TEST REPORT

Application No.:	HKEM2207000751AT
Applicant:	TAKTIK PRODUCTS PTY LTD
Address of Applicant:	304 UPPER HEIDELBERG ROAD, IVANHOE, 3079, VICTORIA, AUSTRALIA
Equipment Under Test (EUT):	
EUT Name:	TENNIS GAME APPARATUS
Model No.:	A1
FCC ID:	A8MSTTA1-22
IC:	29292-TTA122
HVIN:	4.0
Standard(s) :	47 CFR Part 15, Subpart C RSS-247 Issue 2 RSS-Gen Issue 5
Date of Receipt:	2022-09-01
Date of Test:	2022-09-01 to 2022-09-08
Date of Issue:	2022-09-08
Test Result:	The submitted sample was found to comply with the test requirement

Law Man Kit
EMC Manager

Revision Record			
Revision No.	**Date**	**Report superseded**	**Remark**

Authorized for issue by:				
				
		Chan Chun Lok /Project Engineer		Date: 2022-09-08
				
		Law Man Kit /Reviewer		Date: 2022-09-08

2 Test Summary

IC:

Radio Spectrum Technical Requirement				
Item	**Standard**	**Method**	**Requirement**	**Result**
Antenna Requirement	RSS-247 Issue 2, February 2017	N/A	RSS-Gen Section 6.8	Pass

Radio Spectrum Matter Part				
Item	**Standard**	**Method**	**Requirement**	**Result**
99% Bandwidth	RSS-247 Issue 2, February 2017	ANSI C63.10 (2013) Section 6.9.3	RSS-Gen Section 6.7	Pass
Minimum 6dB Bandwidth	RSS-247 Issue 2, February 2017	ANSI C63.10 (2013) Section 11.8.1	RSS-247 Section 5.2(a)	Pass
Conducted Peak Output Power	RSS-247 Issue 2, February 2017	ANSI C63.10 (2013) Section 11.9.1	RSS-247 Section 5.4(d)	Pass
Power Spectrum Density	RSS-247 Issue 2, February 2017	ANSI C63.10 (2013) Section 11.10.2	RSS-247 Clause 5.2(b)	Pass
Conducted Band Edges Measurement	RSS-247 Issue 2, February 2017	ANSI C63.10 (2013) Section 11.12	RSS-247 Section 5.5	Pass
Conducted Spurious Emissions	RSS-247 Issue 2, February 2017	ANSI C63.10 (2013) Section 11.11	RSS-247 Section 5.5	Pass
Radiated Emissions which fall in the restricted bands	RSS-247 Issue 2, February 2017	ANSI C63.10 (2013) Section 6.10.5	Section 3.3 & RSS-Gen Section 8.10	Pass
Radiated Spurious Emissions	RSS-247 Issue 2, February 2017	ANSI C63.10 (2013) Section 6.4&6.5&6.6	RSS-247 Section 5.5	Pass

Note: Frequency stability requested in RSS GEN Section 8.1.1 has been complied since the result of band edge can demonstrate.

FCC:

Radio Spectrum Technical Requirement				
Item	**Standard**	**Method**	**Requirement**	**Result**
Antenna Requirement	47 CFR Part 15, Subpart C	N/A	47 CFR Part 15, Subpart C 15.203 & 15.247(b)(4)	Pass

Radio Spectrum Matter Part				
Item	**Standard**	**Method**	**Requirement**	**Result**
Minimum 6dB Bandwidth	47 CFR Part 15, Subpart C	ANSI C63.10 (2013) Section 11.8.1	47 CFR Part 15, Subpart C 15.247(a)(2)	Pass
Conducted Peak Output Power	47 CFR Part 15, Subpart C	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	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	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	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	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	ANSI C63.10 (2013) Section 6.4,6.5,6.6	47 CFR Part 15, Subpart C 15.247(d)	Pass

Declaration of EUT Family Grouping:

N/A

Abbreviation:

Tx: In this whole report Tx (or tx) means Transmitter.

Rx: In this whole report Rx (or rx) means Receiver.

RF: In this whole report RF means Radiated Frequency.

CH: In this whole report CH means channel.

Volt: In this whole report Volt means Voltage.

Temp: In this whole report Temp means Temperature.

Humid: In this whole report Humid means humidity.

Press: In this whole report Press means Pressure.

N/A: In this whole report not application.

3 Contents

4 General Information

4.1 Details of E.U.T.

Power supply:	DC 6 V (‘AA’ size battery x 4)
Test voltage:	DC 6 V
Cable:	N/A
Antenna Gain:	3.4 dBi
Antenna Type:	PCB Antenna
Bluetooth Version:	V4.2 LE
Channel Separation:	2MHz
Modulation Type:	GFSK
Number of Channels:	40
Operation Frequency:	2402MHz to 2480MHz
Power Class:	<10mW
Series No.:	A1
Firmware Version:	1.0
Hardware Version:	4.0

Frequency Lists:

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

The frequencies under test are bolded.

4.2 Description of Support Units

Description	Manufacturer	Model No.	Serial No.
Galaxy A51	Samsung	SM-A515F	R58N23ACSTV
Laptop	DELL	P75F	475LXQ2
EspRFTestTool_v2.8_Manual.exe	TAKTIK PRODUCTS PTY LTD	N/A	N/A

Note: The laptop and the software EspRFTestTool_v2.8_Manual.exe were for the control of the engineering mode and the Galaxy A51 provided Bluetooth connection to the EUT.

4.3 Modulation Configuration

RF software:	EspRFTestTool_v2.8_Manual.exe			
Modulation	**Packet**	**Packet Type**	**Packet Size**	**Power**
GFSK	Default	LE_prbs9	Default	8
Remark: 1. 8 value was set in test software as maximum output power setting.				

4.4 Measurement Uncertainty

RF

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 (30MHz-40GHz)	1.5dB
5	RF power density	1.5dB
6	Conducted Spurious emissions	1.5dB
7	RF Radiated power & Radiated Spurious emission test	4.5dB (30MHz-1GHz)
		4.7dB (1GHz-6GHz)
		4.7dB (6GHz-18GHz)
		5.7dB (18GHz-40GHz)
8	Temperature test	± 1℃
9	Humidity test	± 3%
10	Supply voltages	± 1.5%
11	Time	± 3%

Remark:

The U_{lab} (lab Uncertainty) is less than U_{cispr} (CISPR Uncertainty), so the test results

- compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.

According to decision rule based on Clause 4.2 of CISPR 16-4-2, the EUT complied with the standards specified above.

4.5 Test Location

All tests were performed at:

SGS Hong Kong Limited

Unit 2 and 3, G/F, Block A, Po Lung Centre,

11 Wang Chiu Road, Kowloon Bay, Kowloon, Hong Kong

Tel: +852 2305 2570 Fax: +852 2756 4480

No tests were sub-contracted.

4.6 Test Facility

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

- **IAS Accreditation (Lab Code: TL-817)**

SGS Hong Kong Limited has met the requirements of AC89, IAS Accreditation Criteria for Testing Laboratories, and has demonstrated compliance with ISO/IEC Standard 17025:2017, General requirements for the competence of testing and calibration laboratories. This organization is accredited to provide the services specified in the scope of accreditation maintained on the IAS website (www.iasonline.org).

The report must not be used by the client to claim product certification, approval, or endorsement by IAS, NIST, or any agency of the Federal Government.

- **FCC Recognized Accredited Test Firm(CAB Registration No.: 514599)**

SGS Hong Kong Limited has been accredited and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Designation Number: HK0015, Test Firm Registration Number: 514599.

- **Industry Canada (Site Registration No.: 26103; CAB Identifier No.: HK0015)**

SGS Hong Kong Limited has been recognized by Department of Innovation, Science and Economic Development (ISED) Canada as a wireless testing laboratory. The acceptance letter from the ISED is maintained in our files. CAB Identifier No: HK0015, Site Registration Number: 26103.

4.7 Deviation from Standards

None

4.8 Abnormalities from Standard Conditions

None

5 Equipment List

99% Bandwidth, Minimum 6dB Bandwidth, Conducted Peak Output Power, Power Spectrum Density, Conducted Band Edges Measurement, Conducted Spurious Emissions					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
FSV40 SIGNAL ANALYZER 40GHz	Rohde & Schwarz	FSV40	E235	2022/08/17	2023/08/16
OSP	Rohde & Schwarz	OSP-B157W8	E242	2022/04/20	2023/04/19
Cable	Rohde & Schwarz	J12J103539-00-2	E239	2021/09/17	2022/09/16
WMS32 Test software	Rohde & Schwarz	N/A	Version 11	N/A	N/A

Radiated Emissions which fall in the restricted bands, Radiated Spurious Emissions					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
3m Semi-Anechoic Chamber	ChamPro	N/A	E229	2022/08/08	2023/08/07
Coaxial Cable	SGS	N/A	E167	2022/07/15	2023/07/14
EMI Test Receiver 9kHz to 7GHz	Rohde & Schwarz	ESR7 / 102298	E314	2022/06/29	2023/06/28
EMC32 Test software	Rohde & Schwarz	Version 10	N/A	N/A	N/A
Signal and Spectrum Analyzer 2Hz - 26.5GHz	Rohde & Schwarz	FSW26	E296	2022/08/17	2023/08/16
Preamplifier 33dB, 1 - 18GHz	Schwarzbeck	BBV9718	E214	2022/04/09	2023/04/08
RF cable SMA to SMA 10000mm	HUBER+SUHNER	SF104-26.5/2*11SMA 45	E207	2021/09/17	2022/09/16
Boresight Mast Controller	ChamPro	AM-BS-4500-E	E237	N/A	N/A
Turntable with Controller	ChamPro	EM1000	E238	N/A	N/A
Band Reject Filter 2.4 -2.5GHz	MICRO-TRONICS	BRM50702	E324	2021/09/17	2022/09/16

