TEST REPORT

Application No.:	HKEM2012001282AT
Applicant:	Home Fragrance Italia S.r.L.
Address of Applicant:	Via Tonale 26, Milan 20125, Italy
Equipment Under Test (EUT):	
EUT Name:	Aroma Diffuser with speaker with wireless technology
Model No.:	NA-393
FCC ID:	2AZTFDUPL
Trade mark:	Millefiori
Standard(s) :	47 CFR Part 15, Subpart C 15.247
Date of Receipt:	2020-12-03
Date of Test:	2020-12-09 to 2020-12-22
Date of Issue:	2020-12-28
Test Result:	**Pass***

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

Law Man Kit
EMC Manager

Revision Record				
Version	**Chapter**	**Date**	**Modifier**	**Remark**
01		*2020-12-28*		*Original*

Authorized for issue by:				
				
		Leo Xu /Project Engineer		Date: 2020-12-28
				
		Law Man Kit /Reviewer		Date: 2020-12-28

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 7.8.2	47 CFR Part 15, Subpart C 15.247a(1)	Pass
Hopping Channel Number	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
Dwell Time	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
Conducted Band Edges Measurement	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 Spurious Emissions	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
Radiated Emissions which fall in the restricted bands	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 6.10.5	47 CFR Part 15, Subpart C 15.205 & 15.209	Pass
Radiated Spurious Emissions	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 6.4,6.5,6.6	47 CFR Part 15, Subpart C 15.205 & 15.209	Pass

Declaration of EUT Family Grouping:

N/A

Abbreviation:

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

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

RF: In this whole report RF means Radiated Frequency.

CH: In this whole report CH means channel.

Volt: In this whole report Volt means Voltage.

Temp: In this whole report Temp means Temperature.

Humid: In this whole report Humid means humidity.

Press: In this whole report Press means Pressure.

N/A: In this whole report not application.

3 Contents

4 General Information

4.1 Details of E.U.T.

Power supply:	Adaptor model: GQ12-120100-AG Input: AC 100-240V, 50/60Hz, 0.4A Output: DC12V, 1A
Test voltage:	AC 120V
Cable:	Power Cable: 185 cm unshielded 2 wires DC cable
Antenna Gain:	0 dBi
Antenna Type:	Integral Antenna
Bluetooth Version:	V5.0 Classic
Channel Spacing:	1MHz
Modulation Type:	GFSK, π/4DQPSK, 8DPSK
Number of Channels:	79
Operation Frequency:	2402MHz to 2480MHz
Spectrum Spread Technology:	Frequency Hopping Spread Spectrum(FHSS)
Series number:	A1
Hardware Version:	V3.1
Software Version:	V1.0

4.2 Description of Support Units

The EUT has been tested with corresponding accessories as below:
Supplied by SGS:

Description	Manufacturer	Model No.	Serial No.
Galaxy A51	Samsung	SM-A515F	R58N23ACSTV
Surface Pro	Microsoft	1866	N/A

4.3 Modulation configure

RF software:	BK32xx RF Test_V1.5			
Modulation	**Packet**	**Packet Type**	**Packet Size**	**Power**
GFSK	DH1	Pn9	Default	2
	DH3	Pn9	Default	2
	DH5	Pn9	Default	2
	DM1	Pn9	Default	2
	DM3	Pn9	Default	2
	DM5	Pn9	Default	2
	HV1	Pn9	Default	2
	HV2	Pn9	Default	2
	HV3	Pn9	Default	2
π/4DQPSK	2DH1	Pn9	Default	2
	2DH3	Pn9	Default	2
	2DH5	Pn9	Default	2
8DPSK	3DH1	Pn9	Default	2
	3DH3	Pn9	Default	2
	3DH5	Pn9	Default	2
Remark: 1. Only two samples were used for RF test.				

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	4.9dB (30MHz-1GHz)
		4.6dB (1GHz-6GHz)
		4.7dB (6GHz-18GHz)
		5.6dB (18GHz-40GHz)
8	Temperature test	± 1℃
9	Humidity test	± 3%
10	Supply voltages	± 1.5%
11	Time	± 3%

Remark:

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

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

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

4.5 Test Location

All tests were performed at:

SGS Hong Kong Limited

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

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

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

No tests were sub-contracted.

4.6 Test Facility

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

- **HOKLAS (Lab Code: 009)**

SGS Hong Kong Limited has been accepted by HKAS Executive, on the recommendation of the Accreditation Advisory Board, as a HOKLAS Accredited Laboratory, this laboratory meets the requirements of ISO/IEC 17025:2017 an it has been accredited for performing specific test as listed in the scope of accreditation within the test category of Electrical and Electronic Products.

- **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

Conducted Emissions at AC Power Line (150kHz-30MHz)					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
EMI Test Receiver 9kHz to 3.6GHz	Rohde & Schwarz	ESR3 / 102326	E231	2020/08/31	2021/08/30
Signal Generator	Rohde & Schwarz	SMT03	E177	2020/03/12	2021/03/11
Artificial Mains Network (LISN)	Schwarzbeck	NSLK 8127 / 8127312	E005	2020/05/12	2021/05/11
Impulse Limiter	Rohde & Schwarz	ESH-3-Z2 / 357881052	E028	2020/09/12	2021/09/11
EMC32 Test software	Rohde & Schwarz	Version 10	N/A	N/A	N/A

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**
SMBV100A VECTOR SIGNAL GENERATOR	Rohde & Schwarz	SMBV100A	E234	2020/08/31	2021/08/30
FSV40 SIGNAL ANALYZER 40GHz	Rohde & Schwarz	FSV40	E235	2020/08/31	2021/08/30
Wireless Conn. Tester (CMW)	Rohde & Schwarz	CMW270	E240	CAL IN USE	CAL IN USE
OSP	Rohde & Schwarz	OSP-B157W8	E242	2020/08/31	2021/08/30
Cable	Rohde & Schwarz	J12J103539-00-2	E239	2020/09/21	2021/09/20
Cable	Rohde & Schwarz	J12J103539-00-2	E239	2020/09/21	2021/09/20
WMS32 Test software	Rohde & Schwarz	N/A	Version 11	N/A	N/A

Radiated Spurious Emissions					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
3m Semi-Anechoic Chamber	ChamPro	N/A	E229	2020/08/09	2021/08/08
Coaxial Cable	SGS	N/A	E167	2020/07/20	2021/07/19
EMI Test Receiver 9kHz to 7GHz	Rohde & Schwarz	ESR7 / 102298	E314	2020/05/18	2021/05/18
TRILOG Super Broadb. Test Antenna, (25) 30-1000 MHz	Schwarzbeck	9168-1110	E311	2020/02/13	2022/02/12
EMC32 Test software	Rohde & Schwarz	Version 10	N/A	N/A	N/A
Signal and Spectrum Analyzer 2Hz - 26.5GHz	Rohde & Schwarz	FSW26	E296	2020/08/31	2021/08/30
Horn Antenna 1 - 18GHz	Schwarzbeck	BBHA9120D	E211	2020/03/11	2022/03/10
Horn Antenna 15 - 40GHz	Schwarzbeck	BBHA9170	E212	2020/01/29	2022/01/28
Preamplifier 33dB, 1 - 18GHz	Schwarzbeck	BBV9718	E214	2020/04/09	2021/04/08

Preamplifier 33dB, 18 - 26.5GHz	Schwarzbeck	BBV9719	E215	2019/04/24	2021/04/23
Broadband Coaxial Preamplifier typ. 30 dB, 18-40 G	Schwarzbeck	BBV 9721	E266	2020/09/21	2021/09/20
Highpass Filter 3.5-26.5GHz	Wainwright	WHNX3.5/26.5 G-6SS	E205	2019/04/24	2021/04/23
Band Reject Filter 2.4-2.5GHz	Wainwright	WRCJV 2400/2500-2100	E206	2019/04/24	2021/04/23
RF cable SMA to SMA 10000mm	HUBER+SUHNER	SF104-26.5/2*11SMA 45	E207	2020/09/21	2021/09/20
Boresight Mast Controller	ChamPro	AM-BS-4500-E	E237	N/A	N/A
Turntable with Controller	ChamPro	EM1000	E238	N/A	N/A

General used equipment					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
Digital temperature & humidity data logger	SATO	SK-L200TH II	E232	2020/09/12	2021/09/11
Electronic Digital Thermometer with Hygrometer	nil	2074/2075	E159	2020/09/12	2021/09/11
Barometer with digital thermometer	SATO	7612-00	E218	2020/04/23	2021/04/22
Conditional Chamber	Zhong Zhi Testing Instruments	CZ-E-608D	E216	2020/08/31	2021/08/30

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.

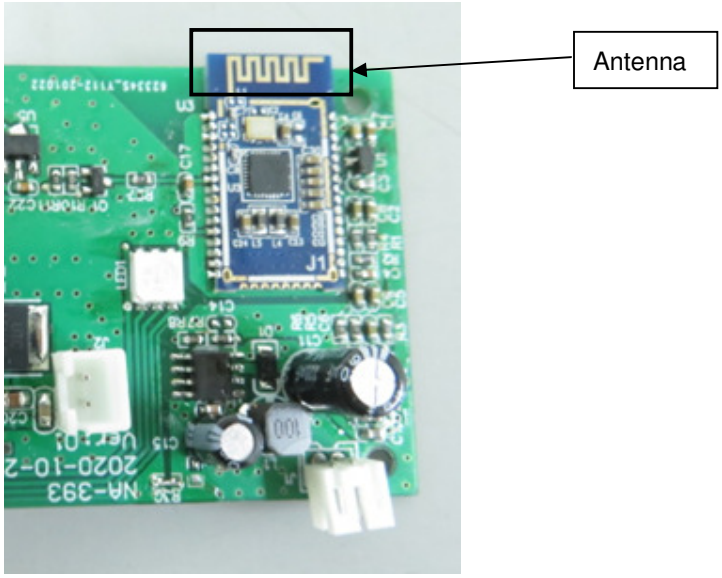
15.247(b) (4) requirement:

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 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 Emissions at AC Power Line (150kHz-30MHz)

Test Requirement 47 CFR Part 15, Subpart C 15.207

Test Method: ANSI C63.10 (2013) Section 6.2

Limit:

Frequency of emission(MHz)	Conducted limit(dBμV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50
*Decreases with the logarithm of the frequency.		

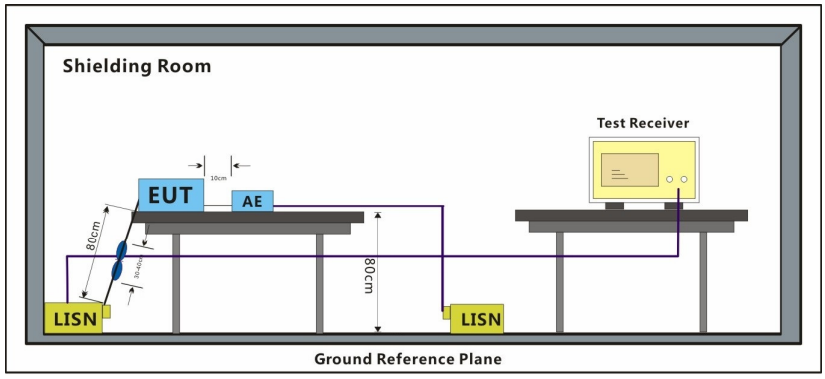
7.1.1 E.U.T. Operation

Operating Environment:

Temperature: 21.0 °C Humidity: 50.0 % RH :

Test mode a:TX_Keep the EUT transmitted the continuous modulation test signal at the specific channel(s).

7.1.2 Test Setup Diagram



7.1.3 Measurement Procedure and Data

1) The mains terminal disturbance voltage test was conducted in a shielded room.

2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50ohm/50μH + 5ohm linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded.

3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane,

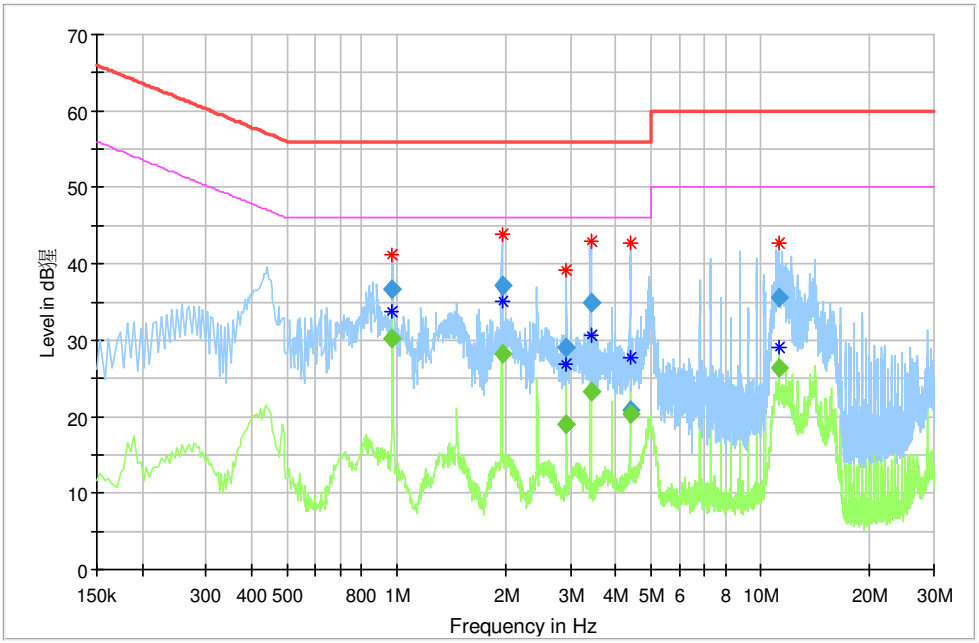
4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2.

5) In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10 on conducted measurement.

Remark: LISN=Read Level+ Cable Loss+ LISN Factor

Mode: a;
Line: Live Line

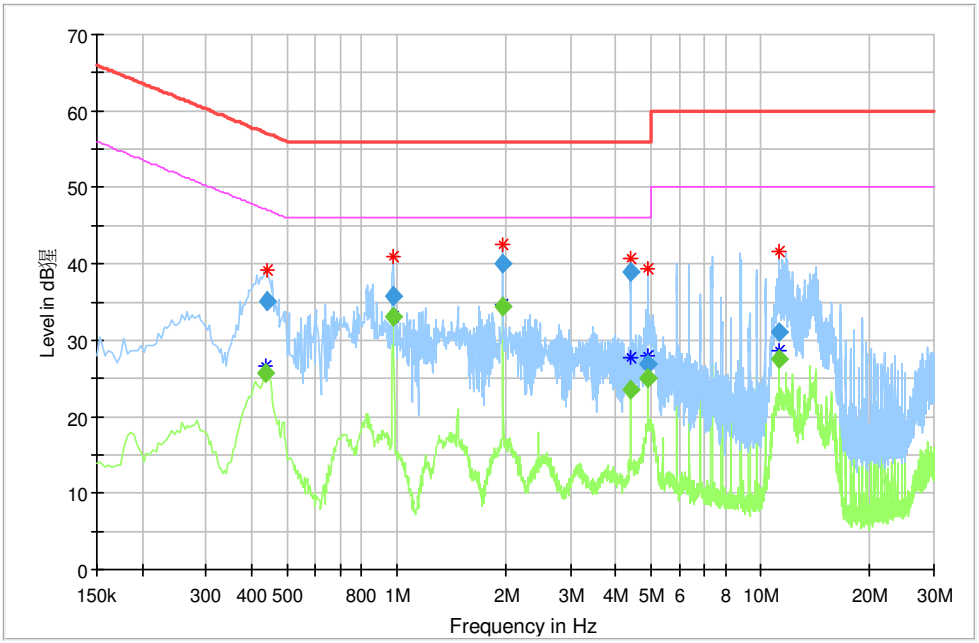
Full Spectrum



Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Corr. (dB)	Result
0.974000	---	30.2	46.0	15.8	10.1	Pass
0.974000	36.7	---	56.0	19.3	10.1	Pass
1.950000	---	28.2	46.0	17.8	10.2	Pass
1.950000	37.1	---	56.0	18.9	10.2	Pass
2.926000	---	19.1	46.0	26.9	10.2	Pass
2.926000	29.2	---	56.0	26.8	10.2	Pass
3.414000	35.0	---	56.0	21.0	10.2	Pass
3.414000	---	23.3	46.0	22.7	10.2	Pass
4.382000	20.8	---	56.0	35.2	10.3	Pass
4.390000	---	20.4	46.0	25.6	10.3	Pass
11.202000	35.6	---	60.0	24.4	10.7	Pass
11.234000	---	26.5	50.0	23.5	10.7	Pass

Mode: a;
Line: Neutral Line

Full Spectrum



Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Corr. (dB)	Result
0.438000	---	25.8	47.1	21.3	10.0	Pass
0.442000	35.2	---	57.0	21.8	10.0	Pass
0.978000	---	33.2	46.0	12.8	10.2	Pass
0.982000	35.7	---	56.0	20.3	10.2	Pass
1.958000	40.1	---	56.0	15.9	10.4	Pass
1.958000	---	34.4	46.0	11.6	10.4	Pass
4.394000	---	23.4	46.0	22.6	10.5	Pass
4.398000	39.0	---	56.0	17.0	10.5	Pass
4.890000	---	25.0	46.0	21.0	10.6	Pass
4.894000	26.8	---	56.0	29.2	10.6	Pass
11.266000	---	27.6	50.0	22.4	11.0	Pass
11.266000	31.0	---	60.0	29.0	11.0	Pass

7.2 Conducted Peak Output Power

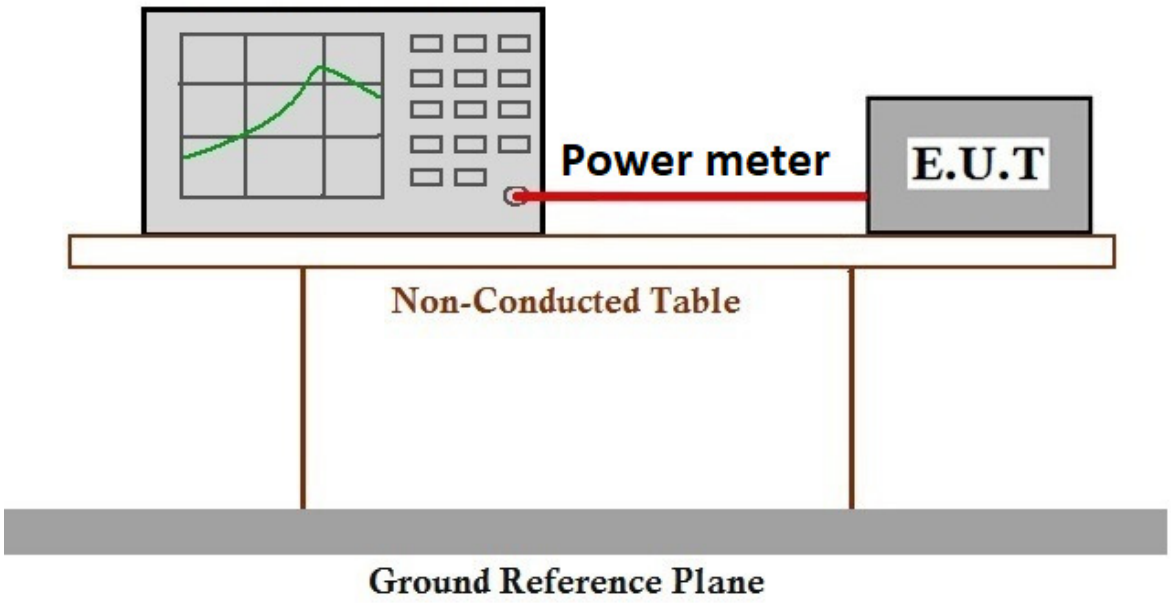
Test Requirement 47 CFR Part 15, Subpart C 15.247(b)(1)
Test Method: ANSI C63.10 (2013) Section 7.8.5
Limit:

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

7.2.1 E.U.T. Operation

Operating Environment:
Temperature: 21.0 °C Humidity: 48.0 % RH :
Test mode c: TX_Hop mode_Keep the EUT in frequency hopping mode with GFSK modulation, π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.

