



FCC - TEST REPORT

Report Number : **4842025239900B** Date of Issue: 2025.04.27

Model : THP01-ZB-V5

Product Type : Dual Band Wireless Multi-mode Gateway

Applicant : Zhejiang Lingzhu Technology Co., Ltd.

Address : Room 302, No 1 Building Huace Center, Xihu District 310000,
Hangzhou City, Zhejiang Province, PEOPLE'S REPUBLIC OF
CHINA

Manufacturer : Zhejiang Lingzhu Technology Co., Ltd.

Address : Room 302, No 1 Building Huace Center, Xihu District 310000,
Hangzhou City, Zhejiang Province, PEOPLE'S REPUBLIC OF
CHINA

Test Result : ☒ Positive ☐ Negative

Total pages including
Appendices : 78



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2 Report Modification Record

Alterations and additions to this report will be issued to the holders of each copy in the form of a complete document.

Issue	Description of Change	Date of Issue
1	First Issue	2025.04.27



3 Details about the Test Laboratory

Test Site 1

Company name: TÜV SÜD Certification and Testing (China) Co., Ltd.

Floor 1-4, Building B, No.37, Tuanjie Road(Middle), Xishan Economic and Technological Development Zone, Wuxi, Jiangsu. China

Test Firm FCC
Registration
Number: 571980

Designation
number: CN1405

Telephone: +86 510 8820 3737
Fax: +86 510 8820 3636

4 Description of the Equipment under Test

Product: Dual Band Wireless Multi-mode Gateway

PMN / HVIN / Model no.: THP01-ZB-V5

FCC ID: 2BEWX-THP01-ZB

Rating: Gateway Input: DC 5V, 1A
Adapter Input: 100-240V~, 50/60Hz, 0.25A
Adapter Output: DC 5.0V, 1.0A, 5.0W

RF Transmission Frequency: Bluetooth Low Energy: 2402MHz-2480MHz

No. of Operated Channel: 40

Modulation: GFSK

Channel list:

Bluetooth Low Energy							
Ch	Fre(MHz)	Ch	Fre(MHz)	Ch	Fre(MHz)	Ch	Fre(MHz)
0	2402	10	2422	20	2442	30	2462
1	2404	11	2424	21	2444	31	2464
2	2406	12	2426	22	2446	32	2466
3	2408	13	2428	23	2448	33	2468
4	2410	14	2430	24	2450	34	2470
5	2412	15	2432	25	2452	35	2472
6	2414	16	2434	26	2454	36	2474
7	2416	17	2436	27	2456	37	2476
8	2418	18	2438	28	2458	38	2478
9	2420	19	2440	29	2460	39	2480

Hardware Version: V1.0.3

Software Version: V1.0.0

Antenna Type: Metal PCB Antenna

Antenna Gain: 1.98dBi

Description of the EUT: The Equipment Under Test (EUT) is a Dual Band Wireless Multi-mode Gateway which supports 2.4GHz & 5GHz Wi-Fi, Low Energy Bluetooth (1Mbps & 2Mbps data rate) and Zigbee functions. We tested it and listed the worst data in this report

Test sample no.: WUX 0896895-002

Remark: This report is only for BLE



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 or any information supplied.



5 Summary of Test Standards

Test Standards	
FCC Part 15 Subpart C	PART 15 - RADIO FREQUENCY DEVICES Subpart C - Intentional Radiators

All the test methods were according to KDB 558074 D01 15.247 Meas Guidance v05r02 and ANSI C63.10 (2020).

6 Summary of Test Results

Technical Requirements						
Test Condition		Pages	Test Site	Test Result		
				Pass	Fail	N/A
§15.207	Conducted emission AC power port	14-16	Site 1	☒	☐	☐
§15.247 (b) (3)	Conducted peak output power	17-19	Site 1	☒	☐	☐
§15.247(a)(1)	20dB bandwidth	---	---	☐	☐	☒
§15.247(a)(1)	Carrier frequency separation	---	---	☐	☐	☒
§15.247(a)(1)(iii)	Number of hopping frequencies	---	---	☐	☐	☒
§15.247(a)(1)(iii)	Dwell Time	---	---	☐	☐	☒
§15.247(a)(2)	6dB bandwidth and 99% Occupied Bandwidth	20-26	Site 1	☒	☐	☐
§15.247(e)	Power spectral density	27-29	Site 1	☒	☐	☐
§15.247(d)	Spurious RF conducted emissions	30-39	Site 1	☒	☐	☐
§15.247(d)	Band edge	40-43	Site 1	☒	☐	☐
§15.247(d) & §15.209 & §15.205	Spurious radiated emissions for transmitter	44-74	Site 1	☒	☐	☐
§15.203	Antenna requirement	See note 1		☒	☐	☐

Remark 1: N/A – Not Applicable.

Note 1: The EUT uses a PCB antenna, which gain is 1.98dBi. In accordance to §15.203, It is considered sufficiently to comply with the provisions of this section.



7 General Remarks

Remarks

This submittal(s) (test report) is intended for FCC ID: 2BEWX-THP01-ZB, complies with Section 15.203,15.205,15.207,15.209,15.247 of the FCC Part 15, Subpart C Rules.

SUMMARY:

All tests according to the regulations cited on page 8 were

■ - Performed

□ - **Not** Performed

The Equipment under Test

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

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

Sample Received Date: 2025.3.13

Testing Start Date: 2025.3.15

Testing End Date: 2025.4.15

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

Reviewed by:

Bo Dai
Project Manager

Prepared by:

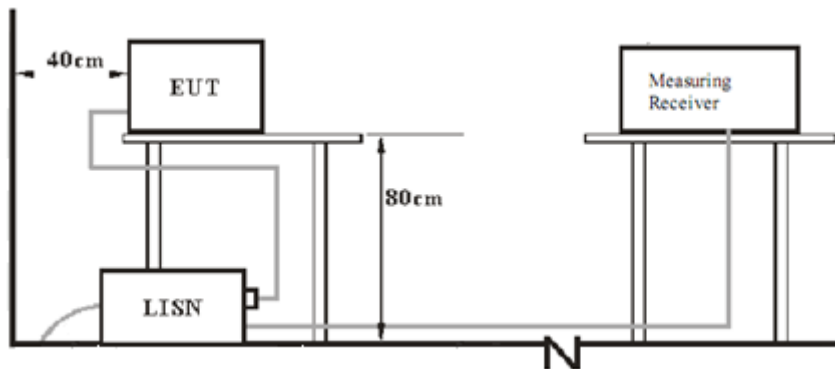
Xin Feng
Project Engineer

Tested by:

Zhihua Xia
Test Engineer

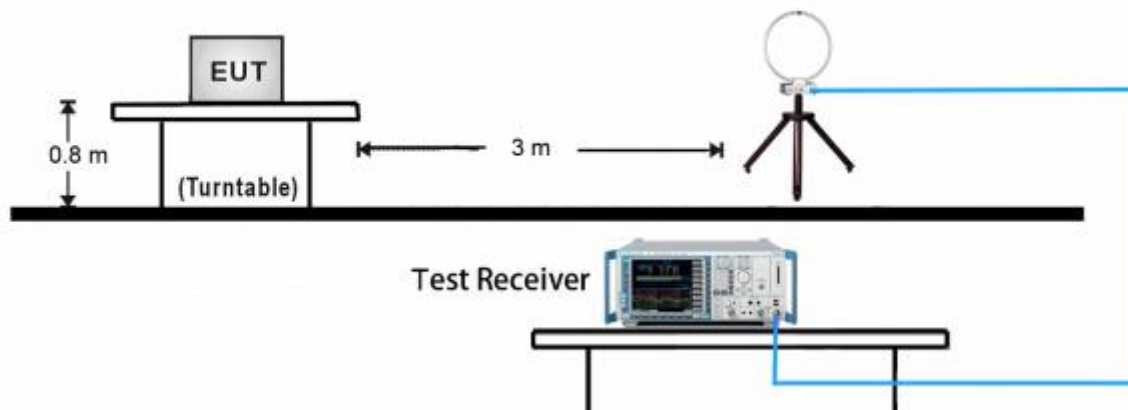
8 Test Setups

7.1 AC Power Line Conducted Emission test setups

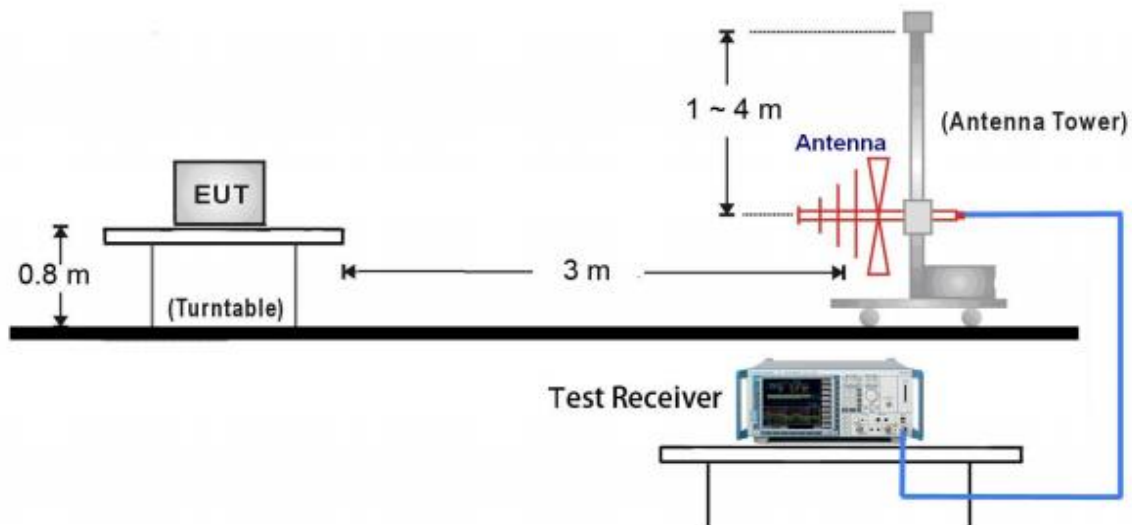


7.2 Radiated test setups

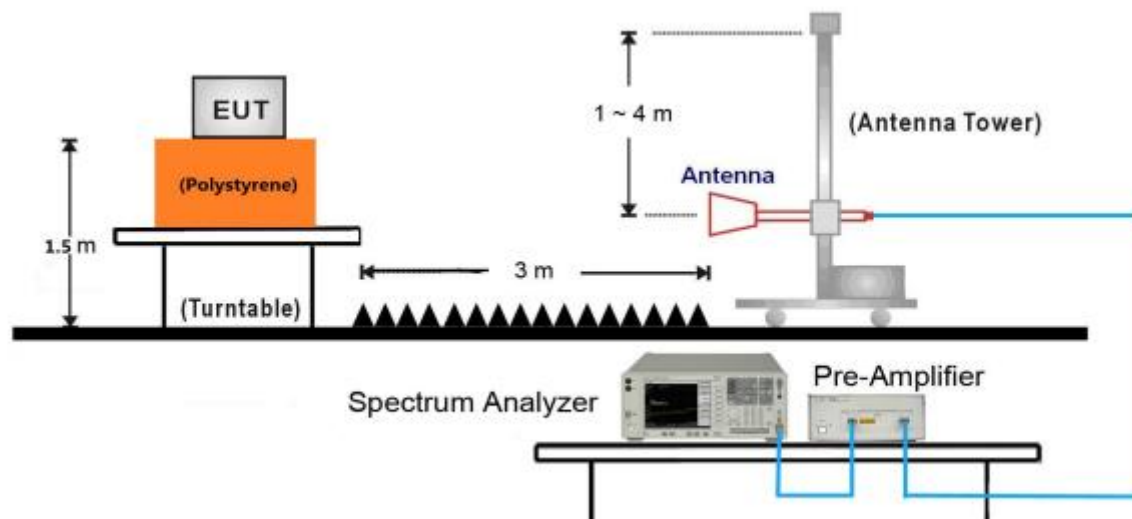
9kHz ~ 30MHz Test Setup:



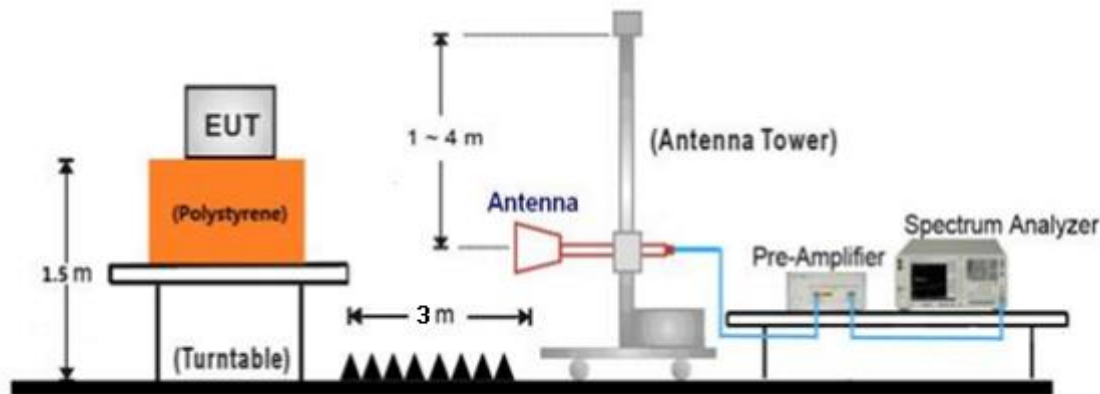
30MHz ~ 1GHz Test Setup:



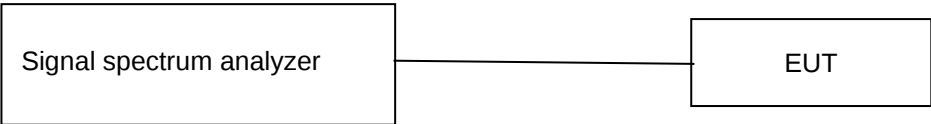
1GHz ~ 18GHz Test Setup:



18GHz ~ 25GHz Test Setup:



7.3 Conducted RF test setups



9 Systems test configuration

Auxiliary Equipment Used during Test:

DESCRIPTION	MANUFACTURER	MODEL NO.(SHIELD)	S/N(LENGTH)
Notebook	Huawei	VLT-W50	2018AP1231

Test software: RTLBTAPP.exe

Test Mode Applicability and Tested Channel Detail:

Mode	Tested Channel	Data Rate	Modulation	Power level setting (Index Value)
Bluetooth LE	0	1 Mbps	GFSK	0X3B
	19			0X3B
	39			0X3B
Bluetooth LE	0	2 Mbps	GFSK	0X3B
	19			0X3B
	39			0X3B

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.

