Report No. : FR731330-01AA





# FCC RADIO TEST REPORT

FCC ID	E7WPA7510V2	
Equipment	AC750 Wi-Fi Range Extender, AV1000 Powerline Edition	l.
Brand Name	p-link	
Model Name	TL-WPA7510	
Applicant	FP-Link Technologies Co., Ltd. Building 24 (floors 1,3,4,5) and 28 (floors1-4), Central Science and Technology Park,Nanshan Shenzhen, 5180 China	57
Manufacturer	FP-Link Technologies Co., Ltd. Building 24 (floors 1,3,4,5) and 28 (floors1-4), Central Science and Technology Park,Nanshan Shenzhen, 5180 China	57
Standard	47 CFR FCC Part 15.247	

The product was received on Jul. 20, 2018, and testing was started from Sep. 08, 2018 and completed on Nov. 19, 2018. We, SPORTON INTERNATIONAL INC. EMC & Wireless Communications 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 report must not be used by the client to claim product certification, approval, or endorsement by TAF or any agency of government.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full.

Approved by: Cliff Char

SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.)

TEL : 886-3-656-9065 FAX : 886-3-656-9085 Report Template No.: CB Ver1.0 Page Number: 1 of 28Issued Date: Dec. 06, 2018Report Version: 01



## **Table of Contents**

Histor	History of this test report4					
Summ	nary of Test Result	5				
1	General Description	6				
1.1	Information	6				
1.2	Testing Applied Standards	8				
1.3	Testing Location Information	8				
1.4	Measurement Uncertainty	8				
2	Test Configuration of EUT	9				
2.1	Test Channel Mode	9				
2.2	The Worst Case Measurement Configuration	10				
2.3	EUT Operation during Test					
2.4	Accessories					
2.5	Support Equipment					
2.6	Test Setup Diagram	12				
3	Transmitter Test Result	14				
3.1	AC Power-line Conducted Emissions	14				
3.2	DTS Bandwidth					
3.3	Maximum Conducted Output Power					
3.4	Power Spectral Density					
3.5	Emissions in Non-restricted Frequency Bands					
3.6	Emissions in Restricted Frequency Bands	23				
4	Test Equipment and Calibration Data	27				
Apper	ndix A. Test Results of AC Power-line Conducted Emissions					
Apper	ndix B. Test Results of DTS Bandwidth					
Apper	ndix C. Test Results of Maximum Conducted Output Power					
Apper	ndix D. Test Results of Power Spectral Density					
Apper	ndix E. Test Results of Emissions in Non-restricted Frequency Bands					
Apper	ndix F. Test Results of Emissions in Restricted Frequency Bands					
Apper	ndix G. Test Results of Radiated Emission Co-location					
Apper	ndix H. Test Photos					



Photographs of EUT v01



## History of this test report

Report No.	Version	Description	Issued Date
FR731330-01AA	01	Initial issue of report	Dec. 06, 2018



### **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 judgment of conformity in the report is based on the measurement results excluding the measurement uncertainty.

#### **Comments and Explanations:**

None

Reviewed by: Cliff Chang

Report Producer: Vicky 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
2.4G	802.11b	20	2TX
2.4G	802.11g	20	2TX
2.4G	802.11n HT20	20	2TX
2.4G	802.11n HT40	40	2TX

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.
- Nss-Min is the minimum number of spatial streams.
- Nant is the number of outputs. e.g., 2(2,3) means have 2 outputs for port 2 and port 3. 2 means have 2 outputs for port 1 and port 2.

#### 1.1.2 Antenna Information

Amt	Port	Brand	Madal Nama	Antonno Tuno	Connector	Gain	(dBi)
Ant.	Port	Brano	Model Name	Antenna Type	Connector	2.4GHz	5GHz
1	1	tp-link	-	Printed Antenna	N/A	2	-
2	2	tp-link	-	Printed Antenna	N/A	2	-
3	1	tp-link	-	Printed Antenna	N/A	-	2.98

Note: The EUT has three Antennas.

#### For 2.4GHz function:

#### For IEEE 802.11b/g/n mode (2TX/2RX)

Ant. 1(Port 1) and Ant. 2(Port 2) can be used as transmitting/receiving antenna.

Ant. 1(Port 1) and Ant. 2(Port 2) could transmit/receive simultaneously.

#### For 5GHz function:

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

Only Ant. 3(Port 1) can be used as transmitting/receiving antenna.



#### 1.1.3 Mode Test Duty Cycle

Mode	DC	DCF(dB)	T(s)	VBW(Hz) ≥ 1/T
802.11b	1	0	n/a (DC>=0.98)	n/a (DC>=0.98)
802.11g	0.992	0.035	n/a (DC>=0.98)	n/a (DC>=0.98)
802.11n HT20	0.994	0.026	n/a (DC>=0.98)	n/a (DC>=0.98)
802.11n HT40	0.984	0.07	n/a (DC>=0.98)	n/a (DC>=0.98)

Note:

• DC is Duty Cycle.

DCF is Duty Cycle Factor.

#### 1.1.4 EUT Operational Condition

EUT Power Type Internal Power Supply				
Beamforming Function				Without beamforming
Function	Point-to-multipoint		Point-to-point	
Test Software Version         MT7620 QA Version 1.0.6.0				



### **1.2 Testing Applied 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
- FCC KDB 558074 D01 v05
- FCC KDB 662911 D01 v02r01

### **1.3 Testing Location Information**

	Testing Location						
	HWA YA ADD : No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.)						
		TEL	:	886-3-327-3456 FAX : 886-3-327-0973			
$\boxtimes$	JHUBEI	ADD	:	No.8, Lane 724, Bo-ai St., Jhubei City, HsinChu County 302, Taiwan, R.O.C.			
		TEL	:	886-3-656-9065 FAX : 886-3-656-9085			

Test Condition	Test Site No.	Test Engineer	Test Environment	Test Date
RF Conducted	TH01-CB	Serway Li	23°C / 60%	Sep. 13, 2018
Radiated	03CH01-CB	Mason Chen	20°C / 55%	Sep. 08, 2018~Sep. 18, 2018
AC Conduction	CO01-CB	GN Hou	24°C / 68%	Nov. 19, 2018

Test site Designation No. TW0006 with FCC.

Test site registered number IC 4086D with Industry Canada.

### **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 (30MHz ~ 1,000MHz)	3.6 dB	Confidence levels of 95%
Radiated Emission (1GHz ~ 18GHz)	3.7 dB	Confidence levels of 95%
Radiated Emission (18GHz ~ 40GHz)	3.5 dB	Confidence levels of 95%
Conducted Emission	1.7 dB	Confidence levels of 95%
Output Power Measurement	1.33 dB	Confidence levels of 95%
Power Density Measurement	1.27 dB	Confidence levels of 95%
Bandwidth Measurement	9.74 x10 <sup>-8</sup>	Confidence levels of 95%



## 2 Test Configuration of EUT

### 2.1 Test Channel Mode

Mode	Power Setting
802.11b_Nss1,(1Mbps)_2TX	-
2412MHz	11/10
2437MHz	10/0E
2462MHz	0C/0C
802.11g_Nss1,(6Mbps)_2TX	-
2412MHz	0B/0A
2417MHz	15/12
2422MHz	1C/19
2427MHz	22/20
2432MHz	2F/2D
2437MHz	2F/2D
2442MHz	22/20
2447MHz	1D/1B
2452MHz	17/17
2457MHz	11/11
2462MHz	05/05
802.11n HT20_Nss1,(MCS0)_2TX	-
2412MHz	08/07
2417MHz	14/11
2422MHz	19/16
2427MHz	1D/1B
2432MHz	2F/2D
2437MHz	2F/2D
2442MHz	20/1E
2447MHz	19/17
2452MHz	14/14
2457MHz	10/10
2462MHz	04/04
802.11n HT40_Nss1,(MCS0)_2TX	-
2422MHz	05/02
2427MHz	0D/0B
2437MHz	0D/0B
2442MHz	08/06
2447MHz	05/03
2452MHz	01/01

TEL : 886-3-656-9065 FAX : 886-3-656-9085 Report Template No.: CB Ver1.0 Page Number: 9 of 28Issued Date: Dec. 06, 2018Report Version: 01



## 2.2 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 CTX		
1	CTX-2.4GHz	
2 CTX-5GHz		
For operating mode 1 is the worst case and it was record in this test report		

For operating mode 1 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		

The Worst Case Mode for Following Conformance Tests				
Tests Item Emissions in Restricted Frequency Bands				
Test ConditionRadiated measurementIf EUT consist of multiple antenna assembly (multiple antenna are used in E regardless of spatial multiplexing MIMO configuration), the radiated test sho be performed with highest antenna gain of each antenna type.				
Operating Mode < 1GHz	СТХ			
For 2.4GHz: The EUT was performed at Y axis and Z axis position for Radiated emission above 1GHz test, and the worst case was found at Y axis. So the measurement will follow this same test configuration. For 5GHz: The EUT was performed at Y axis and Z axis position for Radiated emission above 1GHz test, and the worst case was found at Z axis. So the measurement will follow this same test configuration.				
1	EUT in Y axis-2.4GHz			
2	EUT in Z axis-5GHz			
For operating mode 1 is the worst case and it was record in this test report.				
Operating Mode > 1GHz CTX				
The EUT was performed at Y axis and Z axis position, and the worst case was found at Y axis. So the measurement will follow this same test configuration.				
1 EUT in Y axis				

The Worst Case Mode for Following Conformance Tests			
Tests Item         Simultaneous Transmission Analysis - Radiated Emission Co-location			
Test Condition Radiated measurement			
Operating Mode Normal Link			
The EUT was performed at Y axis and Z axis position for Radiated emission above 1GHz test, and the worst case was found at Y axis. So the measurement will follow this same test configuration.			
1 EUT in Y axis-WLAN 2.4GHz+WLAN 5GHz			
Refer to Appendix G for Radiated Emission Co-location.			

