

TEST REPORT

No. AR20-0054489-01

performed in accordance with

FCC Rules: Code of Federal Regulations (CFR) no. 47
Part 15 Subpart C Section 15.247

PRODUCT	Multi-user call forwarding device for 2voice system with integrated Wi-Fi radio
MODEL(s) TESTED	1083/83-US
FCC ID	REA108383
TRADE MARK(s)	URMET

APPLICANT	URMET S.p.A. ~ Via Bologna, 188/c ~ I-10154 TORINO
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Tested by	Robertino Torri <i>[Laboratory Technician]</i>	
Approved by	Giovanni Di Turi <i>[Laboratory manager]</i>	

Revision Sheet

Release No.	Date	Revision Description
Rev. 0	2020-10-16	First edition Digital signed - AR20-0054489-01_TR_FCC 15.247 - URMET - 1083-83

The results of tests and checks reported in this Test Report refer exclusively to the samples tested and described in the Report itself.

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1. GENERAL DATA

SAMPLE		
Samples received on	2020-07-17	(Item(s) sampled and sent by applicant)
IMQ reference samples	BEM	100317
Samples tested No.	1	
Object under analysis recognition	Not carried out Except where stated, characteristics of products were taken from client description and were not verified by the laboratory	
Date of acceptance of test item	2020-07-17	
TEST LOCATION		
Testing dates	2020-08-03 ÷ 2020-09-11	
Testing laboratory	IMQ S.p.A. - Via Quintiliano, 43 – I-20138 Milano	
Testing site	Via Quintiliano, 43 – I-20138 Milano	
ENVIRONMENTAL CONDITIONING		
Parameter	Measured	
Ambient Temperature	21.0 ÷ 23.0 °C	
Relative Humidity	47 ÷ 55 %	
Atmospheric Pressure	991 ÷ 1001 mbar	
The laboratory is monitored by a continuous environmental conditions measurements system. Temperature, humidity and pressure data are recorded on a weekly basis and stored in local archive.		
REMARKS		
<p>Throughout this report a point (comma) is used as the decimal separator.</p> <p>The ability or reliability of this product to perform its intended function in a particular application has not been investigated.</p> <p>Unless otherwise specified, warnings, installation instruction and/or user manual provided with the sample have been checked in Italian or English version only.</p> <p>IMQ declines any responsibility derived from missing or wrong information provided aside by the applicant.</p>		

2. REFERENCE DOCUMENT

	DOCUMENT	DATE	TITLE
<input checked="" type="checkbox"/>	47 CFR Part 15	2015	Radio Frequency Device
<input checked="" type="checkbox"/>	ANSI C63.4	2014	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
<input checked="" type="checkbox"/>	ANSI C63.10	2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

3. EQUIPMENT UNDER TEST (EUT) DETAILS

GENERAL DATA (According to manufacturer declaration)

MODEL (basic)	Description
1083/83-US	Multi-user call forwarding device for 2voice system with integrated Wi-Fi radio
VARIANTS (derived)	Description
/	/

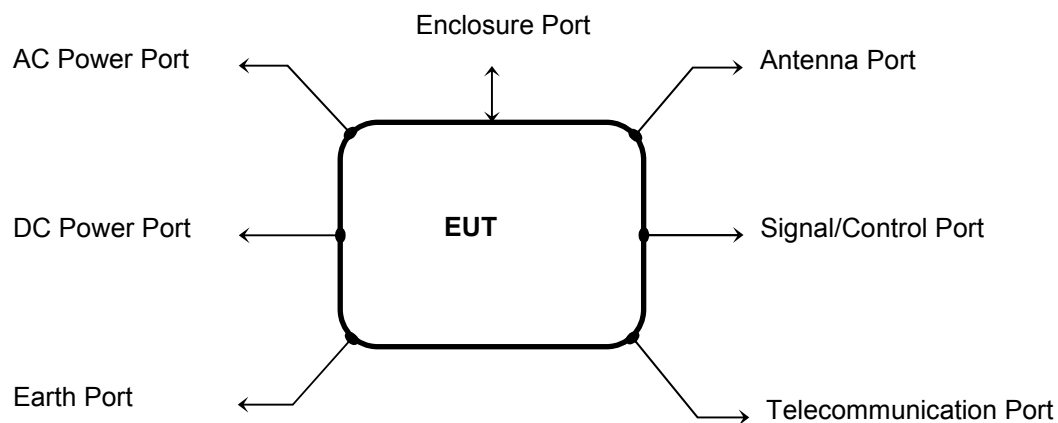
FCC ID	REA108383
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Manufacturer	URMET S.p.A. ~ Via Bologna, 188/c ~ I-10154 TORINO
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Type of equipment	DTS - Digital transmission equipment (Wi-Fi radio module)
Operating frequency	2412-2462MHz for 802.11b/g/n(HT20) 2422-2452MHz for 802.11n(HT40)
Max RF conducted power	802.11b : 17.95 dBm 802.11g : 12.93 dBm 802.11n(HT20) : 13.26 dBm 802.11n(HT40) : 13.11 dBm
Modulation	802.11b : DSSS(DBPSK/DQPSK/CCK) 802.11g/n : OFDM(BPSK/QPSK/16QAM/64QAM)
Number of channel	802.11b/g/n(HT20) : 11 802.11n(HT40) : 7
Antenna	Integrated on PCB. Gain 2dBi
Interfaces	URMET CS1083-051B
Integrated interfaces	URMET CS1083-050B
Dedicated AC supply	URMET 1083/20A and 1083/24
Remarks	None

4. TEST CONFIGURATION OF EQUIPMENT UNDER TEST

EUT PORTS



Port	Description	Max length
Enclosure	Plastic	/
AC power	Dedicated AC/DC power supply adapter	/
DC power	/	/
Earth	/	/
Telecommunication	LAN on interface for programming	/
Signal & Control	I/O input on interface	/
Antenna	Integrated on PCB	/

STATE OF THE EUT DURING TESTS

Test mode description and RF parameters used during test

List of frequency and channel for **802.11b/g/n (HT20)**

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2412	4	2427	7	2442	10	2457
2	2417	5	2432	8	2447	11	2462
3	2422	6	2437	9	2452	---	---

List of frequency and channel for **802.11n (HT40)**

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
3	2422	5	2432	7	2442	9	2452
4	2427	6	2437	8	2447	---	---

Frequency and channel used for test of **802.11b/g/n (HT20)**

Lower		Middle		Higher	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2412	6	2437	11	2462

Frequency and channel used for test of **802.11n (HT40)**

Lower		Middle		Higher	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
3	2422	6	2437	9	2452

Data rate used for all test (*)

802.11b	802.11g	802.11n (HT20)	802.11n (HT40)
1 Mbps	6 Mbps	MCS0	MCS0

(*)The choice of transmission speed was made based on preliminary analysis measurements in order to maximize the emission characteristics of measurement performed.

Ref.	Mode	Description
#1	Operating	The EUT is mounted and supply in normal operating condition. The Transmitter was operated in the normal operating mode. The TX frequency was fixed which was for the purpose of the measurements. Channel included the lower, middle and higher frequency to perform the test as above described.

SUPPORT EQUIPMENT

Defined as equipment needed for correct operation or loading of the EUT, but not considered as tested

Equipment	Manufacturer	Model
PC with dedicated SW & FW for radio parameter management	/	/

Engineering program for management of RF parameters was used during testing to control the EUT for staying in continuous transmission.

ELECTROMAGNETICALLY RELEVANT COMPONENTS

Component	No.	Manufacturer	Model
1083/83 Wi-Fi integrated board	1	URMET	CS1083/50B
1083/83 Interface board	1	URMET	CS1083/51B
Power supply bus	1	URMET	1083/20A
Power supply DC	1	URMET	1083/24
RF filter	1	URMET	1332/86
Wi-Fi module	1	LB-LINK	BL-R8188EU1(EUS)

RFI SUPPRESSION DEVICES

Component	No.	Manufacturer	Model
/	/	/	/

EMI PROTECTION DEVICES

Component	No.	Manufacturer	Model
/	/	/	/

EUT TECHNICAL DOCUMENTATION

Document	Reference
/	/

5. METHODS OF MEASUREMENT

All compliance measurements have been carried out using the procedures described in the standard ANSI C63.4-2014, ANSI C63.10-2013 and Section 15.31 of CFR47 Part 15 – Subpart A (General).

Additional test requirements have been adopted according to the reference Section indicated in the § 6 of this test report.

FREQUENCY RANGE INVESTIGATED

Radiated emission tests: from 9 kHz to tenth harmonic of fundamental.

6. SUMMARY OF TEST RESULTS

POSSIBLE TEST CASE VERDICTS	
Test object meets the requirement	PASS
Test object does not meet the requirement	FAIL
Test case does not apply to the test object	N.A.
Test not performed	N.P.

CFR47 Part 15	TITLE	RESULT
§ 15.203, § 15.247 (b)(4)(i)	Antenna Requirements	PASS
§ 15.207 (a)	Conducted Emission	PASS
§ 15.209 (a) (f)	Radiated Emission	PASS
§ 15.247 (a)	Frequency Hopping Spread Spectrum Specifications	
§ 15.247(a)	20 dB Bandwidth	N.A. ¹
§ 15.247(a)(1)	Carrier frequency (Hopping Channel) Separation	N.A. ¹
§ 15.247(a)(1)(iii)	Number of Hopping Channels Used	N.A. ¹
§ 15.247(a)(1)(iii)	Channel occupancy time	N.A. ¹
§ 15.247(a)(2)	6dB Minimum Bandwidth	PASS
§ 15.247(b)	Maximum Peak Output Power	
§ 15.247(b) (1)	Peak Output Power	N.A.
§ 15.247(b) (3)	RF power output, radiated (EIRP)	PASS
§ 15.247(b) (4)	Antenna gain	N.A.
§ 15.247(c)	Operation with directional antenna gains greater than 6 dBi	N.A.
§ 15.247 (d)	100 kHz Bandwidth of Frequency Band Edges	PASS
§ 15.247 (d)	Radiated Emission	PASS
§ 15.247 (e)	Power Spectral Density	PASS
§ 15.247 (f)	Hybrid systems	N.A. ¹
§ 15.247 (g)	FHSS Transmission characteristics	N.A. ¹
§ 15.247 (h)	Recognition of occupied channel and multiple transmission	N.A. ¹
§ 15.247(i), § 47CFR 1.1307(b)(1)	RF humane exposure	PASS

Note 1 Not applicable for DTS equipment

7. TEST RESULTS

7.1 ANTENNA REQUIREMENTS

TEST REQUIREMENT

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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

Testing dates	2020-08-03
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Antenna specifications

N° of authorized antenna types	/
Antenna type	Integrated on PCB
Maximum total gain	2 dBi
External power amplifiers	Not present

TEST RESULT

The EUT meets the requirements of section 15.203 and 15.204

7.2 AC MAINS POWER SUPPLY CONDUCTED EMISSION

TEST REQUIREMENT

Test setup	ANSI C63.4
Test facility	Shielded chamber
Frequency range	150 kHz – 30 MHz
IF bandwidth	9 kHz
EMC class	B
EUT operating condition	#1
Testing dates	2020-08-03

LIMITS

Band of operations	Quasi-Peak (dB μ V)	Average Limit (dB μ V)
0.15 \div 0.5	66 \div 56	56 \div 46
0.5 \div 5	56	46
5 \div 30	60	50

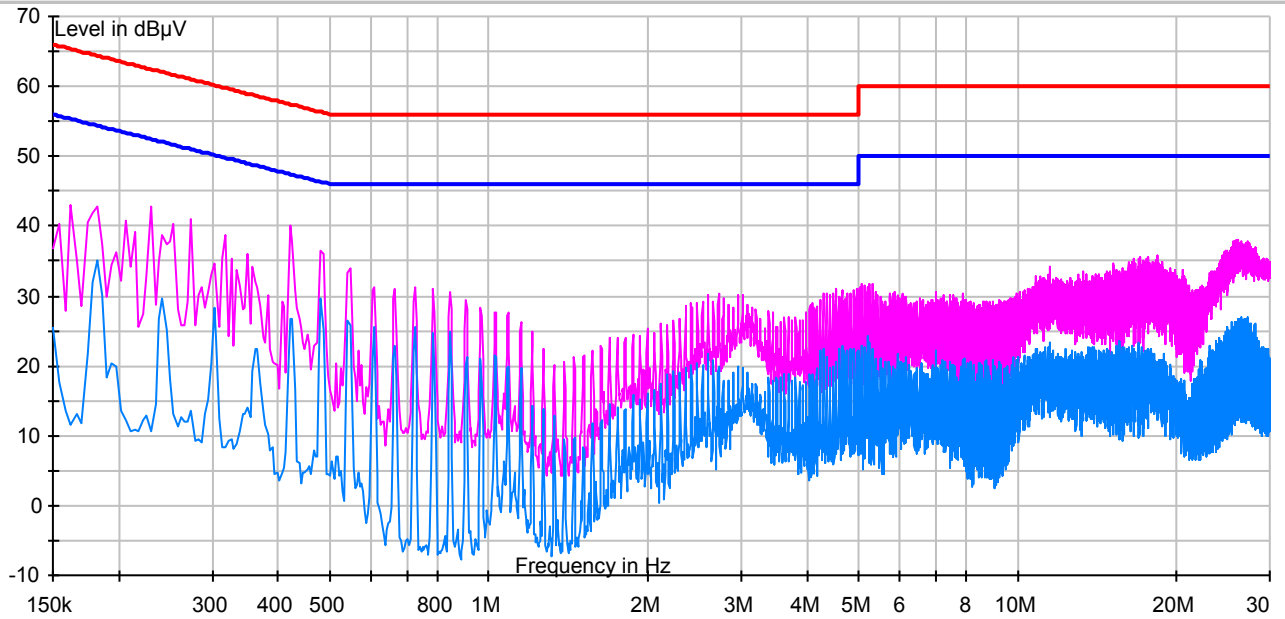
TEST RESULT

The EUT meets the requirements of sections 15.207 (a).

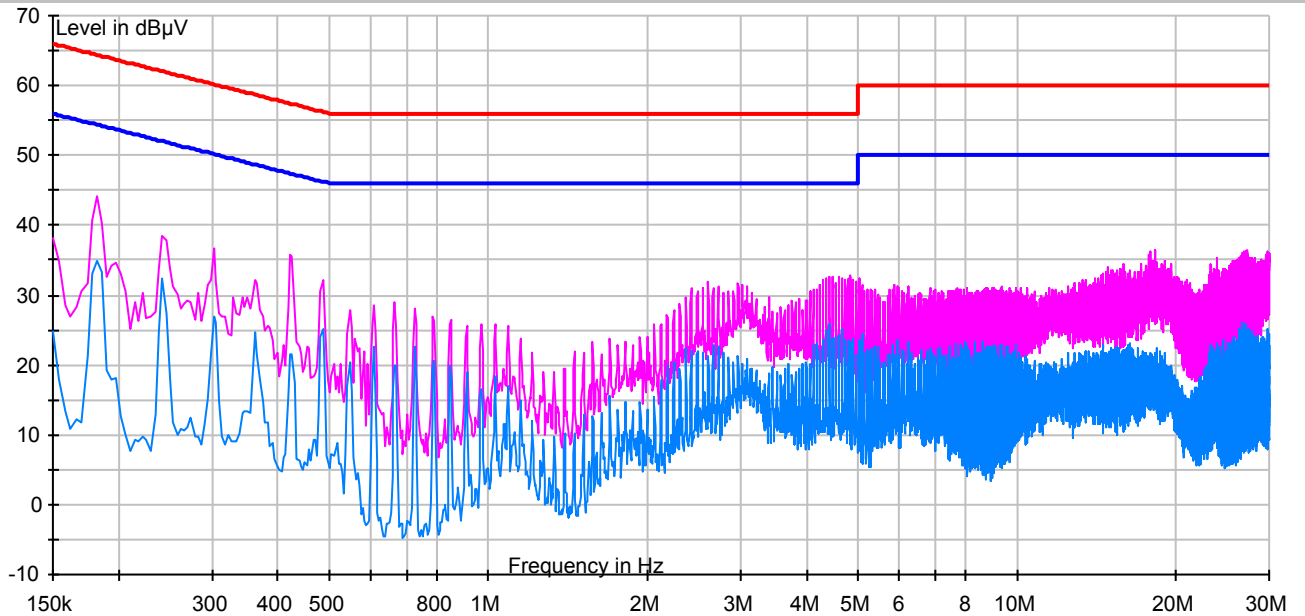
TEST PROCEDURE

- 1) The EUT was placed on a wooden table of size, 80 cm by 80 cm, raised 80 cm in which is located 40 cm away from the vertical wall the shielded room.
- 2) Each EUT power cord input cord was individually connected through a 50 Ω /50 μ H LISN to the input power source.
- 3) Exploratory measurements were made to identify the frequency of the emission that had the highest amplitude relative to the limit by operating the EUT in a range of typical modes of operation, cable position, and with a typical system equipment configuration and arrangement. Based on the exploratory tests of the EUT, the one EUT cable configuration and arrangement and mode of operation that had produced the emission with the highest amplitude relative to the limit was selected for the final measurement.
- 4) The final test on all current-carrying conductors of all of the power cords to the equipment that comprises the EUT (but not the cords associated with other non-EUT equipment is the system) was then performed over the frequency range of 0.15 MHz to 30 MHz.
- 5) The measurements were made with the detector set to PEAK and AVERAGE amplitude within a bandwidth of 9 kHz during the measurements.
- 6) The measurements with Quasi-Peak detector are performed only for frequencies for which the Peak values are \geq (Q.P. limit - 6 dB).

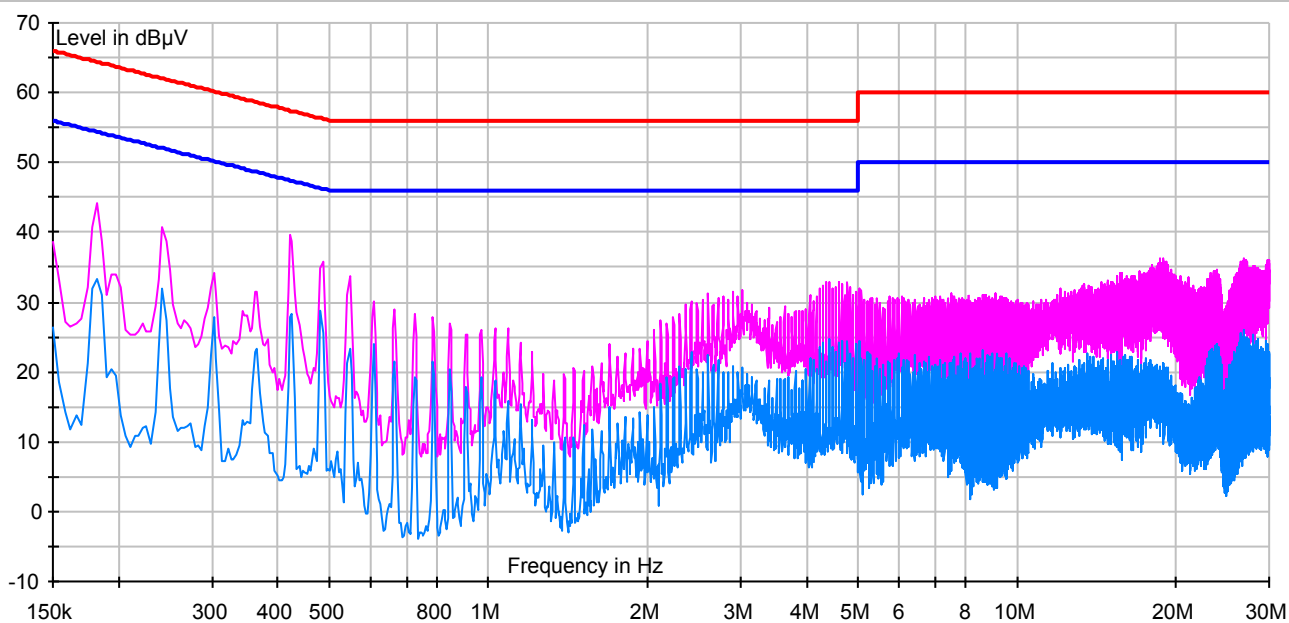
Worst case measurement result of 802.11b modulation



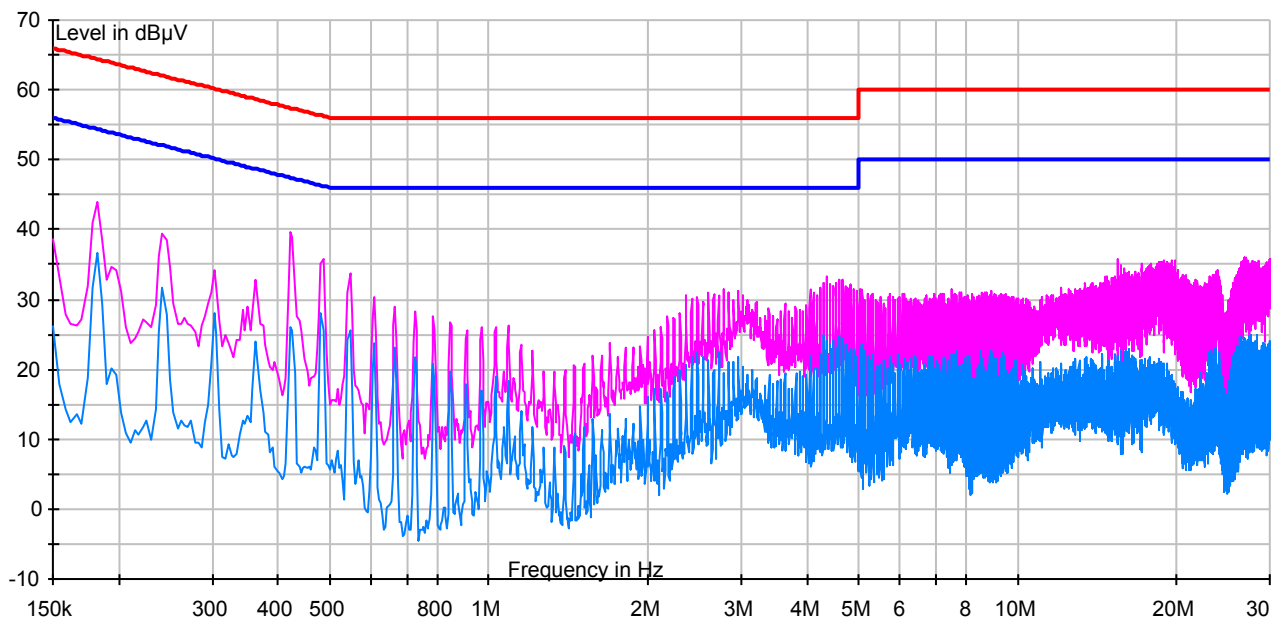
Worst case measurement result of 802.11g modulation



Worst case measurement result of 802.11n HT20 modulation



Worst case measurement result of 802.11n HT40 modulation



7.3 RADIATED DISTURBANCES

TEST REQUIREMENT

Test setup	ANSI C63.4
Test facility	Semi-anechoic chamber
Test distance	3 meters
Frequency range	9 kHz to tenth harmonic of fundamental
IF bandwidth (below 30 MHz)	9 kHz
IF bandwidth (below 1,000 MHz)	120 kHz
IF bandwidth (above 1,000 MHz)	1 MHz
EMC class	B
EUT operating condition	#1
<p>Remark:</p> <p>In accordance with part 15.31 (f) (2), where the measurement distance was specified to be 30 or 300 meters, a correction factor was applied in order to permit measurement to be performed at a separation distance. The applied formula for limits at 3 meter is:</p> <p>Extrapolation (dB) = $40\log(300\text{meter} / 3\text{meter}) = +80\text{db}$</p> <p>Extrapolation (dB) = $40\log(30\text{meter} / 3\text{meter}) = +40\text{db}$</p>	
Testing dates	2020-09-01 ÷ 2020-09-11

LIMITS

Band of operations	Peak (dB μ V/m)	Average Limit (dB μ V/m)
Restricted bands (§ 15.205)	74	54
Other bands	According to 15.209 or fundamental -20dB (which is greater)	According to 15.209 or fundamental -20dB (which is greater)

TEST PROCEDURE

- 1) The EUT was placed on turntable which is 0.8 m above the ground plane
- 2) The turntable shall rotate from 0° to 360° degrees to determine the position of maximum emission level.
- 3) The EUT is positioned 3 m away from the receiving antenna, which varied from 1 to 4 m to find the highest emission.
- 4) The measurements were made with the detector set to PEAK and AVERAGE amplitude within a bandwidth of 100 kHz below 1000 MHz and 1 MHz above 1000 MHz.
- 5) The receiving antenna was positioned in both horizontal and vertical polarization.
- 6) The measurements with Quasi-Peak detector, below 1000 MHz are performed only for frequencies for which the Peak values are \geq (Q.P. limit - 6 dB).

TEST RESULT

The EUT has been tested in 3 orthogonal axes at the frequencies lowest, middle and highest for each modulation.

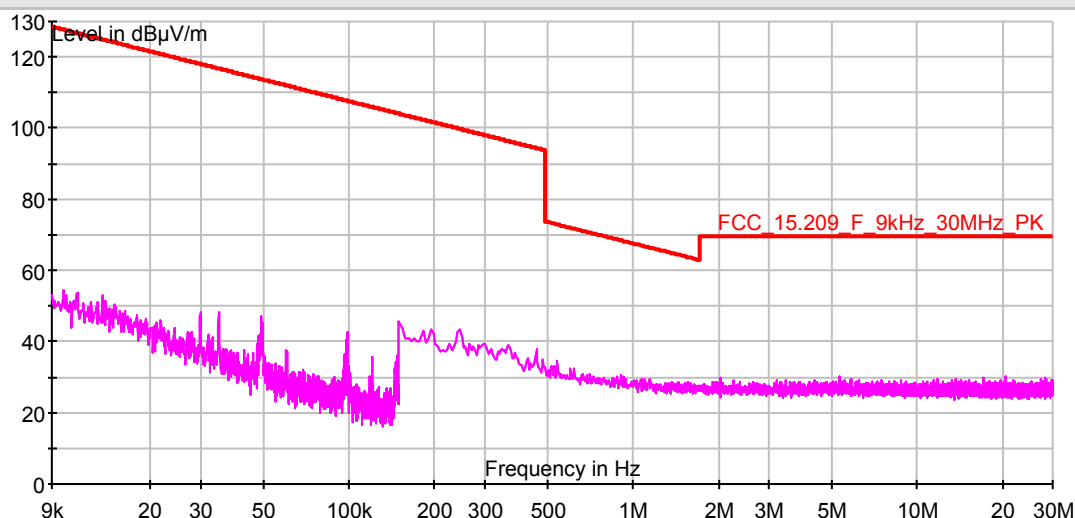
The results reported are worst case.