10 Technical Requirement

10.1 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

According to §15.207, conducted emissions limit as below:

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

150k-30MHz Conducted Emission Test

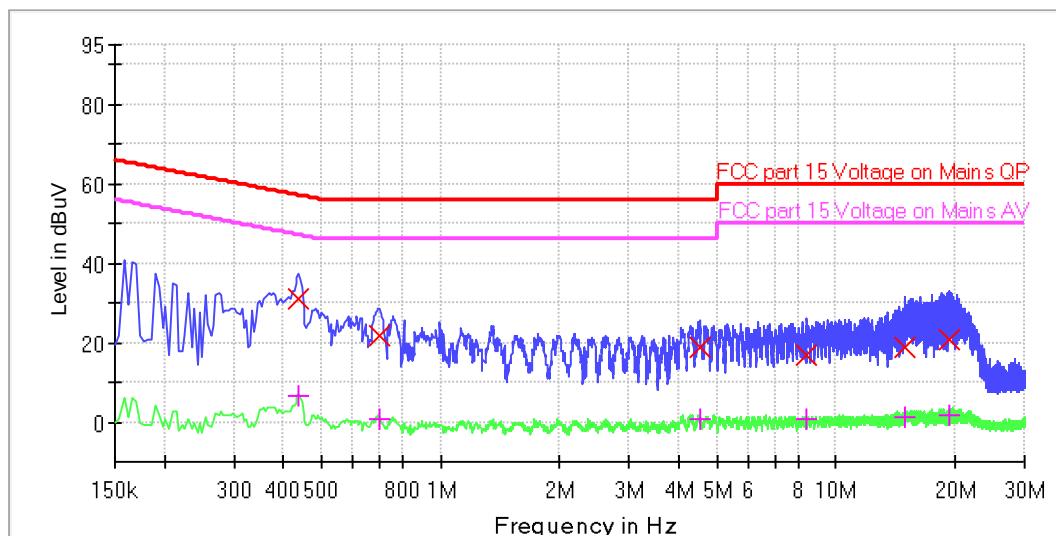
EUT Information

EUT: Dual Band Wireless Multi-mode Gateway
Model: THP01-ZB-V5
Client: Zhejiang Lingzhu Technology Co., Ltd
Operating Conditions: Power on, BLE transmitting, Data rate: 2Mbps, 2480MHz
Operator Name: Zhihua Xia
Input: AC 120V 60Hz
Test Standard: FCC Part 15.207(a)
Comment: Phase L
Sample No.: WUX 0896895-002

Scan Setup: Mains Voltage LISN 2 Lines 150kHz-30MHz Pre Fcc [EMI conducted]

Hardware Setup: Mains Voltage LISN 2 Lines 150kHz-30MHz_Fcc
Receiver: [ESW 8]
Level Unit: dBuV

Subrange	Step Size	Detectors	IF BW	Meas. Time	Preamp
150 kHz - 30 MHz	4 kHz	PK+ ; AVG	9 kHz	0.01 s	0 dB

**Limit and Margin**

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Meas. Time (ms)	Bandwidth (kHz)	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBuV)	Margin - CAV (dB)	Limit - CAV (dBuV)
0.438000	30.8	6.6	1000.0	9.000	10.4	26.3	57.1	40.5	47.1
0.698000	21.6	0.8	1000.0	9.000	10.4	34.4	56.0	45.2	46.0
4.510000	18.6	0.8	1000.0	9.000	10.5	37.4	56.0	45.2	46.0
8.462000	16.9	0.6	1000.0	9.000	10.7	43.1	60.0	49.4	50.0
15.002000	18.9	1.2	1000.0	9.000	10.8	41.1	60.0	48.8	50.0
19.426000	20.9	1.6	1000.0	9.000	10.8	39.2	60.0	48.4	50.0

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

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

150k-30MHz Conducted Emission Test

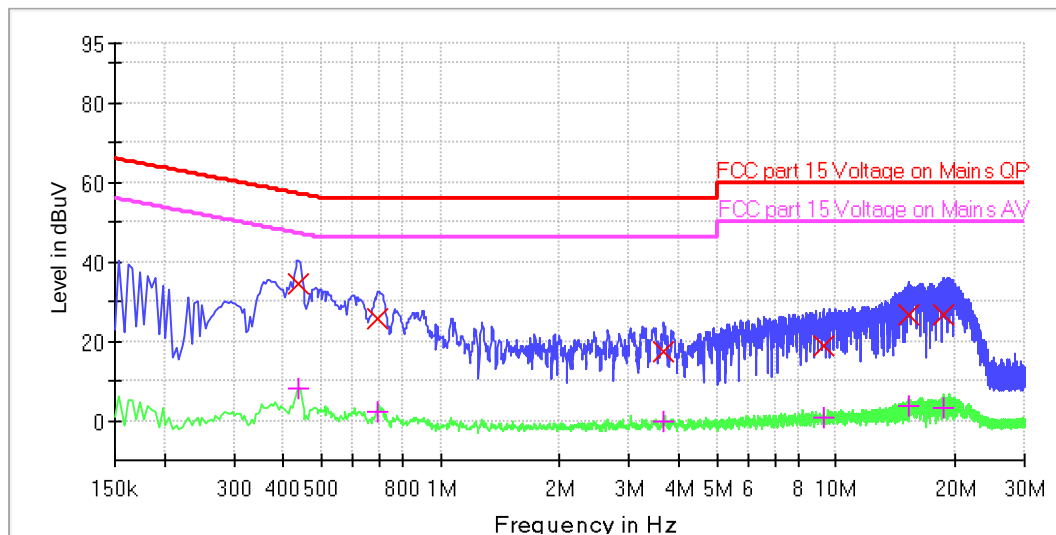
EUT Information

EUT: Dual Band Wireless Multi-mode Gateway
Model: THP01-ZB-V5
Client: Zhejiang Lingzhu Technology Co., Ltd
Operating Conditions: Power on, BLE transmitting, Data rate: 2Mbps, 2480MHz
Operator Name: Zhihua Xia
Input: AC 120V 60Hz
Test Standard: FCC Part 15.207(a)
Comment: Phase N
Sample No.: WUX 0896895-002

Scan Setup: Mains Voltage LISN 2 Lines 150kHz-30MHz Pre Fcc [EMI conducted]

Hardware Setup: Mains Voltage LISN 2 Lines 150kHz-30MHz_Fcc
Receiver: [ESW 8]
Level Unit: dBuV

Subrange	Step Size	Detectors	IF BW	Meas. Time	Preamp
150 kHz - 30 MHz	4 kHz	PK+ ; AVG	9 kHz	0.01 s	0 dB



Limit and Margin

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Meas. Time (ms)	Bandwidth (kHz)	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBuV)	Margin - CAV (dB)	Limit - CAV (dBuV)
0.438000	34.4	8.0	1000.0	9.000	10.4	22.7	57.1	39.1	47.1
0.694000	25.4	2.2	1000.0	9.000	10.4	30.6	56.0	43.8	46.0
3.674000	17.3	-0.3	1000.0	9.000	10.5	38.7	56.0	46.3	46.0
9.286000	18.8	0.6	1000.0	9.000	10.7	41.2	60.0	49.4	50.0
15.258000	26.6	3.8	1000.0	9.000	10.8	33.4	60.0	46.2	50.0
18.630000	26.5	3.3	1000.0	9.000	10.8	33.5	60.0	46.7	50.0

Note 1: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)
Factor (dB) = Cable Loss (dB) + LISN Factor (dB) + 10dB Attenuator

10.2 Conducted peak output power

Test Method

1. The RF output of EUT was connected to the spectrum analyzer by RF cable. The path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously.
3. Use the following test receiver settings:
Span = approximately 5 times the 6dB bandwidth, centered on a channel need to test,
RBW > the 6dB bandwidth of the emission being measured, VBW $\geq$ 3RBW,
Sweep = auto, Detector function = peak, Trace = max hold
4. 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 and record the results in the test report.
5. Repeat above procedures until all frequencies measured were complete.

Limits

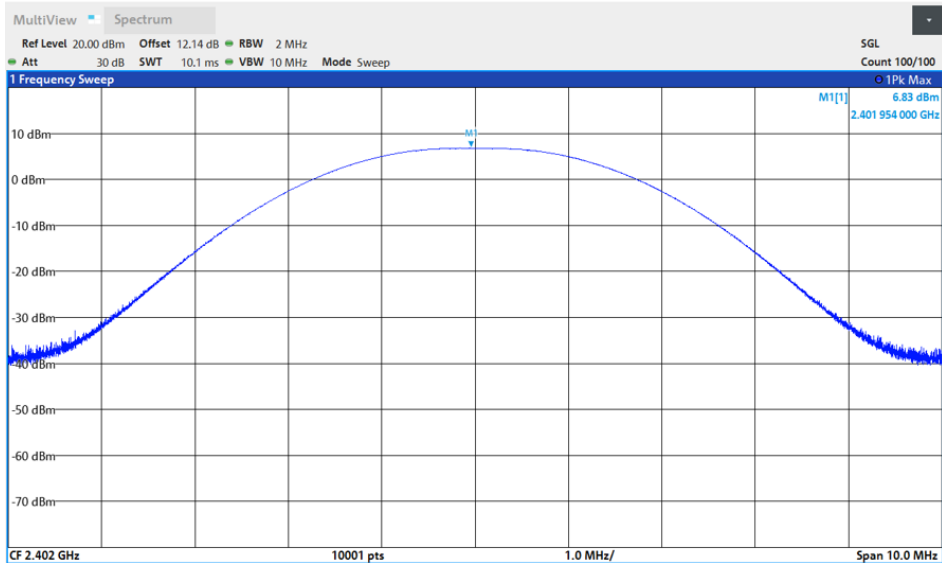
According to §15.247 (b) (3), conducted peak output power limit as below:

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

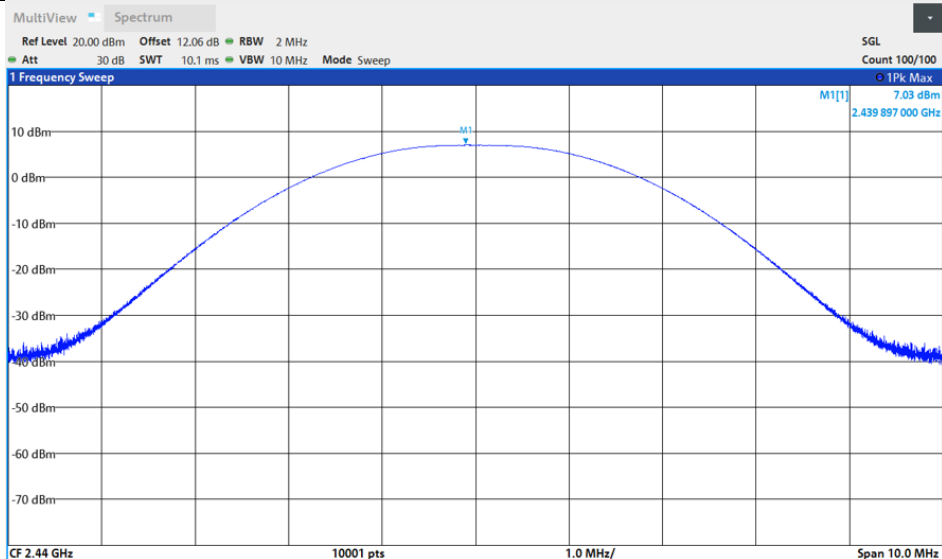
Test result as below table

Bluetooth LE Test Result				
Data transmission Rate	Frequency (MHz)	Conducted Peak Output Power (dBm) §15.247 (b) (3)		
		Result	limit	Verdict
1Mbps	2402MHz	6.83	≤ 30	Pass
	2440MHz	7.03	≤ 30	Pass
	2480MHz	7.00	≤ 30	Pass
2Mbps	2402MHz	6.83	≤ 30	Pass
	2440MHz	7.08	≤ 30	Pass
	2480MHz	7.11	≤ 30	Pass

