

Report No.: FR7D2234-14



# FCC RADIO TEST REPORT

FCC ID

: HEDML16035

Equipment

: MetroLin Outdoor 60GHz PTP + 5GHz + 2.4GHz

**Brand Name** 

: Ignitenet

Model Name

: ML1-60-35/ML1-60-19

Applicant

: Accton Technology Corp

No. 1, Creation Rd. III, Science-based Industrial

Park Hsin Chu 30077, Taiwan

Manufacturer (1): Joy Technology (Shen Zhen) Co. Ltd

HengKeng Ind., Shangpai, Shangwu, Aiqun Rd.,

Shiyan Town, Shenzhen 518108 China

Manufacturer (2) : Accton Technology Corp

No. 1, Creation Rd. III, Science-based Industrial

Park Hsin Chu 30077, Taiwan

Standard

: 47 CFR FCC Part 15.407

The product was received on Aug. 19, 2019, and testing was started from Aug. 24, 2019 and completed on Aug. 27, 2019 . 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.

SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory

No. 52. Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.)

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Report Template No.: CB-A12\_1 Ver1.0

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: Nov. 18, 2019

Report Version : 01

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Photographs of EUT v01

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# History of this test report

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Report No.	Version	Description	Issued Date
FR7D2234-14	01	Initial issue of report	Nov. 18, 2019

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# **Summary of Test Result**

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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:**

The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

Reviewed by: Sam Chen
Report Producer: Wendy Pan

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# 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]

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Band	Mode	BWch (MHz)	Nant
5.25-5.35GHz	802.11a	20	2TX
5.25-5.35GHz	802.11n HT20	20	2TX
5.25-5.35GHz	802.11ac VHT20	20	2TX
5.25-5.35GHz	802.11n HT40	40	2TX
5.25-5.35GHz	802.11ac VHT40	40	2TX
5.25-5.35GHz	802.11ac VHT80	80	2TX
5.47-5.725GHz	802.11a	20	2TX
5.47-5.725GHz	802.11n HT20	20	2TX
5.47-5.725GHz	802.11ac VHT20	20	2TX
5.47-5.725GHz	802.11n HT40	40	2TX
5.47-5.725GHz	802.11ac VHT40	40	2TX
5.47-5.725GHz	802.11ac VHT80	80	2TX

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#### 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.

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- 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

#### For WLAN Function:

<u> </u>	· · · · · · · · · · · · · · · · ·									
Set	Brand	P/N (Model Name)	Antenna Type		Antenna Gain (dBi)					
1	FT-RF	OS-242509-NM	Dipole	N-Male						
2	Accton	120G00000174X	Dish Ant.	MMCX	Note 1					
3	Accton	120G00000175X	Dish Ant.	MMCX						

#### Note 1:

Set	Antenna Gain (dBi)					Cable Loss True Gain (dB) (dBi)						
Set	2.4GHz	5GHz Band 1	5GHz Band 2	5GHz Band 3	5GHz Band 4	2.4GHz	4GHz 5GHz		5GHz Band 1	5GHz Band 2	5GHz Band 3	5GHz Band 4
1	9.00	-	-	-	-	1.18	-	7.82	-	-	-	-
2	-	20.00	16.10	16.00	20.00	-	-	-	20.00	16.10	16.00	20.00
3	-	13.40	10.70	10.70	13.40	-	-	-	13.40	10.70	10.70	13.40

Note2: The above information was declared by manufacturer.

EUT 1 allocates with antenna set 1 and set 2.

EUT 2 allocates with antenna set 1 and set 3.

Because 5GHz Set 2 and Set 3 are the same type antennas, only the higher gain antenna "Set 2" was tested.

#### For 2.4GHz function:

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

Port 1 and Port 2 connect to Set 1.

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

Port 1 and Port 2 could transmit/receive simultaneously.

#### For 5GHz function:

#### For IEEE 802.11a/n/ac mode (2TX/2RX):

Port 1 and Port 2 connect to Set 2 or Set 3.

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

Port 1 and Port 2 could transmit/receive simultaneously.

#### For 60GHz Function:

Ant.	Brand	Part Number	Antenna Type	Connector	Gain (dBi)	
1	Accton	123400001485A	Dish Ant.	N/A	42	
2	Accton	123400001486A	Dish Ant.	N/A	38	

Note: The above information was declared by manufacturer.

EUT 1 allocates with antenna set 1.

EUT 2 allocates with antenna set 2

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

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### 1.1.3 Mode Test Duty Cycle

Mode	DC	DCF(dB)	T(s)	VBW(Hz) ≥ 1/T
802.11a	0.965	0.15	2.068m	1k
802.11ac VHT20	0.985	0.07	n/a (DC>=0.98)	n/a (DC>=0.98)
802.11ac VHT40	0.968	0.14	2.44m	1k
802.11ac VHT80	0.933	0.3	1.15m	1k

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N	Oto.	

- DC is Duty Cycle.
- DCF is Duty Cycle Factor.

### 1.1.4 EUT Operational Condition

EUT Power Type	From PoE or DC 48V					
Beamforming Function		With beamforming		Without beamforming		
Weather Band		With 5600~5650MHz		Without 5600~5650MHz		
Function		Outdoor P2M		Indoor P2M		
i dilotion	$\boxtimes$	Fixed P2P		Client		
TPC Function		☑ With TPC		Without TPC		
Test Software Version		QCARCT(V3.0.187.0)				

Note: The above information was declared by manufacturer.

### 1.1.5 Table for Multiple Listing

The EUT has two model names which are identical to each other in all aspects except for the following table:

Drand Name	Model News	FUT No	WLAN 2.4GHz	WLAN 5GHz	60GHz	
Brand Name	Model Name	EUT No.	Ant. Model Name	Ant. Model Name	Ant. Model Name	
Ignitonot	ML1-60-35	EUT 1	OS-242509-NM	120G00000174X	123400001485A	
Ignitenet	ML1-60-19	EUT 2	OS-242509-NM	120G00000175X	123400001486A	

From the above models, model: ML1-60-35 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: FR7D2234-05AB Below is the table for the change of the product with respect to the original one.

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

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### 1.2 Applicable Standards

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

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- 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	Lance Wu	23.9~25.3°C / 63~68%	Aug. 27, 2019
Radiated	03CH03-CB	Welson Chen	24.2~25.7°C / 62~68%	Aug. 24, 2019 ~ Aug. 26, 2019

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)	4.3 dB	Confidence levels of 95%
Radiated Emission (18GHz ~ 40GHz)	5.1 dB	Confidence levels of 95%
Conducted Emission	2.4 dB	Confidence levels of 95%
Output Power Measurement	1.5 dB	Confidence levels of 95%
Power Density Measurement	2.4 dB	Confidence levels of 95%
Bandwidth Measurement	2%	Confidence levels of 95%

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# 2 Test Configuration of EUT

## 2.1 Test Channel Mode

Mode	PowerSetting
802.11a_Nss1,(6Mbps)_2TX	-
5260MHz	6.5
5300MHz	6.5
5320MHz	6.5
5500MHz	7
5580MHz	6.5
5700MHz	2.5
802.11ac VHT20_Nss1,(MCS0)_2TX	-
5260MHz	6.5
5300MHz	6.5
5320MHz	7
5500MHz	7
5580MHz	7
5700MHz	2.5
802.11ac VHT40_Nss1,(MCS0)_2TX	-
5270MHz	8.5
5310MHz	9.5
5510MHz	9.5
5550MHz	9.5
5670MHz	9.5
802.11ac VHT80_Nss1,(MCS0)_2TX	-
5290MHz	9.5
5530MHz	9.5
5610MHz	9.5

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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.

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## 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

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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	CTX		

The Worst Case Mode for Following Conformance Tests		
Tests Item Simultaneous Transmission Analysis - Co-location RF Exposure Evaluation		
Operating Mode		
1	EUT 1 - WLAN 2.4GHz + WLAN 5GHz + 60GHz	
Refer to Sporton Test Report No.: FA7D2234-14 for Co-location RF Exposure Evaluation.		

Note: 1. The EUT can only be used at Y axis position.

<sup>3.</sup> The PoE is for measurement only, would not be marketed, and its information as below:

Equipment Brand		Model	FCC ID
PoE	CARRIER	GME241DA-480050G	N/A

## 2.3 EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

### 2.4 Accessories

N/A

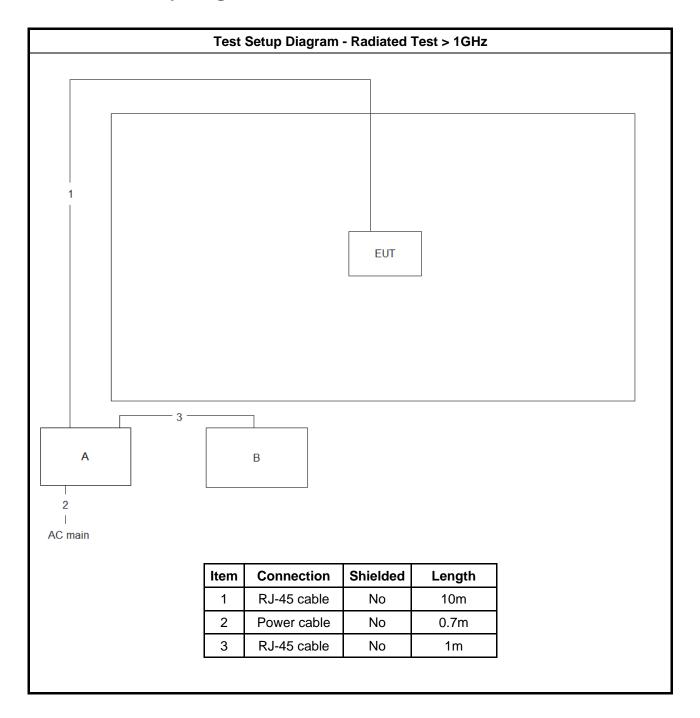
# 2.5 Support Equipment

	Support Equipment				
No.	No. Equipment Brand Name Model Name FCC ID				
Α	Notebook	DELL	E4300	N/A	
В	PoE	CARRIER	GME241DA-480050G	N/A	

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<sup>2.</sup> The defines from manufacturer, "USB port" without any function, and it was performed test at the load.

# 2.6 Test Setup Diagram



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## 3 Transmitter Test Result

### 3.1 Emission Bandwidth

### 3.1.1 Emission Bandwidth Limit

	Emission Bandwidth Limit			
UNI	I Devices			
	For the 5.15-5.25 GHz band, N/A			
$\boxtimes$	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.			
	For the 5.725-5.85 GHz band, 6 dB emission bandwidth ≥ 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 ≥ 500kHz.			

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### 3.1.2 Measuring Instruments

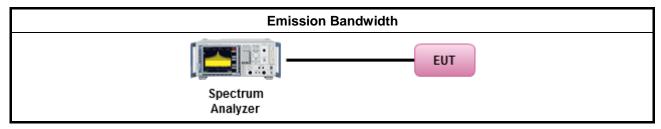
Refer a test equipment and calibration data table in this test report.

### 3.1.3 Test Procedures

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

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### 3.1.4 Test Setup



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## 3.1.5 Test Result of Emission Bandwidth

Refer as Appendix A

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# 3.2 Maximum Conducted Output Power

## 3.2.1 Maximum Conducted Output Power Limit

	Maximum Conducted Output Power Limit							
UNI	I 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 $\leq$ 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 <sub>Out</sub> ) shall not exceed the lesser of 250 mW. If G <sub>TX</sub> > 6 dBi, then P <sub>Out</sub> = 24 - (G <sub>TX</sub> - 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 <sub>Out</sub> ) shall not exceed the lesser of 1 W. If G <sub>TX</sub> > 6 dBi, then P <sub>Out</sub> = 30 − (G <sub>TX</sub> − 6).							
	Point-to-point systems (P2P): the maximum conducted output power (P <sub>Out</sub> ) 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 <sub>Out</sub> ) shall not exceed the lesser of 1 W. If G <sub>TX</sub> > 6 dBi, then P <sub>Out</sub> = 30 − (G <sub>TX</sub> − 6).							
	<ul> <li>Point-to-point systems (P2P): the maximum conducted output power (P<sub>Out</sub>) shall not exceed the lesser of 1 W.</li> </ul>							
	= maximum conducted output power in dBm, = the maximum transmitting antenna directional gain in dBi.							

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### 3.2.2 Measuring Instruments

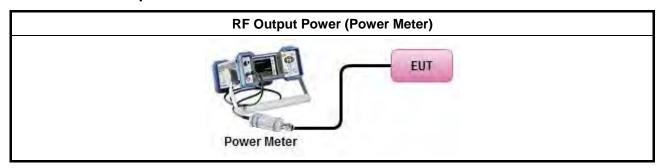
Refer a test equipment and calibration data table in this test report.

#### 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.
	<ul> <li>If multiple transmit chains, EIRP calculation could be following as methods:</li> <li>P<sub>total</sub> = P<sub>1</sub> + P<sub>2</sub> + + P<sub>n</sub></li> <li>(calculated in linear unit [mW] and transfer to log unit [dBm])</li> <li>EIRP<sub>total</sub> = P<sub>total</sub> + DG</li> </ul>

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### 3.2.4 Test Setup



### 3.2.5 Test Result of Maximum Conducted Output Power

Refer as Appendix B

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# 3.3 Peak Power Spectral Density

## 3.3.1 Peak Power Spectral Density Limit

	Peak Power Spectral Density Limit							
UNI	I Devices							
	For the 5.15-5.25 GHz band:							
	<ul> <li>Outdoor AP: the peak power spectral density (PPSD) shall not exceed the lesser of 17dBm/MHz. If G<sub>TX</sub> &gt; 6 dBi, then P<sub>Out</sub> = 17 - (G<sub>TX</sub> - 6).</li> </ul>							
	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 <sub>TX</sub> > 6 dBi, then PPSD= 11 - (G <sub>TX</sub> - 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 – ( $G_{TX} - 6$ ).							
	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) ≤ 10 dBm/MHz.							
	For the 5.25-5.35 GHz band, the peak power spectral density (PPSD) ≤ 11 dBm/MHz.							
	<ul> <li>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:</li> <li>-13 dBW/MHz for 0° ≤ θ &lt; 8°; -13 − 0.716 (θ-8) dBW/MHz for 8° ≤ θ &lt; 40°</li> <li>-35.9 − 1.22 (θ-40) dBW/MHz for 40° ≤ θ ≤ 45°; -42 dBW/MHz for θ &gt; 45°</li> </ul>							
	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= $30 - (G_{TX} - 6)$ .							
	<ul> <li>Point-to-point systems (P2P): the peak power spectral density (PPSD) ≤ 30 dBm/500kHz.</li> </ul>							
pow	<b>PPSD</b> = peak power spectral density that he same method as used to determine the conducted output power shall be used to determine the power spectral density. And power spectral density in dBm/MHz $G_{TX}$ = the maximum transmitting antenna directional gain in dBi.							

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## 3.3.2 Measuring Instruments

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

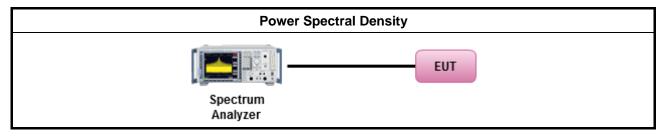
### 3.3.3 Test Procedures

		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]
	$\boxtimes$	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
	$\boxtimes$	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 $

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### 3.3.4 Test Setup



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### 3.3.5 Test Result of Peak Power Spectral Density

Refer as Appendix C

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### 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				

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- 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

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linear distance for field-strength measurements, inverse of linear distance-squared for power-density measurements).

