



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

Report No.: SZEM171201212602
Page: 1 of 52

TEST REPORT

Application No.: SZEM1712012126CR
Applicant: Heartisans Limited
Address of Applicant: Unit 333B, Core Building 2 No.1 Science Park West Avenue, Hongkong
Manufacturer: Heartisans Limited
Address of Manufacturer: Unit 333B, Core Building 2 No.1 Science Park West Avenue, Hongkong
Factory: Sky Light Electronic (Shenzhen) Limited
Address of Factory: No.1, 5 and 6 Building, JinBi Industrial Area, HuangTian, BaoAn , Shenzhen, China.

Equipment Under Test (EUT):
EUT Name: Heartisans
Model No.: Solace
Trade mark: Heartisans
FCC ID: 2ANZ9SOL001
Standard(s) : 47 CFR Part 15, Subpart C 15.247
Date of Receipt: 2017-12-01
Date of Test: 2017-12-07 to 2017-12-13
Date of Issue: 2017-12-14

Test Result:	Pass*
---------------------	-------

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

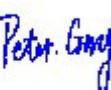


Jack Zhang
EMC Laboratory Manager

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.

This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx> and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at <http://www.sgs.com/en/Terms-and-Conditions/Terms-e-Document.aspx>. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 30 days only.

Revision Record				
Version	Chapter	Date	Modifier	Remark
01		2017-12-14		Original

Authorized for issue by:			
		 Peter Geng	
		<hr/> Peter Geng /Project Engineer	
		 Eric Fu	
		<hr/> 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
Minimum 6dB Bandwidth	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 11.8.1	47 CFR Part 15, Subpart C 15.247a(2)	Pass
Conducted Peak Output Power	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 11.9.1	47 CFR Part 15, Subpart C 15.247(b)(3)	Pass
Power Spectrum Density	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 11.10.2	47 CFR Part 15, Subpart C 15.247(e)	Pass
Conducted Band Edges Measurement	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 11.13.3.2	47 CFR Part 15, Subpart C 15.247(d)	Pass
Conducted Spurious Emissions	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 11.11	47 CFR Part 15, Subpart C 15.247(d)	Pass
Radiated Emissions which fall in the restricted bands	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 6.10.5	47 CFR Part 15, Subpart C 15.205 & 15.209	Pass
Radiated Spurious Emissions	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 6.4,6.5,6.6	47 CFR Part 15, Subpart C 15.205 & 15.209	Pass

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.....	6
4.3 MEASUREMENT UNCERTAINTY	6
4.4 TEST LOCATION	7
4.5 TEST FACILITY	7
4.6 DEVIATION FROM STANDARDS.....	7
4.7 ABNORMALITIES FROM STANDARD CONDITIONS	7
5 EQUIPMENT LIST	8
6 RADIO SPECTRUM TECHNICAL REQUIREMENT.....	10
6.1 ANTENNA REQUIREMENT.....	10
6.1.1 <i>Test Requirement:</i>	10
6.1.2 <i>Conclusion</i>	10
7 RADIO SPECTRUM MATTER TEST RESULTS	11
7.1 MINIMUM 6dB BANDWIDTH	11
7.1.1 <i>E.U.T. Operation</i>	11
7.1.2 <i>Test Setup Diagram</i>	11
7.1.3 <i>Measurement Procedure and Data</i>	11
7.2 CONDUCTED PEAK OUTPUT POWER.....	12
7.2.1 <i>E.U.T. Operation</i>	12
7.2.2 <i>Test Setup Diagram</i>	12
7.2.3 <i>Measurement Procedure and Data</i>	12
7.3 POWER SPECTRUM DENSITY	13
7.3.1 <i>E.U.T. Operation</i>	13
7.3.2 <i>Test Setup Diagram</i>	13
7.3.3 <i>Measurement Procedure and Data</i>	13
7.4 CONDUCTED BAND EDGES MEASUREMENT	14
7.4.1 <i>E.U.T. Operation</i>	15
7.4.2 <i>Test Setup Diagram</i>	15
7.4.3 <i>Measurement Procedure and Data</i>	15
7.5 CONDUCTED SPURIOUS EMISSIONS.....	16
7.5.1 <i>E.U.T. Operation</i>	17
7.5.2 <i>Test Setup Diagram</i>	17
7.5.3 <i>Measurement Procedure and Data</i>	17
7.6 RADIATED EMISSIONS WHICH FALL IN THE RESTRICTED BANDS	18
7.6.1 <i>E.U.T. Operation</i>	19
7.6.2 <i>Test Setup Diagram</i>	19
7.6.3 <i>Measurement Procedure and Data</i>	19
7.7 RADIATED SPURIOUS EMISSIONS.....	25
7.7.1 <i>E.U.T. Operation</i>	26
7.7.2 <i>Test Setup Diagram</i>	26

7.7.3 Measurement Procedure and Data.....	27
8 APPENDIX.....	37
8.1 APPENDIX 15.247.....	37-52

4 General Information

4.1 Details of E.U.T.

Power supply:	DC 3.7V rechargeable battery which charged from a charging dock which connected from USB port
Bluetooth version:	V4.0 BLE
Antenna Type	Monopole antenna
Antenna Gain	-6dBi
Channel Spacing	2MHz
Modulation Type	GFSK
Number of Channels	40
Operation Frequency	2402MHz to 2480MHz

4.2 Description of Support Units

The EUT has been tested as an independent unit.

4.3 Measurement Uncertainty

No.	Item	Measurement Uncertainty
1	Radio Frequency	7.25×10^{-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 (Below 1GHz) 4.8dB (Above 1GHz)
9	Temperature test	1°C
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 3m Fully-anechoic chamber for above 1GHz, 10m Semi-anechoic chamber for below 1GHz, Shielded Room for Mains Port Conducted Interference Measurement and Telecommunication Port Conducted Interference Measurement of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-20026, R-14188, C-12383 and T-11153 respectively.

- FCC –Designation Number: CN1178**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized as an accredited testing laboratory.

Designation Number: CN1178. Test Firm Registration Number: 406779.

- 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 tests					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
DC Power Supply	ZhaoXin	RXN-305D	SEM011-02	2017-09-27	2018-09-26
Spectrum Analyzer	Rohde & Schwarz	FSP	SEM004-06	2017-09-27	2018-09-26
Measurement Software	JS Tonscend	JS1120-2 BT/WIFI V2.	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM031-02	2017-07-13	2018-07-12
Attenuator	Weinschel Associates	WA41	SEM021-09	N/A	N/A
Signal Generator	KEYSIGHT	N5173B	SEM006-05	2017-09-27	2018-09-26
Power Meter	Rohde & Schwarz	NRVS	SEM014-02	2017-09-27	2018-09-26

Radiated Spurious Emissions					
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	2017-08-05	2020-08-04
MXE EMI Receiver (20Hz-8.4GHz)	Agilent Technologies	N9038A	SEM004-05	2017-09-27	2018-09-26
BiConiLog Antenna (26-3000MHz)	ETS-LINDGREN	3142C	SEM003-01	2017-06-27	2020-06-26
Pre-amplifier (0.1-1300MHz)	Agilent Technologies	8447D	SEM005-01	2017-04-14	2018-04-13
Measurement Software	AUDIX	e3 V8.2014-6-27	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM025-01	2017-07-13	2018-07-12

Radiated Spurious Emissions					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
3m Semi-Anechoic Chamber	AUDIX	N/A	SEM001-02	2017-05-02	2020-05-01
Measurement Software	AUDIX	e3 V8.2014-6-27	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM026-01	2017-07-13	2018-07-12
Spectrum Analyzer	Rohde & Schwarz	FSU43	SEM004-08	2017-04-14	2018-04-13
BiConiLog Antenna (26-3000MHz)	ETS-Lindgren	3142C	SEM003-01	2017-06-27	2020-06-26
Horn Antenna (1-18GHz)	Rohde & Schwarz	HF907	SEM003-07	2015-06-14	2018-06-13
Horn Antenna (15GHz-40GHz)	Schwarzbeck	BBHA 9170	SEM003-15	2017-10-17	2020-10-16
Pre-amplifier (0.1-1300MHz)	HP	8447D	SEM005-02	2017-09-27	2018-09-26
Low Noise Amplifier(100MHz-18GHz)	Black Diamond Series	BDLNA-0118-352810	SEM005-05	2017-09-27	2018-09-27
Pre-amplifier(18-26GHz)	Rohde & Schwarz	CH14-H052	SEM005-17	2017-12-04	2018-12-03
Pre-amplifier (26GHz-40GHz)	Compliance Directions Systems Inc.	PAP-2640-50	SEM005-08	2017-04-14	2018-04-13
DC Power Supply	Zhao Xin	RXN-305D	SEM011-02	2017-09-27	2018-09-26
Active Loop Antenna	ETS-Lindgren	6502	SEM003-08	2017-08-22	2020-08-21
Band filter	N/A	N/A	SEM023-01	N/A	N/A

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	2017-09-29	2018-09-28
Humidity/ Temperature Indicator	Shanghai Meteorological Industry Factory	ZJ1-2B	SEM002-04	2017-09-29	2018-09-28
Humidity/ Temperature Indicator	Mingle	N/A	SEM002-08	2017-09-29	2018-09-28
Barometer	Changchun Meteorological Industry Factory	DYM3	SEM002-01	2017-04-18	2018-04-17

6 Radio Spectrum Technical Requirement

6.1 Antenna Requirement

6.1.1 Test Requirement:

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

6.1.2 Conclusion

Standard Requirement:

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

15.247(b) (4) requirement:

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

EUT Antenna:

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

7 Radio Spectrum Matter Test Results

7.1 Minimum 6dB Bandwidth

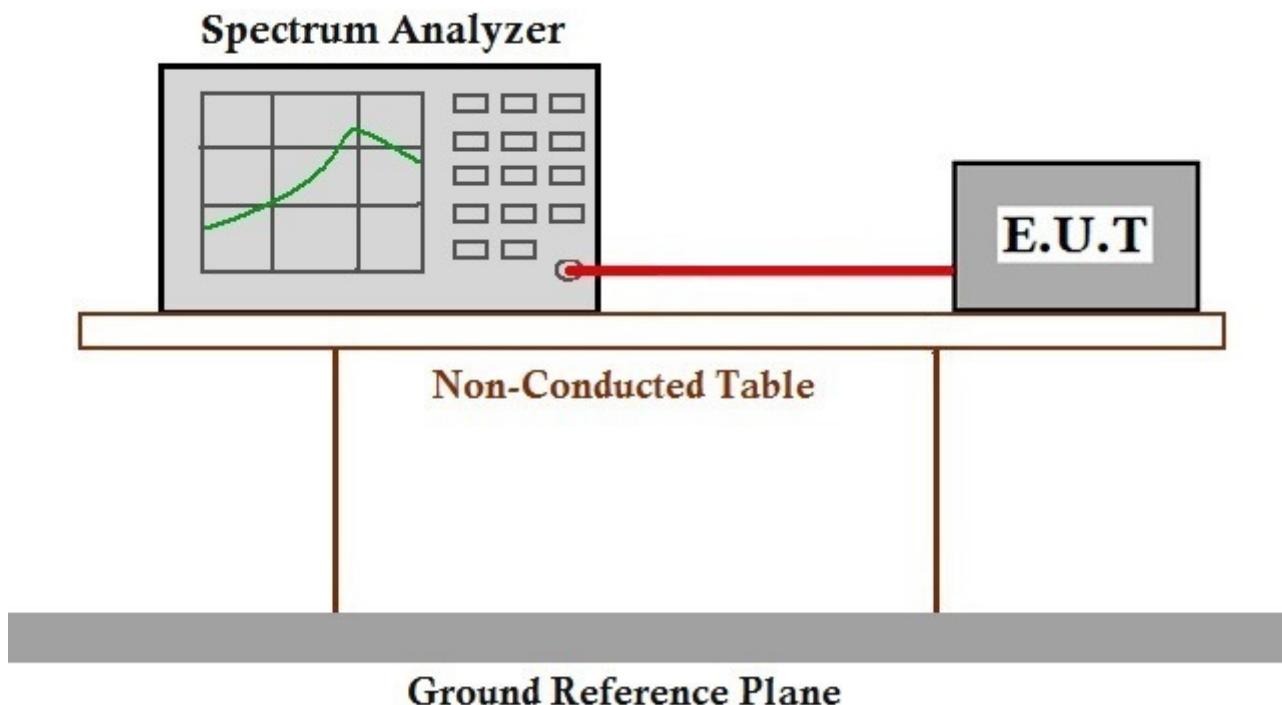
Test Requirement 47 CFR Part 15, Subpart C 15.247a(2)
Test Method: ANSI C63.10 (2013) Section 11.8.1
Limit: ≥ 500 kHz

7.1.1 E.U.T. Operation

Operating Environment:

Temperature: 25.6 °C Humidity: 31.7 % RH Atmospheric Pressure: 1020 mbar
Test mode a:TX mode_Keep the EUT in continuously transmitting mode with GFSK modulation

7.1.2 Test Setup Diagram



7.1.3 Measurement Procedure and Data

The detailed test data see: Appendix 15.247

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

Limit:

Frequency range(MHz)	Output power of the intentional radiator(watt)
902-928	1 for ≥ 50 hopping channels
	0.25 for $25 \leq$ 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

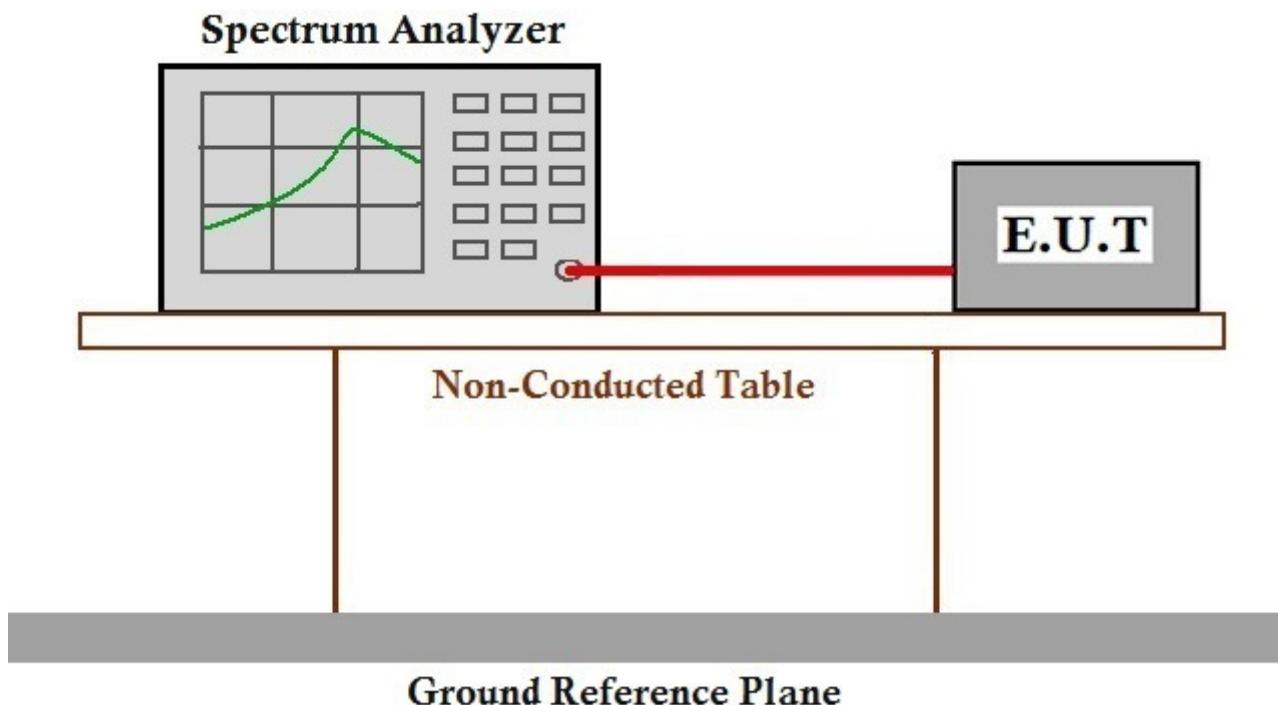
7.2.1 E.U.T. Operation

Operating Environment:

Temperature: 25.6 °C Humidity: 31.7 % RH Atmospheric Pressure: 1020 mbar

Test mode a:TX mode_Keep the EUT in continuously transmitting mode with GFSK modulation

7.2.2 Test Setup Diagram



7.2.3 Measurement Procedure and Data

The detailed test data see: Appendix 15.247

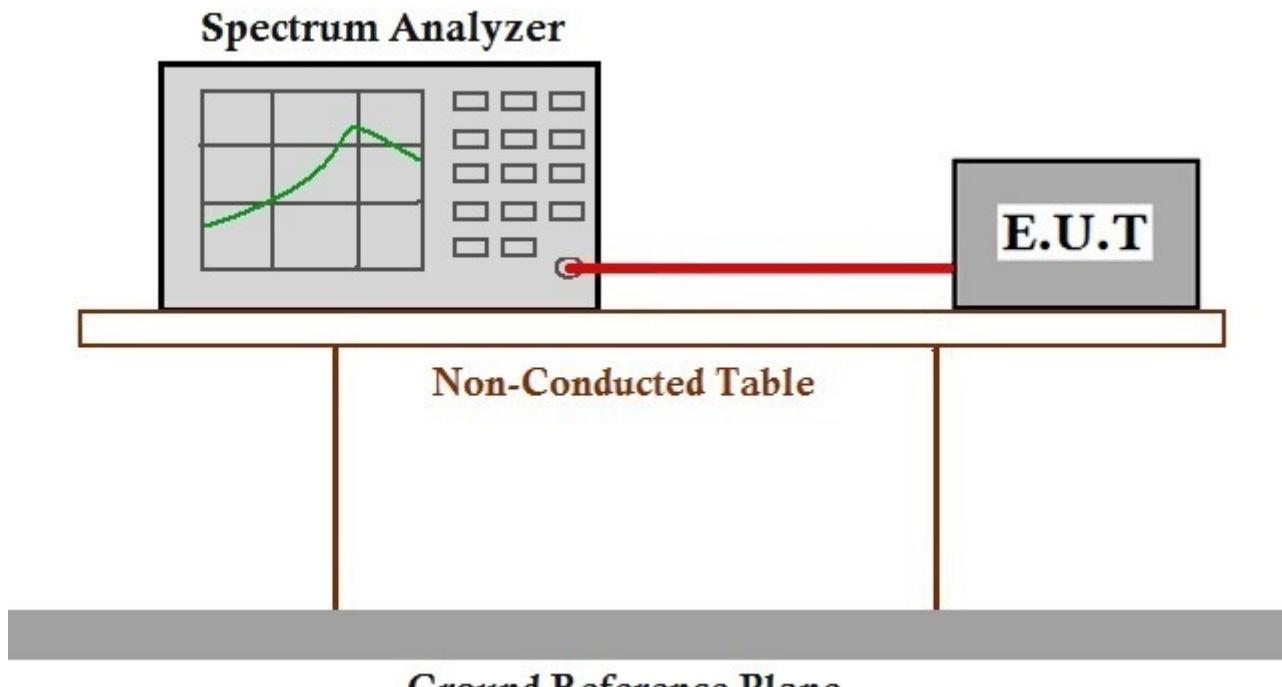
7.3 Power Spectrum Density

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

7.3.1 E.U.T. Operation

Operating Environment:
Temperature: 25.6 °C Humidity: 31.7 % RH Atmospheric Pressure: 1020 mbar
Test mode a:TX mode_Keep the EUT in continuously transmitting mode with GFSK modulation

7.3.2 Test Setup Diagram



7.3.3 Measurement Procedure and Data

The detailed test data see: Appendix 15.247

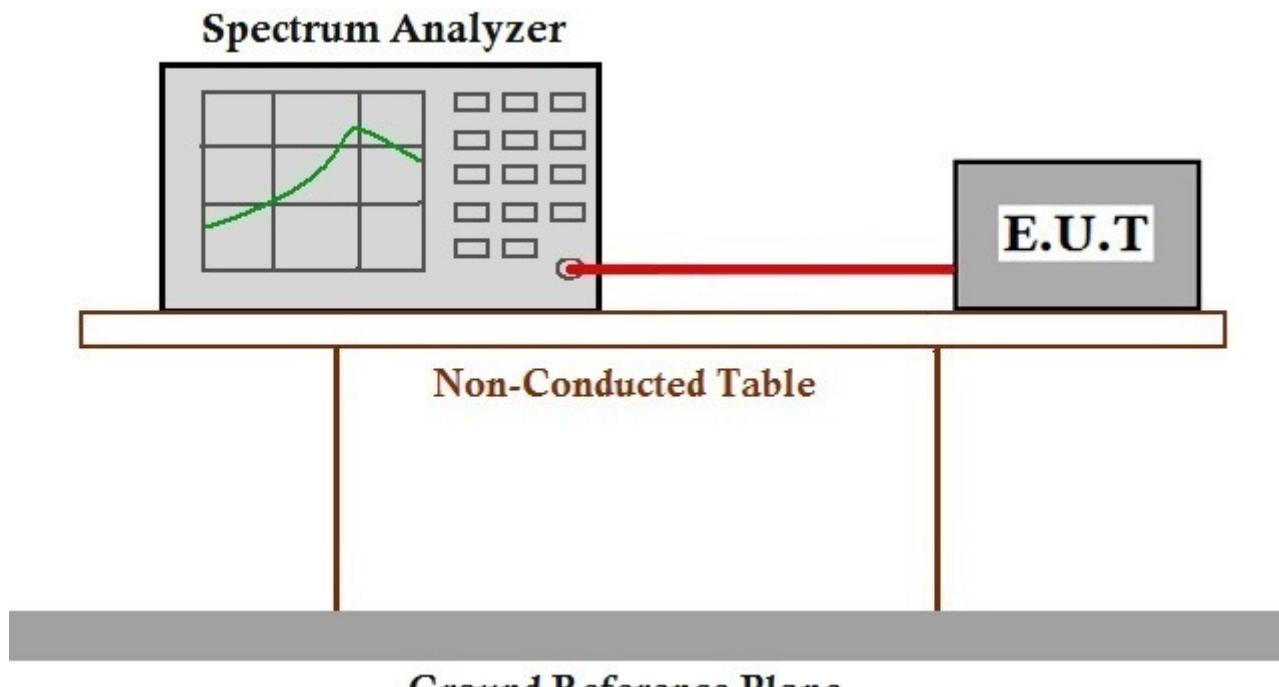
7.4 Conducted Band Edges Measurement

Test Requirement	47 CFR Part 15, Subpart C 15.247(d)
Test Method:	ANSI C63.10 (2013) Section 11.13.3.2
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c))

7.4.1 E.U.T. Operation

Operating Environment:

Temperature: 25.6 °C Humidity: 31.7 % RH Atmospheric Pressure: 1020 mbar
Test mode a:TX mode_Keep the EUT in continuously transmitting mode with GFSK modulation

7.4.2 Test Setup Diagram**7.4.3 Measurement Procedure and Data**

The detailed test data see: Appendix 15.247

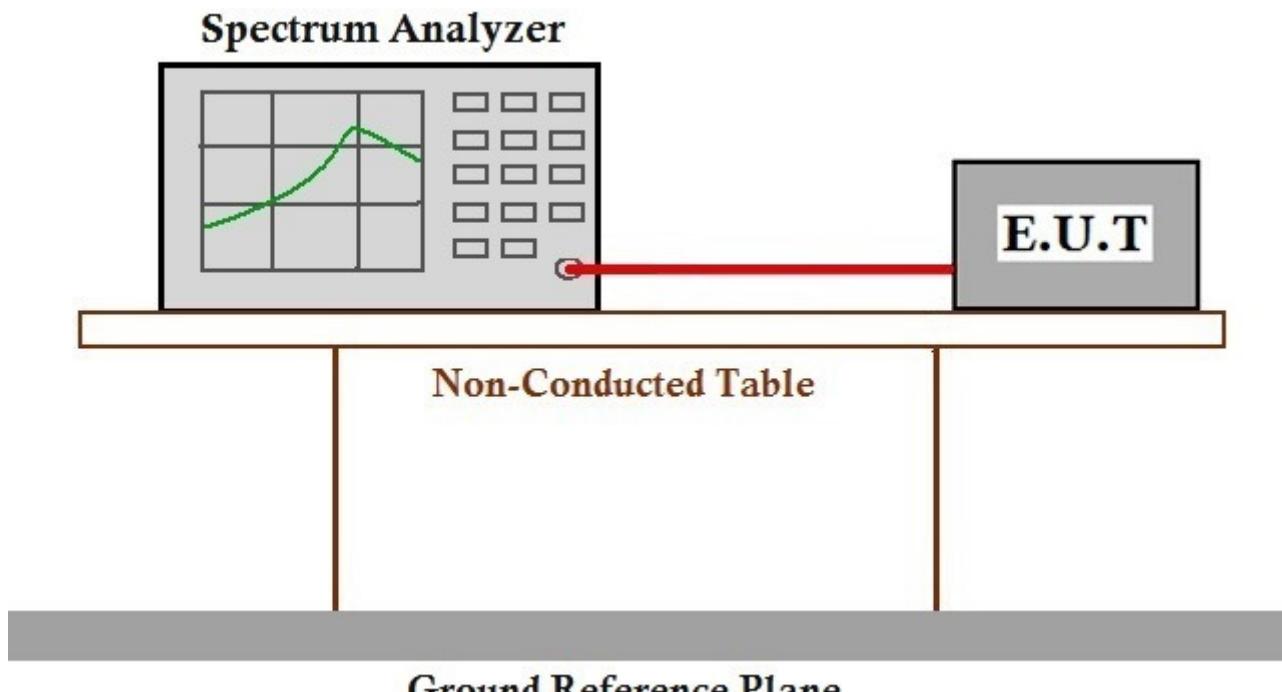
7.5 Conducted Spurious Emissions

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

7.5.1 E.U.T. Operation

Operating Environment:

Temperature: 25.6 °C Humidity: 31.7 % RH Atmospheric Pressure: 1020 mbar
Test mode a:TX mode_Keep the EUT in continuously transmitting mode with GFSK modulation

7.5.2 Test Setup Diagram**7.5.3 Measurement Procedure and Data**

The detailed test data see: Appendix 15.247

7.6 Radiated Emissions which fall in the restricted bands

Test Requirement 47 CFR Part 15, Subpart C 15.205 & 15.209

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

Measurement Distance: 3m

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

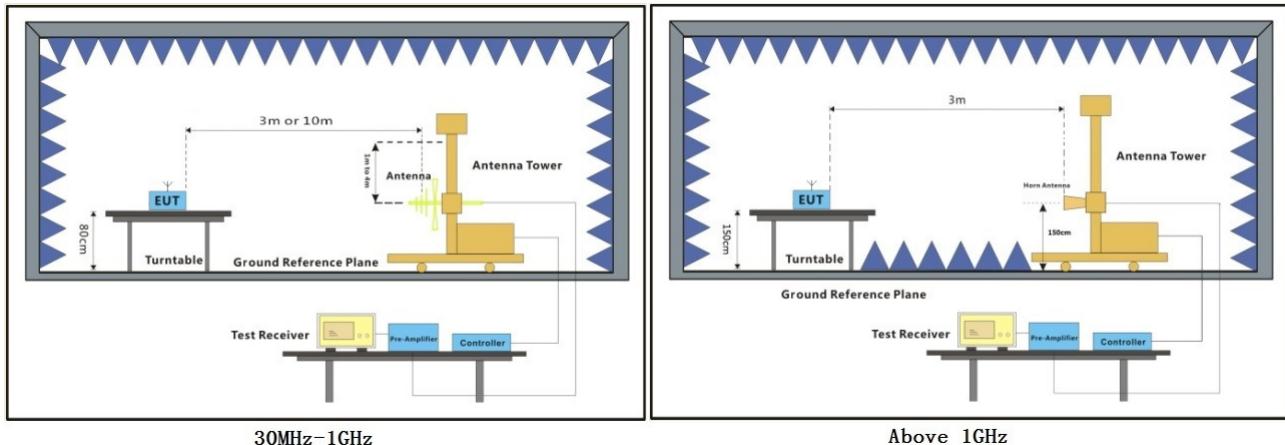
Remark: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90kHz, 110-490kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector, the peak field 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: 21.3 °C Humidity: 53.6 % RH Atmospheric Pressure: 1020 mbar
Test mode a:TX mode_Keep the EUT in continuously transmitting mode with GFSK modulation

7.6.2 Test Setup Diagram

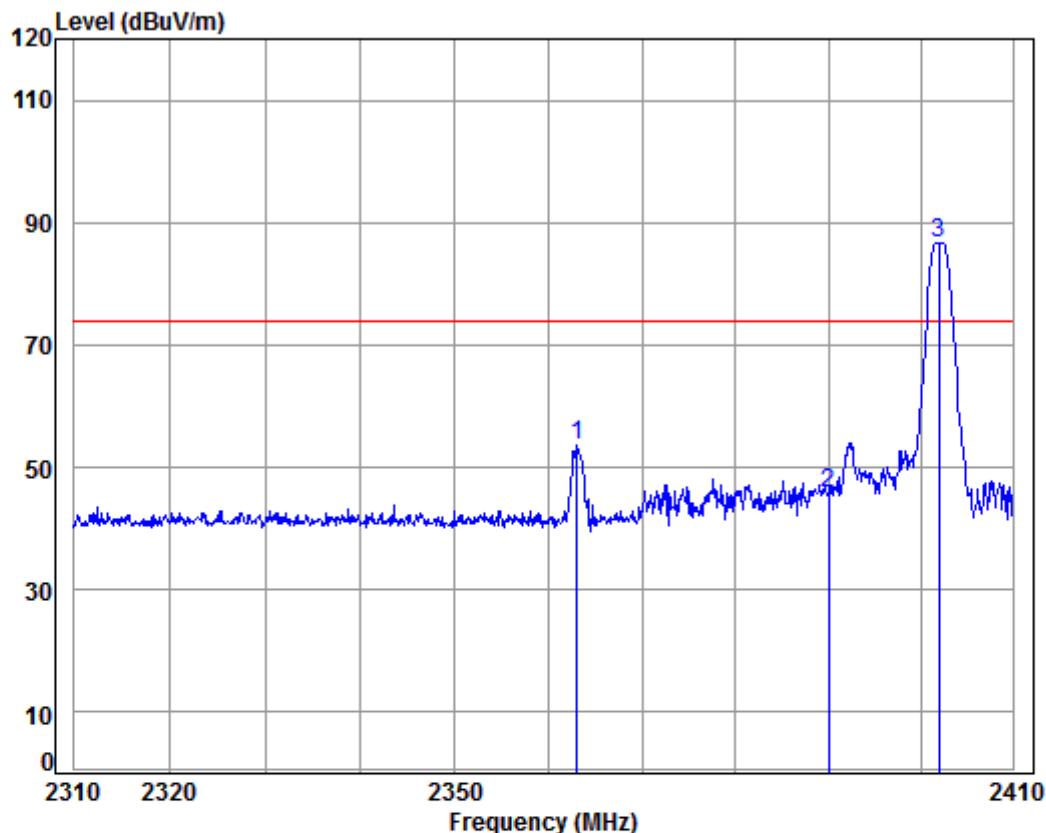


7.6.3 Measurement Procedure and Data

- 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.
- 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.
- 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.
- 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.
- 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.
- The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- 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.
- Test the EUT in the lowest channel, the middle channel, the Highest channel.
- 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.
- Repeat above procedures until all frequencies measured was complete.

