

REPORT

For

Avari Wireless Inc.

1400 112th Ave SE, Ste 100 Bellevue, WA 98004

Date: June 11, 2024 Report No.: 20.01.22192-1

Revision No.: Rev 1 Project No.: 22192

Equipment: Dual-Band Medium Power Remote Unit

Model No.: RU37-2-PS-FG-21-4N-A0-1 FCC ID: 2BA6ERU372PSFG21A

Date Issued:June 11, 2024 Project No.: 22192 Client: Avari Wireless Inc. Report No.: 20.01.22192-1 Revision No.: 1

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TEST REPORT						
FCC Part 15, Subpart B - Unintentional Radiators FCC Part 90 - Private Land Mobile Radio Services						
Report Reference No	20.01.22192-1					
Report Revision History	✓ Rev. 0✓ Rev.1					
Compiled by (+ signature)	Zara Vali Zara Vali					
Approved by (+ signature)	Zara Vali Jack Qin Jack Qin					
Date of issue	June 11, 2024					
Total number of pages	85					
FCC Site Registration No.:	CA5970					
IC Site Registration No.:	5970A-2					
Testing Laboratory	LabTest Certification Inc.					
Address:	Unit 3128-20800 Westminster HWY, Richmond, B.C. V6V 2W3 Canada					
Applicant's name	Avari Wireless Inc.					
Address	1400 112th Ave SE, Ste 100 Bellevue, WA 98004					
Manufacture's Name	Avari Wireless Inc.					
Address	1400 112th Ave SE, S	te 100 Bellevue, WA 98004				
Test specification:						
Standards	FCC Part 90 Priva	ate Land Mobile Radio Services				
Test procedure:	 KDB 935210 D05 Indus Booster Basic Meas v01r04 ANSI/TIA-603- E-2016 ANSI C63.4:2014 					
Test item description:						
Trade Mark:	: RU37™					
Model/Type reference:	RU37-2-PS-FG-21-4N-A0-1					
Serial Number:	10911139E01BD2001					
FCC ID:	2BA6ERU372PSFG21A					
Possible test case verdicts:						

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Client: Avari Wireless Inc.

- test case does not apply to the test object:	N/A
- test object does meet the requirement:	P (Pass)
- test object does not meet the requirement	F (Fail)
Date of receipt of test item	February 12, 2024
Date of performance of tests	February 12, 2024

Revision History

Revision	Date	Reason For Change	Author
0	May 3rd, 2024	Initial Data	Zara Vali
1	June 11, 2024	Updating standards for radiated emission	Zara Vali

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Result Summary

Tests performed:

Conducted Measurement Radiated Emissions on Enclosure **Testing location:**

Bench top, Richmond Lab In SAC, Richmond Lab

Client: Avari Wireless Inc.

The tests indicated in Test Summary were performed on the product constructed as described below.

The test sections are the verbatim text from the actual data sheets used during the investigation. These test sections include the test name, the specified test Method, a list of the actual Test Equipment Used, documentation Photos, Results and raw Data. No additions, deviations, or exclusions have been made from the standard(s) unless specifically noted.

Based on the results of our investigation, we have concluded the product tested complies with the requirements of the standard(s) indicated. The results obtained in this test report pertain only to the item tested. LabTest does not make any claims of compliance for samples or variants which were not tested.

The Compliance Status is a judgment based on the direct measurements and calculated highest emissions to appropriate standard limits. Measurement uncertainty values, provided on calibration certificates, were not be used in the judgment of the final status of compliance.

DCN: 1036. Rev 1

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Test Item	Regulation	Measurement Method	Result
AGC Threshold	FCC Part 2 2.1046(a) FCC Part 90.219(d)	ANSI TIA-603- E-2016 KDB 935210 D05, v01r03, Section 4.2	PASS
Occupied Bandwidth	FCC Part 2 2.1049	ANSI/TIA-603- E-2016; KDB 935210 D05, v01r03	PASS
Out of Band Rejection	FCC Part 2 2.1046(a) FCC Part 90.219(d)	ANSI TIA-603- E-2016 KDB 935210 D05, v01r03, Section 4.3	PASS
Input-versus-output Signal Comparison	FCC Part 90.210 (j) (h) (g) (c) (d) and (e)	ANSI TIA-603- E-2016 KDB 935210 D05, v01r03, Section 4.4	PASS
Input/output Power and Amplifier/Booster Gain	FCC Part 90.219	ANSI TIA-603- E-2016 KDB 935210 D05, v01r03, Section 4.5	PASS
Noise Figure	FCC Part 90.219	ANSI TIA-603- E-2016 KDB 935210 D05, v01r03, Section 4.6	PASS
Measuring out-of-band/out-of- block (including intermodulation) and spurious emissions	FCC Part 90.219	ANSI TIA-603- E-2016 KDB 935210 D05, v01r03, Section 4.7	PASS
Frequency stability	NA	ANSI TIA-603- E-2016 KDB 935210 D05, v01r03, Section 4.8	PASS
Spurious emissions radiated measurements	FCC Part 90 (§ 90.219 and § 90.210)	ANSI C63.4:2014 KDB 935210 D05, v01r03, Section 4.9 ANSI C63.26-2015	PASS
Radiated Emissions	FCC Part 90 (§ 90.219 and § 90.210)	ANSI C63.4:0214, CISPR 16-2-1 ANSI C63.26-2015 KDB 935210 D05 v01r04	PASS
Conducted Emissions at AC Main	FCC Part 15 Subpart B (§ 15.107)	ANSI C63.4:2014, CISPR 16-2-1	PASS

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1. EUT Information

EUT Description and Variant Models

Description:

The RU37 800PS/415PS/150 PS is a tri-band remote unit that provides at least 5 W of output power on each band. The tri-band unit supports up to 3 bands in a sealed type 2 chassis for Class A operation. On the downlink path the RU37 PS remote receives an aggregated stream of digitized RF signals from an DMU PS, which it then converts into analog RF signals. Depending on the frequency band, the signal is amplified in the RF module and then sent out through simplex RF ports to an external filter. On the UL path the RU37 PS remote receives analog RF signals for the RF band, from an external filter. The RF signals are converted into a digital data stream and then delivered over optical fiber to an DMU

PS. The RU37 PS remote also accommodates a 1 Gbps Ethernet backhaul for transporting the data from nearby IP devices such as security cameras and Wi-Fi access points. The intentional transmitter only exists in the downlink path and hence the EMC tests in this report dedicated to the downlink emission.

In order to build up a complete signal booster system, the DMU PS was connected as the Auxiliary device. The DMU PS does not have an anntenna port, where the signal was injected and ejected via coaxial cables.



