FCC RADIO TEST REPORT

Report No. : FR801215-01



FCC RADIO TEST REPORT

FCC ID	:	TE7RE220
Equipment	:	AC750 Wi-Fi Range Extender
Brand Name	:	tp-link
Model Name	:	RE200, RE220
Applicant	:	TP-Link Technologies Co., Ltd. Building 24 (floors 1,3,4,5) and 28 (floors1-4), Central Science and Technology Park,Nanshan Shenzhen, 518057 China
Manufacturer		TP-Link Technologies Co., Ltd. Building 24 (floors 1,3,4,5) and 28 (floors1-4), Central Science and Technology Park,Nanshan Shenzhen, 518057 China
Standard	:	47 CFR FCC Part 15.407

The product was received on Oct. 15, 2018, and testing was started from Oct. 22, 2018 and completed on Dec. 04, 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 variant 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.

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Approved by: Sam Chen

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 24Issued Date: Dec. 26, 2018Report Version: 01



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Photographs of EUT v01



History of this test report

Report No.	Version	Description	Issued Date
FR8O1215-01	01	Initial issue of report	Dec. 26, 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	15.407(a)	Emission Bandwidth	PASS	-
3.2	15.407(a)	Maximum Conducted Output Power	PASS	-
3.3	15.407(a)	Peak Power Spectral Density	PASS	-
3.4	15.407(b)	Unwanted Emissions	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:

None

Reviewed by: Sam Chen

Report Producer: Cindy Peng



1 General Description

1.1 Information

1.1.1 **RF General Information**

Frequency Range (MHz)	IEEE Std. 802.11	Ch. Frequency (MHz)	Channel Number
5250-5350	a, n (HT20), ac (VHT20)	5260-5320	52-64 [4]
5470-5725		5500-5700	100-140 [11]
5250-5350	n (HT40), ac (VHT40)	5270-5310	54-62 [2]
5470-5725		5510-5670	102-134 [5]
5250-5350	ac (VHT80)	5290	58 [1]
5470-5725		5530-5610	106-122 [2]

Band	Mode	BWch (MHz)	Nant
5.25-5.35GHz	802.11a	20	1TX
5.25-5.35GHz	802.11n HT20	20	1TX
5.25-5.35GHz	802.11ac VHT20	20	1TX
5.25-5.35GHz	802.11n HT40	40	1TX
5.25-5.35GHz	802.11ac VHT40	40	1TX
5.25-5.35GHz	802.11ac VHT80	80	1TX
5.47-5.725GHz	802.11a	20	1TX
5.47-5.725GHz	802.11n HT20	20	1TX
5.47-5.725GHz	802.11ac VHT20	20	1TX
5.47-5.725GHz	802.11n HT40	40	1TX
5.47-5.725GHz	802.11ac VHT40	40	1TX
5.47-5.725GHz	802.11ac VHT80	80	1TX

Note:

• 11a, HT20 and HT40 use a combination of OFDM-BPSK, QPSK, 16QAM, 64QAM modulation.

 VHT20, VHT40 and VHT80 use a combination of OFDM-BPSK, QPSK, 16QAM, 64QAM, 256QAM 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

Ant.	Port	Brand	Model Name	Antenna Type	Connector	Gain (dBi)	Remark
1	1	TP-LINK	-	Printed Antenna	N/A	1.95	WLAN 2.4GHz
2	2	TP-LINK	-	Printed Antenna	N/A	1.96	WLAN 2.4GHz
3	1	TP-LINK	-	Printed Antenna	Murata	2.98	WLAN 5GHz

Note: The EUT has three antennas.

Ant. 1 and Ant. 2 supports 2.4GHz WLAN function, and Ant. 3 supports 5GHz WLAN function.

For WLAN 2.4GHz function (2TX/2RX):

Port 1 and Port 2 could transmit/receive simultaneously.

For WLAN 5GHz function (1TX/1RX):

Only Port 1 could transmit/receive.

1.1.3 Mode Test Duty Cycle

Mode	DC	DCF(dB)	T(s)	VBW(Hz) ≥ 1/T
802.11a	1	0	n/a (DC>=0.98)	n/a (DC>=0.98)
802.11ac VHT20	1	0	n/a (DC>=0.98)	n/a (DC>=0.98)
802.11ac VHT40	1	0	n/a (DC>=0.98)	n/a (DC>=0.98)
802.11ac VHT80	1	0	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	Inte	Internal power supply		
Beamforming Function		With beamforming	\boxtimes	Without beamforming
Weather Band	\boxtimes	With 5600~5650MHz		Without 5600~5650MHz
Function		Outdoor P2M	\boxtimes	Indoor P2M
runction		Fixed P2P		Client
TPC Function	\boxtimes	With TPC		Without TPC
Test Software Version	MT	7xxE QA V2.0.10.0		



1.1.5 Table for Multiple Listing

The model names in the following table are all refer to the identical product.

Model Name	Description	
RE200	There is nothing different of two models, just for different marketing use.	
RE220		

From the above models, model: RE220 was selected as representative model for the test and its data was recorded in this report.

1.1.6 Table for Class II Change

This product is an extension of original one reported under Sporton project number: FR8O1215 Below is the table for the change of the product with respect to the original one.

Modifications	Performance Checking
	1. Emission Bandwidth.
Adding 5GHz band 2 and band 3 (5250~5350	2. Maximum Conducted Output Power.
MHz, 5470~5725 MHz) for this device.	3. Peak Power Spectral Density.
	4. Unwanted Emissions Above 1GHz.



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 789033 D02 v02r01
- FCC KDB 412172 D01 v01r01

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	Eason Chen	20°C / 60%	Oct. 25, 2018~Dec. 04, 2018
Radiated	03CH01-CB	Paul Chen	22°C / 54%	Oct. 22, 2018~Dec. 03, 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
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 ⁻⁸	Confidence levels of 95%



2 Test Configuration of EUT

2.1 Test Channel Mode

Mode	Power Setting
802.11a_Nss1,(6Mbps)_1TX	-
5260MHz	19
5300MHz	18
5320MHz	14
5500MHz	10
5580MHz	10
5700MHz	0F
802.11ac VHT20_Nss1,(MCS0)_1TX	-
5260MHz	19
5300MHz	18
5320MHz	15
5500MHz	11
5580MHz	15
5700MHz	10
802.11ac VHT40_Nss1,(MCS0)_1TX	-
5270MHz	1A
5310MHz	0C
5510MHz	0A
5550MHz	18
5670MHz	15
802.11ac VHT80_Nss1,(MCS0)_1TX	-
5290MHz	07
5530MHz	07
5610MHz	14

Note:

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VHT20/VHT40 covers HT20/HT40, due to same modulation. The power setting for 802.11n HT20 and HT40 are the same or lower than 802.11ac VHT20 and VHT40.



2.2 The Worst Case Measurement Configuration

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

The Worst Case Mode for Following Conformance Tests	
Tests Item	Unwanted Emissions
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 CTX	
1	CTX - EUT in Z axis
2	CTX - EUT in Y axis
Mode 2 has been evaluate	ed to be the worst case after evaluating. Consequently, measurement will follow

Mode 2 has been evaluated to be the worst case after evaluating. Consequently, measurement will follow this same test mode.

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.: FA8O1215-01 for Co-location RF Exposure Evaluation.		

