TEST REPORT

REPORT NUMBER: I23W00008-WIFI 2.4G 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-WIF 2.4G 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 Band	2402MHz-2480MHz
WLAN Frequency Band	Wi-Fi2.4G:802.11b/g/n, Wi-Fi 5G U-NII-1/Wi-Fi 5G U-NII-3:802.11a/n/ac
Type of WLAN modulation	802.11b: DSSS, 802.11g/n: OFDM
Extreme Temperature	-40-85℃
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)
WLAN	2.4G	2412MHz-2472MHz	--

3.3. Outline of Equipment under Test

3.4. Internal Identification of AE used during the test

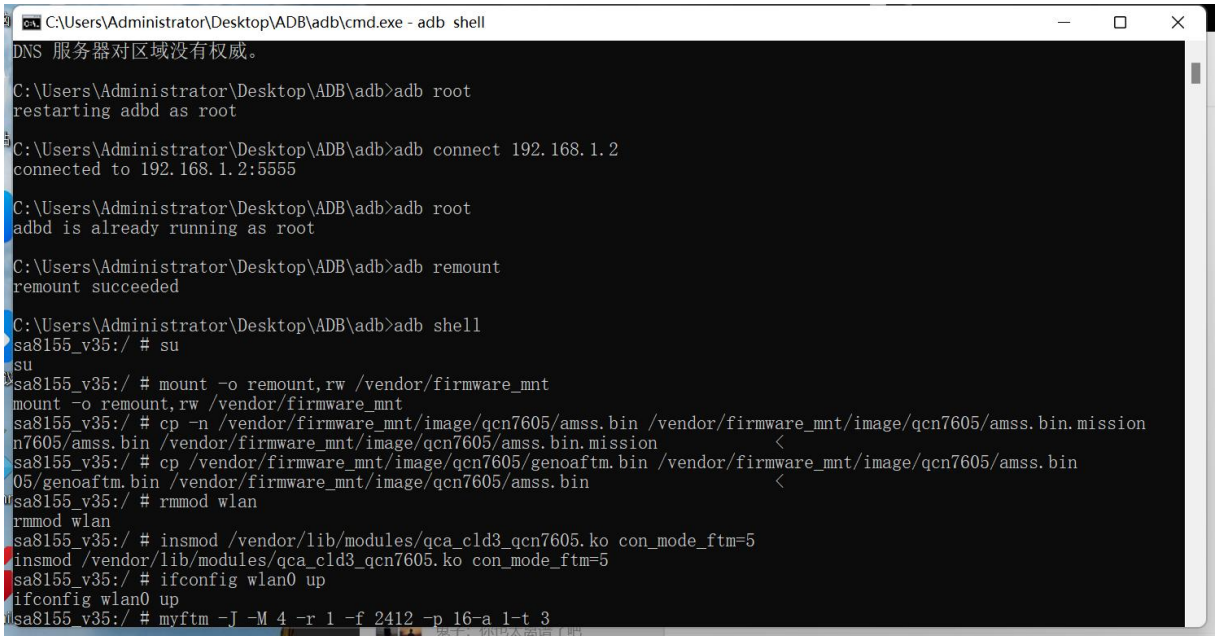
AE ID*	Description	dB*
AE1	RF cable	0.5dB

*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

A brief summary of the tests carried out is shown as following

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)	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. 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(b)(3)	<30

Measurement Uncertainty:

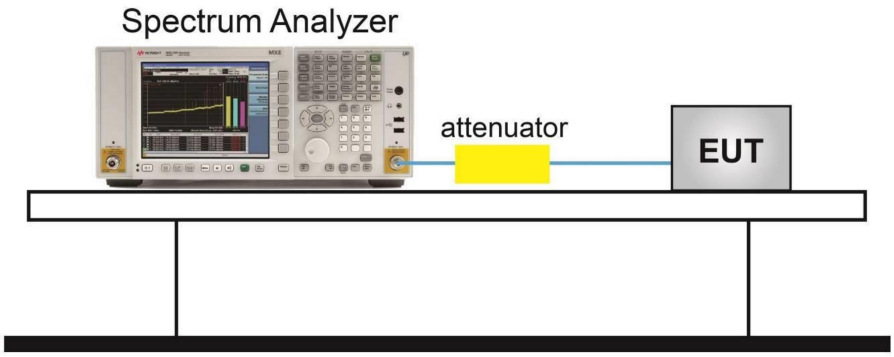
Measurement Uncertainty	±0.48dB

Test Procedure

The measurement is according to ANSI C63.10 clause 11.9.

1. Set span to at least 1.5 times the OBW.
2. Set RBW = 1-5% of the OBW, not to exceed 1 MHz.
3. Set VBW ≥ 3 x RBW.
4. Number of points in sweep ≥ 2 span / RBW. (This gives bin-to-bin spacing ≤ RBW/2, so that narrowband signals are not lost between frequency bins.)
5. Sweep time = auto.
6. Detector = RMS (i.e., power averaging), if available. Otherwise, use sample detector mode.
7. If transmit duty cycle < 98 %, use a sweep trigger with the level set to enable triggering only on full power pulses. The transmitter shall operate at maximum power control level for the entire duration of every sweep. If the EUT transmits continuously (i.e., with no off intervals) or at duty cycle ≥ 98 %, and if each transmission is entirely at the maximum power control level, then the trigger shall be set to "free run".
8. Trace average at least 100 traces in power averaging (i.e., RMS) mode.i) Compute power by integrating the spectrum across the OBW of the signal using the instrument's band power measurement function, with band limits set equal to the OBW band edges. If the instrument does not have a band power function, sum the spectrum levels (in power units) at intervals equal to the RBW extending across the entire OBW of the spectrum

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.		

Maximum Average Output Power-conducted

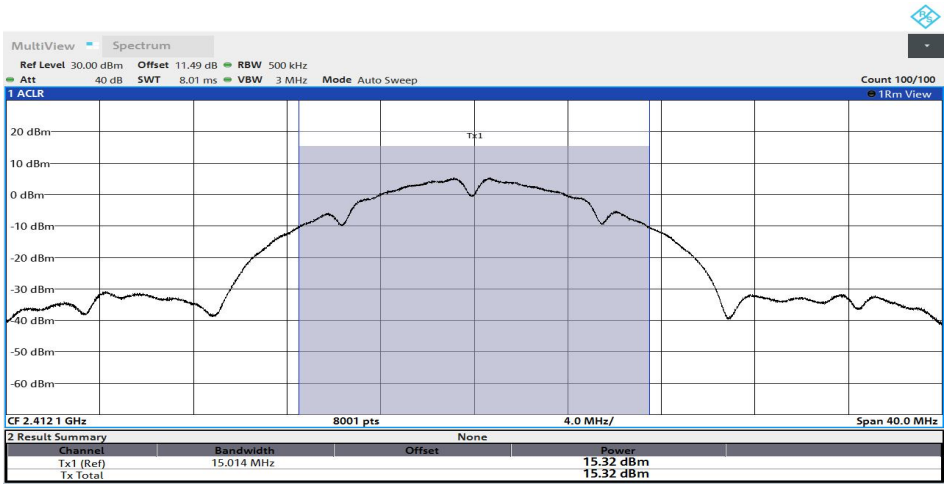
Measurement Results

TestMode	Antenna	Frequency[MHz]	Peak Powert[dBm]	Conducted Limit[dBm]	EIRP [dBm]	EIRP Limit[dBm]	Verdict
11B	Ant1	2412	15.32	≤30.00	17.66	≤36.00	PASS
11B	Ant1	2437	15.96	≤30.00	18.30	≤36.00	PASS
11B	Ant1	2462	15.36	≤30.00	17.70	≤36.00	PASS
11G	Ant1	2412	10.67	≤30.00	13.01	≤36.00	PASS
11G	Ant1	2437	11.24	≤30.00	13.58	≤36.00	PASS
11G	Ant1	2462	10.83	≤30.00	13.17	≤36.00	PASS
11N20SISO	Ant1	2412	7.07	≤30.00	9.41	≤36.00	PASS
11N20SISO	Ant1	2437	7.64	≤30.00	9.98	≤36.00	PASS
11N20SISO	Ant1	2462	7.07	≤30.00	9.41	≤36.00	PASS
11N40SISO	Ant1	2422	9.89	≤30.00	12.23	≤36.00	PASS
11N40SISO	Ant1	2437	10.26	≤30.00	12.60	≤36.00	PASS
11N40SISO	Ant1	2452	9.60	≤30.00	11.94	≤36.00	PASS

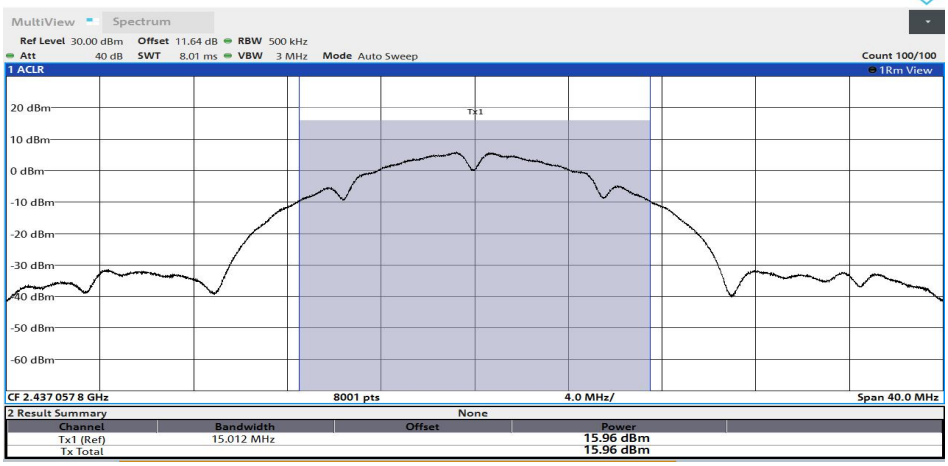
Conclusion: PASS

TEST PLOTS:

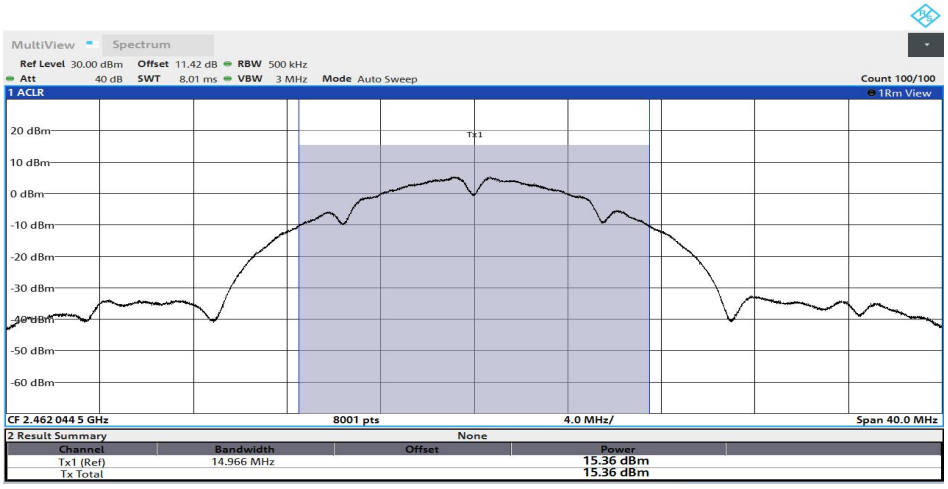
11B-Ant1-2412-----17.03-97.63-0.10



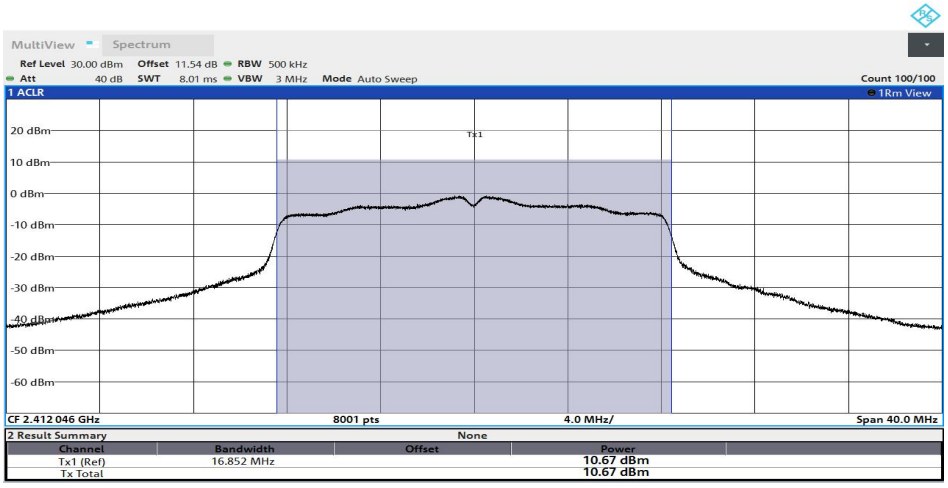
11B-Ant1-2437-----14.87-97.63-0.10



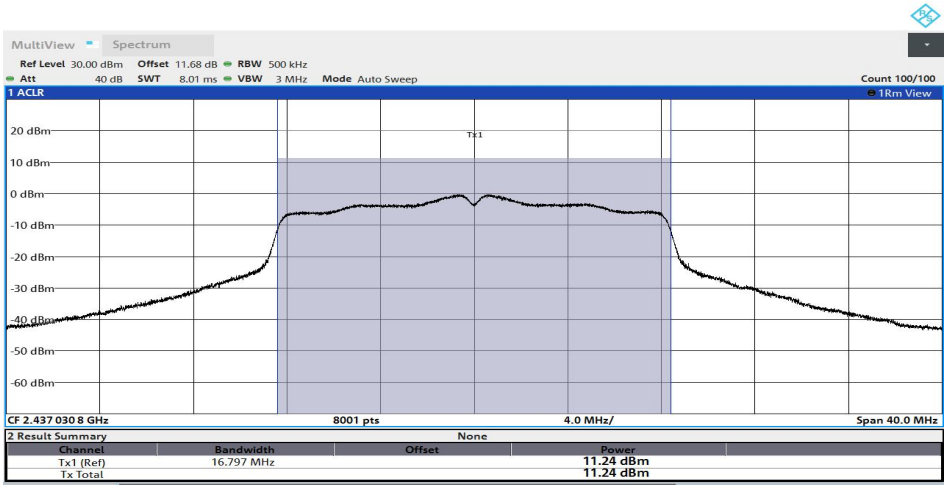
11B-Ant1-2462-----15.68-97.63-0.10



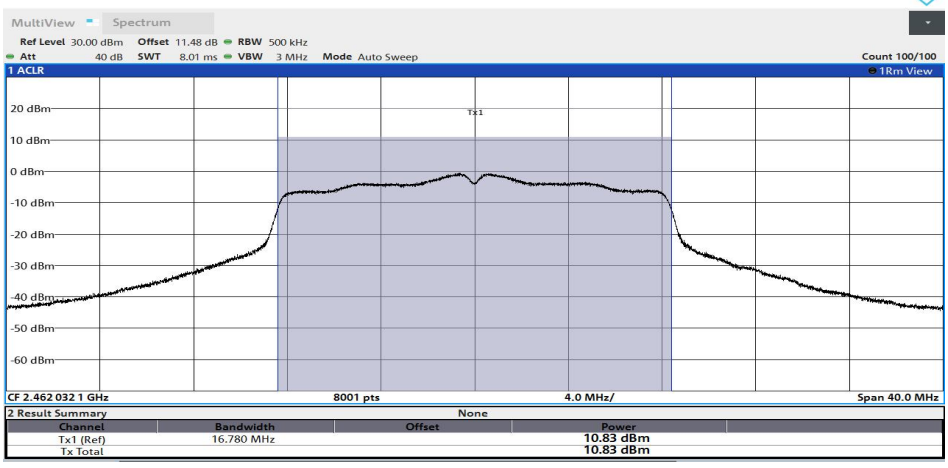
11G-Ant1-2412-----9.56-87.26-0.59



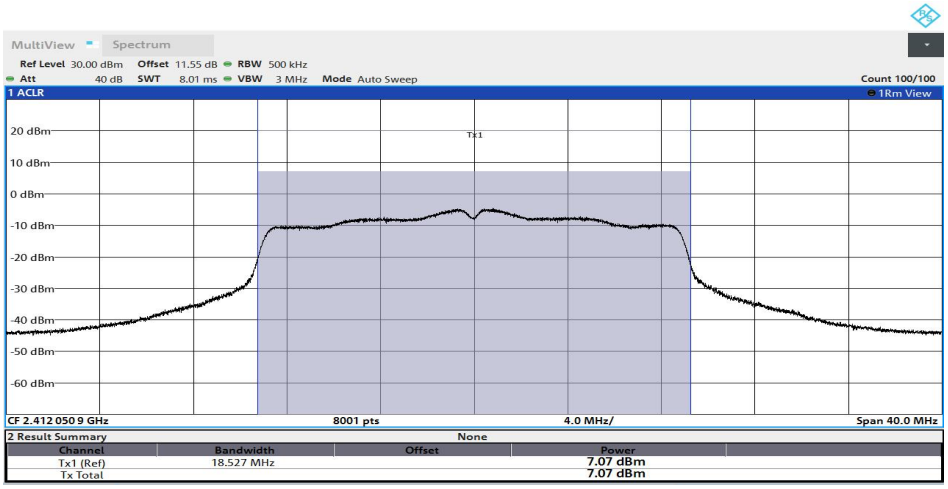
11G-Ant1-2437-----7.33-87.26-0.59



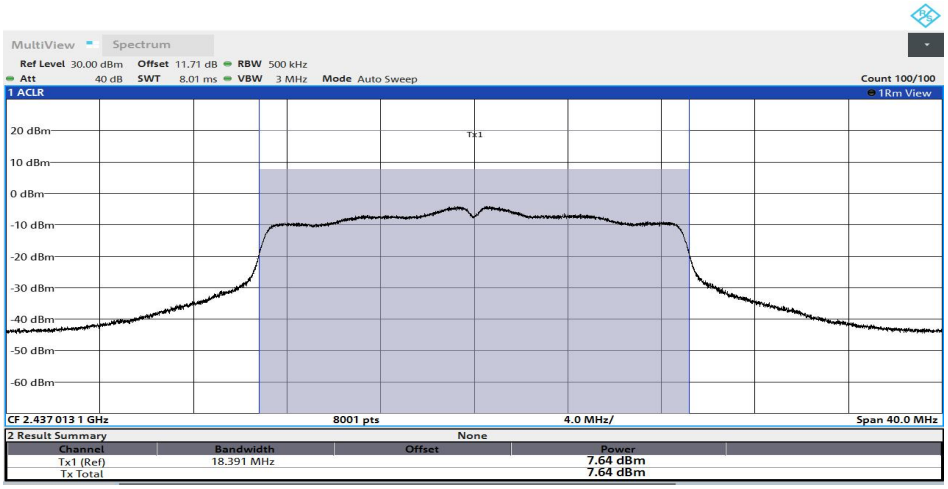
11G-Ant1-2462-----8.73-87.18-0.60



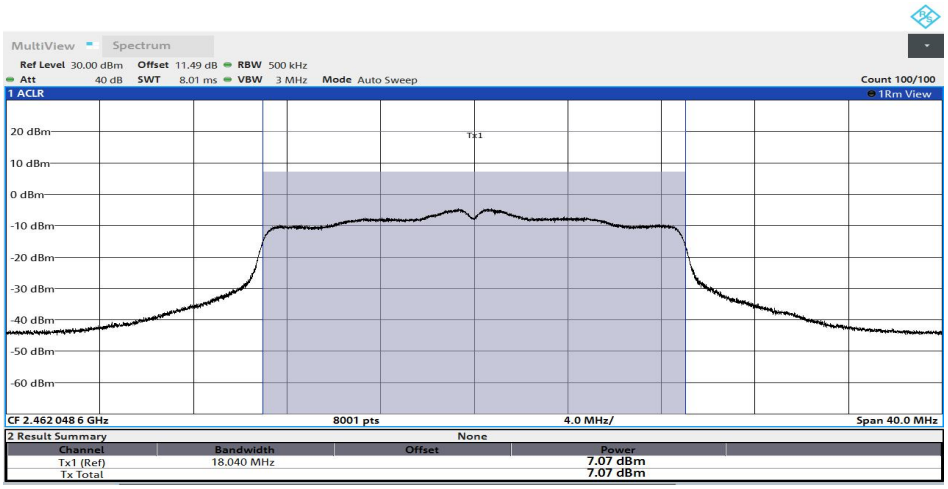
11N20SISO-Ant1-2412-----9.62-86.58-0.63



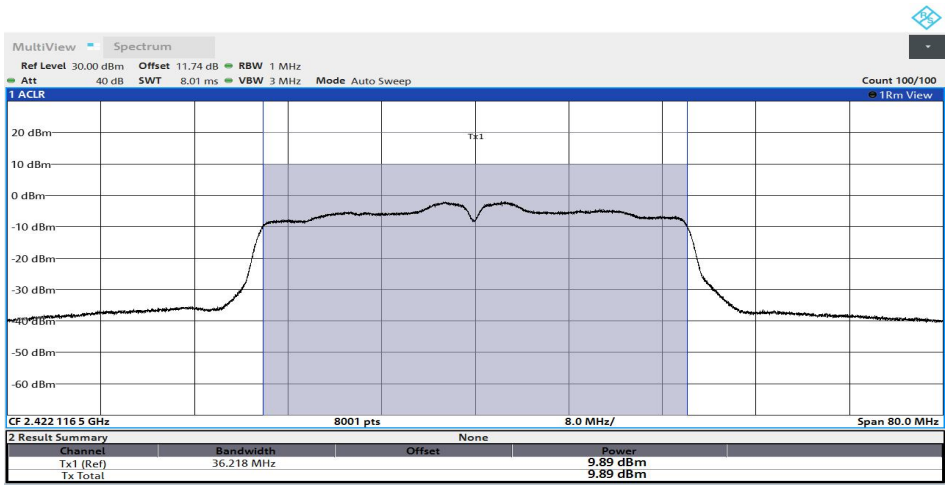
11N20SISO-Ant1-2437-----7.48-86.49-0.63



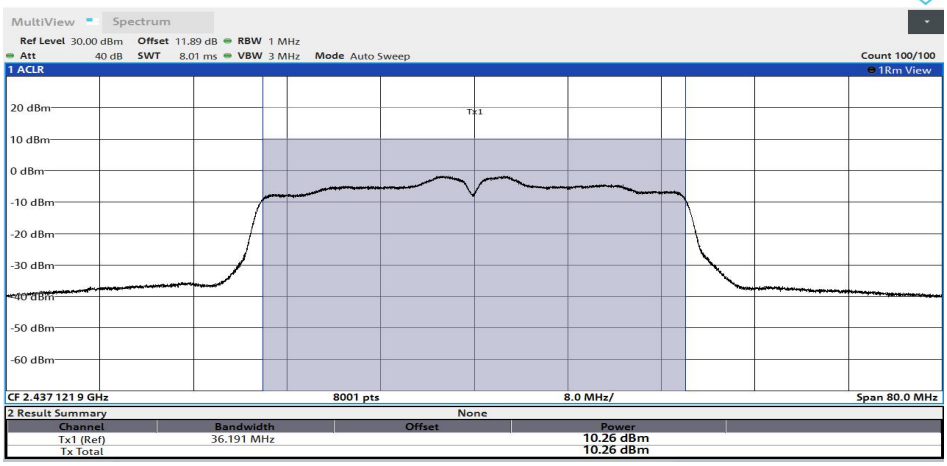
11N20SISO-Ant1-2462-----9.00-86.49-0.63



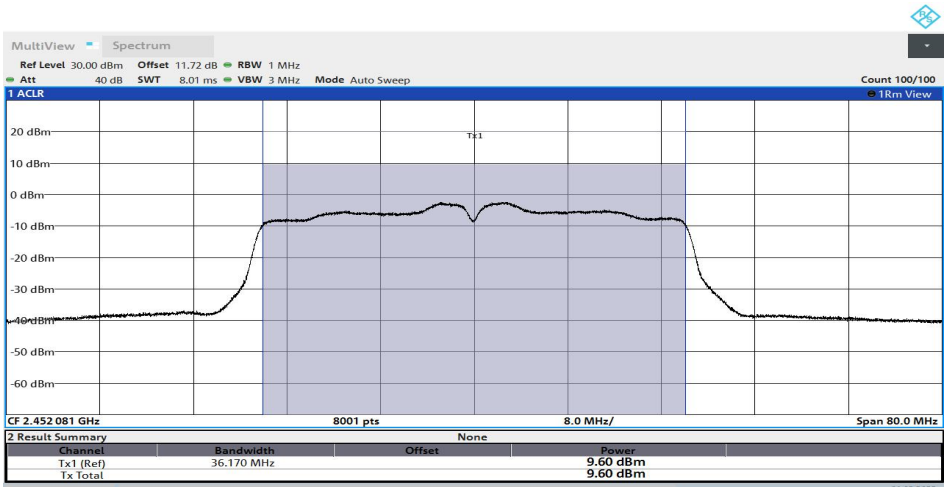
11N40SISO-Ant1-2422-----9.94-95.00-0.22



11N40SISO-Ant1-2437-----13.42-94.00-0.27



11N40SISO-Ant1-2452-----9.81-95.00-0.22



6.3. Peak Power Spectral Density

Specifications:	FCC CFR 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 CFR Part 15.247(e)	≤ 8dBm/3 KHz

Measurement Uncertainty:

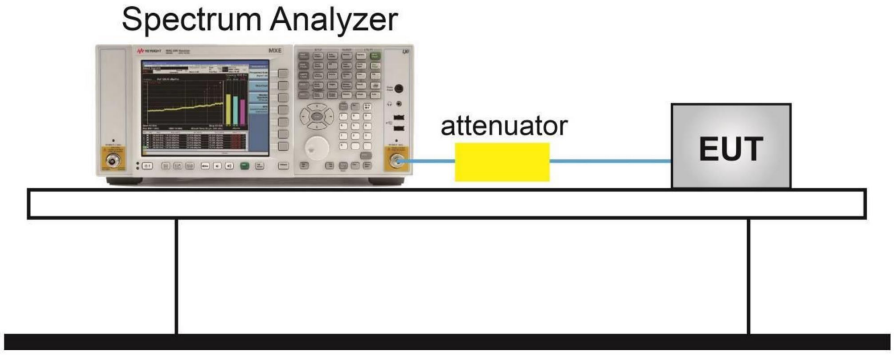
Measurement Uncertainty	±0.5dB

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=3kHz
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