Variant Models:

The following variant models were not tested as part of this evaluation but have been identified by the manufacturer as being electrically identical models, depopulated models, or with reasonable similarity to the model(s) tested. Intertek does not make any claims of compliance for samples or variants which were not tested.

RU37-2-PS-FG-21-4N-A0-1 Dual Band UHF VHF model as tested

Dual Band

- 1. RU37-2-PS-FG-21-4N-D0-1
- 2. RU33-2- PS-FG-21-4N-D0-1

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Single Band

3. RU37-1-PS-F-21-2N-D0-1

4. RU33-1- PS-F-21-2N-D0-1

5. RU37-1-PS-G-21-2N-D0-1

6. RU33-1- PS-G-21-2N-D0-1

Application for:	PS 415/150 Remote Unit, Dual Band Medium Power DAS				
Passing Transmit Frequency:	400 MHz – 425 MHz 152 MHz – 174 MHz				
Operating Transmit Frequency FCC:	406.1 MHz – 425 MHz 150.8 MHz – 156.2475 MHz 157.1875 MHz – 161.575 MHz 161.775 MHz – 161.9625 MHz 162. 0375 MHz – 173.4 MHz				
Passing Receive Frequency	405 MHz – 430 MHz 152 MHz – 174 MHz				
Operating Receive Frequency FCC	406.1 MHz – 430 MHz 150.8 MHz – 156.2475 MHz 157.1875 MHz – 161.575 MHz 161.775 MHz – 161.9625 MHz 162. 0375 MHz – 173.4 MHz				
Number of Channels:	Up to 64 channels				
Rated RF Output (e.i.r.p.):	37 dBm				
Modulation Type:	P25 Phase I C4FM, CQPSK; P25 Phase II HDQPSK on full band of Band 415 and Band 150				
Equipment mobility:	Fixed				
Operating condition:	-40 to +50 °C				
Mass of equipment (g):	< 27,700g				
Dimensions (W X D X H)	410 mm X 230 mm X 696 mm				
Nominal Voltages for:	48 V stand-alone equipment 48 V combined (or host) equipment				
Supply Voltage:	ACAmps 48V _ DC7.1 Amps				

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If DC Power:	Internal Power Supply
	$_{\underline{\sqrt{}}}$ External Power Supply
	Battery
	☐ Nickel Cadmium
	☐ Alkaline
	☐ Nickel-Metal Hydride
	☐ Lithium-Ion
	□ Other

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Client Equipment Used During Test

Use*	Product Type	Manufacturer	Model	Comments	
EUT	RU37, 415PS, 150 PS	Avari Wireless Inc.		EUT where the RF (I/O) antenna is attached via duplexers/multiplexer when necessary.	
AE1	DMU, 415PS, 150PS	Avari Wireless Inc.		Auxiliary equipment, which is the front end of system interfaced to Base Station.	
AE2	Element Manager (DMC)	Avari Wireless Inc.	EM-1A	Auxiliary equipment provides the configuration and control interface to <i>DMU</i> and <i>RU</i> 37.	
AE3 Power Supply MeanWell HGL-480H-48 AC to DC Converter, I/P: 120VAC, 60Hz, 5.5A O/P: +48VDC, 480W					
	Abbreviations:				

EUT - Equipment Under Test

AE - Auxiliary/Associated Equipment

SIM - Simulator (Not Subjected to Test)

Software and Firmware

Use*	Description	Version		
EUT	Software installed	5.6.0-0.5750		
AE1	Software installed	5.6.0-0.5750		
AE2	Software installed	5.7.1-1385		

Abbreviations:

EUT - Equipment Under Test,

AE - Auxiliary/Associated Equipment, or

SIM - Simulator (Not Subjected to Test)

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Input/Output Ports

Port #	Name	Type*	Cable Max. >3m	Cable Shielded	Comments
1	DC Power Port	DC	No	No	Dual feed 48 VDC Assembly
2	4 * RF Input/Output Ports	I/O	No	No	N-Type Coaxial
3	2 * Optical Fibre I/O Ports	I/O	No	No	LC/UPC Duplex
4	2 * TP	TP	No	No	RJ-45

*Note: AC = AC Power Port DC = DC Power Port N/E = Non-Electrical

I/O = Signal Input or Output Port (Not Involved in Process Control)

TP = Telecommunication Ports

Power Interface

Mode	Voltage	Current	Power	Frequency	Phases	Comments
#	(V)	(A)	(W)	(DC/AC-Hz)	(#)	
1	48	7.1	340	DC	-	DC power port is connected to AC/DC convertor.

EUT Operation Modes

Mode #	Description
1	UL and DL transmission and receiving ON

EUT Configuration Modes

Mode #	Description
1	DMU maximum input threshold set to -10 dBm, uplink attenuation set to 0dB; RU37 uplink and downlink attenuation set to 0dB.

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2. Description of Test Setup

Test Equipment Verified for function

Model #	Description	Checked Function	Results
KT-N9038A	Spectrum Analyzer	Frequency and Amplitude	Connected 50MHz and -20 dBm Ref_signal and checked OK
JB1	Antenna, 30 to 2000MHz	Checked structure	Normal – no damage
SAS-571	Antenna, 1 to 18GHz	Checked structure	Normal – no damage
KT-N5172B	Signal Generator	Frequency, Amplitude and Modulation	Within MFR Specs
KT-N9020B	Spectrum Analyzer	Frquency and Amplitude	Within MFR Specs

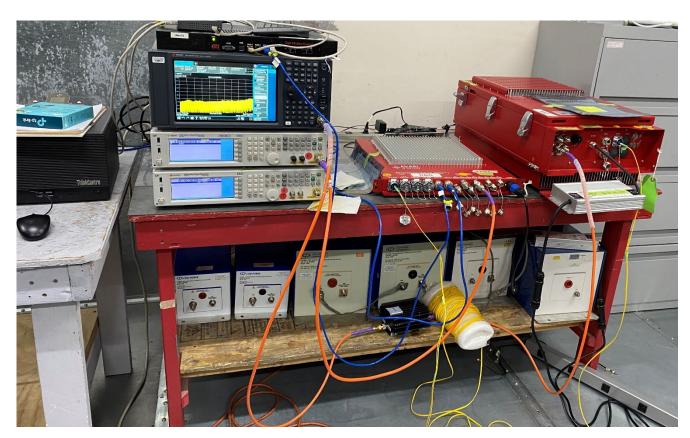
Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests:

Parameter	Uncertainty		
Radio Frequency	±1 ppm		
Total RF Power: Conducted	±1 dB		
RF Power Density: Conducted	±2.75 dB		
Spurious Emissions: Conducted	±3 dB		
Temperature	±1 °C		
Humidity	±5 %		
DC and Low Frequency Voltages	±3 %		
Radiated Emission, 30 to 18,000MHz	± 4.95 dB		

