



REPORT

For

Dali Wireless, Inc.

535 Middlefield Road, Suite 280
Menlo Park, CA 94025

Date: 22 January 2018
Report No.: 16608-1E
Revision No.: 1
Project No.: 16608
Equipment: Dual-band Medium Power Remote Unit
Model No.: hd33-2-PS-DH-10-4N-D0
FCC ID: HCOHD332PSDH10A

ONE STOP GLOBAL CERTIFICATION SOLUTIONS



Unit 205 – 8291 92 ST., Delta, BC
V4G 0A4, Canada
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TEST REPORT_FCC Part 2, 90		
Private Land Mobile Services		
Report Reference No.:	16608-1E	
Report Revision History.:	✓ Rev. 0: 12 January 2018 ✓ Rev. 1: 22 January 2018	
Compiled by (+ signature)	Sophie Piao,	
	Daniel Lee	
Approved by (+ signature)	Jeremy Lee	
Date of issue	22 January 2018	
Total number of pages	104	
FCC Site Registration No.:	CA5970	
IC Site Registration No.:	5970A-2	
Testing Laboratory	LabTest Certification Inc.	
Address	Unit 205 – 8291 92ST. Delta, B.C. V4G 0A4, 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 ➤ RSS-131 ➤ RSS-GEN	
Test procedure	➤ ANSI/TIA-603- E-2016 ➤ FCC KDB 935210 D05 Indus Booster Basic Meas v01r02: October 27, 2017 ➤ RSS-131 ➤ RSS-GEN	
Non-standard test method	N/A	
Test Report Form(s) Originator	Jeremy Lee	

Master TRF	1036_Rev2 – RF Report Template
Test item description :	
Trade Mark	hd33™
Model/Type reference	hd33-2-PS-DH-10-4N-D0
Serial Number	10911103RA1B7B002
FCC ID	HCOHD332PSDH10A
IC ID	-
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	November 22, 2017 & January 04, 2018
Date (s) of performance of tests.....	November 22, 2017 & January 04, 2018

Revision History

Revision	Date	Reason For Change	Author(s)
0	Jan 09, 2018	Initial Data	Sophie Piao & Daniel Lee
1	Jan 22, 2018	Correction for mistake	Jeremy Lee

Device Under Test Description

Application for	PS 150/450 Remote Unit, Dual Band Medium Power DAS
Passing Transmit/Receive Frequency .:	130 MHz – 174 MHz 450 MHz – 512 MHz
Operating Transmit/Receive Frequency FCC	150.8 MHz – 156.2475 MHz 157.1875 MHz – 161.575 MHz 161.775 MHz – 161.9625 MHz 162.0375 MHz – 173.4 MHz 450 MHz – 454 MHz 456 MHz - 462.5375 MHz 462.7375 MHz – 467.5375 MHz 467.7375 MHz – 512 MHz

Operating Transmit/Receive Frequency Industrial Canada	138 MHz – 144 MHz 148 MHz – 174 MHz 450 MHz – 470 MHz
Number of Channels	As many as which can fit
Rated RF Output(e.i.r.p.)	33 dBm
Modulation Type	P25 Phase I C4FM, CQPSK; P25 Phase II HDQPSK
Equipment mobility	Fixed
Operating condition.....	-40 to +50 °C
Mass of equipment (g)	< 22,700g
Dimension(W X D X H)	430 mm X 194 mm X 466 mm
Nominal Voltages for:	<u>48 V</u> stand-alone equipment <u>48 V</u> combined (or host) equipment
Supply Voltage:	_____ AC _____ Amps <u>48V</u> DC <u>3.125</u> 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.
Testing location/ address.....		8618 Commerce Court, Burnaby, B.C. V5A 4N6, Canada

Summary of testing:	
Tests performed (name of test and test clause): Conducted Measurement Radiated Emissions on Enclosure	Testing location: Client Site as Witness Testing 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 hd33 150PS 450PS is a dual-band remote unit that provides 2 W of output power on each band. The dual-band unit supports one or two bands in a sealed type 1 pluggable module chassis.

