

Report No. : FR0D1716AA



# **RADIO TEST REPORT**

FCC ID	7	UDX-60074010
Equipment	0 8	Network Camera
Brand Name	:	CISCO
Model Name		MV52-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 5F, No. 101, Neihuan N. Rd., Nanzih Dist., Kaohsiung City 811, Taiwan, R.O.C.
Standard		47 CFR FCC Part 15.247

The product was received on Feb. 02, 2021, and testing was started from Mar. 20, 2021 and completed on Sep. 16, 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.

20151

Approved by: Cliff Chang

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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Page Number: 1 of 31Issued Date: Oct. 05, 2021Report Version: 01



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#### Photographs of EUT v01



# History of this test report

Report No.	Version	Description	Issued Date
FR0D1716AA	01	Initial issue of report	Oct. 05, 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: Sandy Chuang



# **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	1TX
2.4-2.4835GHz	802.11g	20	1TX
2.4-2.4835GHz	802.11n HT20	20	1TX
2.4-2.4835GHz	802.11n HT40	40	1TX

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				Antenna		Gain (dBi)		
Ant.	WLAN 2.4GHz	WLAN 5GHz	Bluetooth	Brand	Model Name	Туре	Connector	WLAN 2.4GHz	WLAN 5GHz	Bluetooth
1	2	2	2	Aristotle	RFA-25- 10160	PIFA	I-PEX	2.50	3.50	2.50
2	1	1	1	Aristotle	RFA-25- 10160	PIFA	I-PEX	3.69	3.90	3.69

Note : The above information was declared by manufacturer.

#### 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	0.879	0.56	1.361m	1k
802.11n HT20	0.862	0.64	1.273m	1k
802.11n HT40	0.763	1.17	633.75u	3k

Note:

• DC is Duty Cycle.

DCF is Duty Cycle Factor.

### 1.1.4 EUT Operational Condition

EUT Power Type	From Power Adapter(DC 12V) or PoE				
Beamforming Function	□ With beamforming ☑ Without beamforming				
Test Software Version	QRCT (ver. 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 15.247
- 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 Laboratory						
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. TW3787 with FCC.					
	Conformity Assessment Body Identifier (CABID) TW3787 with ISED.					

Test Condition	Test Site No.	Test Engineer	Test Environment (°C / %)	Test Date
RF Conducted	TH02-CB	Caster Chang	21.1-21.7 / 62-65	Mar. 24, 2021~ Mar. 31, 2021
Radiated (Below 1GHz)	03CH05-CB	Eason Chen	25.8-28.2 / 56-59	Aug. 25, 2021~ Sep. 16, 2021
Radiated (Above 1GHz)	03CH01-CB	Ron Huang	20.3-21.4 / 56-58	Mar. 20, 2021~ Mar. 24, 2021
AC Conduction	CO01-CB	Zack Kuo	22~23 / 60~62	Aug. 31, 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)

#### For Other Tests:

Test Items	Uncertainty	Remark
Radiated Emission (1GHz ~ 18GHz)	5.0 dB	Confidence levels of 95%
Radiated Emission (18GHz ~ 40GHz)	4.9 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%
Conducted Emission	2.5 dB	Confidence levels of 95%

#### For AC Conduction and Radiated (Below 1GHz) test:

Test Items	Uncertainty	Remark
Conducted Emission (150kHz ~ 30MHz)	2.0 dB	Confidence levels of 95%
Radiated Emission (9kHz ~ 30MHz)	4.2 dB	Confidence levels of 95%
Radiated Emission (30MHz ~ 1,000MHz)	5.5 dB	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	19
2437MHz	21
2457MHz	20
2462MHz	18
802.11n HT20_Nss1,(MCS0)_1TX	-
2412MHz	18.5
2437MHz	21
2457MHz	19.5
2462MHz 17.5	
802.11n HT40_Nss1,(MCS0)_1TX	-
2422MHz	18
2437MHz	19
2452MHz	17.5



# 2.2 The Worst Case Measurement Configuration

Tł	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 Test Voltage: 120Vac / 60Hz		
Operating Mode	Normal Link		
1	EUT + 2.4GHz + Bluetooth + Adapter (DC 12V)		
2	EUT + 5GHz + Bluetooth + Adapter (DC 12V)		
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 + Bluetooth + PoE			
Mode 2 generated the wor	Mode 2 generated the worst test result, so it was recorded in this report.		

The Worst Case Mode for Following Conformance Tests	
Tests Item	DTS Bandwidth Maximum Conducted Output Power Power Spectral Density
Test Condition	Conducted measurement at transmit chains

Th	The 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 + Bluetooth + Adapter (DC 12V)		
2	EUT in Y axis + 2.4GHz + Bluetooth + Adapter (DC 12V)		
Mode 2 has been evaluate this same test mode.	d to be the worst case among Mode 1~2, thus measurement for Mode 3 will follow		
3	EUT in Y axis + 5GHz + Bluetooth + Adapter (DC 12V)		
Mode 3 has been evaluated to be the worst case among Mode 1~3, thus measurement for Mode 4 will follow this same test mode.			
4	EUT in Y axis + 5GHz + Bluetooth + PoE		
For operating mode 4 is the worst case and it was record in this test report.			
Operating Mode > 1GHz CTX			
The EUT was performed a	t Y axis and Z axis position, and the worst case as below:		
1	EUT in Y axis		

Note: The Adapter and PoE below are for measurement only, would not be marketed.

The Adapter and PoE information as below:

Support Unit	Brand	Model Number
Adapter	CISCO	MA-PWR-30W-US
PoE	PHIHONG	POEA33U-1ATE

# 2.3 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.

# 2.4 Accessories

N/A



# 2.5 Support Equipment

#### For AC Conduction:

	Support Equipment			
No.	Equipment	Brand Name	Model Name	FCC ID
А	LAN NB	DELL	E6430	N/A
В	AP Router	ASUS	RP-N53	MSQ-RPN53
С	Microphone	E-books	S71	N/A
D	2.4/5G NB	DELL	E6430 N/A	
Е	Adapter	CISCO	MA-PWR-30W-US	N/A
F	Smart phone	Samsung	Galaxy J2	N/A

#### For Radiated (below 1GHz):

	Support Equipment			
No.	Equipment	Brand Name	Model Name	FCC ID
А	PoE	PHIHONG	POEA33U-1ATE	N/A
В	NB	DELL	E4300	N/A
С	WLAN AP	ASUS	RT-AX88U	MSQ-RTAXHP00
D	NB	DELL	E4300	N/A
Е	Microphone	E-books	S71	N/A
F	iPad mini	Apple	ME2791A/A	N/A

#### For Radiated (above 1GHz):

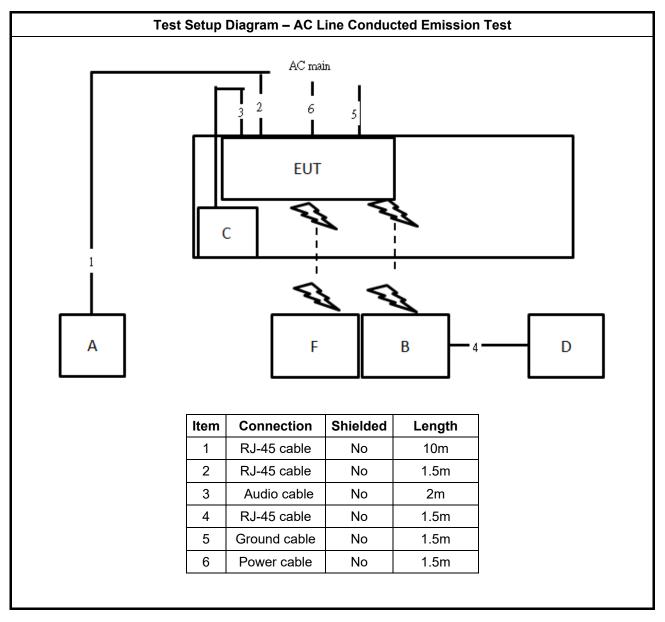
	Support Equipment			
No.	No. Equipment Brand Name Model Name FCC ID			
А	NB	DELL	E4300	N/A
В	Fixture	CISCO	MV52-HW-Test	N/A
С	Adapter	CISCO	MA-PWR-30W-US	N/A

