

Report No.: FR761315AA
Project No: CB10608149

FCC Test Report

Equipment : Access Point

Brand Name : Aerohive

Model No. : AP150W

FCC ID : WBV-AP150W

Standard : 47 CFR FCC Part 15.247

Operating Band : 2400 MHz - 2483.5 MHz

Function : Point-to-multipoint; Point-to-point

Applicant : Aerohive Networks Inc.

1011 McCarthy Blvd, Milpitas, CA 95035

Manufacturer : Aerohive Networks Inc.

1011 McCarthy Blvd, Milpitas, CA 95035

The product sample received on Jun. 13, 2017 and completely tested on Jul. 28, 2017. We, SPORTON, would like to declare that the tested sample has been evaluated in accordance with the procedures given in ANSI C63.10-2013 and shown compliance with the applicable technical standards.

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

Cliff Chang

SPORTON INTERNATIONAL INC.

ilac MRA



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Summary of Test Result

	Conformance Test Specifications							
Report Clause	Ref. Std. Clause	Description	Limit	Result				
1.1.2	15.203	Antenna Requirement	FCC 15.203	Complied				
3.1	15.207	AC Power-line Conducted Emissions	FCC 15.207	Complied				
3.2	15.247(a)	DTS Bandwidth	≥500kHz	Complied				
3.3	15.247(b)	Maximum Conducted Output Power	Power [dBm]:30	Complied				
3.4	15.247(e)	Power Spectral Density	PSD [dBm/3kHz]:8	Complied				
3.5	15.247(d)	Emissions in Non-restricted Frequency Bands	Non-Restricted Bands: > 30 dBc	Complied				
3.6	15.247(d)	Emissions in Restricted Frequency Bands	Restricted Bands: FCC 15.209	Complied				

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Revision History

Report No.	Version	Description	Issued Date
FR761315AA	Rev. 01	Initial issue of report	Aug. 23, 2017

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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
2400-2483.5	b, g, n (HT20), ac (VHT20)	2412-2462	1-11 [11]

Band	Band Mode		Nant
2.4-2.4835GHz	802.11b	20	2TX
2.4-2.4835GHz	802.11g	20	2TX
2.4-2.4835GHz	802.11n HT20	20	2TX
2.4-2.4835GHz	802.11n HT20-BF	20	2TX
2.4-2.4835GHz	802.11ac VHT20	20	2TX
2.4-2.4835GHz	802.11ac VHT20-BF	20	2TX

Note:

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- ◆ 11b mode uses a combination of DSSS-DBPSK, DQPSK, CCK modulation.
- 11g, HT20 use a combination of OFDM-BPSK, QPSK, 16QAM, 64QAM modulation.
- VHT20 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.

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1.1.2 Antenna Information

Ant.	Brand	P/N	Antenna Type	Connector	Gain	(dBi)
Ant.	Bianu	1714	Antenna Type	Connector	2.4G	5G
1	WNC	95XKAA15.GCY	PCB Antenna	I-PEX	2.33	5.88
2	WNC	95XKAA15.GCZ	PCB Antenna	I-PEX	3.45	5.86
3	WNC	95XKAA15.GC1	PCB Antenna	I-PEX	3.63	5.86

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Note: The EUT has three antennas.

<For 2.4GHz WLAN Function>

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

Ant. 2 connect to port 1 and Ant. 3 connect to port 2

Ant. 2 and Ant. 3 could transmit/receive simultaneously.

<For 5GHz WLAN Function>

For IEEE 802.11a/n/ac mode (3TX, 3RX):

Ant. 1 connect to port 1, Ant. 2 connect to port 2 and Ant. 3 connect to port 3

Ant. 1, Ant. 2 and Ant. 3 could transmit/receive simultaneously.

<For Bluetooth Function>

For bluetooth mode (1TX, 1RX):

Ant. 1 connect to port 1

Only Ant. 1 can be used as transmitting/receiving antenna.

1.1.3 Mode Test Duty Cycle

Mode	DC	DCF(dB)	T(s)	VBW(Hz) ≥ 1/T
802.11b	0.991	0.039	n/a (DC>=0.98)	n/a (DC>=0.98)
802.11g	0.951	0.218	2.068m	1k
802.11ac VHT20	0.951	0.218	1.933m	1k
802.11ac VHT20-BF	0.868	0.615	1.948m	1k

1.1.4 EUT Operational Condition

EUT Power Type		m Power Adapter or PoE	
Beamforming Function	\boxtimes	With beamforming for 802.11n/ac.	Without beamforming

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1.2 Testing Applied 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 558074 D01 v04
- FCC KDB 662911 D01 v02r01
- FCC KDB 644545 D01 v01r02
- FCC KDB 412172 D01 v01r01

1.3 Testing Location Information

	Testing Location						
	HWA YA	ADD	:	lo. 52, Hwa Ya 1st Rd., Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C.			
		TEL	:	886-3-327-3456 FAX : 886-3-318-0055			
\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	Eddie Weng	23°C / 55%	Jun. 24, 2017
Radiated (For below 1GHz)	03CH01-CB	Welson Chen & Nyle Chang & Peter Wu	22°C / 54%	Jul. 19, 2017
Radiated (For above 1GHz)	03CH01-CB	Welson Chen & Nyle Chang & Peter Wu	22°C / 54%	Jun. 16, 2017 ~ Jul. 20, 2017
AC Conduction	CO01-CB	Howard Lin	22°C / 54%	Jul. 28, 2017

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)	3.2 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%

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2 Test Configuration of EUT

2.1 Test Channel Mode

Mode	Power Setting
802.11b_(1Mbps)_2TX	-
2412MHz	62
2437MHz	76
2462MHz	64
802.11g_(6Mbps)_2TX	-
2412MHz	62
2437MHz	64
2462MHz	59
802.11ac VHT20_Nss1,(MCS0)_2TX	-
2412MHz	58
2437MHz	65
2462MHz	55
802.11ac VHT20-BF_Nss1,(MCS0)_2TX	-
2412MHz	53
2437MHz	65
2462MHz	55

Note:

- VHT20 covers HT20, due to same modulation. The power setting for 802.11n HT20 is the same or lower than 802.11ac VHT20.
- There are two modes of EUT for 802.11n/ac in 2.4GHz/5GHz. One is beamforming mode, and the other is non-beamforming mode. Both modes have been tested and recorded in this test report.

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2.2 The Worst Case Measurement Configuration

The Worst Case Mode for Following Conformance Tests				
Tests Item AC power-line conducted emissions				
Condition	Condition AC power-line conducted measurement for line and neutral			
Operating Mode Normal Link				
1	EUT + Adapter			

	The Worst Case Mode for Following Conformance Tests			
Tests Item	DTS Bandwidth Maximum Conducted Output Power Power Spectral Density Emissions in Non-restricted Frequency Bands			
Test Condition	Test Condition Conducted measurement at transmit chains			

The Worst Case Mode for Following Conformance Tests			
Tests Item Emissions in Restricted Frequency Bands			
Test Condition	Radiated measurement If EUT consist of multiple antenna assembly (multiple antenna are used in EUT regardless of spatial multiplexing MIMO configuration), the radiated test should be performed with highest antenna gain of each antenna type.		
Operating Mode < 1GHz Normal Link			
1	Normal Link - EUT in Y axis + Adapter		
2	Normal Link - EUT in Y axis + PoE 1		
3	Normal Link - EUT in Y axis + PoE 2		
For operating mode 1 is the worst case and it was record in this test report.			
Operating Mode > 1GHz CTX			
1	EUT in Y axis		

The Worst Case Mode for Following Conformance Tests			
Tests Item Simultaneous Transmission Analysis - Radiated Emission Co-location			
Test Condition Radiated measurement			
Operating Mode	Normal Link		
1 WLAN 2.4GHz+WLAN 5GHz+Bluetooth			
Refer to Appendix G for Radiated Emission Co-location.			

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The Worst Case Mode for Following Conformance Tests					
Tests Item Simultaneous Transmission Analysis - Co-location RF Exposure Evaluation					
Operating Mode	Operating Mode				
1	1 WLAN 2.4GHz+WLAN 5GHz+Bluetooth				
Refer to Sporton Test Report No.: FA761315 for Co-location RF Exposure Evaluation.					

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- Note 1: The EUT can only be used at Y axis position.
- Note 2: The defines from manufacturer, "console port" without any function, and it was performed test at the load.
- Note 3: PoE and Adapter information as below:

The EUT was powered by PoE or Adapter, and the PoE and Adapter was for measurement only, would not be marketed.

Support Unit	Brand	Model
Adapter	CUI INC	SWI36-48-N
PoE 1	Microsemi	PD-3501G/AC
PoE 2	Microsemi	PD-9001GR/AT/AC

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2.3 EUT Operation during Test

For CTX Mode:

non-beamforming mode:

The EUT was programmed to be in continuously transmitting mode.

beamforming mode:

For Conducted Mode:

The EUT was programmed to be in continuously transmitting mode.

For Radiated Mode:

During the test, the following programs under WIN XP were executed.

The program was executed as follows:

- 1. During the test, the EUT operation to normal function.
- 2. Executed command fixed test channel under Telnet.
- 3. Executed "Lantest.exe" to link with the remote workstation to transmit and receive packet by WLAN module and transmit duty cycle no less than 98%.

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For Normal Link:

During the test, the EUT operation to normal function.

2.4 Accessories

Wall-mounted rack*1

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2.5 Support Equipment

For Test Site No: CO01-CB

	Support Equipment				
No.	No. Equipment Brand Name Model Name FCC ID				
1 NB*5 DELL E6430		DoC			
2 PoE Loader Leader PFS-4010 Doc		DoC			
3	Adapter	CUI INC	SWI36-48-N	DoC	

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

	Support Equipment					
No.	No. Equipment Brand Name Model Name FCC ID					
1	NB*4	DELL	E4300	DoC		
2	2 NB Apple Mac Book Do			DoC		
3	3 PoE Loader WNC M1 DoC					
4	Adapter	CUI INC	SWI36-48-N	DoC		

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

For non-beamforming mode

	Support Equipment				
No.	No. Equipment Brand Name Model Name FCC ID				
1	1 NB DELL E4300				
2	2 PoE 1 Microsemi PD-3501G/AC DoC				

For beamforming mode

	Support Equipment					
No.	No. Equipment Brand Name Model Name FCC ID					
1	NB*2	DELL	E4300	DoC		
2	2 PoE 1 Microsemi PD-3501G/AC DoC					
3 WLAN module Broadcom BCM943162ZP QDS-BRCM		QDS-BRCM1075				
4	Test fixture	N/A	N/A	N/A		

For Test Site No: TH01-CB

	Support Equipment					
No.	No. Equipment Brand Name Model Name FCC ID					
1	NB	E4300	DoC			
2	/ POE/					

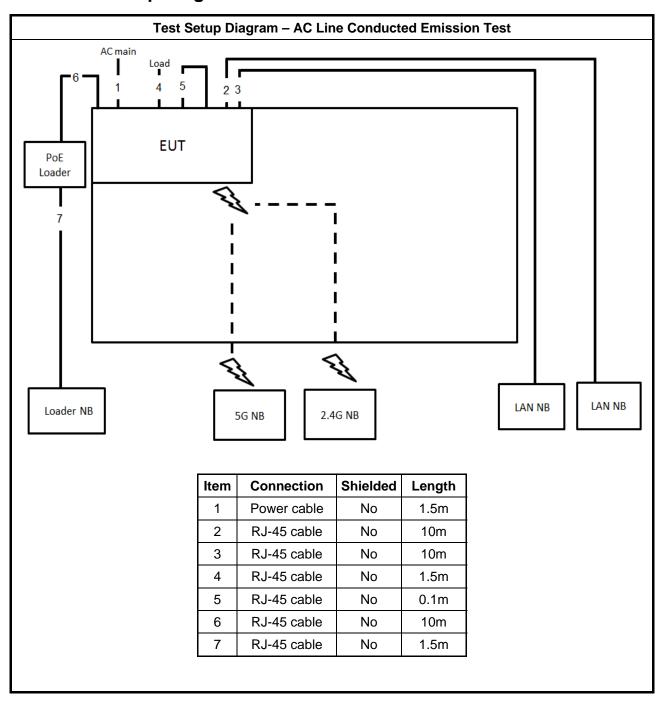
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2.6 Test Setup Diagram



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Test Setup Diagram - Radiated Test < 1GHz AC MAIN LOAD EUT LAN NB LAN NB PoE loader 2.4G NB 5G NB

Item	Connection	Shielded	Length
1	Power cable	No	1.5m
2	RJ-45 cable	No	10m
3	RJ-45 cable	No	10m
4	RJ-45 cable	No	10m
5	Power cable	No	1.5m
6	RJ-45 cable	No	0.1m
7	RJ-45 cable	No	1.5m

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Test Setup Diagram - Radiated Test > 1GHz / For non-beamforming mode EUT PoE LAN NB AC MAIN Connection Shielded ltem Length 1 RJ-45 cable No 10 2 RJ-45 cable 1.5 No 3 Power cable No 1.8

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Test Setup Diagram - Radiated Test > 1GHz / For beamforming mode

EUT

POE

AC MAIN

LAN NB

WLAN module
Test fixture

NB

Item	Connection	Shielded	Length
1	RJ-45 cable	No	10
2	RJ-45 cable	No	1.5
3	Power cable	No	1.8
4	RJ-45 cable	No	1.5

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3 Transmitter Test Result

3.1 AC Power-line Conducted Emissions

3.1.1 AC Power-line Conducted Emissions Limit

AC Power-line Conducted Emissions Limit		
Frequency Emission (MHz)	Quasi-Peak	Average
0.15-0.5	66 - 56 *	56 - 46 *
0.5-5	56	46
5-30	60	50

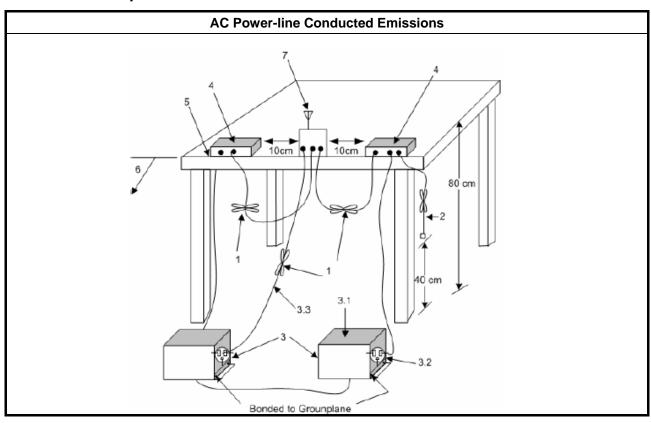
3.1.2 Measuring Instruments

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

3.1.3 Test Procedures

	Test Method
□ Refer as A	NSI C63.10-2013, clause 6.2 for AC power-line conducted emissions.

3.1.4 Test Setup



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3.1.5 Test Result of AC Power-line Conducted Emissions

Refer as Appendix A

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3.2 DTS Bandwidth

3.2.1 6dB Bandwidth Limit

6dB Bandwidth Limit	
Systems using digital modulation techniques:	
■ 6 dB bandwidth ≥ 500 kHz.	•

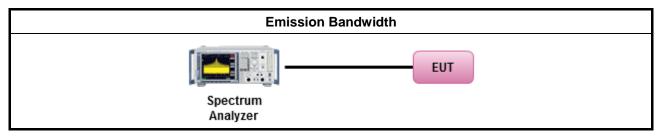
3.2.2 Measuring Instruments

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 558074, clause 8.1 Option 1 for 6 dB bandwidth measurement.		
	Refer as FCC KDB 558074, clause 8.2 Option 2 for 6 dB bandwidth measurement.		
	Refer as ANSI C63.10, clause 6.9.1 for occupied bandwidth testing.		

3.2.4 Test Setup



3.2.5 Test Result of Emission Bandwidth

Refer as Appendix B

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3.3 Maximum Conducted Output Power

3.3.1 Maximum Conducted Output Power Limit

Maximum Conducted Output Power Limit

- If $G_{TX} \le 6$ dBi, then $P_{Out} \le 30$ dBm (1 W)
- Point-to-multipoint systems (P2M): If $G_{TX} > 6$ dBi, then $P_{Out} = 30 (G_{TX} 6)$ dBm
- Point-to-point systems (P2P): If $G_{TX} > 6$ dBi, then $P_{Out} = 30 (G_{TX} 6)/3$ dBm
- Smart antenna system (SAS):
 - Single beam: If $G_{TX} > 6$ dBi, then $P_{Out} = 30 (G_{TX} 6)/3$ dBm
 - Overlap beam: If $G_{TX} > 6$ dBi, then $P_{Out} = 30 (G_{TX} 6)/3$ dBm
 - Aggregate power on all beams: If $G_{TX} > 6$ dBi, then $P_{Out} = 30 (G_{TX} 6)/3 + 8$ dB dBm

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 \mathbf{P}_{Out} = maximum peak conducted output power or maximum conducted output power in dBm, \mathbf{G}_{TX} = the maximum transmitting antenna directional gain in dBi.

3.3.2 Measuring Instruments

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

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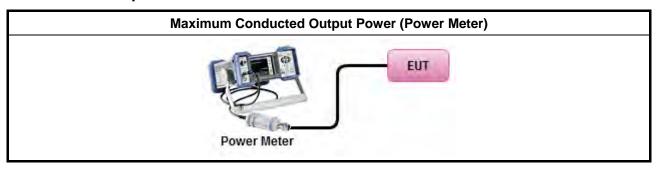
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3.3.3 Test Procedures

	Test Method
•	Maximum Peak Conducted Output Power
	Refer as FCC KDB 558074, clause 9.1.1 Option 1 (RBW ≥ EBW method).
	Refer as FCC KDB 558074, clause 9.1.2 Option 2 (peak power meter for VBW ≥ DTS BW)
•	Maximum Conducted Output Power
	duty cycle ≥ 98% or external video / power trigger]
	Refer as FCC KDB 558074, clause 9.2.2.2 Method AVGSA-1 (spectral trace averaging).
	Refer as FCC KDB 558074, clause 9.2.2.3 Method AVGSA-1 Alt. (slow sweep speed)
	duty cycle < 98% and average over on/off periods with duty factor
	Refer as FCC KDB 558074, clause 9.2.2.4 Method AVGSA-2 (spectral trace averaging).
	Refer as FCC KDB 558074, clause 9.2.2.5 Method AVGSA-2 Alt. (slow sweep speed)
	RF power meter and average over on/off periods with duty factor or gated trigger
	Refer as FCC KDB 558074, clause 9.2.3 Method AVGPM-G (using an RF average power meter).
	Refer as FCC KDB 558074, clause 9.1.2 PKPM1 Peak power meter method.
•	For conducted measurement.
	If the EUT supports multiple transmit chains using options given below: Refer as FCC KDB 662911, In-band power measurements. Using the measure-and-sum approach, measured all transmit ports individually. Sum the power (in linear power units e.g., mW) of all ports for each individual sample and save them.
	■ If multiple transmit chains, EIRP calculation could be following as methods: P _{total} = P ₁ + P ₂ + + P _n (calculated in linear unit [mW] and transfer to log unit [dBm]) EIRP _{total} = P _{total} + DG

3.3.4 Test Setup



3.3.5 Test Result of Maximum Conducted Output Power

Refer as Appendix C

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3.4 Power Spectral Density

3.4.1 Power Spectral Density Limit

	Power Spectral Density Limit
-	Power Spectral Density (PSD) ≤ 8 dBm/3kHz

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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
-	outp the con- of th	k power spectral density procedures that the same method as used to determine the conducted out power. If maximum peak conducted output power was measured to demonstrate compliance to output power limit, then the peak PSD procedure below (Method PKPSD) shall be used. If maximum ducted output power was measured to demonstrate compliance to the output power limit, then one e average PSD procedures shall be used, as applicable based on the following criteria (the peak procedure is also an acceptable option).
	\boxtimes	Refer as FCC KDB 558074, clause 10.2 Method PKPSD (RBW=3-100kHz; Detector=peak).
	[dut	cycle ≥ 98% or external video / power trigger]
		Refer as FCC KDB 558074, clause 10.3 Method AVGPSD-1 (spectral trace averaging).
		Refer as FCC KDB 558074, clause 10.4 Method AVGPSD-2 (slow sweep speed)
	duty	cycle < 98% and average over on/off periods with duty factor
		Refer as FCC KDB 558074, clause 10.5 Method AVGPSD-1 Alt (spectral trace averaging).
		Refer as FCC KDB 558074, clause 10.6 Method AVGPSD-2 Alt. (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.

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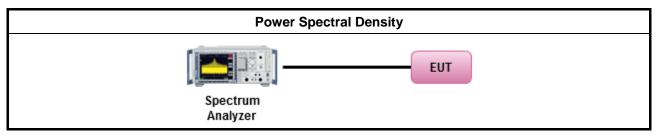
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FCC Test Report

3.4.4 Test Setup



3.4.5 Test Result of Power Spectral Density

Refer as Appendix D

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3.5 Emissions in Non-restricted Frequency Bands

3.5.1 Emissions in Non-restricted Frequency Bands Limit

Un-restricted Ban	d Emissions Limit
RF output power procedure	Limit (dB)
Peak output power procedure	20
Average output power procedure	30

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- Note 1: If the peak output power procedure is used to measure the fundamental emission power to demonstrate compliance to requirements, then the peak conducted output power measured within any 100 kHz outside the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum measured in-band peak PSD level.
- Note 2: If the average output power procedure is used to measure the fundamental emission power to demonstrate compliance to requirements, then the power in any 100 kHz outside of the authorized frequency band shall be attenuated by at least 30 dB relative to the maximum measured in-band average PSD level.

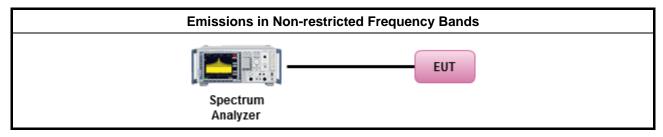
3.5.2 Measuring Instruments

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

3.5.3 Test Procedures

Test Method	
 Refer as FCC KDB 558074, clause 11 for unwanted emissions into non-restricted bands 	•

3.5.4 Test Setup



3.5.5 Test Result of Emissions in Non-restricted Frequency Bands

Refer as Appendix E

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3.6 Emissions in Restricted Frequency Bands

3.6.1 Emissions in Restricted Frequency Bands Limit

Restricted Band Emissions Limit			
Frequency Range (MHz)	Field Strength (uV/m)	Field Strength (dBuV/m)	Measure Distance (m)
0.009~0.490	2400/F(kHz)	48.5 - 13.8	300
0.490~1.705	24000/F(kHz)	33.8 - 23	30
1.705~30.0	30	29	30
30~88	100	40	3
88~216	150	43.5	3
216~960	200	46	3
Above 960	500	54	3

Note 1: Test distance for frequencies at or above 30 MHz, measurements may be performed at a distance other than the limit distance provided they are not performed in the near field and the emissions to be measured can be detected by the measurement equipment. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse of linear distance for field-strength measurements, inverse of linear distance-squared for power-density measurements).

Note 2: Test distance for frequencies at below 30 MHz, measurements may be performed at a distance closer than the EUT limit distance; however, an attempt should be made to avoid making measurements in the near field. When performing measurements below 30 MHz at a closer distance than the limit distance, the results shall be extrapolated to the specified distance by either making measurements at a minimum of two or more distances on at least one radial to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB/decade). The test report shall specify the extrapolation method used to determine compliance of the EUT.

3.6.2 Measuring Instruments

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

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3.6.3 Test Procedures

		Test Method
•	The	average emission levels shall be measured in [duty cycle ≥ 98 or duty factor].
•		er as ANSI C63.10, clause 6.9.2.2 band-edge testing shall be performed at the lowest frequency nnel and highest frequency channel within the allowed operating band.
•	For	the transmitter unwanted emissions shall be measured using following options below:
	•	Refer as FCC KDB 558074, clause 12 for unwanted emissions into restricted bands.
		☐ Refer as FCC KDB 558074, clause 12.2.5.1 Option 1 (trace averaging for duty cycle ≥98%)
		Refer as FCC KDB 558074, clause 12.2.5.2 Option 2 (trace averaging + duty factor).
		Refer as FCC KDB 558074, clause 12.2.5.3 Option 3 (Reduced VBW≥1/T).
		☐ Refer as ANSI C63.10, clause 4.2.3.2.3 (Reduced VBW). VBW ≥ 1/T, where T is pulse time.
		Refer as ANSI C63.10, clause 4.2.3.2.4 average value of pulsed emissions.
		Refer as FCC KDB 558074, clause 12.2.4 measurement procedure peak limit.
•	For	the transmitter band-edge emissions shall be measured using following options below:
	•	Refer as FCC KDB 558074 clause 13.1, When the performing peak or average radiated measurements, emissions within 2 MHz of the authorized band edge may be measured using the marker-delta method described below.
		Refer as FCC KDB 558074, clause 13.2 (ANSI C63.10, clause 6.9.3) for marker-delta method for band-edge measurements.
	•	Refer as FCC KDB 558074, clause 13.3 for narrower resolution bandwidth (100kHz) using the band power and summing the spectral levels (i.e., 1 MHz).
•	For	conducted and cabinet radiation measurement, refer as FCC KDB 558074, clause 12.2.2.
	•	For conducted unwanted emissions into restricted bands (absolute emission limits). Devices with multiple transmit chains using options given below: (1) Measure and sum the spectra across the outputs or (2) Measure and add 10 log(N) dB
	•	For FCC KDB 662911 The methodology described here may overestimate array gain, thereby resulting in apparent failures to satisfy the out-of-band limits even if the device is actually compliant. In such cases, compliance may be demonstrated by performing radiated tests around the frequencies at which the apparent failures occurred.