The Worst Case Mode for Following Conformance Tests		
Tests Item         Simultaneous Transmission Analysis - Co-location RF Exposure Evaluation		
Operating Mode		
1 WLAN 2.4GHz+WLAN 5GHz		
Refer to Sporton Test Report No.: FA731330-01 for Co-location RF Exposure Evaluation.		

### 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 Test Site No: CO01-CB

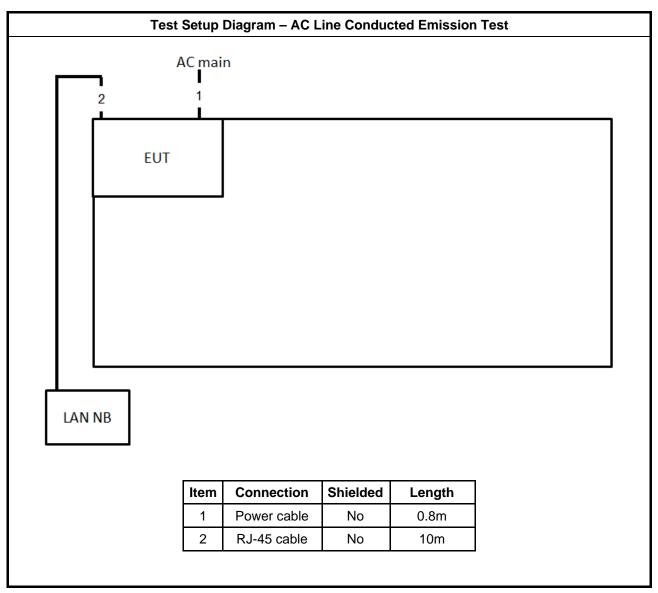
Support Equipment				
No.	Equipment	Brand Name	Model Name	FCC ID
1	NB	DELL	E6430	N/A

#### For Test Site No: 03CH01-CB and TH01-CB

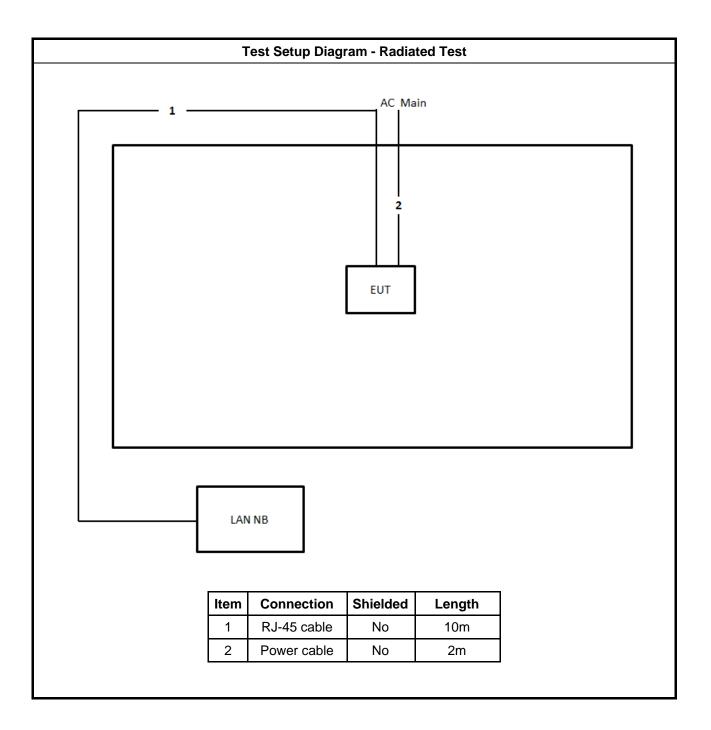
Support Equipment				
No.	Equipment	Brand Name	Model Name	FCC ID
1	NB	DELL	E4300	N/A



## 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 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.			

, and the second s

### 3.1.2 Measuring Instruments

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

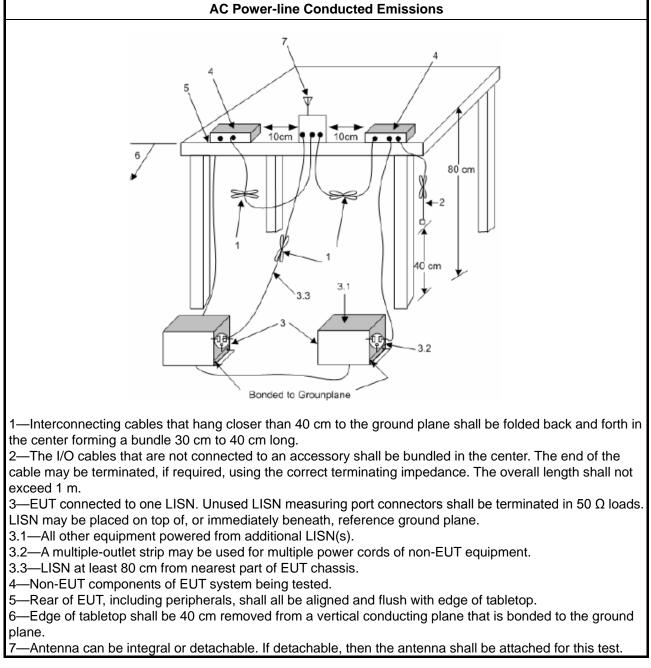
#### 3.1.3 Test Procedures

**Test Method** 

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



#### 3.1.4 Test Setup



#### 3.1.5 Test Result of AC Power-line Conducted Emissions

Refer as Appendix A



### 3.2 DTS Bandwidth

#### 3.2.1 6dB Bandwidth Limit

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

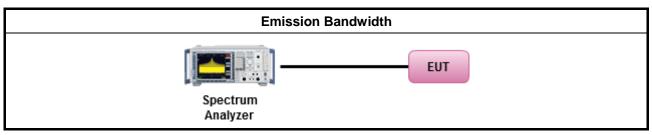
#### 3.2.2 Measuring Instruments

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

#### 3.2.3 Test Procedures

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



#### **Maximum Conducted Output Power** 3.3

#### 3.3.1 Maximum Conducted Output Power Limit

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

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

•	Point-to-multipoint systems	(P2M): If $G_{TX}$	> 6 dBi, then P <sub>Ou</sub>	$_{t} = 30 - (G_{TX} - 6) \text{ dBm}$
---	-----------------------------	--------------------	-------------------------------	--

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

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

Pout = 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**

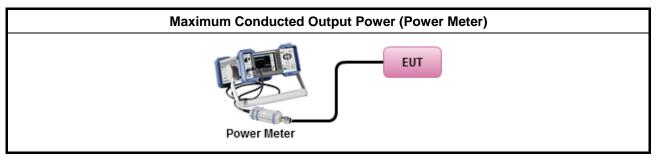
Refer a test equipment and calibration data table in this test report.



#### 3.3.3 Test Procedures

		Test Method
•	Max	imum Peak Conducted Output Power
		Refer as FCC KDB 558074, clause 8.3.1.1 & C63.10 clause 11.9.1.1 (RBW ≥ EBW method).
		Refer as FCC KDB 558074, clause 8.3.1.3 & C63.10 clause 11.9.1.3 (peak power meter).
•	Max	imum Conducted Output Power
	[duty	/ 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)
	$\boxtimes$	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 <sub>total</sub> = P <sub>total</sub> + 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.

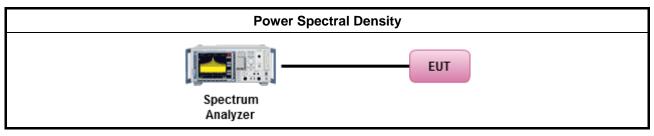
#### 3.4.3 Test Procedures

		Test Method
•	outp the c conc of th	k power spectral density procedures that the same method as used to determine the conducted ut power. If maximum peak conducted output power was measured to demonstrate compliance to output power limit, then the peak PSD procedure below (Method PKPSD) shall be used. If maximum ducted output power was measured to demonstrate compliance to the output power limit, then one e average PSD procedures shall be used, as applicable based on the following criteria (the peak procedure is also an acceptable option).
	$\square$	Refer as FCC KDB 558074, clause 8.4 & C63.10 clause 11.10.2 Method PKPSD.
	[duty	/ cycle ≥ 98% or external video / power trigger]
		Refer as FCC KDB 558074, clause 8.4 & C63.10 clause 11.10.3 Method AVGPSD-1.
		Refer as FCC KDB 558074, clause 8.4 & C63.10 clause 11.10.5 Method AVGPSD-2.
		Refer as FCC KDB 558074, clause 8.4 & C63.10 clause 11.10.7 Method AVGPSD-3.
	duty	cycle < 98% and average over on/off periods with duty factor
		Refer as FCC KDB 558074, clause 8.4 & C63.10 clause 11.10.4 Method AVGPSD-1A. (alternative).
		Refer as FCC KDB 558074, clause 8.4 & C63.10 clause 11.10.6 Method AVGPSD-2A. (alternative)
		Refer as FCC KDB 558074, clause 8.4 & C63.10 clause 11.10.6 Method AVGPSD-3A. (alternative)
-	For	conducted measurement.
	•	If The 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,
TEL	: 886-3	3-656-9065 Page Number : 20 of 28



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 (dB)					
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

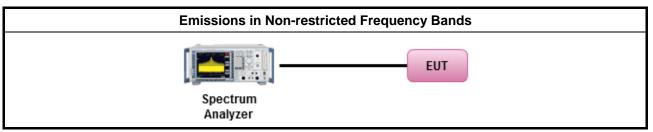
Refer a test equipment and calibration data table in this test report.