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

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



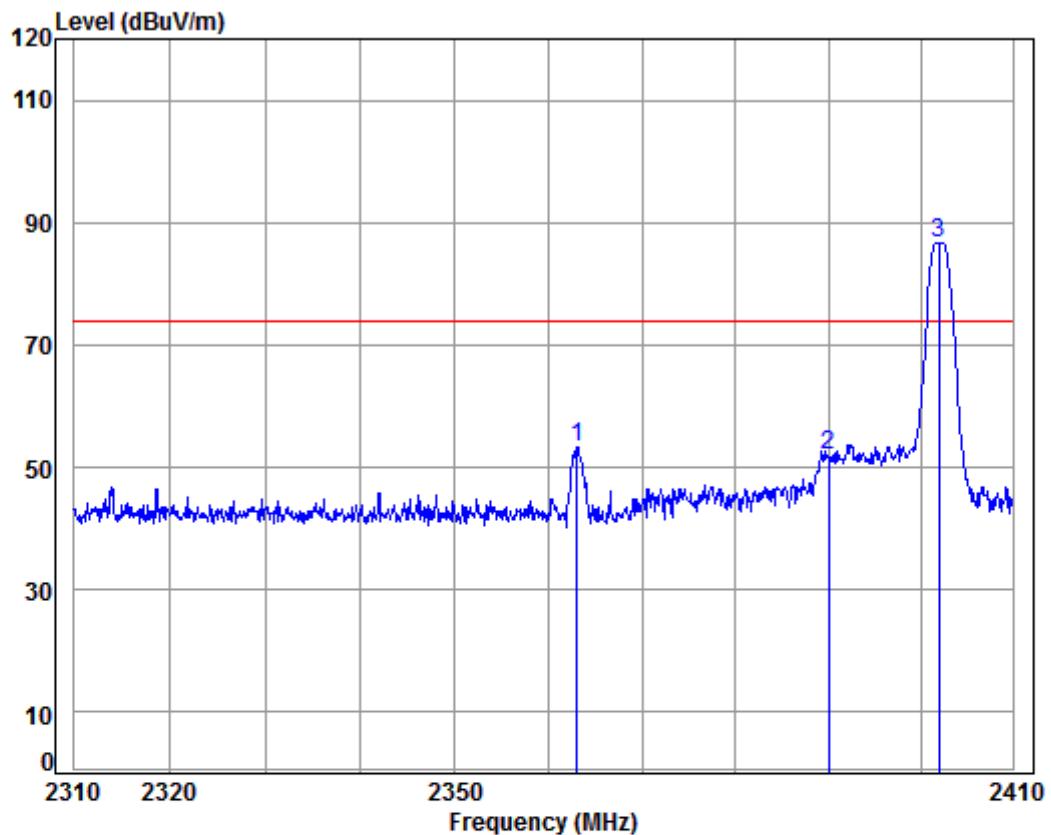
Condition: 3m HORIZONTAL

Job No : 12126CR

Mode : 2402 Band edge

Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Limit		Over Limit	Remark
					dB	dB/m		
	MHz							
1	2363.073	5.44	29.00	37.66	56.85	53.63	74.00	-20.37 peak
2	2390.000	5.47	29.08	37.66	49.04	45.93	74.00	-28.07 peak
3 pp	2402.000	5.49	29.11	37.65	89.80	86.75	74.00	12.75 peak

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



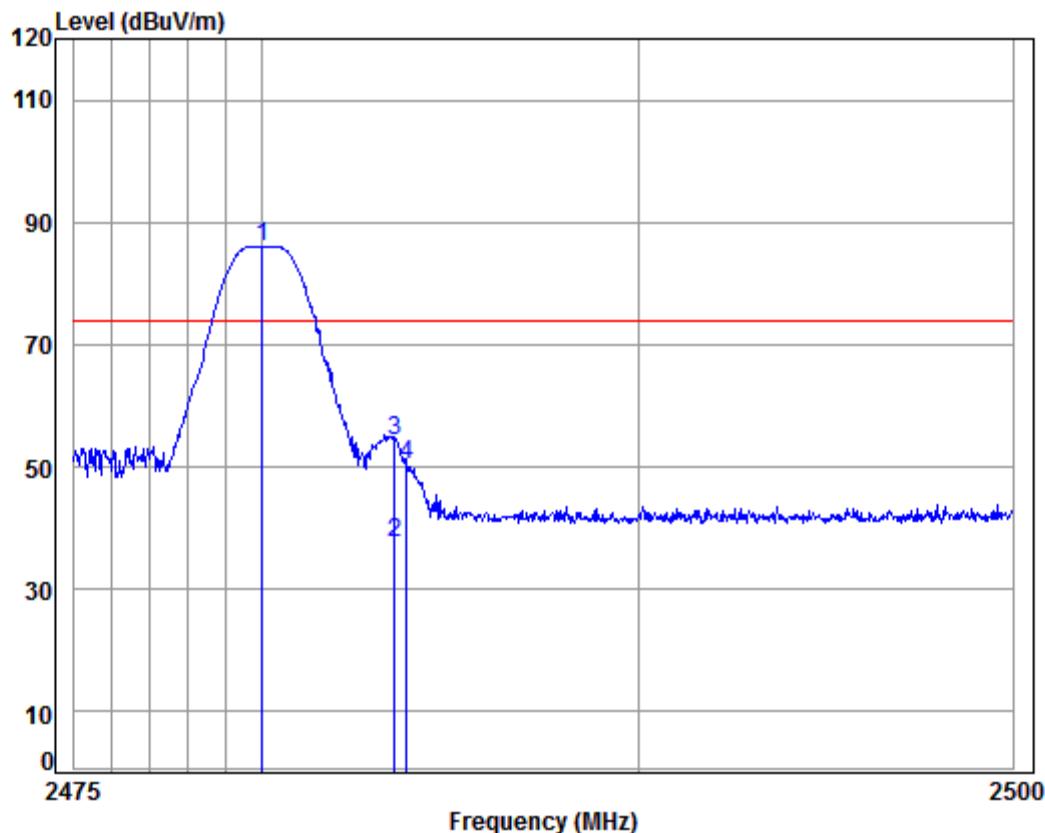
Condition: 3m VERTICAL

Job No : 12126CR

Mode : 2402 Band edge

Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Limit		Over Limit	Remark
					dB	dB/m		
	MHz							
1	2363.073	5.44	29.00	37.66	56.45	53.23	74.00	-20.77 peak
2	2390.000	5.47	29.08	37.66	55.14	52.03	74.00	-21.97 peak
3 pp	2402.000	5.49	29.11	37.65	89.82	86.77	74.00	12.77 peak

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



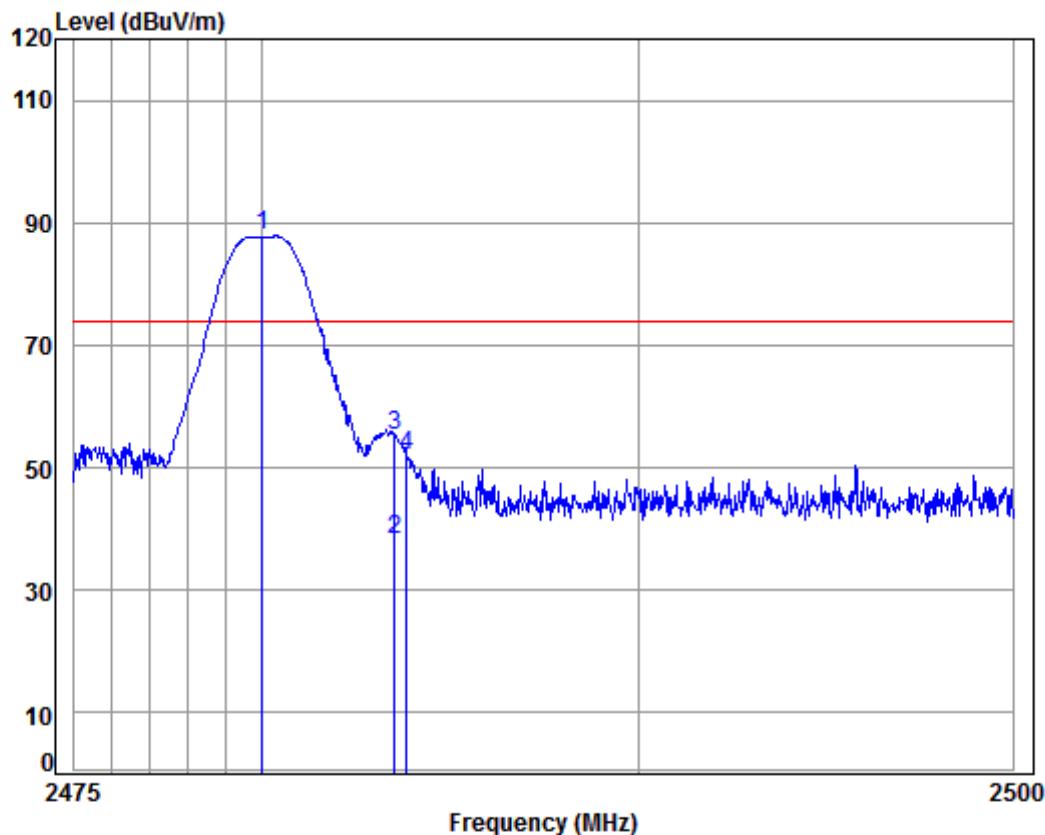
Condition: 3m HORIZONTAL

Job No : 12126CR

Mode : 2480 Band edge

Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Limit		Over Limit	Remark
					dB	dB/m		
	MHz							
1 pp	2480.000	5.59	29.34	37.65	88.87	86.15	74.00	12.15 peak
2 av	2483.500	5.60	29.35	37.65	40.24	37.54	54.00	-16.46 Average
3	2483.500	5.60	29.35	37.65	57.04	54.34	74.00	-19.66 peak
4	2483.821	5.60	29.35	37.65	53.01	50.31	74.00	-23.69 peak

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



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) 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 above measurement data were shown in the report.

7.7 Radiated Spurious Emissions

Test Requirement 47 CFR Part 15, Subpart C 15.205 & 15.209

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

Measurement Distance: 3m

Limit:

Frequency(MHz)	Field strength(microvolts/meter)	Measurement distance(meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

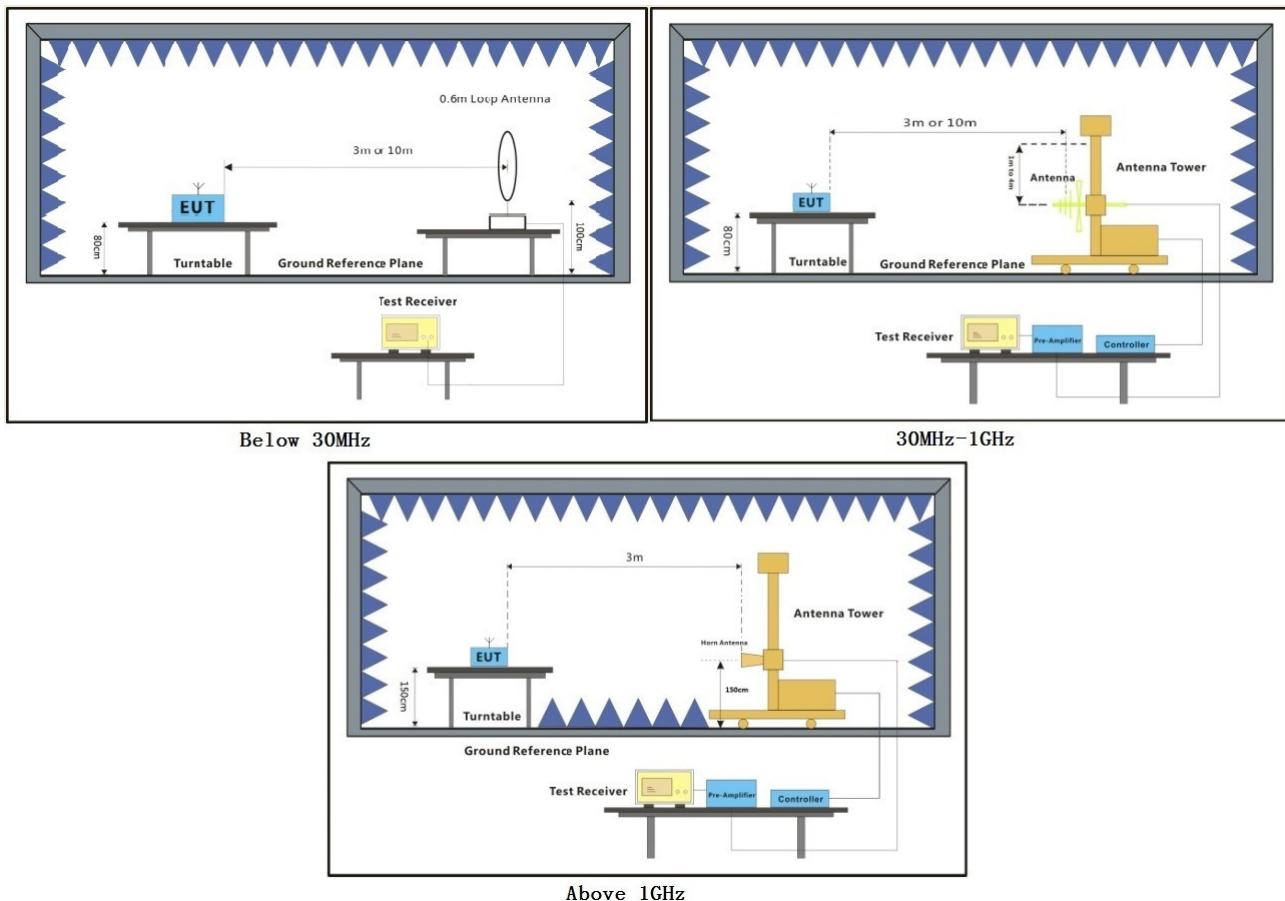
Remark: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90kHz, 110-490kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

7.7.1 E.U.T. Operation

Operating Environment:

Temperature: 23 °C Humidity: 33.8 % RH Atmospheric Pressure: 1020 mbar
 Test mode a:TX mode_Keep the EUT in continuously transmitting mode with GFSK modulation
 for below 1000MHz, tests were conducted in H/M/L channels and the worst case is reported only.

7.7.2 Test Setup Diagram



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.