2.3 EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.



2.4 Accessories

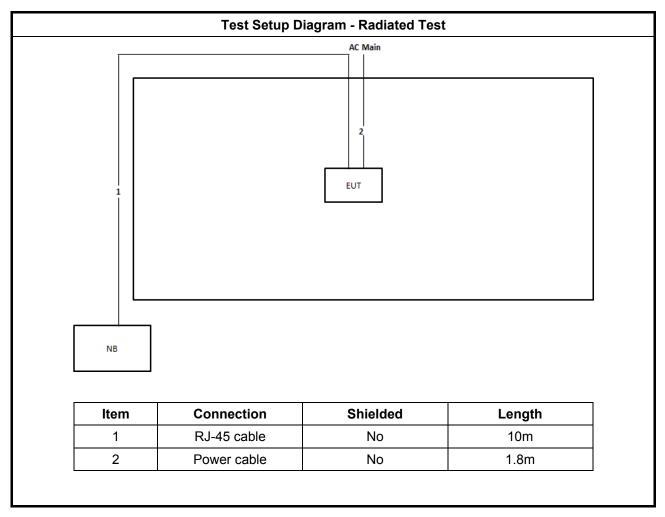
N/A

2.5 Support Equipment

Support Equipment				
No.	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 Emission Bandwidth

3.1.1 Emission Bandwidth Limit

	Emission Bandwidth Limit		
UN	UNII Devices		
	For the 5.15-5.25 GHz band, N/A		
\square	For the 5.25-5.35 GHz band, the maximum conducted output power shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in MHz.		
\square	For the 5.47-5.725 GHz band, the maximum conducted output power shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in MHz.		
	For the 5.725-5.85 GHz band, 6 dB emission bandwidth \geq 500kHz.		
LE-	LAN Devices		
	For the band 5.15-5.25 GHz, the maximum e.i.r.p. shall not exceed 200 mW or 10 + 10 log B, dBm, whichever power is less. B is the 99% emission bandwidth in MHz.		
	For the 5.25-5.35 GHz band, the maximum e.i.r.p. shall not exceed 1.0 W or 17 + 10 log B, dBm, whichever power is less. B is the 99% emission bandwidth in MHz		
	For the 5.47-5.6 GHz band and 5.65-5.725 GHz band, the maximum e.i.r.p. shall not exceed 1.0 W or 17 + 10 log B, dBm, whichever power is less. B is the 99% emission bandwidth in MHz		
	For the 5.725-5.85 GHz band, 6 dB emission bandwidth \geq 500kHz.		

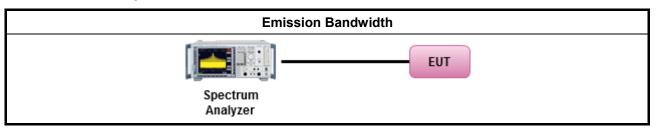
3.1.2 Measuring Instruments

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

3.1.3 Test Procedures

	Test Method		
•	For the emission bandwidth shall be measured using one of the options below:		
	Refer as FCC KDB 789033, clause C for EBW and clause D for OBW measurement.		
	Refer as ANSI C63.10, clause 6.9.1 for occupied bandwidth testing.		
	Refer as IC RSS-Gen, clause 4.6 for bandwidth testing.		

3.1.4 Test Setup





3.1.5 Test Result of Emission Bandwidth

Refer as Appendix A



3.2 Maximum Conducted Output Power

3.2.1 Maximum Conducted Output Power Limit

	Maximum Conducted Output Power Limit		
UNI	UNII Devices		
	For the 5.15-5.25 GHz band:		
	 Outdoor AP: the maximum conducted output power (P_{Out}) shall not exceed the lesser of 1 W. If G_{TX} > 6 dBi, then P_{Out} = 30 - (G_{TX} - 6). e.i.r.p. at any elevation angle above 30 degrees ≤ 125mW [21dBm] 		
	 Indoor AP: the maximum conducted output power (P_{Out}) shall not exceed the lesser of 1 W. If G_{TX} > 6 dBi, then P_{Out} = 30 - (G_{TX} - 6) 		
	 Point-to-point AP: the maximum conducted output power (P_{Out}) shall not exceed the lesser of 1 W If G_{TX} > 23 dBi, then P_{Out} = 30 – (G_{TX} – 23). 		
	 Mobile or Portable Client: the maximum conducted output power (P_{Out}) shall not exceed the lesser of 250 mW. If G_{TX} > 6 dBi, then P_{Out} = 24 – (G_{TX} – 6). 		
	For the 5.25-5.35 GHz band, the maximum conducted output power (P_{Out}) shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in MHz. If G_{TX} > 6 dBi, then P_{Out} = 24 – (G_{TX} – 6).		
	For the 5.47-5.725 GHz band, the maximum conducted output power (P_{Out}) shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in MHz. If G_{TX} > 6 dBi, then P_{Out} = 24 – (G_{TX} – 6).		
	For the 5.725-5.85 GHz band:		
	 Point-to-multipoint systems (P2M): the maximum conducted output power (P_{Out}) shall not exceed the lesser of 1 W. If G_{TX} > 6 dBi, then P_{Out} = 30 - (G_{TX} - 6). 		
	 Point-to-point systems (P2P): the maximum conducted output power (P_{Out}) shall not exceed the lesser of 1 W. 		
LE-	LAN Devices		
	For the 5.15-5.25 GHz band, the maximum e.i.r.p. shall not exceed 200 mW or 10 + 10 log B, dBm, whichever power is less. B is the 99% emission bandwidth in MHz.		
	For the 5.25-5.35 GHz band, the maximum e.i.r.p. shall not exceed 1.0 W or 17 + 10 log B, dBm, whichever power is less. B is the 99% emission bandwidth in MHz		
	For the 5.47-5.6 GHz band and 5.65-5.725 GHz band, the maximum e.i.r.p. shall not exceed 1.0 W or 17 + 10 log B, dBm, whichever power is less. B is the 99% emission bandwidth in MHz		
	For the 5.725-5.85 GHz band:		
	 Point-to-multipoint systems (P2M): the maximum conducted output power (P_{Out}) shall not exceed the lesser of 1 W. If G_{TX} > 6 dBi, then P_{Out} = 30 - (G_{TX} - 6). 		
	 Point-to-point systems (P2P): the maximum conducted output power (P_{Out}) shall not exceed the lesser of 1 W. 		
	t = maximum conducted output power in dBm, = the maximum transmitting antenna directional gain in dBi.		



3.2.2 Measuring Instruments

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

3.2.3 Test Procedures

	Test Method		
-	Maximum Conducted Output Power		
	Average over on/off periods with duty factor		
	Refer as FCC KDB 789033, clause E Method SA-2 (spectral trace averaging).		
	Refer as FCC KDB 789033, clause E Method SA-2 Alt. (RMS detection with slow sweep speed)		
	Wideband RF power meter and average over on/off periods with duty factor		
	Refer as FCC KDB 789033, clause E Method PM-G (using an 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} = P₁ + P₂ + + P_n (calculated in linear unit [mW] and transfer to log unit [dBm]) EIRP_{total} = P_{total} + DG 		

