

FCC Test Report

FCC ID : TVE-120506

Equipment : 2T2R PCIeModule selectable 5GHz+2.4G

Model No. : WMDQ-177ACN

Brand Name : Fortinet, Inc.

Applicant : Fortinet, Inc.

Address : 899 Kifer Road Sunnyvale, CA 94086, USA

Standard : 47 CFR FCC Part 15.247

Received Date : Jul. 16, 2015

Tested Date : Jul. 30 ~ Aug. 13, 2015

We, International Certification Corp., would like to declare that the tested sample has been evaluated and in compliance with the requirement of the above standards. The test results contained in this report refer exclusively to the product. It may be duplicated completely for legal use with the approval of the applicant. It shall not be reproduced except in full without the written approval of our laboratory.

Approved & Reviewed by:

Gary Chang / Manager

ilac MRA



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Release Record

Report No.	Version	Description	Issued Date
FR571605AC	Rev. 01	Initial issue	Sep. 07, 2015

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Summary of Test Results

FCC Rules	Test Items	Measured	Result
15.207	Conducted Emissions	[dBuV]: 0.180MHz 40.46 (Margin -14.04dB) - AV	Pass
15.247(d)	Radiated Emissions	[dBuV/m at 3m]: 2483.50MHz	Pass
15.209	INdulated Liffissions	53.48 (Margin -0.52dB) - AV	F 033
15.247(b)(3)	Maximum Output Power	Max Power [dBm]: 26.35	Pass
15.247(a)(2)	6dB Bandwidth	Meet the requirement of limit	Pass
15.247(e)	Power Spectral Density	Meet the requirement of limit	Pass
15.203	Antenna Requirement	Meet the requirement of limit	Pass

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1 General Description

1.1 Information

1.1.1 Specification of the Equipment under Test (EUT)

RF General Information								
Frequency Range (MHz)	IEEE Std. 802.11	Ch. Freq. (MHz)	Channel Number	Transmit Chains (N _{TX})	Data Rate / MCS			
2400-2483.5	b	2412-2462	1-11 [11]	2	1-11 Mbps			
2400-2483.5	g	2412-2462	1-11 [11]	2	6-54 Mbps			
2400-2483.5	n (HT20)	2412-2462	1-11 [11]	2	MCS 0-15			
2400-2483.5	n (HT40)	2422-2452	3-9 [7]	2	MCS 0-15			

Note 1: RF output power specifies that Maximum Peak Conducted Output Power.

Note 2: 802.11b uses a combination of DSSS-DBPSK, DQPSK, CCK modulation.

Note 3: 802.11g/n uses a combination of OFDM-BPSK, QPSK, 16QAM, 64QAM modulation.

1.1.2 Antenna Details

Ant. No.	Model	Туре	Connector	Operating Frequency (MHz) / Gain (dBi)		
Ant. No.	Wodel		Connector	2400~2483.5	5150~5250	5725~5850
1	C210-510579-A	Dipole	R-SMA	2.8	3	2.2

1.1.3 Power Supply Type of Equipment under Test (EUT)

Power Supply Type	3.3Vdc from host
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1.1.4 Accessories

N/A

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1.1.5 Channel List

Frequency	band (MHz)	2400~2483.5		
802.11 b /	g / n HT20	802.11n HT40		
Channel	Channel Frequency(MHz)		Frequency(MHz)	
1	2412	3	2422	
2	2417	4	2427	
3	2422	5	2432	
4	2427	6	2437	
5	2432	7	2442	
6	2437	8	2447	
7	2442	9	2452	
8	2447			
9	2452			
10	2457			
11	2462			

1.1.6 Test Tool and Duty Cycle

Test Tool	ART2-GUI, version: 2.3				
	Mode	Duty cycle (%)	Duty factor (dB)		
	11b	11b 100.00%			
Duty Cycle and Duty Factor	11g	98.26%	0.08		
	HT20	98.16%	0.08		
	HT40	93.07%	0.31		

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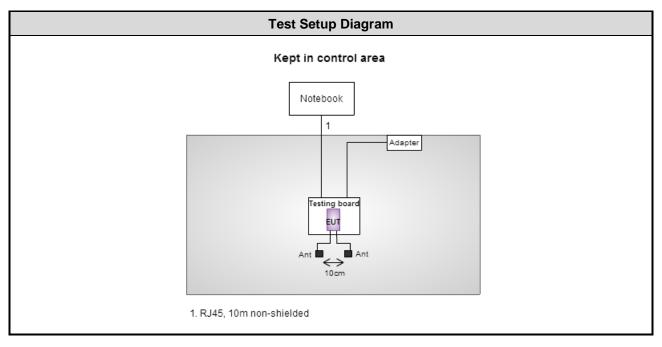
1.1.7 Power Setting

Modulation Mode	Test Frequency (MHz)	Power Set
11b	2412	18.5
11b	2437	22
11b	2462	18
11g	2412	15
11g	2437	20.5
11g	2462	14
HT20	2412	14
HT20	2437	20.5
HT20	2462	13.5
HT40	2422	10.5
HT40	2437	15.5
HT40	2452	10.5

1.2 Local Support Equipment List

	Support Equipment List						
No.	No. Equipment Brand Model FCC ID Signal cable / Length (m)						
1	Notebook	DELL	Latitude E6440	DoC	RJ45, 10m non-shielded.		

1.3 Test Setup Chart



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1.4 The Equipment List

Test Item	Conducted Emission	Conducted Emission					
Test Site	Conduction room 1 / (CO01-WS)						
Instrument Manufacturer Model No. Serial No. Calibration Date Calibration Unt							
EMC Receiver	R&S	ESCS 30	100169	Oct. 17, 2014	Oct. 16, 2015		
LISN	SCHWARZBECK	Schwarzbeck 8127	8127-667	Nov. 17, 2014	Nov. 16, 2015		
RF Cable-CON	Woken	CFD200-NL	CFD200-NL-001	Dec. 31, 2014	Dec. 30, 2015		
Measurement Software AUDIX e3 6.120210k NA NA NA							
Note: Calibration Interval of instruments listed above is one year.							

Test Item	Radiated Emission							
Test Site	966 chamber1 / (03CH	H01-WS)						
Instrument	Manufacturer	Manufacturer Model No. Serial No. Calibration Date Calibration Unt						
Spectrum Analyzer	R&S	FSV40	101498	Dec. 09, 2014	Dec. 08, 2015			
Receiver	R&S	ESR3	101658	Nov. 10, 2014	Nov. 09, 2015			
Bilog Antenna	SCHWARZBECK	VULB9168	VULB9168-522	Sep. 05, 2014	Sep. 04, 2015			
Horn Antenna 1G-18G	SCHWARZBECK	BBHA 9120 D	BBHA 9120 D 1096	Dec. 11, 2014	Dec. 10, 2015			
Horn Antenna 18G-40G	SCHWARZBECK	BBHA 9170	BBHA 9170517	Nov. 10, 2014	Nov. 09, 2015			
Loop Antenna	R&S	HFH2-Z2	11900	Nov. 10, 2014	Nov. 09, 2015			
Preamplifier	Burgeon	BPA-530	SN:100219	Sep. 09, 2014	Sep. 08, 2015			
Preamplifier	Agilent	83017A	MY39501308	Oct. 09, 2014	Oct. 08, 2015			
Preamplifier	EMC	EMC184045B	980192	Aug. 26, 2014	Aug. 25, 2015			
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16014/4	Dec. 15, 2014	Dec. 14, 2015			
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16019/4	Dec. 15, 2014	Dec. 14, 2015			
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16139/4	Dec. 15, 2014	Dec. 14, 2015			
LF cable 3M	Woken	CFD400NL-LW	CFD400NL-001	Dec. 15, 2014	Dec. 14, 2015			
LF cable 10M	Woken	CFD400NL-LW	CFD400NL-002	Dec. 15, 2014	Dec. 14, 2015			
Measurement Software	AUDIX	e3	6.120210g	NA	NA			
Note: Calibration Inter	rval of instruments listed	d above is one year.						

Test Item	RF Conducted							
Test Site	(TH01-WS)							
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Until			
Spectrum Analyzer	R&S	FSV40	101063	Feb. 03, 2015	Feb. 02, 2016			
Power Meter	Anritsu	ML2495A	1241002	Sep. 29, 2014	Sep. 28, 2015			
Power Sensor	Anritsu	MA2411B	1207366	Sep. 29, 2014	Sep. 28, 2015			
Measurement Software	Sporton	Sporton_1	1.3.30	NA	NA			
Note: Calibration Inter	Note: Calibration Interval of instruments listed above is one year.							

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1.5 Test Standards

According to the specification of EUT, the EUT must comply with following standards and KDB documents.

47 CFR FCC Part 15.247
ANSI C63.10-2013
FCC KDB 558074 D01 DTS Meas Guidance v03r03
FCC KDB 662911 D01 Multiple Transmitter Output v02r01

1.6 Measurement Uncertainty

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor (k=2)

Measurement Uncertainty							
Parameters	Uncertainty						
Bandwidth	±34.134 Hz						
Conducted power	±0.808 dB						
Power density	±0.463 dB						
Conducted emission	±2.670 dB						
AC conducted emission	±2.92 dB						
Radiated emission ≤ 1GHz	±3.72 dB						
Radiated emission > 1GHz	±5.65 dB						

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2 Test Configuration

2.1 Testing Condition

Test Item	Test Site	Ambient Condition	Tested By
AC Conduction	CO01-WS	22°C / 58%	Kevin Ma
Radiated Emissions	03CH01-WS	24-25°C / 63-66%	Aska Huang Morgan Chen
RF Conducted	TH01-WS	22°C / 63%	Felix Sung

FCC site registration No.: 657002IC site registration No.: 10807A-1

2.2 The Worst Test Modes and Channel Details

Test item	Modulation Mode	Test Frequency (MHz)	Data Rate (Mbps) / MCS	Test Configuration
Conducted Emissions	11g	2437	6 Mbps	
Radiated Emissions ≤1GHz	11g	2437	6 Mbps	
Radiated Emissions >1GHz Maximum Output Power 6dB bandwidth Power spectral density	11b 11g HT20 HT40	2412 / 2437 / 2462 2412 / 2437 / 2462 2412 / 2437 / 2462 2412 / 2437 / 2452 2422 / 2437 / 2452	1 Mbps 6 Mbps MCS 0 MCS 0	

NOTE:

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^{1.} The EUT was pretested with 3 orientations placed on the table for the radiated emission measurement – X, Y, and Z-plane. The **X-plane** results were found as the worst case and were shown in this report.



3 Transmitter Test Results

3.1 Conducted Emissions

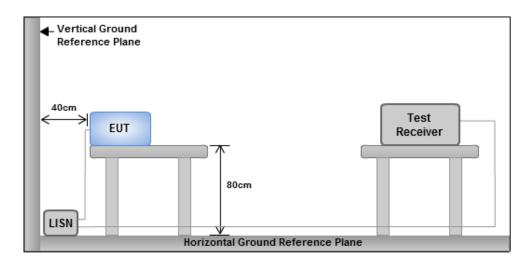
3.1.1 Limit of Conducted Emissions

Conducted Emissions Limit							
Frequency Emission (MHz) Quasi-Peak Average							
0.15-0.5	66 - 56 *	56 - 46 *					
0.5-5	56	46					
5-30	60	50					
Note 1: * Decreases with the logarith	m of the frequency.	-					

3.1.2 Test Procedures

- 1. The device is placed on a test table, raised 80 cm above the reference ground plane. The vertical conducting plane is located 40 cm to the rear of the device.
- 2. The device is connected to line impedance stabilization network (LISN) and other accessories are connected to other LISN. Measured levels of AC power line conducted emission are across the 50 Ω LISN port.
- 3. AC conducted emission measurements is made over frequency range from 150 kHz to 30 MHz.
- 4. This measurement was performed with AC 120V / 60Hz.

