

FCC - TEST REPORT

Report Number : **709502100632-00** Date of Issue: December 7, 2021

Model : **FOTRIC 326M etc. (Details refer to page 4)**

Product Type : Infrared Thermal Camera

FCC ID : 2AZTCMOTH

Applicant : FOTRIC INC.

Address : No. 14, Lane 2500, Xiupu Road, Pudong, 201201 Shanghai,
PEOPLE'S REPUBLIC OF CHINA

Manufacturer : FOTRIC INC.

Address : No. 14, Lane 2500, Xiupu Road, Pudong, 201201 Shanghai,
PEOPLE'S REPUBLIC OF CHINA

Test Result : ☒ **Positive** ☐ **Negative**

Total pages including Appendices : 64

TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch is a subcontractor to TÜV SÜD Product Service GmbH according to the principles outlined in ISO 17025.

TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch reports apply only to the specific samples tested under stated test conditions. Construction of the actual test samples has been documented. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. The manufacturer/importer is responsible to the Competent Authorities in Europe for any modifications made to the production units which result in non-compliance to the relevant regulations. TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch shall have no liability for any deductions, inferences or generalizations drawn by the client or others from TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch issued reports.

This report is the confidential property of the client. As a mutual protection to our clients, the public and ourselves, extracts from the test report shall not be reproduced except in full without our written approval.

1 Table of Contents

1	Table of Contents	2
2	Details about the Test Laboratory	3
3	Description of the Equipment Under Test.....	4
4	Summary of Test Standards	6
5	Summary of Test Results	7
6	General Remarks	8
7	Test Setups	9
8	Systems test configuration	12
9	Technical Requirement.....	13
9.1	Conducted Emission.....	13
9.2	Conducted peak output power.....	16
9.3	20 dB Occupied Bandwidth	20
9.4	Carrier Frequency Separation	24
9.5	Number of hopping frequencies.....	27
9.6	Dwell Time	29
9.7	Spurious RF conducted emissions	33
9.8	Band edge testing.....	50
9.9	Spurious radiated emissions for transmitter and receiver.....	56
10	Test Equipment List	61
11	System Measurement Uncertainty.....	62
12	Photographs of Test Set-ups	63
13	Photographs of EUT	64



2 Details about the Test Laboratory

Details about the Test Laboratory

Test Site 1	TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch No.16 Lane, 1951 Du Hui Road, Shanghai 201108, P.R. China
Telephone:	+86 21 6141 0123
Fax:	+86 21 6140 8600
FCC Registration No.:	820234
FCC Designation Number:	CN1183
ISED#:	25988
CAB identifier:	CN0101

3 Description of the Equipment Under Test

Product:	Infrared Thermal Camera
Model no.:	FOTRIC 326Q, FOTRIC 325Q, FOTRIC 325Q, FOTRIC 323Q, FOTRIC 323Q, FOTRIC 321Q, FOTRIC 316, FOTRIC 315, FOTRIC 314, FOTRIC 313, FOTRIC 312, FOTRIC 311, FOTRIC 336Q, FOTRIC 335Q, FOTRIC 334Q, FOTRIC 333Q, FOTRIC 332QA, FOTRIC 331QA, FOTRIC 336QA, FOTRIC 335QA, FOTRIC 334QA, FOTRIC 333QA, FOTRIC 332QA, FOTRIC 331QA, FOTRIC 326X, FOTRIC 325X, FOTRIC 324X, FOTRIC 323X, FOTRIC 322X, FOTRIC 321X, FOTRIC 316B, FOTRIC 315B, FOTRIC 314B, FOTRIC 313B, FOTRIC 312B, FOTRIC 311B, FOTRIC 326M, FOTRIC 325M, FOTRIC 325M, FOTRIC 323M, FOTRIC 322M, FOTRIC 321M, FOTRIC 326F, FOTRIC 325F, FOTRIC 323F, FOTRIC 322F, FOTRIC 321F, FOTRIC 326G, FOTRIC 325G, FOTRIC 324G, FOTRIC 323G, FOTRIC 322G, FOTRIC 321G, FOTRIC 329G, FOTRIC 328G, FOTRIC 327G, FOTRIC 329P, FOTRIC 328P, FOTRIC 327P, FOTRIC 326P, FOTRIC 325P, FOTRIC 324P, FOTRIC 323P, FOTRIC 322P, FOTRIC 321P, FOTRIC 326E, FOTRIC 325E, FOTRIC 324E, FOTRIC 323E, FOTRIC 322E, FOTRIC 321E, FOTRIC 329E, FOTRIC 328E, FOTRIC 327E, FOTRIC 311CE, FOTRIC 691B
Sample(s) Tested:	FOTRIC 326M
FCC ID:	2AZTCMOTH
Options and accessories:	Test harness
Rating:	DC 3.6V Li-ion Battery
RF Transmission Frequency:	2402~2480MHz for Bluetooth For 2.4G & 5G Wi-Fi For 802.11b/g/n-HT20: 2412~2462 MHz For 802.11n-HT40: 2422~2452 MHz 5180~5240 MHz (U-NII-1) 5260~5320 MHz (U-NII-2A) 5500~5720 MHz (U-NII-2C) 5745~5825 MHz (U-NII-3)
No. of Operated Channel:	79 channels for Bluetooth 4.2+EDR 40 channels for Bluetooth 4.2 BLE For 2.4GHz Wi-Fi

Operation Frequency each of channel For 802.11b/g/n(H20)							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
1	2412MHz	4	2427MHz	7	2442MHz	10	2457MHz
2	2417MHz	5	2432MHz	8	2447MHz	11	2462MHz
3	2422MHz	6	2437MHz	9	2452MHz		

Operation Frequency each of channel For 802.11n(H40)							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
		4	2427MHz	7	2442MHz		
		5	2432MHz	8	2447MHz		
3	2422MHz	6	2437MHz	9	2452MHz		

5180~5240 MHz (U-NII-1)

5260~5320 MHz (U-NII-2A)

5500~5720 MHz (U-NII-2C)

5745~5825 MHz (U-NII-3)

Modulation: Bluetooth 4.2+EDR FHSS: GFSK, $\pi/4$ DQPSK, 8DPSK
 Bluetooth 4.2 BLE digital modulation: GFSK
 For Wi-Fi: Direct Sequence Spread Spectrum (DSSS) for 802.11b
 Orthogonal Frequency Division Multiplexing (OFDM) for 802.11a/b/g/n/ac

Hardware Version: V02

Software Version: 1.0.13

Data speed:

1. Bluetooth 4.2+EDR FHSS: 1Mbps, 2Mbps, 3Mbps
2. Bluetooth 4.2 BLE digital modulation: 1Mbps
3. Wi-Fi: 11b 1 ~ 11Mbps,
 11g/a 6 ~ 54Mbps, 11n HT20 6.5 ~ 72.2Mbps,
 11n HT 40 13.5 ~ 150Mbps,
 11ac VHT40 13.5 ~ 200Mbps,
 11ac VHT80 29.3 ~ 433.3Mbps

Duty Cycle: 100%

Antenna Type: PIFA Antenna

Antenna Gain: 2.5dBi

Description of the EUT: The Equipment Under Test (EUT) is an Infrared Thermal Camera with Bluetooth and Wi-Fi Module. The EUT support Bluetooth 4.2+EDR and support BLE function and Wi-Fi operated at 5GHz and 2.4GHz. Only 2.4G Bluetooth 4.2+EDR included in this report.

Test sample no.: SHA-564832-1

The sample's mentioned in this report is/are submitted/ supplied/ manufactured by client. The laboratory therefore assumes no responsibility for accuracy of information on the brand name, model number, origin of manufacture, consignment, antenna gain or any information supplied.



China

4 Summary of Test Standards

Test Standards	
FCC Part 15 Subpart C 10-1-2020 Edition	PART 15 - RADIO FREQUENCY DEVICES Subpart C - Intentional Radiators

All the test methods were according to Public Notice DA 00-705 -Frequency Hopper Spread Spectrum Test Procedure released by FCC on March 30, 2000, KDB558074 D01 v05r02 and C63.10 (2013).

5 Summary of Test Results

Technical Requirements				
FCC Part 15 Subpart C				
Test Condition		Pages	Test Site	Test Result
§15.207	Conducted emission AC power port	13-15	Site 1	Pass
§15.247(b)(1)	Conducted peak output power	16-19	Site 1	Pass
§15.247(a)(2)	6dB bandwidth	---	---	N/A
§15.247(a)(1)	20dB Occupied Bandwidth	20-23	Site 1	Pass
§15.247(a)(1)	Carrier frequency separation	24-26	Site 1	Pass
§15.247(a)(1)(iii)	Number of hopping frequencies	27-28	Site 1	Pass
§15.247(a)(1)(iii)	Dwell Time	29-32	Site 1	Pass
§15.247(e)	Power spectral density*	---	---	N/A
§15.247(d)	Spurious RF conducted emissions	33-49	Site 1	Pass
§15.247(d)	Band edge	50-55	Site 1	Pass
§15.247(d) & §15.209 &	Spurious radiated emissions for transmitter and receiver	56-60	Site 1	Pass
§15.203	Antenna requirement	See note 1		Pass

Note 1: The EUT uses a patch antenna, which gain is 2.5dBi. In accordance to §15.203, It is considered sufficiently to comply with the provisions of this section.

15.203 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(c) (1)(i) requirement: (i) Systems operating in the 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.

6 General Remarks

Remarks

This submittal(s) (test report) is intended for FCC ID: 2AZTCMOTH, complies with Section 15.207, 15.209, 15.247 of the FCC Part 15, Subpart C rules.

This report is only for Bluetooth EDR. The TX and RX range is 2402MHz-2480MHz.

According to the client's declaration, all the models have the same electrical circuit board and mechanical structure, except pixel, or shell color differences, so we chose the FOTRIC 326M to perform all the tests.

SUMMARY:

All tests according to the regulations cited on page 7 were

■ - Performed

□ - **Not** Performed

The Equipment Under Test

■ - **Fulfills** the general approval requirements.

□ - **Does not** fulfill the general approval requirements.

Sample Received Date: July 9, 2021

Testing Start Date: July 13, 2021

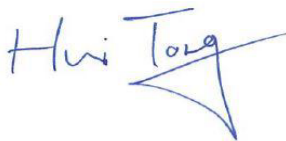
Testing End Date: December 7, 2021

TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch

Reviewed by:

Prepared by:

Tested by:



Hui TONG
Review Engineer

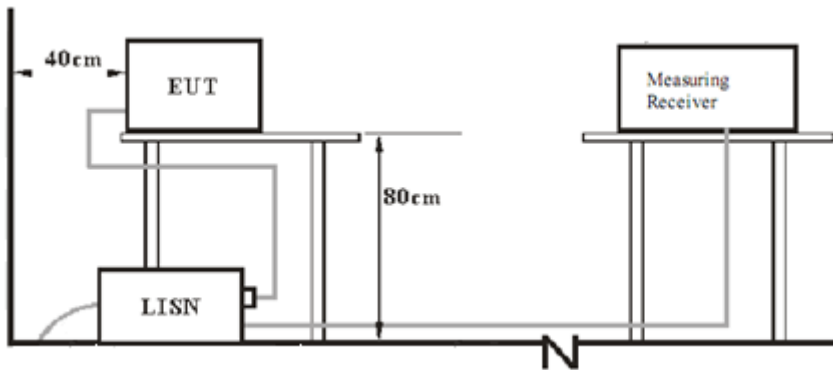
Zhining ZHANG
Project Engineer



Wenqiang LU
Test Engineer

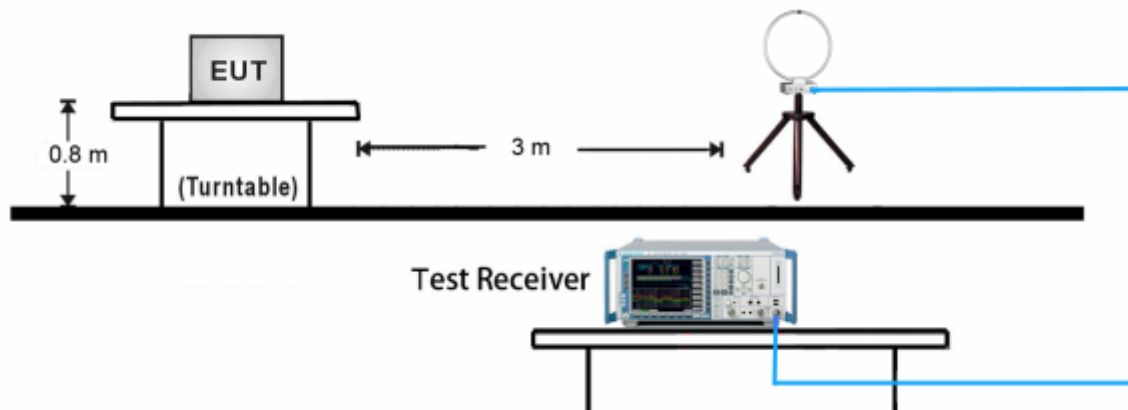
7 Test Setups

7.1 AC Power Line Conducted Emission test setups

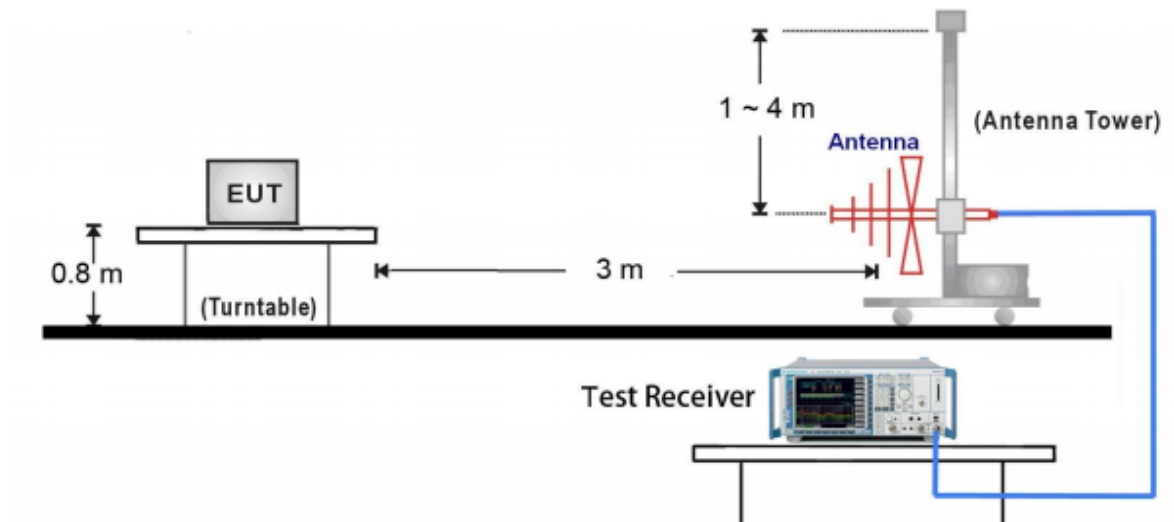


7.2 Radiated test setups

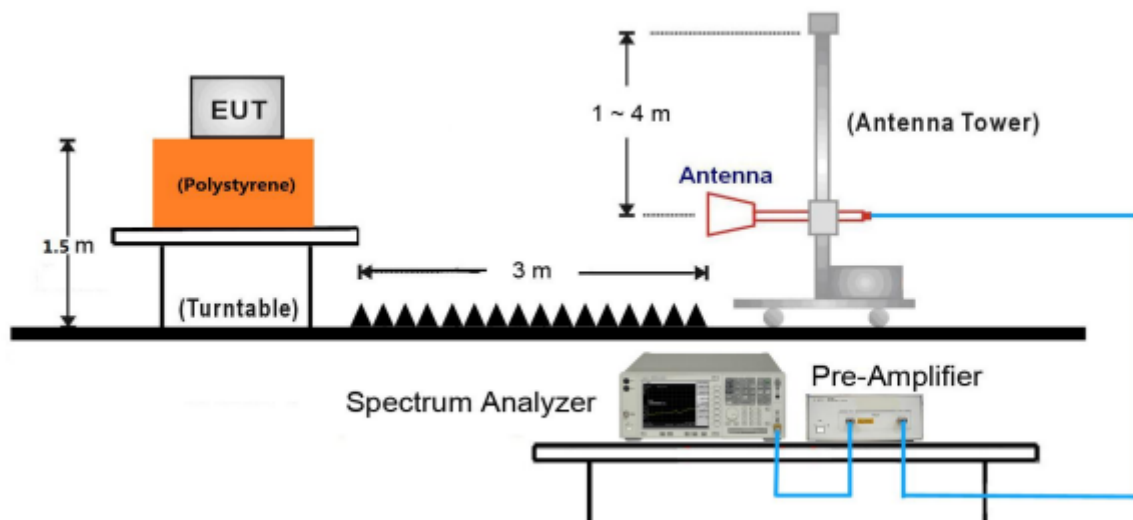
9kHz ~ 30MHz Test Setup:



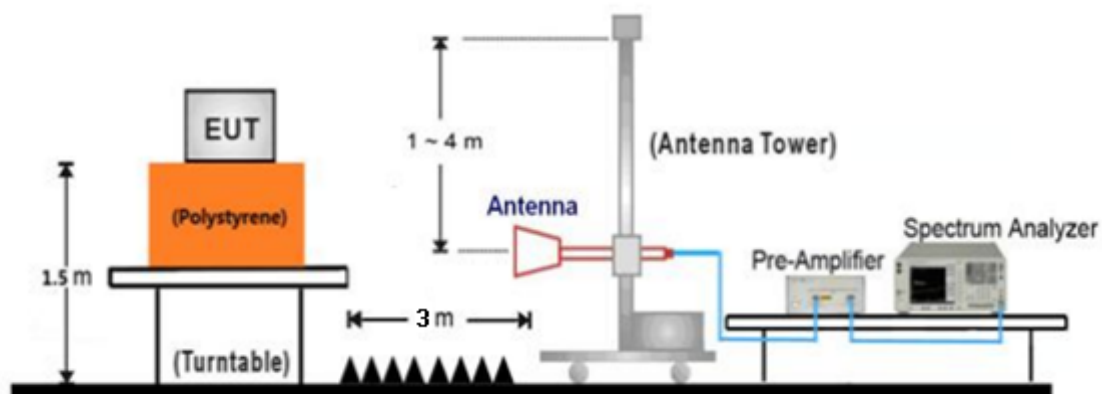
30MHz ~ 1GHz Test Setup:



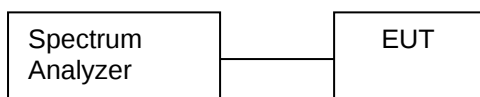
1GHz ~ 18GHz Test Setup:



18GHz ~ 25GHz Test Setup:



7.3 Conducted RF test setups



8 Systems test configuration

Auxiliary Equipment Used during Test:

DESCRIPTION	MANUFACTURER	MODEL NO.(SHIELD)	S/N(LENGTH)
Notebook	Lenovo	X240	--

Test software: QRCT.exe, which used to control the EUT in continues transmitting mode.