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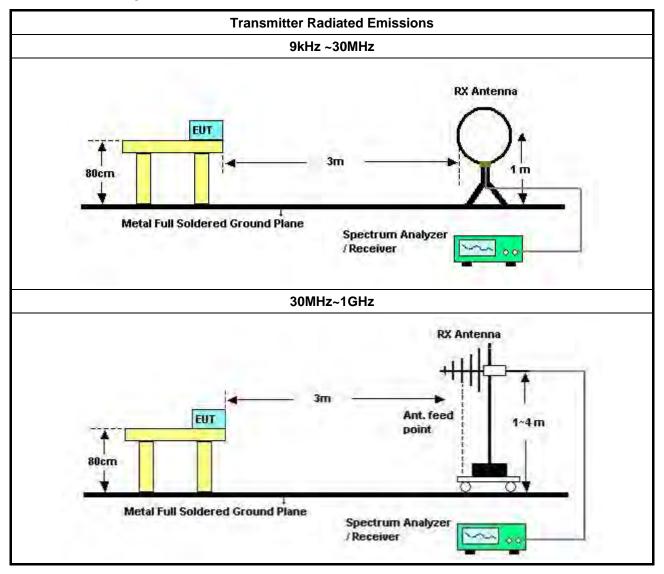
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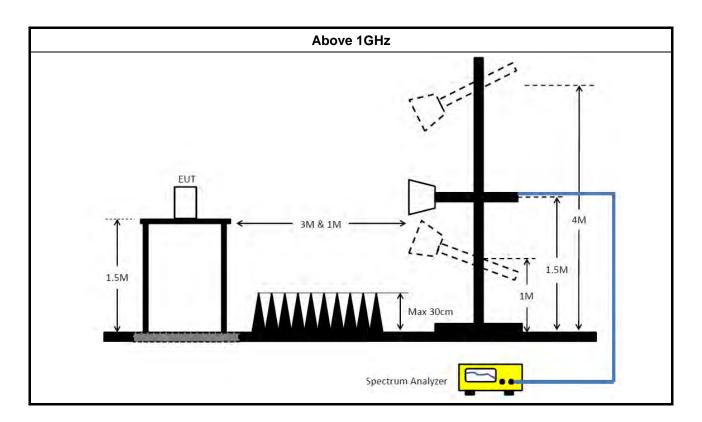
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3.6.4 Test Setup



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3.6.5 Transmitter Radiated Unwanted Emissions (Below 30MHz)

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

3.6.6 Test Result of Transmitter Radiated Unwanted Emissions

Refer as Appendix F

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4 Test Equipment and Calibration Data

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Remark
EMI Receiver	Agilent	N9038A	My52260123	9kHz ~ 8.45GHz	Jan. 23, 2017	Conduction (CO01-CB)
LISN	F.C.C.	FCC-LISN-50-16-2	04083	150kHz ~ 100MHz	Dec. 14, 2016	Conduction (CO01-CB)
LISN	Schwarzbeck	NSLK 8127	8127647	9kHz ~ 30MHz	Dec. 21, 2016	Conduction (CO01-CB)
COND Cable	Woken	Cable	01	150kHz ~ 30MHz	May 23, 2017	Conduction (CO01-CB)
Software	Audix	E3	6.120210n	-	N.C.R.	Conduction (CO01-CB)
BILOG ANTENNA with 6dB Attenuator	TESEQ & EMCI	CBL6112D&N-6-06	37880&AT-N0609	20MHz ~ 2GHz	Aug. 30, 2016	Radiation (03CH01-CB)
Loop Antenna	Teseq	HLA 6120	24155	9kHz - 30 MHz	Mar. 16, 2016*	Radiation (03CH01-CB)
Horn Antenna	EMCO	3115	00075790	750MHz ~ 18GHz	Nov. 10, 2016	Radiation (03CH01-CB)
Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170252	15GHz ~ 40GHz	Jul. 25, 2016	Radiation (03CH01-CB)
Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170252	15GHz ~ 40GHz	Jul. 05, 2017	Radiation (03CH01-CB)
Pre-Amplifier	EMCI	EMC330N	980332	20MHz ~ 3GHz	May 02, 2017	Radiation (03CH01-CB)
Pre-Amplifier	Agilent	8449B	3008A02310	1GHz ~ 26.5GHz	Jan. 16, 2017	Radiation (03CH01-CB)
Pre-Amplifier	MITEQ	TTA1840-35-HG	1864479	18GHz ~ 40GHz	Jun. 28, 2016	Radiation (03CH01-CB)
Pre-Amplifier	MITEQ	TTA1840-35-HG	1864479	18GHz ~ 40GHz	Jul. 10, 2017	Radiation (03CH01-CB)
Spectrum Analyzer	R&S	FSP40	100056	9kHz ~ 40GHz	Nov. 22, 2016	Radiation (03CH01-CB)
EMI Test	R&S	ESCS	100355	9kHz ~ 2.75GHz	May 06, 2017	Radiation (03CH01-CB)
RF Cable-low	Woken	Low Cable-16+17	N/A	30 MHz ~ 1 GHz	Oct. 24, 2016	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-16	N/A	1 GHz ~ 18 GHz	Oct. 24, 2016	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-16+17	N/A	1 GHz ~ 18 GHz	Oct. 24, 2016	Radiation (03CH01-CB)

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Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Remark
RF Cable-high	Woken	High Cable-40G#1	N/A	18GHz ~ 40 GHz	Oct. 24, 2016	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-40G#2	N/A	18GHz ~ 40 GHz	Oct. 24, 2016	Radiation (03CH01-CB)
Test Software	Audix	E3	6.2009-10-7	N/A	N/A	Radiation (03CH01-CB)
Spectrum analyzer	R&S	FSV40	100979	9kHz~40GHz	Dec. 26, 2016	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-6	1 GHz – 26.5 GHz	Oct. 24, 2016	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-7	1 GHz –26.5 GHz	Oct. 24, 2016	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-8	1 GHz –26.5 GHz	Oct. 24, 2016	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-9	1 GHz –26.5 GHz	Oct. 24, 2016	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-10	1 GHz –26.5 GHz	Oct. 24, 2016	Conducted (TH01-CB)
Power Sensor	Agilent	U2021XA	MY53410001	50MHz~18GHz	Nov. 22, 2016	Conducted (TH01-CB)

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

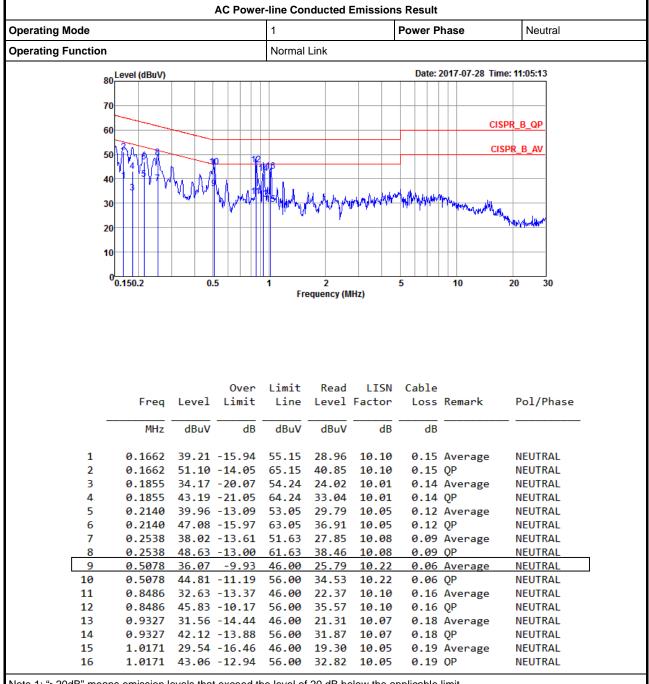
N.C.R. means Non-Calibration required.

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[&]quot;*" Calibration Interval of instruments listed above is two years.

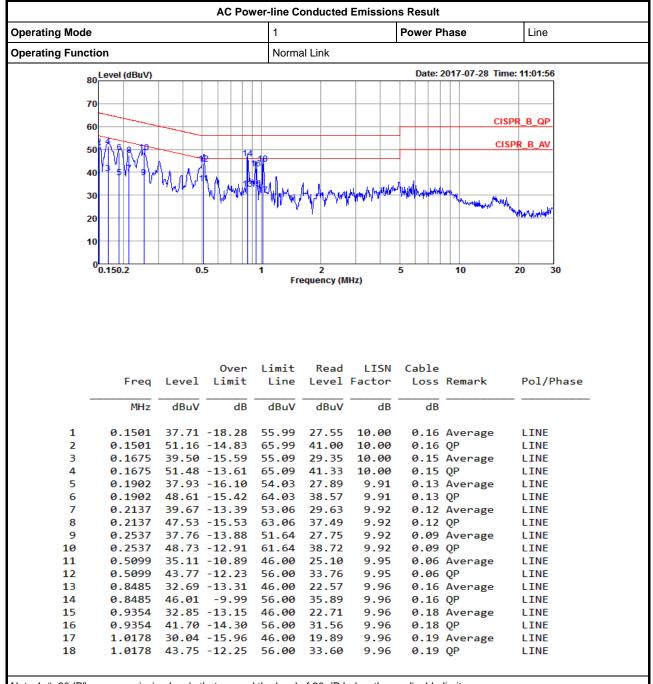
AC Power-line Conducted Emissions Result



Note 1: ">20dB" means emission levels that exceed the level of 20 dB below the applicable limit.

Note 2: "N/F" means Nothing Found emissions (No emissions were detected.)

AC Power-line Conducted Emissions Result



Note 1: ">20dB" means emission levels that exceed the level of 20 dB below the applicable limit.

Note 2: "N/F" means Nothing Found emissions (No emissions were detected.)



EBW Result Appendix B

Summary

Mode	Max-N dB	Max-OBW	ITU-Code	Min-N dB	Min-OBW
	(Hz)	(Hz)		(Hz)	(Hz)
802.11b_(1Mbps)_2TX	-	-	-	-	-
2.4-2.4835GHz	7.55M	13.243M	13M2G1D	7M	10.27M
802.11g_(6Mbps)_2TX	-	-	-	-	-
2.4-2.4835GHz	16.375M	16.592M	16M6D1D	16.325M	16.517M
802.11ac VHT20_Nss1,(MCS0)_2TX	-	-	-	-	-
2.4-2.4835GHz	17.6M	17.816M	17M8D1D	17.575M	17.741M
802.11ac VHT20-BF_Nss1,(MCS0)_2TX	-	-	-	-	-
2.4-2.4835GHz	17.7M	17.816M	17M8D1D	17.55M	17.691M

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

Result

Resuit						
Mode	Result	Limit	Port 1-N dB	Port 1-OBW	Port 2-N dB	Port 2-OBW
		(Hz)	(Hz)	(Hz)	(Hz)	(Hz)
802.11b_(1Mbps)_2TX	-	-	-	-	-	-
2412MHz	Pass	500k	7.5M	10.295M	7.05M	10.595M
2437MHz	Pass	500k	7.55M	11.919M	7.5M	13.243M
2462MHz	Pass	500k	7.525M	10.27M	7M	11.294M
802.11g_(6Mbps)_2TX	-	-	-	-	-	-
2412MHz	Pass	500k	16.325M	16.567M	16.325M	16.542M
2437MHz	Pass	500k	16.325M	16.567M	16.325M	16.592M
2462MHz	Pass	500k	16.35M	16.517M	16.375M	16.592M
802.11ac VHT20_Nss1,(MCS0)_2TX	-	-	-	-	-	-
2412MHz	Pass	500k	17.575M	17.766M	17.6M	17.766M
2437MHz	Pass	500k	17.575M	17.766M	17.6M	17.741M
2462MHz	Pass	500k	17.575M	17.766M	17.6M	17.816M
802.11ac VHT20-BF_Nss1,(MCS0)_2TX	-	-	-	-	-	-
2412MHz	Pass	500k	17.55M	17.741M	17.55M	17.741M
2437MHz	Pass	500k	17.575M	17.816M	17.575M	17.741M
2462MHz	Pass	500k	17.675M	17.691M	17.7M	17.691M

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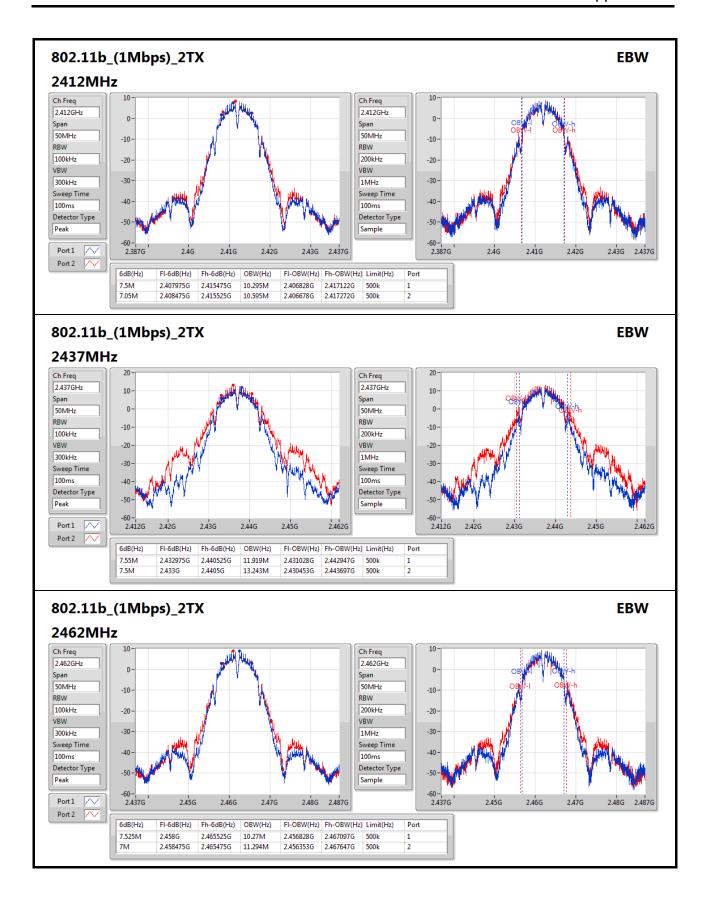
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Port X-N dB = Port X 6dB down bandwidth; Port X-OBW = Port X 99% occupied bandwidth;

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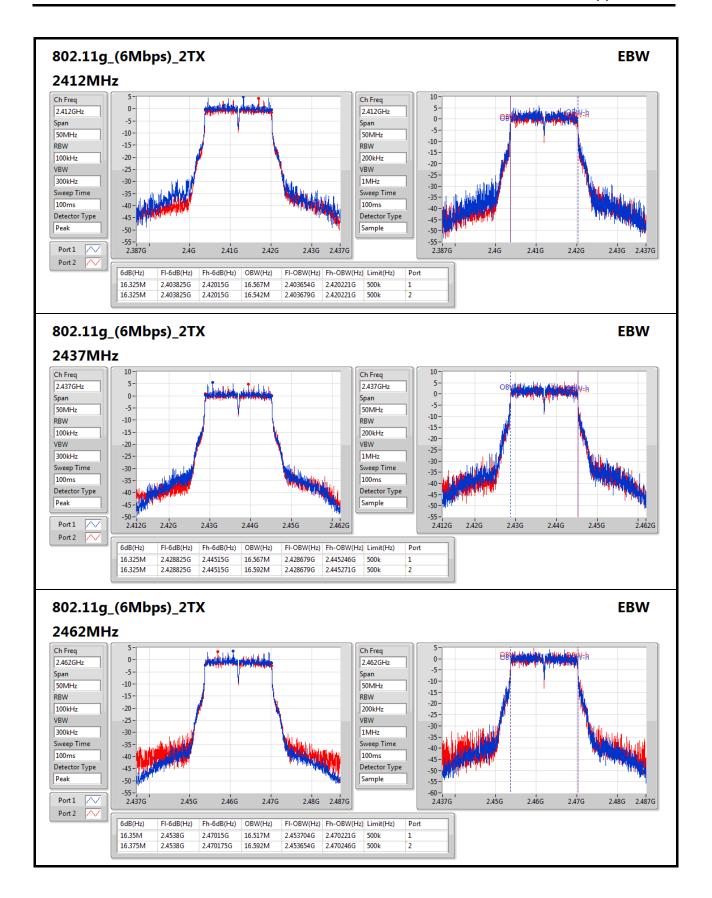
Appendix B





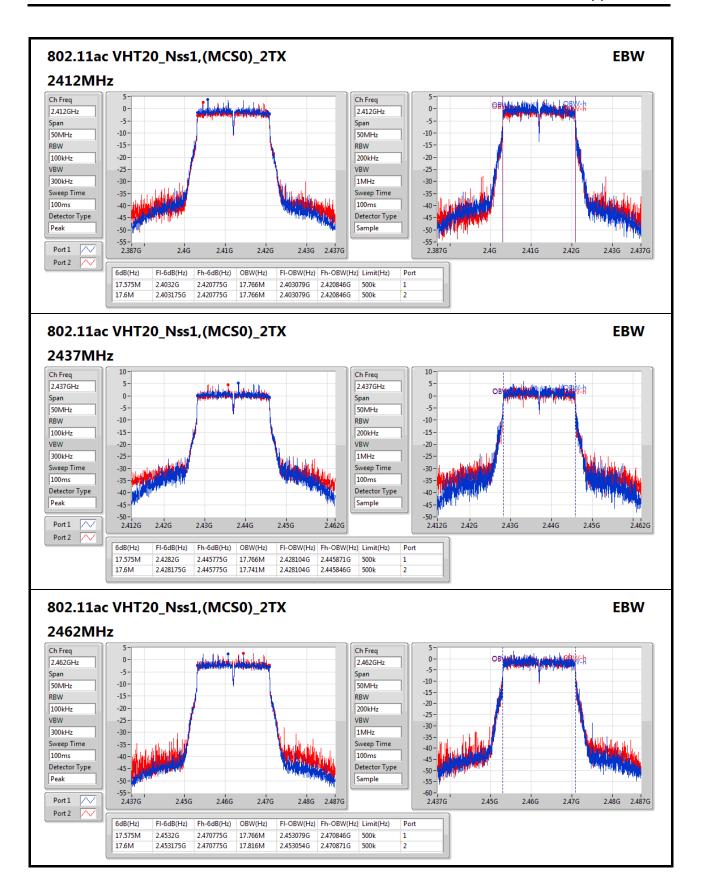
Appendix B





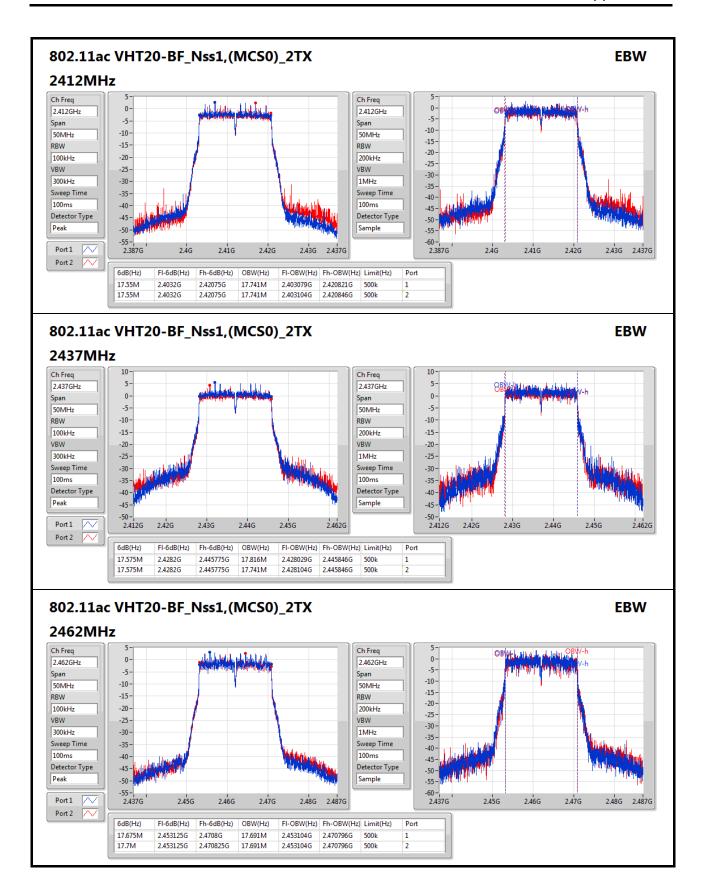
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Appendix B EBW Result



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Appendix B EBW Result





AV Power Result Appendix C

Summary

Mode	Total Power	Total Power
	(dBm)	(W)
802.11b_(1Mbps)_2TX	-	-
2.4-2.4835GHz	23.68	0.23335
802.11g_(6Mbps)_2TX	-	-
2.4-2.4835GHz	19.48	0.08872
802.11ac VHT20_Nss1,(MCS0)_2TX	-	-
2.4-2.4835GHz	19.92	0.09817
802.11ac VHT20-BF_Nss1,(MCS0)_2TX	-	-
2.4-2.4835GHz	19.63	0.09183

Result

Mode	Result	DG	Port 1	Port 2	Total Power	Power Limit
		(dBi)	(dBm)	(dBm)	(dBm)	(dBm)
802.11b_(1Mbps)_2TX	-	-	-	-	-	-
2412MHz	Pass	3.63	16.19	16.12	19.17	30.00
2437MHz	Pass	3.63	19.96	21.28	23.68	30.00
2462MHz	Pass	3.63	16.69	16.84	19.78	30.00
802.11g_(6Mbps)_2TX	-	-	-	-	-	-
2412MHz	Pass	3.63	16.60	15.67	19.17	30.00
2437MHz	Pass	3.63	16.65	16.27	19.48	30.00
2462MHz	Pass	3.63	15.50	15.26	18.39	30.00
802.11ac VHT20_Nss1,(MCS0)_2TX	-	-	-	-	-	-
2412MHz	Pass	3.63	15.26	14.32	17.82	30.00
2437MHz	Pass	3.63	17.19	16.62	19.92	30.00
2462MHz	Pass	3.63	14.42	14.35	17.40	30.00
802.11ac VHT20-BF_Nss1,(MCS0)_2TX	-	-	-	-	-	-
2412MHz	Pass	6.55	14.15	13.70	16.94	29.45
2437MHz	Pass	6.55	17.11	16.06	19.63	29.45
2462MHz	Pass	6.55	14.44	14.42	17.44	29.45

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



Appendix D **PSD Result**

Summary

Gammary	
Mode	PD
	(dBm/RBW)
802.11b_(1Mbps)_2TX	-
2.4-2.4835GHz	0.60
802.11g_(6Mbps)_2TX	-
2.4-2.4835GHz	-6.64
802.11ac VHT20_Nss1,(MCS0)_2TX	-
2.4-2.4835GHz	-7.06
802.11ac VHT20-BF_Nss1,(MCS0)_2TX	-
2.4-2.4835GHz	-8.01

RBW=3kHz.

Result

Mode	Result	DG	Port 1	Port 2	PD	PD Limit
		(dBi)	(dBm/RBW)	(dBm/RBW)	(dBm/RBW)	(dBm/RBW)
802.11b_(1Mbps)_2TX	-	-	-	-	-	-
2412MHz	Pass	6.55	-6.10	-6.54	-4.57	7.45
2437MHz	Pass	6.55	-1.31	-2.36	0.60	7.45
2462MHz	Pass	6.55	-6.17	-5.85	-4.99	7.45
802.11g_(6Mbps)_2TX	-	-	-	-	-	-
2412MHz	Pass	6.55	-9.66	-9.52	-7.65	7.45
2437MHz	Pass	6.55	-8.26	-9.40	-6.64	7.45
2462MHz	Pass	6.55	-9.33	-10.99	-7.94	7.45
802.11ac VHT20_Nss1,(MCS0)_2TX	-	-	-	-	-	-
2412MHz	Pass	6.55	-11.02	-11.23	-9.40	7.45
2437MHz	Pass	6.55	-8.75	-8.62	-7.06	7.45
2462MHz	Pass	6.55	-11.71	-11.81	-10.73	7.45
802.11ac VHT20-BF_Nss1,(MCS0)_2TX	-	-	-	-	-	-
2412MHz	Pass	6.55	-12.64	-13.17	-11.36	7.45
2437MHz	Pass	6.55	-9.35	-8.55	-8.01	7.45
2462MHz	Pass	6.55	-11.53	-12.29	-9.84	7.45

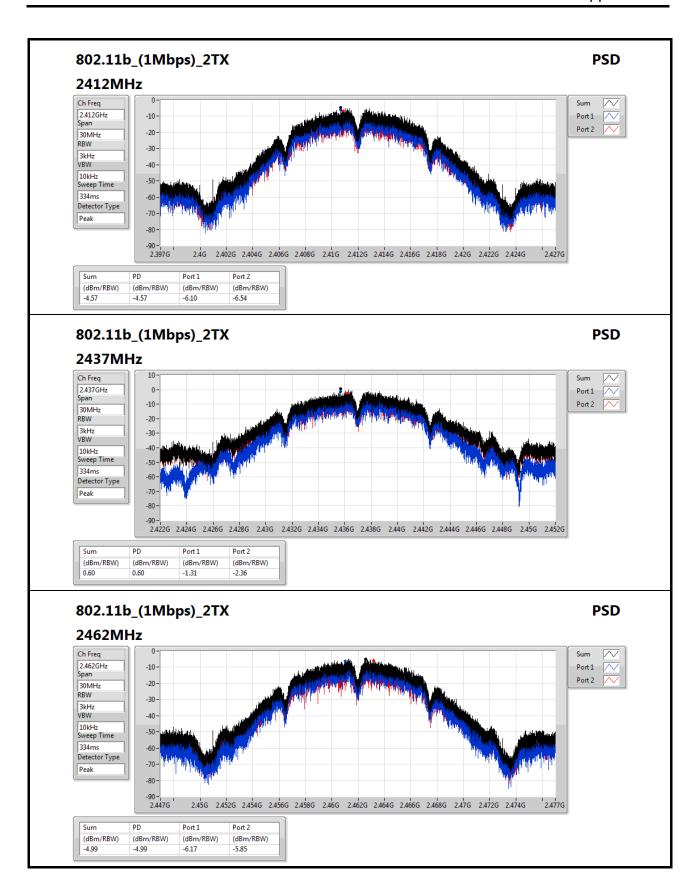
DG = Directional Gain; RBW=3kHz;
 PD = trace bin-by-bin of each transmits port summing can be performed maximum power density;
 Port X = Port X power density;

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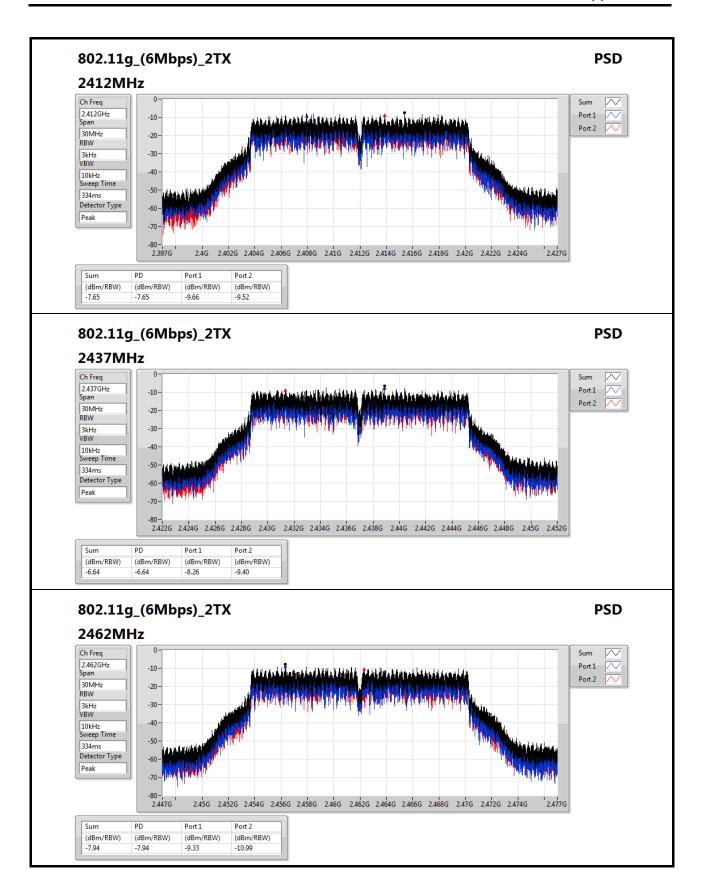
Appendix D