On the downlink path the hd33 PS remote receives an aggregated stream of digitized RF signals from an UBiT-*hd*Host PS or 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 hd33 PS remote receives analog RF signals for the RF band, from an external VHF/UHF filter. The RF signals are converted into a digital data stream and then delivered over optical fiber to a UBiT-*hd*Host PS or airHost PS. The hd33 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 UBiT-*hd*Host was connected as the Auxiliary device. The UbiT-*hd*Host does not have antenna port, where the signal was injected and ejected via coaxial cables.

- Top View



- Connector Side View



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.

hd33-1-PS-D-10-2N-D0 – single band VHF model
hd33-1-PS-H-10-1N-D0 – single band UHF model
hd33-2-PS-DH-10-4N-D0 – dual band VHF UHF model as tested

Client Equipment Used During Test

Use*	Product Type	Manufacturer	Model	Comments
EUT	hd33, 150PS, 450PS	Dali Wireless Inc.	hd33-2-PS-DH-10-4N-D0	EUT where the RF (I/O) antenna attached via duplexers/multiplexer when necessary.
AE1	UBiT-hdHost, 150PS, 450PS	Dali Wireless Inc.	UBiT-hdHost-PS-D-DH-SS4Q	Auxiliary equipment, which is connected to the Base Station via RF coaxial cables, has no air interface.
AE2	UBiT-CP	Dali Wireless Inc.	UBiT-CP	Auxiliary equipment provides the configuration and control interface to UBiT-hdHost and hd33.
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	2.1.1-rc1.242
AE1	Software installed	2.1.1-rc1.242
AE2	Software installed	2.1.1-rc1.242
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
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1	DC Power Port	DC	No	No	Dual feed 48 VDC Assembly
2	2 * RF Input Ports	I/O	No	No	N-Type Coaxial
3	2 * RF Output Ports	I/O	No	No	N-Type Coaxial
4	2 * Optical Fibre I/O Ports	I/O	No	No	LC/UPC Duplex
5	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 (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	UbiT-hdHost maximum input threshold set to -10 dBm, uplink attenuation set to 0dB; hd33 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

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%.

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
Output Power (Conducted)	FCC Part 2 2.1046 FCC Part 90.219	ANSI TIA-603-E-2016	Compliant
Unwanted Emissions (Transmitter Conducted)	FCC Part 2 2.1046(a) FCC Part 90.210	ANSI TIA-603- E-2016 & FCC KDB 935210 D05, v01r02	Compliant
Spectrum Emission Mask	FCC Part 90 90.210	ANSI TIA-603- E-2016 & FCC KDB 935210 D05, v01r02	Compliant
Out of Band Rejection	FCC KDB 935210 D05, v01r02	FCC KDB 935210 D05, v01r02	Compliant
Intermodulation	FCC Part 90 90.219	ANSI TIA-603- E-2016 & FCC KDB 935210 D05, v01r02	Compliant
Input/output Power and Amplifier/Booster Gain	FCC Part 90 90.219	ANSI TIA-603- E-2016 & FCC KDB 935210 D05, v01r02	Compliant
Noise Figure	FCC Part 90 90.219	ANSI TIA-603- E-2016 & FCC KDB 935210 D05, v01r02	Compliant
Radiated Emissions - Enclosure	FCC Part 2.1053, FCC Part 90.210 & FCC Part 90.219	ANSI TIA-603-D	Compliant

Industrial Canada			
Test Type	Regulation	Measurement Method	Result
Output Power (Conducted)	RSS-131, Sec 6.2	RSS-131, Sec 4.3	Compliant
Occupied Bandwidth	RSS-GEN, Sec 4.6.1	RSS-GEN, Sec 4.6.1	Compliant
Unwanted Emissions (Transmitter Conducted)	RSS-131 Sec 6.4	RSS-131 Sec4.4	Compliant
Passband Gain and Bandwidth	RSS-131 Sec 6.1	RSS-131 Sec 4.2	Compliant