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### 3.4.2 Measuring Instruments

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

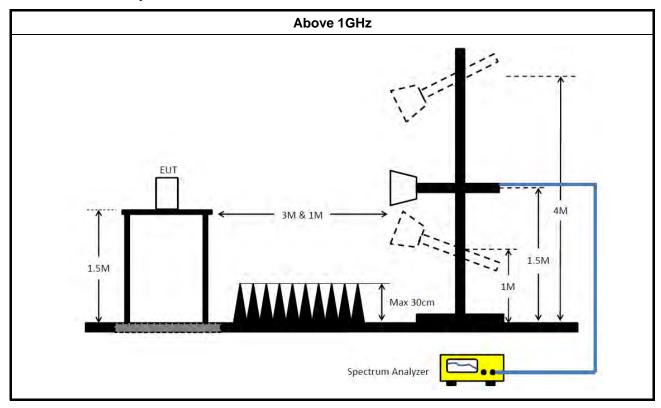
#### 3.4.3 Test Procedures

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

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### 3.4.4 Test Setup



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### 3.4.5 Measurement Results Calculation

The measured Level is calculated using:
Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

### 3.4.6 Test Result of Transmitter Unwanted Emissions

Refer as Appendix D

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# 4 Test Equipment and Calibration Data

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Calibration Due Date	Remark
Horn Antenna	ETS · Lindgren	3115	6821	750MHz~18GH z	Jan. 24, 2019	Jan. 23, 2020	Radiation (03CH03-CB)
Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170252	15GHz ~ 40GHz	Jun. 27, 2019	Jun. 26, 2020	Radiation (03CH03-CB)
Pre-Amplifier	Agilent	8449B	3008A02097	1GHz ~ 26.5GHz	Dec. 20, 2018	Dec. 19, 2019	Radiation (03CH03-CB)
Pre-Amplifier	MITEQ	TTA1840-35-H G	1864479	18GHz ~ 40GHz	Jul. 03, 2019	Jul. 02, 2020	Radiation (03CH03-CB)
Spectrum Analyzer	R&S	FSP40	100019	9kHz ~ 40GHz	Jun. 19, 2019	Jun. 18, 2020	Radiation (03CH03-CB)
RF Cable-high	Woken	RG402	High Cable-20+27	1GHz ~ 18GHz	Oct. 08, 2018	Oct. 07, 2019	Radiation (03CH03-CB)
RF Cable-high	Woken	RG402	High Cable-27	1GHz ~ 18GHz	Oct. 08, 2018	Oct. 07, 2019	Radiation (03CH03-CB)
RF Cable-high	Woken	RG402	High Cable-40G#1	18GHz ~ 40 GHz	Jul. 24, 2019	Jul. 23, 2020	Radiation (03CH03-CB)
RF Cable-high	Woken	RG402	High Cable-40G#2	18GHz ~ 40 GHz	Jul. 24, 2019	Jul. 23, 2020	Radiation (03CH03-CB)
Spectrum analyzer	R&S	FSV40	100979	9kHz~40GHz	Feb. 25, 2019	Feb. 24, 2020	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)
RF Cable-high	Woken	RG402	High Cable-28	1 GHz –26.5 GHz	Nov. 19, 2018	Nov. 18, 2019	Conducted (TH01-CB)
Power Sensor	Agilent	E9327A	US40442088	50MHz~18GHz	Jan. 15, 2019	Jan. 14, 2020	Conducted (TH01-CB)
Power Meter	Agilent	E4416A	GB41291199	50MHz~18GHz	Jan. 15, 2019	Jan. 14, 2020	Conducted (TH01-CB)

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

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Appendix A **EBW** 

**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)_2TX	21.85M	16.523M	16M5D1D	21.35M	16.455M
802.11ac VHT20_Nss1,(MCS0)_2TX	24.1M	17.742M	17M7D1D	22.675M	17.675M
802.11ac VHT40_Nss1,(MCS0)_2TX	44.25M	36.305M	36M3D1D	43.6M	36.207M
802.11ac VHT80_Nss1,(MCS0)_2TX	89.4M	75.886M	75M9D1D	87.8M	75.837M
5.47-5.725GHz	-	-	-	-	-
802.11a_Nss1,(6Mbps)_2TX	22.4M	16.553M	16M6D1D	21.2M	16.473M
802.11ac VHT20_Nss1,(MCS0)_2TX	23.3M	17.723M	17M7D1D	22.175M	17.665M
802.11ac VHT40_Nss1,(MCS0)_2TX	44.45M	36.41M	36M4D1D	43.55M	36.205M
802.11ac VHT80_Nss1,(MCS0)_2TX	89.3M	76.123M	76M1D1D	87.7M	75.833M

Max-N dB = Maximum 6dB down bandwidth for 5.725-5.85GHz band / Maximum 26dB down bandwidth for other band;

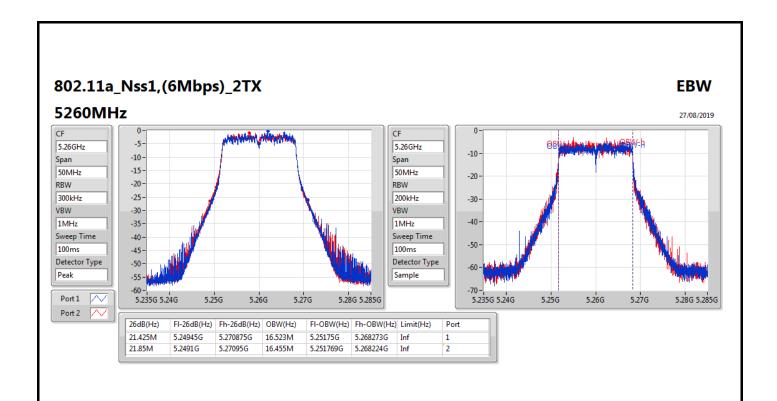
Max-OBW = Maximum99% occupied bandwidth;
Min-N dB = Minimum 6dB down bandwidth for 5.725-5.85GHz band / Maximum 26dB down bandwidth for other band;

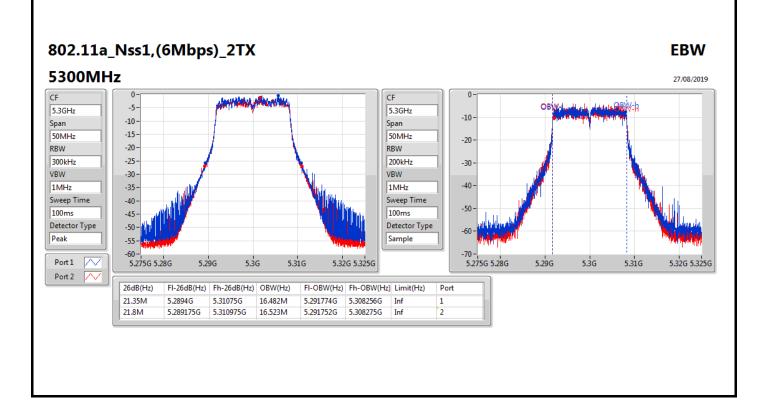
Min-OBW = Minimum 99% occupied bandwidth;

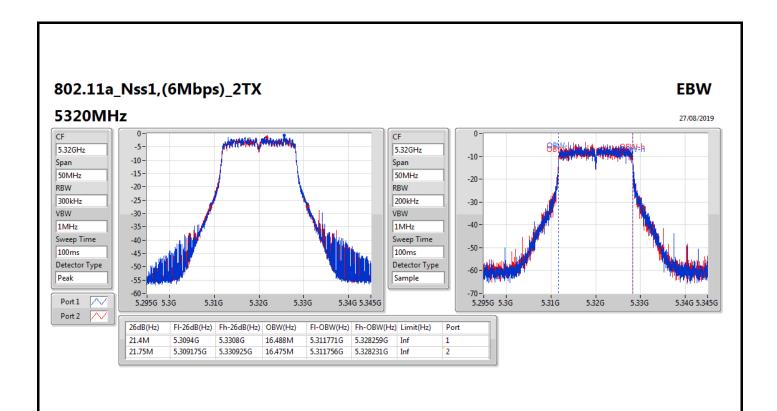
### Result

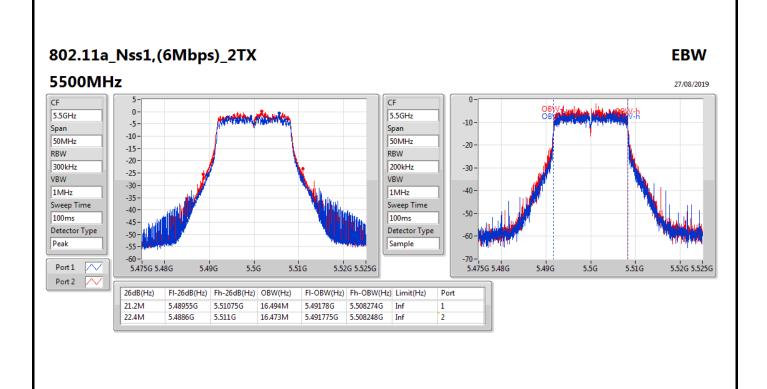
Mode	Result	Limit	Port 1-N dB	Port 1-OBW	Port 2-N dB	Port 2-OBW
		(Hz)	(Hz)	(Hz)	(Hz)	(Hz)
802.11a_Nss1,(6Mbps)_2TX	-	-	-	-	-	-
5260MHz	Pass	Inf	21.425M	16.523M	21.85M	16.455M
5300MHz	Pass	Inf	21.35M	16.482M	21.8M	16.523M
5320MHz	Pass	Inf	21.4M	16.488M	21.75M	16.475M
5500MHz	Pass	Inf	21.2M	16.494M	22.4M	16.473M
5580MHz	Pass	Inf	21.375M	16.505M	21.825M	16.553M
5700MHz	Pass	Inf	21.65M	16.476M	21.775M	16.511M
802.11ac VHT20_Nss1,(MCS0)_2TX	-	-	-	-	-	-
5260MHz	Pass	Inf	22.7M	17.742M	23.025M	17.675M
5300MHz	Pass	Inf	22.95M	17.711M	23.55M	17.69M
5320MHz	Pass	Inf	22.675M	17.7M	24.1M	17.691M
5500MHz	Pass	Inf	22.175M	17.665M	23.075M	17.709M
5580MHz	Pass	Inf	22.75M	17.723M	23.2M	17.718M
5700MHz	Pass	Inf	22.6M	17.695M	23.3M	17.704M
802.11ac VHT40_Nss1,(MCS0)_2TX	-	-	-	-	-	-
5270MHz	Pass	Inf	44.1M	36.207M	44.2M	36.267M
5310MHz	Pass	Inf	44.25M	36.27M	43.6M	36.305M
5510MHz	Pass	Inf	44.35M	36.285M	43.55M	36.225M
5550MHz	Pass	Inf	44.45M	36.359M	43.7M	36.282M
5670MHz	Pass	Inf	44.45M	36.41M	44.05M	36.205M
802.11ac VHT80_Nss1,(MCS0)_2TX	-	-	-	-	-	-
5290MHz	Pass	Inf	87.8M	75.837M	89.4M	75.886M
5530MHz	Pass	Inf	87.7M	76.01M	89M	76.123M
5610MHz	Pass	Inf	88.6M	75.981M	89.3M	75.833M

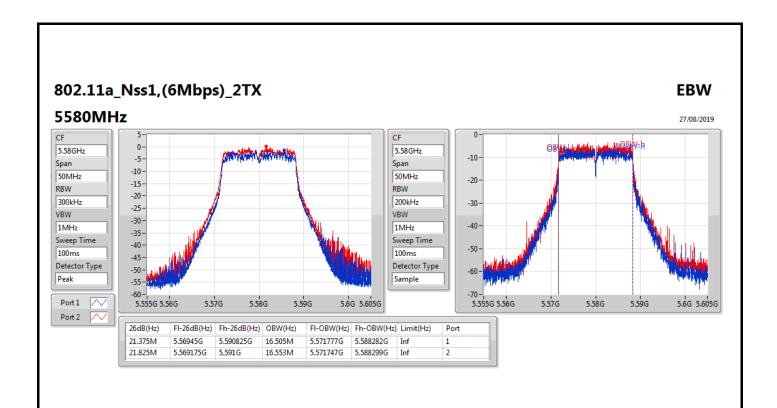
Port X-N dB = Port X 6dB down bandwidth for 5.725-5.85GHz band / 26dB down bandwidth for other band Port X-OBW = Port X 99% occupied bandwidth;

