REPORT

For

Dali Wireless, Inc.

535 Middlefield Road, Suite 280
Menlo Park, CA 94025

Date:	11 April 2022
Report No.:	20.01.20808
Revision No.:	1
Project No.:	20808
Equipment:	Advanced Digital Distributed Antenna System
Model No.:	hd37-3-PS-ABH-21-1N-D0
FCC ID:	HCOHD373PSABH21A

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ISO 17025 ACCREDITED

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TABLE OF CONTENTS

TEST REPORT_FCC Part 2, 90 3
Revision History 4
Device Under Test Description 4
Program details 5
Description of Equipment Under Test and Variant Models 6
Client Equipment Used During Test 8
Software and Firmware 8
Input/Output Ports 8
Power Interface 9
EUT Operation Modes 9
EUT Configuration Modes 9
Test Equipment Verified for function 9
Test Station Photo 10
Test Station Cables and Loads 10
Test Station Insertion Loss 10
Measurement Uncertainty 11
Result Summary 12
Spurious emissions 12
AGC Threshold 13
Test setup 13
Results – Output Power FCC Requirement 14
Occupied Bandwidth 15
Test setup 16
Results 17
Out of Band Rejection 28
Test setup 28
Results 29
Input-Versus-Output Signal Comparison 32
Test setup 32
Results 33
Input/output Power and Amplifier/Booster Gain 52
Test setup 53
Results 54
Out-Of-Band / Out-Of-Block Intermodulation and Spurious Emissions 55
Test setup 56
Results 57
Noise Figure 75
Test setup 75
Results 76
Frequency Stability 77
Raradiated Emissions - Enclosure 78
Test setup 79
Measurement Procedure 80
Test Result 80
Graphical Representation for Emission - Radiated 30kHz to 30MHz 81
Graphical Representation for Emission - Radiated 30MHz to 1GHz 82
Graphical Representation for Emission - Radiated 1 to 9GHz 83
Table Representation for Emission - Radiated 30MHz to 18GHz 83
APPENDIX A: ISO 17025:2005 Accreditation Certificate 84

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TEST REPORT_FCC Part 2, 90		
Private Land Mobile Services		
Report Reference No.....:	20.01.20808	
Report Revision History. .....:	✓ Rev. 1	
Compiled by (+ signature).....	Jack Qin	
Approved by (+ signature).....	David Johanson	
Date of issue.....:	March 31, 2022	
Total number of pages.....		
FCC Site Registration No.:	721268	
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.....:	Dali Wireless, Inc.	
Address .....:	535 Middlefield Road, Suite 280, Menlo Park, CA 94025	
Manufacture's Name .....:	Dali Wireless (Canada) Inc.	
Address .....:	8618 Commerce Court, Burnaby, B.C. V5A 4N6, Canada	
Test specification:		
Standards.....:	➢ FCC Part 2; 2018 ➢ FCC Part 90; 2018	
Test procedure.....:	➢ FCC KDB 935210 D05 Indus Booster Basic Meas v01r03: April 15, 2019 ➢ ANSI/TIA-603- E-2016 ➢ ANSI C63.4:2014	
Test item description:		
Trade Mark.....:	hd37™	
Model/Type reference .....:	hd37-3-PS-ABH-21-1N-D0-1	
Serial Number.....:	10911132E01BB9008	
FCC ID .....:	HCOHD373PSABH21A	

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Possible test case verdicts:	
- 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)
Testing:	
Date of receipt of test item .....:	07 March 2022
Date (s) of performance of tests.....:	07 to 14 March 2022

Revision History

Revision	Date	Reason For Change	Author(s)
0	March 31, 2022	Initial Data	Jack Qin
1	April 11, 2022	Update	Jack Qin

Device Under Test Description

Application for	PS 700/800/450 Remote Unit, Dual Band Medium Power DAS
Passing Transmit Frequency	851 MHz – 861 MHz 769 MHz – 775 MHz 450 MHz – 470 MHz
Operating Transmit Frequency FCC	851 MHz – 861 MHz 758 MHz – 768 MHz 769 MHz – 775 MHz 450 MHz – 454 MHz 456 MHz – 462.5375 MHz 462.7375 MHz – 467.5375 MHz 467.7375 MHz – 512 MHz
Passing Receive Frequency	806 MHz – 816 MHz 788 MHz – 805 MHz 450 MHz – 470 MHz

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Operating Receive Frequency FCC	806 MHz – 816 MHz 788 MHz – 798 MHz 799 MHz – 805 MHz 450 MHz – 454 MHz 456 MHz – 462.5375 MHz 462.7375 MHz – 467.5375 MHz 467.7375 MHz – 512 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 800 and Band UHF; FM on Band 800 between 851 MHz – 854 MHz only; P25 Phase I C4FM, CQPSK; P25 Phase II HDQPSK on Band 700 between 769 MHz – 775 MHz
Equipment mobility	Fixed
Operating condition.....	-40 to +50 °C
Mass of equipment (g).....	< 27,700g
Dimension(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:	_____ AC _____ Amps 48V DC 7.083 Amps
If DC Power:	___ Internal Power Supply _√_ External Power Supply ___ Battery ☐ Nickel Cadmium ☐ Alkaline ☐ Nickel-Metal Hydride ☐ Lithium-Ion ☐ Other

Program details

Testing Facility by procedure:		
☒	**Radiated Measurement**	LabTest Certification Inc.
Testing location/ address..... :		Unit 3128-20800 Westminster HWY, Richmond, B.C. V6V 2W3 Canada
☒	**Conducted Measurement**:	LabTest Certification Inc.

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Testing location/ address…… :	Unit 3128-20800 Westminster HWY, Richmond, B.C. V6V 2W3 Canada

Summary of testing:	
Tests performed (name of test and test clause): **Conducted Measurement** **Radiated Emissions on Enclosure**	**Testing location:** **Bench top, Richmond** **In SAC, Richmond**
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(s) tested. LabTest does not make any claims of compliance for samples or variants which were not tested.	

Description of Equipment Under Test and Variant Models

Description:
The hd37 700PS/800PS/UHF PS is a triple-band remote unit that provides at least 5 W of output power on each band. The triple-band unit supports up to 3 bands in a sealed type 2 chassis for Class A operation.

On the downlink path the hd37 PS remote receives an aggregated stream of digitized RF signals from an airHost 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 hd37 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 airHost PS. The hd37 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 airHost was connected as the Auxiliary device. The airHost the signal was injected and ejected via coaxial cables.

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

hd37-3-PS-ABH-21-1N-D0-1– Triple band 700PS 800PS UHF PS model as tested

Tri Band

1. hd37-3-PS-ABH-21-1N-D0 (hd37 with 700,800, UHF PS)
2. hd33-3-PS-ABH-21-1N-D0 (hd33 with 700,800, UHF PS)

Dual Band:

1. hd37-2-PS-AB-21-3N-D0 (hd37 with 700,800PS)
2. hd33-2-PS-AB-21-3N-D0 (hd33 with 700,800PS)
3. hd37-2-PS-AH-21-4N-D0 (hd37 with 700, UHF PS)
4. hd33-2-PS-AH-21-4N-D0 (hd33 with 700, UHF PS)
5. hd37-2-PS-BH-21-3N-D0 (hd37 with 800, UHF PS)
6. hd33-2-PS-BH-21-3N-D0 (hd33 with 800, UHF PS)

Single Band:

1. hd37-1-PS-H-21-1N-D0 (hd37 with UHF PS)
2. hd33-1-PS-H-21-1N-D0 (hd33 with UHF PS)
3. hd37-1-PS-B-21-1N-D0 (hd37 with 800PS)
4. hd33-1-PS-B-21-1N-D0 (hd33 with 800PS)
5. hd37-1-PS-A-21-1N-D0 (hd37 with 700PS)
6. hd33-1-PS-A-21-1N-D0 (hd33 with 700PS)

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Client Equipment Used During Test

Use*	Product Type	Manufacturer	Model	Comments
EUT	*hd37, 700PS, 800PS, UHF PS*	Dali Wireless Inc.	hd37-3-PS-ABH-21-1N-D0	EUT where the RF (I/O) antenna attached via duplexers/multiplexer when necessary.
AE1	*airHost, 700PS, 800PS, UHF PS*	Dali Wireless Inc.	AH37-3-PS-ABH-21-3N-D0	Auxiliary equipment, which is the front end of system interfaced to Base Station.
AE2	Dali Matrix Console	Dali Wireless Inc.	hdCNSL-1-8-4-120G-AC	Auxiliary equipment provides the configuration and control interface to *air*Host and *hd*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, or SIM - Simulator (Not Subjected to Test)				

Software and Firmware

Use*	Description	Version
EUT	Software installed	5.2.0-0.5594
AE1	Software installed	5.2.0-0.5594
AE2	Software installed	5.2.0-0.1111
Abbreviations: EUT - Equipment Under Test, AE - Auxiliary/Associated Equipment, or SIM - Simulator (Not Subjected to Test)		

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	1 * 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

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DCN: 1036, Rev 1

*Note: AC = AC Power PortDC = 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 (V)	Current (A)	Power (W)	Frequency (DC/AC-Hz)	Phases (#)	Comments
1	48	-	-	DC	-	

EUT Operation Modes

Mode #	Description
1	UL and DL transmission and receiving ON

EUT Configuration Modes

Mode #	Description
1	airHost maximum input threshold set to -55 dBm, uplink attenuation set to 0dB; *hd*37 uplink and downlink attenuation set to 0dB.

Test Equipment Verified for function

Model #	Description	Checked Function	Results
N9038A	Spectrum Analyzer	Frequency and Amplitude	Connected 50MHz and -20 dBm Ref siganl and checked OK.
JB1	Antenna, 30 to 2000MHz	Checked structure	Normal – no damage.
SAS-571	Antenna, 1 to 18GHz	Checked structure	Normal – no damage.
AL-130	Antenna, 9kHz to 30MHz	Checked structure	Normal – no damage.
KT-N5172B	Signal Generator, up to 6GHz	Frequency, Amplitude and Modulation	Within MFR Specs
KT-N9010A	Spectrum Analyzer	Frquency and Amplitude	Within MFR Specs

