.35	37.95	63.45	60.26	74.00	-13.74	peak
4		2483.923	5.41	29.35	37.95	54.26	51.07	54.00	-2.93	Average
5		2483.923	5.41	29.35	37.95	62.03	58.84	74.00	-15.16	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 6.10.4
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.		

7.8.1 E.U.T. Operation

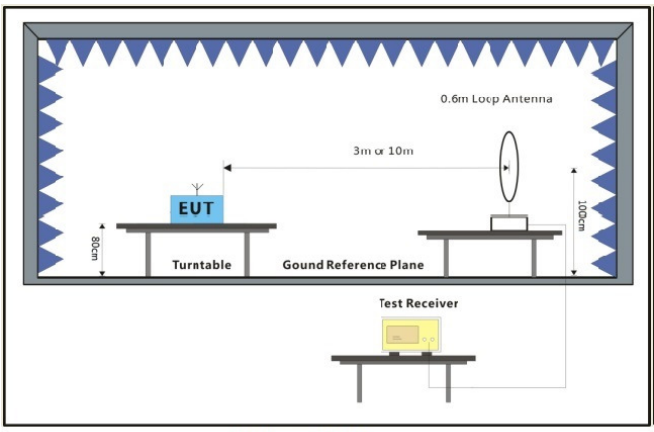
Operating Environment:

Temperature: 24 °C Humidity: 58 % RH Atmospheric Pressure: 1020 mbar

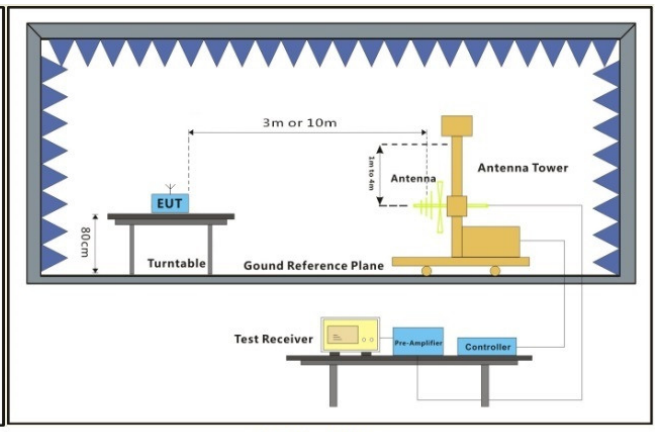
ExploratoryTest Mode: a:TX mode_Keep the EUT in transmitting mode

Final Test Mode: Test channel low/middle and high, the worst case is the high channel.
Only the worst case is recorded in the report.

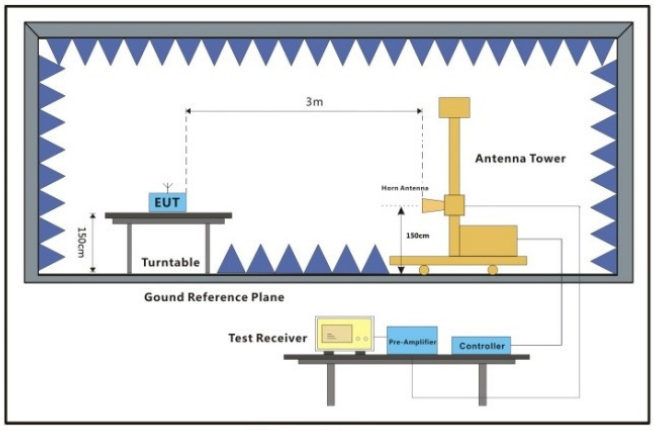
7.8.2 Test Setup Diagram



Below 30MHz



30MHz-1GHz



Above 1GHz

7.8.3 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 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.

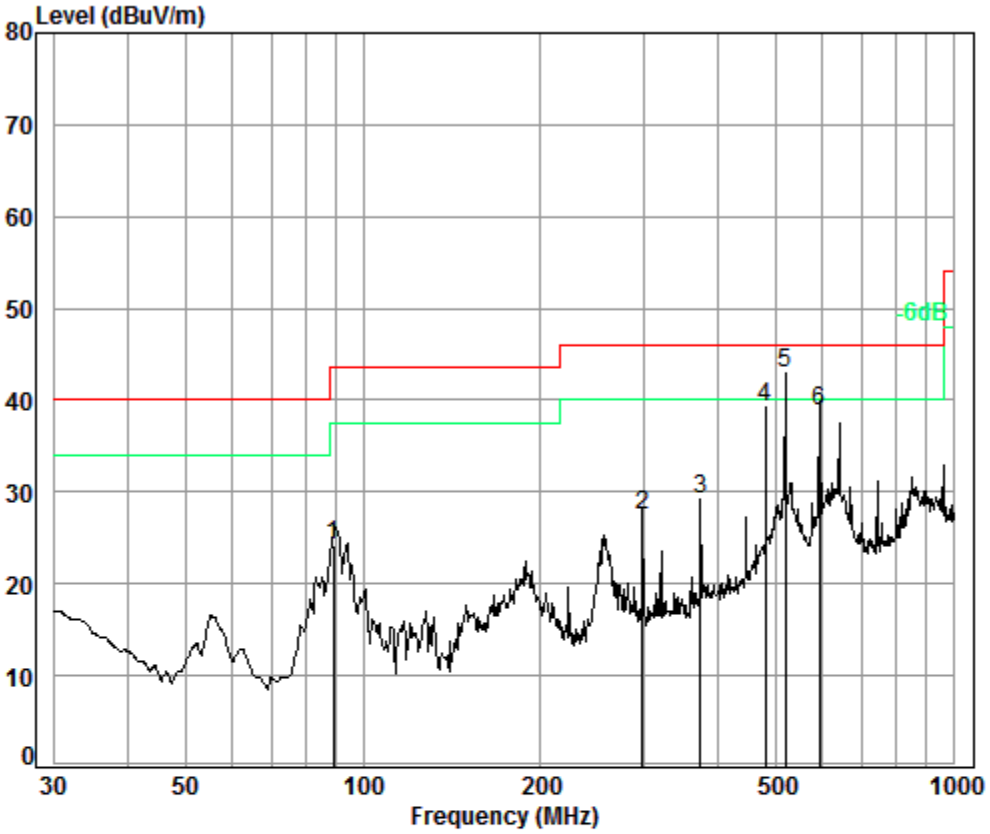
i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.

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

Below 1G

Detector:Peak

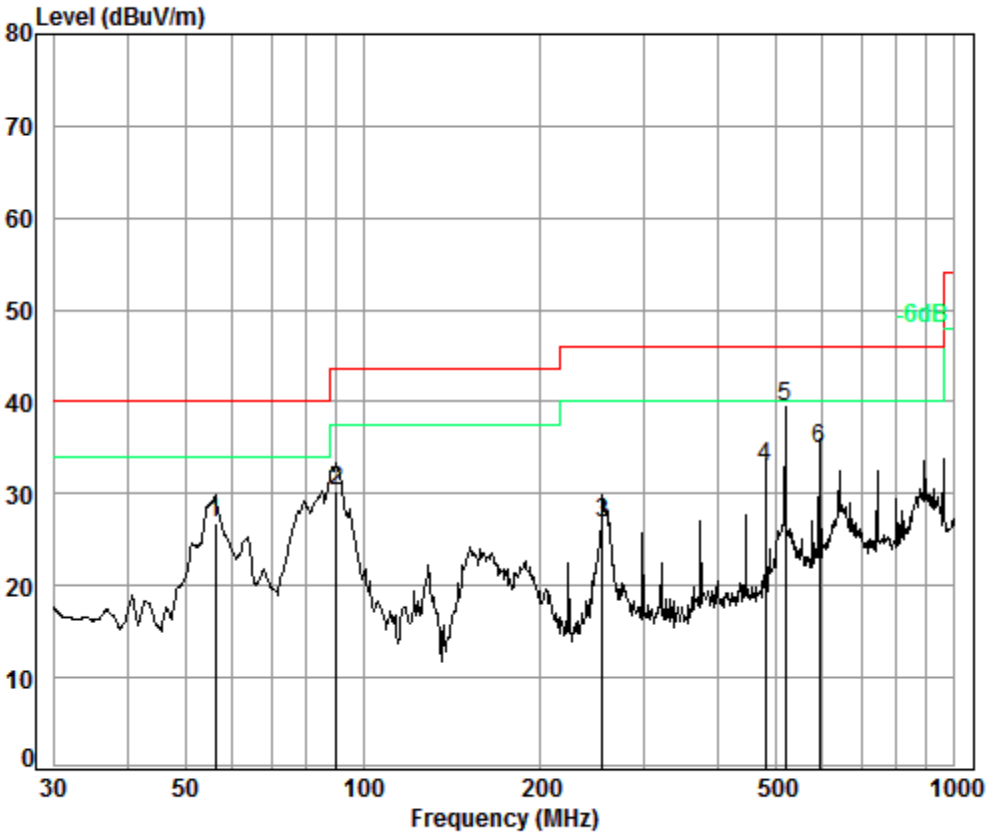
Mode:a;Polarization:Horizontal



Condition: 3m HORIZONTAL
Job No. : 02506CR
Test mode: a

	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	89.28	1.10	8.63	27.22	41.76	24.27	43.50	-19.23
2	297.22	1.89	13.78	26.41	38.12	27.38	46.00	-18.62
3	372.00	2.12	15.75	26.95	38.25	29.17	46.00	-16.83
4	480.53	2.53	17.80	27.60	46.56	39.29	46.00	-6.71
5 pp	519.06	2.62	18.33	27.67	49.58	42.86	46.00	-3.14
6	593.05	2.69	19.61	27.55	44.04	38.79	46.00	-7.21

Mode:a;Polarization:Vertical



Condition: 3m VERTICAL
Job No. : 02506CR
Test mode: a

	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	56.20	0.80	7.77	27.27	45.49	26.79	40.00	-13.21
2	90.22	1.10	8.71	27.21	47.66	30.26	43.50	-13.24
3	254.73	1.70	12.39	26.52	39.24	26.81	46.00	-19.19
4	480.53	2.53	17.80	27.60	40.15	32.88	46.00	-13.12
5 pp	519.06	2.62	18.33	27.67	46.25	39.53	46.00	-6.47
6	593.05	2.69	19.61	27.55	40.23	34.98	46.00	-11.02

Above 1GHz

Mode:a; Polarization:Horizontal; Channel:Low

Freq (MHz)	Antenna_ Factor (dB/m)	Cable_ Loss (dB)	Preamp_ Gain (dB)	Read_ Level (dBuV)	Level (dBuV/m)	Limit_ Line (dBuV/m)	Over_ Limit (dB)	Remark
3748.808	32.92	6.51	37.97	44.19	46.16	74	-27.84	Peak
4816	34.18	7.74	38.41	48.68	52.58	54	-1.42	Average
4816	34.19	7.75	38.41	57.95	61.87	74	-12.13	Peak
5572.778	34.45	8.33	38.39	45.16	50.01	74	-23.99	Peak
7224	36.41	9.67	37.1	41.22	50.45	54	-3.55	Average
7224	36.41	9.67	37.09	50.8	60.04	74	-13.96	Peak
9314.291	37.17	10.85	35.24	40.69	53.91	74	-20.09	Peak
10640.49	37.27	11.97	35.22	38.67	53.12	74	-20.88	Peak

Mode:a; Polarization:Vertical; Channel:Low

Freq (MHz)	Antenna_ Factor (dB/m)	Cable_ Loss (dB)	Preamp_ Gain (dB)	Read_ Level (dBuV)	Level (dBuV/m)	Limit_ Line (dBuV/m)	Over_ Limit (dB)	Remark
3754.236	32.94	6.51	37.98	43.57	45.55	74	-28.45	Peak
4816	34.19	7.75	38.41	48.89	52.81	54	-1.19	Average
4816	34.19	7.75	38.41	58.04	61.96	74	-12.04	Peak
6193.614	34.86	8.87	38.11	44.08	50	74	-24	Peak
7224	36.41	9.66	37.1	41.24	50.46	54	-3.54	Average
7224	36.41	9.66	37.1	51.52	60.74	74	-13.26	Peak
8441.494	36.07	10.28	35.96	41.97	52.67	74	-21.33	Peak
10795.57	37.46	12.1	35.3	38.88	53.56	74	-20.44	Peak

Mode:a; Polarization:Horizontal; Channel:middle

Freq (MHz)	Antenna_ Factor (dB/m)	Cable_ Loss (dB)	Preamp_ Gain (dB)	Read_ Level (dBuV)	Level (dBuV/m)	Limit_ Line (dBuV/m)	Over_ Limit (dB)	Remark
3781.495	33.01	6.53	37.98	44.97	47.03	74	-26.97	Peak
4880	34.29	7.83	38.44	56.09	60.18	74	-13.82	Peak
4880	34.29	7.83	38.44	46.12	50.21	54	-3.79	Average
6140.076	34.82	8.84	38.16	44.32	50.11	74	-23.89	Peak
7320	36.37	9.73	37.01	52.63	61.95	74	-12.05	Peak
7320	36.37	9.73	37.01	42.79	52.11	54	-1.89	Average
9273.947	37.1	10.83	35.26	40.48	53.58	74	-20.42	Peak
10842.53	37.51	12.14	35.32	38.62	53.37	74	-20.63	Peak

Mode:a; Polarization:Vertical; Channel:middle

Freq (MHz)	Antenna_ Factor (dB/m)	Cable_ Loss (dB)	Preamp_ Gain (dB)	Read_ Level (dBuV)	Level (dBuV/m)	Limit_ Line (dBuV/m)	Over_ Limit (dB)	Remark
3836.607	33.16	6.58	37.98	44.57	46.82	74	-27.18	Peak
4880	34.29	7.83	38.44	47.13	51.22	54	-2.78	Average
4880	34.29	7.83	38.44	56.74	60.83	74	-13.17	Peak
5778.052	34.57	8.53	38.34	45.1	50.25	74	-23.75	Peak
7320	36.37	9.73	37.01	42.37	51.69	54	-2.31	Average
7320	36.37	9.73	37.01	52.06	61.39	74	-12.61	Peak
8626.71	36.16	10.41	35.77	41.67	52.82	74	-21.18	Peak
10671.33	37.31	12	35.24	39.08	53.58	74	-20.42	Peak