3.2.4 Test Setup

RF Output Power (Power Meter)	
EUT Power Meter	

3.2.5 Test Result of Maximum Conducted Output Power

Refer as Appendix B



3.3 Peak Power Spectral Density

3.3.1 Peak Power Spectral Density Limit

	Peak Power Spectral Density Limit						
UNI	UNII Devices						
	For the 5.15-5.25 GHz band:						
	• Outdoor AP: the peak power spectral density (PPSD) shall not exceed the lesser of 17dBm/MHz. If $G_{TX} > 6$ dBi, then $P_{Out} = 17 - (G_{TX} - 6)$.						
	• Indoor AP: the peak power spectral density (PPSD) shall not exceed the lesser of 17dBm/MHz. If $G_{TX} > 6$ dBi, then $P_{Out} = 17 - (G_{TX} - 6)$.						
	• Point-to-point AP: the peak power spectral density (PPSD) shall not exceed the lesser of 17dBm/MHz. If $G_{TX} > 23$ dBi, then $P_{Out} = 17 - (G_{TX} - 23)$.						
	 Mobile or Portable Client: the peak power spectral density (PPSD) ≤ 11 dBm/MHz. If G_{TX} > 6 dBi, then PPSD= 11 – (G_{TX} – 6) 						
	For the 5.25-5.35 GHz band, the peak power spectral density (PPSD) \leq 11 dBm/MHz. If G _{TX} > 6 dBi, then PPSD= 11 – (G _{TX} – 6).						
\boxtimes	For the 5.47-5.725 GHz band, the peak power spectral density (PPSD) \leq 11 dBm/MHz. If G _{TX} > 6 dBi, then PPSD= 11 - (G _{TX} - 6).						
	For the 5.725-5.85 GHz band:						
	• Point-to-multipoint systems (P2M): the peak power spectral density (PPSD) \leq 30 dBm/500kHz. If $G_{TX} > 6$ dBi, then PPSD= 30 – ($G_{TX} - 6$).						
	 Point-to-point systems (P2P): the peak power spectral density (PPSD) ≤ 30 dBm/500kHz. 						
LE-	LAN Devices						
	For the 5.15-5.25 GHz band, the e.i.r.p. peak power spectral density (PPSD) \leq 10 dBm/MHz.						
	For the 5.25-5.35 GHz band, the peak power spectral density (PPSD) \leq 11 dBm/MHz.						
	 e.i.r.p. greater than 200 mW shall comply with the following e.i.r.p. at different elevations, where θ is the angle above the local horizontal plane (of the Earth) as shown below: -13 dBW/MHz for 0° ≤ θ < 8°; -13 - 0.716 (θ-8) dBW/MHz for 8° ≤ θ < 40° -35.9 - 1.22 (θ-40) dBW/MHz for 40° ≤ θ ≤ 45°; -42 dBW/MHz for θ > 45° 						
	For the 5.47-5.6 GHz band and 5.65-5.725 GHz band, the peak power spectral density (PPSD) \leq 11 dBm/MHz.						
	For the 5.725-5.85 GHz band:						
	• Point-to-multipoint systems (P2M): the peak power spectral density (PPSD) \leq 30 dBm/500kHz. If $G_{TX} > 6$ dBi, then PPSD= 30 – ($G_{TX} - 6$).						
	 Point-to-point systems (P2P): the peak power spectral density (PPSD) ≤ 30 dBm/500kHz. 						
pow	SD = peak power spectral density that he same method as used to determine the conducted output ver shall be used to determine the power spectral density. And power spectral density in dBm/MHz = 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.

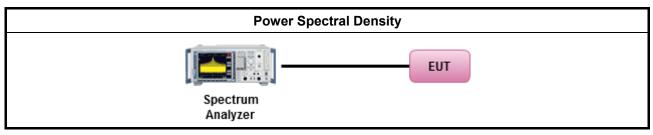


3.3.3 Test Procedures

		Test Method			
•	Peak power spectral density procedures that the same method as used to determine the conducted output power shall be used to determine the peak power spectral density and use the peak search function on the spectrum analyzer to find the peak of the spectrum. For the peak power spectral density shall be measured using below options:				
		Refer as FCC KDB 789033, F)5) power spectral density can be measured using resolution bandwidths < 1 MHz provided that the results are integrated over 1 MHz bandwidth			
	[duty	y cycle ≥ 98% or external video / power trigger]			
	\square	Refer as FCC KDB 789033, clause E Method SA-1 (spectral trace averaging).			
		Refer as FCC KDB 789033, clause E Method SA-1 Alt. (RMS detection with slow sweep speed)			
	duty	cycle < 98% and average over on/off periods with duty factor			
	\square	Refer as FCC KDB 789033, clause E Method SA-2 (spectral trace averaging).			
		Refer as FCC KDB 789033, clause E Method SA-2 Alt. (RMS detection with slow sweep speed)			
-	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,			
		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.			
		If multiple transmit chains, EIRP PPSD calculation could be following as methods: $PPSD_{total} = PPSD_1 + PPSD_2 + + PPSD_n$ (calculated in linear unit [mW] and transfer to log unit [dBm]) $EIRP_{total} = PPSD_{total} + DG$			



3.3.4 Test Setup



3.3.5 Test Result of Peak Power Spectral Density

Refer as Appendix C



3.4 Unwanted Emissions

3.4.1 Transmitter Unwanted Emissions Limit

Unwanted emissions below 1 GHz and restricted band emissions above 1GHz 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.

	Un-restricted band emissions above 1GHz Limit		
Operating Band	Limit		
🔲 5.15 - 5.25 GHz	e.i.r.p27 dBm [68.2 dBuV/m@3m]		
🔀 5.25 - 5.35 GHz	e.i.r.p27 dBm [68.2 dBuV/m@3m]		
🔀 5.47 - 5.725 GHz	e.i.r.p27 dBm [68.2 dBuV/m@3m]		
☐ 5.725 - 5.85 GHz	all emissions shall be limited to a level of -27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.		
Note 1: 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).

3.4.2 **Measuring Instruments**

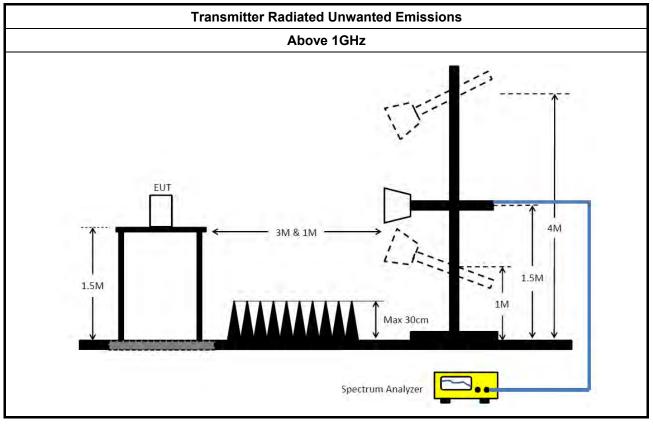
Refer a test equipment and calibration data table in this test report.

3.4.3 **Test Procedures**

		Test Method			
•	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. Measurements shall not be performed at a distance greater than 30 m for frequencies above 30 MHz, unless it can be further demonstrated that measurements at a distance of 30 m or less are impractical. 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).				
•	The	average emission levels shall be measured in [duty cycle \geq 98 or duty factor].			
•	For	the transmitter unwanted emissions shall be measured using following options below:			
	•	Refer as FCC KDB 789033, clause G)2) for unwanted emissions into non-restricted bands.			
	•	Refer as FCC KDB 789033, clause G)1) for unwanted emissions into restricted bands.			
		Refer as FCC KDB 789033, G)6) Method AD (Trace Averaging).			
		Refer as FCC KDB 789033, G)6) Method VB (Reduced VBW).			
		☐ Refer as ANSI C63.10, clause 11.12.2.5.3 (Reduced VBW). VBW ≥ 1/T, where T is pulse time.			
		Refer as ANSI C63.10, clause 7.5 average value of pulsed emissions.			
		Refer as FCC KDB 789033, clause G)5) measurement procedure peak limit.			
		Refer as ANSI C63.10, clause 4.1.4.2.2 measurement procedure peak limit.			
•	For	radiated measurement.			
	•	Refer as ANSI C63.10, clause 6.4 for radiated emissions below 30 MHz and test distance is 3m.			
	•	Refer as ANSI C63.10, clause 6.5 for radiated emissions 30 MHz to 1 GHz and test distance is 3m.			
	•	Refer as ANSI C63.10, clause 6.6 for radiated emissions above 1GHz.			
•	The	any unwanted emissions level shall not exceed the fundamental emission level.			
•		amplitude of spurious emissions that are attenuated by more than 20 dB below the permissible value no need to be reported.			