The system was configured to hopping mode and non-hopping mode.

Hopping mode: typical working mode (normal hopping status)

Non-hopping mode: The system was configured to operate at a signal channel transmitting. The test software allows the configuration and operation at the worst-case duty and the highest transmit power

9 Technical Requirement

9.1 Conducted Emission

Test Method

1. The EUT was placed on a table, which is 0.8m above ground plane
2. The power line of the EUT is connected to the AC mains through a Artificial Mains Network (A.M.N.).
3. Maximum procedure was performed to ensure EUT compliance
4. A EMI test receiver is used to test the emissions from both sides of AC line

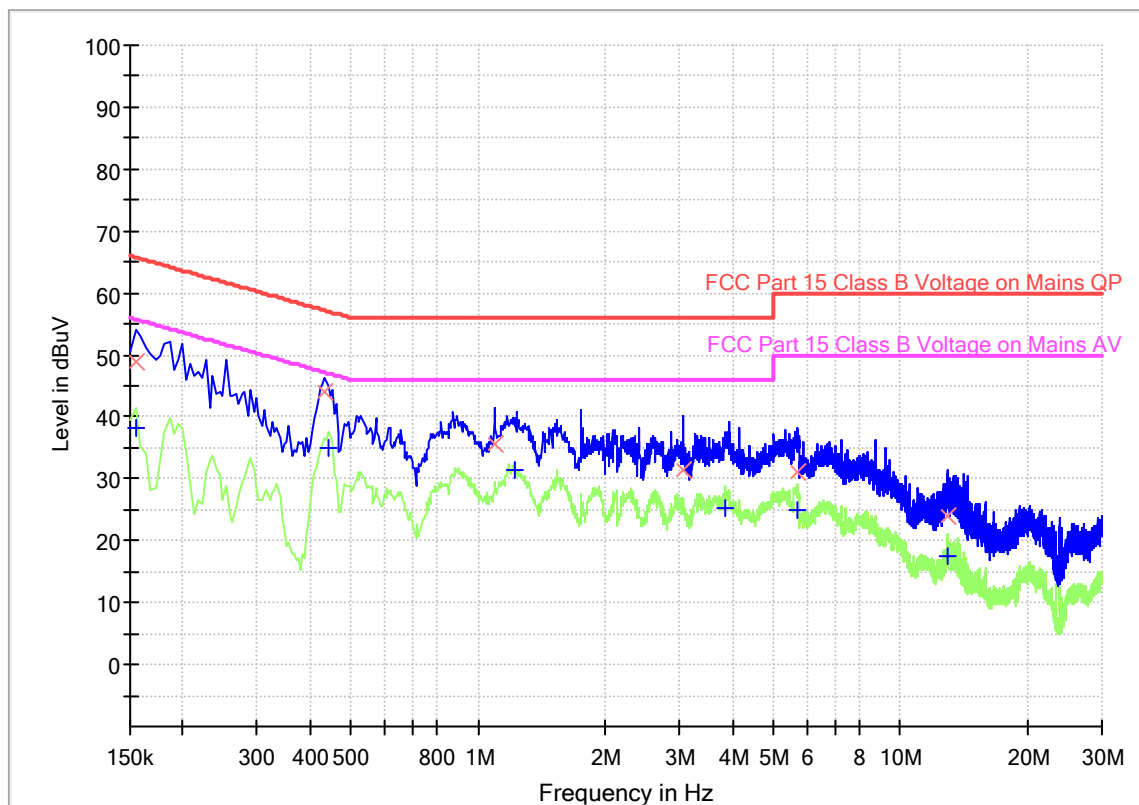
Limit

Frequency MHz	QP Limit dB μ V	AV Limit dB μ V
0.150-0.500	66-56*	56-46*
0.500-5	56	46
5-30	60	50

Decreasing linearly with logarithm of the frequency

Conducted Emission

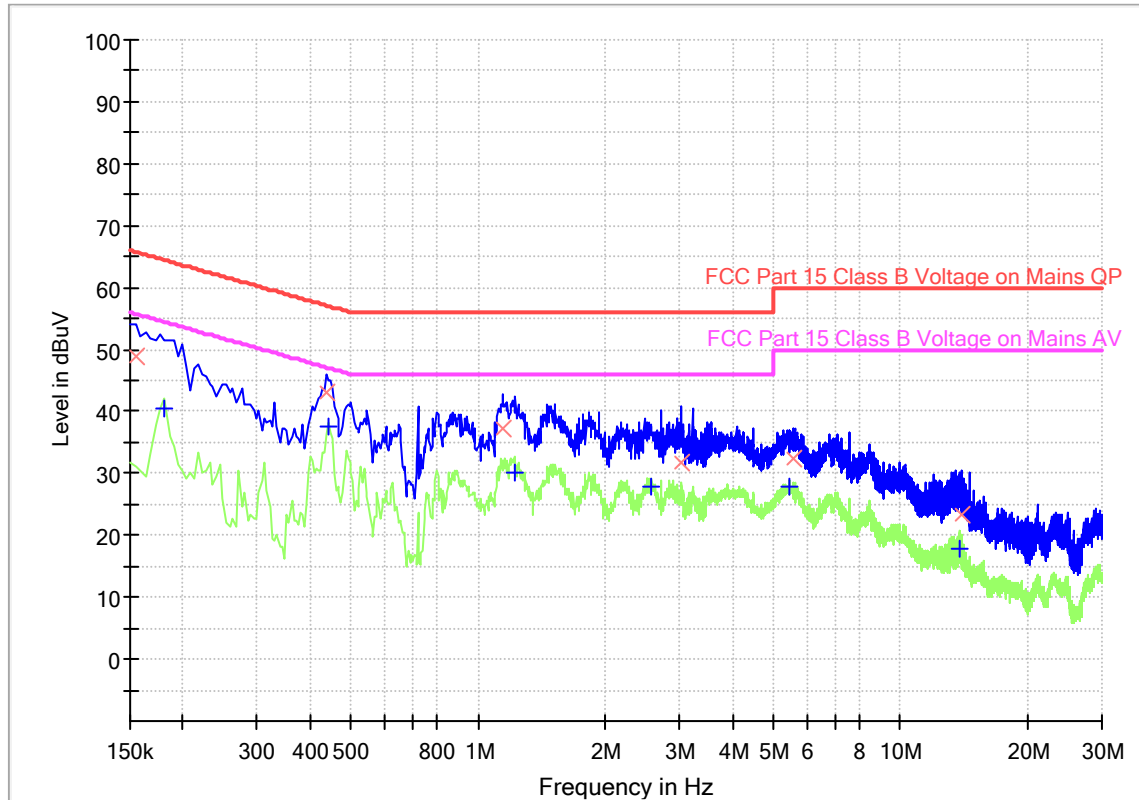
Product Type : Infrared Thermal Camera
 M/N : FOTRIC 326M
 Operating Condition : Mode 1: Tx_2480MHz for 3DH5
 Test Specification : L-Line
 Comment : AC 120V/60Hz (charging mode)



Final Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.154500	---	38.07	55.75	17.68	1000.0	9.000	L1	19.5
0.154500	48.81	---	65.75	16.94	1000.0	9.000	L1	19.5
0.433500	44.15	---	57.19	13.04	1000.0	9.000	L1	19.5
0.442500	---	34.95	47.01	12.06	1000.0	9.000	L1	19.5
1.095000	35.65	---	56.00	20.35	1000.0	9.000	L1	19.5
1.216500	---	31.29	46.00	14.71	1000.0	9.000	L1	19.5
3.070500	31.40	---	56.00	24.60	1000.0	9.000	L1	19.5
3.840000	---	25.29	46.00	20.71	1000.0	9.000	L1	19.5
5.685000	31.10	---	60.00	28.90	1000.0	9.000	L1	19.6
5.689500	---	24.91	50.00	25.09	1000.0	9.000	L1	19.6
12.988500	---	17.39	50.00	32.61	1000.0	9.000	L1	19.7
12.988500	23.84	---	60.00	36.16	1000.0	9.000	L1	19.7

Product Type : Infrared Thermal Camera
 M/N : FOTRIC 326M
 Operating Condition : Mode 1: Tx_2480MHz for 3DH5
 Test Specification : N-Line
 Comment : AC 120V/60Hz (charging mode)



Final Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.154500	48.75	---	65.75	17.00	1000.0	9.000	N	19.5
0.181500	---	40.38	54.42	14.04	1000.0	9.000	N	19.5
0.438000	43.07	---	57.10	14.03	1000.0	9.000	N	19.5
0.442500	---	37.42	47.01	9.59	1000.0	9.000	N	19.5
1.144500	37.34	---	56.00	18.66	1000.0	9.000	N	19.5
1.216500	---	30.12	46.00	15.88	1000.0	9.000	N	19.5
2.580000	---	27.98	46.00	18.02	1000.0	9.000	N	19.6
3.030000	31.78	---	56.00	24.22	1000.0	9.000	N	19.6
5.469000	---	27.94	50.00	22.06	1000.0	9.000	N	19.6
5.577000	32.35	---	60.00	27.65	1000.0	9.000	N	19.6
13.875000	---	17.97	50.00	32.03	1000.0	9.000	N	19.8
13.938000	23.18	---	60.00	36.82	1000.0	9.000	N	19.8

Note 1: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + LISN Factor (dB) + 10dB Attenuator

9.2 Conducted peak output power

Test Method

1. Use the following spectrum analyzer settings:
Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel
RBW > the 20 dB bandwidth of the emission being measured, VBW ≥ RBW,
Sweep = auto, Detector function = peak, Trace = max hold
2. Add a correction factor to the display.
3. Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power

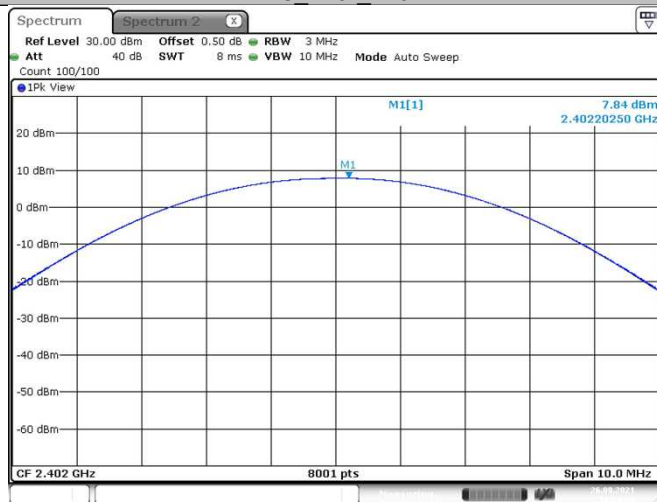
Limits

Frequency Range MHz	Limit W	Limit dBm
2400-2483.5	≤1	≤30

Conducted peak output power

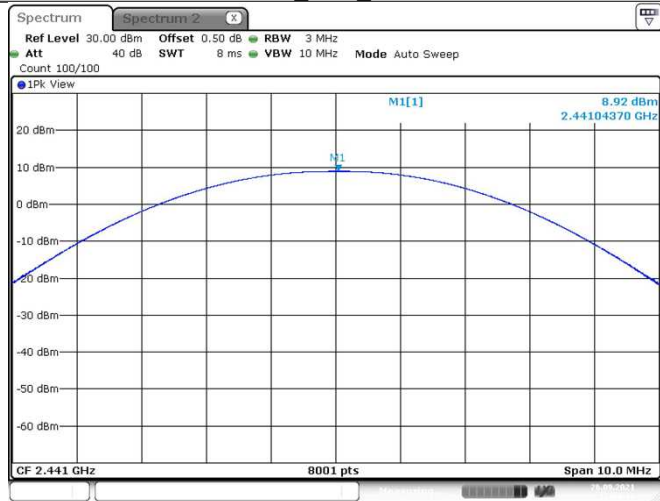
TestMode	Antenna	Channel	Result[dBm]	Limit[dBm]	Verdict
DH5	Ant1	2402	7.84	≤30	PASS
		2441	8.92	≤30	PASS
		2480	4.46	≤30	PASS
2DH5	Ant1	2402	7.86	≤30	PASS
		2441	8.97	≤30	PASS
		2480	4.5	≤30	PASS
3DH5	Ant1	2402	8.02	≤30	PASS
		2441	9.18	≤30	PASS
		2480	4.77	≤30	PASS