3.1.3 Test Setup



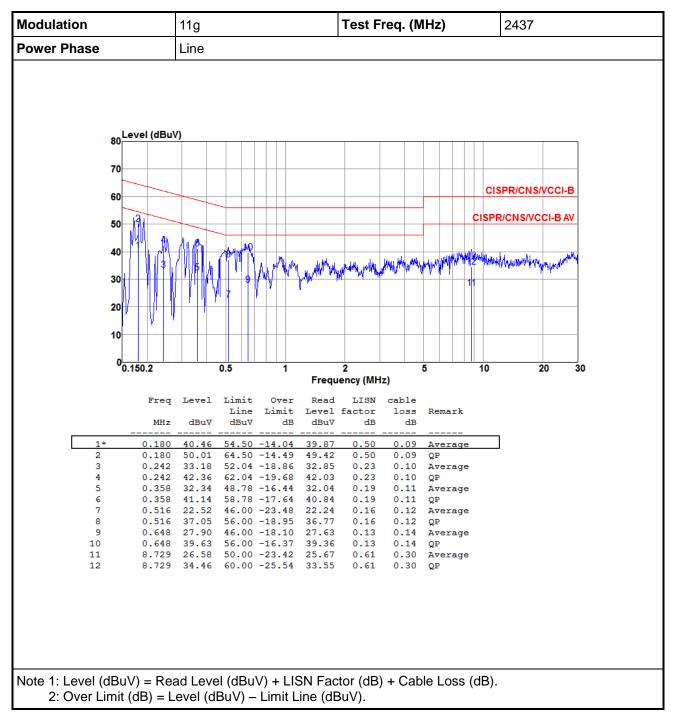
Note: 1. Support units were connected to second LISN.

Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes

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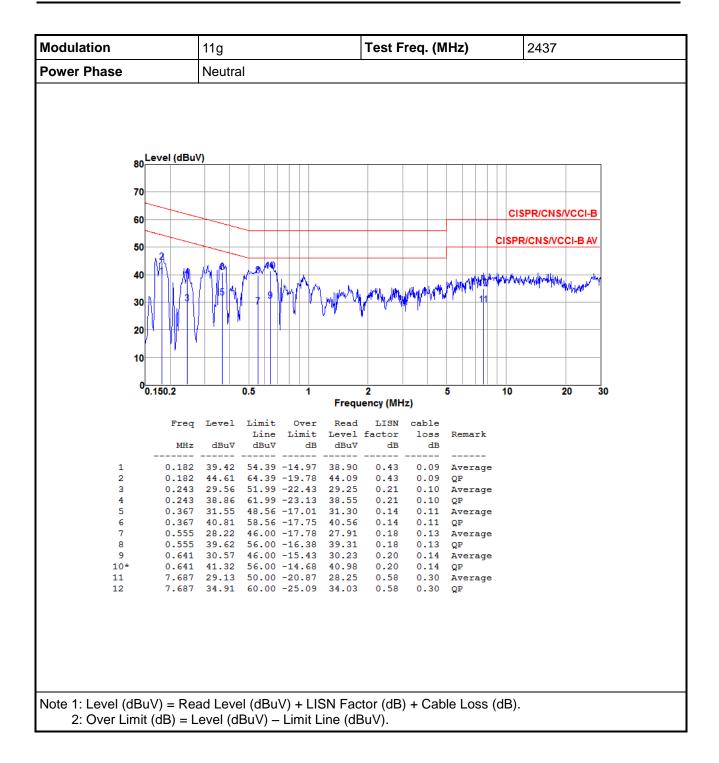


3.1.4 Test Result of Conducted Emissions



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3.2 6dB and Occupied Bandwidth

3.2.1 Limit of 6dB Bandwidth

The minimum 6dB bandwidth shall be at least 500 kHz.

3.2.2 Test Procedures

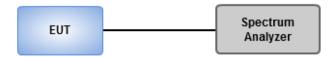
6dB Bandwidth

- 1. Set resolution bandwidth (RBW) = 100 kHz, Video bandwidth = 300 kHz.
- 2. Detector = Peak, Trace mode = max hold.
- 3. Sweep = auto couple, Allow the trace to stabilize.
- 4. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower) that are attenuated by 6dB relative to the maximum level measured in the fundamental emission.

Occupied Bandwidth

- Set resolution bandwidth (RBW) = 1 MHz, Video bandwidth = 3 MHz.
- 2. Detector = Sample, Trace mode = max hold.
- 3 Sweep = auto couple, Allow the trace to stabilize.
- 4. Use the OBW measurement function of spectrum analyzer to measure the occupied bandwidth.

3.2.3 Test Setup

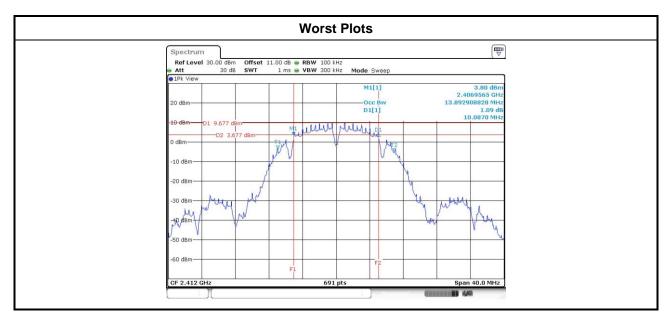


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3.2.4 Test Result of 6dB and Occupied Bandwidth

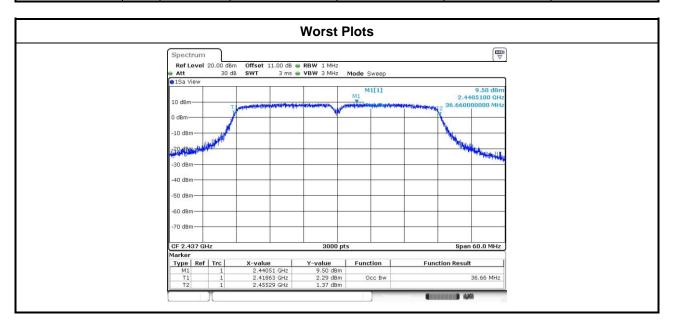
Modulation	N	Eron (MU=)		6dB Bandv	vidth (MHz)		Limit (kU=)
Mode	N _{TX}	Freq. (MHz)	Chain 0	Chain 1	Chain 2	Chain 3	Limit (kHz)
11b	2	2412	10.09	10.09			
11b	2	2437	10.09	10.09			500
11b	2	2462	10.09	10.09			500
11g	2	2412	16.35	16.35			500
11g	2	2437	16.35	16.35			500
11g	2	2462	16.35	16.35			500
HT20	2	2412	17.33	17.57			500
HT20	2	2437	17.28	17.62			500
HT20	2	2462	17.16	17.57			500
HT40	2	2422	35.71	35.48			500
HT40	2	2437	35.48	35.48			500
HT40	2	2452	36.29	35.83			500



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Modulation	N	Freq.		99% Occupied E	Bandwidth (MHz)	
Mode	N _{TX}	(MHz)	Chain 0	Chain 1	Chain 2	Chain 3
11b	2	2412	13.93	13.95		
11b	2	2437	15.09	14.92		
11b	2	2462	13.97	13.88		
11g	2	2412	16.67	16.64		
11g	2	2437	18.83	17.74		
11g	2	2462	16.68	16.60		
HT20	2	2412	17.80	17.77		
HT20	2	2437	19.25	18.58		
HT20	2	2462	17.79	17.78		
HT40	2	2422	36.52	36.50		
HT40	2	2437	36.66	36.58		
HT40	2	2452	36.56	36.56		



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3.3 RF Output Power

3.3.1 Limit of RF Output Power

Conducted power shall not exceed 1Watt.

Antenna gain <= 6dBi, no any corresponding reduction is in output power limit.

Antenna gain > 6dBi

Non Fixed, point to point operations.
The conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dB

Fixed, point to point operations
Systems operating in the 2400–2483.5 MHz band that are used exclusively for fixed, point-to-point Operations, maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

Systems operating in the 5725–5850 MHz band that are used exclusively for fixed, point-to-point operations, no any corresponding reduction is in transmitter peak output power

3.3.2 Test Procedures

Maximum Peak Conducted Output Power

- 1. Set RBW = 1MHz, VBW = 3MHz, Detector = Peak.
- 2. Sweep time = auto, Trace mode = max hold, Allow trace to fully stabilize.
- 3. Use the spectrum analyzer channel power measurement function with the band limits set equal to the DTS bandwidth edges.

Nower meter

- A broadband Peak RF power meter is used for output power measurement. The video bandwidth of power meter is greater than DTS bandwidth of EUT. If duty cycle of test signal is not 100 %, trigger and gating function of power meter will be enabled to capture transmission burst for measuring output power.
- Maximum Conducted Output Power (For reference only)

Nower meter

 A broadband Average RF power meter is used for output power measurement. The video bandwidth of power meter is greater than DTS bandwidth of EUT. If duty cycle of test signal is not 100 %, trigger and gating function of power meter will be enabled to capture transmission burst for measuring output power.

3.3.3 Test Setup



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3.3.4 Test Result of Maximum Output Power

Modulation Mode	N _{TX}	Freq. (MHz)	Peak		d output p 3m)	Total Power	Total Power	Limit	
Wode		(IVITIZ)	Chain 0	Chain 1	Chain 2	Chain 3	(mW)	(dBm)	(dBm)
11b	2	2412	21.33	21.06			263.475	24.21	30.00
11b	2	2437	22.87	23.17			401.134	26.03	30.00
11b	2	2462	21.56	20.89			265.963	24.25	30.00
11g	2	2412	21.56	20.89			265.963	24.25	30.00
11g	2	2437	23.16	23.51			431.402	26.35	30.00
11g	2	2462	21.41	20.67			255.038	24.07	30.00
HT20	2	2412	20.51	20.53			225.440	23.53	30.00
HT20	2	2437	23.15	23.49			429.895	26.33	30.00
HT20	2	2462	20.85	20.01			221.849	23.46	30.00
HT40	2	2422	16.71	16.49			91.447	19.61	30.00
HT40	2	2437	21.65	21.58			290.098	24.63	30.00
HT40	2	2452	17.15	16.51			96.651	19.85	30.00

Modulation Mode	N _{TX}	Freq.	Conducted (average) output power (dBm)			ıt power	Total Power	Total Power	Limit
Wiode		(MHz)	Chain 0	Chain 1	Chain 2	Chain 3	(mW)	(dBm)	(dBm)
11b	2	2412	19.12	18.88			158.926	22.01	30.00
11b	2	2437	21.39	21.61			282.598	24.51	30.00
11b	2	2462	19.45	18.56			159.884	22.04	30.00
11g	2	2412	15.58	15.41			70.895	18.51	30.00
11g	2	2437	20.02	20.04			201.387	23.04	30.00
11g	2	2462	15.47	14.51			63.486	18.03	30.00
HT20	2	2412	14.47	14.45			55.851	17.47	30.00
HT20	2	2437	20.02	20.01			200.692	23.03	30.00
HT20	2	2462	14.79	13.95			54.961	17.40	30.00
HT40	2	2422	10.65	10.29			22.305	13.48	30.00
HT40	2	2437	15.65	15.52			72.373	18.60	30.00
HT40	2	2452	11.09	10.38			23.767	13.76	30.00

Note: Conducted average output power is for reference only.

