China

FCC - TEST REPORT

Report Number	:	**708881974840-00**	Date of Issue:	October 18, 2019

Model	:	WRD3L
Product Type	:	WIFI Module
FCC ID	:	2ANDL- WRD3L
Applicant	:	Hangzhou Tuya Information Technology Co.,Ltd
Address of Applicant	:	Room701,Building3,More Center,No.87 GuDun
	:	Road,Hangzhou,Zhejiang China
Manufacturer	:	Hangzhou Tuya Information Technology Co.,Ltd
Address of Manufacturer	:	Room701,Building3,More Center,No.87 GuDun
	:	Road,Hangzhou,Zhejiang China
Factory	:	Newtronics Hangzhou Co.,Ltd
Address of Factory	:	No.15,Jiu zhou Road,Jiang Gan Science&Technology Economic Park Hangzhou

Test Result	:	■ **Positive**	☐ **Negative**
Total pages including Appendices	:	46	

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1 Table of Contents

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2 Details about the Test Laboratory

Details about the Test Laboratory
Test Site 1

Company name:	TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch No.16 Lane, 1951 Du Hui Road, Shanghai 201108, P.R. China
FCC Registration No.:	820234
Telephone:	+86 21 6141 0123
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3 Description of the Equipment under Test

Description of the Equipment Under Test

Product:	WIFI Module
Model no.:	WRD3L
FCC ID:	2ANDL-WRD3L
Trade Mark:	NA
Options and accessories:	NA
Input Rated Voltage:	DC 3.0-3.6V
RF Transmission Frequency:	802.11b/g/n-HT20: 2412~2462 MHz
No. of Operated Channel:	11 for 802.11b/802.11g/802.11(H20)

Channel list:

Operation Frequency each of channel For 802.11b/g/n(H20)

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

Radio technology:	IEEE 802.11b/802.11g/802.11(H20)
Modulation:	Direct Sequence Spread Spectrum (DSSS) for 802.11b Orthogonal Frequency Division Multiplexing(OFDM) for 802.11g/n
Data speed (IEEE 802.11b):	1Mbps, 2Mbps, 5.5Mbps, 11Mbps
Data speed (IEEE 802.11g):	6Mbps, 9Mbps, 12Mbps, 18Mbps, 24Mbps, 36Mbps, 48Mbps,54Mbps
Data speed (IEEE 802.11n):	Up to 72Mbps
Antenna Type:	PCB antenna
Antenna Gain:	1.0dBi
Description of the EUT:	The Equipment Under Test (EUT) is a WIFI Module supports 2.4GHz WIFI functions.

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4 Summary of Test Standards

Test Standards	
FCC Part 15 Subpart C	PART 15 - RADIO FREQUENCY DEVICES Subpart C - Intentional Radiators

All the test methods were according to KDB558074 D01 DTS Measurement Guidance v05r02 and ANSI C63.10 (2013).

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5 Summary of Test Results

Technical Requirements						
FCC Part 15 Subpart C						
Test Condition		Pages	Test Site	Test Result		
				Pass	Fail	N/A
§15.207	Conducted emission AC power port	12-14	---	☒	☐	☐
§15.247 (b) (1)	Conducted peak output power	15	Site 1	☒	☐	☐
§15.247(a)(1)	20dB bandwidth	---	---	☐	☐	☒
§15.247(a)(1)	Carrier frequency separation	---	---	☐	☐	☒
§15.247(a)(1)(iii)	Number of hopping frequencies	---	---	☐	☐	☒
§15.247(a)(1)(iii)	Dwell Time	---	---	☐	☐	☒
§15.247(e)	Power spectral density	20-23	Site 1	☒	☐	☐
§15.247(a)(2)	6dB bandwidth and 99% Occupied Bandwidth	16-19	Site 1	☒	☐	☐
§15.247(d)	Spurious RF conducted emissions	24-33	Site 1	☒	☐	☐
§15.247(d)	Spurious radiated emissions and Band edge for transmitter	34-42	Site 1	☒	☐	☐
§15.203	Antenna requirement	See note 1		☒	☐	☐

Remark 1: N/A – Not Applicable.
Note 1: The EUT uses a permanently integral antenna, which gain is 1.0dBi. According to §15.203, it is considered sufficiently to comply with the provisions of this section.

15.203 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, 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. 15.247(c) (1)(i) requirement: (i) Systems operating in the 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.

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6 General Remarks

Remarks

This submittal(s) (test report) is intended for FCC ID: 2ANDL-WRD3L, complies with Section 15.207, 15.209, 15.247 of the FCC Part 15, Subpart C Rules.

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SUMMARY:

All tests according to the regulations cited on page 5 were

■ - Performed

☐ - **Not** Performed

The Equipment under Test

■ - **Fulfills** the general approval requirements.

☐ - **Does not** fulfill the general approval requirements.

Sample Received Date:	September 21, 2019
Testing Start Date:	September 21, 2019
Testing End Date:	September 30, 2019

- TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch

Reviewed by:	Prepared by:	Tested by:
Hui TONG	Jiaxi XU	Wenqiang LU
EMC Section Manager	EMC Project Engineer	EMC Test Engineer

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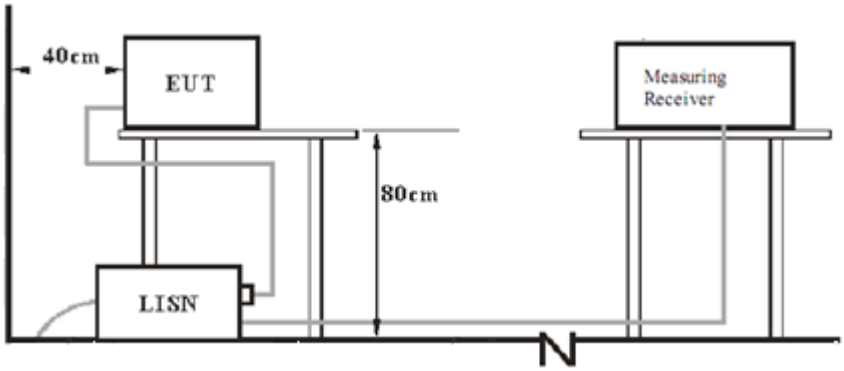
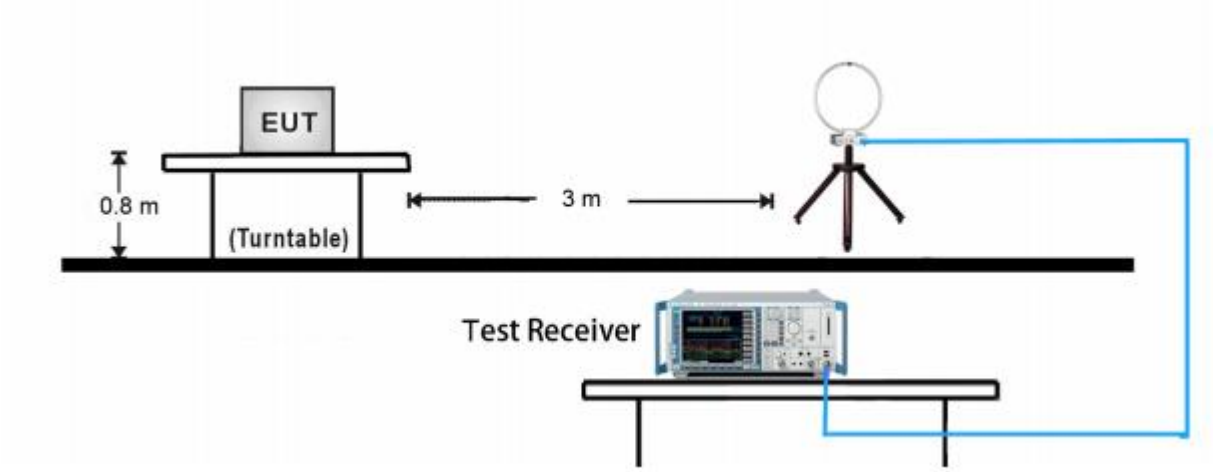
7 Test Setups

7.1 AC Power Line Conducted Emission test setups



7.2 Radiated test setups

9kHz ~ 30MHz Test Setup:



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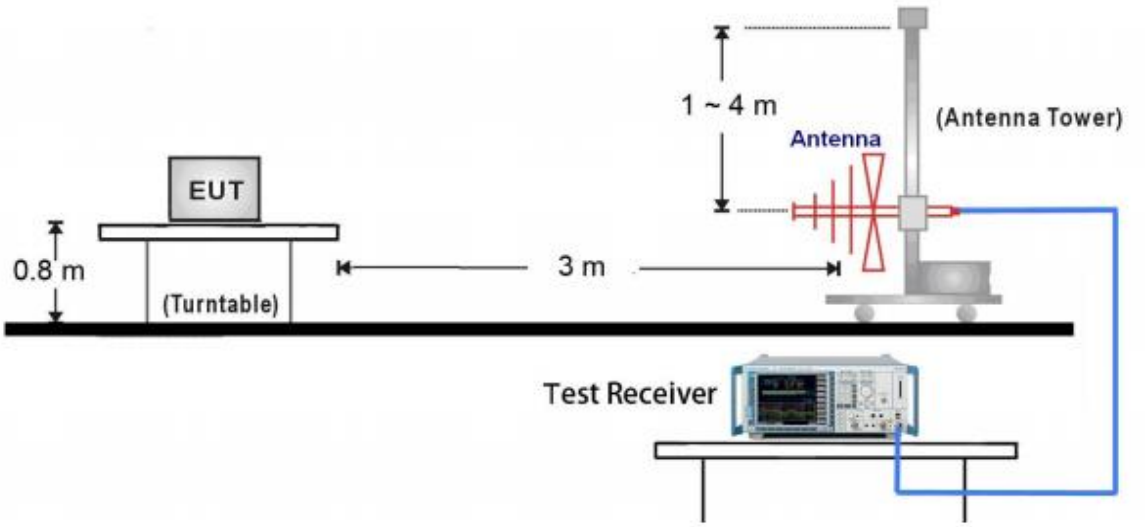
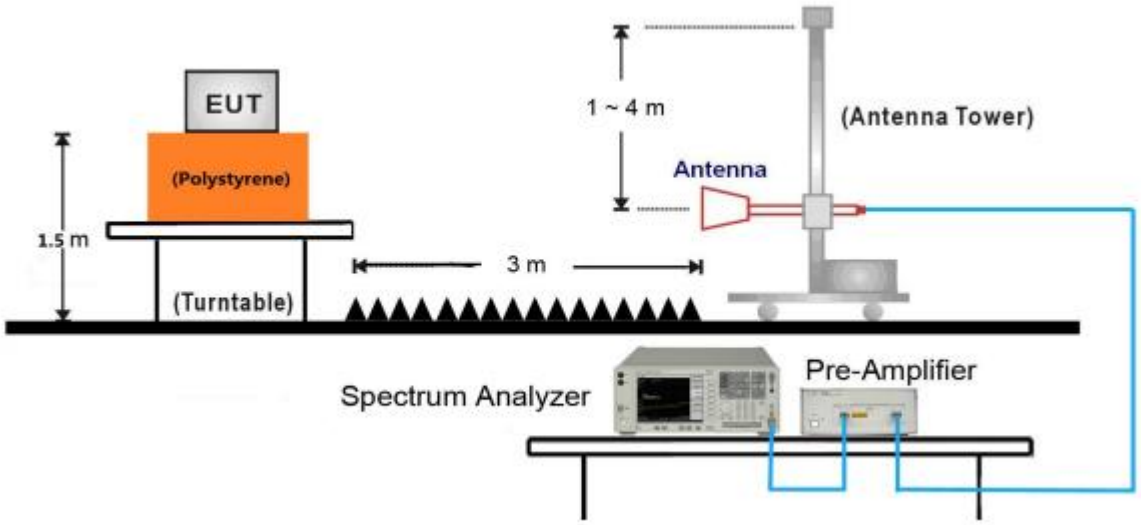
30MHz ~ 1GHz Test Setup:



1GHz ~ 18GHz Test Setup:



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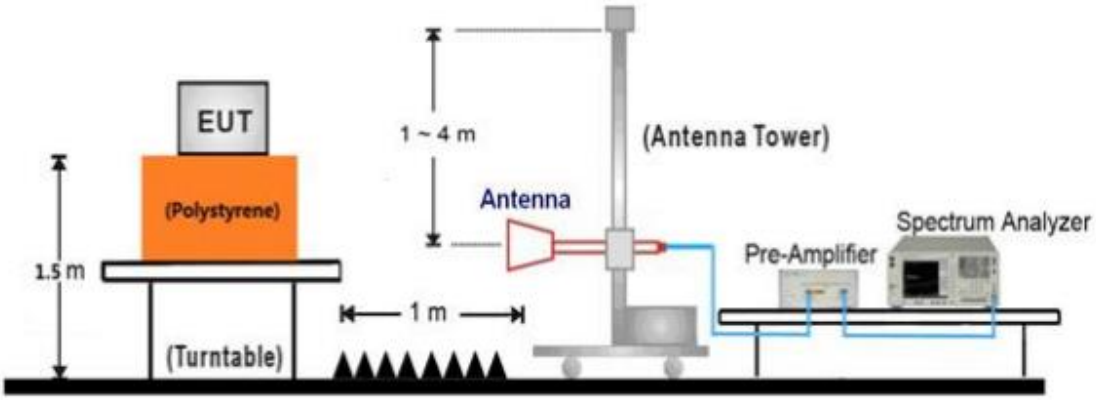
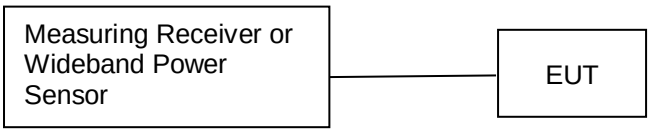
18GHz ~ 25GHz Test Setup:



7.3 Conducted RF test setups



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8 Systems test configuration

Auxiliary Equipment Used during Test:

DESCRIPTION	MANUFACTURER	MODEL NO.(SHIELD)
Notebook	Lenove	X240

Test channel & mode:
The EUT configured using a proprietary communication interface provided by the client. The interface allows channel control required to support the evaluation.

Test software	SecureCRT

802.11b/802.11g/802.11n-HT20

Test mode	Channel	Frequency (MHz)
Tx	1	2412
Tx	6	2437
Tx	11	2462

The pre-test has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates.

Tested Channel	Modulation Type	Data Rate
Low, Middle, High	802.11b: DSSS	1Mbps
Low, Middle, High	802.11g: OFDM	6Mbps
Low, Middle, High	802.11n (HT20): OFDM	MCS0 (6.5Mbps)

Device Capabilities
This device contains the following capabilities:
802.11b/g/n-HT20 Wi-Fi Device.
Duty Cycle: 100%
Note: 2.4GHz WLAN (DTS) operation is possible in 20MHz channel bandwidths.

