

# TEST REPORT

**Application No.:** HKEM2311000863PF  
**Applicant:** Termatrac Pty Ltd  
**Address of Applicant:** 44/28 Burnside Rd, Omeau, Qld, 4208, Australia  
**Equipment Under Test (EUT):**  
**EUT Name:** T5 iTraker  
**Model No.:** T5  
**FCC ID:** 2BEMQ-T5B  
**Standard(s) :** 47 CFR Part 15, Subpart C 15.247  
**Date of Receipt:** 2023-12-14  
**Date of Test:** 2023-12-14 to 2023-12-22  
**Date of Issue:** 2023-12-22

<b>Test Result:</b>	The submitted sample was found to comply with the test requirement
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**Law Man Kit**  
 EMC Manager

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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			
Revision No.	Date	Report superseded	Remark

Authorized for issue by:				
				
		Chan Chun Lok /Project Engineer		Date: 2023-12-22
				
		Law Man Kit /Reviewer		Date: 2023-12-22

## 2 Test Summary

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 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 (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 (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 (d)	Pass
Conducted Spurious Emissions	47 CFR Part 15, Subpart C	ANSI C63.10 (2013) Section 11.11	47 CFR Part 15, Subpart C (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 15.205 & 15.209	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

	Page
<b>1 COVER PAGE .....</b>	<b>1</b>
<b>2 TEST SUMMARY .....</b>	<b>3</b>
<b>3 CONTENTS .....</b>	<b>4</b>
<b>4 GENERAL INFORMATION .....</b>	<b>6</b>
4.1 DETAILS OF E.U.T. ....	6
4.2 DESCRIPTION OF SUPPORT UNITS .....	7
4.3 MODULATION CONFIGURATION .....	7
4.4 MEASUREMENT UNCERTAINTY.....	7
4.5 TEST LOCATION.....	8
4.6 TEST FACILITY.....	8
4.7 DEVIATION FROM STANDARDS .....	8
4.8 ABNORMALITIES FROM STANDARD CONDITIONS.....	8
<b>5 EQUIPMENT LIST.....</b>	<b>9</b>
<b>6 RADIO SPECTRUM TECHNICAL REQUIREMENT.....</b>	<b>11</b>
6.1 ANTENNA REQUIREMENT .....	11
6.1.1 <i>Test Requirement:</i> .....	11
6.1.2 <i>Conclusion</i> .....	11
<b>7 RADIO SPECTRUM MATTER TEST RESULTS .....</b>	<b>12</b>
7.1 MINIMUM 6dB BANDWIDTH.....	12
7.1.1 <i>E.U.T. Operation</i> .....	12
7.1.2 <i>Test Setup Diagram</i> .....	12
7.1.3 <i>Measurement Procedure and Data</i> .....	12
7.2 CONDUCTED PEAK OUTPUT POWER .....	13
7.2.1 <i>E.U.T. Operation</i> .....	13
7.2.2 <i>Test Setup Diagram</i> .....	13
7.2.3 <i>Measurement Procedure and Data</i> .....	13
7.3 POWER SPECTRUM DENSITY .....	14
7.3.1 <i>E.U.T. Operation</i> .....	14
7.3.2 <i>Test Setup Diagram</i> .....	14
7.3.3 <i>Measurement Procedure and Data</i> .....	14
7.4 CONDUCTED BAND EDGES MEASUREMENT .....	15
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> .....	16
7.5.2 <i>Test Setup Diagram</i> .....	16
7.5.3 <i>Measurement Procedure and Data</i> .....	16
7.6 RADIATED EMISSIONS WHICH FALL IN THE RESTRICTED BANDS.....	17
7.6.1 <i>E.U.T. Operation</i> .....	18
7.6.2 <i>Test Setup Diagram</i> .....	18
7.6.3 <i>Measurement Procedure and Data</i> .....	19
7.7 RADIATED SPURIOUS EMISSIONS.....	20
7.7.1 <i>E.U.T. Operation</i> .....	20
7.7.2 <i>Test Setup Diagram</i> .....	20



7.7.3 Measurement Procedure and Data.....21

8 PHOTOGRAPHS.....25

8.1 EUT CONSTRUCTIONAL DETAILS (EUT PHOTOS).....25

9 APPENDIX 15.247 .....26

9.1 MINIMUM 6DB BANDWIDTH.....26

9.2 PEAK CONDUCTED OUTPUT POWER.....28

9.3 POWER SPECTRUM DENSITY.....30

9.4 CONDUCTED BAND EDGE MEASUREMENT .....32

9.5 CONDUCTED SPURIOUS EMISSION.....34

## 4 General Information

### 4.1 Details of E.U.T.

Power supply:	Battery Model: DNK 103049 Output: DC 3.7 V
Test voltage:	DC 3.7 V
Cable:	Power Cable: 95.5 cm unshielded 2-wire USB cable
Antenna Gain:	0.1 dBi
Antenna Type:	PCB Antenna
Bluetooth Version:	V5.1 LE
Channel Separation:	2MHz
Modulation Type:	GFSK
Number of Channels:	40
Operation Frequency:	2402MHz to 2480MHz
Series No.:	A1
Firmware Version:	2.130
Hardware Version:	1.0

Frequency Lists:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	<b>2402</b>	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	<b>2440</b>	39	<b>2480</b>

The frequencies under test are bolded.

## 4.2 Description of Support Units

Description	Manufacturer	Model No.	Serial No.
Smart phone	Samsung	N/A	N/A
Laptop	DELL	P75F	475LXQ2
NRF_Connect.exe	C-MER RainsOptics Limited	N/A	N/A

Note: The laptop and the software NRF\_Connect.exe were for the control of the engineering mode and the Smart phone provided Bluetooth connection to the EUT.

## 4.3 Modulation Configuration

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

## 4.4 Measurement Uncertainty

RF

No.	Item	Measurement Uncertainty
1	Radio Frequency	$\pm 7.25 \times 10^{-8}$
2	Duty cycle	$\pm 0.37\%$
3	Occupied Bandwidth	$\pm 3\%$
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	4.7dB (30MHz-1GHz)
		4.7dB (1GHz-6GHz)
		4.7dB (6GHz-18GHz)
		5.7dB (18GHz-40GHz)
8	Temperature test	$\pm 1^{\circ}\text{C}$
9	Humidity test	$\pm 3\%$
10	Supply voltages	$\pm 1.5\%$
11	Time	$\pm 3\%$

Remark:

The  $U_{\text{lab}}$  (lab Uncertainty) is less than  $U_{\text{CISPR}}$  (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](http://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

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## 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	2023/09/26	2024/09/25
OSP-B157W8 OSP-B157W8 PLUS	Rohde & Schwarz	OSP-B157W8	E332	2023/09/26	2024/09/25
Cable	Rohde & Schwarz	J12J103539-00-2	E239	2023/09/17	2024/09/16
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	2023/08/09	2024/08/08
Coaxial Cable	SGS	N/A	E167	2023/07/07	2024/07/06
Active Loop Antenna 9k-30MHz	Schwarzbeck	FMZB 1513	E327	2022/11/23	2024/11/22
EMI Test Receiver 9kHz to 7GHz	Rohde & Schwarz	ESR7 / 102298	E314	2023/06/13	2024/06/12
TRILOG Super Broadb. Test Antenna, (25) 30-1000 MHz	Schwarzbeck	VULB 9168	E311	2022/03/08	2024/03/07
EMC32 Test software	Rohde & Schwarz	Version 10	N/A	N/A	N/A
Signal and Spectrum Analyzer 2Hz - 26.5GHz	Rohde & Schwarz	FSW26	E296	2023/09/26	2024/09/25
Horn Antenna 1 - 18GHz	Schwarzbeck	BBHA9120D	E211	2022/03/03	2024/03/02
Preamplifier 33dB, 1 - 18GHz	Schwarzbeck	BBV9718	E214	2023/01/20	2024/01/19
RF cable SMA to SMA 10000mm	HUBER+SUHNER	SF104-26.5/2*11SMA 45	E207	2023/09/17	2024/09/16
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	2023/09/10	2024/09/09

General used equipment					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
Digital temperature & humidity data logger	SATO	SK-L200TH II	E232	2023/10/04	2024/10/03
Electronic Digital Thermometer with Hygrometer	nil	2074/2075	E159	2023/10/02	2024/10/01
Barometer with digital thermometer	SATO	7612-00	E218	2023/06/29	2024/06/28
Conditional Chamber	Zhong Zhi Testing Instruments	CZ-E-608D	E216	2023/09/26	2024/09/25

## 6 Radio Spectrum Technical Requirement

### 6.1 Antenna Requirement

#### 6.1.1 Test Requirement:

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 0.1 dBi.