General used equipment					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
Digital temperature & humidity data logger	SATO	SK-L200TH II	E232	2022/08/16	2023/08/15
Electronic Digital Thermometer with Hygrometer	nil	2074/2075	E159	2022/08/16	2023/08/15
Barometer with digital thermometer	SATO	7612-00	E218	2022/03/29	2023/03/28
Conditional Chamber	Zhong Zhi Testing Instruments	CZ-E-608D	E216	2022/08/17	2023/08/16

6 Radio Spectrum Technical Requirement

6.1 Antenna Requirement

6.1.1 Test Requirement:

RSS-Gen Section 6.8

47 CFR Part 15, Subpart C 15.203 & 15.247(b)(4)

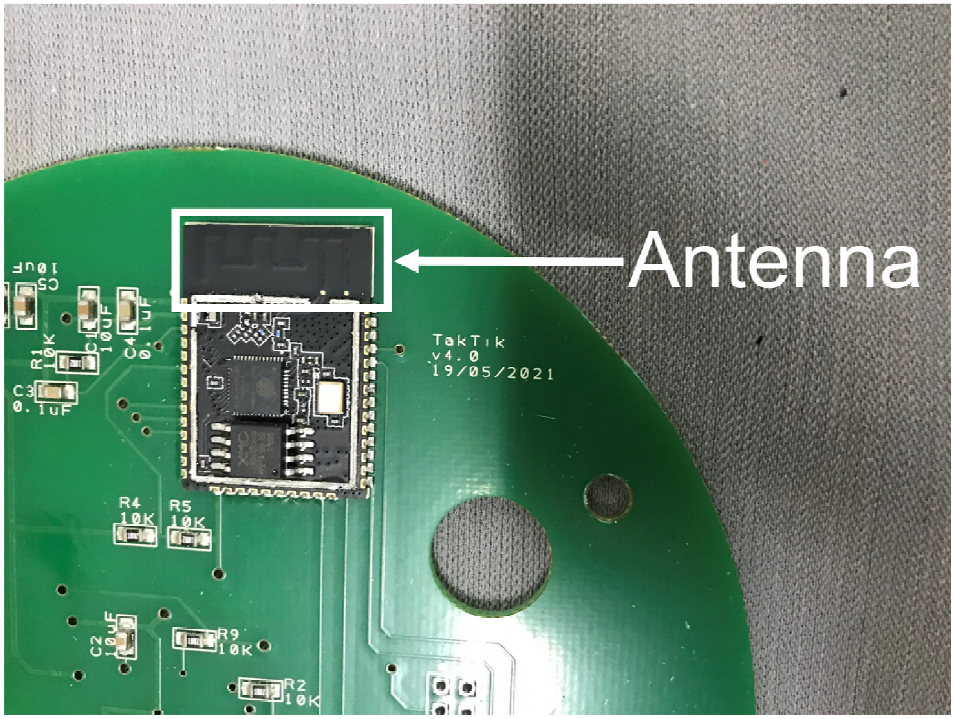
6.1.2 Conclusion

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 3.4 dBi.

Antenna location: Refer to internal photo.

7 Radio Spectrum Matter Test Results

7.1 99% Bandwidth

Test Requirement RSS-Gen Section 6.7

Test Method: ANSI C63.10 (2013) Section 6.9.3

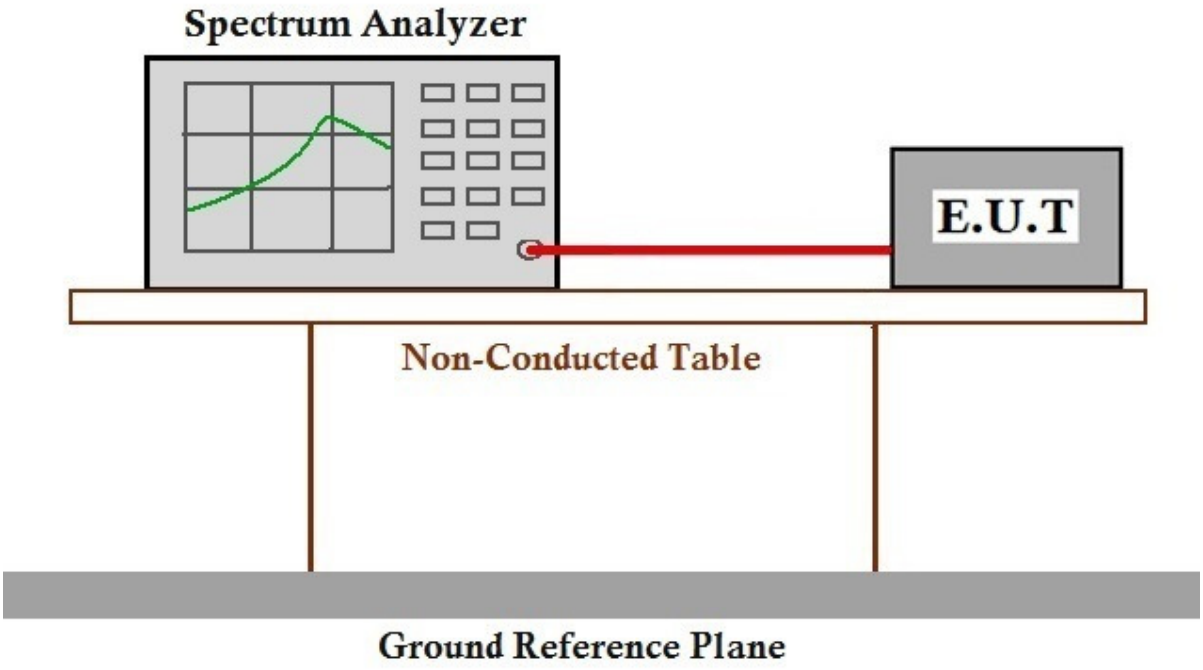
7.1.1 E.U.T. Operation

Operating Environment:

Temperature: 27.6 °C Humidity: 52.8 % RH

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 method see: ANSI C63.10 (2013) Section 6.9.3

The detailed test data see: Appendix 15.247 RSS 247 RSS247

7.2 Minimum 6dB Bandwidth

Test Requirement	RSS-247 Section 5.2(a) 47 CFR Part 15, Subpart C 15.247(a)(2)
Test Method:	ANSI C63.10 (2013) Section 11.8.1
Limit:	⩾500 kHz

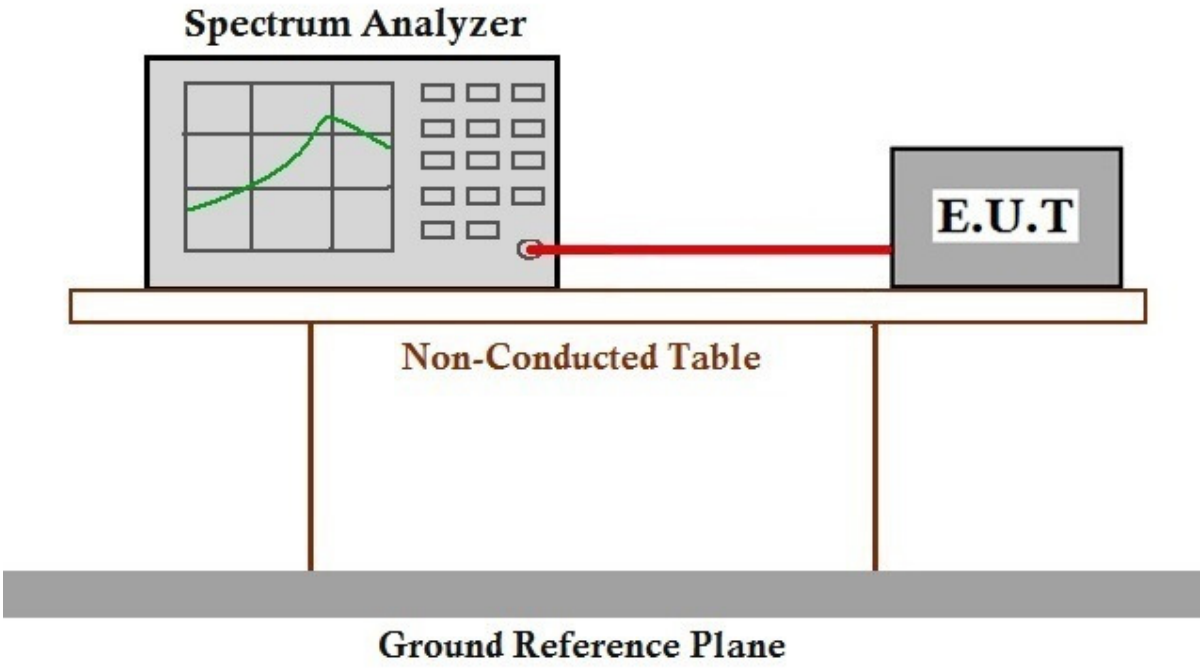
7.2.1 E.U.T. Operation

Operating Environment:

Temperature: 26.7 °C Humidity: 52.7 % RH

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 method see: ANSI C63.10 (2013) Section 11.8.1