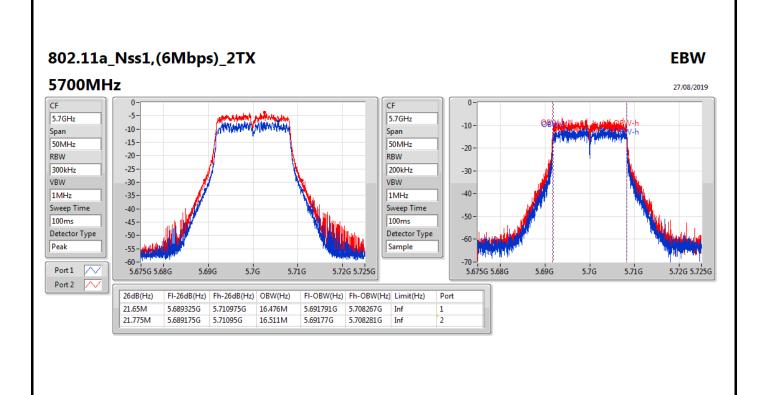


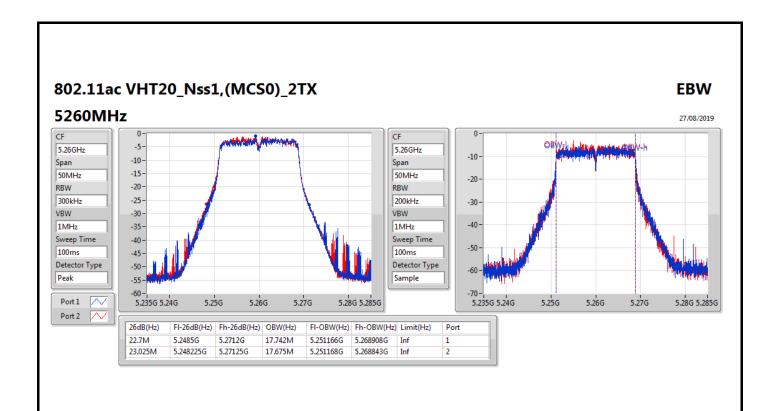


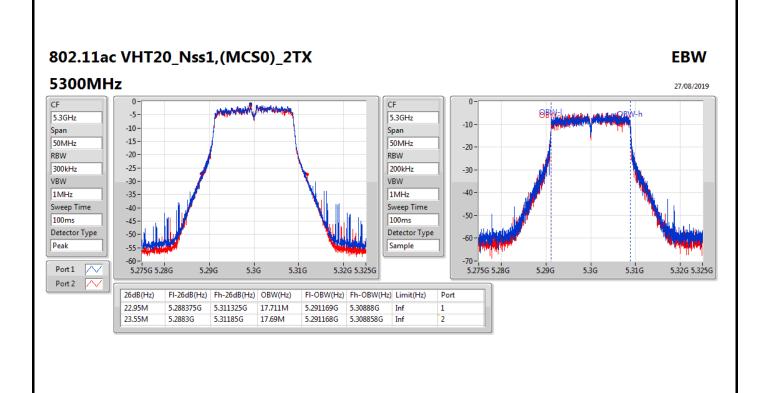


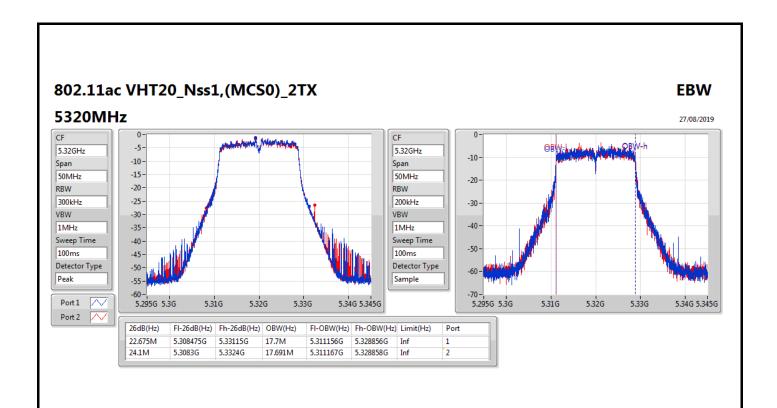


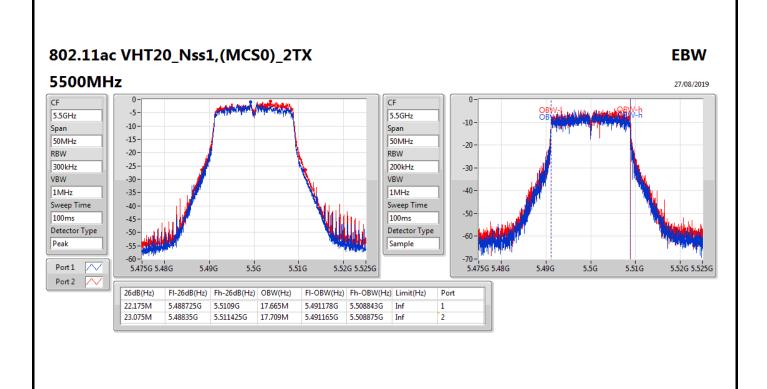


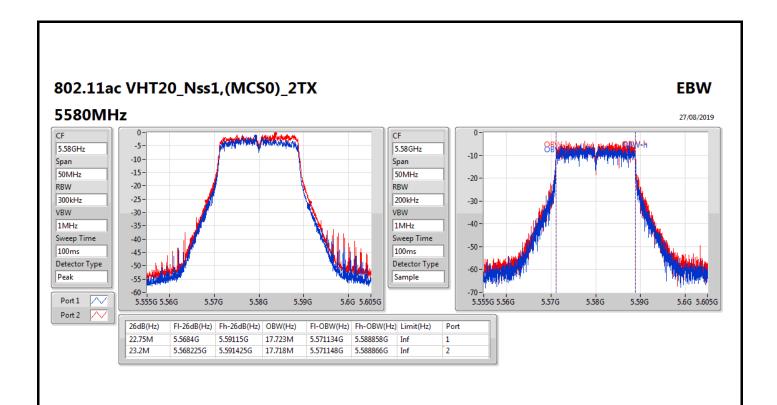


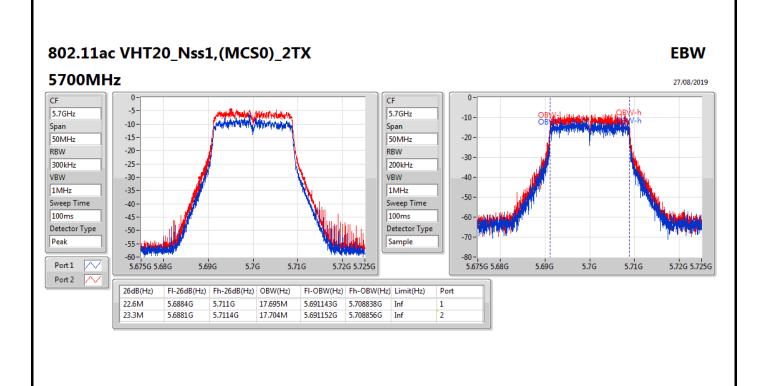


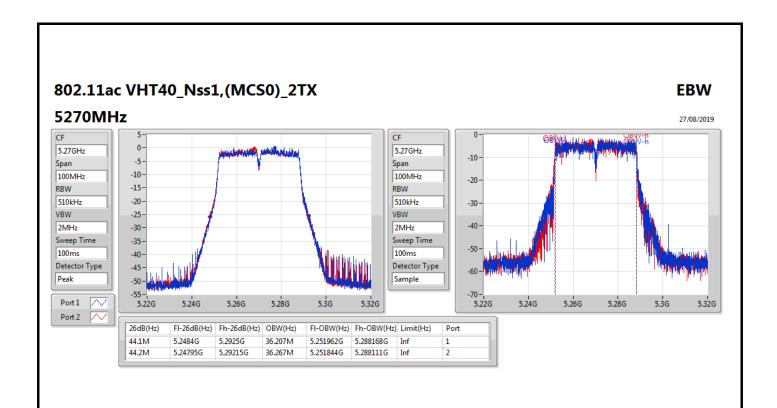


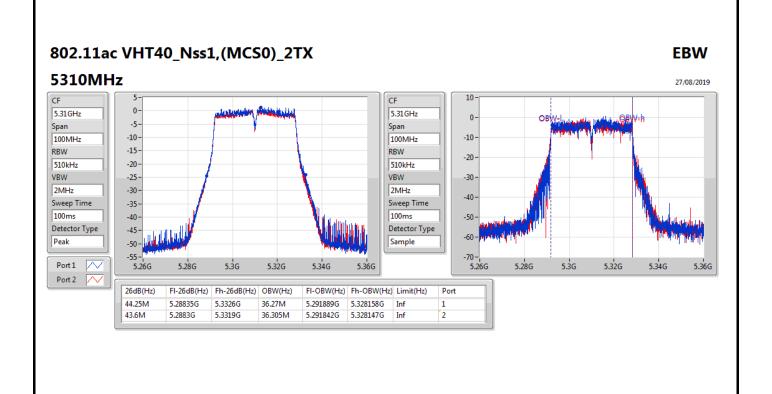


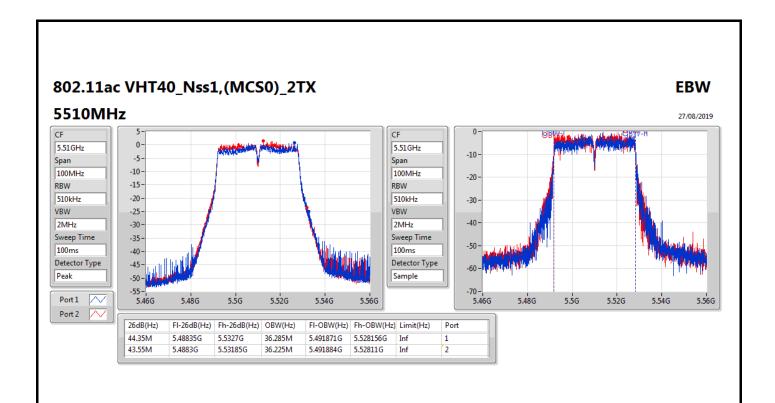


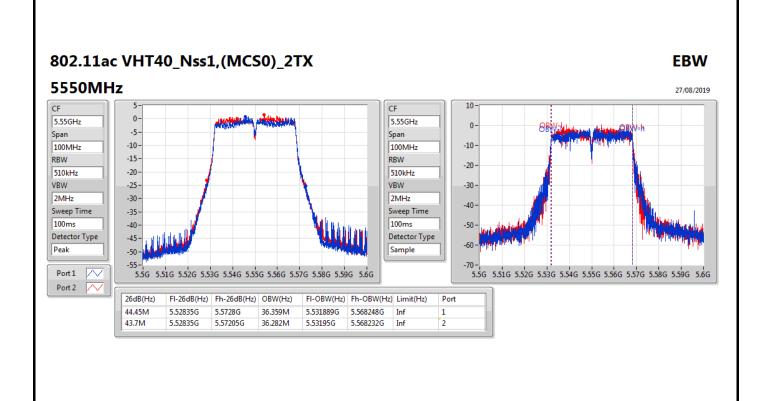


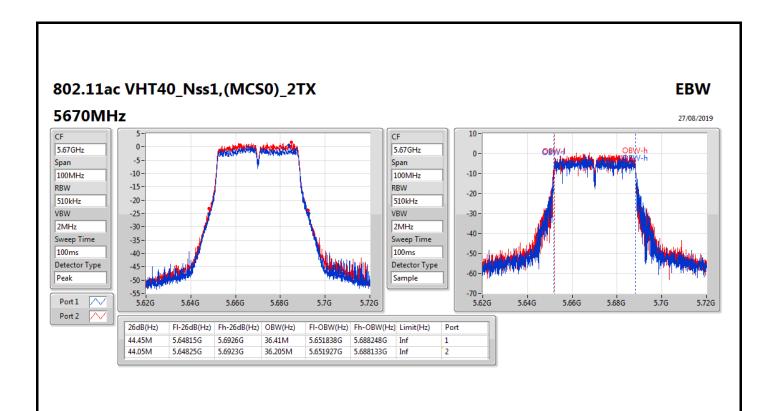


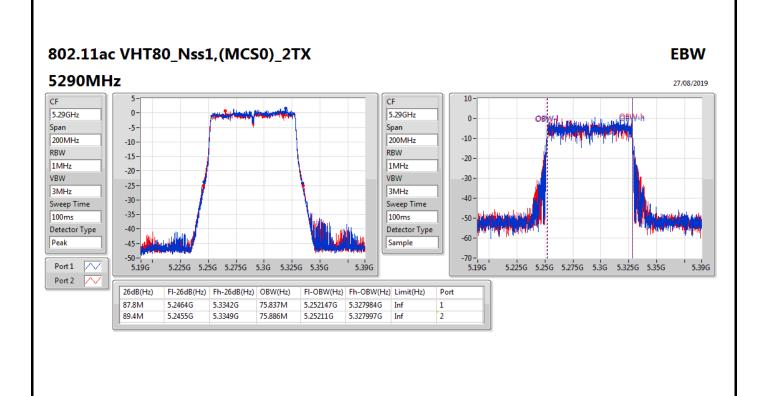


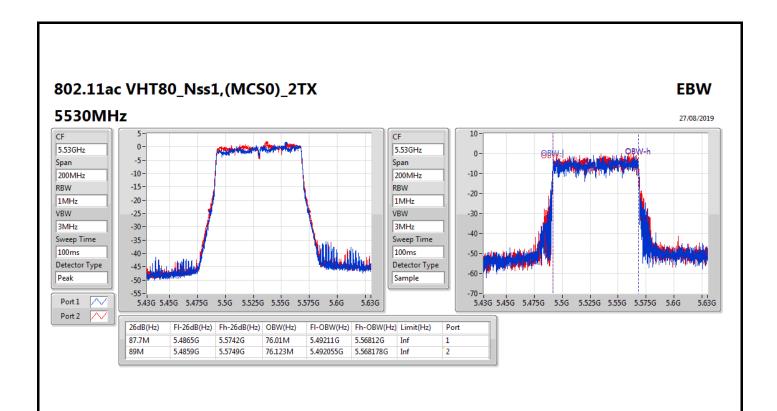


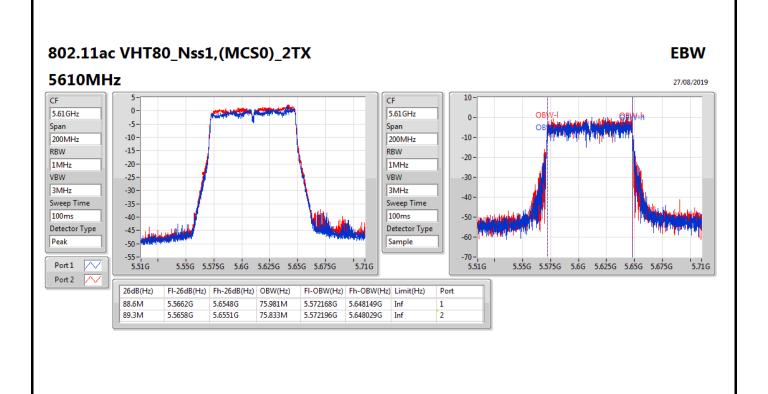














Average Power Appendix B

**Summary** 

Mode	Total Power	Total Power
	(dBm)	(W)
5.25-5.35GHz	-	-
802.11a_Nss1,(6Mbps)_2TX	10.85	0.01216
802.11ac VHT20_Nss1,(MCS0)_2TX	11.01	0.01262
802.11ac VHT40_Nss1,(MCS0)_2TX	13.70	0.02344
802.11ac VHT80_Nss1,(MCS0)_2TX	13.58	0.02280
5.47-5.725GHz	-	-
802.11a_Nss1,(6Mbps)_2TX	11.20	0.01318
802.11ac VHT20_Nss1,(MCS0)_2TX	11.29	0.01346
802.11ac VHT40_Nss1,(MCS0)_2TX	13.78	0.02388
802.11ac VHT80_Nss1,(MCS0)_2TX	13.59	0.02286

Average Power Appendix B

#### Result

Mode	Result	DG	Port 1	Port 2	Total Power	Power Limit
		(dBi)	(dBm)	(dBm)	(dBm)	(dBm)
802.11a_Nss1,(6Mbps)_2TX	-	-	-	-	-	-
5260MHz	Pass	16.10	7.61	8.05	10.85	13.88
5300MHz	Pass	16.10	7.99	7.69	10.85	13.88
5320MHz	Pass	16.10	7.73	7.67	10.71	13.88
5500MHz	Pass	16.00	7.50	8.79	11.20	13.98
5580MHz	Pass	16.00	6.63	8.46	10.65	13.98
5700MHz	Pass	16.00	1.12	4.57	6.19	13.98
802.11ac VHT20_Nss1,(MCS0)_2TX	-	-	-	-	-	-
5260MHz	Pass	16.10	7.61	8.14	10.89	13.88
5300MHz	Pass	16.10	8.08	7.88	10.99	13.88
5320MHz	Pass	16.10	6.77	8.96	11.01	13.88
5500MHz	Pass	16.00	7.66	8.83	11.29	13.98
5580MHz	Pass	16.00	7.39	8.97	11.26	13.98
5700MHz	Pass	16.00	1.16	4.53	6.17	13.98
802.11ac VHT40_Nss1,(MCS0)_2TX	-	-	-	-	-	-
5270MHz	Pass	16.10	9.62	9.65	12.65	13.88
5310MHz	Pass	16.10	11.09	10.25	13.70	13.88
5510MHz	Pass	16.00	9.83	11.55	13.78	13.98
5550MHz	Pass	16.00	10.39	11.12	13.78	13.98
5670MHz	Pass	16.00	9.89	11.48	13.77	13.98
802.11ac VHT80_Nss1,(MCS0)_2TX	-	-	-	-	-	-
5290MHz	Pass	16.10	10.57	10.56	13.58	13.88
5530MHz	Pass	16.00	9.94	11.13	13.59	13.98
5610MHz	Pass	16.00	10.04	11.00	13.56	13.98

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



Page No.

