

Report No. : FR892823AB



FCC RADIO TEST REPORT

FCC ID		TE7RE205V2
Equipment	;	AC750 Wi-Fi Range Extender
Brand Name		tp-link
Model Name	-	RE205
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. 01, 2018, and testing was started from Oct. 25, 2018 and completed on Oct. 31, 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 Chang

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



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Photographs of EUT v01



History of this test report

Report No.	Version	Description	Issued Date
FR892823AB	01	Initial issue of report	Dec. 26, 2018
FR892823AB	02	Removing 5GHz Band 2 and Band 3 (5250~5350 MHz, 5470~5725 MHz) for this device.	Jan. 23, 2019



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	15.407(a)	Emission Bandwidth	PASS	-
3.3	15.407(a)	Maximum Conducted Output Power	PASS	-
3.4	15.407(a)	Peak Power Spectral Density	PASS	-
3.5	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:

The EUT supports AP and Extender mode, only Extender mode was tested and recorded in this test report by applicant request.

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
5150-5250	a, n (HT20), ac (VHT20)	5180-5240	36-48 [4]
5725-5850		5745-5825	149-165 [5]
5150-5250	n (HT40), ac (VHT40)	5190-5230	38-46 [2]
5725-5850		5755-5795	151-159 [2]
5150-5250	ac (VHT80)	5210	42 [1]
5725-5850		5775	155 [1]

Band	Mode	BWch (MHz)	Nant
5.15-5.25GHz	802.11a	20	1TX
5.15-5.25GHz	802.11n HT20	20	1TX
5.15-5.25GHz	802.11ac VHT20	20	1TX
5.15-5.25GHz	802.11n HT40	40	1TX
5.15-5.25GHz	802.11ac VHT40	40	1TX
5.15-5.25GHz	802.11ac VHT80	80	1TX
5.725-5.85GHz	802.11a	20	1TX
5.725-5.85GHz	802.11n HT20	20	1TX
5.725-5.85GHz	802.11ac VHT20	20	1TX
5.725-5.85GHz	802.11n HT40	40	1TX
5.725-5.85GHz	802.11ac VHT40	40	1TX
5.725-5.85GHz	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	Product Number	Antonno Tyroo	Connector	Gain (dBi)		
Ant.	Port		Product Number	Antenna Type	Connector	2.4GHz	5GHz
1	1	TP-LINK	3101501563	Dipole Antenna	I-PEX	2	3
2	2	TP-LINK	3101501562	Dipole Antenna	I-PEX	2	-

Note: The EUT has two antennas.

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 simultaneously.

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	Internal power supply			
Beamforming Function			Without beamforming	
Function		Outdoor P2M	\boxtimes	Indoor P2M
Function		Fixed P2P		Client
Test Software Version	MT76xxE_AP V2.0.10.0			

1.1.5 Table for EUT support function

Function
AP
Extender

Note: The EUT supports AP and Extender mode, only Extender mode was tested and recorded in this test report by applicant request.



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 662911 D01 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	Paul Chen	22°C / 54%	Oct. 30, 2018~Oct. 31, 2018
Radiated below 1GHz	03CH01-CB	Paul Chen	24°C / 58%	Oct. 25, 2018~Oct. 26, 2018
Radiated above 1GHz	03CH01-CB	Cola Chang	24°C / 58%	Oct. 25, 2018~Oct. 31, 2018
AC Conduction	CO02-CB	Rick Yeh	25°C / 60%	Oct. 30, 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 ⁻⁸	Confidence levels of 95%



2 Test Configuration of EUT

2.1 Test Channel Mode

Mode	Power Setting
802.11a_Nss1,(6Mbps)_1TX	-
5180MHz	14
5200MHz	26
5240MHz	1C
5745MHz	28
5785MHz	28
5825MHz	28
802.11ac VHT20_Nss1,(MCS0)_1TX	-
5180MHz	14
5200MHz	26
5240MHz	1B
5745MHz	28
5785MHz	28
5825MHz	28
802.11ac VHT40_Nss1,(MCS0)_1TX	-
5190MHz	0B
5230MHz	1A
5755MHz	23
5795MHz	28
802.11ac VHT80_Nss1,(MCS0)_1TX	-
5210MHz	09
5775MHz	1B

Note:

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 AC power-line conducted emissions	
Condition AC power-line conducted measurement for line and neutral	
Operating Mode Normal Link	
1	Extender mode

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	

Th	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 Normal Link			
1	Extender mode - EUT in Y axis		
2	Extender mode - EUT in Z axis		
For operating mode 1 is th	e worst case and it was record in this test report.		
Operating Mode > 1GHz CTX			
	t Y axis and Z axis position for Radiated emission above 1GHz test, and the worst So the measurement will follow this same test configuration.		
1	EUT in Z axis		

The Worst Case Mode for Following Conformance Tests		
Tests Item Simultaneous Transmission Analysis - Radiated Emission Co-location		
Test Condition	Radiated measurement	
Operating Mode	erating Mode Normal Link	
The EUT was performed at Y axis and Z axis position for Radiated emission 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 F 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.: FA892823 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: CO02-CB

Support Equipment			
Equipment	Brand Name	Model Name	FCC ID
NB*3	DELL	E6430	N/A
AP Router ASUS RP-N53 MSQ-RPN53			

For Test Site No: 03CH01-CB (below 1GHz)

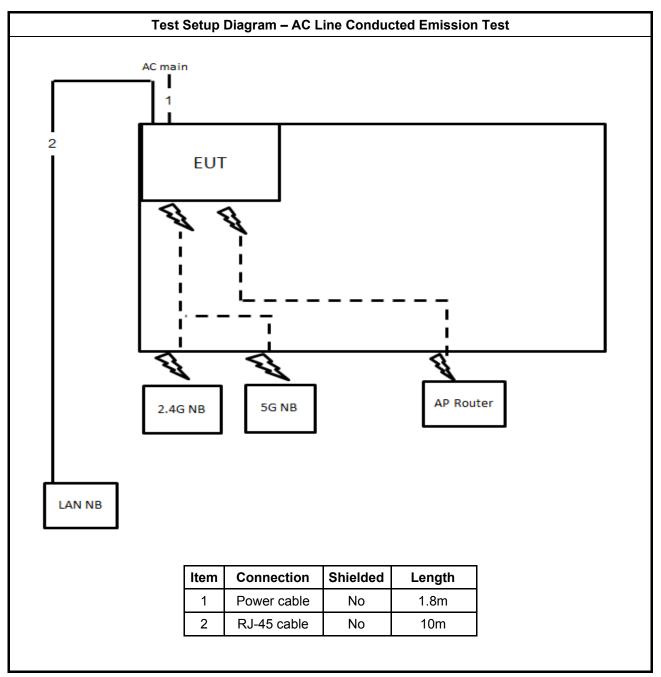
Support Equipment			
Equipment Brand Name Model Name FCC ID			
NB*3	DELL	E4300	N/A
WLAN AP NETGEAR WNDR3300v2 PY309300116			