The measurement of spurious emission of EUT in receiver mode is deemed to be fulfilled as no limits are exceeded in transmitter mode (condition considered more burdensome).

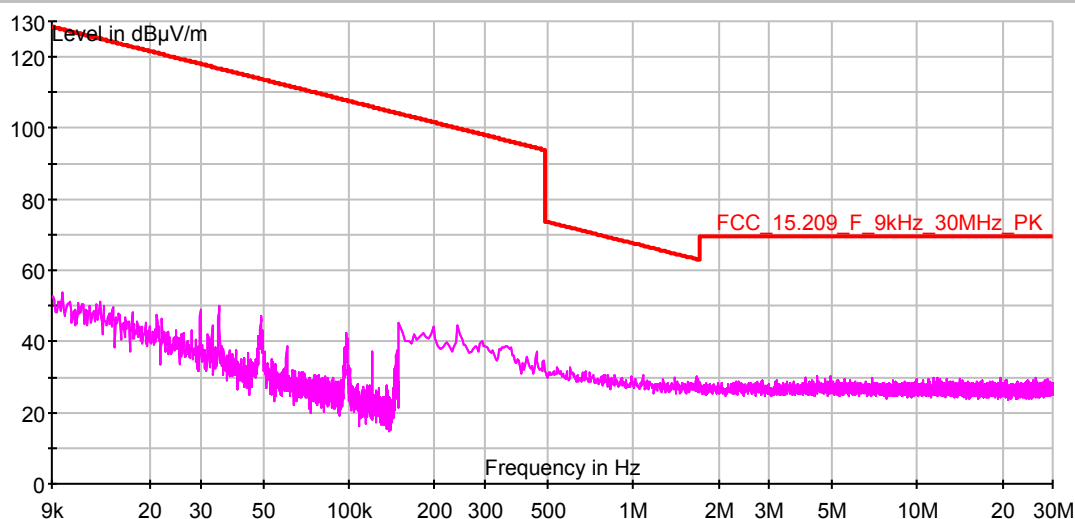
The EUT meets the requirements of sections 15.205 (b), 15.209 and 15.247.

9 kHz÷30 MHz - Measurement result of 802.11b modulation

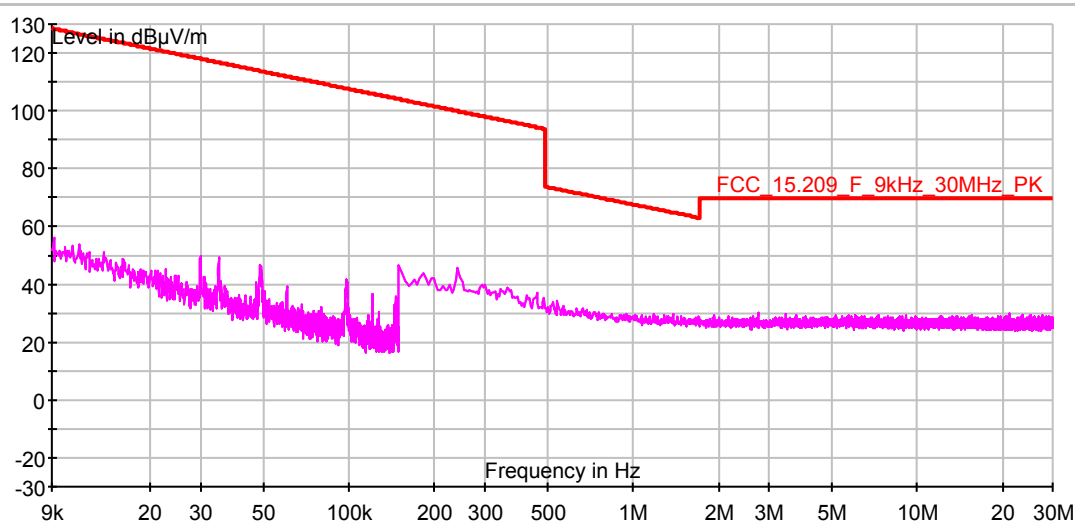
LOWER CHANNEL



MIDDLE CHANNEL

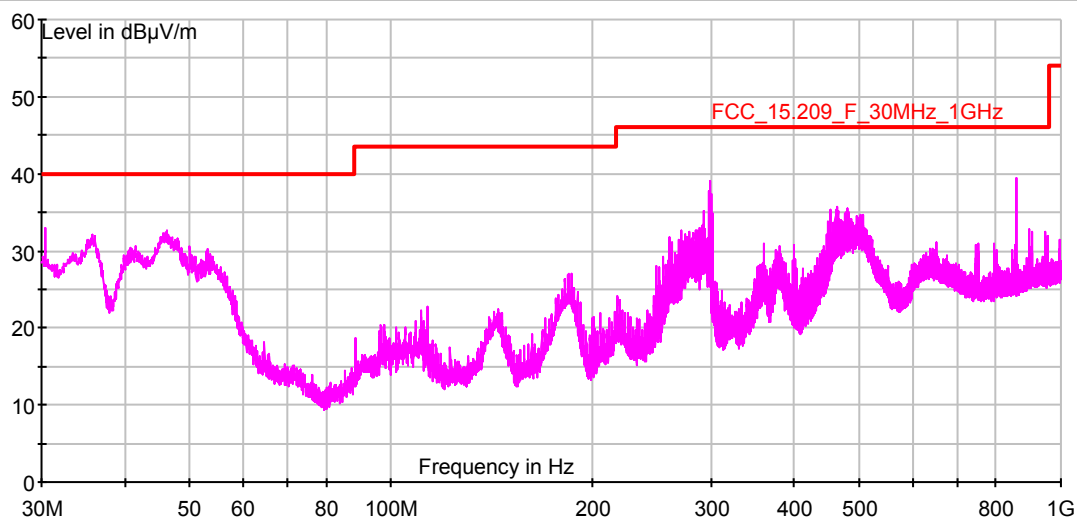


HIGHER CHANNEL

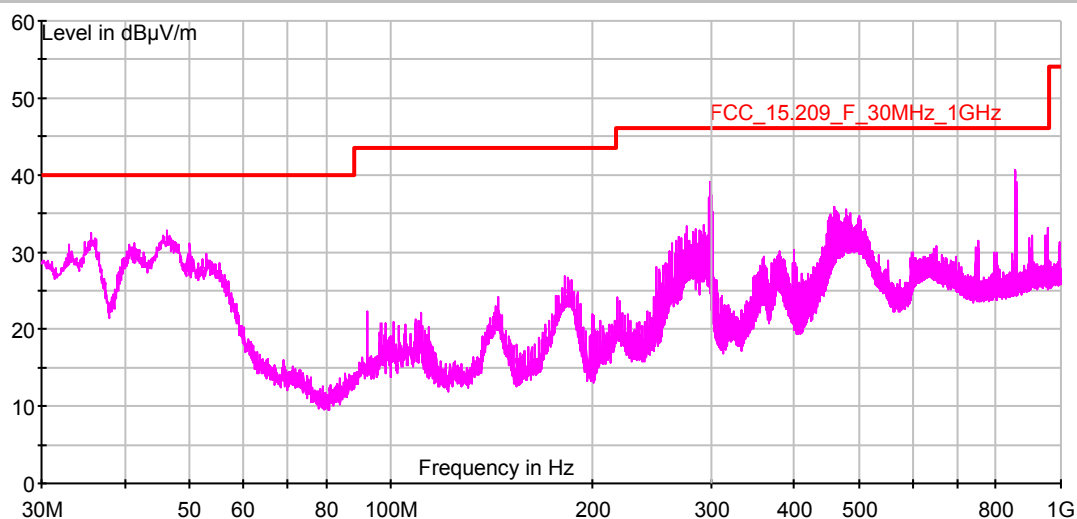


30÷1,000 MHz - MEASUREMENT RESULT OF 802.11B MODULATION

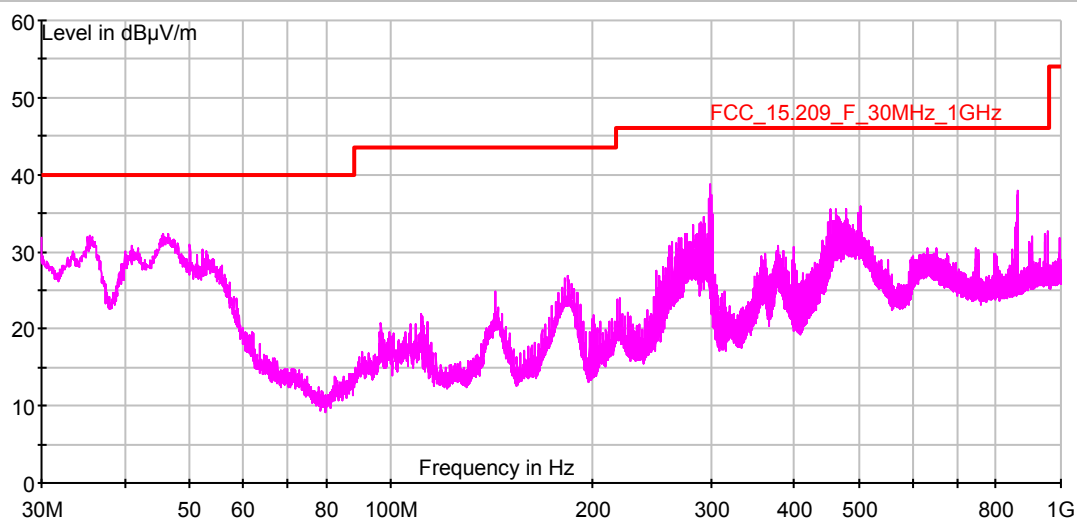
LOWER CHANNEL



MIDDLE CHANNEL

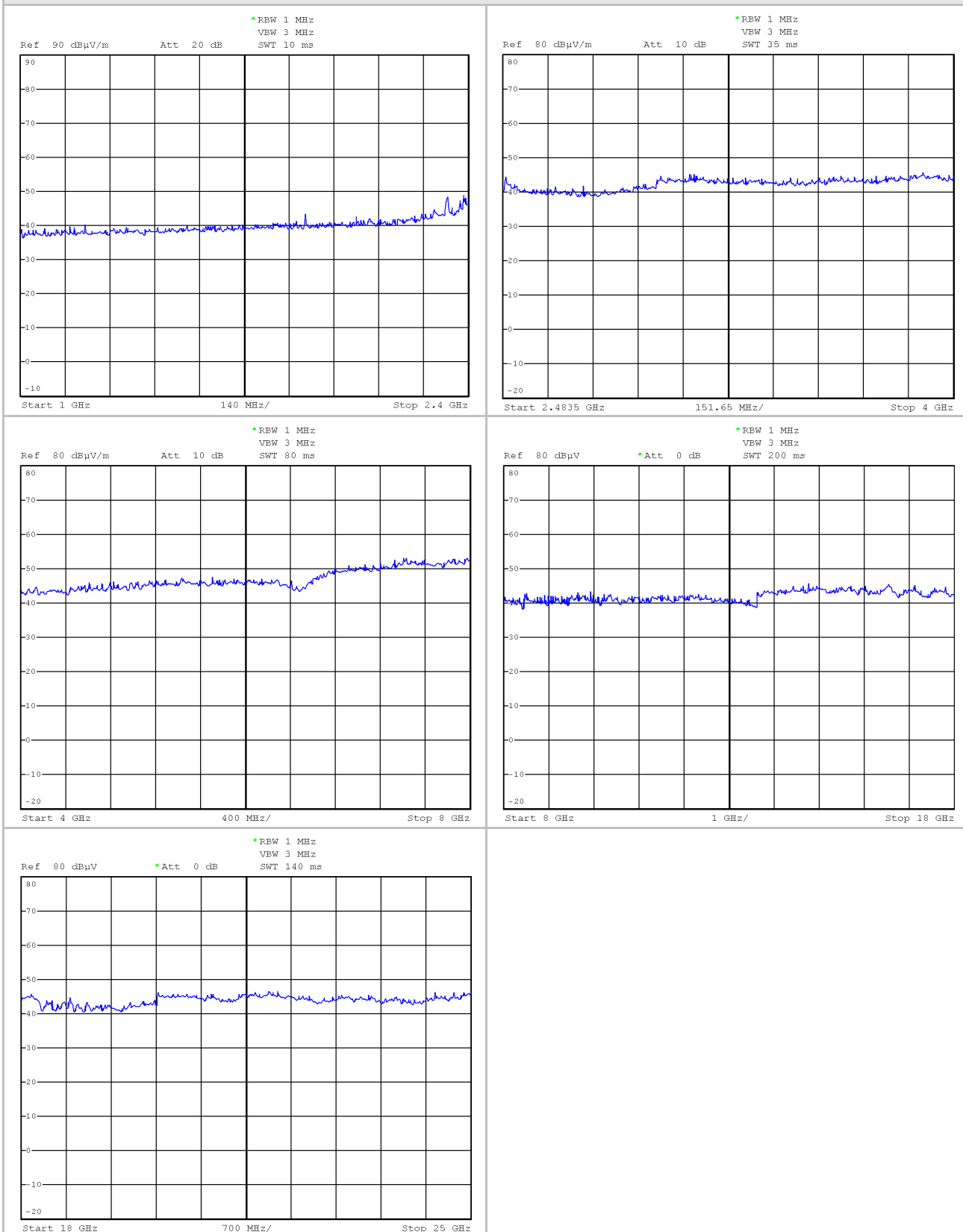


HIGHER CHANNEL

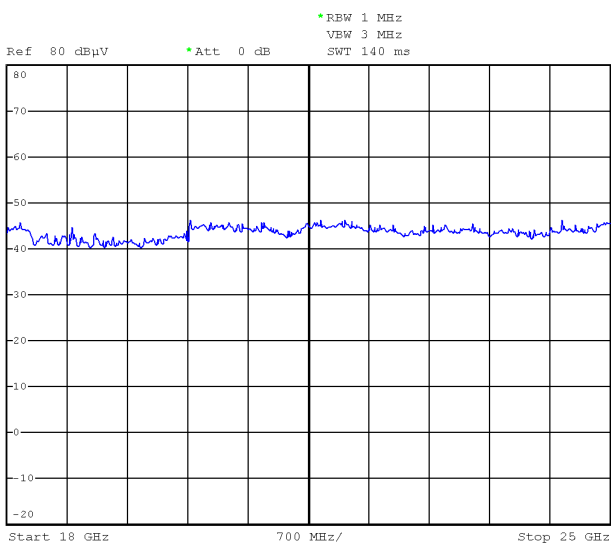
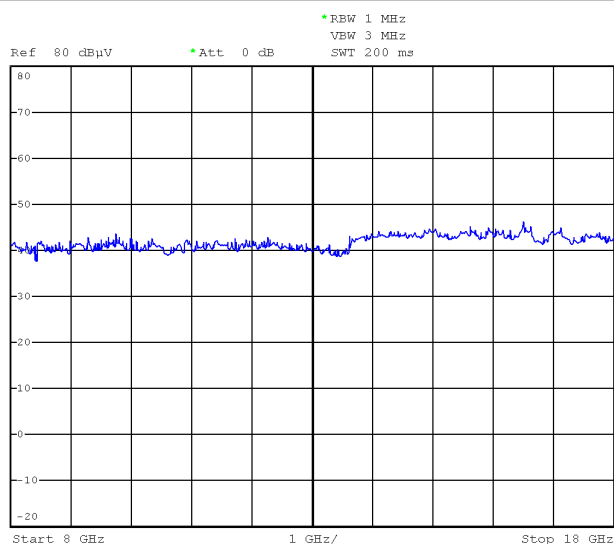
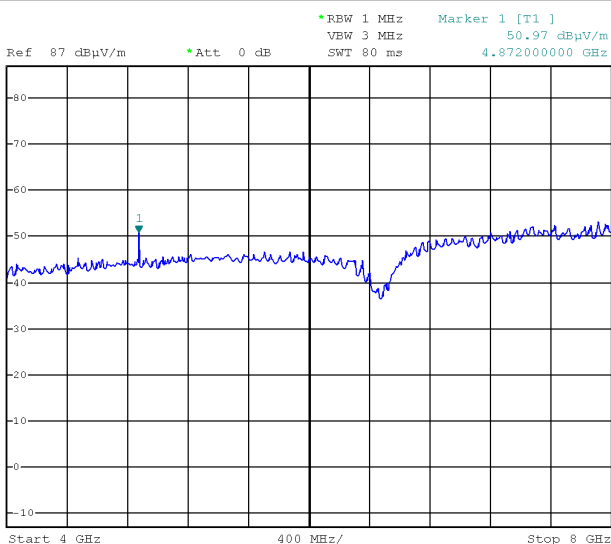
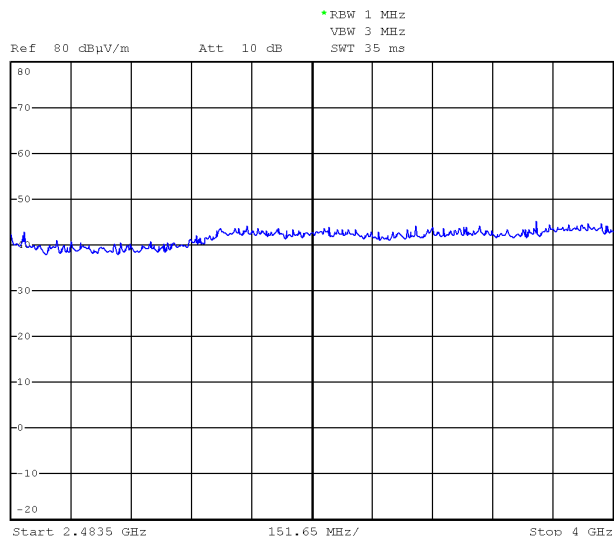
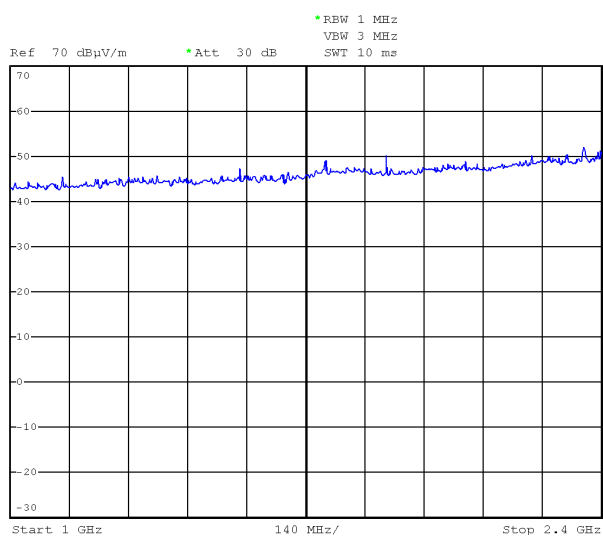


>1,000 MHz - Measurement result of 802.11b modulation

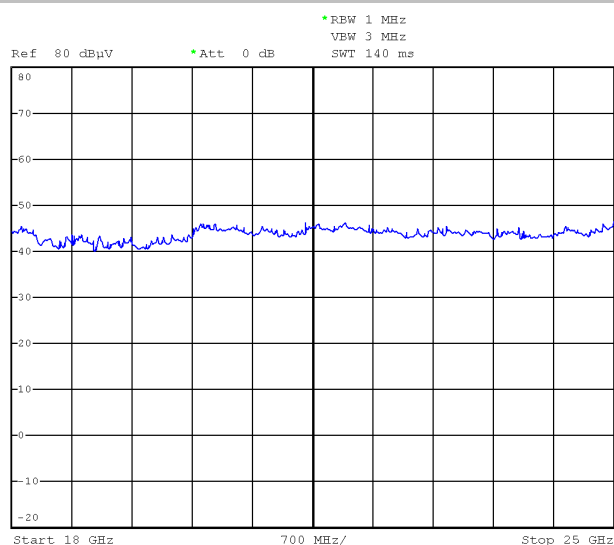
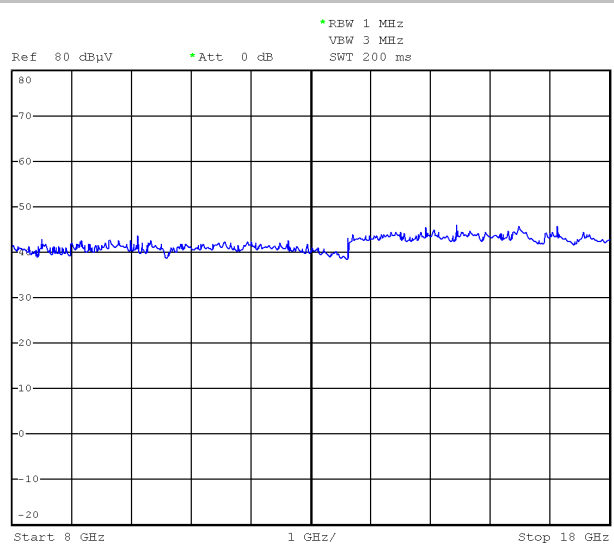
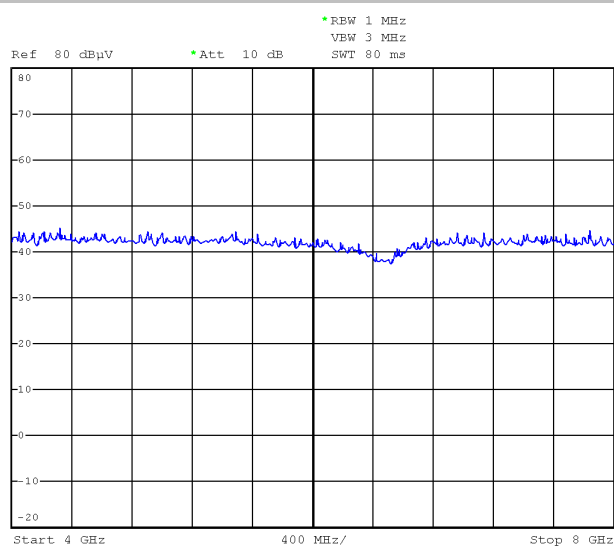
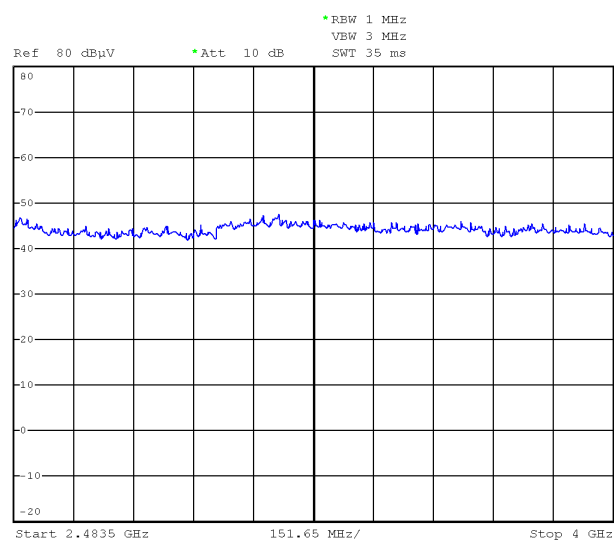
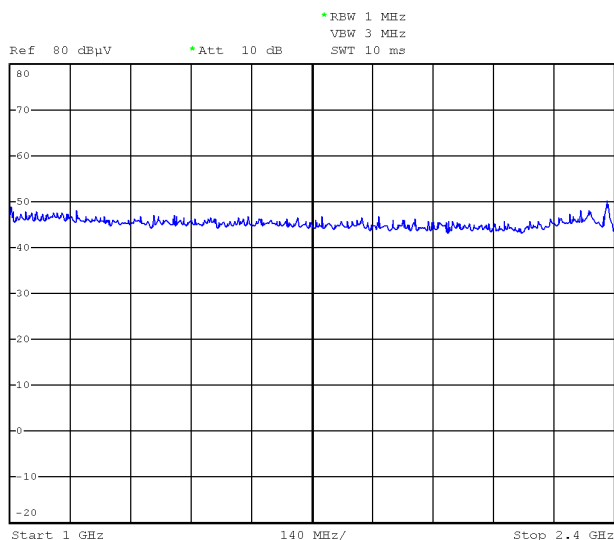
MEASUREMENTS RESULTS - Channel LOWER