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**Summary** 

Mode	PD					
	(dBm/RBW)					
5.25-5.35GHz	-					
802.11a_Nss1,(6Mbps)_2TX	-2.31					
802.11ac VHT20_Nss1,(MCS0)_2TX	-2.22					
802.11ac VHT40_Nss1,(MCS0)_2TX	-2.39					
802.11ac VHT80_Nss1,(MCS0)_2TX	-6.00					
5.47-5.725GHz	-					
802.11a_Nss1,(6Mbps)_2TX	-2.08					
802.11ac VHT20_Nss1,(MCS0)_2TX	-2.31					
802.11ac VHT40_Nss1,(MCS0)_2TX	-2.59					
802.11ac VHT80_Nss1,(MCS0)_2TX	-5.49					

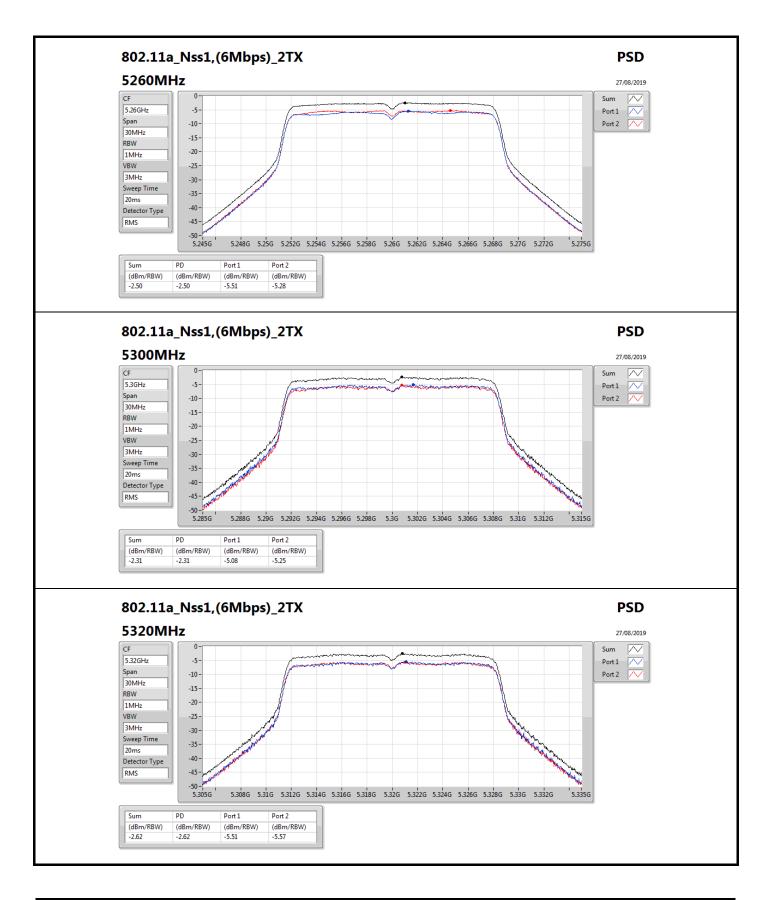
**RBW** = 500 kHz for 5.725-5.85GHz band / 1MHz for other band;

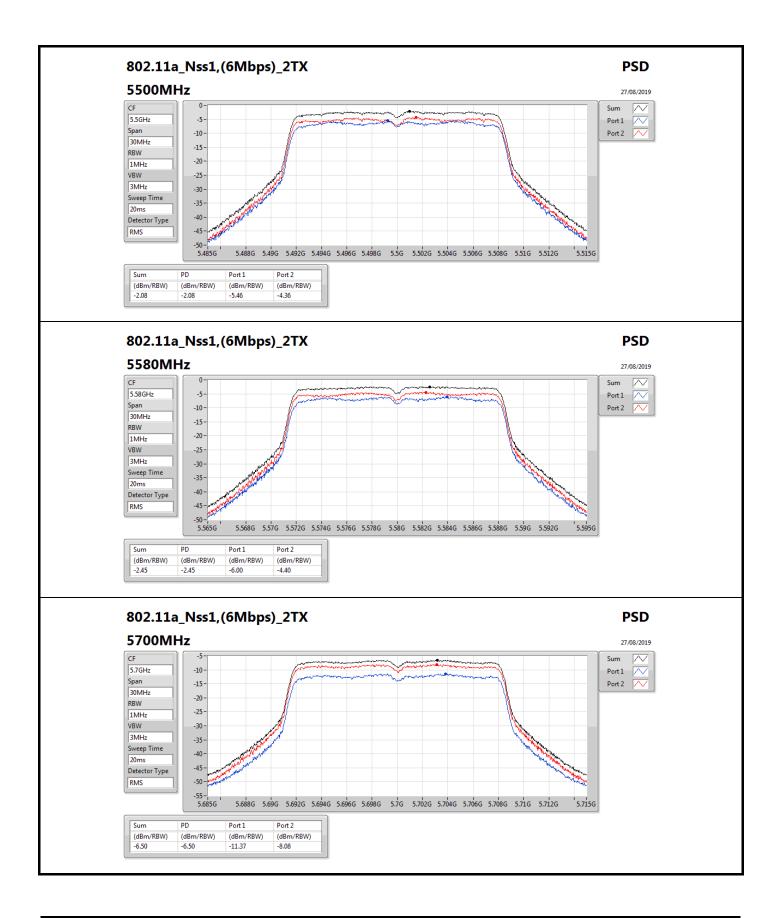
Appendix C **PSD** 

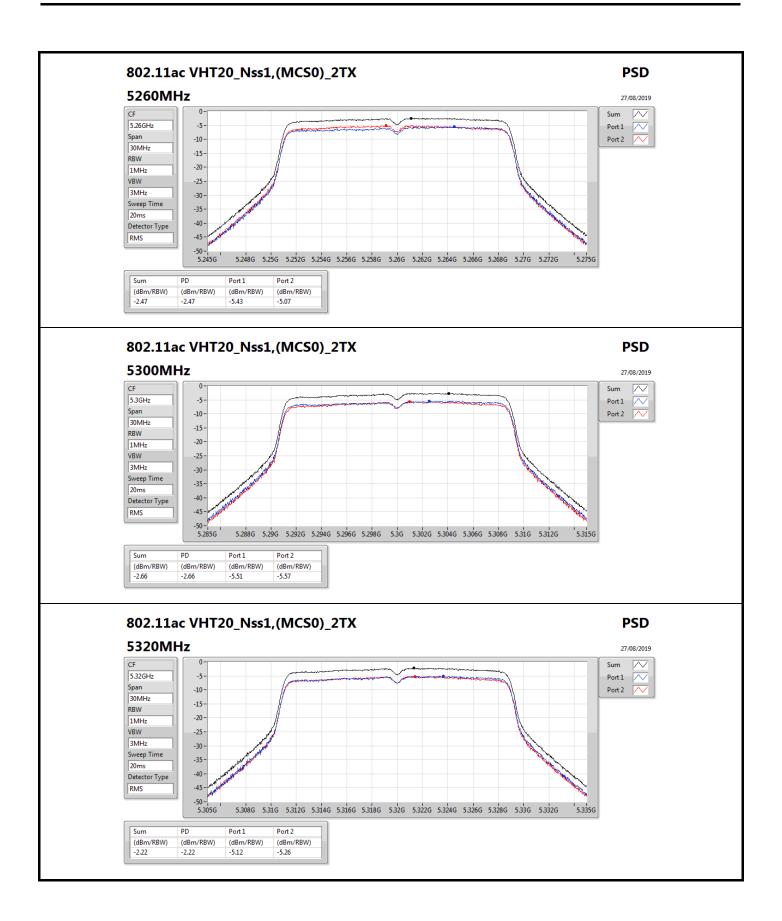
## Result

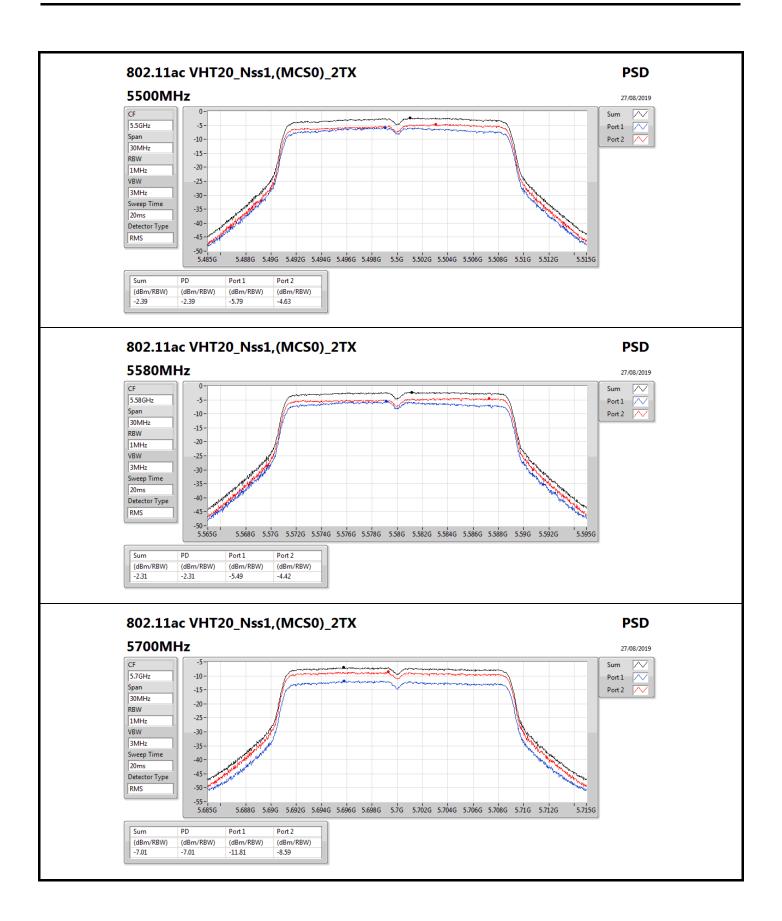
Mode	Result	DG	Port 1	Port 2	PD	PD Limit	
		(dBi)	(dBm/RBW)	(dBm/RBW)	(dBm/RBW)	(dBm/RBW)	
802.11a_Nss1,(6Mbps)_2TX	-	-	-	-	-	-	
5260MHz	Pass	19.11	-5.51	-5.28	-2.50	-2.11	
5300MHz	Pass	19.11	-5.08	-5.25	-2.31	-2.11	
5320MHz	Pass	19.11	-5.51	-5.57	-2.62	-2.11	
5500MHz	Pass	19.01	-5.46	-4.36	-2.08	-2.01	
5580MHz	Pass	19.01	-6.00	-4.40	-2.45	-2.01	
5700MHz	Pass	19.01	-11.37	-8.08	-6.50	-2.01	
802.11ac VHT20_Nss1,(MCS0)_2TX	-	-	-	-	-	-	
5260MHz	Pass	19.11	-5.43	-5.07	-2.47	-2.11	
5300MHz	Pass	19.11	-5.51	-5.57	-2.66	-2.11	
5320MHz	Pass	19.11	-5.12	-5.26	-2.22	-2.11	
5500MHz	Pass	19.01	-5.79	-4.63	-2.39	-2.01	
5580MHz	Pass	19.01	-5.49	-4.42	-2.31	-2.01	
5700MHz	Pass	19.01	-11.81	-8.59	-7.01	-2.01	
802.11ac VHT40_Nss1,(MCS0)_2TX	-	-	-	-	-	-	
5270MHz	Pass	19.11	-6.21	-6.25	-3.41	-2.11	
5310MHz	Pass	19.11	-5.10	-5.46	-2.39	-2.11	
5510MHz	Pass	19.01	-6.11	-5.03	-2.77	-2.01	
5550MHz	Pass	19.01	-5.86	-5.15	-2.88	-2.01	
5670MHz	Pass	19.01	-6.18	-5.02	-2.59	-2.01	
802.11ac VHT80_Nss1,(MCS0)_2TX	-	-	-	-	-	-	
5290MHz	Pass	19.11	-8.77	-9.21	-6.00	-2.11	
5530MHz	Pass	19.01	-9.03	-8.33	-6.05	-2.01	
5610MHz	Pass	19.01	-9.03	-7.73	-5.49	-2.01	

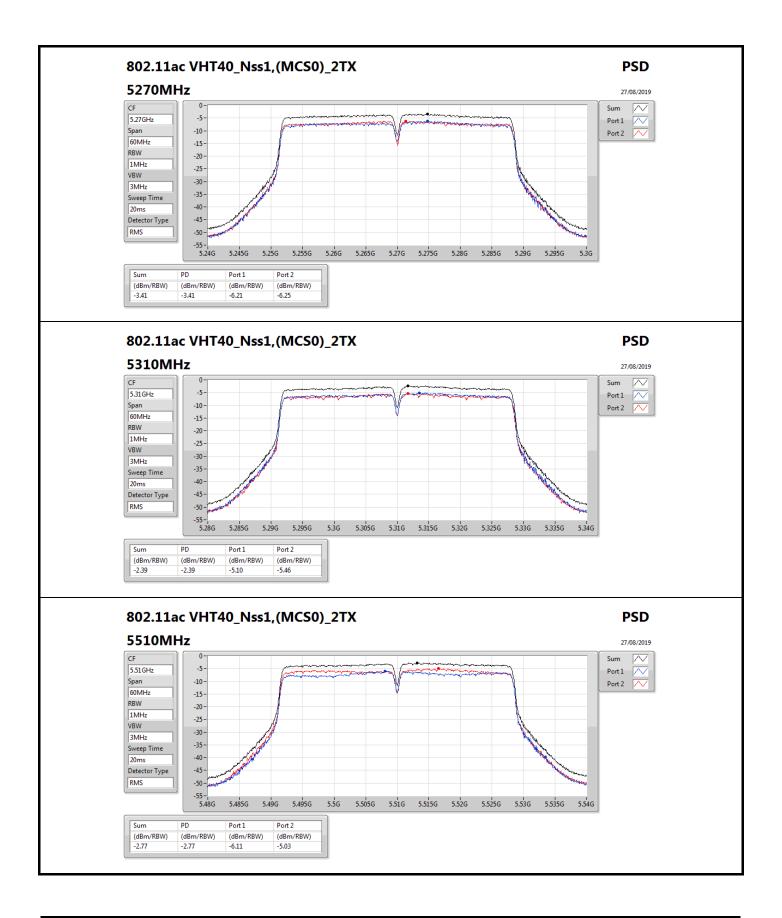
DG = Directional Gain; RBW = 500 kHz for 5.725-5.85GHz band / 1MHz for other band;
PD = trace bin-by-bin of each transmits port summing can be performed maximum power density; Port X = Port X power density;