The detailed test data see: Appendix 15.247 RSS 247

7.3 Conducted Peak Output Power

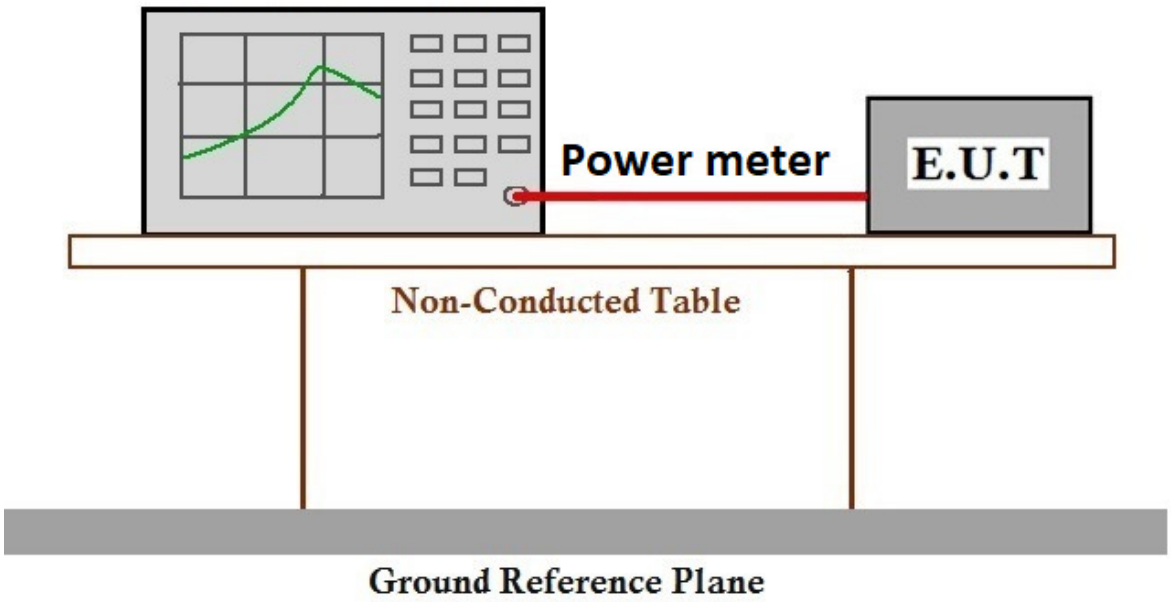
Test Requirement RSS-247 Section 5.4(d)
47 CFR Part 15, Subpart C 15.247(b)(3)
Test Method: ANSI C63.10 (2013) Section 11.9.1
Limit:

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

7.3.1 E.U.T. Operation

Operating Environment:
Temperature: 26.7 °C Humidity: 53.7 % RH
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 method see: ANSI C63.10 (2013) Section 11.9.1
The detailed test data see: Appendix 15.247 RSS 247

7.4 Power Spectrum Density

Test Requirement	RSS-247 Clause 5.2(b) 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

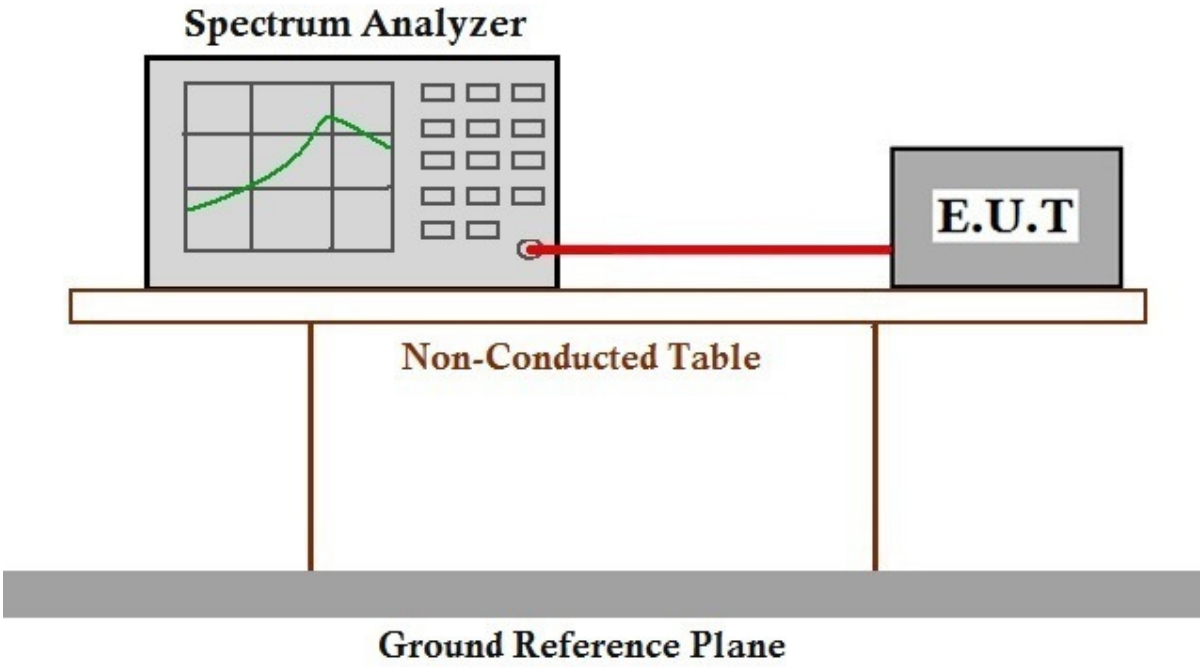
7.4.1 E.U.T. Operation

Operating Environment:

Temperature: 26.8 °C Humidity: 53.8 % RH

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 method see: ANSI C63.10 (2013) Section 11.10.2

The detailed test data see: Appendix 15.247 RSS 247

7.5 Conducted Band Edges Measurement

Test Requirement	RSS-247 Section 5.5 47 CFR Part 15, Subpart C 15.247(d)
Test Method:	ANSI C63.10 (2013) Section 11.13.3.2
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)

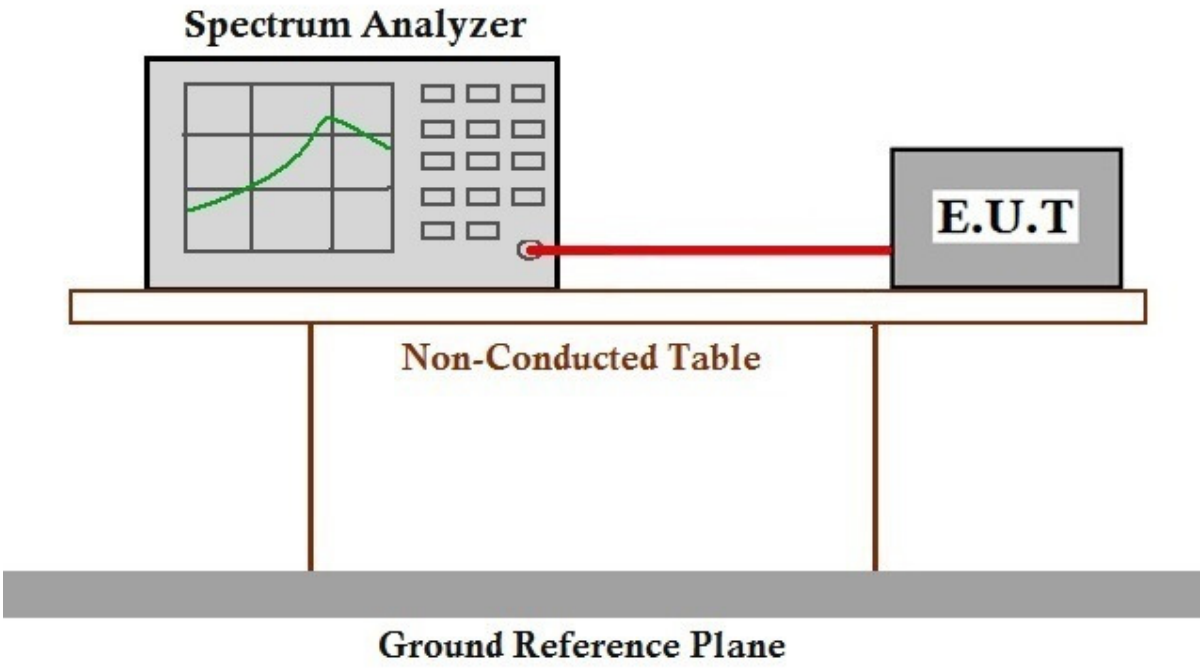
7.5.1 E.U.T. Operation

Operating Environment:

Temperature: 25.8 °C Humidity: 52.9 % RH

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 method see: ANSI C63.10 (2013) Section 11.13.3.2

The detailed test data see: Appendix 15.247 RSS 247

7.6 Conducted Spurious Emissions

Test Requirement	RSS-247 Section 5.5 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)

