



FCC PART 15C TEST REPORT No. I21Z70475-IOT03

for

SAMSUNG Electronics Co., Ltd

Multi-band GSM/WCDMA/LTE phone with Bluetooth, WLAN

SM-A037U

With

FCC ID: ZCASMA037U

Hardware Version: REV1.0

Software Version: A037U.001

Issued Date: 2021-10-27

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.

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REPORT HISTORY

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1. Test Laboratory

1.1.Introduction & Accreditation

Telecommunication Technology Labs, CAICT is an ISO/IEC 17025:2017 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 (ISED#: 24849). The detail accreditation scope can be found on NVLAP website.

1.2.Testing Location

Location 1:CTTL(Huayuan North Road)

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

Radiated testing Location: CTTL (BDA)

Address: No. 18A, Kangding Street, Beijing Economic-Technology
Development Area, Beijing, 100176, P.R. China

1.3. Testing Environment

Normal Temperature: 15-35°C

Relative Humidity: 20-75%

1.4. Project date

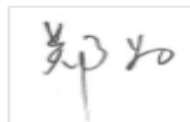
Testing Start Date: 2021-10-01

Testing End Date: 2021-10-27

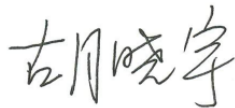
1.5. Signature

封爱宇

Feng Aiyu
(Prepared this test report)



Zheng Wei
(Reviewed this test report)



Hu Xiaoyu
(Approved this test report)

2. Client Information

2.1.Applicant Information

Company Name: SAMSUNG Electronics Co., Ltd
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City: /
Postal Code: /
Contact: Jenni Chun
Telephone: +1-201-937-4203
Email: j1.chun@samsung.com

2.2.Manufacturer Information

Company Name: SAMSUNG Electronics Co., Ltd.
Address: Samsung R5, Maetan dong 129, Samsung ro
Youngtong gu, Suwon city 443 742, Korea
Contact: (Sunghoon Cho)
Email: ggobi.cho@samsung.com
Telephone: +82-10-2722-4159
Fax: /

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

3.1. About EUT

Description	Multi-band GSM/WCDMA/LTE phone with Bluetooth, WLAN
Model name	SM-A037U
FCC ID	ZCASMA037U
With WLAN Function	Yes
Frequency Band	ISM 2400MHz~2483.5MHz
Type of Modulation	DSSS/CCK/OFDM
Number of Channels	11
Antenna	Integral Antenna
MAX Conducted Power	28.31dBm
Power Supply	3.85V

3.2. Internal Identification of EUT

EUT ID*	SN or IMEI	HW Version	SW Version
UT02a	2170475UT 02a	REV1.0	A037U.001
UT19a	2170475UT19a	REV1.0	A037U.001

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

3.3. Internal Identification of AE

AE ID*	Description	Remark
AE1	Adapter1	Type C
AE2	Data Cable1	Type C
AE3	Data Cable2	Type C
AE4	Headset	/
AE5	Battery1	/
AE6	Battery2	/
AE2		
Model	EP-DN980BWE	
Manufacturer	R.F.Tech Electronics(HuiZhou)Co.,Ltd.	
Length	/	
AE3		
Model	EP-DN980BWE	
Manufacturer	DONGGUAN KSD CO.,LTD	
Length	/	
AE4		
Model	EHS61ASFWE	
Manufacturer	Yuenchang	
Length	/	
AE5		

Model	WT-S-W1
Manufacturer	SCUD (Fujian) Electronics Co.,Ltd.
AE6	
Model	SCUD-WT-W1
Manufacturer	SCUD (Fujian) Electronics Co.,Ltd.

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

Note: AE1 is not AE for EUT, provided by applicant for relevant testing.

3.4. General Description

The Equipment under Test (EUT) is a model of Multi-band GSM/WCDMA/LTE phone with Bluetooth, WLAN

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:	2018
	15.205 Restricted bands of operation;	
	15.209 Radiated emission limits, general requirements;	
ANSI C63.10	15.247 Operation within the bands 902-928MHz, 2400-2483.5 MHz, and 5725-5850 MHz.	2013
	American National Standard of Procedures for Compliance	
	Testing of Unlicensed Wireless Devices	
KDB 558074 D01	Federal Communications Commission Office of	2019
	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

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)	/	P
Peak Power Spectral Density	15.247 (e)	/	P
Occupied 6dB Bandwidth	15.247 (a)	/	P
Band Edges Compliance	15.247 (d)	/	P
Transmitter Spurious Emission - Conducted	15.247 (d)	/	P
Transmitter Spurious Emission - Radiated	15.247, 15.205, 15.209	/	P
AC Powerline Conducted Emission	15.107, 15.207	/	P

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
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.

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°C
Voltage	V nom	3.85V(By battery)
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	2022-05-15
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	R&S	1 year	2022-02-23
2	EMI Antenna	VULB9163	9163-482	Schwarzbeck	1 year	2021-11-04
3	EMI Antenna	LB-180-NF	2030013000 41	A-INFO	1 year	2022-02-28
4	EMI Antenna	LB-180400-25-C-KF	2110084000 06	A-INFO	1 year	2022-02-28
5	Analytical Spectrometer	FSV40	101047	R&S	1 year	2022-06-02

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)
$30\text{MHz} \leq f \leq 2\text{GHz}$	1.22
$2\text{GHz} \leq f \leq 3.6\text{GHz}$	1.22
$3.6\text{GHz} \leq f \leq 8\text{GHz}$	1.22
$8\text{GHz} \leq f \leq 12.75\text{GHz}$	1.51
$12.75\text{GHz} \leq f \leq 26\text{GHz}$	1.51
$26\text{GHz} \leq f \leq 40\text{GHz}$	1.59

Radiated (k=2)

Frequency Range	Uncertainty(dB)
9kHz-30MHz	/
$30\text{MHz} \leq f \leq 1\text{GHz}$	5.40
$1\text{GHz} \leq f \leq 18\text{GHz}$	4.32
$18\text{GHz} \leq f \leq 40\text{GHz}$	5.26

7.6. AC Power-line Conducted Emission

Measurement Uncertainty : 3.10dB,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

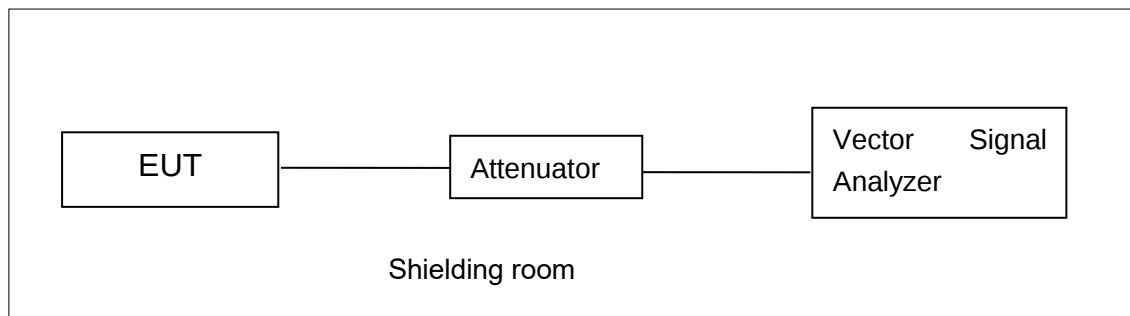


Fig.A.1.1.1: Test Setup Diagram for Conducted Measurements

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 = 10Hz;

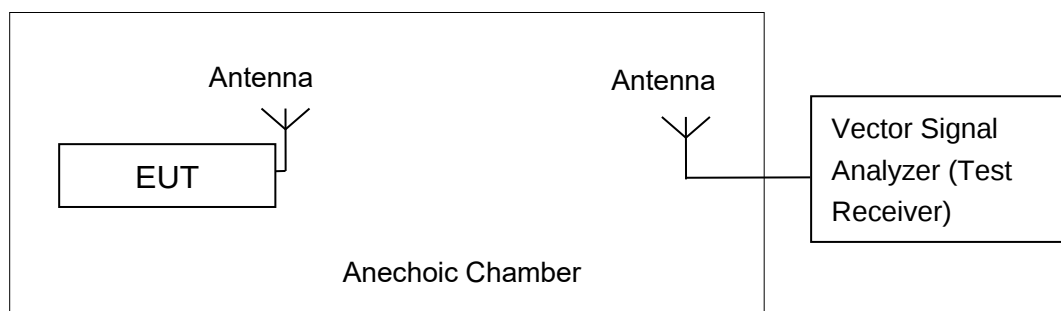


Fig.A.1.2.1: Test Setup Diagram for Radiated Measurements

A.2. Maximum Output Power

Method of Measurement: See ANSI C63.10-2013-clause 11.9.1.2

- Set the RBW = 1 MHz.
- Set the VBW = 3 MHz.
- Set the span $\geq [1.5 \times \text{DTS bandwidth}]$.
- Detector = peak.
- Sweep time = auto couple.
- Trace mode = max hold.
- Allow trace to fully stabilize.
- Use the instrument's band/channel power measurement function with the band limits set equal to the DTS bandwidth edges (for some instruments, this may require a manual override to select the peak detector).

Measurement Limit:

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

EUT ID: EUT02

A.2.1. Peak Output Power-conducted

Measurement Results:

802.11b/g mode

Channel rate	1Mbps	2Mbps	5.5Mbps	11Mbps
1	24.32	24.71	26.35	28.31
6	/	/	/	28.03
11	/	/	/	27.91

Channel rate	6Mbps	9Mbps	12Mbps	18Mbps	24Mbps	36Mbps	48Mbps	54Mbps
1	27.96	27.05	27.47	27.58	26.98	26.83	27.14	25.8
6	27.66	/	/	/	/	/	/	/
11	27.54	/	/	/	/	/	/	/

The data rate 11Mbps and 6Mbps are selected as worse condition, and the following cases are performed with this condition.

802.11n-HT20 mode

Channel rate	MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
1	27.93	27.36	27.49	27.78	26.65	26.71	26.84	25.98
6	27.81	/	/	/	/	/	/	/

11	27.43	/	/	/	/	/	/	/
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The data rate MCS0 is selected as worse condition, and the following cases are performed with this condition.

Conclusion: Pass

A.3. Peak Power Spectral Density

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

- Set analyzer center frequency to DTS channel center frequency.
- Set the span to 1.5 times the DTS bandwidth.
- Set the RBW to RBW = 3 kHz.
- Set the VBW = 10 kHz.
- Detector = peak.
- Sweep time = auto couple.
- Trace mode = max hold.
- Allow trace to fully stabilize.
- 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:

UT02

802.11b/g mode

Mode	Channel	Power Spectral Density (dBm/3 kHz)		Conclusion
802.11b	1	Fig.A.3.1	-2.29	P
	6	Fig.A.3.2	-2.73	P
	11	Fig.A.3.3	-1.88	P
802.11g	1	Fig.A.3.4	-5.91	P
	6	Fig.A.3.5	-5.13	P
	11	Fig.A.3.6	-5.44	P

802.11n-HT20 mode

Mode	Channel	Power Spectral Density (dBm/3 kHz)		Conclusion
802.11n (HT20)	1	Fig.A.3.7	-5.08	P
	6	Fig.A.3.8	-6.45	P
	11	Fig.A.3.9	-5.77	P

Conclusion: Pass

Test graphs as below:

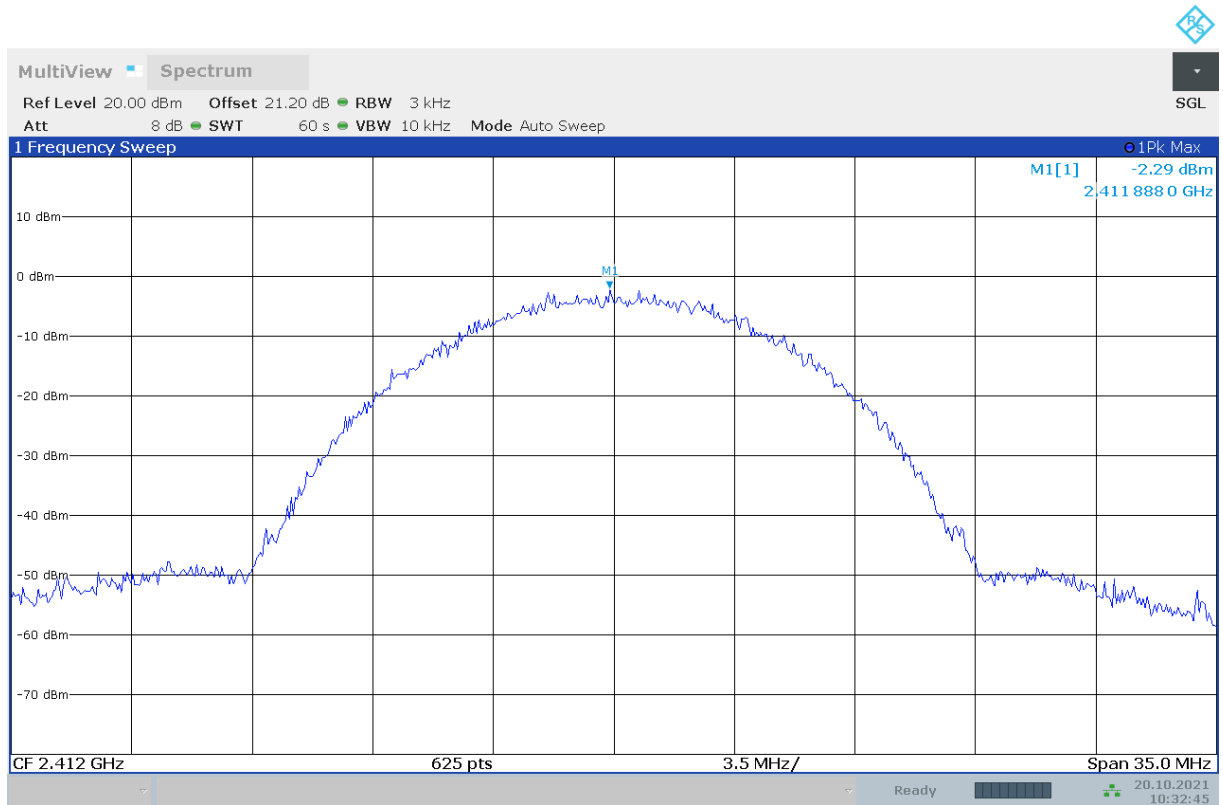


Fig.A.3.1 Power Spectral Density(802.11b,Ch1)

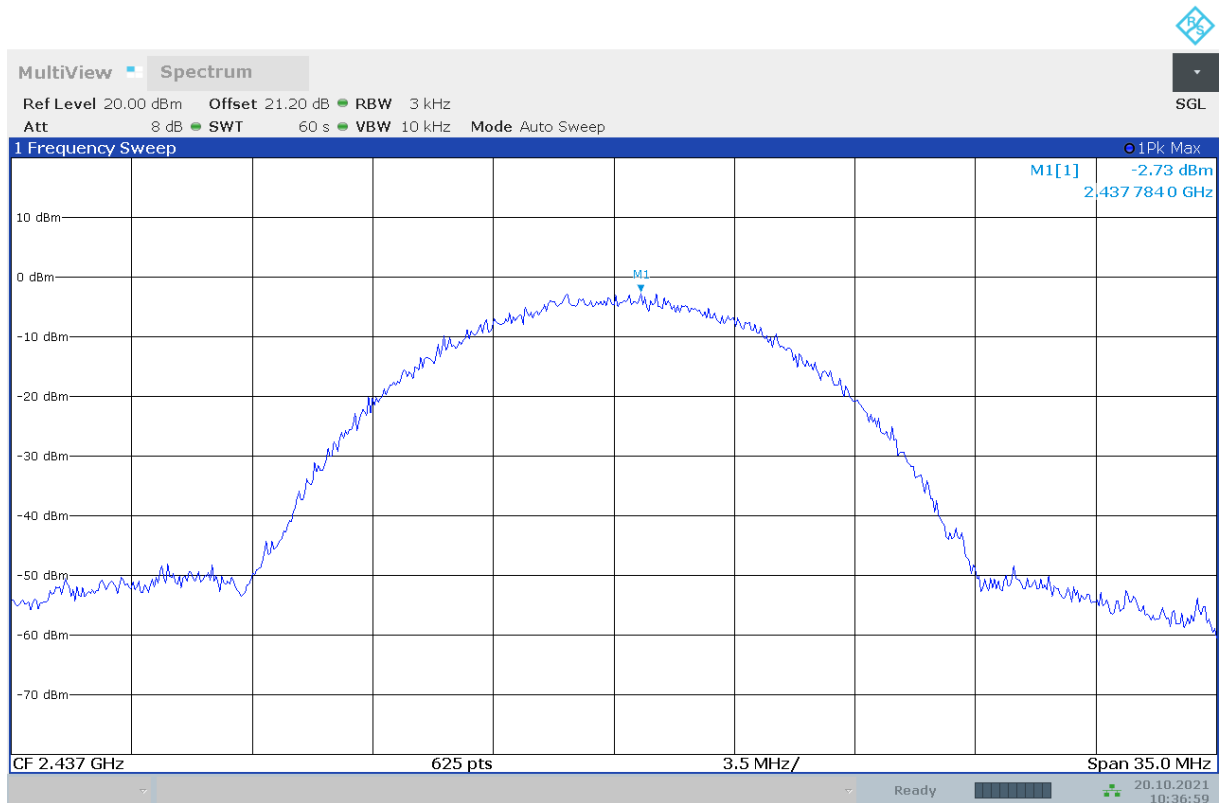


Fig.A.3.2 Power Spectral Density (802.11b, Ch 6)

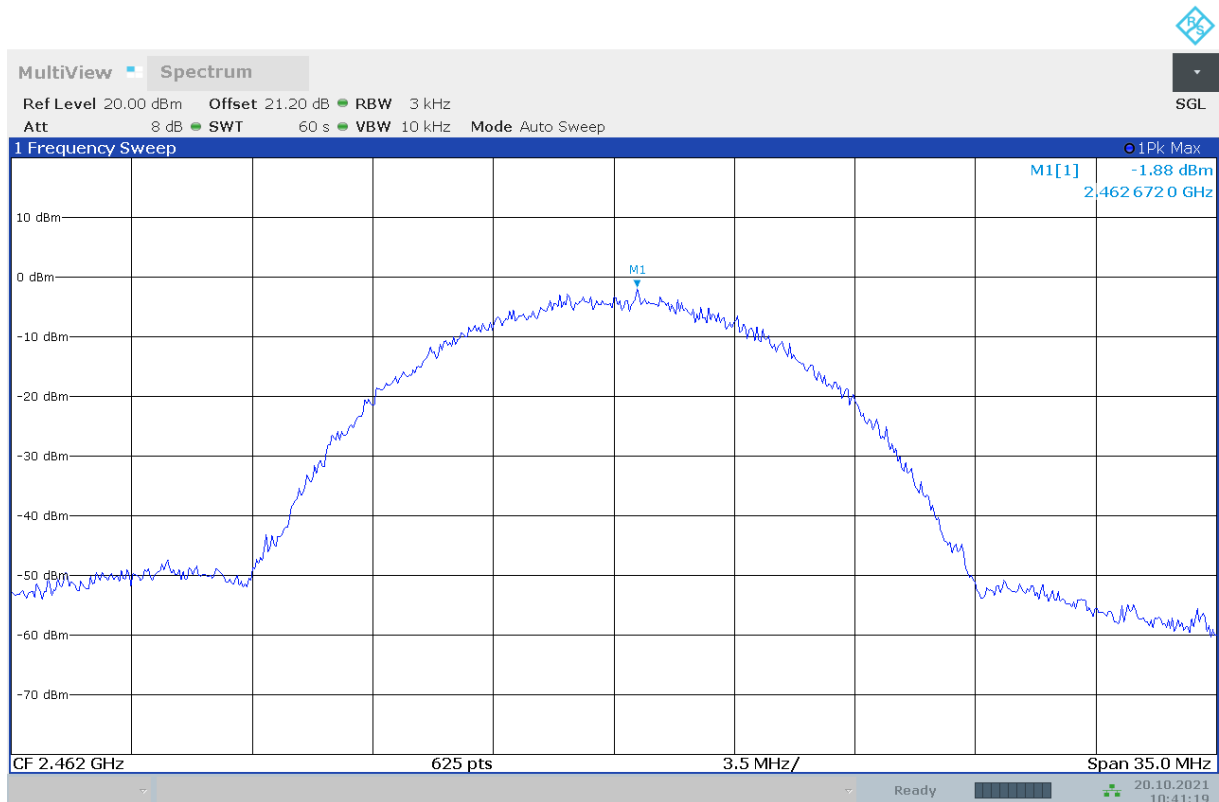


Fig.A.3.3 Power Spectral Density (802.11b, Ch 11)

