FCC PART 15C
TEST REPORT
No.I22Z61591-IOT01

for

HMD Global Oy

GSM/WCDMA/LTE phone

TA-1420

FCC ID : 2AJOTTA-1420

with

Hardware Version: 1.0

Software Version: 00.2231.20.01

Issued Date: 2022-09-26

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 CTTL.

The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S.Government.

Test Laboratory:

CTTL-Telecommunication Technology Labs, CAICT

No. 52, Huayuan North Road, Haidian District, Beijing, P. R. China 100191.

Tel:+86(0)10-62304633-2512, Fax:+86(0)10-62304633-2504

Email: cttl_terminals@caict.ac.cn, website: www.caict.ac.cn

REPORT HISTORY

Report Number	Revision	Description	Issue Date
I22Z61591-IOT01	Rev.0	1st edition	2022-09-23
I22Z61591-IOT01	Rev.1	Add the model name on first page.	2022-09-26

CONTENTS

1. Test Laboratory

1.1. Introduction & Accreditation

Telecommunication Technology Labs, CAICT is an ISO/IEC 17025:2005 accredited test laboratory under NATIONAL VOLUNTARY LABORATORY ACCREDITATION PROGRAM (NVLAP) with lab code 600118-0, and is also an FCC accredited test laboratory (CN5017), and ISED accredited test laboratory (CN0066). The detail accreditation scope can be found on NVLAP website.

1.2. Testing Location

Conducted testing Location: CTTL(huayuan North Road)

Address: No. 52, Huayuan North Road, Haidian District, Beijing, P. R. China100191

Radiated testing Location: CTTL(huayuan North Road)

Address: No. 52, Huayuan North Road, Haidian District, Beijing, P. R. China100191

1.3. Testing Environment

Normal Temperature: 15-35℃

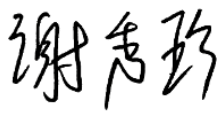
Relative Humidity: 20-75%

1.4. Project date

Testing Start Date: 2021-08-13

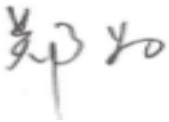
Testing End Date: 2022-09-23

1.5. Signature



Xie Xiuzhen

(Prepared this test report)



Zheng Wei

(Reviewed this test report)

Pang Shuai

(Approved this test report)

2. Client Information

2.1. Applicant Information

Company Name:	HMD Global Oy
Address:	Bertel Jungin aukio 9, 02600 Espoo, FINLAND
City:	Espoo
Postal Code:	/
Country:	FINLAND
Contact:	Mikko Kahlos
Email:	mikko.kahlos@hmdglobal.com
Telephone	+358 408036126

2.2. Manufacturer Information

Company Name:	HMD Global Oy
Address:	Bertel Jungin aukio 9, 02600 Espoo, FINLAND
City:	Espoo
Postal Code:	/
Country:	FINLAND
Contact:	Mikko Kahlos
Email:	mikko.kahlos@hmdglobal.com
Telephone	+358 408036126

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

3.1. About EUT

Description	GSM/WCDMA/LTE phone
Model name	TA-1420
FCC ID	2AJOTTA-1420
With WLAN Function	Yes
Frequency Range	ISM 2400MHz~2483.5MHz
Type of Modulation	DSSS/CCK/OFDM
Number of Channels	11
Antenna	Integral Antenna
MAX Conducted Power	25.99dBm
Power Supply	3.85V

3.2. Internal Identification of EUT

EUT ID*	SN or IMEI	HW Version	SW Version
EUT54	/	1.0	00.2231.20.01
EUT1	/	1.0	00.2231.20.01

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

3.3. Internal Identification of AE

AE ID*	Description	SN
AE1	SWITCHING ADAPTER	/
AE2	HEADSET	/
AE3	BATTERY	/

AE1

Model	DSA-5PF18-05 FUS 050100
Manufacturer	DVE
Length of cable	/

AE2

Type	WH-108
Manufacturer	Rongtaifeng
Length of cable	/

AE3

Type	HE40
Manufacturer	SHENZHEN UTILITY ENERGY CO., LTD.

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

3.4. General Description

The Equipment under Test (EUT) is a model of GSM/WCDMA/LTE phone with integrated antenna and inbuilt battery.

It consists of normal options: travel charger, USB cable.

Manual and specifications of the EUT were provided to fulfil the test.

Samples undergoing test were selected by the client.

3.5. Interpretation of the Test Environment

For the test methods, the test environment uncertainty figures correspond to an expansion factor k=2.

Measurement Uncertainty

Parameter	Uncertainty
temperature	0.48°C
humidity	2 %
DC voltages	0.003V

4. Reference Documents

4.1. Documents supplied by applicant

EUT feature information is supplied by the applicant 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, 2400-2483.5 MHz, and 5725-5850 MHz.	2018
ANSI C63.10	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices	2013
KDB 558074 D01	Federal Communications Commission Office of Engineering and Technology Laboratory Division GUIDANCE FOR COMPLIANCE MEASUREMENTS ON DIGITAL TRANSMISSION SYSTEM, FREQUENCY HOPPING SPREAD SPECTRUM SYSTEM, AND HYBRID SYSTEM DEVICES OPERATING UNDER SECTION 15.247 OF THE FCC RULES	2019

5. Test Results

5.1. Summary of Test Results

SUMMARY OF MEASUREMENT RESULTS	Sub-clause of Part15C	Sub-clause of IC	Verdict
Maximum Peak Output Power	15.247 (b)	/	BR
Peak Power Spectral Density	15.247 (e)	/	BR
Occupied 6dB Bandwidth	15.247 (a)	/	BR
Band Edges Compliance	15.247 (d)	/	BR
Transmitter Spurious Emission - Conducted	15.247 (d)	/	BR
Transmitter Spurious Emission - Radiated	15.247, 15.205, 15.209	/	BR
AC Powerline Conducted Emission	15.107, 15.207	/	BR

Please refer to **ANNEX A** for detail.

Terms used in Verdict column

P	Pass, The EUT complies with the essential requirements in the standard.
NP	Not Perform, The test was not performed by CTTL
BR	Re-use test data from basic model report.
NA	Not Applicable, The test was not applicable
F	Fail, The EUT does not comply with the essential requirements in the standard

5.2. Statements

The test cases as listed in section 5.1 of this report for the EUT specified in section 3 was performed by CTTL and according to the standards or reference documents listed in section 4.2

The EUT met all requirements of the standards or reference documents, and only the WLAN function was tested in this report.

The Equipment Under Test (EUT) model TA-1420 (FCC ID: 2AJOTTA-1420) is variant products of N139DL (FCC ID: 2AJOTTA-1398), according to the declaration of changes provided by the applicant and FCC KDB publication 484596 D01, spot check measurements were performed on this device, all the test results are derived from test report No.I21Z61291-IOT08.

For detail differences between two models please refer the Declaration of Changes document.

5.3. Test Conditions

T nom	Normal Temperature
T min	Low Temperature
T max	High Temperature
V nom	Normal Voltage

For this report, if the test cases listed above are tested under normal temperature and normal voltage, and also under norm humidity, the specific condition is shown as follows:

Temperature	T nom	26℃
Voltage	V nom	3.85V
Humidity	H nom	20-75%

6. Test Facilities Utilized

Conducted test system

No.	Equipment	Model	Serial Number	Manufacturer	Calibration Period	Calibration Due date
1	Vector Signal Analyzer	FSQ40	200089	Rohde & Schwarz	1 year	2023-05-15
2	LISN	ENV216	101200	R&S	1 year	2022-05-30
3	Test Receiver	ESCI	100344	R&S	1 year	2022-02-23
4	Shielding Room	S81	/	ETS-Lindgren	/	/

Radiated emission test system

No.	Equipment	Model	Serial Number	Manufacturer	Calibration Period	Calibration Due date
1	Test Receiver	ESU26	100235	Rohde & Schwarz	1 year	2022-02-23
2	BiLog Antenna	VULB9163	9163-01223	Schwarzbeck	1 year	2022-03-22
3	Antenna	3115	6914	ETS-Lindgren	1 year	2022-02-03
4	Dual-Ridge Waveguide Horn Antenna	3116	2661	ETS-Lindgren	1 year	2022-01-05
5	Analytical Spectrometer	FSV40	R&S	101047	1 year	2022-05-17

7. Measurement Uncertainty

7.1. Maximum Output Power

Measurement Uncertainty: 0.387dB,k=1.96

7.2. Peak Power Spectral Density

Measurement Uncertainty: 0.705dB,k=1.96

7.3. DTS 6-dB Signal Bandwidth

Measurement Uncertainty: 60.80Hz,k=1.96

7.4. Band Edges Compliance

Measurement Uncertainty : 0.62dB,k=1.96

7.5. Transmitter Spurious Emission

Conducted (k=1.96)

Frequency Range	Uncertainty(dB)
30MHz ≤ f ≤ 2GHz	1.22
2GHz ≤ f ≤3.6GHz	1.22
3.6GHz ≤ f ≤8GHz	1.22
8GHz ≤ f ≤12.75GHz	1.51
12.75GHz ≤ f ≤26GHz	1.51
26GHz ≤ f ≤40GHz	1.59

Radiated (k=2)

Frequency Range	Uncertainty(dB)
9kHz-30MHz	/
30MHz ≤ f ≤ 1GHz	5.16
1GHz ≤ f ≤18GHz	5.44
18GHz ≤ f ≤40GHz	5.28

7.6. AC Power-line Conducted Emission

Measurement Uncertainty: 3.08dB, k=2

ANNEX A: Detailed Test Results

A.1. Measurement Method

A.1.1. Conducted Measurements

Connect the EUT to the test system as Fig.A.1.1.1 shows.
Set the EUT to the required work mode.
Set the EUT to the required channel.
Set the Vector Signal Analyzer and start measurement.
Record the values. Vector Signal Analyzer

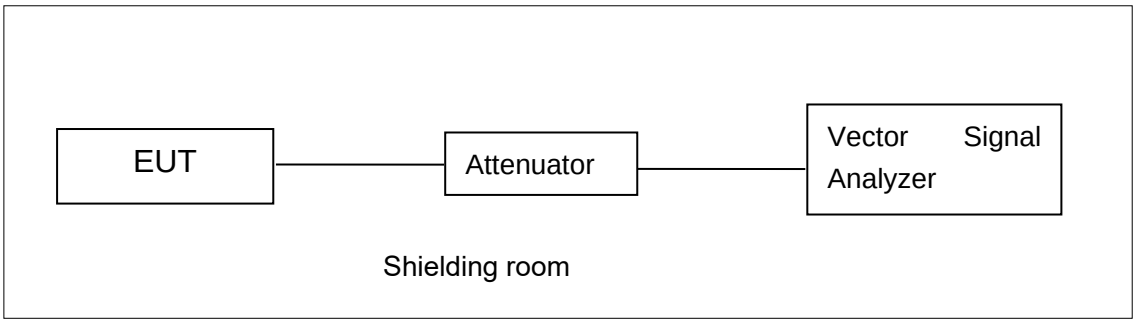


Fig.A.1.1.1: Test Setup Diagram for Conducted Measurements

A.1.2. Radiated Emission Measurements

In the case of radiated emission, the used settings are as follows,
Sweep frequency from 30 MHz to 1GHz, RBW = 100 kHz, VBW = 300 kHz;
Sweep frequency from 1 GHz to 26GHz, RBW = 1MHz, VBW = 3MHz;

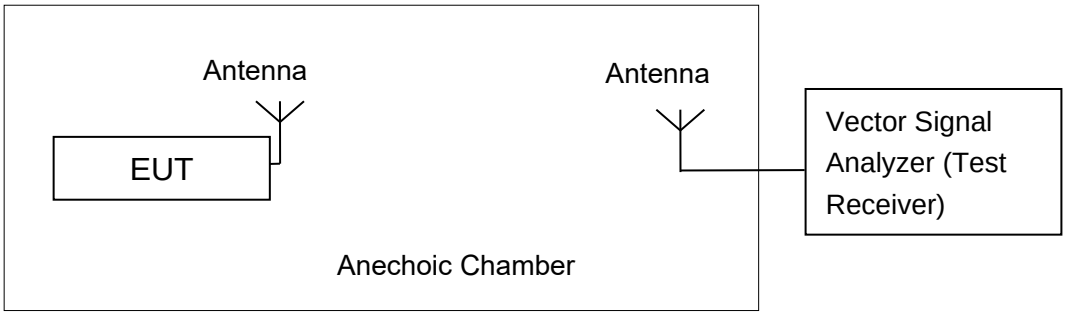


Fig.A.1.2.1: Test Setup Diagram for Radiated Measurements

A.2. Maximum Output Power

Method of Measurement: See ANSI C63.10-2013-clause 11.9.1.3

The maximum peak conducted output power may be measured using a broadband peak RF power meter.

The power meter shall have a video bandwidth that is greater than or equal to the DTS bandwidth and shall

use a fast-responding diode detector.

Measurement Limit:

Standard	Limit (dBm)
FCC CRF Part 15.247(b)	< 30

EUT ID: EUT54

A.2.1. Peak Output Power-conducted

Measurement Results:

802.11b/g mode

Mode	Data Rate (Mbps)	Test Result (dBm)		
		2412MHz (Ch1)	2437MHz (Ch6)	2462 MHz (Ch11)
802.11b	1	20.10	21.40	20.25
	2	/	/	/
	5.5	/	/	/
	11	/	/	/
802.11g	6	23.11	22.50	22.30
	9	/	/	/
	12	/	/	/
	18	/	/	/
	24	/	/	/
	36	/	/	/
	48	/	/	/
	54	/	/	/

The data rate 1Mbps and 6Mbps are selected as worst condition, and the following cases are performed with this condition.

802.11n-HT20 mode

Mode	Data Rate (Index)	Test Result (dBm)		
		2412MHz (Ch1)	2437MHz (Ch6)	2462 MHz (Ch11)
802.11n (20MHz)	MCS0	22.16	21.46	21.43
	MCS1	/	/	/
	MCS2	/	/	/
	MCS3	/	/	/
	MCS4	/	/	/
	MCS5	/	/	/
	MCS6	/	/	/
	MCS7	/	/	/

The data rate MCS0 are selected as worst condition, and the following cases are performed with this condition.

Note:The duty cycle of the EUT is 100%.

The spot check result of average output power is 15.04dBm (802.11b 5.5Mbps ch6 prototype result: 16.48dBm).

Conclusion: Pass

A.3. Peak Power Spectral Density

Method of Measurement: See ANSI C63.10-2013-clause 11.10.2

a) Set analyzer center frequency to DTS channel center frequency.
b) Set the span to 1.5 times the DTS bandwidth.
c) Set the RBW to RBW = 3 kHz.
d) Set the VBW = 10 kHz.
e) Detector = peak.
f) Sweep time = auto couple.
g) Trace mode = max hold.
h) Allow trace to fully stabilize.
i) Use the peak marker function to determine the maximum amplitude level within the RBW.

Measurement Limit:

Standard	Limit
FCC CRF Part 15.247(e)	< 8 dBm/3 kHz

Measurement Results:

Mode	Channel	Power Spectral Density (dBm/3 kHz) ANT0	
802.11b	1	Fig.3.1.	-5.75
	6	Fig.3.2.	-6.03
	11	Fig.3.3.	-5.28
802.11g	1	Fig.3.4.	-11.08
	6	Fig.3.5.	-10.75
	11	Fig.3.6.	-11.79
802.11n (HT20)	1	Fig.3.7.	-12.75
	6	Fig.3.8.	-12.25
	11	Fig.3.9.	-13.20

Conclusion: Pass

Test graphs as below:

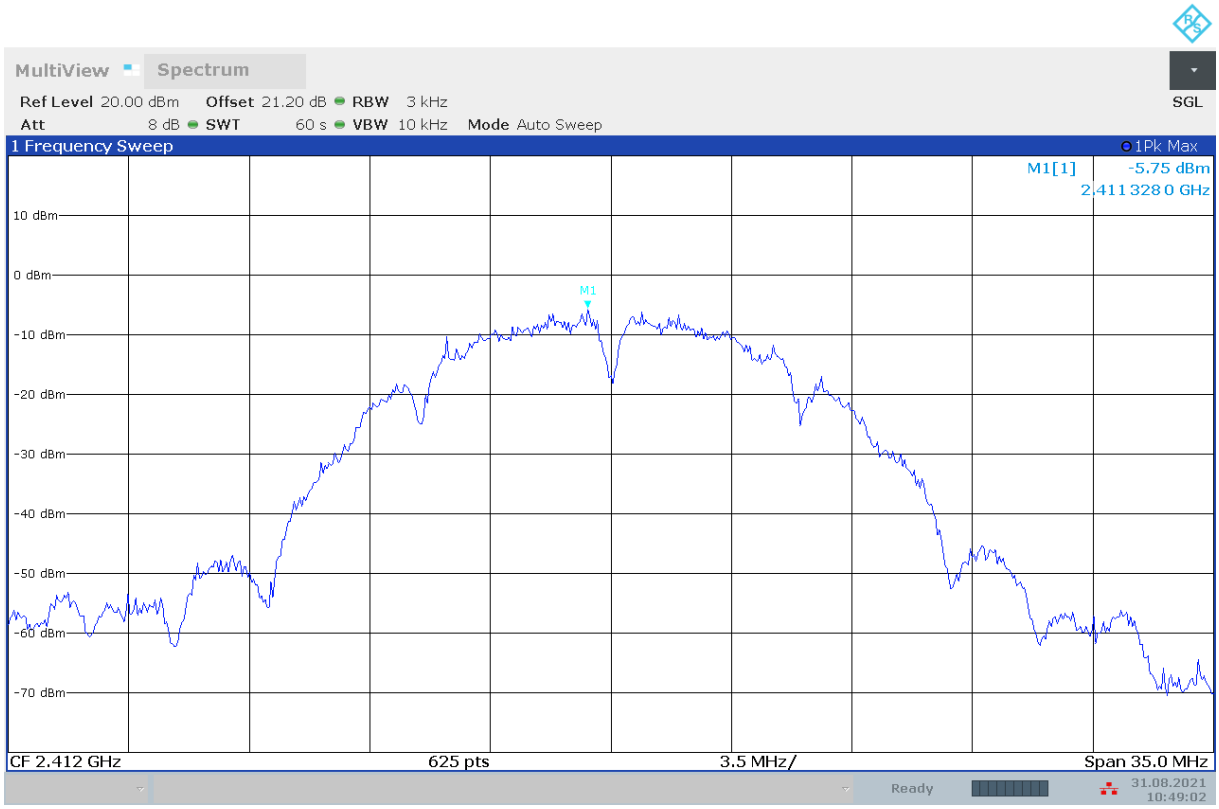


Fig.A.3.1 Power Spectral Density(802.11b,Ch1)

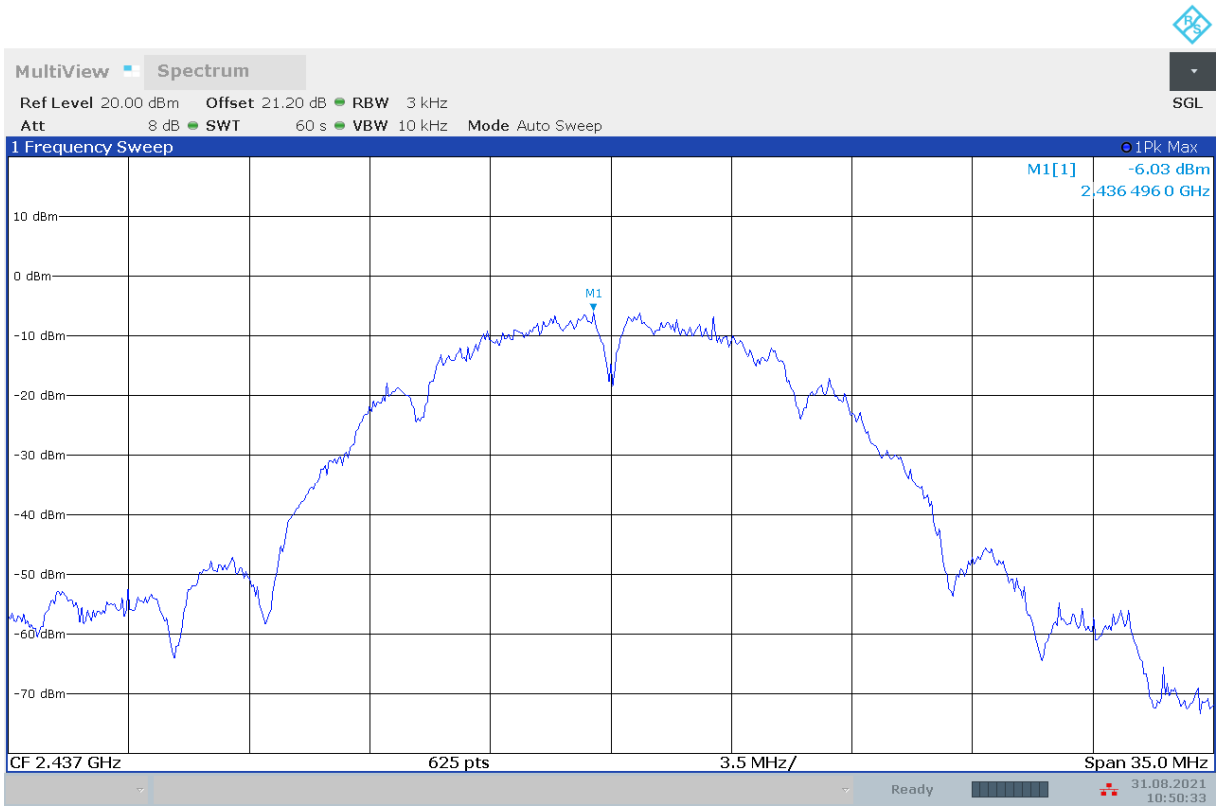


Fig.A.3.2 Power Spectral Density (802.11b, Ch 6)

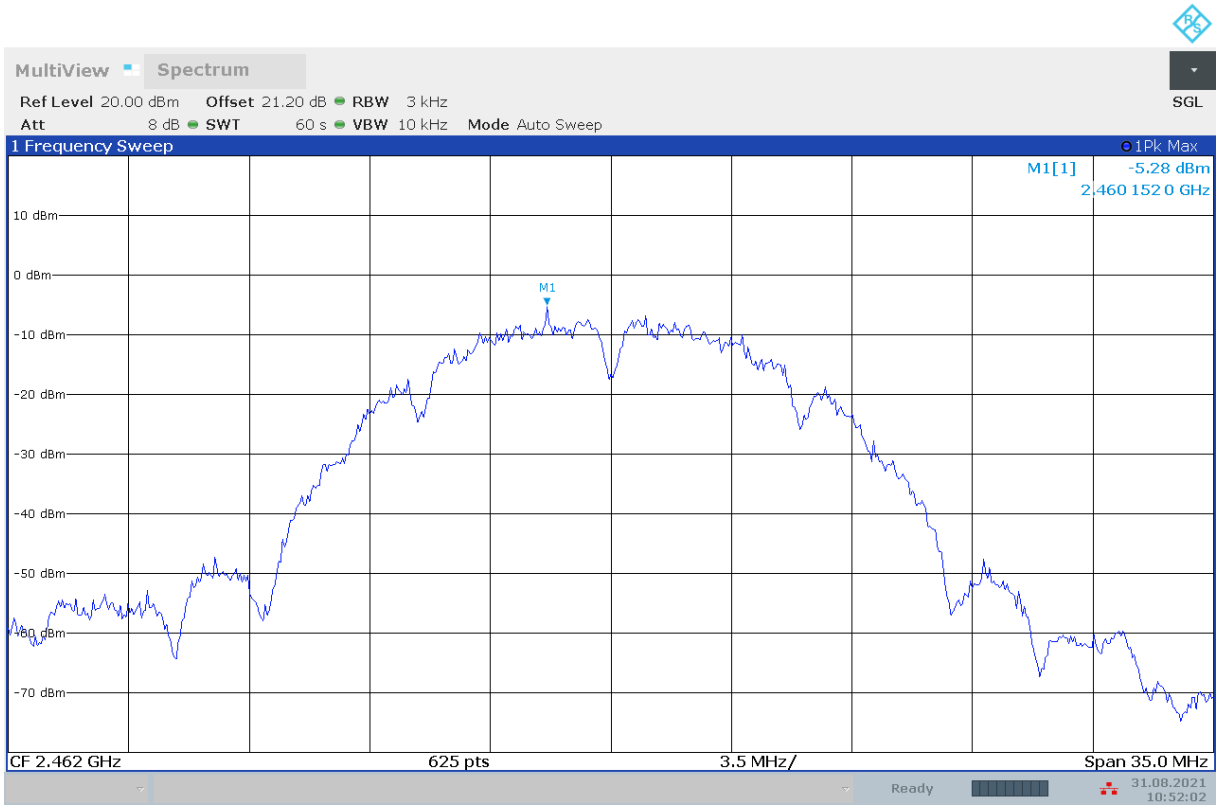


Fig.A.3.3 Power Spectral Density (802.11b, Ch 11)