#### 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)	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.

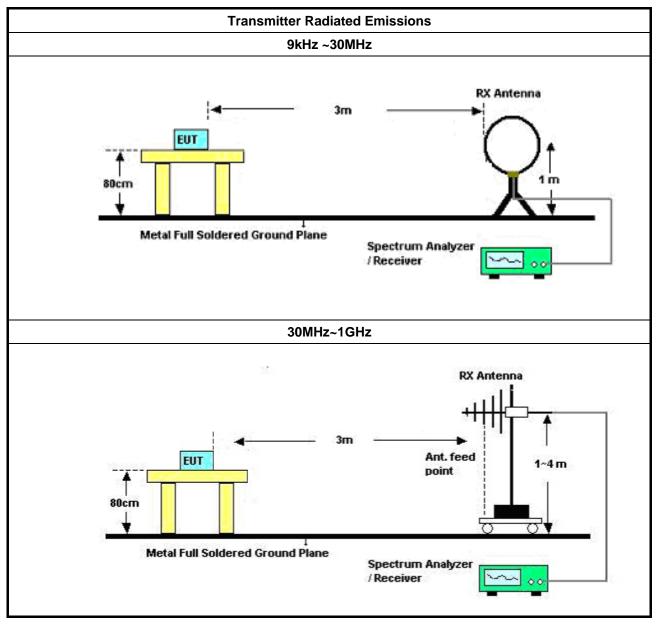


#### 3.6.3 Test Procedures

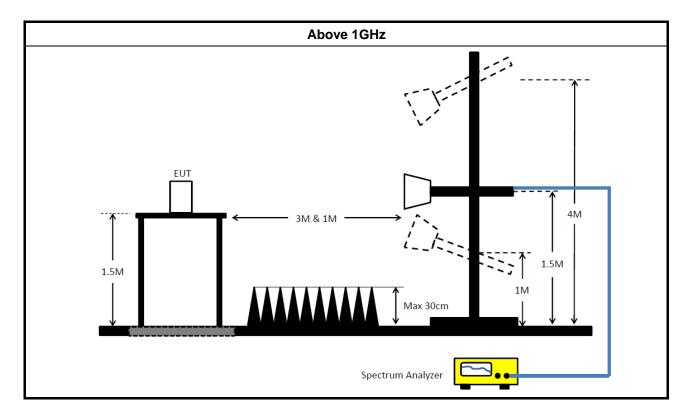
	Test Method								
•	The average emission levels shall be measured in [duty cycle $\geq$ 98 or duty factor].								
•	Refer as ANSI C63.10, clause 6.9.2.2 band-edge testing shall be performed at the lowest frequency channel and highest frequency channel within the allowed operating band.								
•	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 du 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 4.2.3.2.3 (Reduced VBW). VBW $\geq$ 1/T, where T is pulse time.								
	Refer as ANSI C63.10, clause 4.2.3.2.4 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 Transmitter Radiated Unwanted Emissions (Below 30MHz)

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 10 harmonic or 40 GHz, whichever is appropriate.

#### 3.6.6 Test Result of Transmitter Radiated Unwanted Emissions

Refer as Appendix F



#### **Test Equipment and Calibration Data** 4

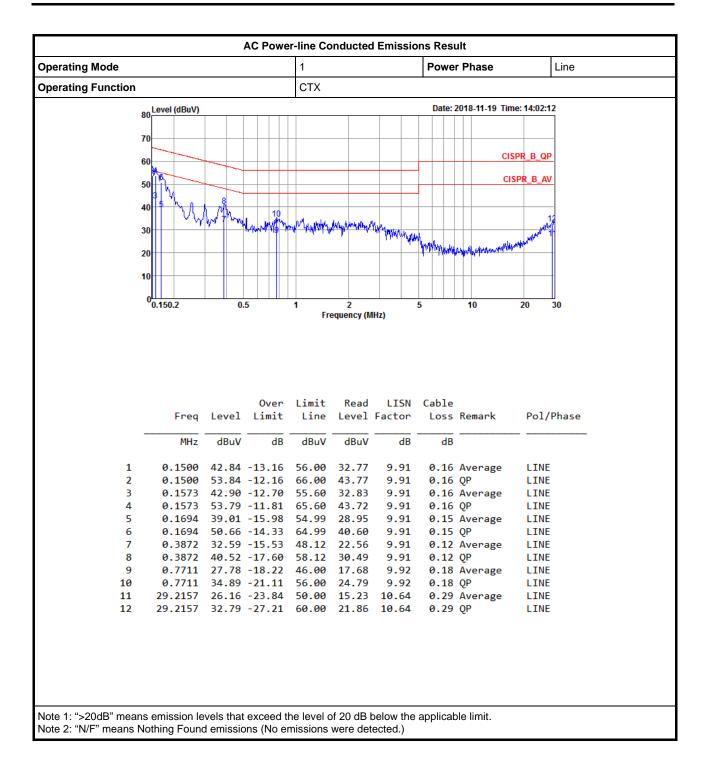
Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Calibration Due Date	Remark
EMI Receiver	Agilent	N9038A	My52260123	9kHz ~ 8.45GHz	Jan. 31, 2018	Jan. 30, 2019	Conduction (CO01-CB)
LISN	F.C.C.	FCC-LISN-50- 16-2	04083	150kHz ~ 100MHz	Dec. 20, 2017	Dec. 19, 2018	Conduction (CO01-CB)
LISN	Schwarzbeck	NSLK 8127	8127647	9kHz ~ 30MHz	Dec. 29, 2017	Dec. 28, 2018	Conduction (CO01-CB)
COND Cable	Woken	Cable	Low cable-CO01	150kHz ~ 30MHz	May 22, 2018	May 21, 2019	Conduction (CO01-CB)
Software	Audix	E3	6.120210n	-	N.C.R.	N.C.R.	Conduction (CO01-CB)
BILOG ANTENNA with 6dB Attenuator	TESEQ & EMCI	CBL6112D & N-6-06	37880 & AT-N0609	20MHz ~ 2GHz	Aug. 27, 2018	Aug. 26, 2019	Radiation (03CH01-CB)
Horn Antenna	EMCO	3115	00075790	750MHz ~ 18GHz	Nov. 20, 2017	Nov. 19, 2018	Radiation (03CH01-CB)
Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170252	15GHz ~ 40GHz	Jun. 28, 2018	Jun. 27, 2019	Radiation (03CH01-CB)
Pre-Amplifier	EMCI	EMC330N	980332	20MHz ~ 3GHz	May 02, 2018	May 01, 2019	Radiation (03CH01-CB)
Pre-Amplifier	Agilent	8449B	3008A02310	1GHz ~ 26.5GHz	Jan. 09, 2018	Jan. 08, 2019	Radiation (03CH01-CB)
Pre-Amplifier	MITEQ	TTA1840-35-H G	1864479	18GHz ~ 40GHz	Jul. 04, 2018	Jul. 03, 2019	Radiation (03CH01-CB)
Spectrum Analyzer	R&S	FSP40	100056	9kHz ~ 40GHz	Nov. 23, 2017	Nov. 22, 2018	Radiation (03CH01-CB)
EMI Test	R&S	ESCS	100354	9kHz ~ 2.75GHz	Dec. 08, 2017	Dec. 07, 2018	Radiation (03CH01-CB)
Loop Antenna	Teseq	HLA 6120	24155	9kHz - 30 MHz	Mar. 16, 2018	Mar. 15, 2019	Radiation (03CH01-CB)
RF Cable-low	Woken	Low Cable-16+17	N/A	30 MHz ~ 1 GHz	Oct. 11, 2017	Oct. 10, 2018	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-16	N/A	1 GHz ~ 18 GHz	Oct. 11, 2017	Oct. 10, 2018	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-16+17	N/A	1 GHz ~ 18 GHz	Oct. 11, 2017	Oct. 10, 2018	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-40G#1	N/A	18GHz ~ 40 GHz	Jul. 27, 2018	Jul. 26, 2019	Radiation (03CH01-CB)