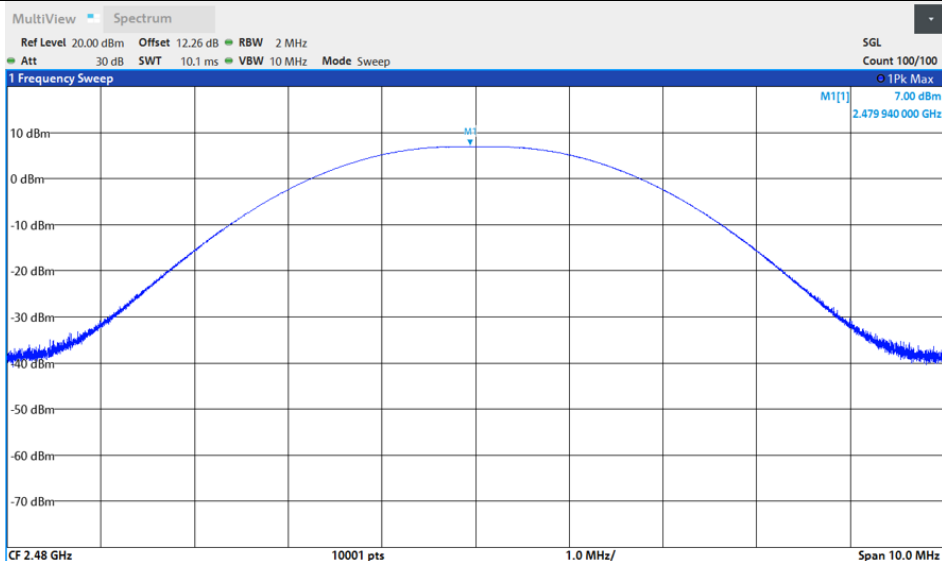
BLE_1Mbps_Ant1_2402MHz



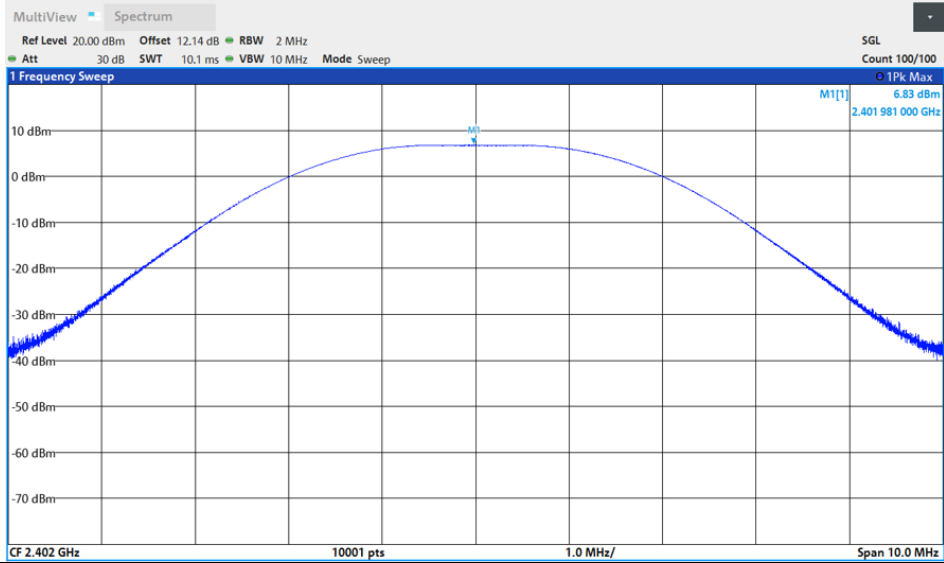
BLE_1Mbps_Ant1_2440MHz



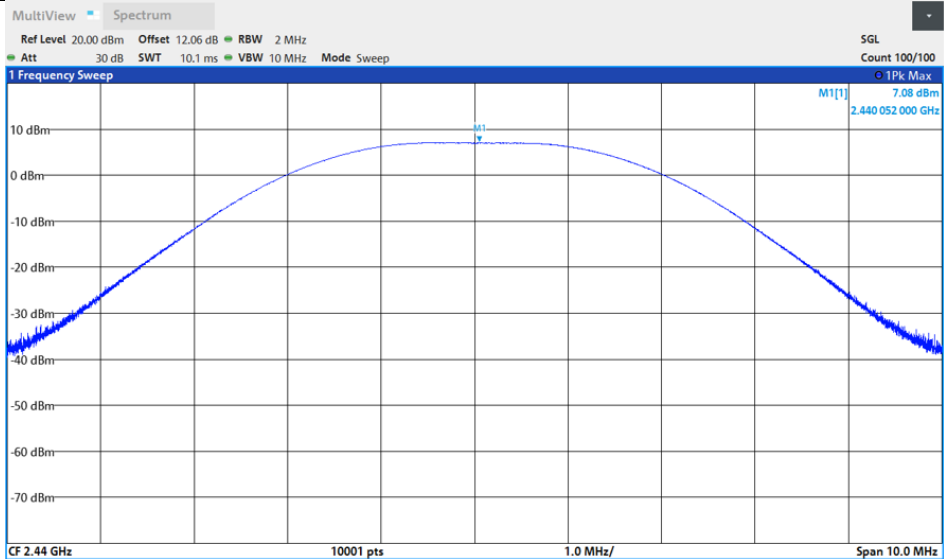
BLE_1Mbps_Ant1_2480MHz



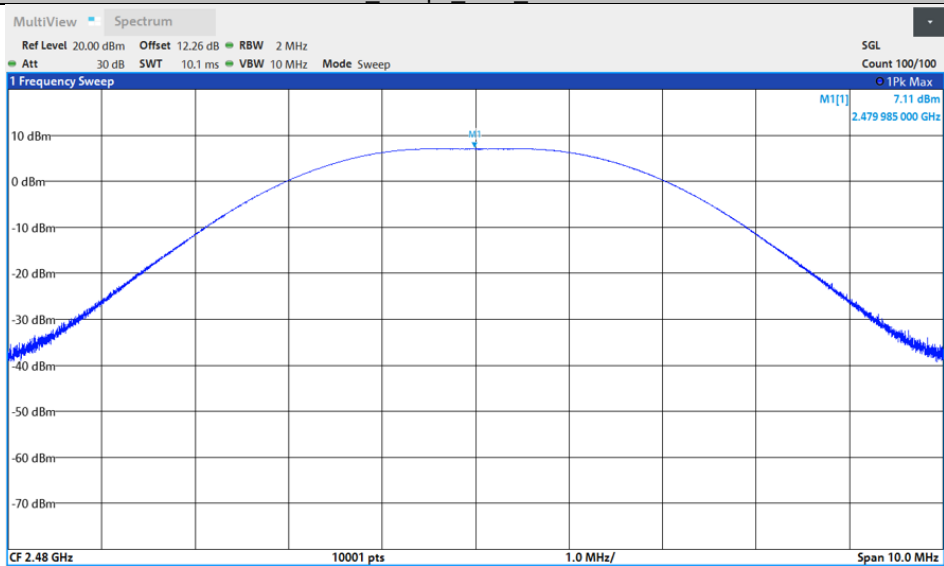
BLE_2Mbps_Ant1_2402MHz



BLE_2Mbps_Ant1_2440MHz



BLE_2Mbps_Ant1_2480MHz



10.3 6dB bandwidth and 99% Occupied Bandwidth

Test Method for 6 dB Bandwidth

1. Set RBW = shall be in the range of 1% to 5% of the OBW but not less than 100 kHz.
2. Set the VBW $\geq [3 \times \text{RBW}]$.
3. Detector = peak.
RBW=100KHz, VBW $\geq$ 3RBW, Sweep = auto, Detector function = peak, Trace = max hold
4. Trace mode = max-hold.
5. Sweep = No faster than coupled (auto) time.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission by placing two markers, one at the lowest frequency and the other at the highest frequency of the envelope of the spectral display, such that each marker is at or slightly below the “-6 dB down amplitude”. If a marker is below this “-6 dB down amplitude” value, then it shall be as close as possible to this value.

Test Method for 99 % Bandwidth

1. Use the following spectrum analyzer settings:
RBW=1% to 5% of the actual occupied, VBW $\geq$ 3RBW, Sweep = auto,
Detector function = peak, Trace = max hold
2. Use the occupied bandwidth measurement capability of test receiver.
3. Allow the trace to stabilize, record the occupied bandwidth value.

Limit

6dB bandwidth Limit [kHz]

99% bandwidth Limit [kHz]

≥ 500

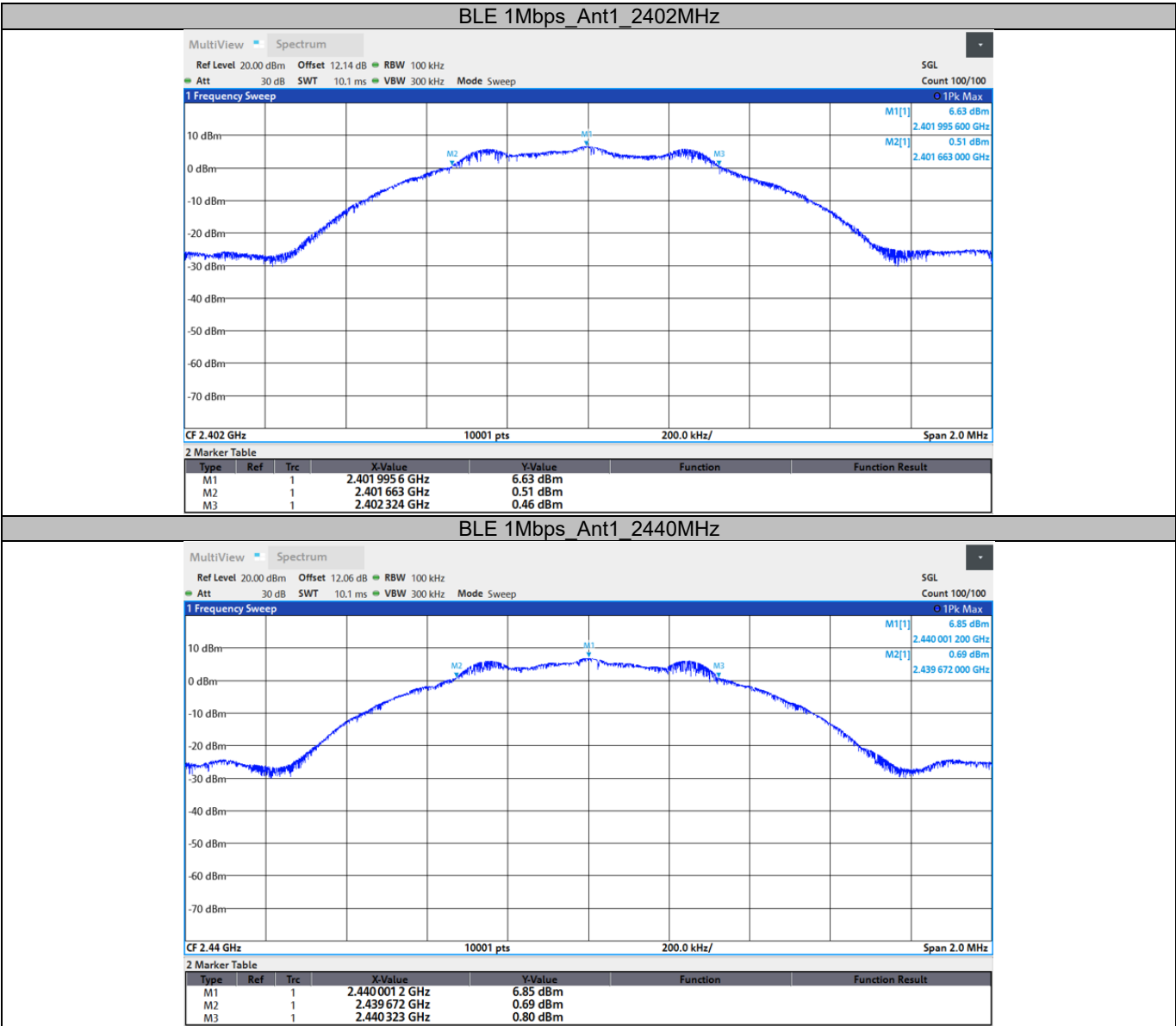
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Test result