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

Remark:

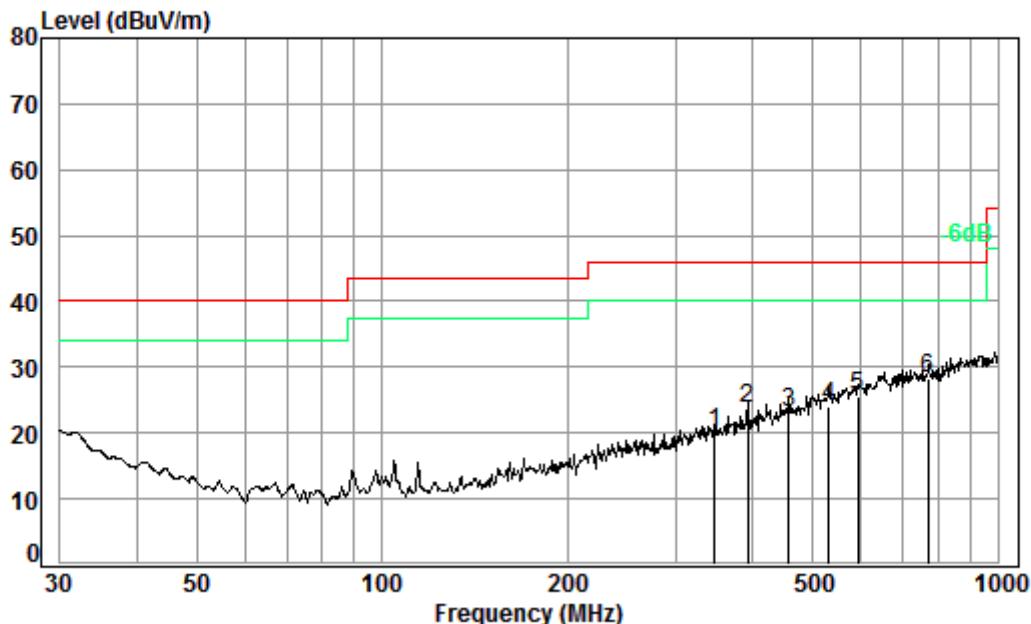
- 1) For emission below 1GHz, through pre-scan found the worst case is the lowest channel. Only the worst case is recorded in the report.
- 2) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

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

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

- 4) 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. For the emissions whose peak level is lower than the average limit, only the peak measurement is shown in the report.

Mode:a; Polarization:Horizontal; Channel:Low



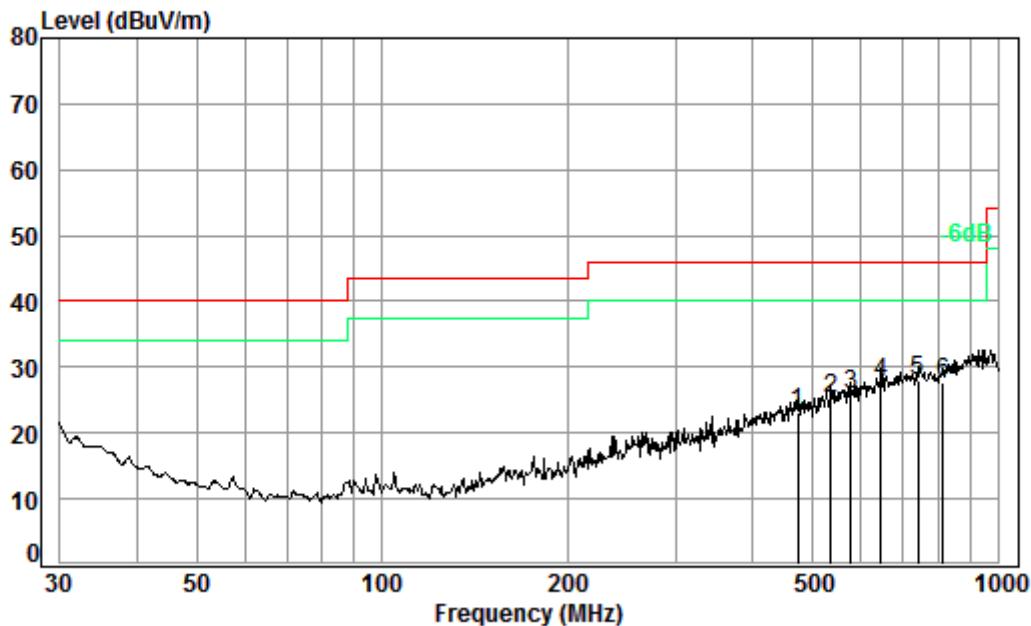
Condition: 3m HORIZONTAL

Job No. : 12126CR

Test mode: a

Freq	Cable	Ant	Preamp	Read	Limit		Over	
	Loss	Factor	Factor	Level	Level	Line	Limit	
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1	346.81	2.05	21.01	26.77	23.89	20.18	46.00	-25.82
2	392.10	2.18	22.21	27.09	26.38	23.68	46.00	-22.32
3	457.51	2.44	23.72	27.48	24.57	23.25	46.00	-22.75
4	531.96	2.63	25.28	27.65	23.87	24.13	46.00	-21.87
5	593.05	2.69	26.47	27.55	23.83	25.44	46.00	-20.56
6 pp	771.45	3.12	28.34	27.33	24.24	28.37	46.00	-17.63

Mode:a; Polarization:Vertical; Channel:Low



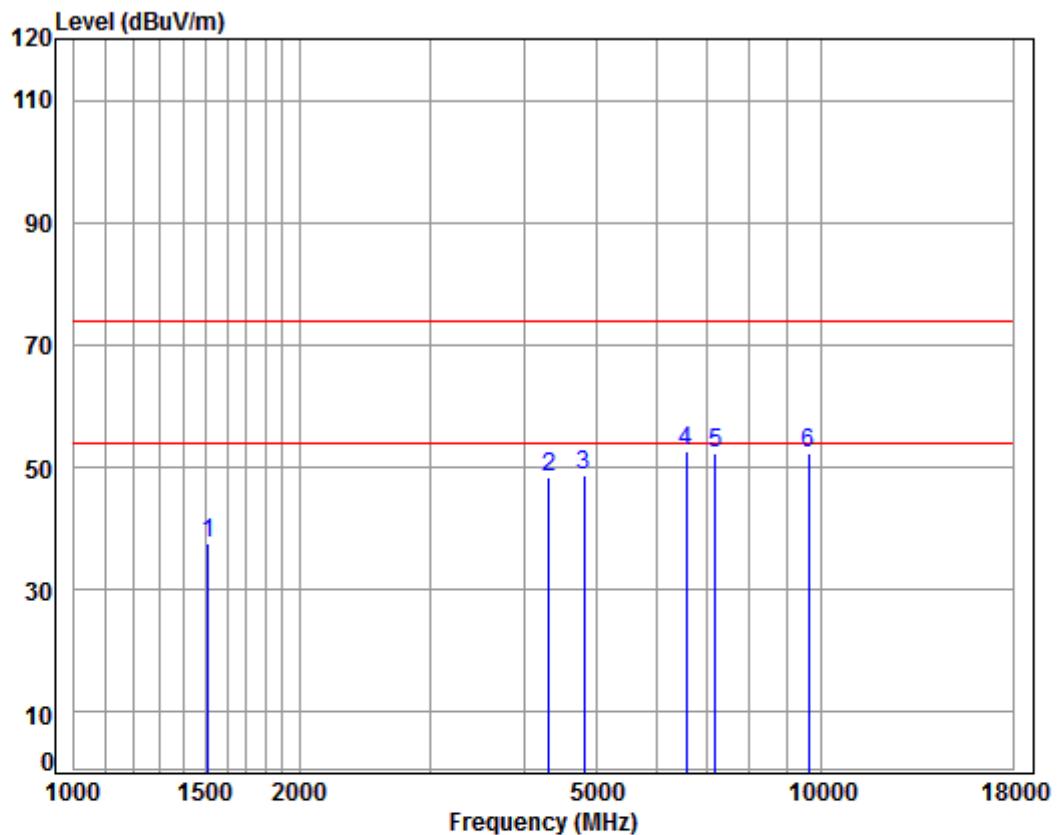
Condition: 3m VERTICAL

Job No. : 12126CR

Test mode: a

Freq	Cable	Ant	Preamp	Read	Limit		Over	
	Loss	Factor	Factor	Level	Level	Line	Limit	
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1	473.83	2.50	24.07	27.58	24.11	23.10	46.00	-22.90
2	535.71	2.64	25.36	27.64	24.82	25.18	46.00	-20.82
3	576.64	2.68	26.16	27.57	24.54	25.81	46.00	-20.19
4	645.12	2.80	27.21	27.48	25.27	27.80	46.00	-18.20
5 pp	742.26	3.03	28.16	27.36	24.30	28.13	46.00	-17.87
6	813.11	3.26	28.68	27.23	23.00	27.71	46.00	-18.29

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



Condition: 3m HORIZONTAL

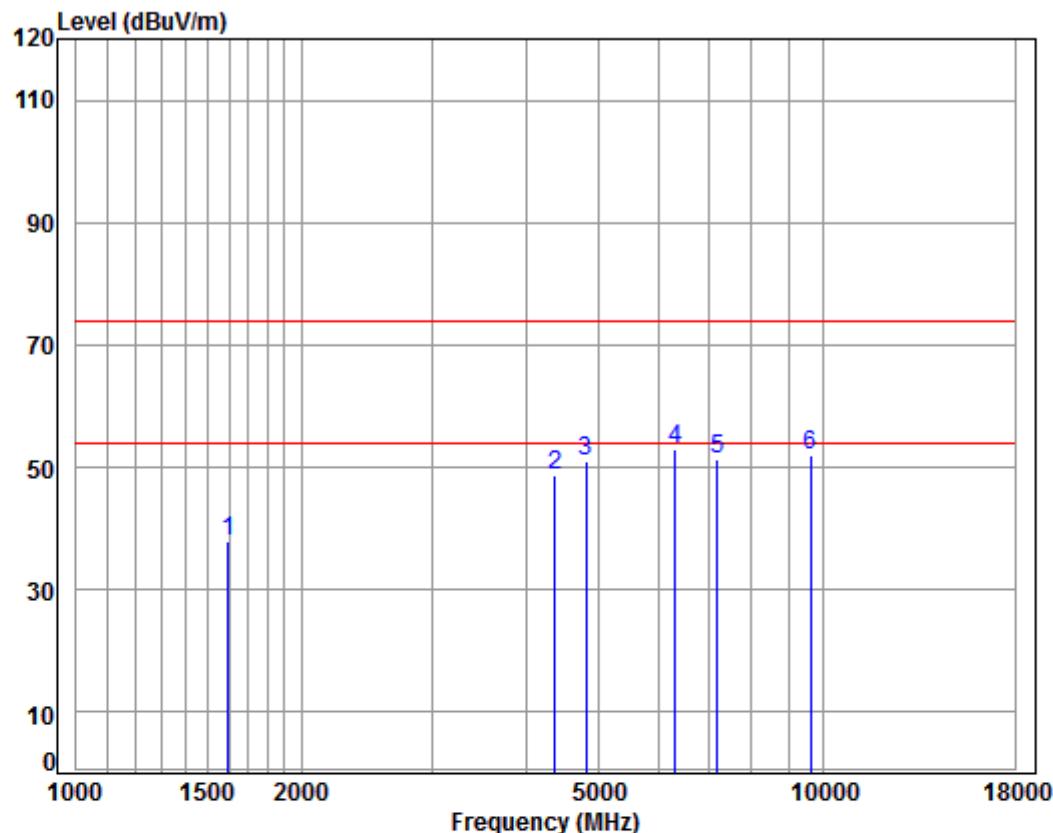
Job No : 12126CR

Mode : 2402 TX SE

Note :

		Cable Freq	Loss	Ant Factor	Preamp Factor	Read Level	Limit Level	Line Limit	Over Limit	Remark
		MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1511.833	5.46	25.85	37.74	43.99	37.56	74.00	-36.44	peak	
2	4316.859	7.36	33.60	37.17	44.65	48.44	74.00	-25.56	peak	
3	4804.000	7.89	34.16	37.26	43.91	48.70	74.00	-25.30	peak	
4 pp	6583.209	11.30	35.34	37.72	43.82	52.74	74.00	-21.26	peak	
5	7206.000	10.08	36.42	37.56	43.38	52.32	74.00	-21.68	peak	
6	9608.000	10.75	37.52	35.80	39.70	52.17	74.00	-21.83	peak	

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



Condition: 3m VERTICAL

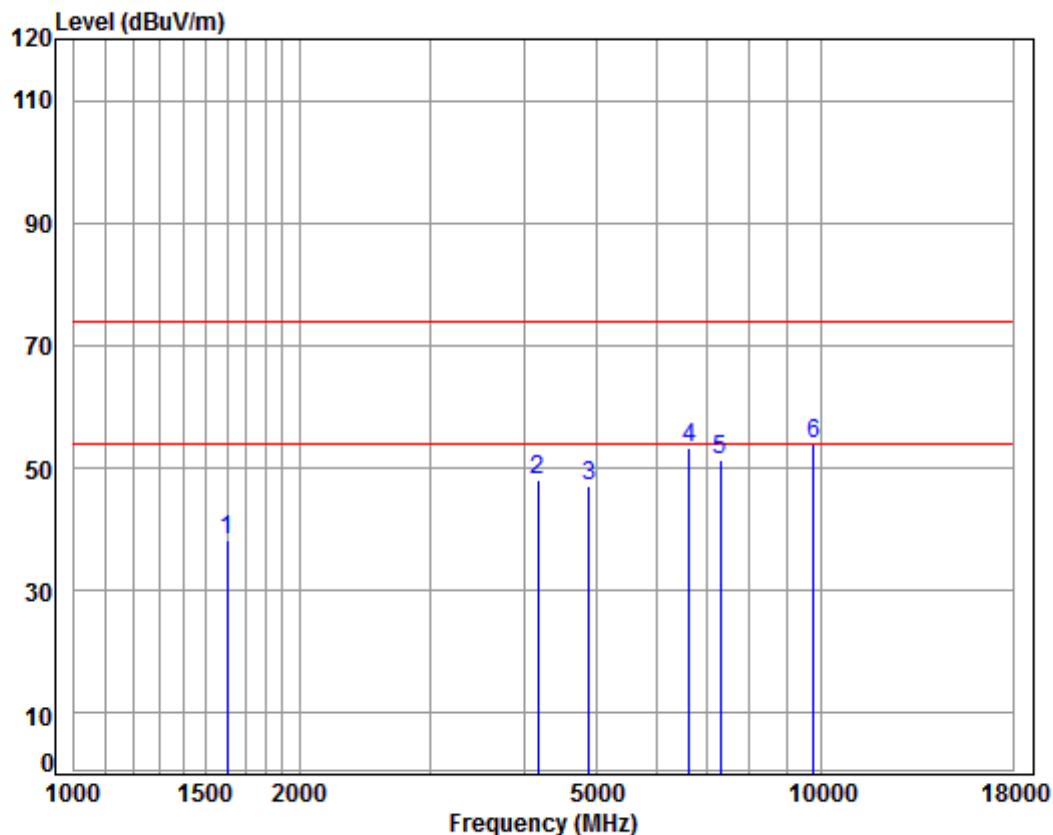
Job No : 12126CR

Mode : 2402 TX SE

Note :

