

Report No.: FR261015-03

# RADIO TEST REPORT

FCC ID

: Z8H89FT0078

Equipment

: XV2-21X Indoor Wi-Fi 6 Access Point

**Brand Name** 

: Cambium Networks

Model Name

: XV2-21X

Applicant

: Cambium Networks Inc.

3800 Golf Road, Suite 360 Rolling Meadows, IL 60008, USA

Manufacturer: Cambium Networks, Ltd.

Ashburton, TQ13 7UP, UK

Standard

: 47 CFR FCC Part 15.407

The product was received on Nov. 10, 2022, and testing was started from Nov. 10, 2022 and completed on Nov. 11, 2022. We, Sporton International Inc. Hsinchu 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 test results in this variant report apply exclusively to the tested model / sample. Without written approval of Sporton International Inc. Hsinchu Laboratory, the test report shall not be reproduced except in full.

Approved by: Sam Chen

Sporton International Inc. Hsinchu Laboratory

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TEL: 886-3-656-9065

FAX: 886-3-656-9085

Report Template No.: CB-A12\_6 Ver1.0

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: Dec. 12, 2022

Report Version

: 01

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Appendix B. Test Results of Maximum EIRP Output Power

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Photographs of EUT v01

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# History of this test report

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Report No.	Version	Description	Issued Date
FR261015-03	01	Initial issue of report	Dec. 12, 2022

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# **Summary of Test Result**

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Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
1.1.2	15.203	Antenna Requirement	PASS	-
3.1	15.407(a)	Emission Bandwidth	PASS	-
3.2	15.407(a)	Maximum EIRP Output Power	PASS	-
3.3	15.407(a)	EIRP Power Spectral Density	PASS	-
3.4	15.407(b)	Unwanted Emissions	PASS	-

#### **Declaration of Conformity:**

- The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers. It's means measurement values may risk exceeding the limit of regulation standards, if measurement uncertainty is include in test results.
- 2. The measurement uncertainty please refer to report "Measurement Uncertainty".

#### **Comments and Explanations:**

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

Reviewed by: Sam Chen

Report Producer: Vicky Huang

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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	
5725-5895	a, n (HT20), ac (VHT20), ax (HEW20)	5845-5885	169-177[3]	
5725-5895	n (HT40), ac (VHT40), ax (HEW40)	5835-5875	167-175[2]	
5725-5895	ac (VHT80), ax (HEW80)	5855	171[1]	
5725-5895	ac (VHT160), ax (HEW160)	5815	163[1]	

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Band	Mode	BWch (MHz)	Nant
5.725-5.895GHz	802.11a	20	2TX
5.725-5.895GHz	802.11n HT20	20	2TX
5.725-5.895GHz	802.11n HT20-BF	20	2TX
5.725-5.895GHz	802.11ac VHT20	20	2TX
5.725-5.895GHz	802.11ac VHT20-BF	20	2TX
5.725-5.895GHz	802.11ax HEW20	20	2TX
5.725-5.895GHz	802.11ax HEW20-BF	20	2TX
5.725-5.895GHz	802.11n HT40	40	2TX
5.725-5.895GHz	802.11n HT40-BF	40	2TX
5.725-5.895GHz	802.11ac VHT40	40	2TX
5.725-5.895GHz	802.11ac VHT40-BF	40	2TX
5.725-5.895GHz	802.11ax HEW40	40	2TX
5.725-5.895GHz	802.11ax HEW40-BF	40	2TX
5.725-5.895GHz	802.11ac VHT80	80	2TX
5.725-5.895GHz	802.11ac VHT80-BF	80	2TX
5.725-5.895GHz	802.11ax HEW80	80	2TX
5.725-5.895GHz	802.11ax HEW80-BF	80	2TX
5.725-5.895GHz	802.11ac VHT160	160	2TX
5.725-5.895GHz	802.11ac VHT160-BF	160	2TX
5.725-5.895GHz	802.11ax HEW160	160	2TX
5.725-5.895GHz	802.11ax HEW160-BF	160	2TX

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#### Note:

- 11a, HT20 and HT40 use a combination of OFDM-BPSK, QPSK, 16QAM, 64QAM modulation.
- VHT20, VHT40, VHT80 and VHT160 use a combination of OFDM-BPSK, QPSK, 16QAM, 64QAM, 256QAM modulation.

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- ◆ HEW20, HEW40, HEW80 and HEW160 use a combination of OFDMA-BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM modulation.
- BWch is the nominal channel bandwidth.

#### 1.1.2 Antenna Information

Ant.	Port		Brand	Model Name	Antenna Type	Connector	Gain (dBi)
AIII.	WLAN 2.4GHz	WLAN 5GHz	Dialiu	Woder Name	Antenna Type	Connector	Gaiii (GBI)
1	1	-	Gemtek	WRTQ-369AX	PIFA	MHF	
2	2	-	Gemtek	WRTQ-369AX	PIFA	MHF	Note1
3	-	2	Gemtek	WRTQ-369AX	PIFA	MHF	Note1
4	-	1	Gemtek	WRTQ-369AX	PIFA	MHF	

#### Note1:

	Antenna Gain (dBi)						Cable Loss (dB)					
Ant.	WLAN 2.4GHz	WLAN 5GHz UNII 1	5GHz	WLAN 5GHz UNII 2C	WLAN 5GHz UNII 3	WLAN 5GHz UNII 4	WLAN 2.4GHz	WLAN 5GHz UNII 1	WLAN 5GHz UNII 2A	WLAN 5GHz UNII 2C	WLAN 5GHz UNII 3	WLAN 5GHz UNII 4
1	5.65	-	-	-	-	-	0.6	-	-	-	-	-
2	5	-	-	-	-	-	0.35	-	-	-		-
3	-	6.32	7.2	7.76	7.79	7.79	-	0.9	0.9	0.9	0.9	0.9
4	-	6.92	6.89	8.16	8.15	7.48	-	0.4	0.4	0.4	0.4	0.4

	Net Gain (dBi)								
Ant.	WLAN 2.4GHz	WLAN 5GHz UNII 1	WLAN 5GHz UNII 2A	WLAN 5GHz UNII 2C	WLAN 5GHz UNII 3	WLAN 5GHz UNII 4			
1	5.05	-	-	-	-	-			
2	4.65	-	-	-	-	-			
3	-	5.42	6.3	6.86	6.89	6.89			
4	-	6.52	6.49	7.76	7.75	7.08			

Note2: The above information was declared by manufacturer. Note3: The EUT doesn't enable the DFS band at this time.

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Note4: Directional gain information

Type	Maximum Output Power	Power Spectral Density
Non-BF	Directional gain = Max.gain + array gain. For power measurements on IEEE 802.11 devices Array Gain = 0 dB (i.e., no array gain) for N ANT ≤ 4	$Directional Gain = 10 \cdot \log \left[ \frac{\sum_{j=1}^{N_{obs}} \left( \sum_{k=1}^{N_{obs}} \mathbf{g}_{j,k} \right)^{2}}{N_{ANT}} \right]$
BF	Directional Gain = $10 \cdot \log \left[ \frac{\sum_{j=1}^{N_{ab}} \left( \sum_{k=1}^{N_{ab}} \mathbf{g}_{j,k} \right)^{2}}{N_{AbT}} \right]$	Directional Gain = $10 \cdot \log \left[ \frac{\sum_{j=1}^{N_{eff}} \left( \sum_{k=1}^{N_{eff}} \mathbf{g}_{j,k} \right)^{2}}{N_{ANT}} \right]$

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Ex.

$$\begin{split} & \text{NSS1}(\text{g1,1}) = 10^{\text{G1/20}} \text{ ; NSS1}(\text{g1,2}) = 10^{\text{G2/20}}; \\ & \text{gj,k} = (\text{Nss1}(\text{g1,1}) + \text{Nss1}(\text{g1,2}))^2 \\ & \text{DG} = 10 \log[(\text{Nss1}(\text{g1,1}) + \text{Nss1}(\text{g1,2}))^2 \ / \ N_{\text{ANT}}] \Rightarrow 10 \log[(10^{\text{G1/20}} + 10^{\text{G2/20}})^2 \ / \ N_{\text{ANT}}] \end{split}$$
 Where ;

#### Note5: For 2.4GHz function:

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

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

Port 1 and Port 2 could transmit/receive simultaneously.

For 5GHz function:

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

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

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
802.11a	0.937	0.28	1.98m	1k
802.11ax HEW20	0.908	0.42	5.448m	300
802.11ax HEW20-BF	0.9	0.46	5.446m	300
802.11ax HEW40	0.926	0.33	5.448m	300
802.11ax HEW40-BF	0.915	0.39	5.446m	300
802.11ax HEW80	0.923	0.35	5.448m	300
802.11ax HEW80-BF	0.924	0.34	5.446m	300
802.11ax HEW160	0.906	0.43	5.448m	300
802.11ax HEW160-BF	0.898	0.47	5.445m	300

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

### 1.1.4 EUT Operational Condition

EUT Power Type	Fror	From PoE				
	$\boxtimes$	With beamforming		Without beamforming		
Beamforming Function	The product has beamforming function for n/VHT/ax in 2.4GHz, n/ac/ax in 5GHz.					
Function	$\boxtimes$	Point-to-multipoint		Point-to-point		
Device Type	$\boxtimes$	Indoor Access Point	$\boxtimes$	Subordinate		
Device Type		Indoor Client				
<b>Channel Puncturing Function</b>		Supported	$\boxtimes$	Unsupported		
Support RU	$\boxtimes$	Full RU		Partial RU		
<b>Test Software Version</b>	QSPR Version 5.0-00199					

Note: The above information was declared by manufacturer.

### 1.1.5 Table for EUT supports functions

Function
AP
Bridge
Mesh

Note 1: After evaluating, AP Mode was selected to test and record in the report.

Note 2: The above information was declared by manufacturer.

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# 1.1.6 Table for Permissive Change

This product is an extension of original one reported under Sporton project number: FR261015AB.

Below is the table for the change of the product with respect to the original one.

Modifications	Performance Checking
	1. Emission Bandwidth
1. Adding the UNII 4 (5725~5895MHz) for this device.	2. Maximum EIRP Output Power
2. Adding the 160MHz in UNII 4.	3. EIRP Power Spectral Density
	4. Unwanted Emissions <above 1ghz=""></above>

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## 1.2 Applicable Standards

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

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- 47 CFR FCC Part 15
- ANSI C63.10-2013
- FCC KDB 789033 D02 v02r01

The following reference test guidance is not within the scope of accreditation of TAF.

- FCC KDB 662911 D01 v02r01
- FCC KDB 412172 D01 v01r01
- FCC KDB 291074 D02 v01

## 1.3 Testing Location Information

Testing Location Information					
Test Lab. : Sporton International Inc. Hsinchu Laboratory					
Hsinchu	ADD: No.8, Ln. 724, Bo'ai St., Zhubei City, Hsinchu County 302010, Taiwan (R.O.C.)				
(TAF: 3787)	TEL: 886-3-656-9065 FAX: 886-3-656-9085				
	Test site Designation No. TW3787 with FCC.				

Conformity Assessment Body Identifier (CABID) TW3787 with ISED.

Test Condition	Test Site No.	Test Engineer	Test Environment (°C / %)	Test Date
RF Conducted	TH03-CB	Eason Chen	20.9-22.5 / 60-68	Nov. 11, 2022
Radiated	03CH03-CB	Brian Sun	24.2-25.3 / 56-59	Nov. 10, 2022~ Nov. 11, 2022

## 1.4 Measurement Uncertainty

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor (k=2)

Test Items	Uncertainty	Remark
Radiated Emission (1GHz ~ 18GHz)	5.2 dB	Confidence levels of 95%
Radiated Emission (18GHz ~ 40GHz)	4.7 dB	Confidence levels of 95%
Conducted Emission	3.2 dB	Confidence levels of 95%
Output Power Measurement	0.8 dB	Confidence levels of 95%
Power Density Measurement	3.2 dB	Confidence levels of 95%
Bandwidth Measurement	2.0 %	Confidence levels of 95%

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# 2 Test Configuration of EUT

### 2.1 Test Channel Mode

Mode	Power Setting
802.11a_Nss1,(6Mbps)_2TX	-
5845MHz	19
5865MHz	19
5885MHz	18.5
802.11ax HEW20_Nss1,(MCS0)_2TX	-
5845MHz	20.5
5865MHz	19.5
5885MHz	19.5
802.11ax HEW40_Nss1,(MCS0)_2TX	-
5835MHz	24
5875MHz	22.5
802.11ax HEW80_Nss1,(MCS0)_2TX	-
5855MHz	25
802.11ax HEW160_Nss1,(MCS0)_2TX	-
5815MHz	20.5
802.11ax HEW20-BF_Nss1,(MCS0)_2TX	-
5845MHz	20.5
5865MHz	19.5
5885MHz	19.5
802.11ax HEW40-BF_Nss1,(MCS0)_2TX	-
5835MHz	22.5
5875MHz	22.5
802.11ax HEW80-BF_Nss1,(MCS0)_2TX	-
5855MHz	22.5
802.11ax HEW160-BF_Nss1,(MCS0)_2TX	-
5815MHz	20.5

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Note1: Evaluated HEW20/HEW40/HEW80/HEW160 mode only, due to similar modulation. The power setting of HT20/HT40/VHT20/VHT40/VHT80/VHT160 mode are the same or lower than HEW20/HEW40/HEW80/HEW160.

Note2: The EUT supports beamforming and CDD modes, and the CDD mode is the worst case. Therefore, all test items are evaluated in the report. The beamforming mode only evaluates the output power.

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# 2.2 The Worst Case Measurement Configuration

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

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Th	The Worst Case Mode for Following Conformance Tests		
Tests Item	Unwanted Emissions		
Test Condition  Radiated measurement If EUT consist of multiple antenna assembly (multiple antenna are used in E regardless of spatial multiplexing MIMO configuration), the radiated test sho be performed with highest antenna gain of each antenna type.			
Operating Mode > 1GHz	ode > 1GHz CTX		
The EUT was performed at measurement will follow the	t X axis, Y axis and Z axis position, and the worst case was found at Z axis. So the is same test configuration.		
1	EUT in Z axis		

The Worst Case Mode for Following Conformance Tests				
Tests Item	Tests Item Simultaneous Transmission Analysis - Co-location RF Exposure Evaluation			
Operating Mode				
1	1 WLAN 2.4GHz + WLAN 5GHz			
Refer to Sporton Test Report No.: FA261015-03 for Co-location RF Exposure Evaluation.				

Note: The EUT was powered by PoE, and the PoE was for measurement only, it would not be marketed.