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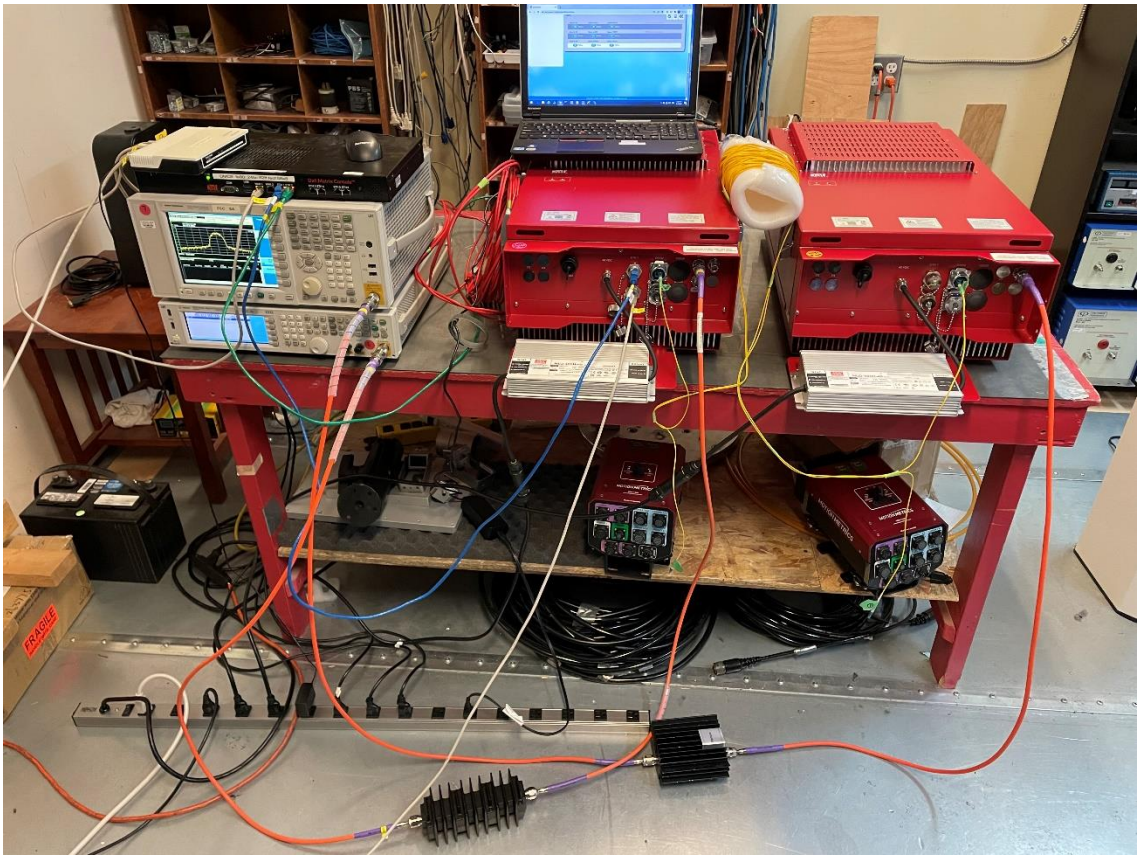
Test Station Photo



Test Station Cables and Loads

Model #	Manufacture	Description
3 x TM8-N1S1-60	MegaPhase	3 times N male to SMA male coaxial cable in 60 inches
1 x 58-40-34	Aeroflex	40dB 50W attenuator
1 x 49-30-34	Aeroflex	30dB 25W attenuators

Test Station Insertion Loss

	Band 800	Band 700	Band UHF
DL Receiver	31.0 dB	31.0 dB	30.7 dB
DL Transmitter	40.7 dB	41.0 dB	41.2 dB

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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 6,000MHz	± 4.95 dB

Uncertainty figures are valid to a confidence level of 95%.

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Result Summary

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.

FCC Part			
Test Type	**Regulation**	**Measurement Method**	**Result**
AGC Threshold	FCC KDB 935210 D05, v01r03, Section 4.2	ANSI TIA-603- E-2016	PASS
Out of Band Rejection	FCC KDB 935210 D05, v01r03, Section 4.3	ANSI TIA-603- E-2016	PASS
Input-versus-output Signal Comparison	FCC KDB 935210 D05, v01r03, Section 4.4	ANSI TIA-603- E-2016	PASS
Input/output Power and Amplifier/Booster Gain	FCC KDB 935210 D05, v01r03, Section 4.5	ANSI TIA-603- E-2016	PASS
Noise Figure	FCC KDB 935210 D05, v01r03, Section 4.6	ANSI TIA-603- E-2016	PASS
Measuring out-of-band/out-of-block (including intermodulation) and spurious emissions	FCC KDB 935210 D05, v01r03, Section 4.7	ANSI TIA-603- E-2016	PASS
Frequency stability	FCC KDB 935210 D05, v01r03, Section 4.8	ANSI TIA-603- E-2016	PASS
Spurious emissions radiated measurements	FCC KDB 935210 D05, v01r03, Section 4.9	ANSI C63.4:2014	PASS

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AGC Threshold

Governing Doc	FCC Part 2 2.1046(a) FCC Part 90.219(d)	Room Temperature (°C)	
Test Procedure	ANSI/TIA-603- E-2016; FCC KDB 935210 D05, v01r03;	Relative Humidity (%)	
Test Location	Richmond	Barometric Pressure (kPa)	
Test Engineer		Date	March 7, 2022
EUT Voltage	☒ DC	☒ 120VAC @ 60Hz	

Test Equipment Used	Manufacturer	Model	Serial Number	Calibration date	Calibration due
Signal Generator	Keysight	N5172B	MY53050270	Oct 9, 2021	Oct 9, 2023
Spectrum Analyzer	Keysight	N9010A	MY50520285	Oct 11, 2021	Oct 11, 2023

Frequency Range:	☒ 851 MHz – 861 MHz ☒ 769 MHz – 775 MHz ☒ 450MHz – 470MHz
Detector:	☒ Peak
Type of Facility:	☒ Test bench
Distance:	☒ Direct
Arrangement of EUT:	☒ Table-top only ☐ Floor-standing only ☐ Rack Mounted

Output Power is
less than 37.22 dBm in band 800,
less than 36.65 dBm in band 700,
and less than 35.30 dBm in band UHF.

Compliant ☒ Non-Compliant ☐ Not Applicable ☐

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.

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Results – Output Power FCC Requirement

Frequency Range (MHz)	Frequency (MHz)	Input Power Trip ALC (dBm)	Output Power (dBm)	Output Power (W)
806 - 816	851.0125	-51.4	37.01	5.02
	856	-51.4	37.18	5.22
	860.9875	-50.8	37.22	5.27
799 - 805	769.0125	-52.9	36.36	4.33
	772	-51.9	36.65	4.62
	774.9875	-50.8	36.26	4.22
450 - 470	450.8125	-51.8	34.65	2.91
	451.85	-52.0	35.3	3.39
	452.8875	-50.8	33.78	2.39

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Occupied Bandwidth

Governing Doc	FCC Part 2 2.1049	Room Temperature (°C)	
Test Procedure	ANSI/TIA-603- E-2016; FCC KDB 935210 D05, v01r03	Relative Humidity (%)	
Test Location	Richmond	Barometric Pressure	
Test Engineer		Date	March 7, 2022
EUT Voltage	☒ +48VDC	☐ 120VAC @ 60Hz	

Test Equipment Used	Manufacturer	Model	Serial Number	Calibration date	Calibration due
Signal Generator	Keysight	N5172B	MY53050270	Oct 9, 2021	Oct 9, 2023
Spectrum Analyzer	Keysight	N9010A	MY50520285	Oct 11, 2021	Oct 11, 2023

Frequency Range:	☒ 806 MHz – 816 MHz; ☒ 799 MHz – 805 MHz; ☒ 450 MHz – 470 MHz
Detector:	☒ Peak
Type of Facility:	☒ Test bench
Distance:	☒ Direct
Arrangement of EUT:	☒ Table-top only ☐ Floor-standing only ☐ Rack Mounted

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-Compliant ☐ Not Applicable ☐

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Test setup

Description of test set-up:
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 The EUT was set to **Operation Mode #1 with configuration Mode #1.** The occupied bandwidth of DL output is measured under one input conditions: - Nominal: with input 0.5dB below AGC threshold

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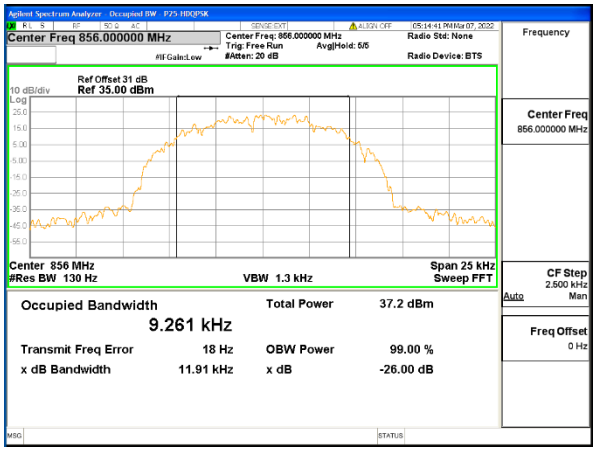
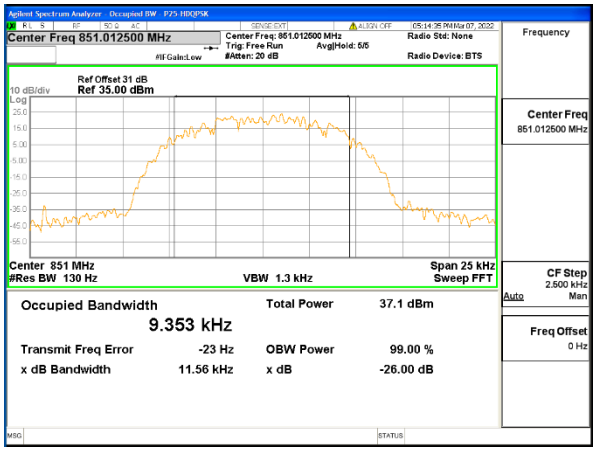
Results

