China

FCC - TEST REPORT

Report Number	:	**708881974833-00**	Date of Issue:	October 31, 2019
Model	:	**TYWE3SE**		
Product Type	:	TYWE3SE Wi-Fi and Bluetooth Module		
FCC ID	:	2ANDL-TYWE3SE		
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, Zhejiang China		
Test Result	:	■ **Positive** ☐ **Negative**		
Total pages including Appendices	:	48		

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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
Test Firm Registration Number:	820234
Telephone:	+86 21 6141 0123
Fax:	+86 21 6140 8600

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3 Description of the Equipment under Test

Product:	TYWE3SE Wi-Fi and Bluetooth Module
Model no.:	TYWE3SE
FCC ID:	2ANDL-TYWE3SE
Options and accessories:	N/A
Rating:	3~3.6V DC
RF Transmission Frequency:	2402~2480MHz for Bluetooth For 2.4G Wi-Fi For 802.11b/g/n-HT20: 2412~2462 MHz For 802.11n-HT40: 2422~2452 MHz
No. of Operated Channel:	79 for Bluetooth 4.2 BR+EDR 40 for Bluetooth 4.2 BLE For 2.4GHz Wi-Fi

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		

Operation Frequency each of channel For 802.11n(H40)

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

Modulation:	Bluetooth 4.2 BR+EDR FHSS: GFSK, 8DPSK, π/4 DQPSK Bluetooth 4.2 BLE DHSS: QPSK For Wi-Fi: Direct Sequence Spread Spectrum (DSSS) for 802.11b Orthogonal Frequency Division Multiplexing(OFDM) for 802.11g/n
Data speed:	1. Bluetooth BR+EDR: 1Mbps, 2Mbps, 3Mbps 2. Bluetooth BLE: 1Mbps 3. 802.11b: 1, 2, 5.5, or 11 (Mbit/s) 802.11g: 6, 9, 12, 18, 24, 36, 48, or 54 (Mbit/s) 802.11n: HT20 & HT40 MCS0 to MCS7
Duty Cycle:	100%
Antenna Type:	PCB

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Antenna Gain:	2.5dBi
Description of the EUT:	The Equipment Under Test (EUT) is a RF Module with Bluetooth and WI-FI function. The EUT support Bluetooth 4.2 BR+EDR and support BLE function and Wi-Fi operated at 2.4GHz. Only 2.4G Wi-Fi included in this report.

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4 Summary of Test Standards

Test Standards	
FCC Part 15 Subpart C 10-1-2014 Edition	PART 15 - RADIO FREQUENCY DEVICES Subpart C - Intentional Radiators

All the test methods were according to KDB 558074 D01 15.247 Meas 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	13	Site 1	☒	☐	☒
§15.247 (b) (1)	Conducted peak output power	16	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(a)(2)	6dB Occupied Bandwidth	17	Site 1	☒	☐	☐
§15.247(e)	Power spectral density	22	Site 1	☒	☐	☐
§15.247(d)	Conducted Band Edge and Out-of-Band Emissions	27	Site 1	☒	☐	☐
§15.247(d) & §15.209	Spurious radiated emissions for transmitter	40	Site 1	☒	☐	☐
§15.203	Antenna requirement	See note 1		☒	☐	☐

Note 1: N/A=Not Applicable. Conducted emission is not apply for battery operated device.
Note 2: The EUT uses a permanently integral antenna, which gain is 2.5dBi. In accordance 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-TYWE3SE, complies with Section 15.207, 15.209, 15.247 of the FCC Part 15, Subpart C rules.

This report in only for 2.4GHz Wi-Fi. The TX and RX range is 2412MHz-2462MHz.

SUMMARY:

All tests according to the regulations cited on page 6 were

■ - Performed

☐ - **Not** Performed

The Equipment under Test

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

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

Sample Received Date:	July 29, 2019
Testing Start Date:	July 31, 2019
Testing End Date:	August 30, 2019

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Reviewed by:	Prepared by:	Tested by:
Hui TONG	Jiaxi XU	Wenqiang LU
Review Engineer	Project Engineer	Test Engineer

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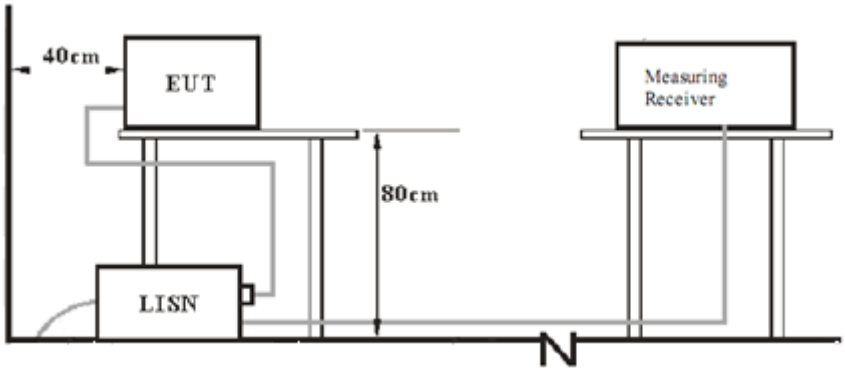
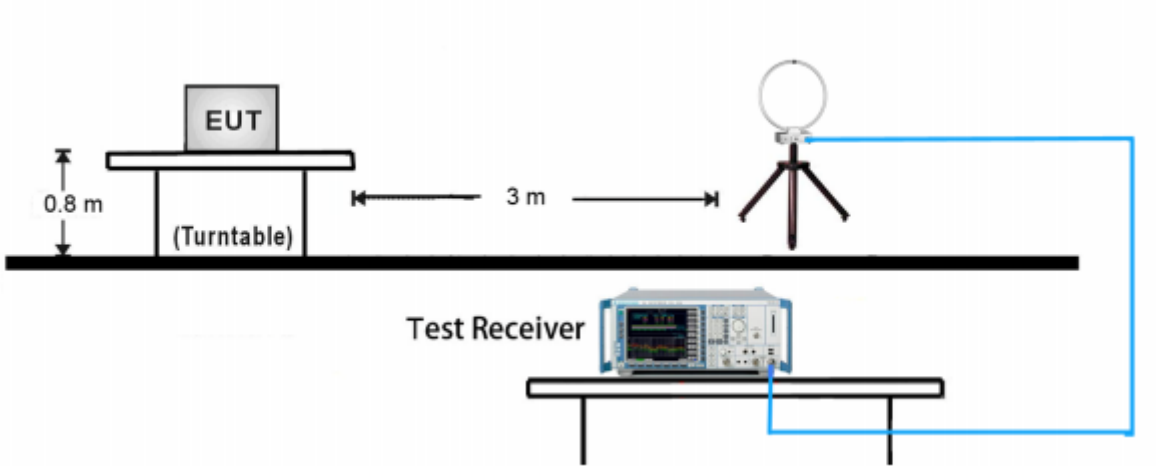
7 Test Setups

7.1 AC Power Line Conducted Emission test setups



7.2 Radiated test setups

9kHz ~ 30MHz Test Setup:



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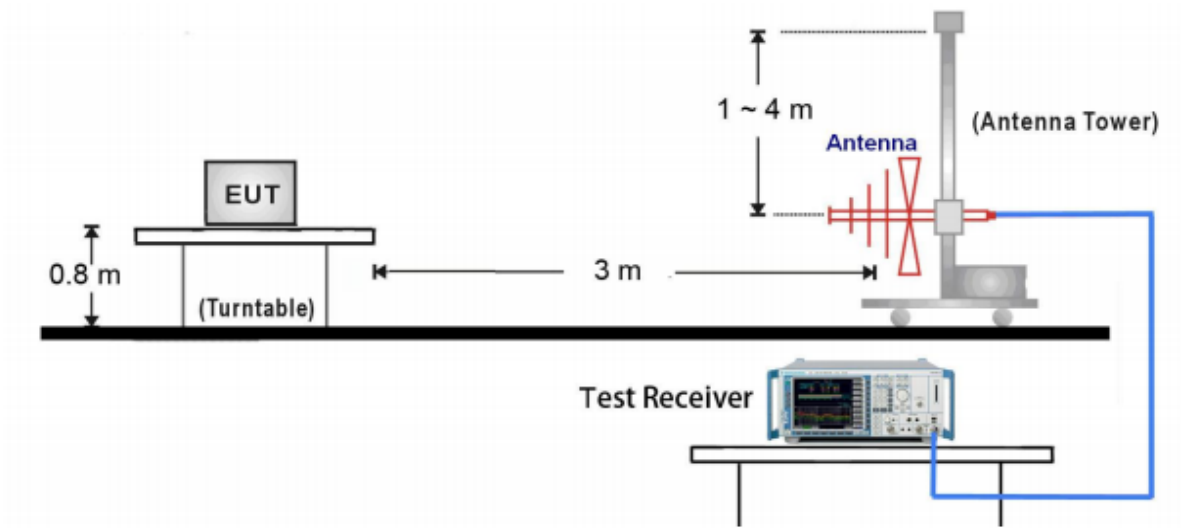
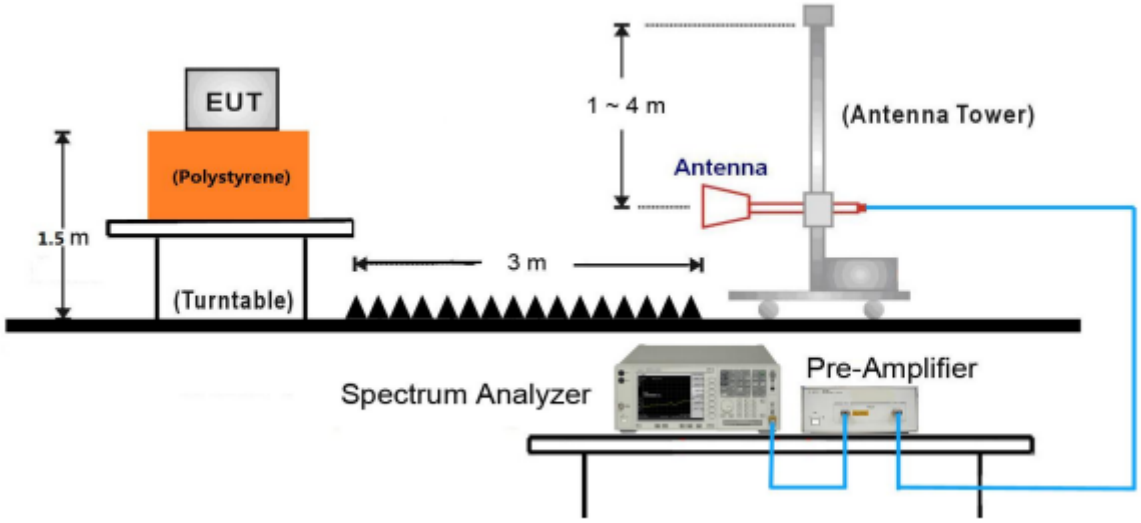
30MHz ~ 1GHz Test Setup:



1GHz ~ 18GHz Test Setup:



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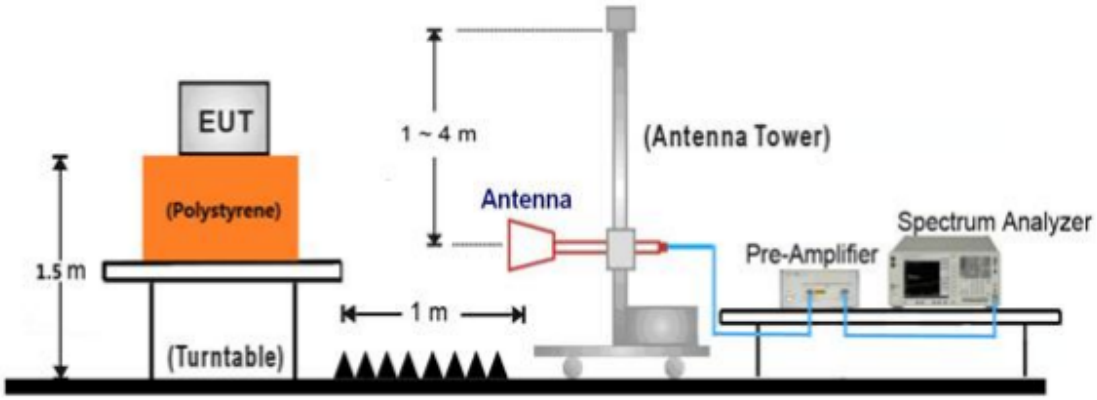
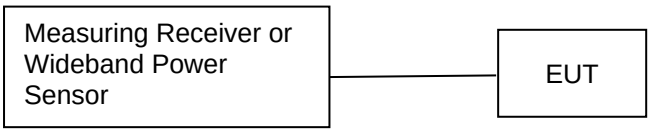
18GHz ~ 25GHz Test Setup:



7.3 Conducted RF test setups



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8 Systems test configuration

Auxiliary Equipment Used during Test:

DESCRIPTION	MANUFACTURER	MODEL NO.(SHIELD)	S/N(LENGTH)
Notebook	Lenove	X240	--

Test software: SecureCRT, which used to control the EUT in continues transmitting mode

802.11b/802.11g/802.11n-HT20

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

802.11n-HT40

Test mode	Channel	Frequency (MHz)
Tx	3	2422
Tx	6	2437
Tx	9	2452

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)
Low, Middle, High	802.11n (HT40): OFDM	MCS0 (13.5Mbps)

Device Capabilities

This device contains the following capabilities:
802.11b/g/n-HT20/n-HT40 Wi-Fi Device.
Duty Cycle: 100%
Note: 2.4GHz WLAN (DTS) operation is possible in 20MHz, and 40MHz 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 an 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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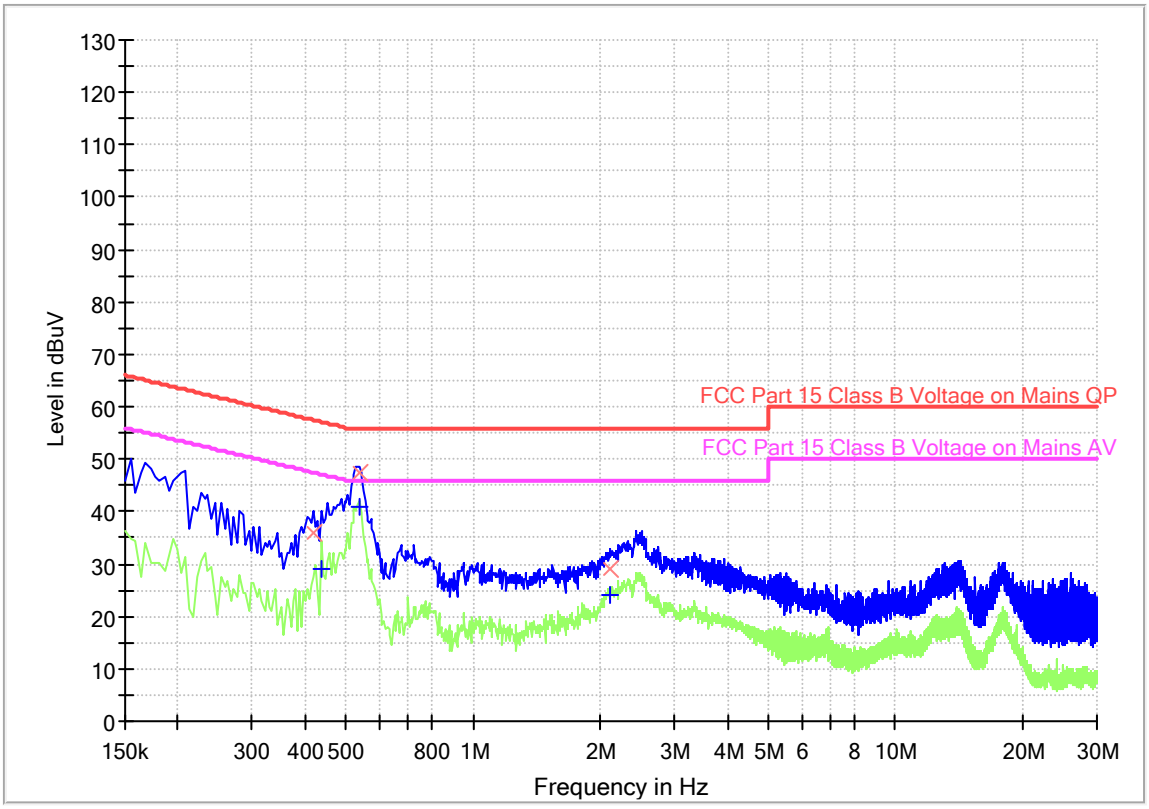
Conducted Emission