Mode:a; Polarization:Horizontal; Channel:High

Freq (MHz)	Antenna_ Factor (dB/m)	Cable_ Loss (dB)	Preamp_ Gain (dB)	Read_ Level (dBuV)	Level (dBuV/m)	Limit_ Line (dBuV/m)	Over_ Limit (dB)	Remark
3898.16	33.33	6.62	37.99	43.84	46.27	74	-27.73	Peak
4936	34.39	7.91	38.47	47.23	51.49	54	-2.51	Average
4936	34.39	7.91	38.47	57.39	61.65	74	-12.35	Peak
6131.199	34.81	8.83	38.17	45.28	51.04	74	-22.96	Peak
7404	36.33	9.79	36.93	42.7	52.11	54	-1.89	Average
7404	36.34	9.79	36.94	51.95	61.36	74	-12.64	Peak
9354.81	37.24	10.87	35.22	40.32	53.65	74	-20.35	Peak
11258.19	37.91	12.3	35.45	38.18	53.5	74	-20.5	Peak

Mode:a; Polarization:Vertical; Channel:High

Freq (MHz)	Antenna_ Factor (dB/m)	Cable_ Loss (dB)	Preamp_ Gain (dB)	Read_ Level (dBuV)	Level (dBuV/m)	Limit_ Line (dBuV/m)	Over_ Limit (dB)	Remark
3647.151	32.63	6.42	37.96	44.17	45.78	74	-28.22	Peak
4936	34.4	7.92	38.47	48.18	52.46	54	-1.54	Average
4936	34.4	7.92	38.47	57.88	62.16	74	-11.84	Peak
5769.698	34.57	8.53	38.35	44.53	49.68	74	-24.32	Peak
7404	36.34	9.78	36.94	42.56	51.96	54	-2.04	Average
7404	36.34	9.78	36.94	52.39	61.79	74	-12.21	Peak
8368.526	36.15	10.24	36.03	41.97	52.63	74	-21.37	Peak
10412.04	37.19	11.79	35.11	39.32	53.63	74	-20.37	Peak

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

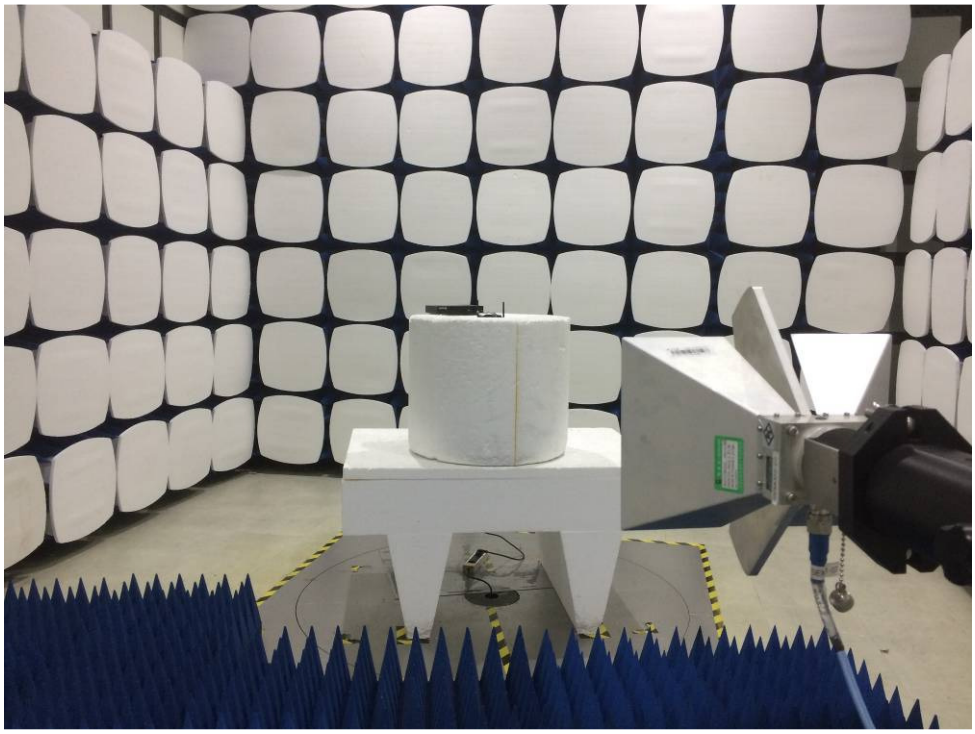
2) Scan from 9kHz to 25GHz,The disturbance above 13GHz and below 30MHz was very low, and the above harmonics were the highest point could be found when testing, so only the above harmonics had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below 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 above measurement data were shown in the report.

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 SZEM1703002506CR.

9 Appendix

9.1 Appendix 15.247

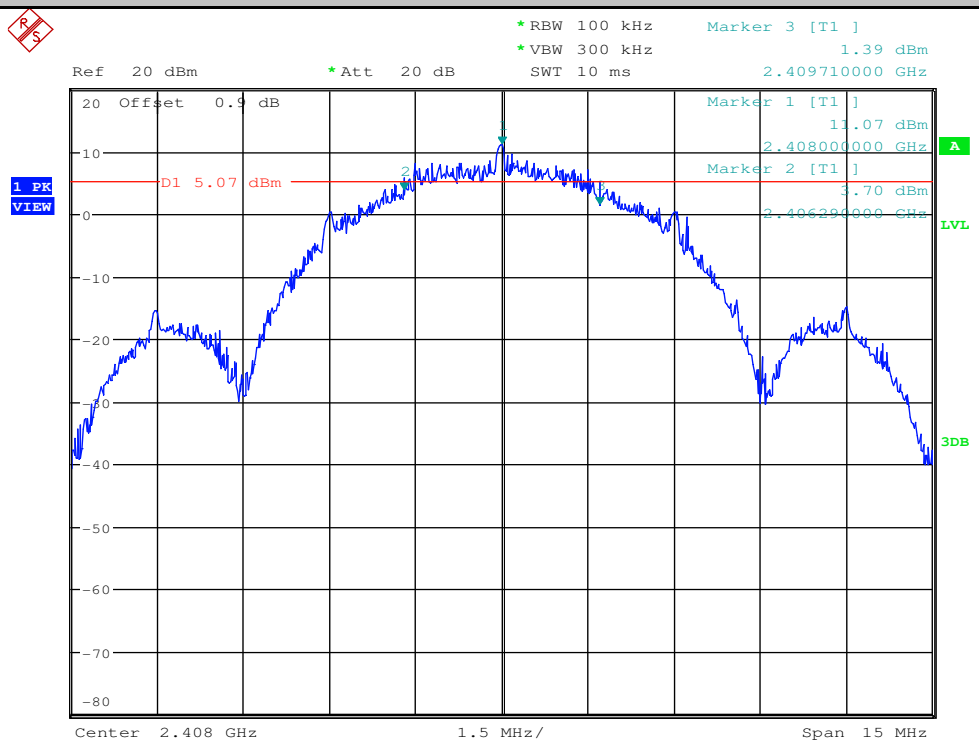
Module 1

1.6dB Bandwidth

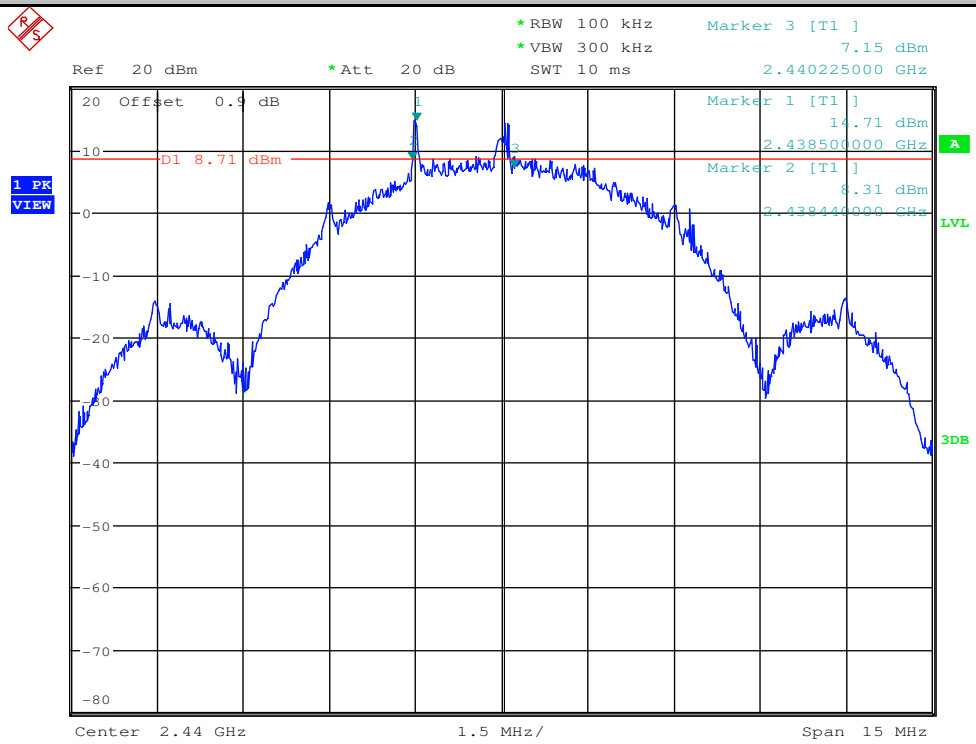
Test Channel	EBW[MHz]	Limit	Verdict
2408	3.420	>=0.5	PASS
2440	1.785	>=0.5	PASS
2468	3.525	>=0.5	PASS

TEST PLOT

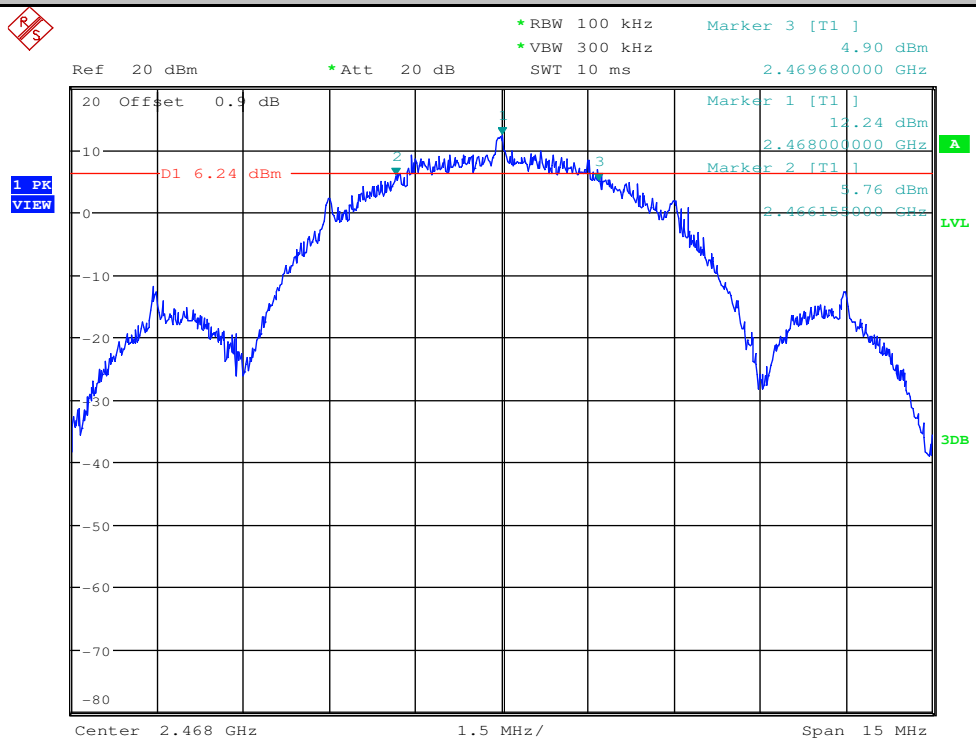
6dB Bandwidth_2408



6dB Bandwidth_2440



6dB Bandwidth_2468

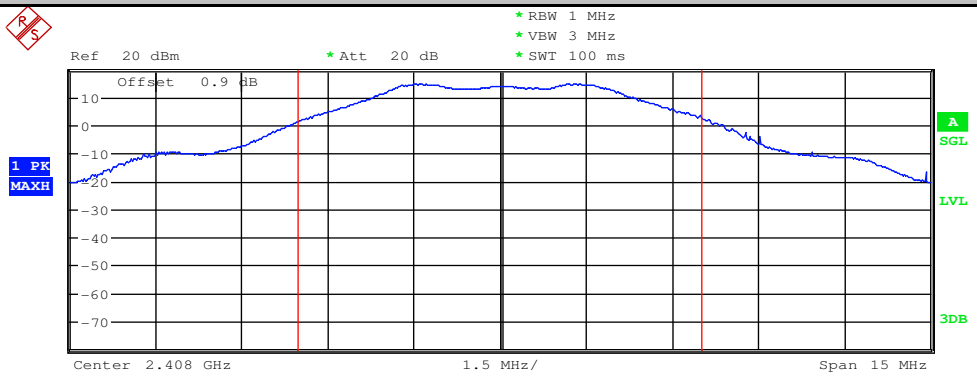


2.Maximum peak conducted output power

Test Channel	Power[dBm]	Limit[dBm]	Verdict
2408	19.66	<30	PASS
2440	20.34	<30	PASS
2468	21.22	<30	PASS

