

Report No.: FR8N1551



FCC RADIO TEST REPORT

FCC ID : 2AJUC-DBWRT01R

Equipment: ZEBRA Hotspot USB 2.4G

Brand Name : ZEBRA Hotspot

Model Name : DBWRT01R

Applicant : Habilis Net Technology Co., LTD

6F, NO.6, Sec. 4, Xin-Yi Rd. Da-An Dist. Taipei Taiwan R.O.C

Manufacturer : Shen Zhen Frelink Electronic co.,Ltd

Third floor, building 5, no. 123 shuitian industrial zone, yuidong road, shuitian community, shiyan

street, baoan district, shenzhen city, guangdong province

Standard: 47 CFR FCC Part 15.247

The product was received on Nov. 23, 2018, and testing was started from Jan. 04, 2019 and completed on Jan. 14, 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 report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full.

Approved by: Sam Chen

SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory

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

TEL: 886-3-656-9065 FAX: 886-3-656-9085

Report Template No.: CB Ver1.0

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Report Version : 01

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Photographs of EUT v01

History of this test report

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Report No.	Version	Description	Issued Date
FR8N1551	01	Initial issue of report	Jan. 24, 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	15.207	AC Power-line Conducted Emissions	PASS	-
3.2	15.247(a)	DTS Bandwidth	PASS	-
3.3	15.247(b)	Maximum Conducted Output Power	PASS	-
3.4	15.247(e)	Power Spectral Density	PASS	-
3.5	15.247(d)	Emissions in Non-restricted Frequency Bands	PASS	-
3.6	15.247(d)	Emissions in Restricted Frequency Bands	PASS	-

Declaration of Conformity:

The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.

Comments and Explanations:

- The test configuration, test mode and test software were written in this test report are declared by the manufacturer.
- 2. 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: Cindy Peng

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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)	2412-2462	1-11 [11]
2400-2483.5	n (HT40)	2422-2452	3-9 [7]

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Band	Mode	BWch (MHz)	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 HT40	40	2TX

Note:

- ◆ 11b mode uses a combination of DSSS-DBPSK, DQPSK, CCK modulation.
- 11g, HT20 and HT40 use a combination of OFDM-BPSK, QPSK, 16QAM, 64QAM modulation.
- BWch is the nominal channel bandwidth.
- Nss-Min is the minimum number of spatial streams.
- Nant is the number of outputs. e.g., 2(2,3) means have 2 outputs for port 2 and port 3. 2 means have 2 outputs for port 1 and port 2.

1.1.2 Antenna Information

Ant.	Port	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	1	N/A	N/A	PCB Antenna	N/A	2
2	2	N/A	N/A	PCB Antenna	N/A	2

Note 1: The above information was declared by manufacturer.

Note 2: The EUT has two antennas (2TX/2RX).

Port 1 and Port 2 could transmit/receive simultaneously.

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1.1.3 Mode Test Duty Cycle

Mode	DC	DCF(dB)	T(s)	VBW(Hz) ≥ 1/T
802.11b	0.98	0.088	n/a (DC>=0.98)	n/a (DC>=0.98)
802.11g	0.837	0.773	1.44m	1k
802.11n HT20	0.799	0.975	1.348m	1k
802.11n HT40	0.76	1.192	670u	3k

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NI	UtD.

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

1.1.4 EUT Operational Condition

EUT Power Type	From host system			
Beamforming Function	☐ With beamforming ☑ Without beamforming			
Test Software Version	MT7620 V1.0.6.0			

Note: The above information was declared by manufacturer.

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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 v05
- FCC KDB 662911 D01 v02r01

1.3 Testing Location Information

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

Test Condition	Test Site No.	Test Engineer	Test Environment	Test Date
RF Conducted	TH01-CB	Serway Li	20°C / 60%	Jan. 07, 2019~Jan. 09, 2019
Radiated	03CH01-CB	Stim Sung	22°C / 54%	Jan. 04, 2019~Jan. 14, 2019
AC Conduction	CO02-CB	Max Lin	22°C / 59%	Jan. 08, 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
Conducted Emission (150kHz ~ 30MHz)	2.0 dB	Confidence levels of 95%
Radiated Emission (30MHz ~ 1,000MHz)	3.6 dB	Confidence levels of 95%
Radiated Emission (1GHz ~ 18GHz)	3.7 dB	Confidence levels of 95%
Radiated Emission (18GHz ~ 40GHz)	3.5 dB	Confidence levels of 95%
Conducted Emission	1.7 dB	Confidence levels of 95%
Output Power Measurement	1.33 dB	Confidence levels of 95%
Power Density Measurement	1.27 dB	Confidence levels of 95%
Bandwidth Measurement	9.74 x10 ⁻⁸	Confidence levels of 95%

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2 Test Configuration of EUT

2.1 Test Channel Mode

Mode	Power Setting
802.11b_Nss1,(1Mbps)_2TX	-
2412MHz	00/02
2437MHz	00/03
2462MHz	00/04
802.11g_Nss1,(6Mbps)_2TX	-
2412MHz	00/02
2437MHz	00/03
2462MHz	00/03
802.11n HT20_Nss1,(MCS0)_2TX	-
2412MHz	00/03
2437MHz	00/04
2462MHz	00/05
802.11n HT40_Nss1,(MCS0)_2TX	-
2422MHz	00/03
2437MHz	00/04
2452MHz	00/05

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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 AC power-line conducted measurement for line and neutral	
Operating Mode	СТХ

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

The Want Cose Made for Fallenting Confermance Tests		
In	e 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 regardless of spatial multiplexing MIMO configuration), the radiate be performed with highest antenna gain of each antenna type.		
Operating Mode < 1GHz	CTX	

The EUT was performed at X axis, Y axis and Z axis position for Emissions in Restricted Frequency Bands. EUT X axis generated the worst test result for Emissions in Restricted Frequency Bands Above 1GHz test, thus the measurement for Emissions in Restricted Frequency Bands Below 1GHz test will follow this same test configuration.

1	EUT X axis
Operating Mode > 1GHz	CTX
1	EUT X axis
2	EUT Y axis
3	EUT Z axis

- 1. Mode 1 has been evaluated to be the worst case after evaluating for harmonic test. Consequently, measurement will follow this same test mode.
- 2. Mode 2 has been evaluated to be the worst case after evaluating for bandedge test. Consequently, measurement will follow this same test mode.

Note: The adapter was for measurement only, it would not be marketed.

Equipment Brand Name		Model Name	FCC ID
Adapter	DVE	DSA-12CA-05	N/A

2.3 EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

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2.4 Accessories

N/A

2.5 Support Equipment

For Test Site No: CO02-CB

Support Equipment				
No.	Equipment	Brand Name	Model Name	FCC ID
Α	NB	DELL	E6430	N/A
В	Test fixture	N/A	N/A	N/A
С	Adapter	DVE	DSA-12CA-05	N/A

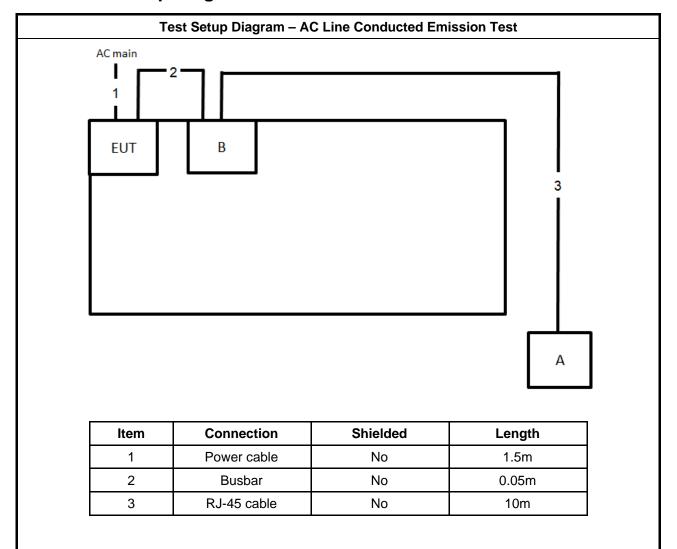
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For Test Site No: 03CH01-CB and TH01-CB

Support Equipment				
No.	Equipment	Brand Name	Model Name	FCC ID
Α	NB	DELL	E4300	N/A
В	Test fixture	N/A	N/A	N/A
С	Adapter	DVE	DSA-12CA-05	N/A

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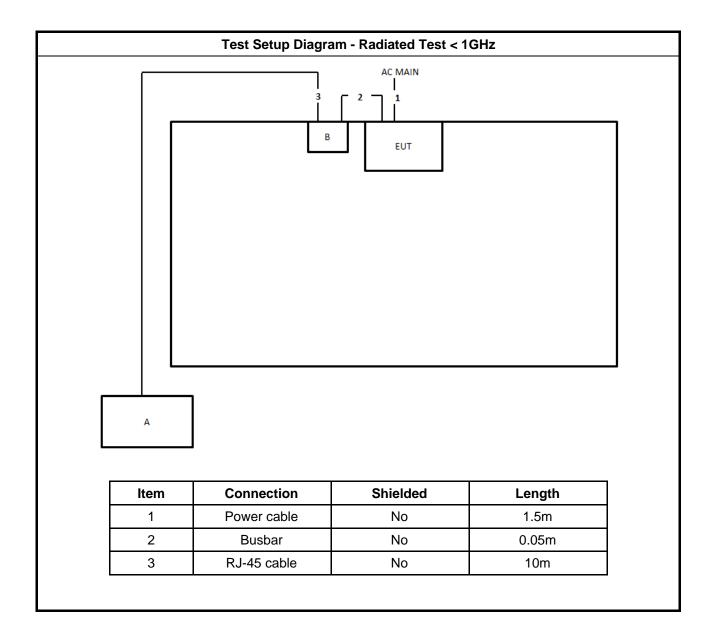
2.6 Test Setup Diagram



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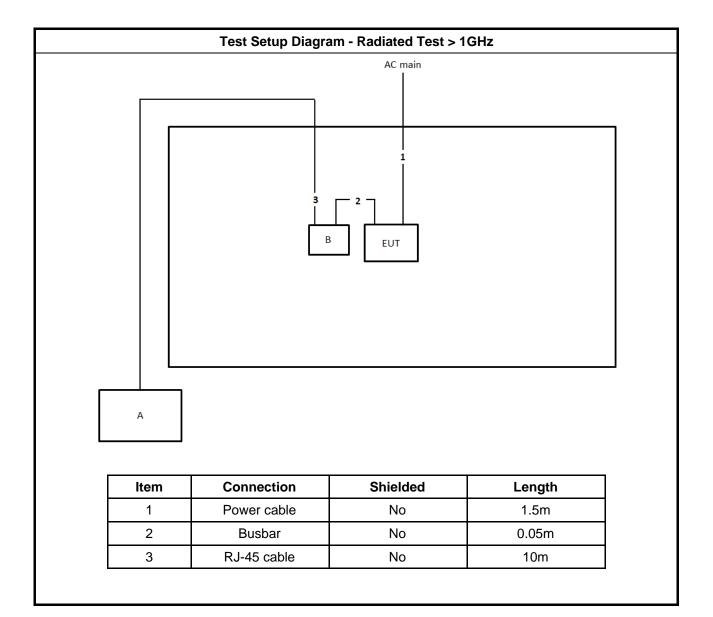
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3 Transmitter Test Result

3.1 AC Power-line Conducted Emissions

3.1.1 AC Power-line Conducted Emissions Limit

AC Powe	er-line Conducted Emissions L	_imit
Frequency Emission (MHz)	Quasi-Peak	Average
0.15-0.5	66 - 56 *	56 - 46 *
0.5-5	56	46
5-30	60	50
Note 1: * Decreases with the logarithm of	of the frequency.	

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3.1.2 Measuring Instruments

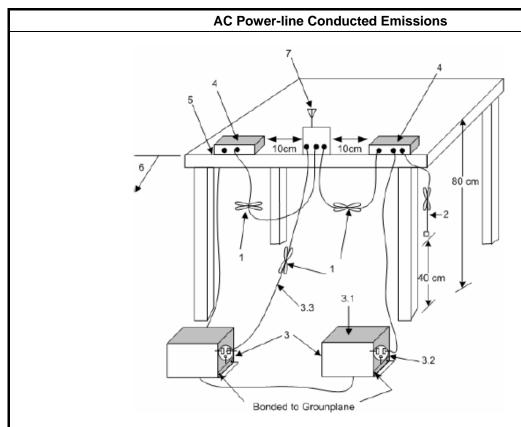
Refer a test equipment and calibration data table in this test report.

3.1.3 Test Procedures

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

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3.1.4 Test Setup



1—Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 cm to 40 cm long.

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- 2—The I/O cables that are not connected to an accessory shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
- 3—EUT connected to one LISN. Unused LISN measuring port connectors shall be terminated in 50 Ω loads. LISN may be placed on top of, or immediately beneath, reference ground plane.
- 3.1—All other equipment powered from additional LISN(s).
- 3.2—A multiple-outlet strip may be used for multiple power cords of non-EUT equipment.
- 3.3—LISN at least 80 cm from nearest part of EUT chassis.
- 4—Non-EUT components of EUT system being tested.
- 5—Rear of EUT, including peripherals, shall all be aligned and flush with edge of tabletop.
- 6—Edge of tabletop shall be 40 cm removed from a vertical conducting plane that is bonded to the ground plane.
- 7—Antenna can be integral or detachable. If detachable, then the antenna shall be attached for this test.

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.	

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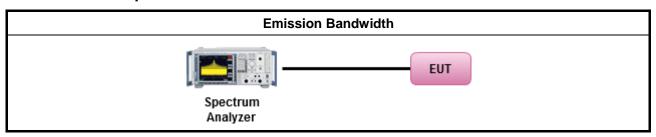
3.2.2 Measuring Instruments

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

3.2.3 Test Procedures

		Test Method
•	For	the emission bandwidth shall be measured using one of the options below:
	\boxtimes	Refer as FCC KDB 558074, clause 8.2 & C63.10 clause 11.8.1 Option 1 for 6 dB bandwidth measurement.
		Refer as FCC KDB 558074, clause 8.2 & C63.10 clause 11.8.2 Option 2 for 6 dB bandwidth measurement.
		Refer as ANSI C63.10, clause 6.9.1 for occupied bandwidth testing.

3.2.4 Test Setup



3.2.5 Test Result of Emission Bandwidth

Refer as Appendix B

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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} ≤ 6 dBi, then P_{Out} ≤ 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.

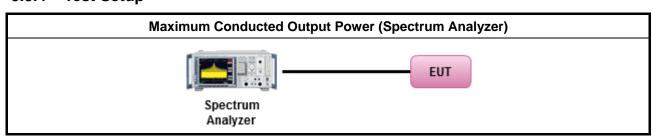
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3.3.3 Test Procedures

		Test Method
•	Max	imum Peak Conducted Output Power
		Refer as FCC KDB 558074, clause 8.3.1.1 & C63.10 clause 11.9.1.1 (RBW ≥ EBW method).
		Refer as FCC KDB 558074, clause 8.3.1.3 & C63.10 clause 11.9.1.3 (peak power meter).
•	Max	imum Conducted Output Power
	[duty	/ cycle ≥ 98% or external video / power trigger]
		Refer as FCC KDB 558074, clause 8.3.2.2 & C63.10 clause 11.9.2.2.2 Method AVGSA-1.
		Refer as FCC KDB 558074, clause $8.3.2.2$ & C63.10 clause $11.9.2.2.3$ Method AVGSA-1A. (alternative)
	duty	cycle < 98% and average over on/off periods with duty factor
		Refer as FCC KDB 558074, clause 8.3.2.2 & C63.10 clause 11.9.2.2.4 Method AVGSA-2.
		Refer as FCC KDB 558074, clause 8.3.2.2 & C63.10 clause 11.9.2.2.5 Method AVGSA-2A (alternative)
		Refer as FCC KDB 558074, clause 8.3.2.2 & C63.10 clause 11.9.2.2.6 Method AVGSA-3
		Refer as FCC KDB 558074, clause 8.3.2.2 & C63.10 clause 11.9.2.2.7 Method AVGSA-3A (alternative)
	Mea	surement using a power meter (PM)
		Refer as FCC KDB 558074, clause $8.3.2.3 \& C63.10$ clause $11.9.2.3.1$ Method AVGPM (using an RF average power meter).
		Refer as FCC KDB 558074, clause 8.3.2.3 & C63.10 clause 11.9.2.3.2 Method AVGPM-G (using an gate RF average power meter).
•	For	conducted measurement.
	•	If the EUT supports multiple transmit chains using options given below: Refer as FCC KDB 662911, In-band power measurements. Using the measure-and-sum approach, measured all transmit ports individually. Sum the power (in linear power units e.g., mW) of all ports for each individual sample and save them.
	•	If multiple transmit chains, EIRP calculation could be following as methods: $P_{total} = P_1 + P_2 + \ldots + P_n$ (calculated in linear unit [mW] and transfer to log unit [dBm]) $EIRP_{total} = P_{total} + DG$

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3.3.4 Test Setup



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3.3.5 Test Result of Maximum Conducted Output Power

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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

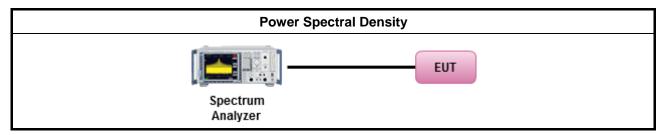
		Test Method							
•	Peak power spectral density procedures that the same method as used to determine the conducte output power. If maximum peak conducted output power was measured to demonstrate compliance t the output power limit, then the peak PSD procedure below (Method PKPSD) shall be used. If maximur conducted output power was measured to demonstrate compliance to the output power limit, then on of the average PSD procedures shall be used, as applicable based on the following criteria (the pea PSD procedure is also an acceptable option).								
		Refer as FCC KDB 558074, clause 8.4 & C63.10 clause 11.10.2 Method PKPSD.							
	[dut	y cycle ≥ 98% or external video / power trigger]							
		Refer as FCC KDB 558074, clause 8.4 & C63.10 clause 11.10.3 Method AVGPSD-1.							
		Refer as FCC KDB 558074, clause 8.4 & C63.10 clause 11.10.5 Method AVGPSD-2.							
		Refer as FCC KDB 558074, clause 8.4 & C63.10 clause 11.10.7 Method AVGPSD-3.							
	duty	cycle < 98% and average over on/off periods with duty factor							
	Refer as FCC KDB 558074, clause 8.4 & C63.10 clause 11.10.4 Method AVGPSD-1A. (alternative).								
	Refer as FCC KDB 558074, clause 8.4 & C63.10 clause 11.10.6 Method AVGPSD-2A. (alternative)								
		Refer as FCC KDB 558074, clause 8.4 & C63.10 clause 11.10.8 Method AVGPSD-3A. (alternative)							
•	For	conducted measurement.							
	•	If The EUT supports multiple transmit chains using options given below:							
		Option 1: Measure and sum the spectra across the outputs. Refer as FCC KDB 662911, In-band power spectral density (PSD). Sample all transmit ports simultaneously using a spectrum analyzer for each transmit port. Where the trace bin-by-bin of each transmit port summing can be performed. (i.e., in the first spectral bin of output 1 is summed with that in the first spectral bin of output 2 and that from the first spectral bin of output 3, and so on up to the NTX output to obtain the value for the first frequency bin of the summed spectrum.). Add up the amplitude (power) values for the different transmit chains and use this as the new data trace.							
		Option 2: Measure and sum spectral maxima across the outputs. With this technique, spectra are measured at each output of the device at the required resolution bandwidth. The maximum value (peak) of each spectrum is determined. These maximum values are then summed mathematically in linear power units across the outputs. These operations shall be performed separately over frequency spans that have different out-of-band or spurious emission limits,							

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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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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 Band Emissions Limit					
RF output power procedure Limit (dBc)					
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.

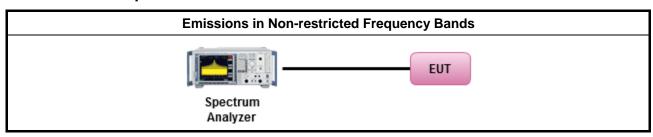
3.5.2 Measuring Instruments

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 8.5 for unwanted emissions into non-restricted bands.

3.5.4 Test Setup



3.5.5 Test Result of Emissions in Non-restricted Frequency Bands

Refer as Appendix E

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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						

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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 ELIT
- Note 3: Using the distance of 1m during the test for above 18 GHz, and the test value to correct for the distance factor at 3m.