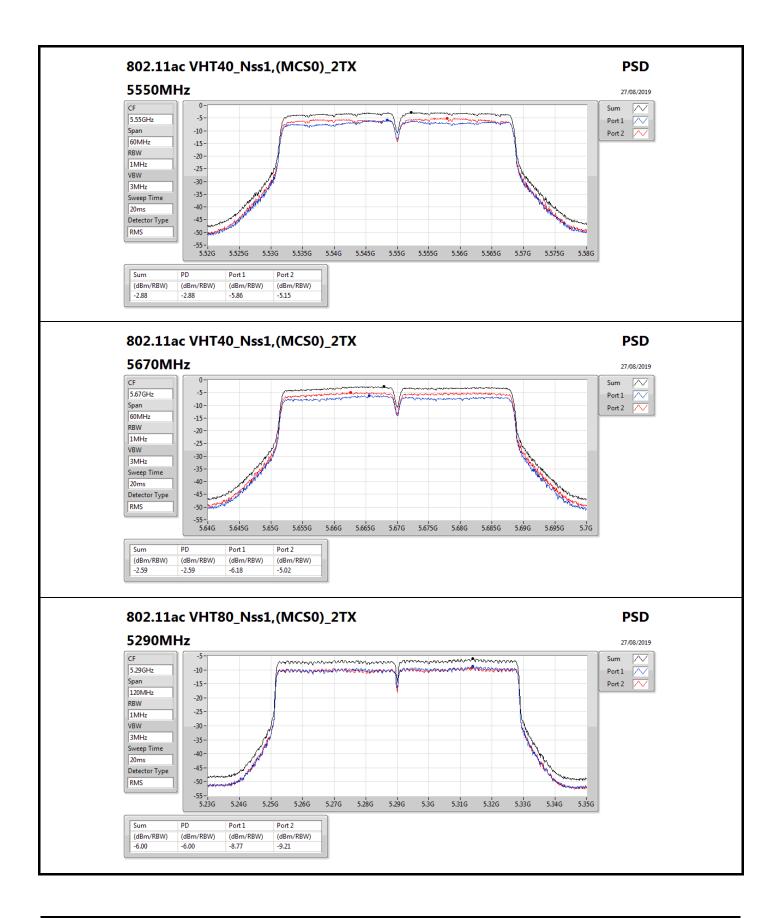


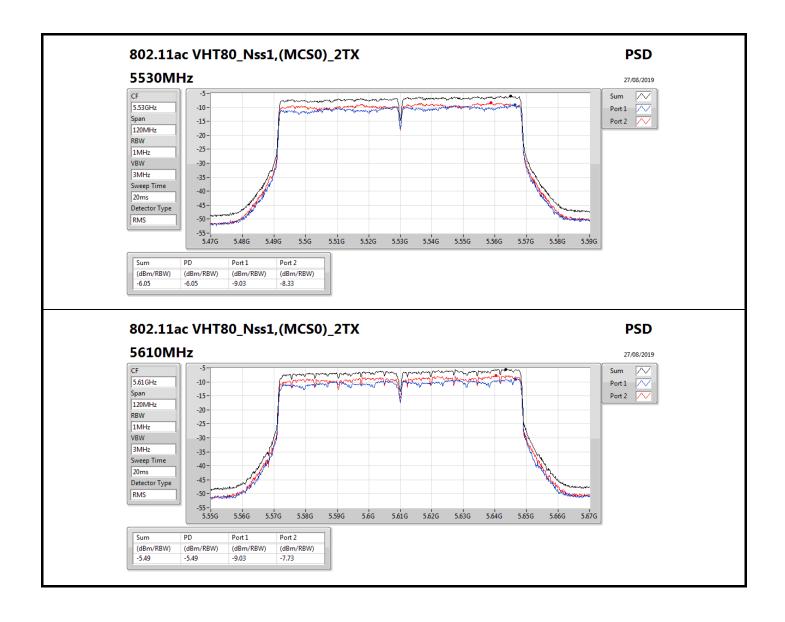














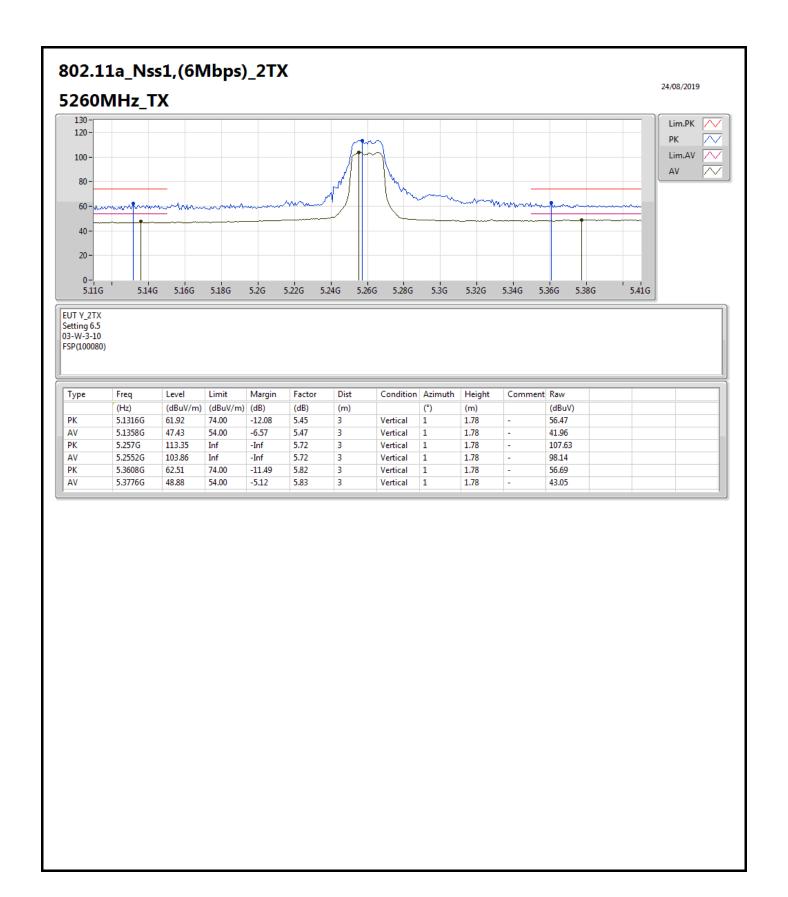
## RSE TX above 1GHz

Appendix D

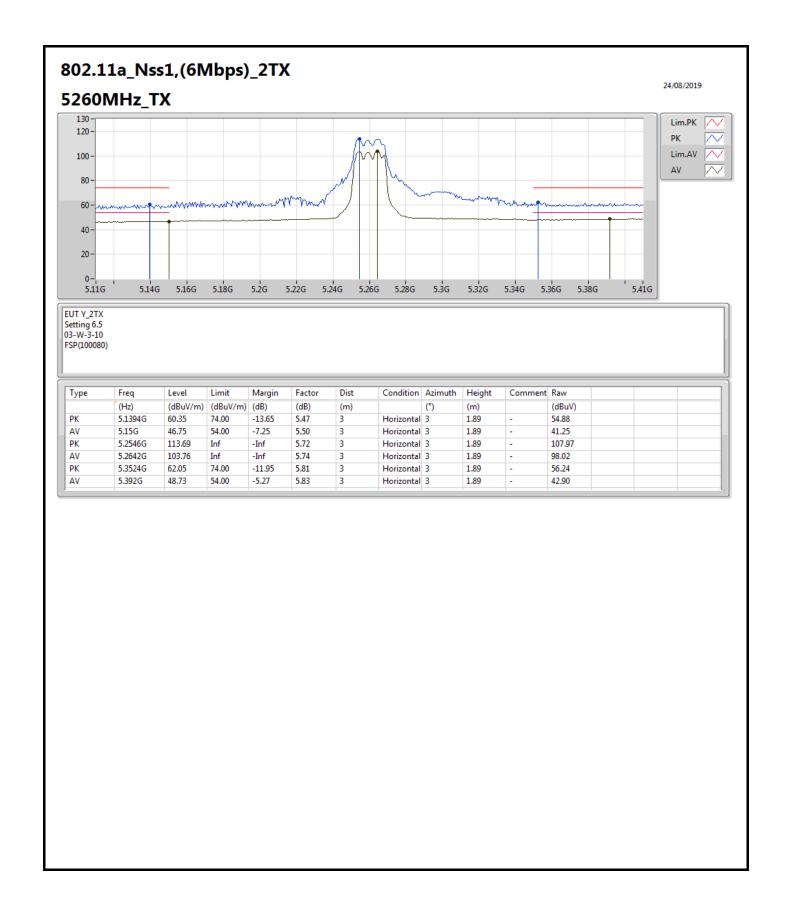
**Summary** 

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	-	-	-	-	-	-	-	-	-	-	-	-
802.11ac VHT20_Nss1,(MCS0)_2TX	Pass	PK	10.59214G	68.17	68.20	-0.03	12.39	3	Horizontal	6	2.00	-