TEST PLOT

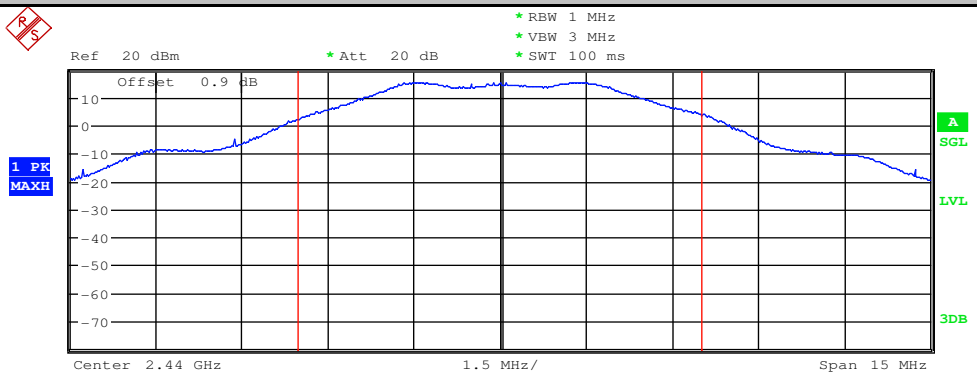
Maximum peak conducted output power_2408



Tx Channel

Bandwidth 7 MHz Power 19.66 dBm

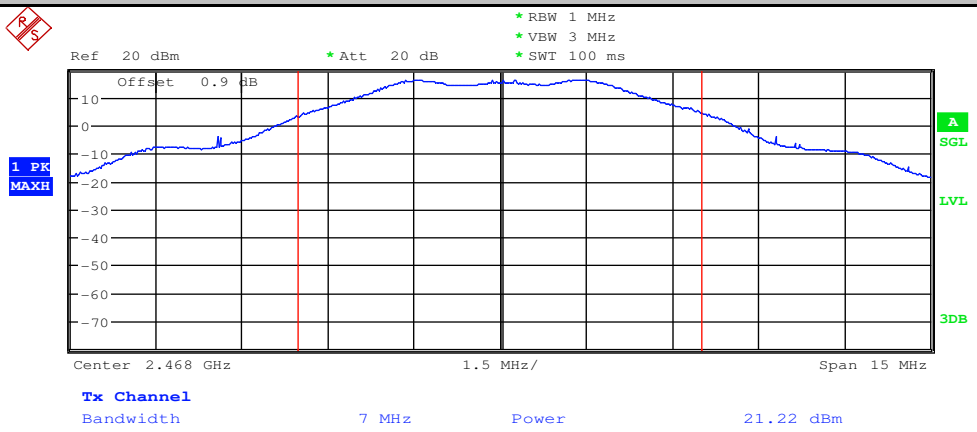
Maximum peak conducted output power_2440



Tx Channel

Bandwidth	7 MHz	Power	20.34 dBm

Maximum peak conducted output power_2468



Tx Channel

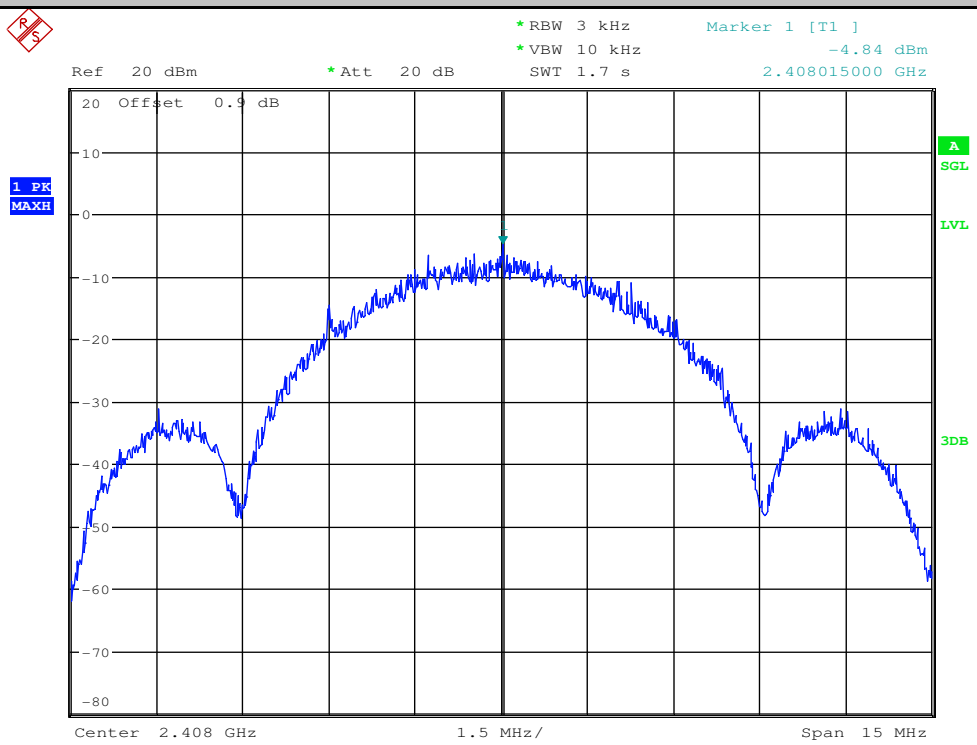
Bandwidth 7 MHz Power 21.22 dBm

3.Maximum Peak power spectral density

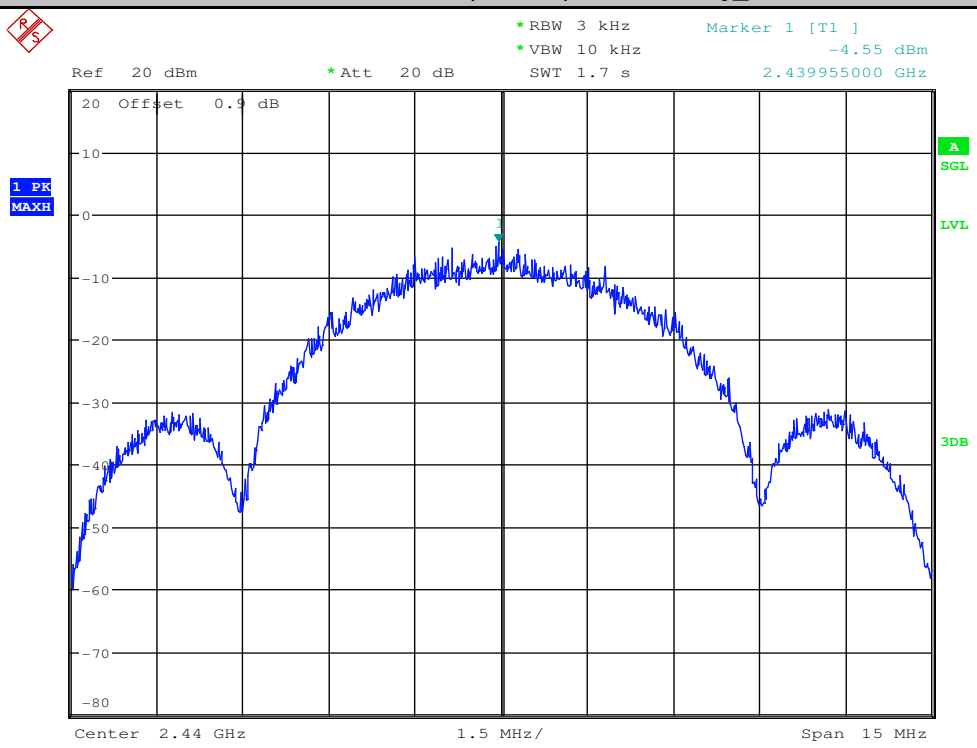
Test Channel	PSD[dBm/3kHz]	Limit[dBm/3kHz]	Verdict
2408	-4.84	<8.00	PASS
2440	-4.55	<8.00	PASS
2468	-2.65	<8.00	PASS

TEST PLOT

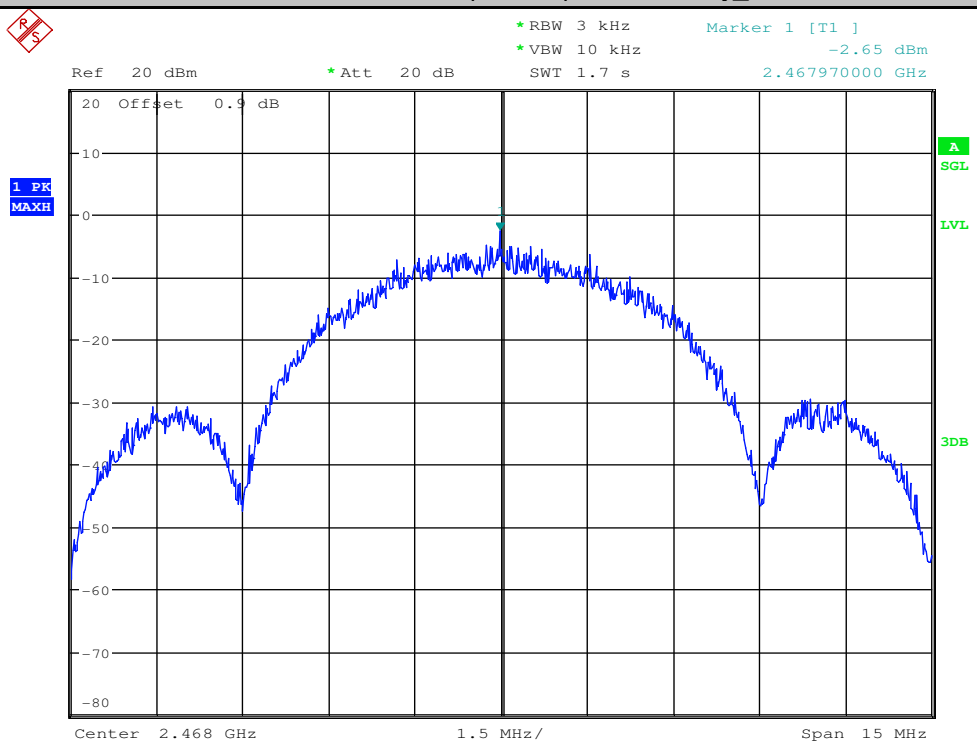
Maximum Peak power spectral density_2408



Maximum Peak power spectral density_2440



Maximum Peak power spectral density_2468

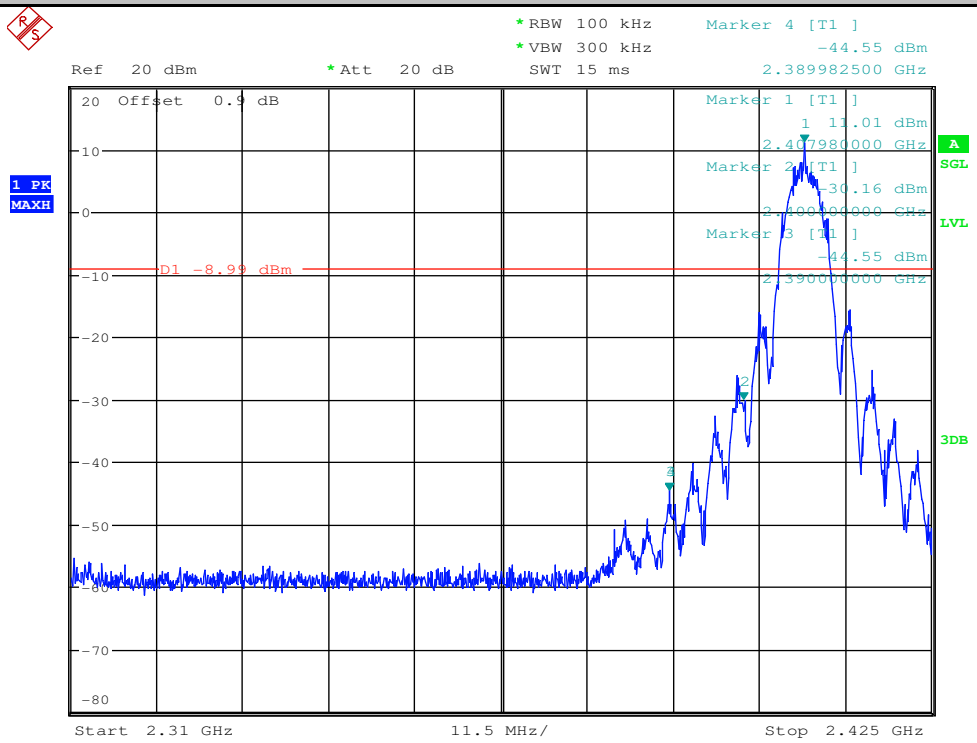


4.Band-edge for RF Conducted Emissions

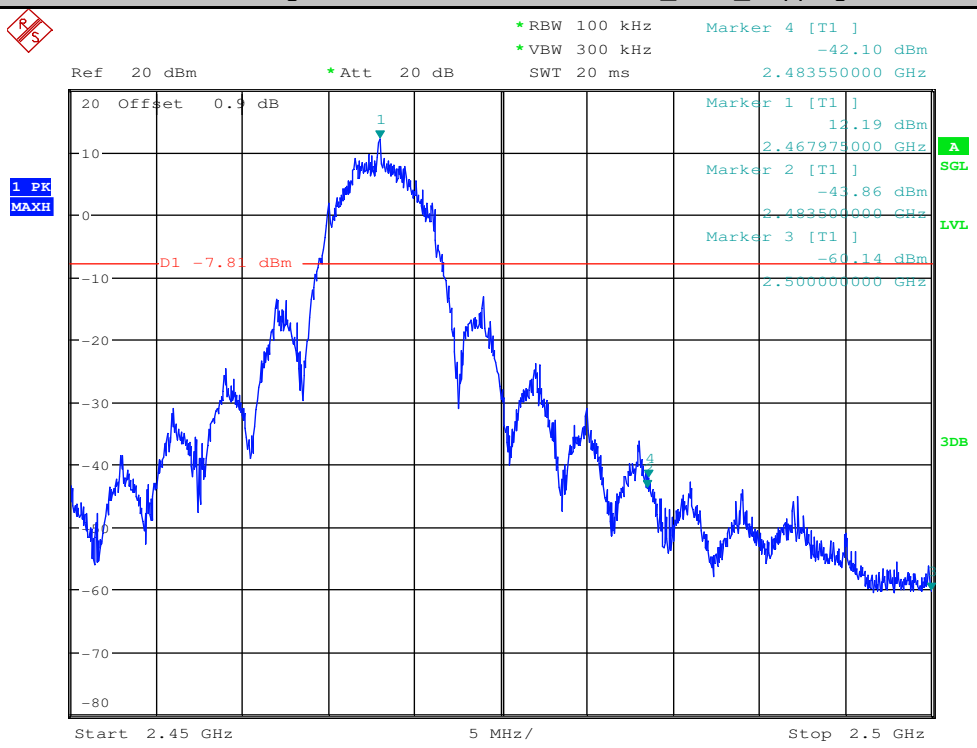
Test Channel	Carrier Power[dBm]	Max. Spurious Level [dBm]	Limit [dBm]	Verdict
2408	11.010	-44.553	<-8.99	PASS
2468	12.190	-42.102	<-7.81	PASS