Output Power (Conducted)

Governing Doc	FCC Part 2 2.1046(a) FCC Part 90.219(d) RSS-131 Sec 6.2	Room Temperature (°C)	24
Test Procedure	ANSI/TIA-603- E-2016; FCC KDB 935210 D05, v01r02; RSS-131 Sec 4.3	Relative Humidity (%)	33.9
Test Location	Burnaby	Barometric Pressure (kPa)	101.3
Test Engineer	Sophie Piao/Jeremy Lee	Date	Jan 04, 2018
EUT Voltage	☒ DC ☐ 120VAC @ 60Hz		
Test Equipment Used	Manufacturer	Model	Serial Number
Signal Generator	Keysight	N5172B	MY53050270
Spectrum Analyzer	Keysight	N9010A	MY50520285
40dB Attenuator	Aeroflex Winschel	58-40-43	n/p
Calibration Calibration due 08/04/17 08/04/18 08/07/17 08/07/18 CVP CVP			
Note) CVP = Calibration Verification Performed internally, n/p = not provided.			
Frequency Range:	☒		
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 34 dBm in band 150 and is less than 34.1 dBm in band 450. The output total power of active dual channels is compressed to the same level due to the ALC control. Each channel power is accordingly 3 dB down from the total power.			
Compliant ☒ Non-Compliant ☐ Not Applicable ☐			

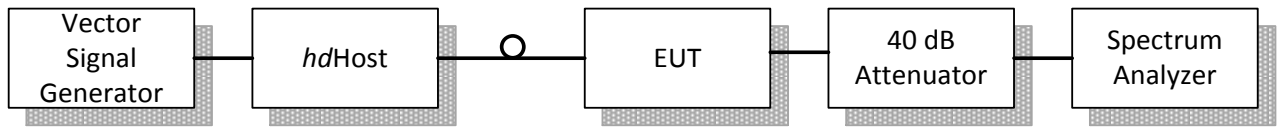
Test setup

Description of test set-up:

Output power is measured by connecting a spectrum analyzer to RF output connector of EUT via 40dB 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.



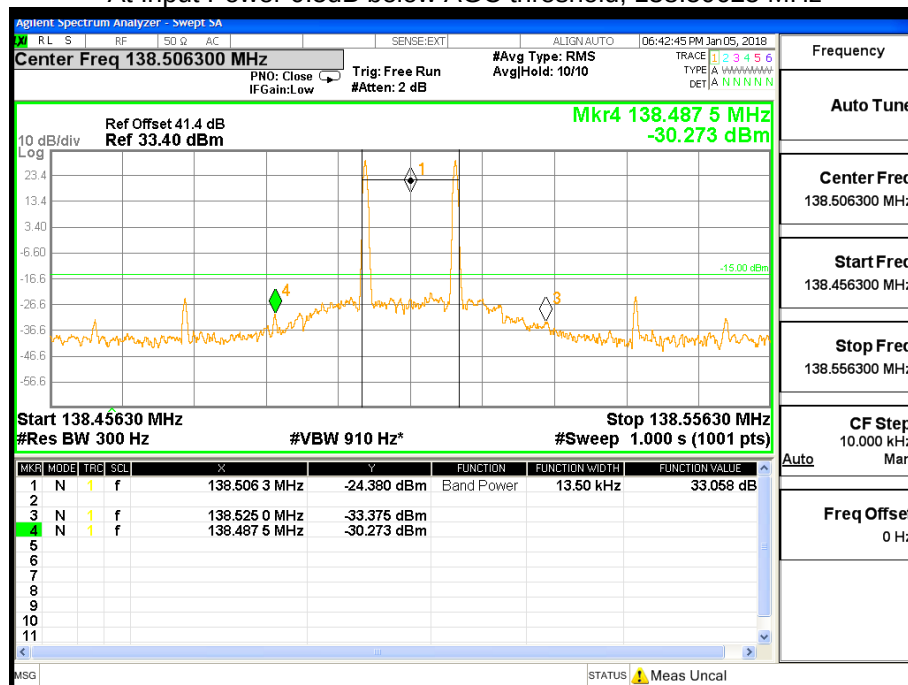
Results – Output Power FCC Requirement and IC Single Channel Requirement