	Freq	Cable	Ant	Preamp	Read	Limit	Over	Remark
		Loss	Factor	Factor	Level			
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1	1597.181	5.35	26.24	37.73	43.95	37.81	74.00	-36.19 peak
2	4367.058	7.41	33.60	37.18	44.75	48.58	74.00	-25.42 peak
3	4804.000	7.89	34.16	37.26	46.24	51.03	74.00	-22.97 peak
4 pp	6322.136	11.20	34.96	37.80	44.56	52.92	74.00	-21.08 peak
5	7206.000	10.08	36.42	37.56	42.33	51.27	74.00	-22.73 peak
6	9608.000	10.75	37.52	35.80	39.48	51.95	74.00	-22.05 peak

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



Condition: 3m HORIZONTAL

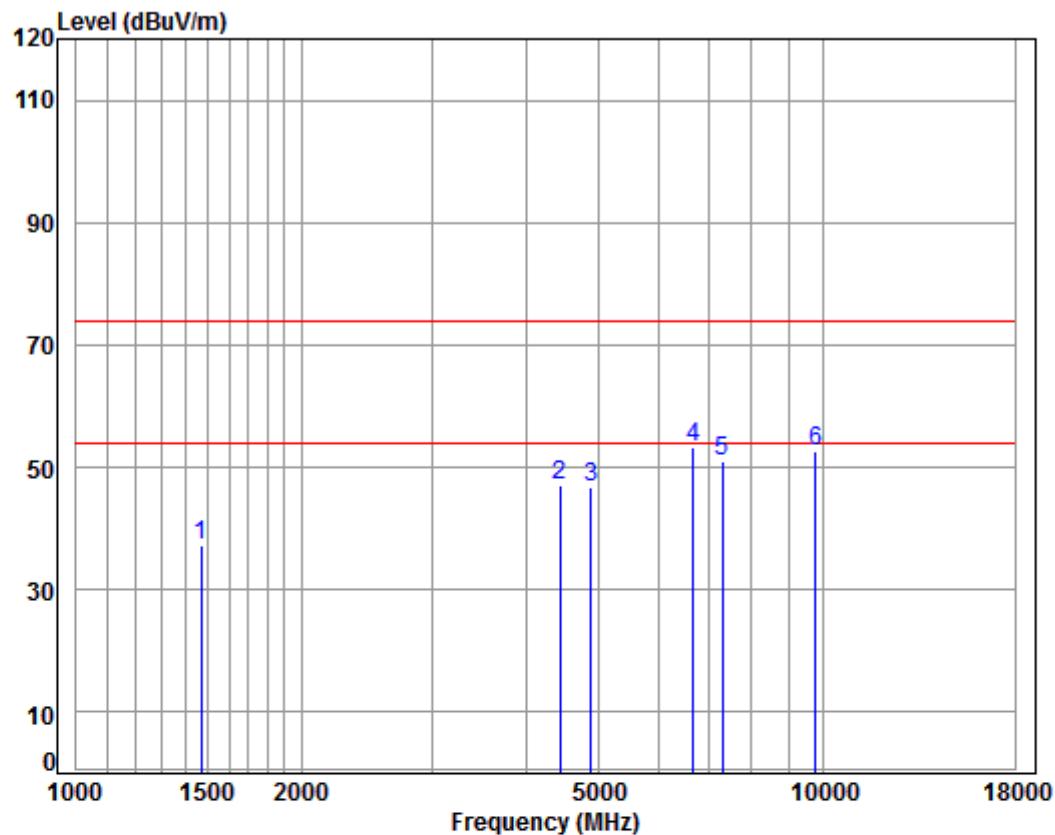
Job No : 12126CR

Mode : 2440 TX SE

Note :

		Cable Freq	Ant Loss	Preamp Factor	Read Level	Limit Level	Line Limit	Over Limit	Remark
		MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1	1601.804	5.35	26.26	38.03	44.82	38.40	74.00	-35.60	peak
2	4169.698	7.18	33.60	38.09	45.44	48.13	74.00	-25.87	peak
3	4880.000	7.97	34.29	38.45	43.13	46.94	74.00	-27.06	peak
4	6640.542	11.13	35.50	37.64	44.17	53.16	74.00	-20.84	peak
5	7320.000	10.05	36.37	37.00	41.76	51.18	74.00	-22.82	peak
6 pp	9760.000	10.82	37.55	35.02	40.44	53.79	74.00	-20.21	peak

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



Condition: 3m VERTICAL

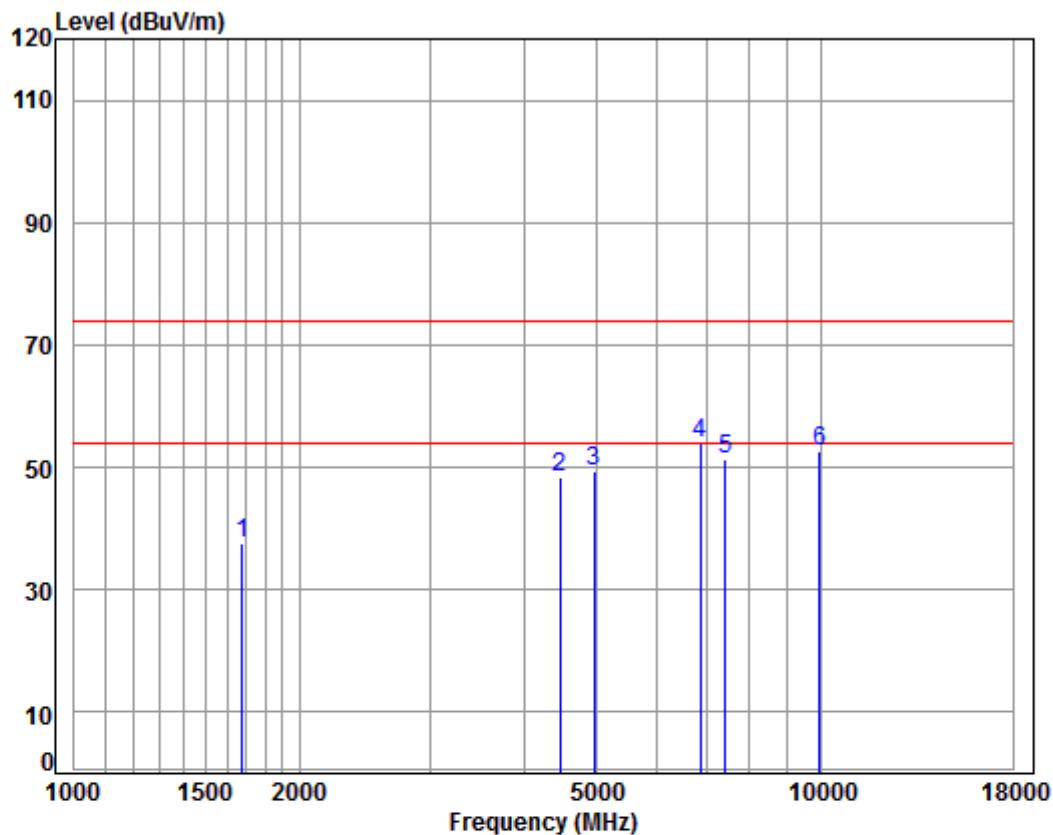
Job No : 12126CR

Mode : 2440 TX SE

Note :

	Freq	Cable	Ant	Preamp	Read	Limit	Over	Remark
		Loss	Factor	Factor	Level			
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1	1468.761	5.38	25.68	38.04	44.16	37.18	74.00	-36.82 peak
2	4443.453	7.50	33.60	38.24	44.37	47.23	74.00	-26.77 peak
3	4880.000	7.97	34.29	38.45	42.89	46.70	74.00	-27.30 peak
4 pp	6679.040	11.02	35.61	37.60	44.24	53.27	74.00	-20.73 peak
5	7320.000	10.05	36.37	37.00	41.49	50.91	74.00	-23.09 peak
6	9760.000	10.82	37.55	35.02	39.23	52.58	74.00	-21.42 peak

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



Condition: 3m HORIZONTAL

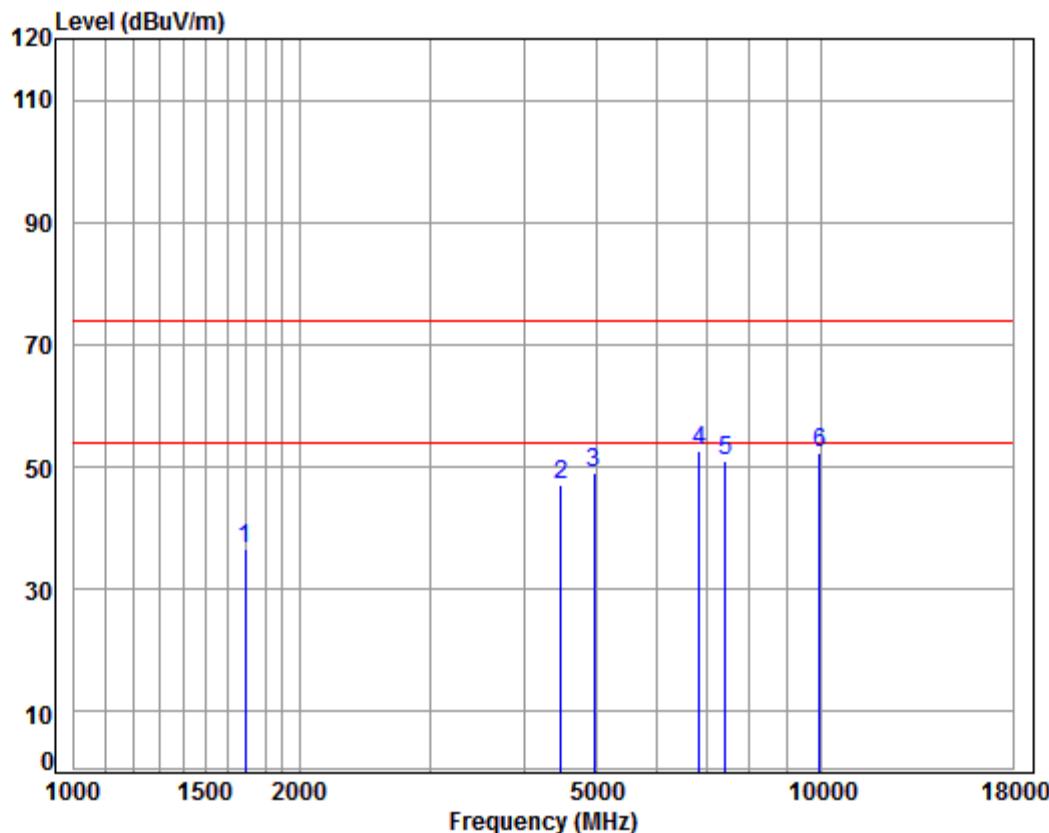
Job No : 12126CR

Mode : 2480 TX SE

Note :

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Limit Level	Line Limit	Over Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1	1677.621	5.25	26.58	38.03	43.85	37.65	74.00	-36.35 peak
2	4469.214	7.53	33.60	38.25	45.40	48.28	74.00	-25.72 peak
3	4960.000	8.05	34.43	38.48	45.21	49.21	74.00	-24.79 peak
4 pp	6874.906	10.47	36.16	37.42	44.66	53.87	74.00	-20.13 peak
5	7440.000	10.02	36.32	36.89	41.95	51.40	74.00	-22.60 peak
6	9920.000	10.90	37.58	34.94	39.10	52.64	74.00	-21.36 peak

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



Condition: 3m VERTICAL

Job No : 12126CR

Mode : 2480 TX SE

Note :

Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Limit		Over Line	Remark
					dB	dBuV	dBuV/m	dBuV/m
1 1692.231	5.24	26.64	38.02	42.88	36.74	74.00	-37.26	peak
2 4482.150	7.54	33.60	38.26	44.37	47.25	74.00	-26.75	peak
3 4960.000	8.05	34.43	38.48	45.05	49.05	74.00	-24.95	peak
4 pp 6855.063	10.53	36.10	37.44	43.43	52.62	74.00	-21.38	peak
5 7440.000	10.02	36.32	36.89	41.66	51.11	74.00	-22.89	peak
6 9920.000	10.90	37.58	34.94	38.86	52.40	74.00	-21.60	peak

Remark:

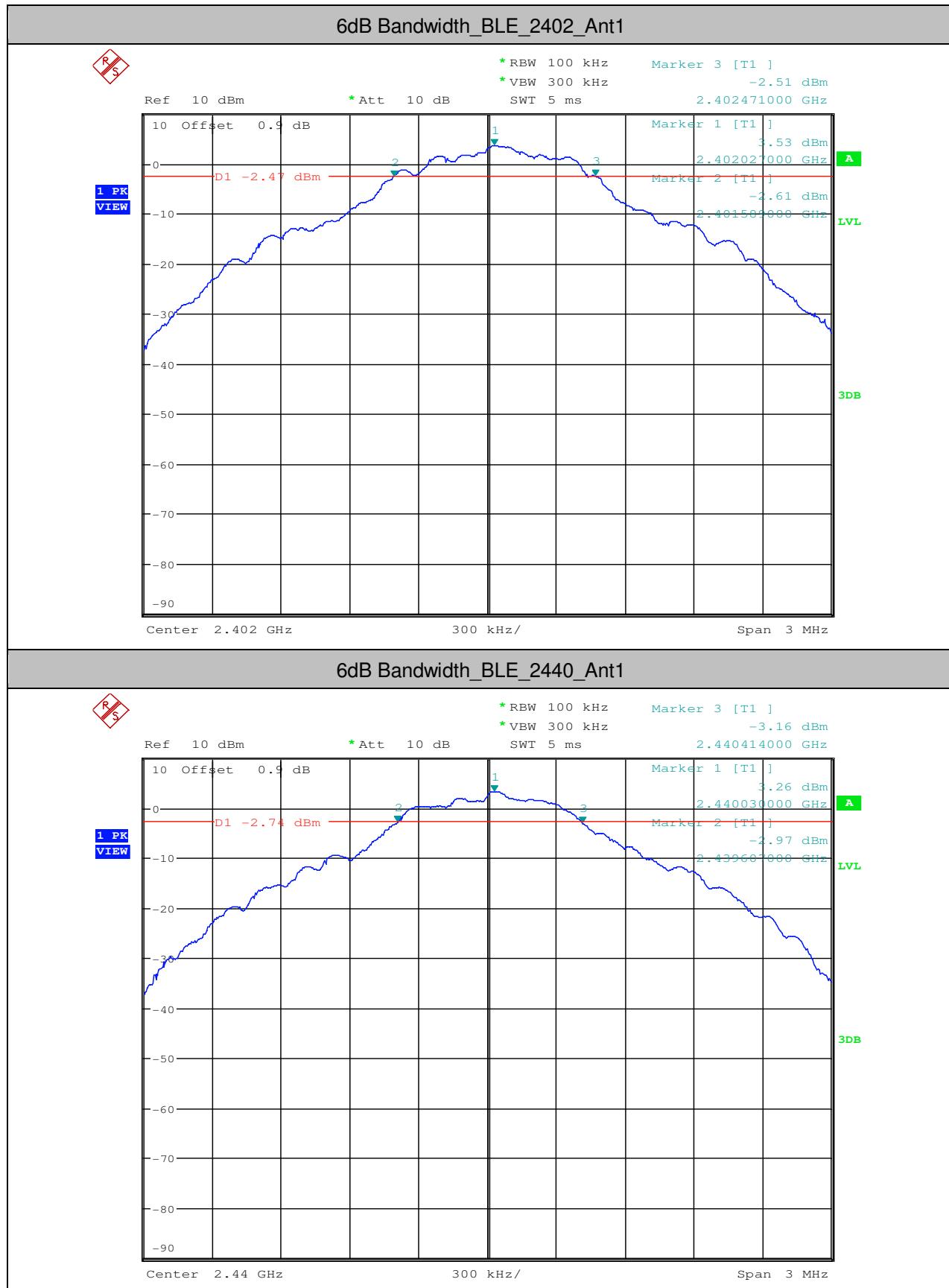
- 3) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:
Final Test Level = Receiver Reading + Antenna Factor + Cable Factor – Preamplifier Factor
- 4) Scan from 9kHz to 25GHz, the disturbance above 18GHz 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.
- 5) 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 above measurement data were shown in the report.