TEST PLOT

Band-edge for RF Conducted Emissions_2408_Hopping Off

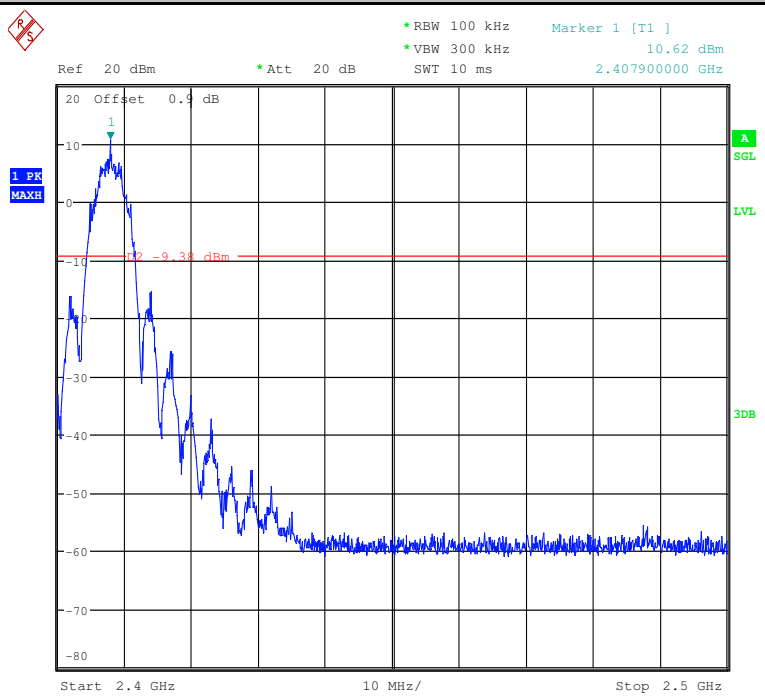


Band-edge for RF Conducted Emissions_2468_Hopping Off

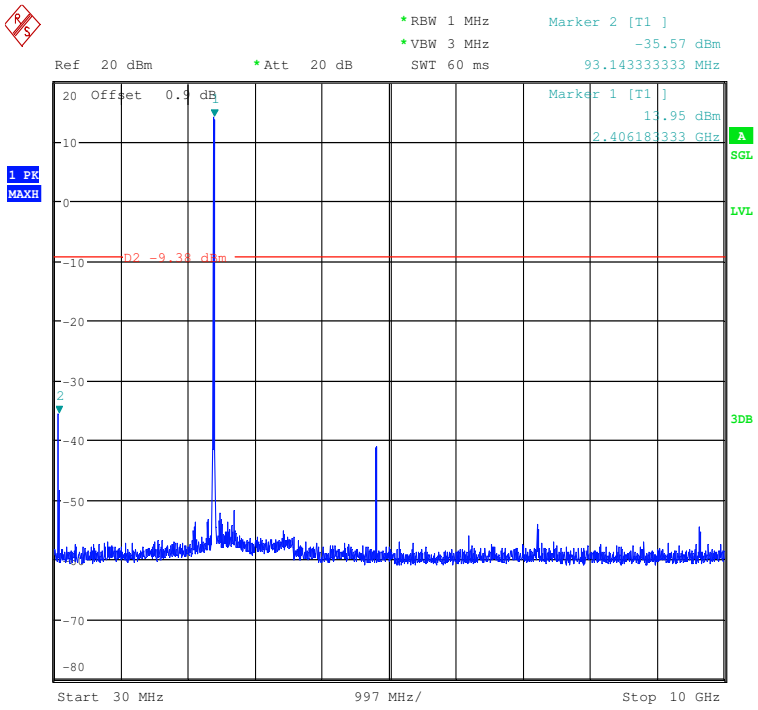


5.RF Conducted Spurious Emissions

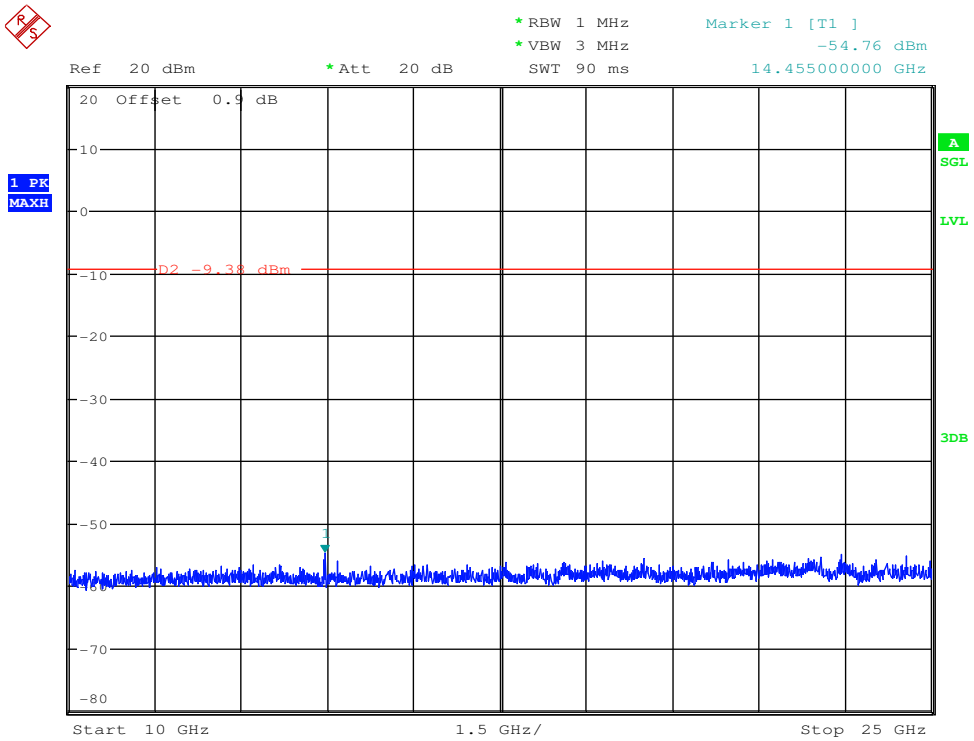
Test Channel	StartFre [MHz]	StopFre [MHz]	RBW [kHz]	VBW [kHz]	Pref[dBm]	Max. Level [dBm]	Limit [dBm]	Verdict
2408	30	10000	1000	3000	10.62	-35.570	<-9.38	PASS
2408	10000	25000	1000	3000	10.62	-54.760	<-9.38	PASS
2440	30	10000	1000	3000	11.1	-34.000	<-8.9	PASS
2440	10000	25000	1000	3000	11.1	-54.340	<-8.9	PASS
2468	30	10000	1000	3000	12.34	-32.010	<-7.66	PASS
2468	10000	25000	1000	3000	12.34	-54.930	<-7.66	PASS

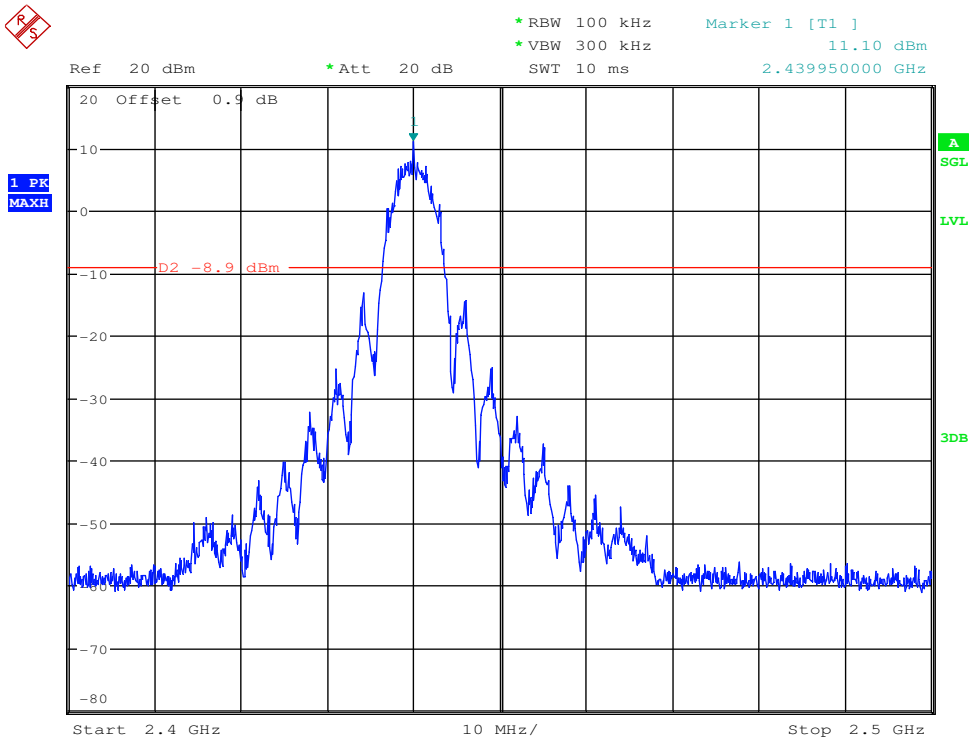
TEST PLOT	
RF Conducted Spurious Emissions_2408	
Pref	