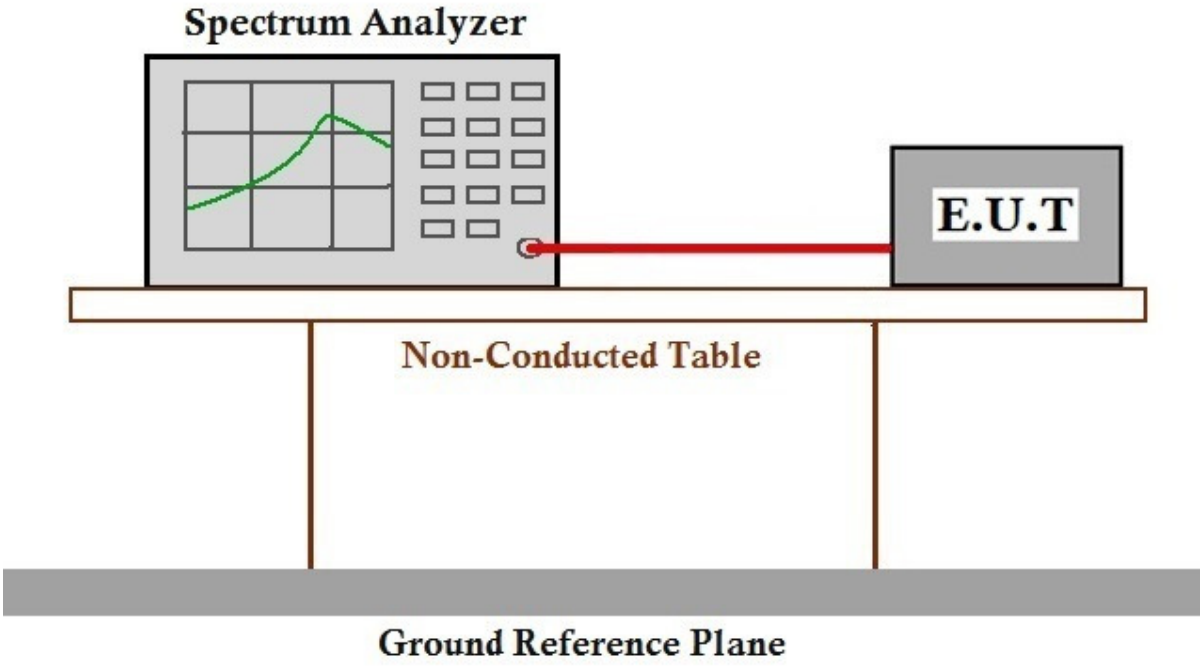
7.6.1 E.U.T. Operation

Operating Environment:

Temperature: 26.7 °C Humidity: 53.8 % RH

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

The detailed test method see: ANSI C63.10 (2013) Section 11.11

The detailed test data see: Appendix 15.247 RSS 247

7.7 Radiated Emissions which fall in the restricted bands

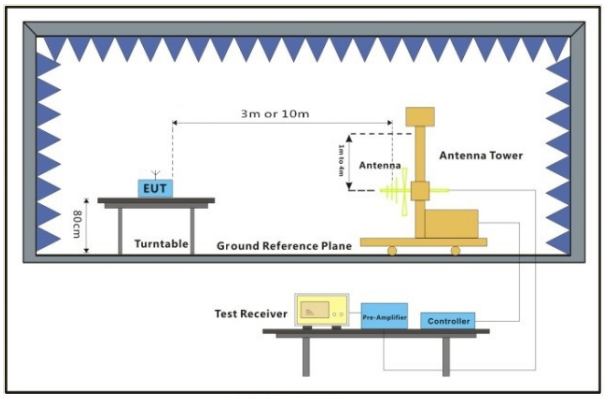
Test Requirement Section 3.3 & RSS-Gen Section 8.10
47 CFR Part 15, Subpart C 15.205 & 15.209
Test Method: ANSI C63.10 (2013) Section 6.10.5
Measurement Distance: 3m
Limit:

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.		

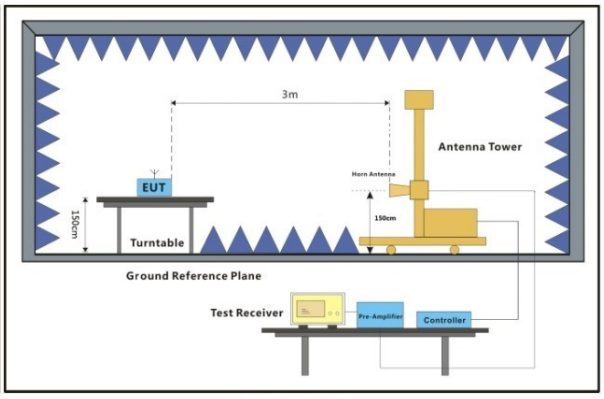
7.7.1 E.U.T. Operation

Operating Environment:
Temperature: 26.7 °C Humidity: 53.8 % RH
Test mode a: TX mode_Keep the EUT in continuously transmitting mode with GFSK modulation

7.7.2 Test Setup Diagram



30MHz-1GHz



Above 1GHz

7.7.3 Measurement Procedure and Data

a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

b. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

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

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

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

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

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

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

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

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

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

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

Frequency (MHz)	Antenna Polarization	Emission Level (dBµV/m)		Limit (dBµV/m)		Result
		Peak	Average	Peak	Average	
2390.000	H	53.2	36.1	74.0	54.0	Pass
2483.500	H	50.0	36.6	74.0	54.0	Pass
2390.000	V	50.8	34.9	74.0	54.0	Pass
2483.500	V	49.8	34.7	74.0	54.0	Pass

7.8 Radiated Spurious Emissions

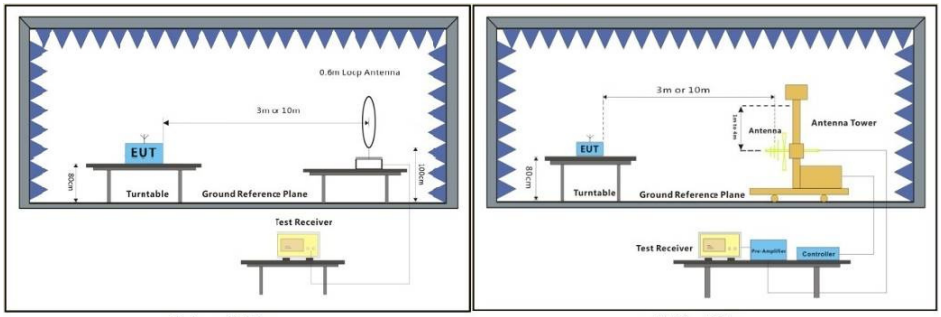
Test Requirement RSS-247 Section 5.5
47 CFR Part 15, Subpart C 15.247(d)
Test Method: ANSI C63.10 (2013) Section 6.4,6.5,6.6
Measurement Distance: 3m
Limit:

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.		

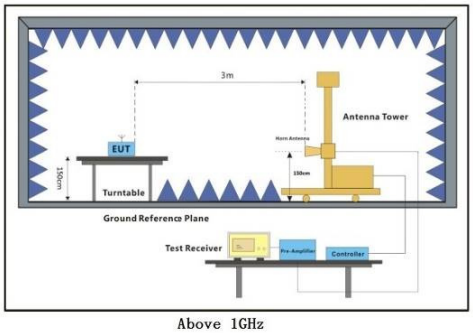
7.8.1 E.U.T. Operation

Operating Environment:
Temperature: 26.6 °C Humidity: 52.8 % RH
Test a: TX mode_Keep the EUT in continuously transmitting mode with GFSK modulation

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 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:

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

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

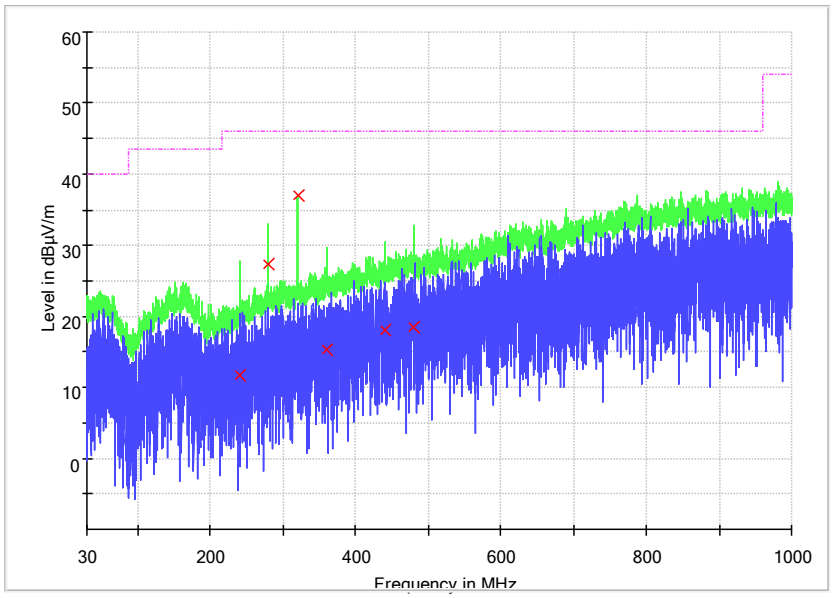
Final Test Level =Receiver Reading + Antenna Factor + Cable Factor – Preamplifier Factor

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

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

Radiated emission below 1GHz

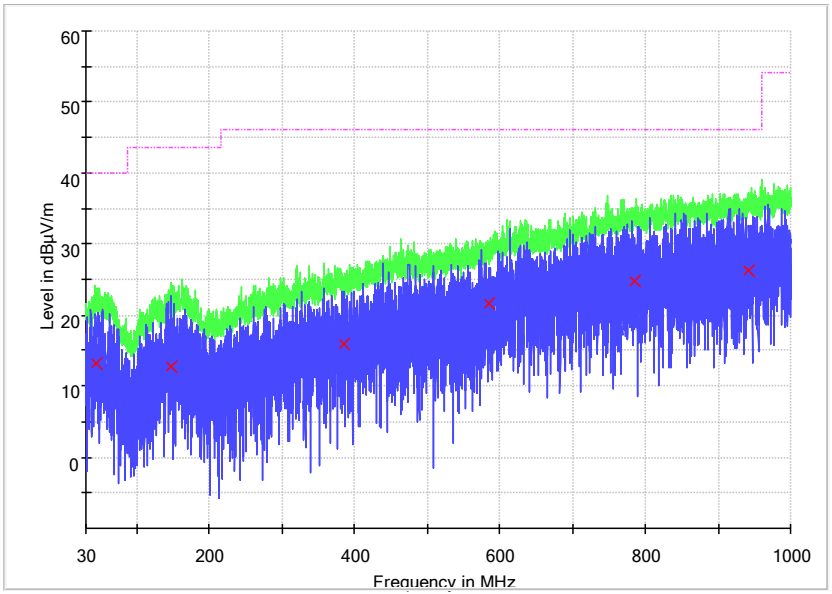
Mode:a; Polarization:Horizontal; Modulation:GFSK;



