TEST REPORT

REPORT NUMBER: I23W00008-BLE RF

ON

Type of Equipment:	Multimedia Control System
Type of Designation:	IN9.0-OS
Brand Name:	HAVAL NOBO
Manufacturer:	NOBO AUTOMOTIVE TECHNOLOGIES CO., LTD.
FCC ID:	2A7V5-IN90-OS-1

ACCORDING TO

FCC Part15

Chongqing Academy of Information and Communications Technology

Month date, year
Mar 23, 2023
Signature

Xiang Luoyong

Director

Note:

The test results in this test report relate only to the devices specified in this report. This report shall not be reproduced except in full without the written approval of Chongqing Academy of Information and Communications Technology.

Revision Version

Report Number	Revision	Date	Memo
I23W00008-BLE RF	00	2023-03-23	Initial creation of test report

CONTENTS

1. Test Laboratory

1.1. Testing Location

Name:	Chongqing Academy of Information and Communications Technology
FCC/IC Registration Number:	CN1239
Address:	Building C, Technology Innovation Center, No.8, Yuma Road, Chayuan New Area, Nan'an District, Chongqing, People's Republic of China
Postal Code:	401336
Telephone:	0086-23-88069965
Fax:	0086-23-88608777

1.2. Testing Environment

Normal Temperature:	15-35℃
Relative Humidity:	25-75%

1.3. Project data

Testing Start Date:	2023-01-05
Testing End Date:	2023-03-01

1.4. Signature

	2023-03-23
Dong Junxin **(Prepared this test report)**	**Date**
	2023-03-23
Li Xu **(Reviewed this test report)**	**Date**
	2023-03-23
Xiang Luoyong **Director of the laboratory** **(Approved this test report)**	**Date**

2. Client Information

2.1. Applicant Information

Company Name:	NOBO AUTOMOTIVE TECHNOLOGIES CO., LTD.
Address /Post:	No. 668, Caihong Road, Zhangjiagang Economic and Technological Development Zone, Suzhou , Jiangsu, P.R. China
City:	Jiangsu
Country:	China
Telephone:	0512-80616208
Fax:	N/A
Email:	douwenjuan@noboauto.com
Contact Person:	Wenjuan Dou

2.2. Manufacturer Information

Company Name:	NOBO AUTOMOTIVE TECHNOLOGIES CO., LTD.
Address /Post:	No. 668, Caihong Road, Zhangjiagang Economic and Technological Development Zone, Suzhou , Jiangsu, P.R. China
City:	Jiangsu
Country:	China
Telephone:	0512-80616208
Fax:	N/A
Email:	douwenjuan@noboauto.com
Contact Person:	Wenjuan Dou

3. Equipment under Test (EUT) and Ancillary Equipment (AE)

3.1. About EUT

EUT Description	Multimedia Control System
Model name	IN9.0-OS
Brand name	长城汽车 Great Wall Motors HAVAL NOBO
GSM Frequency Band	--
WCDMA Frequency Band	--
LTE Frequency Band	--
BLUETOOTH Frequency	2402MHz-2480MHz
WLAN Frequency	Wi-Fi 2.4G:802.11b/g/n, Wi-Fi 5G U-NII-1/Wi-Fi 5G U-NII-3:802.11a/n/ac
Type of BLE modulation	GFSK;
Extreme Temperature	-40-85°C
Nominal Voltage	12V
Extreme High Voltage	18V
Extreme Low Voltage	7V

Note: Photographs of EUT are shown in ANNEX A of this test report.
Note: High and low voltage values in extreme condition test are given by manufacturer.

3.2. Internal Identification of EUT used during the test

EUT ID*	SN or IMEI	HW Version	SW Version	Date of receipt
S1	NA	AA	AA	2023-03-14
S2	NA	AA	AA	2023-03-14

*EUT ID: is used to identify the test sample in the lab internally.

Technology	Band	UL Freq.(MHz)	DL Freq.(MHz)	Note
BLE	CH0-39	2402-2480		--

3.3. Outline of Equipment under Test

3.4. Internal Identification of AE used during the test

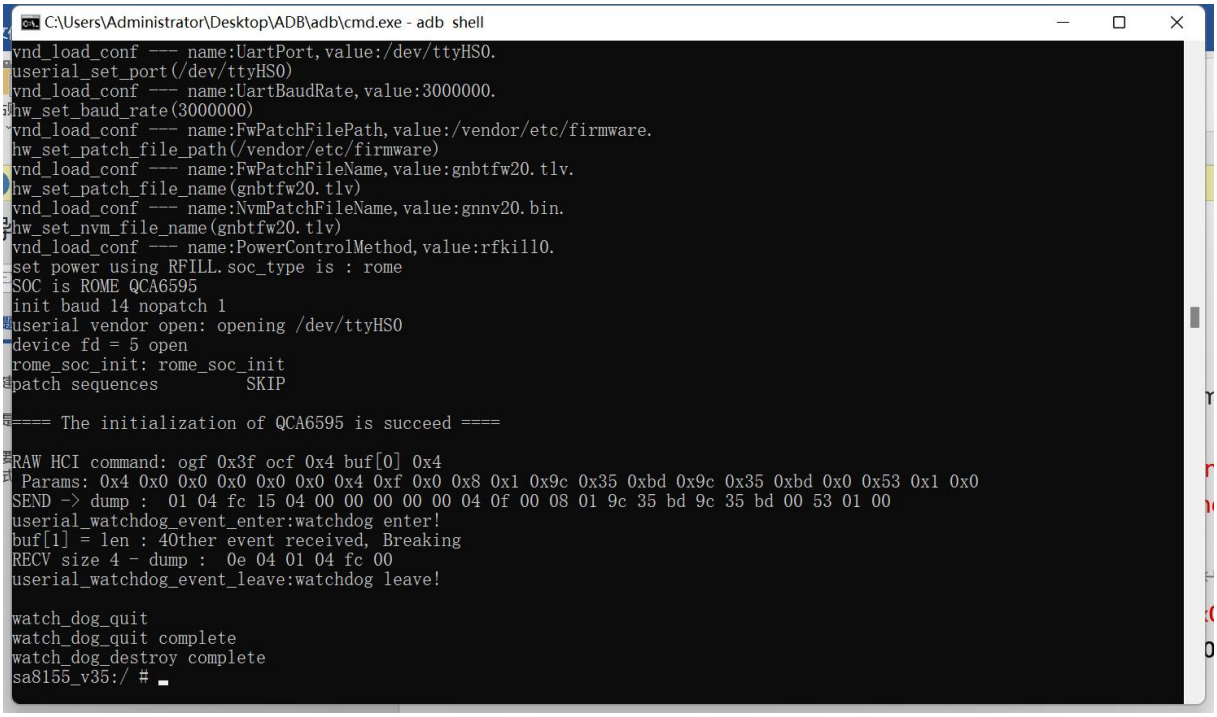
AE ID*	Description	dB*
AE1	RF cable	0.5dB

*AE ID: is used to identify the test sample in the lab internally.

dB*：is provided customer.

3.5. EUT Test RF Confagle Configuration

EUT uses adb tool to control emission measurement, Change power level, channel, rate and HT .



4. Reference Documents

4.1. Documents supplied by applicant

PICS/PIXIT, referring to Annex B for detailed information, is supplied by the client or manufacturer, which is the basis of testing.

4.2. Reference Documents for testing

The following documents listed in this section are referred for testing.

Reference	Title	Version
FCC Part15	FCC CFR 47, Part 15, Subpart C: 15.205 Restricted bands of operation; 15.209 Radiated emission limits, general requirements; 15.247 Operation within the bands 902-928MHz, 2400-2483.5MHz, and 5725-5850MHz	2020
ANSI C63.10	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices	2013
KDB 558074	Guidance for Performing Compliance Measurements on Frequency Hopping Spread Spectrum systems (DSS) Operating Under §15.247	2019

5. Test Equipments Utilized

5.1. RF Test System

No.	Equipment	Model	SN	HW Version	SW Version	Manufacture	Cal.Due Date
1	Spectrum analyzer	FSQ 26	201137/026	--	--	R&S	2023-06-29
2	Spectrum analyzer	FSW26	104280	--	--	R&S	2023-06-29
3	DC Power Supply	3303D	801128	--	--	Topward	2023-06-29
4	Universal Radio Communication Tester	CMW500	152395	--	--	R&S	2023-06-29

5.2. RSE Test System

No.	Equipment	Model	SN	HW Version	SW Version	Manufacture	Cal.Due Date
1	EMI Test Receiver	ESU40	100307	--	--	R&S	2023-06-29
2	TRILOG Broadband Antenna	VULB9163	9163-586	--	--	Schwarzbeck	2024-10-28
3	Horn antenna	9120D	1083	--	--	Schwarzbeck	2024-12-14
4	Amplifier1	SCU-08F1	8320027	--	--	R&S	2023-06-29
5	Amplifier2	SCU-18F	180093	--	--	R&S	2023-06-29

5.3. Climate Chamber

No.	Name	Type	SN	Manufacture	Cal.Due Date
1	Climate chamber	SH-241	92010759	ESPEC	2023-06-29

5.4. Anechoic chamber Vibration table

No.	Name	Type	SN	Manufacture	Cal.Due Date
1	Fully-Anechoic Chamber	FAC5	--	TDK	2024-09-22

5.5. Test software

No.	Name	version	SN	Manufacture
1	EMI Test Software	EMC32 V9.26.01	--	R&S

6. Test Results

6.1. Summary of Test Results

FCC Rules	Name of Test	Result
15.247(b)	Maximum Peak Output Power	Pass
15.247(e)	Peak Power Spectral Density	Pass
15.247(a)	6dB Occupied Bandwidth	Pass
15.247(a)	99% Occupied Bandwidth	Pass
15.247(d)	Band Edges Compliance	Pass
15.247(d)	Transmitter Spurious Emission-Conducted	Pass
15.247/15.205/15.209	Transmitter Spurious Emission-Radiated	Pass
15.207	AC Powerline Conducted Emission	N/A
Note: The IN9.0-OS, manufactured by NOBO AUTOMOTIVE TECHNOLOGIES CO., LTD. is a new product for testing.		

6.2. Peak Output Power-Conducted

Specifications:	FCC 47 Part 15.247(b)
DUT Serial Number:	S1
Test conditions:	Ambient Temperature:15℃-35℃ Relative Humidity:30%-60% Air pressure: 86-106kPa
Test Results:	Pass

Limit Level Construction:

Standard	Limit
FCC 47 Part 15.247,15.205,15.209	<30

Measurement Uncertainty:

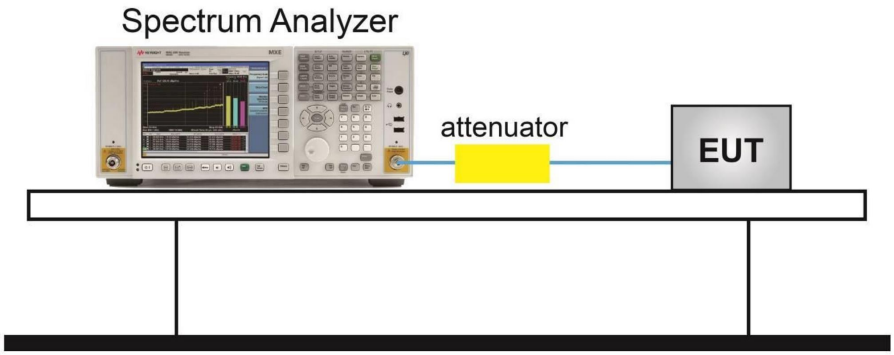
Measurement Uncertainty	±0.46dB

Test Procedure

The measurement is according to ANSI C63.10 clause 11.9.1

1. Set the RBW ≥ DTS bandwidth.
2. Set VBW ≥ [3 × RBW].
3. Set span ≥ [3 × RBW].
4. Sweep time = auto couple.
5. Detector = peak.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.
8. Use peak marker function to determine the peak amplitude level.