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Test Station Photo



Test Station Cables and Loads

Model # Manufacture Description					
3 x TM8-N1S1-60	MegaPhase	N male to SMA male coaxial cable in 60 inches			
1 x 49-30-34	Aeroflex	30dB 25W attenuator			

Test Station Insertion Loss

	Band 415	Band 150
DL Transmitter	31.1 dB	30.7 dB
UL Receiver	0.8 dB	0.8 dB

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3. Test Result

3.1 AGC Threshold

Governing Doc	FCC Part 2 2.10 FCC Part 90.21		Room Temperature	(°C)	21		
Test Procedure	ANSI TIA-603- I KDB 935210 D0 v01r03, Section)5,	Relative Humidity (%	Relative Humidity (%)			
Test Location	Richmond		Barometric Pressure	(hPa)	1012		
Test Engineer	Zara Vali		Date	te February 1.			
EUT Voltage	⊠ +48VD	С	☐ 120VAC @ 60H	lz			
Test Equipment Used	Manufacturer	Model	Serial Number	Calibration date	Calibration due		
Signal Generator	Keysight N5172B		MY53050270	Dec 12, 2023	Dec 12, 2026		
Spectrum Analyzer	Keysight	N9020B	MY62153079	Oct 25, 2023	Aug 1, 2025		
Frequency Range:	⊠ 400 MHz –	425 MHz; ⊠ 152	? MHz – 174 MHz				
Detector:	⊠ Peak						
Type of Facility:	⊠ Test bench						
Distance:	⊠ Direct						
Arrangement of EUT:	ent of EUT: ⊠ Table-top only □ Floor-standing only □ Rack Mo						
Output Power is less than or equal 37.08 dBm in band 415, and less than or equal 37.09 dBm in band 150.							
Compliant ⊠	Non-	Compliant □	Not Applic	able 🗆			

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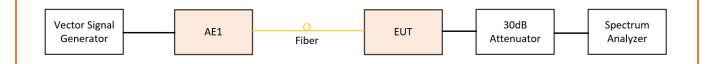
Test setup

Description of test set-up:

Output power is measured by connecting a spectrum analyzer to RF output connector of EUT via 30dB attenuator. With a nominal input power and the amplifier properly adjusted the RF output is measured.

The EUT was set to Operation Mode #1 with configuration Mode #1.

The maximum output power is measured when the Automatic Level Control (ALC) starting to compress the power and hold to a constant level.



Results - Output Power FCC Requirement

Frequency Range (MHz)	Frequency (MHz)	Input Power Trip ALC (dBm)	Output Power (dBm)	Output Power (Watt)
44500	406.1	-10.6	36.99	5.0
415PS 406 - 415	415.5	-10.8	37.03	5.04
400 410	424.9	-11.0	37.08	5.11
	153	-10.8	36.94	4.94
150PS 152 - 174	161.5	-11.4	37.03	5.04
102 - 174	170	-11.2	37.09	5.12

Prepared by: LabTest Certification Inc. Date Issued:June 11, 2024

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3.2 Occupied Bandwidth

•								
Governing Doc	FCC Part 2 2.1049			Room Temperature (°C)		21		
Test Procedure	ANSI/TIA-603- E-2016; KDB 935210 D05, v01r03			Relative Humidity (%)		45		
Test Location	Richmond			Barometric F	Pressure (hPa)	1012		
Test Engineer	Zara Vali			Date		February 12, 2024		
EUT Voltage	⊠ +48VD0			120VAC @) 60Hz			
Test Equipment Used	Manufacturer	Model	Ser	ial Number	Calibration da	ate	Calibration due	
Signal Generator	Keysight	N5172B	MY	53050270	Dec 12, 2023		Dec 12, 2026	
Spectrum Analyzer	Keysight	Keysight N9020B M			Oct 25, 202	3	Aug 1, 2025	
Frequency Range:	⊠ 400 MHz – 425 MHz; ⊠ 152 MHz – 174 MHz							
Detector:	⊠ Peak							
Type of Facility:	⊠ Test bench							
Distance:	⊠ Direct							
Arrangement of EUT:	☑ Table-top only □ Floor-standing only □ Rack Mounted					d		
Output signal has an occupied channel bandwidth less than the designated channel bandwidth on any location on the operating band. - C4FM < 12.5 kHz - CQPSK < 6.25 kHz - HDQPSK < 12.5 kHz - 4 kHz FM with 1kHz deviation < 12.5 kHz								
Compliant ⊠	Non-Co	mpliant 🗆		Not Ap	plicable □			

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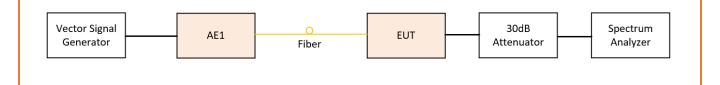
Test setup

Occupied Bandwidth is measured by connecting a Spectrum Analyzer to the RF output connector via 30dB attenuator. The required measurement resolution bandwidth (RBW) is 1% of the emission bandwidth. 99% energy rule was applied to measure the occupied channel bandwidth. The emission bandwidth is measured as the width of the signal between two frequency points on the channel edge, outside of which the transmission power is attenuated at least 26dB below the transmitter output power

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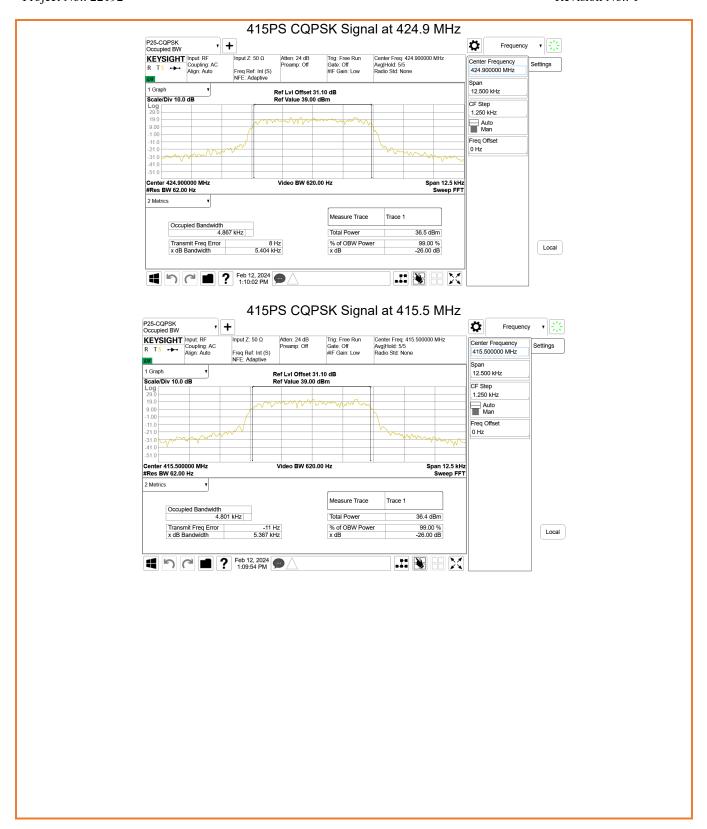
The EUT was set to Operation Mode #1 with configuration Mode #1.