Comment

Frequency (MHz)	QuasiPeak (dBµV/m)	Pol.	Corr. (dB/m)	Margin (dB)	Limit (dBµV/m)	Result
239.987500	11.6	H	12.5	34.4	46.0	Pass
279.962500	27.3	H	14.3	18.8	46.0	Pass
320.007143	37.0	H	15.3	9.0	46.0	Pass
359.982143	15.3	H	16.3	30.7	46.0	Pass
439.932143	18.1	H	18.5	27.9	46.0	Pass
479.976786	18.6	H	19.1	27.4	46.0	Pass

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



Comment

Frequency (MHz)	QuasiPeak (dBµV/m)	Pol.	Corr. (dB/m)	Margin (dB)	Limit (dBµV/m)	Result
43.525000	13.2	V	14.1	26.8	40.0	Pass
147.223214	12.9	V	14.1	30.6	43.5	Pass
384.496429	16.0	V	17.0	30.0	46.0	Pass
584.719643	21.6	V	21.3	24.4	46.0	Pass
785.987500	24.7	V	24.9	21.3	46.0	Pass
941.500000	26.3	V	26.3	19.7	46.0	Pass

Remark: Only the worst case is shown.

Above 1GHz

Channel: Low

Frequency (MHz)	Antenna Polarization	Emission Level (dBµV/m)		Limit (dBµV/m)		Result
		Peak	Average	Peak	Average	
4803.278	H	47.3	36.5	74.0	54.0	PASS
7206.000	H	48.2	34.0	74.0	54.0	PASS
9608.000	H	50.6	36.4	74.0	54.0	PASS
4803.750	V	45.6	33.5	74.0	54.0	PASS
7206.000	V	49.0	34.3	74.0	54.0	PASS
9608.000	V	50.4	36.2	74.0	54.0	PASS

Channel: Middle

Frequency (MHz)	Antenna Polarization	Emission Level (dBµV/m)		Limit (dBµV/m)		Result
		Peak	Average	Peak	Average	
4884.028	H	49.4	41.9	74.0	54.0	PASS
7326.000	H	48.4	34.4	74.0	54.0	PASS
9768.000	H	50.0	36.4	74.0	54.0	PASS
4884.000	V	46.3	33.9	74.0	54.0	PASS
7326.000	V	47.9	34.2	74.0	54.0	PASS
9768.000	V	51.7	38.1	74.0	54.0	PASS

Channel: High

Frequency (MHz)	Antenna Polarization	Emission Level (dBµV/m)		Limit (dBµV/m)		Result
		Peak	Average	Peak	Average	
4959.583	H	51.8	44.7	74.0	54.0	PASS
7440.000	H	47.6	34.4	74.0	54.0	PASS
9920.000	H	51.3	37.0	74.0	54.0	PASS
4959.111	V	46.7	35.1	74.0	54.0	PASS
7440.000	V	48.3	35.8	74.0	54.0	PASS
9920.000	V	50.6	36.8	74.0	54.0	PASS

Remark: Only the worst case is shown.

8 Photographs

8.1 EUT Constructional Details (EUT Photos)

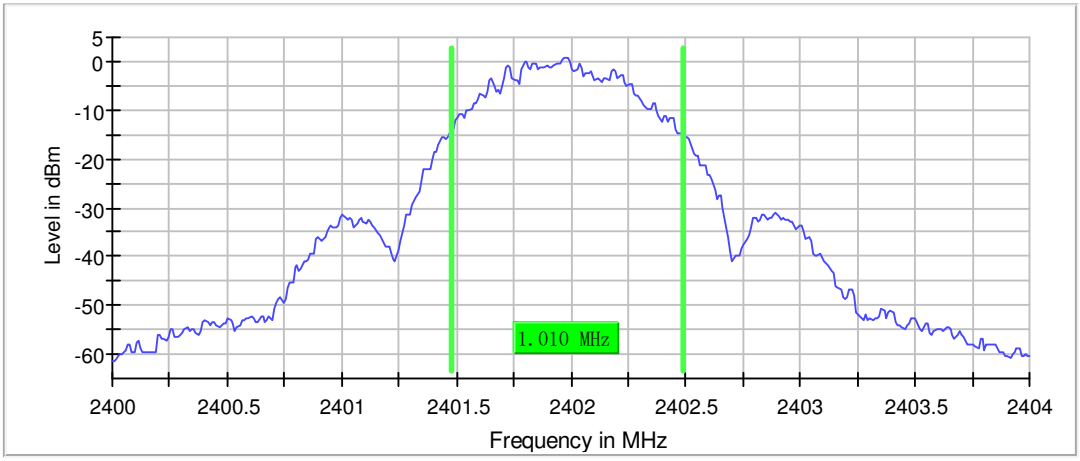
Refer to the appendices external photo, internal photo, and setup photo.

9 Appendix 15.247 RSS 247

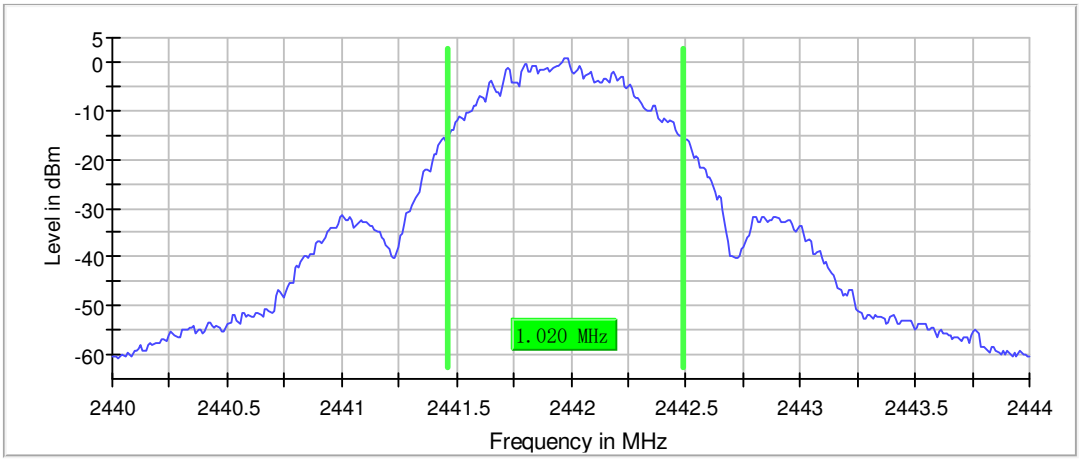
9.1 99% Bandwidth

Frequency (MHz)	Bandwidth (MHz)	Limit (MHz)	Result
2402.000000	1.010000	---	PASS
2442.000000	1.020000	---	PASS
2480.000000	1.020000	---	PASS

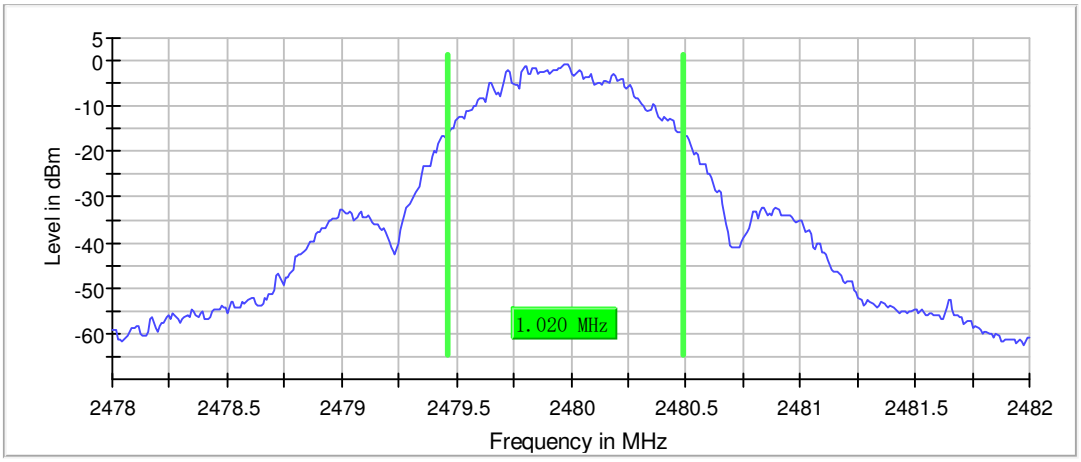
99 % Bandwidth



99 % Bandwidth



99 % Bandwidth



Measurement

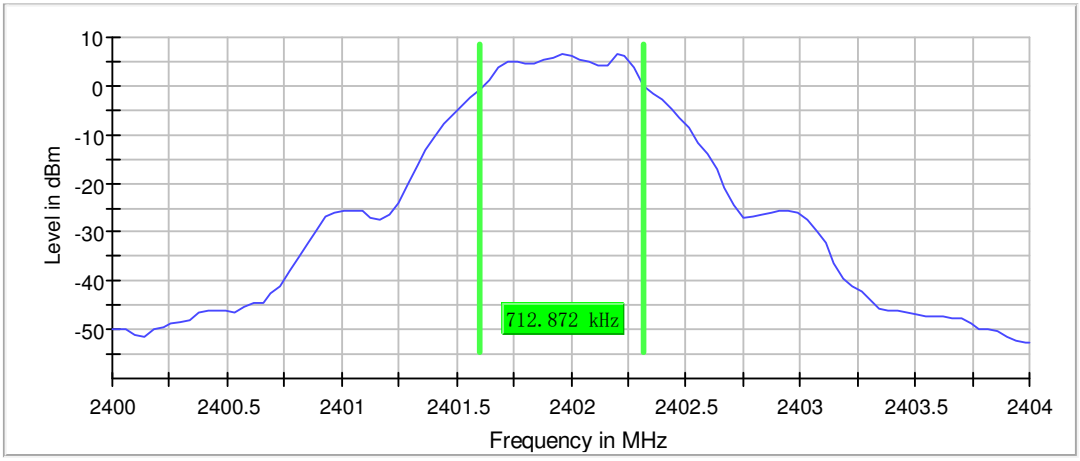
Setting	Instrument Value	Target Value
Start Frequency	2.47800 GHz	2.47800 GHz
Stop Frequency	2.48200 GHz	2.48200 GHz
Span	4.000 MHz	4.000 MHz
RBW	20.000 kHz	>= 20.000 kHz
VBW	100.000 kHz	>= 60.000 kHz
SweepPoints	400	~ 400
Sweeptime	94.824 us	AUTO
Reference Level	0.000 dBm	0.000 dBm
Attenuation	20.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweeptype	FFT	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.30 dB	0.30 dB
Run	8 / max. 150	max. 150
Stable	3 / 3	3
Max Stable Difference	0.29 dB	0.30 dB

Remark: Cable loss 0.8dB was considered and set in system configuration.