Antenna location: Refer to Appendix: internal photo.

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## 7 Radio Spectrum Matter Test Results

### 7.1 Minimum 6dB Bandwidth

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

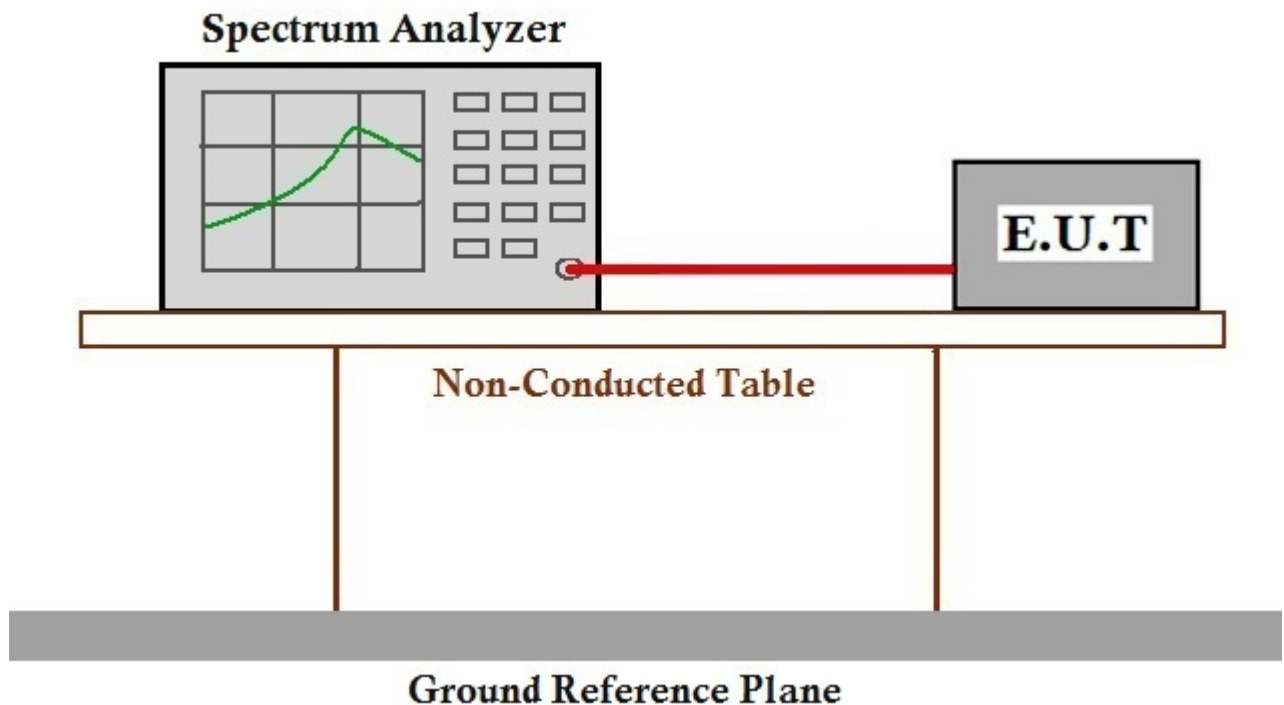
#### 7.1.1 E.U.T. Operation

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

#### 7.1.2 Test Setup Diagram



#### 7.1.3 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

## 7.2 Conducted Peak Output Power

Test Requirement 47 CFR Part 15, Subpart C (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 $\geq 50$ hopping channels
	0.25 for $25 \leq$ hopping channels $< 50$
	1 for digital modulation
2400-2483.5	1 for $\geq 75$ 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

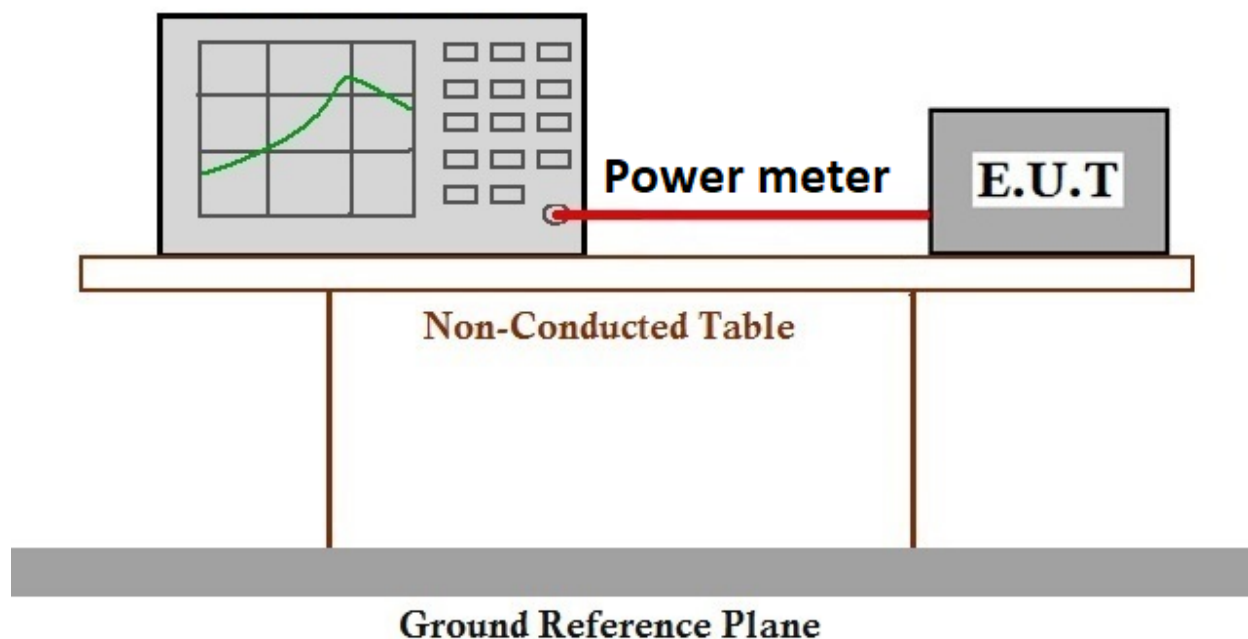
### 7.2.1 E.U.T. Operation

Operating Environment:

Temperature: 26.7 °C Humidity: 53.7 % 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 11.9.1

