Report No. : FR0D1713AA





RADIO TEST REPORT

FCC ID	:	UDX-60069010
Equipment		Network Camera
Brand Name	3	CISCO
Model Name	:	MV2-HW
Applicant		Cisco Systems, Inc. 170 West Tasman Drive, San Jose, CA 95134, USA
Manufacturer		Cisco Systems, Inc. 170 West Tasman Drive, San Jose, CA 95134, USA
Factory		LITE-ON Technology Corp. Networking Plant No. 101, Neihuan N. Rd., Nanzi Processing Export, Nanzi Dist., Kaohsiung City 811, Taiwan
Standard	:	47 CFR FCC Part 15.247

The product was received on Jan. 28, 2021, and testing was started from Jan. 29, 2021 and completed on Apr. 08, 2021. We, Sporton International Inc. Hsinchu Laboratory, would like to declare that the tested sample has been evaluated in accordance with the procedures given in ANSI C63.10-2013 and shown compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International Inc. Hsinchu Laboratory, the test report shall not be reproduced except in full.

Approved by: Sam Chen

Sporton International Inc. Hsinchu Laboratory No.8, Ln. 724, Bo'ai St., Zhubei City, Hsinchu County 302010, Taiwan (R.O.C.)



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History of this test report

Report No.	Version	Description	Issued Date
FR0D1713AA	01	Initial issue of report	May 14, 2021



Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
1.1.2	15.203	Antenna Requirement	PASS	-
3.1	15.207	AC Power-line Conducted Emissions	PASS	-
3.2	15.247(a)	DTS Bandwidth	PASS	-
3.3	15.247(b)	Maximum Conducted Output Power	PASS	-
3.4	15.247(e)	Power Spectral Density	PASS	-
3.5	15.247(d)	Emissions in Non-restricted Frequency Bands	PASS	-
3.6	15.247(d)	Emissions in Restricted Frequency Bands	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.

Reviewed by: Sam Chen

Report Producer: Viola Huang



1 General Description

1.1 Information

1.1.1 RF General Information

Frequency Range (MHz)	IEEE Std. 802.11	Ch. Frequency (MHz)	Channel Number
2400-2483.5	b, g, n (HT20)	2412-2462	1-11 [11]
2400-2483.5	n (HT40)	2422-2452	3-9 [7]

Band Mode		BWch (MHz)	Nant
2.4-2.4835GHz	802.11b	20	1
2.4-2.4835GHz	802.11g	20	1
2.4-2.4835GHz	802.11n HT20	20	1
2.4-2.4835GHz	802.11n HT40	40	1

Note:

- 11b mode uses a combination of DSSS-DBPSK, DQPSK, CCK modulation.
- 11g, HT20 and HT40 use a combination of OFDM-BPSK, QPSK, 16QAM, 64QAM modulation.
- BWch is the nominal channel bandwidth.



1.1.2 Antenna Information

		Port	Port					
Ant.	WLAN 2.4GHz	WLAN 5GHz	Bluetooth	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	2	2	2	Aristotle	RFA-25-10159-P1-V3	PIFA Antenna	I-PEX	Note 1
2	1	1	1	Aristotle	RFA-25-10159-P2	PIFA Antenna	I-PEX	NOLE I

Note 1:

Ant.	Gain (dBi)				
Ant.	WLAN 2.4GHz	WLAN 5GHz	Bluetooth		
1	1.3	2.25	1.3		
2	2.68	2.67	2.68		

Note 2: The above information was declared by manufacturer.

Note 3: The EUT has two antennas.

For 2.4GHz WLAN function

IEEE 802.11b/g/n mode (1TX/1RX):

The EUT supports the antenna with TX and RX diversity functions.

Both port 1 and port 2 support transmit and receive functions, but only one of them will be used at one time.

The port 1 generated the worst case, so it was selected to test and record in the report.

For 5GHz WLAN function

IEEE 802.11a/n/ac mode (1TX/1RX):

The EUT supports the antenna with TX and RX diversity functions.

Both port 1 and port 2 support transmit and receive functions, but only one of them will be used at one time.

The port 1 generated the worst case, so it was selected to test and record in the report.

For Bluetooth function (1TX/1RX):

The EUT supports the antenna with TX and RX diversity functions.

Both port 1 and port 2 support transmit and receive functions, but only one of them will be used at one time.

The port 1 generated the worst case, so it was selected to test and record in the report.



1.1.3 Mode Test Duty Cycle

Mode	DC	DCF(dB)	T(s)	VBW(Hz) ≥ 1/T
802.11b	0.971	0.13	8.195m	300
802.11g	0.882	0.55	1.361m	1k
802.11n HT20	0.842	0.75	1.149m	1k
802.11n HT40	0.762	1.18	632.5u	Зk

Note:

• DC is Duty Cycle.

DCF is Duty Cycle Factor.

1.1.4 EUT Operational Condition

EUT Power Type	From power adapter or host system				
Beamforming Function	With beamforming Without beamforming				
Test Software Version	QRCT.exe Version 4.0.00156.0				

Note: The above information was declared by manufacturer.



1.2 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- 47 CFR FCC Part 15
- ANSI C63.10-2013

The following reference test guidance is not within the scope of accreditation of TAF.

- FCC KDB 558074 D01 v05r02
- FCC KDB 414788 D01 v01r01

1.3 Testing Location Information

Testing Location Information

Test Lab. · Sporton	International Inc. Hsinchu La	boratory
Hsinchu	ADD: No.8, Ln. 724, Bo'ai	St., Zhubei City, Hsinchu County 302010, Taiwan (R.O.C.)
(TAF: 3787)	TEL: 886-3-656-9065	FAX: 886-3-656-9085
	Test site Designation No. T	W3787 with FCC.
	Conformity Assessment Bo	dy Identifier (CABID) TW3787 with ISED.

Test Condition	Test Site No.	Test Engineer	Test Environment (°C / %)	Test Date
RF Conducted	TH03-CB	Nyle Chang	20.4~21.2 / 54~57	Feb. 02, 2021~Feb. 03, 2021
Radiated (for below 1GHz)	03CH05-CB	Cola Fan	21.3~22.5 / 55~58	Apr. 08, 2021
Radiated (for above 1GHz)	03CH02-CB	Brian Sun	20.1~21.3 / 56~58	Jan. 29, 2021~Feb. 01, 2021
	03CH04-CB	Brian Sun	21.5~22.6 / 55~58	Jan. 29, 2021~Feb. 01, 2021
AC Conduction	CO02-CB	Ryo Fan	21~22 / 58~59	Feb. 26, 2021

1.4 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)

Test Items	Uncertainty	Remark
Conducted Emission (150kHz ~ 30MHz)	2.0 dB	Confidence levels of 95%
Radiated Emission (9kHz ~ 30MHz)	3.8 dB	Confidence levels of 95%
Radiated Emission (30MHz ~ 1,000MHz)	5.6 dB	Confidence levels of 95%
Radiated Emission (1GHz ~ 18GHz)	5.0 dB	Confidence levels of 95%
Radiated Emission (18GHz ~ 40GHz)	4.9 dB	Confidence levels of 95%
Conducted Emission	2.8 dB	Confidence levels of 95%
Output Power Measurement	1.4 dB	Confidence levels of 95%
Power Density Measurement	2.8 dB	Confidence levels of 95%
Bandwidth Measurement	0.4%	Confidence levels of 95%



2 Test Configuration of EUT

2.1 Test Channel Mode

Mode	Power Setting
802.11b_Nss1,(1Mbps)_1TX	-
2412MHz	21
2437MHz	21
2462MHz	21
802.11g_Nss1,(6Mbps)_1TX	-
2412MHz	17
2417MHz	19
2437MHz	20
2462MHz	18
802.11n HT20_Nss1,(MCS0)_1TX	-
2412MHz	17
2417MHz	19
2437MHz	20
2457MHz	18
2462MHz	16
802.11n HT40_Nss1,(MCS0)_1TX	-
2422MHz	17
2437MHz	19
2452MHz	18

2.2 Test Voltage

120 V / 60 Hz



2.3 The Worst Case Measurement Configuration

The Worst Case Mode for Following Conformance Tests		
Tests Item	AC power-line conducted emissions	
Condition	AC power-line conducted measurement for line and neutral	
Operating Mode	Normal Link	
1	EUT_2.4GHz + powered from adapter	
2	EUT_5GHz + powered from adapter	
Mode 2 has been evaluated to be the worst case among Mode 1~2, thus measurement for Mode 3 will follow this same test mode.		
3 EUT_5GHz + powered from host system		
For operating mode 2 is the worst case and it was record in this test report.		

The Worst Case Mode for Following Conformance Tests	
Tests Item	DTS Bandwidth Maximum Conducted Output Power Power Spectral Density Emissions in Non-restricted Frequency Bands
Test Condition	Conducted measurement at transmit chains

Th	e Worst Case Mode for Following Conformance Tests	
Tests Item	Emissions in Restricted Frequency Bands	
Test Condition	Radiated measurement If EUT consist of multiple antenna assembly (multiple antenna are used in EUT regardless of spatial multiplexing MIMO configuration), the radiated test should be performed with highest antenna gain of each antenna type.	
Operating Mode < 1GHz	Normal Link	
1	EUT in Z axis_2.4GHz + powered from adapter	
2	EUT in Y axis _2.4GHz + powered from adapter	
Mode 2 has been evaluated to be the worst case among Mode 1~2, thus measurement for Mode 3 will t this same test mode.		
3	EUT in Y axis _5GHz + powered from adapter	
Mode 2 has been evaluated to be the worst case among Mode 1~3, thus measurement for Mode 4 will follo this same test mode.		
4	EUT in Y axis _2.4GHz + powered from host system	
For operating mode 4 is th	e worst case and it was record in this test report.	



	CTX
	The EUT was performed at Y axis and Z axis position and the harmonic worst case was found at Y axis and the bandedge worst case was found at Z axis. So the measurement will follow this same test
1	EUT in Y axis for harmonic and EUT in Z axis for bandedge

2.4 EUT Operation during Test

For CTX Mode:

The EUT was programmed to be in continuously transmitting mode.

For Normal Link:

During the test, the EUT operation to normal function.