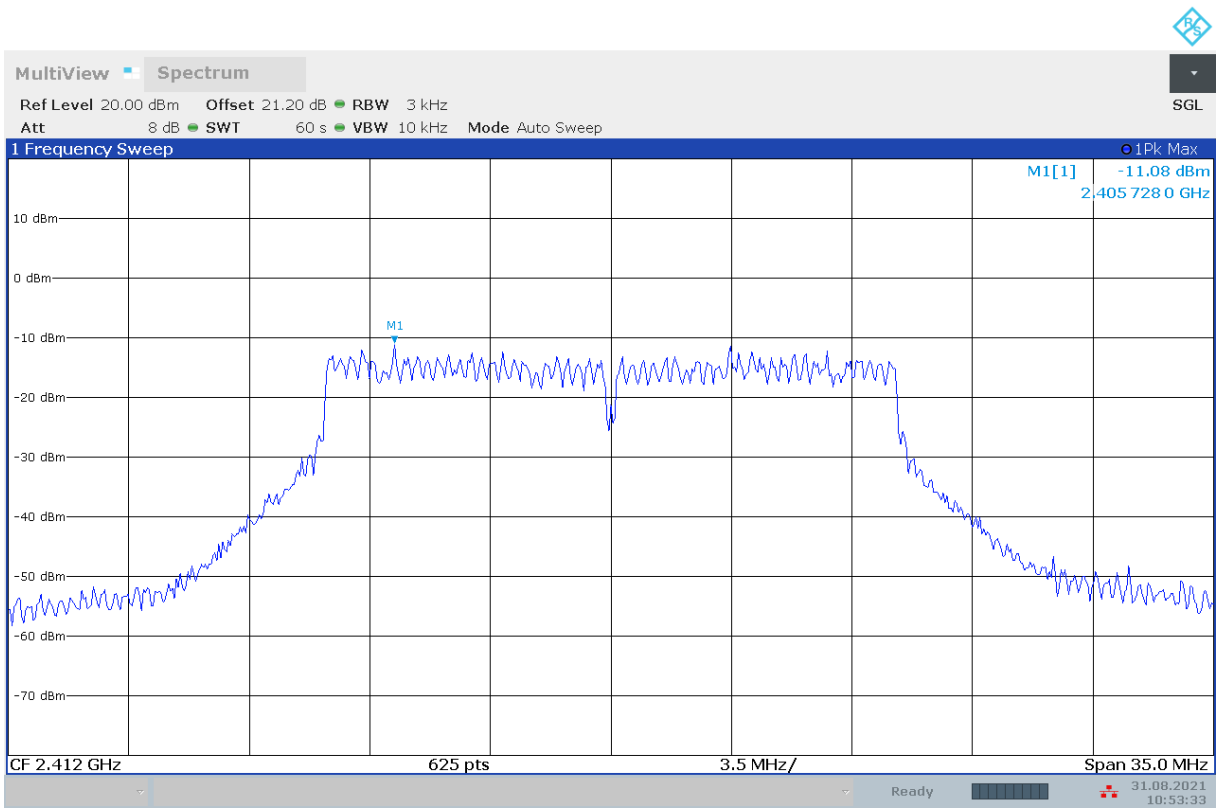


Fig.A.3.4 Power Spectral Density (802.11g, Ch 1)

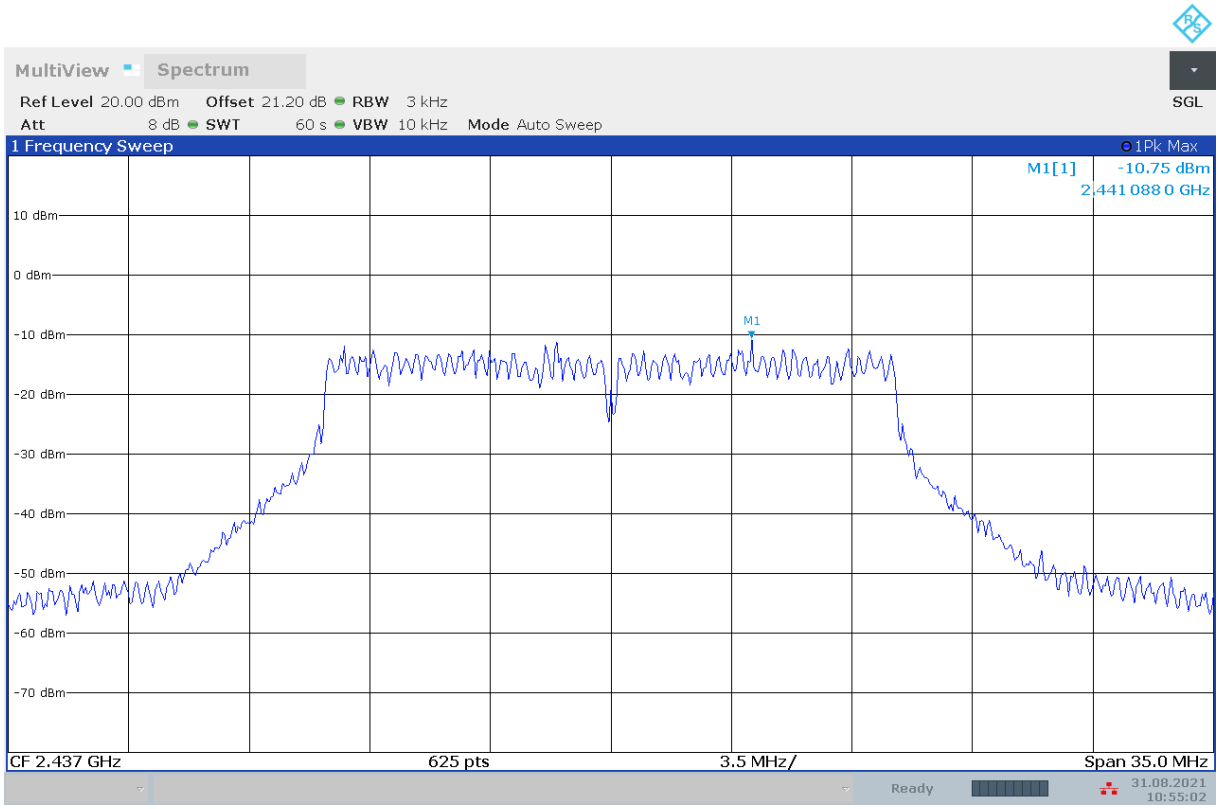


Fig.A.3.5 Power Spectral Density (802.11g, Ch 6)

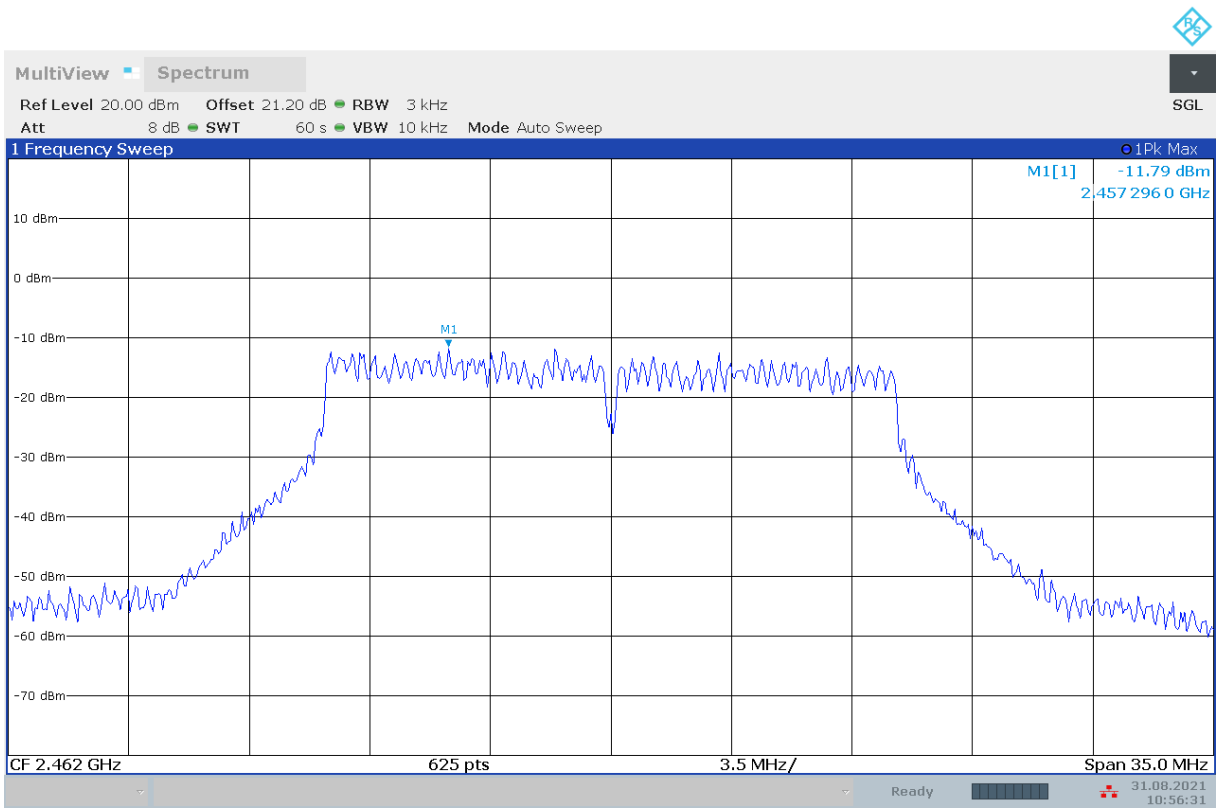


Fig.A.3.6 Power Spectral Density (802.11g, Ch 11)

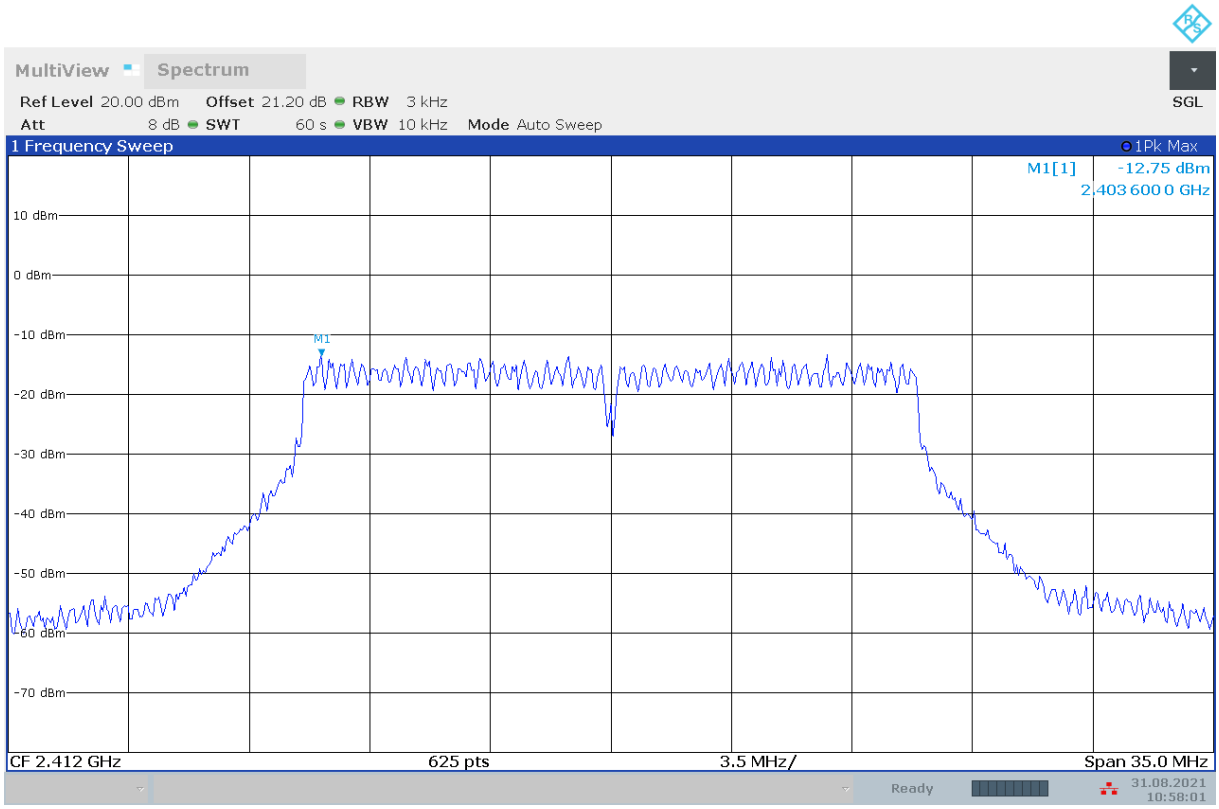


Fig.A.3.7 Power Spectral Density (802.11n-HT20, Ch 1)

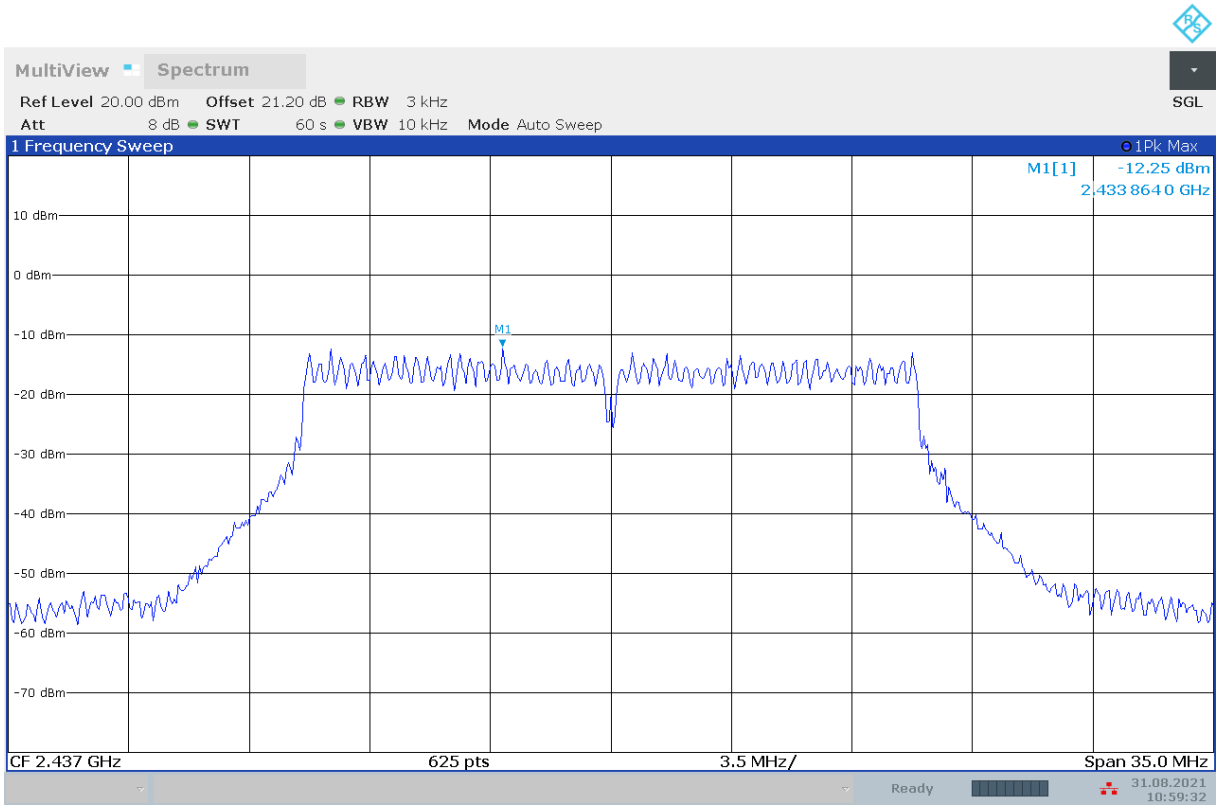


Fig.A.3.8 Power Spectral Density (802.11n-HT20, Ch 6)

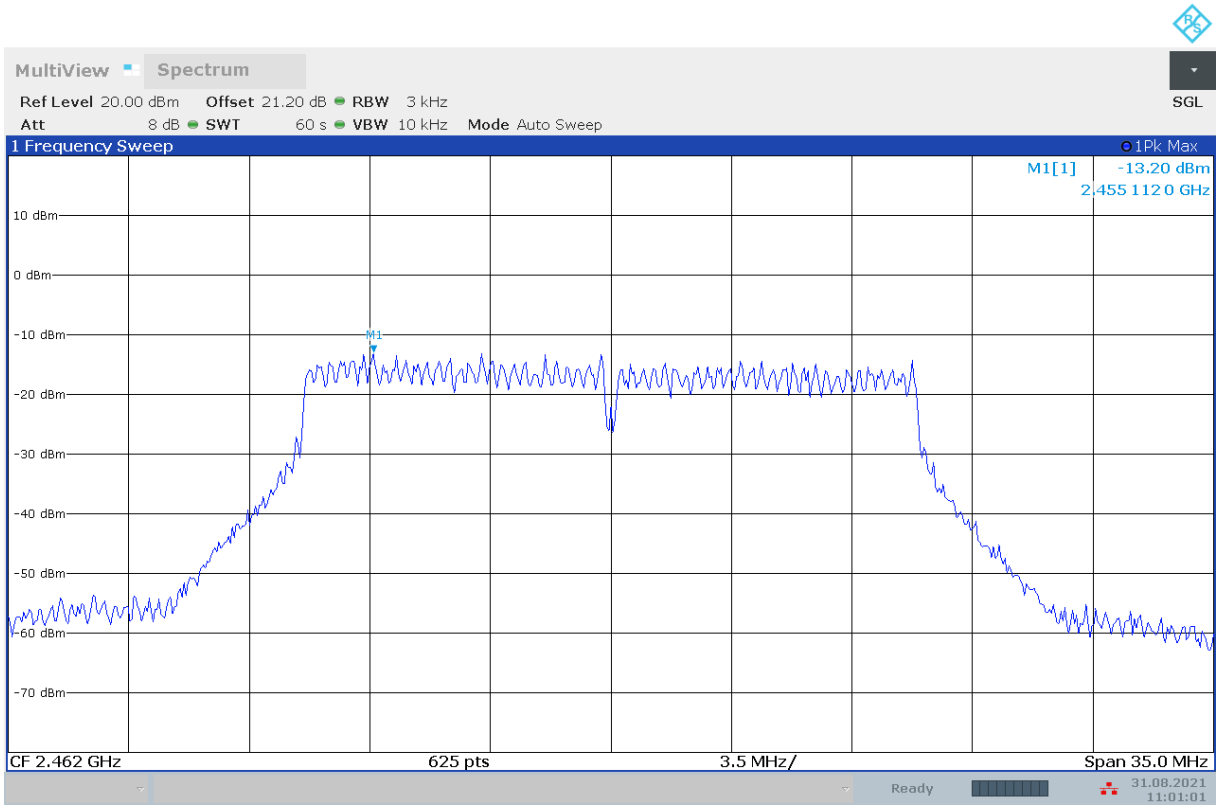


Fig.A.3.9 Power Spectral Density (802.11n-HT20, Ch 11)

A.4. DTS 6-dB Signal Bandwidth

Method of Measurement: See ANSI C63.10-2013 section 11.8.1.

a) Set RBW = 100 kHz.

b) Set the video bandwidth (VBW) = 300 kHz.

c) Detector = Peak.

d) Trace mode = max hold.

e) Sweep = auto couple.

f) Allow the trace to stabilize.

g) 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.

Measurement Limit:

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

EUT ID: EUT54

Measurement Result:

SISO ANT0:

802.11b/g mode

Mode	Channel	Occupied 6dB Bandwidth (kHz)		conclusion
802.11b	1	Fig.A.4.1	9029	P
	6	Fig.A.4.2	9008	P
	11	Fig.A.4.3	8526	P
802.11g	1	Fig.A.4.4	16340	P
	6	Fig.A.4.5	16335	P
	11	Fig.A.4.6	16329	P

802.11n-HT20 mode

Mode	Channel	Occupied 6dB Bandwidth (kHz)		conclusion
802.11n (HT20)	1	Fig.A.4.7	17575	P
	6	Fig.A.4.8	17576	P
	11	Fig.A.4.9	17297	P

Test graphs as below:

SISO ANT0:

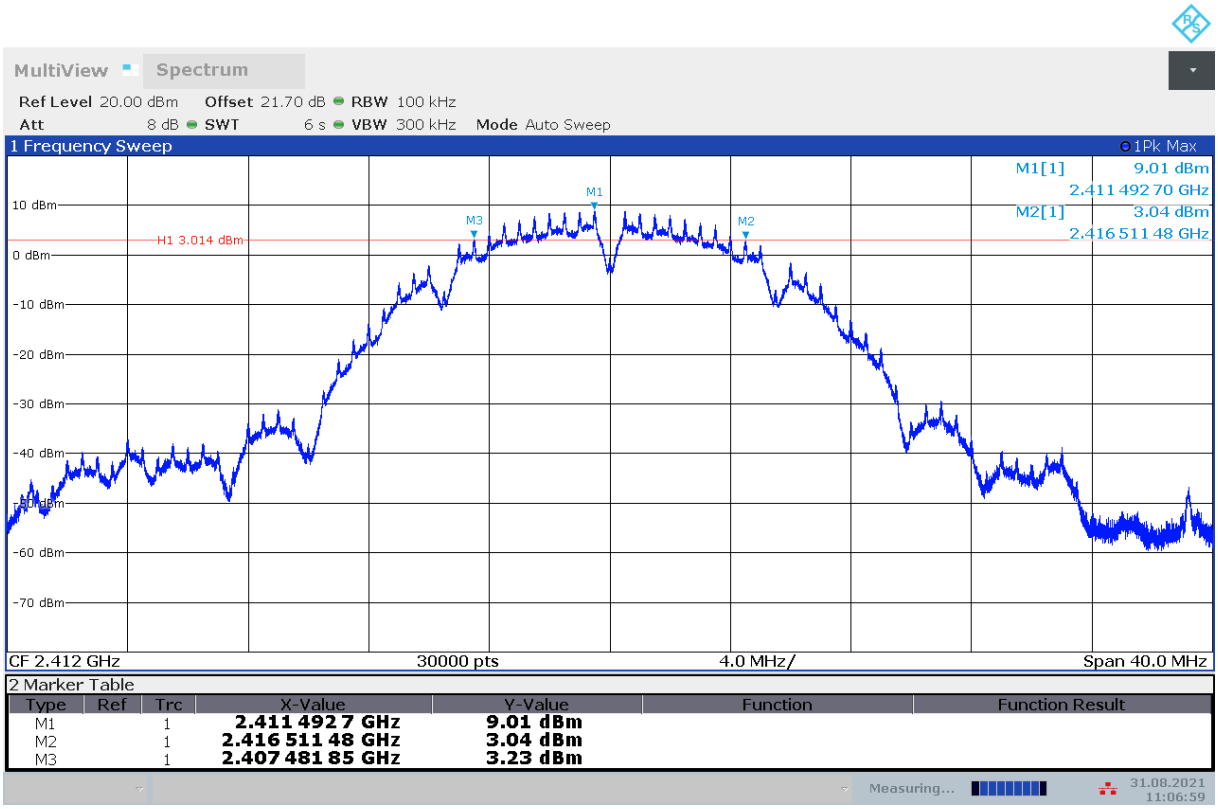


Fig.A.4.1 Occupied 6dB Bandwidth(802.11b,Ch 1)