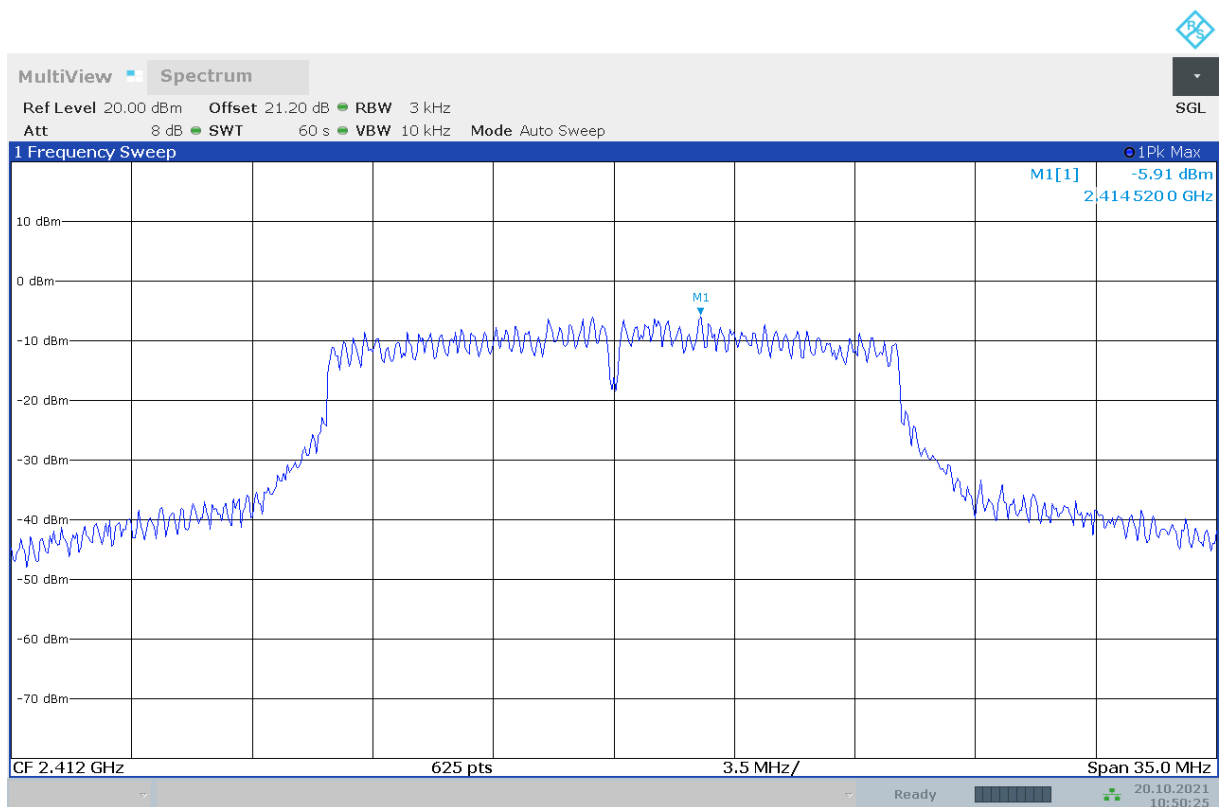


Fig.A.3.4 Power Spectral Density (802.11g, Ch 1)

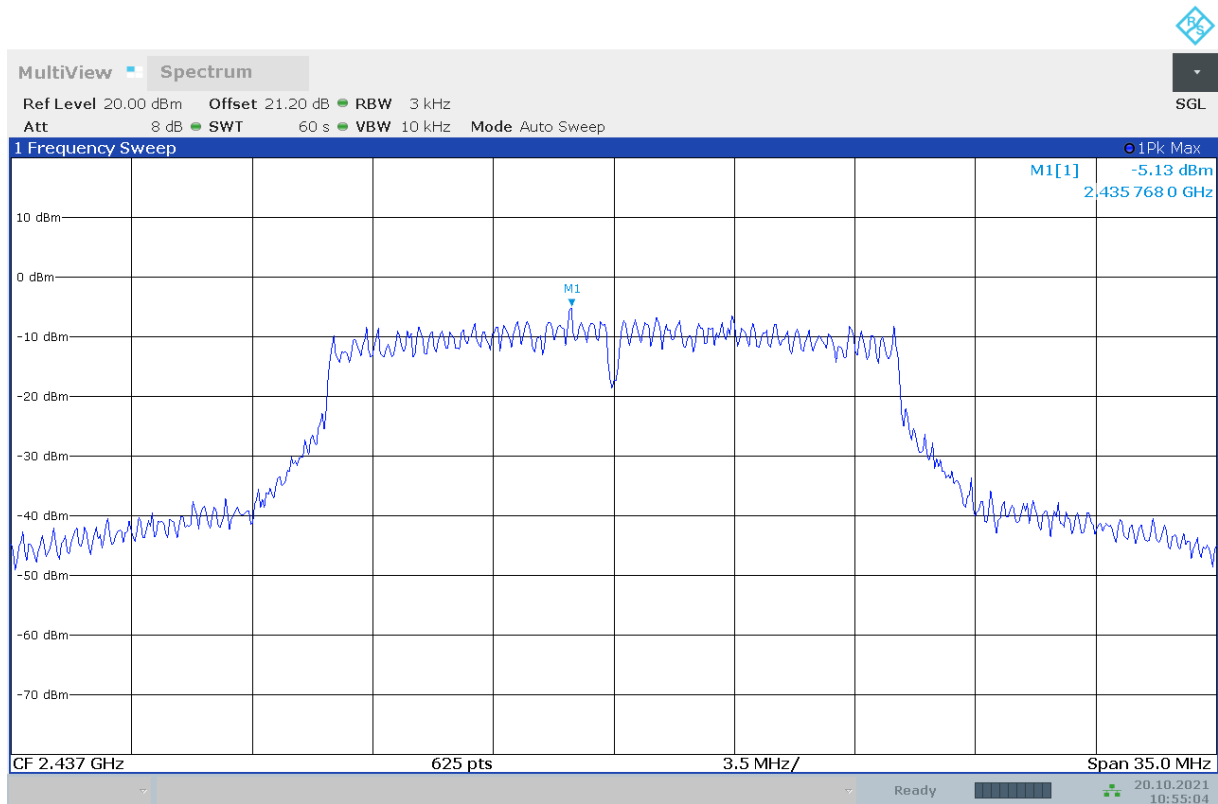


Fig.A.3.5 Power Spectral Density (802.11g, Ch 6)

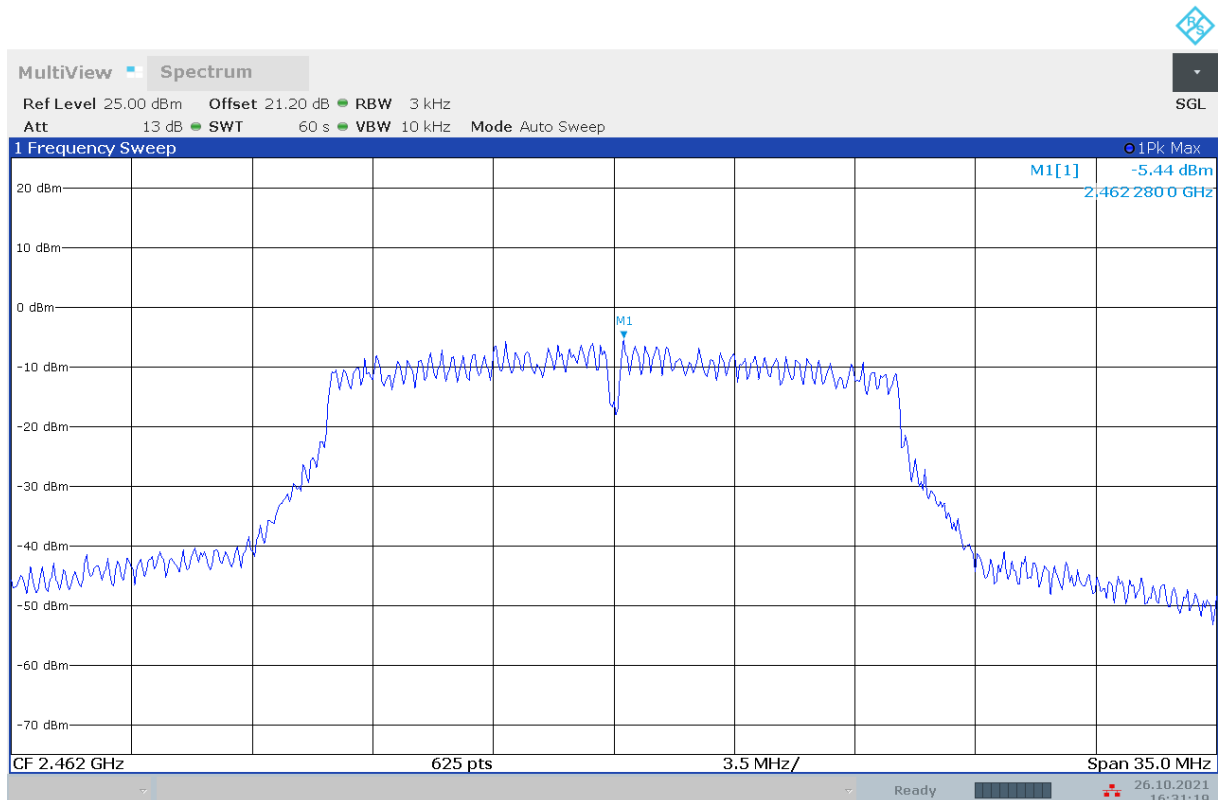


Fig.A.3.6 Power Spectral Density (802.11g, Ch 11)

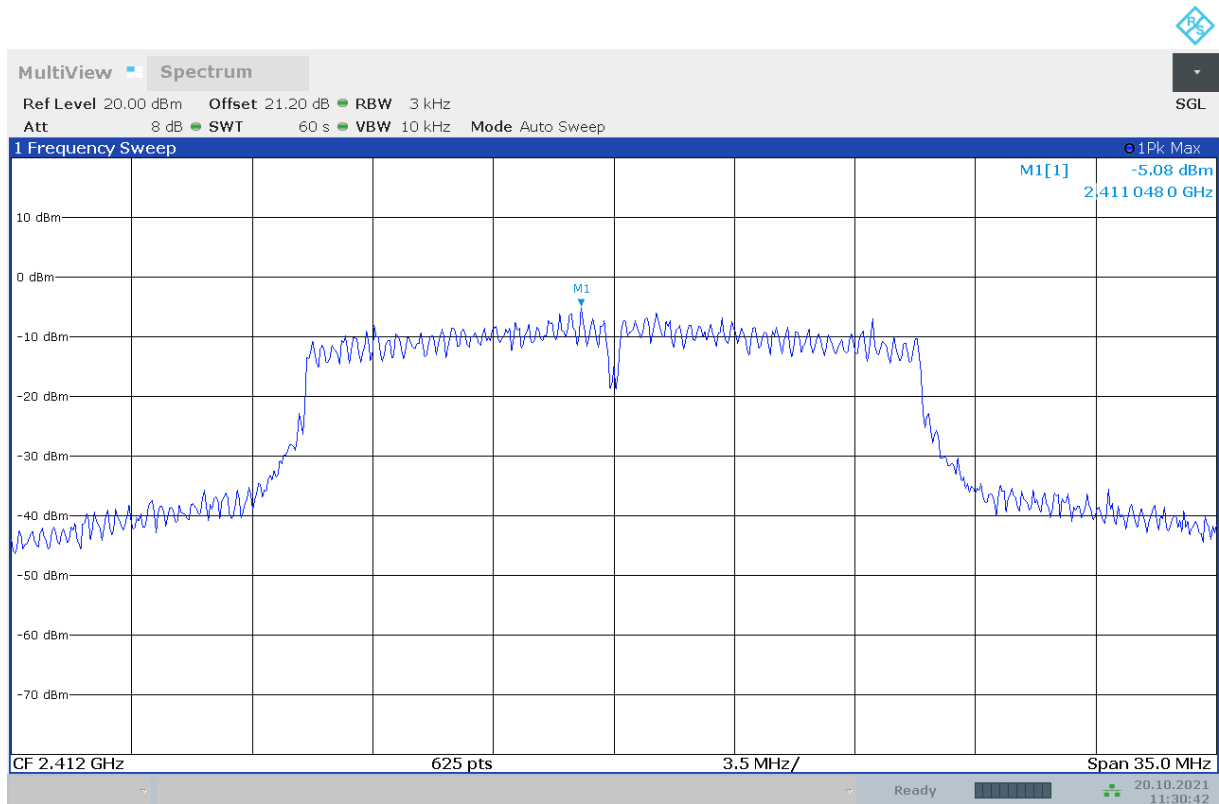


Fig.A.3.7 Power Spectral Density (802.11n-HT20, Ch 1)

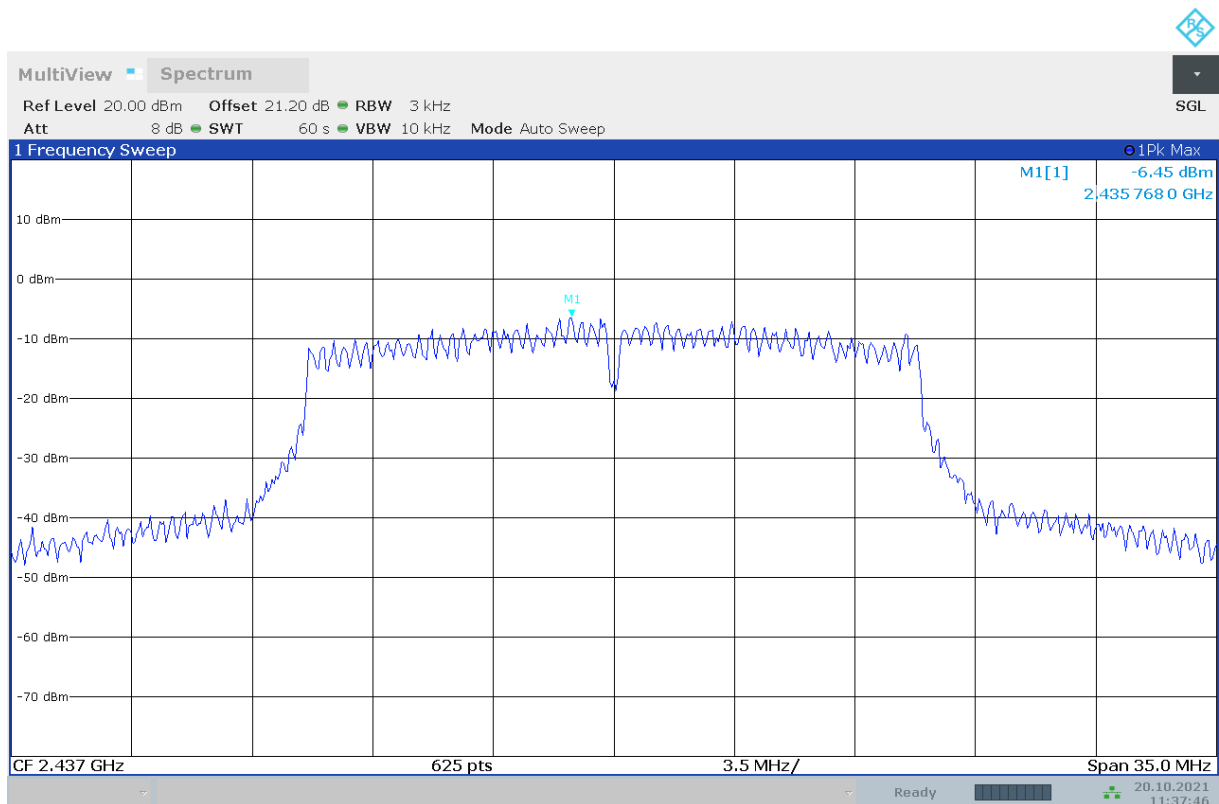


Fig.A.3.8 Power Spectral Density (802.11n-HT20, Ch 6)

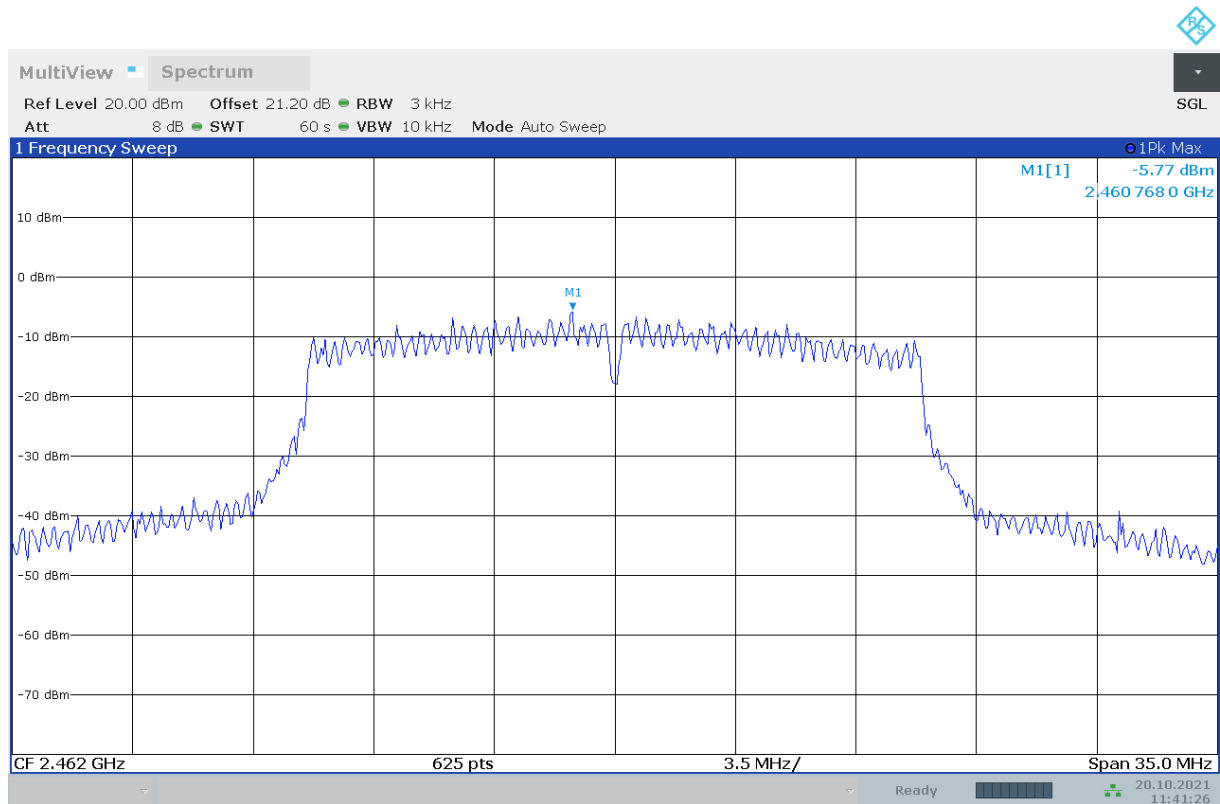


Fig.A.3.9 Power Spectral Density (802.11n-HT20, Ch 11)

A.4. DTS 6-dB Signal Bandwidth

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

- Set RBW = 100 kHz.
- Set the video bandwidth (VBW) = 300 kHz.
- Detector = Peak.
- Trace mode = max hold.
- Sweep = auto couple.
- Allow the trace to stabilize.
- 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: EUT02

Measurement Result:

802.11b/g mode

Mode	Channel	Occupied 6dB Bandwidth (KHz)		conclusion
802.11b	1	Fig.A.4.1	8469.62	P
	6	Fig.A.4.2	8221.61	P
	11	Fig.A.4.3	8658.96	P
802.11g	1	Fig.A.4.4	15313.84	P
	6	Fig.A.4.5	15437.85	P
	11	Fig.A.4.6	15447.18	P

802.11n-HT20 mode

Mode	Channel	Occupied 6dB Bandwidth (KHz)		conclusion
802.11n (HT20)	1	Fig.A.4.7	15455.18	P
	6	Fig.A.4.8	15443.18	P
	11	Fig.A.4.9	15321.84	P

Conclusion: Pass

Test graphs as below:

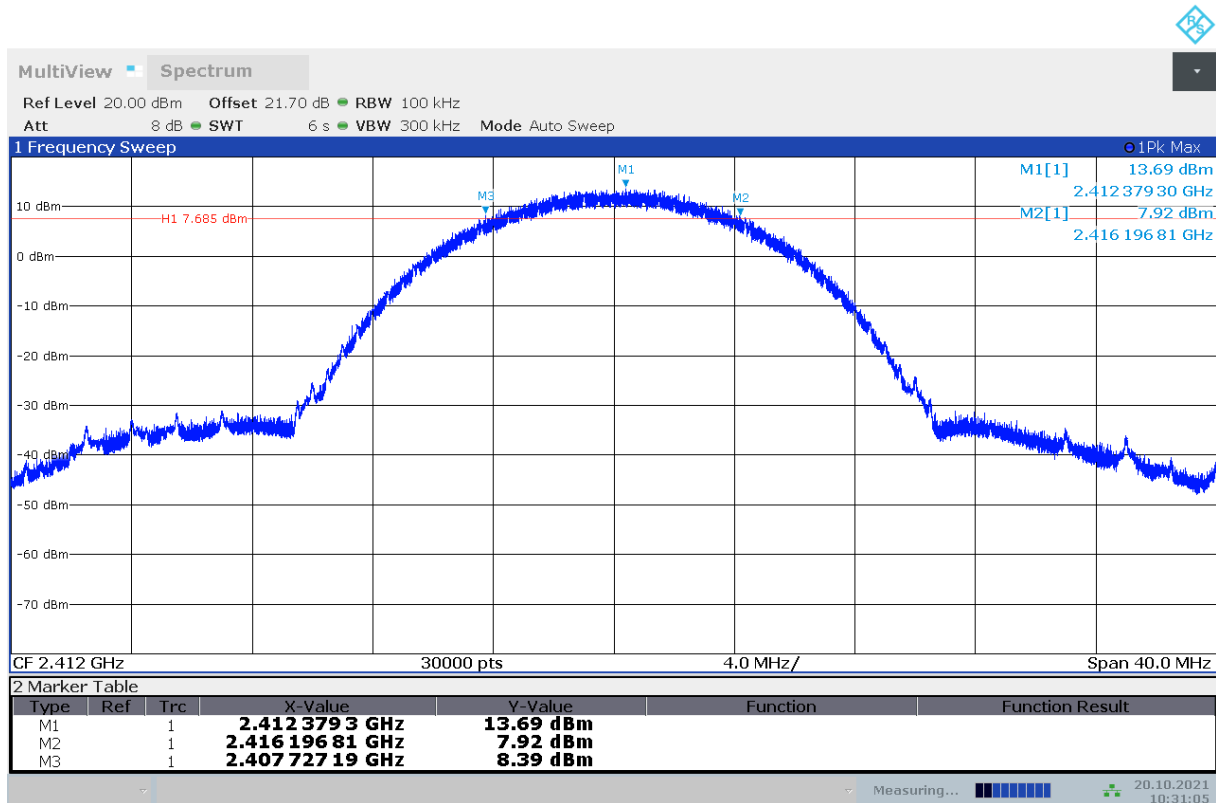


Fig.A.4.1 Occupied 6dB Bandwidth(802.11b,Ch 1)