#### For RF Conducted:

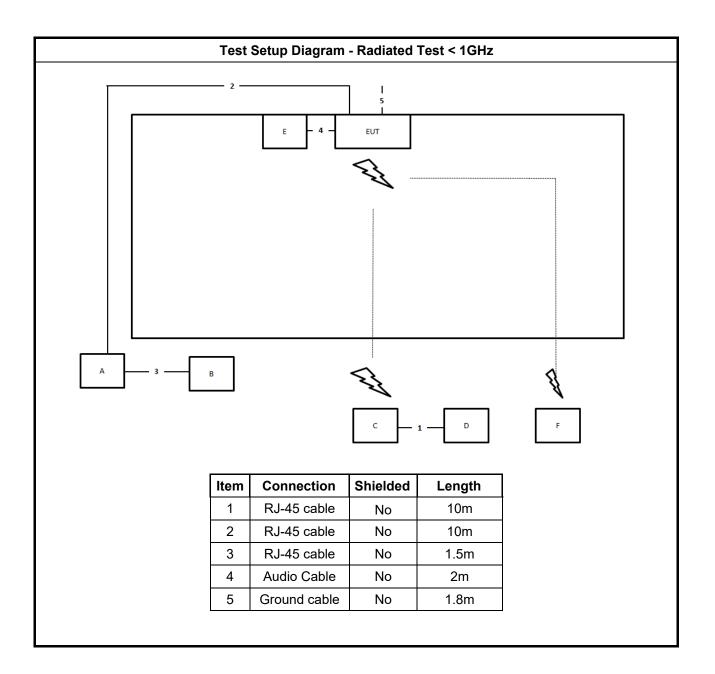
	Support Equipment			
No.	No. Equipment Brand Name Model Name FCC ID			
А	NB	DELL	E4300	N/A
В	Fixture	CISCO	MV52-HW-Test	N/A
С	Adapter	CISCO	MA-PWR-30W-US	N/A



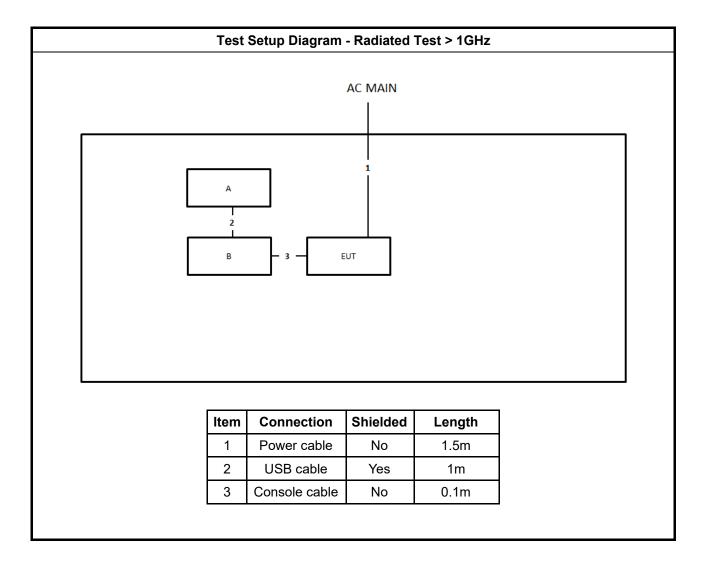
# 2.6 Test Setup Diagram













# 3 Transmitter Test Result

# 3.1 AC Power-line Conducted Emissions

### 3.1.1 AC Power-line Conducted Emissions Limit

AC Powe	er-line Conducted Emissions L	_imit	
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.			

Note 1: \* Decreases with the logarithm of the frequence

# 3.1.2 Measuring Instruments

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

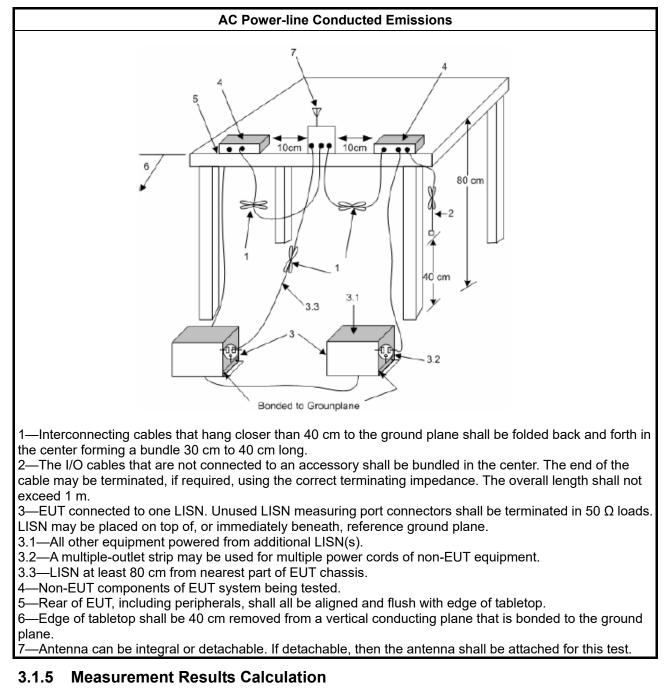
#### 3.1.3 Test Procedures

**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

<ul> <li>Systems using digital modulation techniques:</li> <li>6 dB bandwidth ≥ 500 kHz.</li> </ul>	6dB Bandwidth Limit
6 dB bandwidth ≥ 500 kHz.	Systems using digital modulation techniques:
	<ul> <li>6 dB bandwidth ≥ 500 kHz.</li> </ul>

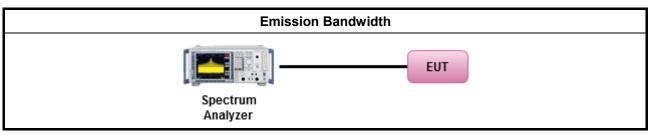
#### 3.2.2 Measuring Instruments

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

#### 3.2.3 Test Procedures

	Test Method								
<ul> <li>For</li> </ul>	<ul> <li>For the emission bandwidth shall be measured using one of the options below:</li> </ul>								
	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

Мах	Maximum Conducted Output Power Limit							
	•	If $G_{TX} \le 6 \text{ dBi}$ , then $P_{Out} \le 30 \text{ dBm} (1 \text{ W})$						
	• Point-to-multipoint systems (P2M): If $G_{TX} > 6 \text{ dBi}$ , then $P_{Out} = 30 - (G_{TX} - 6) \text{ dBm}$							
	<ul> <li>Smart antenna system (SAS):</li> </ul>							
		- Single beam: If $G_{TX} > 6$ dBi, then $P_{Out} = 30 - (G_{TX} - 6)/3$ dBm						
		- Overlap beam: If $G_{TX} > 6$ dBi, then $P_{Out} = 30 - (G_{TX} - 6)/3$ dBm						
		- Aggregate power on all beams: If $G_{TX} > 6 \text{ dBi}$ , then $P_{Out} = 30 - (G_{TX} - 6)/3 + 8 \text{dBm}$						
	$P_{out}$ = 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.

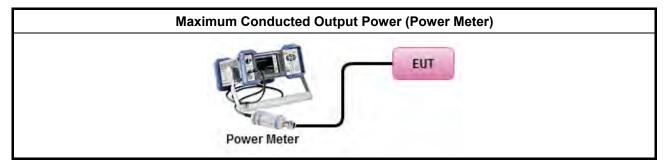


# 3.3.3 Test Procedures

		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 ≥ EBW method).
	$\boxtimes$	Refer as FCC KDB 558074, clause 8.3.1.3 & C63.10 clause 11.9.1.3 (peak power meter).
•	Max	mum 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).
		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

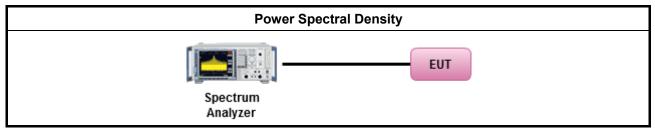
Refer a test equipment and calibration data table in this test report.

#### 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).							
	$\square$	Refe	er as FCC KDB 558074, clause 8.4 & C63.10 clause 11.10 Method Max. PSD.					
•	For	condu	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					
RF output power procedure Limit (dBc)					
Peak output power procedure	20				
Average output power procedure	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

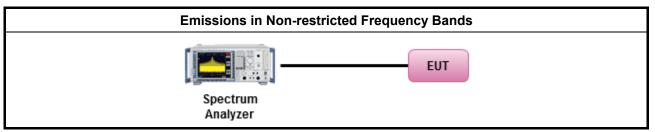
Refer a test equipment and calibration data table in this test report.