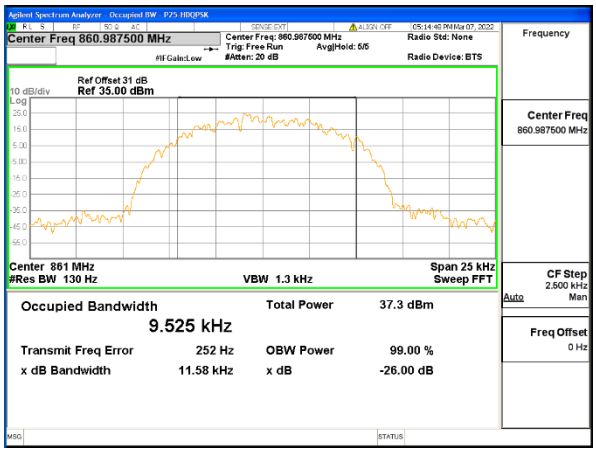
800PS HDQPSK Signal at 856 MHz



800PS HDQPSK Signal at 851.0125 MHz



800PS HDQPSK Signal at 860.9875 MHz



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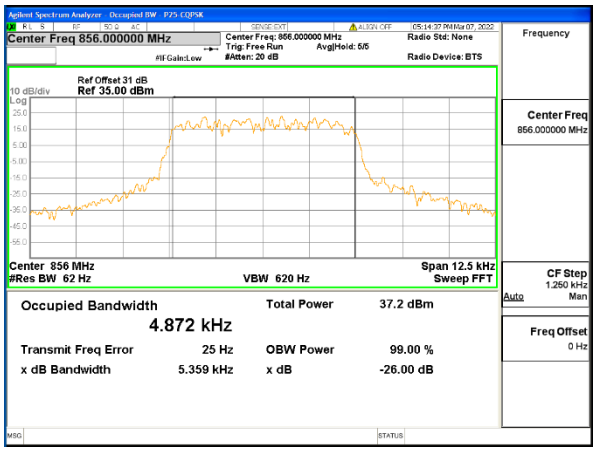
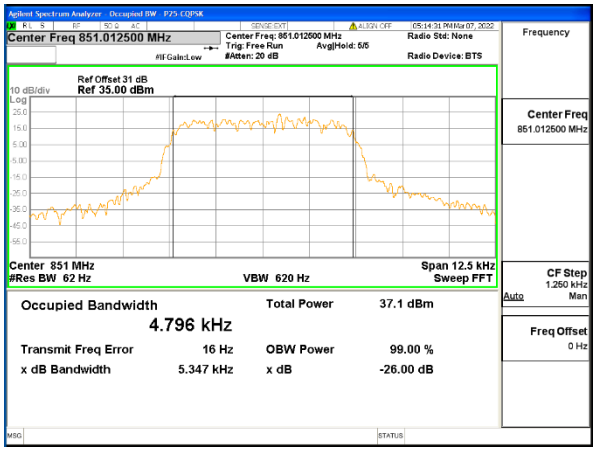
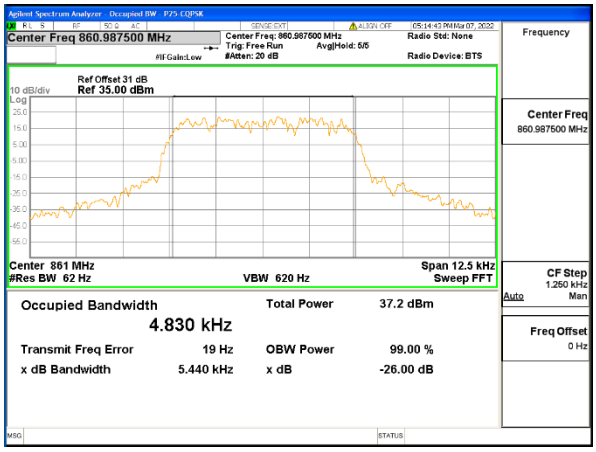
800PS CQPSK Signal at 856 MHz



800PS CQPSK Signal at 851.0125 MHz



800PS CQPSK Signal at 860.9875 MHz



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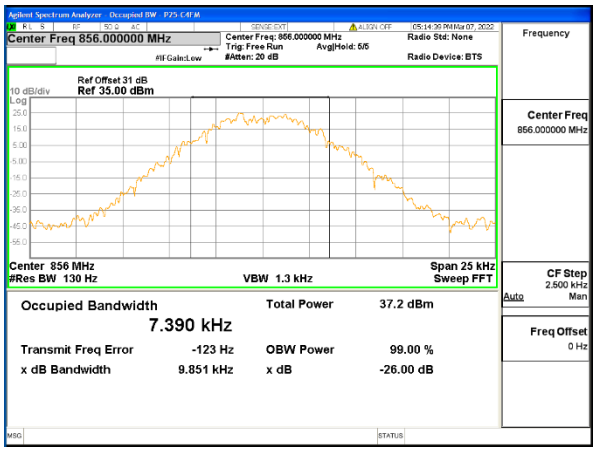
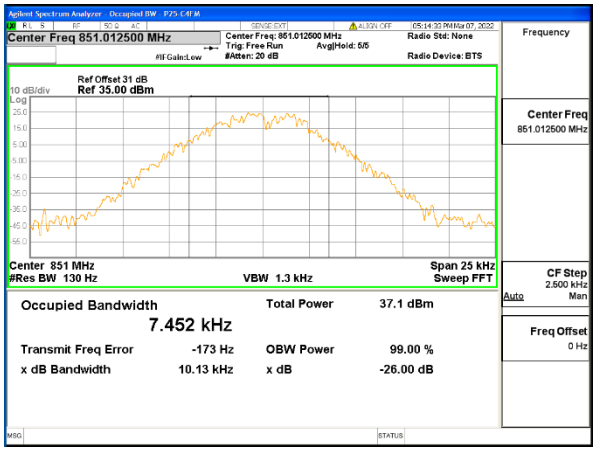
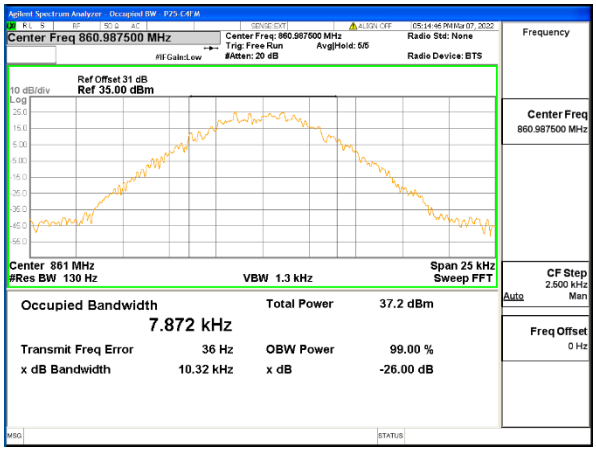
800PS C4FM Signal at 856 MHz



800PS C4FM Signal at 851.0125 MHz



800PS C4FM Signal at 860.9875 MHz



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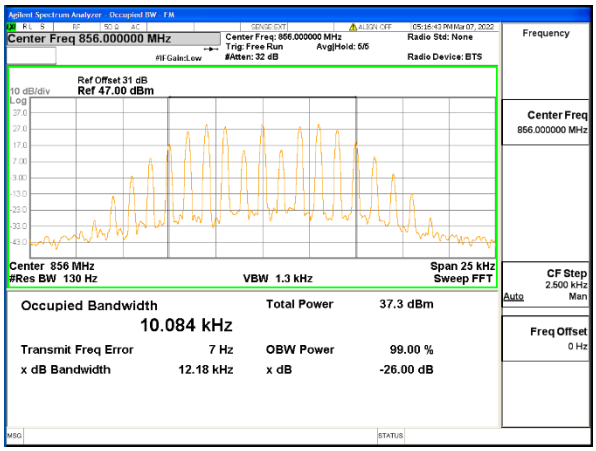
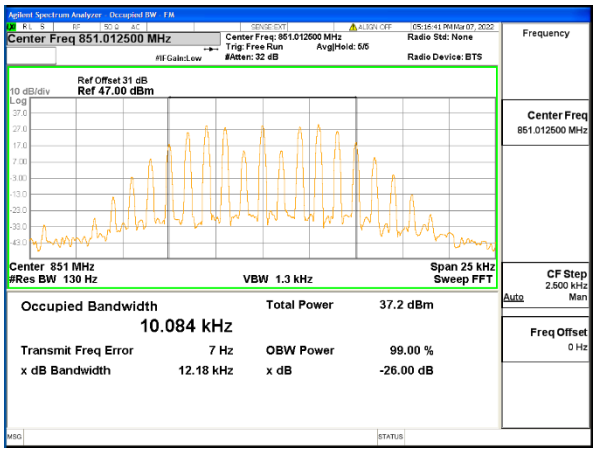
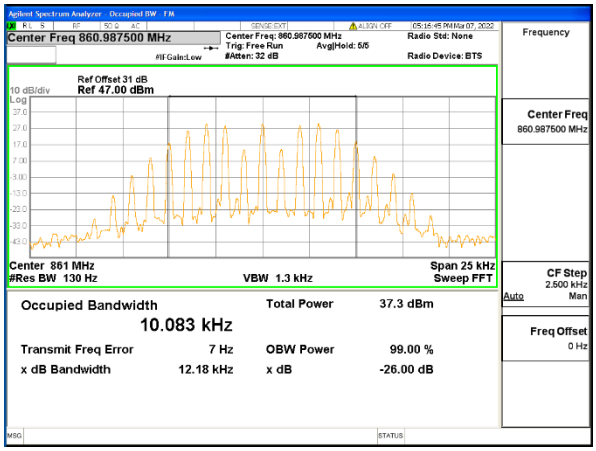
800PS FM Signal at 856 MHz



800PS FM Signal at 851.0125 MHz



800PS FM Signal at 860.9875 MHz



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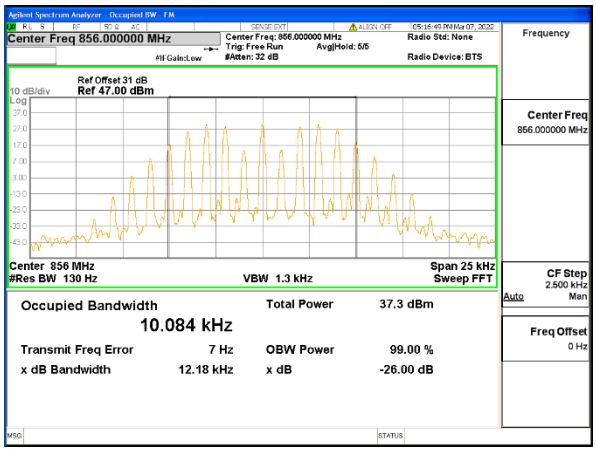
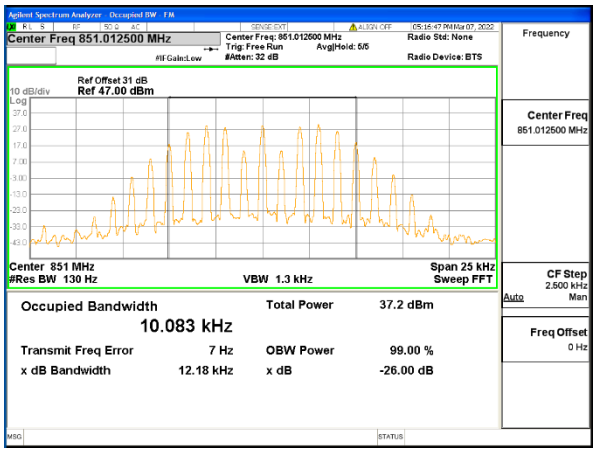
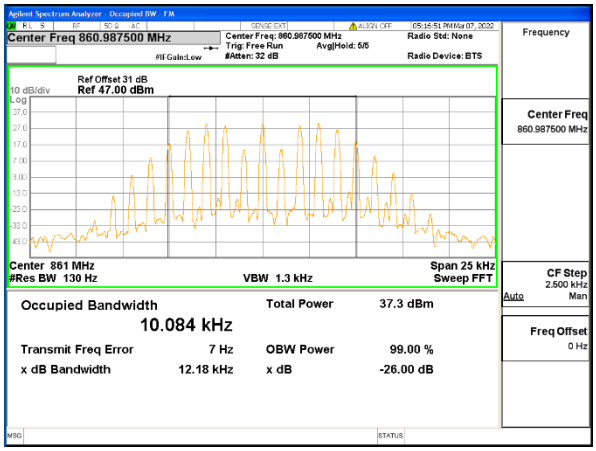
800PS FM Signal at 856 MHz ALC