DH5 Ant1 2402



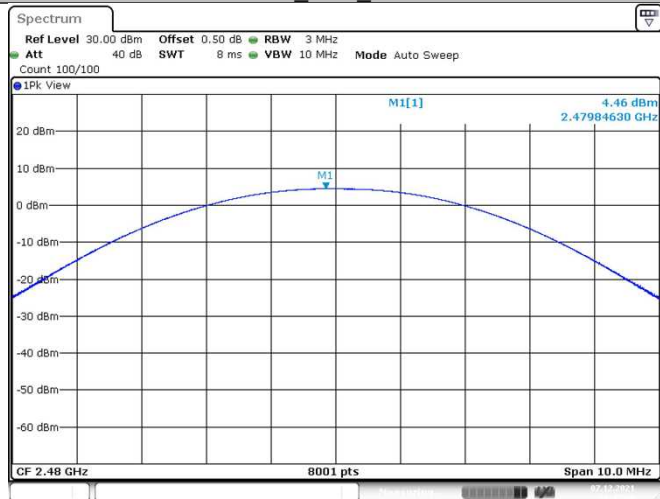
Date: 26 SEP. 2021 16:54:41

DH5_Ant1_2441



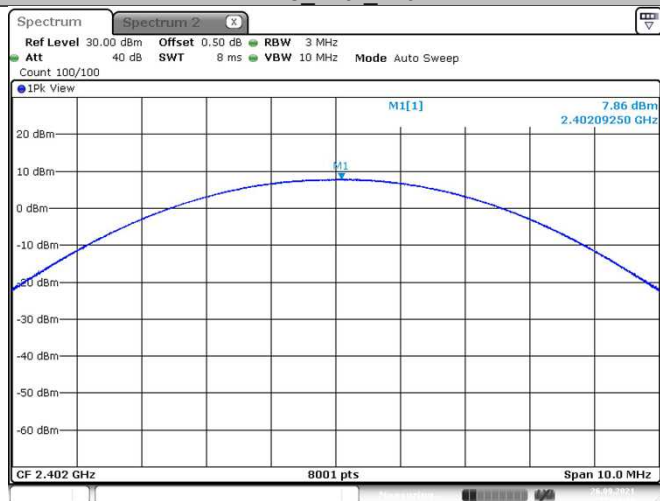
Date: 26.SEP.2021 17:03:19

DH5_Ant1_2480



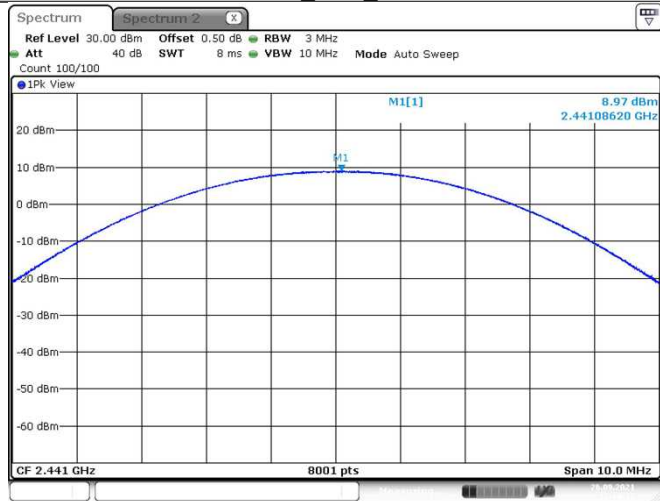
Date: 7.DEC.2021 09:45:43

2DH5_Ant1_2402



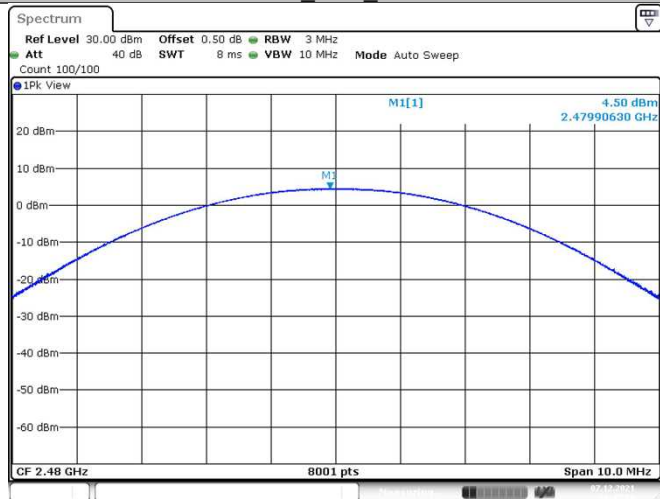
Date: 26.SEP.2021 17:08:13

2DH5_Ant1_2441



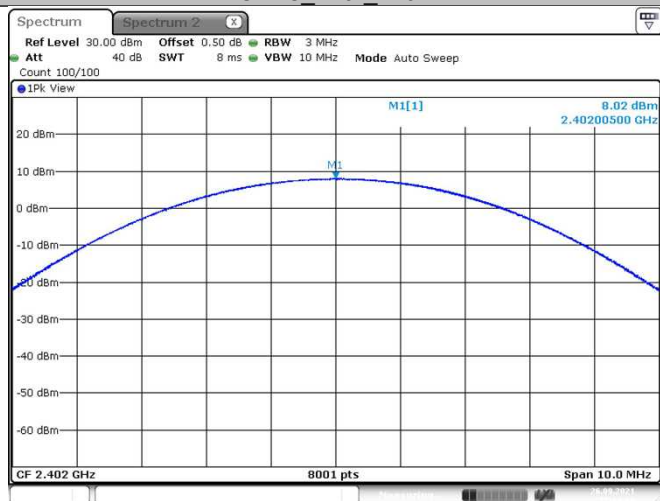
Date: 26.SEP.2021 17:10:17

2DH5_Ant1_2480



Date: 7.DEC.2021 09:47:29

3DH5_Ant1_2402

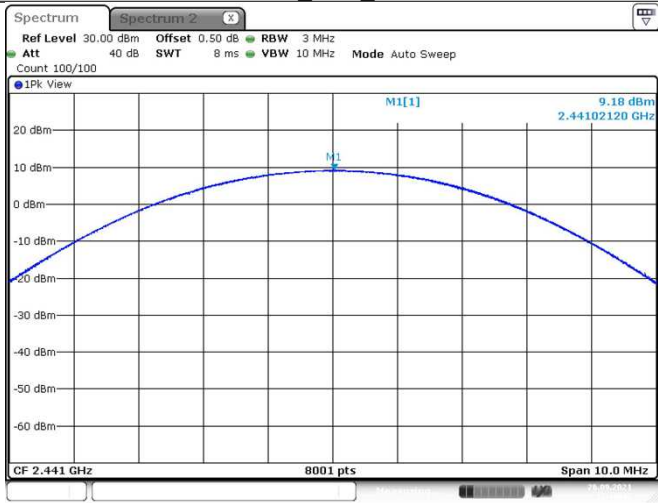


Date: 26.SEP.2021 17:14:37



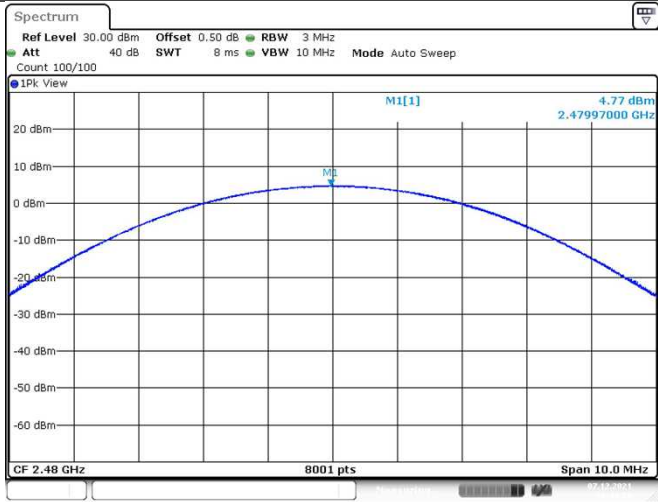
China

3DH5_Ant1_2441



Date: 26.SEP.2021 17:16:42

3DH5_Ant1_2480



Date: 7.DEC.2021 09:49:50

9.3 20 dB Occupied Bandwidth

Test Method

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

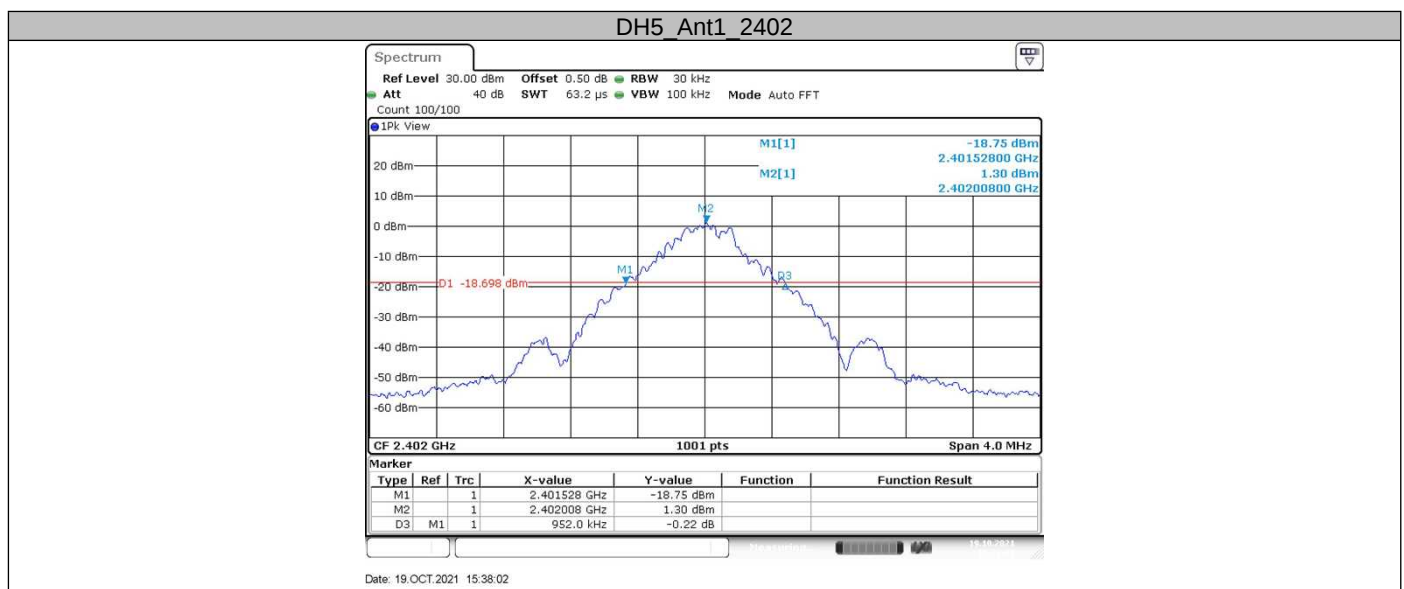
Limit

Limit [kHz]

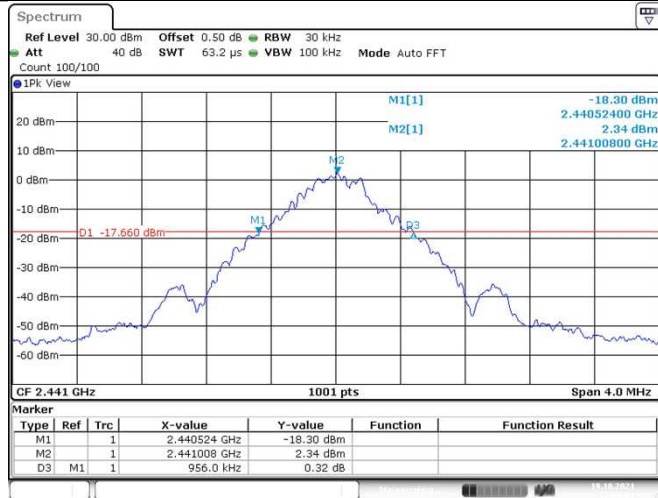
N/A

20 dB Occupied Bandwidth

TestMode	Antenna	Channel	20db EBW[MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
DH5	Ant1	2402	0.952	2401.528	2402.480	0.5	PASS
		2441	0.956	2440.524	2441.480	0.5	PASS
		2480	0.956	2479.524	2480.480	0.5	PASS
2DH5	Ant1	2402	1.284	2401.360	2402.644	0.5	PASS
		2441	1.284	2440.360	2441.644	0.5	PASS
		2480	1.284	2479.360	2480.644	0.5	PASS
3DH5	Ant1	2402	1.288	2401.348	2402.636	0.5	PASS
		2441	1.288	2440.348	2441.636	0.5	PASS
		2480	1.288	2479.348	2480.636	0.5	PASS

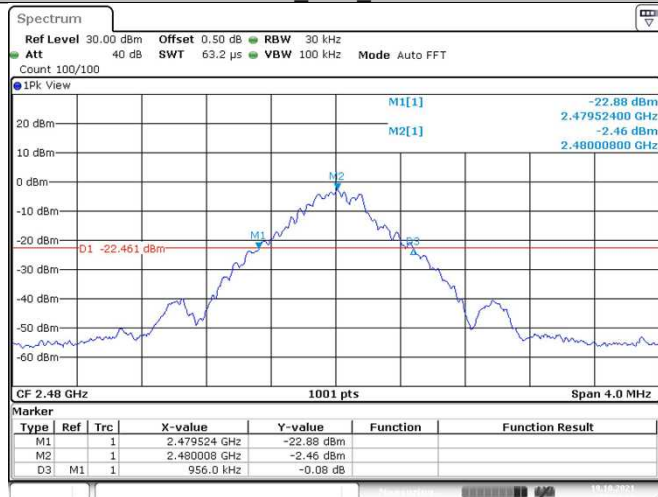


DH5_Ant1_2441



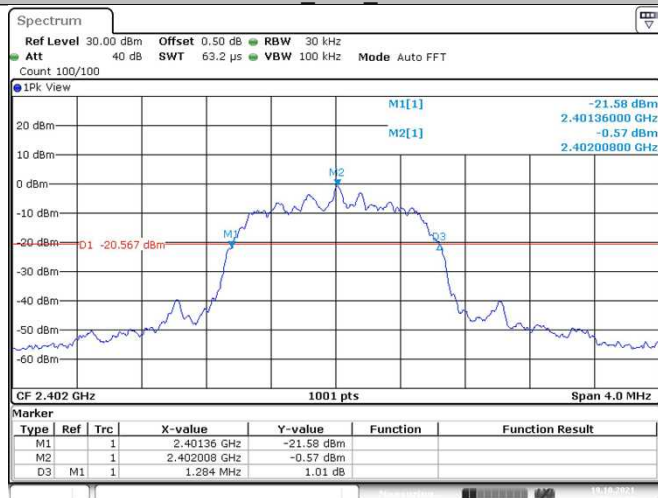
Date: 19.OCT.2021 15:38:51

DH5_Ant1_2480



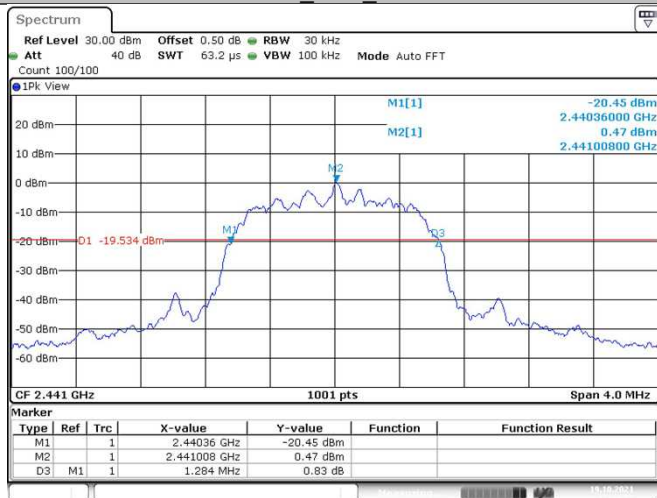
Date: 19.OCT.2021 15:39:30

2DH5_Ant1_2402



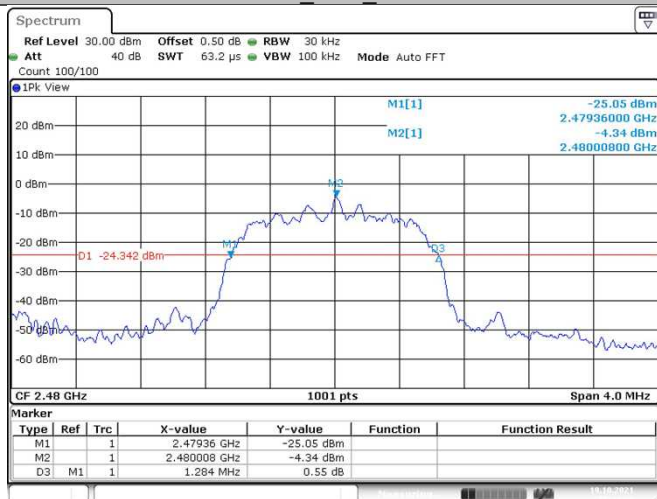
Date: 19.OCT.2021 15:40:02

2DH5_Ant1_2441



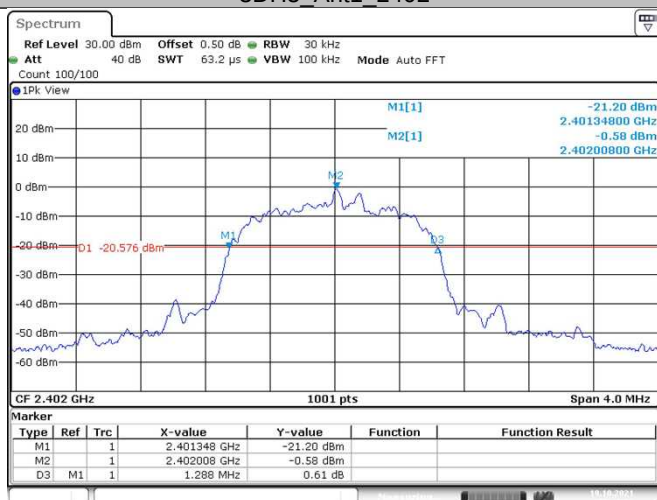
Date: 19.OCT.2021 15:40:27

2DH5_Ant1_2480



Date: 19.OCT.2021 15:40:46

3DH5_Ant1_2402

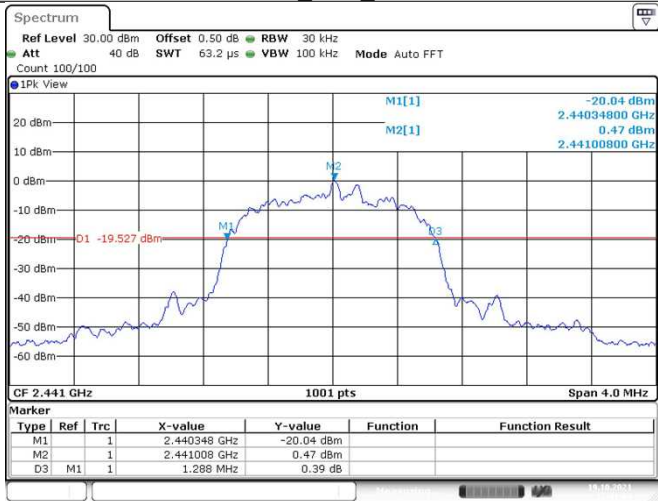


Date: 19.OCT.2021 15:41:29



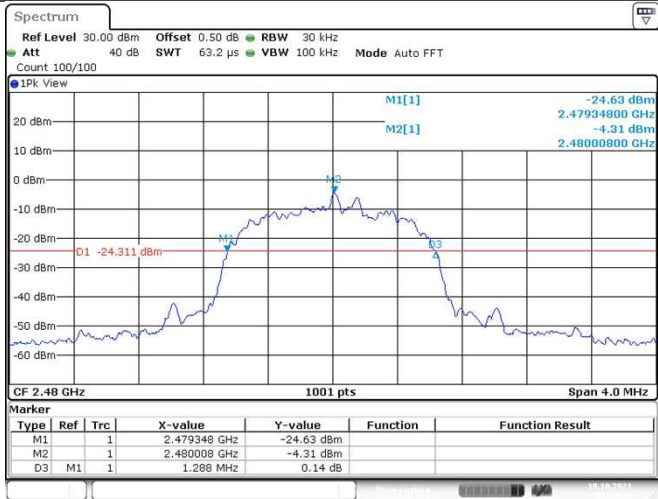
China

3DH5_Ant1_2441



Date: 19.OCT.2021 15:41:54

3DH5_Ant1_2480



Date: 19.OCT.2021 15:42:16

9.4 Carrier Frequency Separation

Test Method

1. Use the following spectrum analyzer settings:
Span = wide enough to capture the peaks of two adjacent channels, $RBW \geq 1\%$ of the span, $VBW \geq RBW$, Sweep = auto, Detector function = peak
2. By using the Max-Hold function record the separation of two adjacent channels.
3. Measure the frequency difference of these two adjacent channels by spectrum analyzer marker function.
4. Repeat above procedures until all frequencies measured were complete.

Limit

Limit kHz
$\geq 25\text{kHz}$ or $2/3$ of the 20 dB bandwidth which is greater

GFSK Modulation Limit

Mode	2/3 of 20 dB Bandwidth MHz
DH5	0.749
2DH5	0.915
3DH5	0.920

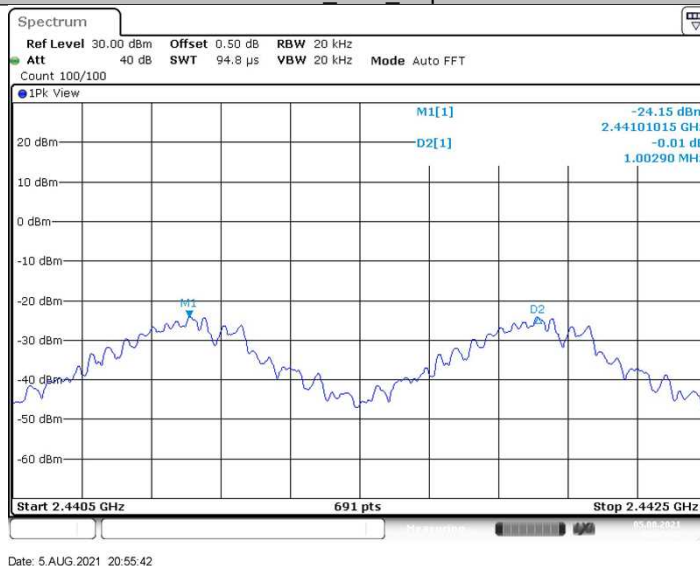
Carrier Frequency Separation

Test result: The measurement was performed with the typical configuration (normal hopping status), here GFSK modulation mode was used to show compliance.