Product Type	:	TYWE3SE Wi-Fi and Bluetooth Module
M/N	:	TYWE3SE
Operating Condition	:	Mode 1: Tx 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)
0.420000	35.97	---	57.45	21.48	1000.0	9.000	L1	19.4
0.438000	---	29.02	47.10	18.08	1000.0	9.000	L1	19.4
0.537000	---	40.92	46.00	5.08	1000.0	9.000	L1	19.4
0.537000	47.35	---	56.00	8.65	1000.0	9.000	L1	19.4
2.103000	---	24.16	46.00	21.84	1000.0	9.000	L1	19.5
2.116500	28.93	---	56.00	27.07	1000.0	9.000	L1	19.5

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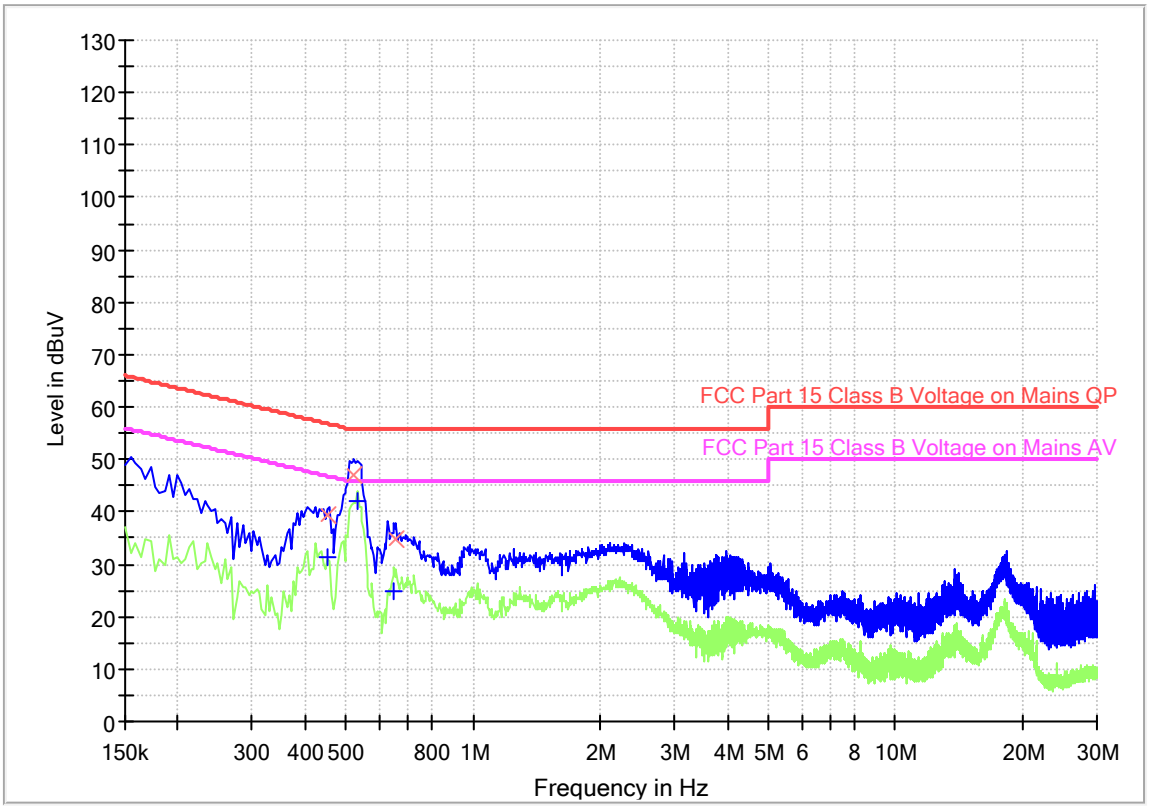
Product Type	:	TYWE3SE Wi-Fi and Bluetooth Module
M/N	:	TYWE3SE
Operating Condition	:	Mode 1: Tx powered by notebook
Test Specification	:	FCC_Part15.207
Comment	:	N-line, AC 120V/60Hz



Final_Result

Frequency (MHz)	Quasi Peak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.451500	---	31.32	46.85	15.53	1000.0	9.000	N	19.5
0.451500	39.21	---	56.85	17.64	1000.0	9.000	N	19.5
0.523500	47.16	---	56.00	8.84	1000.0	9.000	N	19.5
0.532500	---	42.23	46.00	3.77	1000.0	9.000	N	19.5
0.649500	---	24.71	46.00	21.29	1000.0	9.000	N	19.5
0.654000	34.86	---	56.00	21.14	1000.0	9.000	N	19.5

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9.2 Conducted peak output power

Test Method

1. Use the following spectrum analyzer settings:
   RBW > the 6dB 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	2.5	CH01	2412	18.17	30.00
		CH06	2437	17.88	30.00
		CH11	2462	17.82	30.00
g		CH01	2412	**19.66**	30.00
		CH06	2437	19.25	30.00
		CH11	2462	19.19	30.00
n-HT20		CH01	2412	16.51	30.00
		CH06	2437	16.53	30.00
		CH11	2462	16.19	30.00
n-HT40		CH03	2422	17.42	30.00
		CH06	2437	17.14	30.00
		CH09	2452	17.33	30.00

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9.3 6dB 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 X 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	9.081	≥ 0.5	Pass
802.11b	1Mbps	06	2437	8.683	≥ 0.5	Pass
802.11b	1Mbps	11	2462	9.045	≥ 0.5	Pass
802.11g	6Mbps	01	2412	16.57	≥ 0.5	Pass
802.11g	6Mbps	06	2437	16.57	≥ 0.5	Pass
802.11g	6Mbps	11	2462	16.57	≥ 0.5	Pass
802.11n-HT20	6.5Mbps	01	2412	17.77	≥ 0.5	Pass
802.11n-HT20	6.5Mbps	06	2437	17.775	≥ 0.5	Pass
802.11n-HT20	6.5Mbps	11	2462	17.78	≥ 0.5	Pass
802.11n-HT40	13.5Mbps	03	2422	36.614	≥ 0.5	Pass
802.11n-HT40	13.5Mbps	06	2437	36.614	≥ 0.5	Pass
802.11n-HT40	13.5Mbps	09	2452	36.577	≥ 0.5	Pass

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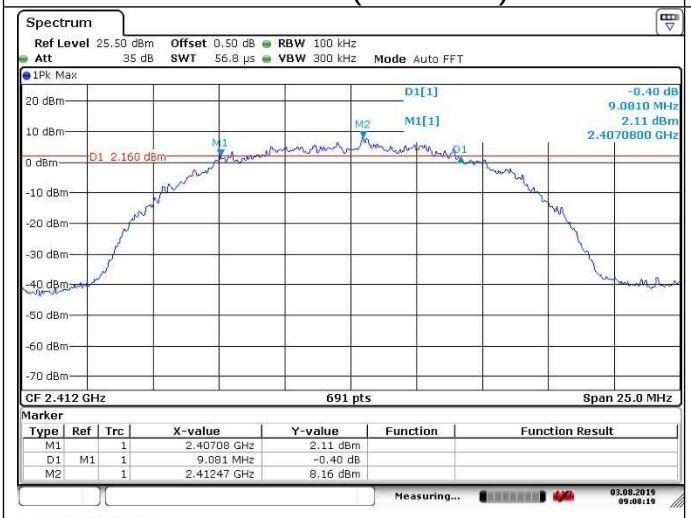
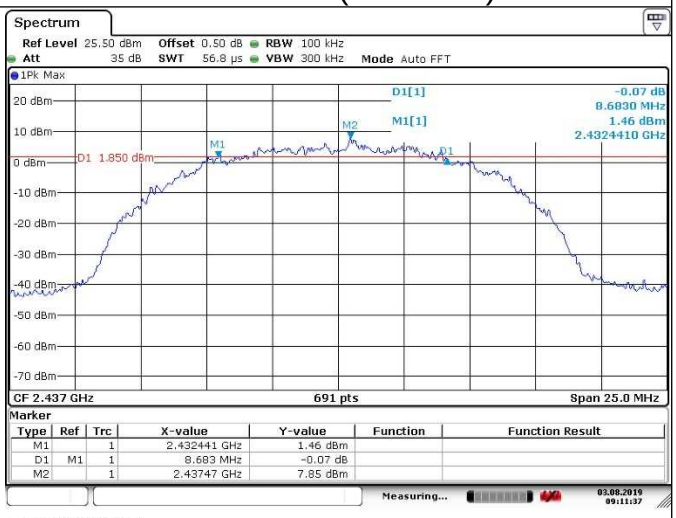
802.11b 6dB Bandwidth

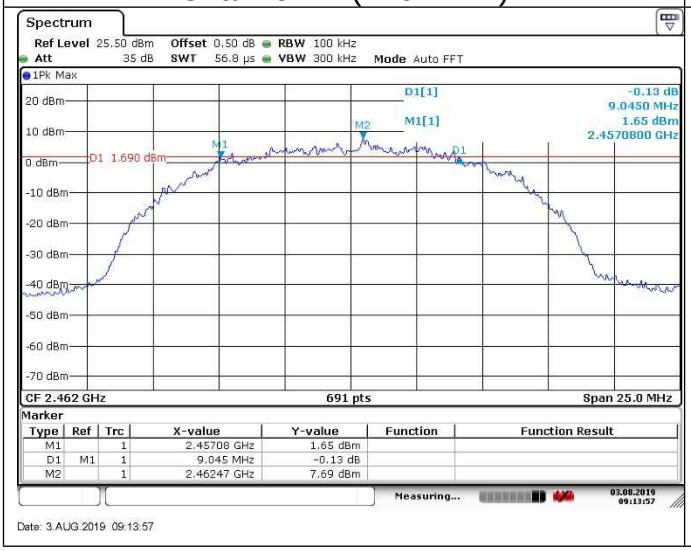
Channel 01 (2412MHz)



Channel 06 (2437MHz)



Channel 11 (2462MHz)



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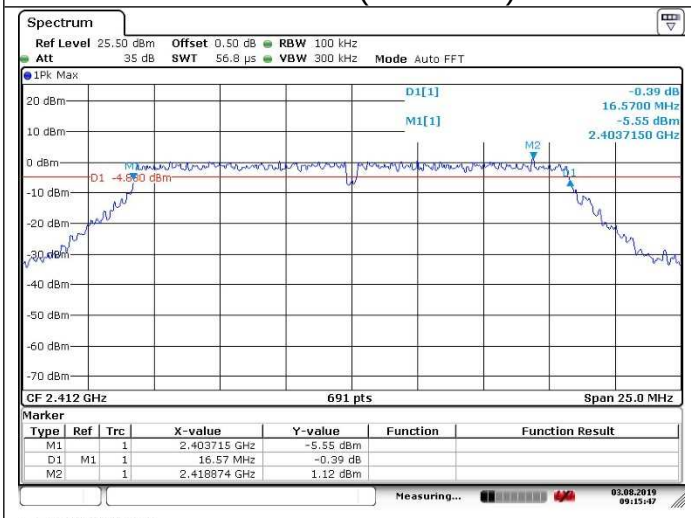
802.11g 6dB Bandwidth

Channel 01 (2412MHz)



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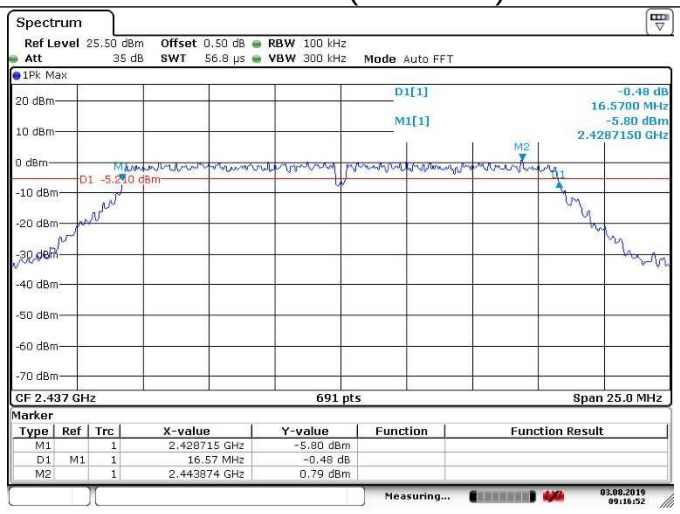
Channel 06 (2437MHz)



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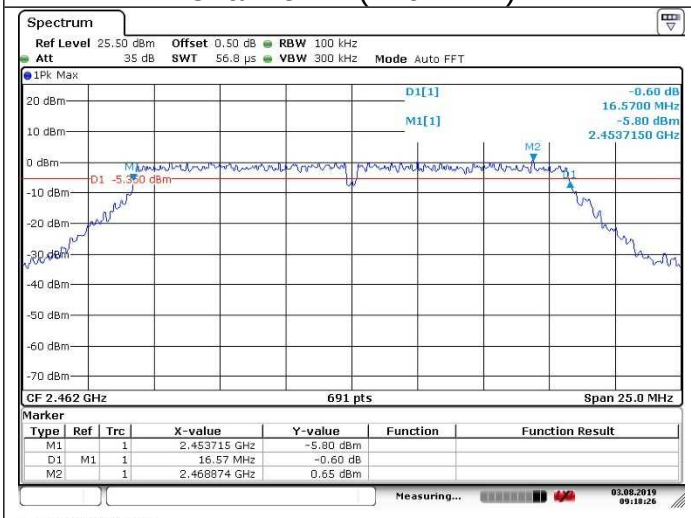
Channel 11 (2462MHz)



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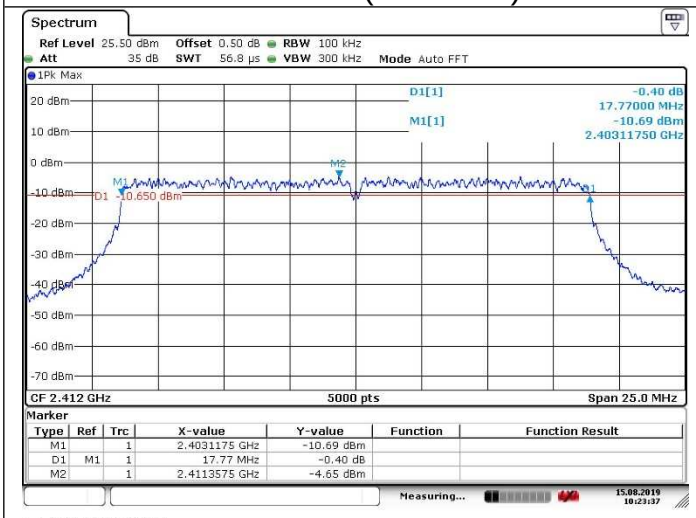
802.11n HT20 6dB Bandwidth