MEASUREMENTS RESULTS - Channel middle

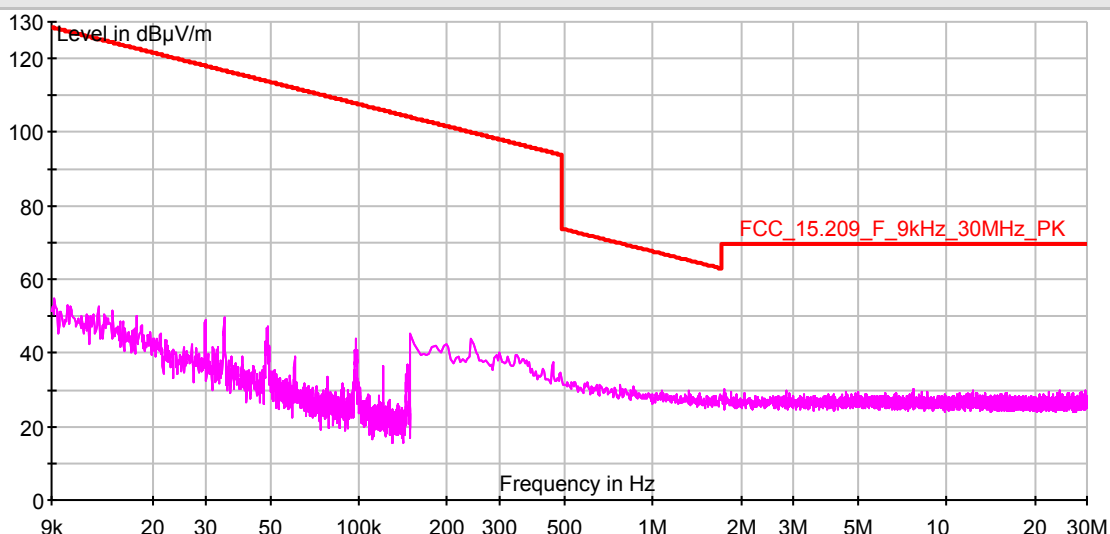


MEASUREMENTS RESULTS - Channel higher

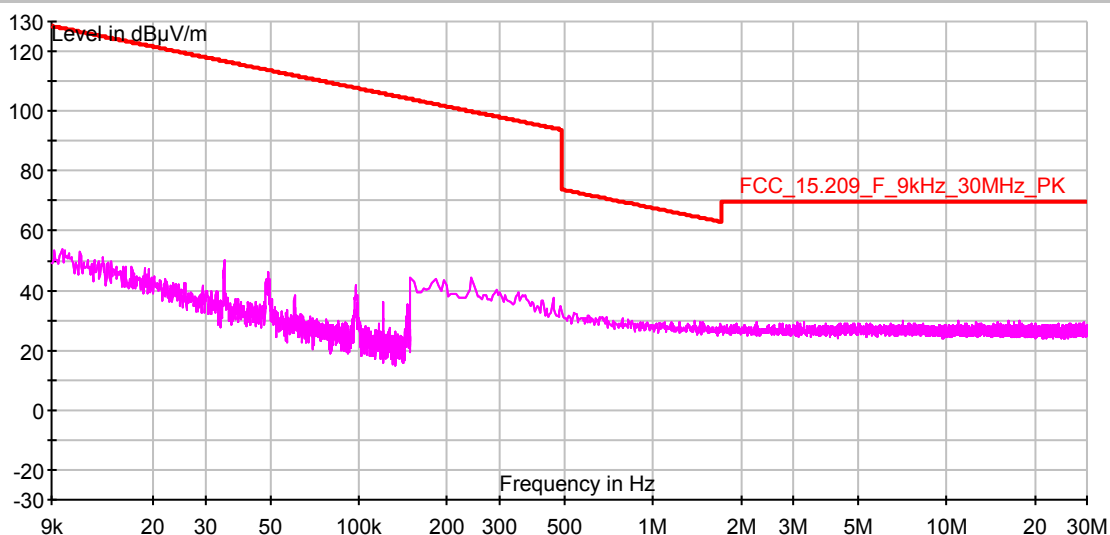


9 kHz÷30 MHz - Measurement result of 802.11g modulation

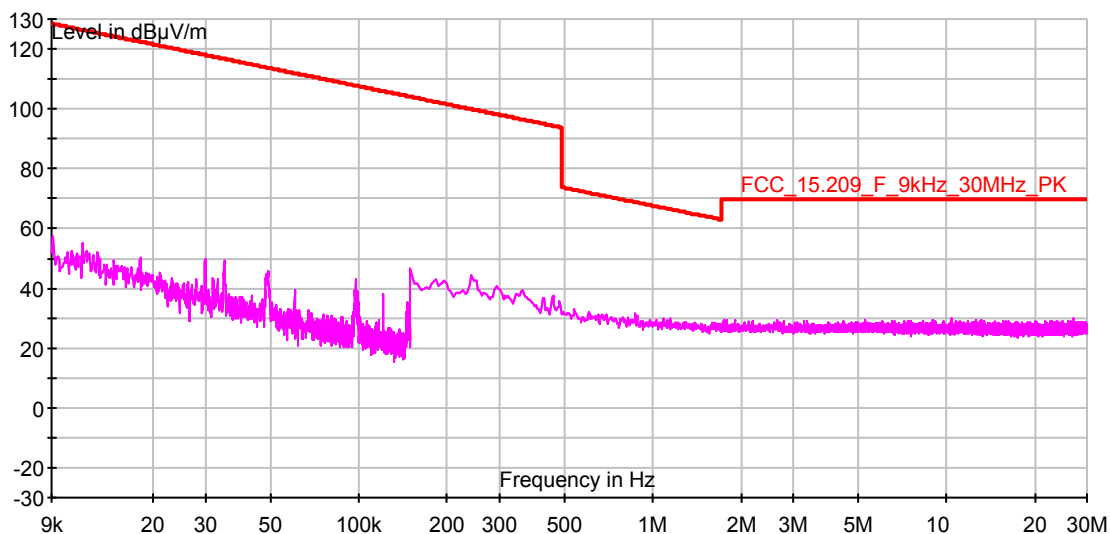
LOWER CHANNEL



MIDDLE CHANNEL

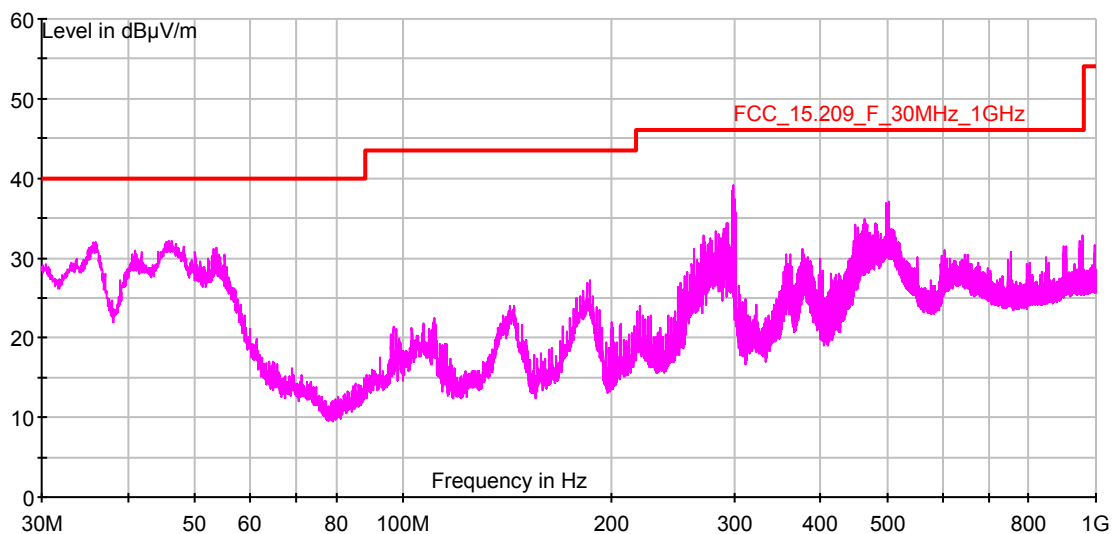


HIGHER CHANNEL

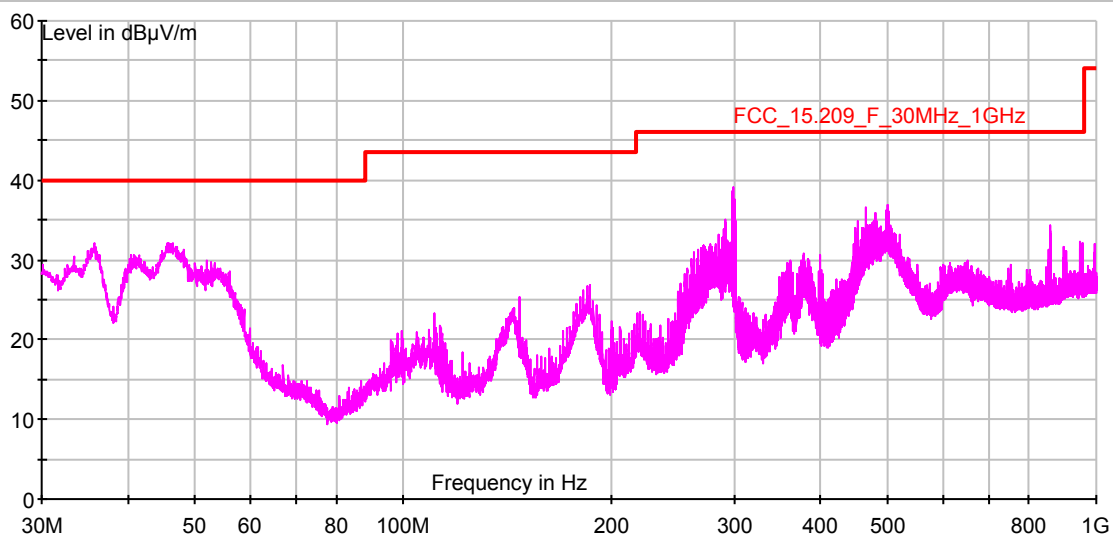


30÷1,000 MHz - Measurement result of 802.11g modulation

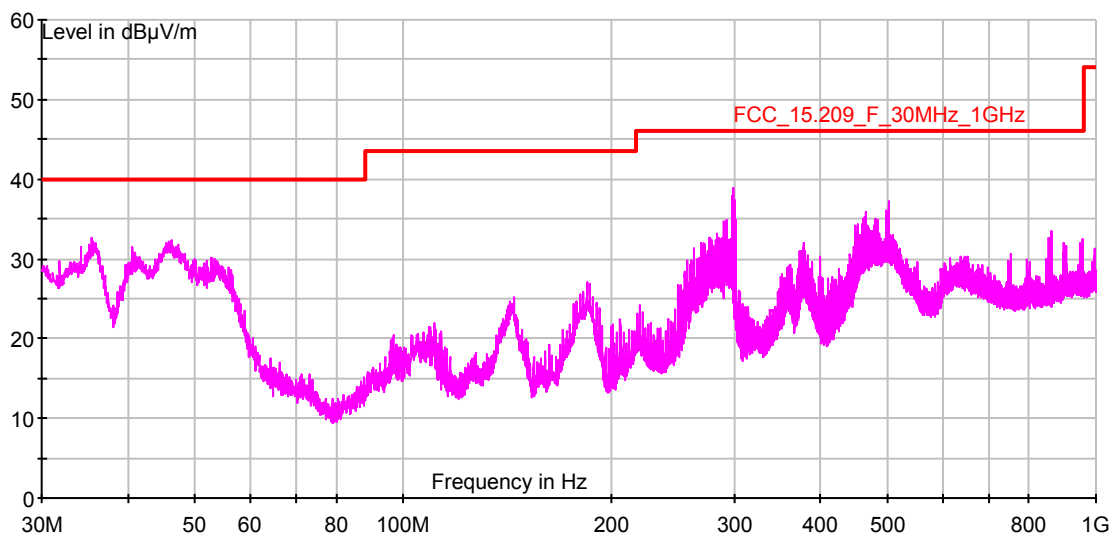
LOWER CHANNEL



MIDDLE CHANNEL

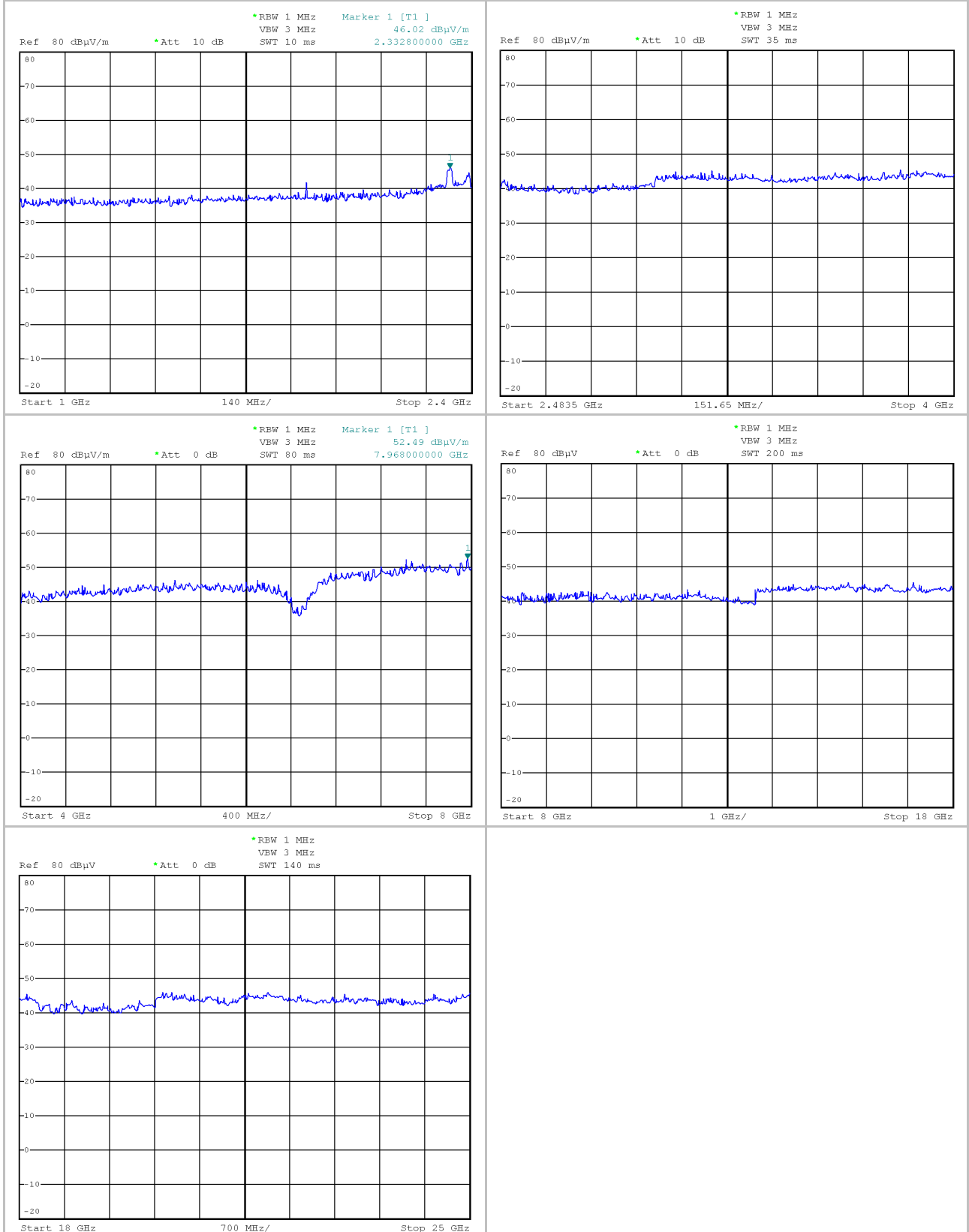


HIGHER CHANNEL

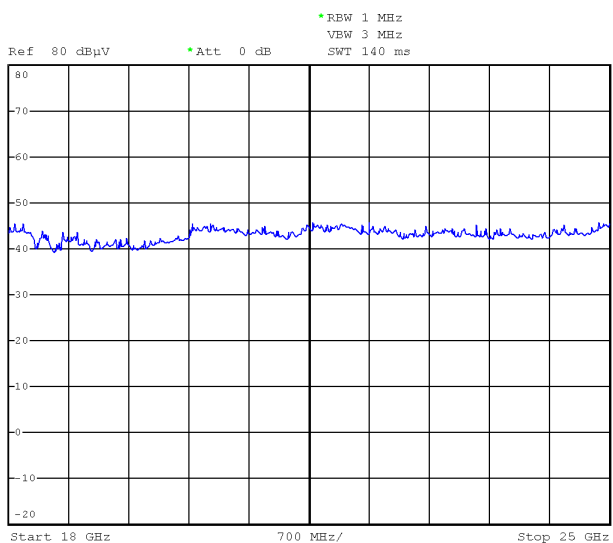
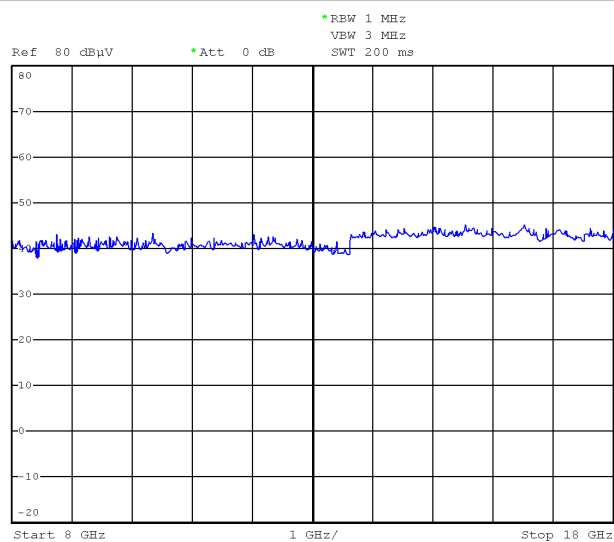
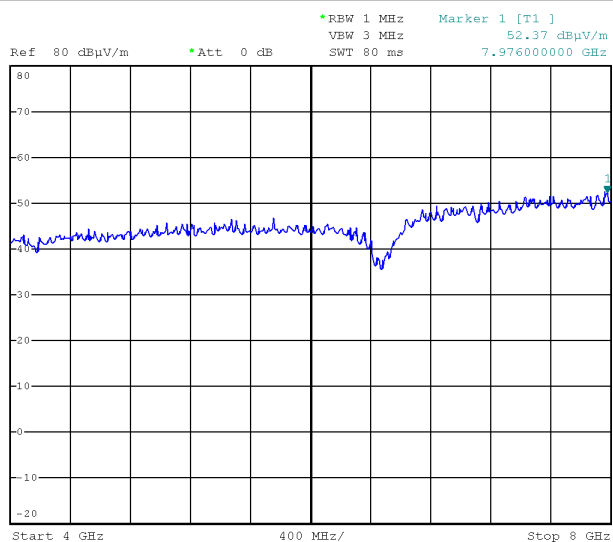
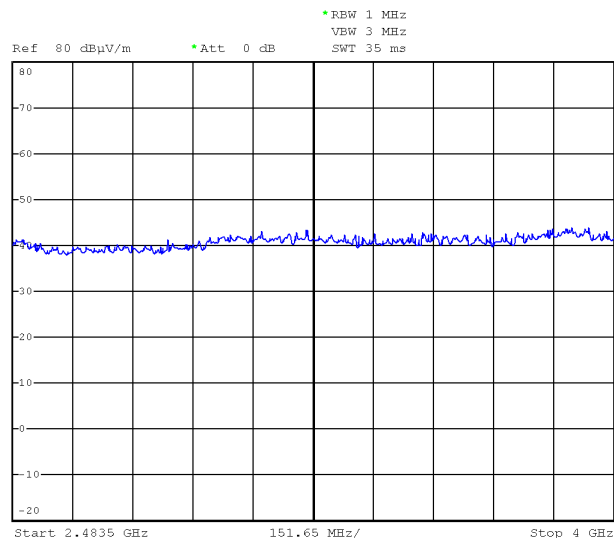
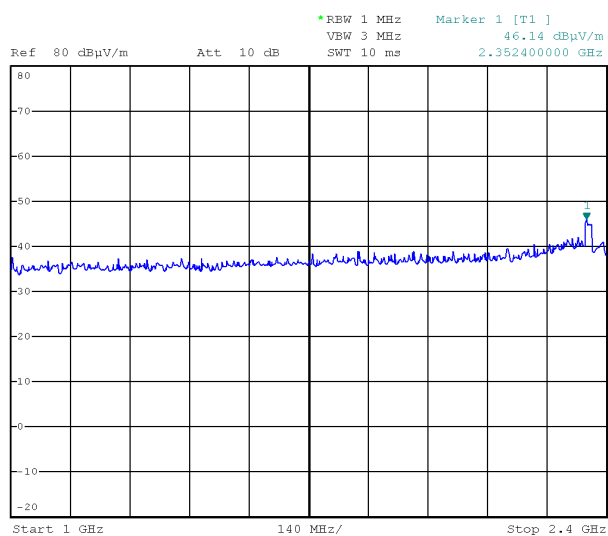


>1,000 MHz - Measurement result of 802.11g modulation

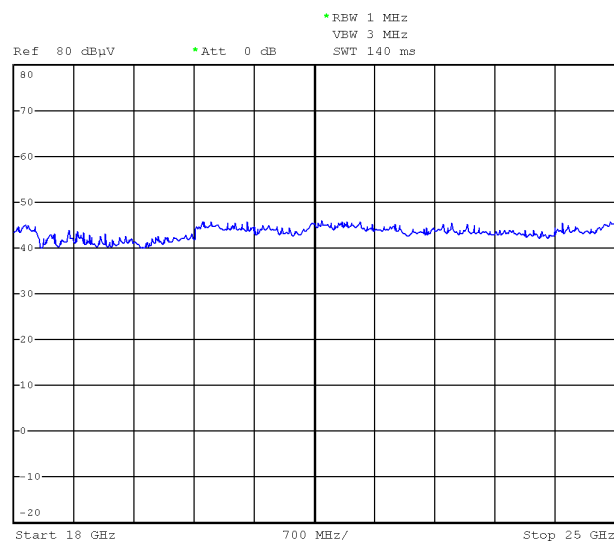
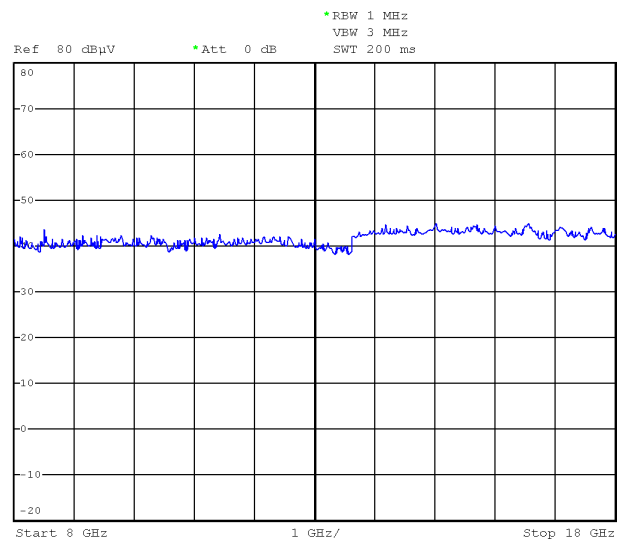
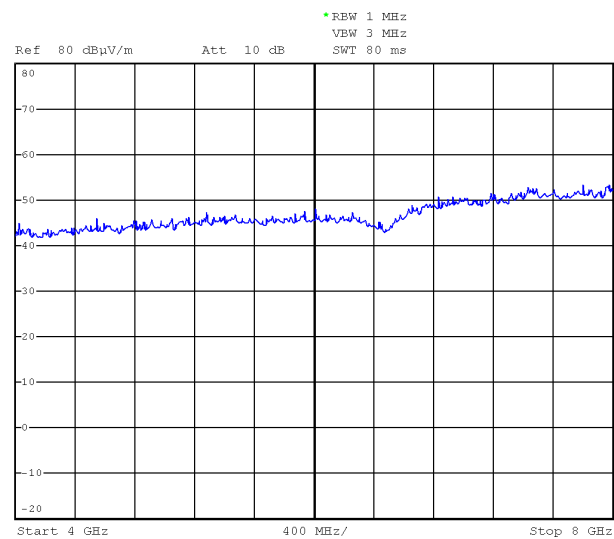
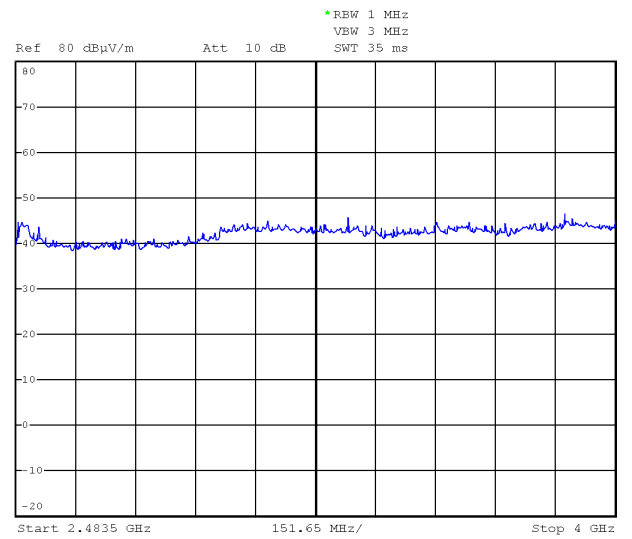
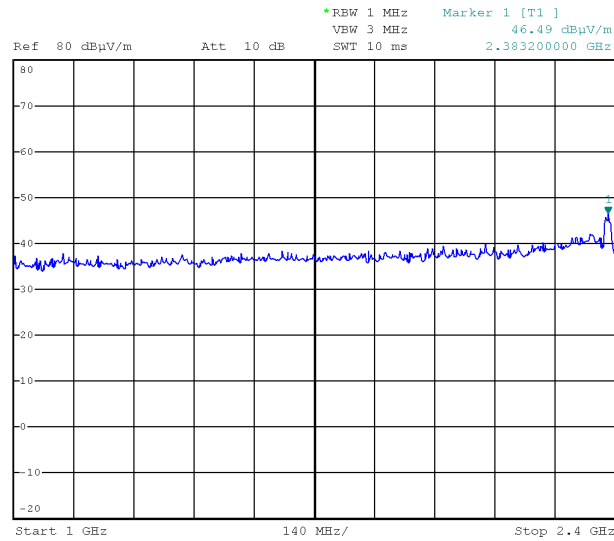
MEASUREMENTS RESULTS - Channel LOWER