800PS FM Signal at 851.0125 MHz ALC



800PS FM Signal at 860.9875 MHz ALC



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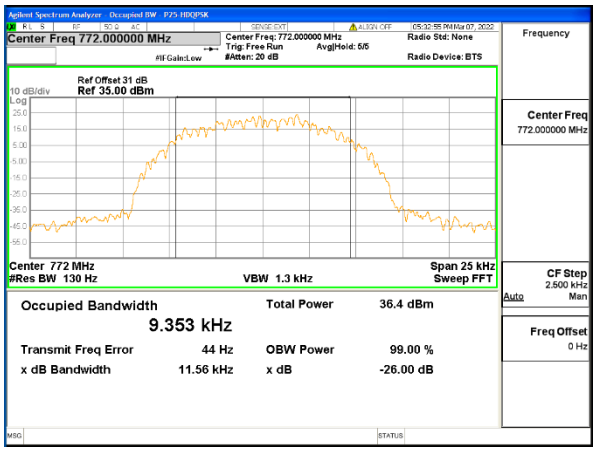
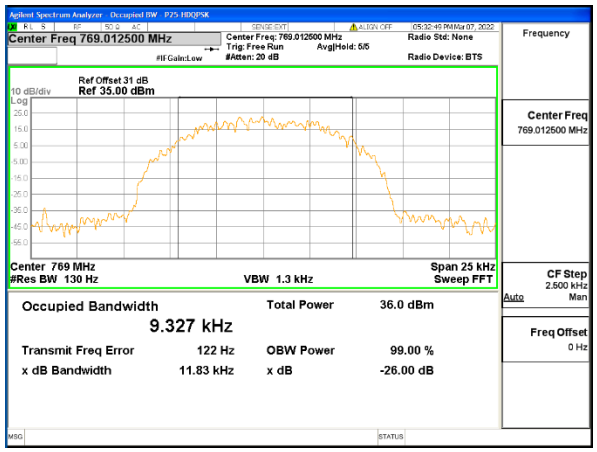
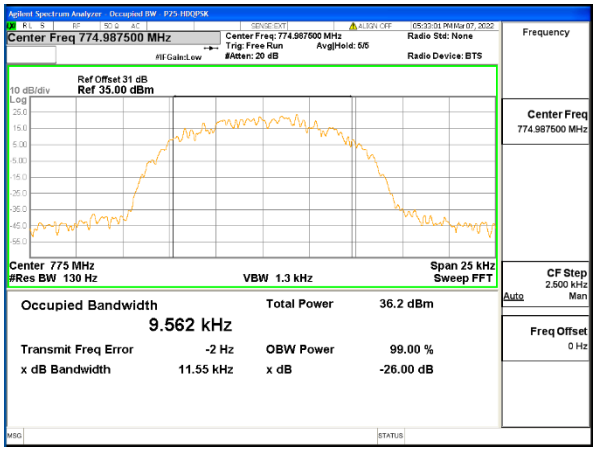
700PS HDQPSK Signal at 772 MHz



700PS HDQPSK Signal at 769.0125 MHz



700PS HDQPSK Signal at 774.9875 MHz



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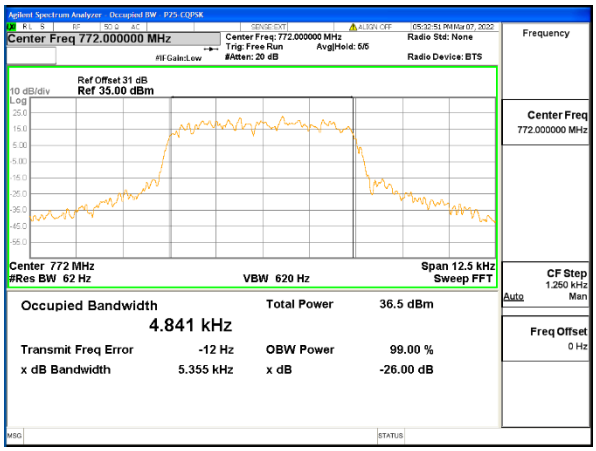
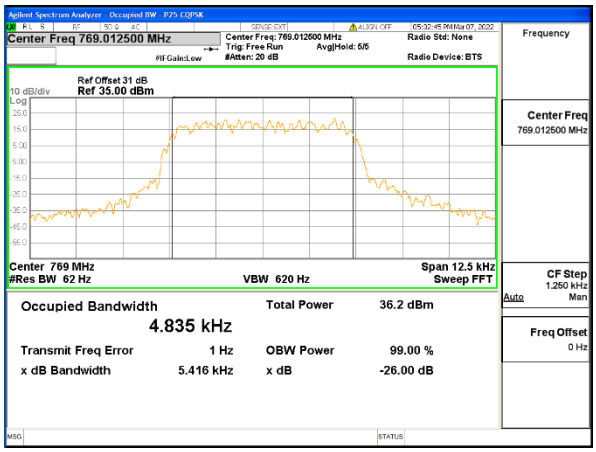
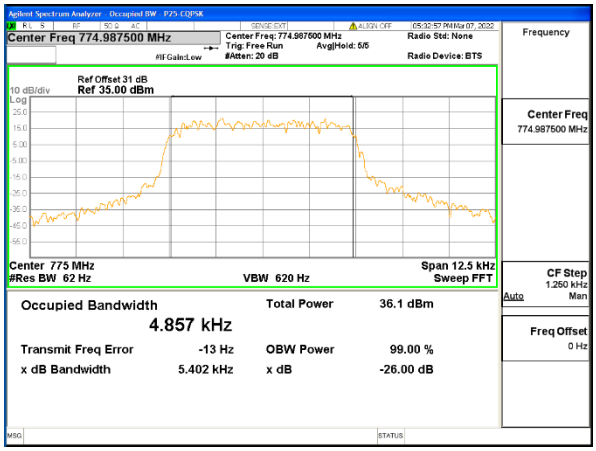
700PS CQPSK Signal at 772 MHz



700PS CQPSK Signal at 769.0125 MHz



700PS CQPSK Signal at 774.9875 MHz



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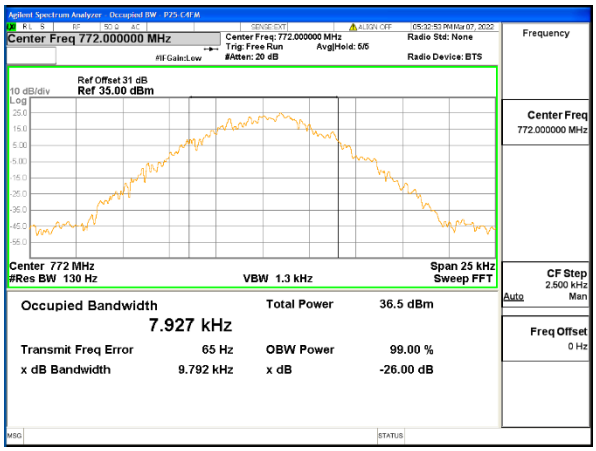
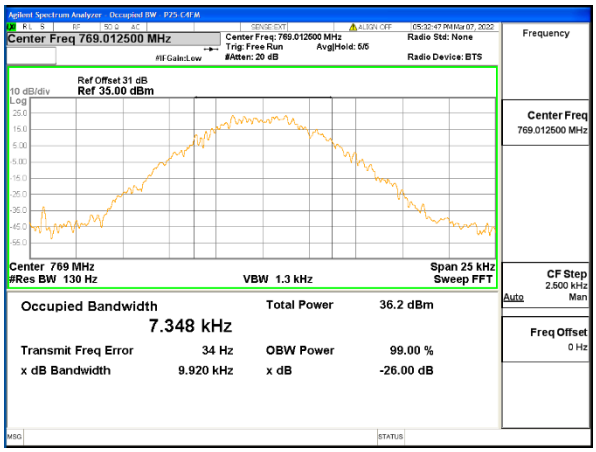
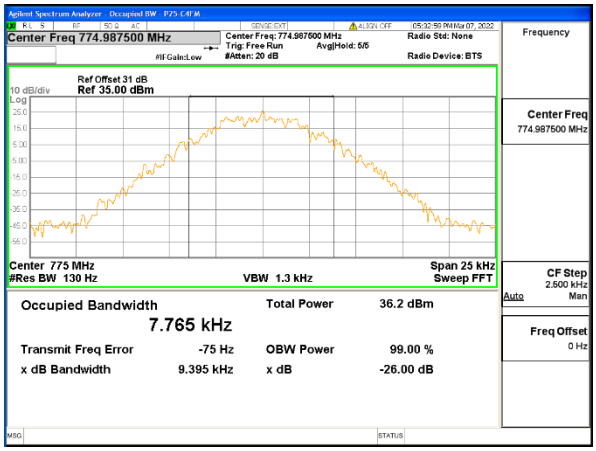
700PS C4FM Signal at 772 MHz



700PS C4FM Signal at 769.0125 MHz



700PS C4FM K Signal at 774.9875 MHz



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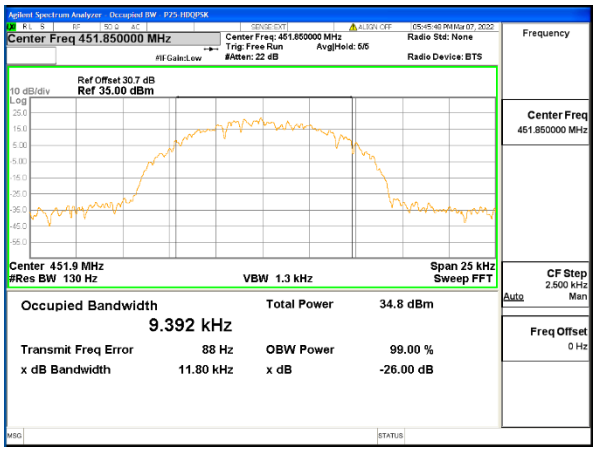
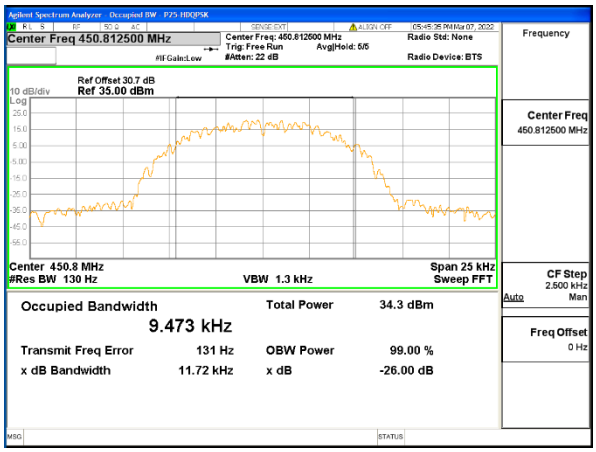
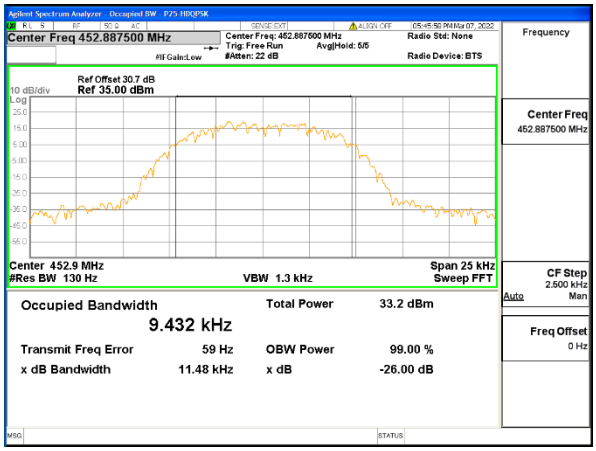
450PS HDQPSK Signal at 451.85 MHz



