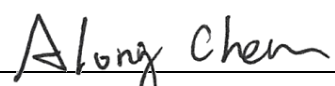


FCC Test Report

FCC ID : TKZAP7628-NN1
Equipment : WiFi Router
Model No. : AP7628-NN1
Applicant : AsiaRF Co., LTD.
Address : 3F, 215, Dehe Road, Yonghe Dist. New Taipei
City Taiwan
Standard : 47 CFR FCC Part 15.247
Received Date : Jun. 14, 2019
Tested Date : Jul. 22 ~ Jul. 31, 2019

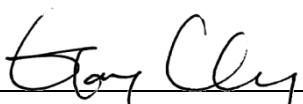
We, International Certification Corp., would like to declare that the tested sample has been evaluated and in compliance with the requirement of the above standards. The test results contained in this report refer exclusively to the product. It may be duplicated completely for legal use with the approval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

Reviewed by:



Along Chen / Assistant Manager

Approved by:



Gary Chang / Manager



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Release Record

Report No.	Version	Description	Issued Date
FR961405	Rev. 01	Initial issue	Aug. 13, 2019

Summary of Test Results

FCC Rules	Test Items	Measured	Result
15.207	Conducted Emissions	[dBuV]:0.428 MHz 39.40 (Margin -7.89dB) - AV	Pass
15.247(d) 15.209	Radiated Emissions	[dBuV/m at 3m]: 7311.00MHz 53.74 (Margin -0.26dB) - AV	Pass
15.247(b)(3)	Maximum Output Power	Max Power [dBm]: 22.91	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

Declaration of Conformity:

The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.

Comments and Explanations:

The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

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.	Type	Gain (dBi)	Connector	Remark
1	PCB	1	---	---

1.1.3 Power Supply Type of Equipment under Test (EUT)

Power Supply Type	5Vdc from adapter
-------------------	-------------------

1.1.4 Accessories

Accessories		
No.	Equipment	Description
1	Adapter 1	Brand: YHY Model: SAW06B050-1000U Power Rating: I/P: 100-240Vac, 50/60Hz, 0.3A O/P: 5Vdc, 1A
2	Adapter 2	Brand: JHD Model: JHD-AP006U-050100BB-2 Power Rating: I/P: 100-240Vac, 50/60Hz, 0.2A O/P: 5Vdc, 1A
3	USB Cable	Brand:  Model: CN161161G1010011 Line: 1m shielded w/o core

1.1.5 Channel List

Frequency band (MHz)		2400~2483.5	
802.11 b / g / n HT20		802.11n HT40	
Channel	Frequency(MHz)	Channel	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	QA Mt7628, Version: V0.0.0.96		
Duty Cycle and Duty Factor	Mode	Duty Cycle (%)	Duty Factor (dB)
	11b	100.00%	0.00
	11g	98.49%	0.07
	HT20	91.13%	0.40
	HT40	87.94%	0.56

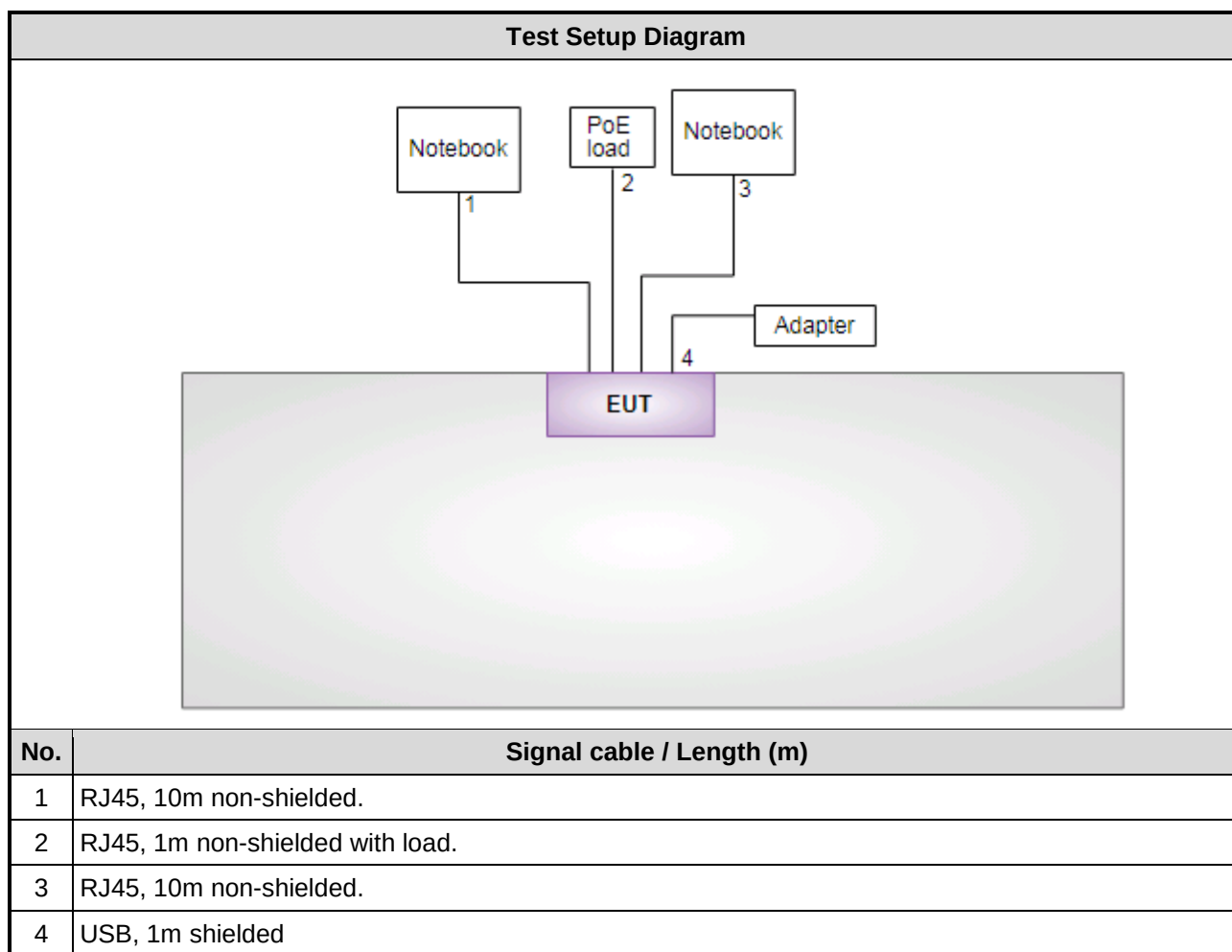
1.1.7 Power Index of Test Tool

Modulation Mode	Test Frequency (MHz)	Power Index
11b	2412	1B
11b	2437	1B
11b	2462	19
11g	2412	17
11g	2437	1F
11g	2462	17
HT20	2412	15
HT20	2437	1D
HT20	2462	17
HT40	2422	10
HT40	2437	19
HT40	2452	13

1.2 Local Support Equipment List

Support Equipment List					
No.	Equipment	Brand	Model	FCC ID	Remarks
1	Notebook	DELL	Latitude E6440	DoC	---
2	Notebook	DELL	Latitude E5420	DoC	---
3	RJ45 load	---	---	---	---

1.3 Test Setup Chart



1.4 The Equipment List

Test Item	Conducted Emission				
Test Site	Conduction room 1 / (CO01-WS)				
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Until
Receiver	R&S	ESR3	101657	Jan. 08, 2019	Jan. 07, 2020
LISN	R&S	ENV216	101579	Mar. 08, 2019	Mar. 07, 2020
LISN (Support Unit)	SCHWARZBECK	Schwarzbeck 8127	8127-666	Nov. 29, 2018	Nov. 28, 2019
RF Cable-CON	Woken	CFD200-NL	CFD200-NL-001	Oct. 23, 2018	Oct. 23, 2019
50 ohm terminal (Support Unit)	NA	50	04	May 28, 2019	May 27, 2020
Measurement Software	AUDIX	e3	6.120210k	NA	NA
Note: Calibration Interval of instruments listed above is one year.					

Test Item	Radiated Emission				
Test Site	966 chamber 3 / (03CH03-WS)				
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Until
Spectrum Analyzer	R&S	FSV40	101499	Jan. 07, 2019	Jan. 06, 2020
Receiver	R&S	ESR3	101658	Dec. 11, 2018	Dec. 10, 2019
Bilog Antenna	SCHWARZBECK	VULB9168	VULB9168-685	Apr. 17, 2019	Apr. 16, 2020
Horn Antenna 1G-18G	SCHWARZBECK	BBHA 9120 D	BBHA 9120 D 1206	Jan. 07, 2019	Jan. 06, 2020
Horn Antenna 18G-40G	SCHWARZBECK	BBHA 9170	BBHA 9170517	Nov. 15, 2018	Nov. 14, 2019
Loop Antenna	R&S	HFH2-Z2	100330	Nov. 09, 2018	Nov. 08, 2019
Loop Antenna Cable	KOAX KABEL	101354-BW	101354-BW	Oct. 08, 2018	Oct. 07, 2019
Preamplifier	EMC	EMC02325	980187	Aug. 24, 2018	Aug. 23, 2019
Preamplifier	Agilent	83017A	MY53270014	Aug. 09, 2018	Aug. 08, 2019
Preamplifier	EMC	EMC184045B	980192	Aug. 09, 2018	Aug. 08, 2019
RF cable-3M	HUBER+SUHNER	SUCOFLEX104	MY22620/4	Oct. 01, 2018	Sep. 30, 2019
RF cable-8M	EMC	EMC104-SM-SM-80 00	181107	Oct. 01, 2018	Sep. 30, 2019
RF cable-1M	HUBER+SUHNER	SUCOFLEX104	MY22624/4	Oct. 01, 2018	Sep. 30, 2019
LF cable-0.8M	EMC	EMC8D-NM-NM-800	EMC8D-NM-NM-800 -001	Oct. 01, 2018	Sep. 30, 2019
LF cable-3M	EMC	EMC8D-NM-NM-300 0	131103	Oct. 01, 2018	Sep. 30, 2019
LF cable-13M	EMC	EMC8D-NM-NM-130 00	131104	Oct. 01, 2018	Sep. 30, 2019
Measurement Software	AUDIX	e3	6.120210g	NA	NA
Note: Calibration Interval of instruments listed 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	Apr. 17, 2019	Apr. 16, 2020
Spectrum Analyzer	R&S	FSV40	101499	Jan. 07, 2019	Jan. 06, 2020
Power Meter	Anritsu	ML2495A	1241002	Oct. 09, 2018	Oct. 08, 2019
Power Sensor	Anritsu	MA2411B	1207366	Oct. 09, 2018	Oct. 08, 2019
MXG-B RF Vector Signal Generator	Agilent	N5182B	MY53050081	Apr. 21, 2019	Apr. 20, 2020
AC POWER SOURCE	APC	AFC-500W	F312060012	Nov. 29, 2018	Nov. 28, 2019
Measurement Software	Sporton	SENSE-15247_DTS	V5.10	NA	NA
Note: Calibration Interval of instruments listed above is one year.					

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 15.247 Meas Guidance v05r02

FCC KDB 662911 D01 Multiple Transmitter Output v02r01

1.6 Deviation from Test Standard and Measurement Procedure

None

1.7 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	±34.130 Hz
Conducted power	±0.808 dB
Power density	±0.583 dB
Conducted emission	±2.715 dB
AC conducted emission	±2.92 dB
Radiated emission ≤ 1GHz	±3.96 dB
Radiated emission > 1GHz	±4.51 dB

2 Test Configuration

2.1 Testing Condition

Test Item	Test Site	Ambient Condition	Tested By
AC Conduction	CO01-WS	24°C / 59%	Alex Tsai
Radiated Emissions	03CH03-WS	25°C / 60%	Roger Lu
RF Conducted	TH01-WS	25°C / 67%	Aska Huang

- FCC Designation No.: TW0009
- FCC site registration No.: 207696
- ISSED#: 10807A
- CAB identifier: TW2732

2.2 The Worst Test Modes and Channel Details

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

NOTE:

- 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.
- Two adapters (SAW06B050-1000U & JHD-AP006U-050100BB-2) had been covered during the pretest and found that **SAW06B050-1000U** adapter was the worst case and was selected for final testing.

3 Transmitter Test Results

3.1 Conducted Emissions

3.1.1 Limit of Conducted Emissions

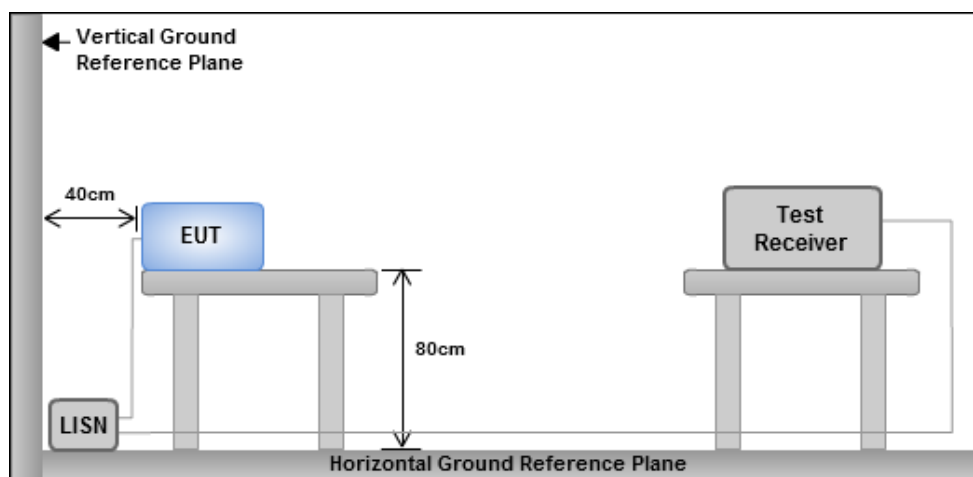
Conducted Emissions Limit		
Frequency Emission (MHz)	Quasi-Peak	Average
0.15-0.5	66 - 56 *	56 - 46 *
0.5-5	56	46
5-30	60	50

Note 1: * Decreases with the logarithm 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.