2.5 Accessories

Accessories				
Equipment Name	Brand Name	Model Name	Rating	
AC Adapter CISCO MA-PWR-USB-US INPUT: 100-240V, 50-60Hz, 0.32A max OUTPUT: 5.0V, 2.0A				
Others				
USB cable*1, Shielded, 3m				
Wall Mount*1				

2.6 Support Equipment

For AC Conduction:

	Support Equipment			
No.	Equipment	Brand Name	Model Name	FCC ID
А	AP Router	ASUS	RP-N53	MSQ-RPN53
В	B AP NB DELL E6430 N/A		N/A	
С	Smart phone	Samsung	Galaxy J2	N/A

For Radiated (below 1GHz):

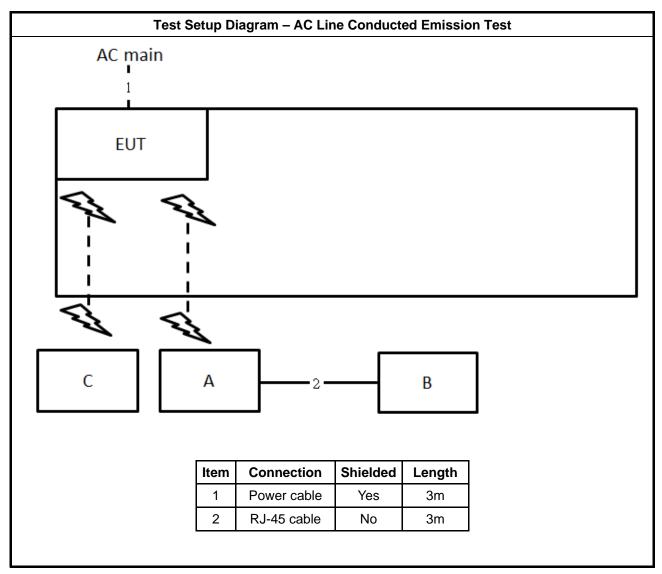
	Support Equipment			
No.	No. Equipment Brand Name Model Name FCC ID		FCC ID	
А	Notebook	DELL	E4300	N/A
В	Notebook	DELL	E4300	N/A
С	WLAN AP	D-LINK	DIR860L	KA2IR860LA1
D	Smart phone	Samsung	Galaxy J2	N/A
Е	Earphone	e-Power	S90W	N/A
F	Mouse	Logitech	M-U0026	N/A

For Radiated (above 1GHz) and RF Conducted:

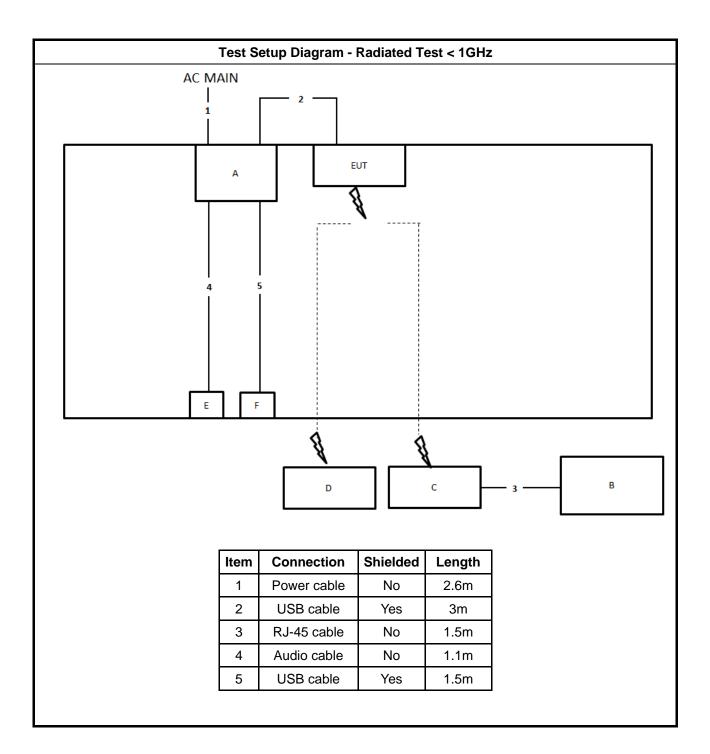
	Support Equipment			
No.	No. Equipment Brand Name Model Name FCC ID			
А	Notebook	DELL	E4300	N/A



2.7 Test Setup Diagram

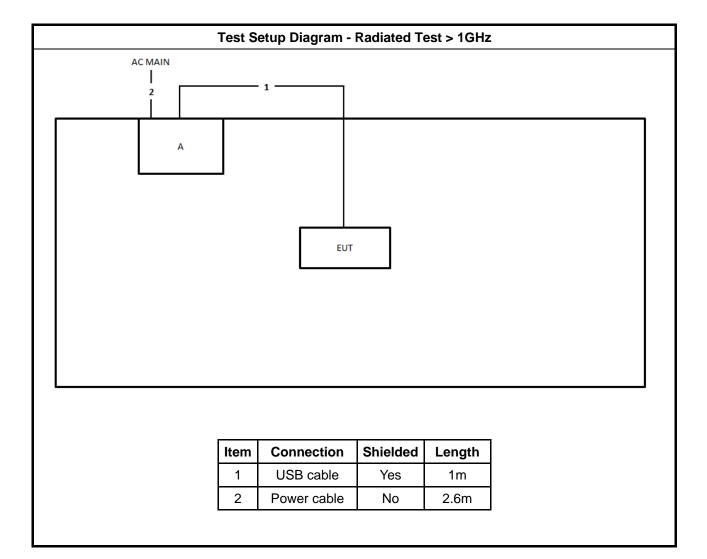














3 Transmitter Test Result

3.1 AC Power-line Conducted Emissions

3.1.1 AC Power-line Conducted Emissions Limit

AC Power-line 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.			

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3.1.2 Measuring Instruments

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

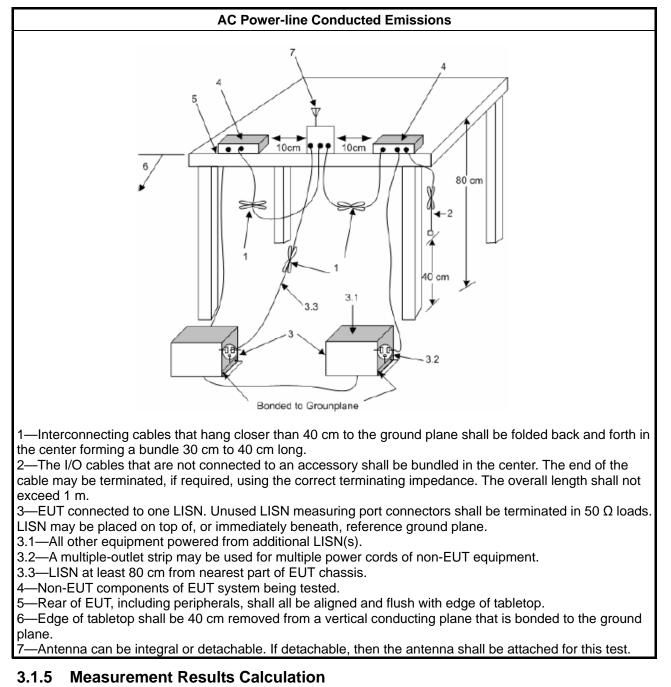
3.1.3 Test Procedures

Test Method

Refer as ANSI C63.10-2013, clause 6.2 for AC power-line conducted emissions.



3.1.4 Test Setup



The measured Level is calculated using:

- a. Corrected Reading: LISN Factor (LISN) + Attenuator (AT/AUX) + Cable Loss (CL) + Read Level (Raw) = Level
- b. Margin = -Limit + Level

3.1.6 Test Result of AC Power-line Conducted Emissions

Refer as Appendix A



3.2 DTS Bandwidth

3.2.1 6dB Bandwidth Limit

Systems using digital modulation techniques:	6dB Bandwidth Limit		
 6 dB bandwidth ≥ 500 kHz. 			

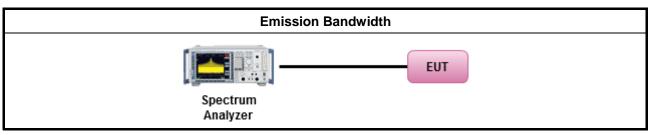
3.2.2 Measuring Instruments

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

3.2.3 Test Procedures

	Test Method								
•	 For the emission bandwidth shall be measured using one of the options below: 								
	\boxtimes	Refer as FCC KDB 558074, clause 8.2 & C63.10 clause 11.8.1 Option 1 for 6 dB bandwidth measurement.							
		Refer as FCC KDB 558074, clause 8.2 & C63.10 clause 11.8.2 Option 2 for 6 dB bandwidth measurement.							
		Refer as ANSI C63.10, clause 6.9.1 for occupied bandwidth testing.							

3.2.4 Test Setup



3.2.5 Test Result of Emission Bandwidth

Refer as Appendix B



3.3 Maximum Conducted Output Power

3.3.1 Maximum Conducted Output Power Limit

Maximum	Conducted	Output	Power Limit
	•••••••••	• aip ai	

If $G_{TX} \leq 6$ dBi, then $P_{Out} \leq 30$ dBm (1 VV)		If $G_{TX} \le 6$ dBi, then $P_{Out} \le 30$ dBm (1 W)	
---	--	--	--

- Point-to-point systems (P2P): If $G_{TX} > 6$ dBi, then $P_{Out} = 30 (G_{TX} 6)/3$ dBm
- Smart antenna system (SAS):

- Single beam: If $G_{TX} > 6$ dBi, then $P_{Out} = 30 - (G_{TX} - 6)/3$ dBm

- Overlap beam: If $G_{TX} > 6 \text{ dBi}$, then $P_{Out} = 30 - (G_{TX} - 6)/3 \text{ dBm}$

- Aggregate power on all beams: If $G_{TX} > 6 \text{ dBi}$, then $P_{Out} = 30 - (G_{TX} - 6)/3 + 8 \text{dB dBm}$

 P_{Out} = maximum peak conducted output power or maximum conducted output power in dBm, G_{TX} = the maximum transmitting antenna directional gain in dBi.