Equipment	Brand Name	Model Name	FCC ID
PoE	Cambium	NET-P15-56IN	N/A

# 2.3 EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

### 2.4 Accessories

Wall-mounted rack\*1, Iron sheet for rack\*1

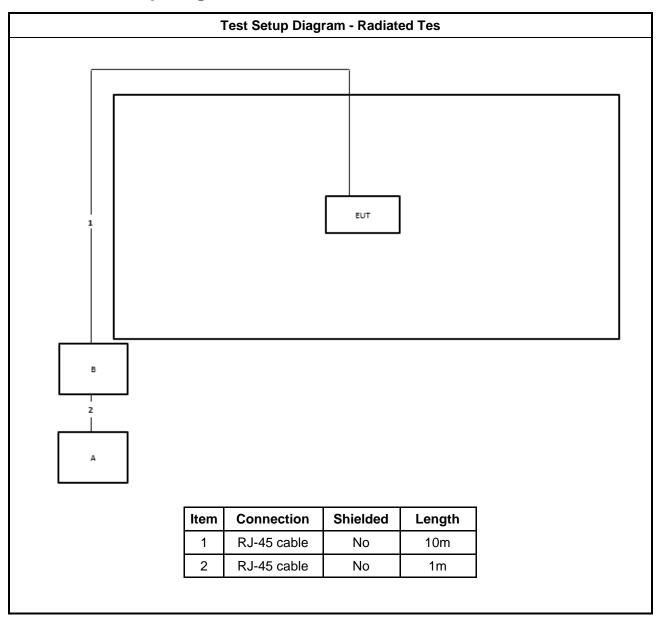
## 2.5 Support Equipment

Support Equipment				
No. Equipment Brand Name Model Name FCC ID				
Α	Notebook	DELL	E4300	N/A
В	PoE	Cambium	NET-P15-56IN	N/A

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# 2.6 Test Setup Diagram



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## 3 Transmitter Test Result

### 3.1 Emission Bandwidth

### 3.1.1 Emission Bandwidth Limit

Emission Bandwidth Limit		
UNII Devices		
For the 5.85-5.895 GHz band, 26 dB emission bandwidth ,N/A. 6 dB emission bandwidth ≥ 500kHz.		

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### 3.1.2 Measuring Instruments

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

### 3.1.3 Test Procedures

	Test Method						
-	For the emission bandwidth shall be measured using one of the options below:						
	Refer as FCC KDB 789033 D02, clause C for EBW and clause D for OBW measurement.						
	Refer as ANSI C63.10, clause 6.9.1 for occupied bandwidth testing.						
	Refer as IC RSS-Gen, clause 4.6 for bandwidth testing.						

## 3.1.4 Test Setup

Emission Bandwidth						
	EUT					
Spectrum Analyzer						

### 3.1.5 Test Result of Emission Bandwidth

Refer as Appendix A

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# 3.2 Maximum EIRP Output Power

### 3.2.1 Limit

	Maximum EIRP Output Power Limit						
UNI	UNII Devices						
$\boxtimes$							
■ Indoor AP & subordinate device < 36 dBm							
	■ Client device < 30 dBm						

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### 3.2.2 Measuring Instruments

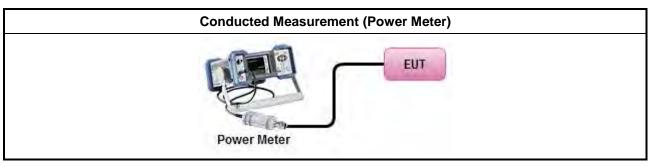
Refer a test equipment and calibration data table in this test report.

### 3.2.3 Test Procedures

		Test Method						
	Ave	rage over on/off periods with duty factor						
	Refer as FCC KDB 789033 D02, clause E Method SA-2 (spectral trace averaging).							
		Refer as FCC KDB 789033 D02, clause E Method SA-2 Alt. (RMS detection with slow sweep speed)						
	Wid	eband RF power meter and average over on/off periods with duty factor						
	$\boxtimes$	Refer as FCC KDB 789033 D02, clause E Method PM-G (using an RF average power meter).						
$\boxtimes$	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]) $EIRP_{total} = P_{total} + DG$						
	For	radiated measurement.						
	•	Refer as FCC KDB 789033 D02 clause II A.1.F "Antenna-port Conducted versus Radiated Testing"						
	•	Refer as ANSI C63.10, clause 6.6 for radiated emissions above 1GHz.						
	•	Refer as FCC KDB 412172 D01 clause 2.2 for EIRP calculation.						

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### 3.2.4 Test Setup



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# 3.2.5 Test Result of Maximum EIRP Output Power

Refer as Appendix B

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# 3.3 EIRP Power Spectral Density

### 3.3.1 Limit

	EIRP Power Spectral Density Limit					
UNI	NII Devices					
$\boxtimes$	☑ For the 5.85-5.895 GHz band:					
	■ Indoor AP & subordinate device < 20dBm/MHz					
	■ Client device < 14dBm/MHz					

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### 3.3.2 Measuring Instruments

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

### 3.3.3 Test Procedures

		Test Method
	outp func	c power spectral density procedures that the same method as used to determine the conducted ut power shall be used to determine the peak power spectral density and use the peak search tion on the spectrum analyzer to find the peak of the spectrum. For the peak power spectral density be measured using below options:
		Refer as FCC KDB 789033 D02, F)5) power spectral density can be measured using resolution bandwidths < 1 MHz provided that the results are integrated over 1 MHz bandwidth
	[duty	cycle ≥ 98% or external video / power trigger]
	$\boxtimes$	Refer as FCC KDB 789033 D02, clause E Method SA-1 (spectral trace averaging).
		Refer as FCC KDB 789033 D02, clause E Method SA-1 Alt. (RMS detection with slow sweep speed)
	duty	cycle < 98% and average over on/off periods with duty factor
	$\boxtimes$	Refer as FCC KDB 789033 D02, clause E Method SA-2 (spectral trace averaging).
		Refer as FCC KDB 789033 D02, clause E Method SA-2 Alt. (RMS detection with slow sweep speed)
$\boxtimes$	For o	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

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Test Method

emission limits,

Option 3: Measure and add 10 log(N) dB, where N is the number of transmit chains. Refer as FCC KDB 662911, In-band power spectral density (PSD). Performed at each transmit chains and each transmit chains shall be compared with the limit have been reduced with 10 log(N). Or each transmit chains shall be add 10 log(N) to compared with the limit.

If multiple transmit chains, EIRP PPSD calculation could be following as methods: PPSD₁ + PPSD₂ +... + PPSD₂ (calculated in linear unit [mW] and transfer to log unit [dBm])

EIRPtotal = PPSD₁ + DG

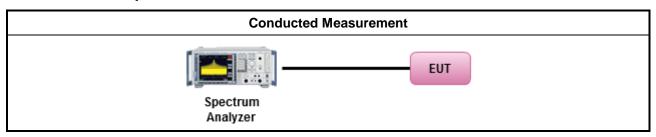
For radiated measurement.

Refer as FCC KDB 789033 D02 clause II A.1.F "Antenna-port Conducted versus Radiated Testing"

Refer as ANSI C63.10, clause 6.6 for radiated emissions above 1GHz.

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#### 3.3.4 Test Setup



### 3.3.5 Test Result of EIRP Power Spectral Density

Refer as Appendix C

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### 3.4 Unwanted Emissions

#### 3.4.1 Transmitter Unwanted Emissions Limit

Unwanted emissions below 1 GHz and restricted band emissions above 1GHz limit							
Frequency Range (MHz)	Field Strength (uV/m)	Field Strength (dBuV/m)	Measure Distance (m)				
0.009~0.490	2400/F(kHz)	48.5 - 13.8	300				
0.490~1.705	24000/F(kHz)	33.8 - 23	30				
1.705~30.0	30	29	30				
30~88	100	40	3				
88~216	150	43.5	3				
216~960	200	46	3				
Above 960	500	54	3				

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- Note 1: Test distance for frequencies at or above 30 MHz, measurements may be performed at a distance other than the limit distance provided they are not performed in the near field and the emissions to be measured can be detected by the measurement equipment. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse of linear distance for field-strength measurements, inverse of linear distance-squared for power-density measurements).
- Note 2: Test distance for frequencies at below 30 MHz, measurements may be performed at a distance closer than the EUT limit distance; however, an attempt should be made to avoid making measurements in the near field. When performing measurements below 30 MHz at a closer distance than the limit distance, the results shall be extrapolated to the specified distance by either making measurements at a minimum of two or more distances on at least one radial to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB/decade). The test report shall specify the extrapolation method used to determine compliance of the EUT

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

	Un-restricted band emissions above 1GHz Limit
Operating Band	Limit
⊠ 5.85 - 5.895 GHz	(i) For an indoor access point or subordinate device, all emissions at or above 5.895 GHz shall not exceed an e.i.r.p. of 15 dBm/MHz and shall decrease linearly to an e.i.r.p. of - 7 dBm/MHz at or above 5.925 GHz. (ii) For a client device, all emissions at or above 5.895 GHz shall not exceed an e.i.r.p. of -5 dBm/MHz and shall decrease linearly to an e.i.r.p. of -27 dBm/MHz at or above 5.925 GHz. (iii) For a client device or indoor access point or subordinate device, all emissions below 5.725 GHz shall not exceed an e.i.r.p. of -27 dBm/MHz at 5.65 GHz increasing linearly to 10 dBm/ MHz at 5.7 GHz, and from 5.7 GHz increasing linearly to a level of 15.6 dBm/MHz at 5.725 GHz.

Note 1: Measurements may be performed at a distance other than the limit distance provided they are not performed in the near field and the emissions to be measured can be detected by the measurement equipment. When performing measurements at a distance other than that specified, the results shall

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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).

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#### 3.4.2 Measuring Instruments

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

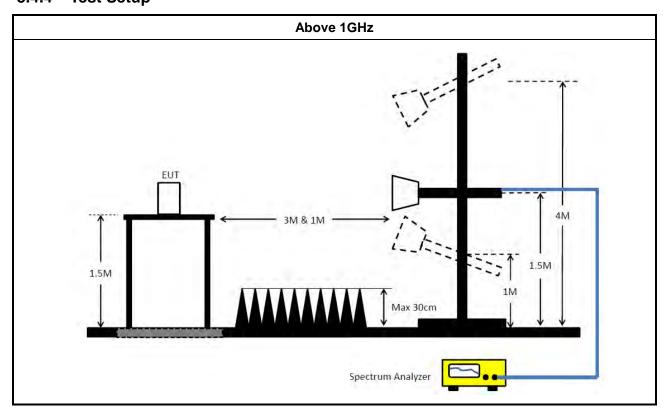
#### 3.4.3 Test Procedures

### **Test Method**

- Measurements may be performed at a distance other than the limit distance provided they are not performed in the near field and the emissions to be measured can be detected by the measurement equipment. Measurements shall not be performed at a distance greater than 30 m for frequencies above 30 MHz, unless it can be further demonstrated that measurements at a distance of 30 m or less are impractical. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse of linear distance for field-strength measurements, inverse of linear distance-squared for power-density measurements).
- The average emission levels shall be measured in [duty cycle ≥ 98 or duty factor].
- For the transmitter unwanted emissions shall be measured using following options below:
  - Refer as FCC KDB 789033 D02, clause G)2) for unwanted emissions into non-restricted bands.
  - Refer as FCC KDB 789033 D02, clause G)1) for unwanted emissions into restricted bands.
    - Refer as FCC KDB 789033 D02, G)6) Method AD (Trace Averaging).
    - Refer as FCC KDB 789033 D02, G)6) Method VB (Reduced VBW).
    - Refer as ANSI C63.10, clause 11.12.2.5.3 (Reduced VBW). VBW ≥ 1/T, where T is pulse time.
    - Refer as ANSI C63.10, clause 7.5 average value of pulsed emissions.
    - Refer as FCC KDB 789033 D02, clause G)5) measurement procedure peak limit.
    - Refer as ANSI C63.10, clause 4.1.4.2.2 measurement procedure peak limit.
- For radiated measurement.
  - Refer as ANSI C63.10, clause 6.4 for radiated emissions below 30 MHz and test distance is 3m.
  - Refer as ANSI C63.10, clause 6.5 for radiated emissions 30 MHz to 1 GHz and test distance is 3m.
  - Refer as ANSI C63.10, clause 6.6 for radiated emissions above 1GHz.
- The any unwanted emissions level shall not exceed the fundamental emission level.
- All amplitude of spurious emissions that are attenuated by more than 20 dB below the permissible value has no need to be reported.

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## 3.4.4 Test Setup



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### 3.4.5 Measurement Results Calculation

The measured Level is calculated using:

Corrected Reading: Antenna factor (AF) + Cable loss (CL) + Read level (Raw) - Preamp factor (PA)(if applicable) = Level.

### 3.4.6 Test Result of Transmitter Unwanted Emissions

Refer as Appendix D

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# 4 Test Equipment and Calibration Data

Instrument	Brand	Model No.	Serial No.	Characteristics	Calibration Date	Calibration Due	Remark
3m Semi Anechoic Chamber VSWR	TDK	SAC-3M	03CH03-CB	1GHz ~18GHz 3m	May 05, 2022	May 04, 2023	Radiation (03CH03-CB)
Horn Antenna	ETS·Lindgren	3115	6821	750MHz~ 18GHz	Jan. 21, 2022	Jan. 20, 2023	Radiation (03CH03-CB)
Horn Antenna	SCHWARZBE AK	BBHA9170	BBHA9170252	15GHz ~ 40GHz	Aug. 22, 2022	Aug. 21, 2023	Radiation (03CH03-CB)
Pre-Amplifier	Agilent	8449B	3008A02097	1GHz ~ 26.5GHz	Jul. 01, 2022	Jun. 30, 2023	Radiation (03CH03-CB)
Pre-Amplifier	EM	EM18G40GA	060874	18GHz ~ 40GHz	Aug. 23 2022	Aug. 22 2023	Radiation (03CH03-CB)
Spectrum Analyzer	R&S	FSP40	100019	9kHz ~ 40GHz	Jun. 10, 2022	Jun. 09, 2023	Radiation (03CH03-CB)
RF Cable-high	Woken	RG402	High Cable-20+29	1GHz ~ 18GHz	Oct. 03, 2022	Oct. 02, 2023	Radiation (03CH03-CB)
RF Cable-high	Woken	RG402	High Cable-29	1GHz ~ 18GHz	Oct. 03, 2022	Oct. 02, 2023	Radiation (03CH03-CB)
High Cable	Woken	WCA0929M	40G#5+7	1GHz ~ 40 GHz	Dec. 14, 2021	Dec. 13, 2022	Radiation (03CH03-CB)
High Cable	Woken	WCA0929M	40G#5	1GHz ~ 40 GHz	Dec. 08, 2021	Dec. 07, 2022	Radiation (03CH03-CB)
High Cable	Woken	WCA0929M	40G#7	1GHz ~ 40 GHz	Dec. 14, 2021	Dec. 13, 2022	Radiation (03CH03-CB)
Test Software	SPORTON	SENSE	V5.10	-	N.C.R.	N.C.R.	Radiation (03CH03-CB)
Spectrum analyzer	R&S	FSV40	101028	9kHz~40GHz	Jan. 07, 2022	Jan. 06, 2023	Conducted (TH03-CB)
Power Sensor	Anritsu	MA2411B	1531344	300MHz~ 40GHz	Jul. 31, 2022	Jul. 30, 2023	Conducted (TH03-CB)
Power Meter	Anritsu	ML2495A	1728002	300MHz~ 40GHz	Jul. 31, 2022	Jul. 30, 2023	Conducted (TH03-CB)
RF Cable-high	Woken	RG402	High Cable-11	1 GHz –18 GHz	Oct. 03, 2022	Oct. 02, 2023	Conducted (TH03-CB)
RF Cable-high	Woken	RG402	High Cable-12	1 GHz –18 GHz	Oct. 03, 2022	Oct. 02, 2023	Conducted (TH03-CB)
RF Cable-high	Woken	RG402	High Cable-13	1 GHz –18 GHz	Oct. 03, 2022	Oct. 02, 2023	Conducted (TH03-CB)
RF Cable-high	Woken	RG402	High Cable-14	1 GHz –18 GHz	Oct. 03, 2022	Oct. 02, 2023	Conducted (TH03-CB)
RF Cable-high	Woken	RG402	High Cable-15	1 GHz –18 GHz	Oct. 03, 2022	Oct. 02, 2023	Conducted (TH03-CB)

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Switch	SPTCB	SP-SWI	SWI-03	1 GHz – 26.5 GHz	Oct. 04, 2022	Oct. 03, 2023	Conducted (TH03-CB)
Test Software	SPORTON	SENSE	V5.10	-	N.C.R.	N.C.R.	Conducted (TH03-CB)

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

NCR means Non-Calibration required.