450PS HDQPSK Signal at 450.8125 MHz



450PS HDQPSK Signal at 452.8875 MHz



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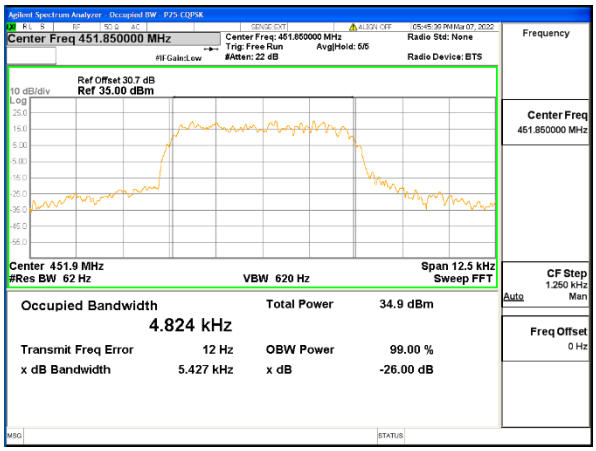
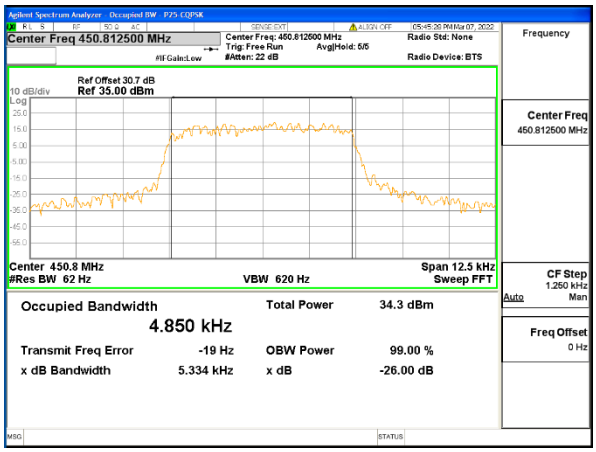
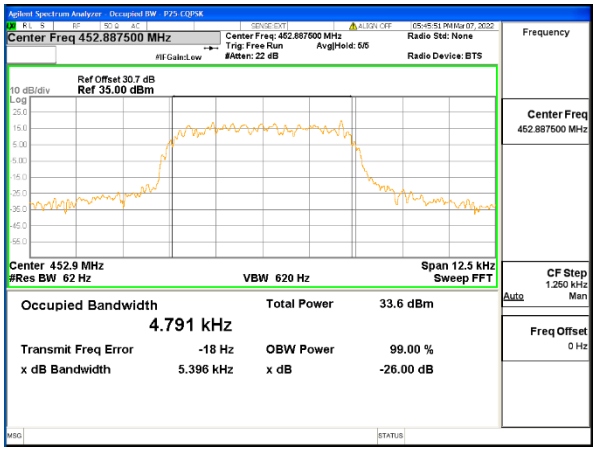
450PS CQPSK Signal at 451.85 MHz



450PS CQPSK Signal at 450.8125 MHz



450PS CQPSK Signal at 452.8875 MHz



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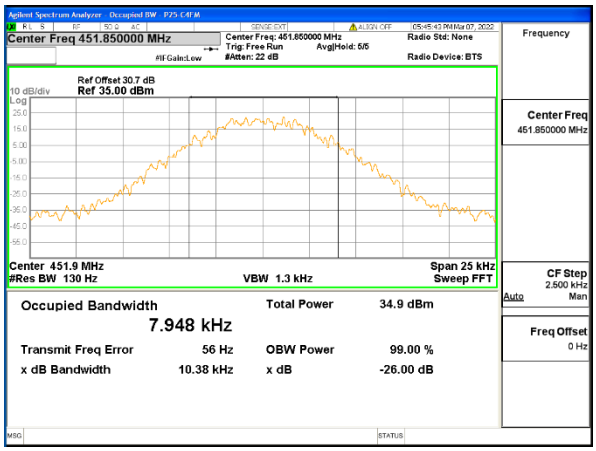
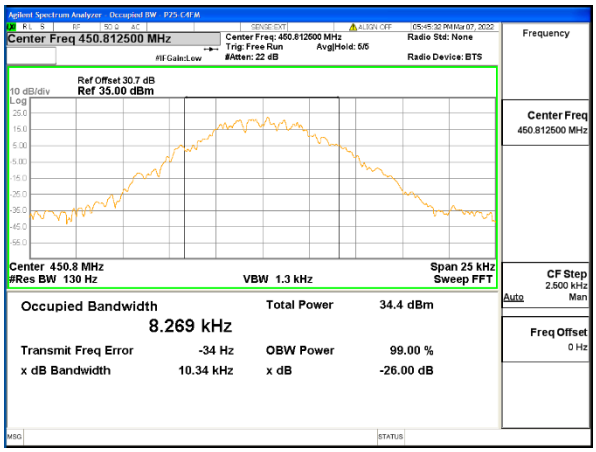
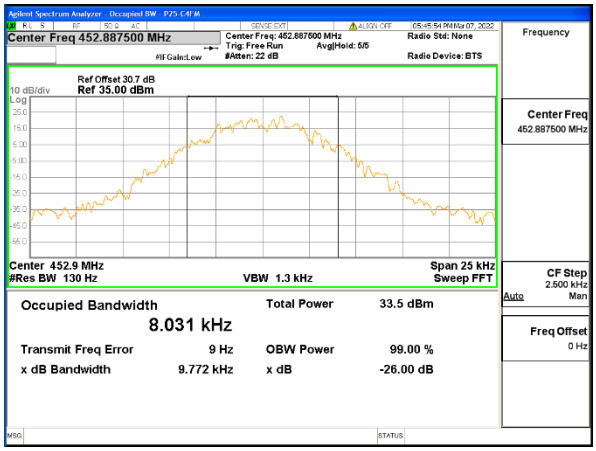
450PS C4FM Signal at 451.85 MHz



450PS C4FM Signal at 450.8125 MHz



450PS C4FM K Signal at 452.8875 MHz



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Out of Band Rejection

Governing Doc	FCC Part 2 2.1046(a) FCC Part 90.219(d)	Room Temperature (°C)	
Test Procedure	ANSI/TIA-603- E; FCC KDB 935210 D05, v01r03	Relative Humidity (%)	
Test Location	Richmond	Barometric Pressure	
Test Engineer		Date	March 7, 2022
EUT Voltage	☒ DC ☐ 120VAC @ 60Hz		

Test Equipment Used	Manufacturer	Model	Serial Number	Calibration date	Calibration due
Signal Generator	Keysight	N5172B	MY53050270	Oct 9, 2021	Oct 9, 2023
Spectrum Analyzer	Keysight	N9010A	MY50520285	Oct 11, 2021	Oct 11, 2023

Frequency Range:	☒ Product Passband ± 250%
Detector:	☒ Peak
RBW/VBW:	☒ 0.1% of 5 times of passband bandwidth
Type of Facility:	☒ Tabletop
Distance:	☒ Direct

Compliant ☒ Non-Compliant ☐ Not Applicable ☐

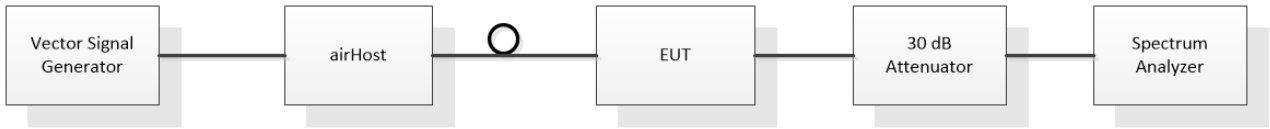
Test setup

Description of test set-up:

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 ampltitude 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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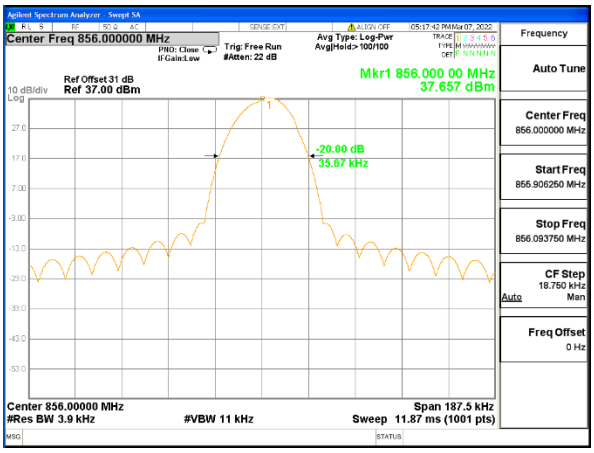
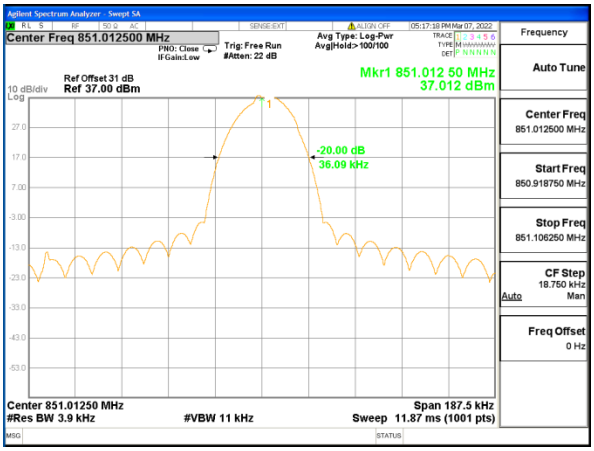
Results