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9 Technical Requirement

9.1 Conducted Emission

Test Method

1. The EUT was placed on a table, which is 0.8m above ground plane
2. The power line of the EUT is connected to the AC mains through a Artificial Mains Network (A.M.N.).
3. Maximum procedure was performed to ensure EUT compliance
4. A EMI test receiver is used to test the emissions from both sides of AC line

Limit

Frequency MHz	QP Limit dBµV	AV Limit dBµV
0.150-0.500	66-56*	56-46*
0.500-5	56	46
5-30	60	50

Decreasing linearly with logarithm of the frequency

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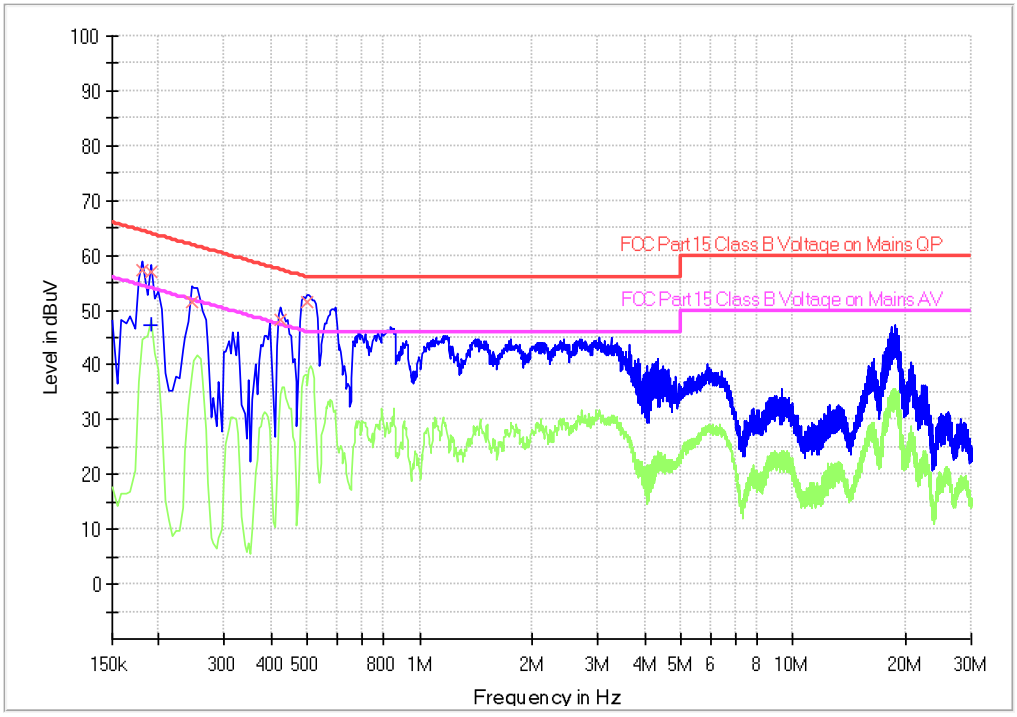
Conducted Emission

Product Type	:	WIFI Module
M/N	:	WRD3L
Operating Condition	:	Mode 1: Tx_802.11g 2437MHz, powered by notebook
Test Specification	:	FCC_Part15.207
Comment	:	L-line, AC 120V/60Hz



Final_Result

Frequency (MHz)	Quasi Peak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.181500	57.23	---	64.42	7.19	1000.0	9.000	L1	19.4
0.190500	---	47.29	54.01	6.72	1000.0	9.000	L1	19.4
0.190500	56.85	---	64.01	7.16	1000.0	9.000	L1	19.4
0.244500	51.53	---	61.94	10.41	1000.0	9.000	L1	19.4
0.424500	48.21	---	57.36	9.15	1000.0	9.000	L1	19.4
0.496500	51.36	---	56.06	4.70	1000.0	9.000	L1	19.4

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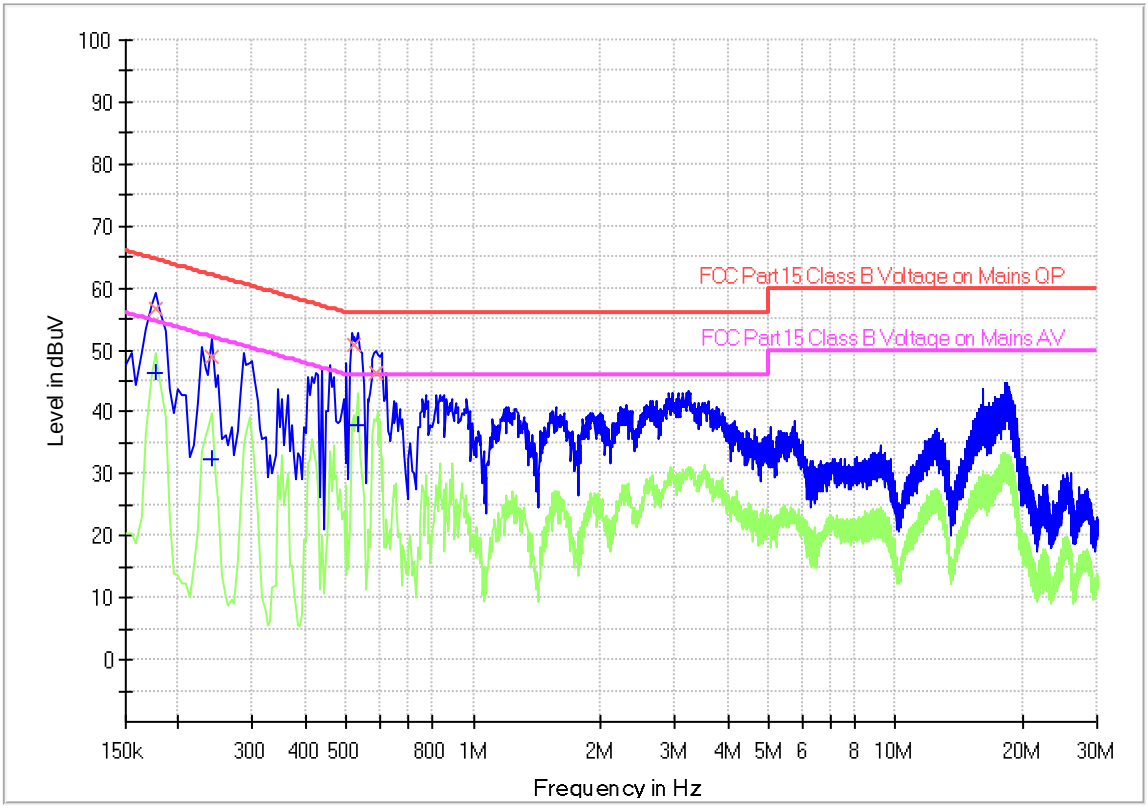
Product Type	:	WIFI Module
M/N	:	WRD3L
		Mode 1: Tx_802.11g 2437MHz, powered by notebook
Test Specification	:	FCC_Part15.207
Comment	:	N-line, AC 120V/60Hz



Final_Result

Frequency (MHz)	Quasi Peak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.177000	---	46.34	54.63	8.29	1000.0	9.000	L1	19.4
0.177000	56.80	---	64.63	7.83	1000.0	9.000	L1	19.4
0.240000	---	32.44	52.10	19.66	1000.0	9.000	L1	19.4
0.240000	49.03	---	62.10	13.07	1000.0	9.000	L1	19.4
0.523500	50.70	---	56.00	5.30	1000.0	9.000	L1	19.4
0.532500	---	37.77	46.00	8.23	1000.0	9.000	L1	19.4
0.586500	46.29	---	56.00	9.71	1000.0	9.000	L1	19.4

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9.2 Conducted peak output power

Test Method

1. Use the following spectrum analyzer settings:
   RBW > the 6 dB bandwidth of the emission being measured, VBW≥3RBW, Span≥3RBW
   Sweep = auto, Detector function = peak, Trace = max hold.
2. Add a correction factor to the display.
3. Use a power meter to measure the conducted peak output power.

Limits

Frequency Range MHz	Limit W	Limit dBm
2400-2483.5	≤1	≤30

Test result as below table

Mode	Antenna Gain (dBi)	Channel	Frequency (MHz)	Peak Power (dBm)	Limit (dBm)
b	N/A	CH01	2412	19.43	30.00
		CH06	2437	19.59	30.00
		CH11	2462	19.17	30.00
g		CH01	2412	23.41	30.00
		CH06	2437	**23.54**	30.00
		CH11	2462	23.37	30.00
n-HT20		CH01	2412	22.36	30.00
		CH06	2437	22.56	30.00
		CH11	2462	22.33	30.00

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9.3 6dB bandwidth Occupied Bandwidth

Test Method

1. Use the following spectrum analyzer settings:
   RBW=100K, VBW≥3RBW, Sweep = auto, Detector function = peak, Trace = max hold
2. Use the automatic bandwidth measurement capability of an instrument, may be employed using the X dB bandwidth mode with X set to 6 dB, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be ≥ 6 dB.
3. Allow the trace to stabilize, record the 6 dB Bandwidth value.

Limit

Limit [kHz]
≥500

Test result

Test Mode	Data Rate / MCS	Channel No.	Freq. (MHz)	6db Bandwidth (MHz)	Limit (MHz)	Result
802.11b	1Mbps	01	2412	10.020	≥ 0.5	Pass
802.11b	1Mbps	06	2437	10.032	≥ 0.5	Pass
802.11b	1Mbps	11	2462	10.032	≥ 0.5	Pass
802.11g	6Mbps	01	2412	16.152	≥ 0.5	Pass
802.11g	6Mbps	06	2437	16.140	≥ 0.5	Pass
802.11g	6Mbps	11	2462	16.170	≥ 0.5	Pass
802.11n-HT20	6.5Mbps	01	2412	16.914	≥ 0.5	Pass
802.11n-HT20	6.5Mbps	06	2437	17.172	≥ 0.5	Pass
802.11n-HT20	6.5Mbps	11	2462	17.304	≥ 0.5	Pass

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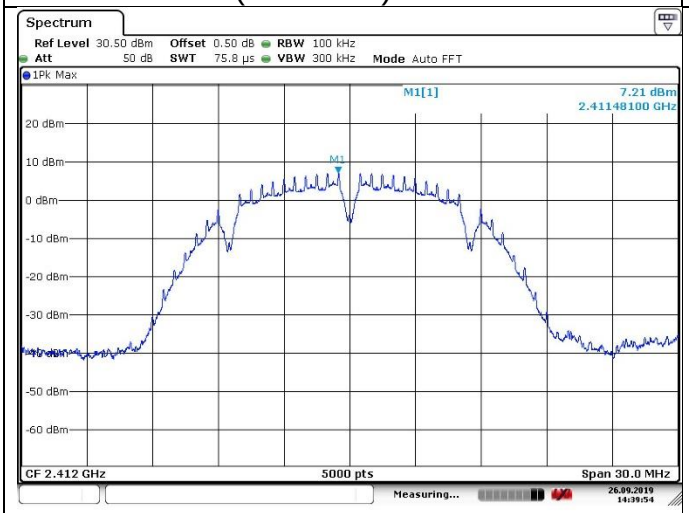
802.11b 6dB Bandwidth

Channel 01 (2412MHz) Reference level



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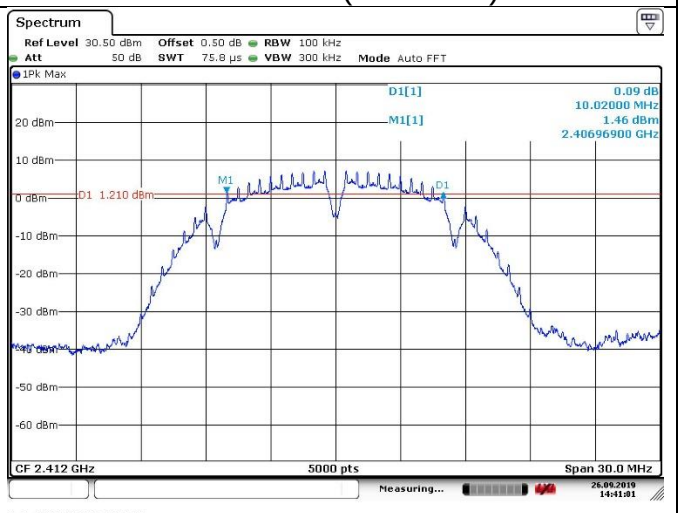
Channel 01 (2412MHz)



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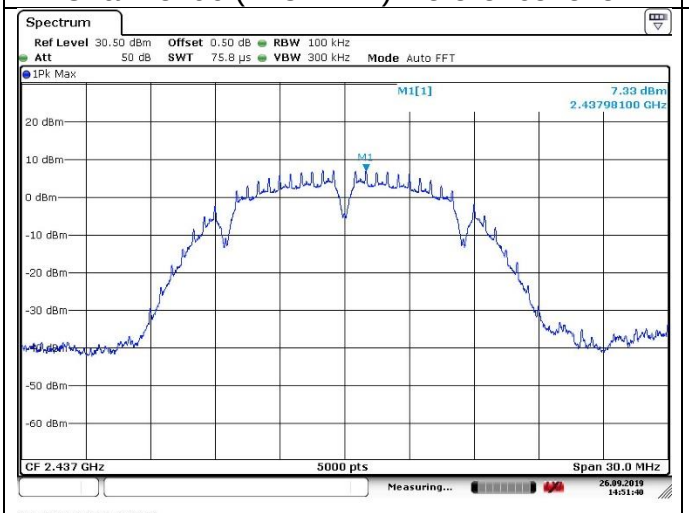
Channel 06 (2437MHz) Reference level



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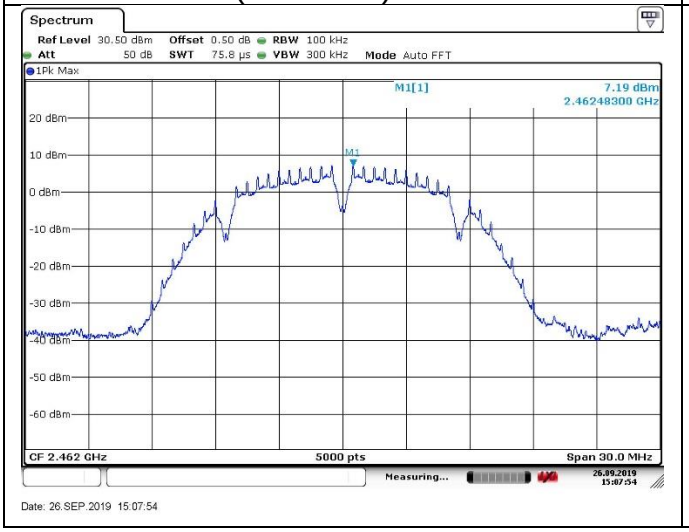
Channel 06 (2437MHz)

Date: 26.SEP.2019 14:52:28

Channel 11 (2462MHz) Reference level



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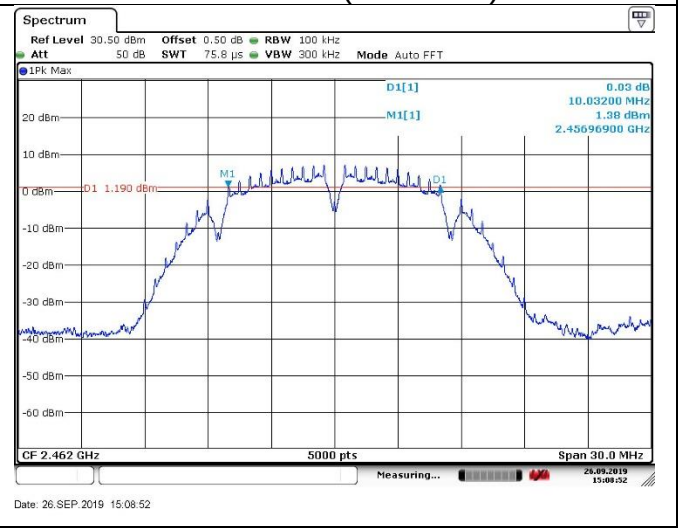
Channel 11 (2462MHz)