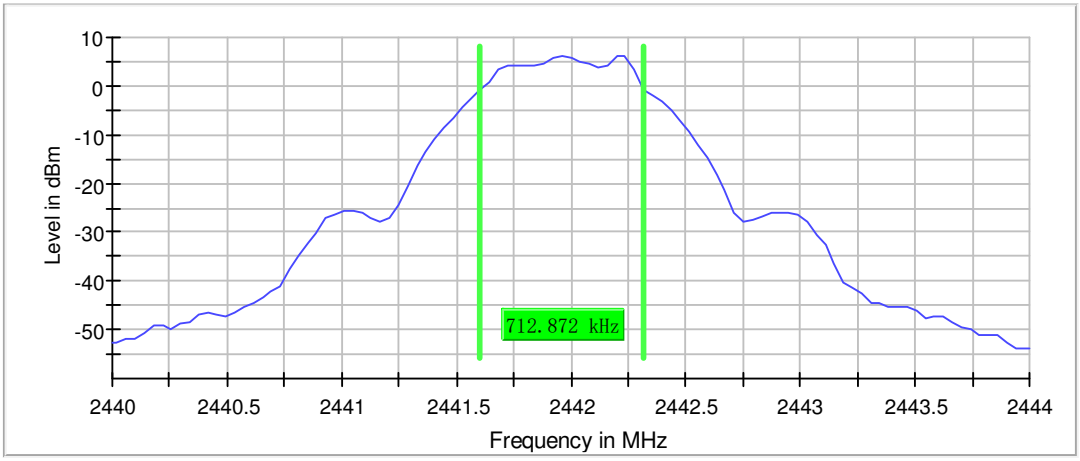
9.2 Minimum 6dB Bandwidth

Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Result
2402.000000	0.712872	---	PASS
2442.000000	0.712872	---	PASS
2480.000000	0.712872	---	PASS

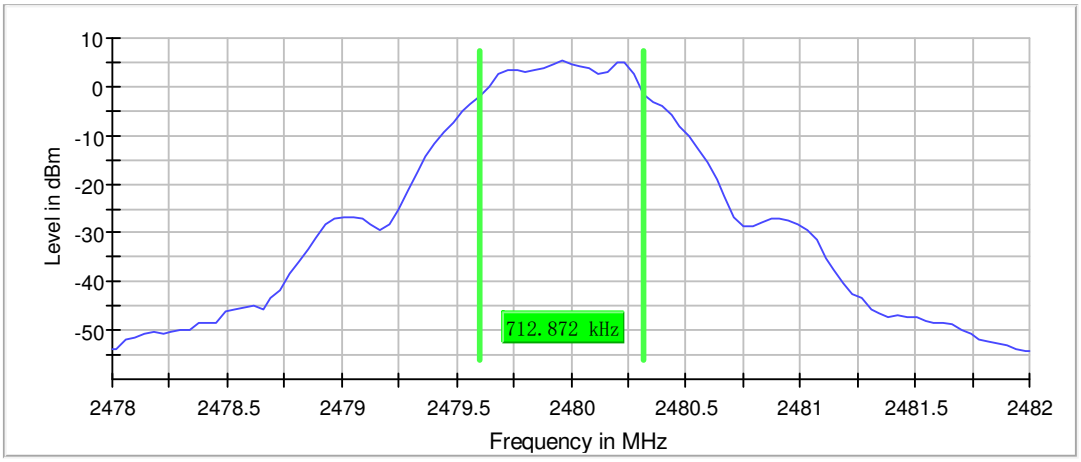
6 dB Bandwidth



6 dB Bandwidth



6 dB Bandwidth



Measurement

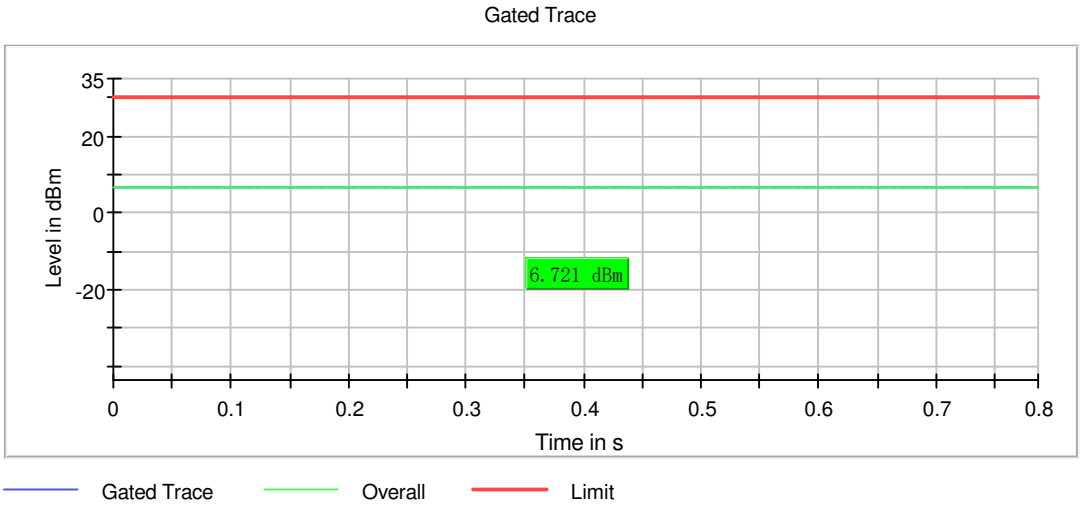
Setting	Instrument Value	Target Value
Start Frequency	2.47800 GHz	2.47800 GHz
Stop Frequency	2.48200 GHz	2.48200 GHz
Span	4.000 MHz	4.000 MHz
RBW	100.000 kHz	~ 100.000 kHz
VBW	300.000 kHz	~ 300.000 kHz
SweepPoints	101	~ 80
Sweeptime	18.938 us	AUTO
Reference Level	0.000 dBm	0.000 dBm
Attenuation	20.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweeptype	FFT	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	12 / max. 150	max. 150
Stable	5 / 5	5
Max Stable Difference	0.08 dB	0.50 dB

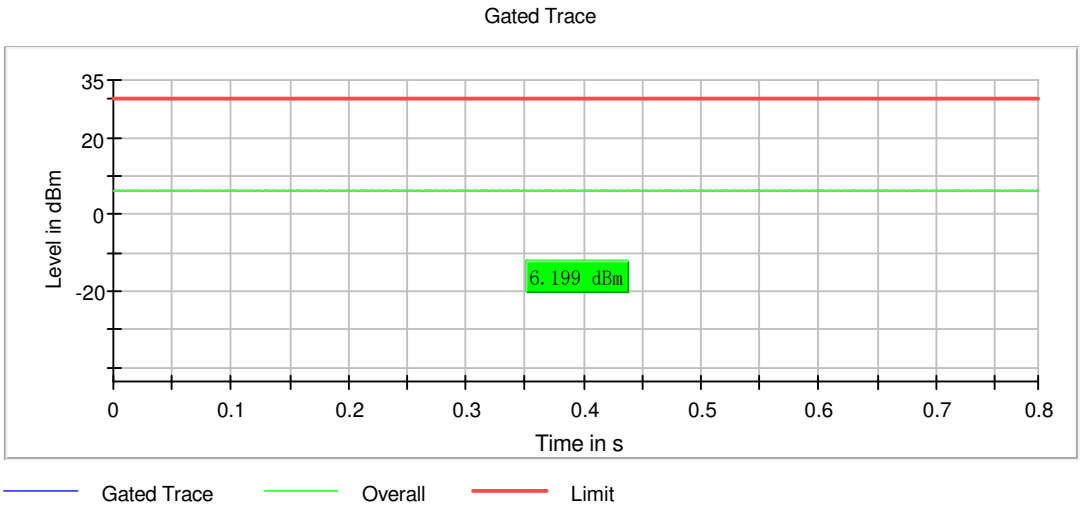
Remark: Cable loss 0.8dB was considered and set in system configuration.