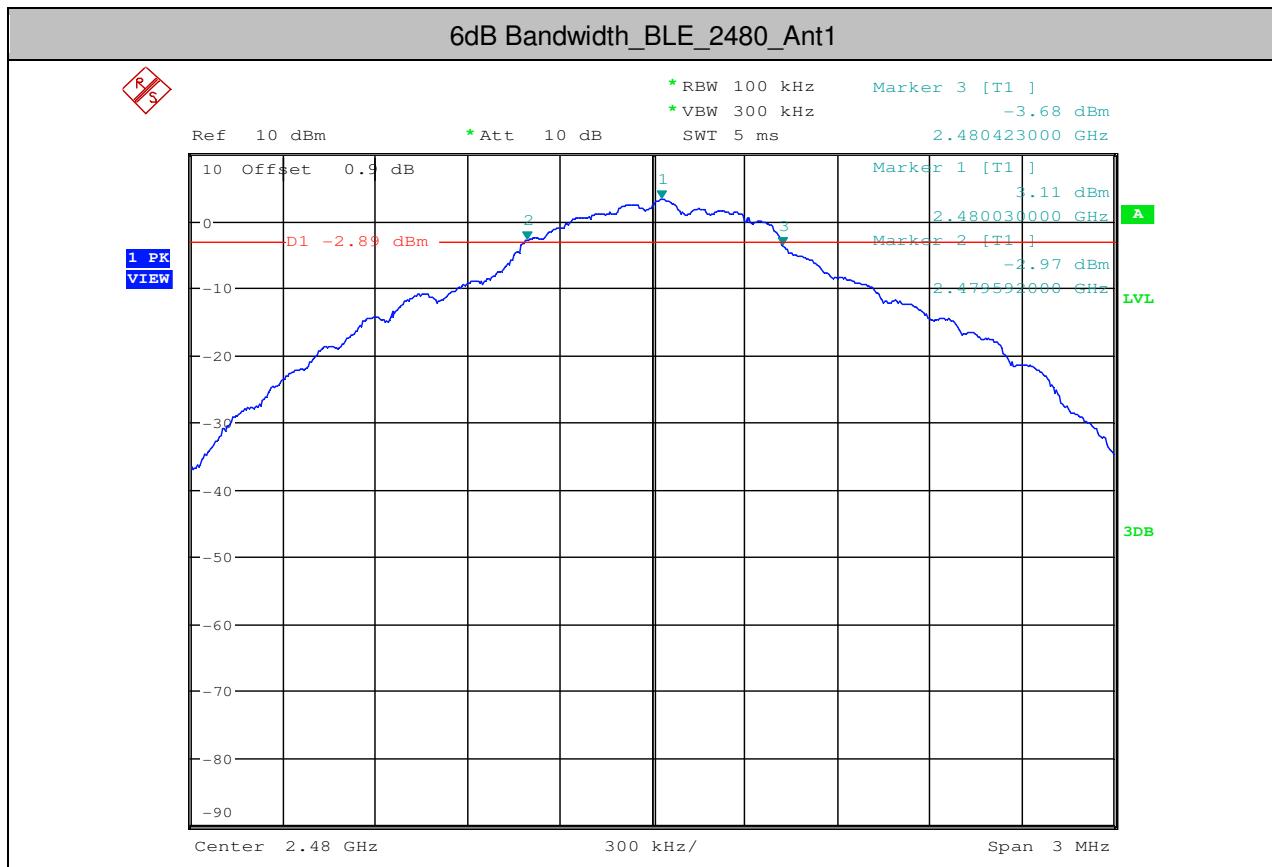
8 Appendix

8.1 Appendix 15.247

1.6dB Bandwidth

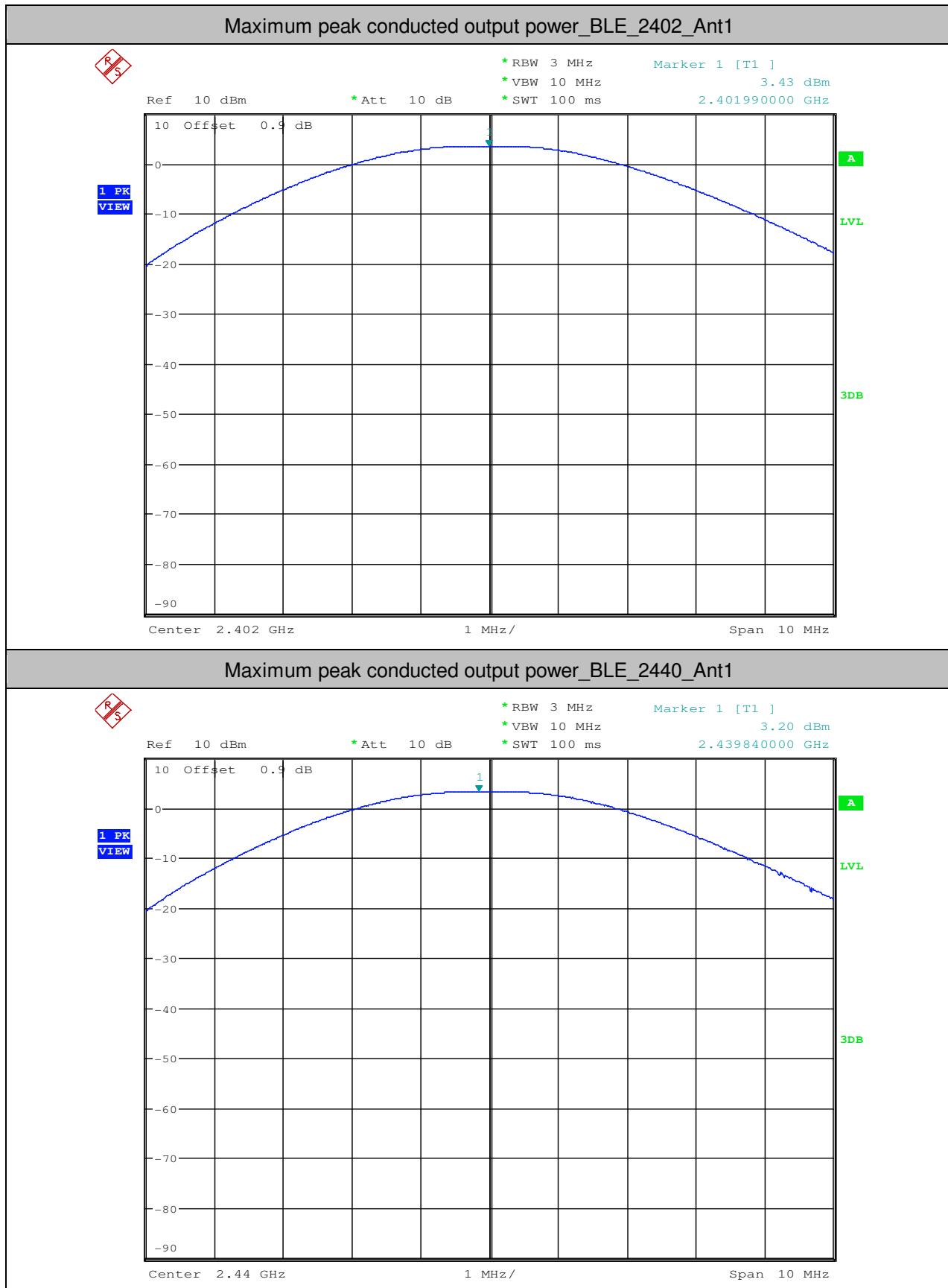
Test Mode	Test Channel	Ant	EBW[MHz]	Limit[MHz]	Verdict
BLE	2402	Ant1	0.882	>=0.5	PASS
BLE	2440	Ant1	0.807	>=0.5	PASS
BLE	2480	Ant1	0.831	>=0.5	PASS

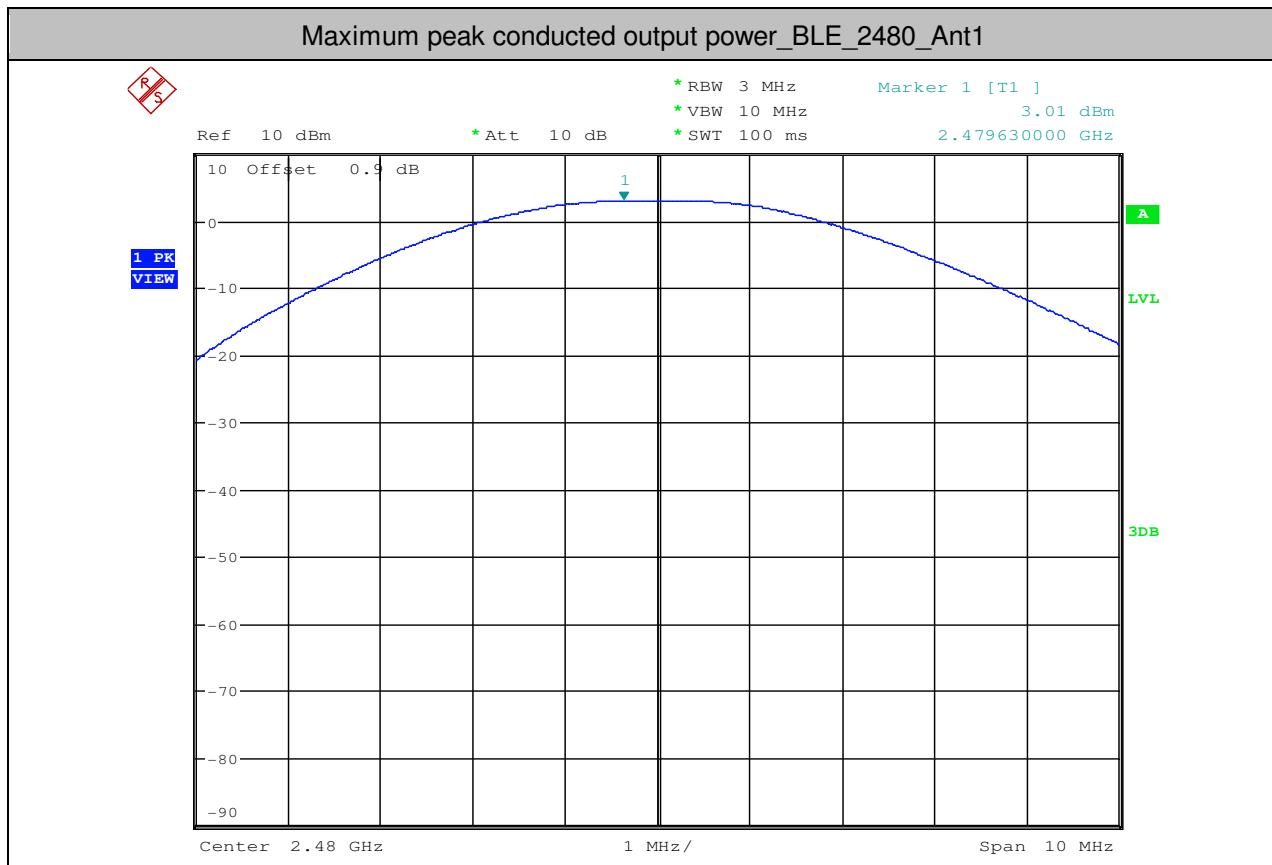




3. Maximum peak conducted output power

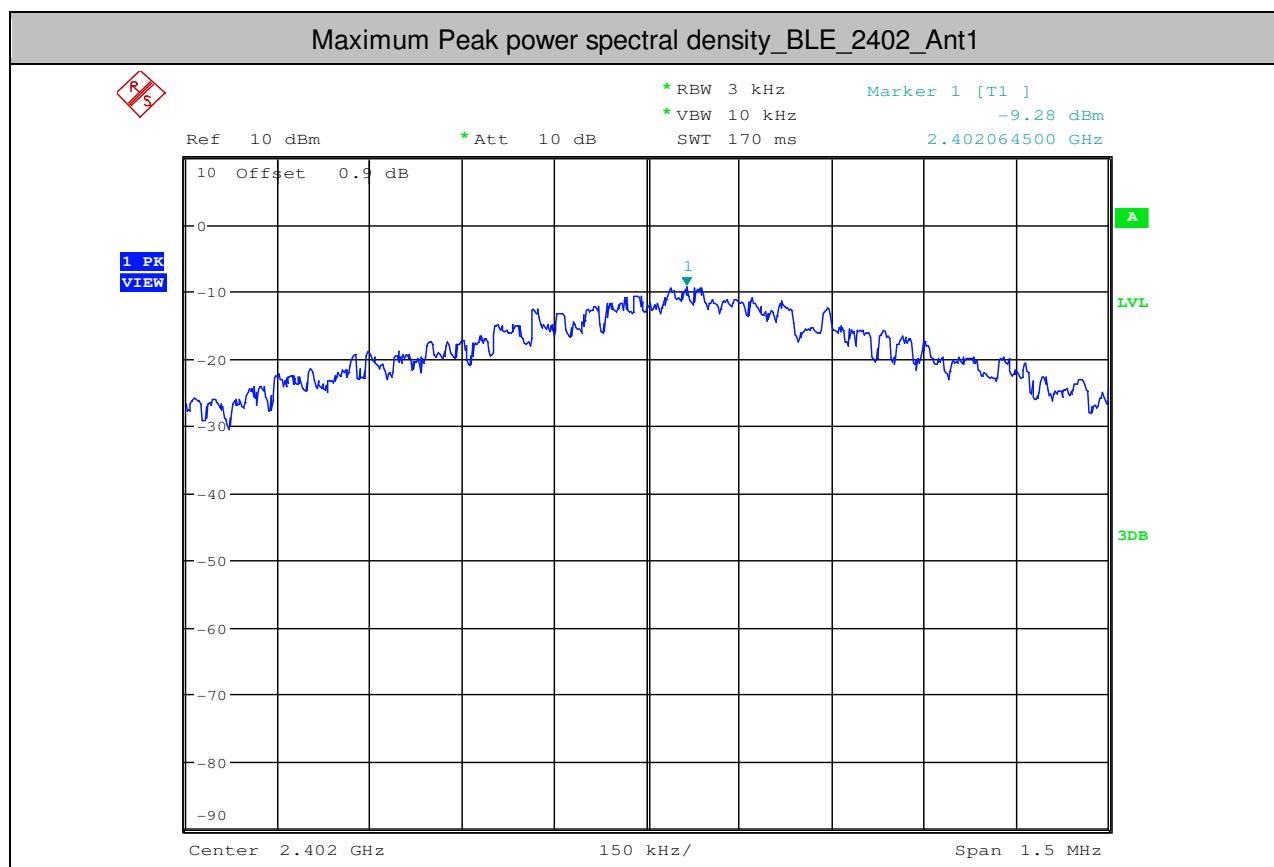
Test Mode	Test Channel	Ant	Power[dBm]	Limit[dBm]	Verdict
BLE	2402	Ant1	3.43	<30	PASS
BLE	2440	Ant1	3.2	<30	PASS
BLE	2480	Ant1	3.01	<30	PASS