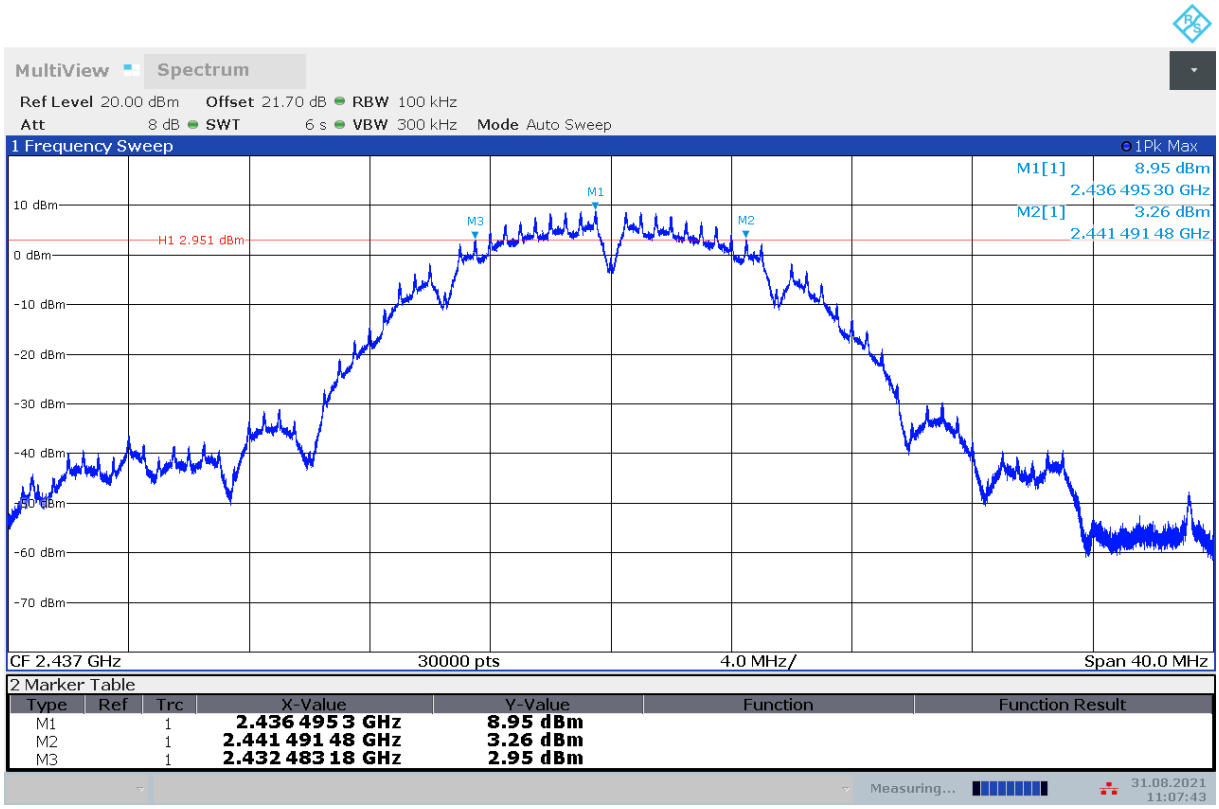


Fig.A.4.2 Occupied 6dB Bandwidth (802.11b, Ch 6)

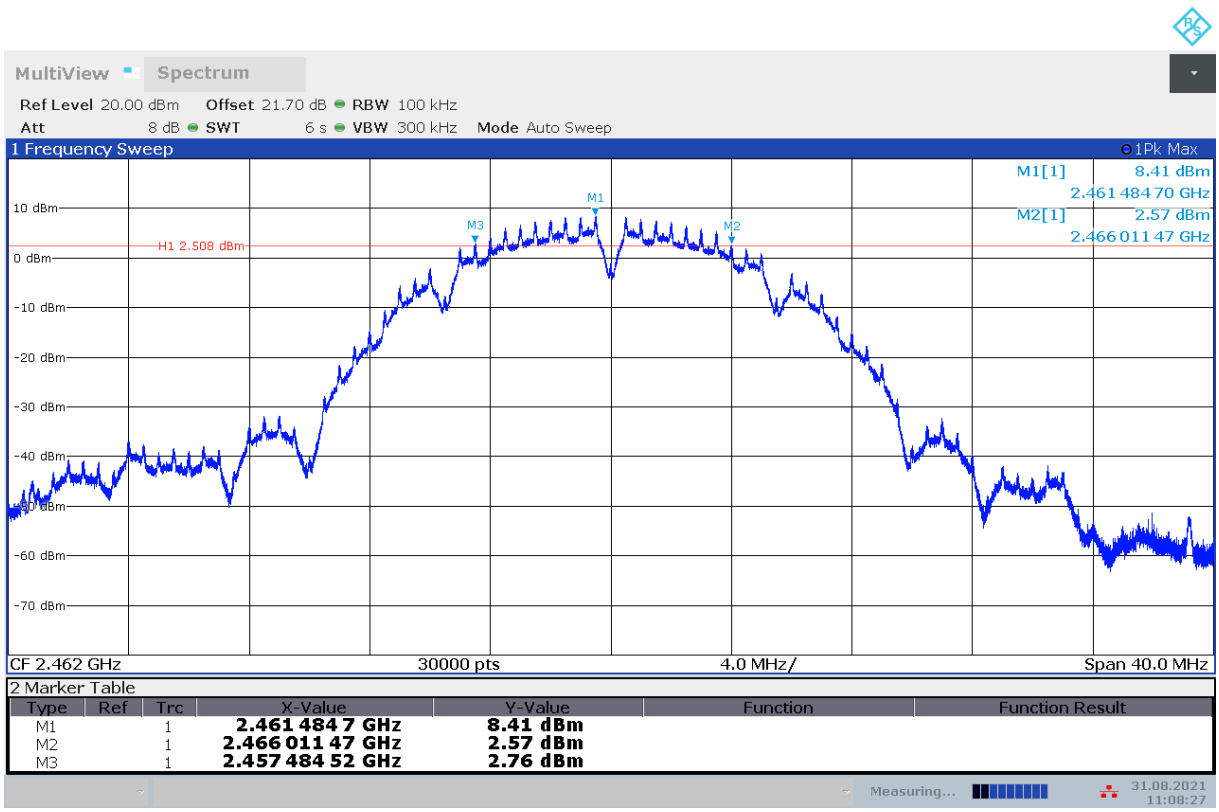


Fig.A.4.3 Occupied 6dB Bandwidth (802.11b, Ch 11)

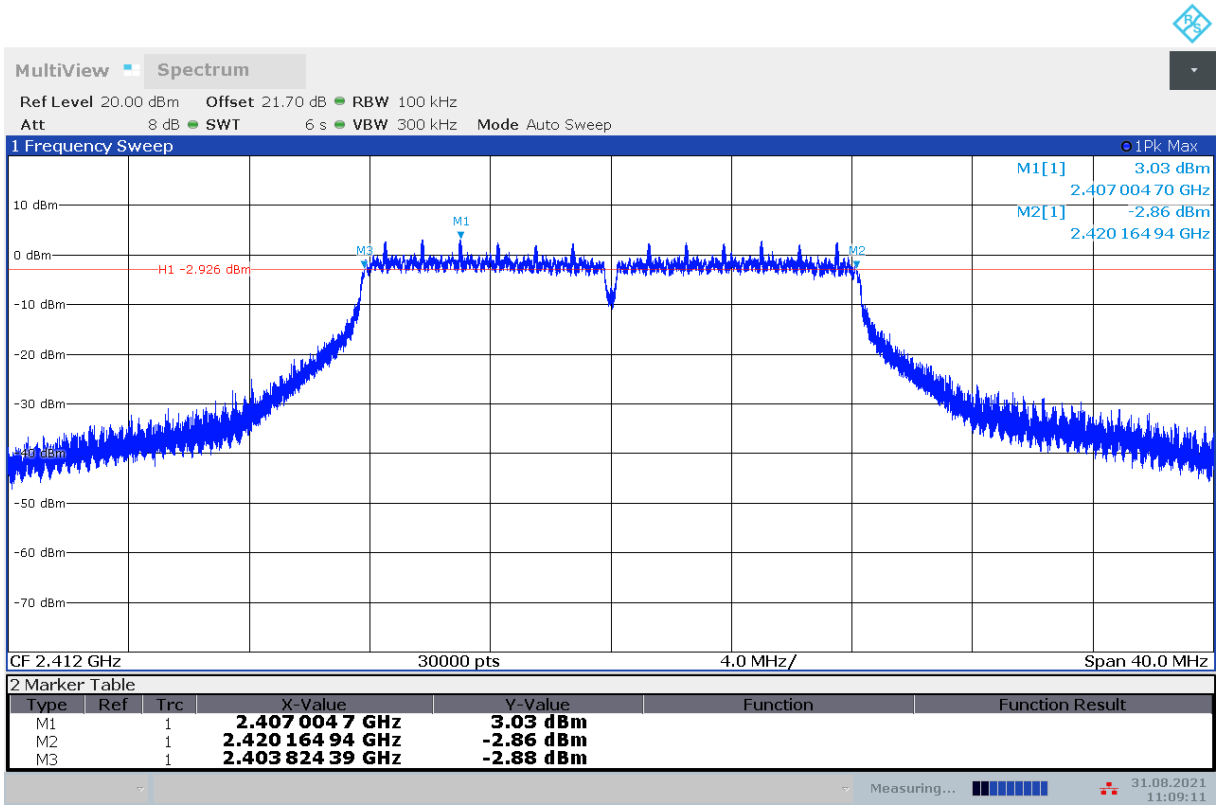


Fig.A.4.4 Occupied 6dB Bandwidth (802.11g, Ch 1)

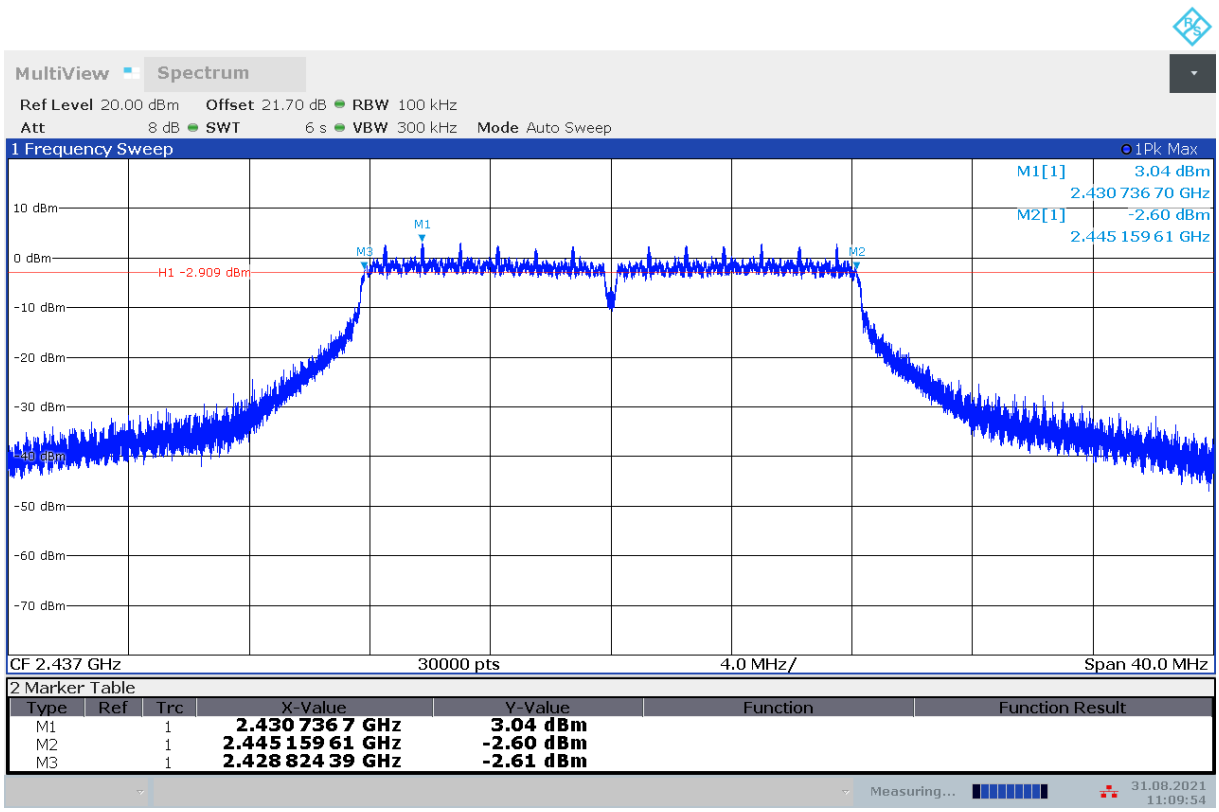


Fig.A.4.5 Occupied 6dB Bandwidth (802.11g, Ch 6)

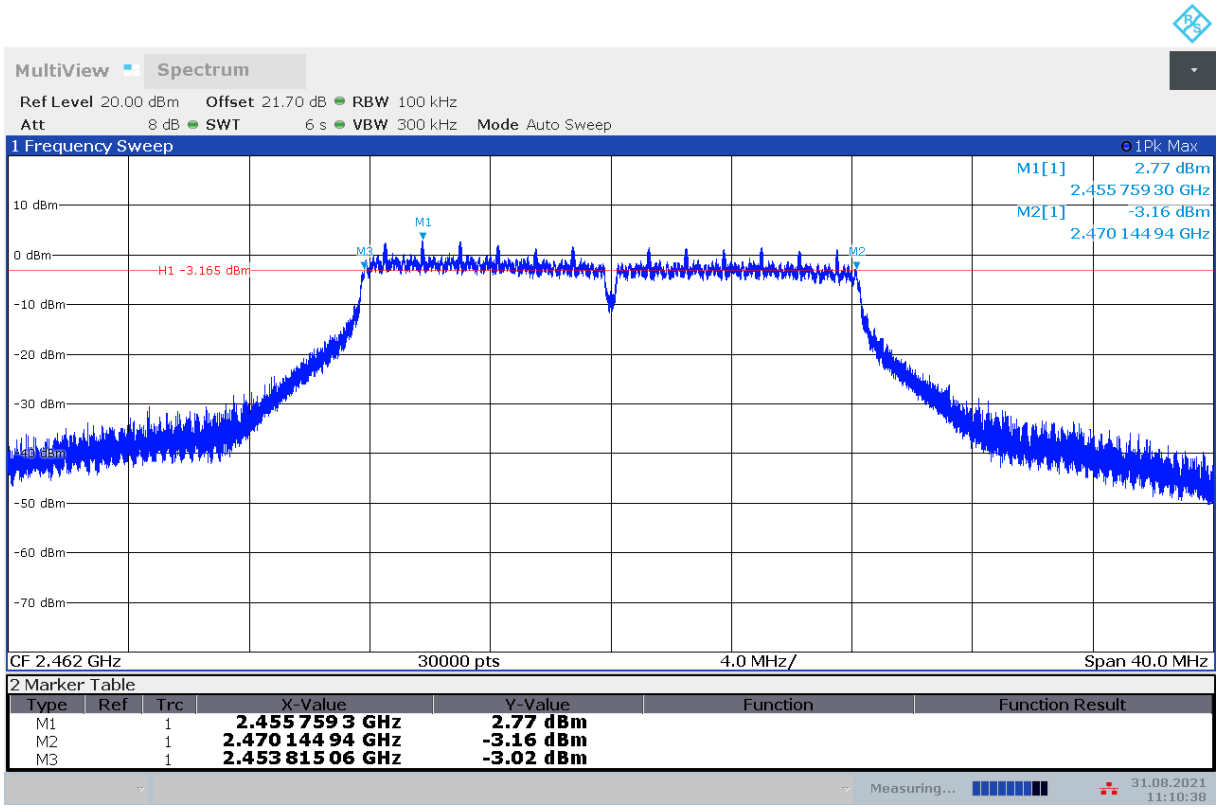


Fig.A.4.6 Occupied 6dB Bandwidth (802.11g, Ch 11)

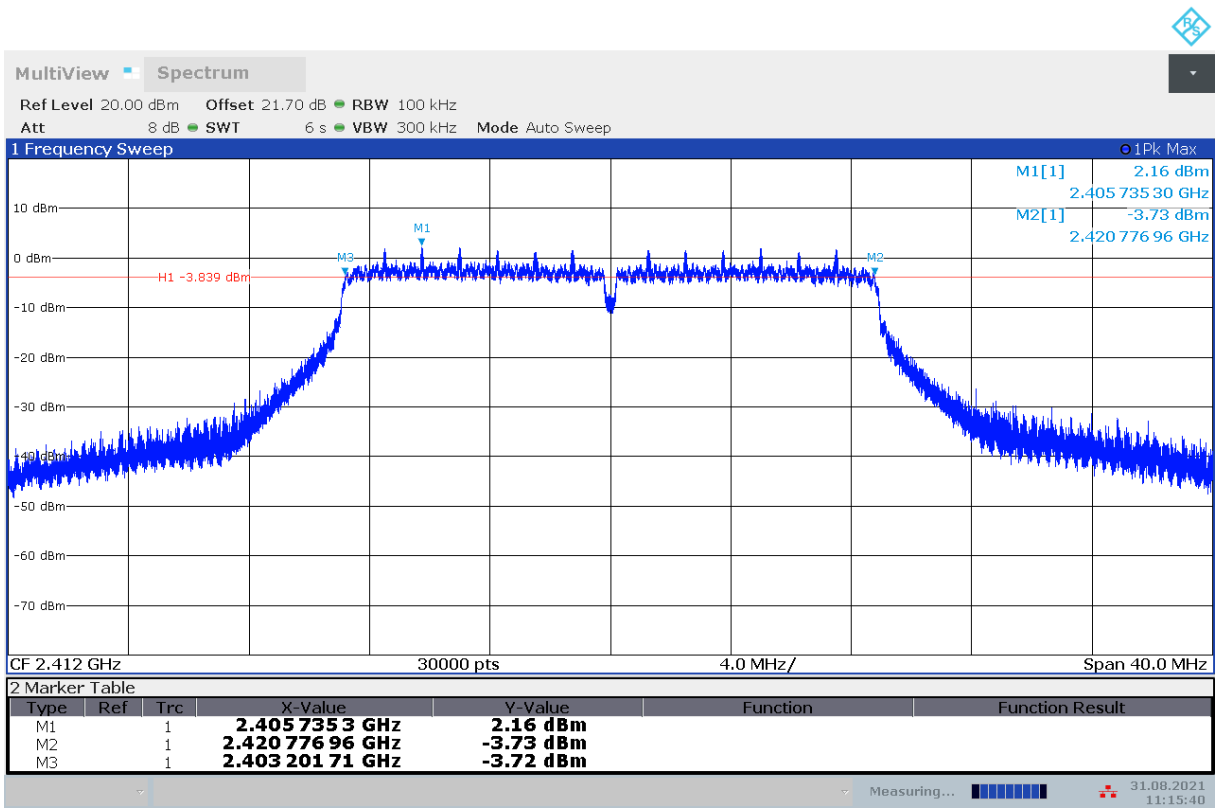


Fig.A.4.7 Occupied 6dB Bandwidth (802.11n-20MHz, Ch 1)

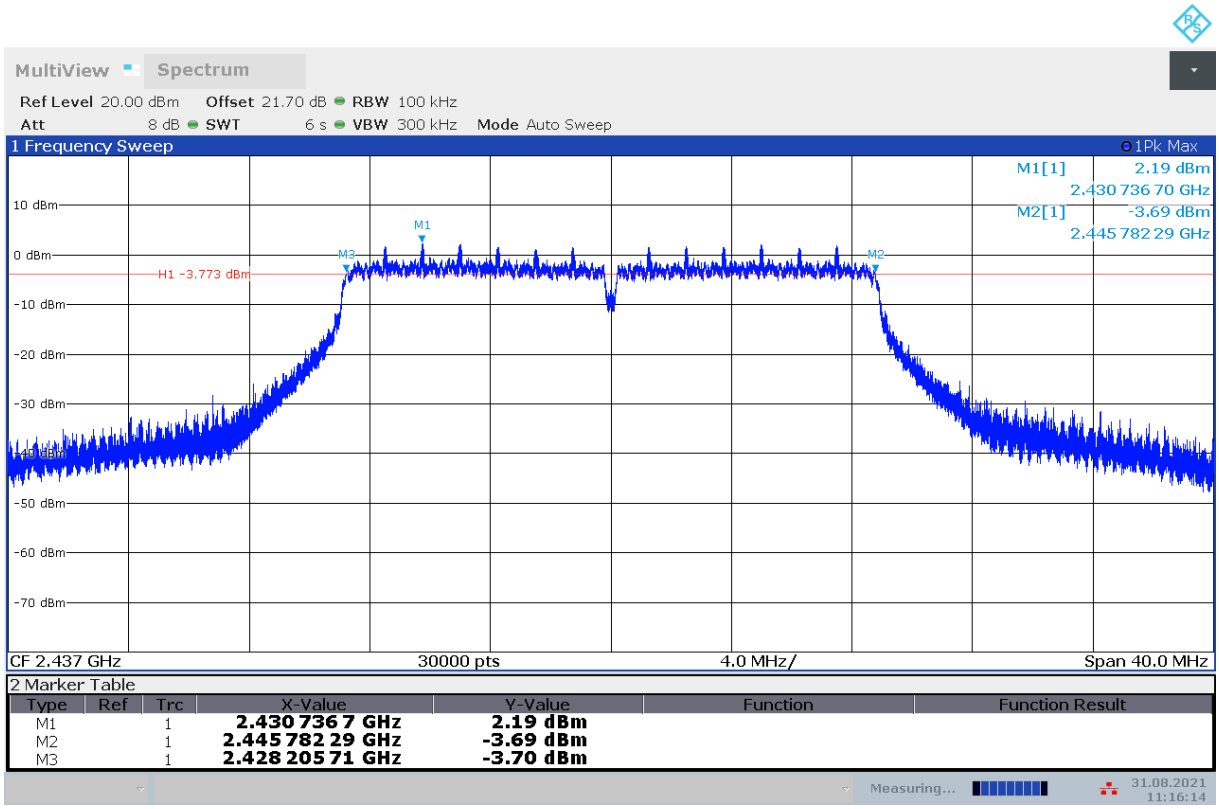


Fig.A.4.8 Occupied 6dB Bandwidth (802.11n-HT20, Ch 6)

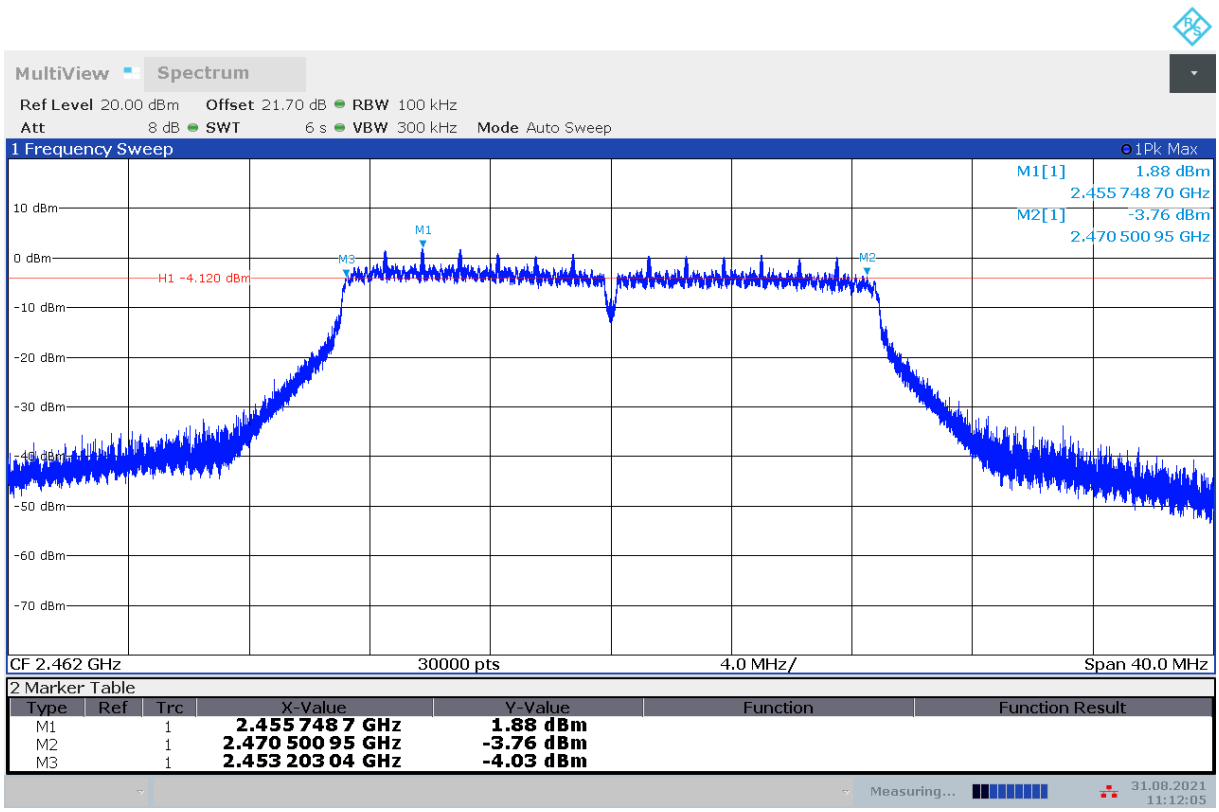


Fig.A.4.9 Occupied 6dB Bandwidth (802.11n-HT20, Ch 11)