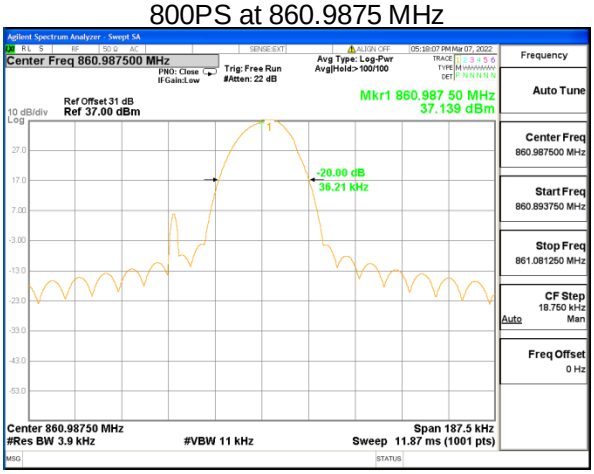
800PS at 856 MHz



800PS at 851.0125 MHz



800PS at 860.9875 MHz



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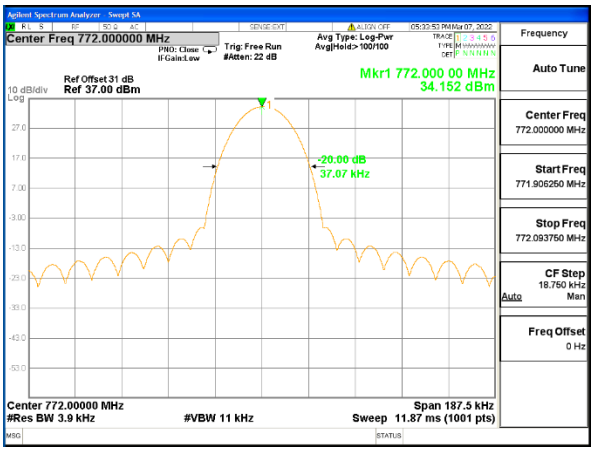
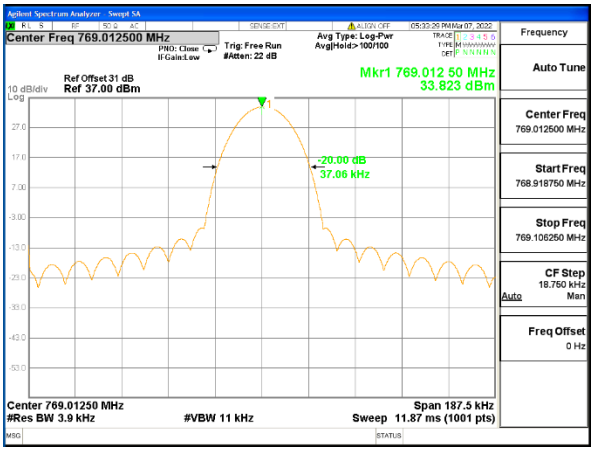
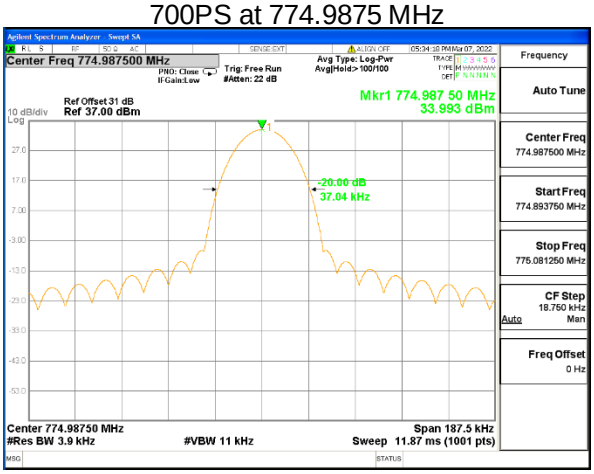
700PS at 772 MHz



700PS at 769.0125 MHz



700PS at 774.9875 MHz



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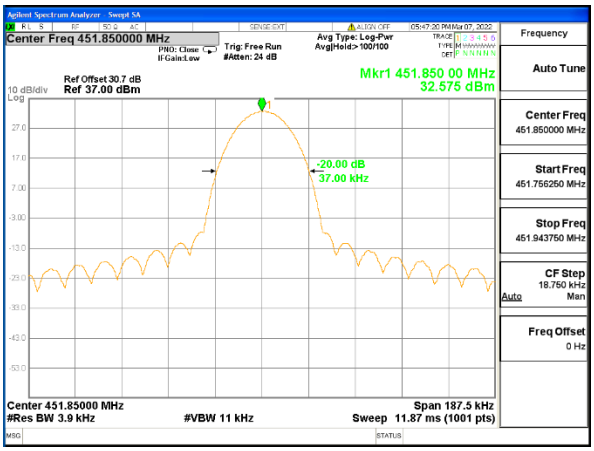
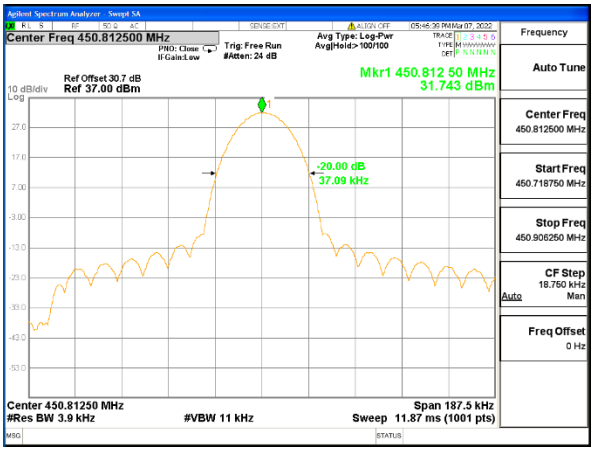
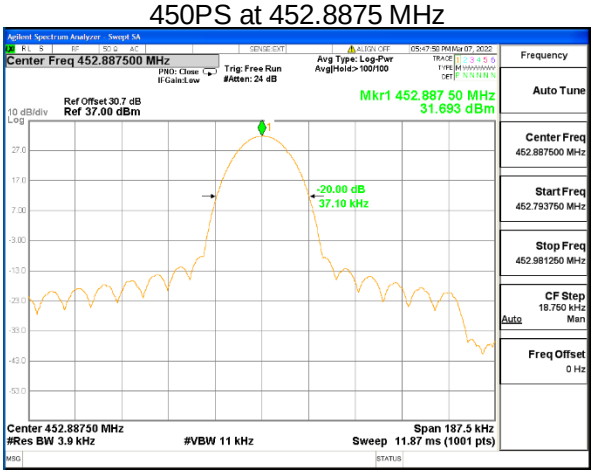
450PS at 451.85 MHz



450PS at 450.8125 MHz



450PS at 452.8875 MHz



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Input-Versus-Output Signal Comparison

Governing Doc	FCC Part 90.210 (j) (h) (g) (c) (d) and (e)	Room Temperature (°C)	
Test Procedure	ANSI/TIA-603- E; FCC KDB 935210 D05, v01r03	Relative Humidity (%)	
Test Location	Richmond	Barometric Pressure (kPa)	
Test Engineer	Jeremy Lee	Date	Mar 7, 2022
EUT Voltage	☒ DC ☐ 120VAC @ 60Hz		

Test Equipment Used	Manufacturer	Model	Serial Number	Calibration date	Calibration due
Signal Generator	Keysight	N5172B	MY53050270	Oct 9, 2021	Oct 9, 2023
Spectrum Analyzer	Keysight	N9010A	MY50520285	Oct 11, 2021	Oct 11, 2023

Frequency Range:	☒ 851 MHz – 861 MHz ☒ 769 MHz – 775 MHz ☒ 450MHz – 470MHz
Detector:	☒ Peak
RBW/VBW:	☒ 100 Hz
Type of Facility:	☒ Testbench
Distance:	☒ direct connect
Arrangement of EUT:	☒ Table-top only ☐ Floor-standing only ☐ Rack Mounted

Signal of all types of modulation is contained within the emission mask.

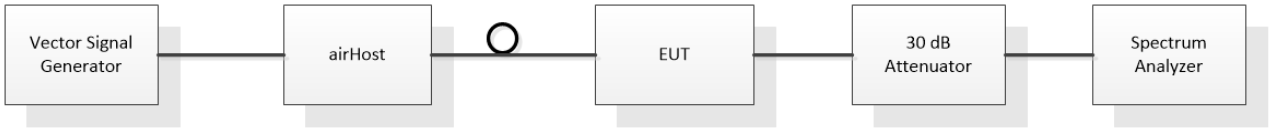
Compliant ☒ Non-Compliant ☐ Not Applicable ☐

Test setup

Description of test set-up:

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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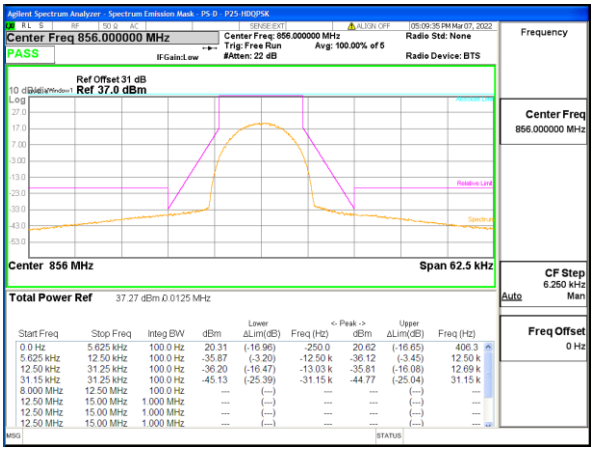
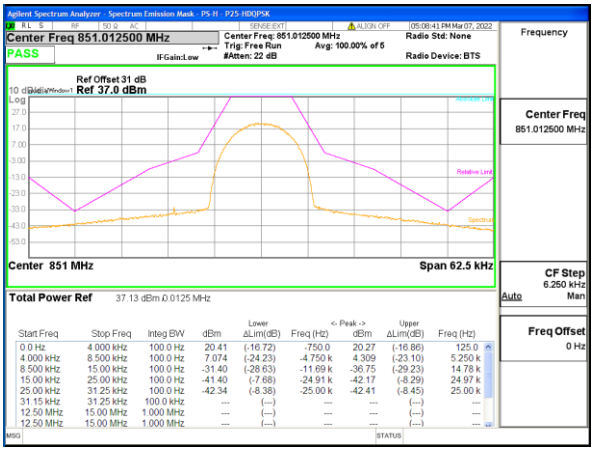
Results

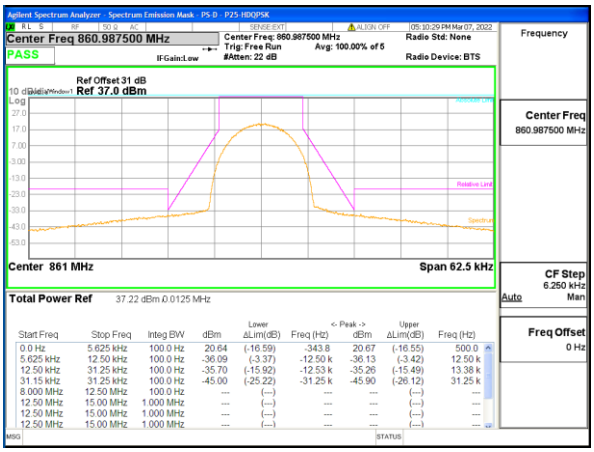
800PS HDQPSK Signal at 856 MHz



800PS HDQPSK Signal at 851.0125 MHz



800PS HDQPSK Signal at 860.9875 MHz



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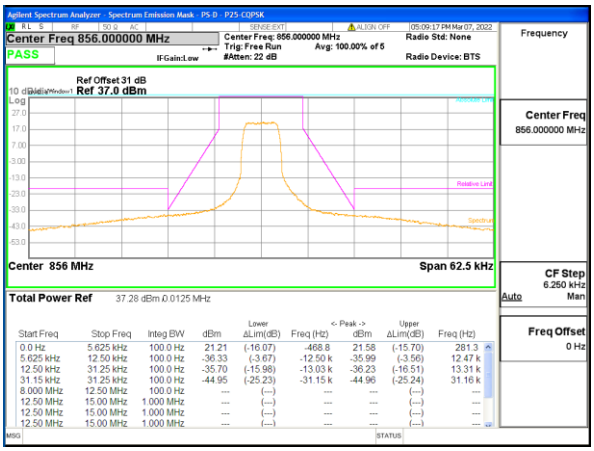
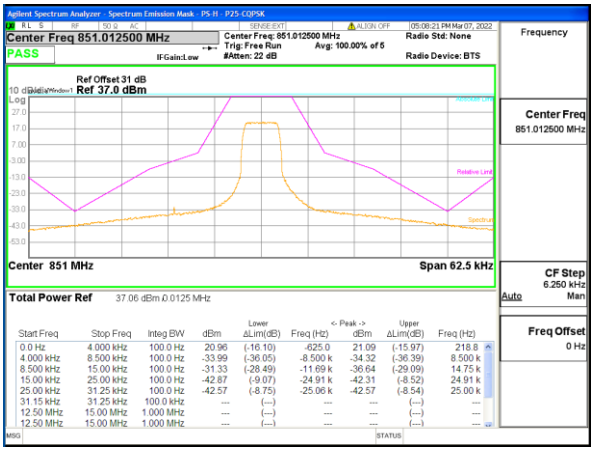
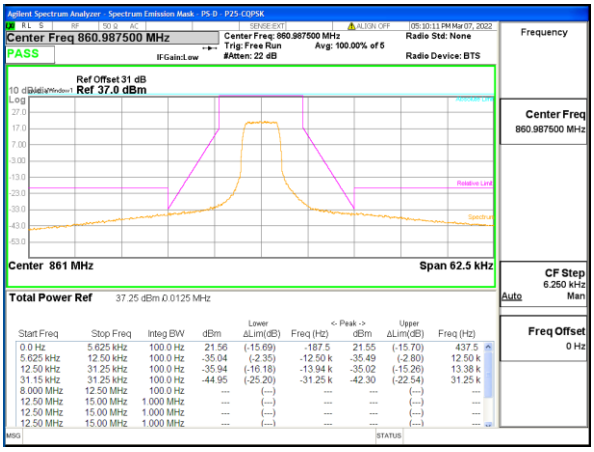
800PS CQPSK Signal at 856 MHz