3.6.2 Measuring Instruments

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

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3.6.3 Test Procedures

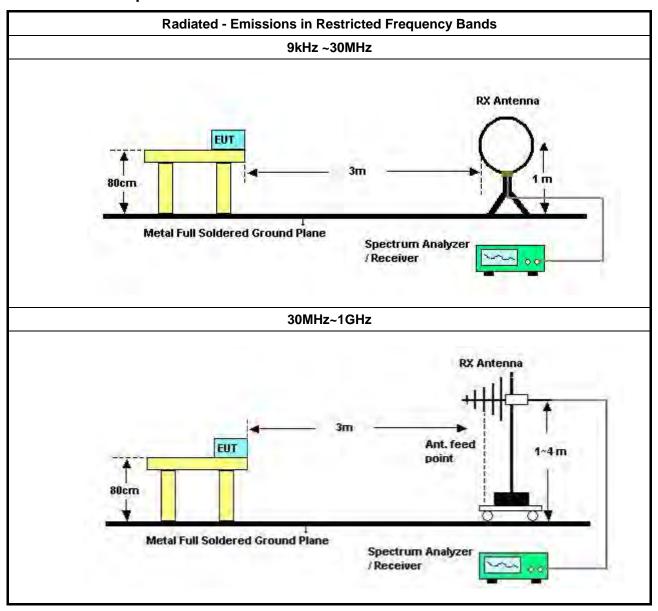
		Test Method								
•	The	average emission levels shall be measured in [duty cycle ≥ 98 or duty factor].								
•	Refer as ANSI C63.10, clause 6.10.3 band-edge testing shall be performed at the lowest frequency channel and highest frequency channel within the allowed operating band.									
•	For	or the transmitter unwanted emissions shall be measured using following options below:								
	•	Refer as FCC KDB 558074, clause 8.6 for unwanted emissions into restricted bands.								
		Refer as FCC KDB 558074, clause 8.6 & C63.10 clause 11.12.2.5.1(trace averaging for duty cycle ≥98%).								
		Refer as FCC KDB 558074, clause 8.6 & C63.10 clause 11.12.2.5.2(trace averaging + duty factor).								
		Refer as FCC KDB 558074, clause 8.6 & C63.10 clause 11.12.2.5.3(Reduced VBW≥1/T).								
		☐ Refer as ANSI C63.10, clause 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 558074, clause 8.6 & C63.10 clause 11.12.2.4 measurement procedure peak limit.								
•	For	the transmitter band-edge emissions shall be measured using following options below:								
	•	Refer as FCC KDB 558074 clause 8.7 & C63.10 clause 11.13.1, When the performing peak or average radiated measurements, emissions within 2 MHz of the authorized band edge may be measured using the marker-delta method described below.								
	•	Refer as FCC KDB 558074, clause 8.7 (ANSI C63.10, clause 6.10.6) for marker-delta method for band-edge measurements.								
	•	Refer as FCC KDB 558074, clause 8.7 for narrower resolution bandwidth (100kHz) using the band power and summing the spectral levels (i.e., 1 MHz).								
	•	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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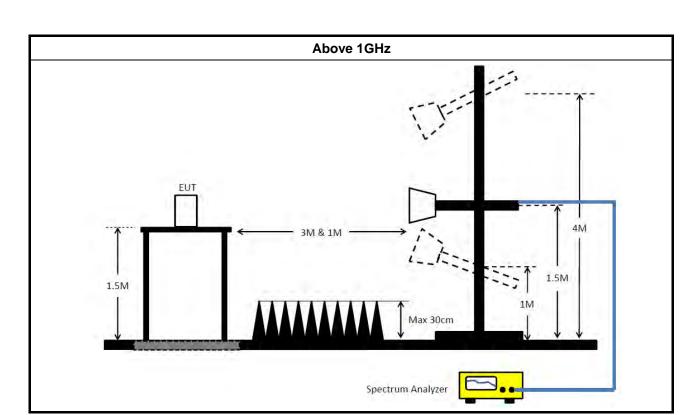
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3.6.4 Test Setup



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3.6.5 Emissions in Restricted Frequency Bands (Below 30MHz)

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

The radiated emissions were investigated from 9 kHz or the lowest frequency generated within the device, up to the 10 harmonic or 40 GHz, whichever is appropriate.

3.6.6 Test Result of Emissions in Restricted Frequency Bands

Refer as Appendix F

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4 Test Equipment and Calibration Data

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Calibration Due Date	Remark
LISN	Schwarzbeck	NSLK 8127	8127650	9kHz ~ 30MHz	Nov. 21, 2018	Nov. 20, 2019	Conduction (CO02-CB)
LISN	Schwarzbeck	NSLK 8127	8127478	9kHz ~ 30MHz	Nov. 05, 2018	Nov. 04, 2019	Conduction (CO02-CB)
EMI Receiver	Agilent	N9038A	MY52260140	9kHz ~ 8.4GHz	Jan. 17, 2018	Jan. 16, 2019	Conduction (CO02-CB)
COND Cable	Woken	Cable	2	0.15MHz ~ 30MHz	Nov. 06, 2018	Nov. 05, 2019	Conduction (CO02-CB)
Software	Audix	E3	6.120210n	-	N.C.R.	N.C.R.	Conduction (CO02-CB)
Loop Antenna	Teseq	HLA 6120	24155	9kHz - 30 MHz	Mar. 16, 2018	Mar. 15, 2019	Radiation (03CH01-CB)
BILOG ANTENNA with 6dB Attenuator	TESEQ & EMCI	CBL6112D & N-6-06	37880 & AT-N0609	20MHz ~ 2GHz	Aug. 27, 2018	Aug. 26, 2019	Radiation (03CH01-CB)
Horn Antenna	EMCO	3115	00075790	750MHz ~ 18GHz	Nov. 13, 2018	Nov. 12, 2019	Radiation (03CH01-CB)
Horn Antenna	Schwarzbeck	BBHA 9170	BBHA91702 52	15GHz ~ 40GHz	Jun. 28, 2018	Jun. 27, 2019	Radiation (03CH01-CB)
Pre-Amplifier	EMCI	EMC330N	980332	20MHz ~ 3GHz	May 02, 2018	May 01, 2019	Radiation (03CH01-CB)
Pre-Amplifier	Agilent	8449B	3008A02310	1GHz ~ 26.5GHz	Jan. 09, 2018	Jan. 08, 2019	Radiation (03CH01-CB)
Pre-Amplifier	Agilent	8449B	3008A02310	1GHz ~ 26.5GHz	Jan. 08, 2019	Jan. 07, 2020	Radiation (03CH01-CB)
Pre-Amplifier	MITEQ	TTA1840-35- HG	1864479	18GHz ~ 40GHz	Jul. 04, 2018	Jul. 03, 2019	Radiation (03CH01-CB)
Spectrum analyzer	R&S	FSP40	100080	9kHz~40GHz	Oct. 03, 2018	Oct. 02, 2019	Radiation (03CH01-CB)
EMI Test Receiver	R&S	ESCS	100359	9kHz ~ 2.75GHz	Jul. 03, 2018	Jul. 02, 2019	Radiation (03CH01-CB)
RF Cable-low	Woken	Low Cable-16+17	N/A	30 MHz ~ 1 GHz	Oct. 08, 2018	Oct. 07, 2019	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-16	N/A	1 GHz ~ 18 GHz	Oct. 08, 2018	Oct. 07, 2019	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-16+17	N/A	1 GHz ~ 18 GHz	Oct. 08, 2018	Oct. 07, 2019	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-40G#1	N/A	18GHz ~ 40 GHz	Jul. 27, 2018	Jul. 26, 2019	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-40G#2	N/A	18GHz ~ 40 GHz	Jul. 27, 2018	Jul. 26, 2019	Radiation (03CH01-CB)
Spectrum analyzer	R&S	FSV40	101027	9kHz~40GHz	Jun. 22, 2018	Jun. 21, 2019	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)

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Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Calibration Due Date	Remark
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	U2021XA	MY53410001	50MHz~18GHz	Nov. 05, 2018	Nov. 04, 2019	Conducted (TH01-CB)

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

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

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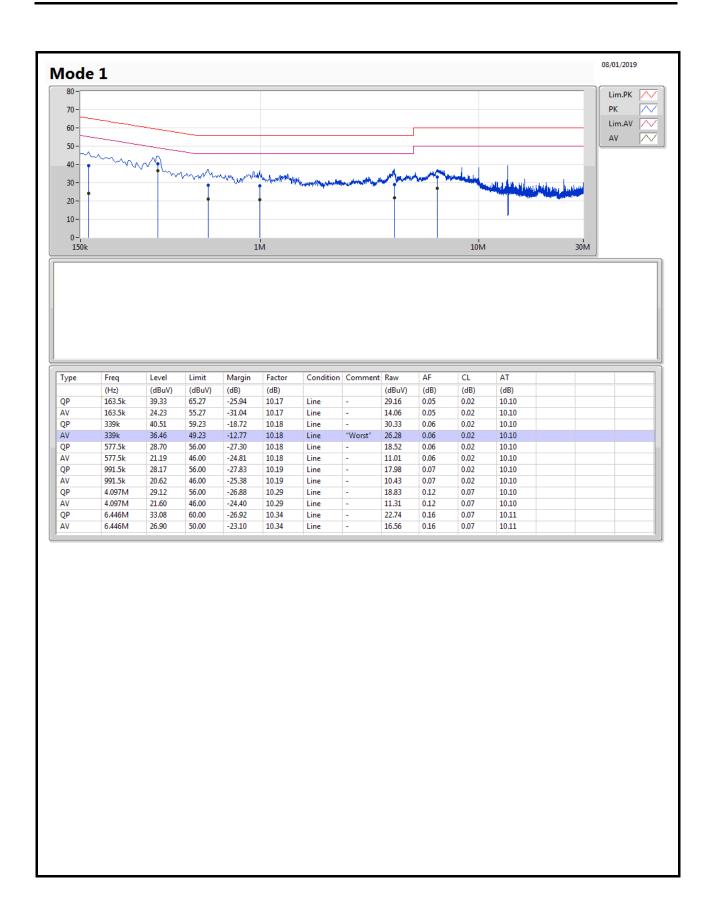
AC Power-line Conducted Emissions Result

Appendix A

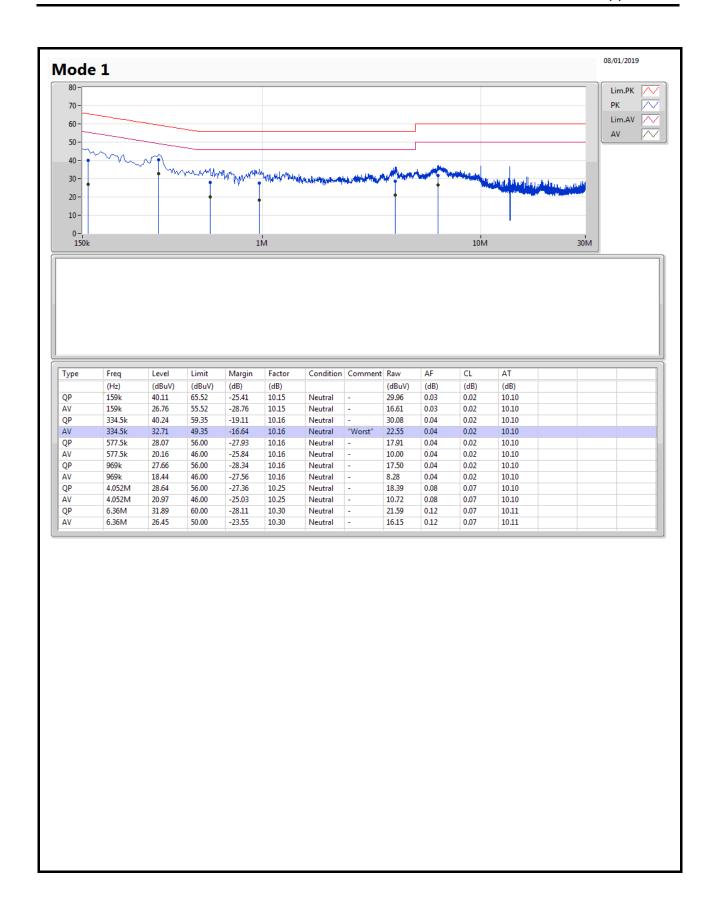
Summary

Mode	Result	Туре	Freq (Hz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Factor (dB)	Condition
Mode 1	Pass	AV	339k	36.46	49.23	-12.77	10.18	Line











Summary

Mode	Max-N dB	Max-OBW	ITU-Code	Min-N dB	Min-OBW
	(Hz)	(Hz)		(Hz)	(Hz)
2.4-2.4835GHz	-	-	-	-	-
802.11b_Nss1,(1Mbps)_2TX	10.075M	12.269M	12M3G1D	10.05M	12.219M
802.11g_Nss1,(6Mbps)_2TX	16.35M	16.617M	16M6D1D	16.325M	16.517M
802.11n HT20_Nss1,(MCS0)_2TX	17.5M	17.641M	17M6D1D	17.075M	17.616M
802.11n HT40_Nss1,(MCS0)_2TX	36.3M	36.332M	36M3D1D	35.9M	36.282M

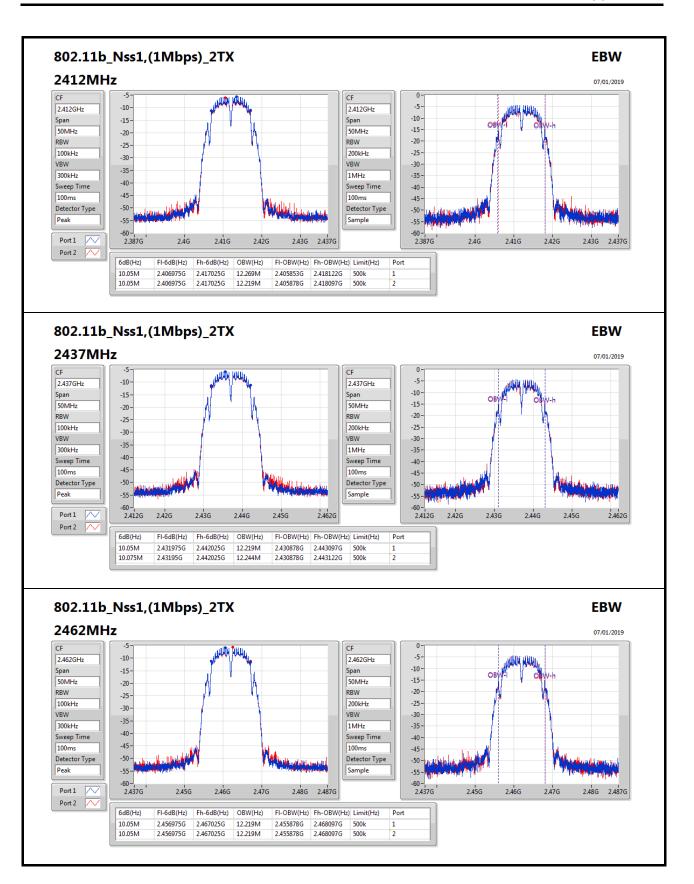
Max-N dB = Maximum 6dB down bandwidth; Max-OBW = Maximum 99% occupied bandwidth; Min-N dB = Minimum 6dB down bandwidth; Min-OBW = Minimum 99% occupied bandwidth;

Result

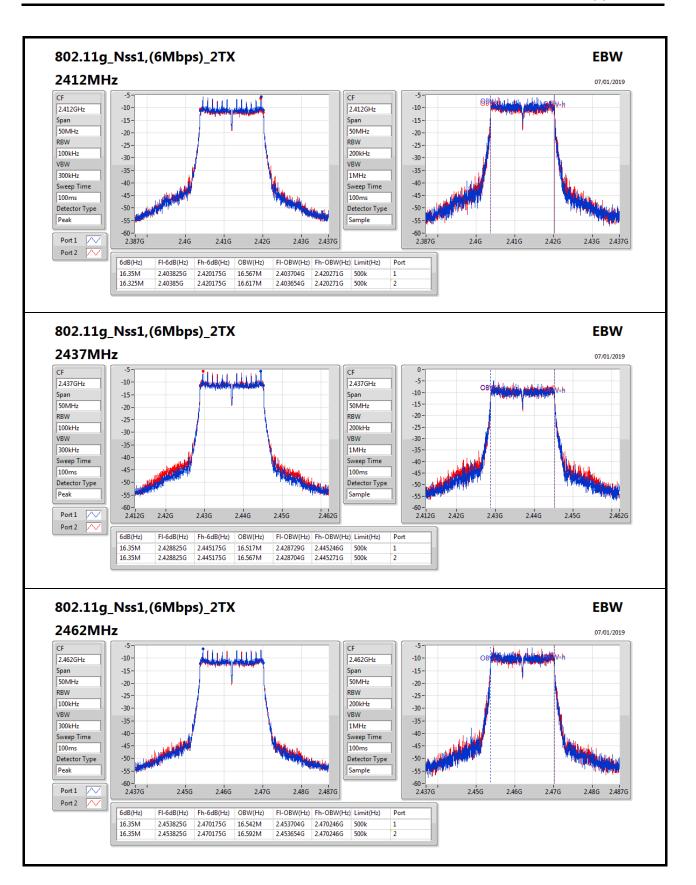
Mode	Result	Limit	Port 1-N dB	Port 1-OBW	Port 2-N dB	Port 2-OBW
		(Hz)	(Hz)	(Hz)	(Hz)	(Hz)
802.11b_Nss1,(1Mbps)_2TX	-	-	-	-	-	-
2412MHz	Pass	500k	10.05M	12.269M	10.05M	12.219M
2437MHz	Pass	500k	10.05M	12.219M	10.075M	12.244M
2462MHz	Pass	500k	10.05M	12.219M	10.05M	12.219M
802.11g_Nss1,(6Mbps)_2TX	-	-	-	-	-	-
2412MHz	Pass	500k	16.35M	16.567M	16.325M	16.617M
2437MHz	Pass	500k	16.35M	16.517M	16.35M	16.567M
2462MHz	Pass	500k	16.35M	16.542M	16.35M	16.592M
802.11n HT20_Nss1,(MCS0)_2TX	-	-	-	-	-	-
2412MHz	Pass	500k	17.5M	17.616M	17.3M	17.641M
2437MHz	Pass	500k	17.075M	17.641M	17.075M	17.641M
2462MHz	Pass	500k	17.075M	17.641M	17.075M	17.616M
802.11n HT40_Nss1,(MCS0)_2TX	-	-	-	-	-	-
2422MHz	Pass	500k	36.05M	36.332M	36.05M	36.282M
2437MHz	Pass	500k	36.3M	36.282M	36.3M	36.282M
2452MHz	Pass	500k	36.3M	36.332M	35.9M	36.332M

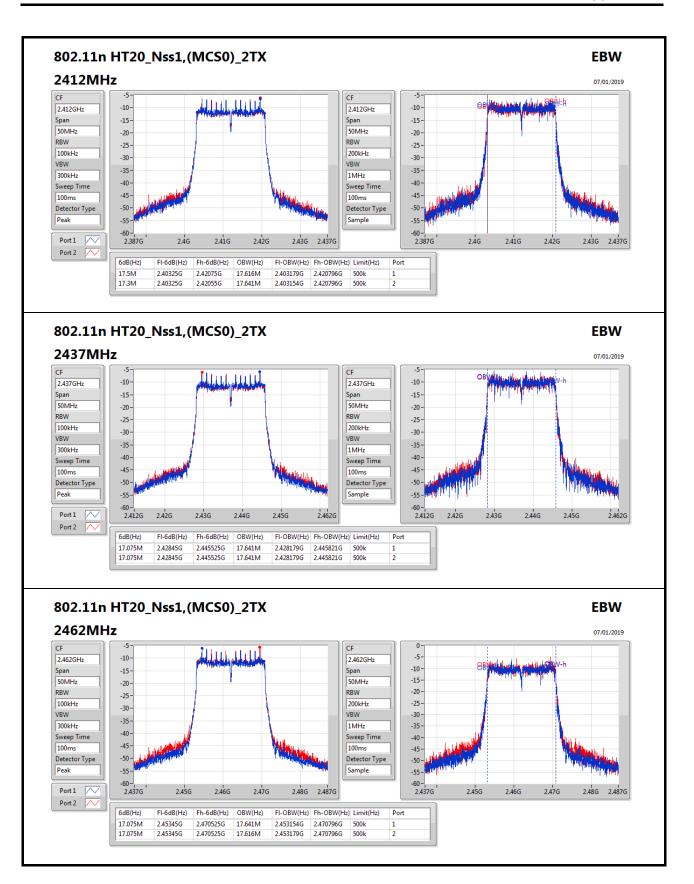
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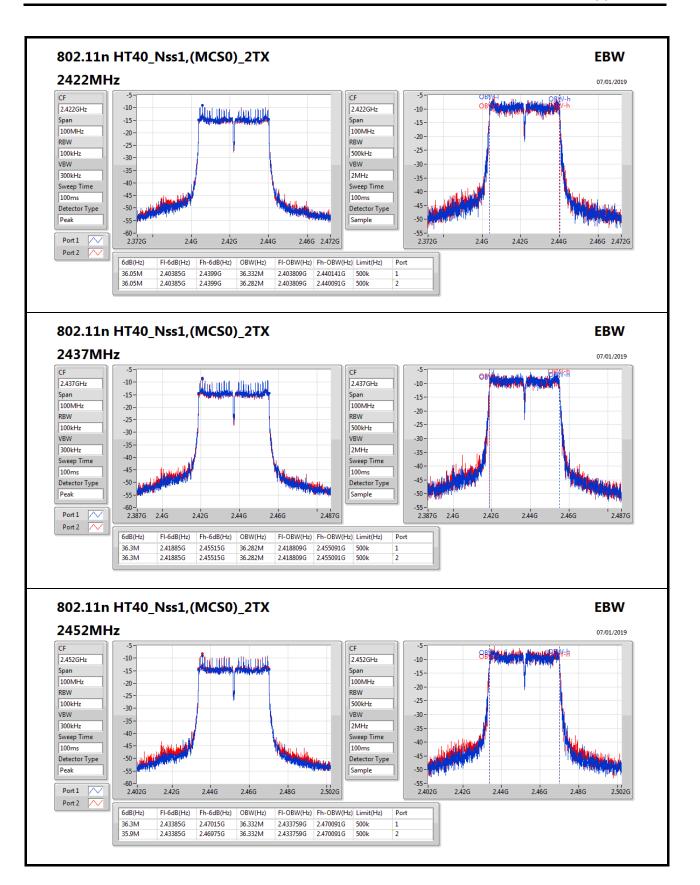
Port X-N dB = Port X 6dB down bandwidth; Port X-OBW = Port X 99% occupied bandwidth;