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Appendix A **EBW** 

#### Summary

Mode	Max-N dB	Max-OBW	ITU-Code	Min-N dB	Min-OBW
	(Hz)	(Hz)		(Hz)	(Hz)
5.725-5.895GHz	-	-	-	-	-
802.11a_Nss1,(6Mbps)_2TX	16.05M	16.363M	16M4D1D	15.27M	16.363M
802.11ax HEW20_Nss1,(MCS0)_2TX	18.78M	18.954M	19M0D1D	17.97M	18.924M
802.11ax HEW40_Nss1,(MCS0)_2TX	37.98M	37.79M	37M8D1D	37.5M	37.731M
802.11ax HEW80_Nss1,(MCS0)_2TX	75.84M	77.342M	77M3D1D	71.64M	77.225M
802.11ax HEW160_Nss1,(MCS0)_2TX	156.48M	155.86M	156MD1D	154.56M	155.625M

 $\label{eq:max-NdB} Max-N\,dB = Maximum\,6dB\,down\,bandwidth\,for\,5.725-5.85GHz\,band\,/\,Maximum\,26dB\,down\,bandwidth\,for\,other\,band;\\ Max-OBW = Maximum\,99\%\,occupied\,bandwidth;\\ Min-N\,dB = Minimum\,6dB\,down\,bandwidth\,for\,5.725-5.85GHz\,band\,/\,Maximum\,26dB\,down\,bandwidth\,for\,other\,band;\\ Min-OBW = Minimum\,99\%\,occupied\,bandwidth\,for\,5.725-5.85GHz\,band\,/\,Maximum\,26dB\,down\,bandwidth\,for\,other\,band;\\ Min-OBW = Minimum\,99\%\,occupied\,bandwidth\,for\,5.725-5.85GHz\,band\,/\,Maximum\,26dB\,down\,bandwidth\,for\,5.725-5.85GHz\,band\,/\,Maximum\,26dB\,down\,bandwidth\,for\,5.725-5.85GHz\,band\,/\,Maximum\,26dB\,down\,bandwidth\,for\,5.725-5.85GHz\,band\,/\,Maximum\,26dB\,down\,bandwidth\,for\,5.725-5.85GHz\,band\,/\,Maximum\,26dB\,down\,bandwidth\,for\,5.725-5.85GHz\,band\,/\,Maximum\,26dB\,down\,bandwidth\,for\,5.725-5.85GHz\,band\,/\,Maximum\,26dB\,down\,bandwidth\,for\,5.725-5.85GHz\,band\,/\,Maximum\,26dB\,down\,bandwidth\,for\,5.725-5.85GHz\,band\,/\,Maximum\,26dB\,down\,bandwidth\,for\,5.725-5.85GHz\,band\,/\,Maximum\,26dB\,down\,bandwidth\,for\,5.725-5.85GHz\,band\,/\,Maximum\,26dB\,down\,bandwidth\,for\,5.725-5.85GHz\,band\,/\,Maximum\,26dB\,down\,bandwidth\,for\,5.725-5.85GHz\,band\,/\,Maximum\,26dB\,down\,bandwidth\,for\,5.725-5.85GHz\,band\,/\,Maximum\,26dB\,down\,bandwidth\,for\,5.725-5.85GHz\,band\,/\,Maximum\,26dB\,down\,bandwidth\,for\,5.725-5.85GHz\,bandwidth\,for\,5.725-5.85GHz\,bandwidth\,for\,5.725-5.85GHz\,bandwidth\,for\,5.725-5.85GHz\,bandwidth\,for\,5.725-5.85GHz\,bandwidth\,for\,5.725-5.85GHz\,bandwidth\,for\,5.725-5.85GHz\,bandwidth\,for\,5.725-5.85GHz\,bandwidth\,for\,5.725-5.85GHz\,bandwidth\,for\,5.725-5.85GHz\,bandwidth\,for\,5.725-5.85GHz\,bandwidth\,for\,5.725-5.85GHz\,bandwidth\,for\,5.725-5.85GHz\,bandwidth\,for\,5.725-5$ 

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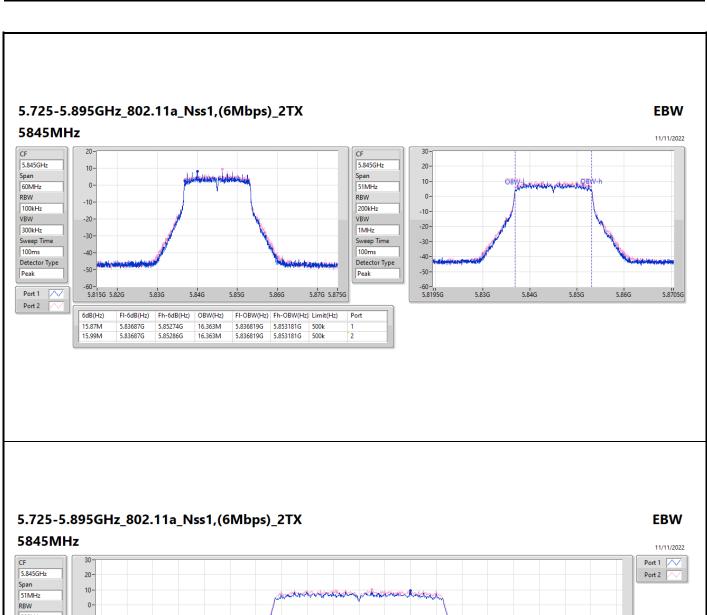
#### Result

Mode	Result	Limit	Port 1-N dB	Port 1-OBW	Port 2-N dB	Port 2-OBW
		(Hz)	(Hz)	(Hz)	(Hz)	(Hz)
802.11a_Nss1,(6Mbps)_2TX	-	-	-	-	-	-
5845MHz	Pass	500k	15.87M	16.363M	15.99M	16.363M
5865MHz	Pass	500k	15.9M	16.363M	16.05M	16.363M
5885MHz	Pass	500k	15.27M	16.363M	16.02M	16.363M
802.11ax HEW20_Nss1,(MCS0)_2TX	-	-	-	-	-	-
5845MHz	Pass	500k	18.6M	18.954M	18.27M	18.924M
5865MHz	Pass	500k	18.78M	18.954M	18.75M	18.924M
5885MHz	Pass	500k	17.97M	18.924M	18.69M	18.924M
802.11ax HEW40_Nss1,(MCS0)_2TX	-	-	-	-	-	-
5835MHz	Pass	500k	37.5M	37.731M	37.74M	37.731M
5875MHz	Pass	500k	37.92M	37.79M	37.98M	37.731M
802.11ax HEW80_Nss1,(MCS0)_2TX	-	-	-	-	-	-
5855MHz	Pass	500k	71.64M	77.342M	75.84M	77.225M
802.11ax HEW160_Nss1,(MCS0)_2TX	-	-	-	-	-	-
5815MHz	Pass	500k	156.48M	155.625M	154.56M	155.86M

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

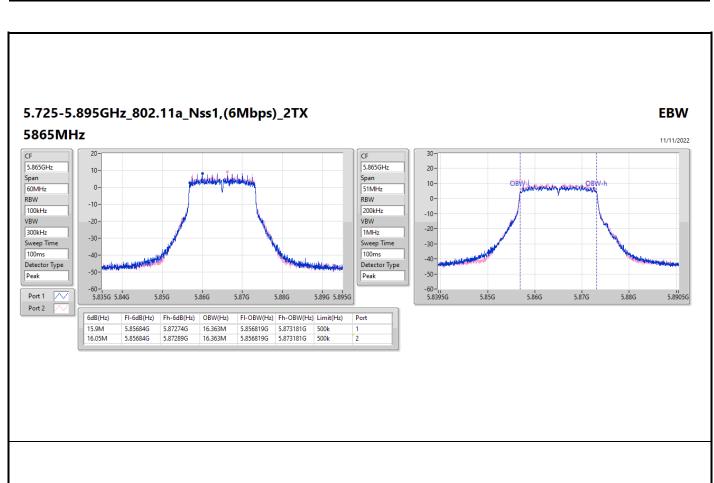
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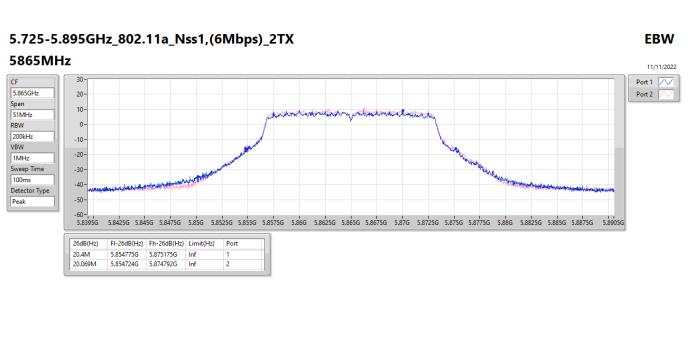
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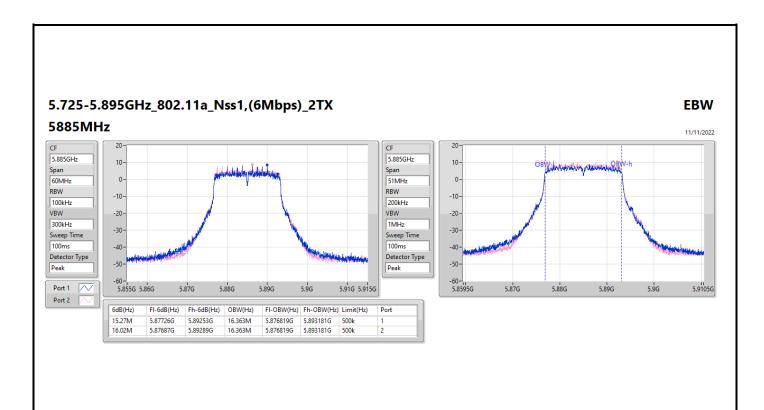
#### 200kHz -10-VBW -20-1MHz Sweep Time -30--40-Detector Type -50--60-5.8195G 5.8225G 5.825G 5.8275G 5.83G 5.8325G 5.8355G 5.8375G 5.84G 5.8425G 5.845G 5.845G 5.845G 5.8575G 5.85G 5.8575G 5.8575G 5.85625G 5.8575G 5.8575G FI-26dB(Hz) Fh-26dB(Hz) Limit(Hz) 5.8348G 5.855175G 5.834724G 5.854665G 20.375M 19.941M

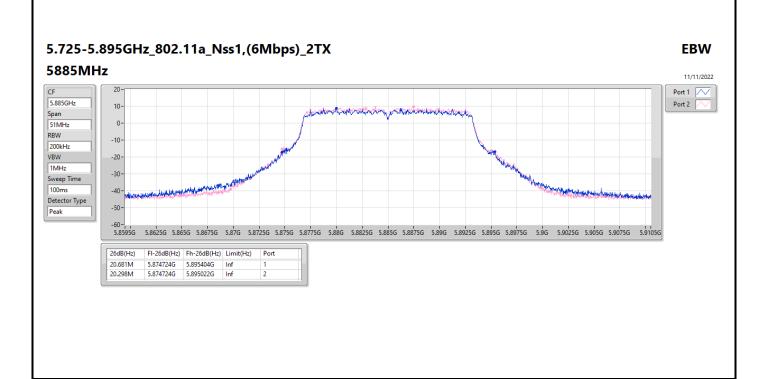
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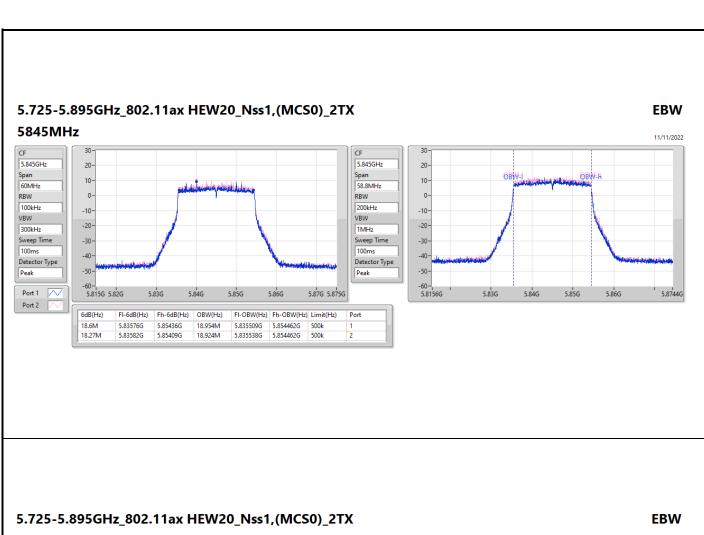


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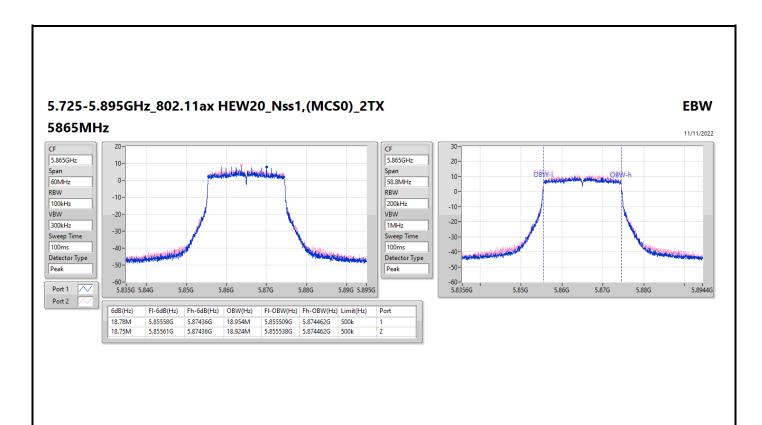