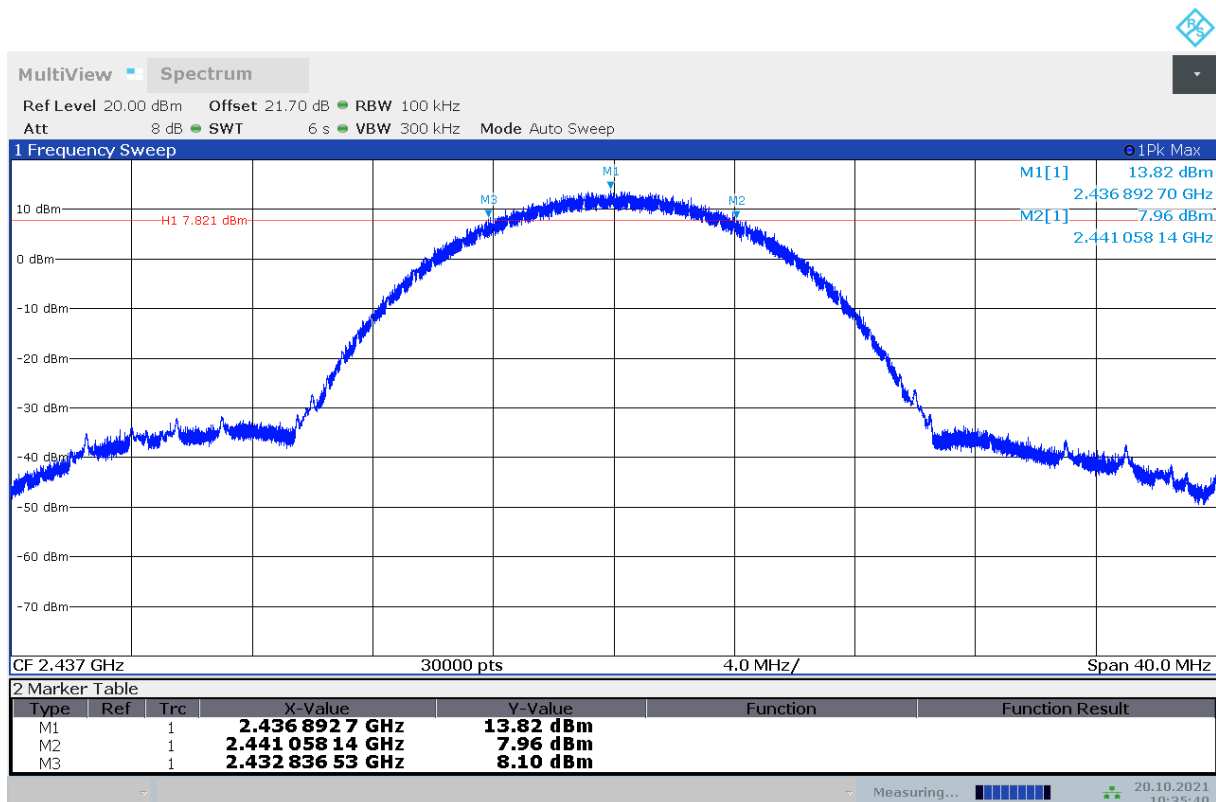


Fig.A.4.2 Occupied 6dB Bandwidth (802.11b, Ch 6)

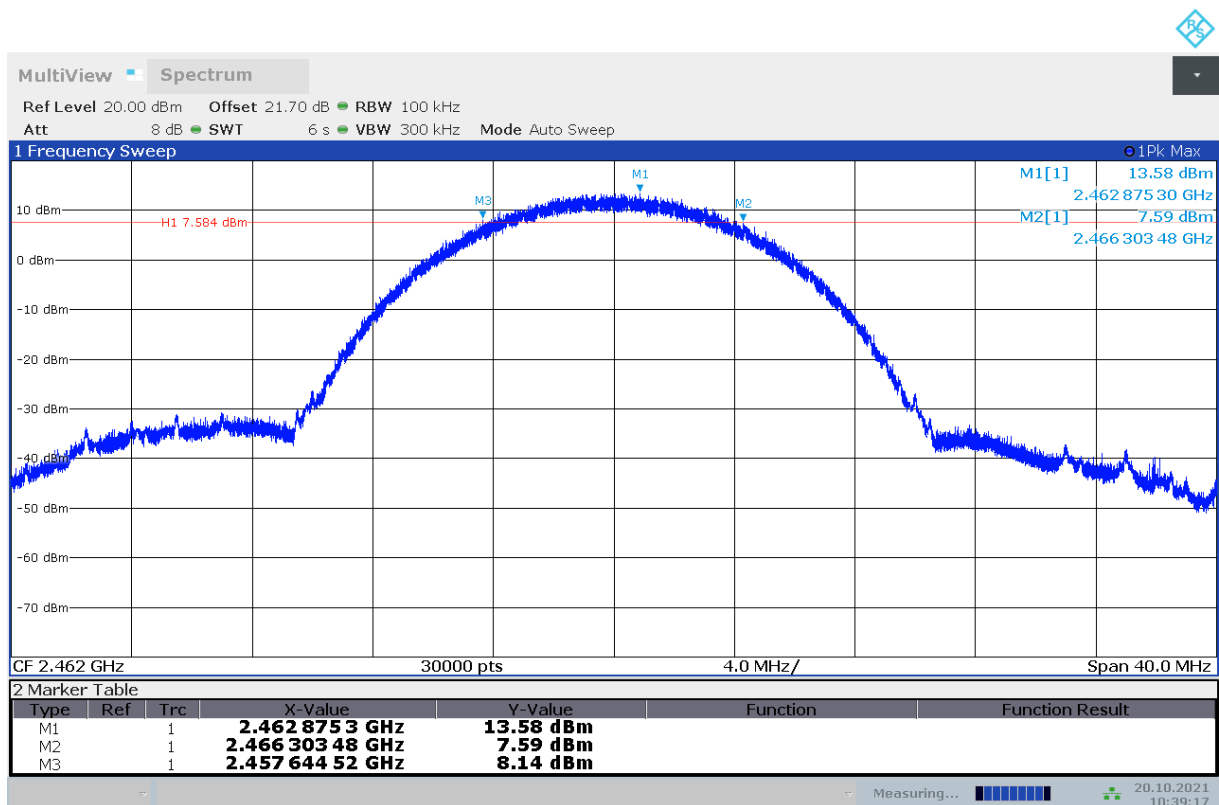


Fig.A.4.3 Occupied 6dB Bandwidth (802.11b, Ch 11)

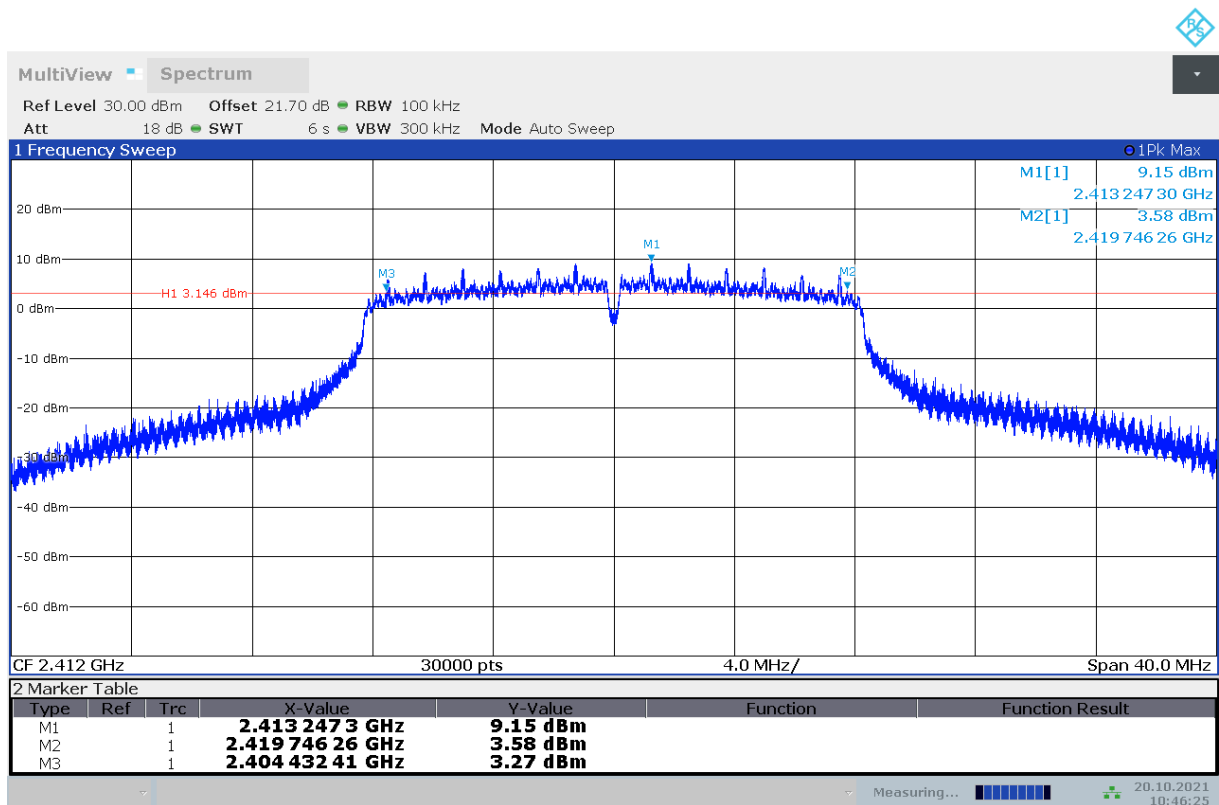


Fig.A.4.4 Occupied 6dB Bandwidth (802.11g, Ch 1)

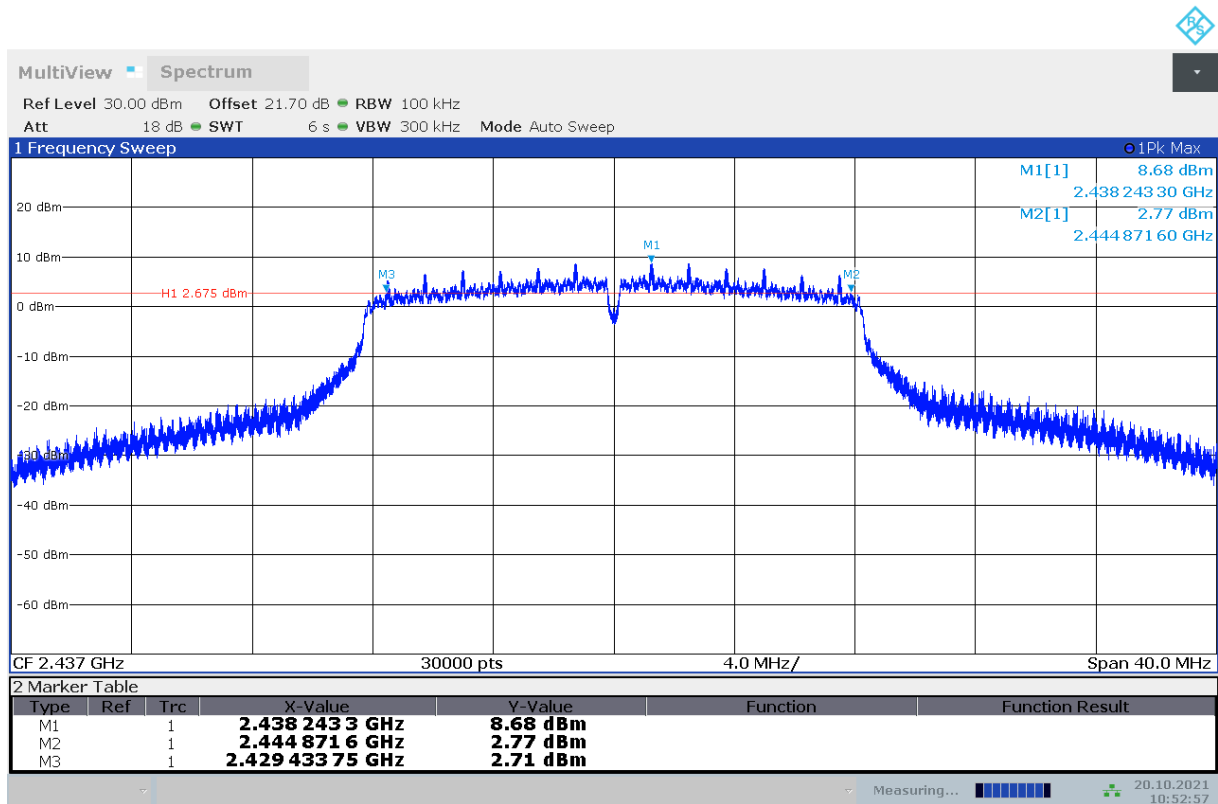


Fig.A.4.5 Occupied 6dB Bandwidth (802.11g, Ch 6)

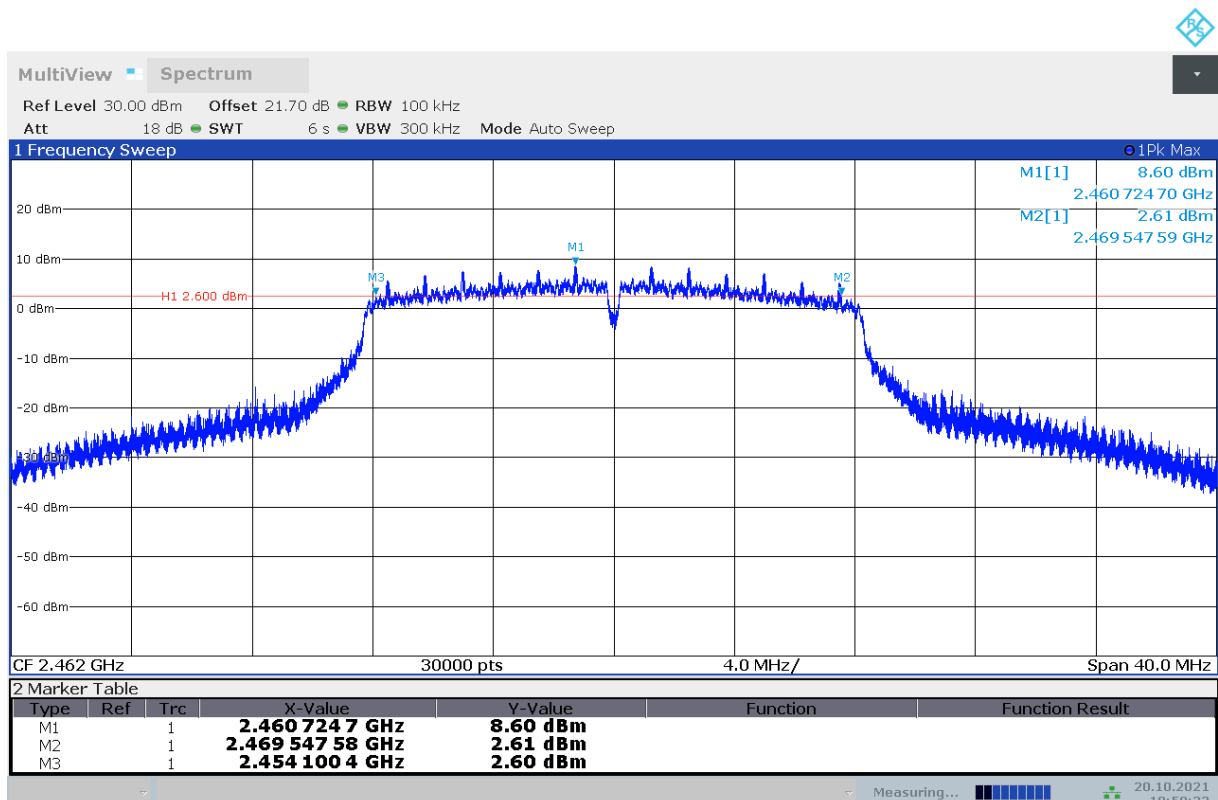


Fig.A.4.6 Occupied 6dB Bandwidth (802.11g, Ch 11)

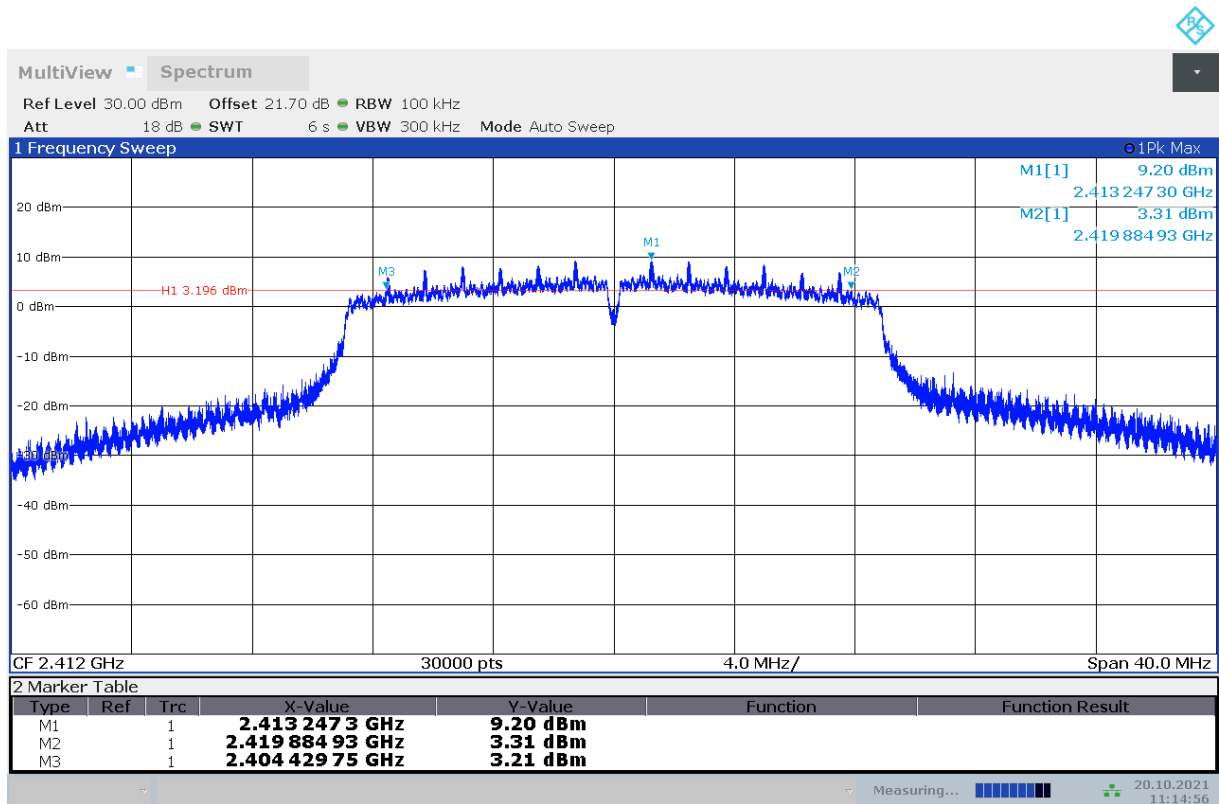


Fig.A.4.7 Occupied 6dB Bandwidth (802.11n-20MHz, Ch 1)