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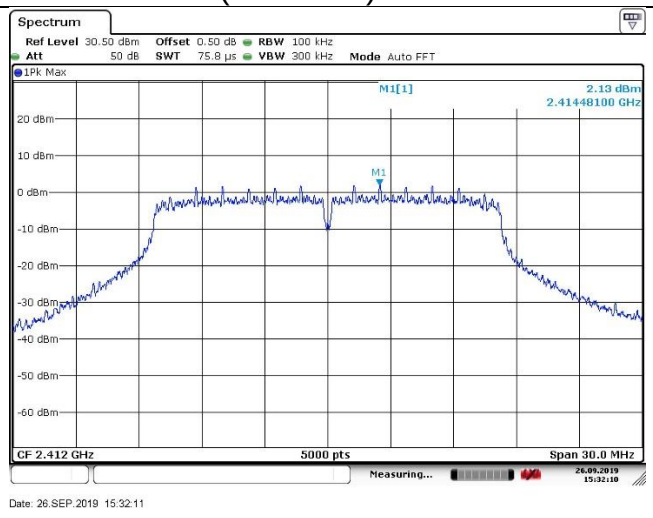
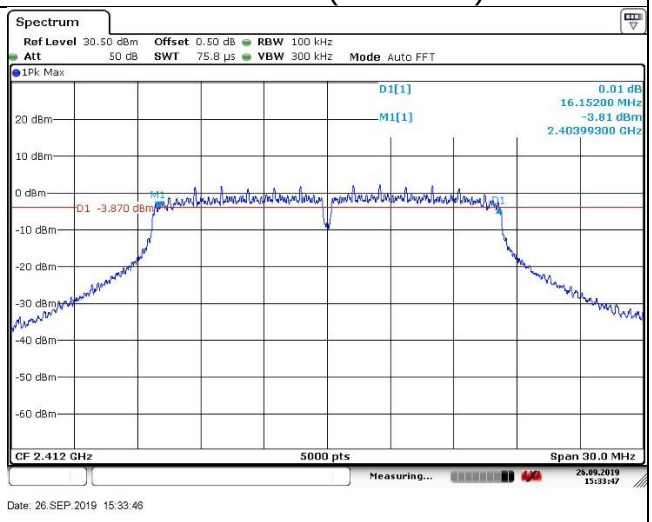
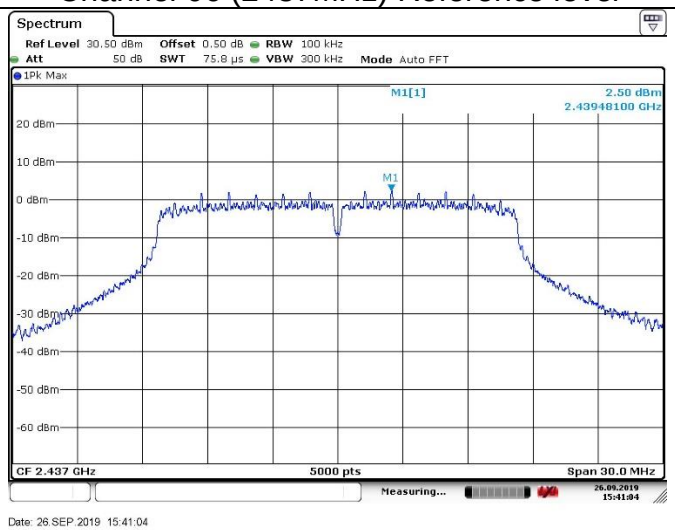
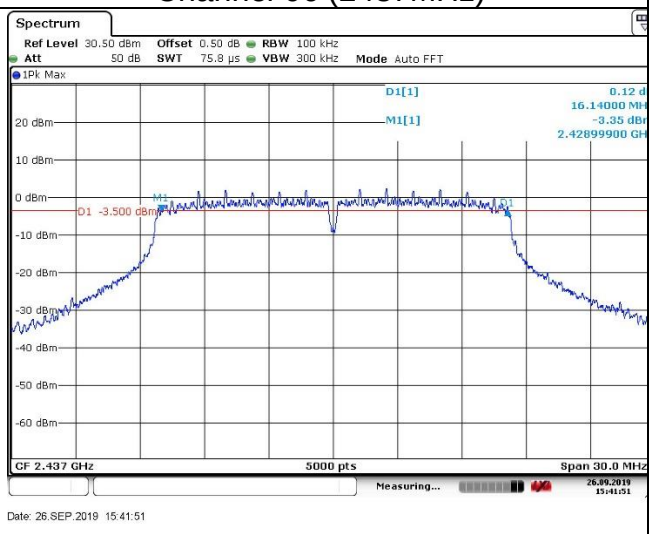
802.11g 6dB Bandwidth	
Channel 01 (2412MHz) Reference level	Channel 01 (2412MHz)
	
Channel 06 (2437MHz) Reference level	Channel 06 (2437MHz)
	
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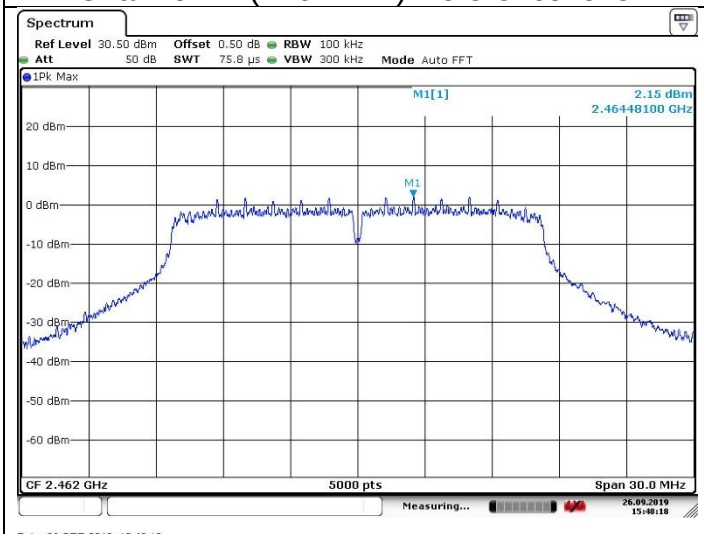
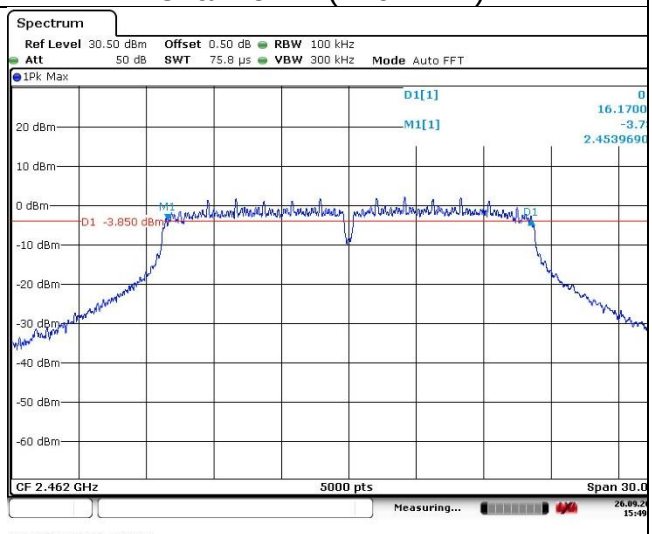
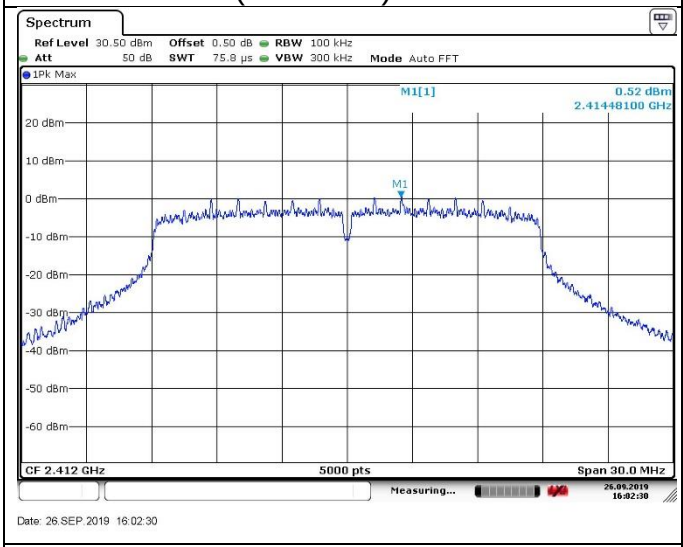
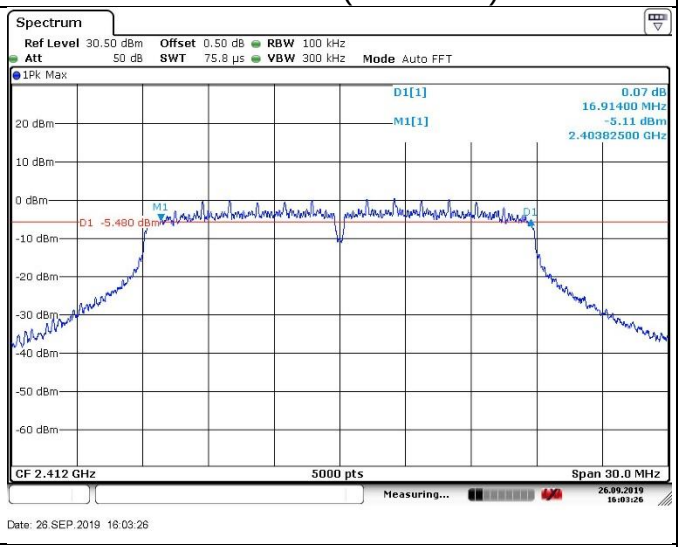
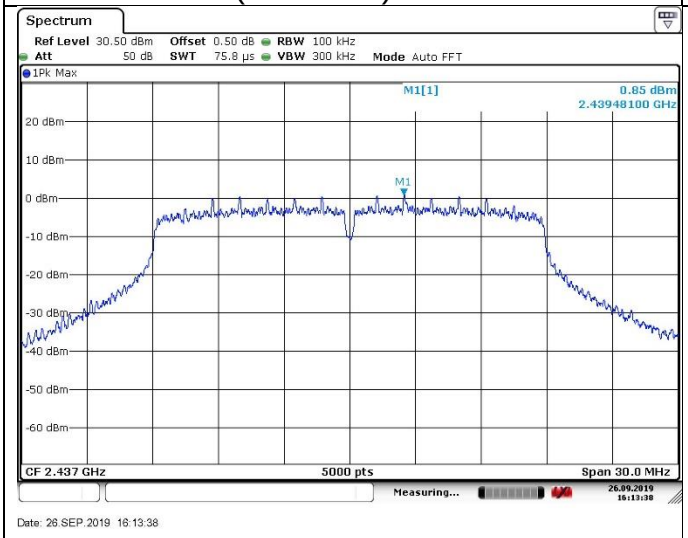
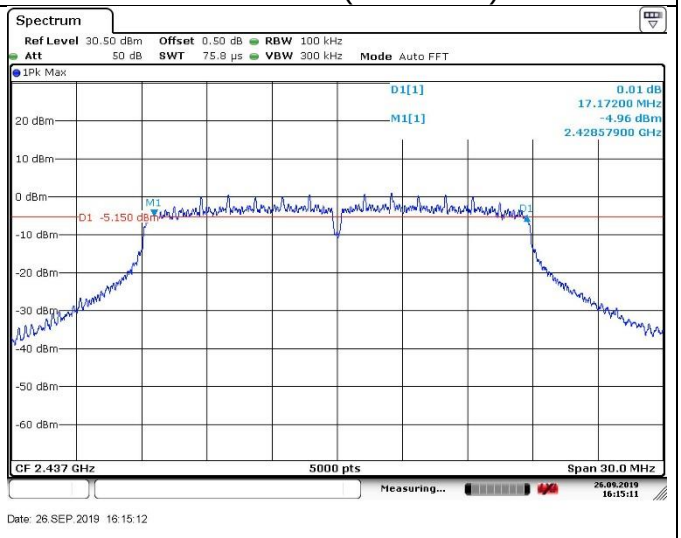
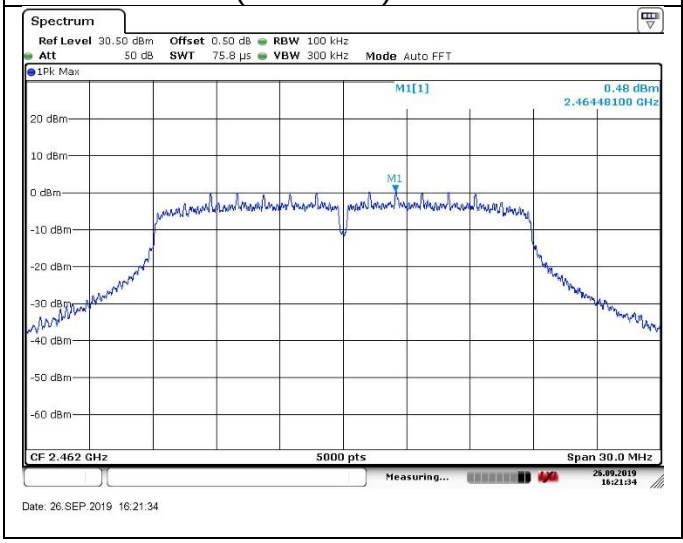
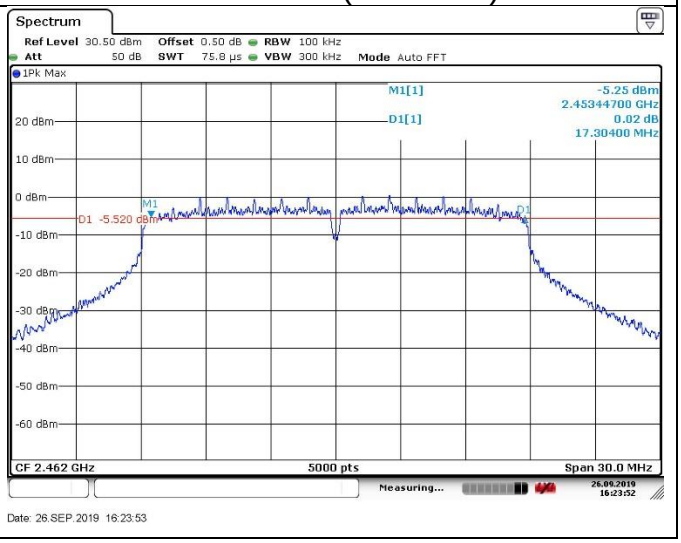
	

802.11n 6dB Bandwidth	
Channel 01 (2412MHz) Reference level	Channel 01 (2412MHz)
	
Channel 06 (2437MHz) Reference level	Channel 06 (2437MHz)
	
Channel 11 (2462MHz) Reference level	Channel 11 (2462MHz)
	

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9.4 Power spectral density

Test Method

This procedure shall be used if average conducted output power was used to demonstrate compliance:

1. Set analyzer center frequency to DTS channel center frequency. RBW=3kHz, VBW≥3RBW, Span=1.5 times DTS bandwidth, Detector=Peak, Sweep=auto, Trace= max hold.
2. Allow trace to fully stabilize, use the peak marker function to determine the maximum amplitude level within the RBW.
3. Repeat above procedures until other frequencies measured were completed.