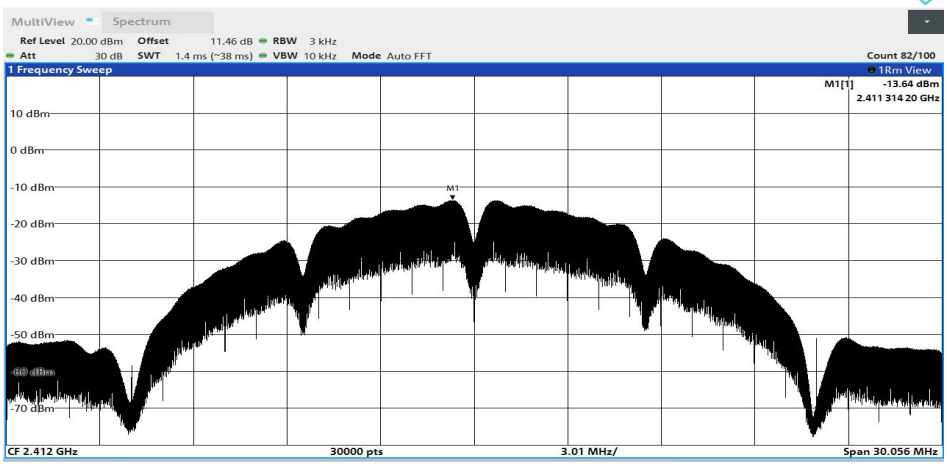
Test setup



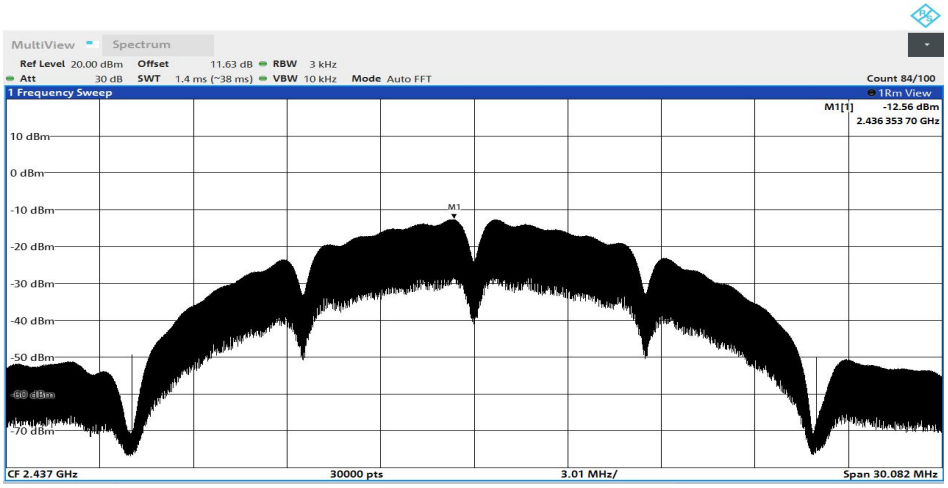
Measurement Result

TestMode	Antenna	Frequency[MHz]	Result[dBm/kHz]	Limit[dBm/3kHz]	Verdict
11B	Ant1	2412	-13.64	≤8.00	PASS
11B	Ant1	2437	-12.56	≤8.00	PASS
11B	Ant1	2462	-13.23	≤8.00	PASS
11G	Ant1	2412	-16.53	≤8.00	PASS
11G	Ant1	2437	-16.9	≤8.00	PASS
11G	Ant1	2462	-17.46	≤8.00	PASS
11N20SISO	Ant1	2412	-16.72	≤8.00	PASS
11N20SISO	Ant1	2437	-16.97	≤8.00	PASS
11N20SISO	Ant1	2462	-20.49	≤8.00	PASS
11N40SISO	Ant1	2422	-20.41	≤8.00	PASS
11N40SISO	Ant1	2437	-20.34	≤8.00	PASS
11N40SISO	Ant1	2452	-23.84	≤8.00	PASS