For Test Site No: 03CH01-CB (above 1GHz) and TH01-CB

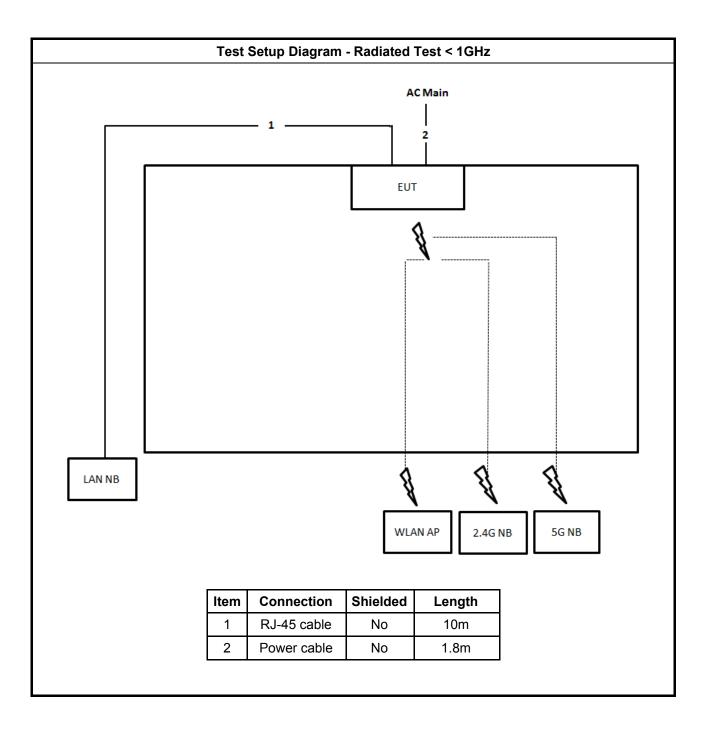
	Suppor	t Equipment	
Equipment	Brand Name	Model Name	FCC ID
NB	DELL	E4300	N/A



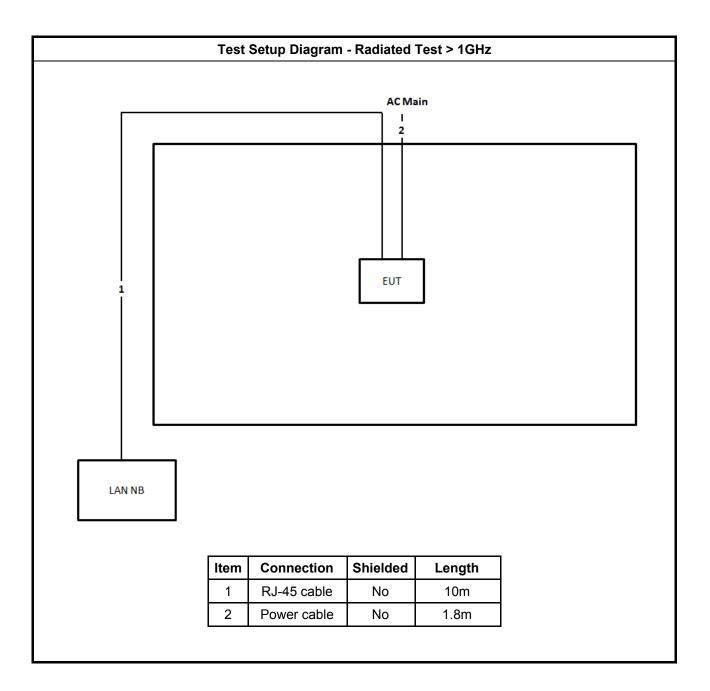
2.6 Test Setup Diagram













3 **Transmitter Test Result**

AC Power-line Conducted Emissions 3.1

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.			

3.1.2 Measuring Instruments

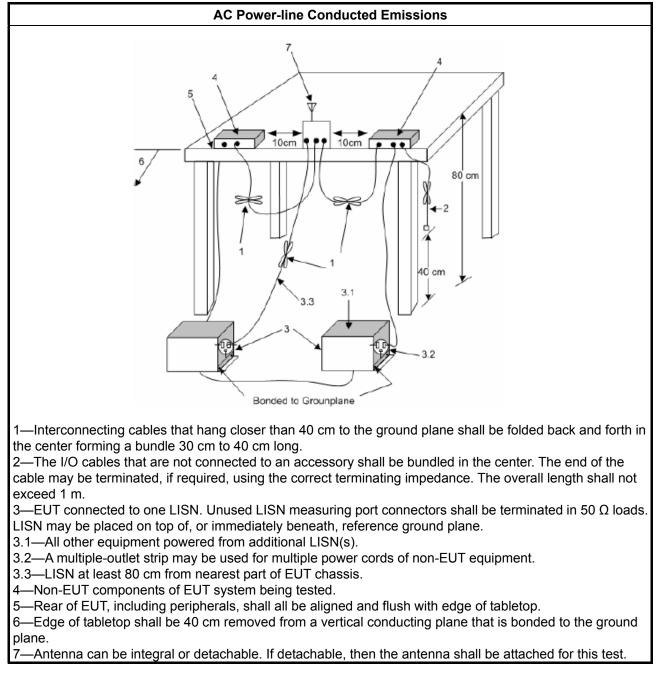
Refer a test equipment and calibration data table in this test report.

3.1.3 **Test Procedures**

Test Method

 \boxtimes 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 Emission Bandwidth

3.2.1 Emission Bandwidth Limit

	Emission Bandwidth Limit		
UNI	I Devices		
\boxtimes	For the 5.15-5.25 GHz band, N/A		
	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.		
	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.		
\boxtimes	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.		

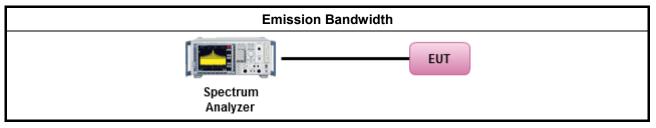
3.2.2 Measuring Instruments

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

3.2.3 Test Procedures

	Test Method							
-	For the emission bandwidth shall be measured using one of the options below:							
	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.							

3.2.4 Test Setup



3.2.5 Test Result of Emission Bandwidth

Refer as Appendix B



3.3 Maximum Conducted Output Power

3.3.1 Maximum Conducted Output Power Limit

	Maximum Conducted Output Power Limit
UN	II Devices
\boxtimes	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 $P_{Out} = 24 - (G_{TX} - 6)$.
\boxtimes	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.



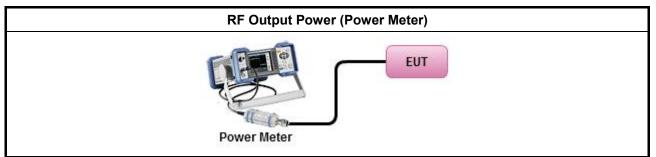
3.3.2 Measuring Instruments

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

3.3.3 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 						

3.3.4 Test Setup



3.3.5 Test Result of Maximum Conducted Output Power

Refer as Appendix C



3.4 Peak Power Spectral Density

3.4.1 Peak Power Spectral Density Limit

	Peak Power Spectral Density Limit
UNI	I Devices
\boxtimes	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).
	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).
\boxtimes	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.

3.4.2 Measuring Instruments

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

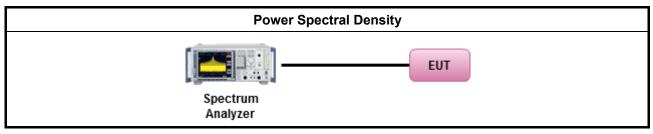


3.4.3 Test Procedures

		Test Method
•	outp func	k power spectral density procedures that the same method as used to determine the conducted ut power shall be used to determine the peak power spectral density and use the peak search tion on the spectrum analyzer to find the peak of the spectrum. For the peak power spectral density I 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	/ 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]) $EIRP_{total} = PPSD_{total} + DG$



3.4.4 Test Setup



3.4.5 Test Result of Peak Power Spectral Density

Refer as Appendix D



3.5 Unwanted Emissions

3.5.1 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).