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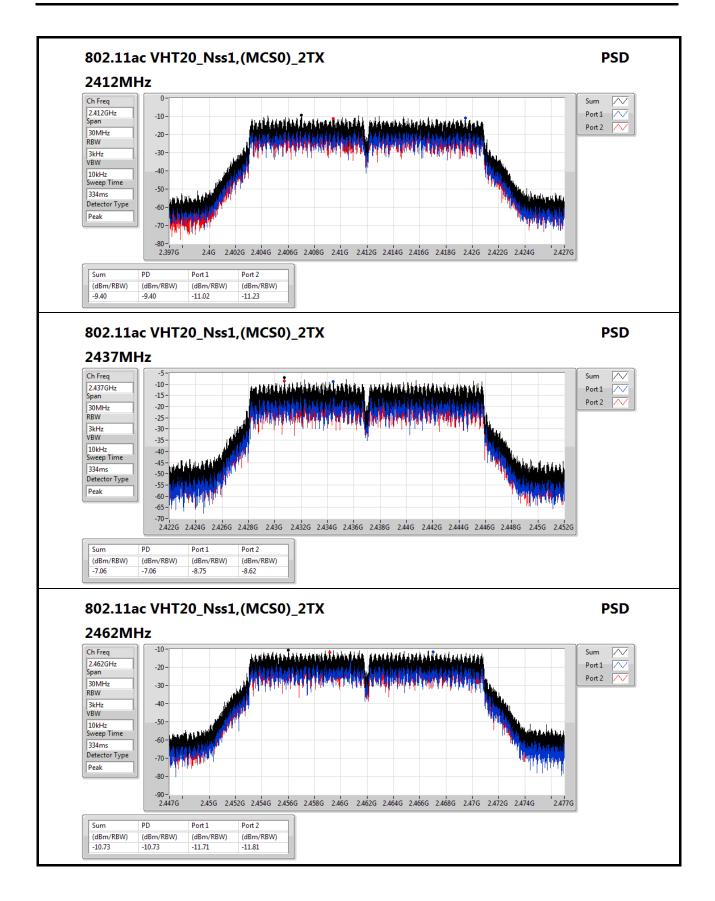
Appendix D



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Appendix D

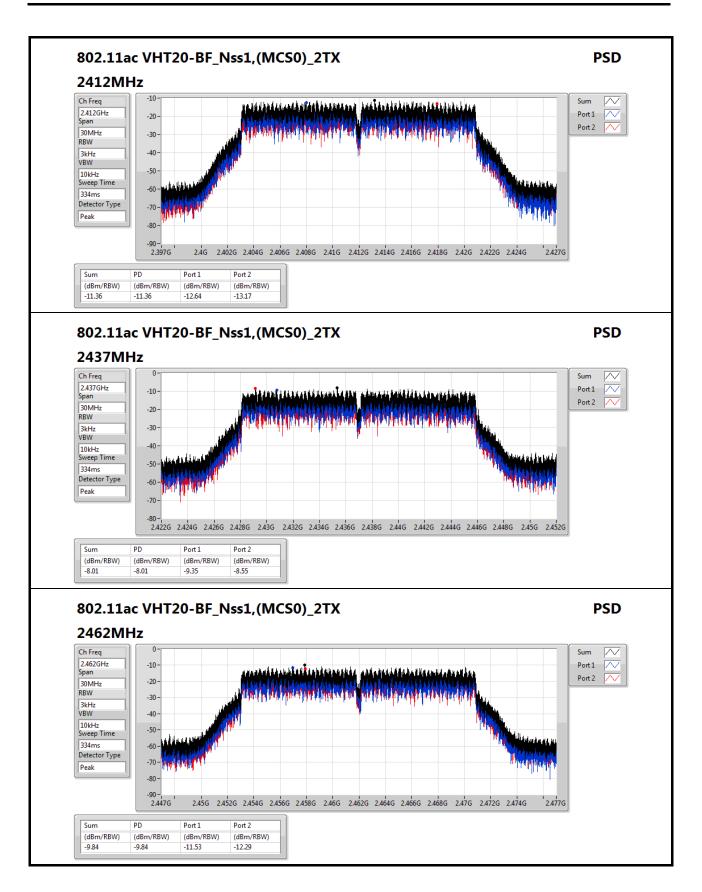




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Appendix D



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CSE Non-restricted Band Result

Appendix E

Summary

Mode	Result	Ref	Ref	Limit	Freq	Level	Freq	Level	Freq	Level	Freq	Level	Port
		(Hz)	(dBm)	(dBm)	(Hz)	(dBm)	(Hz)	(dBm)	(Hz)	(dBm)	(Hz)	(dBm)	
802.11g_(6Mbps)_2TX		-	-	-	-	-	-	-	-	-	-	-	-
2.4-2.4835GHz	Pass	2.440748G	4.35	-25.65	49.805M	-59.29	2.39992G	-29.47	2.48486G	-56.53	21.46557G	-53.02	1

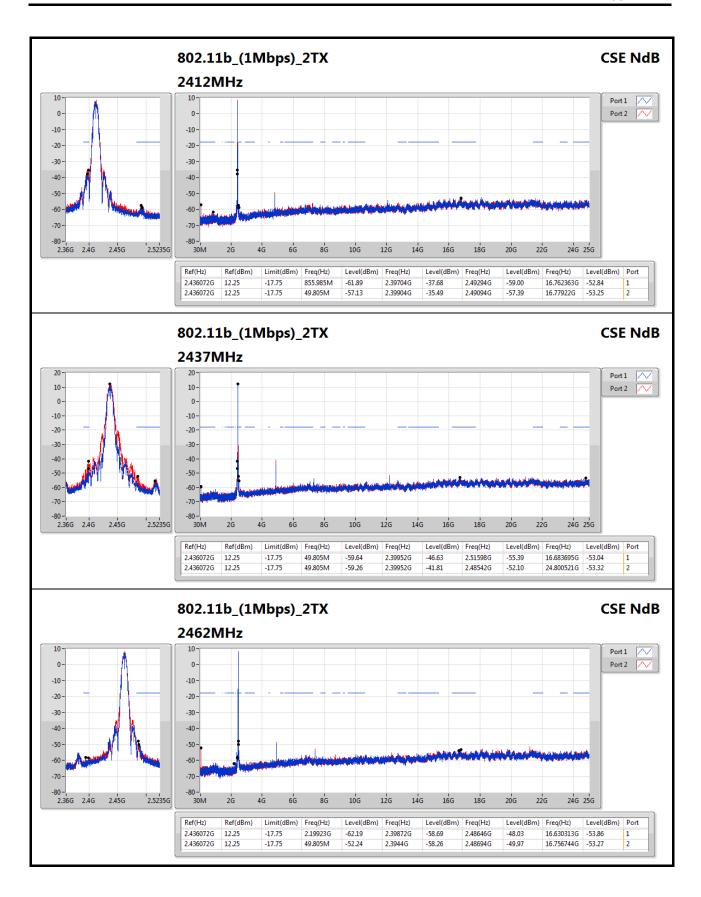
Result

Mode	Result	Ref	Ref	Limit	Freq	Level	Freq	Level	Freq	Level	Freq	Level	Port
		(Hz)	(dBm)	(dBm)	(Hz)	(dBm)	(Hz)	(dBm)	(Hz)	(dBm)	(Hz)	(dBm)	
802.11b_(1Mbps)_2TX	-	-	-	-	-	-	-	-	-	-	-	-	-
2412MHz	Pass	2.436072G	12.25	-17.75	855.985M	-61.89	2.39704G	-37.68	2.49294G	-59.00	16.762363G	-52.84	1
2412MHz	Pass	2.436072G	12.25	-17.75	49.805M	-57.13	2.39904G	-35.49	2.49094G	-57.39	16.77922G	-53.25	2
2437MHz	Pass	2.436072G	12.25	-17.75	49.805M	-59.64	2.39952G	-46.63	2.51598G	-55.39	16.683695G	-53.04	1
2437MHz	Pass	2.436072G	12.25	-17.75	49.805M	-59.26	2.39952G	-41.81	2.48542G	-52.10	24.800521G	-53.32	2
2462MHz	Pass	2.436072G	12.25	-17.75	2.19923G	-62.19	2.39872G	-58.69	2.48646G	-48.03	16.630313G	-53.86	1
2462MHz	Pass	2.436072G	12.25	-17.75	49.805M	-52.24	2.3944G	-58.26	2.48694G	-49.97	16.756744G	-53.27	2
802.11g_(6Mbps)_2TX	-	-		-	-	-	-	-	-	-	-	-	-
2412MHz	Pass	2.440748G	4.35	-25.65	49.805M	-59.29	2.39992G	-29.47	2.48486G	-56.53	21.46557G	-53.02	1
2412MHz	Pass	2.440748G	4.35	-25.65	49.805M	-60.93	2.39992G	-35.67	2.4851G	-58.06	16.326881G	-53.32	2
2437MHz	Pass	2.440748G	4.35	-25.65	49.805M	-42.46	2.39504G	-49.02	2.48382G	-55.30	16.599408G	-52.05	1
2437MHz	Pass	2.440748G	4.35	-25.65	953.845M	-61.98	2.39608G	-41.97	2.48598G	-49.80	21.769003G	-52.65	2
2462MHz	Pass	2.440748G	4.35	-25.65	49.805M	-56.38	2.39808G	-57.65	2.48382G	-43.36	16.737077G	-52.98	1
2462MHz	Pass	2.440748G	4.35	-25.65	49.805M	-58.32	2.39792G	-52.37	2.48446G	-37.54	16.720219G	-53.56	2
802.11ac VHT20_Nss1,(MCS0)_2TX	-	-	-	-	-	-	-	-	-	-	-	-	-
2412MHz	Pass	2.435738G	4.76	-25.24	2.309905G	-62.19	2.39896G	-32.94	2.49446G	-60.04	16.807316G	-52.91	1
2412MHz	Pass	2.435738G	4.76	-25.24	899.09M	-62.48	2.3996G	-35.39	2.48478G	-58.22	16.829792G	-54.14	2
2437MHz	Pass	2.435738G	4.76	-25.24	852.49M	-61.94	2.39544G	-45.10	2.48446G	-51.82	17.695138G	-53.71	1
2437MHz	Pass	2.435738G	4.76	-25.24	49.805M	-46.99	2.39952G	-35.78	2.4867G	-43.37	16.748315G	-53.57	2
2462MHz	Pass	2.435738G	4.76	-25.24	293.29M	-62.58	2.39568G	-57.70	2.48374G	-41.98	17.054557G	-53.51	1
2462MHz	Pass	2.435738G	4.76	-25.24	2.076905G	-62.23	2.3932G	-51.97	2.48374G	-37.06	24.814569G	-52.20	2
802.11ac VHT20-BF_Nss1,(MCS0)_2TX	-	-		-	-	-	-	-	-	-	-	-	-
2412MHz	Pass	2.433233G	4.72	-25.28	671.915M	-62.74	2.39768G	-40.32	2.49822G	-60.19	16.753934G	-53.47	1
2412MHz	Pass	2.433233G	4.72	-25.28	655.605M	-62.19	2.39448G	-38.29	2.48654G	-58.89	24.747139G	-52.99	2
2437MHz	Pass	2.433233G	4.72	-25.28	49.805M	-60.28	2.3988G	-48.23	2.48446G	-54.43	16.742696G	-52.66	1
2437MHz	Pass	2.433233G	4.72	-25.28	49.805M	-60.41	2.3976G	-37.58	2.48446G	-44.63	16.739886G	-53.49	2
2462MHz	Pass	2.433233G	4.72	-25.28	2.307575G	-63.09	2.396G	-57.48	2.48654G	-44.83	16.703362G	-53.15	1
2462MHz	Pass	2.433233G	4.72	-25.28	823.365M	-61.76	2.3932G	-52.72	2.48766G	-36.37	17.029271G	-53.41	2

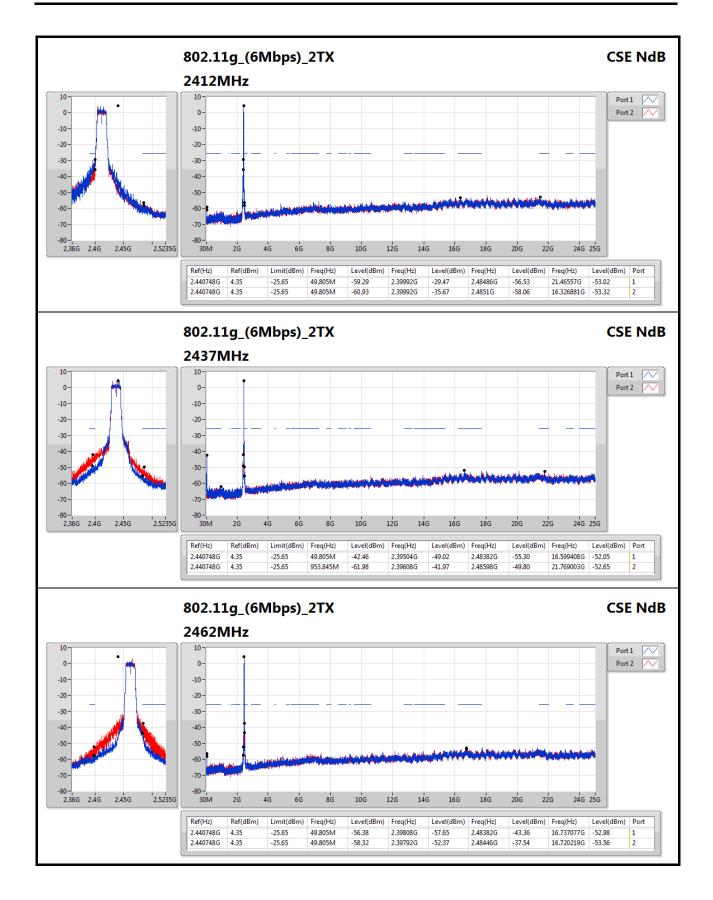
SPORTON INTERNATIONAL INC.

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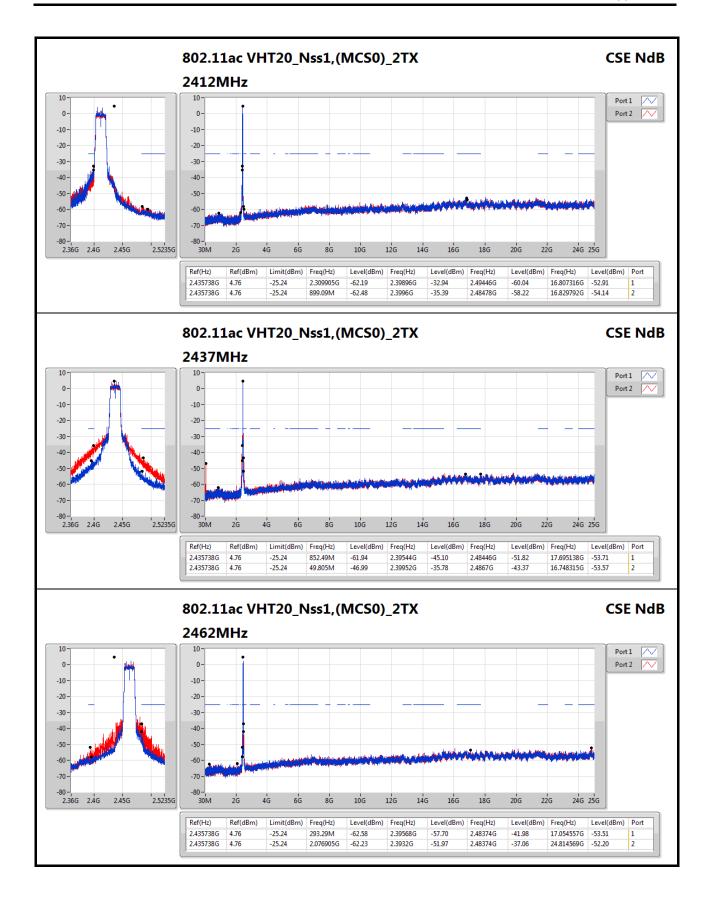




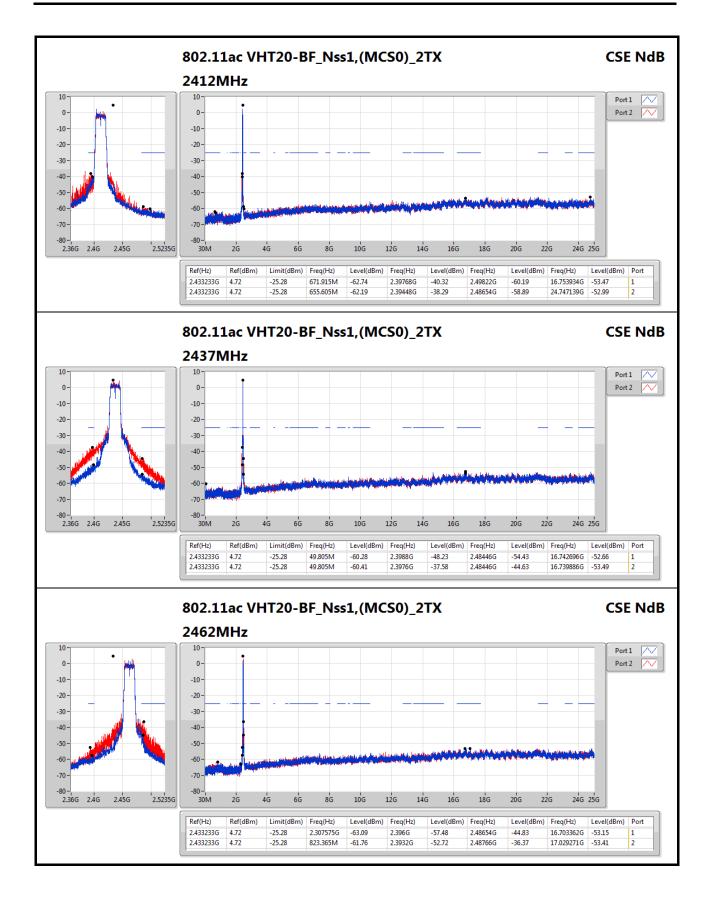




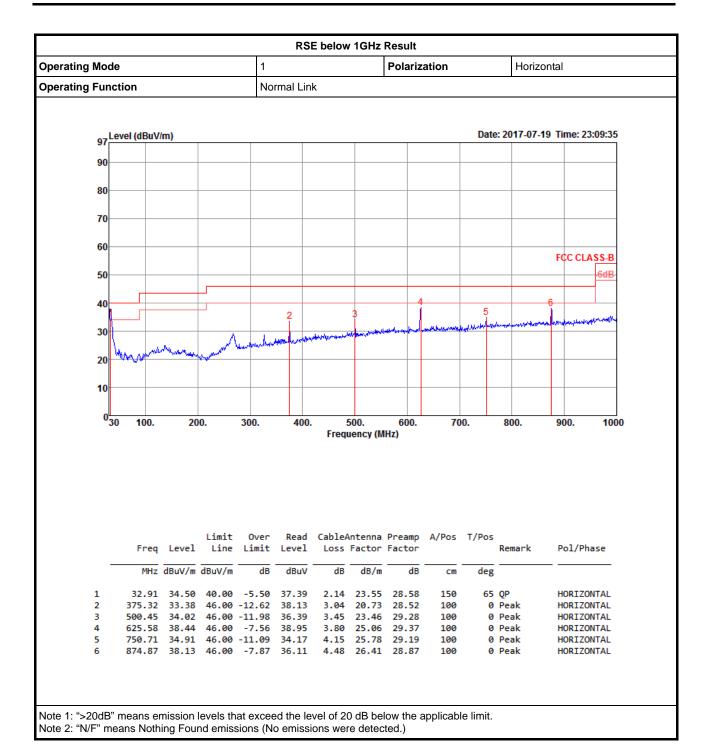






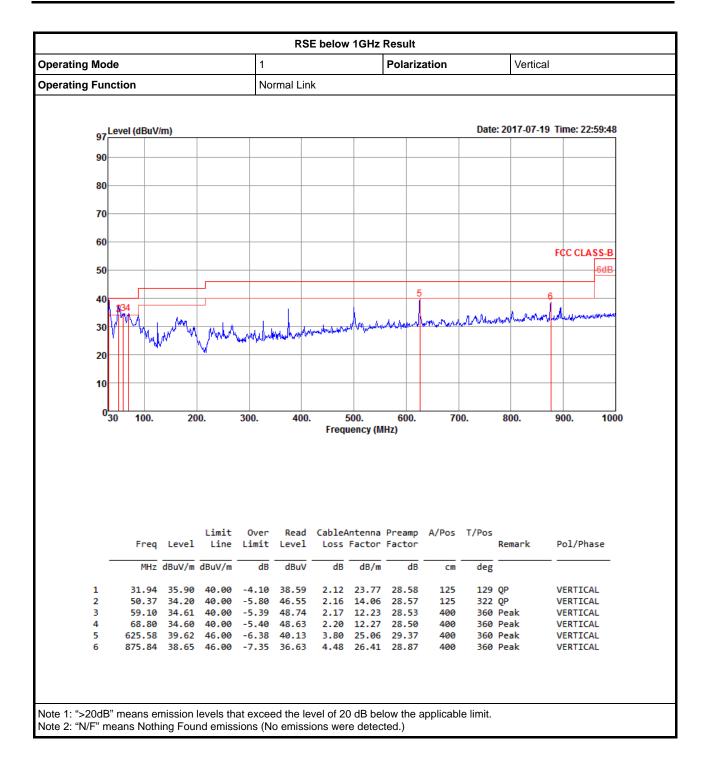






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RSE TX above 1GHz Result

Appendix F.2

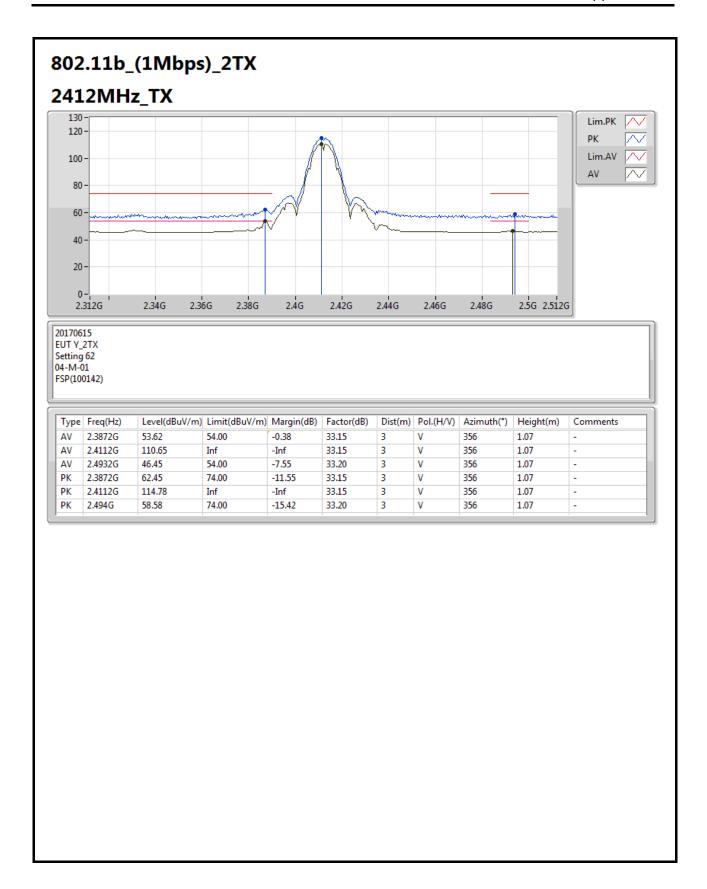
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Summary

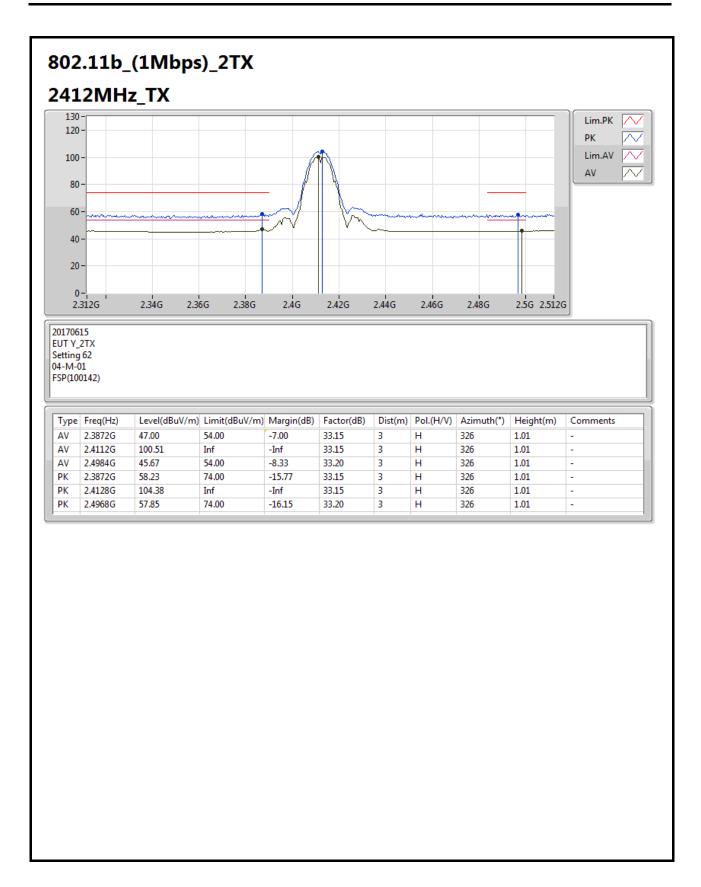
Mode	Result	Туре	Freq	Level	Limit	Margin	Factor	Dist	Pol.	Azimuth	Height	Comments
			(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dB)	(m)	(H/V)	(°)	(m)	
802.11ac VHT20-BF_Nss1,(MCS0)_2TX	-	-	-	-	-	-	-	-	-	-	-	-
2.4-2.4835GHz	Pass	PK	2.3886G	73.97	74.00	-0.03	31.04	3	V	0	1.39	-

SPORTON INTERNATIONAL INC.