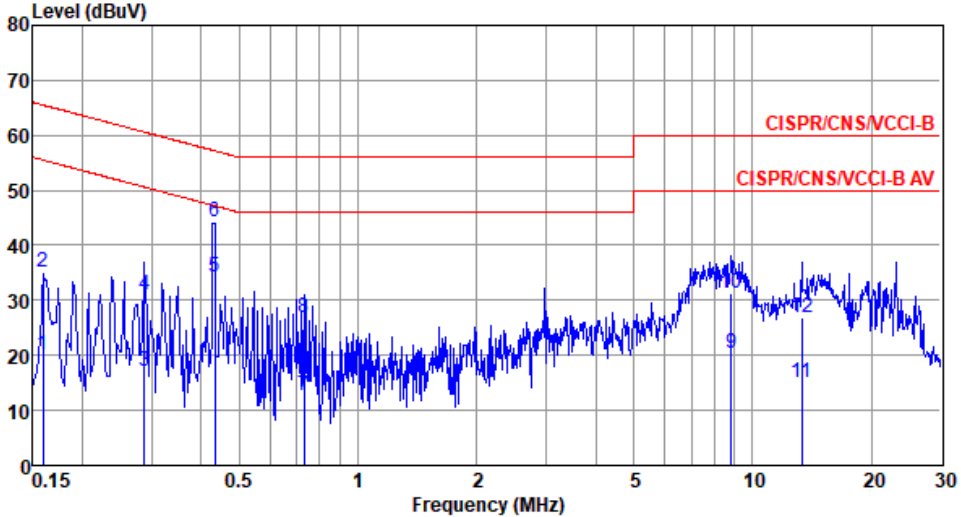
3.1.3 Test Setup



- Note: 1. Support units were connected to second LISN.
2. Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes

3.1.4 Test Result of Conducted Emissions

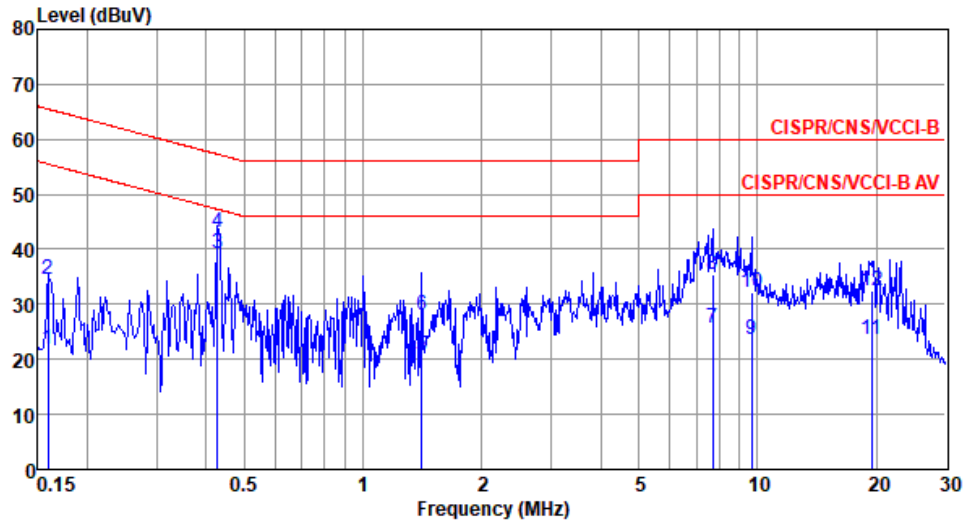
Modulation	11g	Test Freq. (MHz)	2437
Power Phase	Line		



	Freq MHz	Level dBUV	Limit Line dBUV	Over Limit dB	Read Level dBUV	LISN factor dB	cable loss dB	Remark
1	0.159	20.10	55.52	-35.42	10.39	9.53	0.05	Average
2	0.159	35.01	65.52	-30.51	25.30	9.53	0.05	QP
3	0.288	17.00	50.59	-33.59	7.13	9.56	0.08	Average
4	0.288	30.93	60.59	-29.66	21.06	9.56	0.08	QP
5	0.433	34.20	47.20	-13.00	24.29	9.57	0.08	Average
6*	0.433	44.41	57.20	-12.79	34.50	9.57	0.08	QP
7	0.731	12.82	46.00	-33.18	2.85	9.59	0.09	Average
8	0.731	26.75	56.00	-29.25	16.78	9.59	0.09	QP
9	8.822	20.22	50.00	-29.78	9.76	9.64	0.42	Average
10	8.822	31.30	60.00	-28.70	20.84	9.64	0.42	QP
11	13.337	14.95	50.00	-35.05	4.34	9.65	0.52	Average
12	13.337	26.73	60.00	-33.27	16.12	9.65	0.52	QP

Note 1: Level (dBUV) = Read Level (dBUV) + LISN Factor (dB) + Cable Loss (dB).
 2: Over Limit (dB) = Level (dBUV) – Limit Line (dBUV).

Modulation	11g	Test Freq. (MHz)	2437
Power Phase	Neutral		



	Freq MHz	Level dBuV	Limit Line dBuV	Over Limit dB	Read Level dBuV	LISN factor dB	cable loss dB	Remark
1	0.159	21.92	55.52	-33.60	12.18	9.57	0.05	Average
2	0.159	34.43	65.52	-31.09	24.69	9.57	0.05	QP
3*	0.428	39.40	47.29	-7.89	29.58	9.61	0.08	Average
4	0.428	43.09	57.29	-14.20	33.27	9.61	0.08	QP
5	1.411	20.66	46.00	-25.34	10.65	9.64	0.13	Average
6	1.411	27.92	56.00	-28.08	17.91	9.64	0.13	QP
7	7.687	25.67	50.00	-24.33	15.29	9.70	0.39	Average
8	7.687	35.50	60.00	-24.50	25.12	9.70	0.39	QP
9	9.654	23.56	50.00	-26.44	13.12	9.71	0.43	Average
10	9.654	32.28	60.00	-27.72	21.84	9.71	0.43	QP
11	19.428	23.61	50.00	-26.39	12.75	9.81	0.60	Average
12	19.428	32.54	60.00	-27.46	21.68	9.81	0.60	QP

Note 1: Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB).
 2: Over Limit (dB) = Level (dBuV) – Limit Line (dBuV).

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

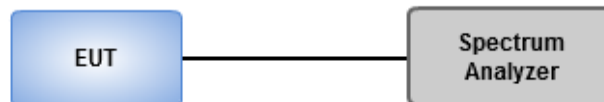
6dB Bandwidth

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

1. Set resolution bandwidth (RBW) = 1% ~ 5 % of OBW, Video bandwidth = 3 x RBW
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



3.2.4 Test Result of 6dB and Occupied Bandwidth

Summary

Mode	Max-N dB (Hz)	Max-OBW (Hz)	ITU-Code	Min-N dB (Hz)	Min-OBW (Hz)
2.4-2.4835GHz	-	-	-	-	-
802.11b_Nss1,(1Mbps)_2TX	10M	14.834M	14M8G1D	9.565M	14.472M
802.11g_Nss1,(6Mbps)_2TX	15.362M	23.01M	23M0D1D	13.768M	16.425M
802.11n HT20_Nss1,(MCS0)_2TX	15.145M	22.142M	22M1D1D	14.058M	17.583M
802.11n HT40_Nss1,(MCS0)_2TX	35.072M	36.614M	36M6D1D	31.304M	36.035M

Max-N dB = Maximum 6dB down bandwidth; **Max-OBW** = Maximum 99% occupied bandwidth;
Min-N dB = Minimum 6dB down bandwidth; **Min-OBW** = Minimum 99% occupied bandwidth;

Result

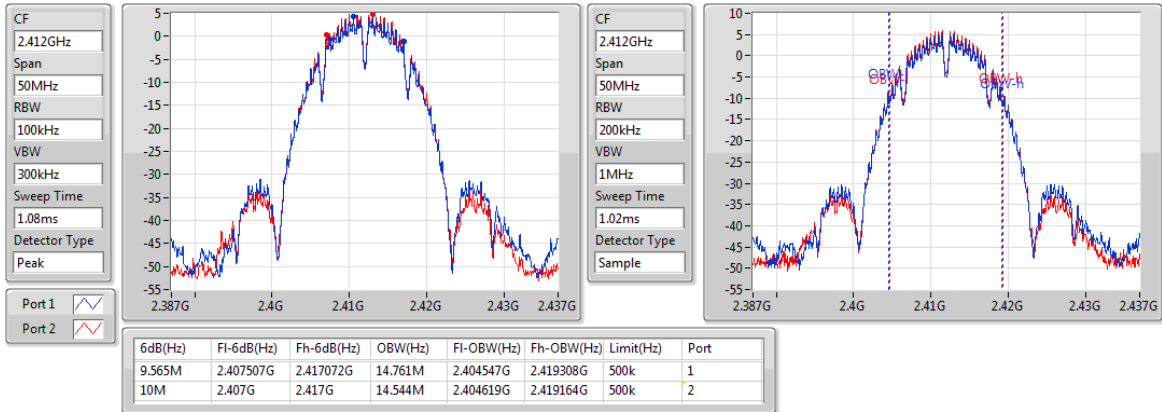
Mode	Result	Limit (Hz)	Port 1-N dB (Hz)	Port 1-OBW (Hz)	Port 2-N dB (Hz)	Port 2-OBW (Hz)
802.11b_Nss1,(1Mbps)_2TX	-	-	-	-	-	-
2412MHz	Pass	500k	9.565M	14.761M	10M	14.544M
2437MHz	Pass	500k	9.565M	14.834M	9.565M	14.616M
2462MHz	Pass	500k	9.565M	14.616M	9.565M	14.472M
802.11g_Nss1,(6Mbps)_2TX	-	-	-	-	-	-
2412MHz	Pass	500k	14.783M	17.004M	13.768M	16.425M
2437MHz	Pass	500k	15M	23.01M	15.362M	19.826M
2462MHz	Pass	500k	15.072M	17.004M	15.145M	16.425M
802.11n HT20_Nss1,(MCS0)_2TX	-	-	-	-	-	-
2412MHz	Pass	500k	15.072M	17.728M	15.072M	17.583M
2437MHz	Pass	500k	15.145M	22.142M	14.638M	18.886M
2462MHz	Pass	500k	15.145M	17.945M	14.058M	17.583M
802.11n HT40_Nss1,(MCS0)_2TX	-	-	-	-	-	-
2422MHz	Pass	500k	32.609M	36.035M	35.072M	36.035M
2437MHz	Pass	500k	35.072M	36.614M	32.609M	36.179M
2452MHz	Pass	500k	31.304M	36.179M	32.609M	36.035M

Port X-N dB = Port X 6dB down bandwidth; **Port X-OBW** = Port X 99% occupied bandwidth;