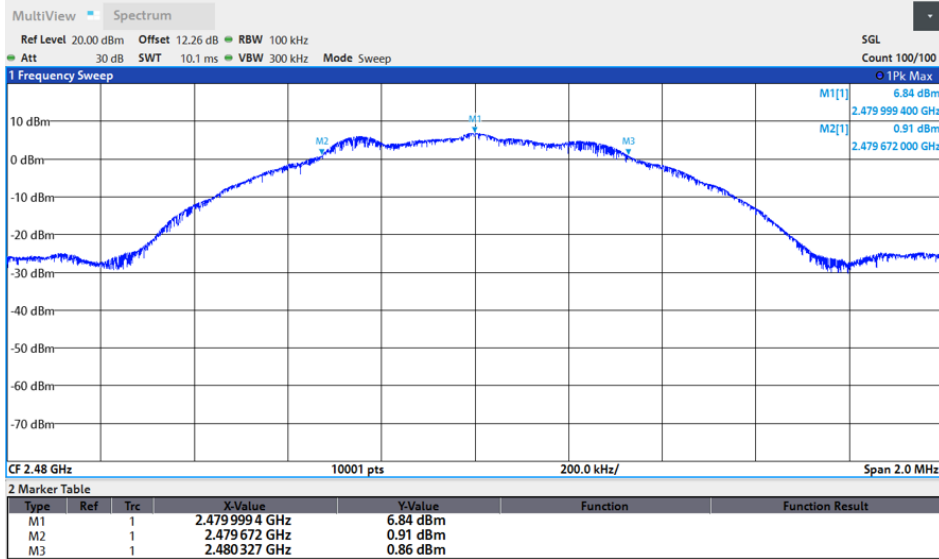
Data transmission rate	Frequency MHz	6dB bandwidth (MHz)		Result	99% occupied bandwidth MHz
		result	limit	verdict	
1Mbps	2402	0.661	≥ 0.5	Pass	1.025
	2440	0.651	≥ 0.5	Pass	1.032
	2480	0.655	≥ 0.5	Pass	1.039
2Mbps	2402	1.129	≥ 0.5	Pass	2.029
	2440	1.135	≥ 0.5	Pass	2.049
	2480	0.967	≥ 0.5	Pass	2.040