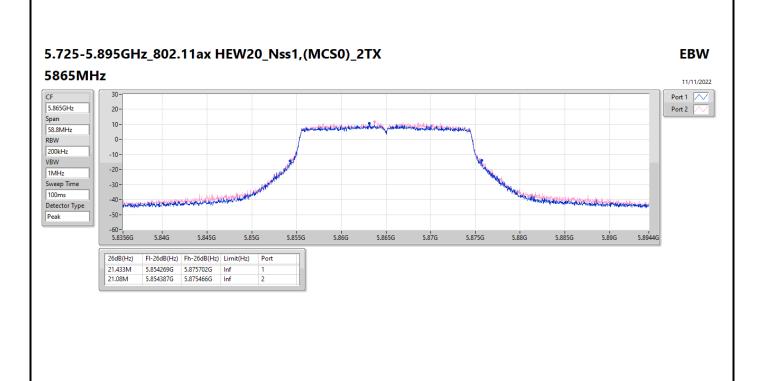
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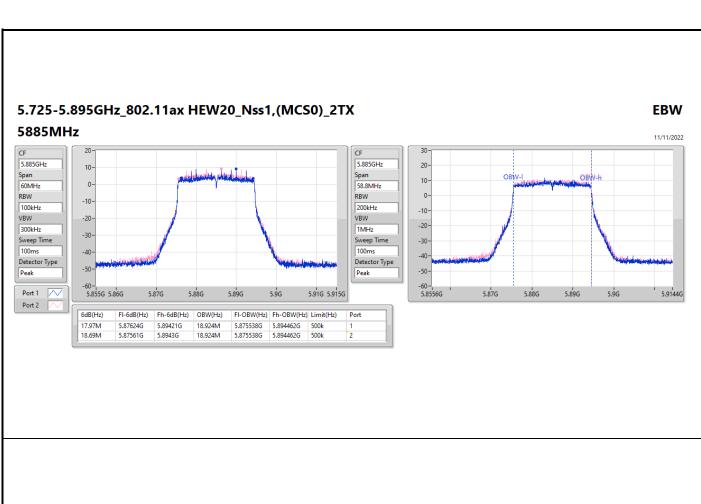
#### 5845MHz 11/11/2022 Port 1 / 5.845GHz 20-Port 2 10-58.8MHz RBW 200kHz -10-VBW -20-1MHz Sweep Time -30-100ms Detector Type -50-Peak 5.845G 5.85G 5.855G 5.87G 5.825G 5.8744G 26dB(Hz) FI-26dB(Hz) Fh-26dB(Hz) Limit(Hz) 20.962M 5.834534G 5.855496G 5.834504G

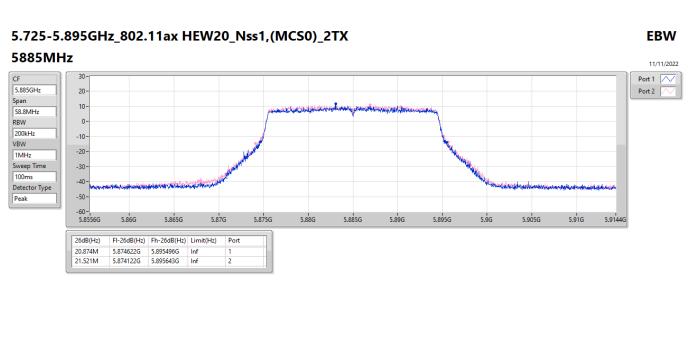
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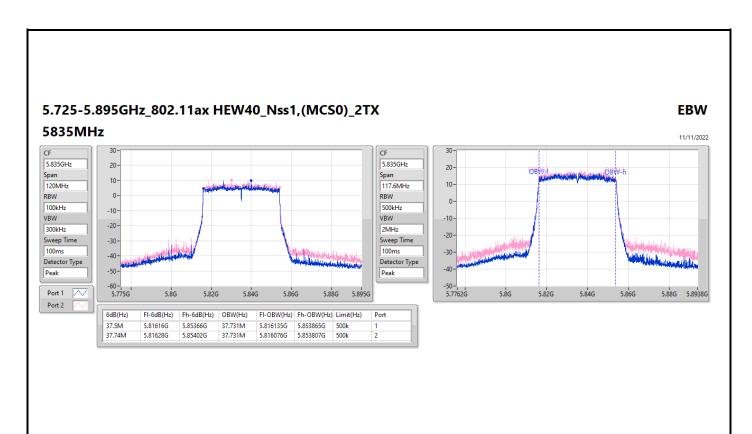


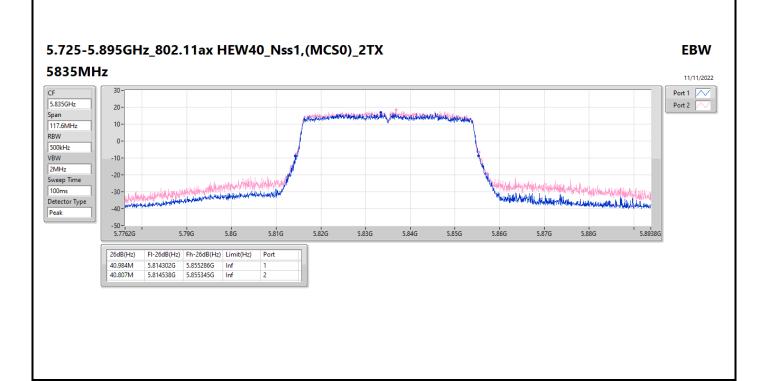
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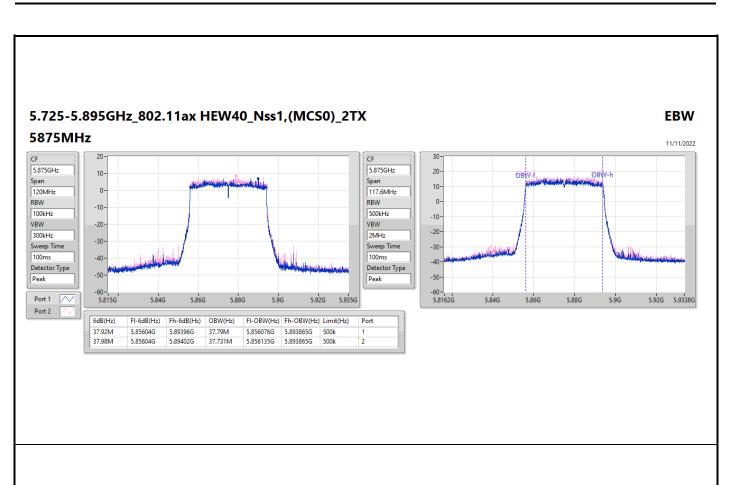


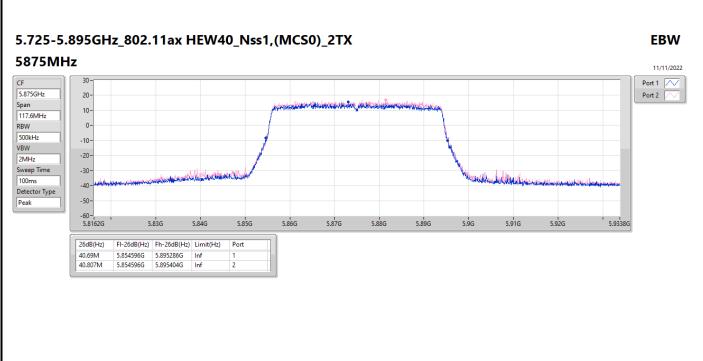
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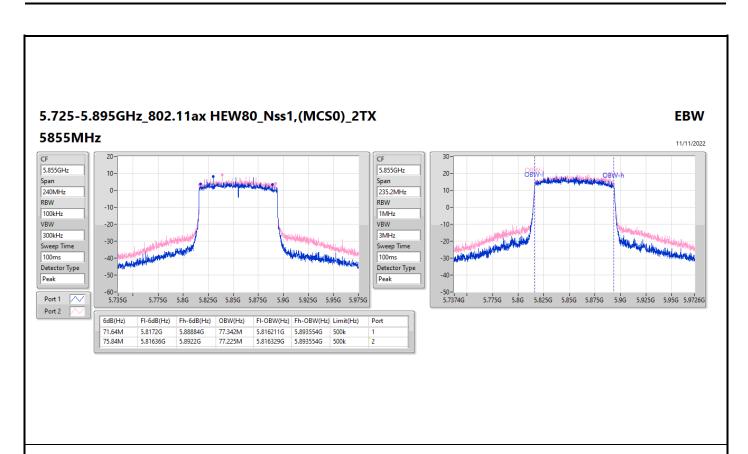


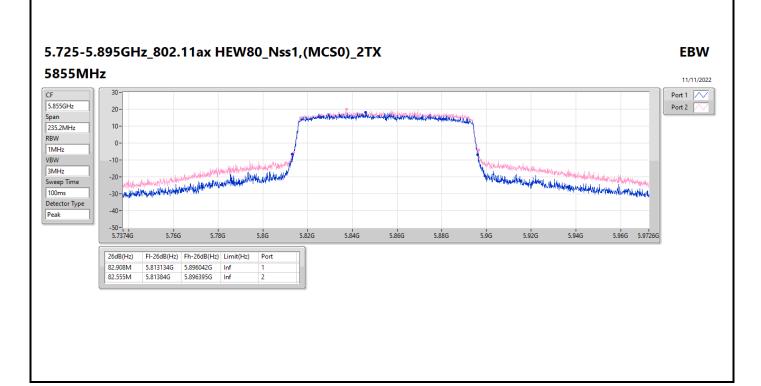
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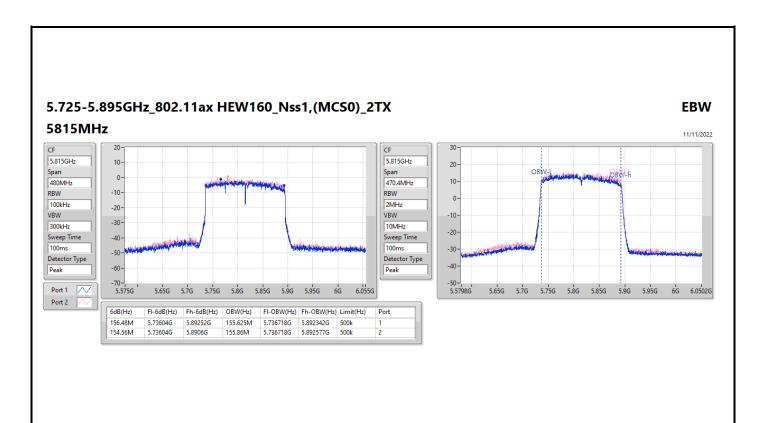


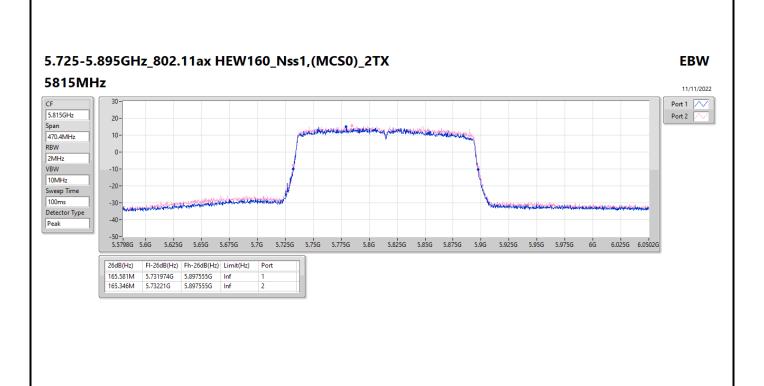
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Average Power Appendix B

### Summary

Mode	Total Power	Total Power	EIRP	EIRP
	(dBm)	(W)	(dBm)	(W)
5.725-5.895GHz	-	•	-	-
802.11a_Nss1,(6Mbps)_2TX	21.96	0.15704	29.04	0.80168
802.11ax HEW20_Nss1,(MCS0)_2TX	23.15	0.20654	30.23	1.05439
802.11ax HEW20-BF_Nss1,(MCS0)_2TX	23.15	0.20654	33.15	2.06538
802.11ax HEW40_Nss1,(MCS0)_2TX	27.12	0.51523	34.20	2.63027
802.11ax HEW40-BF_Nss1,(MCS0)_2TX	25.59	0.36224	35.59	3.62243
802.11ax HEW80_Nss1,(MCS0)_2TX	28.01	0.63241	35.09	3.22849
802.11ax HEW80-BF_Nss1,(MCS0)_2TX	25.50	0.35481	35.50	3.54813
802.11ax HEW160_Nss1,(MCS0)_2TX	24.02	0.25235	31.10	1.28825
802.11ax HEW160-BF_Nss1,(MCS0)_2TX	24.02	0.25235	34.02	2.52348

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Average Power Appendix B

## Result

Mode	Result	DG	Port 1	Port 2	Total Power	EIRP	EIRP Limit	
		(dBi)	(dBm)	(dBm)	(dBm)	(dBm)	(dBm)	
802.11a_Nss1,(6Mbps)_2TX	-	-	-	=	-	-	-	
5845MHz	Pass	7.08	18.16	19.46	21.87	28.95	36.00	
5865MHz	Pass	7.08	18.29	19.52	21.96	29.04	36.00	
5885MHz	Pass	7.08	18.13 19.11		21.66	28.74	36.00	
802.11ax HEW20_Nss1,(MCS0)_2TX	-	-	-	-	-	-	-	
5845MHz	Pass	7.08	19.35	20.80	23.15	30.23	36.00	
5865MHz	Pass	7.08	18.66	19.62	22.18	29.26	36.00	
5885MHz	Pass	7.08	18.86	19.96	22.46	29.54	36.00	
802.11ax HEW40_Nss1,(MCS0)_2TX	-	-	-	-	-	-	-	
5835MHz	Pass	7.08	23.52	24.62	27.12	34.20	36.00	
5875MHz	Pass	7.08	21.94	23.33	25.70	32.78	36.00	
802.11ax HEW80_Nss1,(MCS0)_2TX	-	-	-	-	-	-	-	
5855MHz	Pass	7.08	24.28	25.61	28.01	35.09	36.00	
802.11ax HEW160_Nss1,(MCS0)_2TX	-	-	-	-	-	-	-	
5815MHz	Pass	7.08	20.44	21.51	24.02	31.10	36.00	
802.11ax HEW20-BF_Nss1,(MCS0)_2TX	-	-	-	-	-	-	-	
5845MHz	Pass	10.00	19.35	20.80	23.15	33.15	36.00	
5865MHz	Pass	10.00	18.66	19.62	22.18	32.18	36.00	
5885MHz	Pass	10.00	18.86	19.96	22.46	32.46	36.00	
802.11ax HEW40-BF_Nss1,(MCS0)_2TX	-	-	-	-	-	-	-	
5835MHz	Pass	10.00	21.92	23.06	25.54	35.54	36.00	
5875MHz	Pass	10.00	21.72	23.30	25.59	35.59	36.00	
802.11ax HEW80-BF_Nss1,(MCS0)_2TX	-	-	-	-	-	-	-	
5855MHz	Pass	10.00	21.54	23.27	25.50	35.50	36.00	
802.11ax HEW160-BF_Nss1,(MCS0)_2TX	-	-	-	-	-	-	-	
5815MHz	Pass	10.00	20.44	21.51	24.02	34.02	36.00	

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

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Summary

Mode	PD (dBm/RBW)	EIRP PD (dBm/RBW)
5.725-5.895GHz	-	-
802.11a_Nss1,(6Mbps)_2TX	9.55	19.55
802.11ax HEW20_Nss1,(MCS0)_2TX	9.61	19.61
802.11ax HEW40_Nss1,(MCS0)_2TX	9.57	19.57
802.11ax HEW80_Nss1,(MCS0)_2TX	8.78	18.78
802.11ax HEW160_Nss1,(MCS0)_2TX	0.80	10.80