Appendix C **AV Power Result**

Summary

Mode	Total Power	Total Power
	(dBm)	(W)
2.4-2.4835GHz	-	-
802.11b_Nss1,(1Mbps)_2TX	7.69	0.00587
802.11g_Nss1,(6Mbps)_2TX	7.69	0.00587
802.11n HT20_Nss1,(MCS0)_2TX	7.48	0.00560
802.11n HT40_Nss1,(MCS0)_2TX	7.46	0.00557

Result

Mode	Result	DG	Port 1	Port 2	Total Power	Power Limit
		(dBi)	(dBm)	(dBm)	(dBm)	(dBm)
802.11b_Nss1,(1Mbps)_2TX	-	-	-	-	-	-
2412MHz	Pass	2.00	4.82	4.01	7.44	30.00
2437MHz	Pass	2.00	4.78	4.11	7.47	30.00
2462MHz	Pass	2.00	4.73	4.62	7.69	30.00
802.11g_Nss1,(6Mbps)_2TX	-	-	-	-	-	-
2412MHz	Pass	2.00	5.05	4.24	7.67	30.00
2437MHz	Pass	2.00	5.08	4.24	7.69	30.00
2462MHz	Pass	2.00	4.76	4.02	7.42	30.00
802.11n HT20_Nss1,(MCS0)_2TX	-	-	-	-	-	-
2412MHz	Pass	2.00	4.85	4.01	7.46	30.00
2437MHz	Pass	2.00	4.56	4.38	7.48	30.00
2462MHz	Pass	2.00	4.35	4.36	7.37	30.00
802.11n HT40_Nss1,(MCS0)_2TX	-	-	-	-	-	-
2422MHz	Pass	2.00	4.77	4.11	7.46	30.00
2437MHz	Pass	2.00	4.56	4.25	7.42	30.00
2452MHz	Pass	2.00	4.32	4.52	7.43	30.00

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



Summary

Mode	PD
	(dBm/RBW)
2.4-2.4835GHz	
802.11b_Nss1,(1Mbps)_2TX	-18.56
802.11g_Nss1,(6Mbps)_2TX	-19.91
802.11n HT20_Nss1,(MCS0)_2TX	-19.37
802.11n HT40_Nss1,(MCS0)_2TX	-21.93

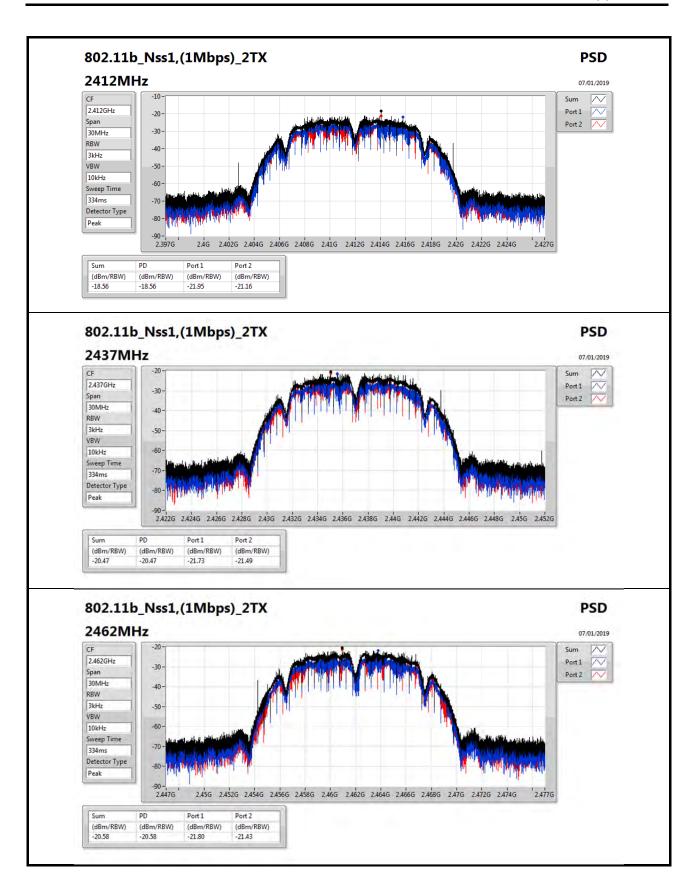
RBW=3kHz.

Result

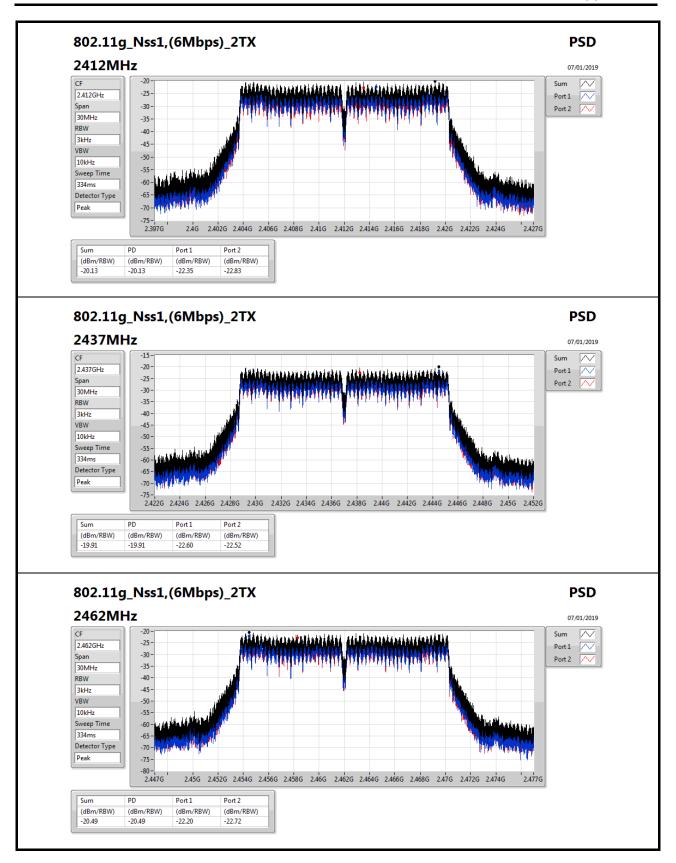
Mode	Result	DG	Port 1	Port 2	PD	PD Limit
		(dBi)	(dBm/RBW)	(dBm/RBW)	(dBm/RBW)	(dBm/RBW)
802.11b_Nss1,(1Mbps)_2TX	-	-	-	-	-	-
2412MHz	Pass	5.01	-21.95	-21.16	-18.56	8.00
2437MHz	Pass	5.01	-21.73	-21.49	-20.47	8.00
2462MHz	Pass	5.01	-21.80	-21.43	-20.58	8.00
802.11g_Nss1,(6Mbps)_2TX	-	-	-	-	-	-
2412MHz	Pass	5.01	-22.35	-22.83	-20.13	8.00
2437MHz	Pass	5.01	-22.60	-22.52	-19.91	8.00
2462MHz	Pass	5.01	-22.20	-22.72	-20.49	8.00
802.11n HT20_Nss1,(MCS0)_2TX	-	-	-	-	-	-
2412MHz	Pass	5.01	-22.37	-22.17	-20.23	8.00
2437MHz	Pass	5.01	-20.53	-22.35	-19.46	8.00
2462MHz	Pass	5.01	-21.31	-22.04	-19.37	8.00
802.11n HT40_Nss1,(MCS0)_2TX	-	-	-	-	-	-
2422MHz	Pass	5.01	-24.31	-24.77	-22.50	8.00
2437MHz	Pass	5.01	-24.39	-25.60	-22.46	8.00
2452MHz	Pass	5.01	-23.56	-24.80	-21.93	8.00

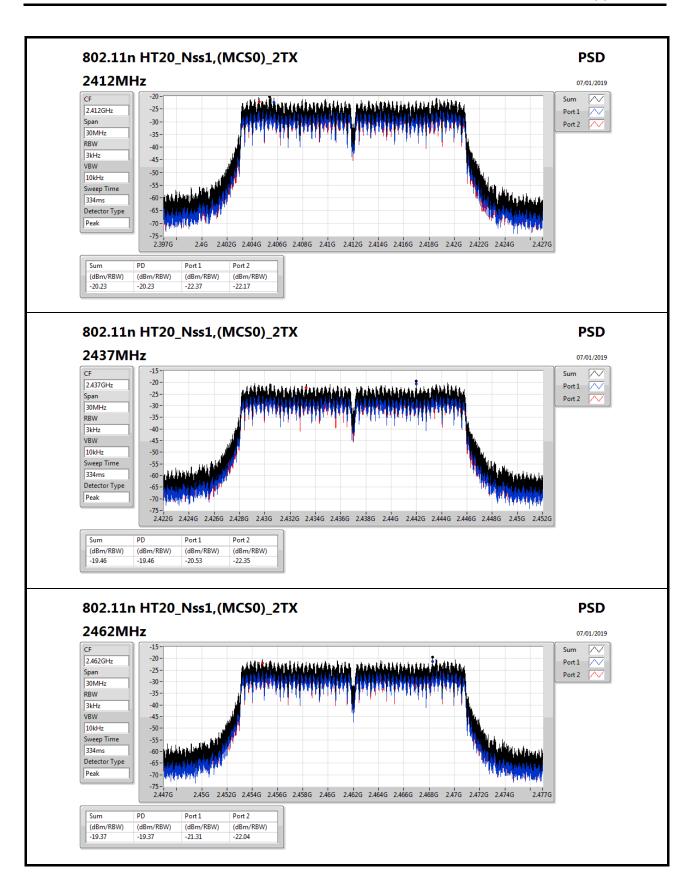
DG = Directional Gain; RBW=3kHz;
PD = trace bin-by-bin of each transmits port summing can be performed maximum power density; Port X = Port Xpower density;



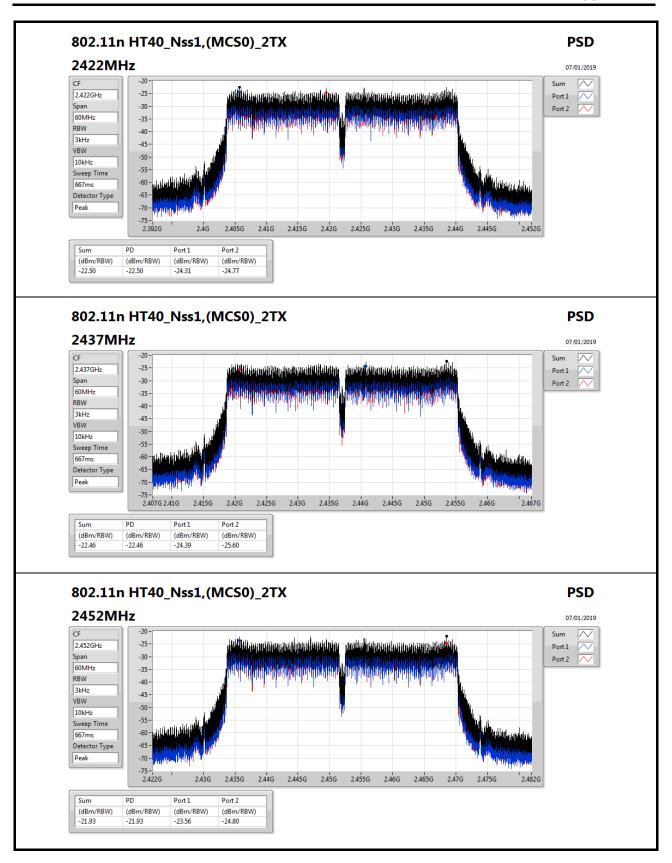














CSE Non-restricted Band Result

Appendix E

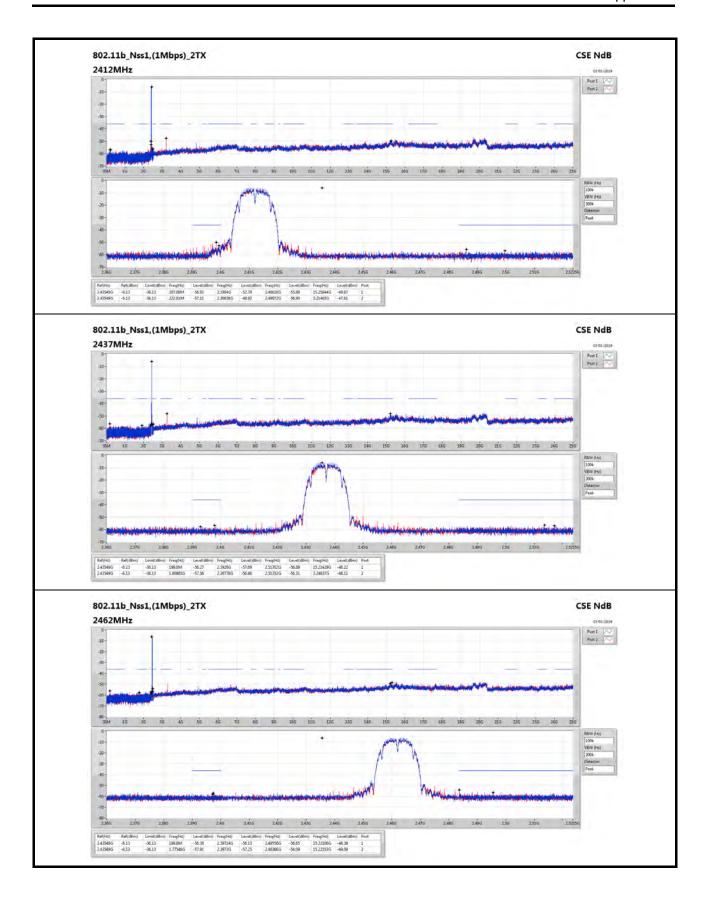
Summary

Mode	Result	Ref	Ref	Limit	Freq	Level	Freq	Level	Freq	Level	Freq	Level	Port
		(Hz)	(dBm)	(dBm)	(Hz)	(dBm)	(Hz)	(dBm)	(Hz)	(dBm)	(Hz)	(dBm)	
2.4-2.4835GHz			-	-	-	-	-		-			-	-
802.11b_Nss1,(1Mbps)_2TX		2.43549G	-6.13	-36.13	222.81M	-57.11	2.39838G	-49.92	2.49972G	-56.90	3.21465G	-47.61	2
802.11g_Nss1,(6Mbps)_2TX		2.44451G	-6.16	-36.16	203.88M	-56.89	2.39982G	-42.64	2.51054G	-55.67	15.23677G	-48.84	1
802.11n HT20_Nss1,(MCS0)_2TX		2.42943G	-8.61	-38.61	1.65751G	-57.11	2.39984G	-43.73	2.50592G	-57.11	3.21465G	-48.07	2
802.11n HT40_Nss1,(MCS0)_2TX	Pass	2.42075G	-13.10	-43.10	1.97736G	-58.05	2.39852G	-44.89	2.4965G	-56.36	15.23451G	-48.39	1

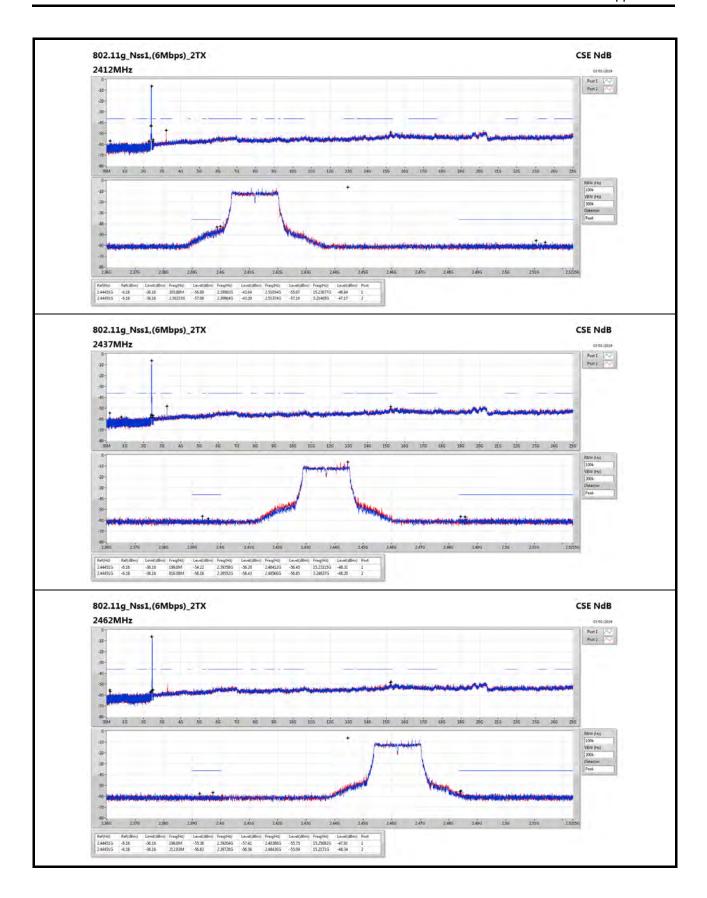
Result

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_Nss1,(1Mbps)_2TX	-	-	-		-	-	-	-	-	-	-	-	-
2412MHz	Pass	2.43549G	-6.13	-36.13	207.08M	-56.92	2.3994G	-52.79	2.48616G	-55.89	15.25644G	-49.67	1
2412MHz	Pass	2.43549G	-6.13	-36.13	222.81M	-57.11	2.39838G	-49.92	2.49972G	-56.90	3.21465G	-47.61	2
2437MHz	Pass	2.43549G	-6.13	-36.13	199.8M	-56.27	2.3928G	-57.69	2.51702G	-56.89	15.21429G	-48.22	1
2437MHz	Pass	2.43549G	-6.13	-36.13	1.90885G	-57.56	2.39778G	-56.66	2.51352G	-56.31	3.24837G	-48.11	2
2462MHz	Pass	2.43549G	-6.13	-36.13	199.8M	-56.30	2.39714G	-58.13	2.49556G	-56.65	15.32106G	-48.39	1
2462MHz	Pass	2.43549G	-6.13	-36.13	1.77546G	-57.91	2.3973G	-57.25	2.48366G	-54.09	15.22553G	-49.09	2
802.11g_Nss1,(6Mbps)_2TX	-	-		-	-		-		-	-	-	-	-
2412MHz	Pass	2.44451G	-6.16	-36.16	203.88M	-56.89	2.39982G	-42.64	2.51054G	-55.67	15.23677G	-48.84	1
2412MHz	Pass	2.44451G	-6.16	-36.16	2.30233G	-57.08	2.39864G	-43.20	2.51374G	-57.10	3.21465G	-47.17	2
2437MHz	Pass	2.44451G	-6.16	-36.16	199.8M	-54.22	2.39358G	-56.20	2.48412G	-56.45	15.23115G	-48.31	1
2437MHz	Pass	2.44451G	-6.16	-36.16	816.08M	-58.16	2.39552G	-58.43	2.48566G	-56.85	3.24837G	-48.20	2
2462MHz	Pass	2.44451G	-6.16	-36.16	199.8M	-55.36	2.39264G	-57.41	2.48388G	-55.75	15.25082G	-47.91	1
2462MHz	Pass	2.44451G	-6.16	-36.16	212.03M	-56.82	2.39728G	-56.56	2.48426G	-55.09	15.2171G	-48.34	2
802.11n HT20_Nss1,(MCS0)_2TX	-	-	-	-	-	-	-	-	-	-	-	-	-
2412MHz	Pass	2.42943G	-8.61	-38.61	199.8M	-57.20	2.39982G	-45.69	2.50064G	-56.46	15.25082G	-48.73	1
2412MHz	Pass	2.42943G	-8.61	-38.61	1.65751G	-57.11	2.39984G	-43.73	2.50592G	-57.11	3.21465G	-48.07	2
2437MHz	Pass	2.42943G	-8.61	-38.61	1.63508G	-57.65	2.39228G	-56.23	2.49348G	-56.35	15.2171G	-48.81	1
2437MHz	Pass	2.42943G	-8.61	-38.61	808.8M	-56.91	2.39128G	-57.49	2.4972G	-57.19	3.24837G	-48.52	2
2462MHz	Pass	2.42943G	-8.61	-38.61	199.8M	-55.49	2.3939G	-57.81	2.48386G	-54.37	14.92772G	-48.98	1
2462MHz	Pass	2.42943G	-8.61	-38.61	207.95M	-58.06	2.39844G	-58.09	2.48362G	-52.66	15.21429G	-48.04	2
802.11n HT40_Nss1,(MCS0)_2TX	-	-	-	-	-	-	-	-	-	-	-	-	-
2422MHz	Pass	2.42075G	-13.10	-43.10	1.97736G	-58.05	2.39852G	-44.89	2.4965G	-56.36	15.23451G	-48.39	1
2422MHz	Pass	2.42075G	-13.10	-43.10	558.99M	-58.02	2.39888G	-45.03	2.49866G	-56.40	3.22818G	-48.50	2
2437MHz	Pass	2.42075G	-13.10	-43.10	2.12678G	-57.69	2.397G	-50.78	2.48382G	-55.83	16.38438G	-49.50	1
2437MHz	Pass	2.42075G	-13.10	-43.10	2.13251G	-57.89	2.39952G	-49.96	2.48574G	-56.41	15.21769G	-47.48	2
2452MHz	Pass	2.42075G	-13.10	-43.10	1.63472G	-57.32	2.392G	-57.62	2.48822G	-52.73	15.23451G	-49.10	1
2452MHz	Pass	2.42075G	-13.10	-43.10	2.30769G	-57.08	2.39188G	-58.10	2.48358G	-50.00	3.26745G	-49.31	2