3.5.2 **Measuring Instruments**

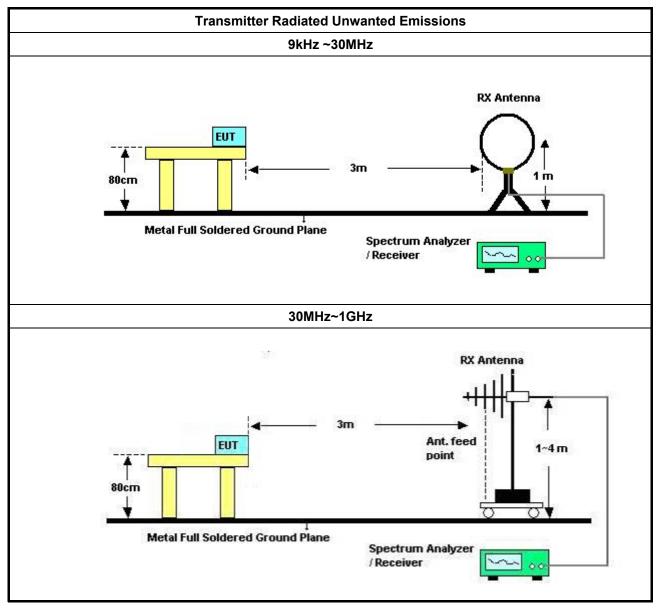
Refer a test equipment and calibration data table in this test report.

3.5.3 **Test Procedures**

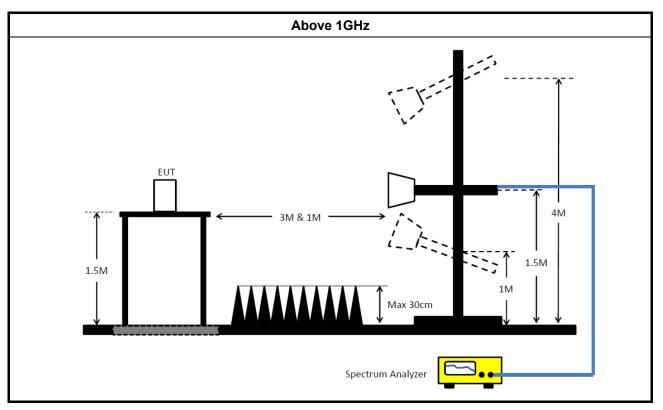
		Test Method					
•	Measurements may be performed at a distance other than the limit distance provided they are not performed in the near field and the emissions to be measured can be detected by the measurement equipment. Measurements shall not be performed at a distance greater than 30 m for frequencies 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.					



3.5.4 Test Setup







3.5.5 Transmitter 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.

3.5.6 Test Result of Transmitter Unwanted Emissions

Refer as Appendix E



4 Test Equipment and Calibration Data

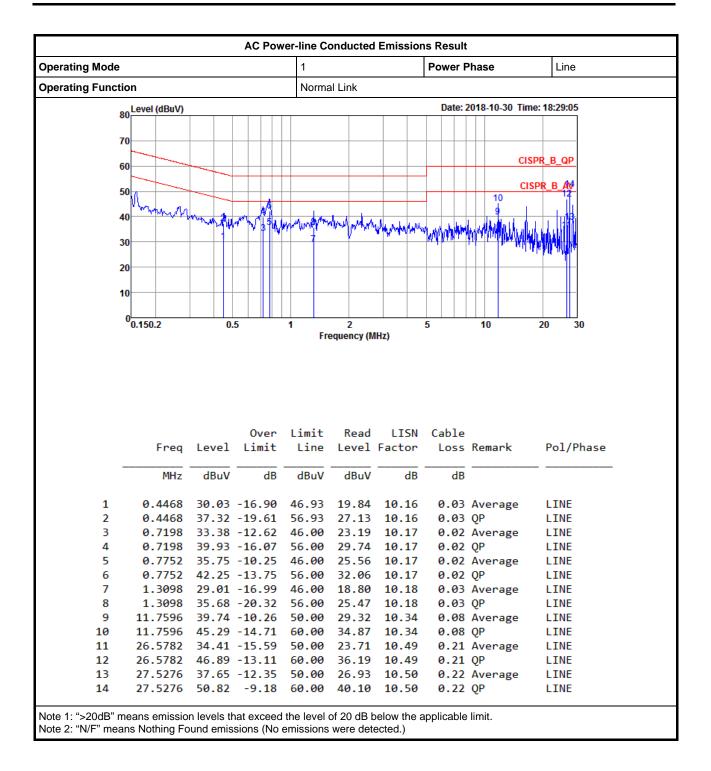
Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Calibration Due Date	Remark
LISN	Schwarzbeck	NSLK 8127	8127650	9kHz ~ 30MHz	Nov. 24, 2017	Nov. 23, 2018	Conduction (CO02-CB)
LISN	Schwarzbeck	NSLK 8127	8127478	9kHz ~ 30MHz	Nov. 13, 2017	Nov. 12, 2018	Conduction (CO02-CB)
EMI Receiver	Agilent	N9038A	MY52260140	9kHz ~ 8.4GHz	Jan. 17, 2018	Jan. 16, 2019	Conduction (CO02-CB)
COND Cable	Woken	Cable	2	0.15MHz ~ 30MHz	Nov. 10, 2017	Nov. 09, 2018	Conduction (CO02-CB)
Software	Audix	E3	6.120210n	-	N.C.R.	N.C.R.	Conduction (CO02-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)
Loop Antenna	Teseq	HLA 6120	24155	9kHz - 30 MHz	Mar. 16, 2018	Mar. 15, 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	100080	9kHz~40GHz	Oct. 03, 2018	Oct. 02, 2019	Radiation (03CH01-CB)
EMI Test Receiver	R&S	ESCS	100359	9kHz ~ 2.75GHz	Jul. 03, 2018	Jul. 02, 2019	Radiation (03CH01-CB)
RF Cable-low	Woken	Low Cable-16+17	N/A	30 MHz ~ 1 GHz	Oct. 08, 2018	Oct. 07, 2019	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)



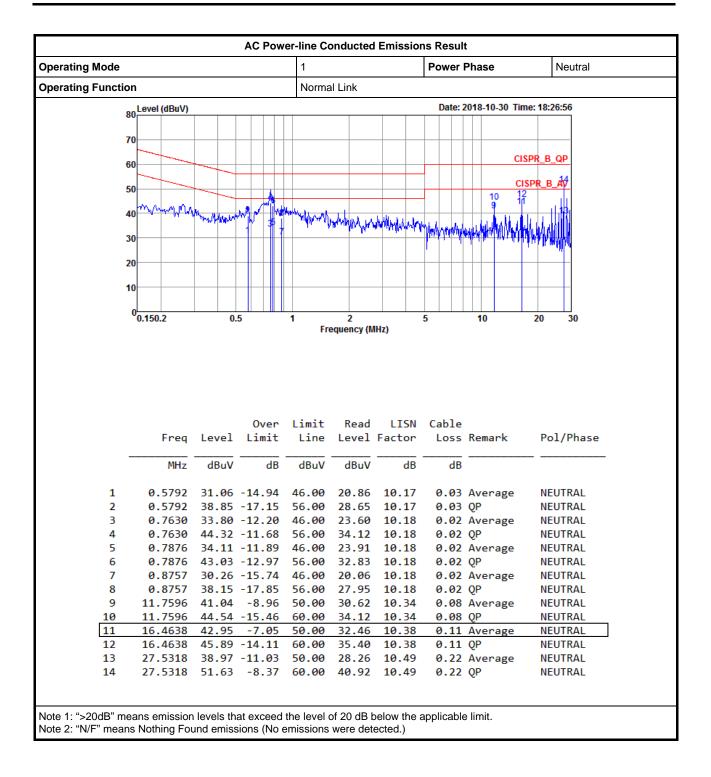
Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Calibration Due Date	Remark
RF Cable-high	Woken	High Cable-40G#2	N/A	18GHz ~ 40 GHz	Jul. 27, 2018	Jul. 26, 2019	Radiation (03CH01-CB)
Spectrum analyzer	R&S	FSV40	100979	9kHz~40GHz	Dec. 21, 2017	Dec. 20, 2018	Conducted (TH01-CB)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