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

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Appendix C **PSD** 

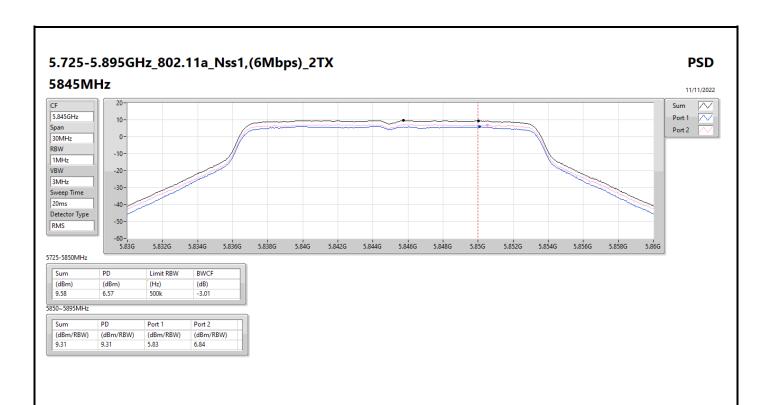
## Result

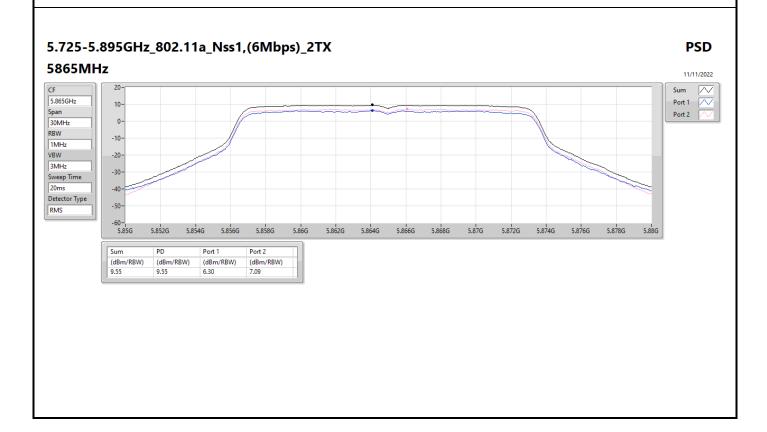
Mode	Result	DG	Port 1	Port 2	PD	EIRP PD	EIRP PD Limit
		(dBi)	(dBm/RBW)	(dBm/RBW)	(dBm/RBW)	(dBm/RBW)	(dBm/RBW)
802.11a_Nss1,(6Mbps)_2TX	-	-	-	-	-	-	-
5845MHz	Pass	10.00	5.83	6.84	9.31	19.31	20.00
5865MHz	Pass	10.00	6.30	7.09	9.55	19.55	20.00
5885MHz	Pass	10.00	5.95	6.74	9.24	19.24	20.00
802.11ax HEW20_Nss1,(MCS0)_2TX	-	-	-	-	-	-	-
5845MHz	Pass	10.00	5.86	7.38	9.61	19.61	20.00
5865MHz	Pass	10.00	5.99	6.95	9.36	19.36	20.00
5885MHz	Pass	10.00	6.19	7.16	9.48	19.48	20.00
802.11ax HEW40_Nss1,(MCS0)_2TX	-	-	-	-	-	-	-
5835MHz	Pass	10.00	5.57	7.38	9.47	19.47	20.00
5875MHz	Pass	10.00	5.82	7.32	9.57	19.57	20.00
802.11ax HEW80_Nss1,(MCS0)_2TX	-	-	-	-	-	-	-
5855MHz	Pass	10.00	5.14	6.49	8.78	18.78	20.00
802.11ax HEW160_Nss1,(MCS0)_2TX	-	-	-	-	-	-	-
5815MHz	Pass	10.00	-2.76	-1.52	0.80	10.80	20.00

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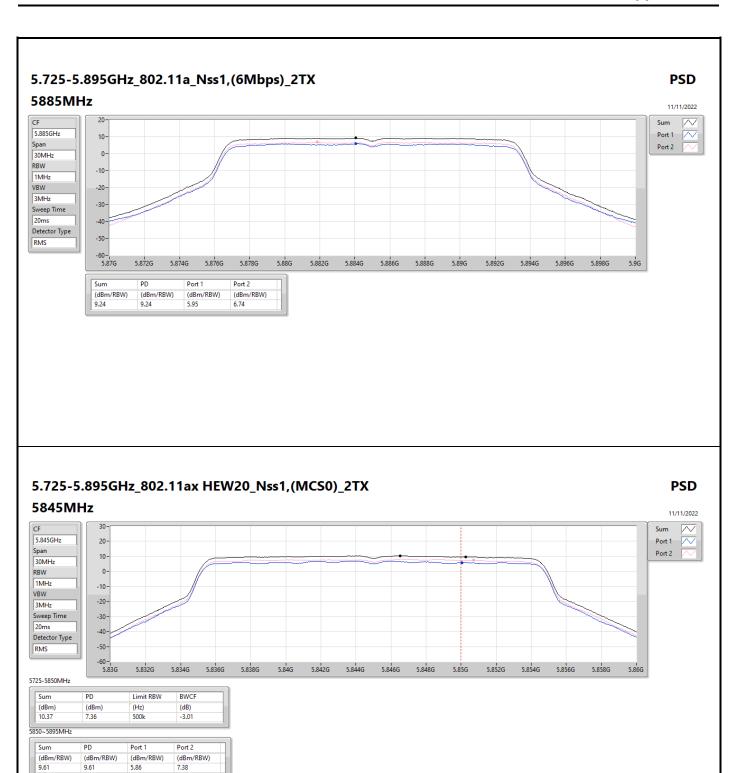
DG = Directional Gain; RBW = 500kHz for 5.725-5.85GHz band / 1MHz for other band; PD = trace bin-by-bin of each transmits port summing can be performed maximum power density; Port X = Port X Power Density;





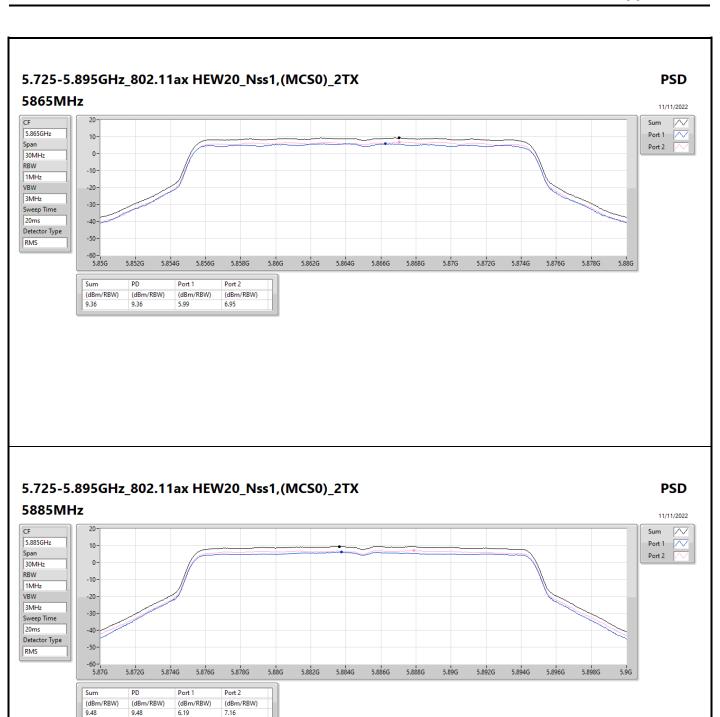
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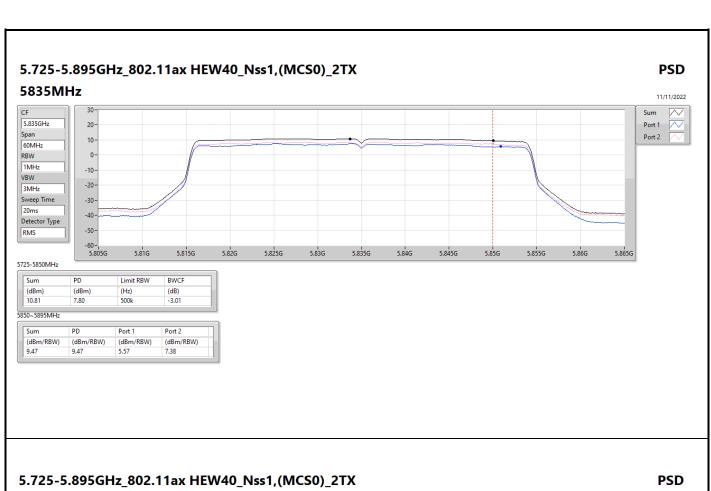
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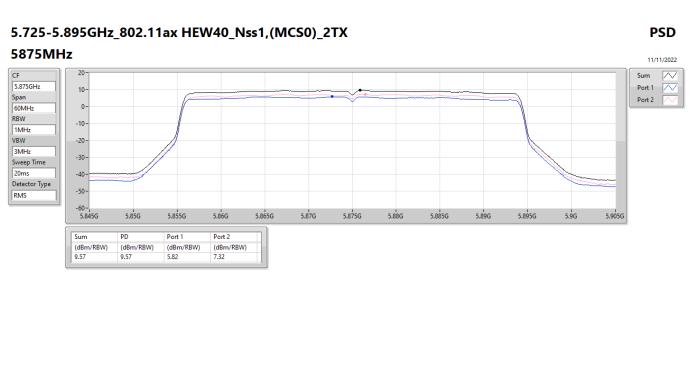
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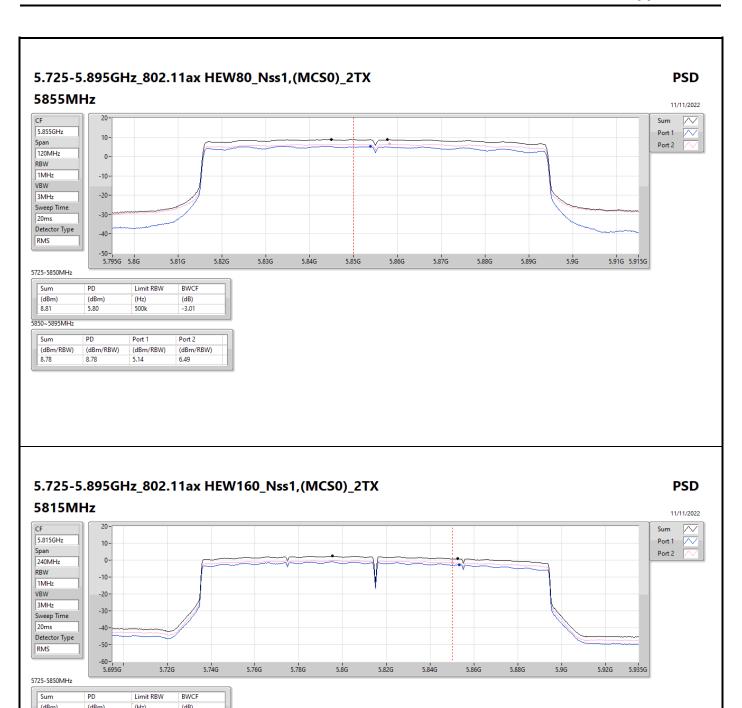
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500k

(dBm/RBW) -2.76 -3.01

(dBm/RBW) -1.52

-0.61

(dBm/RBW) 0.80

2.40

5850~5895MHz

(dBm/RBW) 0.80

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## RSE TX above 1GHz

Appendix D

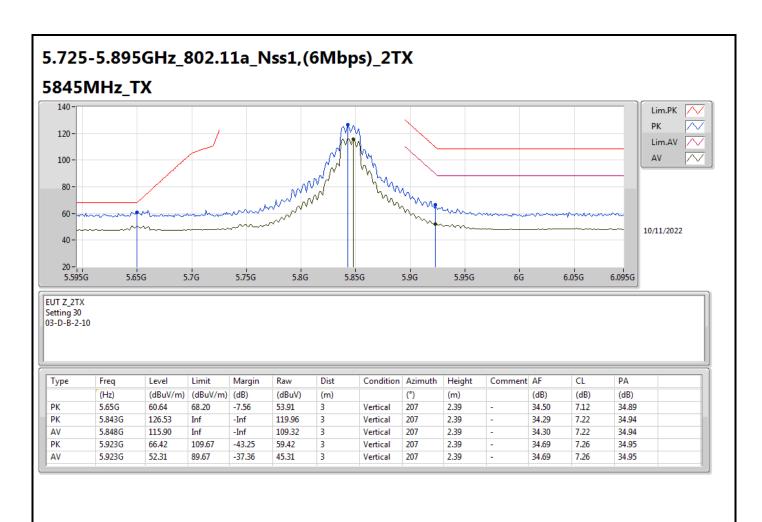
Summary

Mode	Result	Туре	Freq	Level	Limit	Margin	Dist	Condition	Azimuth	Height	Comments
			(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(m)		(°)	(m)	
5.725-5.895GHz	-	-	-	-	-	-	-	-	-	-	-
802.11ax HEW80_Nss1,(MCS0)_2TX	Pass	PK	5.65G	68.16	68.20	-0.04	3	Vertical	204	2.91	-

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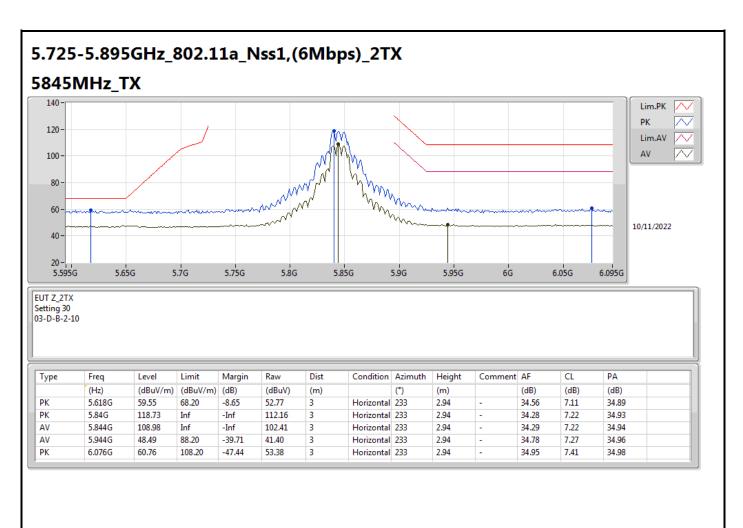




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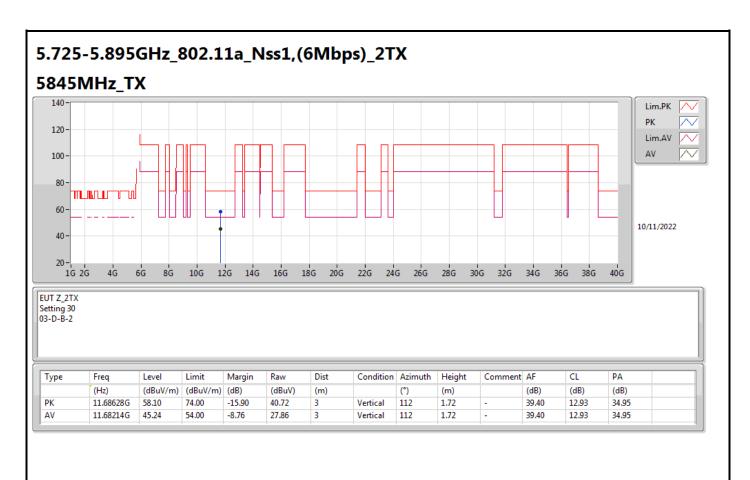