3.3.2 Measuring Instruments

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

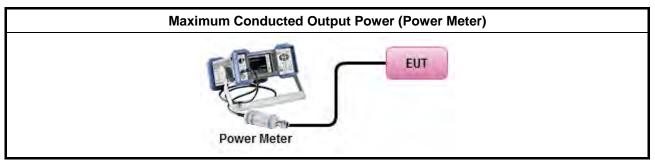


3.3.3 Test Procedures

		Test Method						
•	Max	mum Peak Conducted Output Power						
		Refer as FCC KDB 558074, clause 8.3.1.1 & C63.10 clause 11.9.1.1 (RBW \ge EBW method).						
		Refer as FCC KDB 558074, clause 8.3.1.3 & C63.10 clause 11.9.1.3 (peak power meter).						
•	Maximum Conducted Output Power							
	[duty	r cycle ≥ 98% or external video / power trigger]						
		Refer as FCC KDB 558074, clause 8.3.2.2 & C63.10 clause 11.9.2.2.2 Method AVGSA-1.						
		Refer as FCC KDB 558074, clause 8.3.2.2 & C63.10 clause 11.9.2.2.3 Method AVGSA-1A. (alternative)						
	duty	cycle < 98% and average over on/off periods with duty factor						
		Refer as FCC KDB 558074, clause 8.3.2.2 & C63.10 clause 11.9.2.2.4 Method AVGSA-2.						
		Refer as FCC KDB 558074, clause 8.3.2.2 & C63.10 clause 11.9.2.2.5 Method AVGSA-2A (alternative)						
		Refer as FCC KDB 558074, clause 8.3.2.2 & C63.10 clause 11.9.2.2.6 Method AVGSA-3						
		Refer as FCC KDB 558074, clause 8.3.2.2 & C63.10 clause 11.9.2.2.7 Method AVGSA-3A (alternative)						
	Mea	surement using a power meter (PM)						
		Refer as FCC KDB 558074, clause 8.3.2.3 & C63.10 clause 11.9.2.3.1 Method AVGPM (using an RF average power meter).						
	\boxtimes	Refer as FCC KDB 558074, clause 8.3.2.3 & C63.10 clause 11.9.2.3.2 Method AVGPM-G (using an gate RF average power meter).						
•	For	conducted measurement.						
		If the EUT supports multiple transmit chains using options given below: Refer as FCC KDB 662911, In-band power measurements. Using the measure-and-sum approach, measured all transmit ports individually. Sum the power (in linear power units e.g., mW) of all ports for each individual sample and save them.						
	•	If multiple transmit chains, EIRP calculation could be following as methods: $P_{total} = P_1 + P_2 + + P_n$ (calculated in linear unit [mW] and transfer to log unit [dBm]) $EIRP_{total} = P_{total} + DG$						



3.3.4 Test Setup



3.3.5 Test Result of Maximum Conducted Output Power

Refer as Appendix C



3.4 **Power Spectral Density**

3.4.1 Power Spectral Density Limit

Power Spectral Density Limit
Power Spectral Density (PSD) ≤ 8 dBm/3kHz

3.4.2 Measuring Instruments

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

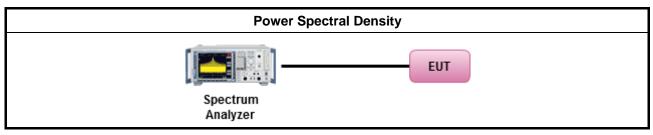
3.4.3 Test Procedures

•

	Test Method								
-	Peak power spectral density procedures that the same method as used to determine the conducted output power. If maximum peak conducted output power was measured to demonstrate compliance to the output power limit, then the peak PSD procedure below (Method PKPSD) shall be used. If maximum conducted output power was measured to demonstrate compliance to the output power limit, then one of the average PSD procedures shall be used, as applicable based on the following criteria (the peak PSD procedure is also an acceptable option).								
	\boxtimes	Refe	er as FCC KDB 558074, clause 8.4 & C63.10 clause 11.10 Method Max. PSD.						
	For	cond	ucted measurement.						
	•	lf Th	e EUT supports multiple transmit chains using options given below:						
			Option 1: Measure and sum the spectra across the outputs. Refer as FCC KDB 662911, In-band power spectral density (PSD). Sample all transmit ports simultaneously using a spectrum analyzer for each transmit port. Where the trace bin-by-bin of each transmit port summing can be performed. (i.e., in the first spectral bin of output 1 is summed with that in the first spectral bin of output 2 and that from the first spectral bin of output 3, and so on up to the NTX output to obtain the value for the first frequency bin of the summed spectrum.). Add up the amplitude (power) values for the different transmit chains and use this as the new data trace.						
			Option 2: Measure and sum spectral maxima across the outputs. With this technique, spectra are measured at each output of the device at the required resolution bandwidth. The maximum value (peak) of each spectrum is determined. These maximum values are then summed mathematically in linear power units across the outputs. These operations shall be performed separately over frequency spans that have different out-of-band or spurious emission limits,						
			Option 3: Measure and add 10 log(N) dB, where N is the number of transmit chains. Refer as FCC KDB 662911, In-band power spectral density (PSD). Performed at each transmit chains and each transmit chains shall be compared with the limit have been reduced with 10 log(N). Or each transmit chains shall be add 10 log(N) to compared with the limit.						



3.4.4 Test Setup



3.4.5 Test Result of Power Spectral Density

Refer as Appendix D



3.5 Emissions in Non-restricted Frequency Bands

3.5.1 Emissions in Non-restricted Frequency Bands Limit

Un-restricted Band Emissions Limit						
Limit (dBc)						
20						
30						

Note 1: If the peak output power procedure is used to measure the fundamental emission power to demonstrate compliance to requirements, then the peak conducted output power measured within any 100 kHz outside the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum measured in-band peak PSD level.

Note 2: If the average output power procedure is used to measure the fundamental emission power to demonstrate compliance to requirements, then the power in any 100 kHz outside of the authorized frequency band shall be attenuated by at least 30 dB relative to the maximum measured in-band average PSD level.

3.5.2 Measuring Instruments

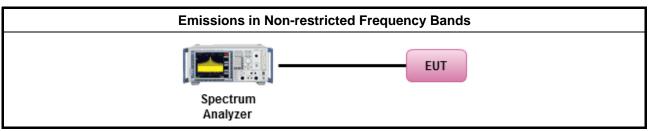
Refer a test equipment and calibration data table in this test report.

3.5.3 Test Procedures

Test Method

Refer as FCC KDB 558074, clause 8.5 for unwanted emissions into non-restricted bands.

3.5.4 Test Setup



3.5.5 Test Result of Emissions in Non-restricted Frequency Bands

Refer as Appendix E



3.6 Emissions in Restricted Frequency Bands

3.6.1 Emissions in Restricted Frequency Bands Limit

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: Test distance for frequencies at or above 30 MHz, measurements may be performed at a distance other than the limit distance provided they are not performed in the near field and the emissions to be measured can be detected by the measurement equipment. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse of linear distance for field-strength measurements, inverse of linear distance-squared for power-density measurements).

Note 2: Test distance for frequencies at below 30 MHz, measurements may be performed at a distance closer than the EUT limit distance; however, an attempt should be made to avoid making measurements in the near field. When performing measurements below 30 MHz at a closer distance than the limit distance, the results shall be extrapolated to the specified distance by either making measurements at a minimum of two or more distances on at least one radial to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB/decade). The test report shall specify the extrapolation method used to determine compliance of the EUT.

Note 3: Using the distance of 1m during the test for above 18 GHz, and the test value to correct for the distance factor at 3m.

3.6.2 Measuring Instruments

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

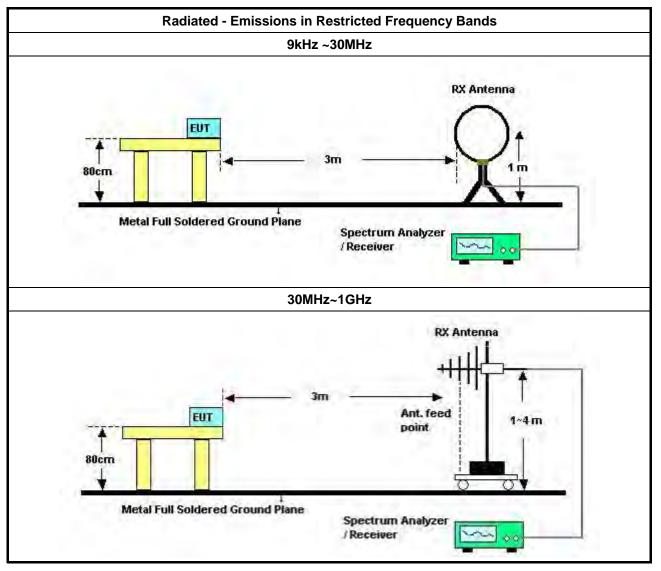


3.6.3 Test Procedures

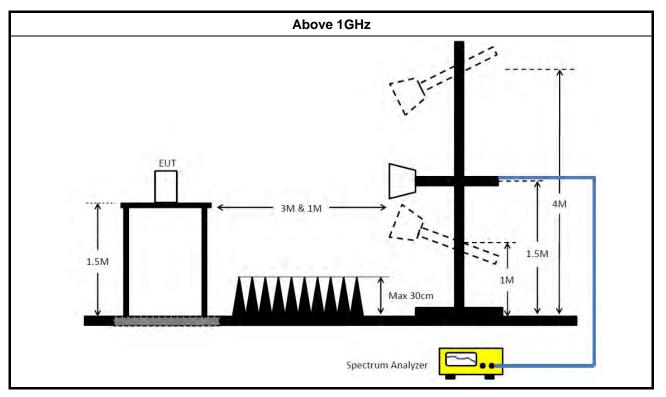
	Test Method							
•	The average emission levels shall be measured in [duty cycle \geq 98 or duty factor].							
•	Refer as ANSI C63.10, clause 6.10.3 band-edge testing shall be performed at the lowest frequency channel and highest frequency channel within the allowed operating band.							
•	For the transmitter unwanted emissions shall be measured using following options below:							
	 Refer as FCC KDB 558074, clause 8.6 for unwanted emissions into restricted bands. 							
	Refer as FCC KDB 558074, clause 8.6 & C63.10 clause 11.12.2.5.1(trace averaging for duty cycle ≥98%).							
	Refer as FCC KDB 558074, clause 8.6 & C63.10 clause 11.12.2.5.2(trace averaging + duty factor).							
	☑ Refer as FCC KDB 558074, clause 8.6 & C63.10 clause 11.12.2.5.3(Reduced VBW≥1/T).							
	□ Refer as ANSI C63.10, clause 11.12.2.5.3 (Reduced VBW). VBW \ge 1/T, where T is pulse time.							
	Refer as ANSI C63.10, clause 7.5 average value of pulsed emissions.							
	Refer as FCC KDB 558074, clause 8.6 & C63.10 clause 11.12.2.4 measurement procedure peak limit.							
•	For the transmitter band-edge emissions shall be measured using following options below:							
	 Refer as FCC KDB 558074 clause 8.7 & C63.10 clause 11.13.1, When the performing peak or average radiated measurements, emissions within 2 MHz of the authorized band edge may be measured using the marker-delta method described below. 							
	 Refer as FCC KDB 558074, clause 8.7 (ANSI C63.10, clause 6.10.6) for marker-delta method for band-edge measurements. 							
	 Refer as FCC KDB 558074, clause 8.7 for narrower resolution bandwidth (100kHz) using the band power and summing the spectral levels (i.e., 1 MHz). 							
	 For conducted unwanted emissions into restricted bands (absolute emission limits). Devices with multiple transmit chains using options given below: (1) Measure and sum the spectra across the outputs or (2) Measure and add 10 log(N) dB 							
	 For FCC KDB 662911 The methodology described here may overestimate array gain, thereby resulting in apparent failures to satisfy the out-of-band limits even if the device is actually compliant. In such cases, compliance may be demonstrated by performing radiated tests around the frequencies at which the apparent failures occurred. 							