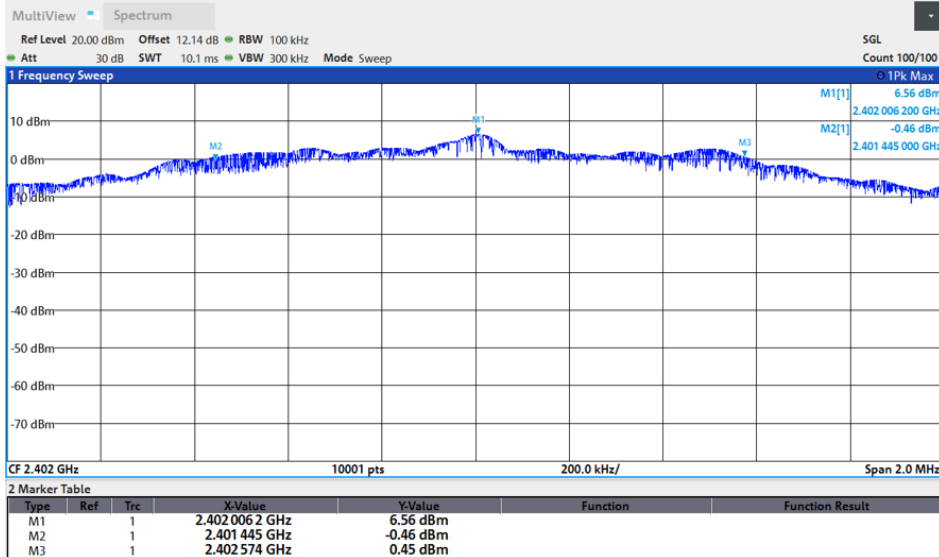
6dB Bandwidth



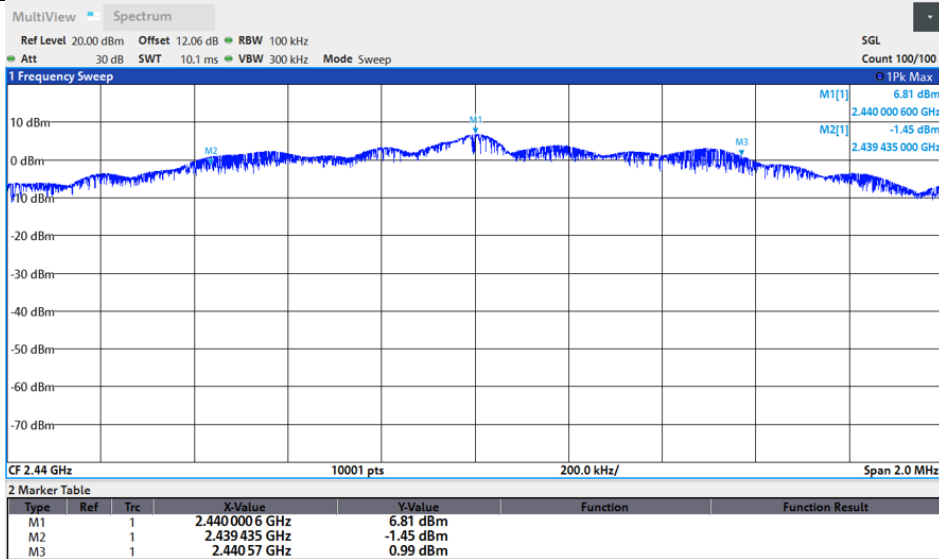
BLE 1Mbps_Ant1_2480MHz

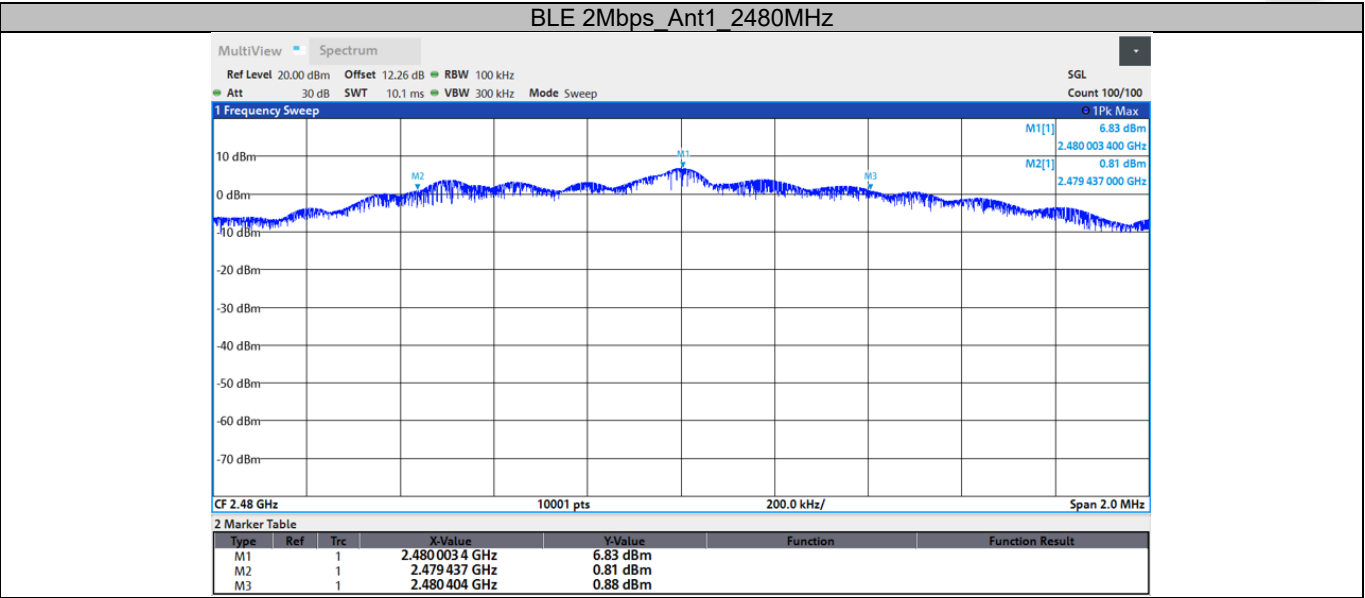


BLE 2Mbps_Ant1_2402MHz



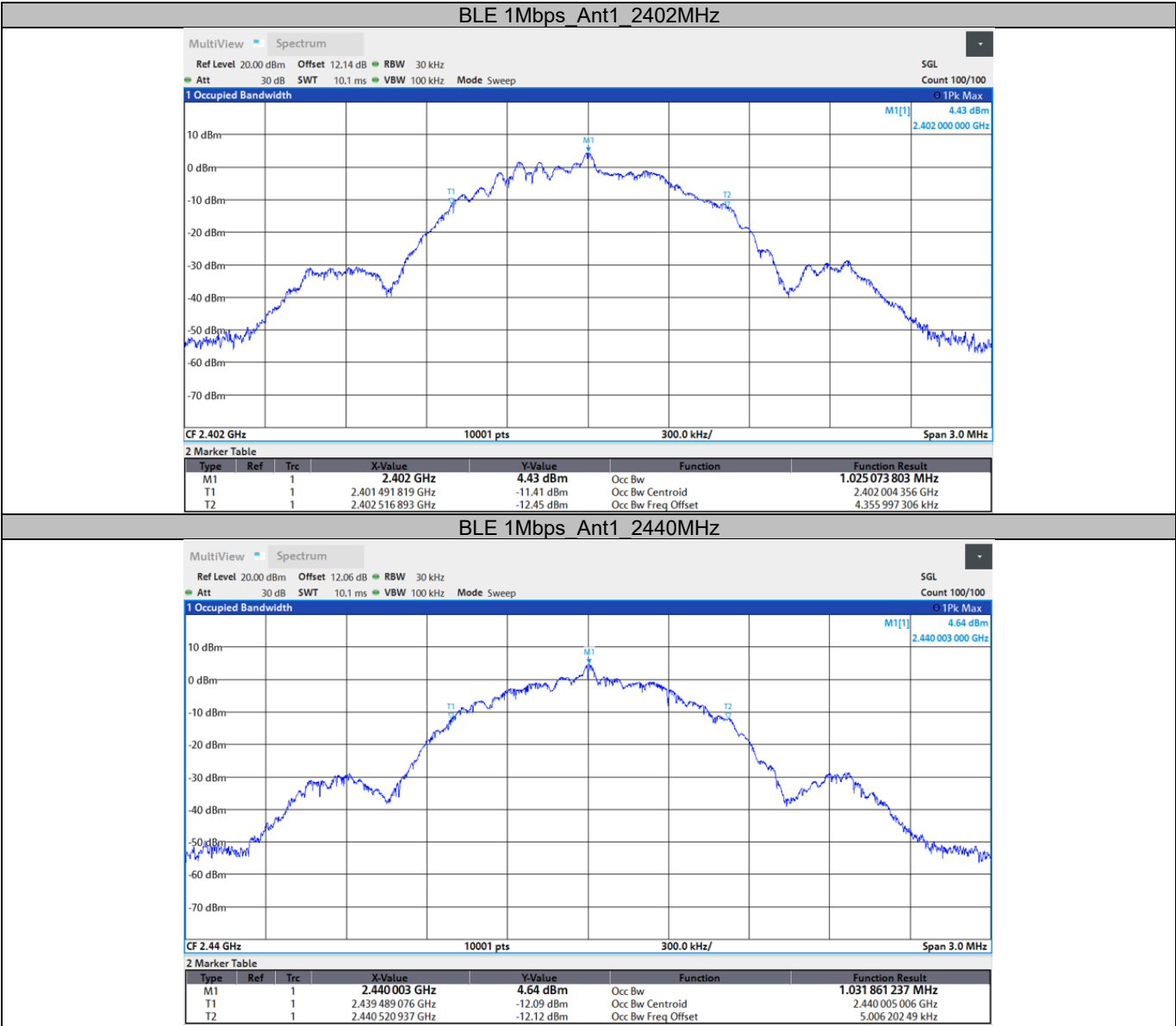
BLE 2Mbps_Ant1_2440MHz



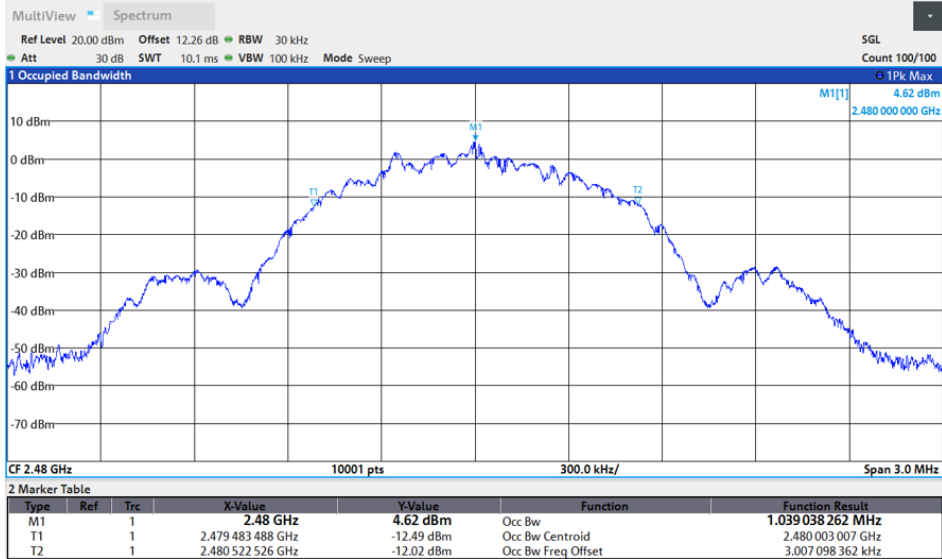




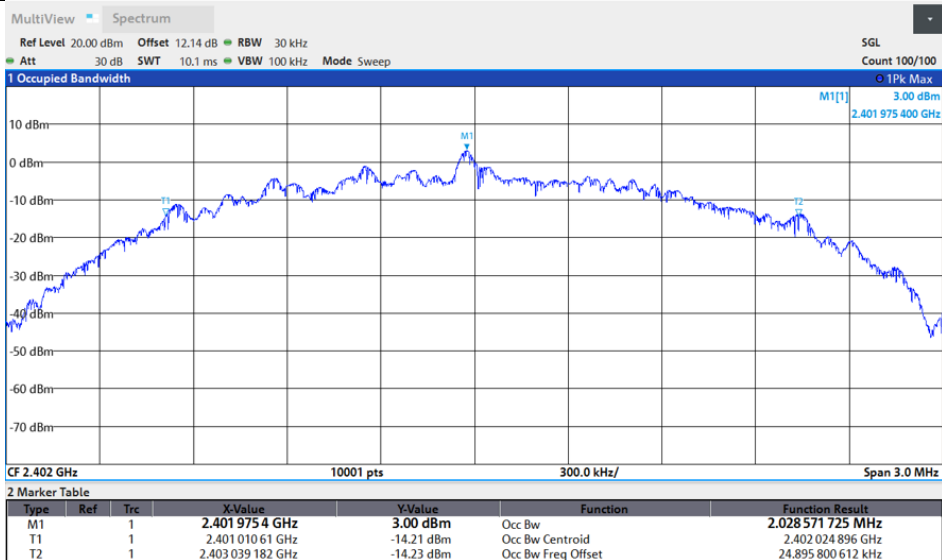
99% Bandwidth



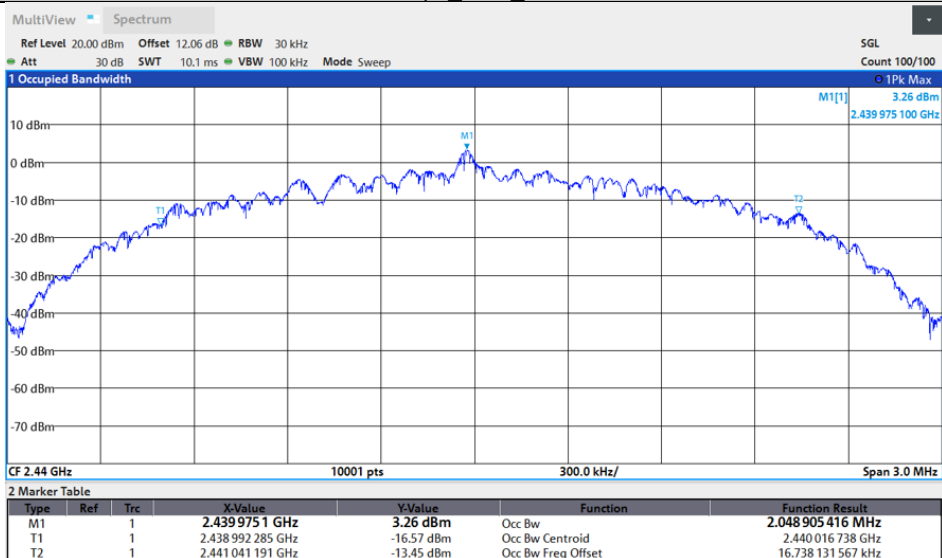
BLE 1Mbps_Ant1_2480MHz

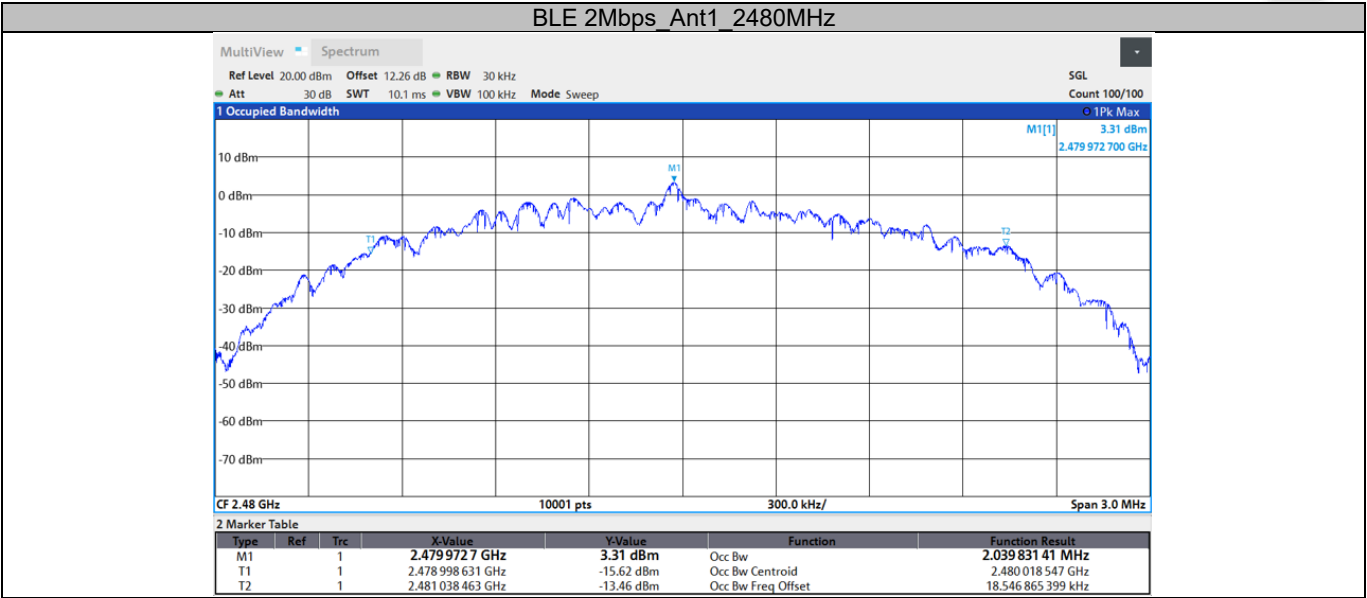


BLE 2Mbps_Ant1_2402MHz



BLE 2Mbps_Ant1_2440MHz





10.4 Power spectral density

Test Method

This procedure shall be used if maximum peak conducted output power was used to demonstrate compliance:

1. The RF output of EUT was connected to the spectrum analyzer. The path loss was compensated to the results for each measurement.
2. Set to the maximum power setting, the instrument center frequency is set to the nominal EUT channel center frequency enable the EUT transmit continuously.
3. Use the following spectrum analyzer settings:
4. Set analyzer center frequency to DTS channel center frequency. RBW=3kHz, VBW $\geq$ 3RBW, Span=1.5 times DTS bandwidth, Detector=Peak, Sweep=auto, Trace= max hold.
5. Allow trace to fully stabilize, use the peak marker function to determine the maximum amplitude level within the RBW.
6. Repeat above procedures until other frequencies measured were completed.

Limit

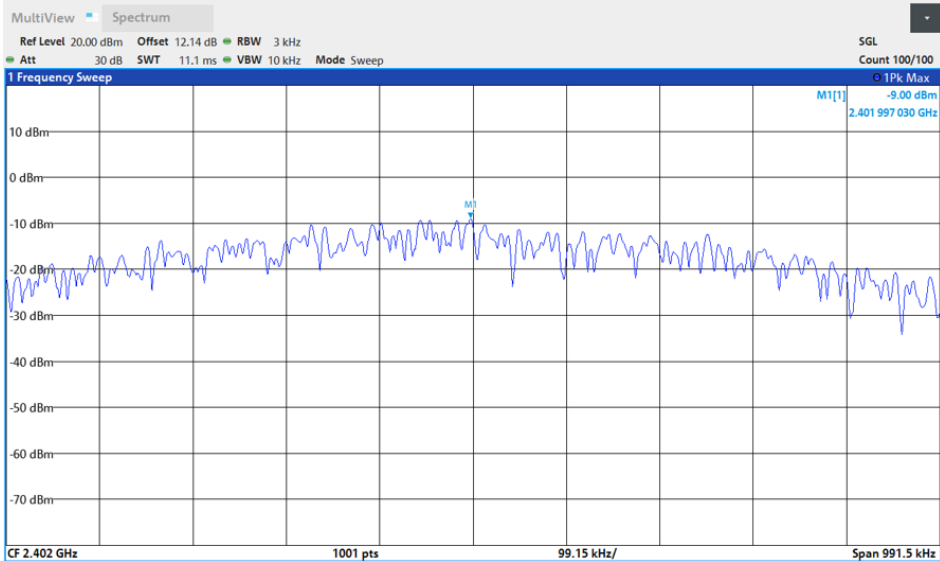
Limit [dBm/3kHz]

≤ 8

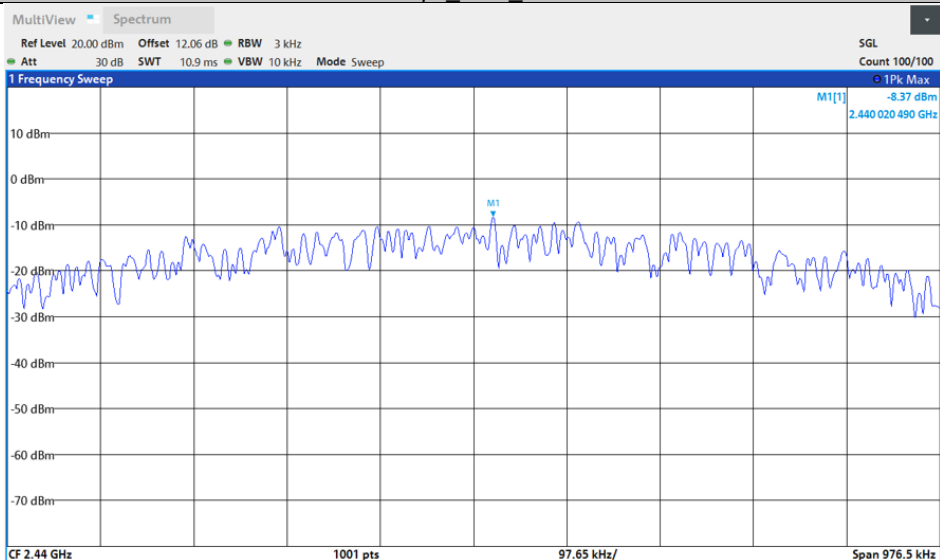
Test result

Data transmission rate	Frequency (MHz)	Power spectral density (dBm/3kHz)	Limit (dBm/3kHz)	Result
1Mbps	2402MHz	-9.00	8	Pass
	2440MHz	-8.37	8	Pass
	2480MHz	-8.21	8	Pass
2Mbps	2402MHz	-10.87	8	Pass
	2440MHz	-11.14	8	Pass
	2480MHz	-11.03	8	Pass

