TEST REPORT

Application No.:	HKEM2402000098AT
Applicant:	E. Gluck Corporation
Address of Applicant:	6015 Little Neck Parkway, Little Neck New York 11362 USA
Equipment Under Test (EUT):	
EUT Name:	MATRIX
Model No.:	42-1006BKBKWM, 42-1006BKTPWM, 42-1007SVSVWM
Additional Model:	Please refer to section 2 of this report which indicates which item was actually tested and which were electrically identical.
FCC ID:	2BFCD421006MTX
Standard(s) :	47 CFR Part 15, Subpart C 15.247
Date of Receipt:	2024-02-20
Date of Test:	2024-02-20 to 2024-02-27
Date of Issue:	2024-02-27
Test Result:	The submitted sample was found to comply with the test requirement

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Revision No.	**Date**	**Report superseded**	**Remark**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: 2024-02-27
		Law Man Kit /Reviewer		Date: 2024-02-27

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(b)(4)	Pass
Other requirements Frequency Hopping Spread Spectrum System Hopping Sequence	47 CFR Part 15, Subpart C 15.247	N/A	47 CFR Part 15, Subpart C 15.247(a)(1),(g),(h)	Pass

Radio Spectrum Matter Part				
Item	**Standard**	**Method**	**Requirement**	**Result**
Conducted Emissions at AC Power Line (150kHz-30MHz)	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 6.2	47 CFR Part 15, Subpart C 15.207	Pass
Conducted Peak Output Power	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 7.8.5	47 CFR Part 15, Subpart C 15.247(b)(1)	Pass
20dB Bandwidth	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 7.8.7	47 CFR Part 15, Subpart C 15.247(a)(1)	Pass
Carrier Frequencies Separation	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 7.8.3	47 CFR Part 15, Subpart C 15.247a(1)(iii)	Pass
Hopping Channel Number	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 7.8.4	47 CFR Part 15, Subpart C 15.247a(1)(iii)	Pass
Dwell Time	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 7.8.6	47 CFR Part 15, Subpart C 15.247(d)	Pass
Conducted Band Edges Measurement	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 7.8.8	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 6.10.5	47 CFR Part 15, Subpart C 15.205 & 15.209	Pass
Radiated Emissions which fall in the restricted bands	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
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:

Item no.: 42-1006BKBKWM, 42-1006BKTPWM, 42-1007SVSVWM

According to the confirmation from the applicant, the above models are identical in all electrical aspects in relating to the circuitry design, PCB layout, electrical components used, internal wiring and functions. The difference is the colours of the bands.

Therefore, only the model 42-1006BKBKWM was tested in this report.

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.

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4 General Information

4.1 Details of E.U.T.

Power supply:	Battery Model: 552020 Output: DC 3.8 V
Test voltage:	DC 3.8 V
Cable:	Power Cable: 56 cm 2-wire unshielded USB cable
Antenna Gain:	0.17 dBi
Antenna Type:	Monopole Antenna
Bluetooth Version:	V5.4 Classic
Channel Separation:	1MHz
Modulation Type:	GFSK, π/4DQPSK, 8DQPSK
Number of Channels:	79
Operation Frequency:	2402MHz to 2480MHz
Series No.:	N/A
Firmware Version:	V1
Hardware Version:	V1

Frequency List:

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	**2402**	26	2428	53	2455
1	2403	27	2429	54	2456
2	2404	28	2430	55	2457
3	2405	29	2431	56	2458
4	2406	30	2432	57	2459
5	2407	31	2433	58	2460
6	2408	32	2434	59	2461
7	2409	33	2435	60	2462
8	2410	34	2436	61	2463
9	2411	35	2437	62	2464
10	2412	36	2438	63	2465
11	2413	37	2439	64	2466
12	2414	38	2440	65	2467
13	2415	**39**	**2441**	66	2468
14	2416	40	2442	67	2469
15	2417	41	2443	68	2470
16	2418	42	2444	69	2471
17	2419	43	2445	70	2472
18	2420	44	2446	71	2473
19	2421	45	2447	72	2474
20	2422	46	2448	73	2475
21	2423	47	2449	74	2476
22	2424	48	2450	75	2477
23	2425	49	2451	76	2478
24	2426	50	2452	77	2479
25	2427	51	2453	**78**	**2480**
26	2428	52	2454		

The frequencies under test are bolded.

4.2 Description of Support Units

Description	Manufacturer	Model No.	Serial No.
Laptop	DELL	P75F	475LXQ2
FCC_assist_1.0.4(1).exe	E. Gluck Corporation	N/A	N/A

Note: The laptop and the software FCC_assist_1.0.4(1).exe were for the control of the engineering mode.

4.3 Modulation Configuration

RF software:	FCC_assist_1.0.4(1).exe			
Modulation	**Packet**	**Packet Type**	**Packet Size**	**Power**
GFSK	DH1	Default	Default	10
	DH3	Default	Default	10
	DH5	Default	Default	10
π/4DQPSK	2DH1	Default	Default	10
	2DH3	Default	Default	10
	2DH5	Default	Default	10
8DQPSK	3DH1	Default	Default	10
	3DH3	Default	Default	10
	3DH5	Default	Default	10
Remark: 1. 10 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	4.7dB (30MHz-1GHz)
		4.7dB (1GHz-6GHz)
		4.7dB (6GHz-18GHz)
		5.7dB (18GHz-40GHz)
8	Temperature test	± 1°C
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, Conducted Peak Output Power, 20dB Bandwidth, Carrier Frequencies Separation, Hopping Channel Number, Dwell Time, 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
EMI Test Receiver 9kHz to 7GHz	Rohde & Schwarz	ESR7 / 102298	E314	2023/06/13	2024/06/12
Active Loop Antenna 9k-30MHz	Schwarzbeck	FMZB 1513	E327	2022/11/23	2024/11/22
TRILOG Super Broadb. Test Antenna, (25) 30-1000 MHz	Schwarzbeck	VULB 9168	E311	2024/03/06	2026/03/05
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	2024/03/06	2026/03/05
Preamplifier 33dB, 1 - 18GHz	Schwarzbeck	BBV9718	E214	2023/09/27	2024/09/26
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
Horn Antenna 15 - 40GHz	Schwarzbeck	BBHA9170	E212	2024/03/28	2026/03/27

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)

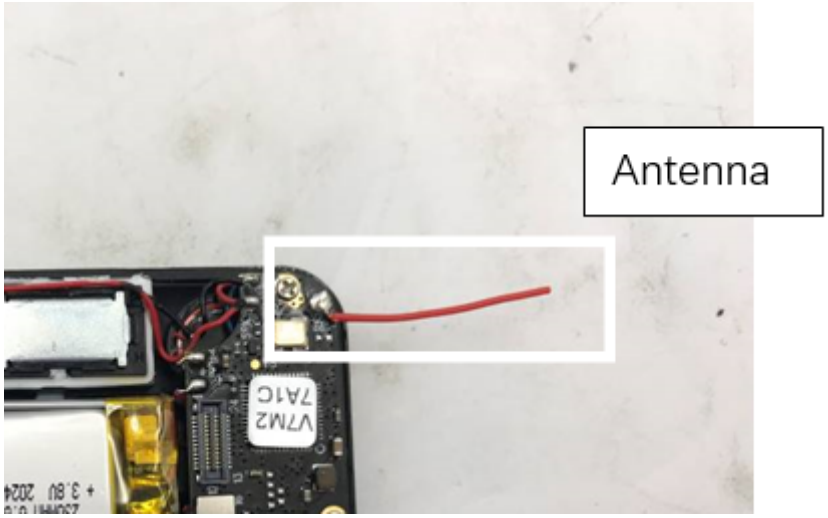
6.1.2 Conclusion

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 0.17 dBi.

Antenna location: Refer to internal photo.

6.2 Other requirements Frequency Hopping Spread Spectrum System Hopping Sequence

6.2.1 Test Requirement:

47 CFR Part 15, Subpart C 15.247(a)(1),(g),(h)

6.2.2 Conclusion

Standard Requirement:

The system shall hop to channel frequencies that are selected at the system hopping rate from a Pseudorandom ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

Frequency hopping spread spectrum systems are not required to employ all available hopping channels during each transmission. However, the system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this section should the transmitter be presented with a continuous data (or information) stream. In addition, a system employing short transmission bursts must comply with the definition of a frequency hopping system and must distribute its transmissions over the minimum number of hopping channels specified in this section.

The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hopsets to avoid hopping on occupied channels is permitted. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.

Compliance for section 15.247(a)(1): According to Technical Specification, the pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first ONE of 9 consecutive ONEs; i.e. the shift register is initialized with nine ones.

> Number of shift register stages: 9

> Length of pseudo-random sequence: 29 -1 = 511 bits

> Longest sequence of zeros: 8 (non-inverted signal)

Linear Feedback Shift Register for Generation of the PRBS sequence

An example of Pseudorandom Frequency Hopping Sequence as follow:

Each frequency used equally on the average by each transmitter.

According to Technical Specification, the receivers are designed to have input and IF bandwidths that match the hopping channel bandwidths of any transmitters and shift frequencies in synchronization with the transmitted signals.

Compliance for section 15.247(g): According to Technical Specification, the system transmits the packet with the pseudorandom hopping frequency with a continuous data and the short burst transmission from the Bluetooth system is also transmitted under the frequency hopping system with the pseudorandom hopping frequency system.

Compliance for section 15.247(h): According to Technical specification, the system incorporates with an adaptive system to detect other user within the spectrum band so that it individually and independently to avoid hopping on the occupied channels.

The system is designed not have the ability to coordinated with other FHSS System in an effort to avoid the simultaneous occupancy of individual hopping frequencies by multiple transmitter.

7 Radio Spectrum Matter Test Results

7.1 Conducted Peak Output Power

Test Requirement 47 CFR Part 15, Subpart C 15.247(b)(1)

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

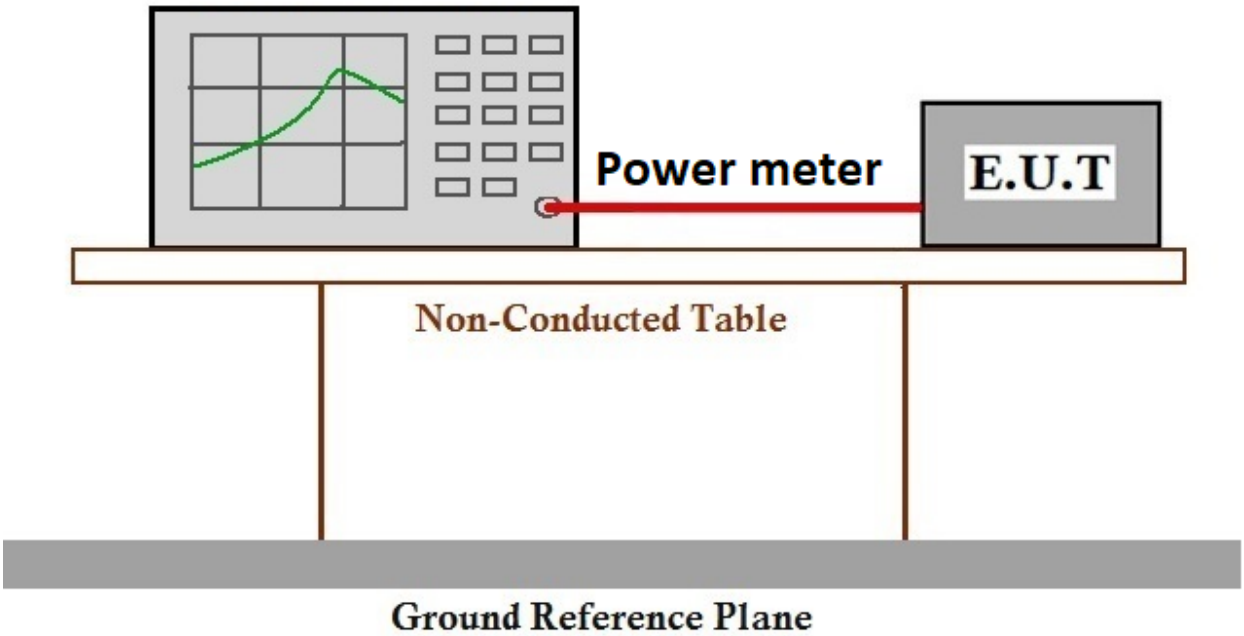
7.1.1 E.U.T. Operation

Operating Environment:

Temperature: 26.7 °C Humidity: 53.7 % RH :

Test mode b: TX_non-Hop mode_Keep the EUT in continuously transmitting mode with GFSK modulation, π/4DQPSK modulation and 8DPSK modulation. All modes have been tested and only the data of worst case (DH5, 2DH5, 3DH5) is recorded in the report.

7.1.2 Test Setup Diagram



7.1.3 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

7.2 20dB Bandwidth

Test Requirement 47 CFR Part 15, Subpart C 15.247(a)(1)
Test Method: ANSI C63.10 (2013) Section 7.8.7

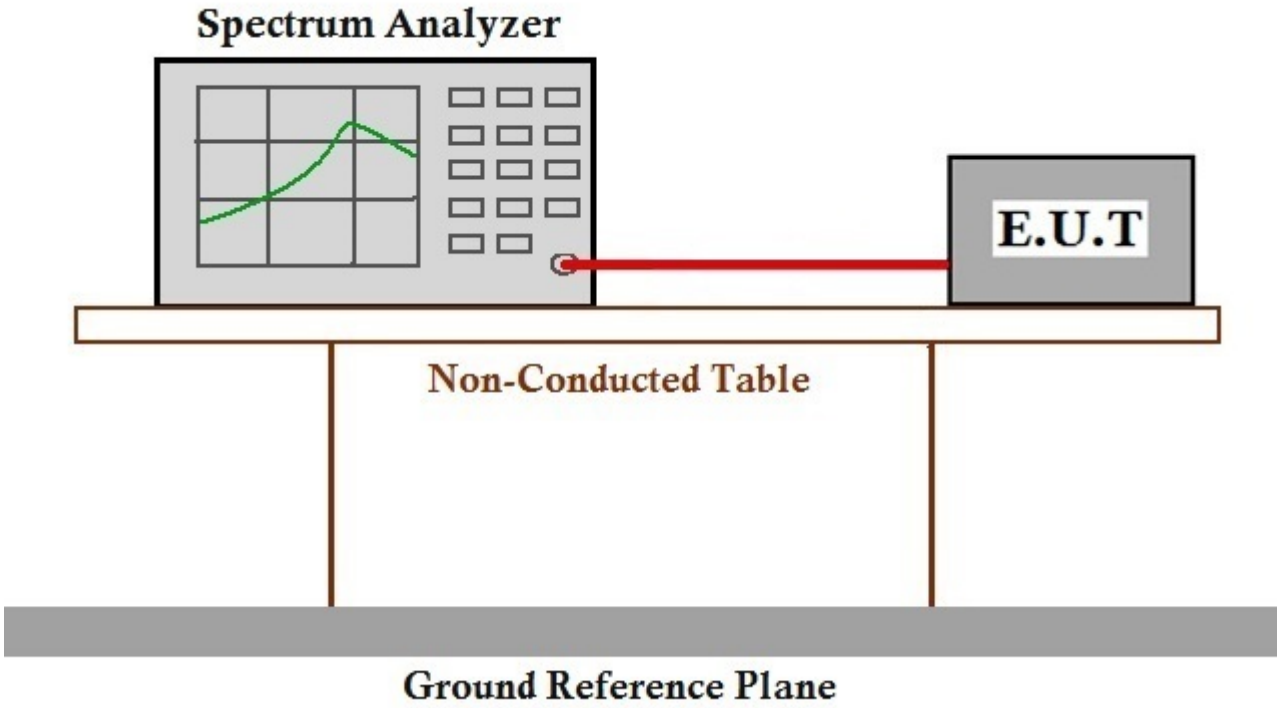
7.2.1 E.U.T. Operation

Operating Environment:

Temperature: 26.7 °C Humidity: 52.7 % RH :

Test mode b: TX_non-Hop mode_Keep the EUT in continuously transmitting mode with GFSK modulation, π/4DQPSK modulation and 8DPSK modulation. All modes have been tested and only the data of worst case (DH5, 2DH5, 3DH5) is recorded in the report.

7.2.2 Test Setup Diagram



7.2.3 Measurement Procedure and Data

The detailed test method see: ANSI C63.10 (2013) Section 7.8.7
The detailed test data see: Appendix 15.247

7.3 Carrier Frequencies Separation

Test Requirement 47 CFR Part 15, Subpart C 15.247a(1)

Test Method: ANSI C63.10 (2013) Section 7.8.2

Limit: 2/3 of the 20dB bandwidth base on the transmission power is less than 0.125W

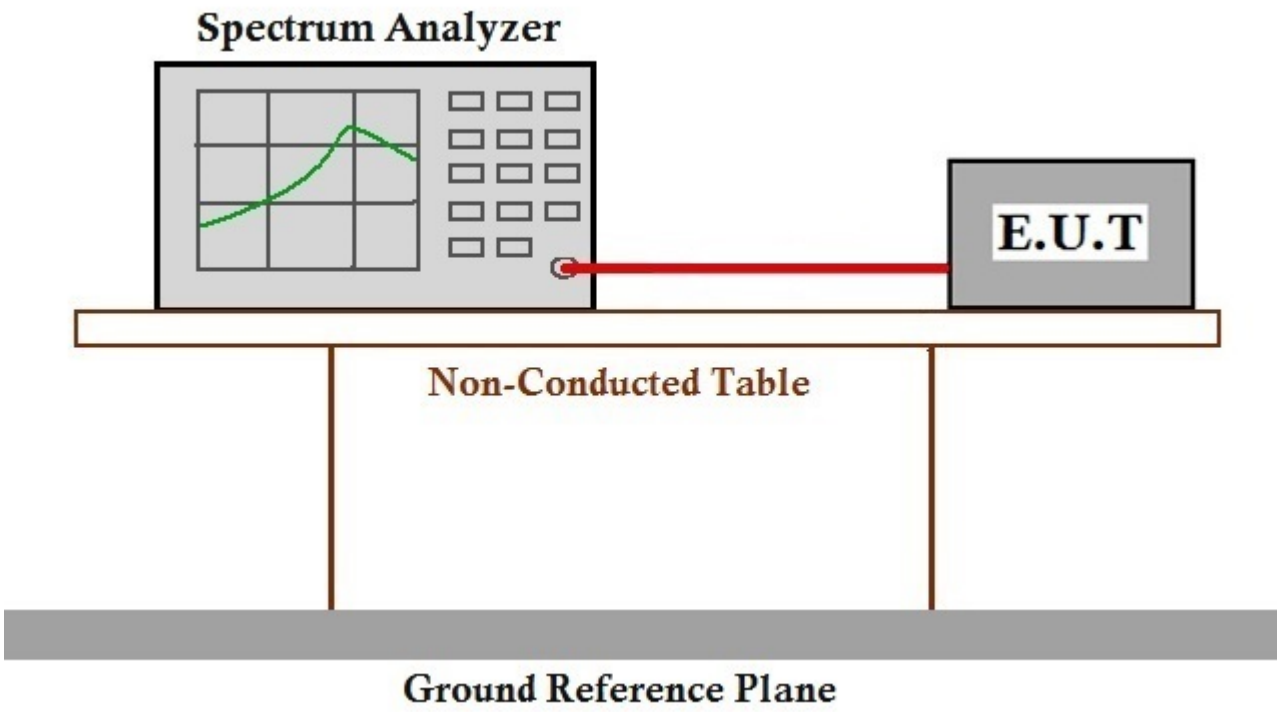
7.3.1 E.U.T. Operation

Operating Environment:

Temperature: 26.8 °C Humidity: 53.8 % RH :

Test mode a: TX_Hop mode_Keep the EUT in frequency hopping mode with GFSK modulation, π/4DQPSK modulation and 8DPSK modulation. All modes have been tested and only the data of worst case (DH5, 2DH5, 3DH5) is recorded in the report.