7.2.2 Test Setup Diagram



7.2.3 Measurement Procedure and Data

The detailed test data see: Appendix 15.247

7.3 20dB Bandwidth

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

Test Method: ANSI C63.10 (2013) Section 7.8.7

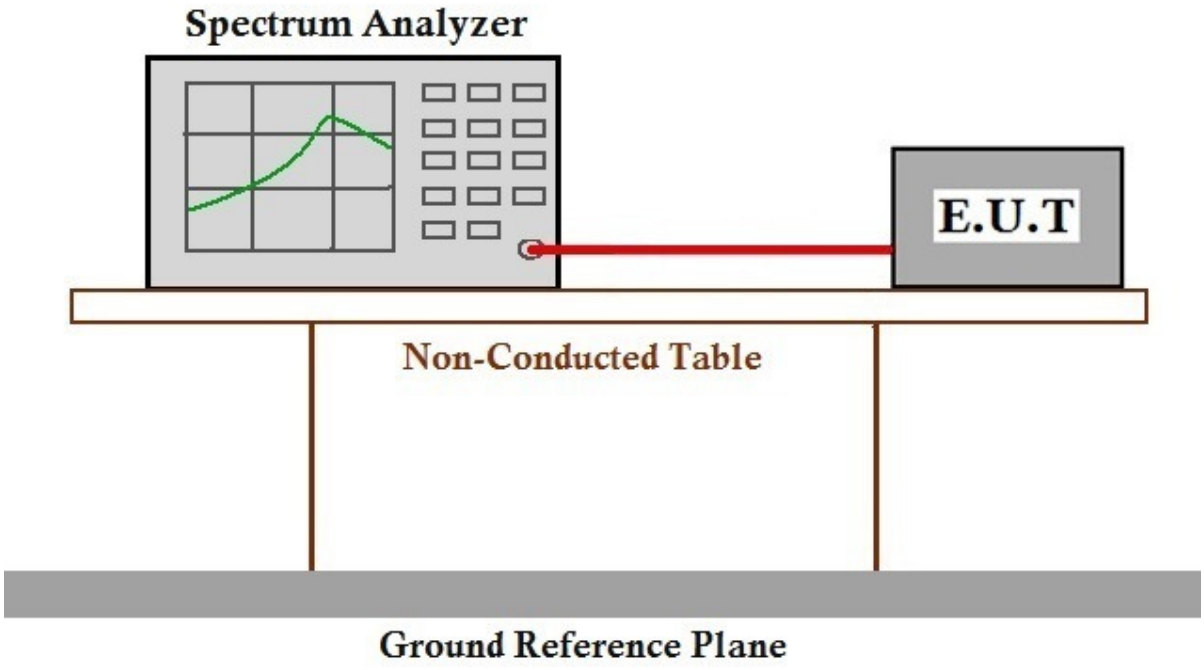
7.3.1 E.U.T. Operation

Operating Environment:

Temperature: 21.0 °C Humidity: 48.0 % RH :

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

7.3.2 Test Setup Diagram



7.3.3 Measurement Procedure and Data

The detailed test data see: Appendix 15.247

7.4 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

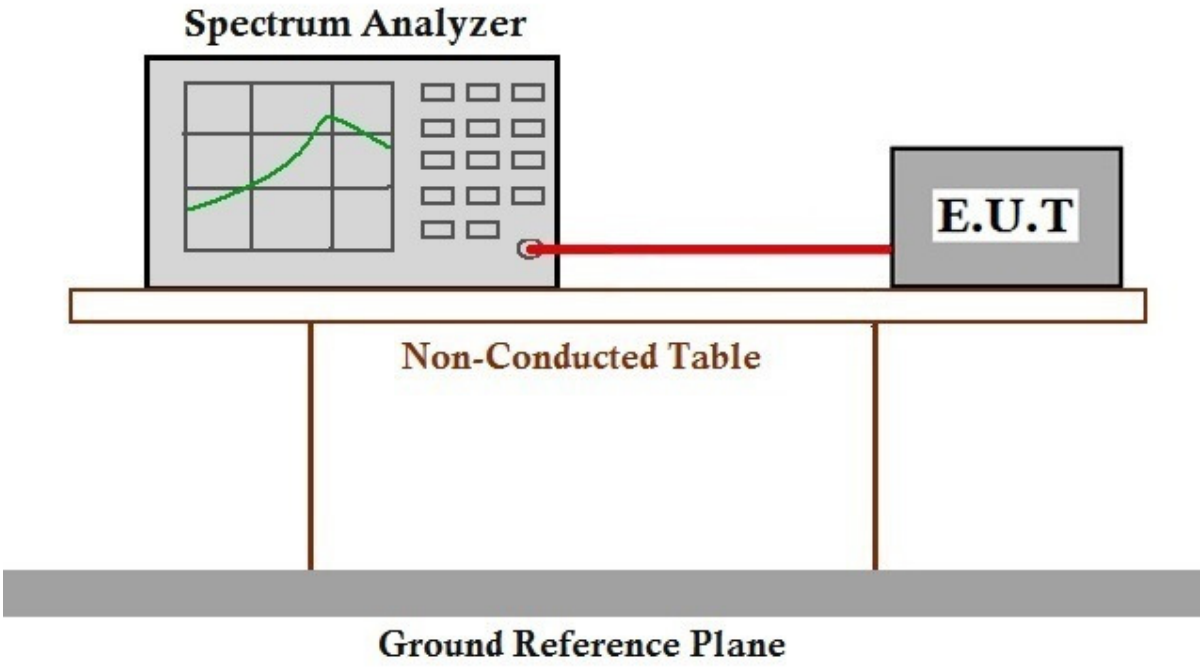
7.4.1 E.U.T. Operation

Operating Environment:

Temperature: 21.0 °C Humidity: 48.0 % RH :

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

7.4.2 Test Setup Diagram



7.4.3 Measurement Procedure and Data

The detailed test data see: Appendix 15.247

7.5 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

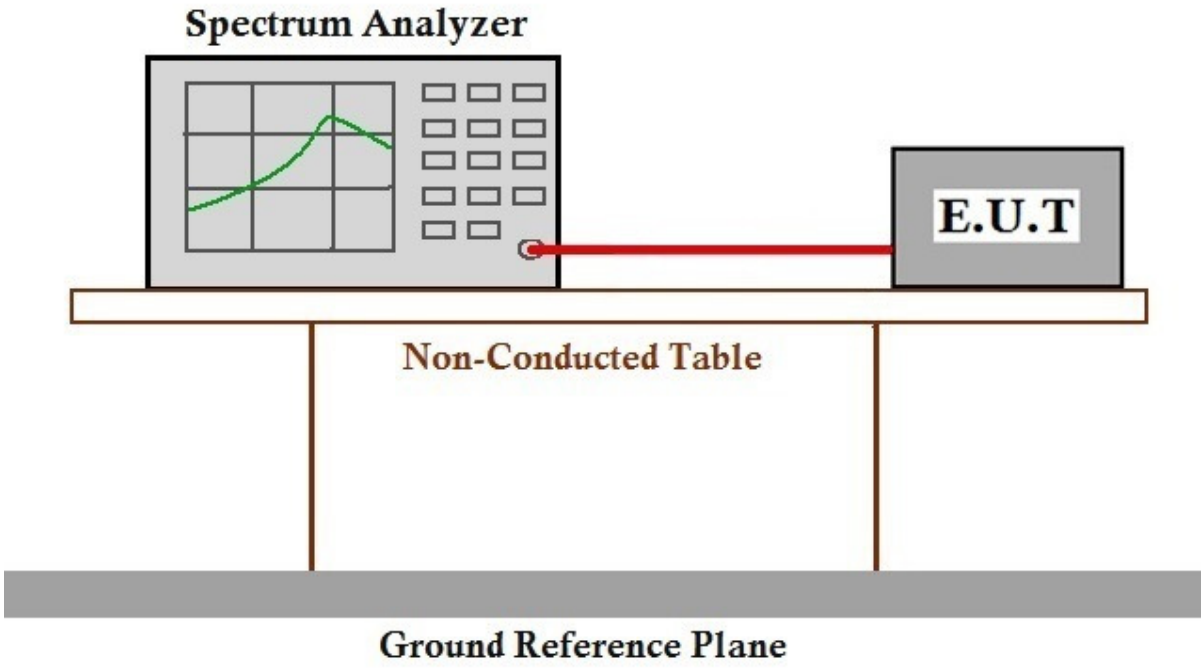
7.5.1 E.U.T. Operation

Operating Environment:

Temperature: 21.0 °C Humidity: 48.0 % RH :

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

7.5.2 Test Setup Diagram



7.5.3 Measurement Procedure and Data

The detailed test data see: Appendix 15.247

7.6 Dwell Time

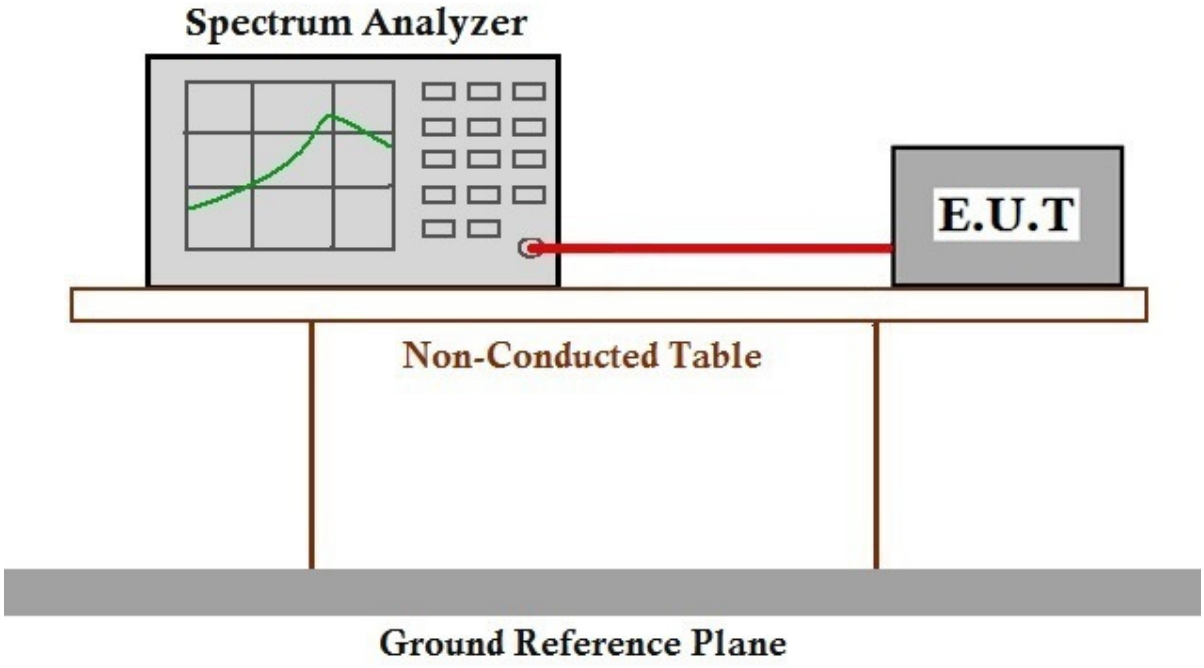
Test Requirement 47 CFR Part 15, Subpart C 15.247a(1)(iii)
Test Method: ANSI C63.10 (2013) Section 7.8.4
Limit:

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

7.6.1 E.U.T. Operation

Operating Environment:
Temperature: 21.0 °C Humidity: 48.0 % RH :
Test mode b: TX_Hop mode_Keep the EUT in frequency hopping mode with GFSK modulation, π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.

7.6.2 Test Setup Diagram



7.6.3 Measurement Procedure and Data

The detailed test data see: Appendix 15.247

7.7 Conducted Band Edges Measurement

Test Requirement	47 CFR Part 15, Subpart C 15.247(d)
Test Method:	ANSI C63.10 (2013) Section 7.8.6
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:

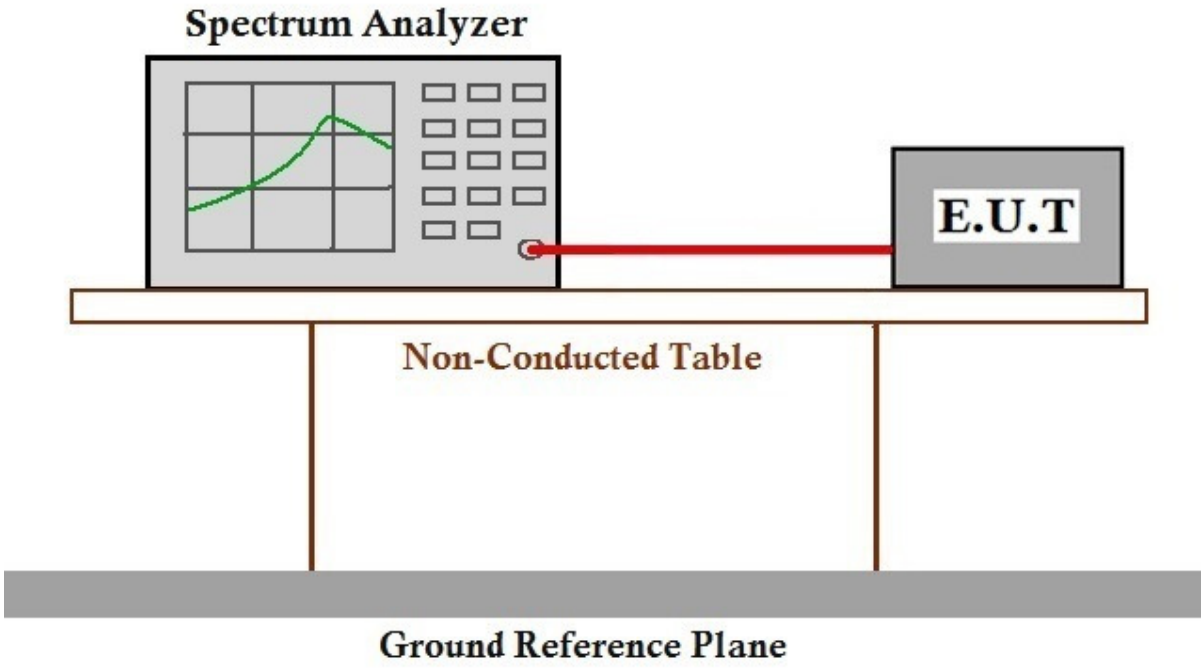
Temperature: 21.0 °C Humidity: 48.0 % RH :

Test mode

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

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

7.7.2 Test Setup Diagram



7.7.3 Measurement Procedure and Data

The detailed test data see: Appendix 15.247

7.8 Conducted Spurious Emissions

Test Requirement	47 CFR Part 15, Subpart C 15.247(d)
Test Method:	ANSI C63.10 (2013) Section 7.8.8
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)

7.8.1 E.U.T. Operation

Operating Environment:

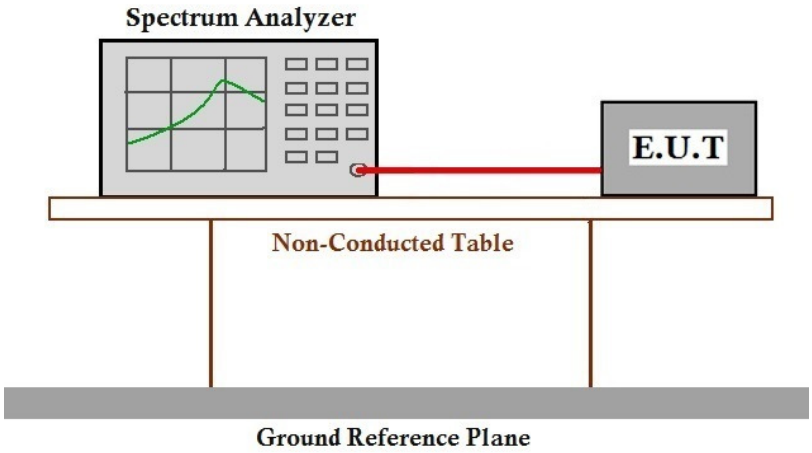
Temperature: 21.0 °C Humidity: 48.0 % RH :

Test mode

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

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

7.8.2 Test Setup Diagram



7.8.3 Measurement Procedure and Data

The detailed test data see: Appendix 15.247

7.9 Radiated Emissions which fall in the restricted bands

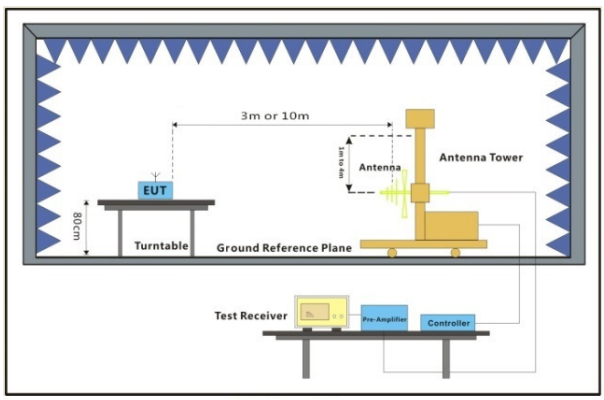
Test Requirement 47 CFR Part 15, Subpart C 15.205 & 15.209
Test Method: ANSI C63.10 (2013) Section 6.10.5
Measurement Distance: 3m
Limit:

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.		

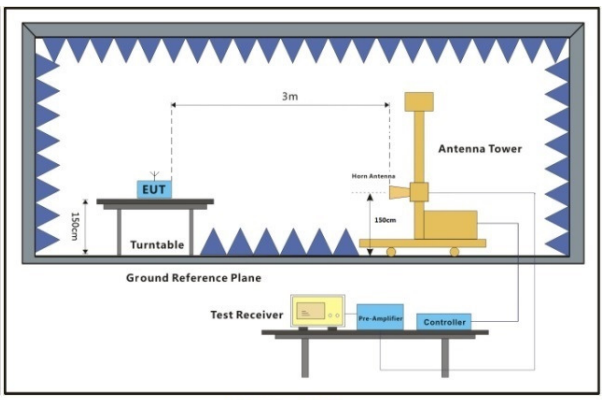
7.9.1 E.U.T. Operation

Operating Environment:
Temperature: 22.5 °C Humidity: 51.0 % RH :
Test mode c: TX_non-Hop mode_Keep the EUT in continuously transmitting mode with GFSK modulation, π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.

7.9.2 Test Setup Diagram



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: 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.

7.9.4 Measurement Procedure and data

Frequency (MHz)	Antenna Polarization	Emission Level (dBµV/m)		Limit (dBµV/m)		Remark
		Peak	Average	Peak	Average	
2390.000	H	49.2	/	74.0	54.0	Pass
2483.500	H	50.1	/	74.0	54.0	Pass
2390.000	V	48.5	/	74.0	54.0	Pass
2483.500	V	52.3	/	74.0	54.0	Pass

7.10 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.		