The occupied bandwidth of UL output is measured under one input conditions: Nominal: with input 0.5dB below AGC threshold



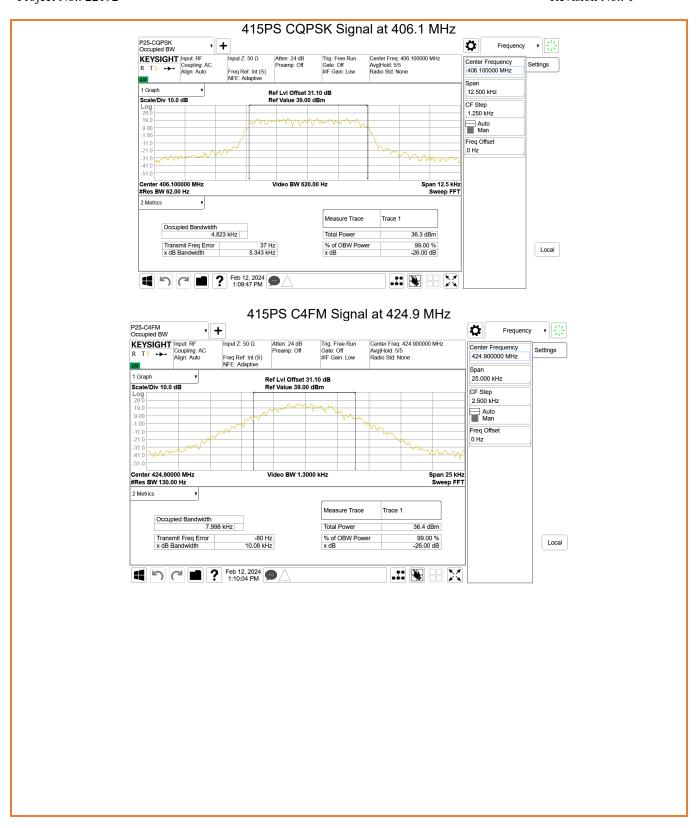
Results - Occupied Bandwidth

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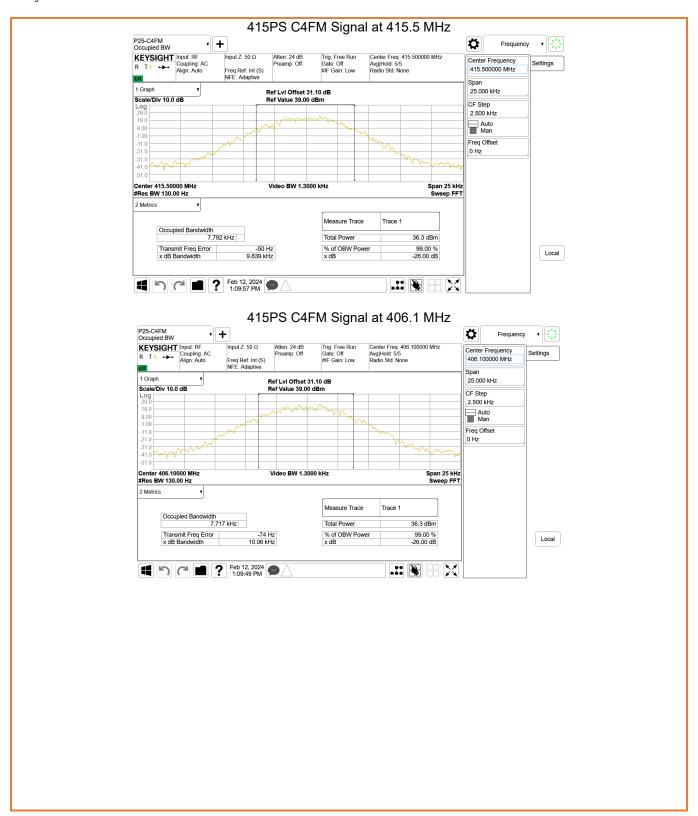
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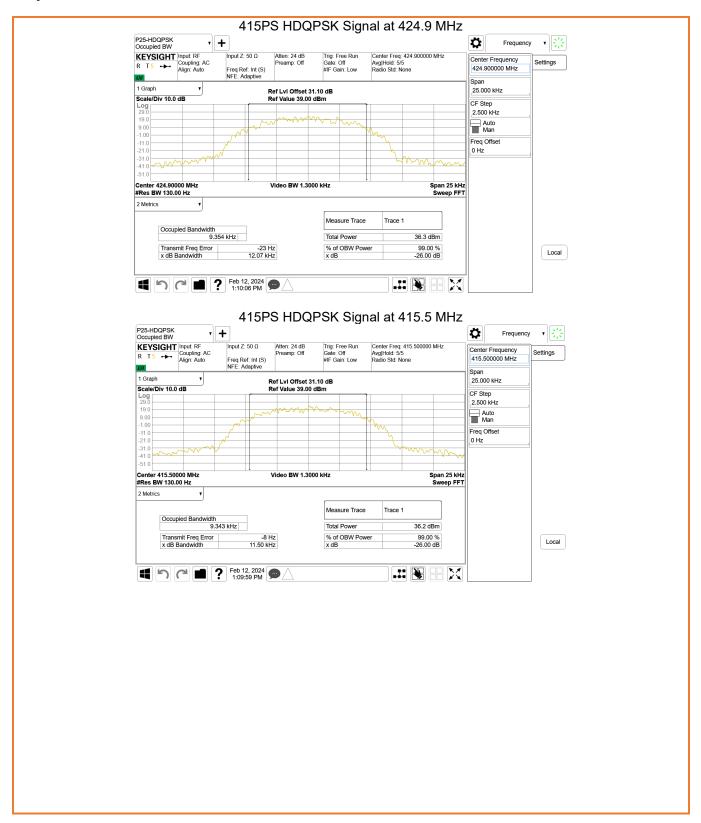