MEASUREMENTS RESULTS - Channel middle

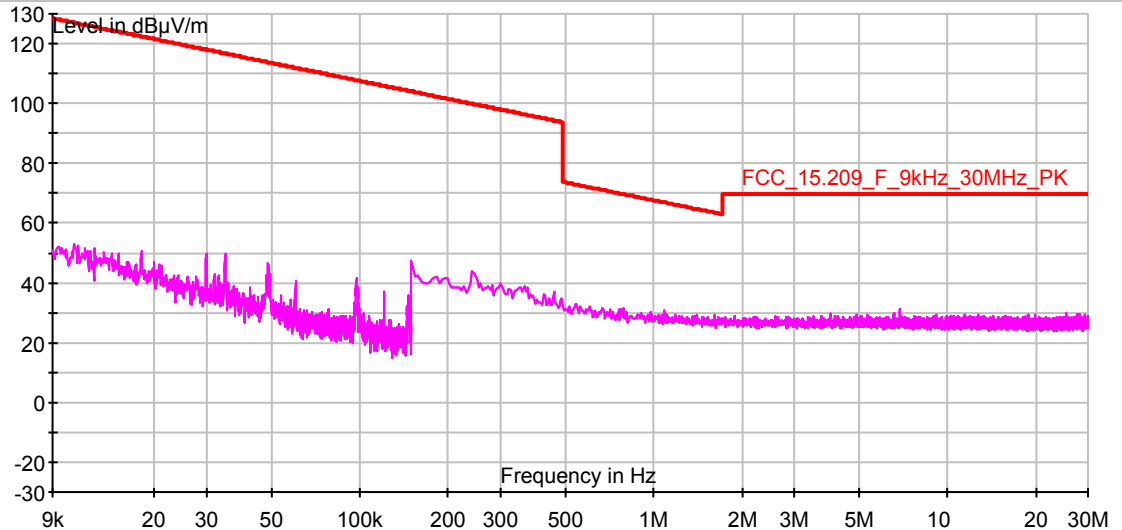


MEASUREMENTS RESULTS - Channel higher

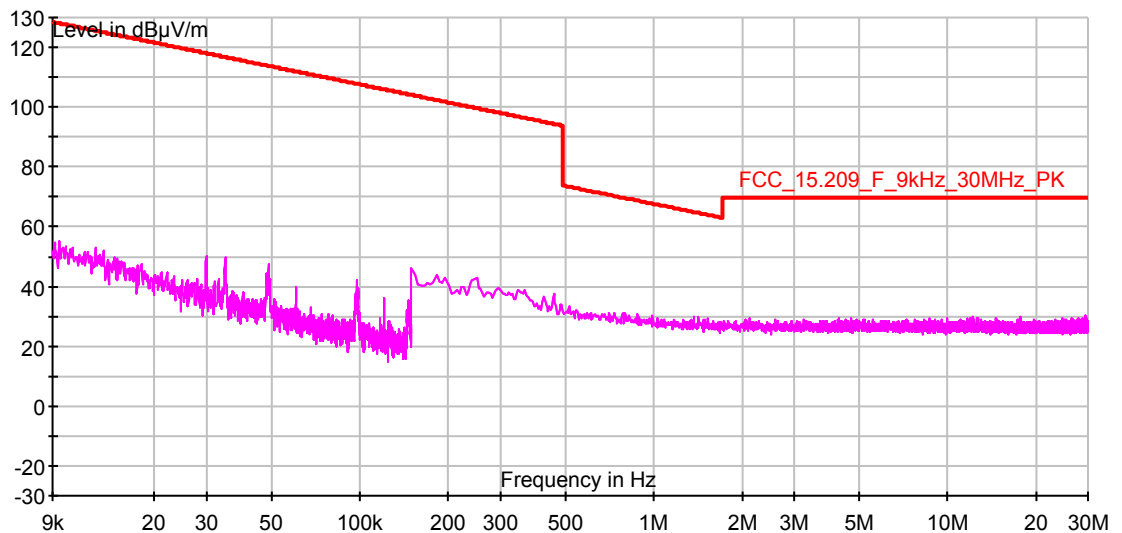


9 kHz÷30 MHz - Measurement result of 802.11n HT20 modulation

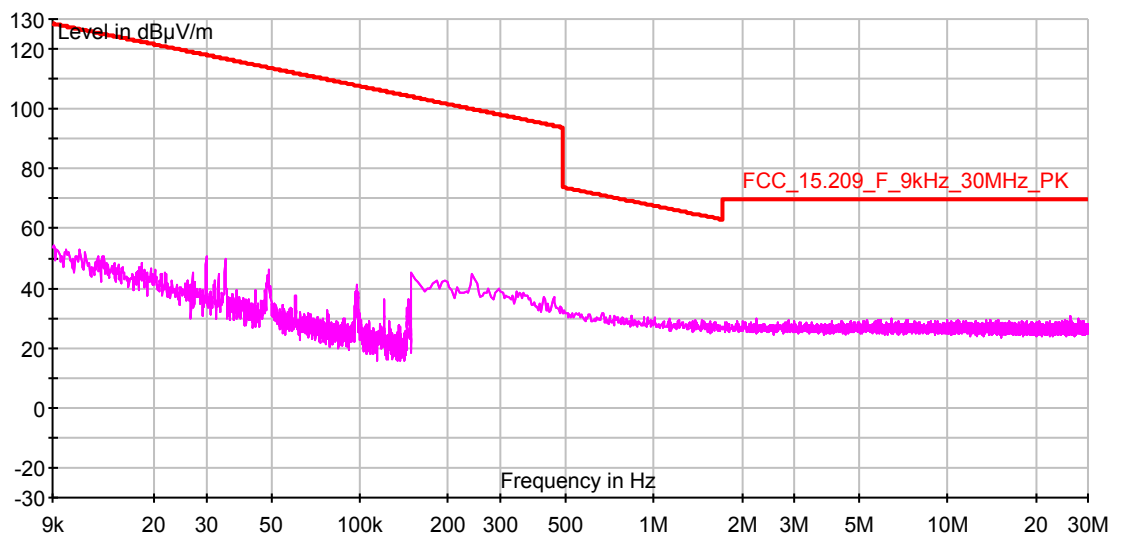
LOWER CHANNEL



MIDDLE CHANNEL

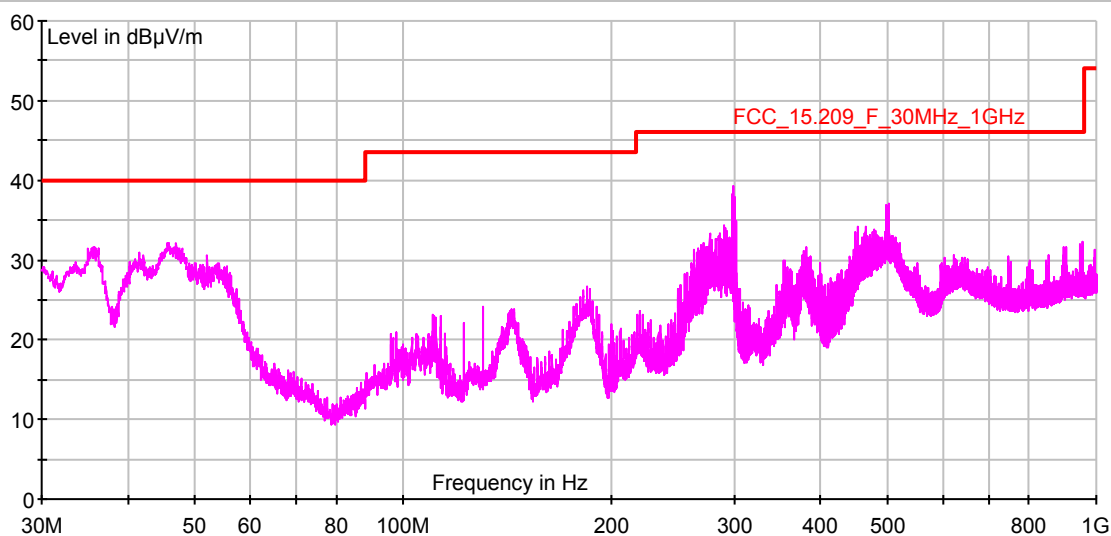


HIGHER CHANNEL

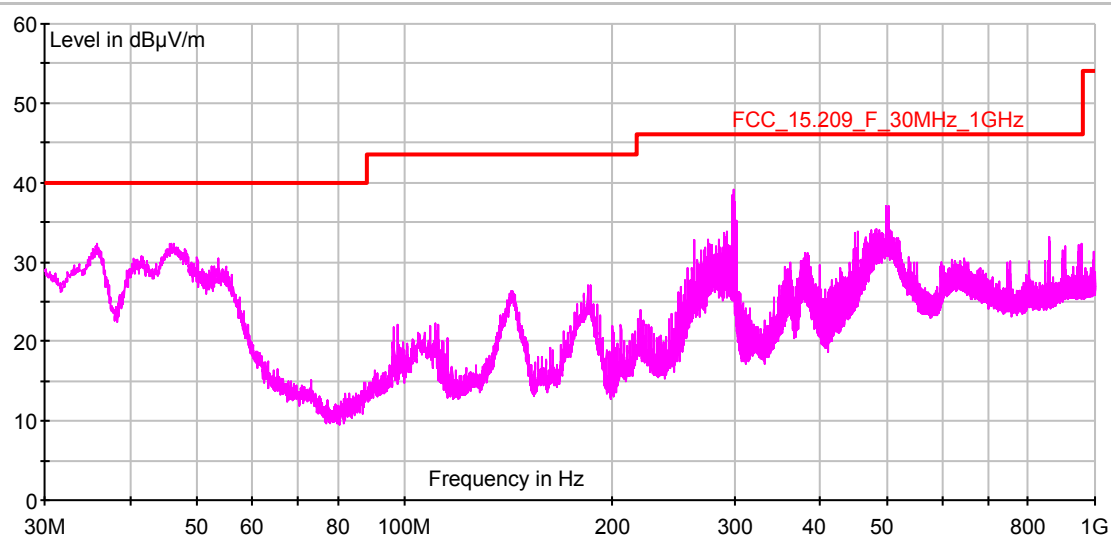


30÷1,000 MHz - Measurement result of 802.11n HT20 modulation

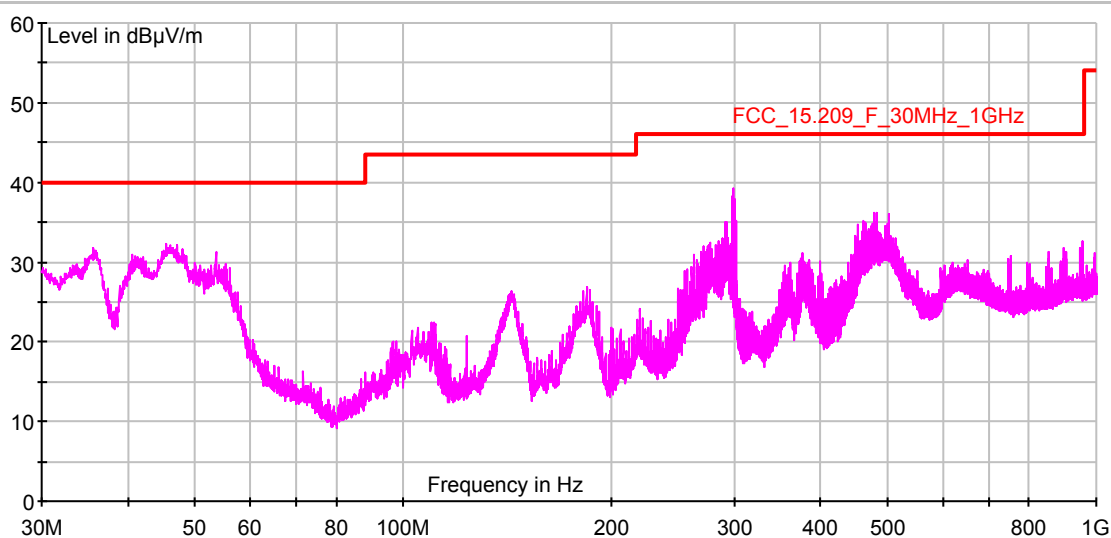
LOWER CHANNEL



MIDDLE CHANNEL

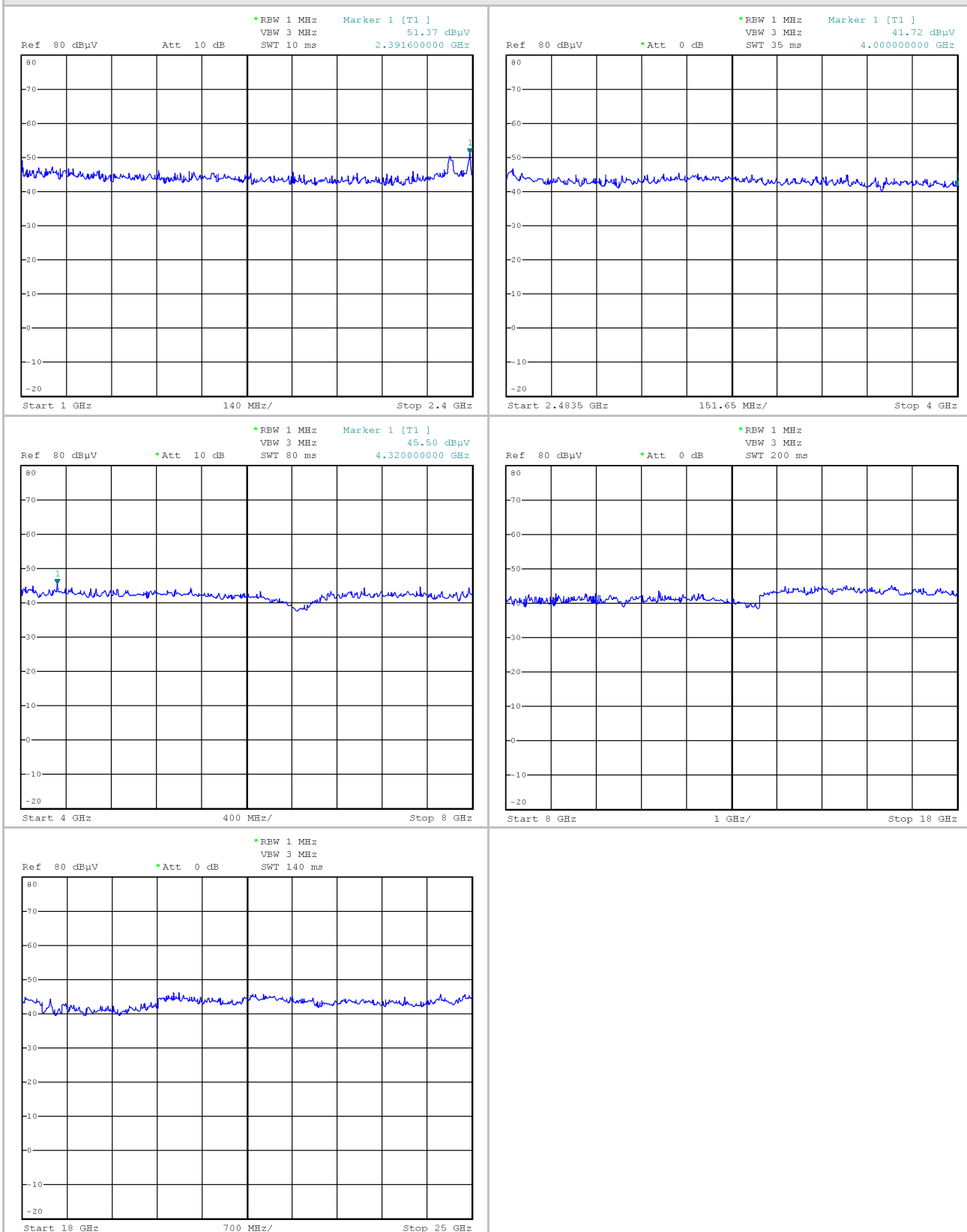


HIGHER CHANNEL

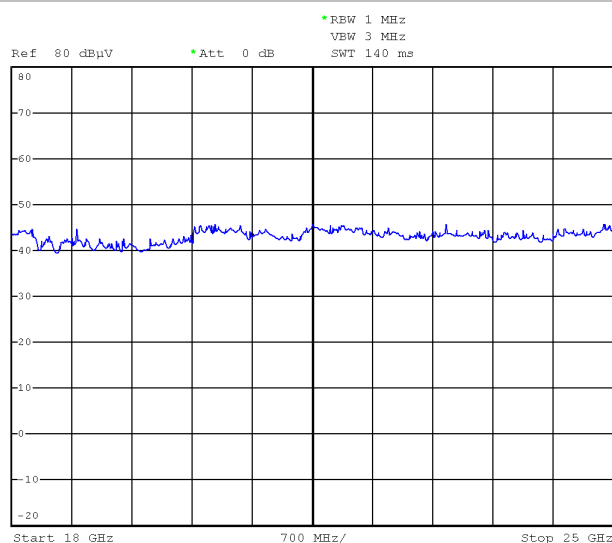
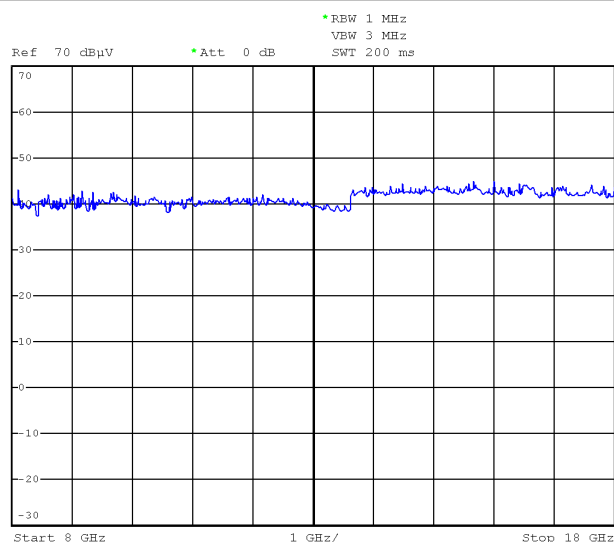
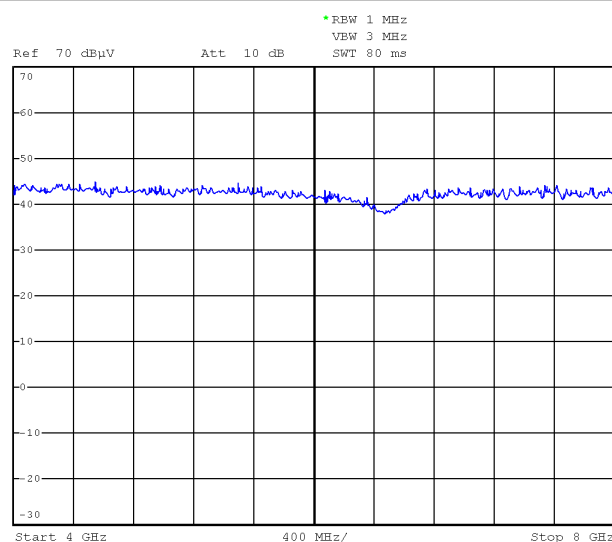
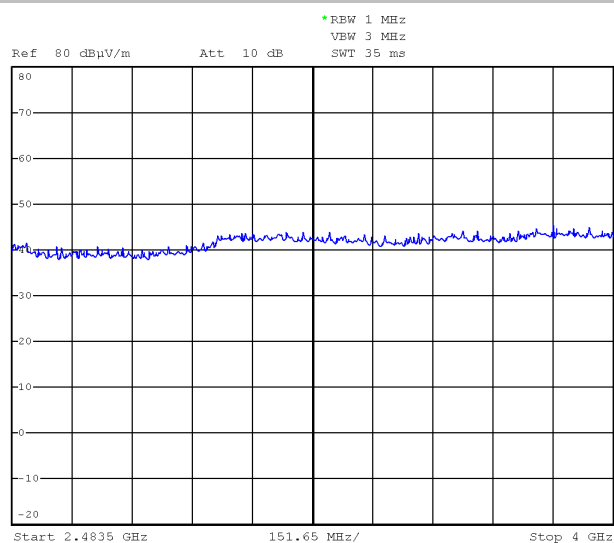
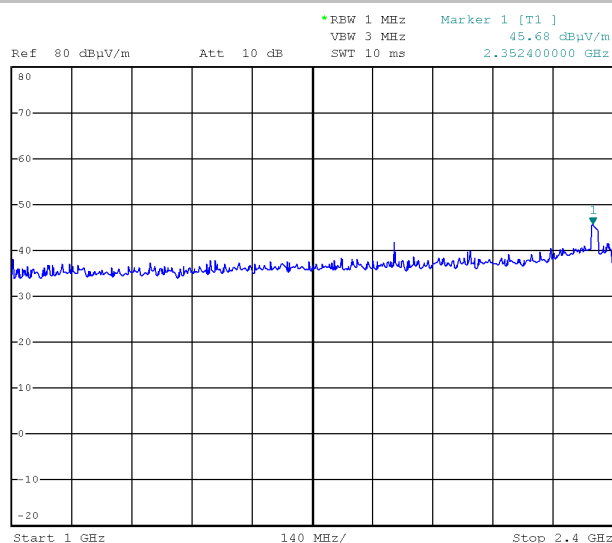


>1,000 MHz - Measurement result of 802.11n HT20 modulation

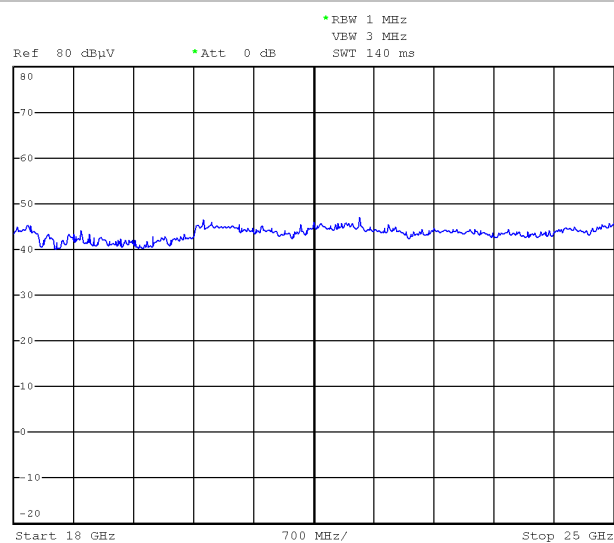
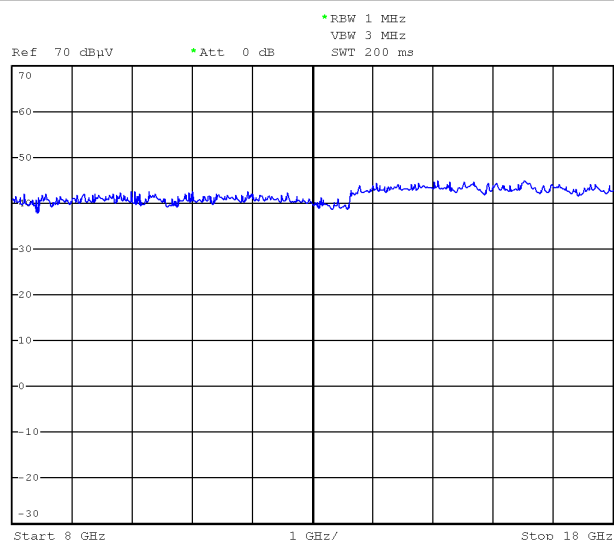
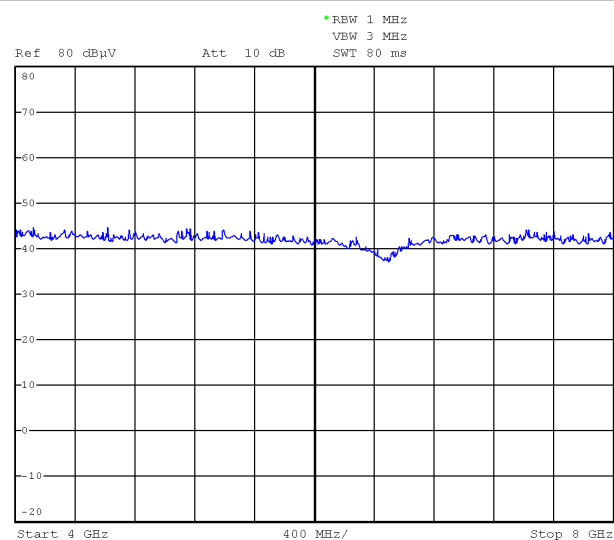
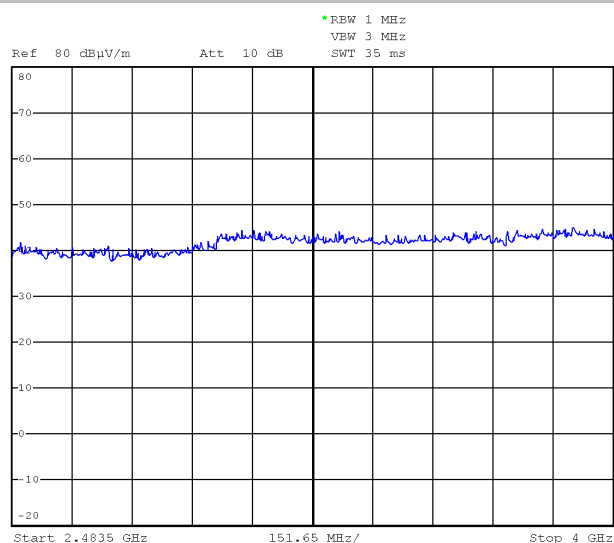
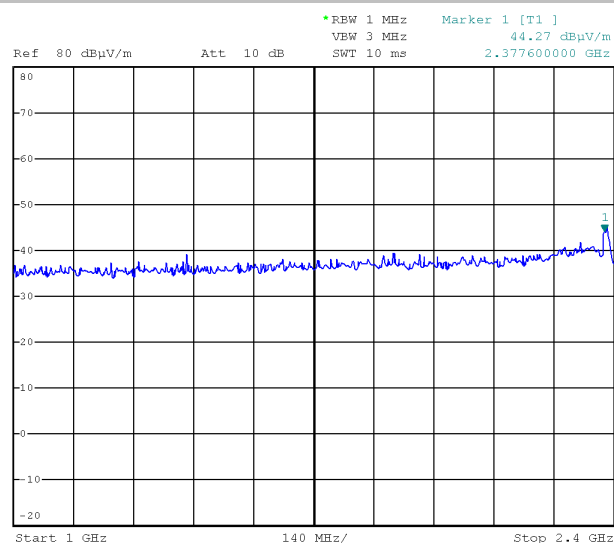
MEASUREMENTS RESULTS - Channel LOWER



