

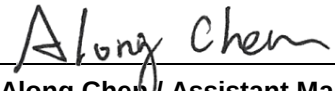
FCC Test Report

FCC ID : P27IP3442M
Equipment : AC2600 Wi-Fi Mesh Router
Model No. : IP3442MXXXXXXXXXX
(refer to item 1.1.1 for more details)
Brand Name : Sercomm
Applicant : Sercomm Corporation
Address : 8F, No. 3-1, YuanQu St., NanKang, Taipei 115,
Taiwan, R.O.C.
Standard : 47 CFR FCC Part 15.247
Received Date : May 14, 2020
Tested Date : May 19 ~ Jun. 12, 2020

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.

The report must not be used by the client to claim product certification, approval, or endorsement by TAF or any agency of government.

Reviewed by:


Along Chen / Assistant Manager

Approved by:

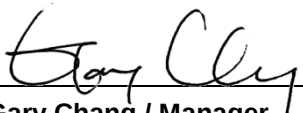

Gary Chang / Manager



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Release Record

Report No.	Version	Description	Issued Date
FR051403AC	Rev. 01	Initial issue	Jun. 23, 2020

Summary of Test Results

FCC Rules	Test Items	Measured	Result
15.207	Conducted Emissions	[dBuV]: 0.165MHz 53.00 (Margin -12.21dB) - QP	Pass
15.247(d) 15.209	Radiated Emissions	[dBuV/m at 3m]: 2483.50MHz 72.92 (Margin -1.08dB) - PK	Pass
15.247(b)(3)	Maximum Output Power	Max Power [dBm]: 26.59	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 Product Details

The following models are provided to this EUT.

Model Name	Description
IP3442MXXXXXXXXXX	the 1st x should be "blank" or "-"; the rest x could be 0 to 9, A to Z, "blank", "-", or "/", for marketing purpose
★ The above models, model IP3442M was selected as a representative one for the final test and only its data was recorded in this report.	

1.1.2 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]	4	1-11 Mbps
2400-2483.5	g	2412-2462	1-11 [11]	4	6-54 Mbps
2400-2483.5	n (HT20)	2412-2462	1-11 [11]	4	MCS 0-31
2400-2483.5	n (HT40)	2422-2452	3-9 [7]	4	MCS 0-31
Note 1: RF output power specifies that Maximum Conducted (Average) 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.					

1.1.3 Antenna Details

Ant. No.	Model	Type	Connector	Gain (dBi)	Remark
1	Ant 1	PIFA	NA	2.8	---
2	Ant 2	PIFA	NA	3.1	---
3	Ant 3	Dipole	UFL	3.0	---
4	Ant 4	Dipole	UFL	2.6	---

1.1.4 Power Supply Type of Equipment under Test (EUT)

Power Supply Type	12Vdc from AC adapter
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1.1.5 Accessories

Accessories		
No.	Equipment	Description
1	AC adapter	Brand: LEI Model: MU24B1120200-A1 I/P: 100-240Vac, 50/60Hz, 0.7A O/P: 12Vdc, 2A Power Line: 1.5m non-shielded without core
2	AC adapter	Brand: MOSO Model: MSS-V2000WR120-024E0-US I/P: 100-240Vac, 50/60Hz, 0.7A max O/P: 12Vdc, 2A Power Line: 1.5m non-shielded without core

1.1.6 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	---	---

1.1.7 Test Tool and Duty Cycle

Test Tool	MT7615 QA, Version: 0.0.1.88		
Duty Cycle and Duty Factor	Mode	Duty Cycle (%)	Duty Factor (dB)
	11b	99.98%	0.00
	11g	98.97%	0.05
	HT20	98.91%	0.05
	HT40	96.48%	0.16

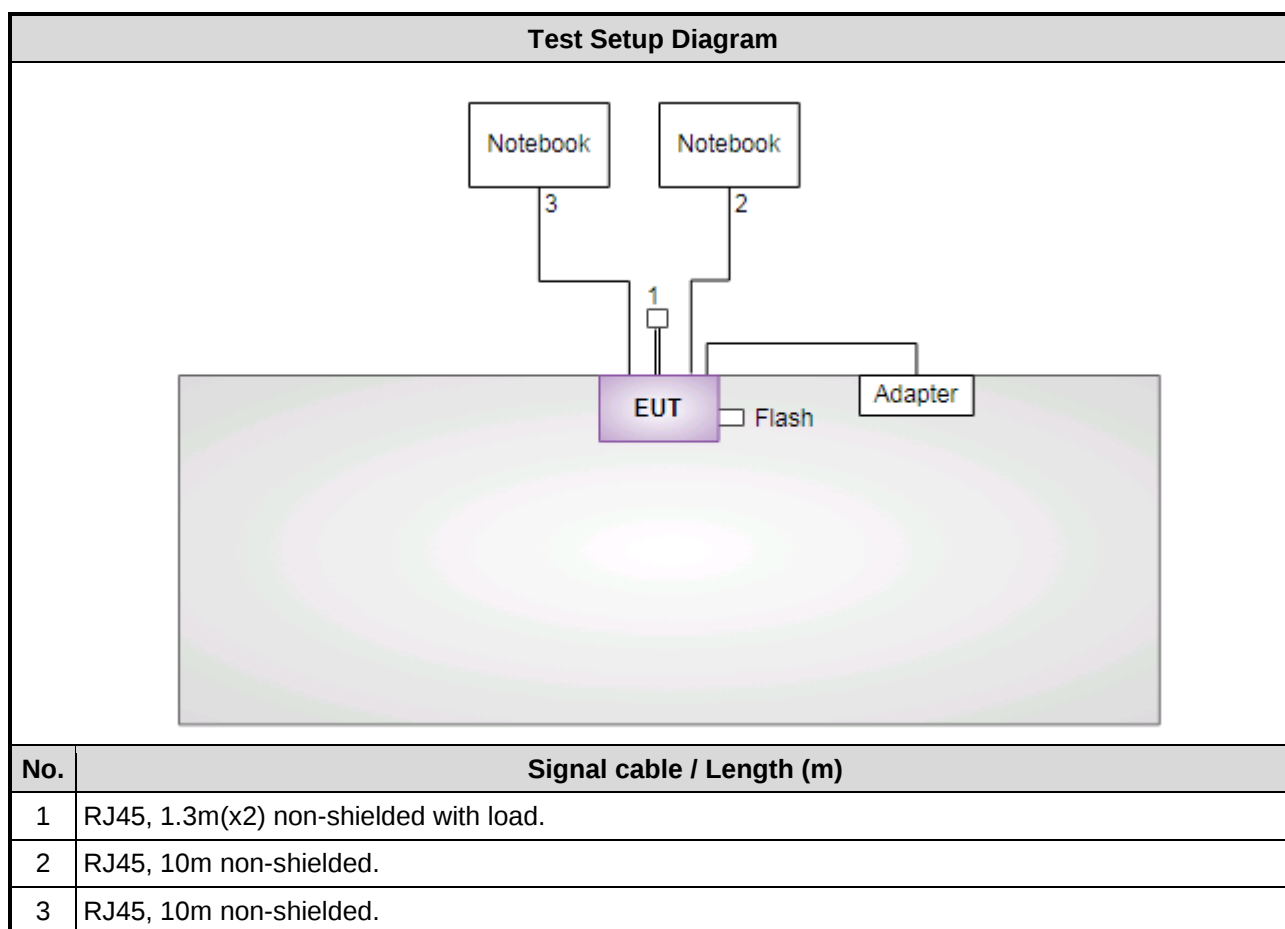
1.1.8 Power Index of Test Tool

Modulation Mode	Test Frequency (MHz)	Power Index
11b	2412	26
11b	2437	26
11b	2462	24
11g	2412	1C
11g	2437	24
11g	2462	18
HT20	2412	1A
HT20	2437	24
HT20	2462	17
HT40	2422	19
HT40	2437	1C
HT40	2452	14

1.2 Local Support Equipment List

Support Equipment List					
No.	Equipment	Brand	Model	FCC ID	Remarks
1	RJ45	ICC	RJ45-1.3m	---	---
2	RJ45	ICC	RJ45-1.3m	---	---
4	RJ45	ICC	RJ45-10m	---	---
5	Notebook	DELL	Latitude E5470	DoC	---
6	Notebook	DELL	Latitude E5470	DoC	---
7	USB 3.0 Flash	Transcend	JetFlash 700	---	---

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	101658	Dec. 12, 2019	Dec. 11, 2020
LISN	R&S	ENV216	101579	Mar. 12, 2020	Mar. 11, 2021
RF Cable-CON	Woken	CFD200-NL	CFD200-NL-001	Oct. 22, 2019	Oct. 21, 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. 09, 2020	Jan. 08, 2021
Receiver	R&S	ESR3	101657	Feb. 14, 2020	Feb. 13, 2021
Bilog Antenna	SCHWARZBECK	VULB9168	VULB9168-685	Apr. 29, 2020	Apr. 28, 2021
Horn Antenna 1G-18G	SCHWARZBECK	BBHA 9120 D	BBHA 9120 D 1206	Dec. 27, 2019	Dec. 26, 2020
Horn Antenna 18G-40G	SCHWARZBECK	BBHA 9170	BBHA 9170517	Nov. 15, 2019	Nov. 14, 2020
Loop Antenna	R&S	HFH2-Z2	100330	Nov. 13, 2019	Nov. 12, 2020
Loop Antenna Cable	KOAX KABEL	101354-BW	101354-BW	Oct. 07, 2019	Oct. 06, 2020
Preamplifier	EMC	EMC02325	980187	Aug. 14, 2019	Aug. 13, 2020
Preamplifier	Agilent	83017A	MY53270014	Aug. 07, 2019	Aug. 06, 2020
Preamplifier	EMC	EMC184045B	980192	Aug. 01, 2019	Jul. 31, 2020
RF cable-3M	HUBER+SUHNER	SUCOFLEX104	MY22620/4	Sep. 27, 2019	Sep. 26, 2020
RF cable-8M	EMC	EMC104-SM-SM-8000	181107	Sep. 27, 2019	Sep. 26, 2020
RF cable-1M	HUBER+SUHNER	SUCOFLEX104	MY22624/4	Sep. 27, 2019	Sep. 26, 2020
LF cable-0.8M	EMC	EMC8D-NM-NM-800	EMC8D-NM-NM-800-001	Sep. 27, 2019	Sep. 26, 2020
LF cable-3M	EMC	EMC8D-NM-NM-3000	131103	Sep. 27, 2019	Sep. 26, 2020
LF cable-13M	EMC	EMC8D-NM-NM-13000	131104	Sep. 27, 2019	Sep. 26, 2020
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. 30, 2020	Apr. 29, 2021
Power Meter	Anritsu	ML2495A	1241002	Oct. 23, 2019	Oct. 22, 2020
Power Sensor	Anritsu	MA2411B	1207366	Oct. 23, 2019	Oct. 22, 2020
Measurement Software	Sporton	Sporton_1	1.3.30	NA	NA
Note: Calibration Interval of instruments listed above is one year.					

1.5 Test Standards

47 CFR FCC Part 15.247
ANSI C63.10-2013

1.6 Reference Guidance

FCC KDB 558074 D01 15.247 Meas Guidance v05r02
FCC KDB 662911 D01 Multiple Transmitter Output v02r01

1.7 Deviation from Test Standard and Measurement Procedure

None

1.8 Measurement Uncertainty

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 ≤ 1 GHz	± 3.96 dB
Radiated emission > 1 GHz	± 4.51 dB

2 Test Configuration

2.1 Testing Condition

Test Item	Test Site	Ambient Condition	Tested By
AC Conduction	CO01-WS	18°C / 61%	Alex Tsai
Radiated Emissions	03CH03-WS	24°C / 68%	Roger Lu
RF Conducted	TH01-WS	23°C / 63%	Brad Wu

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

2.2 Testing Facility

Test Laboratory	International Certification Corp.
Test Site	CO01-WS, TH01-WS
Address of Test Site	No. 3-1, Lane 6, Wen San 3rd St., Kwei Shan District, Tao Yuan City 333, Taiwan, R.O.C.

Test Site	03CH03-WS
Address of Test Site	No. 14-1, Lane 19, Wen San 3rd St., Kwei Shan District, Tao Yuan City 333, Taiwan, R.O.C.

2.3 The Worst Test Modes and Channel Details

Test item	Modulation Mode	Test Frequency (MHz)	Data Rate	Test Configuration
Conducted Emissions	11b	2412	1 Mbps	---
Radiated Emissions ≤1GHz	11b	2412	1 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: Adapter 1 (Brand: LEI) and Adapter 2 (Brand: MOSO) had been covered during the pretest. The worst adapter is **Adapter 2 (Brand: MOSO)**, and only its data was record in this test 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 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.