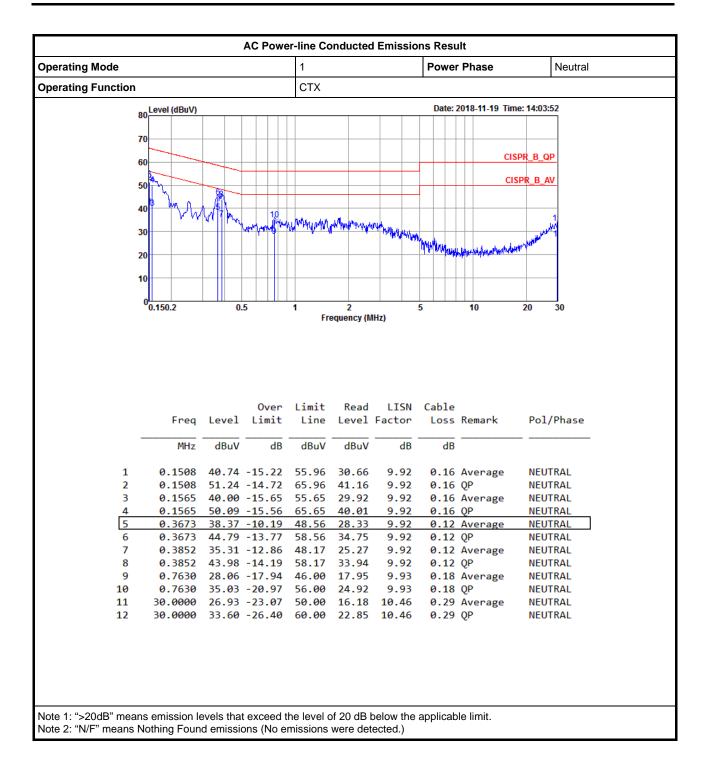
Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Calibration Due Date	Remark
RF Cable-high	Woken	High Cable-40G#2	N/A	18GHz ~ 40 GHz	Jul. 27, 2018	Jul. 26, 2019	Radiation (03CH01-CB)
Spectrum analyzer	R&S	FSV40	100979	9kHz~40GHz	Dec. 21, 2017	Dec. 20, 2018	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-06	1 GHz – 26.5 GHz	Oct. 11, 2017	Oct. 10, 2018	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-07	1 GHz –26.5 GHz	Oct. 11, 2017	Oct. 10, 2018	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-08	1 GHz –26.5 GHz	Oct. 11, 2017	Oct. 10, 2018	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-09	1 GHz –26.5 GHz	Oct. 11, 2017	Oct. 10, 2018	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-10	1 GHz –26.5 GHz	Oct. 11, 2017	Oct. 10, 2018	Conducted (TH01-CB)
Power Sensor	Agilent	U2021XA	MY53410001	50MHz~18GHz	Nov. 20, 2017	Nov. 19, 2018	Conducted (TH01-CB)

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











#### 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)_2TX	10.05M	12.919M	12M9G1D	10M	12.294M
802.11g_Nss1,(6Mbps)_2TX	16.325M	24.488M	24M5D1D	16.325M	16.542M
802.11n HT20_Nss1,(MCS0)_2TX	17.525M	26.237M	26M2D1D	17.05M	17.641M
802.11n HT40_Nss1,(MCS0)_2TX	36.3M	36.382M	36M4D1D	36.05M	36.332M

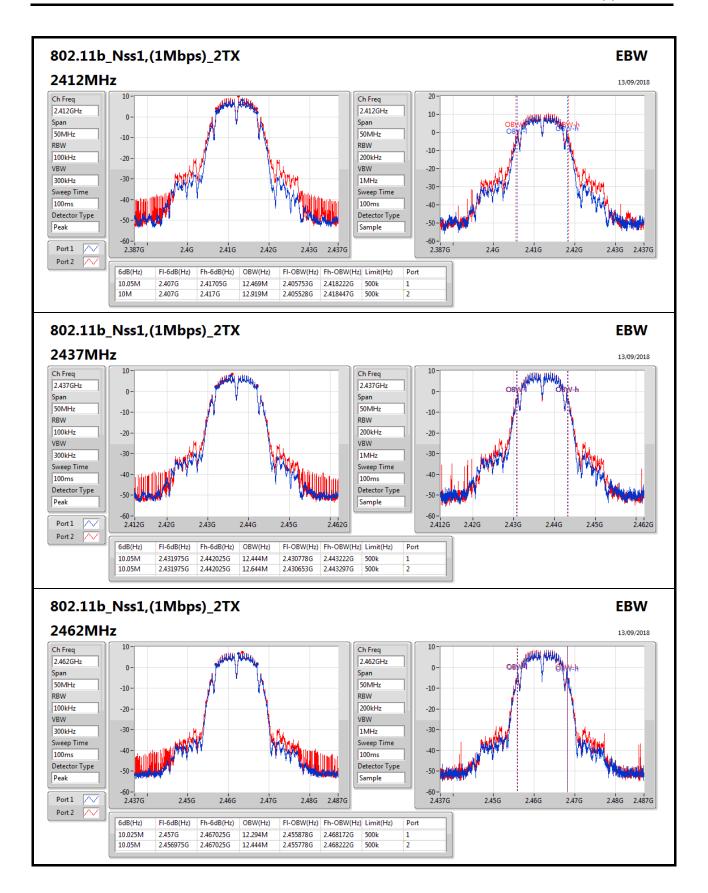
Max-N dB = Maximum 6dB down bandwidth; Max-OBW = Maximum 99% occupied bandwidth; Min-N dB = Minimum 6dB down bandwidth; Min-OBW = Minimum 99% occupied bandwidth;

#### Result

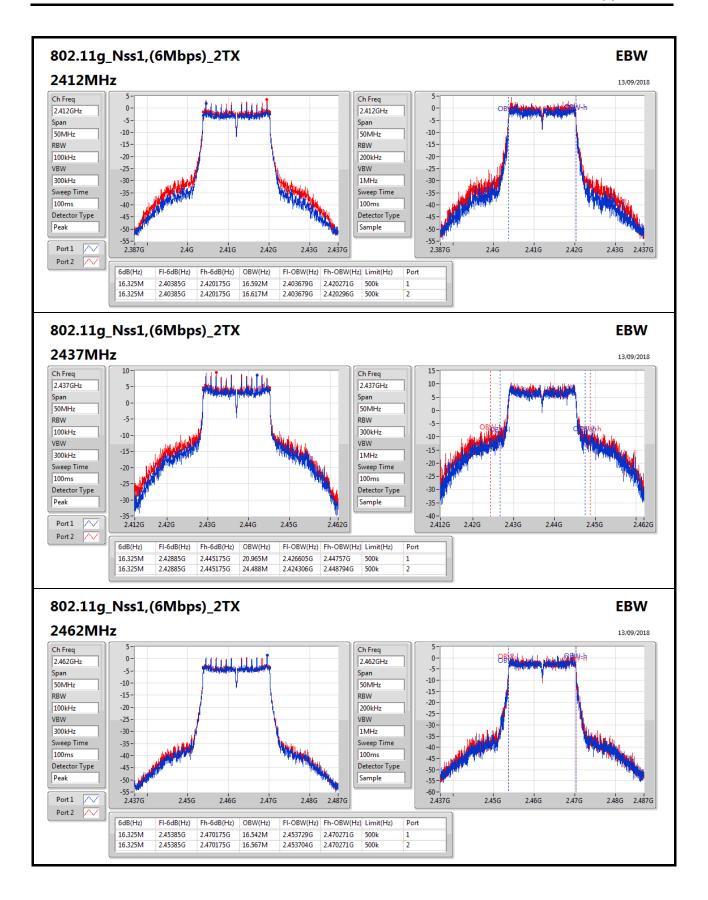
Mode	Result	Limit	Port 1-N dB	Port 1-OBW	Port 2-N dB	Port 2-OBW
		(Hz)	(Hz)	(Hz)	(Hz)	(Hz)
802.11b_Nss1,(1Mbps)_2TX	-	-	-	-	-	-
2412MHz	Pass	500k	10.05M	12.469M	10M	12.919M
2437MHz	Pass	500k	10.05M	12.444M	10.05M	12.644M
2462MHz	Pass	500k	10.025M	12.294M	10.05M	12.444M
802.11g_Nss1,(6Mbps)_2TX	-	-	-	-	-	-
2412MHz	Pass	500k	16.325M	16.592M	16.325M	16.617M
2437MHz	Pass	500k	16.325M	20.965M	16.325M	24.488M
2462MHz	Pass	500k	16.325M	16.542M	16.325M	16.567M
802.11n HT20_Nss1,(MCS0)_2TX	-	-	-	-	-	-
2412MHz	Pass	500k	17.1M	17.641M	17.1M	17.641M
2437MHz	Pass	500k	17.25M	22.639M	17.525M	26.237M
2462MHz	Pass	500k	17.075M	17.641M	17.05M	17.641M
802.11n HT40_Nss1,(MCS0)_2TX	-	-	-	-	-	-
2422MHz	Pass	500k	36.05M	36.332M	36.3M	36.382M
2437MHz	Pass	500k	36.05M	36.382M	36.05M	36.382M
2452MHz	Pass	500k	36.05M	36.332M	36.3M	36.382M