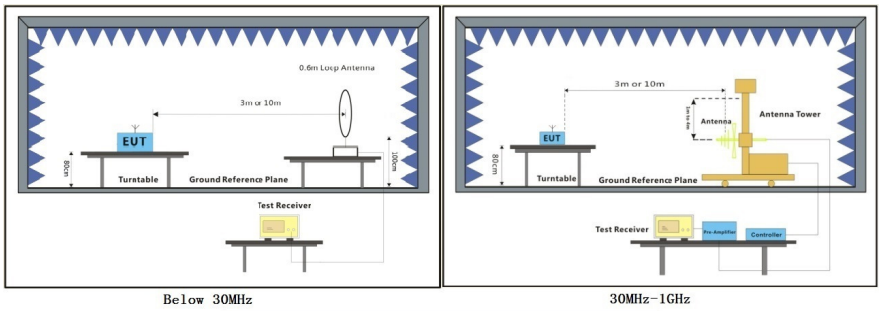
7.10.1 E.U.T. Operation

Operating Environment:

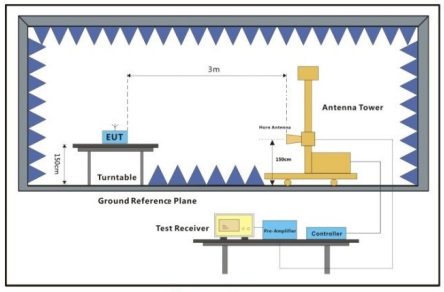
Temperature: 22.5 °C Humidity: 51.0 % RH :

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

7.10.2 Test Setup Diagram



Below 30MHz 30MHz-1GHz



Above 1GHz

7.10.3 Measurement Procedure and Data

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

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

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

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

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

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

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

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

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

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

Remark:

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

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

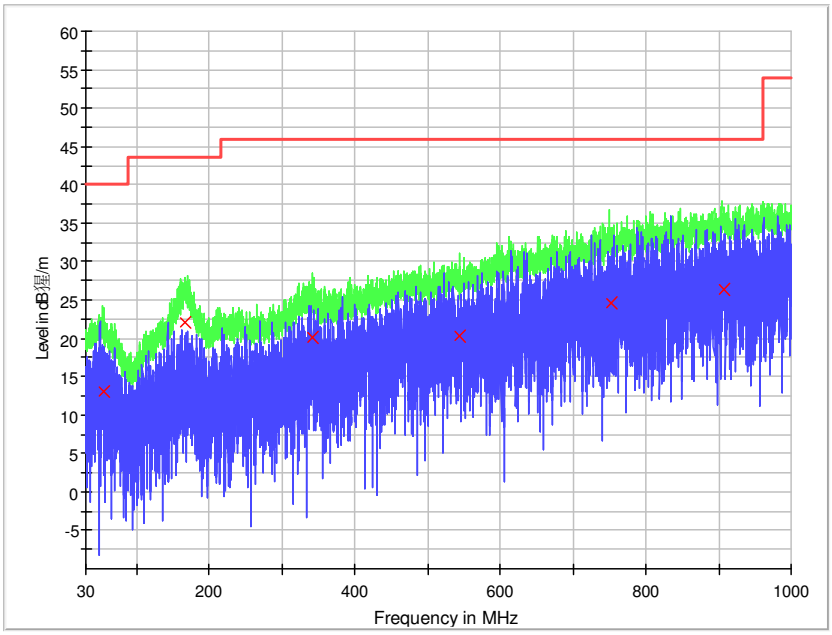
Final Test Level =Receiver Reading + Antenna Factor + Cable Factor – Preamplifier Factor

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

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

Radiated emission below 1GHz

Horizontal (worse plots was shown as below)

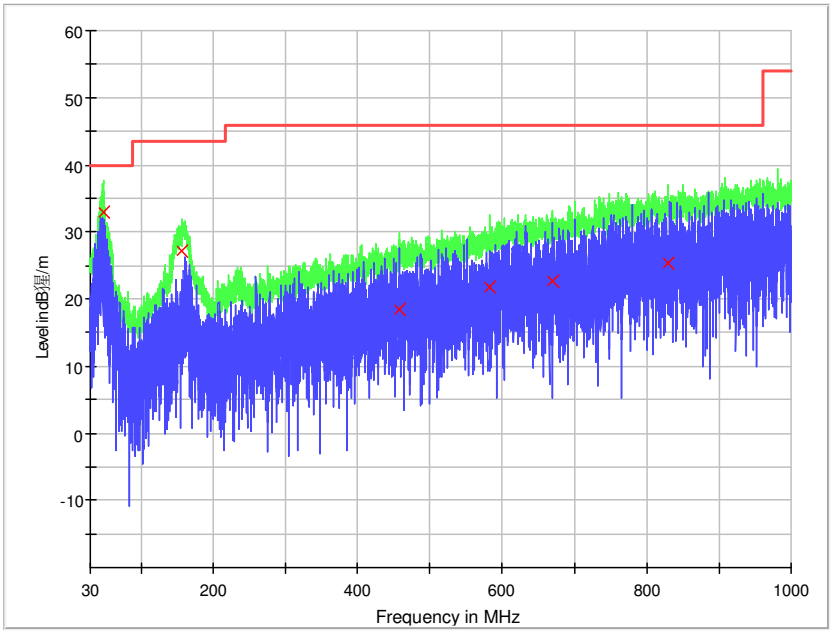


Frequency (MHz)	QuasiPeak (dBµV/m)	Pol.	Corr. (dB/m)	Margin (dB)	Limit (dBµV/m)	Result
55.427857	13.0	H	14.0	27.0	40.0	Pass
166.631429	22.1	H	14.2	21.4	43.5	Pass
341.647143	20.1	H	15.9	25.9	46.0	Pass
543.060714	20.4	H	20.4	25.6	46.0	Pass
752.095714	24.6	H	24.6	21.4	46.0	Pass
906.672143	26.3	H	26.2	19.7	46.0	Pass

Remark:

1. All readings are Quasi-Peak values.
2. Correction Factor = Antenna Factor + Cable Loss.
3. Pol. = antenna polarization

Vertical (worse plots was shown as below)



Frequency (MHz)	QuasiPeak (dBµV/m)	Pol.	Corr. (dB/m)	Margin (dB)	Limit (dBµV/m)	Result
47.737143	32.9	V	14.2	7.1	40.0	Pass
157.416429	27.0	V	14.4	16.5	43.5	Pass
457.215714	18.4	V	18.9	27.6	46.0	Pass
583.385000	21.9	V	21.3	24.1	46.0	Pass
670.615714	22.8	V	22.7	23.2	46.0	Pass
829.210714	25.4	V	25.2	20.6	46.0	Pass

Remark:
1. All readings are Quasi-Peak values.
2. Correction Factor = Antenna Factor + Cable Loss.
3. Pol. = antenna polarization

Above 1GHz

Channel:Low

Frequency (MHz)	Antenna Polarization	Emission Level (dBμV/m)		Limit (dBμV/m)		Remark
		Peak	Average	Peak	Average	
1574.125	V	39.8	/	74.0	54.0	Pass
4003.000	H	50.4	/	74.0	54.0	Pass
5148.000	H	48.6	/	74.0	54.0	Pass
7144.500	H	54.4	41.4	74.0	54.0	Pass
9364.500	V	57.7	44.6	74.0	54.0	Pass
12461.000	V	62.3	49.4	74.0	54.0	Pass

Channel:Middle

Frequency (MHz)	Antenna Polarization	Emission Level (dBμV/m)		Limit (dBμV/m)		Remark
		Peak	Average	Peak	Average	
1932.625	H	41.9	/	74.0	54.0	Pass
3604.375	V	45.4	/	74.0	54.0	Pass
4860.000	H	47.0	/	74.0	54.0	Pass
5833.000	V	48.6	/	74.0	54.0	Pass
7903.500	H	57.3	44.6	74.0	54.0	Pass
8634.000	V	56.7	43.2	74.0	54.0	Pass

Channel: High

Frequency (MHz)	Antenna Polarization	Emission Level (dBμV/m)		Limit (dBμV/m)		Remark
		Peak	Average	Peak	Average	
1932.250	V	43.1	/	74.0	54.0	Pass
4412.000	V	46.9	/	74.0	54.0	Pass
5367.500	H	48.3	/	74.0	54.0	Pass
6350.000	V	50.4	/	74.0	54.0	Pass
7902.000	H	57.6	44.3	74.0	54.0	Pass
11144.000	H	60.3	46.9	74.0	54.0	Pass

8 Photographs

Remark: Photos refer to Appendix: External Photo and Internal Phot

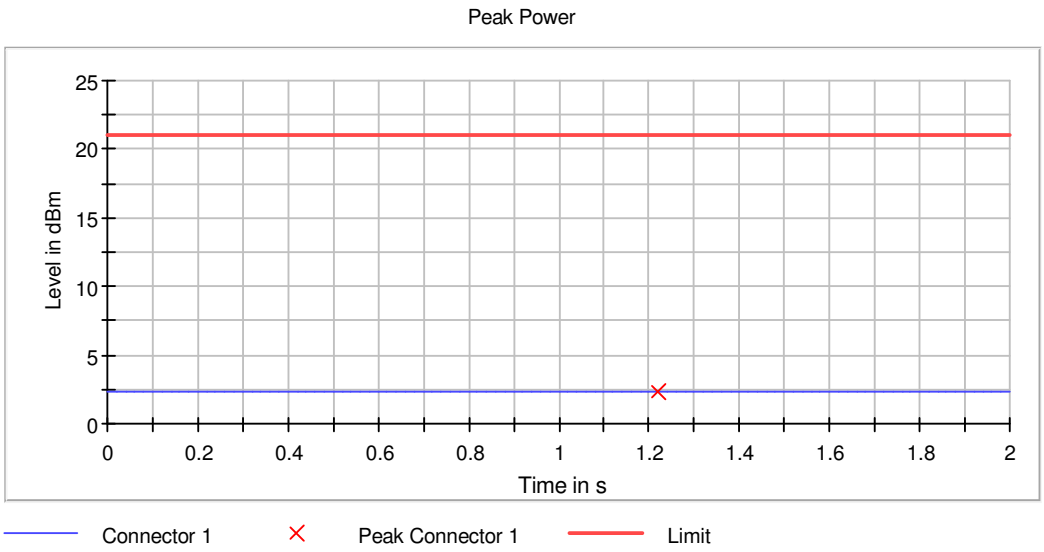
9 Appendix

9.1 Peak conducted output power

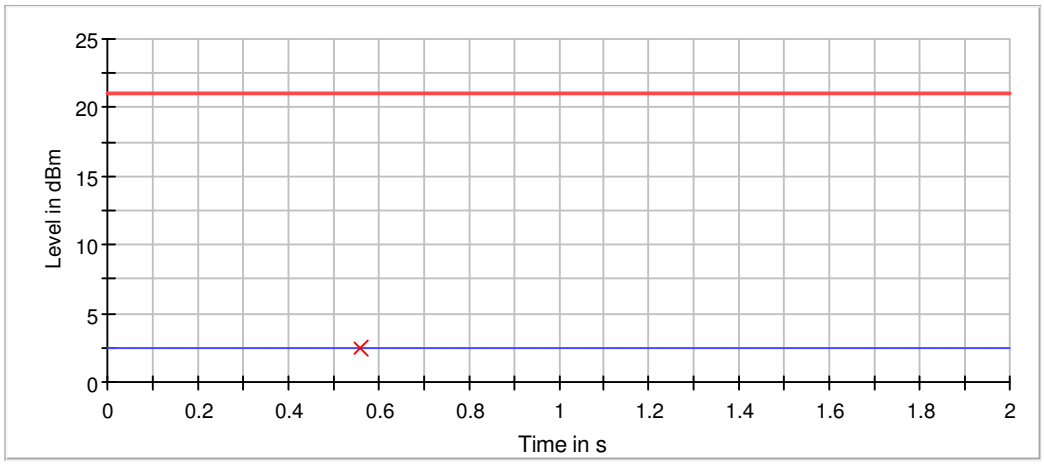
The worst case is shown below.

Test Mode	DUT Frequency (MHz)	Peak Power (dBm)	Limit Max (dBm)	Result
DH5	2402.000000	2.3	21.0	PASS
	2441.000000	2.5	21.0	PASS
	2480.000000	2.1	21.0	PASS
2DH5	2402.000000	2.5	21.0	PASS
	2441.000000	2.7	21.0	PASS
	2480.000000	2.3	21.0	PASS
3DH5	2402.000000	2.6	21.0	PASS
	2441.000000	2.6	21.0	PASS
	2480.000000	2.2	21.0	PASS
DM5	2402.000000	2.4	21.0	PASS
	2441.000000	2.6	21.0	PASS
	2480.000000	2.2	21.0	PASS
HV3	2402.000000	2.5	21.0	PASS
	2441.000000	2.6	21.0	PASS
	2480.000000	2.3	21.0	PASS

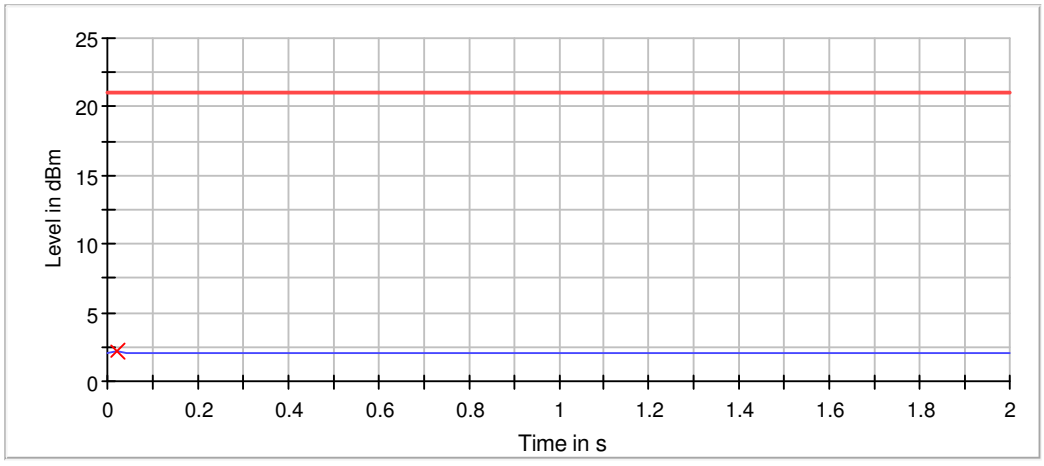
DH5:



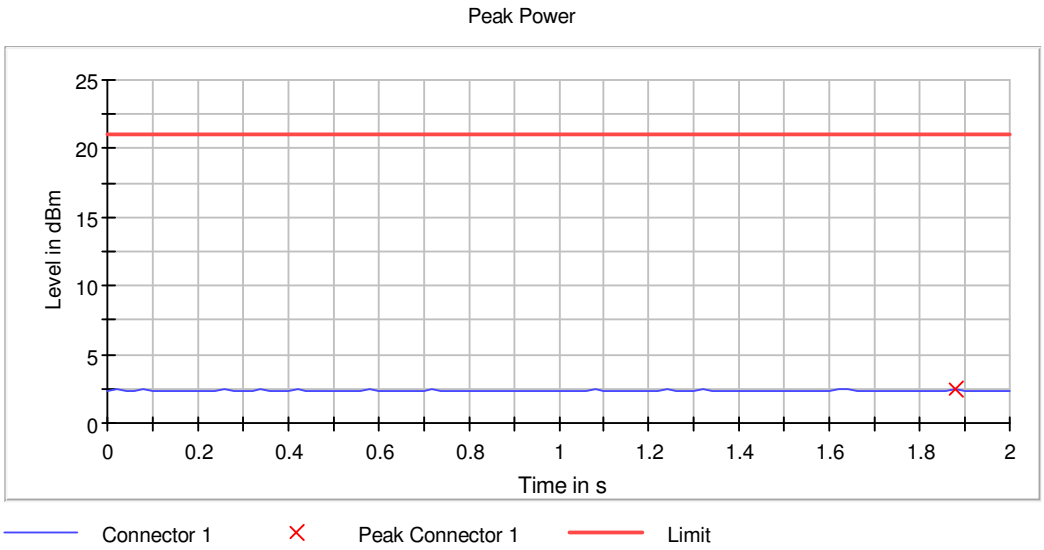
Peak Power

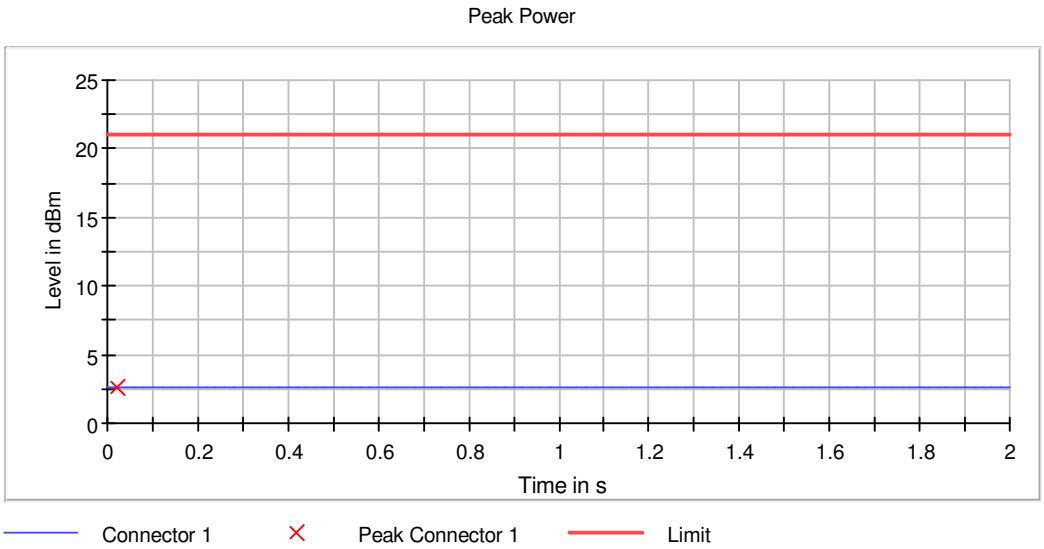


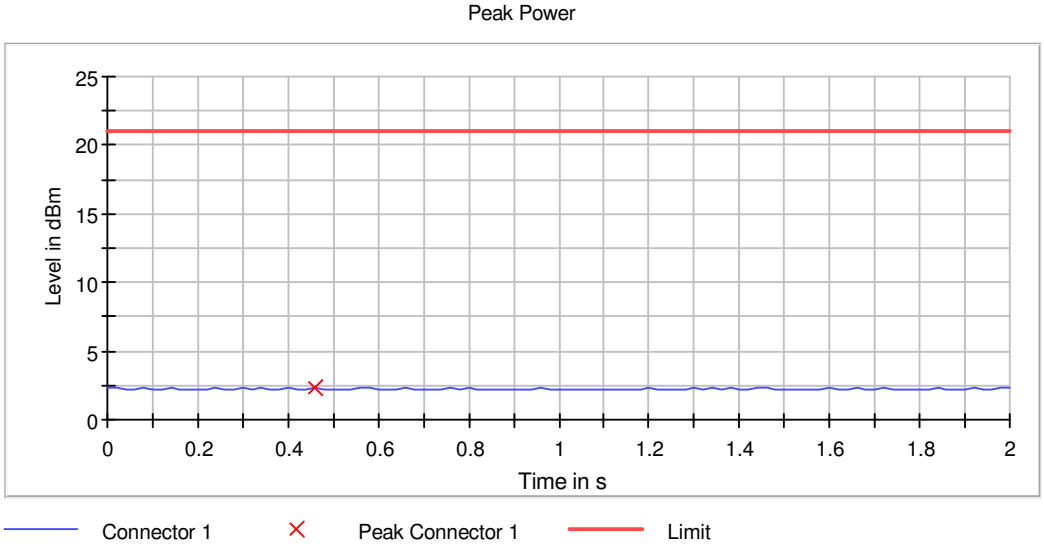
Peak Power



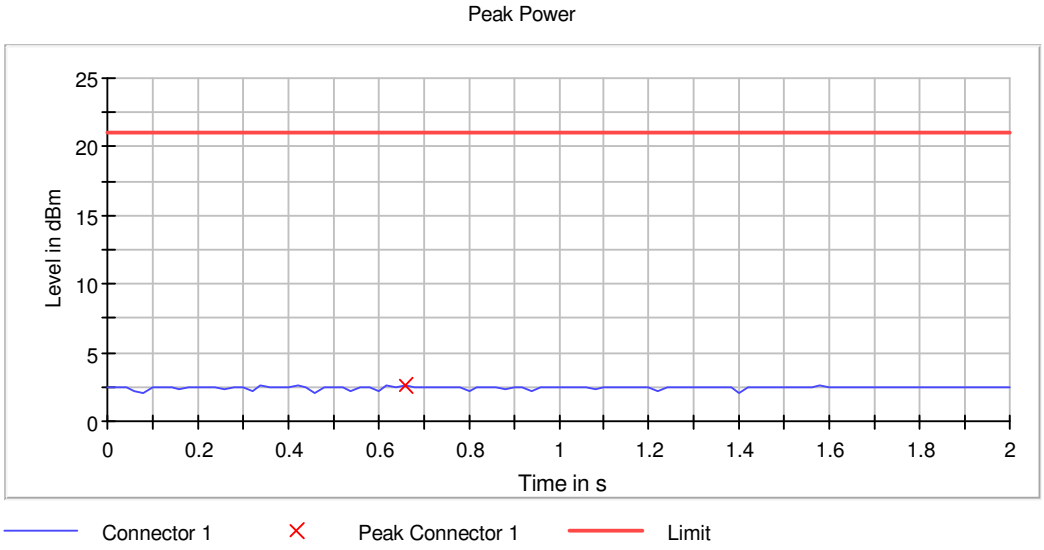
2DH5:


Peak Power
Level in dBm
25
20
15
10
5
0
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
Time in s
Connector 1
Peak Connector 1
Limit

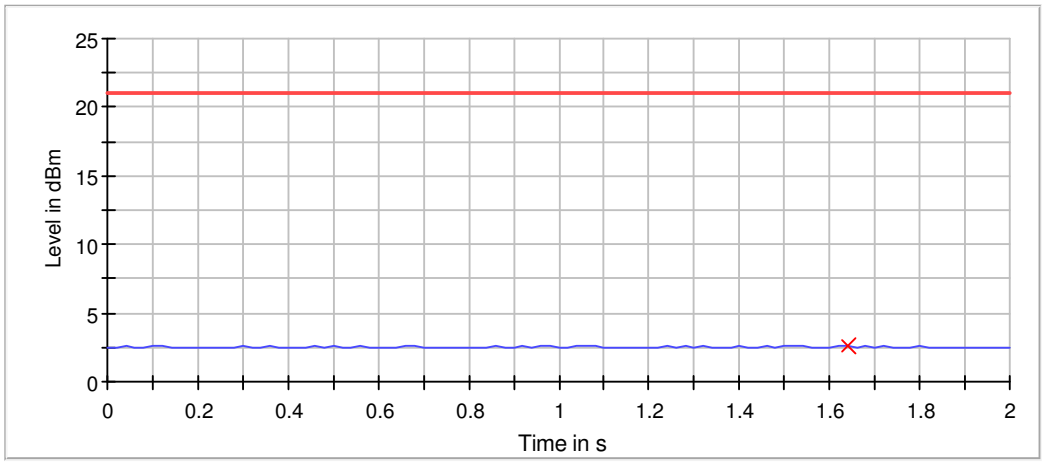

Peak Power
Level in dBm
25
20
15
10
5
0
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
Time in s
Connector 1
Peak Connector 1
Limit


Peak Power
Level in dBm
25
20
15
10
5
0
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
Time in s
Connector 1
Peak Connector 1
Limit

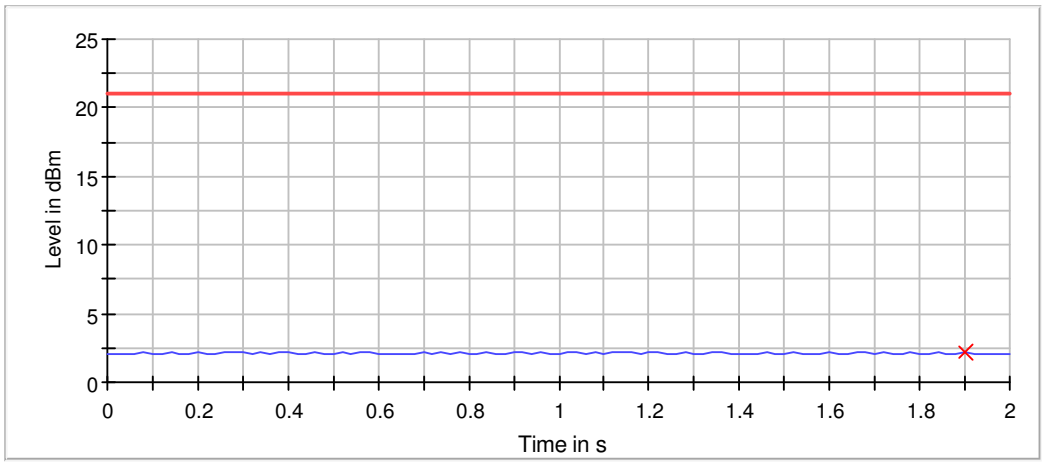
3DH5:


Peak Power
Level in dBm
25
20
15
10
5
0
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
Time in s
Connector 1
Peak Connector 1
Limit

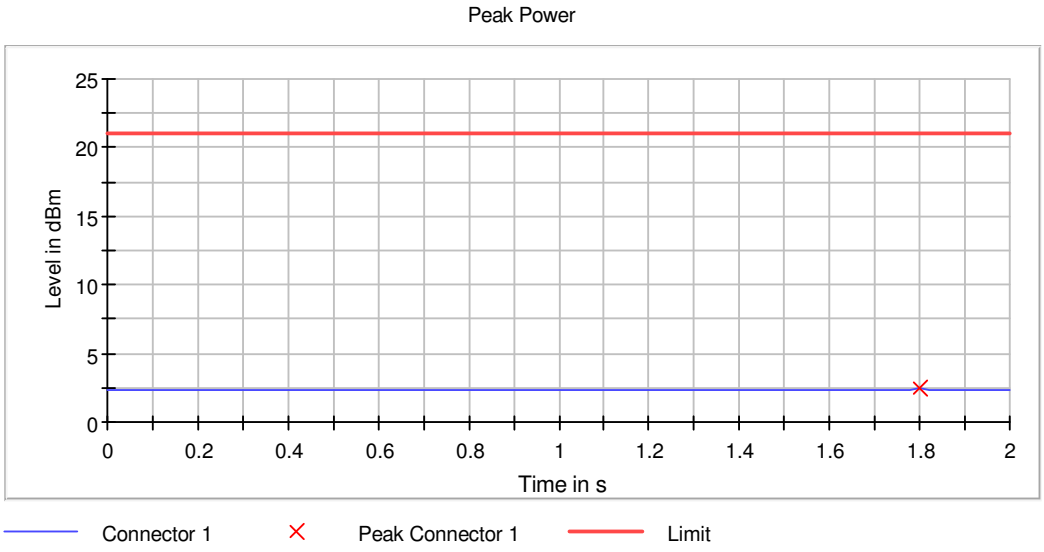
Peak Power

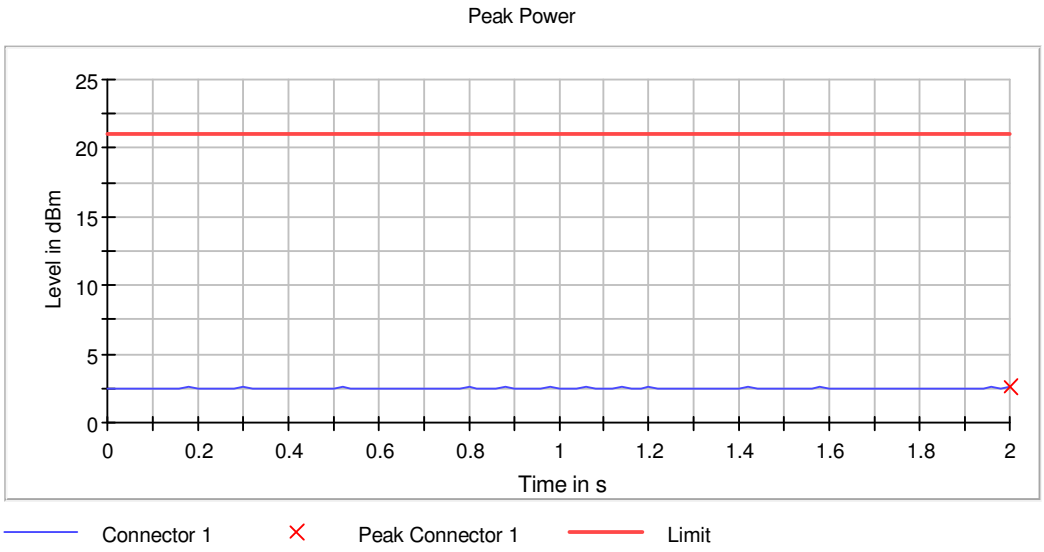


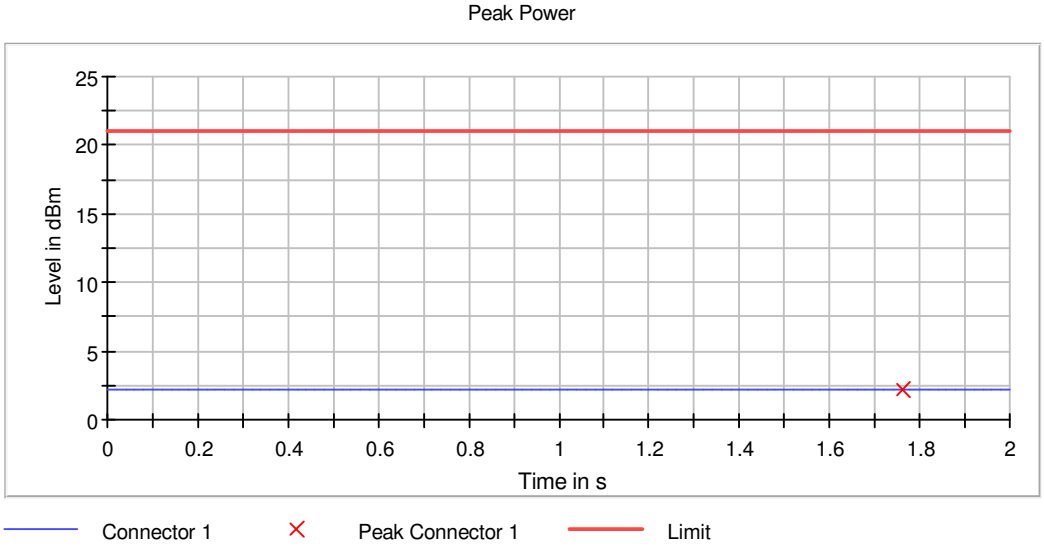
Peak Power



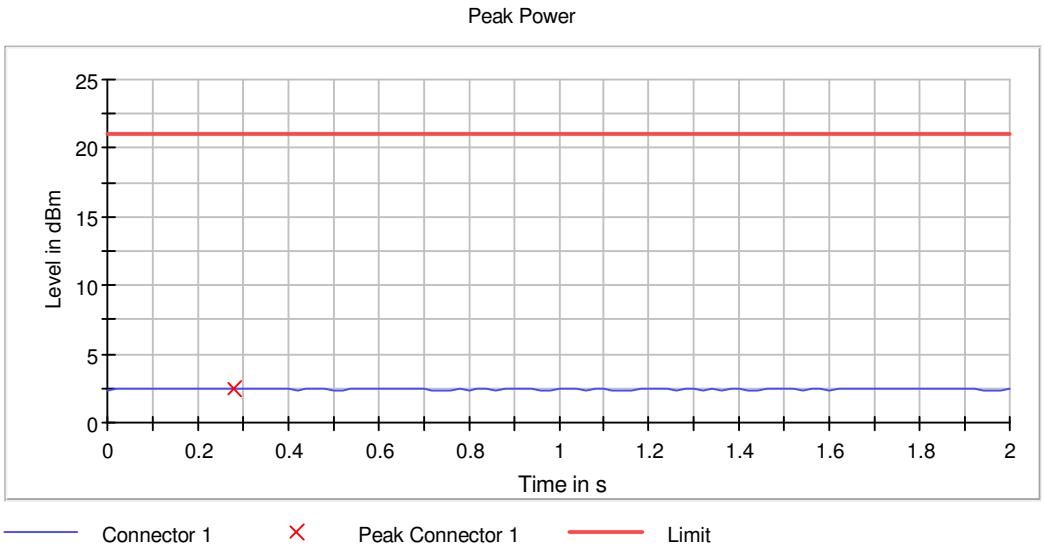
DM5:

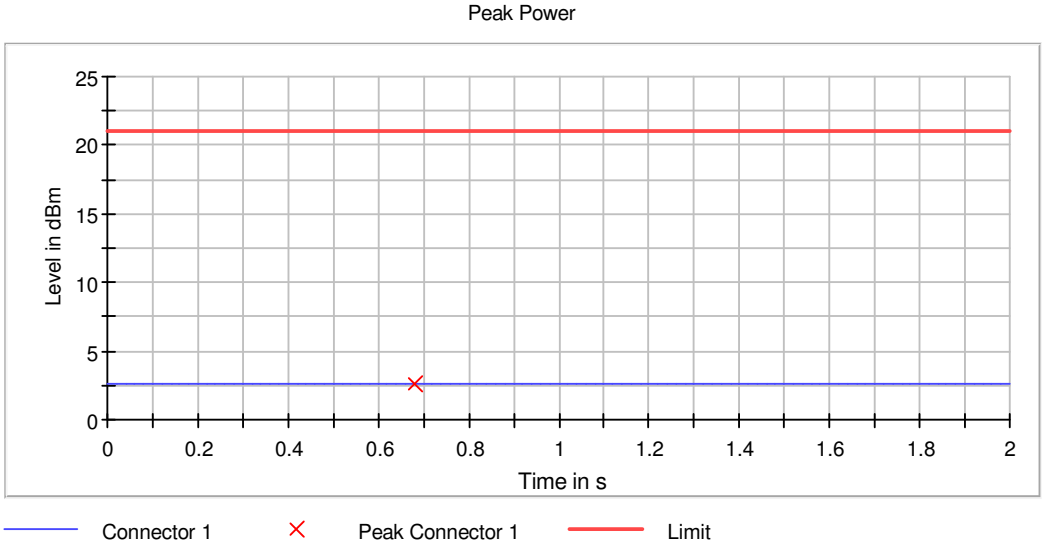

Peak Power
Level in dBm
25
20
15
10
5
0
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
Time in s
Connector 1
Peak Connector 1
Limit

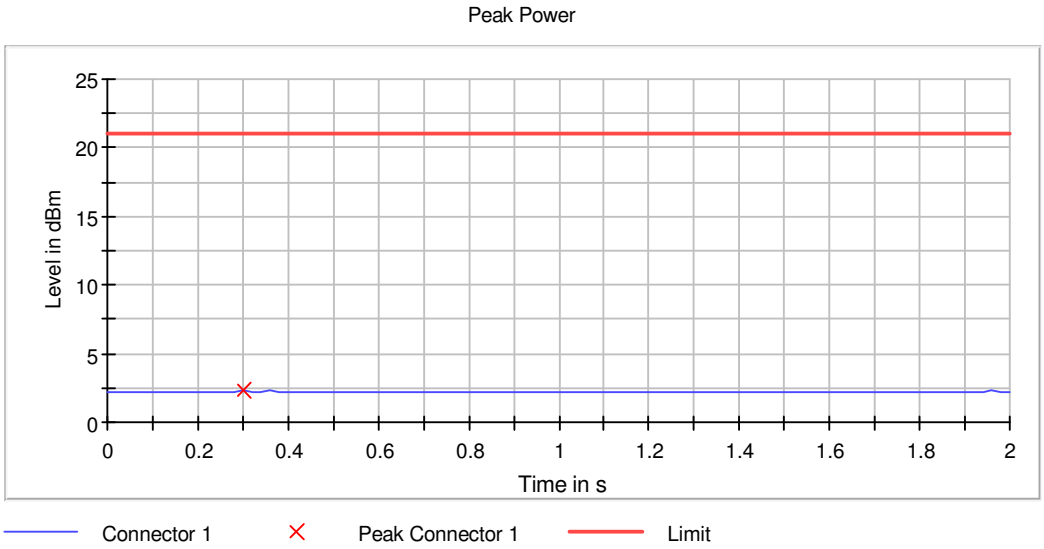

Peak Power
Level in dBm
25
20
15
10
5
0
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
Time in s
Connector 1
Peak Connector 1
Limit


Peak Power
Level in dBm
25
20
15
10
5
0
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
Time in s
Connector 1
Peak Connector 1
Limit

HV3:


Peak Power
Level in dBm
25
20
15
10
5
0
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
Time in s
Connector 1
Peak Connector 1
Limit


Peak Power
Level in dBm
25
20
15
10
5
0
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
Time in s
Connector 1
Peak Connector 1
Limit


Peak Power
Level in dBm
25
20
15
10
5
0
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
Time in s
Connector 1
Peak Connector 1
Limit

Measurement Setting

Setting	Instrument Value	Target Value
Center Frequency	2.40200 GHz	2.40200 GHz
Span	ZeroSpan	ZeroSpan
RBW	1.229 MHz	>= 1.000 MHz
VBW	10.000 MHz	>= 6.000 MHz
SweepPoints	101	~ 101
Sweeptime	2.000 s	2.000 s
Reference Level	10.000 dBm	10.000 dBm
Attenuation	30.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	10	10
Filter	Channel	Channel
Trace Mode	Max Hold	Max Hold
Sweeptype	Sweep	AUTO
Preamp	off	off

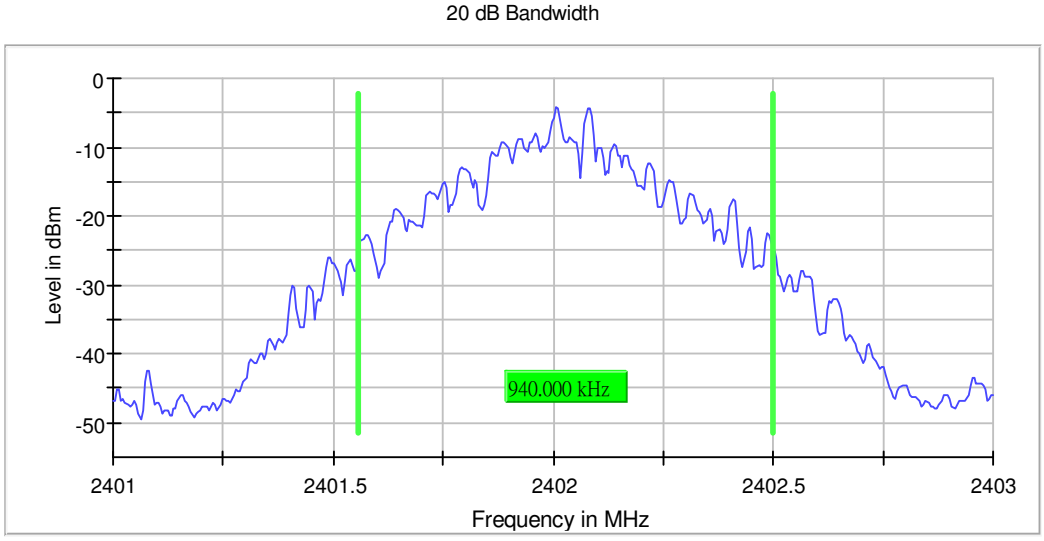
Remark: Cable loss 0.8dB was considered and set in system configuration.

9.2 Emission Bandwidth 20 dB

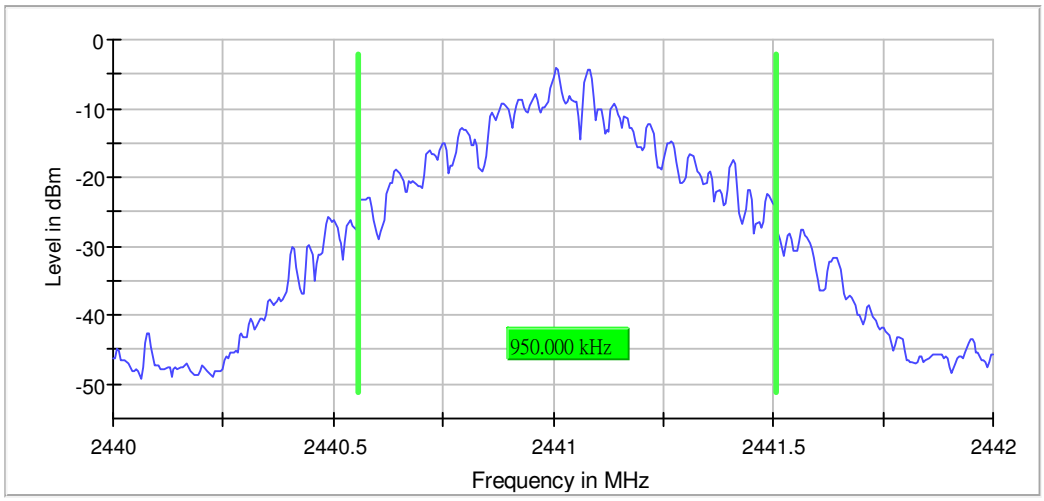
The worst case is shown below.