A.5. Band Edges Compliance

Method of Measurement: See ANSI C63.10-2013-clause 6.10.4

Connect the spectrum analyzer to the EUT using an appropriate RF cable connected to the EUT output. Configure the spectrum analyzer settings as described below.

a) Set Span = 100MHz
b) Sweep Time: coupled
c) Set the RBW= 100 kHz
c) Set the VBW= 300 kHz
d) Detector: Peak
e) Trace: Max hold

Measurement Limit:

Standard	Limit (dBc)
FCC 47 CFR Part 15.247 (d)	> 20

EUT ID: EUT54

Measurement Result:

802.11b/g mode

Mode	Channel	Test Results	Conclusion
802.11b	1	Fig.A.5.1	**P**
	11	Fig.A.5.2	**P**
802.11g	1	Fig.A.5.3	**P**
	11	Fig.A.5.4	**P**

802.11n-HT20 mode

Mode	Channel	Test Results	Conclusion
802.11n (HT20)	1	Fig.A.5.5	**P**
	11	Fig.A.5.6	**P**

Test graphs as below:

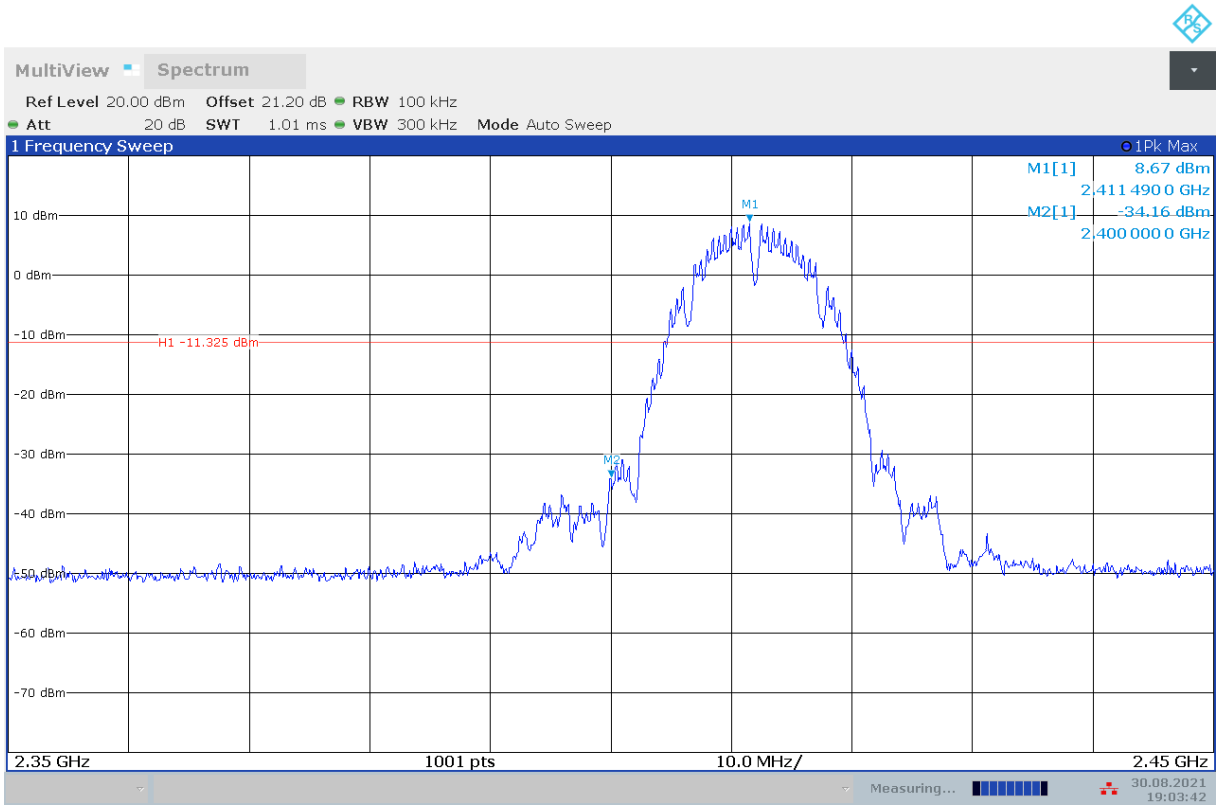


Fig.A.5.1 Band Edges (802.11b, Ch 1)

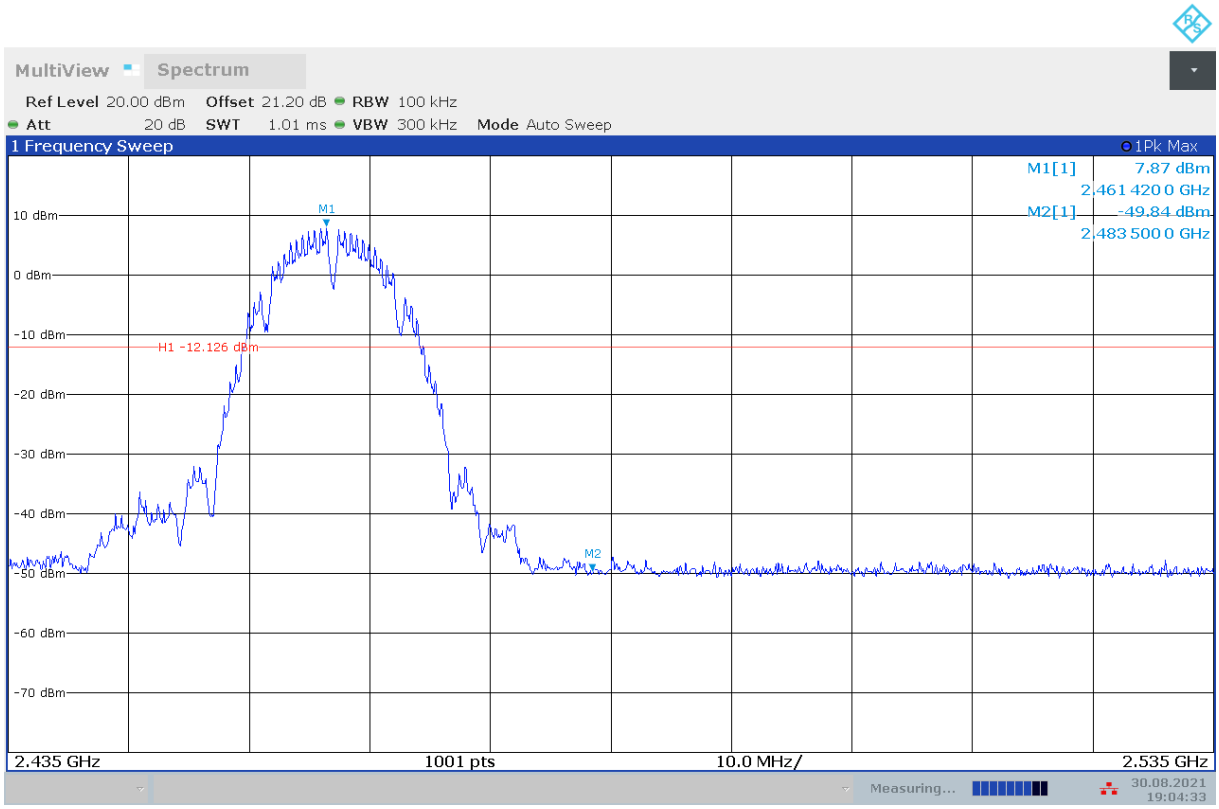


Fig.A.5.2 Band Edges (802.11b, Ch 11)

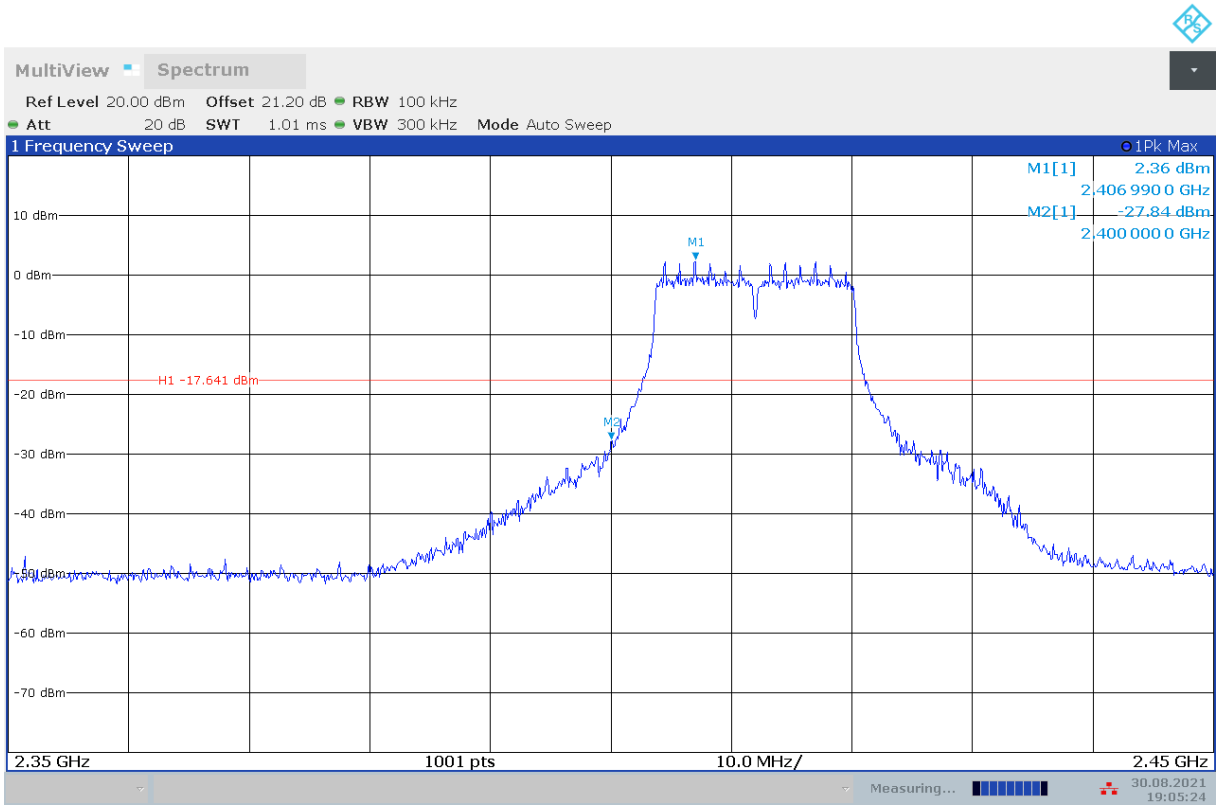


Fig.A.5.3 Band Edges (802.11g, Ch 1)

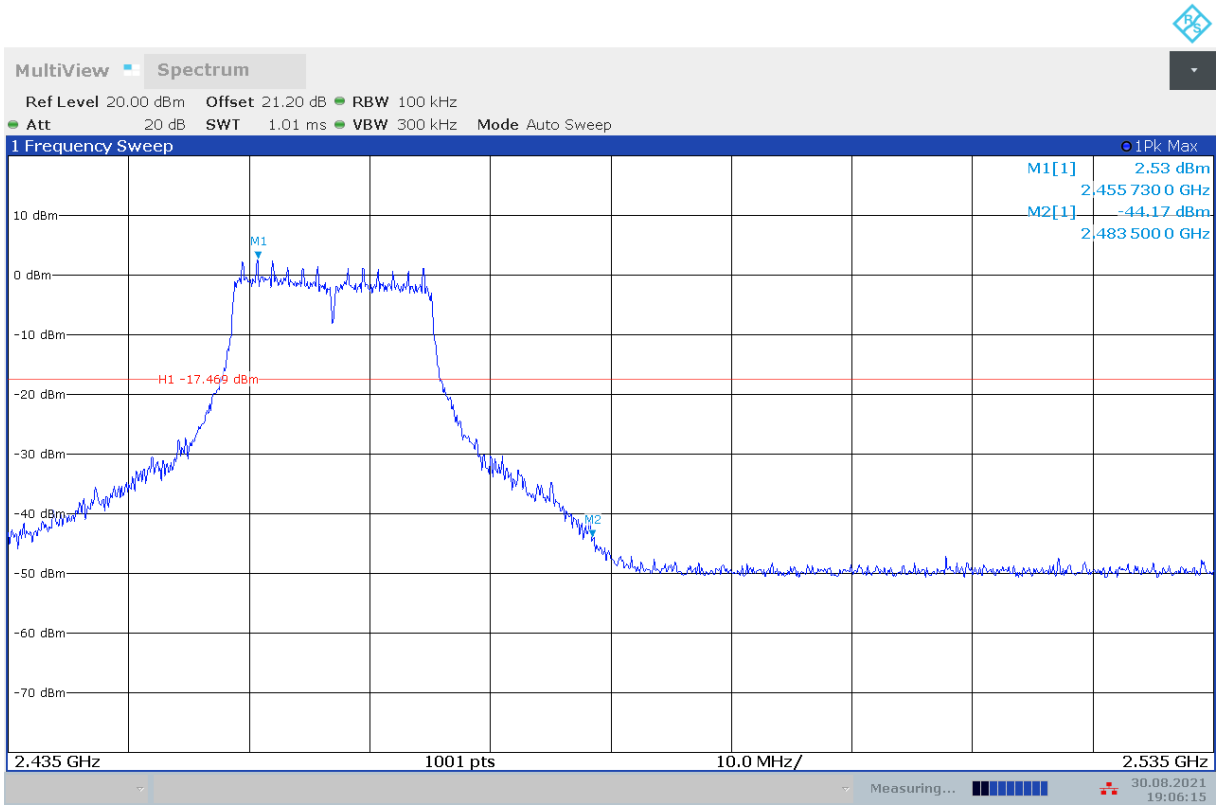


Fig.A.5.4 Band Edges (802.11g, Ch 11)

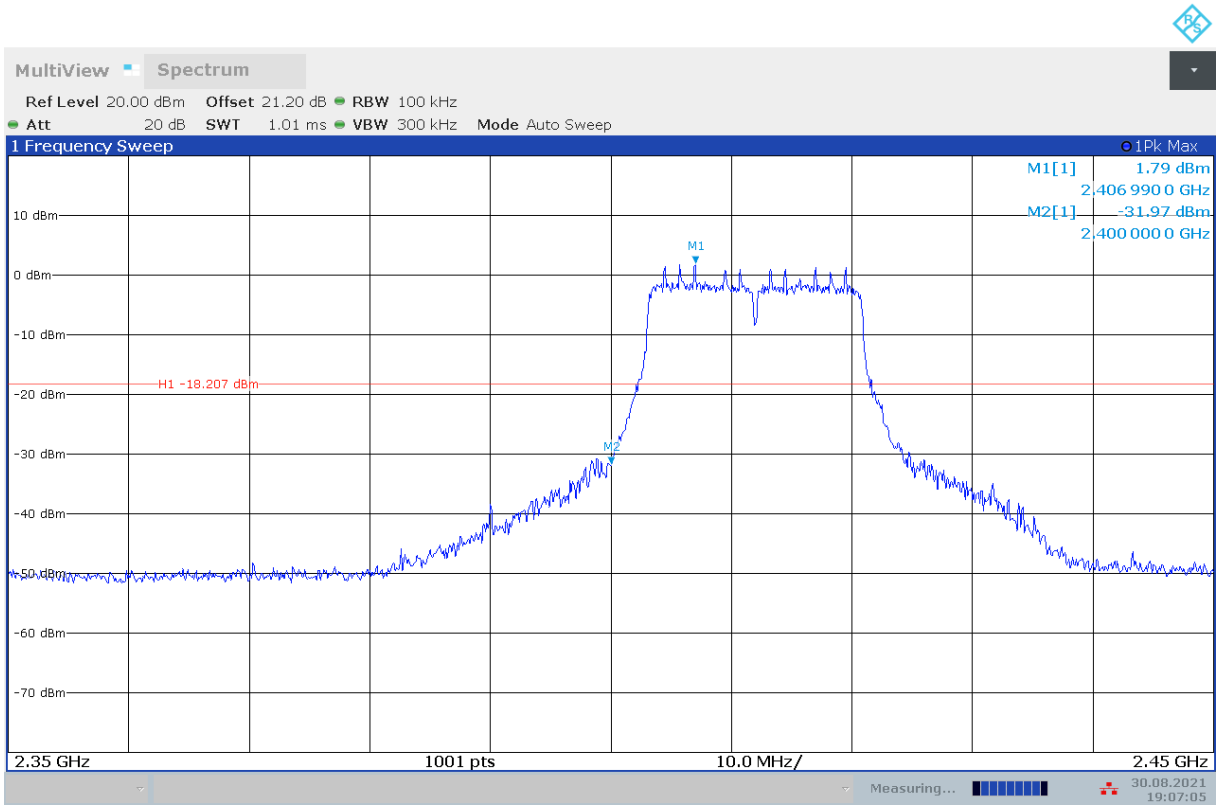


Fig.A.5.5 Band Edges (802.11n-HT20, Ch 1)

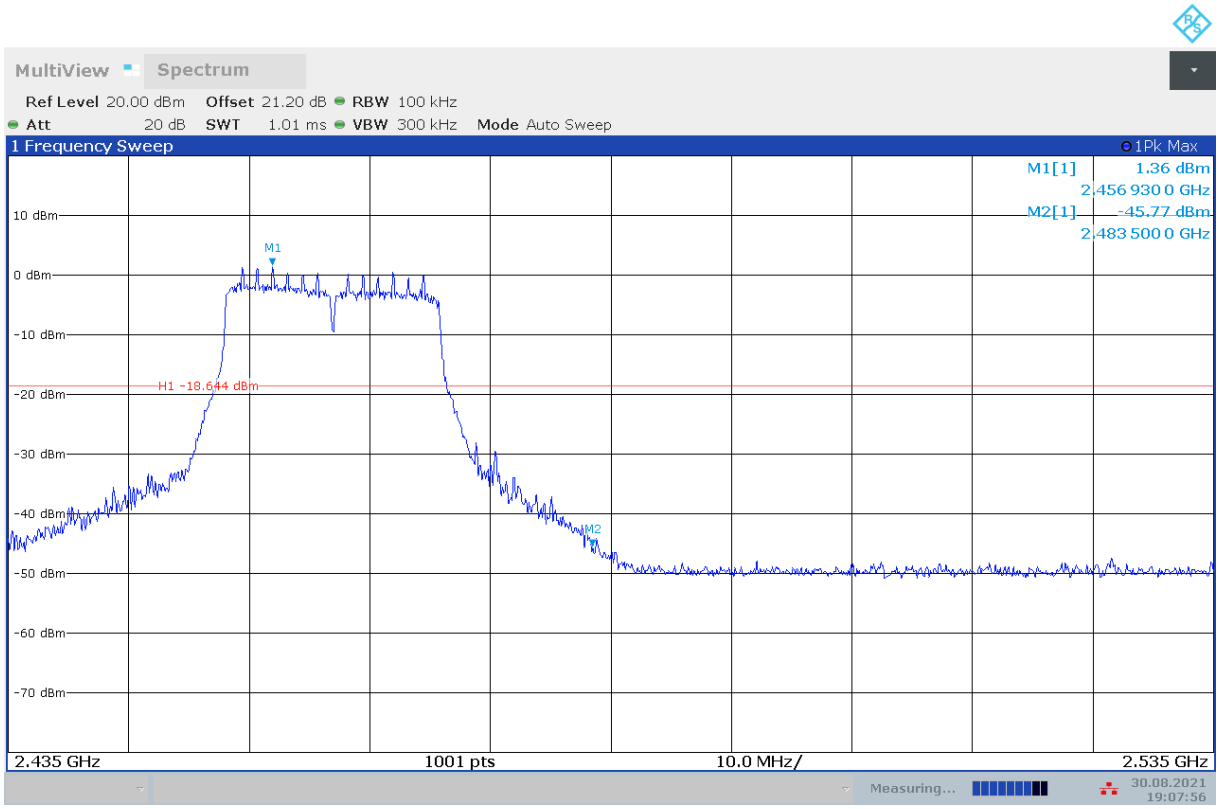


Fig.A.5.6 Band Edges (802.11n-HT20, Ch 11)

A.6. Transmitter Spurious Emission

A.6.1 Transmitter Spurious Emission – Conducted

Method of Measurement: See ANSI C63.10-2013-clause 11.11

Establish a reference level by using the following procedure:

a) Set instrument center frequency to DTS channel center frequency

b) Set the span to ≥ 1.5 times the DTS bandwidth

c) Set the RBW= 100 kHz

d) Set the VBW= 300 kHz

e) Detector = Peak

f) Sweep time = auto couple

g) Trace mode = max hold

h) Allow trace to fully stabilize

i) Use the peak marker function to determine the maximum PSD level

Note that the channel found to contain the maximum PSD level can be used to establish the reference level.

Establish an emission level by using the following procedure:

a) Set the center frequency and span to encompass frequency range to be measured.

b) Set the RBW = 100 kHz.

c) Set the VBW = 300 kHz.

d) Detector = peak.

e) Sweep time = auto couple.

f) Trace mode = max hold.

g) Allow trace to fully stabilize.

h) Use the peak marker function to determine the maximum amplitude level.

Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) is attenuated by at least the minimum requirements specified in 11.11. Report the three highest emissions relative to the limit.