Test setup



Antenna gain of EUT

No.	Item(s)	Data
1	Antenna gain of EUT	2.34 dBi
Note: The data is provided by the customer may affect the validity of the test results in this report, and the impact and consequences of this shall be undertaken by the customer.		

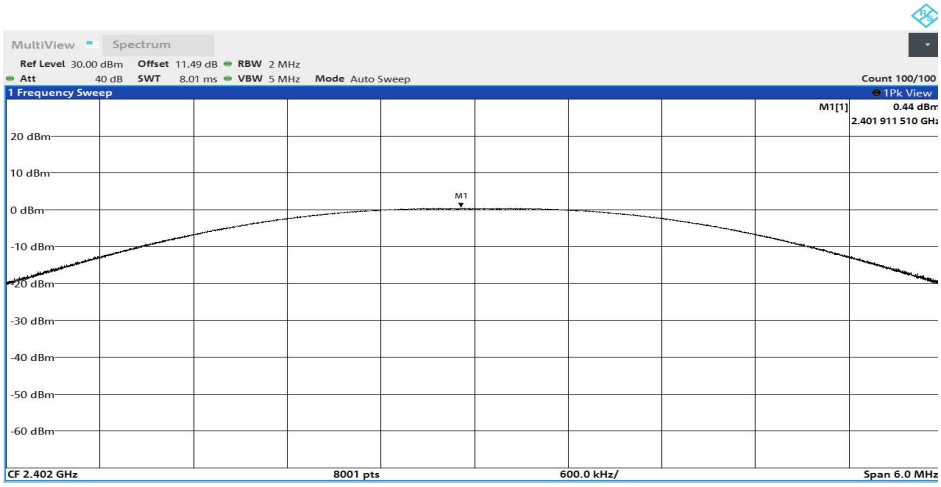
Test Result Peak

TestMode	Antenna	Frequency [MHz]	Conducted Peak Power[dBm]	Conducted Limit[dBm]	EIRP[dBm]	EIRP Limit[dBm]	Verdict
BLE_125K	Ant1	2402	0.44	≤30	2.78	≤36	PASS
BLE_125K	Ant1	2440	0.66	≤30	3	≤36	PASS
BLE_125K	Ant1	2480	1.43	≤30	3.77	≤36	PASS

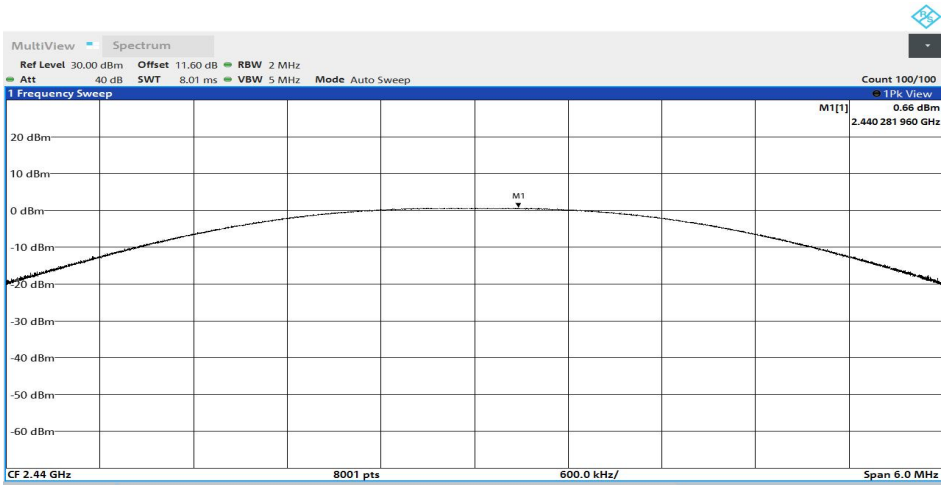
BLE_1M	Ant1	2402	0.83	≤30	3.17	≤36	PASS
BLE_1M	Ant1	2440	0.95	≤30	3.29	≤36	PASS
BLE_1M	Ant1	2480	1.7	≤30	4.04	≤36	PASS
BLE_2M	Ant1	2402	0.5	≤30	2.84	≤36	PASS
BLE_2M	Ant1	2440	0.75	≤30	3.09	≤36	PASS
BLE_2M	Ant1	2480	1.63	≤30	3.97	≤36	PASS
BLE_500K	Ant1	2402	0.31	≤30	2.65	≤36	PASS
BLE_500K	Ant1	2440	0.58	≤30	2.92	≤36	PASS
BLE_500K	Ant1	2480	1.31	≤30	3.65	≤36	PASS

Test graphs as below

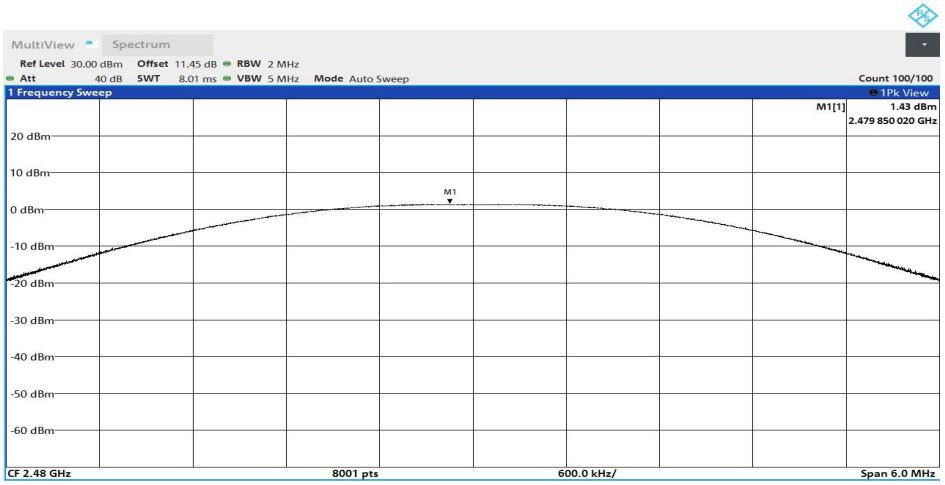
BLE_125K-Ant1-2402



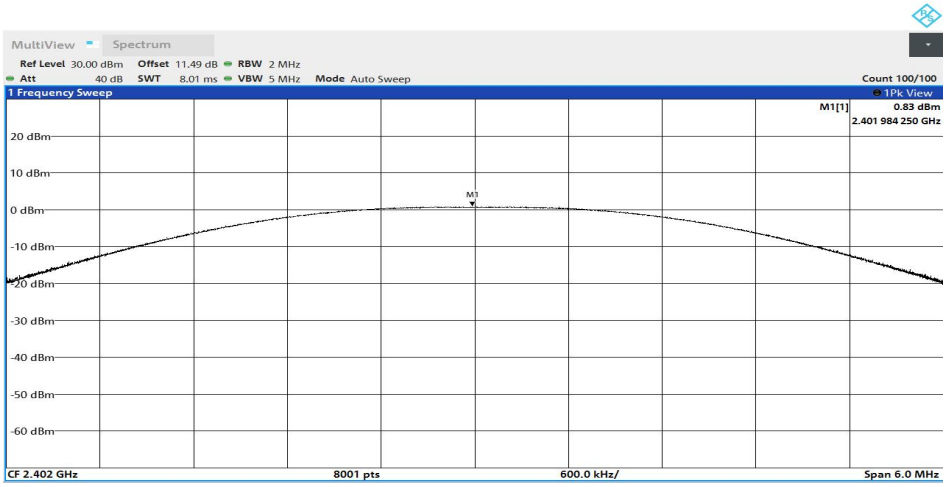
BLE_125K-Ant1-2440



BLE_125K-Ant1-2480



BLE_1M-Ant1-2402



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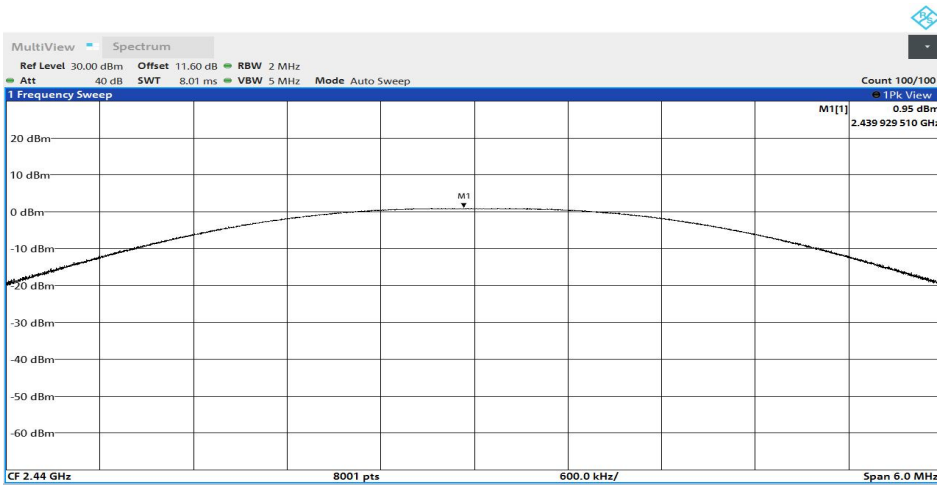

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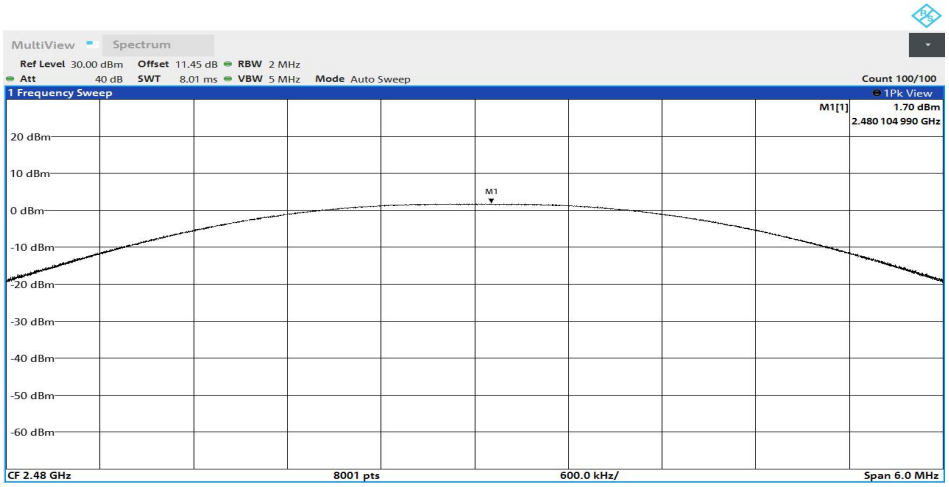