The detailed test data see: Appendix 15.247

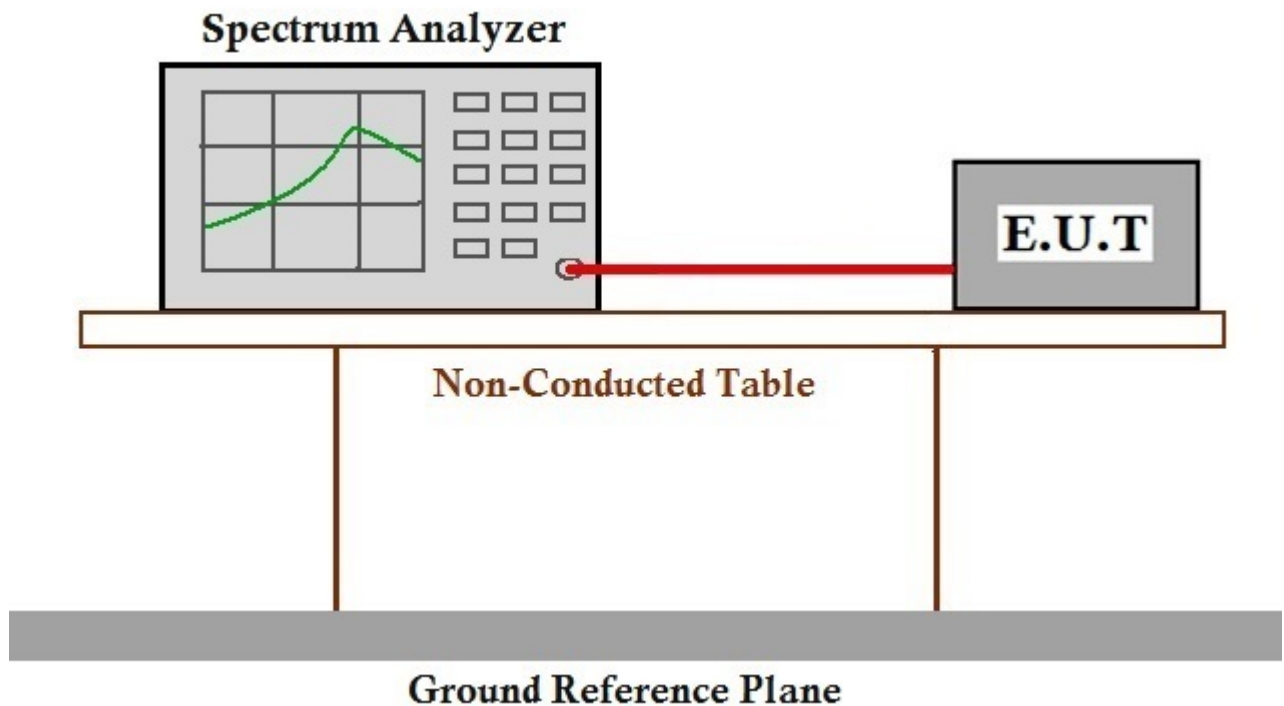
## 7.3 Power Spectrum Density

Test Requirement 47 CFR Part 15, Subpart C (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: 26.8 °C Humidity: 53.8 % 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 11.10.2  
 The detailed test data see: Appendix 15.247

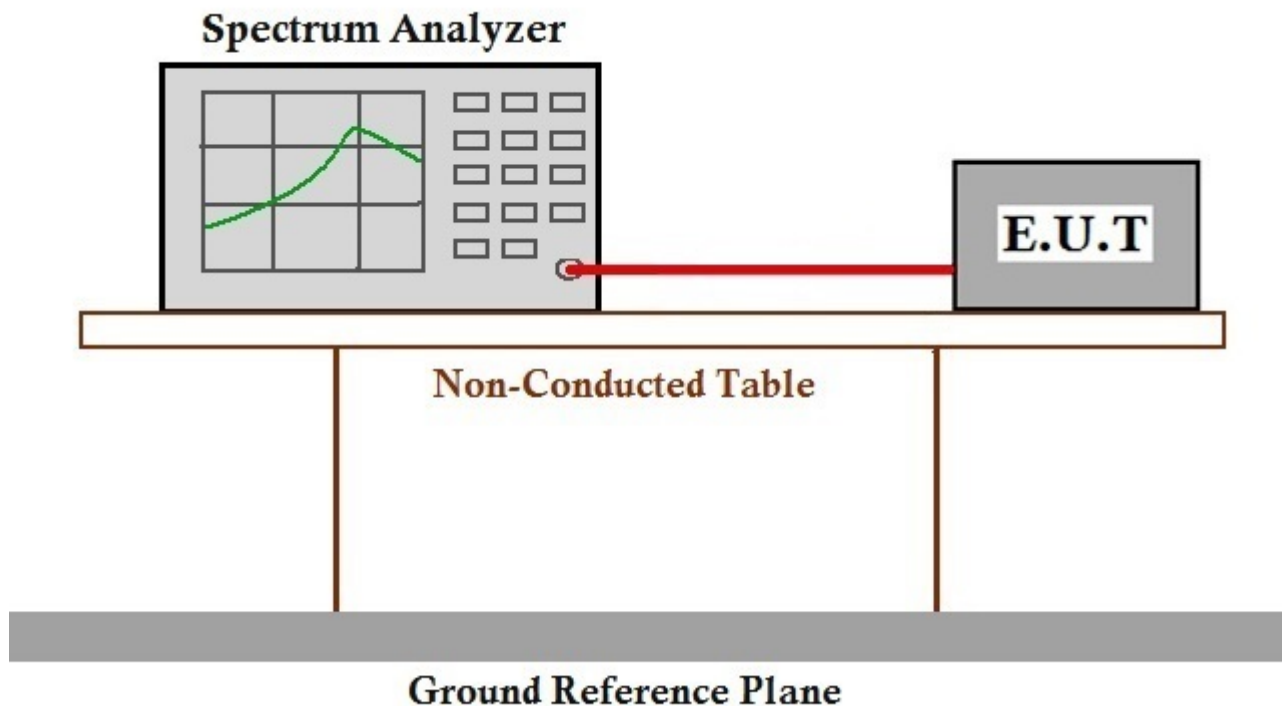
## 7.4 Conducted Band Edges Measurement

Test Requirement	47 CFR Part 15, Subpart C (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:	25.8 °C	Humidity:	52.9 % 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 11.13.3.2

The detailed test data see: Appendix 15.247

## 7.5 Conducted Spurious Emissions

Test Requirement	47 CFR Part 15, Subpart C (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))

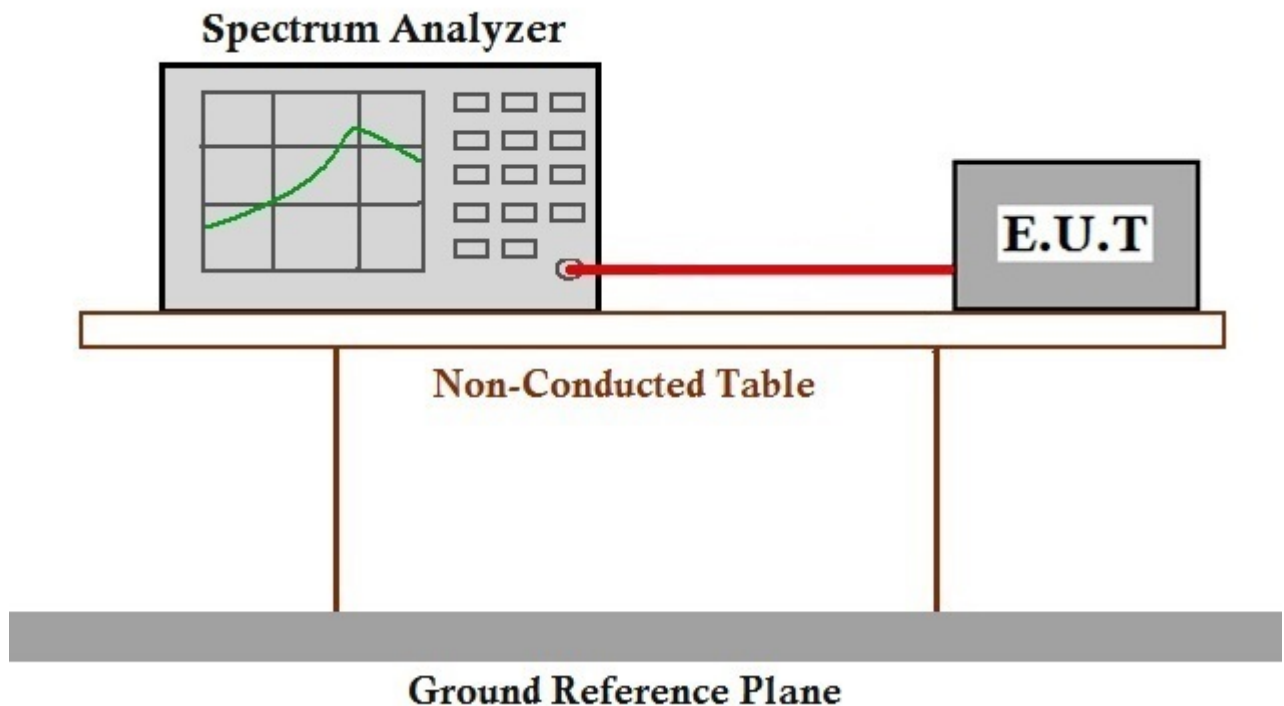
### 7.5.1 E.U.T. Operation

Operating Environment:

Temperature: 26.7 °C Humidity: 53.8 % 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 11.11

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.