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3.4 Power Spectral Density

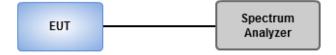
3.4.1 Limit of Power Spectral Density

Power spectral density shall not be greater than 8 dBm in any 3 kHz band.

3.4.2 Test Procedures

- Maximum peak conducted output power was used to demonstrate compliance to the fundamental output power limit.
 - Set the RBW = 3kHz, VBW = 10kHz.
 - Detector = Peak, Sweep time = auto couple.
 - 3. Trace mode = max hold, allow trace to fully stabilize.
 - 4. Use the peak marker function to determine the maximum amplitude level.
- Maximum (average) conducted output power was used to demonstrate compliance to the fundamental output power limit.
 - 1. Set the RBW = 100kHz, VBW = 300 kHz.
 - 2. Detector = RMS, Sweep time = auto couple.
 - 3. Set the sweep time to: ≥ 10 x (number of measurement points in sweep) x (maximum data rate per stream).
 - 4. Perform the measurement over a single sweep.
 - 5. Use the peak marker function to determine the maximum amplitude level.

3.4.3 Test Setup



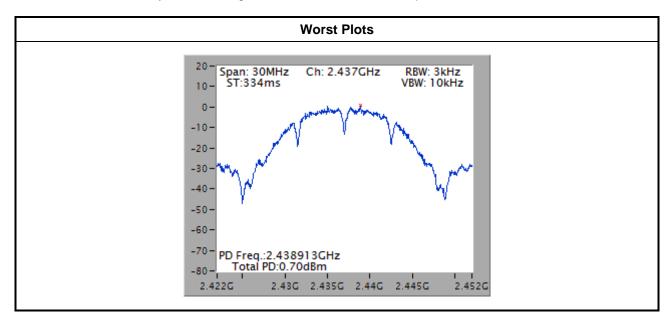
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3.4.4 Test Result of Power Spectral Density

Modulation Mode	N _{TX}	Freq. (MHz)	Total Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)
11b	2	2412	-1.06	8.00
11b	2	2437	0.70	8.00
11b	2	2462	-1.14	8.00
11g	2	2412	-6.95	8.00
11g	2	2437	-3.36	8.00
11g	2	2462	-7.63	8.00
HT20	2	2412	-8.33	8.00
HT20	2	2437	-3.22	8.00
HT20	2	2462	-8.94	8.00
HT40	2	2422	-15.41	8.00
HT40	2	2437	-9.77	8.00
HT40	2	2452	-14.97	8.00

Note: Test result is bin-by-bin summing measured value of each TX port.



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3.5 Unwanted Emissions into Restricted Frequency Bands

3.5.1 Limit of Unwanted Emissions into Restricted Frequency Bands

	Restricted Band Emissions Limit									
Frequency Range (MHz)	Field Strength (uV/m)	Field Strength (dBuV/m)	Measure Distance (m)							
0.009~0.490	2400/F(kHz)	48.5 - 13.8	300							
0.490~1.705	24000/F(kHz)	33.8 - 23	30							
1.705~30.0	30	29	30							
30~88	100	40	3							
88~216	150	43.5	3							
216~960	200	46	3							
Above 960	500	54	3							

Note 1:

Qusai-Peak value is measured for frequency below 1GHz except for 9–90 kHz, 110–490 kHz frequency band. Peak and average value are measured for frequency above 1GHz. The limit on average radio frequency emission is as above table. The limit on peak radio frequency emissions is 20 dB above the maximum permitted average emission limit **Note 2:**

Measurements may be performed at a distance other than what is specified provided. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor as below, Frequency at or above 30 MHz: 20 dB/decade Frequency below 30 MHz: 40 dB/decade.

3.5.2 Test Procedures

- 1. Measurement is made at a semi-anechoic chamber that incorporates a turntable allowing a EUT rotation of 360°. A continuously-rotating, remotely-controlled turntable is installed at the test site to support the EUT and facilitate determination of the direction of maximum radiation for each EUT emission frequency. The EUT is placed at test table. For emissions testing at or below 1 GHz, the table height is 80 cm above the reference ground plane. For emission measurements above 1 GHz, the table height is 1.5 m
- 2. Measurement is made with the antenna positioned in both the horizontal and vertical planes of polarization. The measurement antenna is varied in height (1m ~ 4m) above the reference ground plane to obtain the maximum signal strength. Distance between EUT and antenna is 3 m.
- 3. This investigation is performed with the EUT rotated 360°, the antenna height scanned between 1 m and 4 m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations.

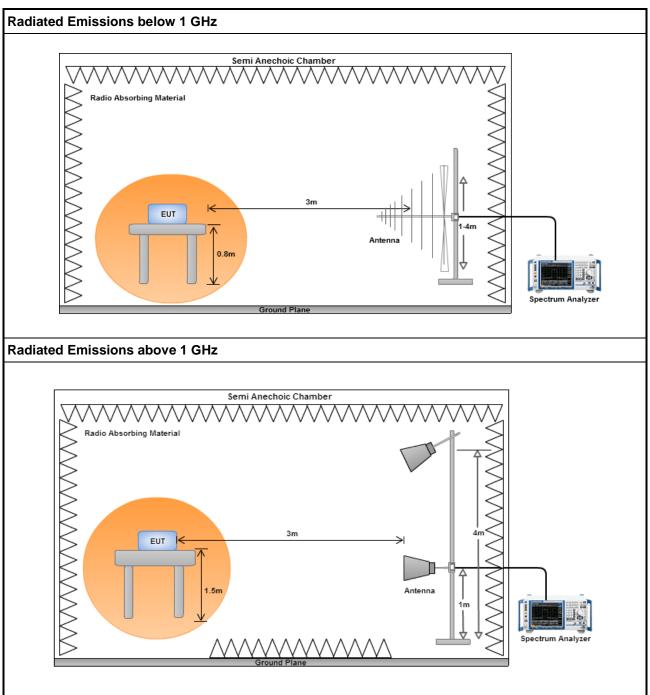
Note:

- 1. 120kHz measurement bandwidth of test receiver and Quasi-peak detector is for radiated emission below 1GHz.
- 2. RBW=1MHz, VBW=3MHz and Peak detector is for peak measured value of radiated emission above 1GHz.
- RBW=1MHz, VBW=1/T and Peak detector is for average measured value of radiated emission above 1GHz.

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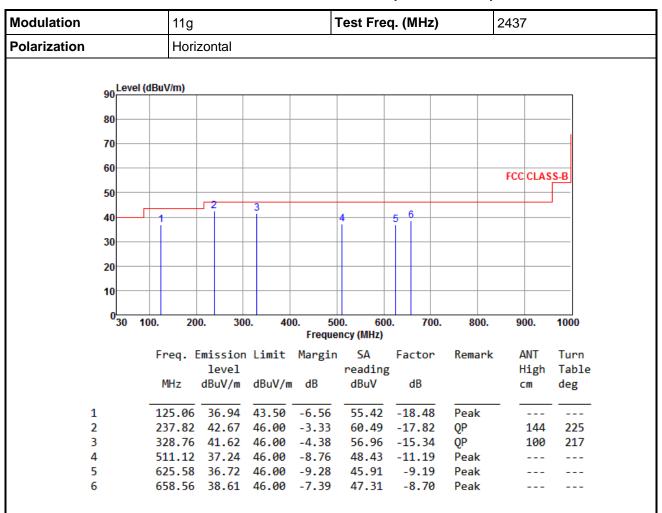
3.5.3 Test Setup



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3.5.4 Transmitter Radiated Unwanted Emissions (Below 1GHz)



Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)

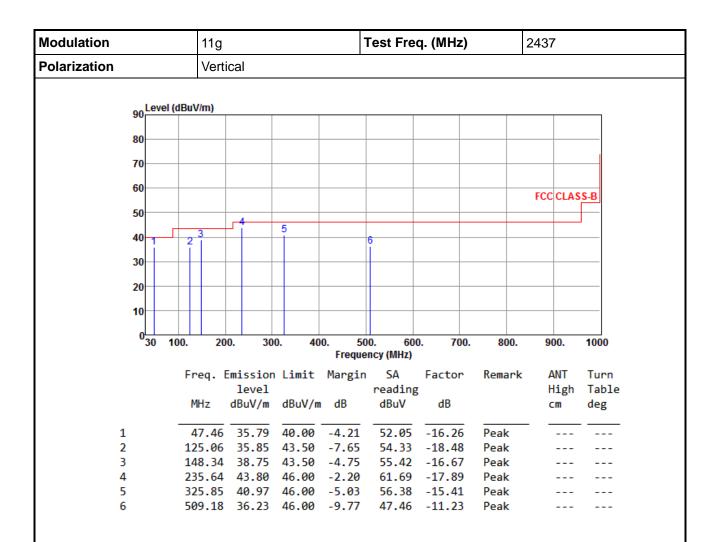
*Factor includes antenna factor, cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

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*Factor includes antenna factor, cable loss and amplifier gain

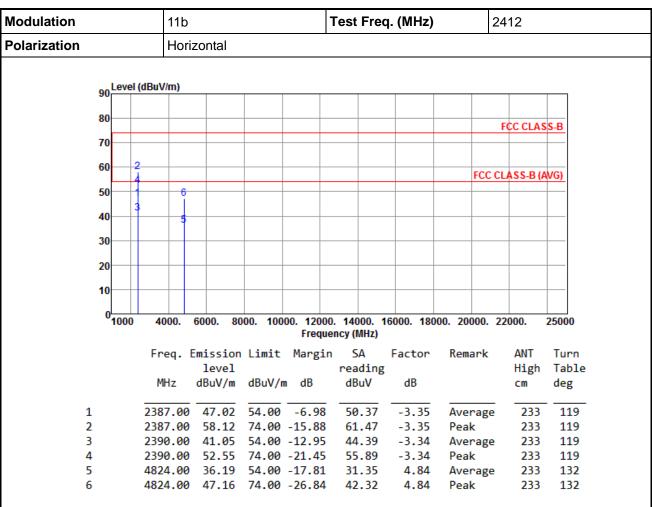
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

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3.5.5 Transmitter Radiated Unwanted Emissions (Above 1GHz) for 11b



Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)

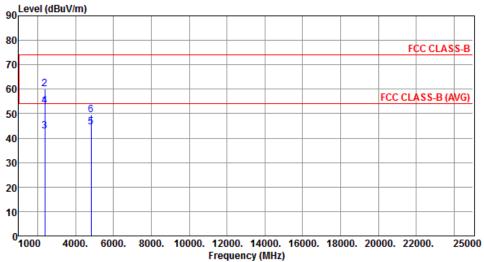
*Factor includes antenna factor, cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) - Limit (dBuV/m).