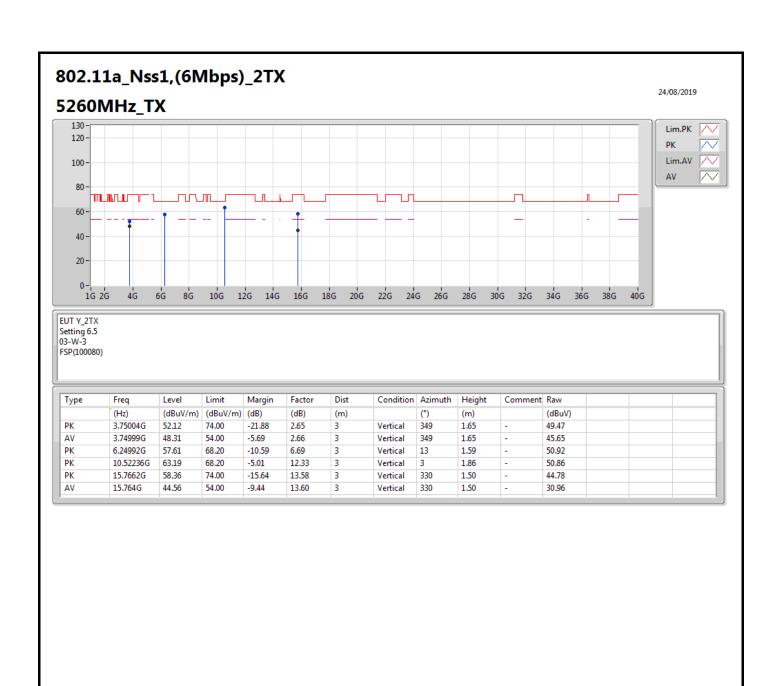




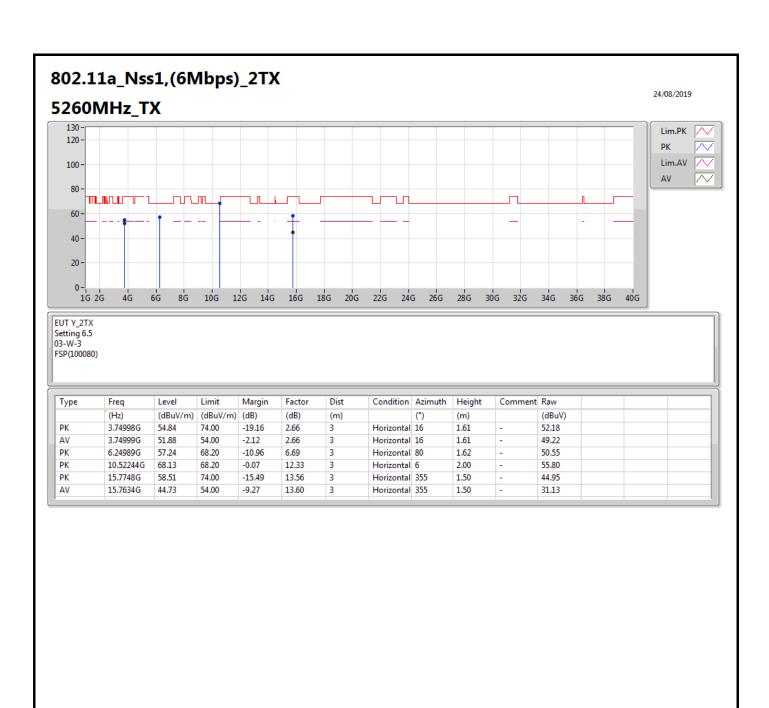




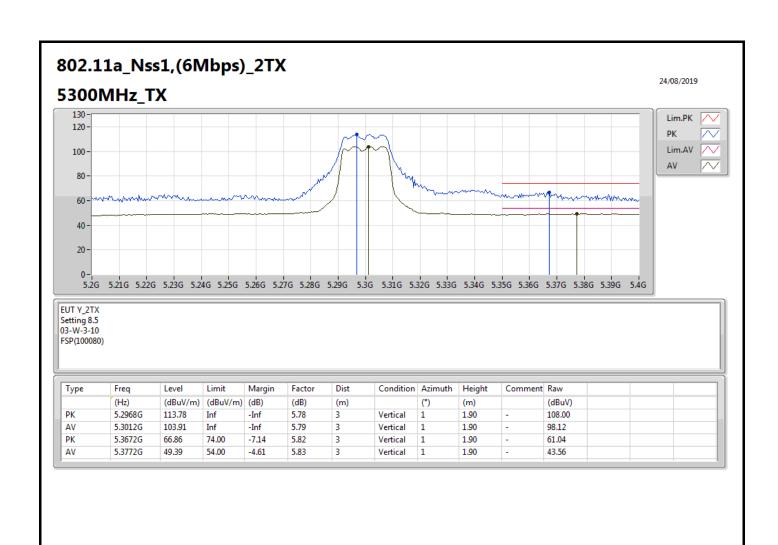




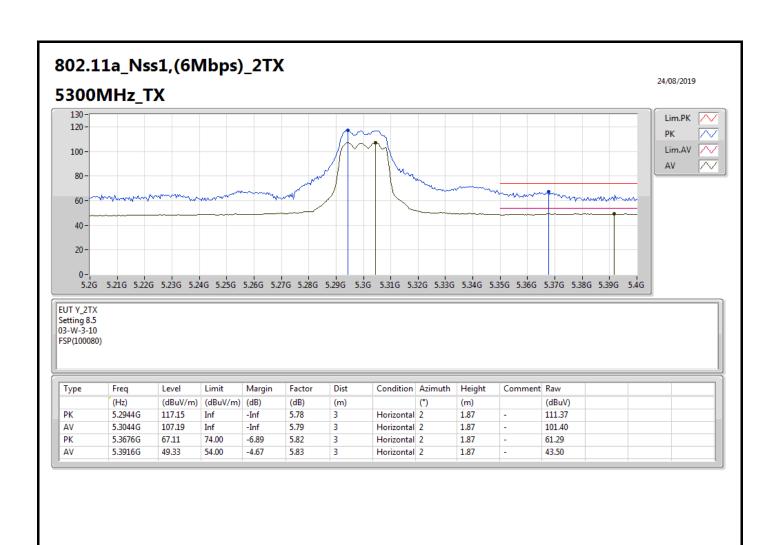




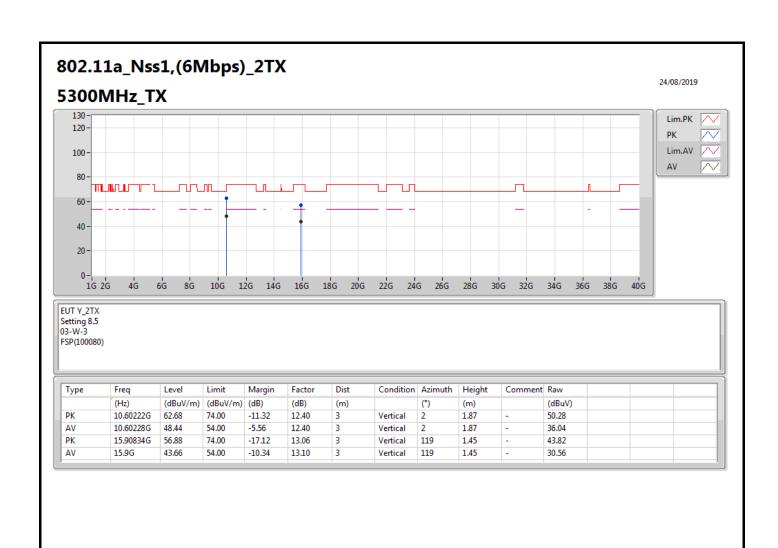




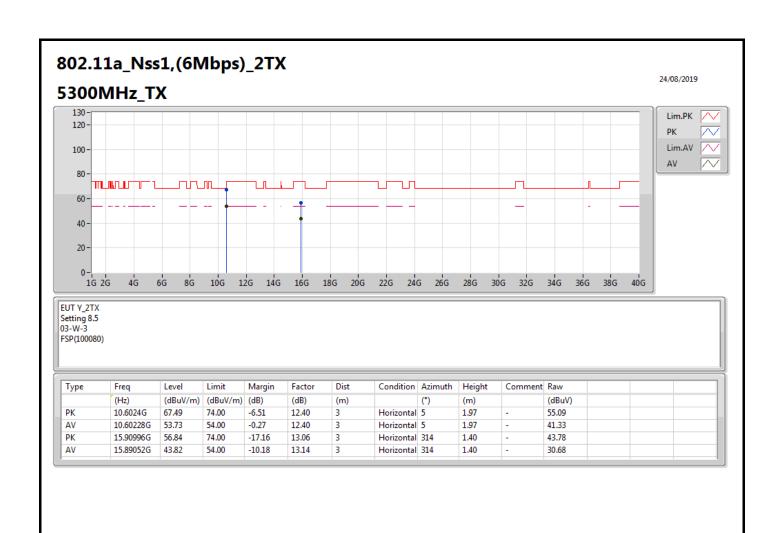




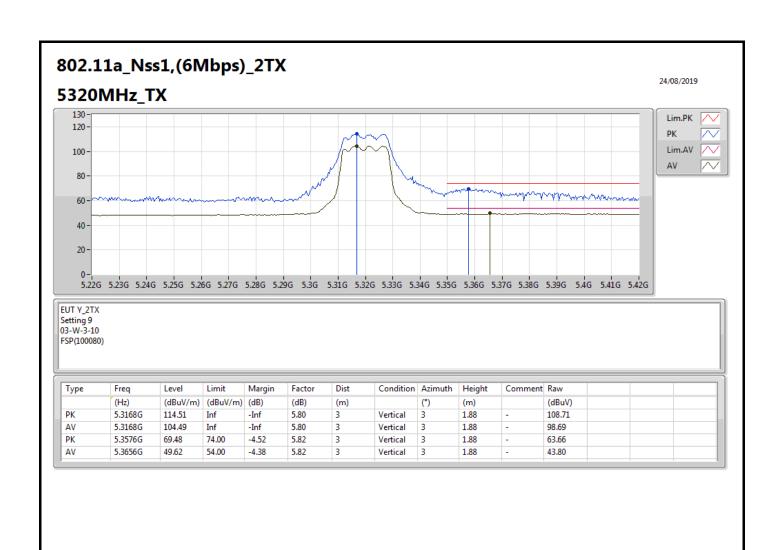




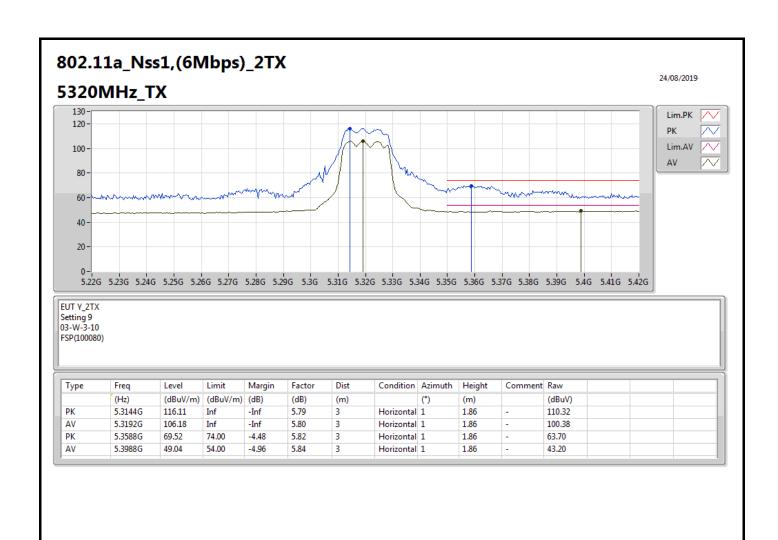




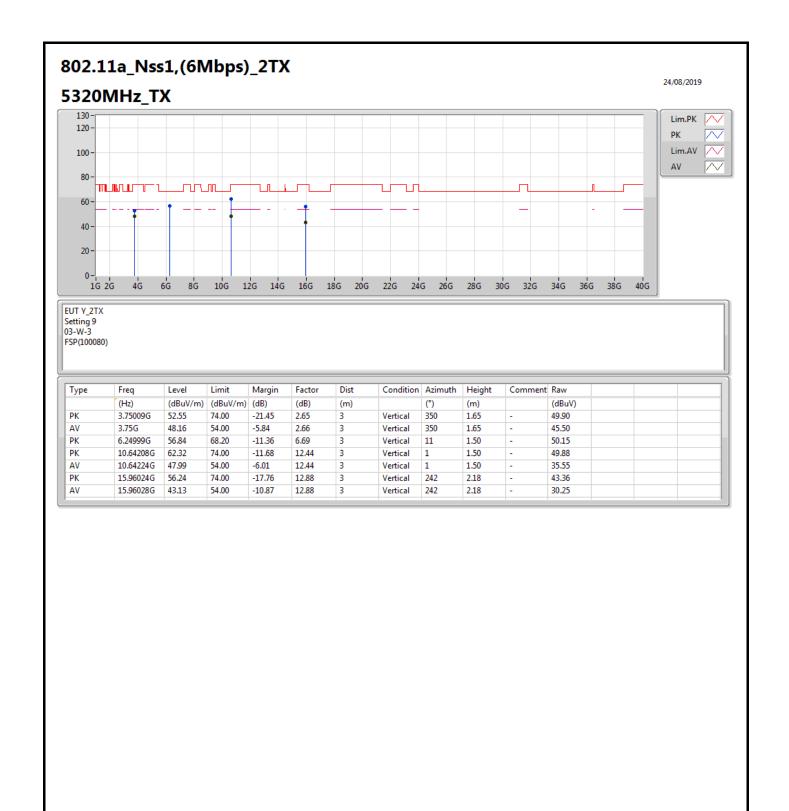




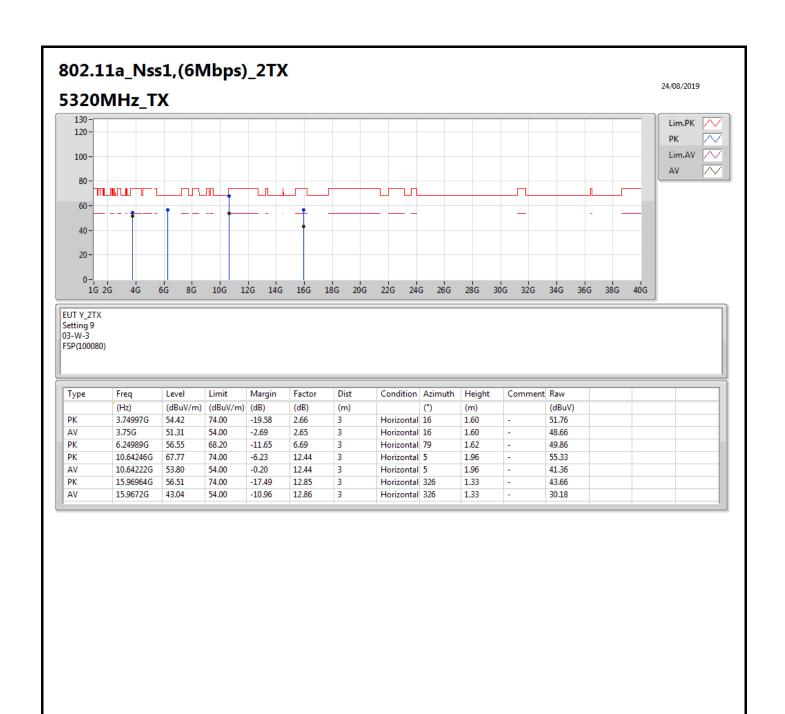




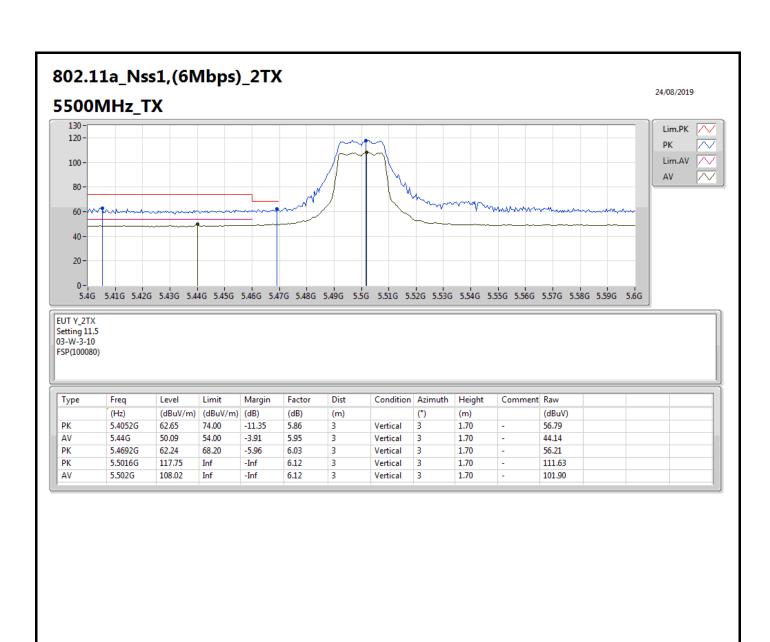




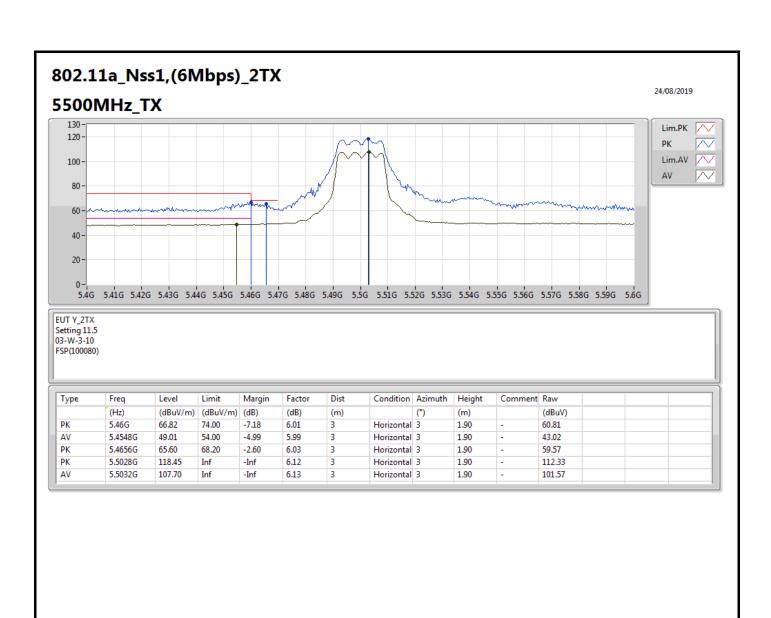




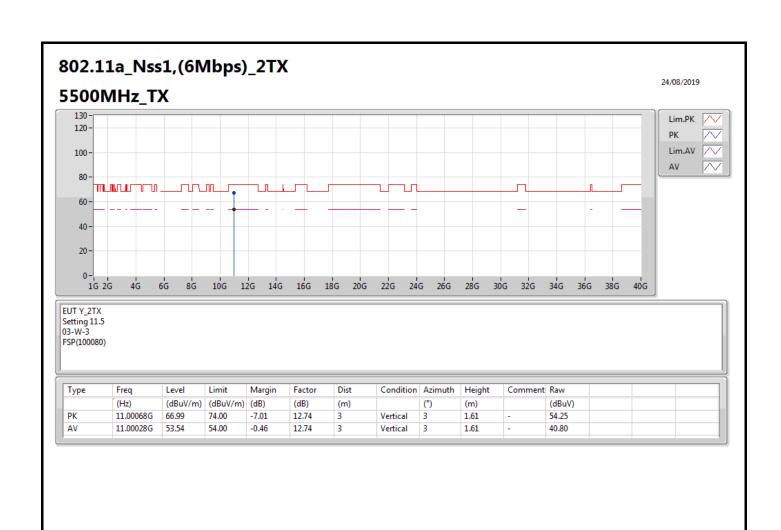




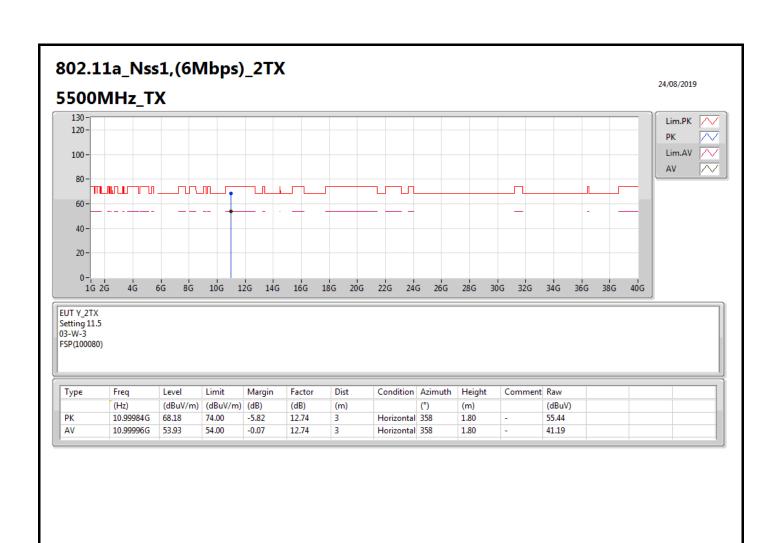