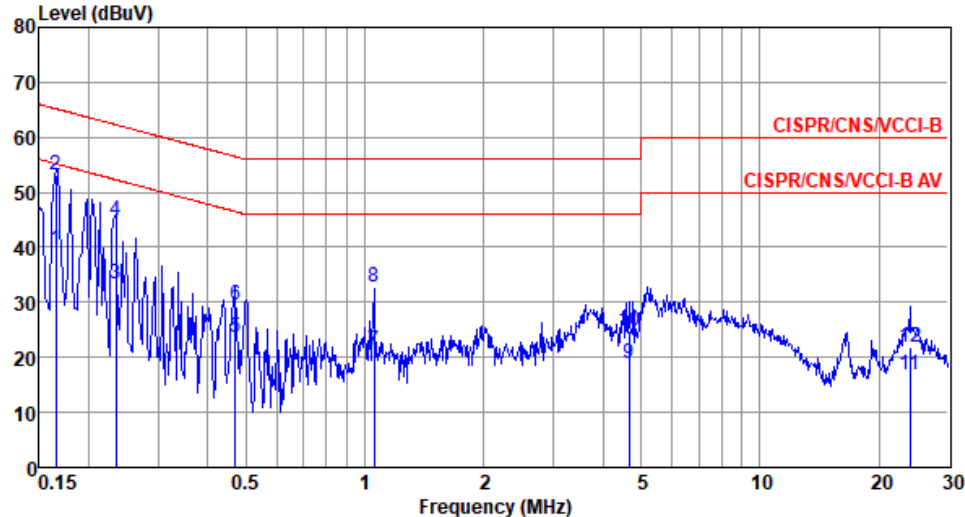
3.1.3 Test Setup



- 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	11b	Test Freq. (MHz)	2412
Power Phase	Line		

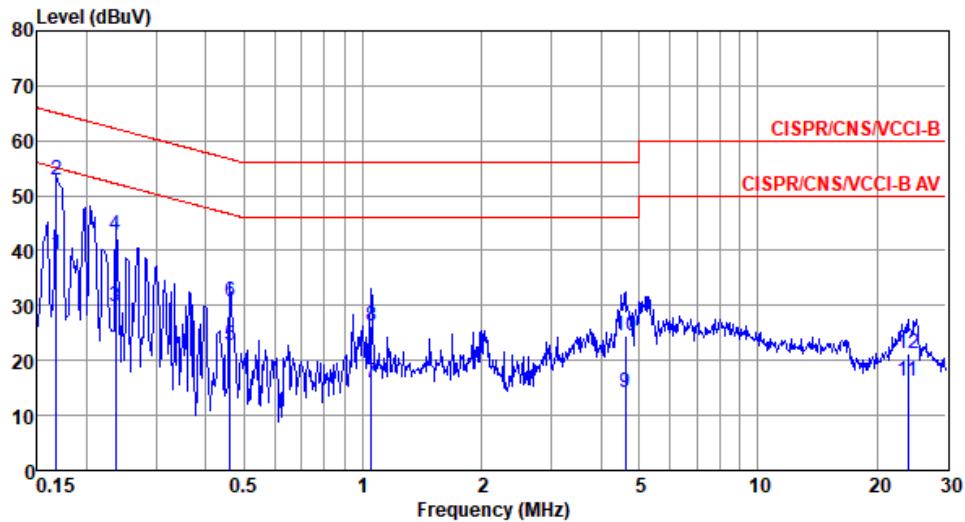


	Freq	Level	Limit	Over	Read	LISN	cable	
	MHz	dBuV	Line	Limit	Level	factor	loss	Remark
			dBuV	dB	dBuV	dB	dB	
1	0.165	39.52	55.21	-15.69	29.66	9.64	0.05	Average
2*	0.165	53.00	65.21	-12.21	43.14	9.64	0.05	QP
3	0.234	33.25	52.30	-19.05	23.36	9.63	0.06	Average
4	0.234	44.90	62.30	-17.40	35.01	9.63	0.06	QP
5	0.471	23.55	46.49	-22.94	13.57	9.63	0.09	Average
6	0.471	29.53	56.49	-26.96	19.55	9.63	0.09	QP
7	1.054	21.24	46.00	-24.76	11.17	9.63	0.12	Average
8	1.054	32.70	56.00	-23.30	22.63	9.63	0.12	QP
9	4.672	18.97	46.00	-27.03	8.62	9.66	0.31	Average
10	4.672	24.85	56.00	-31.15	14.50	9.66	0.31	QP
11	24.015	16.83	50.00	-33.17	5.78	9.67	0.70	Average
12	24.015	21.91	60.00	-38.09	10.86	9.67	0.70	QP

Note 1: Level (dBUV) = Read Level (dBUV) + LISN Factor (dB) + Cable Loss (dB).

2: Over Limit (dB) = Level (dBUV) – Limit Line (dBUV).

Modulation	11b	Test Freq. (MHz)	2412
Power Phase	Neutral		



	Freq MHz	Level dBuV	Limit Line dBuV	Over Limit dB	Read Level dBuV	LISN factor dB	cable loss dB	Remark
1	0.168	39.17	55.08	-15.91	29.33	9.66	0.05	Average
2*	0.168	52.83	65.08	-12.25	42.99	9.66	0.05	QP
3	0.237	29.73	52.22	-22.49	19.87	9.65	0.06	Average
4	0.237	42.73	62.22	-19.49	32.87	9.65	0.06	QP
5	0.461	22.87	46.67	-23.80	12.96	9.65	0.09	Average
6	0.461	30.77	56.67	-25.90	20.86	9.65	0.09	QP
7	1.049	15.98	46.00	-30.02	6.01	9.65	0.12	Average
8	1.049	26.15	56.00	-29.85	16.18	9.65	0.12	QP
9	4.622	14.28	46.00	-31.72	4.02	9.68	0.31	Average
10	4.622	24.56	56.00	-31.44	14.30	9.68	0.31	QP
11	24.015	16.25	50.00	-33.75	5.09	9.81	0.70	Average
12	24.015	21.32	60.00	-38.68	10.16	9.81	0.70	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)_4TX	10M	14.689M	14M7G1D	9.058M	13.965M
802.11g_Nss1,(6Mbps)_4TX	16.304M	16.932M	16M9D1D	10.29M	16.353M
802.11n HT20_Nss1,(MCS0)_4TX	16.594M	17.945M	17M9D1D	13.188M	17.438M
802.11n HT40_Nss1,(MCS0)_4TX	35.072M	36.179M	36M2D1D	31.304M	35.89M

Max-N dB = Maximum6dB downbandwidth;**Max-OBW** = Maximum99% occupied bandwidth;

Min-N dB = Minimum6dB downbandwidth;**Min-OBW** = Minimum99% occupied bandwidth;

Result

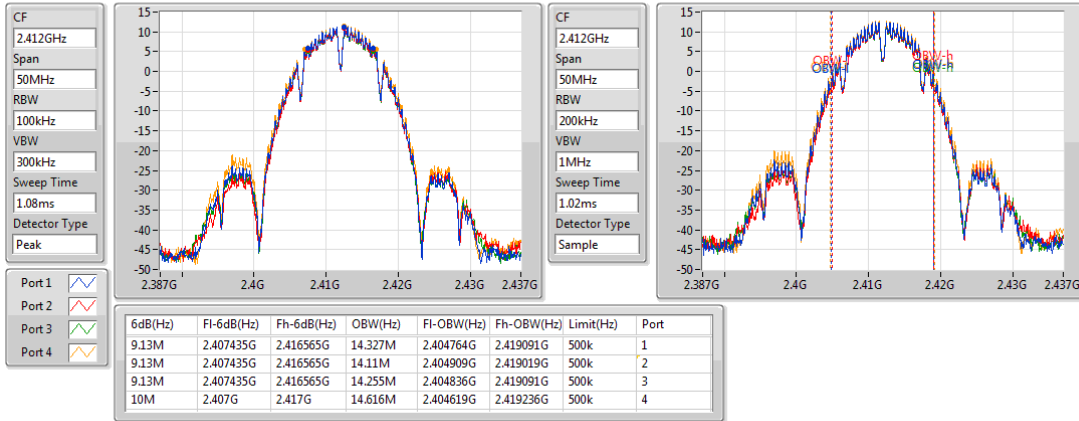
Mode	Result	Limit (Hz)	Port 1-N dB (Hz)	Port 1-OBW (Hz)	Port 2-N dB (Hz)	Port 2-OBW (Hz)	Port 3-N dB (Hz)	Port 3-OBW (Hz)	Port 4-N dB (Hz)	Port 4-OBW (Hz)
802.11b_Nss1,(1Mbps)_4TX	-	-	-	-	-	-	-	-	-	-
2412MHz	Pass	500k	9.13M	14.327M	9.13M	14.11M	9.13M	14.255M	10M	14.616M
2437MHz	Pass	500k	9.13M	14.255M	9.13M	14.182M	9.13M	14.255M	10M	14.689M
2462MHz	Pass	500k	9.058M	14.038M	9.058M	13.965M	9.13M	13.965M	9.13M	14.11M
802.11g_Nss1,(6Mbps)_4TX	-	-	-	-	-	-	-	-	-	-
2412MHz	Pass	500k	13.768M	16.498M	15.435M	16.353M	13.043M	16.498M	16.304M	16.498M
2437MHz	Pass	500k	10.29M	16.932M	14.42M	16.715M	15.435M	16.932M	14.42M	16.86M
2462MHz	Pass	500k	15.797M	16.425M	15.072M	16.353M	16.304M	16.425M	15.652M	16.425M
802.11n HT20_Nss1,(MCS0)_4TX	-	-	-	-	-	-	-	-	-	-
2412MHz	Pass	500k	15.87M	17.511M	14.71M	17.511M	13.188M	17.583M	16.594M	17.511M
2437MHz	Pass	500k	15.145M	17.873M	15.942M	17.945M	13.841M	17.873M	15.145M	17.945M
2462MHz	Pass	500k	15.072M	17.438M	15.725M	17.438M	15.797M	17.511M	15.29M	17.511M
802.11n HT40_Nss1,(MCS0)_4TX	-	-	-	-	-	-	-	-	-	-
2422MHz	Pass	500k	31.304M	35.89M	33.768M	36.179M	32.609M	35.89M	32.609M	35.89M
2437MHz	Pass	500k	33.913M	35.89M	35.072M	36.179M	35.072M	35.89M	34.058M	36.035M
2452MHz	Pass	500k	31.304M	36.035M	33.768M	36.035M	33.913M	35.89M	35.072M	36.035M

Port X-N dB = Port X6dB downbandwidth; **Port X-OBW** = Port X99% occupied bandwidth;

802.11b_Nss1,(1Mbps)_4TX

EBW

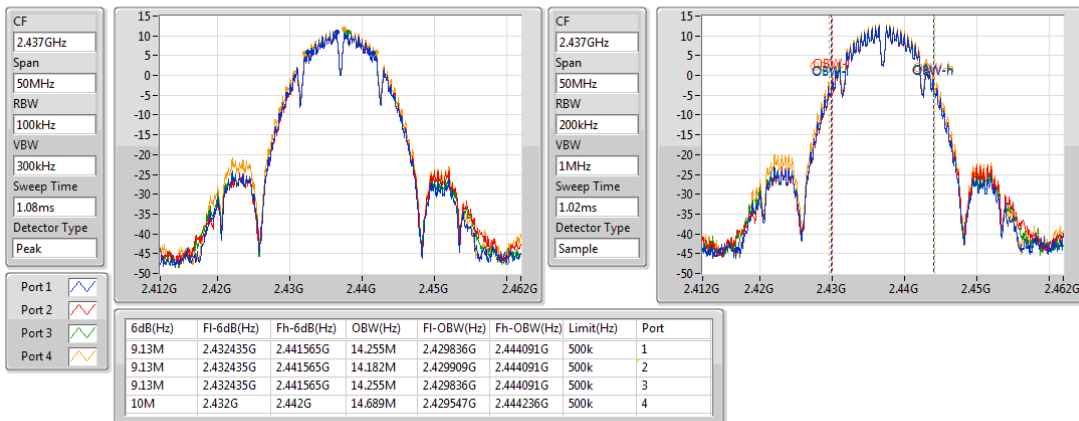
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802.11b_Nss1,(1Mbps)_4TX