CSE_1

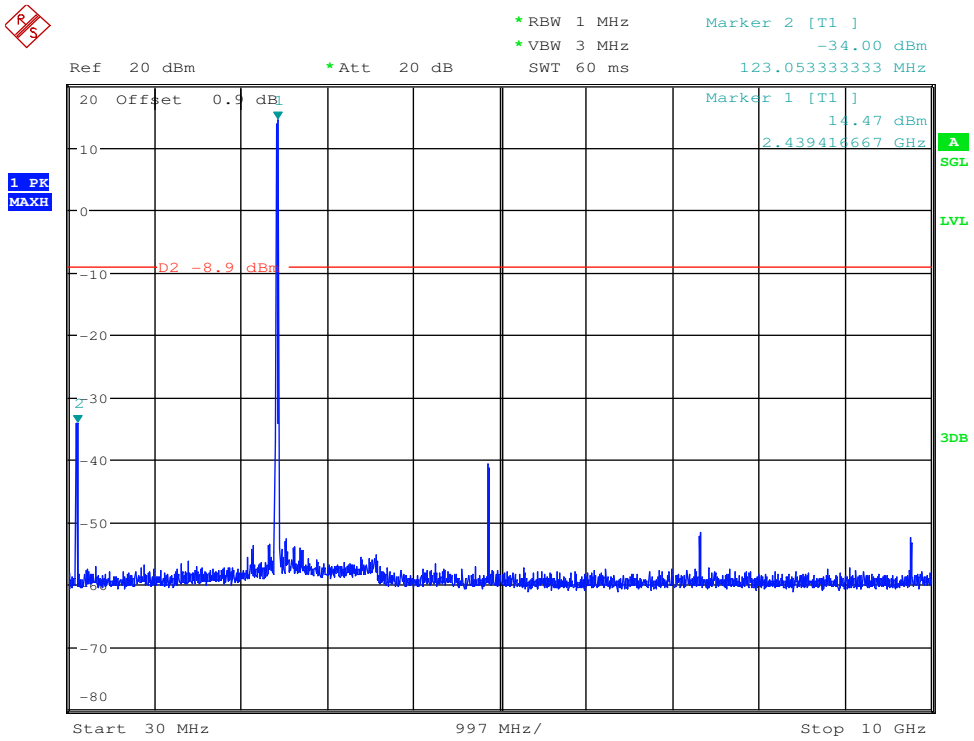


CSE_2

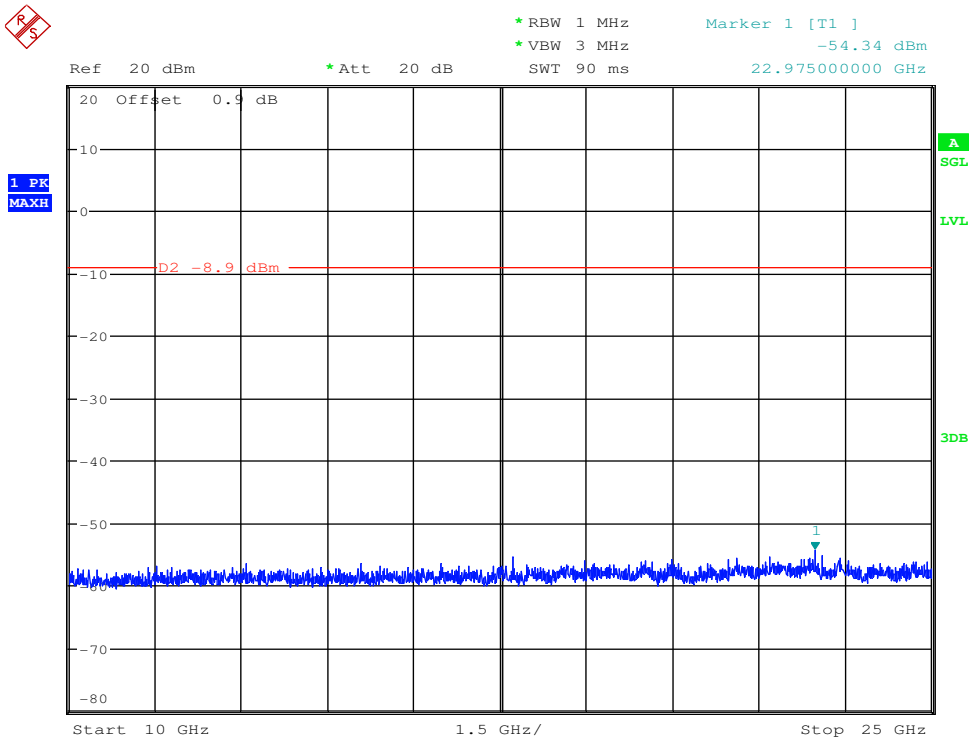


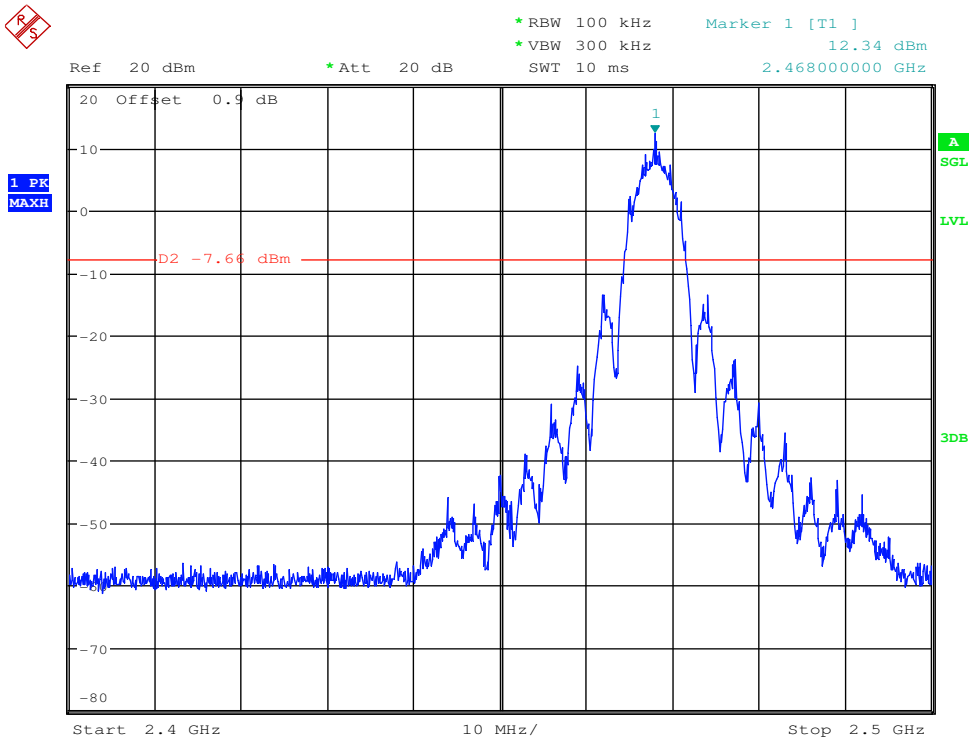
RF Conducted Spurious Emissions_2440	
Pref	

CSE_1

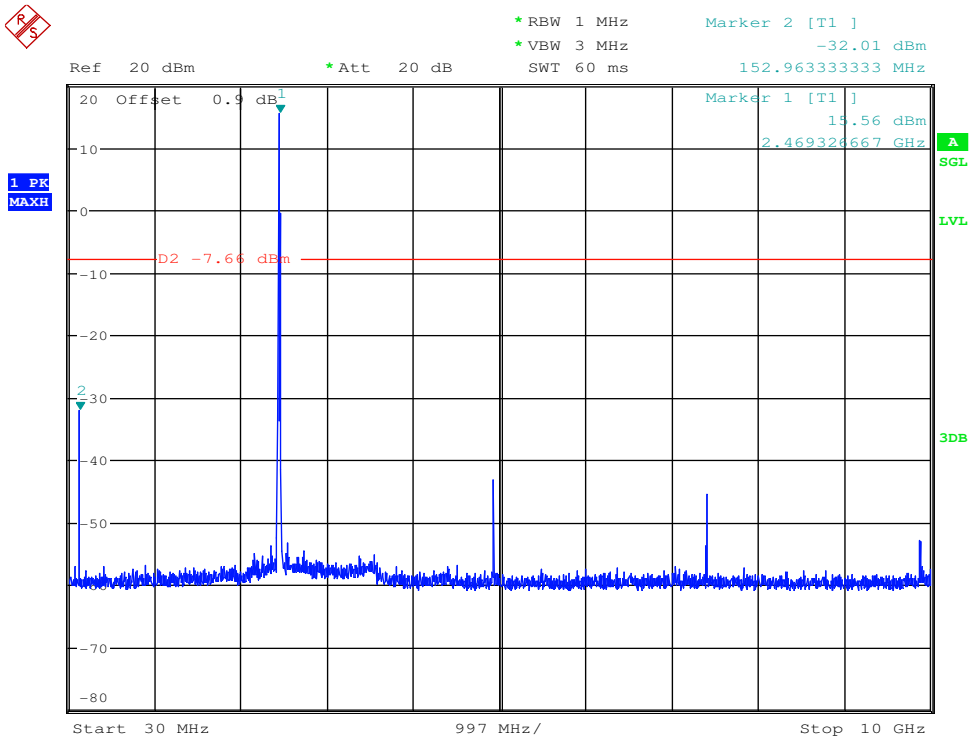


CSE_2



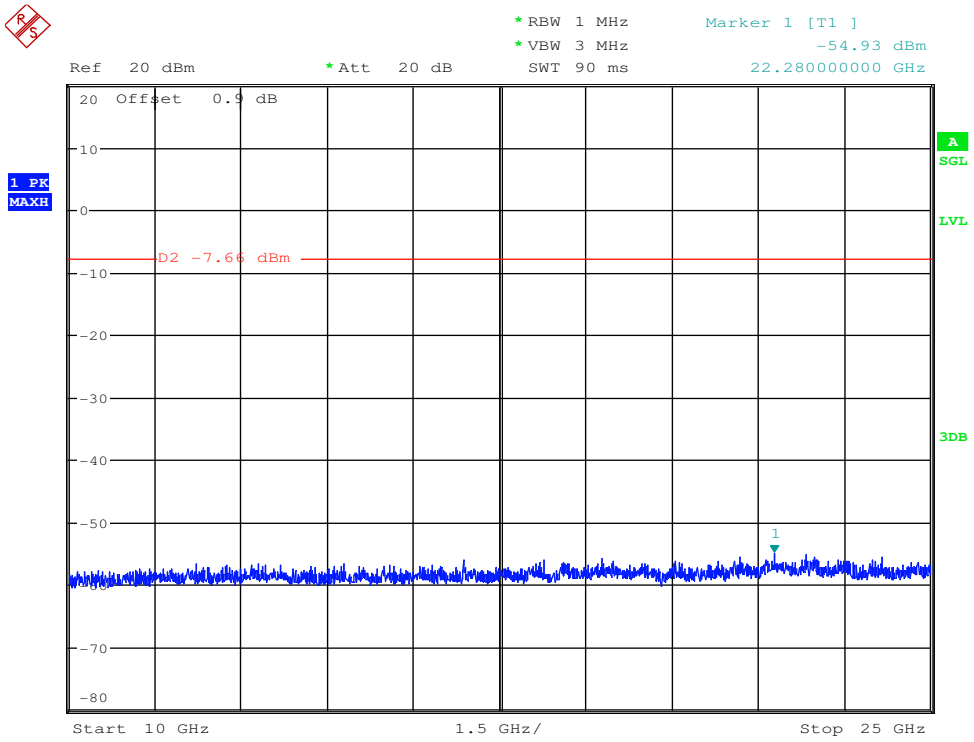
RF Conducted Spurious Emissions_2468	
Pref	

CSE_1



Date: 23.MAY.2017 20:16:17

CSE_2



Date: 23.MAY.2017 20:16:31

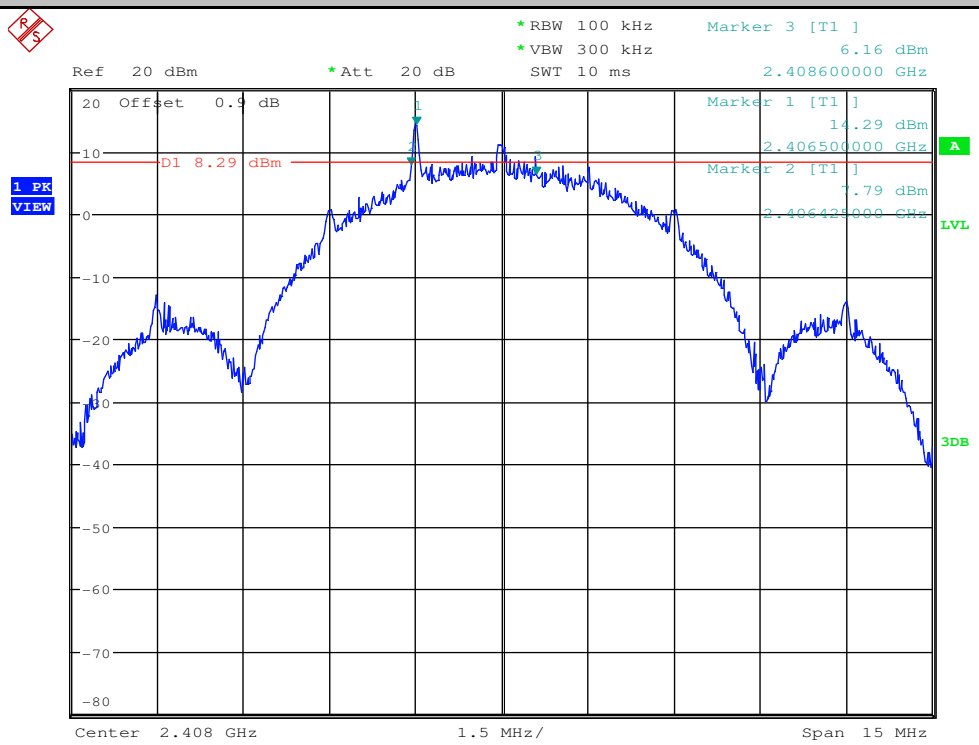
Module 2

1.6dB Bandwidth

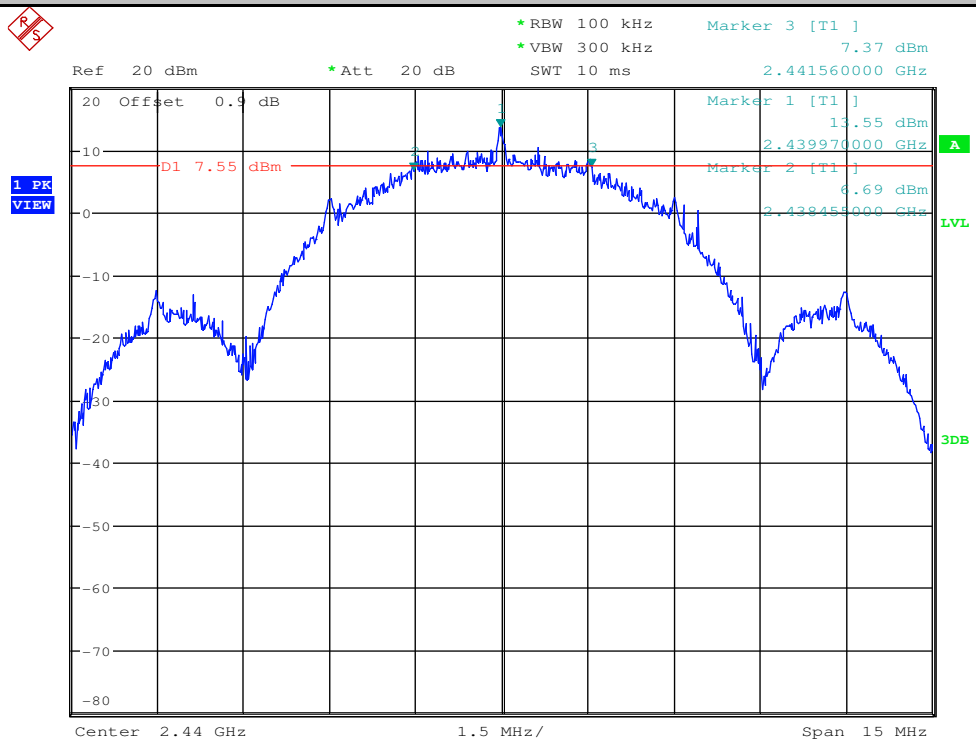
Test Channel	EBW[MHz]	Limit	Verdict
2408	2.175	>=0.5	PASS
2440	3.105	>=0.5	PASS
2468	3.195	>=0.5	PASS