802.11b_Nss1,(1Mbps)_2TX

EBW

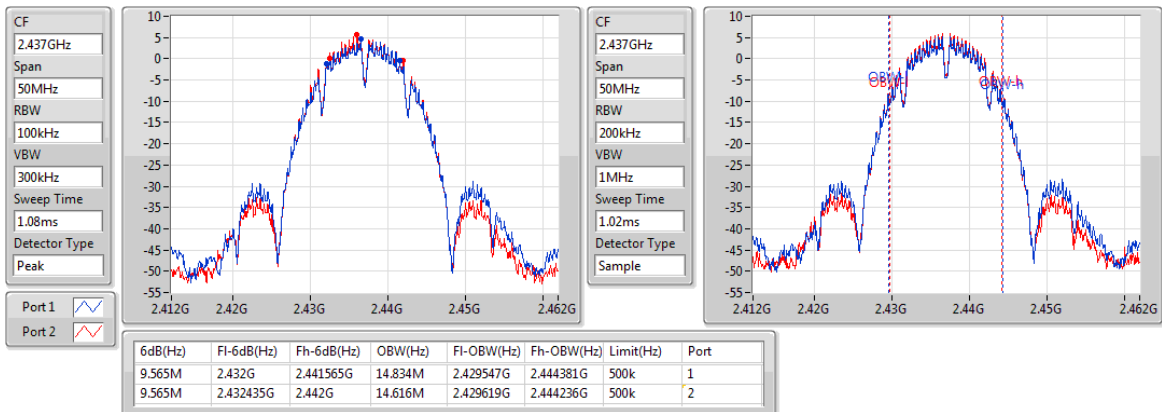
2412MHz



802.11b_Nss1,(1Mbps)_2TX

EBW

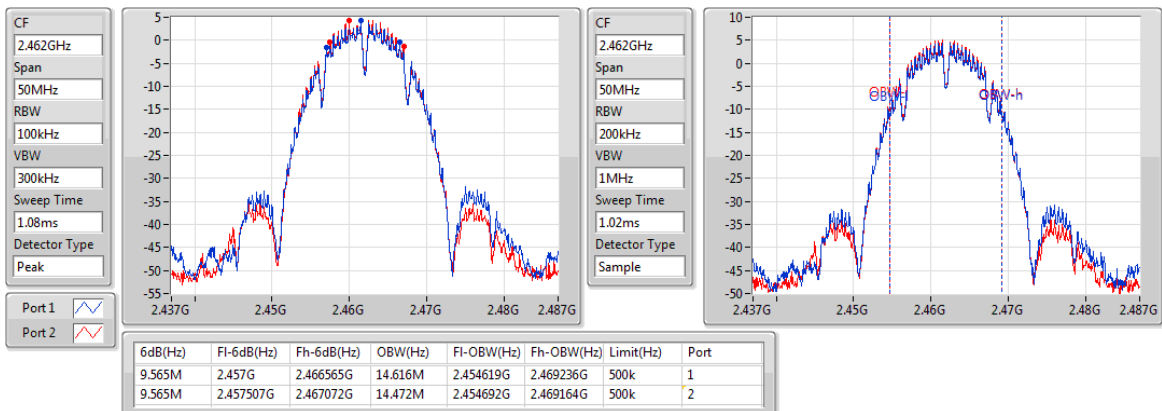
2437MHz



802.11b_Nss1,(1Mbps)_2TX

EBW

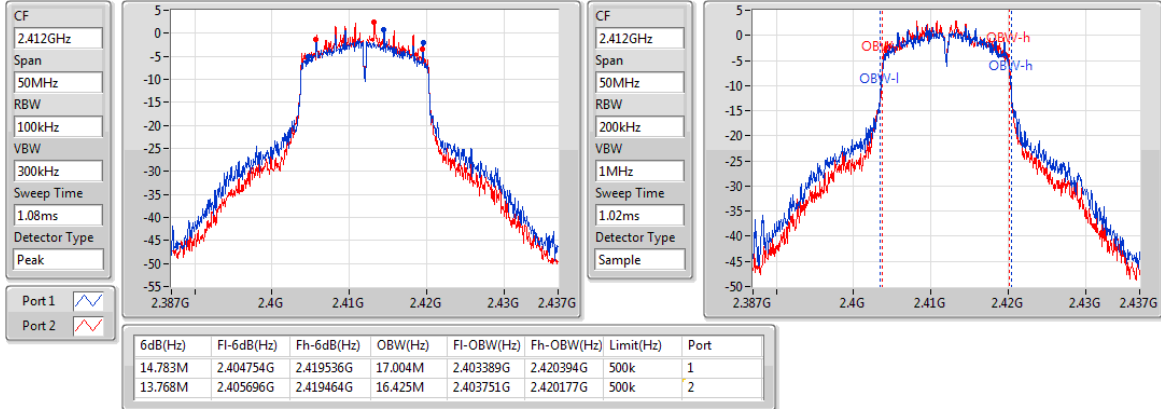
2462MHz



802.11g_Nss1,(6Mbps)_2TX

EBW

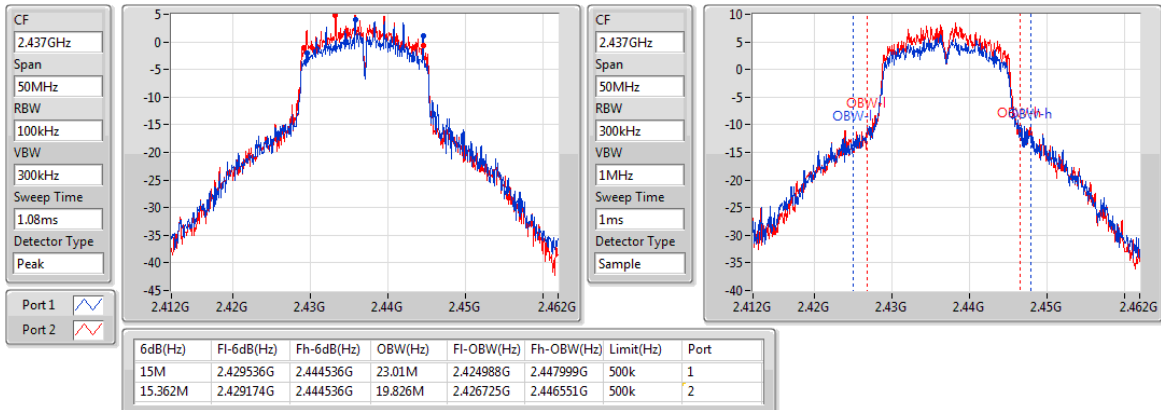
2412MHz



802.11g_Nss1,(6Mbps)_2TX

EBW

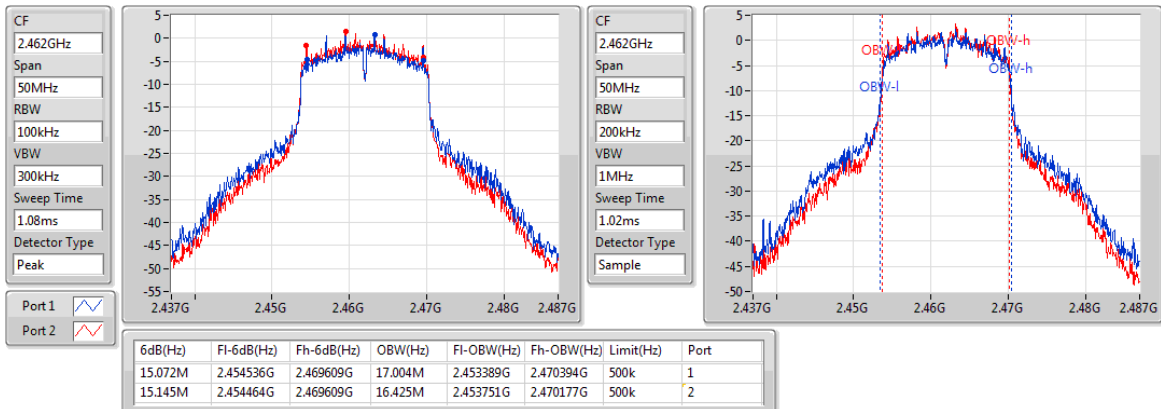
2437MHz



802.11g_Nss1,(6Mbps)_2TX

EBW

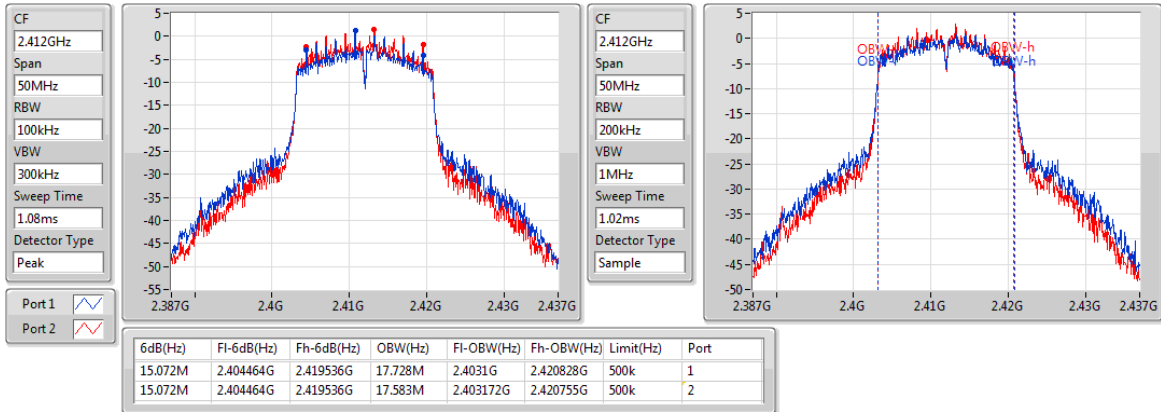
2462MHz



802.11n HT20_Nss1,(MCS0)_2TX

EBW

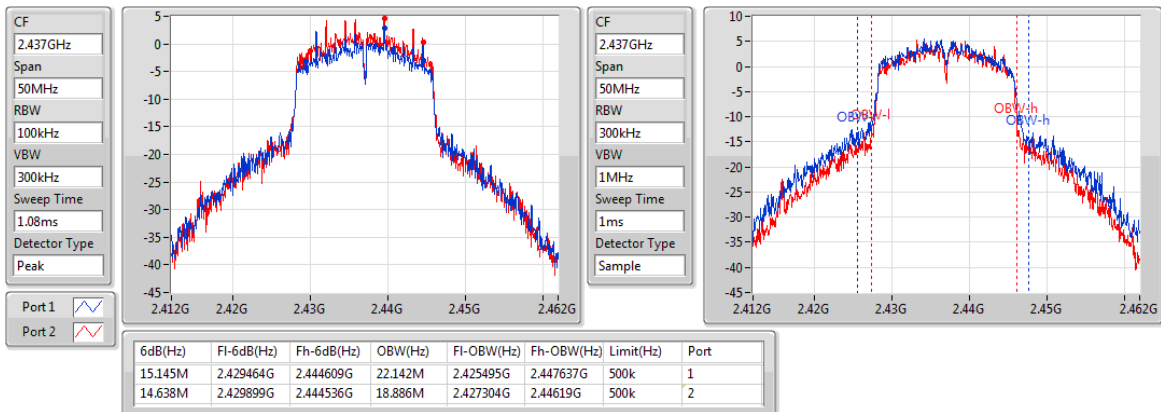
2412MHz



802.11n HT20_Nss1,(MCS0)_2TX

EBW

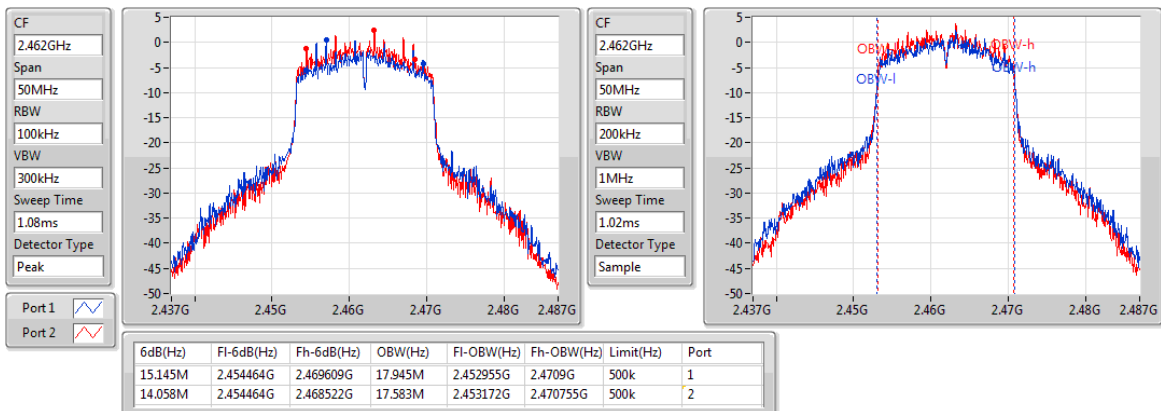
2437MHz



802.11n HT20_Nss1,(MCS0)_2TX

EBW

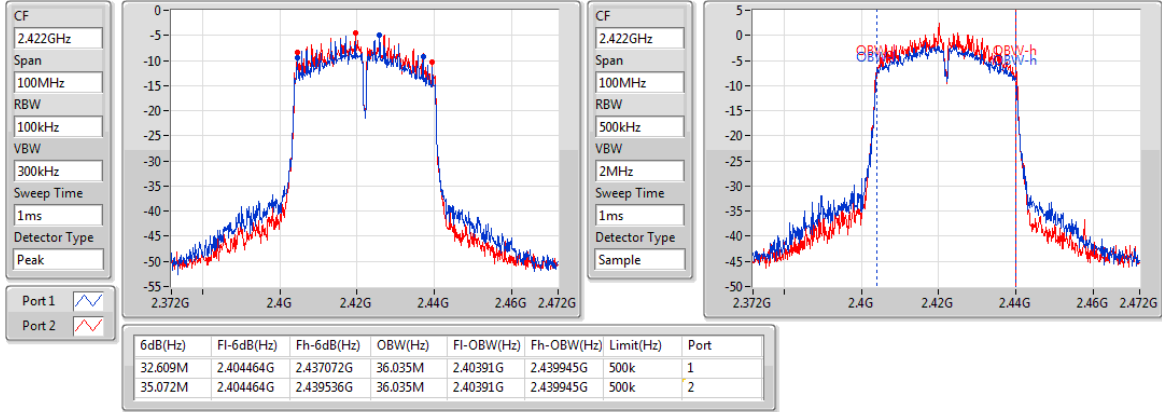
2462MHz



802.11n HT40_Nss1,(MCS0)_2TX

EBW

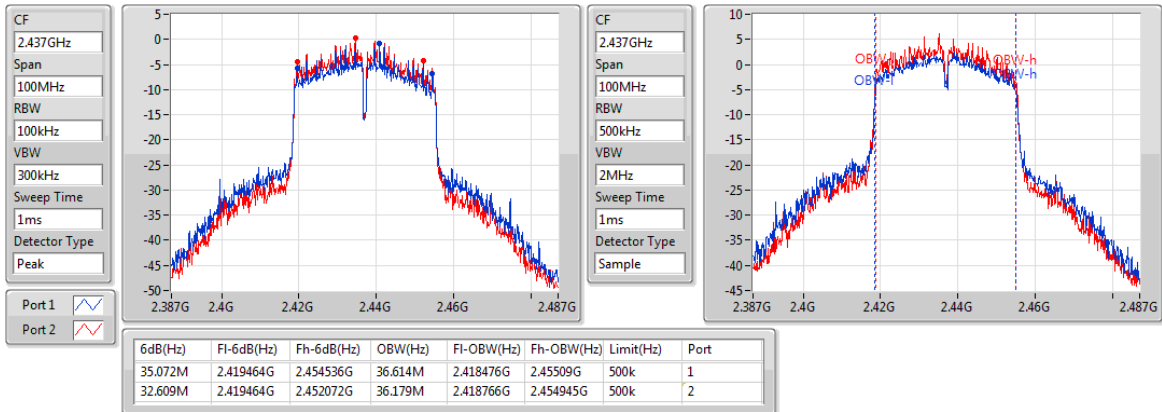
2422MHz



802.11n HT40_Nss1,(MCS0)_2TX

EBW

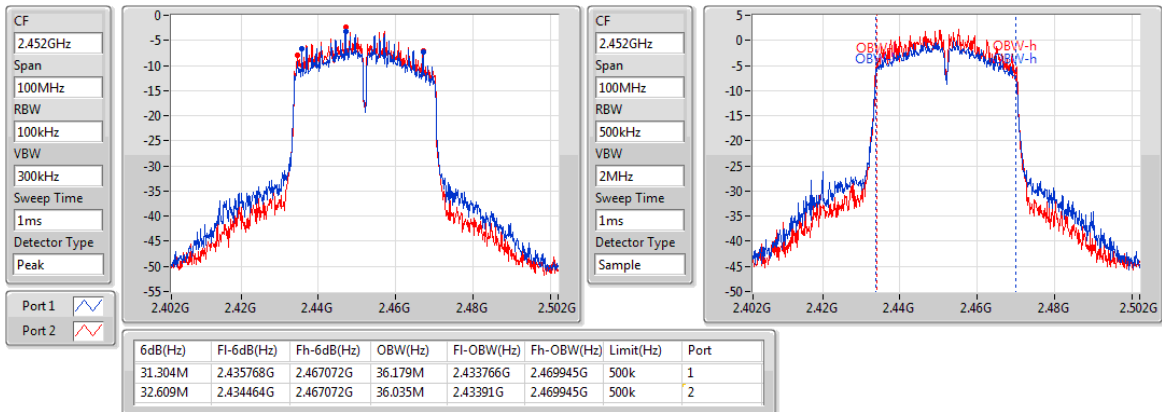
2437MHz



802.11n HT40_Nss1,(MCS0)_2TX

EBW

2452MHz



3.3 RF Output Power

3.3.1 Limit of RF Output Power

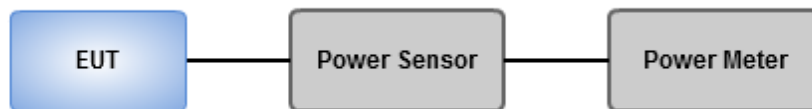
Conducted power shall not exceed 1Watt.

Antenna gain $\leq 6\text{dBi}$, no any corresponding reduction is in output power limit.

3.3.2 Test Procedures

A broadband 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



3.3.4 Test Result of Maximum Output Power

Peak Power

Summary

Mode	Total Power (dBm)	Total Power (W)
2.4-2.4835GHz	-	-
802.11b_Nss1,(1Mbps)_2TX	19.53	0.08974
802.11g_Nss1,(6Mbps)_2TX	22.91	0.19543
802.11n HT20_Nss1,(MCS0)_2TX	22.66	0.18450
802.11n HT40_Nss1,(MCS0)_2TX	21.58	0.14388

Result

Mode	Result	DG (dBi)	Port 1 (dBm)	Port 2 (dBm)	Total Power (dBm)	Power Limit (dBm)	EIRP (dBm)	EIRP Limit (dBm)
802.11b_Nss1,(1Mbps)_2TX	-	-	-	-	-	-	-	-
2412MHz	Pass	1.00	16.39	16.65	19.53	30.00	20.53	36.00
2437MHz	Pass	1.00	16.24	16.53	19.40	30.00	20.40	36.00
2462MHz	Pass	1.00	15.35	15.30	18.34	30.00	19.34	36.00
802.11g_Nss1,(6Mbps)_2TX	-	-	-	-	-	-	-	-
2412MHz	Pass	1.00	18.41	19.34	21.91	30.00	22.91	36.00
2437MHz	Pass	1.00	19.04	20.62	22.91	30.00	23.91	36.00
2462MHz	Pass	1.00	18.12	19.32	21.77	30.00	22.77	36.00
802.11n HT20_Nss1,(MCS0)_2TX	-	-	-	-	-	-	-	-
2412MHz	Pass	1.00	17.93	18.54	21.26	30.00	22.26	36.00
2437MHz	Pass	1.00	18.72	20.41	22.66	30.00	23.66	36.00
2462MHz	Pass	1.00	17.95	19.04	21.54	30.00	22.54	36.00
802.11n HT40_Nss1,(MCS0)_2TX	-	-	-	-	-	-	-	-
2422MHz	Pass	1.00	15.27	15.52	18.41	30.00	19.41	36.00
2437MHz	Pass	1.00	17.83	19.21	21.58	30.00	22.58	36.00
2452MHz	Pass	1.00	15.85	16.97	19.46	30.00	20.46	36.00

DG = Directional Gain; **Port X** = Port X output power

Average Power

Summary

Mode	Total Power (dBm)	Total Power (W)