800PS CQPSK Signal at 851.0125 MHz



800PS CQPSK Signal at 860.9875 MHz



800PS C4FM Signal at 856 MHz

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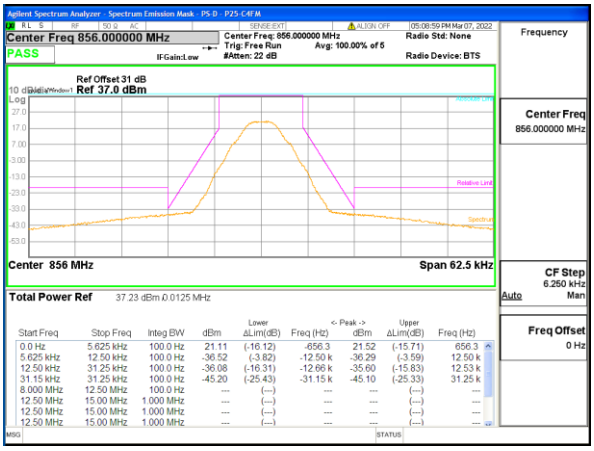
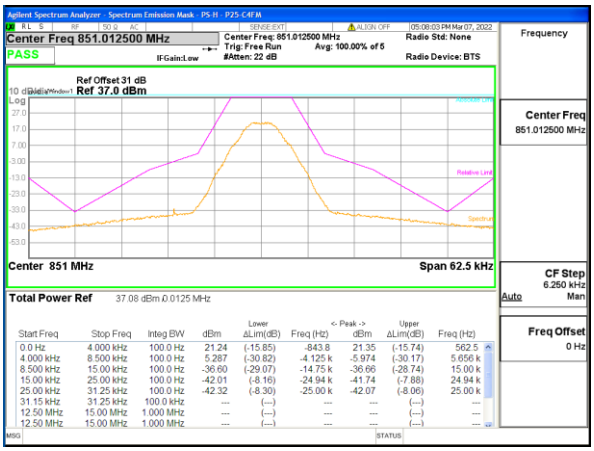
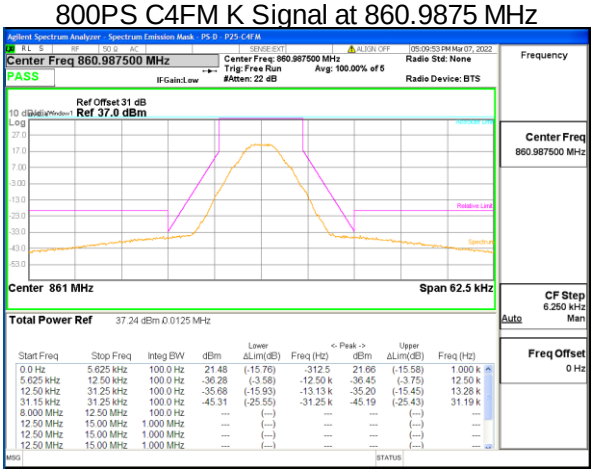


800PS C4FM Signal at 851.0125 MHz



800PS C4FM K Signal at 860.9875 MHz



800PS HDQPSK Signal at 856 MHz ALC

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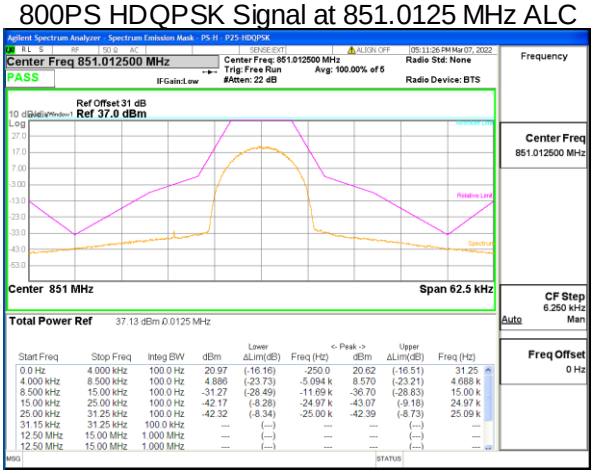
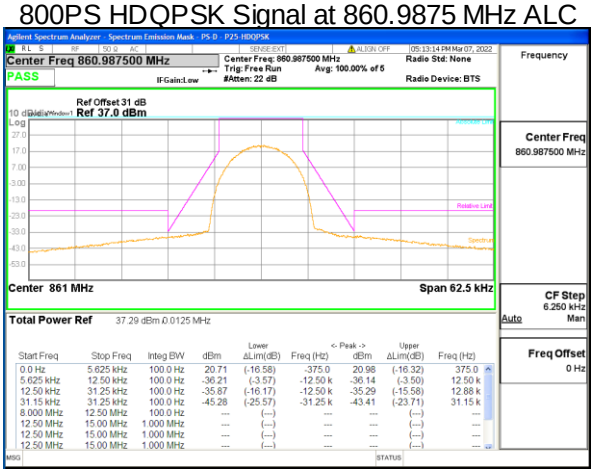
800PS HDQPSK Signal at 851.0125 MHz ALC



800PS HDQPSK Signal at 860.9875 MHz ALC



800PS CQPSK Signal at 856 MHz ALC

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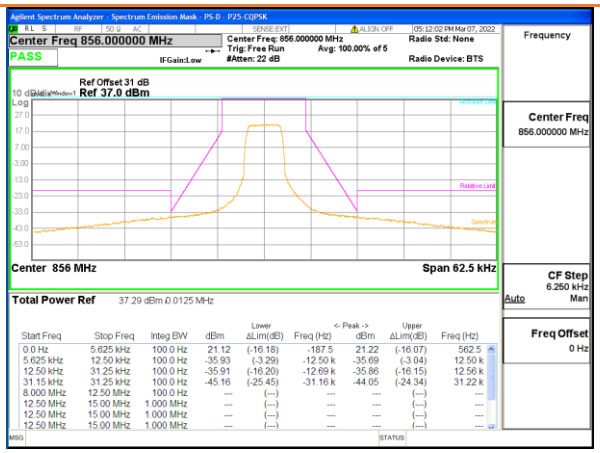
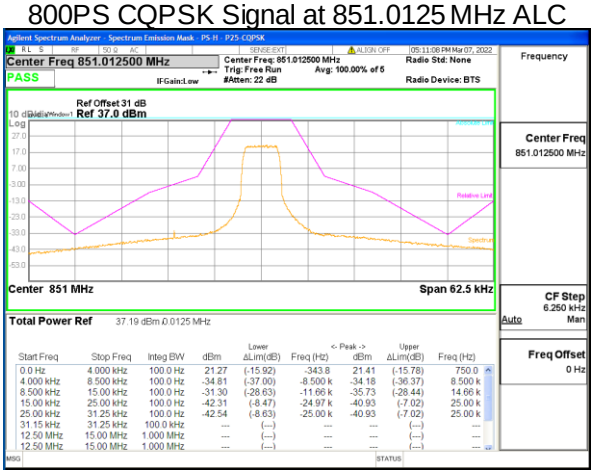
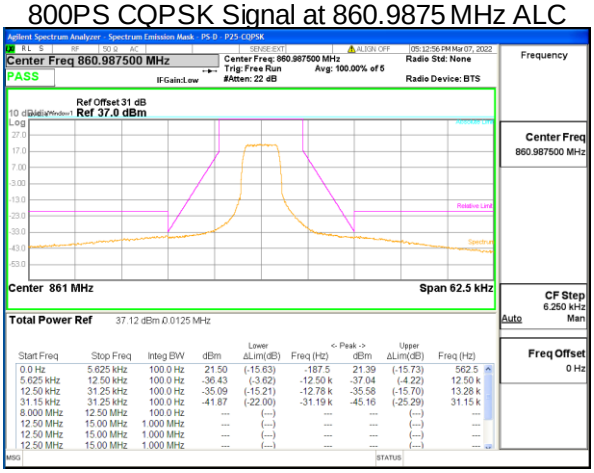


800PS CQPSK Signal at 851.0125 MHz ALC



800PS CQPSK Signal at 860.9875 MHz ALC



800PS C4FM Signal at 856 MHz ALC

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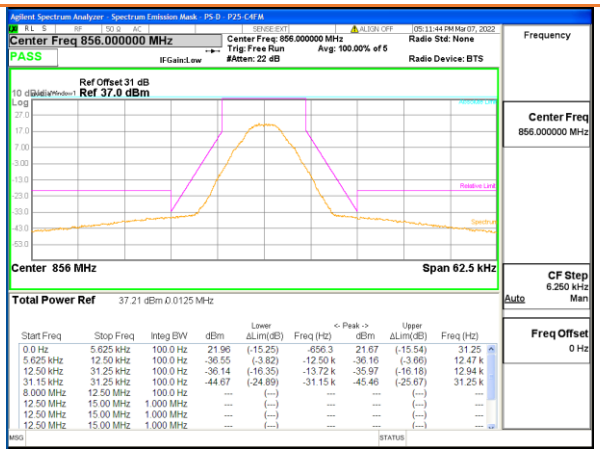
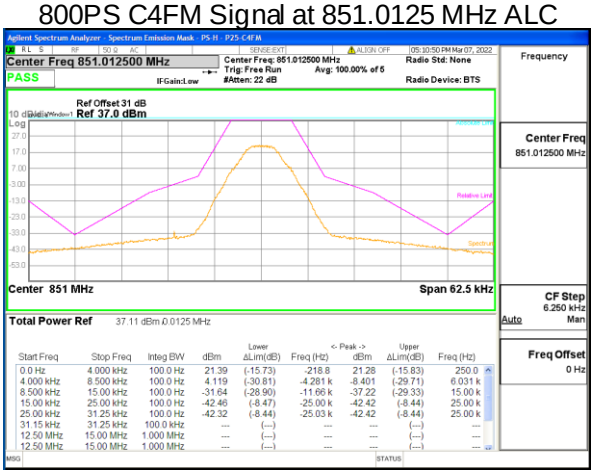
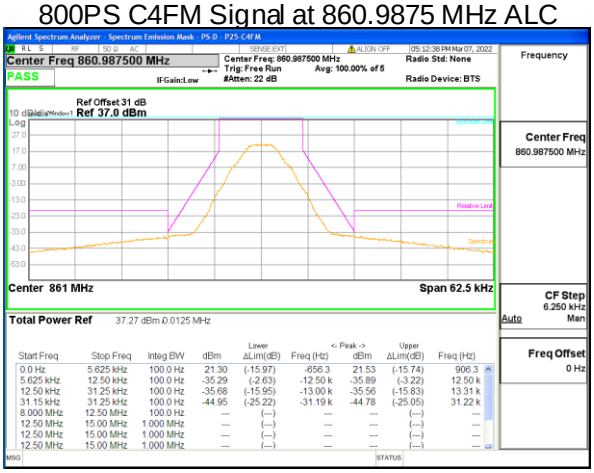