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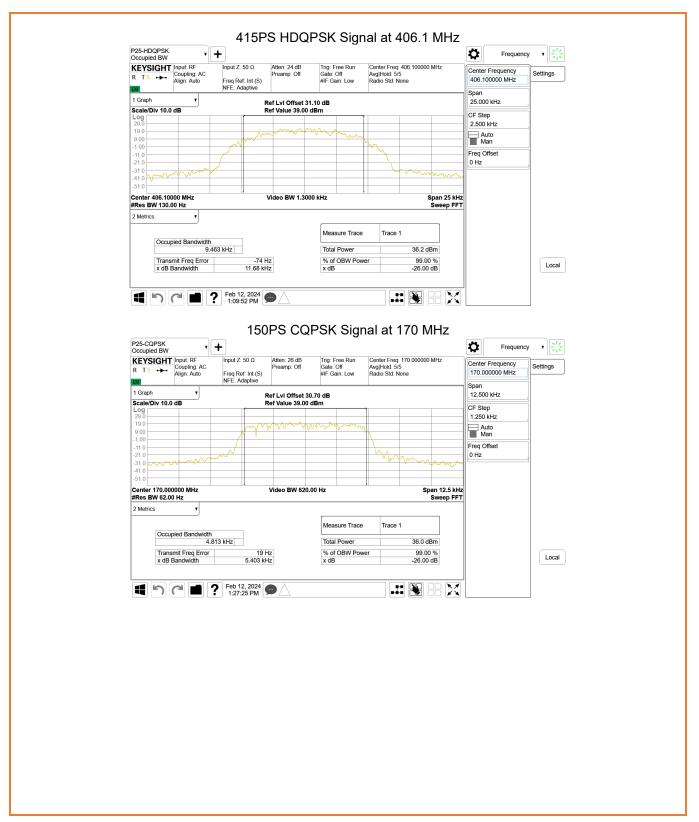
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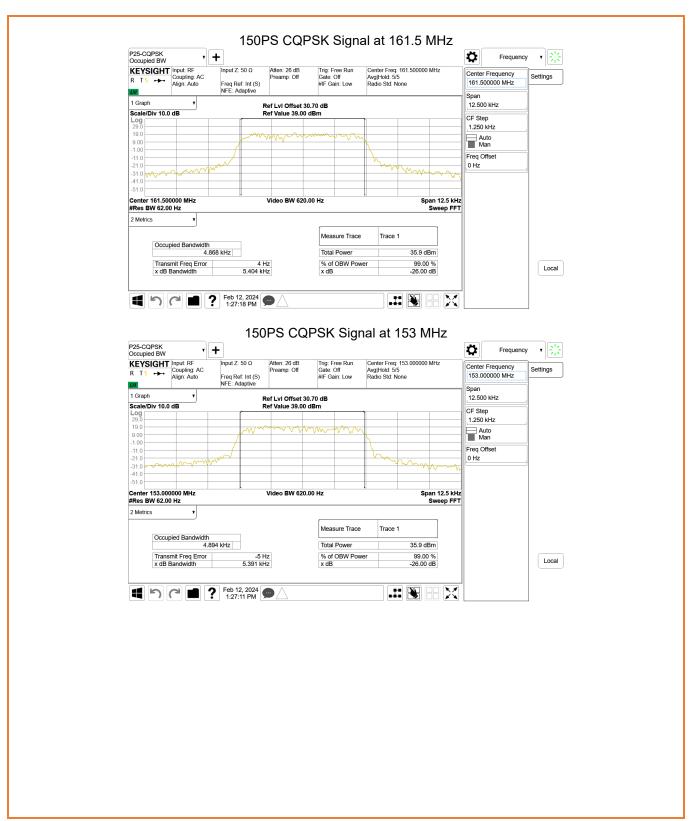
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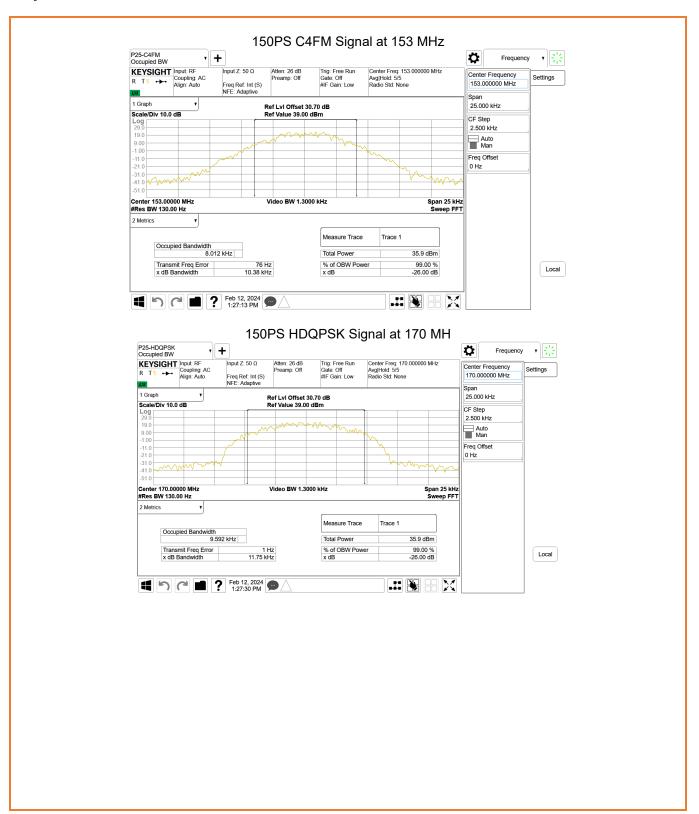
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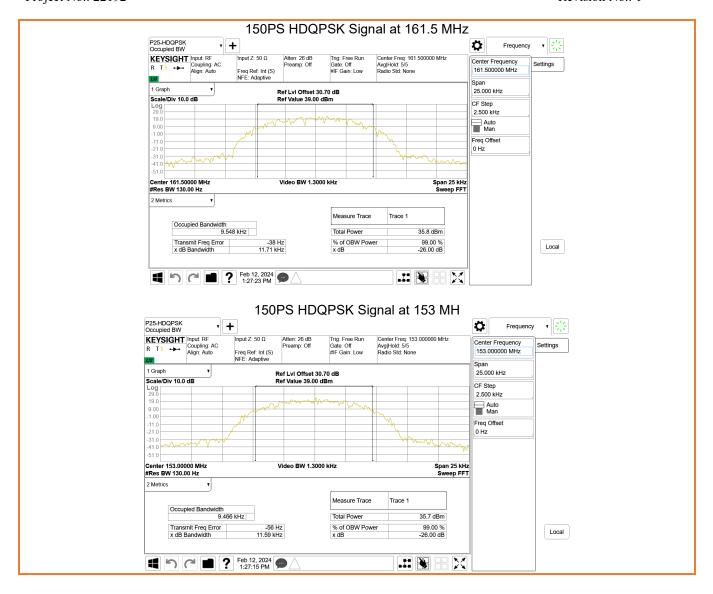