3.4.4 Test Setup



3.4.5 Test Result of Transmitter Unwanted Emissions

Refer as Appendix D



4 Test Equipment and Calibration Data

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Calibration Due Date	Remark
Horn Antenna	EMCO	3115	00075790	750MHz ~ 18GHz	Nov. 20, 2017	Nov. 19, 2018	Radiation (03CH01-CB)
Horn Antenna	EMCO	3115	00075790	750MHz ~ 18GHz	Nov. 13, 2018	Nov. 12, 2019	Radiation (03CH01-CB)
Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170252	15GHz ~ 40GHz	Jun. 28, 2018	Jun. 27, 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- HG	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)
Spectrum analy zer	R&S	FSP40	100080	9kHz~40GHz	Oct. 03, 2018	Oct. 02, 2019	Radiation (03CH01-CB)
EMI Test	R&S	ESCS	100354	9kHz ~ 2.75GHz	Dec. 08, 2017	Dec. 07, 2018	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-16	N/A	1 GHz ~ 18 GHz	Oct. 08, 2018	Oct. 07, 2019	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-16+17	N/A	1 GHz ~ 18 GHz	Oct. 08, 2018	Oct. 07, 2019	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)
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. 08, 2018	Oct. 07, 2019	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-07	1 GHz –26.5 GHz	Oct. 08, 2018	Oct. 07, 2019	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-08	1 GHz –26.5 GHz	Oct. 08, 2018	Oct. 07, 2019	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-09	1 GHz –26.5 GHz	Oct. 08, 2018	Oct. 07, 2019	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-10	1 GHz –26.5 GHz	Oct. 08, 2018	Oct. 07, 2019	Conducted (TH01-CB)
Power Sensor	Agilent	U2021XA	MY53410001	50MHz~18GHz	Nov. 20, 2017	Nov. 19, 2018	Conducted (TH01-CB)
Power Sensor	Agilent	U2021XA	MY53410001	50MHz~18GHz	Nov. 05, 2018	Nov. 04, 2019	Conducted (TH01-CB)

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



Summary

Mode	Max-N dB	Max-OBW	ITU-Code	Min-N dB	Min-OBW
	(Hz)	(Hz)		(Hz)	(Hz)
5.25-5.35GHz	-	-	-	-	-
802.11a_Nss1,(6Mbps)_1TX	39.45M	19.615M	19M6D1D	34.925M	16.642M
802.11ac VHT20_Nss1,(MCS0)_1TX	43.65M	18.891M	18M9D1D	42.175M	17.716M
802.11ac VHT40_Nss1,(MCS0)_1TX	92.5M	39.93M	39M9D1D	41.35M	36.132M
802.11ac VHT80_Nss1,(MCS0)_1TX	97.1M	75.262M	75M3D1D	97.1M	75.262M
5.47-5.725GHz	-	-	-	-	-
802.11a_Nss1,(6Mbps)_1TX	25.325M	16.542M	16M5D1D	23.175M	16.467M
802.11ac VHT20_Nss1,(MCS0)_1TX	42.1M	17.791M	17M8D1D	21.65M	17.541M
802.11ac VHT40_Nss1,(MCS0)_1TX	93.9M	37.831M	37M8D1D	41.1M	36.082M
802.11ac VHT80_Nss1,(MCS0)_1TX	171M	76.262M	76M3D1D	98.3M	75.662M

Max-N dB = Maximum 6dB down bandwidth for 5.725-5.85GHz band / Maximum 26dB down bandwidth for other band; Max-OBW = Maximum 99% occupied bandwidth; Min-N dB = Minimum 6dB down bandwidth for 5.725-5.85GHz band / Maximum 26dB down bandwidth for other band;

Min-OBW = Minimum 99% occupied bandwidth;

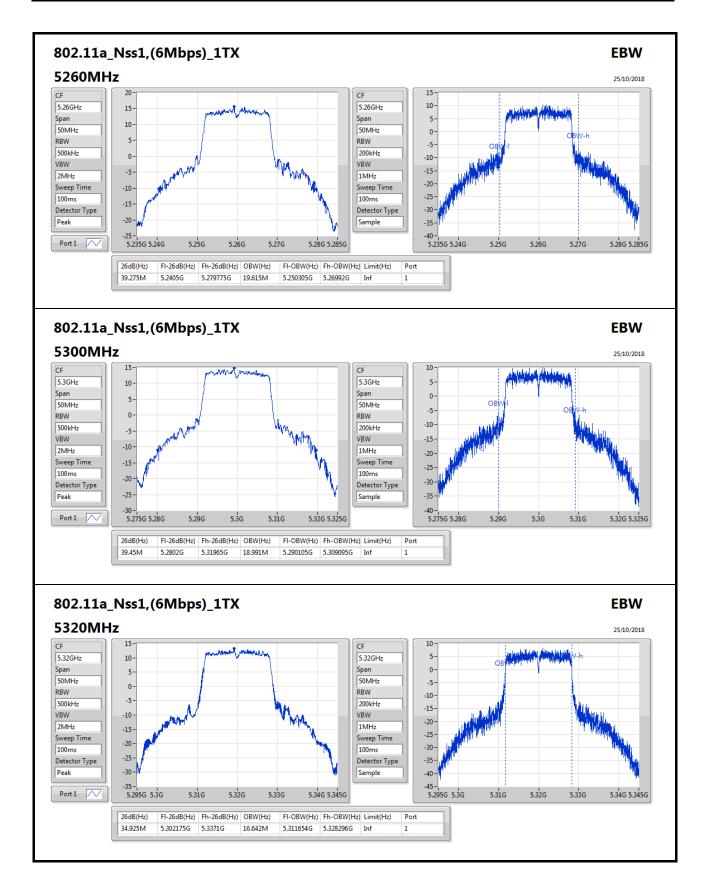


Result

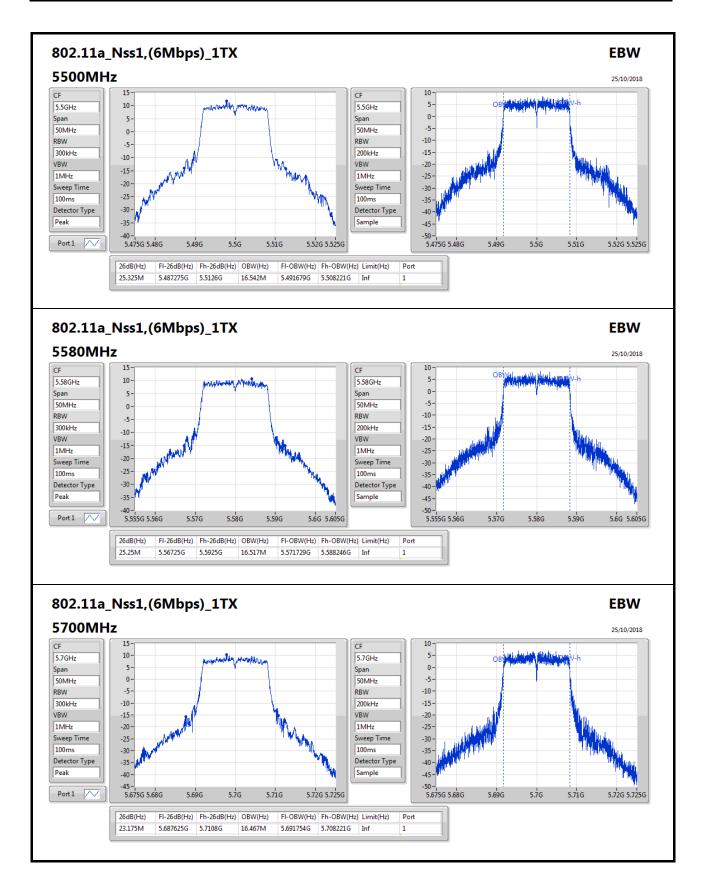
Mode	Result	Limit	Port 1-N dB	Port 1-OBW
		(Hz)	(Hz)	(Hz)
802.11a_Nss1,(6Mbps)_1TX	-	-	-	-
5260MHz	Pass	Inf	39.275M	19.615M
5300MHz	Pass	Inf	39.45M	18.991M
5320MHz	Pass	Inf	34.925M	16.642M
5500MHz	Pass	Inf	25.325M	16.542M
5580MHz	Pass	Inf	25.25M	16.517M
5700MHz	Pass	Inf	23.175M	16.467M
802.11ac VHT20_Nss1,(MCS0)_1TX	-	-	-	-
5260MHz	Pass	Inf	43.65M	18.841M
5300MHz	Pass	Inf	43.65M	18.891M
5320MHz	Pass	Inf	42.175M	17.716M
5500MHz	Pass	Inf	27.375M	17.591M
5580MHz	Pass	Inf	42.1M	17.791M
5700MHz	Pass	Inf	21.65M	17.541M
802.11ac VHT40_Nss1,(MCS0)_1TX	-	-	-	-
5270MHz	Pass	Inf	92.5M	39.93M
5310MHz	Pass	Inf	41.35M	36.132M
5510MHz	Pass	Inf	41.1M	36.082M
5550MHz	Pass	Inf	93.9M	37.831M
5670MHz	Pass	Inf	76.8M	36.482M
802.11ac VHT80_Nss1,(MCS0)_1TX	-	-	-	-
5290MHz	Pass	Inf	97.1M	75.262M
5530MHz	Pass	Inf	98.3M	75.662M
5610MHz	Pass	Inf	171M	76.262M