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Modulation	11b	-	Test Freq.	(MHz)	24	12		
Polarization	Vertical							
90 Level (dBu)	//m)							

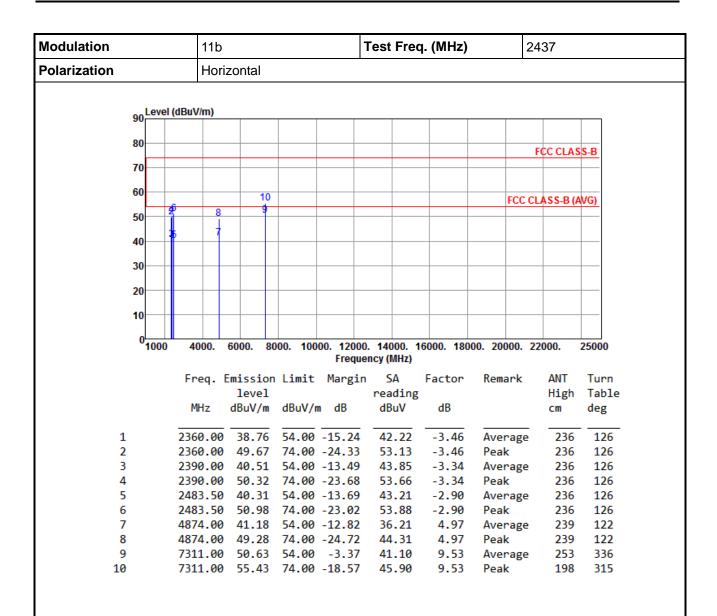


	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Ü	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2387.00	53.17	54.00	-0.83	56.52	-3.35	Average	207	0
2	2387.00	60.02	74.00	-13.98	63.37	-3.35	Peak	207	0
3	2390.00	42.77	54.00	-11.23	46.11	-3.34	Average	207	0
4	2390.00	53.15	74.00	-20.85	56.49	-3.34	Peak	207	0
5	4824.00	44.64	54.00	-9.36	39.80	4.84	Average	259	20
6	4824.00	49.53	74.00	-24.47	44.69	4.84	Peak	259	20

*Factor includes antenna factor, cable loss and amplifier gain Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

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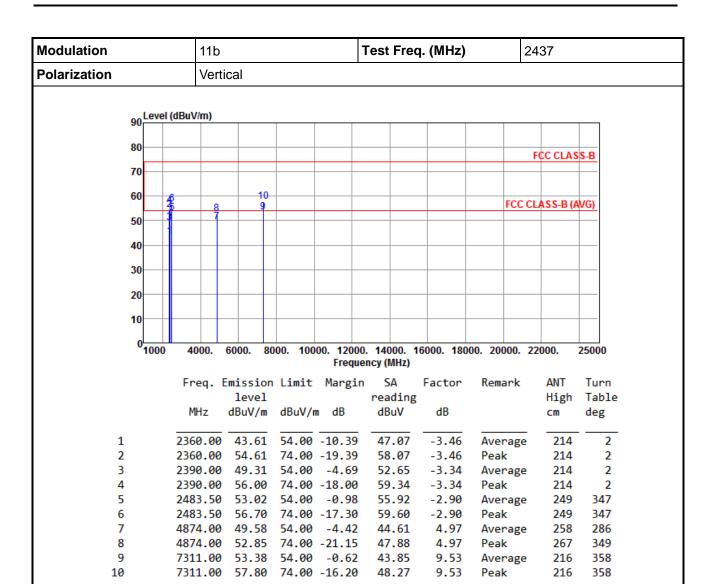


*Factor includes antenna factor, cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

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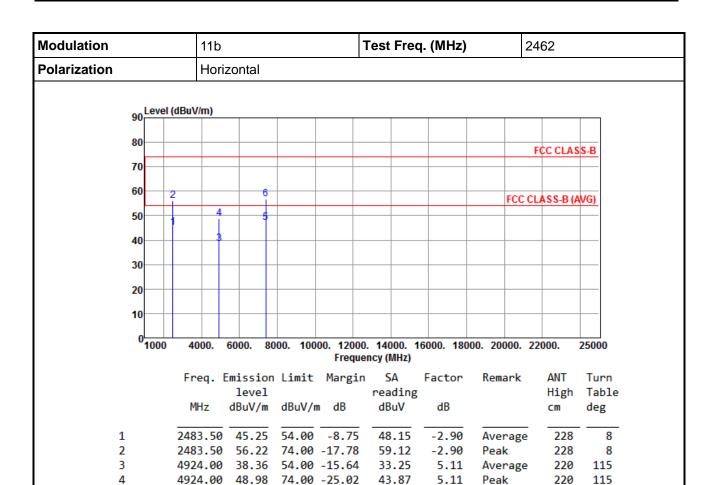


*Factor includes antenna factor, cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

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54.00 -6.98

37.35

47.07

9.67

9.67

Average

Peak

188

188

344

344

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB) *Factor includes antenna factor, cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

7386.00 47.02

7386.00 56.74 74.00 -17.26

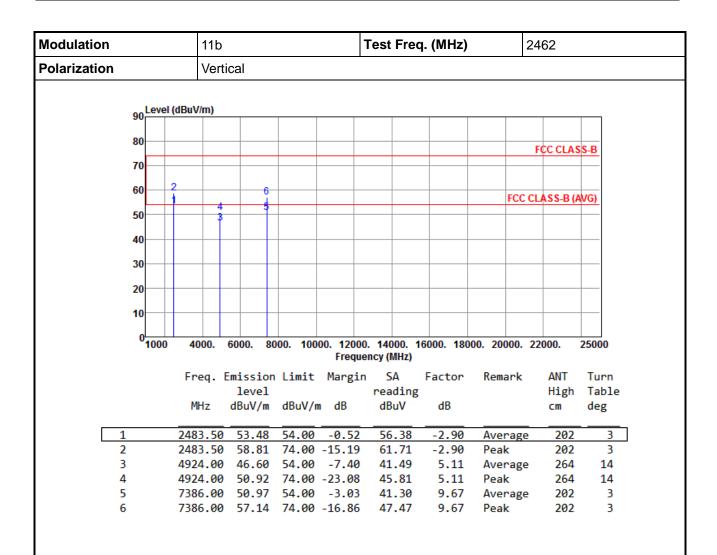
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5

6





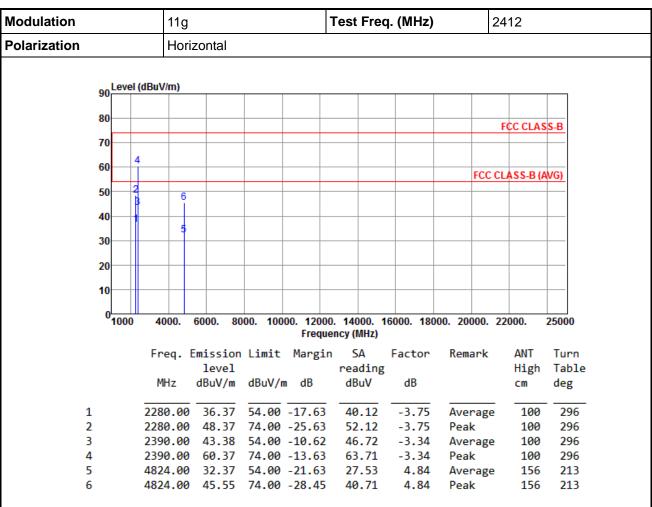
*Factor includes antenna factor, cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

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3.5.6 Transmitter Radiated Unwanted Emissions (Above 1GHz) for 11g



Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)

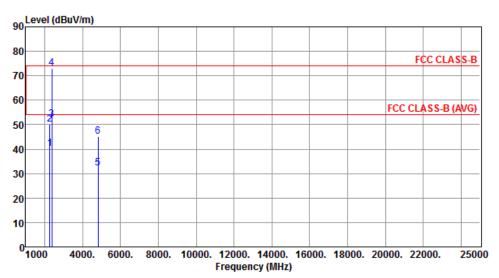
*Factor includes antenna factor, cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) - Limit (dBuV/m).

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Modulation	11g	Test Freq. (MHz)	2412
Polarization	Vertical		



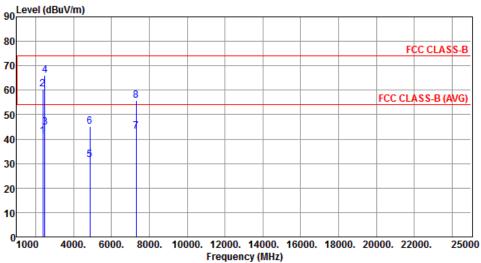
	Freq.	Emission level	Limit	Margin	SA reading	Factor	Remark	ANT High	Turn Table
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB		cm	deg
1	2280.00	40.32	54.00	-13.68	44.07	-3.75	Average	260	0
2	2280.00	50.06	74.00	-23.94	53.81	-3.75	Peak	260	0
3	2390.00	52.28	54.00	-1.72	55.62	-3.34	Average	299	356
4	2390.00	73.19	74.00	-0.81	76.53	-3.34	Peak	299	356
5	4824.00	32.26	54.00	-21.74	27.42	4.84	Average	200	156
6	4824.00	45.22	74.00	-28.78	40.38	4.84	Peak	200	156

*Factor includes antenna factor , cable loss and amplifier gain Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

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Modulation	11g		Те	st Freq.	243	2437			
Polarization	Horizo	ntal							
90 Leve	el (dBuV/m)								



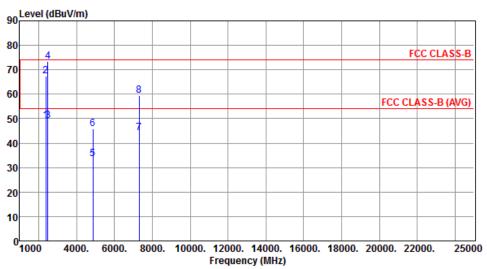
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Ü	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2390.00	41.27	54.00	-12.73	44.61	-3.34	Average	136	288
2	2390.00	60.34	74.00	-13.66	63.68	-3.34	Peak	136	288
3	2483.50	44.97	54.00	-9.03	47.87	-2.90	Average	136	288
4	2483.50	66.07	74.00	-7.93	68.97	-2.90	Peak	136	288
5	4874.00	31.62	54.00	-22.38	26.65	4.97	Average	100	155
6	4874.00	45.10	74.00	-28.90	40.13	4.97	Peak	100	155
7	7311.00	43.30	54.00	-10.70	33.77	9.53	Average	120	39
8	7311.00	55.80	74.00	-18.20	46.27	9.53	Peak	120	39

*Factor includes antenna factor, cable loss and amplifier gain Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

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Modulation	11g	Test Freq. (MHz)	2437
Polarization	Vertical		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	J	SA reading dBuV	Factor dB	Remark	ANT High	Turn Table
	PHIZ	ubuv/III	ubuv/III	ub	ubuv	ub		cm	deg
1	2390.00	49.13	54.00	-4.87	52.47	-3.34	Average	304	3
2	2390.00	67.57	74.00	-6.43	70.91	-3.34	Peak	304	3
3	2483.50	49.29	54.00	-4.71	52.19	-2.90	Average	101	185
4	2483.50	73.33	74.00	-0.67	76.23	-2.90	Peak	101	185
5	4874.00	33.65	54.00	-20.35	28.68	4.97	Average	285	359
6	4874.00	45.85	74.00	-28.15	40.88	4.97	Peak	285	359
7	7311.00	44.29	54.00	-9.71	34.76	9.53	Average	237	5
8	7311.00	59.47	74.00	-14.53	49.94	9.53	Peak	237	5

*Factor includes antenna factor , cable loss and amplifier gain Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