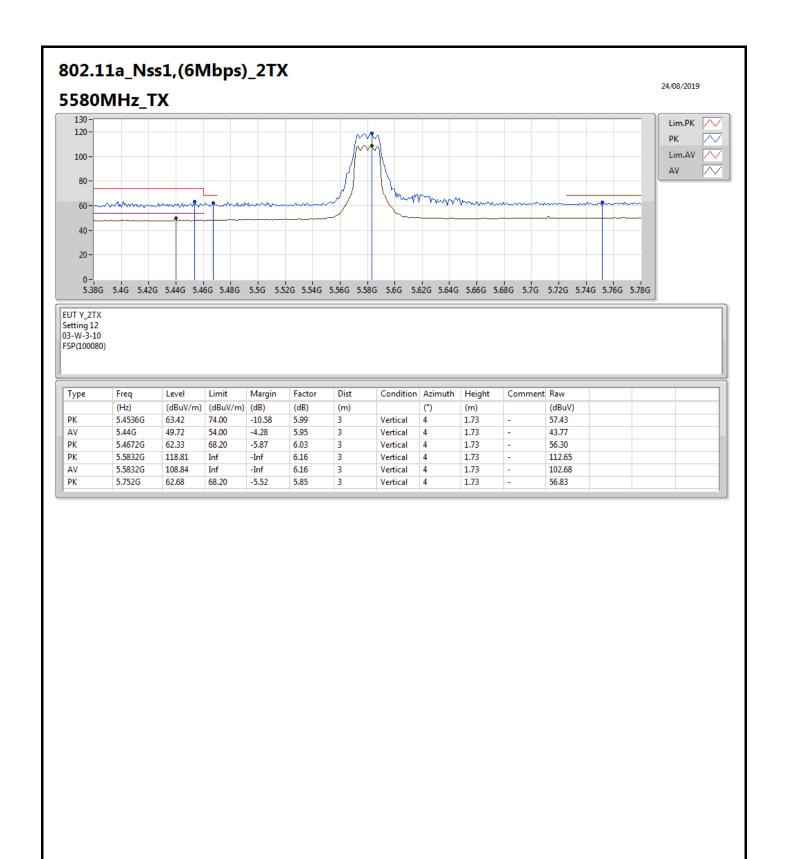




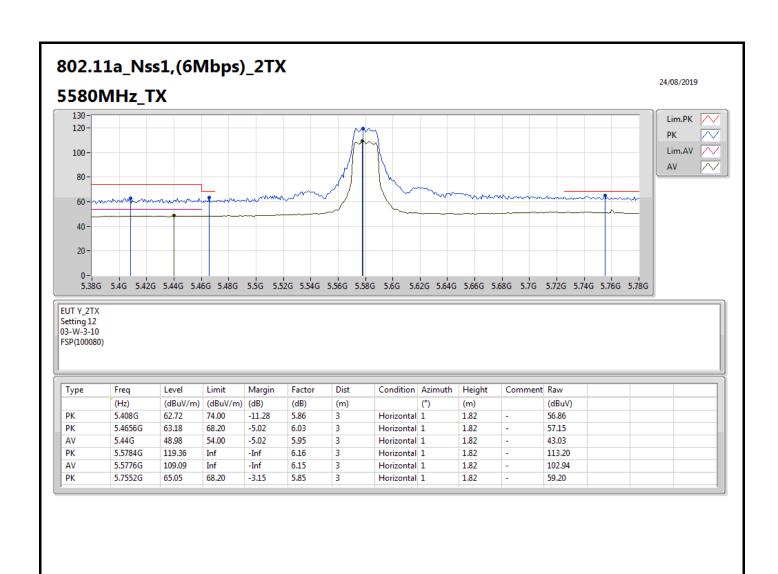




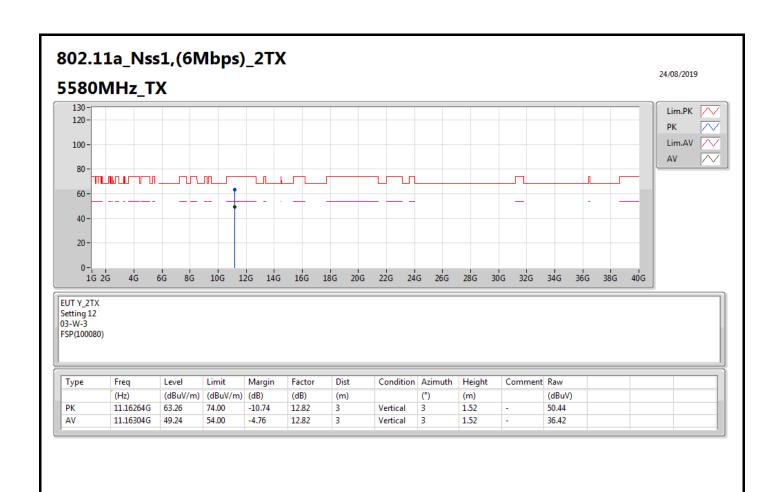




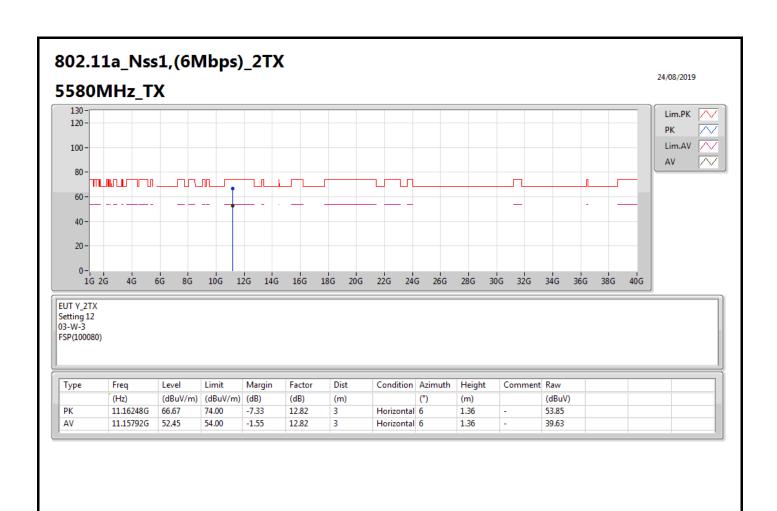




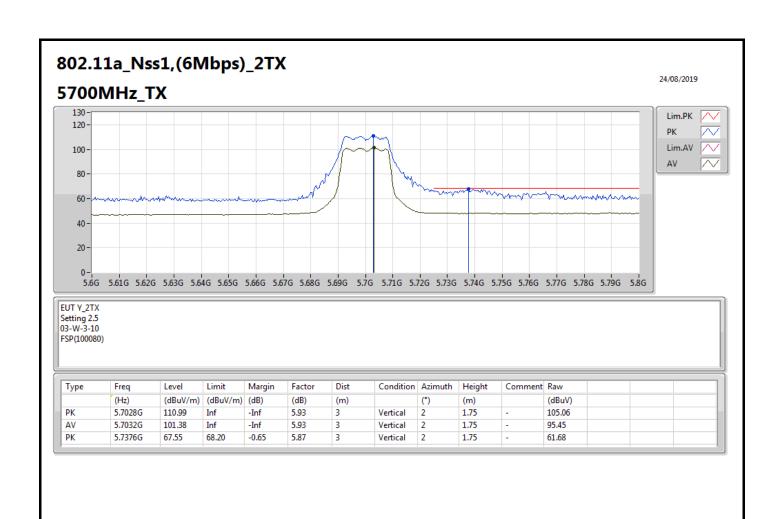




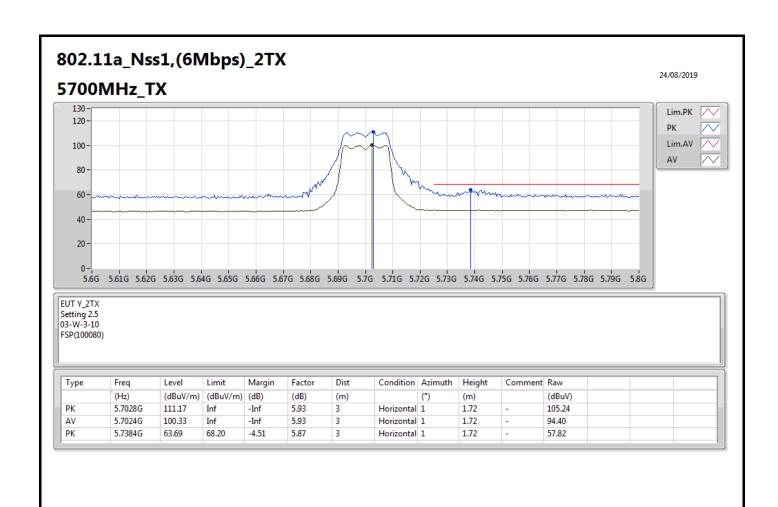




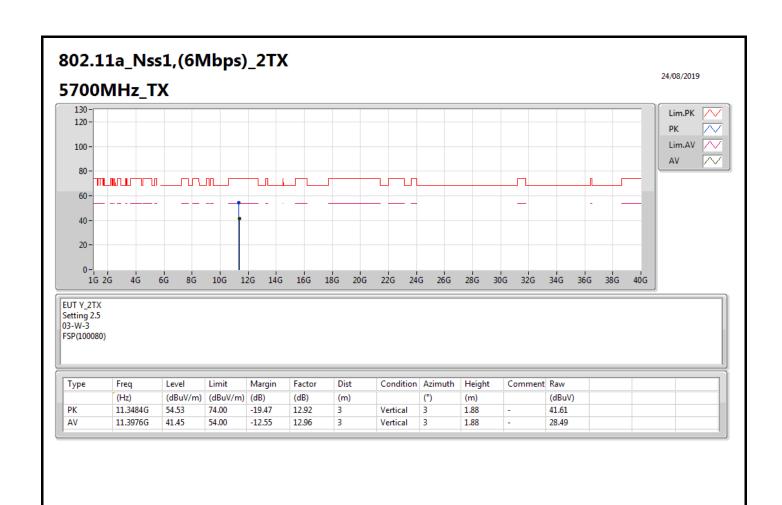




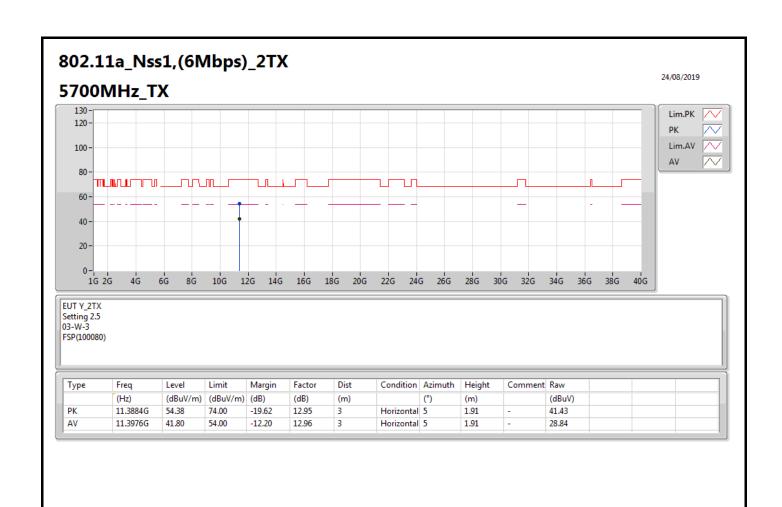




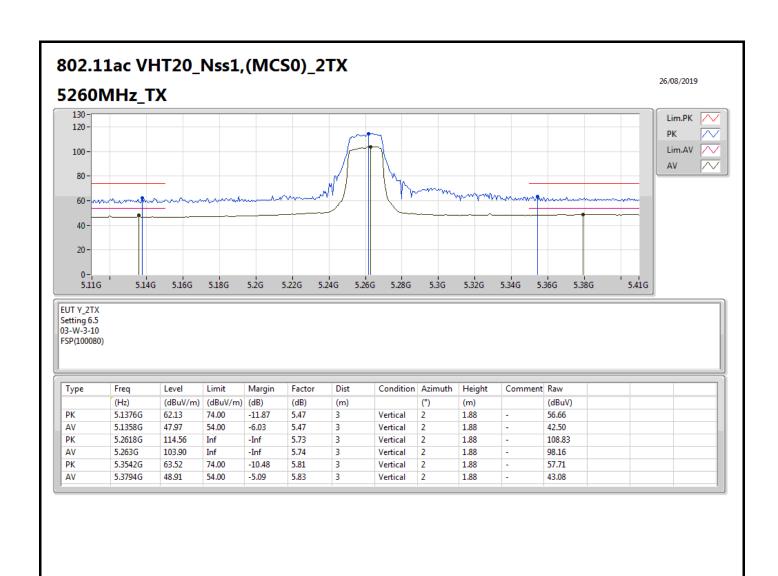




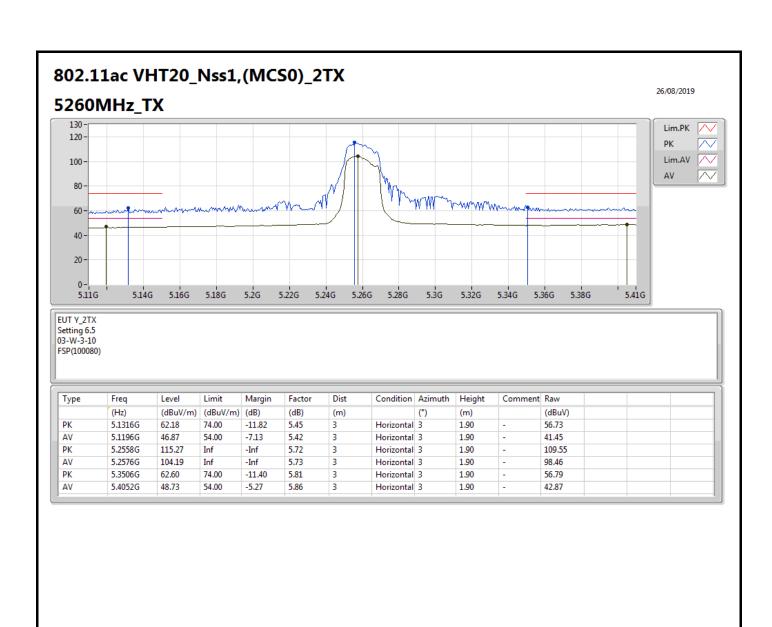




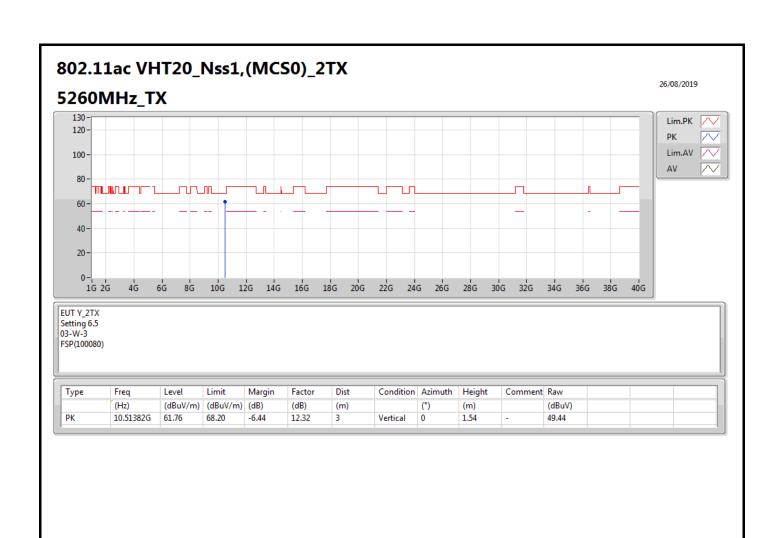




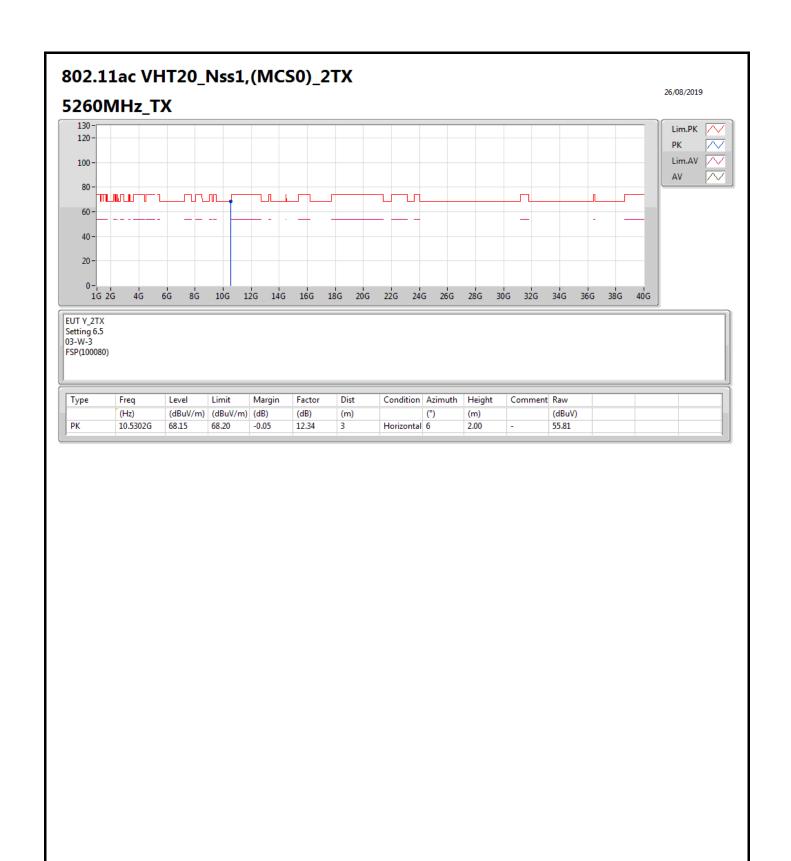




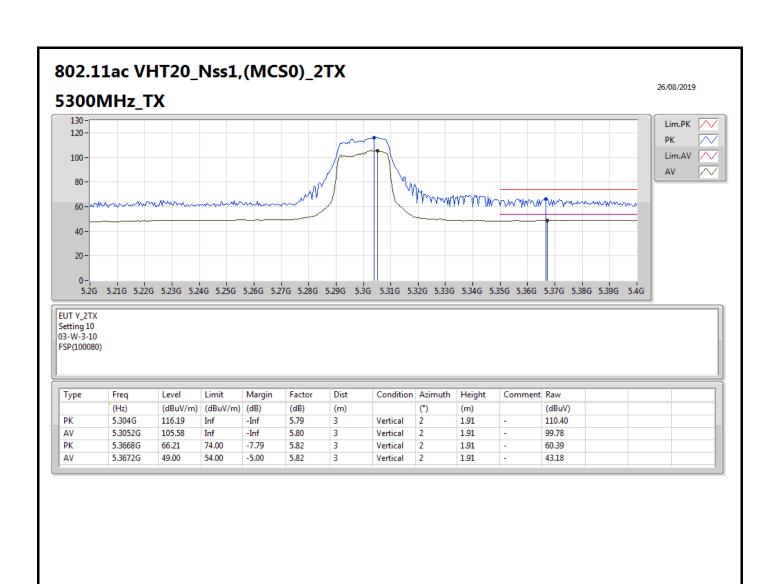




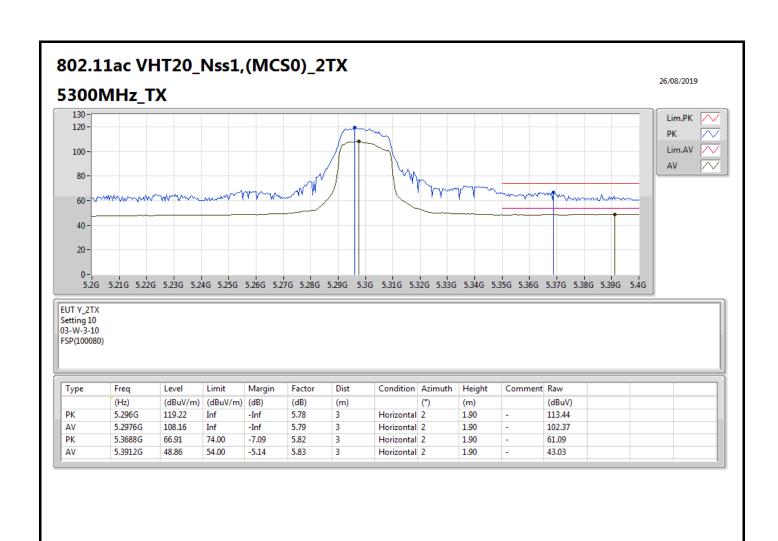