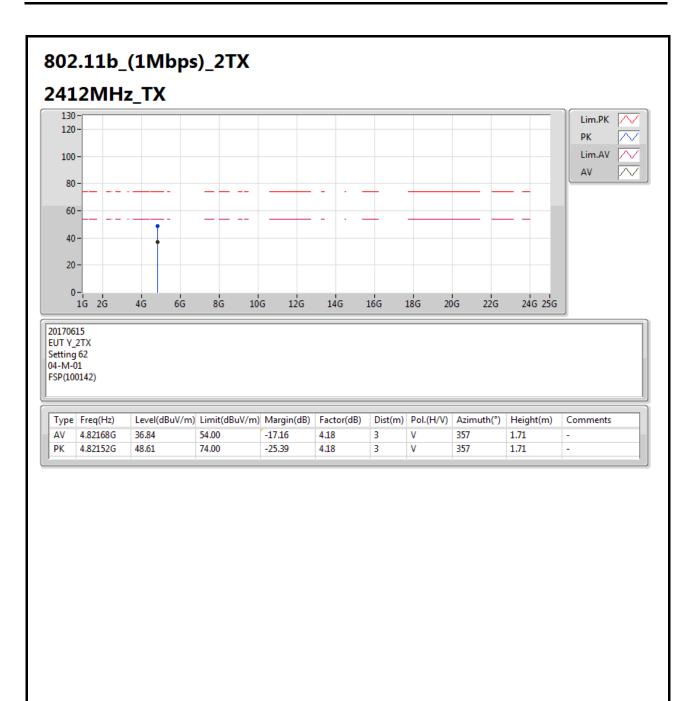




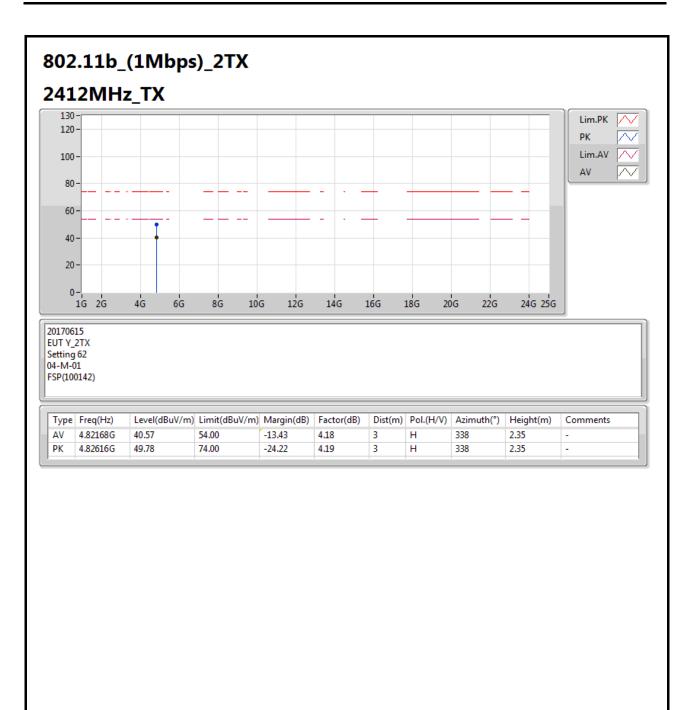




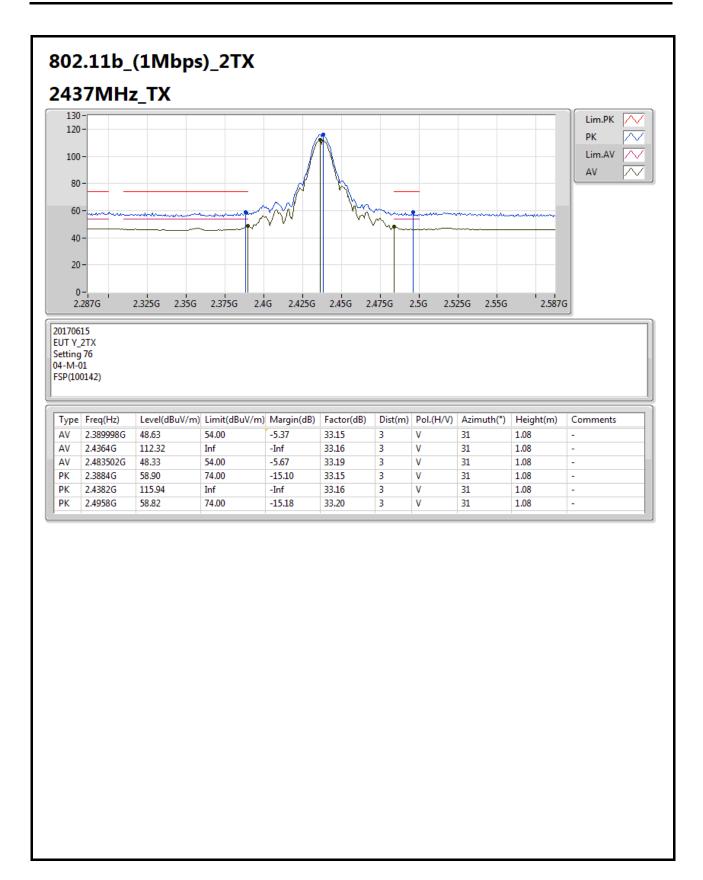




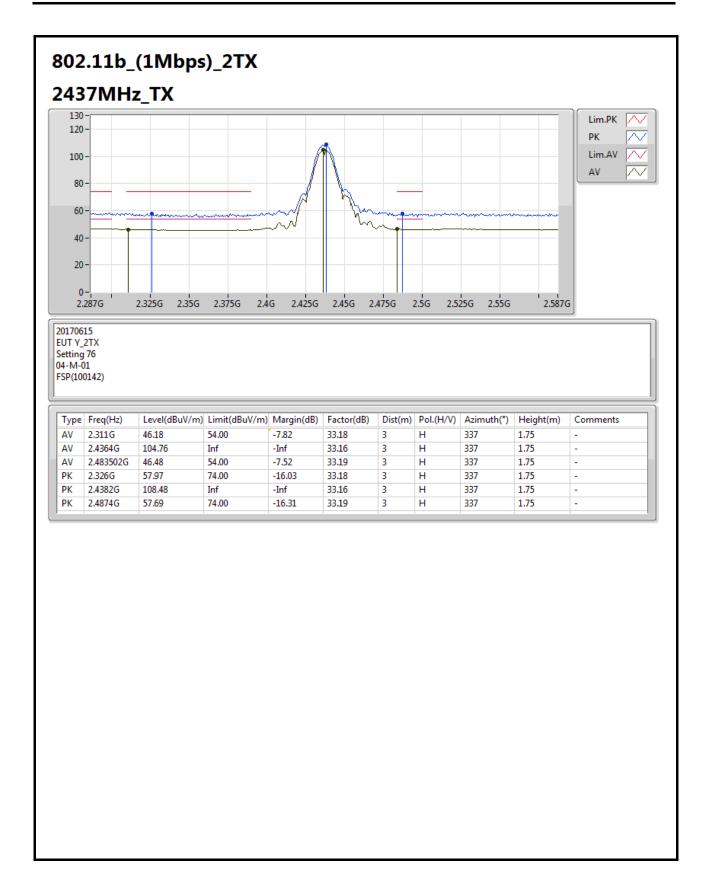




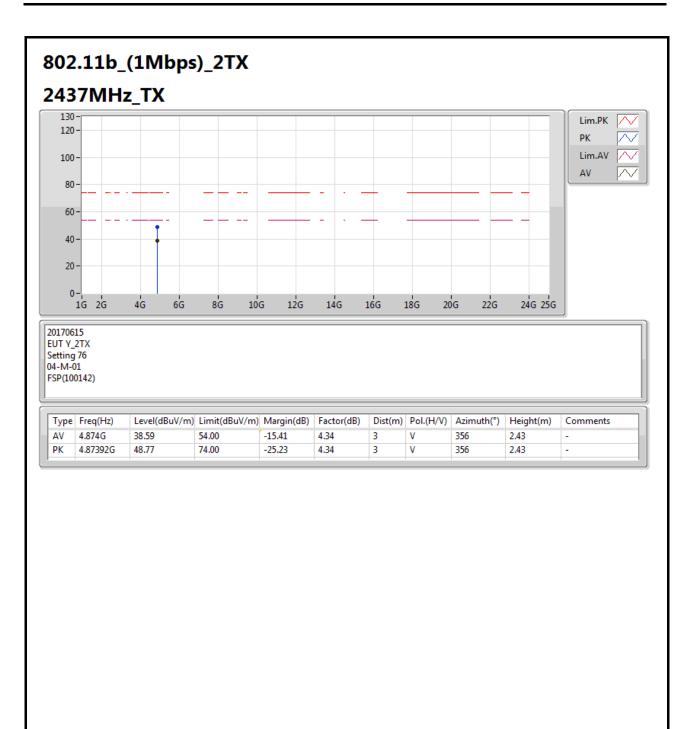




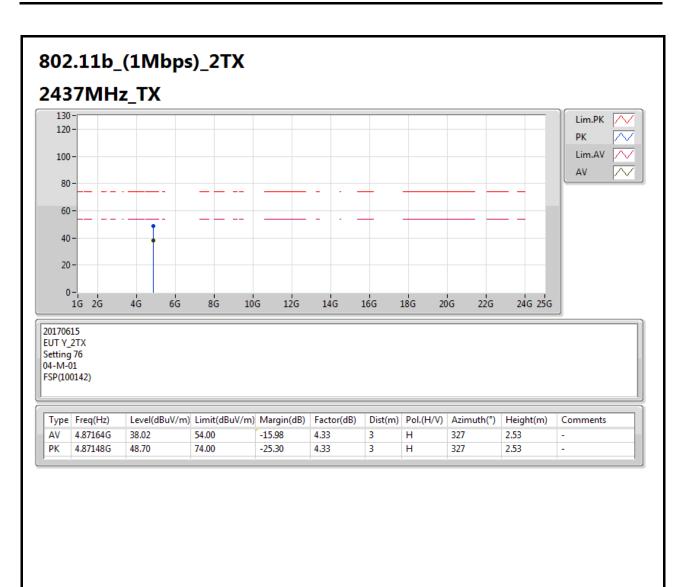




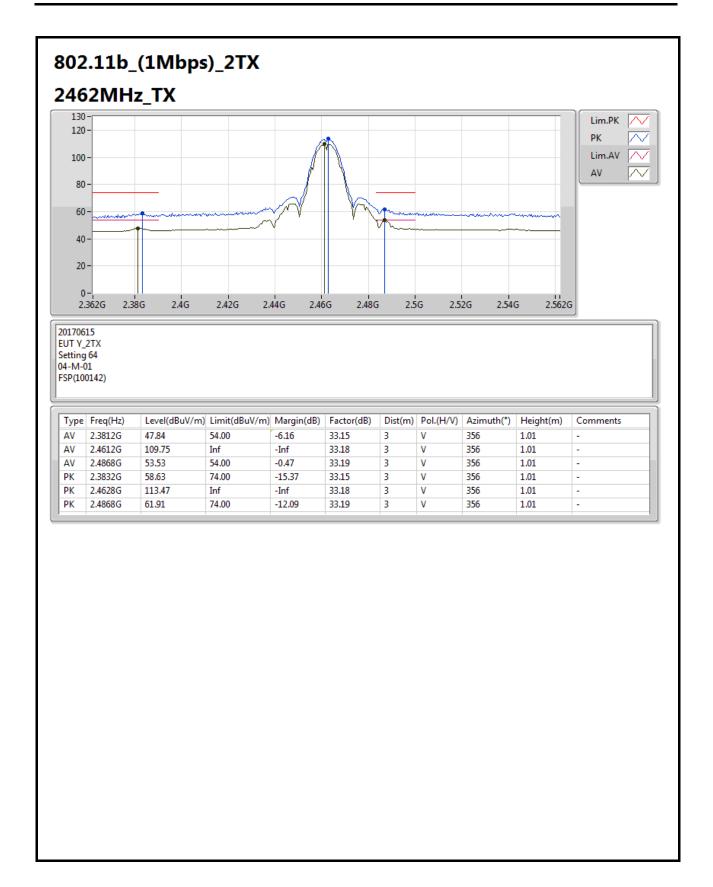




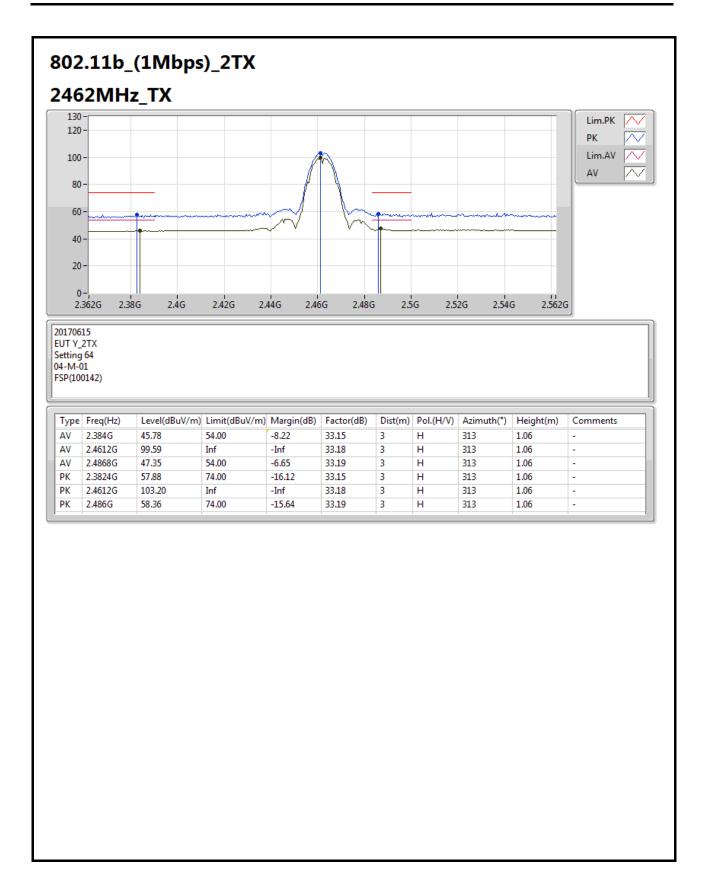




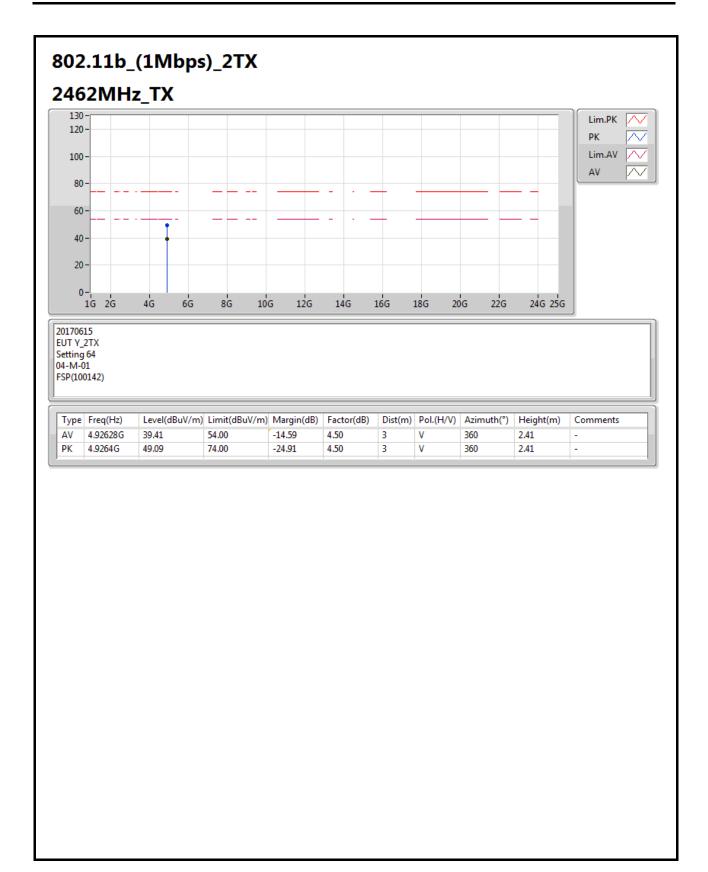








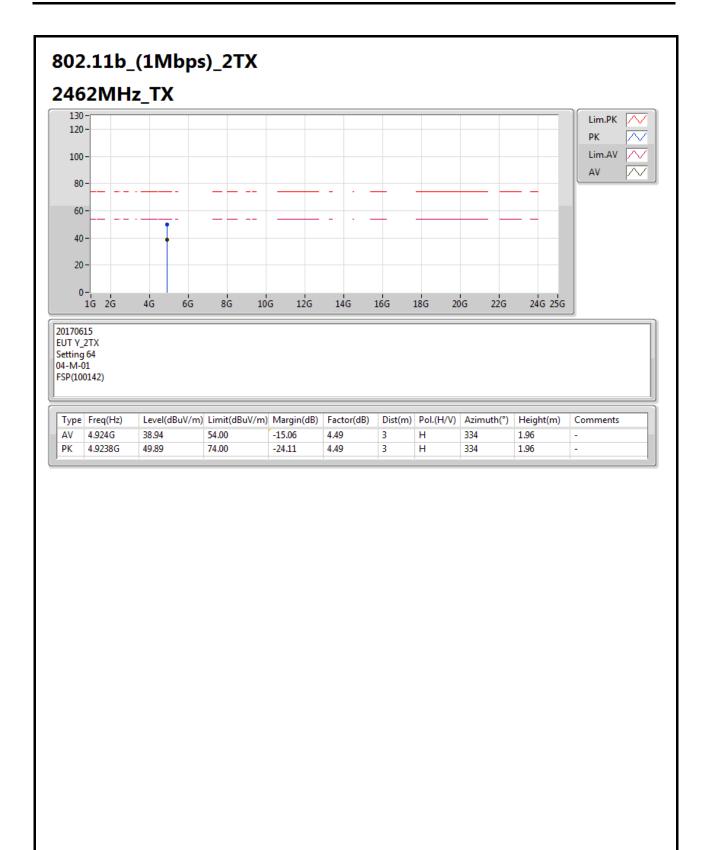




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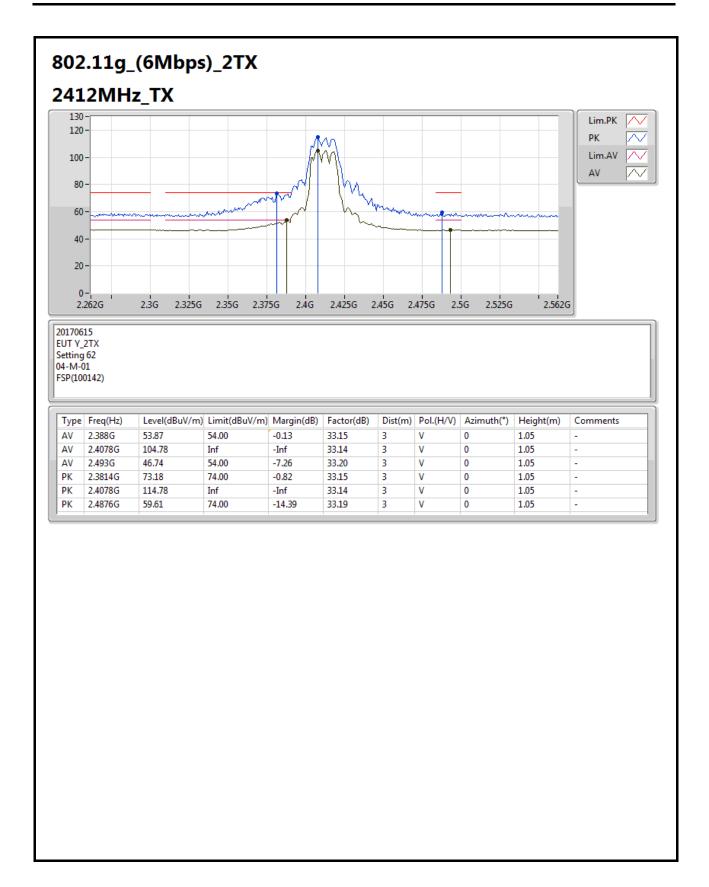




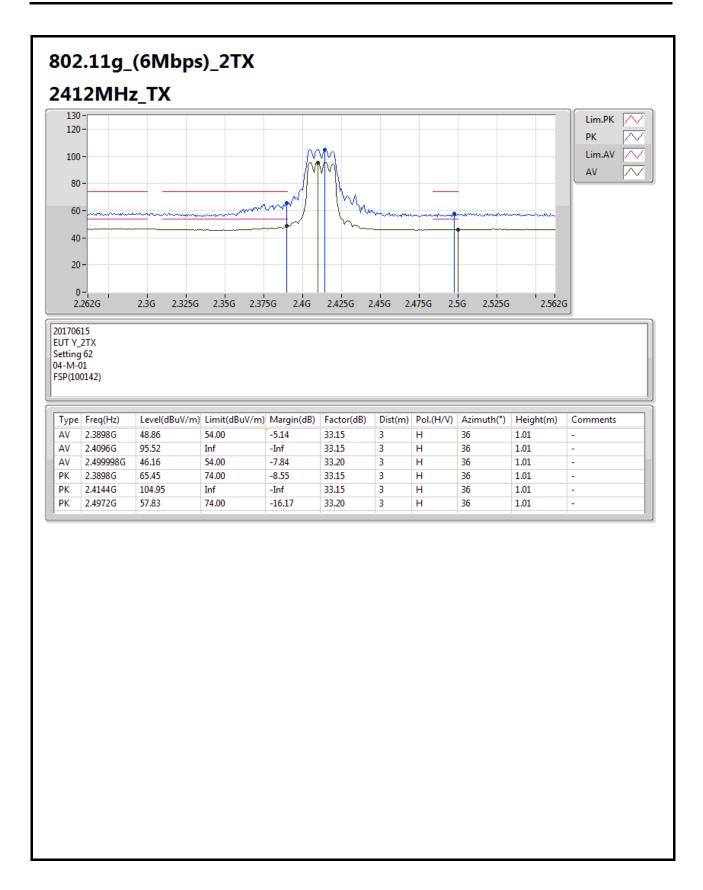
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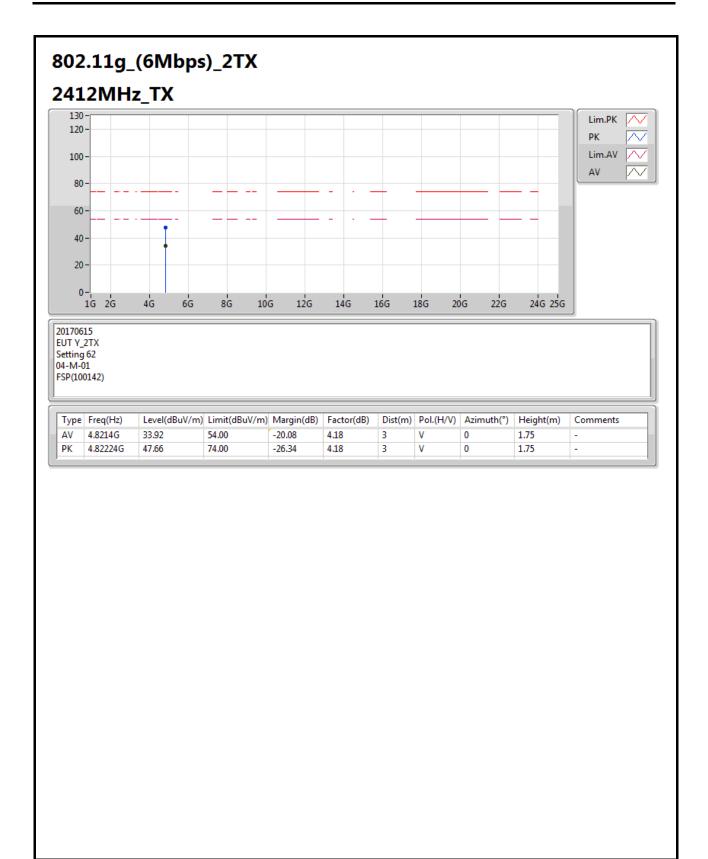




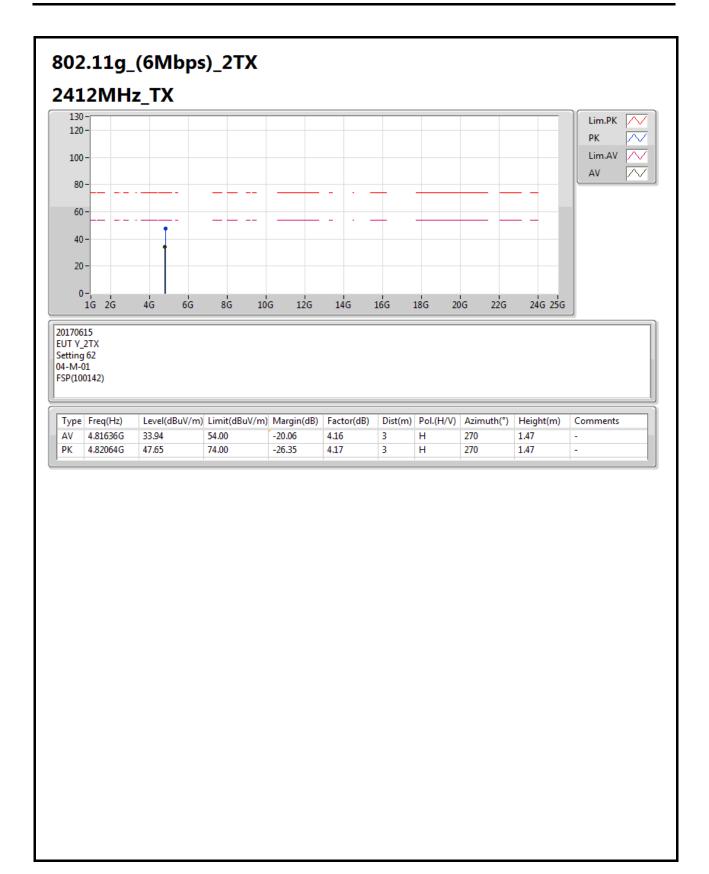
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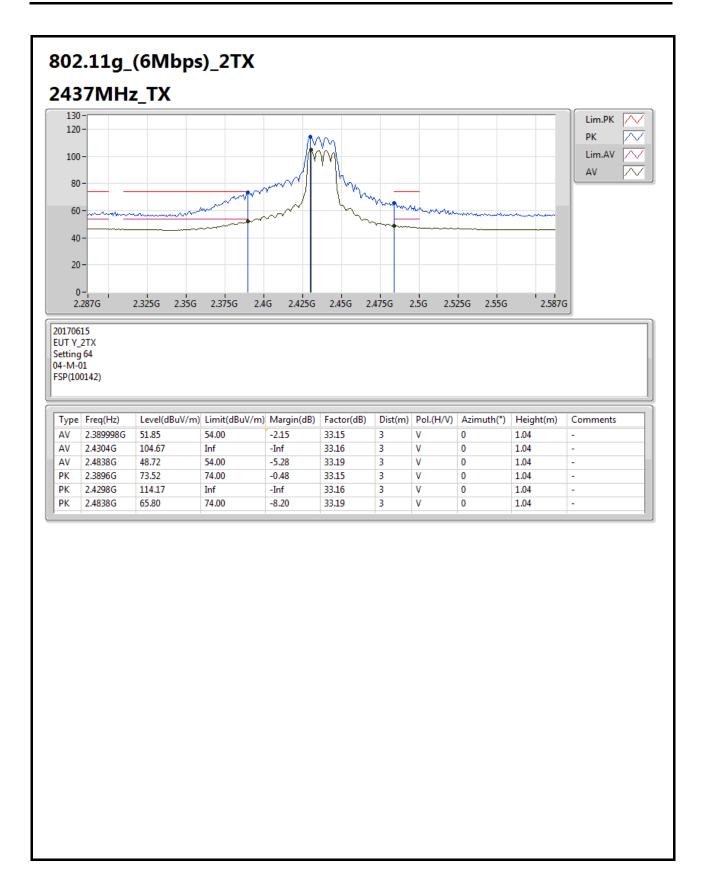