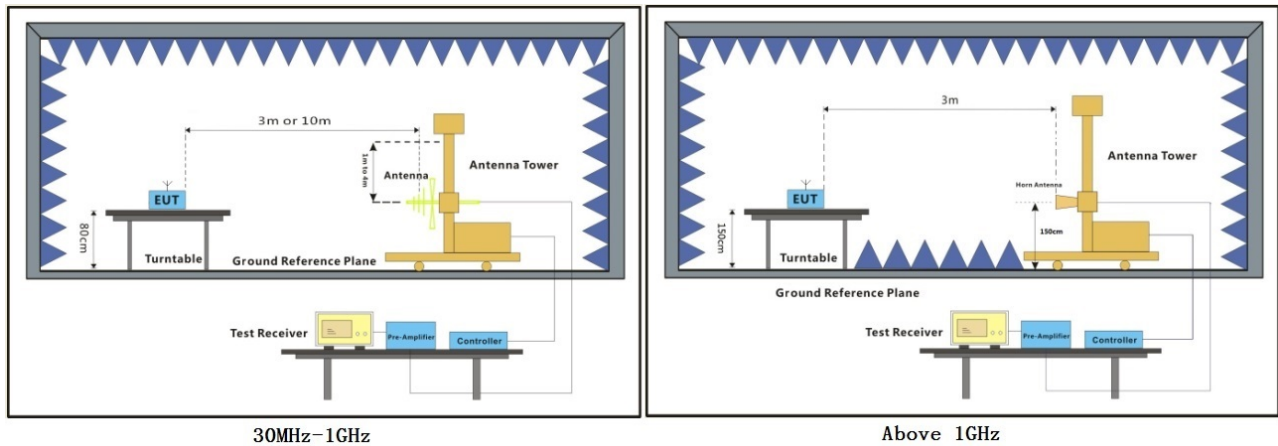
## 7.6.1 E.U.T. Operation

Operating Environment:

Temperature: 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

- 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	49.0	29.5	74.0	54.0	Pass
2483.500	H	55.8	29.2	74.0	54.0	Pass
2390.000	V	47.5	31.6	74.0	54.0	Pass
2483.500	V	53.0	32.1	74.0	54.0	Pass

## 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.

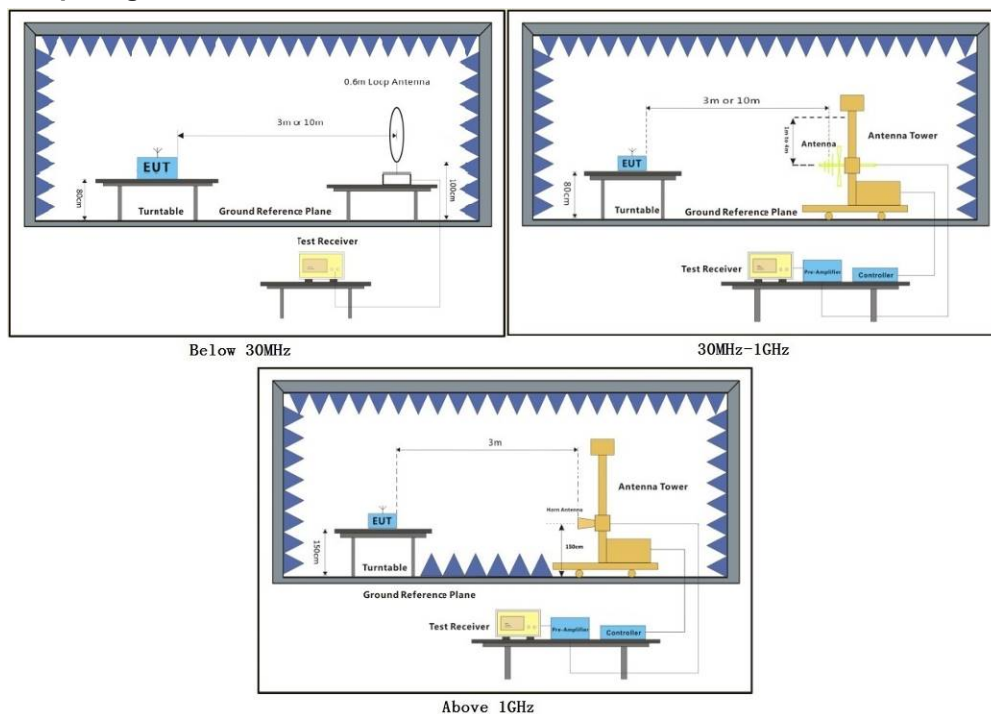
### 7.7.1 E.U.T. Operation

Operating Environment:

Temperature: 26.6 °C Humidity: 52.8 % RH :

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

### 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:

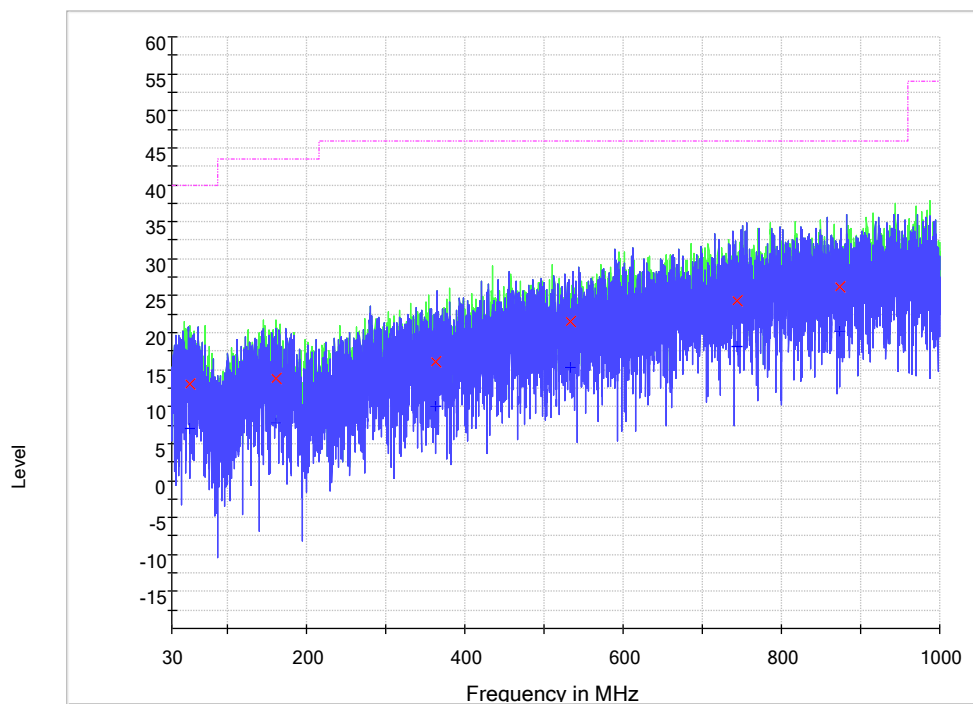
- 1) For emission below 1GHz, through pre-scan found the worst case is the lowest channel. Only the worst case is recorded in the report.
- 2) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:  
Final 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 30MHz

The measurements with active loop antenna were greater than 20dB below the limit, so the test data were not recorded in the test report.

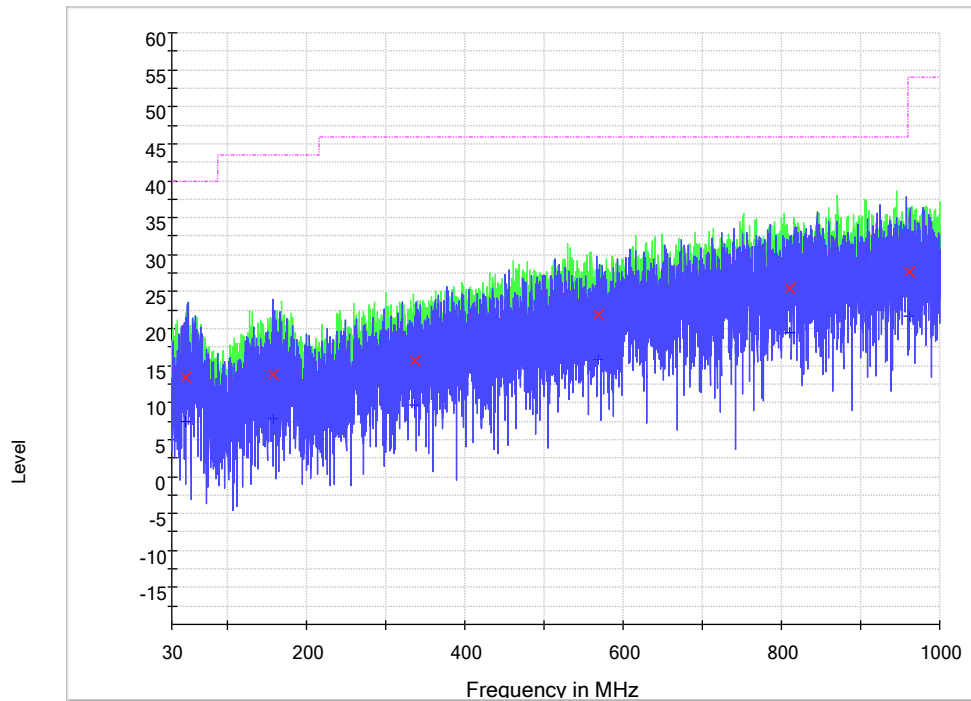
### Radiated emission below 1GHz

Mode:a; Polarization:Horizontal; Modulation:GFSK;Channel:2402 MHz



Frequency (MHz)	QuasiPeak (dBμV/m)	Pol.	Corr. (dB/m)	Margin (dB)	Limit (dBμV/m)	Result
53.066071	13.0	H	14.2	27.0	40.0	Pass
162.405357	13.8	H	14.5	29.7	43.5	Pass
362.907143	16.2	H	16.4	29.9	46.0	Pass
534.019643	21.5	H	21.1	24.5	46.0	Pass
743.226786	24.2	H	24.2	21.8	46.0	Pass
873.319643	26.1	H	25.3	19.9	46.0	Pass