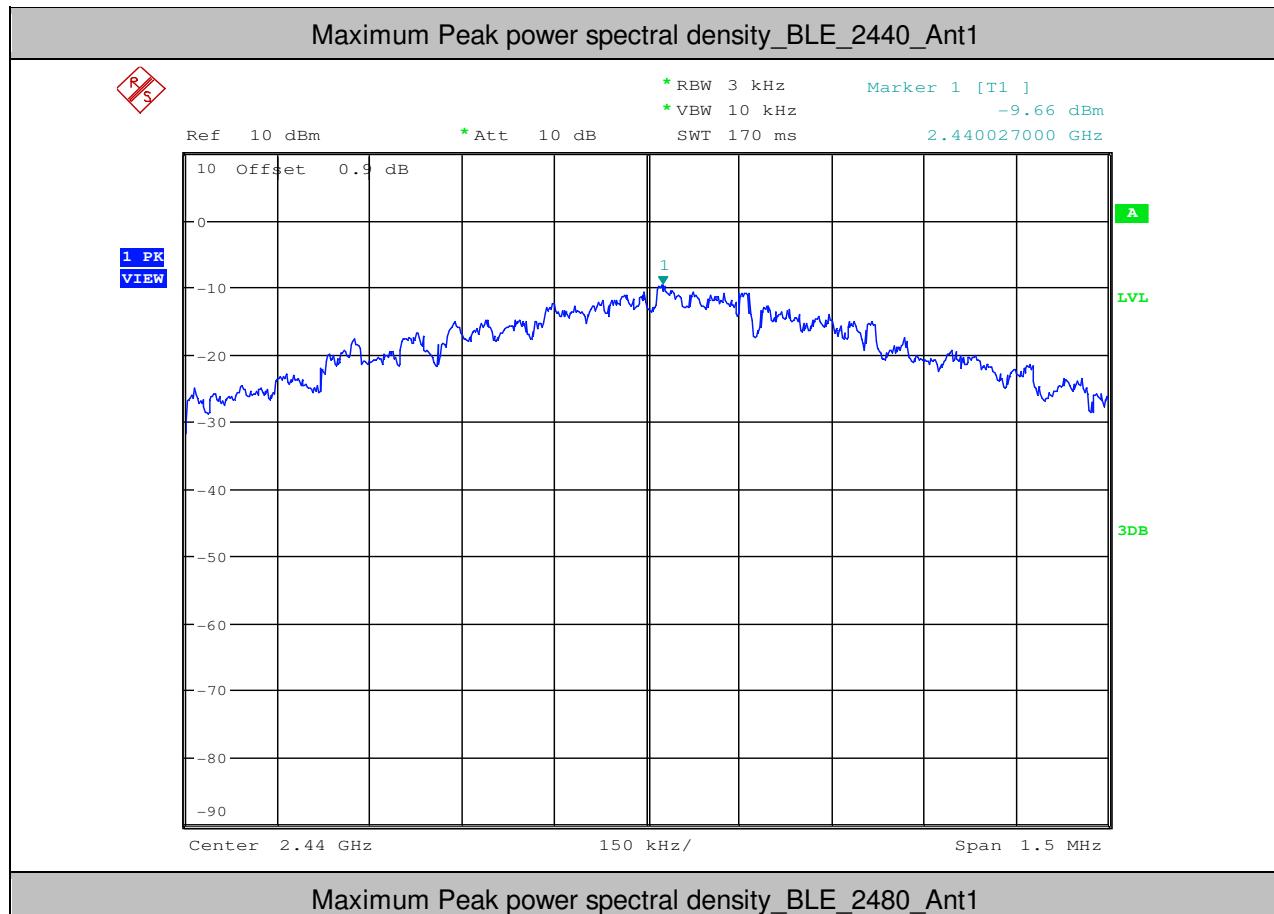


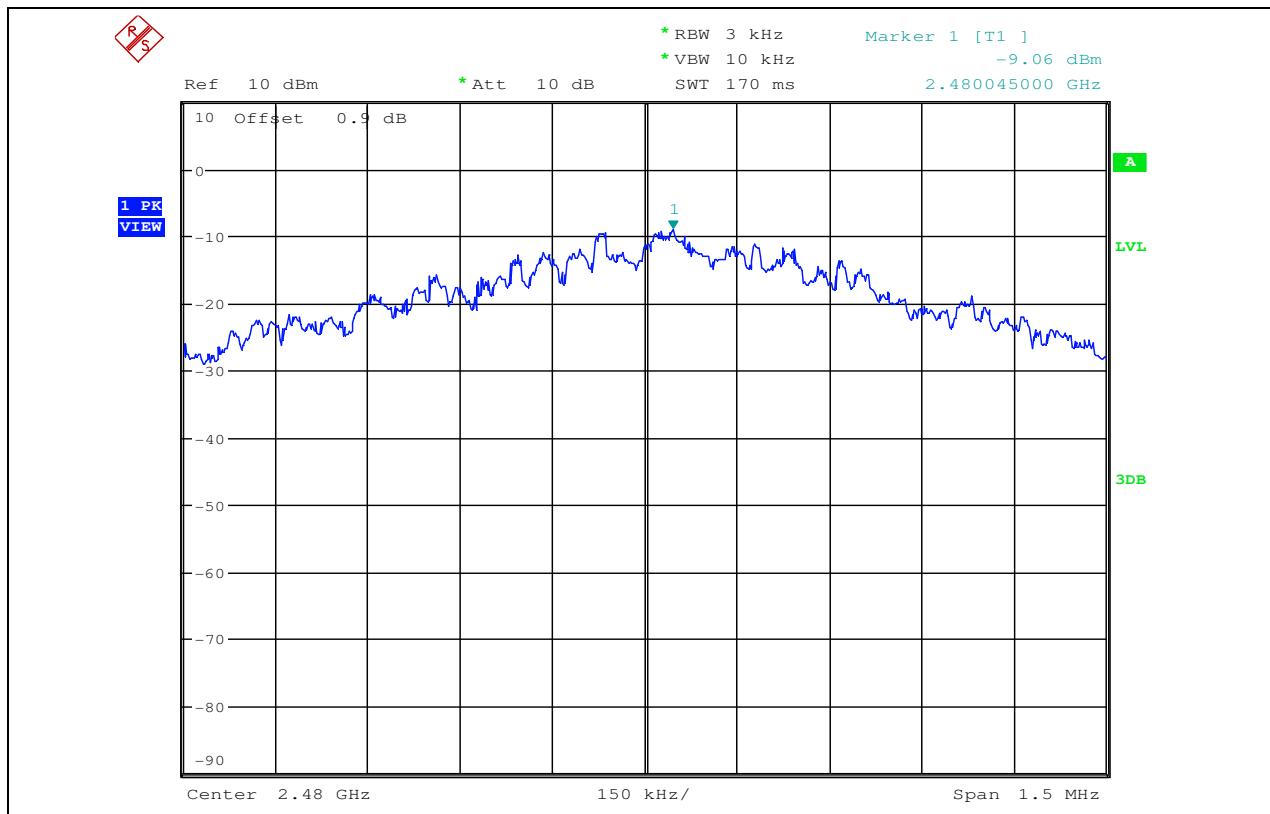


4. Maximum Peak power spectral density

Test Mode	Test Channel	Ant	PSD[dBm/3kHz]	Limit[dBm/3kHz]	Verdict
BLE	2402	Ant1	-9.28	<8.00	PASS
BLE	2440	Ant1	-9.66	<8.00	PASS
BLE	2480	Ant1	-9.06	<8.00	PASS