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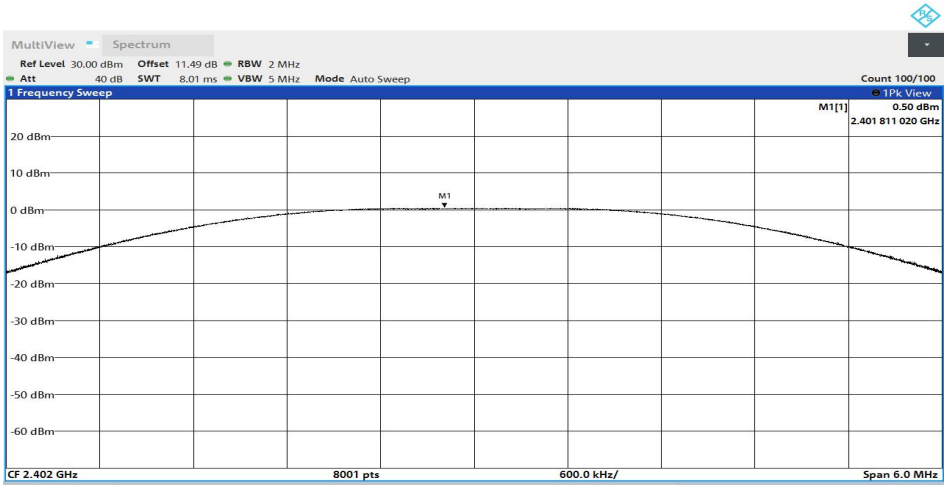

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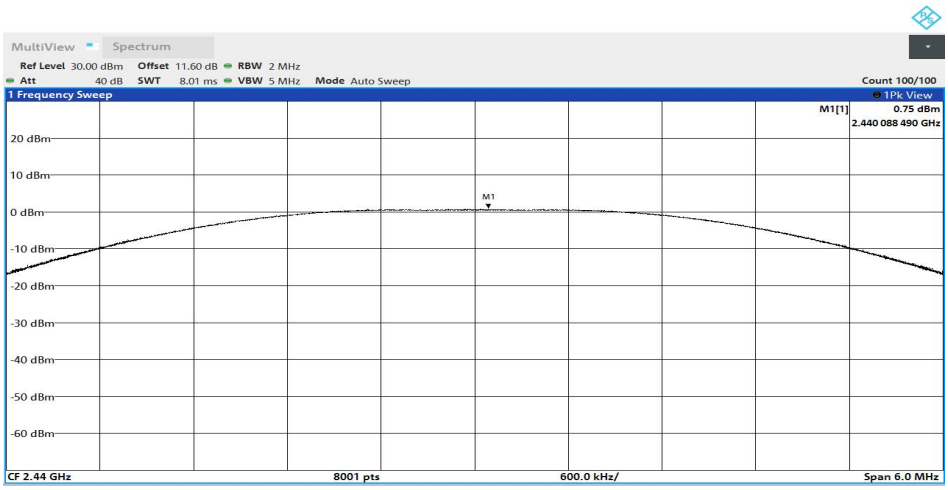

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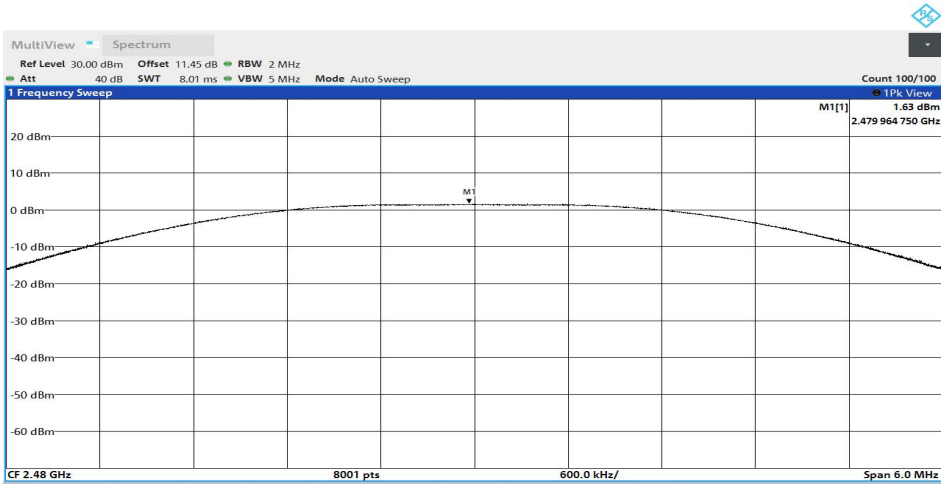
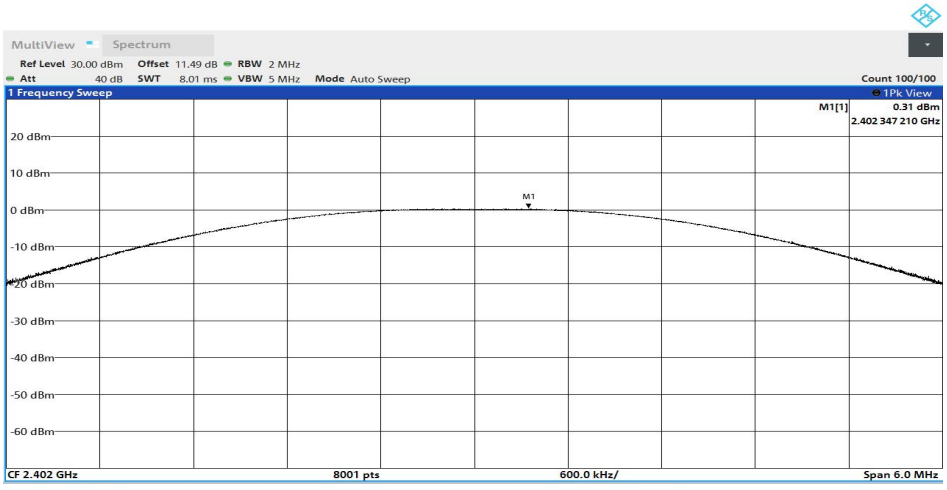
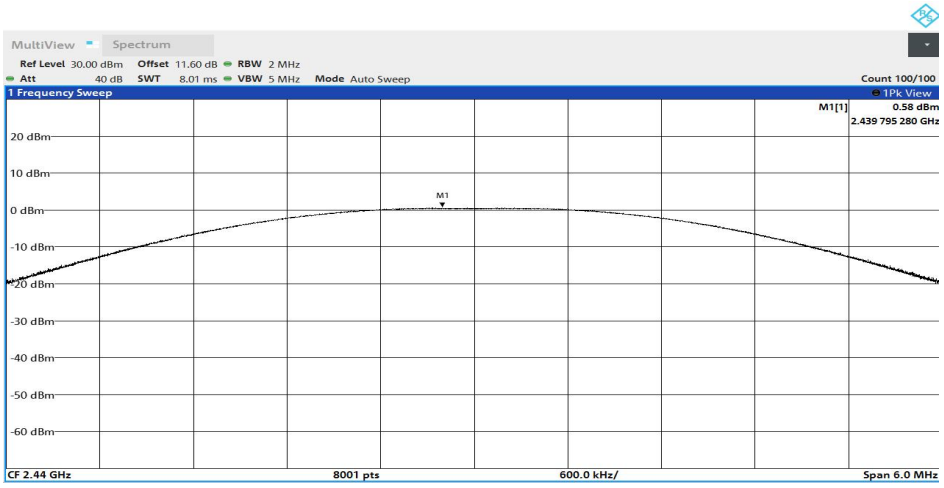


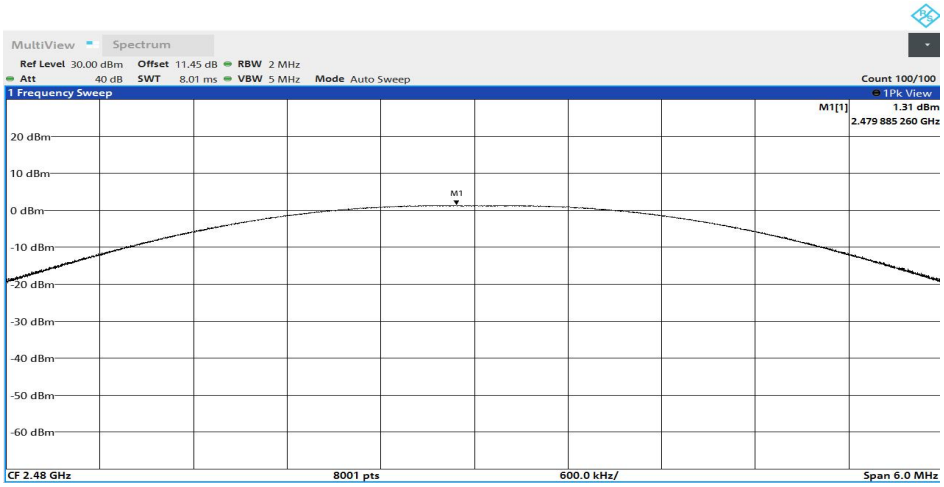
BLE_500K-Ant1-2402



BLE_500K-Ant1-2440



BLE_500K-Ant1-2480



6.3. 99% Occupied Bandwidth

Specifications:	15.247(a)
DUT Serial Number:	S1
Test conditions:	Ambient Temperature:15℃-35℃ Relative Humidity:30%-60% Air pressure: 86-106kPa
Test Results:	Pass

Limit Level Construction:

Standard	Limit
15.247(a)	N/A

Measurement Uncertainty:

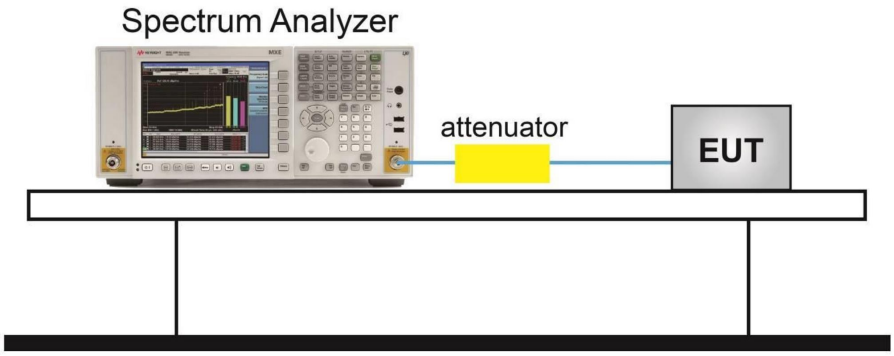
Measurement Uncertainty	±0.72KHz

Test procedures

The measurement is according to ANSI C63.10 clause 6.9.3.

1. The output power of EUT was connected to the spectrum analyzer. The path loss was compensated to the results for each measurement.
2. Enable EUT transmitter maximum power continuously.
3. Set RBW shall be in the range of 1% to 5% of the OBW.
4. Set the VBW ≥ [3 × RBW].
5. Detector = peak.
6. Trace mode = max hold.
7. Sweep = auto couple.
8. Allow the trace to stabilize.
9. The occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5% of the total mean power of the given emission.