800PS C4FM Signal at 851.0125 MHz ALC



800PS C4FM Signal at 860.9875 MHz ALC



800PS FM Signal at 856 MHz

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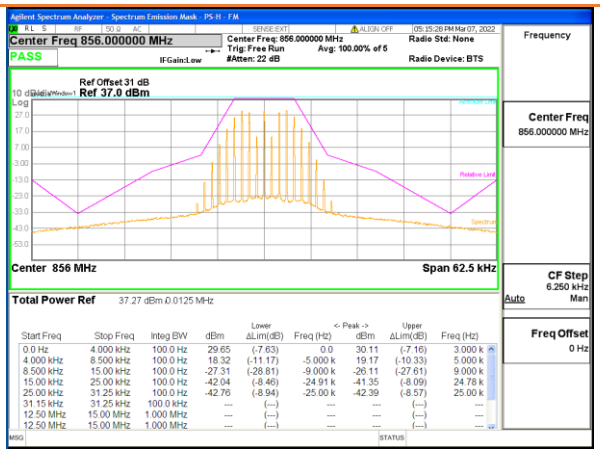
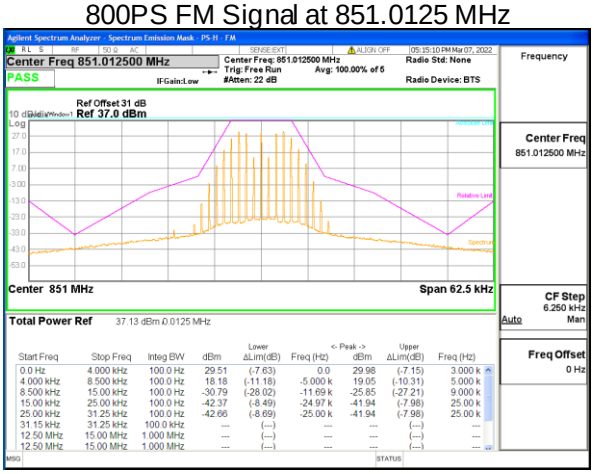
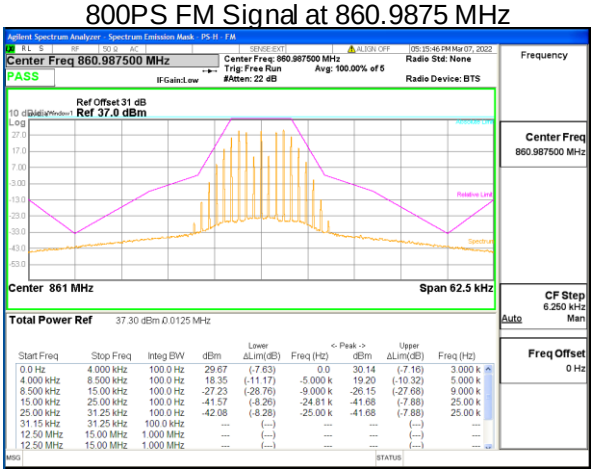


800PS FM Signal at 851.0125 MHz



800PS FM Signal at 860.9875 MHz



800PS FM Signal at 856 MHz ALC

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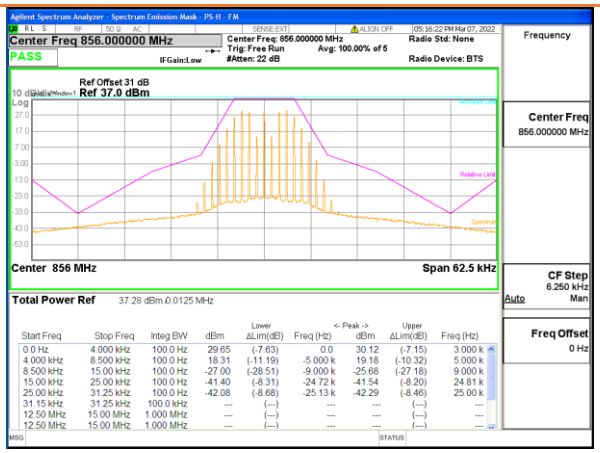
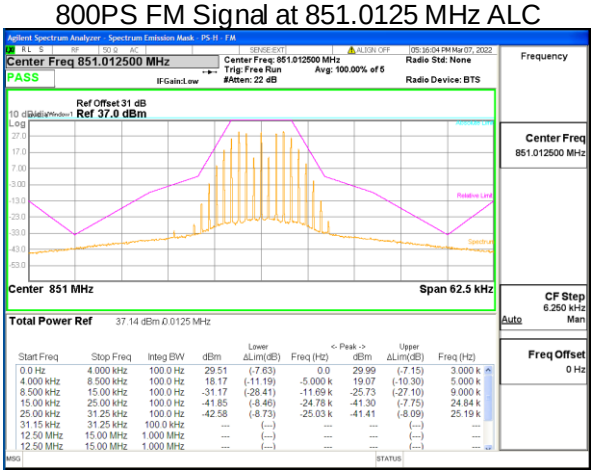
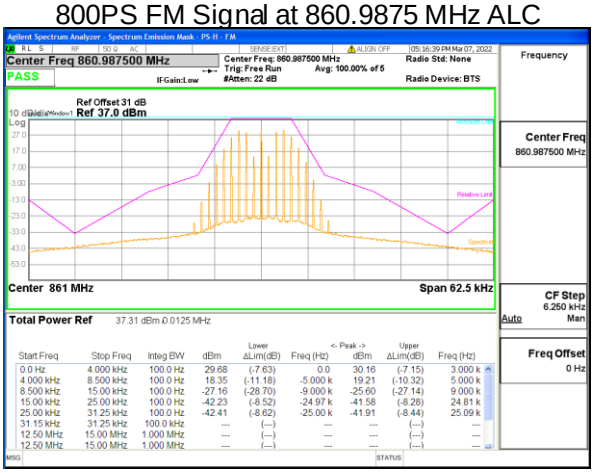


800PS FM Signal at 851.0125 MHz ALC



800PS FM Signal at 860.9875 MHz ALC



700PS HDQPSK Signal at 772 MHz

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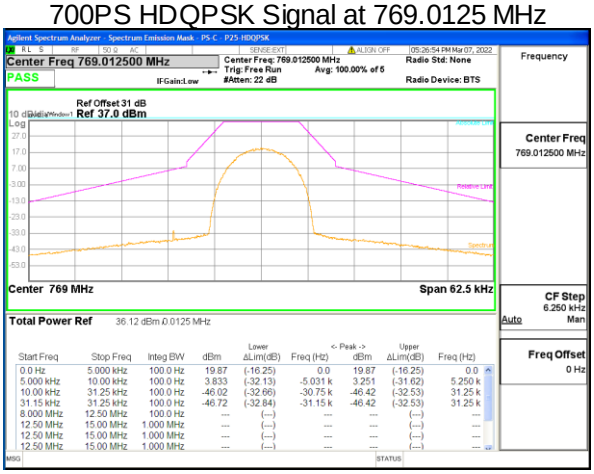
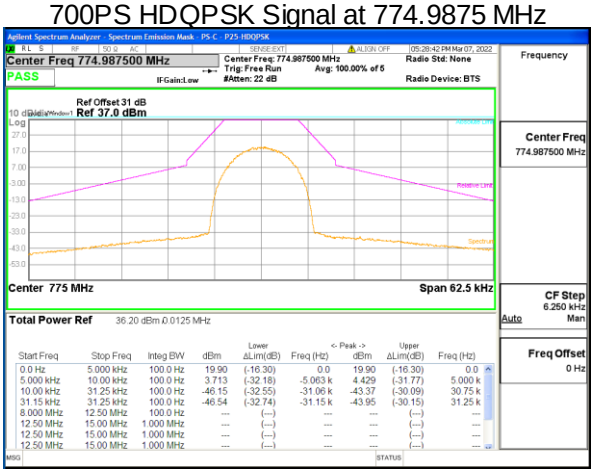
700PS HDQPSK Signal at 769.0125 MHz



700PS HDQPSK Signal at 774.9875 MHz



700PS CQPSK Signal at 772 MHz

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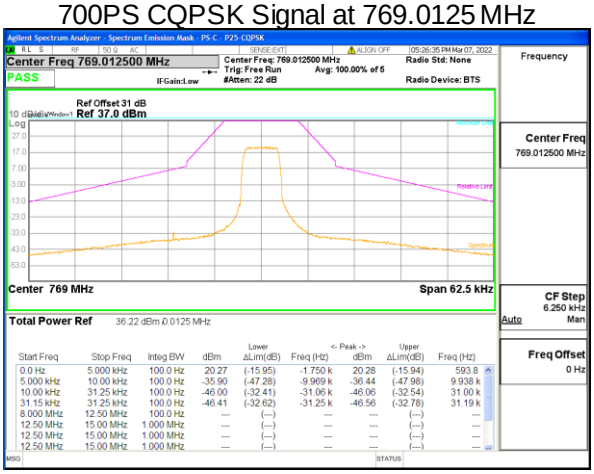
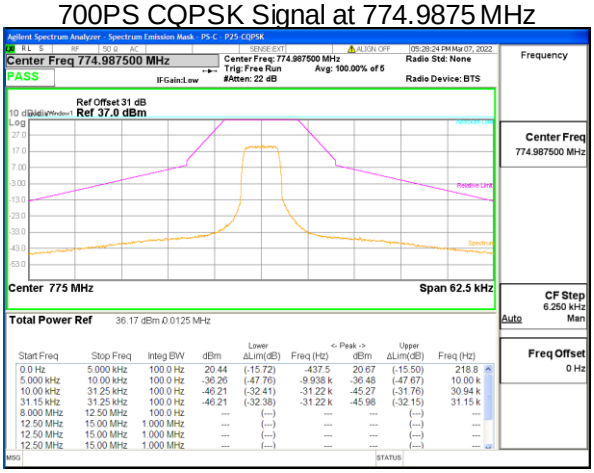
700PS CQPSK Signal at 769.0125 MHz



700PS CQPSK Signal at 774.9875 MHz



700PS C4FM Signal at 772 MHz

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