Mode:a; Polarization:Vertical; Modulation:GFSK;Channel:2402 MHz



Frequency (MHz)	QuasiPeak (dBμV/m)	Pol.	Corr. (dB/m)	Margin (dB)	Limit (dBμV/m)	Result
47.285714	13.4	V	14.2	26.6	40.0	Pass
157.321429	13.8	V	14.4	29.7	43.5	Pass
336.860714	15.7	V	16.0	30.3	46.0	Pass
569.119643	21.9	V	21.4	24.1	46.0	Pass
809.805357	25.4	V	25.0	20.6	46.0	Pass
961.557143	27.8	V	26.9	26.2	54.0	Pass

Remark: Only the worst case is shown.

### Above 1GHz

Channel: Low

Frequency (MHz)	Antenna Polarization	Emission Level (dB $\mu$ V/m)		Limit (dB $\mu$ V/m)		Remark
		Peak	Average	Peak	Average	
4804.000	H	52.9	40.2	74.0	54.0	PASS
7206.000	H	48.3	36.2	74.0	54.0	PASS
9608.000	H	49.8	37.4	74.0	54.0	PASS
4804.000	V	55.9	42.1	74.0	54.0	PASS
7206.000	V	52.2	41.8	74.0	54.0	PASS
9608.000	V	50.6	39.9	74.0	54.0	PASS

Channel: Middle

Frequency (MHz)	Antenna Polarization	Emission Level (dB $\mu$ V/m)		Limit (dB $\mu$ V/m)		Remark
		Peak	Average	Peak	Average	
4880.000	H	47.5	35.5	74.0	54.0	PASS
7320.000	H	52.2	42.0	74.0	54.0	PASS
9760.000	H	46.5	33.6	74.0	54.0	PASS
4880.000	V	47.4	36.5	74.0	54.0	PASS
7320.000	V	50.5	39.6	74.0	54.0	PASS
9760.000	V	46.3	34.0	74.0	54.0	PASS

Channel: High

Frequency (MHz)	Antenna Polarization	Emission Level (dB $\mu$ V/m)		Limit (dB $\mu$ V/m)		Remark
		Peak	Average	Peak	Average	
4960.000	H	52.5	38.1	74.0	54.0	PASS
7440.000	H	54.2	39.9	74.0	54.0	PASS
9920.000	H	54.3	43.1	74.0	54.0	PASS
4960.000	V	54.8	44.3	74.0	54.0	PASS
7440.000	V	48.4	35.5	74.0	54.0	PASS
9920.000	V	59.4	49.2	74.0	54.0	PASS





## **8 Photographs**

### **8.1 EUT Constructional Details (EUT Photos)**

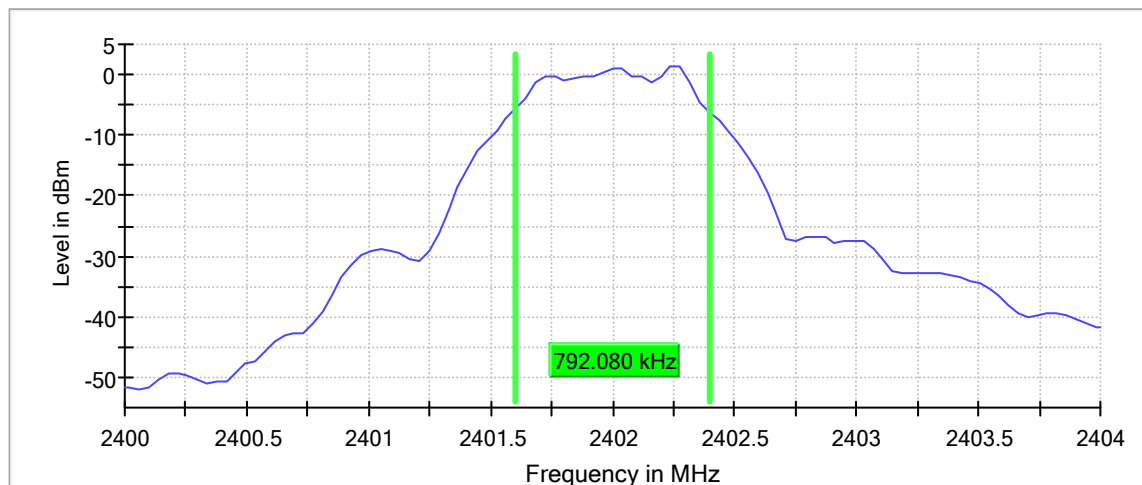
Refer to the appendices external, internal and setup photos.

## 9 Appendix 15.247

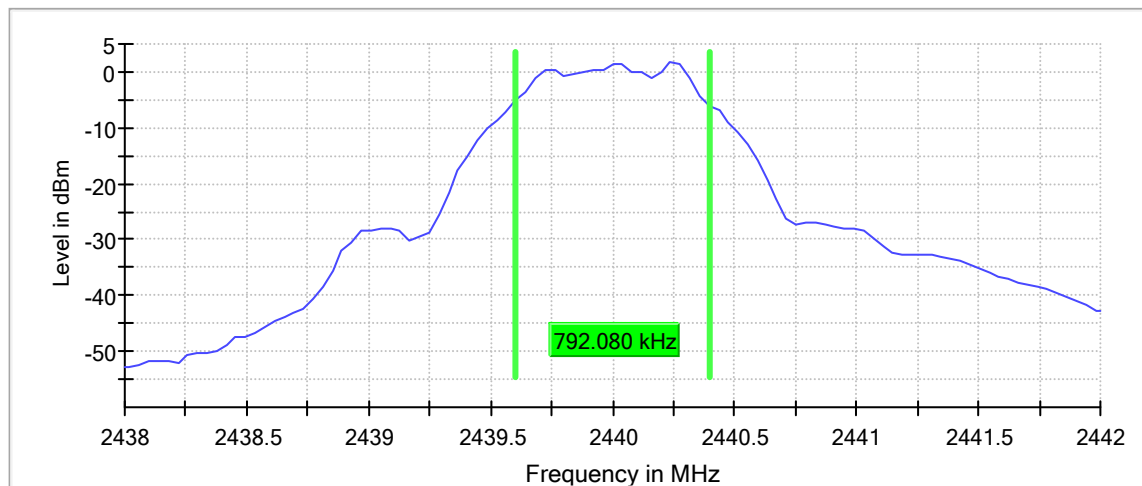
### 9.1 Minimum 6dB Bandwidth

Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Result
2402.000000	0.792080	---	PASS
2440.000000	0.792080	---	PASS
2480.000000	0.752476	---	PASS