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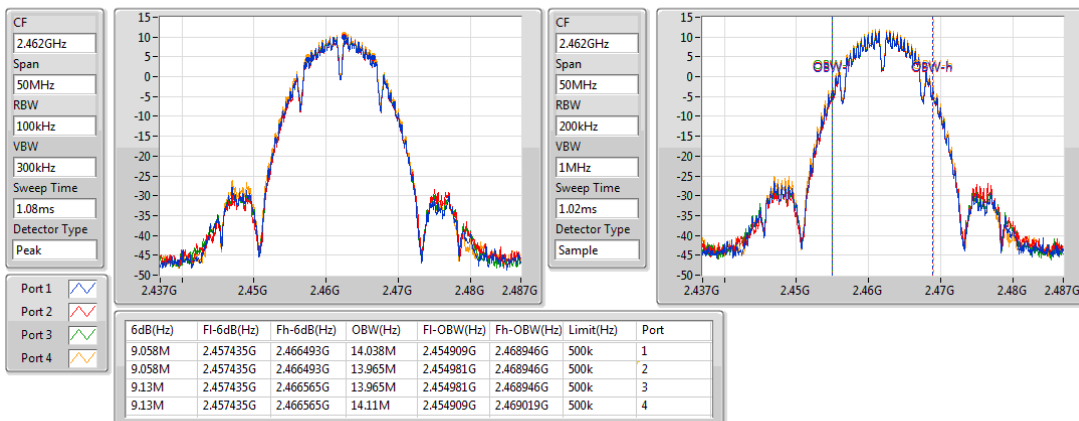
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802.11b_Nss1,(1Mbps)_4TX

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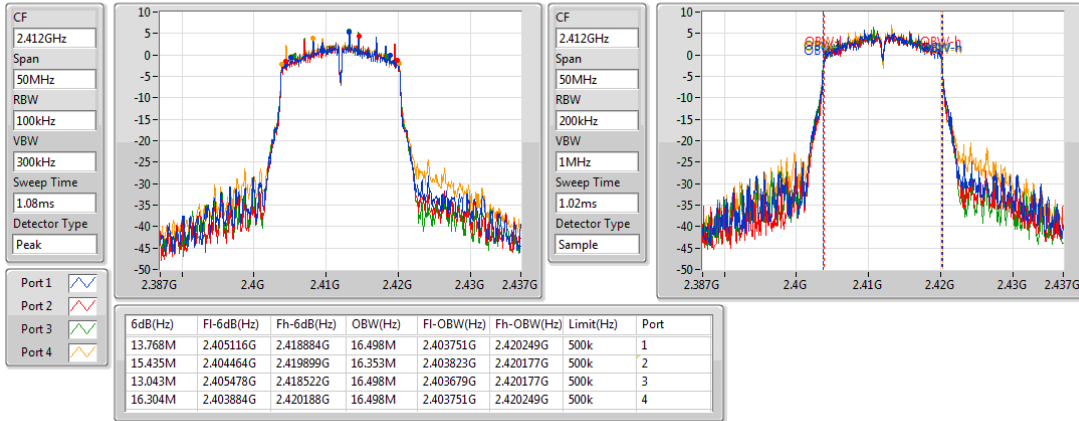
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802.11g_Nss1,(6Mbps)_4TX

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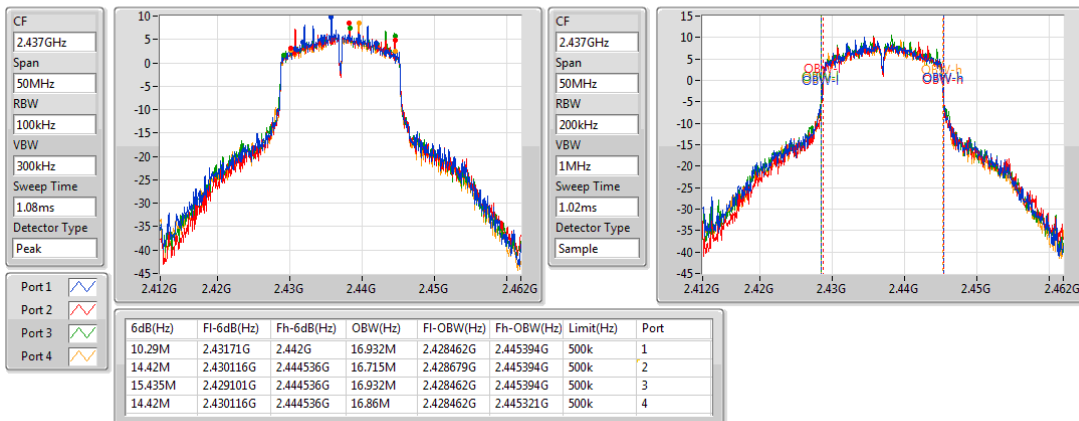
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802.11g_Nss1,(6Mbps)_4TX

EBW

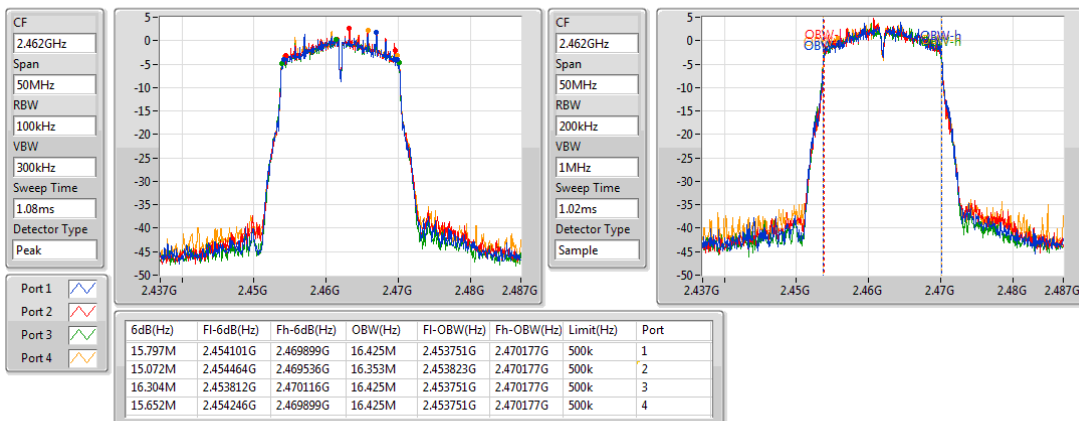
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802.11g_Nss1,(6Mbps)_4TX

EBW

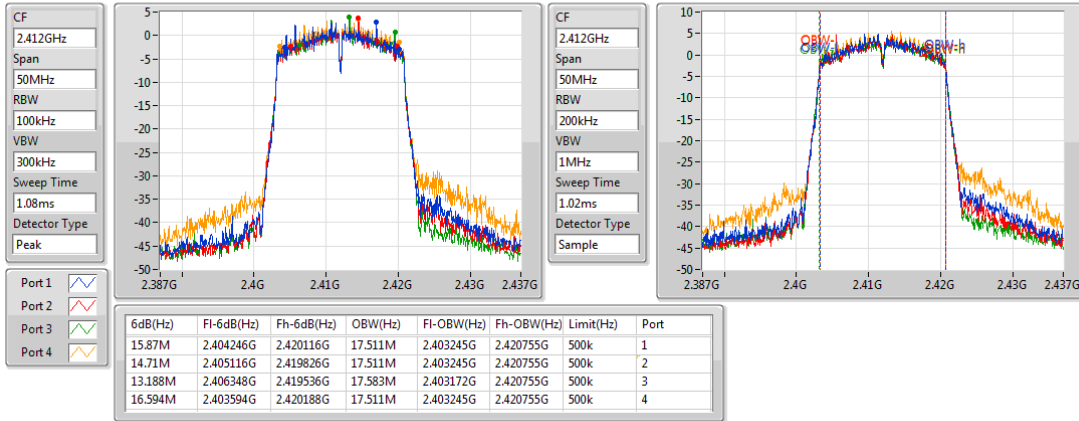
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802.11n HT20_Nss1,(MCS0)_4TX

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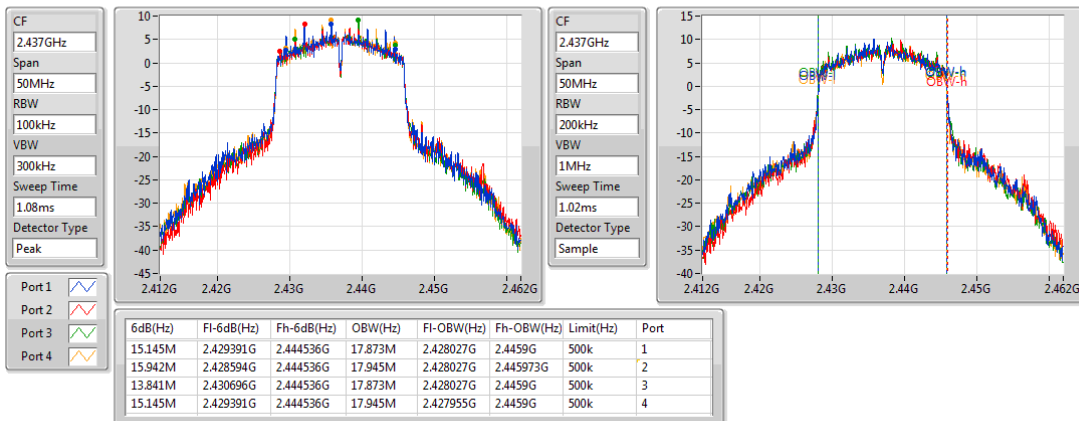
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802.11n HT20_Nss1,(MCS0)_4TX

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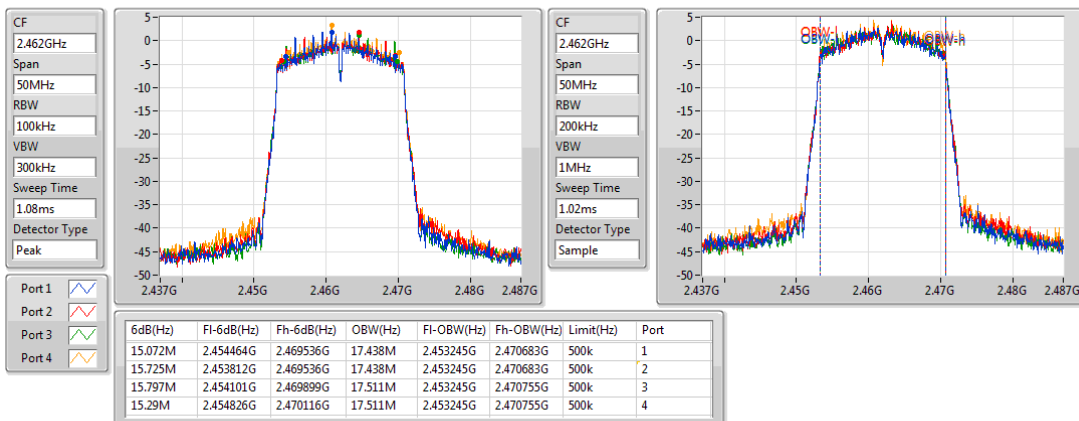
2437MHz