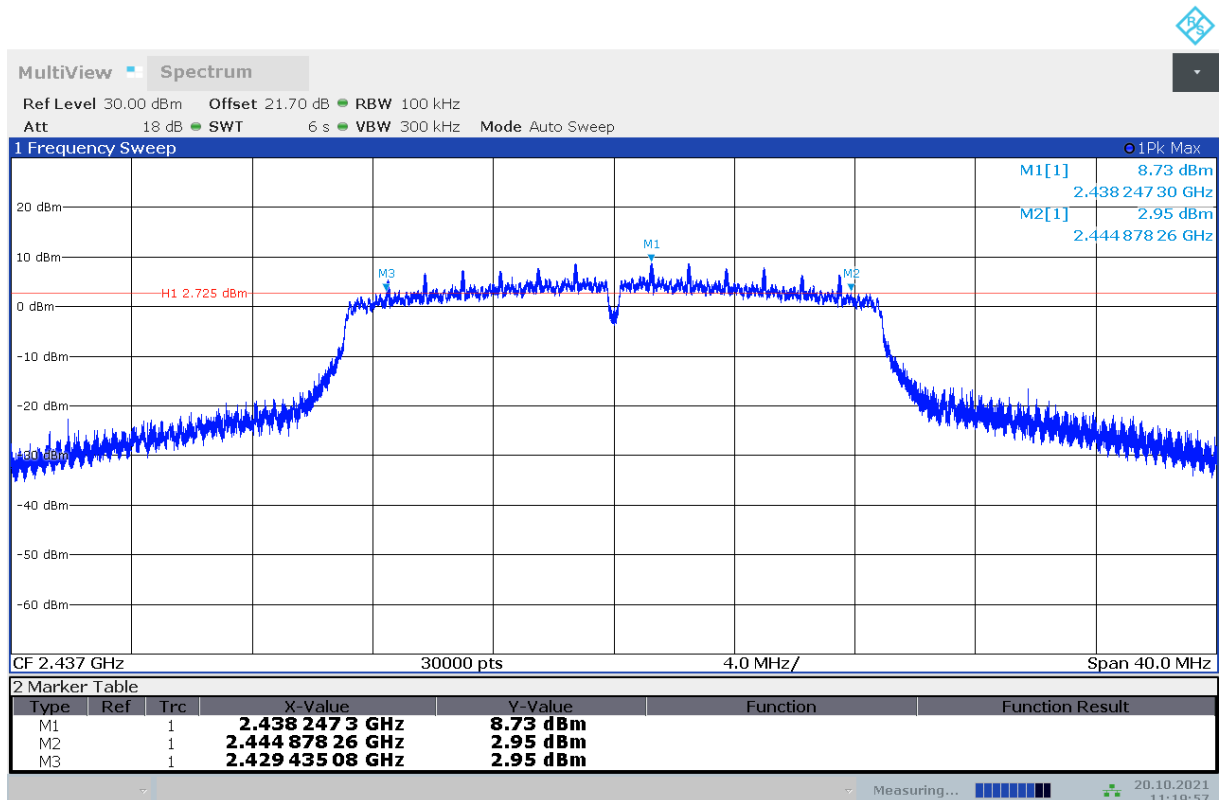


Fig.A.4.8 Occupied 6dB Bandwidth (802.11n-HT20, Ch 6)

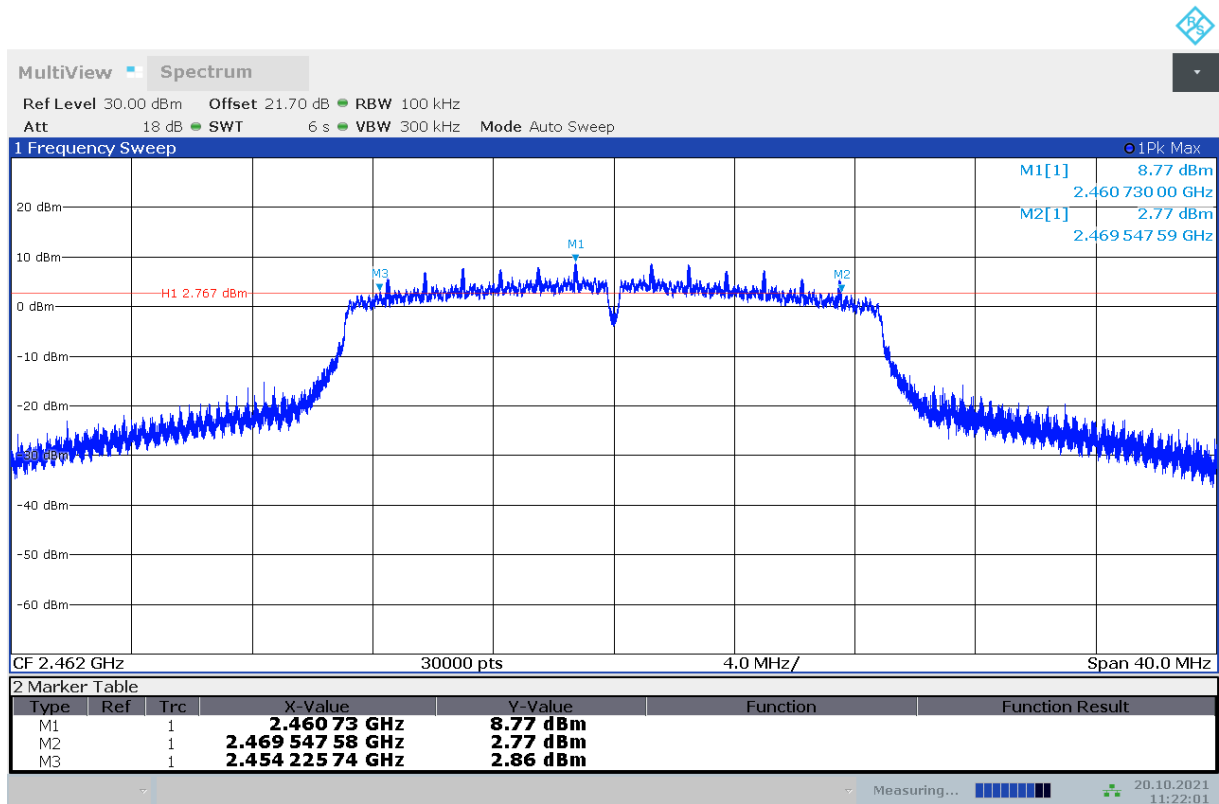


Fig.A.4.9 Occupied 6dB Bandwidth (802.11n-HT20, Ch 11)

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: EUT02

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

Conclusion: Pass

Test graphs as below:

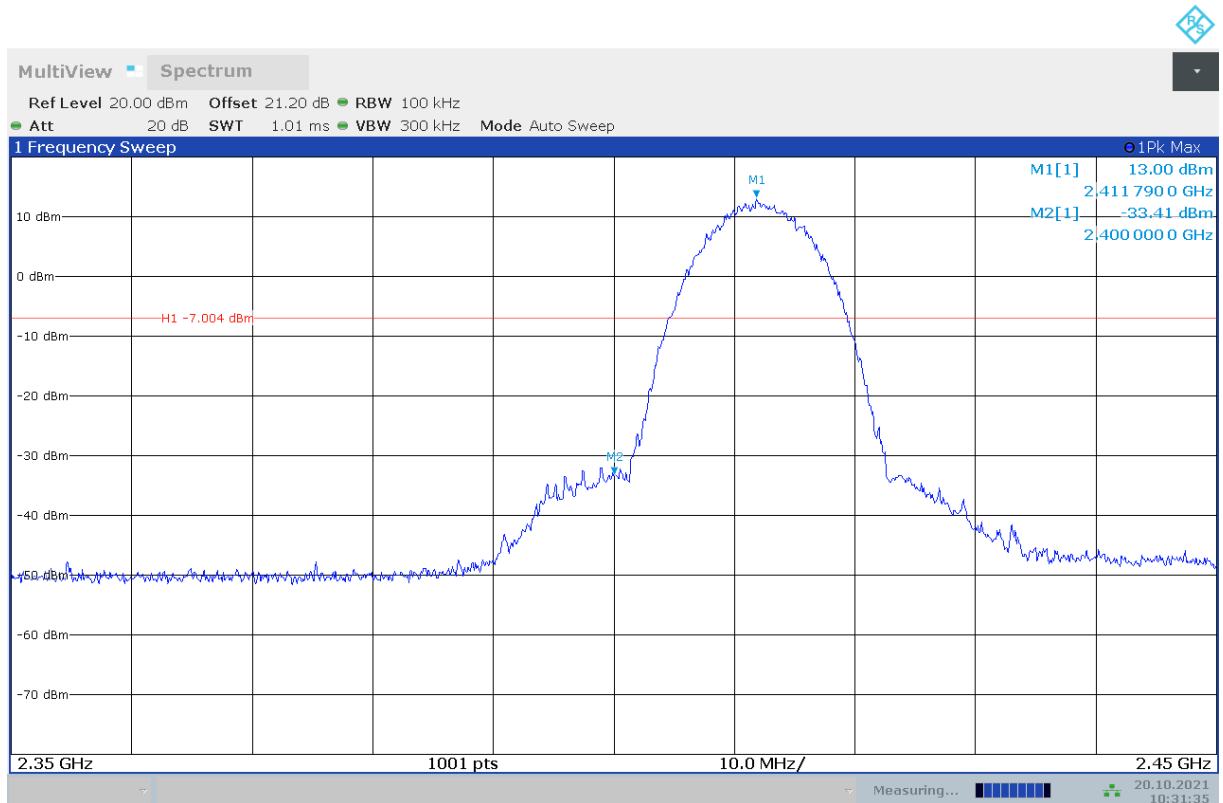


Fig.A.5.1 Band Edges (802.11b, Ch 1)

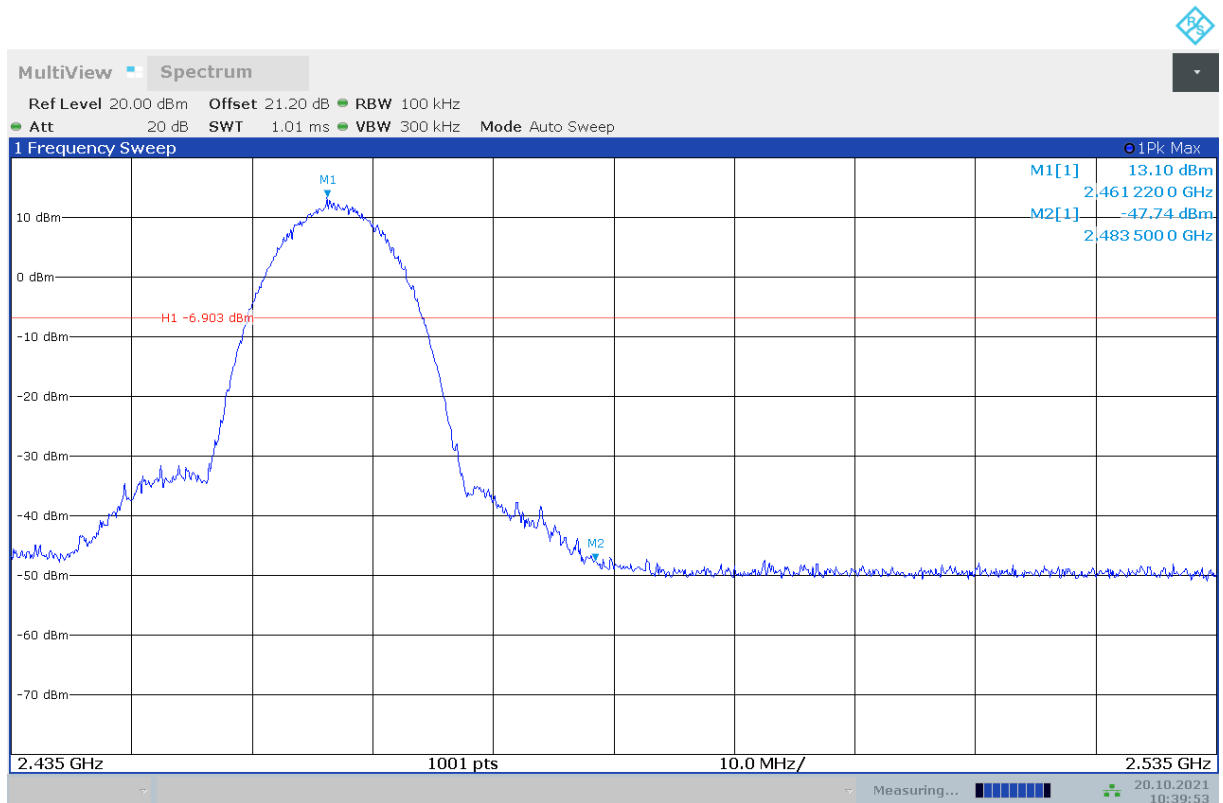


Fig.A.5.2 Band Edges (802.11b, Ch 11)

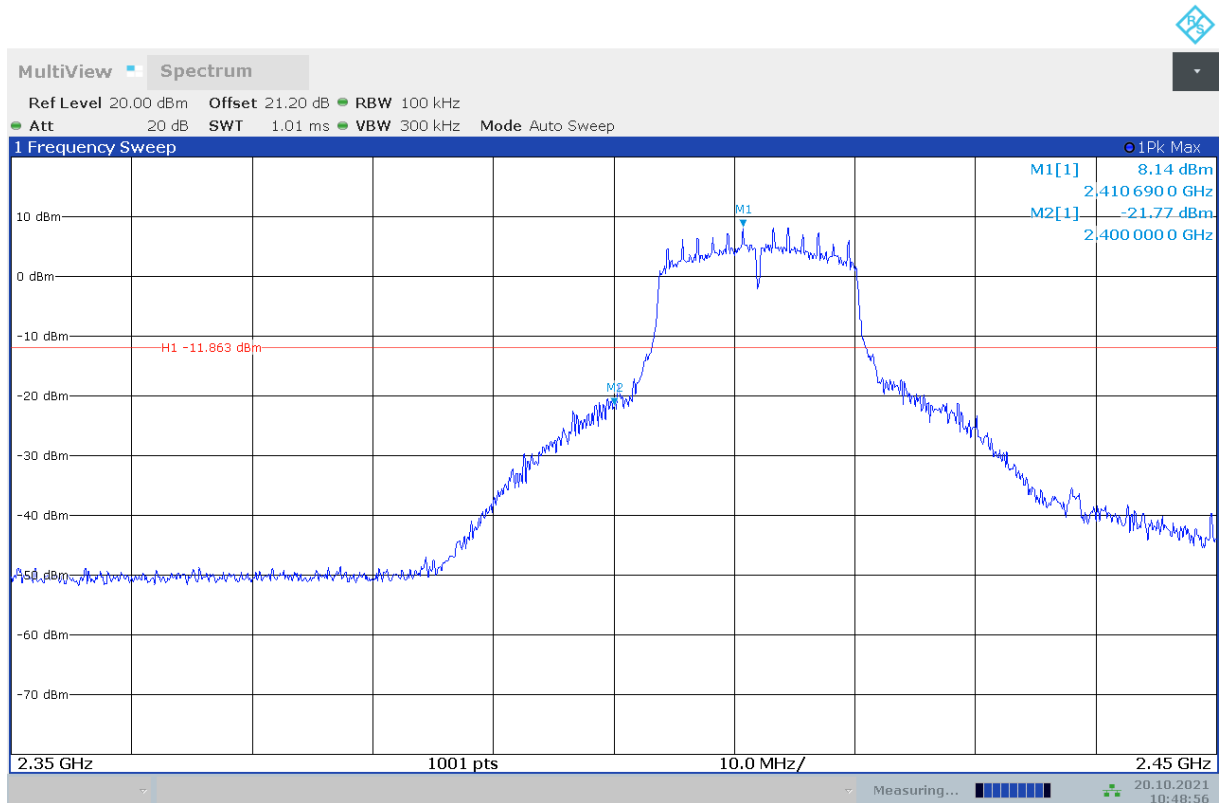


Fig.A.5.3 Band Edges (802.11g, Ch 1)



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

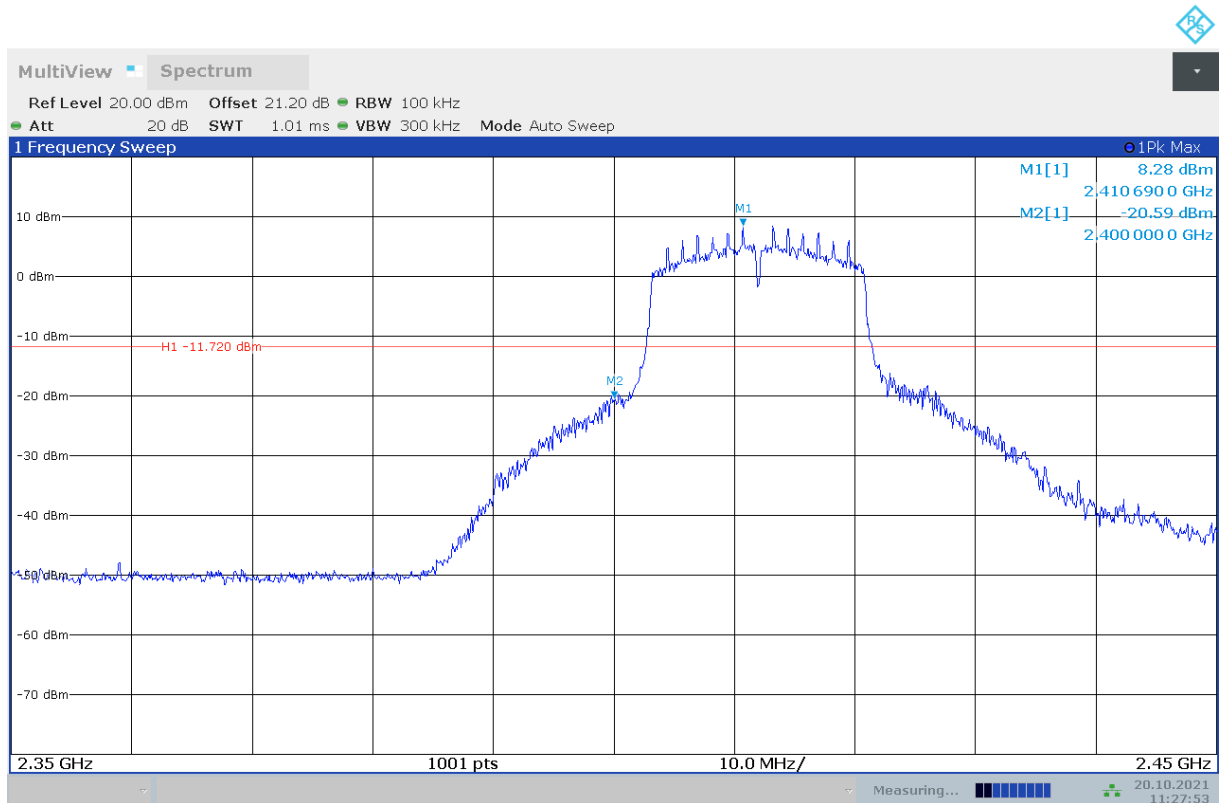


Fig.A.5.5 Band Edges (802.11n-HT20, Ch 1)

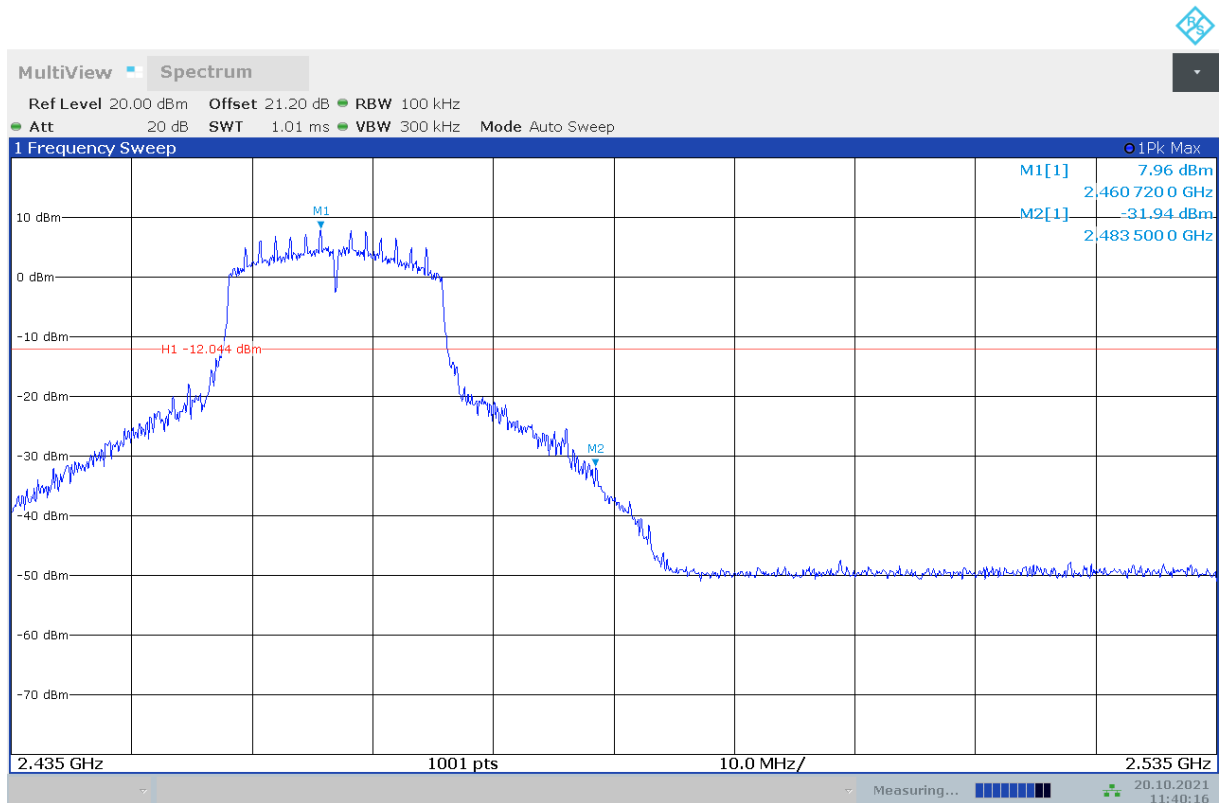


Fig.A.5.6 Band Edges (802.11n-HT20, Ch 11)

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: EUT02

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:

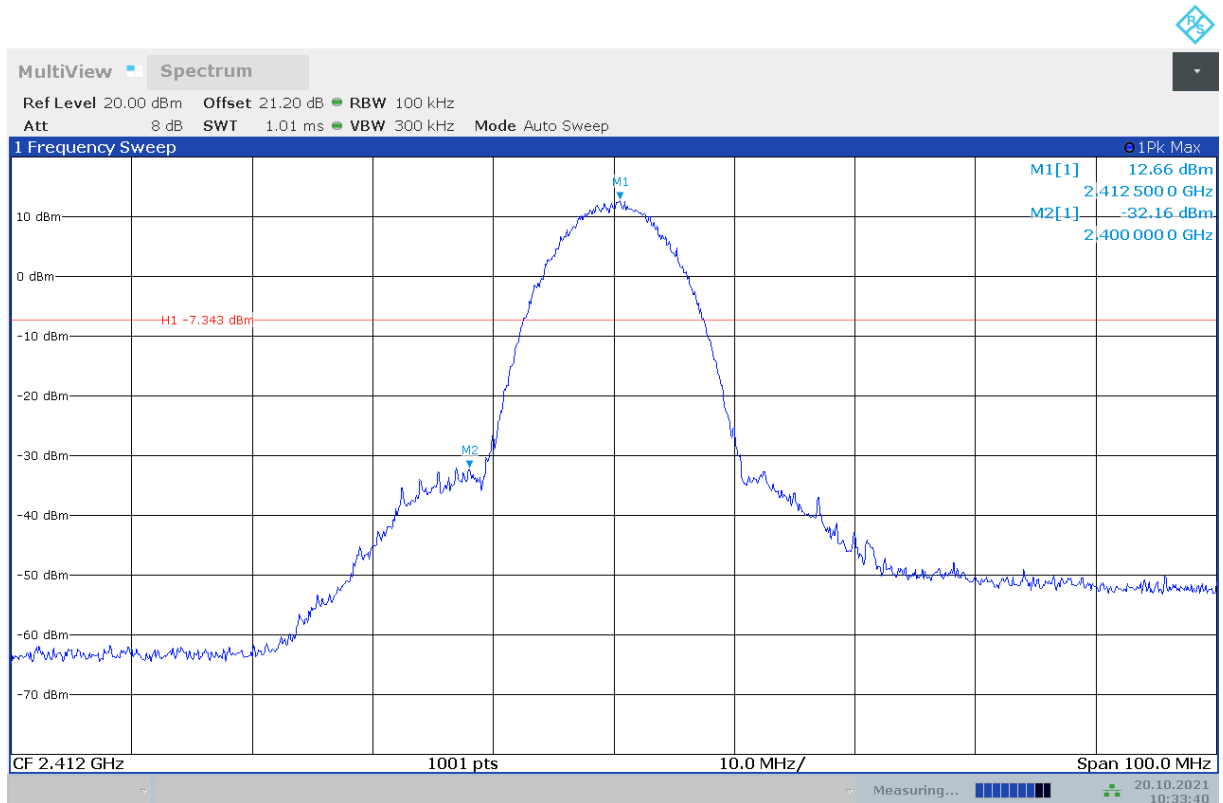


Fig.A.6.1.1 Transmitter Spurious Emission - Conducted (802.11b, Ch1, Center Frequency)

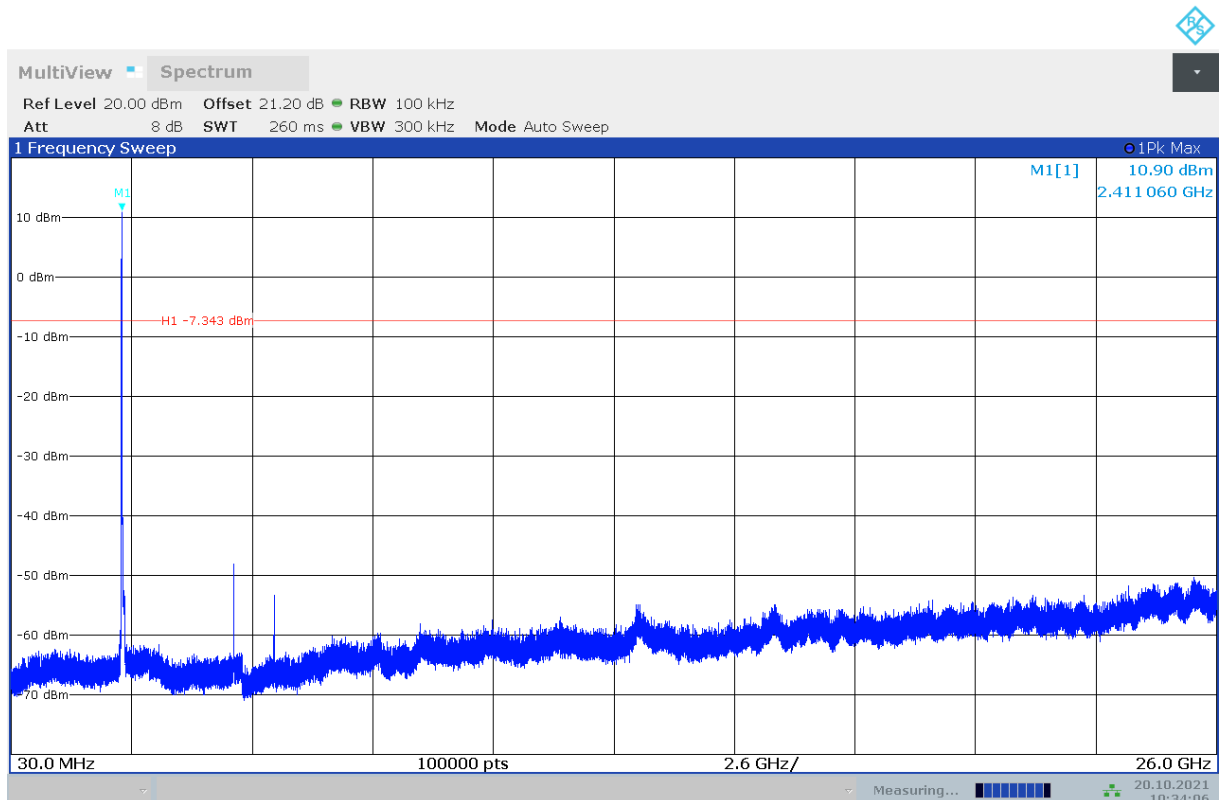


Fig.A.6.1.2 Transmitter Spurious Emission - Conducted (802.11b, Ch1, 30 MHz-26 GHz)

GHz)

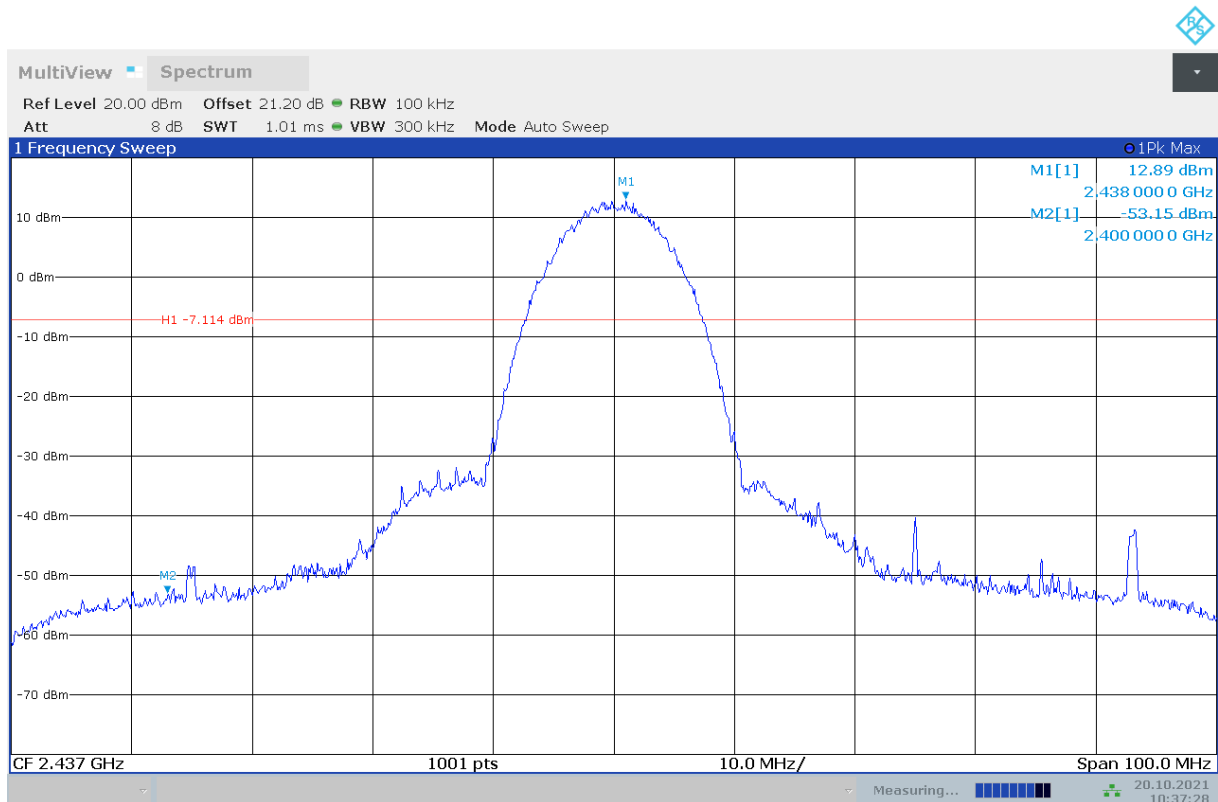


Fig.A.6.1.3 Transmitter Spurious Emission - Conducted (802.11b, Ch6, Center Frequency)

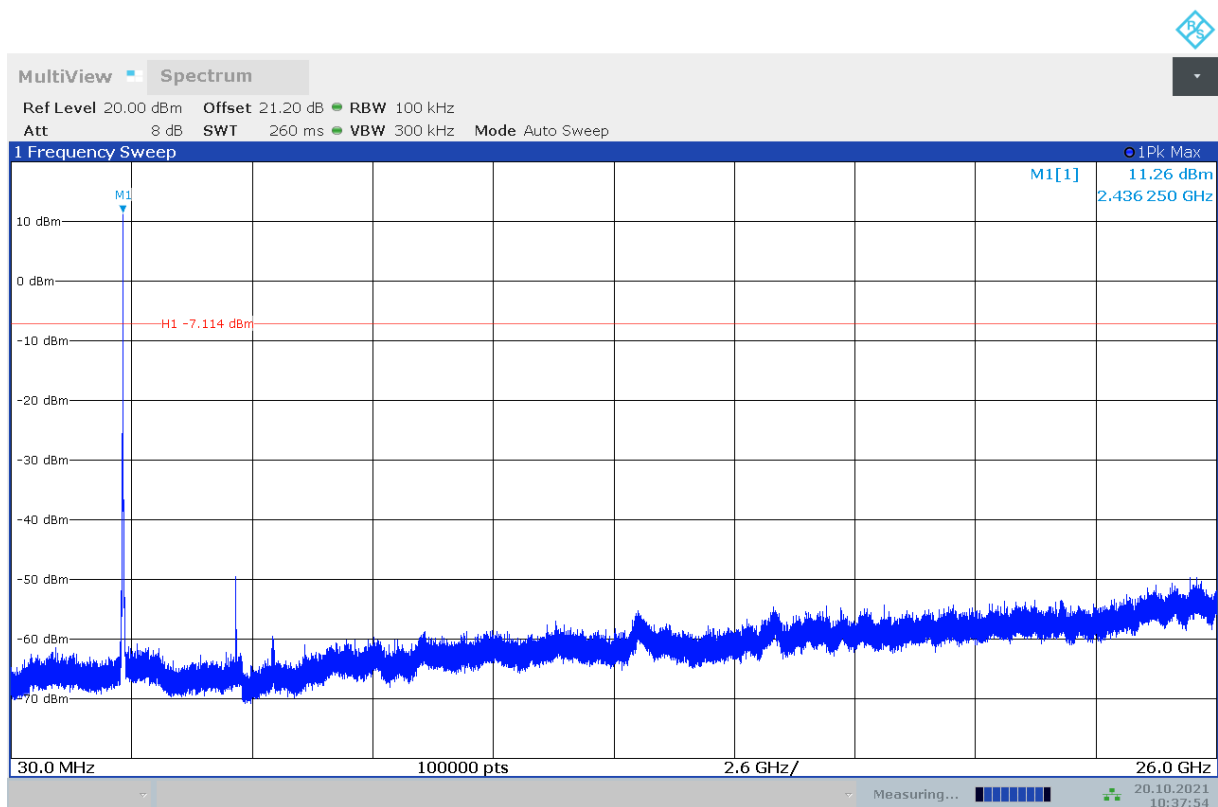


Fig.A.6.1.4 Transmitter Spurious Emission - Conducted (802.11b, Ch6, 30 MHz-26 GHz)

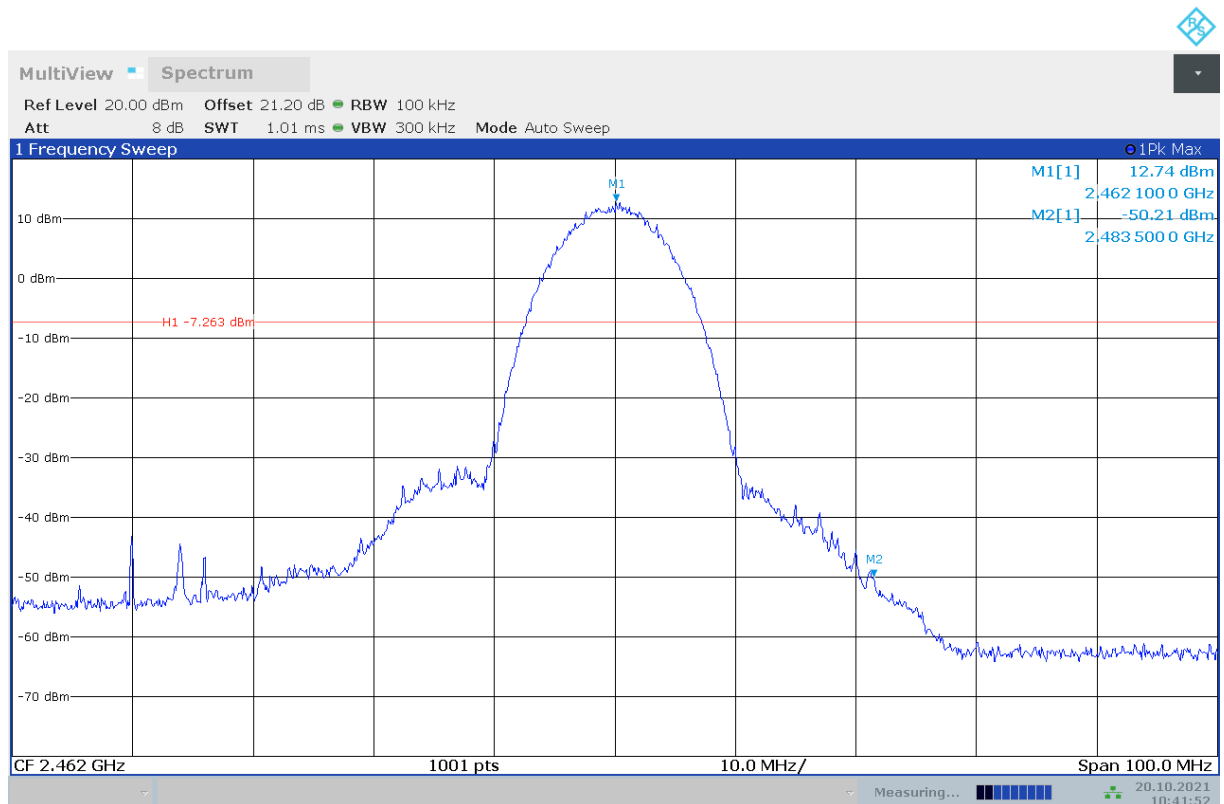


Fig.A.6.1.5 Transmitter Spurious Emission - Conducted (802.11b, Ch11, Center Frequency)

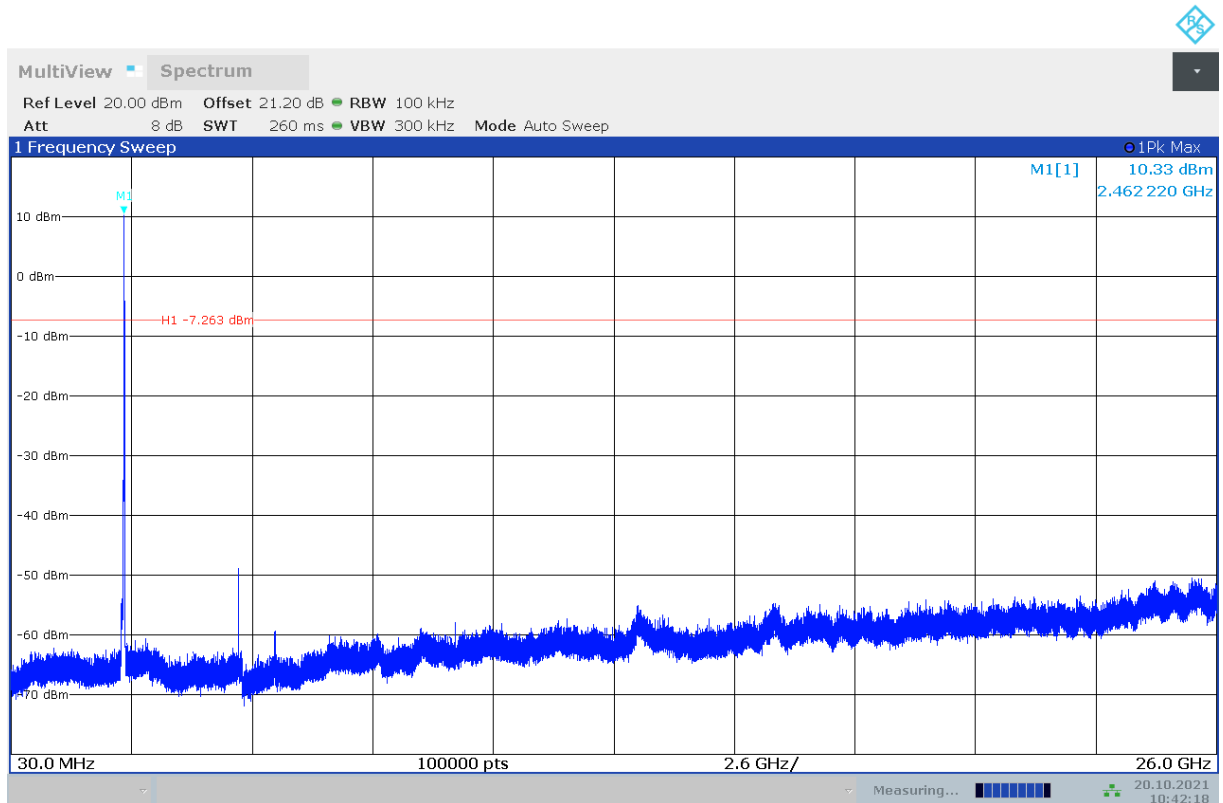


Fig.A.6.1.6 Transmitter Spurious Emission - Conducted (802.11b, Ch11, 30 MHz-26 GHz)

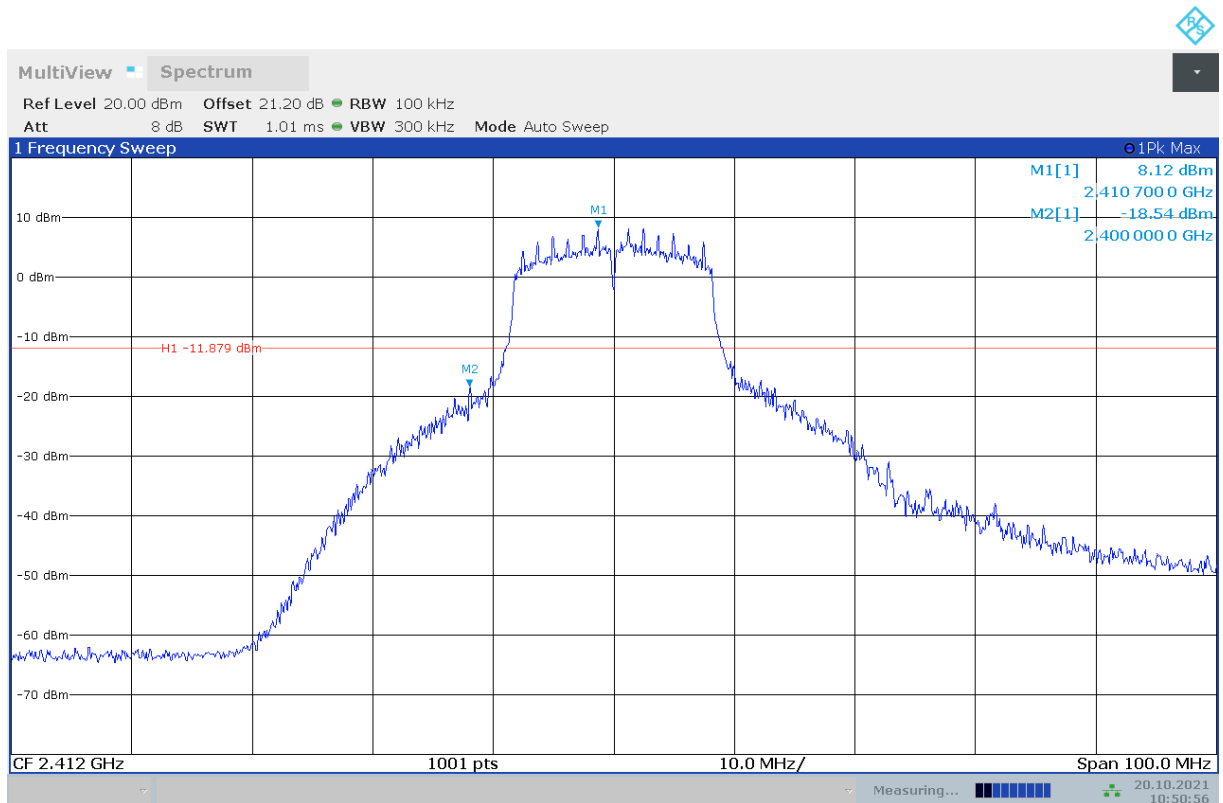


Fig.A.6.1.7 Transmitter Spurious Emission - Conducted (802.11g, Ch1, Center)