#### 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)	Frequency Range (MHz) Field Strength (uV/m) Field Strength (dBuV/m) Measure Distance								
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.

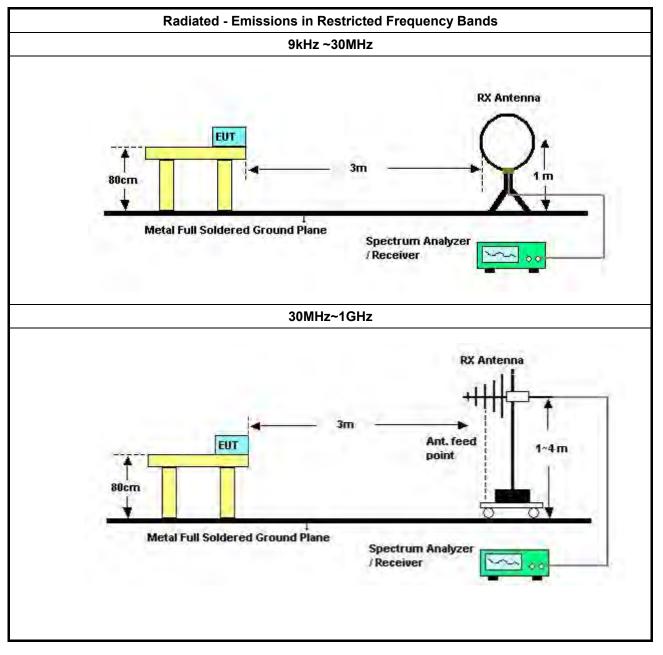


### 3.6.3 Test Procedures

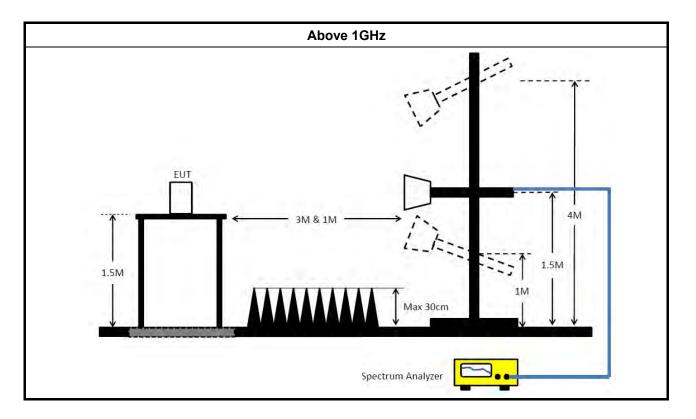
	Test Method
•	The average emission levels shall be measured in [duty cycle $\geq$ 98 or duty factor].
•	Refer as ANSI C63.10, clause 6.10.3 band-edge testing shall be performed at the lowest frequency channel and highest frequency channel within the allowed operating band.
•	For the transmitter unwanted emissions shall be measured using following options below:
	<ul> <li>Refer as FCC KDB 558074, clause 8.6 for unwanted emissions into restricted bands.</li> </ul>
	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:
	<ul> <li>Refer as FCC KDB 558074 clause 8.7 &amp; 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.</li> </ul>
	<ul> <li>Refer as FCC KDB 558074, clause 8.7 (ANSI C63.10, clause 6.10.6) for marker-delta method for band-edge measurements.</li> </ul>
	<ul> <li>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).</li> </ul>
	<ul> <li>For conducted unwanted emissions into restricted bands (absolute emission limits). Devices with multiple transmit chains using options given below:         <ul> <li>(1) Measure and sum the spectra across the outputs or</li> <li>(2) Measure and add 10 log(N) dB</li> </ul> </li> </ul>
	<ul> <li>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.</li> </ul>



# 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



# 4 Test Equipment and Calibration Data

Instrument	Brand	Model No.	Serial No.	Characteristics	Calibration Date	Calibration Due Date	Remark
EMI Receiver	Agilent	N9038A	My52260123	9kHz ~ 8.4GHz	Mar. 03, 2021	Mar. 02, 2022	Conduction (CO01-CB)
LISN	F.C.C.	FCC-LISN-50- 16-2	04083	150kHz ~ 100MHz	Jan. 06, 2021	Jan. 05, 2022	Conduction (CO01-CB)
LISN	Schwarzbeck	NSLK 8127	8127647	9kHz ~ 30MHz	Mar. 07, 2021	Mar. 06, 2022	Conduction (CO01-CB)
COND Cable	Woken	Cable	Low cable-CO01	9kHz ~ 30MHz	May 19, 2021	May 18, 2022	Conduction (CO01-CB)
Pulse Limiter	Rohde&Schwa rz	ESH3-Z2	100430	9kHz ~ 30MHz	Jan. 30, 2021	Jan. 29, 2022	Conduction (CO01-CB)
Software	SPORTON	SENSE	V5.10	-	N.C.R.	N.C.R.	Conduction (CO01-CB)
Loop Antenna	Teseq	HLA 6120	24155	9kHz - 30 MHz	Apr. 14, 2021	Apr. 13, 2022	Radiation (03CH05-CB)
3m Semi Anechoic Chamber NSA	TDK	SAC-3M	03CH05-CB	30 MHz ~ 1 GHz	Aug. 09, 2021	Aug. 08, 2022	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. 27, 2021	Apr. 26, 2022	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	Jun. 21, 2021	Jun. 20, 2022	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	ТDК	SAC-3M	03CH01-CB	1GHz ~18GHz 3m	May 29, 2020	May 28, 2021	Radiation (03CH01-CB)
Horn Antenna	ETS-LINDGRE N	3115	00075790	750MHz ~ 18GHz	Nov. 06, 2020	Nov. 05, 2021	Radiation (03CH01-CB)
Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170252	15GHz ~ 40GHz	Jul. 21, 2020	Jul. 20, 2021	Radiation (03CH01-CB)
Pre-Amplifier	Agilent	8449B	3008A02310	1GHz ~ 26.5GHz	Jan. 07, 2021	Jan. 06, 2022	Radiation (03CH01-CB)
Pre-Amplifier	MITEQ	TTA1840-35-H G	1864479	18GHz ~ 40GHz	Jul. 08, 2020	Jul. 07, 2021	Radiation (03CH01-CB)
Spectrum Analyzer	R&S	FSP40	100056	9kHz ~ 40GHz	Apr. 16, 2020	Apr. 15, 2021	Radiation (03CH01-CB)
RF Cable-high	Woken	RG402	High Cable-16	1 GHz ~ 18 GHz	Oct. 05, 2020	Oct. 04, 2021	Radiation (03CH01-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-16+17	1 GHz ~ 18 GHz	Oct. 05, 2020	Oct. 04, 2021	Radiation (03CH01-CB)
RF Cable-high	Woken	RG402	High Cable-40G#1	18GHz ~ 40 GHz	Jul. 16, 2020	Jul. 15, 2021	Radiation (03CH01-CB)
RF Cable-high	Woken	RG402	High Cable-40G#2	18GHz ~ 40 GHz	Jul. 16, 2020	Jul. 15, 2021	Radiation (03CH01-CB)
Test Software	SPORTON	SENSE	V5.10	-	N.C.R.	N.C.R.	Radiation (03CH01-CB)
Spectrum analyzer	R&S	FSV40	101027	9kHz~40GHz	Jul. 27, 2020	Jul. 26, 2021	Conducted (TH02-CB)
Power Sensor	Anritsu	MA2411B	1126203	300MHz~40GHz	Sep. 17, 2020	Sep. 16, 2021	Conducted (TH02-CB)
Power Meter	Anritsu	ML2495A	1210004	300MHz~40GHz	Sep. 17, 2020	Sep. 16, 2021	Conducted (TH02-CB)
RF Cable-high	Woken	RG402	High Cable-01	1 GHz – 18 GHz	Oct. 05, 2020	Oct. 04, 2021	Conducted (TH02-CB)
RF Cable-high	Woken	RG402	High Cable-02	1 GHz – 18 GHz	Oct. 05, 2020	Oct. 04, 2021	Conducted (TH02-CB)
RF Cable-high	Woken	RG402	High Cable-03	1 GHz – 18 GHz	Oct. 05, 2020	Oct. 04, 2021	Conducted (TH02-CB)
RF Cable-high	Woken	RG402	High Cable-04	1 GHz – 18 GHz	Oct. 05, 2020	Oct. 04, 2021	Conducted (TH02-CB)
RF Cable-high	Woken	RG402	High Cable-05	1 GHz – 18 GHz	Oct. 05, 2020	Oct. 04, 2021	Conducted (TH02-CB)
Test Software	SPORTON	SENSE	V5.10	-	N.C.R.	N.C.R.	Conducted (TH02-CB)

Note: Calibration Interval of instruments listed above is one year.