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)
5.15-5.25GHz	-	-	-	-	-
802.11a_Nss1,(6Mbps)_1TX	48.225M	30.4M	30M4D1D	37.65M	16.95M
802.11ac VHT20_Nss1,(MCS0)_1TX	50M	31.5M	31M5D1D	42.275M	17.691M
802.11ac VHT40_Nss1,(MCS0)_1TX	88.15M	37.781M	37M8D1D	41.2M	36.082M
802.11ac VHT80_Nss1,(MCS0)_1TX	93.7M	75.462M	75M5D1D	93.7M	75.462M
5.725-5.85GHz	-	-	-	-	-
802.11a_Nss1,(6Mbps)_1TX	16.4M	30.95M	30M9D1D	16.375M	30.225M
802.11ac VHT20_Nss1,(MCS0)_1TX	17.675M	32.134M	32M1D1D	17.65M	31.834M
802.11ac VHT40_Nss1,(MCS0)_1TX	36.4M	65.467M	65M5D1D	36.35M	57.571M
802.11ac VHT80_Nss1,(MCS0)_1TX	76.3M	77.361M	77M4D1D	76.3M	77.361M

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;



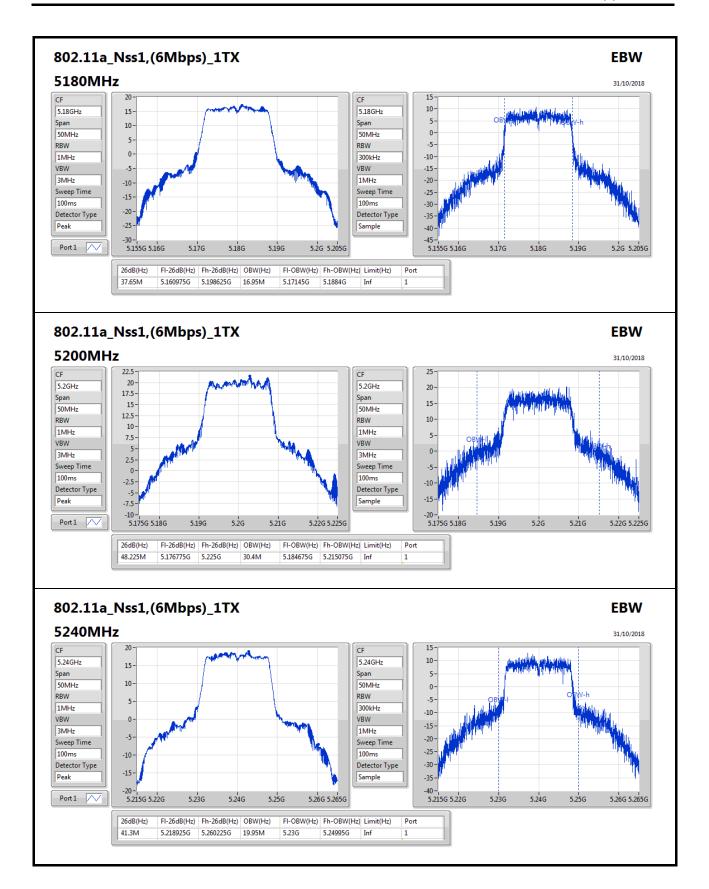
Appendix B

Result

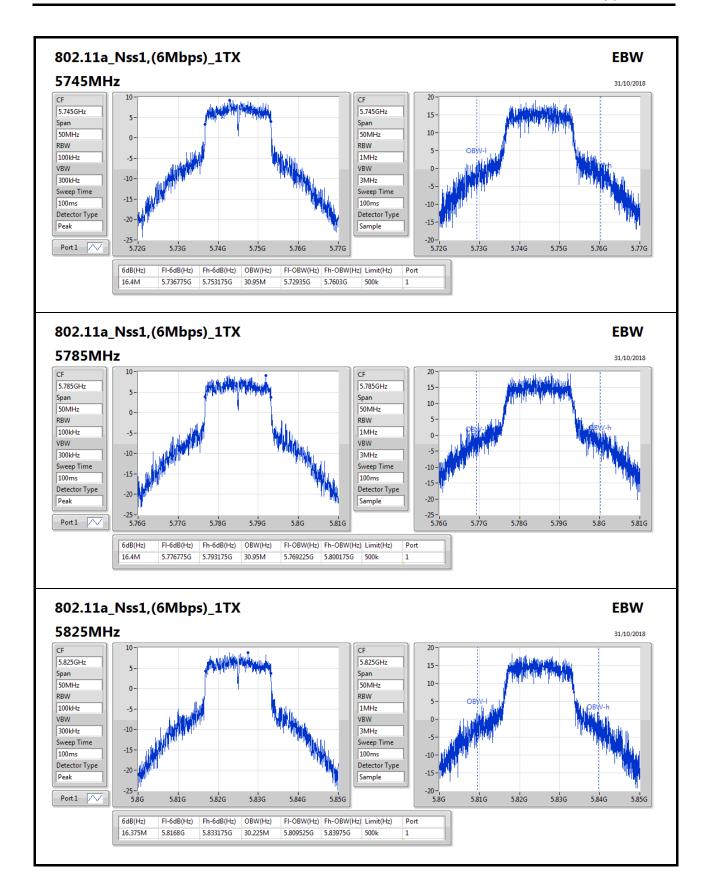
Mode	Result	Limit	Port 1-N dB	Port 1-OBW
		(Hz)	(Hz)	(Hz)
802.11a_Nss1,(6Mbps)_1TX	-	-	-	-
5180MHz	Pass	Inf	37.65M	16.95M
5200MHz	Pass	Inf	48.225M	30.4M
5240MHz	Pass	Inf	41.3M	19.95M
5745MHz	Pass	500k	16.4M	30.95M
5785MHz	Pass	500k	16.4M	30.95M
5825MHz	Pass	500k	16.375M	30.225M
802.11ac VHT20_Nss1,(MCS0)_1TX	-	-	-	-
5180MHz	Pass	Inf	42.275M	17.691M
5200MHz	Pass	Inf	50M	31.5M
5240MHz	Pass	Inf	45.7M	19.475M
5745MHz	Pass	500k	17.675M	31.984M
5785MHz	Pass	500k	17.65M	31.834M
5825MHz	Pass	500k	17.675M	32.134M
802.11ac VHT40_Nss1,(MCS0)_1TX	-	-	-	-
5190MHz	Pass	Inf	41.2M	36.082M
5230MHz	Pass	Inf	88.15M	37.781M
5755MHz	Pass	500k	36.4M	57.571M
5795MHz	Pass	500k	36.35M	65.467M
802.11ac VHT80_Nss1,(MCS0)_1TX	-	-	-	-
5210MHz	Pass	Inf	93.7M	75.462M
5775MHz	Pass	500k	76.3M	77.361M