Limit

Limit [dBm]
≤8

Test result

Test Mode	Data Rate / MCS	Channel No.	Freq. (MHz)	PSD (dBm / 10kHz)	Limit (dBm/3kHz)	Result
802.11b	1Mbps	01	2412	−4.88	≤8	Pass
802.11b	1Mbps	06	2437	−4.63	≤8	Pass
802.11b	1Mbps	11	2462	−4.95	≤8	Pass
802.11g	6Mbps	01	2412	−10.72	≤8	Pass
802.11g	6Mbps	06	2437	−10.41	≤8	Pass
802.11g	6Mbps	11	2462	−10.79	≤8	Pass
802.11n-HT20	6.5Mbps	01	2412	−11.99	≤8	Pass
802.11n-HT20	6.5Mbps	06	2437	−11.88	≤8	Pass
802.11n-HT20	6.5Mbps	11	2462	−12.27	≤8	Pass

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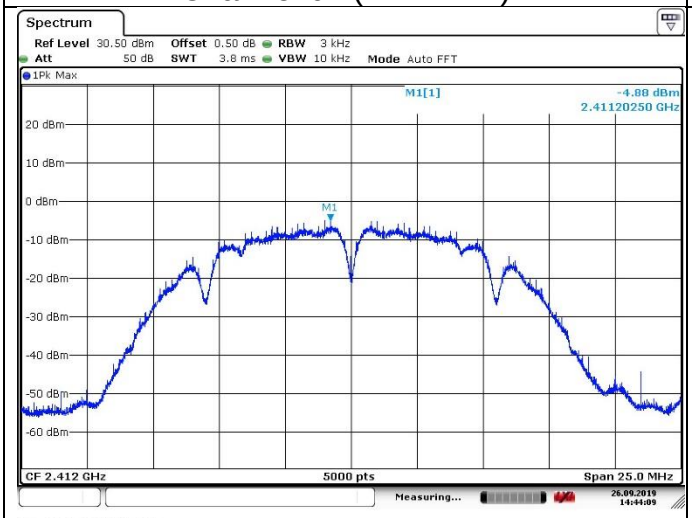
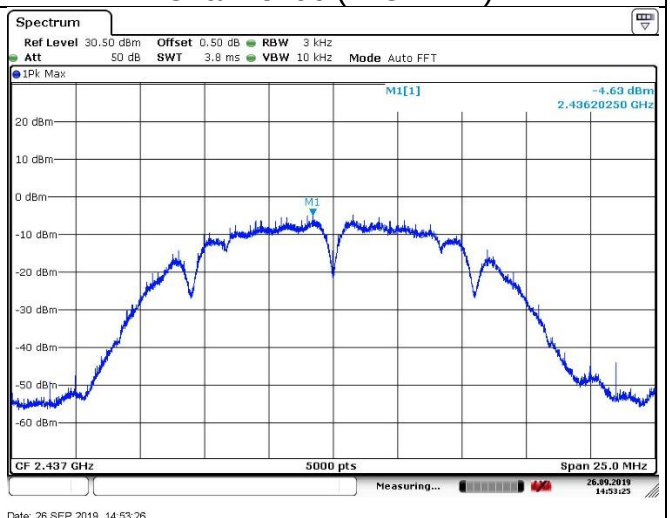
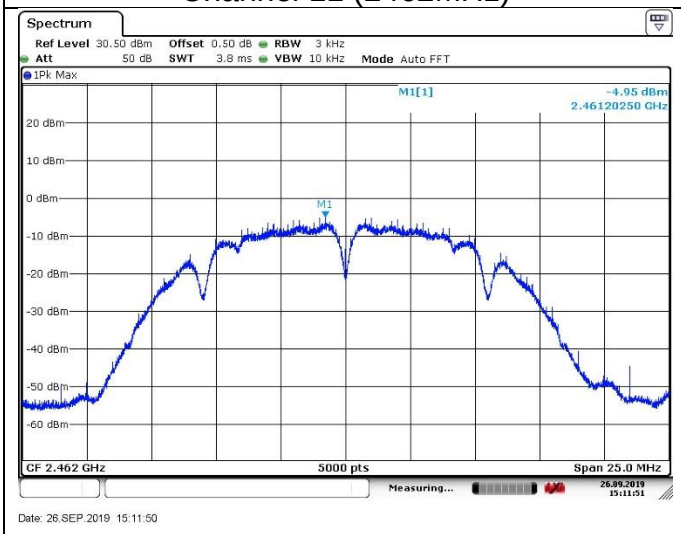
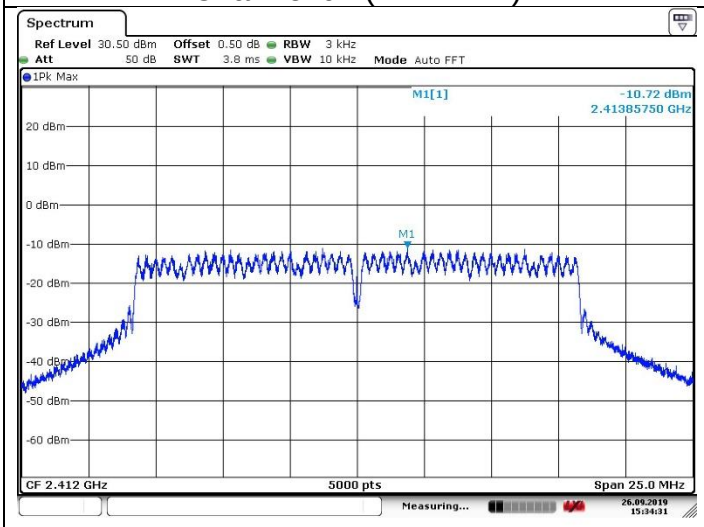
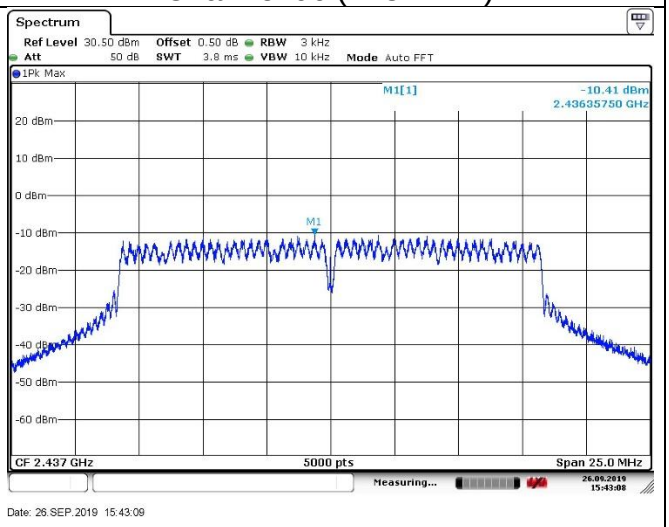
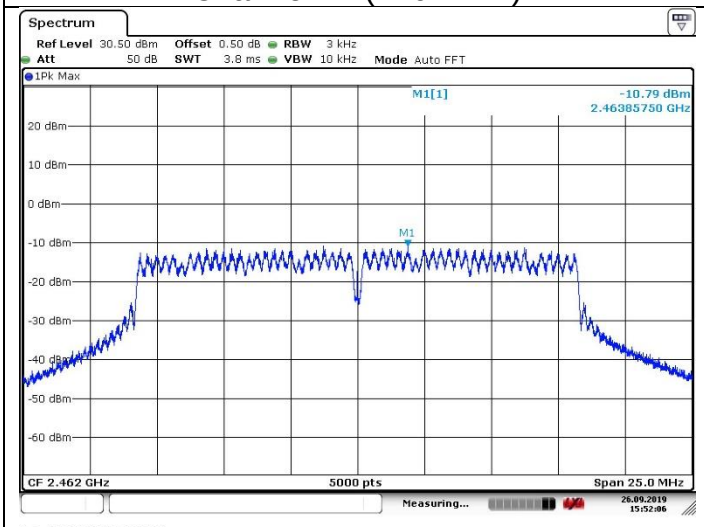
802.11b PSD	
Channel 01 (2412MHz)	Channel 06 (2437MHz)
	
Channel 11 (2462MHz)	
	

802.11g PSD	
Channel 01 (2412MHz)	Channel 06 (2437MHz)
 Date: 26.SEP.2019 15:34:31	 Date: 26.SEP.2019 15:43:09
Channel 11 (2462MHz)	
 Date: 26.SEP.2019 15:52:06	

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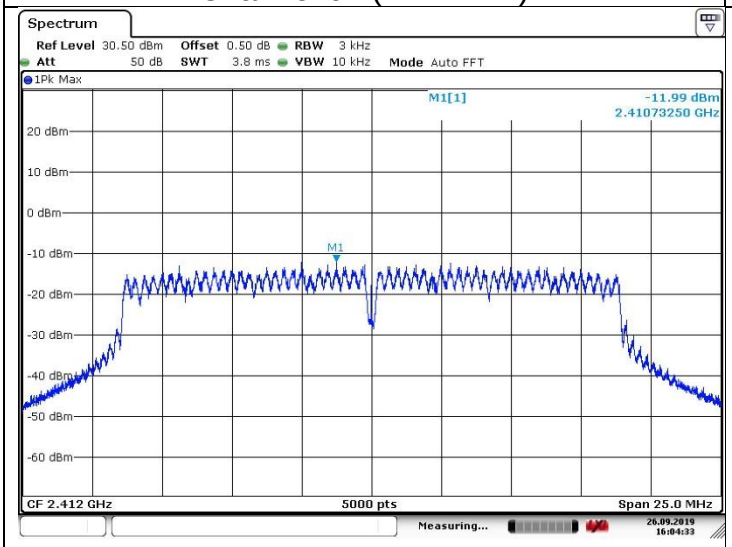
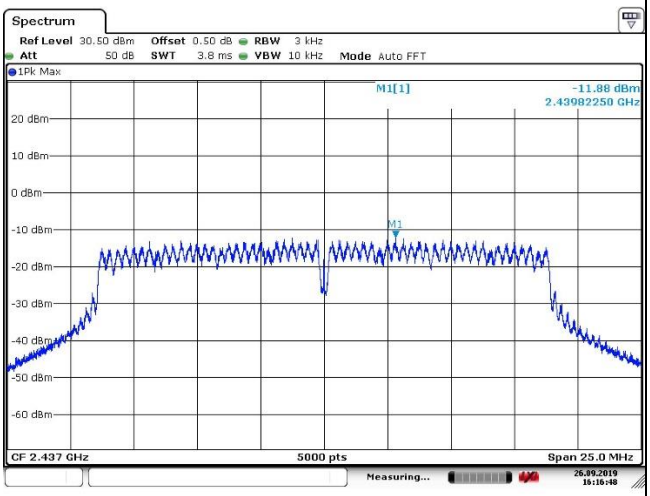
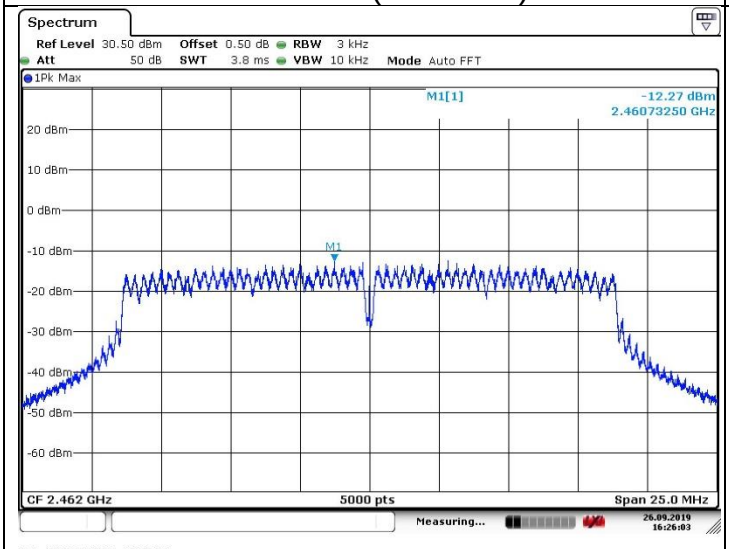
802.11n HT20 PSD	
Channel 01 (2412MHz)	Channel 06 (2437MHz)
	
Channel 11 (2462MHz)	
	

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9.5 Conducted Band Edge and Out-of-Band Emissions

Test Method

1. Establish a reference level by using the following procedure:
   a. Set RBW=100 kHz. VBW≥3RBW. Detector =peak, Sweep time = auto couple, Trace mode = max hold.
   b. Allow trace to fully stabilize, use the peak marker function to determine the maximum PSD level.
2. Use the maximum PSD level to establish the reference level.
   a. Set the center frequency and span to encompass frequency range to be measured.
   b. 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) are attenuated by at least the minimum requirements, report the three highest emissions relative to the limit.
3. Repeat above procedures until other frequencies measured were completed.

Limit

Frequency Range MHz	Limit (dBc)
30-25000	-20

Test result

Test Mode	Data Rate / MCS	Channel No.	Freq. (MHz)	Limit	Result
802.11b	1Mbps	01	2412	20dBc	Pass
802.11b	1Mbps	06	2437	20dBc	Pass
802.11b	1Mbps	11	2462	20dBc	Pass
802.11g	6Mbps	01	2412	20dBc	Pass
802.11g	6Mbps	06	2437	20dBc	Pass
802.11g	6Mbps	11	2462	20dBc	Pass
802.11n-HT20	6.5Mbps	01	2412	20dBc	Pass
802.11n-HT20	6.5Mbps	06	2437	20dBc	Pass
802.11n-HT20	6.5Mbps	11	2462	20dBc	Pass

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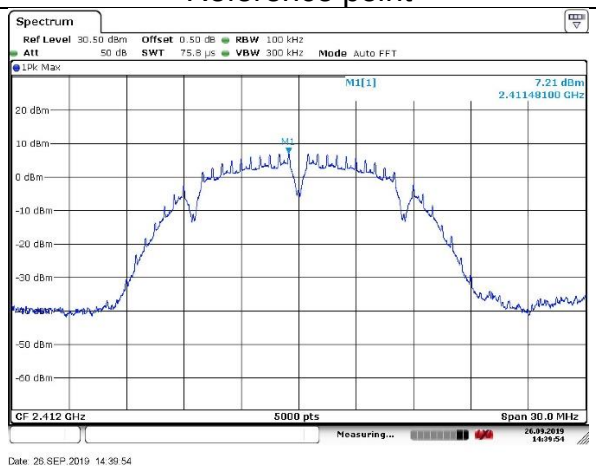
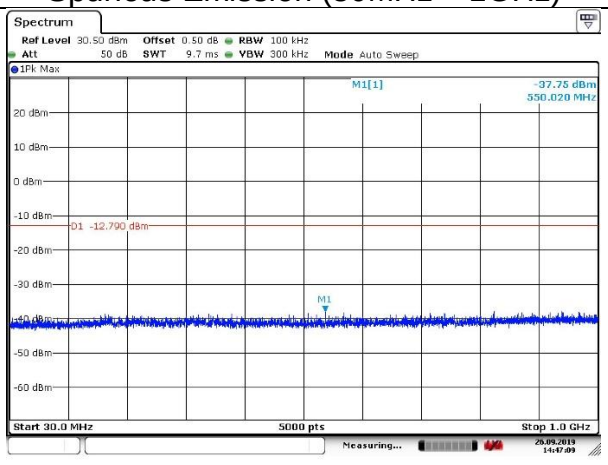
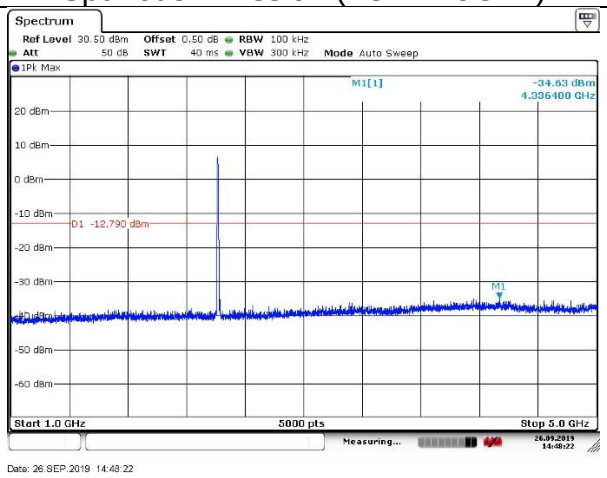
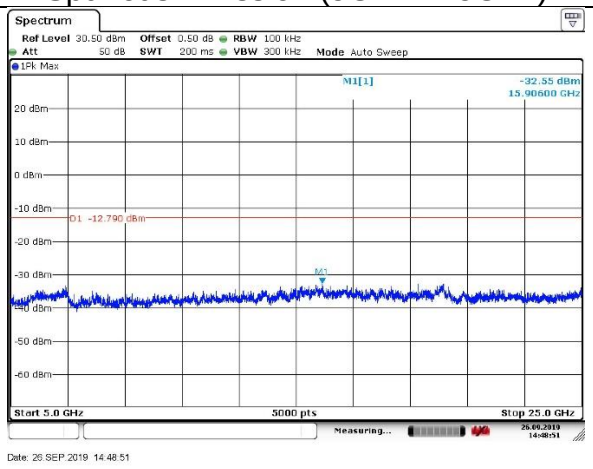
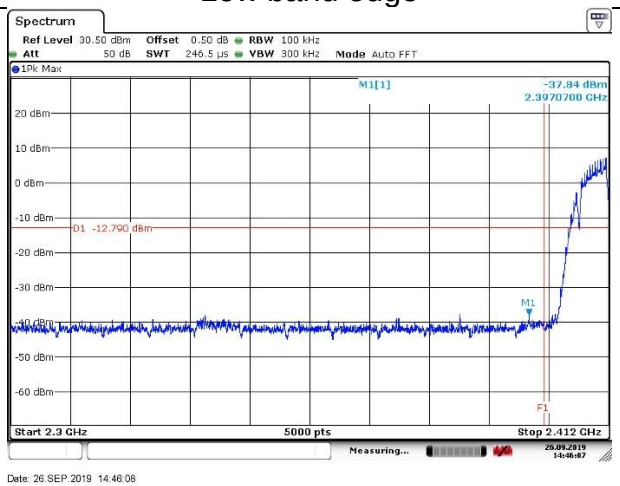
Spurious RF conducted emissions