Port X-N dB = Port **X** 6dB down bandwidth for 5.725-5.85GHz band / 26dB down bandwidth for other band **Port X-OBW** = Port **X** 99% occupied bandwidth;

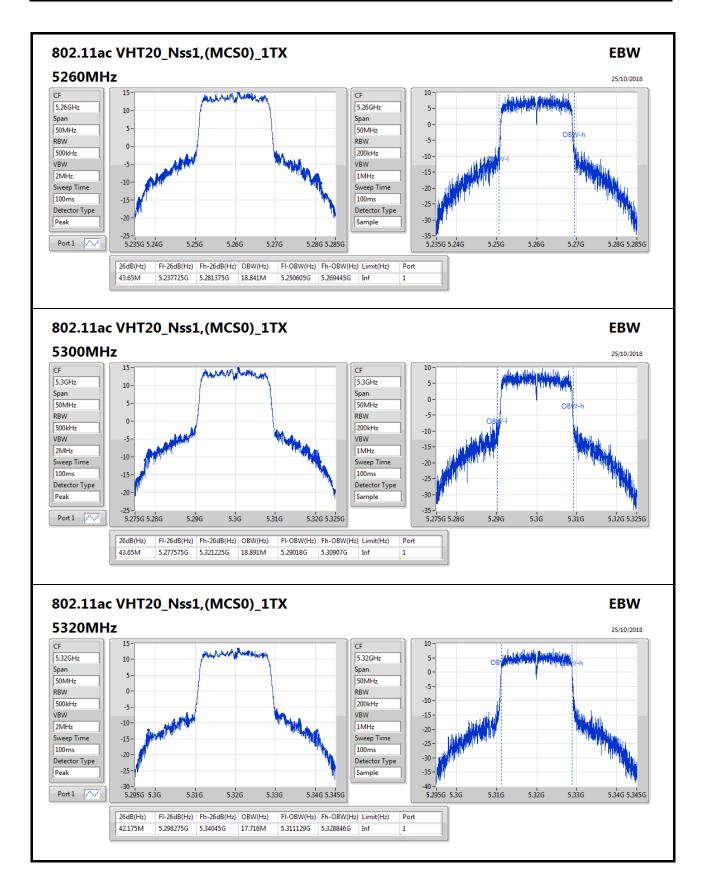




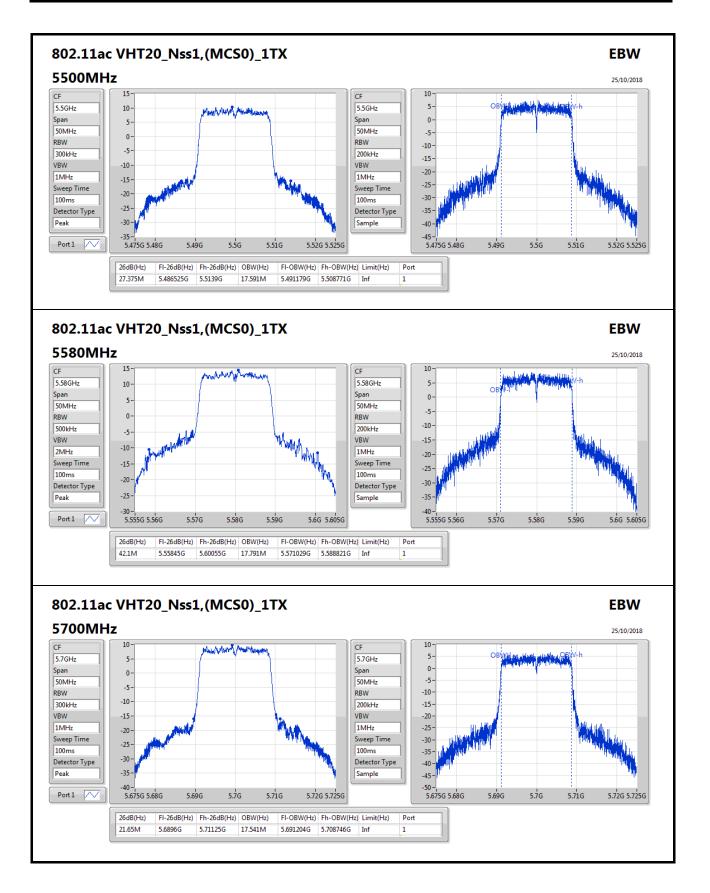




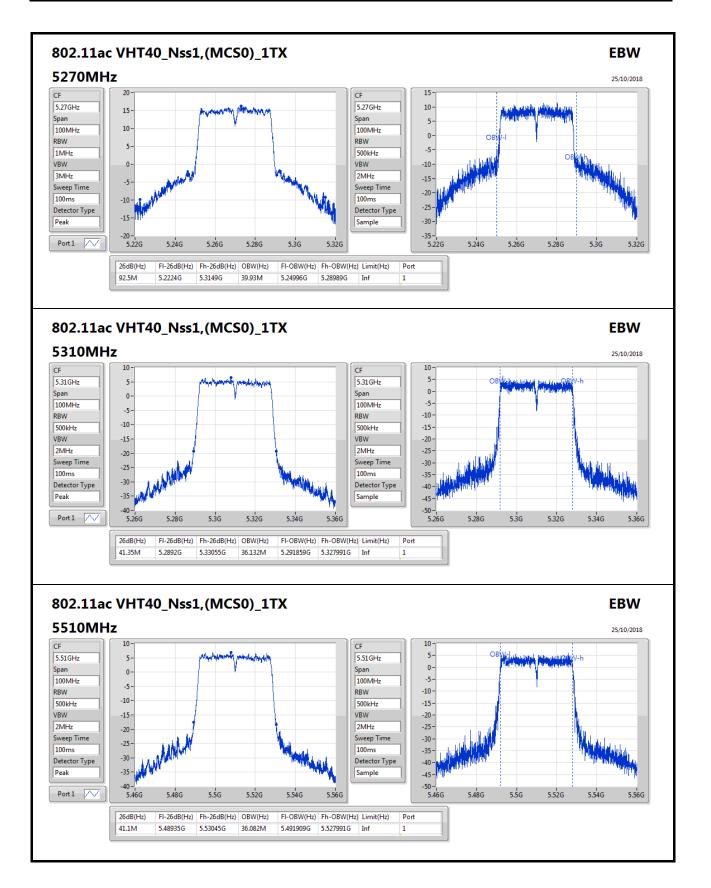




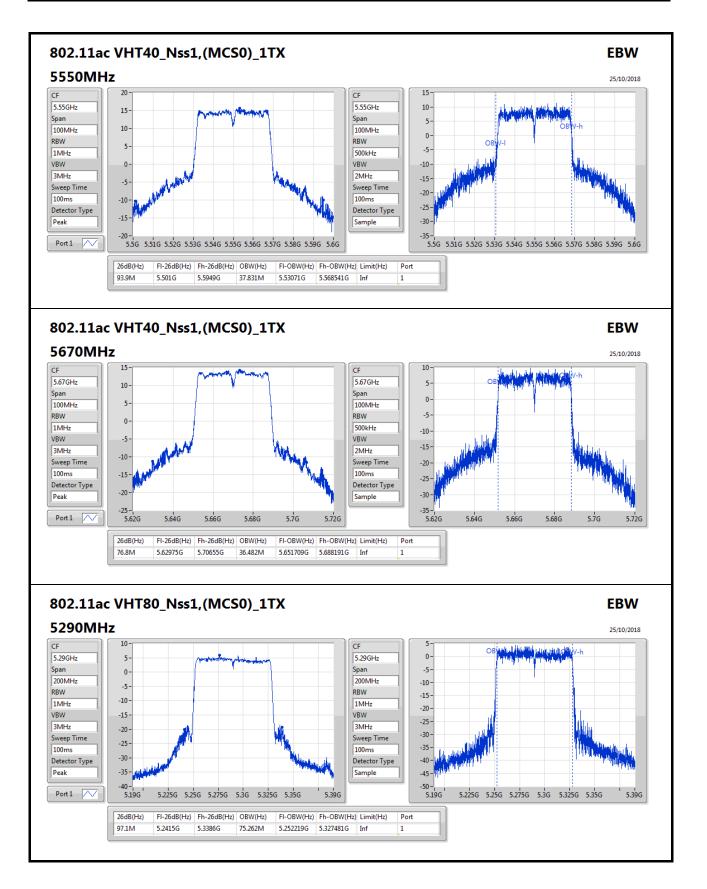




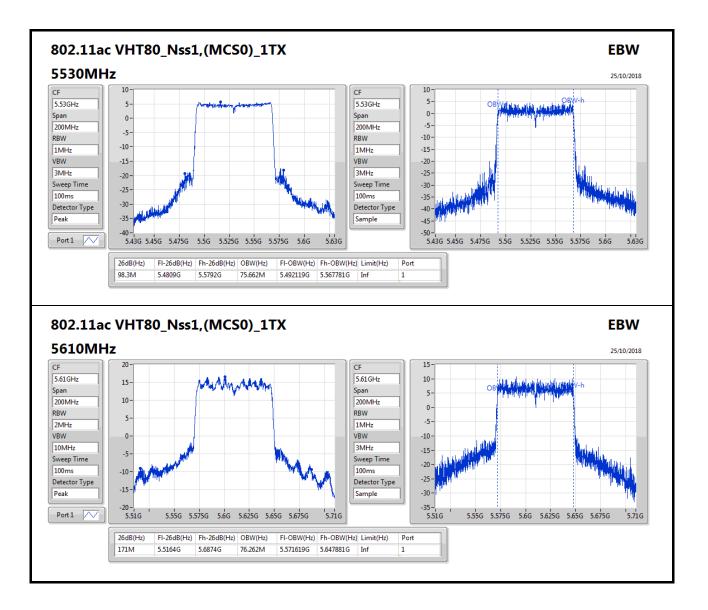














Summary

Mode	Total Power	Total Power
	(dBm)	(W)
5.25-5.35GHz	-	-
802.11a_Nss1,(6Mbps)_1TX	22.39	0.17338
802.11ac VHT20_Nss1,(MCS0)_1TX	22.16	0.16444
802.11ac VHT40_Nss1,(MCS0)_1TX	22.42	0.17458
802.11ac VHT80_Nss1,(MCS0)_1TX	15.22	0.03327
5.47-5.725GHz	-	-
802.11a_Nss1,(6Mbps)_1TX	20.34	0.10814
802.11ac VHT20_Nss1,(MCS0)_1TX	21.60	0.14454
802.11ac VHT40_Nss1,(MCS0)_1TX	22.19	0.16558
802.11ac VHT80_Nss1,(MCS0)_1TX	21.01	0.12618



Result

Mode	Result	DG	Port 1	Total Power	Power Limit
		(dBi)	(dBm)	(dBm)	(dBm)
802.11a_Nss1,(6Mbps)_1TX	-	-	-	-	-
5260MHz	Pass	2.98	22.39	22.39	23.98
5300MHz	Pass	2.98	21.95	21.95	23.98
5320MHz	Pass	2.98	20.55	20.55	23.98
5500MHz	Pass	2.98	20.34	20.34	23.98