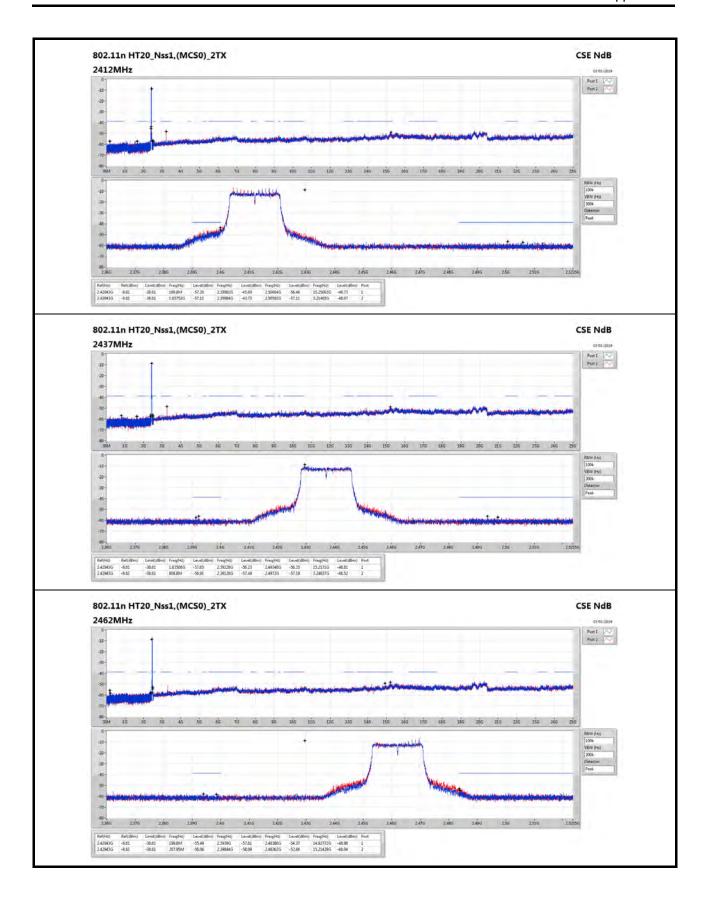




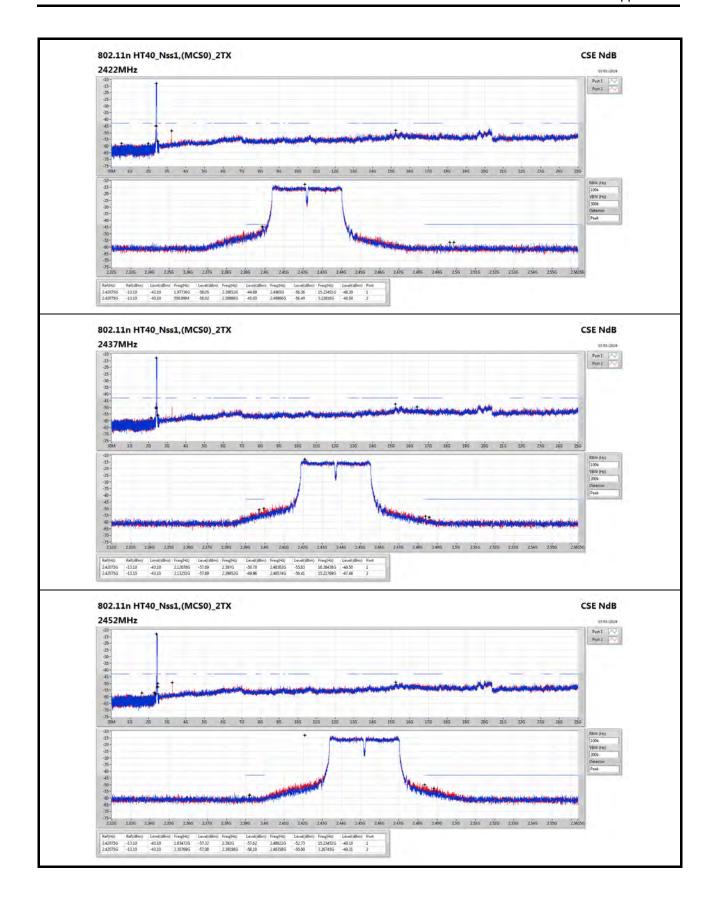






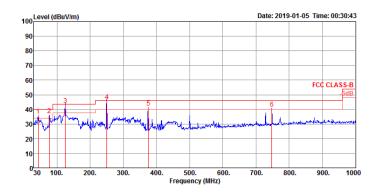








RSE below 1GHz Result											
Operating Mode 1 Polarization Vertical											
Operating Function	СТХ										

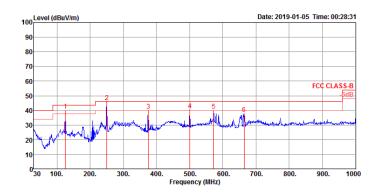


	Freq	Level	Limit Line					Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	43.58	35.65	40.00	-4.35	48.64	0.88	17.82	31.69	150	0	Peak	VERTICAL
2	77.53	36.20	40.00	-3.80	53.79	1.14	13.13	31.86	150	0	Peak	VERTICAL
3	125.06	43.05	43.50	-0.45	54.90	1.44	18.60	31.89	103	115	QP	VERTICAL
4	250.19	45.76	46.00	-0.24	56.80	2.04	18.90	31.98	100	356	QP	VERTICAL
5	375.32	41.38	46.00	-4.62	49.10	2.51	21.88	32.11	150	0	Peak	VERTICAL
6	747.80	40.64	46.00	-5.36	43.37	3.63	26.17	32.53	150	0	Peak	VERTICAL

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.)



RSE below 1GHz Result											
Operating Mode	1	Polarization	Horizontal								
Operating Function	СТХ										



	Freq	Level	Limit Line					Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	125.06	39.93	43.50	-3.57	51.78	1.44	18.60	31.89	100	360	Peak	HORIZONTAL
2	250.19	45.94	46.00	-0.06	56.98	2.04	18.90	31.98	112	169	QP	HORIZONTAL
3	375.32	40.03	46.00	-5.97	47.75	2.51	21.88	32.11	100	360	Peak	HORIZONTAL
4	500.45	40.18	46.00	-5.82	45.67	2.94	23.83	32.26	100	360	Peak	HORIZONTAL
5	572.23	39.74	46.00	-6.26	44.18	3.20	24.74	32.38	100	360	Peak	HORIZONTAL
6	664.38	37.75	46.00	-8.25	41.37	3.31	25.53	32.46	100	360	Peak	HORIZONTAL

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.)



RSE TX above 1GHz Result

Appendix F.2

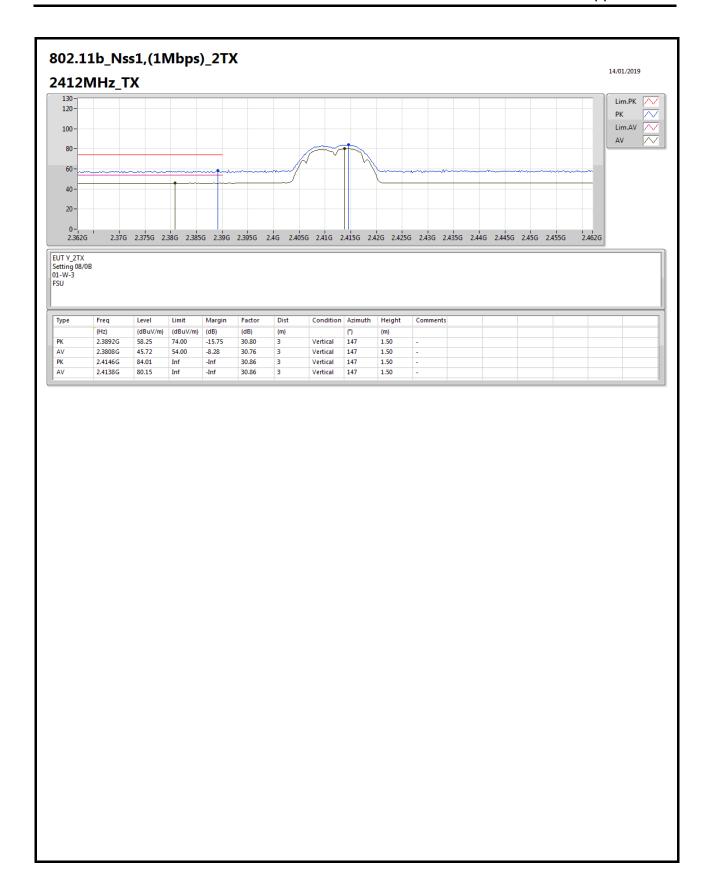
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Summary

Mode	Result	Туре	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Comments
			(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dB)	(m)		(°)	(m)	
2.4-2.4835GHz	-	-	-	-	-	-	-	-	-	-	-	-
802.11n HT40_Nss1,(MCS0)_2TX	Pass	AV	2.39G	53.97	54.00	-0.03	30.80	3	Vertical	63	1.43	-