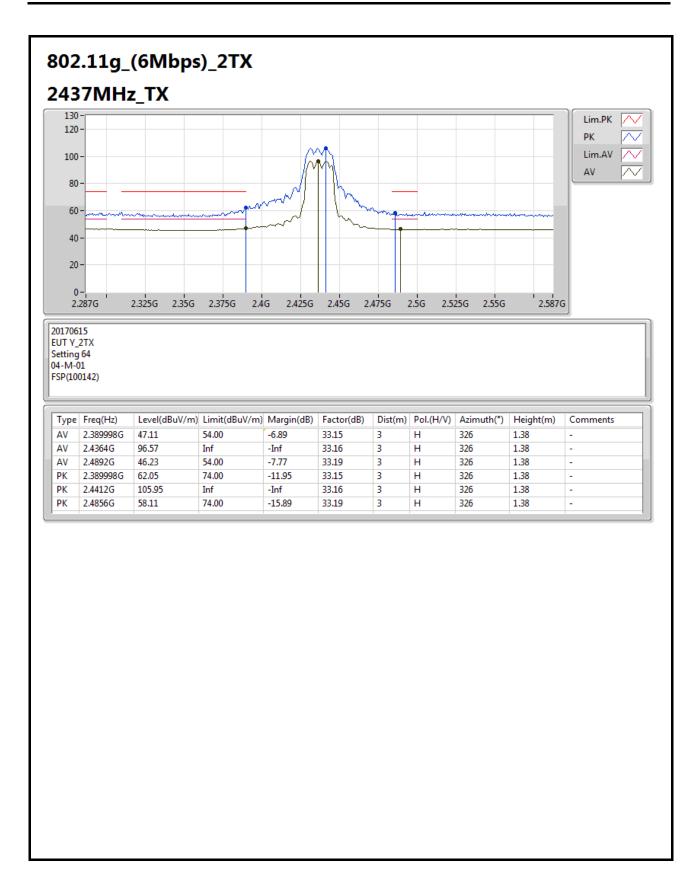




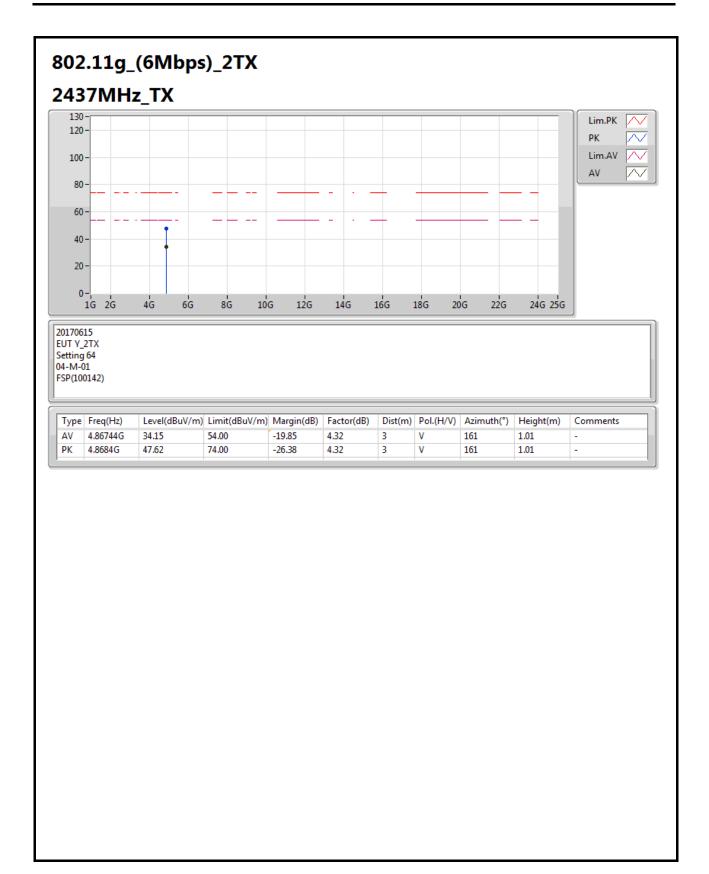
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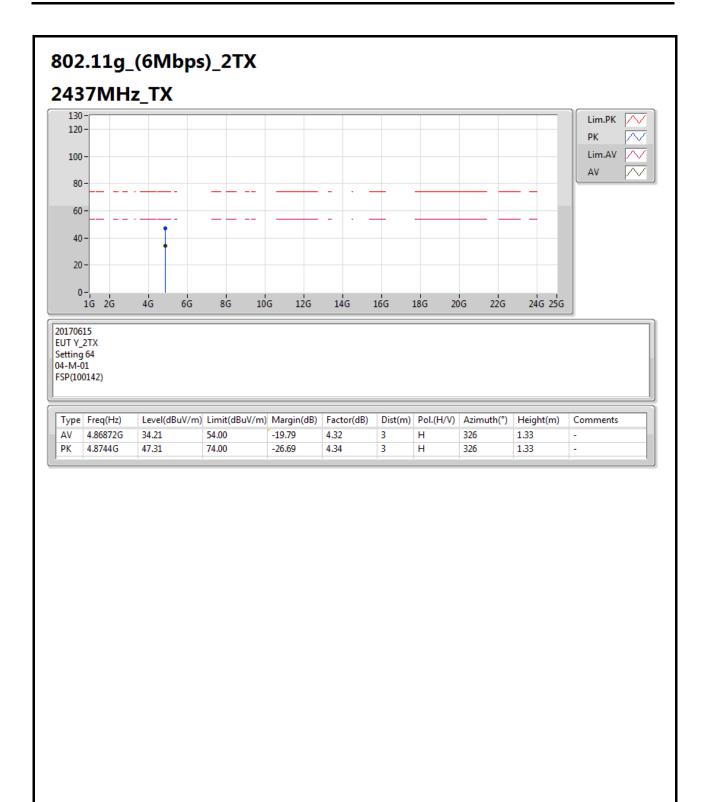








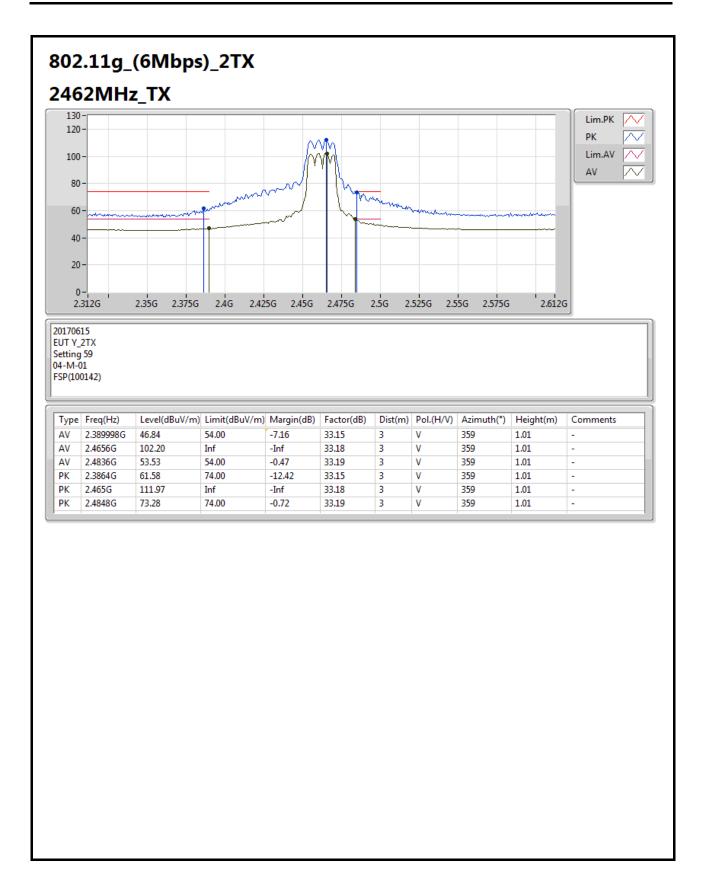




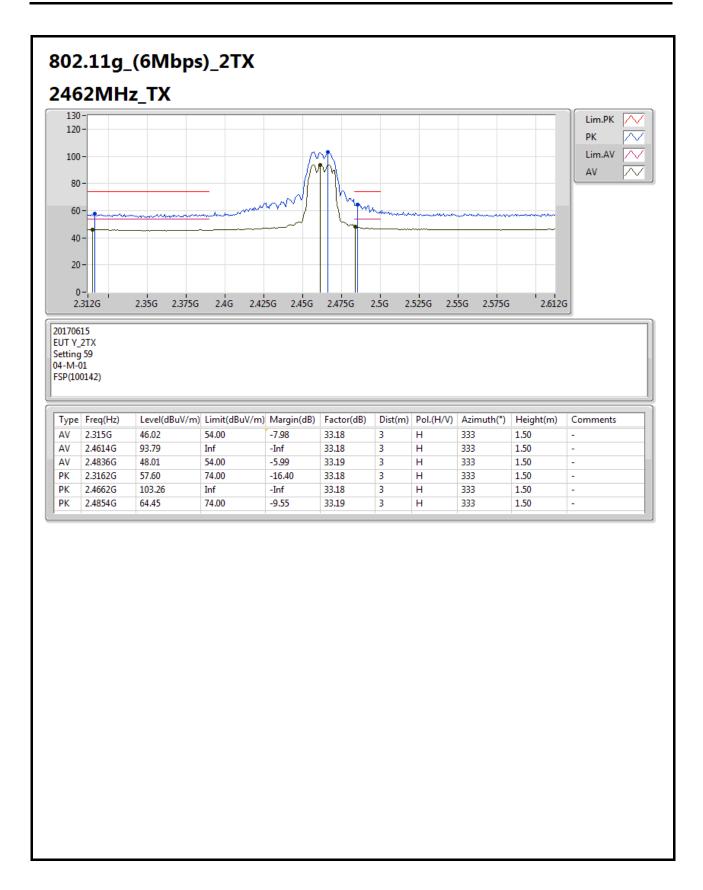
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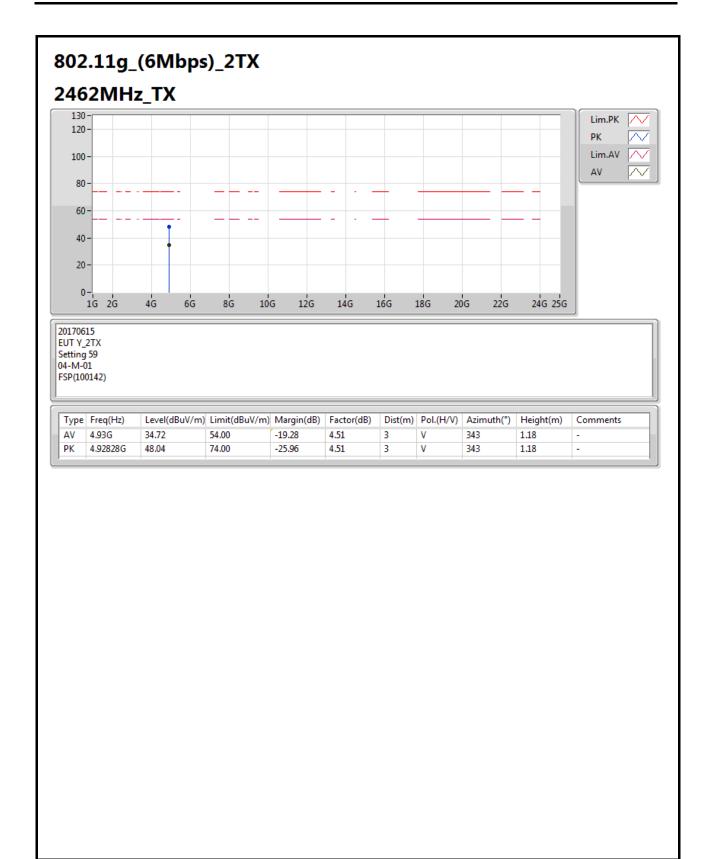




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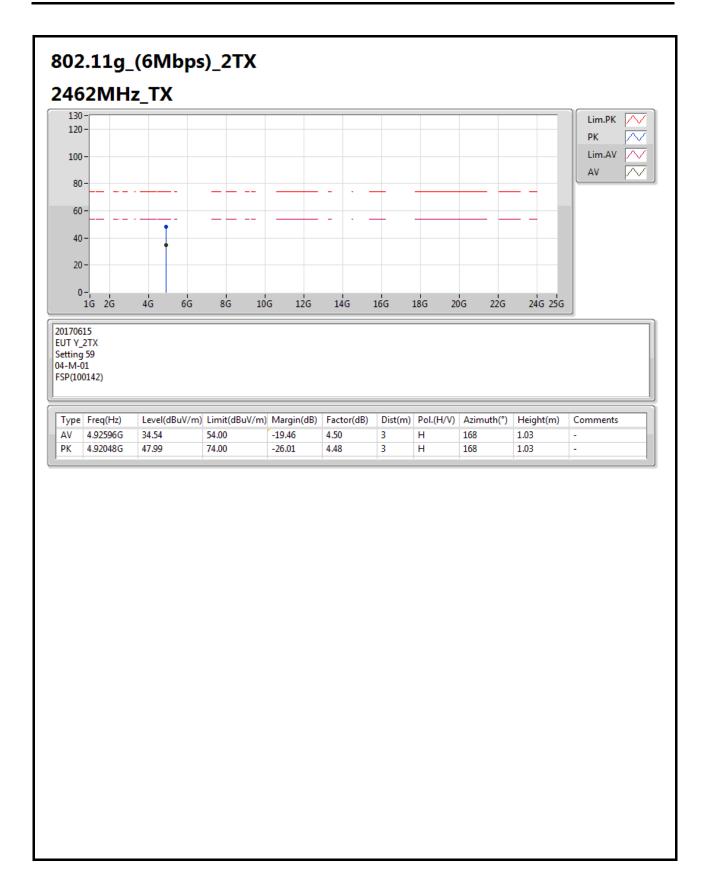
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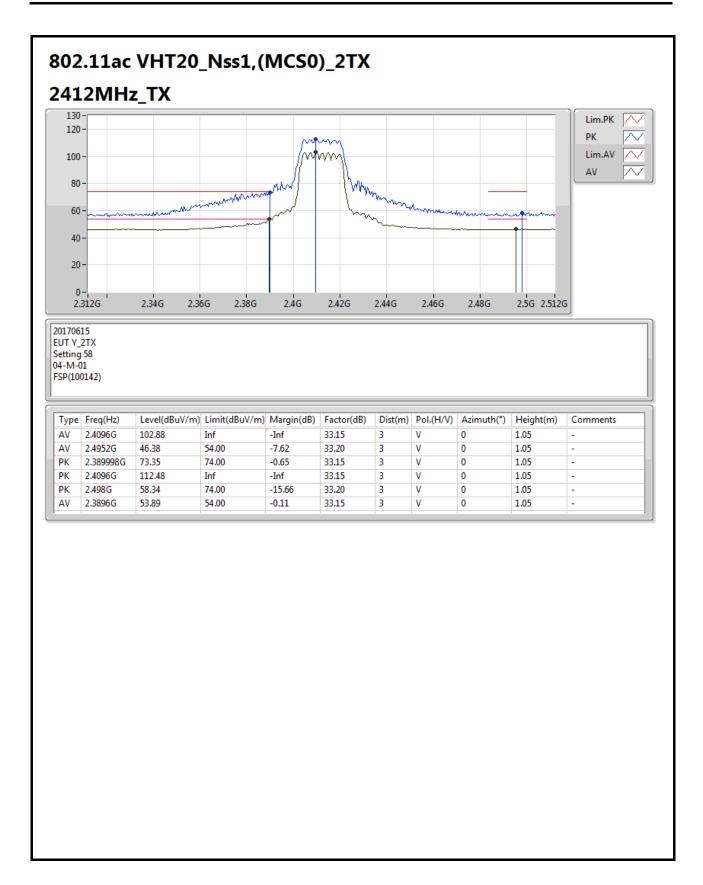
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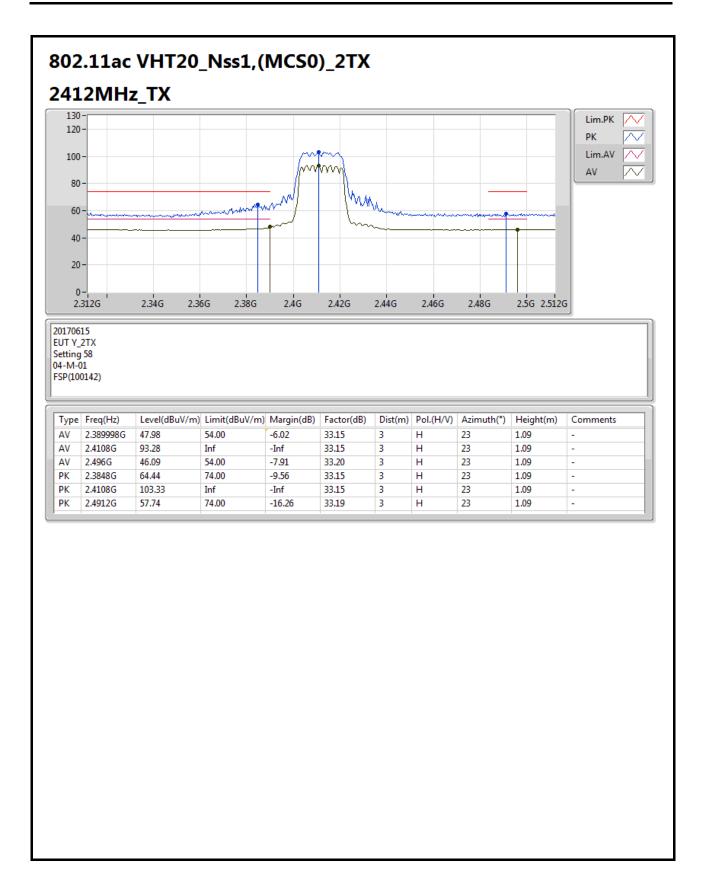


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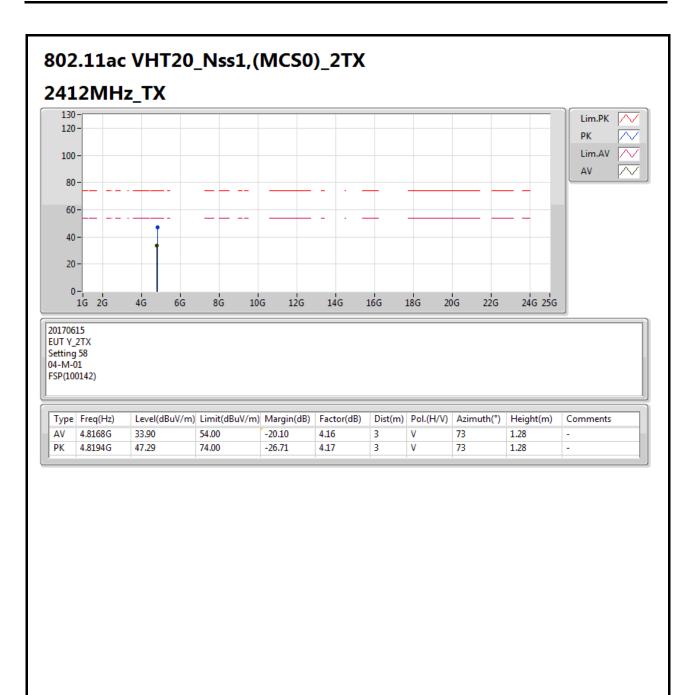