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Modulation			119	11g			Test	Freq	ı. (MHz)		24	2462		
Polarization			Но	rizont	al							•		
	90	Level ((dBuV/m)											
	80													
				_								F	CC CLAS	S-B
	70	2	2											
	60											FCC CL	ASS-B (A	VG)
	50			4	- 6									
	40													
				3										
	30													
	20													
	10													
	0													
	·	1000	4000.	6000	. 80	000. 100		0. 140 ency (I		6000. 180	00. 200	00. 22	000.	25000
			Freq.	Emis	sion	Limit	Margi	n S	Α	Factor	Rema	rk	ANT	Turn
					vel				ding				High	Table
			MHz	dBu	V/m	dBuV/	m dB	dB	uV	dB			CM	deg
:	1		2483.5	0 45	.21	54.00	-8.79	48	.11	-2.90	Aver	age	122	299
	2		2483.5		.19	74.00			.09	-2.90	Peak		122	299
	3		4924.0		.96		-22.04		.85	5.11	Aver		155	212
	4						-28.28		.61	5.11	Peak		155	212
	5 6						-16.44 -22.80		.89 .53	9.67 9.67	Aver Peak	_	100 100	168 168

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)

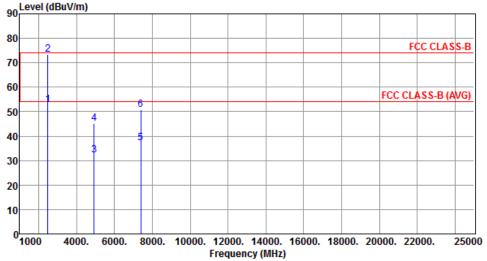
*Factor includes antenna factor , cable loss and amplifier gain Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

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Modulation	11g	Test Freq. (MHz)	2462
Polarization	Vertical		
90 Level (d	BuV/m)		
00			



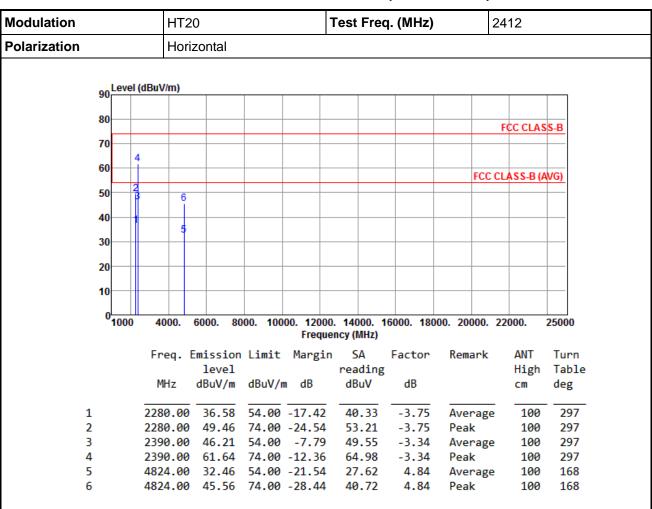
	Freq.	Emission level	Limit	Margin	SA reading	Factor	Remark	ANT High	Turn Table
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB		cm	deg
1	2483.50	52.95	54.00	-1.05	55.85	-2.90	Average	278	5
2	2483.50	73.25	74.00	-0.75	76.15	-2.90	Peak	278	5
3	4924.00	32.11	54.00	-21.89	27.00	5.11	Average	156	62
4	4924.00	45.23	74.00	-28.77	40.12	5.11	Peak	156	62
5	7386.00	37.20	54.00	-16.80	27.53	9.67	Average	155	185
6	7386.00	50.85	74.00	-23.15	41.18	9.67	Peak	155	185

*Factor includes antenna factor, cable loss and amplifier gain Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

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3.5.7 Transmitter Radiated Unwanted Emissions (Above 1GHz) for HT20



Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)

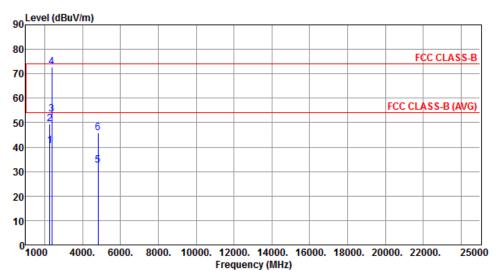
*Factor includes antenna factor, cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) - Limit (dBuV/m).

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Modulation	HT20	Test Freq. (MHz)	2412
Polarization	Vertical		



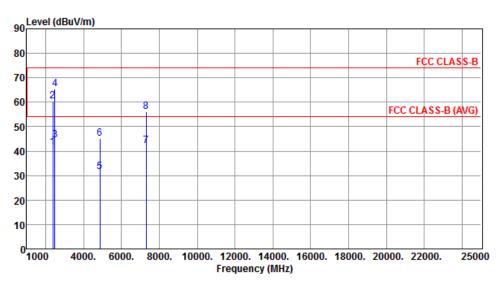
	Freq.	Emission level dBuV/m	Limit dBuV/m		SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
4	2200 00	40. 37	<u></u> .	12 (2	44.42		A	200	
1	2280.00	40.37	54.00	-13.63	44.12	-3.75	Average	268	2
2	2280.00	49.56	74.00	-24.44	53.31	-3.75	Peak	268	2
3	2390.00	53.34	54.00	-0.66	56.68	-3.34	Average	268	2
4	2390.00	72.89	74.00	-1.11	76.23	-3.34	Peak	268	2
5	4824.00	32.39	54.00	-21.61	27.55	4.84	Average	155	186
6	4824.00	45.67	74.00	-28.33	40.83	4.84	Peak	155	186

*Factor includes antenna factor , cable loss and amplifier gain Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

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Polarization Horizontal	Modulation	HT20	Test Freq. (MHz)	2437
Total Zation	Polarization	Horizontal		



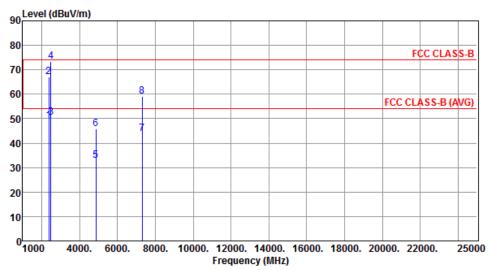
	Freq.	Emission level	Limit	Margin	SA reading	Factor	Remark	ANT High	Turn Table
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB		cm	deg
1	2390.00	41.64	54.00	-12.36	44.98	-3.34	Average	130	285
2	2390.00	60.41	74.00	-13.59	63.75	-3.34	Peak	130	285
3	2483.50	44.66	54.00	-9.34	47.56	-2.90	Average	130	285
4	2483.50	65.56	74.00	-8.44	68.46	-2.90	Peak	130	285
5	4874.00	31.55	54.00	-22.45	26.58	4.97	Average	100	142
6	4874.00	45.24	74.00	-28.76	40.27	4.97	Peak	100	142
7	7311.00	42.07	54.00	-11.93	32.54	9.53	Average	116	53
8	7311.00	56.00	74.00	-18.00	46.47	9.53	Peak	116	53

*Factor includes antenna factor , cable loss and amplifier gain Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

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Modulation	HT20	Test Freq. (MHz)	2437
Polarization	Vertical		



	Freq.	Emission level	Limit	Margin	SA reading	Factor	Remark	ANT High	Turn Table
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB		cm	deg
1	2390.00	49.16	54.00	-4.84	52.50	-3.34	Average	219	0
2	2390.00	67.08	74.00	-6.92	70.42	-3.34	Peak	219	0
3	2483.50	50.58	54.00	-3.42	53.48	-2.90	Average	219	0
4	2483.50	73.33	74.00	-0.67	76.23	-2.90	Peak	219	0
5	4874.00	32.83	54.00	-21.17	27.86	4.97	Average	155	156
6	4874.00	45.70	74.00	-28.30	40.73	4.97	Peak	155	156
7	7311.00	43.96	54.00	-10.04	34.43	9.53	Average	234	4
8	7311.00	59.21	74.00	-14.79	49.68	9.53	Peak	234	4

*Factor includes antenna factor , cable loss and amplifier gain Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

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01000

4000.

Modulation			HT20			Test	Freq.	(MHz)	24	62	
Polarization			Horizo	ntal		•			•		
	90 <mark>[</mark>	_evel (dB	uV/m)		I						
	80-								F	CC CLAS	S-B
	70	2									
	60								FCC CL/	ASS-B (A	VG)
	50	+	4	6							
	40		3	5							
	30										
	20										

	Freq. 8	Emission level	Limit	Margin	SA reading	Factor	Remark	ANT High	Turn Table
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB		cm	deg
1	2483.50	43.93	54.00	-10.07	46.83	-2.90	Average	153	295
2	2483.50		74.00		64.28	-2.90	Peak	153	295
3	4924.00	32.62	54.00	-21.38	27.51	5.11	Average	123	213
4	4924.00	45.79	74.00	-28.21	40.68	5.11	Peak	123	213
5	7386.00	37.28	54.00	-16.72	27.61	9.67	Average	108	168
6	7386.00	50.11	74.00	-23.89	40.44	9.67	Peak	108	168

Frequency (MHz)

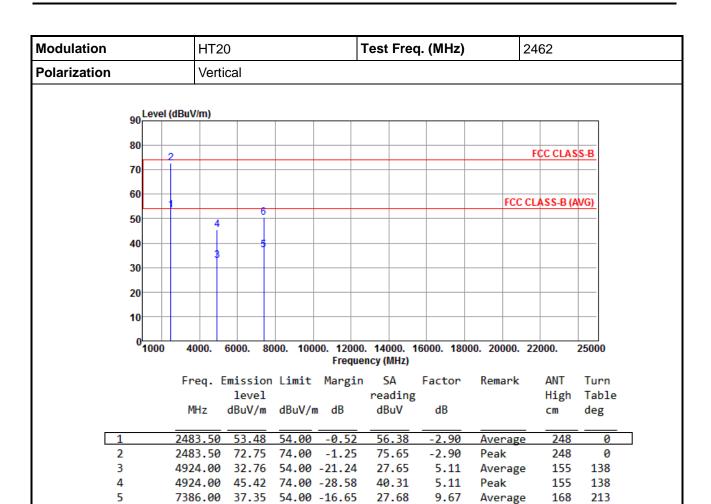
8000. 10000. 12000. 14000. 16000. 18000. 20000. 22000.