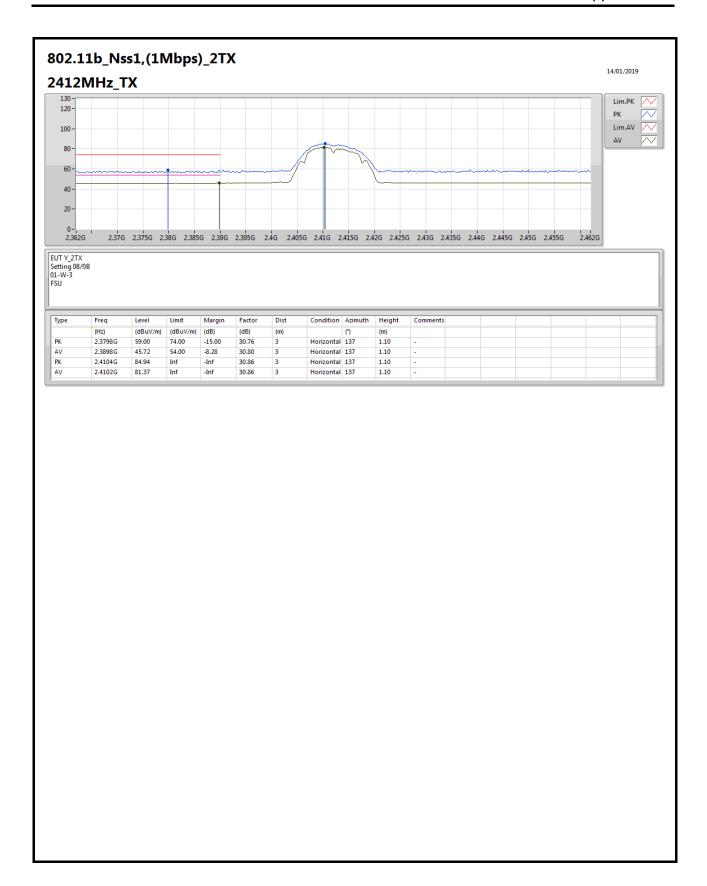
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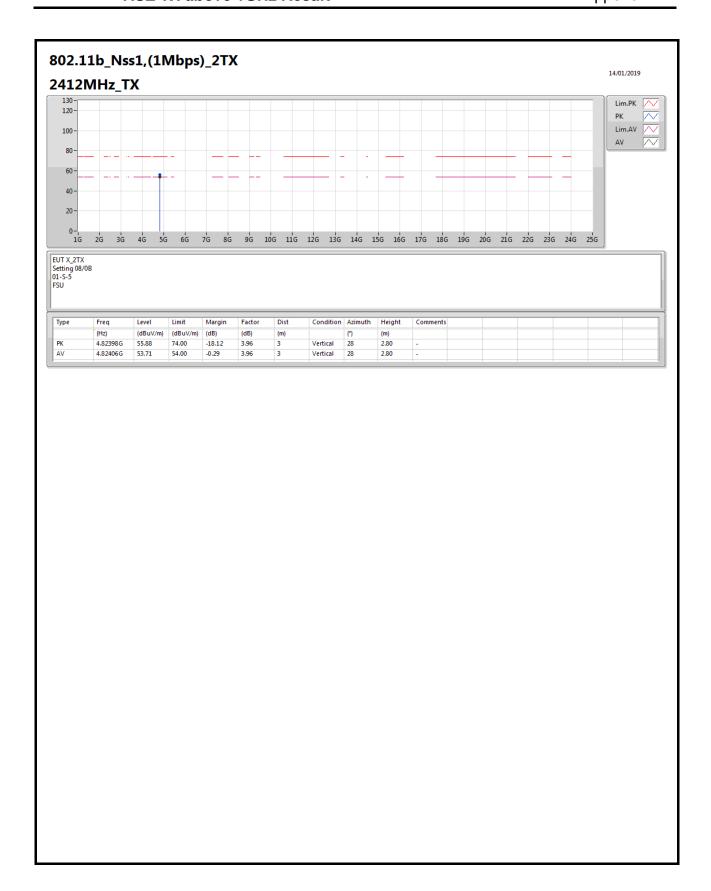
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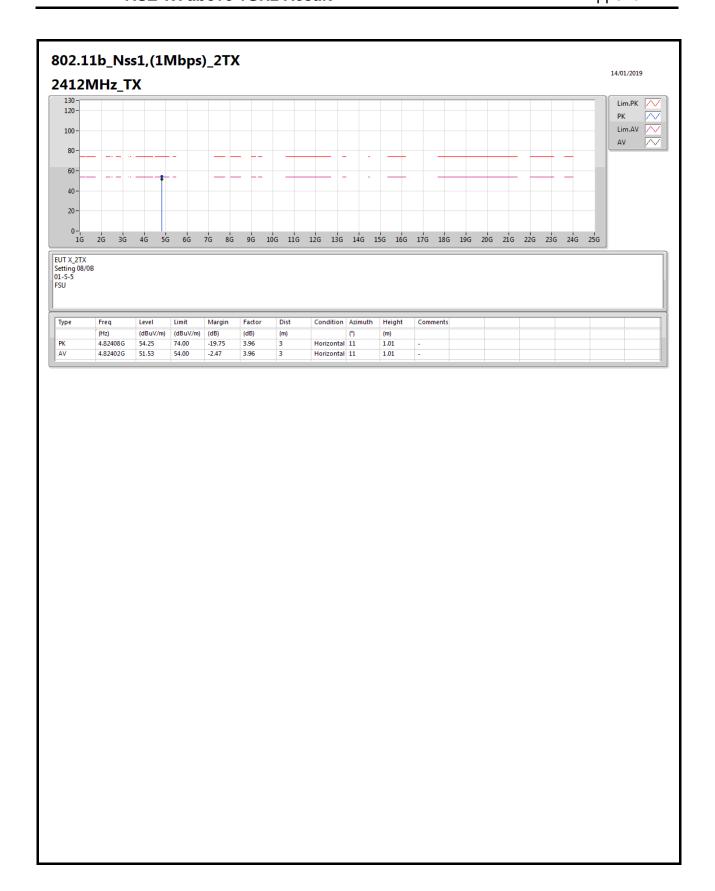
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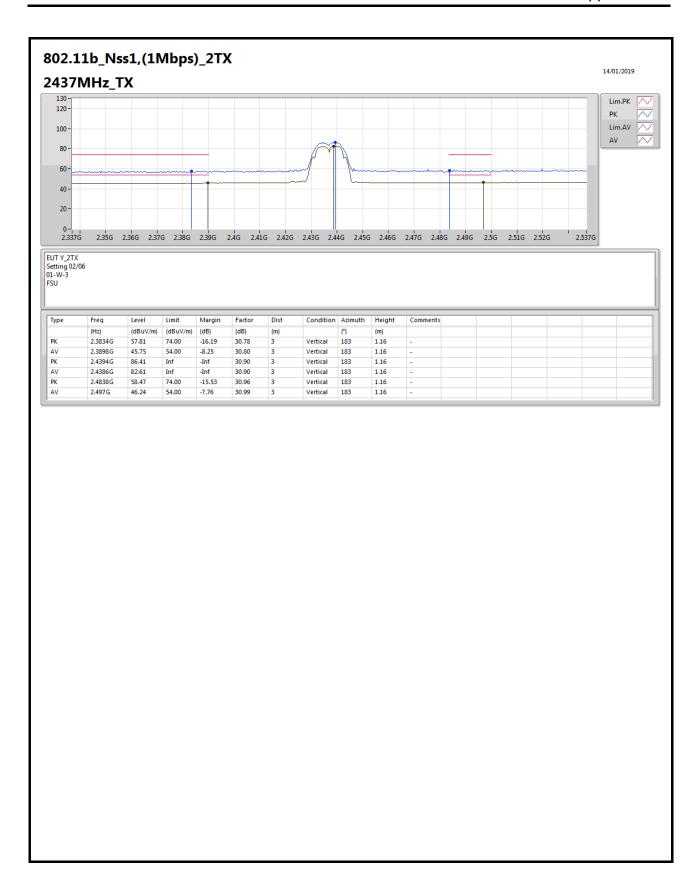
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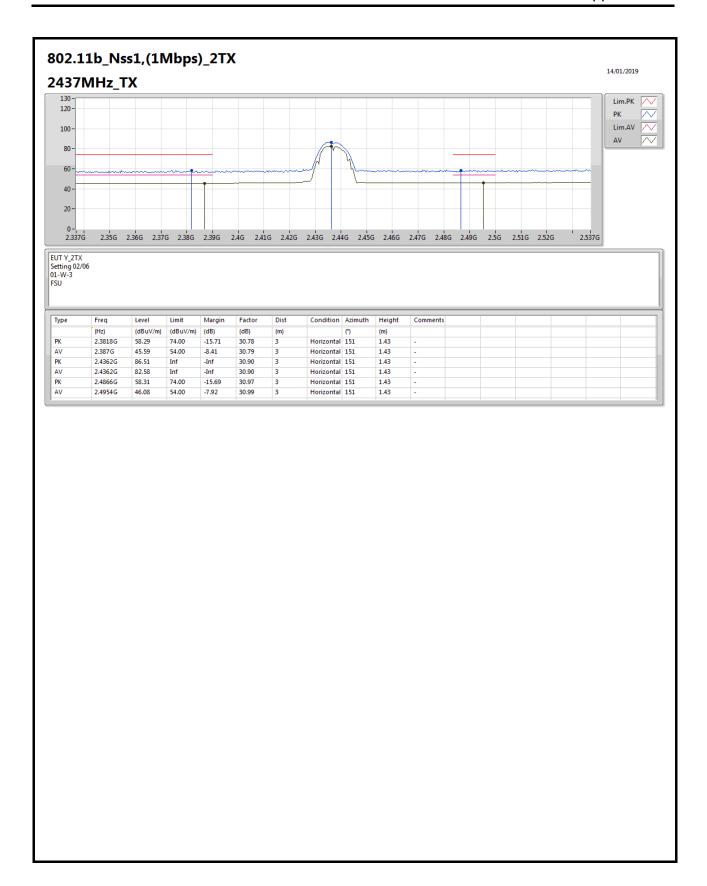
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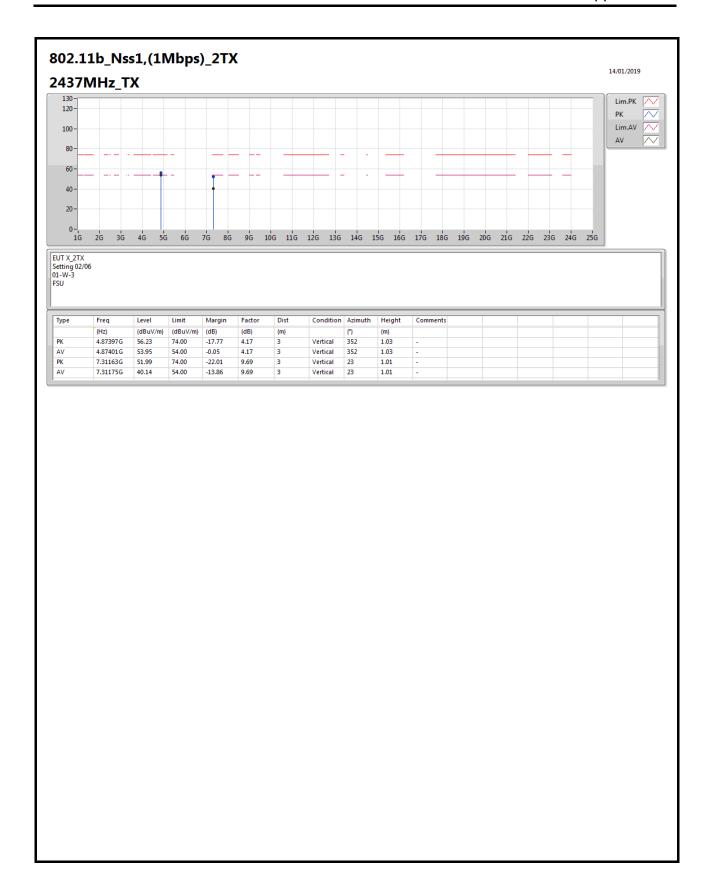
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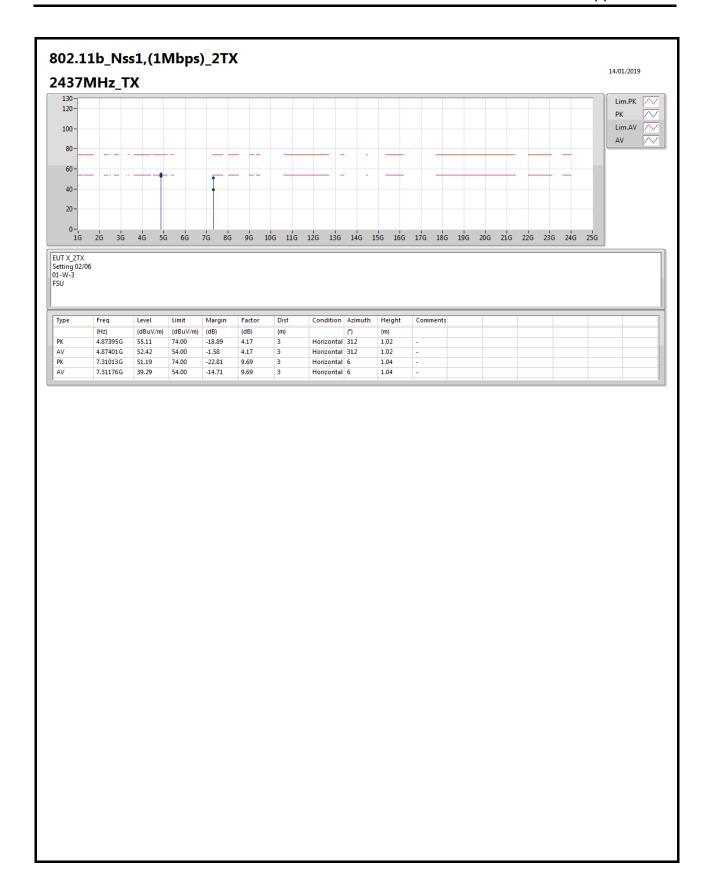
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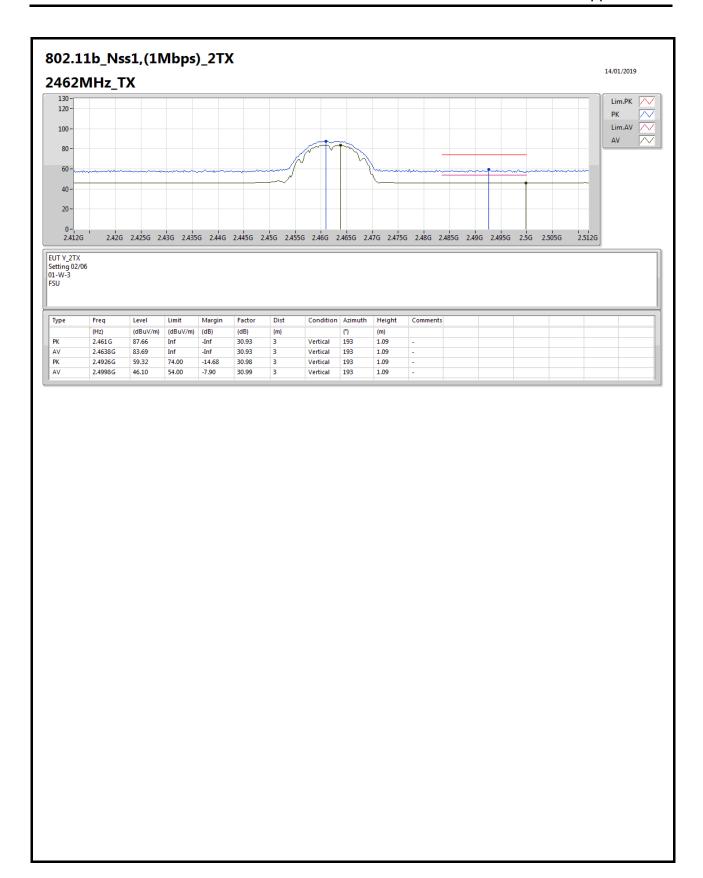
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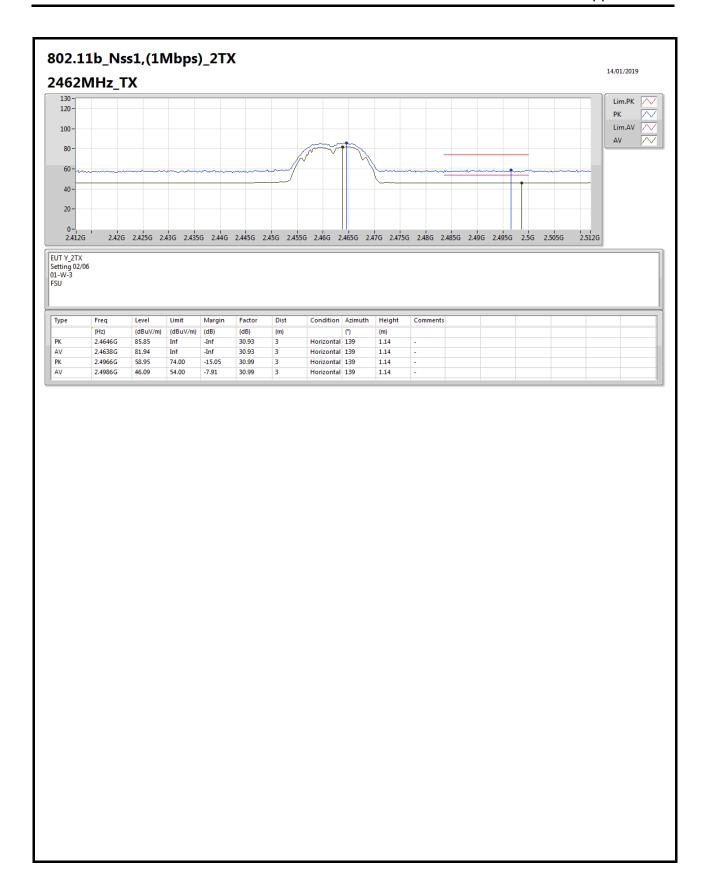
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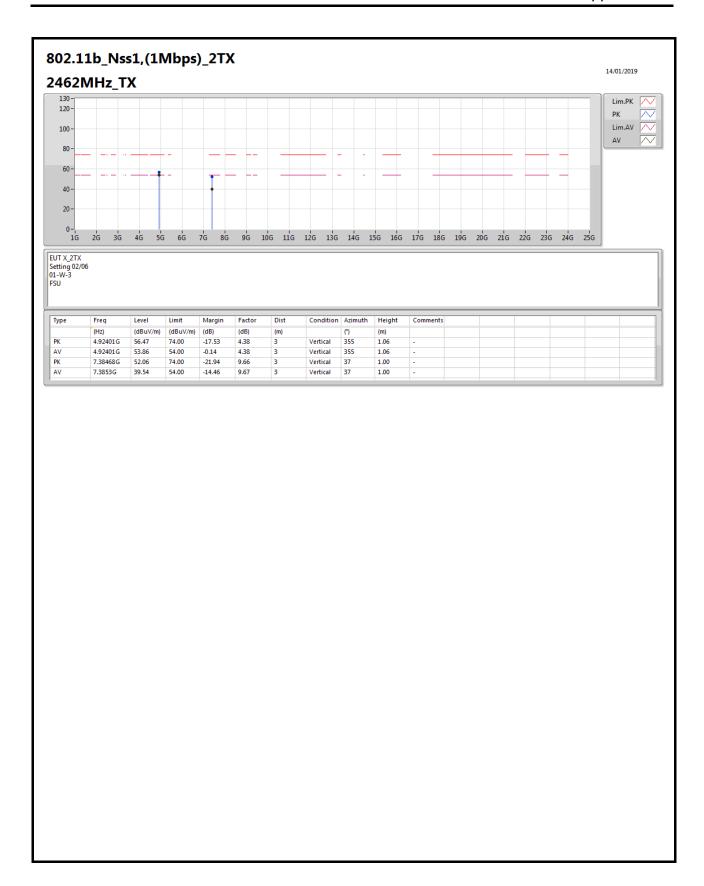
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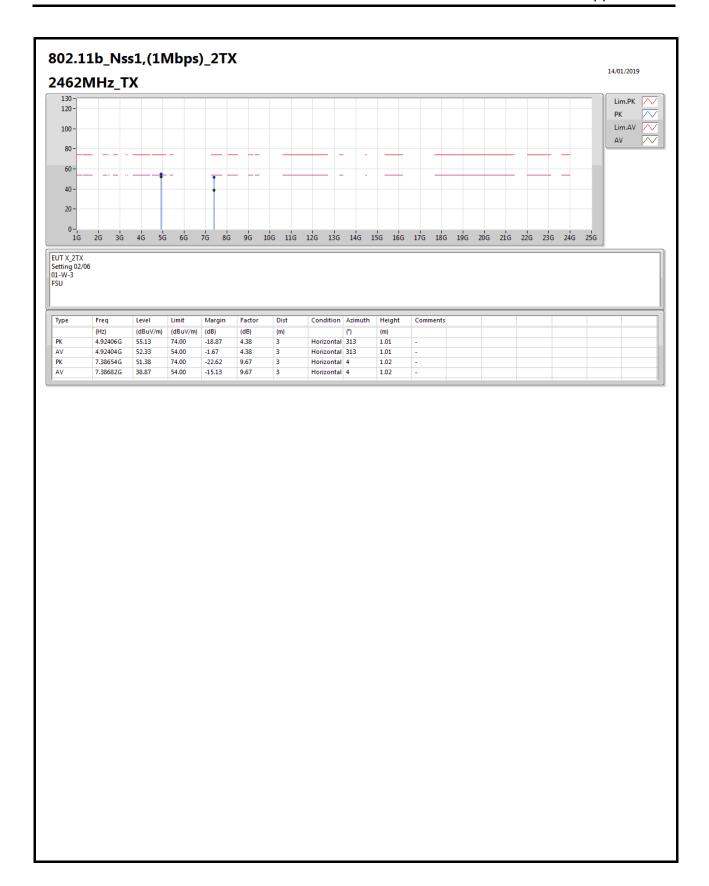
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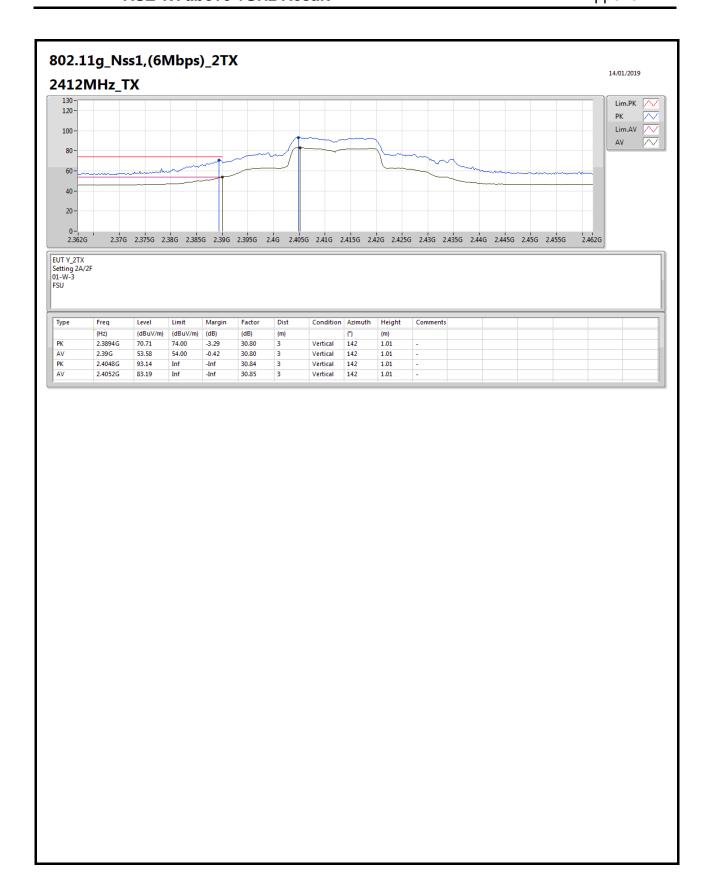