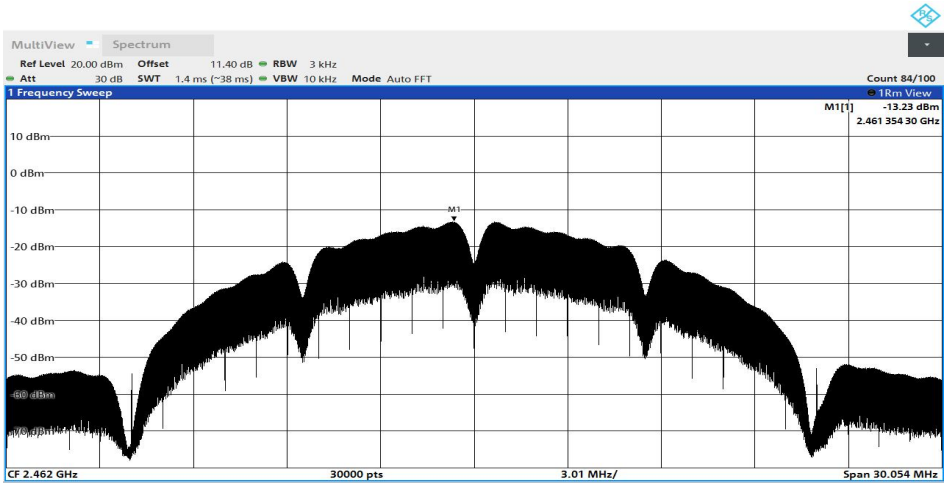
11B-Ant1-2412--14.06-0.10-0.00-0.00



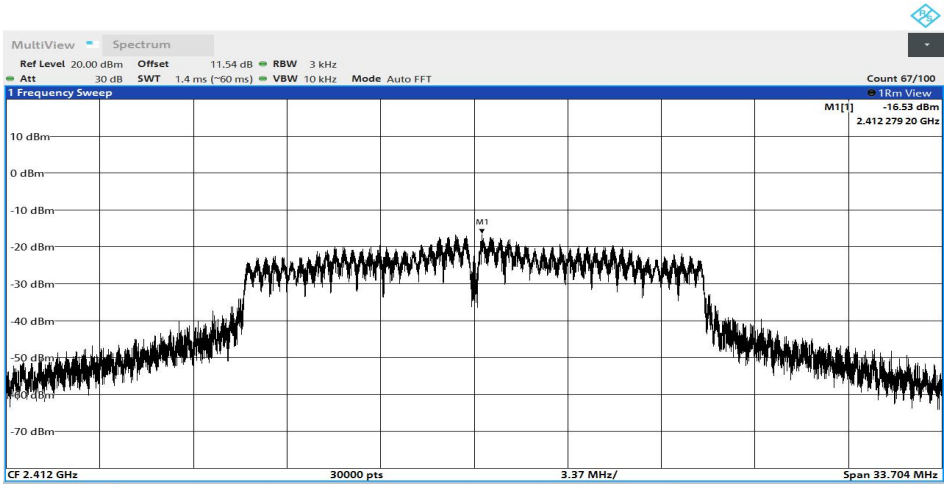
11B-Ant1-2437--16.20-0.10-0.00-0.00



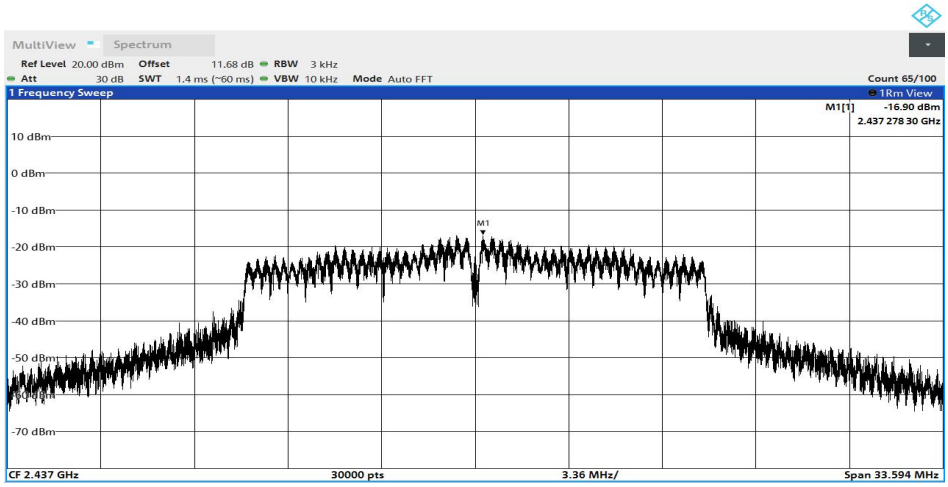
11B-Ant1-2462--15.32-0.10-0.00-0.00



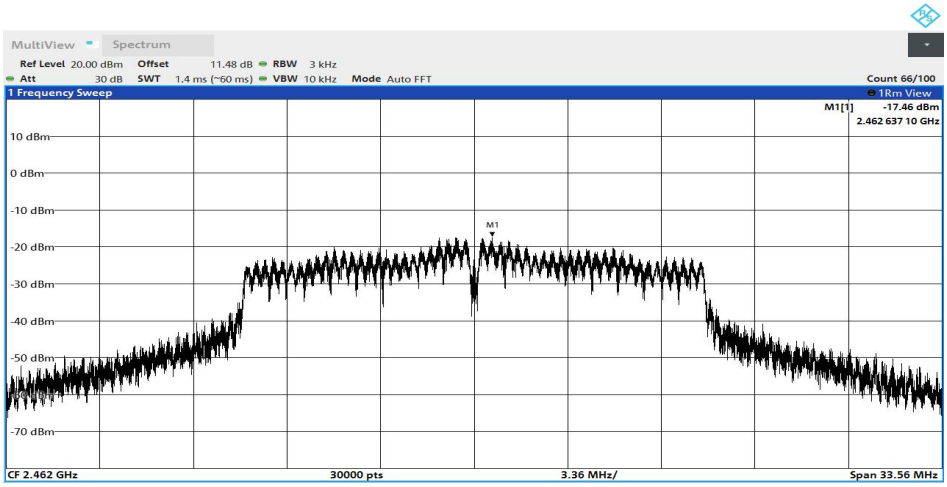
11G-Ant1-2412--20.86-0.59-0.00-0.00



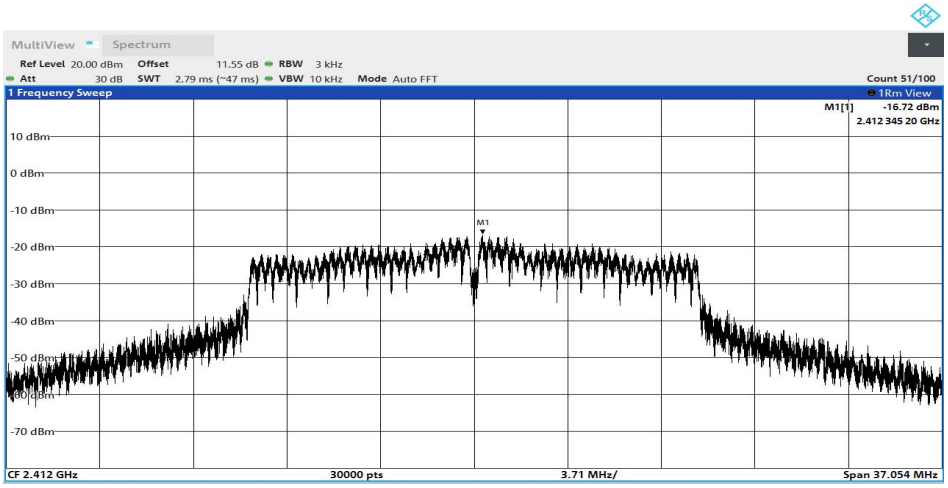
11G-Ant1-2437--25.68-0.59-0.00-0.00



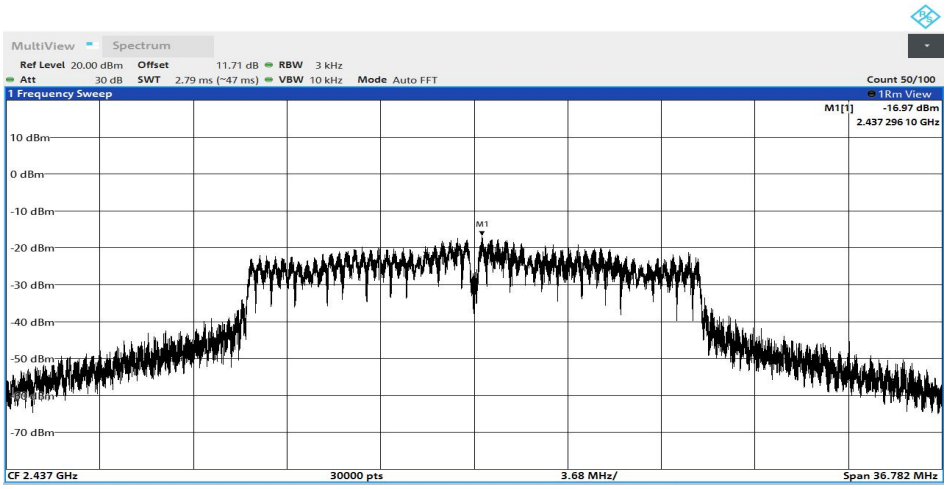
11G-Ant1-2462--23.34-0.60-0.00-0.00



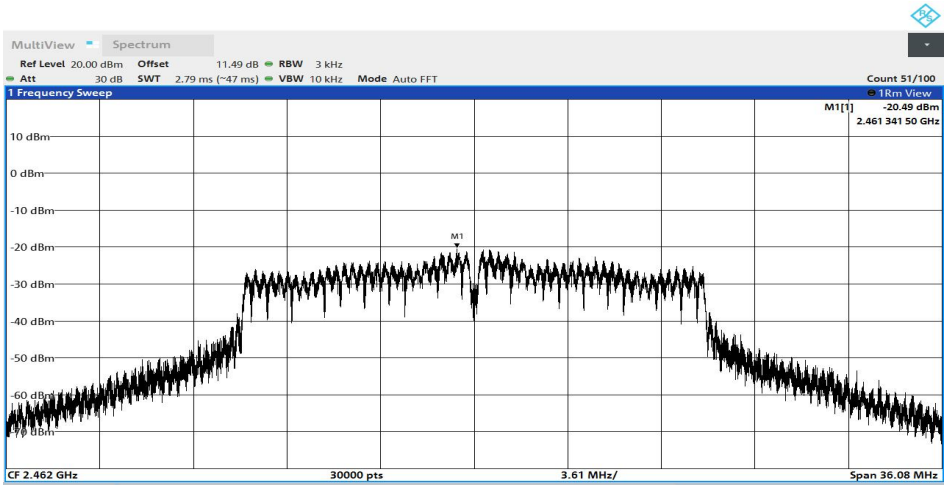
11N20SISO-Ant1-2412--21.10-0.63-0.00-0.00



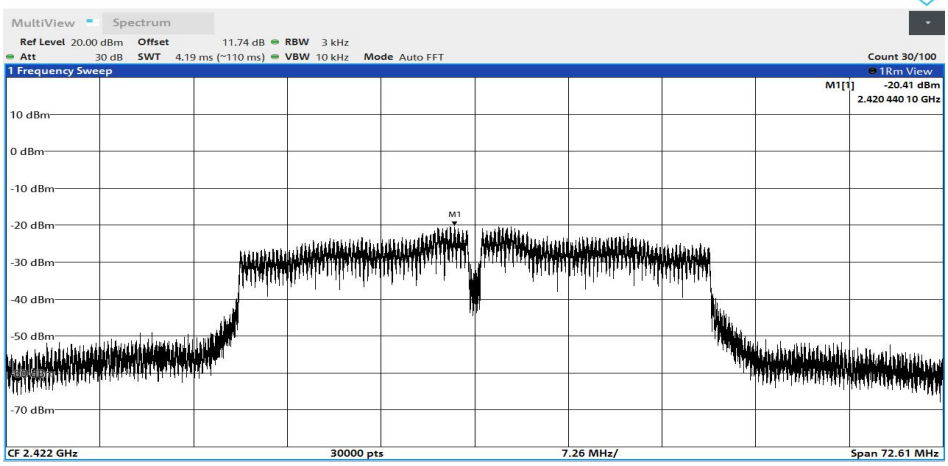
11N20SISO-Ant1-2437--25.50-0.63-0.00-0.00



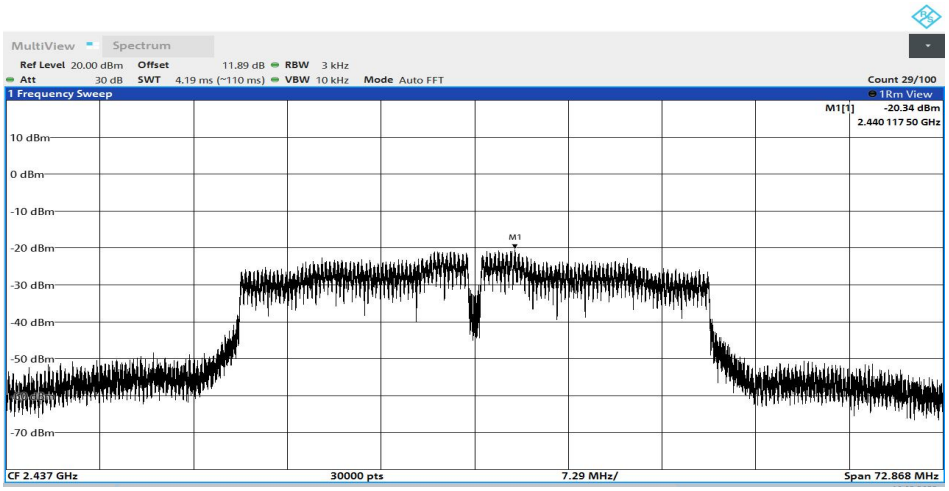
11N20SISO-Ant1-2462--23.45-0.63-0.00-0.00



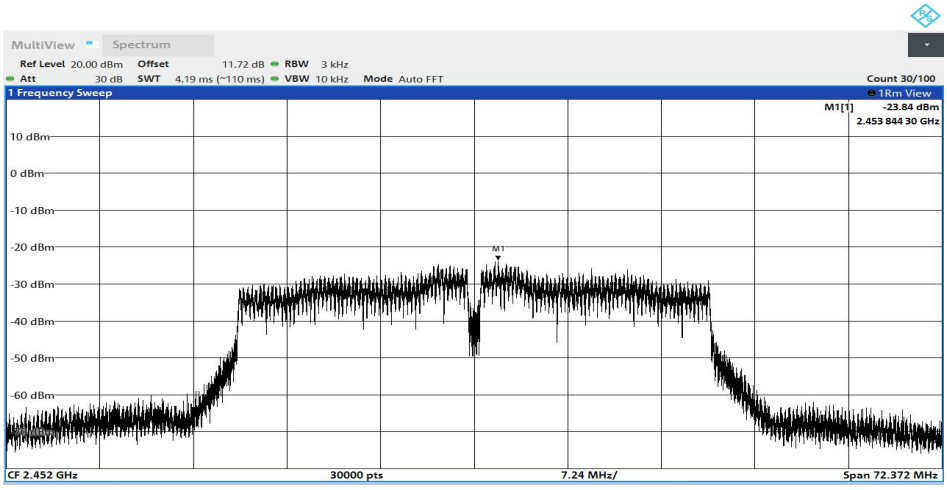
11N40SISO-Ant1-2422--20.63-0.22-0.00-0.00



11N40SISO-Ant1-2437--20.61-0.27-0.00-0.00



11N40SISO-Ant1-2452--24.06-0.22-0.00-0.00



6.4. Occupied Channel Bandwidth

Specifications:	FCC 47 Part 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
FCC 47 Part 15.247(a) (2)	≥500KHz

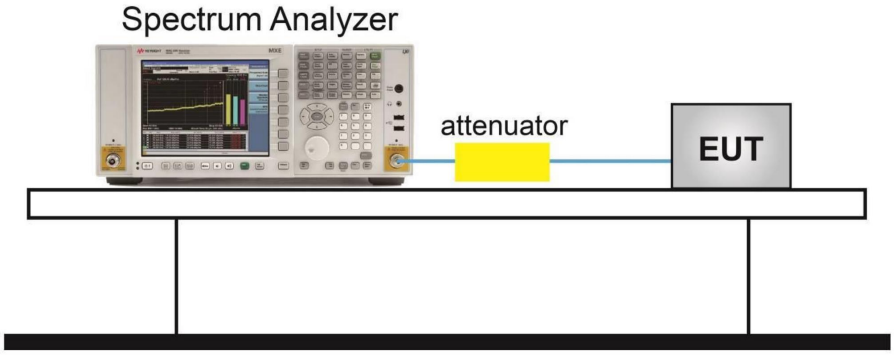
Measurement Uncertainty:

Measurement Uncertainty	20kHz

Test procedures

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


Spectrum Analyzer
attenuator
EUT

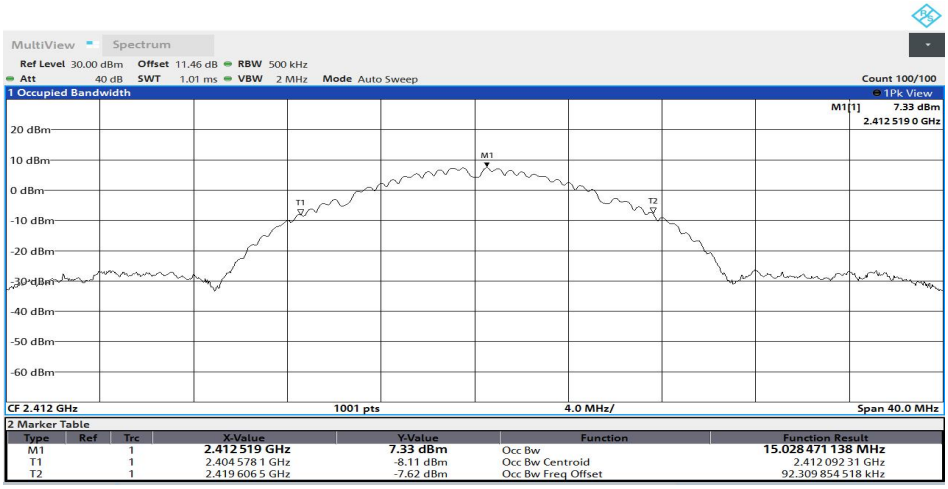
Measurement Results

TestMode	Antenna	Frequency[MHz]	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
11B	Ant1	2412	15.028	2404.5930	2419.6068	0.5	PASS
11B	Ant1	2437	15.041	2429.5518	2444.5638	0.5	PASS
11B	Ant1	2462	15.027	2454.5615	2469.5279	0.5	PASS
11G	Ant1	2412	16.852	2403.6178	2420.4664	0.5	PASS
11G	Ant1	2437	16.797	2428.6350	2445.4102	0.5	PASS
11G	Ant1	2462	16.78	2453.6522	2470.4261	0.5	PASS
11N20SISO	Ant1	2412	18.527	2403.0419	2421.0493	0.5	PASS
11N20SISO	Ant1	2437	18.391	2428.0694	2446.0226	0.5	PASS
11N20SISO	Ant1	2462	18.04	2453.0630	2471.0028	0.5	PASS
11N40SISO	Ant1	2422	36.305	2403.9506	2440.2558	0.5	PASS
11N40SISO	Ant1	2452	36.186	2433.9844	2470.1705	0.5	PASS
11N40SISO	Ant1	2437	36.434	2418.7659	2455.2000	0.5	PASS