MEASUREMENTS RESULTS - Channel middle

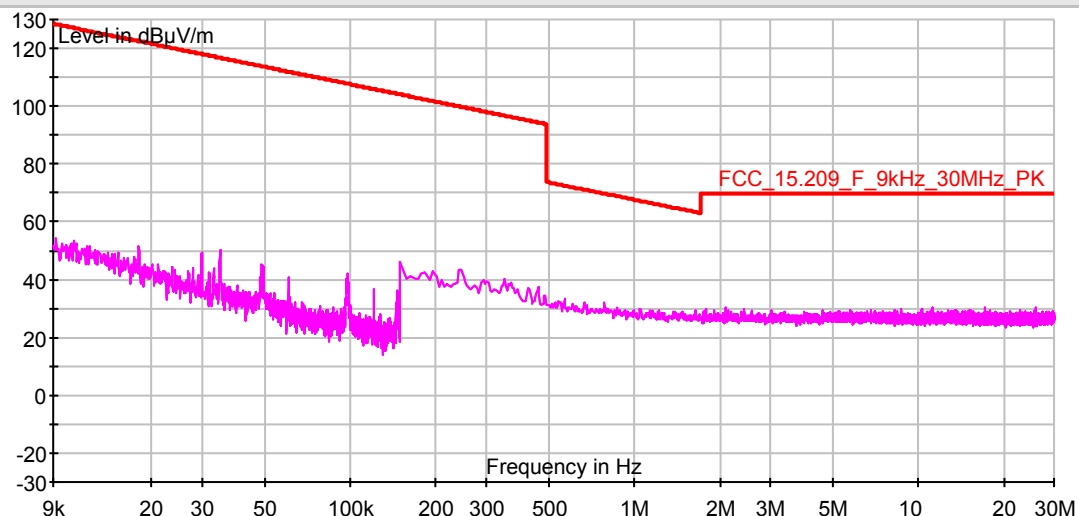


MEASUREMENTS RESULTS - Channel higher

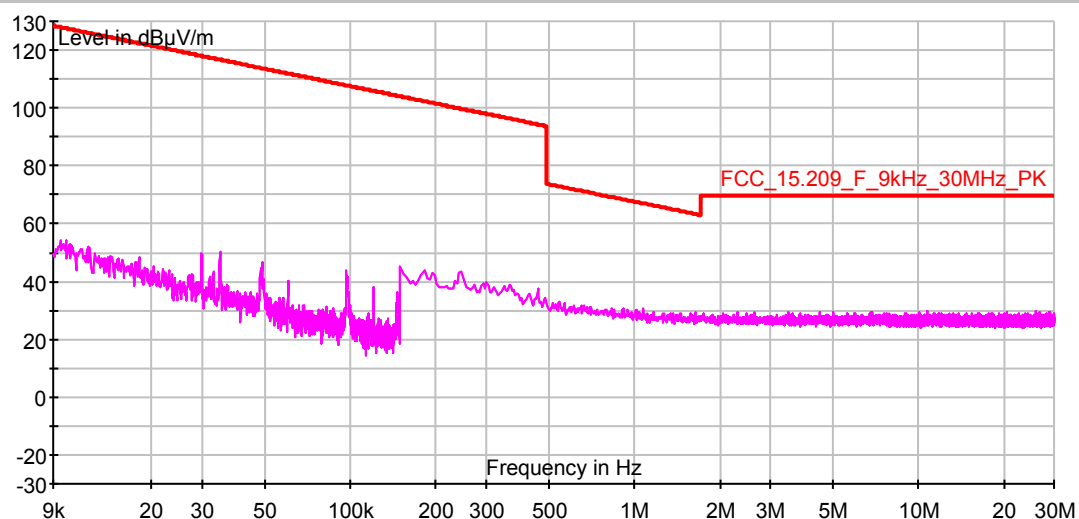


9 kHz÷30 MHz - Measurement result of 802.11n HT40 modulation

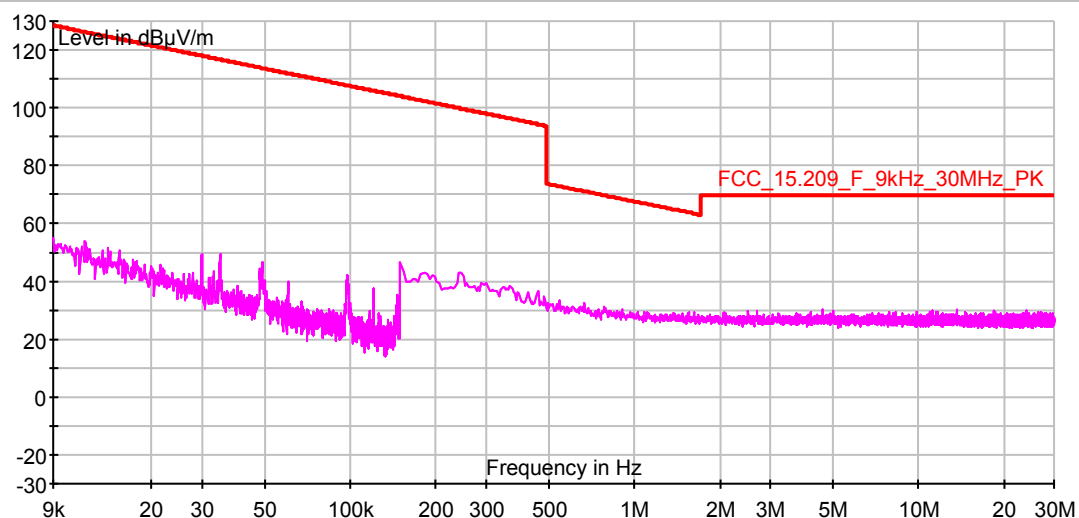
LOWER CHANNEL



MIDDLE CHANNEL

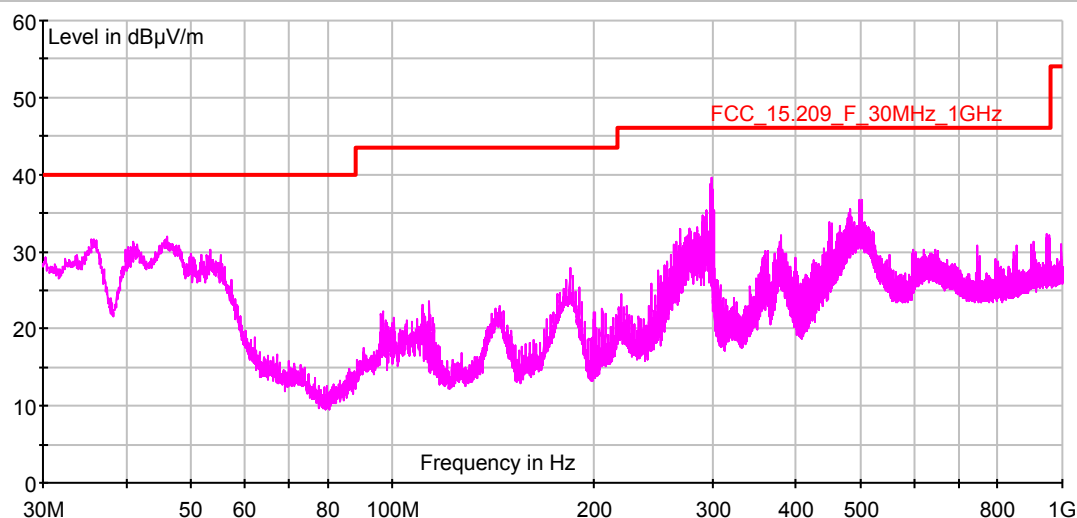


HIGHER CHANNEL

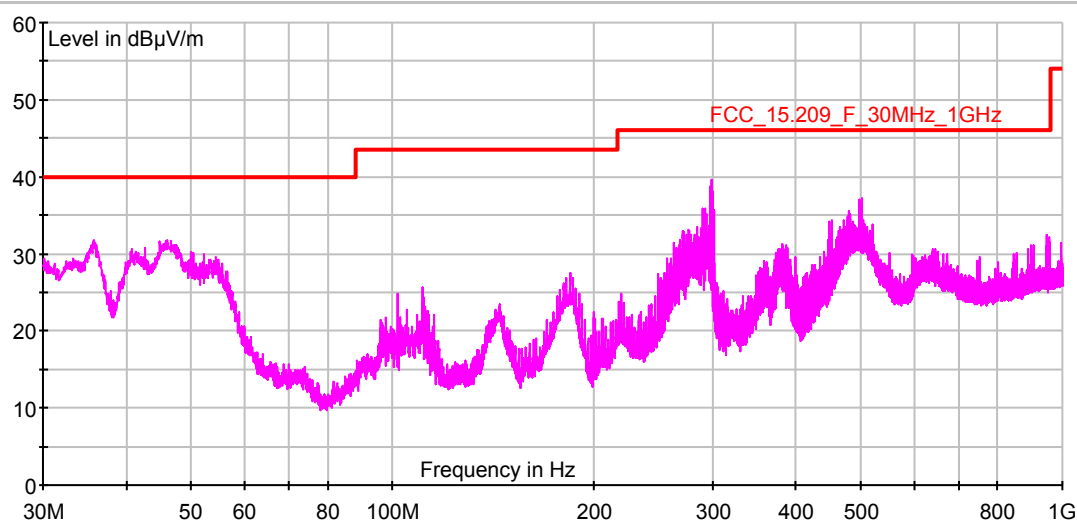


30÷1,000 MHz - Measurement result of 802.11n HT40 modulation

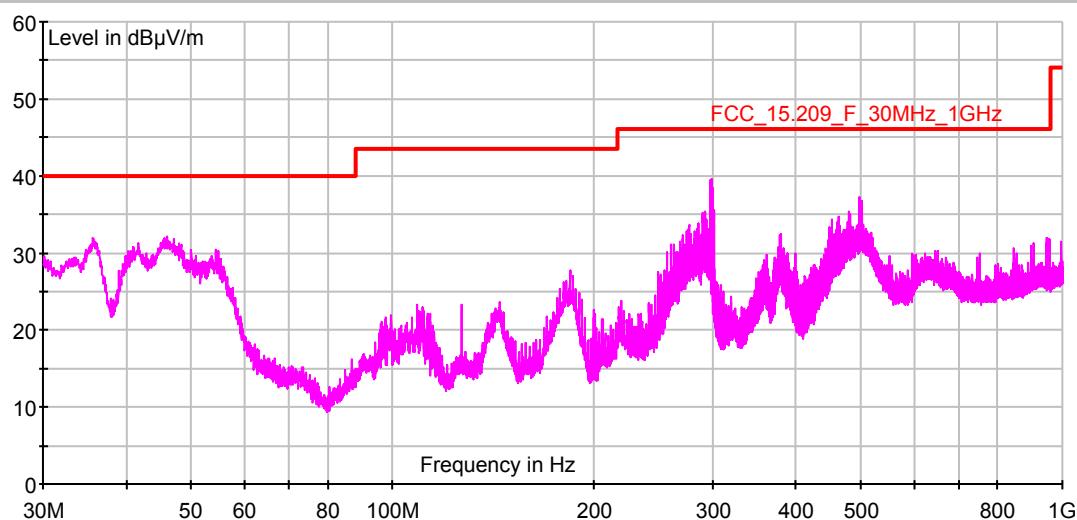
LOWER CHANNEL



MIDDLE CHANNEL

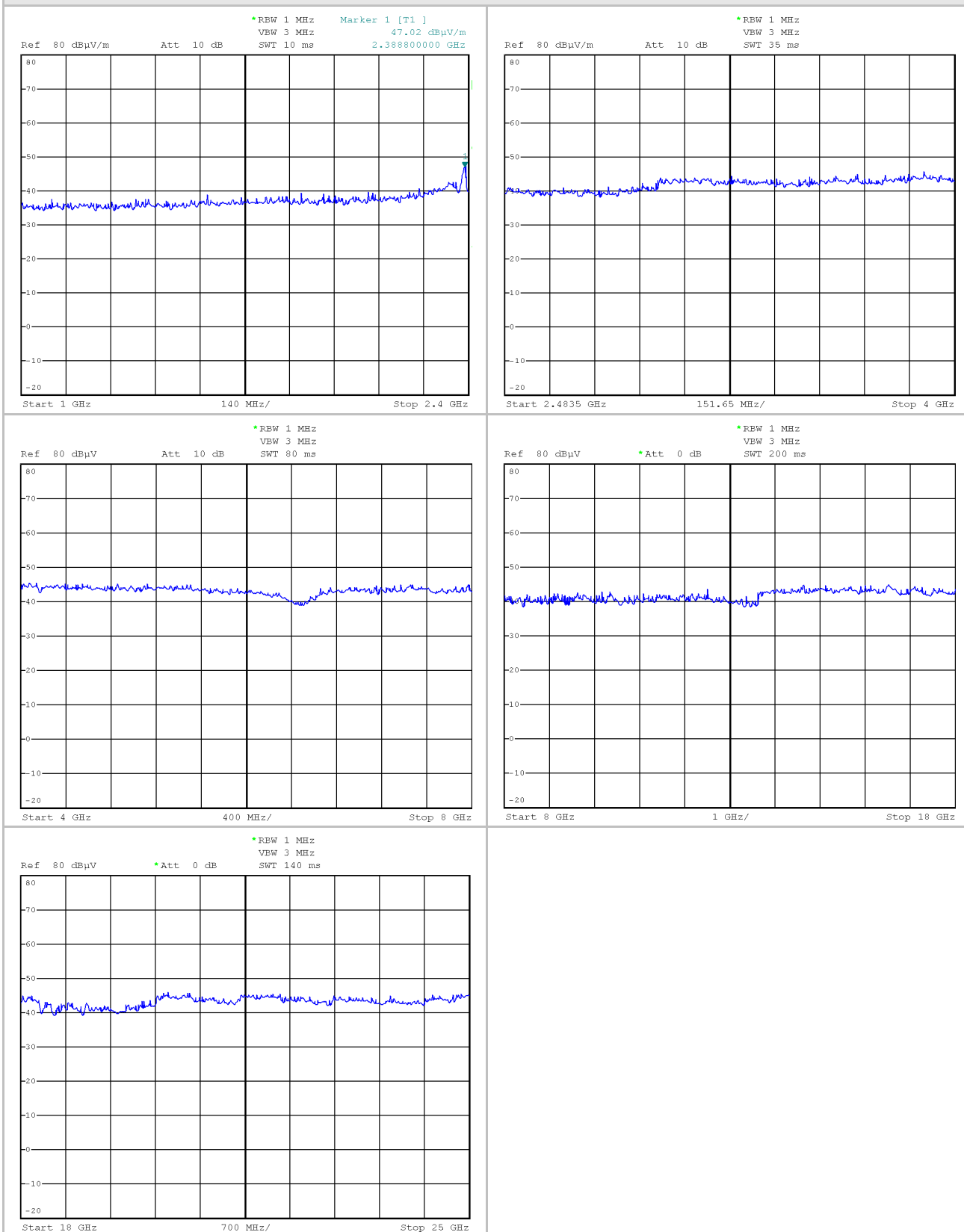


HIGHER CHANNEL

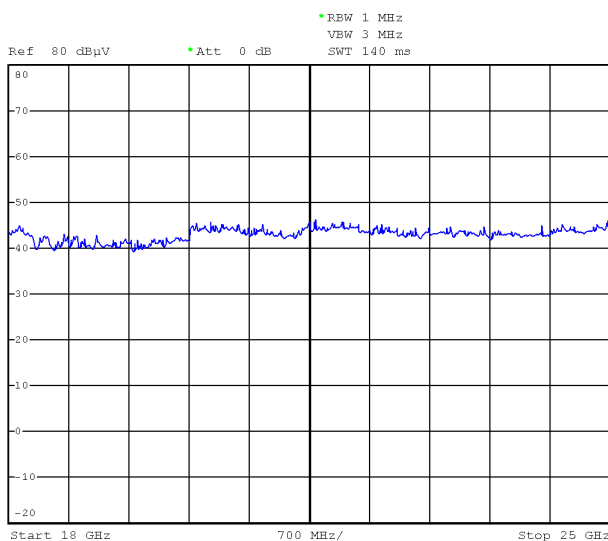
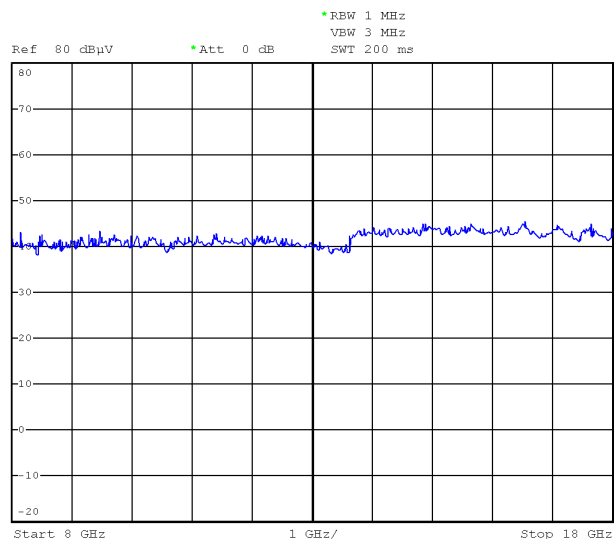
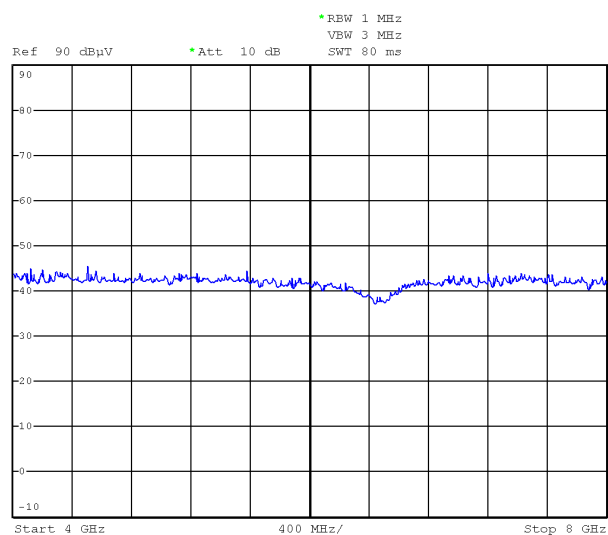
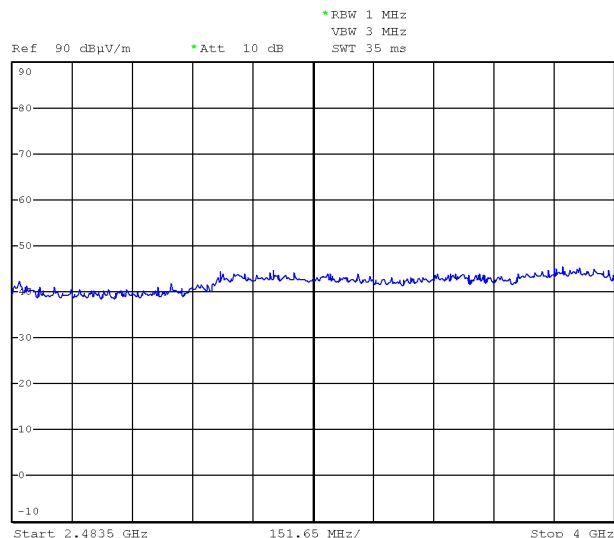
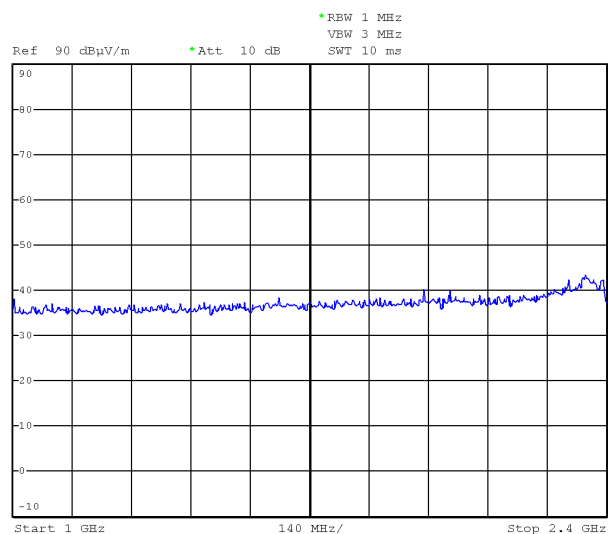


>1,000 MHz - Measurement result of 802.11n HT40 modulation

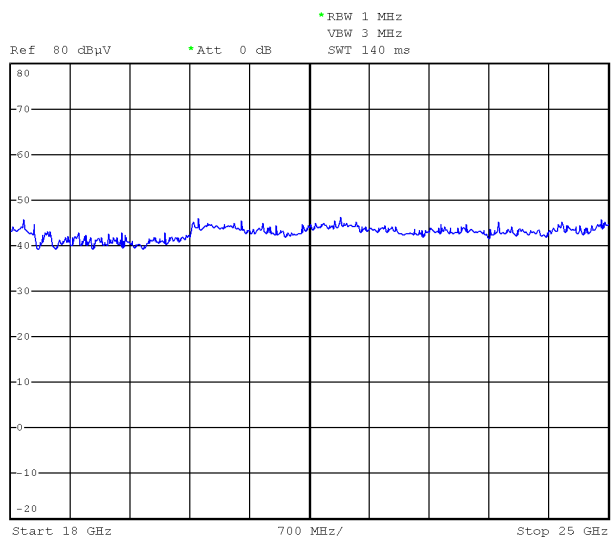
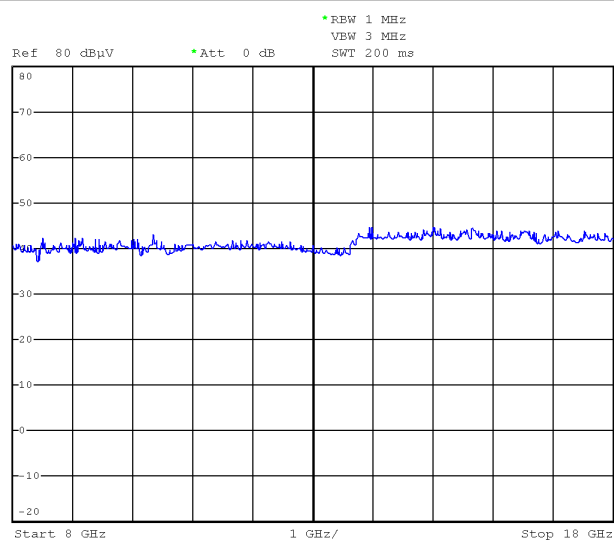
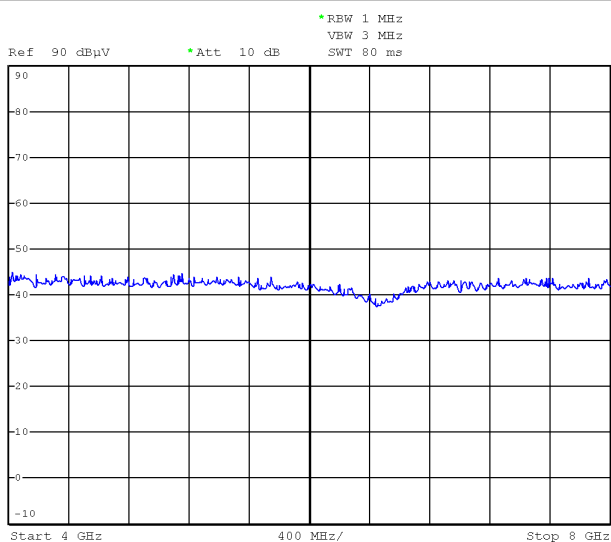
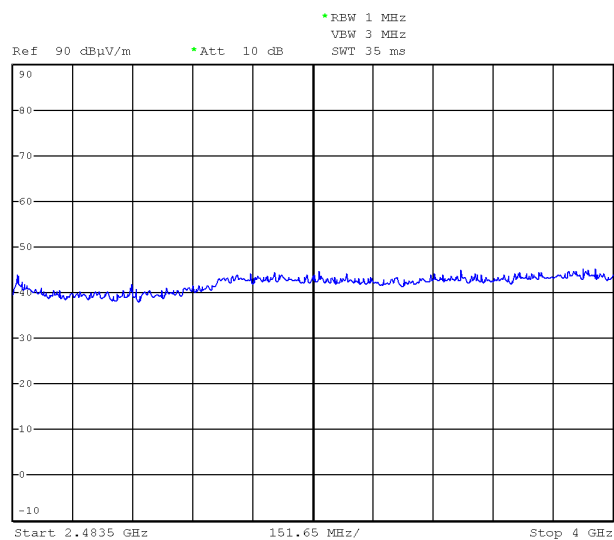
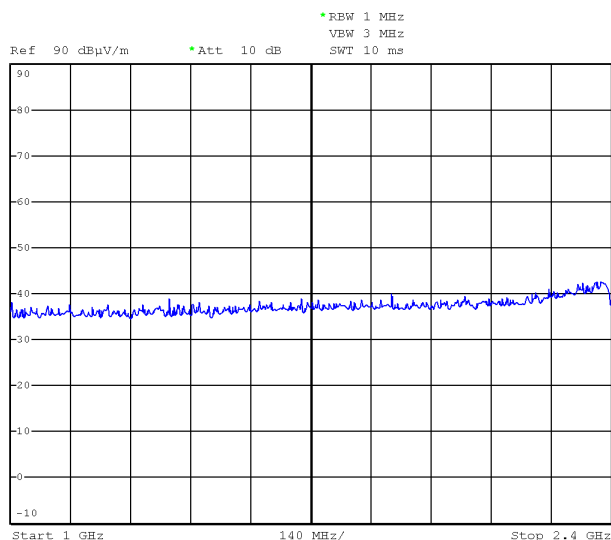
MEASUREMENTS RESULTS - Channel LOWER



MEASUREMENTS RESULTS - Channel middle



MEASUREMENTS RESULTS - Channel higher



7.4 6 dB BANDWIDTH

TEST REQUIREMENT

Spectrum analyzer settings

Span	Wide enough for the measurement to be made
Resolution bandwidth (RBW)	100 kHz
Video bandwidth (VBW)	300 kHz
Sweep time (SWT)	AUTO
Detector function	Peak
Trace	Max hold
EUT operating condition	#1
Remark	None
Testing dates	2020-08-31

TEST RESULT

The EUT meets the requirements of sections 15.247 (a) (2)

TEST PROCEDURE

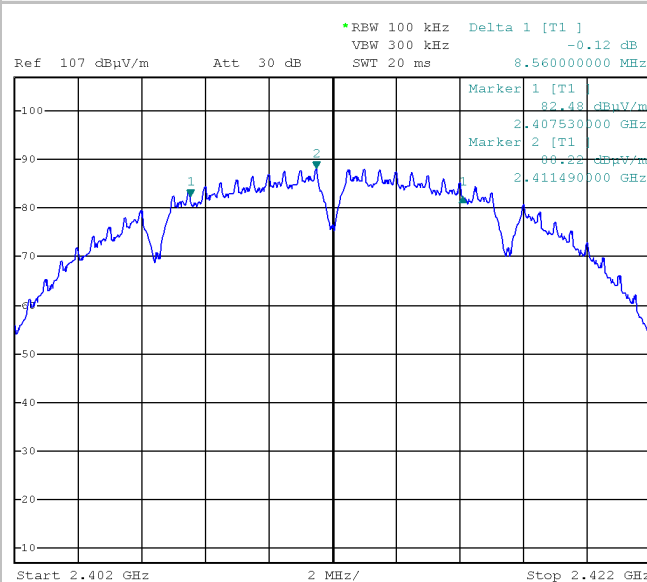
The Channel bandwidth is defined as the total spectrum the power of which is higher than peak power minus 6 dB.