Test Mode	DUT Frequency (MHz)	Bandwidth (MHz)	Limit (MHz)	Result
DH5	2402.000000	0.94	---	PASS
	2441.000000	0.95	---	PASS
	2480.000000	0.95	---	PASS
2DH5	2402.000000	0.94	---	PASS
	2441.000000	0.95	---	PASS
	2480.000000	0.94	---	PASS
3DH5	2402.000000	0.94	---	PASS
	2441.000000	0.94	---	PASS
	2480.000000	0.94	---	PASS
DM5	2402.000000	0.95	---	PASS
	2441.000000	0.95	---	PASS
	2480.000000	0.95	---	PASS
HV3	2402.000000	0.95	---	PASS
	2441.000000	0.95	---	PASS
	2480.000000	0.95	---	PASS

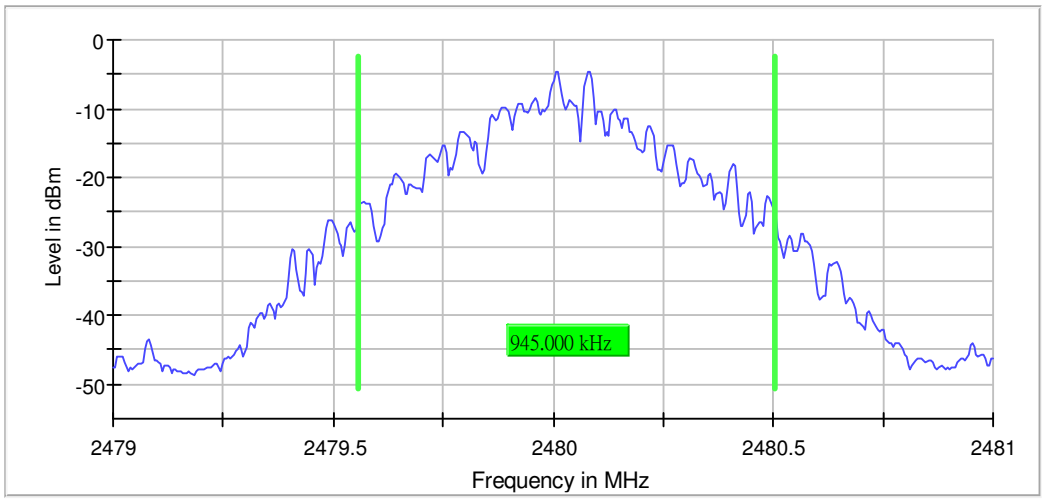
DH5:



20 dB Bandwidth

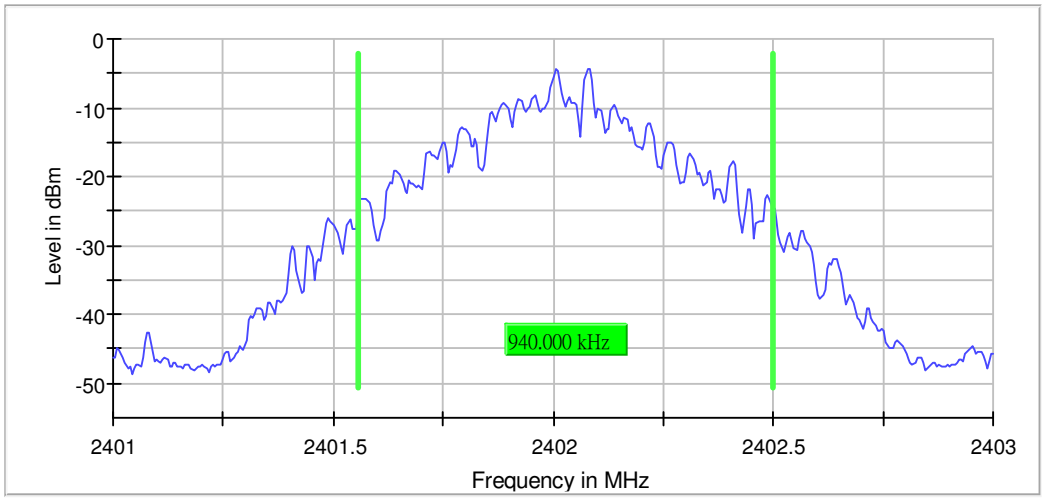


20 dB Bandwidth

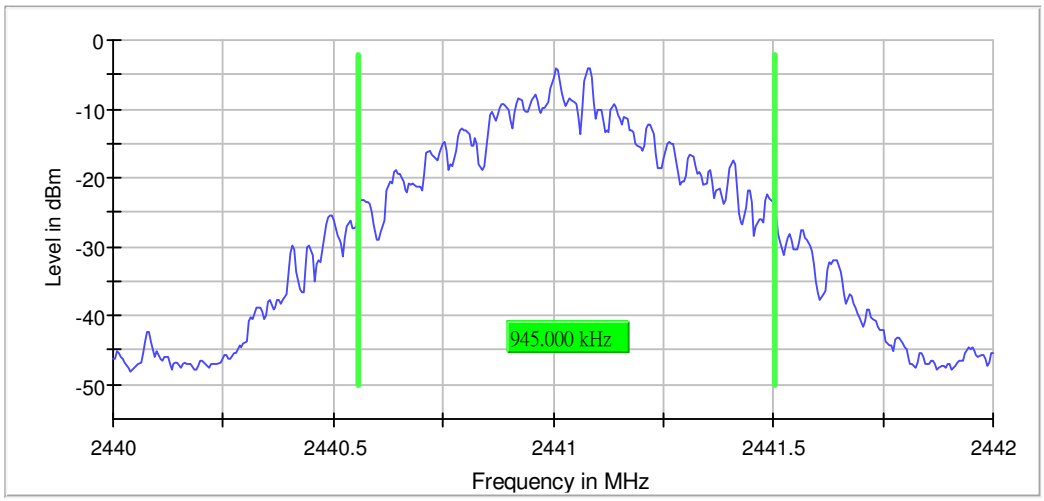


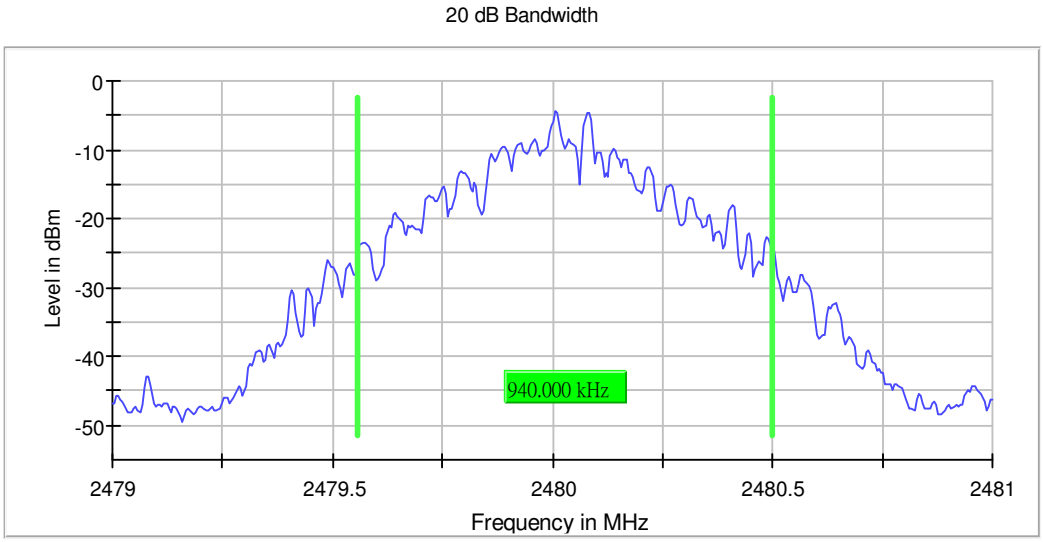
2DH5:

20 dB Bandwidth

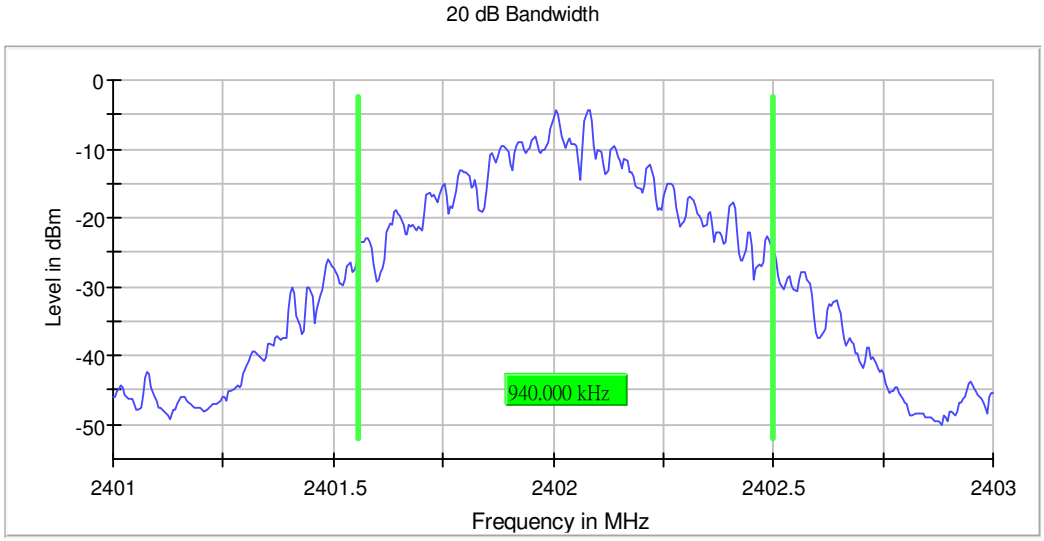


20 dB Bandwidth

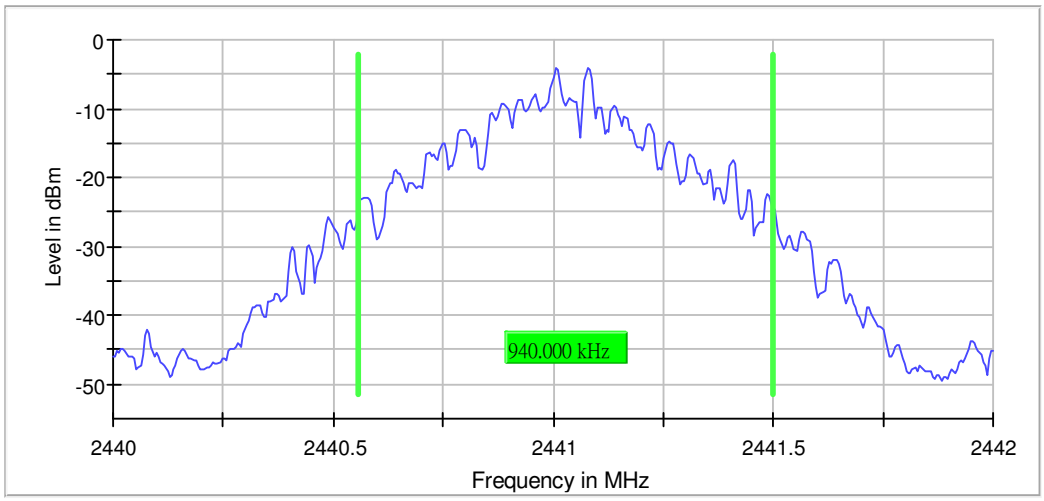



20 dB Bandwidth
0
-10
-20
-30
-40
-50
Level in dBm
940.000 kHz
2479
2479.5
2480
2480.5
2481
Frequency in MHz

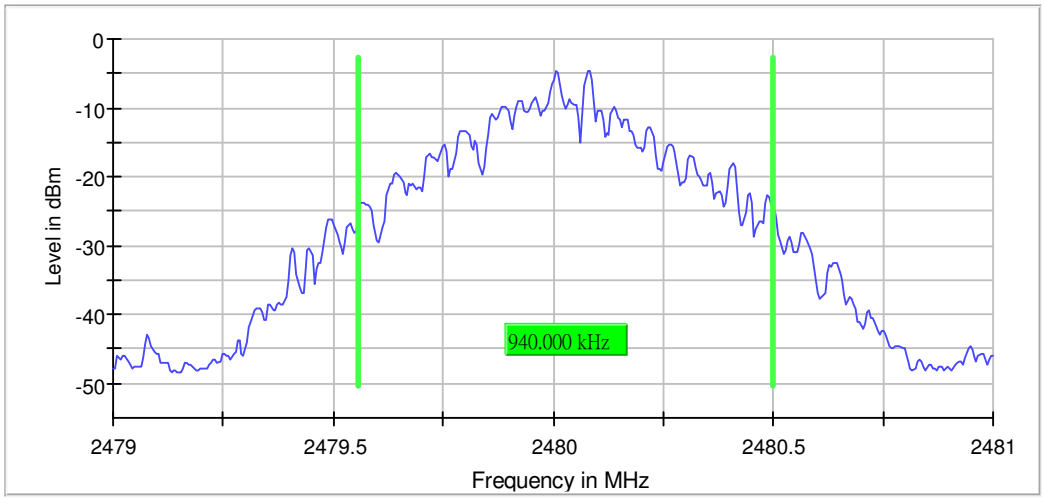
3DH5:


20 dB Bandwidth
0
-10
-20
-30
-40
-50
Level in dBm
940.000 kHz
2401
2401.5
2402
2402.5
2403
Frequency in MHz

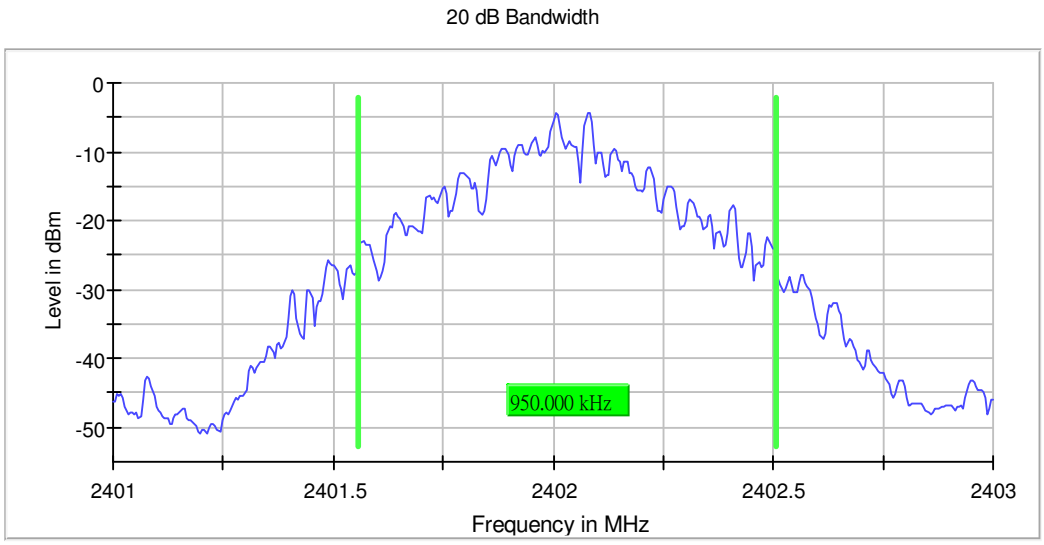
20 dB Bandwidth

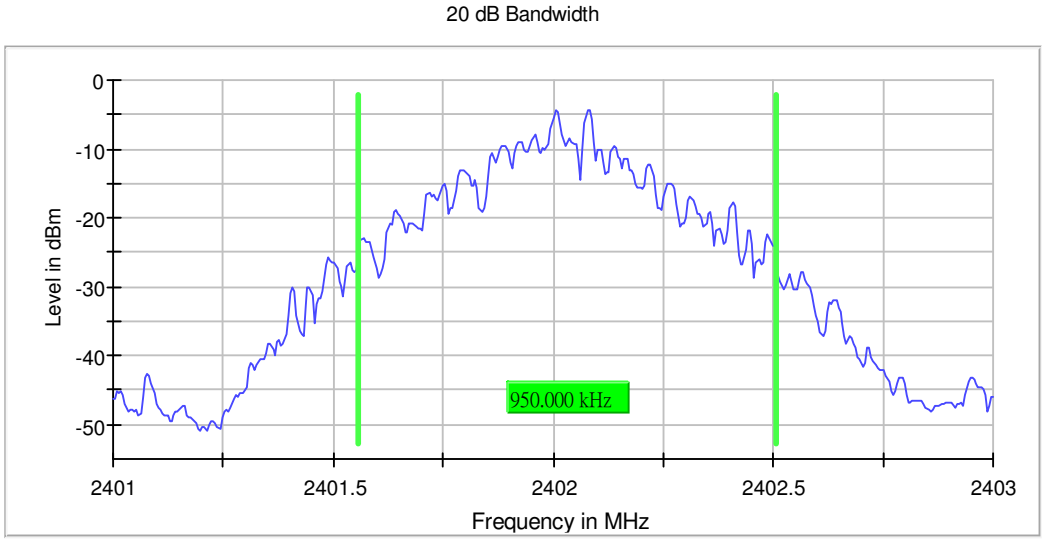


20 dB Bandwidth

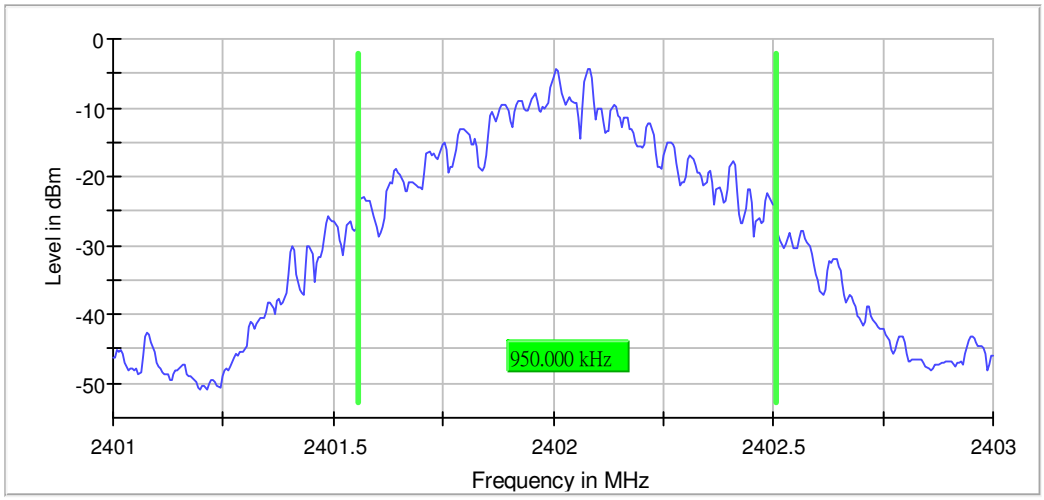


DM5:


20 dB Bandwidth
0
-10
-20
-30
-40
-50
Level in dBm
950.000 kHz
2401
2401.5
2402
2402.5
2403
Frequency in MHz

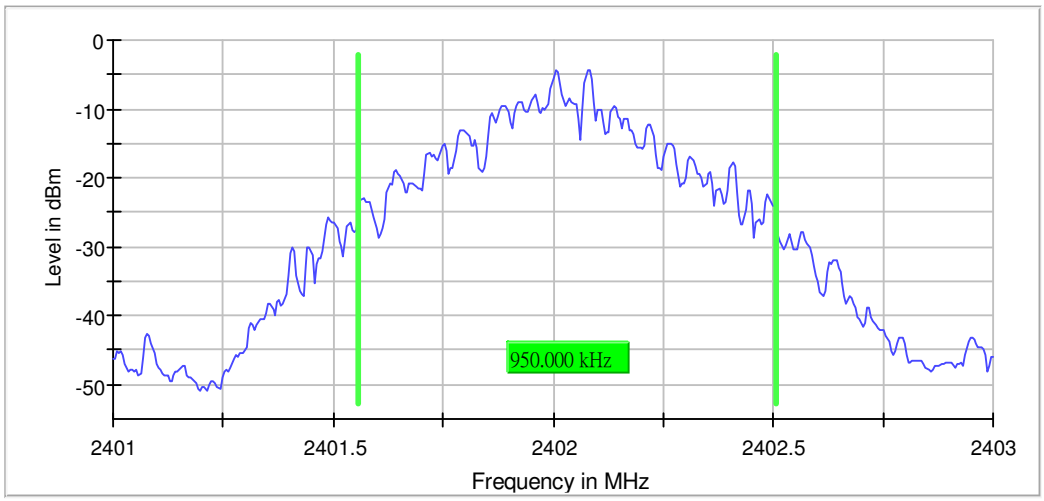

20 dB Bandwidth
0
-10
-20
-30
-40
-50
Level in dBm
950.000 kHz
2401
2401.5
2402
2402.5
2403
Frequency in MHz