7.3.2 Test Setup Diagram



7.3.3 Measurement Procedure and Data

The detailed test method see: ANSI C63.10 (2013) Section 7.8.2

The detailed test data see: Appendix 15.247

7.4 Hopping Channel Number

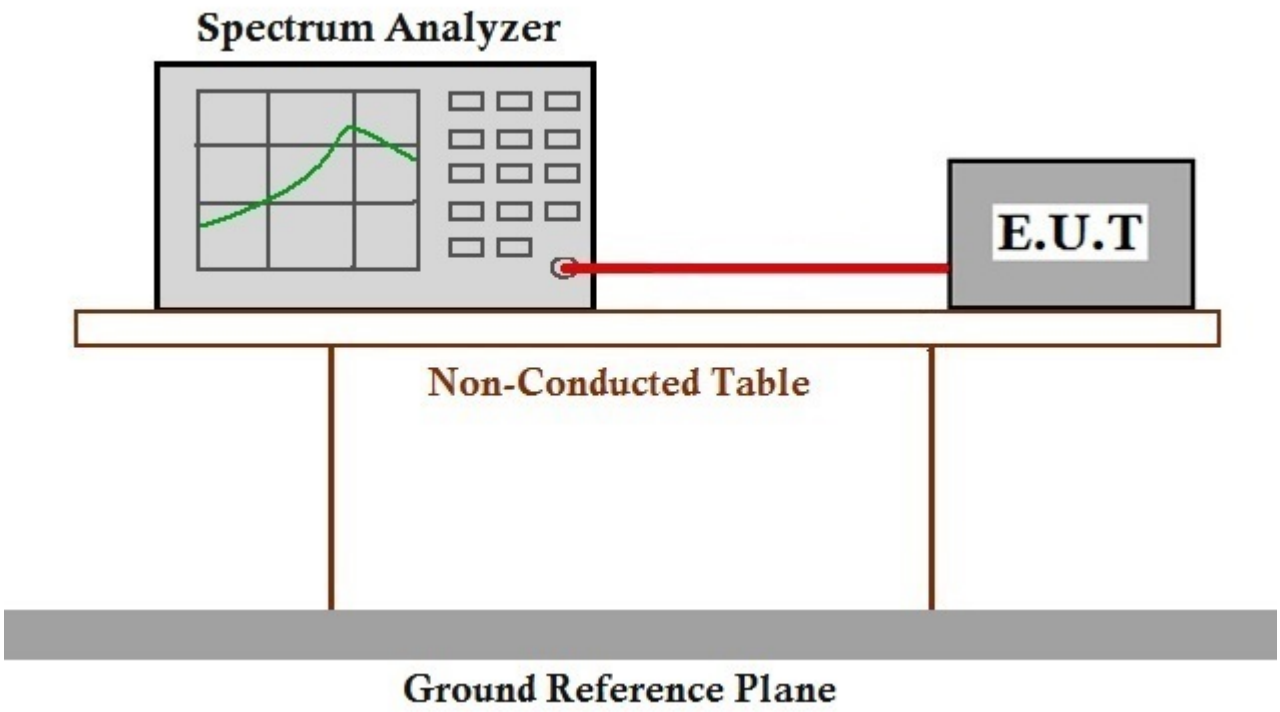
Test Requirement 47 CFR Part 15, Subpart C 15.247a(1)(iii)
Test Method: ANSI C63.10 (2013) Section 7.8.3
Limit:

Frequency range(MHz)	Number of hopping channels (minimum)
902-928	50 for 20dB bandwidth <250kHz
	25 for 20dB bandwidth ≥250kHz
2400-2483.5	15
5725-5850	75

7.4.1 E.U.T. Operation

Operating Environment:
Temperature: 26.8 °C Humidity: 53.8 % RH :
Test mode a: TX_Hop mode_Keep the EUT in frequency hopping mode with GFSK modulation, π/4DQPSK modulation and 8DPSK modulation. All modes have been tested and only the data of worst case (DH5, 2DH5, 3DH5) is recorded in the report.

7.4.2 Test Setup Diagram



7.4.3 Measurement Procedure and Data

The detailed test method see: ANSI C63.10 (2013) Section 7.8.3
The detailed test data see: Appendix 15.247

7.5 Carrier Frequencies Separation

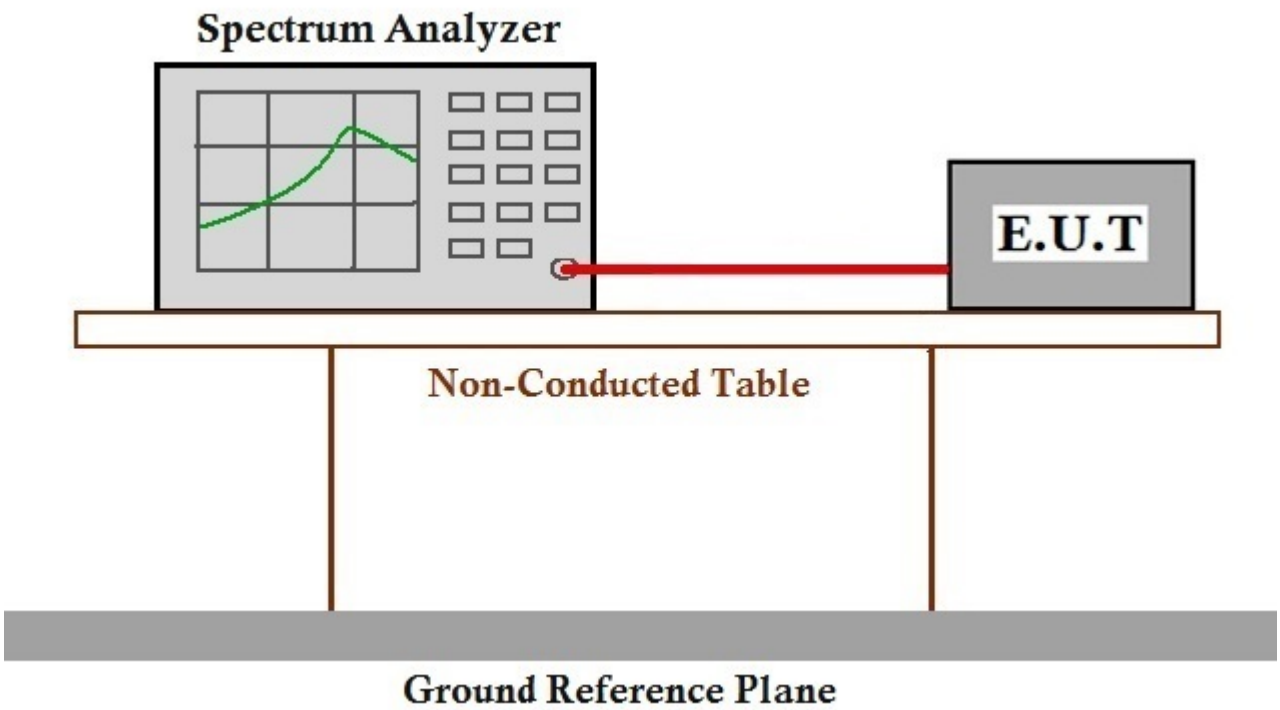
Test Requirement 47 CFR Part 15, Subpart C 15.247a(1)(iii)
Test Method: ANSI C63.10 (2013) Section 7.8.4
Limit:

Frequency(MHz)	Limit
902-928	0.4S within a 20S period(20dB bandwidth<250kHz)
	0.4S within a 10S period(20dB bandwidth≥250kHz)
2400-2483.5	0.4S within a period of 0.4S multiplied by the number of hopping channels
5725-5850	0.4S within a 30S period

7.5.1 E.U.T. Operation

Operating Environment:
Temperature: 26.8 °C Humidity: 53.8 % RH :
Test mode a: TX_Hop mode_Keep the EUT in frequency hopping mode with GFSK modulation, π/4DQPSK modulation and 8DPSK modulation. All modes have been tested and only the data of worst case (DH5, 2DH5, 3DH5) is recorded in the report.

7.5.2 Test Setup Diagram



7.5.3 Measurement Procedure and Data

The detailed test method see: ANSI C63.10 (2013) Section 7.8.4
The detailed test data see: Appendix 15.247

7.6 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)

7.6.1 E.U.T. Operation

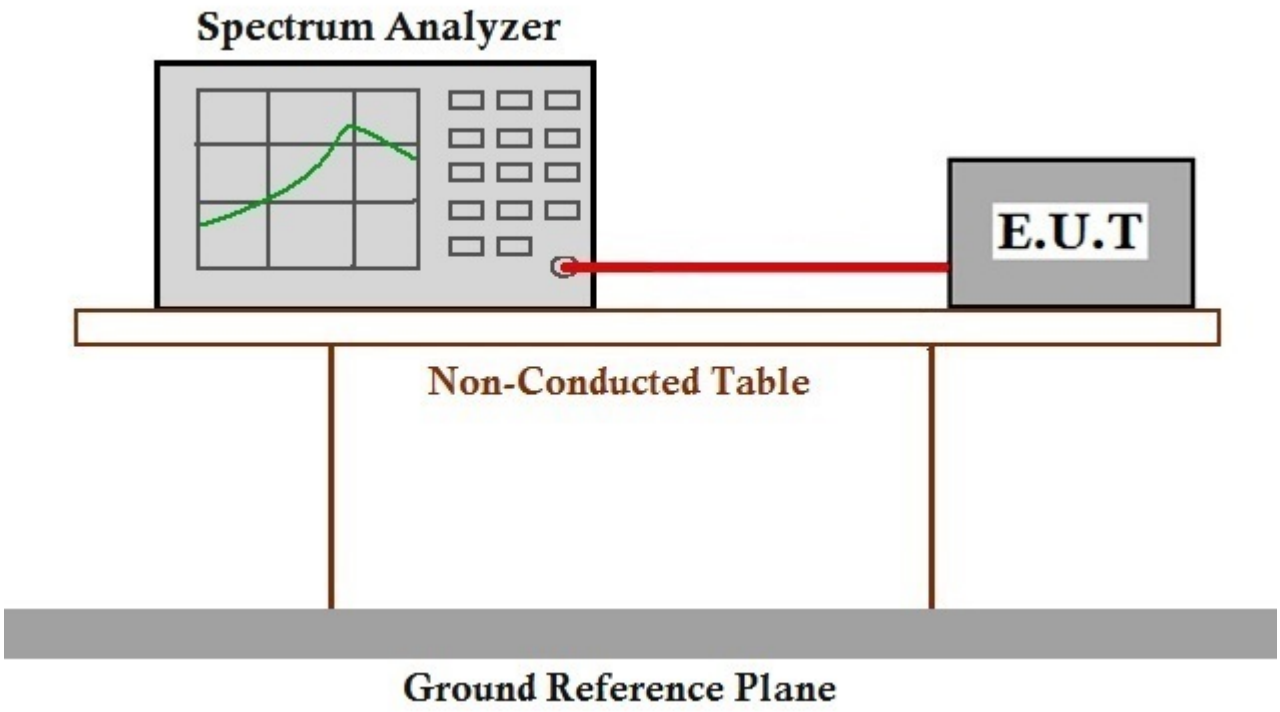
Operating Environment:

Temperature: 25.8 °C Humidity: 52.9 % RH :

Test mode: a: TX_Hop mode_Keep the EUT in frequency hopping mode with GFSK modulation, π/4DQPSK modulation and 8DPSK modulation. All modes have been tested and only the data of worst case (DH5, 2DH5, 3DH5) is recorded in the report.

b: TX_non-Hop mode_Keep the EUT in continuously transmitting mode with GFSK modulation, π/4DQPSK modulation and 8DPSK modulation. All modes have been tested and only the data of worst case (DH5, 2DH5, 3DH5) is recorded in the report.

7.6.2 Test Setup Diagram



7.6.3 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

7.7 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)

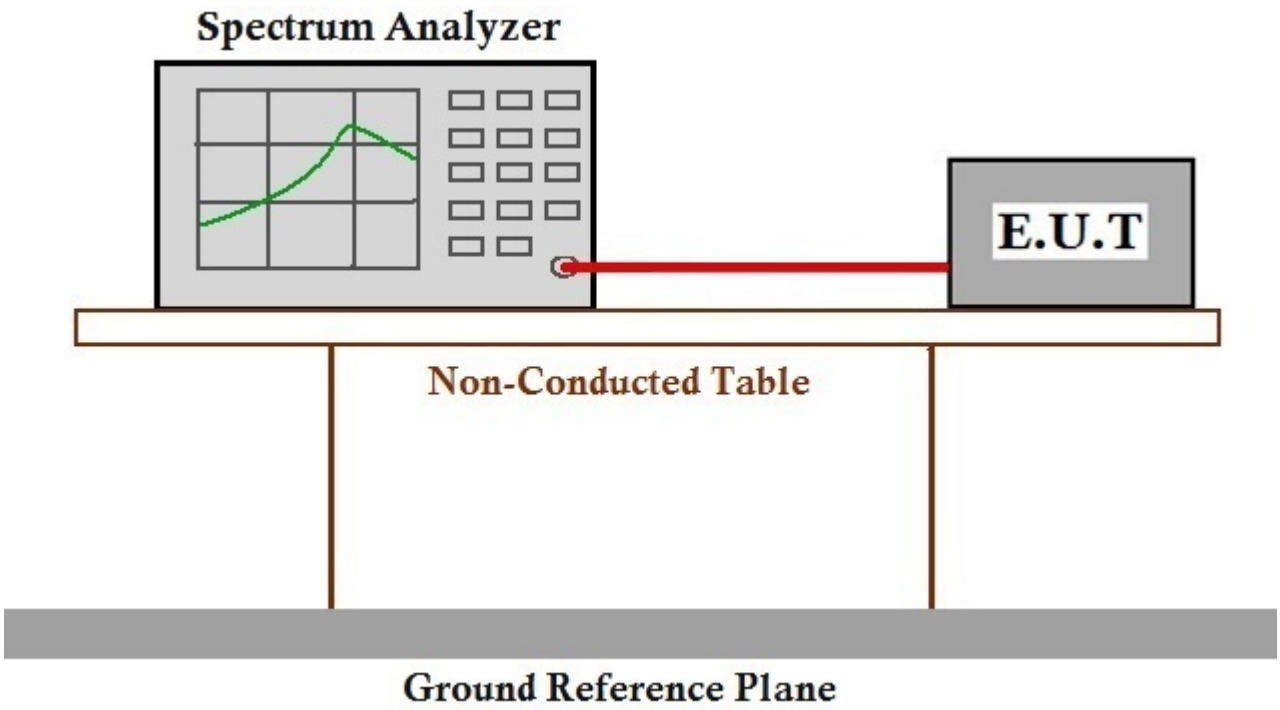
7.7.1 E.U.T. Operation

Operating Environment:

Temperature: 26.7 °C Humidity: 53.8 % RH :

Test mode: b: TX_non-Hop mode_Keep the EUT in continuously transmitting mode with GFSK modulation, π/4DQPSK modulation and 8DPSK modulation. All modes have been tested and only the data of worst case (DH5, 2DH5, 3DH5) is recorded in the report.

7.7.2 Test Setup Diagram



7.7.3 Measurement Procedure and Data

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

The detailed test data see: Appendix 15.247

7.8 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.		

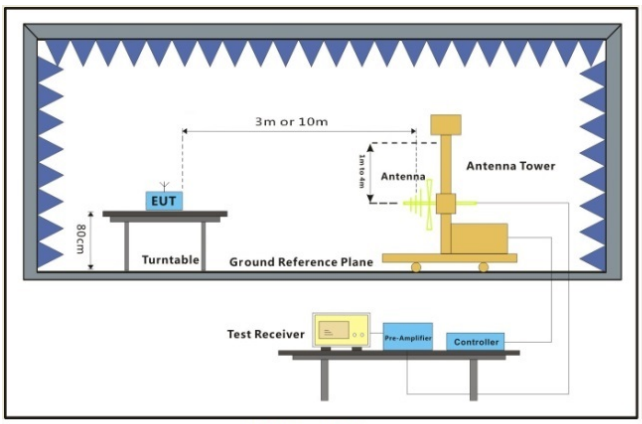
7.8.1 E.U.T. Operation

Operating Environment:

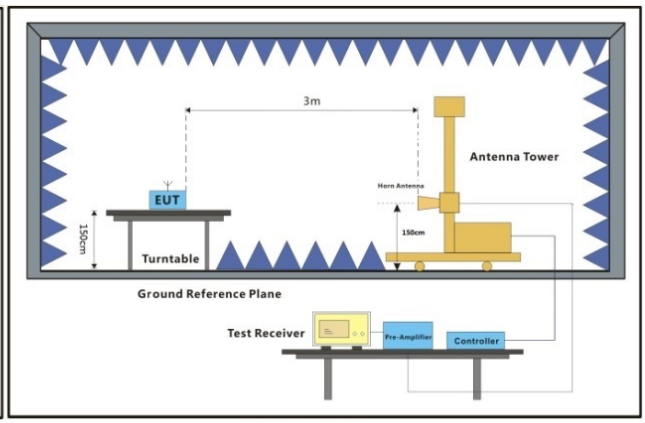
Temperature: 26.7 °C Humidity: 53.8 % RH :

Test mode b: TX_non-Hop mode_Keep the EUT in continuously transmitting mode with GFSK modulation, π/4DQPSK modulation and 8DPSK modulation. All modes have been tested and only the data of worst case (DH5, 2DH5, 3DH5) is recorded in the report.

7.8.2 Test Setup Diagram



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: 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.