Channel 01 (2412MHz)



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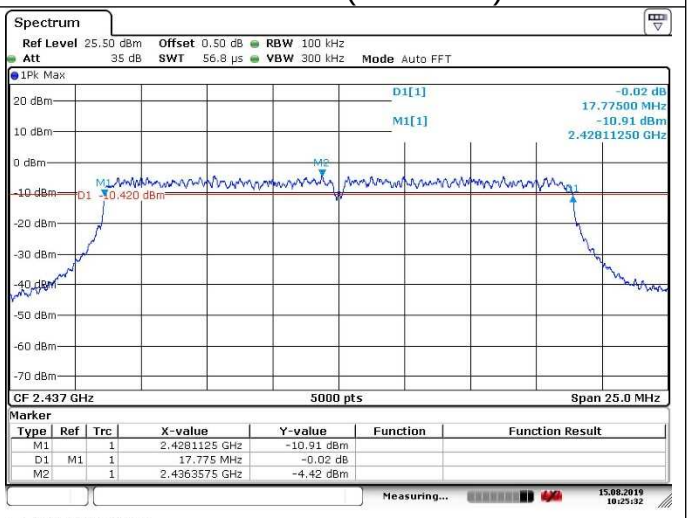
Channel 06 (2437MHz)



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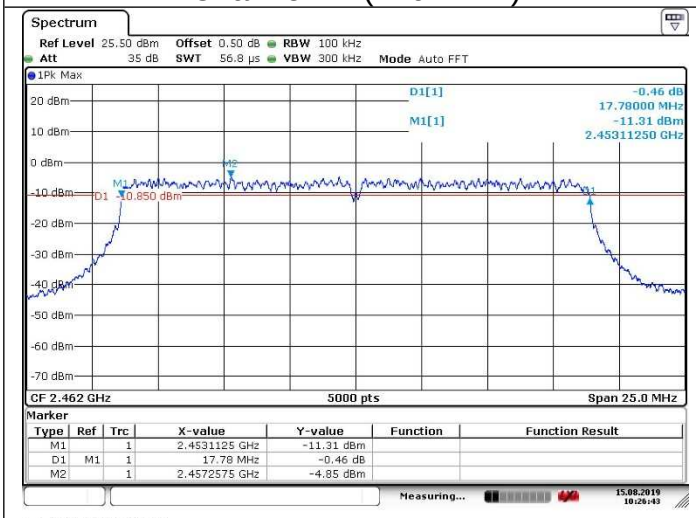
Channel 11 (2462MHz)



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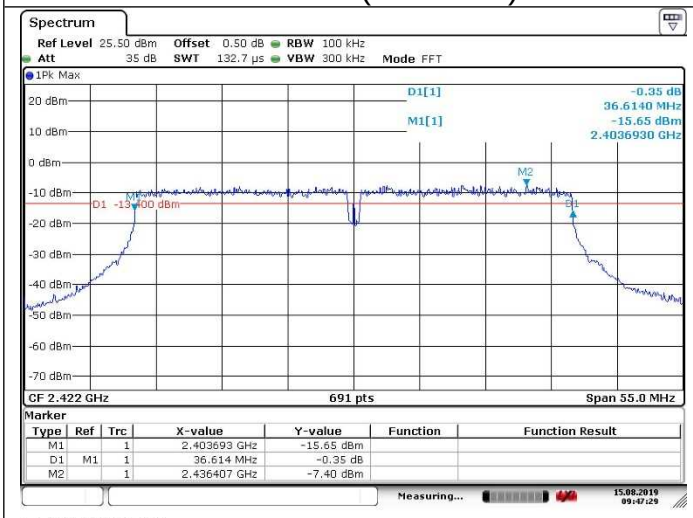
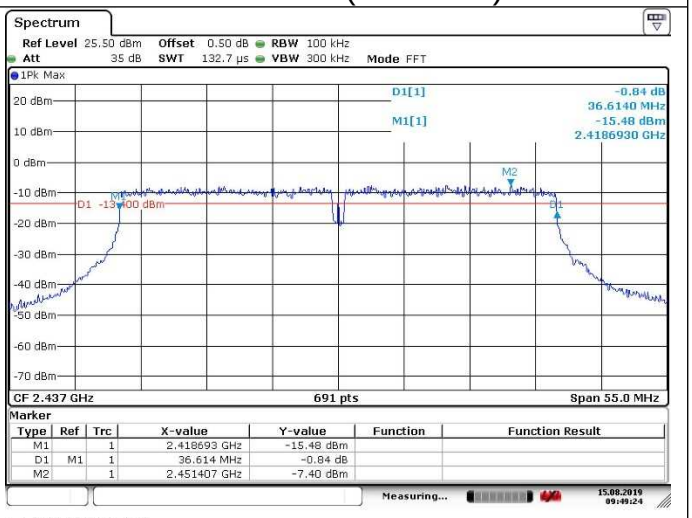
802.11n HT40 6dB Bandwidth

Channel 03 (2422MHz)



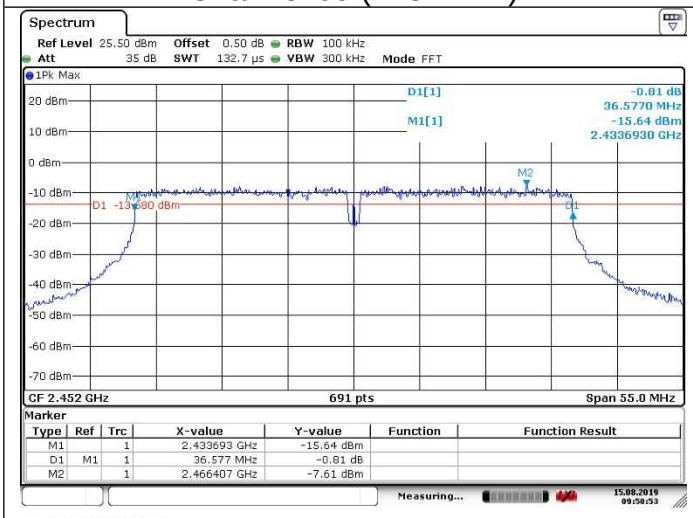
Date: 15.AUG.2019 09:47:30

Channel 06 (2437MHz)



Date: 15.AUG.2019 09:49:24

Channel 09 (2452MHz)



Date: 15.AUG.2019 09:50:53

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9.4 Power spectral density

Test Method

This procedure shall be used if maximum peak 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	-8.1	≤8	Pass
802.11b	1Mbps	06	2437	-8.35	≤8	Pass
802.11b	1Mbps	11	2462	-8.41	≤8	Pass
802.11g	6Mbps	01	2412	-14.08	≤8	Pass
802.11g	6Mbps	06	2437	-14.68	≤8	Pass
802.11g	6Mbps	11	2462	-14.72	≤8	Pass
802.11n-HT20	6.5Mbps	01	2412	-14.32	≤8	Pass
802.11n-HT20	6.5Mbps	06	2437	-14.53	≤8	Pass
802.11n-HT20	6.5Mbps	11	2462	-15.03	≤8	Pass
802.11n-HT40	13.5Mbps	03	2422	-15.02	≤8	Pass
802.11n-HT40	13.5Mbps	06	2437	-15.11	≤8	Pass
802.11n-HT40	13.5Mbps	09	2452	-15.15	≤8	Pass

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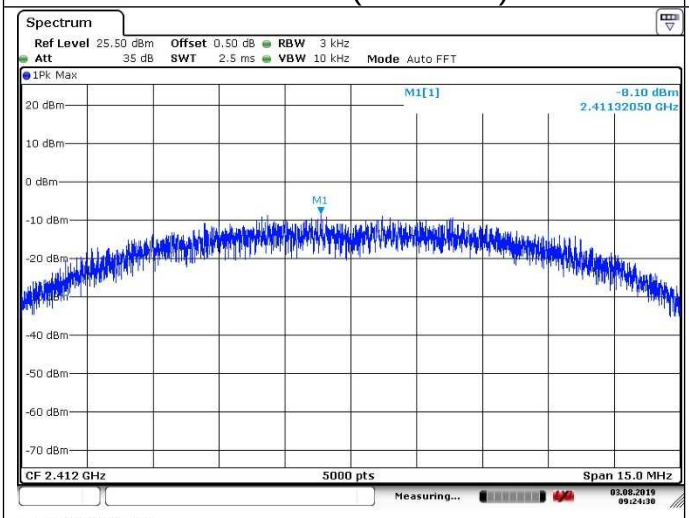
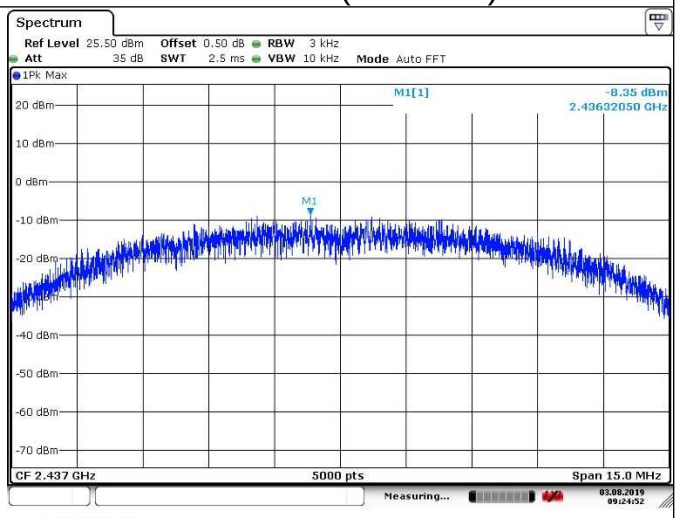
802.11b PSD

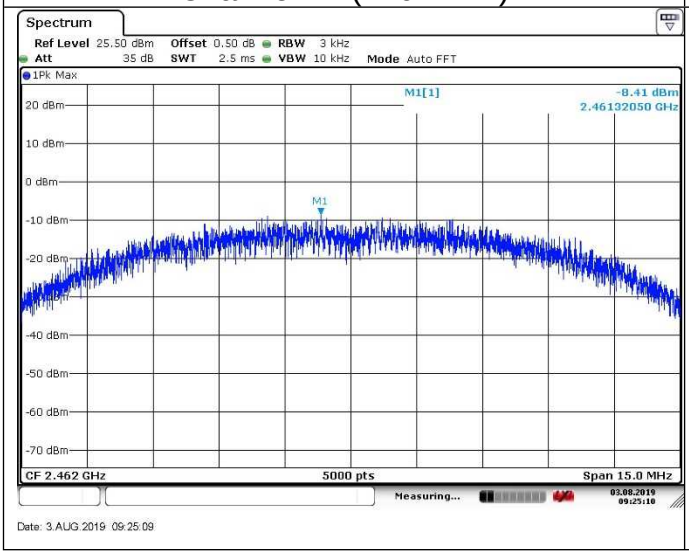
Channel 01 (2412MHz)



Channel 06 (2437MHz)



Channel 11 (2462MHz)



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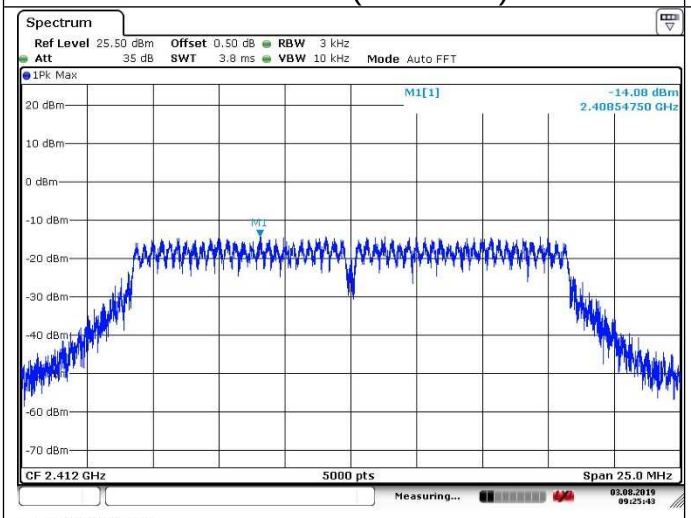
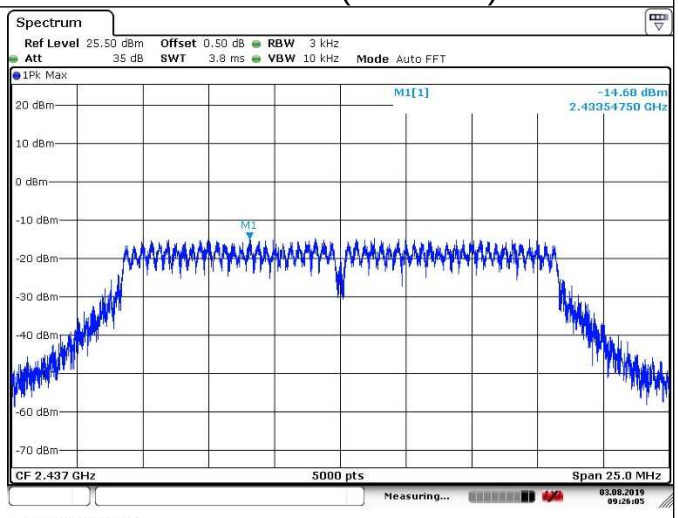
802.11g PSD

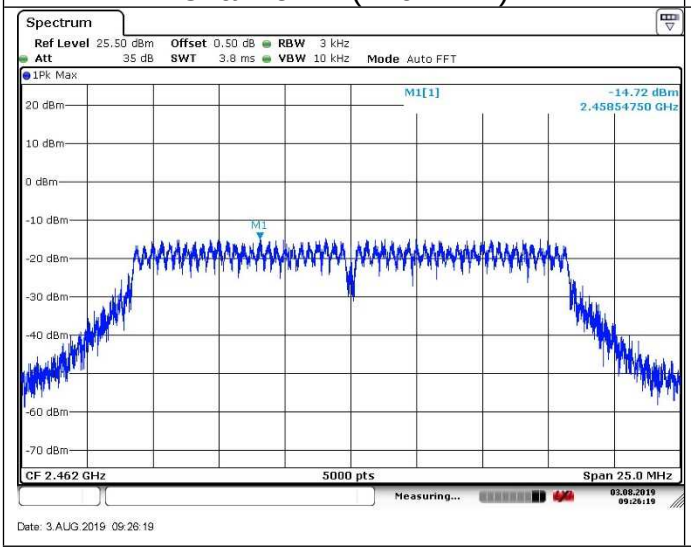
Channel 01 (2412MHz)



Channel 06 (2437MHz)



Channel 11 (2462MHz)