802.11b Out-of-Band Emissions	
Channel 01 (2412MHz)	
Reference point	Spurious Emission (30MHz – 1GHz)
	
Spurious Emission (1GHz –5GHz)	Spurious Emission (5GHz –25GHz)
	
Low band edge	
	

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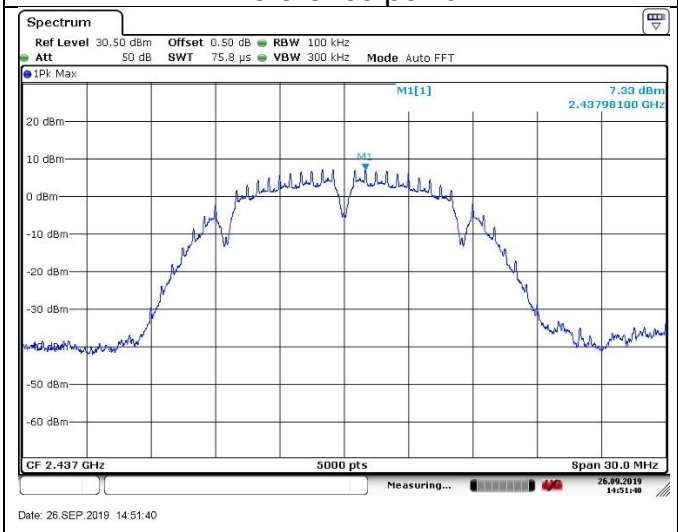
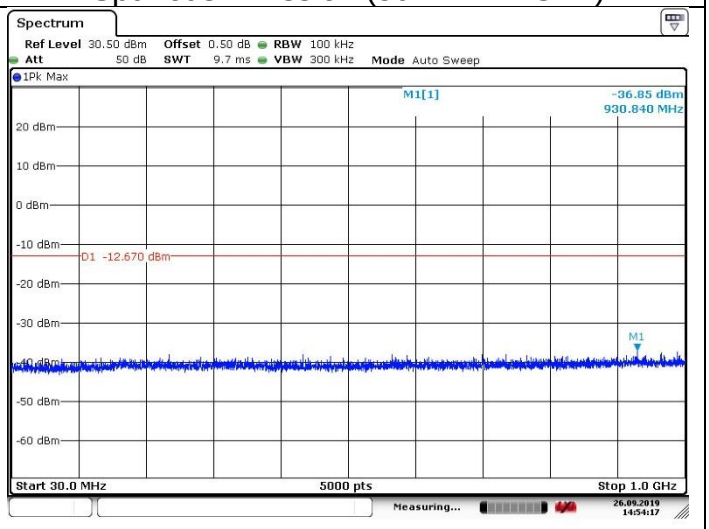
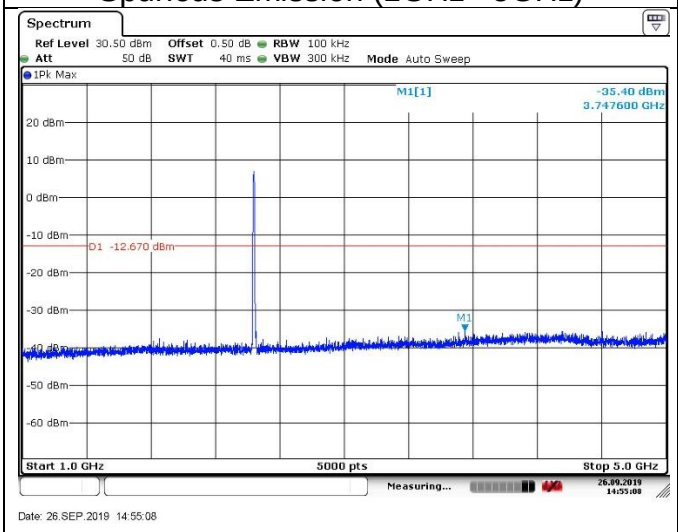
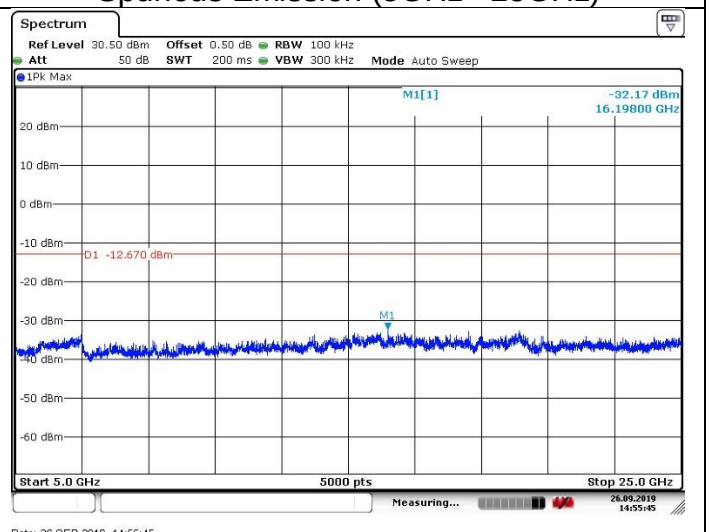
802.11b Out-of-Band Emission	
Channel 06 (2437MHz)	
Reference point	Spurious Emission (30MHz – 1GHz)
	
Spurious Emission (1GHz –5GHz)	Spurious Emission (5GHz –25GHz)
	

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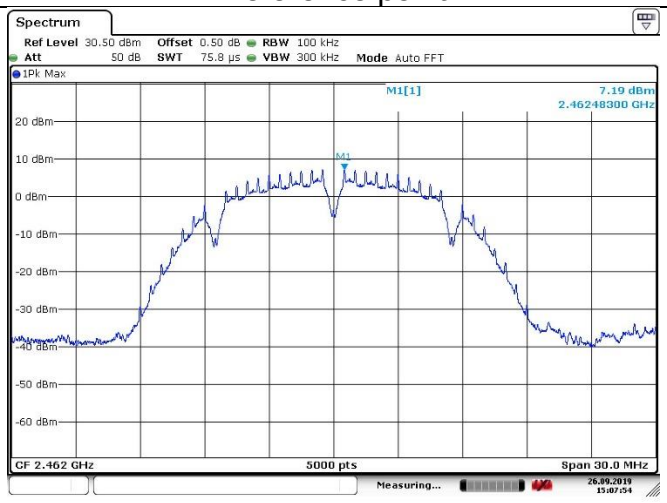
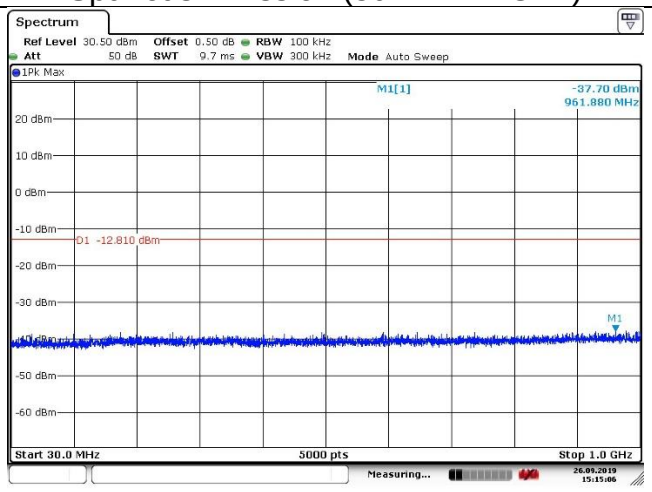
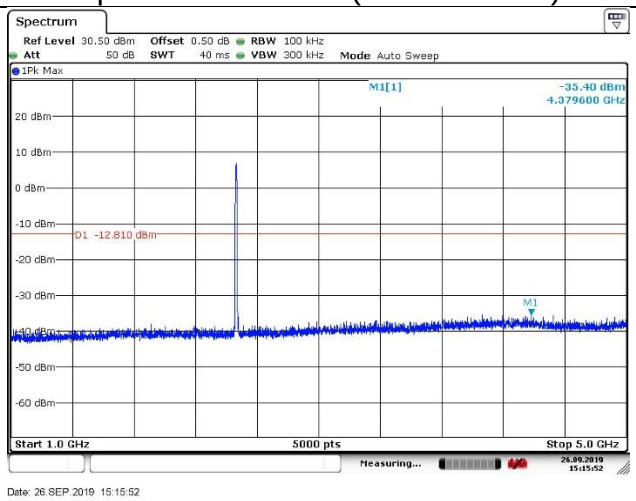
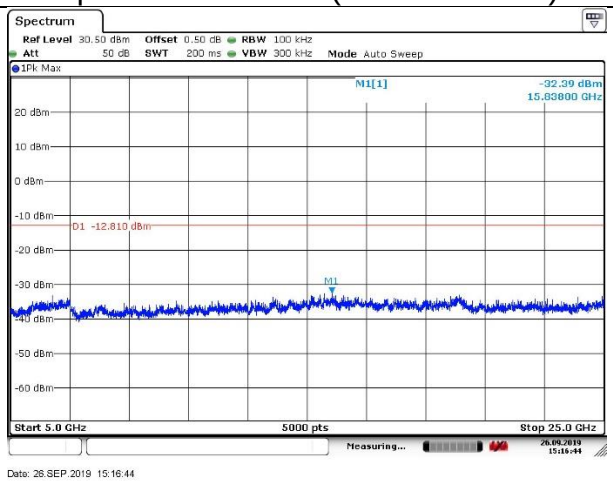
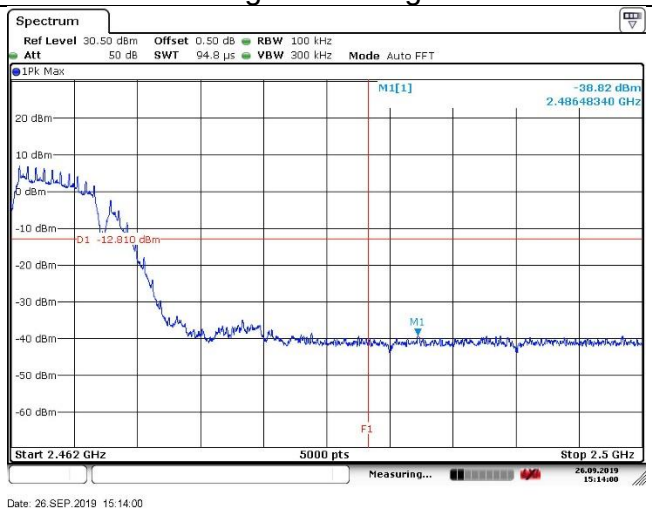
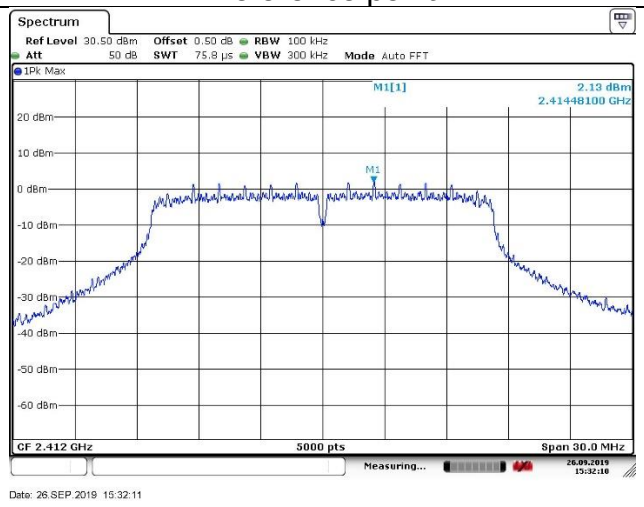
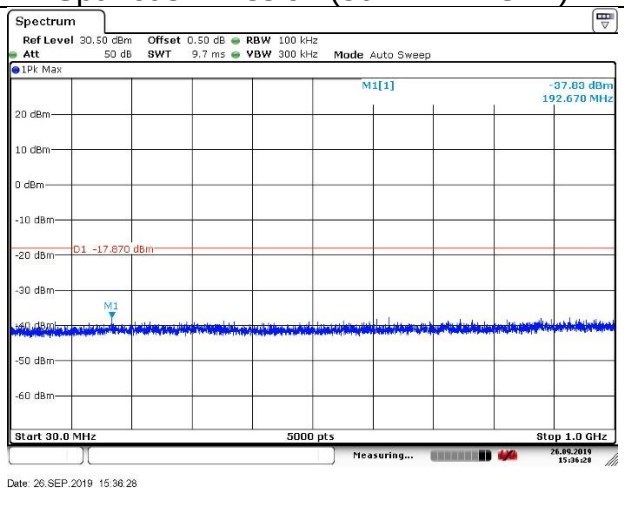
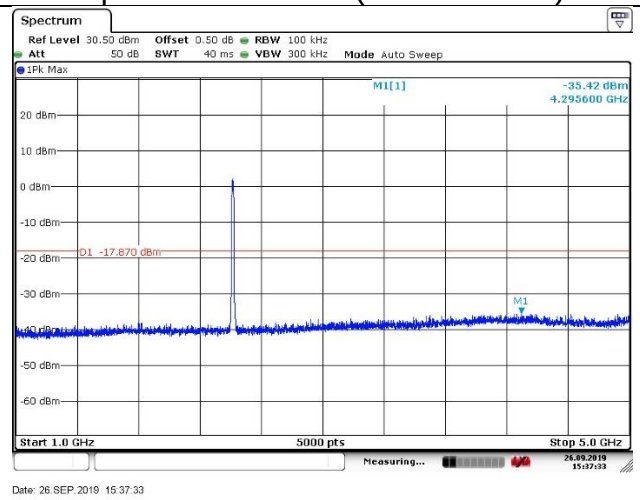
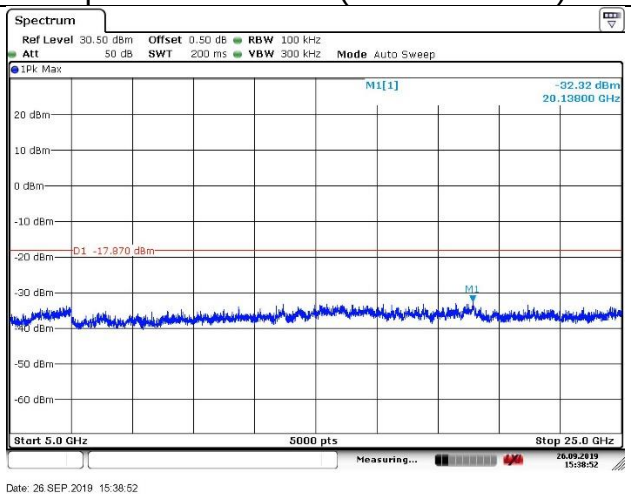
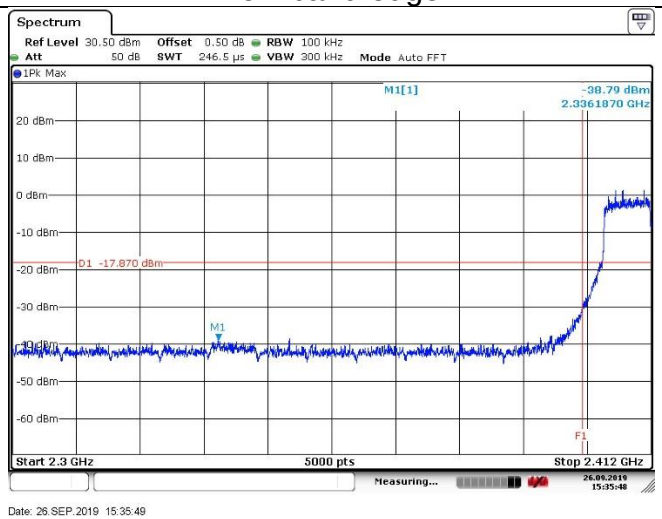
802.11b Out-of-Band Emissions	
Channel 01 (2462MHz)	
Reference point	Spurious Emission (30MHz – 1GHz)
	