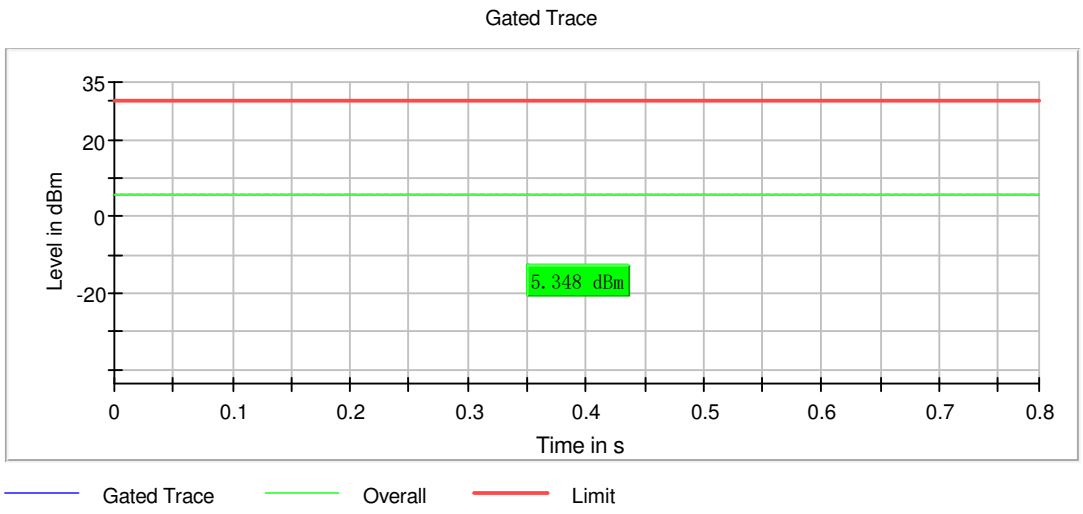
9.3 Peak conducted output power

Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	Result
2402.000000	6.7	30.0	PASS
2442.000000	6.2	30.0	PASS
2480.000000	5.3	30.0	PASS

Remark: Antenna gain is 3.4 dBi



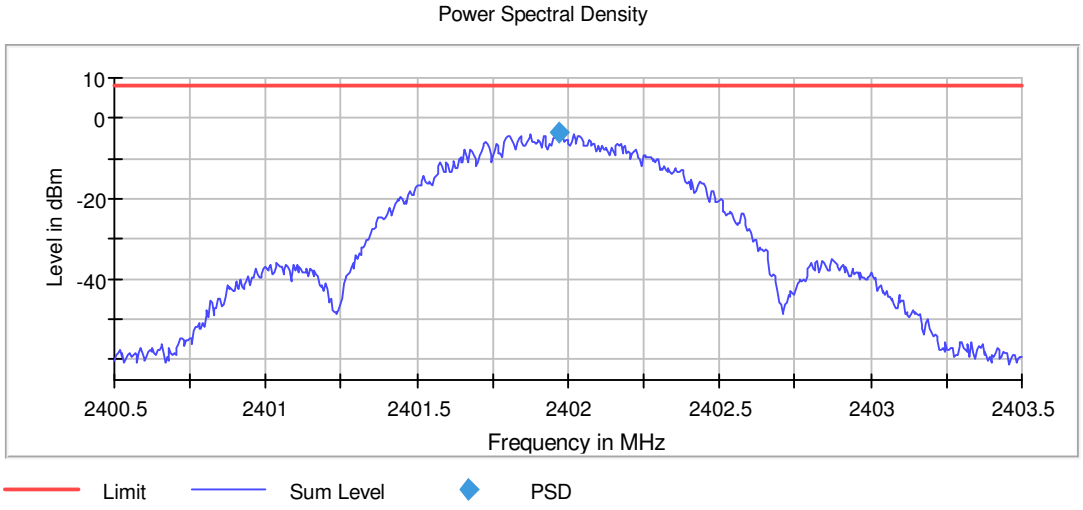




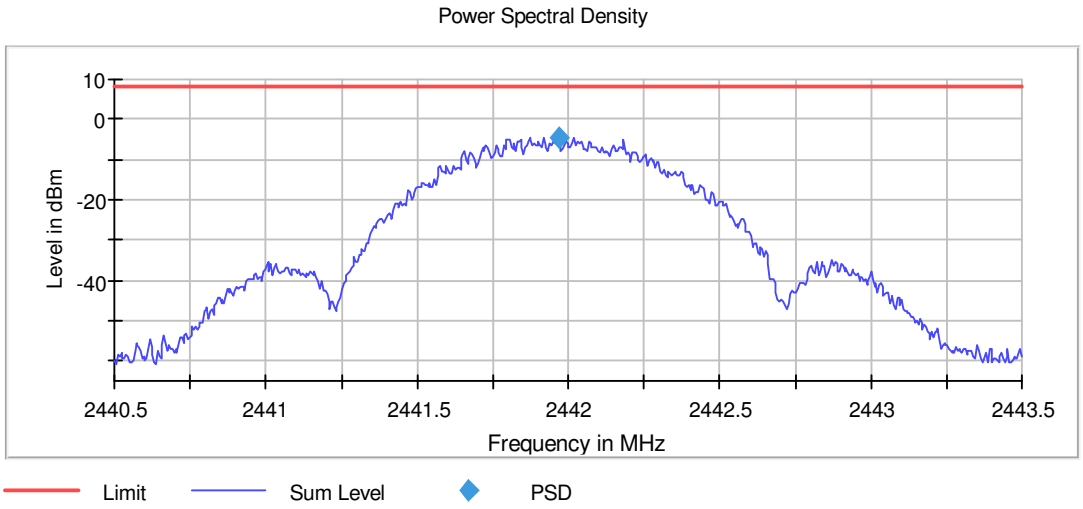
Remark: Cable loss 0.8dB was considered and set in system configuration.

9.4 Power Spectrum Density

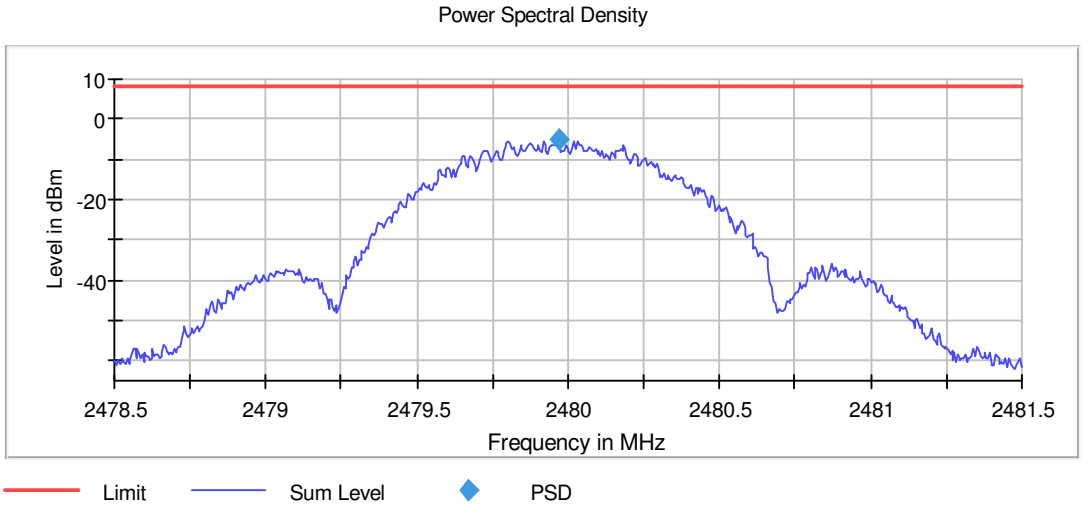
DUT Frequency (MHz)	Frequency (MHz)	PSD (dBm)	Limit Max (dBm)	Result
2402.000000	2401.967500	-3.797	8.0	PASS



DUT Frequency (MHz)	Frequency (MHz)	PSD (dBm)	Limit Max (dBm)	Result
2442.000000	2441.967500	-4.422	8.0	PASS



DUT Frequency (MHz)	Frequency (MHz)	PSD (dBm)	Limit Max (dBm)	Result
2480.000000	2479.967500	-4.976	8.0	PASS



Measurement

Setting	Instrument Value	Target Value
Start Frequency	2.47850 GHz	2.47850 GHz
Stop Frequency	2.48150 GHz	2.48150 GHz
Span	3.000 MHz	3.000 MHz
RBW	10.000 kHz	<= 10.000 kHz
VBW	30.000 kHz	>= 30.000 kHz
SweepPoints	600	~ 600
Sweeptime	12.000 ms	12.000 ms
Reference Level	0.000 dBm	0.000 dBm
Attenuation	20.000 dB	AUTO
Detector	RMS	RMS
SweepCount	1	1
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweeptype	Sweep	Sweep
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	56 / max. 150	max. 150
Stable	3 / 3	3
Max Stable Difference	0.04 dB	0.50 dB

Remark: Cable loss 0.8dB was considered and set in system configuration.