5580MHz	Pass	2.98	20.13	20.13	23.98
5700MHz	Pass	2.98	18.93	18.93	23.98
802.11ac VHT20_Nss1,(MCS0)_1TX	-	-	-	-	-
5260MHz	Pass	2.98	22.16	22.16	23.98
5300MHz	Pass	2.98	21.95	21.95	23.98
5320MHz	Pass	2.98	20.53	20.53	23.98
5500MHz	Pass	2.98	19.90	19.90	23.98
5580MHz	Pass	2.98	21.60	21.60	23.98
5700MHz	Pass	2.98	19.31	19.31	23.98
802.11ac VHT40_Nss1,(MCS0)_1TX	-	-	-	-	-
5270MHz	Pass	2.98	22.42	22.42	23.98
5310MHz	Pass	2.98	16.85	16.85	23.98
5510MHz	Pass	2.98	17.24	17.24	23.98
5550MHz	Pass	2.98	22.19	22.19	23.98
5670MHz	Pass	2.98	20.96	20.96	23.98
802.11ac VHT80_Nss1,(MCS0)_1TX	-	-	-	-	-
5290MHz	Pass	2.98	15.22	15.22	23.98
5530MHz	Pass	2.98	15.72	15.72	23.98
5610MHz	Pass	2.98	21.01	21.01	23.98

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



Summary

Mode	PD
	(dBm/RBW)
5.25-5.35GHz	· ·
802.11a_Nss1,(6Mbps)_1TX	9.23
802.11ac VHT20_Nss1,(MCS0)_1TX	8.69
802.11ac VHT40_Nss1,(MCS0)_1TX	5.84
802.11ac VHT80_Nss1,(MCS0)_1TX	-4.66
5.47-5.725GHz	
802.11a_Nss1,(6Mbps)_1TX	6.99
802.11ac VHT20_Nss1,(MCS0)_1TX	8.05
802.11ac VHT40_Nss1,(MCS0)_1TX	5.44
802.11ac VHT80_Nss1,(MCS0)_1TX	1.57