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

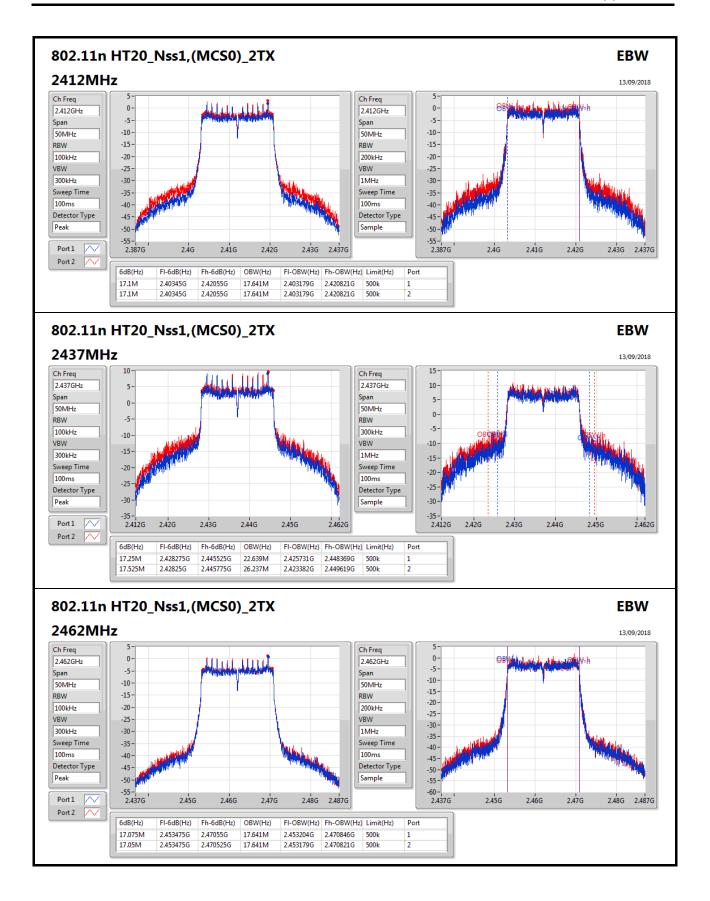




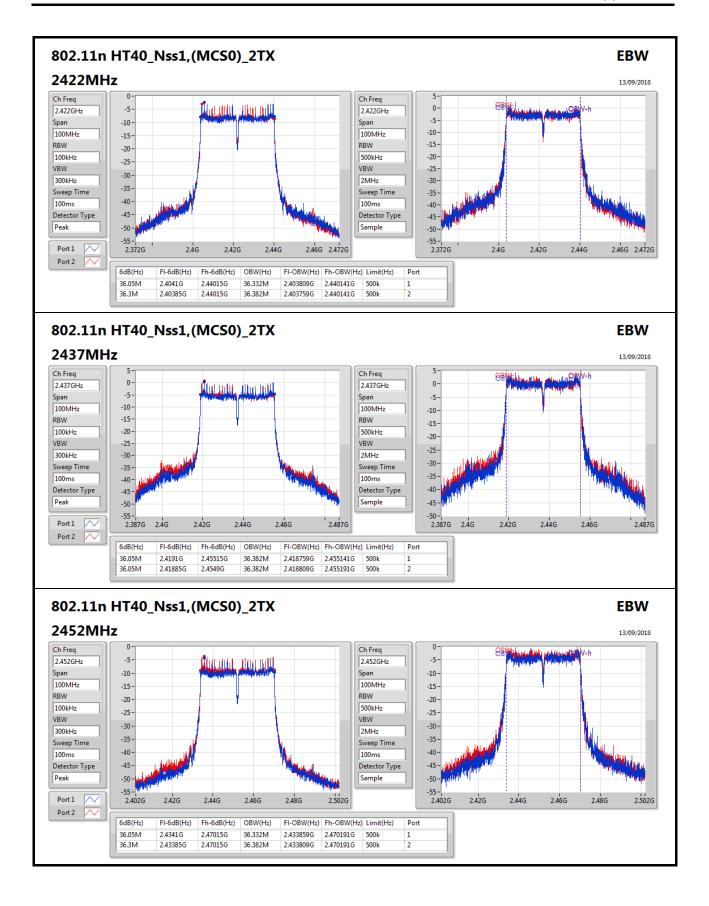














#### **AV Power Result**

Summary

Summary Mode		Total Powe	er		Total Power			
		(dBm)			(W)			
2.4-2.4835GHz		-			-			
802.11b_Nss1,(1Mbps)_2TX		22.99			0.19907			
802.11g_Nss1,(6Mbps)_2TX		23.85			0.24266			
802.11n HT20_Nss1,(MCS0)_2TX		23.55			0.22646			
802.11n HT40_Nss1,(MCS0)_2TX		17.81			0.06039			
Result								
Mode	Result	DG	Port 1	Port 2	Total Power	Power Limit		
		(dBi)	(dBm)	(dBm)	(dBm)	(dBm)		
802.11b_Nss1,(1Mbps)_2TX	-	-	-	-	-	-		
2412MHz	Pass	2.00	19.48	20.43	22.99	30.00		
2437MHz	Pass	2.00	19.25	19.49	22.38	30.00		
2462MHz	Pass	2.00	17.52	18.47	21.03	30.00		
802.11g_Nss1,(6Mbps)_2TX	-	-	-	-	-	-		
2412MHz	Pass	2.00	14.35	15.27	17.84	30.00		
2417MHz	Pass	2.00	18.41	18.46	21.45	30.00		
2422MHz	Pass	2.00	19.82	20.32	23.09	30.00		
2427MHz	Pass	2.00	20.39	21.07	23.75	30.00		
2432MHz	Pass	2.00	20.36	21.14	23.78	30.00		
2437MHz	Pass	2.00	20.57	21.09	23.85	30.00		
2442MHz	Pass	2.00	20.13	20.84	23.51	30.00		
2447MHz	Pass	2.00	19.51	19.63	22.58	30.00		
2452MHz	Pass	2.00	18.74	19.18	21.98	30.00		
2457MHz	Pass	2.00	16.76	17.27	20.03	30.00		
2462MHz	Pass	2.00	12.64	13.34	16.01	30.00		
802.11n HT20_Nss1,(MCS0)_2TX	-	-	-	-	-	-		
2412MHz	Pass	2.00	13.61	14.55	17.12	30.00		
2417MHz	Pass	2.00	17.89	18.05	20.98	30.00		
2422MHz	Pass	2.00	19.33	19.38	22.37	30.00		
2427MHz	Pass	2.00	19.75	20.06	22.92	30.00		
2432MHz	Pass	2.00	20.18	20.79	23.51	30.00		
2437MHz	Pass	2.00	20.22	20.84	23.55	30.00		
2442MHz	Pass	2.00	20.35	20.63	23.50	30.00		
2447MHz	Pass	2.00	19.17	19.29	22.24	30.00		
2452MHz	Pass	2.00	18.13	18.62	21.39	30.00		
2457MHz	Pass	2.00	16.58	17.16	19.89	30.00		
2462MHz	Pass	2.00	12.13	12.82	15.50	30.00		



#### **AV Power Result**

# Appendix C

802.11n HT40_Nss1,(MCS0)_2TX	-	-	-	-	-	-
2422MHz	Pass	2.00	12.01	12.05	15.04	30.00
2427MHz	Pass	2.00	14.59	14.95	17.78	30.00
2437MHz	Pass	2.00	14.63	14.97	17.81	30.00
2442MHz	Pass	2.00	13.41	13.45	16.44	30.00
2447MHz	Pass	2.00	12.08	12.11	15.11	30.00
2452MHz	Pass	2.00	10.36	11.18	13.80	30.00

DG = Directional Gain; Port X = Port X output power Note : Conducted average output power is for reference only



**PSD** Result

Summary

Mode	PD
	(dBm/RBW)
2.4-2.4835GHz	-
802.11b_Nss1,(1Mbps)_2TX	-4.58
802.11g_Nss1,(6Mbps)_2TX	-4.09
802.11n HT20_Nss1,(MCS0)_2TX	-3.73
802.11n HT40_Nss1,(MCS0)_2TX	-11.28

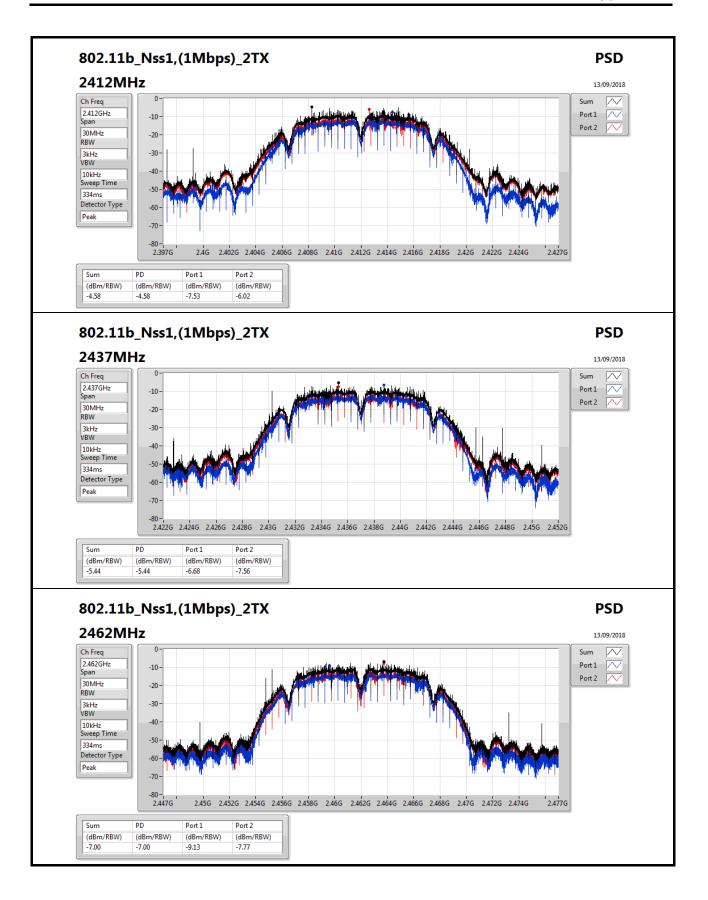
RBW=3kHz.