2.4-2.4835GHz	-	-
802.11b_Nss1,(1Mbps)_2TX	17.75	0.05957
802.11g_Nss1,(6Mbps)_2TX	18.74	0.07482
802.11n HT20_Nss1,(MCS0)_2TX	17.89	0.06152
802.11n HT40_Nss1,(MCS0)_2TX	15.60	0.03631

Result

Mode	Result	DG (dBi)	Port 1 (dBm)	Port 2 (dBm)	Total Power (dBm)	Power Limit (dBm)	EIRP (dBm)	EIRP Limit (dBm)
802.11b_Nss1,(1Mbps)_2TX	-	-	-	-	-	-	-	-
2412MHz	Pass	1.00	14.65	14.83	17.75	-	18.75	-
2437MHz	Pass	1.00	14.48	14.76	17.63	-	18.63	-
2462MHz	Pass	1.00	13.61	13.51	16.57	-	17.57	-
802.11g_Nss1,(6Mbps)_2TX	-	-	-	-	-	-	-	-
2412MHz	Pass	1.00	12.26	12.81	15.55	-	16.55	-
2437MHz	Pass	1.00	15.04	16.32	18.74	-	19.74	-
2462MHz	Pass	1.00	12.25	12.61	15.44	-	16.44	-
802.11n HT20_Nss1,(MCS0)_2TX	-	-	-	-	-	-	-	-
2412MHz	Pass	1.00	11.44	11.89	14.68	-	15.68	-
2437MHz	Pass	1.00	14.23	15.44	17.89	-	18.89	-
2462MHz	Pass	1.00	12.12	12.62	15.39	-	16.39	-
802.11n HT40_Nss1,(MCS0)_2TX	-	-	-	-	-	-	-	-
2422MHz	Pass	1.00	8.23	8.59	11.42	-	12.42	-
2437MHz	Pass	1.00	12.32	12.84	15.60	-	16.60	-
2452MHz	Pass	1.00	9.54	10.04	12.81	-	13.81	-

DG = Directional Gain; **Port X** = Port X output power

Note : Conducted average output power is for reference only

3.4 Power Spectral Density

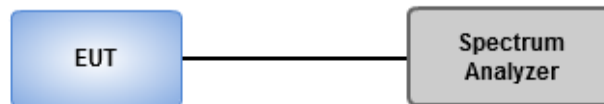
3.4.1 Limit of Power Spectral Density

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

3.4.2 Test Procedures

1. Set the RBW = 3 kHz, VBW = 10 kHz.
2. 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.

3.4.3 Test Setup



3.4.4 Test Result of Power Spectral Density

Summary

Mode	PD (dBm/RBW)
2.4-2.4835GHz	-
802.11b_Nss1,(1Mbps)_2TX	-6.56
802.11g_Nss1,(6Mbps)_2TX	-7.65
802.11n HT20_Nss1,(MCS0)_2TX	-9.87
802.11n HT40_Nss1,(MCS0)_2TX	-14.42

Result

Mode	Result	DG (dBi)	Port 1 (dBm/RBW W)	Port 2 (dBm/RBW W)	PD (dBm/RBW W)	PD Limit (dBm/RBW W)
802.11b_Nss1,(1Mbps)_2TX	-	-	-	-	-	-
2412MHz	Pass	4.01	-9.58	-9.37	-6.94	8.00
2437MHz	Pass	4.01	-9.04	-8.57	-6.56	8.00
2462MHz	Pass	4.01	-9.85	-9.55	-6.98	8.00
802.11g_Nss1,(6Mbps)_2TX	-	-	-	-	-	-
2412MHz	Pass	4.01	-14.75	-14.21	-12.20	8.00
2437MHz	Pass	4.01	-10.49	-10.41	-7.65	8.00
2462MHz	Pass	4.01	-14.91	-13.95	-11.90	8.00
802.11n HT20_Nss1,(MCS0)_2TX	-	-	-	-	-	-
2412MHz	Pass	4.01	-16.01	-13.25	-11.40	8.00
2437MHz	Pass	4.01	-12.50	-11.43	-9.87	8.00
2462MHz	Pass	4.01	-14.94	-13.48	-11.63	8.00
802.11n HT40_Nss1,(MCS0)_2TX	-	-	-	-	-	-
2422MHz	Pass	4.01	-21.41	-20.64	-18.23	8.00
2437MHz	Pass	4.01	-16.89	-16.19	-14.42	8.00
2452MHz	Pass	4.01	-20.26	-19.23	-17.24	8.00

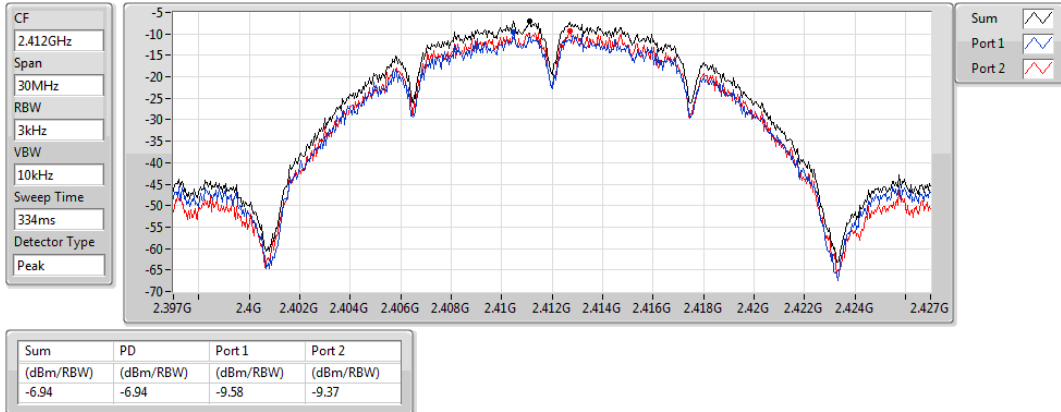
DG = Directional Gain;

PD = trace bin-by-bin of each transmits port summing can be performed maximum power density; **Port X** = Port X power density;