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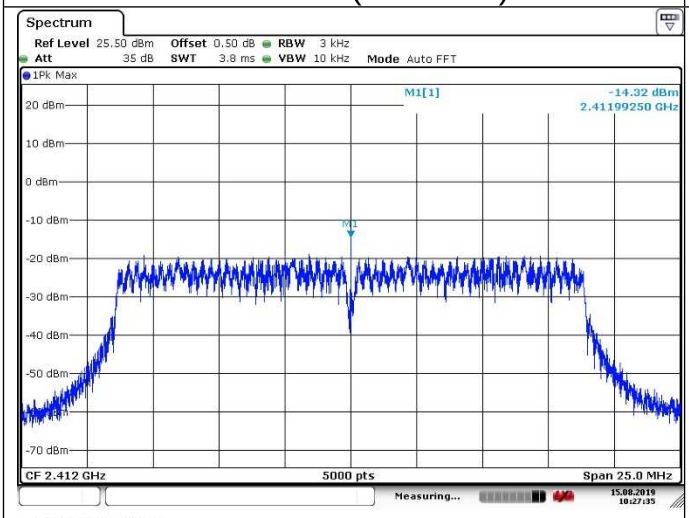
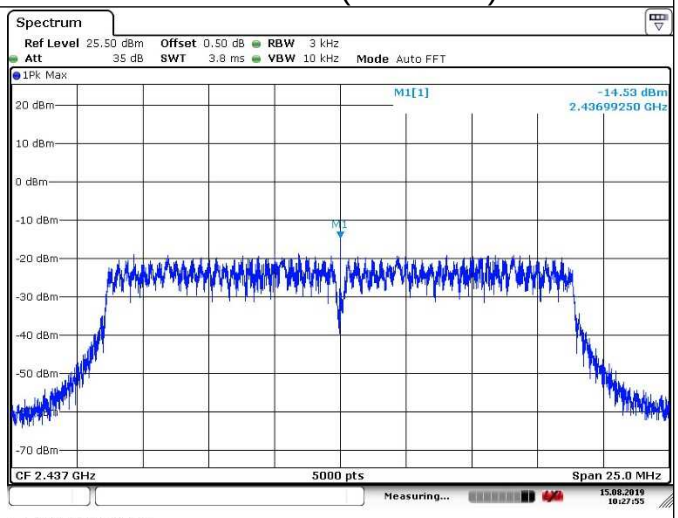
802.11n HT20 PSD

Channel 01 (2412MHz)



Date: 15.AUG.2019 10:27:35

Channel 06 (2437MHz)



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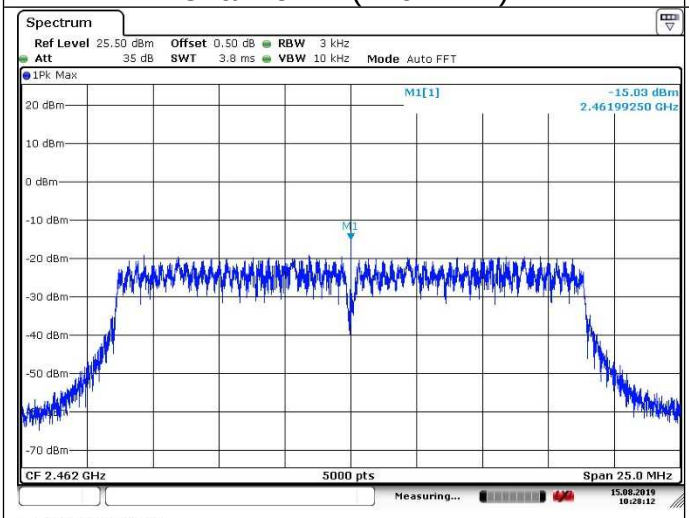
Channel 11 (2462MHz)



Date: 15.AUG.2019 10:28:13

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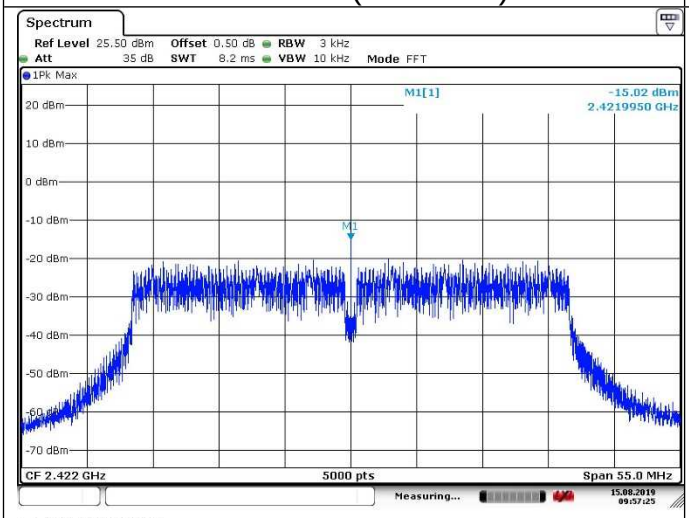
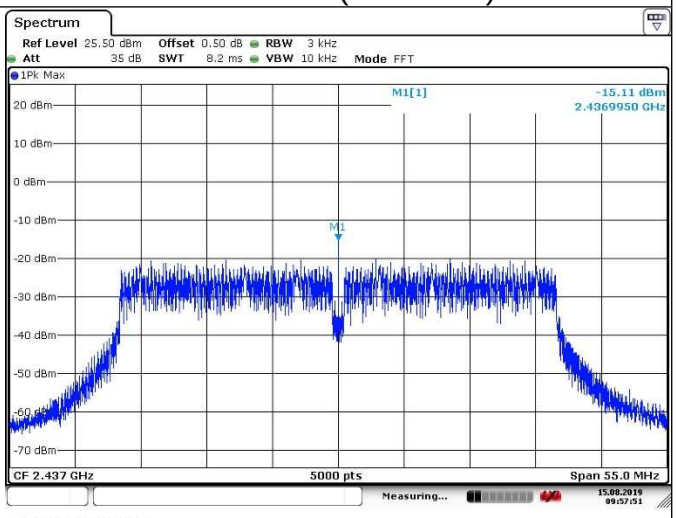
802.11n HT40 PSD

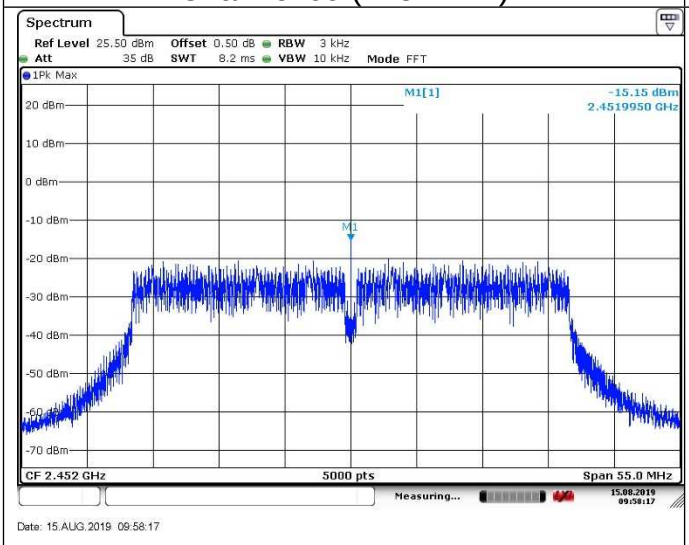
Channel 03 (2422MHz)



Channel 06 (2437MHz)



Channel 09 (2452MHz)



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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
802.11n-HT40	13.5Mbps	03	2422	20dBc	Pass
802.11n-HT40	13.5Mbps	06	2437	20dBc	Pass
802.11n-HT40	13.5Mbps	09	2452	20dBc	Pass

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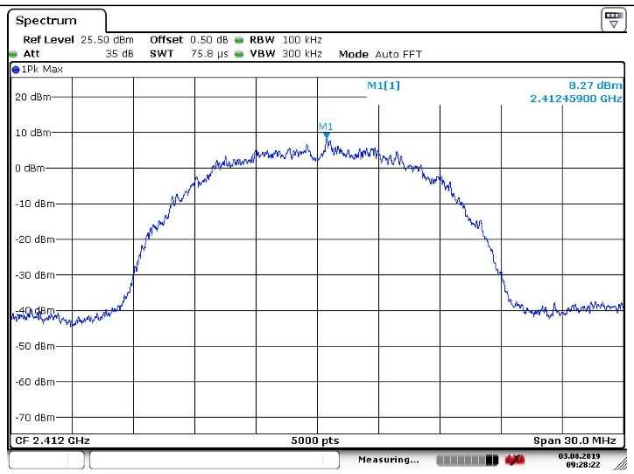
Spurious RF conducted emissions

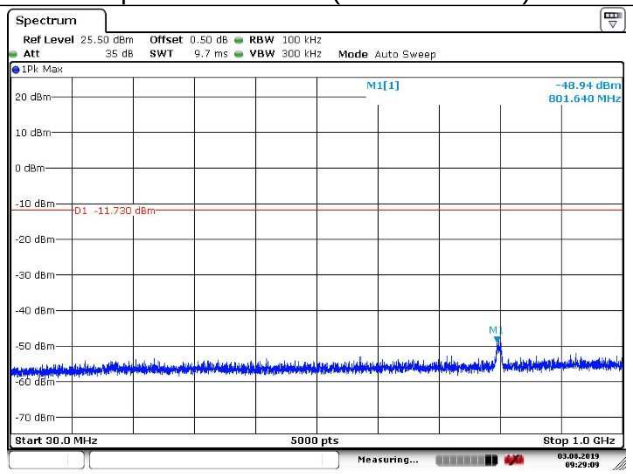
802.11b Out-of-Band Emissions

Channel 01 (2412MHz)

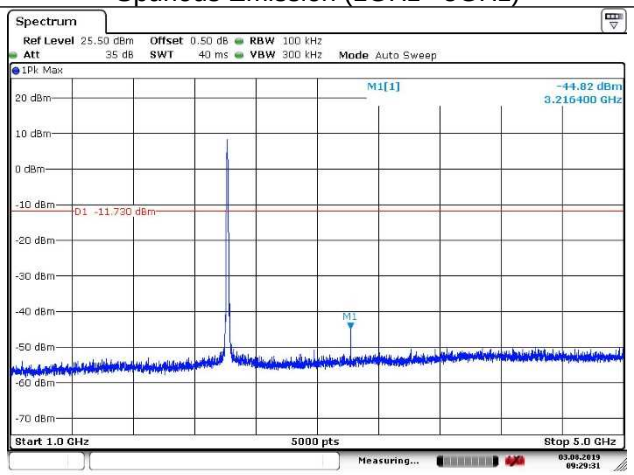
Reference level



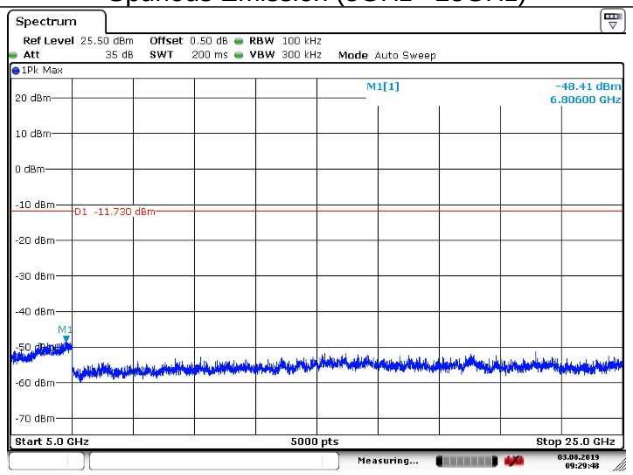
Spurious Emission (30MHz – 1GHz)



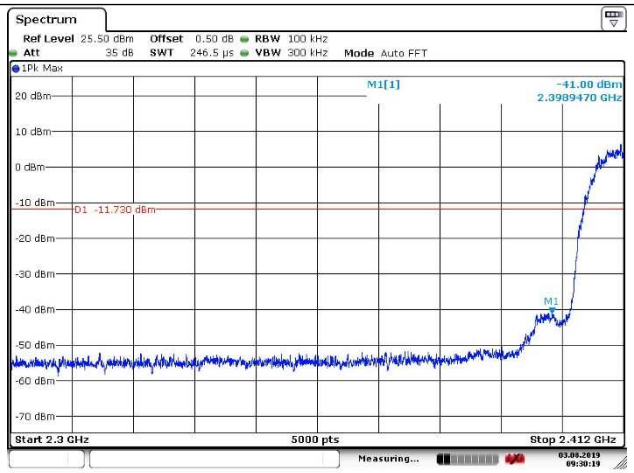
Spurious Emission (1GHz –5GHz)



Spurious Emission (5GHz –25GHz)



Low band edge



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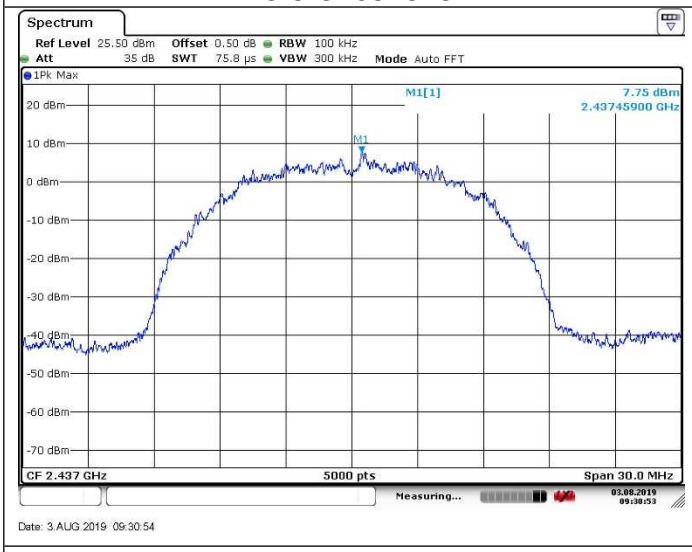
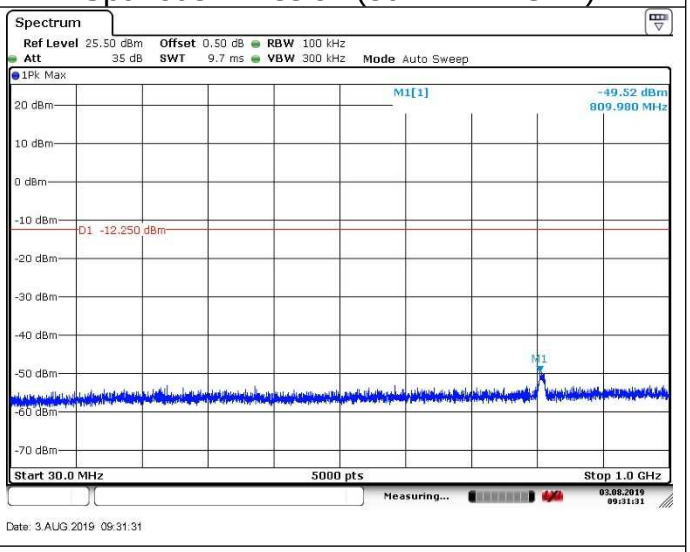
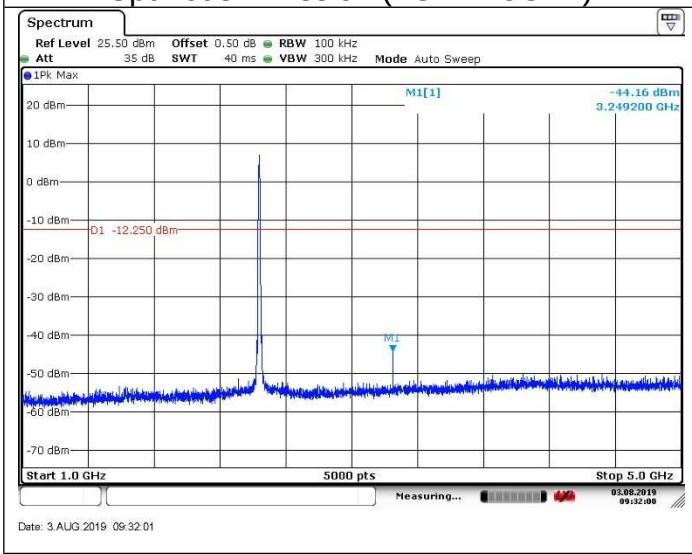
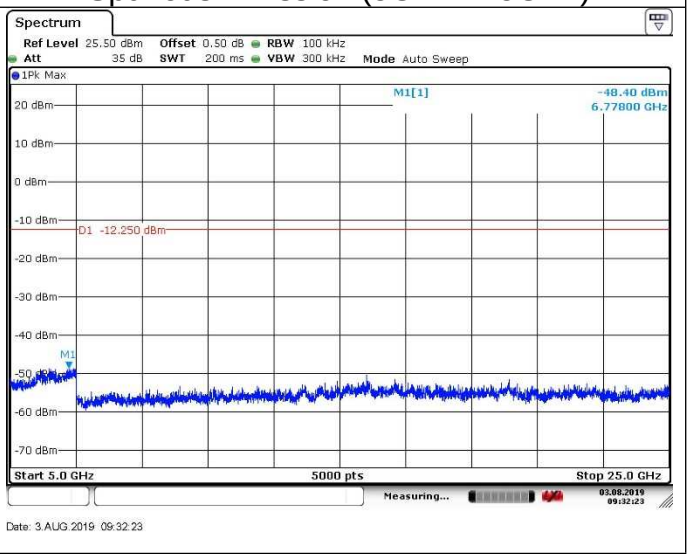
802.11b Out-of-Band Emission	
Channel 06 (2437MHz)	
Reference level	Spurious Emission (30MHz – 1GHz)
	