NCR means Non-Calibration required.



# **Conducted Emissions at Powerline**

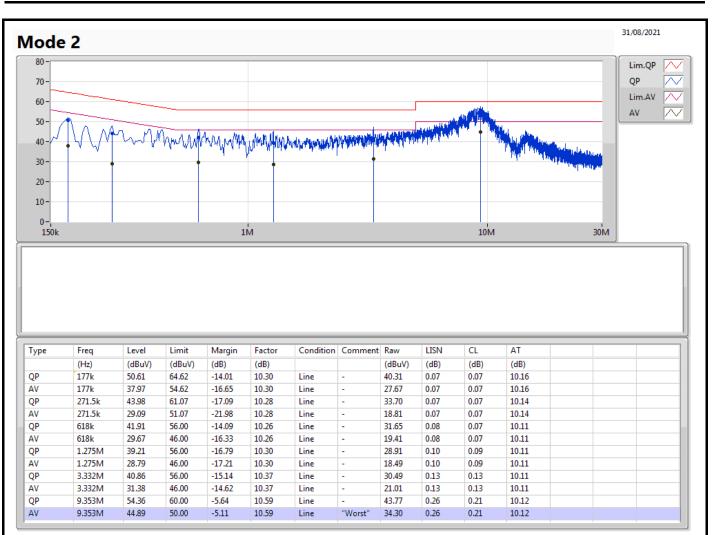
# Appendix A

Summary	Summary									
Mode	Result	Туре	Freq	Level	Limit	Margin	Condition			
			(Hz)	(dBuV)	(dBuV)	(dB)				
Mode 2	Pass	AV	9.353M	44.89	50.00	-5.11	Line			

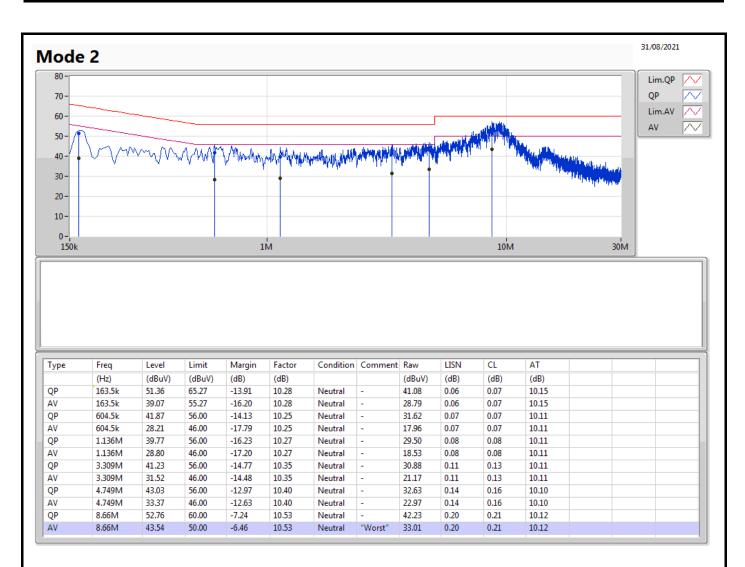


#### **Conducted Emissions at Powerline**

# 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	8.575M	13.168M	13M2G1D	8.5M	13.068M
802.11g_Nss1,(6Mbps)_1TX	16.325M	20.24M	20M2D1D	16.325M	16.917M
802.11n HT20_Nss1,(MCS0)_1TX	17.575M	21.614M	21M6D1D	17.275M	17.891M
802.11n HT40_Nss1,(MCS0)_1TX	35.4M	36.832M	36M8D1D	35.05M	36.432M

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;



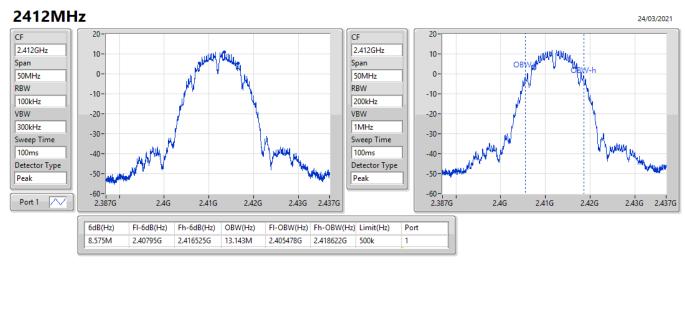
#### Result

Mode	Result	Limit	Port 1-N dB	Port 1-OBW
		(Hz)	(Hz)	(Hz)
802.11b_Nss1,(1Mbps)_1TX	-	-	-	-
2412MHz	Pass	500k	8.575M	13.143M
2437MHz	Pass	500k	8.525M	13.168M
2462MHz	Pass	500k	8.5M	13.068M
802.11g_Nss1,(6Mbps)_1TX	-	-	-	-
2412MHz	Pass	500k	16.325M	16.967M
2437MHz	Pass	500k	16.325M	20.24M
2462MHz	Pass	500k	16.325M	16.917M
802.11n HT20_Nss1,(MCS0)_1TX	-	-	-	-
2412MHz	Pass	500k	17.275M	17.941M
2437MHz	Pass	500k	17.575M	21.614M
2462MHz	Pass	500k	17.525M	17.891M
802.11n HT40_Nss1,(MCS0)_1TX	-	-	-	-
2422MHz	Pass	500k	35.4M	36.432M
2437MHz	Pass	500k	35.1M	36.832M
2452MHz	Pass	500k	35.05M	36.432M

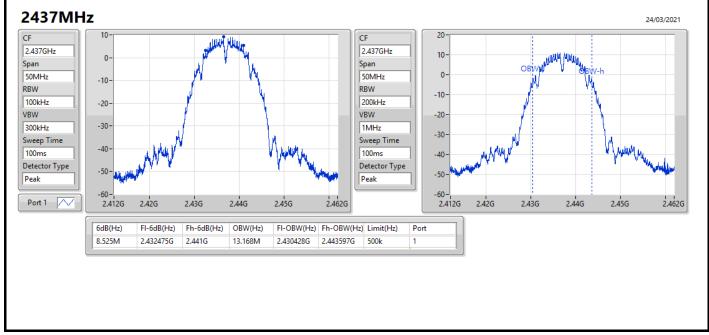
Port X-N dB = Port X 6dB down bandwidth; Port X-OBW = Port X 99% occupied bandwidth;