3.6.4 Test Setup







3.6.5 Measurement Results Calculation

The measured Level is calculated using:

Corrected Reading: Antenna factor (AF) + Cable loss (CL) + Read level (Raw) - Preamp factor (PA)(if applicable) = Level.

3.6.6 Emissions in Restricted Frequency Bands (Below 30MHz)

There is a comparison data of both open-field test site and alternative test site - semi-Anechoic chamber according to KDB414788 Radiated Test Site, and the result came out very similar.

All amplitude of spurious emissions that are attenuated by more than 20 dB below the permissible value has no need to be reported.

The radiated emissions were investigated from 9 kHz or the lowest frequency generated within the device, up to the 10th harmonic or 40 GHz, whichever is appropriate.

3.6.7 Test Result of Emissions in Restricted Frequency Bands

Refer as Appendix F



Test Equipment and Calibration Data 4

					Calibration	Calibration	
Instrument	Brand	Model No.	Serial No.	Characteristics	Date	Due Date	Remark
LISN	Schwarzbeck	NSLK 8127	8127650	9kHz ~ 30MHz	Dec. 04, 2020	Dec. 03, 2021	Conduction (CO02-CB)
LISN	Schwarzbeck	NSLK 8127	8127478	9kHz ~ 30MHz	Nov. 20, 2020	Nov. 19, 2021	Conduction (CO02-CB)
EMI Receiver	Agilent	N9038A	MY52260140	9kHz ~ 8.4GHz	Mar. 10, 2020	Mar. 09, 2021	Conduction (CO02-CB)
COND Cable	Woken	Cable	2	0.15MHz~30MHz	Oct. 20, 2020	Oct. 19, 2021	Conduction (CO02-CB)
Software	SPORTON	SENSE	V5.10	-	N.C.R.	N.C.R.	Conduction (CO02-CB)
Pulse Limiter	Schwarzbeck	VTSD 9561F-N	00378	9kHz ~ 30MHz	Mar. 19, 2020	Mar. 18, 2021	Conduction (CO02-CB)
Loop Antenna	Teseq	HLA 6120	24155	9kHz - 30 MHz	Apr. 13, 2020	Apr. 12, 2021	Radiation (03CH05-CB)
3m Semi Anechoic Chamber NSA	TDK	SAC-3M	03CH05-CB	30 MHz ~ 1 GHz	Aug. 10, 2020	Aug. 09, 2021	Radiation (03CH05-CB)
Bilog Antenna with 6dB Attenuator	TESEQ & EMCI	CBL 6112D & N-6-06	35236 & AT-N0610	30MHz ~ 2GHz	Mar. 26, 2021	Mar. 25, 2022	Radiation (03CH05-CB)
Pre-Amplifier	EMCI	EMC330N	980331	20MHz ~ 3GHz	Apr. 28, 2020	Apr. 27, 2021	Radiation (03CH05-CB)
Spectrum Analyzer	R&S	FSP40	100304	9kHz ~ 40GHz	Nov. 10, 2020	Nov. 09, 2021	Radiation (03CH05-CB)
EMI Test Receiver	R&S	ESCS	826547/017	9kHz ~ 2.75GHz	May 13, 2020	May 12, 2021	Radiation (03CH05-CB)
RF Cable-low	Woken	RG402	Low Cable-04+23	30MHz~1GHz	Oct. 05, 2020	Oct. 04, 2021	Radiation (03CH05-CB)
Test Software	SPORTON	SENSE	V5.10	-	N.C.R.	N.C.R.	Radiation (03CH05-CB)
3m Semi Anechoic Chamber VSWR	RIKEN	SAC-3M	03CH02-CB	1GHz ~18GHz 3m	Mar. 28, 2020	Mar. 27, 2021	Radiation (03CH02-CB)
Horn Antenna	EMCO	3115	9610-4976	1GHz ~ 18GHz	Apr. 21, 2020	Apr. 20, 2021	Radiation (03CH02-CB)
Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170252	15GHz ~ 40GHz	Jul. 21, 2020	Jul. 20, 2021	Radiation (03CH02-CB)
Pre-Amplifier	Agilent	83017A	MY39501305	1GHz ~ 26.5GHz	Jul. 13, 2020	Jul. 12, 2021	Radiation (03CH02-CB)
Pre-Amplifier	MITEQ	TTA1840-35-HG	1864479	18GHz ~ 40GHz	Jul. 08, 2020	Jul. 07, 2021	Radiation (03CH02-CB)
Spectrum analyzer	R&S	FSU	100015	9kHz~26GHz	Oct. 15, 2020	Oct. 14, 2021	Radiation (03CH02-CB)
RF Cable-high	Woken	RG402	High Cable-18	1GHz ~ 18GHz	Oct. 05, 2020	Oct. 04, 2021	Radiation (03CH02-CB)
RF Cable-high	Woken	RG402	High Cable-18+19	1GHz ~ 18GHz	Oct. 05, 2020	Oct. 04, 2021	Radiation (03CH02-CB)

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Instrument	Brand	Model No.	Serial No.	Characteristics	Calibration Date	Calibration Due Date	Remark
RF Cable-high	Woken	RG402	High Cable-40G#1	18GHz ~ 40 GHz	Jul. 16, 2020	Jul. 15, 2021	Radiation (03CH02-CB)
RF Cable-high	Woken	RG402	High Cable-40G#2	18GHz ~ 40 GHz	Jul. 16, 2020	Jul. 15, 2021	Radiation (03CH02-CB)
Test Software	SPORTON	SENSE	V5.10	-	N.C.R.	N.C.R.	Radiation (03CH02-CB)
3m Semi Anechoic Chamber VSWR	TDK	SAC-3M	03CH04-CB	1GHz ~18GHz 3m	Feb. 26, 2020	Feb. 25, 2021	Radiation (03CH04-CB)
Horn Antenna	ETS • Lindgren	3115	00143147	750MHz~18GHz	Oct. 23, 2020	Oct. 22, 2021	Radiation (03CH04-CB)
Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170252	15GHz ~ 40GHz	Jul. 21, 2020	Jul. 20, 2021	Radiation (03CH04-CB)
Pre-Amplifier	Agilent	83017A	MY53270063	0.5GHz~26.5GHz	Jul. 14, 2020	Jul. 13, 2021	Radiation (03CH04-CB)
Pre-Amplifier	MITEQ	TTA1840-35-HG	1864479	18GHz ~ 40GHz	Jul. 08, 2020	Jul. 07, 2021	Radiation (03CH04-CB)
Signal Analyzer	R&S	FSV40	101904	9kHz ~ 40GHz	Mar 12, 2020	Mar 11, 2021	Radiation (03CH04-CB
RF Cable-high	Woken	RG402	High Cable-21	1GHz - 18GHz	Oct. 05, 2020	Oct. 04, 2021	Radiation (03CH04-CB)
RF Cable-high	Woken	RG402	High Cable-21+67	1GHz - 18GHz	Nov. 05, 2020	Nov. 04, 2021	Radiation (03CH04-CB)
RF Cable-high	Woken	RG402	High Cable-40G#1	18GHz ~ 40 GHz	Jul. 16, 2020	Jul. 15, 2021	Radiation (03CH04-CB)
RF Cable-high	Woken	RG402	High Cable-40G#2	18GHz ~ 40 GHz	Jul. 16, 2020	Jul. 15, 2021	Radiation (03CH04-CB)
Test Software	SPORTON	SENSE	V5.10	-	N.C.R.	N.C.R.	Radiation (03CH04-CB)
Spectrum analyzer	R&S	FSV40	101028	9kHz~40GHz	Dec. 31, 2020	Dec. 30, 2021	Conducted (TH03-CB)
Power Sensor	Anritsu	MA2411B	1726195	300MHz~40GHz	Aug. 17, 2020	Aug. 16, 2021	Conducted (TH03-CB)
Power Meter	Anritsu	ML2495A	1035008	300MHz~40GHz	Aug. 17, 2020	Aug. 16, 2021	Conducted (TH03-CB)
RF Cable-high	Woken	RG402	High Cable-11	1 GHz –18 GHz	Oct. 05, 2020	Oct. 04, 2021	Conducted (TH03-CB)
RF Cable-high	Woken	RG402	High Cable-12	1 GHz –18 GHz	Oct. 05, 2020	Oct. 04, 2021	Conducted (TH03-CB)
RF Cable-high	Woken	RG402	High Cable-13	1 GHz –18 GHz	Oct. 05, 2020	Oct. 04, 2021	Conducted (TH03-CB)
RF Cable-high	Woken	RG402	High Cable-14	1 GHz –18 GHz	Oct. 05, 2020	Oct. 04, 2021	Conducted (TH03-CB)
RF Cable-high	Woken	RG402	High Cable-15	1 GHz –18 GHz	Oct. 05, 2020	Oct. 04, 2021	Conducted (TH03-CB)
Test Software	SPORTON	SENSE	V5.10	-	N.C.R.	N.C.R.	Conducted (TH03-CB)

Note: Calibration Interval of instruments listed above is one year. N.C.R. means Non-Calibration required.

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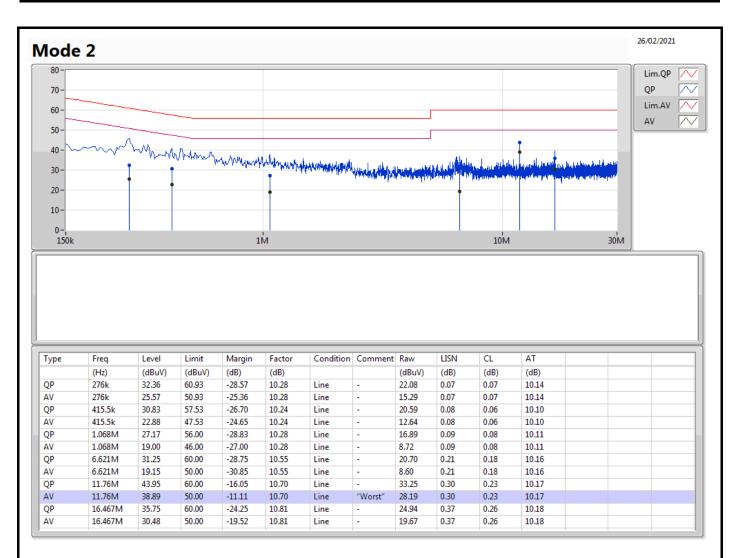
Conducted Emissions at Powerline

Appendix A

Summary							
Mode	Result	Туре	Freq	Level	Limit	Margin	Condition
			(Hz)	(dBuV)	(dBuV)	(dB)	
Mode 2	Pass	AV	11.76M	38.89	50.00	-11.11	Line