Spurious Emission (1GHz –5GHz)	Spurious Emission (5GHz –25GHz)
	

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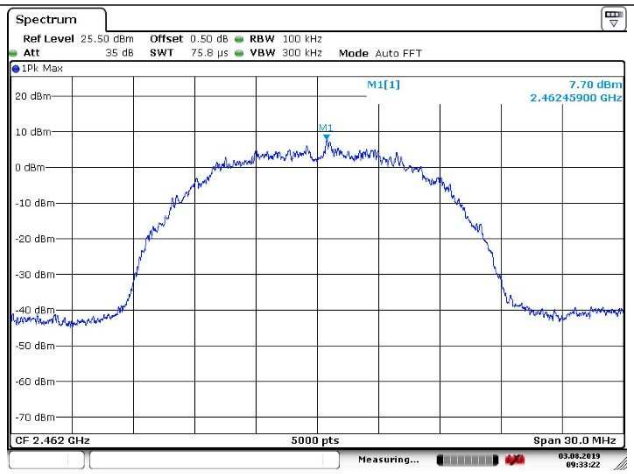
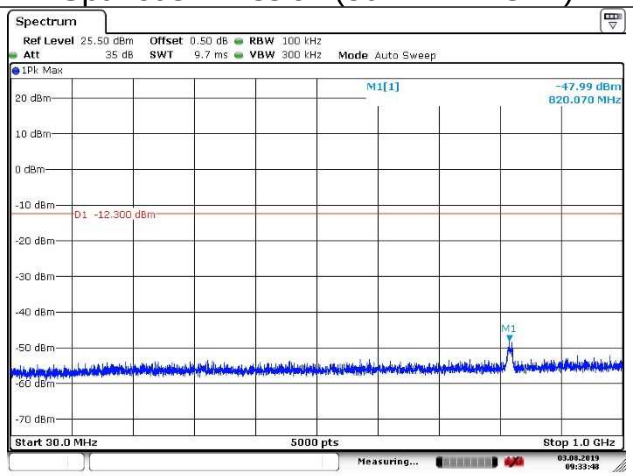
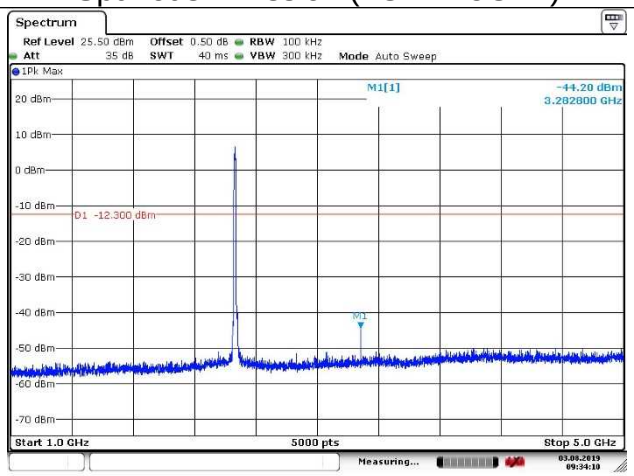
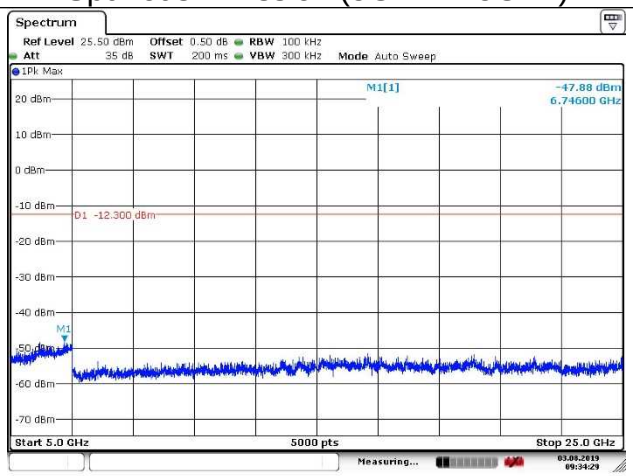
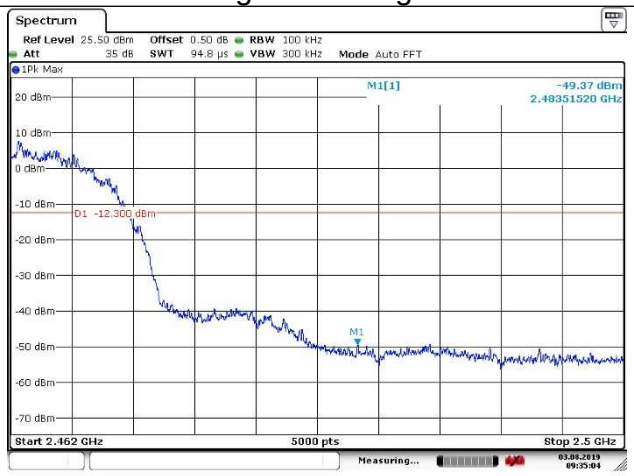
802.11b Out-of-Band Emissions	
Channel 01 (2462MHz)	
Reference level	Spurious Emission (30MHz – 1GHz)
	
Spurious Emission (1GHz –5GHz)	Spurious Emission (5GHz –25GHz)
	
High band edge	
	

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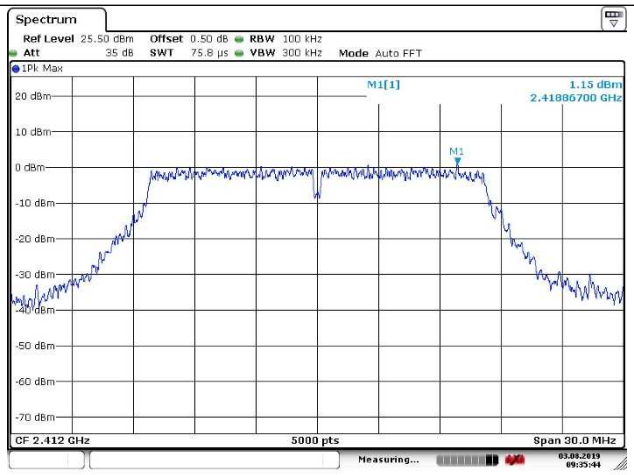
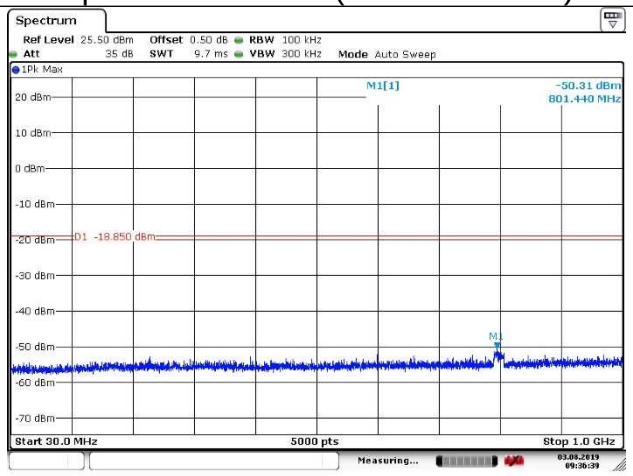
802.11g Out-of-Band Emissions

Channel 01 (2412MHz)

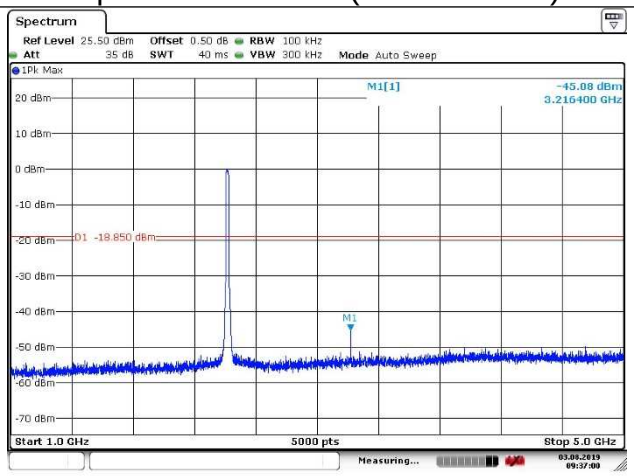
Reference level



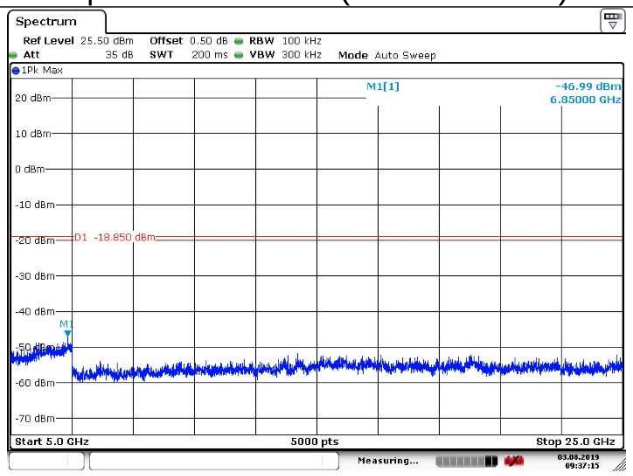
Spurious Emission (30MHz – 1GHz)



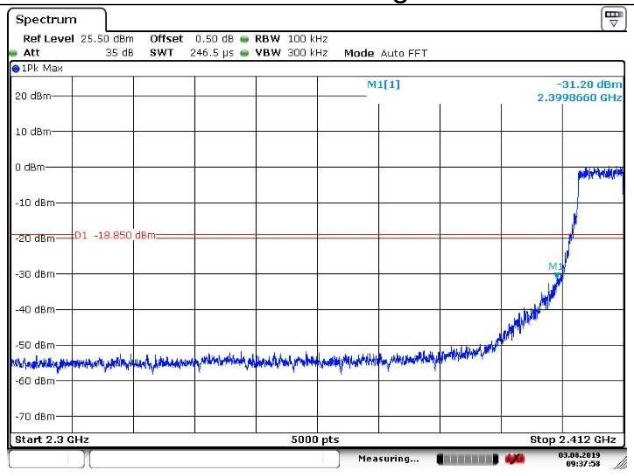
Spurious Emission (1GHz –5GHz)



Spurious Emission (5GHz –25GHz)



Low band edge



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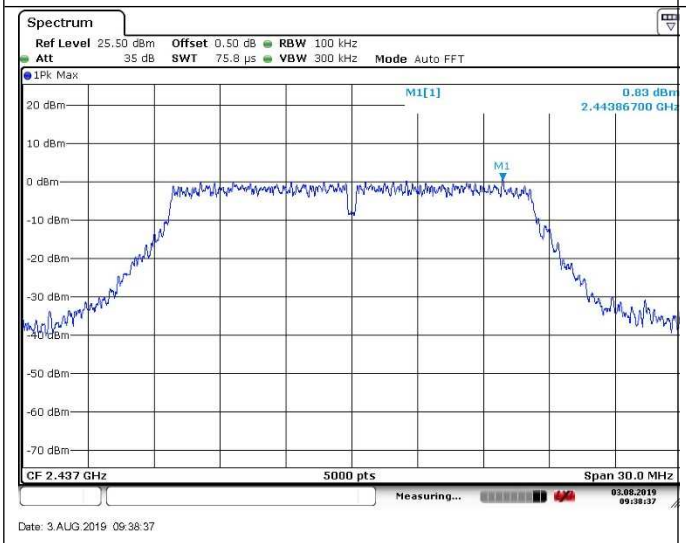
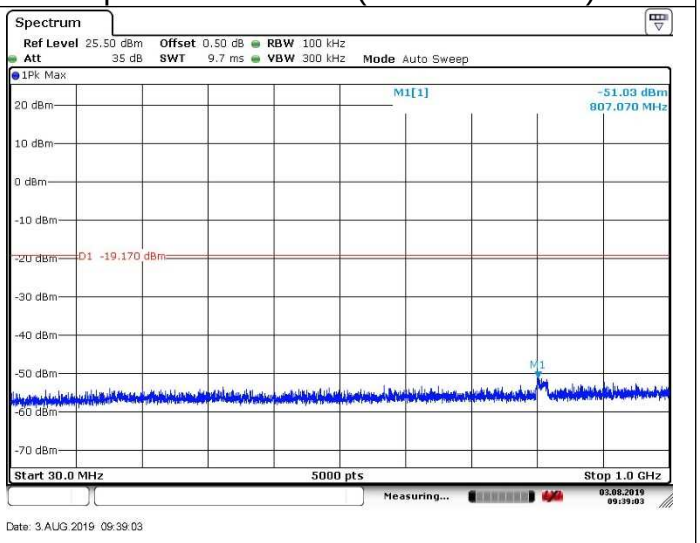
802.11g Out-of-Band Emissions

Channel 06 (2437MHz)