## 802.11b\_Nss1,(1Mbps)\_1TX



## 802.11b\_Nss1,(1Mbps)\_1TX



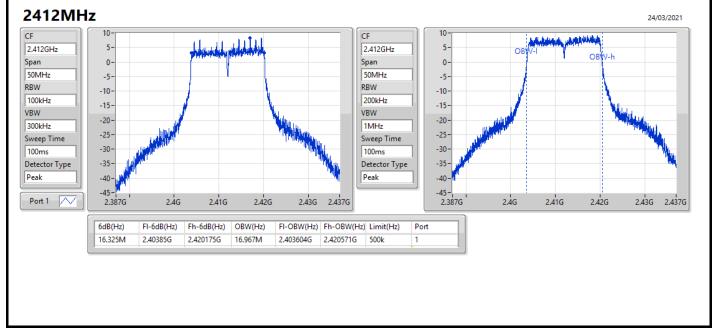


### 802.11b\_Nss1,(1Mbps)\_1TX

### EBW

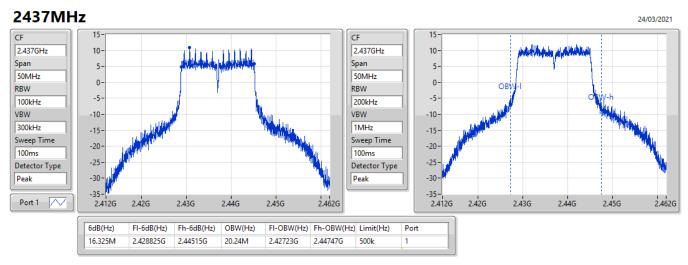


## 802.11g\_Nss1,(6Mbps)\_1TX

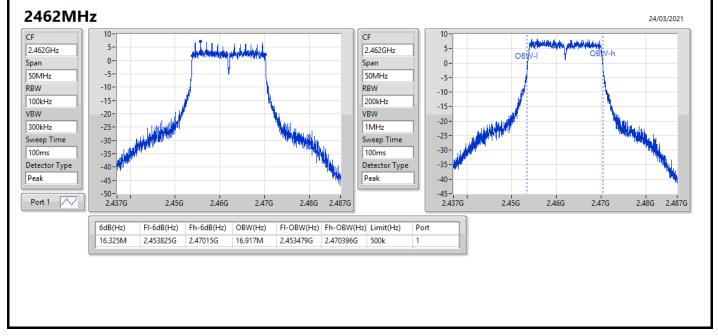




## 802.11g\_Nss1,(6Mbps)\_1TX

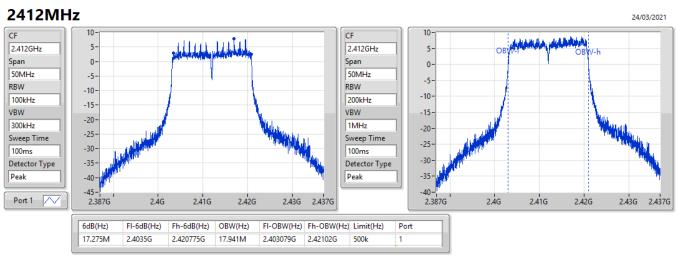


## 802.11g\_Nss1,(6Mbps)\_1TX



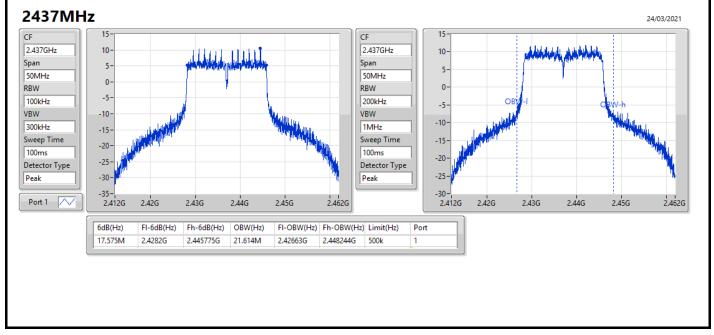


# 802.11n HT20\_Nss1,(MCS0)\_1TX



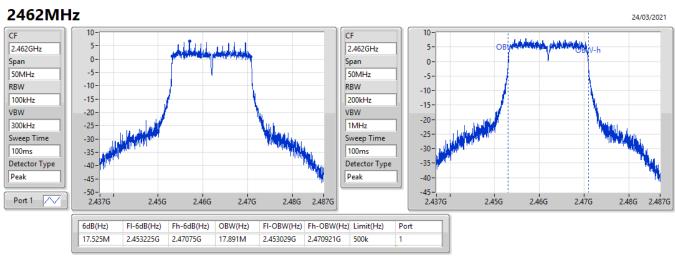
## 802.11n HT20\_Nss1,(MCS0)\_1TX



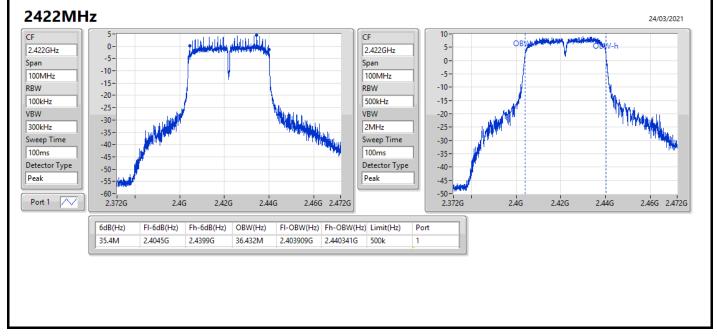




## 802.11n HT20\_Nss1,(MCS0)\_1TX

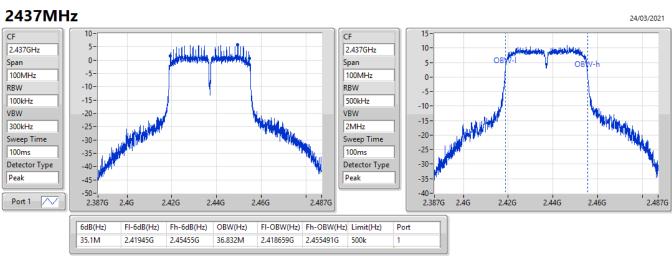


## 802.11n HT40\_Nss1,(MCS0)\_1TX



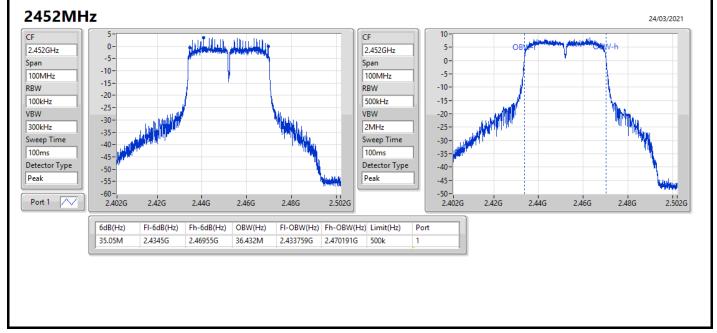


### 802.11n HT40\_Nss1,(MCS0)\_1TX



## 802.11n HT40\_Nss1,(MCS0)\_1TX







#### Summary

Mode	Total Power	Total Power
	(dBm)	(W)
2.4-2.4835GHz	-	-
802.11b_Nss1,(1Mbps)_1TX	20.05	0.10116
802.11g_Nss1,(6Mbps)_1TX	21.15	0.13032
802.11n HT20_Nss1,(MCS0)_1TX	21.15	0.13032
802.11n HT40_Nss1,(MCS0)_1TX	19.12	0.08166



### Average Power

## Appendix C

#### Result

Mode	Result	DG	Port 1	Total Power	Power Limit
		(dBi)	(dBm)	(dBm)	(dBm)
802.11b_Nss1,(1Mbps)_1TX	-	-	-	-	-
2412MHz	Pass	3.69	20.05	20.05	30.00
2437MHz	Pass	3.69	19.96	19.96	30.00
2462MHz	Pass	3.69	20.00	20.00	30.00
802.11g_Nss1,(6Mbps)_1TX	-	-	-	-	-
2412MHz	Pass	3.69	19.10	19.10	30.00
2437MHz	Pass	3.69	21.15	21.15	30.00
2457MHz	Pass	3.69	19.85	19.85	30.00
2462MHz	Pass	3.69	18.11	18.11	30.00
802.11n HT20_Nss1,(MCS0)_1TX	-	-	-	-	-
2412MHz	Pass	3.69	18.76	18.76	30.00
2437MHz	Pass	3.69	21.15	21.15	30.00
2457MHz	Pass	3.69	19.48	19.48	30.00
2462MHz	Pass	3.69	17.66	17.66	30.00
802.11n HT40_Nss1,(MCS0)_1TX	-	-	-	-	-
2422MHz	Pass	3.69	17.95	17.95	30.00
2437MHz	Pass	3.69	19.12	19.12	30.00
2452MHz	Pass	3.69	17.03	17.03	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	-2.46
802.11g_Nss1,(6Mbps)_1TX	-3.42
802.11n HT20_Nss1,(MCS0)_1TX	-5.44
802.11n HT40_Nss1,(MCS0)_1TX	-9.15