Frequency Range (MHz)	Frequency (MHz)	Input Power Trip ALC (dBm)	Output Power (dBm)	Limit (37dBm)
150.8 – 156.2475	150.815	-10	33.8	PASS
157.1875 – 161.575	157.47	-10	34.0	PASS
161.775 – 161.9625	161.79	-10	33.9	PASS
162.0375 – 173.4	173.39625	-10.5	33.4	PASS
450 - 454	450.0125	-10.5	33.2	PASS
456 – 462.5375	462.53125	-10	34.0	PASS
462.7375 – 467.5375	463.6375	-10	34.1	PASS
467.7375 - 512	511.9875	-10	33.3	PASS

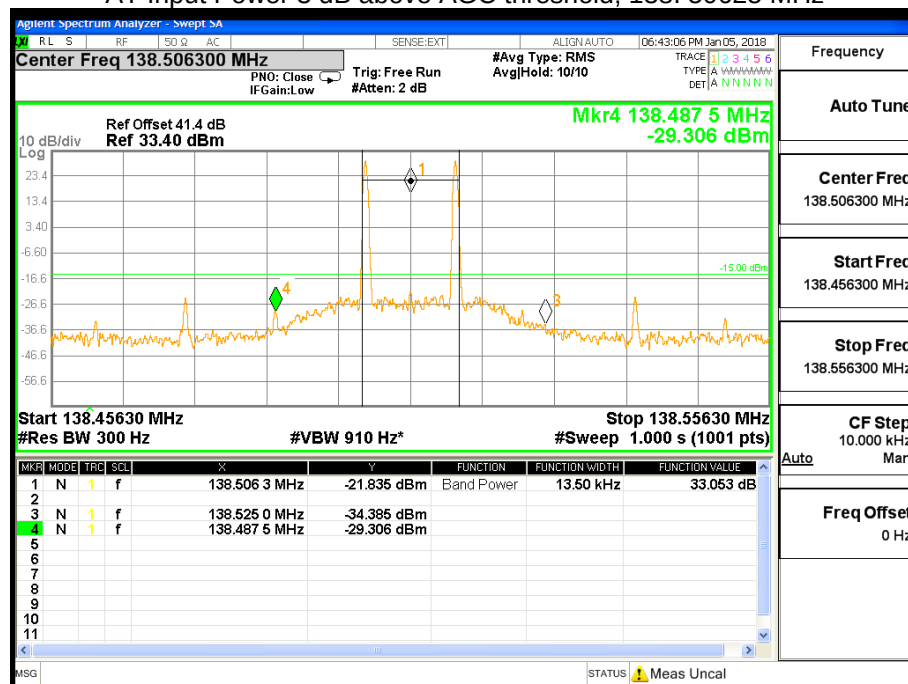
Results – Output Power IC Multi-Channel Requirement

The output total power of active dual channels is compressed to the same level due to the ALC control. Each channel power is accordingly 3 dB down from the total power.