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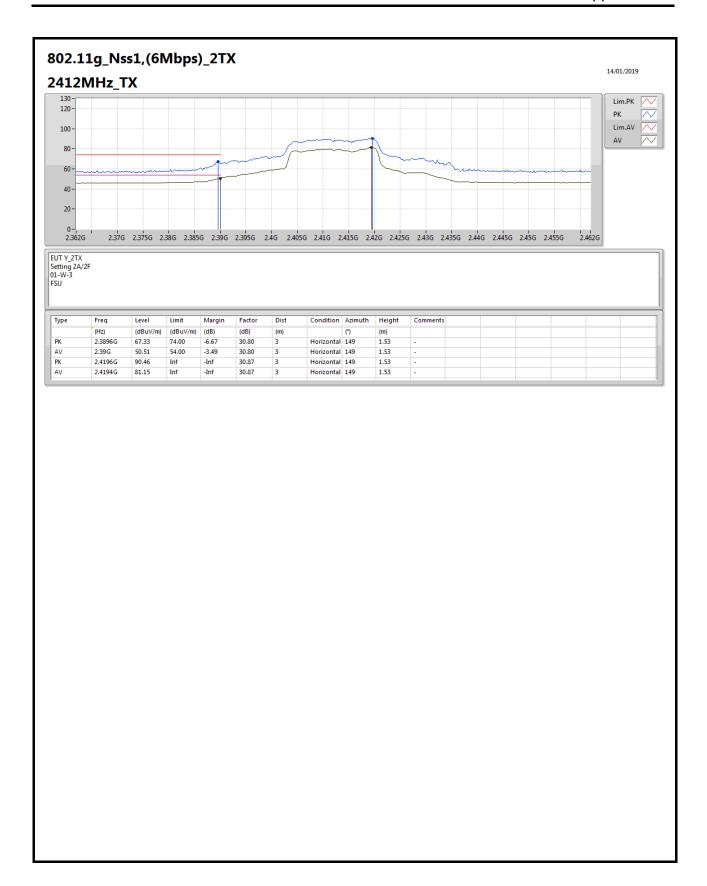
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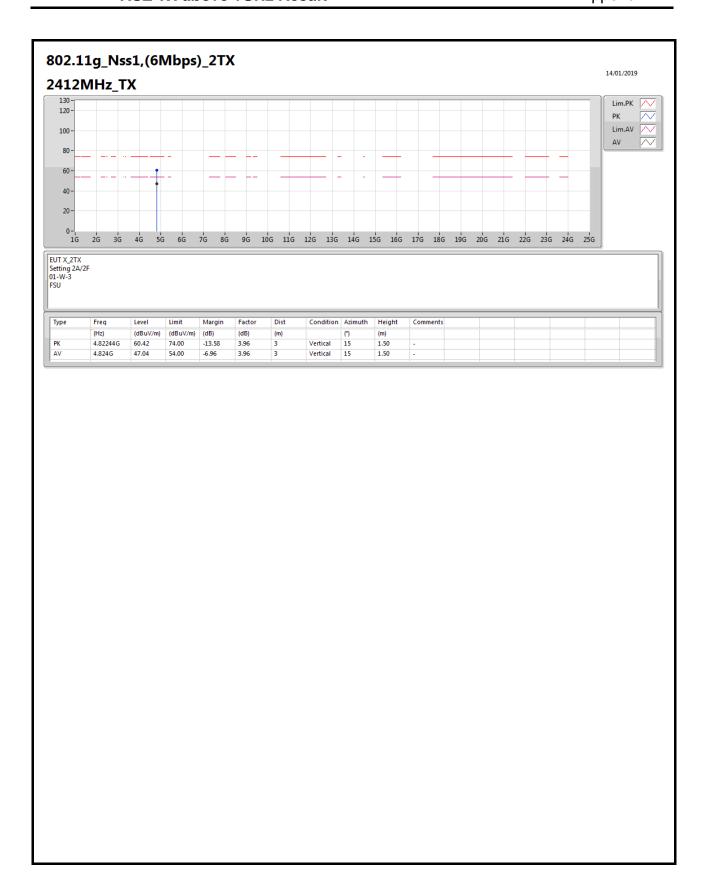
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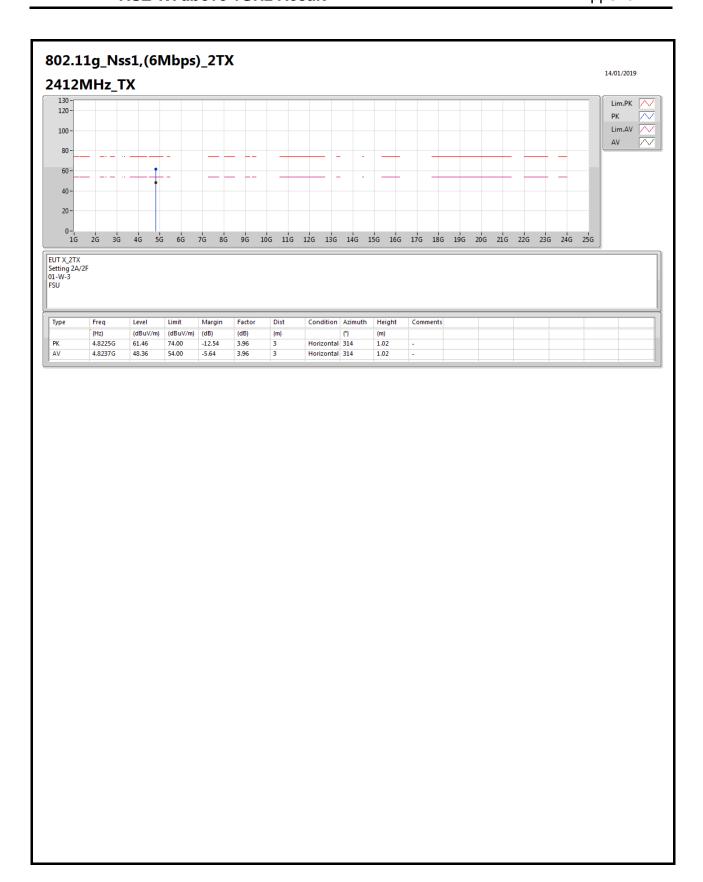
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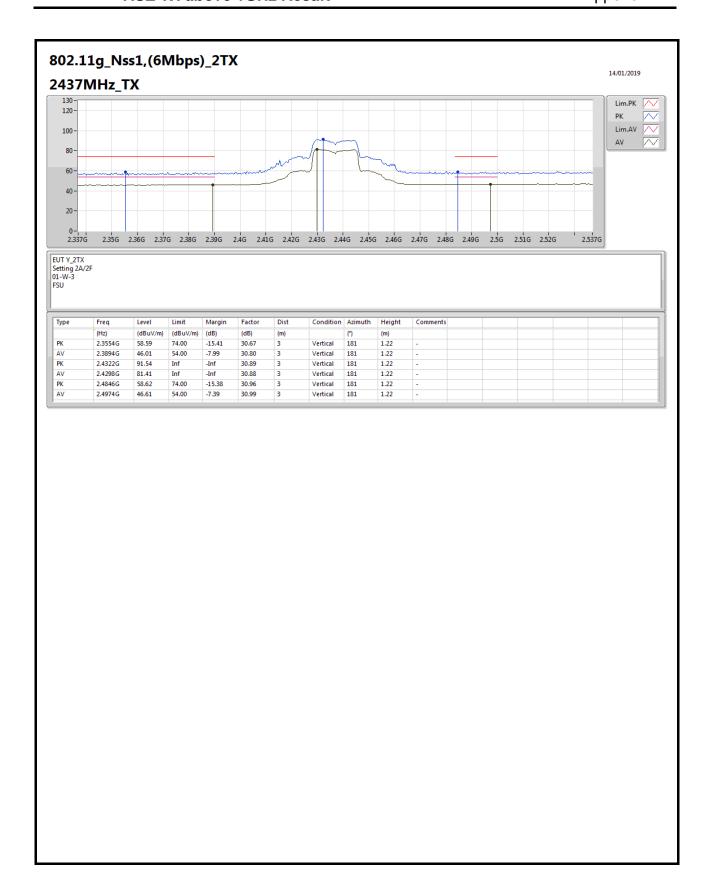
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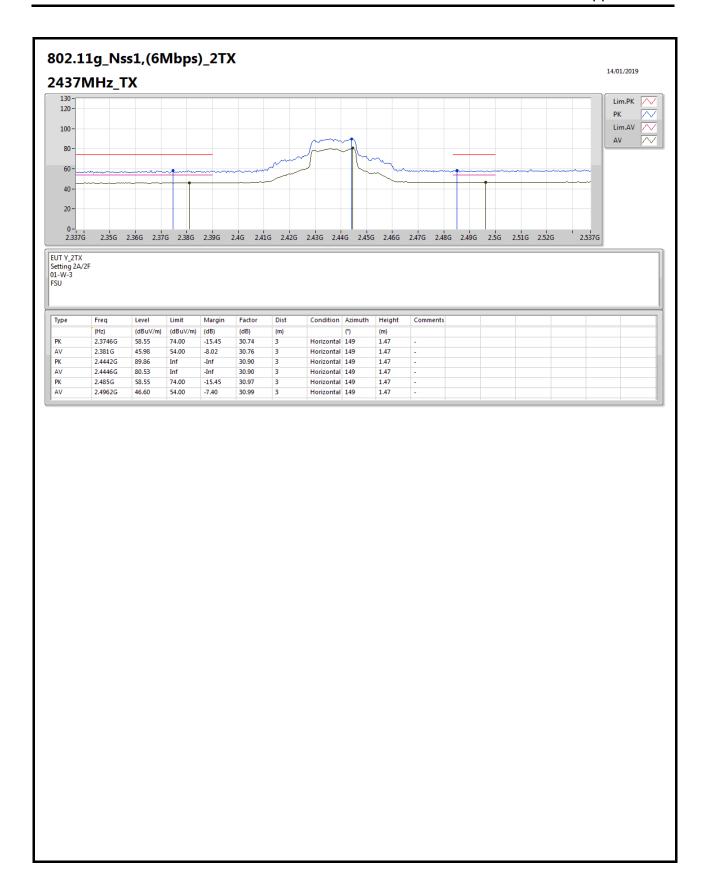
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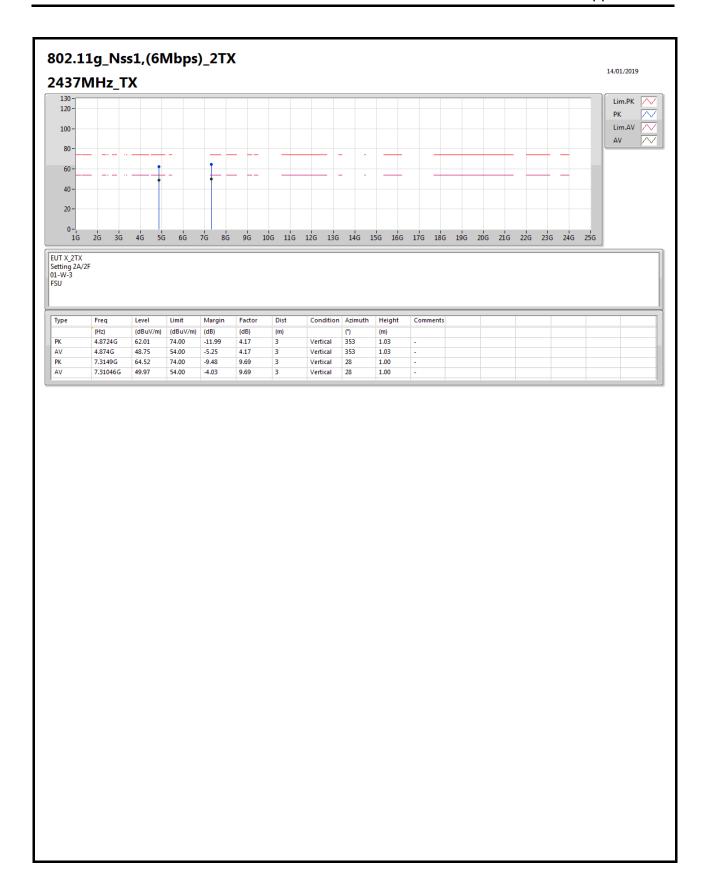
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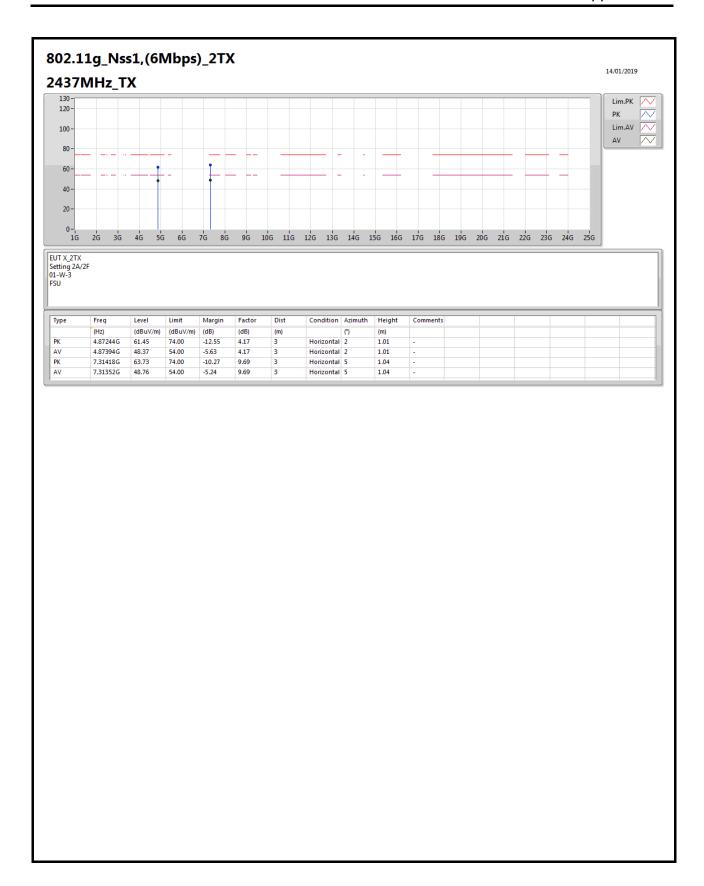
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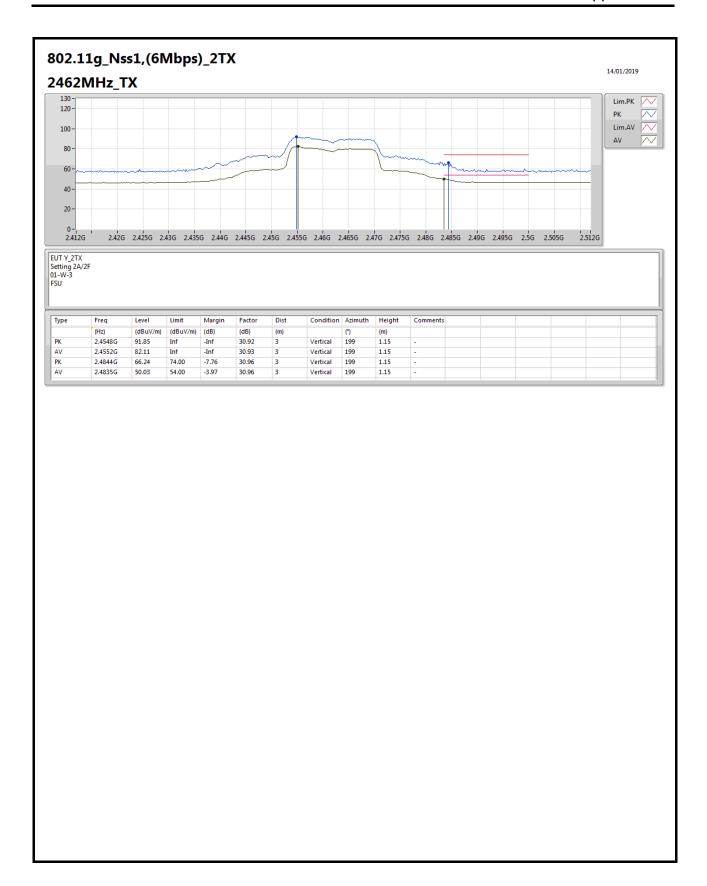
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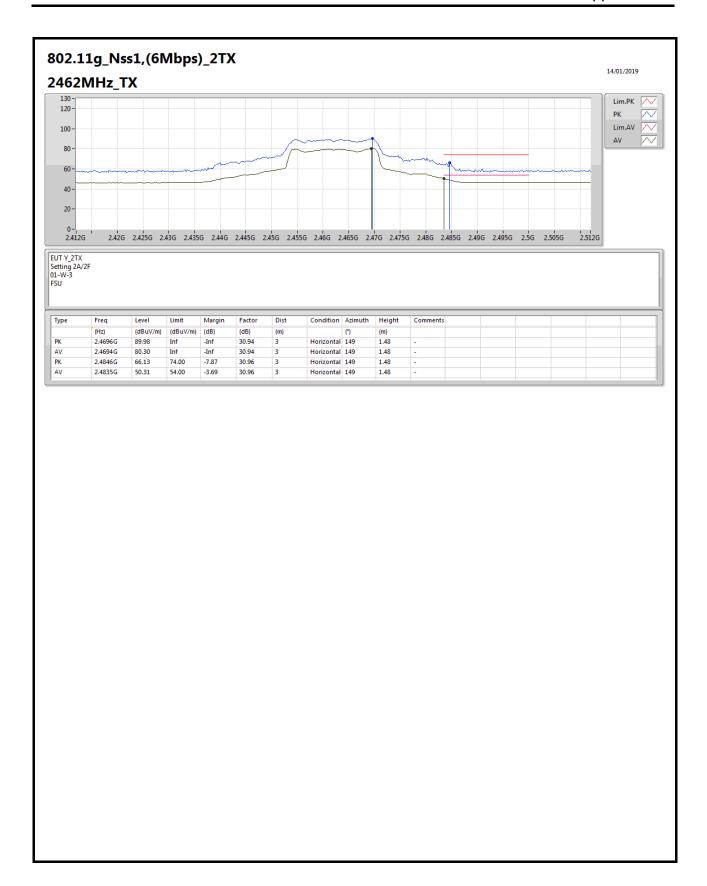
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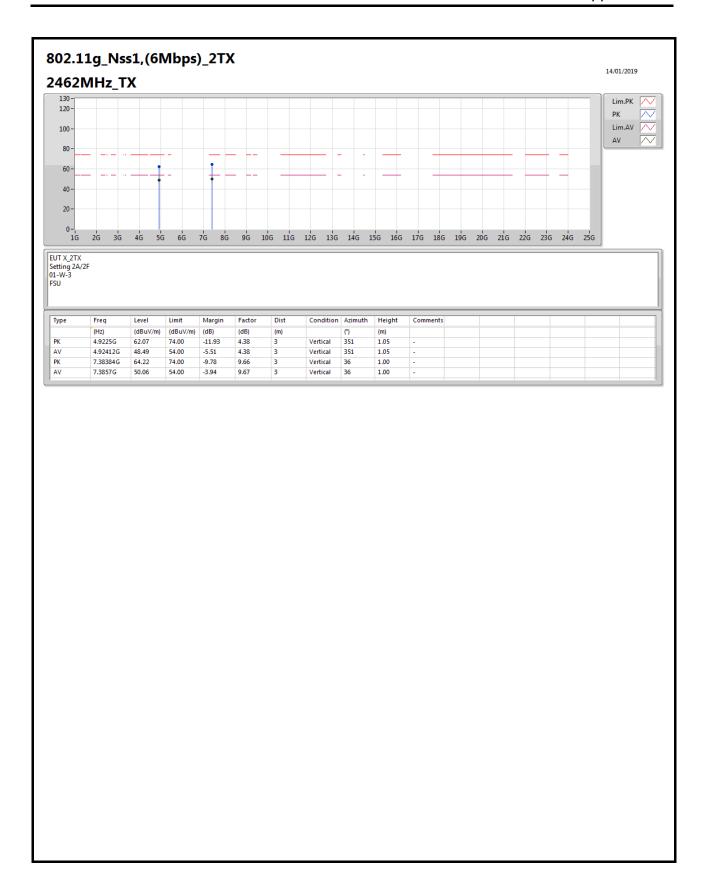
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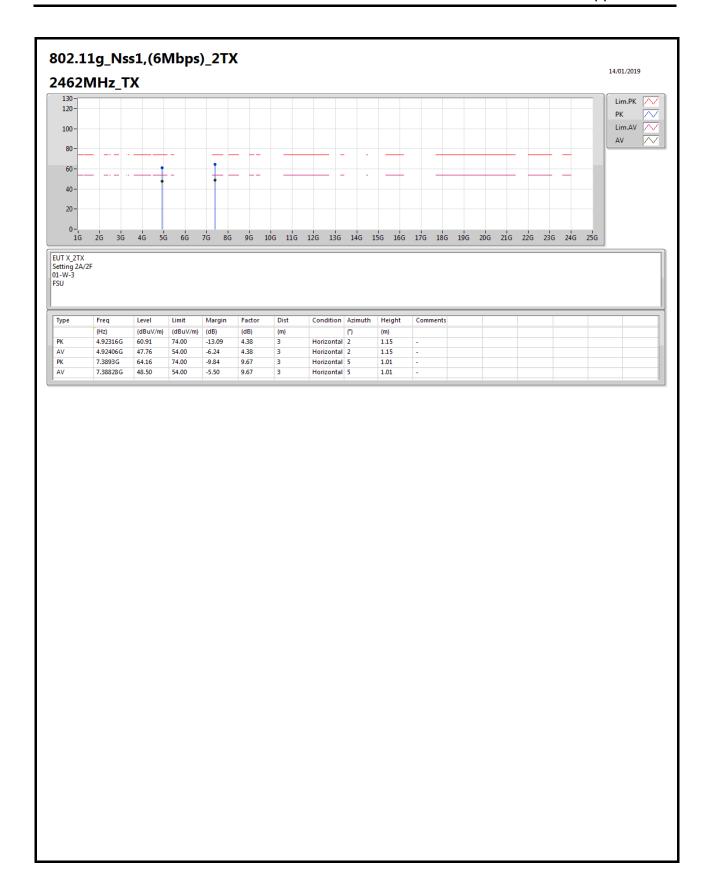
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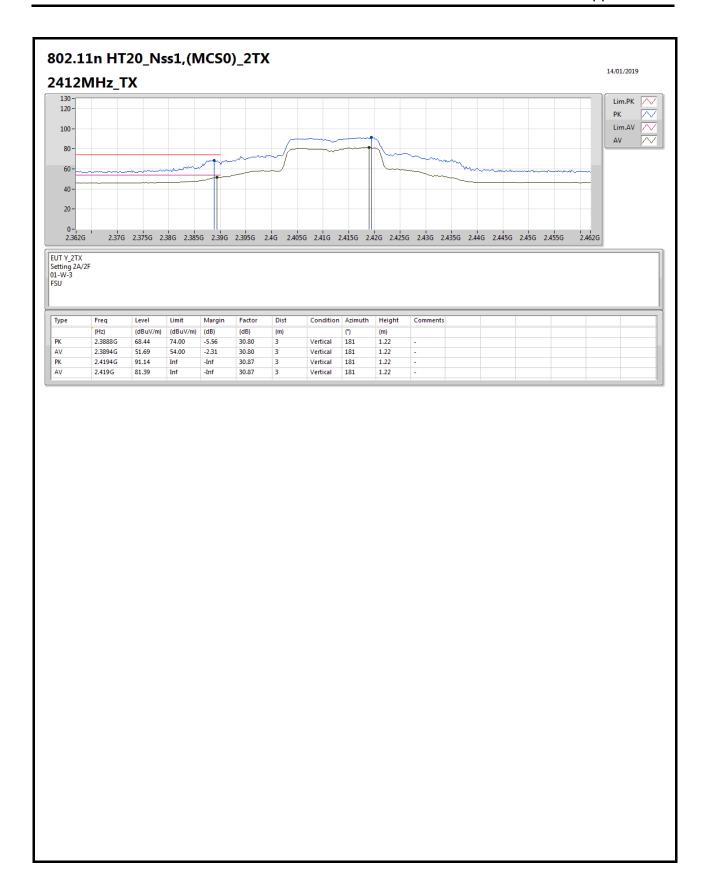