802.11b_Nss1,(1Mbps)_2TX

PSD

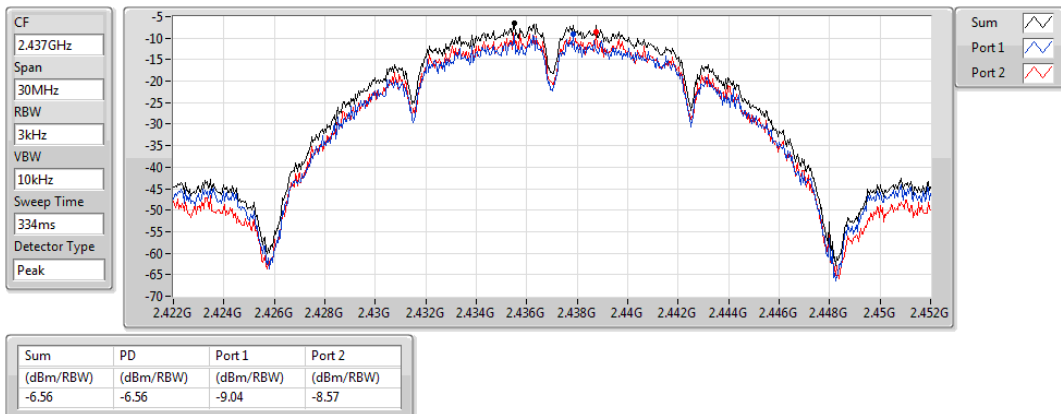
2412MHz



802.11b_Nss1,(1Mbps)_2TX

PSD

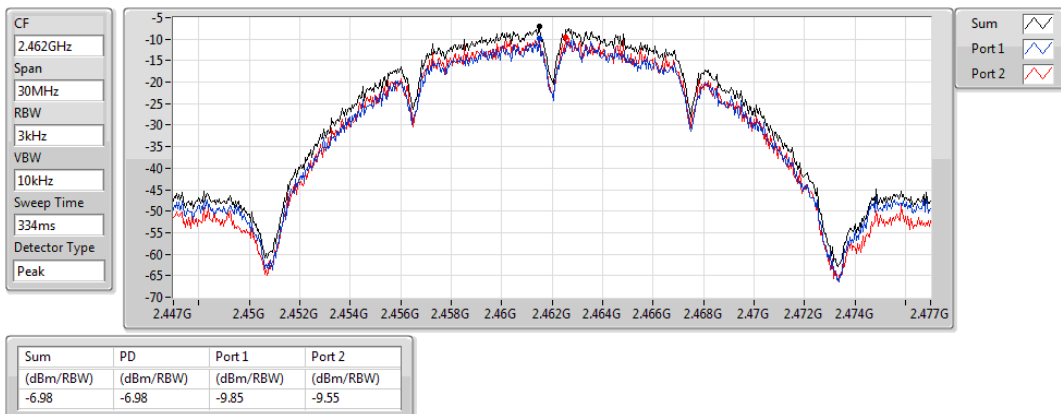
2437MHz



802.11b_Nss1,(1Mbps)_2TX

PSD

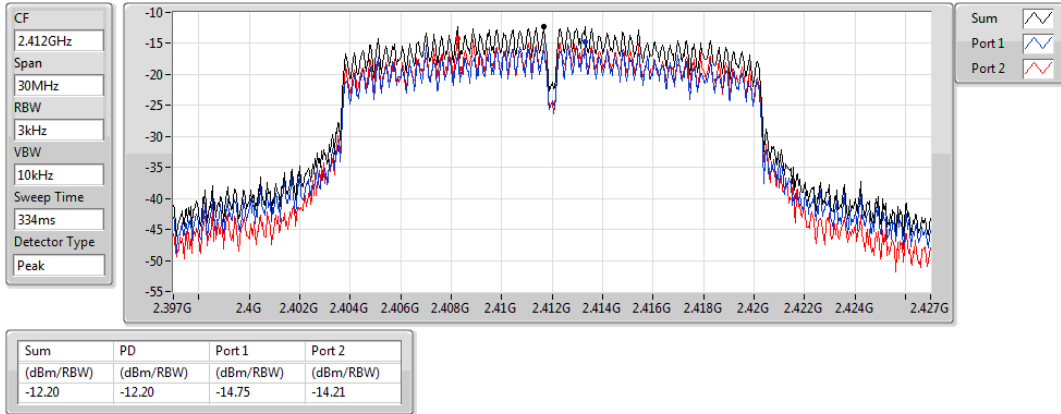
2462MHz



802.11g_Nss1,(6Mbps)_2TX

PSD

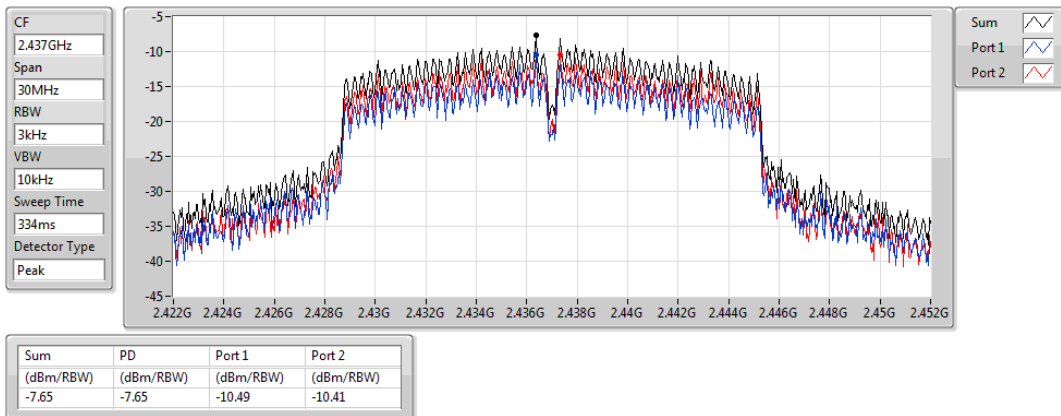
2412MHz



802.11g_Nss1,(6Mbps)_2TX

PSD

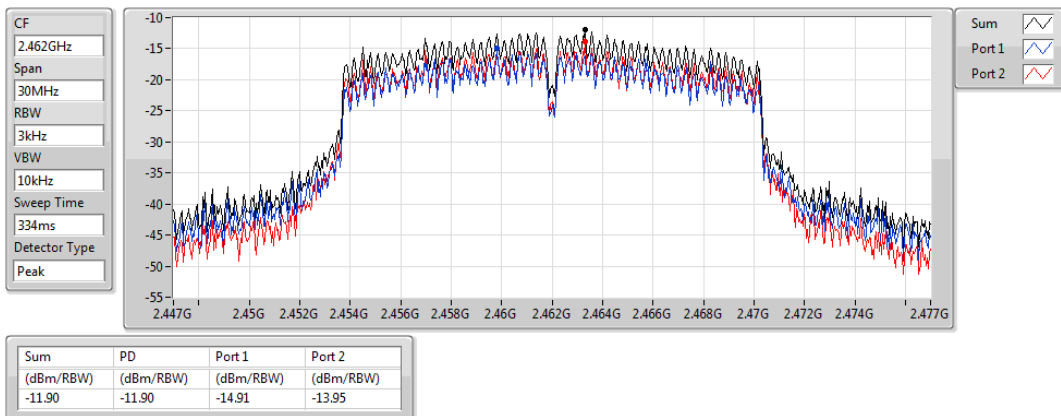
2437MHz



802.11g_Nss1,(6Mbps)_2TX

PSD

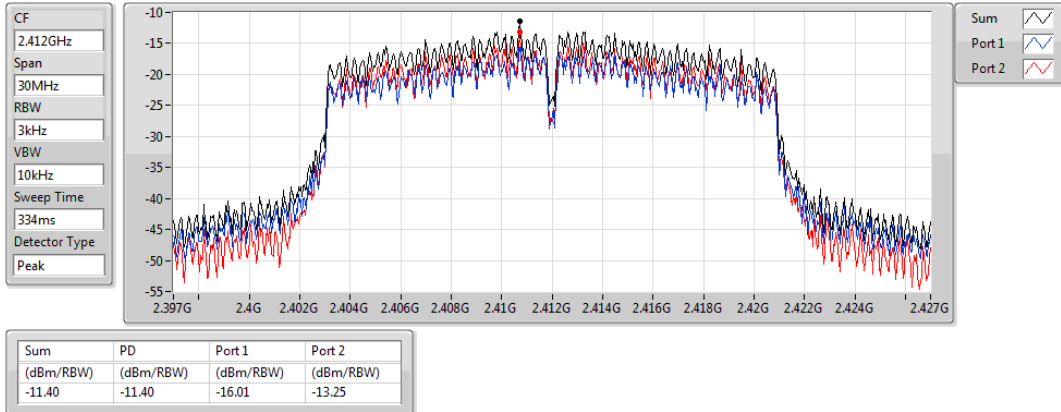
2462MHz



802.11n HT20_Nss1,(MCS0)_2TX

PSD

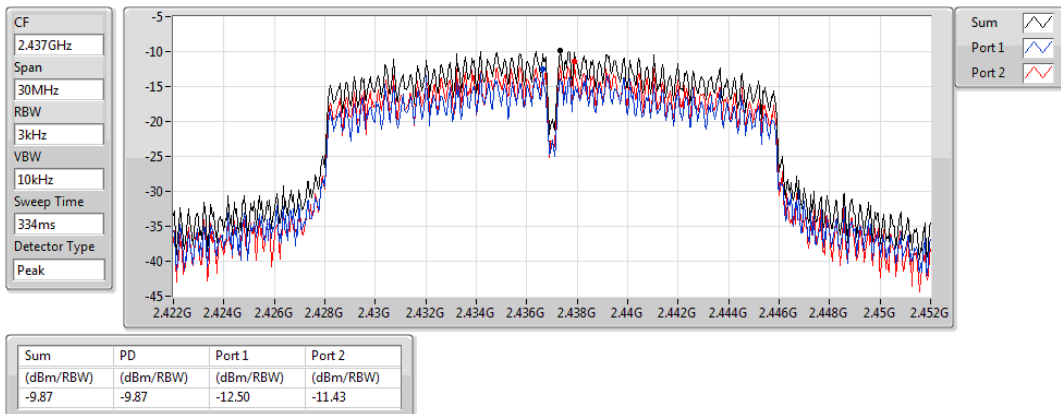
2412MHz



802.11n HT20_Nss1,(MCS0)_2TX

PSD

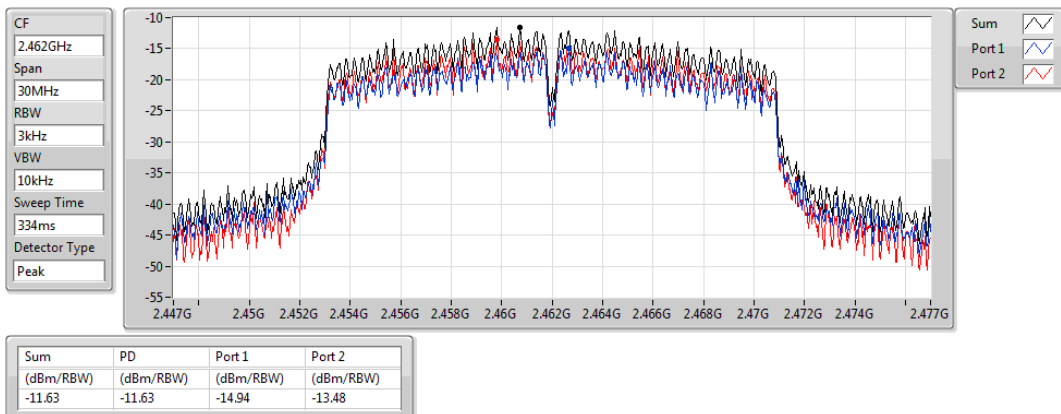
2437MHz



802.11n HT20_Nss1,(MCS0)_2TX

PSD

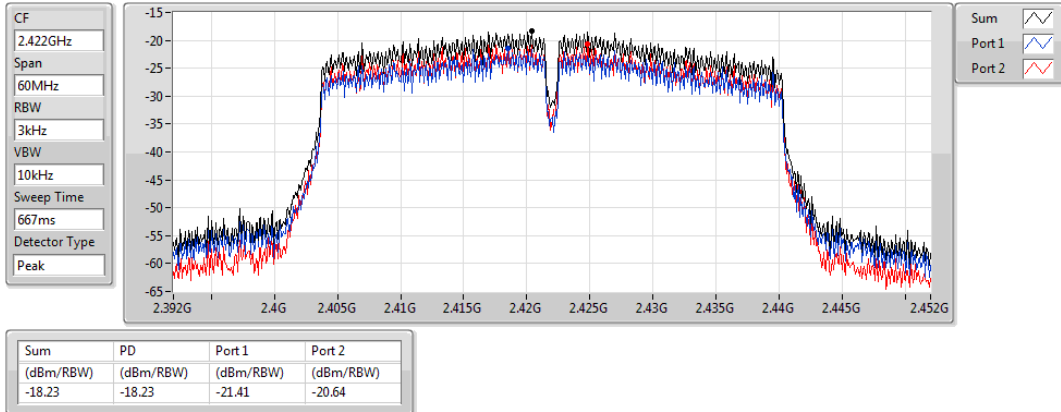
2462MHz



802.11n HT40_Nss1,(MCS0)_2TX

PSD

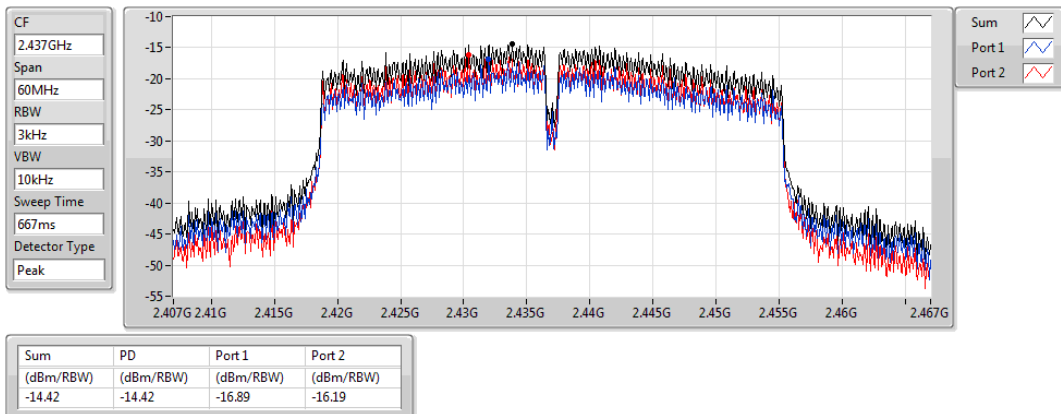
2422MHz



802.11n HT40_Nss1,(MCS0)_2TX

PSD

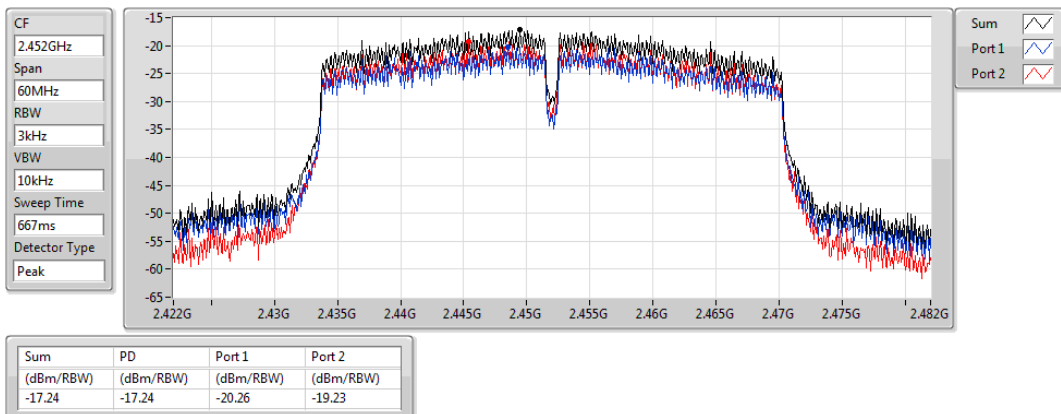
2437MHz



802.11n HT40_Nss1,(MCS0)_2TX

PSD

2452MHz



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:
Quasi-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