Test setup

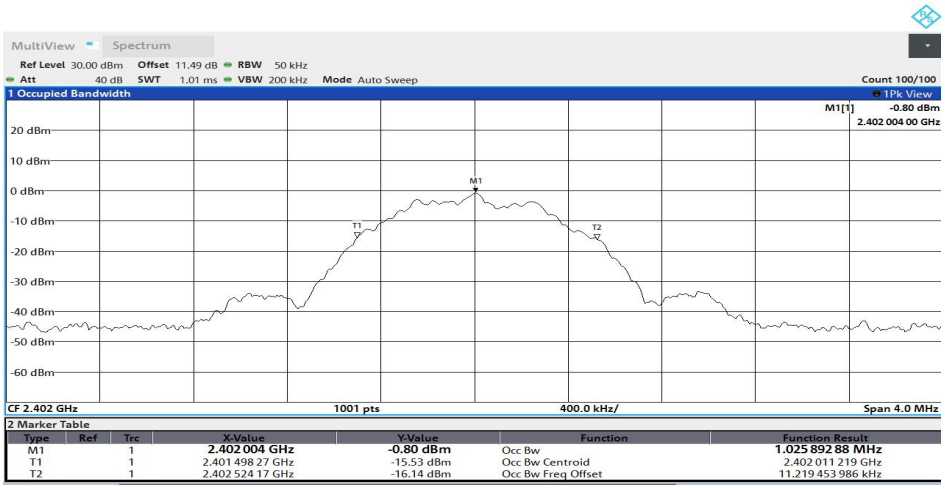


Measurement Result

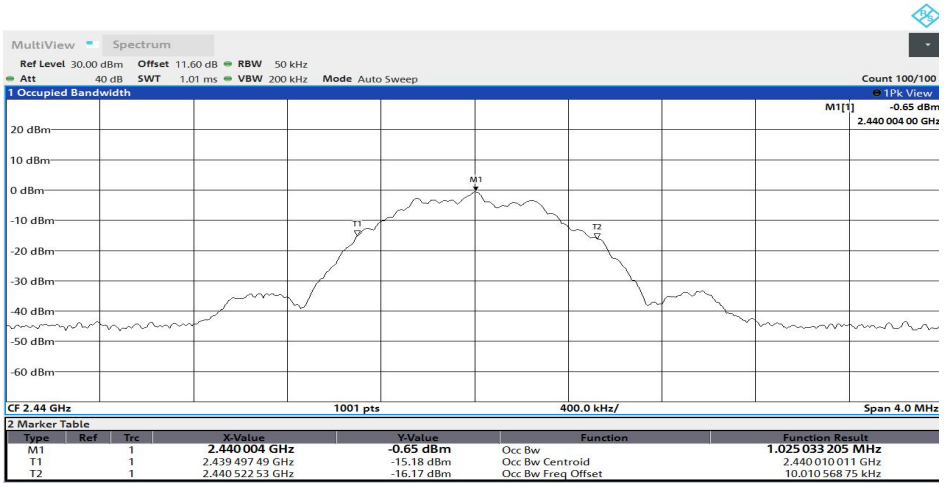
TestMode	Antenna	Frequency[MHz]	OCB [MHz]	FL[MHz]	FH[MHz]
BLE_1M	Ant1	2402	1.026	2401.4983	2402.5242
BLE_1M	Ant1	2440	1.025	2439.4975	2440.5225
BLE_1M	Ant1	2480	1.025	2479.4973	2480.5220
BLE_2M	Ant1	2402	2.016	2401.0101	2403.0259
BLE_2M	Ant1	2440	2.015	2439.0099	2441.0254
BLE_2M	Ant1	2480	2.015	2479.0096	2481.0242
BLE_125K	Ant1	2402	1.024	2401.4907	2402.5144
BLE_125K	Ant1	2440	1.024	2439.4907	2440.5146
BLE_125K	Ant1	2480	1.022	2479.4915	2480.5138
BLE_500K	Ant1	2402	1.047	2401.4748	2402.5221
BLE_500K	Ant1	2440	1.045	2439.4755	2440.5209
BLE_500K	Ant1	2480	1.047	2479.4750	2480.5215

Test graphs as below

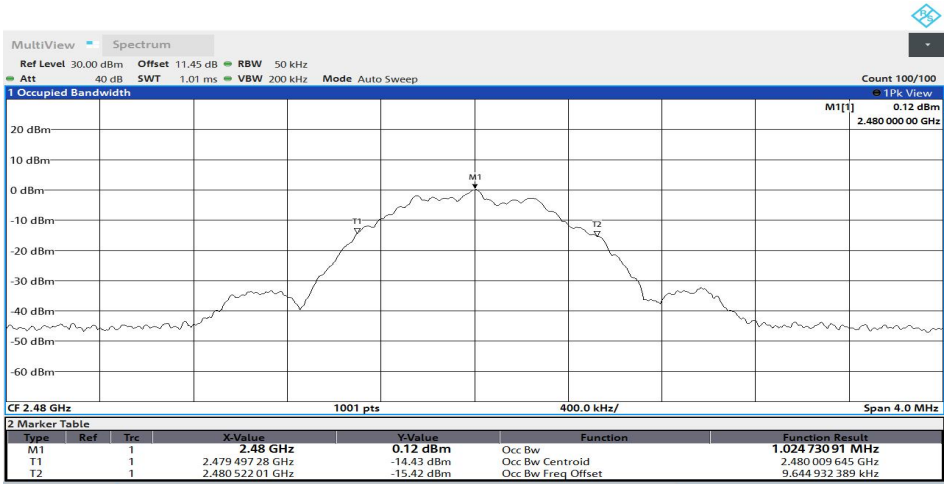
BLE_1M-Ant1-2402



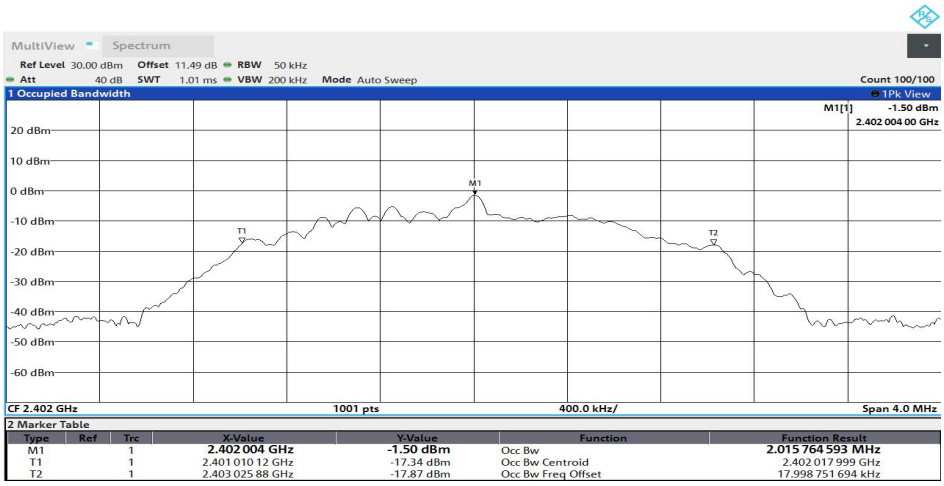
BLE_1M-Ant1-2440



BLE_1M-Ant1-2480



BLE_2M-Ant1-2402



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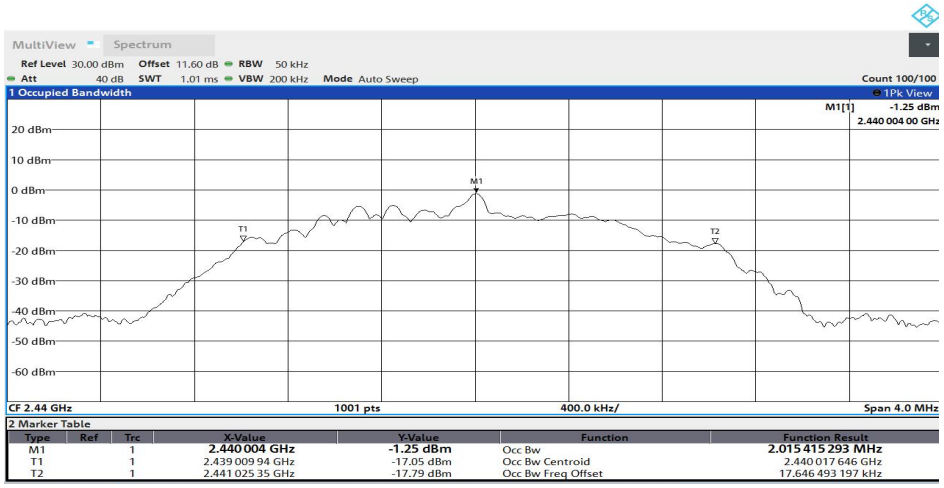

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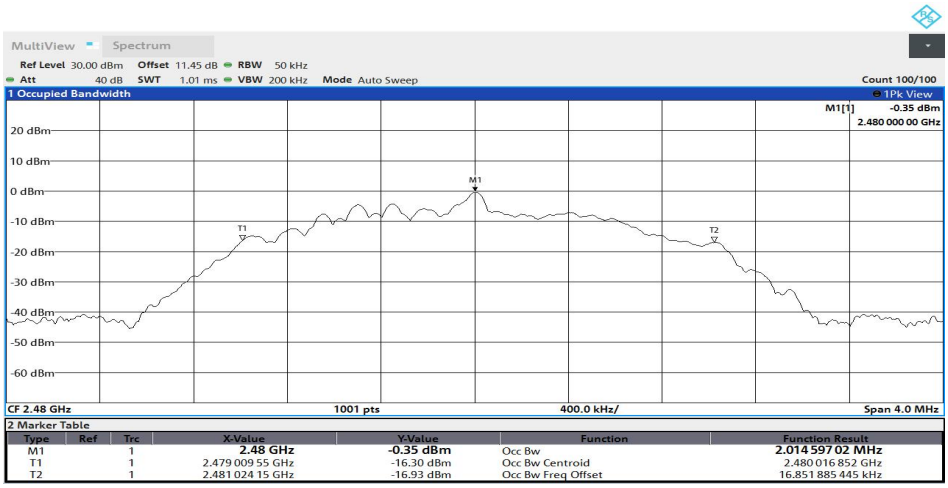
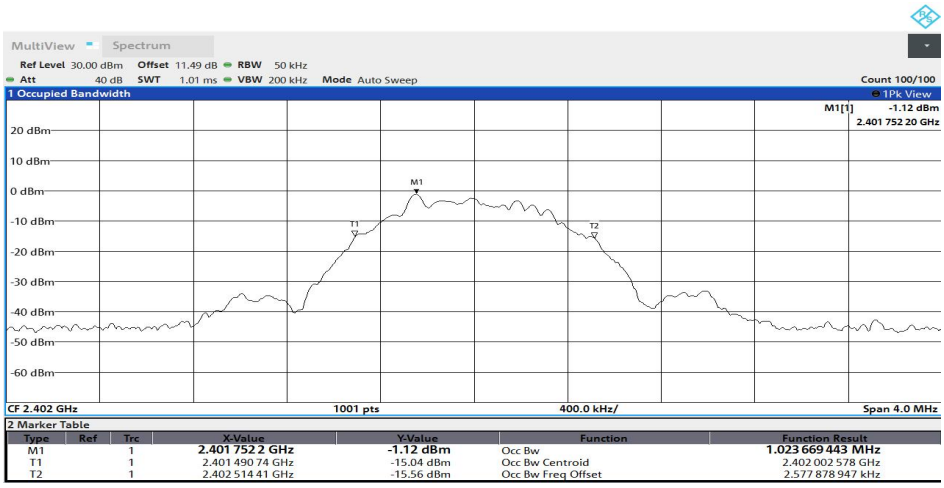
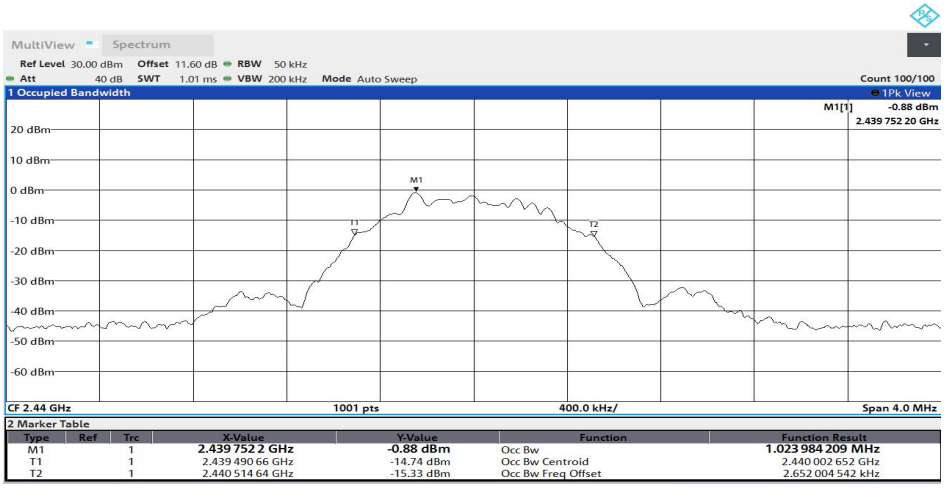


