TEST REPORT

Report No.:	TW2202136E
File reference No.:	2022-03-26
Applicant:	Dragino Technology Co., Limited
Product:	Wireless module
Model No.:	R8601
Trademark:	DRAGINO
Test Standards:	FCC Part 15.247
Test result:	It is herewith confirmed and found to comply with the requirements set up by ANSI C63.10, FCC Part 15.247 for the evaluation of electromagnetic compatibility

Approved By:

Terry Tang

Manager

Dated: March 26, 2022

Results appearing herein relate only to the sample tested

The technical reports is issued errors and omissions exempt and is subject to withdrawal at

SHENZHEN TIMEWAY TESTING LABORATORIES

Zone C, 1st Floor, Block B, Jun Xiang Da Building, Zhongshan Park Road West, Tong Le Village, Nanshan District, Shenzhen, China

Tel (755) 83448688, Fax (755) 83442996, E-Mail:info@timeway-lab.com

Special Statement:

The testing quality ability of our laboratory meet with "Quality Law of People's Republic of China" Clause 19.

The testing quality system of our laboratory meet with ISO/IEC-17025 requirements, which is approved by CNAL. This approval result is accepted by MRA of APLAC.

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

CNAL-LAB Code: L2292

The EMC Laboratory has been assessed and in compliance with CNAL/AC01:2002 accreditation criteria for testing Laboratories (identical to ISO/IEC 17025:2005 General Requirements) for the Competence of testing Laboratories.

FCC-Registration No.: 744189

The EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications commission. The acceptance letter from the FCC is maintained in our files. Registration No.: 744189.

Industry Canada (IC) —Registration No.:5205A

The EMC Laboratory has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 5205A.

A2LA (Certification Number:5013.01)

The EMC Laboratory has been accredited by the American Association for Laboratory Accreditation (A2LA). Certification Number:5013.01

Test Report Conclusion

Content

1.0 General Details

1.1 Test Lab Details

Name: SHENZHEN TIMEWAY TESTING LABORATORIES.

Address: Zone C, 1st Floor, Block B, Jun Xiang Da Building, Zhongshan Park Road West, Tong Le Village, Nanshan District, Shenzhen, China

Telephone: (755) 83448688

Fax: (755) 83442996

Site Listed with Federal Communications commission (FCC)

Registration Number:744189

For 3m Anechoic Chamber

Site Listed with Industry Canada of Ottawa, Canada

Registration Number: IC: 5205A

For 3m Anechoic Chamber

1.2 Applicant Details

Applicant: Dragino Technology Co., Limited

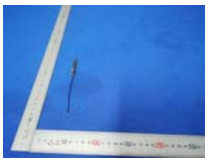
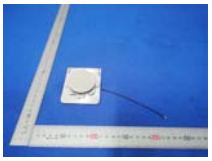
Address: Room 202, Block B, BCT Incubation Bases, No.8 CaiYunRoad LongCheng Street, LongGang District; Shenzhen 518116, China

Telephone: --

Fax: --

1.3 Description of EUT

Product:	Wireless module
Manufacturer:	Dragino Technology Co., Limited
Address:	Room 202, Block B, BCT Incubation Bases, No.8 CaiYunRoad LongCheng Street, LongGang District; Shenzhen 518116, China
Trademark:	DRAGINO
Model Number:	R8601
Additional Model Number:	N/A
Hardware Version:	V2.1
Software Version:	V2.1
Serial No.:	S/N:00000001
Type of Modulation	IEEE 802.11b: DSSS (CCK, QPSK, DBPSK)
	IEEE 802.11g/n (HT20, HT40): OFDM (64QAM, 16QAM, QPSK, BPSK)
Frequency range	IEEE 802.11b/g/n (HT20): 2412-2462MHz;
	IEEE 802.11n HT40: 2422-2452MHz;
Channel Spacing	5MHz for IEEE 802.11b/g/n (HT20, HT40)
Air Data Rate	IEEE 802.11b: 11, 5.5, 2, 1 Mbps
	IEEE 802.11g: 54, 48,36, 24, 18, 12, 9, 6 Mbps

	IEEE 802.11n HT20/HT40: mcs0-mcs7
Frequency Selection	By software
Channel Number	IEEE 802.11b/g/n (HT20): 11 Channels; IEEE 802.11n (HT40): 7 Channels;
Antenna Connector:	Male IPEX antenna connector
Antenna:	Alternative integral antennas provided to the EUT.
ANT 1:	 with Gain 2.0dBi maximum (Get from the antenna specification)
ANT 2:	 with Gain 3.0dBi maximum (Get from the antenna specification)
Rating:	DC3.3V

1.4 Submitted Sample: 2 Samples

1.5 Test Duration

2022-02-19 to 2022-03-26

1.6 Test Uncertainty

Conducted Emissions Uncertainty =3.6dB

Radiated Emissions below 1GHz Uncertainty =4.7dB

Radiated Emissions above 1GHz Uncertainty =6.0dB

Conducted Power Uncertainty =6.0dB

Occupied Channel Bandwidth Uncertainty =5%

Note: The measurement uncertainty is for coverage factor of k=2 and a level of confidence of 95%.

1.7 Test Engineer

The sample tested by Andy Xing

Print Name: Andy Xing

2.0 Test Equipment					
Instrument Type	Manufacturer	Model	Serial No.	Date of Cal.	Due Date
ESPI Test Receiver	R&S	ESPI 3	100379	2021-06-18	2022-06-17
Impuls-Begrenzer	R&S	ESH3-Z2	100281	2021-06-18	2022-06-17
Loop Antenna	EMCO	6507	00078608	2021-06-18	2024-06-17
Spectrum	R&S	FSIQ26	100292	2021-06-18	2022-06-17
Horn Antenna	A-INFO	LB-180400-KF	CON21060660	2021-07-02	2024-07-02
Horn Antenna	R&S	BBHA 9120D	9120D-631	2021-07-02	2024-07-02
Power meter	Anritsu	ML2487A	6K00003613	2021-06-18	2022-06-17
Power sensor	Anritsu	MA2491A	32263	2021-06-18	2022-06-17
Bilog Antenna	Schwarebeck	VULB9163	9163/340	2021-07-02	2024-07-01
9*6*6 Anechoic	--	--	N/A	2021-07-02	2022-07-15
EMI Test Receiver	RS	ESVB	826156/011	2021-06-18	2022-06-17
EMI Test Receiver	RS	ESH3	860904/006	2021-06-18	2022-06-17
Spectrum	HP/Agilent	ESA-L1500A	US37451154	2021-06-18	2022-06-17
Spectrum	HP/Agilent	E4407B	MY50441392	2021-06-18	2022-06-17
Spectrum	RS	FSP	1164.4391.38	2022-01-14	2023-01-13
RF Cable	Zhengdi	ZT26-NJ-NJ-8 M/FA	--	2021-06-18	2022-06-17
RF Cable	Zhengdi	7m	--	2021-06-18	2022-06-17
RF Switch	EM	EMSW18	060391	2021-06-18	2022-06-17
Pre-Amplifier	Schwarebeck	BBV9743	#218	2021-06-18	2022-06-17
Pre-Amplifier	HP/Agilent	8449B	3008A00160	2021-06-18	2022-06-17
LISN	SCHAFFNER	NNB42	00012	2022-01-05	2023-01-04

2.2 Automation Test Software

For Conducted Emission Test

Name	Version
EZ-EMC	Ver.EMC-CON 3A1.1

For Radiated Emissions

Name	Version
EMI Test Software BL410-EV18.91	V18.905
EMI Test Software BL410-EV18.806 High Frequency	V18.06

3. DESCRIPTION OF TEST MODES

IEEE 802.11b, 802.11g, 802.11n (HT20) mode

The EUT had been tested under operating condition. There are three channels have been tested as following:

Channel	Frequency (MHz)
Low	2412
Middle	2437
High	2462

IEEE 802.11b mode: 1Mbps data rate (worst case) was chosen for full testing. IEEE 802.11g mode: 6Mbps data rate (worst case) was chosen for full testing. IEEE 802.11n (HT20) mode: mcs0 (worst case) were chosen for full testing

IEEE 802.11n (HT40) mode

The EUT had been tested under operating condition. There are three channels have been tested as following:

Channel	Frequency (MHz)
Low	2422
Middle	2437
High	2452

IEEE 802.11n (HT40) mode: mcs0 data rate (worst case) were chosen for full testing

Note: During the test, the duty cycle was set up to >98%

3.0 Technical Details

3.1 Summary of test results

The EUT has been tested according to the following specifications:

Standard	Test Type	Result	Notes
FCC Part 15, Paragraph15.203	Antenna Requirement	Pass	Complies
FCC Part 15, Paragraph15.207	Conducted Emission Test	Pass	Complies
FCC Part 15 Subpart C Paragraph 15.247(a)(2) Limit	Spectrum bandwidth of a Orthogonal Frequency Division Multiplex System Limit: 6dB bandwidth>500kHz	Pass	Complies
FCC Part 15, Paragraph 15.247(b)	Maximum peak output power Limit: max. 30dBm	Pass	Complies
FCC Part 15, Paragraph 15.109,15.205 & 15.209	Transmitter Radiated Emission Limit: Table 15.209	Pass	Complies
FCC Part 15, Paragraph 15.247(e)	Power Spectral Density Limit: max. 8dBm/3kHz	Pass	Complies
FCC Part 15, Paragraph 15.247(d)	Out of Band Emission and Restricted Band Radiation Limit: 20dB less than peak value of fundamental frequency Restricted band limit: Table 15.209	Pass	Complies

3.2 Test Standards

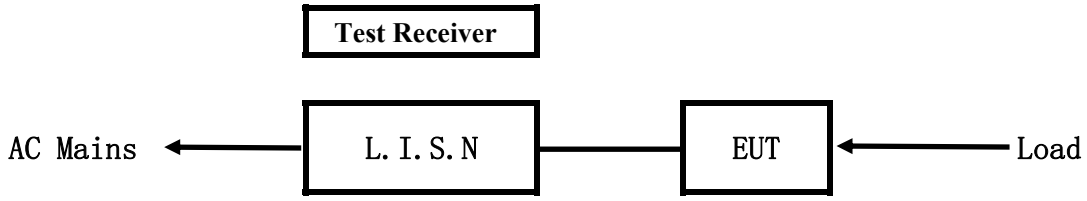
FCC Part 15 Subpart & Subpart C, Paragraph 15.247

4.0 EUT Modification

No modification by SHENZHEN TIMEWAY TESTING LABORATORIES.

5.0 Power Line Conducted Emission Test

5.1 Schematics of the test



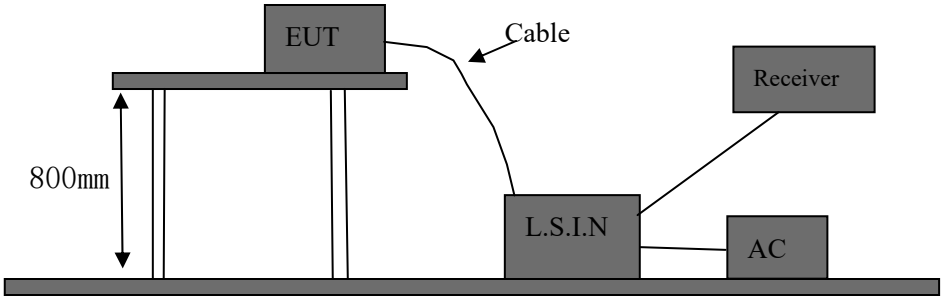
EUT: Equipment Under Test

5.2 Test Method and test Procedure

The EUT was tested according to ANSI C63.10-2013.The Frequency spectrum From 0.15MHz to 30MHz was investigated. The LISN used was 50ohm/50uH as specified by section 5.1 of ANSI C63.10 –2013.

Test Voltage: 120V~, 60Hz

Block diagram of Test setup



5.3 Configuration of The EUT

The EUT was configured according to ANSI C63.10-2013. All interface ports were connected to the appropriate peripherals. All peripherals and cables are listed below.

A. EUT

Device	Manufacturer	Model	FCC ID
Wireless module	Dragino Technology Co., Limited	R8601	ZHZR8601

B. Internal Device

Device	Manufacturer	Model	FCC ID/DOC
N/A			

C. Peripherals

Device	Manufacturer	Model	FCC ID/DOC	Cable
PC	DELL	P54G	--	--

5.4 EUT Operating Condition

Operating condition is according to ANSI C63.10-2013.

A Setup the EUT and simulators as shown on follow

B Enable AF signal and confirm EUT active to normal condition

5.5 Power line conducted Emission Limit according to Paragraph 15.207

Frequency (MHz)	Limits (dB μ V)	
	Quasi-peak Level	Average Level
0.15 ～ 0.50	66.0～56.0*	56.0～46.0*
0.50 ～ 5.00	56.0	46.0
5.00 ～ 30.00	60.0	50.0

Notes: 1. *Decreasing linearly with logarithm of frequency.

2. The tighter limit shall apply at the transition frequencies

5.6 Test Results

The frequency spectrum from 0.15MHz to 30MHz was investigated. All reading are quasi-peak values with a resolution bandwidth of 9kHz.

A: Conducted Emission on Live Terminal (150kHz to 30MHz)

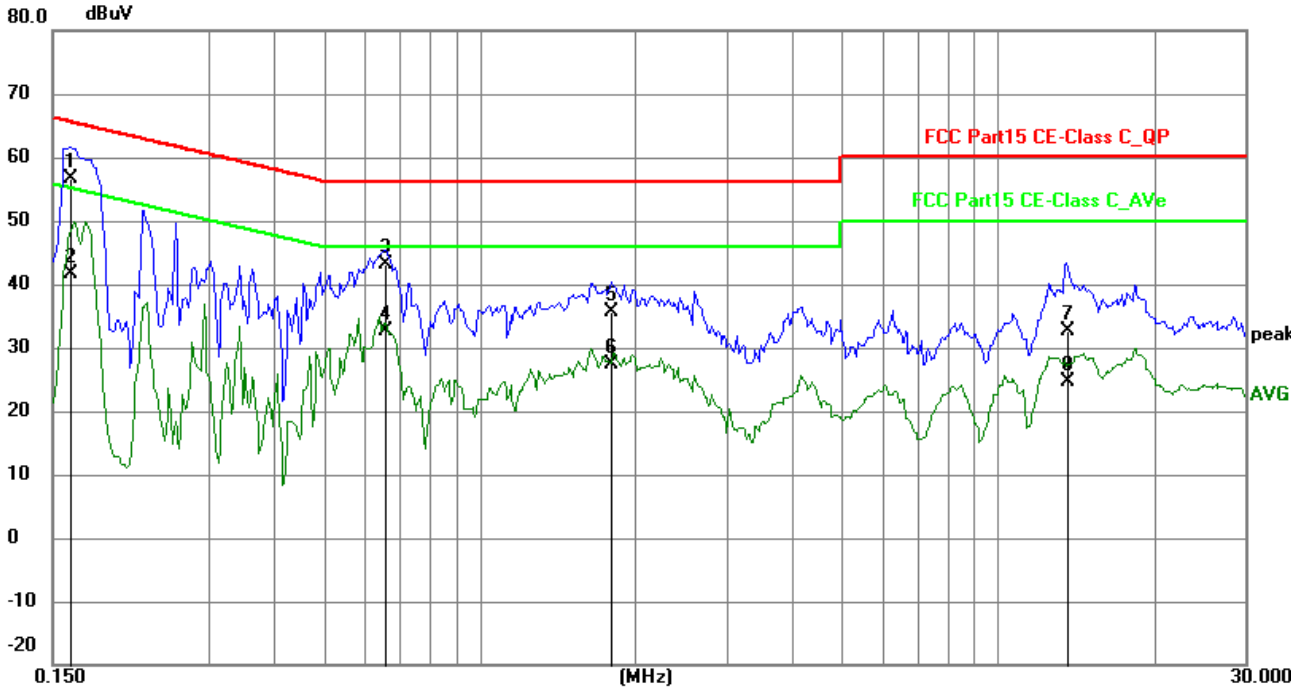
EUT Operating Environment

Temperature: 26℃ Humidity: 65%RH Atmospheric Pressure: 101 kPa

EUT set Condition: Keep WIFI Transmitting

Results: Pass

Please refer to following diagram for individual



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F
1	0.1617	46.80	9.78	56.58	65.38	-8.80	QP	P
2	0.1617	31.95	9.78	41.73	55.38	-13.65	AVG	P
3	0.6570	33.27	9.78	43.05	56.00	-12.95	QP	P
4	0.6570	22.73	9.78	32.51	46.00	-13.49	AVG	P
5	1.7997	25.82	9.80	35.62	56.00	-20.38	QP	P
6	1.7997	17.49	9.80	27.29	46.00	-18.71	AVG	P
7	13.5612	22.37	10.32	32.69	60.00	-27.31	QP	P
8	13.5612	14.43	10.32	24.75	50.00	-25.25	AVG	P

B: Conducted Emission on Neutral Terminal (150kHz to 30MHz)

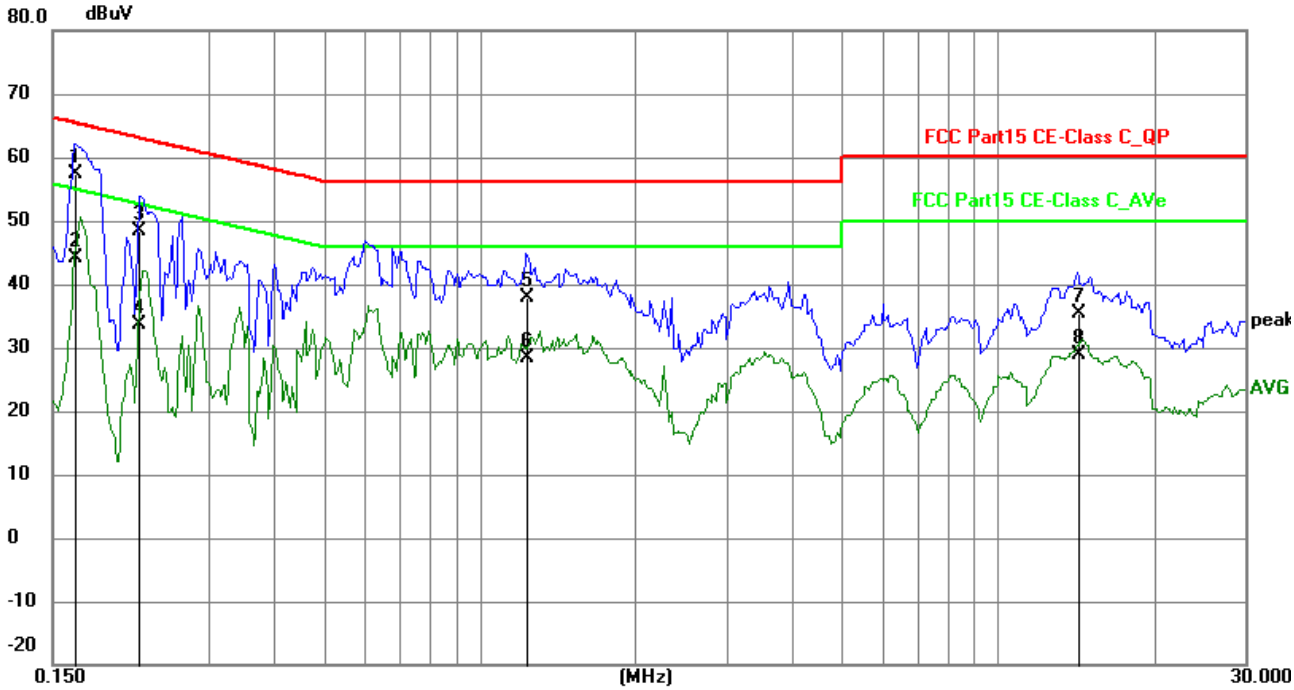
EUT Operating Environment

Temperature: 26℃ Humidity: 65%RH Atmospheric Pressure: 101 kPa

EUT set Condition: Keep WIFI Transmitting

Results: Pass

Please refer to following diagram for individual



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F
1	0.1655	47.73	9.77	57.50	65.18	-7.68	QP	P
2	0.1655	34.27	9.77	44.04	55.18	-11.14	AVG	P
3	0.2202	38.58	9.75	48.33	62.81	-14.48	QP	P
4	0.2202	23.77	9.75	33.52	52.81	-19.29	AVG	P
5	1.2342	28.13	9.79	37.92	56.00	-18.08	QP	P
6	1.2342	18.63	9.79	28.42	46.00	-17.58	AVG	P
7	14.2476	25.07	10.35	35.42	60.00	-24.58	QP	P
8	14.2476	18.42	10.35	28.77	50.00	-21.23	AVG	P

6 Radiated Emission Test

6.1 Test Method and test Procedure:

(1) The EUT was tested according to ANSI C63.10-2013. The radiated test was performed at Timeway EMC Laboratory. This site is on file with the FCC laboratory division, Registration No. 744189

(2) The EUT, peripherals were put on the turntable which table size is 1m x 1.5 m, table high 0.8 m. All set up is according to ANSI C63.10-2013.

(3) The frequency spectrum from 30 MHz to 25 GHz was investigated. All readings from 30 MHz to 1 GHz are Quasi-peak values with a resolution bandwidth of 120 kHz. F For measurement above 1GHz, peak values with RBW=1MHz VBW=3MHz and PK detector. AV value with RBW=1MHz, VBW=3MHz and RMS detector. Measurements were made at 3 meters.

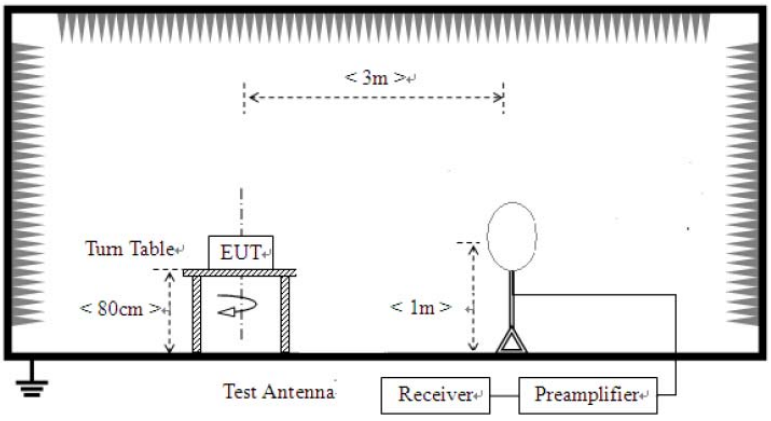
(4) The antenna high is varied from 1 m to 4 m high to find the maximum emission for each frequency.