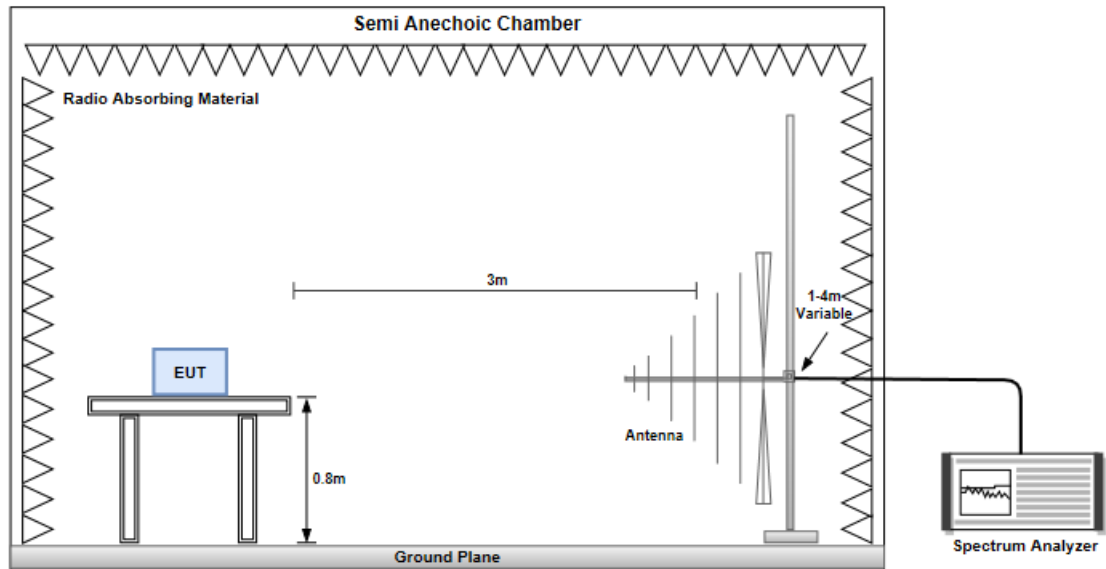
1. Measurement is made at a semi-anechoic chamber that incorporates a turntable allowing a EUT rotation of 360°. A continuously-rotating, remotely-controlled turntable is installed at the test site to support the EUT and facilitate determination of the direction of maximum radiation for each EUT emission 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:

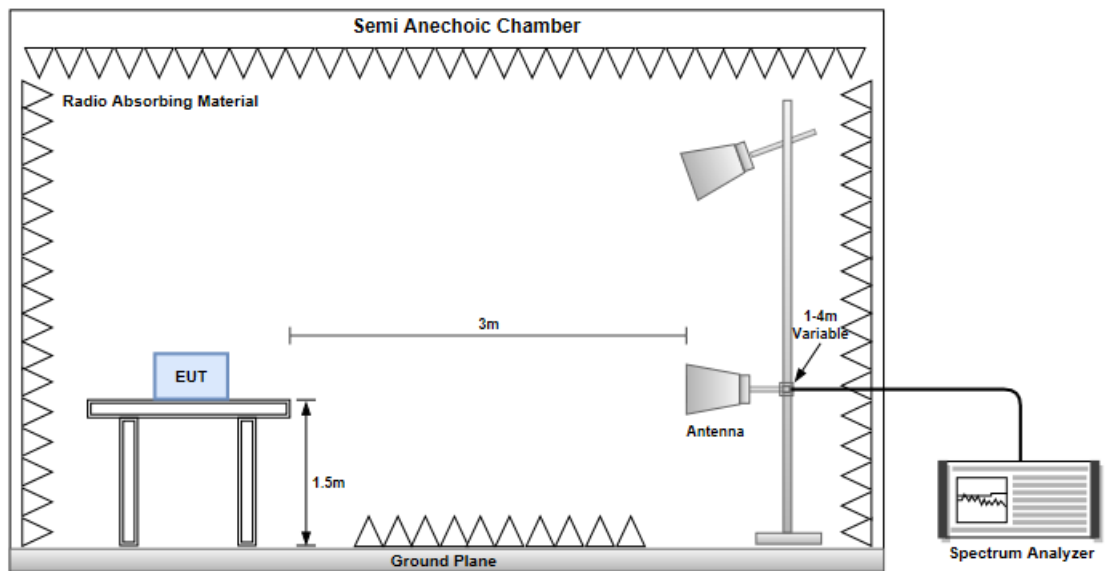
1. 120kHz measurement bandwidth of test receiver and Quasi-peak detector is for radiated emission below 1GHz.
2. RBW=1MHz, VBW=3MHz and Peak detector is for peak measured value of radiated emission above 1GHz.
3. RBW=1MHz, VBW=1/T and Peak detector is for average measured value of radiated emission above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

3.5.3 Test Setup

Radiated Emissions below 1 GHz

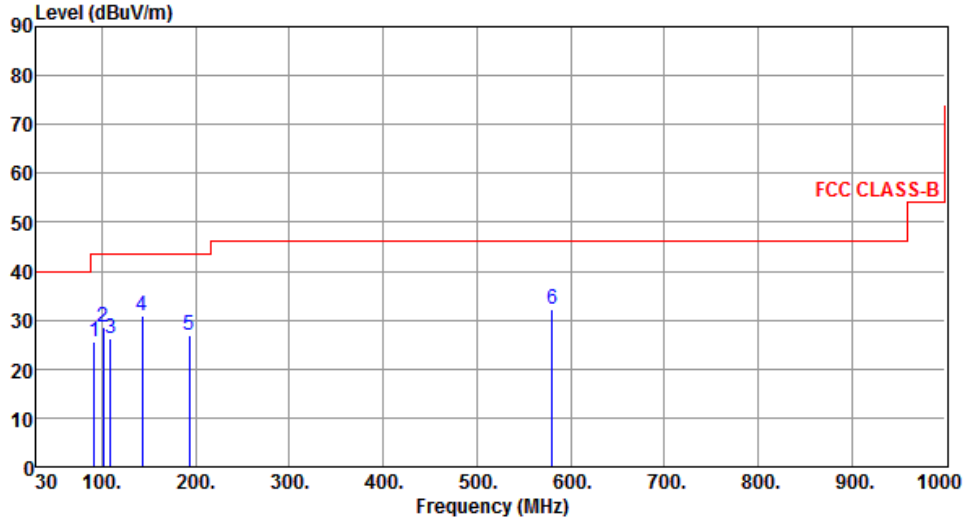


Radiated Emissions above 1 GHz



3.5.4 Transmitter Radiated Unwanted Emissions (Below 1GHz)

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



The graph displays the radiated unwanted emissions for a transmitter. The y-axis represents the Level in dBUV/m, ranging from 0 to 90. The x-axis represents the Frequency in MHz, ranging from 30 to 1000. A red line indicates the FCC CLASS-B limit, which is 40 dBUV/m from 30 MHz to 100 MHz, 45 dBUV/m from 100 MHz to 1000 MHz, and 55 dBUV/m from 1000 MHz to 10000 MHz. Six measured peaks are shown as blue vertical lines, labeled 1 through 6. The peak levels are: 1 (92.08 MHz, 25.70 dBUV/m), 2 (101.78 MHz, 28.58 dBUV/m), 3 (109.54 MHz, 26.29 dBUV/m), 4 (142.52 MHz, 30.82 dBUV/m), 5 (192.96 MHz, 26.85 dBUV/m), and 6 (579.99 MHz, 32.26 dBUV/m). All measured peaks are well below the FCC CLASS-B limit.

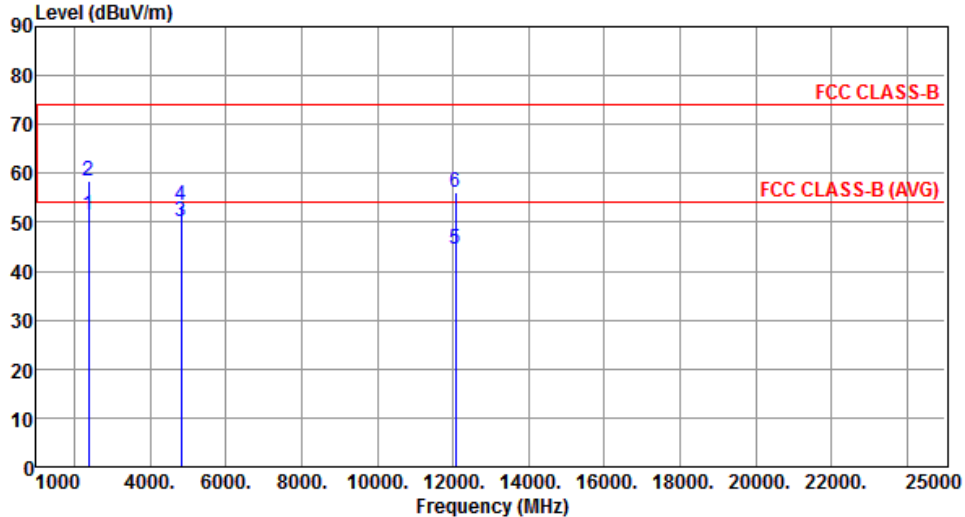
	Freq. MHz	Emission level dBUV/m	Limit dBUV/m	Margin dB	SA reading dBUV	Factor dB	Remark	ANT High cm	Turn Table deg
1	92.08	25.70	43.50	-17.80	40.35	-14.65	Peak	---	---
2	101.78	28.58	43.50	-14.92	41.98	-13.40	Peak	---	---
3	109.54	26.29	43.50	-17.21	38.49	-12.20	Peak	---	---
4	142.52	30.82	43.50	-12.68	39.91	-9.09	Peak	---	---
5	192.96	26.85	43.50	-16.65	38.51	-11.66	Peak	---	---
6	579.99	32.26	46.00	-13.74	33.94	-1.68	Peak	---	---

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.

Modulation	11g	Test Freq. (MHz)	2437
Polarization	Vertical		
Level (dBuV/m) <			

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

Modulation	11b	Test Freq. (MHz)	2412
Polarization	Horizontal		



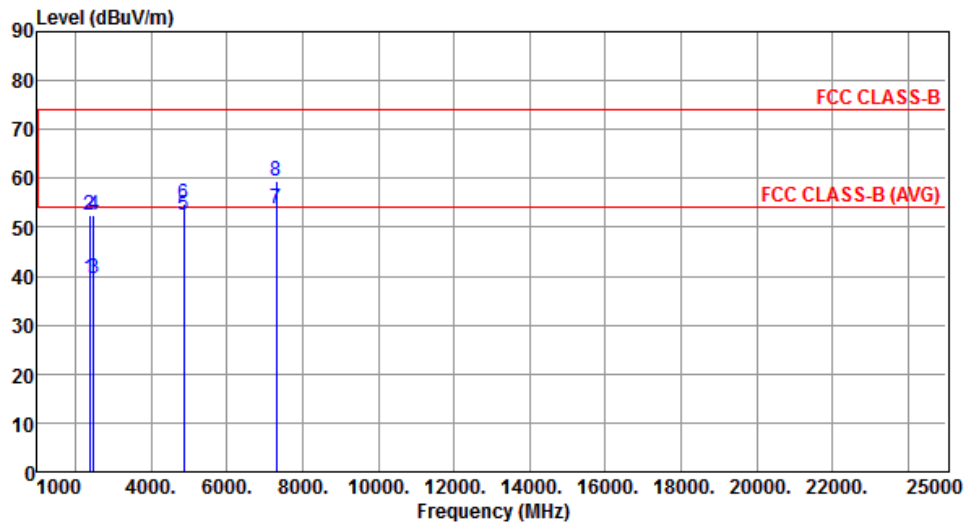
	Freq. MHz	Emission level dBUV/m	Limit dBUV/m	Margin dB	SA reading dBUV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2390.00	51.50	54.00	-2.50	52.46	-0.96	Average	109	26
2	2390.00	58.41	74.00	-15.59	59.37	-0.96	Peak	109	26
3	4824.00	50.06	54.00	-3.94	45.19	4.87	Average	102	272
4	4824.00	53.51	74.00	-20.49	48.64	4.87	Peak	102	272
5	12060.00	44.48	54.00	-9.52	29.56	14.92	Average	100	30
6	12060.00	56.20	74.00	-17.80	41.28	14.92	Peak	100	30

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).