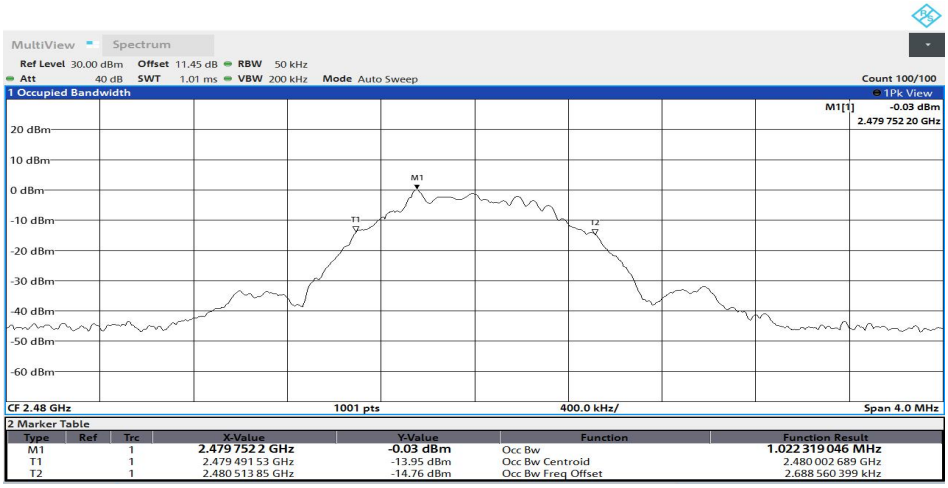
BLE_125K-Ant1-2402



BLE_125K-Ant1-2440



BLE_125K-Ant1-2480



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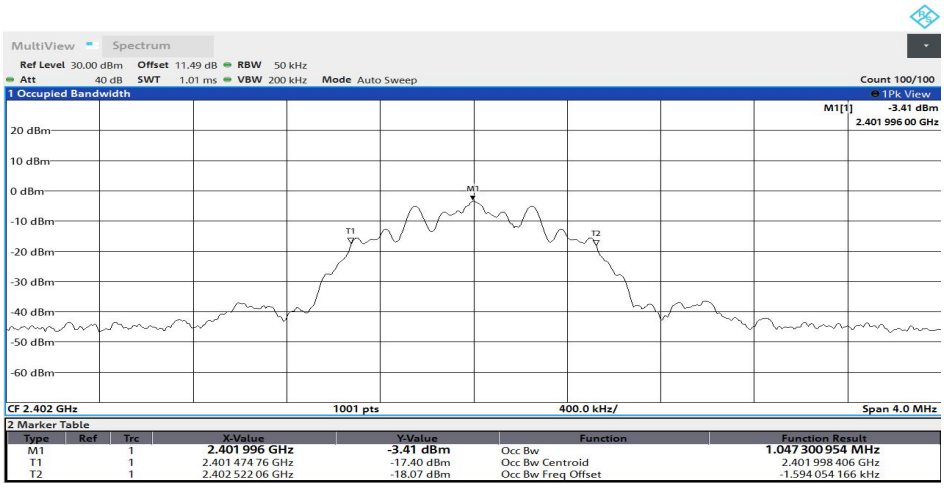
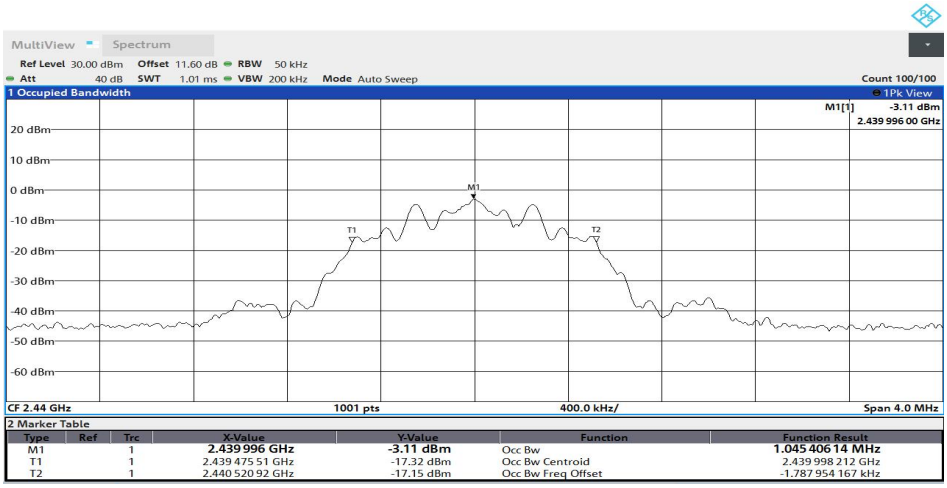
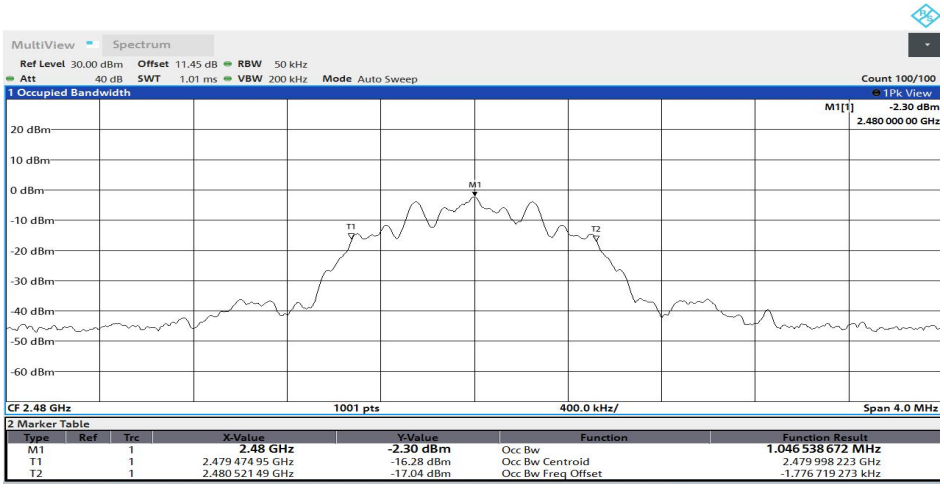


BLE_500K-Ant1-2440



BLE_500K-Ant1-2480



6.4. Peak Power Spectral Density

Specifications:	FCC 47 Part 15.247(e)
DUT Serial Number:	S1
Test conditions:	Ambient Temperature:15℃-35℃ Relative Humidity:30%-60% Air pressure: 86-106kPa
Test Results:	Pass

Limit Level Construction:

Standard	Limit
FCC 47 Part 15.247(e)	≤ 8dBm/3 kHz

Measurement Uncertainty:

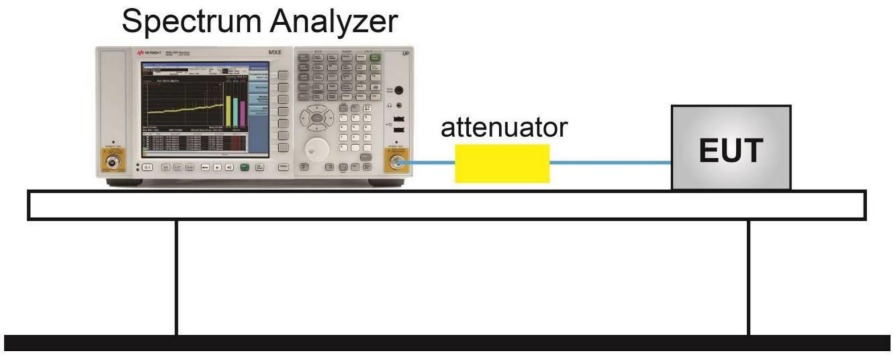
Measurement Uncertainty	±0.56dB

Test procedures

The measurement is according to ANSI C63.10 clause 11.10.

1. The output power of EUT was connected to the spectrum analyzer. The path loss was compensated to the results for each measurement.
2. Enable EUT transmitter maximum power continuously.
3. Set analyzer center frequency to DTS channel center frequency.
4. Set the span to 1.5 times the DTS bandwidth.
5. Set the RBW to 3 kHz ≤ RBW ≤ 100 kHz.
6. Set the VBW ≥ [3 × RBW].
7. Detector = peak.
8. Sweep time = auto couple.
9. Trace mode = max hold.
10. Allow trace to fully stabilize.
11. Use the peak marker function to determine the maximum amplitude level within the RBW.
12. If measured value exceeds requirement, then reduce RBW (but no less than 3 kHz) and repeat.