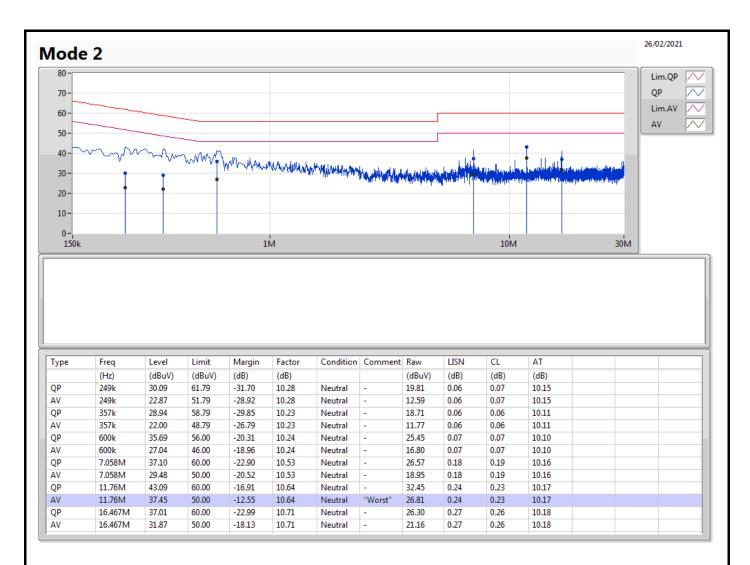


Appendix A





Appendix A





Summary

Mode	Max-N dB	Max-OBW	ITU-Code	Min-N dB	Min-OBW
	(Hz)	(Hz)		(Hz)	(Hz)
2.4-2.4835GHz	-	-	-	-	-
802.11b_Nss1,(1Mbps)_1TX	9M	13.668M	13M7G1D	8.55M	13.393M
802.11g_Nss1,(6Mbps)_1TX	16.325M	18.191M	18M2D1D	16.3M	16.842M
802.11n HT20_Nss1,(MCS0)_1TX	17.575M	18.841M	18M8D1D	17.55M	17.866M
802.11n HT40_Nss1,(MCS0)_1TX	35.15M	36.432M	36M4D1D	35.05M	36.332M

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

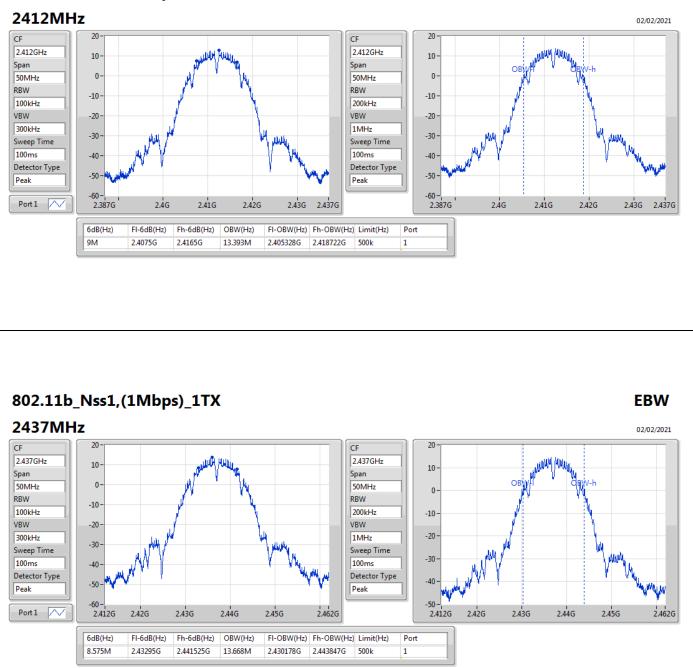
Mode	Result	Limit	Port 1-N dB	Port 1-OBW
		(Hz)	(Hz)	(Hz)
802.11b_Nss1,(1Mbps)_1TX	-	-	-	-
2412MHz	Pass	500k	9M	13.393M
2437MHz	Pass	500k	8.575M	13.668M
2462MHz	Pass	500k	8.55M	13.643M
802.11g_Nss1,(6Mbps)_1TX	-	-	-	-
2412MHz	Pass	500k	16.3M	16.842M
2437MHz	Pass	500k	16.325M	18.191M
2462MHz	Pass	500k	16.325M	16.917M
802.11n HT20_Nss1,(MCS0)_1TX	-	-	-	-
2412MHz	Pass	500k	17.575M	17.941M
2437MHz	Pass	500k	17.55M	18.841M
2462MHz	Pass	500k	17.55M	17.866M
802.11n HT40_Nss1,(MCS0)_1TX	-	-	-	-
2422MHz	Pass	500k	35.05M	36.332M
2437MHz	Pass	500k	35.15M	36.432M
2452MHz	Pass	500k	35.1M	36.382M