Spurious Emission (1GHz –5GHz)	Spurious Emission (5GHz –25GHz)
	
High band edge	
	

802.11g Out-of-Band Emissions	
Channel 01 (2412MHz)	
Reference point	Spurious Emission (30MHz – 1GHz)
	
Spurious Emission (1GHz –5GHz)	Spurious Emission (5GHz –25GHz)
	
Low band edge	
	

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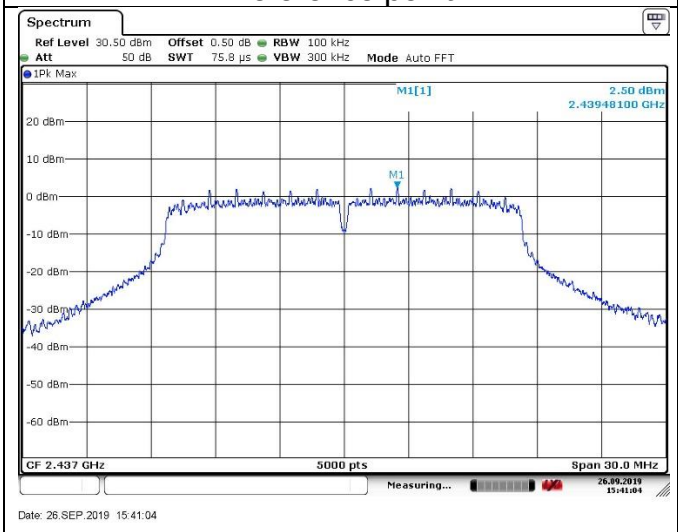
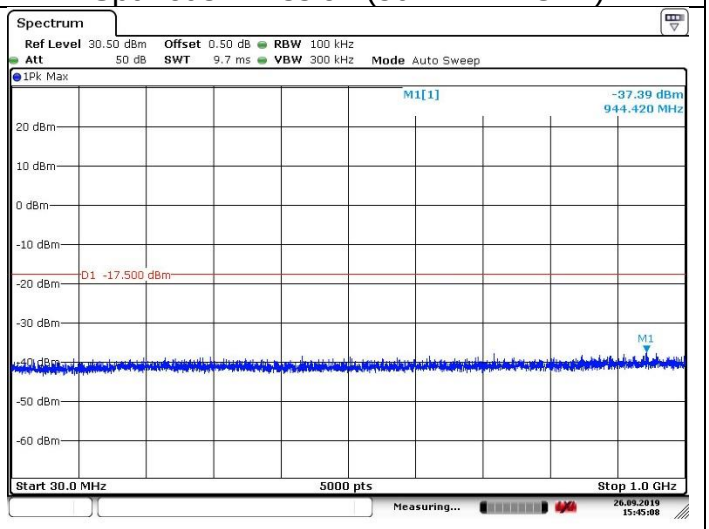
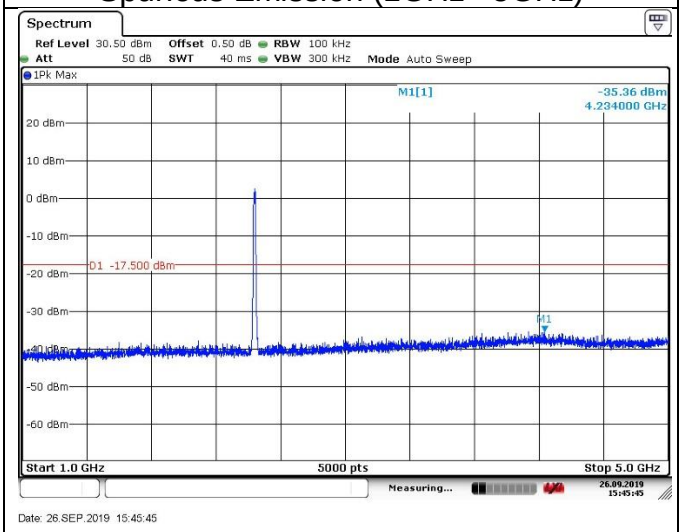
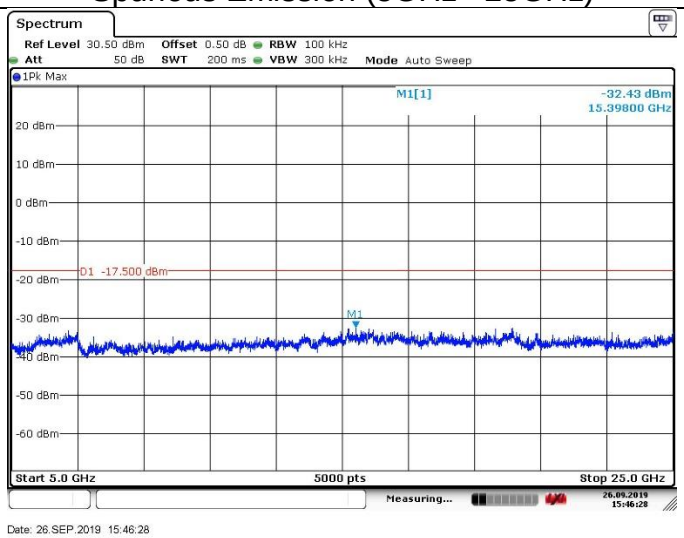
802.11g Out-of-Band Emissions	
Channel 06 (2437MHz)	
Reference point	Spurious Emission (30MHz – 1GHz)
	
Spurious Emission (1GHz –5GHz)	Spurious Emission (5GHz –25GHz)
	

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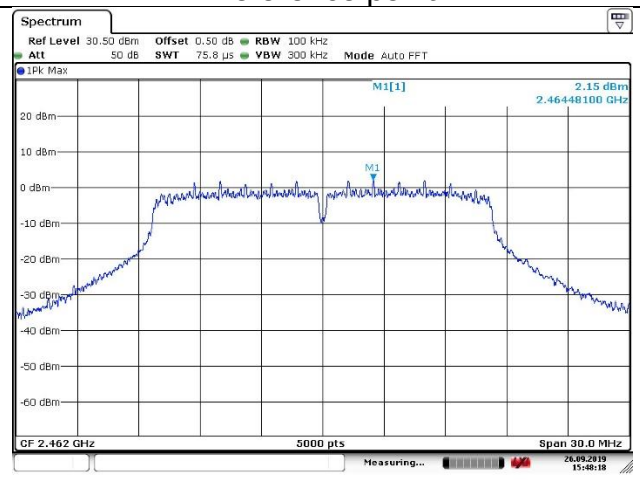
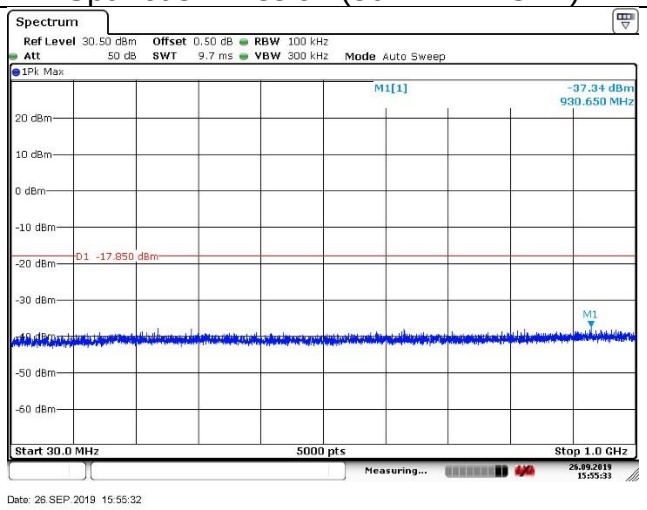
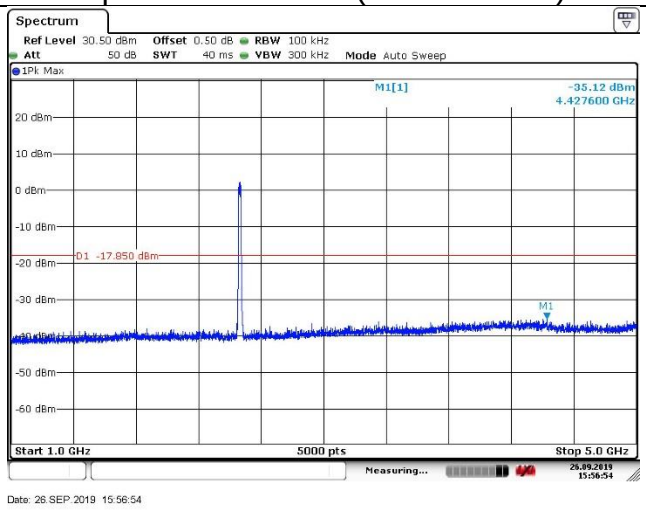
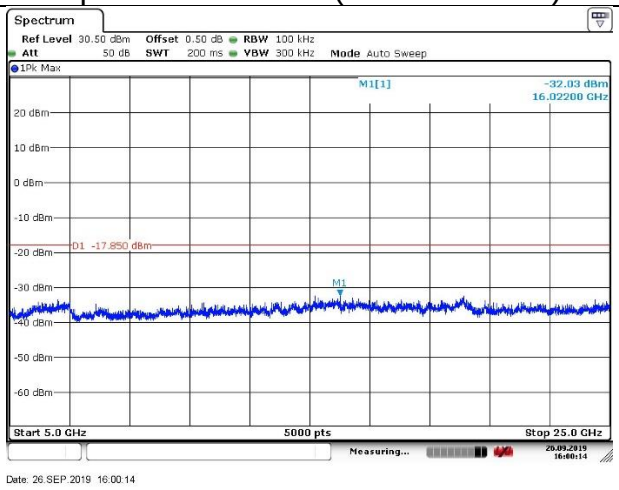
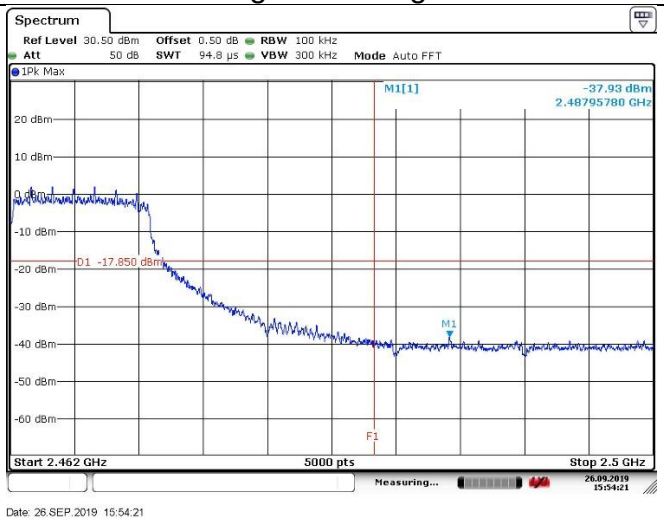
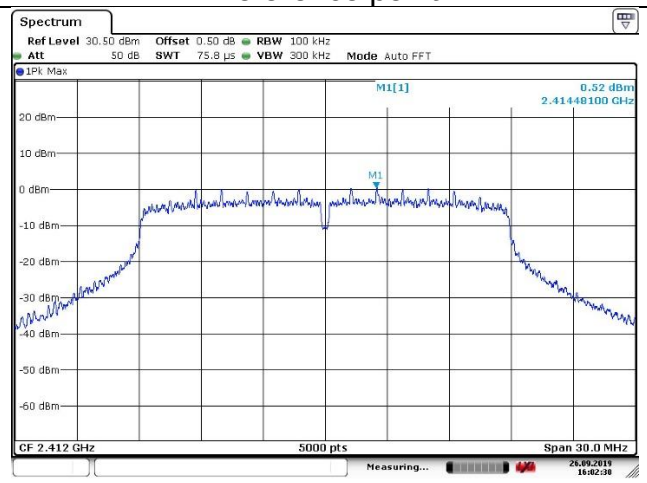
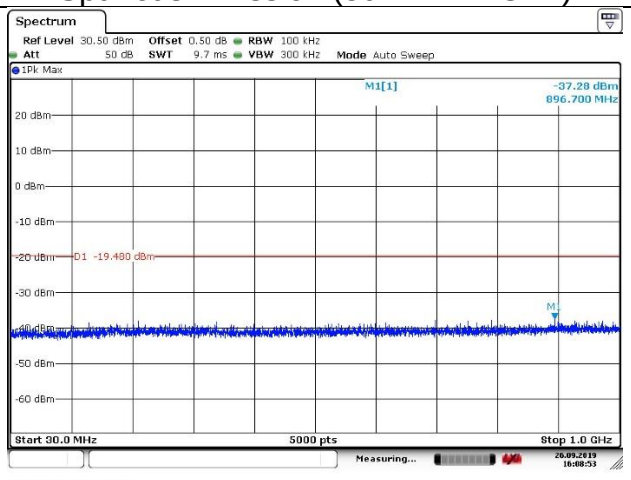
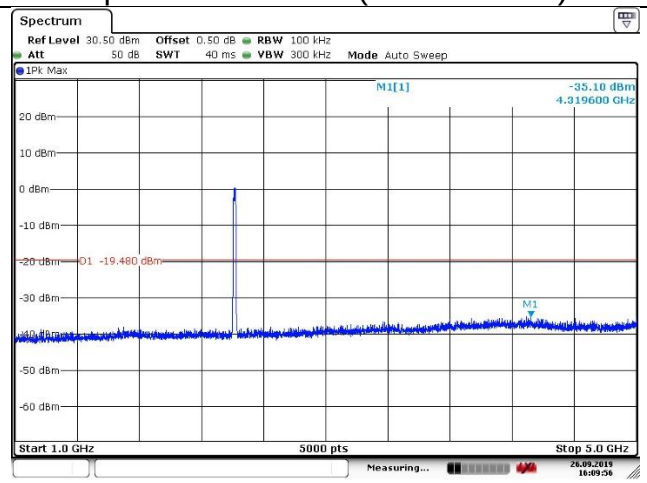
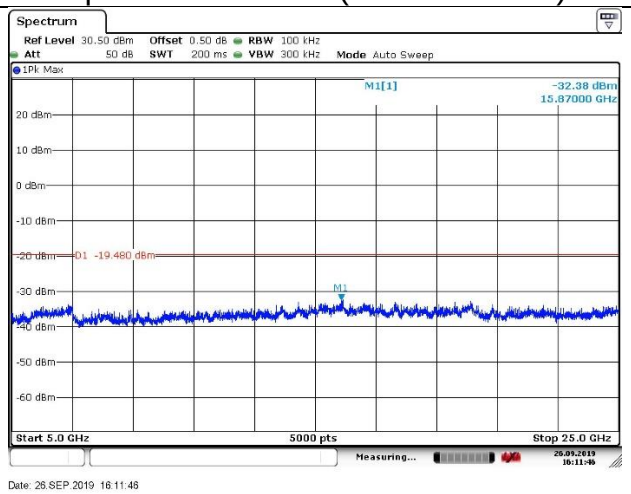
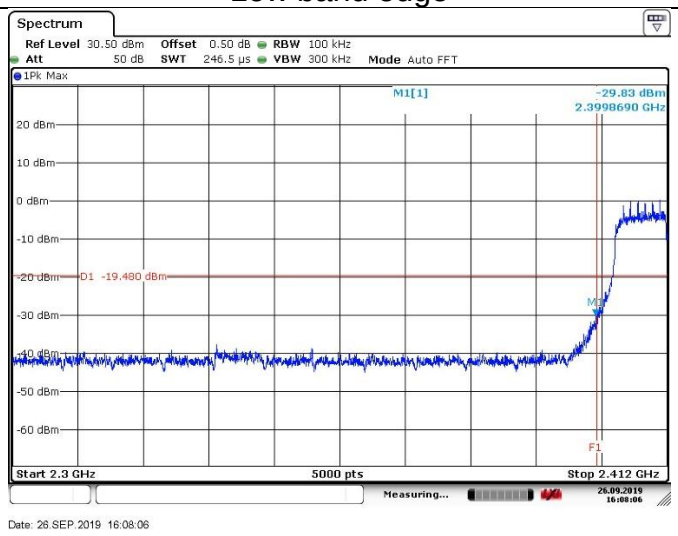
802.11g Out-of-Band Emissions	
Channel 11 (2462MHz)	
Reference point	Spurious Emission (30MHz – 1GHz)
	