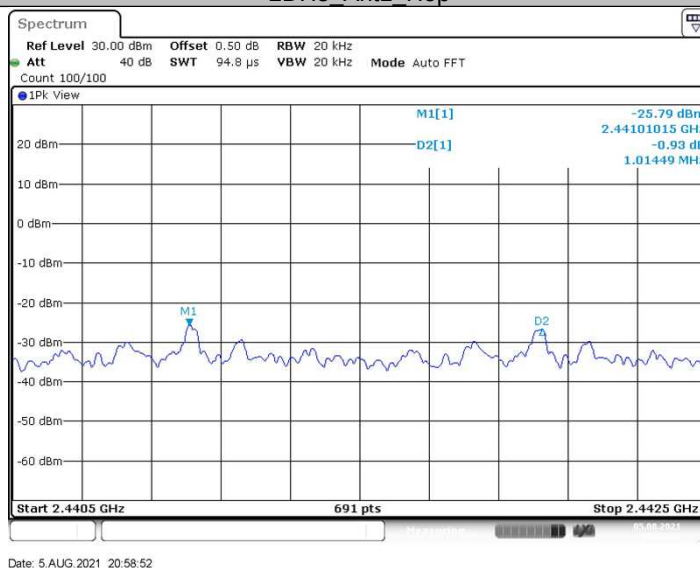
GFSK Modulation test result

TestMode	Antenna	Channel	Result [MHz]	Limit [MHz]	Verdict
DH5	Ant1	Hop	1.003	≥ 0.025	PASS
2DH5	Ant1	Hop	1.014	≥ 0.025	PASS
3DH5	Ant1	Hop	1.003	≥ 0.025	PASS

DH5_Ant1_Hop

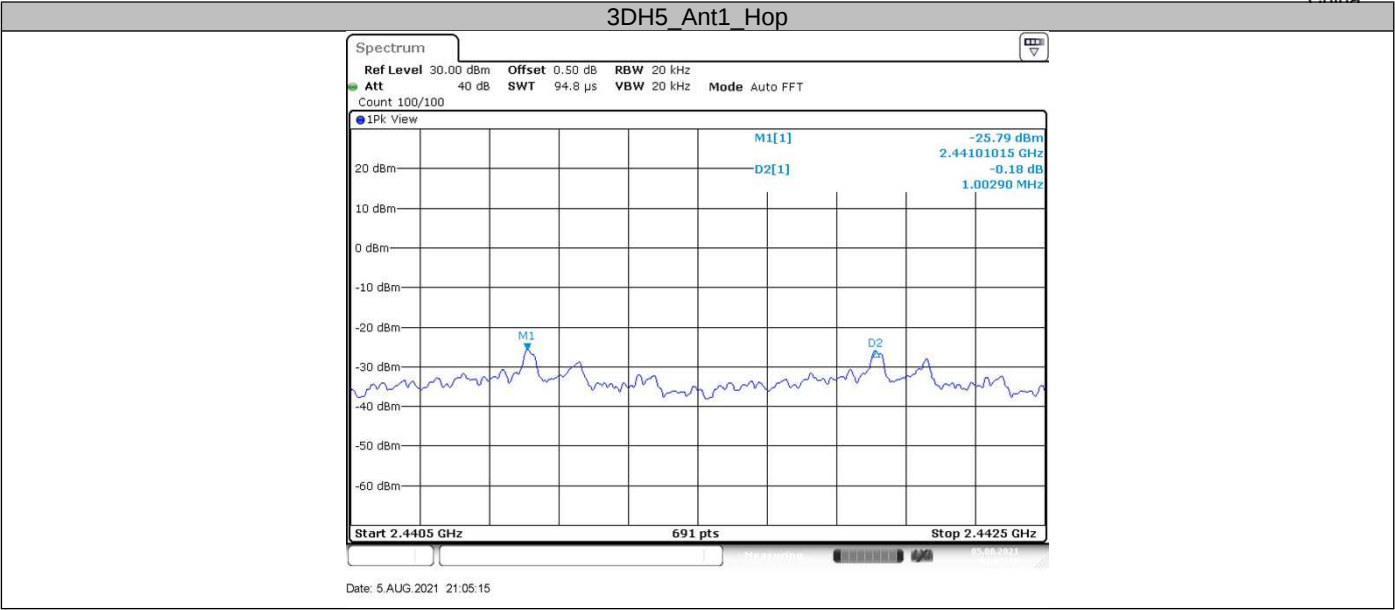


2DH5_Ant1_Hop





China



9.5 Number of hopping frequencies

Test Method

- 1. Use the following spectrum analyzer settings:
Span = wide enough to capture the peaks of two adjacent channels, $RBW \geq 1\%$ of the span, $VBW \geq RBW$, Sweep = auto, Detector function = peak
- 2. Set the spectrum analyzer on Max-Hold Mode, and then keep the EUT in hopping mode.
- 3. Record all the signals from each channel until each one has been recorded.
- 4. Repeat above procedures until all frequencies measured were complete.

Limit

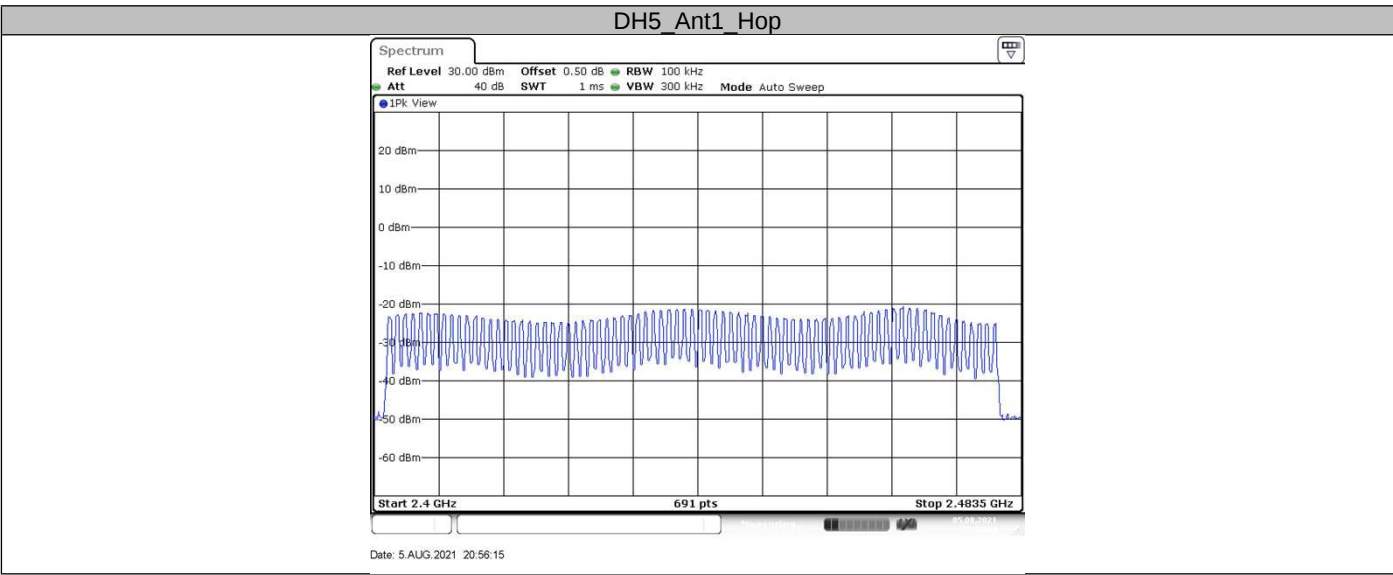
Limit
number

≥ 15

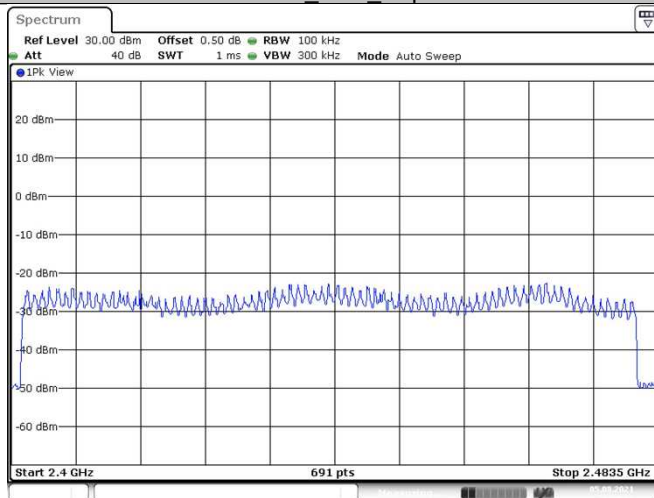
Number of hopping frequencies

Test result: The measurement was performed with the typical configuration (normal hopping status), and the total hopping channels is constant for the all modulation mode according with the Bluetooth Core Specification. Here GFSK modulation mode was used to show compliance.

TestMode	Antenna	Channel	Result[Num]	Limit[Num]	Verdict
DH5	Ant1	Hop	79	>=15	PASS
2DH5	Ant1	Hop	79	>=15	PASS
3DH5	Ant1	Hop	79	>=15	PASS

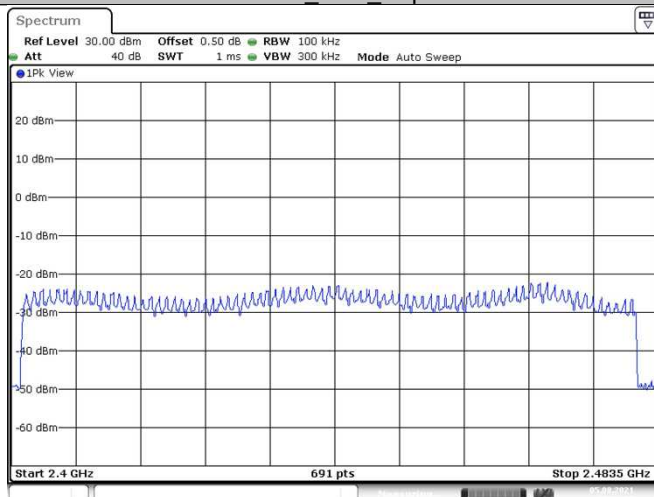


2DH5_Ant1_Hop



Date: 5.AUG.2021 20:59:20

3DH5_Ant1_Hop



Date: 5.AUG.2021 21:06:05

9.6 Dwell Time

Test Method

1. Connect EUT antenna terminal to the spectrum analyzer with a low loss cable.
Equipment mode: Spectrum analyzer
2. RBW: 1MHz; VBW: 1MHz; SPAN: Zero Span
3. Adjust the center frequency of spectrum analyzer on any frequency be measured.
4. Measure the Dwell Time by spectrum analyzer Marker function.
5. Repeat above procedures until all frequencies measured were complete.

Limit

The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

Dwell Time

Dwell time

The maximum dwell time shall be 0,4 s.

According to the Bluetooth Core Specification, the worse result (DH5 mode) was reported to show compliance.

The Dwell Time = Burst Width * Total Hops. The detailed calculations are showed as follows:

The duration for dwell time calculation: $0.4 \text{ [s]} * \text{hopping number} = 0.4 \text{ [s]} * 79 \text{ [ch]} = 31.6 \text{ [s*ch]}$;

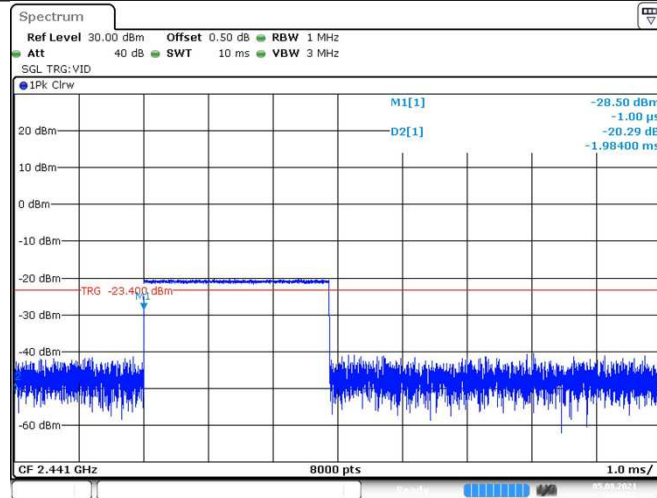
The burst width, which is directly measured, refers to the duration on one channel hop.

The maximum number of hopping channels in 31.6s for DH5= $1600 / 6 / 79 * 31.6 = 106.67$

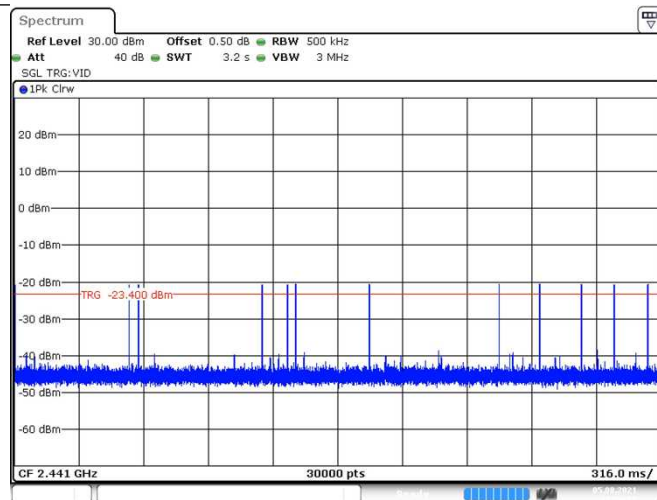
Test Result

TestMode	Antenna	Channel	BurstWidth [ms]	TotalHops [Num]	Result[s]	Limit[s]	Verdict
DH5	Ant1	Hop	1.98	120	0.238	≤ 0.4	PASS
2DH5	Ant1	Hop	0.44	90	0.039	≤ 0.4	PASS
3DH5	Ant1	Hop	1.98	120	0.237	≤ 0.4	PASS

DH5_Ant1_Hop

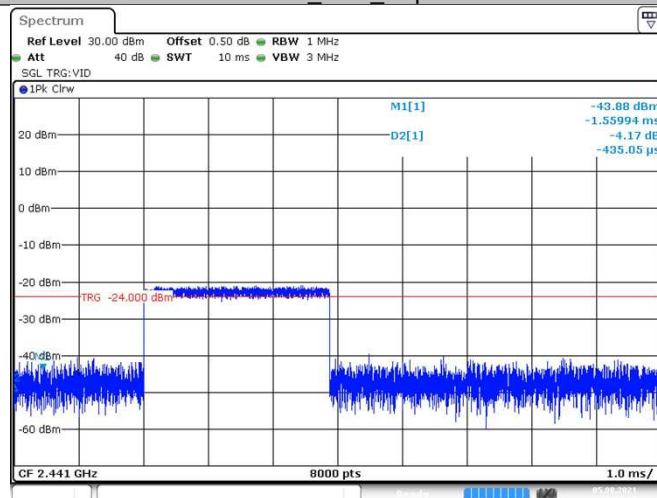


Date: 5 AUG. 2021 20:56:26

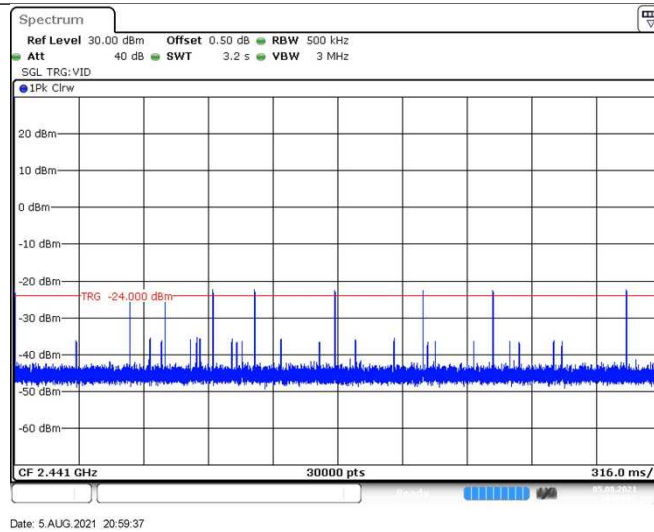


Date: 5 AUG. 2021 20:56:32

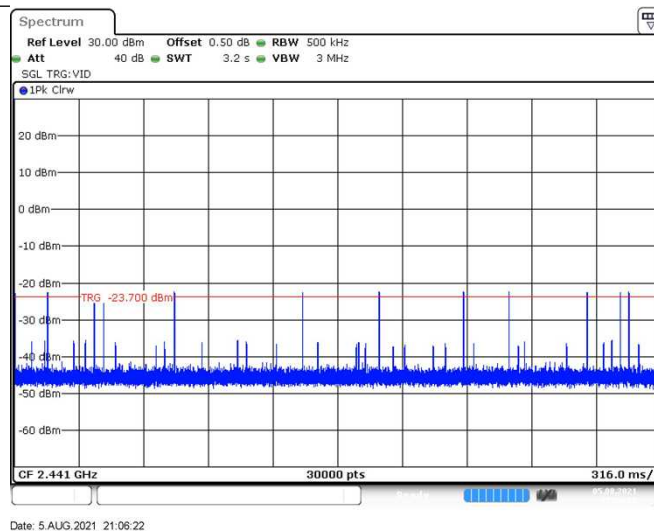
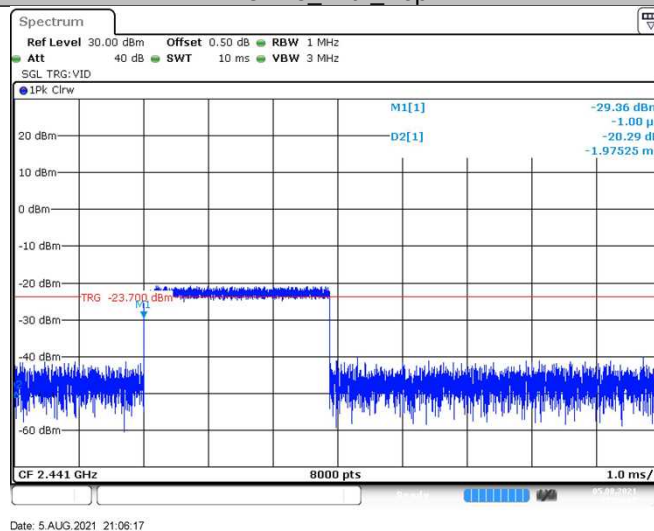
2DH5_Ant1_Hop



Date: 5 AUG. 2021 20:59:32



3DH5_Ant1_Hop



9.7 Spurious RF conducted emissions

Test Method

1. Use the following spectrum analyzer settings:
Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.
RBW = 100 kHz, VBW ≥ RBW, Sweep = auto, Detector function = peak, Trace = max hold
2. Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded.
3. The level displayed must comply with the limit specified in this Section. Submit these plots.
4. Repeat above procedures until all frequencies measured were complete.