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

EBW



802.11b_Nss1,(1Mbps)_1TX

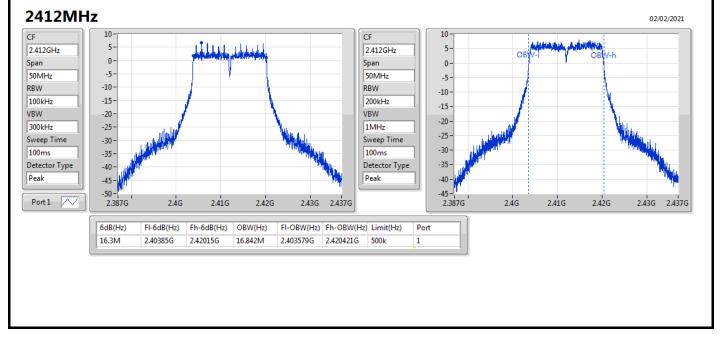




802.11b_Nss1,(1Mbps)_1TX

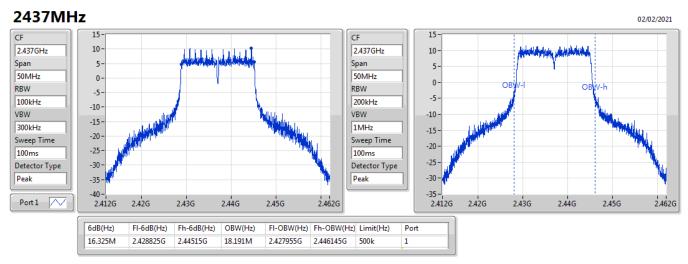


802.11g_Nss1,(6Mbps)_1TX

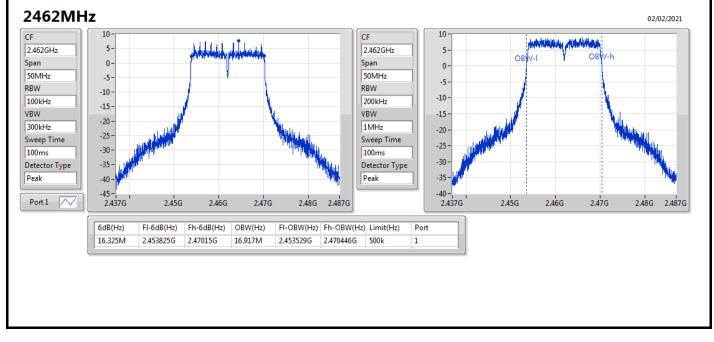




802.11g_Nss1,(6Mbps)_1TX



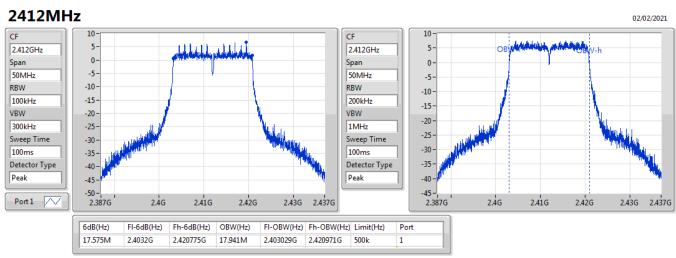
802.11g_Nss1,(6Mbps)_1TX



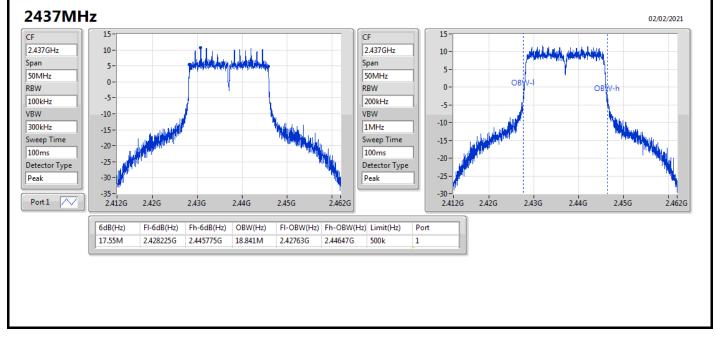


EBW

802.11n HT20_Nss1,(MCS0)_1TX

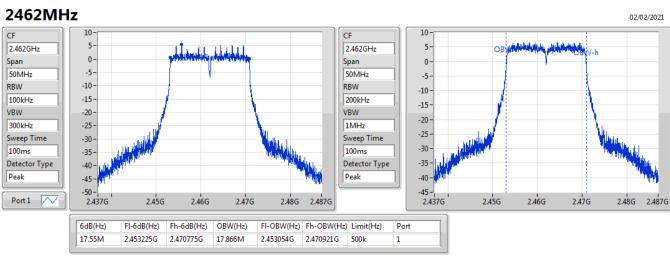


802.11n HT20_Nss1,(MCS0)_1TX

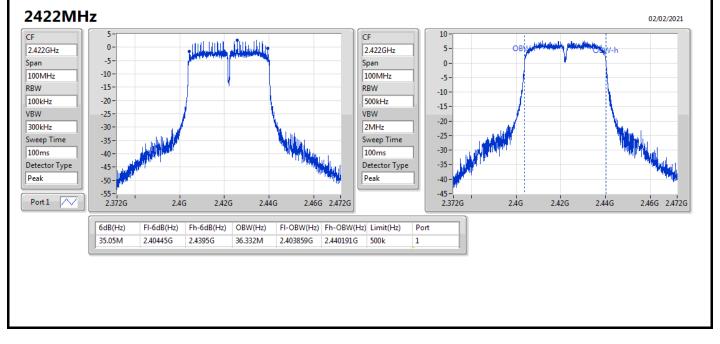




802.11n HT20_Nss1,(MCS0)_1TX



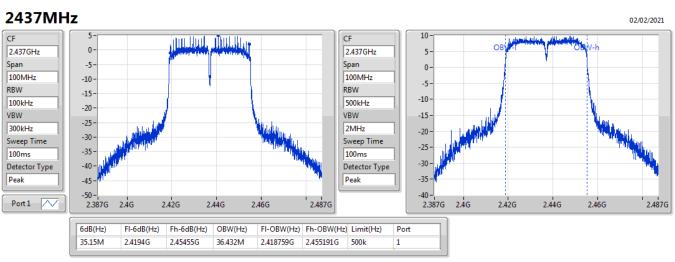
802.11n HT40_Nss1,(MCS0)_1TX



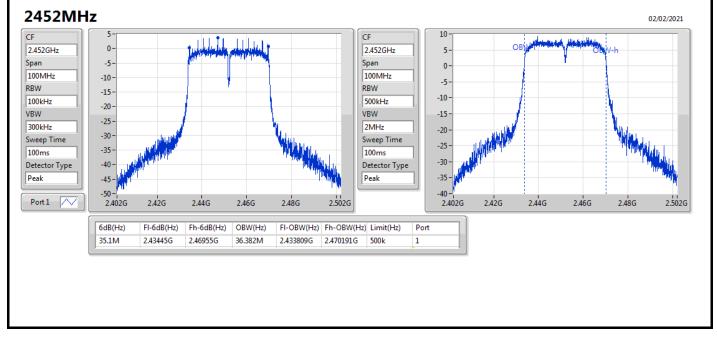


EBW

802.11n HT40_Nss1,(MCS0)_1TX



802.11n HT40_Nss1,(MCS0)_1TX





Summary

Mode	Total Power	Total Power
	(dBm)	(W)
2.4-2.4835GHz	-	-
802.11b_Nss1,(1Mbps)_1TX	22.60	0.18197
802.11g_Nss1,(6Mbps)_1TX	21.69	0.14757
802.11n HT20_Nss1,(MCS0)_1TX	21.61	0.14488
802.11n HT40_Nss1,(MCS0)_1TX	19.02	0.07980



Result

Mode	Result	DG	Port 1	Total Power	Power Limit
		(dBi)	(dBm)	(dBm)	(dBm)
802.11b_Nss1,(1Mbps)_1TX	-	-	-	-	-
2412MHz	Pass	2.68	21.91	21.91	30.00
2437MHz	Pass	2.68	22.60	22.60	30.00
2462MHz	Pass	2.68	22.55	22.55	30.00
802.11g_Nss1,(6Mbps)_1TX	-	-	-	-	-
2412MHz	Pass	2.68	18.04	18.04	30.00
2417MHz	Pass	2.68	20.01	20.01	30.00
2437MHz	Pass	2.68	21.69	21.69	30.00
2462MHz	Pass	2.68	19.17	19.17	30.00
802.11n HT20_Nss1,(MCS0)_1TX	-	-	-	-	-
2412MHz	Pass	2.68	18.05	18.05	30.00
2417MHz	Pass	2.68	20.09	20.09	30.00
2437MHz	Pass	2.68	21.61	21.61	30.00
2457MHz	Pass	2.68	19.26	19.26	30.00
2462MHz	Pass	2.68	17.27	17.27	30.00
802.11n HT40_Nss1,(MCS0)_1TX	-	-	-	-	-
2422MHz	Pass	2.68	16.66	16.66	30.00
2437MHz	Pass	2.68	19.02	19.02	30.00
2452MHz	Pass	2.68	17.96	17.96	30.00

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



Summary

Mode	PD
	(dBm/RBW)
2.4-2.4835GHz	
802.11b_Nss1,(1Mbps)_1TX	-0.45
802.11g_Nss1,(6Mbps)_1TX	-4.40
802.11n HT20_Nss1,(MCS0)_1TX	-5.15
802.11n HT40_Nss1,(MCS0)_1TX	-9.76

RBW = 500 kHz for 5.725-5.85GHz band / 1MHz for other band;

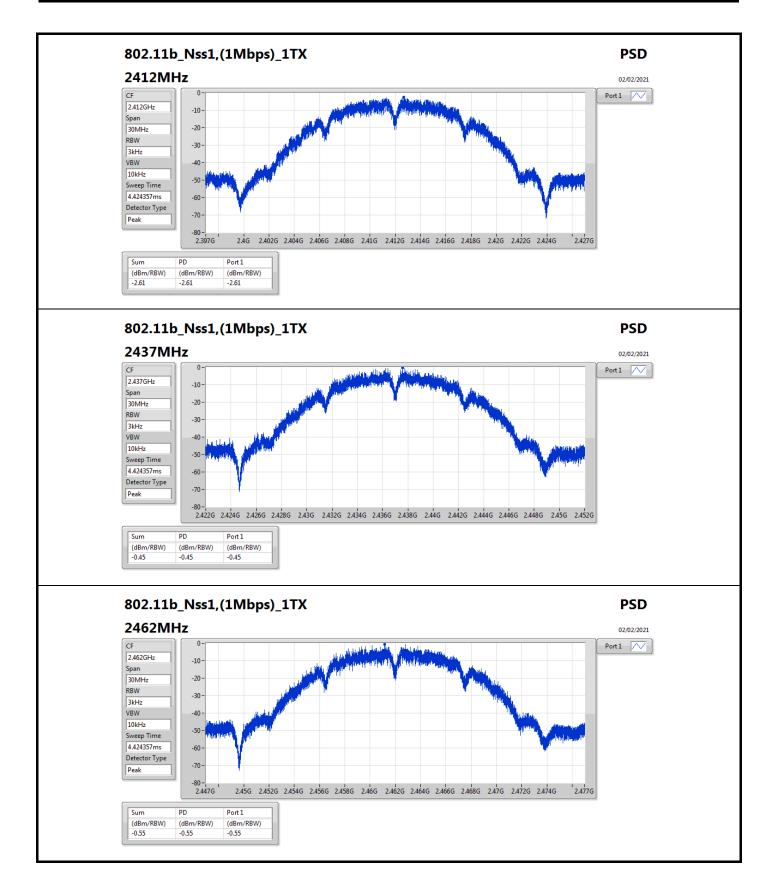


Result

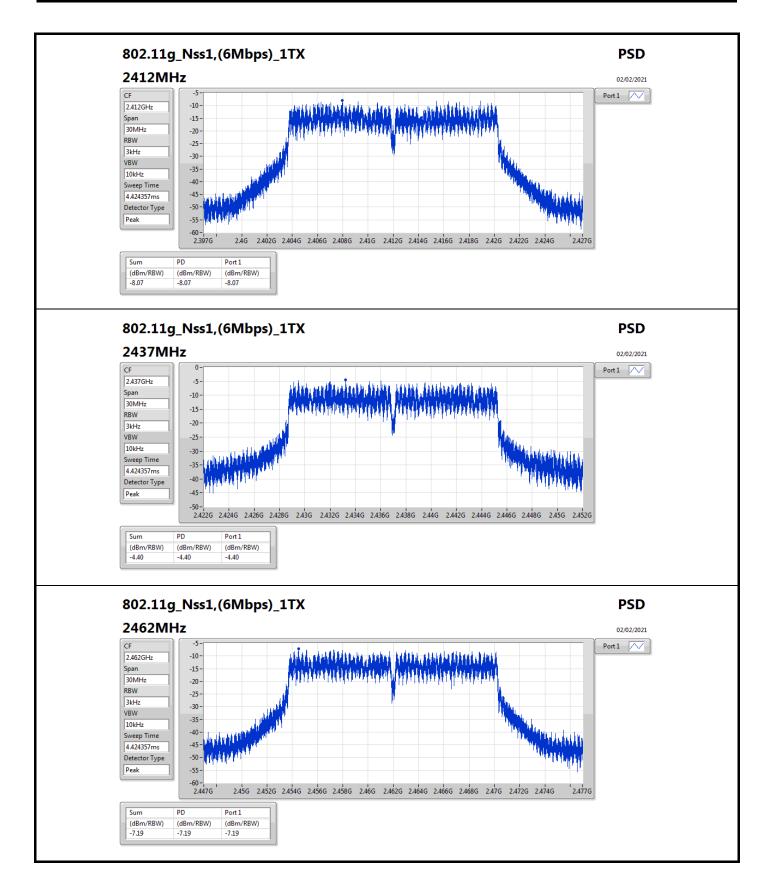
Mode	Result	DG	Port 1	PD	PD Limit
		(dBi)	(dBm/RBW)	(dBm/RBW)	(dBm/RBW)
802.11b_Nss1,(1Mbps)_1TX	-	-	-	-	-
2412MHz	Pass	2.68	-2.61	-2.61	8.00
2437MHz	Pass	2.68	-0.45	-0.45	8.00
2462MHz	Pass	2.68	-0.55	-0.55	8.00
802.11g_Nss1,(6Mbps)_1TX	-	-	-	-	-
2412MHz	Pass	2.68	-8.07	-8.07	8.00
2437MHz	Pass	2.68	-4.40	-4.40	8.00
2462MHz	Pass	2.68	-7.19	-7.19	8.00
802.11n HT20_Nss1,(MCS0)_1TX	-	-	-	-	-
2412MHz	Pass	2.68	-8.29	-8.29	8.00
2437MHz	Pass	2.68	-5.15	-5.15	8.00
2462MHz	Pass	2.68	-8.92	-8.92	8.00
802.11n HT40_Nss1,(MCS0)_1TX	-	-	-	-	-
2422MHz	Pass	2.68	-10.74	-10.74	8.00
2437MHz	Pass	2.68	-9.76	-9.76	8.00
2452MHz	Pass	2.68	-10.71	-10.71	8.00

DG = Directional Gain; RBW = 500 kHz for 5.725-5.85GHz band / 1MHz for other band;
 PD = trace bin-by-bin of each transmits port summing can be performed maximum power density; Port X = Port X power density;