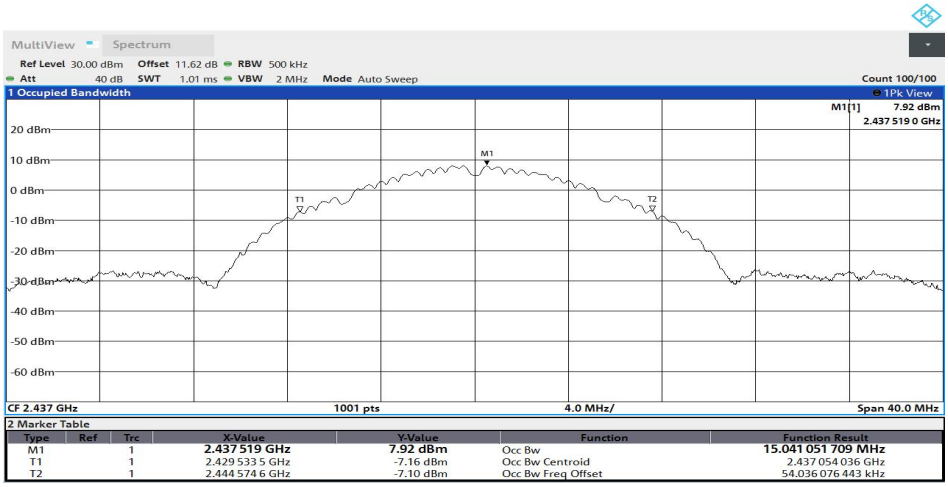
Conclusion: PASS

Test graphs as below

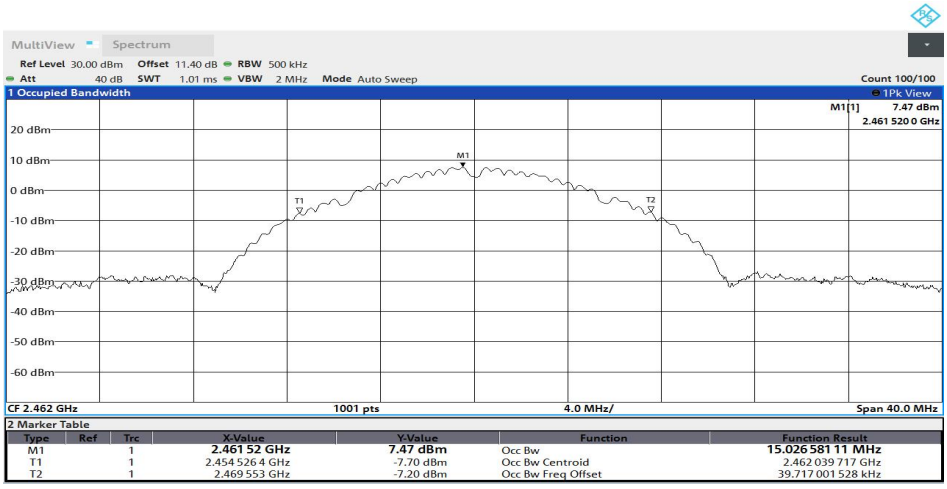
11B-Ant1-2412



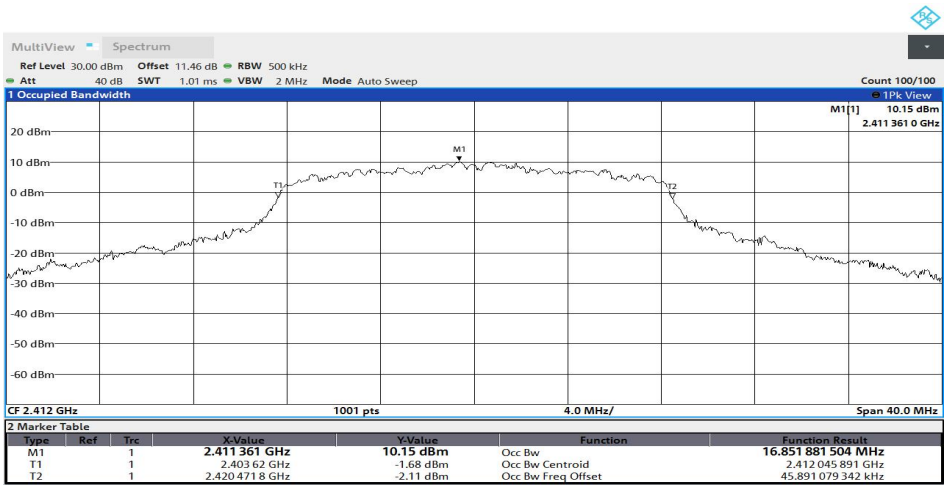
11B-Ant1-2437



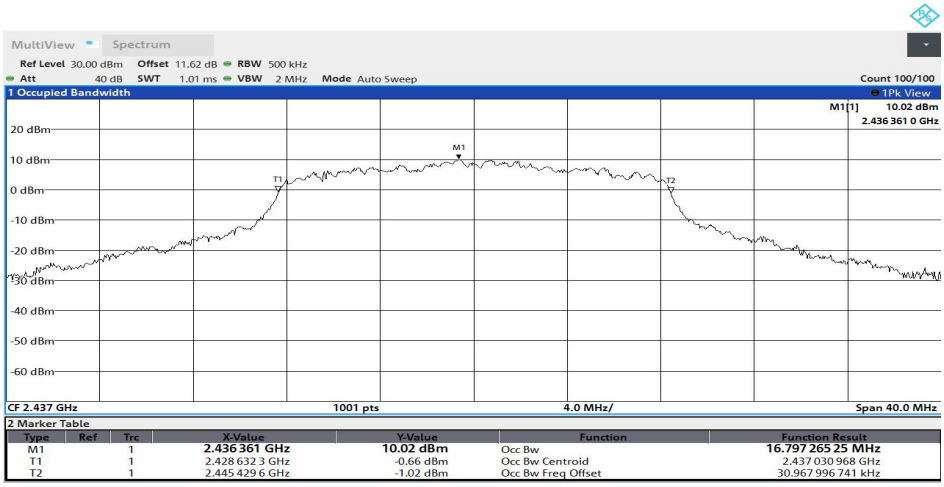
11B-Ant1-2462



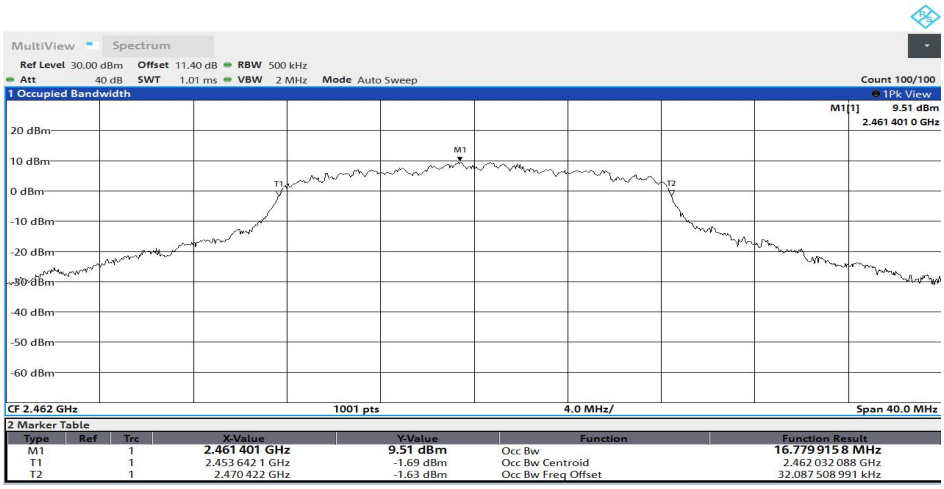
11G-Ant1-2412



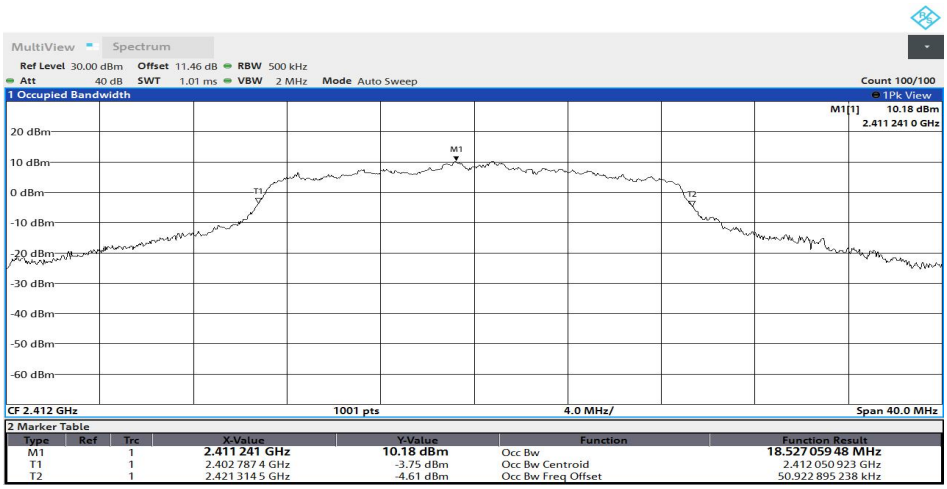
11G-Ant1-2437



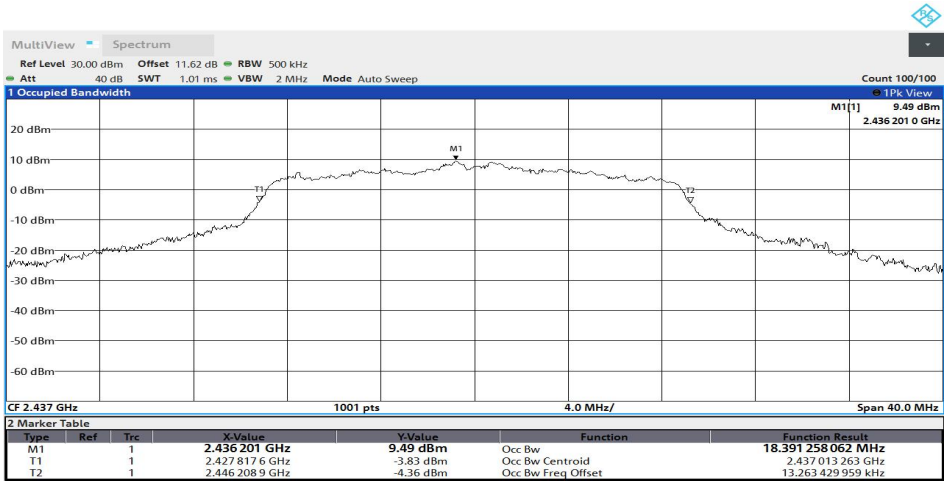
11G-Ant1-2462



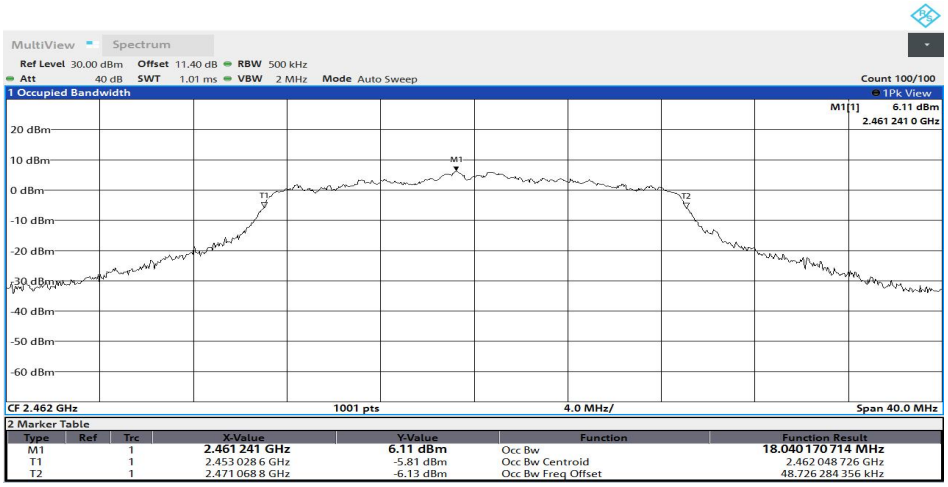
11N20SISO-Ant1-2412