Limit

Frequency Range MHz	Limit (dBc)
30-25000	-20

Spurious RF conducted emissions

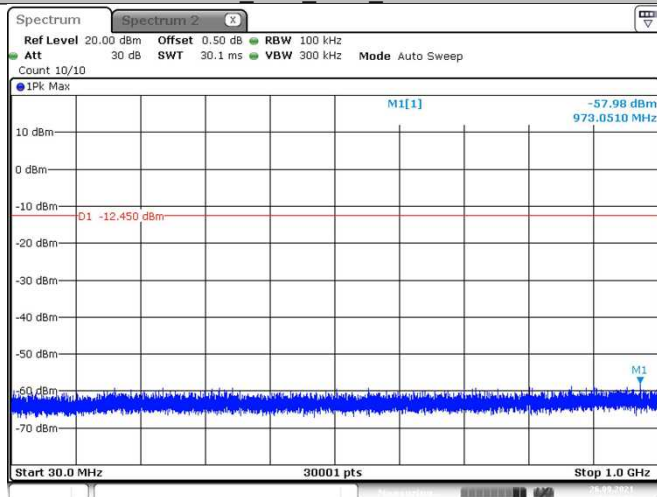
TestMode	Antenna	Channel	FreqRange [MHz]	RefLevel [dBm]	Result [dBm]	Limit [dBm]	Verdict
DH5	Ant1	2402	Reference	7.55	7.55	---	PASS
			30~1000	7.55	-57.98	<=-12.45	PASS
			1000~5000	7.55	-54.71	<=-12.45	PASS
			5000~26500	7.55	-52.15	<=-12.45	PASS
		2441	Reference	8.58	8.58	---	PASS
			30~1000	8.58	-57.97	<=-11.42	PASS
			1000~5000	8.58	-54.83	<=-11.42	PASS
			5000~26500	8.58	-52.57	<=-11.42	PASS
		2480	Reference	4.10	4.10	---	PASS
			30~1000	4.10	-57.34	<=-15.9	PASS
			1000~5000	4.10	-47.94	<=-15.9	PASS
			5000~26500	4.10	-51.75	<=-15.9	PASS
2DH5	Ant1	2402	Reference	5.86	5.86	---	PASS
			30~1000	5.86	-58.95	<=-14.14	PASS
			1000~5000	5.86	-55.81	<=-14.14	PASS
			5000~26500	5.86	-51.9	<=-14.14	PASS
		2441	Reference	6.85	6.85	---	PASS
			30~1000	6.85	-58.49	<=-13.15	PASS
			1000~5000	6.85	-55.1	<=-13.15	PASS
			5000~26500	6.85	-51.62	<=-13.15	PASS
		2480	Reference	2.45	2.45	---	PASS
			30~1000	2.45	-58.42	<=-17.55	PASS
			1000~5000	2.45	-53.54	<=-17.55	PASS
			5000~26500	2.45	-51.79	<=-17.55	PASS
3DH5	Ant1	2402	Reference	5.92	5.92	---	PASS
			30~1000	5.92	-57.98	<=-14.08	PASS
			1000~5000	5.92	-54.35	<=-14.08	PASS
			5000~26500	5.92	-52.1	<=-14.08	PASS
		2441	Reference	6.90	6.90	---	PASS
			30~1000	6.90	-58.23	<=-13.1	PASS
			1000~5000	6.90	-55.53	<=-13.1	PASS
			5000~26500	6.90	-52.48	<=-13.1	PASS
		2480	Reference	2.46	2.46	---	PASS
			30~1000	2.46	-58.07	<=-17.54	PASS
			1000~5000	2.46	-51.71	<=-17.54	PASS
			5000~26500	2.46	-52.2	<=-17.54	PASS