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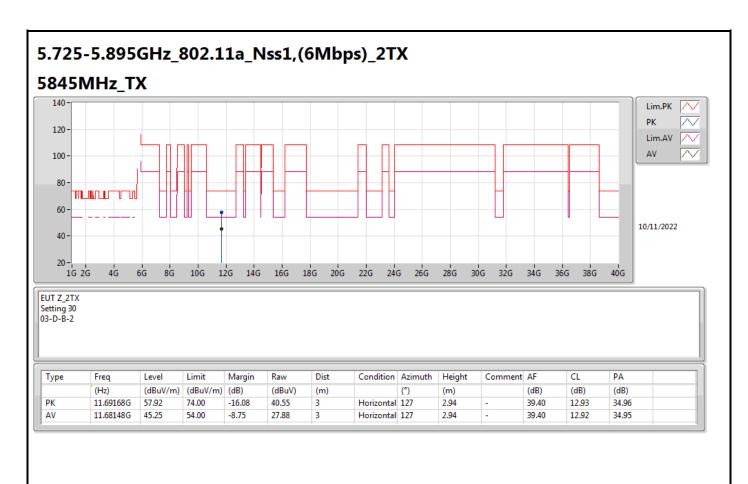




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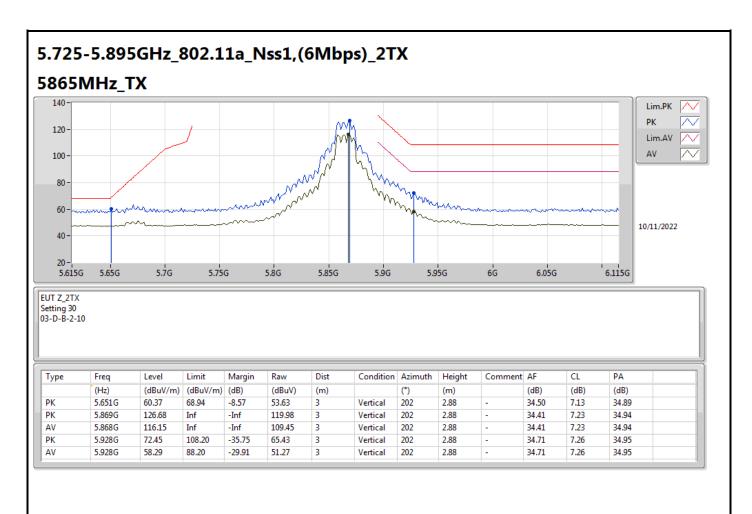




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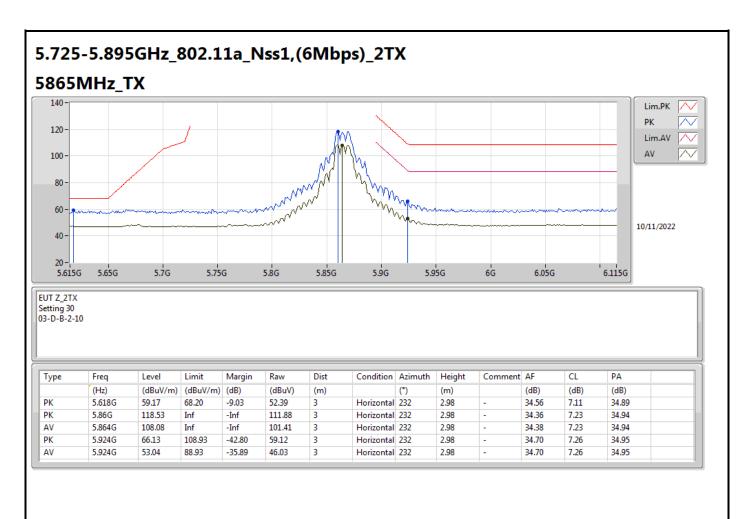




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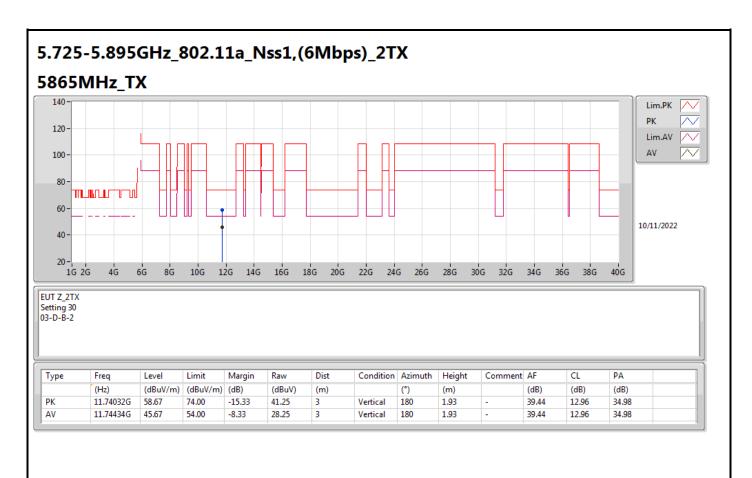




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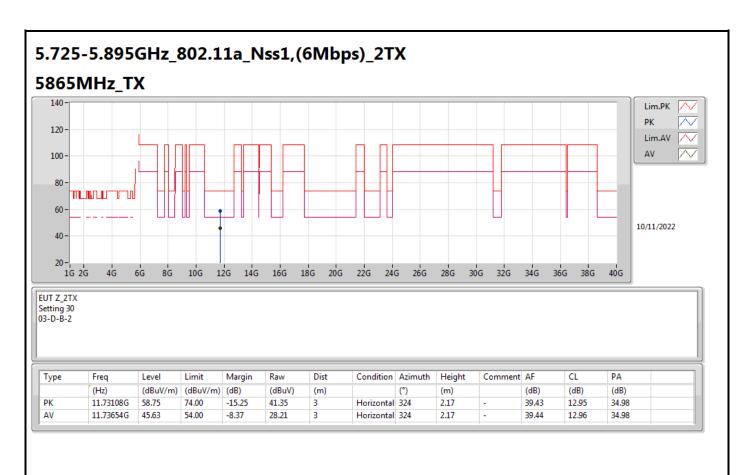




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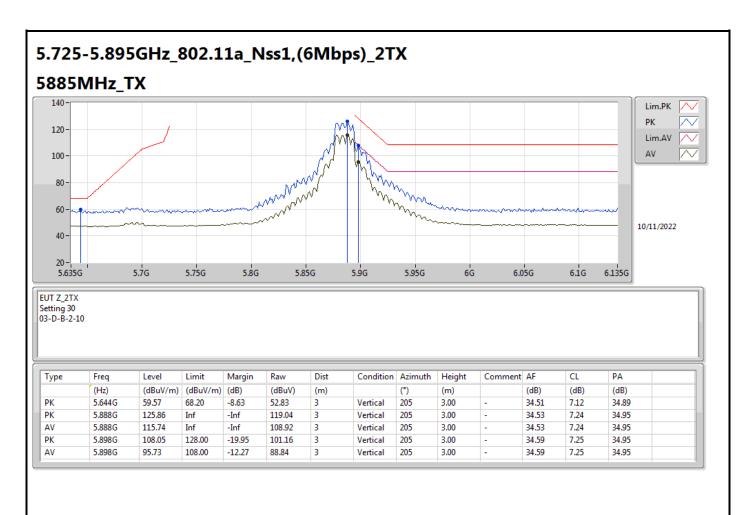




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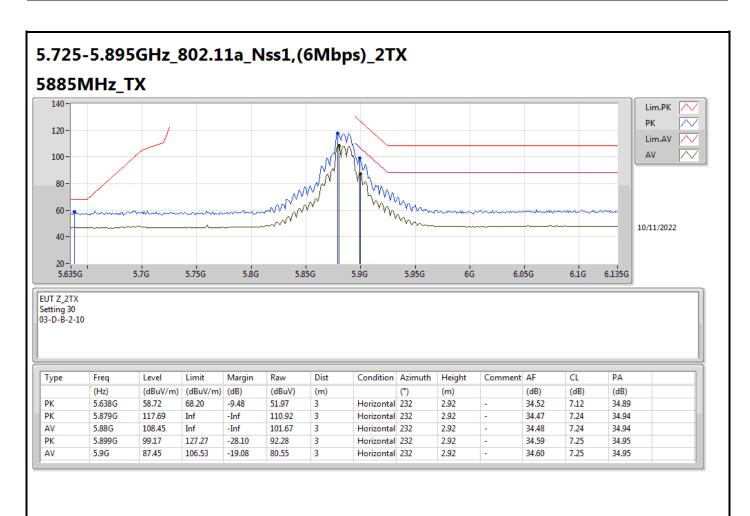




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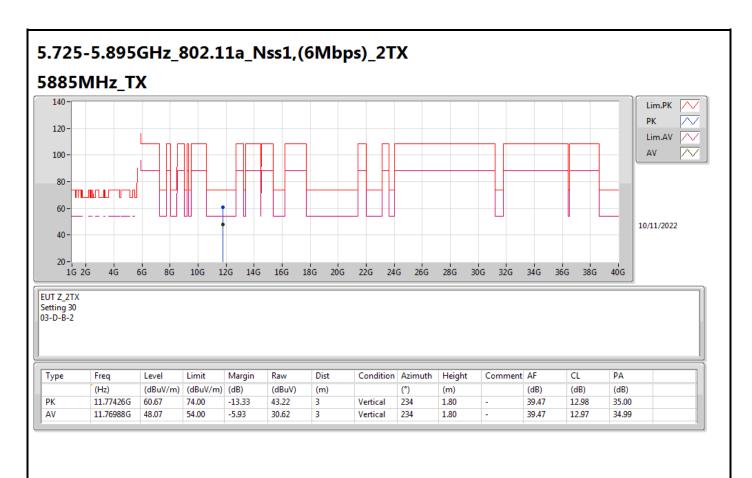
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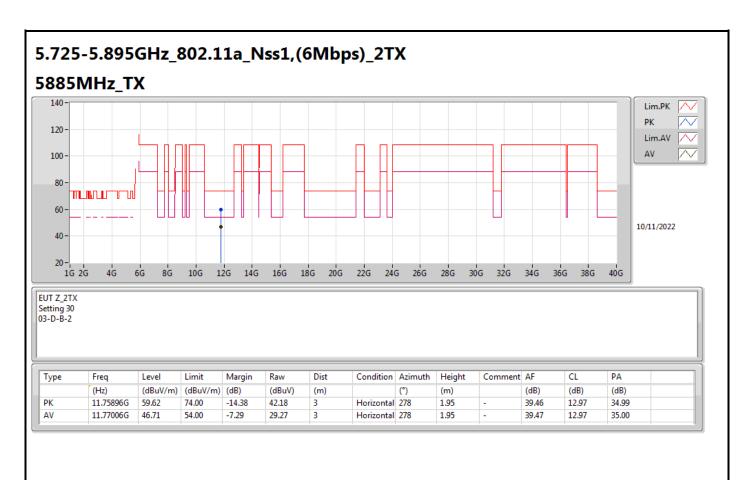




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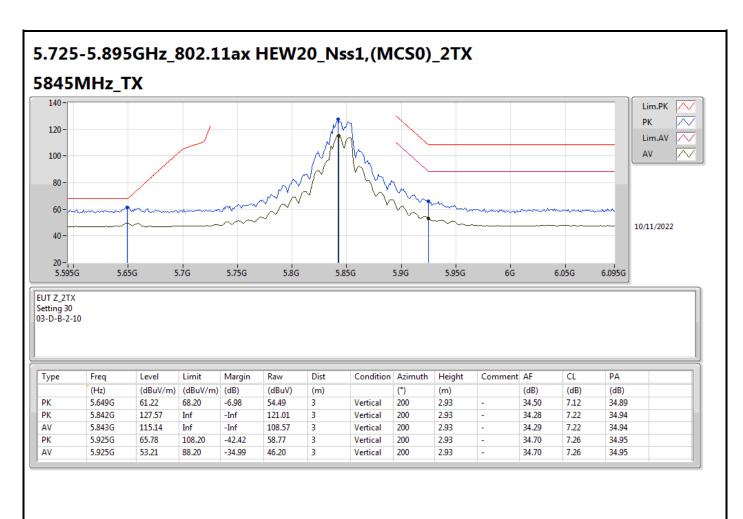




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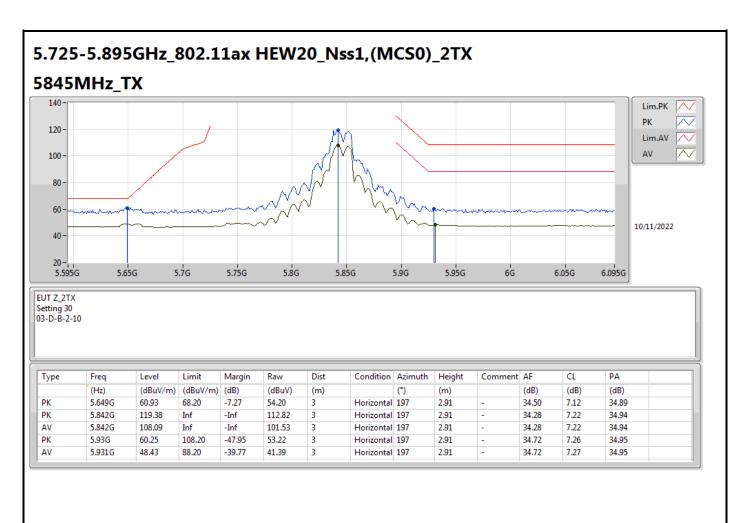




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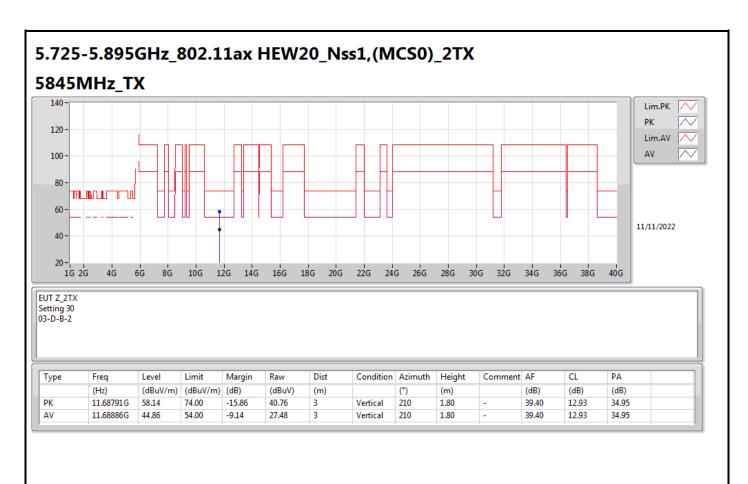