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

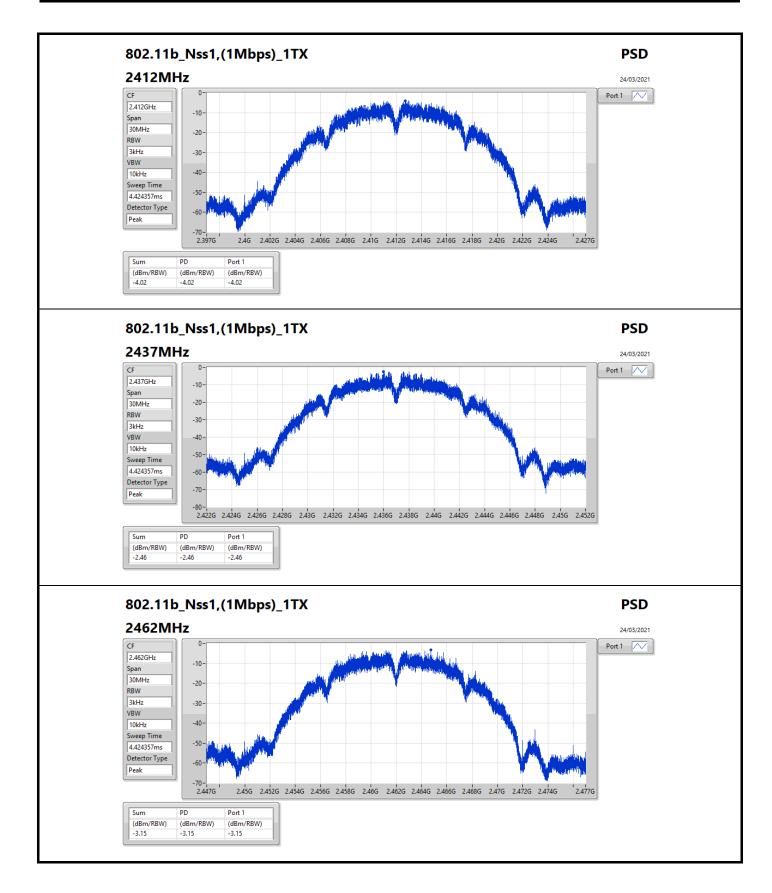


#### Result

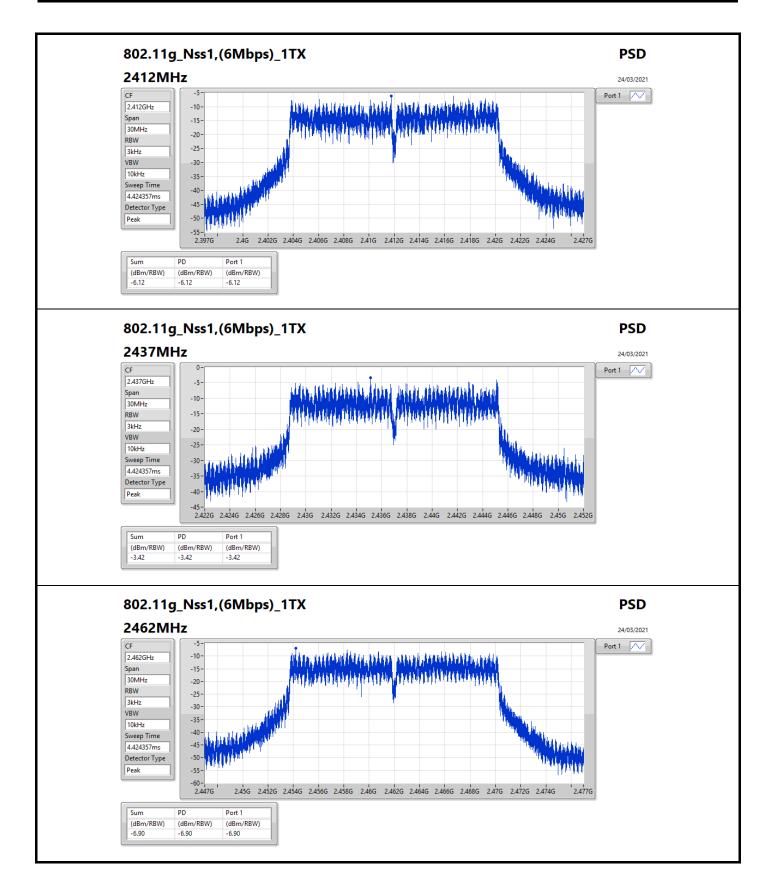
Mode	Result	DG	Port 1	PD	PD Limit
		(dBi)	(dBm/RBW)	(dBm/RBW)	(dBm/RBW)
802.11b_Nss1,(1Mbps)_1TX	-	-	-	-	-
2412MHz	Pass	3.69	-4.02	-4.02	8.00
2437MHz	Pass	3.69	-2.46	-2.46	8.00
2462MHz	Pass	3.69	-3.15	-3.15	8.00
802.11g_Nss1,(6Mbps)_1TX	-	-	-	-	-
2412MHz	Pass	3.69	-6.12	-6.12	8.00
2437MHz	Pass	3.69	-3.42	-3.42	8.00
2462MHz	Pass	3.69	-6.90	-6.90	8.00
802.11n HT20_Nss1,(MCS0)_1TX	-	-	-	-	-
2412MHz	Pass	3.69	-6.70	-6.70	8.00
2437MHz	Pass	3.69	-5.44	-5.44	8.00
2462MHz	Pass	3.69	-8.02	-8.02	8.00
802.11n HT40_Nss1,(MCS0)_1TX	-	-	-	-	-
2422MHz	Pass	3.69	-9.15	-9.15	8.00
2437MHz	Pass	3.69	-29.85	-29.85	8.00
2452MHz	Pass	3.69	-10.61	-10.61	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;