#### Result

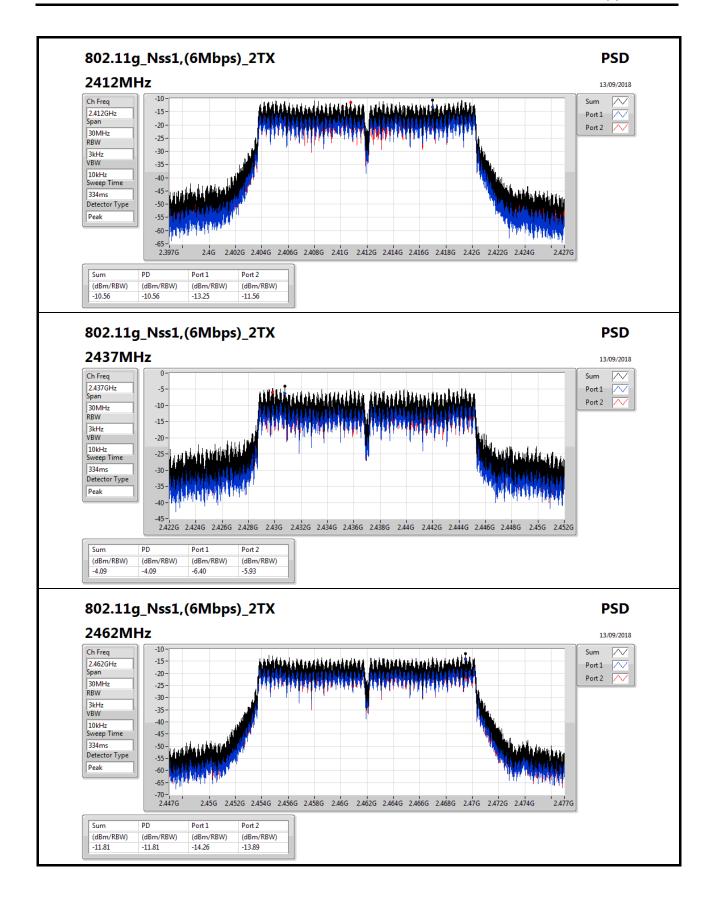
Mode	Result	DG	Port 1	Port 2	PD	PD Limit	
		(dBi)	(dBm/RBW)	(dBm/RBW)	(dBm/RBW)	(dBm/RBW)	
802.11b_Nss1,(1Mbps)_2TX	-	-	-	-	-	-	
2412MHz	Pass	5.01	-7.53	-6.02	-4.58	8.00	
2437MHz	Pass	5.01	-6.68	-7.56	-5.44	8.00	
2462MHz	Pass	5.01	-9.13	-7.77	-7.00	8.00	
802.11g_Nss1,(6Mbps)_2TX	-	-	-	-	-	-	
2412MHz	Pass	5.01	-13.25	-11.56	-10.56	8.00	
2437MHz	Pass	5.01	-6.40	-5.93	-4.09	8.00	
2462MHz	Pass	5.01	-14.26	-13.89	-11.81	8.00	
802.11n HT20_Nss1,(MCS0)_2TX	-	-	-	-	-	-	
2412MHz	Pass	5.01	-12.80	-11.83	-9.73	8.00	
2437MHz	Pass	5.01	-6.19	-5.26	-3.73	8.00	
2462MHz	Pass	5.01	-14.62	-14.16	-12.62	8.00	
802.11n HT40_Nss1,(MCS0)_2TX	-	-	-	-	-	-	
2422MHz	Pass	5.01	-17.95	-18.01	-15.60	8.00	
2437MHz	Pass	5.01	-14.01	-13.63	-11.28	8.00	
2452MHz	Pass	5.01	-19.61	-18.68	-16.36	8.00	

DG = Directional Gain; RBW=3kHz;
 PD = trace bin-by-bin of each transmits port summing can be performed maximum power density;
 Port X = Port Xpower density;