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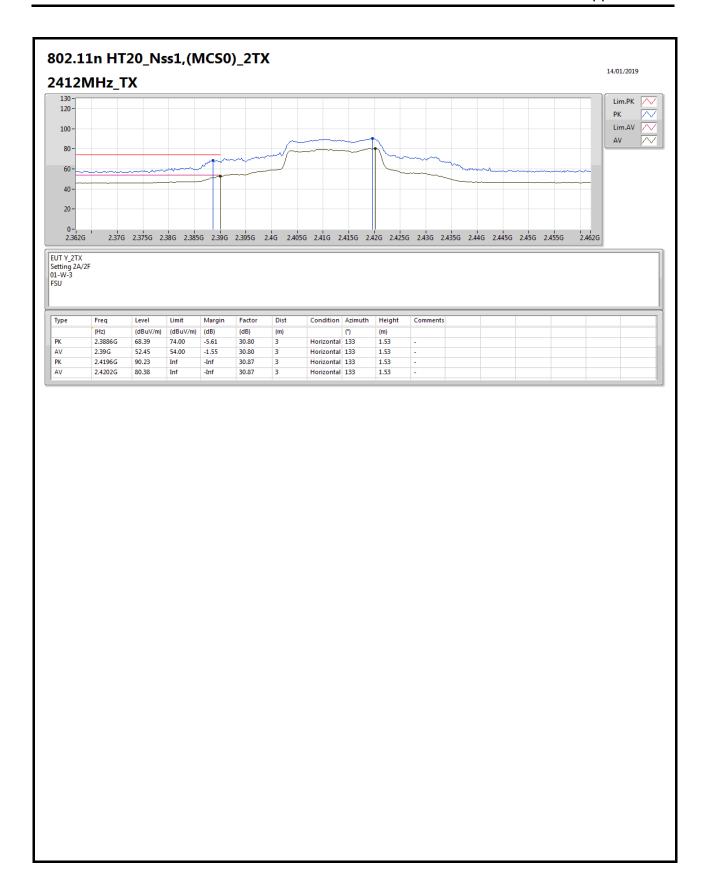
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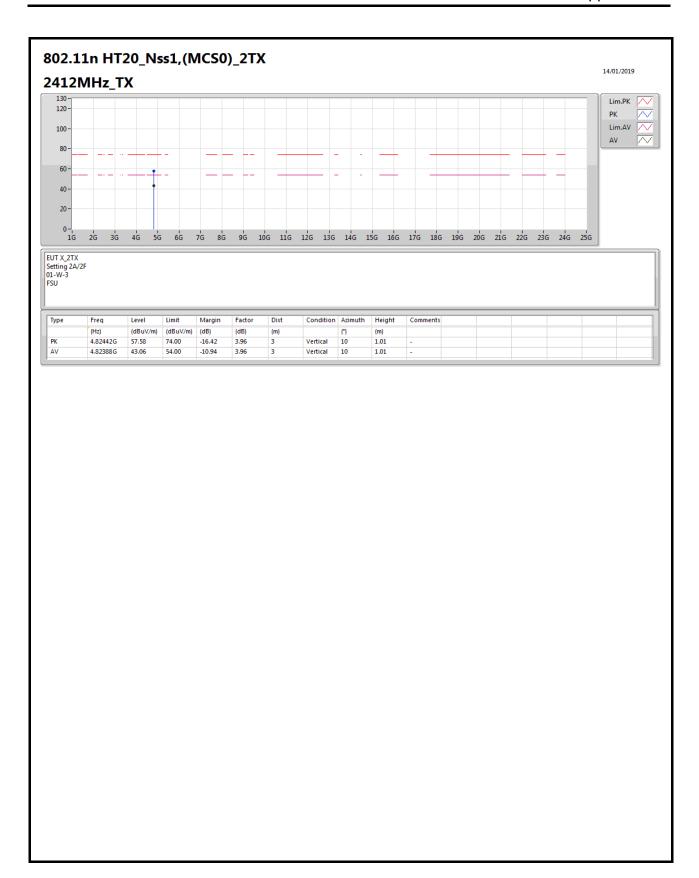
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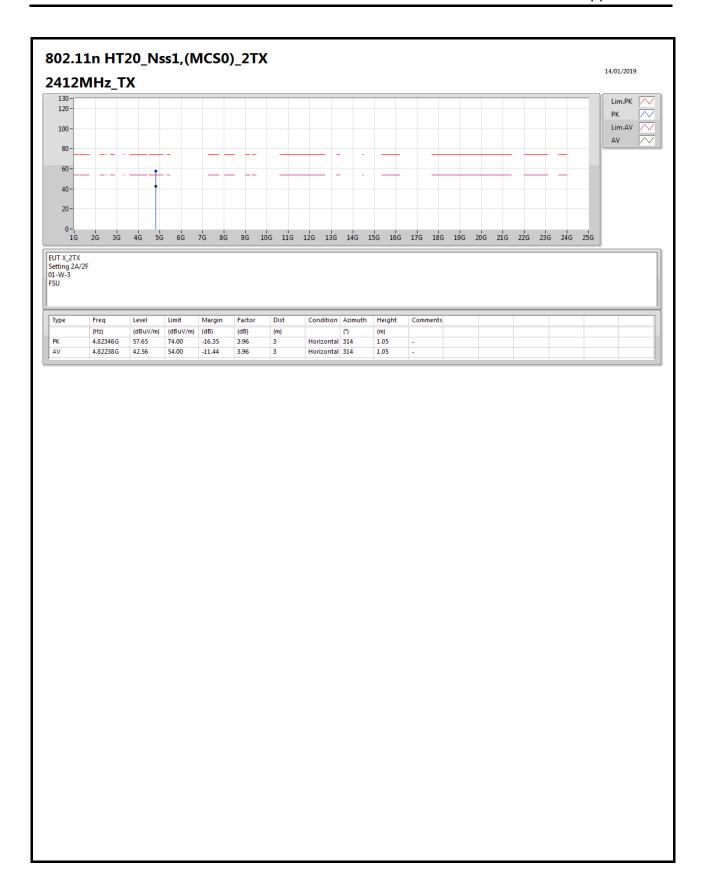
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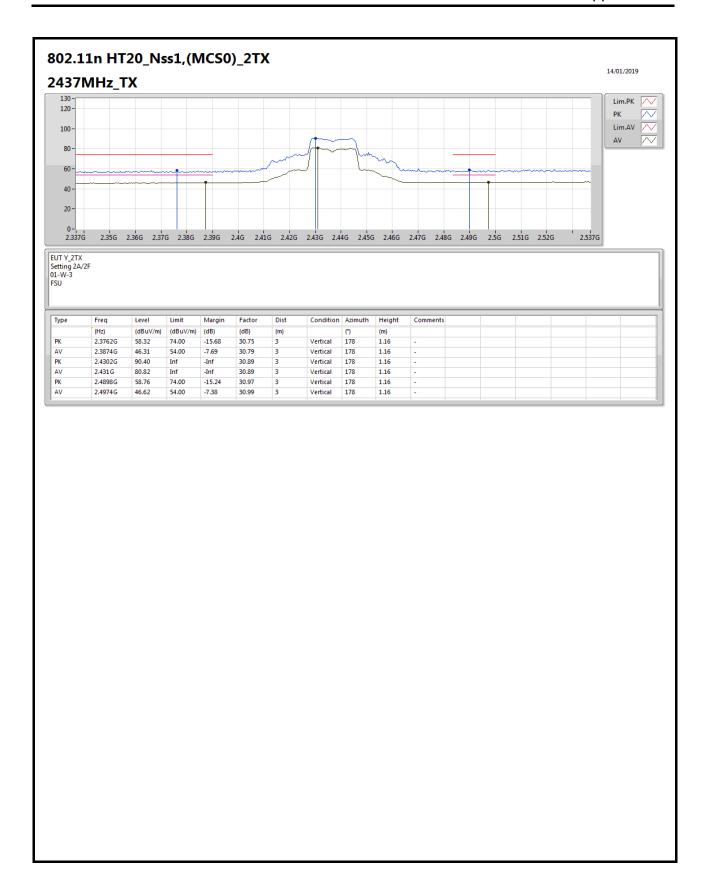
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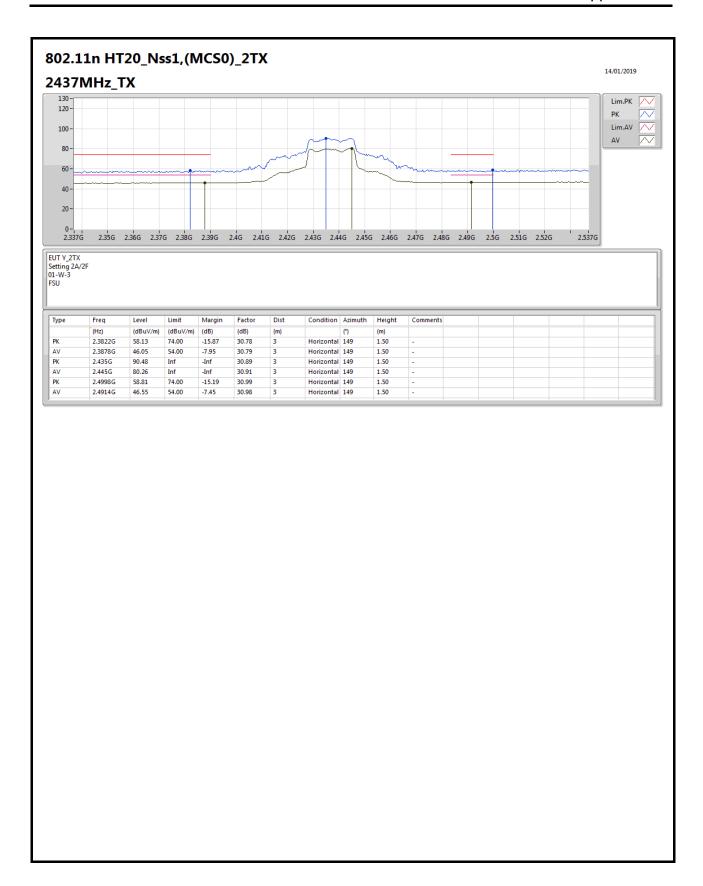
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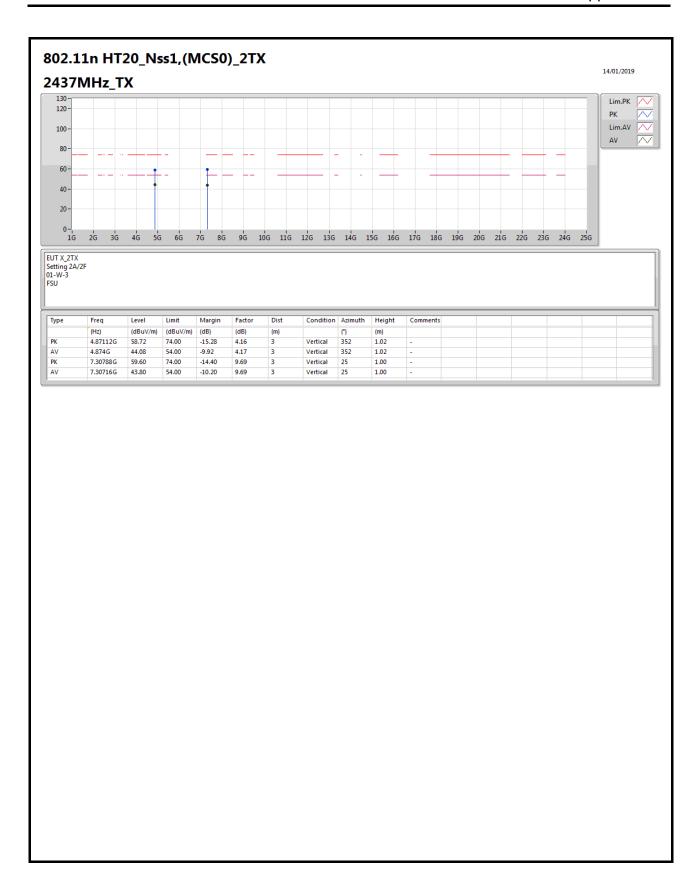
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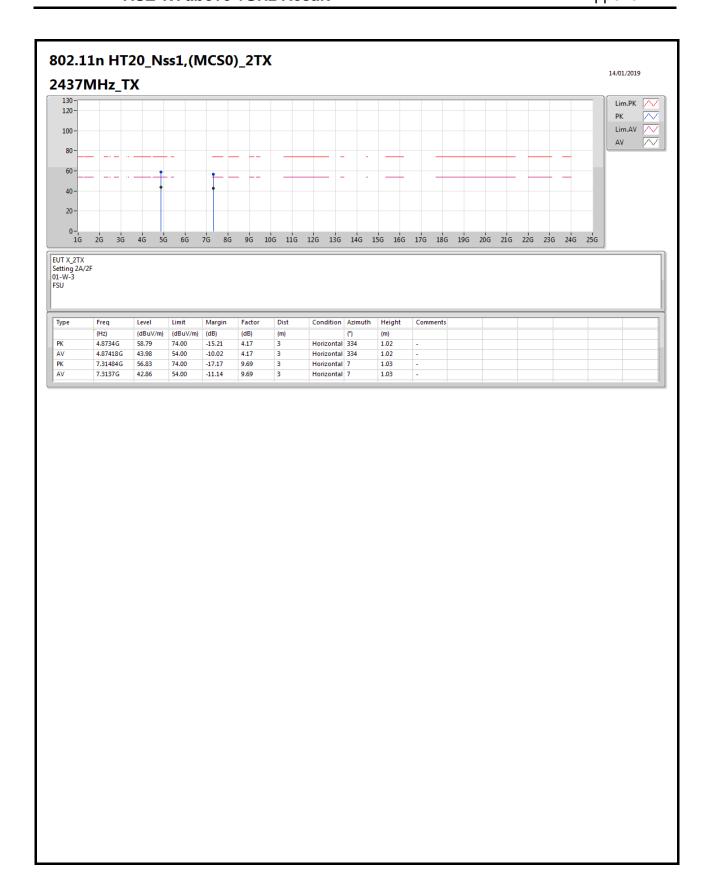
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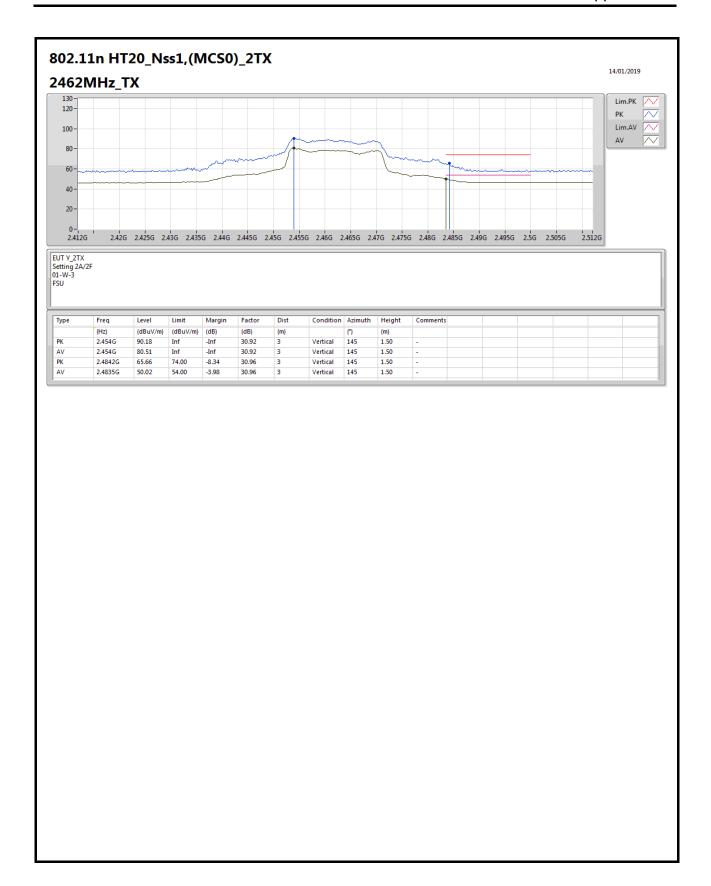
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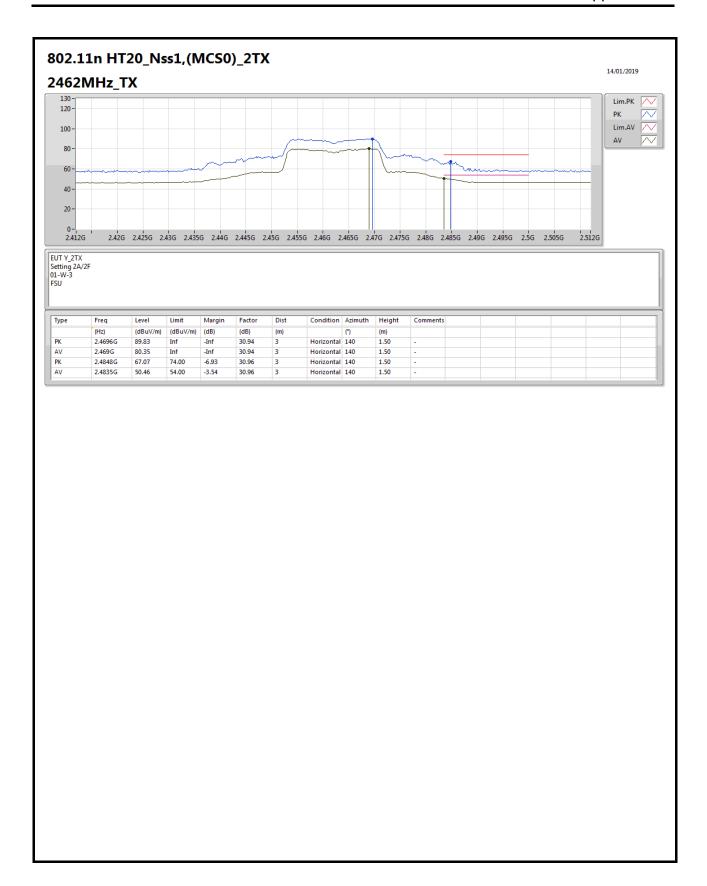
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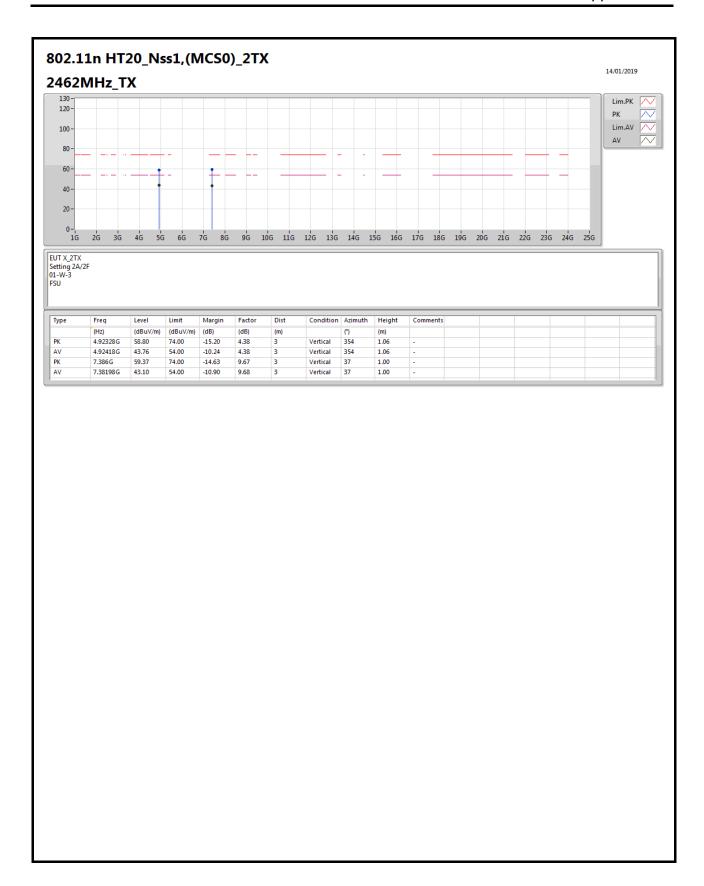
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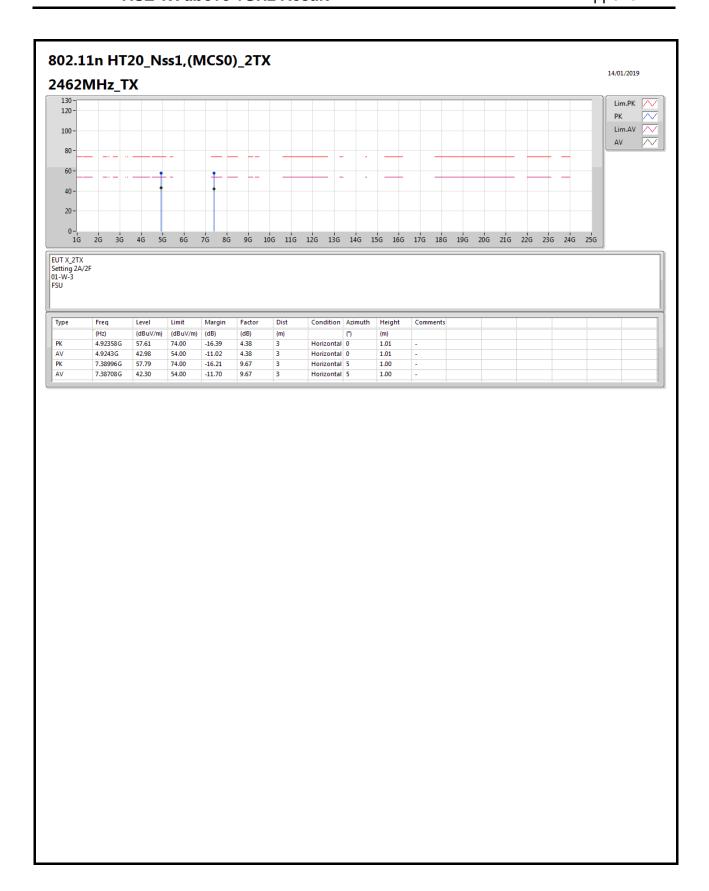