802.11n HT20_Nss1,(MCS0)_4TX

EBW

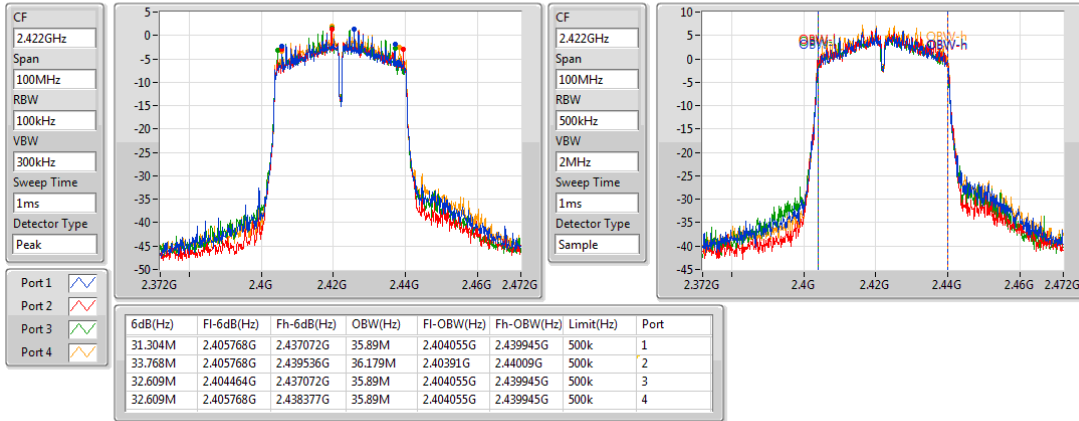
2462MHz



802.11n HT40_Nss1,(MCS0)_4TX

EBW

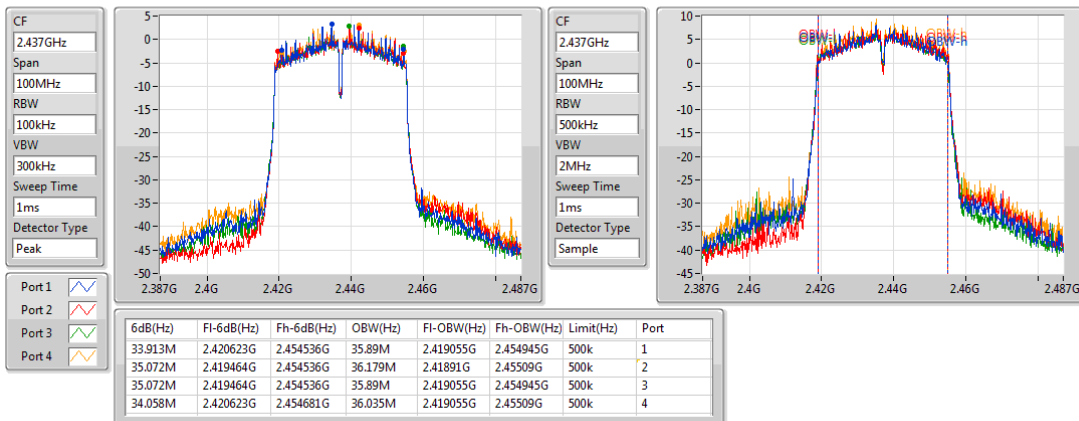
2422MHz



802.11n HT40_Nss1,(MCS0)_4TX

EBW

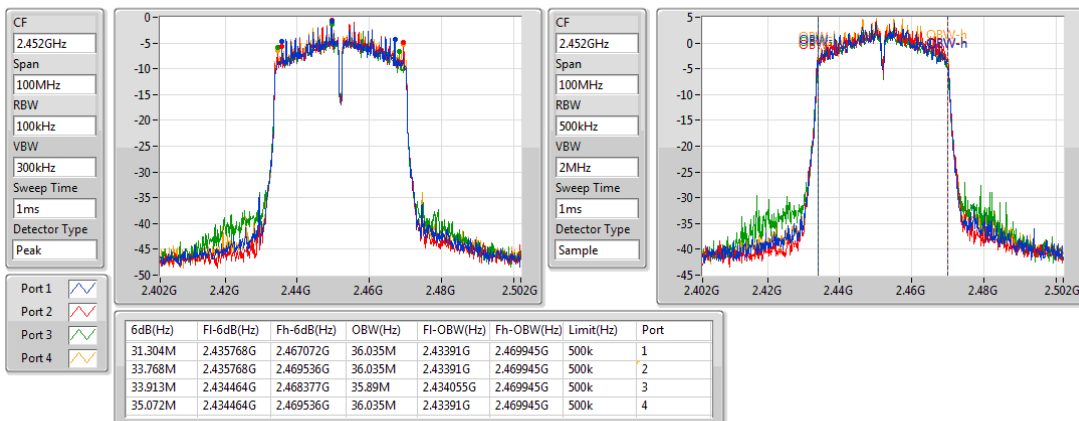
2437MHz



802.11n HT40_Nss1,(MCS0)_4TX

EBW

2452MHz



3.3 RF Output Power

3.3.1 Limit of RF Output Power

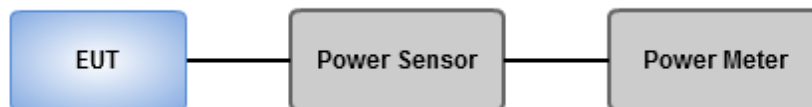
Conducted power shall not exceed 1Watt.

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

Summary

Mode	Total Power (dBm)	Total Power (W)
2.4-2.4835GHz	-	-
802.11b_Nss1,(1Mbps)_4TX	26.59	0.45604
802.11g_Nss1,(6Mbps)_4TX	25.43	0.34914
802.11n HT20_Nss1,(MCS0)_4TX	25.36	0.34356
802.11n HT40_Nss1,(MCS0)_4TX	21.54	0.14256

Result

Mode	Result	DG (dBi)	Port 1 (dBm)	Port 2 (dBm)	Port 3 (dBm)	Port 4 (dBm)	Total Power (dBm)	Power Limit (dBm)	EIRP (dBm)	EIRP Limit (dBm)
802.11b_Nss1,(1Mbps)_4TX	-	-	-	-	-	-	-	-	-	-
2412MHz	Pass	3.10	20.73	20.61	20.49	20.44	26.59	30.00	29.69	36.00
2437MHz	Pass	3.10	20.74	20.66	20.27	20.32	26.52	30.00	29.62	36.00
2462MHz	Pass	3.10	19.72	19.41	19.24	19.33	25.45	30.00	28.55	36.00
802.11g_Nss1,(6Mbps)_4TX	-	-	-	-	-	-	-	-	-	-
2412MHz	Pass	3.10	15.76	15.74	15.34	15.57	21.63	30.00	24.73	36.00
2437MHz	Pass	3.10	19.81	19.49	19.12	19.17	25.43	30.00	28.53	36.00
2462MHz	Pass	3.10	13.74	13.82	13.19	13.69	19.64	30.00	22.74	36.00
802.11n HT20_Nss1,(MCS0)_4TX	-	-	-	-	-	-	-	-	-	-
2412MHz	Pass	3.10	14.65	14.99	14.27	14.49	20.63	30.00	23.73	36.00
2437MHz	Pass	3.10	19.58	19.48	19.07	19.22	25.36	30.00	28.46	36.00
2462MHz	Pass	3.10	13.19	13.26	12.56	12.97	19.02	30.00	22.12	36.00
802.11n HT40_Nss1,(MCS0)_4TX	-	-	-	-	-	-	-	-	-	-
2422MHz	Pass	3.10	14.33	14.45	13.85	13.98	20.18	30.00	23.28	36.00
2437MHz	Pass	3.10	15.78	15.63	15.22	15.43	21.54	30.00	24.64	36.00
2452MHz	Pass	3.10	11.65	11.64	11.13	11.44	17.49	30.00	20.59	36.00

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

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

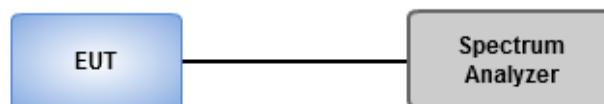
Average PSD, duty cycle $\geq 98\%$

1. Set the RBW = 30 kHz, VBW = 100 kHz.
2. Detector = RMS, Sweep time = auto couple.
3. Sweep time = auto couple.
4. Employ trace averaging (RMS) mode over a minimum of 100 traces.
5. Use the peak marker function to determine the maximum amplitude level.

Average PSD, duty cycle $< 98\%$

1. Set the RBW = 30 kHz, VBW = 100 kHz. Detector = RMS.
2. Set the sweep time to: ≥ 10 (number of measurement points in sweep) $\times$ (total on/off period of the transmitted signal).
3. Perform the measurement over a single sweep.
4. Use the peak marker function to determine the maximum amplitude level.
5. Add $10 \log (1/x)$, where x is the duty cycle.

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)_4TX	4.39
802.11g_Nss1,(6Mbps)_4TX	1.81
802.11n HT20_Nss1,(MCS0)_4TX	1.99
802.11n HT40_Nss1,(MCS0)_4TX	-5.10

RBW=30kHz.

Result

Mode	Result	DG (dBi)	Port 1 (dBm/RBW W)	Port 2 (dBm/RBW W)	Port 3 (dBm/RBW W)	Port 4 (dBm/RBW W)	PD (dBm/RBW W)	PD Limit (dBm/RBW W)
802.11b_Nss1,(1Mbps)_4TX	-	-	-	-	-	-	-	-
2412MHz	Pass	8.90	-1.27	-1.14	-1.78	-1.14	4.39	5.10
2437MHz	Pass	8.90	-1.30	-1.37	-1.43	-1.99	4.14	5.10
2462MHz	Pass	8.90	-1.70	-1.41	-1.85	-1.03	4.21	5.10
802.11g_Nss1,(6Mbps)_4TX	-	-	-	-	-	-	-	-
2412MHz	Pass	8.90	-7.39	-7.38	-7.63	-7.04	-1.77	5.10
2437MHz	Pass	8.90	-3.01	-3.34	-3.69	-4.05	1.81	5.10
2462MHz	Pass	8.90	-9.38	-9.40	-9.53	-8.98	-3.72	5.10
802.11n HT20_Nss1,(MCS0)_4TX	-	-	-	-	-	-	-	-
2412MHz	Pass	8.90	-8.07	-7.74	-8.72	-7.50	-2.58	5.10
2437MHz	Pass	8.90	-3.40	-3.78	-3.69	-3.57	1.99	5.10
2462MHz	Pass	8.90	-9.82	-9.79	-10.16	-8.20	-4.06	5.10
802.11n HT40_Nss1,(MCS0)_4TX	-	-	-	-	-	-	-	-
2422MHz	Pass	8.90	-12.53	-12.82	-12.70	-11.98	-6.63	5.10
2437MHz	Pass	8.90	-10.95	-11.05	-11.19	-10.81	-5.10	5.10
2452MHz	Pass	8.90	-15.14	-14.93	-15.22	-14.68	-9.11	5.10

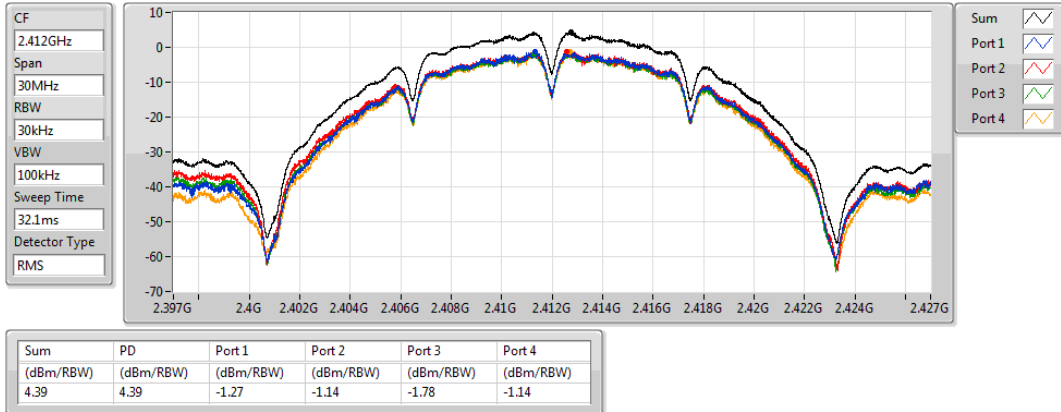
PD = trace bin-by-bin of each transmits port summing can be performed maximum power density; Port X = Port Xpower density;
DG = Directional Gain;

Directional gain = $10 * \log((10^{2.8/20} + 10^{3.1/20} + 10^{3/20} + 10^{2.6/20})^2 / 4) = 8.9 \text{ dBi} > 6 \text{ dBi}$, Limit shall be reduced to 8 dBm – (8.9 dBi – 6 dBi) = 5.1 dBm