25000

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)
*Factor includes antenna factor , cable loss and amplifier gain
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

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40.68

9.67

Peak

168

213

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)
*Factor includes antenna factor, cable loss and amplifier gain

7386.00 50.35 74.00 -23.65

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

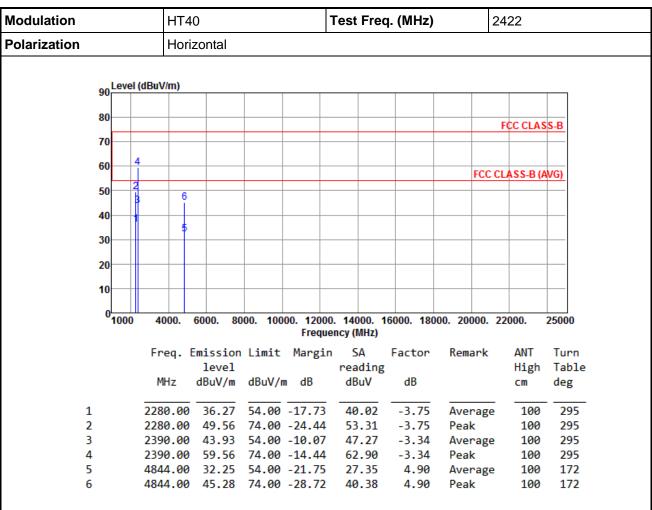
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3.5.8 Transmitter Radiated Unwanted Emissions (Above 1GHz) for HT40



Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)

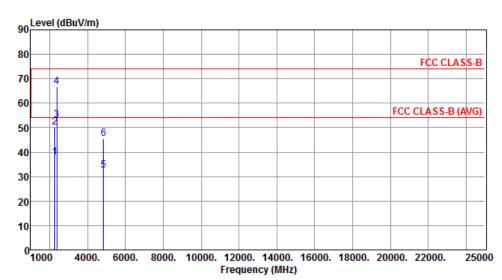
*Factor includes antenna factor, cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

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Modulation	HT40	Test Freq. (MHz)	2422
Polarization	Vertical		



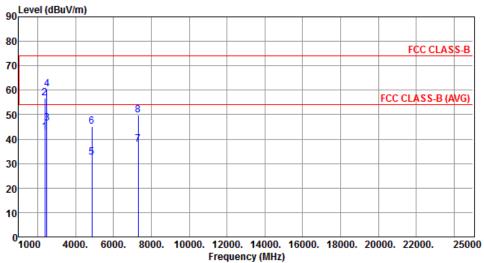
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Ū	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2280.00	37.93	<u> </u>	16 07	41.68	-3.75	Average	258	
_	2200.00	37.33	34.00	-10.07	41.00	-3./3	Average	230	U
2	2280.00	50.26	74.00	-23.74	54.01	-3.75	Peak	258	0
3	2390.00	53.20	54.00	-0.80	56.54	-3.34	Average	341	0
4	2390.00	66.80	74.00	-7.20	70.14	-3.34	Peak	341	0
5	4844.00	32.58	54.00	-21.42	27.68	4.90	Average	142	165
6	4844.00	45.43	74.00	-28.57	40.53	4.90	Peak	142	165

*Factor includes antenna factor, cable loss and amplifier gain Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

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Modulation	HT40	Test Free	ղ. (MHz))	24	37		
Polarization	Horizontal							
90 Level (dBu\	//m)							



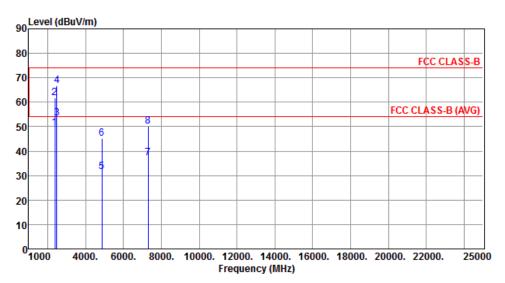
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m		SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2390.00	42.68	54.00	-11.32	46.02	-3.34	Average	100	294
2	2390.00	56.88	74.00	-17.12	60.22	-3.34	Peak	100	294
3	2483.50	46.35	54.00	-7.65	49.25	-2.90	Average	100	294
4	2483.50	60.54	74.00	-13.46	63.44	-2.90	Peak	100	294
5	4874.00	32.53	54.00	-21.47	27.56	4.97	Average	100	155
6	4874.00	45.28	74.00	-28.72	40.31	4.97	Peak	100	155
7	7311.00	37.74	54.00	-16.26	28.21	9.53	Average	100	155
8	7311.00	49.85	74.00	-24.15	40.32	9.53	Peak	100	155

*Factor includes antenna factor, cable loss and amplifier gain Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

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Modulation	HT40	Test Freq. (MHz)	2437
Polarization	Vertical		



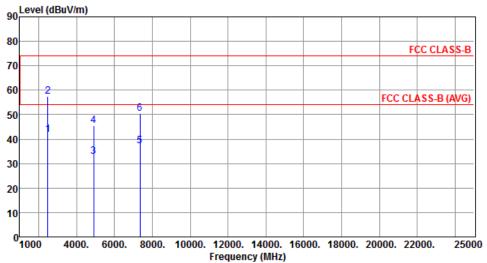
	Freq.	Emission level	Limit	Margin	SA reading	Factor	Remark	ANT High	Turn Table
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB		cm	deg
1	2390.00	49.57	54.00	-4.43	52.91	-3.34	Average	234	0
2	2390.00	61.89	74.00	-12.11	65.23	-3.34	Peak	234	0
3	2483.50	53.35	54.00	-0.65	56.25	-2.90	Average	279	0
4	2483.50	66.63	74.00	-7.37	69.53	-2.90	Peak	279	0
5	4874.00	31.69	54.00	-22.31	26.72	4.97	Average	100	212
6	4874.00	45.20	74.00	-28.80	40.23	4.97	Peak	100	212
7	7311.00	37.09	54.00	-16.91	27.56	9.53	Average	100	12
8	7311.00	50.06	74.00	-23.94	40.53	9.53	Peak	100	12

*Factor includes antenna factor, cable loss and amplifier gain Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

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Modulation	HT40	Test Freq. (MHz)	2452				
Polarization	Horizontal						
oo Level (dBuV/m)							



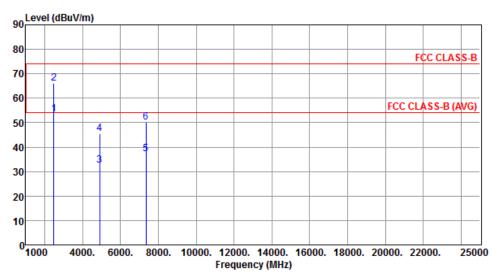
		Emission level		Ū	SA reading		Remark	ANT High	Turn Table
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB		cm	deg
1	2483.50	41.75	54.00	-12.25	44.65	-2.90	Average	100	295
2	2483.50	57.44	74.00	-16.56	60.34	-2.90	Peak	100	295
3	4904.00	32.91	54.00	-21.09	27.85	5.06	Average	100	172
4	4904.00	45.58	74.00	-28.42	40.52	5.06	Peak	100	172
5	7356.00	37.23	54.00	-16.77	27.62	9.61	Average	100	218
6	7356.00	50.33	74.00	-23.67	40.72	9.61	Peak	100	218

*Factor includes antenna factor, cable loss and amplifier gain Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

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Modulation	HT40	Test Freq. (MHz)	2452
Polarization	Vertical		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Ū	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
									- 0
1	2483.50	53.45	54.00	-0.55	56.35	-2.90	Average	248	341
2	2483.50	66.22	74.00	-7.78	69.12	-2.90	Peak	248	341
3	4904.00	32.67	54.00	-21.33	27.61	5.06	Average	100	166
4	4904.00	45.58	74.00	-28.42	40.52	5.06	Peak	100	166
5	7356.00	37.26	54.00	-16.74	27.65	9.61	Average	100	218
6	7356.00	49.99	74.00	-24.01	40.38	9.61	Peak	100	218

*Factor includes antenna factor , cable loss and amplifier gain Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

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3.6 Emissions in Non-Restricted Frequency Bands

3.6.1 Emissions in Non-Restricted Frequency Bands Limit

Peak power in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz

3.6.2 Measuring Instruments

Refer a test equipment and calibration data table in this test report.

3.6.3 Test Procedures

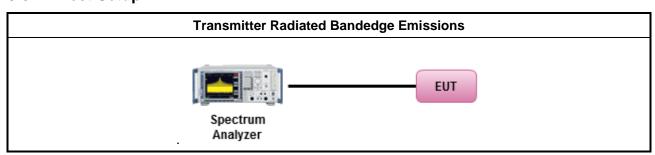
Reference level measurement

- 1. Set RBW=100kHz, VBW = 300kHz, Detector = Peak, Sweep time = Auto
- 2. Trace = max hold, Allow Trace to fully stabilize
- 3. Use the peak marker function to determine the maximum PSD level

Emission level measurement

- 1. Set RBW=100kHz, VBW = 300kHz, Detector = Peak, Sweep time = Auto
- 2. Trace = max hold, Allow Trace to fully stabilize
- 3. Scan Frequency range is up to 25GHz
- 4. Use the peak marker function to determine the maximum amplitude level

3.6.4 Test Setup



3.6.5 Test Result of Emissions in non-restricted frequency bands

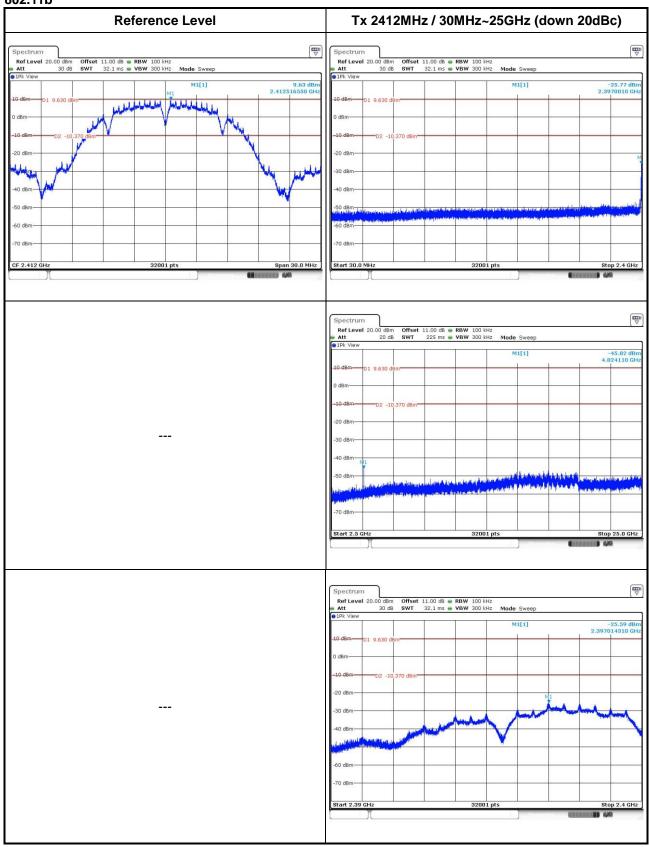
This test item is performed on each TX output individually without summing or adding 10 $log(N_{ANT})$ since measurements are made relative to the in-band emissions on the individual outputs. Only worst test result of each operating mode is presented.