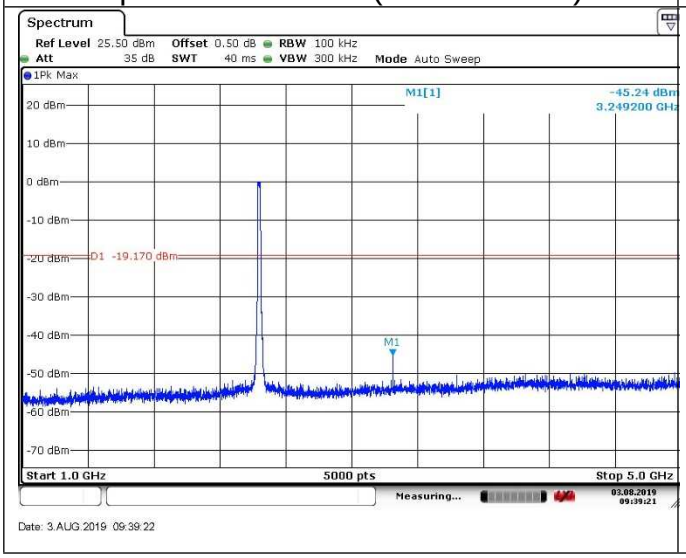
Reference level



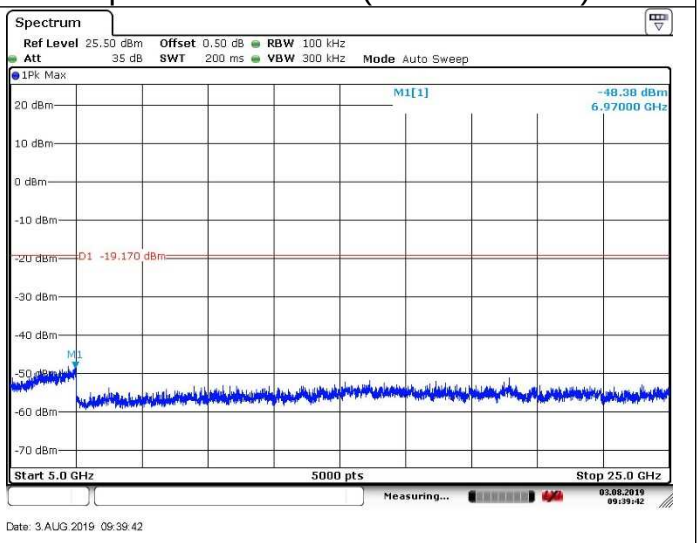
Spurious Emission (30MHz – 1GHz)



Spurious Emission (1GHz –5GHz)



Spurious Emission (5GHz –25GHz)



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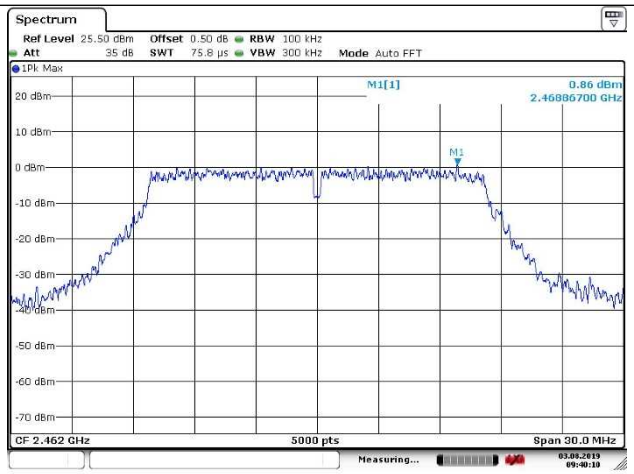
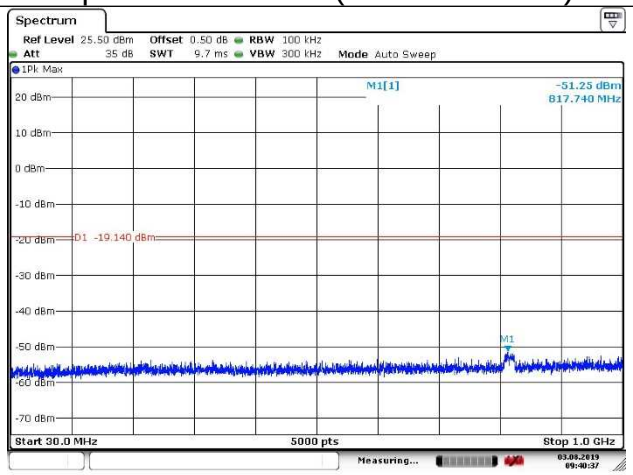
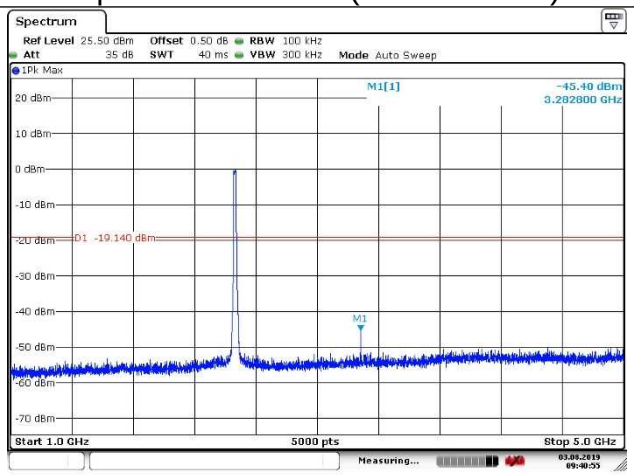
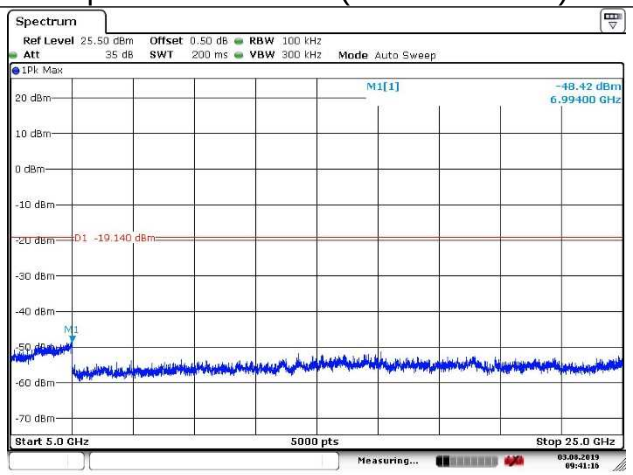
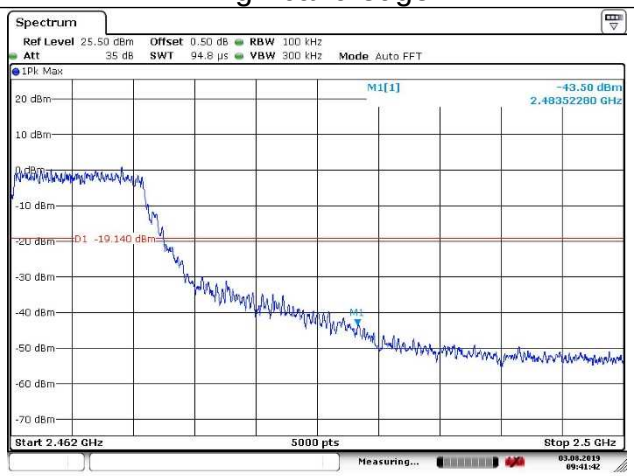
802.11g Out-of-Band Emissions	
Channel 11 (2462MHz)	
Reference level	Spurious Emission (30MHz – 1GHz)
	
Spurious Emission (1GHz –5GHz)	Spurious Emission (5GHz –25GHz)
	
High band edge	
	

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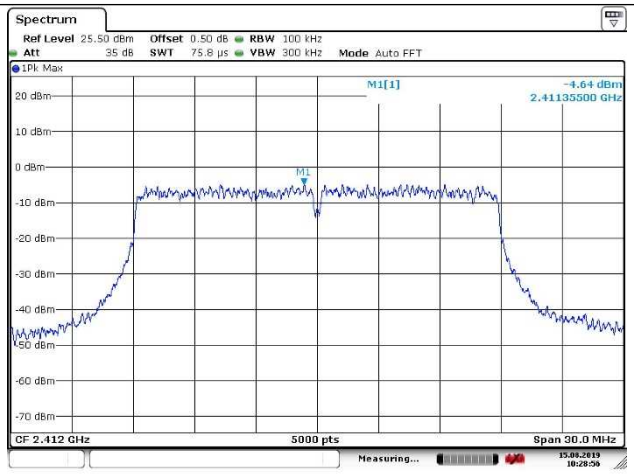
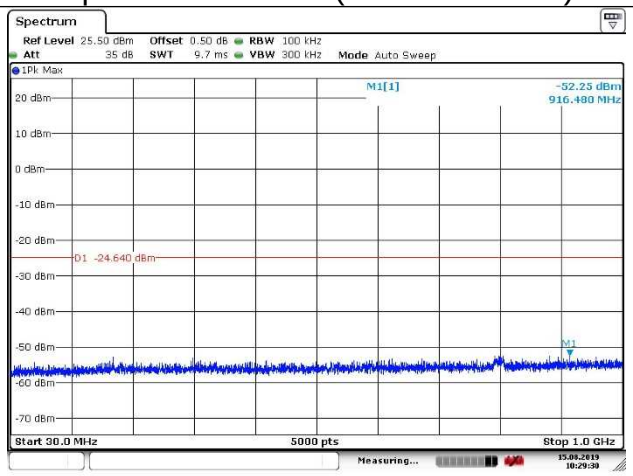
802.11n-HT20 Out-of-Band Emissions

Channel 01 (2412MHz)

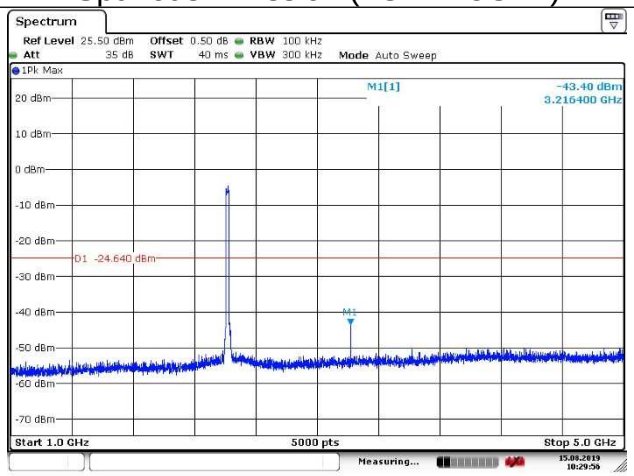
Reference level



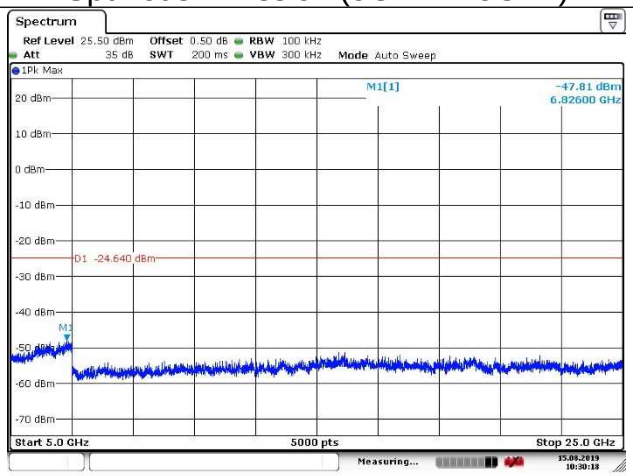
Spurious Emission (30MHz – 1GHz)



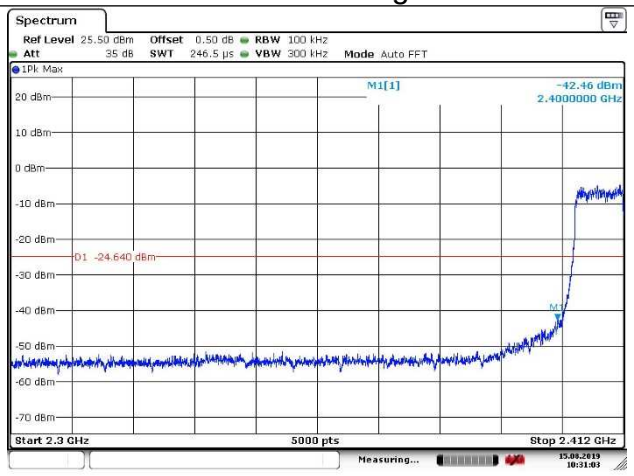
Spurious Emission (1GHz –5GHz)



Spurious Emission (5GHz –25GHz)



Low band edge



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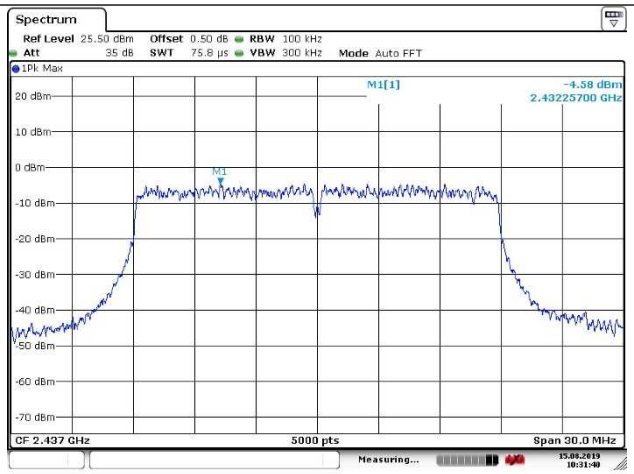
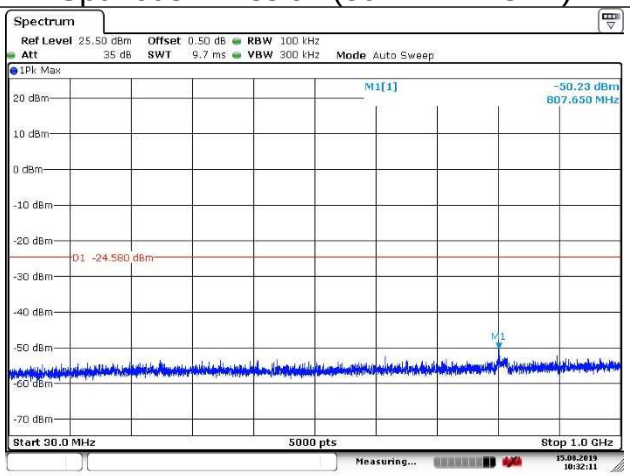
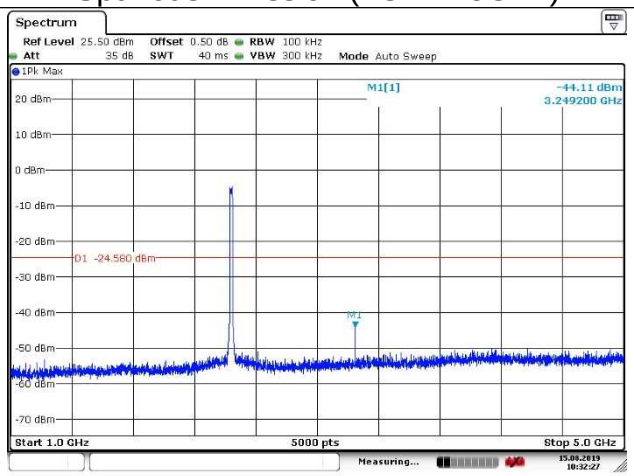
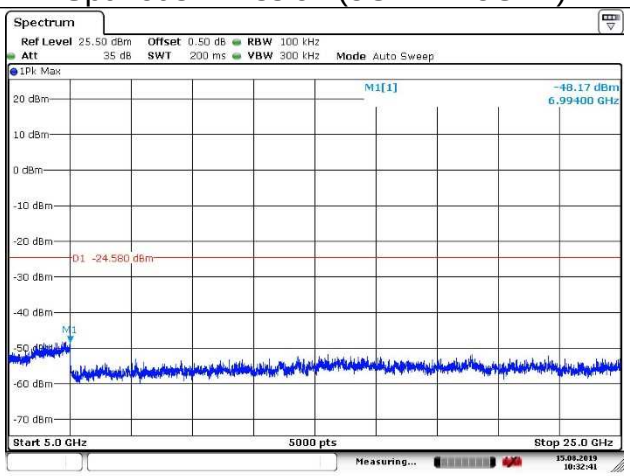
802.11n-HT20 Out-of-Band Emissions	
Channel 06 (2437MHz)	
Reference level	Spurious Emission (30MHz – 1GHz)
 Date: 15.AUG.2019 10:31:41	 Date: 15.AUG.2019 10:32:11
Spurious Emission (1GHz –5GHz)	Spurious Emission (5GHz –25GHz)
 Date: 15.AUG.2019 10:32:27	 Date: 15.AUG.2019 10:32:41