MEASUREMENTS RESULTS

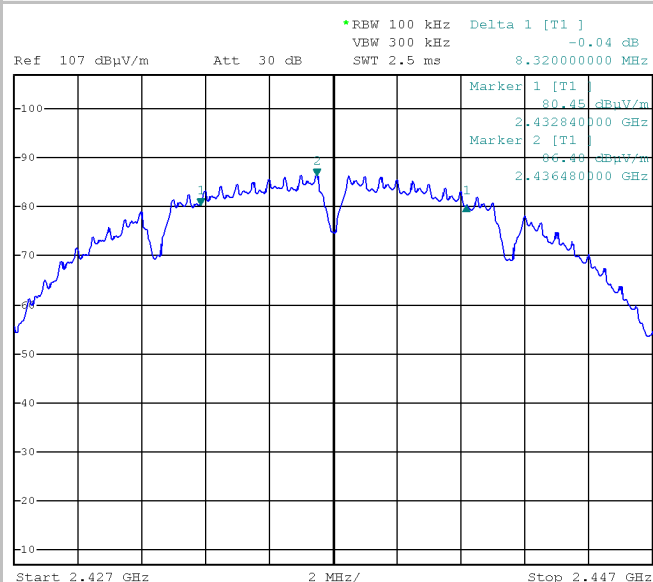
Modulation 802.11b

Channel (No.)	Frequency (MHz)	Channel Bandwidth (MHz)	Plot (No.)
1	2412	8.5600	1
6	2437	8.3200	2
11	2462	8.4800	3

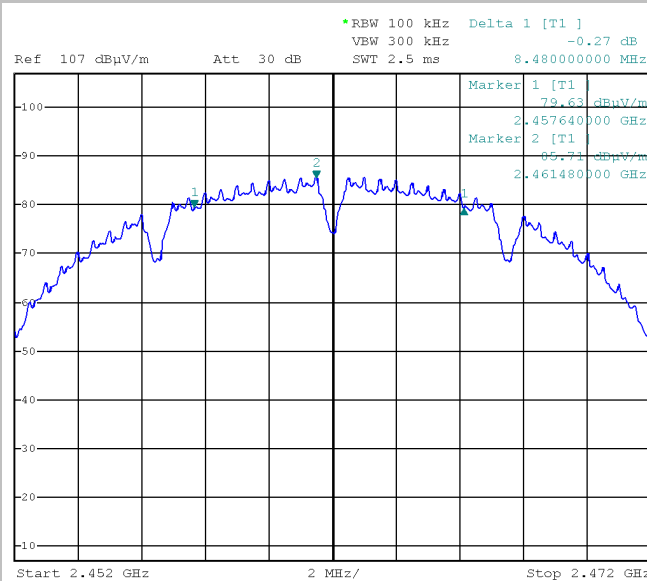
Plot 1



Plot 2



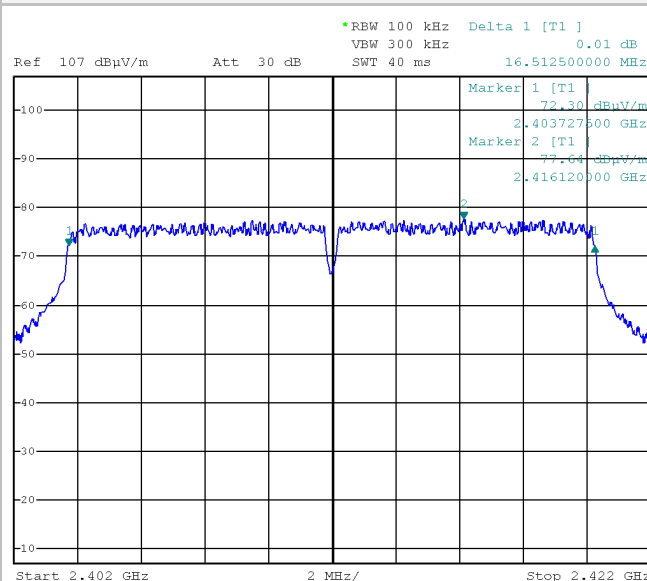
Plot 3



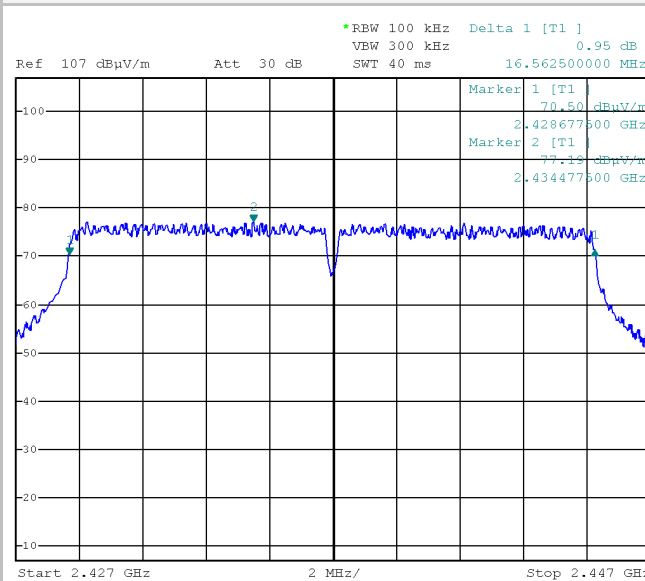
Modulation 802.11g

Channel (No.)	Frequency (MHz)	Channel Bandwidth (MHz)	Plot (No.)
1	2412	16.5125	1
6	2437	16.5625	2
11	2462	16.5275	3

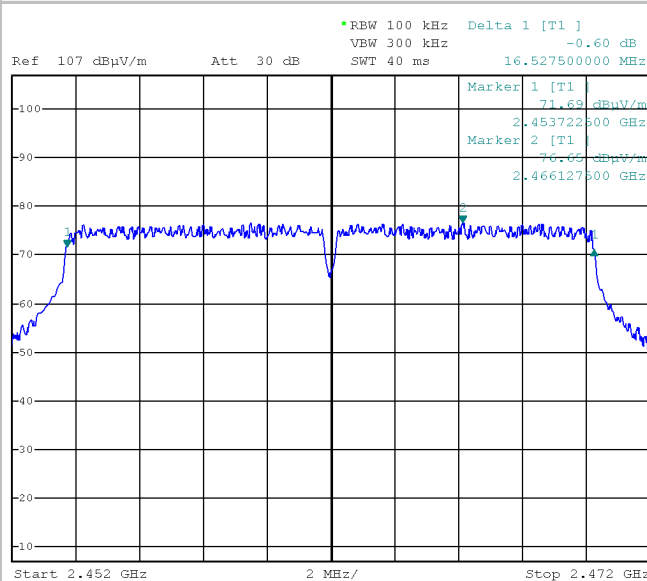
Plot 1



Plot 2



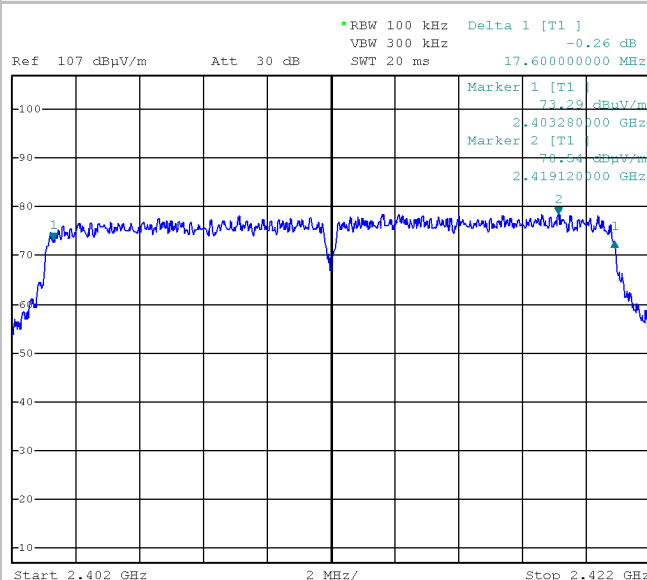
Plot 3



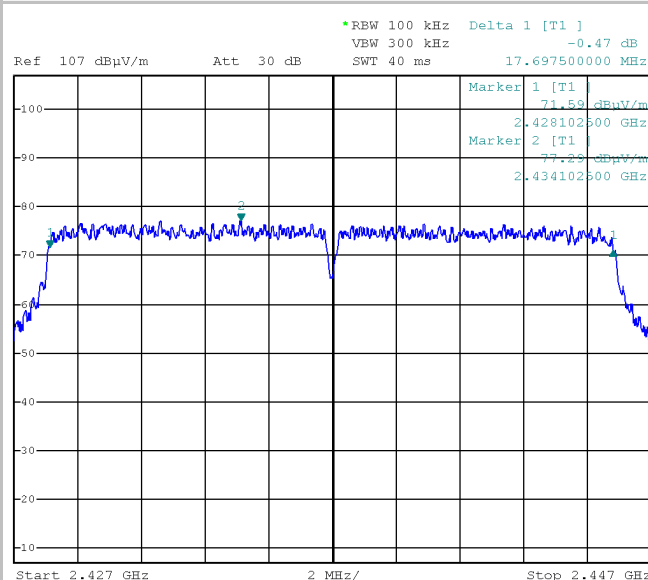
Modulation 802.11n (HT20)

Channel (No.)	Frequency (MHz)	Channel Bandwidth (MHz)	Plot (No.)
1	2412	17.6000	1
6	2437	17.6975	2
11	2462	17.7600	3

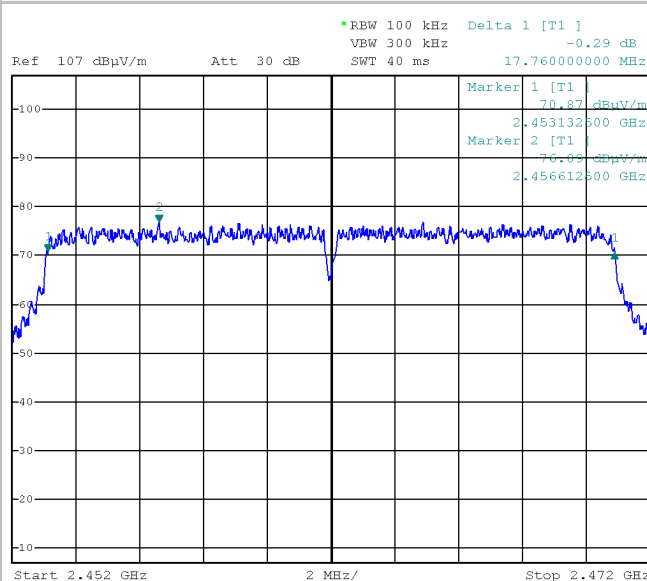
Plot 1



Plot 2



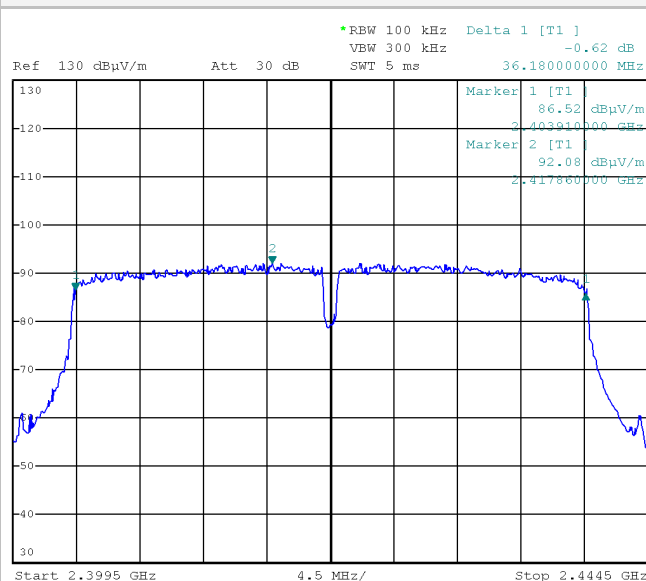
Plot 3



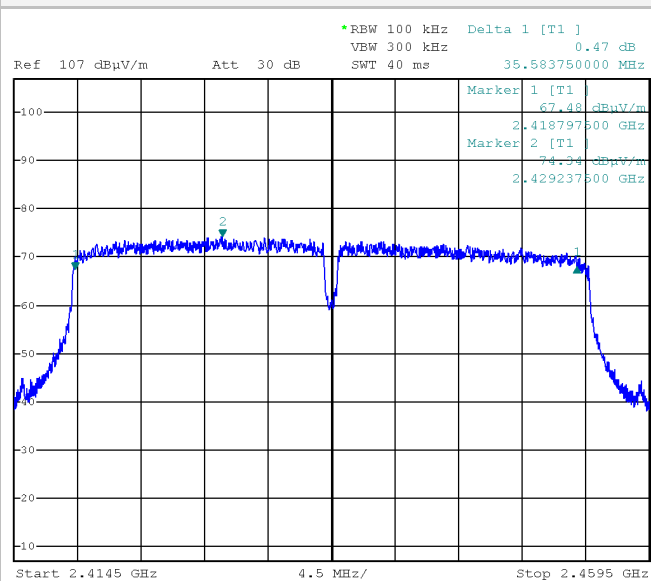
Modulation 802.11n (HT40)

Channel (No.)	Frequency (MHz)	Channel Bandwidth (MHz)	Plot (No.)
3	2422	36.18000	1
6	2437	35.58375	2
9	2452	36.36000	3

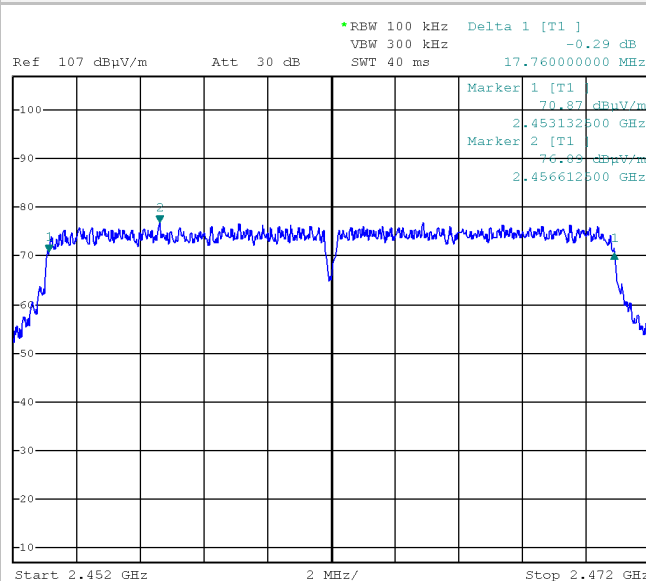
Plot 1



Plot 2



Plot 3



7.5 MAXIMUM PEAK OUTPUT POWER

TEST PROCEDURE

The maximum peak conducted output power was measured using a wideband power sensor.

The power sensor must have a bandwidth that is greater than or equal to the DTS bandwidth and shall utilize a fast, average-responding diode type sensor.

As the transmitter antenna integrated, the temporary RF connector is mounted on PCB of the transmitter at the output antenna port and was connected to the power sensor for conducted measurement.

Turn on the EUT and power meter and then record the peak power value.

Above procedures was repeated on all channels needed to be tested.

Detector function	Peak
EUT operating condition	#1
Remark	/
Testing dates	2020-09-01

Channel	Max conducted output power (dBm)					Result
	802.11b	802.11g	802.11n(HT20)	802.11n(HT40)	Limit	
Lowest	17.65	12.44	12.63	12.24	30	Pass
Middle	17.85	12.82	12.32	12.92		
Highest	17.95	12.93	13.26	13.11		

TEST RESULT

The EUT meets the requirements of sections 15.247 (b) (3)

7.6 BAND-EDGE COMPLIANCE OF RF RADIATED EMISSIONS

TEST REQUIREMENT

Spectrum analyzer settings

Span	Wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation
Resolution bandwidth (RBW)	1 MHz (100 kHz band-edge)
Video bandwidth (VBW)	1 MHz (100 kHz band-edge)
Sweep time (SWT)	Auto
Detector function	Peak
Trace	Max hold
Attenuator	/
Deviation to test procedure	None
EUT operating condition	#1
Remark	None
Testing dates	2020-08-31

TEST RESULT

The EUT meets the requirements of sections 15.247 (d).
All out of band spurious emissions are more 20 dB below the in band power of the fundamental.

LIMITS

-20 dB below peak output power

TEST PROCEDURE

Only for measuring emissions up to 2 MHz removed from the band-edge the "delta" technique for Radiated emissions was used.

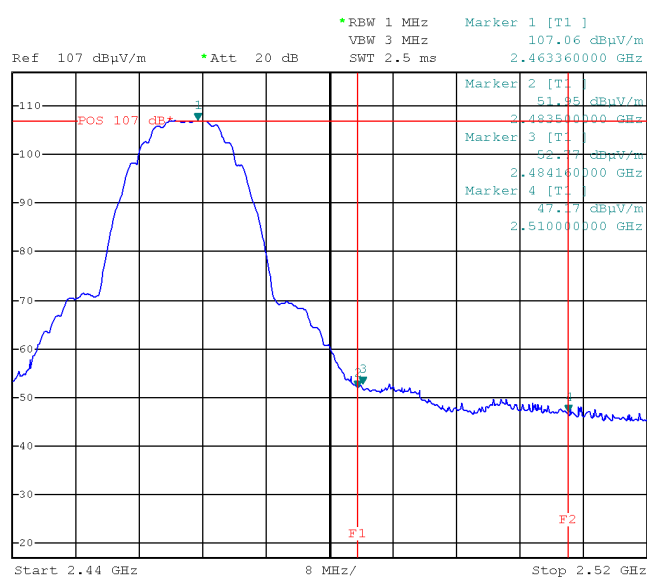
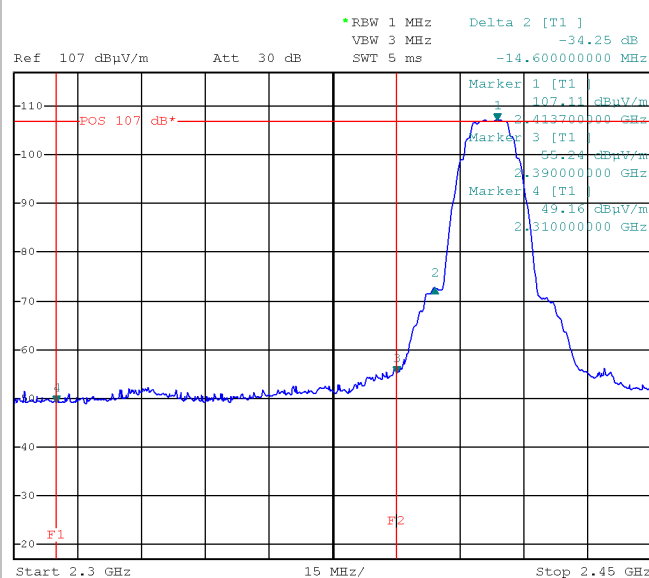
Delta technique: The transmitter output was connected to the spectrum analyser through a test fixture (radio frequency coupling device associated with the dedicated antenna of the equipment under test)

Once the trace is stabilized, by the marker the emission at the band edge (or on the highest modulation product outside of the band, if this level is greater than that at the band edge) was set.

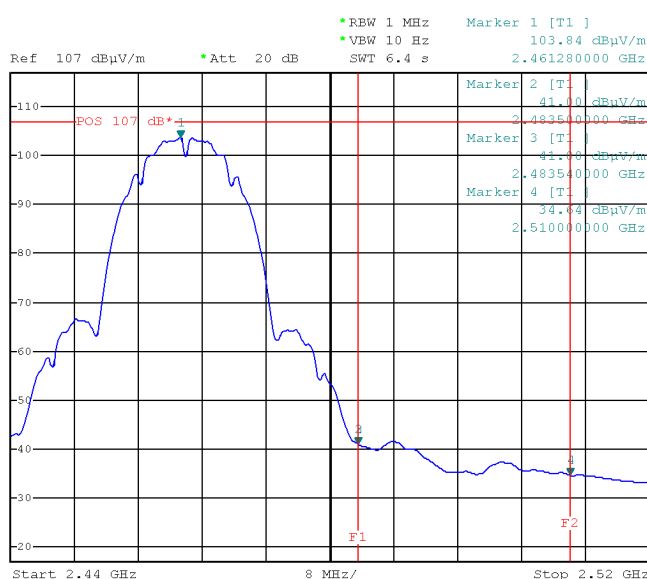
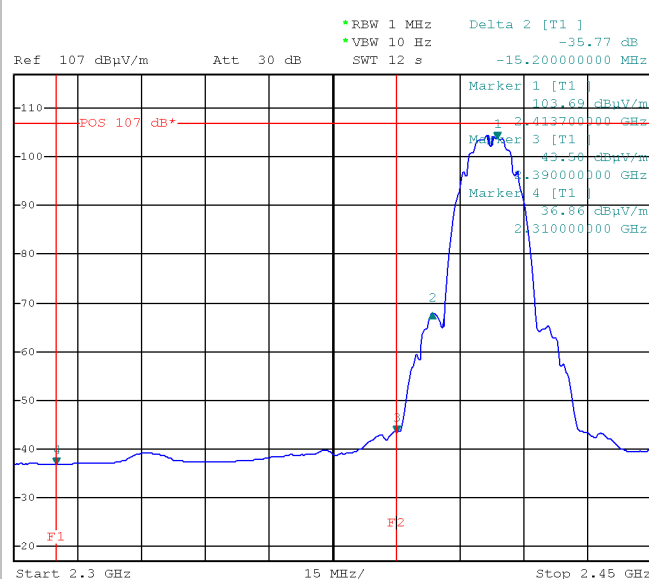
The "n" by the marker-delta function and the marker-to-peak function the peak of the in-band emission was selected. The marker-delta value displayed was compared with the limit specified in this Section

MEASUREMENTS RESULTS Modulation 802.11b

Band-edge (Peak)

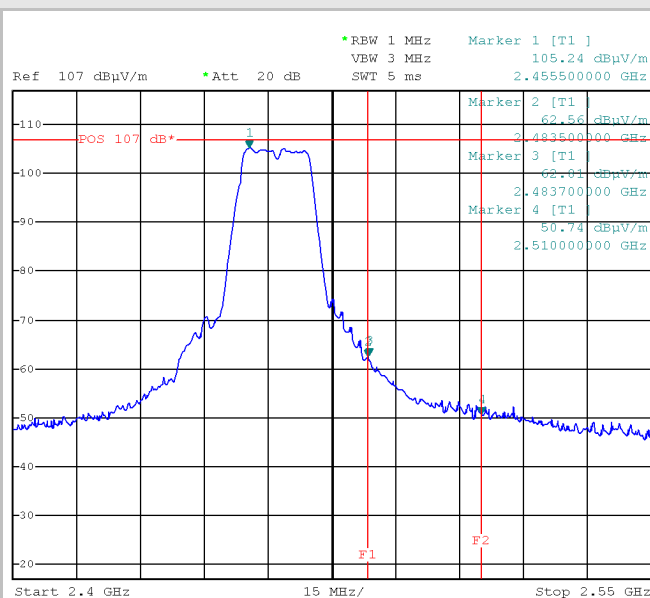
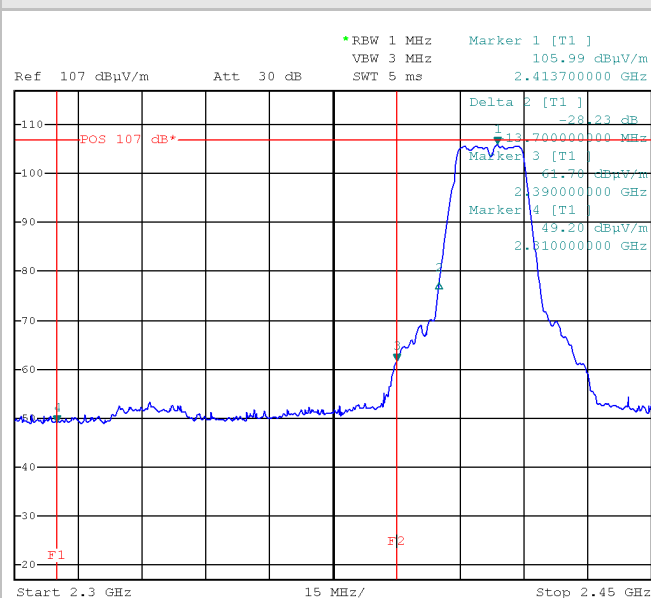