802.11b_Nss1,(1Mbps)_4TX

PSD

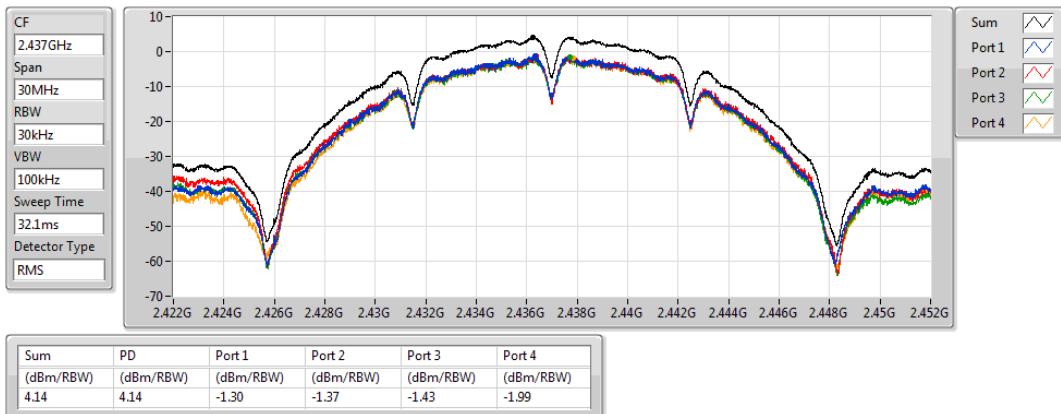
2412MHz



802.11b_Nss1,(1Mbps)_4TX

PSD

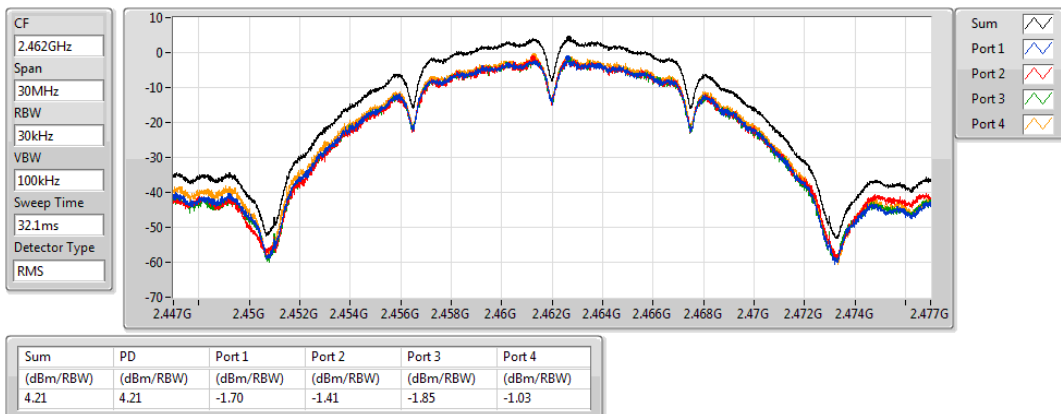
2437MHz



802.11b_Nss1,(1Mbps)_4TX

PSD

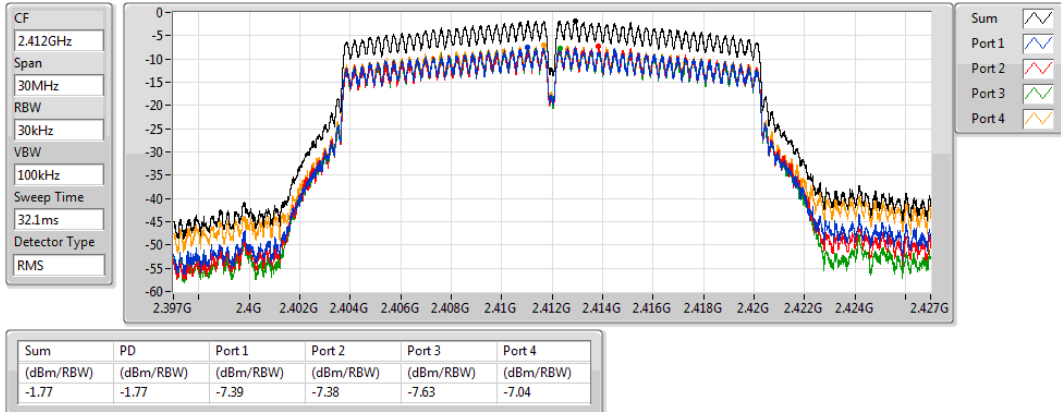
2462MHz



802.11g_Nss1,(6Mbps)_4TX

PSD

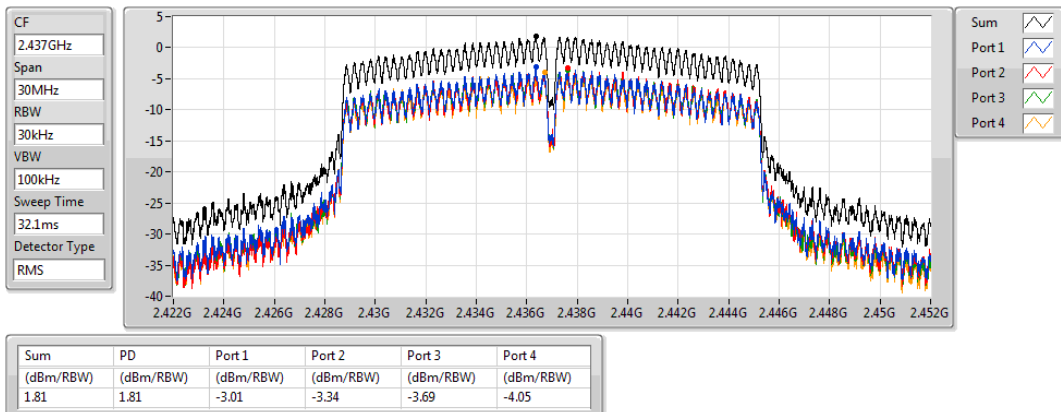
2412MHz



802.11g_Nss1,(6Mbps)_4TX

PSD

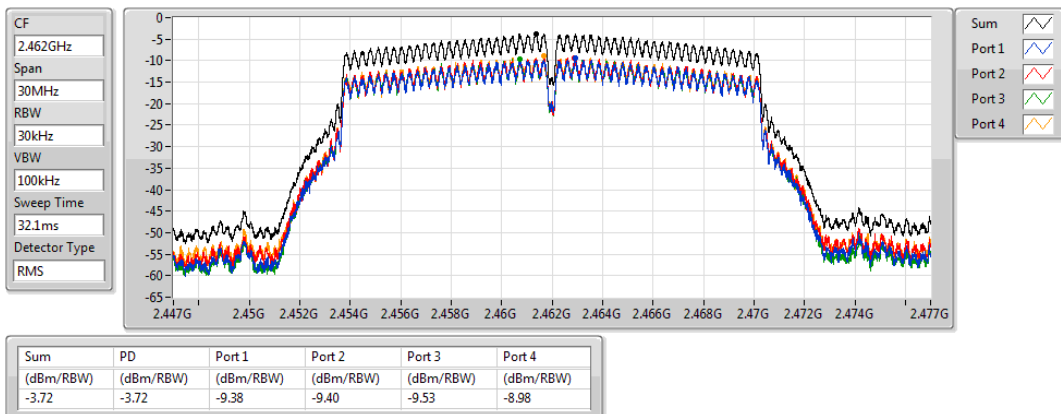
2437MHz



802.11g_Nss1,(6Mbps)_4TX

PSD

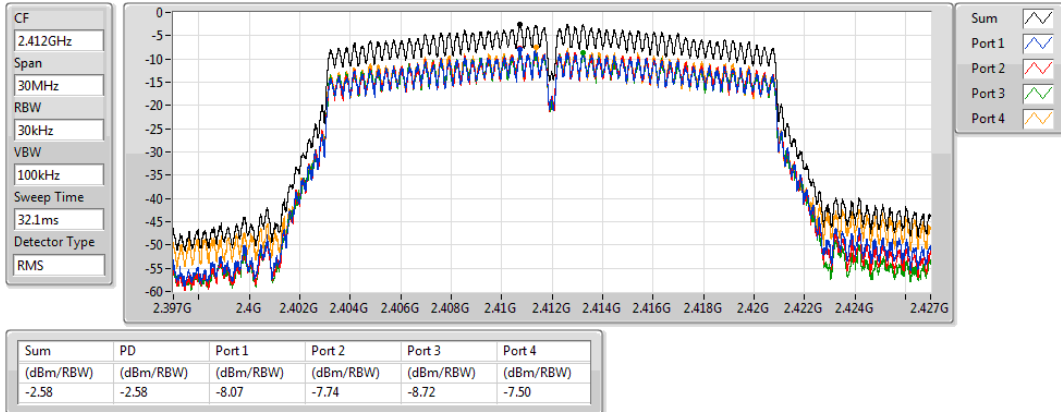
2462MHz



802.11n HT20_Nss1,(MCS0)_4TX

PSD

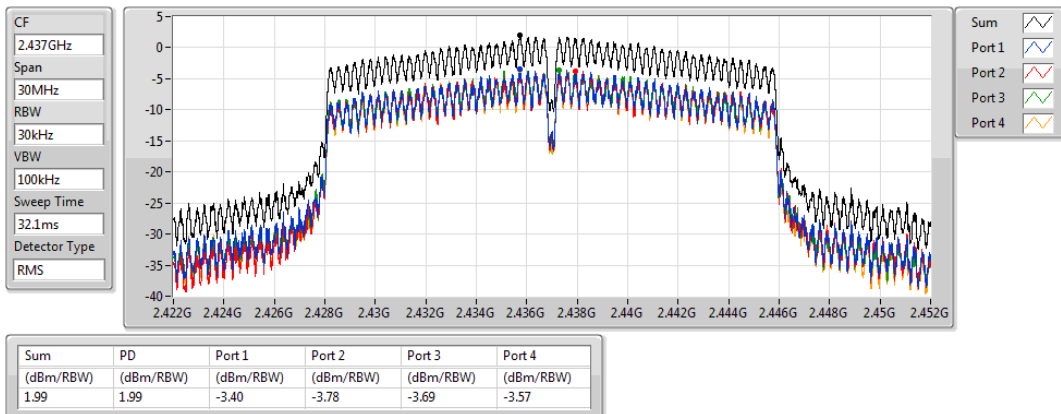
2412MHz



802.11n HT20_Nss1,(MCS0)_4TX

PSD

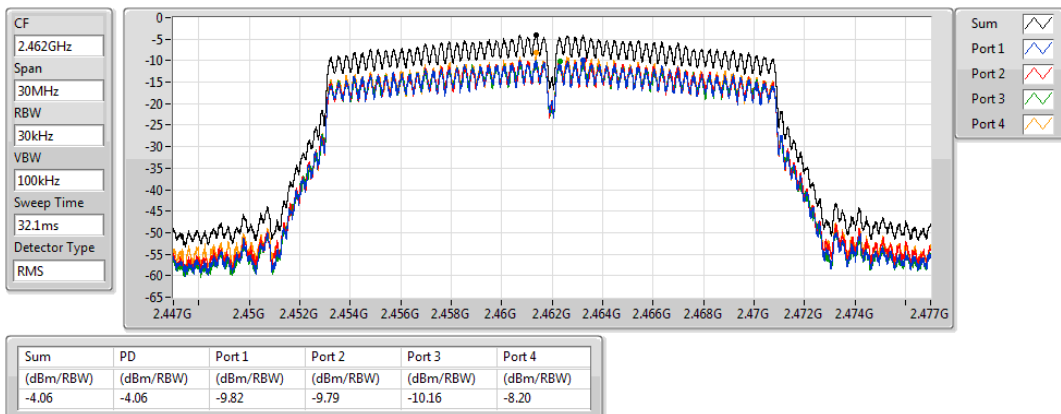
2437MHz



802.11n HT20_Nss1,(MCS0)_4TX

PSD

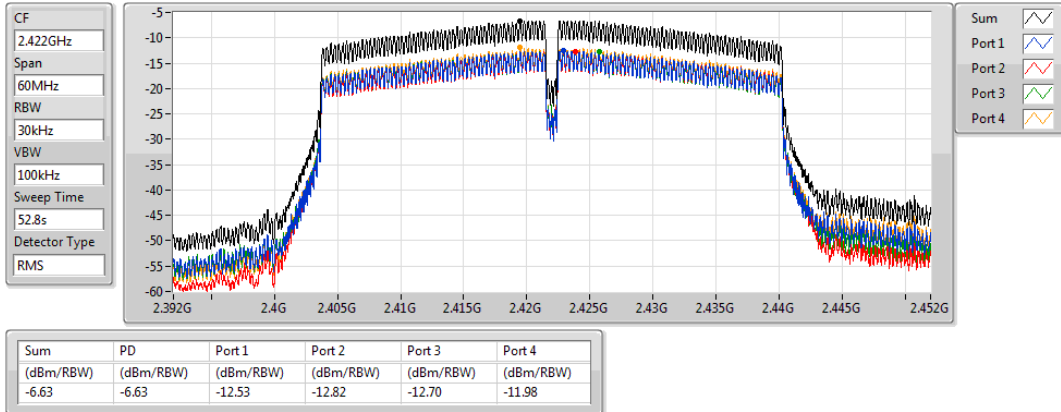
2462MHz



802.11n HT40_Nss1,(MCS0)_4TX

PSD

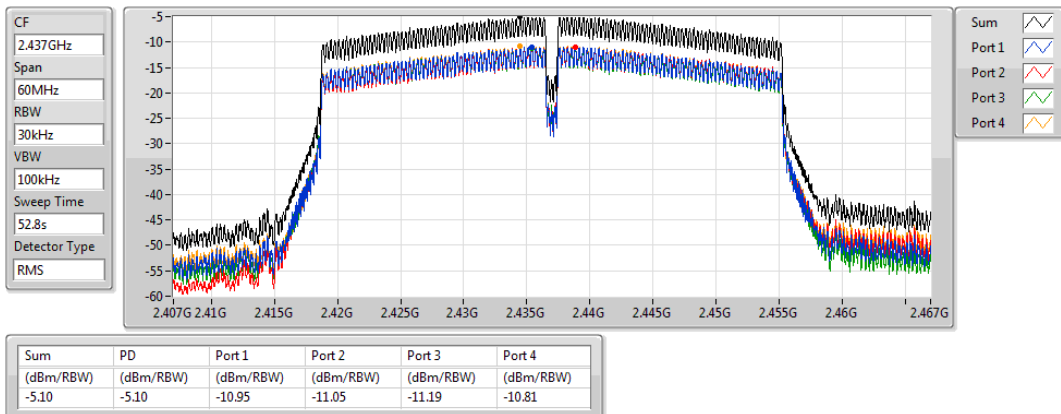
2422MHz



802.11n HT40_Nss1,(MCS0)_4TX

PSD

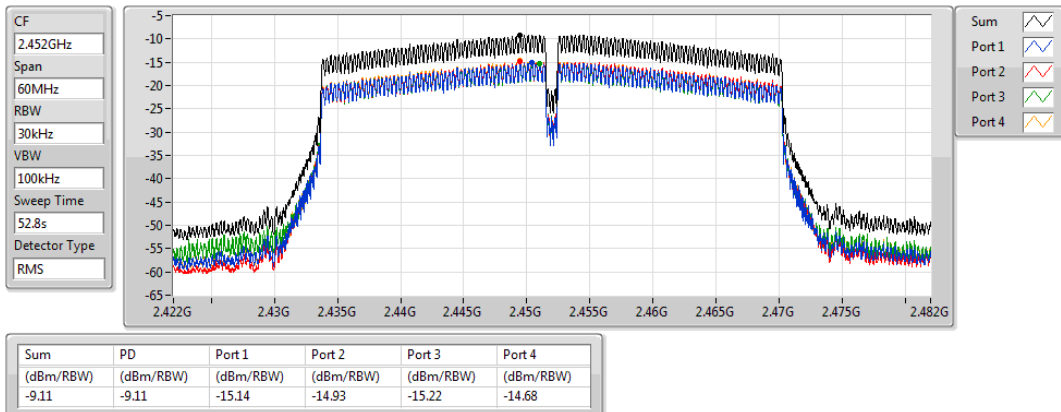
2437MHz



802.11n HT40_Nss1,(MCS0)_4TX

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

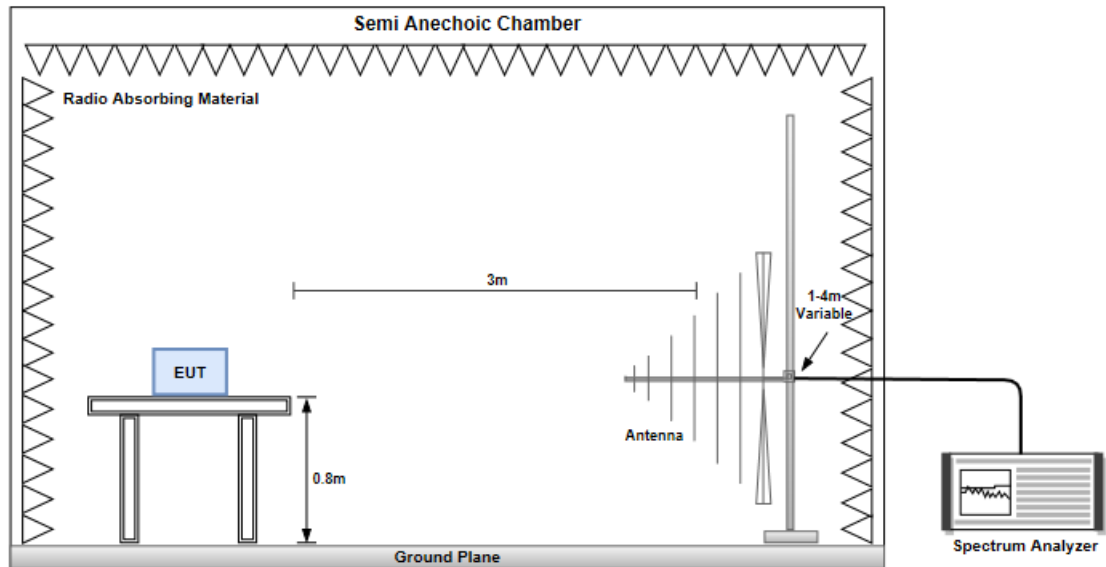
1. Measurement is made at a semi-anechoic chamber that incorporates a turntable allowing a EUT rotation of 360°. A continuously-rotating, remotely-controlled turntable is installed at the test site to support the EUT and facilitate determination of the direction of maximum radiation for each EUT emission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

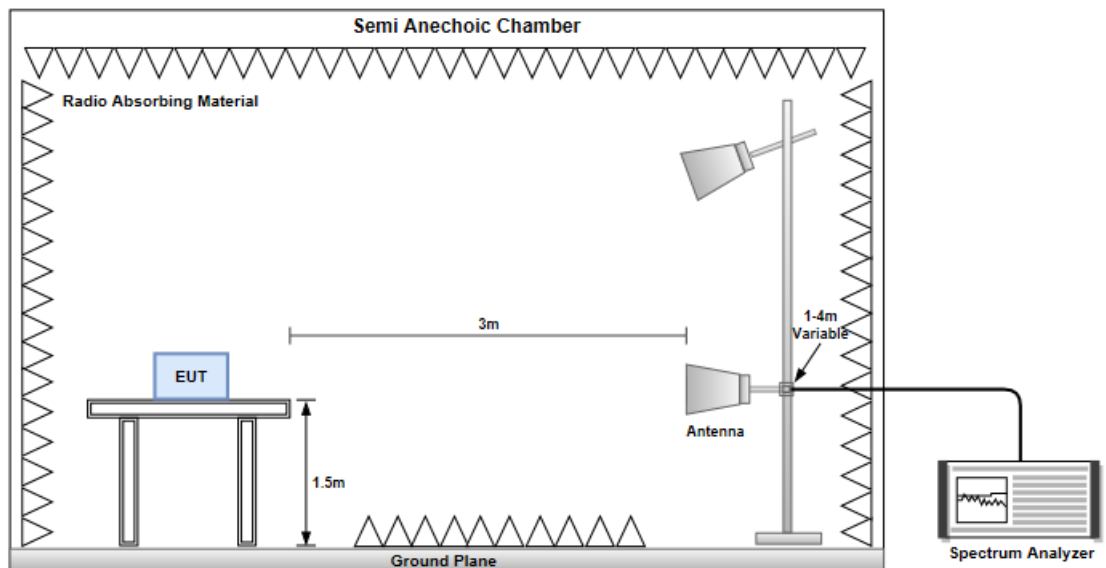
1. 120kHz measurement bandwidth of test receiver and Quasi-peak detector is for radiated emission below 1GHz.
2. RBW=1MHz, VBW=3MHz and Peak detector is for peak measured value of radiated emission above 1GHz.
3. RBW=1MHz, VBW=1/T and Peak detector is for average measured value of radiated emission above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

3.5.3 Test Setup

Radiated Emissions below 1 GHz

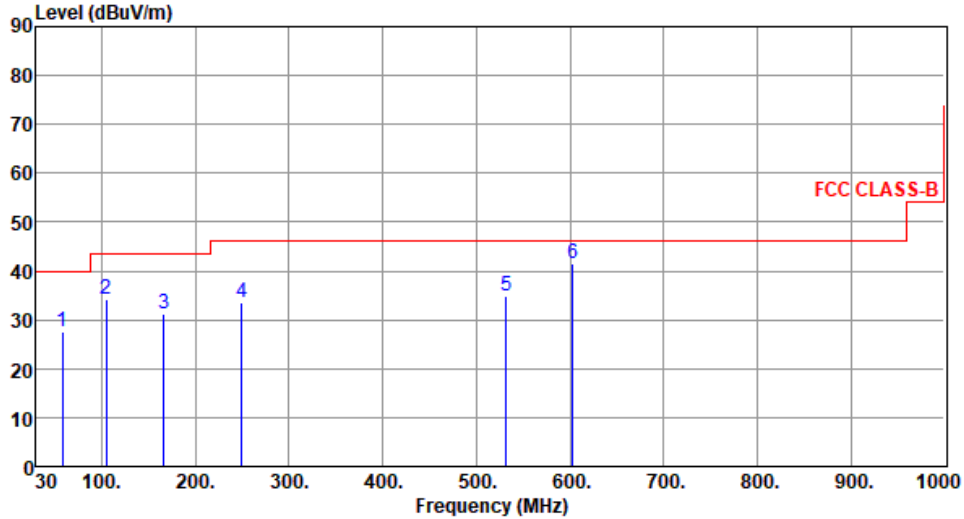


Radiated Emissions above 1 GHz



3.5.4 Transmitter Radiated Unwanted Emissions (Below 1GHz)

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