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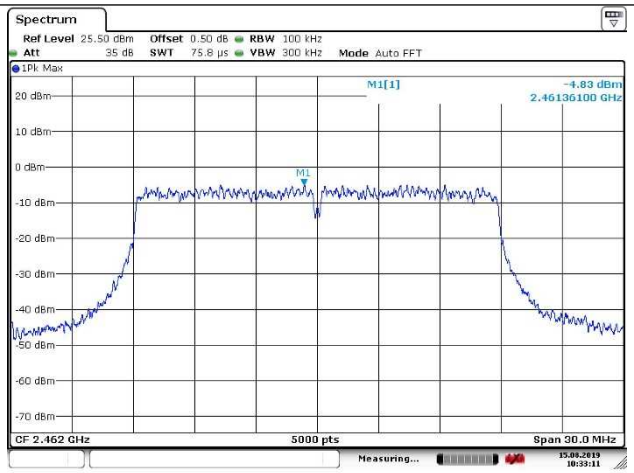
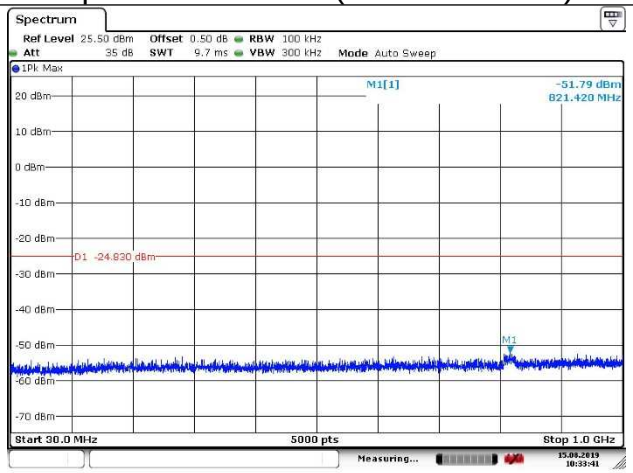
802.11n-HT20 Out-of-Band Emissions

Channel 11 (2462MHz)

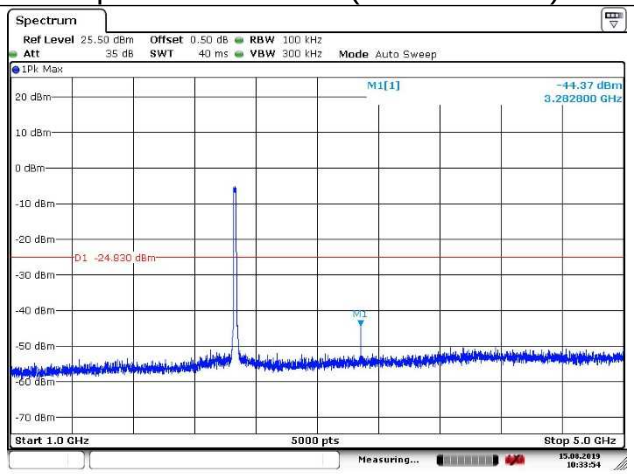
Reference level



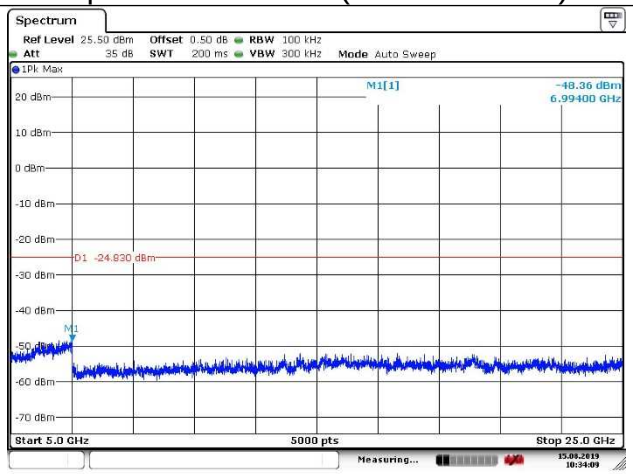
Spurious Emission (30MHz – 1GHz)



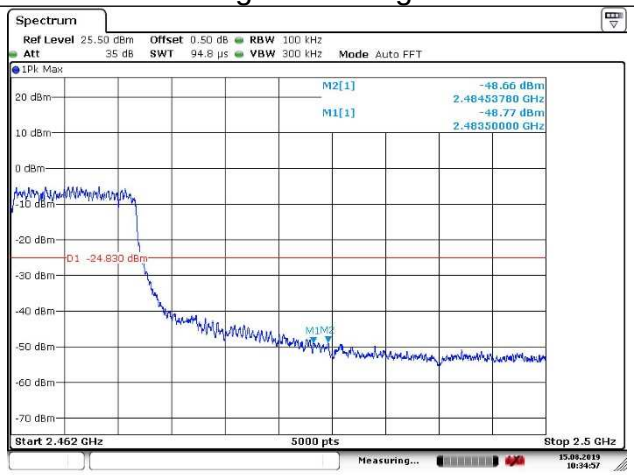
Spurious Emission (1GHz –5GHz)



Spurious Emission (5GHz –25GHz)



High band edge



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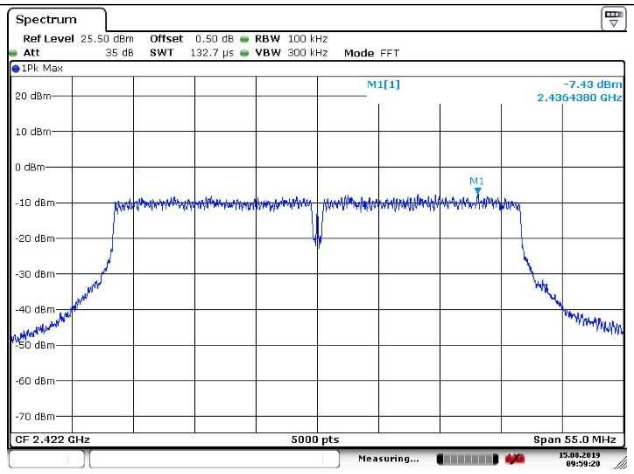
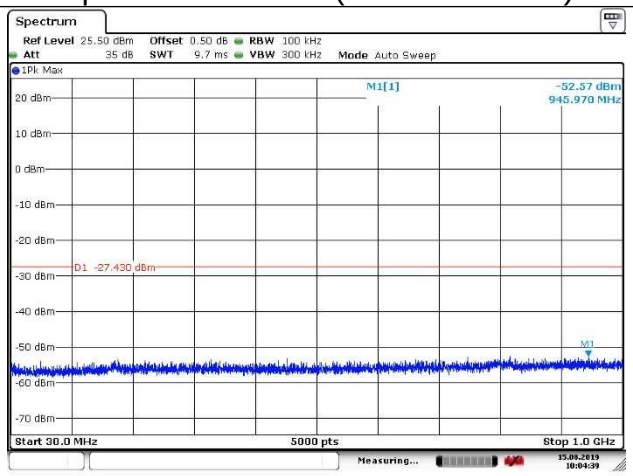
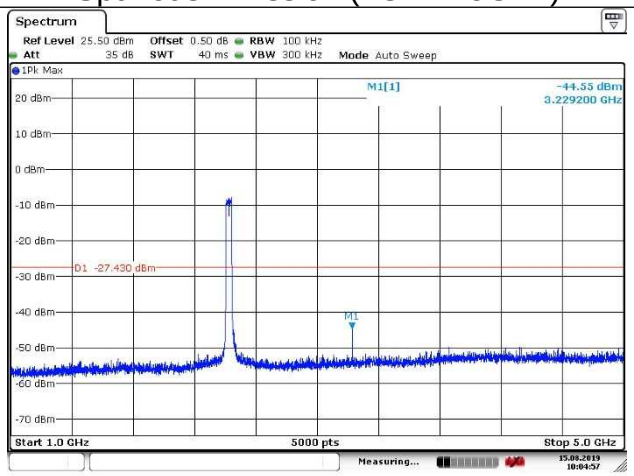
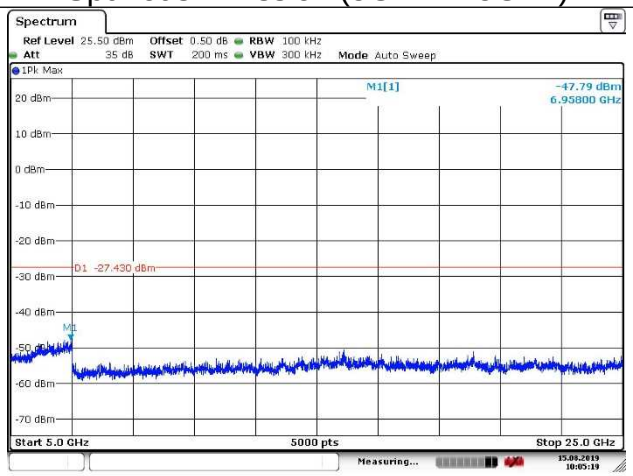
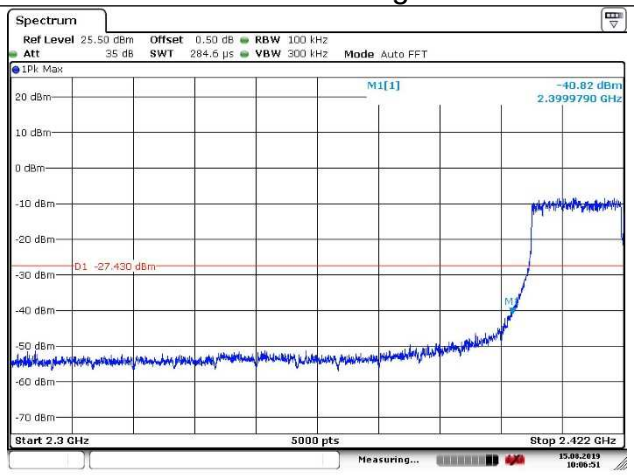
802.11n-HT40 Out-of-Band Emissions	
Channel 03 (2422MHz)	
Reference level	Spurious Emission (30MHz – 1GHz)
	
Spurious Emission (1GHz –5GHz)	Spurious Emission (5GHz –25GHz)
	
Low band edge	
	

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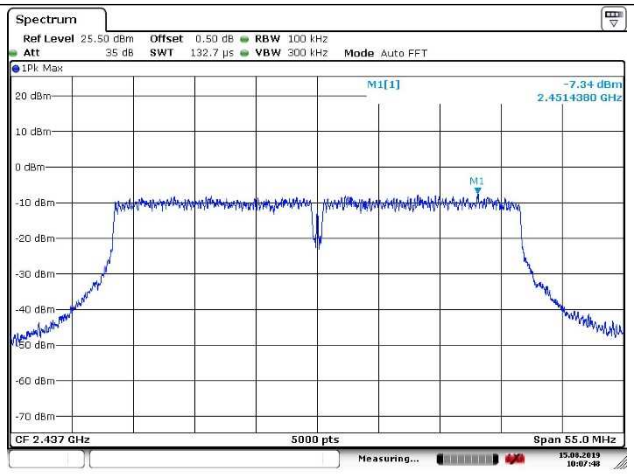
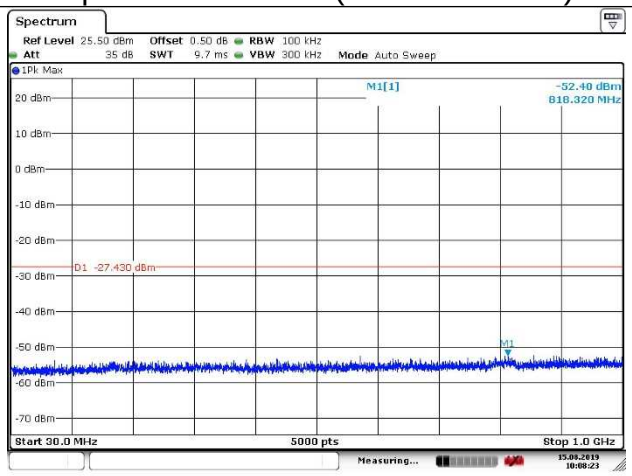
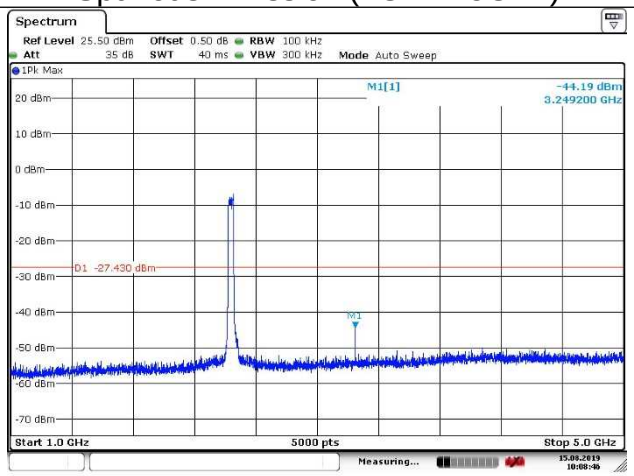
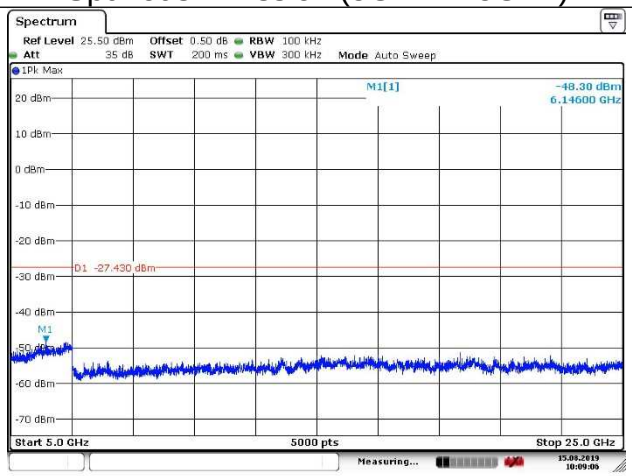
802.11n-HT40 Out-of-Band Emissions	
Channel 06 (2437MHz)	
Reference level	Spurious Emission (30MHz – 1GHz)
	
Spurious Emission (1GHz –5GHz)	Spurious Emission (5GHz –25GHz)
	