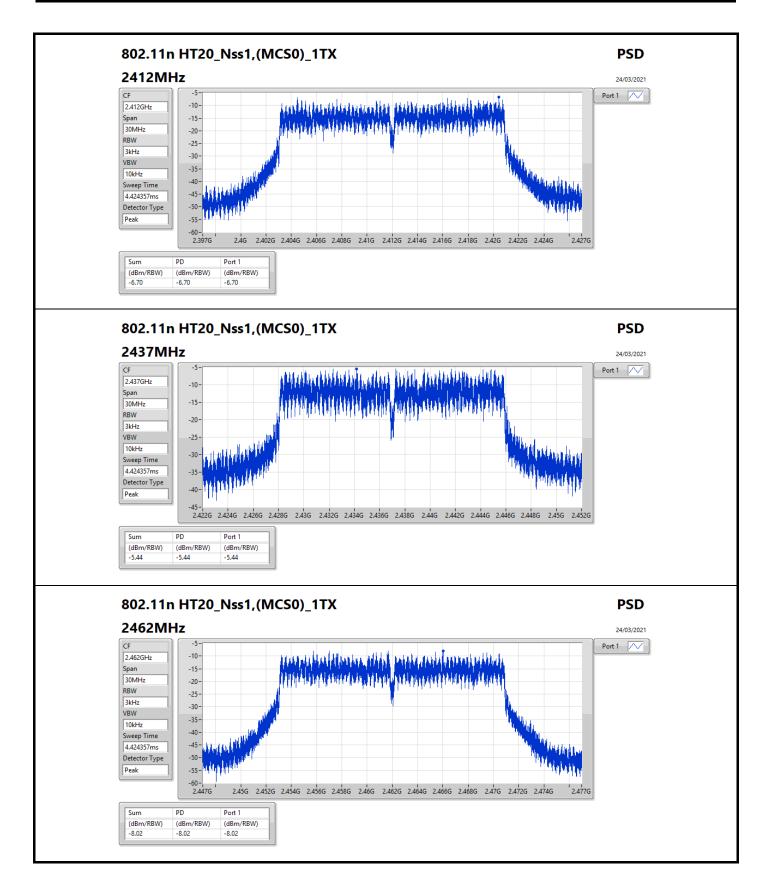




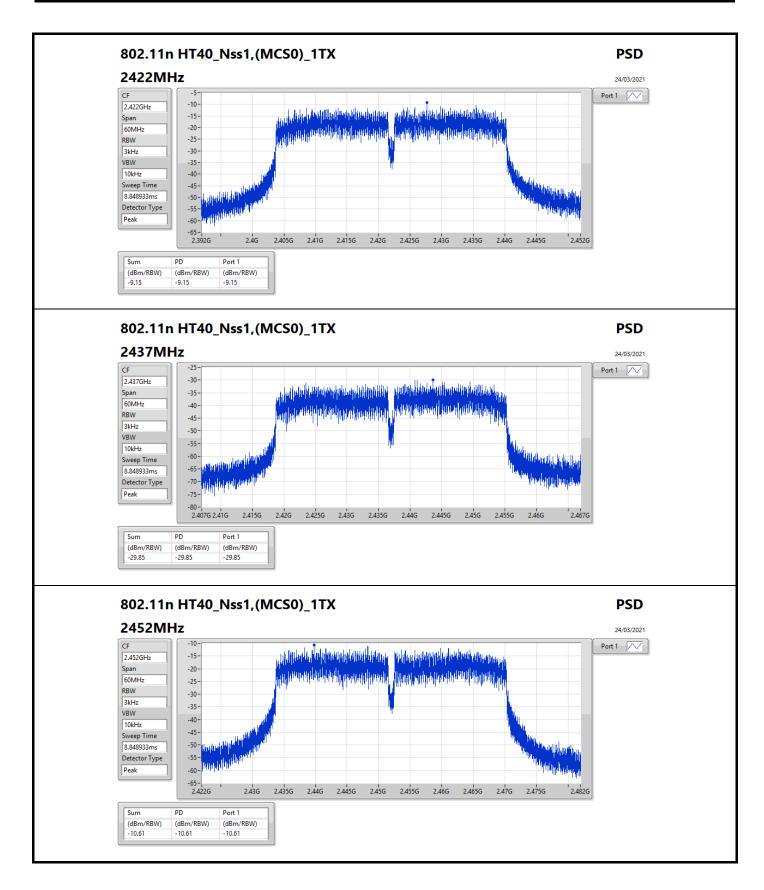














## Appendix E

#### Summary

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	2.41349G	11.67	-18.33	159.9M	-49.30	2.39752G	-35.88	2.4G	-39.69	2.48684G	-51.28	16.56007G	-43.55	1
802.11g_Nss1,(6Mbps)_1TX	Pass	2.43073G	10.67	-19.33	159.9M	-50.87	2.39986G	-21.61	2.4G	-24.83	2.49432G	-51.29	24.99438G	-43.03	1
802.11n HT20_Nss1,(MCS0)_1TX	Pass	2.44451G	10.59	-19.41	159.9M	-48.38	2.39918G	-22.39	2.4G	-25.62	2.50804G	-51.95	24.96629G	-42.29	1
802.11n HT40_Nss1,(MCS0)_1TX	Pass	2.44075G	5.66	-24.34	159.96M	-49.29	2.39992G	-25.89	2.4G	-28.66	2.48478G	-34.66	16.71252G	-43.45	1



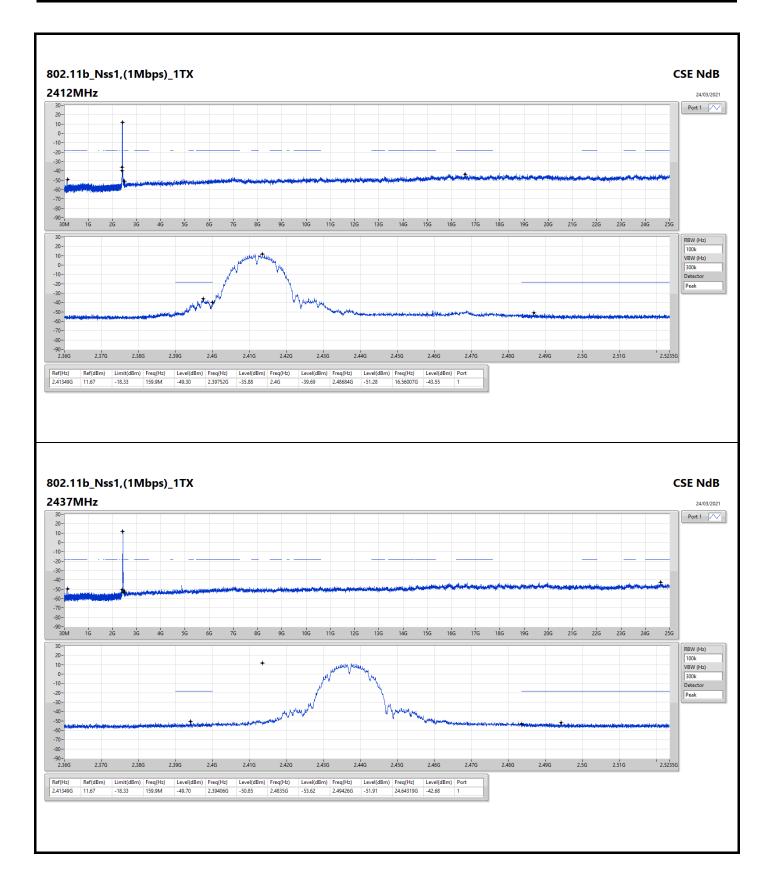
## CSE(Non-restricted Band)

## Appendix E

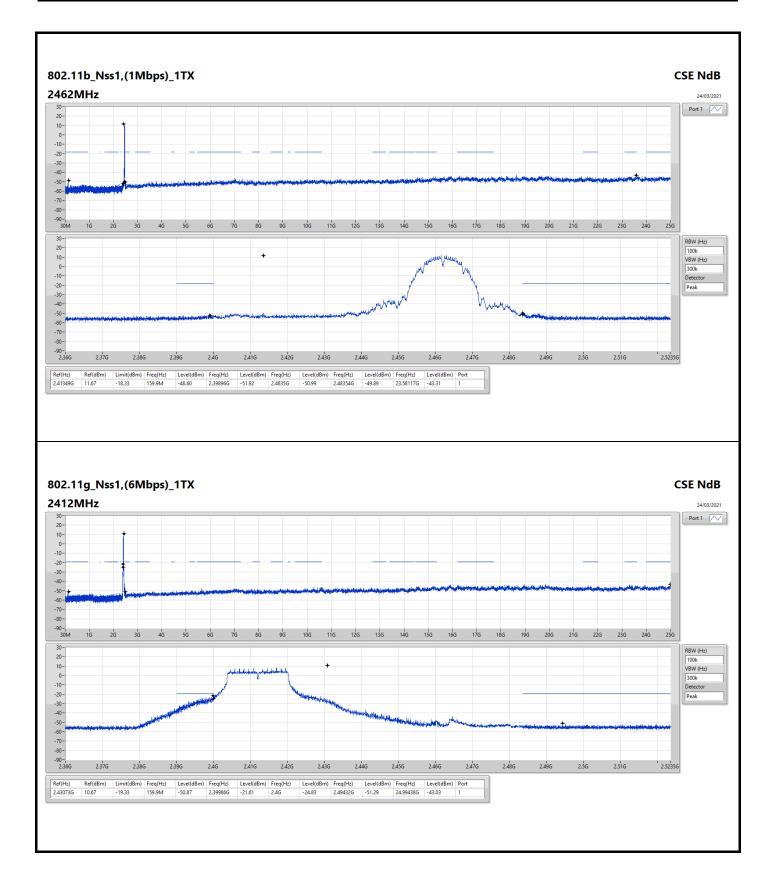
#### Result

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	2.41349G	11.67	-18.33	159.9M	-49.30	2.39752G	-35.88	2.4G	-39.69	2.48684G	-51.28	16.56007G	-43.55	1
2437MHz	Pass	2.41349G	11.67	-18.33	159.9M	-49.70	2.39406G	-50.85	2.4835G	-53.62	2.49426G	-51.91	24.64319G	-42.68	1
2462MHz	Pass	2.41349G	11.67	-18.33	159.9M	-48.60	2.39896G	-51.92	2.4835G	-50.99	2.48354G	-49.89	23.58117G	-43.31	1
802.11g_Nss1,(6Mbps)_1TX	-		-	-	-	-		-		-	-	-	-	-	-
2412MHz	Pass	2.43073G	10.67	-19.33	159.9M	-50.87	2.39986G	-21.61	2.4G	-24.83	2.49432G	-51.29	24.99438G	-43.03	1
2437MHz	Pass	2.43073G	10.67	-19.33	159.9M	-50.80	2.39892G	-39.86	2.4G	-41.19	2.48428G	-42.75	17.63052G	-42.78	1
2462MHz	Pass	2.43073G	10.67	-19.33	159.9M	-50.71	2.39742G	-50.91	2.4835G	-38.23	2.48354G	-35.38	24.89886G	-42.98	1
802.11n HT20_Nss1,(MCS0)_1TX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2412MHz	Pass	2.44451G	10.59	-19.41	159.9M	-48.38	2.39918G	-22.39	2.4G	-25.62	2.50804G	-51.95	24.96629G	-42.29	1
2437MHz	Pass	2.44451G	10.59	-19.41	159.9M	-51.17	2.3995G	-37.47	2.4G	-41.19	2.4848G	-41.85	24.61228G	-43.62	1
2462MHz	Pass	2.44451G	10.59	-19.41	159.9M	-47.23	2.39424G	-50.78	2.4835G	-39.53	2.4835G	-34.75	17.64176G	-43.89	1
802.11n HT40_Nss1,(MCS0)_1TX	-		-	-	-	-	-	-	-	-	-	-	-	-	-
2422MHz	Pass	2.44075G	5.66	-24.34	159.96M	-48.22	2.39888G	-27.10	2.4G	-28.19	2.4835G	-43.38	24.96915G	-43.06	1
2437MHz	Pass	2.44075G	5.66	-24.34	159.96M	-49.29	2.39992G	-25.89	2.4G	-28.66	2.48478G	-34.66	16.71252G	-43.45	1
2452MHz	Pass	2.44075G	5.66	-24.34	159.96M	-49.92	2.39852G	-44.86	2.4835G	-37.34	2.4845G	-32.31	17.66887G	-43.00	1