DH5_Ant1_2402_0-Reference



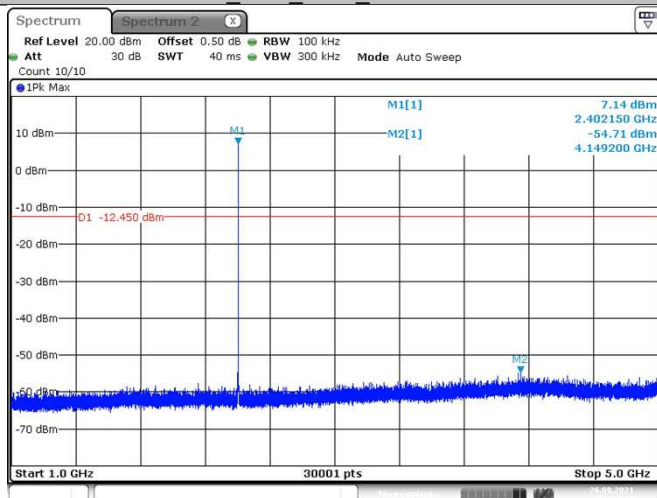
Date: 26.SEP.2021 16:54:54

DH5_Ant1_2402_30-1000



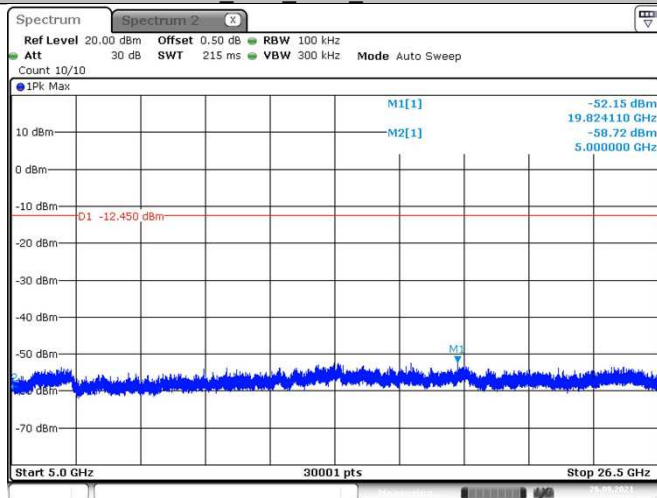
Date: 26.SEP.2021 16:54:59

DH5_Ant1_2402_1000-5000



Date: 26.SEP.2021 16:55:11

DH5_Ant1_2402_5000~26500



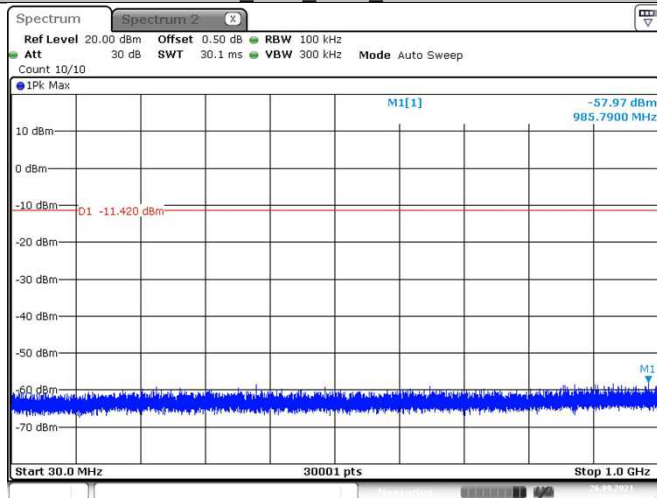
Date: 26.SEP.2021 16:55:42

DH5_Ant1_2441_0~Reference



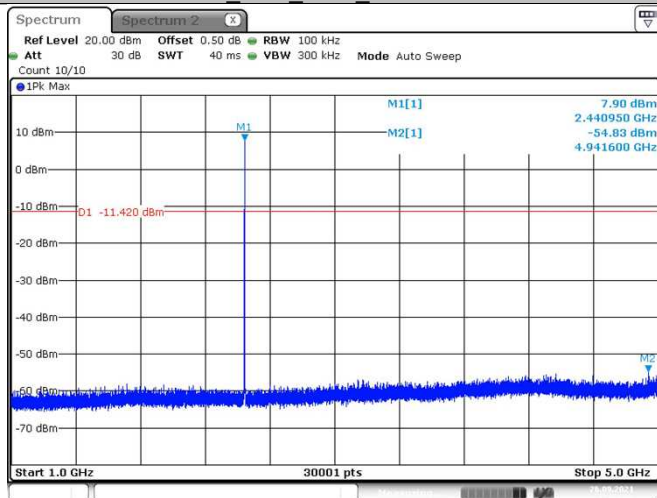
Date: 26.SEP.2021 17:03:24

DH5_Ant1_2441_30~1000



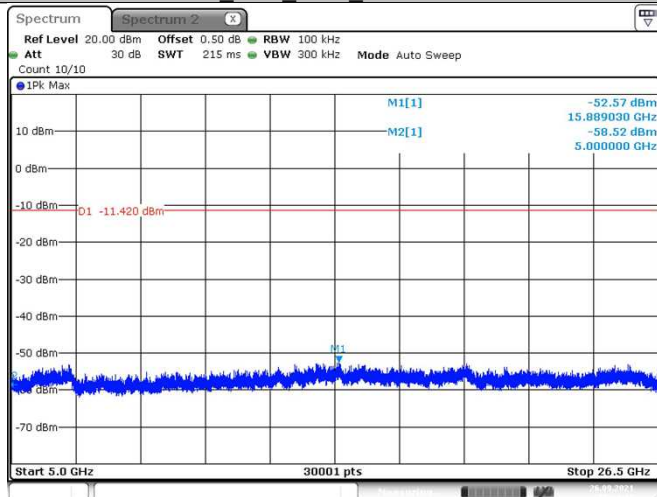
Date: 26.SEP.2021 17:03:28

DH5_Ant1_2441_1000~5000



Date: 26.SEP.2021 17:03:40

DH5_Ant1_2441_5000~26500



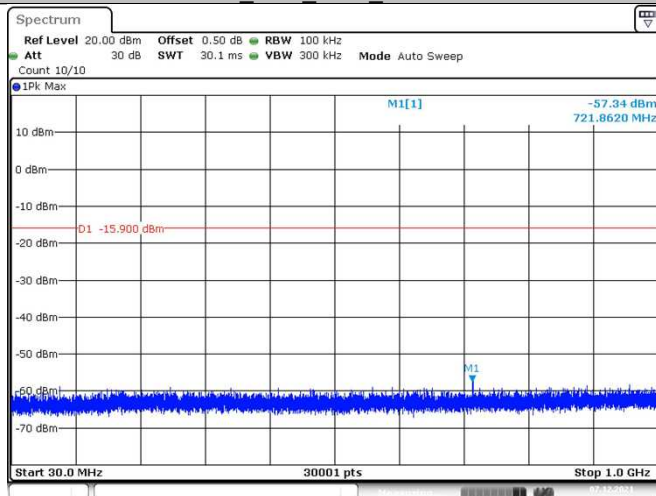
Date: 26.SEP.2021 17:04:12

DH5_Ant1_2480_0~Reference



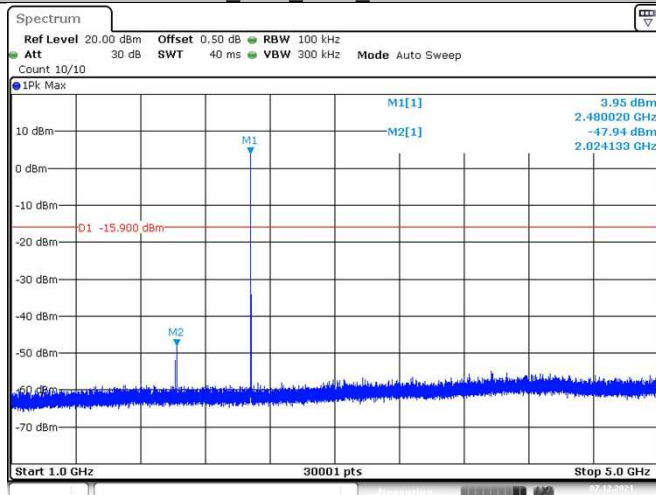
Date: 7.DEC.2021 09:45:57

DH5_Ant1_2480_30~1000



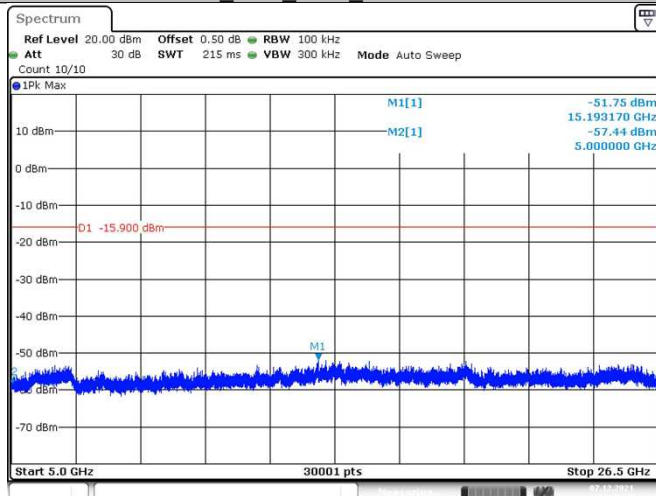
Date: 7.DEC.2021 09:46:02

DH5_Ant1_2480_1000~5000



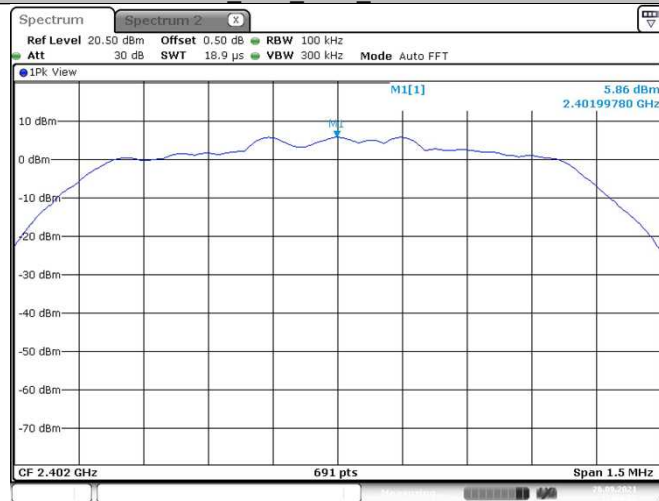
Date: 7.DEC.2021 09:46:14

DH5_Ant1_2480_5000~26500



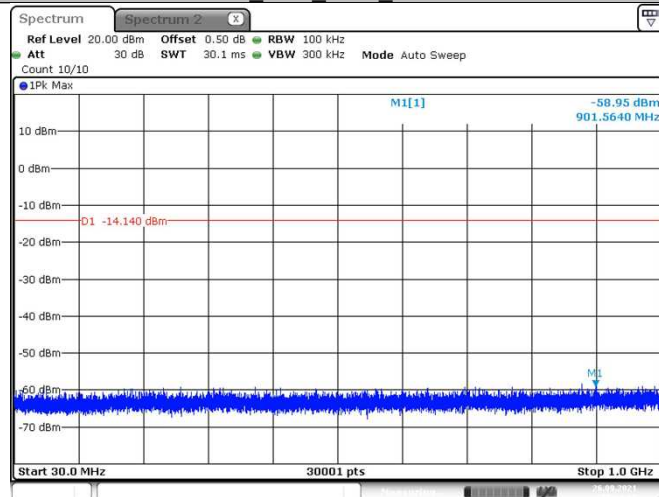
Date: 7.DEC.2021 09:46:45

2DH5_Ant1_2402_0-Reference



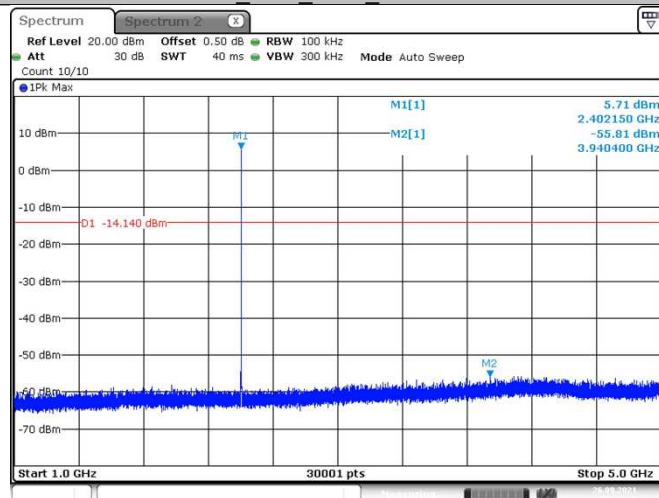
Date: 26.SEP.2021 17:08:27

2DH5_Ant1_2402_30-1000



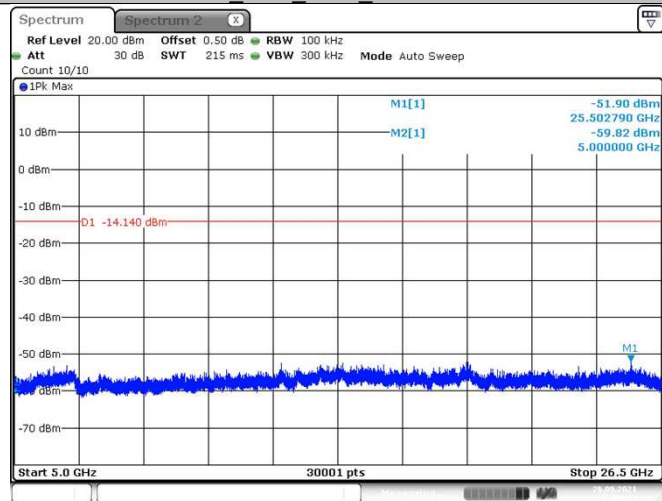
Date: 26.SEP.2021 17:08:31

2DH5_Ant1_2402_1000-5000



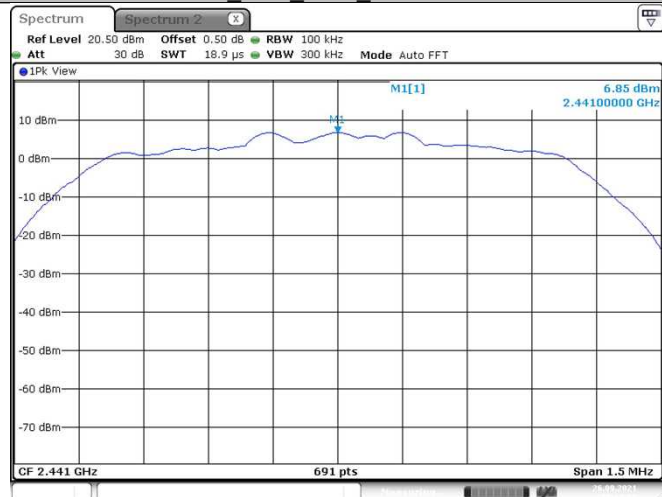
Date: 26.SEP.2021 17:08:43

2DH5_Ant1_2402_5000~26500



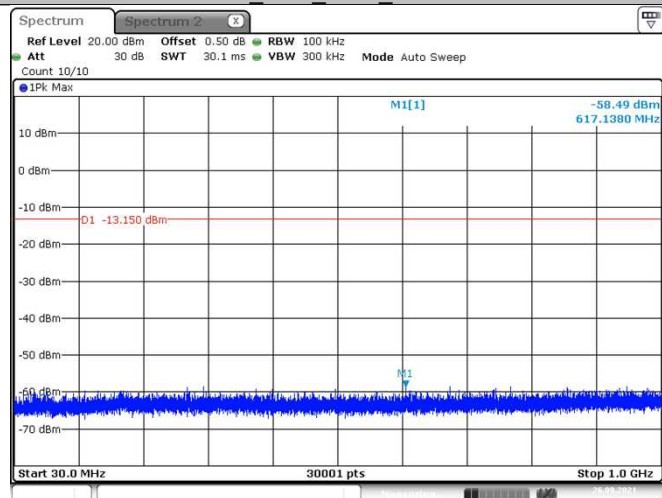
Date: 26.SEP.2021 17:09:15

2DH5_Ant1_2441_0~Reference

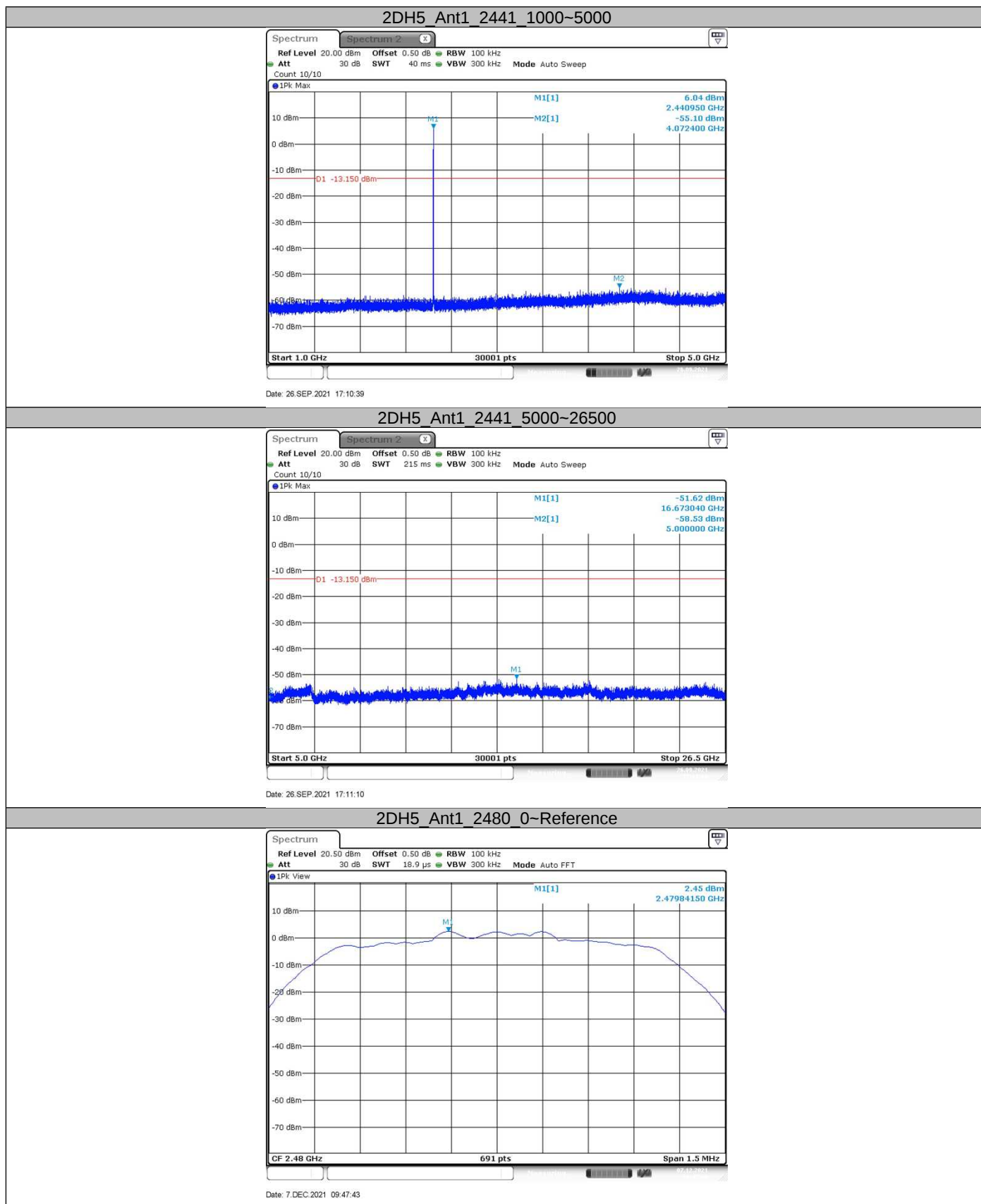


Date: 26.SEP.2021 17:10:22

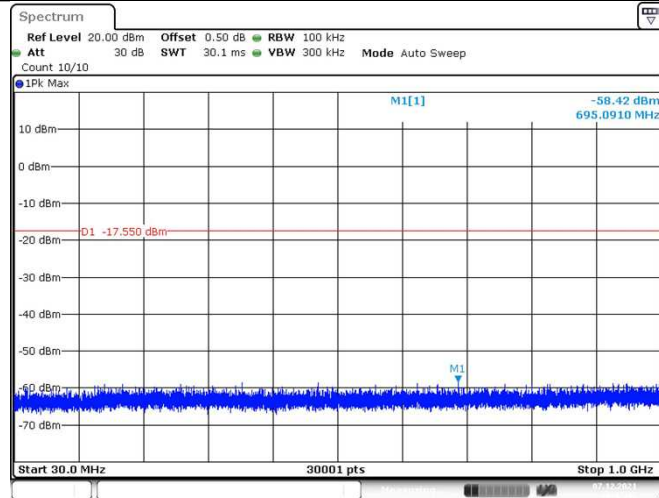
2DH5_Ant1_2441_30~1000



Date: 26.SEP.2021 17:10:27

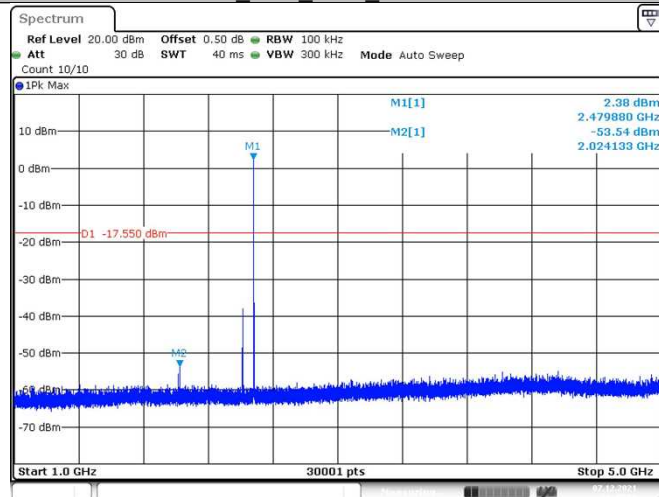


2DH5_Ant1_2480_30~1000



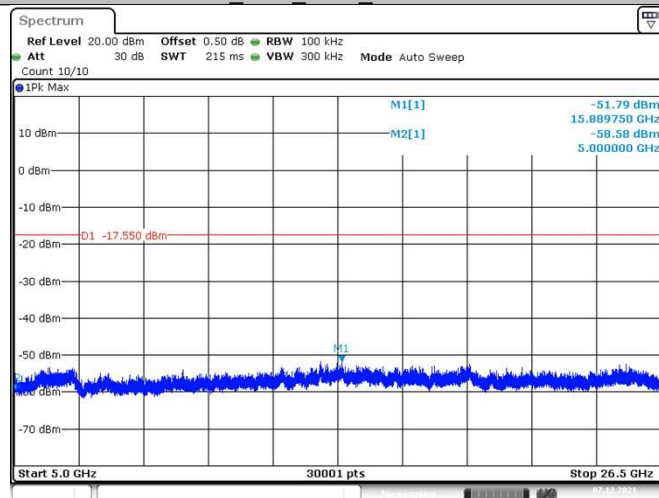
Date: 7 DEC 2021 09:47:47

2DH5_Ant1_2480_1000~5000



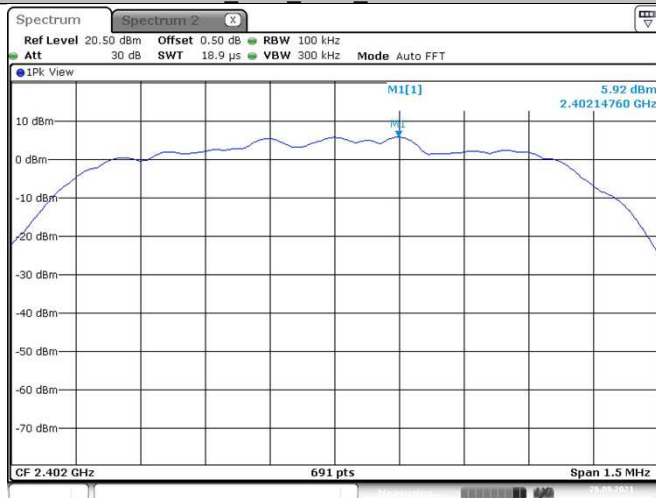
Date: 7 DEC 2021 09:47:59

2DH5_Ant1_2480_5000~26500



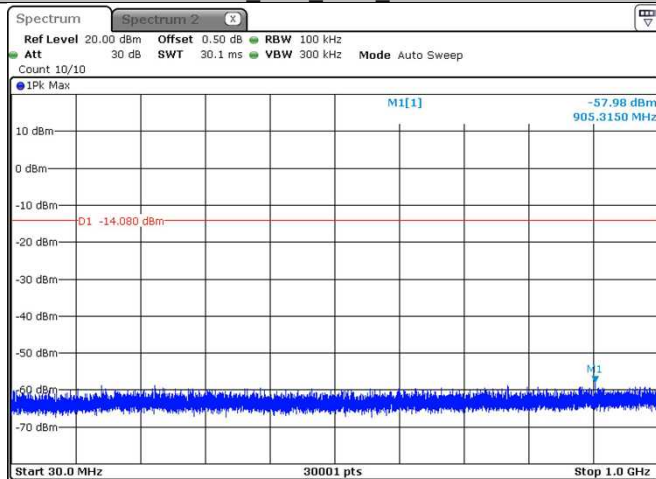
Date: 7 DEC 2021 09:48:30

3DH5_Ant1_2402_0-Reference



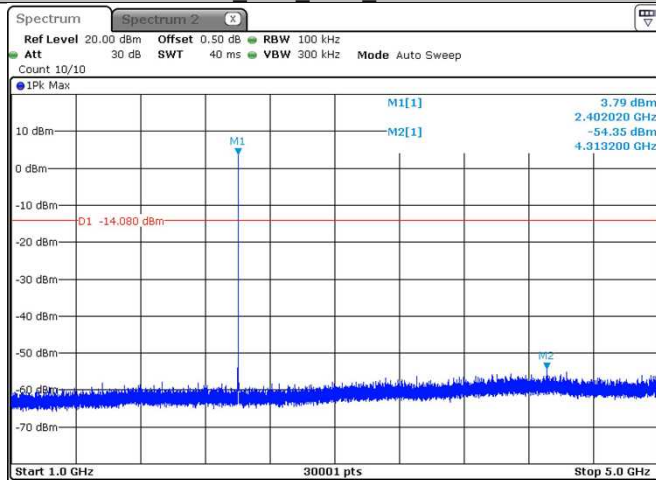
Date: 26.SEP.2021 17:14:51

3DH5_Ant1_2402_30-1000



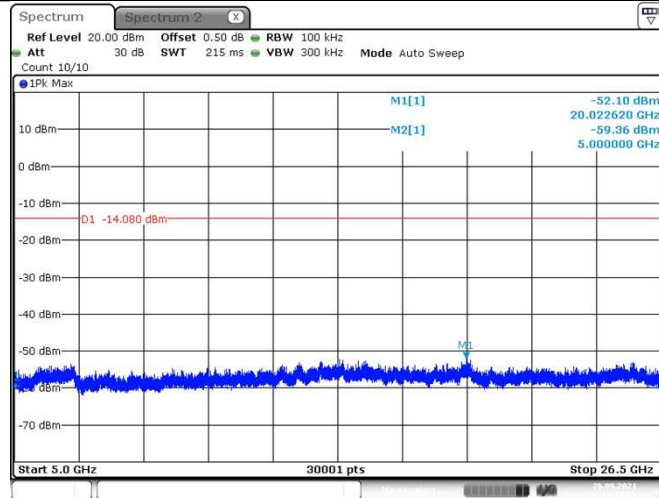
Date: 26.SEP.2021 17:14:55

3DH5_Ant1_2402_1000-5000



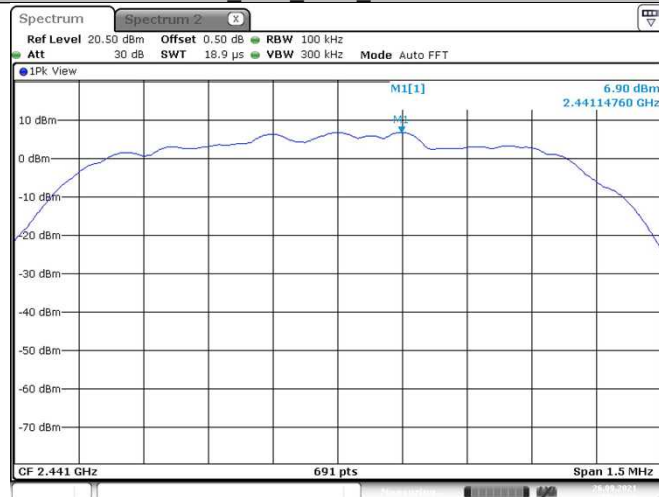
Date: 26.SEP.2021 17:15:07

3DH5_Ant1_2402_5000~26500



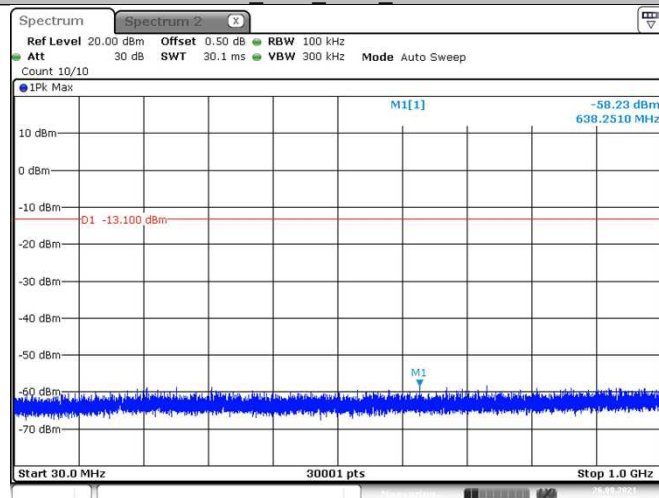
Date: 26 SEP 2021 17:15:39

3DH5_Ant1_2441_0~Reference



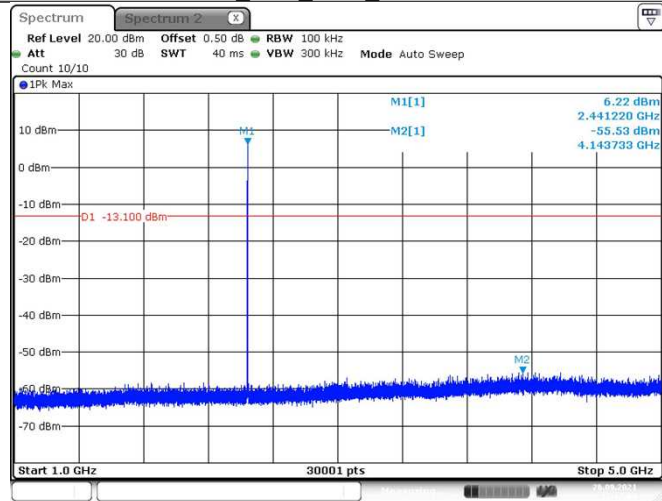
Date: 26 SEP 2021 17:16:47

3DH5_Ant1_2441_30~1000



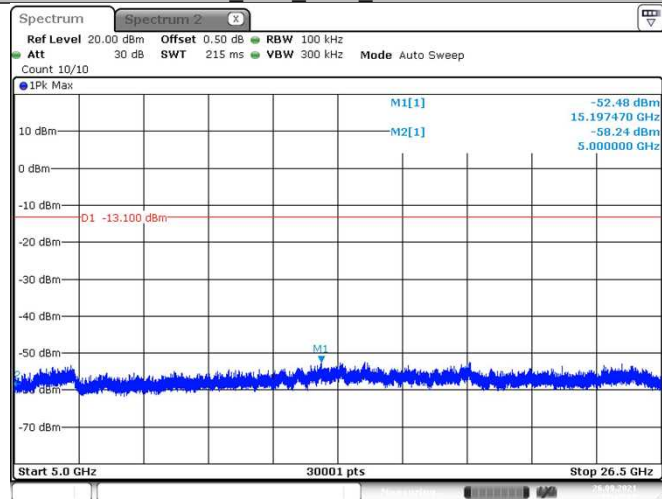
Date: 26 SEP 2021 17:16:52

3DH5_Ant1_2441_1000~5000



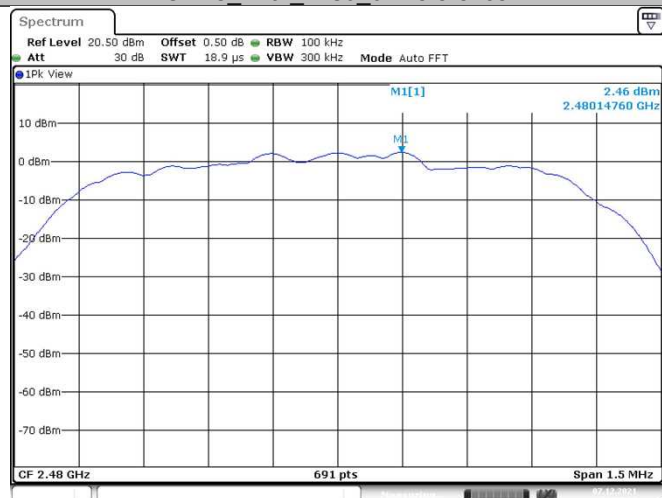
Date: 26.SEP.2021 17:17:04

3DH5_Ant1_2441_5000~26500



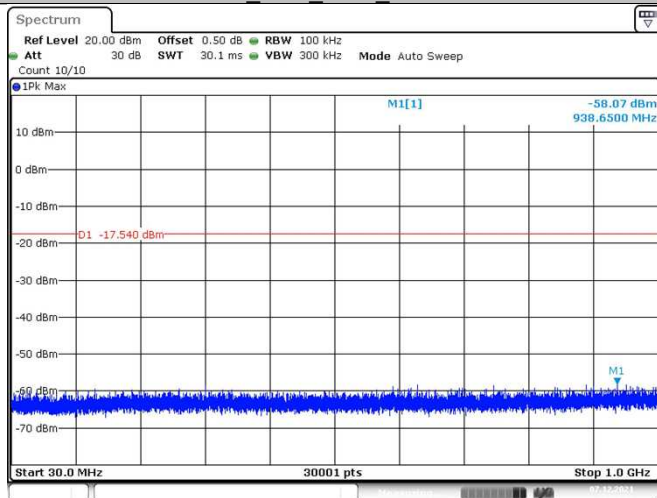
Date: 26.SEP.2021 17:17:35

3DH5_Ant1_2480_0~Reference



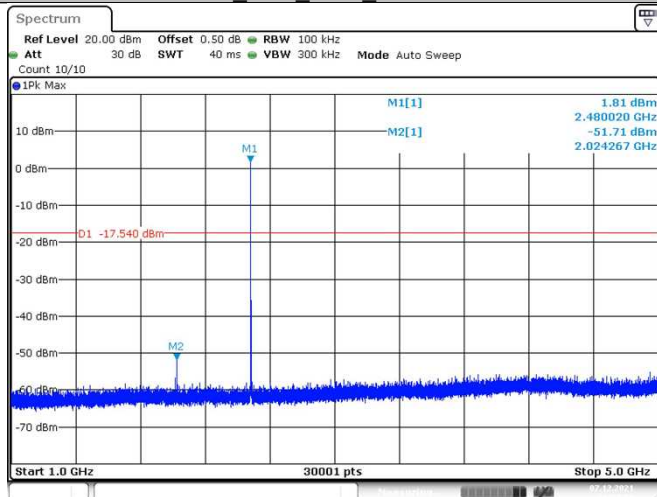
Date: 7.DEC.2021 09:50:04

3DH5_Ant1_2480_30~1000



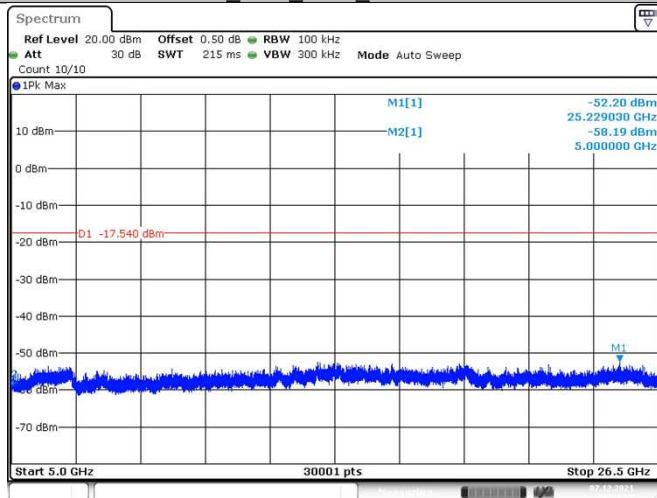
Date: 7 DEC 2021 09:50:08

3DH5_Ant1_2480_1000~5000



Date: 7 DEC 2021 09:50:20

3DH5_Ant1_2480_5000~26500