Band-edge (Average)

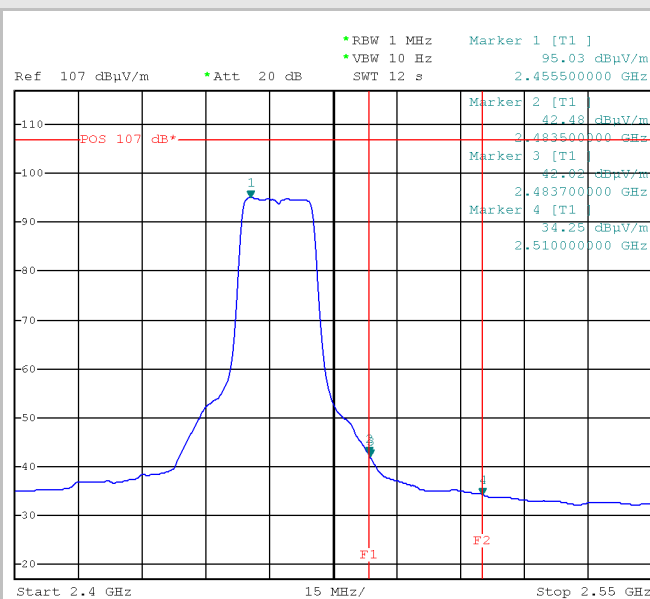
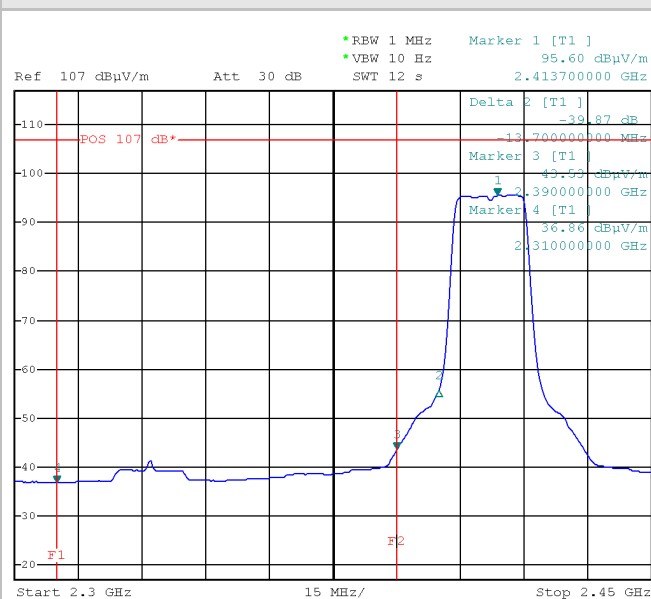


MEASUREMENTS RESULTS Modulation 802.11g

Band-edge (Peak)

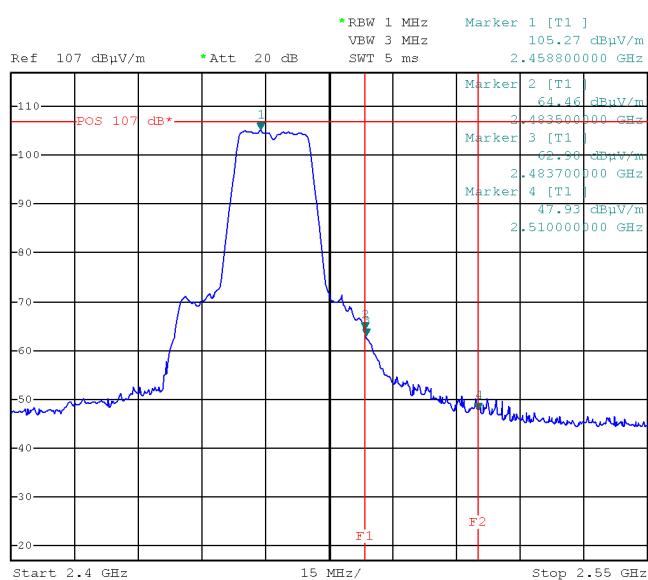
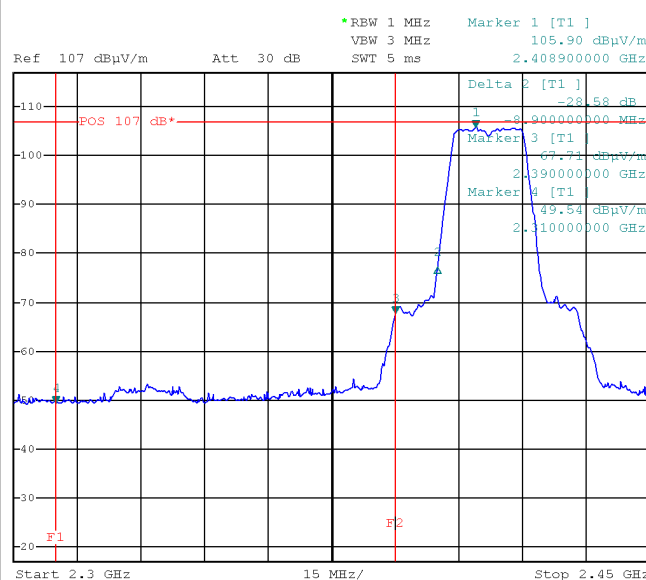


Band-edge (AverAge)

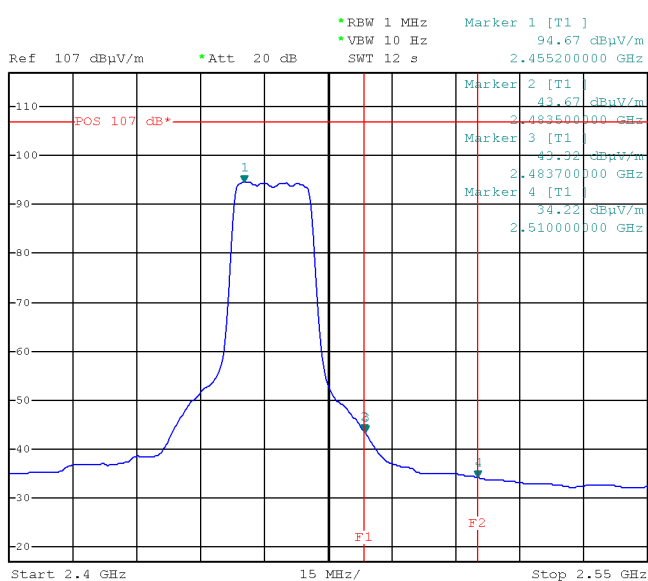
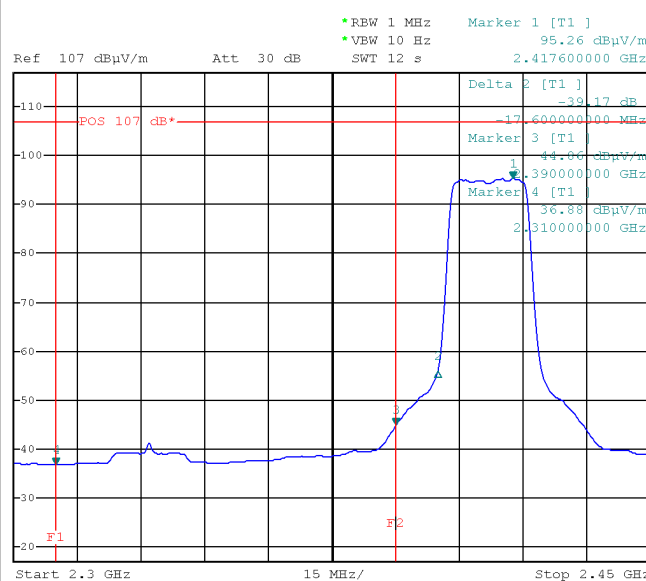


MEASUREMENTS RESULTS Modulation 802.11n (HT20)

Band-edge (Peak)

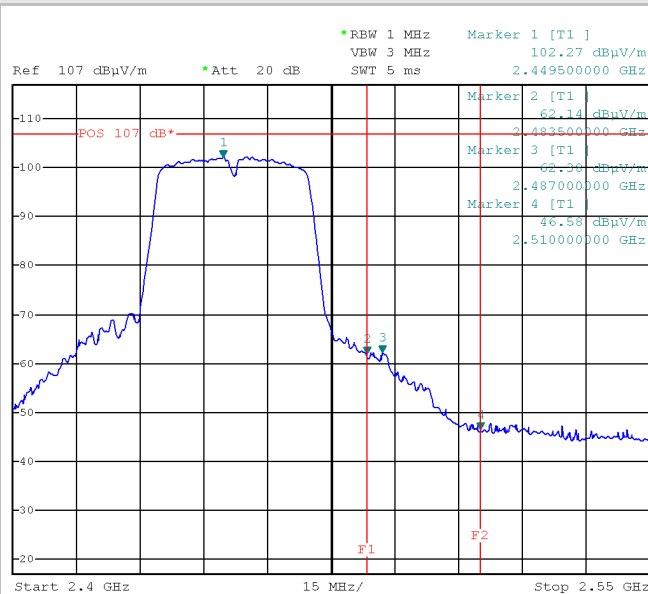
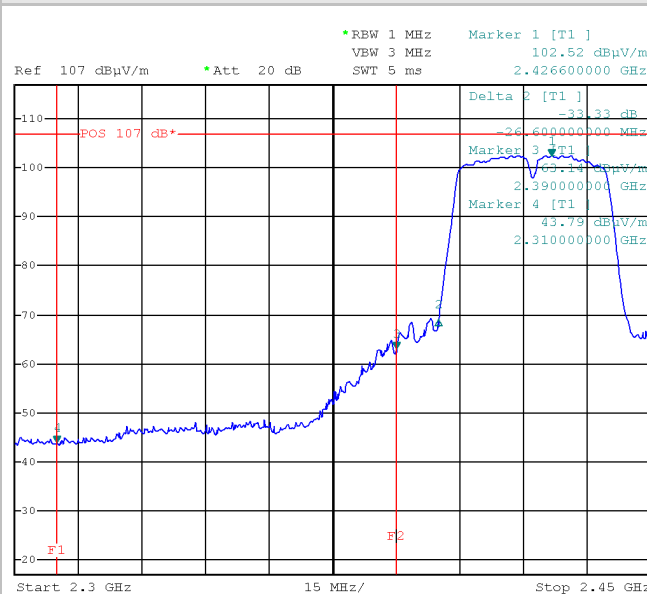


Band-edge (AverAge)

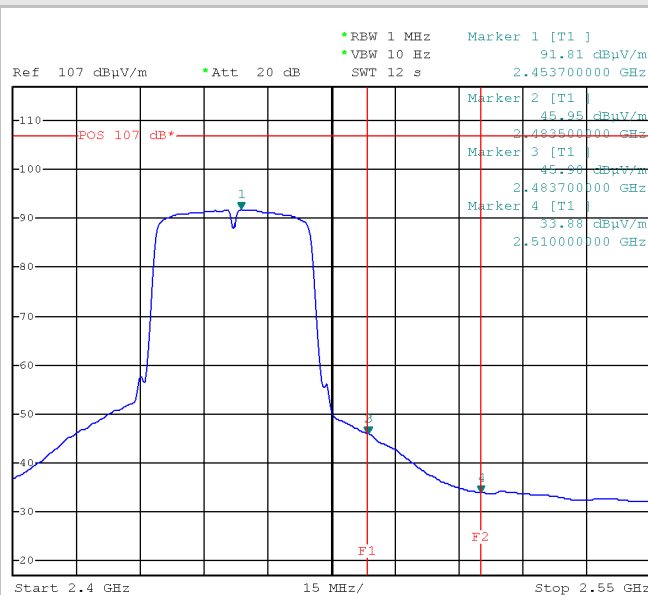
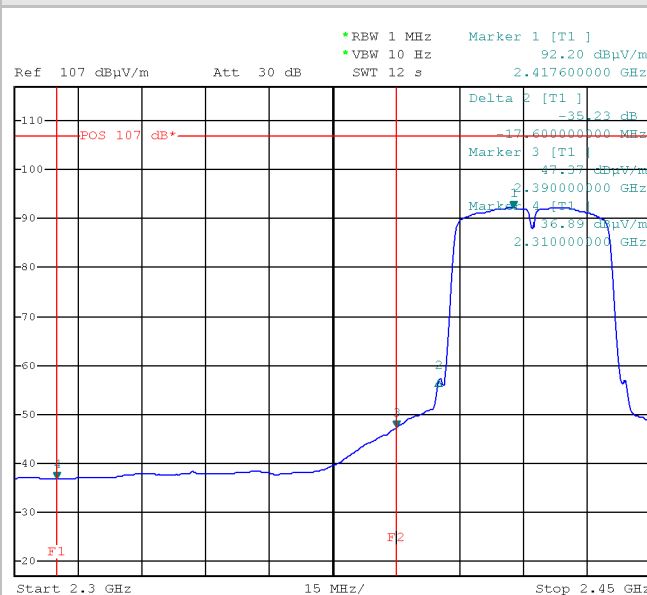


MEASUREMENTS RESULTS Modulation 802.11n (HT40)

Band-edge (PeakK)



Band-edge (AveAge)



7.7 CONDUCTED EMISSIONS OUTSIDE THE BAND

TEST REQUIREMENT

Spectrum analyzer settings

Span	/
Resolution bandwidth (RBW)	100 kHz
Video bandwidth (VBW)	300 kHz
Sweep time (SWT)	as necessary to capture the entire dwell time
Detector function	Peak
Trace	Max hold
Attenuator	/
Deviation to test procedure	None
EUT operating condition	#1
Remark	None
Testing dates	2020-09-01

TEST RESULT

The EUT meets the requirements of sections 15.247 (d)
All out of band spurious emissions are more 20 dB below the in band power of the fundamental.

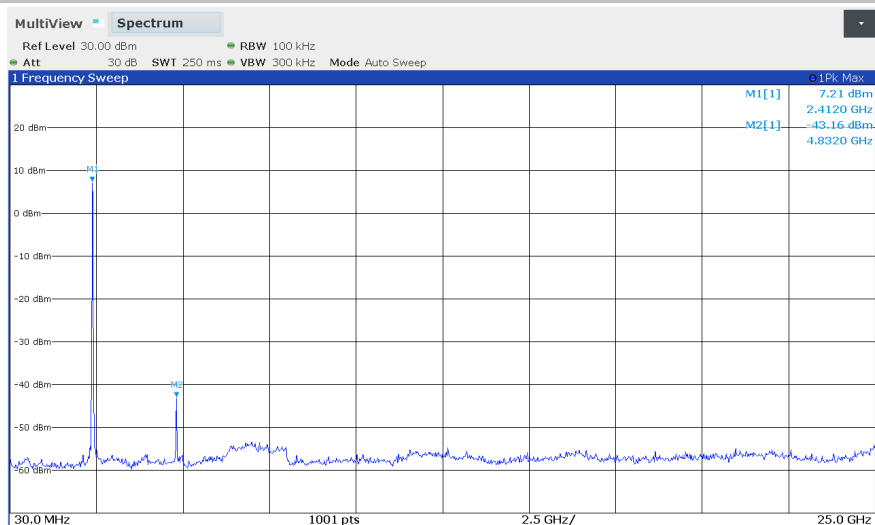
LIMITS

-20 dB below peak output power

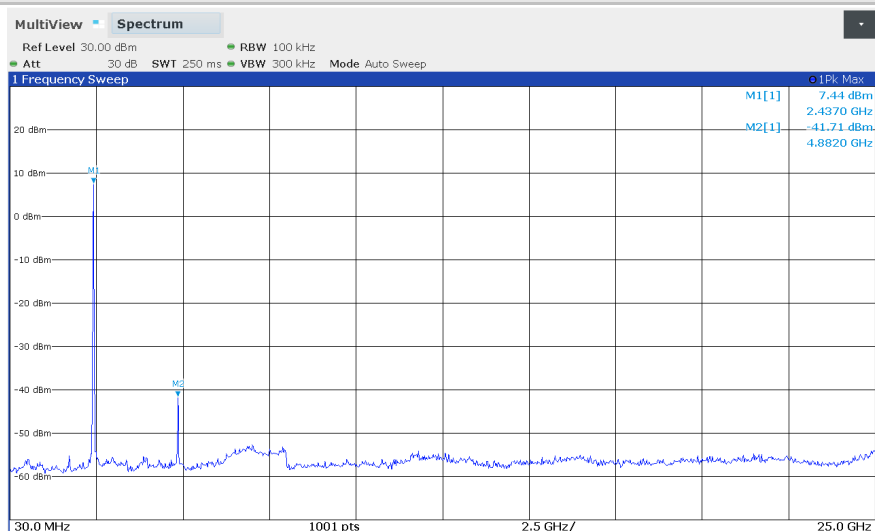
TEST PROCEDURE

As the transmitter antenna is integrated, the temporary RF connector is mounted on PCB.
The conducted spurious emissions were measured conducted using a spectrum analyzer at low, middle, and high channels.

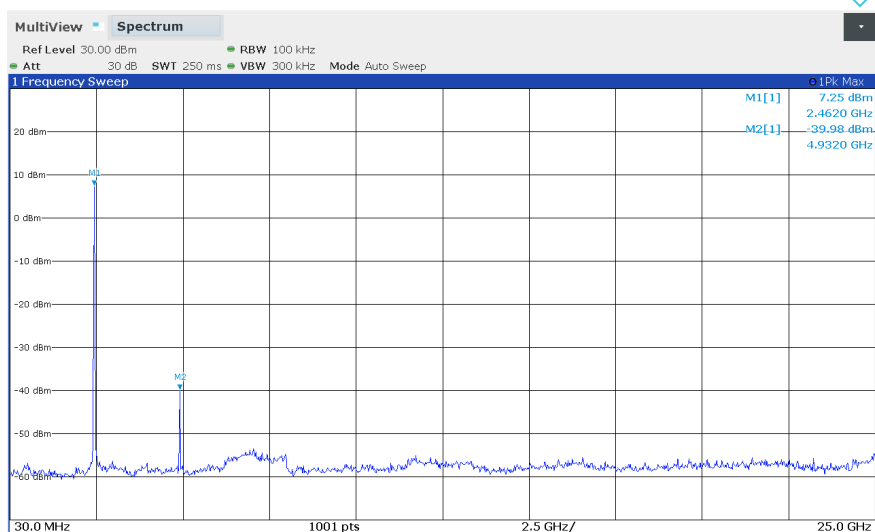
MEASUREMENTS RESULTS - Modulation 802.11b lower



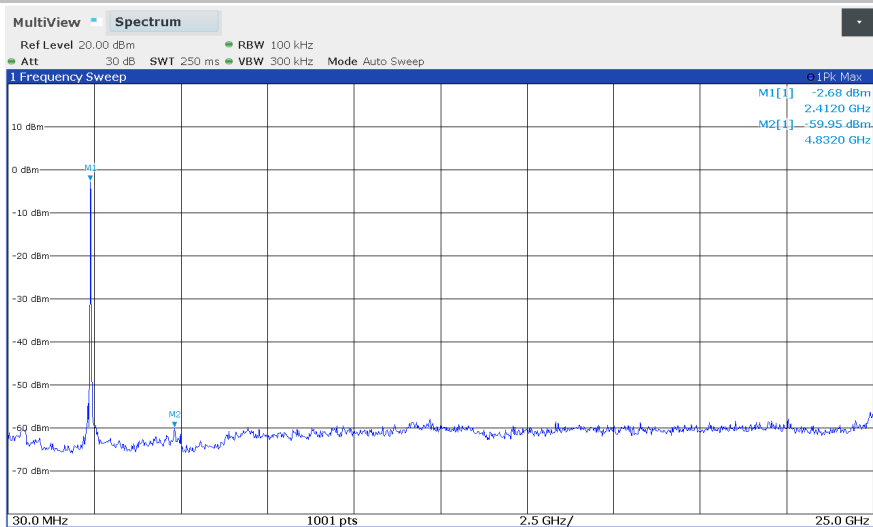
MEASUREMENTS RESULTS - Modulation 802.11b middle



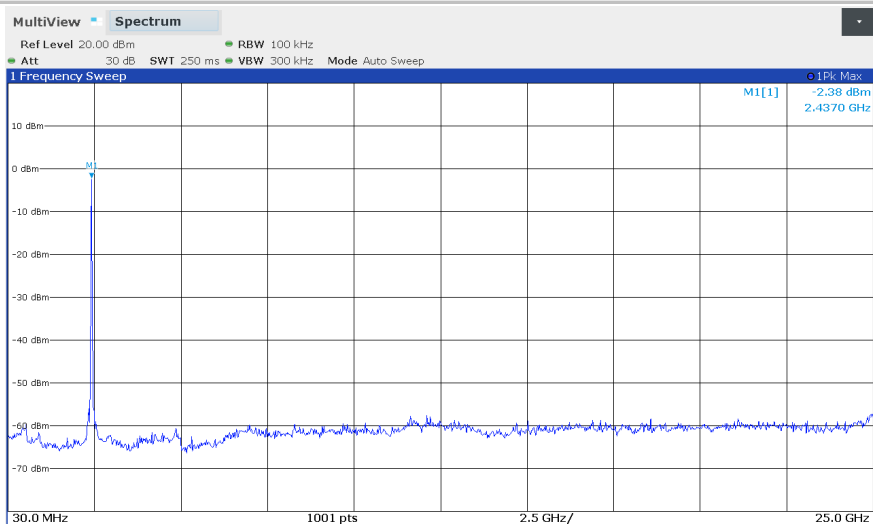
MEASUREMENTS RESULTS - Modulation 802.11b higher



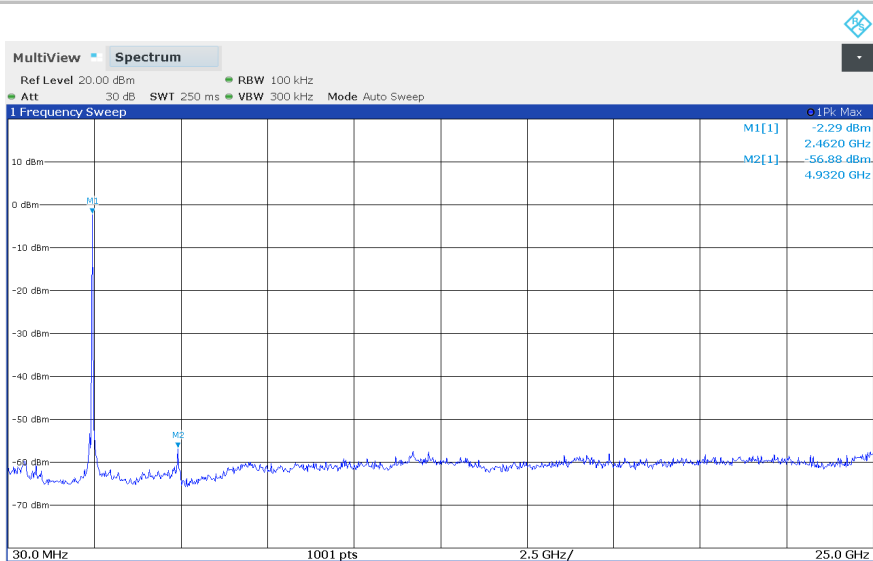
MEASUREMENTS RESULTS - Modulation 802.11g lower



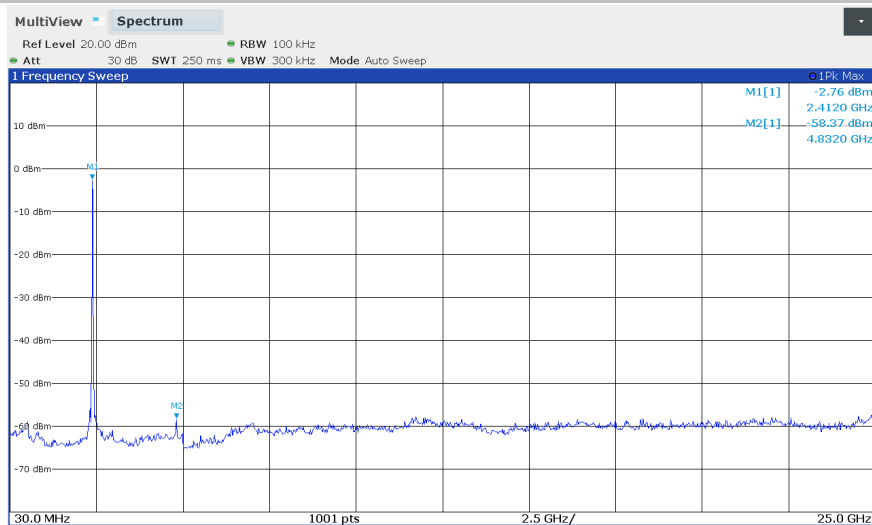
MEASUREMENTS RESULTS - Modulation 802.11g middle



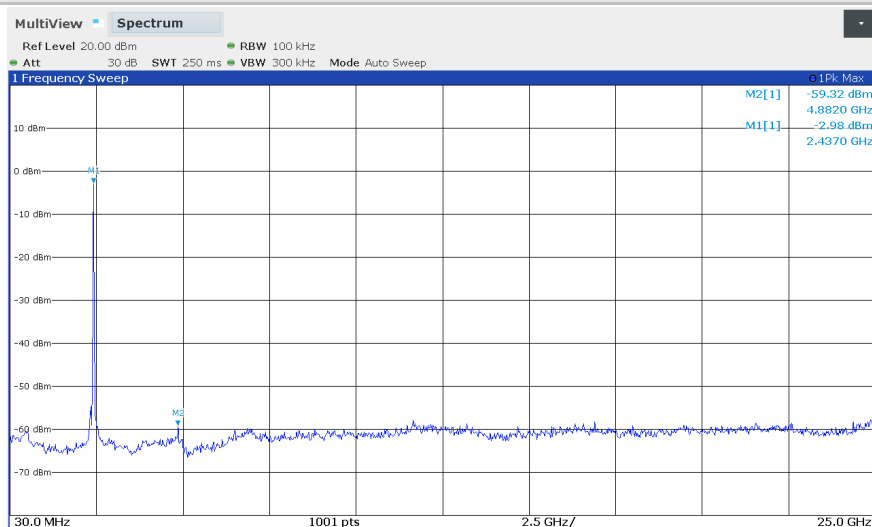
MEASUREMENTS RESULTS - Modulation 802.11g higher