Measurement Limit:

Standard	Limit
FCC 47 CFR Part 15.247 (d)	20dB below peak output power in 100 kHz bandwidth

EUT ID: EUT54

Measurement Results:

MODE	Channel	Frequency Range	Test Results	Conclusion
802.11b	1	2.412 GHz	Fig.A.6.1.1	P
		30 MHz ~ 26 GHz	Fig.A.6.1.2	P
	6	2.437 GHz	Fig.A.6.1.3	P
		30 MHz ~ 26 GHz	Fig.A.6.1.4	P
	11	2.462 GHz	Fig.A.6.1.5	P
		30 MHz ~ 26 GHz	Fig.A.6.1.6	P
MODE	**Channel**	**Frequency Range**	**Test Results**	**Conclusion**
802.11g	1	2.412 GHz	Fig.A.6.1.7	P
		30 MHz ~ 26 GHz	Fig.A.6.1.8	P
	6	2.437 GHz	Fig.A.6.1.9	P
		30 MHz ~ 26 GHz	Fig.A.6.1.10	P
	11	2.462 GHz	Fig.A.6.1.11	P
		30 MHz ~ 26 GHz	Fig.A.6.1.12	P
MODE	**Channel**	**Frequency Range**	**Test Results**	**Conclusion**
802.11n (HT20)	1	2.412 GHz	Fig.A.6.1.13	P
		30 MHz ~ 26 GHz	Fig.A.6.1.14	P
	6	2.437 GHz	Fig.A.6.1.15	P
		30 MHz ~ 26 GHz	Fig.A.6.1.16	P
	11	2.462 GHz	Fig.A.6.1.17	P
		30 MHz ~ 26 GHz	Fig.A.6.1.18	P

Conclusion: Pass

Test graphs as below:

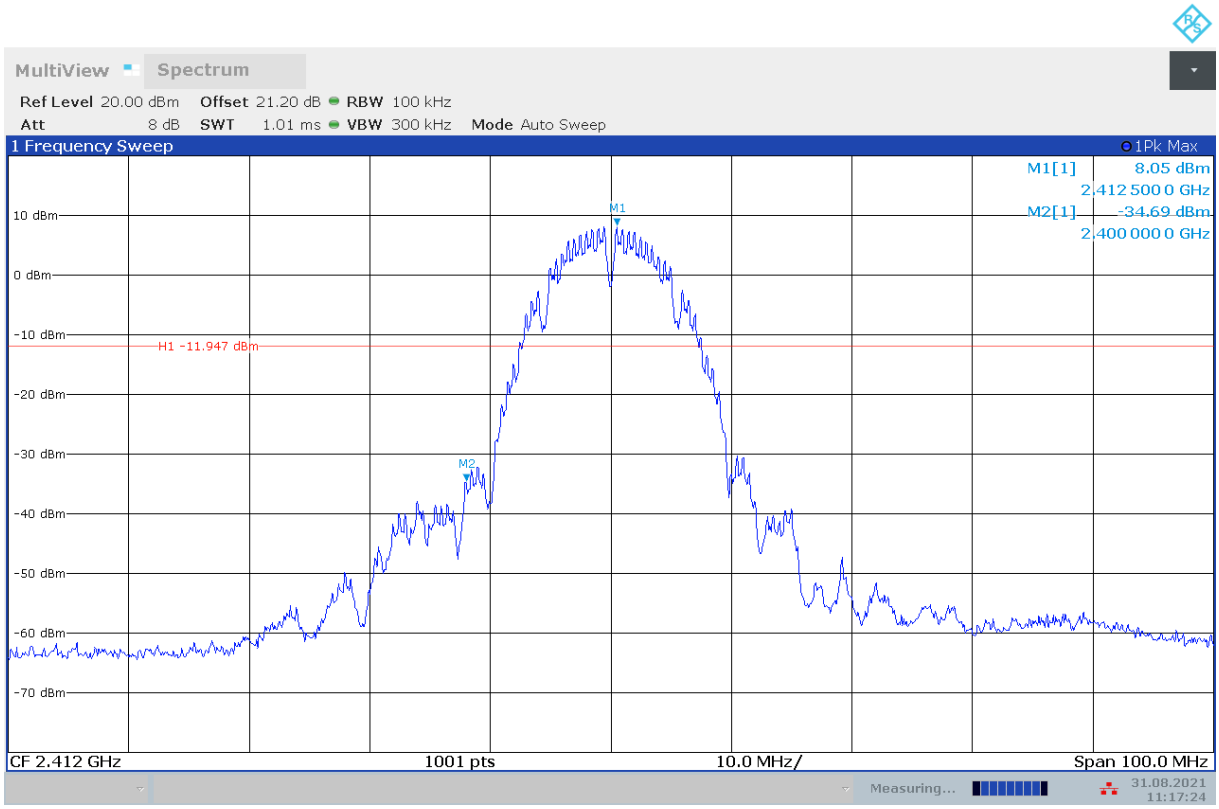


Fig.A.6.1.1 Transmitter Spurious Emission - Conducted (802.11b, Ch1, Center Frequency)

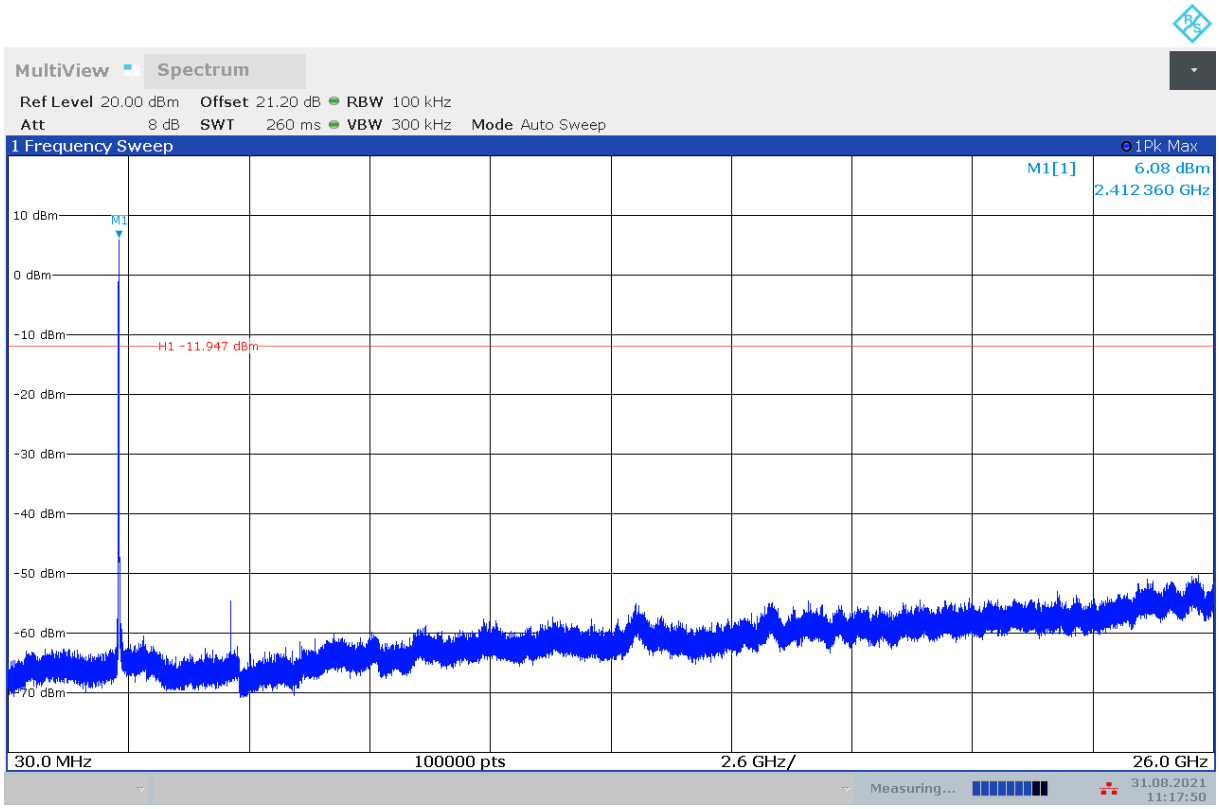


Fig.A.6.1.2 Transmitter Spurious Emission - Conducted (802.11b, Ch1, 30 MHz-26

GHz)

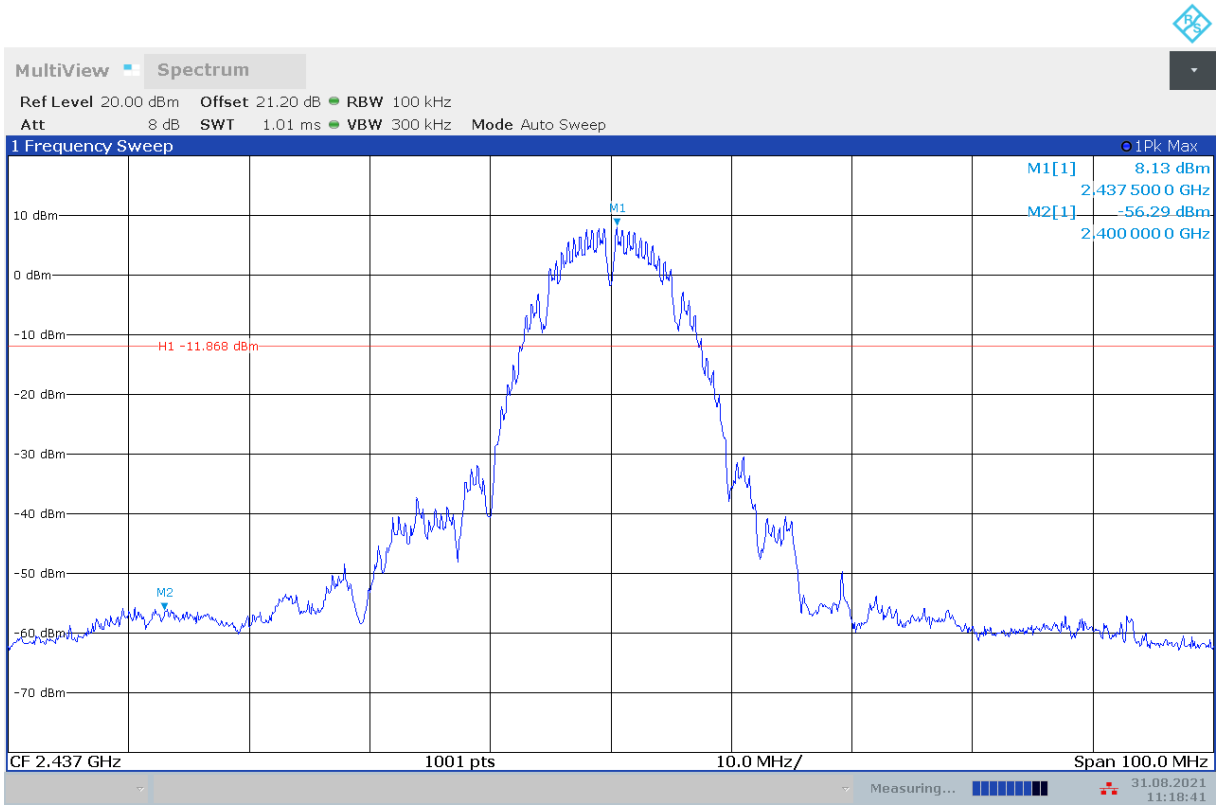


Fig.A.6.1.3 Transmitter Spurious Emission - Conducted (802.11b, Ch6, Center Frequency)

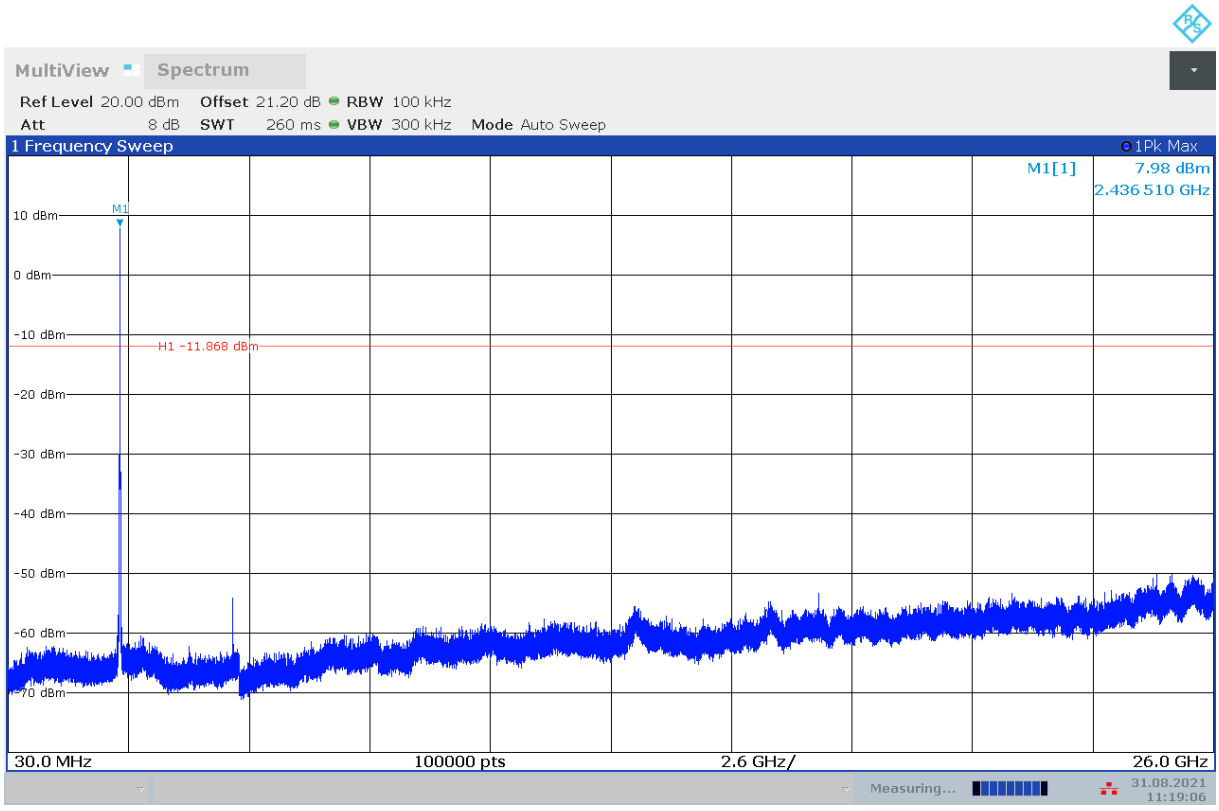


Fig.A.6.1.4 Transmitter Spurious Emission - Conducted (802.11b, Ch6, 30 MHz-26 GHz)

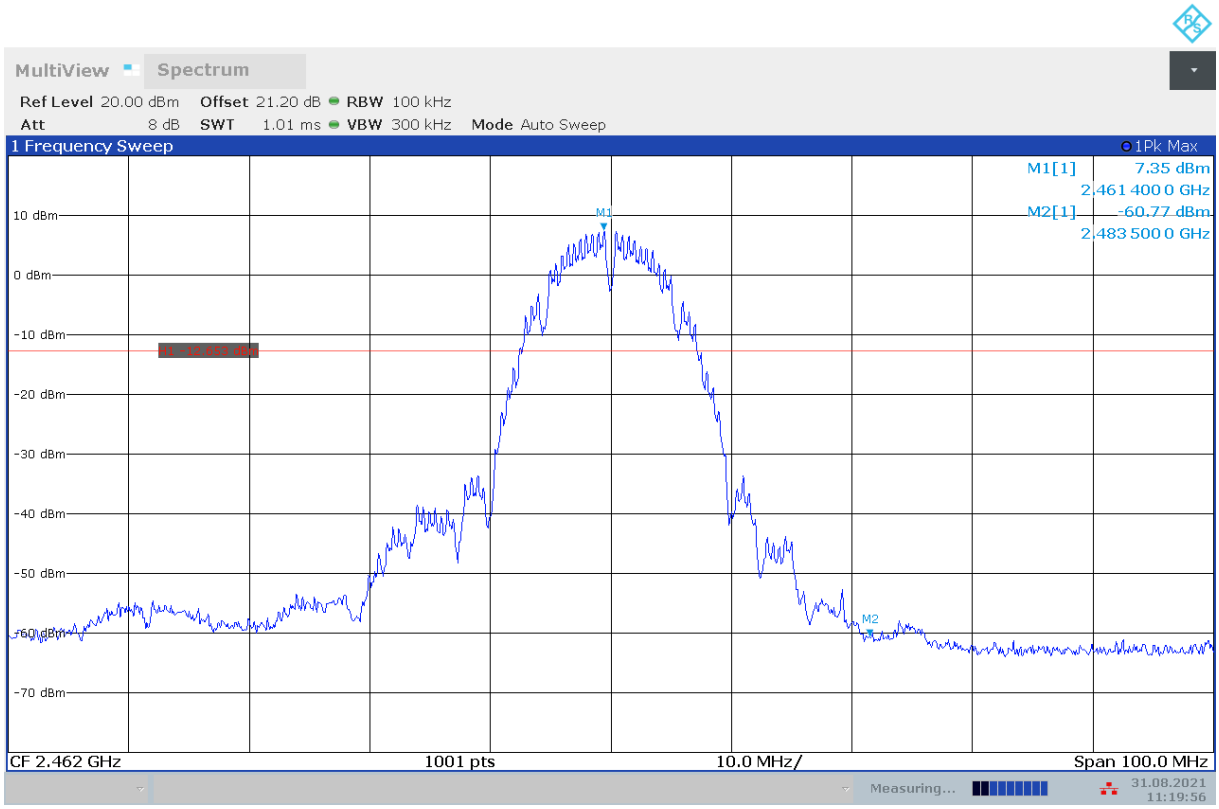


Fig.A.6.1.5 Transmitter Spurious Emission - Conducted (802.11b, Ch11, Center Frequency)

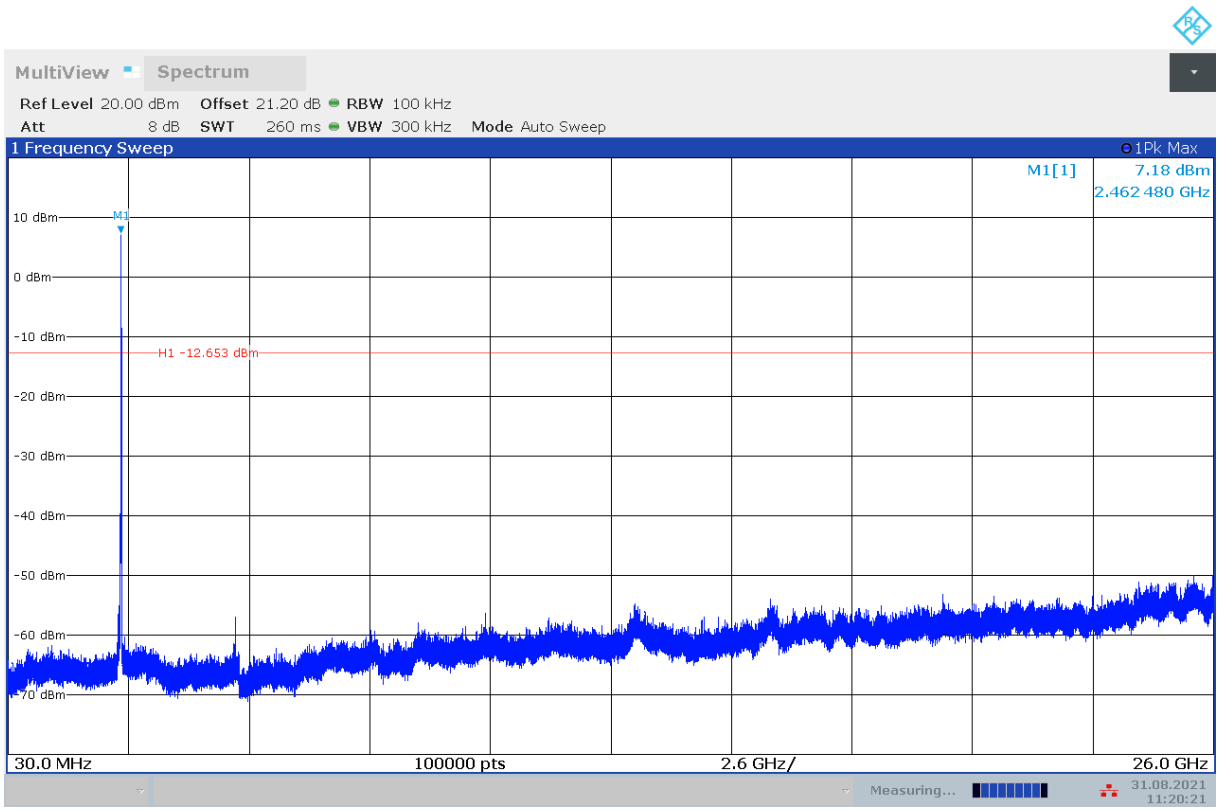


Fig.A.6.1.6 Transmitter Spurious Emission - Conducted (802.11b, Ch11, 30 MHz-26 GHz)

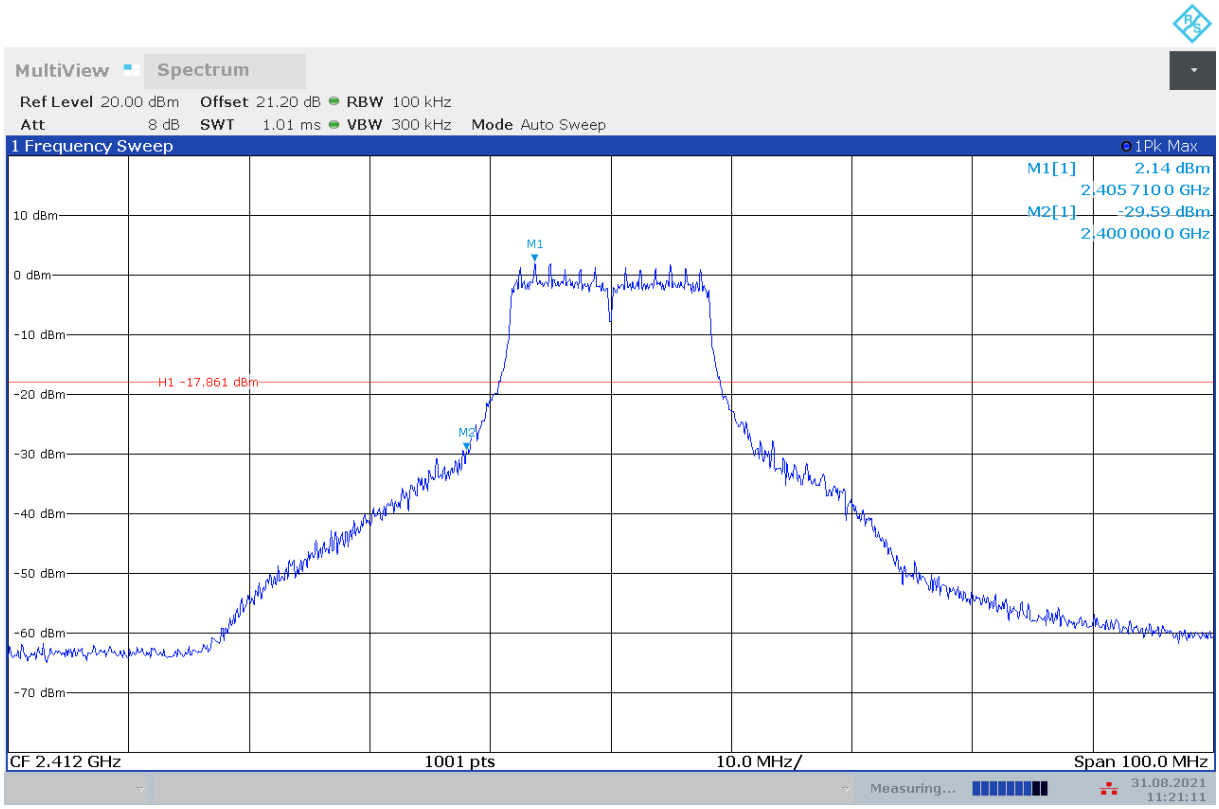


Fig.A.6.1.7 Transmitter Spurious Emission - Conducted (802.11g, Ch1, Center Frequency)

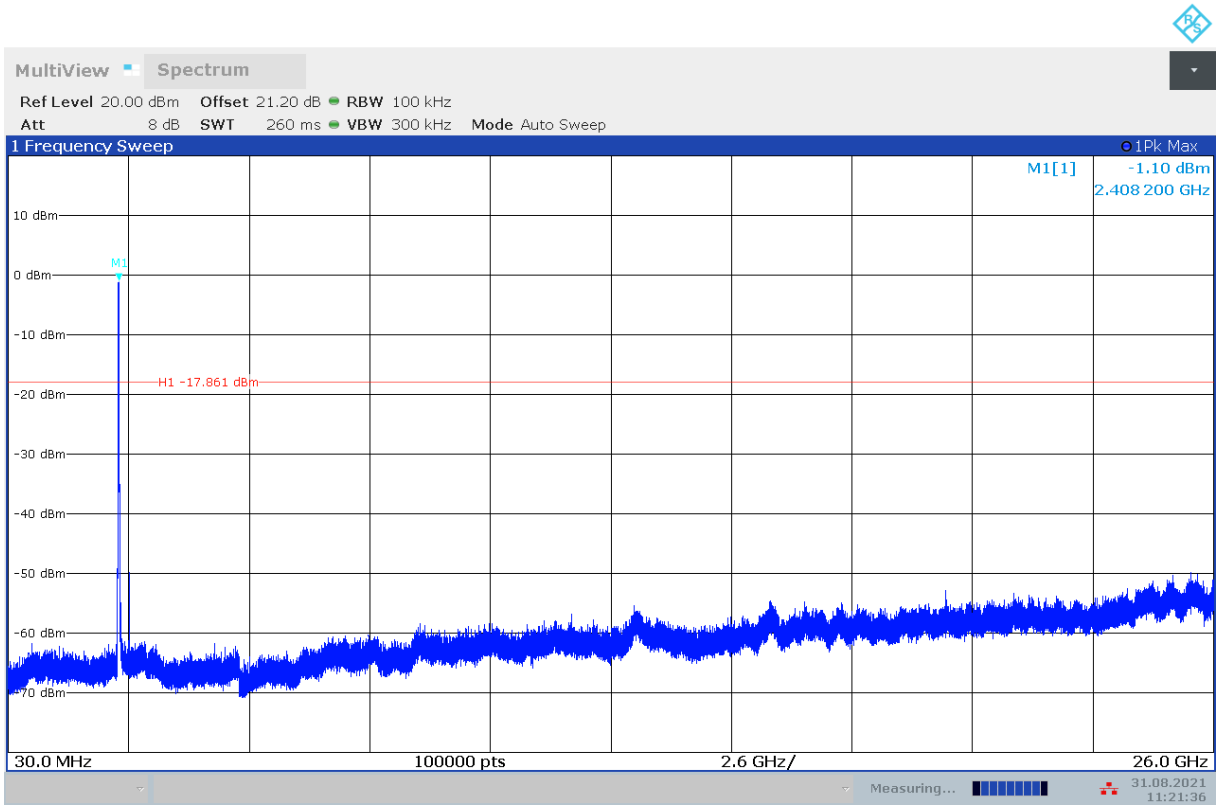


Fig.A.6.1.8 Transmitter Spurious Emission - Conducted (802.11g, Ch1, 30 MHz-26 GHz)