(5) Maximizing procedure was performed on the six (6) highest emissions to ensure EUT compliance is with all installation combinations. All data was recorded in the peak detection mode. Quasi-peak readings was performed only when an emission was found to be marginal (within -4 dB of specification limit), and are distinguished with a "**QP**" in the data table.

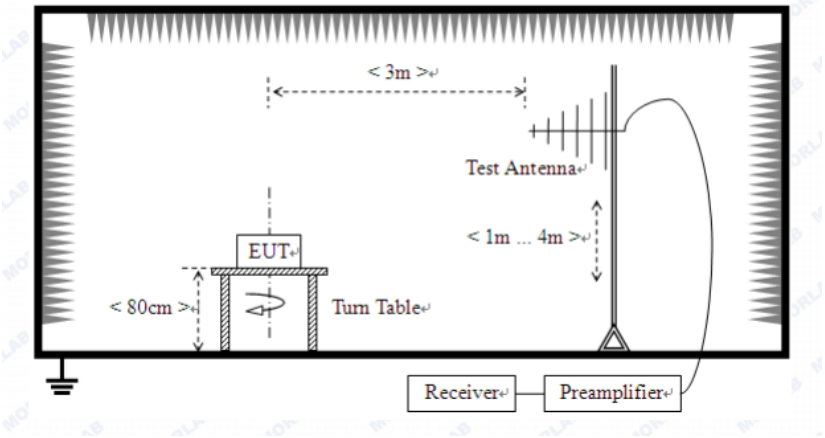
(6) The antenna polarization: Vertical polarization and Horizontal polarization.

Block diagram of Test setup

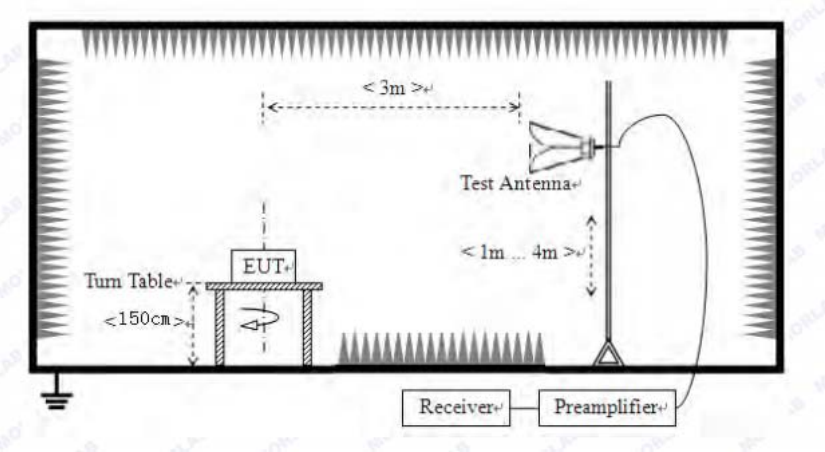
For radiated emissions from 9kHz to 30MHz



For radiated emissions from 30MHz to1GHz



For radiated emissions above 1GHz



6.2 Configuration of The EUT

Same as section 5.3 of this report

6.3 EUT Operating Condition

Same as section 5.4 of this report.

6.4 Radiated Emission Limit

All emission from a digital device, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strength specified below:

Frequencies in restricted band are compiled to limit on Paragraph 15.209

Frequency Range (MHz)	Distance (m)	Field strength (dB μ V/m)
0.009-0.490	3	20log(2400/F(kHz)) +40log (300/3)
0.490-1.705	3	20log(24000/F(kHz)) +40log (30/3)
1.705-30	3	69.5
30-88	3	40.0
88-216	3	43.5
216-960	3	46.0
Above 960	3	54.0

Note: 1. RF Voltage (dBuV) = 20 log RF Voltage (uV)

2. In the Above Table, the higher limit applies at the band edges.

3. Distance refers to the distance in meters between the measuring instrument antenna and the EUT

4. Worse case were recorded in the test report. 802.11b was the worst case.

Note: Test data for ANT 1 from page 16-19

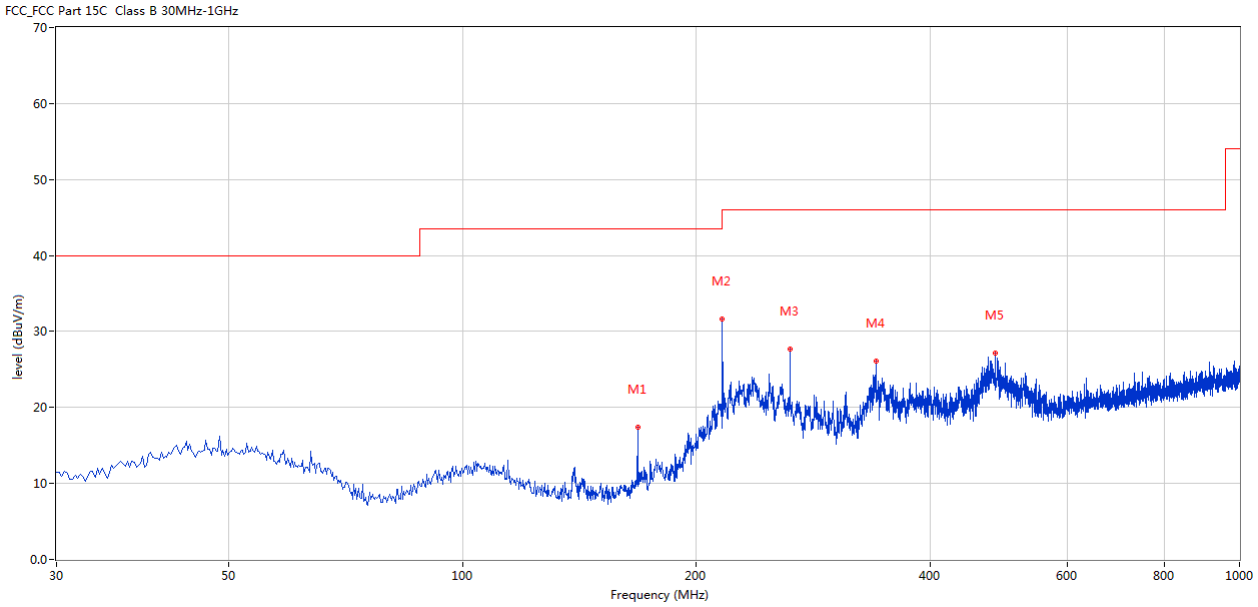
Test result

General Radiated Emission Data and Harmonics Radiated Emission Data

Radiated Emission In Horizontal (30MHz----1000MHz)

EUT set Condition: **Keep Transmitting**

Results: **Pass**



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	167.948	17.45	-16.14	43.5	-26.05	Peak	286.00	100	Horizontal	Pass
2	215.951	31.58	-13.60	43.5	-11.92	Peak	301.00	100	Horizontal	Pass
3	263.954	27.70	-11.79	46.0	-18.30	Peak	252.00	100	Horizontal	Pass
4	340.322	26.07	-9.79	46.0	-19.93	Peak	229.00	100	Horizontal	Pass
5	485.059	27.22	-7.28	46.0	-18.78	Peak	100.00	100	Horizontal	Pass

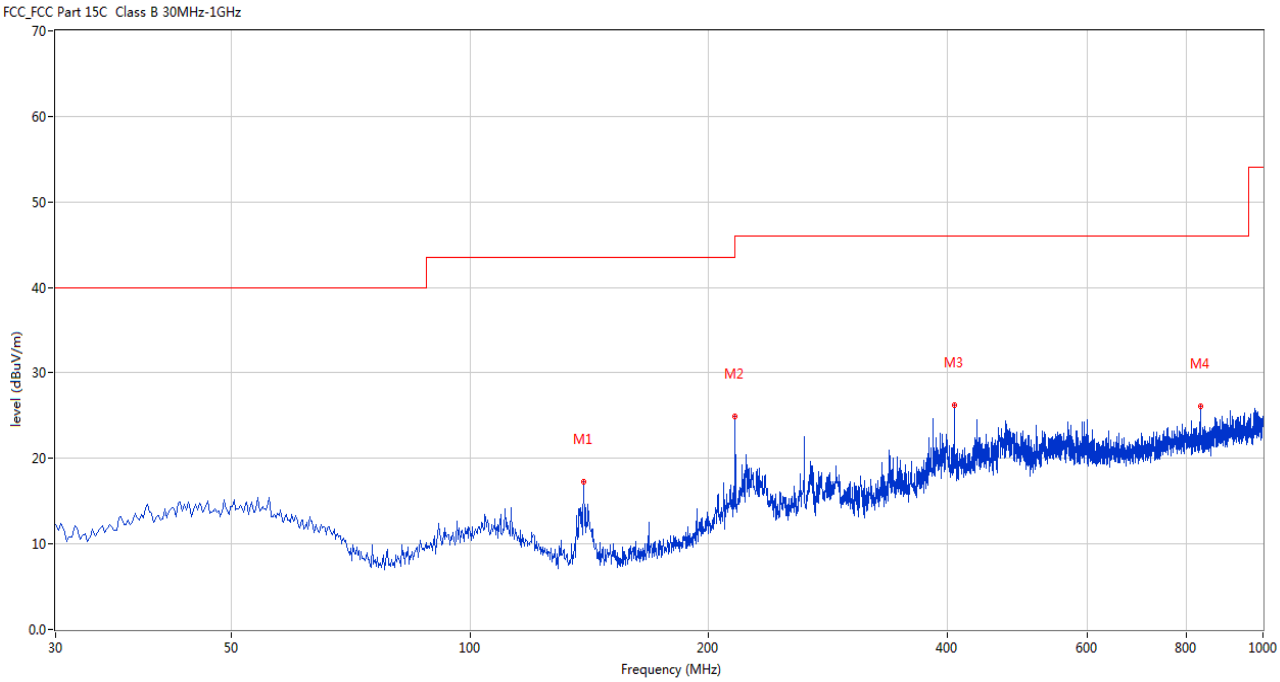
Test result

General Radiated Emission Data and Harmonics Radiated Emission Data

Radiated Emission In Vertical (30MHz----1000MHz)

EUT set Condition: **Keep Transmitting**

Results: **Pass**



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	139.098	17.30	-17.21	43.5	-26.20	Peak	342.00	100	Vertical	Pass
2	215.951	24.92	-13.60	43.5	-18.58	Peak	265.00	100	Vertical	Pass
3	407.963	26.18	-8.47	46.0	-19.82	Peak	359.00	100	Vertical	Pass
4	833.444	26.15	-2.82	46.0	-19.85	Peak	220.00	100	Vertical	Pass

Operation Mode: Transmitting under CH01 for 802.11b mode

Frequency (MHz)	Level@3m (dB μ V/m)	Antenna Polarity	Limit@3m (dB μ V/m)
4824.00	60.82（PK）/ 47.18 (AV)	H	74(Peak)/ 54(AV)
4824.00	57.32（PK）/ 44.09 (AV)	V	74(Peak)/ 54(AV)
7236.00	--	H/V	74(Peak)/ 54(AV)
9648.00	--	H/V	74(Peak)/ 54(AV)
12060	--	H/V	74(Peak)/ 54(AV)
14472	--	H/V	74(Peak)/ 54(AV)
16884	--	H/V	74(Peak)/ 54(AV)
19296	--	H/V	74(Peak)/ 54(AV)
21708	--	H/V	74(Peak)/ 54(AV)
24120	--	H/V	74(Peak)/ 54(AV)

Operation Mode: Transmitting under CH06 for 802.11b mode

Frequency (MHz)	Level@3m (dB μ V/m)	Antenna Polarity	Limit@3m (dB μ V/m)
4874.00	61.15（PK）/ 48.76 (AV)	H	74(Peak)/ 54(AV)
4874.00	57.62（PK）/ 44.38 (AV)	V	74(Peak)/ 54(AV)
7311.00	--	H/V	74(Peak)/ 54(AV)
9748.00	--	H/V	74(Peak)/ 54(AV)
12185	--	H/V	74(Peak)/ 54(AV)
14622	--	H/V	74(Peak)/ 54(AV)
17059	--	H/V	74(Peak)/ 54(AV)
19496	--	H/V	74(Peak)/ 54(AV)
21933	--	H/V	74(Peak)/ 54(AV)
24370	--	H/V	74(Peak)/ 54(AV)

Operation Mode: Transmitting under CH11 for 802.11b mode

Frequency (MHz)	Level@3m (dB μ V/m)	Antenna Polarity	Limit@3m (dB μ V/m)
4924	60.85（PK）/ 48.28 (AV)	H	74(Peak)/ 54(AV)
4924	57.51（PK）/ 44.40 (AV)	V	74(Peak)/ 54(AV)
7368	--	H/V	74(Peak)/ 54(AV)
9848	--	H/V	74(Peak)/ 54(AV)
12310	--	H/V	74(Peak)/ 54(AV)
14772	--	H/V	74(Peak)/ 54(AV)
17234	--	H/V	74(Peak)/ 54(AV)
19696	--	H/V	74(Peak)/ 54(AV)
22158	--	H/V	74(Peak)/ 54(AV)
24620	--	H/V	74(Peak)/ 54(AV)

Note: Test data for ANT 2 from page 20-23

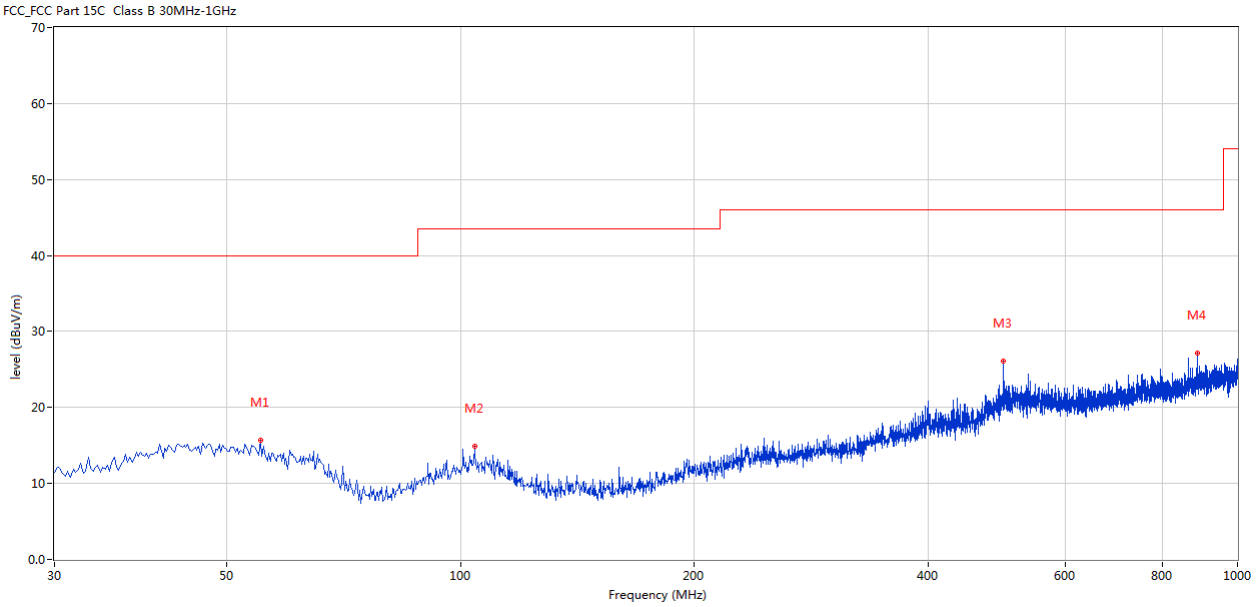
Test result

General Radiated Emission Data and Harmonics Radiated Emission Data

Radiated Emission In Horizontal (30MHz----1000MHz)

EUT set Condition: **Keep Transmitting**

Results: **Pass**



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	55.214	15.73	-11.83	40.0	-24.27	Peak	299.00	100	Horizontal	Pass
2	104.186	14.87	-13.30	43.5	-28.63	Peak	210.00	100	Horizontal	Pass
3	500.090	26.04	-6.91	46.0	-19.96	Peak	360.00	100	Horizontal	Pass
4	887.023	27.12	-2.08	46.0	-18.88	Peak	360.00	100	Horizontal	Pass

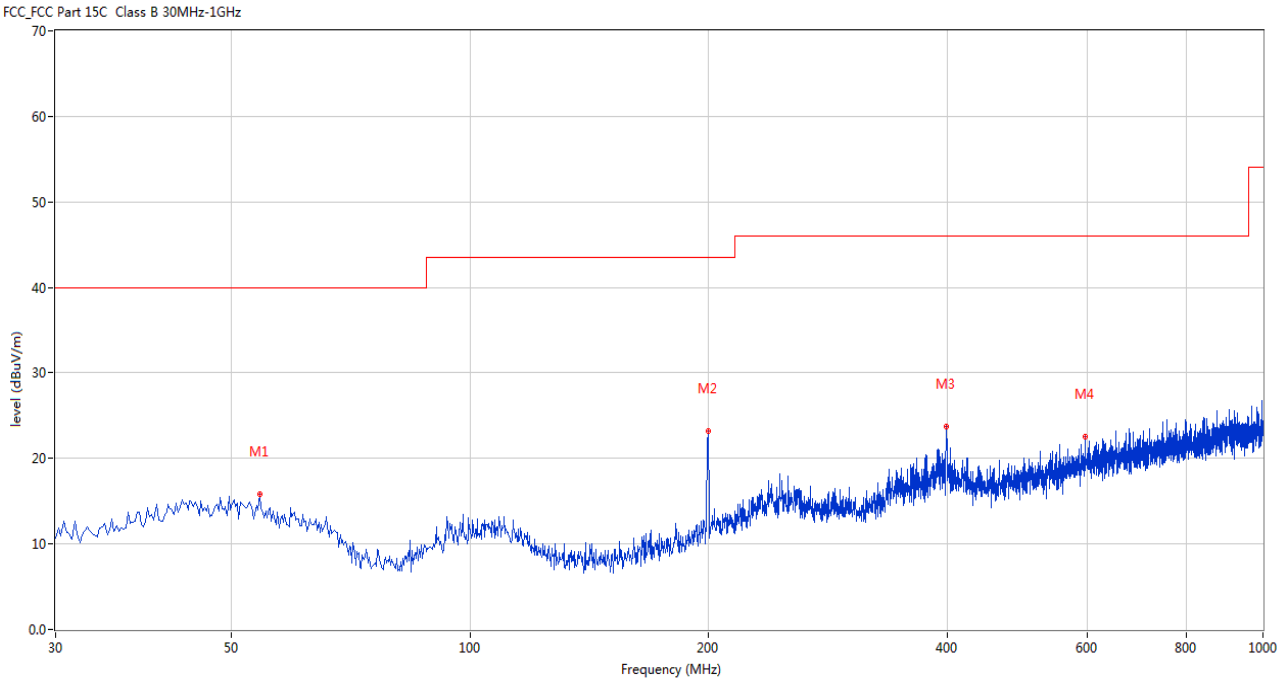
Test result

General Radiated Emission Data and Harmonics Radiated Emission Data

Radiated Emission In Vertical (30MHz----1000MHz)

EUT set Condition: **Keep Transmitting**

Results: **Pass**



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	54.244	15.88	-11.60	40.0	-24.12	Peak	336.00	100	Vertical	Pass
2	199.950	23.22	-13.45	43.5	-20.28	Peak	360.00	100	Vertical	Pass
3	398.508	23.68	-8.65	46.0	-22.32	Peak	321.00	100	Vertical	Pass
4	596.823	22.59	-5.11	46.0	-23.41	Peak	360.00	100	Vertical	Pass

Operation Mode: Transmitting under CH01 for 802.11b mode

Frequency (MHz)	Level@3m (dB μ V/m)	Antenna Polarity	Limit@3m (dB μ V/m)
4824.00	63.51（PK）/ 50.70 (AV)	H	74(Peak)/ 54(AV)
4824.00	59.85（PK）/ 46.59 (AV)	V	74(Peak)/ 54(AV)
7236.00	--	H/V	74(Peak)/ 54(AV)
9648.00	--	H/V	74(Peak)/ 54(AV)
12060	--	H/V	74(Peak)/ 54(AV)
14472	--	H/V	74(Peak)/ 54(AV)
16884	--	H/V	74(Peak)/ 54(AV)
19296	--	H/V	74(Peak)/ 54(AV)
21708	--	H/V	74(Peak)/ 54(AV)
24120	--	H/V	74(Peak)/ 54(AV)

Operation Mode: Transmitting under CH06 for 802.11b mode

Frequency (MHz)	Level@3m (dB μ V/m)	Antenna Polarity	Limit@3m (dB μ V/m)
4874.00	64.23（PK）/ 51.95 (AV)	H	74(Peak)/ 54(AV)
4874.00	60.03（PK）/ 46.88 (AV)	V	74(Peak)/ 54(AV)
7311.00	--	H/V	74(Peak)/ 54(AV)
9748.00	--	H/V	74(Peak)/ 54(AV)
12185	--	H/V	74(Peak)/ 54(AV)
14622	--	H/V	74(Peak)/ 54(AV)
17059	--	H/V	74(Peak)/ 54(AV)
19496	--	H/V	74(Peak)/ 54(AV)
21933	--	H/V	74(Peak)/ 54(AV)
24370	--	H/V	74(Peak)/ 54(AV)

Operation Mode: Transmitting under CH11 for 802.11b mode

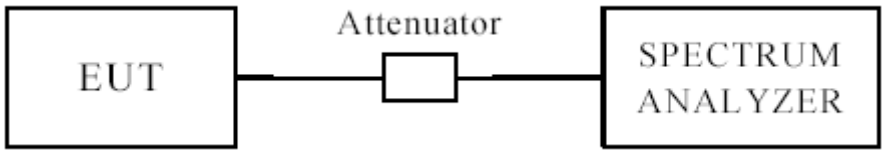
Frequency (MHz)	Level@3m (dB μ V/m)	Antenna Polarity	Limit@3m (dB μ V/m)
4924	63.41（PK）/ 50.52 (AV)	H	74(Peak)/ 54(AV)
4924	60.15（PK）/ 47.26 (AV)	V	74(Peak)/ 54(AV)
7368	--	H/V	74(Peak)/ 54(AV)
9848	--	H/V	74(Peak)/ 54(AV)
12310	--	H/V	74(Peak)/ 54(AV)
14772	--	H/V	74(Peak)/ 54(AV)
17234	--	H/V	74(Peak)/ 54(AV)
19696	--	H/V	74(Peak)/ 54(AV)
22158	--	H/V	74(Peak)/ 54(AV)
24620	--	H/V	74(Peak)/ 54(AV)