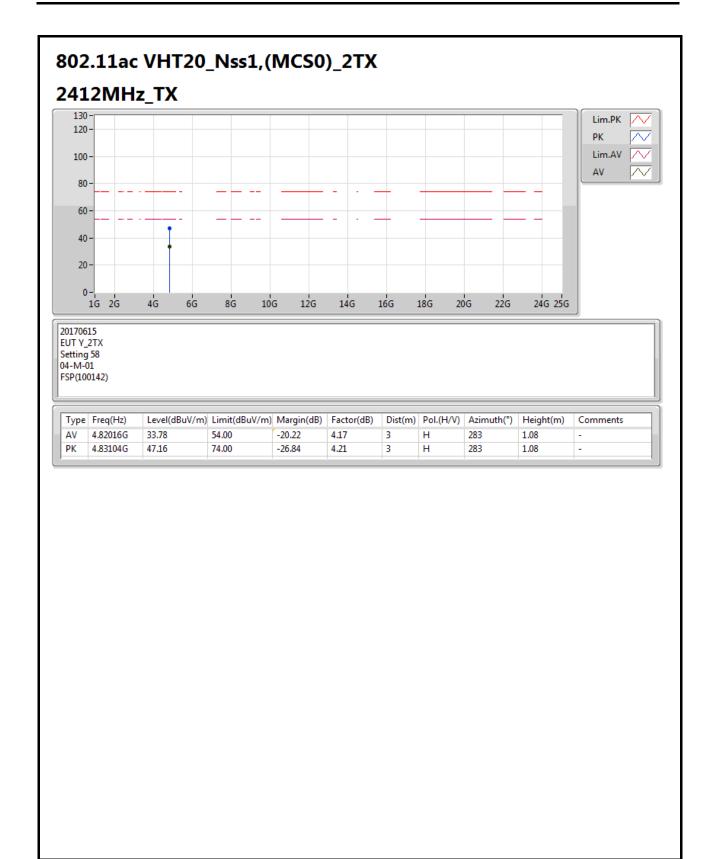




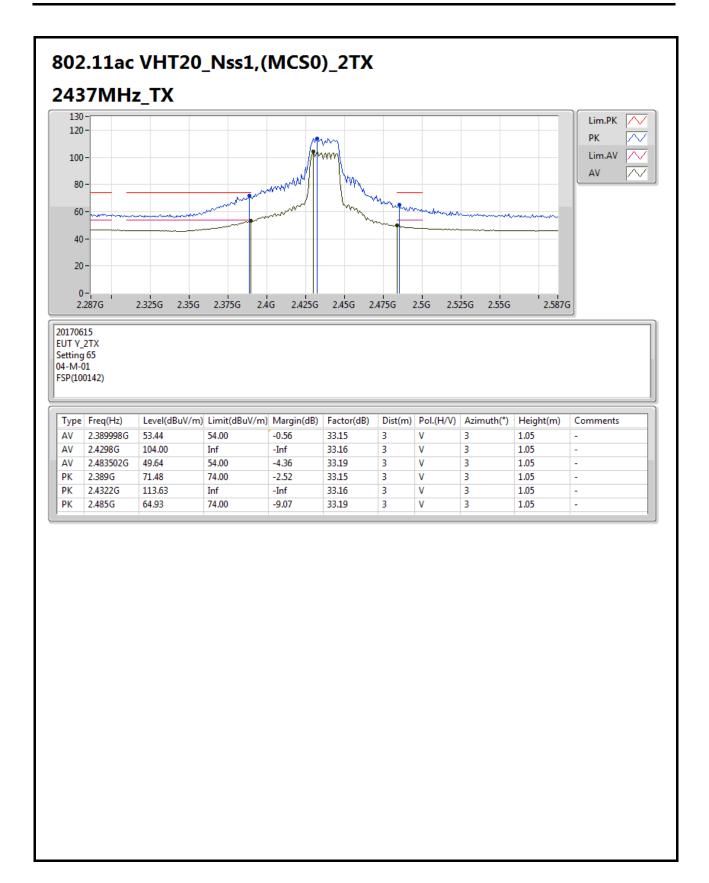




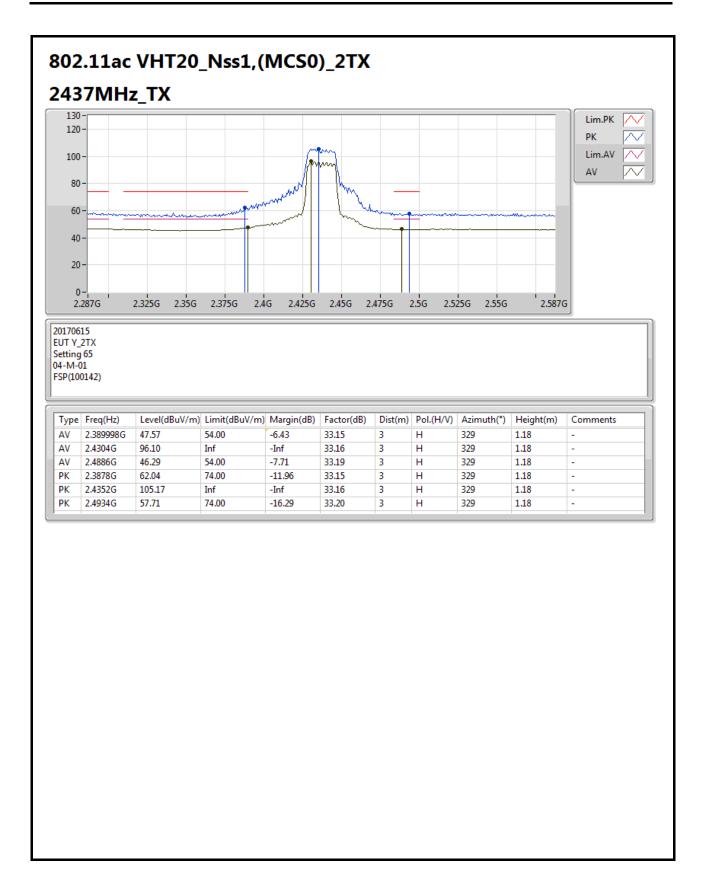




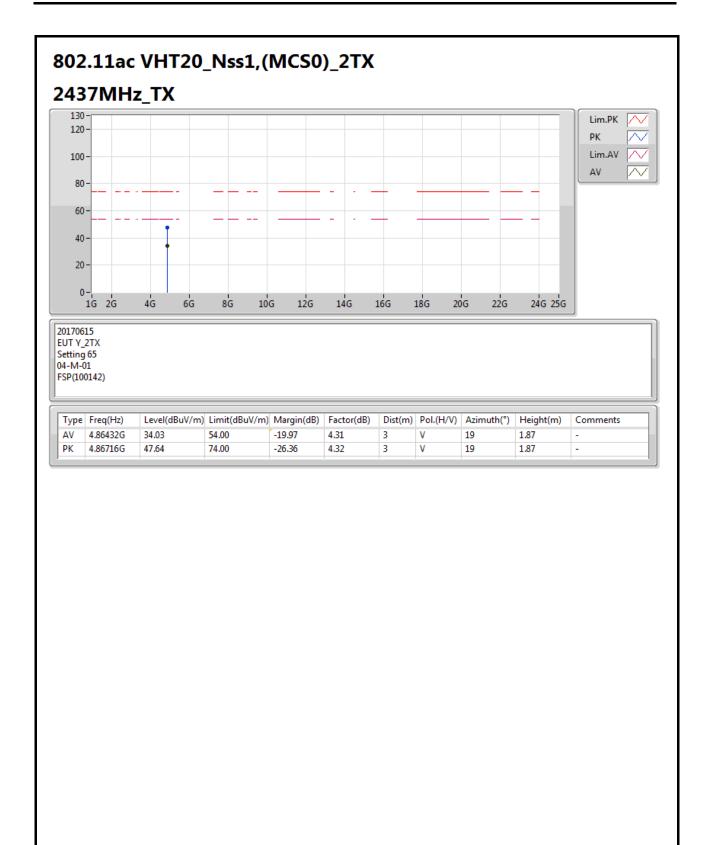




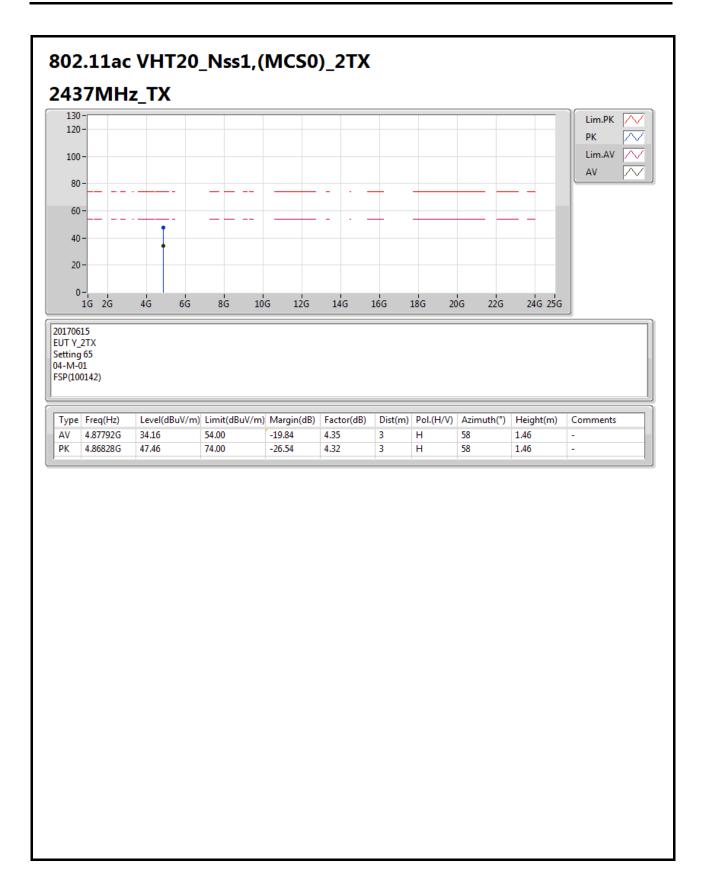






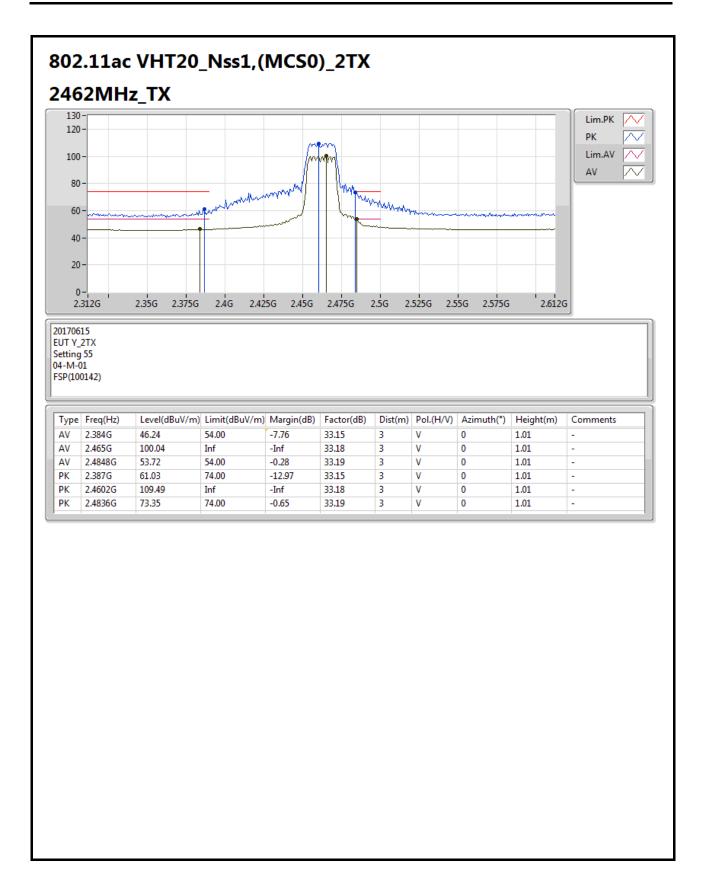






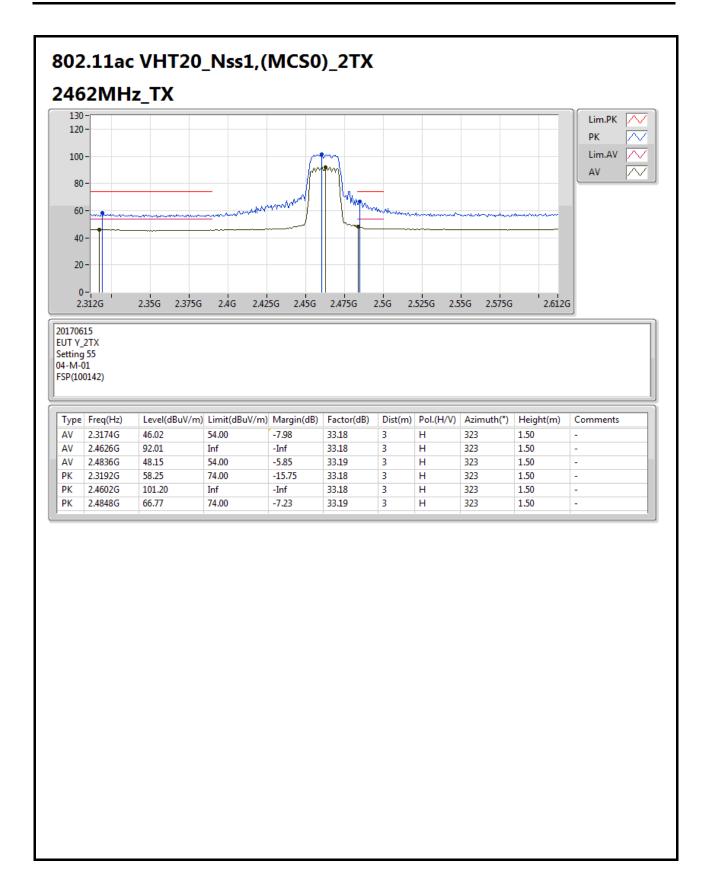
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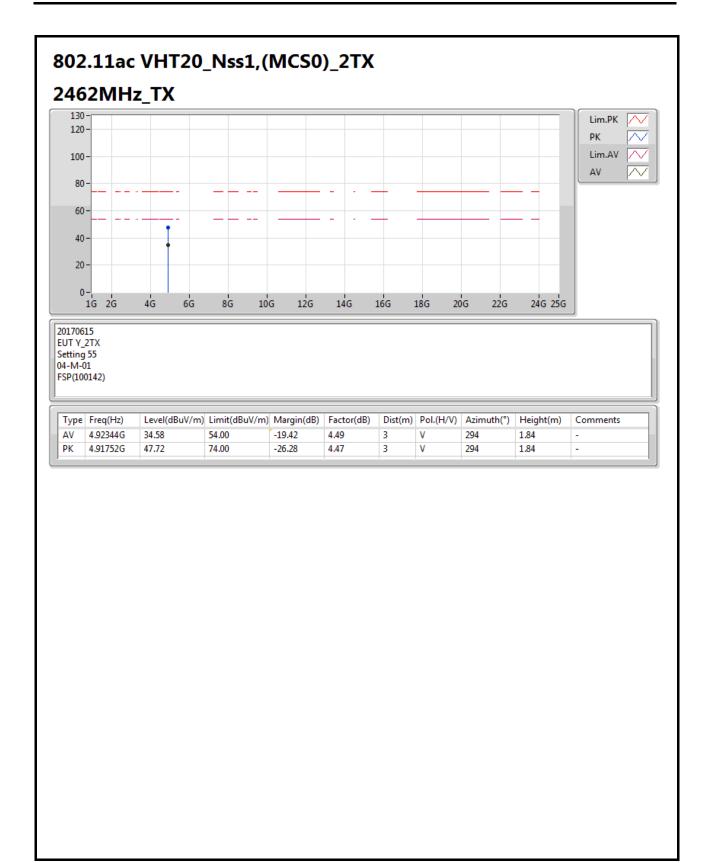


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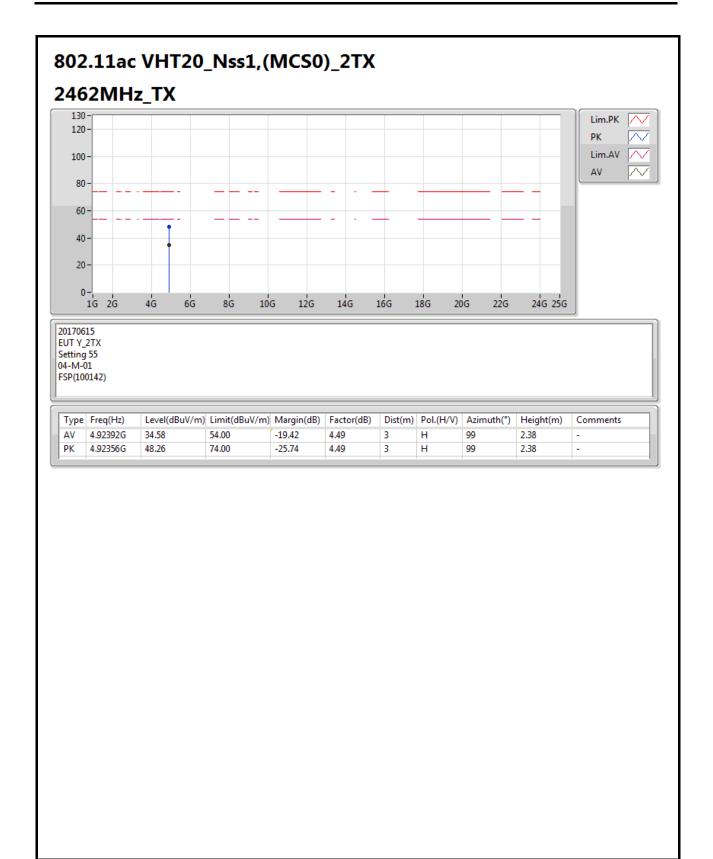




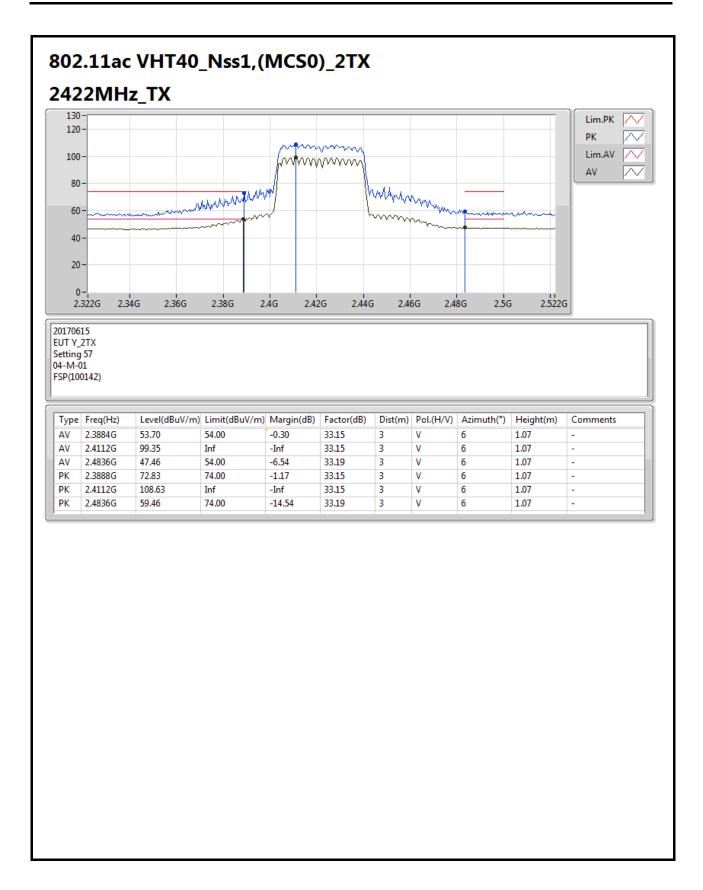
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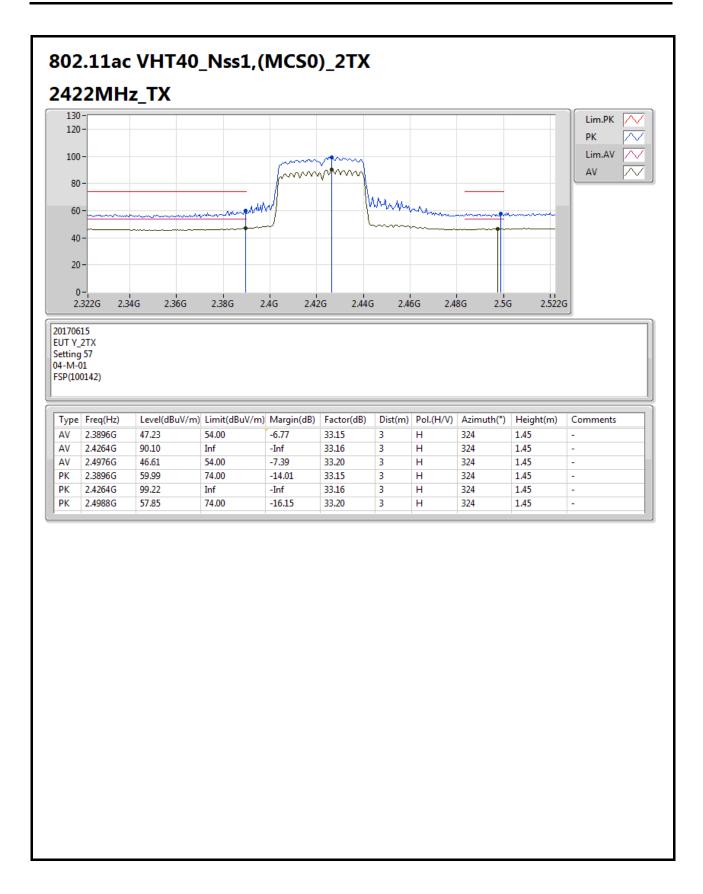