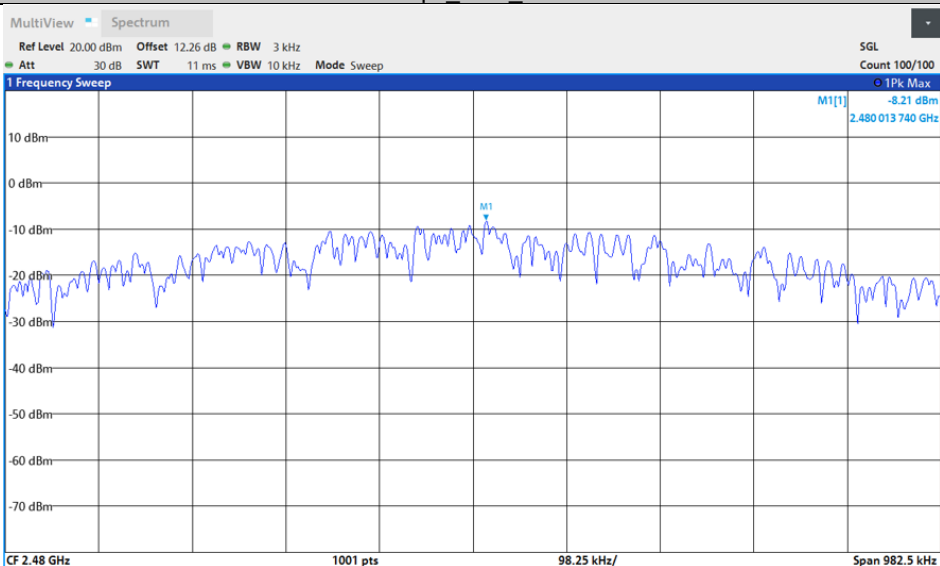
BLE 1Mbps_Ant1_2402MHz



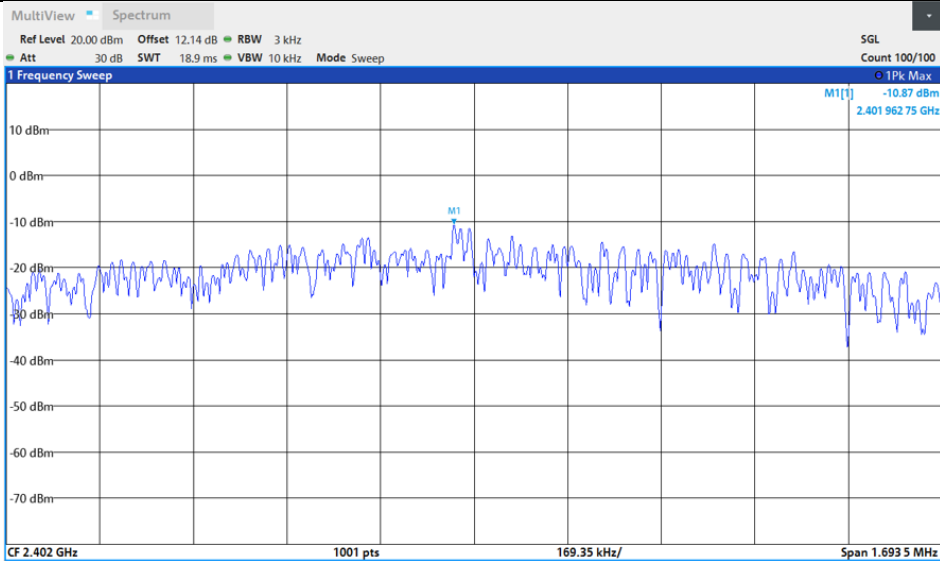
BLE 1Mbps_Ant1_2440MHz



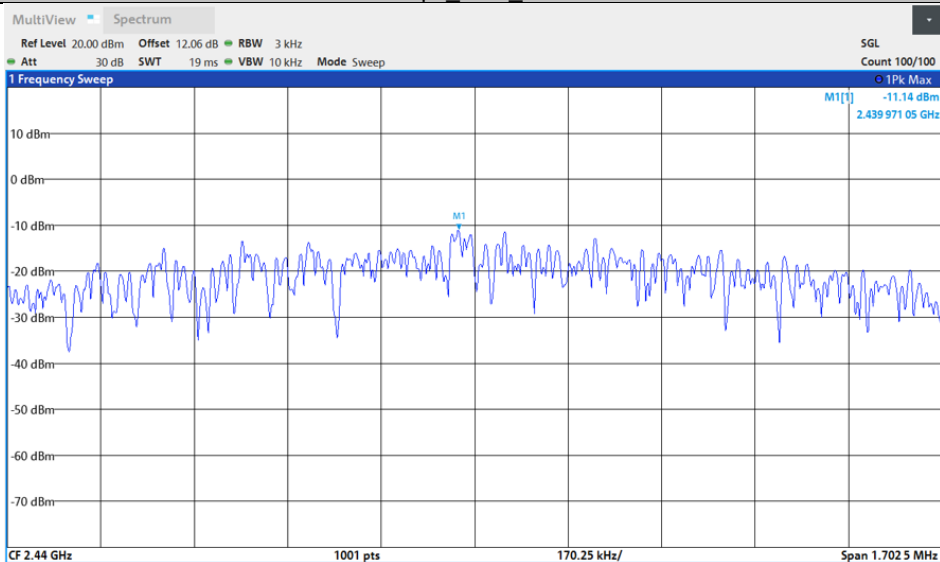
BLE 1Mbps_Ant1_2480MHz



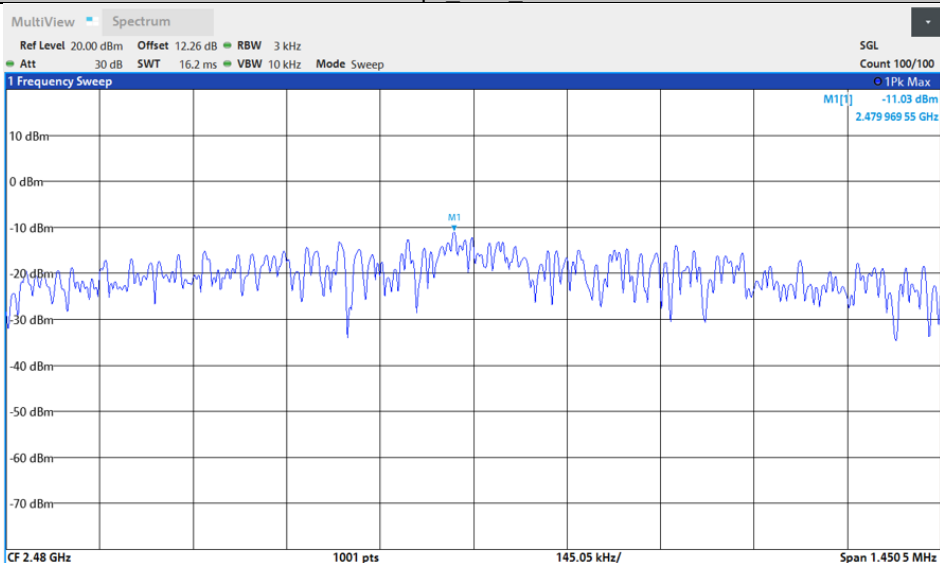
BLE 2Mbps_Ant1_2402MHz



BLE 2Mbps_Ant1_2440MHz



BLE 2Mbps_Ant1_2480MHz



10.5 Spurious RF conducted emissions

Test Method

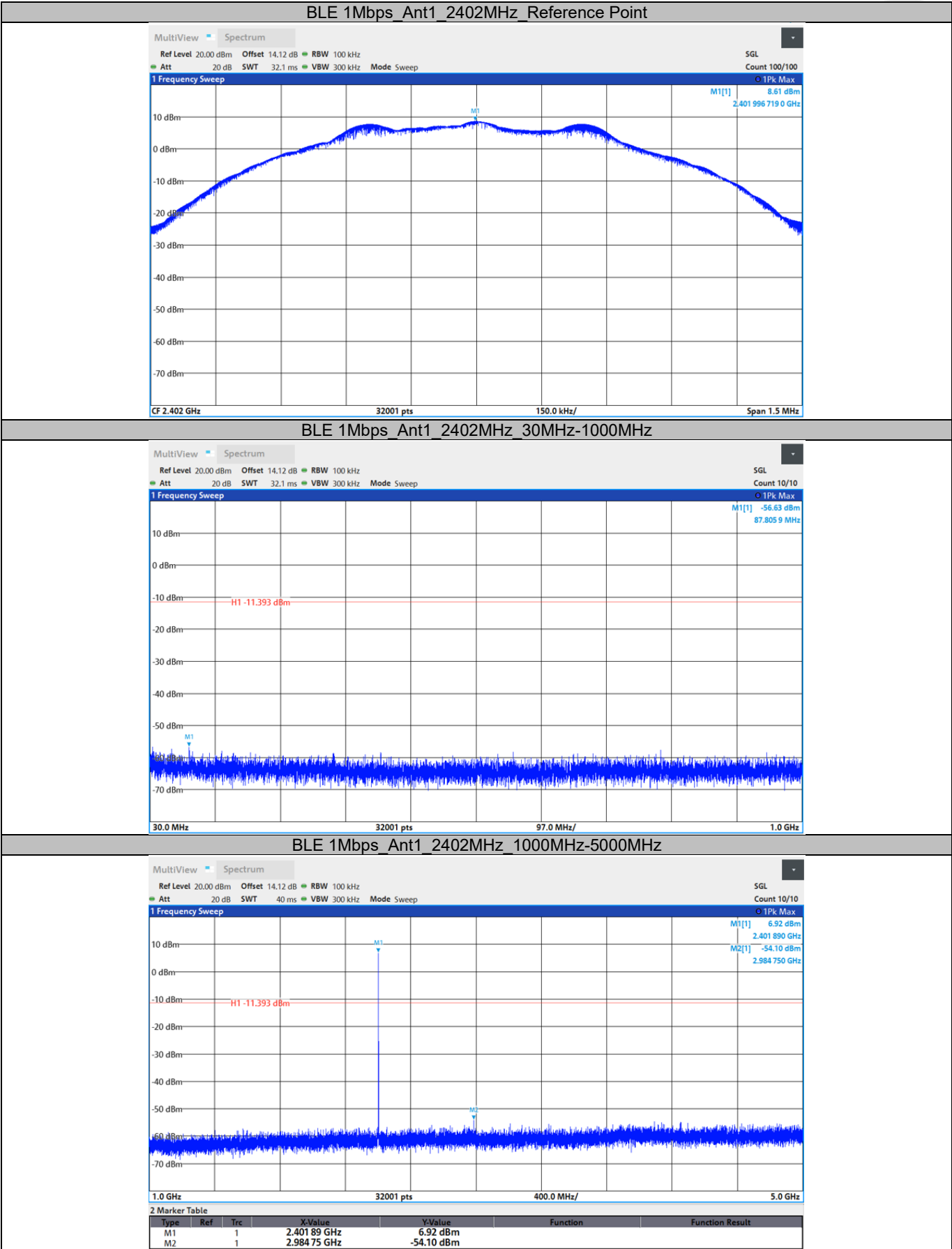
1. The RF output of EUT was connected to the spectrum analyzer by RF cable. The path loss was compensated to the results for each measurement.
2. Set to the maximum power setting, the instrument center frequency is set to the nominal EUT channel center frequency enable the EUT transmit continuously.
3. 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 $\geq$ 3RBW, Sweep = auto, Detector function = peak, Trace = max hold
4. Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded.
5. The level displayed must comply with the limit specified in this Section. Submit these plots.
6. Repeat above procedures until all frequencies measured were complete.