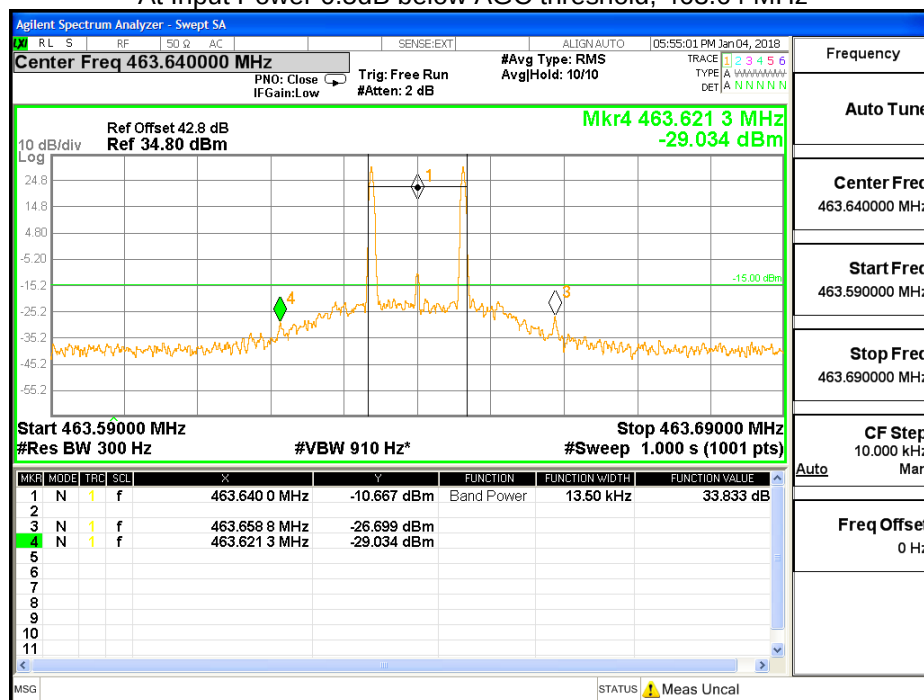
At Input Power 0.5dB below AGC threshold, 138.50625 MHz



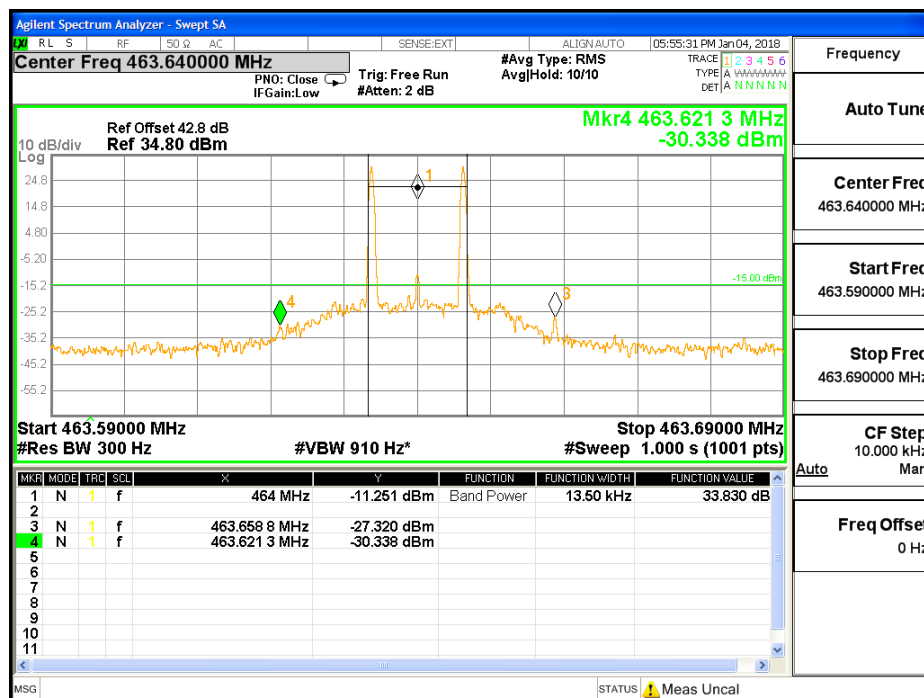
AT Input Power 3 dB above AGC threshold; 138. 50625 MHz