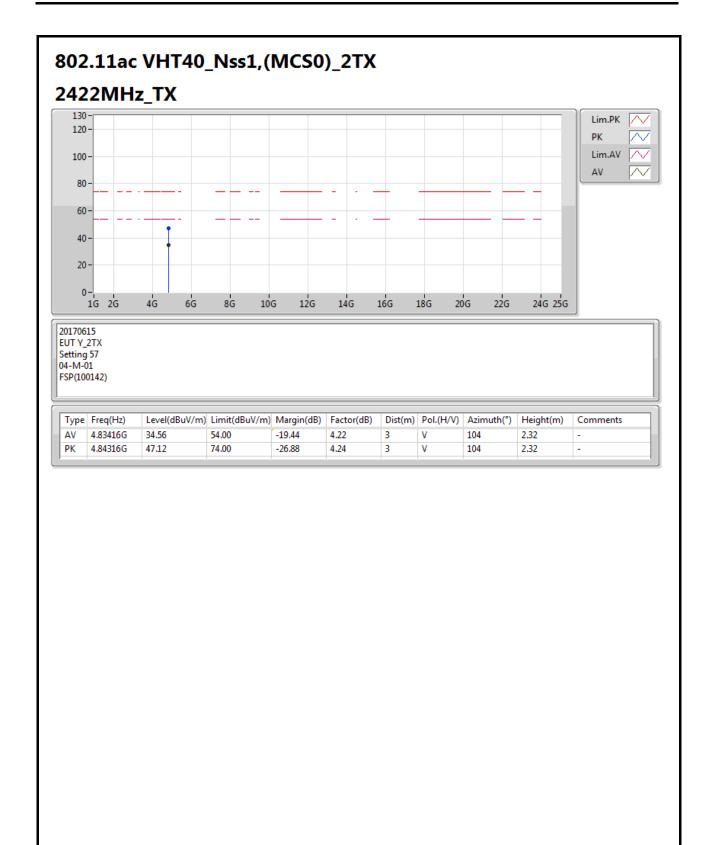




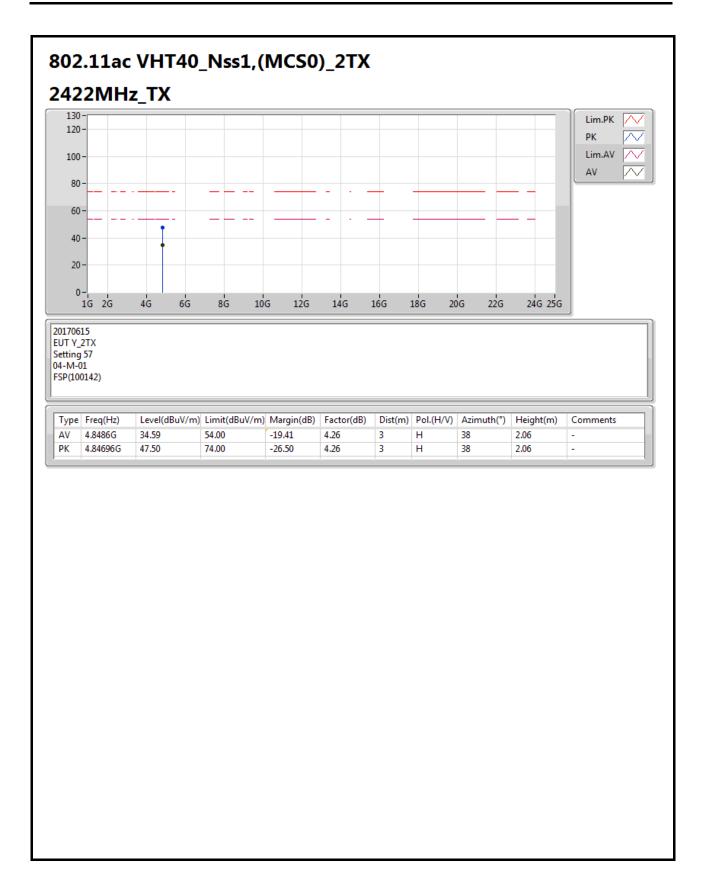




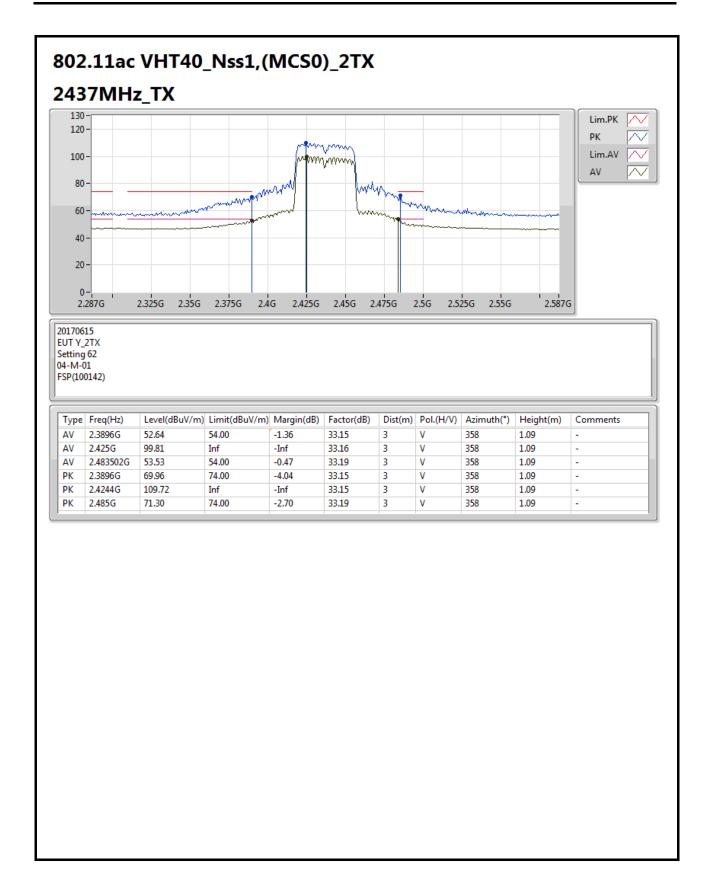




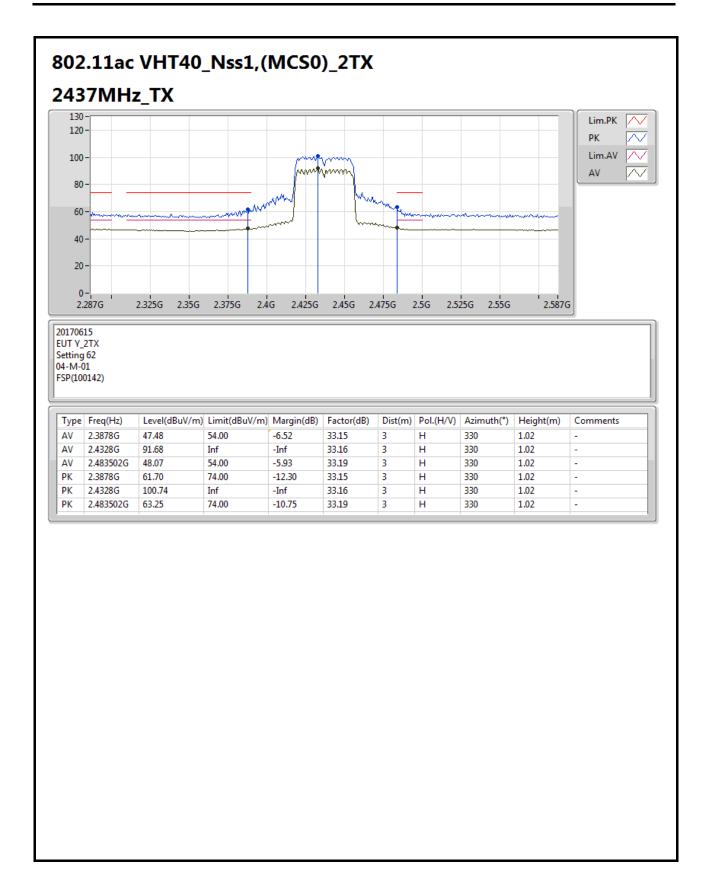




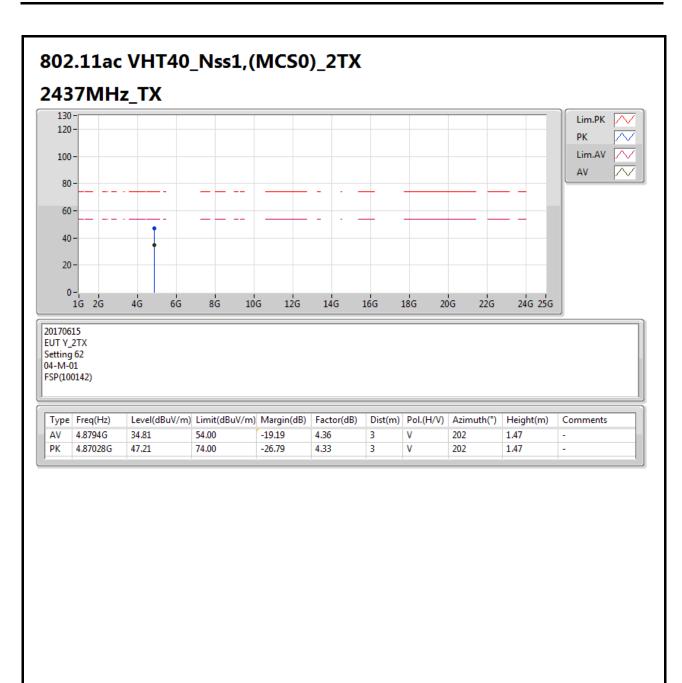




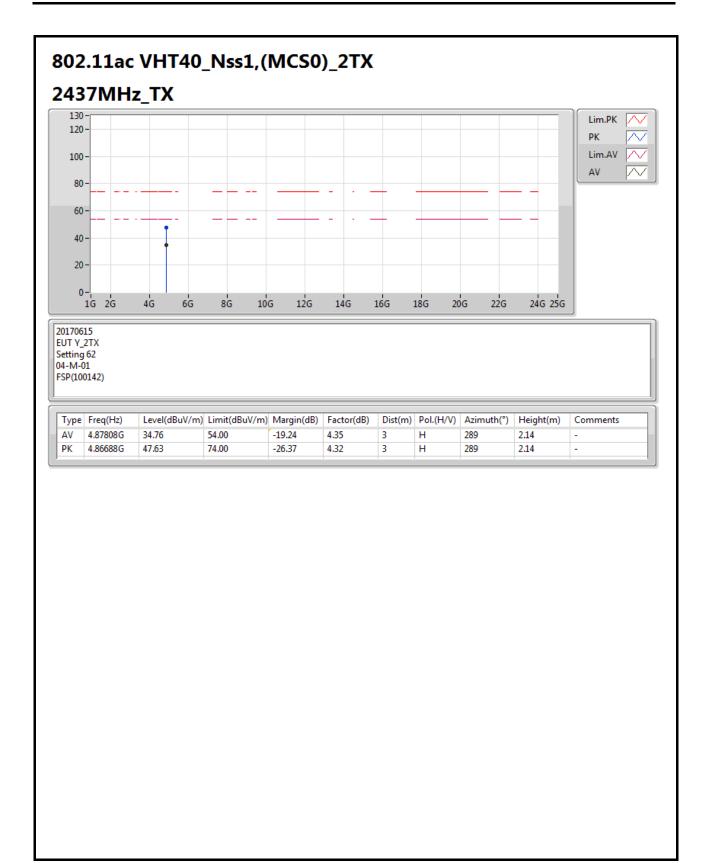




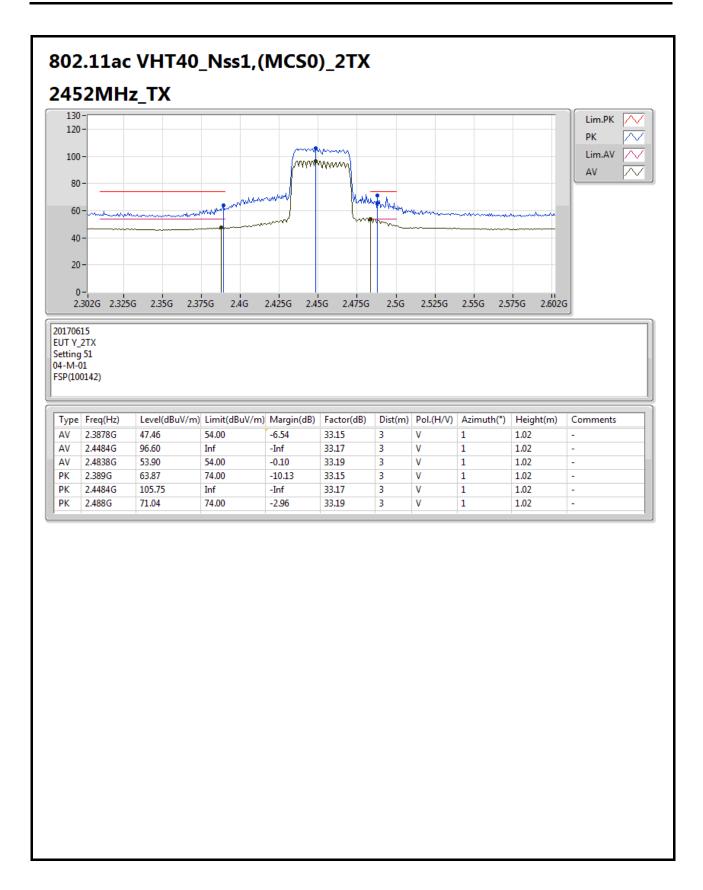




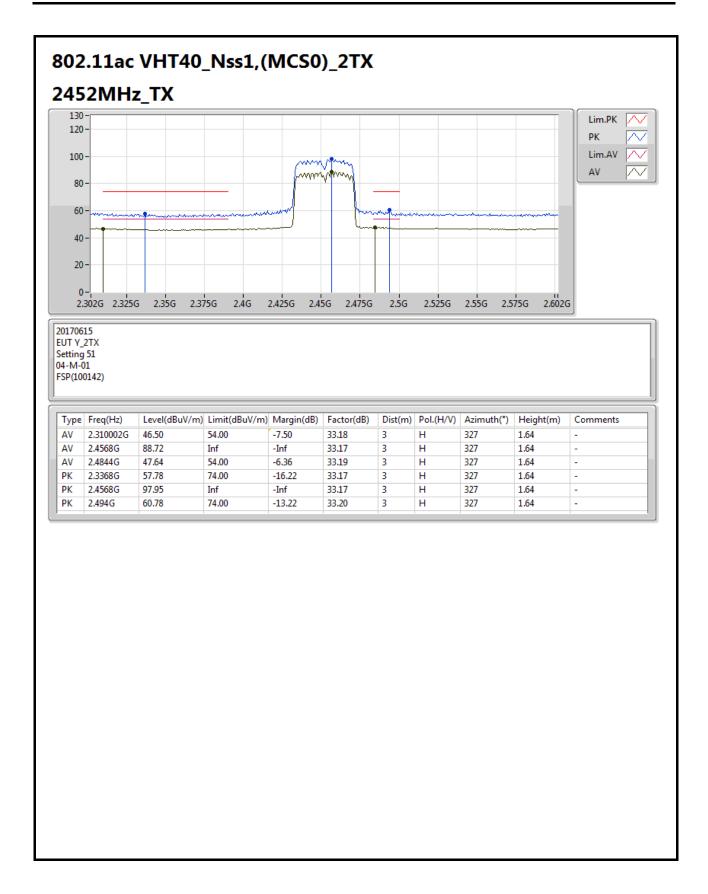




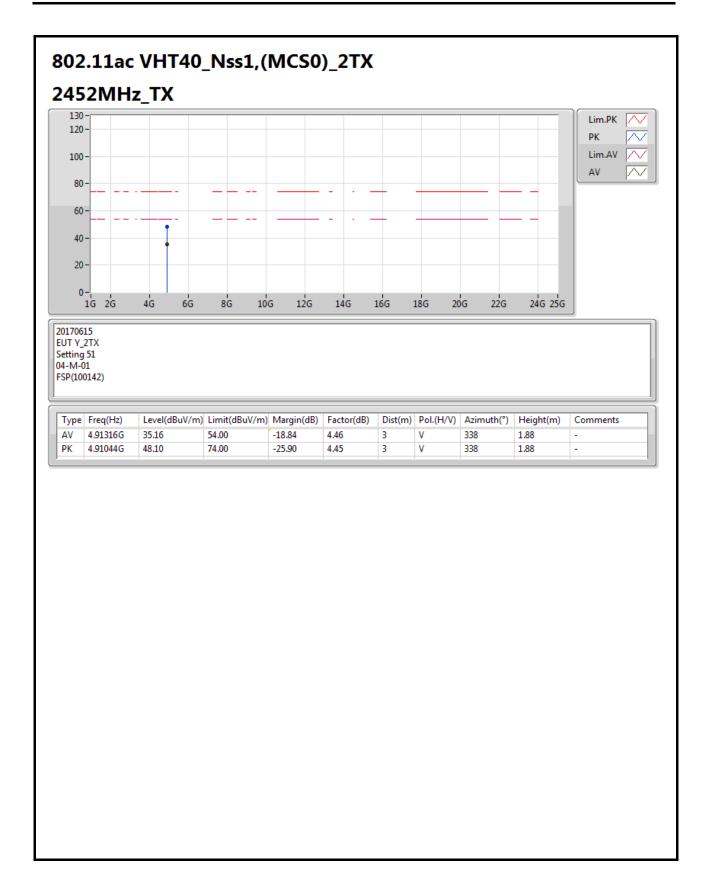










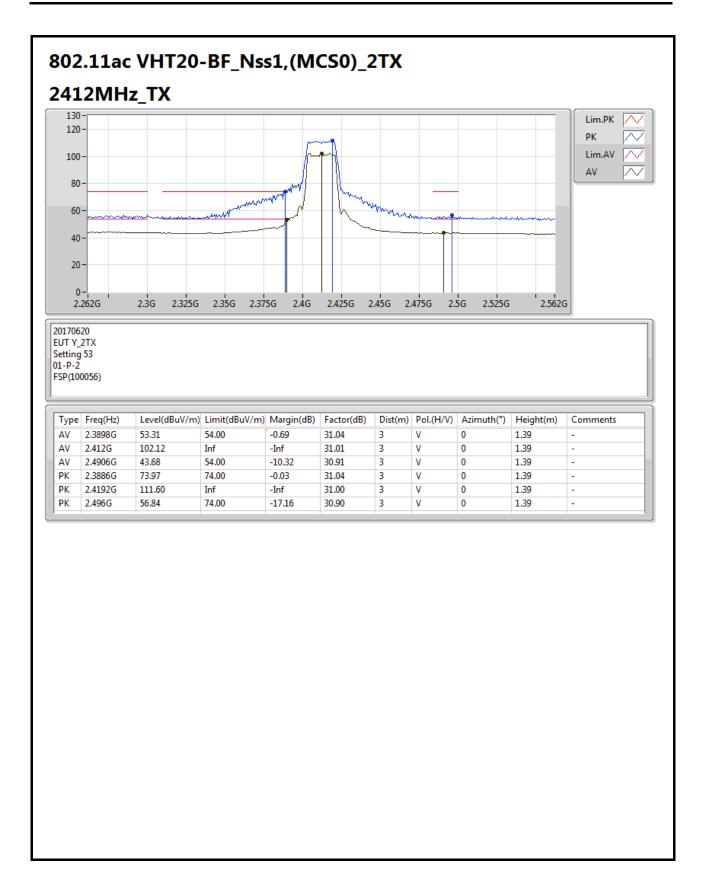




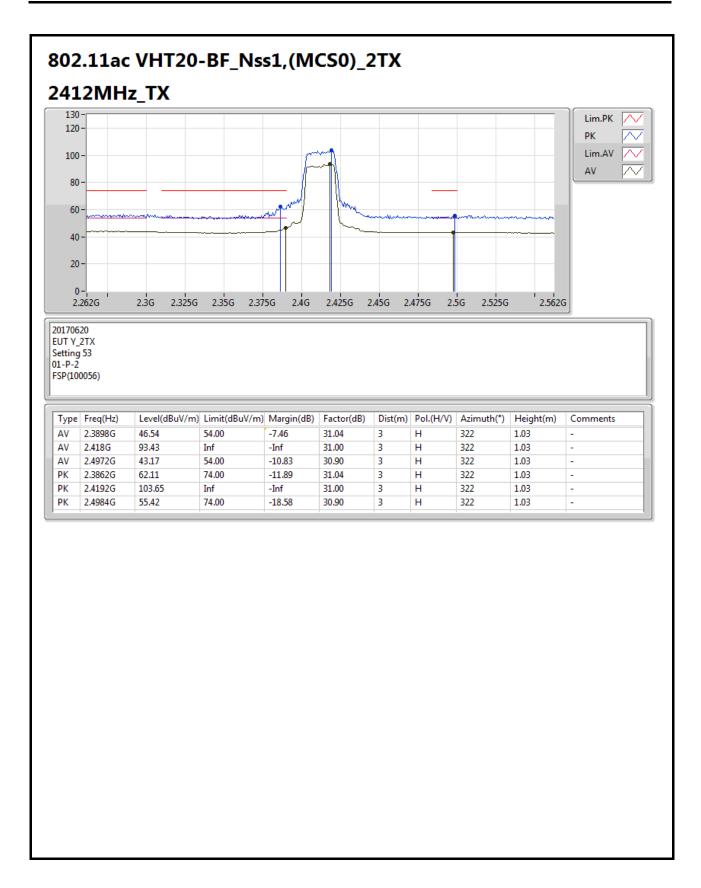


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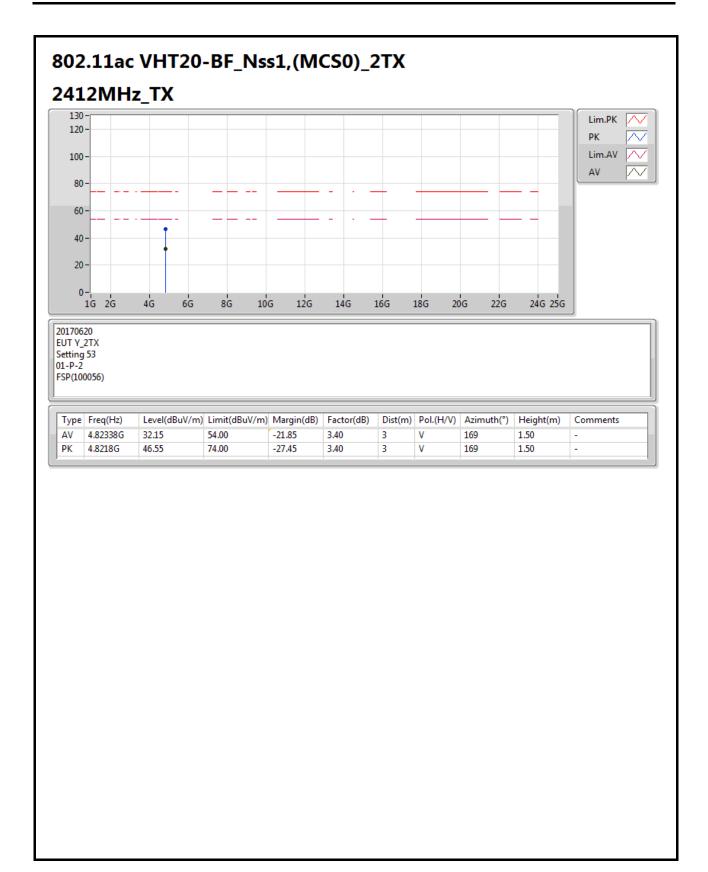




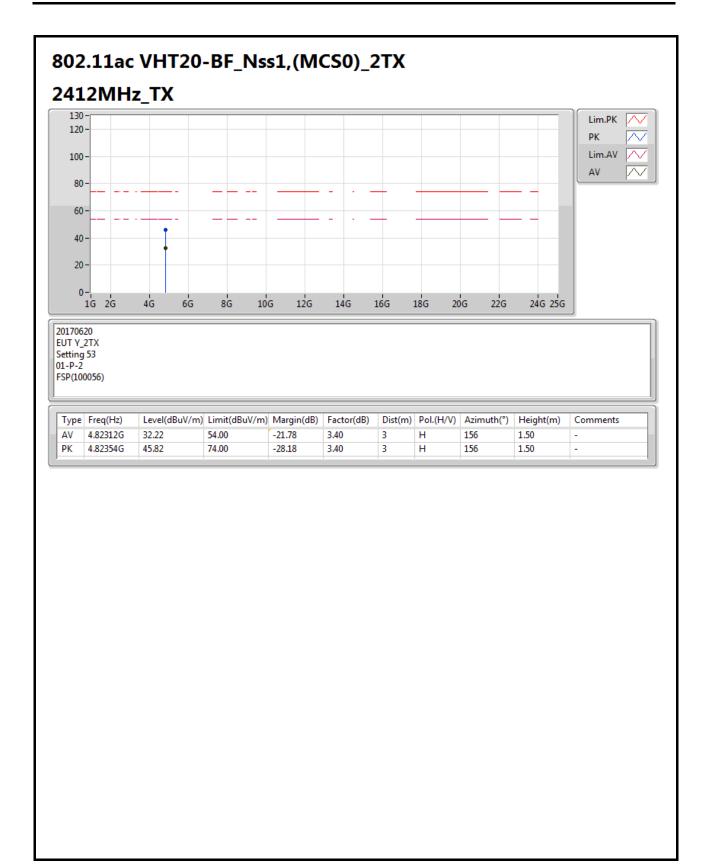




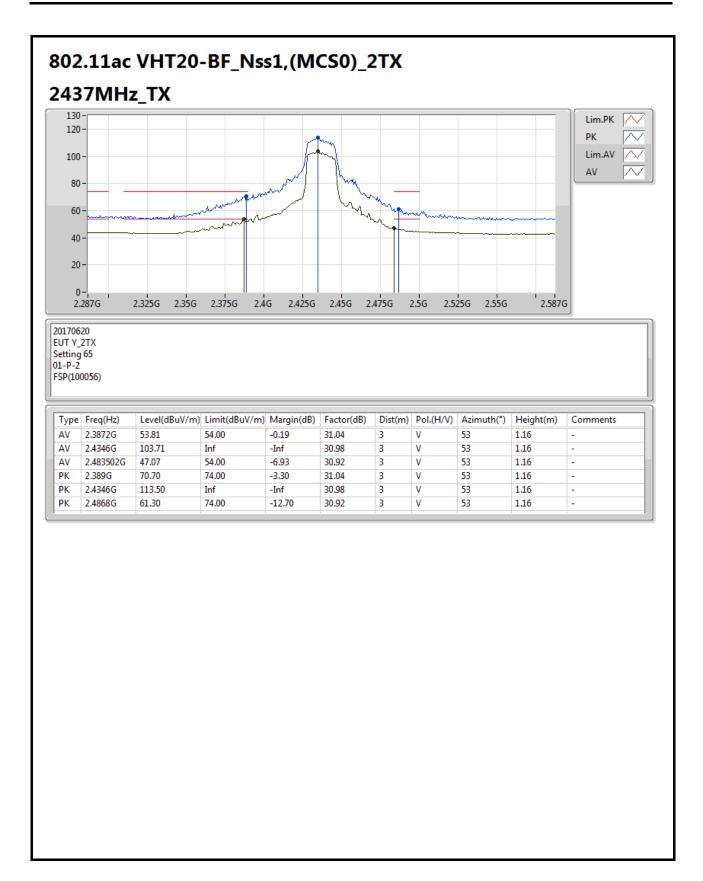




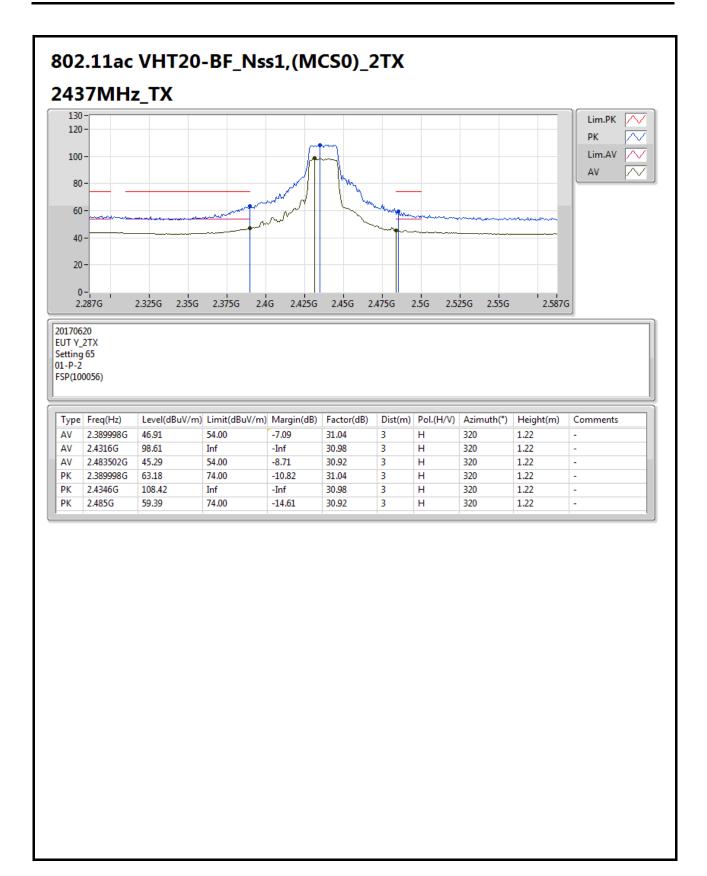




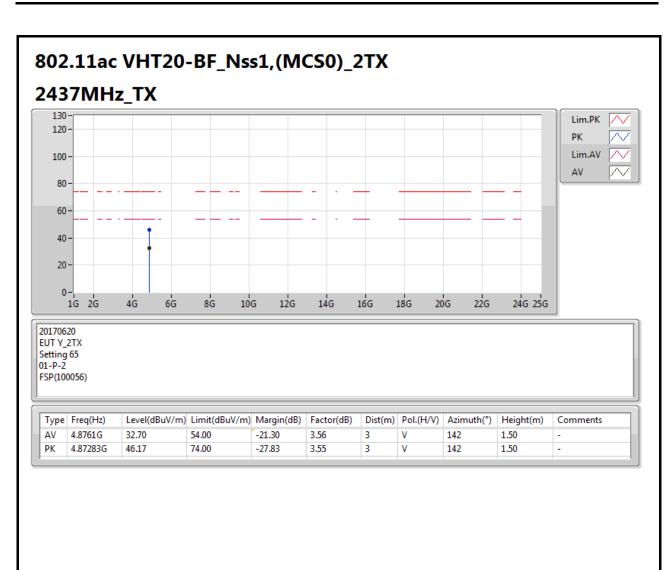




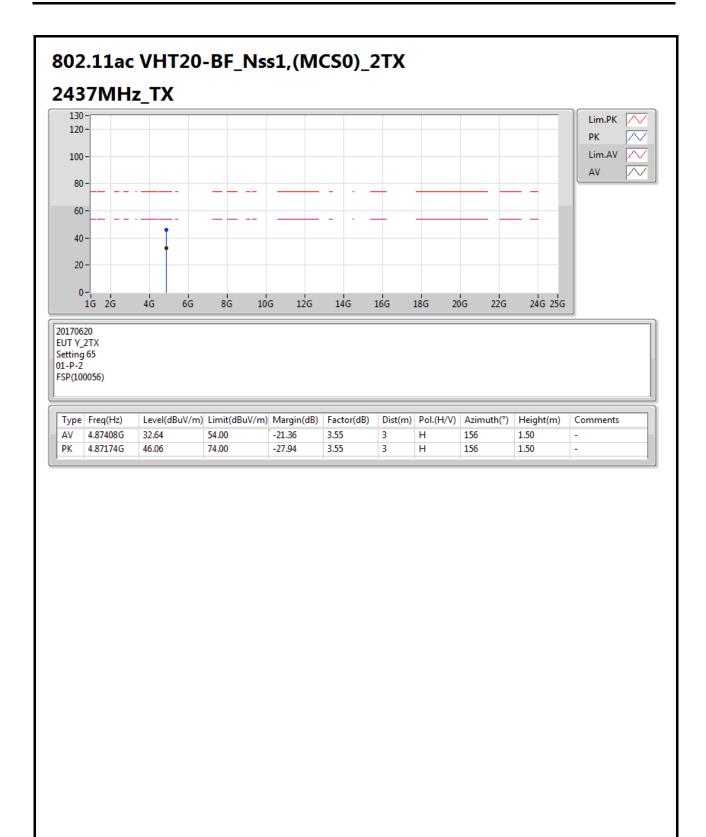






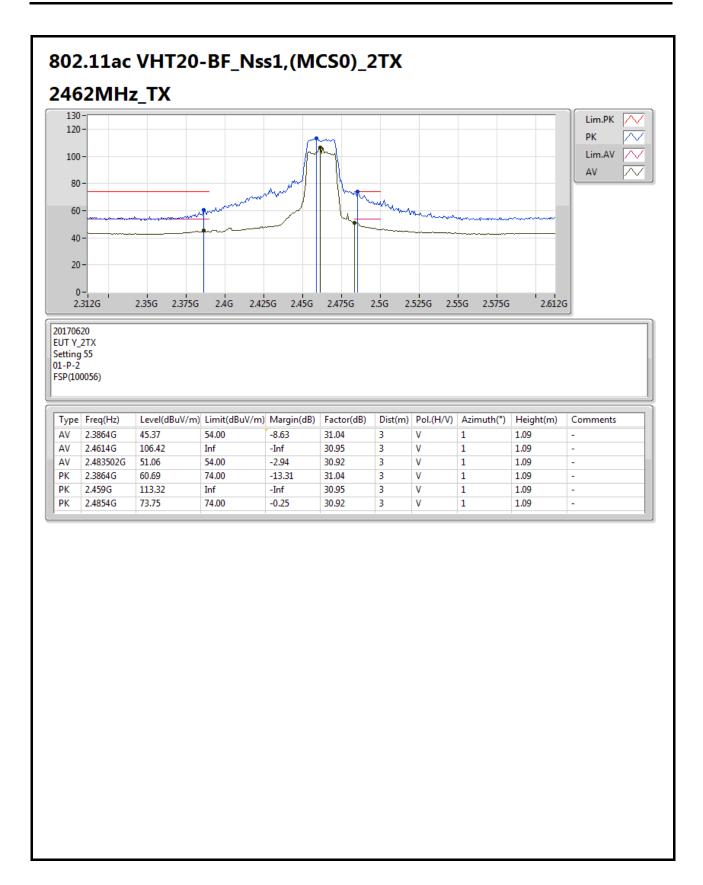




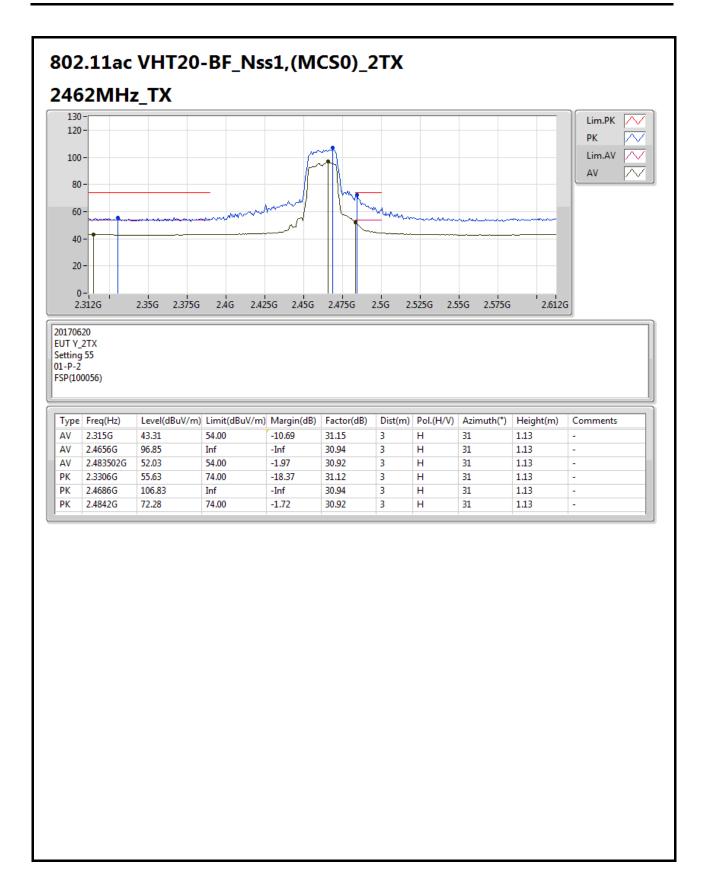


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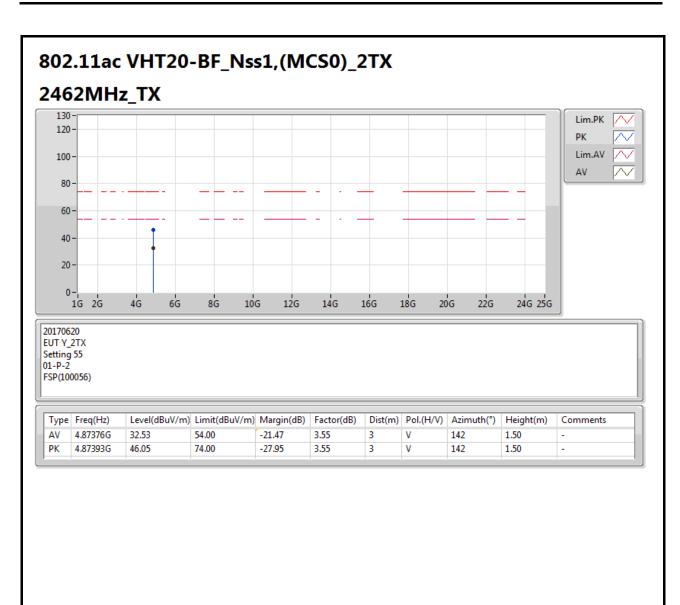