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

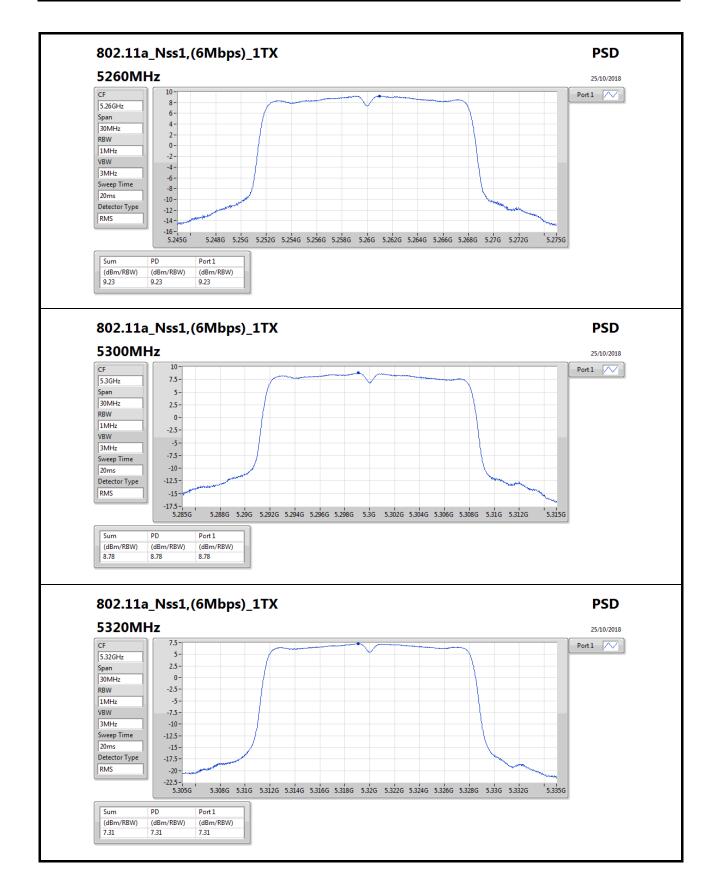
SPORTON LAB.	PSD Result

Result

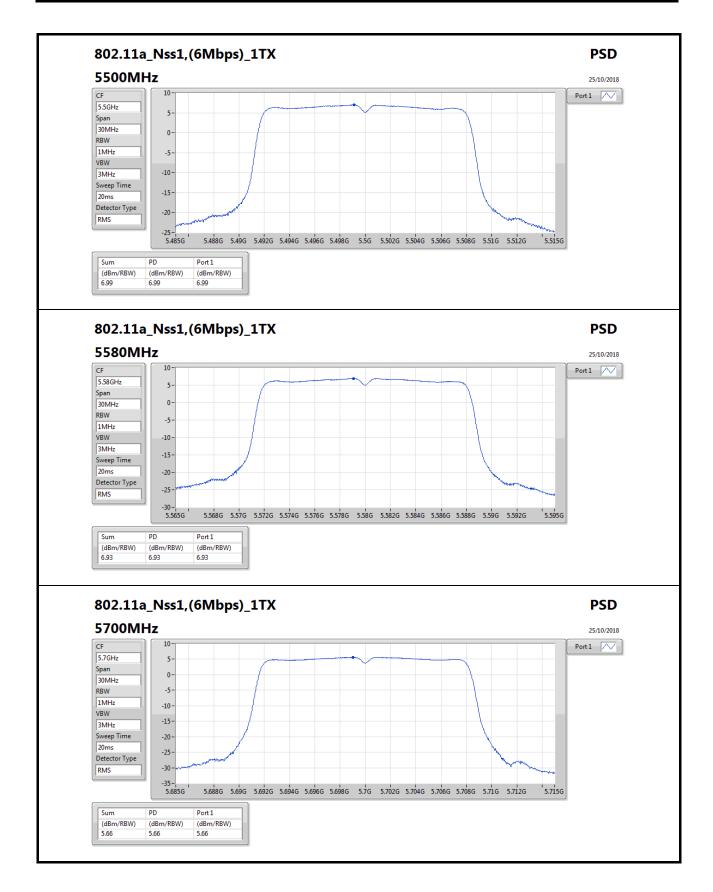
Mode	Result	DG	Port 1	PD	PD Limit
		(dBi)	(dBm/RBW)	(dBm/RBW)	(dBm/RBW)
802.11a_Nss1,(6Mbps)_1TX	-	-	-	-	-
5260MHz	Pass	2.98	9.23	9.23	11.00
5300MHz	Pass	2.98	8.78	8.78	11.00
5320MHz	Pass	2.98	7.31	7.31	11.00
5500MHz	Pass	2.98	6.99	6.99 6.93	11.00 11.00
5580MHz	Pass	2.98	6.93		
5700MHz	Pass	2.98	5.66	5.66	11.00
802.11ac VHT20_Nss1,(MCS0)_1TX	-	-	-	-	-
5260MHz	Pass	2.98	8.69	8.69	11.00
5300MHz	Pass	2.98	8.40	8.40	11.00
5320MHz	Pass	2.98	7.00	7.00	11.00
5500MHz	Pass	2.98	6.36	6.36	11.00
5580MHz	Pass	2.98	8.05	8.05	11.00
5700MHz	Pass	2.98	5.95	5.95	11.00
802.11ac VHT40_Nss1,(MCS0)_1TX	-	-	-	-	-
5270MHz	Pass	2.98	5.84	5.84	11.00
5310MHz	Pass	2.98	0.27	0.27	11.00
5510MHz	Pass	2.98	0.58	0.58	11.00
5550MHz	Pass	2.98	5.44	5.44	11.00
5670MHz	Pass	2.98	4.12	4.12	11.00
802.11ac VHT80_Nss1,(MCS0)_1TX	-	-	-	-	-
5290MHz	Pass	2.98	-4.66	-4.66	11.00
5530MHz	Pass	2.98	-3.84	-3.84	11.00
5610MHz	Pass	2.98	1.57	1.57	11.00

DG = Directional Gain; **RBW** = 500kHz 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 Xpower density;