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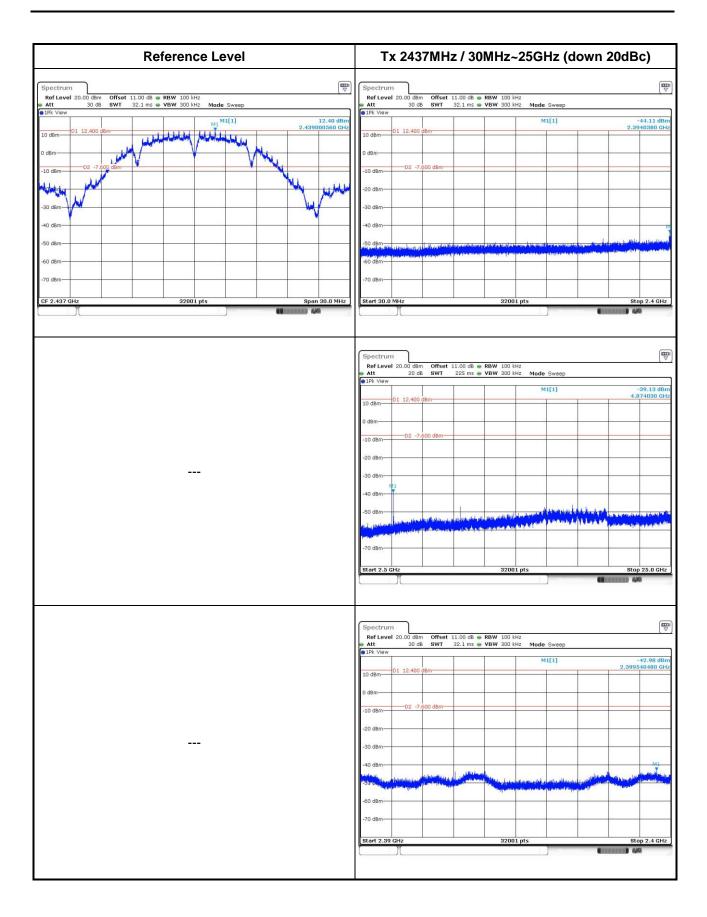
3.6.6 Unwanted Emissions into Non-Restricted Frequency Bands

802.11b



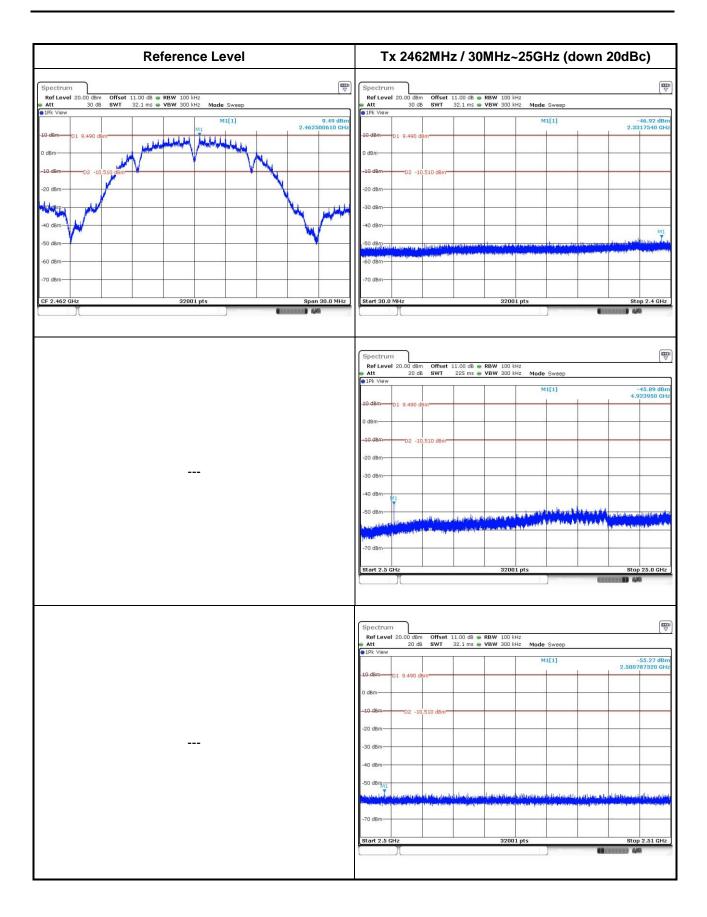
Report No.: FR571605AC Report Version: Rev. 01





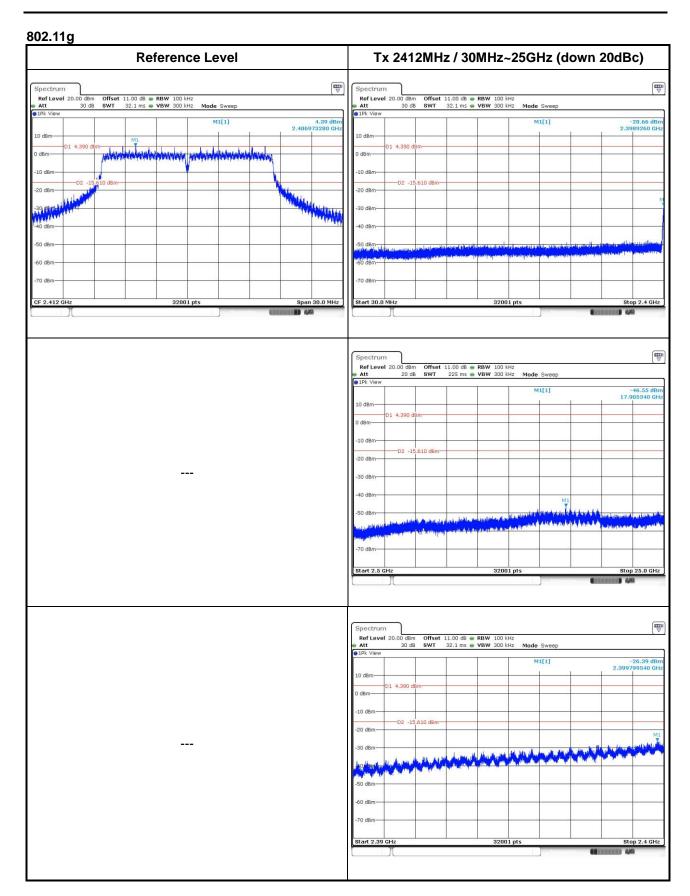
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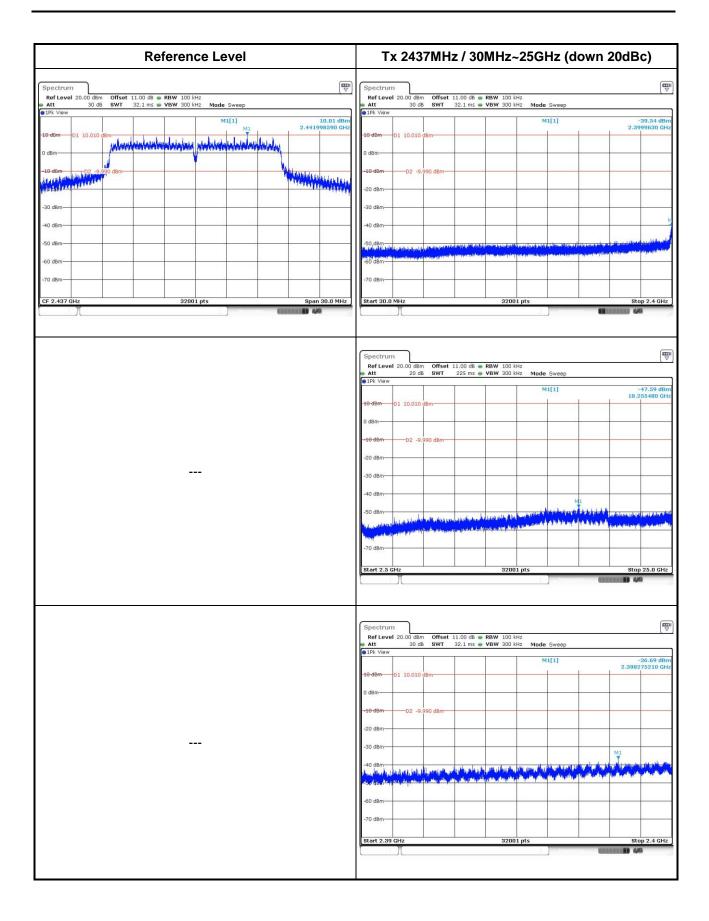
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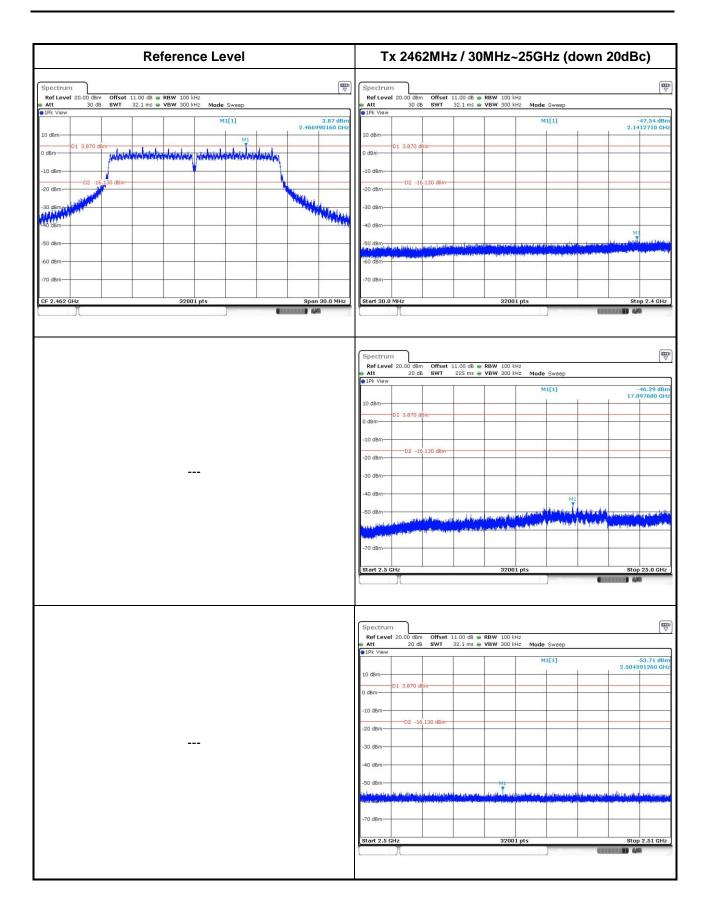
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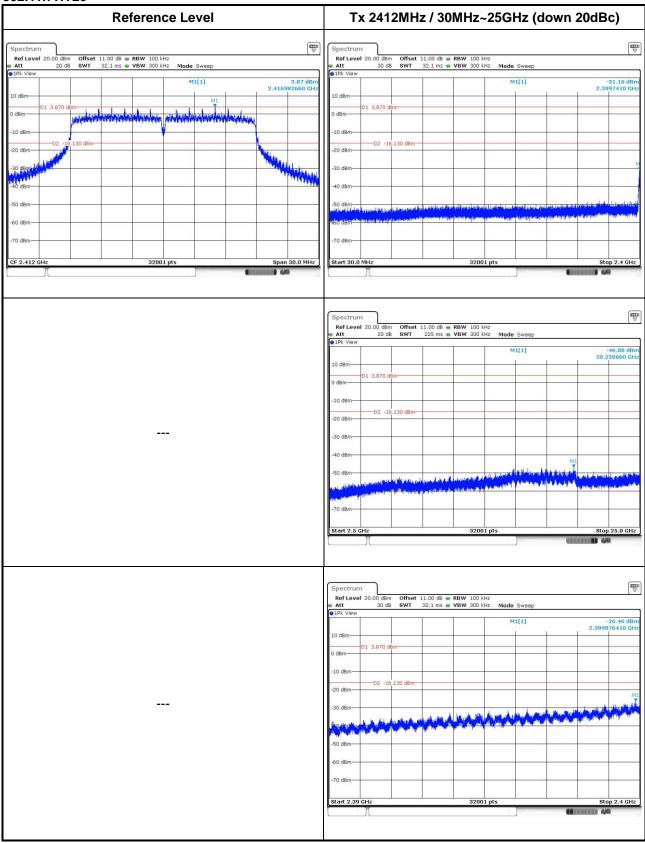