Date: 7 DEC 2021 09:50:52

9.8 Band edge testing

Test Method

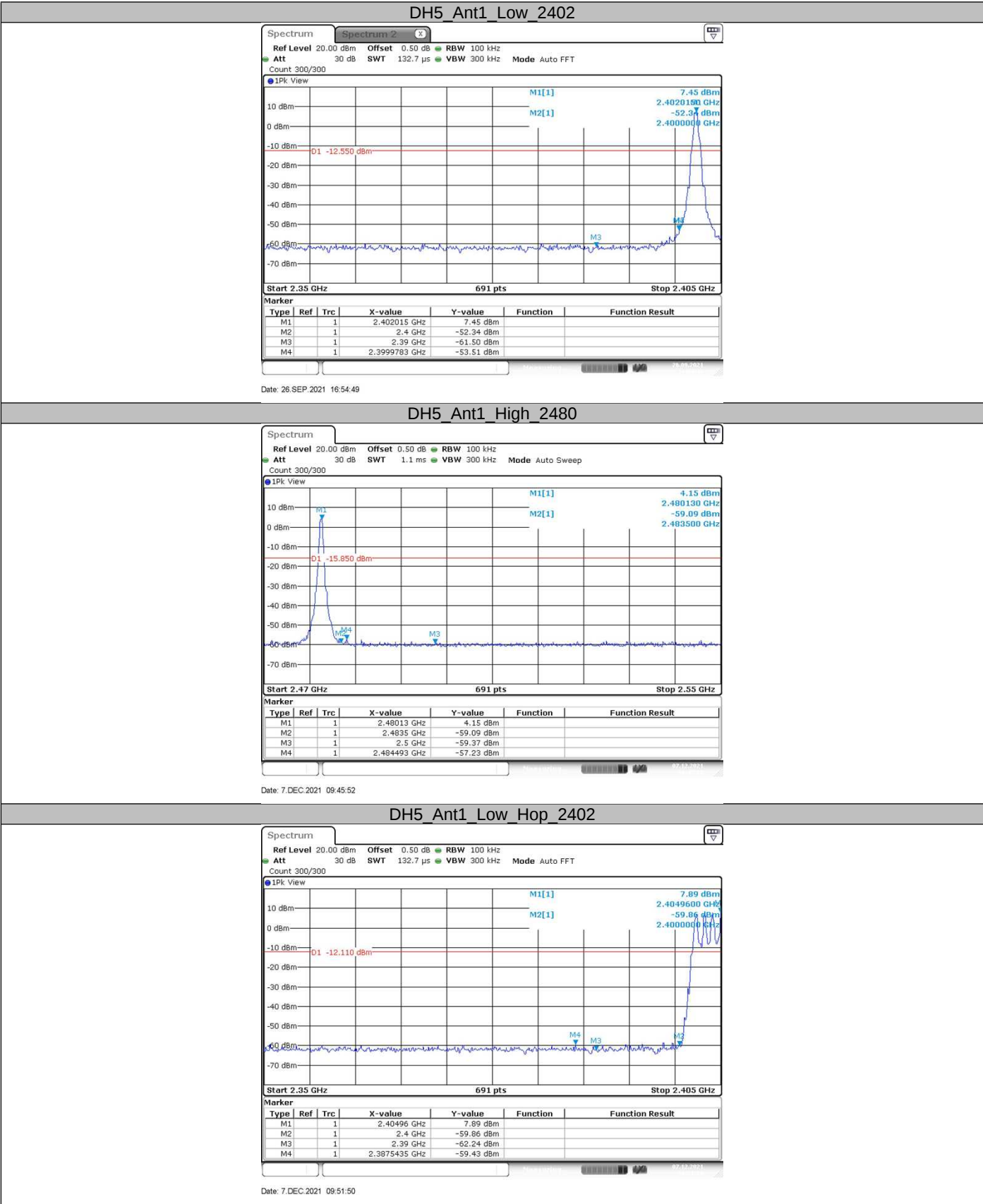
- 1 Use the following spectrum analyzer settings:
Span = wide enough to capture the peak level of the in-band emission and all spurious
RBW = 100 kHz, VBW $\geq$ RBW, Sweep = auto, Detector function = peak, Trace = max hold
- 2 Allow the trace to stabilize, use the peak and delta measurement to record the result.
- 3 The level displayed must comply with the limit specified in this Section.
- 4 Repeat the test at the hopping off and hopping on mode, submit all the plots.

Limit:

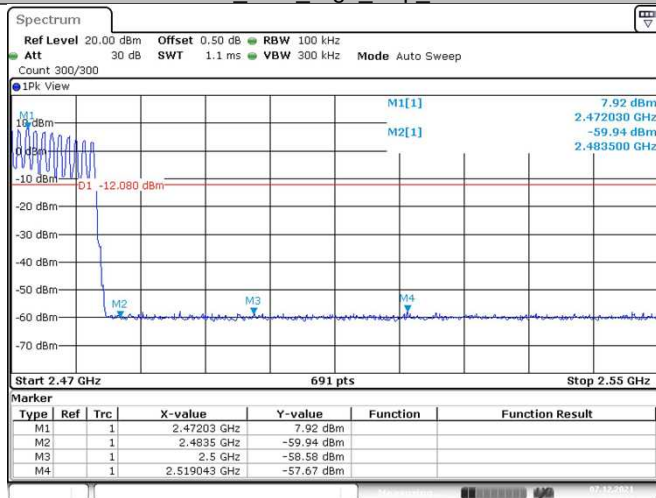
In any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. 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 Section 15.205(c)).

Band edge testing

TestMode	Antenna	ChName	Channel	RefLevel [dBm]	Result [dBm]	Limit [dBm]	Verdict
DH5	Ant1	Low	2402	7.45	-53.51	≤ -12.55	PASS
		High	2480	4.15	-57.23	≤ -15.85	PASS
		Low	Hop_2402	7.89	-59.43	≤ -12.11	PASS
		High	Hop_2480	7.92	-57.67	≤ -12.08	PASS
2DH5	Ant1	Low	2402	5.81	-52.76	≤ -14.19	PASS
		High	2480	2.40	-58	≤ -17.6	PASS
		Low	Hop_2402	2.55	-59.22	≤ -17.45	PASS
		High	Hop_2480	6.41	-58.19	≤ -13.59	PASS
3DH5	Ant1	Low	2402	5.93	-54.31	≤ -14.07	PASS
		High	2480	2.50	-57.93	≤ -17.5	PASS
		Low	Hop_2402	5.11	-59.08	≤ -14.89	PASS
		High	Hop_2480	5.64	-57.77	≤ -14.36	PASS

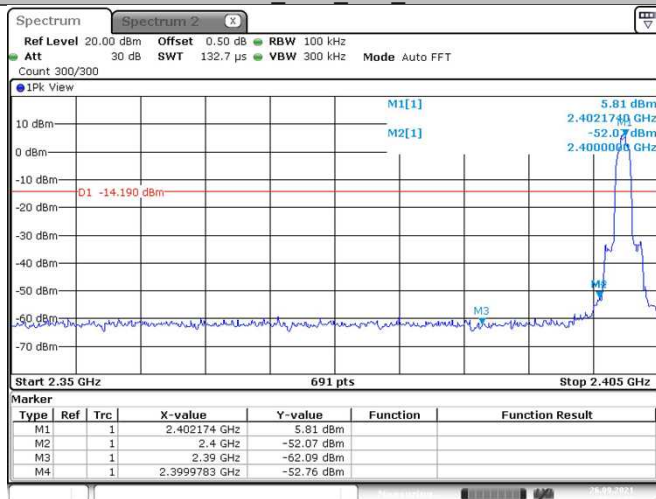


DH5_Ant1_High_Hop_2480



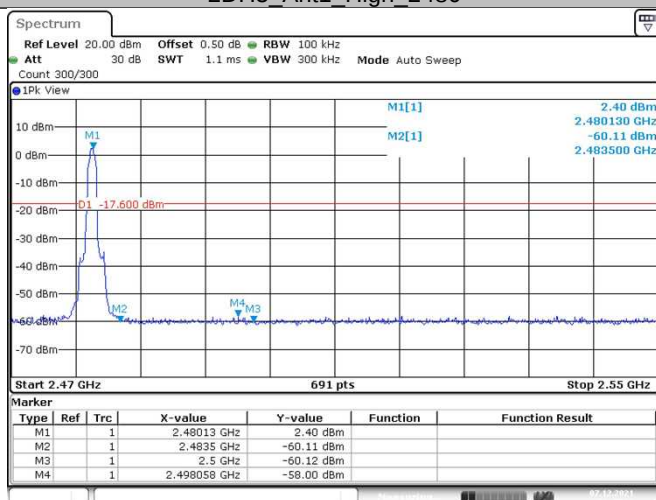
Date: 7.DEC.2021 09:53:14

2DH5_Ant1_Low_2402



Date: 26.SEP.2021 17:08:22

2DH5_Ant1_High_2480

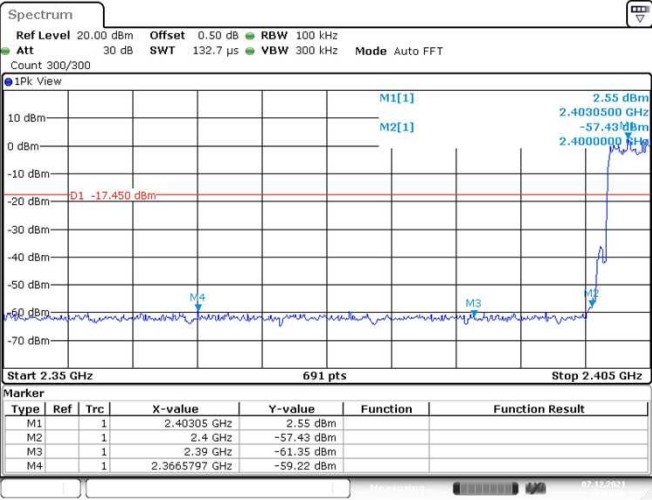


Date: 7.DEC.2021 09:47:38



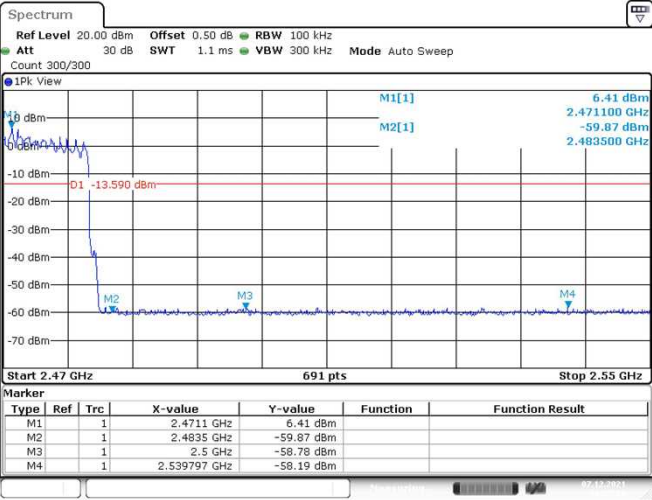
China

2DH5_Ant1_Low_Hop_2402



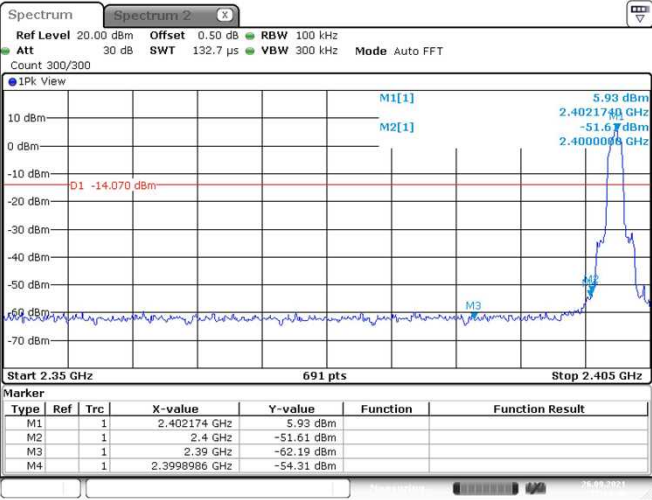
Date: 7.DEC.2021 09:53:46

2DH5_Ant1_High_Hop_2480



Date: 7.DEC.2021 09:55:57

3DH5_Ant1_Low_2402

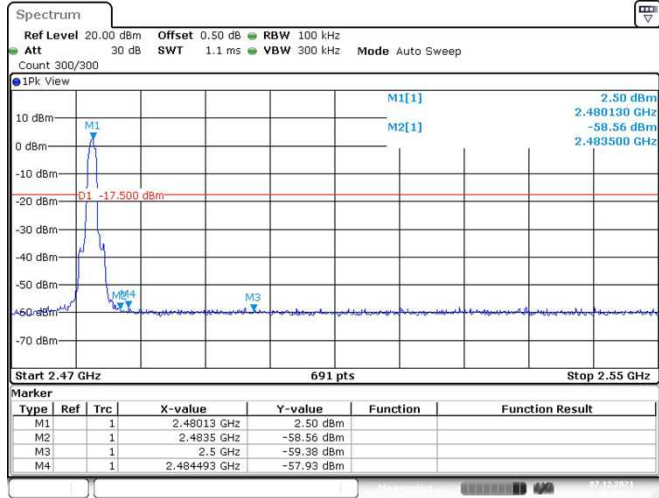


Date: 26.SEP.2021 17:14:46



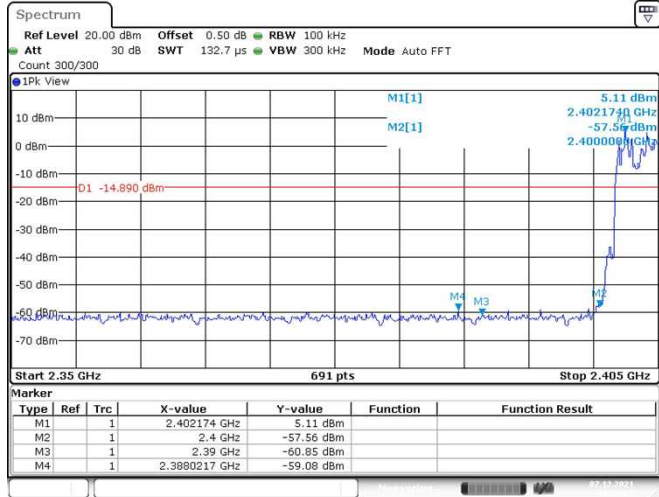
China

3DH5_Ant1_High_2480



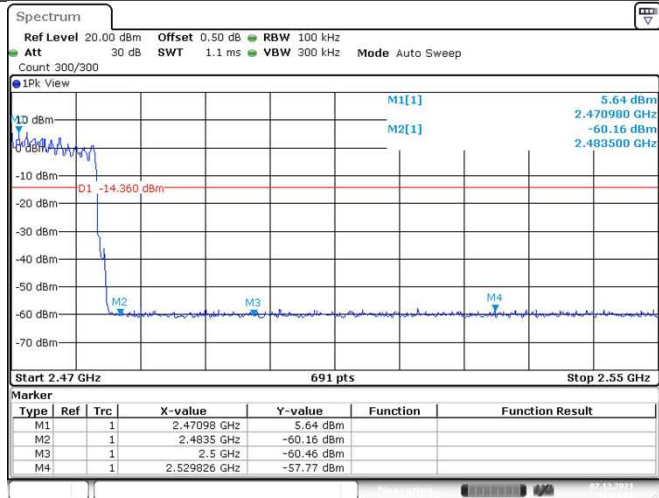
Date: 7.DEC.2021 09:49:59

3DH5_Ant1_Low_Hop_2402



Date: 7.DEC.2021 09:56:27

3DH5_Ant1_High_Hop_2480



Date: 7.DEC.2021 09:58:21

9.9 Spurious radiated emissions for transmitter and receiver

Test Method

1. The EUT was placed on a turn table which is 1.5m above ground plane for above 1GHz and 0.8m above ground for below 1GHz at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
2. The EUT was set 3 meters away from the interference – receiving antenna, which was mounted on the top of a variable – height antenna tower.
3. The height of antenna 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.
4. 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 and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. Use the following spectrum analyzer settings According to C63.10:

For Below 1GHz

Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the in-band emission and all spurious
 RBW = 100 kHz to 120 kHz, VBW ≥ RBW for peak measurement, Sweep = auto, Detector function = peak, Trace = max hold.