DH5:

Frequency (MHz)	Antenna Polarization	Emission Level (dBμV/m)		Limit (dBμV/m)		Result
		Peak	Average	Peak	Average	
2390.000	H	48.7	29.3	74.0	54.0	Pass
2483.500	H	57.3	42.2	74.0	54.0	Pass
2390.000	V	49.9	28.5	74.0	54.0	Pass
2483.500	V	50.8	36.1	74.0	54.0	Pass

2DH5:

Frequency (MHz)	Antenna Polarization	Emission Level (dBμV/m)		Limit (dBμV/m)		Result
		Peak	Average	Peak	Average	
2390.000	H	46.6	29.4	74.0	54.0	Pass
2483.500	H	56.4	23.4	74.0	54.0	Pass
2390.000	V	49.1	30.3	74.0	54.0	Pass
2483.500	V	58.0	23.2	74.0	54.0	Pass

3DH5:

Frequency (MHz)	Antenna Polarization	Emission Level (dBμV/m)		Limit (dBμV/m)		Result
		Peak	Average	Peak	Average	
2390.000	H	46.9	29.4	74.0	54.0	Pass
2483.500	H	54.8	23.9	74.0	54.0	Pass
2390.000	V	47.6	29.2	74.0	54.0	Pass
2483.500	V	57.7	23.8	74.0	54.0	Pass

7.9 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.		

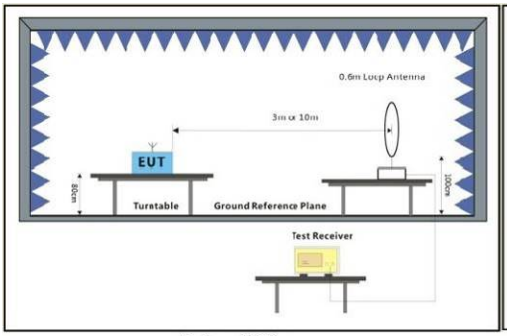
7.9.1 E.U.T. Operation

Operating Environment:

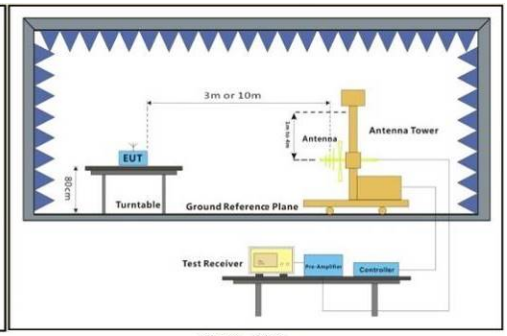
Temperature: 26.6 °C Humidity: 52.8 % RH :

Test b: TX_non-Hop mode_Keep the EUT in continuously transmitting mode with GFSK modulation, π/4DQPSK modulation and 8DPSK modulation. All modes have been tested and only the data of worst case (DH5, 2DH5, 3DH5) is recorded in the report.

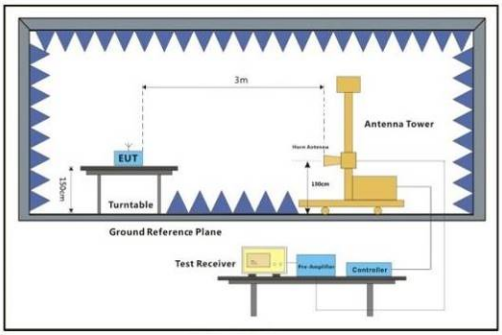
7.9.2 Test Setup Diagram



Below 30MHz



30MHz-1GHz



Above 1GHz

7.9.3 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.

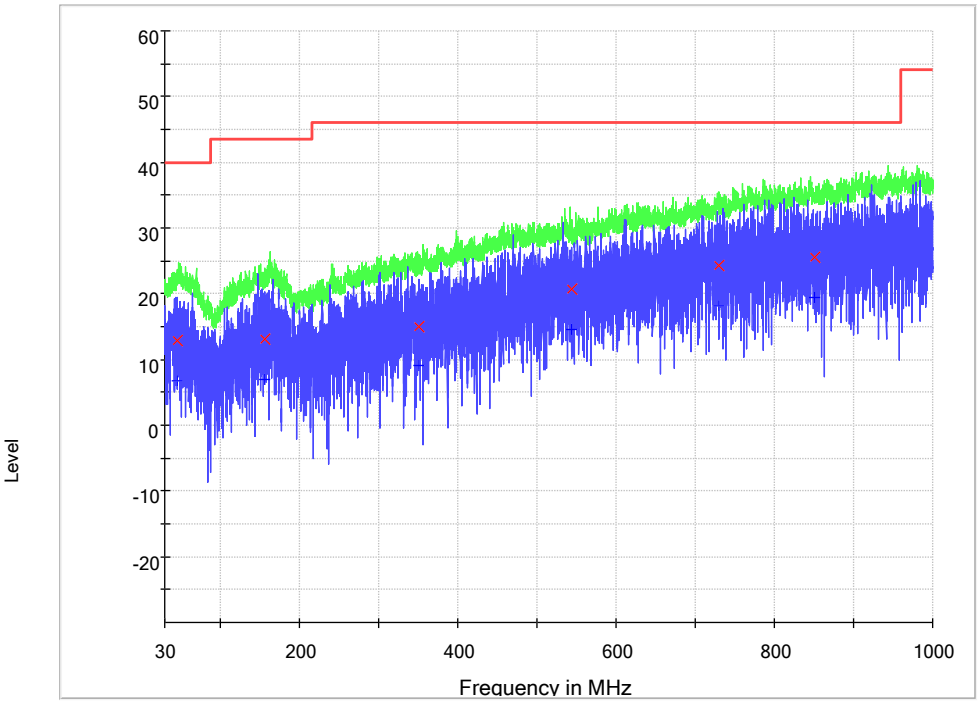
DH5

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.

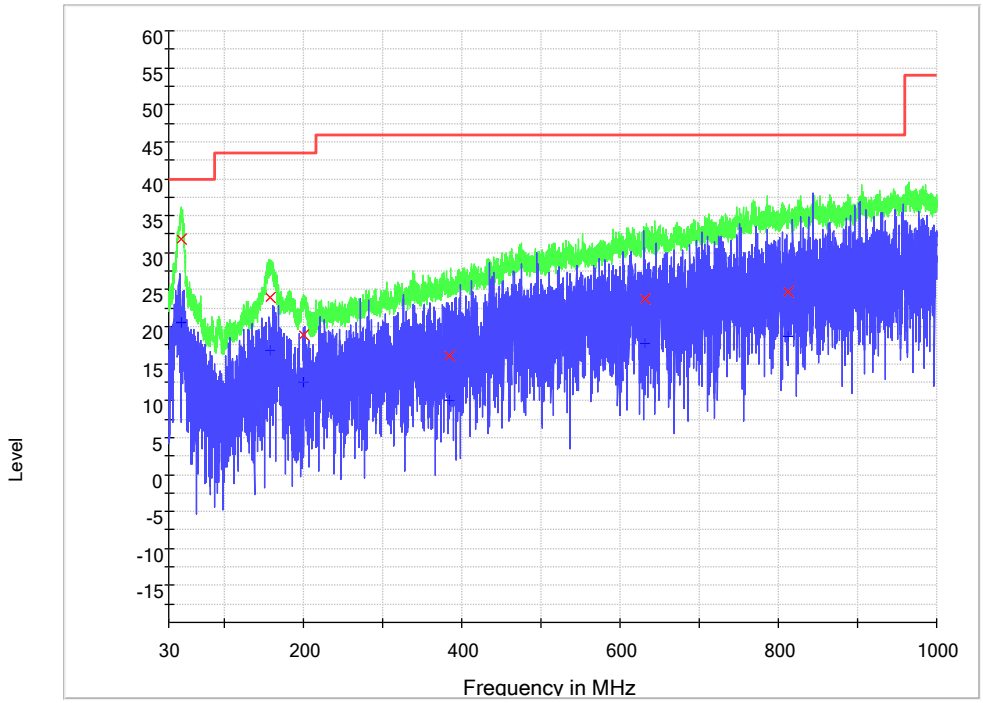
Radiated emission below 1GHz

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



Frequency (MHz)	QuasiPeak (dBµV/m)	Pol.	Corr. (dB/m)	Margin (dB)	Limit (dBµV/m)	Result
45.753571	12.9	H	14.1	27.1	40.0	Pass
156.973214	13.0	H	14.4	30.5	43.5	Pass
350.719643	15.1	H	16.2	31.0	46.0	Pass
543.908929	20.7	H	21.0	25.3	46.0	Pass
729.994643	24.4	H	23.8	21.7	46.0	Pass
850.337500	25.6	H	25.4	20.4	46.0	Pass

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



Frequency (MHz)	QuasiPeak (dBµV/m)	Pol.	Corr. (dB/m)	Margin (dB)	Limit (dBµV/m)	Result
45.614286	31.9	V	14.1	8.1	40.0	Pass
157.808929	24.0	V	14.4	19.5	43.5	Pass
200.917857	19.0	V	10.7	24.5	43.5	Pass
383.660714	16.1	V	17.0	29.9	46.0	Pass
630.962500	23.8	V	22.7	22.2	46.0	Pass
812.521429	24.8	V	25.0	21.2	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)		Remark
		Peak	Average	Peak	Average	
4803.750	H	54.4	42.5	74.0	54.0	PASS
7205.531	H	55.9	42.3	74.0	54.0	PASS
9607.313	H	59.4	44.6	74.0	54.0	PASS
4804.281	V	49.9	37.6	74.0	54.0	PASS
7205.531	V	57.1	43.3	74.0	54.0	PASS
9608.375	V	55.3	41.8	74.0	54.0	PASS

Channel: Middle

Frequency (MHz)	Antenna Polarization	Emission Level (dBμV/m)		Limit (dBμV/m)		Remark
		Peak	Average	Peak	Average	
4881.844	H	54.1	42.5	74.0	54.0	PASS
7323.469	H	55.6	42.2	74.0	54.0	PASS
9763.500	H	60.4	46.7	74.0	54.0	PASS
4881.313	V	52.8	38.9	74.0	54.0	PASS
7322.938	V	55.4	43.2	74.0	54.0	PASS
9762.969	V	59.3	43.8	74.0	54.0	PASS

Channel: High

Frequency (MHz)	Antenna Polarization	Emission Level (dBμV/m)		Limit (dBμV/m)		Remark
		Peak	Average	Peak	Average	
4959.406	H	51.2	37.8	74.0	54.0	PASS
7439.813	H	54.1	41.8	74.0	54.0	PASS
9913.844	H	60.3	48.2	74.0	54.0	PASS
4959.406	V	51.0	37.3	74.0	54.0	PASS
7439.281	V	55.2	40.8	74.0	54.0	PASS
9913.844	V	55.1	43.1	74.0	54.0	PASS

Remark: Only the worst case is shown.

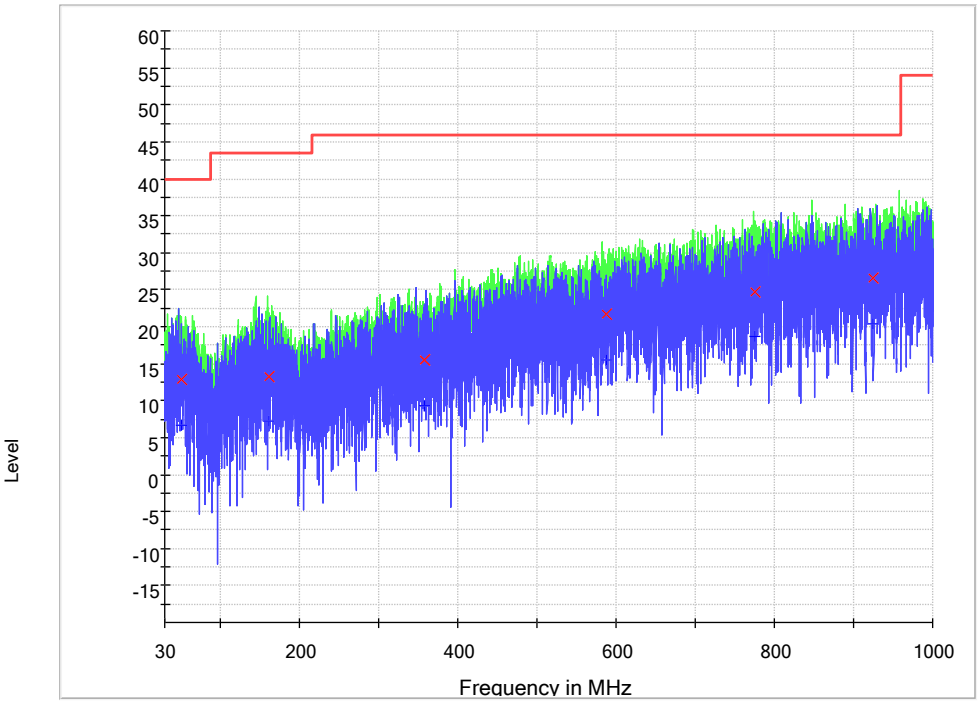
2DH5

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.

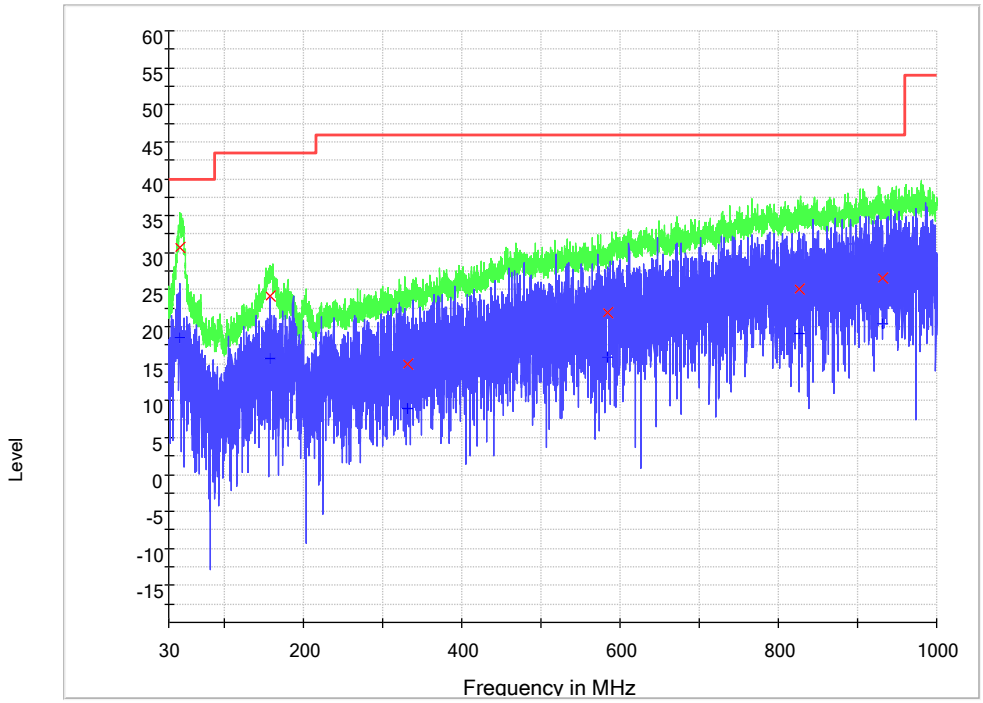
Radiated emission below 1GHz

Mode:a; Polarization:Horizontal; Modulation: π/4DQPSK; Channel:2402MHz



Frequency (MHz)	QuasiPeak (dBµV/m)	Pol.	Corr. (dB/m)	Margin (dB)	Limit (dBµV/m)	Result
50.628571	12.8	H	14.2	27.2	40.0	Pass
161.291071	13.3	H	14.5	30.2	43.5	Pass
358.867857	15.5	H	16.3	30.5	46.0	Pass
587.017857	21.6	H	21.8	24.4	46.0	Pass
776.098214	24.7	H	25.0	21.3	46.0	Pass
924.785714	26.5	H	26.3	19.5	46.0	Pass

Mode:a; Polarization:Vertical; Modulation: π/4DQPSK; Channel:2402MHz



Frequency (MHz)	QuasiPeak (dBµV/m)	Pol.	Corr. (dB/m)	Margin (dB)	Limit (dBµV/m)	Result
44.291071	30.7	V	14.0	9.3	40.0	Pass
157.878571	24.0	V	14.4	19.5	43.5	Pass
331.080357	15.0	V	15.9	31.0	46.0	Pass
584.928571	21.9	V	21.7	24.1	46.0	Pass
826.589286	25.1	V	25.3	20.9	46.0	Pass
931.889286	26.5	V	26.4	19.5	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)		Remark
		Peak	Average	Peak	Average	
4804.281	H	54.2	40.8	74.0	54.0	PASS
7205.531	H	56.0	41.0	74.0	54.0	PASS
9607.313	H	59.2	43.6	74.0	54.0	PASS
4803.750	V	54.1	40.8	74.0	54.0	PASS
7206.063	V	55.3	41.9	74.0	54.0	PASS
9607.313	V	59.5	43.6	74.0	54.0	PASS

Channel: Middle

Frequency (MHz)	Antenna Polarization	Emission Level (dBμV/m)		Limit (dBμV/m)		Remark
		Peak	Average	Peak	Average	
4881.844	H	53.9	40.8	74.0	54.0	PASS
7322.406	H	55.1	40.1	74.0	54.0	PASS
9757.656	H	61.5	48.4	74.0	54.0	PASS
4881.313	V	50.2	35.5	74.0	54.0	PASS
7321.875	V	54.4	38.4	74.0	54.0	PASS
9757.353	V	58.4	42.7	74.0	54.0	PASS

Channel: High

Frequency (MHz)	Antenna Polarization	Emission Level (dBμV/m)		Limit (dBμV/m)		Remark
		Peak	Average	Peak	Average	
4959.406	H	51.3	37.0	74.0	54.0	PASS
7439.281	H	54.7	39.2	74.0	54.0	PASS
9913.844	H	60.4	48.7	74.0	54.0	PASS
4959.406	V	50.9	36.5	74.0	54.0	PASS
7440.344	V	55.8	41.7	74.0	54.0	PASS
9919.156	V	54.0	38.9	74.0	54.0	PASS

Remark: Only the worst case is shown.