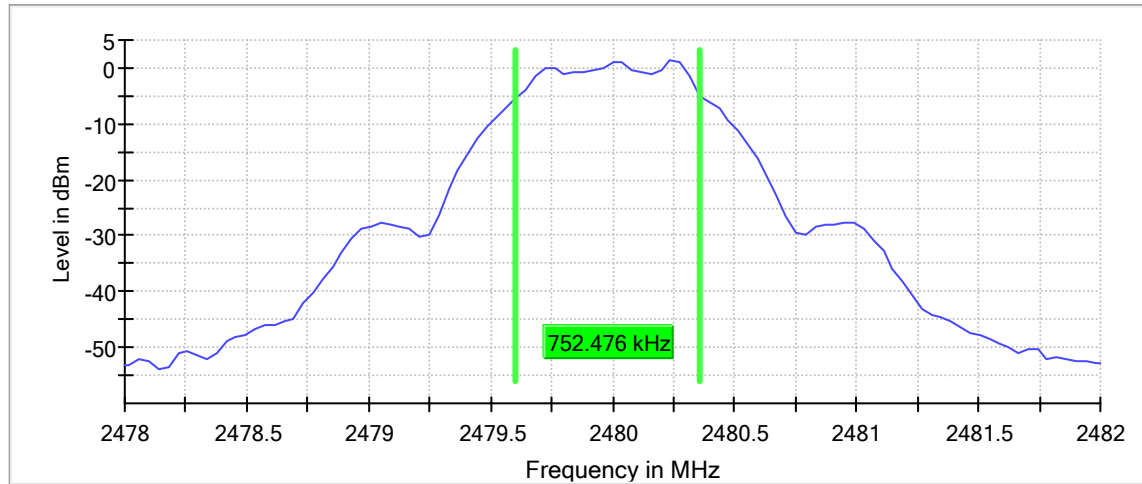
6 dB Bandwidth



6 dB Bandwidth



6 dB Bandwidth



## Measurement

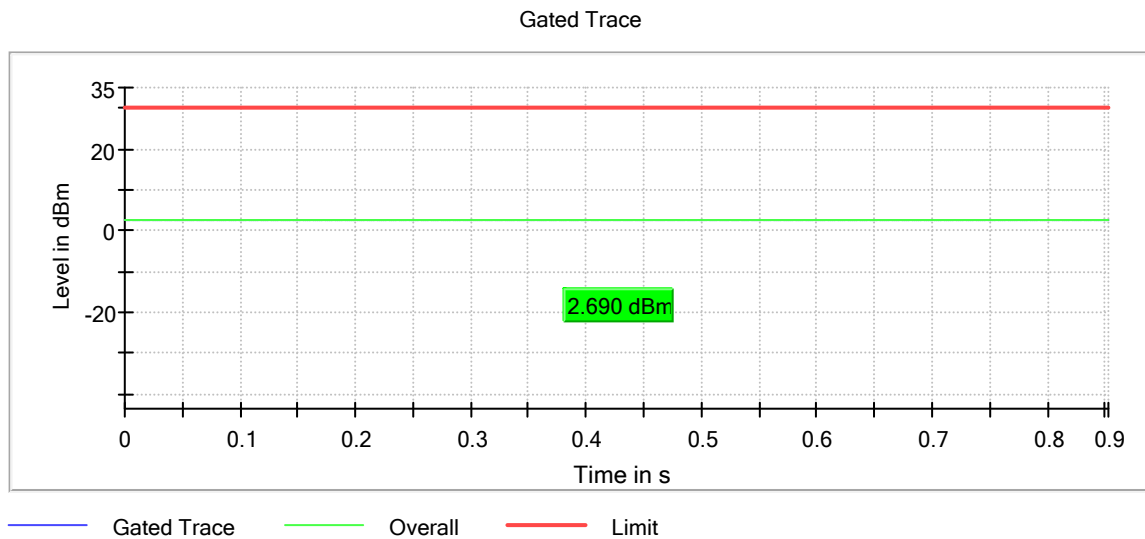
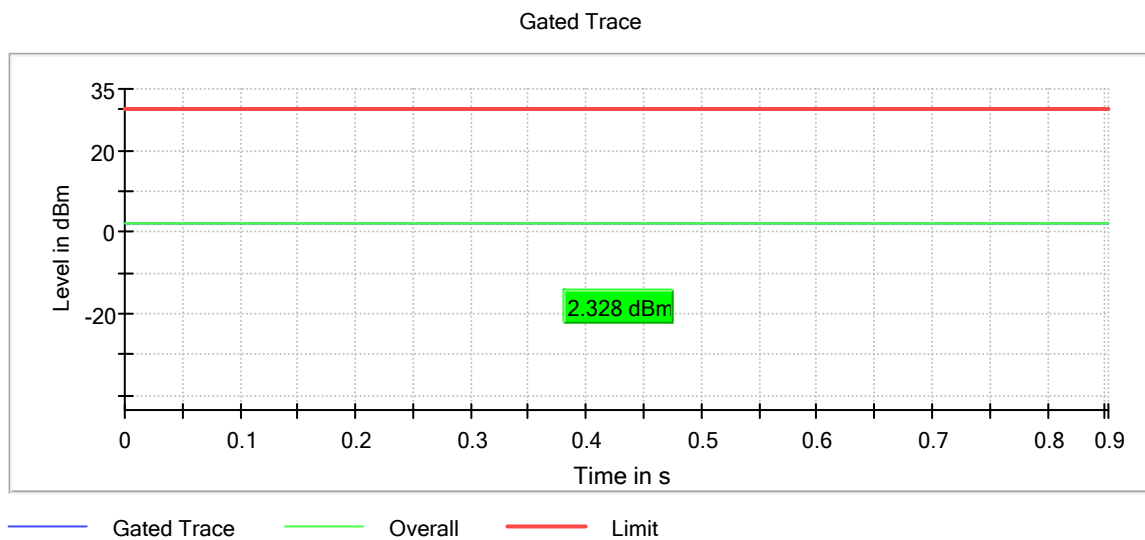
Setting	Instrument Value	Target Value
Start Frequency	2.47800 GHz	2.47800 GHz
Stop Frequency	2.48200 GHz	2.48200 GHz
Span	4.000 MHz	4.000 MHz
RBW	100.000 kHz	~ 100.000 kHz
VBW	300.000 kHz	~ 300.000 kHz
SweepPoints	101	~ 80
Sweeptime	18.938 $\mu$ s	AUTO
Reference Level	0.000 dBm	0.000 dBm
Attenuation	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	9 / max. 150	max. 150
Stable	5 / 5	5
Max Stable Difference	0.20 dB	0.50 dB

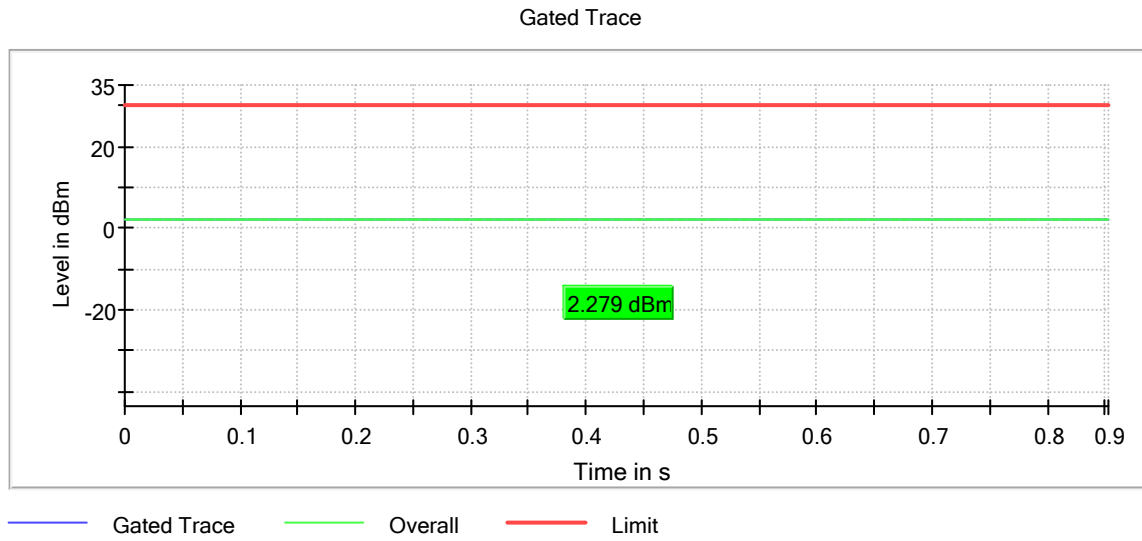
Remark: Cable loss 0.8dB was considered and set in system configuration.