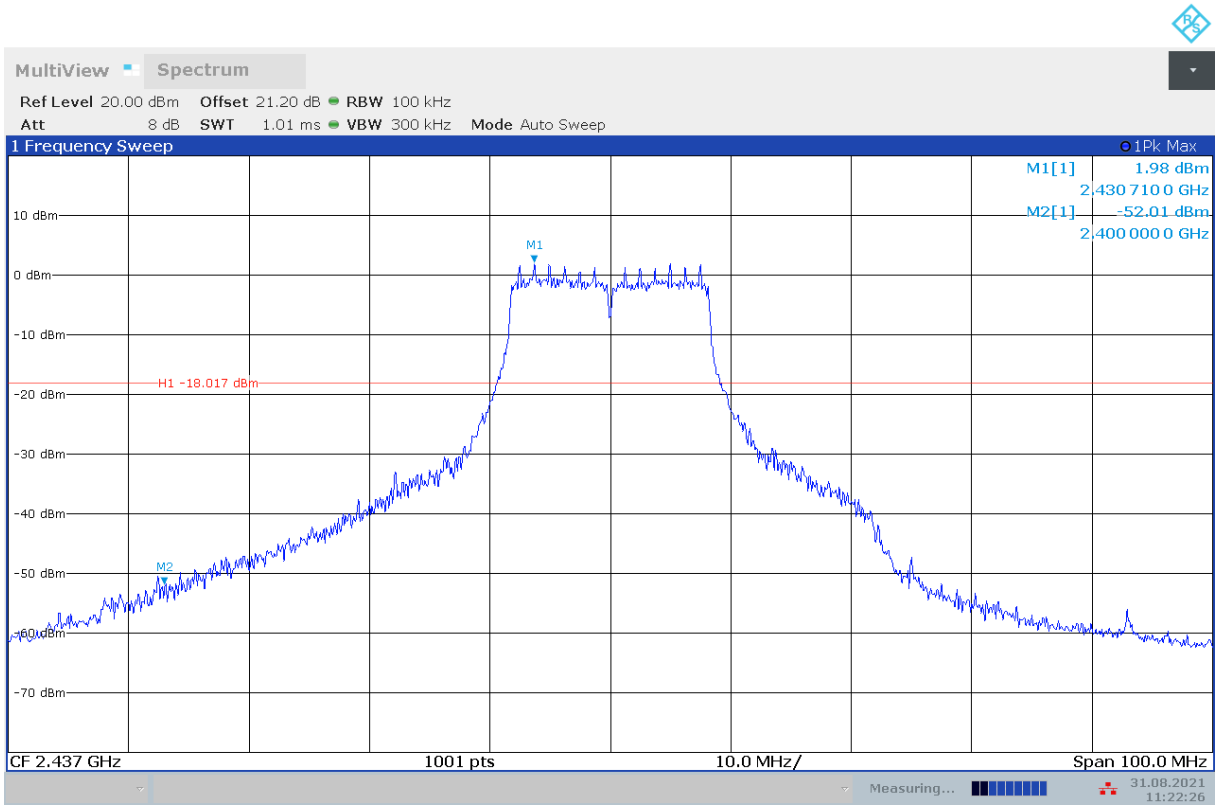


Fig.A.6.1.9 Transmitter Spurious Emission - Conducted (802.11g, Ch6, Center Frequency)

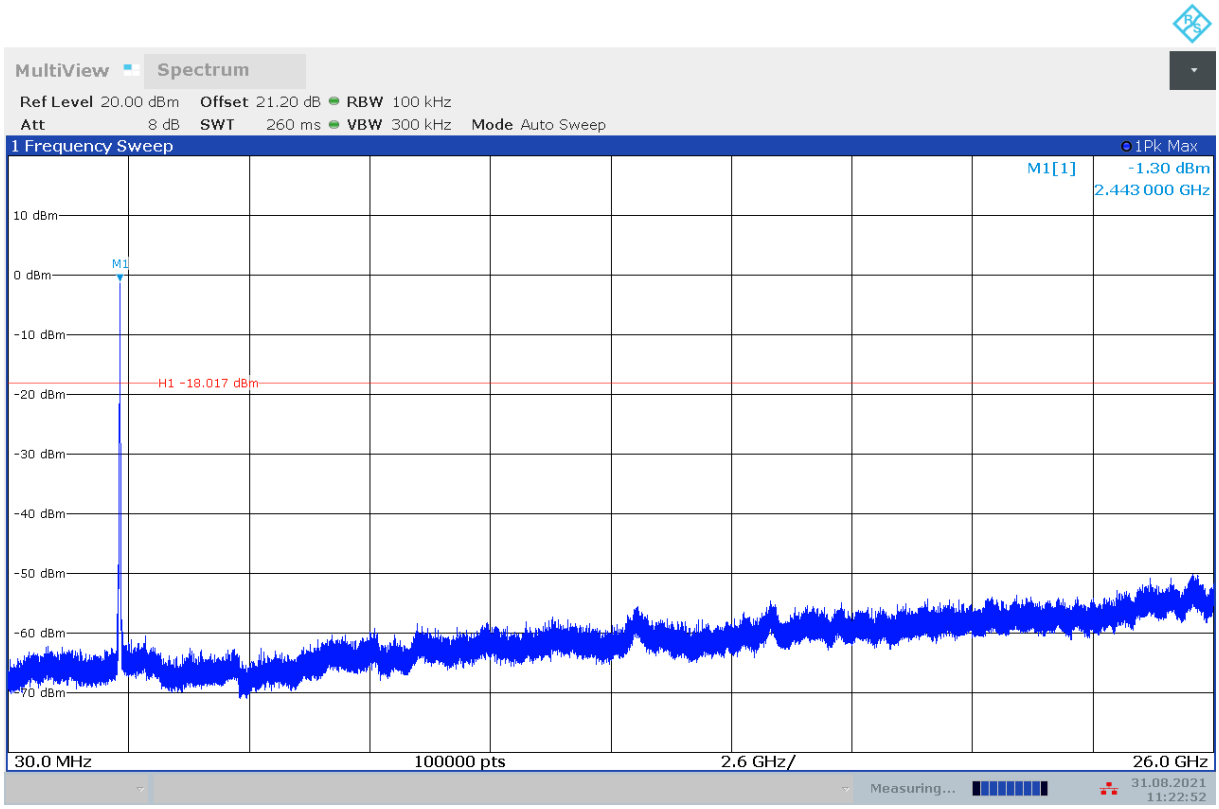


Fig.A.6.1.10 Transmitter Spurious Emission - Conducted (802.11g, Ch6, 30 MHz-26 GHz)

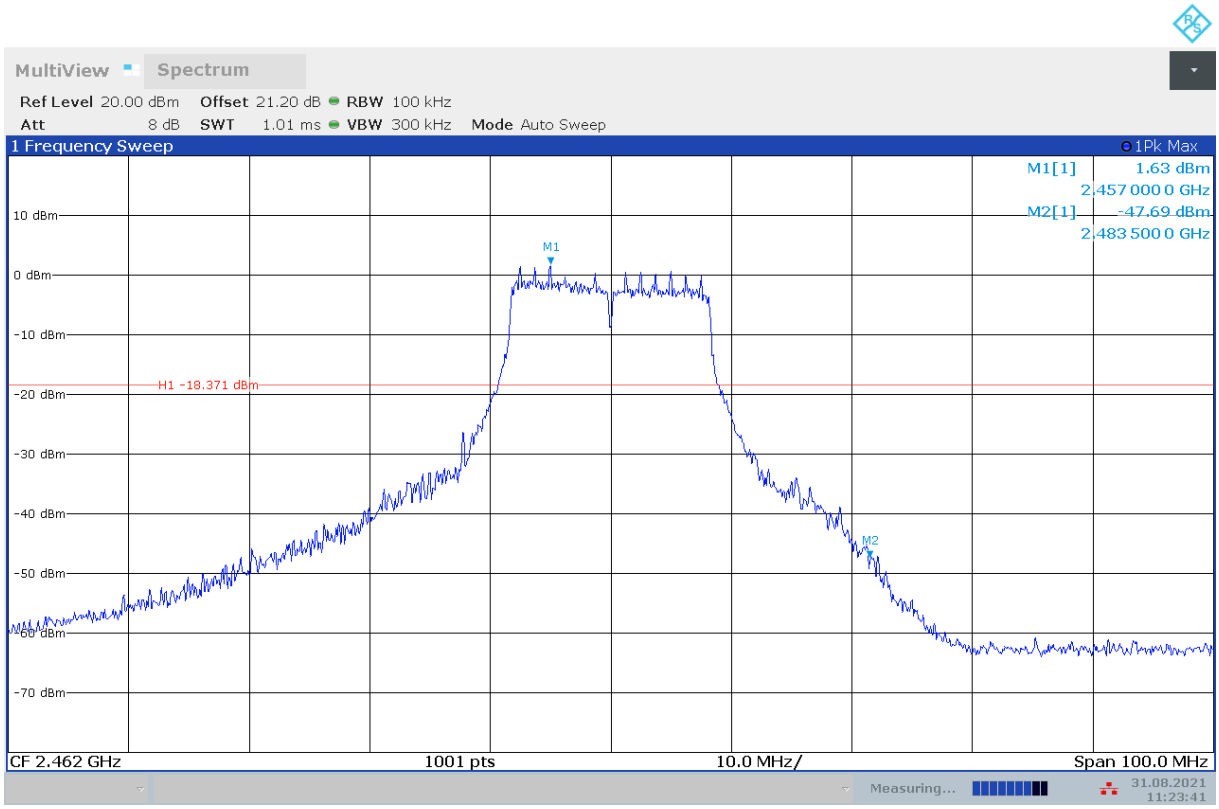


Fig.A.6.1.11 Transmitter Spurious Emission - Conducted (802.11g, Ch11, Center Frequency)

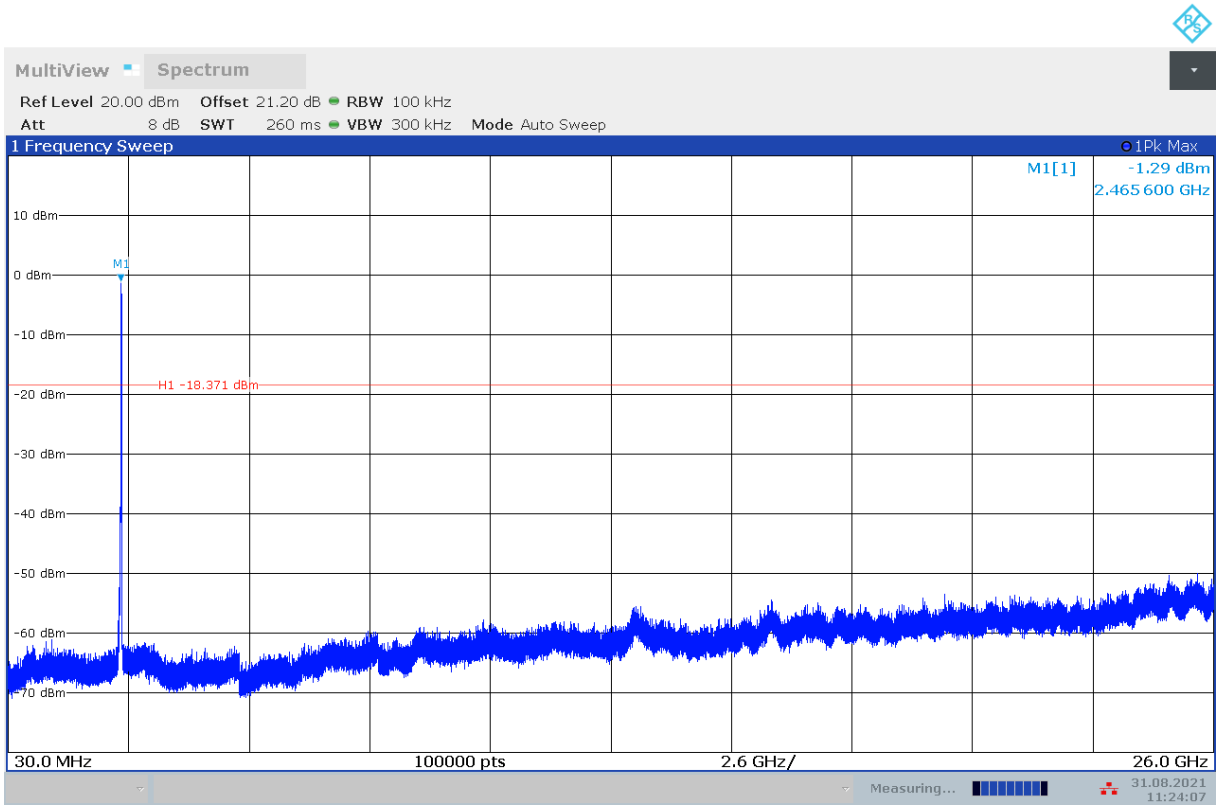


Fig.A.6.1.12 Transmitter Spurious Emission - Conducted (802.11g, Ch11, 30 MHz-26 GHz)

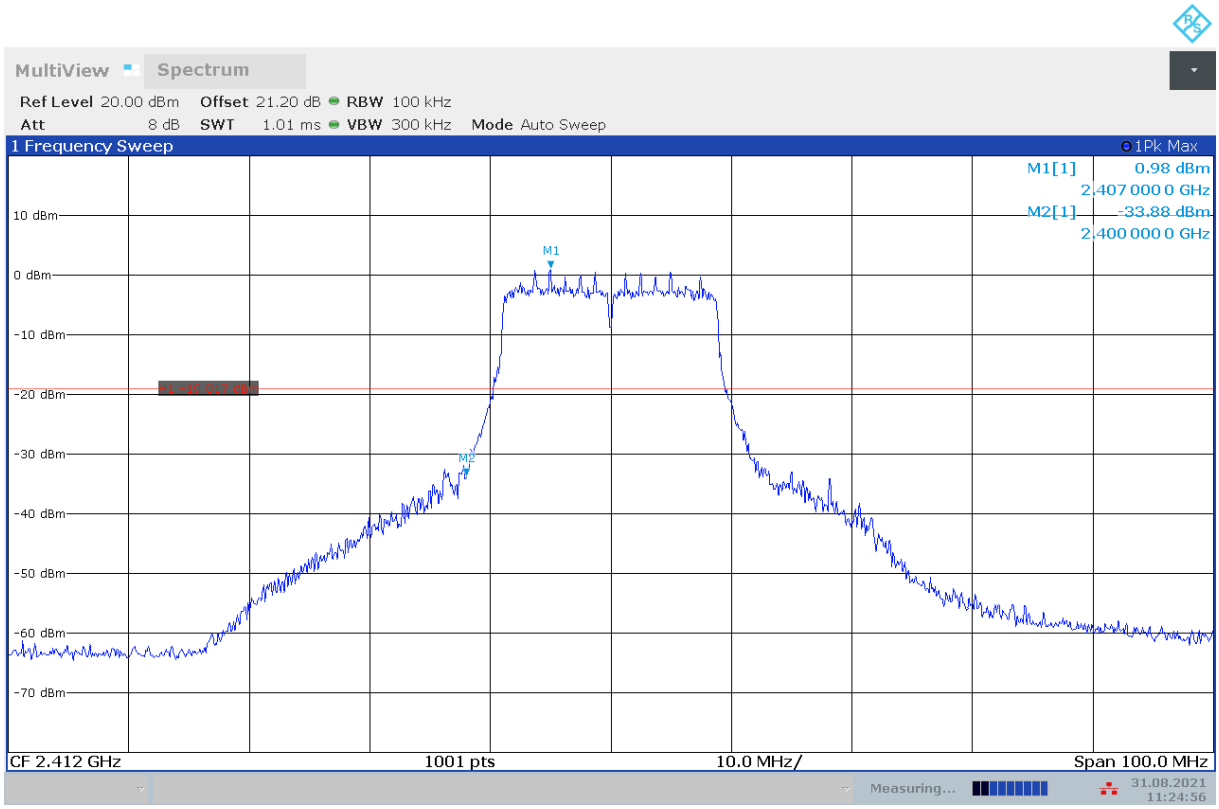


Fig.A.6.1.13 Transmitter Spurious Emission - Conducted (802.11n-HT20, Ch1, Center

Frequency)

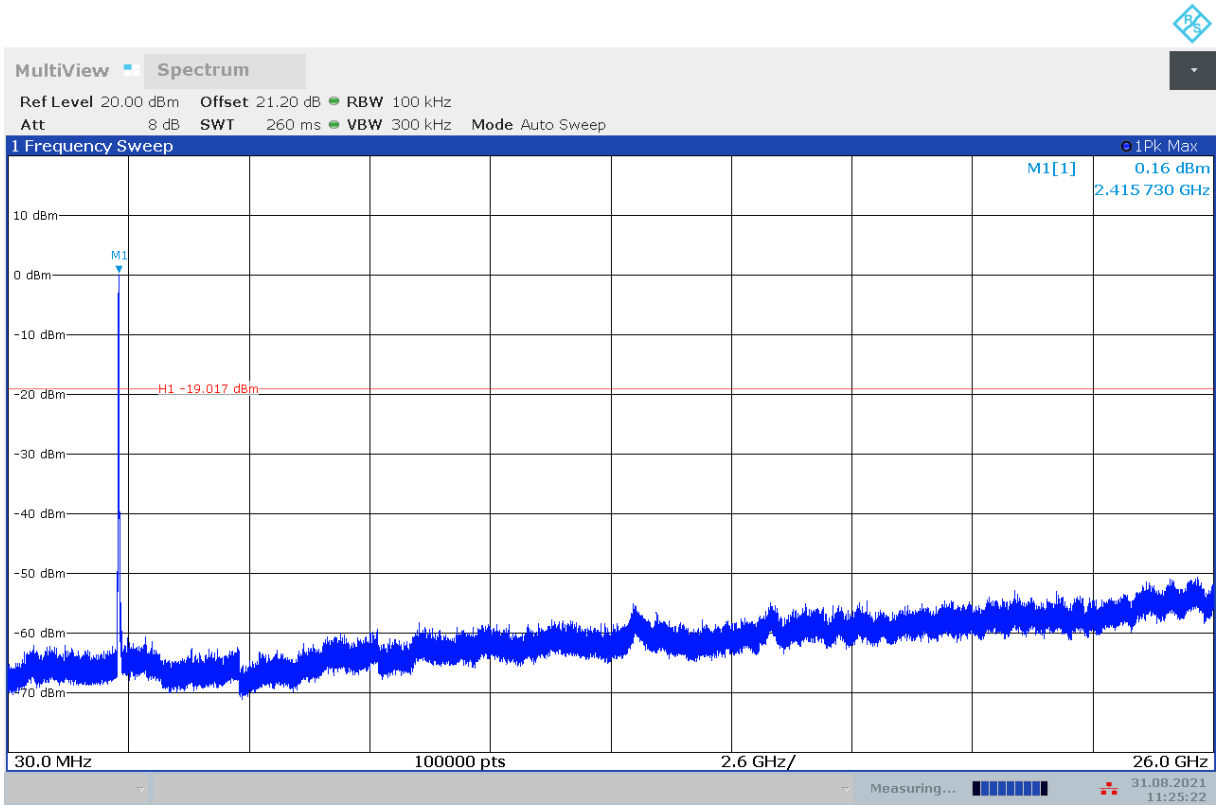


Fig.A.6.1.14 Transmitter Spurious Emission - Conducted (802.11n-HT20, Ch1, 30 MHz-26 GHz)

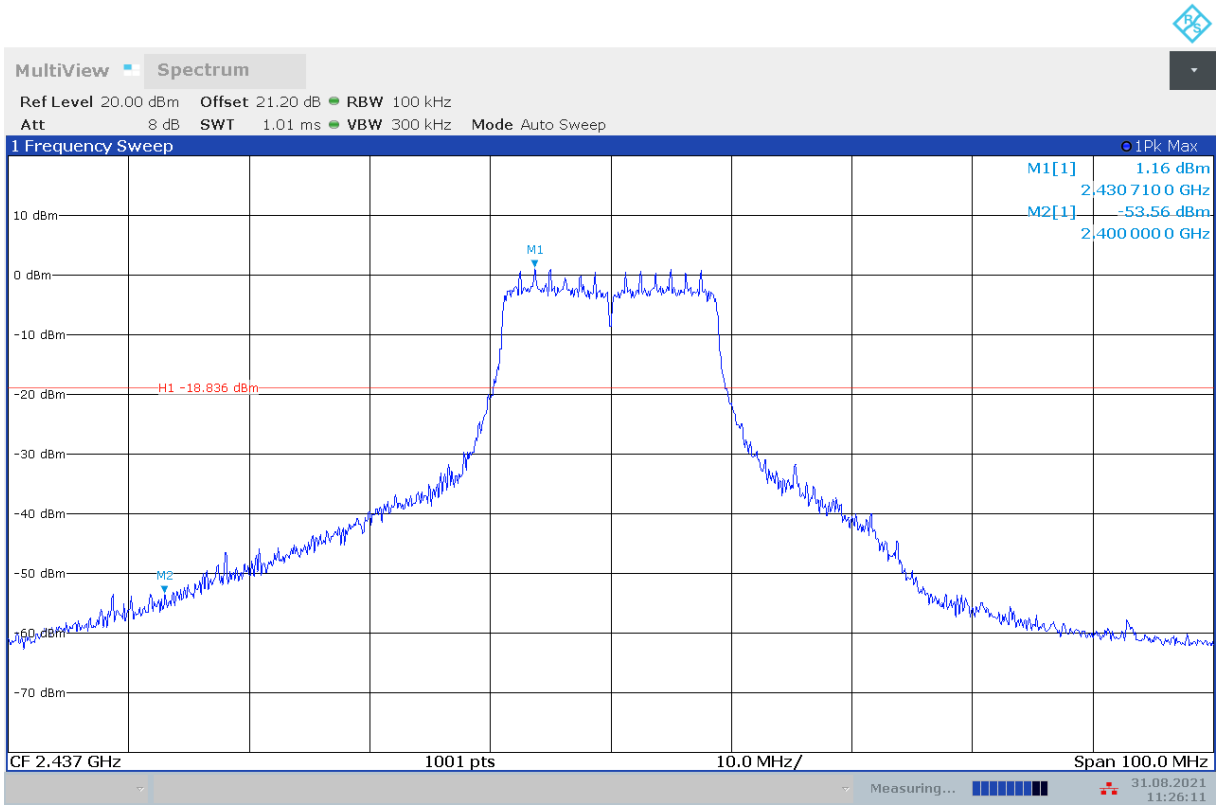


Fig.A.6.1.15 Transmitter Spurious Emission - Conducted (802.11n-HT20, Ch6, Center Frequency)