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3.3 Out of Band Rejection

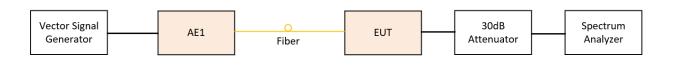
•								
Governing Doc	FCC Part 2 2.1046(a) FCC Part 90.219(d)			Room Temperature (°C)		20.5		
Test Procedure	ANSI/TIA-603- E; FCC KDB 935210 D05, v01r03			Relative Humidity (%)		38.6		
Test Location	Richmond			Barometric Pi	ressure	101.8		
Test Engineer	Zara Vali			Date		Fel	oruary 12, 2024	
EUT Voltage	⊠ +48VDC □] 120VAC @ 60Hz				
Test Equipment Used	Manufacturer	Model	Se	erial Number Calibration		date Calibration du		
Signal Generator	Keysight	N5172B	M	Y53050270	Dec 12, 2	023	Dec 12, 2026	
Spectrum Analyzer	Keysight	N9020B	M	//Y62153079 Oct 25, 2		2023 Aug 1, 2025		
Frequency Range:	⊠ Product Passba	and ± 250%						
Detector:	⊠ Peak							
RBW/VBW: ⊠ 1 to 5% of the EUT passband /			nd / 🖹	≥ 3 X RBW				
Type of Facility:	⊠ Tabletop							
Distance:	⊠ Direct							
Compliant ⊠ Non-Compliant □				Not Applicable □				

Test setup

The procedure used was ANSI/TIA-603-E-2016 and FCC KDB 935210 D05 Indus Booster Basic Meas v01r03. The signal booster was set to maximum gain. A swept CW signal was set to the range of ±250 % of the product pass band. The CW amplitude was set to 3 dB below the AGC threshold so that the ALC should not activate throughout the test.

After the max-hold sweep trace was completed, a marker was set to the peak amplitude, and a 20dB bandwidth was measured between two additional markers fall 20 dB from the peak.

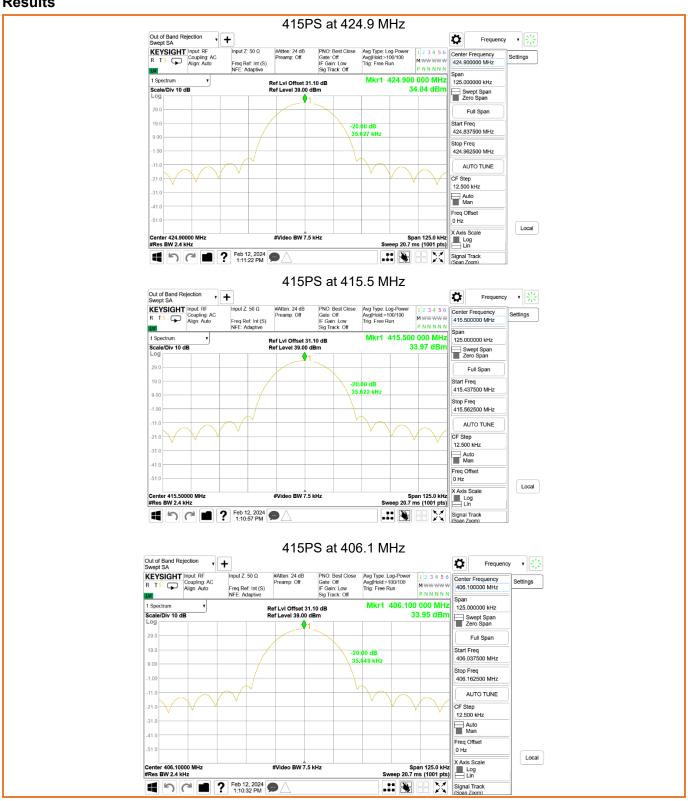
The EUT was set to Operation Mode #1 with configuration Mode #1.



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Results



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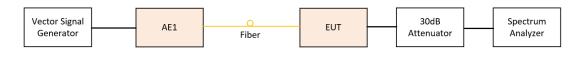
3.4 Input-Versus-Output Signal Comparison

Governing Doc	FCC Part 90.210 (e)	(j) (h) (g) (c) (d)	Room Temperature (°C)			20.5	
Test Procedure	ANSI/TIA-603- E; FCC KDB 935210		Relative Humidity (%)			38.6	
Test Location	Richmond			Barometric Pressur	e (kPa)	101.8	
Test Engineer	Zara Vali			Date		February 12, 2024	
EUT Voltage	⊠ +48VD0)		120VAC @ 60Hz			
Test Equipment Used	Manufacturer	Model	del Serial Number			n	Calibration due
Signal Generator	Keysight	N5172B	MY53050270		Dec 12, 2023		Dec 12, 2026
Spectrum Analyzer	Keysight	N9020B		MY62153079	Oct 25, 2023		Aug 1, 2025
Frequency Range:	⊠ 400 MHz – 42	25 MHz; ⊠ 152	MHz –	174 MHz			
Detector:	⊠ Peak						
RBW/VBW:	⊠100 Hz						
Type of Facility:	⊠ Testbench						
Distance:	⊠ direct connect	t					
Arrangement of EUT:	⊠ Table-top onl	y □ Floor-s	tandin	g only 🛮 Rack Mo	unted		
Signal of all types of modulation is contained within the emission mask.							
Compliant ⊠	Non-C	Compliant □		Not Applicable			