## 9.2 Peak conducted output power

Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	Result
2402.000000	2.3	30.0	PASS
2440.000000	2.7	30.0	PASS
2480.000000	2.3	30.0	PASS

Remark: Antenna gain is 0.1 dBi



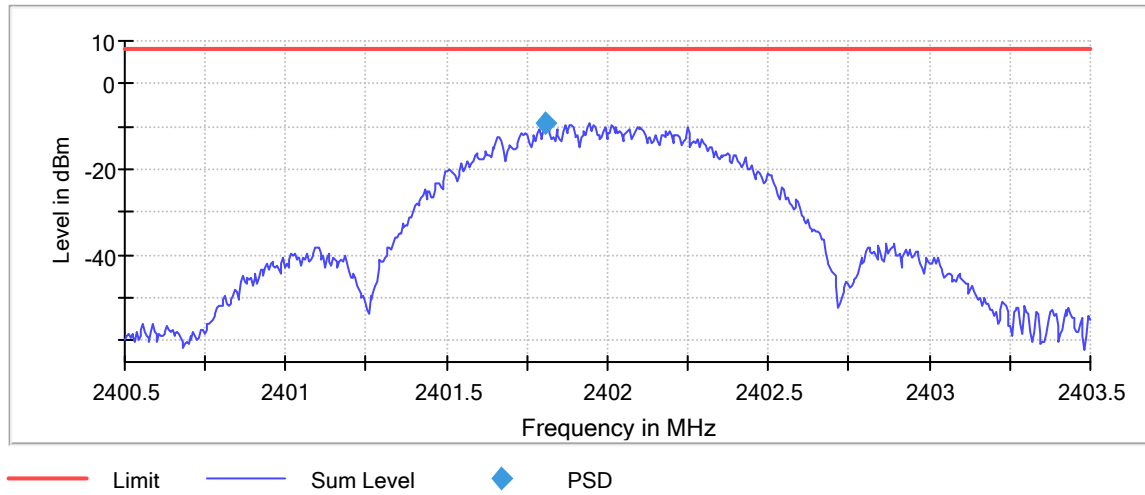


Remark: Cable loss 0.8dB was considered and set in system configuration.

### 9.3 Power Spectrum Density

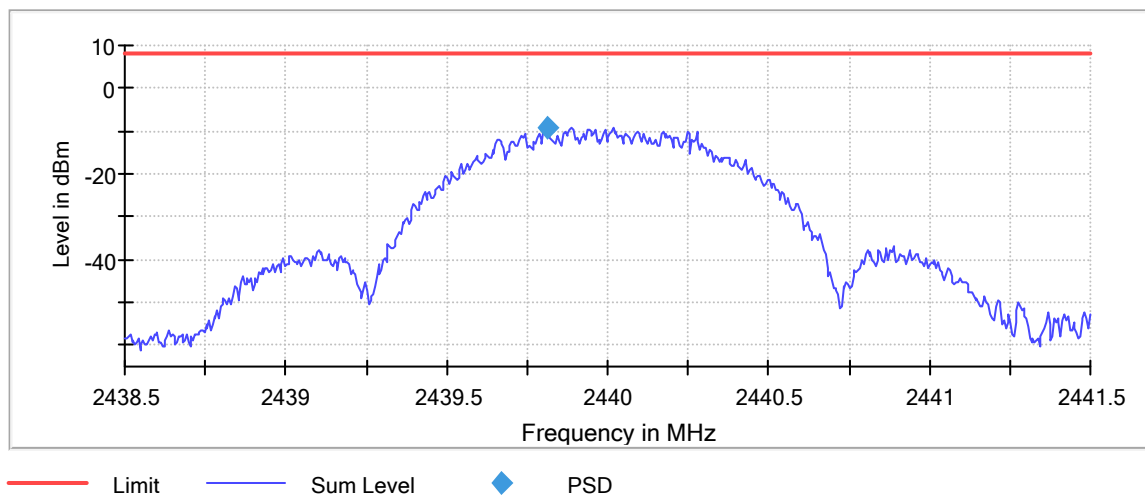
DUT Frequency (MHz)	Frequency (MHz)	PSD (dBm)	Limit Max (dBm)	Result
2402.000000	2401.807500	-9.196	8.0	PASS

Power Spectral Density



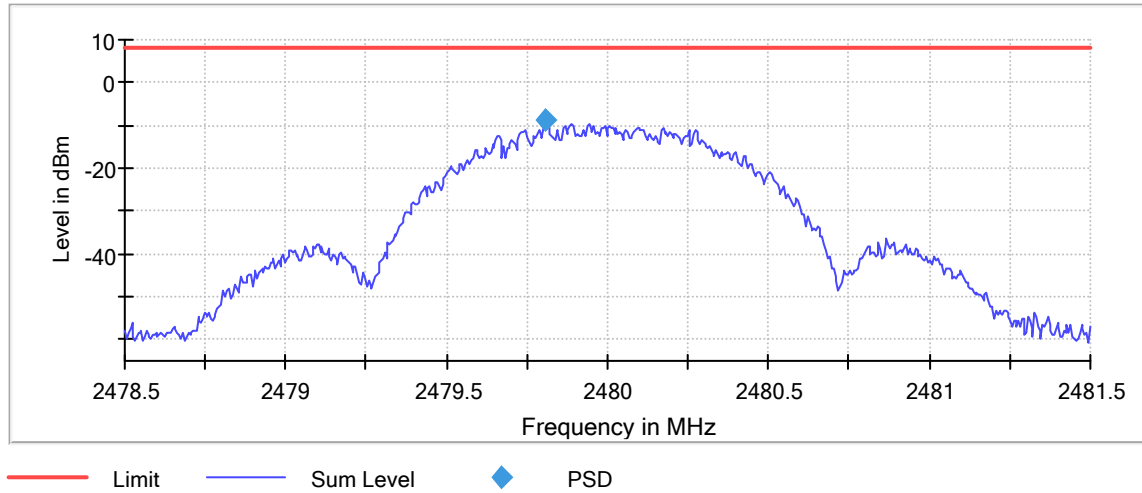
DUT Frequency (MHz)	Frequency (MHz)	PSD (dBm)	Limit Max (dBm)	Result
2440.000000	2439.812500	-9.229	8.0	PASS

Power Spectral Density



DUT Frequency (MHz)	Frequency (MHz)	PSD (dBm)	Limit Max (dBm)	Result
2480.000000	2479.807500	-8.944	8.0	PASS

Power Spectral Density



## 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	$\leq 10.000$ kHz
VBW	30.000 kHz	$\geq 30.000$ 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	0.13 dB	0.50 dB