Limit

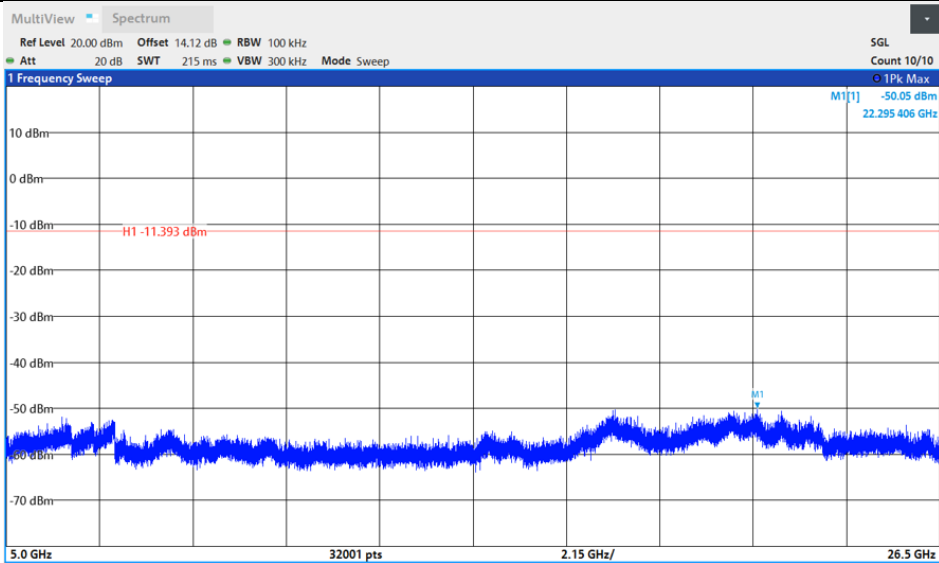
Frequency Range MHz	Limit (dBc)
30-25000	-20

Spurious RF conducted emissions

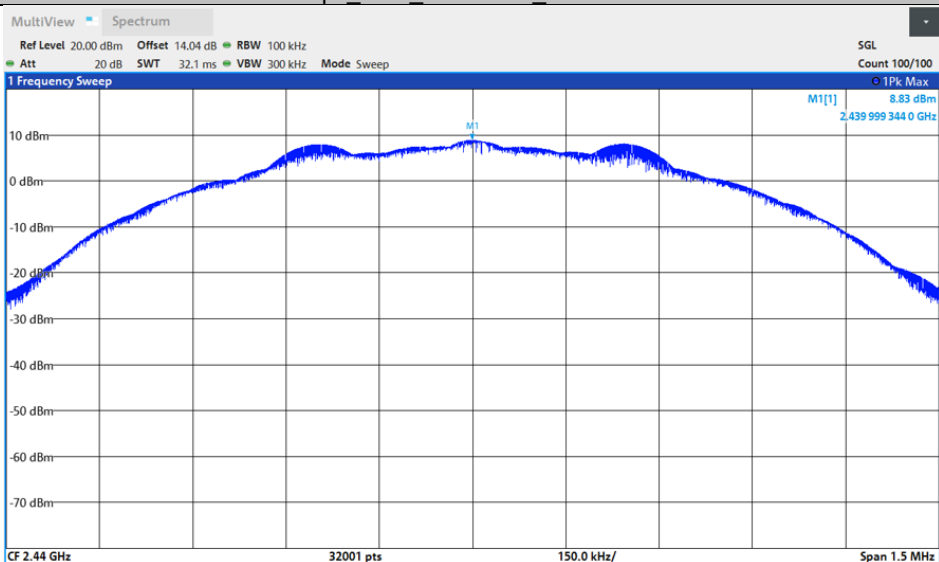
Test Mode	Test Frequency (MHz)	Freq. Range (MHz)	Result (dBm)	Limit (dBm)	Verdict
BLE_1Mbps	2402	Reference	8.61	---	PASS
		30~1000	-56.63	<=-11.39	PASS
		1000~26500	-50.05	<=-11.39	PASS
	2440	Reference	8.83	---	PASS
		30~1000	-56.58	<=-11.17	PASS
		1000~26500	-50.32	<=-11.17	PASS
	2480	Reference	8.81	---	PASS
		30~1000	-56.98	<=-11.19	PASS
		1000~26500	-50.04	<=-11.19	PASS
BLE_2Mbps	2402	Reference	8.56	---	PASS
		30~1000	-56.81	<=-11.44	PASS
		1000~26500	-49.11	<=-11.44	PASS
	2440	Reference	8.81	---	PASS
		30~1000	-56.60	<=-11.19	PASS
		1000~26500	-50.49	<=-11.19	PASS
	2480	Reference	8.83	---	PASS
		30~1000	-56.45	<=-11.17	PASS
		1000~26500	-49.99	<=-11.17	PASS