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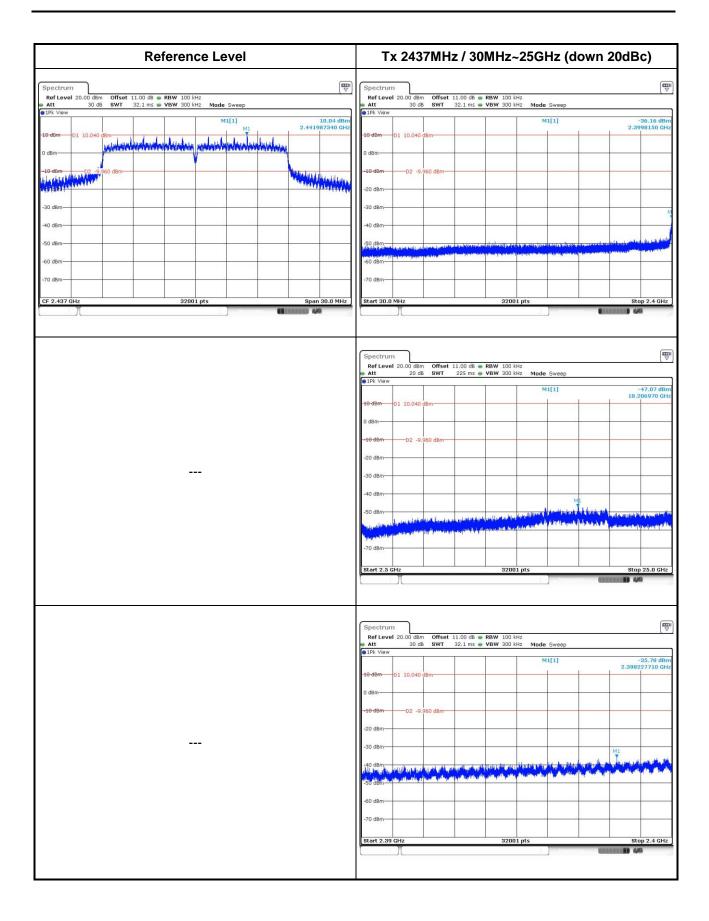


802.11n HT20



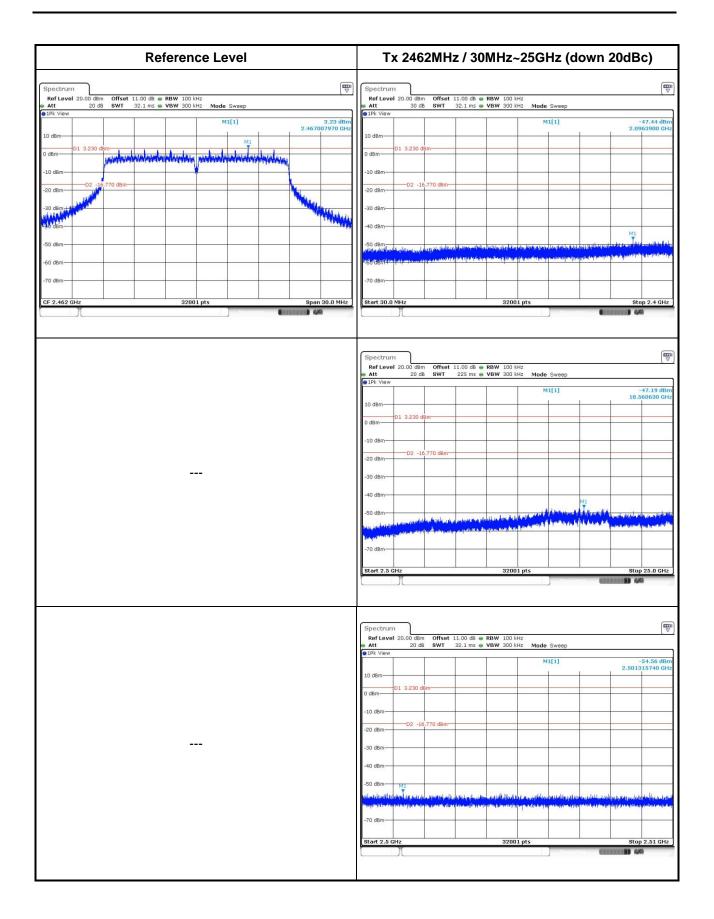
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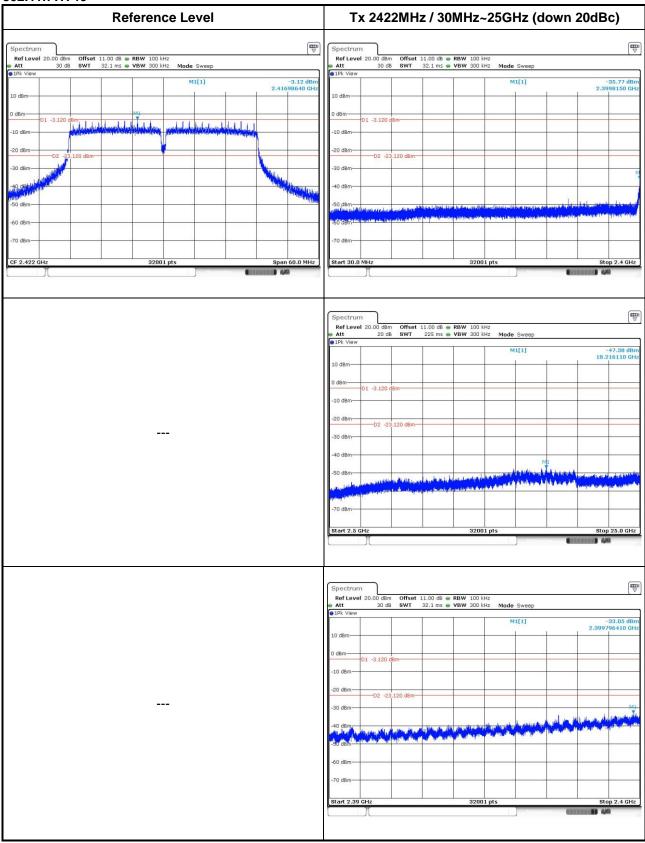




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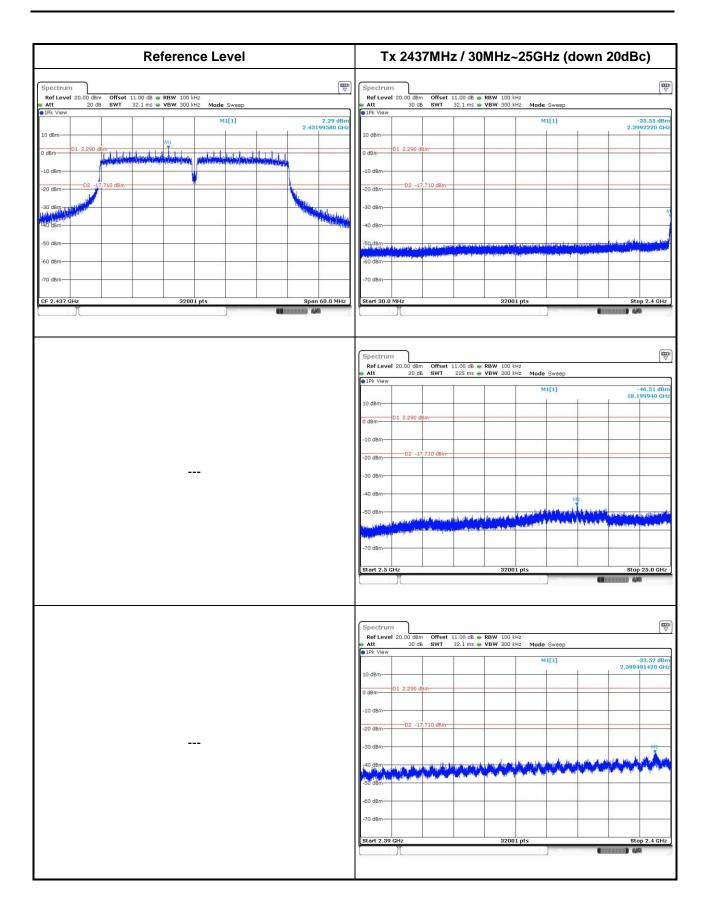


802.11n HT40



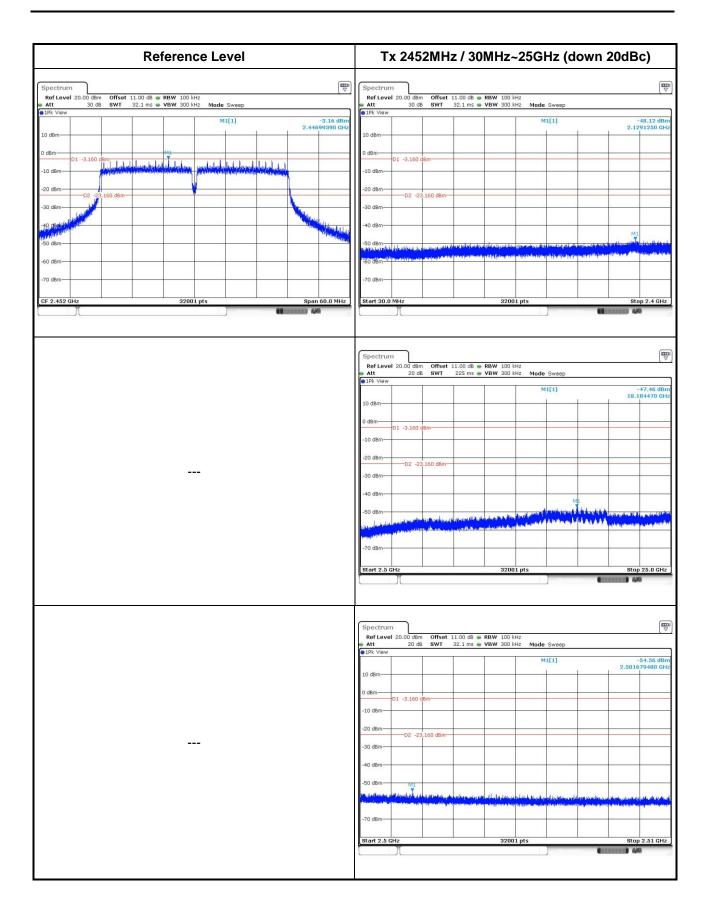
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4 Test laboratory information

Established in 2012, ICC provides foremost EMC & RF Testing and advisory consultation services by our skilled engineers and technicians. Our services employ a wide variety of advanced edge test equipment and one of the widest certification extents in the business.

International Certification Corp, it is our definitive objective is to institute long term, trust-based associations with our clients. The expectation we set up with our clients is based on outstanding service, practical expertise and devotion to a certified value structure. Our passion is to grant our clients with best EMC / RF services by oriented knowledgeable and accommodating staff.

Our Test sites are located at Linkou District and Kwei Shan Hsiang. Location map can be found on our website http://www.icertifi.com.tw.

Linkou

Tel: 886-2-2601-1640

No. 30-2, Ding Fwu Tsuen, Lin Kou District, New Taipei City, Taiwan,

R.O.C.

Kwei Shan

Tel: 886-3-271-8666 No. 3-1, Lane 6, Wen San 3rd St., Kwei Shan Hsiang, Tao Yuan Hsien 333, Taiwan, R.O.C. Kwei Shan Site II

Tel: 886-3-271-8640

No. 14-1, Lane 19, Wen San 3rd St., Kwei Shan Hsiang, Tao Yuan Hsien 333, Taiwan, R.O.C.

If you have any suggestion, please feel free to contact us as below information

Tel: 886-3-271-8666 Fax: 886-3-318-0155

Email: ICC_Service@icertifi.com.tw

<u>==END</u>==

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