Note: 1. Level = Reading + AF + Cable - Preamp + Filter - Dist, Margin = Level - Limit

2. Remark "---" means that the emissions level is too low to be measured
3. For 802.11b mode at 1Mbps
4. For radiated Emissions from 18-25GHz and below 30MHz, it is only the floor noise and less than the limit for more than 20dB. No necessary to take down.
5. Note: the final peak measurement results less than the AV limit. No necessary to take down the final AV measurement result

7.0 6dB Bandwidth Measurement

7.1 Test Setup



7.2 Limits of 6dB Bandwidth Measurement

The minimum of 6dB Bandwidth Measurement is >500 kHz

7.3 Test Procedure

1. Set resolution bandwidth (RBW) = 100 kHz
2. Set the video bandwidth (VBW) ≥ 3 x RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

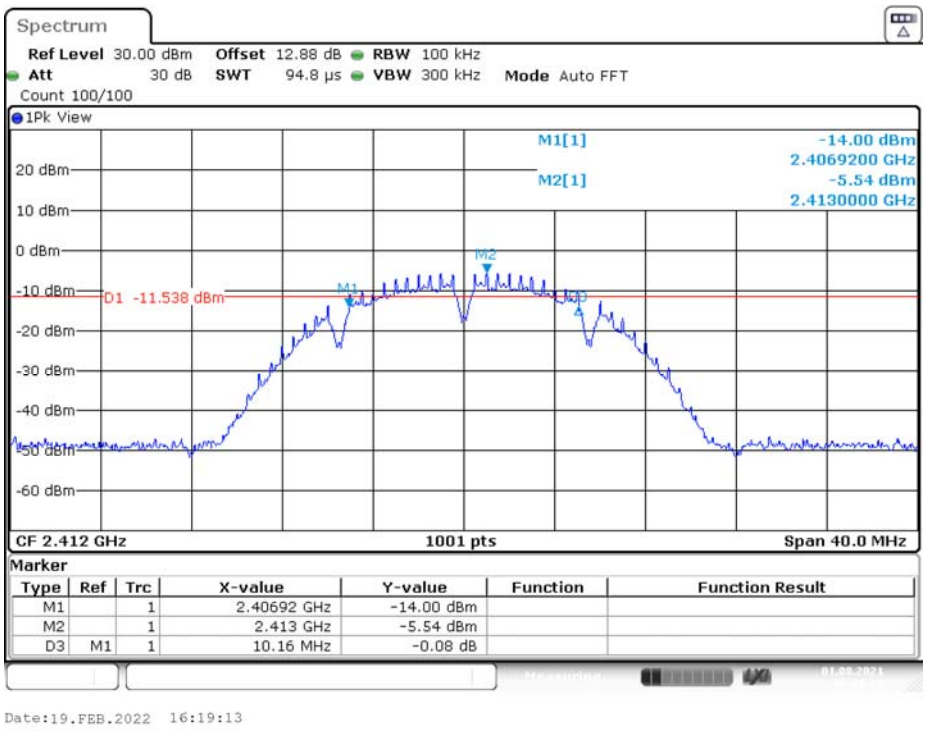
7.4 Test Result

6dB Occupied Bandwidth

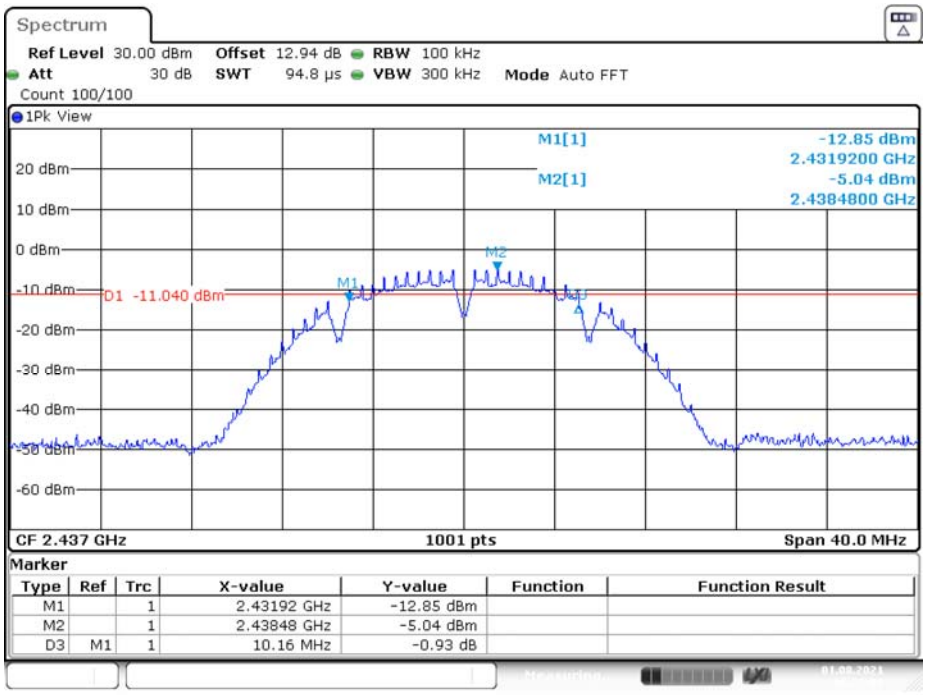
EUT	Wireless module	Model	R8601
Mode	802.11b	Test Voltage	DC3.3V
Temperature	24 deg. C,	Humidity	56% RH

Channel	Channel Frequency (MHz)	Data Transfer Rate (Mbps)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass/ Fail
1	2412	1	10.16	0.5	Pass
6	2437	1	10.16	0.5	Pass
11	2462	1	10.16	0.5	Pass

1. 802.11b at 1Mbps of CH01

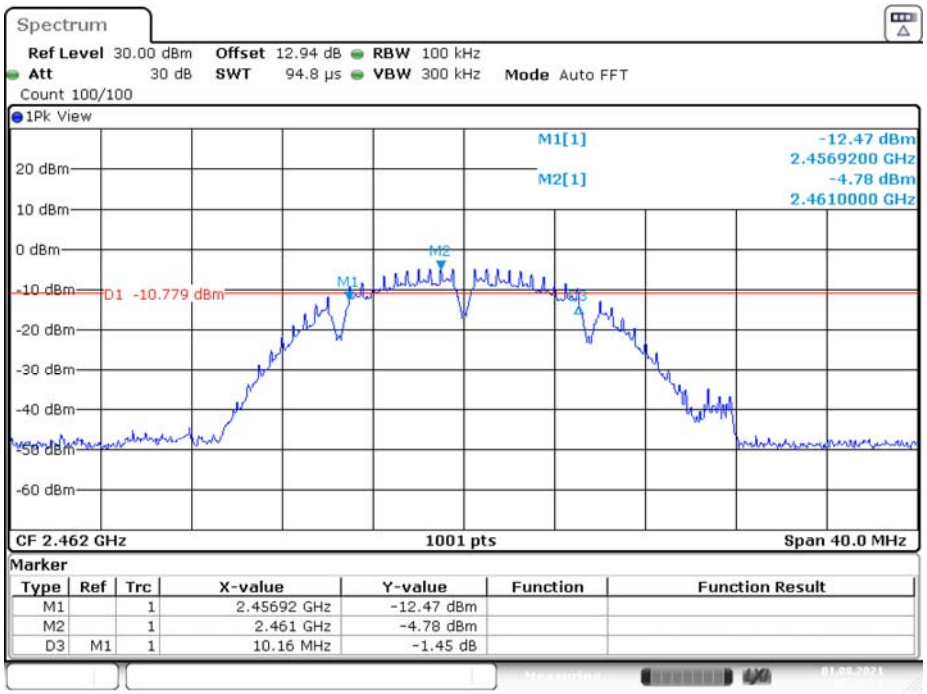


2. 802.11b at 1Mbps of CH06



Date:19.FEB.2022 16:23:09

3. 802.11b at 1Mbps of CH11



Date:19.FEB.2022 16:25:22

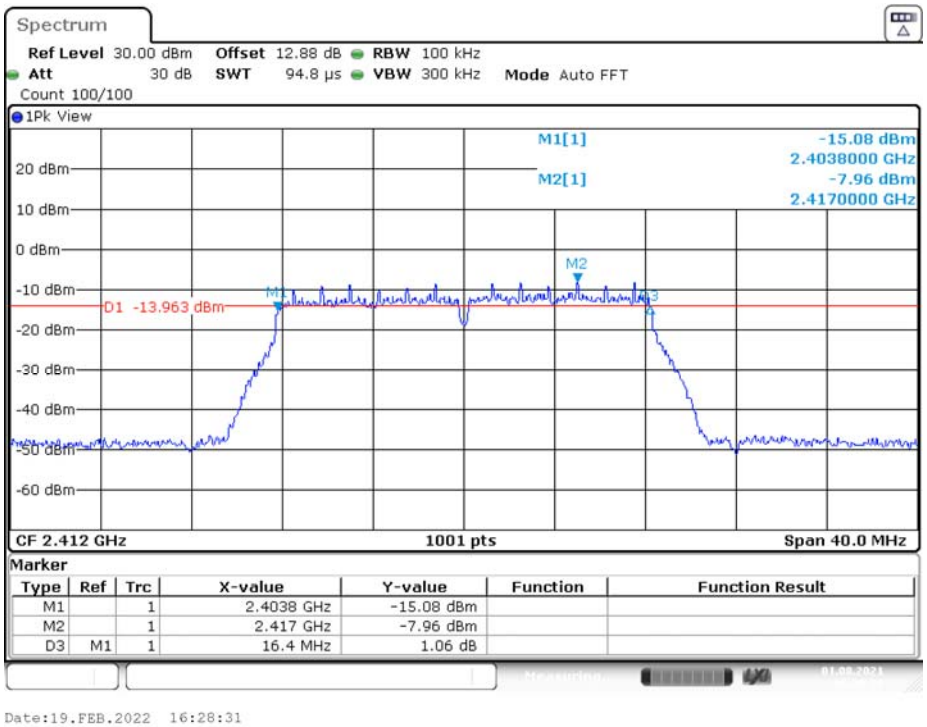
6dB Occupied Bandwidth

EUT	Wireless module	Model	R8601
Mode	802.11g	Test Voltage	DC3.3V
Temperature	24 deg. C,	Humidity	56% RH

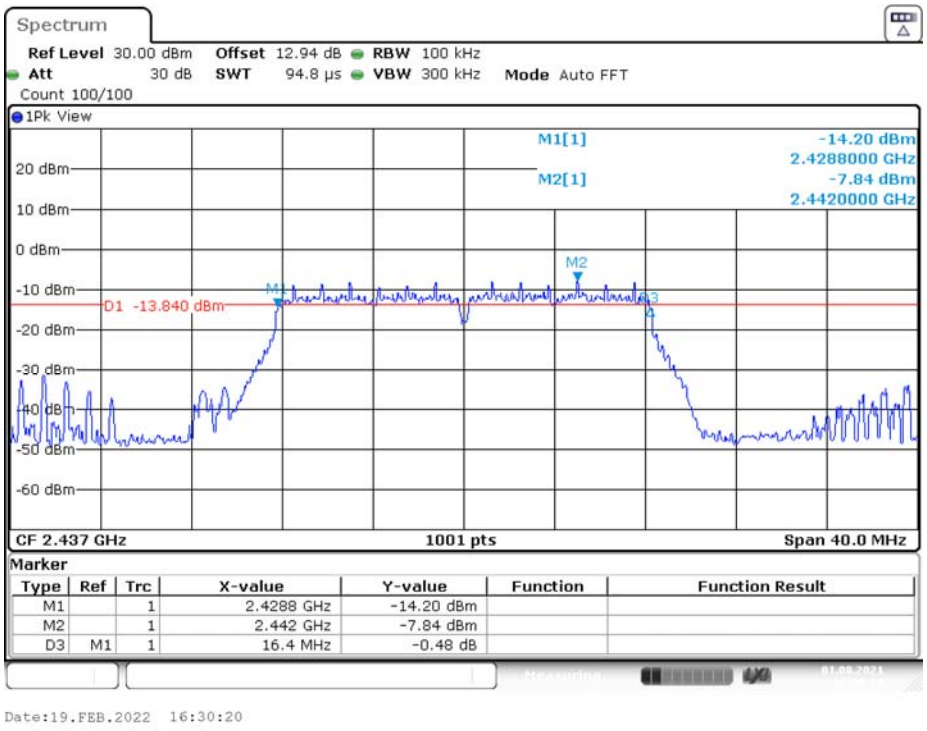
Channel	Channel Frequency (MHz)	Data Transfer Rate (Mbps)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass/ Fail
1	2412	6	16.40	0.5	Pass
6	2437	6	16.40	0.5	Pass
11	2462	6	16.44	0.5	Pass

Test Plots:

1. 802.11g at 6Mbps of CH01

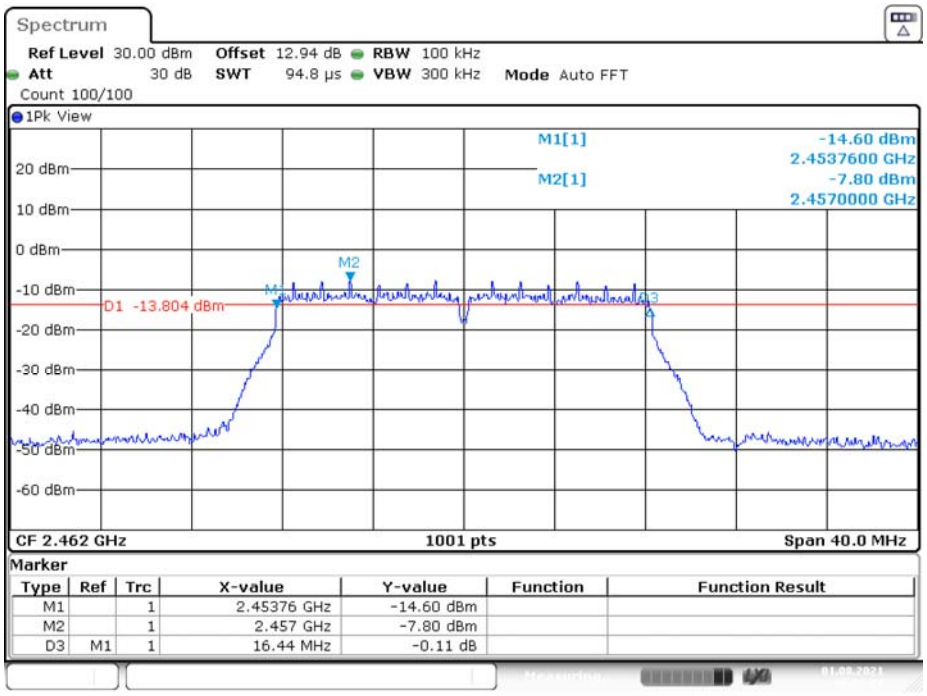


2. 802.11g at 6Mbps of CH06



Date:19.FEB.2022 16:30:20

3. 802.11g at 6Mbps of CH11



Date:19.FEB.2022 16:32:35

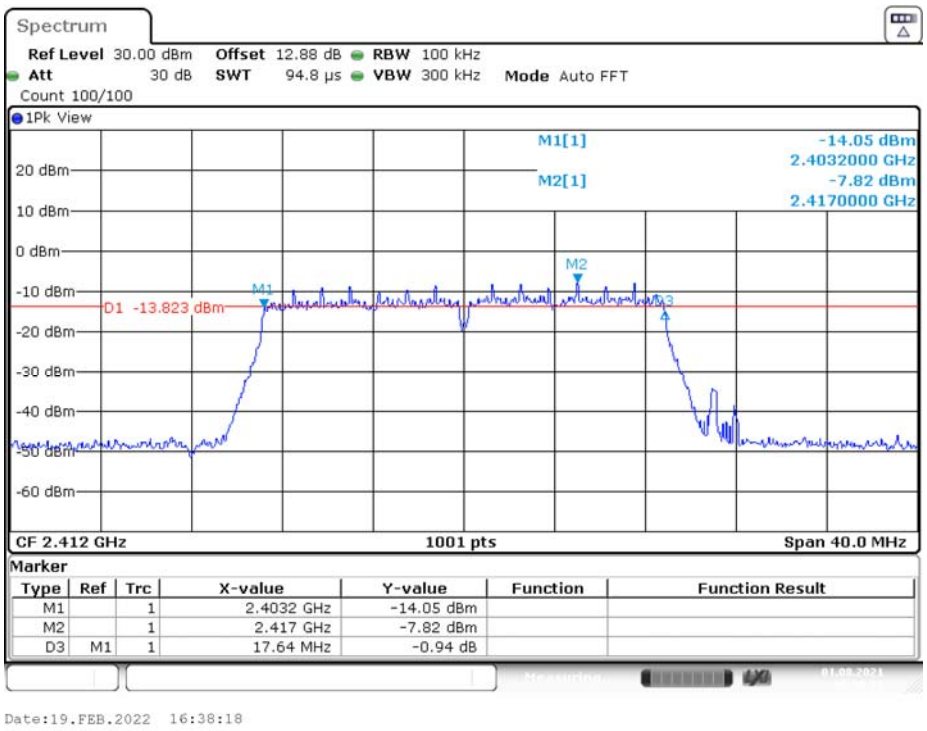
6dB Occupied Bandwidth

EUT	Wireless module	Model	R8601
Mode	802.11n HT20	Test Voltage	DC3.3V
Temperature	24 deg. C,	Humidity	56% RH

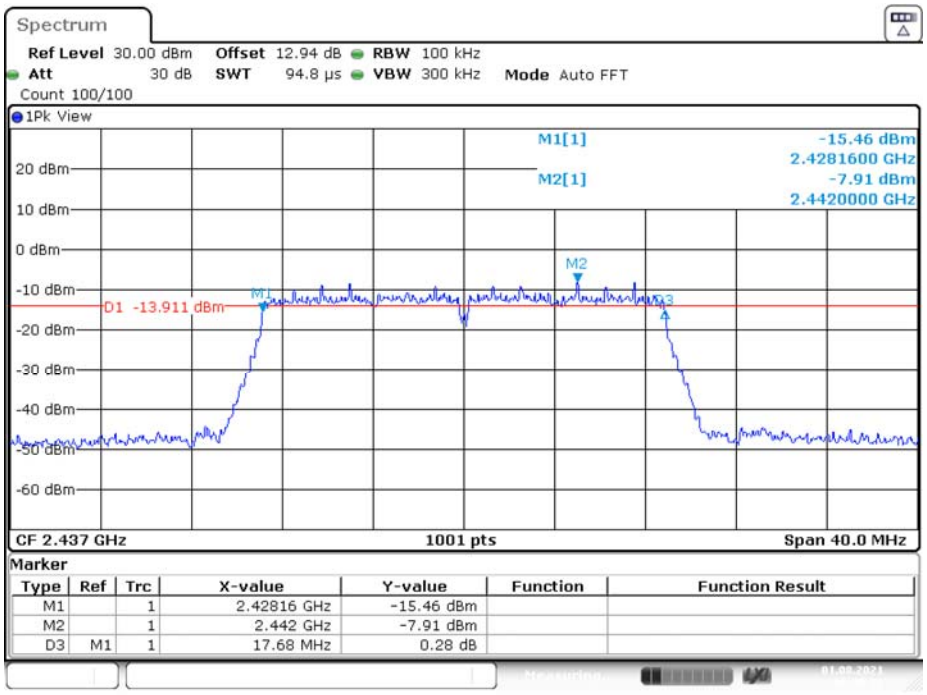
Channel	Channel Frequency (MHz)	Data Transfer Rate (Mbps)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass/ Fail
1	2412	mcs0	17.64	0.5	Pass
6	2437	mcs0	17.68	0.5	Pass
11	2462	mcs0	17.64	0.5	Pass

Test Plots:

1. 802.11n at HT20 of CH01

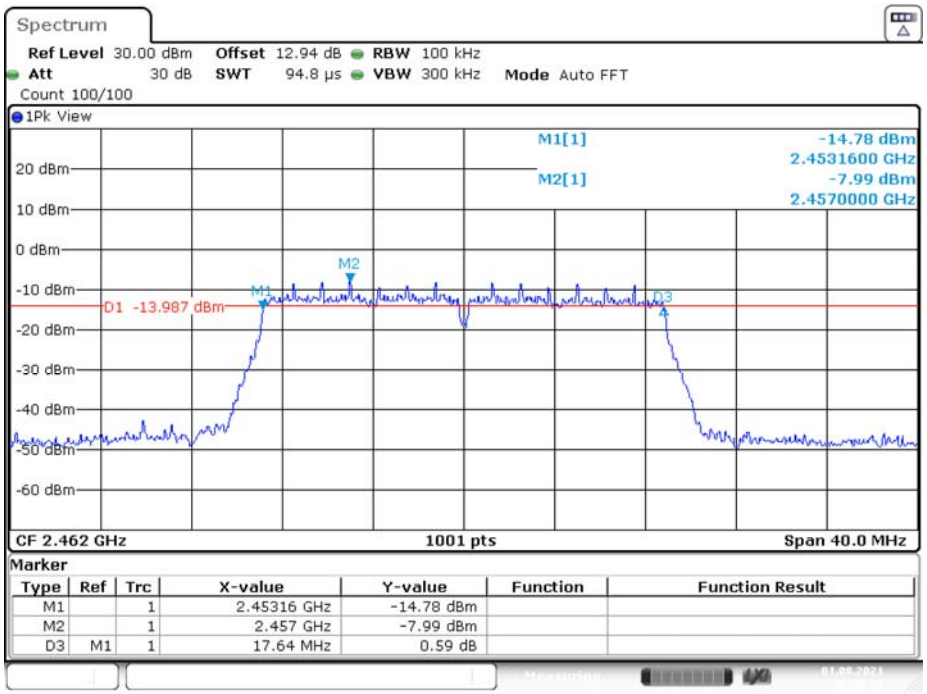


2. 802.11n at HT20 of CH06



Date:19.FEB.2022 16:43:36

3. 802.11n at HT20 of CH11



Date:19.FEB.2022 16:45:47

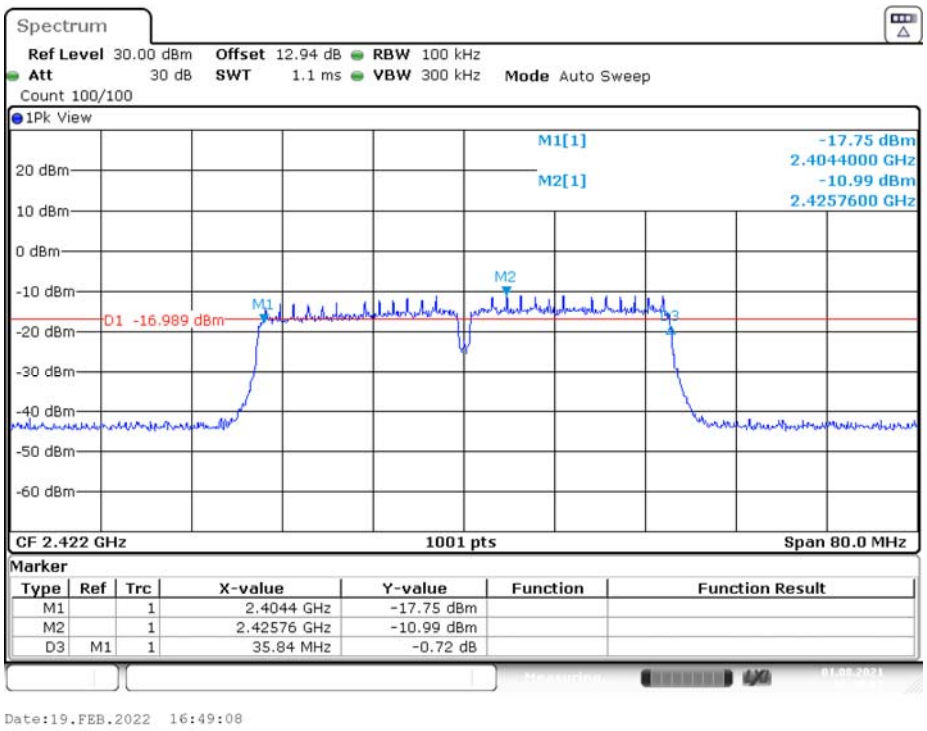
6dB Occupied Bandwidth

EUT	Wireless module	Model	R8601
Mode	802.11n HT40	Test Voltage	DC3.3V
Temperature	24 deg. C,	Humidity	56% RH