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;

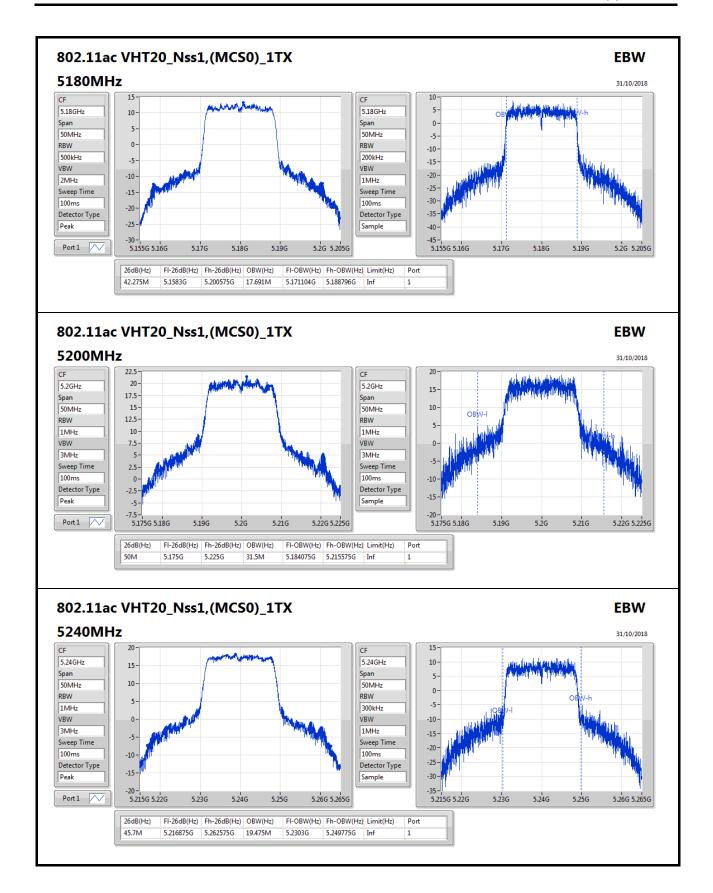




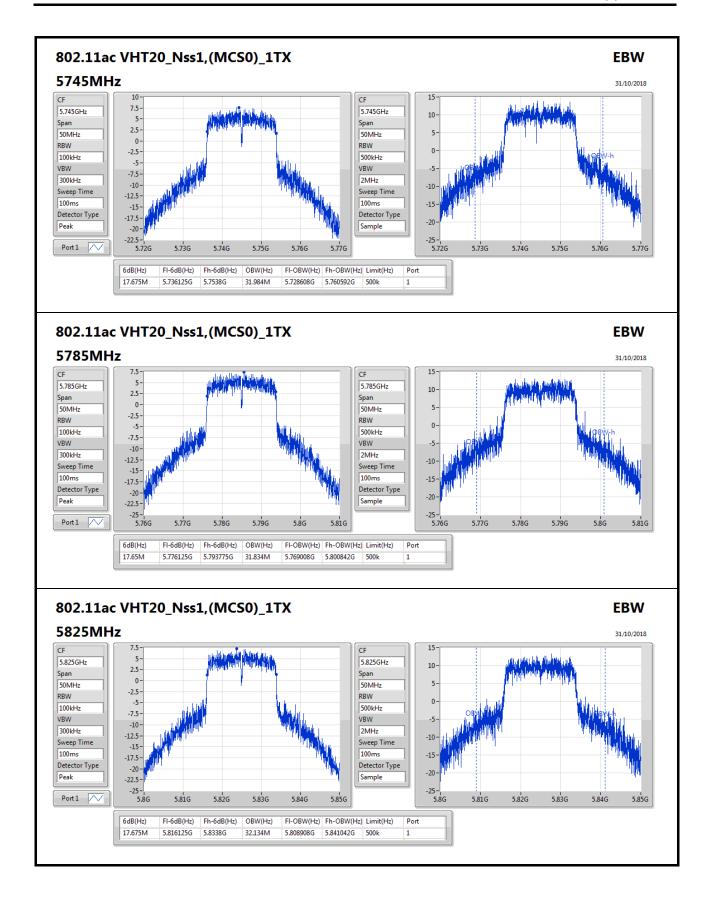




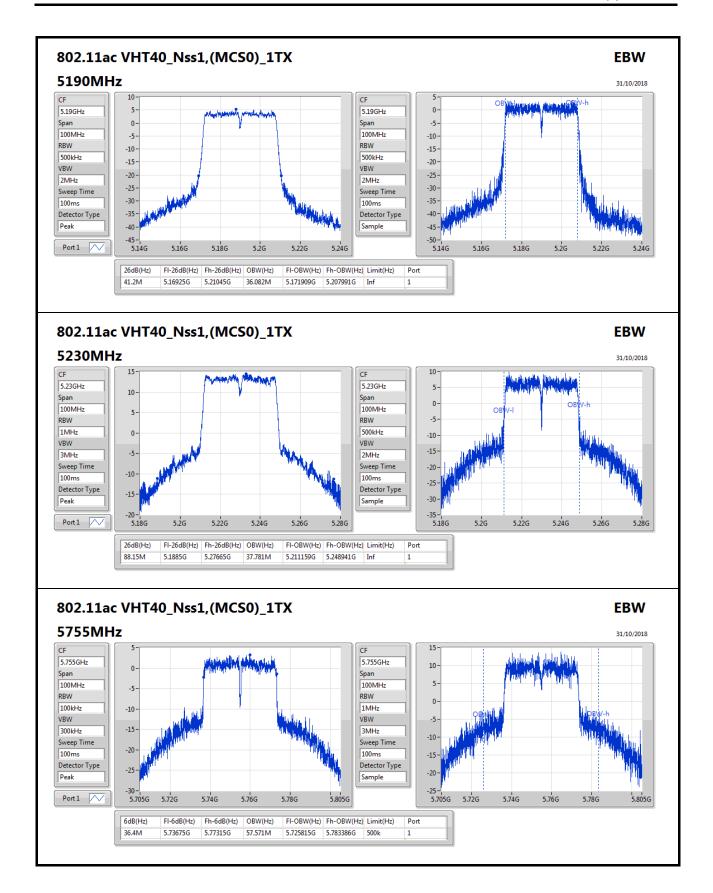






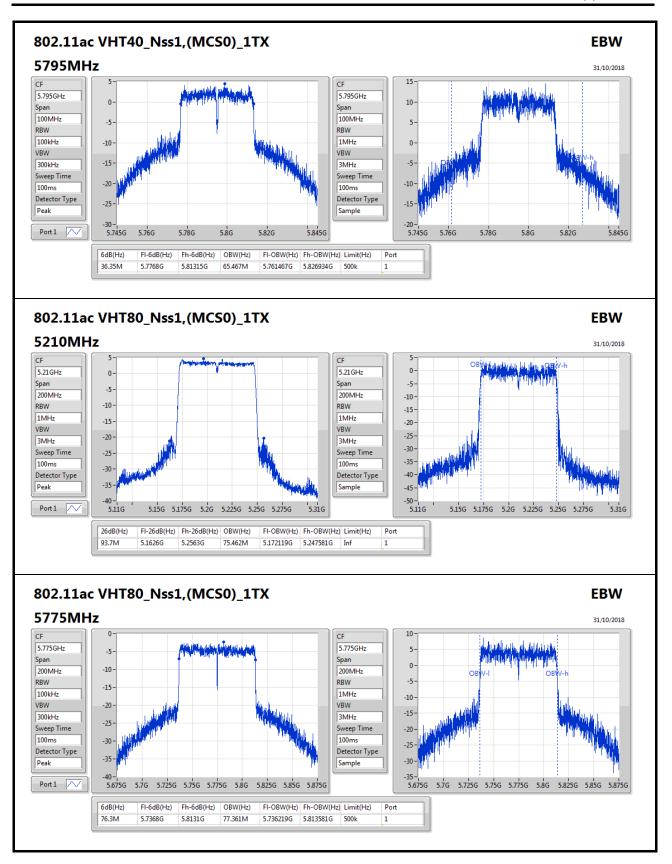








EBW Result





Power Result

Appendix C

Summary

Mode	Total Power	Total Power			
	(dBm)	(W)			
5.15-5.25GHz	-	-			
802.11a_Nss1,(6Mbps)_1TX	23.46	0.22182			
802.11ac VHT20_Nss1,(MCS0)_1TX	23.35	0.21627			
802.11ac VHT40_Nss1,(MCS0)_1TX	21.06	0.12764			
802.11ac VHT80_Nss1,(MCS0)_1TX	14.35	0.02723			
5.725-5.85GHz	-	-			
802.11a_Nss1,(6Mbps)_1TX	22.21	0.16634			
802.11ac VHT20_Nss1,(MCS0)_1TX	21.98	0.15776			
802.11ac VHT40_Nss1,(MCS0)_1TX	21.66	0.14655			
802.11ac VHT80_Nss1,(MCS0)_1TX	18.72	0.07447			



Power Result

Appendix C

Result

Mode	Result	DG	Port 1	Total Power	Power Limi	
		(dBi)	(dBm)	(dBm)	(dBm)	
802.11a_Nss1,(6Mbps)_1TX	-	-	-	-	-	
5180MHz	Pass	3.00	19.75	19.75	30.00	
5200MHz	Pass	3.00	23.46	23.46	30.00	
5240MHz	Pass	3.00	21.13	21.13	30.00	
5745MHz	Pass	3.00	22.21	22.21	30.00	
5785MHz	Pass	3.00 3.00	22.00	22.00	30.00	
5825MHz	Pass		21.86	21.86	30.00	
802.11ac VHT20_Nss1,(MCS0)_1TX	-	-	-	-	-	
5180MHz	Pass	3.00	20.12	20.12	30.00	
5200MHz	Pass	3.00 3.00 3.00 3.00 3.00 3.00	23.35 20.83 21.98 21.56 21.56	23.35	30.00 30.00 30.00 30.00 30.00	
5240MHz	Pass			20.83		
5745MHz	Pass			21.98		
5785MHz	Pass			21.56		
5825MHz	Pass			21.56		
802.11ac VHT40_Nss1,(MCS0)_1TX	-	-	-	-	-	
5190MHz	Pass	3.00	15.69	15.69	30.00	
5230MHz	Pass	3.00	21.06	21.06	30.00 30.00 30.00	
5755MHz	Pass	3.00	21.06	21.06		
5795MHz	Pass	3.00	21.66	21.66		
802.11ac VHT80_Nss1,(MCS0)_1TX	-	-	-	-	-	
5210MHz	Pass	3.00	14.35	14.35	30.00	
5775MHz	Pass	3.00	18.72	18.72	30.00	

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



Summary

Mode	PD
	(dBm/RBW)
5.15-5.25GHz	-
802.11a_Nss1,(6Mbps)_1TX	10.69
802.11ac VHT20_Nss1,(MCS0)_1TX	10.30
802.11ac VHT40_Nss1,(MCS0)_1TX	4.27
802.11ac VHT80_Nss1,(MCS0)_1TX	-5.25
5.725-5.85GHz	-
802.11a_Nss1,(6Mbps)_1TX	6.75
802.11ac VHT20_Nss1,(MCS0)_1TX	6.59
802.11ac VHT40_Nss1,(MCS0)_1TX	3.38
802.11ac VHT80_Nss1,(MCS0)_1TX	-2.27