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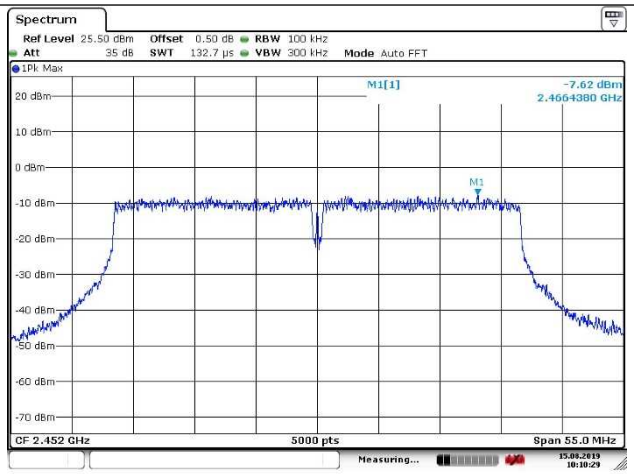
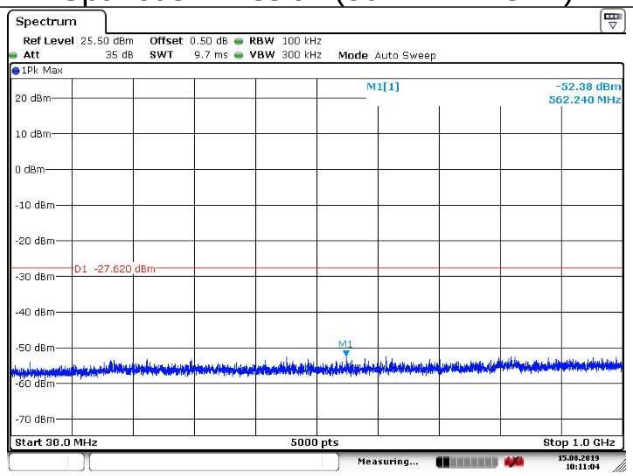
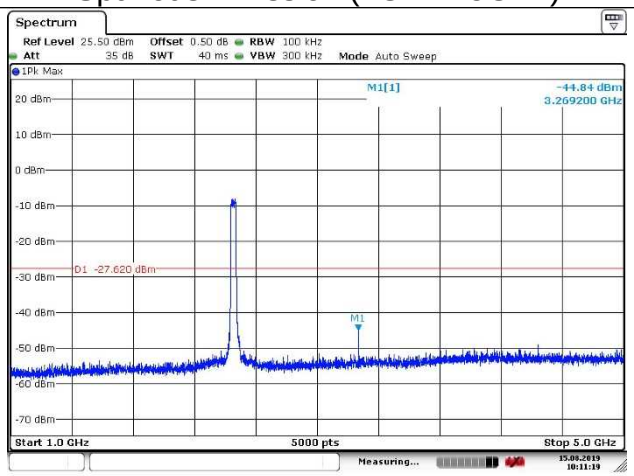
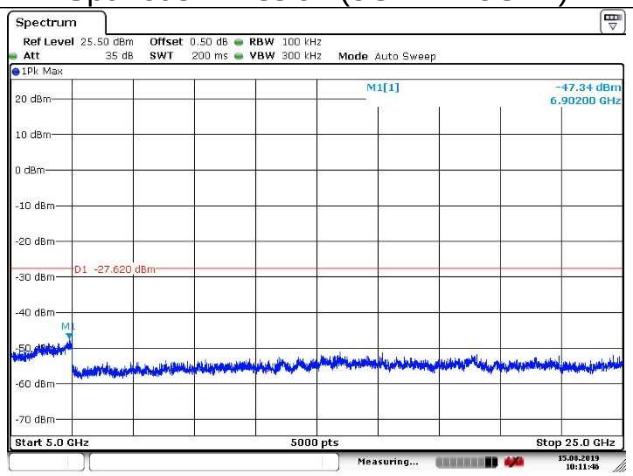
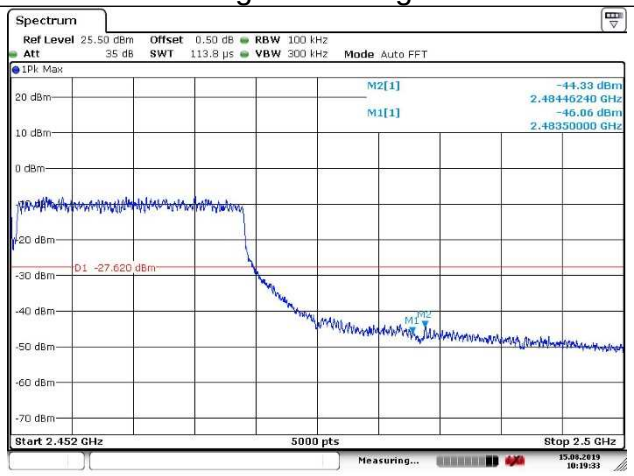
802.11n-HT40 Out-of-Band Emissions	
Channel 09 (2452MHz)	
Reference level	Spurious Emission (30MHz – 1GHz)
	
Spurious Emission (1GHz –5GHz)	Spurious Emission (5GHz –25GHz)
	
High band edge	
	

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9.6 Spurious radiated emissions for transmitter

Test Method

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:

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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.

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.
The only worse case (which is subject to the maximum EIRP, 802.11b mode) are listed in the report.

Transmitting spurious emission test result as below:

802.11 b
2412MHz

Frequency	Emission Level	Polarization	Limit	Detector	Margin	Result
MHz	dBuV/m		dBµV/m		dBµV/m	
2390	55.01	H	74	PK	18.99	Pass
2390	44.4	H	54	AV	9.6	Pass
4824	50.14	H	74	PK	23.86	Pass
2390	56.71	V	74	PK	17.29	Pass
2390	45.7	V	54	AV	8.3	Pass
4824	50.93	V	74	PK	23.07	Pass

2437MHz

Frequency	Emission Level	Polarization	Limit	Detector	Margin	Result
MHz	dBuV/m		dBµV/m		dBµV/m	
4874	47.39	H	74	PK	26.61	Pass
4874	48.04	V	74	PK	25.96	Pass

2462MHz

Frequency	Emission Level	Polarization	Limit	Detector	Margin	Result
MHz	dBuV/m		dBµV/m		dBµV/m	
2483.5	46.68	H	74	PK	27.32	Pass
4924	46.05	H	74	PK	27.95	Pass
2483.5	49.31	V	74	PK	24.69	Pass
4924	48.24	V	74	PK	25.76	Pass

Remark:

(1) Above 1GHz: Corrector factor = Antenna Factor + Cable Loss- Pre-amplifier
Below 1GHz: Corrector factor = Antenna Factor + Cable Loss
Emission Level =Reading level +Correction Factor
(The Reading Level is recorded by software which is not shown in the sheet)

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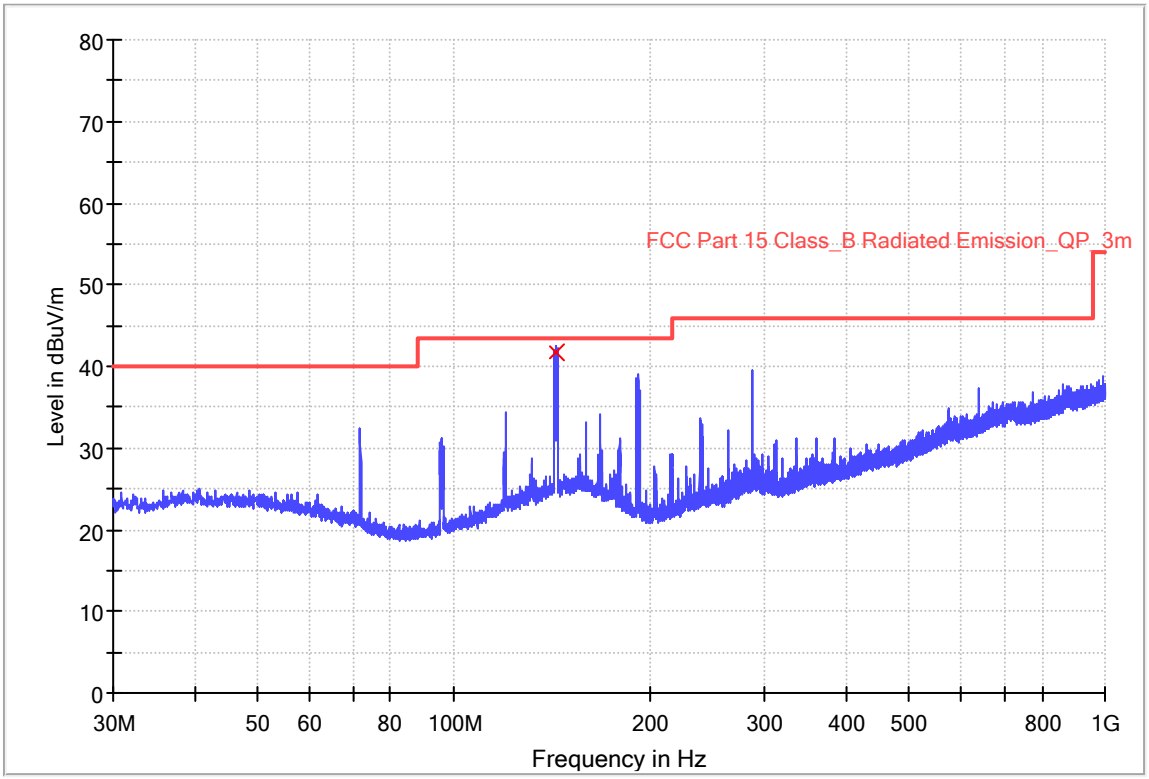
The worst case of Radiated Emission below 1GHz:

Site: 3 meter chamber	Time: 2019/08/21 - 17:21
Limit: FCC_Part15.109_RE(3m)_ClassB	Engineer: Wenqiang LU
Probe: VULB9168	Polarity: Horizontal
EUT: TYWE3SE Wi-Fi and Bluetooth Module, Model no: TYWE3SE	Power: Power by notebook
Note: There is the worst case within frequency range 30MHz~1GHz.	

RE_VULB9168_pre_Cont_30-1000



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)
143.880000	41.6	1000.0	120.000	150.1	H	2.0	15.2	1.9	43.5

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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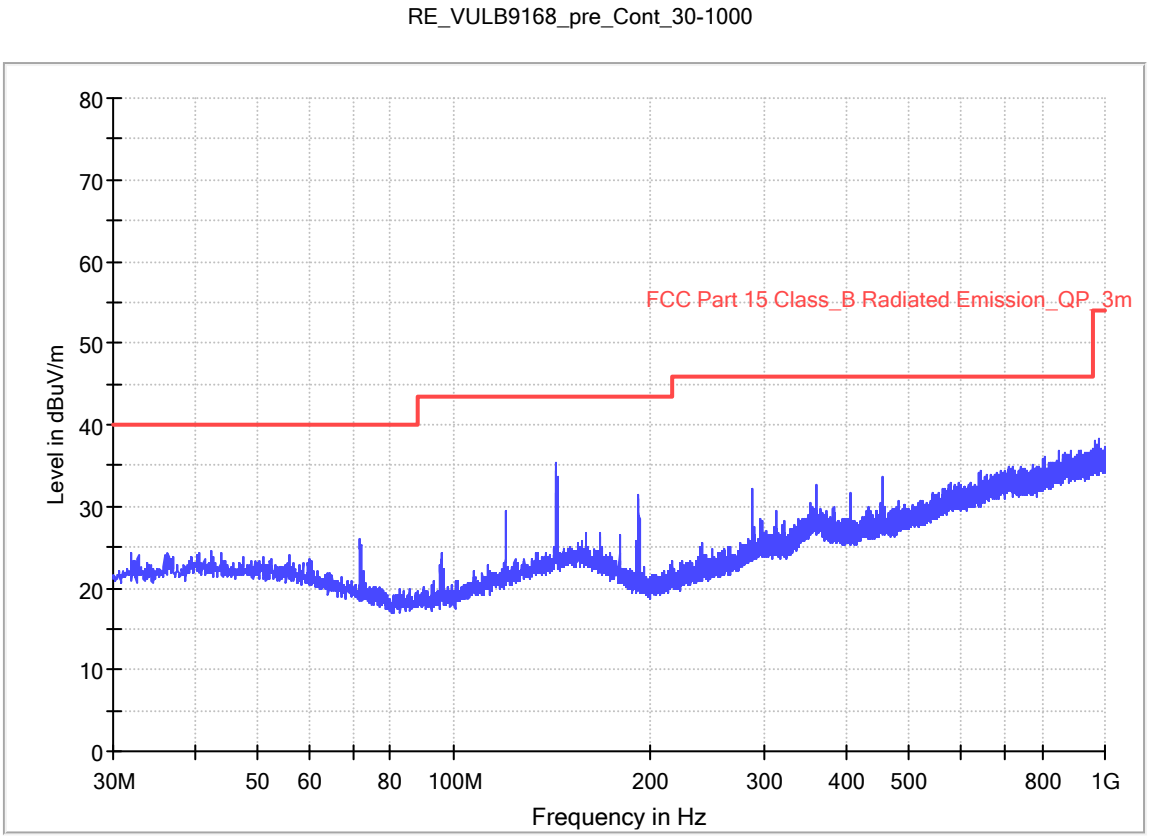
The worst case of Radiated Emission below 1GHz:

Site: 3 meter chamber	Time: 2019/08/21 - 17:40
Limit: FCC_Part15.109_RE(3m)_ClassB	Engineer: Wenqiang LU
Probe: VULB9168	Polarity: Vertical
EUT: TYWE3SE Wi-Fi and Bluetooth Module, Model no: TYWE3SE	Power: Power by notebook
Note: There is the worst case within frequency range 30MHz~1GHz.	



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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10 Test Equipment List

List of Test Instruments

Test Site1

	DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DATE	CAL. DUE DATE
C	Signal Analyzer	Rohde & Schwarz	FSV40	101091	2019-8-5	2020-8-4
	Wideband power sensor	Rohde & Schwarz	NRP-Z81	104782	2018-12-28	2019-12-27
RE	EMI Test Receiver	Rohde & Schwarz	ESR3	101906	2019-8-5	2020-8-4
	Signal Analyzer	Rohde & Schwarz	FSV40	101091	2019-8-5	2020-8-4
	Trilog Super Broadband Test Antenna	Schwarzbeck	VULB 9168	961	2019-3-16	2022-3-15
	Horn Antenna	Rohde & Schwarz	HF907	102393	2018-6-11	2021-4-1
	Pre-amplifier	Rohde & Schwarz	SCU-18D	19006451	2019-8-5	2020-8-4
	Loop antenna	Rohde & Schwarz	HFH2-Z2	100443	2019-6-28	2020-6-27
	DOUBLE-RIDGED WAVEGUIDE HORN WITH PRE-AMPLIFIER (18 GHZ - 40 GHZ)	ETS-Lindgren	3116C-PA	002222727	2018-1-29	2021-1-28
	3m Semi-anechoic chamber	TDK	9X6X6	----	2018-5-11	2021-5-10
CE	EMI Test Receiver	Rohde & Schwarz	ESR3	101907	2019-8-5	2020-8-4
	LISN	Rohde & Schwarz	ENV216	101924	2019-8-5	2020-8-4

Measurement Software Information			
Test Item	Software	Manufacturer	Version
C	Power Viewer	Rohde & Schwarz	V 11.0
RE	EMC 32	Rohde & Schwarz	V9.15.00
CE	EMC 32	Rohde & Schwarz	V9.15.03

C - Conducted RF tests

- Conducted peak output power
- 6dB Occupied Bandwidth
- Power spectral density*
- Conducted Band Edge and Out-of-Band Emissions

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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:

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, ±5.49dB 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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