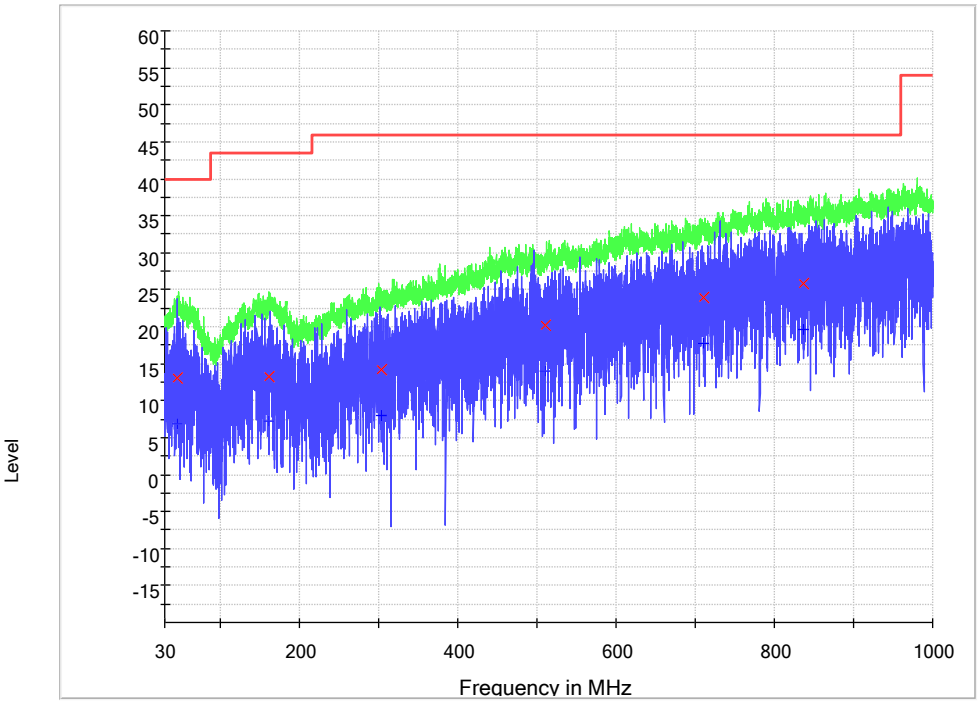
3DH5

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.

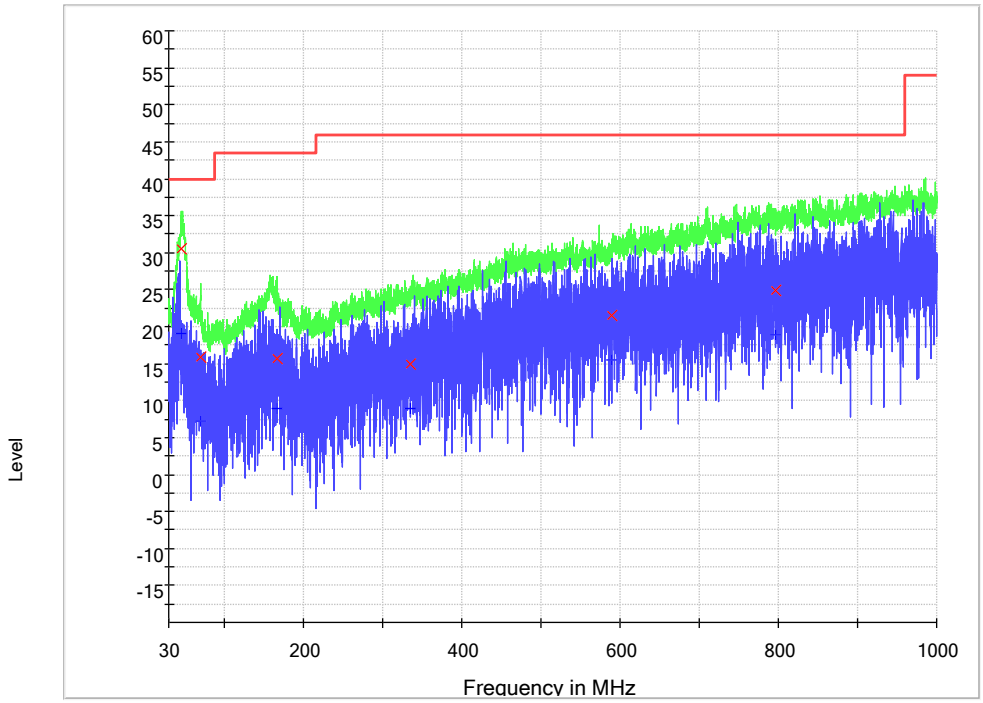
Radiated emission below 1GHz

Mode:a; Polarization:Horizontal; Modulation: 8DQPSK; Channel:2402MHz



Frequency (MHz)	QuasiPeak (dBµV/m)	Pol.	Corr. (dB/m)	Margin (dB)	Limit (dBµV/m)	Result
45.544643	13.0	H	14.1	27.0	40.0	Pass
161.778571	13.3	H	14.5	30.2	43.5	Pass
303.850000	14.1	H	15.0	31.9	46.0	Pass
509.783929	20.2	H	20.6	25.8	46.0	Pass
710.633929	23.9	H	23.7	22.2	46.0	Pass
837.244643	25.8	H	25.4	20.2	46.0	Pass

Mode:a; Polarization:Vertical; Modulation: 8DQPSK; Channel:2402MHz



Frequency (MHz)	QuasiPeak (dBµV/m)	Pol.	Corr. (dB/m)	Margin (dB)	Limit (dBµV/m)	Result
46.241071	30.5	V	14.1	9.6	40.0	Pass
69.641071	15.9	V	12.4	24.1	40.0	Pass
166.166071	15.7	V	14.3	27.8	43.5	Pass
335.050000	15.0	V	16.0	31.0	46.0	Pass
588.689286	21.5	V	21.8	24.5	46.0	Pass
797.269643	25.0	V	24.9	21.0	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)		Remark
		Peak	Average	Peak	Average	
4803.750	H	54.3	40.9	74.0	54.0	PASS
7206.063	H	56.1	41.8	74.0	54.0	PASS
9602.000	H	60.5	48.6	74.0	54.0	PASS
4803.750	V	50.0	36.6	74.0	54.0	PASS
7206.063	V	57.4	43.0	74.0	54.0	PASS
9607.313	V	56.1	40.8	74.0	54.0	PASS

Channel: Middle

Frequency (MHz)	Antenna Polarization	Emission Level (dBμV/m)		Limit (dBμV/m)		Remark
		Peak	Average	Peak	Average	
4881.844	H	54.1	41.1	74.0	54.0	PASS
7322.406	H	55.8	40.9	74.0	54.0	PASS
9762.969	H	59.5	43.1	74.0	54.0	PASS
4881.313	V	50.3	35.7	74.0	54.0	PASS
7321.875	V	55.1	38.4	74.0	54.0	PASS
9764.563	V	57.5	42.5	74.0	54.0	PASS

Channel: High

Frequency (MHz)	Antenna Polarization	Emission Level (dBμV/m)		Limit (dBμV/m)		Remark
		Peak	Average	Peak	Average	
4959.938	H	52.1	39.2	74.0	54.0	PASS
7440.344	H	53.4	39.6	74.0	54.0	PASS
9913.844	H	60.5	48.6	74.0	54.0	PASS
4959.406	V	51.2	36.6	74.0	54.0	PASS
7440.344	V	55.7	41.6	74.0	54.0	PASS
9914.375	V	54.4	42.7	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, internal and setup photos.

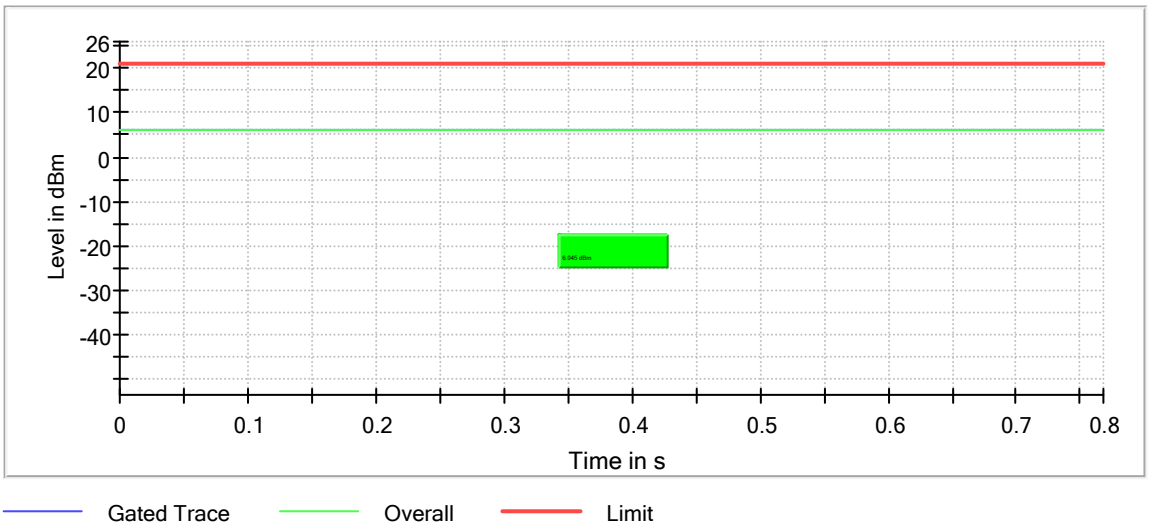
9 Appendix 15.247

9.1 Peak conducted output power

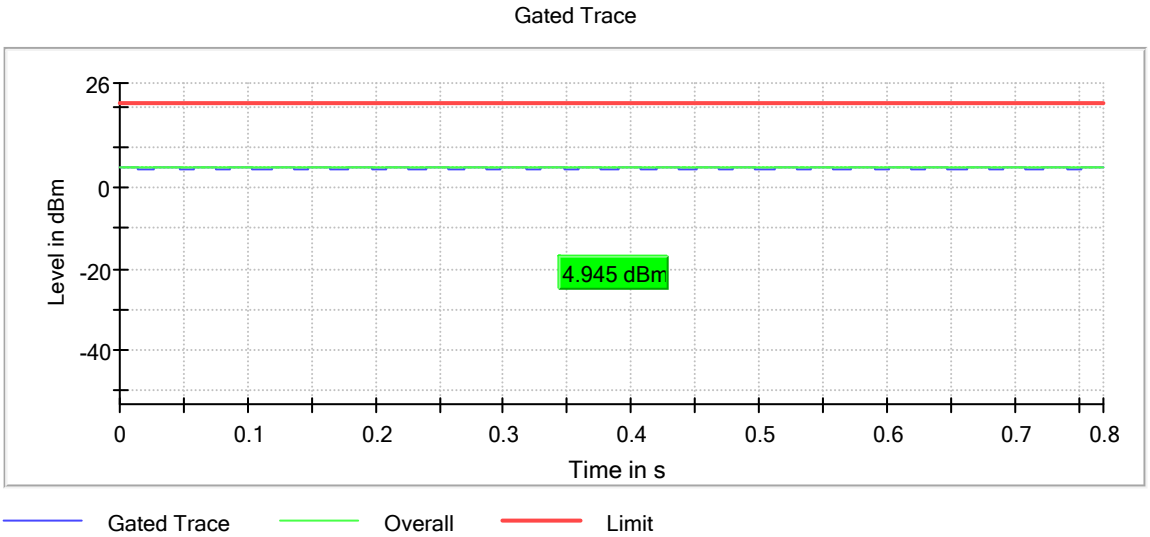
Test Mode	Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	Result
DH5	2402.000000	5.3	21.0	PASS
	2441.000000	6.0	21.0	PASS
	2480.000000	5.1	21.0	PASS
2DH5	2402.000000	4.2	21.0	PASS
	2441.000000	4.9	21.0	PASS
	2480.000000	4.1	21.0	PASS
3DH5	2402.000000	4.2	21.0	PASS
	2441.000000	4.9	21.0	PASS
	2480.000000	4.1	21.0	PASS

Remark: Antenna gain is 0.17 dBi

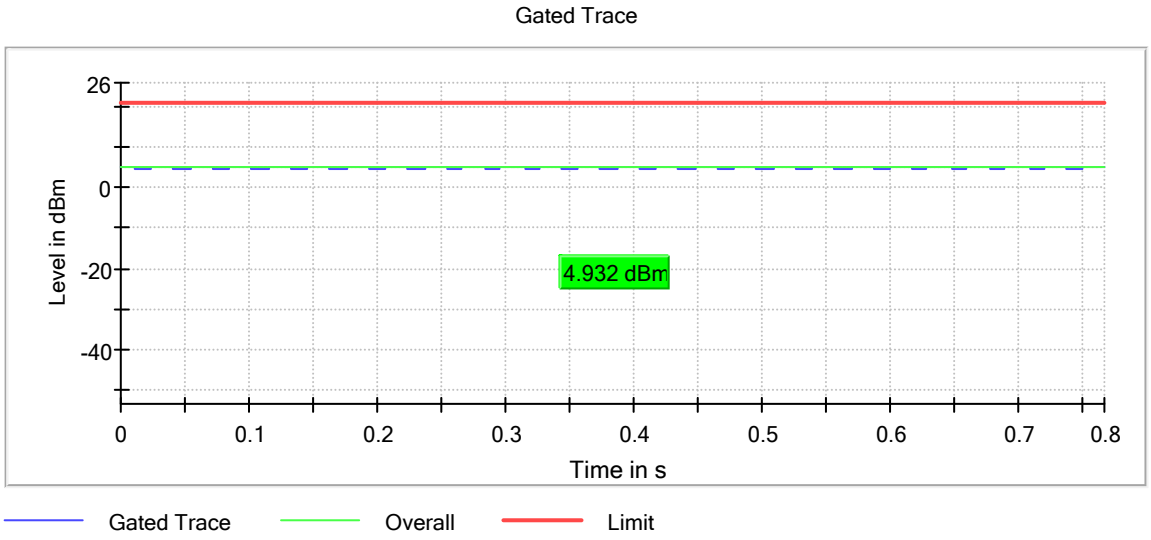
DH5


26
20
10
0
-10
-20
-30
-40
Level in dBm
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
Time in s
Gated Trace
Overall
Limit

2DH5


Gated Trace
26
0
-20
-40
Level in dBm
4.945 dBm
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
Time in s
Gated Trace
Overall
Limit

3DH5

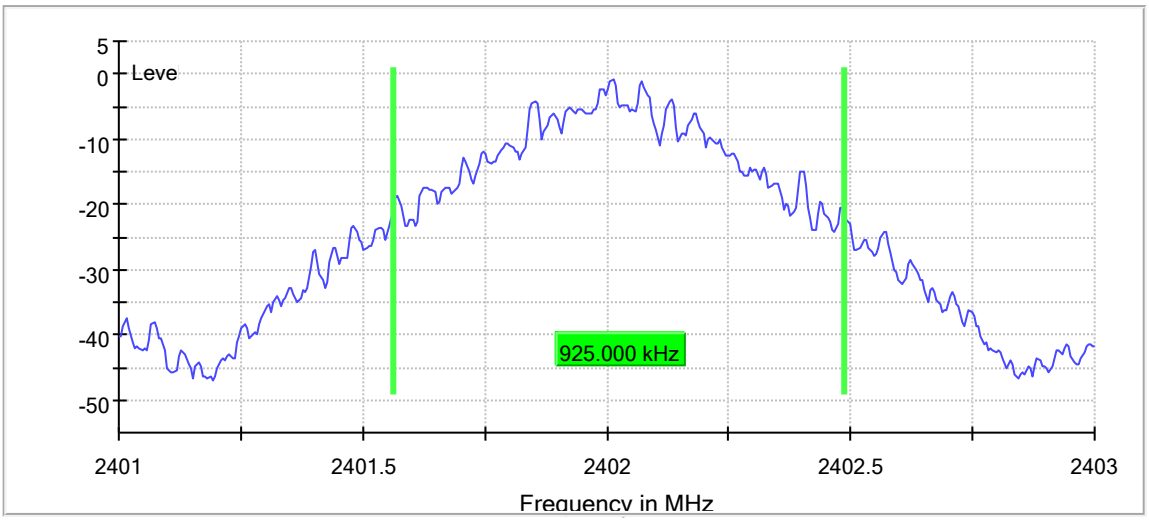


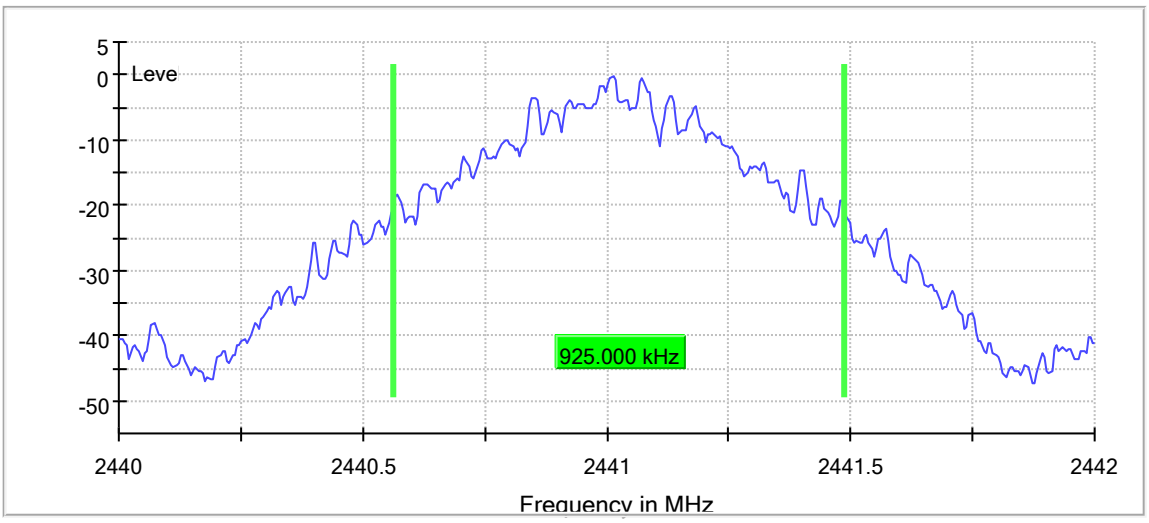
Remark: Cable loss 0.8dB was considered and set in system configuration.