TEST PLOT

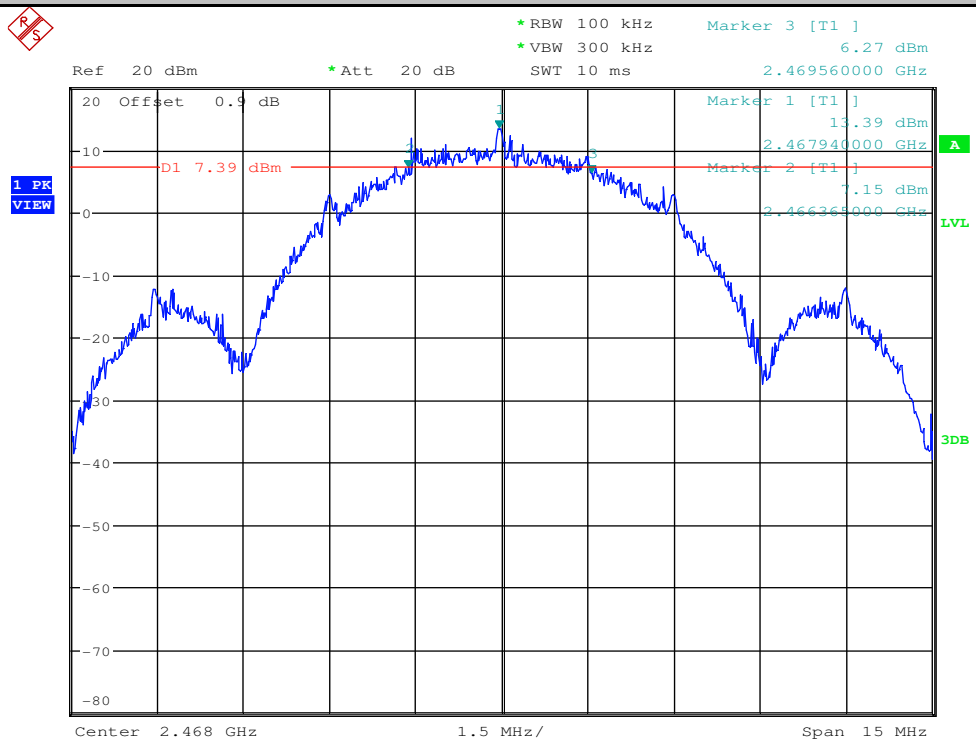
6dB Bandwidth_2408



6dB Bandwidth_2440



6dB Bandwidth_2468

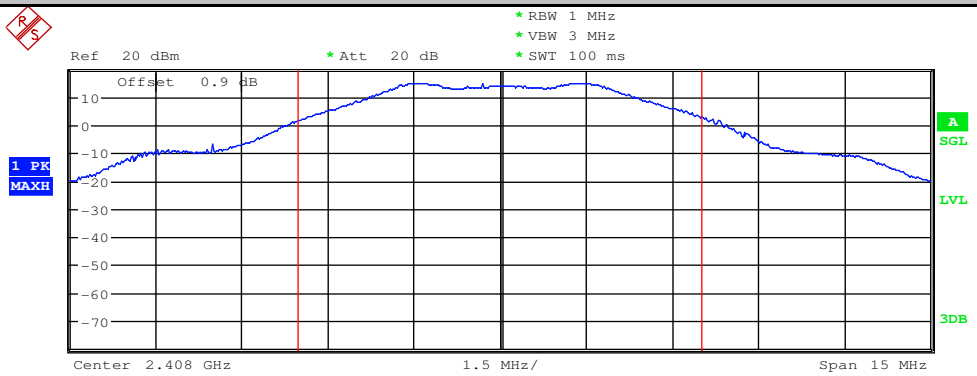


2.Maximum peak conducted output power

Test Channel	Power[dBm]	Limit[dBm]	Verdict
2408	19.82	<30	PASS
2440	21.1	<30	PASS
2468	22.1	<30	PASS

TEST PLOT

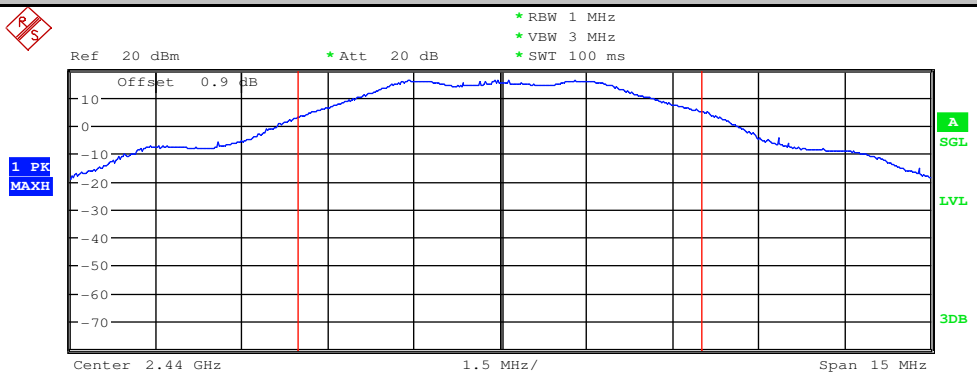
Maximum peak conducted output power_2408



Tx Channel

Bandwidth 7 MHz Power 19.82 dBm

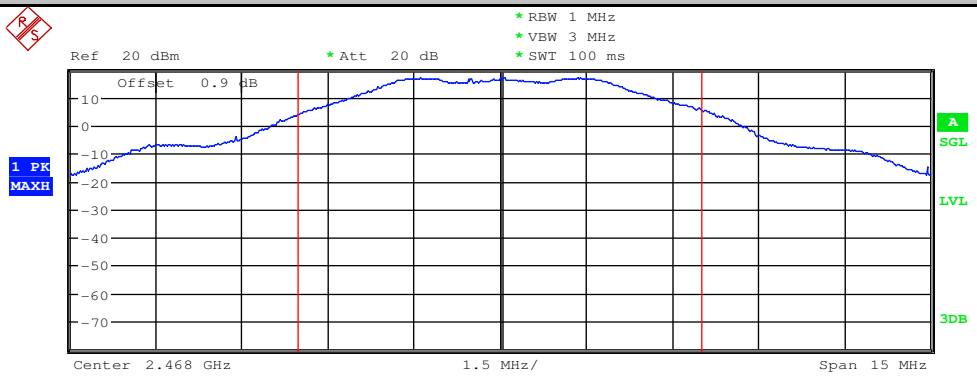
Maximum peak conducted output power_2440



Tx Channel

Bandwidth	7 MHz	Power	21.10 dBm

Maximum peak conducted output power_2468



Tx Channel

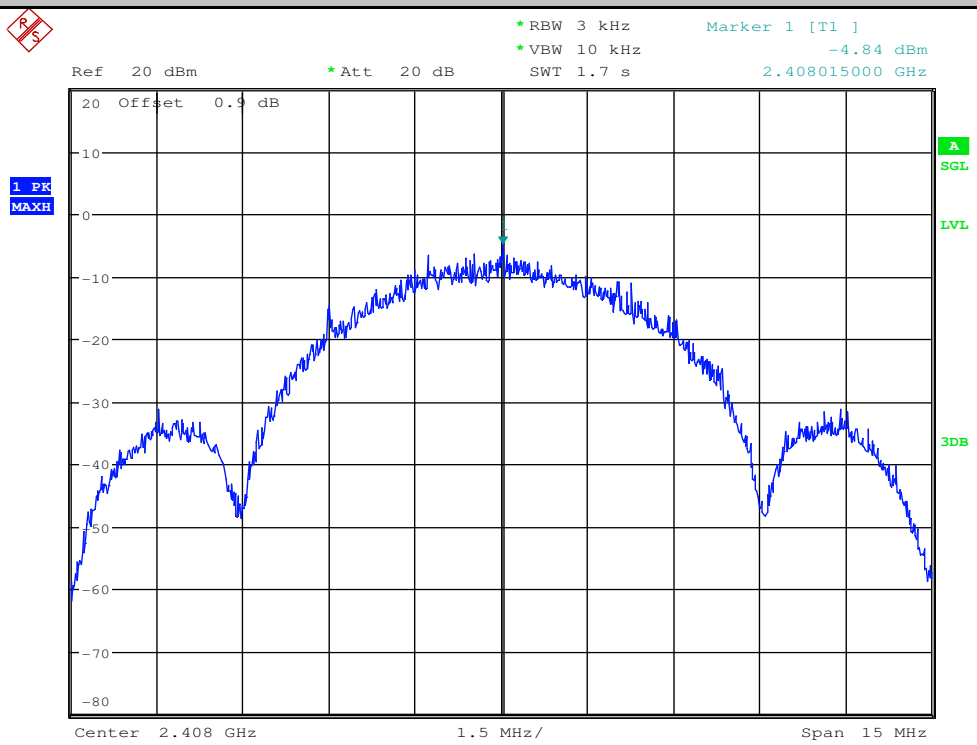
Bandwidth	7 MHz	Power	22.10 dBm

3.Maximum Peak power spectral density

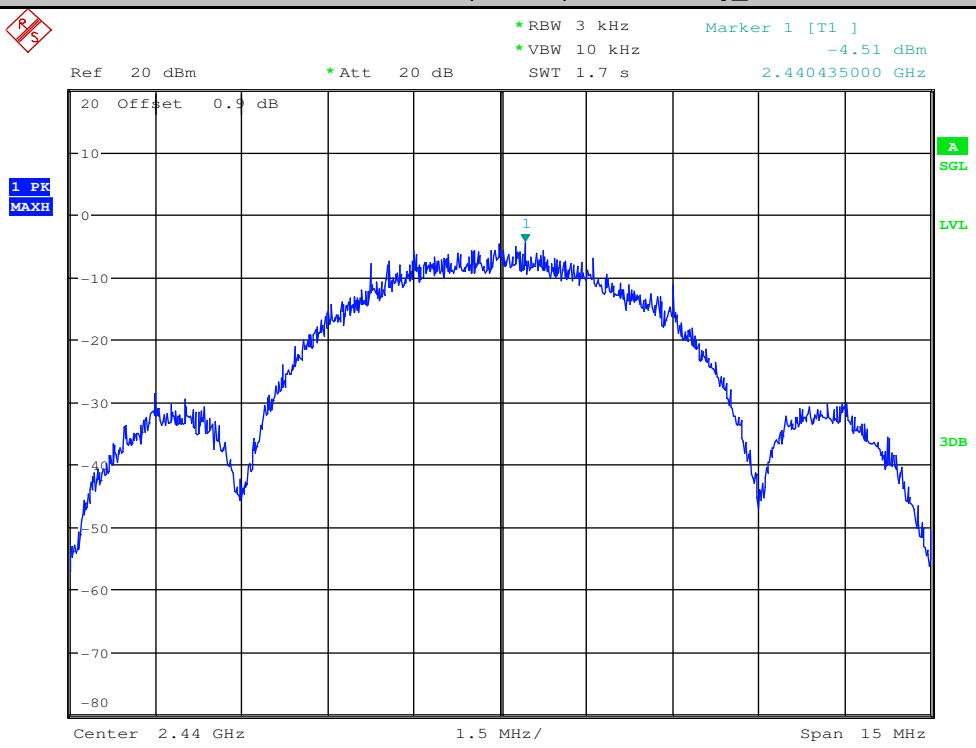
Test Channel	PSD[dBm/3kHz]	Limit[dBm/3kHz]	Verdict
2408	-4.84	<8.00	PASS
2440	-4.51	<8.00	PASS
2468	-0.47	<8.00	PASS

TEST PLOT

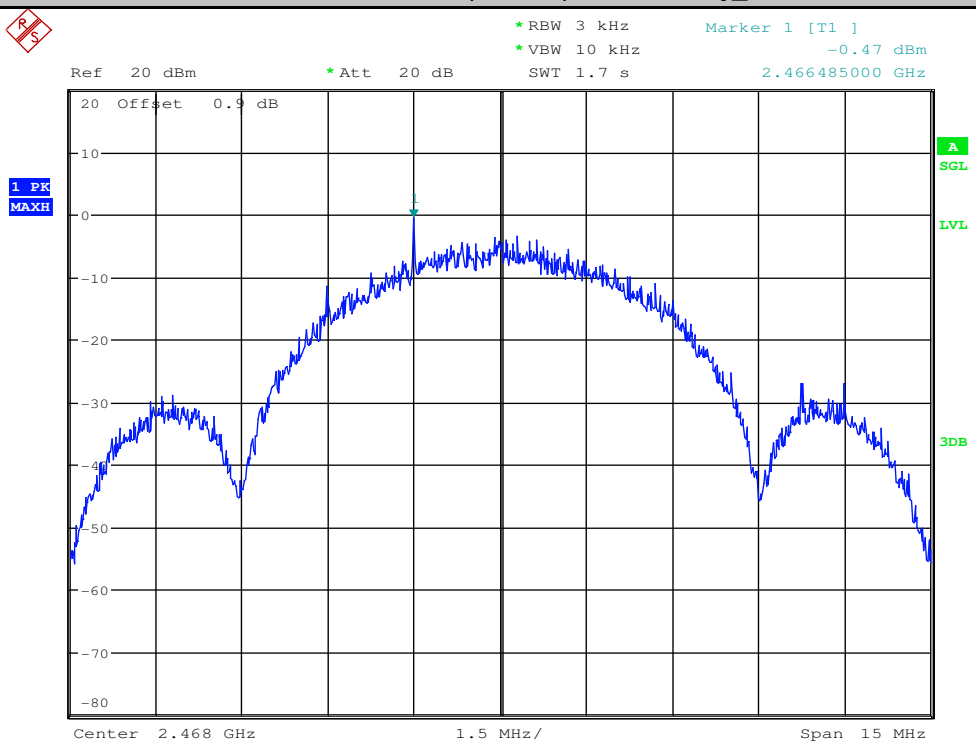
Maximum Peak power spectral density_2408