20 dB Bandwidth

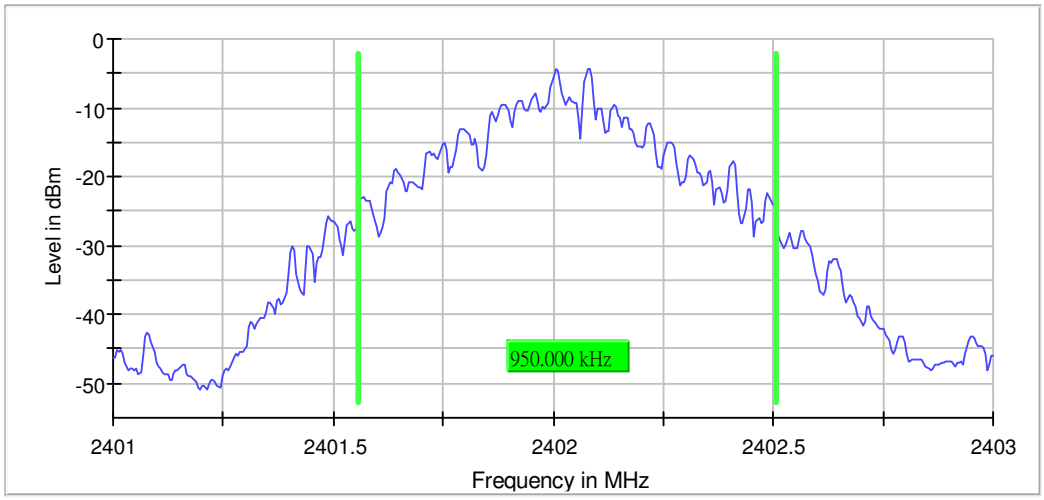


HV3:

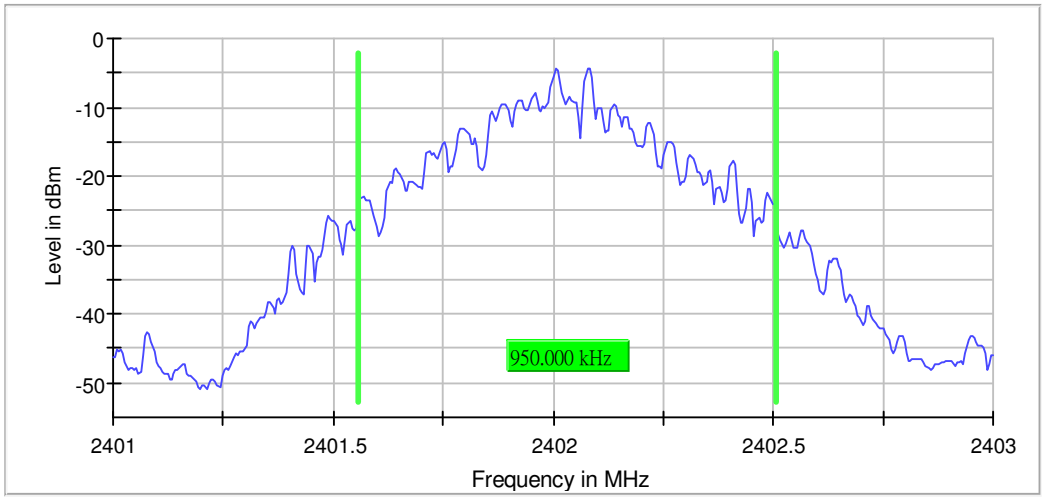
20 dB Bandwidth



20 dB Bandwidth



20 dB Bandwidth



Measurement Setting

Setting	Instrument Value	Target Value
RBW	30.000 kHz	>= 30.000 kHz
VBW	100.000 kHz	>= 100.000
SweepPoints	400	~ 400
Sweeptime	75.781 µs	AUTO
Reference Level	10.000 dBm	10.000 dBm
Attenuation	30.000 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	24 / max. 150	max. 150
Stable	5 / 5	5
Max Stable Difference	0.15 dB	0.50 dB

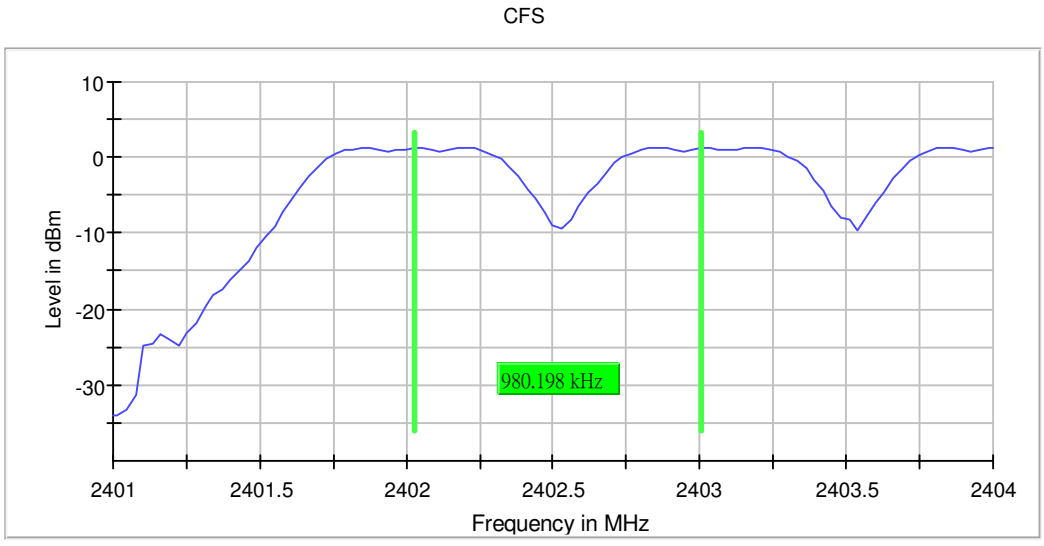
Remark: Cable loss 0.8dB was considered and set in system configuration.

9.3 Carrier Frequency Separation

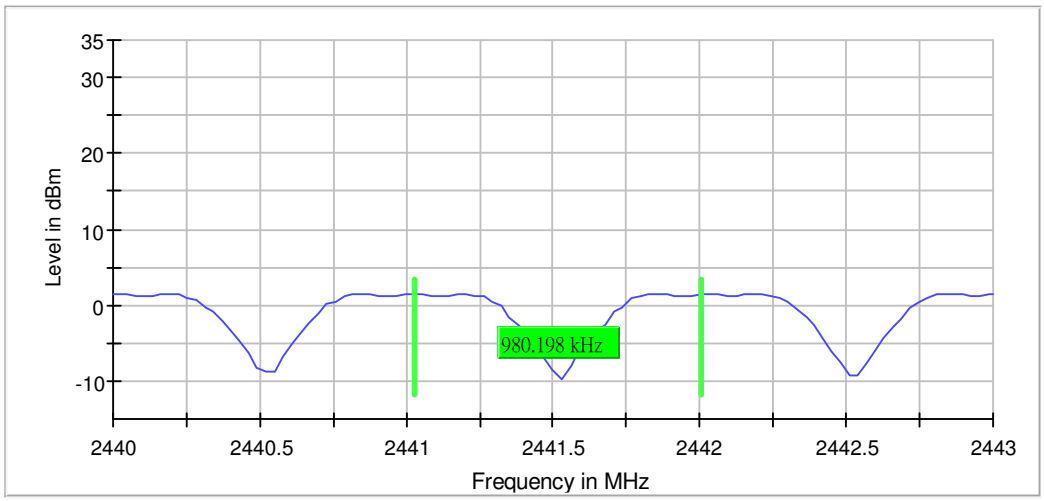
Test Mode	DUT Frequency (MHz)	Frequency Separation (MHz)	Limit (MHz)	Result
DH5	2402.000000	0.980	0.63	PASS
	2441.000000	0.980	0.63	PASS
	2480.000000	0.980	0.63	PASS
2DH5	2402.000000	0.980	0.63	PASS
	2441.000000	0.980	0.63	PASS
	2480.000000	0.980	0.63	PASS
3DH5	2402.000000	0.980	0.63	PASS
	2441.000000	0.980	0.63	PASS
	2480.000000	0.980	0.63	PASS
DM5	2402.000000	0.980	0.63	PASS
	2441.000000	1.010	0.63	PASS
	2480.000000	0.980	0.63	PASS
HV3	2402.000000	0.980	0.63	PASS
	2441.000000	0.980	0.63	PASS
	2480.000000	0.980	0.63	PASS

Remark: Limit = 2/3* 0.95dB Bandwidth

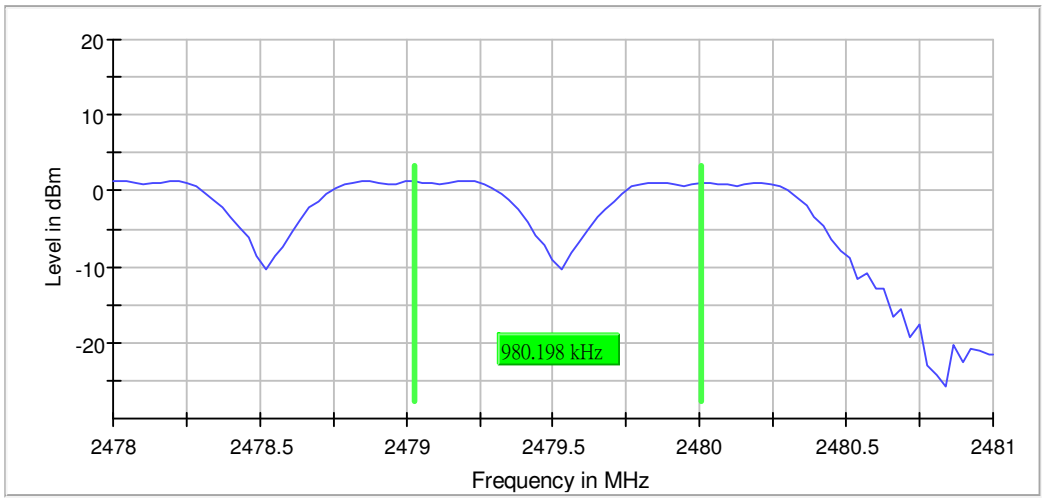
DH5:



CFS

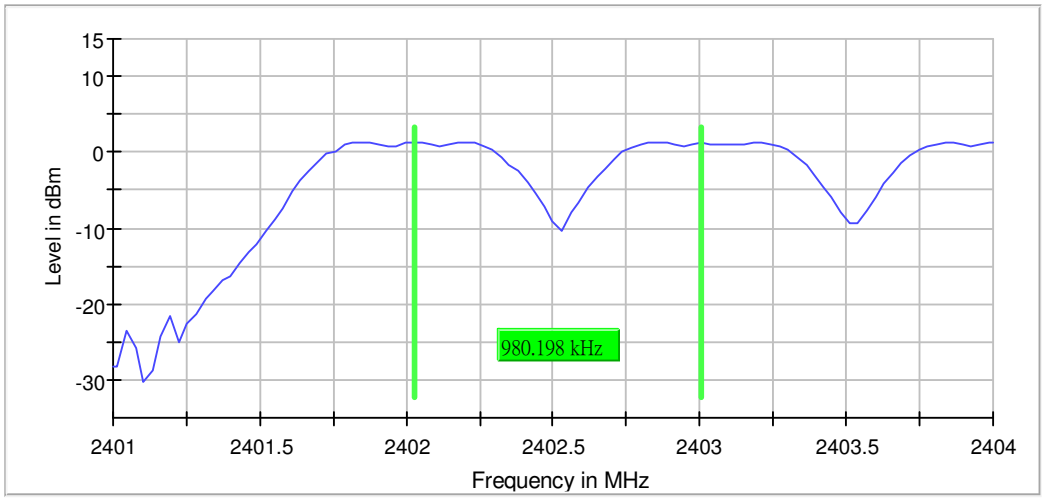

35
30
20
10
0
-10
Level in dBm
980.198 kHz
2440
2440.5
2441
2441.5
2442
2442.5
2443
Frequency in MHz

CFS

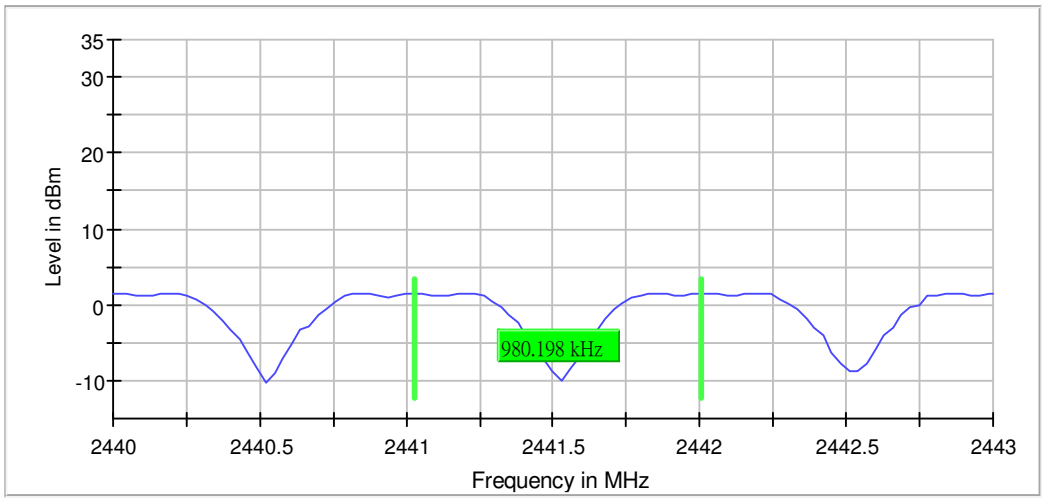

20
10
0
-10
-20
Level in dBm
980.198 kHz
2478
2478.5
2479
2479.5
2480
2480.5
2481
Frequency in MHz

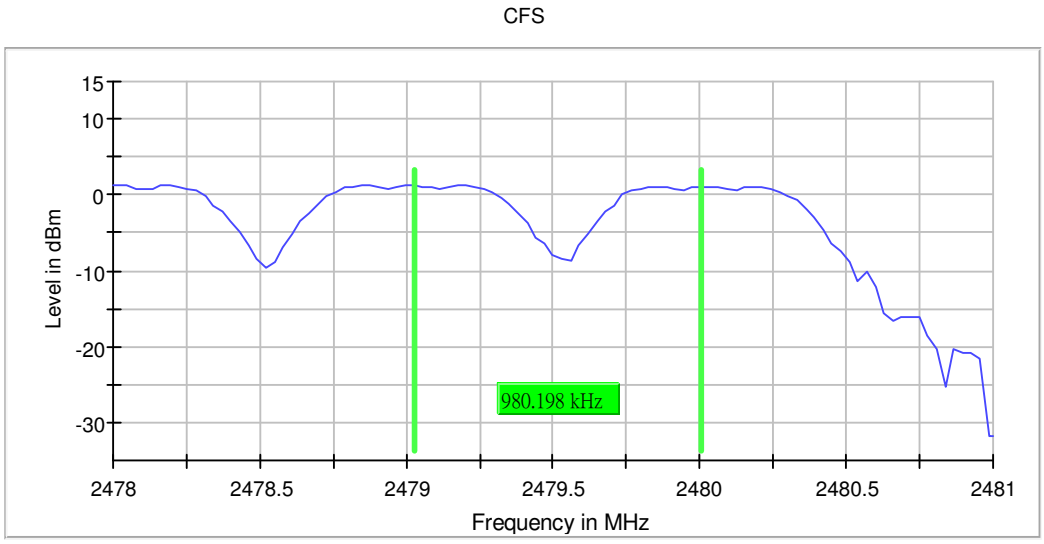
2DH5:

CFS

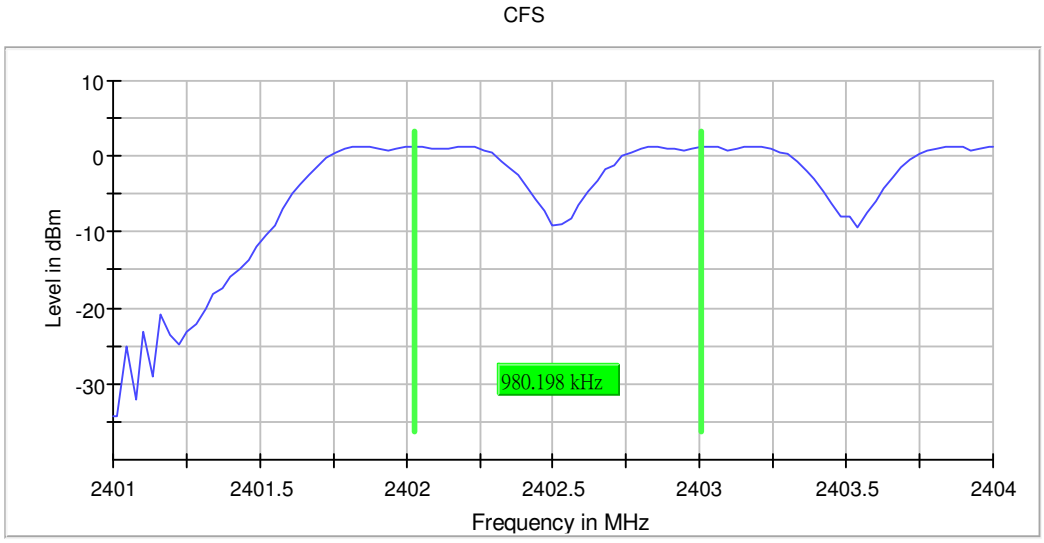

15
10
0
-10
-20
-30
Level in dBm
980.198 kHz
2401
2401.5
2402
2402.5
2403
2403.5
2404
Frequency in MHz

CFS

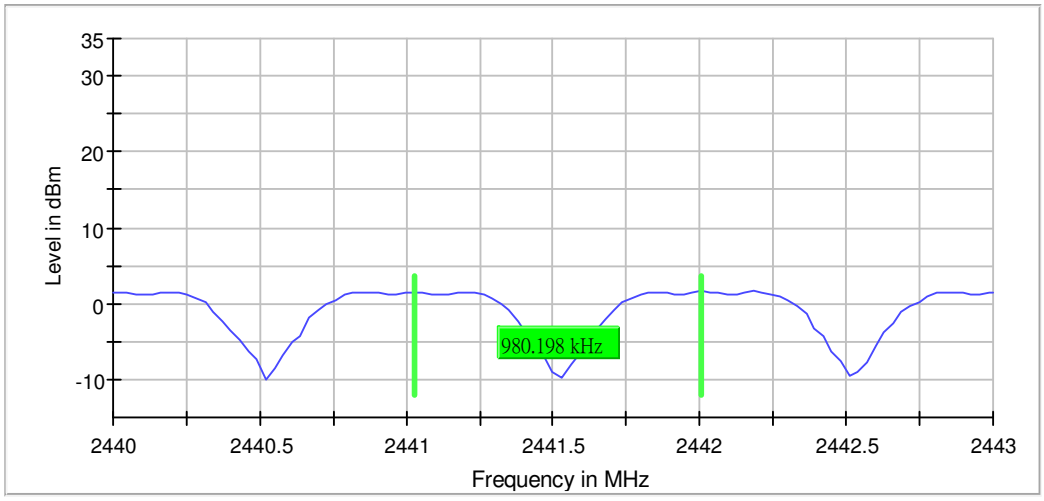

35
30
20
10
0
-10
Level in dBm
980.198 kHz
2440
2440.5
2441
2441.5
2442
2442.5
2443
Frequency in MHz


CFS
15
10
0
-10
-20
-30
Level in dBm
980.198 kHz
2478
2478.5
2479
2479.5
2480
2480.5
2481
Frequency in MHz