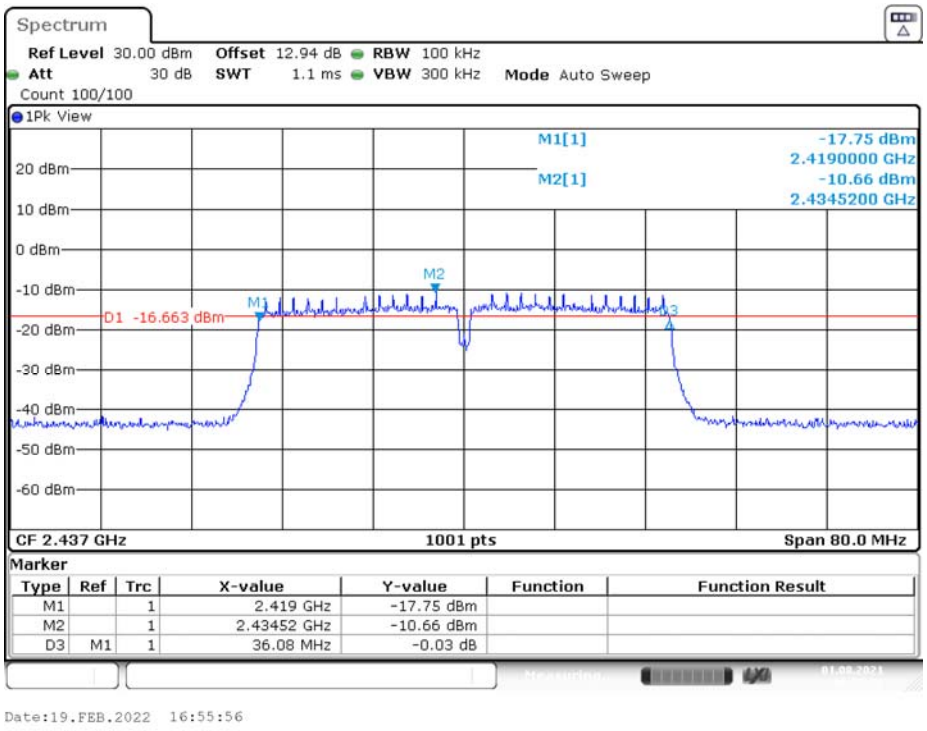
Channel	Channel Frequency (MHz)	Data Transfer Rate (Mbps)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass/ Fail
3	2422	mcs0	35.84	0.5	Pass
6	2437	mcs0	36.08	0.5	Pass
9	2452	mcs0	36.00	0.5	Pass

Test Plots:

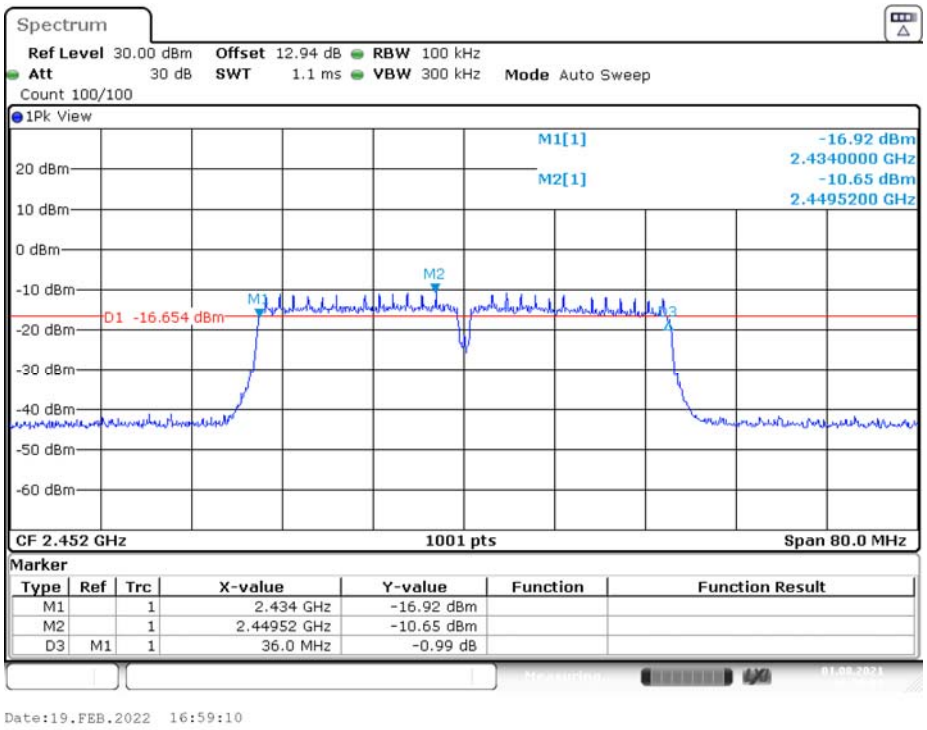
1. 802.11n at HT40 of CH03



2. 802.11n at HT40 of CH06

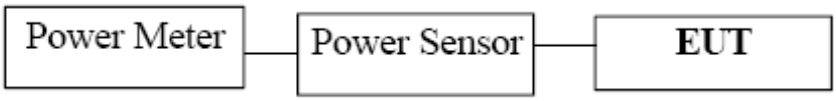


3. 802.11n at HT40 of CH09



8. Maximum Output Power

8.1 Test Setup



8.2 Limits of Maximum Output Power

The Maximum Output Power Measurement is 30dBm.

8.3 Test Procedure

The RF power output was measured with a Power meter connected to the RF Antenna connector (conducted measurement) while EUT was operating in transmit mode at the appropriate centre frequency.

Note: The Peak Power was measured

8.4Test Results

EUT	Wireless module	Model	R8601
Mode	802.11b	Test Voltage	DC3.3V
Temperature	24 deg. C,	Humidity	56% RH

Channel	Frequency (MHz)	Max. Power Output (dBm)	Power Limit (dBm)	Pass/ Fail
		Peak		
1	2412	15.36	30	Pass
6	2437	15.68	30	Pass
11	2462	15.73	30	Pass

Note: 1. At finial test to get the worst-case emission at 1Mbps for CH01, CH06 and CH11
2. The result basic equation calculation as follow:
Power Output = Power Reading + Cable loss + Attenuator
3. The worse case was recorded

EUT	Wireless module	Model	R8601
Mode	802.11g	Test Voltage	DC3.3V
Temperature	24 deg. C,	Humidity	56% RH

Channel	Frequency (MHz)	Max. Power Output (dBm)	Power Limit (dBm)	Pass/ Fail
		Peak		
1	2412	14.97	30	Pass
6	2437	14.85	30	Pass
11	2462	14.77	30	Pass

Note: 1. At finial test to get the worst-case emission at 6Mbps for CH01, CH06 and CH11
2. The result basic equation calculation as follow:
Power Output = Power Reading + Cable loss + Attenuator
3. The worse case was recorded

EUT	Wireless module	Model	R8601
Mode	802.11n HT20 mcs0	Test Voltage	DC3.3V
Temperature	24 deg. C,	Humidity	56% RH

Channel	Frequency (MHz)	Max. Power Output (dBm)	Power Limit (dBm)	Pass/ Fail
		Peak		
1	2412	14.69	30	Pass
6	2437	14.52	30	Pass
11	2462	14.43	30	Pass

Note: 1. At finial test to get the worst-case emission at mcs0 of 11n HT20 for CH01, CH06 and CH11

2. The result basic equation calculation as follow:

Power Output = Power Reading + Cable loss + Attenuator

3. The worse case was recorded

EUT	Wireless module	Model	R8601
Mode	802.11n HT40 mcs0	Test Voltage	DC3.3V
Temperature	24 deg. C,	Humidity	56% RH

Channel	Frequency (MHz)	Max. Power Output (dBm)	Power Limit (dBm)	Pass/ Fail
		Peak		
1	2412	13.99	30	Pass
6	2437	13.91	30	Pass
11	2462	13.89	30	Pass

Note: 1. At finial test to get the worst-case emission at msc0 of 11n HT40 for CH03, CH06 and CH09

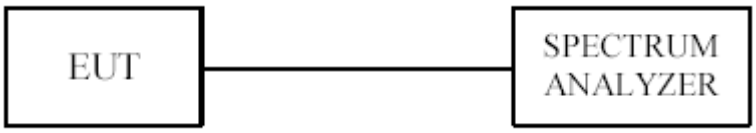
2. The result basic equation calculation as follow:

Power Output = Power Reading + Cable loss + Attenuator

3. The worse case was recorded

9. Power Spectral Density Measurement

9.1 Test Setup



9.2 Limits of Power Spectral Density Measurement

The Maximum Power Spectral Density Measurement is 8dBm/3kHz.

9.3 Test Procedure

1. Use this procedure when the maximum peak conducted output power in the fundamental emission is used to demonstrate compliance.
2. Set the RBW = 3 kHz.
3. Set the VBW ≥ 10 kHz.
4. Set the span to 1.5 times the DTS channel bandwidth.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.
11. The resulting peak PSD level must be ≤ 8 dBm/3kHz.

9.4Test Result

EUT	Wireless module	Model	R8601	
Mode	802.11b	Test Voltage	DC3.3V	
Temperature	24 deg. C,	Humidity	56% RH	
Channel	Frequency (MHz)	Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)	Pass/ Fail
1	2412	-19.77	8	Pass
6	2437	-18.44	8	Pass
11	2462	-19.35	8	Pass

EUT	Wireless module	Model	R8601	
Mode	802.11g	Test Voltage	DC3.3V	
Temperature	24 deg. C,	Humidity	56% RH	
Channel	Frequency (MHz)	Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)	Pass/ Fail
1	2412	-20.74	8	Pass
6	2437	-21.75	8	Pass
11	2462	-20.78	8	Pass

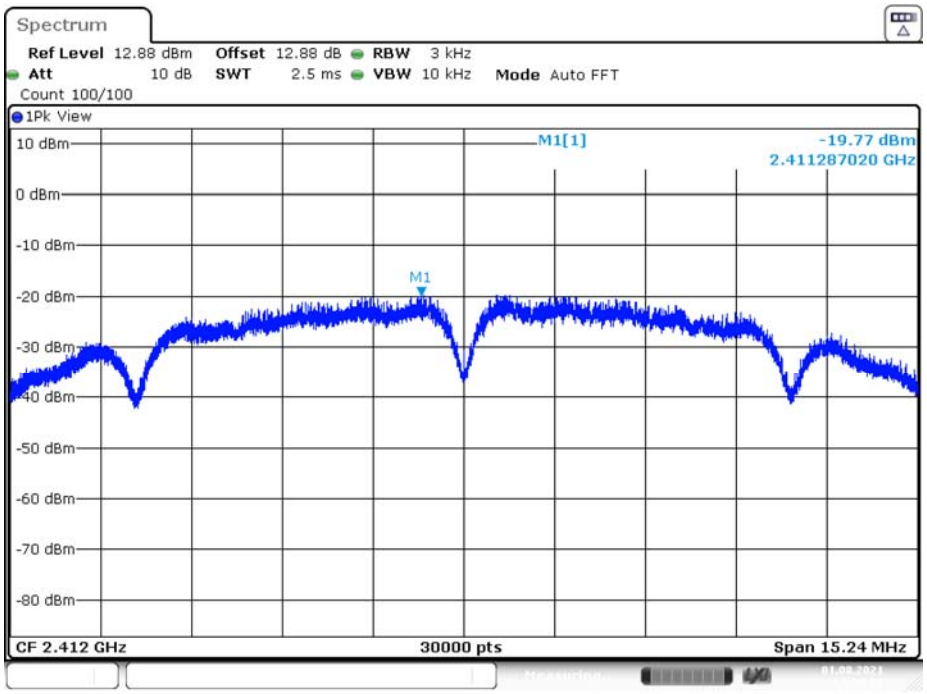
EUT	Wireless module	Model	R8601	
Mode	802.11n HT20 mcs0	Test Voltage	DC3.3V	
Temperature	24 deg. C,	Humidity	56% RH	
Channel	Frequency (MHz)	Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)	Pass/ Fail
1	2412	-22.27	8	Pass
6	2437	-22.53	8	Pass
11	2462	-21.18	8	Pass

EUT	Wireless module	Model	R8601
Mode	802.11n HT40 mcs0	Test Voltage	DC3.3V
Temperature	24 deg. C,	Humidity	56% RH

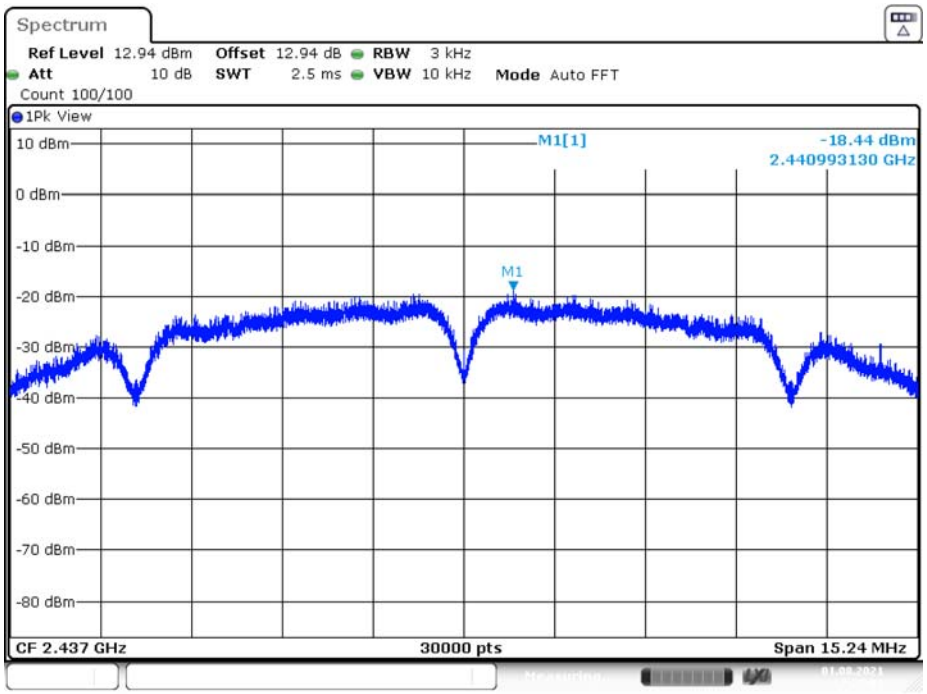
Channel	Frequency (MHz)	Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)	Pass/ Fail
3	2422	-24.50	8	Pass
6	2437	-23.85	8	Pass
9	2452	-24.46	8	Pass