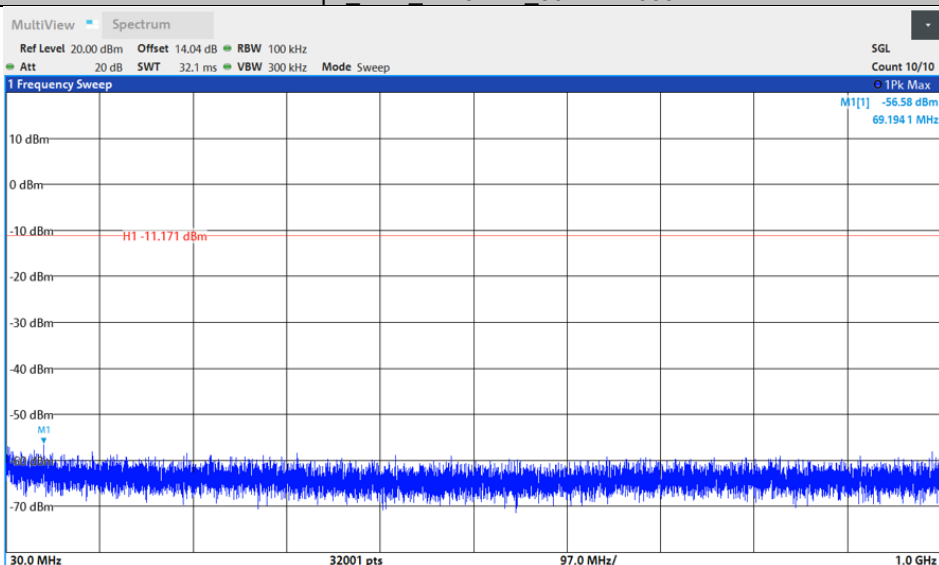
BLE 1Mbps_Ant1_2402MHz_5000MHz-26500MHz



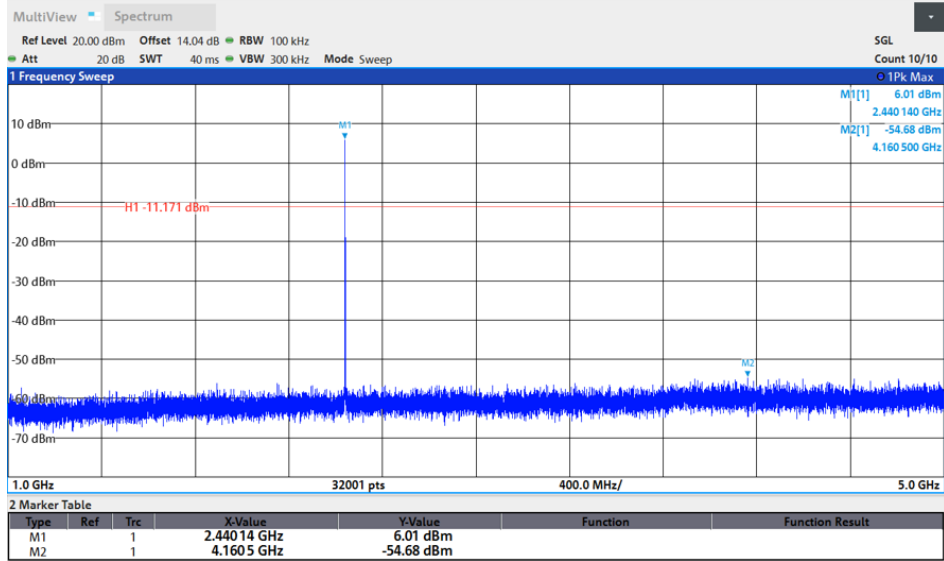
BLE 1Mbps_Ant1_2440MHz_Reference Point



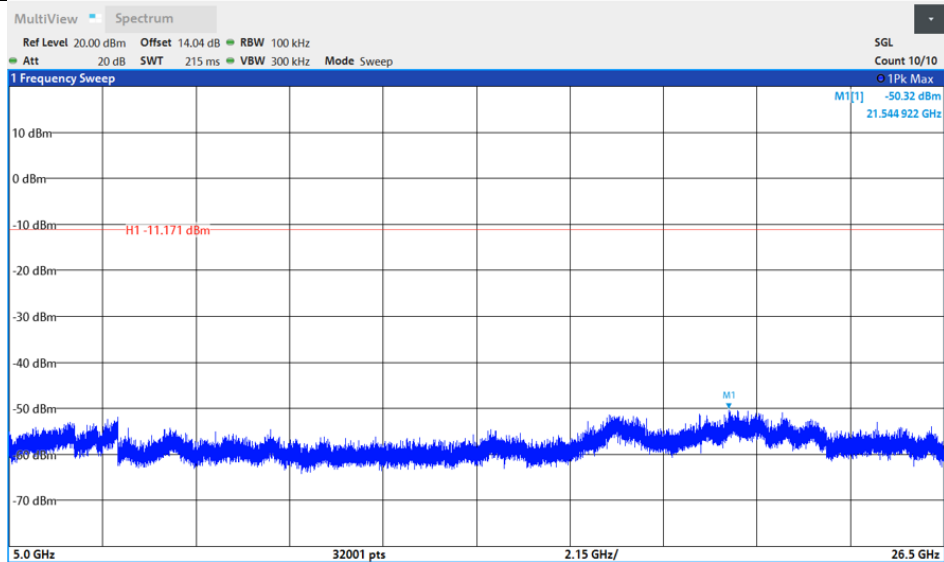
BLE 1Mbps_Ant1_2440MHz_30MHz-1000MHz



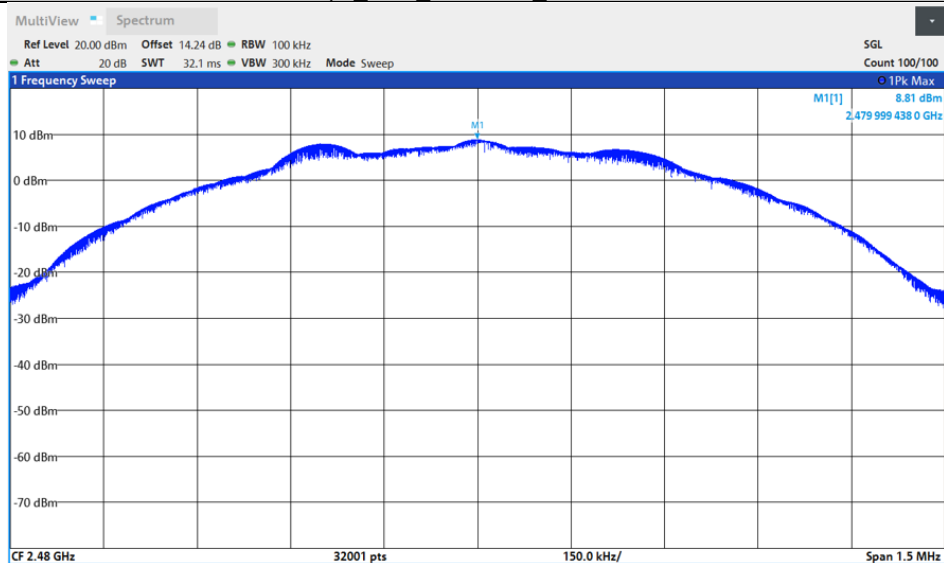
BLE 1Mbps_Ant1_2440MHz_1000MHz-5000MHz

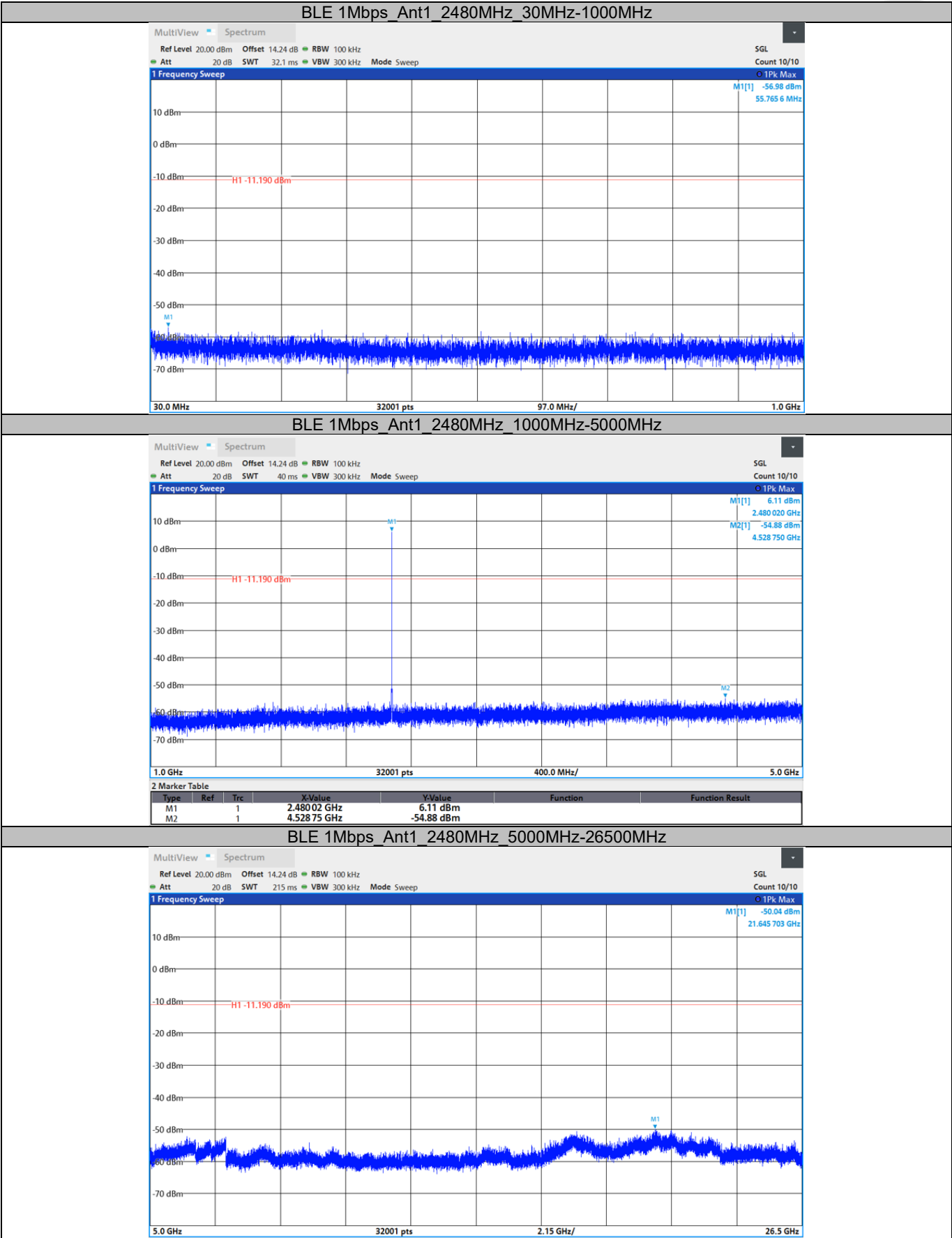


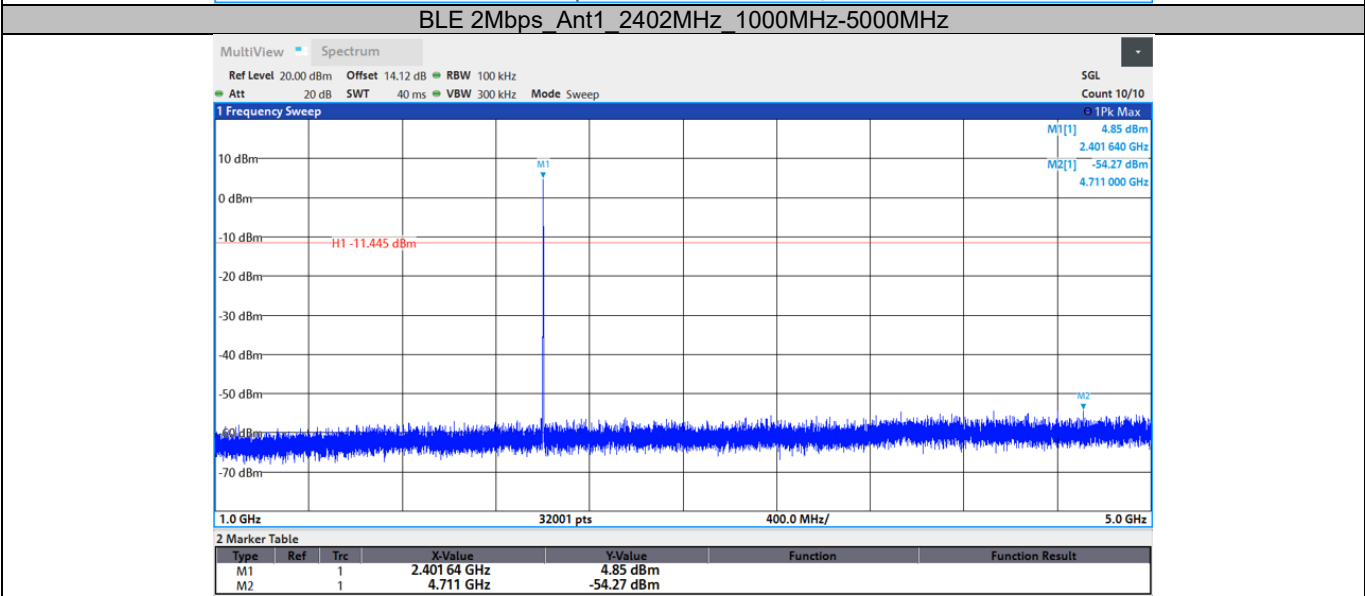
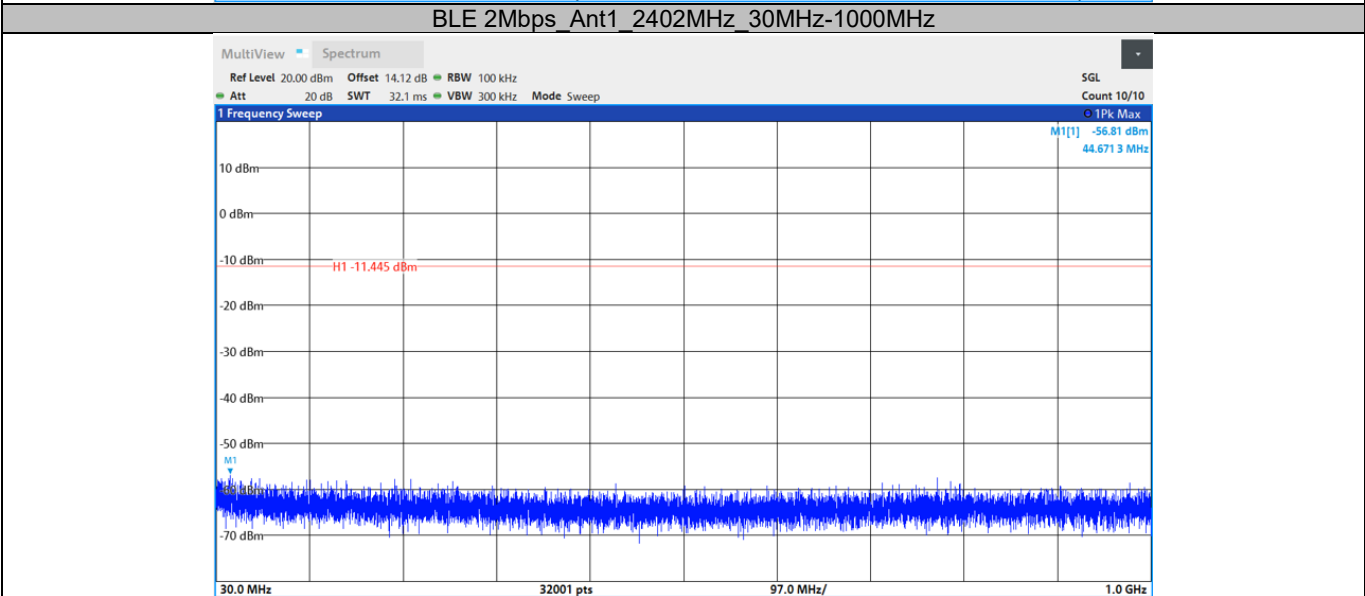
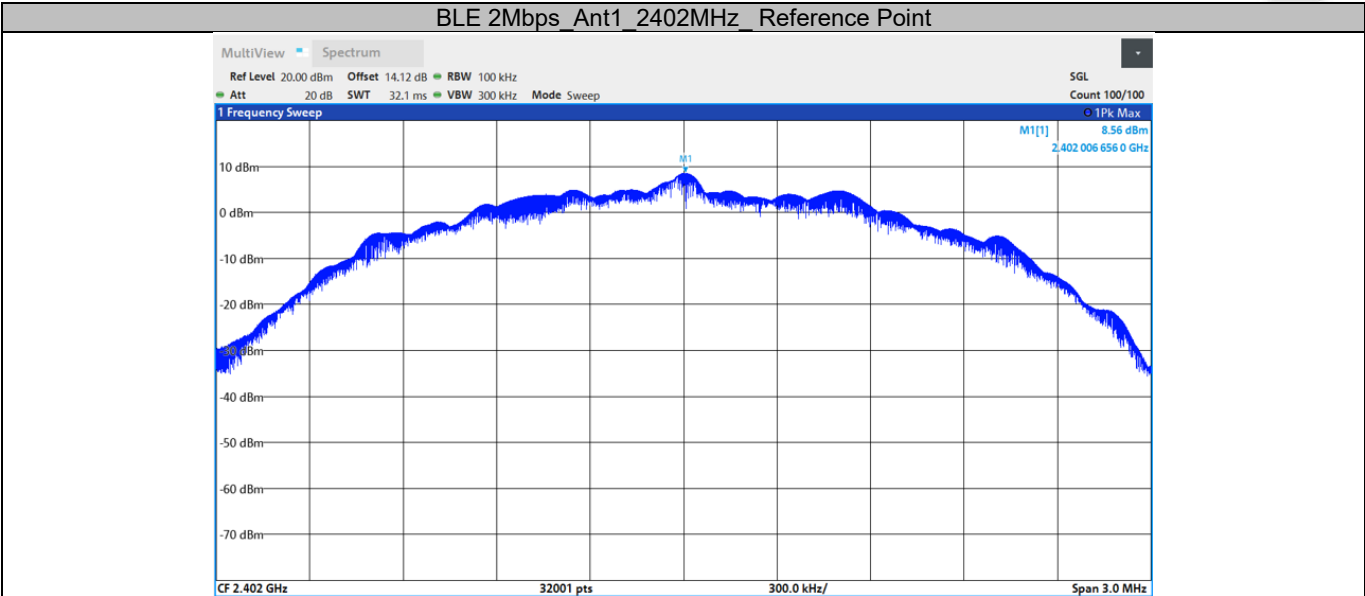
BLE 1Mbps_Ant1_2440MHz_5000MHz-26500MHz



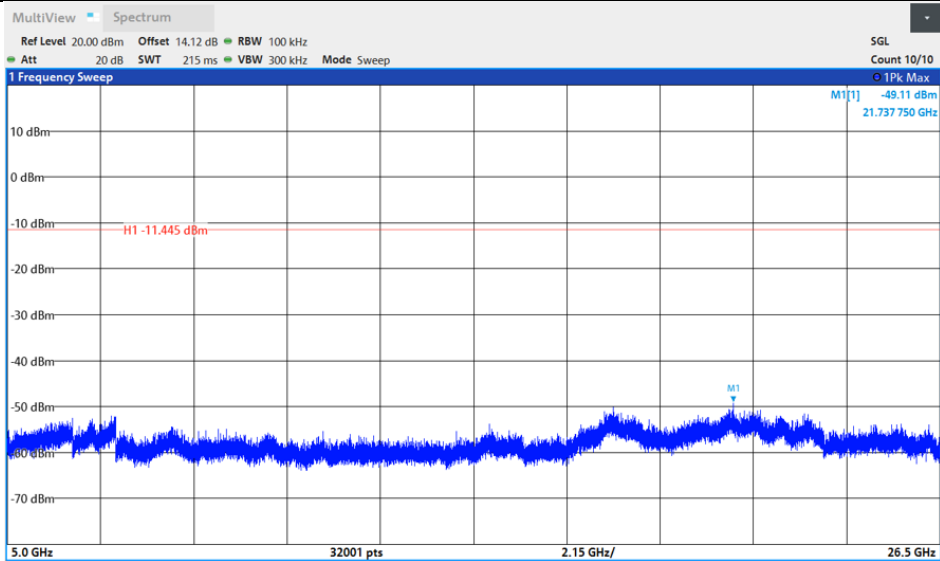
BLE 1Mbps_Ant1_2480MHz_Reference Point



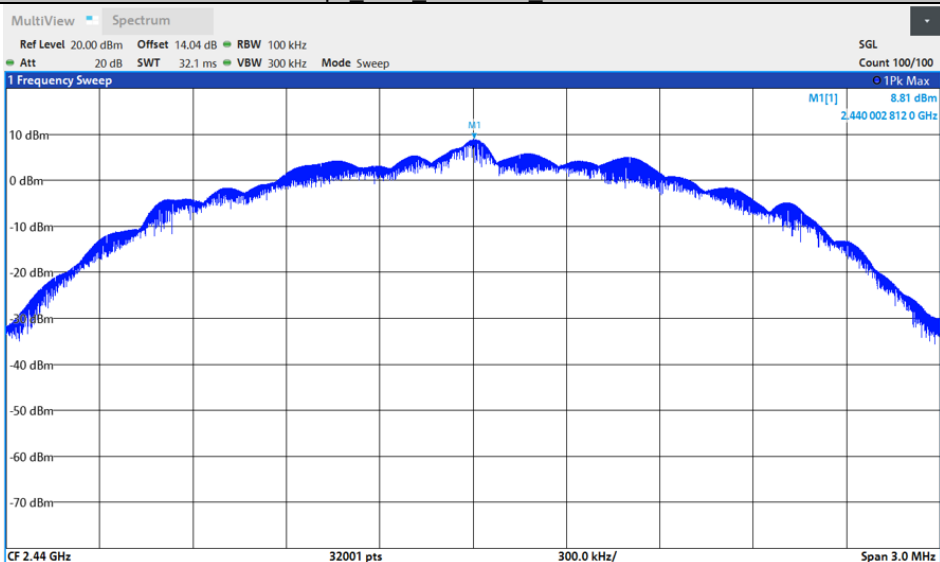




BLE 2Mbps_Ant1_2402MHz_5000MHz-26500MHz



BLE 2Mbps_Ant1_2440MHz_Reference Point



BLE 2Mbps_Ant1_2440MHz_30MHz-1000MHz