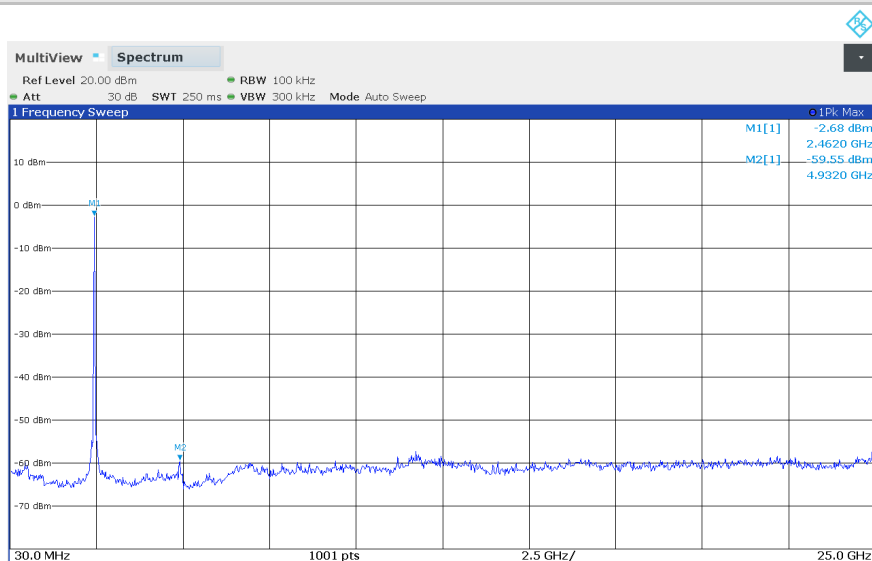
MEASUREMENTS RESULTS - Modulation 802.11n HT20 lower



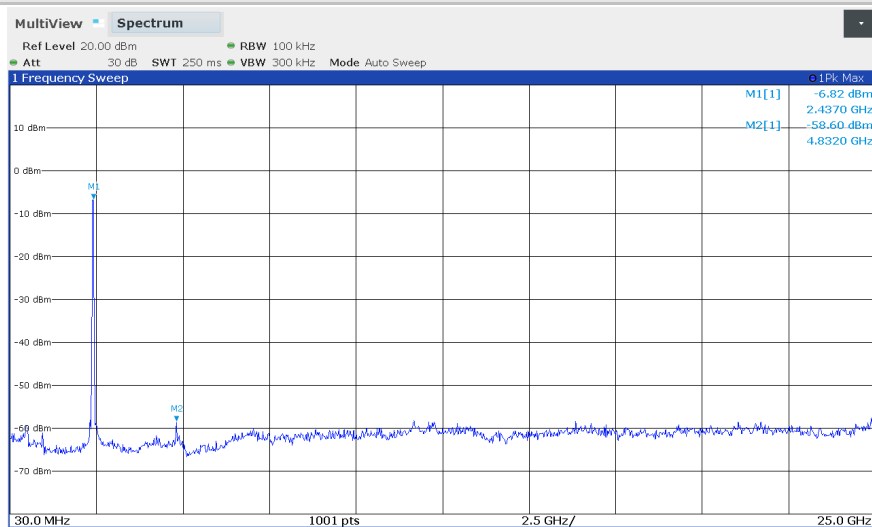
MEASUREMENTS RESULTS - Modulation 802.11n HT20 middle



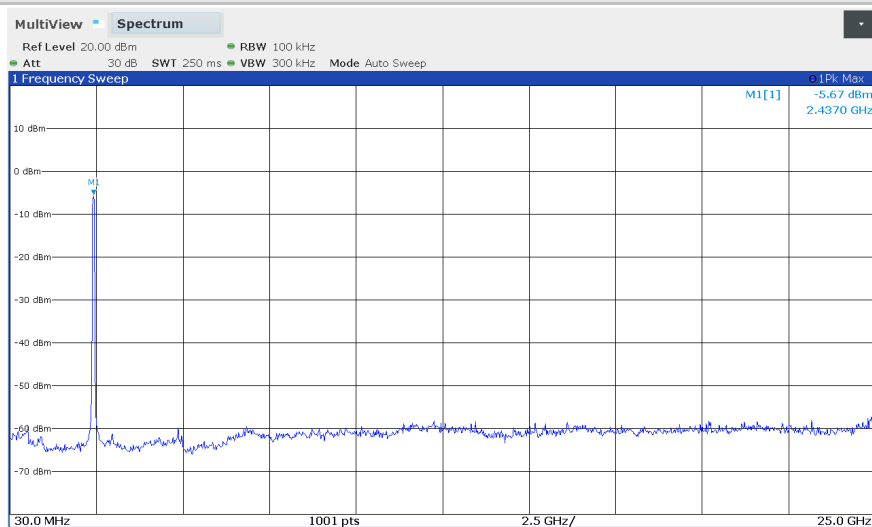
MEASUREMENTS RESULTS - Modulation 802.11n HT20 higher



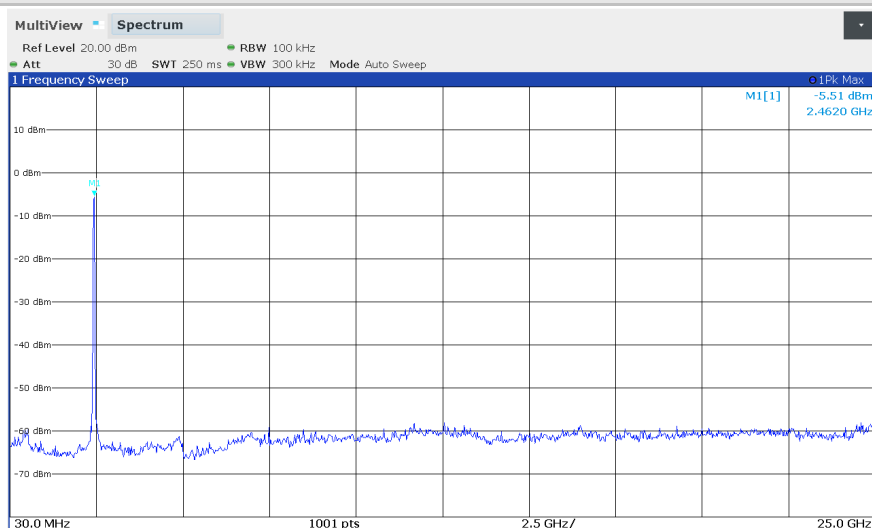
MEASUREMENTS RESULTS - Modulation 802.11n HT40 lower



MEASUREMENTS RESULTS - Modulation 802.11n HT40 middle



MEASUREMENTS RESULTS - Modulation 802.11n HT40 higher



7.8 TRANSMITTER POWER SPECTRAL DENSITY

TEST REQUIREMENT	
Spectrum analyzer settings	
Span	1.5 MHz
Resolution bandwidth (RBW)	3 kHz
Video bandwidth (VBW)	10 kHz
Sweep time (SWT)	500 s
Detector function	Peak
Trace	Max hold
Attenuator	/
Deviation to test procedure	None
EUT operating condition	#1
Remark	None
Testing dates	2020-09-01

TEST RESULT
The EUT meets the requirements of sections 15.247 (e)

LIMITS
8 dBm in 3 kHz bandwidth.

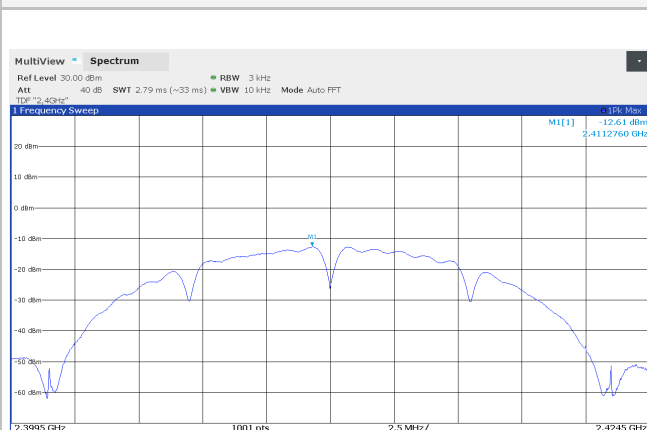
TEST PROCEDURE
<p>As the transmitter antenna is integrated, the temporary RF connector is mounted on PCB.</p> <p>The conducted power spectral density were measured using a spectrum analyzer at low, middle, and high channels.</p> <p>After trace stabilisation, the marker shall be set on the signal peak. The indicated level is the power spectral density.</p>

MEASUREMENTS RESULTS

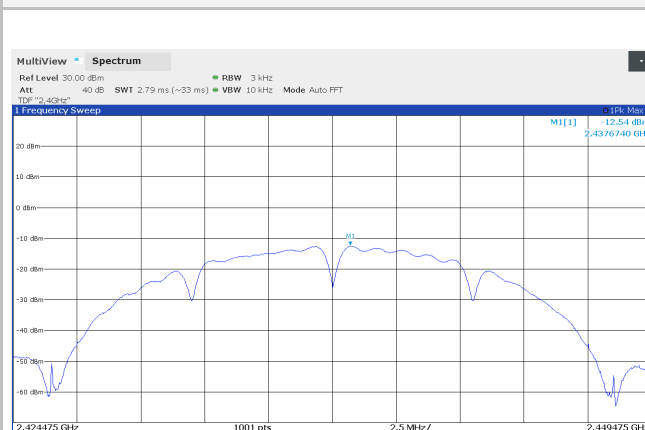
Modulation 802.11b

Channel (No.)	Frequency (MHz)	Measured Power (dBm)	Limit (dBm)	Plot (No.)
1	2412	-12.61	8	1
6	2437	-12.54	8	2
11	2462	-12.06	8	3

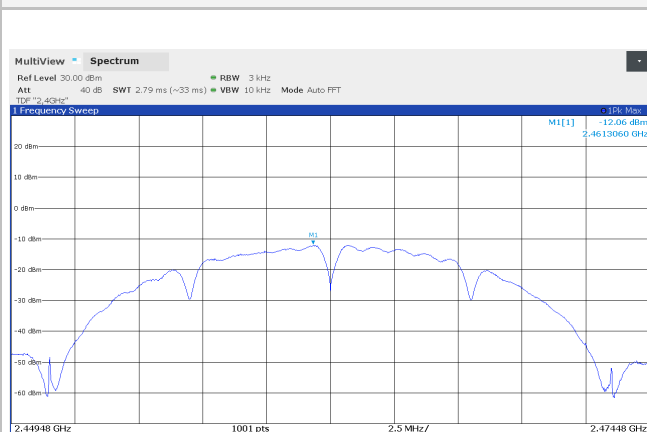
Plot 1



Plot 2



Plot 3

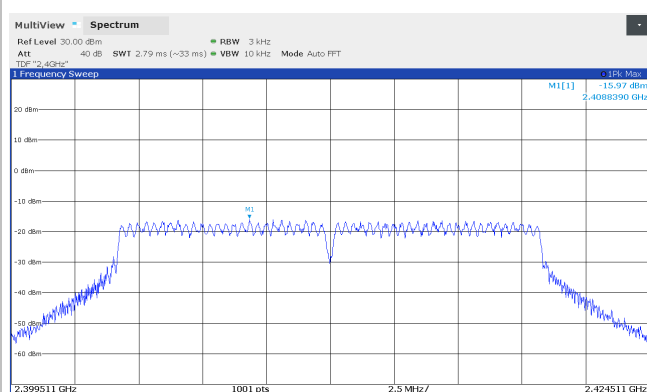


/

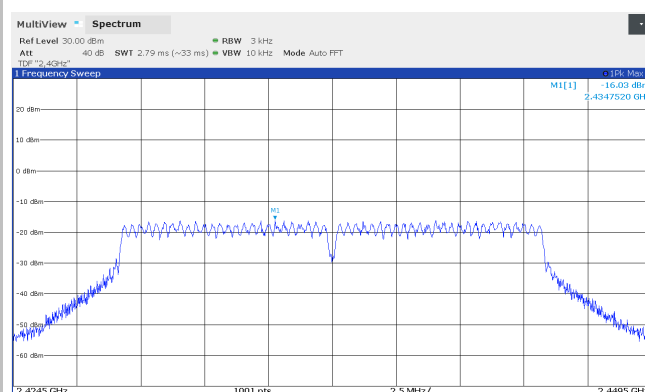
Modulation 802.11g

Channel (No.)	Frequency (MHz)	Measured Power (dBm)	Limit (dBm)	Plot (No.)
1	2412	-15.97	8	1
6	2437	-16.03	8	2
11	2462	-15.46	8	3

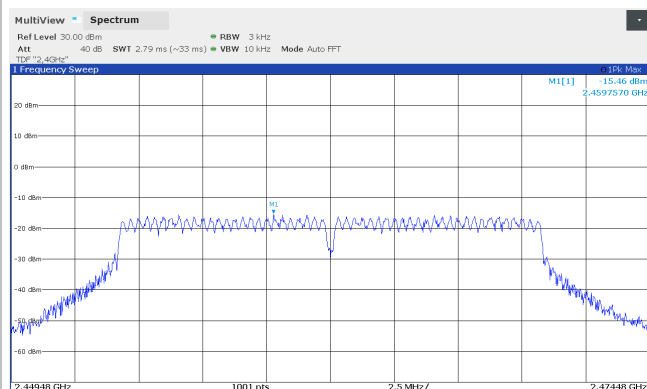
Plot 1



Plot 2



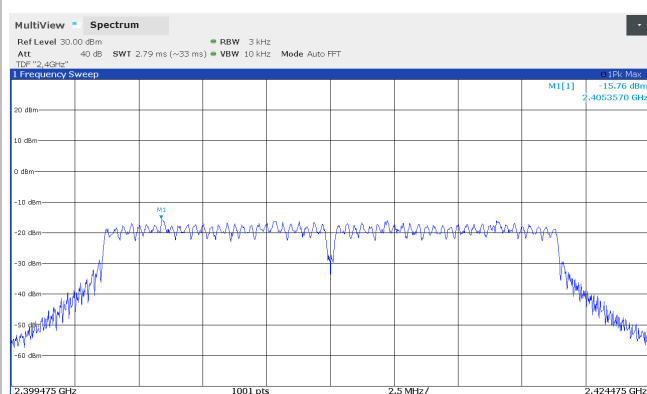
Plot 3



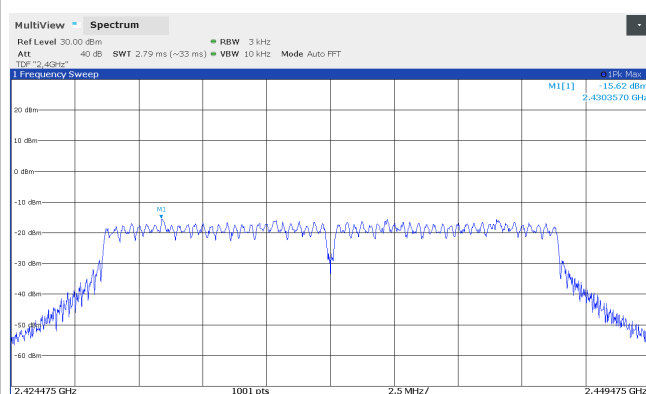
Modulation 802.11n HT20

Channel (No.)	Frequency (MHz)	Measured Power (dBm)	Limit (dBm)	Plot (No.)
1	2412	-15.76	8	1
6	2437	-15.62	8	2
11	2462	-15.01	8	3

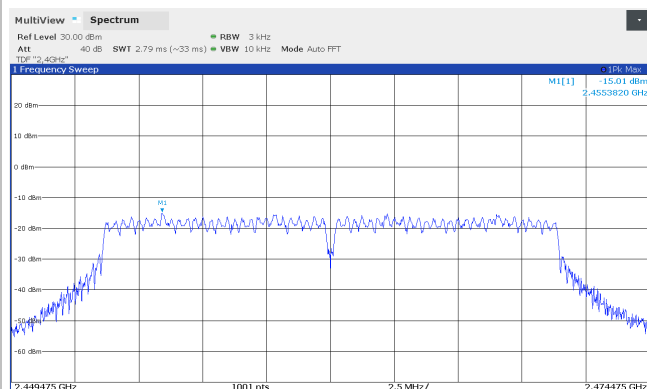
Plot 1



Plot 2



Plot 3

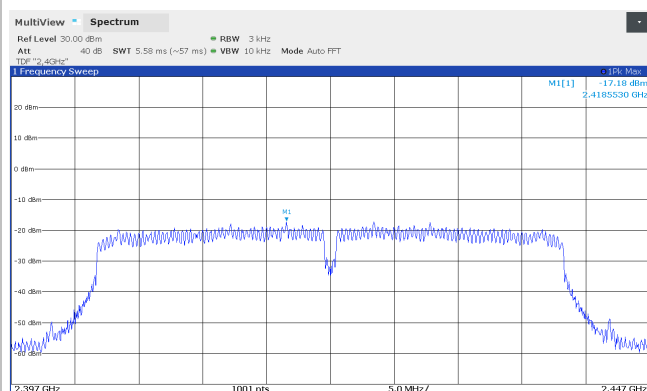


/

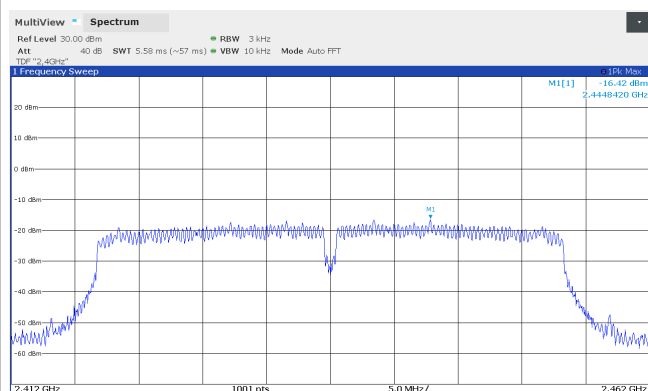
Modulation 802.11n HT40

Channel (No.)	Frequency (MHz)	Measured Power (dBm)	Limit (dBm)	Plot (No.)
3	2422	-17.18	8	1
6	2437	-16.42	8	2
9	2452	-16.85	8	3

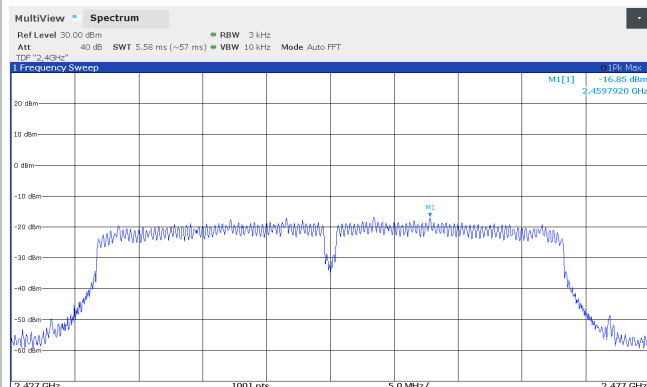
Plot 1



Plot 2



Plot 3



/

7.9 RF EXPOSURE EVALUATION

TEST REQUIREMENT	
Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines § 1.1310.	
EUT classification (fixed, mobile or portable devices)	Fixed according to § 2.1091(b) of this Chapter
LIMITS	According to Table 1 to §1.1310(e)(1) — Limits for Maximum Permissible Exposure (MPE)
Testing dates	2020-09-02

TABLE 1 TO §1.1310(E)(1) — LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
(i) Limits for Occupational/Controlled Exposure				
0.3-3.0	614	1.63	*(100)	≤6
3.0-30	1842/f	4.89/f	*(900/f ²)	<6
30-300	61.4	0.163	1.0	<6
300-1,500			f/300	<6
1,500-100,000			5	<6
(ii) Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*(100)	<30
1.34-30	824/f	2.19/f	*(180/f ²)	<30
30-300	27.5	0.073	0.2	<30
300-1,500			f/1500	<30
1,500-100,000			1.0	<30

f = frequency in MHz. * = Plane-wave equivalent power density.

Modulation 802.11b								
Channel No.	Conducted power (dBm)	Tune-up (dB)	Antenna gain (dBi)	Max Power (dBm)	Max Power (mW)	Min distance (cm)	Power density (mW/cm ²)	Limit (mW/cm ²)
1 (2.412GHz)	17.65	0.5	2	20.15	103.514	20	0.0206	1
6 (2.437GHz)	17.85	0.5	2	20.35	108.393	20	0.0216	
11 (2.462GHz)	17.95	0.5	2	20.45	110.917	20	0.0221	

Modulation 802.11g								
Channel No.	Conducted power (dBm)	Tune-up (dB)	Antenna gain (dBi)	Max Power (dBm)	Max Power (mW)	Min distance (cm)	Power density (mW/cm ²)	Limit (mW/cm ²)
1 (2.412GHz)	12.44	0.5	2	14.94	31.189	20	0.0062	1
6 (2.437GHz)	12.82	0.5	2	15.32	34.041	20	0.0068	
11 (2.462GHz)	12.93	0.5	2	15.43	34.914	20	0.0069	

Modulation 802.11n HT20								
Channel No.	Conducted power (dBm)	Tune-up (dB)	Antenna gain (dBi)	Max Power (dBm)	Max Power (mW)	Min distance (cm)	Power density (mW/cm ²)	Limit (mW/cm ²)
1 (2.412GHz)	12.63	0.5	2	15.13	32.584	20	0.0065	1
6 (2.437GHz)	12.32	0.5	2	14.82	30.339	20	0.0060	
11 (2.462GHz)	13.26	0.5	2	15.76	37.670	20	0.0075	

Modulation 802.11n HT40								
Channel No.	Conducted power (dBm)	Tune-up (dB)	Antenna gain (dBi)	Max Power (dBm)	Max Power (mW)	Min distance (cm)	Power density (mW/cm ²)	Limit (mW/cm ²)
3 (2.422GHz)	12.24	0.5	2	14.74	29.785	20	0.0059	1
6 (2.437GHz)	12.92	0.5	2	15.42	34.834	20	0.0069	
9 (2.452GHz)	13.11	0.5	2	15.61	36.392	20	0.0072	

TEST RESULT

This value is less than the low threshold limit. No SAR test is required.

Maximum radiated power was taken into consideration to establish the worst case aggregate maximum output power.

8. MEASUREMENTS AND TESTS UNCERTAINTY

Unless otherwise stated the uncertainties for the tests and measurements are evaluated in according to IMQ Operational Instruction IO-LAB-001 and IO-LAB-004. and requirement of NIST Technical Note 1297 and NIS 81: 1994 "The Treatment of Uncertainty in EMC Measurements"

The expanded uncertainty was calculated for all measurements and tests listed in this test report according to CISPR 16-4-2 "Specification for radio disturbance and immunity measuring apparatus and methods – Part 4-2: Uncertainty in EMC Measurements", with UKAS document LAB 34 and is documented in the quality system accordance to ISO/IEC 17025.

Internal Procedure PG-037 ensures that the requirements for traceability of calibrations, of all test equipment requiring calibration, and calibration intervals are met.

Methods/Standard	Parameter	Expanded Uncertainty	Unit	Confidence level
Continuous disturbance	QP detector 9 – 150 kHz	2.4	dB	95%
	QP detector 150 k – 30 MHz	2.2	dB	95%
	QP detector using Voltage Probe	1.5	dB	95%
	QP detector using ISN	2.5	dB	95%
	QP detector using Current Probe	1.8	dB	95%
Radiated disturbance	QP detector (30 MHz - 100 MHz) H polarization	4.0	dB	95%
	QP detector (30 MHz - 100 MHz) V polarization	3.9	dB	95%
	QP detector (100 MHz - 200 MHz) H polarization	2.9	dB	95%
	QP detector (100 MHz - 200 MHz) V polarization	4.0	dB	95%
	QP detector (200 MHz - 1000 MHz) H polarization	3.5	dB	95%
	QP detector (200 MHz - 1000 MHz) V polarization	3.4	dB	95%
	PK detector 1-6 GHz	4.3	dB	95%
	PK detector 6-18 GHz	4.8	dB	95%
	PK detector 18-26 GHz	4.9	dB	95%
	PK detector 26-40 GHz	5.2	dB	95%

9. LIST OF MEASURING EQUIPMENT AND CALIBRATION INFORMATION

Instrument	Manufacturer	Model	IMQ Ref.	Calibration	
				Last date	Due date
Shielded anechoic chamber	--	--	P02386	/	/
EMI RECEIVER	RHODE & SCHWARZ	ESU8	S05562	2020-08-10	2021-08-31
SPECTRUM ANALYSER	ROHDE & SCHWARZ	FSP40	S03629	2019-11-06	2020-11-30
SPECTRUM ANALYSER	ROHDE & SCHWARZ	FSW50	S07990	2020-06-05	2021-06-30
POWER SENSOR	ROHDE & SCHWARZ	NRP-Z81	S06704	2019-09-24	2020-11-30 ^(*)
LISN	ROHDE & SCHWARZ	ENV216	S03631	2019-11-11	2020-11-30
LOOP ANTENNA	ROHDE & SCHWARZ	HFH2-Z2E	S08326	2019-12-05	2020-12-31
LOG ANTENNA	ARA	LPB-2520/1	S03511	2019-11-15	2020-11-30
ANTENNA HORN	SCHWARZBECK	BBHA9120D	S03463	2017-11-23	2020-11-30
SOFTWARE	ROHDE & SCHWARZ	EMC 32 Vers. 8.30	W-00124-K1	/	/

Note

(*) Some calibration intervals may be extended, based on sufficient calibration data and experience of use (see IEC 60111:2015 clause 8.3)

END OF TEST REPORT