Spurious Emission (1GHz –5GHz)	Spurious Emission (5GHz –25GHz)
	
High band edge	
	

802.11n-HT20 Out-of-Band Emissions	
Channel 01 (2412MHz)	
Reference point	Spurious Emission (30MHz – 1GHz)
	
Spurious Emission (1GHz –5GHz)	Spurious Emission (5GHz –25GHz)
	
Low band edge	
	

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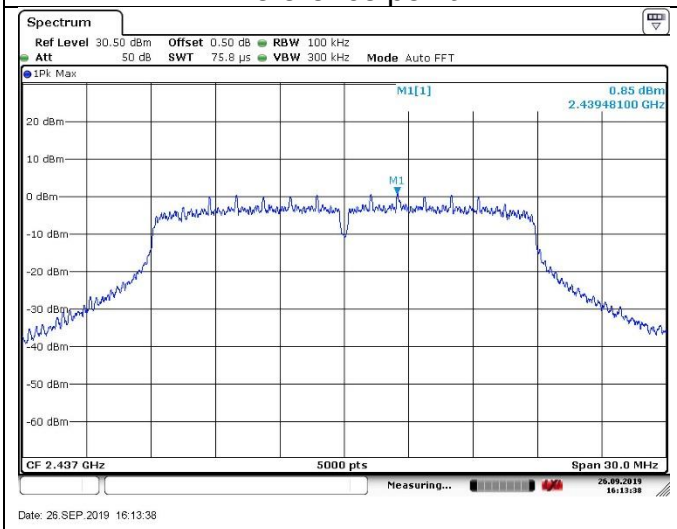
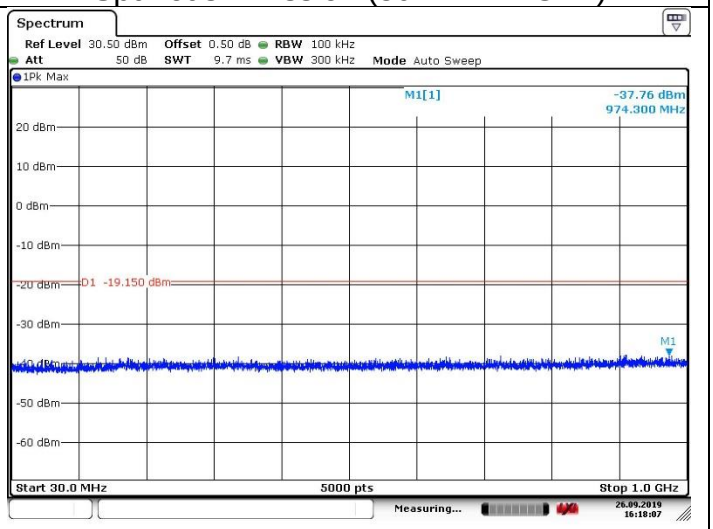
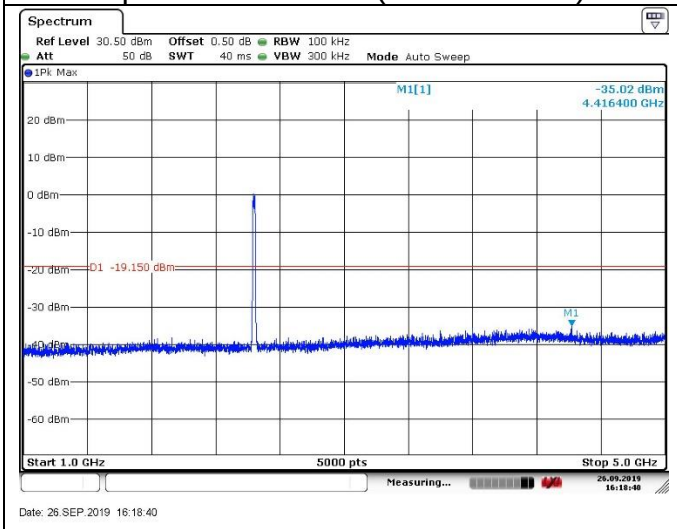
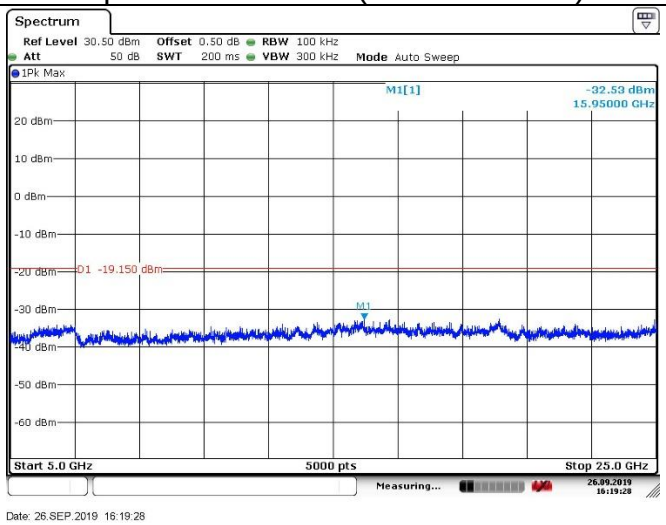
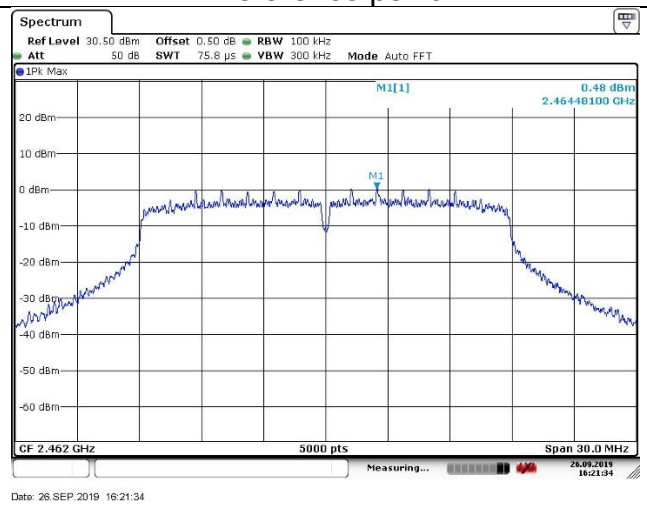
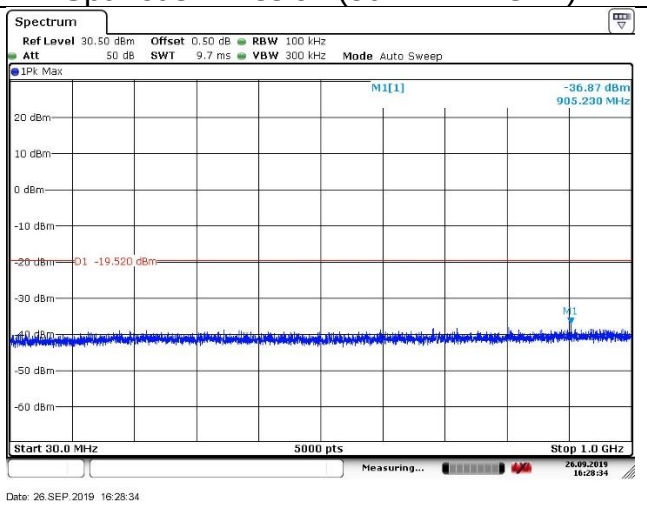
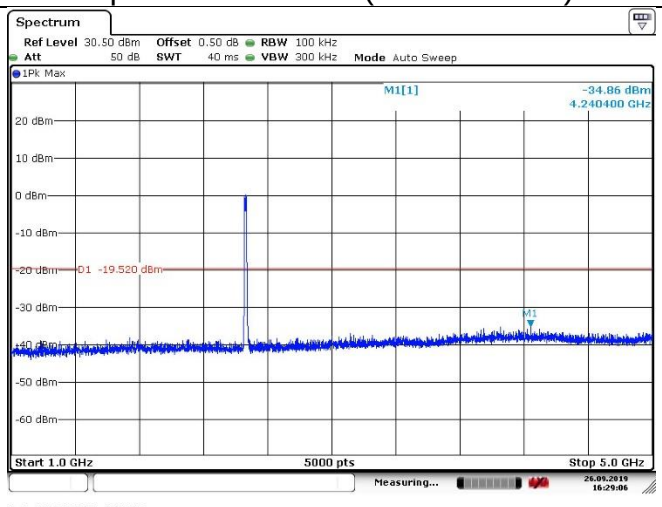
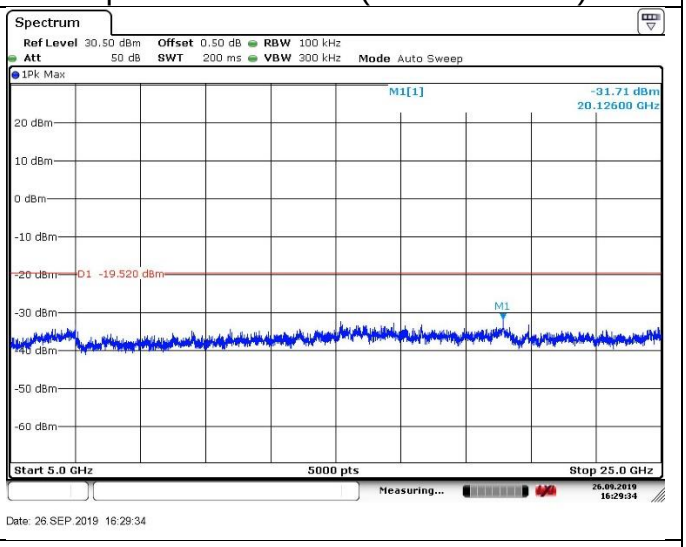
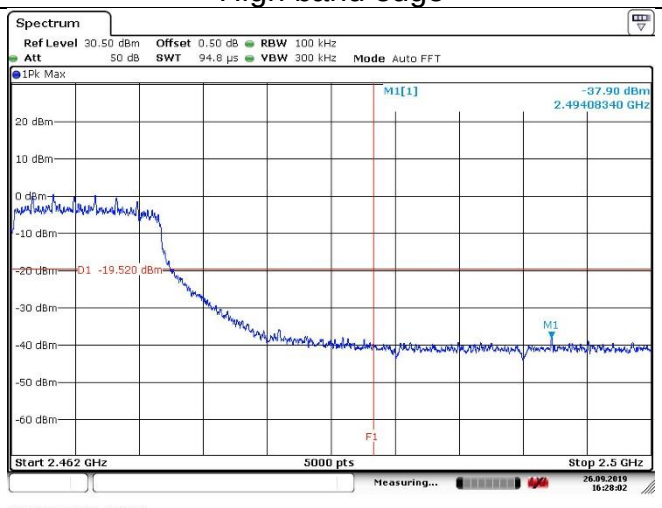
802.11n-HT20 Out-of-Band Emissions	
Channel 06 (2437MHz)	
Reference point	Spurious Emission (30MHz – 1GHz)
	
Spurious Emission (1GHz –5GHz)	Spurious Emission (5GHz –25GHz)
	

802.11n-HT20 Out-of-Band Emissions	
Channel 11 (2462MHz)	
Reference point	Spurious Emission (30MHz – 1GHz)
	
Spurious Emission (1GHz –5GHz)	Spurious Emission (5GHz –25GHz)
	
High band edge	
	

9.6 Spurious radiated emissions for transmitter

Test Method

1. 1: The EUT was place on a turn table which is 1.5m above ground plane for above 1GHz and 0.8m above ground for below 1GHz at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
2. The EUT was set 3 meters away from the interference – receiving antenna, which was mounted on the top of a variable – height antenna tower.
3. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. Use the following spectrum analyzer settings According to C63.10:

For Below 1GHz

Use the following spectrum analyzer settings:
Span = wide enough to capture the peak level of the in-band emission and all spurious
RBW = 100 kHz to 120 kHz, VBW≥RBW for peak measurement, Sweep = auto, Detector function = peak, Trace = max hold.

For Peak unwanted emissions Above 1GHz:

Span = wide enough to capture the peak level of the in-band emission and all spurious
RBW = 1MHz, VBW≥RBW for peak measurement, Sweep = auto, Detector function = peak, Trace = max hold.

Procedures for average unwanted emissions measurements above 1000 MHz

a) RBW = 1MHz.
b) VBW ≥ [3 × RBW].
c) Detector = RMS (power averaging), if [span / (# of points in sweep)] ≤ RBW / 2. Satisfying this condition can require increasing the number of points in the sweep or reducing the span. If the condition is not satisfied, then the detector mode shall be set to peak.
d) Averaging type = power (i.e., rms) (As an alternative, the detector and averaging type may be set for linear voltage averaging. Some instruments require linear display mode to use linear voltage averaging. Log or dB averaging shall not be used.)
e) Sweep time = auto.
f) Perform a trace average of at least 100 traces if the transmission is continuous. If the transmission is not continuous, then the number of traces shall be increased by a factor of 1 / D, where D is the duty cycle. For example, with 50% duty cycle, at least 200 traces shall be averaged. (If a specific emission is demonstrated to be continuous—i.e., 100% duty cycle—then rather than turning ON and OFF with the transmit cycle, at least 100 traces shall be averaged.)
g) If tests are performed with the EUT transmitting at a duty cycle less than 98%, then a correction factor shall be added to the measurement results prior to comparing with the emission limit, to compute the emission level that would have been measured had the test been performed at 100% duty cycle. The correction factor is computed as follows:
1) If power averaging (rms) mode was used in the preceding step e), then the correction

factor is [10 log (1 / D)], where D is the duty cycle. For example, if the transmit duty cycle was 50%, then 3 dB shall be added to the measured emission levels.
2) If linear voltage averaging mode was used in the preceding step e), then the correction factor is [20 log (1 / D)], where D is the duty cycle. For example, if the transmit duty cycle was 50%, then 6 dB shall be added to the measured emission levels.
3) If a specific emission is demonstrated to be continuous (100% duty cycle) rather than turning ON and OFF with the transmit cycle, then no duty cycle correction is required for that emission.

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Limit

The radio emission outside the operating frequency band shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power. Radiated emissions which fall in the restricted bands, as defined in section15.205, must comply with the radiated emission limits specified in section 15.209.

Frequency MHz	Field Strength uV/m	Measured Distance Meters
0.009~0.490	2400/F (kHz)	300
0.490~1.705	24000/F (kHz)	30
1.705~30	30	30

Frequency MHz	Field Strength uV/m	Field Strength dBµV/m	Detector
30-88	100	40	QP
88-216	150	43.5	QP
216-960	200	46	QP
960-1000	500	54	QP
Above 1000	500	54	AV
Above 1000	5000	74	PK

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Spurious radiated emissions for transmitter

According to C63.10, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement, so AV emission value did not show in below table if the peak value complies with average limit.