Test Setup

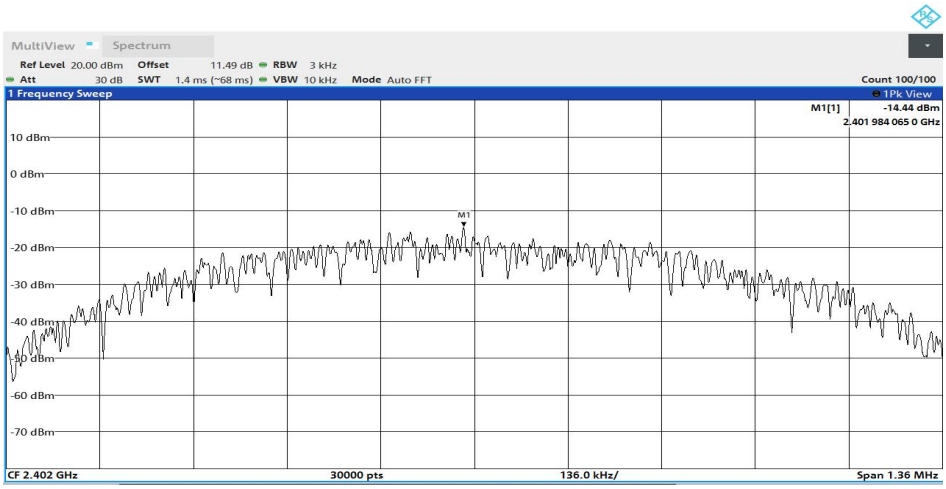


Measurement Results

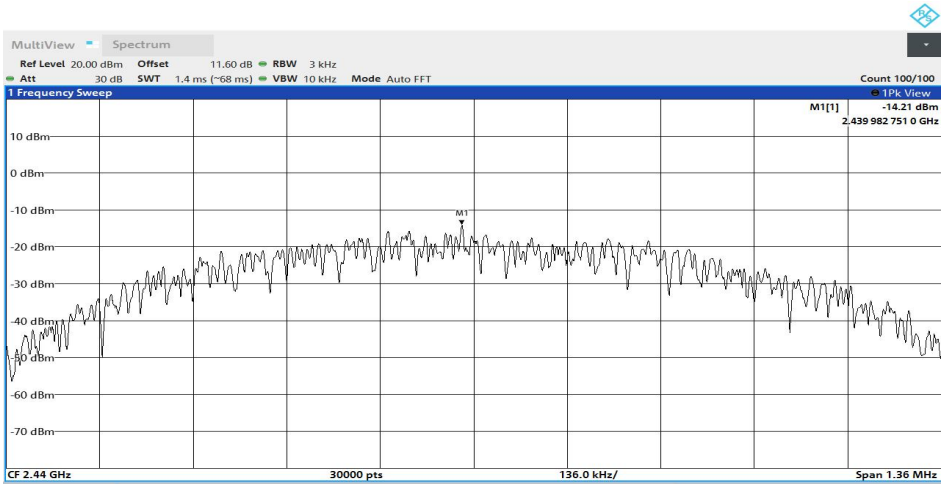
TestMode	Antenna	Frequency[MHz]	Result[dBm/3kHz]	Limit[dBm/3kHz]	Verdict
BLE_1M	Ant1	2402	-14.44	≤8.00	PASS
BLE_1M	Ant1	2440	-14.21	≤8.00	PASS
BLE_1M	Ant1	2480	-13.48	≤8.00	PASS
BLE_2M	Ant1	2402	-17.71	≤8.00	PASS
BLE_2M	Ant1	2440	-17.48	≤8.00	PASS
BLE_2M	Ant1	2480	-16.58	≤8.00	PASS
BLE_125K	Ant1	2402	-7.44	≤8.00	PASS
BLE_125K	Ant1	2440	-6.19	≤8.00	PASS
BLE_125K	Ant1	2480	-7.15	≤8.00	PASS
BLE_500K	Ant1	2402	-6.31	≤8.00	PASS
BLE_500K	Ant1	2440	-6.05	≤8.00	PASS
BLE_500K	Ant1	2480	-5.2	≤8.00	PASS