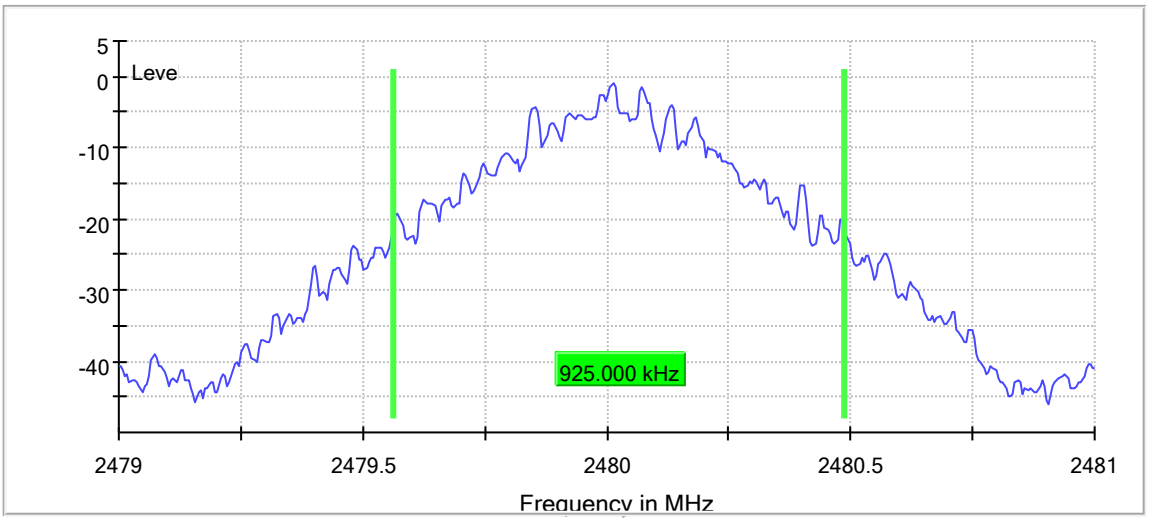
9.2 20dB Bandwidth

Test Mode	Frequency (MHz)	Bandwidth (MHz)	Limit (MHz)	Result
DH5	2402.000000	0.925000	---	PASS
	2441.000000	0.925000	---	PASS
	2480.000000	0.925000	---	PASS
2DH5	2402.000000	1.260000	---	PASS
	2441.000000	1.310000	---	PASS
	2480.000000	1.260000	---	PASS
3DH5	2402.000000	1.255000	---	PASS
	2441.000000	1.265000	---	PASS
	2480.000000	1.265000	---	PASS

DH5

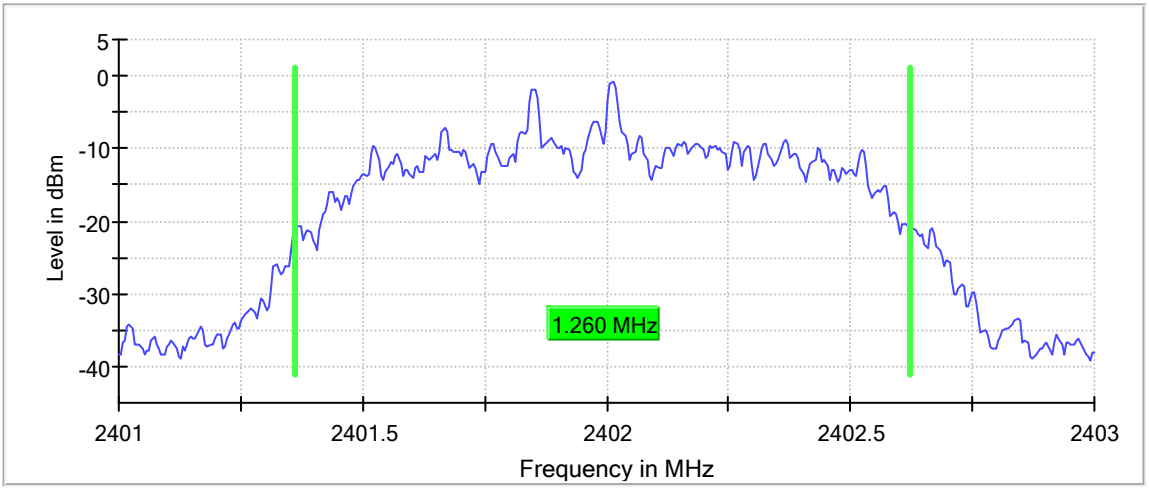




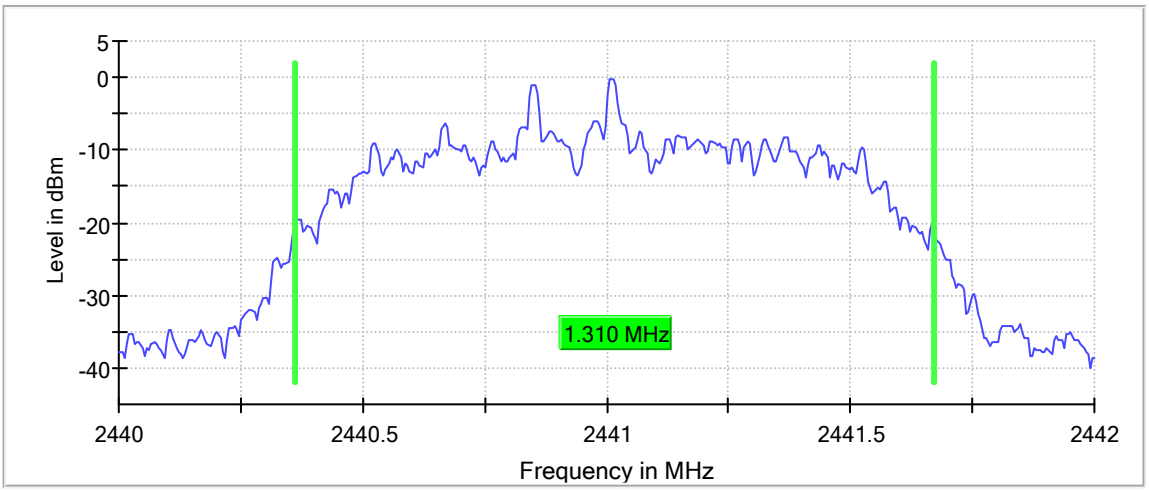


2DH5

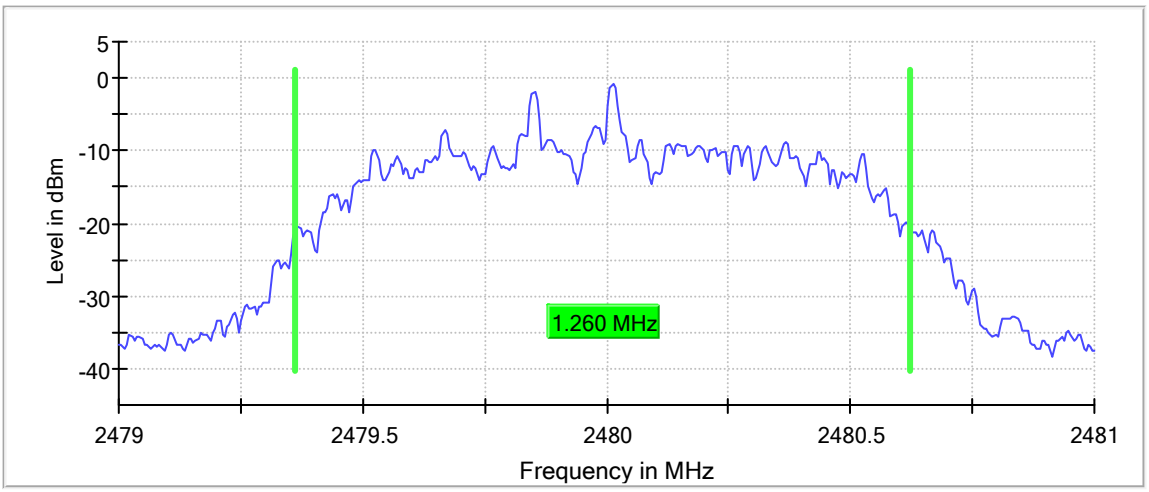
20 dB Bandwidth



20 dB Bandwidth

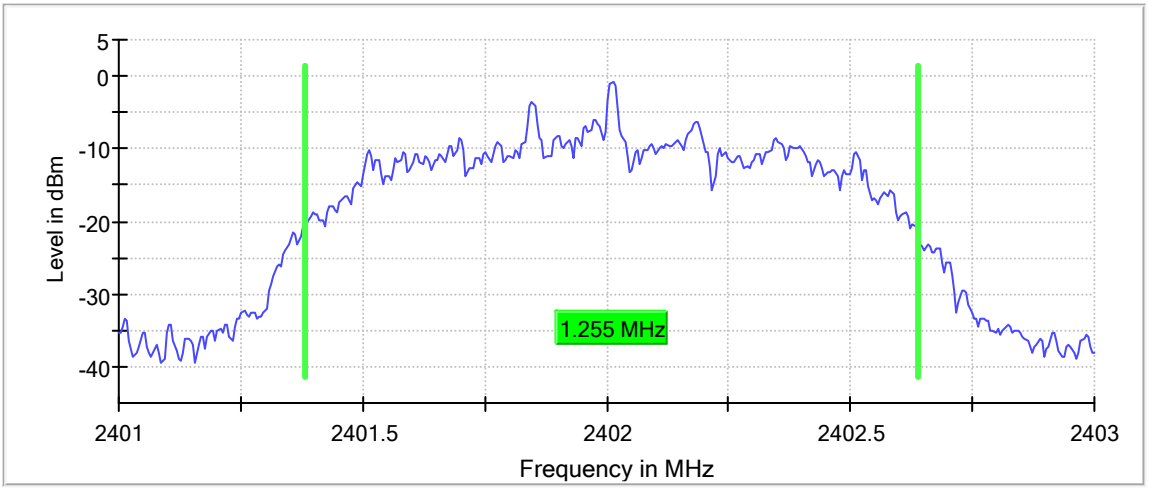


20 dB Bandwidth

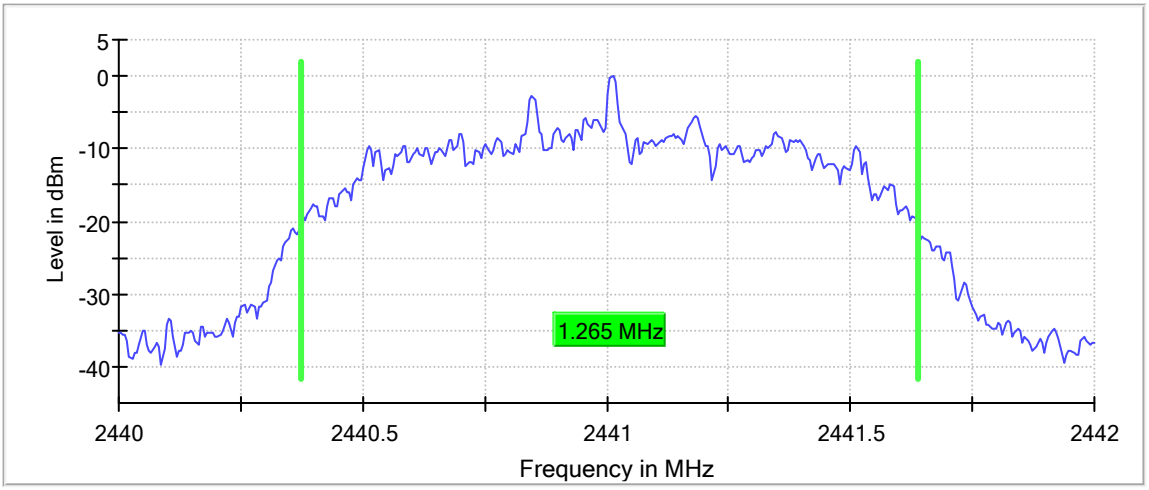


3DH5

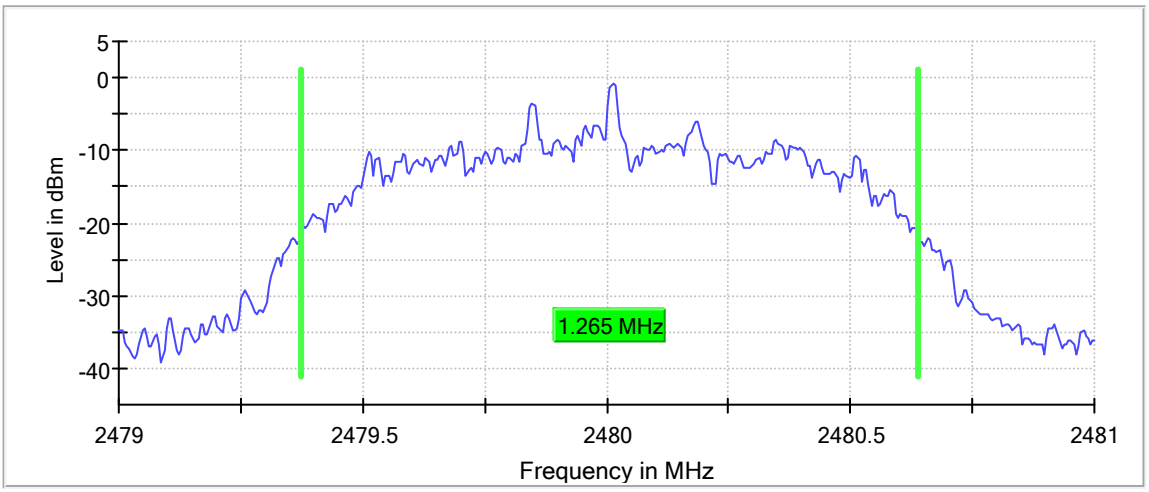
20 dB Bandwidth



20 dB Bandwidth



20 dB Bandwidth



Measurement

Setting	Instrument Value	Target Value
Start Frequency	2.47900 GHz	2.47900 GHz
Stop Frequency	2.48100 GHz	2.48100 GHz
Span	2.000 MHz	2.000 MHz
RBW	30.000 kHz	>= 30.000 kHz
VBW	100.000 kHz	>= 100.000 kHz
SweepPoints	400	~ 400
Sweeptime	189.648 µs	AUTO
Reference Level	0.000 dBm	0.000 dBm
Attenuation	20.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	200	200
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	8 / max. 150	max. 150
Stable	5 / 5	5
Max Stable Difference	0.15 dB	0.50 dB

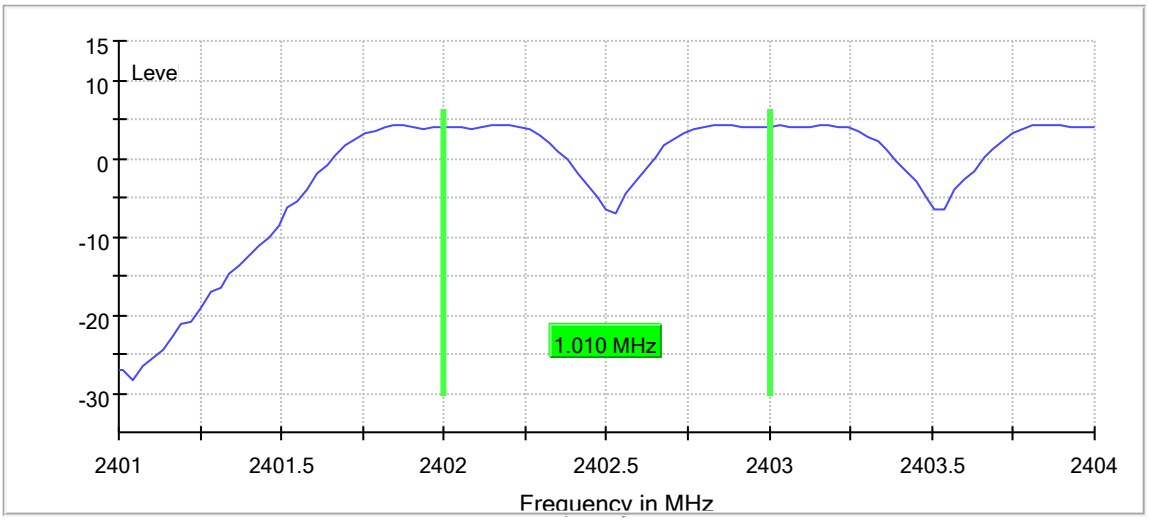
Remark: Cable loss 0.8dB was considered and set in system configuration.

9.3 Carrier Frequency Separation

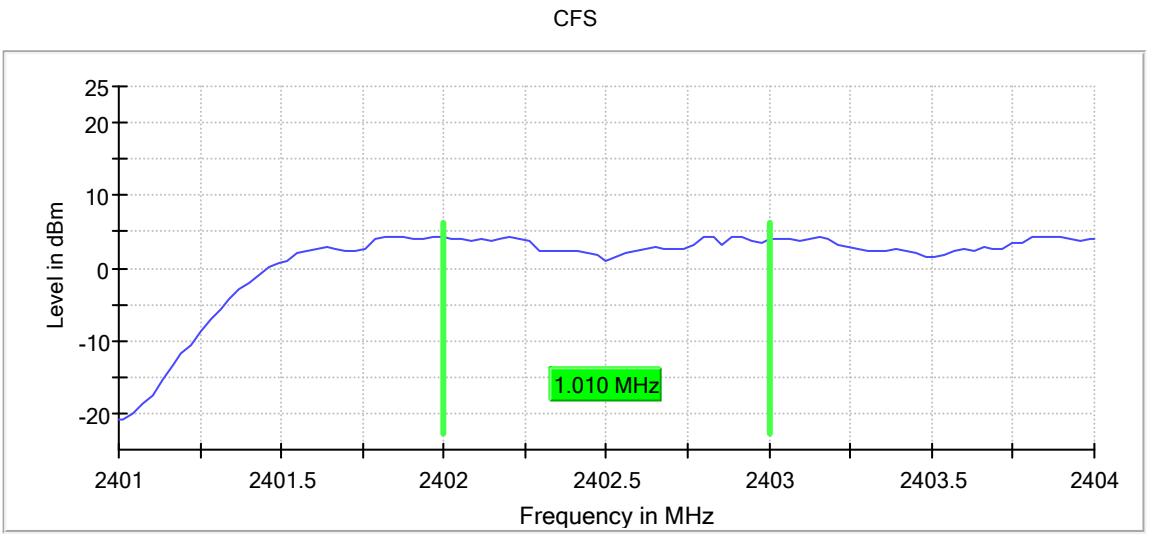
Test Mode	Frequency (MHz)	Bandwidth (MHz)	Limit (MHz)	Result
DH5	2402.000000	1.009900	0.616667	PASS
2DH5	2402.000000	1.009900	0.840000	PASS
3DH5	2402.000000	0.980198	0.836667	PASS

Remark: Limit = 2/3* 20dB Bandwidth
The channel shown is the worst case:

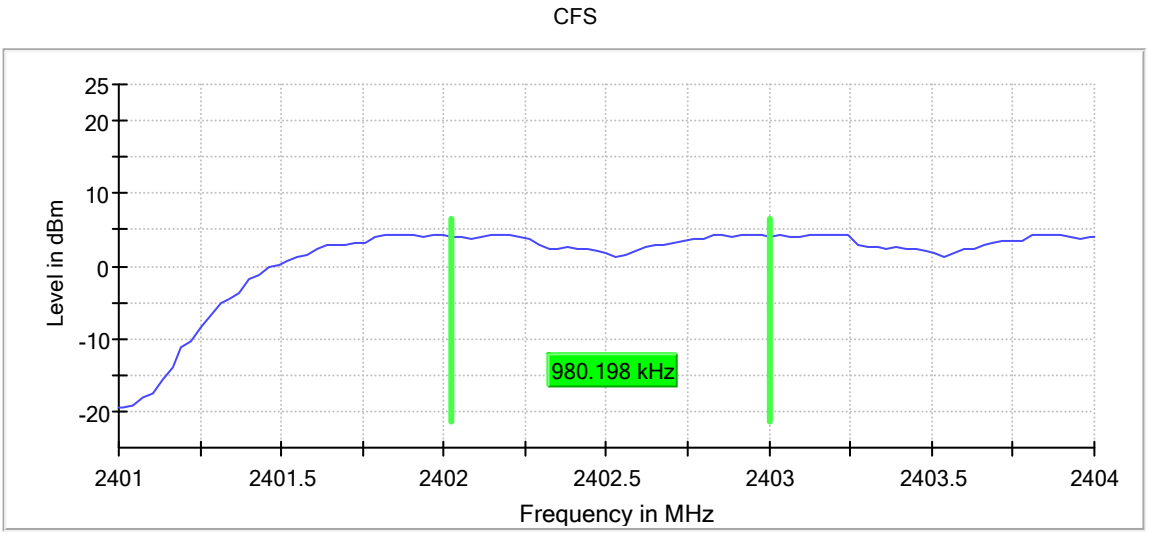
DH5



2DH5



3DH5



Measurement

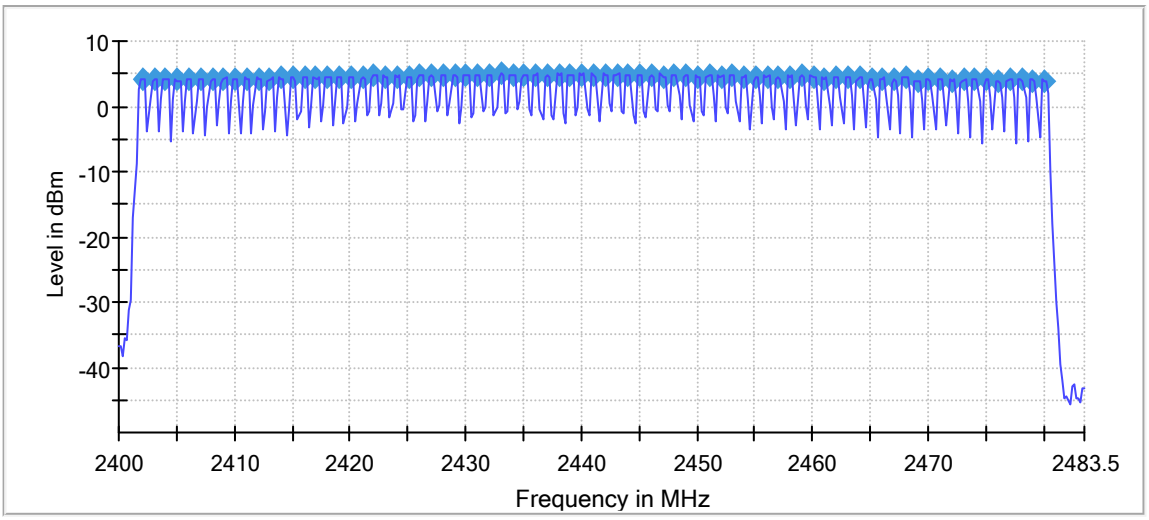
Setting	Instrument Value	Target Value
Start Frequency	2.40100 GHz	2.40100 GHz
Stop Frequency	2.40400 GHz	2.40400 GHz
Span	3.000 MHz	3.000 MHz
RBW	300.000 kHz	<= 300.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	101	~ 10
Sweeptime	1.000 ms	AUTO
Reference Level	0.000 dBm	0.000 dBm
Attenuation	20.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	200	200
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	28 / max. 150	max. 150
Stable	10 / 10	10
Max Stable Difference	0.02 dB	0.50 dB

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

9.4 Hopping Channel Number

Hopping Channel Number	Limit Min	Result
79	15	PASS

Remark: Only the worst case is shown.



Measurement

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	200.000 kHz	<= 299.000 kHz
VBW	200.000 kHz	>= 200.000 kHz
SweepPoints	418	~ 418
Sweeptime	1.060 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	43 / max. 150	max. 150
Stable	3 / 3	3
Max Stable Difference	0.37 dB	0.50 dB

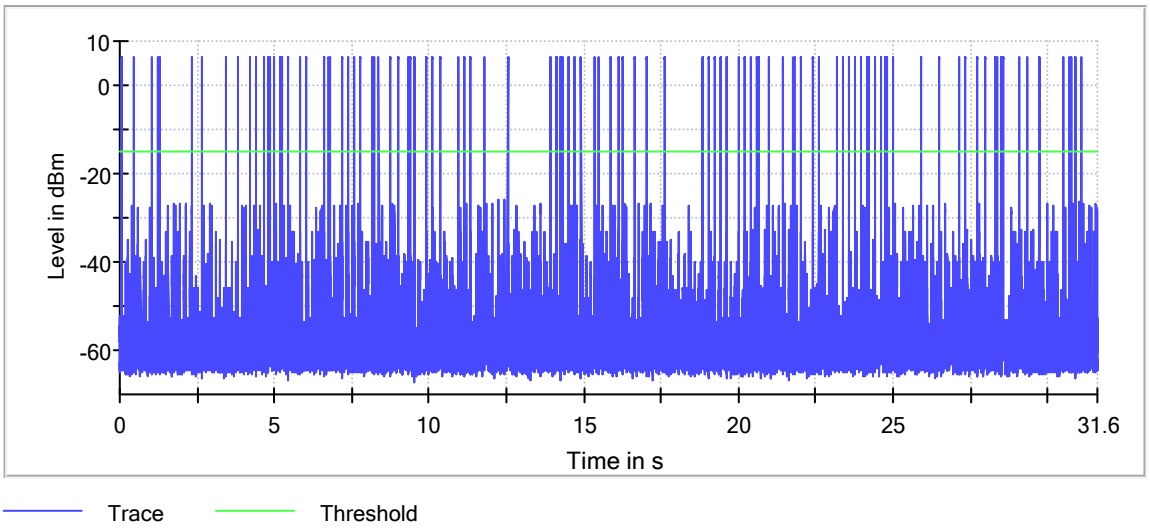
Remark: Cable loss 0.8dB was considered and set in system configuration.

9.5 Dwell Time

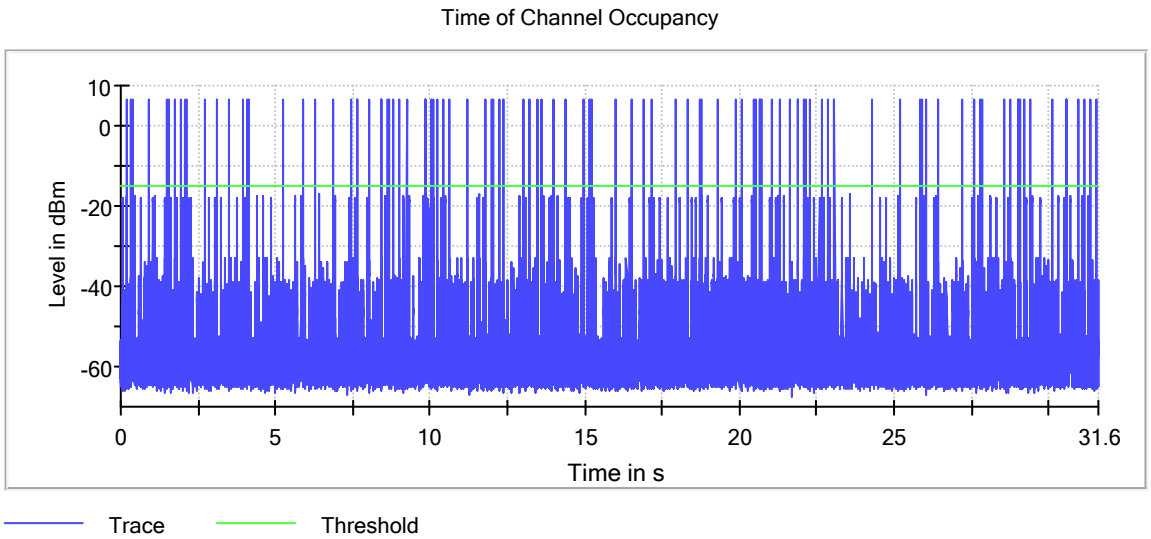
Test Mode	Frequency (MHz)	Number of Channel	Observation Time (s)	Dwell Time (ms)	Limit (ms)	Result
DH5	2402.000000	79	31.6	336.330	≤400.000	PASS
2DH5	2402.000000	79	31.6	287.500	≤400.000	PASS
3DH5	2402.000000	79	31.6	278.920	≤400.000	PASS

Remark: The channel shown is the worst case:

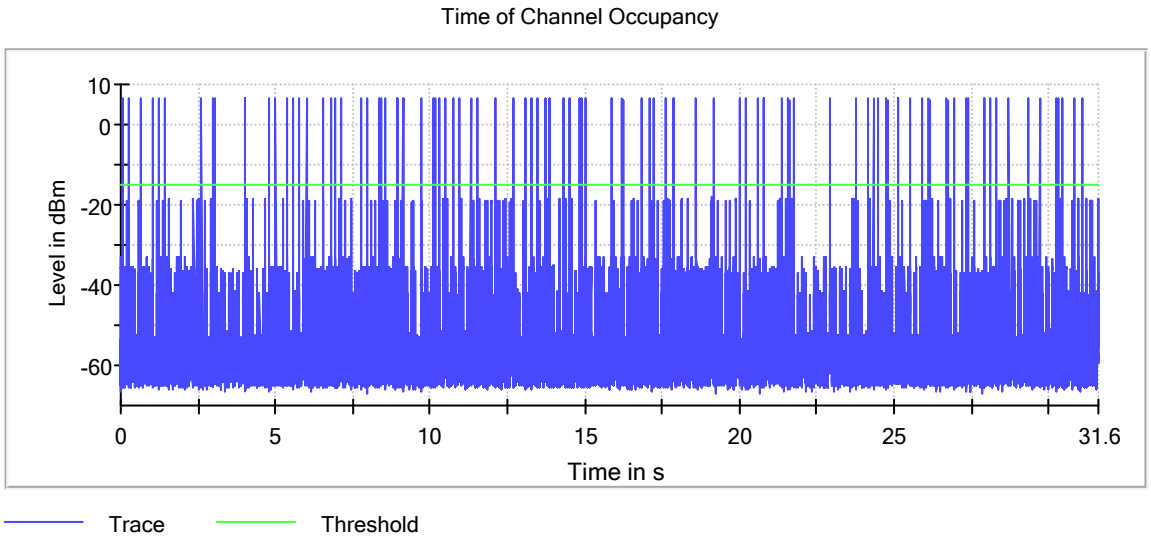
DH5



2DH5



3DH5



Measurement

Setting	Instrument Value	Target Value
Center Frequency	2.40200 GHz	2.40200 GHz
Span	ZeroSpan	ZeroSpan
RBW	500.000 kHz	~ 500.000 kHz
VBW	1.000 MHz	~ 1.500 MHz
SweepPoints	30001	~ 30001
Sweeptime	31.600 s	31.600 s
Reference Level	-10.000 dBm	-10.000 dBm
Attenuation	0.000 dB	0.000 dB
Detector	MaxPeak	MaxPeak
SweepCount	1	1
Filter	Channel	Channel
Trace Mode	Clear Write	Clear Write
Sweeptype	Sweep	AUTO
Preamp	off	off
Trigger	External	External
Trigger Offset	0.000 s	0.000 s

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

9.6 Conducted Band Edge Measurement

DH5

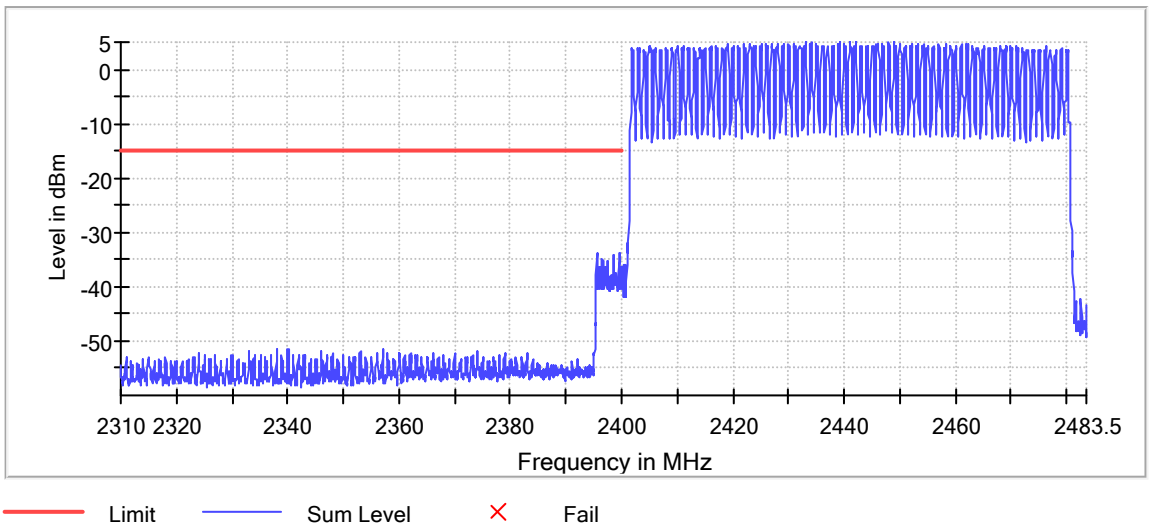
Hopping:

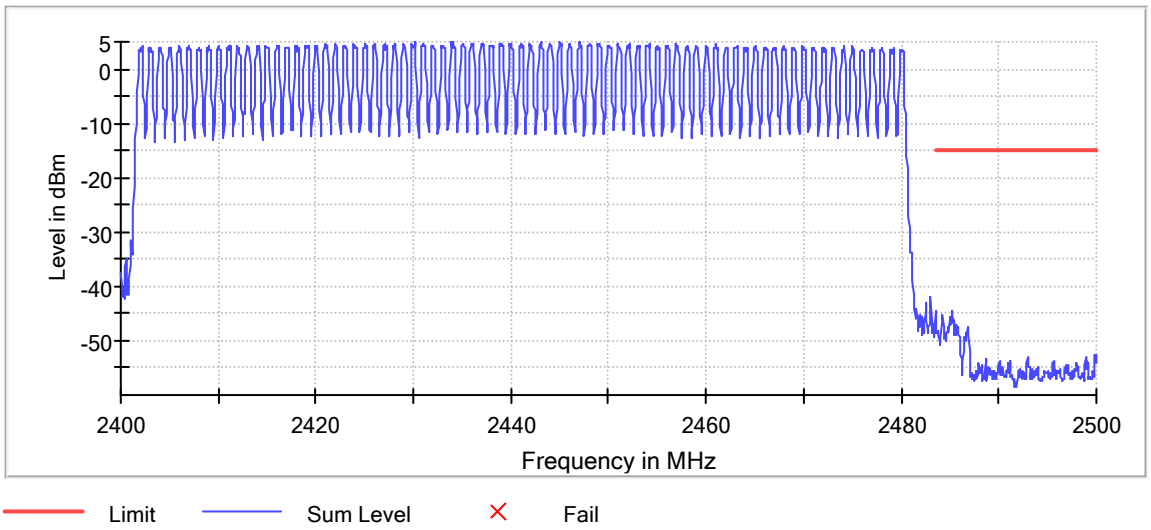
Inband Peak

Frequency (MHz)	Level (dBm)
2402.200000	5.0
2479.775000	4.9

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2395.525000	-33.8	18.8	-15.0	PASS
2485.225000	-44.3	29.2	-15.1	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	137 / max. 150	max. 150
Stable	3 / 3	3
Max Stable Difference	0.10 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 µs	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	25 / max. 150	max. 150
Stable	3 / 3	3
Max Stable Difference	0.00 dB	0.50 dB

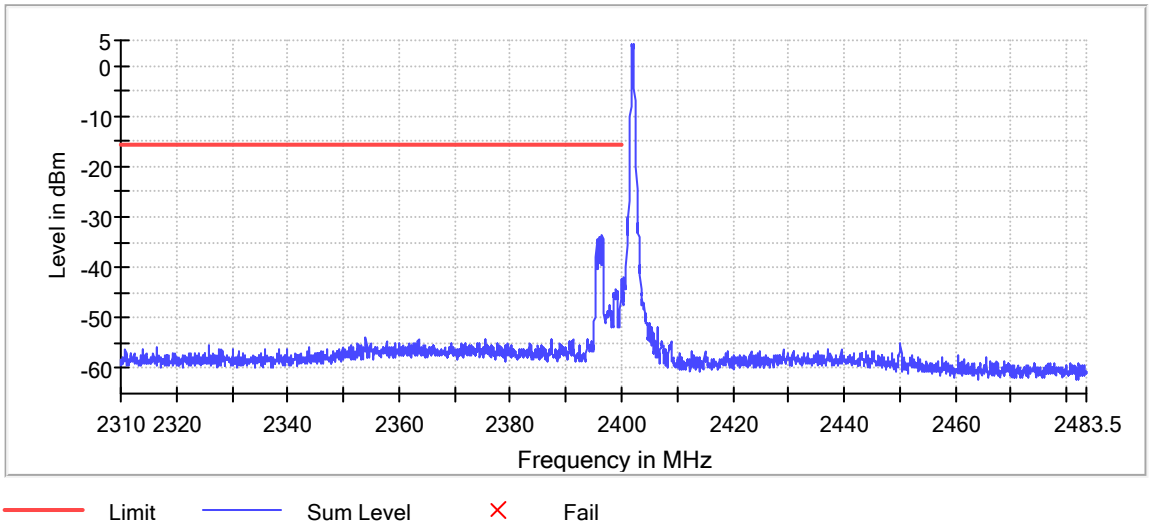
Remark: Cable loss 0.8dB was considered and set in system configuration.