The graph displays the radiated unwanted emissions for a transmitter operating at 2412 MHz. The y-axis represents the emission 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 labeled with numbers 1 through 6, corresponding to the data in the table below.

	Freq. MHz	Emission level dBUV/m	Limit dBUV/m	Margin dB	SA reading dBUV	Factor dB	Remark	ANT High cm	Turn Table deg
1	58.26	27.55	40.00	-12.45	36.77	-9.22	Peak	---	---
2	104.53	34.31	43.50	-9.19	47.25	-12.94	Peak	---	---
3	166.28	31.31	43.50	-12.19	40.49	-9.18	Peak	---	---
4	249.36	33.45	46.00	-12.55	43.63	-10.18	Peak	---	---
5	531.52	34.85	46.00	-11.15	37.36	-2.51	Peak	---	---
6	603.25	41.43	46.00	-4.57	41.92	-0.49	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	11b	Test Freq. (MHz)	2412
Polarization	Vertical		
Level (dBUV/m) <			

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

Modulation	11b	Test Freq. (MHz)	2412
Polarization	Horizontal		
Level (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		
Level (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	43.49	54.00	-10.51	43.25	0.24	Average	223	190
2	2390.00	67.55	74.00	-6.45	67.31	0.24	Peak	223	190
3	4824.00	34.61	54.00	-19.39	28.11	6.50	Average	100	46
4	4824.00	47.73	74.00	-26.27	41.23	6.50	Peak	100	46
5	12060.00	46.59	54.00	-7.41	30.35	16.24	Average	100	128
6	12060.00	57.99	74.00	-16.01	41.75	16.24	Peak	100	128

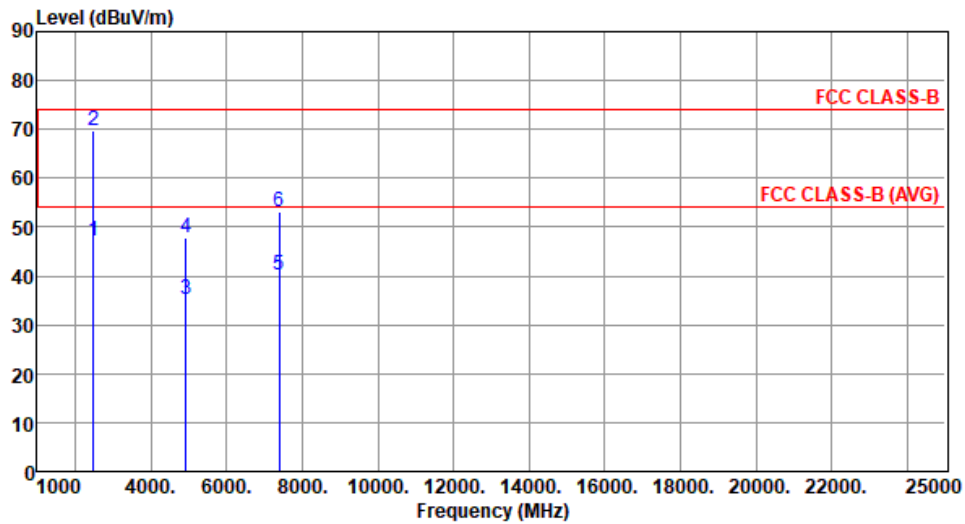
Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)
*Factor includes antenna factor , cable loss and amplifier gain
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

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		



	Freq. MHz	Emission level dBUV/m	Limit dBUV/m	Margin dB	SA reading dBUV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2483.50	47.21	54.00	-6.79	46.96	0.25	Average	231	213
2	2483.50	69.81	74.00	-4.19	69.56	0.25	Peak	231	213
3	4924.00	35.07	54.00	-18.93	28.56	6.51	Average	100	156
4	4924.00	47.76	74.00	-26.24	41.25	6.51	Peak	100	156
5	7386.00	40.18	54.00	-13.82	28.37	11.81	Average	100	131
6	7386.00	53.09	74.00	-20.91	41.28	11.81	Peak	100	131