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

## 9.4 Conducted Band Edge Measurement

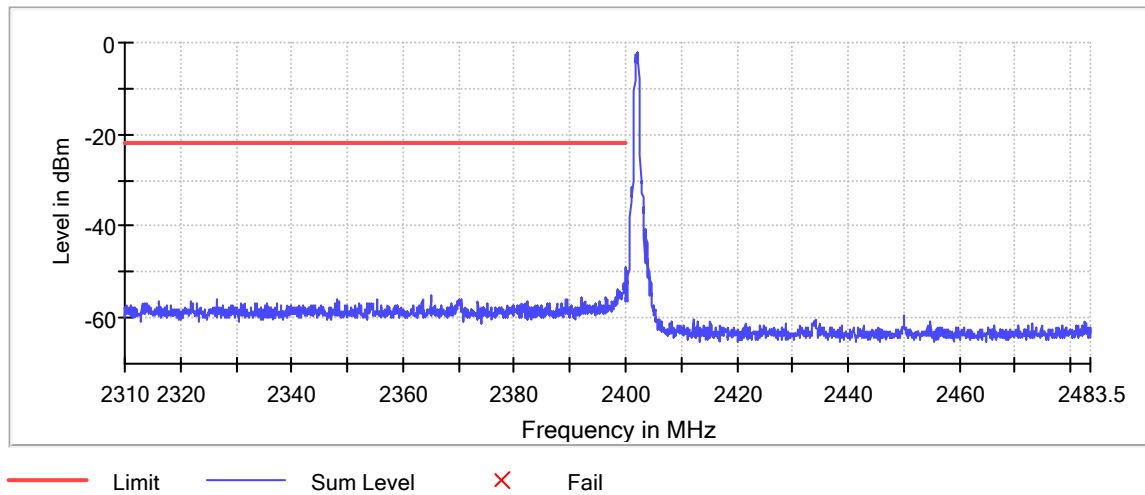
Inband Peak

Frequency (MHz)	Level (dBm)
2402.200000	-2.1
2479.775000	-2.2

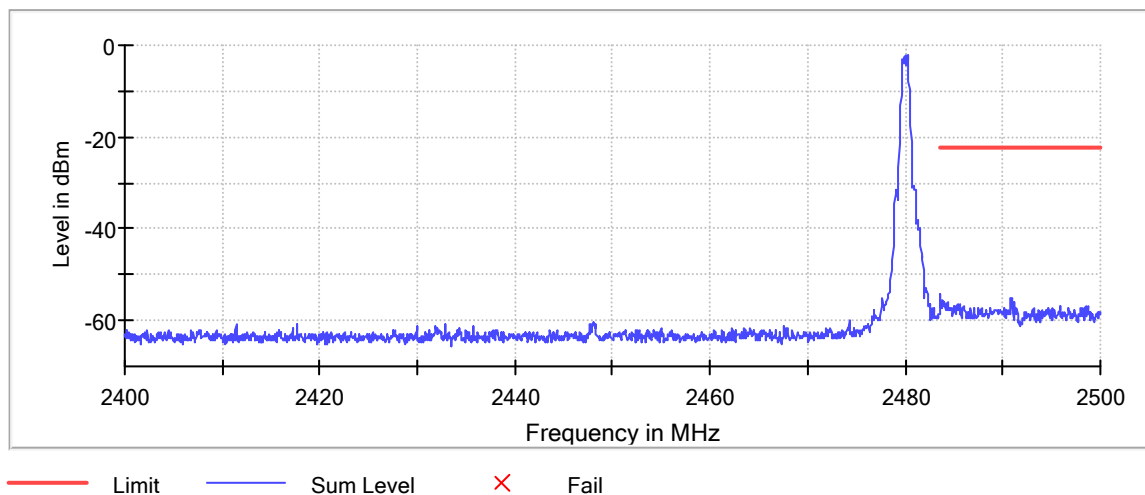
Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2399.975000	-49.0	26.9	-22.1	PASS
2483.525000	-54.0	31.8	-22.2	PASS

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

Band Edge



Band Edge





## 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	9 / max. 150	max. 150
Stable	3 / 3	3
Max Stable Difference	0.29 dB	0.50 dB

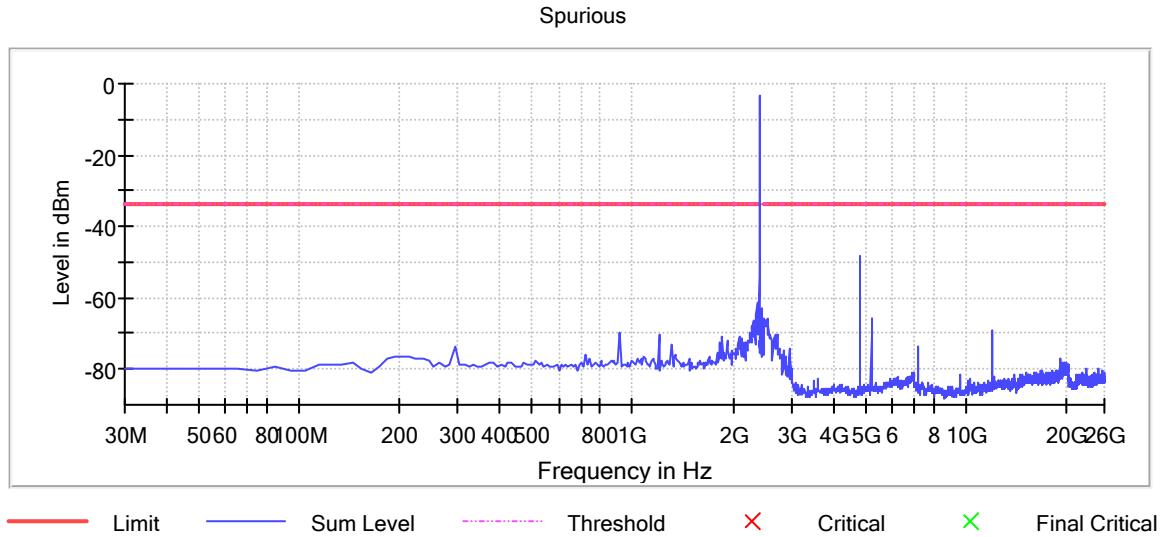
## Measurement 2

Setting	Instrument Value	Target Value
Start Frequency	2.48350 GHz	2.48350 GHz
Stop Frequency	2.50000 GHz	2.50000 GHz
Span	16.500 MHz	16.500 MHz
RBW	100.000 kHz	<= 100.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	330	~ 330
Sweeptime	37.969 $\mu$ s	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	4 / max. 150	max. 150
Stable	3 / 3	3
Max Stable Difference	0.00 dB	0.50 dB

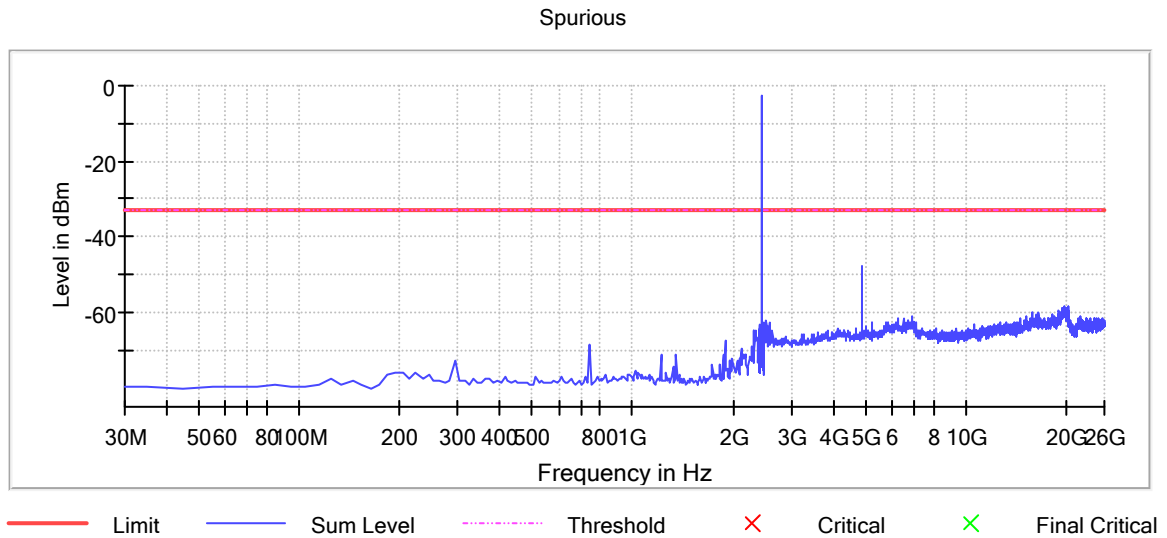
Remark: Cable loss 0.8dB was considered and set in system configuration.

## 9.5 Conducted spurious emission

### Lowest Channel

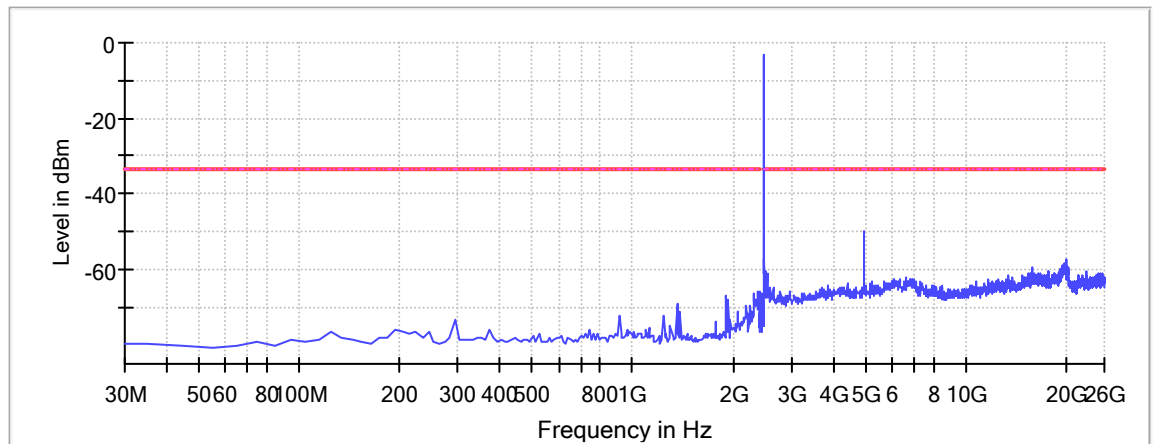


### Middle Channel



## Highest Channel

Spurious



— Limit    — Sum Level    - - - - - Threshold    × Critical    × Final Critical

## 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	11 / 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 -