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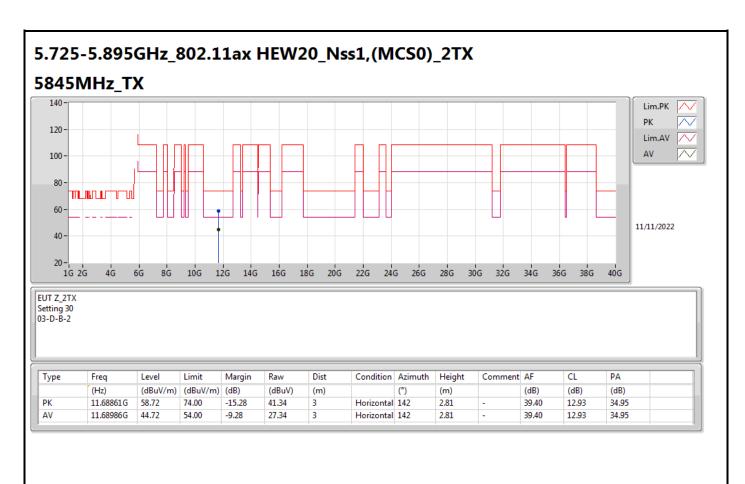




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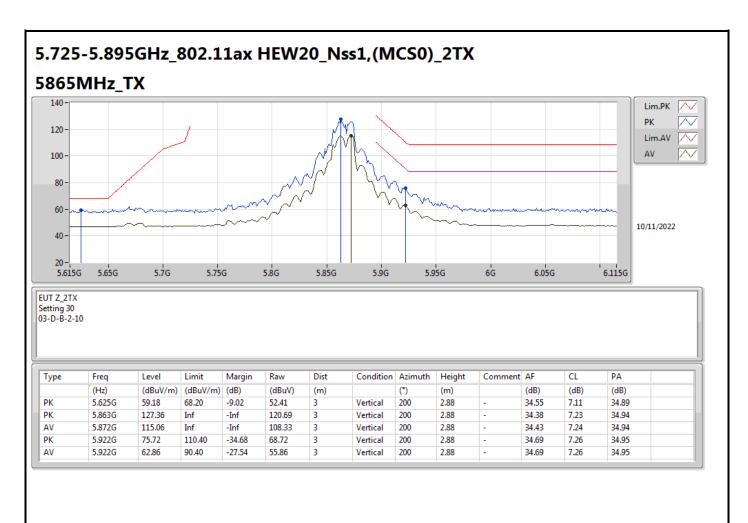




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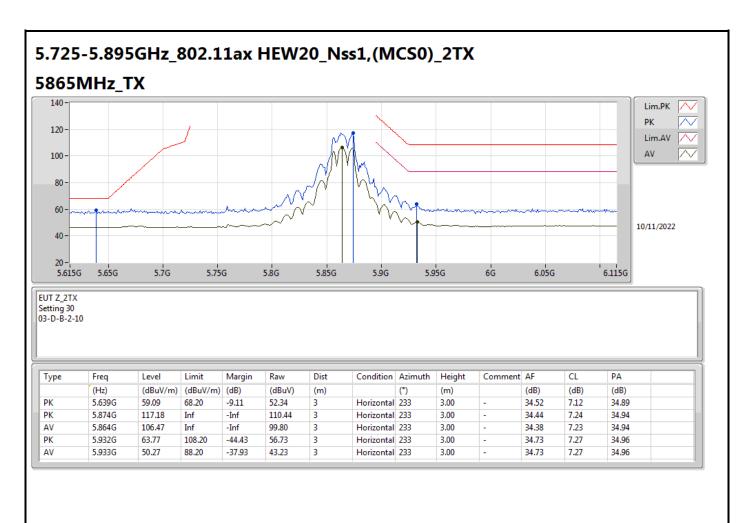




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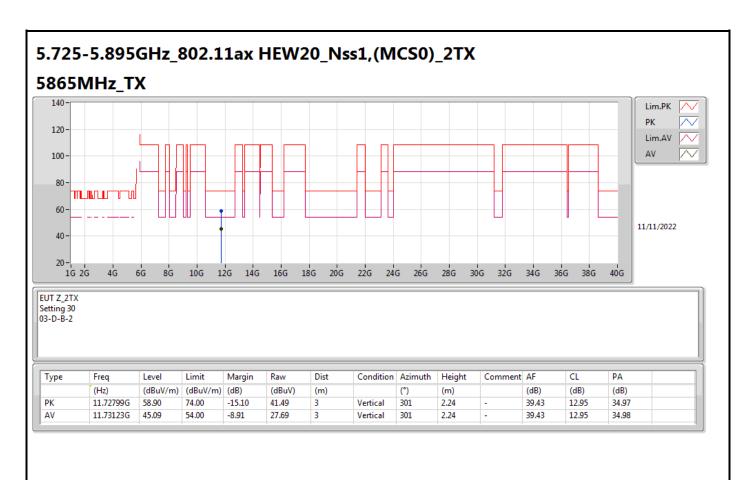




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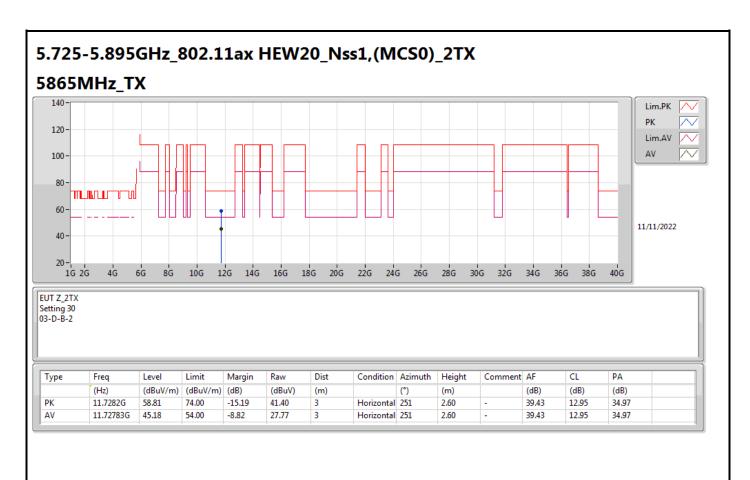
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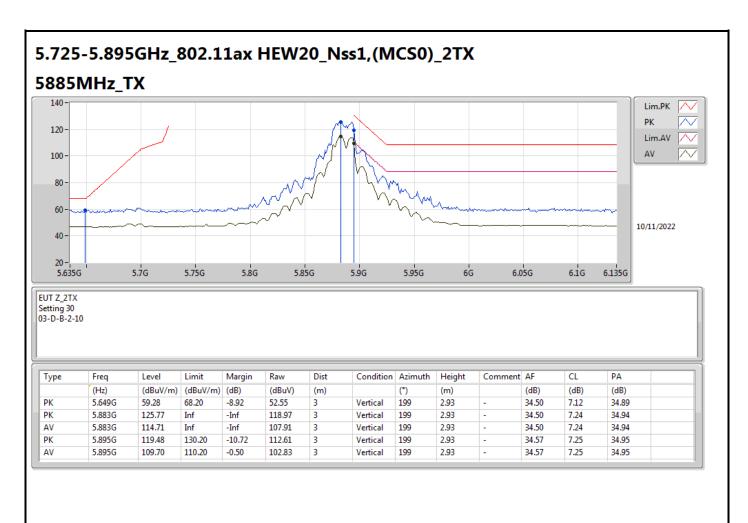




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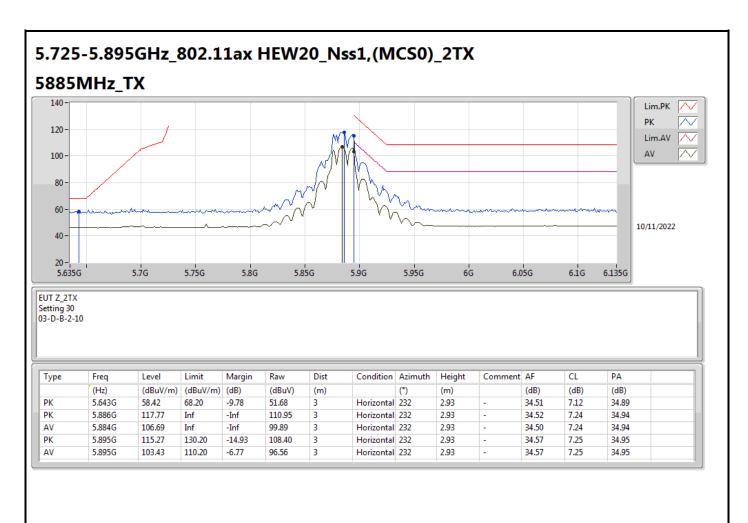




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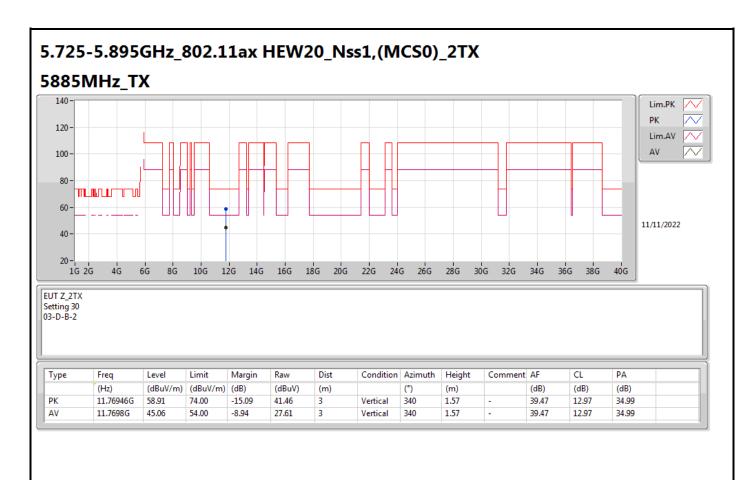




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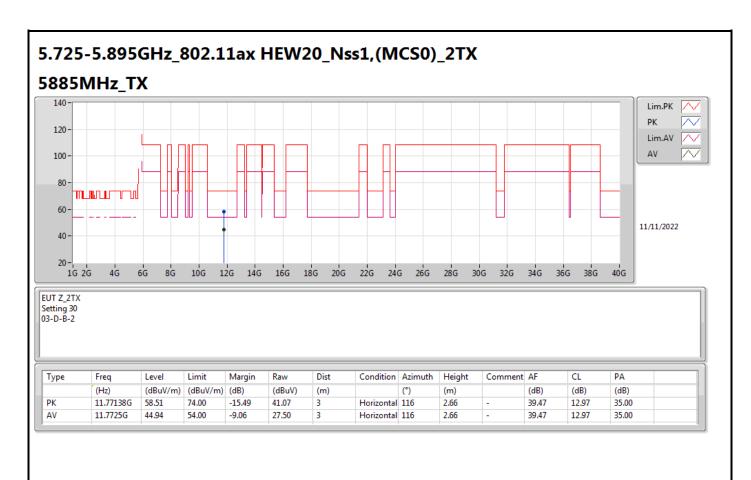




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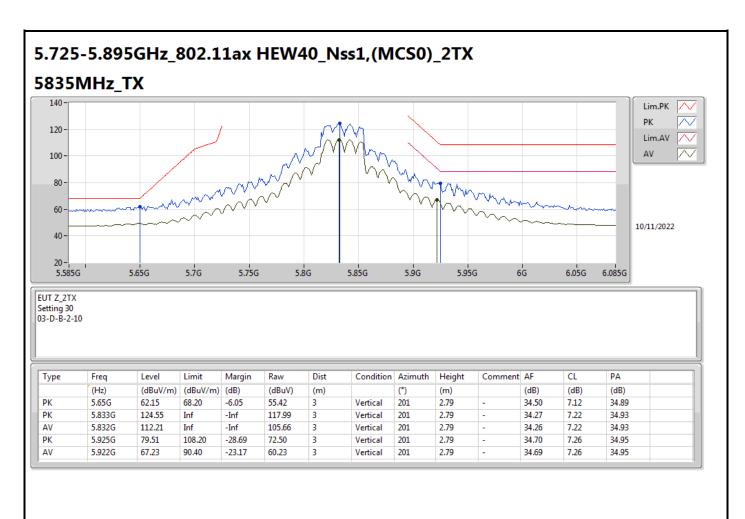




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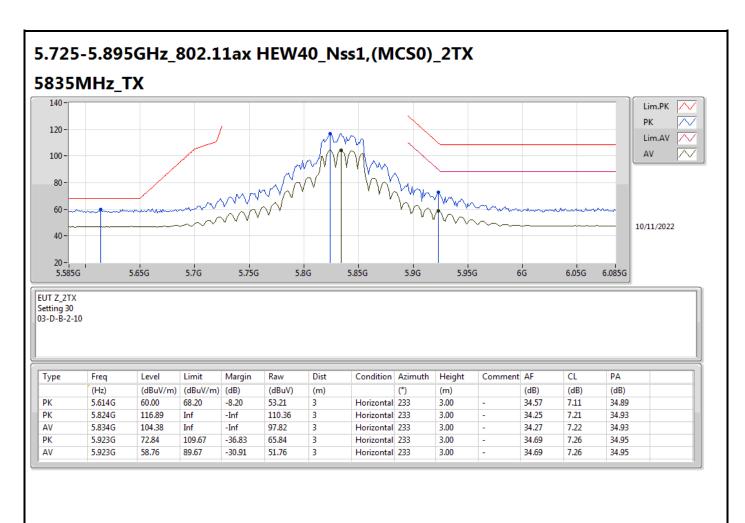
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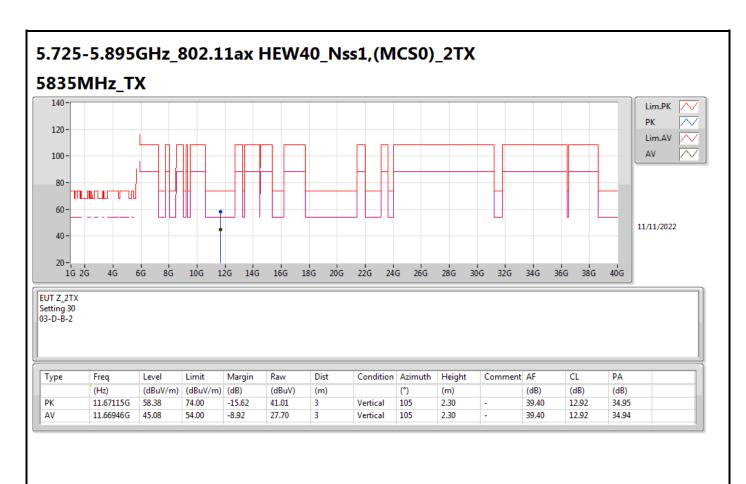




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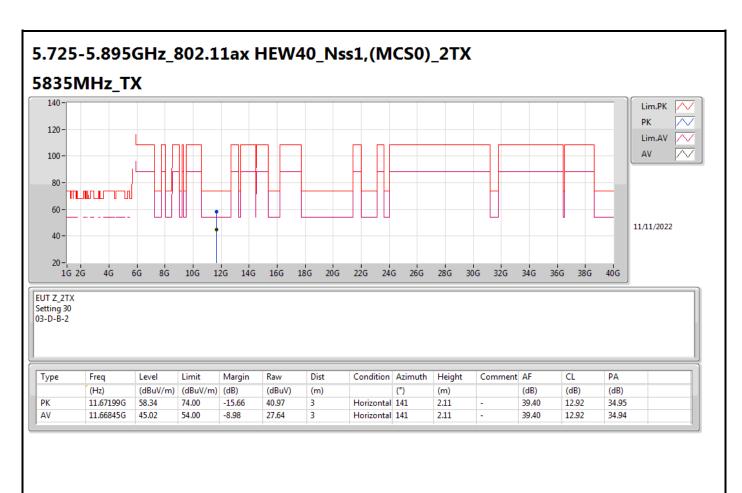