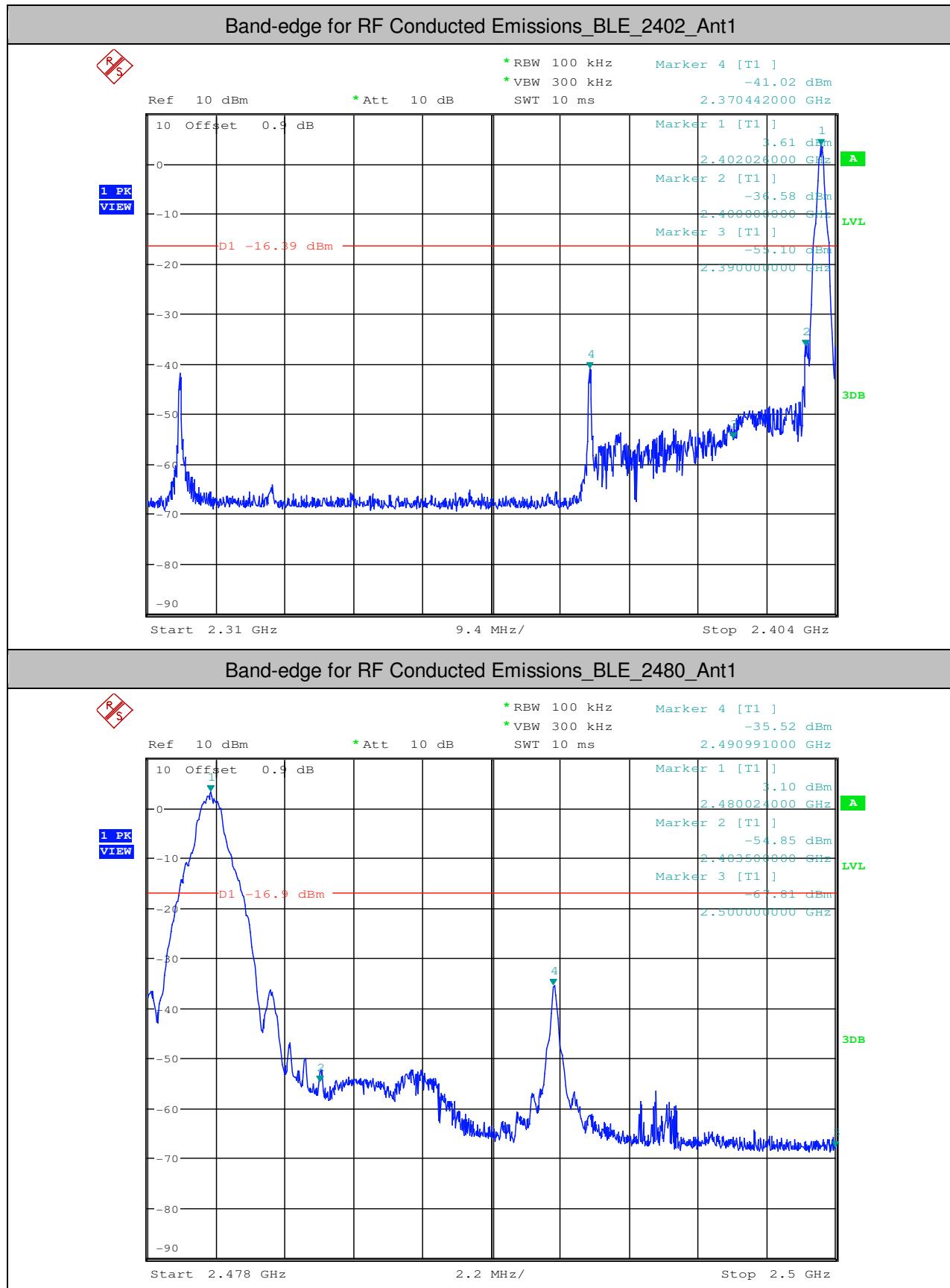






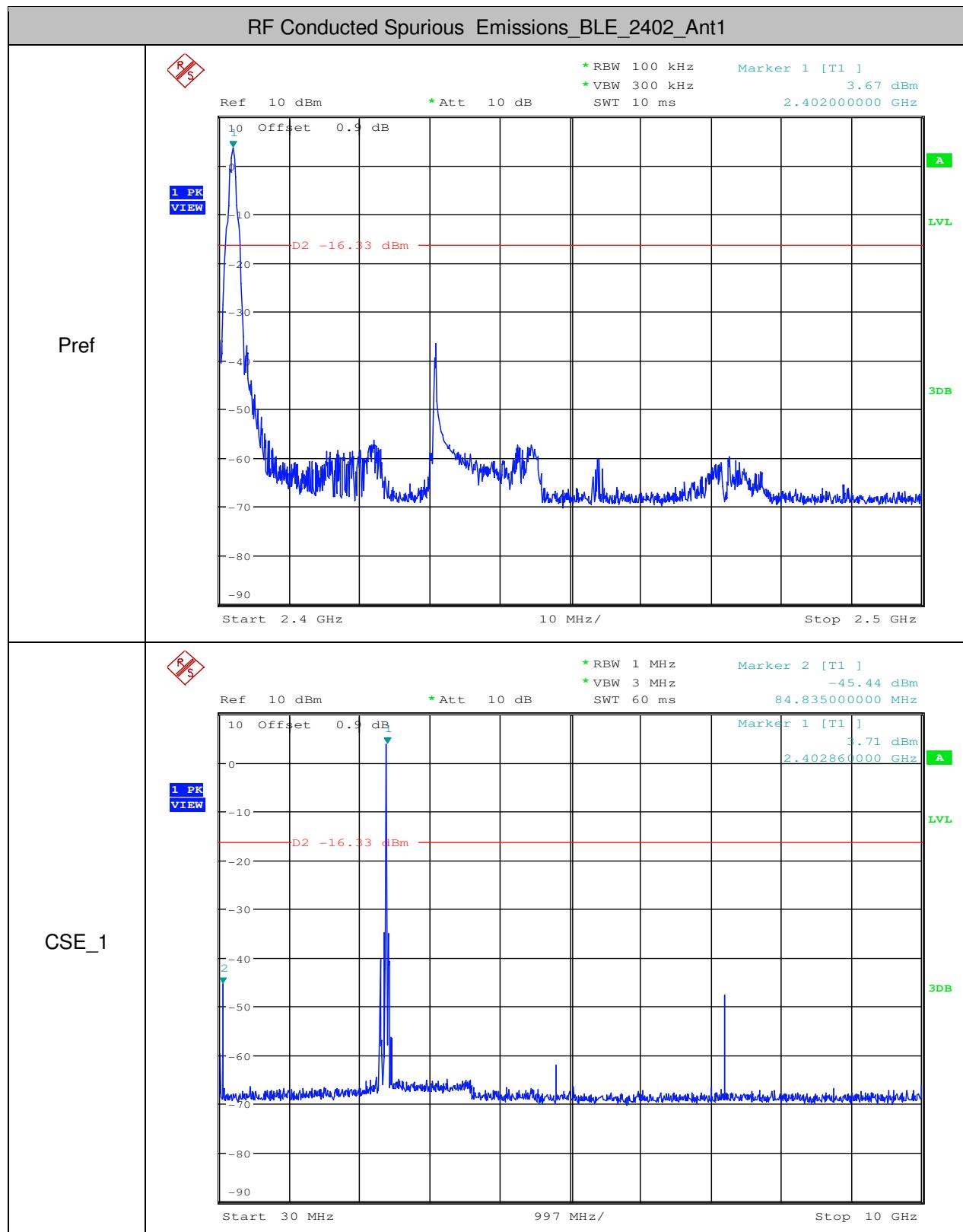
5. Band-edge for RF Conducted Emissions

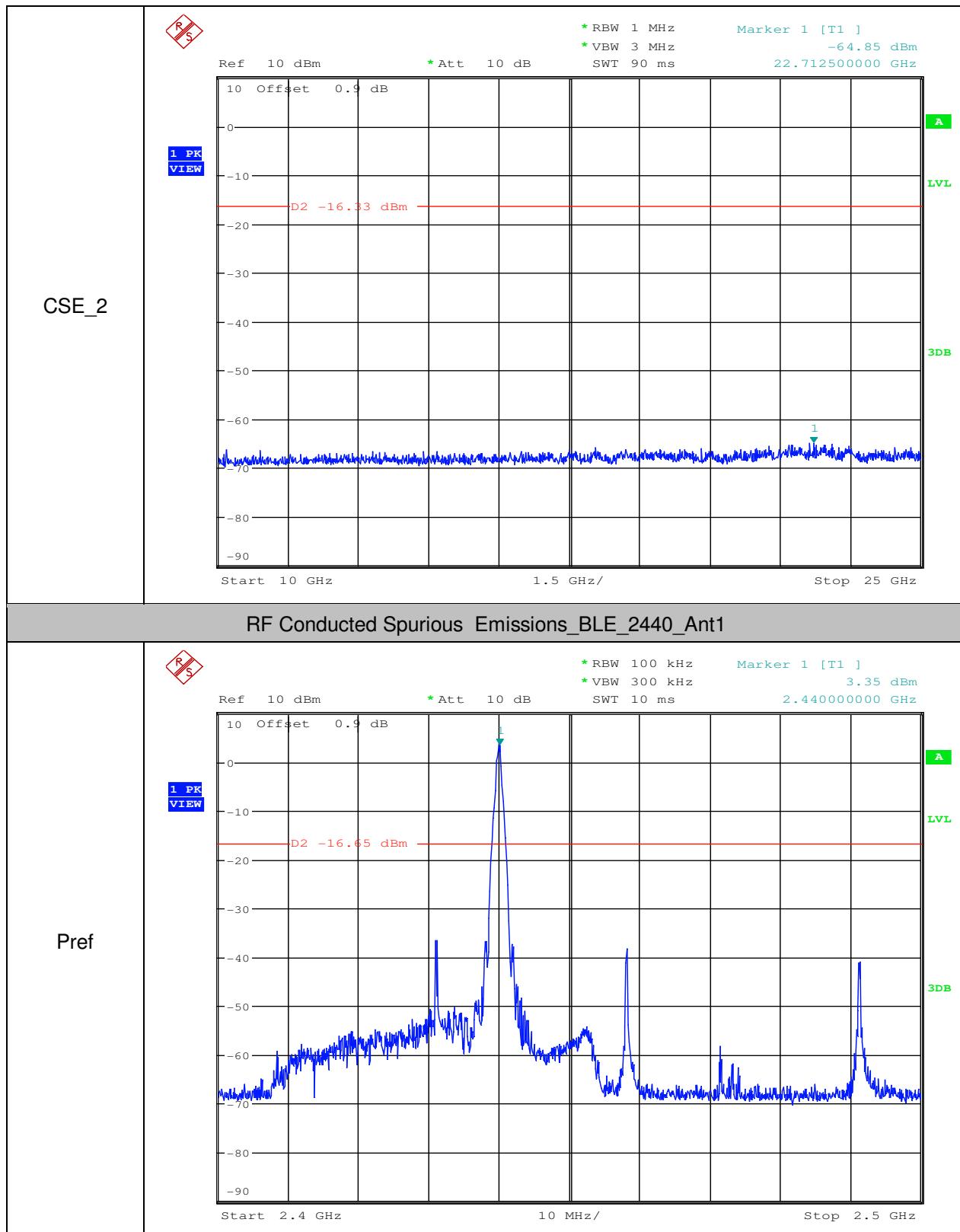
Test Mode	Test Channel	Ant	Carrier Power[dBm]	Max. Spurious Level [dBm]	Limit [dBm]	Verdict
BLE	2402	Ant1	3.610	-41.022	<-16.39	PASS
BLE	2480	Ant1	3.100	-35.521	<-16.9	PASS

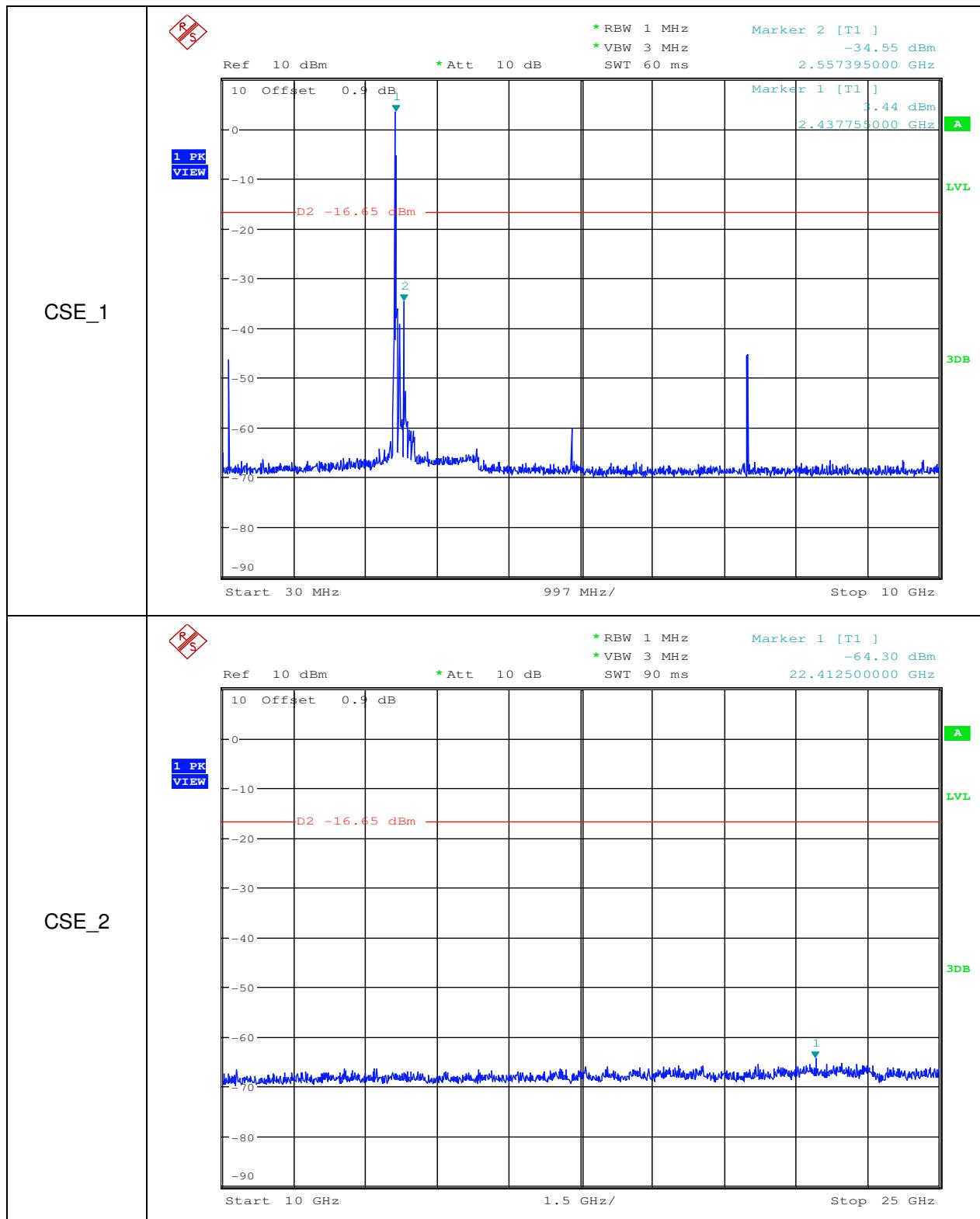


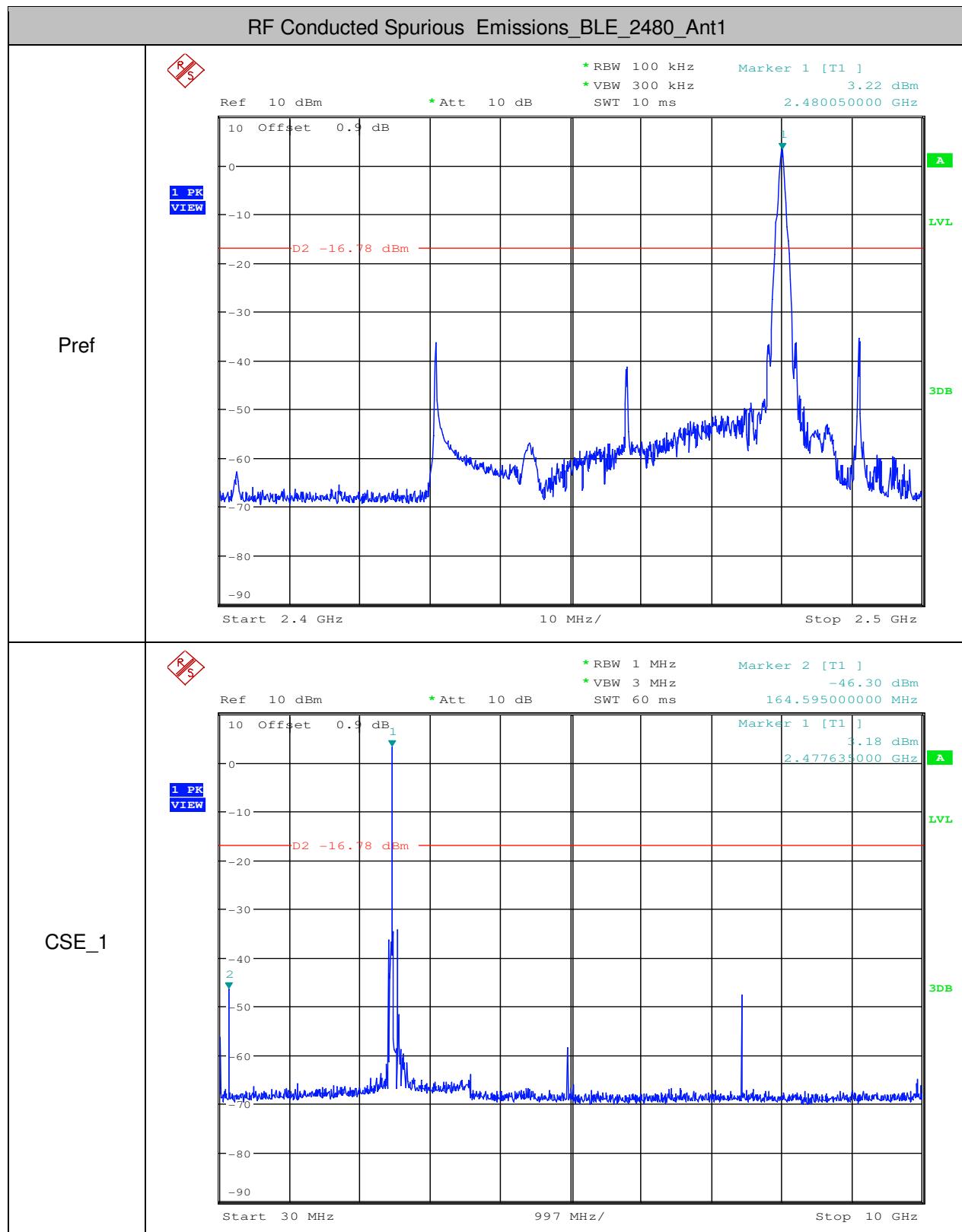
6.RF Conducted Spurious Emissions

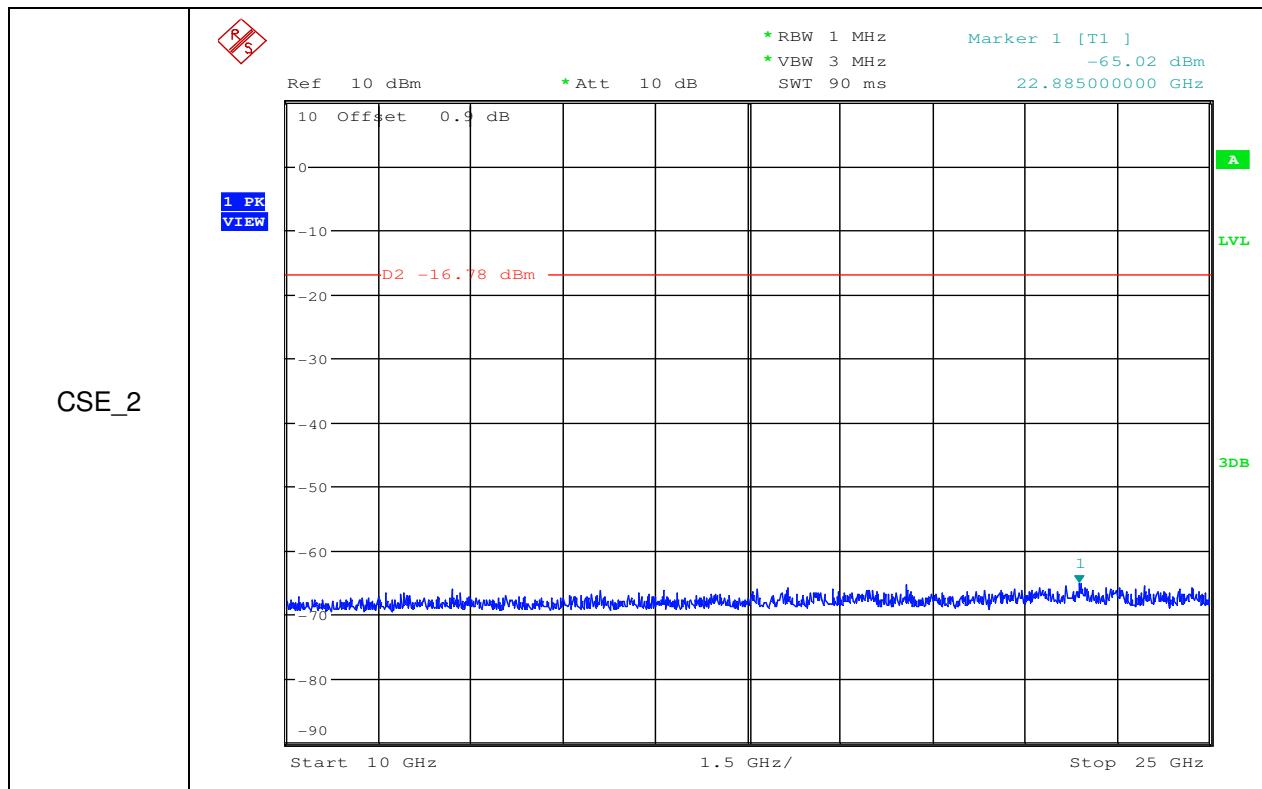
Test Mode	Test Channel	StartFre [MHz]	StopFre [MHz]	RBW [kHz]	VBW [kHz]	Pref[dBm]	Max. Level [dBm]	Limit [dBm]	Verdict
BLE	2402	30	10000	1000	3000	3.67	-45.440	<-16.33	PASS
BLE	2402	10000	25000	1000	3000	3.67	-64.850	<-16.33	PASS
BLE	2440	30	10000	1000	3000	3.35	-34.550	<-16.65	PASS
BLE	2440	10000	25000	1000	3000	3.35	-64.300	<-16.65	PASS
BLE	2480	30	10000	1000	3000	3.22	-46.300	<-16.78	PASS
BLE	2480	10000	25000	1000	3000	3.22	-65.020	<-16.78	PASS











- End of the Report -