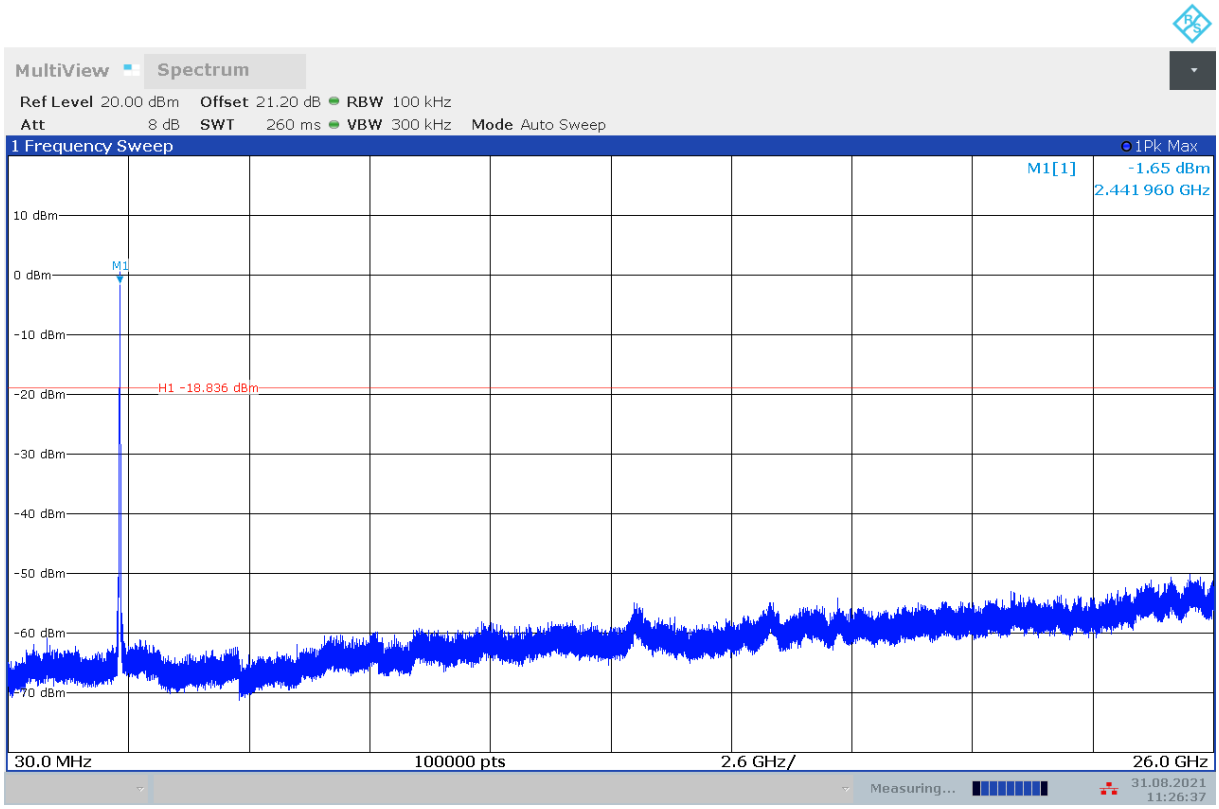


Fig.A.6.1.16 Transmitter Spurious Emission - Conducted (802.11n-HT20, Ch6, 30 MHz-26 GHz)

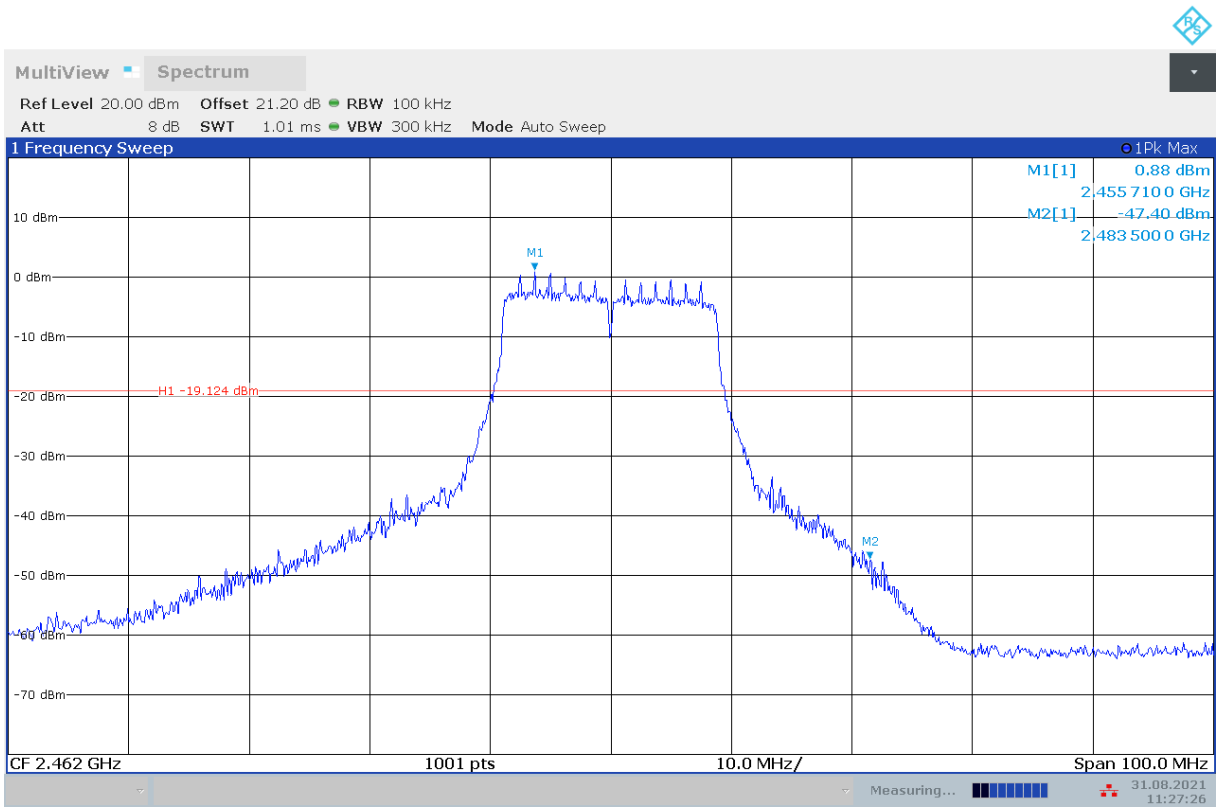


Fig.A.6.1.17 Transmitter Spurious Emission - Conducted (802.11n-HT20, Ch11, Center Frequency)

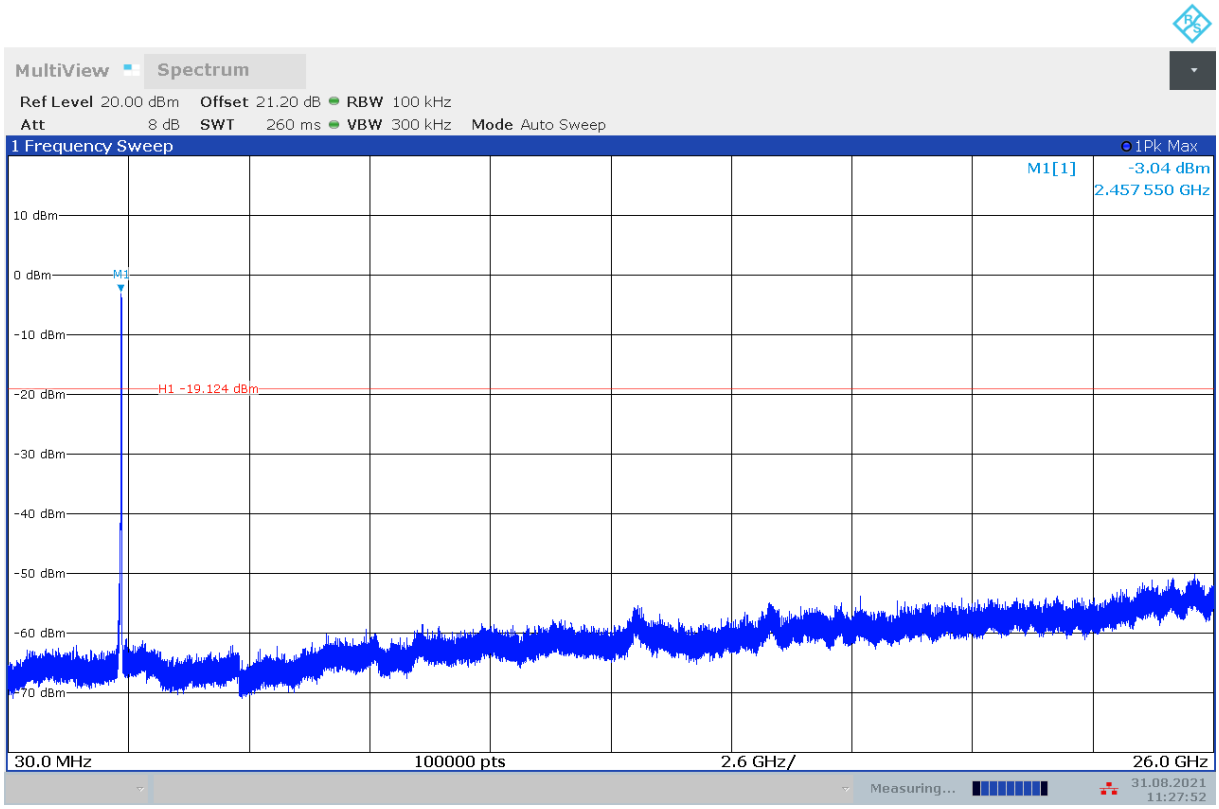


Fig.A.6.1.18 Transmitter Spurious Emission - Conducted (802.11n-HT20, Ch11, 30 MHz-26 GHz)

A.6.2 Transmitter Spurious Emission - Radiated

Method of Measurement: See ANSI C63.10-2013-clause 6.4 &6.5 & 6.6

Measurement Limit:

Standard	Limit
FCC 47 CFR Part 15.247, 15.205, 15.209	20dB below peak output power

In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a) (see § 15.205(c)).

Limit in restricted band:

Frequency of emission (MHz)	Field strength (uV/m)	Field strength (dBuV/m)	Measurement distance (m)
30-88	100	40	3
88-216	150	43.5	3
216-960	200	46	3
Above 960	500	54	3

Frequency (MHz)	Field strength(μV/m)	Measurement distance (m)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30

Set up:

Tabletop devices shall be placed on a nonconducting platform with nominal top surface dimensions 1 m by 1.5 m. For emissions testing at or below 1 GHz, the table height shall be 80 cm above the reference ground plane. For emission measurements above 1 GHz, the table height shall be 1.5 m

The EUT and transmitting antenna shall be centered on the turntable.

Test Procedure

The EUT was placed on a non-conductive table. The measurement antenna was placed at a distance of 3 meters from the EUT. The test is carried out on both vertical and horizontal polarization and only maximization result of both polarizations is kept. During the test, the turntable is rotated 360° and the measurement antenna is moved from 1m to 4m to get the maximization result. This maximization process was repeated with the EUT positioned in each of its three orthogonal orientations.

The receiver references:

Frequency of emission (MHz)	RBW/VBW	Sweep Time(s)
30-1000	100kHz/300kHz	5
1000-4000	1MHz/3MHz	15
4000-18000	1MHz/3MHz	40
18000-26500	1MHz/3MHz	20

EUT ID: EUT1

Measurement results:

802.11b mode

Mode	Channel	Frequency Range	Test Results	Conclusion
802.11b	1	2.31GHz~2.43GHz---L	Fig.A.6.2.1	**P**
	11	2.45GHz~2.50GHz---H	Fig.A.6.2.2	**P**

802.11g mode

Mode	Channel	Frequency Range	Test Results	Conclusion
802.11g	1	2.31GHz~2.43GHz---L	Fig.A.6.2.3	**P**
	11	2.45GHz~2.50GHz---H	Fig.A.6.2.4	**P**

802.11n-HT20 mode

Mode	Channel	Frequency Range	Test Results	Conclusion
802.11n (HT20)	1	2.31GHz~2.43GHz---L	Fig.A.6.2.5	**P**
	11	2.45GHz~2.50GHz---H	Fig.A.6.2.6	**P**

Conclusion: Pass

Note:

1. A "reference path loss" is established and the A_{Rpl} is the attenuation of “reference path loss”, and including the gain of receive antenna, the gain of the preamplifier, the cable loss.
P_{Mea} is the field strength recorded from the instrument.
The measurement results are obtained as described below:
Result=P_{Mea}+A_{Rpl}= P_{Mea}+Cable Loss+Antenna Factor

2. The range of evaluated frequency is from 9 kHz to 26GHz. Measurement value show only up to 6 maximum emissions noted.

Peak

802.11b

Ch1

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17986.500	56.30	-25.50	46.70	35.10	74.00	17.70	H
14417.000	51.71	-28.60	42.50	37.81	74.00	22.29	V
7235.000	48.85	-35.50	36.40	47.95	74.00	25.15	V
12727.500	47.41	-30.50	39.10	38.81	74.00	26.59	H
8996.500	44.89	-33.30	38.20	39.99	74.00	29.11	H
2387.800	58.19	-20.00	28.10	50.19	74.00	15.81	H

Ch6

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17936.000	56.87	-25.50	46.70	35.67	74.00	17.13	V
14326.000	51.74	-28.40	42.30	37.84	74.00	22.26	V
12659.500	47.34	-30.50	39.10	38.74	74.00	26.66	V
7308.000	44.96	-35.00	36.50	43.36	74.00	29.04	H
9002.000	44.81	-33.30	38.20	39.91	74.00	29.19	H
4574.000	40.47	-37.50	32.60	45.37	74.00	33.53	V

Ch11

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17996.500	57.09	-25.50	46.70	35.89	74.00	16.91	V
14479.000	51.95	-28.60	42.50	38.05	74.00	22.05	H
12642.500	47.05	-31.00	39.00	39.15	74.00	26.95	H
8760.500	44.82	-33.90	38.10	40.62	74.00	29.18	H
7918.000	43.20	-34.90	37.10	41.00	74.00	30.80	H
2485.300	54.81	-20.00	28.30	46.51	74.00	19.19	H

802.11g

Ch1

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17953.500	57.14	-25.50	46.70	35.94	74.00	16.86	V
14378.000	51.57	-28.40	42.30	37.67	74.00	22.43	V
7225.500	48.81	-35.50	36.40	47.91	74.00	25.19	V
12457.500	47.26	-31.20	38.90	39.56	74.00	26.74	H
9668.500	44.56	-33.00	38.00	39.56	74.00	29.44	H
2389.400	71.01	-20.00	28.10	63.01	74.00	3.00	H

Ch6

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17996.500	56.47	-25.50	46.70	35.27	74.00	17.53	V
14380.000	51.66	-28.40	42.30	37.76	74.00	22.34	V
12760.000	48.21	-30.50	39.10	39.61	74.00	25.79	V
8984.500	45.19	-33.30	38.20	40.29	74.00	28.81	H
7749.500	43.99	-34.80	37.00	41.89	74.00	30.01	H
4374.000	39.58	-37.90	32.40	45.08	74.00	34.42	V

Ch11

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17989.500	57.52	-25.50	46.70	36.32	74.00	16.48	H
14501.500	52.15	-28.60	42.50	38.25	74.00	21.85	V
12873.000	47.76	-30.70	39.10	39.26	74.00	26.24	V
9205.500	45.20	-33.70	38.00	40.90	74.00	28.80	V
7949.000	43.30	-34.80	37.10	41.00	74.00	30.70	V
2483.600	69.68	-20.00	28.30	61.38	74.00	4.32	H

802.11n-HT20

Ch1

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17942.500	56.52	-25.50	46.70	35.32	74.00	17.48	V
14353.500	52.00	-28.40	42.30	38.10	74.00	22.00	H
7228.500	47.83	-35.50	36.40	46.93	74.00	26.17	H
12844.500	47.12	-30.70	39.10	38.62	74.00	26.88	V
9182.000	44.77	-33.80	38.10	40.57	74.00	29.23	V
2389.200	68.65	-20.00	28.10	60.65	74.00	5.35	H

Ch6

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17983.000	56.36	-25.50	46.70	35.16	74.00	17.64	H
14352.000	52.04	-28.40	42.30	38.14	74.00	21.96	H
12054.000	47.19	-31.60	39.00	39.79	74.00	26.81	H
7307.500	46.71	-35.00	36.50	45.11	74.00	27.29	V
9195.500	44.76	-33.80	38.10	40.56	74.00	29.24	H
4438.000	41.88	-37.60	32.40	47.08	74.00	32.12	V

Ch11

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17919.500	56.62	-25.50	46.70	35.42	74.00	17.38	V
14314.000	52.00	-28.40	42.30	38.10	74.00	22.00	V
12042.000	47.58	-31.60	39.00	40.18	74.00	26.42	H
9519.000	44.89	-33.20	37.90	40.19	74.00	29.11	V
2484.602	70.31	-20.00	28.30	62.01	74.00	3.69	V
2485.100	70.46	-20.00	28.30	62.16	74.00	3.54	H

Average

802.11b

Ch1

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17972.000	45.84	-25.50	46.70	24.64	54.00	8.16	V
7234.500	43.90	-35.50	36.40	43.00	54.00	10.10	V
14507.000	40.05	-28.60	42.50	26.15	54.00	13.95	H
12933.500	35.64	-30.50	39.20	26.94	54.00	18.36	V
8994.000	33.44	-33.30	38.20	28.54	54.00	20.56	V
2386.600	51.16	-20.00	28.10	43.06	54.00	2.84	H

Ch6

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17995.500	45.50	-25.50	46.70	24.30	54.00	8.50	V
14476.500	39.87	-28.60	42.50	25.97	54.00	14.13	H
7308.500	39.35	-35.00	36.50	37.75	54.00	14.65	H
12675.000	35.71	-30.50	39.10	27.11	54.00	18.29	V
9075.500	33.38	-33.80	38.10	28.98	54.00	20.62	H
4587.500	29.26	-37.30	32.70	33.96	54.00	24.74	V

Ch11

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17994.500	45.56	-25.50	46.70	24.36	54.00	8.44	H
14301.500	39.82	-28.40	42.30	25.92	54.00	14.18	V
12878.500	35.56	-30.70	39.10	27.06	54.00	18.44	H
9505.500	33.26	-33.20	37.90	28.56	54.00	20.74	V
5760.000	32.71	-36.40	34.30	34.81	54.00	21.29	V
2485.000	43.88	-20.00	28.30	35.58	54.00	10.12	H

802.11g

Ch1

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17989.000	45.64	-25.50	46.70	24.44	54.00	8.36	V
14386.500	39.62	-28.40	42.30	25.72	54.00	14.38	H
7241.500	36.38	-35.50	36.40	35.48	54.00	17.62	V
12964.000	35.64	-30.50	39.20	26.94	54.00	18.36	V
9498.500	33.46	-33.20	37.90	28.76	54.00	20.54	V
2389.900	51.57	-20.00	28.10	43.47	54.00	2.43	H

Ch6

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17987.500	45.26	-25.50	46.70	24.06	54.00	8.74	H
14400.000	39.90	-28.60	42.50	26.00	54.00	14.10	H
12645.000	35.81	-31.00	39.00	27.91	54.00	18.19	H
8978.500	33.26	-33.30	38.20	28.36	54.00	20.74	H
5760.000	32.68	-36.40	34.30	34.78	54.00	21.32	V
4961.000	27.94	-37.10	33.30	31.74	54.00	26.06	H

Ch11

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17993.000	45.16	-25.50	46.70	23.96	54.00	8.84	V
14401.500	39.90	-28.60	42.50	26.00	54.00	14.10	V
12668.000	35.71	-30.50	39.10	27.11	54.00	18.29	H
9088.500	33.15	-33.80	38.10	28.75	54.00	20.85	V
2483.600	48.96	-20.00	28.30	40.66	54.00	5.04	H
2485.000	45.66	-20.00	28.30	37.36	54.00	8.34	H

802.11n-HT20

Ch1

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17979.000	45.25	-25.50	46.70	24.05	54.00	8.75	H
14333.000	39.62	-28.40	42.30	25.72	54.00	14.38	H
7229.500	36.33	-35.50	36.40	35.43	54.00	17.67	H
12974.500	35.62	-30.50	39.20	26.92	54.00	18.38	V
8990.500	33.13	-33.30	38.20	28.23	54.00	20.87	V
2389.900	51.22	-20.00	28.10	43.12	54.00	2.78	H

Ch6

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17991.500	45.34	-25.50	46.70	24.14	54.00	8.66	V
14314.500	39.94	-28.40	42.30	26.04	54.00	14.06	V
7307.000	36.09	-35.00	36.50	34.49	54.00	17.91	V
12940.500	35.84	-30.50	39.20	27.14	54.00	18.16	H
9526.000	33.17	-33.20	37.90	28.47	54.00	20.83	V
4469.500	30.60	-37.70	32.40	35.90	54.00	23.40	V

Ch11

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17995.500	45.32	-25.50	46.70	24.12	54.00	8.68	V
14369.500	39.72	-28.40	42.30	25.82	54.00	14.28	V
12640.500	35.73	-31.00	39.00	27.83	54.00	18.27	V
7388.500	33.37	-35.10	36.60	31.87	54.00	20.63	V
2483.700	50.72	-20.00	28.30	42.42	54.00	3.28	H
2485.100	48.03	-20.00	28.30	39.73	54.00	5.97	H

Test graphs as below:

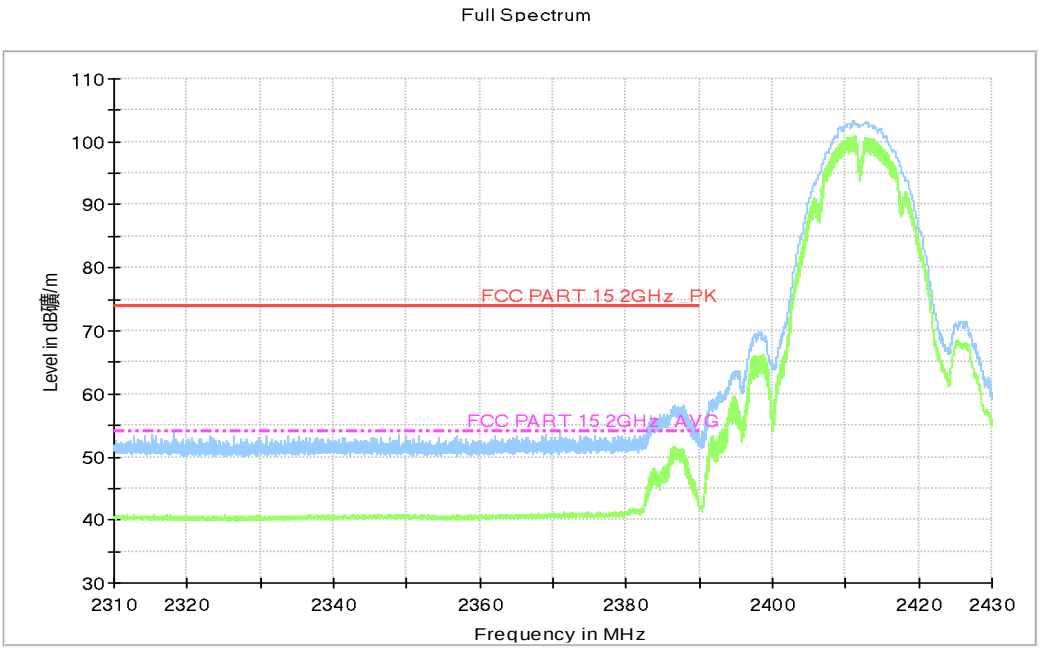


Fig.A.6.2.1 Transmitter Spurious Emission - Radiated (Power): 802.11b, ch1, 2.31 GHz – 2.45GHz

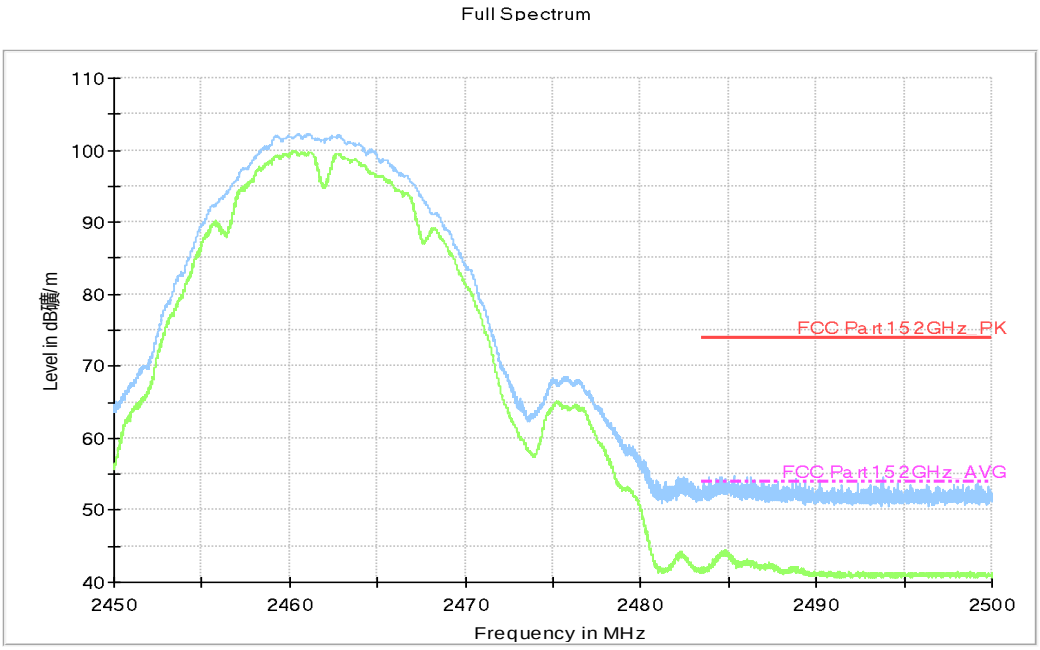


Fig.A.6.2.2 Transmitter Spurious Emission - Radiated (Power): 802.11b, ch11, 2.45 GHz - 2.50GHz