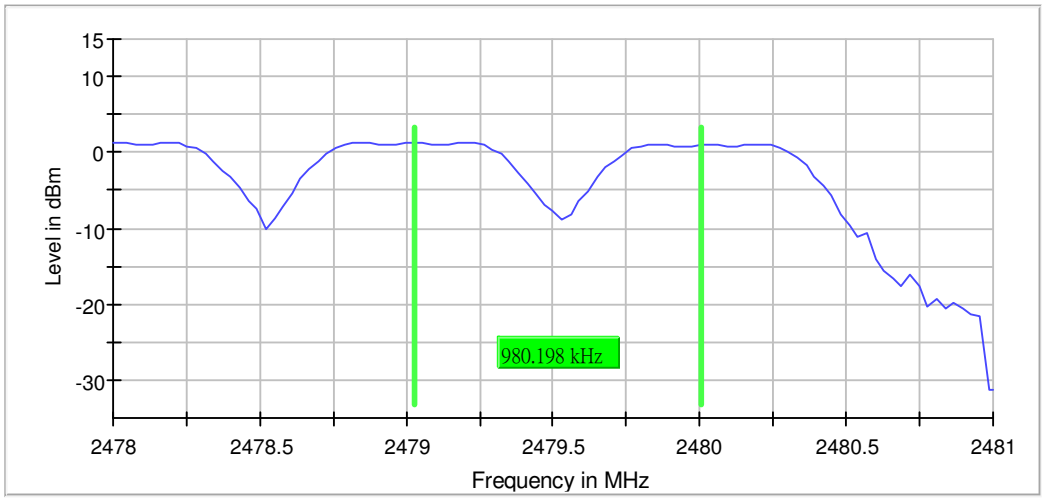
3DH5:


CFS
10
0
-10
-20
-30
Level in dBm
980.198 kHz
2401
2401.5
2402
2402.5
2403
2403.5
2404
Frequency in MHz

CFS

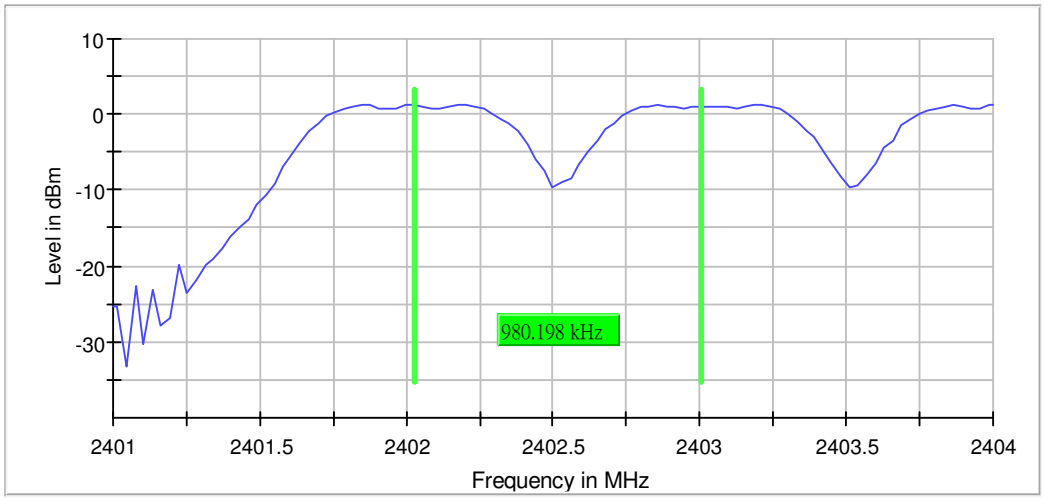

35
30
20
10
0
-10
Level in dBm
980.198 kHz
2440
2440.5
2441
2441.5
2442
2442.5
2443
Frequency in MHz

CFS

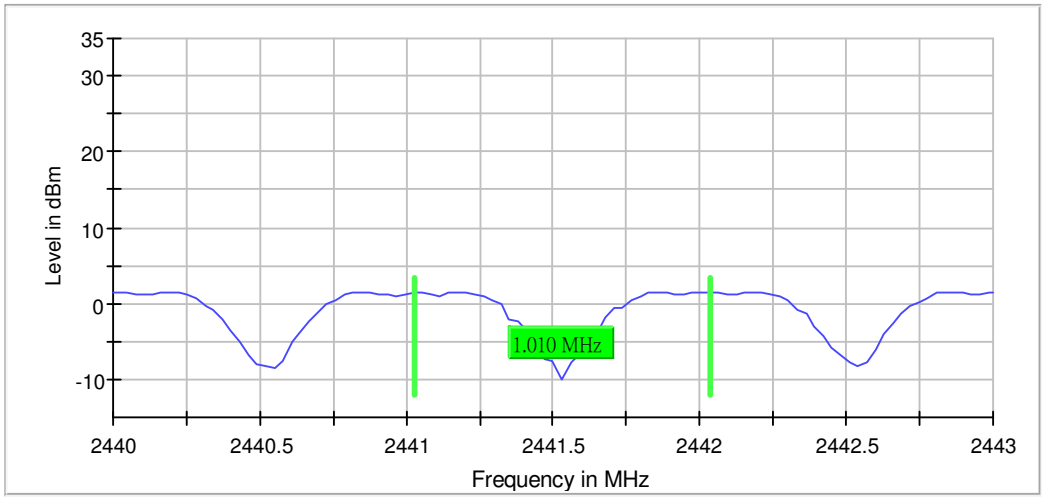

15
10
0
-10
-20
-30
Level in dBm
980.198 kHz
2478
2478.5
2479
2479.5
2480
2480.5
2481
Frequency in MHz

DM5:

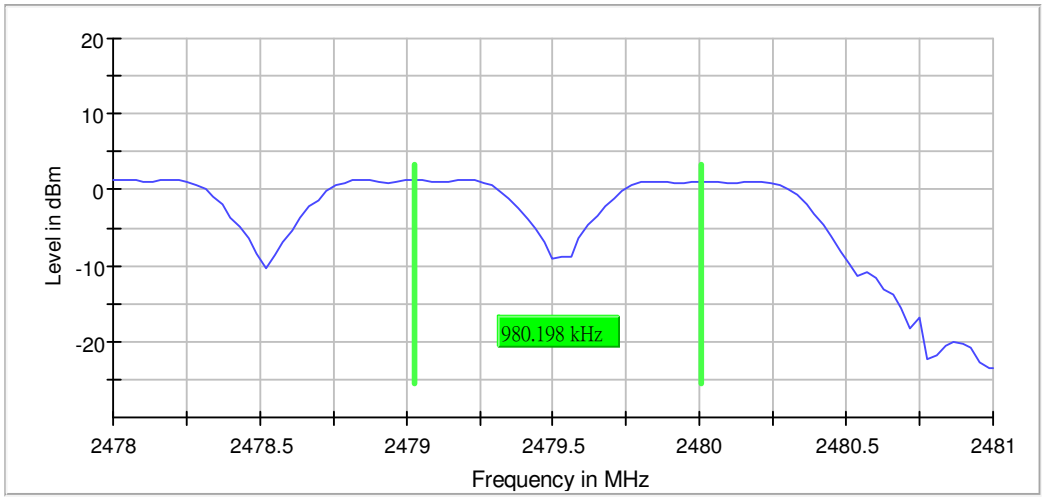
CFS


10
0
-10
-20
-30
Level in dBm
980.198 kHz
2401
2401.5
2402
2402.5
2403
2403.5
2404
Frequency in MHz

CFS

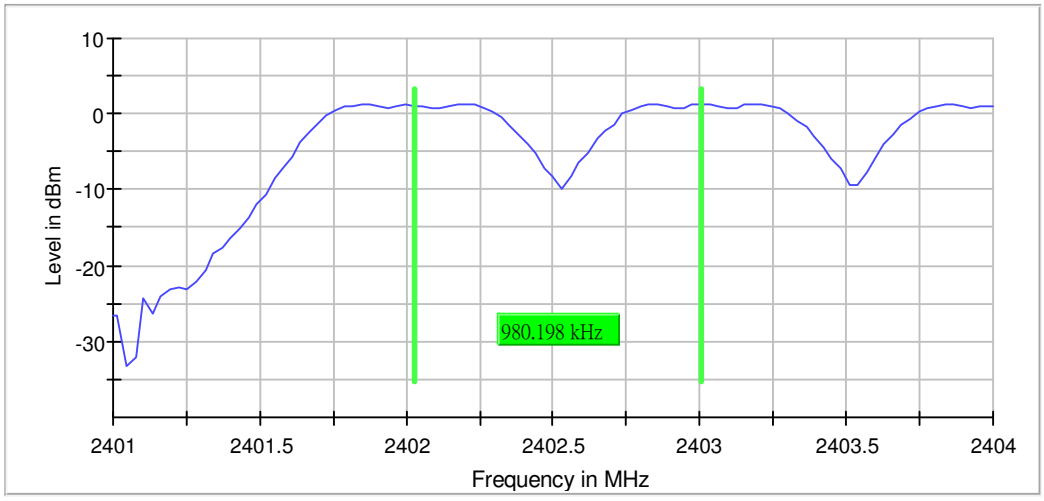

35
30
20
10
0
-10
Level in dBm
1.010 MHz
2440
2440.5
2441
2441.5
2442
2442.5
2443
Frequency in MHz

CFS

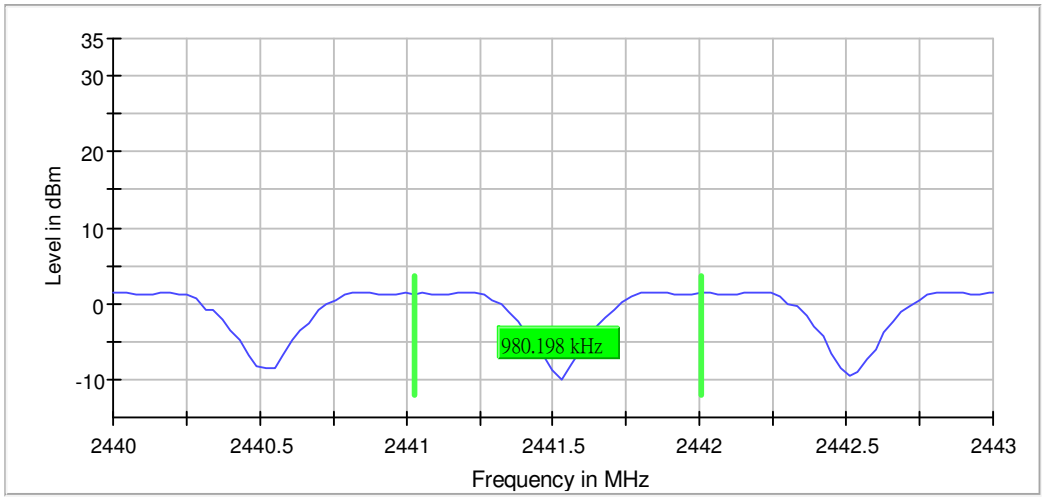

20
10
0
-10
-20
Level in dBm
980.198 kHz
2478
2478.5
2479
2479.5
2480
2480.5
2481
Frequency in MHz

HV3:

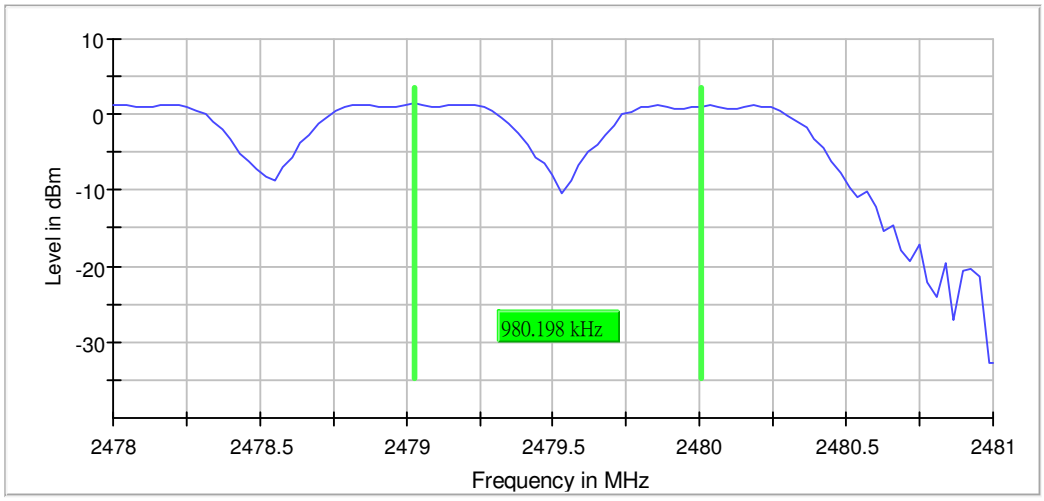
CFS


10
0
-10
-20
-30
Level in dBm
980.198 kHz
2401
2401.5
2402
2402.5
2403
2403.5
2404
Frequency in MHz

CFS


35
30
20
10
0
-10
Level in dBm
980.198 kHz
2440
2440.5
2441
2441.5
2442
2442.5
2443
Frequency in MHz

CFS


10
0
-10
-20
-30
Level in dBm
980.198 kHz
2478
2478.5
2479
2479.5
2480
2480.5
2481
Frequency in MHz

Measurement

Setting	Instrument Value	Target Value
RBW	10.000 kHz	>= 10.000 kHz
VBW	30.000 kHz	>= 30.000 kHz
SweepPoints	101	~ 101
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	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	19 / max. 150	max. 150
Stable	10 / 10	10
Max Stable Difference	0.20 dB	0.50 dB

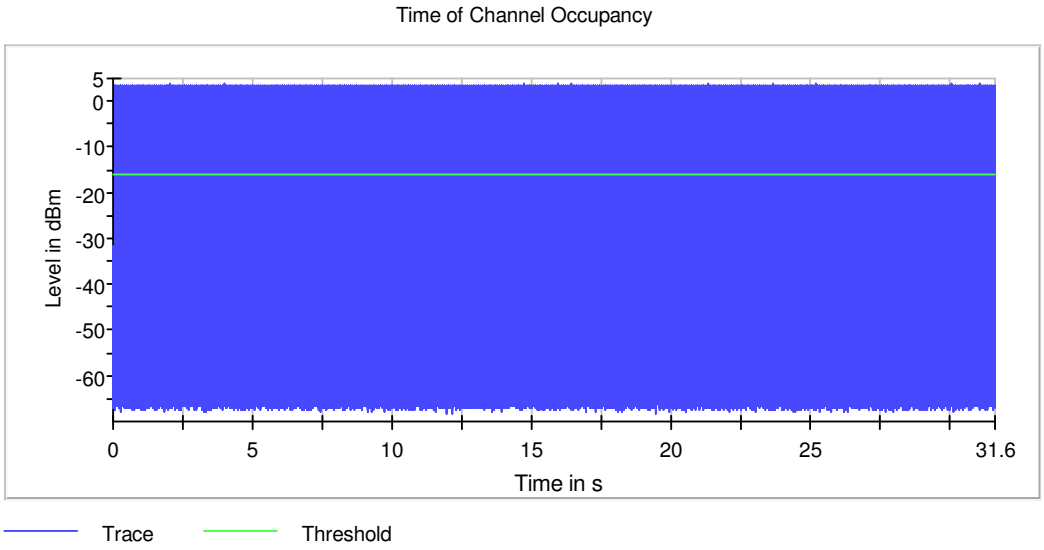
Remark: Cable loss 0.8dB was considered and set in system configuration.

9.4 Dwell Time

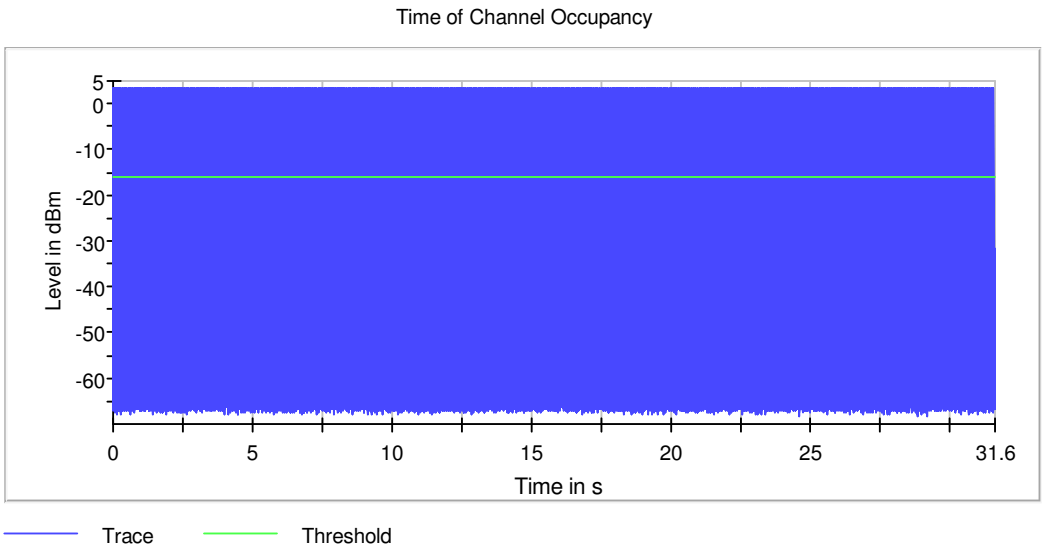
Test Mode	Channel (MHz)	Width of Burst (ms)	Number of Burst(s)	Active Channels	Measurement Time (s)	Dwell Time (ms)	Limit (ms)	Result
DH1	2402	0.393	621	79	31.6	244.05	≤400	Pass
2DH1	2402	0.394	622	79	31.6	244.07	≤400	Pass
3DH1	2402	0.392	620	79	31.6	243.04	≤400	Pass
DM1	2402	0.391	621	79	31.6	242.81	≤400	Pass
HV1	2402	0.393	624	79	31.6	245.23	≤400	Pass

*Remark: the channel shown is the worst case.