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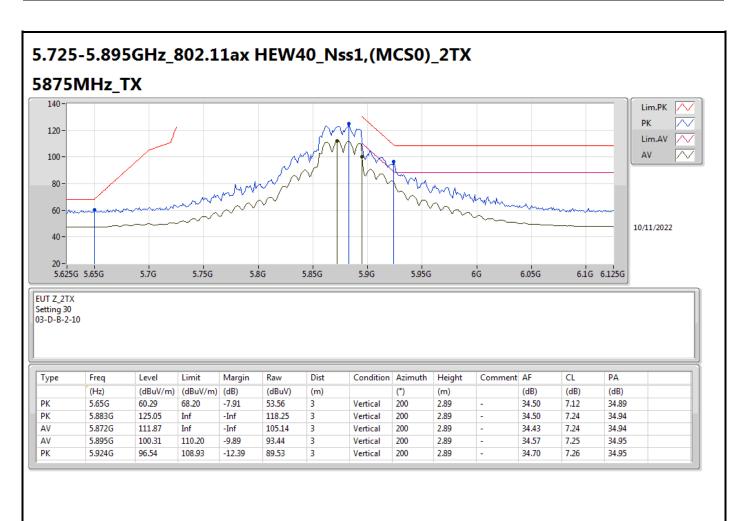
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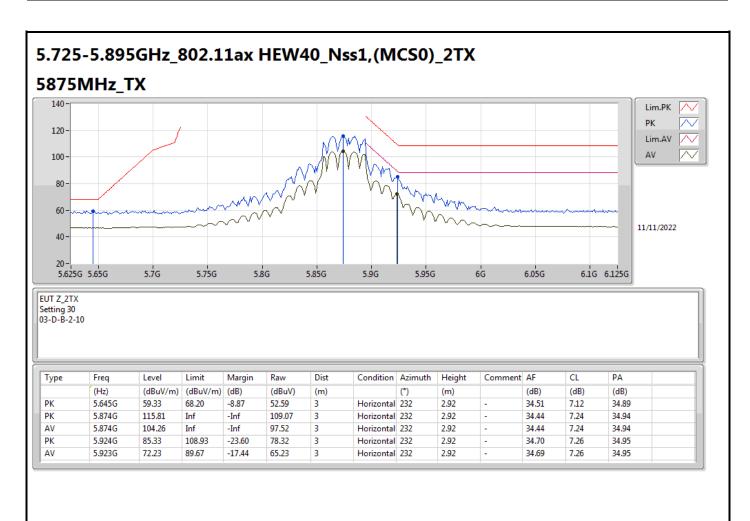




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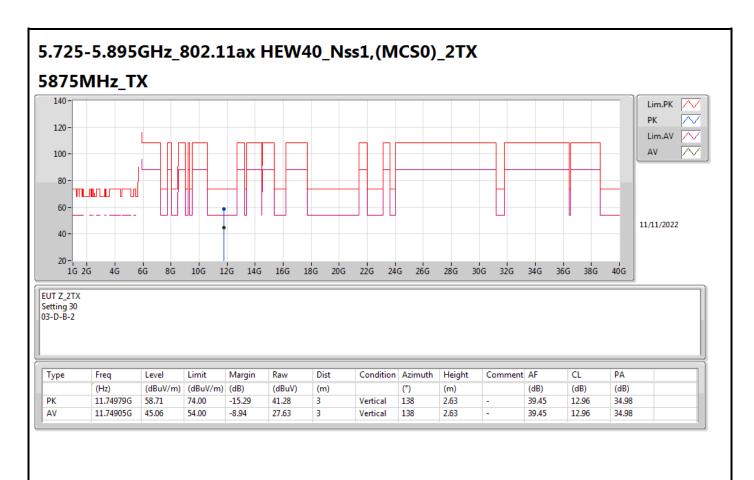




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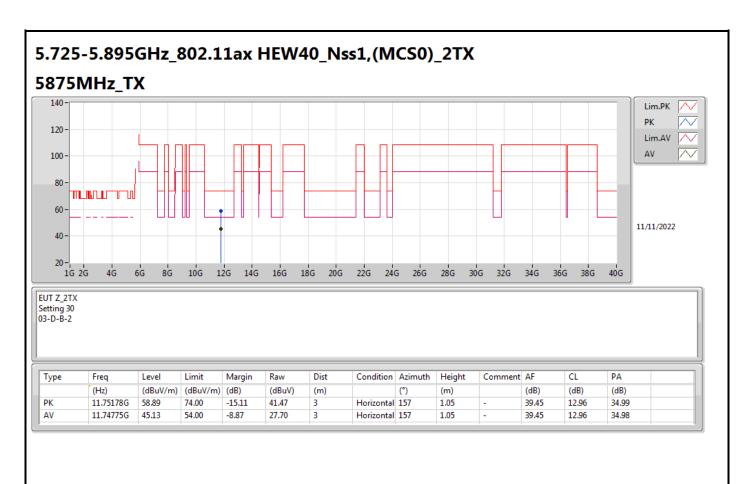




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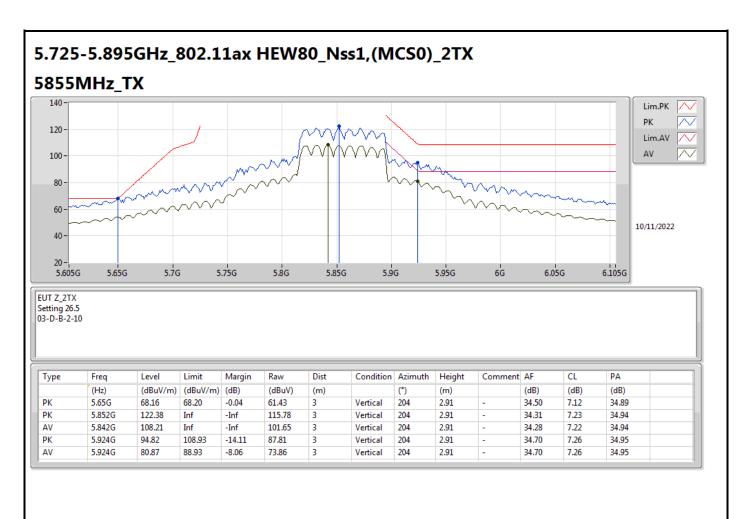
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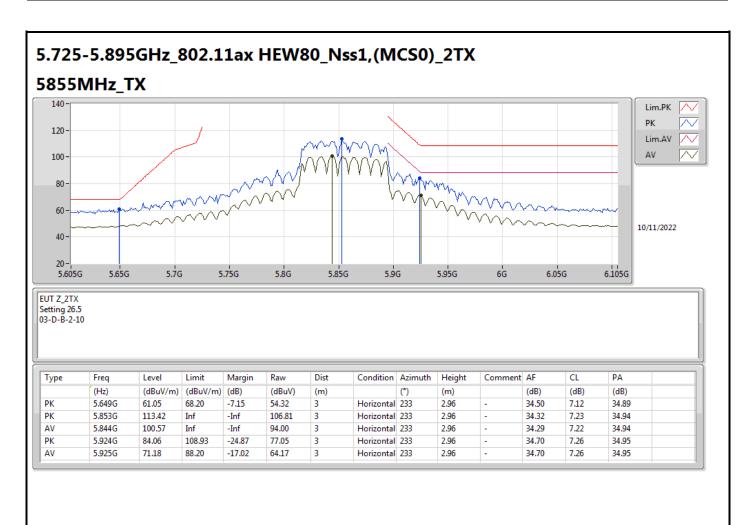




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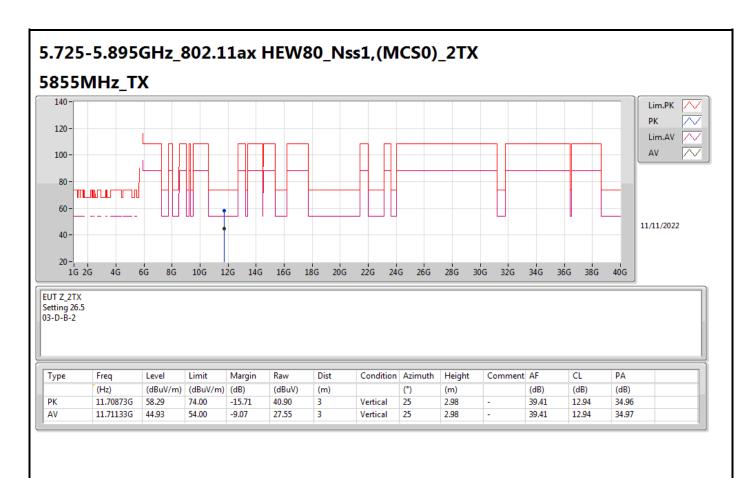




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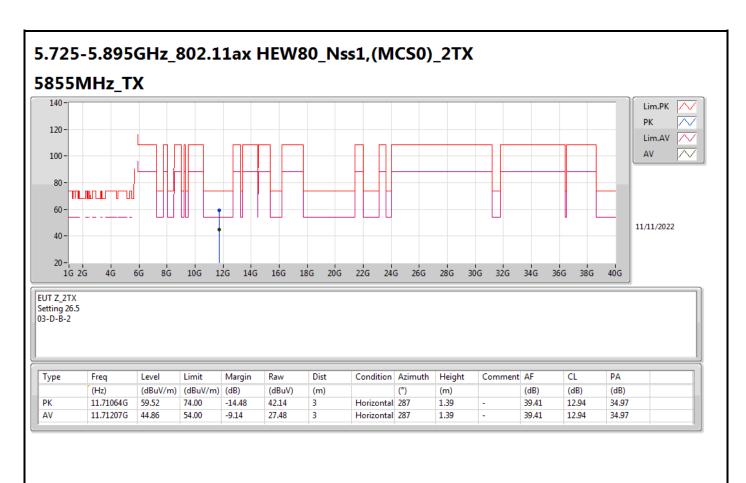
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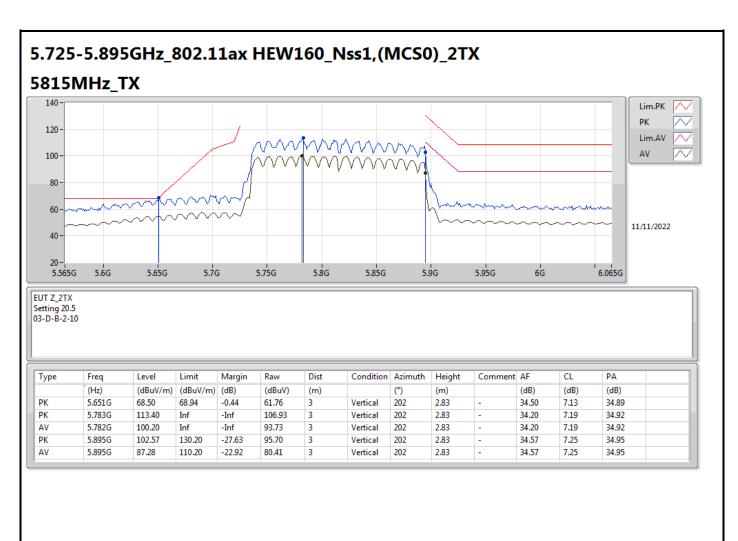




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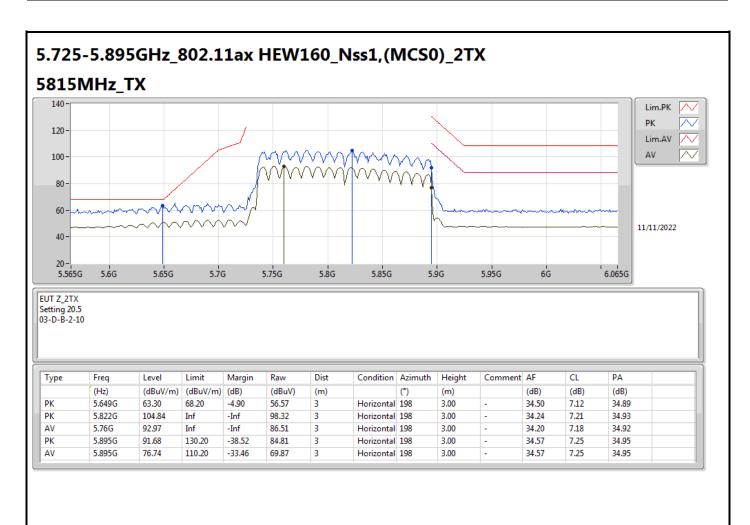




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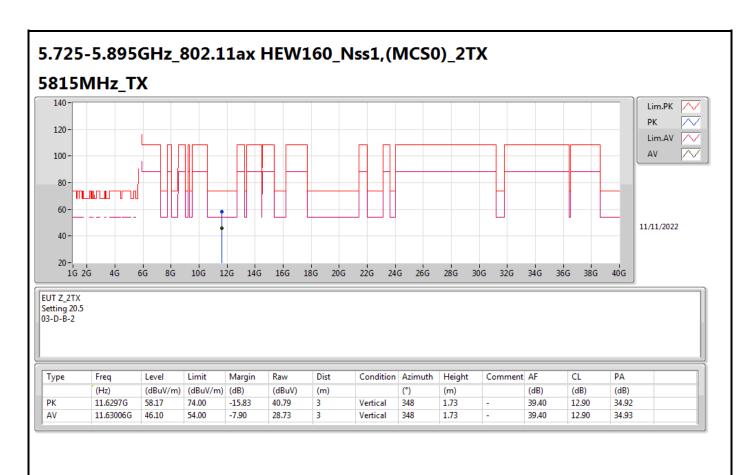




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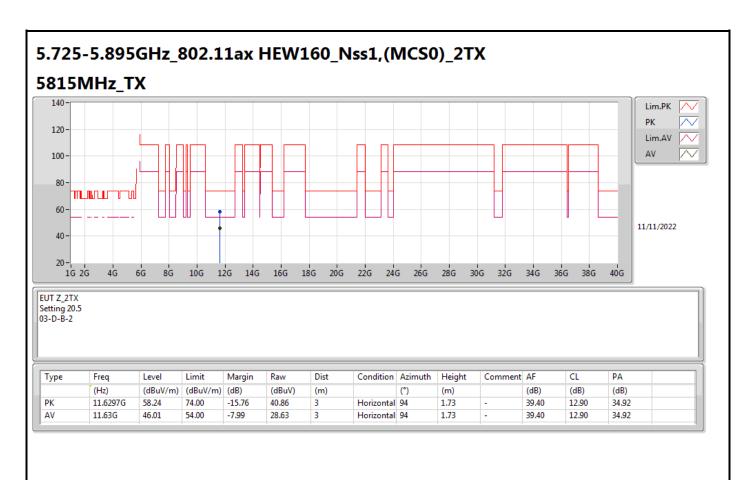




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