Modulation	11b	Test Freq. (MHz)	2412
Polarization	Vertical		
Level (dBuV/m) </			

Modulation	11b	Test Freq. (MHz)	2437
Polarization	Horizontal		
Level (dBUV/m)			

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



	Freq. MHz	Emission level dBUV/m	Limit dBUV/m	Margin dB	SA reading dBUV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2390.00	39.55	54.00	-14.45	40.51	-0.96	Average	100	205
2	2390.00	52.33	74.00	-21.67	53.29	-0.96	Peak	100	205
3	2483.50	39.42	54.00	-14.58	40.54	-1.12	Average	100	205
4	2483.50	52.54	74.00	-21.46	53.66	-1.12	Peak	100	205
5	4874.00	52.59	54.00	-1.41	47.68	4.91	Average	111	196
6	4874.00	54.94	74.00	-19.06	50.03	4.91	Peak	111	196
7	7311.00	53.74	54.00	-0.26	43.39	10.35	Average	347	188
8	7311.00	59.34	74.00	-14.66	48.99	10.35	Peak	347	188

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

*Factor includes antenna factor , cable loss and amplifier gain

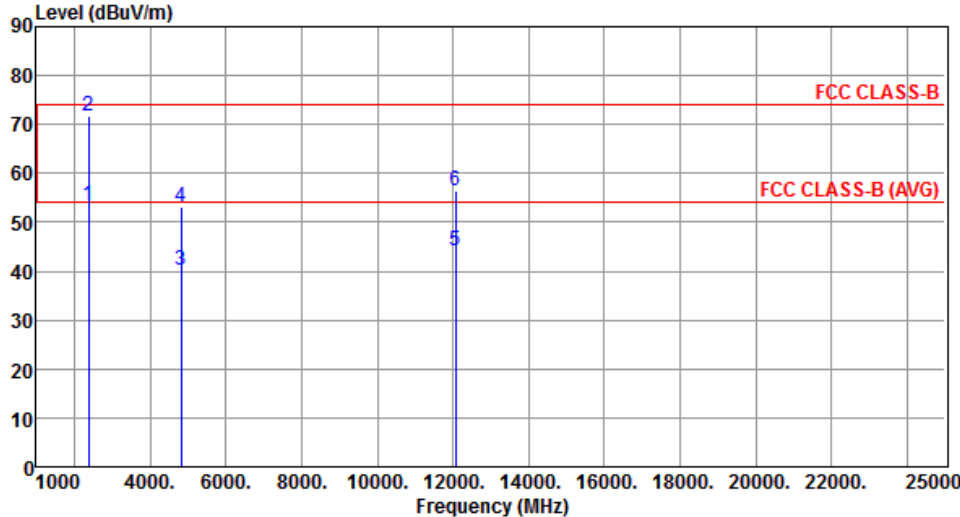
Note 2: Margin (dB) = Emission level (dBUV/m) – Limit (dBUV/m).

Modulation	11b	Test Freq. (MHz)	2462
Polarization	Horizontal		
Level (dBuV/m) <			

Modulation	11b	Test Freq. (MHz)	2462
Polarization	Vertical		
Level (dBUV/m)			

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

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



	Freq. MHz	Emission level dBUV/m	Limit dBUV/m	Margin dB	SA reading dBUV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2390.00	53.60	54.00	-0.40	54.56	-0.96	Average	317	49
2	2390.00	71.60	74.00	-2.40	72.56	-0.96	Peak	317	49
3	4824.00	40.12	54.00	-13.88	35.25	4.87	Average	166	274
4	4824.00	53.22	74.00	-20.78	48.35	4.87	Peak	166	274
5	12060.00	44.04	54.00	-9.96	29.12	14.92	Average	100	30
6	12060.00	56.31	74.00	-17.69	41.39	14.92	Peak	100	30

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).

Modulation	11g	Test Freq. (MHz)	2412
Polarization	Vertical		
Level (dBUV/m)			

Modulation	11g	Test Freq. (MHz)	2437
Polarization	Horizontal		
Level (dBuV/m)			

Modulation	11g	Test Freq. (MHz)	2437
Polarization	Vertical		
Level (dBUV/m)			

Modulation	11g	Test Freq. (MHz)	2462
Polarization	Horizontal		
Level (dBuV/m)			

Modulation	11g	Test Freq. (MHz)	2462
Polarization	Vertical		
Level (dBUV/m) </			

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

Modulation	HT20	Test Freq. (MHz)	2412
Polarization	Horizontal		
Level (dBUV/m)			

Modulation	HT20	Test Freq. (MHz)	2412
Polarization	Vertical		
Level (dBUV/m)			

Modulation	HT20	Test Freq. (MHz)	2437
Polarization	Horizontal		
Level (dBuV/m)			

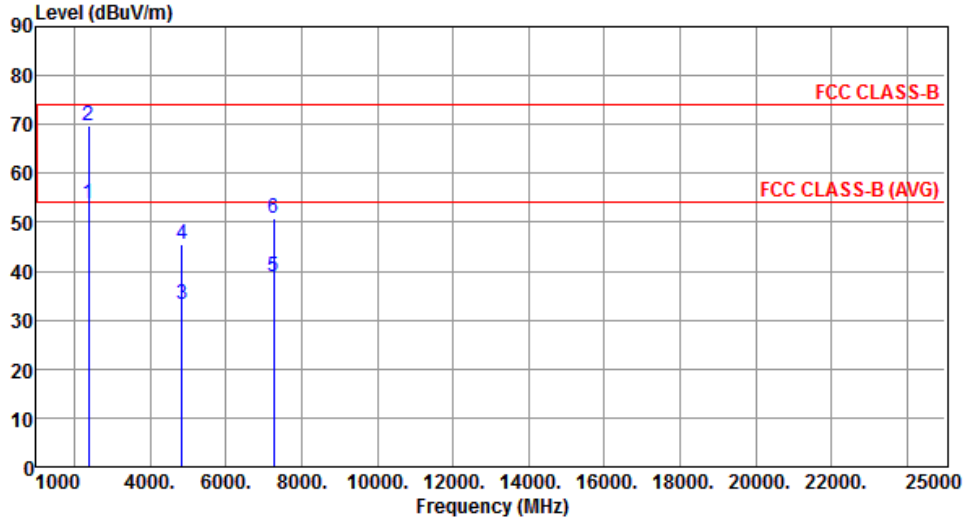
Modulation	HT20	Test Freq. (MHz)	2437
Polarization	Vertical		
Level (dBuV/m) <			

Modulation	HT20	Test Freq. (MHz)	2462
Polarization	Horizontal		
Level (dBUV/m) </			

Modulation	HT20	Test Freq. (MHz)	2462
Polarization	Vertical		
Level (dBUV/m) </			

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

Modulation	HT40	Test Freq. (MHz)	2422
Polarization	Horizontal		



	Freq. MHz	Emission level dBUV/m	Limit dBUV/m	Margin dB	SA reading dBUV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2390.00	53.66	54.00	-0.34	54.62	-0.96	Average	319	0
2	2390.00	69.85	74.00	-4.15	70.81	-0.96	Peak	319	0
3	4844.00	33.17	54.00	-20.83	28.24	4.93	Average	100	30
4	4844.00	45.50	74.00	-28.50	40.57	4.93	Peak	100	30
5	7266.00	38.96	54.00	-15.04	28.56	10.40	Average	100	50
6	7266.00	50.94	74.00	-23.06	40.54	10.40	Peak	100	50

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).

Modulation	HT40	Test Freq. (MHz)	2422
Polarization	Vertical		
Level (dBUV/m)			

Modulation	HT40	Test Freq. (MHz)	2437
Polarization	Horizontal		
Level (dBuV/m) <			

Modulation	HT40	Test Freq. (MHz)	2437
Polarization	Vertical		
Level (dBuV/m)			