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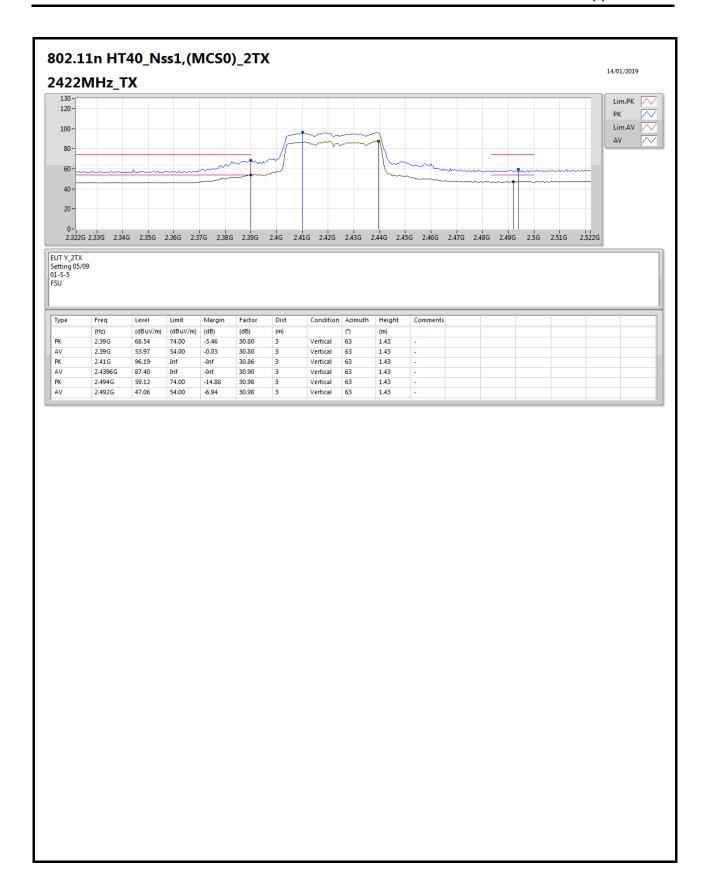
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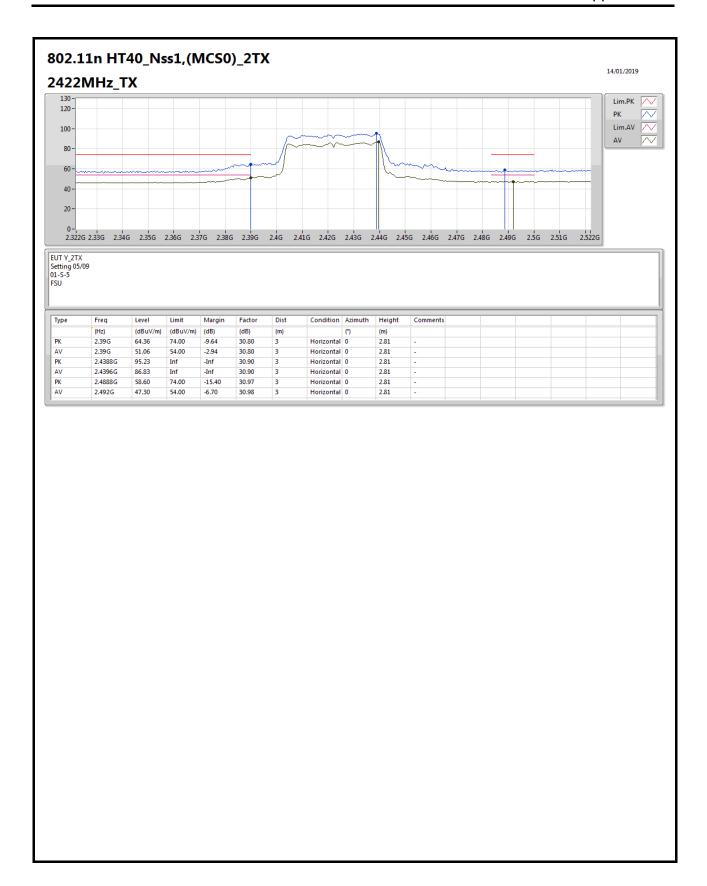
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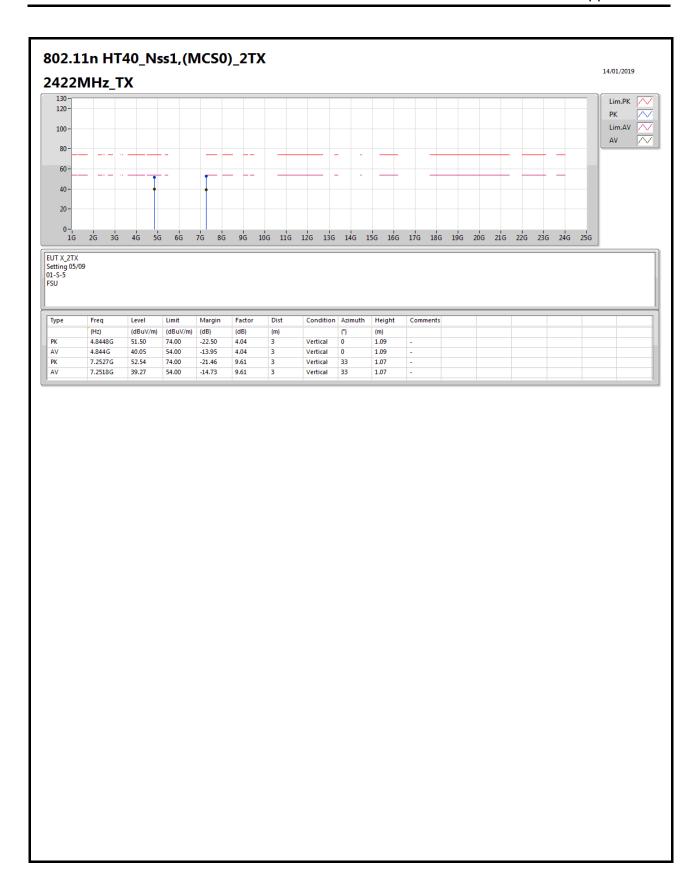
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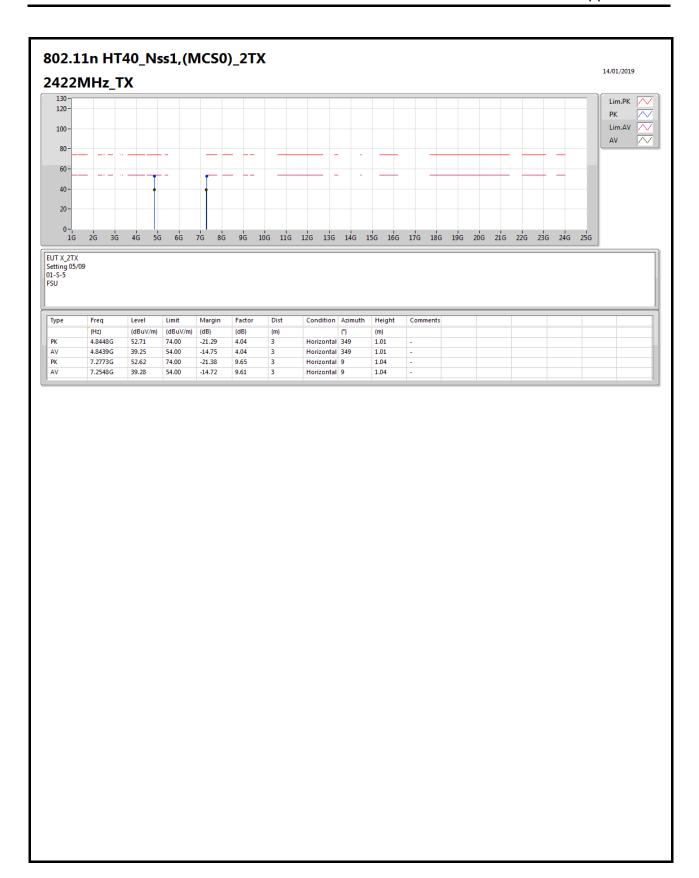
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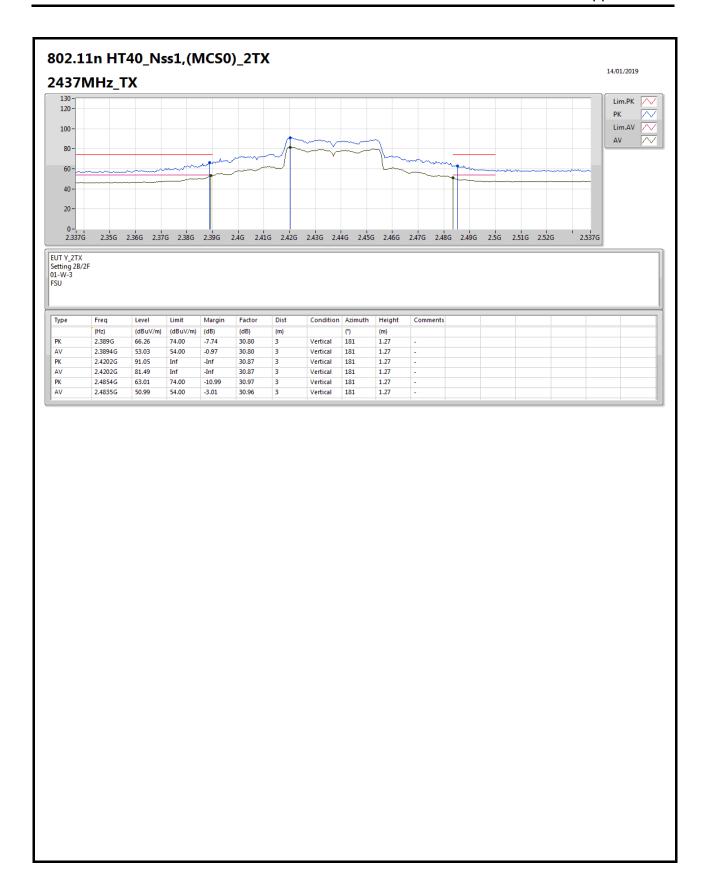
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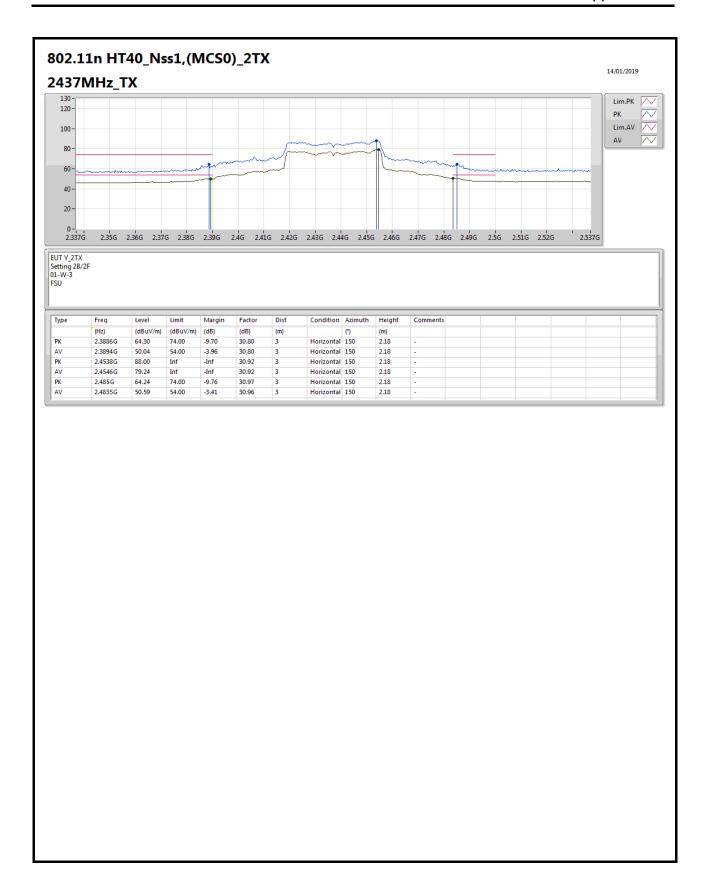
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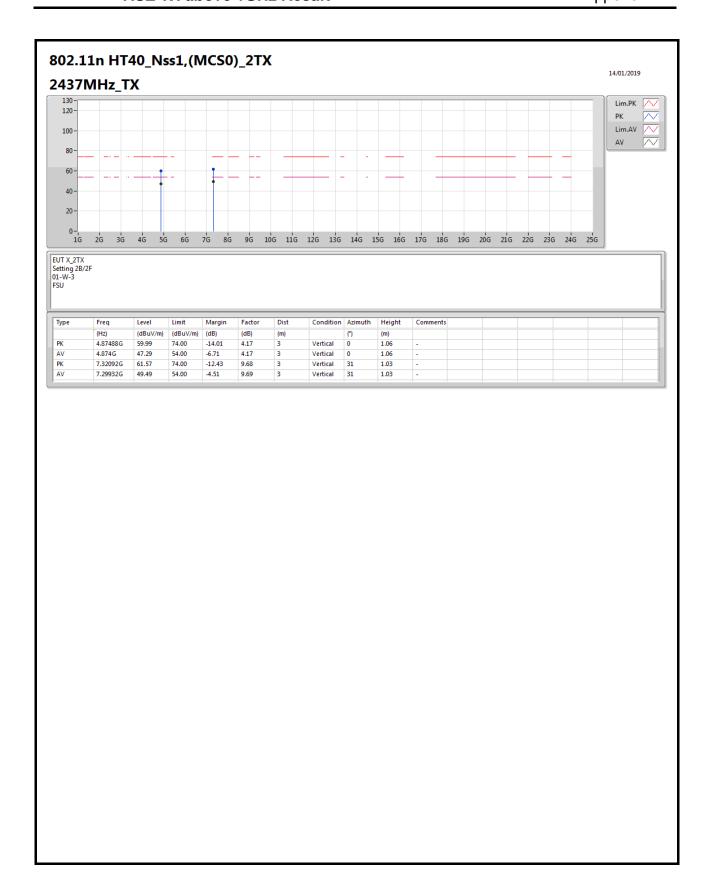
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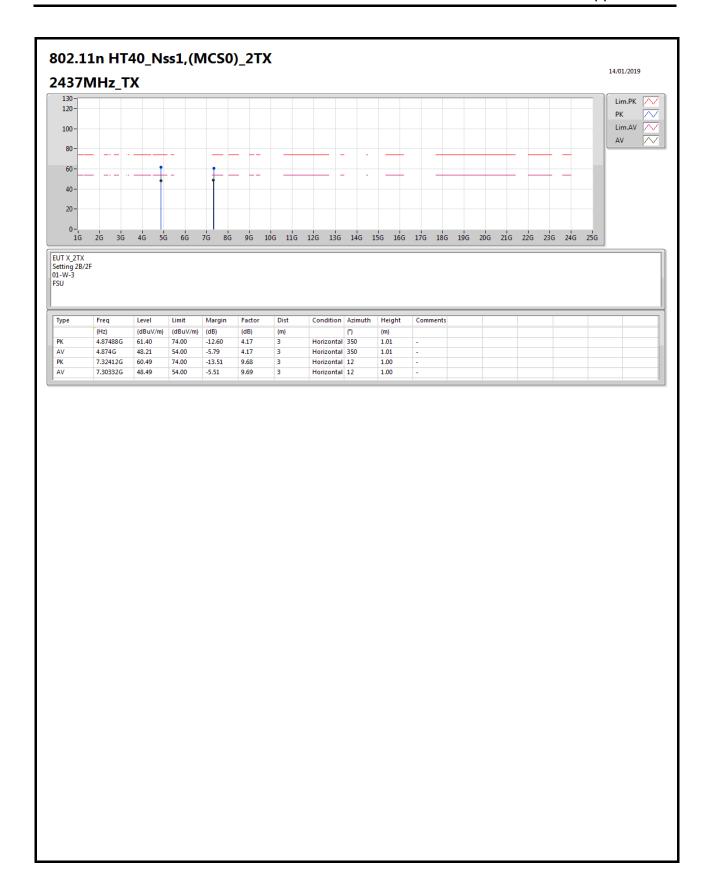
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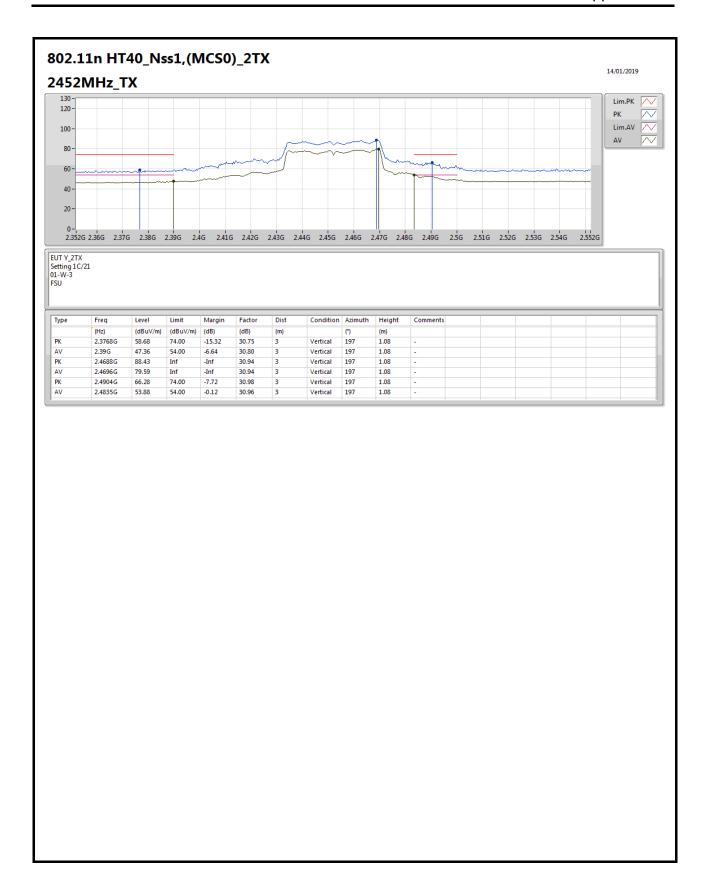
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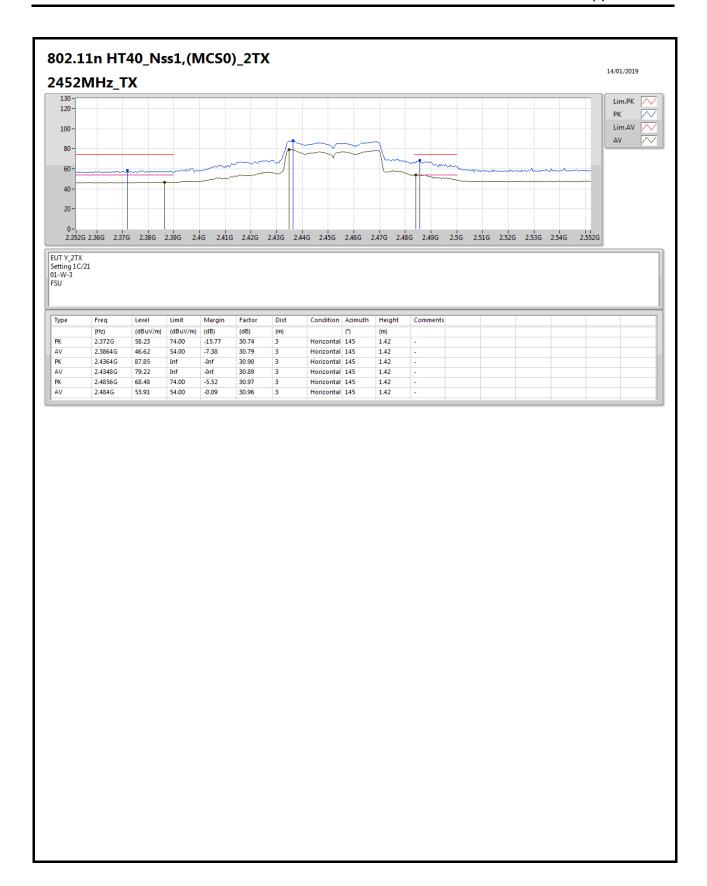
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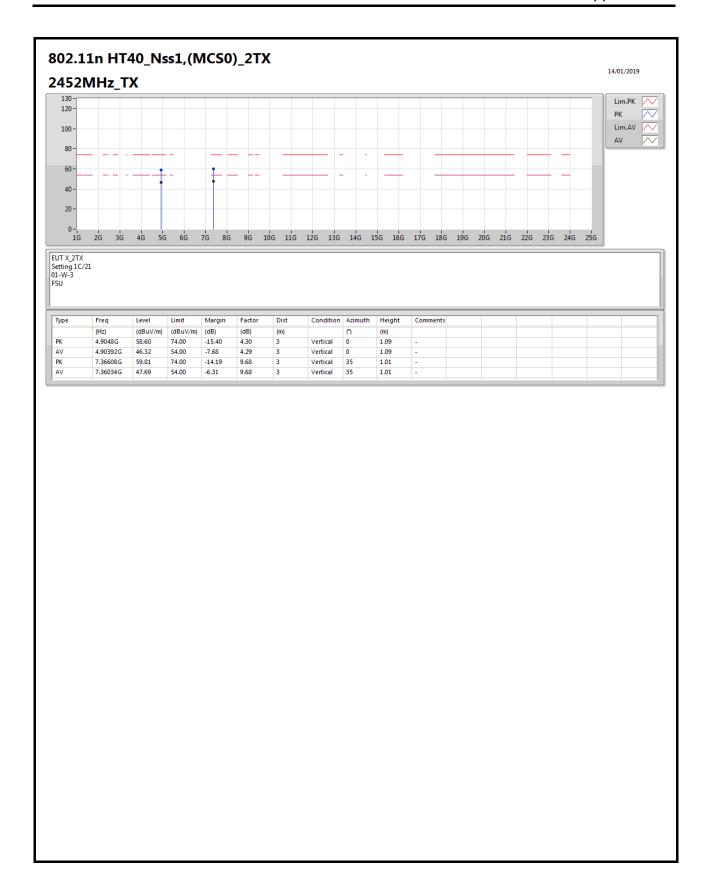
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