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



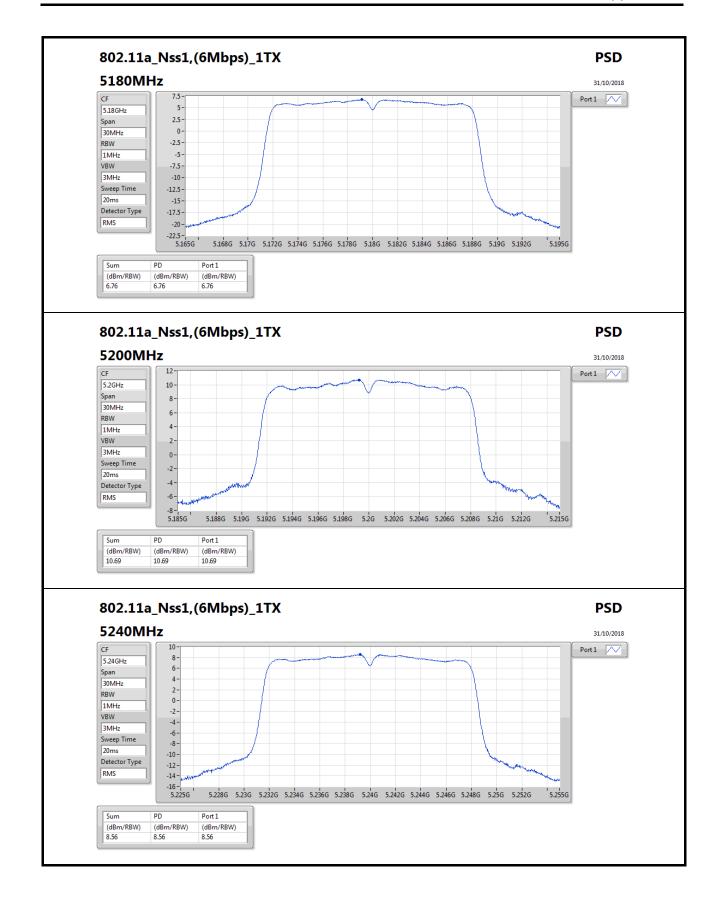
Appendix D

Result

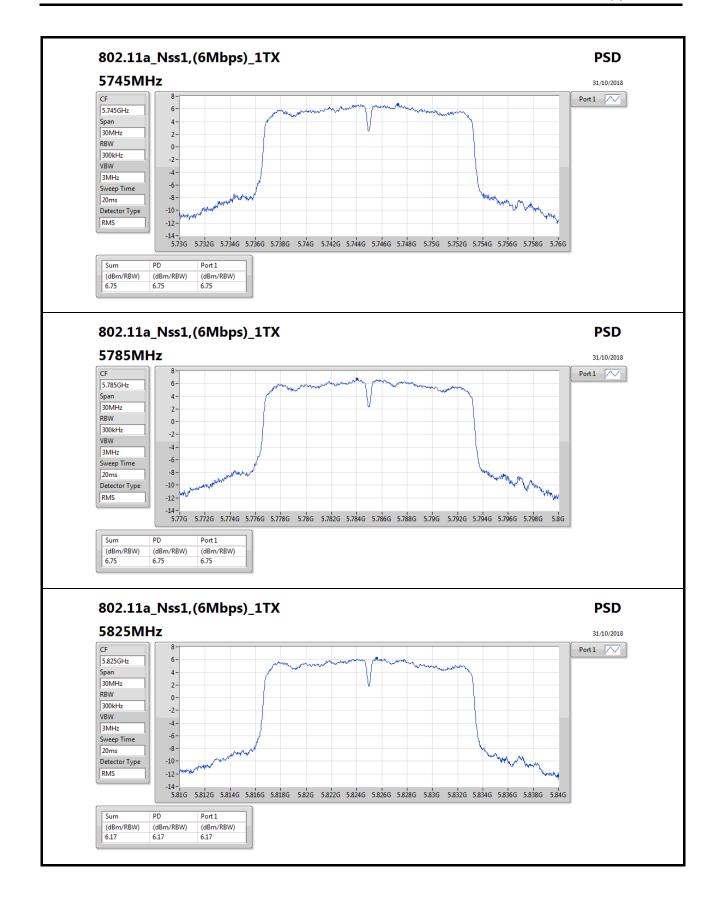
Mode	Result	DG	Port 1	PD	PD Limit	
		(dBi)	(dBm/RBW)	(dBm/RBW)	(dBm/RBW)	
802.11a_Nss1,(6Mbps)_1TX	-	-	-	-	-	
5180MHz	Pass	3.00	6.76	6.76	17.00	
5200MHz	Pass	3.00 3.00 3.00 3.00	10.69 8.56	10.69	17.00	
5240MHz	Pass			8.56	17.00	
5745MHz	Pass		6.75	6.75	30.00	
5785MHz	Pass		6.75	6.75	30.00	
5825MHz	Pass	3.00	6.17	6.17	30.00	
802.11ac VHT20_Nss1,(MCS0)_1TX	-	-	-	-	- 17.00 17.00 17.00 30.00 30.00	
5180MHz	Pass	3.00	7.12	7.12		
5200MHz	Pass	3.00	10.30	10.30		
5240MHz	Pass	3.00 3.00	7.89 6.59 6.41	7.89		
5745MHz	Pass			6.59 6.41		
5785MHz	Pass	3.00				
5825MHz	Pass	3.00	6.21	6.21	30.00	
802.11ac VHT40_Nss1,(MCS0)_1TX	-	-	- -1.17 4.27	-	- 17.00 17.00 30.00	
5190MHz	Pass	3.00		-1.17		
5230MHz	Pass	3.00 3.00		4.27		
5755MHz	Pass		2.74	2.74		
5795MHz	Pass	3.00	3.38	3.38	30.00	
802.11ac VHT80_Nss1,(MCS0)_1TX	-	-	-	-	-	
5210MHz	Pass	3.00 -5.25		-5.25	17.00	
5775MHz	Pass	3.00	-2.27	-2.27	30.00	

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;