9.5 Photo of Power Spectral Density Measurement

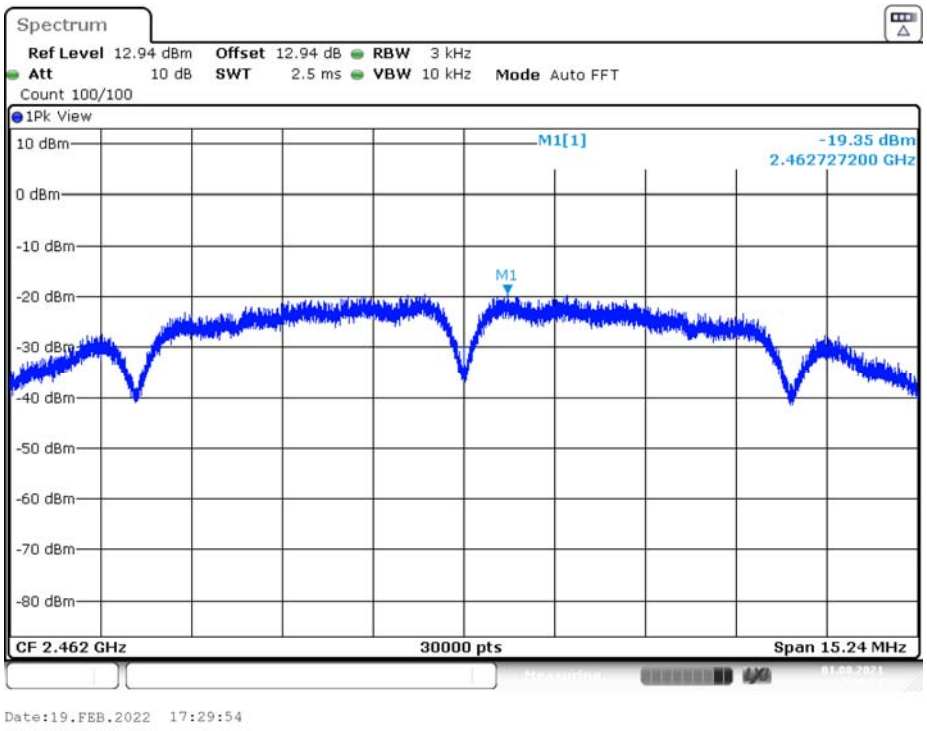
1. 802.11b at 1Mbps of CH1



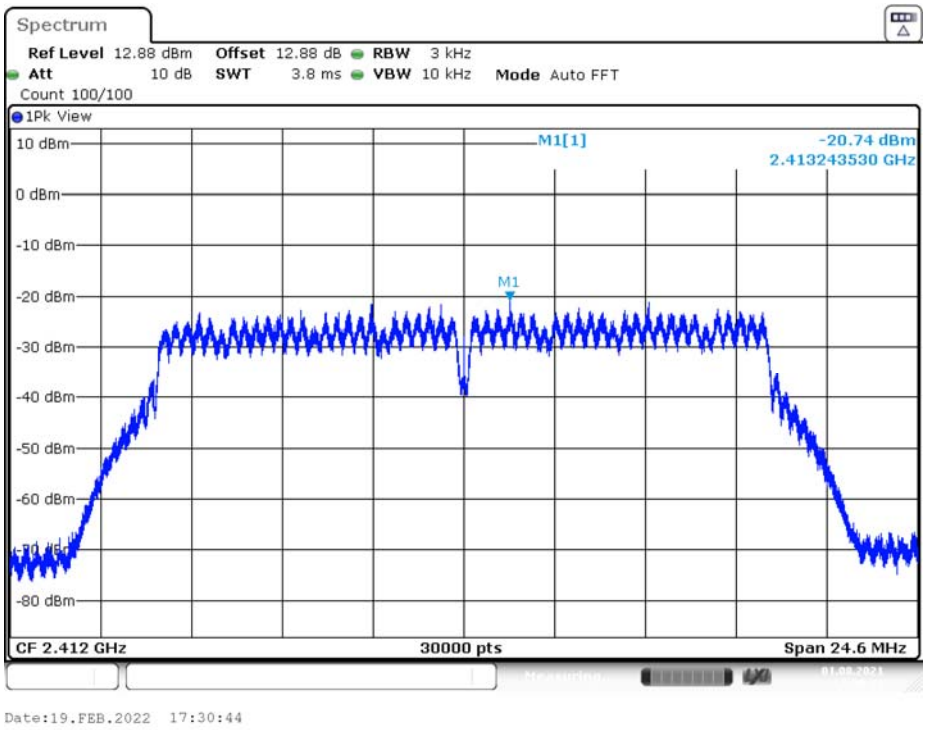
2. 802.11b at 1Mbps of CH6



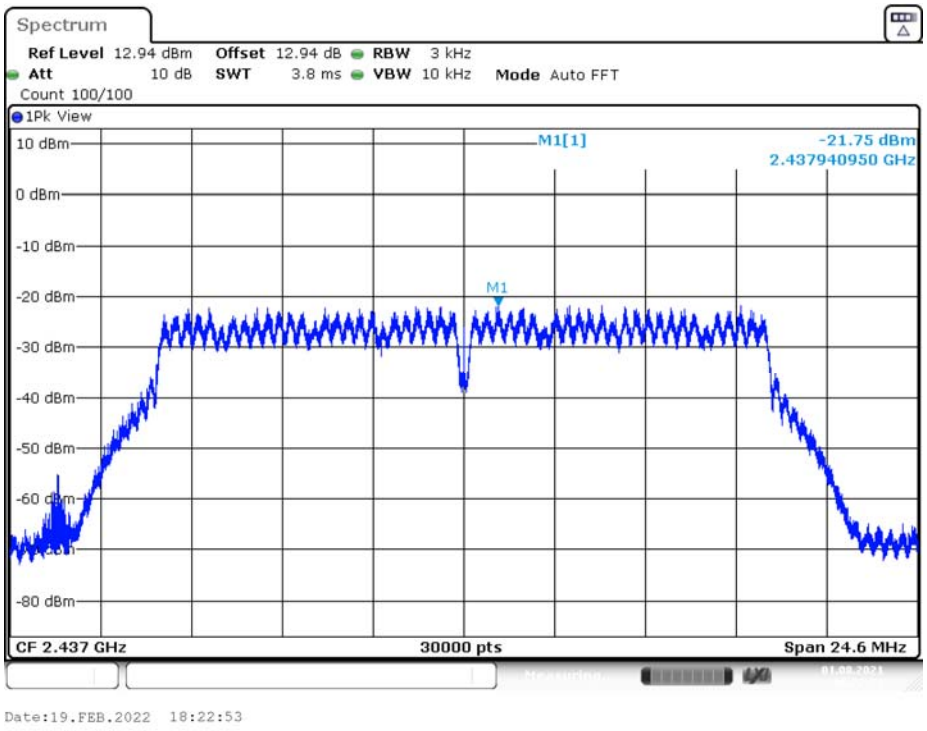
3. 802.11b at 1Mbps of CH11



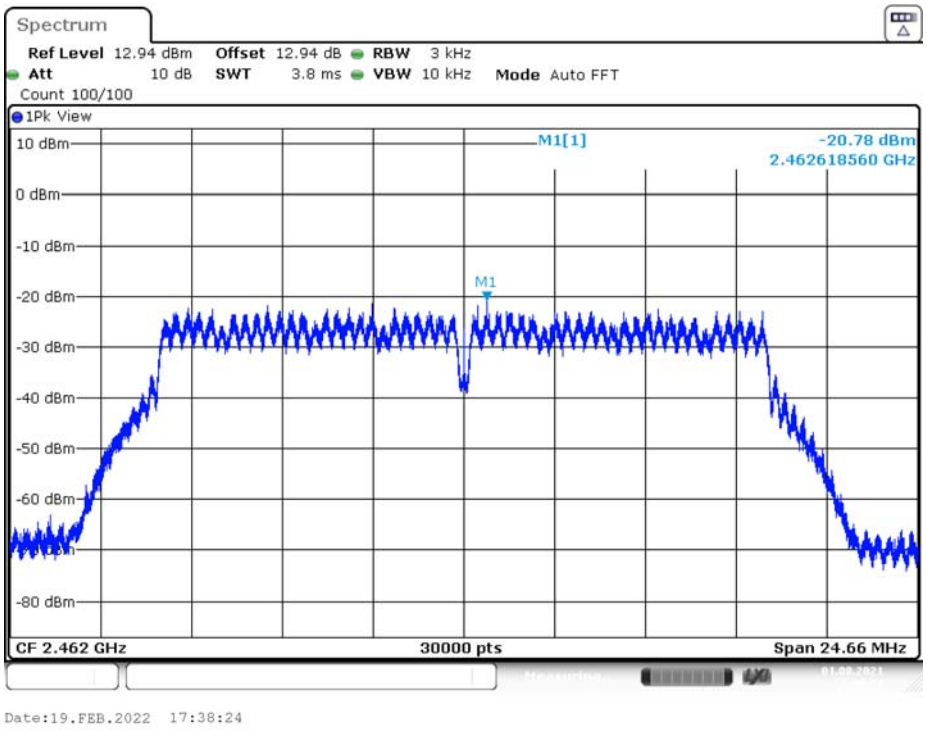
4. 802.11g at 6Mbps of CH1



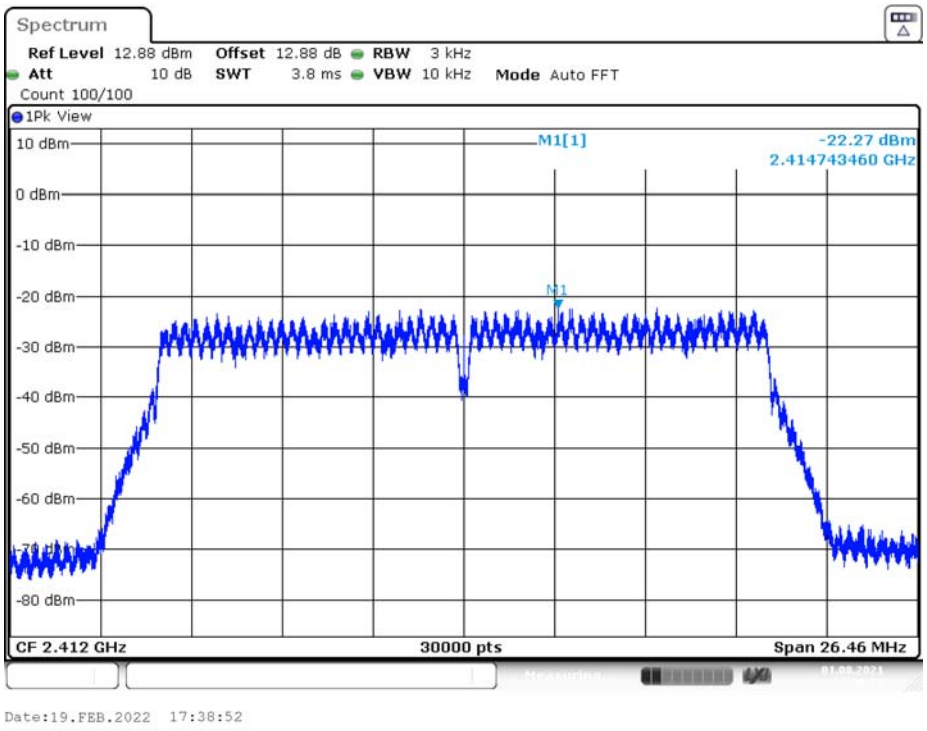
5. 802.11g at 6Mbps of CH6



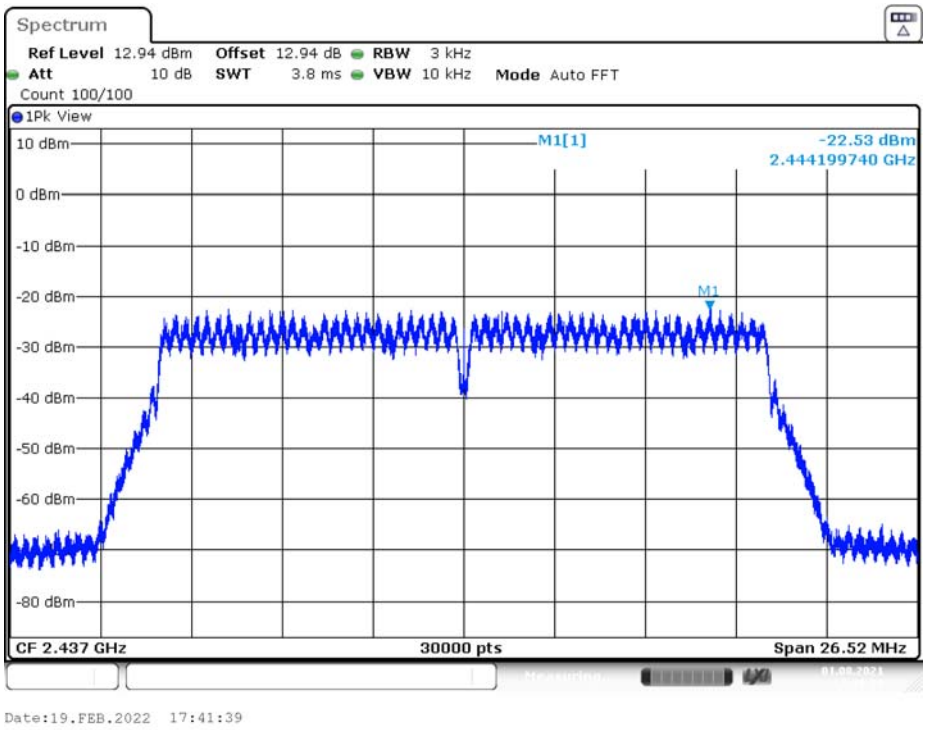
6. 802.11g at 6Mbps of CH11



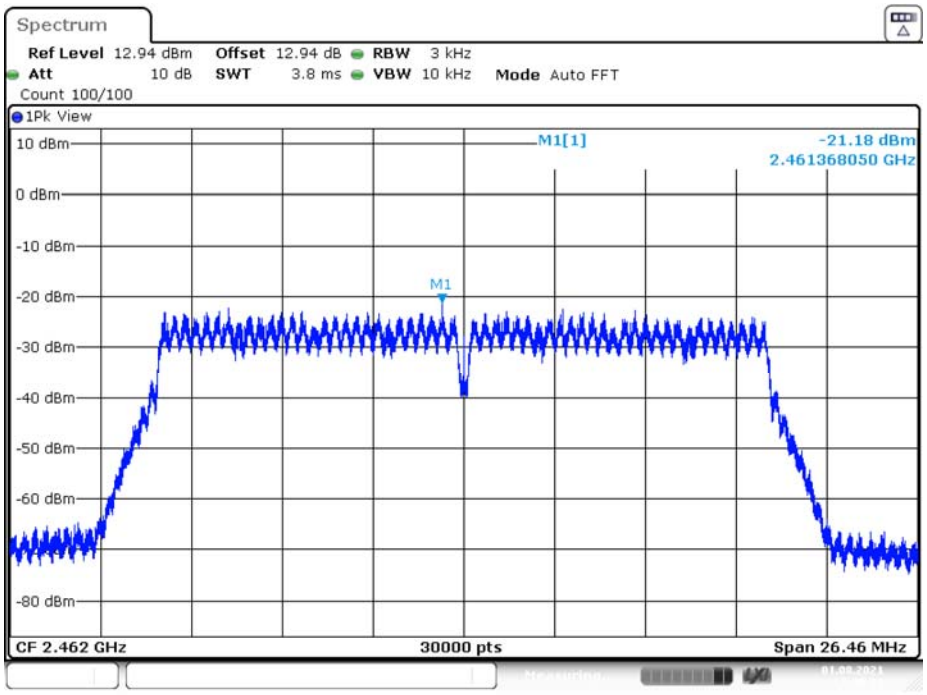
7. 802.11n at HT20 of CH01



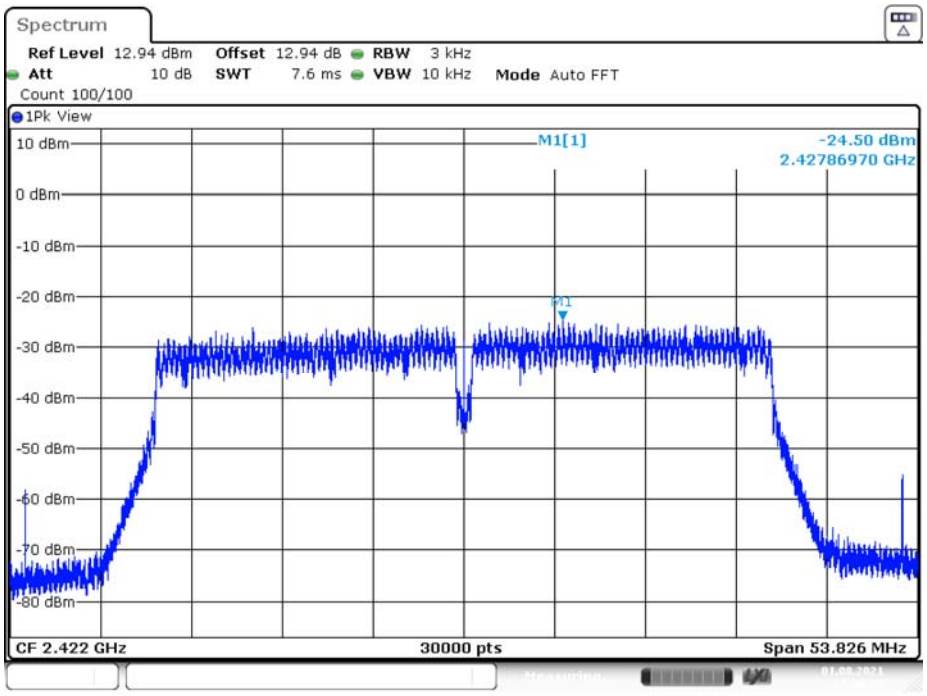
8. 802.11n at HT20 of CH06



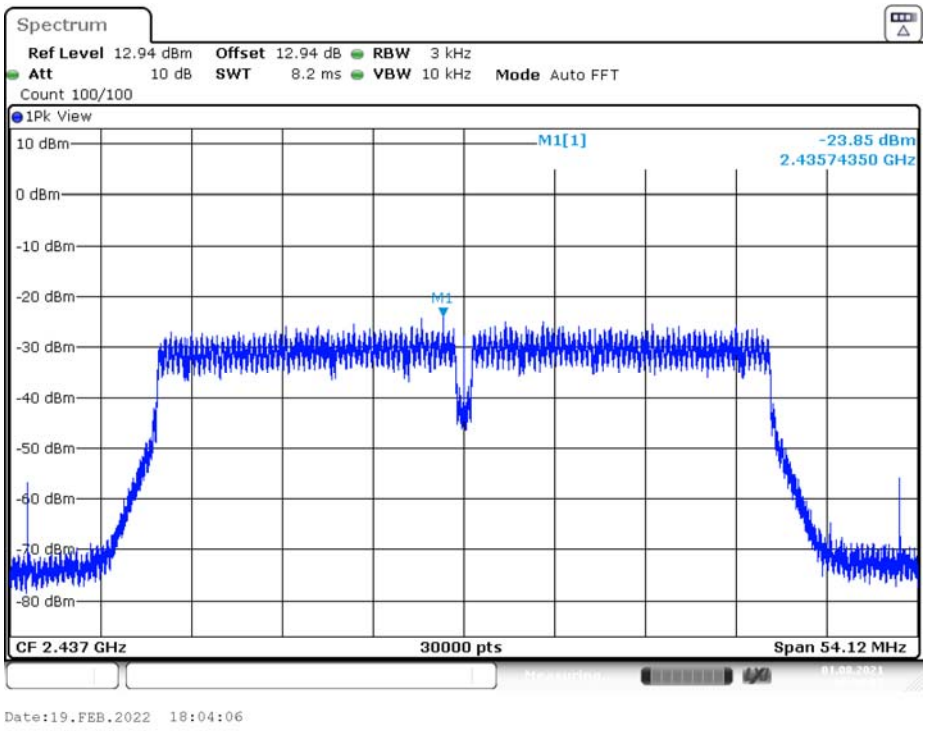
9. 802.11n at HT20 of CH11



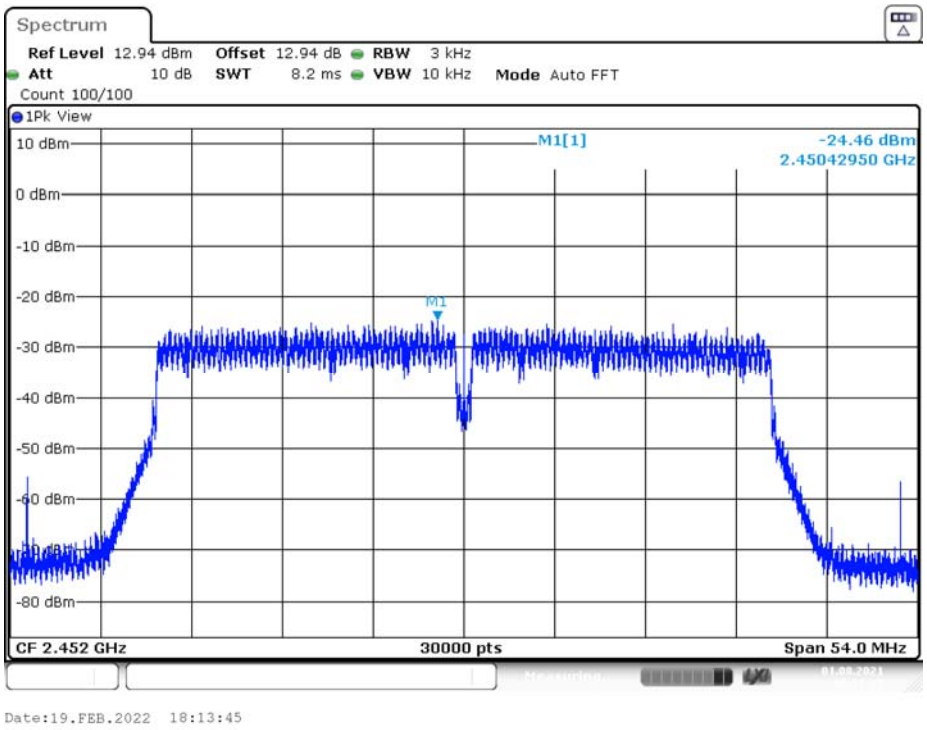
10. 802.11n at HT40 of CH03



11. 802.11n at HT40 of CH06

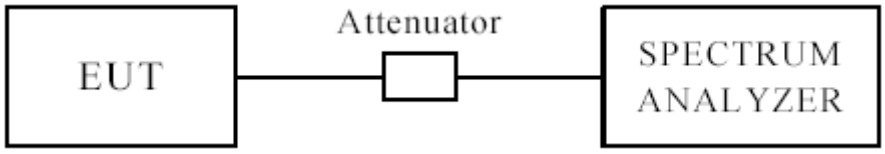


12. 802.11n at HT40 of CH09



10 Out of Band Measurement

10.1 Test Setup for band edge



The restricted band requirement based on radiated emission test; please see the clause 6 for the test setup

10.2 Limits of Out of Band Emissions Measurement

1. Below –20dB of the highest emission level of operating band (in 100kHz Resolution Bandwidth).
2. Fall in the restricted bands listed in section 15.205. The maximum permitted average field strength is listed in section 15.209.

10.3 Test Procedure

For signals in the restricted bands above and below the 2.4-2.483GHz allocated band a measurement was made of radiated emission test. (Peak values with RBW=VBW=1MHz and PK detector. AV value with RBW=1MHz, VBW=10Hz and PK detector)

For bandage test, the spectrum set as follows: RBW=100, VBW=300 kHz. A conducted measurement used

10.4 Test Result

Please see next pages

Note: For band-edge measurement, the frequency from 30MHz-25GHz was tested. And It met the FCC rule.

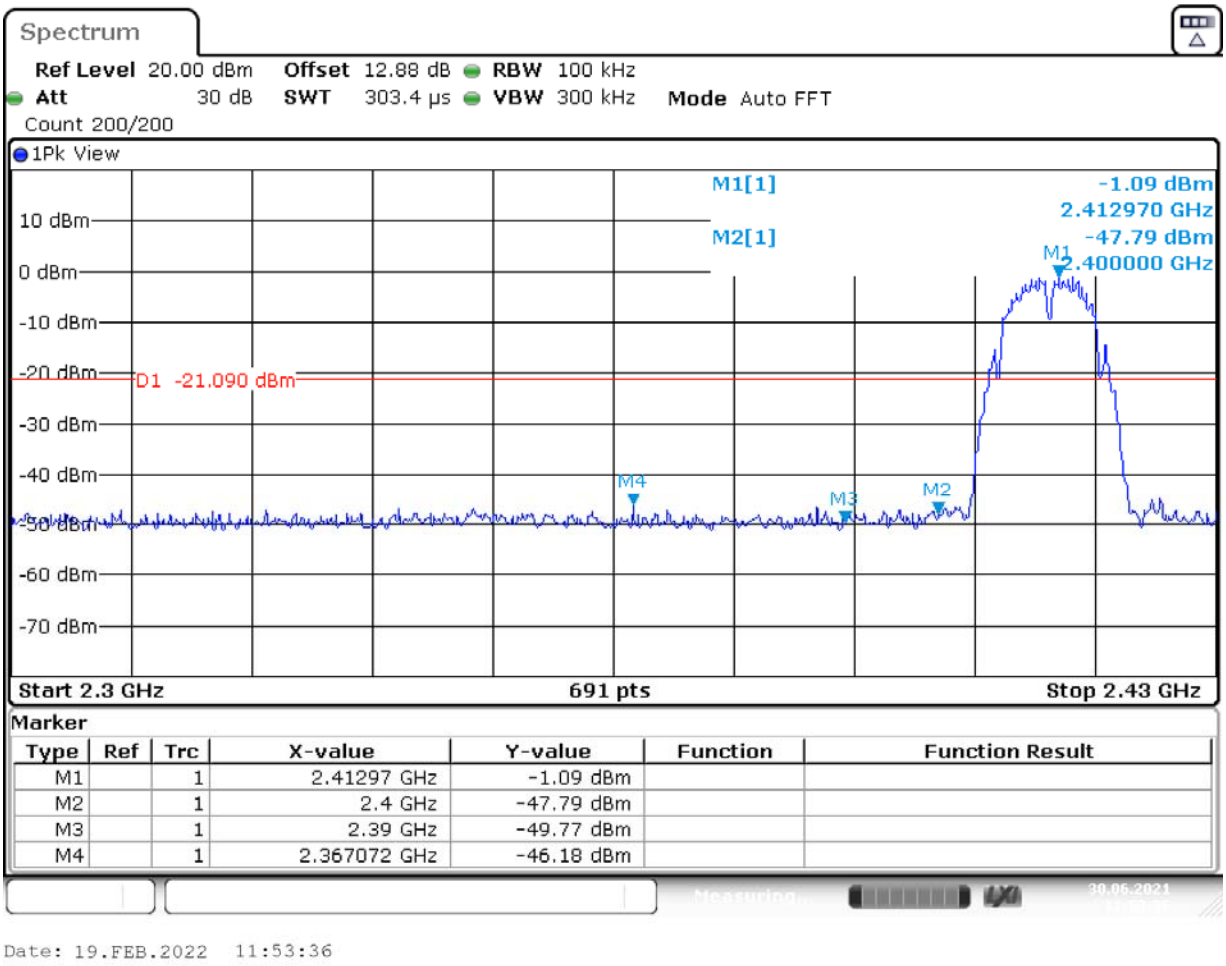
For 802.11b mode

CH01 at 1Mbps

10.4 Band-edge Measurement

EUT	Wireless module	Model	R8601
Mode	Keeping Transmitting	Test Voltage	DC3.3V
Temperature	24 deg. C,	Humidity	56% RH
Test Result:	Pass	Detector	PK

Test Figure:

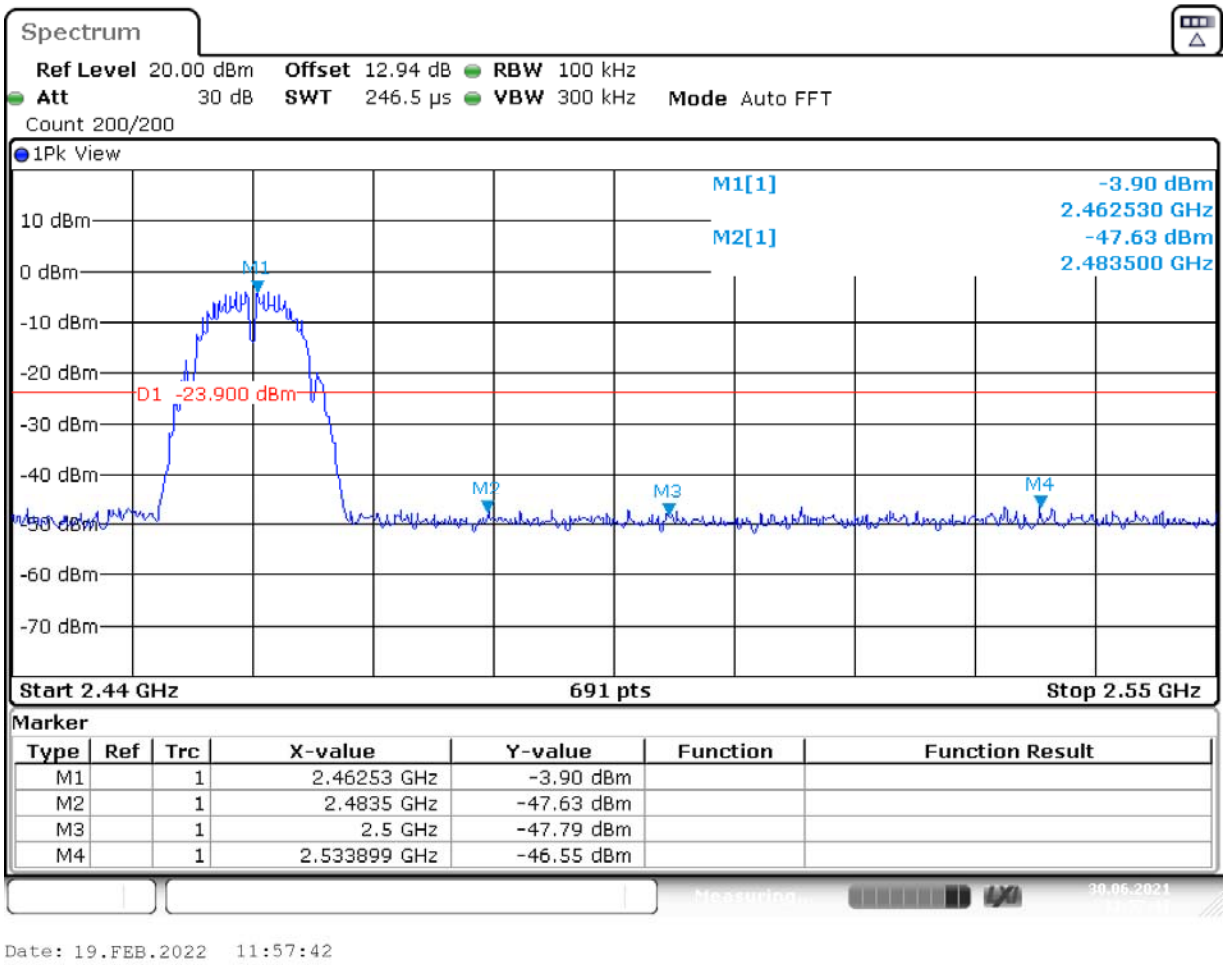


CH11 at 1Mbps

10.4 Band-edge Measurement

EUT	Wireless module	Model	R8601
Mode	Keeping Transmitting	Test Voltage	DC3.3V
Temperature	24 deg. C,	Humidity	56% RH
Test Result:	Pass	Detector	PK

Test Figure:



Date: 19.FEB.2022 11:57:42

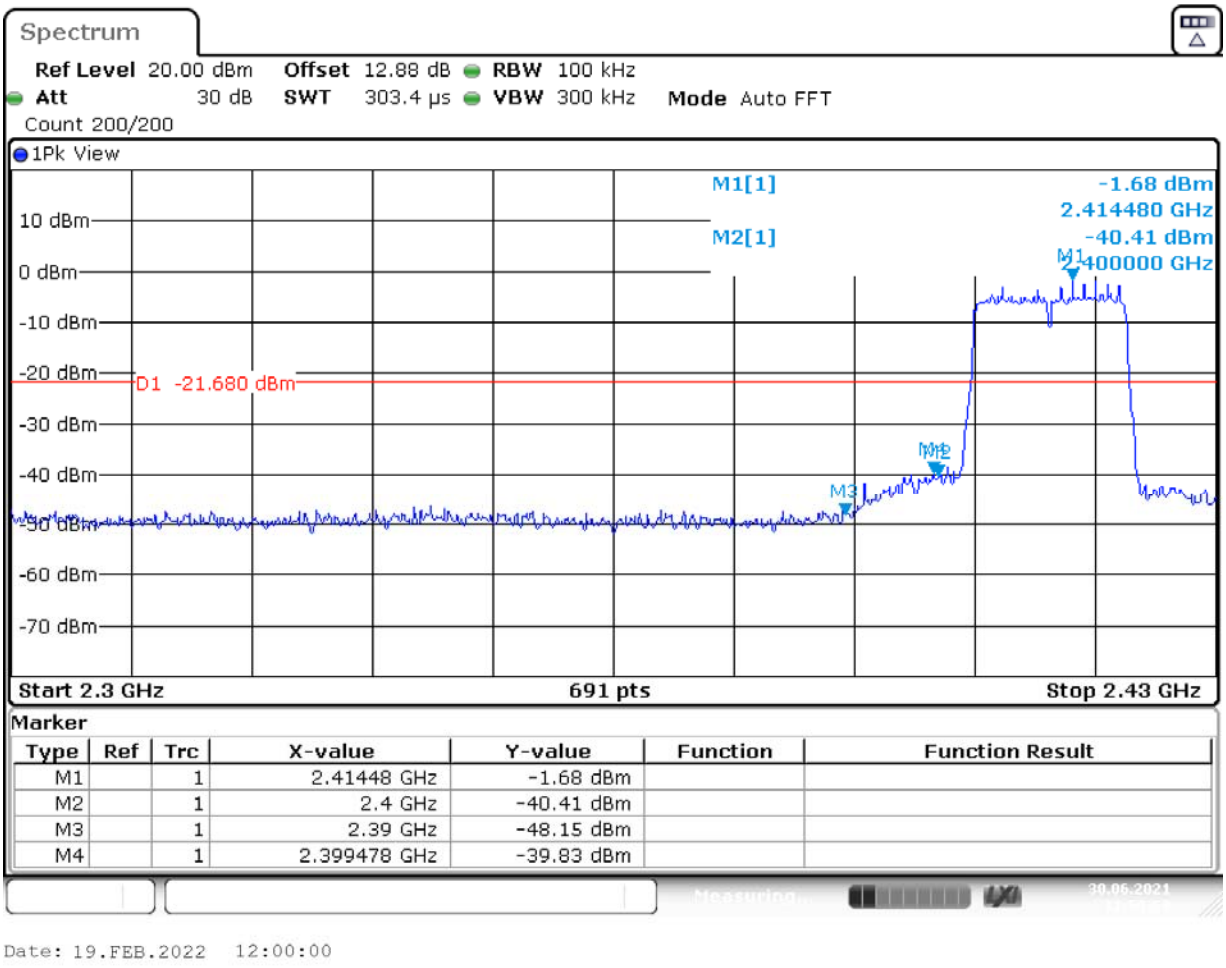
For 802.11g mode

CH01 at 6Mbps

10.4 Band-edge Measurement

EUT	Wireless module	Model	R8601
Mode	Keeping Transmitting	Test Voltage	DC3.3V
Temperature	24 deg. C,	Humidity	56% RH
Test Result:	Pass	Detector	PK

Test Figure:



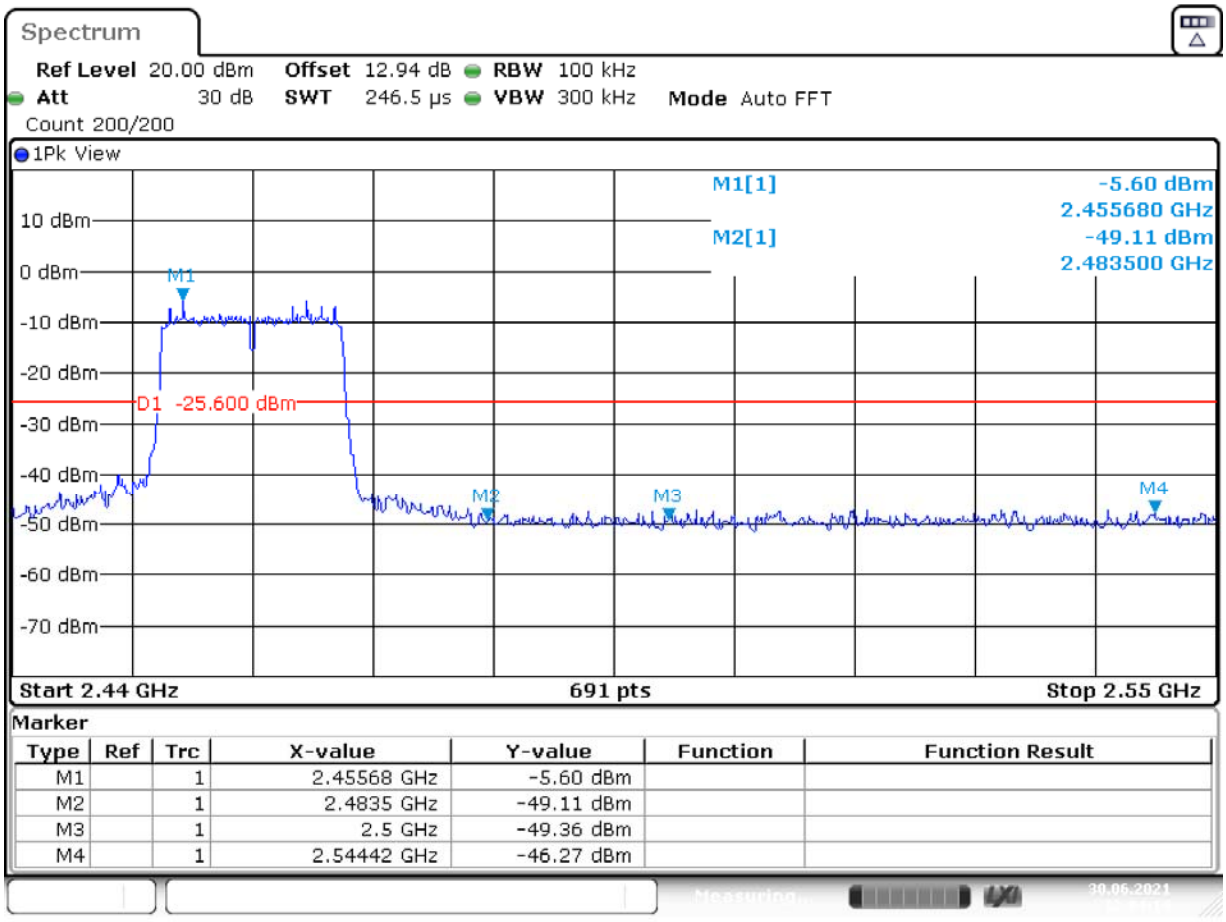
Date: 19.FEB.2022 12:00:00

CH11 at 6Mbps

10.4 Band-edge Measurement

EUT	Wireless module	Model	R8601
Mode	Keeping Transmitting	Test Voltage	DC3.3V
Temperature	24 deg. C,	Humidity	56% RH
Test Result:	Pass	Detector	PK

Test Figure:



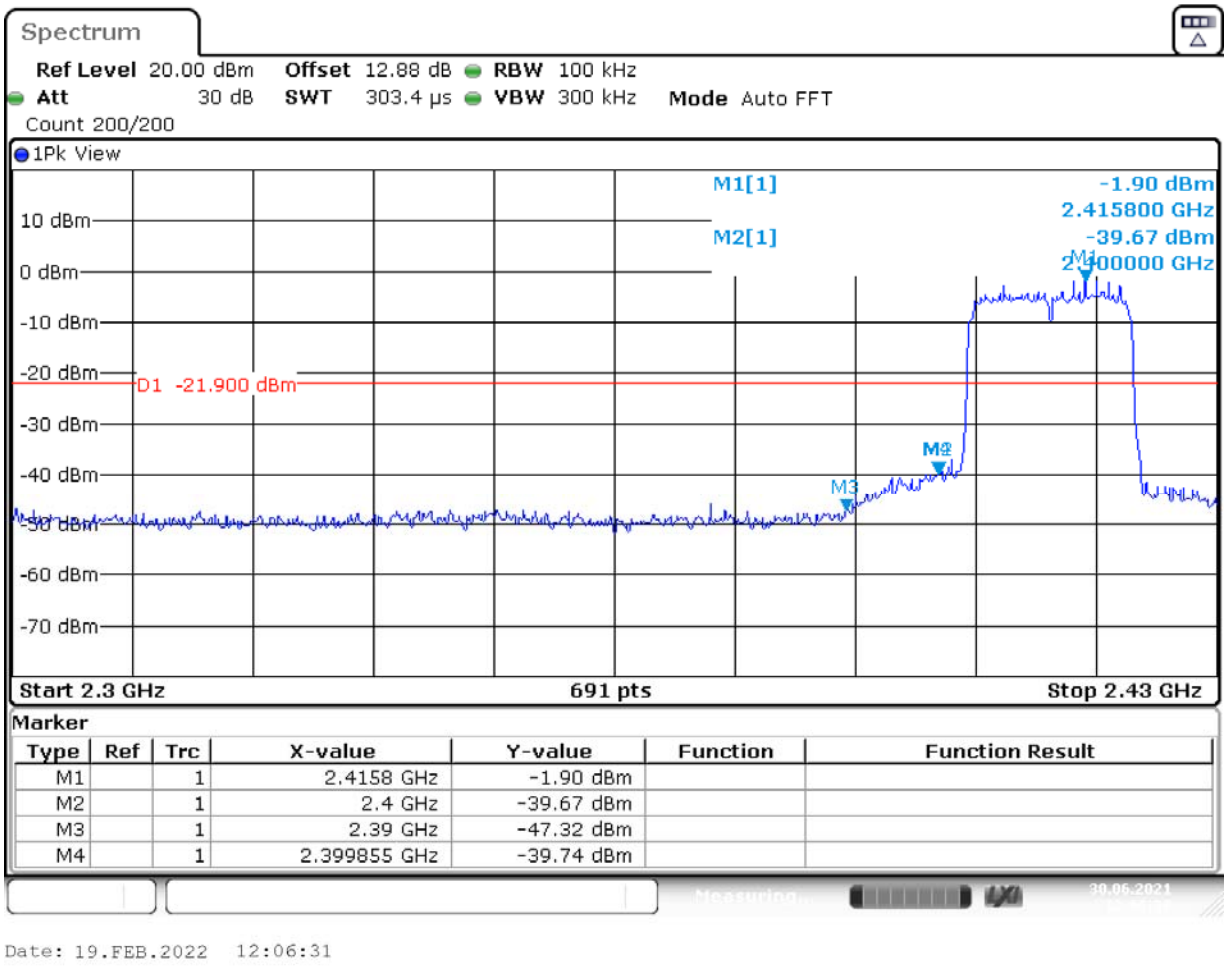
For 802.11n (HT20) mode

CH01 at mcs0

10.4 Band-edge Measurement

EUT	Wireless module	Model	R8601
Mode	Keeping Transmitting	Test Voltage	DC3.3V
Temperature	24 deg. C,	Humidity	56% RH
Test Result:	Pass	Detector	PK

Test Figure:



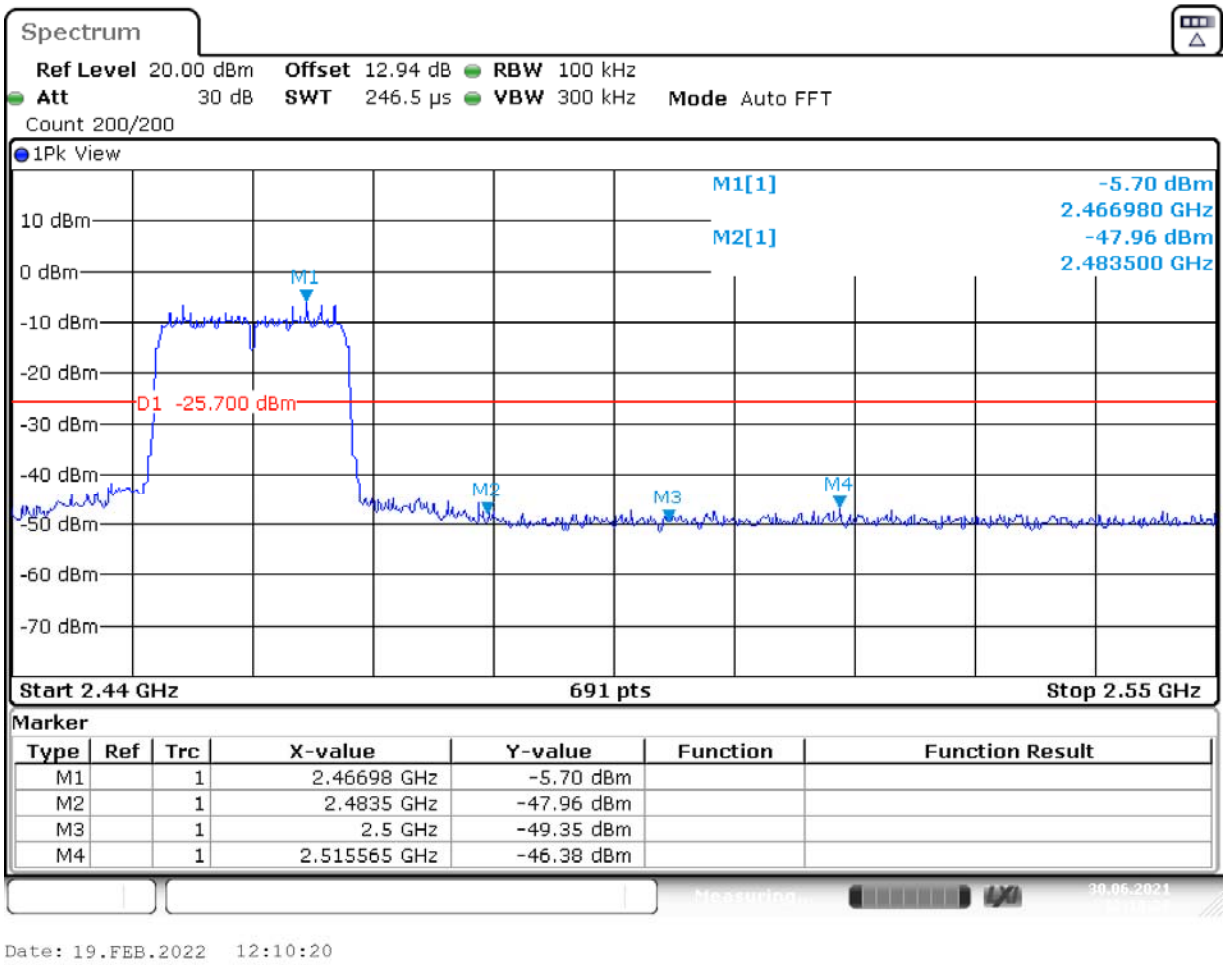
Date: 19.FEB.2022 12:06:31

CH11 at mcs0

10.4 Band-edge Measurement

EUT	Wireless module	Model	R8601
Mode	Keeping Transmitting	Test Voltage	DC3.3V
Temperature	24 deg. C,	Humidity	56% RH
Test Result:	Pass	Detector	PK

Test Figure:



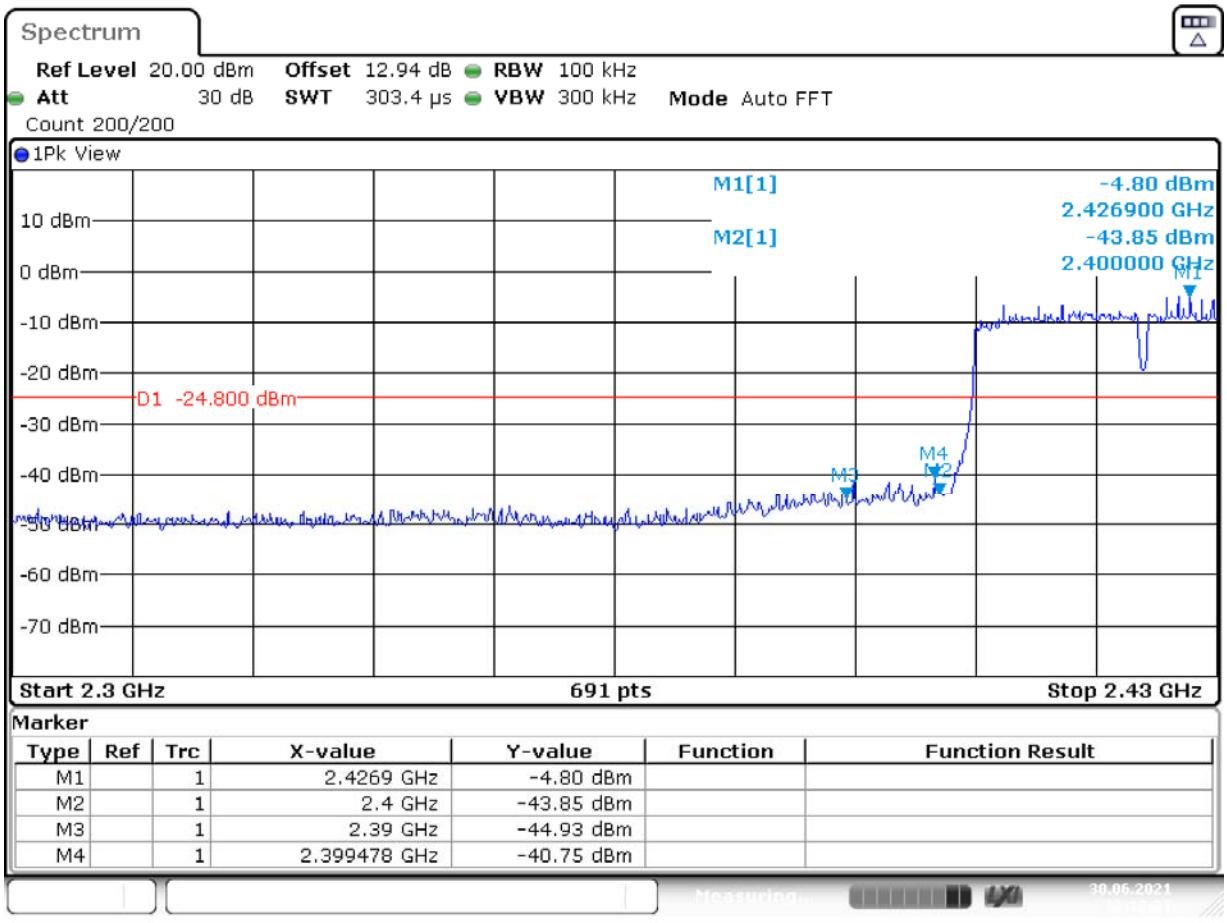
For 802.11n (HT40) mode

CH03 at msc0

10.4 Band-edge and Restricted band Measurement

EUT	Wireless module	Model	R8601
Mode	Keeping Transmitting	Test Voltage	DC3.3V
Temperature	24 deg. C,	Humidity	56% RH
Test Result:	Pass	Detector	PK