For Peak unwanted emissions Above 1GHz:

Span = wide enough to capture the peak level of the in-band emission and all spurious
 RBW = 1MHz, VBW ≥ RBW for peak measurement, Sweep = auto, Detector function = peak, Trace = max hold.

Procedures for average unwanted emissions measurements above 1000 MHz

- a) RBW = 1MHz.
- b) $VBW \geq [3 \times RBW]$.
- c) Detector = RMS (power averaging), if $[\text{span} / (\# \text{ of points in sweep})] \leq RBW / 2$.
 Satisfying this condition can require increasing the number of points in the sweep or reducing the span. If the condition is not satisfied, then the detector mode shall be set to peak.
- d) Averaging type = power (i.e., rms) (As an alternative, the detector and averaging type may be set for linear voltage averaging. Some instruments require linear display mode to use linear voltage averaging. Log or dB averaging shall not be used.)
- e) Sweep time = auto.
- f) Perform a trace average of at least 100 traces if the transmission is continuous. If the transmission is not continuous, then the number of traces shall be increased by a factor of $1 / D$, where D is the duty cycle. For example, with 50% duty cycle, at least 200 traces shall be averaged. (If a specific emission is demonstrated to be continuous—i.e., 100% duty cycle—then rather than turning ON and OFF with the transmit cycle, at least 100 traces shall be averaged.)
- g) If tests are performed with the EUT transmitting at a duty cycle less than 98%, then a correction factor shall be added to the measurement results prior to comparing with the emission limit, to compute the emission level that would have been measured had the test been performed at 100% duty cycle. The correction factor is computed as follows:

- 1) If power averaging (rms) mode was used in the preceding step e), then the correction factor is $[10 \log (1 / D)]$, where D is the duty cycle. For example, if the transmit duty cycle was 50%, then 3 dB shall be added to the measured emission levels.
- 2) If linear voltage averaging mode was used in the preceding step e), then the correction factor is $[20 \log (1 / D)]$, where D is the duty cycle. For example, if the transmit duty cycle was 50%, then 6 dB shall be added to the measured emission levels.
- 3) If a specific emission is demonstrated to be continuous (100% duty cycle) rather than turning ON and OFF with the transmit cycle, then no duty cycle correction is required for that emission.

Limit

The radio emission outside the operating frequency band 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. Radiated emissions which fall in the restricted bands, as defined in section 15.205, must comply with the radiated emission limits specified in section 15.209.

Frequency MHz	Field Strength uV/m	Measured Distance Meters
0.009~0.490	2400/F (kHz)	300
0.490~1.705	24000/F (kHz)	30
1.705~30	30	30

Frequency MHz	Field Strength uV/m	Field Strength dBuV/m	Detector
30-88	100	40	QP
88-216	150	43.5	QP
216-960	200	46	QP
960-1000	500	54	QP
Above 1000	500	54	AV
Above 1000	5000	74	PK

Spurious radiated emissions for transmitter and receiver

According to C63.10, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement, so AV emission value did not show in below table if the peak value complies with average limit.

Pre-scan with three orthogonal axis and the worst case as X axis.

The only worse case (which is subject to the maximum EIRP, 8DPSK 3DH5 mode) test results are listed in the report.

Transmitting spurious emission test result as below:

Bluetooth Mode 8DPSK Modulation 2402MHz Test Result

Frequency	Emission Level	Polarization	Limit	Detector	Margin	Result
MHz	dBuV/m		dBuV/m		dBuV/m	
2384.9	43.91	H	74	PK	30.09	Pass
4804	44.37	H	74	PK	29.63	Pass
2382.3	44.76	V	74	PK	29.24	Pass
4804	43.68	V	74	PK	30.32	Pass

Bluetooth Mode 8DPSK Modulation 2441MHz Test Result

Frequency	Emission Level	Polarization	Limit	Detector	Margin	Result
MHz	dBuV/m		dBuV/m		dBuV/m	
4882	44.33	H	74	PK	29.67	Pass
4882	44.67	V	74	PK	29.33	Pass

Bluetooth Mode 8DPSK Modulation 2480MHz Test Result

Frequency	Emission Level	Polarization	Limit	Detector	Margin	Result
MHz	dBuV/m		dBuV/m		dBuV/m	
2483.8	44.80	H	74	PK	29.20	Pass
4960	45.73	H	74	PK	28.27	Pass
2483.6	45.92	V	74	PK	28.08	Pass
4960	43.68	V	74	PK	30.32	Pass

Remark:

(1) Above 1GHz: Corrector factor = Antenna Factor + Cable Loss- Pre-amplifier

Below 1GHz: Corrector factor = Antenna Factor + Cable Loss

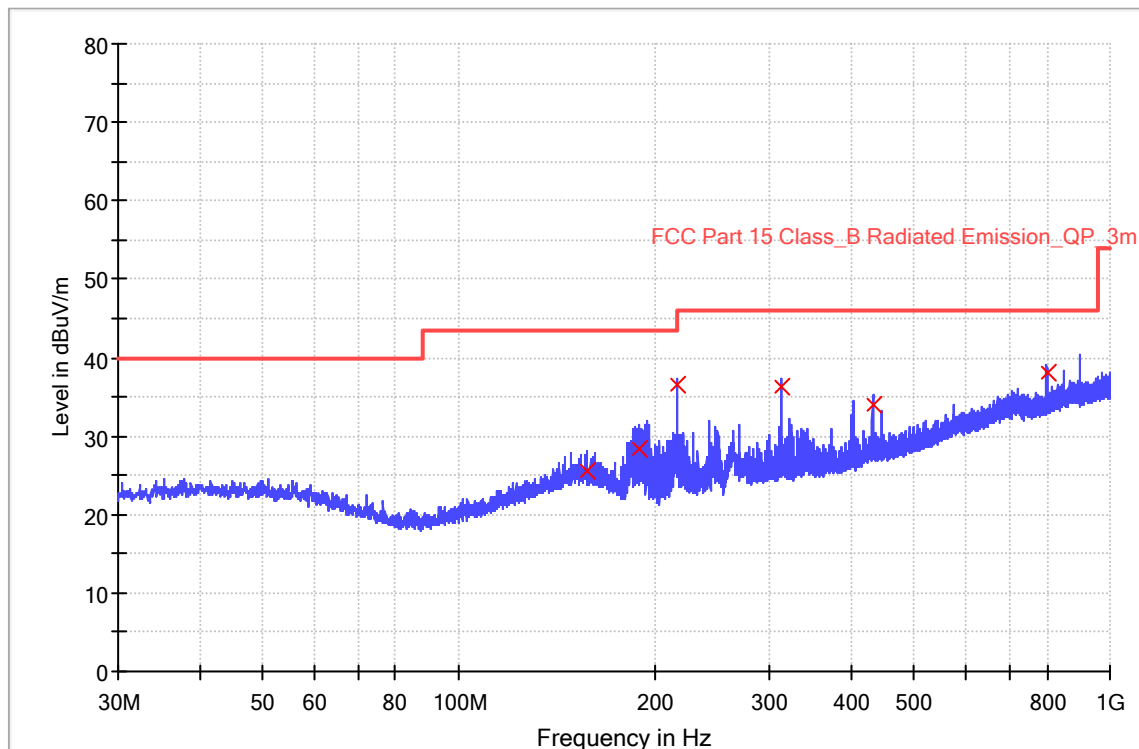
Emission Level = Reading level + Correction Factor

(The Reading Level is recorded by software which is not shown in the sheet)

The worst case of Radiated Emission below 1GHz:

Site: 3 meter chamber	Time: 2021/07/13 - 17:29
Limit: FCC_Part15.109_RE(3m)_ClassB	Engineer: Wenqiang LU
Probe: VULB9168	Polarity: Horizontal
EUT: Infrared Thermal Camera, Model no: FOTRIC 326M	Power: 120VAC, 60Hz for computer
Note: Transmit by at channel 2480MHz and 8DPSK mode.	
Note: Pre-scan with three orthogonal axis and the worst case as X axis.	

RE_VULB9168_pre_Cont_30-1000



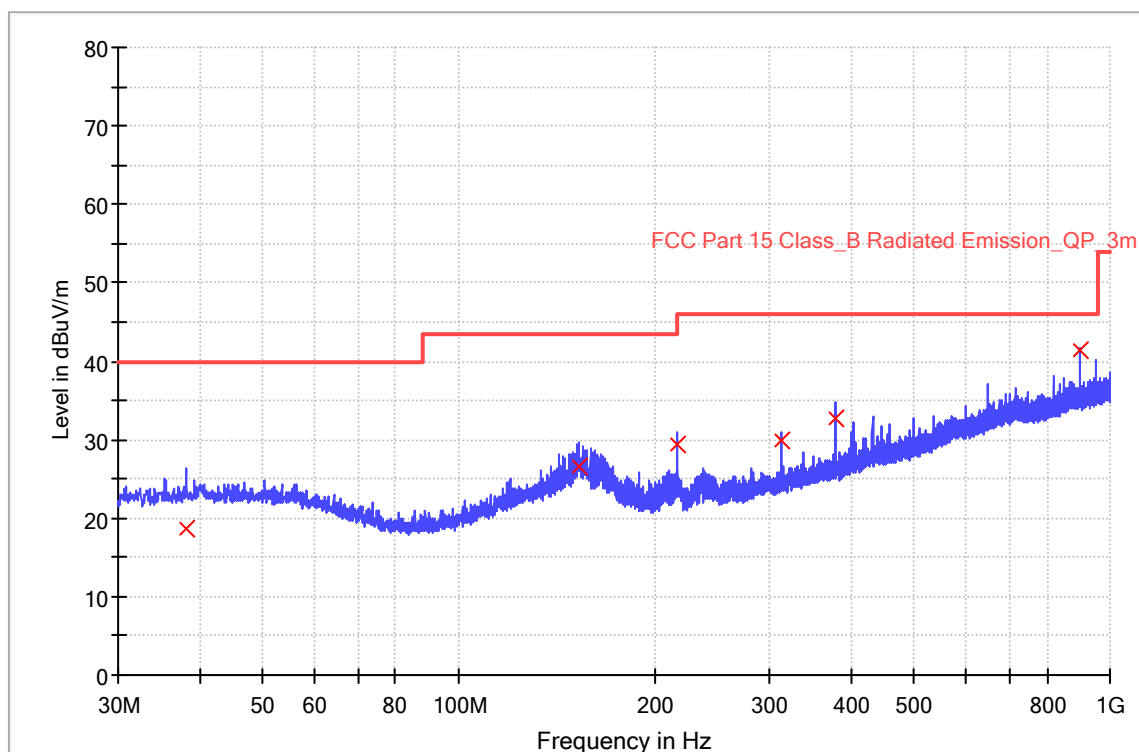
Limit and Margin

Frequency (MHz)	QuasiPeak (dBuV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBuV/m)
157.640000	25.6	1000.0	120.000	100.3	H	324.0	15.7	17.9	43.5
189.000000	28.4	1000.0	120.000	100.3	H	297.0	12.3	15.1	43.5
215.960000	36.4	1000.0	120.000	100.3	H	255.0	12.3	7.1	43.5
311.960000	36.2	1000.0	120.000	100.3	H	216.0	15.3	9.8	46.0
431.960000	34.1	1000.0	120.000	100.3	H	180.0	18.1	12.0	46.0
800.000000	38.0	1000.0	120.000	100.3	H	75.0	24.6	8.0	46.0

The worst case of Radiated Emission below 1GHz:

Site: 3 meter chamber	Time: 2021/07/13 - 17:21
Limit: FCC_Part15.109_RE(3m)_ClassB	Engineer: Wenqiang LU
Probe: VULB9168	Polarity: Vertical
EUT: Infrared Thermal Camera, Model no: FOTRIC 326M	Power: 120VAC, 60Hz for computer
Note: Transmit by at channel 2480MHz and 8DPSK mode.	
Note: Pre-scan with three orthogonal axis and the worst case as X axis.	

RE_VULB9168_pre_Cont_30-1000



Limit and Margin

Frequency (MHz)	QuasiPeak (dBuV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBuV/m)
38.200000	18.7	1000.0	120.000	100.3	V	235.0	14.5	21.3	40.0
153.280000	26.6	1000.0	120.000	100.3	V	42.0	15.7	16.9	43.5
215.960000	29.4	1000.0	120.000	100.3	V	13.0	12.3	14.1	43.5
311.960000	29.9	1000.0	120.000	100.3	V	11.0	15.3	16.1	46.0
379.800000	32.8	1000.0	120.000	100.3	V	312.0	16.9	13.2	46.0
900.000000	41.3	1000.0	120.000	100.3	V	12.0	25.9	4.7	46.0

Note 1: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)

Note 2: The test trace is same as the ambient noise and the amplitude of the emissions are attenuated more than 20dB below the permissible (the test frequency range: 9kHz ~ 30MHz, 18GHz ~ 25GHz), therefore no data appear in the report.

10 Test Equipment List

List of Test Instruments

Test Site1

	DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DATE	CAL. DUE DATE
C	Wideband power sensor	Rohde & Schwarz	NRP-Z81	104782	2020-12-23	2021-12-22
	Signal Analyzer	Rohde & Schwarz	FSV40	101091	2020-8-4	2021-8-3
	Signal Analyzer	Rohde & Schwarz	FSV40	101091	2021-8-2	2022-8-1
RE	EMI Test Receiver	Rohde & Schwarz	ESR3	101906	2020-8-4	2021-8-3
	EMI Test Receiver	Rohde & Schwarz	ESR3	101906	2021-8-2	2022-8-1
	Signal Analyzer	Rohde & Schwarz	FSV40	101091	2020-8-4	2021-8-3
	Signal Analyzer	Rohde & Schwarz	FSV40	101091	2021-8-2	2022-8-1
	Trilog Super Broadband Test Antenna	Schwarzbeck	VULB 9168	961	2019-3-16	2022-3-15
	Horn Antenna	Rohde & Schwarz	HF907	102393	2021-3-15	2022-3-14
	Pre-amplifier	Rohde & Schwarz	SCU-18D	19006451	2020-8-4	2021-8-3
	Pre-amplifier	Rohde & Schwarz	SCU-18D	19006451	2021-8-2	2022-8-1
	Loop antenna	Rohde & Schwarz	HFH2-Z2	100443	2020-5-23	2021-5-22
	Loop antenna	Rohde & Schwarz	HFH2-Z2	100443	2021-5-21	2022-5-20
	DOUBLE-RIDGED WAVEGUIDE HORN WITH PRE-AMPLIFIER (18 GHZ - 40 GHZ)	ETS-Lindgren	3116C-PA	002222727	2020-9-23	2023-9-22
	3m Semi-anechoic chamber	TDK	9X6X6	----	2018-5-11	2021-5-10
	3m Semi-anechoic chamber	TDK	9X6X6	----	2021-5-8	2024-5-7
CE	EMI Test Receiver	Rohde & Schwarz	ESR3	101907	2020-8-4	2021-8-3
	EMI Test Receiver	Rohde & Schwarz	ESR3	101907	2021-8-2	2022-8-1
	LISN	Rohde & Schwarz	ENV216	101924	2020-8-4	2021-8-3
	LISN	Rohde & Schwarz	ENV216	101924	2021-8-2	2022-8-1

Measurement Software Information			
Test Item	Software	Manufacturer	Version
C	Bluetooth and WiFi Test System	Shenzhen JS tonscond co.,ltd	2.6.77.0518
RE	EMC 32	Rohde & Schwarz	V9.15.00
CE	EMC 32	Rohde & Schwarz	V9.15.03

C - Conducted RF tests

- Conducted peak output power
- 6dB bandwidth
- 20dB bandwidth and 99% Occupied Bandwidth
- Carrier frequency separation
- Number of hopping frequencies
- Dwell Time
- Power spectral density*
- Spurious RF conducted emissions
- Band edge

11 System Measurement Uncertainty

For a 95% confidence level, the measurement expanded uncertainties for defined systems, in accordance with the recommendations of ISO 17025 were:

Items	Extended Uncertainty
Conducted Disturbance at Mains Terminals	150kHz to 30MHz, LISN, $\pm 3.16\text{dB}$
Radiated Disturbance	30MHz to 1GHz, $\pm 5.03\text{dB}$ (Horizontal) $\pm 5.12\text{dB}$ (Vertical) 1GHz to 18GHz, $\pm 5.49\text{dB}$ 18GHz to 25GHz, $\pm 5.63\text{dB}$
Carrier power conducted measurement	50MHz~18GHz, $\pm 1.238\text{dB}$
Spurious Emission Conducted Measurement	9kHz ~40GHz, $\pm 1.224\text{dB}$

Measurement Uncertainty Decision Rule:

Determination of conformity with the specification limits is based on the decision rule according to IEC Guide 115: 2007, clause 4.4.3 and 4.5.1.

12 Photographs of Test Set-ups

Refer to the < Test Setup photos >.

13 Photographs of EUT

Refer to the < External Photos > & < Internal Photos >.

THE END