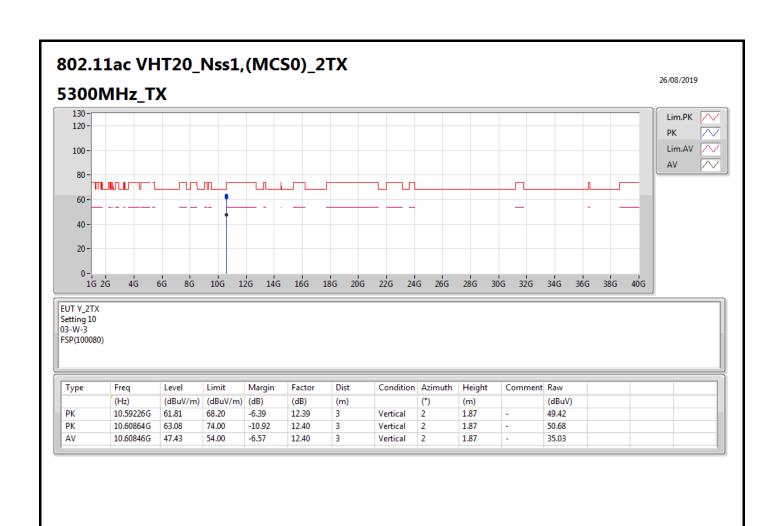




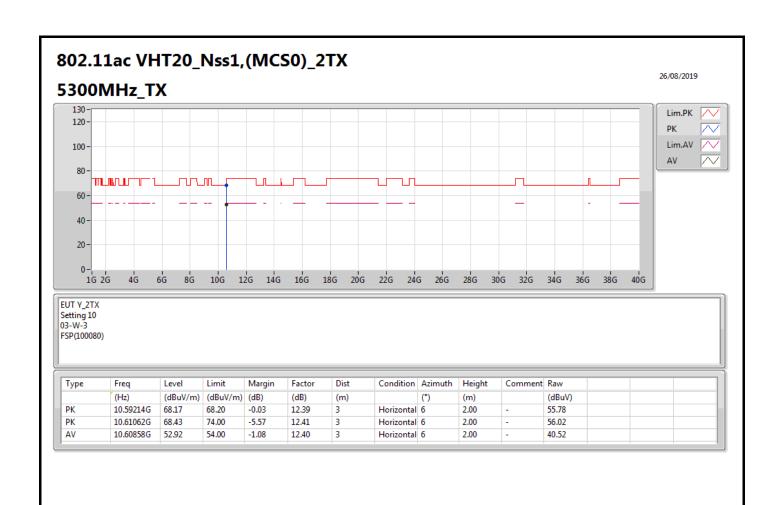




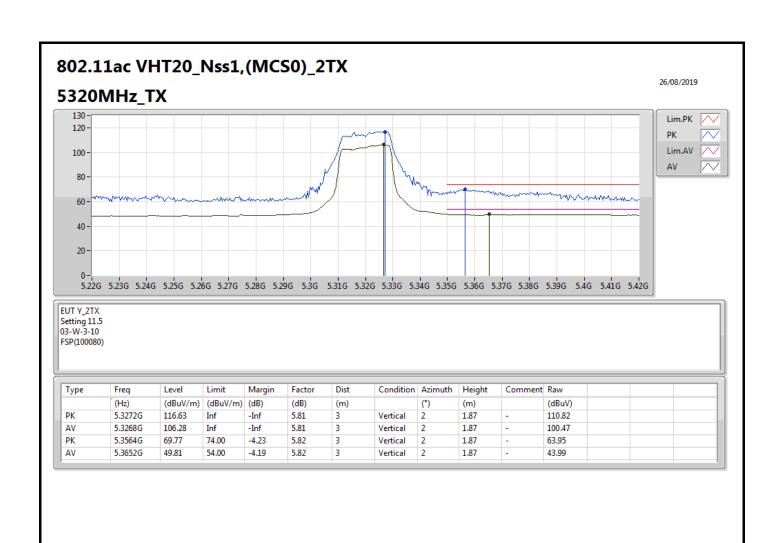




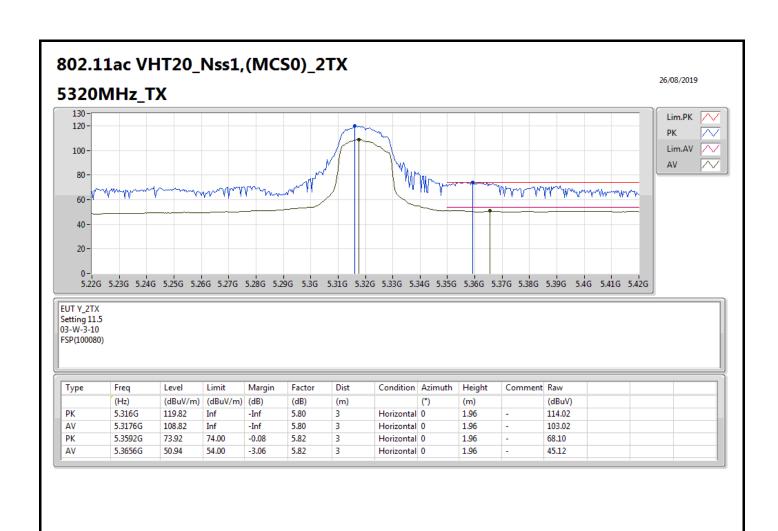




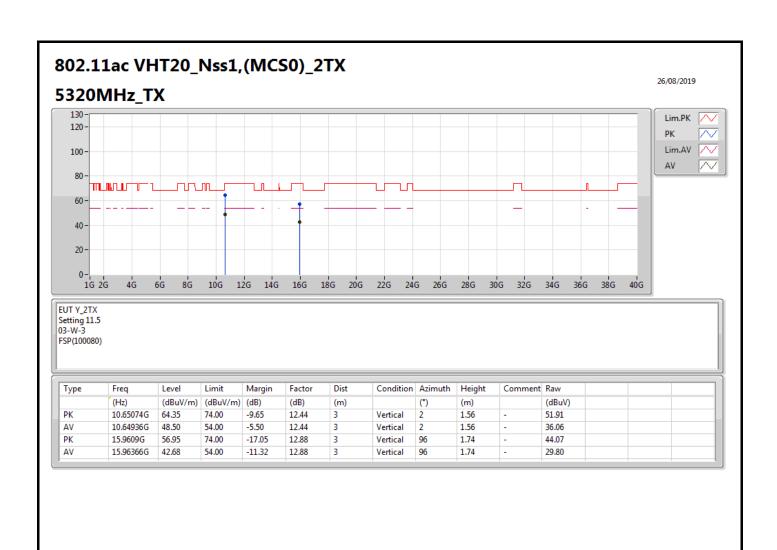




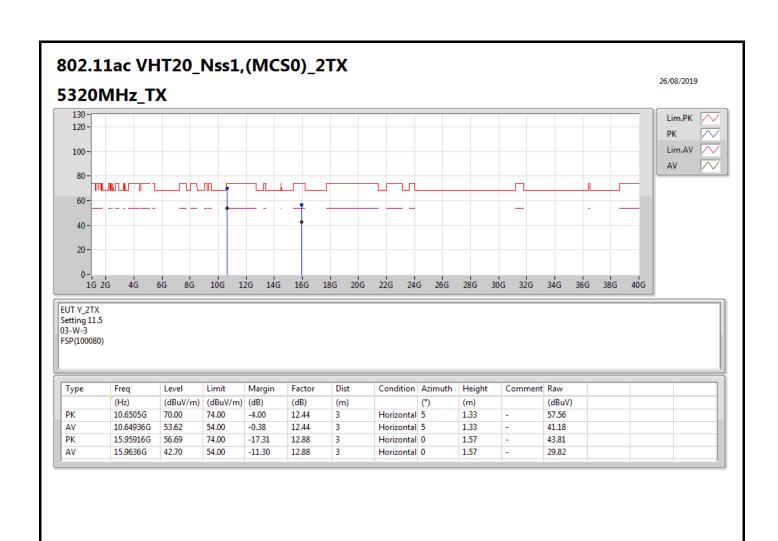




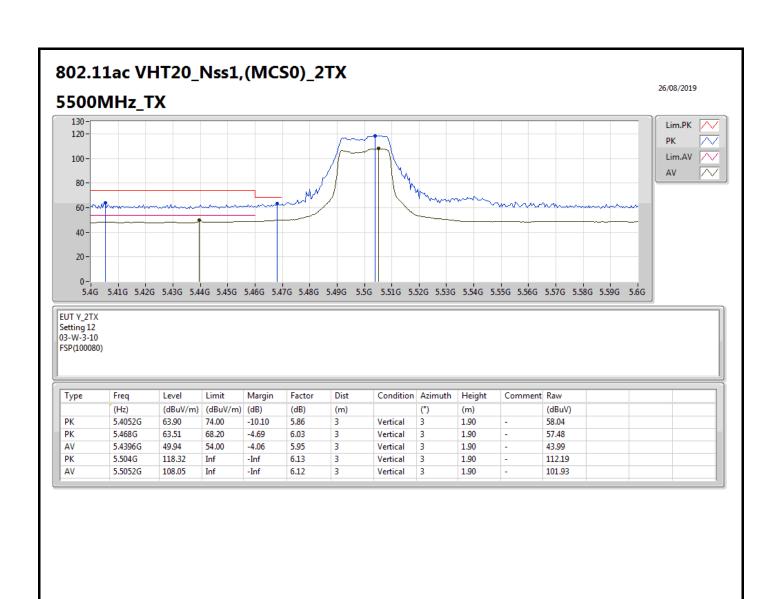




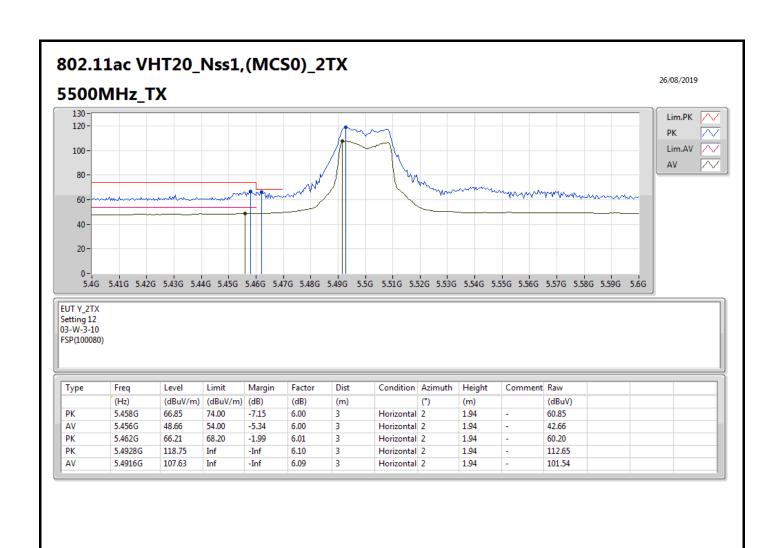




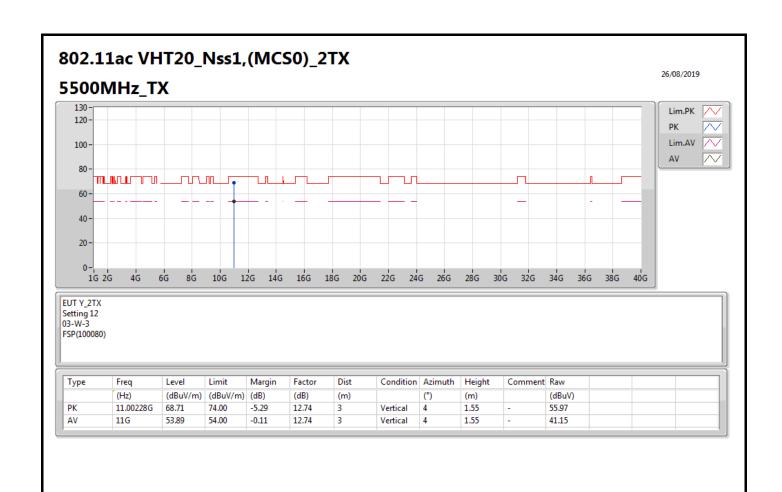




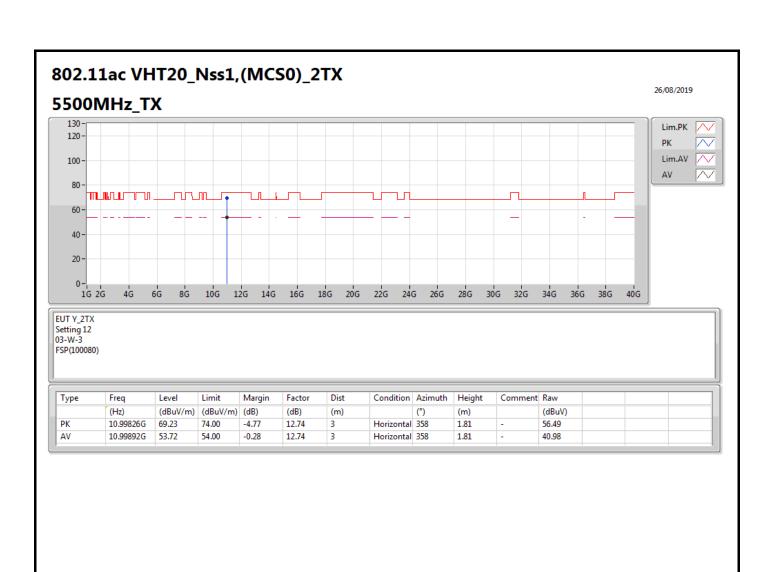




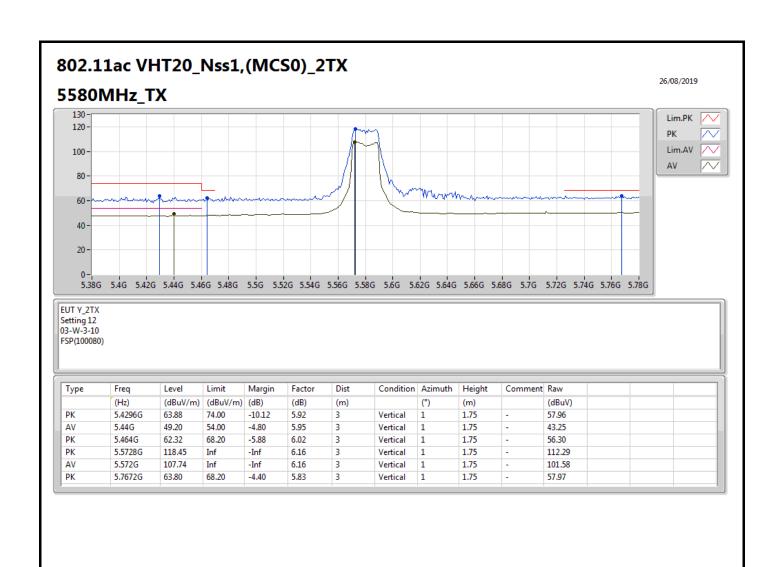




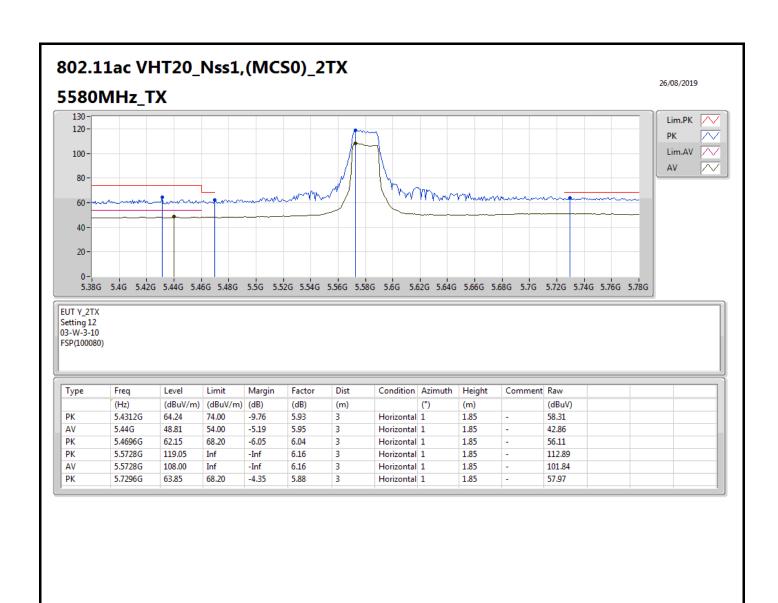












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