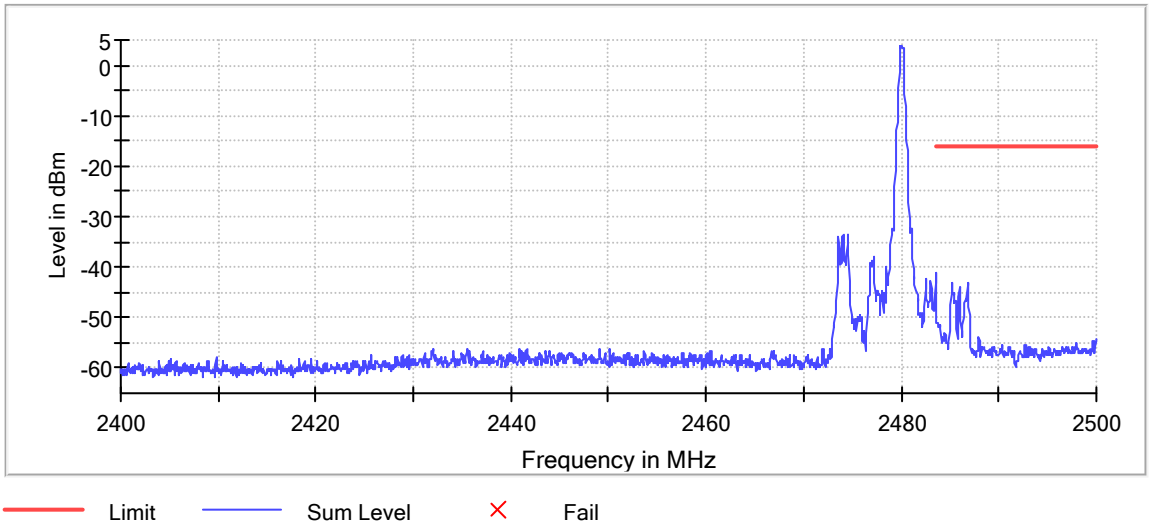
Non-Hopping:
Inband Peak

Frequency (MHz)	Level (dBm)
2402.200000	4.2
2479.775000	4.0

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2396.525000	-33.7	17.9	-15.8	PASS
2483.525000	-41.0	25.0	-16.0	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	7 / max. 150	max. 150
Stable	3 / 3	3
Max Stable Difference	0.00 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 µs	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	15 / 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.

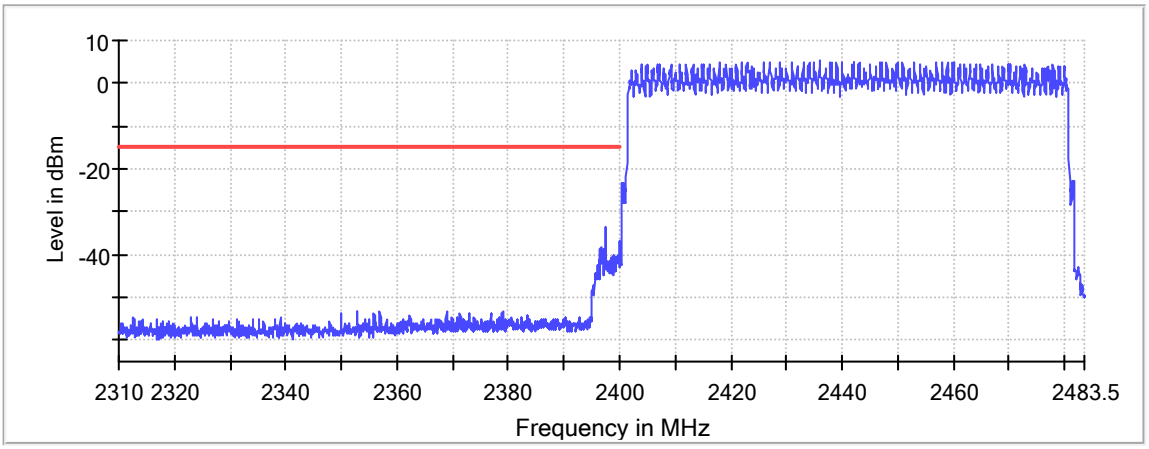
2DH5
Hopping:
Inband Peak

Frequency (MHz)	Level (dBm)
2402.200000	5.1
2479.775000	5.2

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2397.525000	-33.5	18.6	-14.9	PASS
2485.025000	-50.9	36.1	-14.8	PASS

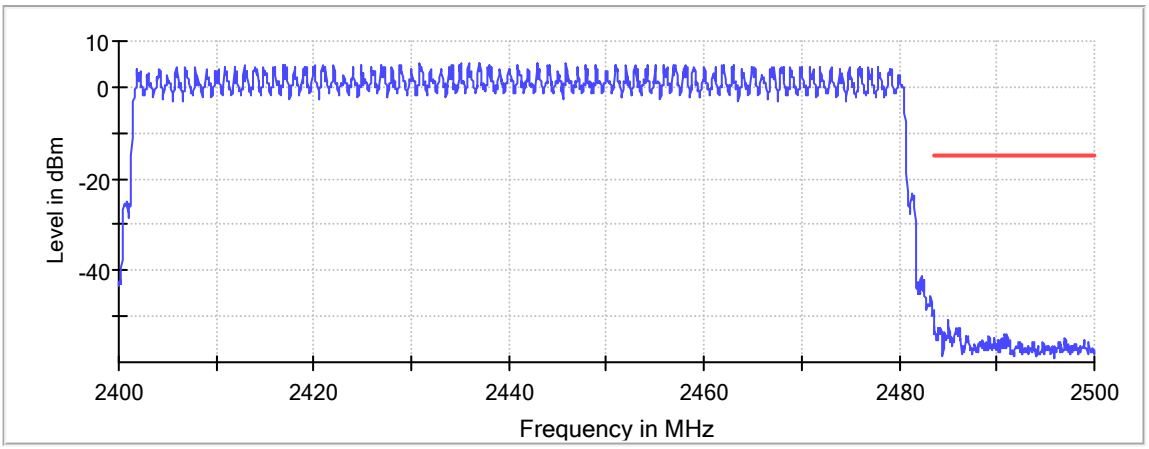
Remark: Limit = Inband peak – 20dB
Only the worst case is shown.

Band Edge



Limit Sum Level Fail

Band Edge



Limit Sum Level Fail

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	139 / max. 150	max. 150
Stable	3 / 3	3
Max Stable Difference	0.00 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 µs	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.

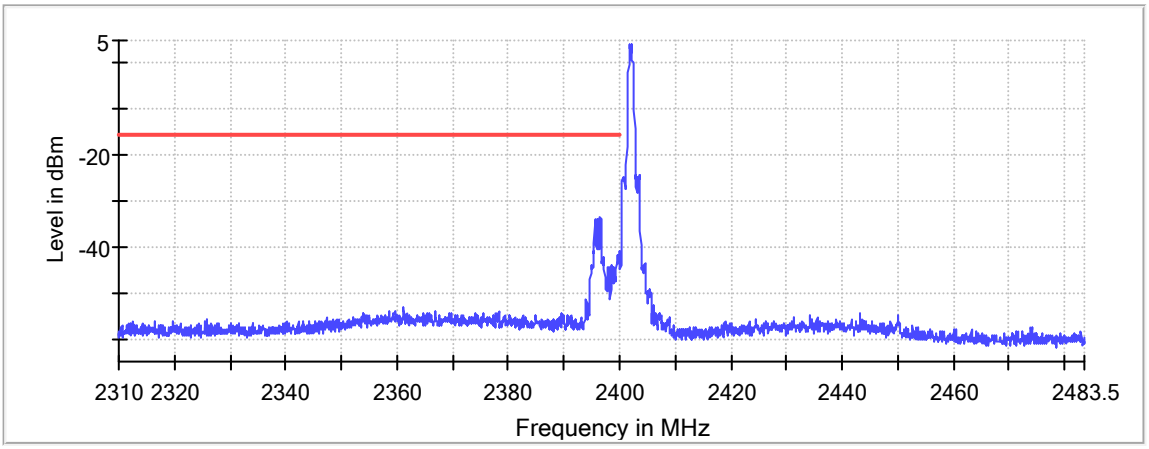
Non-Hopping:
Inband Peak

Frequency (MHz)	Level (dBm)
2402.200000	4.3
2479.775000	4.2

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2396.525000	-33.4	17.7	-15.7	PASS
2483.525000	-41.9	26.1	-15.8	PASS

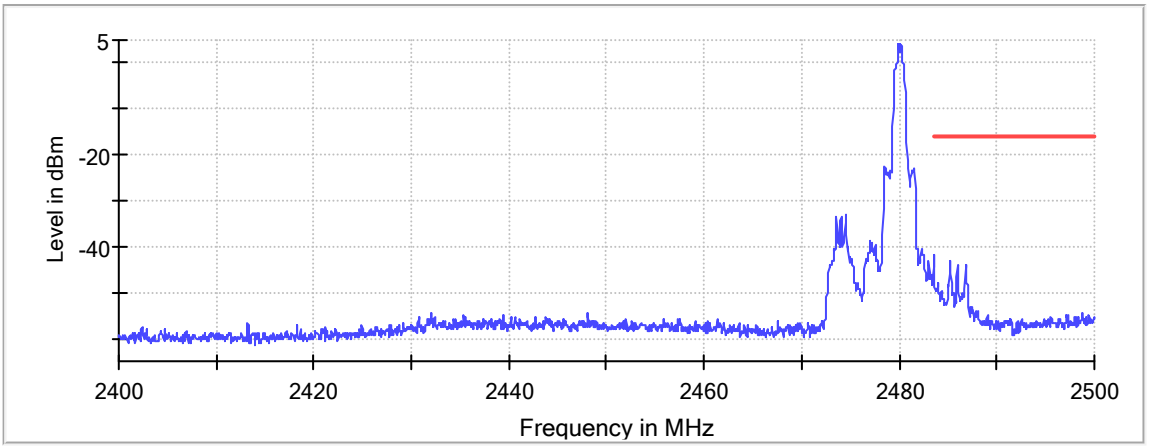
Remark: Limit = Inband peak – 20dB
Only the worst case is shown.

Band Edge



Limit Sum Level Fail

Band Edge



Limit Sum Level Fail

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	17 / max. 150	max. 150
Stable	3 / 3	3
Max Stable Difference	0.15 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 µs	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	3 / 3	3
Max Stable Difference	0.43 dB	0.50 dB

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

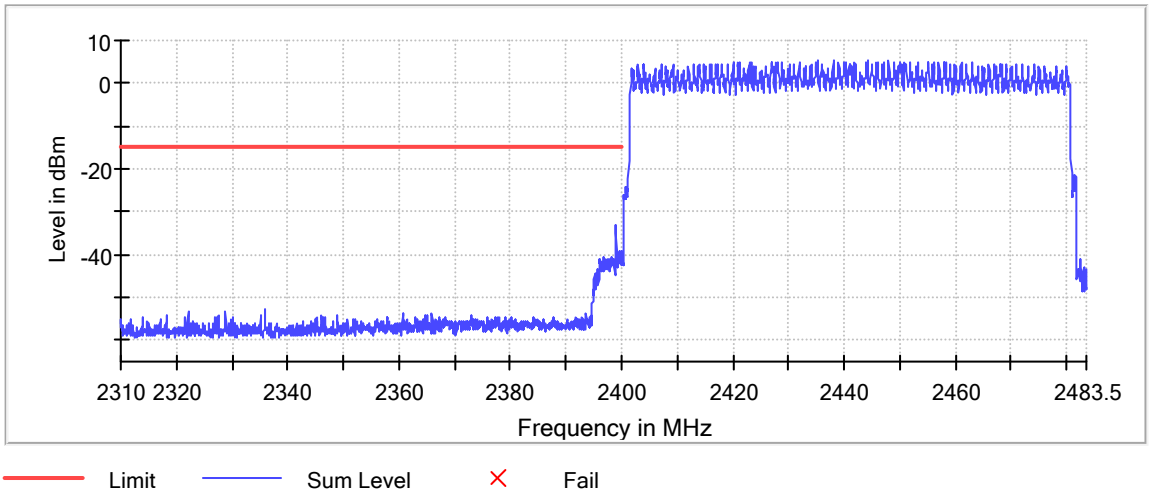
3DH5
Hopping:
Inband Peak

Frequency (MHz)	Level (dBm)
2402.200000	5.2
2479.775000	5.2

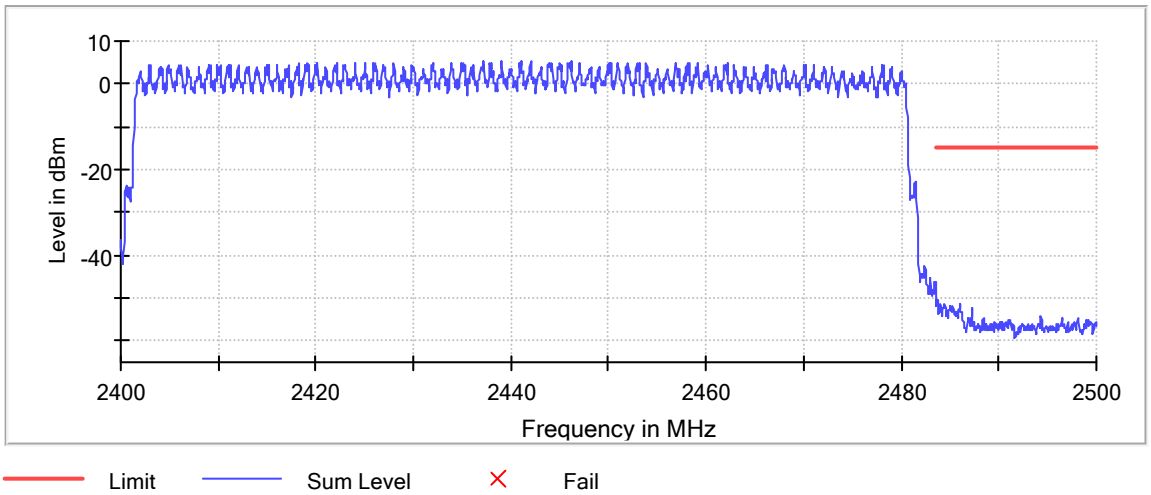
Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2399.025000	-33.4	18.5	-14.8	PASS
2483.525000	-49.7	34.9	-14.8	PASS

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	128 / max. 150	max. 150
Stable	3 / 3	3
Max Stable Difference	0.09 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 µs	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	5 / 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.

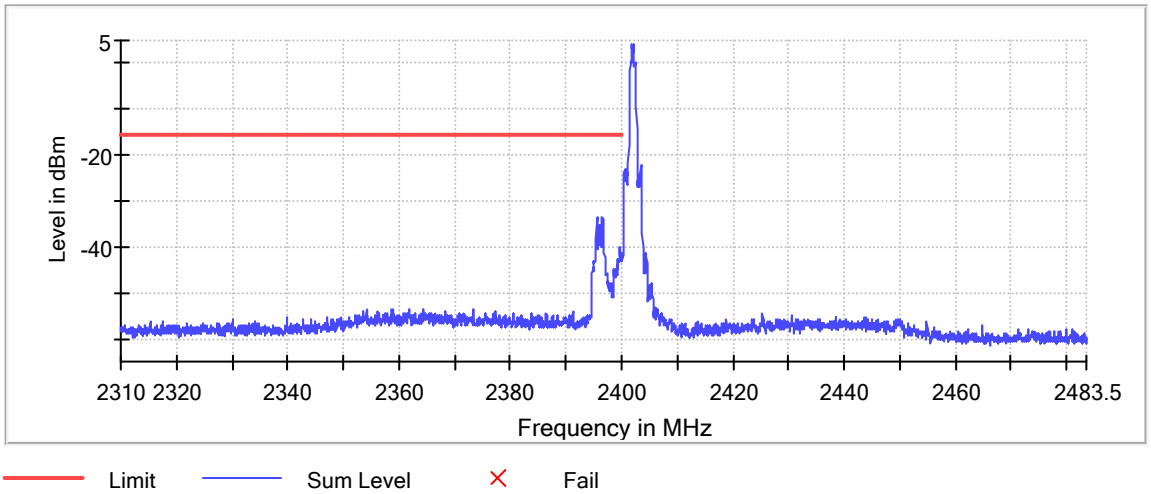
Non-Hopping:
Inband Peak

Frequency (MHz)	Level (dBm)
2402.200000	4.3
2479.775000	4.2

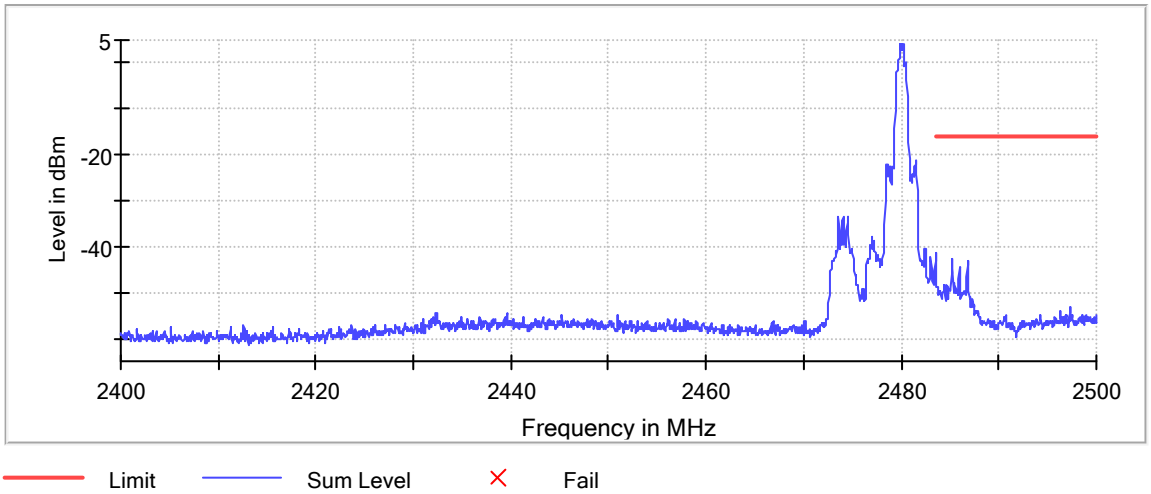
Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2396.525000	-33.5	17.8	-15.7	PASS
2483.525000	-41.5	25.7	-15.8	PASS

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	16 / max. 150	max. 150
Stable	3 / 3	3
Max Stable Difference	0.00 dB	0.50 dB

Measurement 2

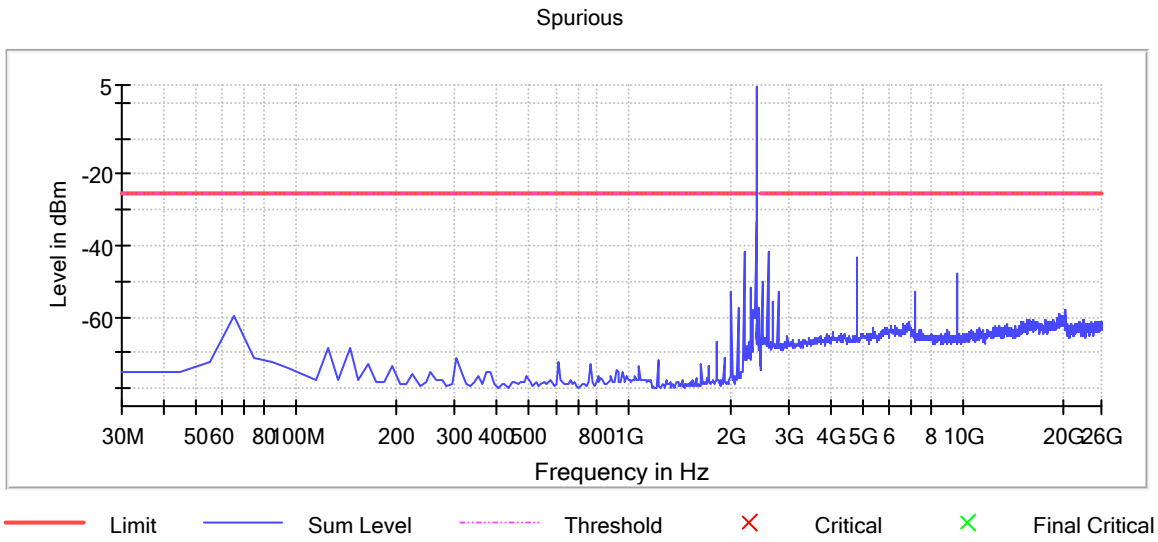
Setting	Instrument Value	Target Value
Start Frequency	2.48350 GHz	2.48350 GHz
Stop Frequency	2.50000 GHz	2.50000 GHz
Span	16.500 MHz	16.500 MHz
RBW	100.000 kHz	<= 100.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	330	~ 330
Sweeptime	37.969 µs	AUTO
Reference Level	0.000 dBm	0.000 dBm
Attenuation	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	11 / 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.