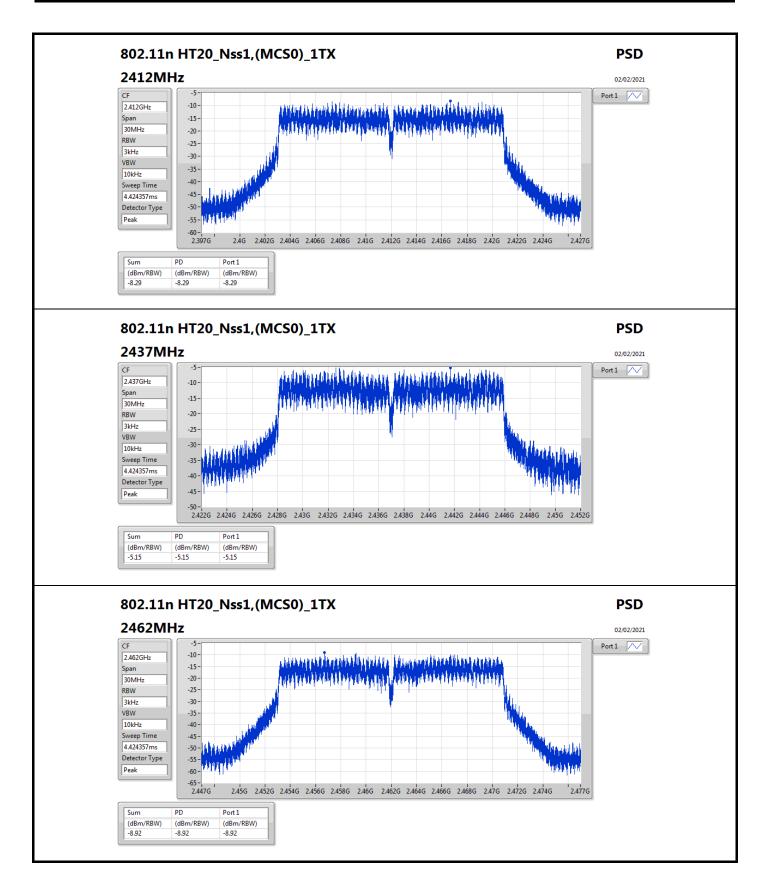




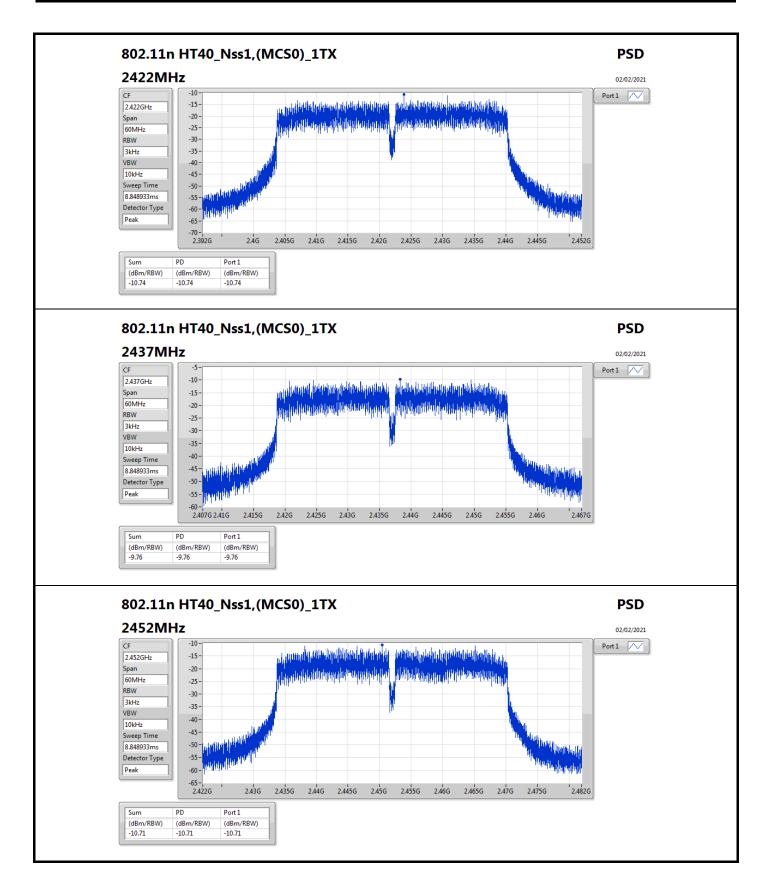














Appendix E

Summary

• anna j															
Mode	Result	Ref	Ref	Limit	Freq	Level	Freq	Level	Freq	Level	Freq	Level	Freq	Level	Port
		(Hz)	(dBm)	(dBm)	(Hz)	(dBm)	(Hz)	(dBm)	(Hz)	(dBm)	(Hz)	(dBm)	(Hz)	(dBm)	
2.4-2.4835GHz	-	-	-	-	-	-	-	-	-	-	-	-		-	-
802.11b_Nss1,(1Mbps)_1TX	Pass	2.43645G	13.71	-16.29	931.71M	-52.22	2.3975G	-29.17	2.4G	-37.57	2.49372G	-51.36	7.23514G	-35.42	1
802.11g_Nss1,(6Mbps)_1TX	Pass	2.44451G	10.09	-19.91	918.6M	-53.35	2.39982G	-24.46	2.4G	-29.20	2.49066G	-51.63	7.23233G	-42.42	1
802.11n HT20_Nss1,(MCS0)_1TX	Pass	2.43198G	10.52	-19.48	449.11M	-52.85	2.39946G	-24.63	2.4G	-26.54	2.492G	-51.36	7.22952G	-42.94	1
802.11n HT40_Nss1,(MCS0)_1TX	Pass	2.43449G	4.86	-25.14	846.96M	-52.98	2.39996G	-29.32	2.4G	-30.83	2.48518G	-38.44	6.84607G	-46.49	1



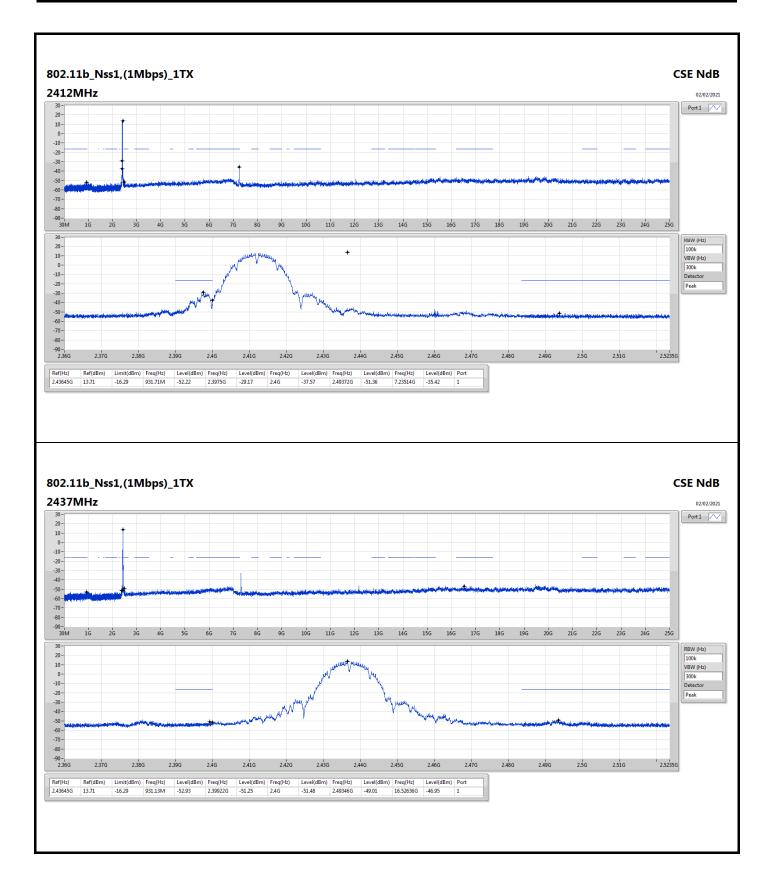
CSE(Non-restricted Band)

Appendix E

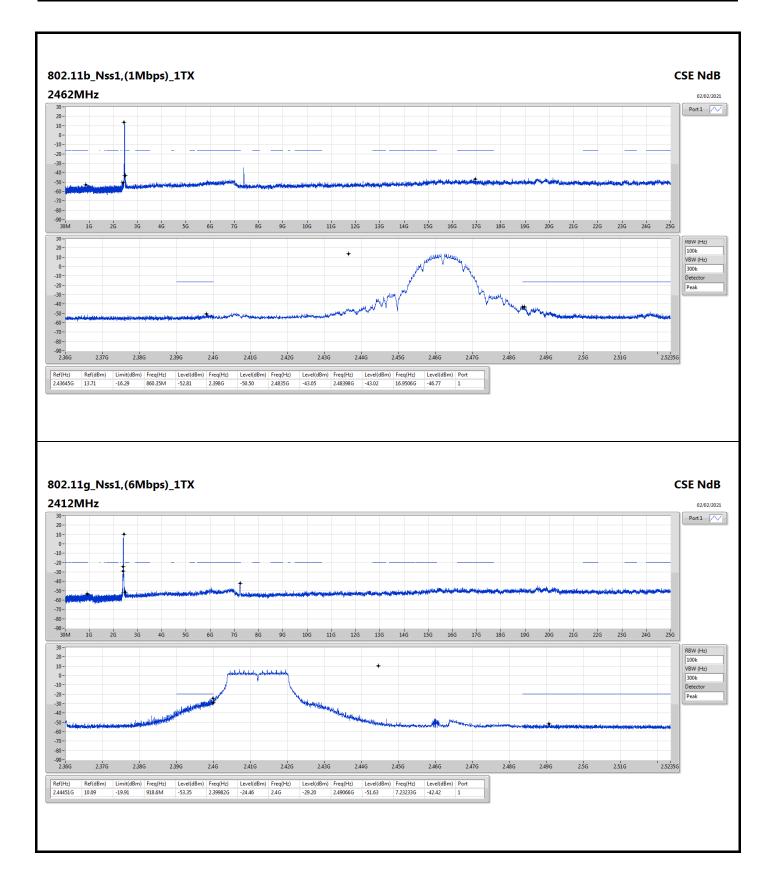
Result

Mode	Result	Ref	Ref	Limit	Freq	Level	Freq	Level	Freq	Level	Freq	Level	Freq	Level	Port
		(Hz)	(dBm)	(dBm)	(Hz)	(dBm)	(Hz)	(dBm)	(Hz)	(dBm)	(Hz)	(dBm)	(Hz)	(dBm)	
802.11b_Nss1,(1Mbps)_1TX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2412MHz	Pass	2.43645G	13.71	-16.29	931.71M	-52.22	2.3975G	-29.17	2.4G	-37.57	2.49372G	-51.36	7.23514G	-35.42	1
2437MHz	Pass	2.43645G	13.71	-16.29	931.13M	-52.93	2.39922G	-51.25	2.4G	-51.48	2.49346G	-49.01	16.52636G	-46.95	1
2462MHz	Pass	2.43645G	13.71	-16.29	860.35M	-52.81	2.398G	-50.50	2.4835G	-43.05	2.48398G	-43.02	16.9506G	-46.77	1
802.11g_Nss1,(6Mbps)_1TX	-	-	-	-	-	-	-	-	-	-	-	-		-	-
2412MHz	Pass	2.44451G	10.09	-19.91	918.6M	-53.35	2.39982G	-24.46	2.4G	-29.20	2.49066G	-51.63	7.23233G	-42.42	1
2437MHz	Pass	2.44451G	10.09	-19.91	2.15583G	-52.90	2.39908G	-41.41	2.4G	-44.06	2.48892G	-41.93	16.44207G	-45.69	1
2462MHz	Pass	2.44451G	10.09	-19.91	1.64469G	-53.04	2.39386G	-50.23	2.4835G	-34.62	2.48356G	-30.35	6.82775G	-45.87	1
802.11n HT20_Nss1,(MCS0)_1TX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2412MHz	Pass	2.43198G	10.52	-19.48	449.11M	-52.85	2.39946G	-24.63	2.4G	-26.54	2.492G	-51.36	7.22952G	-42.94	1
2437MHz	Pass	2.43198G	10.52	-19.48	921.23M	-51.93	2.3995G	-38.53	2.4G	-41.54	2.48824G	-41.23	16.63312G	-46.64	1
2462MHz	Pass	2.43198G	10.52	-19.48	842.3M	-52.97	2.39702G	-51.21	2.4835G	-39.93	2.48394G	-37.71	17.53218G	-46.63	1
802.11n HT40_Nss1,(MCS0)_1TX	-	-	-	-	-	-	-	-		-	-	-	-	-	-
2422MHz	Pass	2.43449G	4.86	-25.14	2.1431G	-52.87	2.39672G	-30.08	2.4G	-30.36	2.48458G	-49.44	24.43909G	-45.86	1
2437MHz	Pass	2.43449G	4.86	-25.14	846.96M	-52.98	2.39996G	-29.32	2.4G	-30.83	2.48518G	-38.44	6.84607G	-46.49	1
2452MHz	Pass	2.43449G	4.86	-25.14	944.86M	-52.66	2.39952G	-44.80	2.4835G	-34.57	2.48562G	-32.65	21.77756G	-46.35	1