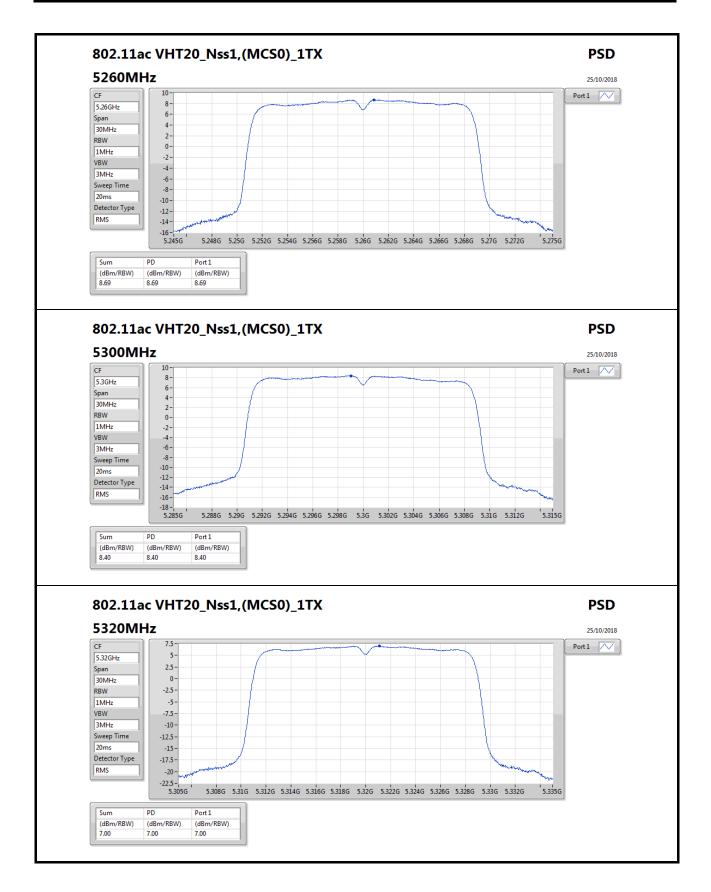




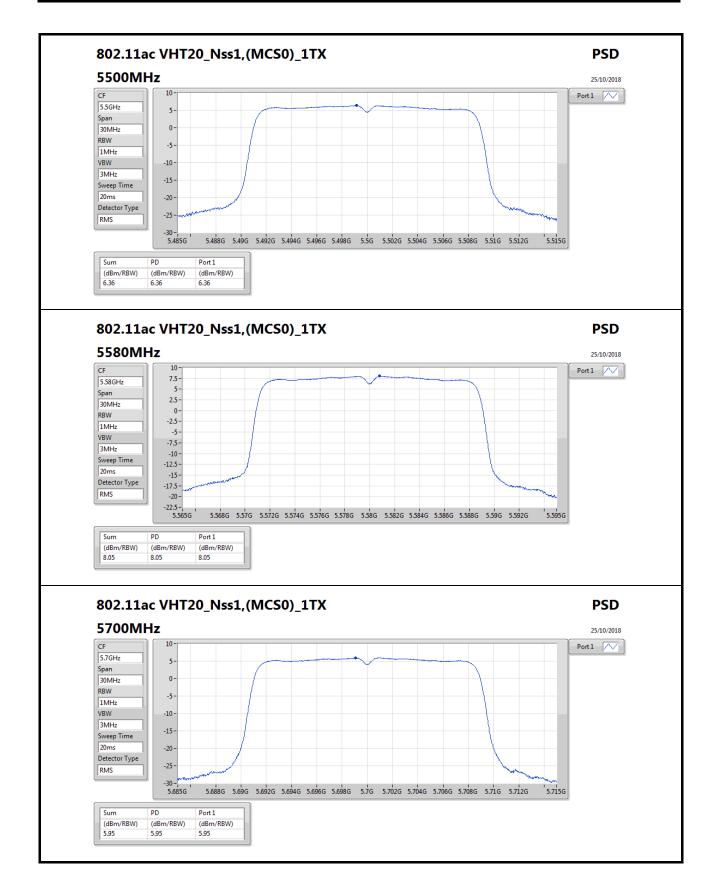




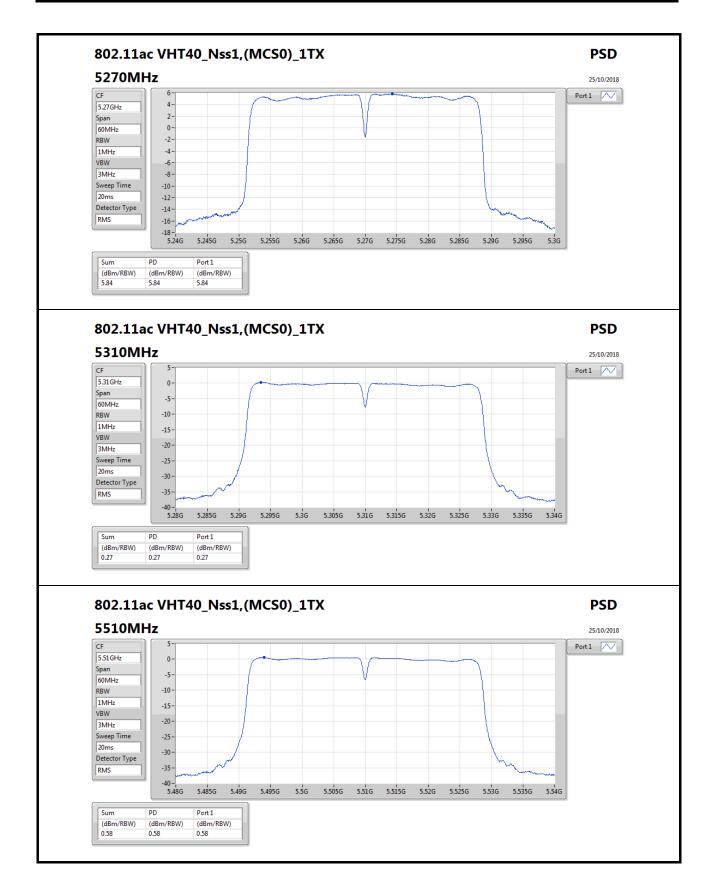




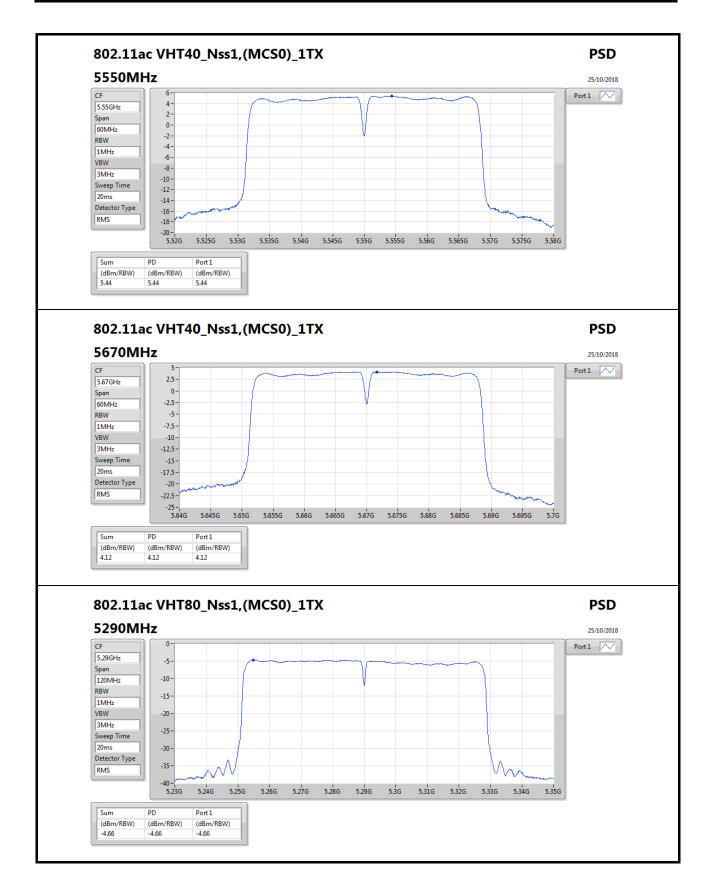




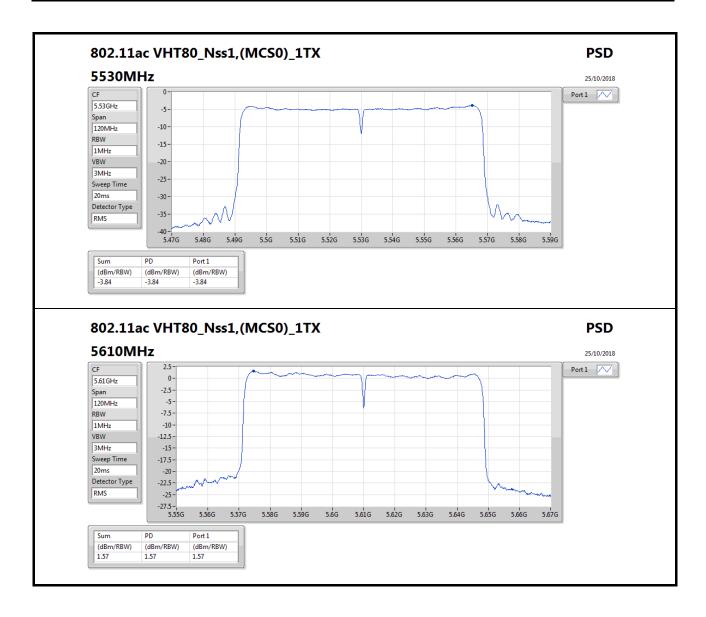














RSE TX above 1GHz Result

Appendix D

Summary

Mode	Result	Туре	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Comments
			(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dB)	(m)		(°)	(m)	
5.25-5.35GHz	-	-	-	-	-	-	-	-	-	-	-	-
802.11a_Nss1,(6Mbps)_1TX	Pass	AV	5.3502G	53.95	54.00	-0.05	8.89	3	Vertical	357	2.48	-