Maximum Peak power spectral density_2440



Maximum Peak power spectral density_2468

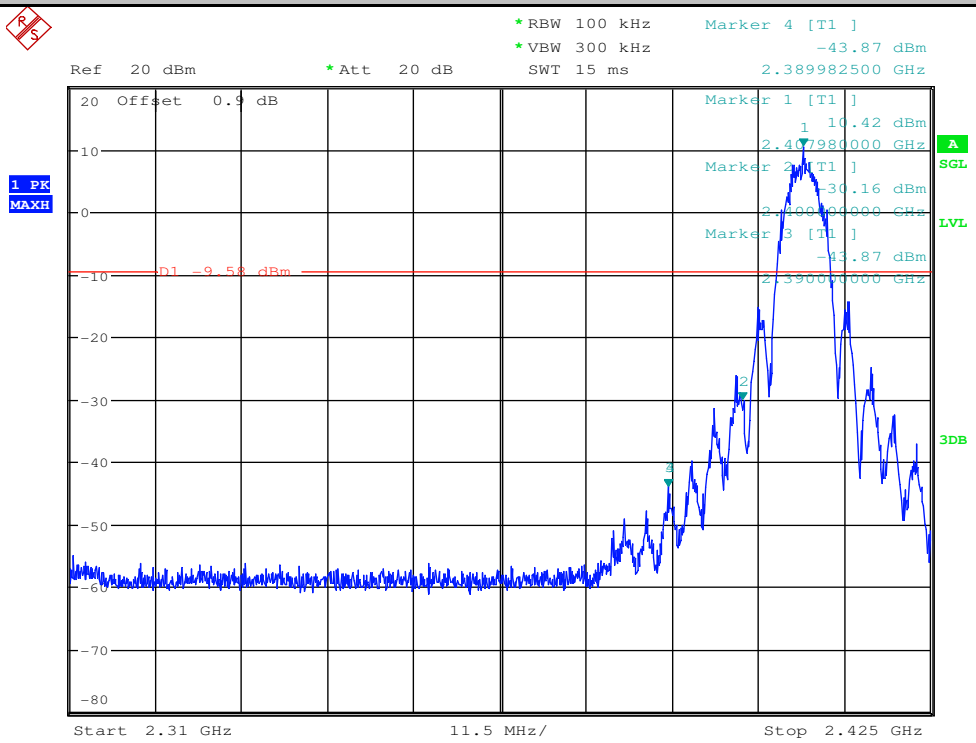


4.Band-edge for RF Conducted Emissions

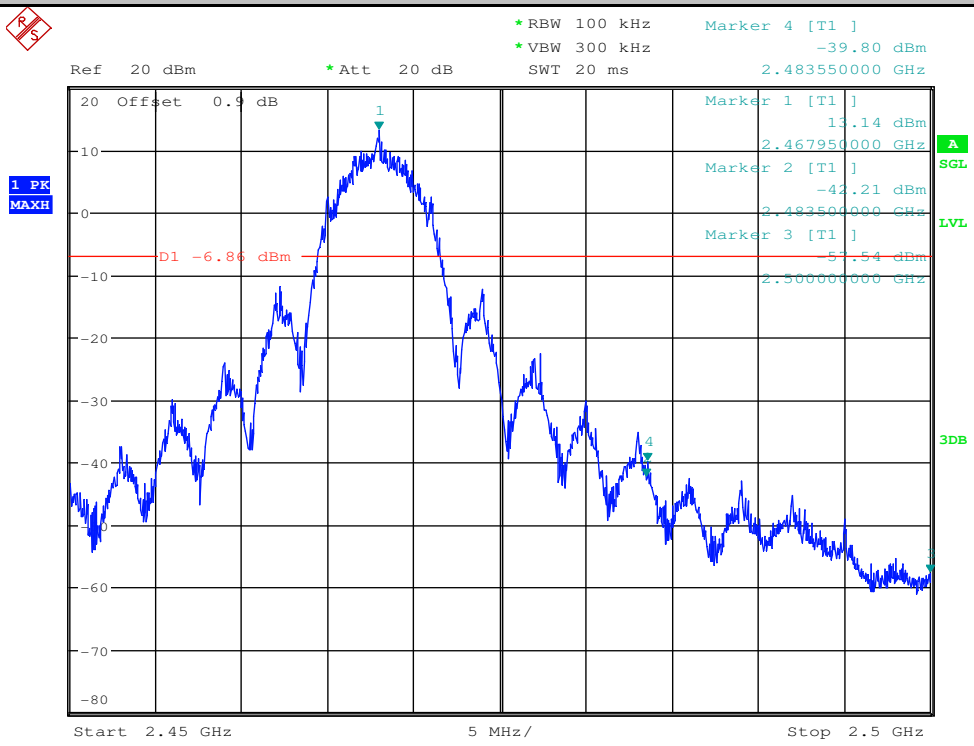
Test Channel	Carrier Power[dBm]	Max. Spurious Level [dBm]	Limit [dBm]	Verdict
2408	10.420	-43.874	<-9.58	PASS
2468	13.140	-39.802	<-6.86	PASS

TEST PLOT

Band-edge for RF Conducted Emissions_2408_Hopping Off

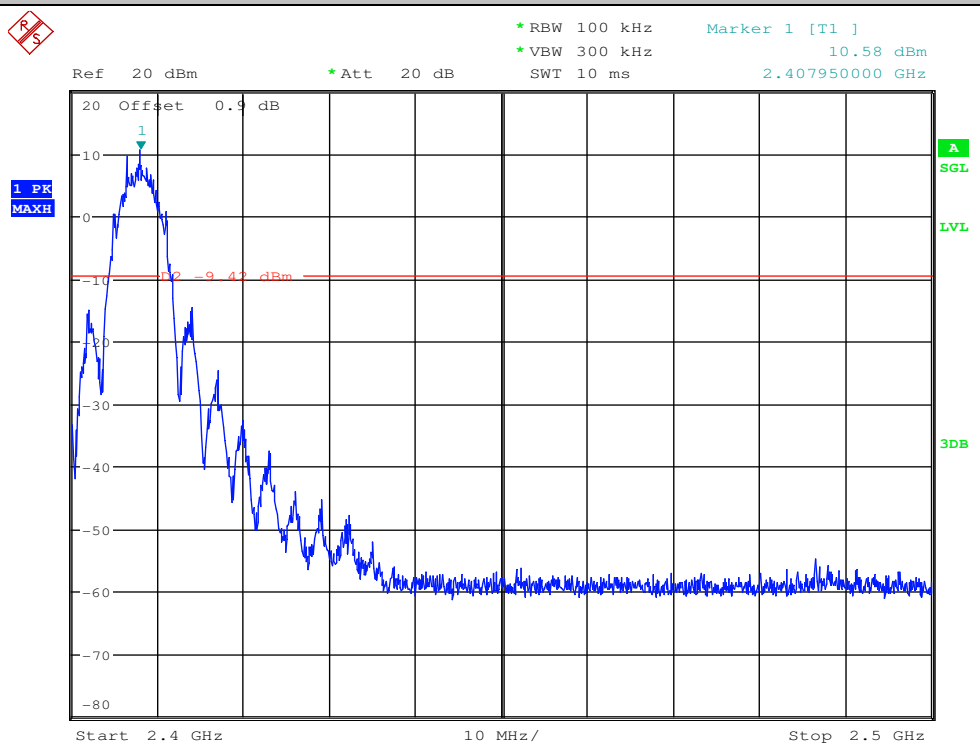


Band-edge for RF Conducted Emissions_2468_Hopping Off

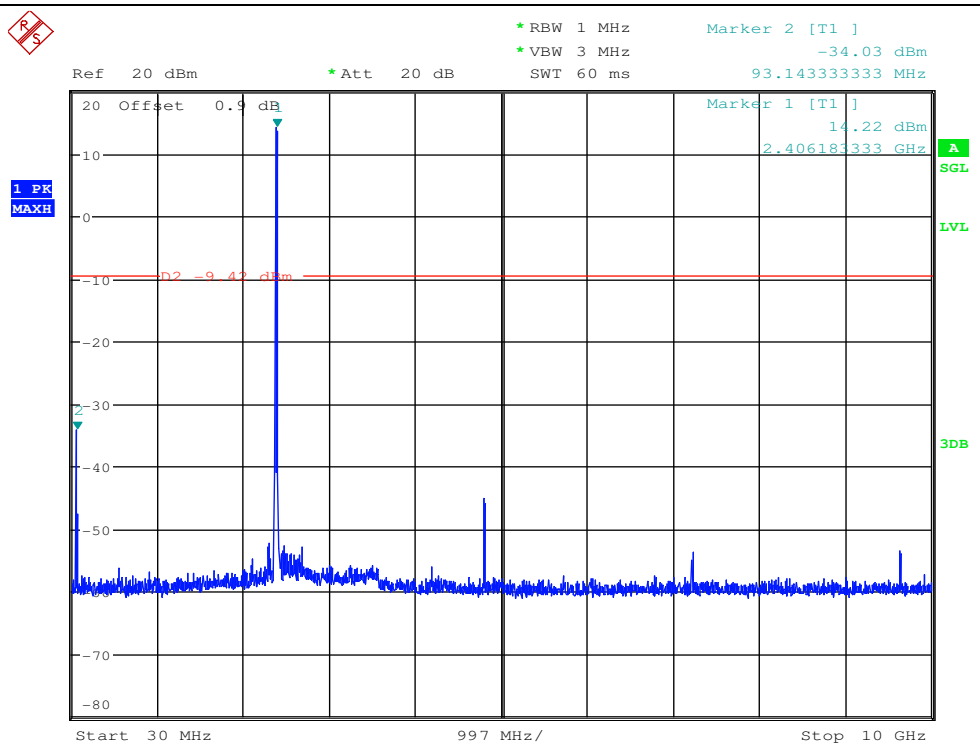


5.RF Conducted Spurious Emissions

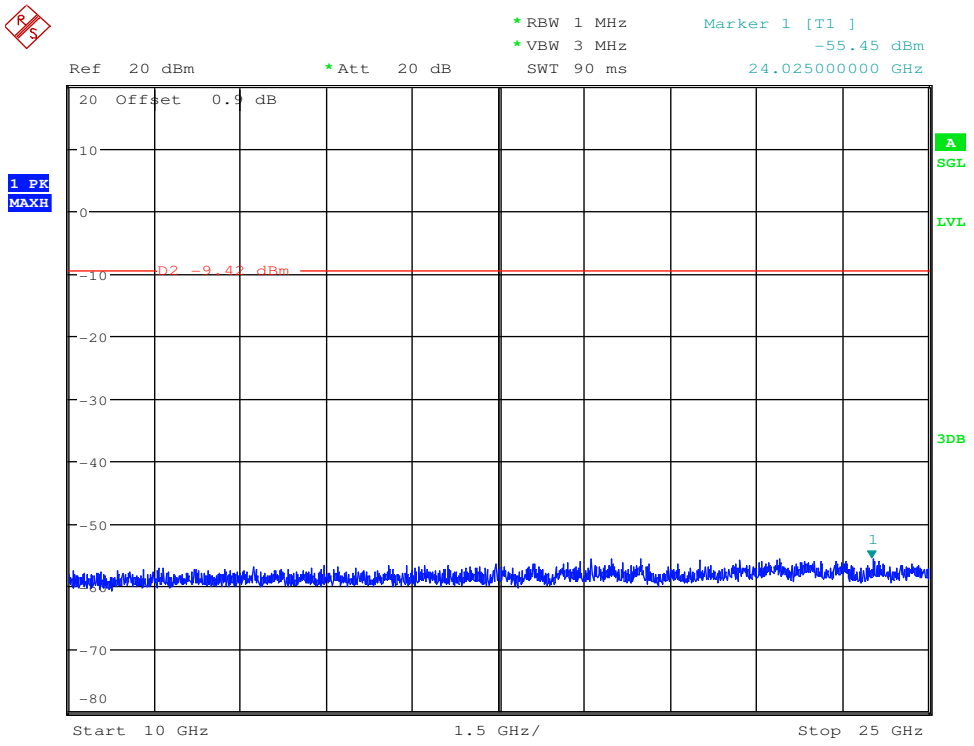
Test Channel	StartFre [MHz]	StopFre [MHz]	RBW [kHz]	VBW [kHz]	Pref[dBm]	Max. Level [dBm]	Limit [dBm]	Verdict
2408	30	10000	1000	3000	10.58	-34.030	<-9.42	PASS
2408	10000	25000	1000	3000	10.58	-55.450	<-9.42	PASS
2440	30	10000	1000	3000	15.57	-32.780	<-4.43	PASS
2440	10000	25000	1000	3000	15.57	-55.050	<-4.43	PASS
2468	30	10000	1000	3000	13.22	-29.870	<-6.78	PASS
2468	10000	25000	1000	3000	13.22	-55.230	<-6.78	PASS

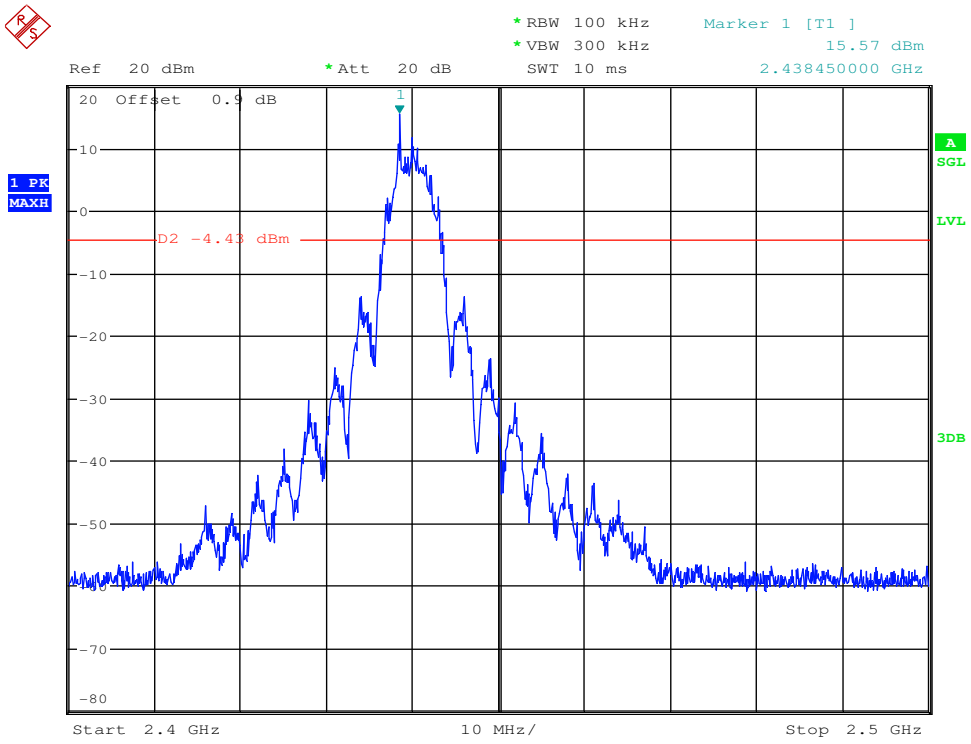
TEST PLOT	
RF Conducted Spurious Emissions_2408	
Pref	