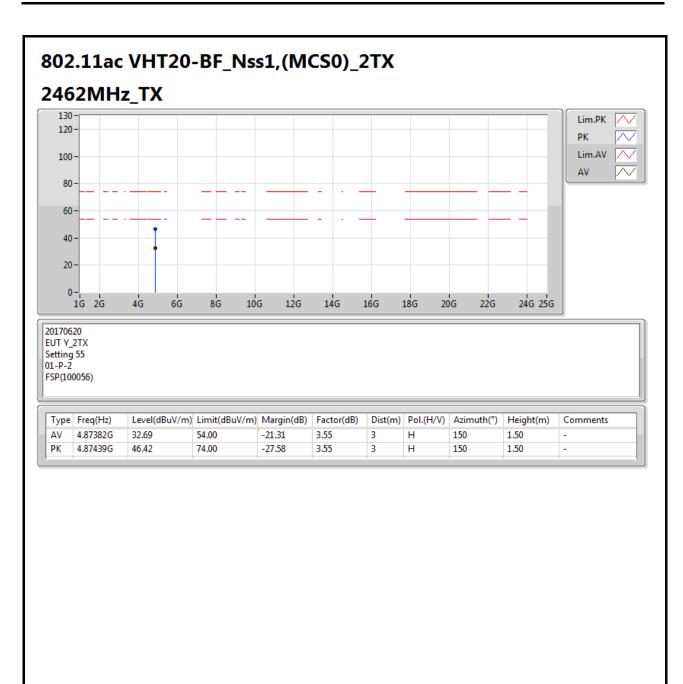




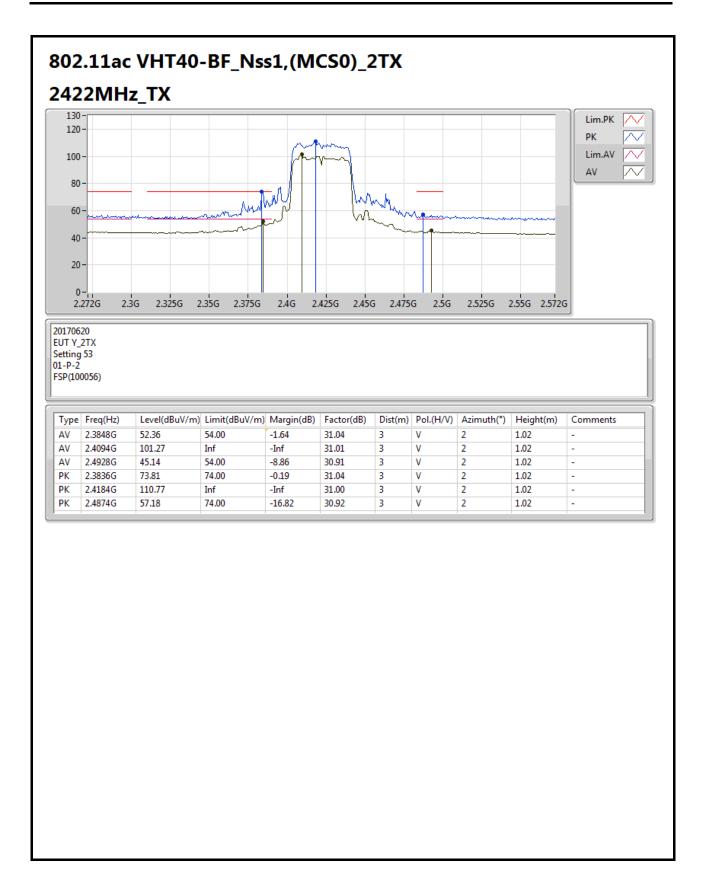




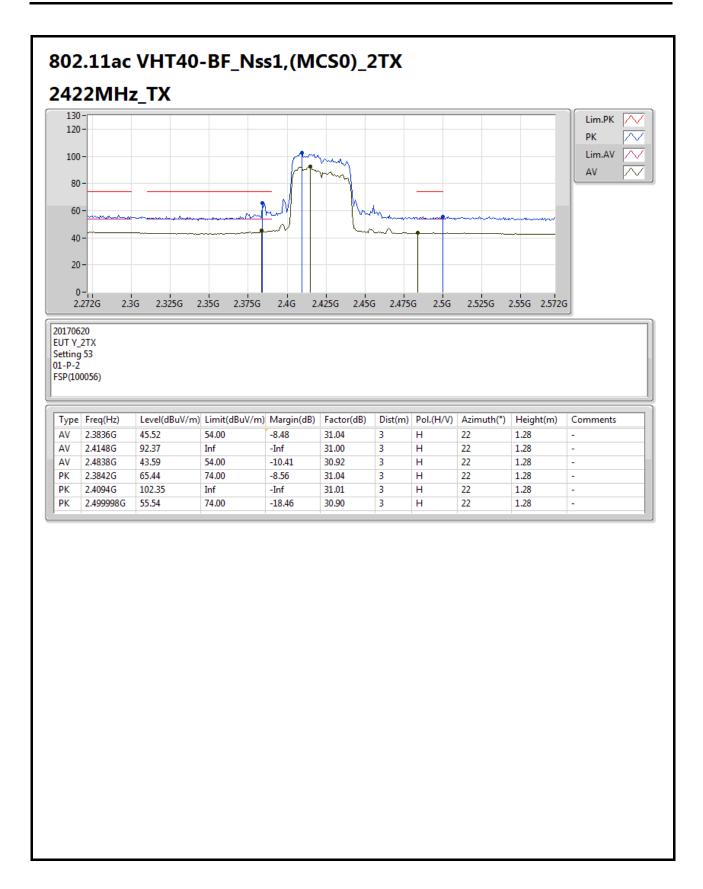




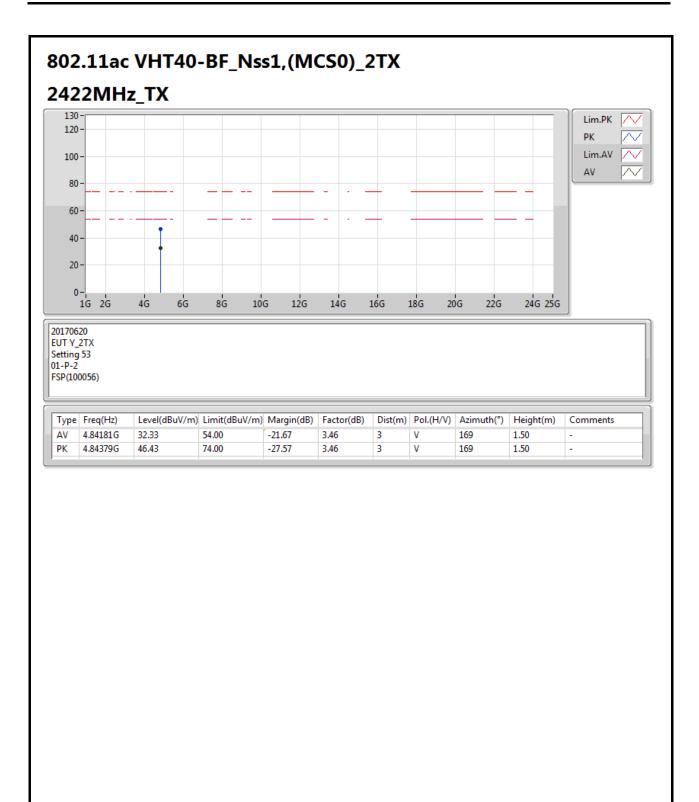




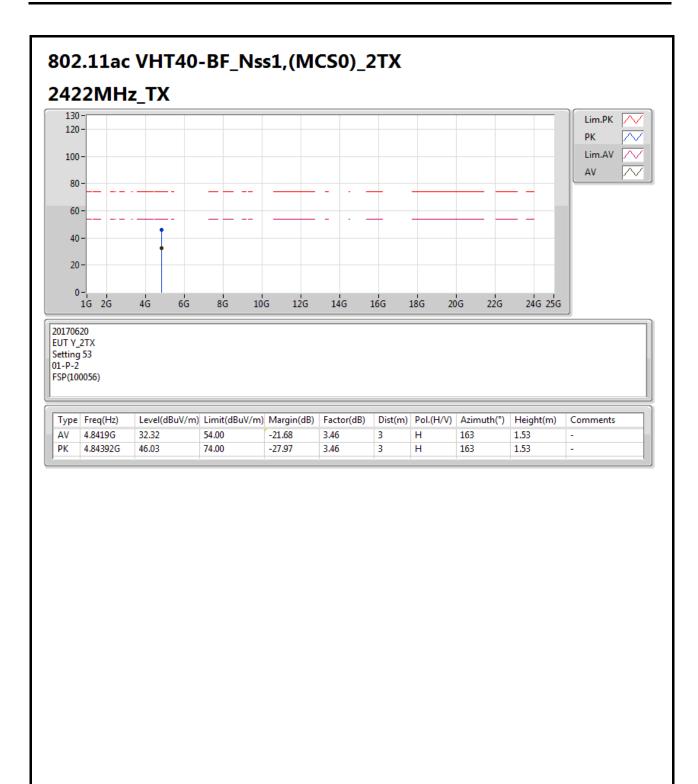




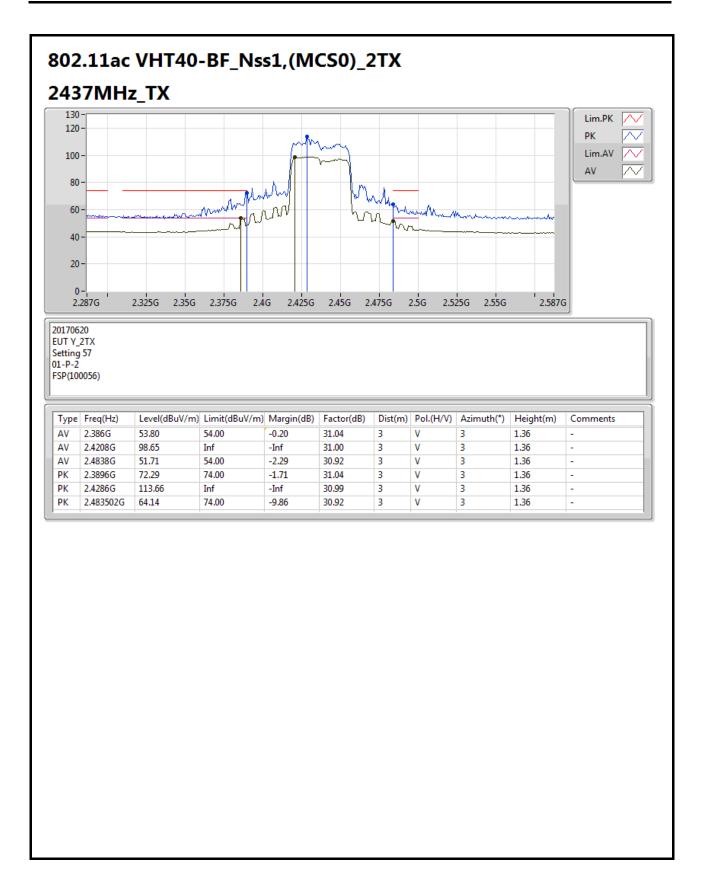




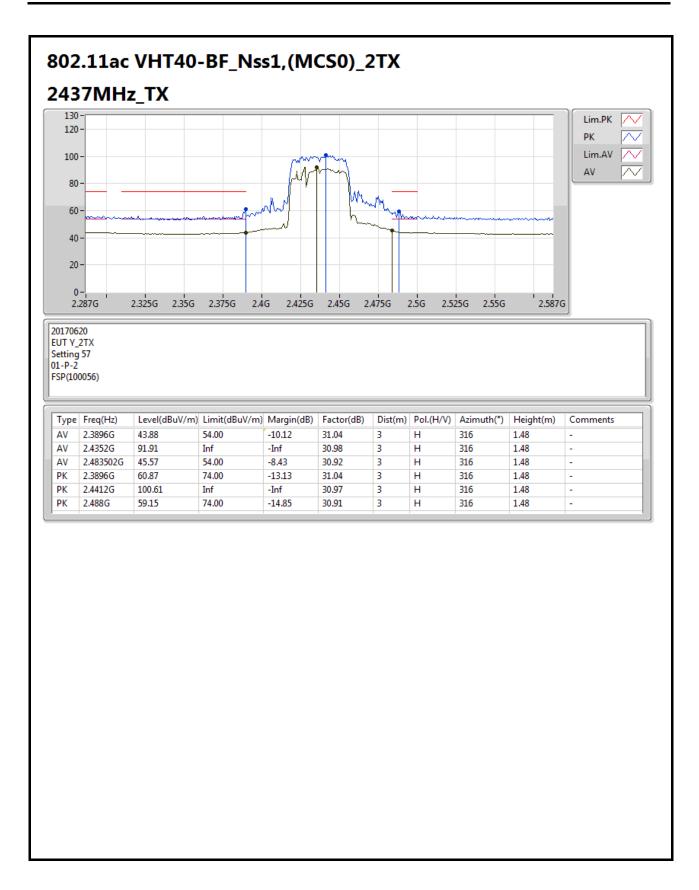




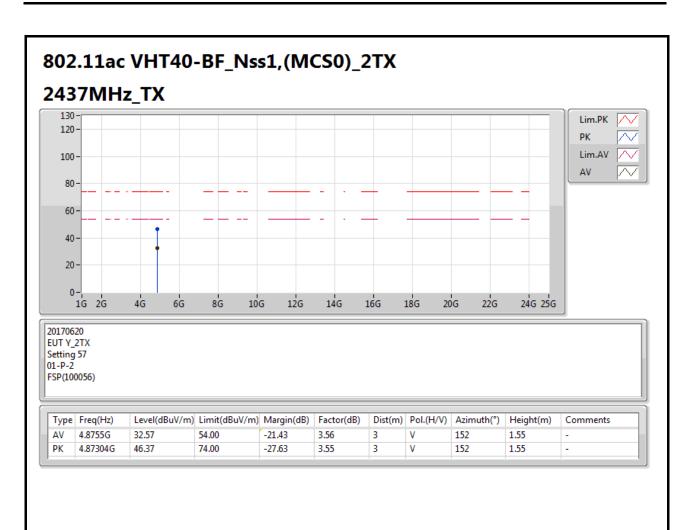




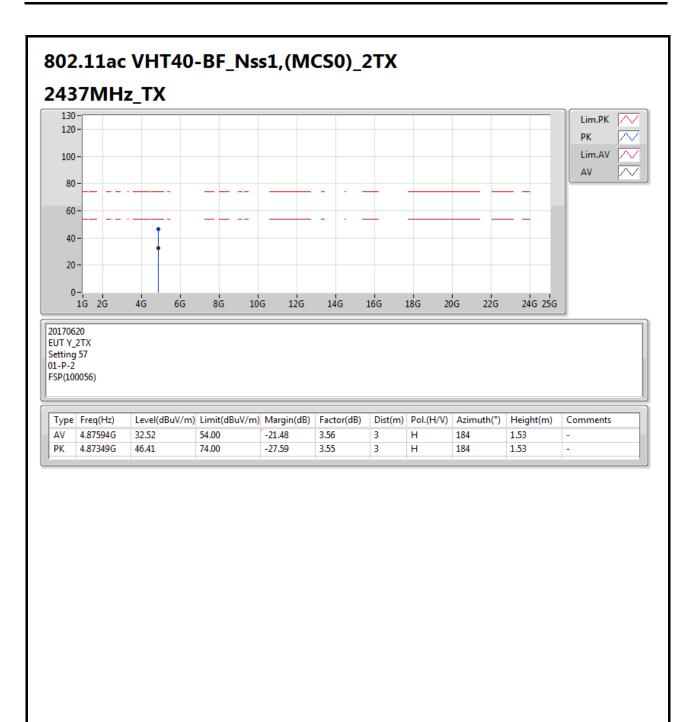




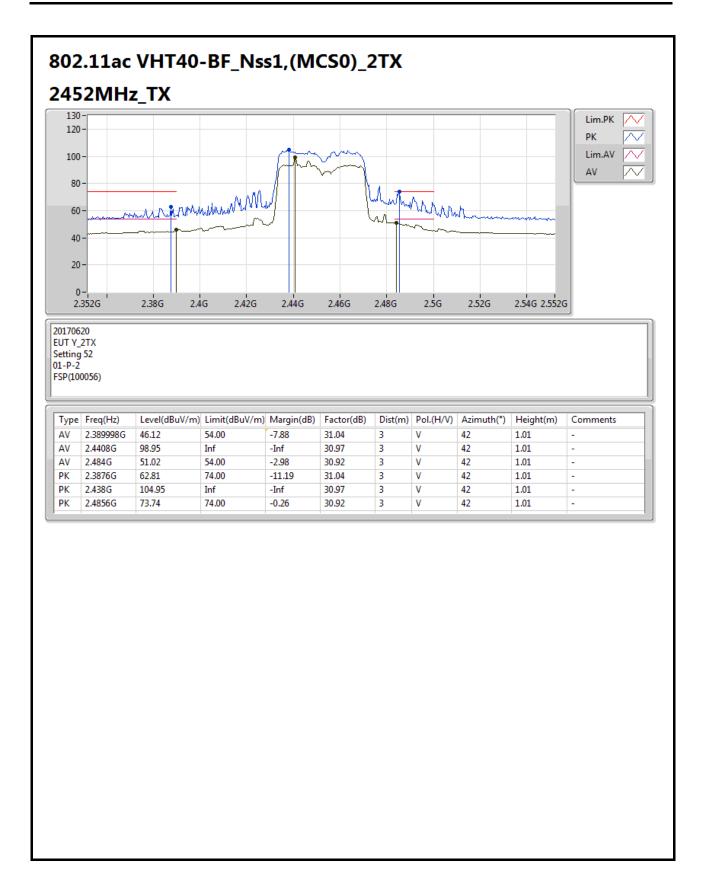




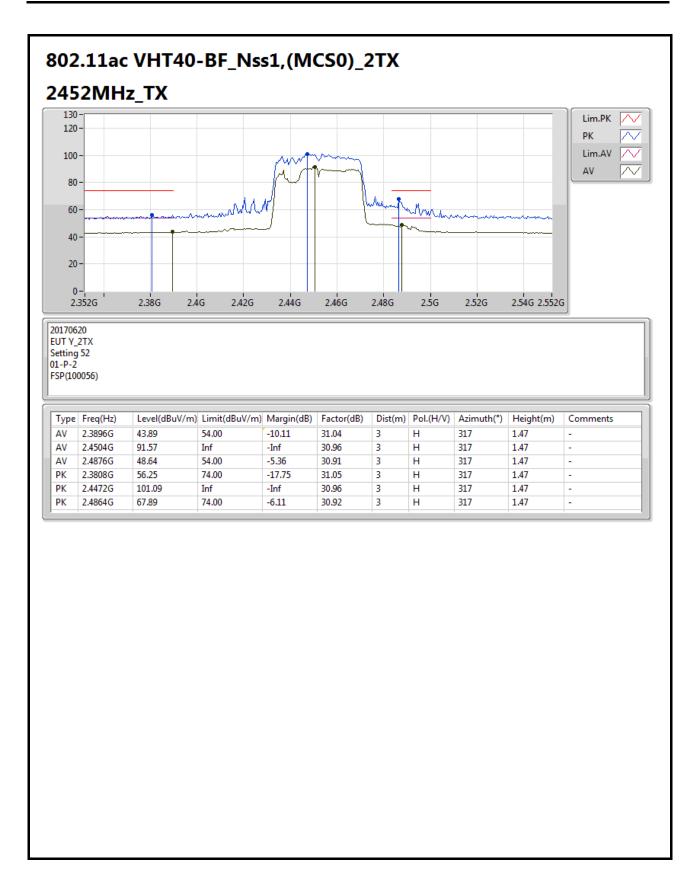




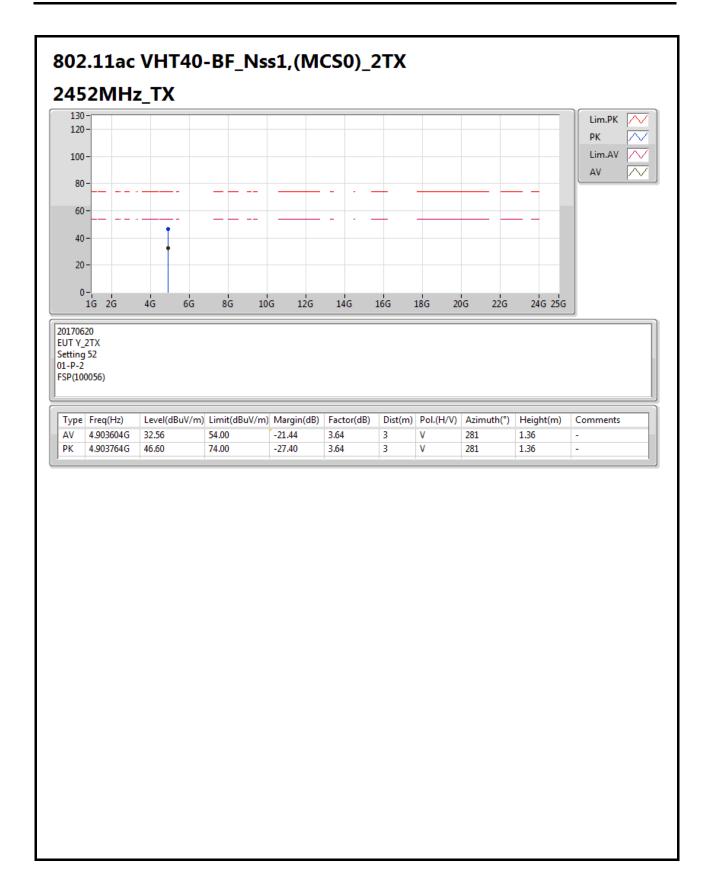




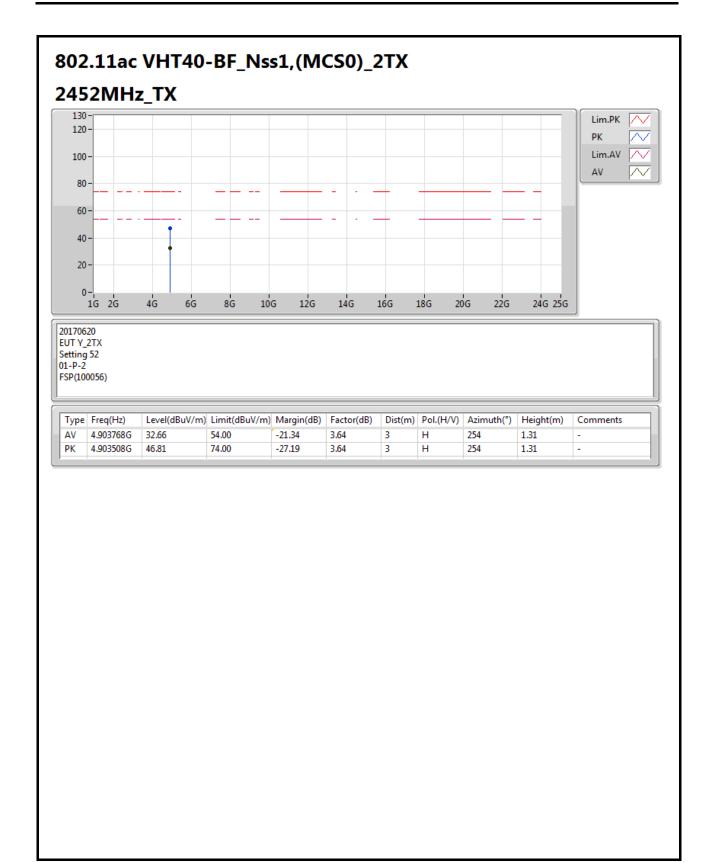






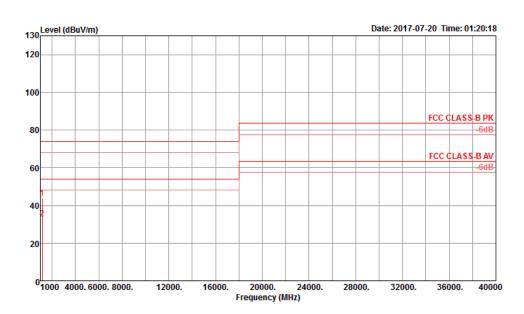






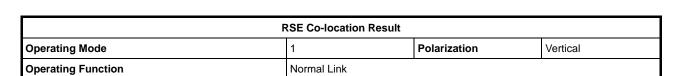


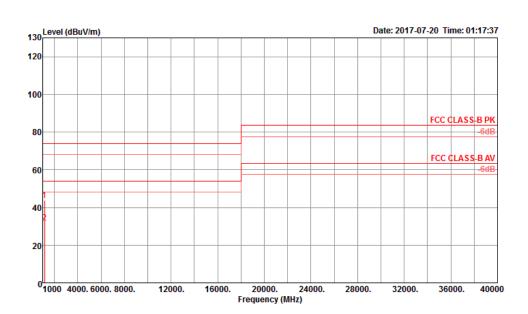
RSE Co-location Result								
Operating Mode	1	Polarization	Horizontal					
Operating Function	Normal Link							



		Freq	Level						Preamp Factor		T/Pos	Remark	Pol/Phase
	-	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	L	1168.46	43.67	74.00	-30.33	50.63	2.99	24.34	34.29	100	360	Peak	HORIZONTAL
	2	1169.00	33.10	54.00	-20.90	40.06	2.99	24.34	34.29	100	360	Average	HORIZONTAL

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	Freq	Level		Over Limit						T/Pos		Pol/Phase	
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg			
1	1168.06	43.72	74.00	-30.28	50.68	2.99	24.34	34.29	100	360	Peak	VERTICAL	
2	1168.46	32.04	54.00	-21.96	39.00	2.99	24.34	34.29	100	360	Average	VERTTCAL	

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