Test setup

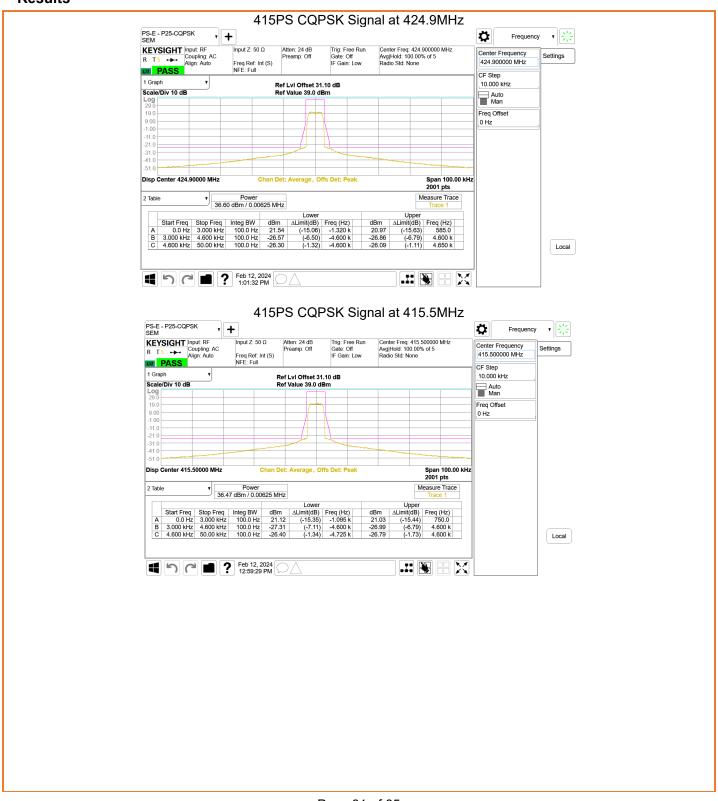
Spectrum Emission Mask is measured by connecting a Spectrum Analyzer to the RF output connector. The input power was adjusted to produce maximum output power on the antenna port. The reference level was measured with integrated BW of the designated channel BW. The emission was measured with RBW 100 Hz.

The EUT was set to Operation Mode #1 with configuration Mode #1.

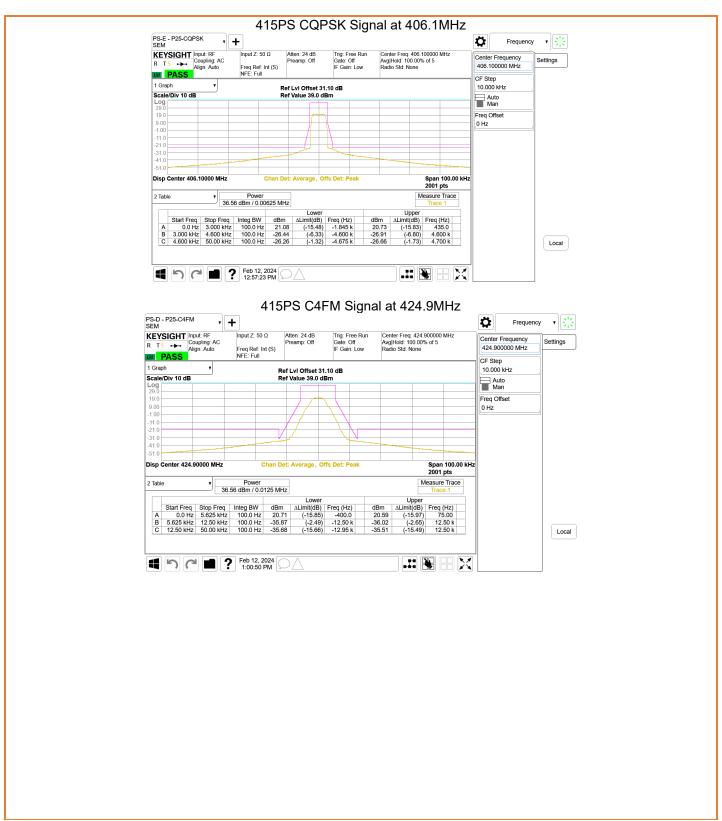


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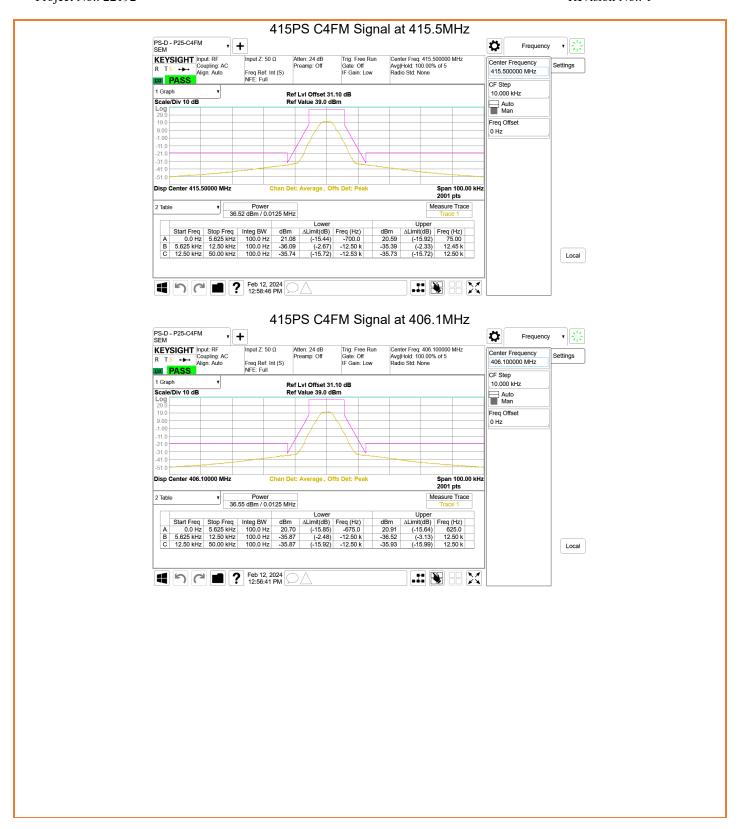
Results