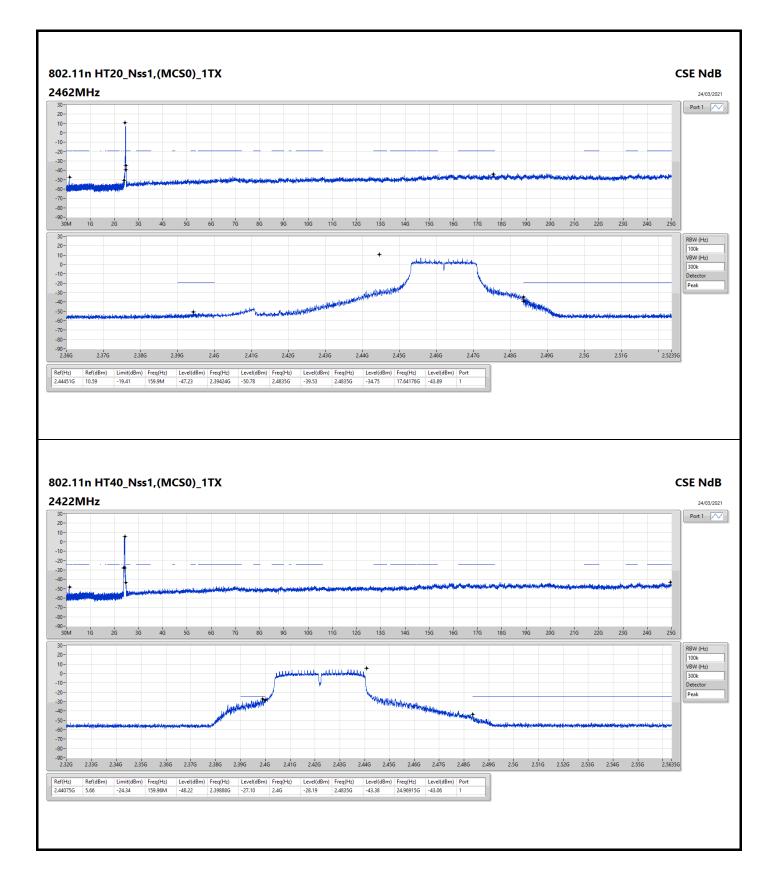




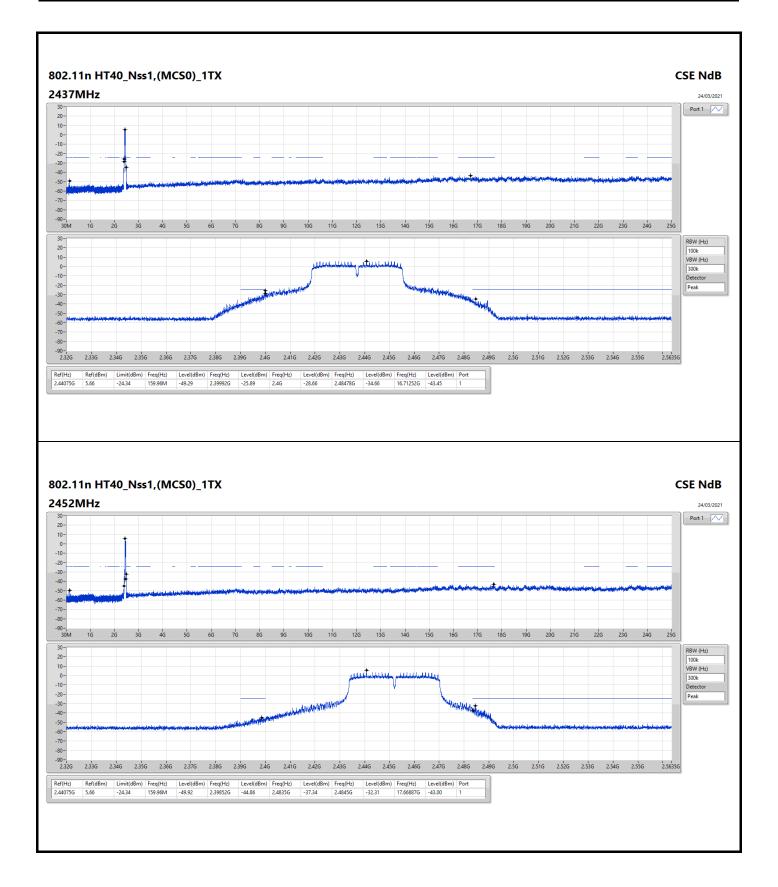














## Radiated Emissions below 1GHz

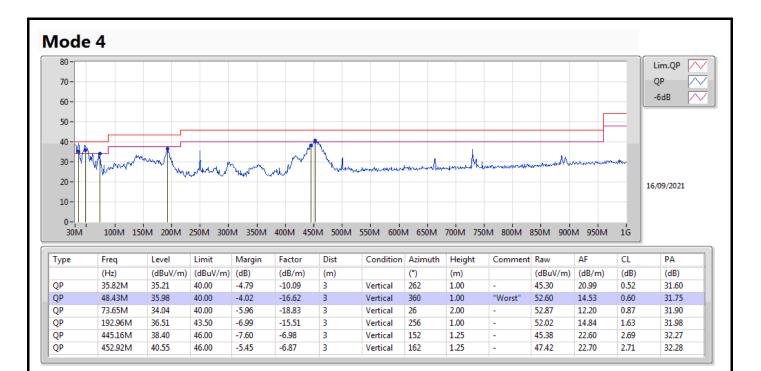
## Appendix F.1

Summary							
Mode	Result	Туре	Freq	Level	Limit	Margin	Condition
			(Hz)	(dBuV/m)	(dBuV/m)	(dB)	
Mode 4	Pass	QP	48.43M	35.98	40.00	-4.02	Vertical



### Radiated Emissions below 1GHz

## Appendix F.1





## Radiated Emissions below 1GHz

#### Mode 4 80 -Lim.QP $\sim$ 70-QP $\sim$ -6dB 60 -50 -40 -30 -20 -16/09/2021 10-0-30M 100M 150M 200M 250M 300M 350M 400M 450M 500M 550M 600M 650M 700M 750M 800M 850M 900M 950M 1G Type Comment Raw CL PA Factor Dist Condition Azimuth Height ΔF Freq Level Limit Margin

1,266	ricq	Cever	CHINC	margin	raccor	Disc	condition	Azimuti	rieigine	comment	11000			10
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dB/m)	(m)		(°)	(m)		(dBuV/m)	(dB/m)	(dB)	(dB)
QP	37.76M	25.93	40.00	-14.07	-11.10	3	Horizontal	79	1.50	-	37.03	19.97	0.56	31.63
QP	202.66M	29.54	43.50	-13.96	-15.24	3	Horizontal	120	3.00	-	44.78	15.04	1.71	31.99
QP	418.97M	30.43	46.00	-15.57	-7.10	3	Horizontal	127	1.00	-	37.53	22.48	2.64	32.22
QP	442.25M	30.78	46.00	-15.22	-7.03	3	Horizontal	118	1.00	-	37.81	22.56	2.68	32.27
QP	663.41M	34.12	46.00	-11.88	-4.70	3	Horizontal	360	1.50	-	38.82	24.52	3.35	32.57
QP	893.3M	35.25	46.00	-10.75	-2.18	3	Horizontal	307	1.00	"Worst"	37.43	26.22	4.25	32.65



## RSE TX above 1GHz

## Appendix F.2

### SSummary

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	2.3884G	53.97	54.00	-0.03	3	Horizontal	199	1.69	-