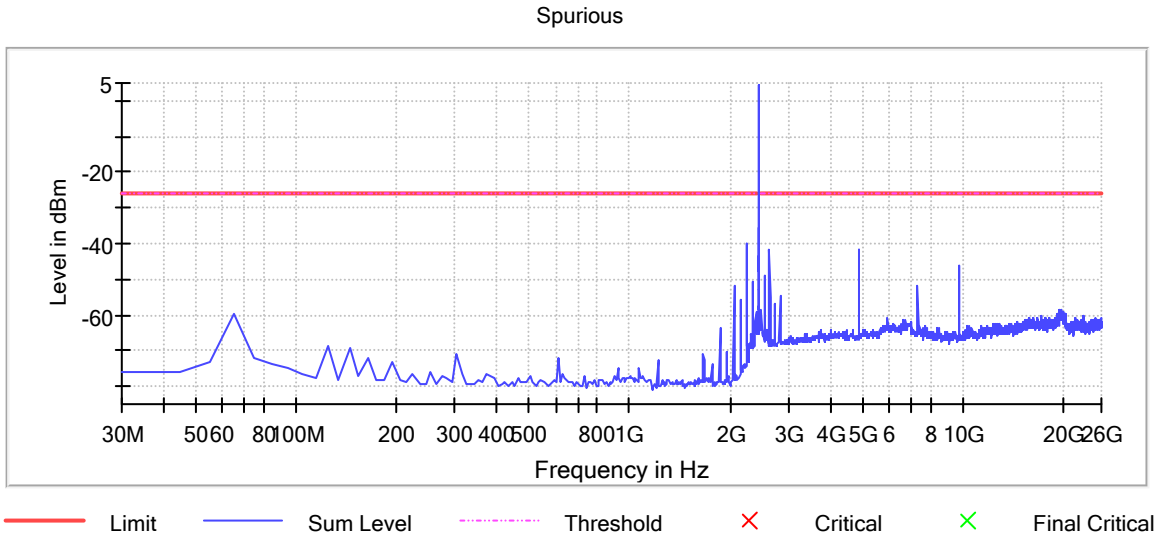
9.7 Conducted spurious emission

DH5

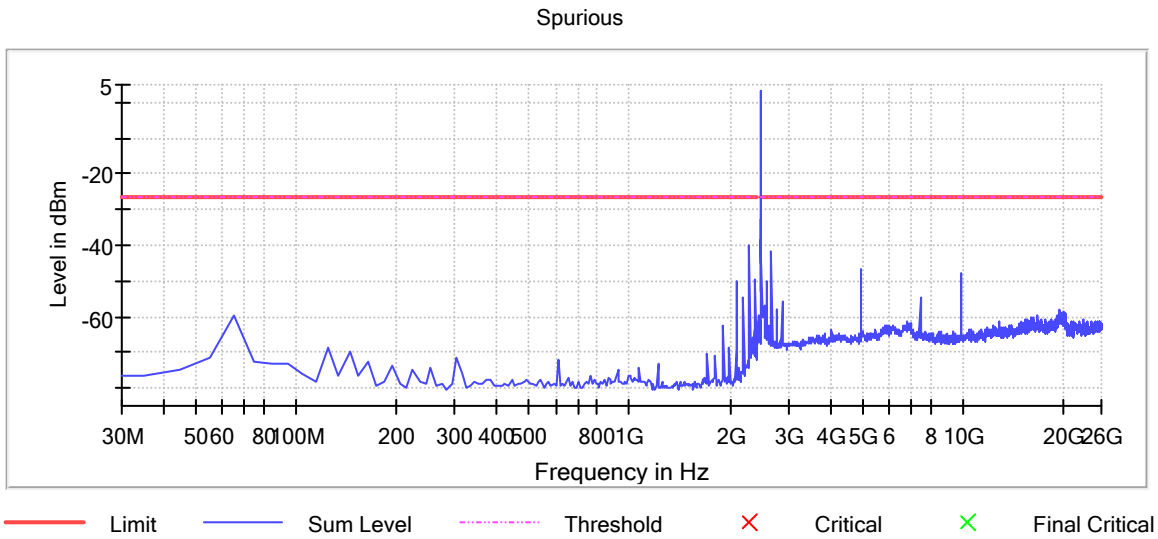
Lowest Channel



Middle Channel



Highest Channel



Remark: Only the worst case is shown.

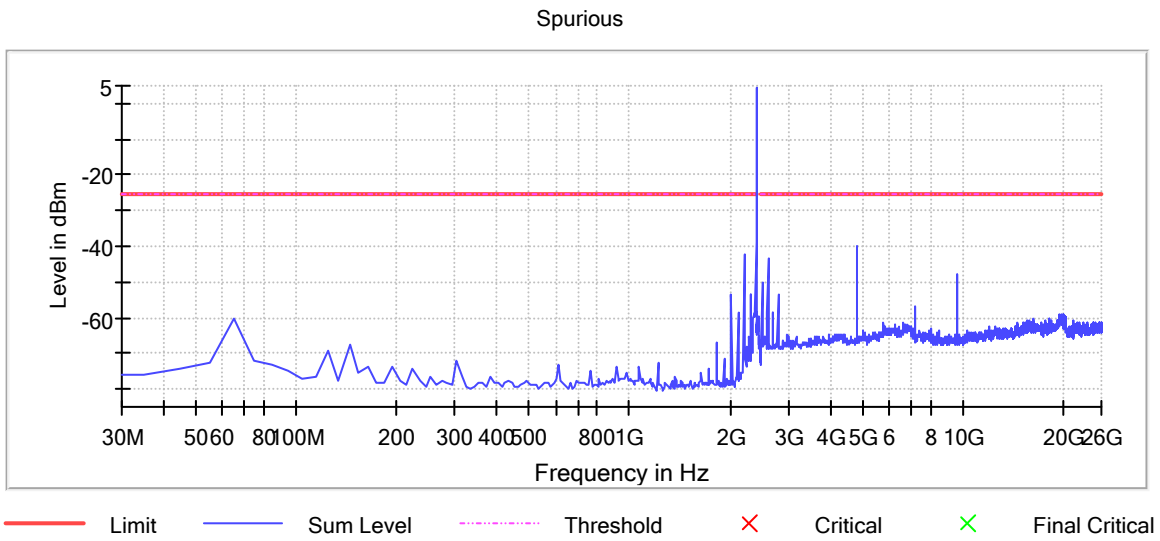
Pre Measurement 1

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	7 / max. 40	max. 40
Stable	3 / 3	3
Max Stable Difference	0.00 dB	0.50 dB

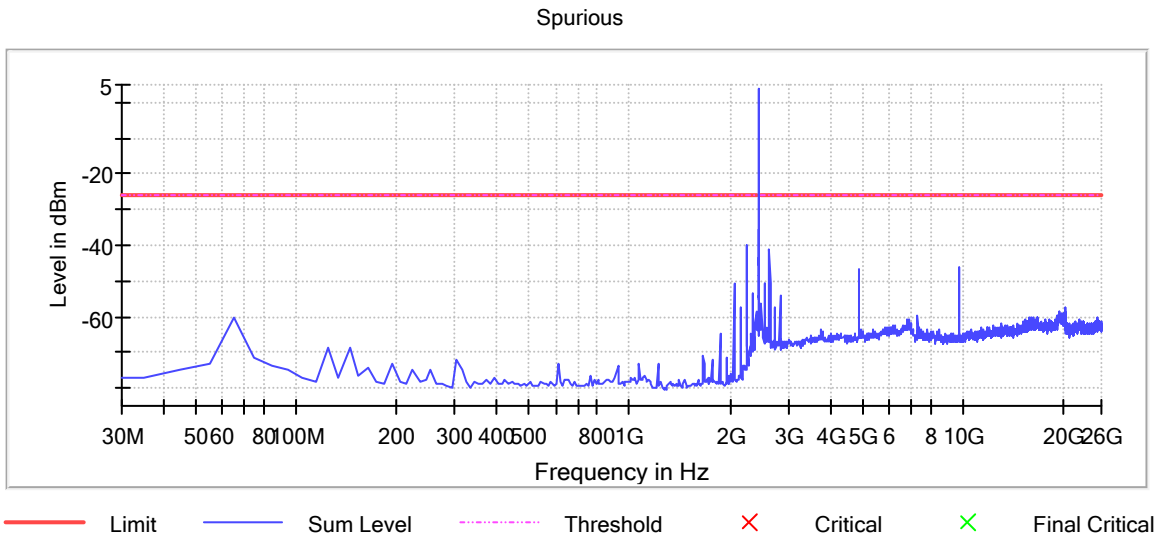
Remark: Cable loss 0.8dB was considered and set in system configuration.

2DH5

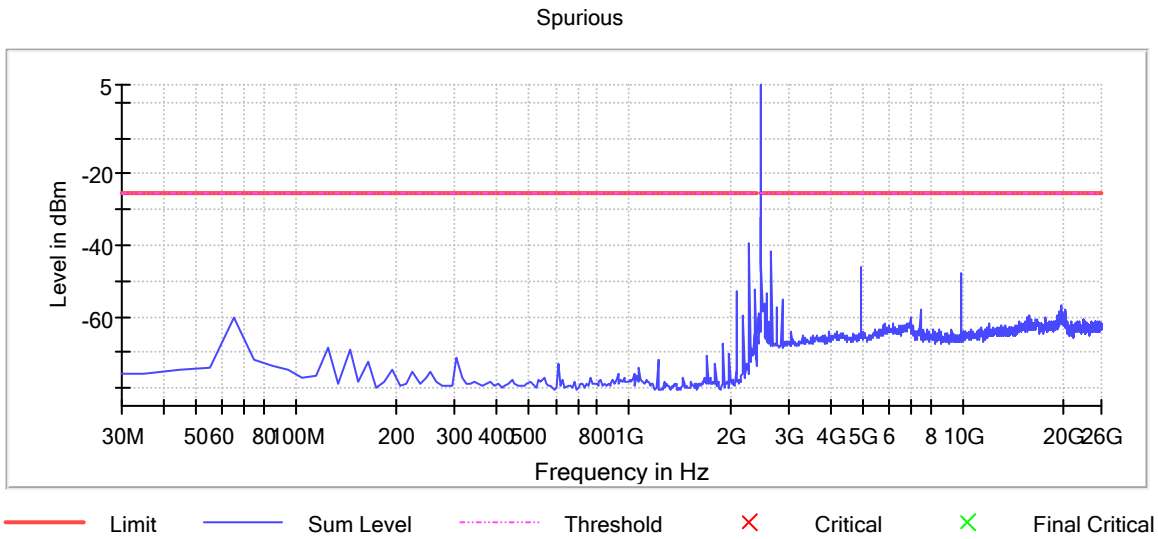
Lowest Channel



Middle Channel



Highest Channel



Remark: Only the worst case is shown.

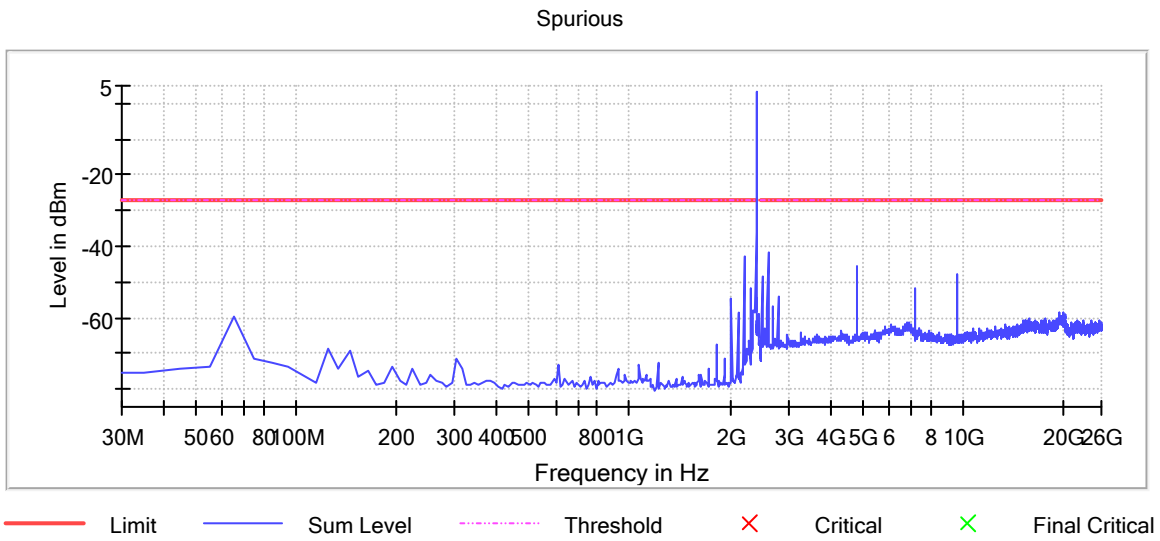
Pre Measurement 1

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	4 / max. 40	max. 40
Stable	3 / 3	3
Max Stable Difference	0.00 dB	0.50 dB

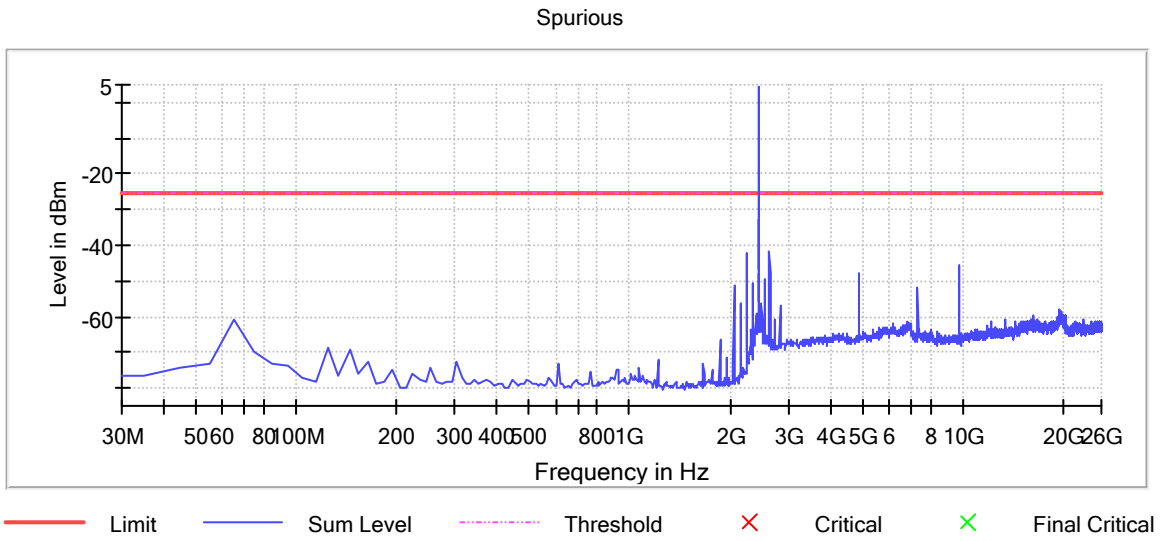
Remark: Cable loss 0.8dB was considered and set in system configuration.

3DH5

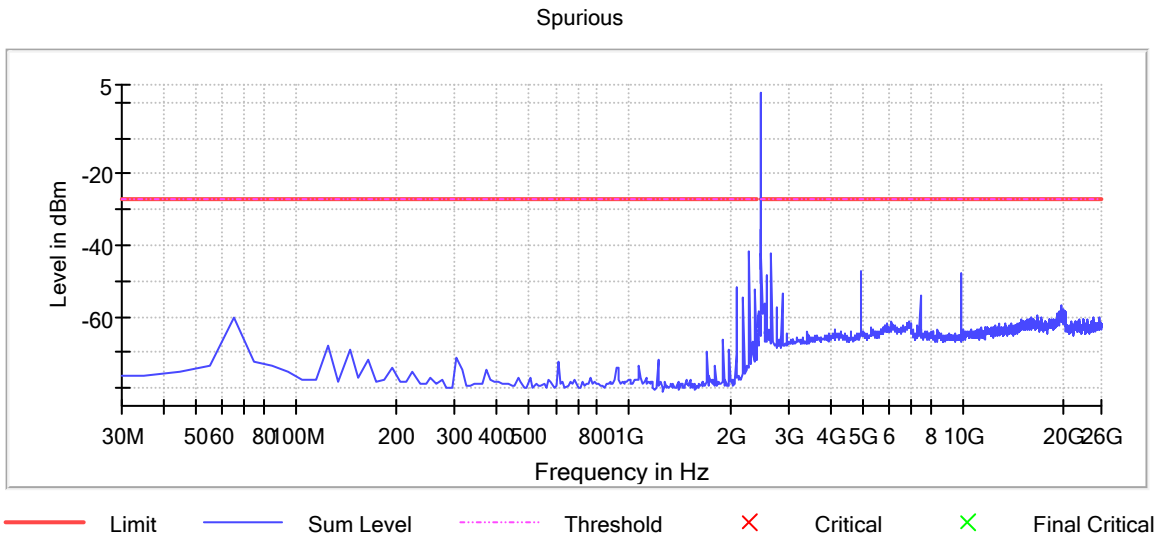
Lowest Channel



Middle Channel



Highest Channel



Remark: Only the worst case is shown.

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 -