Transmitting spurious emission test result as below:
Remark 1: There are the ambient noise within frequency range 9kHz ~ 30MHz and 18GHz ~ 25GHz, the permissible value is not show in the report.
Remark 2: Average measurement was not performed if peak level lower than average limit.
Remark 3: Other frequency was 20dB below limit line with 1-18GHz, there is not show in the report.

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Test Result

Test mode: 802.11b					
Channel 01 (2412MHz)					
Frequency (MHz)	**Measure Level (dBuV/m)**	**Limit (dBuV/M)**	**Margin (dB)**	**Detector**	**Polarization**
2390.0	55.60	74.0	-18.4	Peak	Horizontal
2390.0	41.10	54.0	-12.9	Average	Horizontal
4823.8	42.36	74.0	-31.64	Peak	Horizontal
2382.2	56.37	74.0	-17.63	Peak	Vertical
2382.2	41.44	54.0	-12.56	Average	Vertical
4823.9	43.09	74.0	-30.91	Peak	Vertical

Test mode: 802.11b					
Channel 06 (2437 MHz)					
Frequency (MHz)	**Measure Level (dBuV/m)**	**Limit (dBuV/M)**	**Margin (dB)**	**Detector**	**Polarization**
4873.8	41.33	74.0	-32.67	Peak	Horizontal
7310.7	40.20	74.0	-33.80	Peak	Horizontal
4874.3	39.87	74.0	-34.13	Peak	Vertical
7310.7	39.25	74.0	-34.75	Peak	Vertical

Test mode: 802.11b					
Channel 11 (2462MHz)					
Frequency (MHz)	**Measure Level (dBuV/m)**	**Limit (dBuV/M)**	**Margin (dB)**	**Detector**	**Polarization**
2483.5	56.20	74.0	-17.80	Peak	Horizontal
2483.5	40.12	54.0	-13.88	Average	Horizontal
4923.1	41.22	74.0	-32.78	Peak	Horizontal
2483.7	51.46	74.0	-22.54	Peak	Vertical
4923.8	39.11	74.0	-34.89	Peak	Vertical

Remark:

(1) Emission level= Original Receiver Reading + Correct Factor
(2) Correct Factor = Antenna Factor + Cable Loss -Amplifier gain
(3) Margin = limit – Corrected Reading

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Test mode: 802.11g					
Channel 01 (2412MHz)					
Frequency (MHz)	**Measure Level (dBuV/m)**	**Limit (dBuV/M)**	**Margin (dB)**	**Detector**	**Polarization**
2390.0	58.60	74.0	-15.40	Peak	Horizontal
2390.0	45.50	54.0	-8.50	Average	Horizontal
4823.3	40.50	74.0	-33.50	Peak	Horizontal
2389.6	51.37	74.0	-22.63	Peak	Vertical
4823.2	40.70	74.0	-33.30	Peak	Vertical

Test mode: 802.11g					
Channel 06 (2437 MHz)					
Frequency (MHz)	**Measure Level (dBuV/m)**	**Limit (dBuV/M)**	**Margin (dB)**	**Detector**	**Polarization**
4869.2	41.22	74.0	-32.78	Peak	Horizontal
7311.1	40.34	74.0	-33.66	Peak	Horizontal
4878.1	41.32	74.0	-32.68	Peak	Vertical
7312.5	39.40	74.0	-34.60	Peak	Vertical

Test mode: 802.11g					
Channel 11 (2462MHz)					
Frequency (MHz)	**Measure Level (dBuV/m)**	**Limit (dBuV/M)**	**Margin (dB)**	**Detector**	**Polarization**
2483.5	60.77	74.0	-13.23	Peak	Horizontal
2483.5	42.60	54.0	-11.40	Average	Horizontal
4924.2	40.35	74.0	-33.65	Peak	Horizontal
2483.5	58.88	74.0	-15.12	Peak	Vertical
2483.5	42.62	54.0	-11.38	Average	Vertical
4923.6	40.58	74.0	-33.42	Peak	Vertical

Remark:

(4) Emission level= Original Receiver Reading + Correct Factor
(5) Correct Factor = Antenna Factor + Cable Loss -Amplifier gain
(6) Margin = limit – Corrected Reading

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Test mode: 802.11n-HT20					
Channel 01 (2412MHz)					
Frequency (MHz)	**Measure Level (dBuV/m)**	**Limit (dBuV/M)**	**Margin (dB)**	**Detector**	**Polarization**
2389.6	60.10	74.0	-13.90	Peak	Horizontal
2389.6	41.47	54.0	-12.53	Average	Horizontal
4822.3	40.20	74.0	-33.80	Peak	Horizontal
2390.0	52.02	74.0	-21.98	Peak	Vertical
4825.0	40.17	74.0	-33.83	Peak	Vertical

Test mode: 802.11n-HT20					
Channel 06 (2437 MHz)					
Frequency (MHz)	**Measure Level (dBuV/m)**	**Limit (dBuV/M)**	**Margin (dB)**	**Detector**	**Polarization**
4873.9	40.08	74.0	-33.92	Peak	Horizontal
7312.8	40.00	74.0	-34.00	Peak	Horizontal
4872.5	40.17	74.0	-33.83	Peak	Vertical
7312.8	40.04	74.0	-33.96	Peak	Vertical

Test mode: 802.11n-HT20					
Channel 11 (2462MHz)					
Frequency (MHz)	**Measure Level (dBuV/m)**	**Limit (dBuV/M)**	**Margin (dB)**	**Detector**	**Polarization**
2484.0	56.44	74.0	-17.56	Peak	Horizontal
2484.0	41.33	54.0	-12.67	Average	Horizontal
4920.4	40.35	74.0	-33.65	Peak	Horizontal
2485.2	50.48	74.0	-23.52	Peak	Vertical
4923.6	40.24	74.0	-33.76	Peak	Vertical

Remark:

(1) Emission level= Original Receiver Reading + Correct Factor
(2) Correct Factor = Antenna Factor + Cable Loss -Amplifier gain
(3) Margin = limit – Corrected Reading

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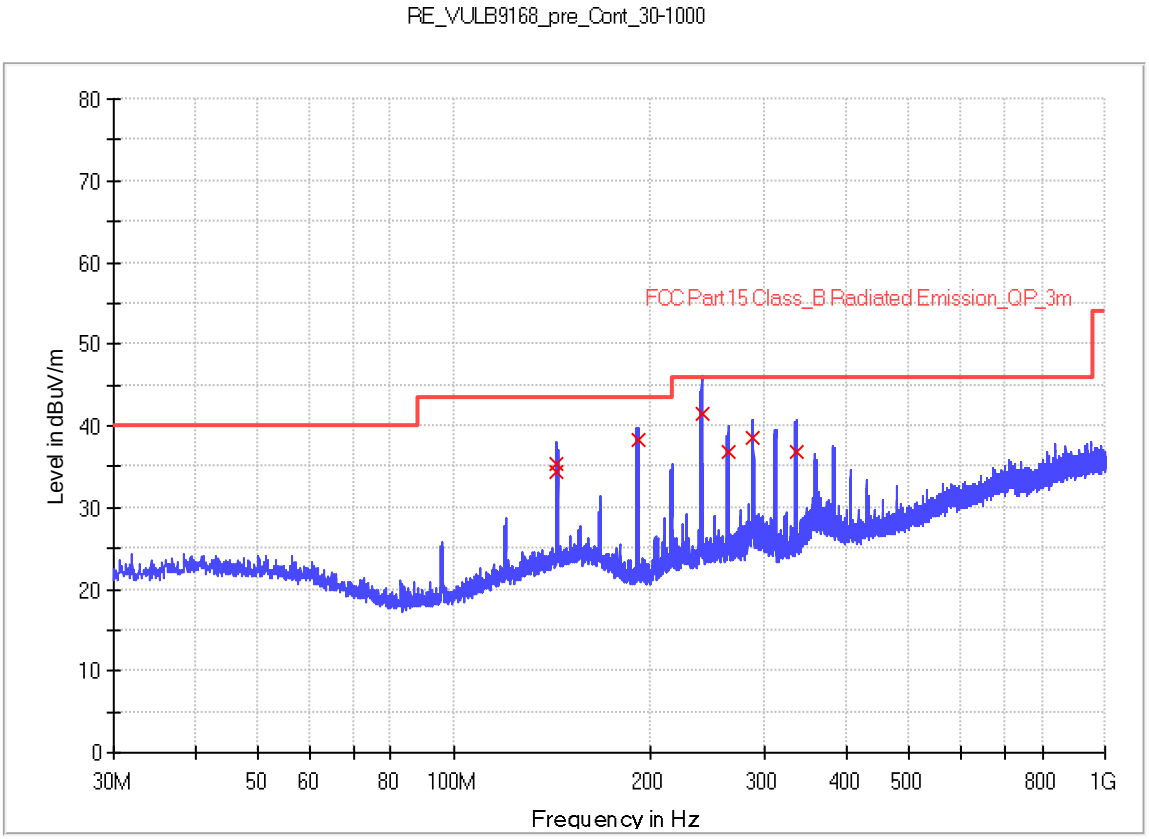
The worst case of Radiated Emission below 1GHz:

Site: 3-meter chamber	Time: 2019/09/30 - 11:15
Limit: FCC_Part15.109_RE(3m)_ClassB	Engineer: Jiaxi XU
Probe: VULB9168	Polarity: Horizontal
EUT: WIFI Module, Model no: WRD3L	Power: 120VAC, 60Hz (powered by notebook)
Note: Transmit by 802.11g at channel 2437MHz. Note: There is the worst case within frequency range 30MHz~1GHz.	



Limit and Margin

Frequency (MHz)	QuasiPeak (dBuV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBuV/m)
191.920000	38.2	1000.0	120.000	100.0	H	359.0	12.1	5.3	43.5
239.960000	41.5	1000.0	120.000	100.0	H	359.0	13.4	4.5	46.0
287.840000	38.4	1000.0	120.000	100.0	H	359.0	14.7	7.6	46.0
335.840000	36.9	1000.0	120.000	100.0	H	359.0	16.0	9.1	46.0

Note 1: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)
Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)
Note 2: The test trace is same as the ambient noise and the amplitude of the emissions are attenuated more than 20dB below the permissible (the test frequency range: 9kHz ~ 30MHz, 18GHz ~ 25GHz), therefore no data appear in the report.

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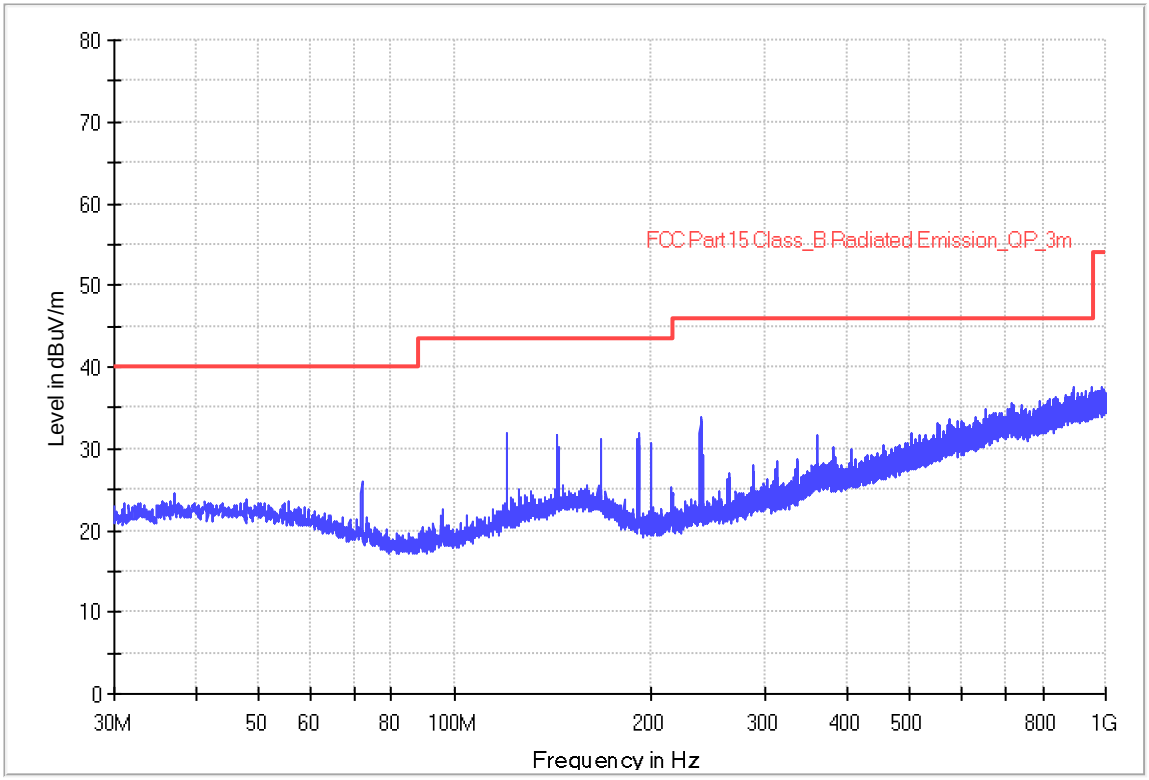
Site: 3-meter chamber	Time: 2019/09/30 - 11:35
Limit: FCC_Part15.109_RE(3m)_ClassB	Engineer: Jiaxi XU
Probe: VULB9168	Polarity: Vertical
EUT: WIFI Module, Model no: WRD3L	Power: 120VAC, 60Hz (powered by notebook)
Note: Transmit by 802.11g at channel 2437MHz. Note: There is the worst case within frequency range 30MHz~1GHz.	

RE_VULB9168_pre_Cont_30-1000



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10 Test Equipment List

List of Test Instruments
Test Site1

	DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DUE DATE
C	Signal Analyzer	Rohde & Schwarz	FSV40	101091	2020-8-4
	Wideband power sensor	Rohde & Schwarz	NRP-Z81	103140	2020-8-4
RE	EMI Test Receiver	Rohde & Schwarz	ESR3	101906	2020-8-4
	Signal Analyzer	Rohde & Schwarz	FSV40	101091	2020-8-4
	Trilog Super Broadband Test Antenna	Schwarzbeck	VULB 9163	848	2021-6-10
	Horn Antenna	Rohde & Schwarz	HF907	102393	2021-4-1
	Pre-amplifier	Rohde & Schwarz	SCU-18D	19006451	2020-8-4
	Loop antenna	Rohde & Schwarz	HFH2-Z2	100443	2020-6-27
	DOUBLE-RIDGED WAVEGUIDE HORN WITH PRE-AMPLIFIER (18 GHZ - 40 GHZ)	ETS-Lindgren	3116C-PA	E326	2021-1-28
	3m Semi-anechoic chamber	TDK	9X6X6	----	2021-5-10
CE	EMI Test Receiver	Rohde & Schwarz	ESR 3	101907	2020-8-4
	LISN	Rohde & Schwarz	ENV216	101924	2020-8-4

C - Conducted RF tests

- Conducted peak output power
- 6dB Occupied Bandwidth
- Power spectral density*
- Spurious RF conducted emissions
- Conducted Band edge

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11 System Measurement Uncertainty

For a 95% confidence level, the measurement expanded uncertainties for defined systems, in accordance with the recommendations of ISO 17025 were:

Test Site1

Items	Extended Uncertainty
Conducted Disturbance at Mains Terminals	150kHz to 30MHz, LISN, 3.16dB
Radiated Disturbance	30MHz to 1GHz, ±5.03dB (Horizontal) ±5.12dB (Vertical) 1GHz to 18GHz, ±5.15dB (Horizontal) ±5.12dB (Vertical) 18GHz to 25GHz, ±4.76dB

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12 Photographs of Test Set-ups

Refer to the < Test Setup photos >.

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13 Photographs of EUT

Refer to the < External Photos > & < Internal Photos >.

THE END

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