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

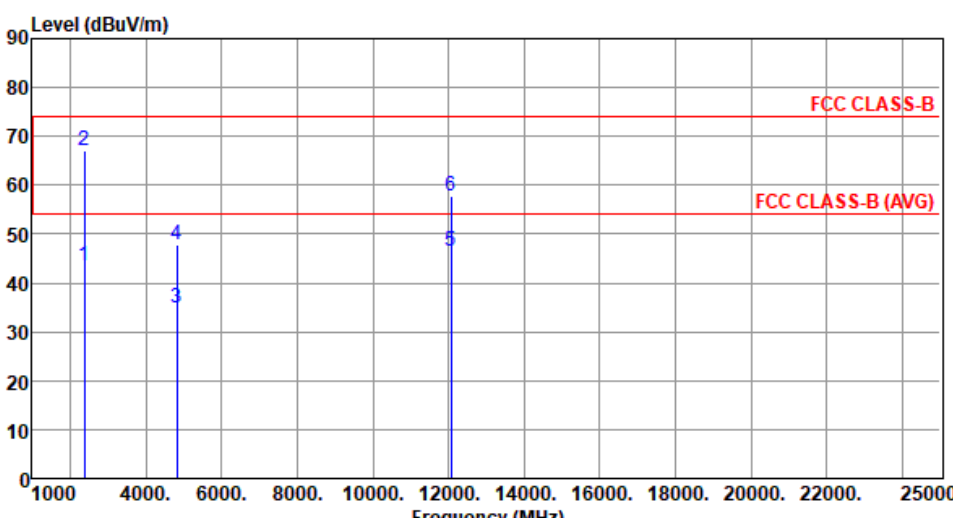
*Factor includes antenna factor , cable loss and amplifier gain

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

Modulation	11g	Test Freq. (MHz)	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		



	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	43.40	54.00	-10.60	43.16	0.24	Average	222	192
2	2390.00	67.09	74.00	-6.91	66.85	0.24	Peak	222	192
3	4824.00	34.75	54.00	-19.25	28.25	6.50	Average	100	51
4	4824.00	47.92	74.00	-26.08	41.42	6.50	Peak	100	51
5	12060.00	46.59	54.00	-7.41	30.35	16.24	Average	100	125
6	12060.00	57.67	74.00	-16.33	41.43	16.24	Peak	100	125

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

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

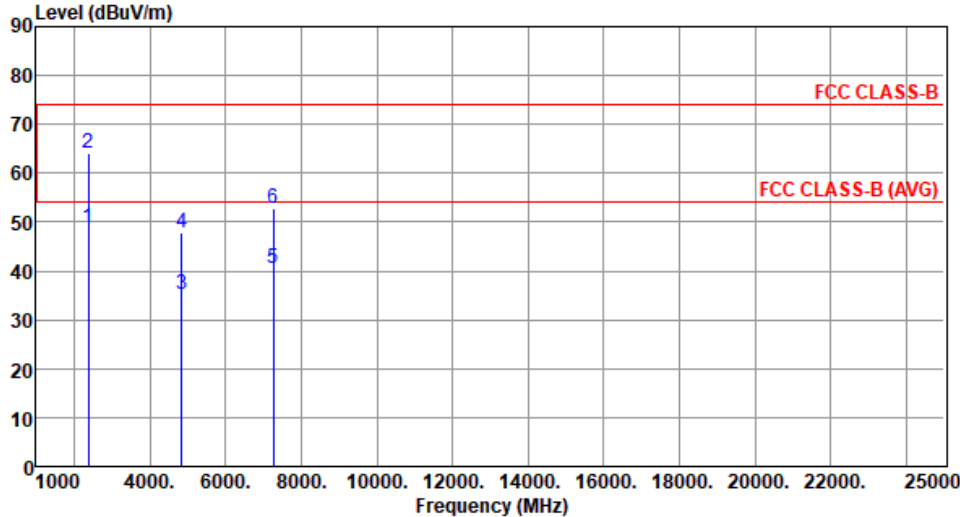
Modulation	HT20	Test Freq. (MHz)	2437
Polarization	Vertical		
Level (dBUV/m)			

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	48.65	54.00	-5.35	48.41	0.24	Average	222	205
2	2390.00	64.20	74.00	-9.80	63.96	0.24	Peak	222	205
3	4844.00	35.05	54.00	-18.95	28.50	6.55	Average	100	68
4	4844.00	47.75	74.00	-26.25	41.20	6.55	Peak	100	68
5	7266.00	40.37	54.00	-13.63	28.76	11.61	Average	100	137
6	7266.00	52.93	74.00	-21.07	41.32	11.61	Peak	100	137

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).

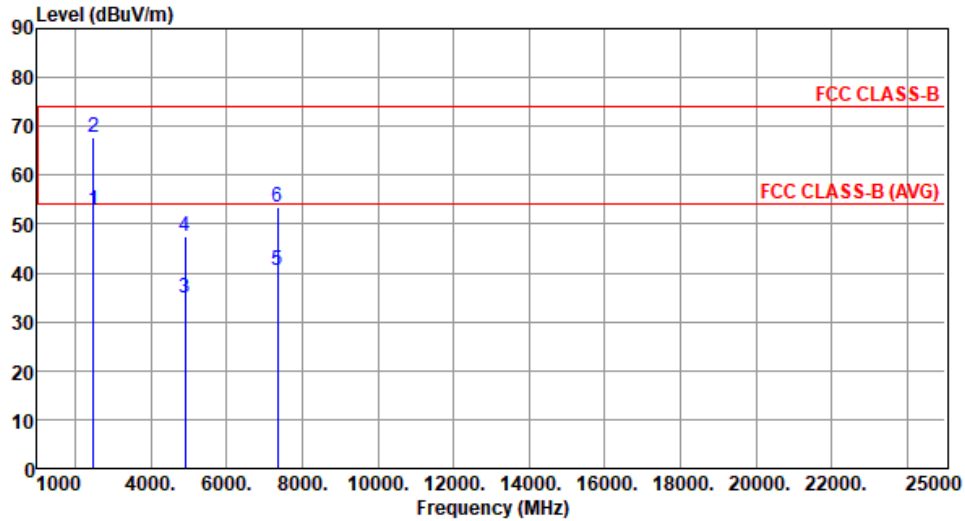
Modulation	HT40	Test Freq. (MHz)	2422
Polarization	Vertical		
Level (dBUV/m) <			

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		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2483.50	52.91	54.00	-1.09	52.66	0.25	Average	258	89
2	2483.50	67.66	74.00	-6.34	67.41	0.25	Peak	258	89
3	4904.00	34.77	54.00	-19.23	28.35	6.42	Average	100	125
4	4904.00	47.62	74.00	-26.38	41.20	6.42	Peak	100	125
5	7356.00	40.53	54.00	-13.47	28.71	11.82	Average	100	163
6	7356.00	53.40	74.00	-20.60	41.58	11.82	Peak	100	163

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).

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 30 dB relative to the maximum in-band peak PSD level in 100 kHz.