Frequency)

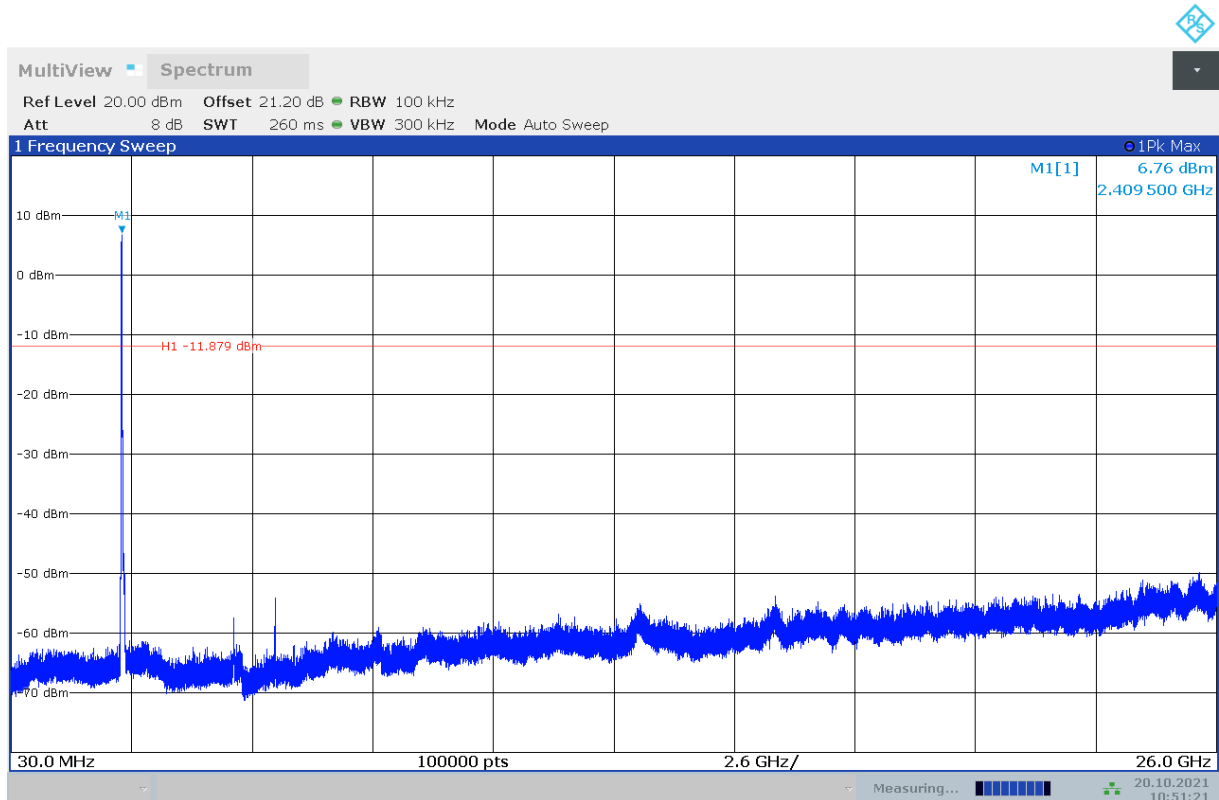


Fig.A.6.1.8 Transmitter Spurious Emission - Conducted (802.11g, Ch1, 30 MHz-26 GHz)

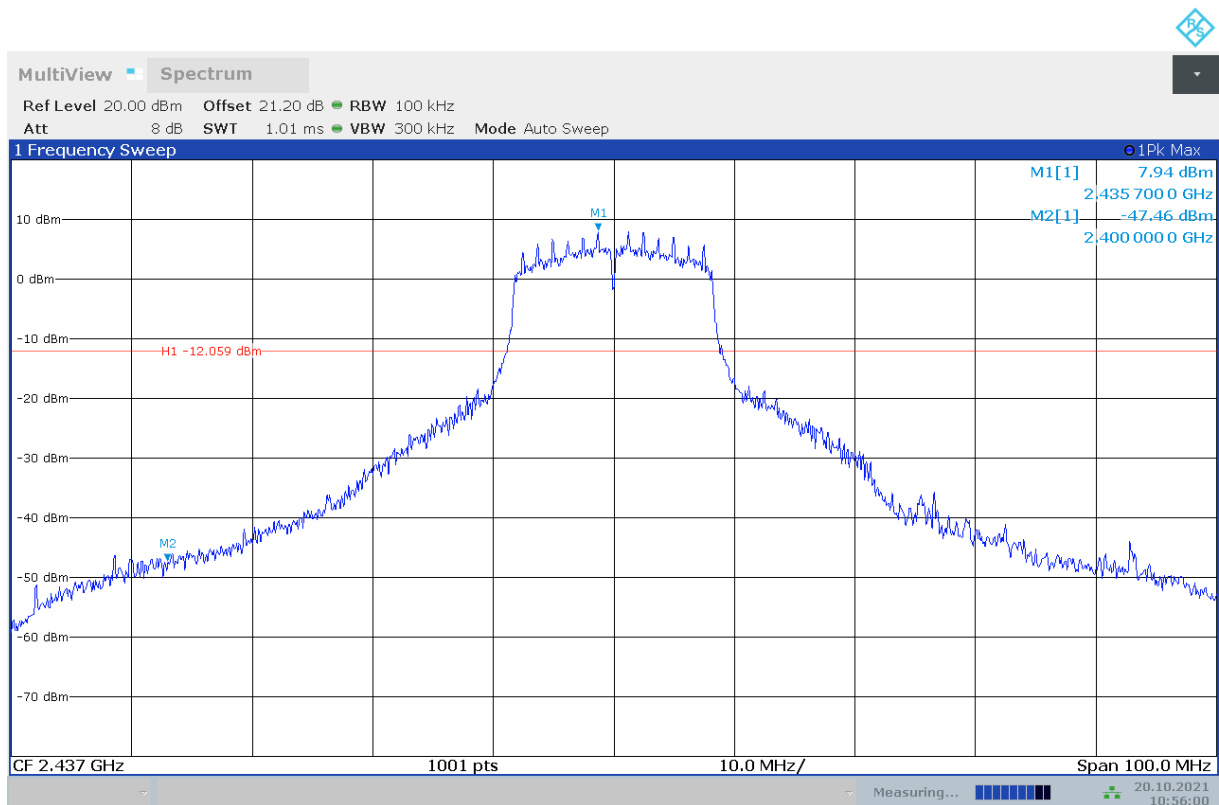


Fig.A.6.1.9 Transmitter Spurious Emission - Conducted (802.11g, Ch6, Center Frequency)

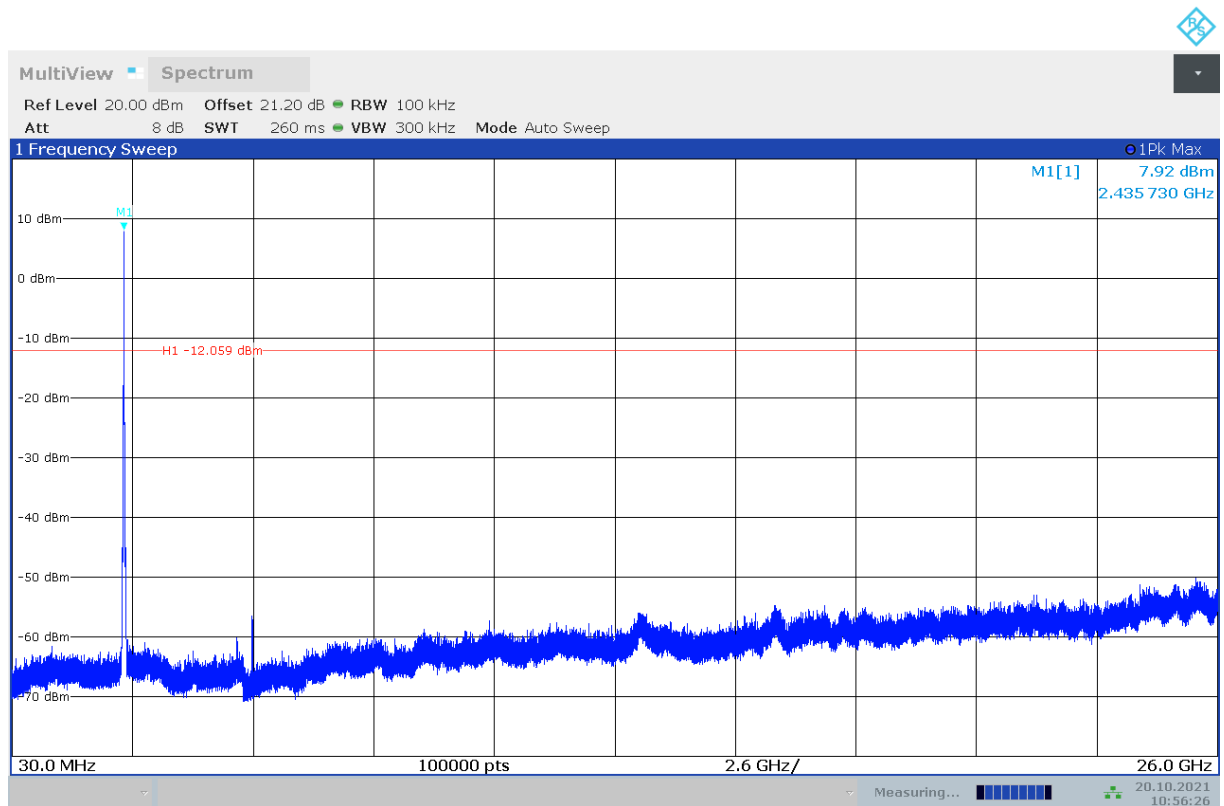


Fig.A.6.1.10 Transmitter Spurious Emission - Conducted (802.11g, Ch6, 30 MHz-26 GHz)

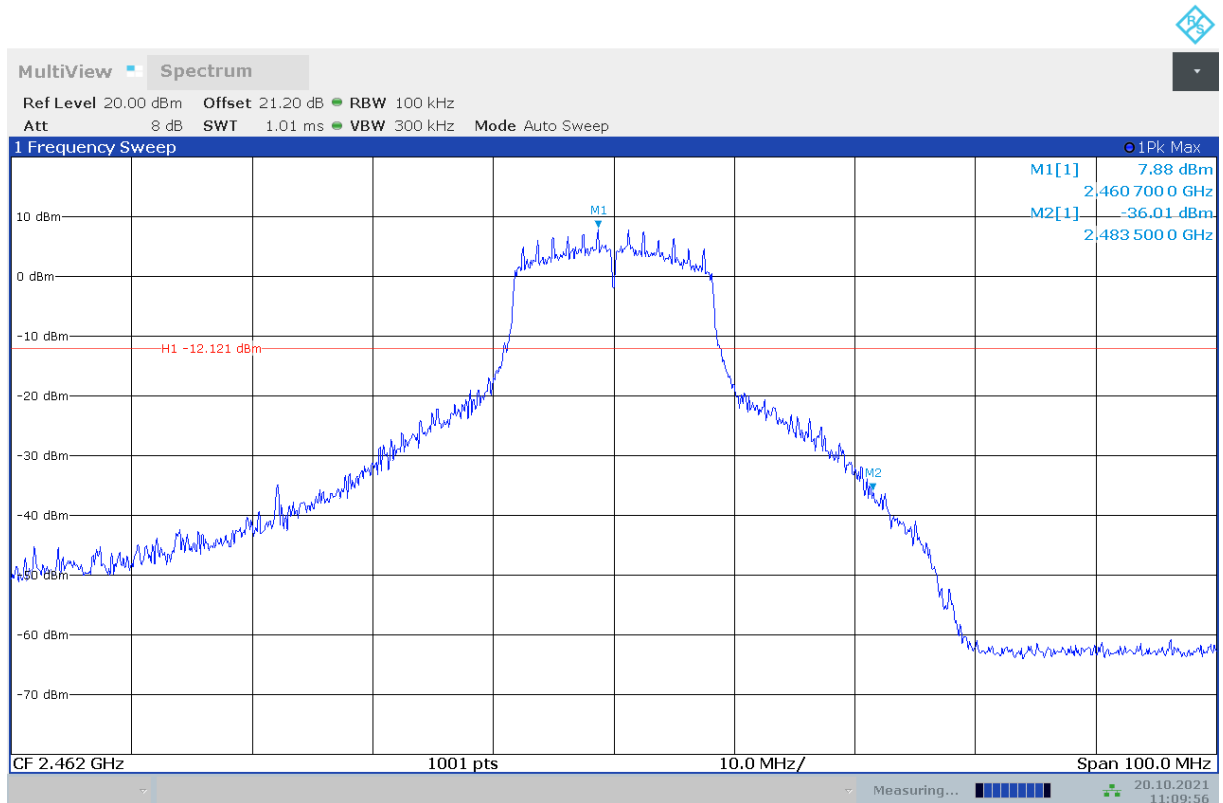


Fig.A.6.1.11 Transmitter Spurious Emission - Conducted (802.11g, Ch11, Center Frequency)

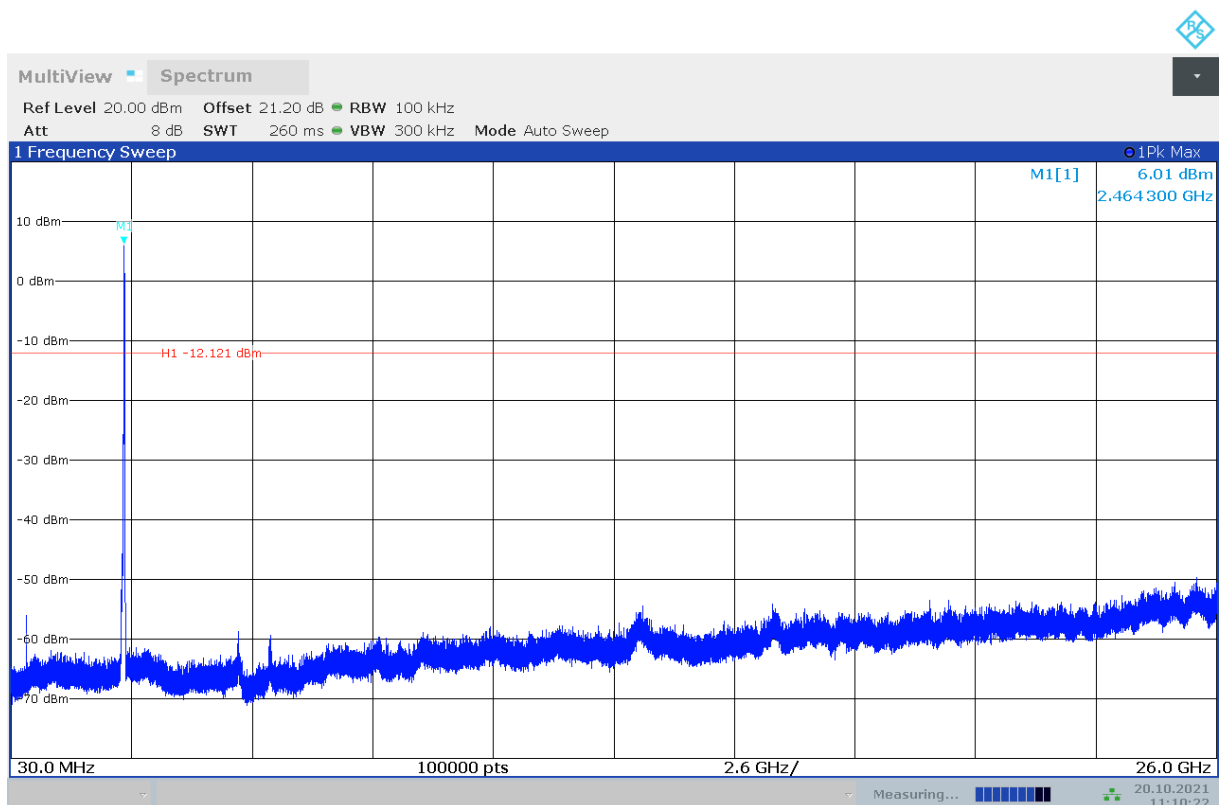


Fig.A.6.1.12 Transmitter Spurious Emission - Conducted (802.11g, Ch11, 30 MHz-26 GHz)

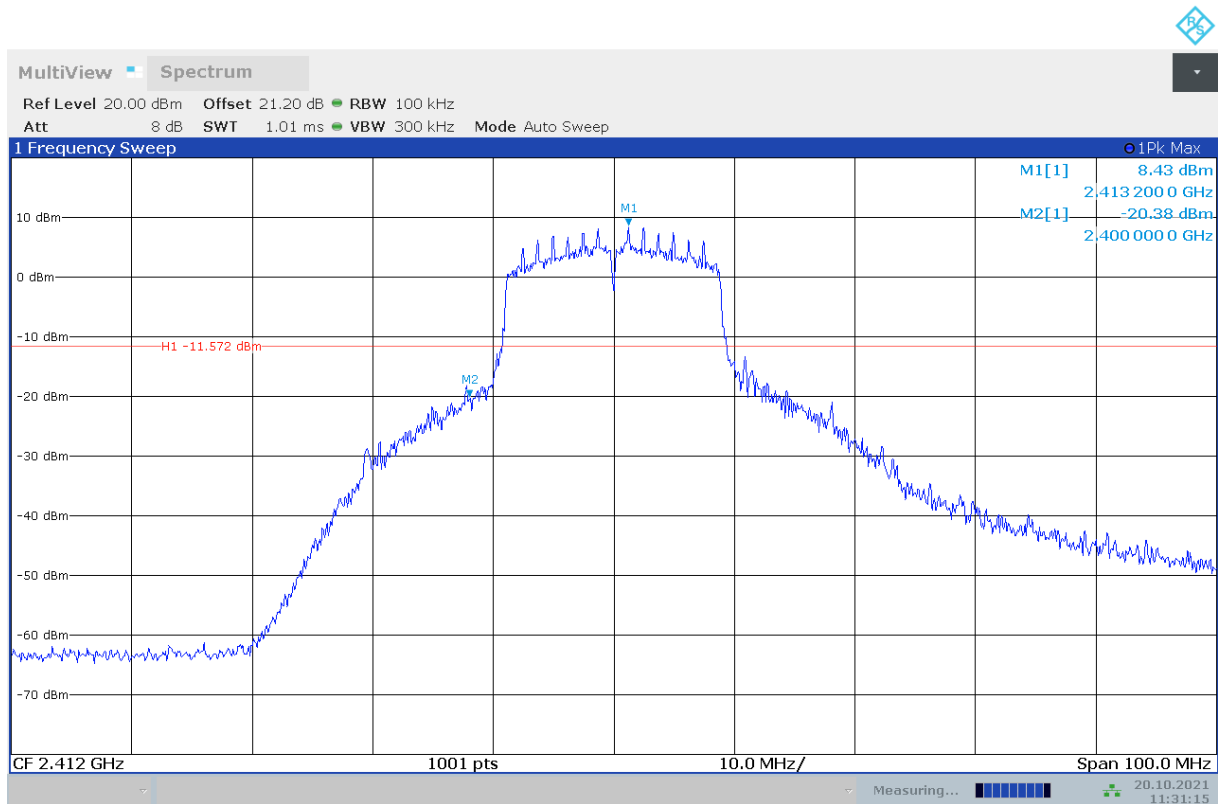


Fig.A.6.1.13 Transmitter Spurious Emission - Conducted (802.11n-HT20, Ch1, Center Frequency)

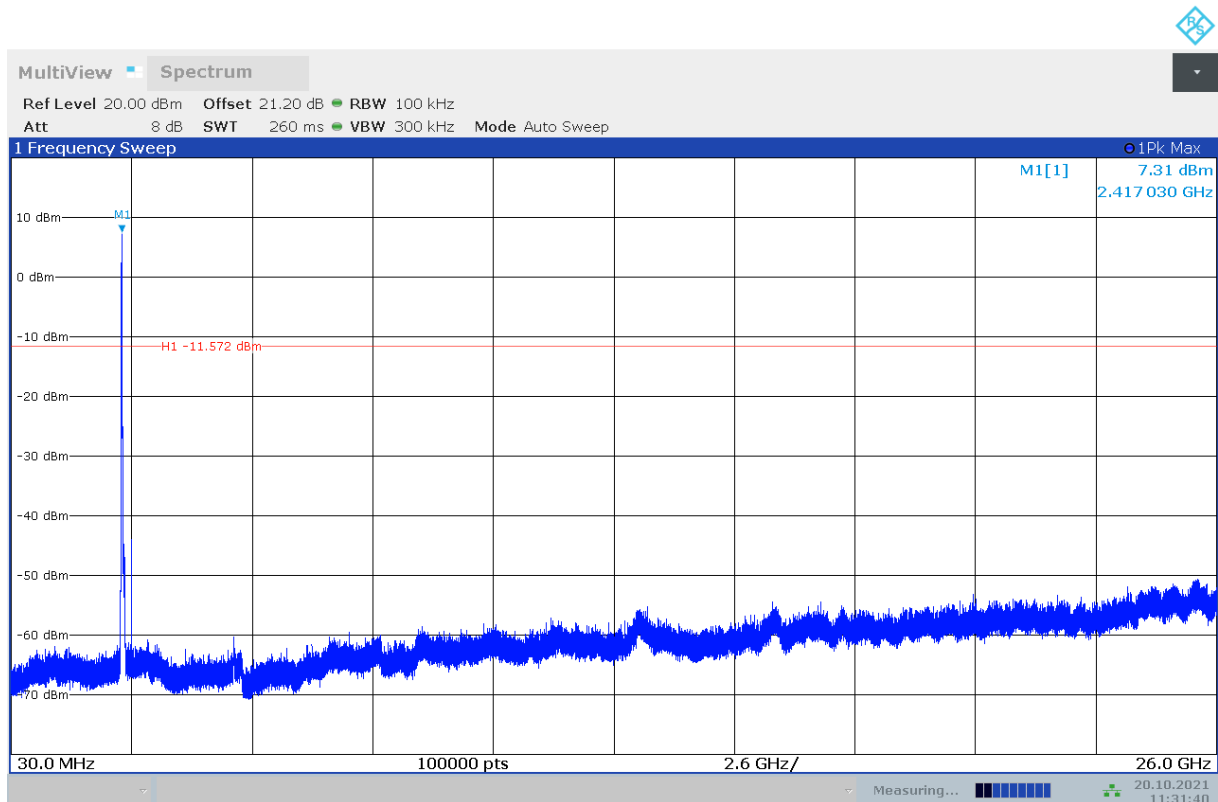


Fig.A.6.1.14 Transmitter Spurious Emission - Conducted (802.11n-HT20, Ch1, 30 MHz-26 GHz)