Test graphs as below

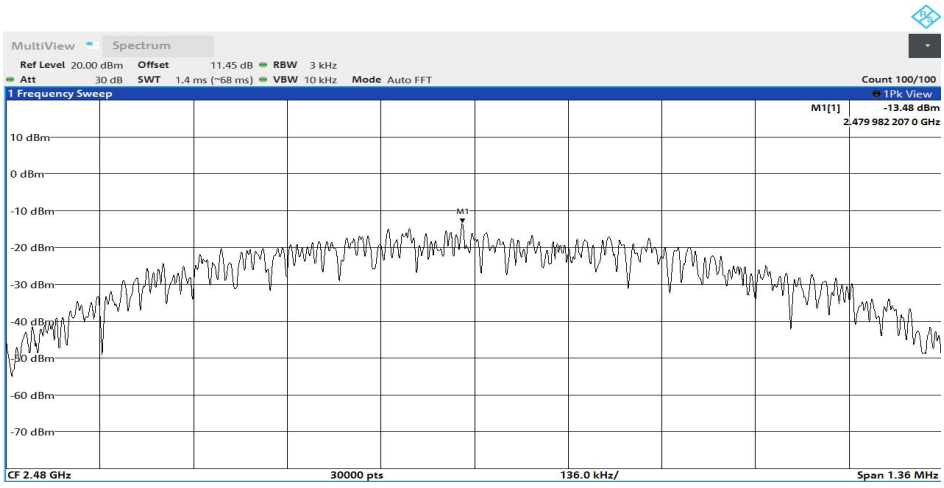
BLE_1M-Ant1-2402--14.44-0.00-0.00-0.00



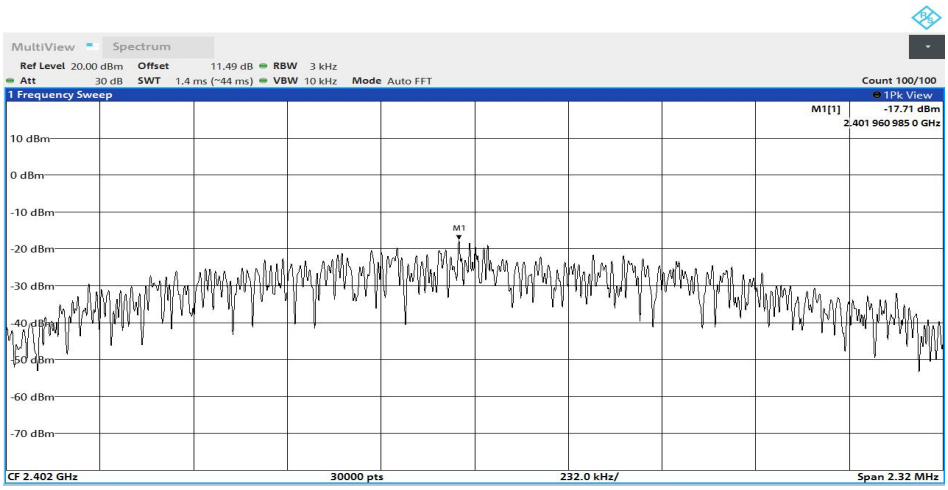
BLE_1M-Ant1-2440--14.21-0.00-0.00-0.00



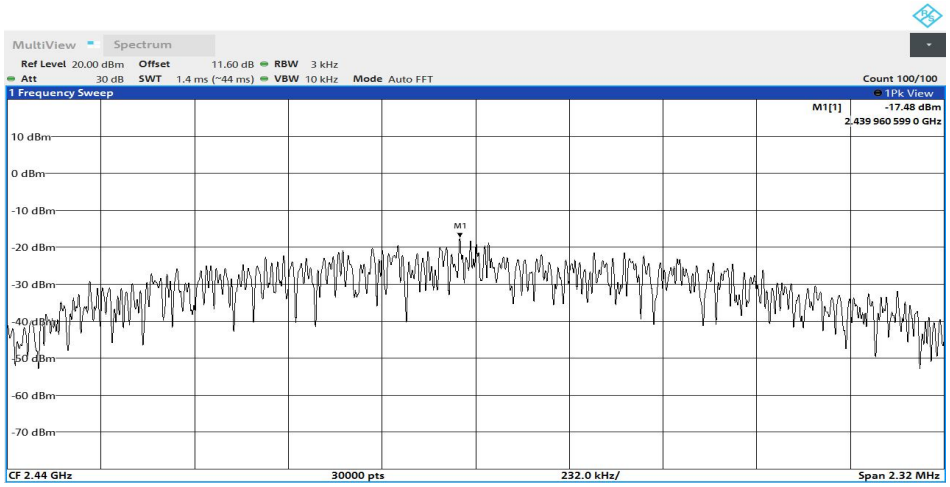
BLE_1M-Ant1-2480--13.48-0.00-0.00-0.00



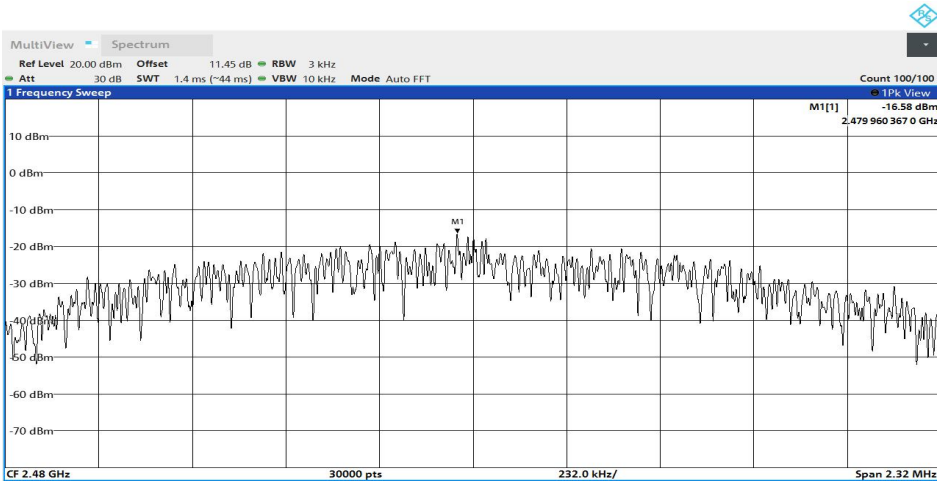
BLE_2M-Ant1-2402--17.71-0.00-0.00-0.00



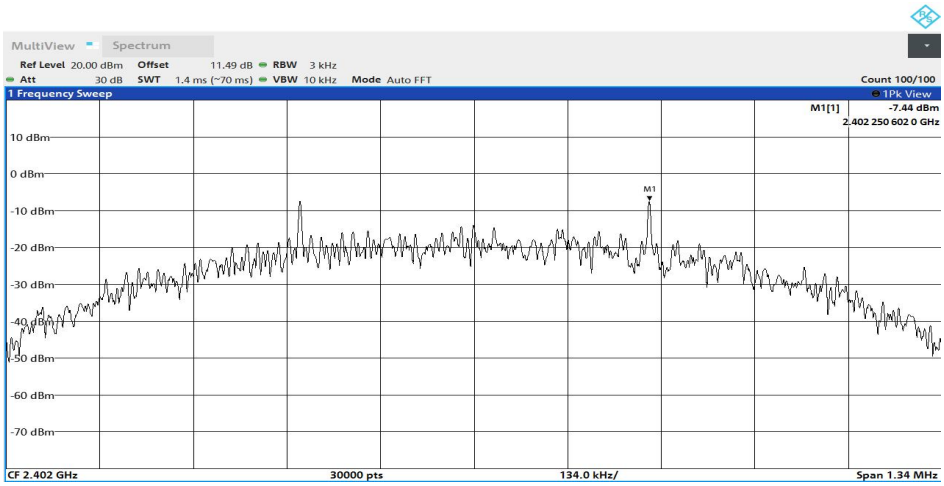
BLE_2M-Ant1-2440--17.48-0.00-0.00-0.00



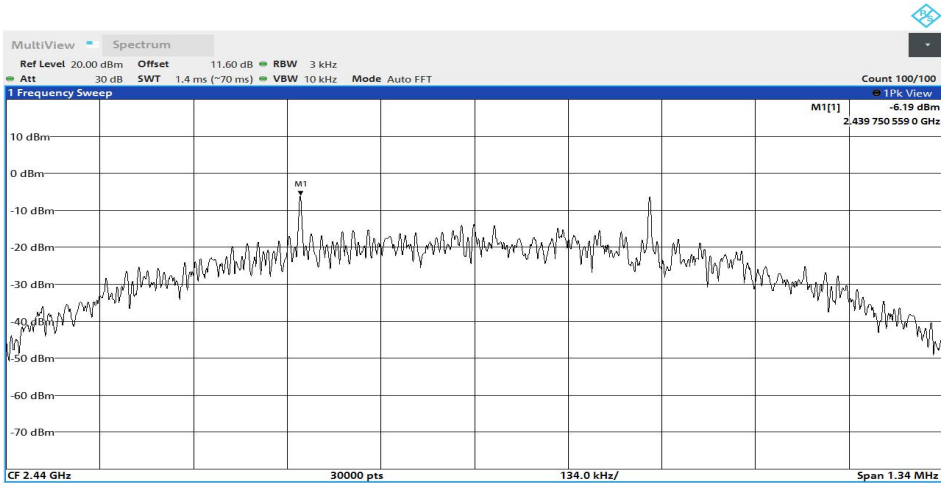
BLE_2M-Ant1-2480--16.58-0.00-0.00-0.00



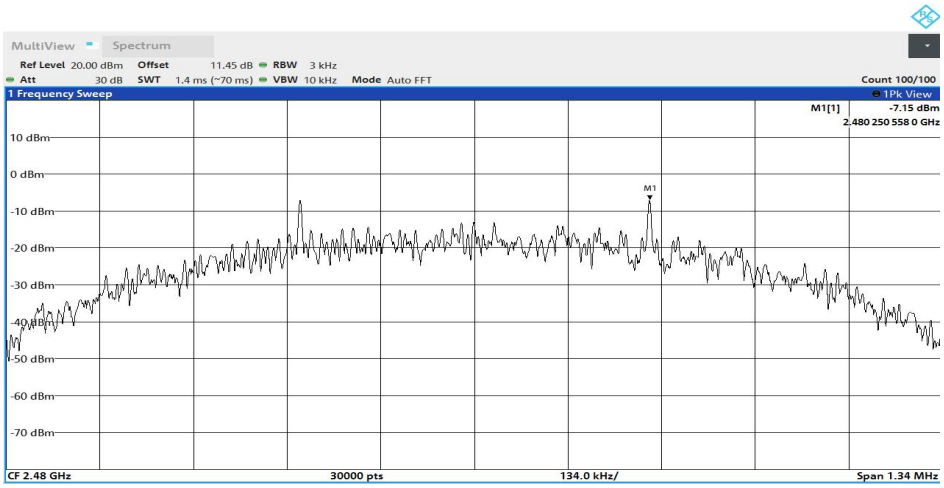
BLE_125K-Ant1-2402--7.44-0.00-0.00-0.00



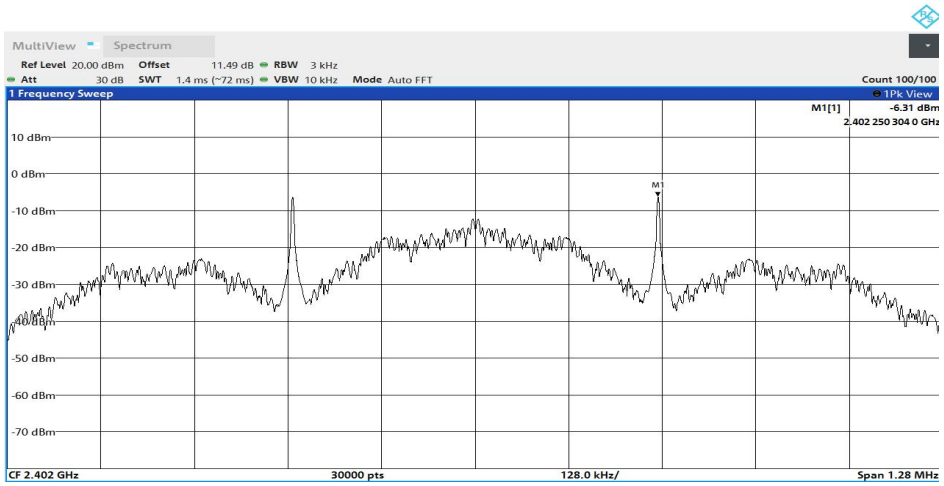
BLE_125K-Ant1-2440--6.19-0.00-0.00-0.00



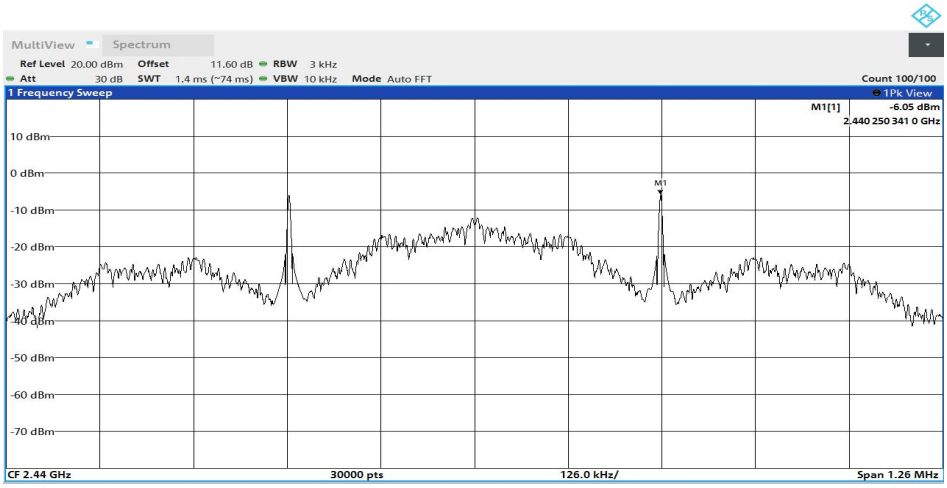
BLE_125K-Ant1-2480--7.15-0.00-0.00-0.00



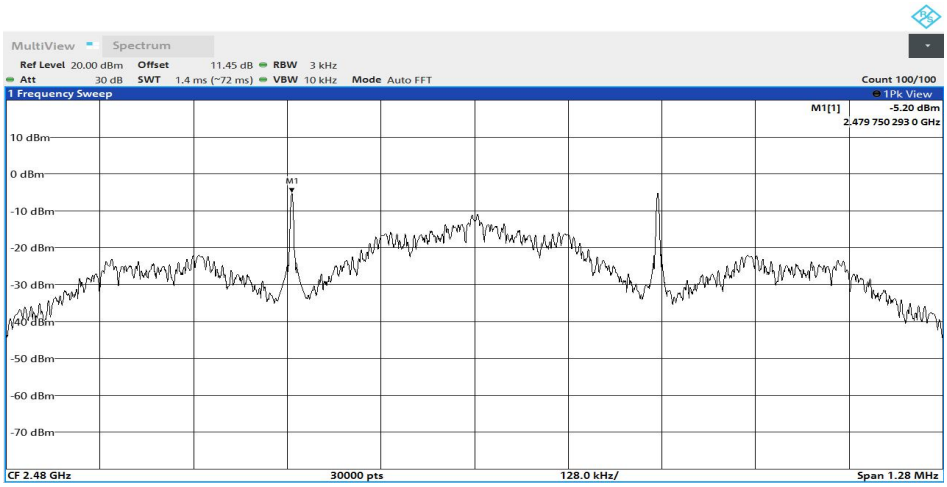
BLE_500K-Ant1-2402--6.31-0.00-0.00-0.00



BLE_500K-Ant1-2440--6.05-0.00-0.00-0.00



BLE_500K-Ant1-2480--5.20-0.00-0.00-0.00



6.5. 6dB Bandwidth

Specifications:	FCC 47 Part 15.247 (a) (2)
DUT Serial Number:	S1
Test conditions:	Ambient Temperature:15℃-35℃ Relative Humidity:30%-60% Air pressure: 86-106kPa
Test Results:	Pass

Limit Level Construction:

Standard	Limit
FCC 47 Part 15.247 (a) (2)	≥500kHz

Measurement Uncertainty:

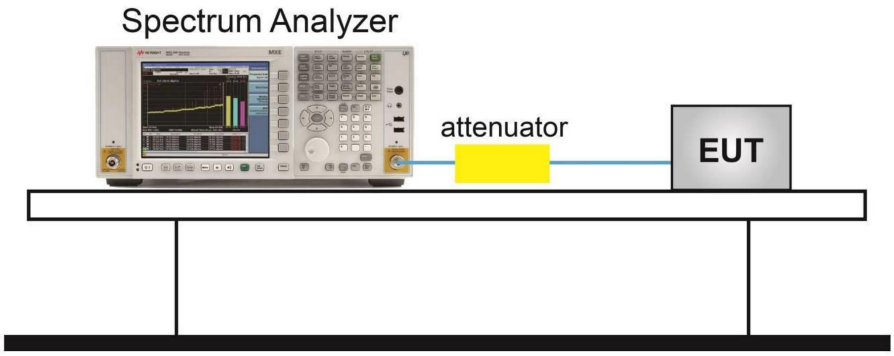
Measurement Uncertainty	±0.72KHz

Test procedures

The measurement is according to ANSI C63.10 clause 11.8.

1. The output power of EUT was connected to the spectrum analyzer. The path loss was compensated to the results for each measurement.
2. Enable EUT transmitter maximum power continuously.
3. Set RBW = 100 kHz.
4. Set the VBW ≥ [3 × RBW].
5. Detector = peak.
6. Trace mode = max hold.
7. Sweep = auto couple.
8. Allow the trace to stabilize.
9. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

Test Setup

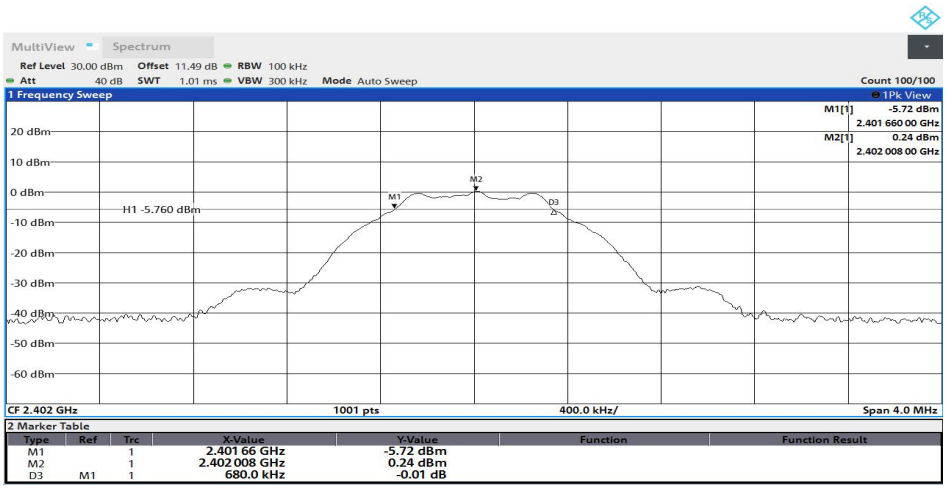


Measurement Result

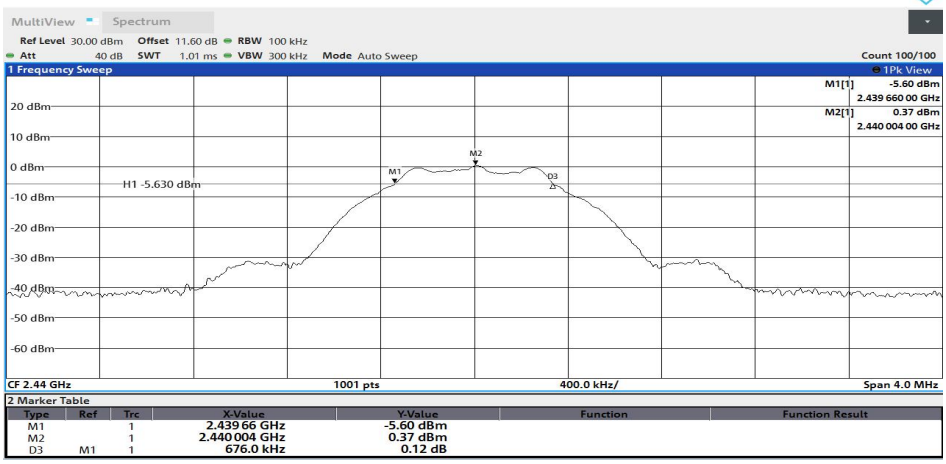
TestMode	Antenna	Frequency[MHz]	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
BLE_1M	Ant1	2402	0.68	2401.66	2402.34	0.5	PASS
BLE_1M	Ant1	2440	0.68	2439.66	2440.34	0.5	PASS
BLE_1M	Ant1	2480	0.68	2479.66	2480.34	0.5	PASS
BLE_2M	Ant1	2402	1.16	2401.42	2402.58	0.5	PASS
BLE_2M	Ant1	2440	1.16	2439.42	2440.58	0.5	PASS
BLE_2M	Ant1	2480	1.16	2479.42	2480.58	0.5	PASS
BLE_125K	Ant1	2402	0.67	2401.67	2402.34	0.5	PASS
BLE_125K	Ant1	2440	0.67	2439.67	2440.34	0.5	PASS
BLE_125K	Ant1	2480	0.67	2479.67	2480.34	0.5	PASS
BLE_500K	Ant1	2402	0.64	2401.68	2402.32	0.5	PASS
BLE_500K	Ant1	2440	0.63	2439.68	2440.32	0.5	PASS
BLE_500K	Ant1	2480	0.64	2479.68	2480.32	0.5	PASS