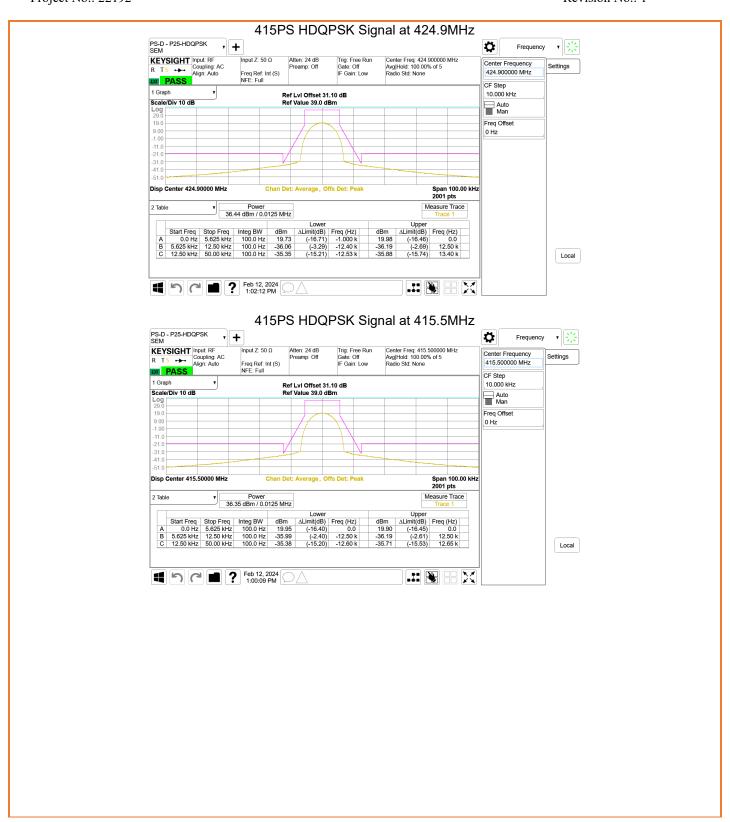
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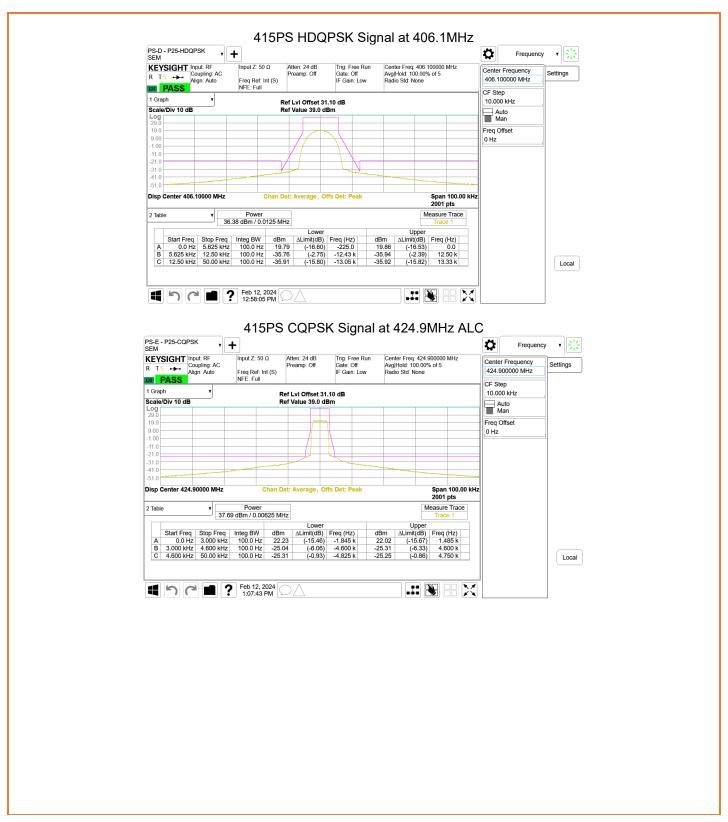
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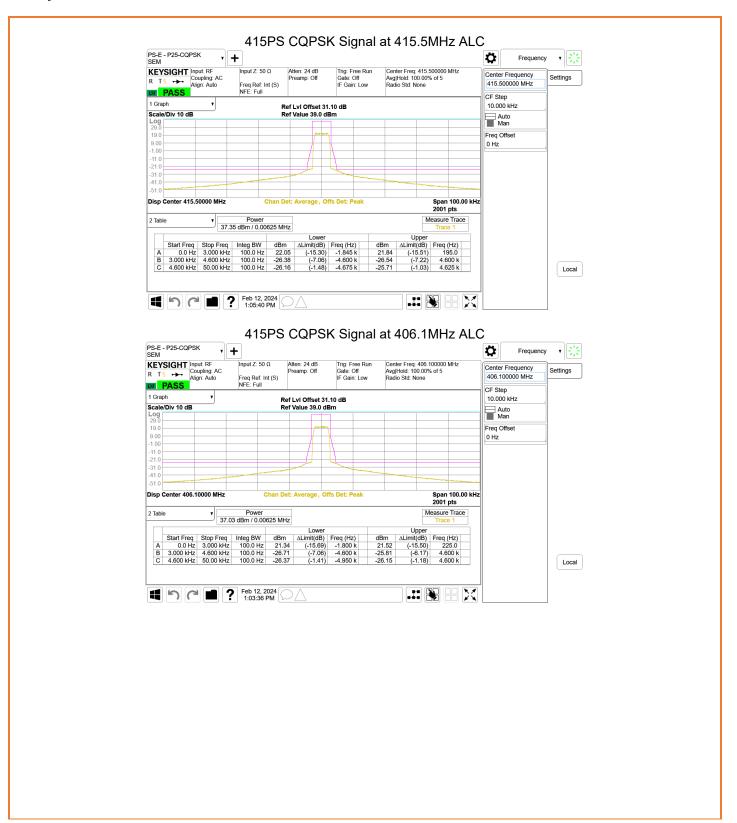
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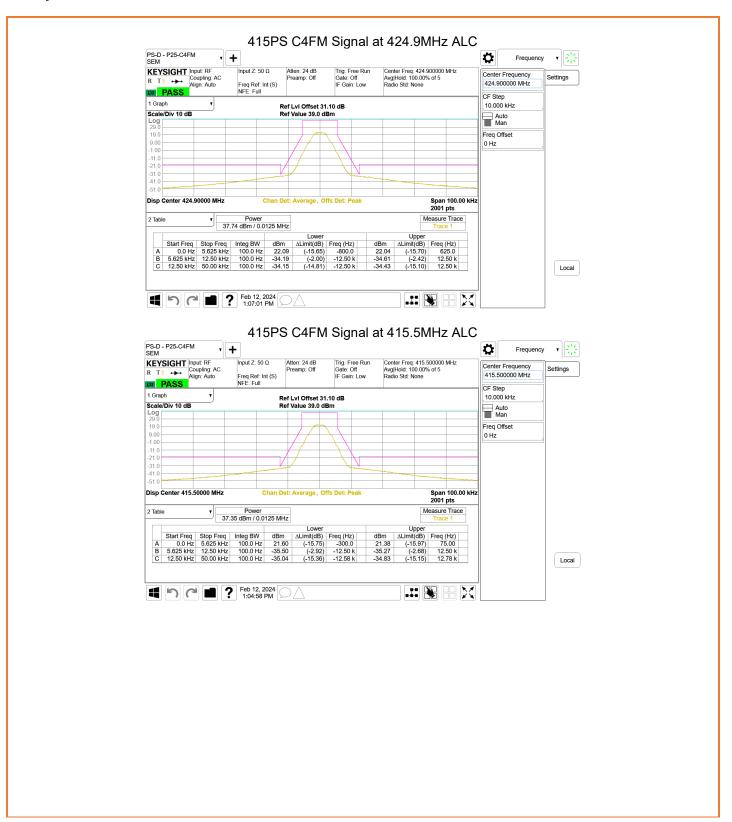


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