Modulation	HT40	Test Freq. (MHz)	2452
Polarization	Horizontal		
Level (dBUV/m) <			

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

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 Test Procedures

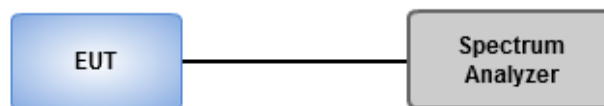
Reference level measurement

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

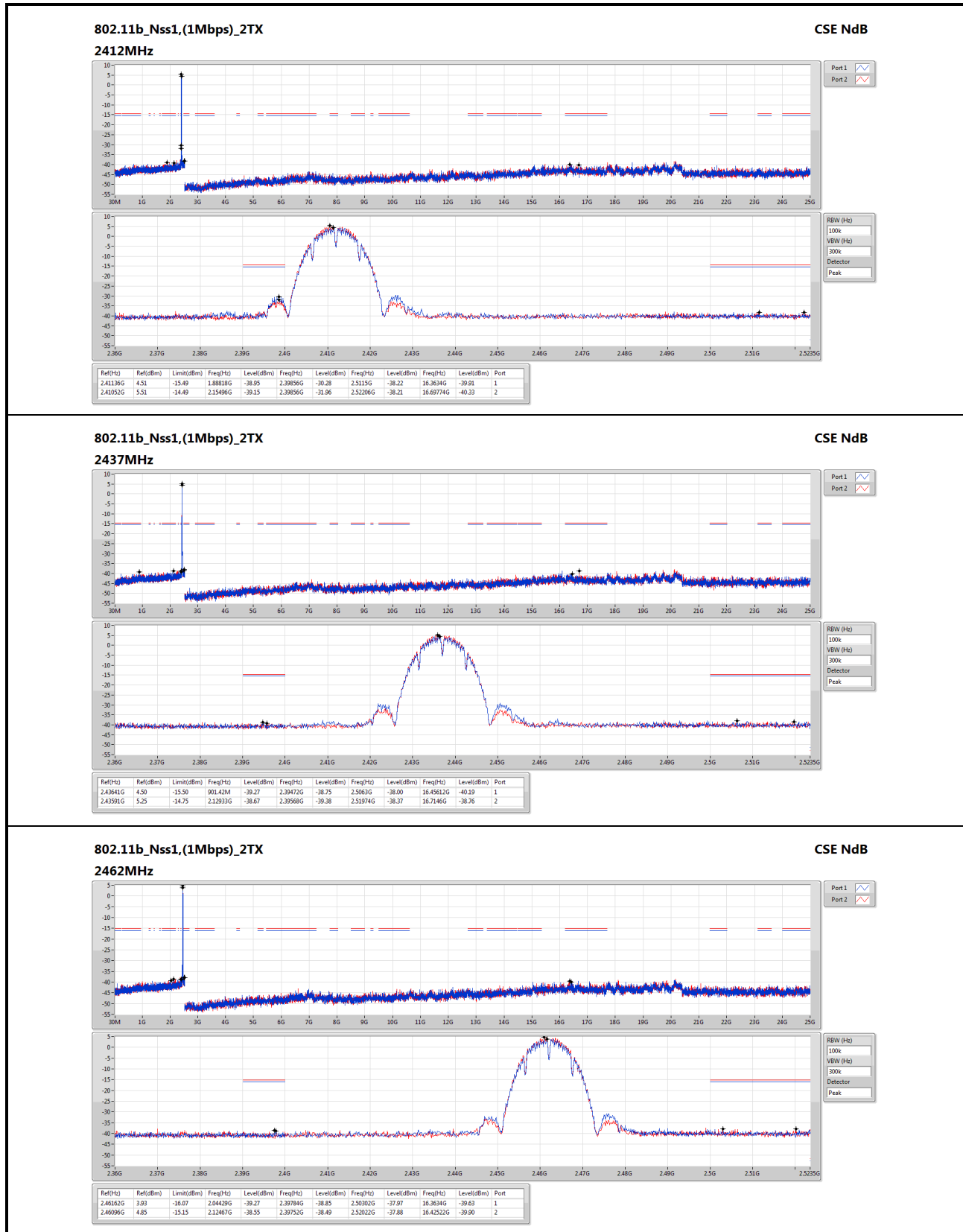
Emission level measurement

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

3.6.3 Test Setup

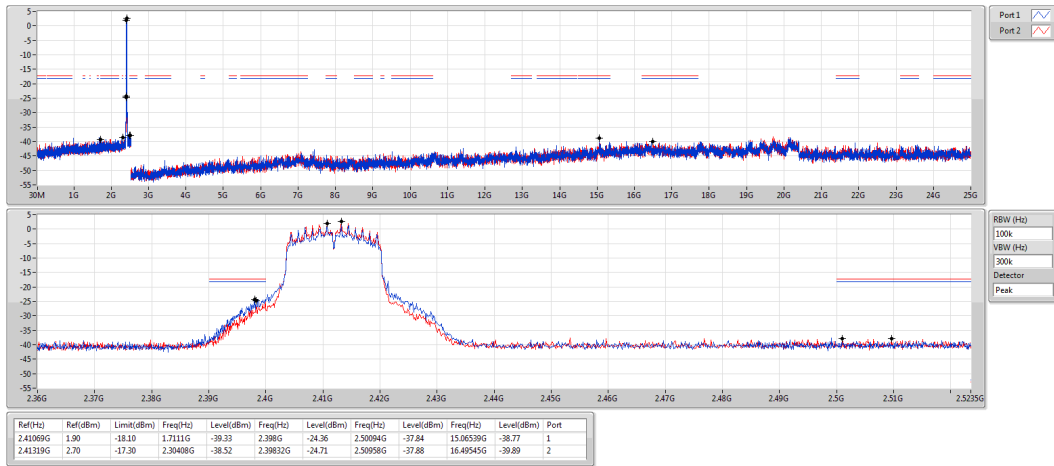


3.6.4 Unwanted Emissions into Non-Restricted Frequency Bands



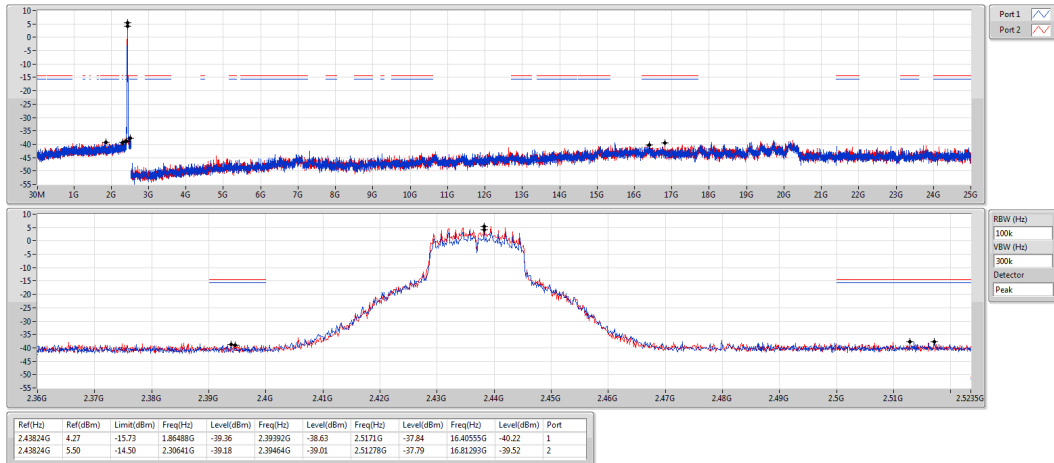
802.11g_Nss1,(6Mbps)_2TX
2412MHz

CSE NdB



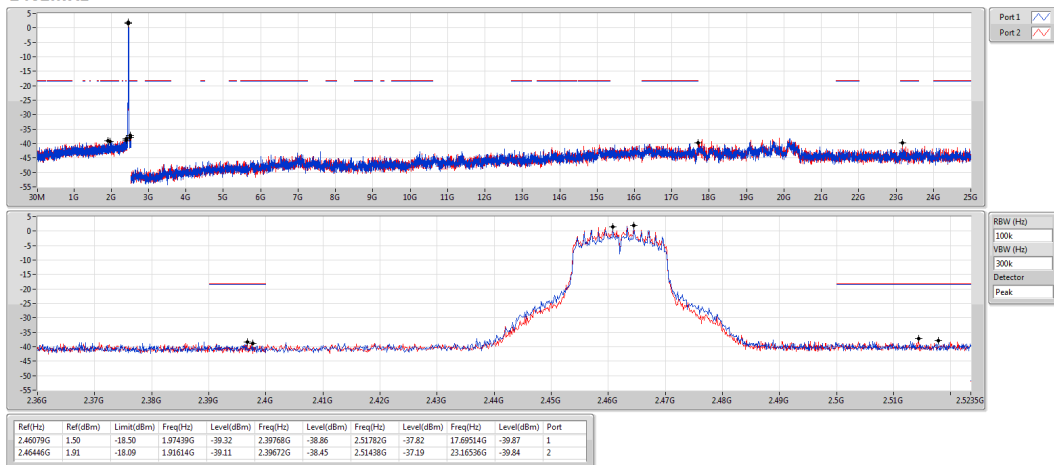
802.11g_Nss1,(6Mbps)_2TX
2437MHz

CSE NdB



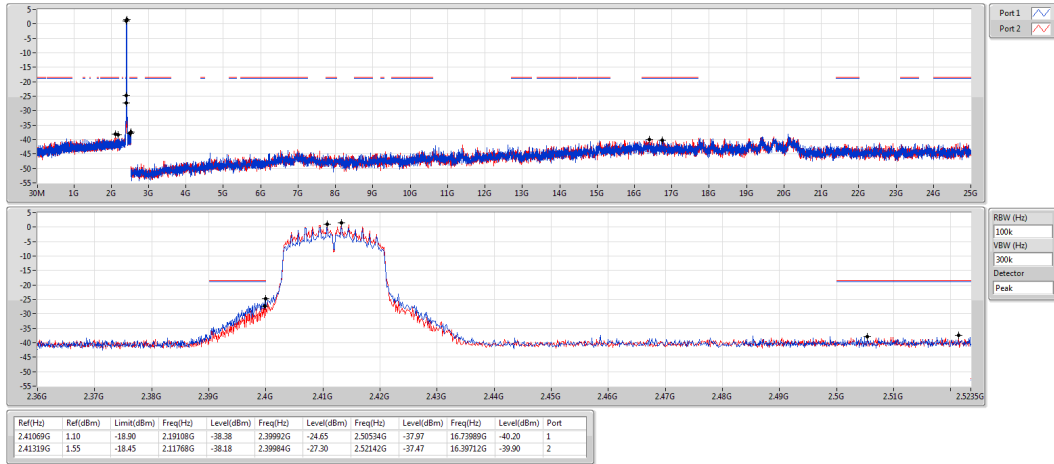
802.11g_Nss1,(6Mbps)_2TX
2462MHz

CSE NdB



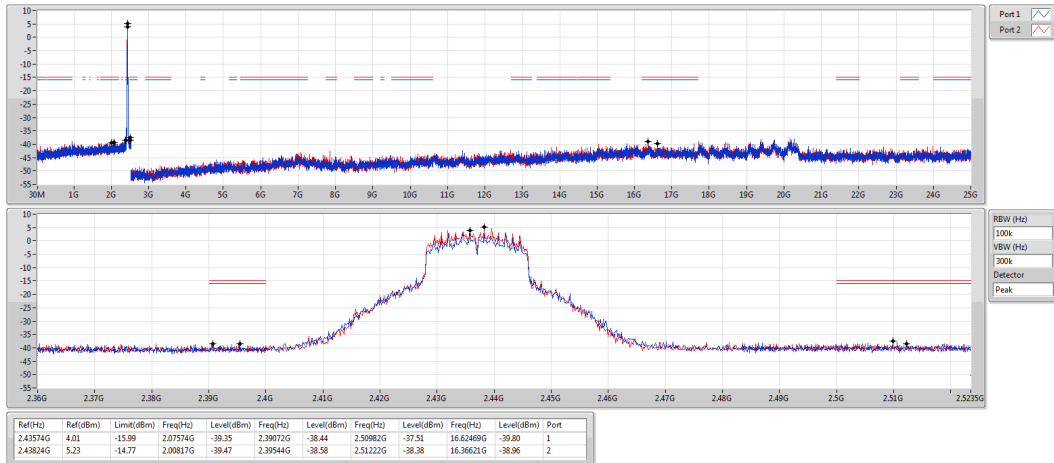
802.11n HT20_Nss1,(MCS0)_2TX
2412MHz

CSE NdB



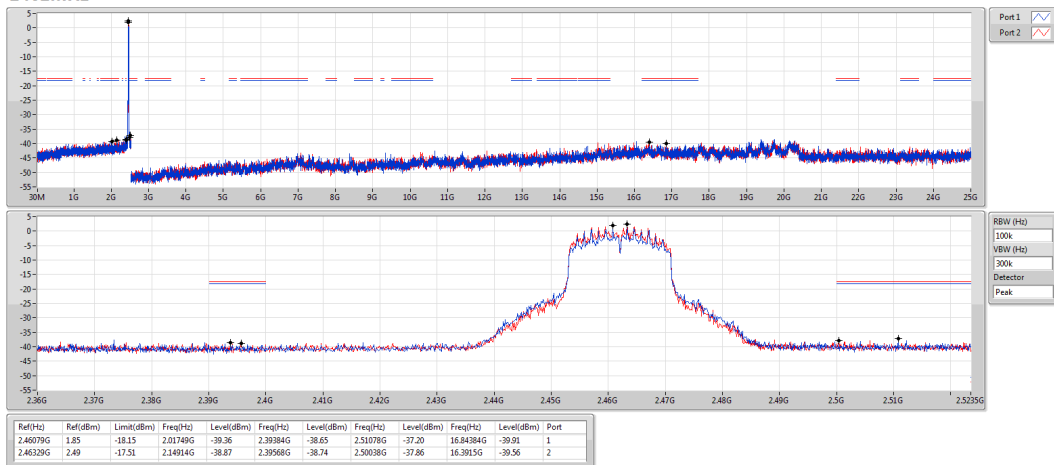
802.11n HT20_Nss1,(MCS0)_2TX
2437MHz

CSE NdB



802.11n HT20_Nss1,(MCS0)_2TX
2462MHz

CSE NdB



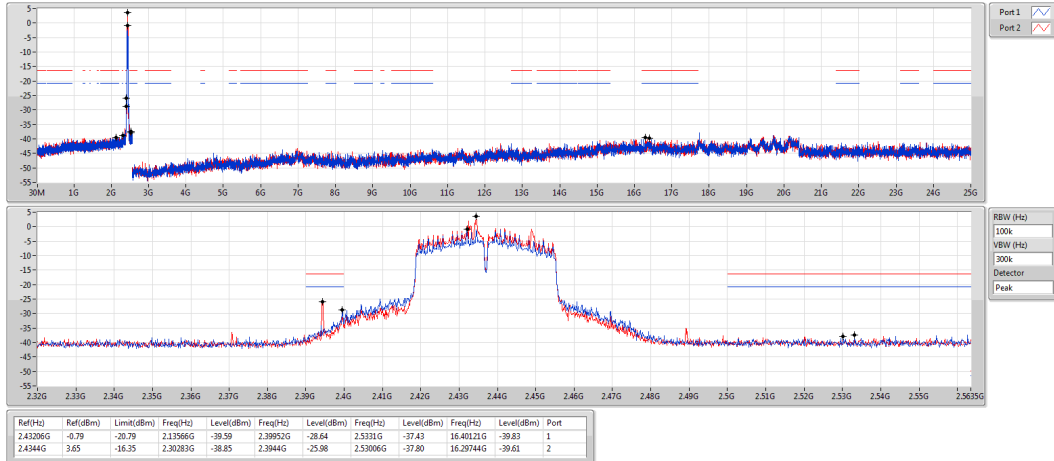
802.11n HT40_Nss1,(MCS0)_2TX
2422MHz

CSE NdB



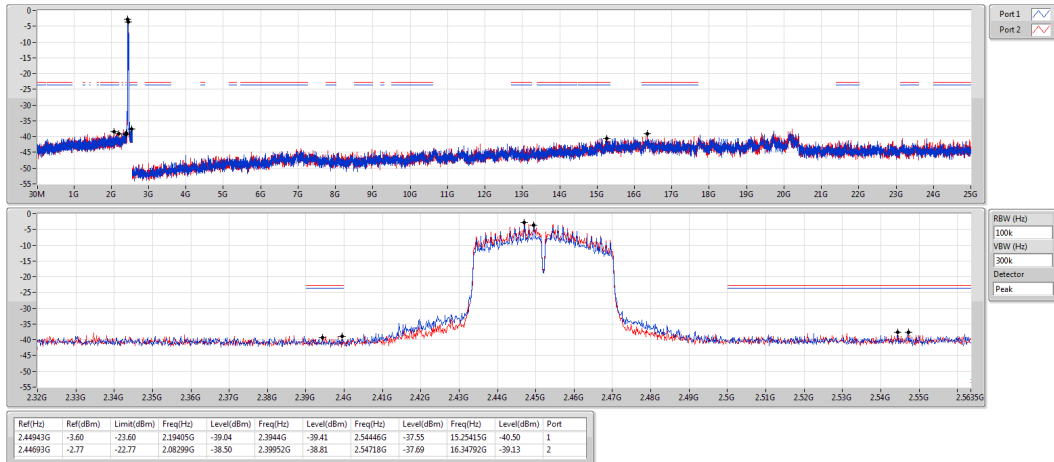
802.11n HT40_Nss1,(MCS0)_2TX
2437MHz

CSE NdB



802.11n HT40_Nss1,(MCS0)_2TX
2452MHz

CSE NdB



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 (EMC and Wireless Communication Laboratory), 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 District. 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 District, Tao Yuan City
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 District, Tao Yuan
City 333, Taiwan, R.O.C.

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

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Fax: 886-3-318-0155

Email: ICC_Service@icertifi.com.tw

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