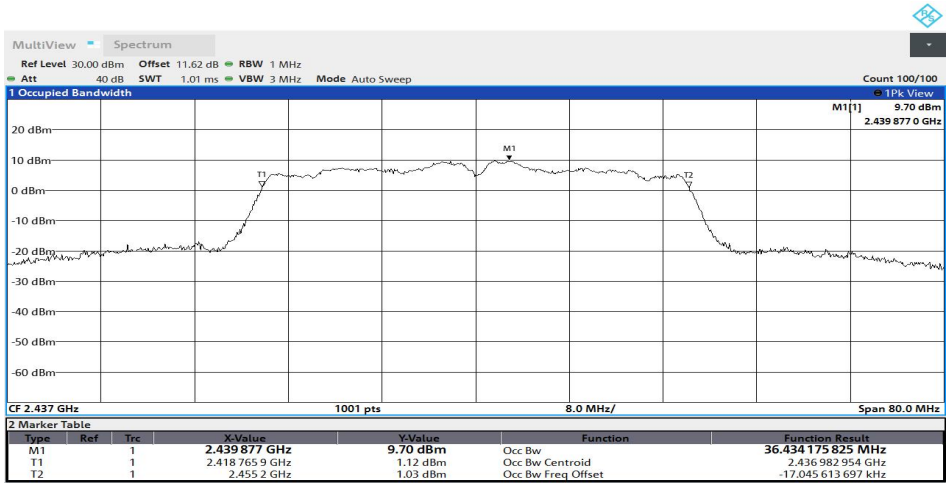
11N20SISO-Ant1-2437



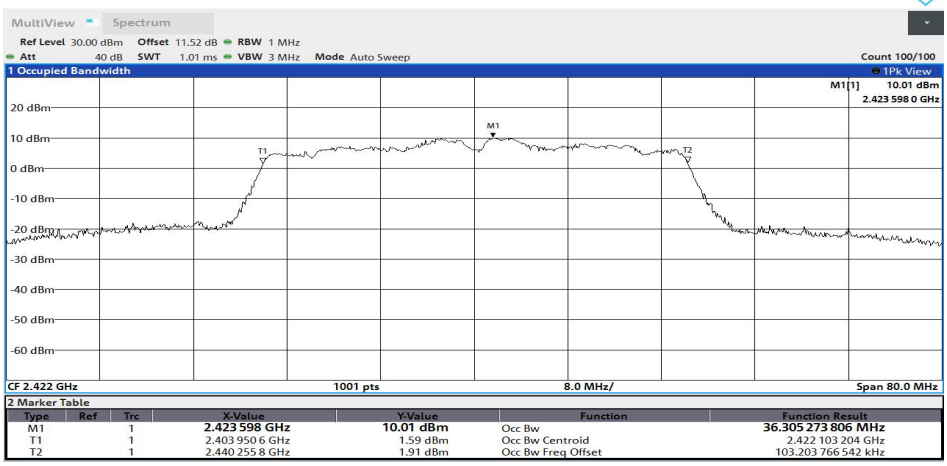
11N20SISO-Ant1-2462



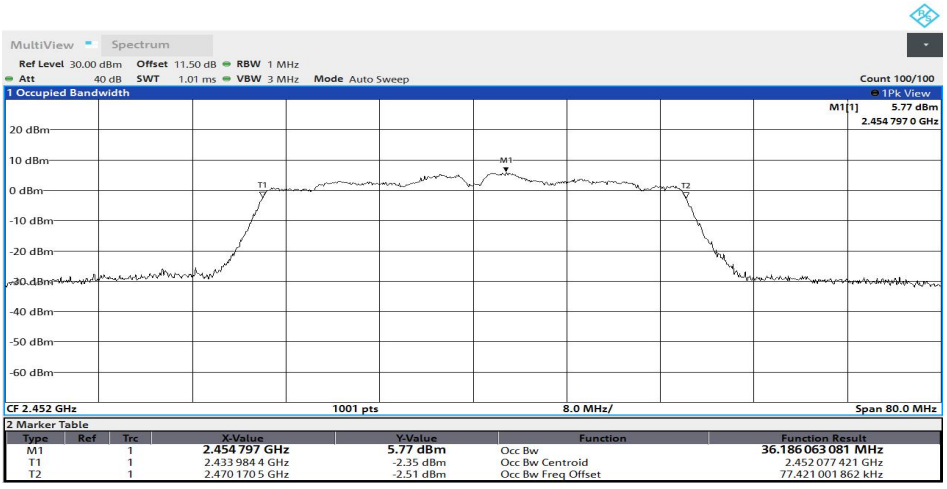
11N40SISO-Ant1-2437



11N40SISO-Ant1-2422



11N40SISO-Ant1-2452



6.5. Band Edges Compliance

Specifications:	FCC 47 Part 15.247(d)
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(d)	>30

Measurement Uncertainty:

Measurement Uncertainty	±0.94dBm/KHz

Test procedures

The measurement is according to ANSI C63.10 clause11.13.