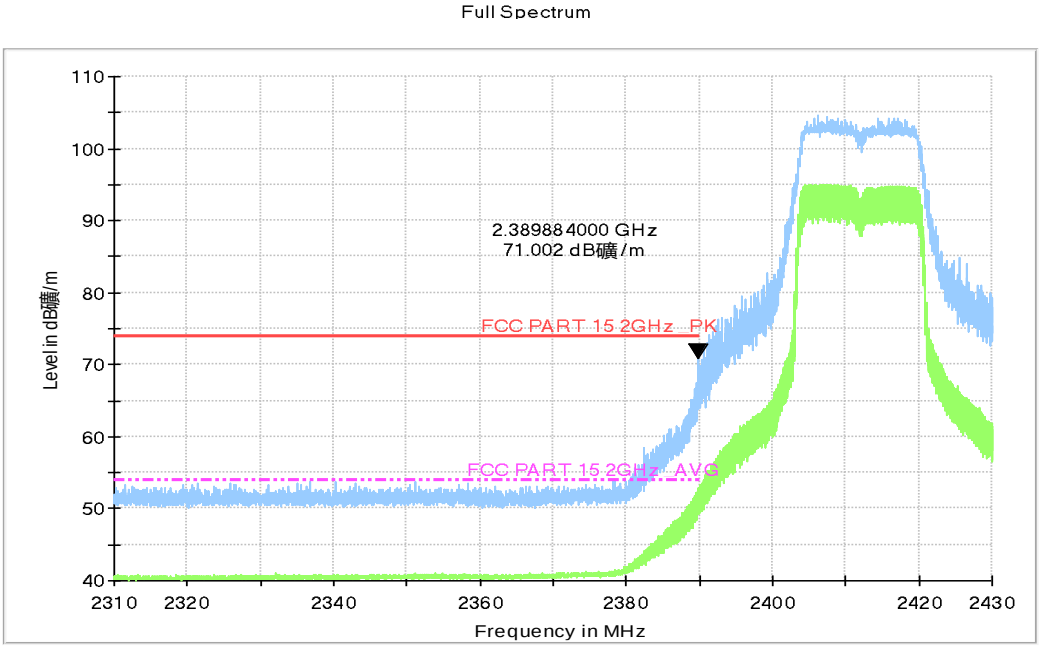


Fig.A.6.2.3 Transmitter Spurious Emission - Radiated (Power): 802.11g, ch1, 2.31 GHz - 2.45GHz

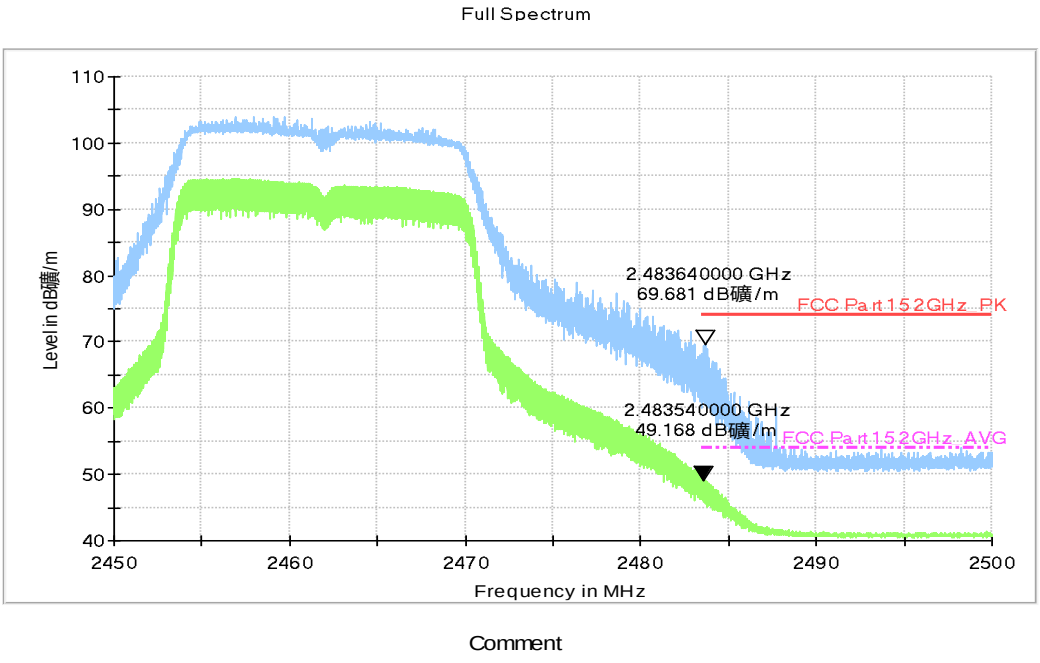


Fig.A.6.2.4 Transmitter Spurious Emission - Radiated (Power): 802.11g, ch11, 2.45 GHz - 2.50GHz

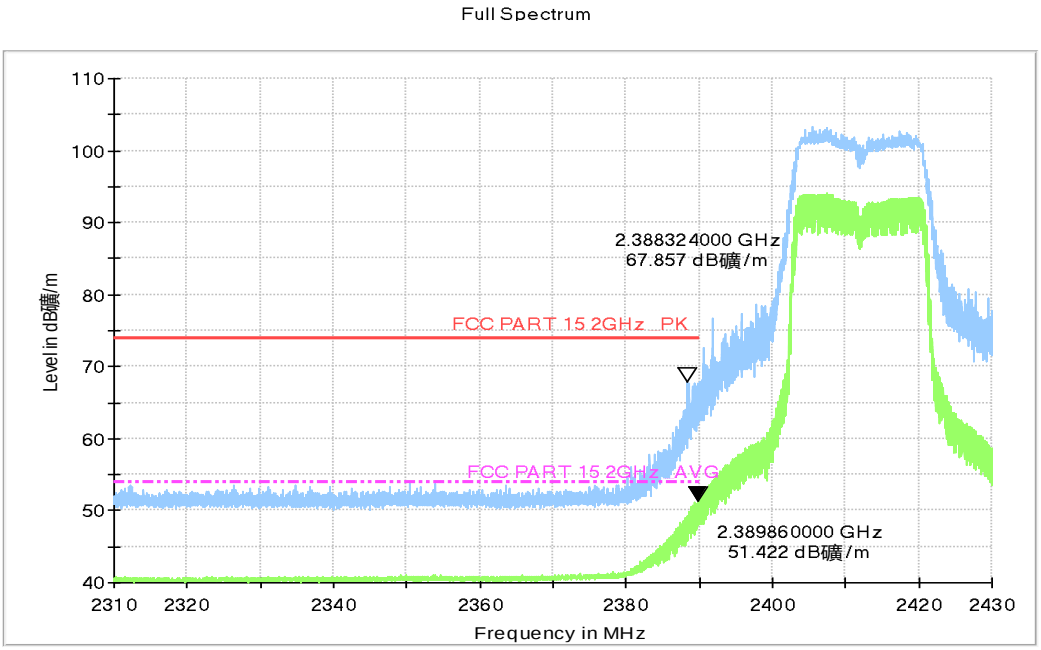


Fig.A.6.2.5 Transmitter Spurious Emission - Radiated (Power): 802.11n-HT20, ch1, 2.31 GHz - 2.45GHz

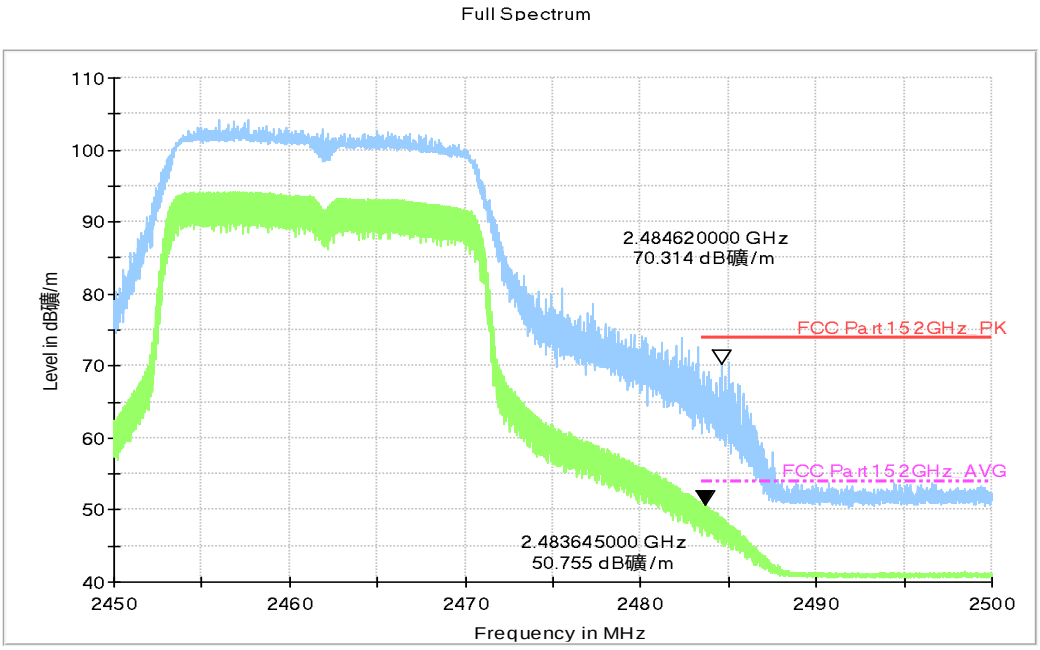


Fig.A.6.2.6 Transmitter Spurious Emission - Radiated (Power): 802.11n-HT20, ch11, 2.45 GHz - 2.50GHz

A.7. AC Power-line Conducted Emission

Method of Measurement:

See Clause 6.2 of ANSI C63.10-2013 specifically.

See Clause 4 and Clause 5 of ANSI C63.10-2013 generally.

The conducted emissions from the AC port of the EUT are measured in a shielding room. The EUT is connected to a Line Impedance Stabilization Network (LISN). An overview sweep with peak detection was performed. The measurements were performed with a quasi-peak detector and if required, an average detector.

The conducted emission measurements were made with the following detector of the test receiver: Quasi-Peak / Average Detector.

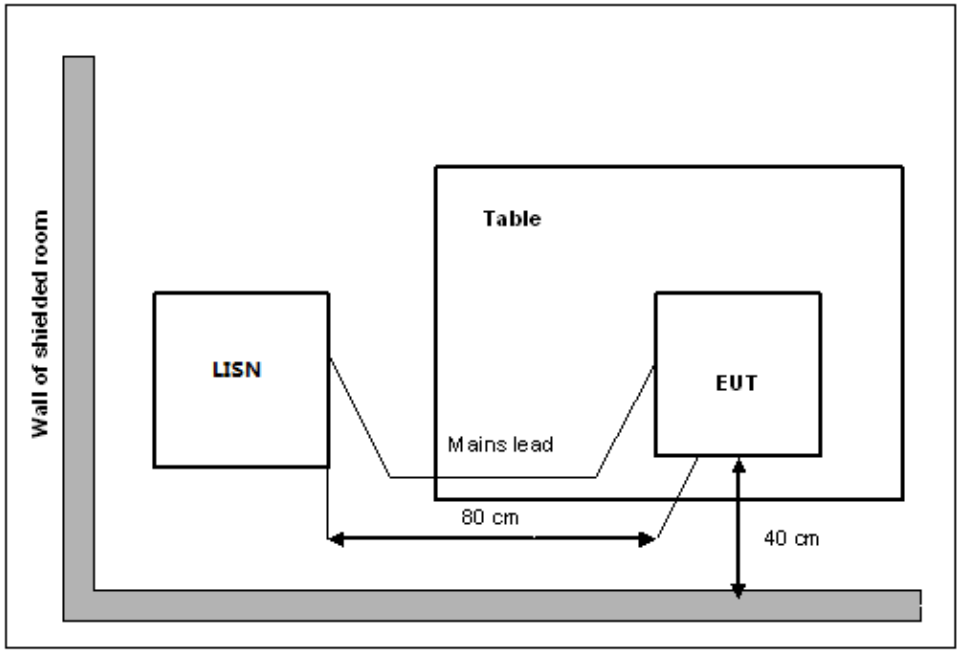
The measurement bandwidth is:

Frequency of Emission (MHz)	RBW/IF bandwidth
0.15-30	9kHz

Test Condition:

Voltage（V）	Frequency（Hz）
120	60

Measurement Setup



Measurement Result and limit:

WLAN (Quasi-peak Limit)

Frequency range (MHz)	Quasi-peak Limit (dBμV)	Result (dBμV)		Conclusion
		With Adapter		
		802.11b	Idle	
0.15 to 0.5	66 to 56	Fig.A.7.1	Fig.A.7.2	P
0.5 to 5	56			
5 to 30	60			
NOTE: The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5 MHz.				

WLAN (Average Limit)

Frequency range (MHz)	Average Limit (dBμV)	Result (dBμV)		Conclusion
		With Adapter		
		802.11b	Idle	
0.15 to 0.5	56 to 46	Fig.A.7.1	Fig.A.7.2	P
0.5 to 5	46			
5 to 30	50			
NOTE: The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5 MHz.				

Conclusion: Pass

Test graphs as below:

Result for Traffic:

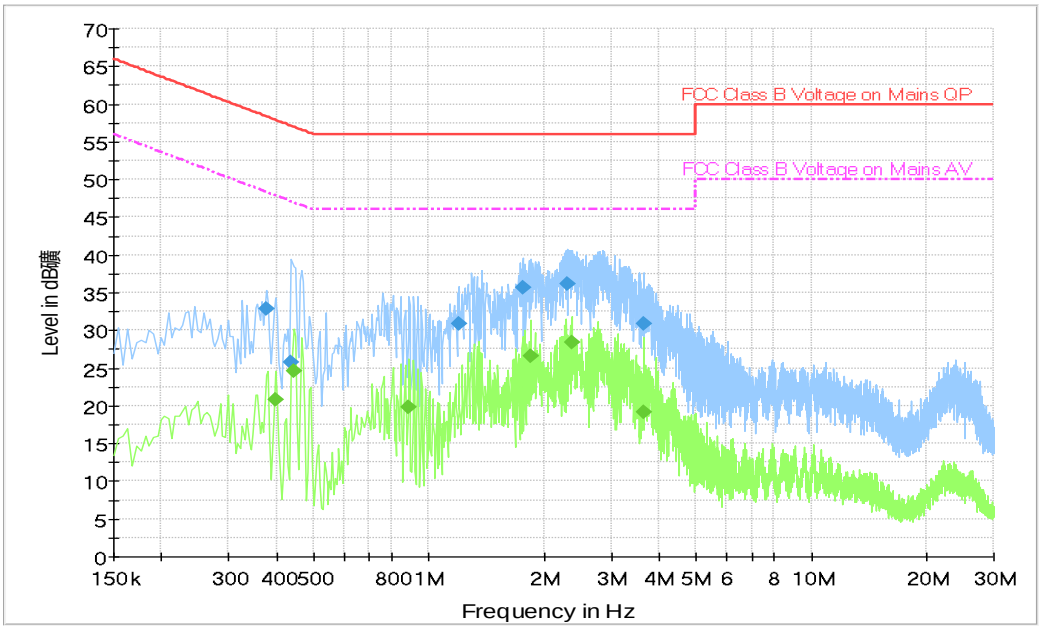


Fig.A.7.1 AC Powerline Conducted Emission-802.11b

Note1: The graphic result above is the maximum of the measurements for both phase line and neutral line.

Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.375000	32.8	1000.	9.000	L1	20.0	25.6	58.4
0.438000	25.8	1000.	9.000	L1	19.9	31.3	57.1
1.198500	30.9	1000.	9.000	L1	19.5	25.1	56.0
1.761000	35.7	1000.	9.000	L1	19.5	20.3	56.0
2.310000	36.1	1000.	9.000	L1	19.5	19.9	56.0
3.660000	30.9	1000.	9.000	L1	19.5	25.1	56.0

Final Result 2

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.397500	20.8	1000.0	9.000	L1	19.9	27.1	47.9
0.442500	24.6	1000.0	9.000	L1	19.9	22.4	47.0
0.888000	19.9	1000.0	9.000	L1	19.6	26.1	46.0
1.846500	26.6	1000.0	9.000	L1	19.5	19.4	46.0
2.359500	28.3	1000.0	9.000	L1	19.5	17.7	46.0
3.660000	19.1	1000.0	9.000	L1	19.5	26.9	46.0

Result for Idle:

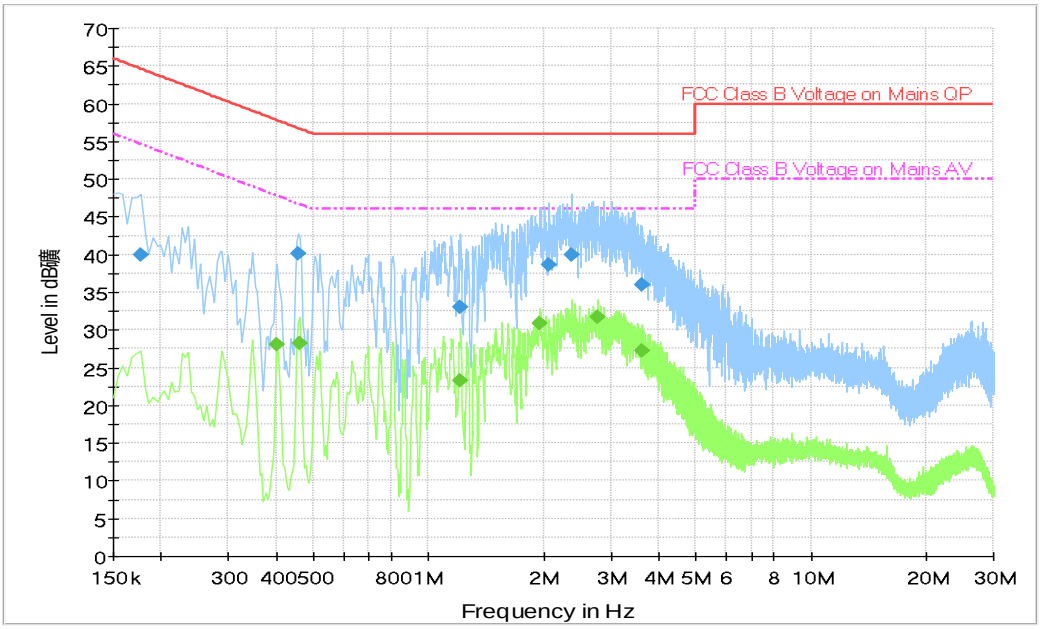


Fig.A.7.2 AC Powerline Conducted Emission-Idle

Note1: The graphic result above is the maximum of the measurements for both phase line and neutral line.

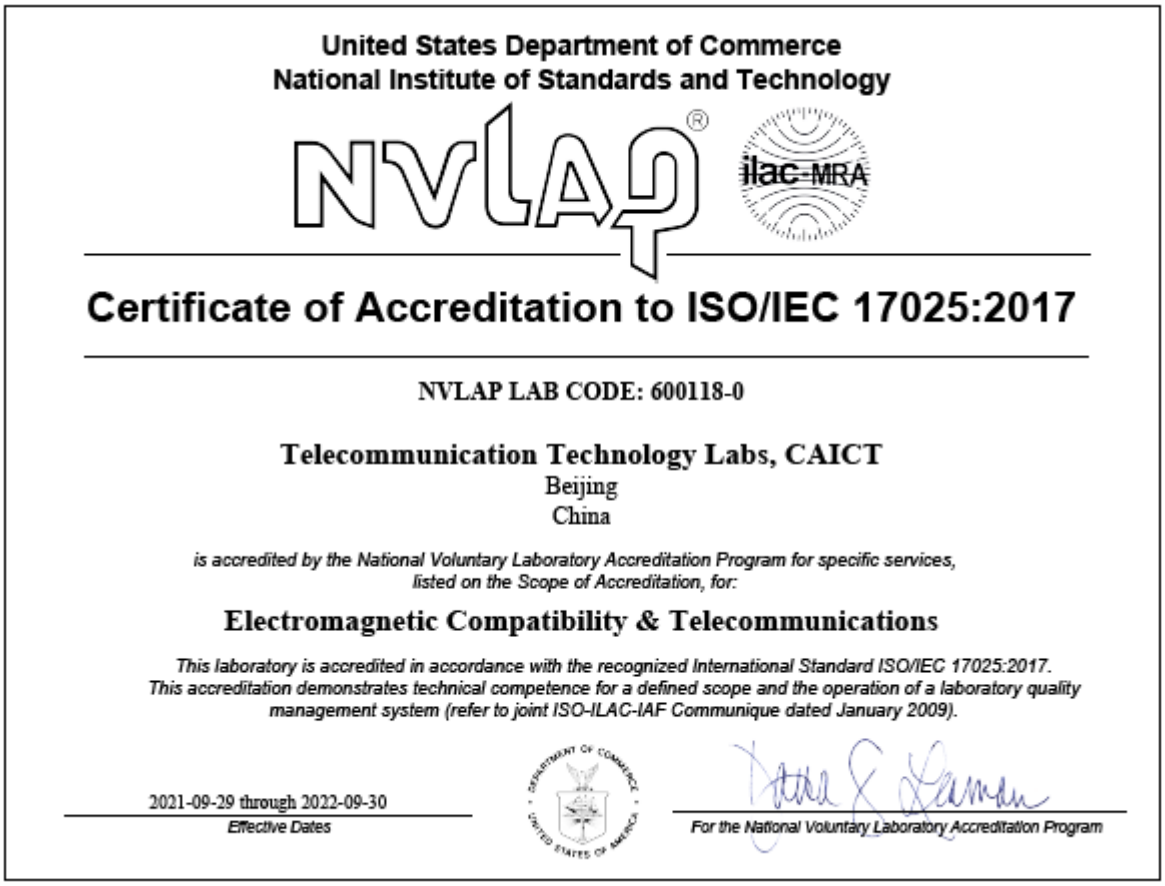
Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.177000	39.9	1000.	9.000	L1	20.0	24.8	64.6
0.456000	40.1	1000.	9.000	L1	19.9	16.6	56.8
1.212000	33.0	1000.	9.000	L1	19.5	23.0	56.0
2.071500	38.7	1000.	9.000	L1	19.5	17.3	56.0
2.364000	39.9	1000.	9.000	L1	19.5	16.1	56.0
3.633000	36.0	1000.	9.000	L1	19.5	20.0	56.0

Final Result 2

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.402000	28.1	1000.0	9.000	L1	19.9	19.7	47.8
0.460500	28.3	1000.0	9.000	L1	19.9	18.4	46.7
1.212000	23.3	1000.0	9.000	L1	19.5	22.7	46.0
1.954500	30.8	1000.0	9.000	L1	19.4	15.2	46.0
2.764500	31.7	1000.0	9.000	L1	19.5	14.3	46.0
3.633000	27.2	1000.0	9.000	L1	19.5	18.8	46.0

ANNEX B: Accreditation Certificate



United States Department of Commerce
National Institute of Standards and Technology

NVLAP®

ilac-MRA

Certificate of Accreditation to ISO/IEC 17025:2017

NVLAP LAB CODE: 600118-0

Telecommunication Technology Labs, CAICT
Beijing
China

is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:

Electromagnetic Compatibility & Telecommunications

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).

2021-09-29 through 2022-09-30
Effective Dates

For the National Voluntary Laboratory Accreditation Program

*****END OF REPORT*****