CSE_1

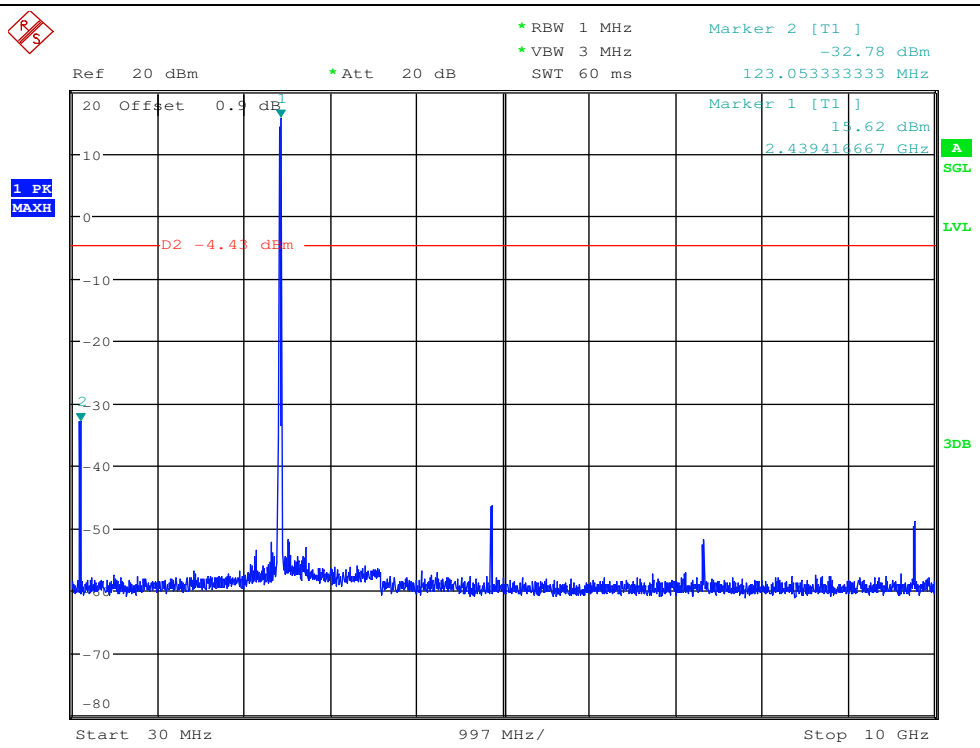


CSE_2

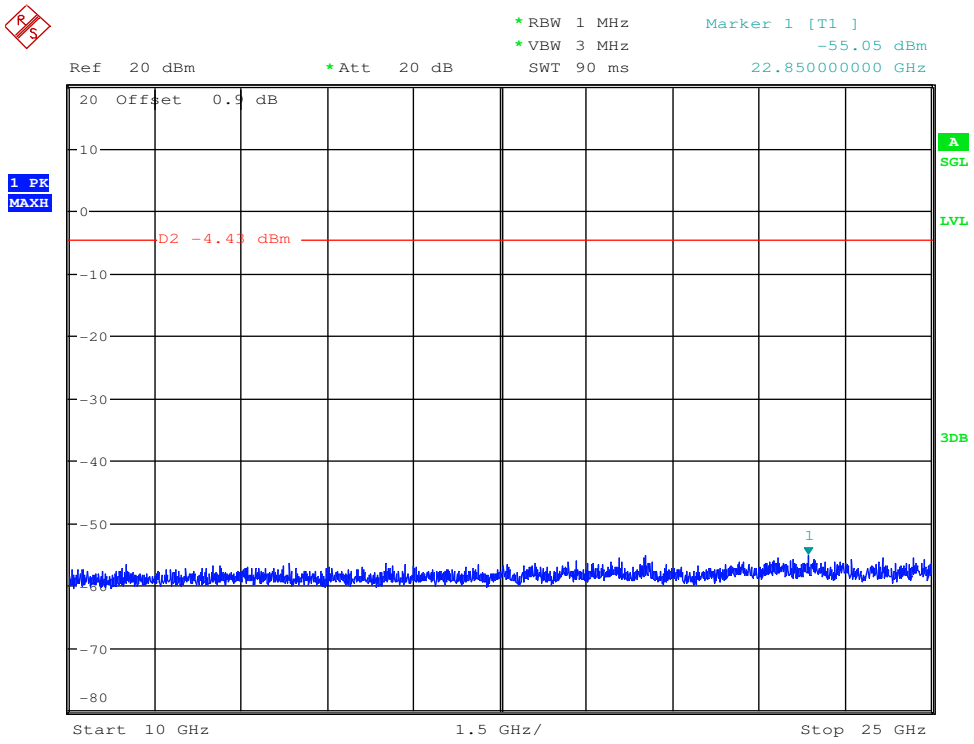


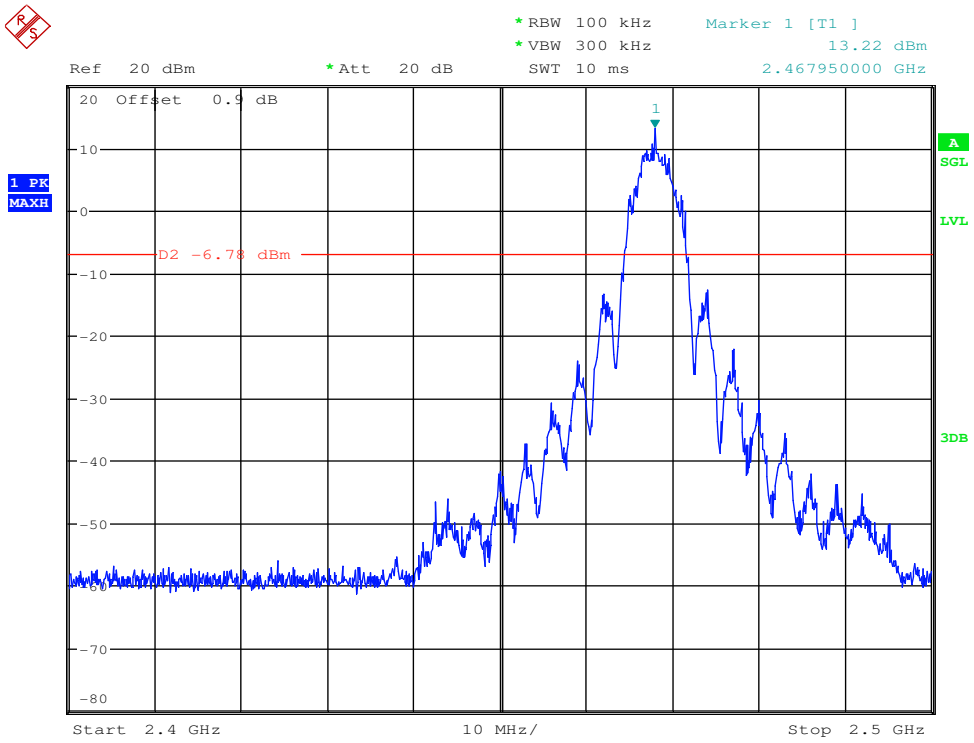
RF Conducted Spurious Emissions_2440	
Pref	

CSE_1

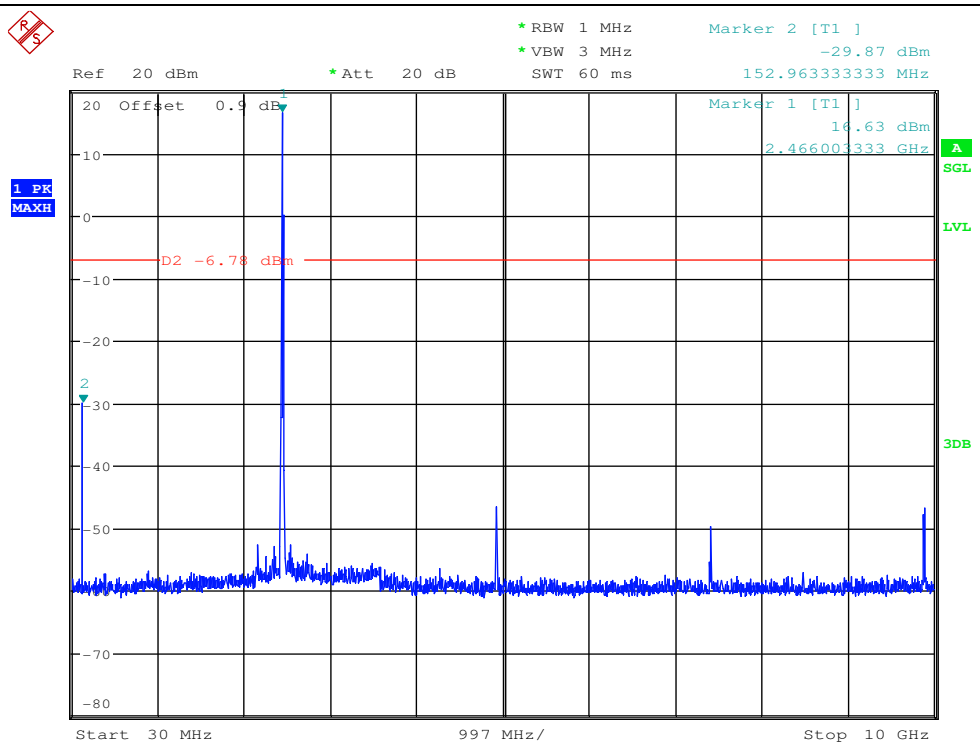


CSE_2

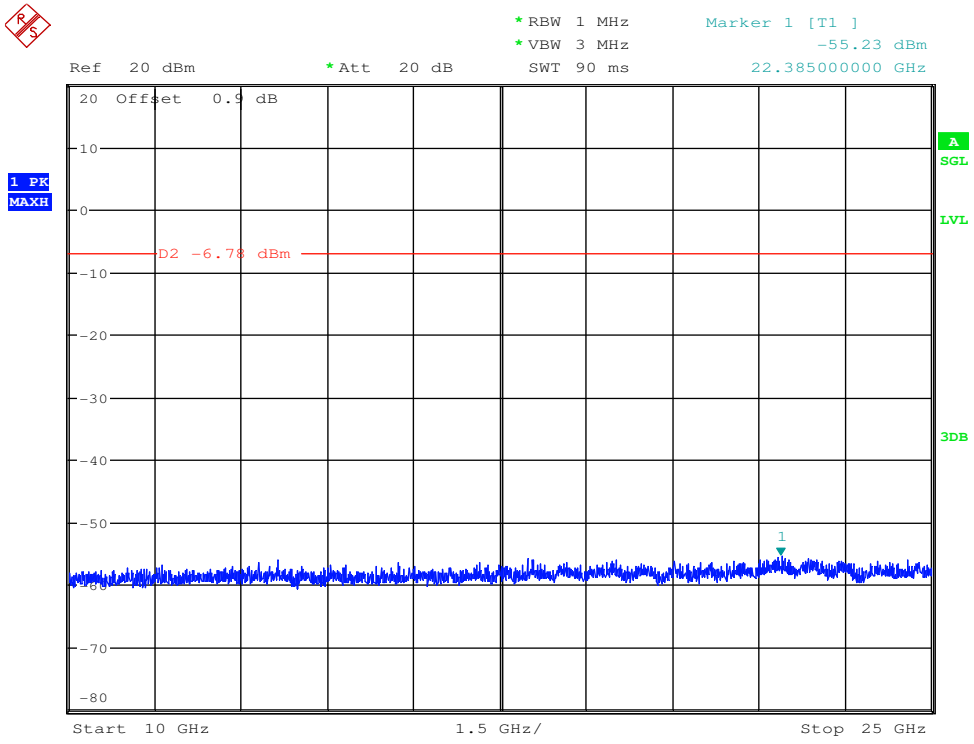


RF Conducted Spurious Emissions_2468	
Pref	

CSE_1



CSE_2



Module 1+ Module 2

1.Maximum peak conducted output power

Test channel	Peak Output Power (dBm)			Limit (dBm)	Result
	Antenna 1	Antenna 2	Antenna 1+Antenna 2		
2408	19.66	19.82	22.75	30.00	Pass
2440	20.34	21.1	23.75	30.00	Pass
2468	21.22	22.1	24.68	30.00	Pass

2.Maximum Peak power spectral density

Test channel	Power Spectral Density (dBm/3KHz)			Limit (8dBm/3KHz)	Result
	Antenna 1	Antenna 2	Antenna 1+Antenna 2		
2408	-4.84	-4.84	-1.81	≤8.00	Pass
2440	-4.55	-4.51	-1.55	≤8.00	Pass
2468	-2.65	-0.47	1.6	≤8.00	Pass