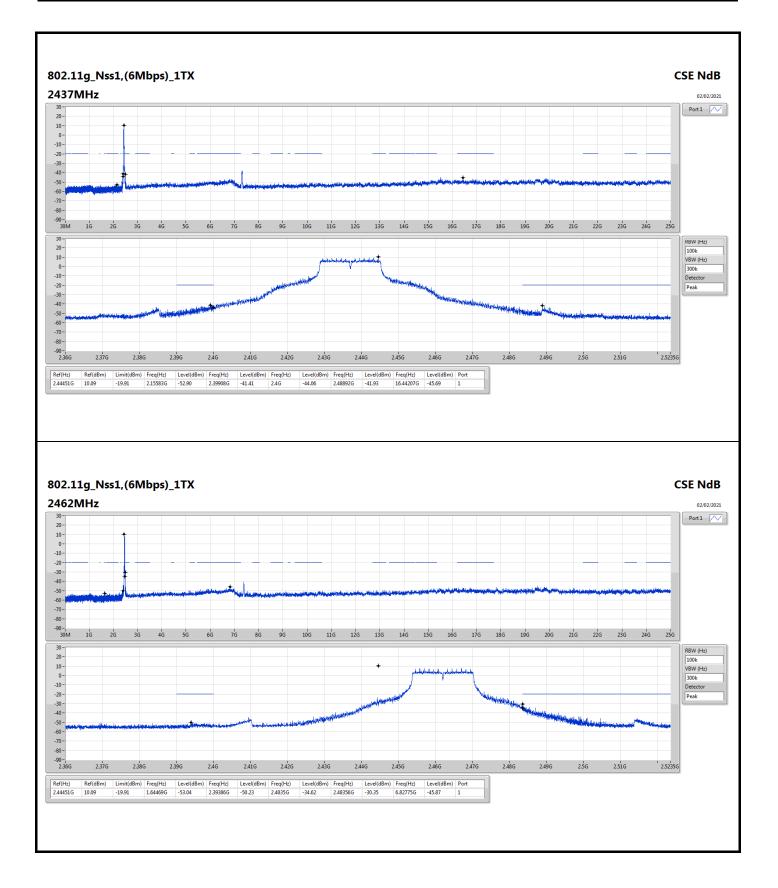








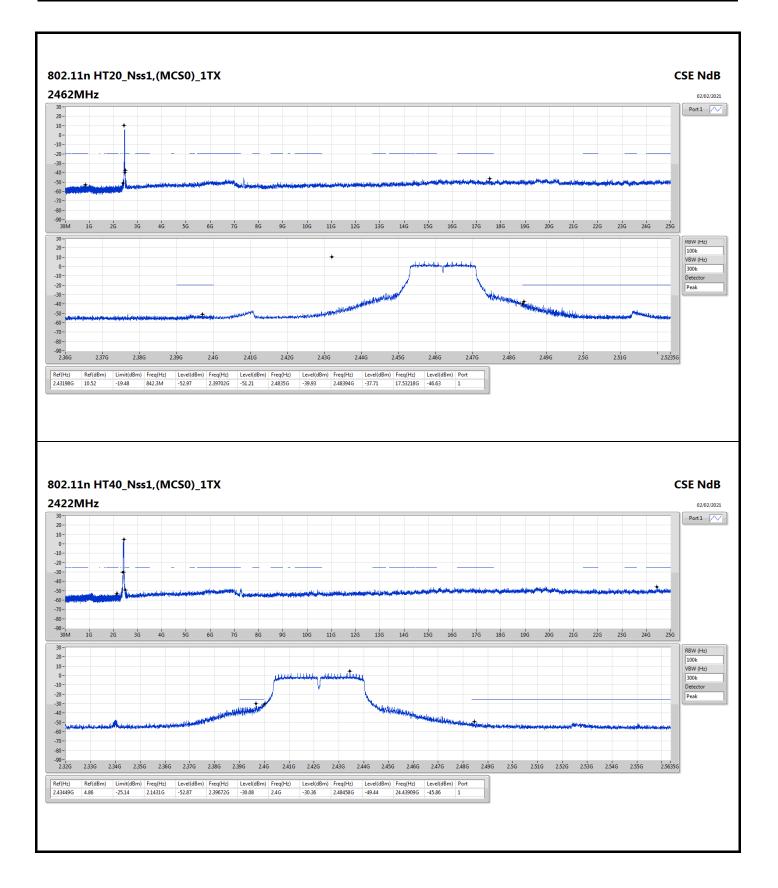




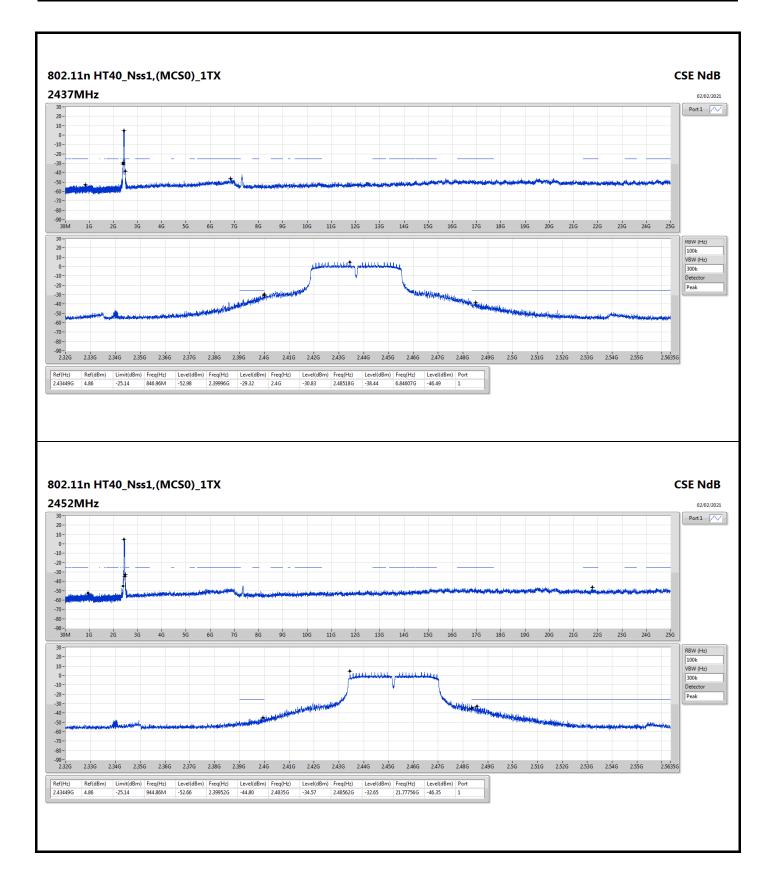












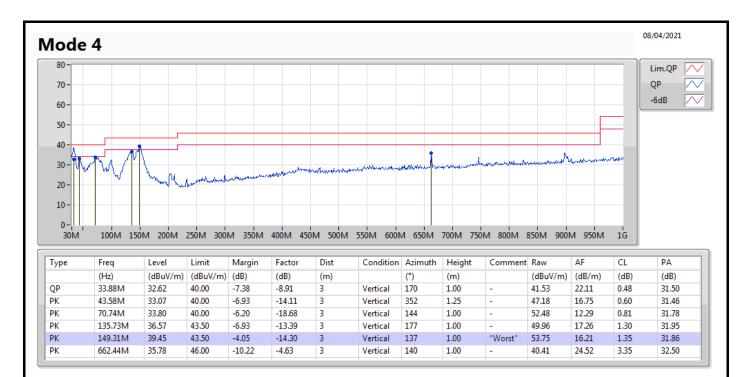


Summary	Summary													
Mode	Result	Type Freq		Level	Limit	Margin	Condition							
			(Hz)	(dBuV/m)	(dBuV/m)	(dB)								
Mode 4	Pass	PK	149.31M	39.45	43.50	-4.05	Vertical							



Radiated Emissions below 1GHz

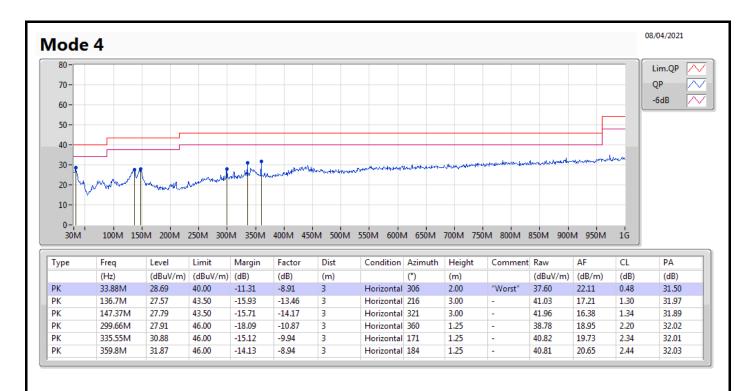
Appendix F.1





Radiated Emissions below 1GHz

Appendix F.1





Appendix F.2

Summary

<u> </u>	anniary											
	Mode	Result	Туре	Freq	Level	Limit	Margin	Dist	Condition	Azimuth	Height	Comments
				(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(m)		(°)	(m)	
	2.4-2.4835GHz	-	-		-	-	-	-	-	-	-	-
	802.11n HT40_Nss1,(MCS0)_1TX	Pass	AV	2.4848G	53.97	54.00	-0.03	3	Vertical	10	1.22	-