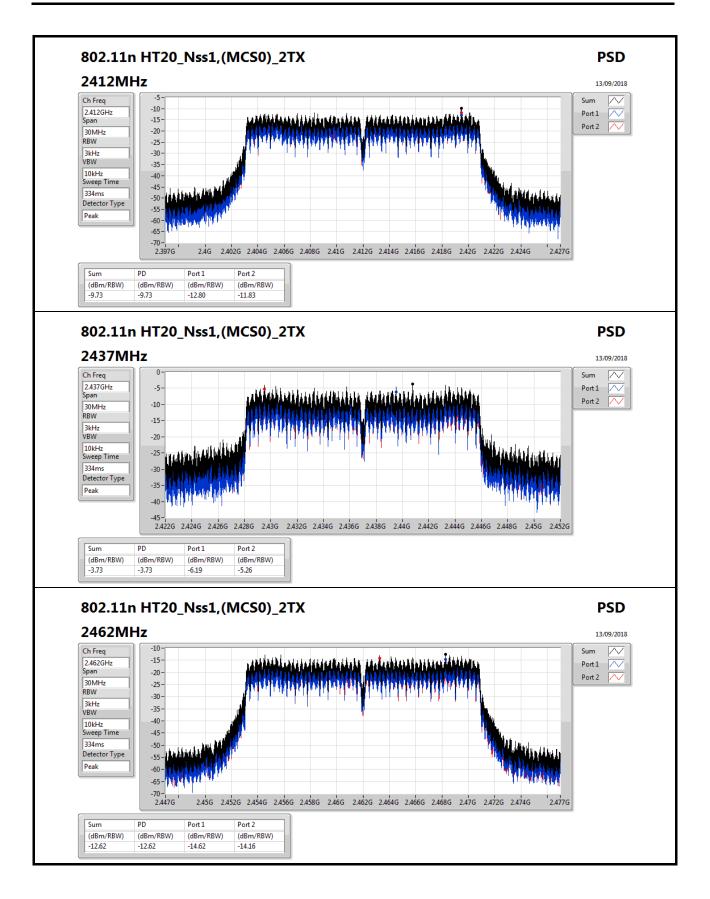




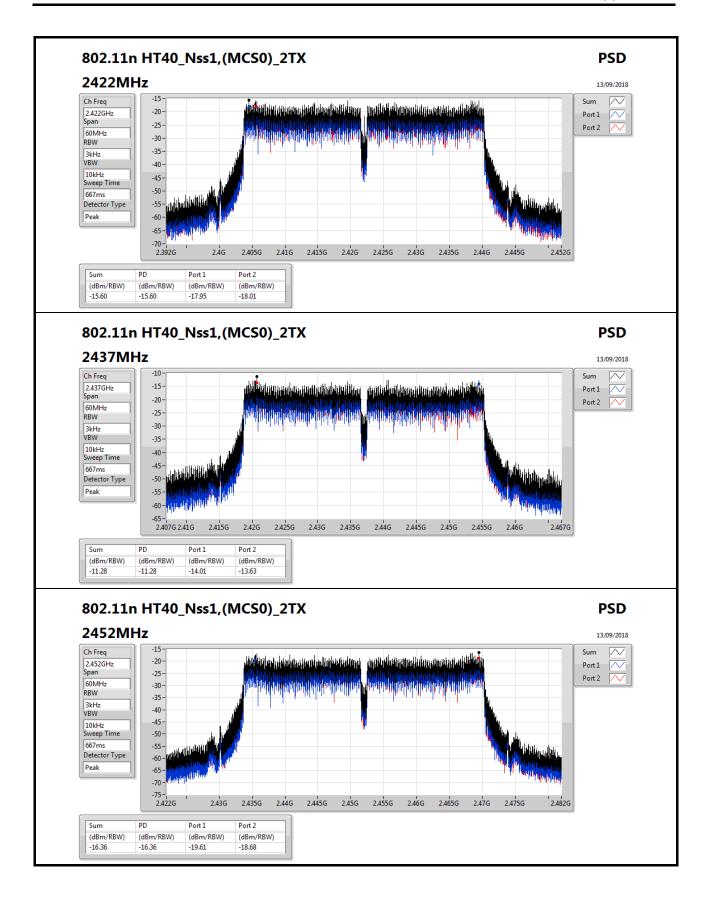














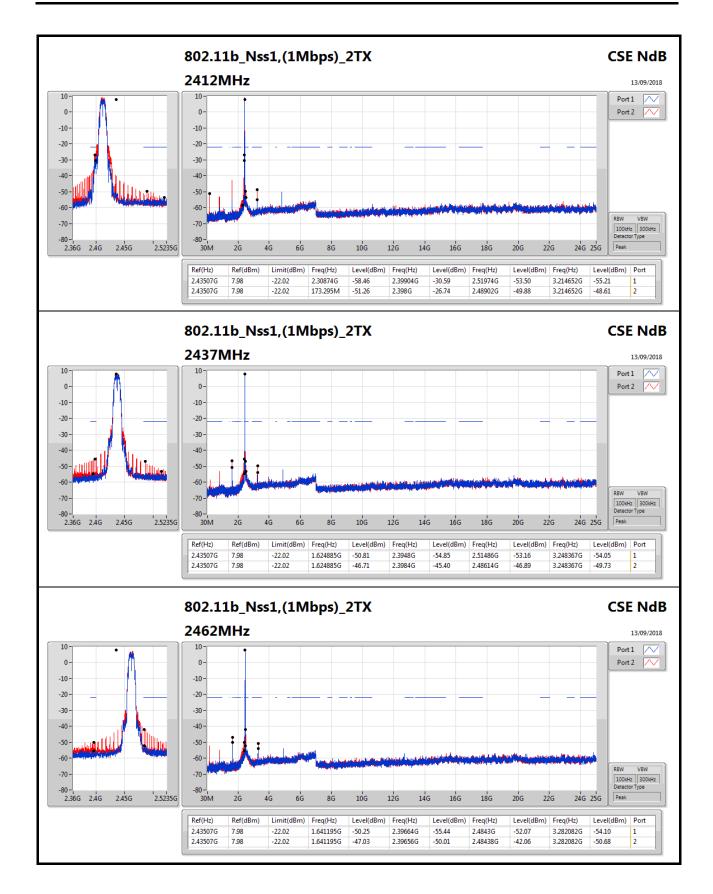
### **CSE Non-restricted Band Result**

#### Appendix E

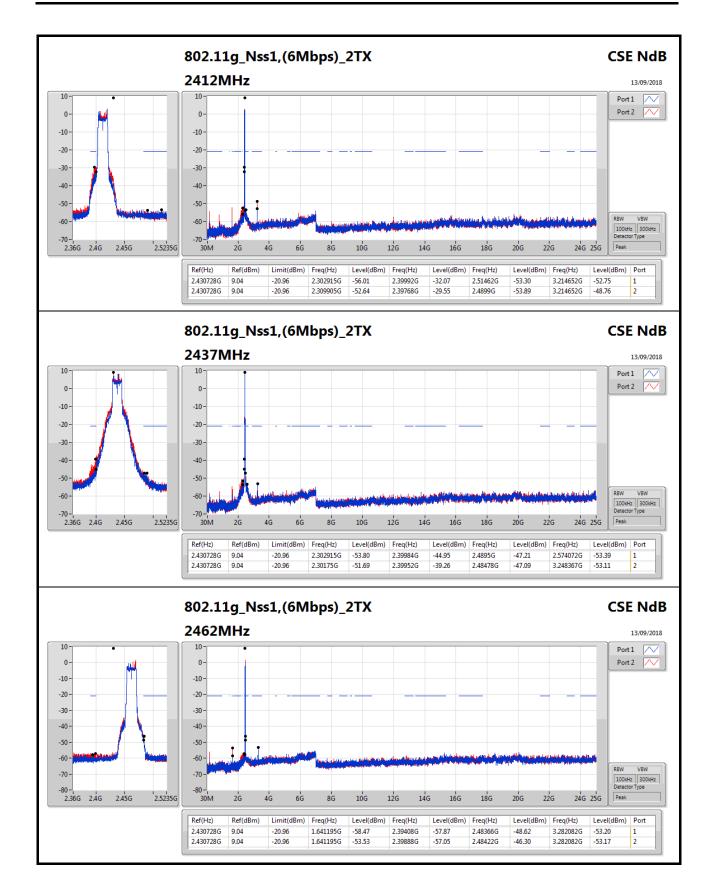
#### Summary

Mode	Result	Ref	Ref	Limit	Freq	Level	Freq	Level	Freq	Level	Freq	Level	Port
		(Hz)	(dBm)	(dBm)	(Hz)	(dBm)	(Hz)	(dBm)	(Hz)	(dBm)	(Hz)	(dBm)	
2.4-2.4835GHz	-		-	-	-	-	-	-	-	-	-	-	-
802.11b_Nss1,(1Mbps)_2TX	Pass	2.43507G	7.98	-22.02	173.295M	-51.26	2.398G	-26.74	2.48902G	-49.88	3.214652G	-48.61	2
802.11g_Nss1,(6Mbps)_2TX	Pass	2.430728G	9.04	-20.96	2.309905G	-52.64	2.39768G	-29.55	2.4899G	-53.89	3.214652G	-48.76	2
802.11n HT20_Nss1,(MCS0)_2TX	Pass	2.430728G	9.69	-20.31	173.295M	-53.44	2.39736G	-31.24	2.5223G	-57.09	3.214652G	-49.78	2
802.11n HT40_Nss1,(MCS0)_2TX	Pass	2.422044G	0.18	-29.82	2.30168G	-53.21	2.39952G	-32.73	2.48478G	-44.93	3.247813G	-49.59	2
esult													
Mode	Result	Ref	Ref	Limit	Freq	Level	Freq	Level	Freq	Level	Freq	Level	Port
		(Hz)	(dBm)	(dBm)	(Hz)	(dBm)	(Hz)	(dBm)	(Hz)	(dBm)	(Hz)	(dBm)	
802.11b_Nss1,(1Mbps)_2TX	-	-		-	-	-	-	-	-	-	-		
2412MHz	Pass	2.43507G	7.98	-22.02	2.30874G	-58.46	2.39904G	-30.59	2.51974G	-53.50	3.214652G	-55.21	1
2412MHz	Pass	2.43507G	7.98	-22.02	173.295M	-51.26	2.398G	-26.74	2.48902G	-49.88	3.214652G	-48.61	2
2437MHz	Pass	2.43507G	7.98	-22.02	1.624885G	-50.81	2.3948G	-54.85	2.51486G	-53.16	3.248367G	-54.05	1
2437MHz	Pass	2.43507G	7.98	-22.02	1.624885G	-46.71	2.3984G	-45.40	2.48614G	-46.89	3.248367G	-49.73	2
2462MHz	Pass	2.43507G	7.98	-22.02	1.641195G	-50.25	2.39664G	-55.44	2.4843G	-52.07	3.282082G	-54.10	1
2462MHz	Pass	2.43507G	7.98	-22.02	1.641195G	-47.03	2.39656G	-50.01	2.48438G	-42.06	3.282082G	-50.68	2
802.11g_Nss1,(6Mbps)_2TX	-	-	-	-	-	-	-		-	-	-	-	
2412MHz	Pass	2.430728G	9.04	-20.96	2.302915G	-56.01	2.39992G	-32.07	2.51462G	-53.30	3.214652G	-52.75	1
2412MHz	Pass	2.430728G	9.04	-20.96	2.309905G	-52.64	2.39768G	-29.55	2.4899G	-53.89	3.214652G	-48.76	2
2437MHz	Pass	2.430728G	9.04	-20.96	2.302915G	-53.80	2.39984G	-44.95	2.4895G	-47.21	2.574072G	-53.39	1
2437MHz	Pass	2.430728G	9.04	-20.96	2.30175G	-51.69	2.39952G	-39.26	2.48478G	-47.09	3.248367G	-53.11	2
2462MHz	Pass	2.430728G	9.04	-20.96	1.641195G	-58.47	2.39408G	-57.87	2.48366G	-48.62	3.282082G	-53.20	1
2462MHz	Pass	2.430728G	9.04	-20.96	1.641195G	-53.53	2.39888G	-57.05	2.48422G	-46.30	3.282082G	-53.17	2
802.11n HT20_Nss1,(MCS0)_2TX	-	-	-	-	-	-	-	-	-	-	-	-	-
2412MHz	Pass	2.430728G	9.69	-20.31	179.12M	-58.18	2.39992G	-34.03	2.52342G	-56.77	6.765939G	-55.51	1
2412MHz	Pass	2.430728G	9.69	-20.31	173.295M	-53.44	2.39736G	-31.24	2.5223G	-57.09	3.214652G	-49.78	2
2437MHz	Pass	2.430728G	9.69	-20.31	2.165445G	-54.08	2.39824G	-40.76	2.48638G	-45.15	2.568453G	-53.44	1
2437MHz	Pass	2.430728G	9.69	-20.31	2.307575G	-51.43	2.39984G	-36.04	2.48438G	-45.92	3.248367G	-52.08	2
2462MHz	Pass	2.430728G	9.69	-20.31	175.625M	-57.60	2.39752G	-58.55	2.48366G	-48.60	3.282082G	-54.12	1
2462MHz	Pass	2.430728G	9.69	-20.31	1.641195G	-52.75	2.39536G	-56.54	2.48446G	-45.74	3.282082G	-53.50	2
802.11n HT40_Nss1,(MCS0)_2TX	-	-	-	-	-	-	-	-	-	-	-	-	-
2422MHz	Pass	2.422044G	0.18	-29.82	176.56M	-60.35	2.39904G	-37.66	2.54878G	-57.33	6.997513G	-54.86	1
2422MHz	Pass	2.422044G	0.18	-29.82	170.835M	-54.73	2.39888G	-37.84	2.51326G	-56.58	3.228181G	-50.02	2
2437MHz	Pass	2.422044G	0.18	-29.82	2.30397G	-56.58	2.3992G	-37.00	2.48382G	-47.19	3.247813G	-53.64	1
2437MHz	Pass	2.422044G	0.18	-29.82	2.30168G	-53.21	2.39952G	-32.73	2.48478G	-44.93	3.247813G	-49.59	2
2452MHz	Pass	2.422044G	0.18	-29.82	1.63529G	-56.69	2.39072G	-57.69	2.48446G	-45.61	3.267445G	-54.87	1
2452MHz	Pass	2.422044G	0.18	-29.82	171.98M	-53.16	2.39856G	-56.75	2.48878G	-46.65	3.267445G	-52.49	2