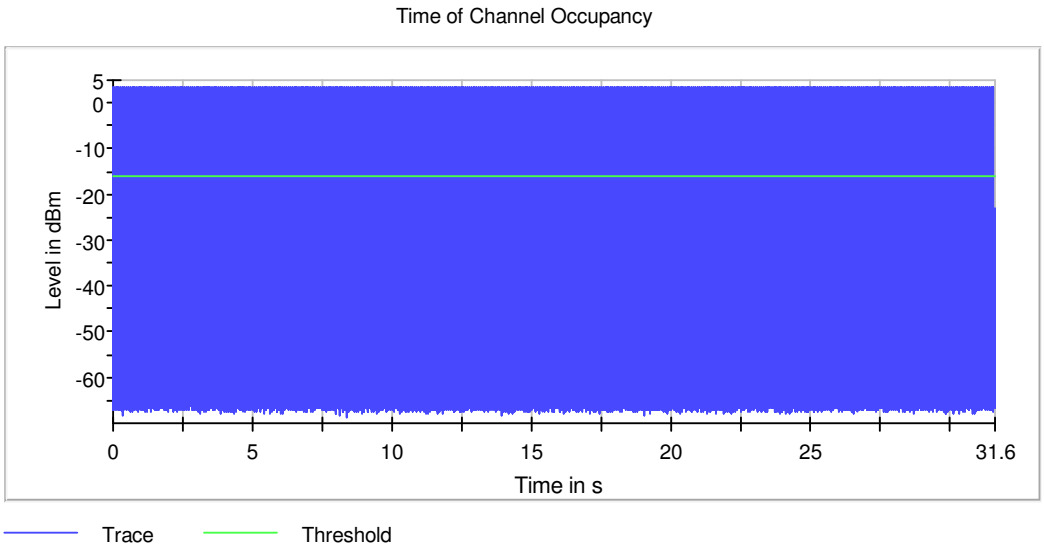
DH1:



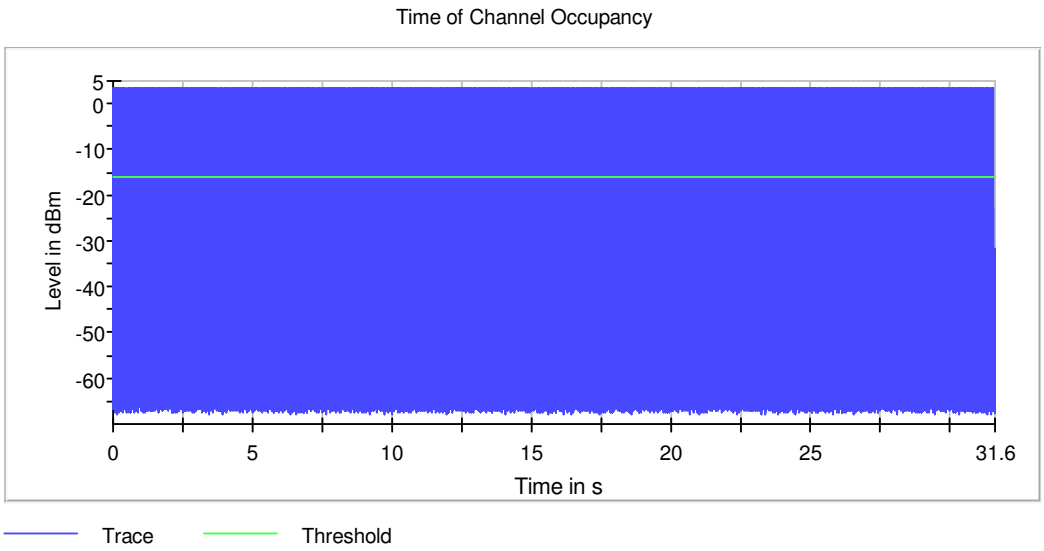
2DH1:


Time of Channel Occupancy
Level in dBm
5
0
-10
-20
-30
-40
-50
-60
0
5
10
15
20
25
31.6
Time in s
Trace
Threshold

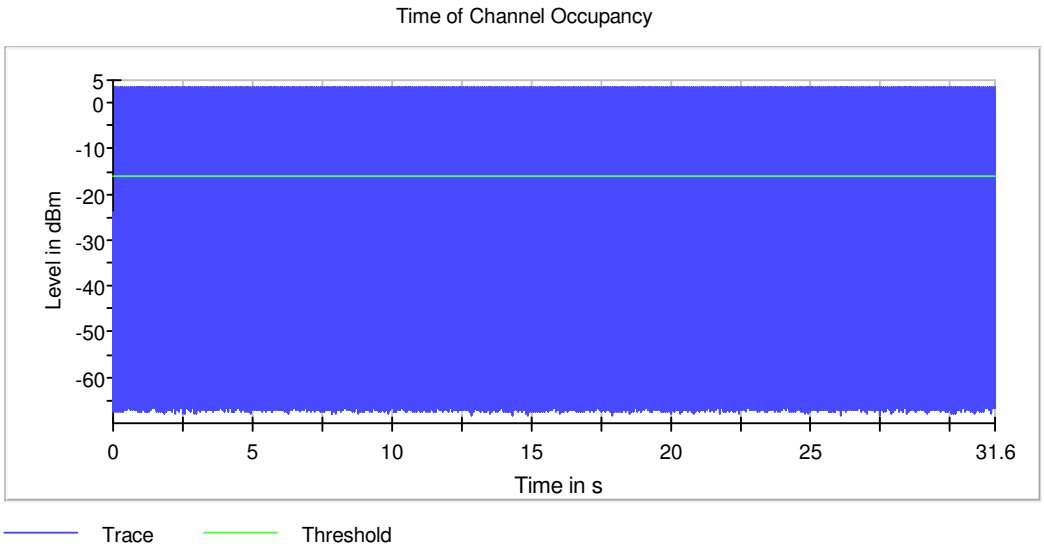
3DH1:


Time of Channel Occupancy
Level in dBm
5
0
-10
-20
-30
-40
-50
-60
0
5
10
15
20
25
31.6
Time in s
Trace
Threshold

DM1:


Time of Channel Occupancy
Level in dBm
5
0
-10
-20
-30
-40
-50
-60
0
5
10
15
20
25
31.6
Time in s
Trace
Threshold

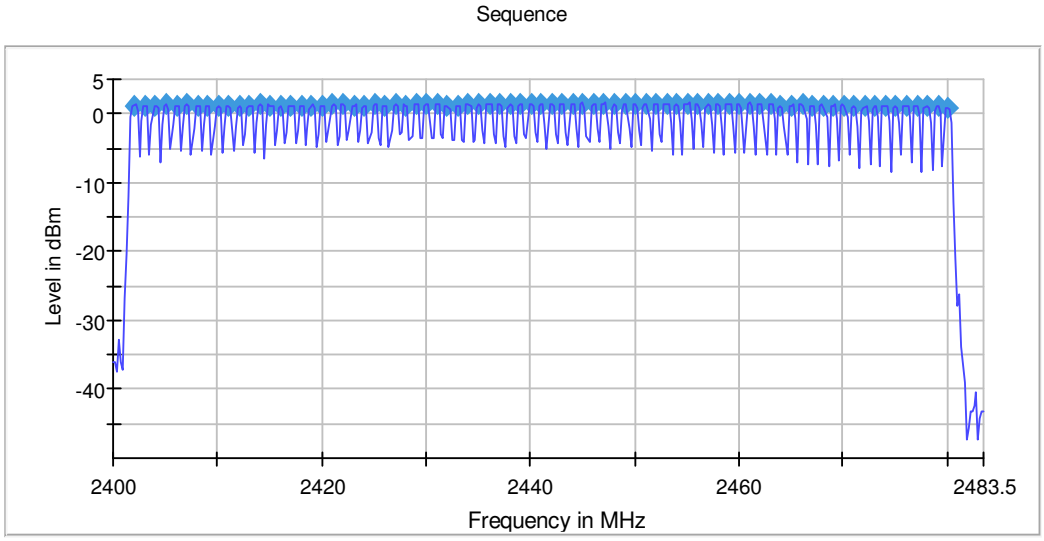
HV1:


Time of Channel Occupancy
Level in dBm
5
0
-10
-20
-30
-40
-50
-60
0
5
10
15
20
25
31.6
Time in s
Trace
Threshold

9.5 Hopping Frequencies

The worst case is shown below.

Channels	Limit Min	Result
79	15	PASS



Measurement Setting

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
VBW	200.000 kHz	>= 200.000
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	74 / max. 150	max. 150

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

9.6 Conducted Band Edge Measurement

The worst case is shown below.

Non-hopping mode

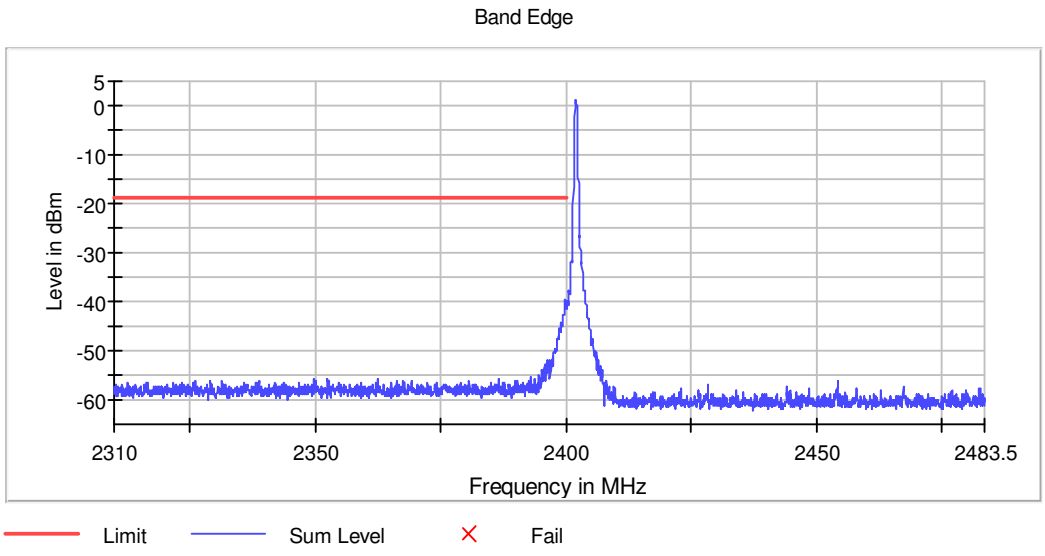
HV1:

Inband Peak

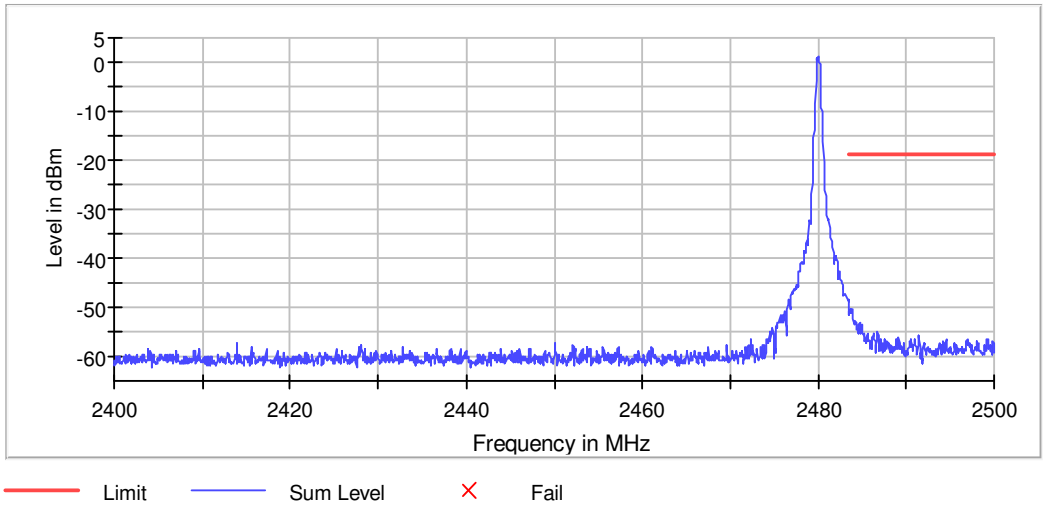
Frequency (MHz)	L evel (dBm)
2402.025000	1.3
2480.025000	1.1

Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Result
2399.925000	-39.5	-18.7	20.8	PASS
2483.875000	-50.3	-18.9	31.4	PASS

Remark: Limit = Inband peak – 20dB



Band Edge



Measurement Setting

Setting	Instrument Value	Target Value
RBW	100.000 kHz	<= 100.000
VBW	300.000 kHz	>= 300.000
SweepPoints	1670	~ 1670
Sweeptime	1.670 ms	AUTO
Reference Level	0.000 dBm	0.000 dBm
Attenuation	20.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweeptype	Sweep	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	5 / max. 150	max. 150
Stable	3 / 3	3
Max Stable Difference	0.11 dB	0.50 dB

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

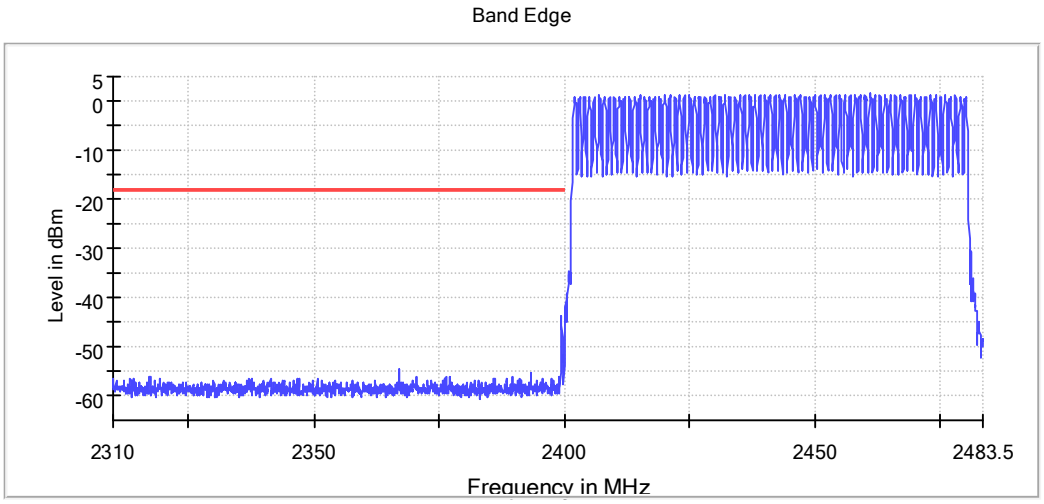
Hopping mode

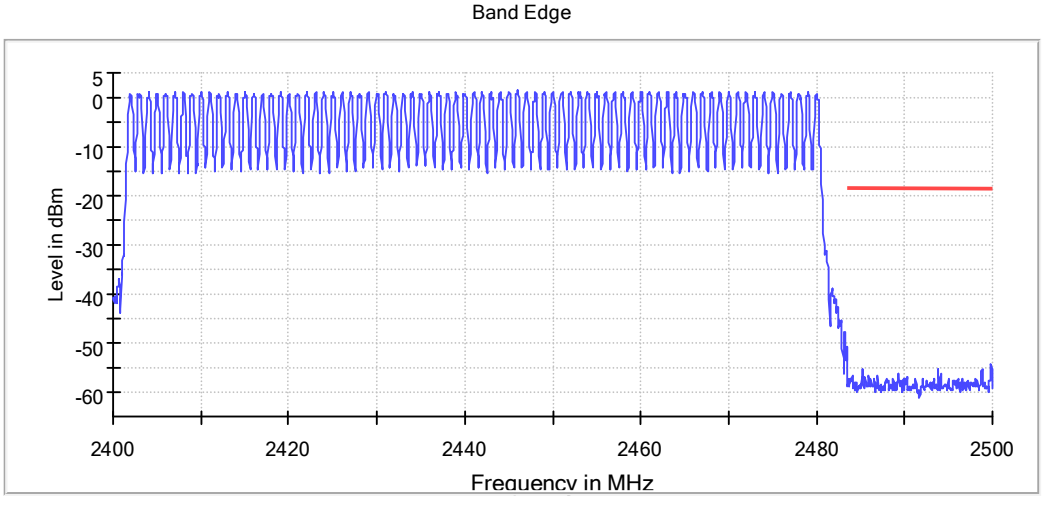
Inband Peak

Frequency (MHz)	Level (dBm)
2461.025000	1.4
2446.025000	1.4

Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Result
2399.425000	-43.9	-18.6	5.3	PASS
2499.875000	-54.3	-18.6	15.7	PASS

Remark: Limit = Inband peak –20dB





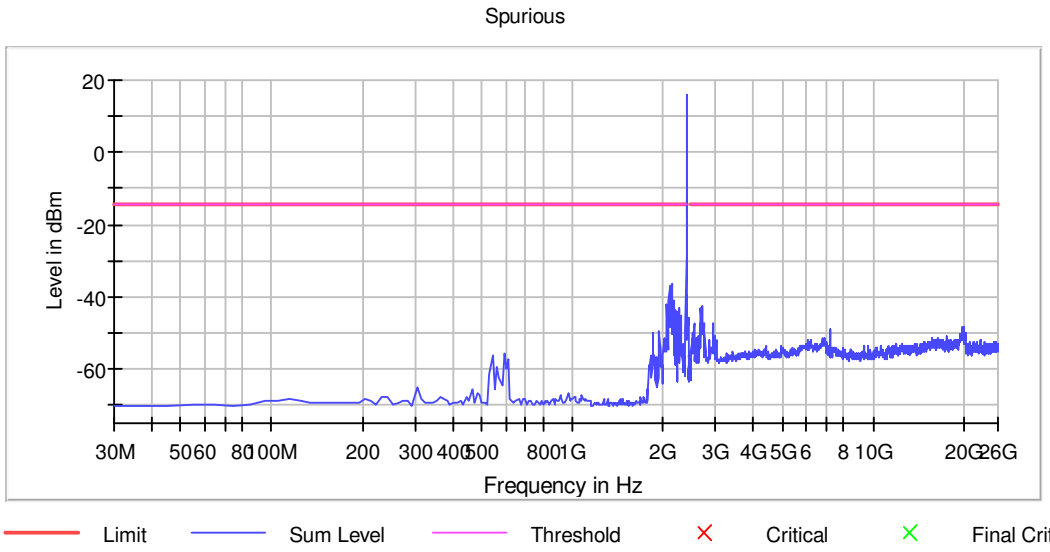
Measurement Setting

Setting	Instrument Value	Target Value
RBW	100.000 kHz	<= 100.000
VBW	300.000 kHz	>= 300.000
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	118 / max. 150	max. 150
Stable	3 / 3	3
Max Stable Difference	0.28 dB	0.50 dB

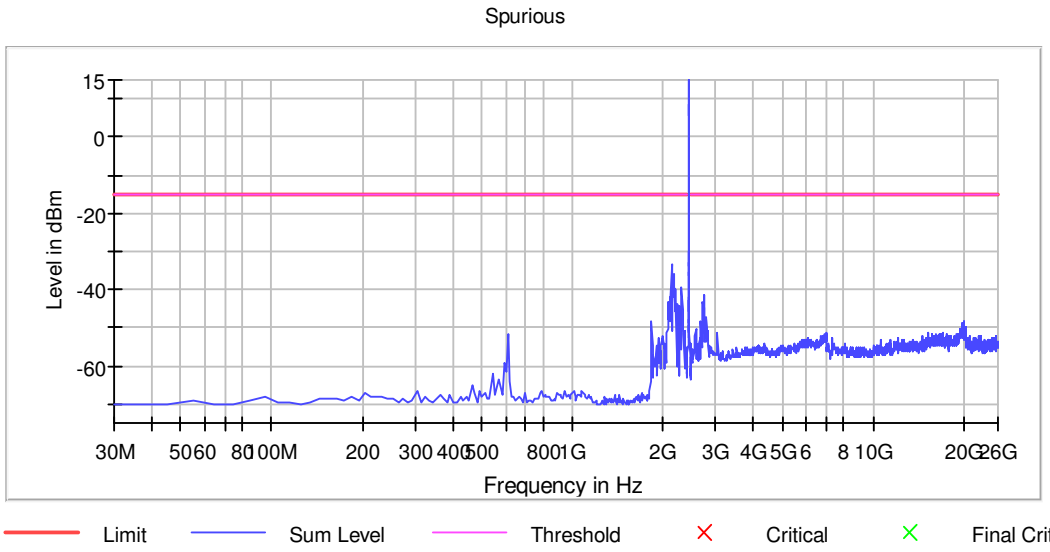
Remark: Cable loss 0.8dB was considered and set in system configuration.

9.7 Conducted spurious emission

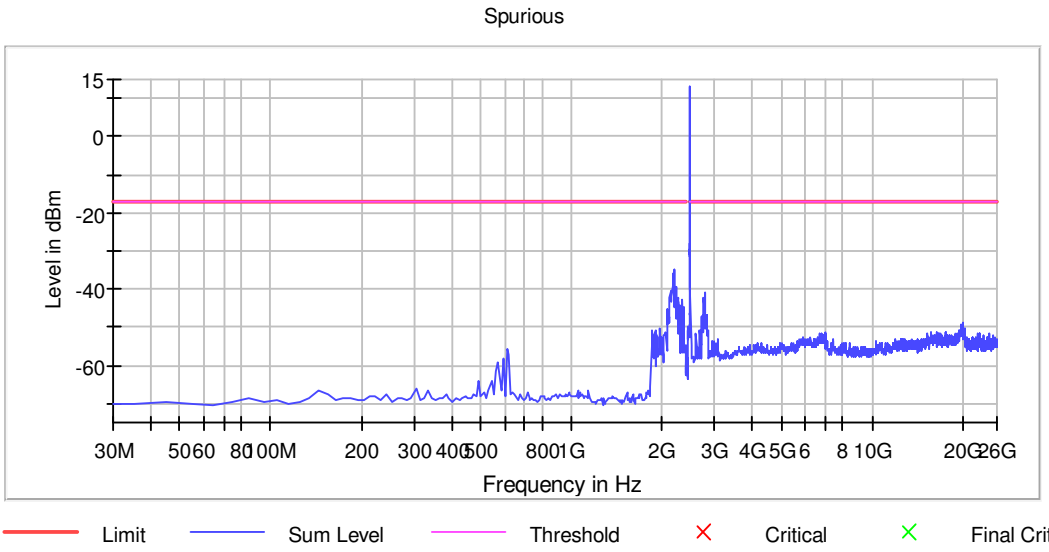
Lowest Channel



Middle Channel



Highest Channel



Measurement Setting

Setting	Instrument Value	Target Value
RBW	100.000 kHz	<= 100.000
VBW	300.000 kHz	>= 300.000
SweepPoints	238	~ 238
Sweeptime	23.700 ms	AUTO
Reference Level	-10.000 dBm	-30.000 dBm
Attenuation	20.000 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	14 / 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 -