3.6.2 Test Procedures

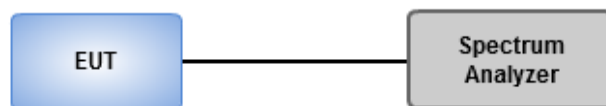
Reference level measurement

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

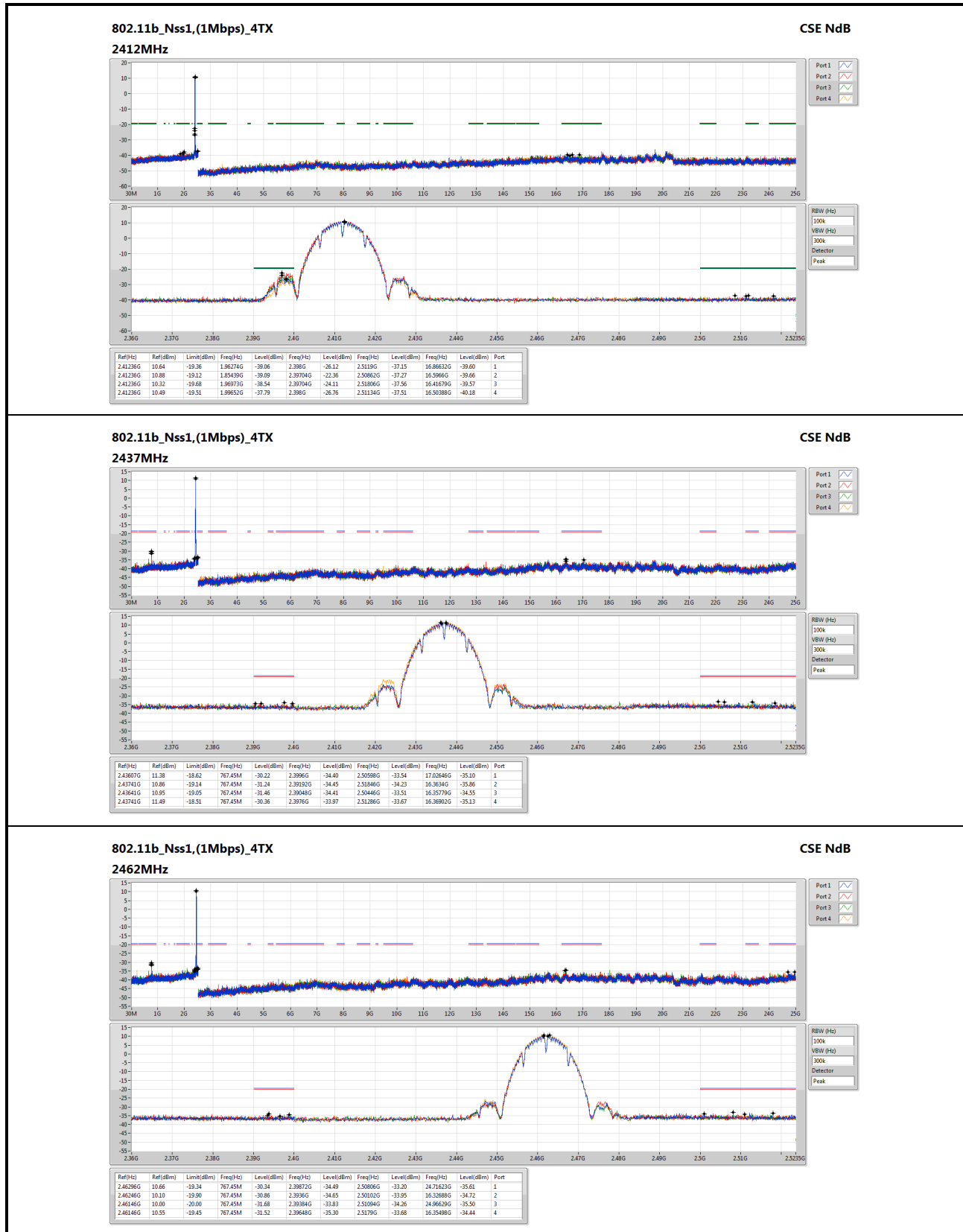
Emission level measurement

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

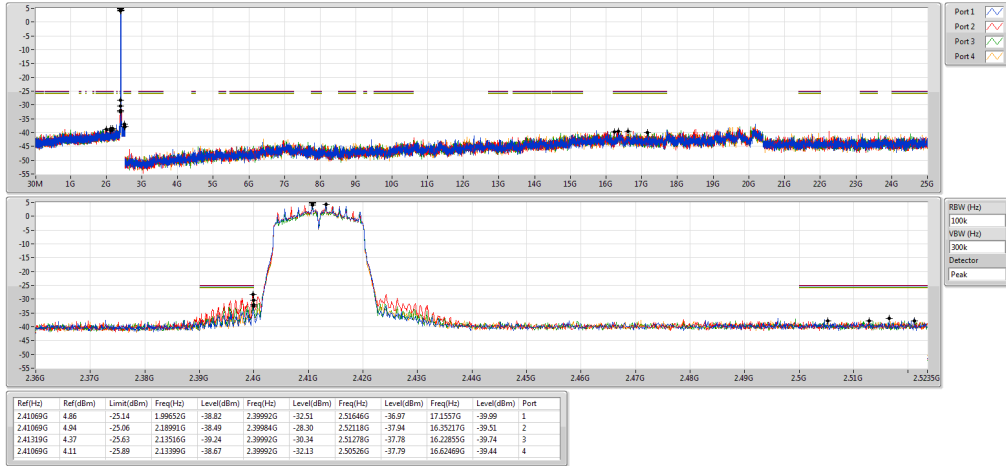


3.6.4 Unwanted Emissions into Non-Restricted Frequency Bands



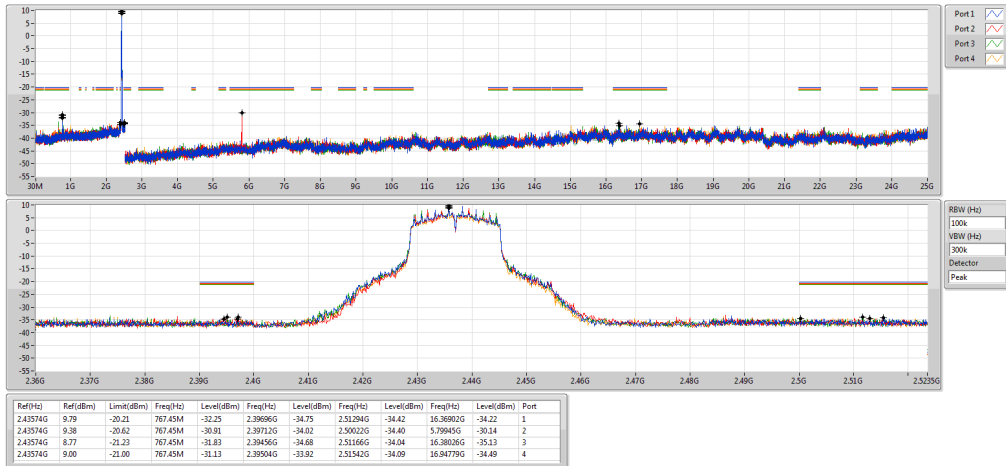
802.11g_Nss1,(6Mbps)_4TX
2412MHz

CSE NdB



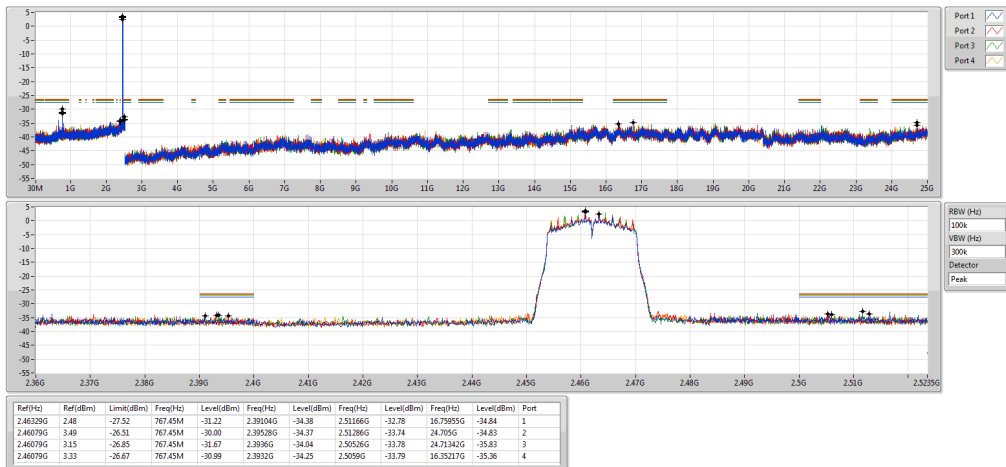
802.11g_Nss1,(6Mbps)_4TX
2437MHz

CSE NdB



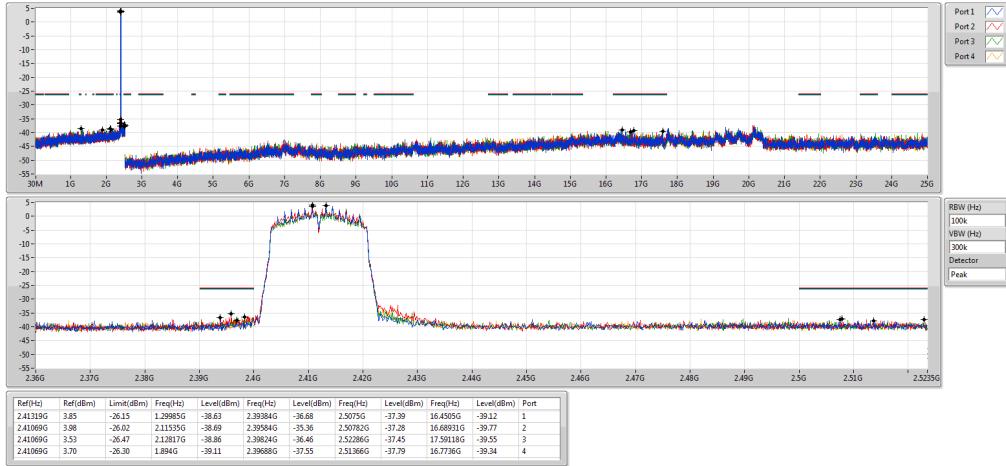
802.11g_Nss1,(6Mbps)_4TX
2462MHz

CSE NdB



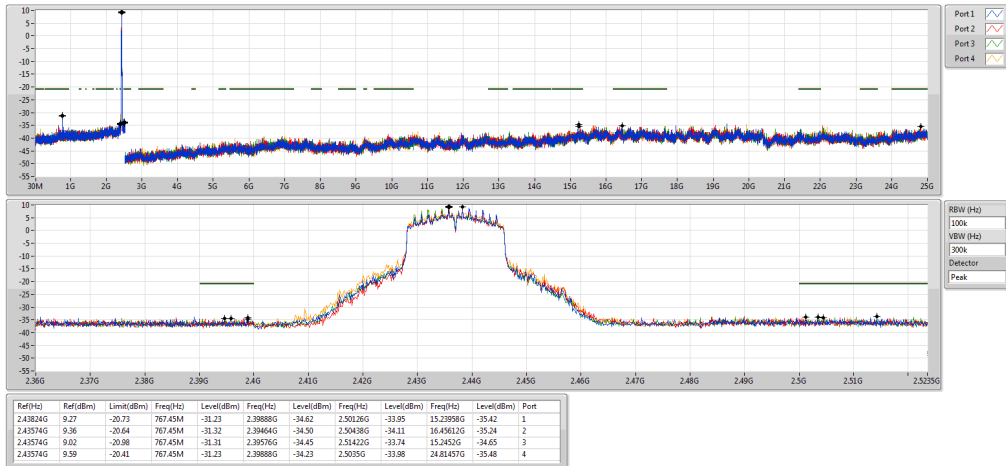
802.11n HT20_Nss1,(MCS0)_4TX
2412MHz

CSE NdB



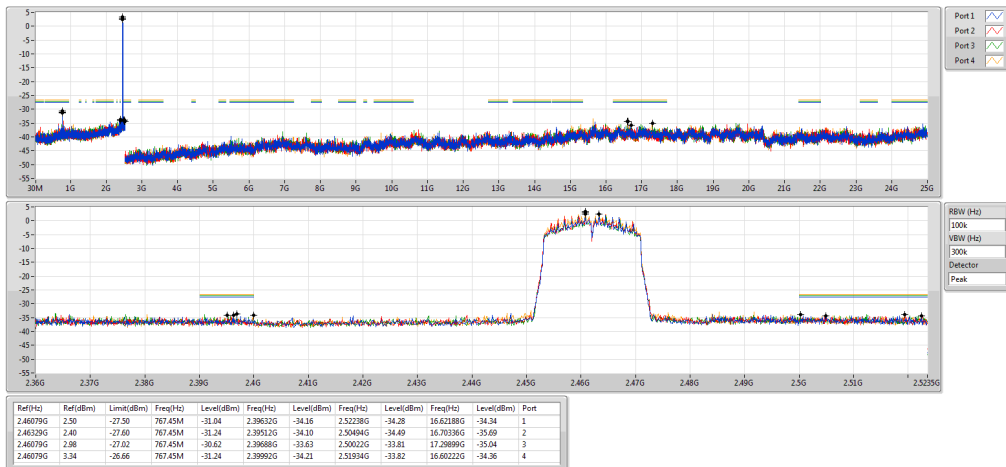
802.11n HT20_Nss1,(MCS0)_4TX
2437MHz

CSE NdB



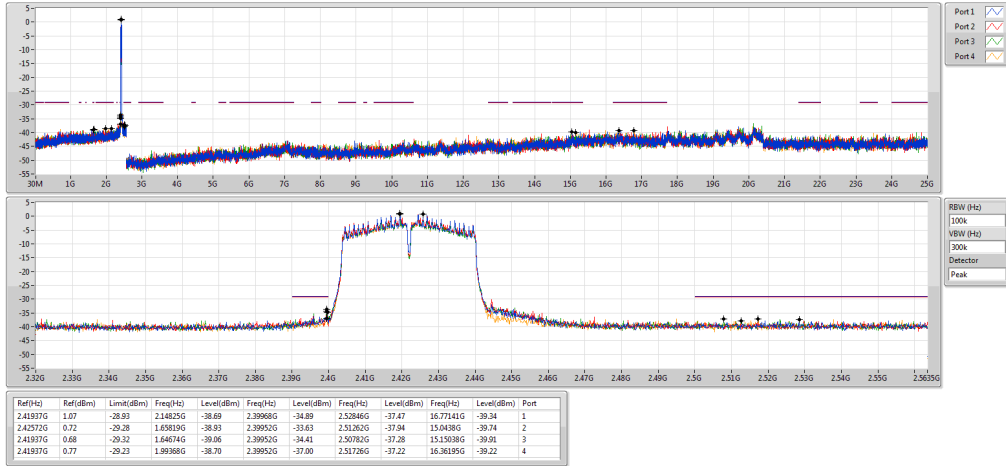
802.11n HT20_Nss1,(MCS0)_4TX
2462MHz

CSE NdB



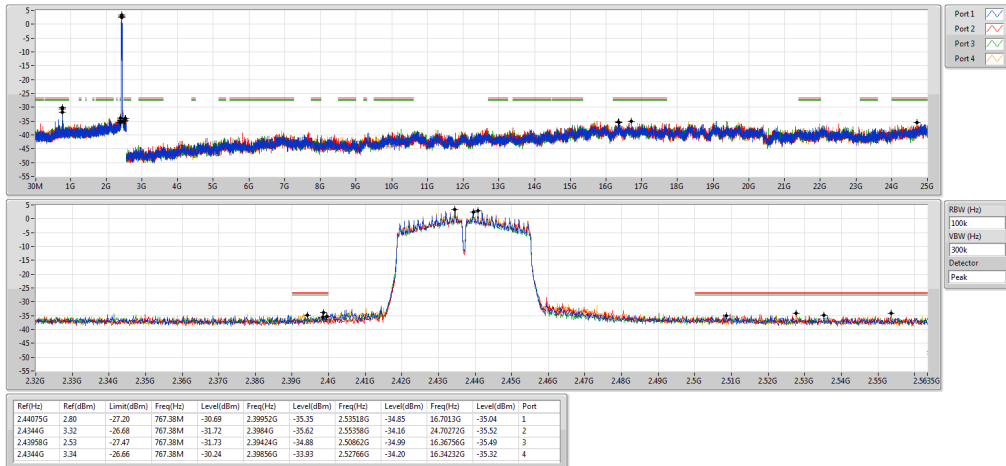
802.11n HT40_Nss1,(MCS0)_4TX
2422MHz

CSE NdB



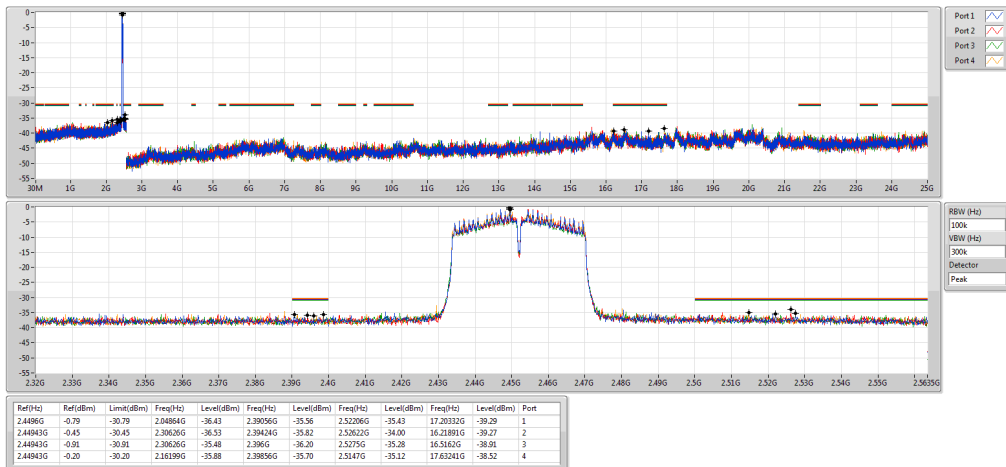
802.11n HT40_Nss1,(MCS0)_4TX
2437MHz

CSE NdB



802.11n HT40_Nss1,(MCS0)_4TX
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.

Tel: 886-3-271-8666

Fax: 886-3-318-0155

Email: ICC_Service@icertifi.com.tw

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