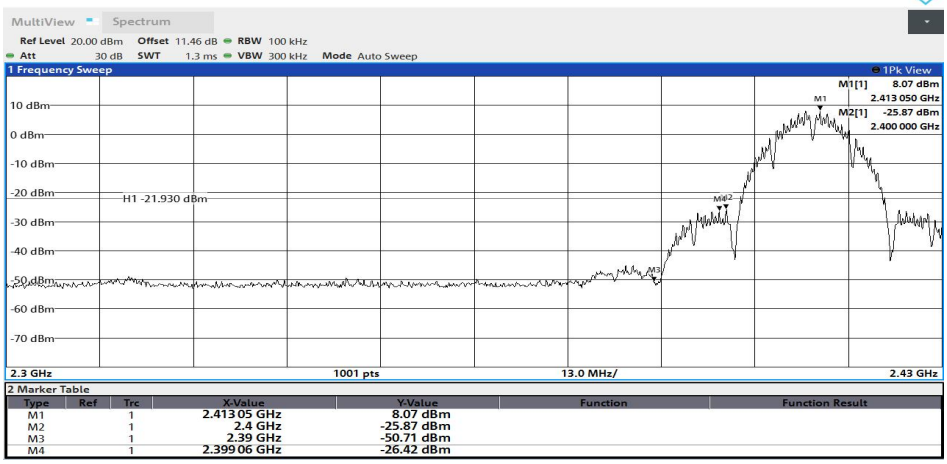
1. The output power of EUT was connected to the spectrum analyzer. The path loss was compensated to the results for each measurement.
2. Enable EUT transmitter maximum power continuously.
3. Set instrument center frequency to the frequency of the emission to be measured (must be within 2MHz of the authorized band edge).
4. Set span to 2 MHz.
5. RBW = 100 kHz.
6. VBW ≥ [3 × RBW].
7. Detector = peak.
8. Sweep time = auto.
9. Trace mode = max hold.
10. Allow sweep to continue until the trace stabilizes

Measurement results

TestMode	Antenna	ChName	Frequency[MHz]	RefLevel[dBm]	Result[dBm]	Limit[dBm]	Verdict
11B	Ant1	Low	2412	8.07	-26.42	≤-21.93	PASS
11B	Ant1	High	2462	6.85	-47	≤-23.15	PASS
11G	Ant1	Low	2412	1.12	-29.86	≤-28.88	PASS
11G	Ant1	High	2462	4.42	-40.75	≤-25.58	PASS
11N20SISO	Ant1	Low	2412	-2.37	-32.58	≤-32.37	PASS
11N20SISO	Ant1	High	2462	4.41	-37.82	≤-25.59	PASS
11N40SISO	Ant1	Low	2422	-1.10	-31.97	≤-31.1	PASS
11N40SISO	Ant1	High	2452	-2.10	-38.91	≤-32.1	PASS

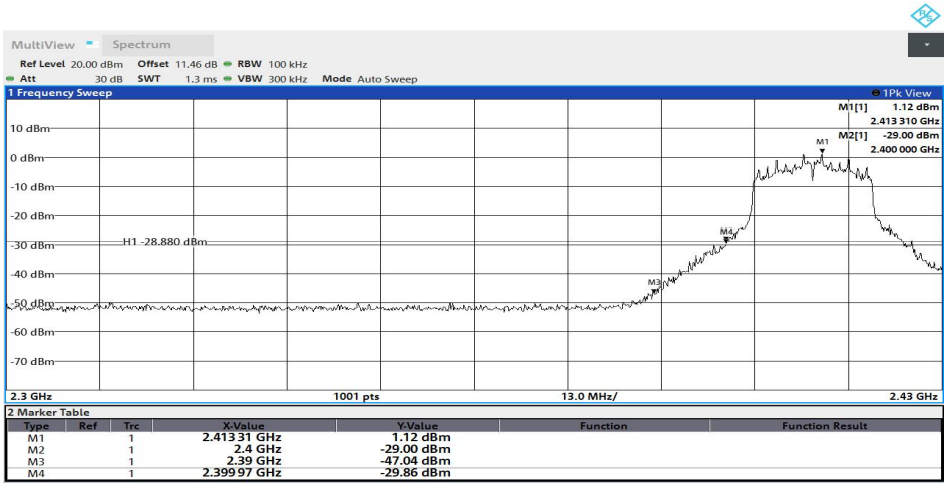
Conclusion: PASS

11B-Ant1-Low-2412-8.60

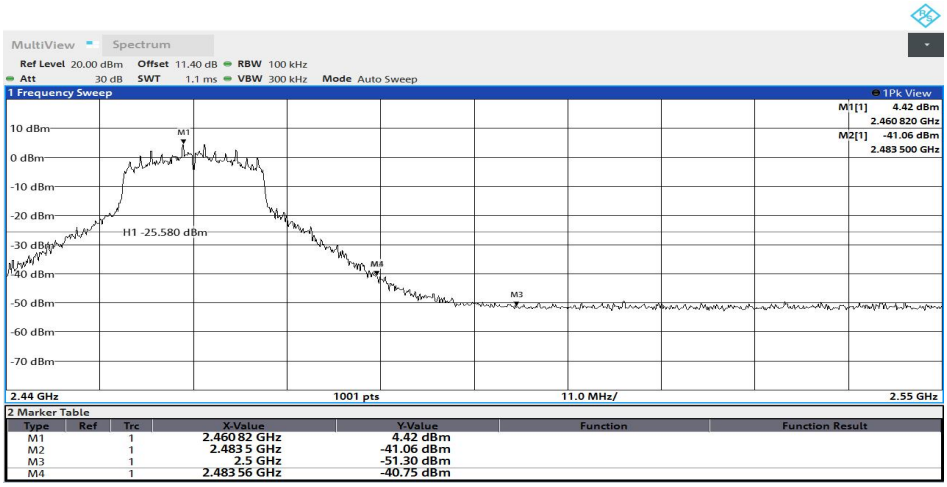


11B-Ant1-High-2462-6.51

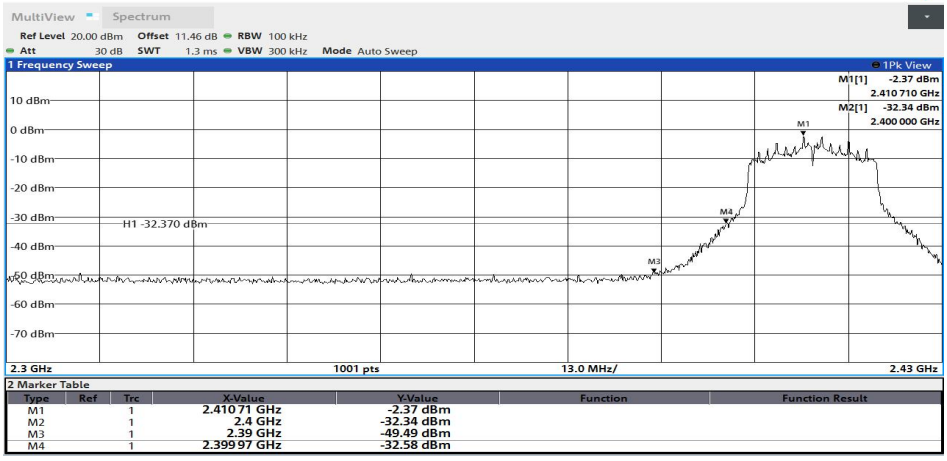
11G-Ant1-Low-2412--1.31



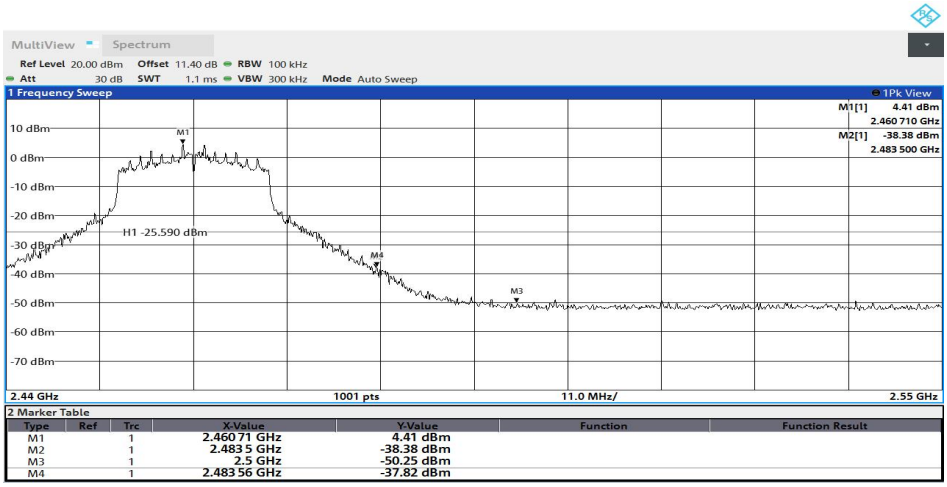
11G-Ant1-High-2462--0.84



11N20SISO-Ant1-Low-2412--1.05



11N20SISO-Ant1-High-2462--0.20



11N40SISO-Ant1-Low-2422--1.10