Test Figure:

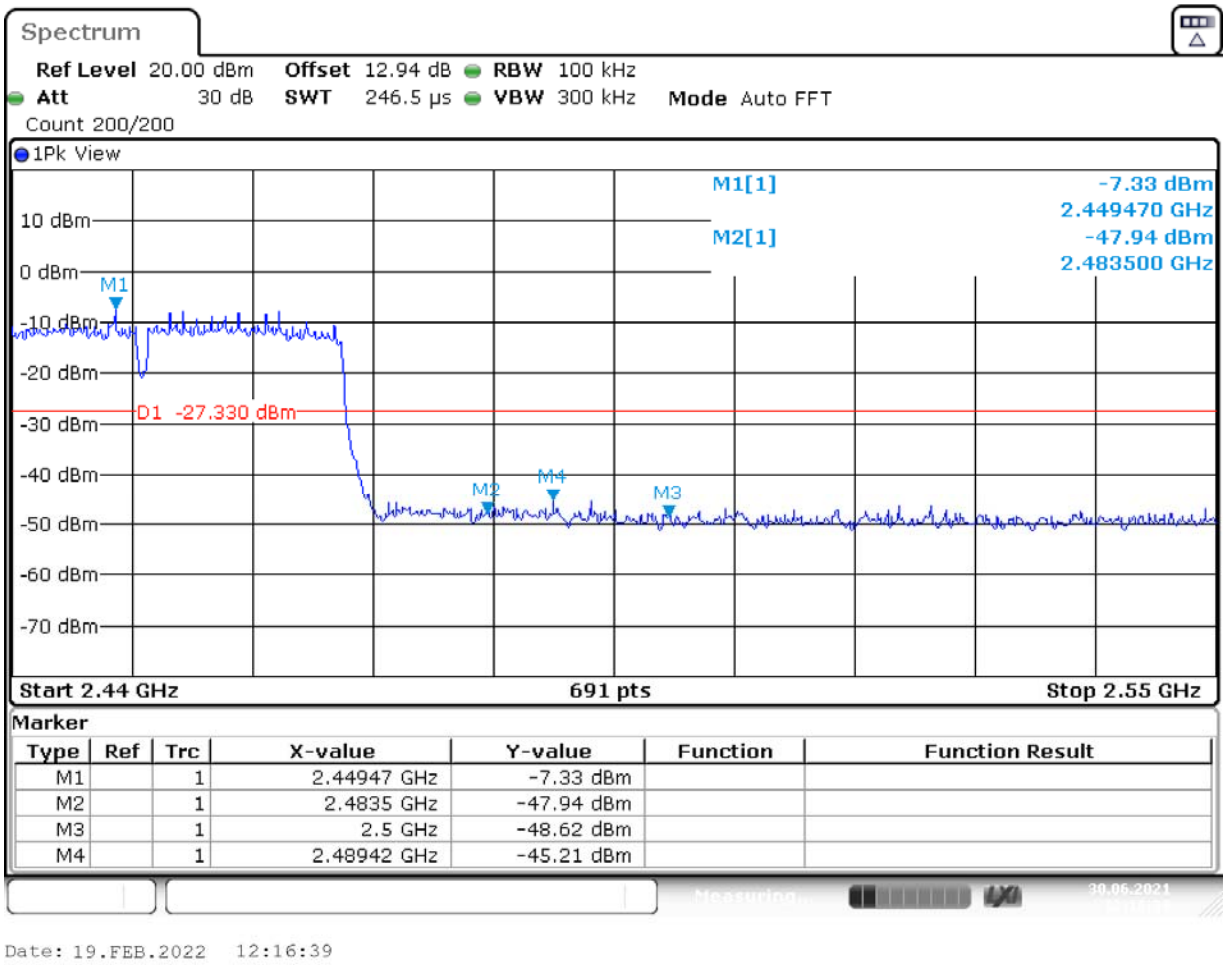


CH09 at msc0

10.4 Band-edge and Restricted band Measurement

EUT	Wireless module	Model	R8601
Mode	Keeping Transmitting	Test Voltage	DC3.3V
Temperature	24 deg. C,	Humidity	56% RH
Test Result:	Pass	Detector	PK

Test Figure:



Note: Test data for ANT 1 from page 54-57

10.5 Restricted band Measurement

EUT	Wireless module		Model	R8601
Mode	Keeping Transmitting		Test Voltage	DC3.3V
Temperature	24 deg. C,		Humidity	56% RH
Test Result:	Pass		Detector	PK
802.11b mode, Low Channel, Horizontal				
2390	PK (dBμV/m)	47.63	Limit	74(dBμV/m)
	AV (dBμV/m)	--		54(dBμV/m)
802.11b mode, Vertical				
2390	PK (dBμV/m)	45.71	Limit	74(dBμV/m)
	AV (dBμV/m)	--		54(dBμV/m)

10.5 Restricted band Measurement

EUT	Wireless module		Model	R8601
Mode	Keeping Transmitting		Test Voltage	DC3.3V
Temperature	24 deg. C,		Humidity	56% RH
Test Result:	Pass		Detector	PK
802.11b mode, High Channel, Horizontal				
2483.5	PK (dBμV/m)	46.96	Limit	74(dBμV/m)
	AV (dBμV/m)	--		54(dBμV/m)
802.11b mode, High Channel, Vertical				
2483.5	PK (dBμV/m)	45.02	Limit	74(dBμV/m)
	AV (dBμV/m)	--		54(dBμV/m)

10.5 Restricted band Measurement

EUT	Wireless module		Model	R8601
Mode	Keeping Transmitting		Test Voltage	DC3.3V
Temperature	24 deg. C,		Humidity	56% RH
Test Result:	Pass		Detector	PK
802.11g mode, Low Channel, Horizontal				
2390	PK (dBμV/m)	49.32	Limit	74(dBμV/m)
	AV (dBμV/m)	--		54(dBμV/m)
802.11g mode, Vertical				
2390	PK (dBμV/m)	46.95	Limit	74(dBμV/m)
	AV (dBμV/m)	--		54(dBμV/m)

10.5 Restricted band Measurement

EUT	Wireless module		Model	R8601
Mode	Keeping Transmitting		Test Voltage	DC3.3V
Temperature	24 deg. C,		Humidity	56% RH
Test Result:	Pass		Detector	PK
802.11g mode, High Channel, Horizontal				
2483.5	PK (dBμV/m)	52.16	Limit	74(dBμV/m)
	AV (dBμV/m)	--		54(dBμV/m)
802.11g mode, High Channel, Vertical				
2483.5	PK (dBμV/m)	49.73	Limit	74(dBμV/m)
	AV (dBμV/m)	--		54(dBμV/m)

10.5 Restricted band Measurement

EUT	Wireless module		Model	R8601
Mode	Keeping Transmitting		Test Voltage	DC3.3V
Temperature	24 deg. C,		Humidity	56% RH
Test Result:	Pass		Detector	PK
802.11n HT20 mode, Low Channel, Horizontal				
2390	PK (dBμV/m)	49.55	Limit	74(dBμV/m)
	AV (dBμV/m)	--		54(dBμV/m)
802.11n HT20 mode, Low Channel, Vertical				
2390	PK (dBμV/m)	47.29	Limit	74(dBμV/m)
	AV (dBμV/m)	--		54(dBμV/m)

10.5 Restricted band Measurement

EUT	Wireless module		Model	R8601
Mode	Keeping Transmitting		Test Voltage	DC3.3V
Temperature	24 deg. C,		Humidity	56% RH
Test Result:	Pass		Detector	PK
802.11n HT20 mode, High Channel, Horizontal				
2483.5	PK (dBμV/m)	55.16	Limit	74(dBμV/m)
	AV (dBμV/m)	37.63		54(dBμV/m)
802.11n HT20 mode, High Channel, Vertical				
2483.5	PK (dBμV/m)	52.17	Limit	74(dBμV/m)
	AV (dBμV/m)	--		54(dBμV/m)

10.5 Restricted band Measurement

EUT	Wireless module		Model	R8601
Mode	Keeping Transmitting		Test Voltage	DC3.3V
Temperature	24 deg. C,		Humidity	56% RH
Test Result:	Pass		Detector	PK
802.11n HT40 mode, Low Channel, Horizontal				
2390	PK (dBμV/m)	50.33	Limit	74(dBμV/m)
	AV (dBμV/m)	--		54(dBμV/m)
802.11n HT40 mode, Low Channel Vertical				
2390	PK (dBμV/m)	48.36	Limit	74(dBμV/m)
	AV (dBμV/m)	--		54(dBμV/m)

10.5 Restricted band Measurement

EUT	Wireless module		Model	R8601
Mode	Keeping Transmitting		Test Voltage	DC3.3V
Temperature	24 deg. C,		Humidity	56% RH
Test Result:	Pass		Detector	PK
802.11n HT40 mode, High Channel, Horizontal				
2483.5	PK (dBμV/m)	58.62	Limit	74(dBμV/m)
	AV (dBμV/m)	42.71		54(dBμV/m)
802.11n HT40 mode, High Channel, Vertical				
2483.5	PK (dBμV/m)	54.60	Limit	74(dBμV/m)
	AV (dBμV/m)	38.13		54(dBμV/m)

Note: Test data for ANT 2 from page 58-61

10.5 Restricted band Measurement

EUT	Wireless module		Model	R8601
Mode	Keeping Transmitting		Test Voltage	DC3.3V
Temperature	24 deg. C,		Humidity	56% RH
Test Result:	Pass		Detector	PK
802.11b mode, Low Channel, Horizontal				
2390	PK (dBμV/m)	48.96	Limit	74(dBμV/m)
	AV (dBμV/m)	--		54(dBμV/m)
802.11b mode, Vertical				
2390	PK (dBμV/m)	46.55	Limit	74(dBμV/m)
	AV (dBμV/m)	--		54(dBμV/m)

10.5 Restricted band Measurement

EUT	Wireless module		Model	R8601
Mode	Keeping Transmitting		Test Voltage	DC3.3V
Temperature	24 deg. C,		Humidity	56% RH
Test Result:	Pass		Detector	PK
802.11b mode, High Channel, Horizontal				
2483.5	PK (dBμV/m)	48.19	Limit	74(dBμV/m)
	AV (dBμV/m)	--		54(dBμV/m)
802.11b mode, High Channel, Vertical				
2483.5	PK (dBμV/m)	46.27	Limit	74(dBμV/m)
	AV (dBμV/m)	--		54(dBμV/m)

10.5 Restricted band Measurement

EUT	Wireless module		Model	R8601
Mode	Keeping Transmitting		Test Voltage	DC3.3V
Temperature	24 deg. C,		Humidity	56% RH
Test Result:	Pass		Detector	PK
802.11g mode, Low Channel, Horizontal				
2390	PK (dBμV/m)	50.63	Limit	74(dBμV/m)
	AV (dBμV/m)	--		54(dBμV/m)
802.11g mode, Vertical				
2390	PK (dBμV/m)	48.07	Limit	74(dBμV/m)
	AV (dBμV/m)	--		54(dBμV/m)

10.5 Restricted band Measurement

EUT	Wireless module		Model	R8601
Mode	Keeping Transmitting		Test Voltage	DC3.3V
Temperature	24 deg. C,		Humidity	56% RH
Test Result:	Pass		Detector	PK
802.11g mode, High Channel, Horizontal				
2483.5	PK (dBμV/m)	54.43	Limit	74(dBμV/m)
	AV (dBμV/m)	38.75		54(dBμV/m)
802.11g mode, High Channel, Vertical				
2483.5	PK (dBμV/m)	51.62	Limit	74(dBμV/m)
	AV (dBμV/m)	--		54(dBμV/m)

10.5 Restricted band Measurement

EUT	Wireless module		Model	R8601
Mode	Keeping Transmitting		Test Voltage	DC3.3V
Temperature	24 deg. C,		Humidity	56% RH
Test Result:	Pass		Detector	PK
802.11n HT20 mode, Low Channel, Horizontal				
2390	PK (dBμV/m)	51.38	Limit	74(dBμV/m)
	AV (dBμV/m)	--		54(dBμV/m)
802.11n HT20 mode, Low Channel, Vertical				
2390	PK (dBμV/m)	48.83	Limit	74(dBμV/m)
	AV (dBμV/m)	--		54(dBμV/m)

10.5 Restricted band Measurement

EUT	Wireless module		Model	R8601
Mode	Keeping Transmitting		Test Voltage	DC3.3V
Temperature	24 deg. C,		Humidity	56% RH
Test Result:	Pass		Detector	PK
802.11n HT20 mode, High Channel, Horizontal				
2483.5	PK (dBμV/m)	57.03	Limit	74(dBμV/m)
	AV (dBμV/m)	41.89		54(dBμV/m)
802.11n HT20 mode, High Channel, Vertical				
2483.5	PK (dBμV/m)	54.62	Limit	74(dBμV/m)
	AV (dBμV/m)	39.18		54(dBμV/m)

10.5 Restricted band Measurement

EUT	Wireless module		Model	R8601
Mode	Keeping Transmitting		Test Voltage	DC3.3V
Temperature	24 deg. C,		Humidity	56% RH
Test Result:	Pass		Detector	PK
802.11n HT40 mode, Low Channel, Horizontal				
2390	PK (dBμV/m)	52.08	Limit	74(dBμV/m)
	AV (dBμV/m)	--		54(dBμV/m)
802.11n HT40 mode, Low Channel Vertical				
2390	PK (dBμV/m)	49.67	Limit	74(dBμV/m)
	AV (dBμV/m)	--		54(dBμV/m)

10.5 Restricted band Measurement

EUT	Wireless module		Model	R8601
Mode	Keeping Transmitting		Test Voltage	DC3.3V
Temperature	24 deg. C,		Humidity	56% RH
Test Result:	Pass		Detector	PK
802.11n HT40 mode, High Channel, Horizontal				
2483.5	PK (dBμV/m)	60.45	Limit	74(dBμV/m)
	AV (dBμV/m)	44.71		54(dBμV/m)
802.11n HT40 mode, High Channel, Vertical				
2483.5	PK (dBμV/m)	56.77	Limit	74(dBμV/m)
	AV (dBμV/m)	41.25		54(dBμV/m)

11.0 Antenna Requirement

11.1 Standard Applicable

For intentional device, according to FCC 47 CFR Section 15.203, 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.

And according to FCC 47 CFR Section 15.247 (b), if transmitter antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the mount in dB that the directional gain of the antenna exceeds 6 dBi.

11.2 Antenna Connected construction

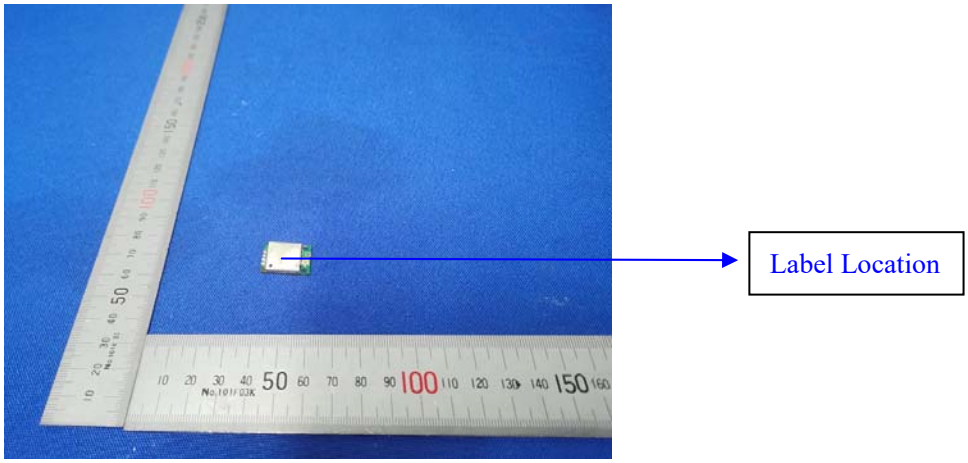
Alternative integral antennas provided to the EUT with male IPEX antenna connector. The gain of the antenna is 2.0dBi maximum for ANT1 and 3.0dBi for ANT 2. (Get from the antenna specification provided the applicant)

12.0 FCC ID Label

FCC ID: ZHZR8601

The label must not be a stick-on paper label. The label on these products must be permanently affixed to the product and readily visible at the time of purchase and must last the expected lifetime of the equipment not be readily detachable.

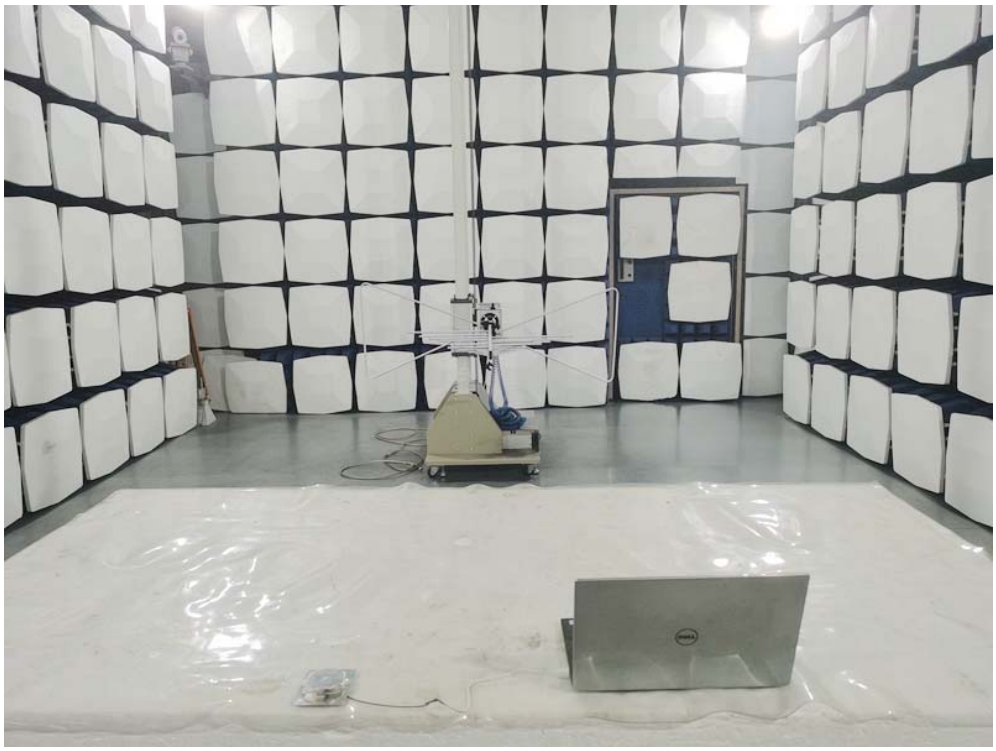
Mark Location:



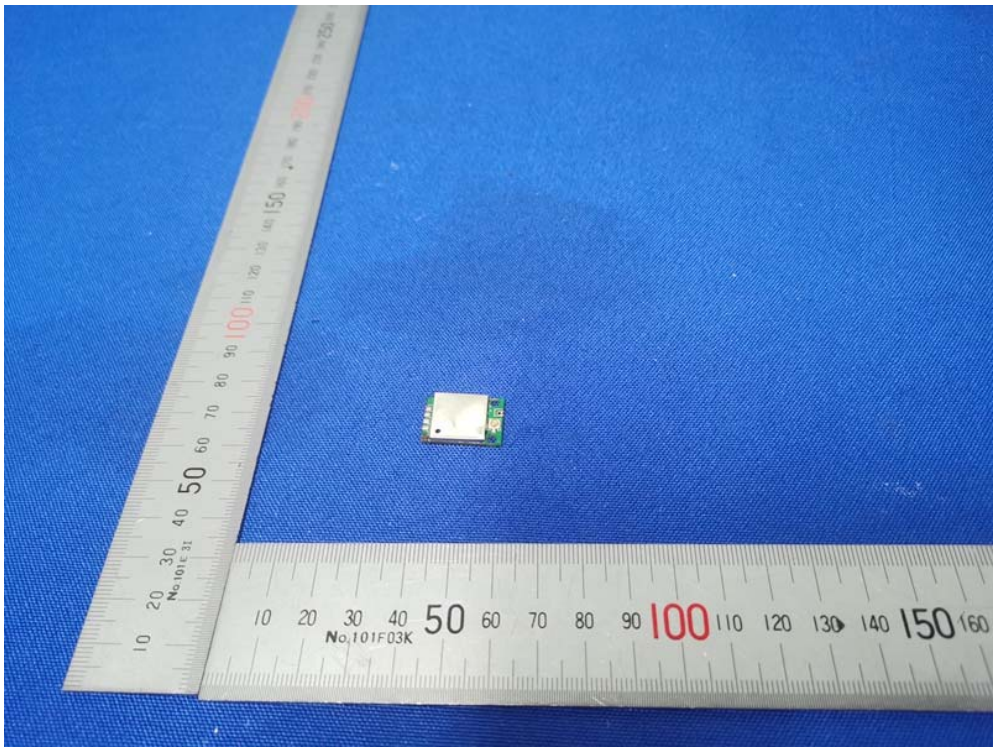
13.0 Photo of testing

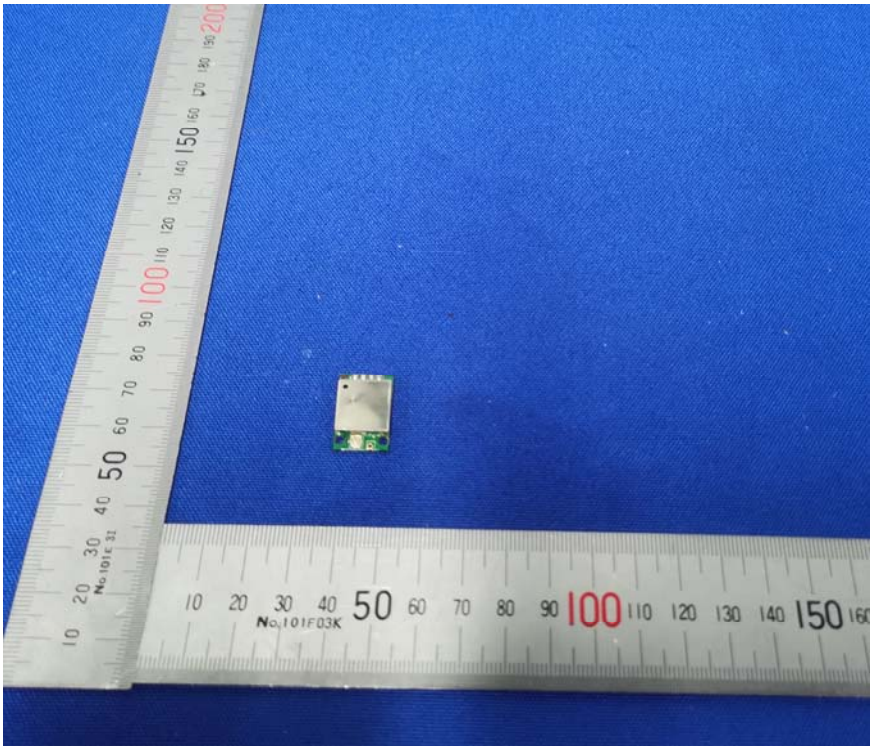
Conducted Emission Test Setup:

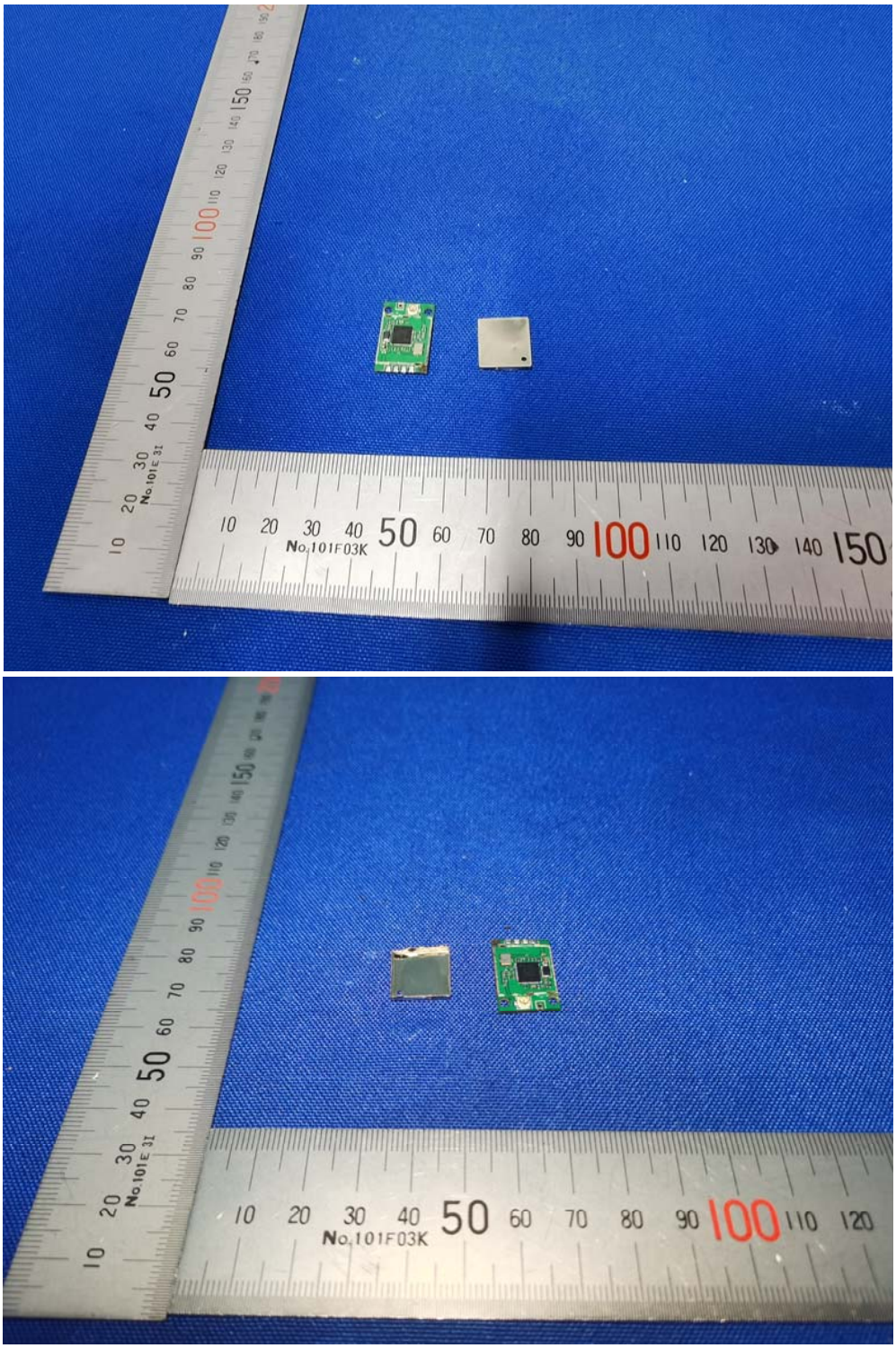
Radiated Emission Test Setup:

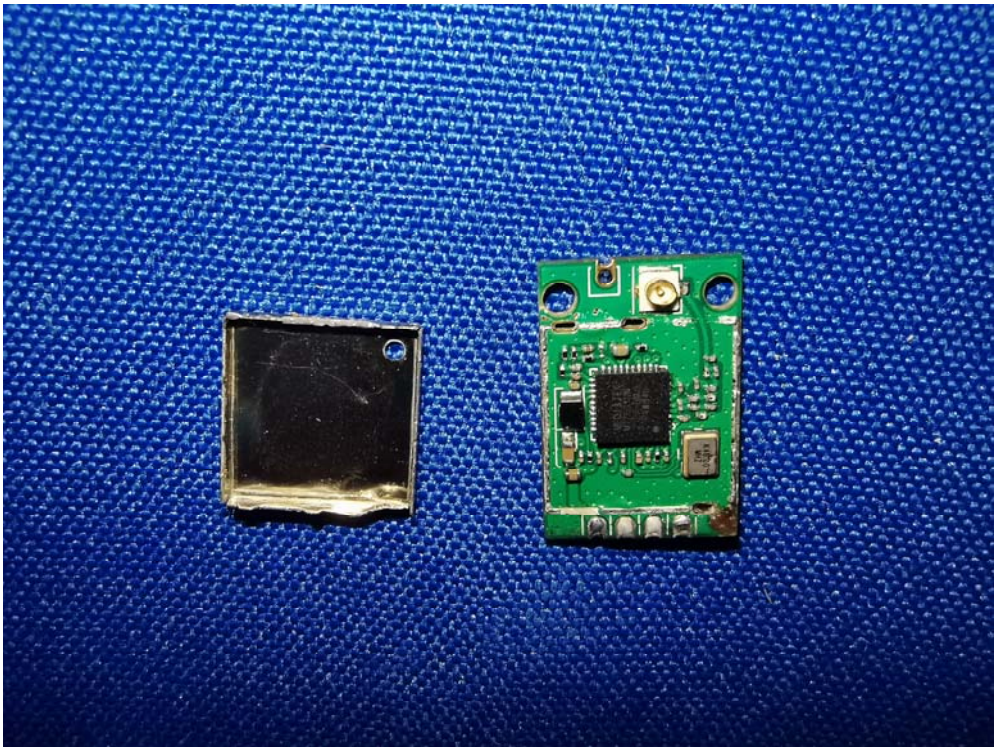


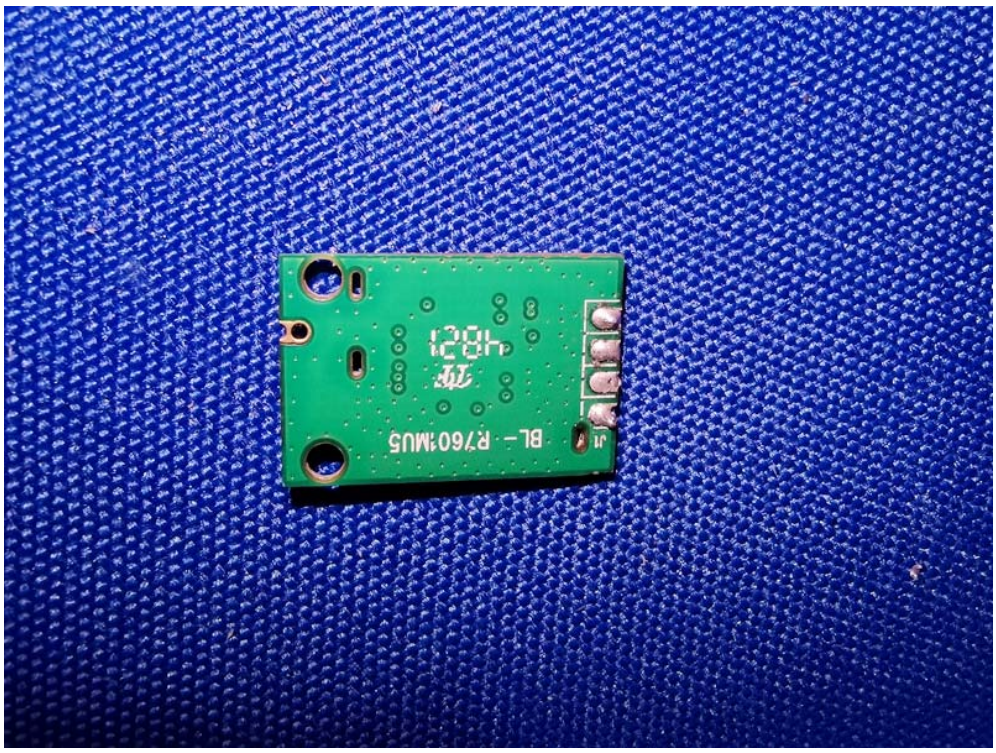
Photographs – EUT



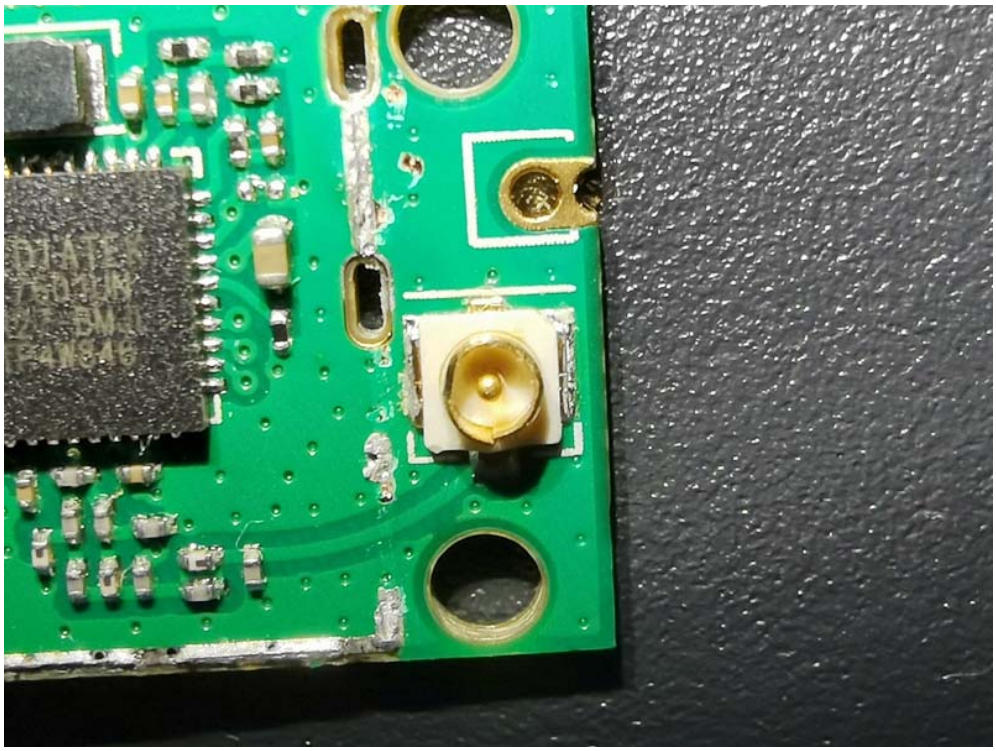




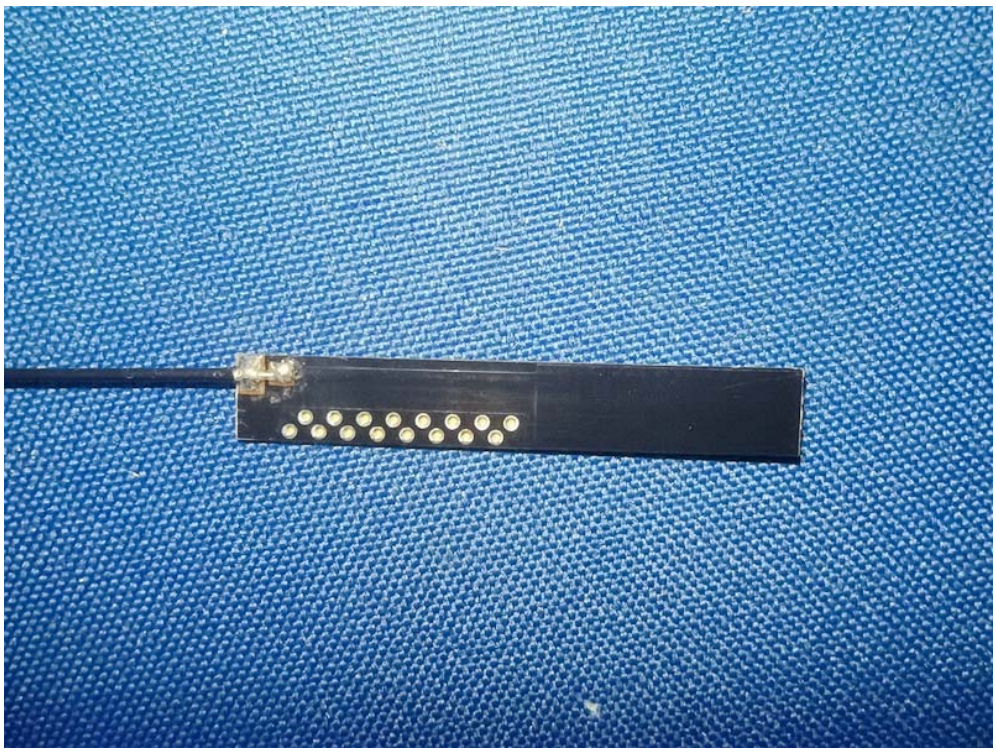




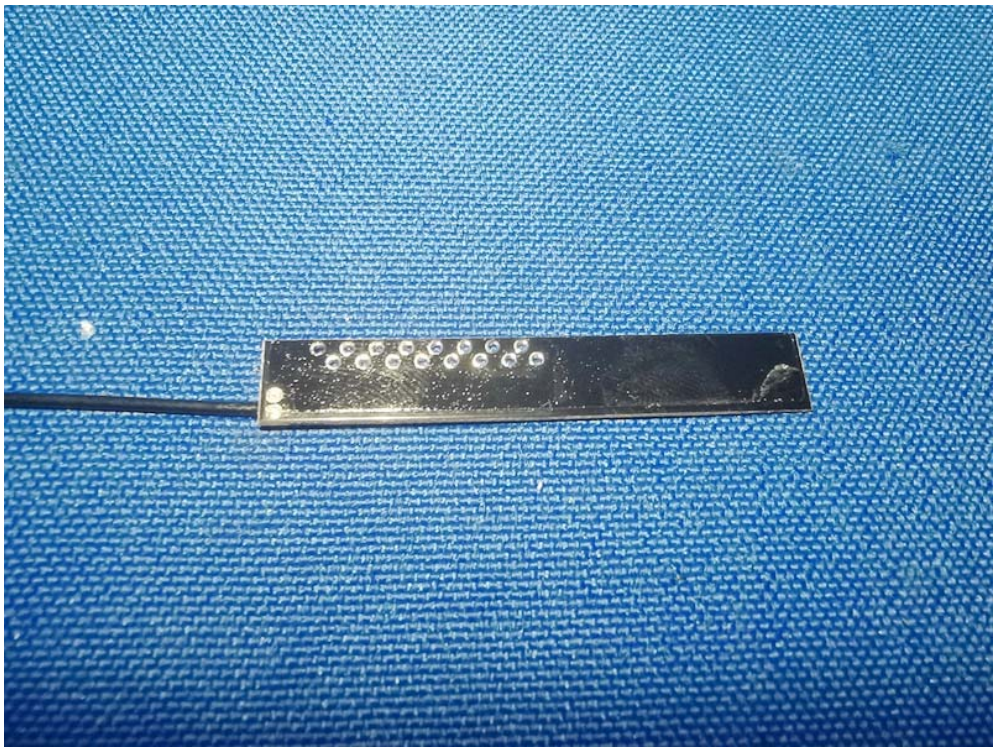
Inside view



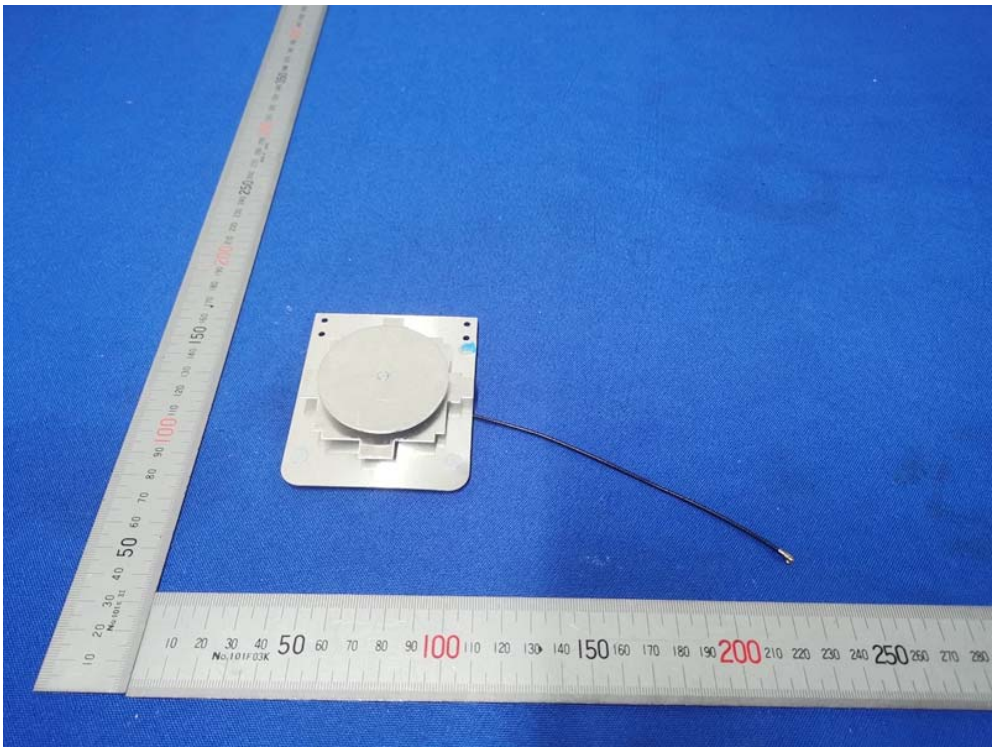
ANT1

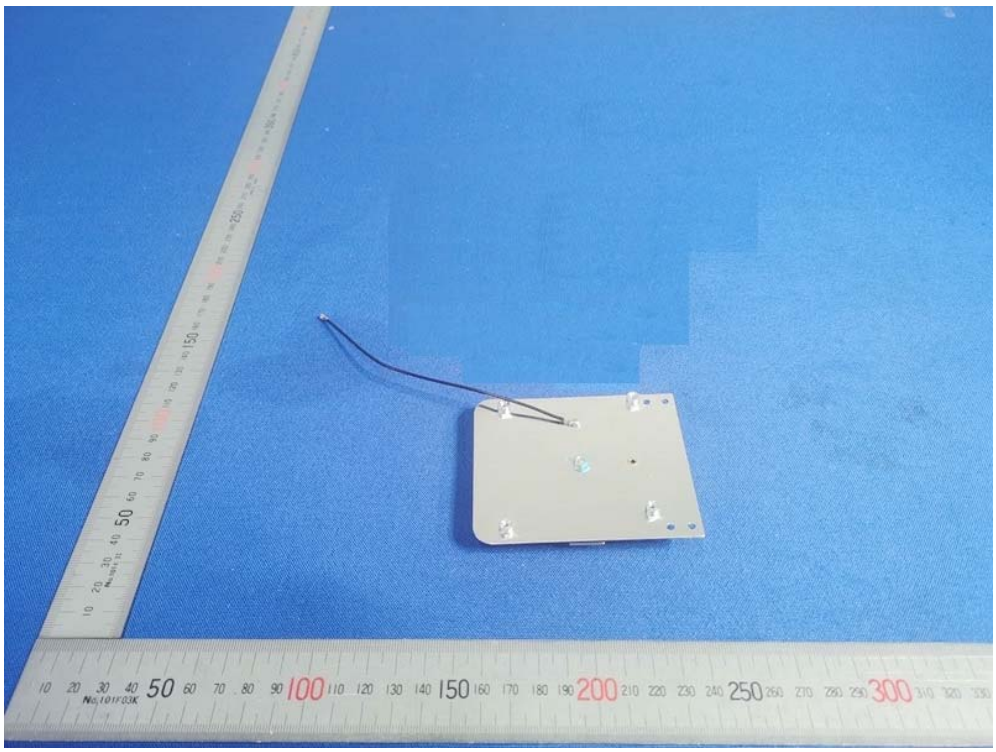


ANT1



ANT2





-End of the report-