Test graphs as below

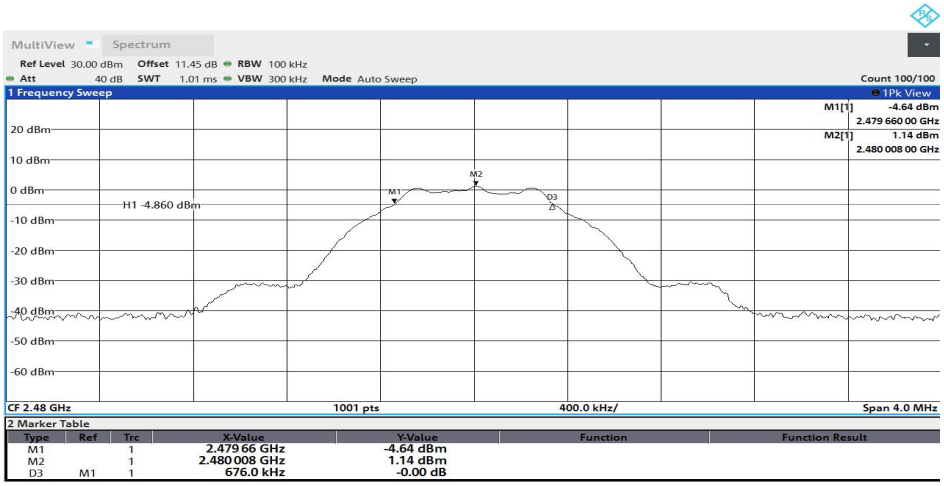
BLE_1M-Ant1-2402



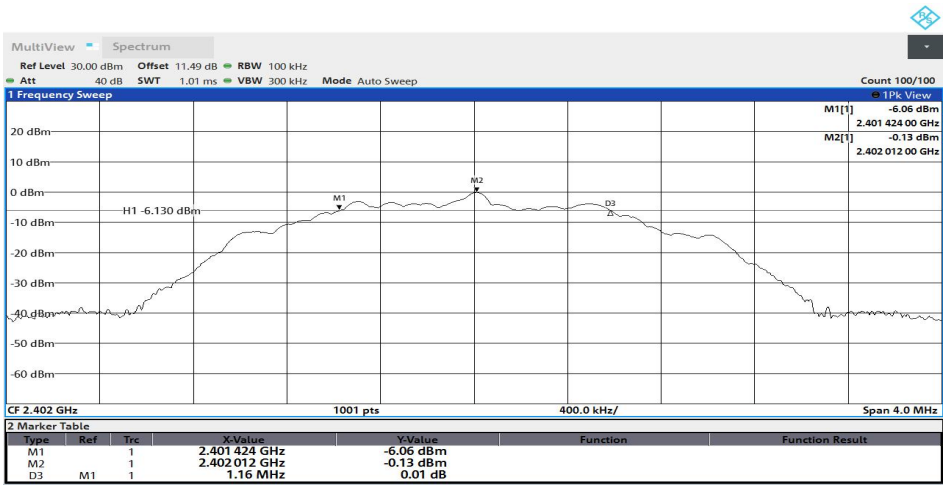
BLE_1M-Ant1-2440



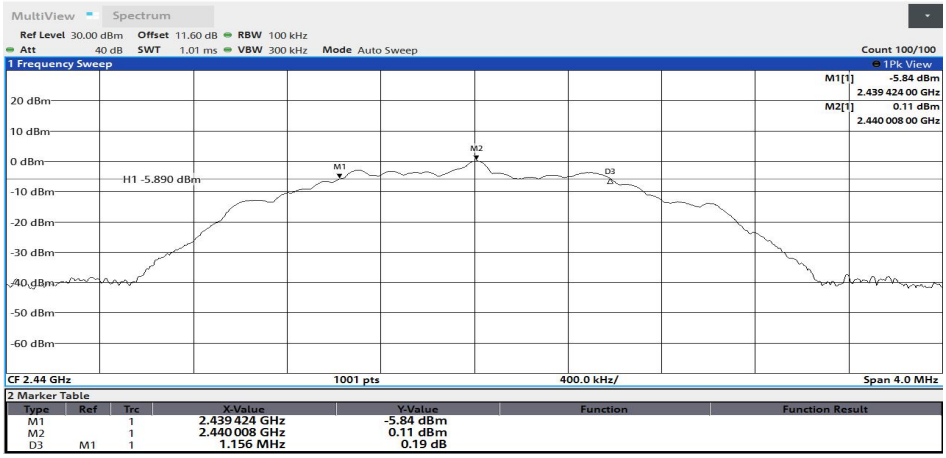
BLE_1M-Ant1-2480



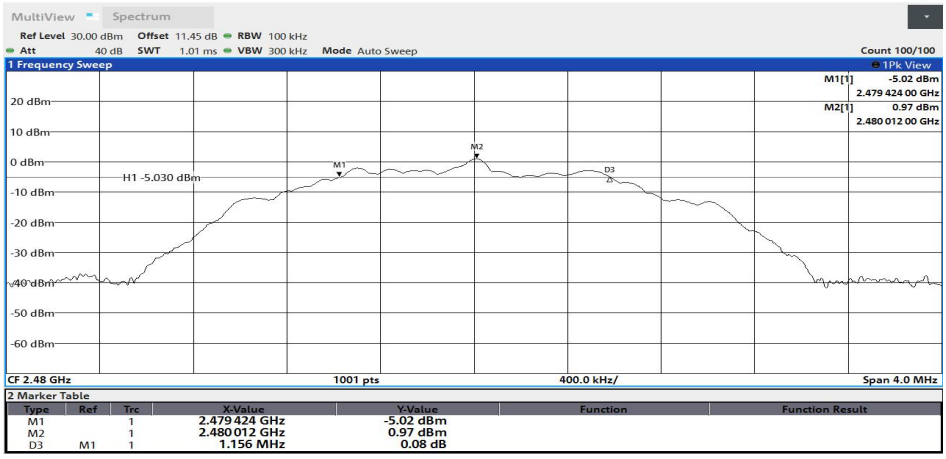
BLE_2M-Ant1-2402



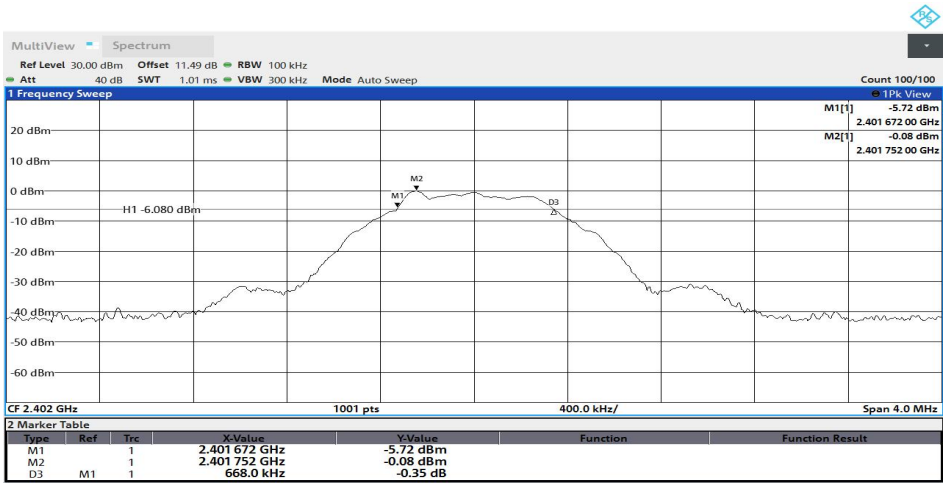
BLE_2M-Ant1-2440



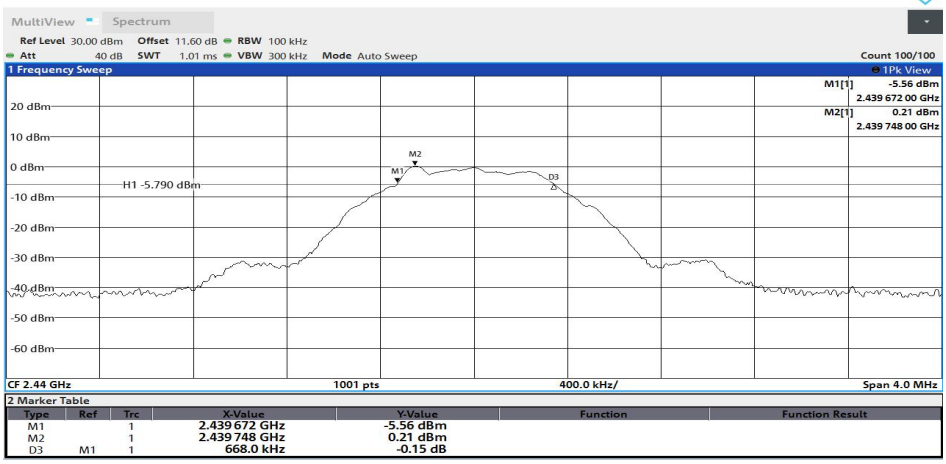
BLE_2M-Ant1-2480



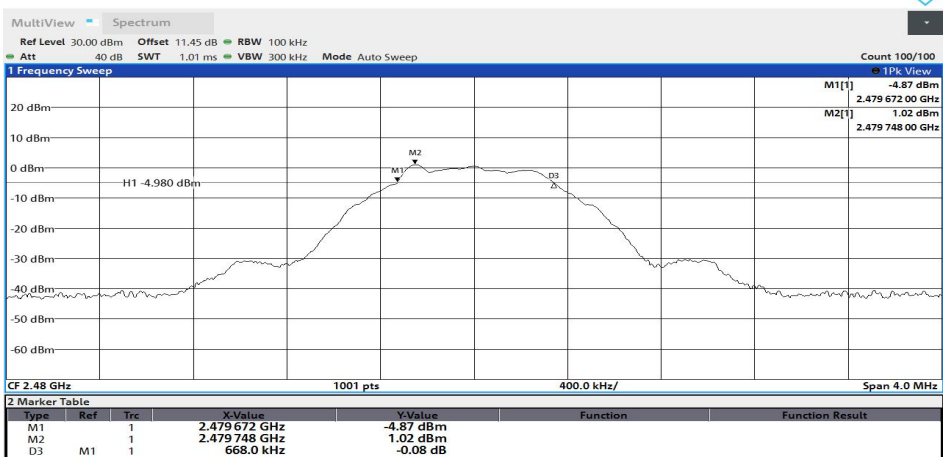
BLE_125K-Ant1-2402



BLE_125K-Ant1-2440



BLE_125K-Ant1-2480



BLE_500K-Ant1-2402