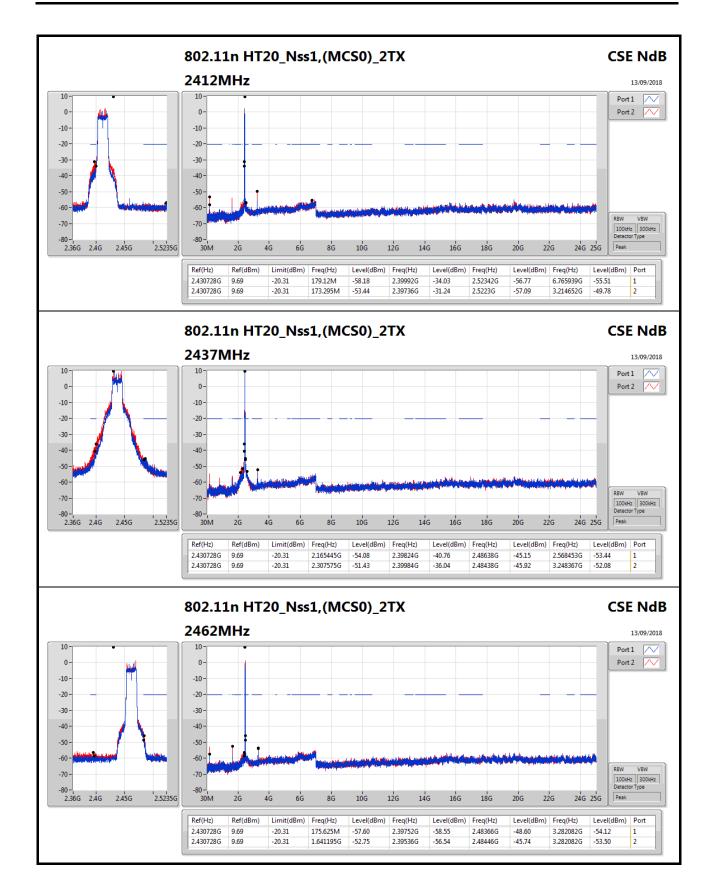




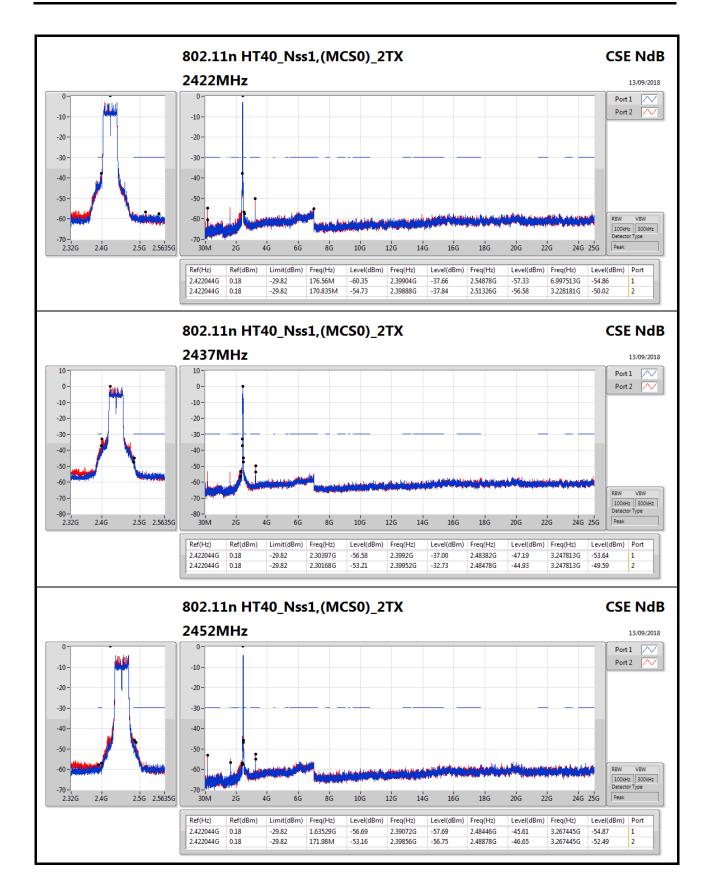




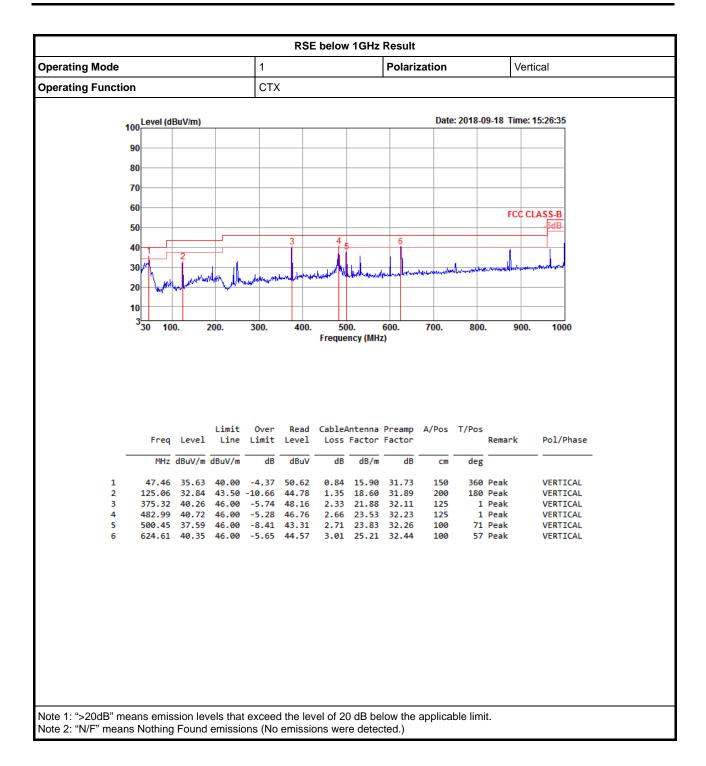




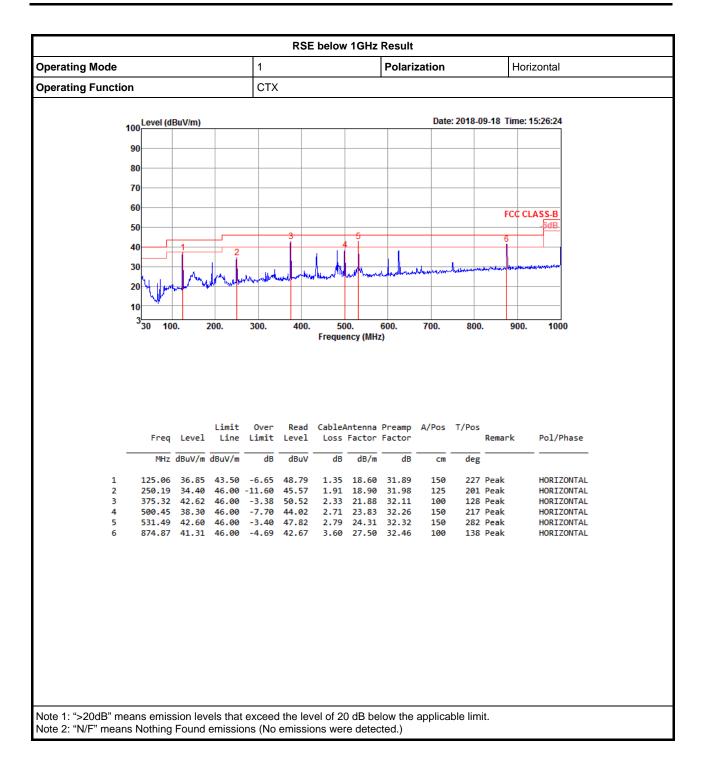














### RSE TX above 1GHz Result

# Appendix F.2

#### Summary

Mode	Result	Туре	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Comments
			(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dB)	(m)		(°)	(m)	
2.4-2.4835GHz	-	-	-	-	-	-	-	-	-	-	-	-
802.11n HT20_Nss1,(MCS0)_2TX	Pass	PK	2.3896G	73.96	74.00	-0.04	33.17	3	Horizontal	354	2.34	-