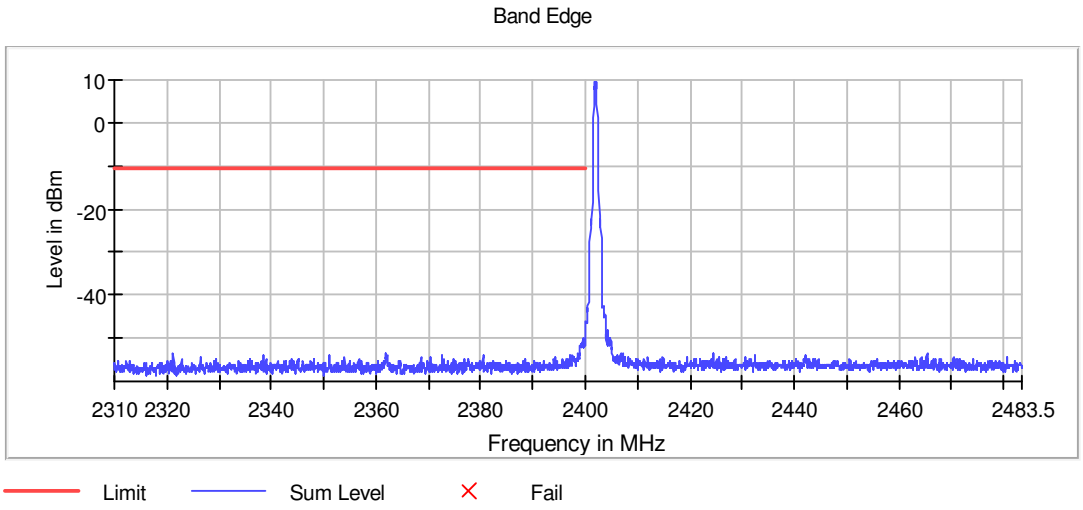
9.5 Conducted Band Edge Measurement

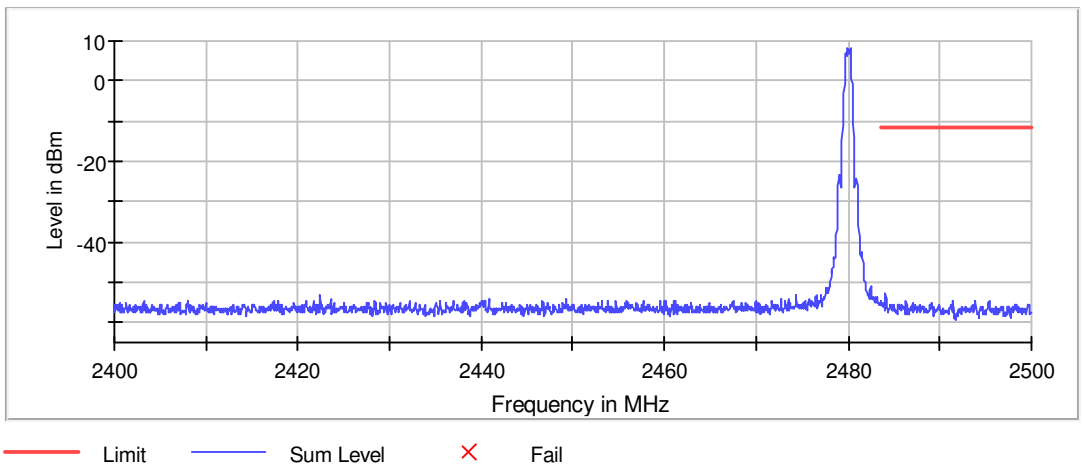
Inband Peak

Frequency (MHz)	Level (dBm)
2402.358000	9.6
2479.829000	8.3

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2399.975000	-49.6	39.2	-10.4	PASS
2484.075000	-52.7	41.1	-11.7	PASS

Remark: Limit = Inband peak – 20dB
Only the worst case is shown.





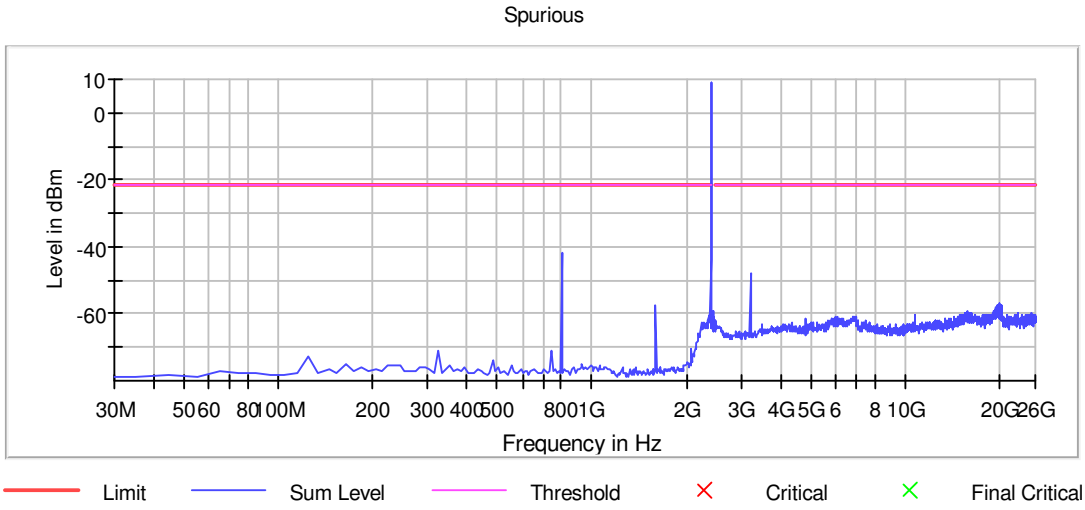
Measurement 1

Setting	Instrument Value	Target Value
Start Frequency	2.40000 GHz	2.40000 GHz
Stop Frequency	2.48350 GHz	2.48350 GHz
Span	83.500 MHz	83.500 MHz
RBW	100.000 kHz	<= 100.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	1670	~ 1670
Sweeptime	1.670 ms	AUTO
Reference Level	0.000 dBm	0.000 dBm
Attenuation	20.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweeptype	Sweep	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	5 / max. 150	max. 150
Stable	3 / 3	3
Max Stable Difference	0.15 dB	0.50 dB

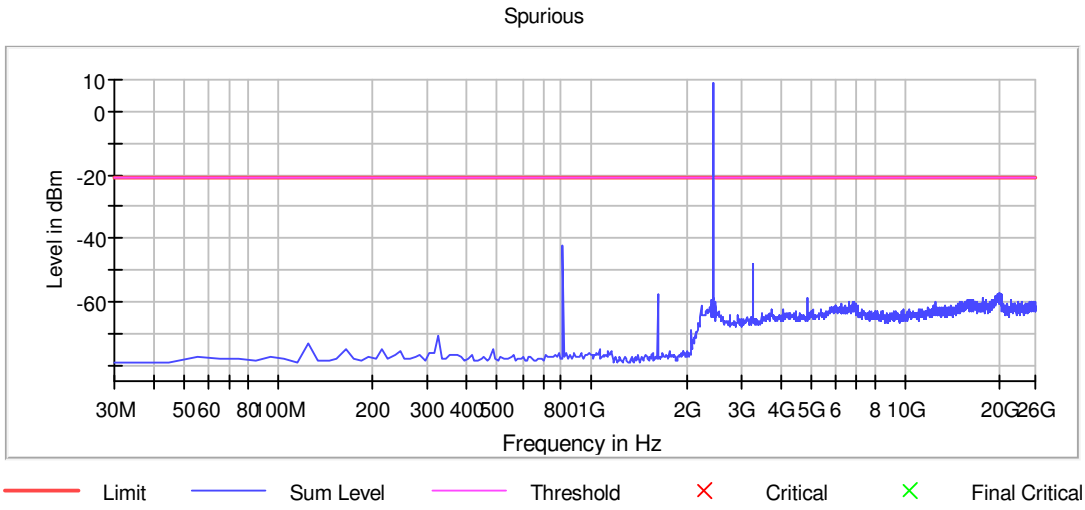
Remark: Cable loss 0.8dB was considered and set in system configuration.

9.6 Conducted spurious emission

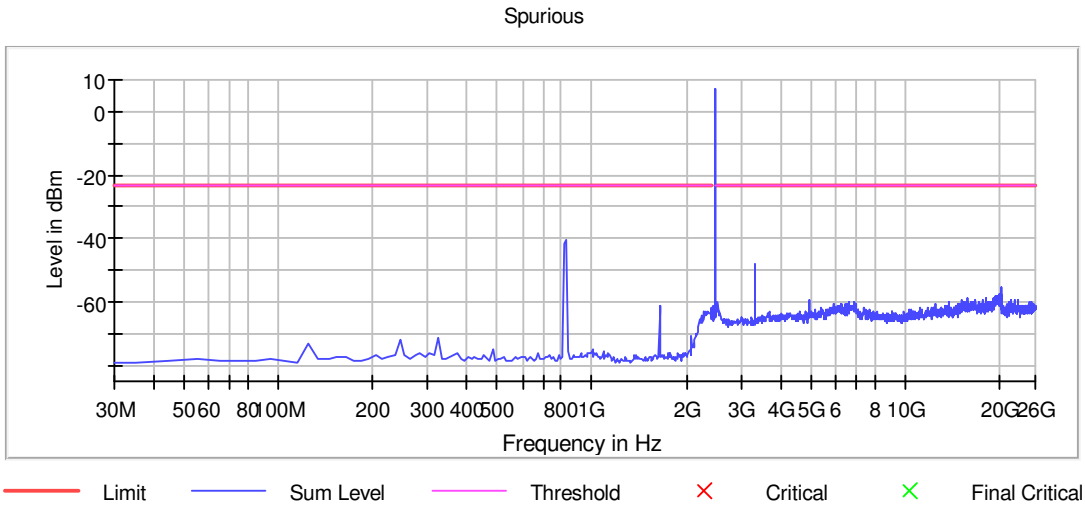
Lowest Channel



Middle Channel



Highest Channel



Pre Measurement 1

Setting	Instrument Value	Target Value
RBW	100.000 kHz	<= 100.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	238	~ 238
Sweeptime	23.700 ms	AUTO
Reference Level	-20.000 dBm	-30.000 dBm
Attenuation	10.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	3	3
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweeptype	Sweep	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	5 / max. 40	max. 40
Stable	3 / 3	3
Max Stable Difference	0.00 dB	0.50 dB

Remark: Cable loss 0.8dB was considered and set in system configuration.

- End of the Report -