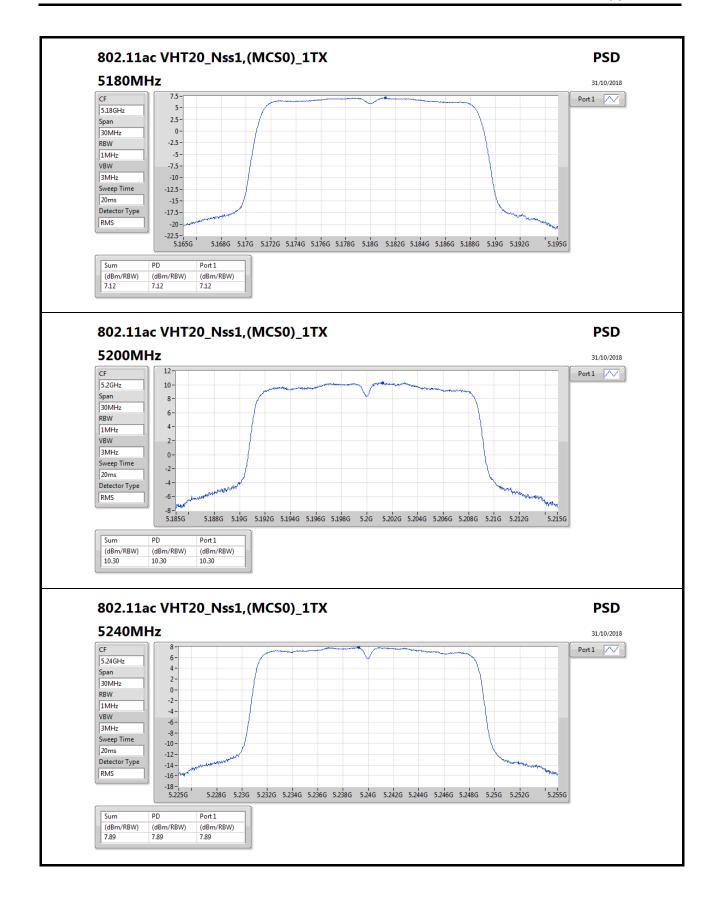




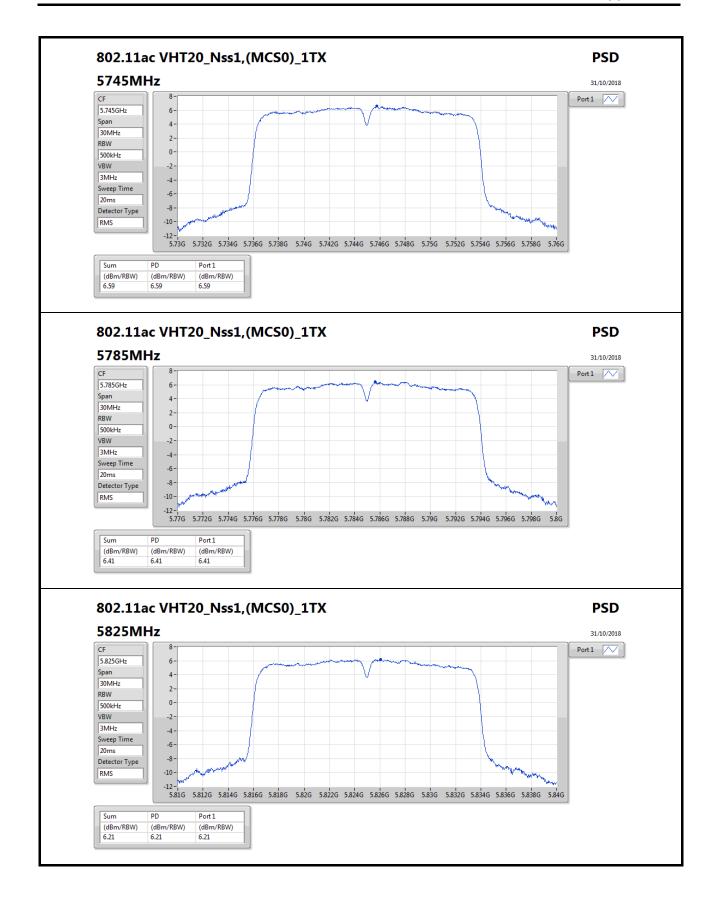




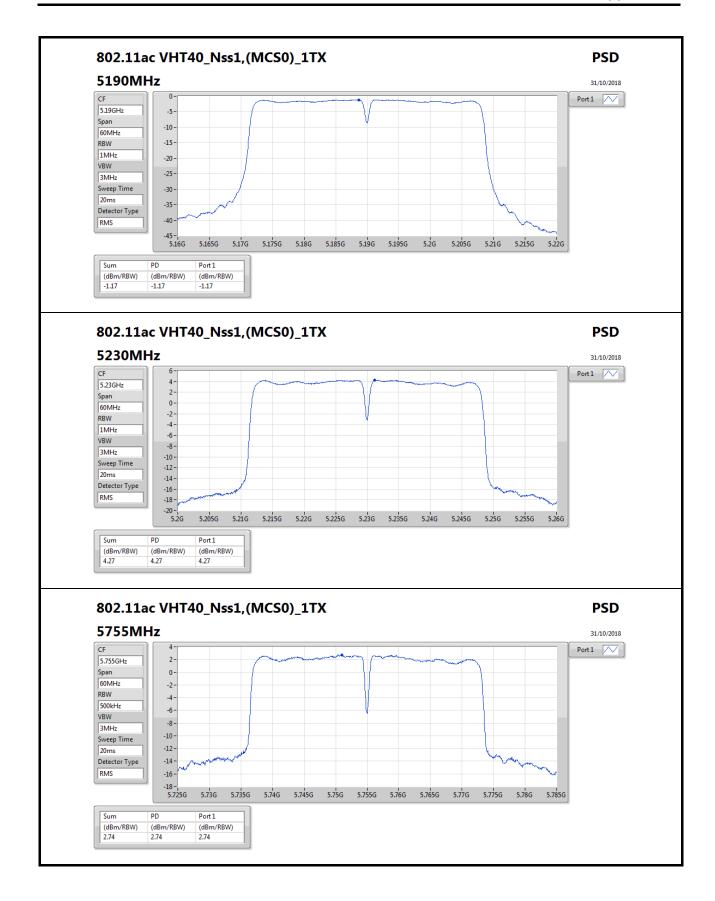






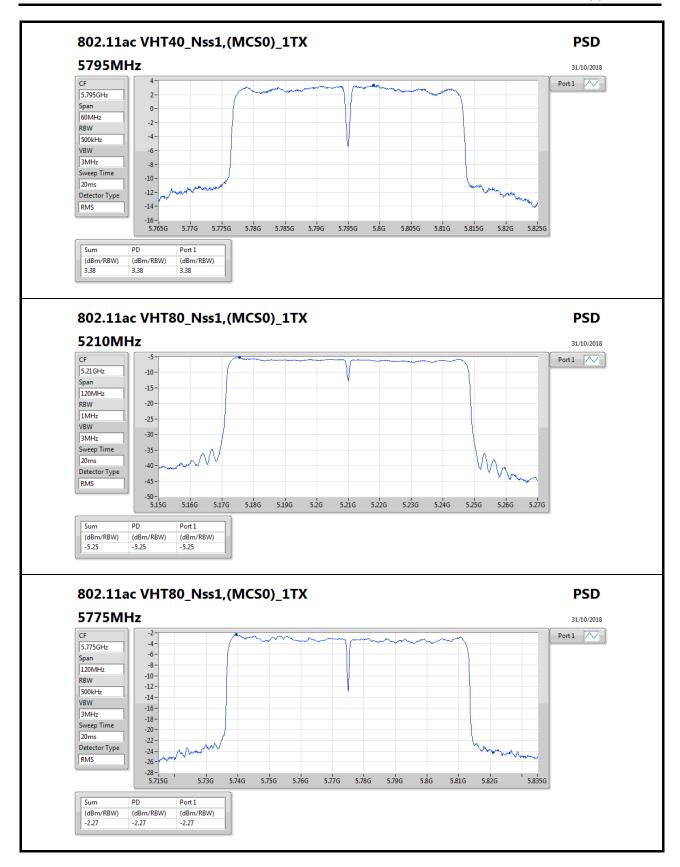




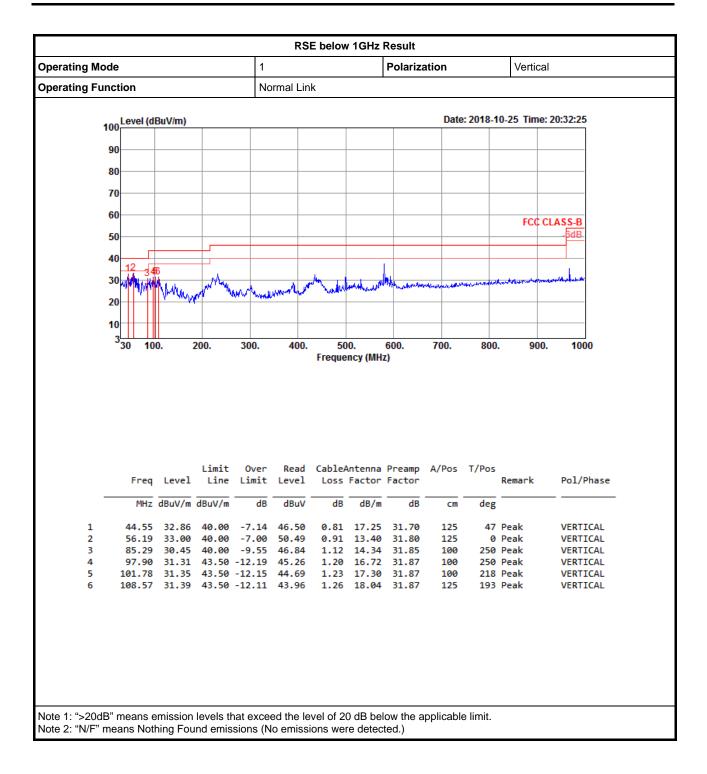




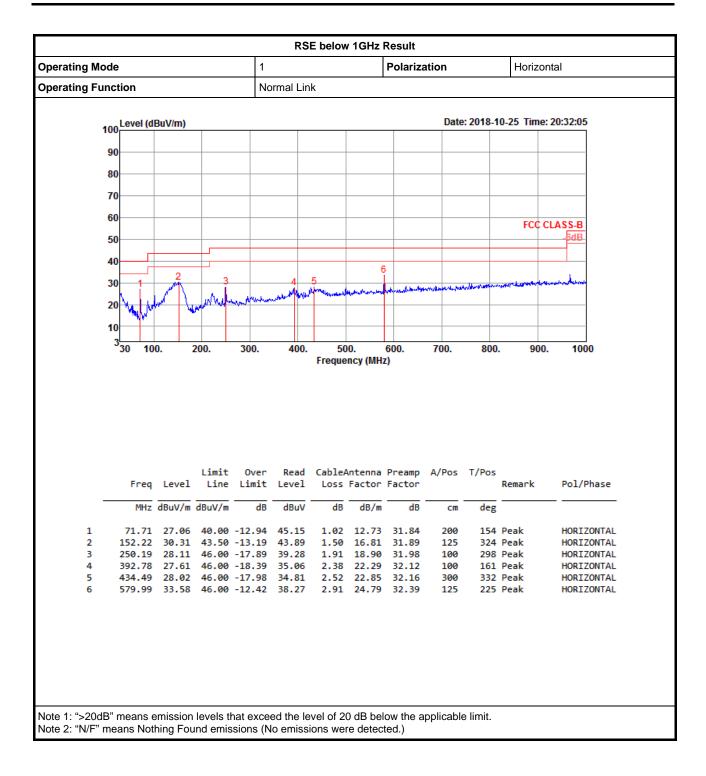
Appendix D













RSE TX above 1GHz Result

Appendix E.2

Summary

Mode	Result	Туре	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Comments
			(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dB)	(m)		(°)	(m)	
5.15-5.25GHz	-	-	-	-	-	-	-	-	-	-	-	-
802.11ac VHT80_Nss1,(MCS0)_1TX	Pass	AV	5.15G	53.99	54.00	-0.01	4.90	3	Vertical	321	2.20	-