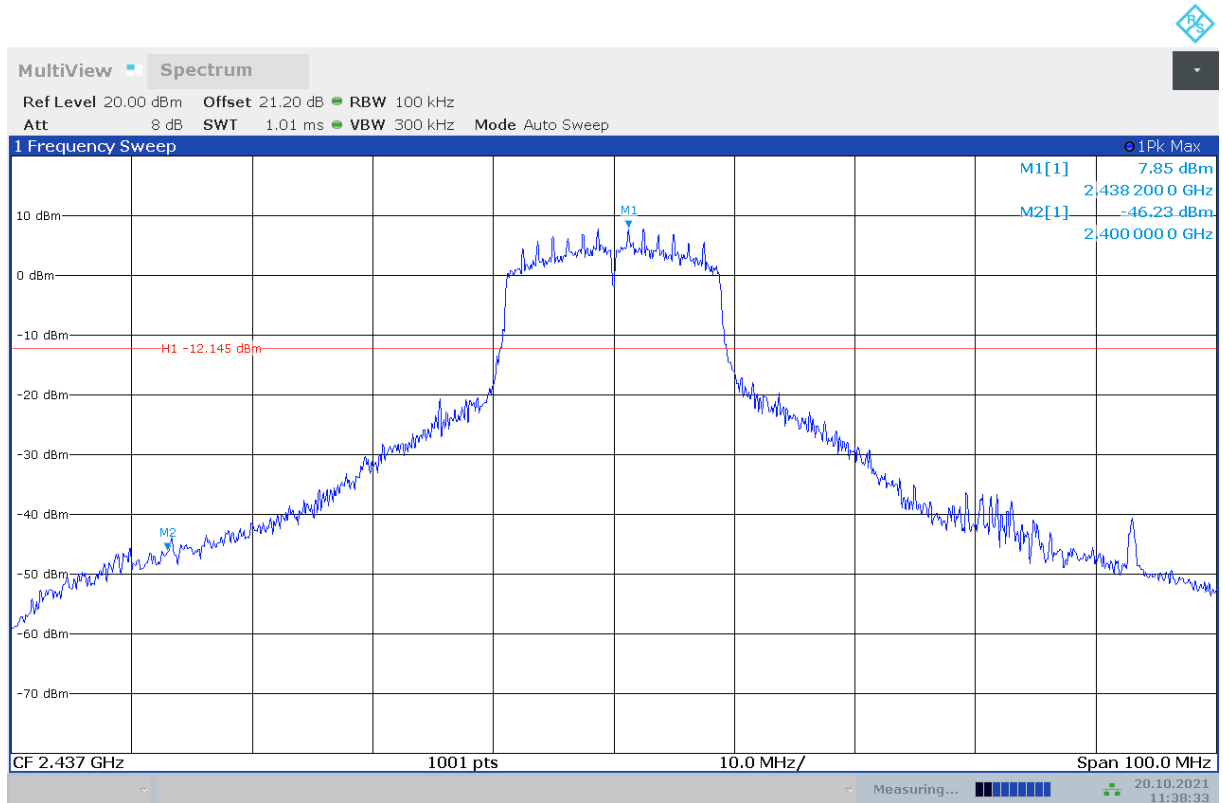


Fig.A.6.1.15 Transmitter Spurious Emission - Conducted (802.11n-HT20, Ch6, Center Frequency)

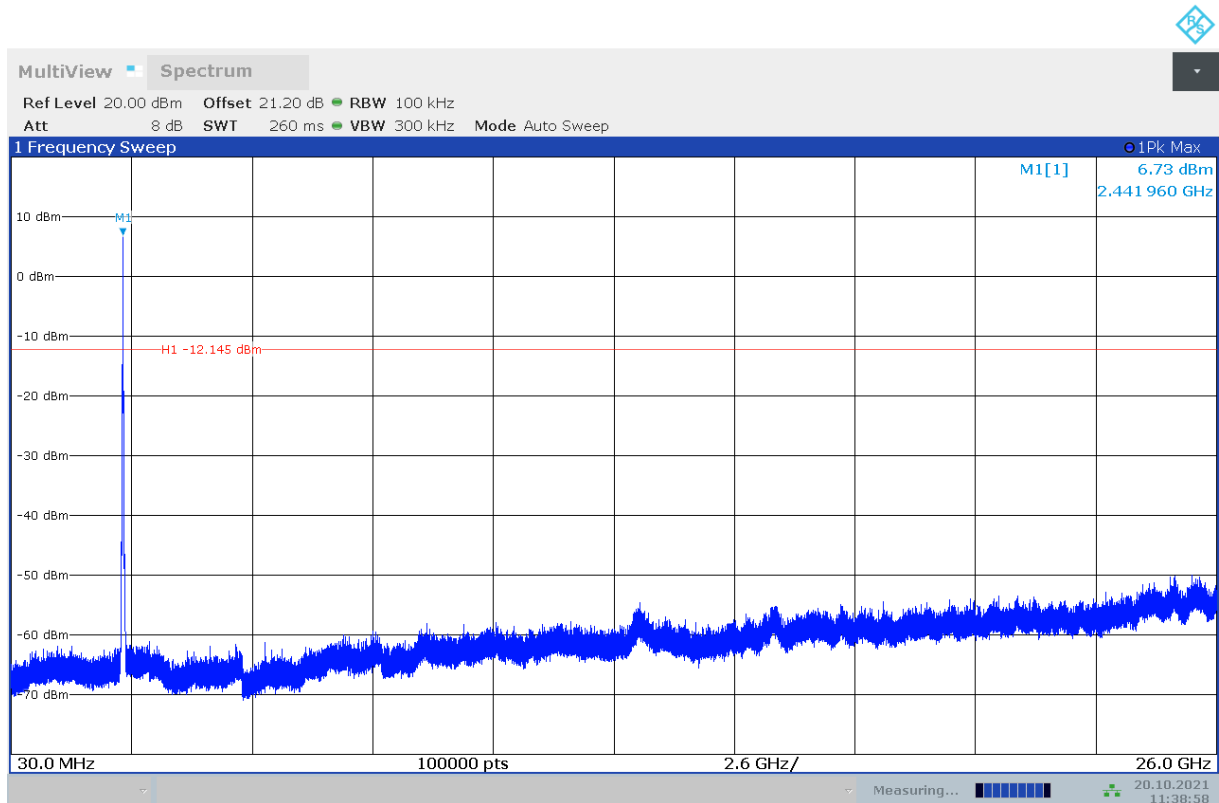


Fig.A.6.1.16 Transmitter Spurious Emission - Conducted (802.11n-HT20, Ch6, 30 MHz-26 GHz)

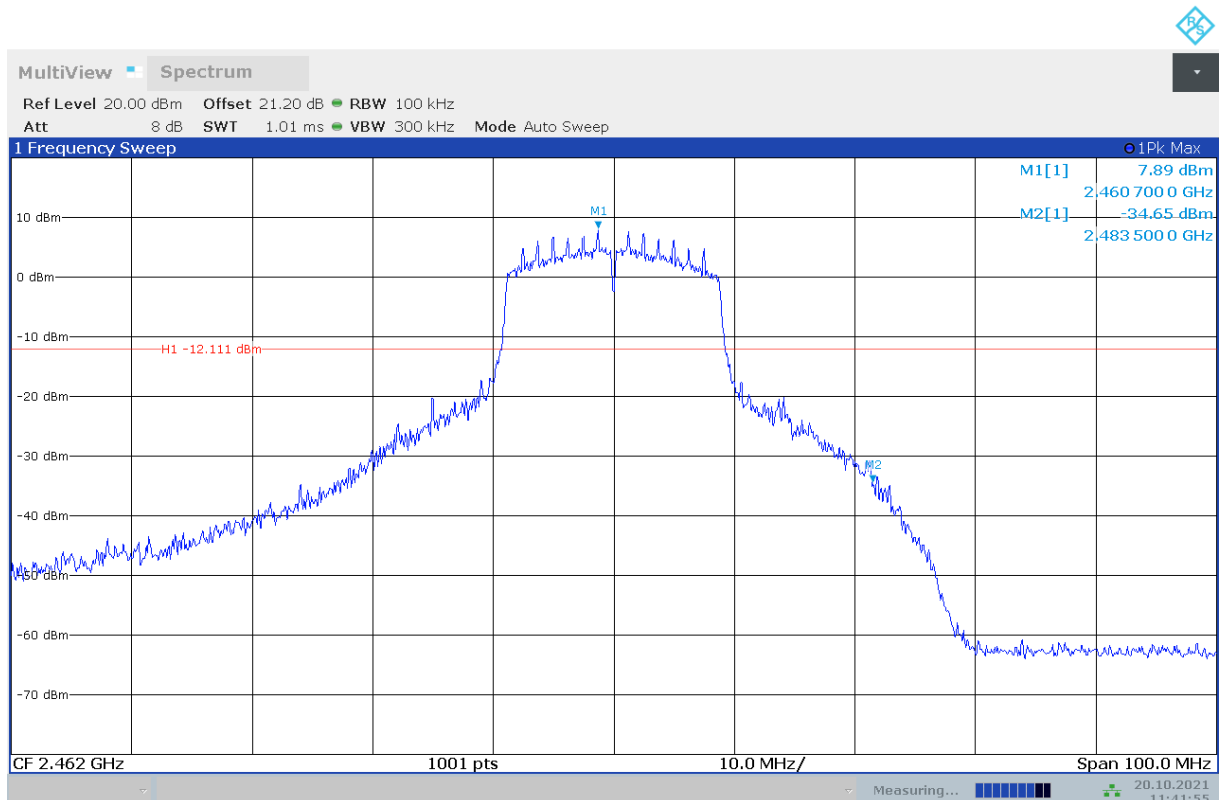


Fig.A.6.1.17 Transmitter Spurious Emission - Conducted (802.11n-HT20, Ch11, Center)

Frequency)

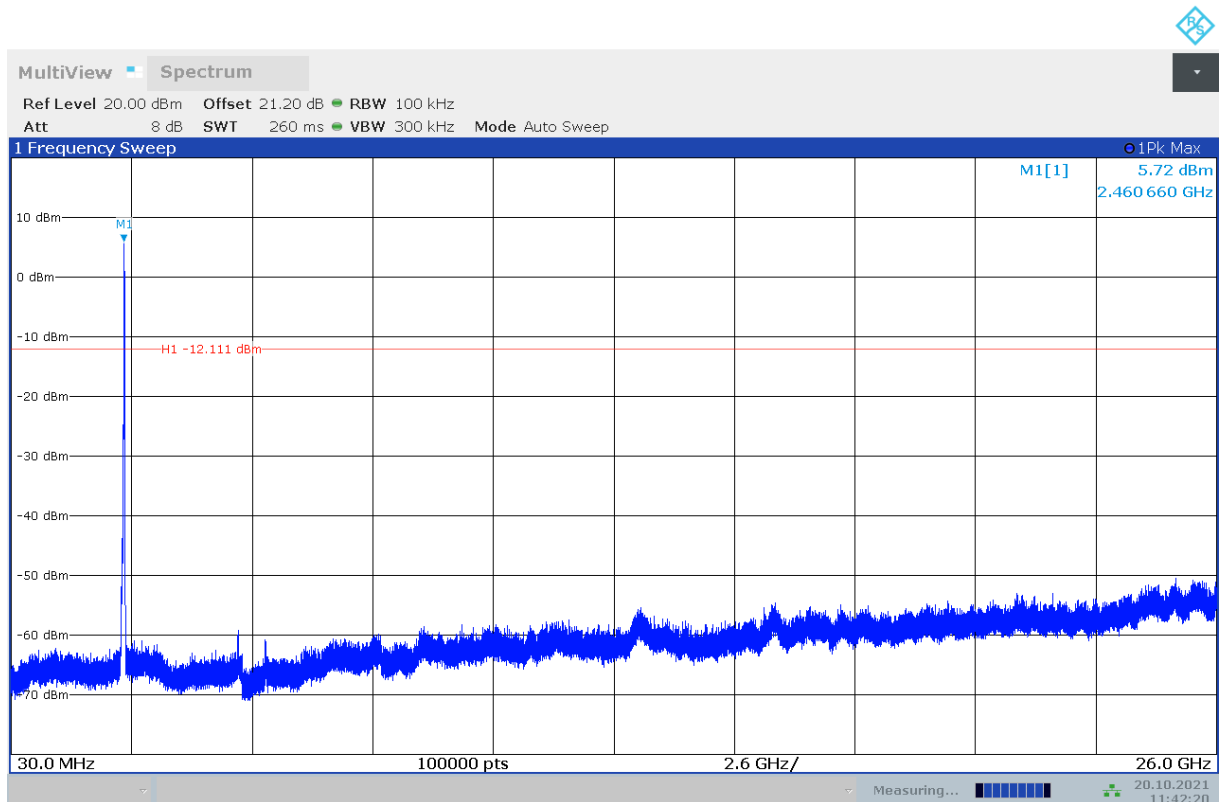


Fig.A.6.1.18 Transmitter Spurious Emission - Conducted (802.11n-HT20, Ch11, 30 MHz-26 GHz)

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
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		(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: UT19a

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
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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)
2349.795	60.98	2.6	27.6	30.72	74.0	13.0	H
2389.433	60.85	2.6	27.7	30.57	74.0	13.2	V
4823.906	39.54	-37.8	32.1	45.31	74.0	34.5	H
7236.094	46.25	-36.9	35.8	47.38	74.0	27.7	H
9647.813	46.17	-35.7	37.8	44.10	74.0	27.8	H
12060.000	46.91	-34.4	39.1	42.28	74.0	27.1	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)
2366.400	39.48	-39.6	27.7	51.44	74.0	34.5	V
2511.200	39.15	-39.5	27.7	50.88	74.0	34.9	V
4874.063	41.60	-37.8	32.2	47.20	74.0	32.4	V
7311.094	46.22	-36.9	36.0	47.15	74.0	27.8	V
9748.125	48.00	-35.7	37.8	45.88	74.0	26.0	V
12185.156	47.81	-34.8	39.0	43.57	74.0	26.2	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)
2489.350	60.73	2.7	27.7	30.34	74.0	13.3	H
2497.756	60.99	2.8	27.7	30.54	74.0	13.0	H
4924.219	40.79	-38.1	32.3	46.62	74.0	33.2	H
7386.094	48.52	-36.8	36.1	49.15	74.0	25.5	H
9847.969	47.44	-35.6	37.8	45.26	74.0	26.6	V
12309.844	46.63	-34.7	38.9	42.42	74.0	27.4	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)
2369.588	61.13	2.6	27.7	30.85	74.0	12.9	V
2389.275	63.64	2.6	27.7	33.36	74.0	10.4	H
4823.906	39.72	-37.8	32.1	45.49	74.0	34.3	V
7236.094	43.48	-36.9	35.8	44.60	74.0	30.5	H
9647.813	45.01	-35.7	37.8	42.94	74.0	29.0	H
12060.000	47.10	-34.4	39.1	42.47	74.0	26.9	V

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)
2363.800	38.92	-39.7	27.6	50.97	74.0	35.1	H
2503.000	39.52	-39.1	27.7	50.93	74.0	34.5	H
4874.063	40.18	-37.8	32.2	45.78	74.0	33.8	V
7311.094	44.38	-36.9	36.0	45.32	74.0	29.6	H
9748.125	45.58	-35.7	37.8	43.45	74.0	28.4	H
12185.156	47.50	-34.8	39.0	43.27	74.0	26.5	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)
2483.569	67.50	2.6	27.7	37.16	74.0	6.5	H
2483.906	68.56	2.6	27.7	38.22	74.0	5.4	V
4924.219	39.47	-38.1	32.3	45.29	74.0	34.5	H
7386.094	45.57	-36.8	36.1	46.20	74.0	28.4	V
9847.969	46.28	-35.6	37.8	44.09	74.0	27.7	H
12309.844	46.76	-34.7	38.9	42.55	74.0	27.2	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)
2389.818	66.26	2.6	27.7	35.98	74.0	7.7	V
2389.940	66.25	2.6	27.7	35.96	74.0	7.8	V
4823.906	39.89	-37.8	32.1	45.66	74.0	34.1	V
7236.094	43.88	-36.9	35.8	45.01	74.0	30.1	V
9647.813	44.92	-35.7	37.8	42.86	74.0	29.1	H
12060.000	47.45	-34.4	39.1	42.82	74.0	26.6	V

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)
2367.800	40.49	-39.6	27.7	52.41	74.0	33.5	V
2510.200	39.71	-39.4	27.7	51.40	74.0	34.3	H
4874.063	40.26	-37.8	32.2	45.86	74.0	33.7	H
7311.094	44.26	-36.9	36.0	45.19	74.0	29.7	V
9748.125	44.78	-35.7	37.8	42.65	74.0	29.2	V
12185.156	48.46	-34.8	39.0	44.22	74.0	25.5	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)
2483.750	69.54	2.6	27.7	39.20	74.0	4.5	H
2484.850	69.60	2.7	27.7	39.25	74.0	4.4	V
4924.219	39.03	-38.1	32.3	44.85	74.0	35.0	V
7386.094	46.54	-36.8	36.1	47.17	74.0	27.5	V
9847.969	44.98	-35.6	37.8	42.79	74.0	29.0	V
12309.844	46.20	-34.7	38.9	41.99	74.0	27.8	V

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)
2358.350	45.93	2.6	27.6	15.65	54.0	8.1	V
2363.150	45.94	2.6	27.6	15.66	54.0	8.1	V
4823.750	27.83	-37.8	32.1	33.61	54.0	26.2	V
7236.250	35.90	-36.9	35.8	37.02	54.0	18.1	V
9648.125	33.50	-35.7	37.8	31.43	54.0	20.5	V
12060.000	35.75	-34.4	39.1	31.13	54.0	18.2	V

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)
2389.725	45.79	2.6	27.7	15.50	54.0	8.2	V
2487.100	46.06	2.7	27.7	15.69	54.0	7.9	V
4873.750	31.25	-37.8	32.2	36.84	54.0	22.8	V
7311.250	37.91	-36.9	36.0	38.85	54.0	16.1	H
9748.125	38.87	-35.7	37.8	36.74	54.0	15.1	H
12185.000	36.22	-34.8	39.0	31.98	54.0	17.8	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)
2485.225	46.51	2.7	27.7	16.16	54.0	7.5	V
2485.750	46.63	2.7	27.7	16.27	54.0	7.4	V
4923.750	28.34	-38.1	32.3	34.16	54.0	25.7	H
7386.250	43.41	-36.8	36.1	44.03	54.0	10.6	H
9848.125	38.79	-35.6	37.8	36.60	54.0	15.2	H
12310.000	36.18	-34.7	38.9	31.97	54.0	17.8	V

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)
2389.800	48.04	2.6	27.7	17.76	54.0	6.0	V
2389.900	48.31	2.6	27.7	18.02	54.0	5.7	V
4823.750	28.26	-37.8	32.1	34.03	54.0	25.7	V
7236.250	33.28	-36.9	35.8	34.40	54.0	20.7	V
9648.125	33.50	-35.7	37.8	31.43	54.0	20.5	V
12060.000	35.54	-34.4	39.1	30.91	54.0	18.5	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)
2369.400	45.86	2.6	27.7	15.59	54.0	8.1	V
2483.825	46.27	2.6	27.7	15.92	54.0	7.7	V
4873.750	28.14	-37.8	32.2	33.74	54.0	25.9	V
7311.250	31.39	-36.9	36.0	32.33	54.0	22.6	V
9748.125	34.36	-35.7	37.8	32.24	54.0	19.6	H
12185.000	36.02	-34.8	39.0	31.78	54.0	18.0	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)
2483.575	48.85	2.6	27.7	18.51	54.0	5.2	V
2483.725	48.76	2.6	27.7	18.42	54.0	5.2	V
4923.750	27.65	-38.1	32.3	33.47	54.0	26.4	H
7386.250	33.64	-36.8	36.1	34.26	54.0	20.4	H
9848.125	33.89	-35.6	37.8	31.70	54.0	20.1	H
12310.000	35.28	-34.7	38.9	31.06	54.0	18.7	V

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)
2389.900	48.84	2.6	27.7	18.56	54.0	5.2	V
2389.975	48.92	2.6	27.7	18.63	54.0	5.1	V
4823.750	28.02	-37.8	32.1	33.79	54.0	26.0	V
7236.250	31.81	-36.9	35.8	32.93	54.0	22.2	V
9648.125	33.58	-35.7	37.8	31.52	54.0	20.4	H
12060.000	35.34	-34.4	39.1	30.71	54.0	18.7	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)
2320.500	45.86	2.6	27.6	15.67	54.0	8.1	V
2483.900	46.29	2.6	27.7	15.94	54.0	7.7	V
4873.750	28.24	-37.8	32.2	33.84	54.0	25.8	H
7311.250	31.53	-36.9	36.0	32.46	54.0	22.5	H
9748.125	34.13	-35.7	37.8	32.01	54.0	19.9	H
12185.000	35.98	-34.8	39.0	31.74	54.0	18.0	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)
2483.550	48.17	2.6	27.7	17.83	54.0	5.8	V
2483.975	47.97	2.6	27.7	17.63	54.0	6.0	V
4823.750	27.75	-37.8	32.1	33.52	54.0	26.3	V
7386.250	35.69	-36.8	36.1	36.31	54.0	18.3	V
9848.125	34.20	-35.6	37.8	32.01	54.0	19.8	H
12310.000	35.45	-34.7	38.9	31.23	54.0	18.6	V

Test graphs as below:

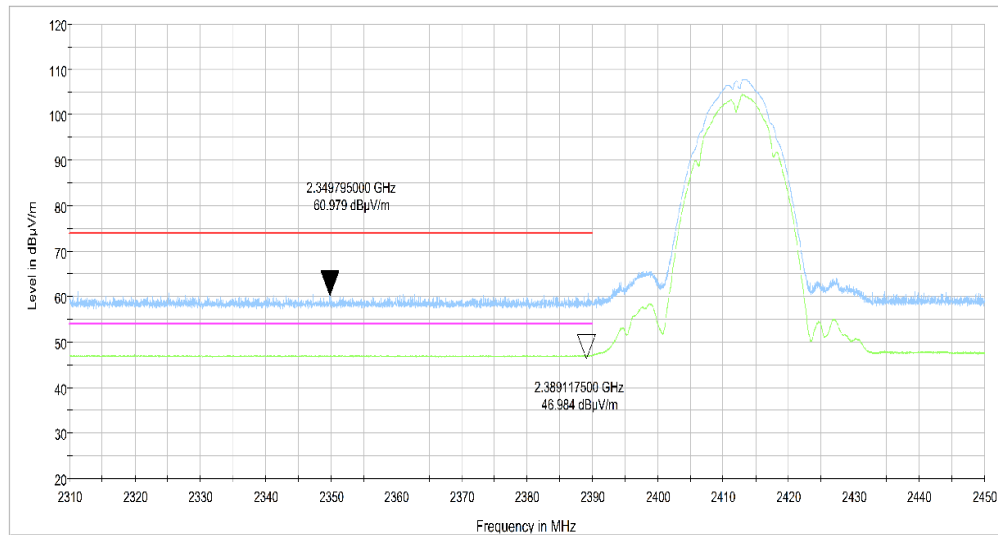


Fig.A.6.2.1 Transmitter Spurious Emission - Radiated (Power): 802.11b, ch1, 2.31 GHz – 2.45GHz

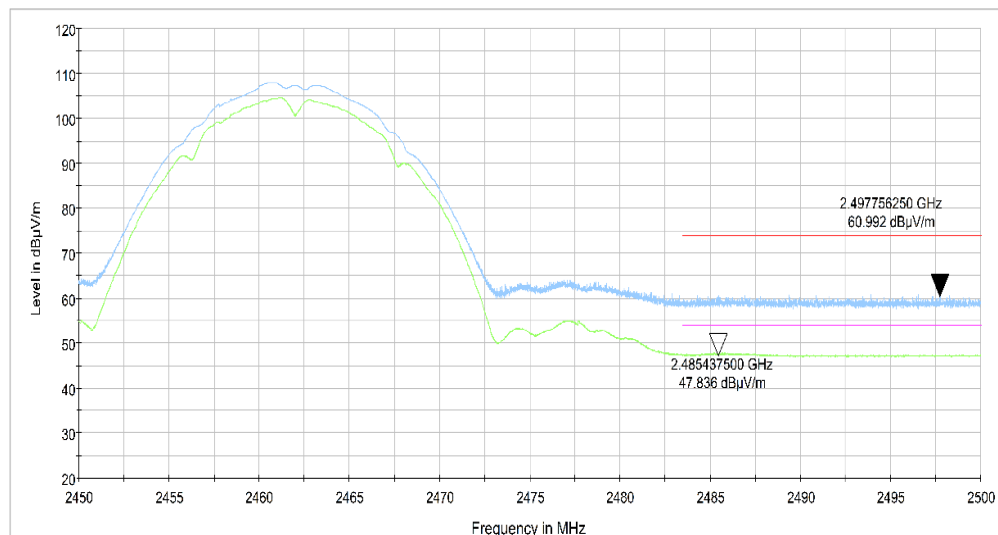


Fig.A.6.2.2 Transmitter Spurious Emission - Radiated (Power): 802.11b, ch11, 2.45 GHz - 2.50GHz

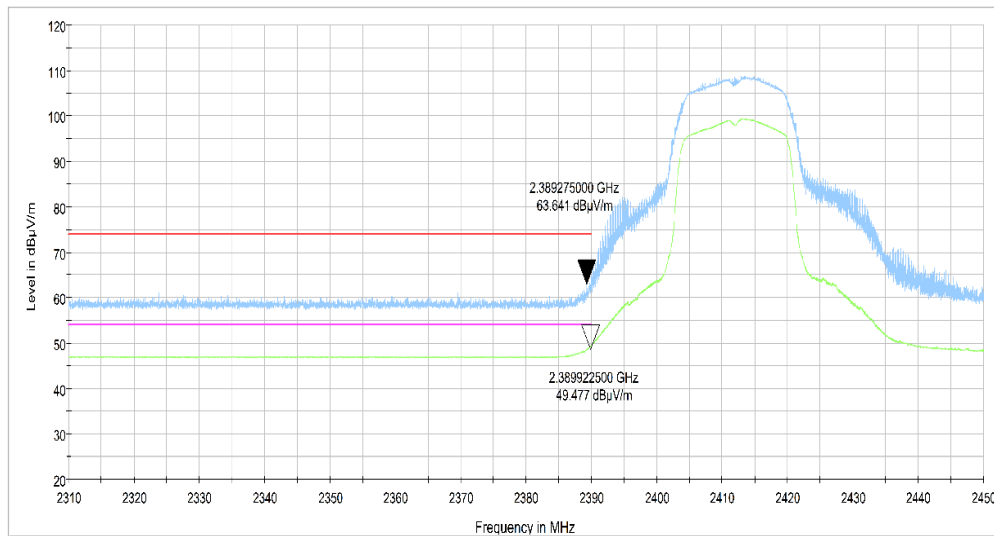


Fig.A.6.2.3 Transmitter Spurious Emission - Radiated (Power): 802.11g, ch1, 2.31 GHz - 2.45GHz

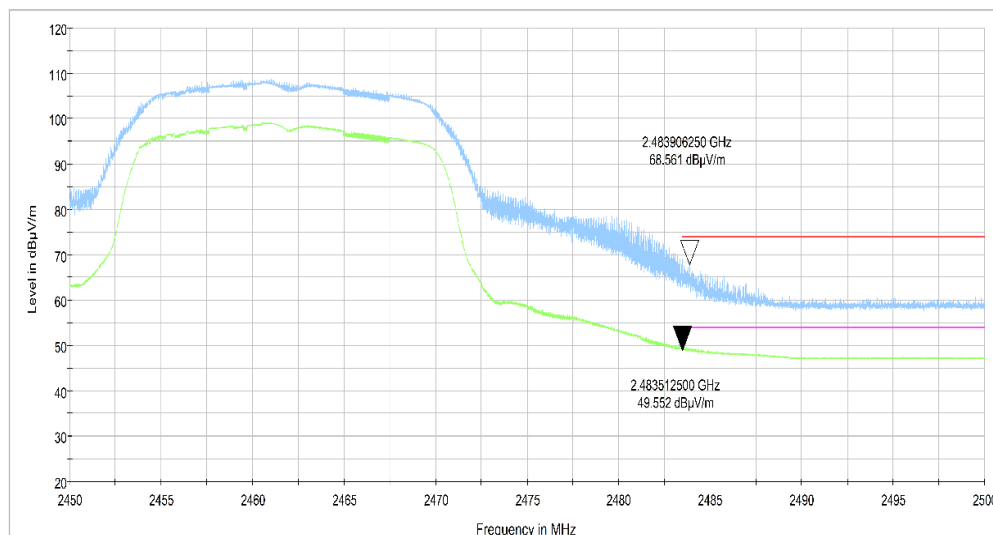
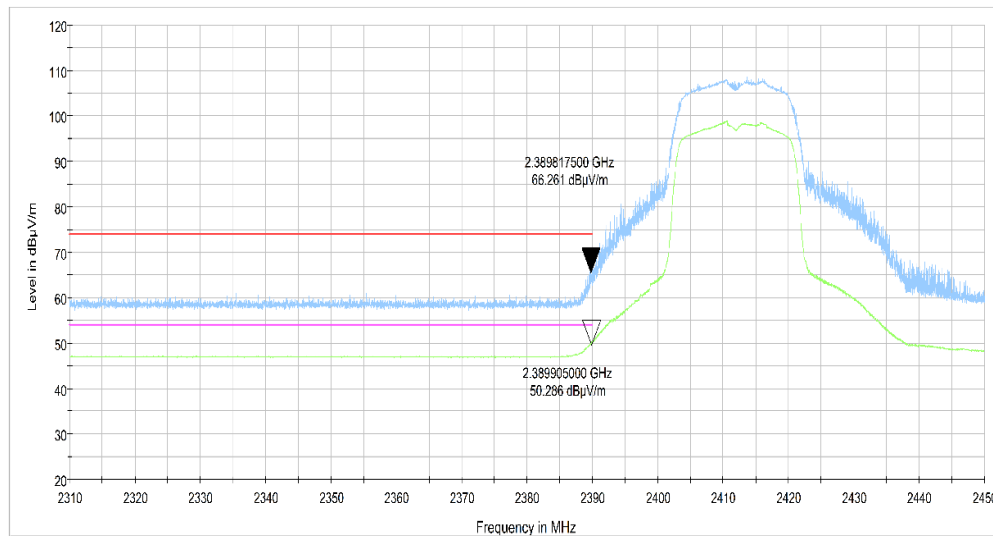
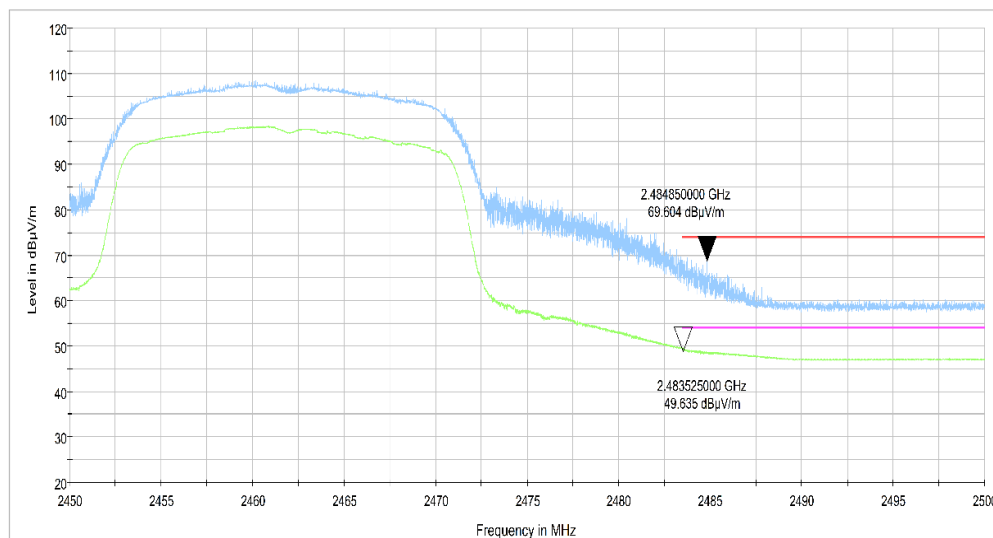


Fig.A.6.2.4 Transmitter Spurious Emission - Radiated (Power): 802.11g, ch11, 2.45 GHz - 2.50GHz



**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.

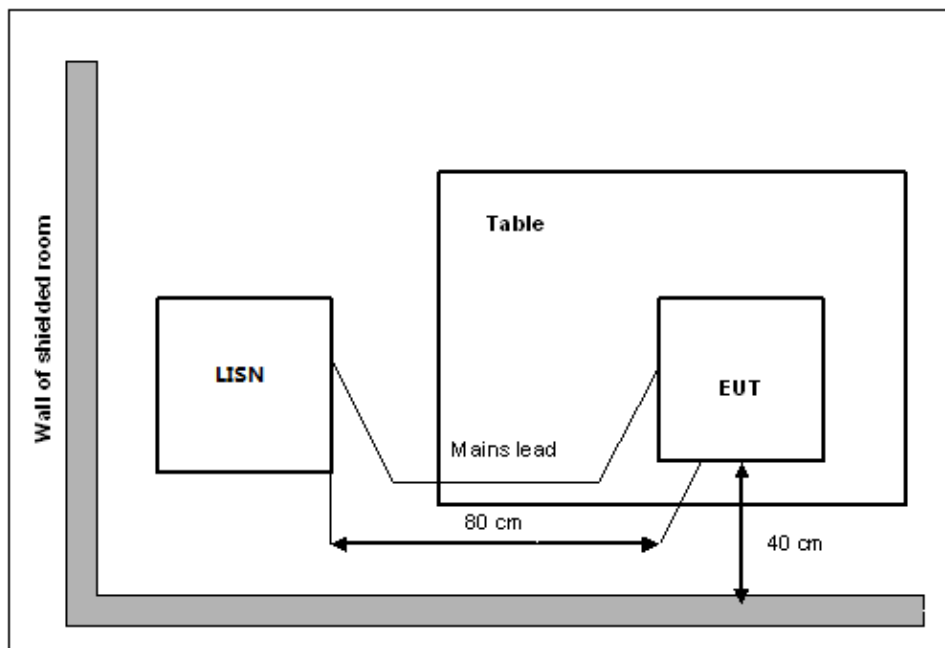
The measurement bandwidth is:

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 charger		
		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 charger		
		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:

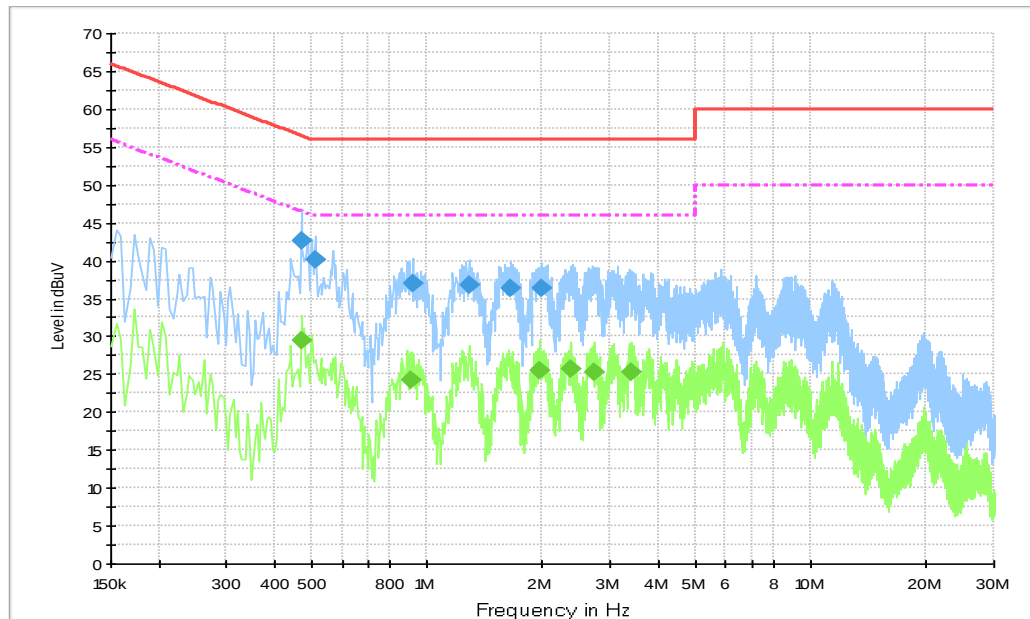


Fig.A.7.1 AC Powerline Conducted Emission-802.11b

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)
0.469500	42.5	5000.	9.000	L1	19.9	14.0	56.5
0.510000	40.1	5000.	9.000	L1	19.9	15.9	56.0
0.919500	36.9	5000.	9.000	L1	19.7	19.1	56.0
1.284000	36.8	5000.	9.000	L1	19.7	19.2	56.0
1.657500	36.4	5000.	9.000	L1	19.7	19.6	56.0
1.986000	36.4	5000.	9.000	L1	19.7	19.6	56.0

Final Result 2

Frequency (MHz)	Average (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.469500	29.5	5000.	9.000	N	19.9	17.0	46.5
0.910500	24.2	5000.	9.000	L1	19.7	21.8	46.0
1.972500	25.4	5000.	9.000	L1	19.7	20.6	46.0
2.377500	25.6	5000.	9.000	N	19.6	20.4	46.0
2.719500	25.3	5000.	9.000	L1	19.6	20.7	46.0
3.403500	25.2	5000.	9.000	N	19.6	20.8	46.0

Result for Idle:

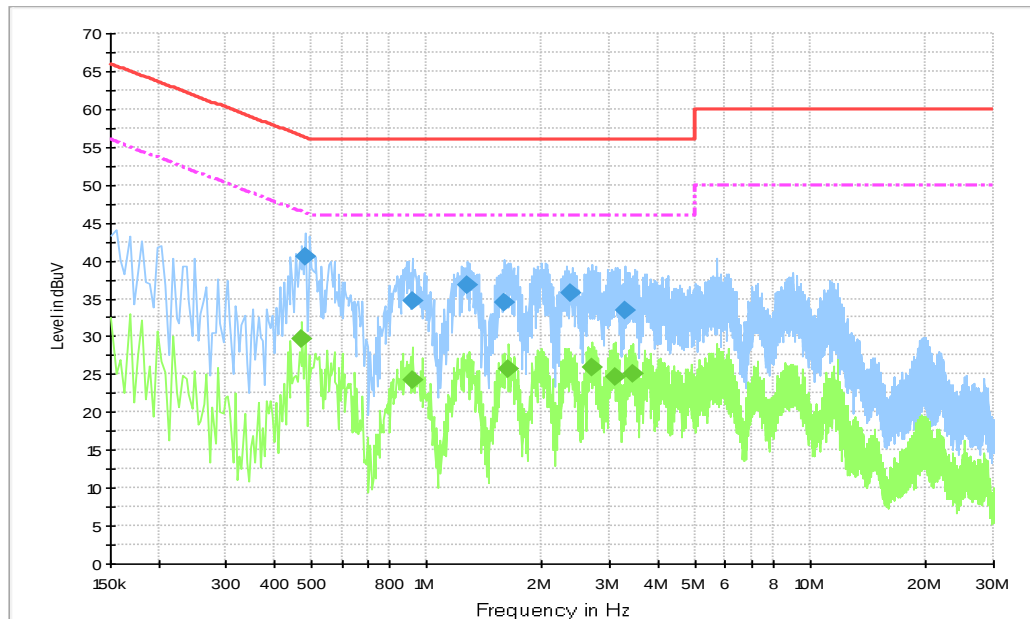


Fig.A.7.2 AC Powerline Conducted Emission-Idle

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)
0.483000	40.5	5000.	9.000	L1	19.9	15.8	56.3
0.915000	34.6	5000.	9.000	N	19.7	21.4	56.0
1.279500	36.9	5000.	9.000	L1	19.7	19.1	56.0
1.590000	34.4	5000.	9.000	N	19.7	21.6	56.0
2.373000	35.7	5000.	9.000	L1	19.6	20.3	56.0
3.300000	33.4	5000.	9.000	L1	19.6	22.6	56.0

Final Result 2

Frequency (MHz)	Average (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.474000	29.6	5000.	9.000	L1	19.9	16.8	46.4
0.915000	24.2	5000.	9.000	L1	19.7	21.8	46.0
1.639500	25.7	5000.	9.000	N	19.7	20.3	46.0
2.701500	25.9	5000.	9.000	L1	19.6	20.1	46.0
3.106500	24.6	5000.	9.000	L1	19.6	21.4	46.0
3.448500	25.1	5000.	9.000	N	19.6	20.9	46.0

Note: The measurement results showed here are worst cases of the combinations of different cables.



ANNEX B: EUT parameters

Disclaimer: The worse case provided by the client may affect the validity of the measurement results in this report, and the client shall bear the impact and consequences arising therefrom.

ANNEX C: Accreditation Certificate

United States Department of Commerce National Institute of Standards and Technology	
 	
Certificate of Accreditation to ISO/IEC 17025:2017	
NVLAP LAB CODE: 600118-0	
Telecommunication Technology Labs, CAICT Beijing China	
<i>is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:</i>	
Electromagnetic Compatibility & Telecommunications	
<i>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).</i>	
2021-09-29 through 2022-09-30 <i>Effective Dates</i>	  <i>For the National Voluntary Laboratory Accreditation Program</i>

END OF REPORT