At Input Power 0.5dB below AGC threshold, 463.64 MHz



AT Input Power 3 dB above AGC threshold; 463.64 MHz



Occupied Bandwidth

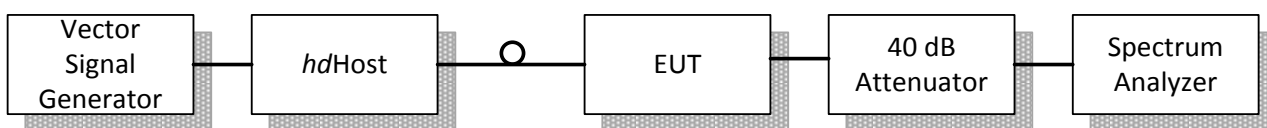
Governing Doc	IC RSS-GEN 4.6.1	Room Temperature (°C)	24
Test Procedure	IC RSS-GEN 4.6.1	Relative Humidity (%)	33.9
Test Location	Burnaby	Barometric Pressure (kPa)	101.3
Test Engineer	Sophie Piao/Jeremy Lee	Date	Jan 04, 2018
EUT Voltage	☒ DC ☐ 120VAC @ 60Hz		
Test Equipment Used	Manufacturer	Model	Serial Number
Signal Generator	Keysight	N5172B	MY53050270
Spectrum Analyzer	Keysight	N9010A	MY50520285
40dB Attenuator	Aeroflex Winschel	58-40-43	n/p
Calibration Calibration due			
08/04/17 08/04/18 08/07/17 08/07/18 CVP CVP			
Note) CVP = Calibration Verification Performed internally, n/p = not provided.			
Frequency Range:	☒		
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			
Compliant ☒ Non-Compliant ☐ Not Applicable ☐			

Test setup

Description of test set-up:

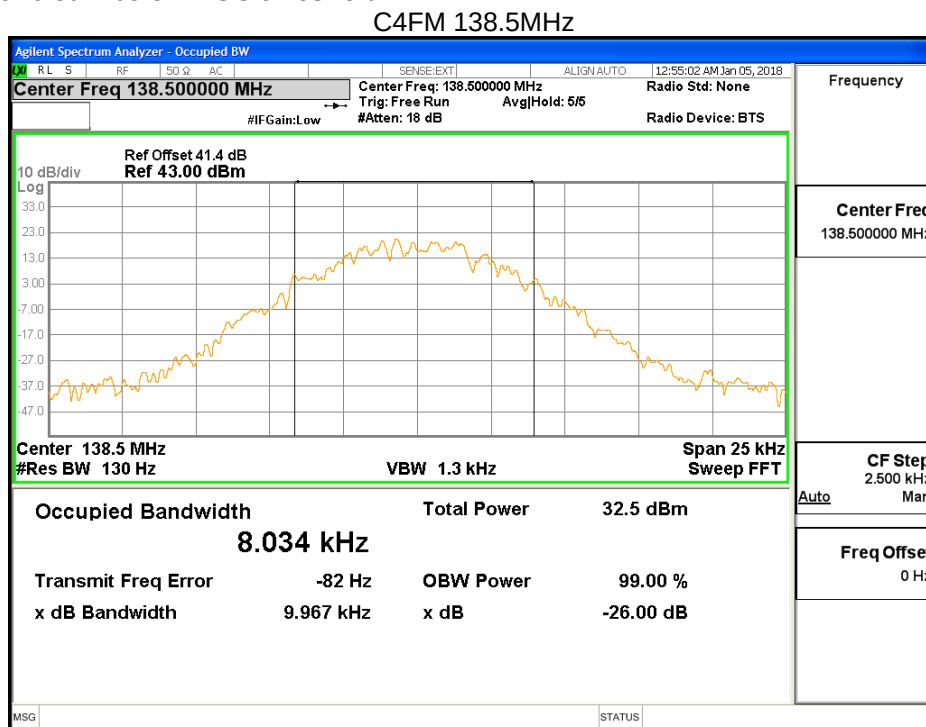
Occupied Bandwidth is measured by connecting a Spectrum Analyzer to the RF output connector via 40dB attenuator. The required measurement resolution bandwidth (RBW) is 1% of the emission bandwidth. 99% energy rule was applied to measure the occupied channel bandwidth. The emission bandwidth is measured 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.**

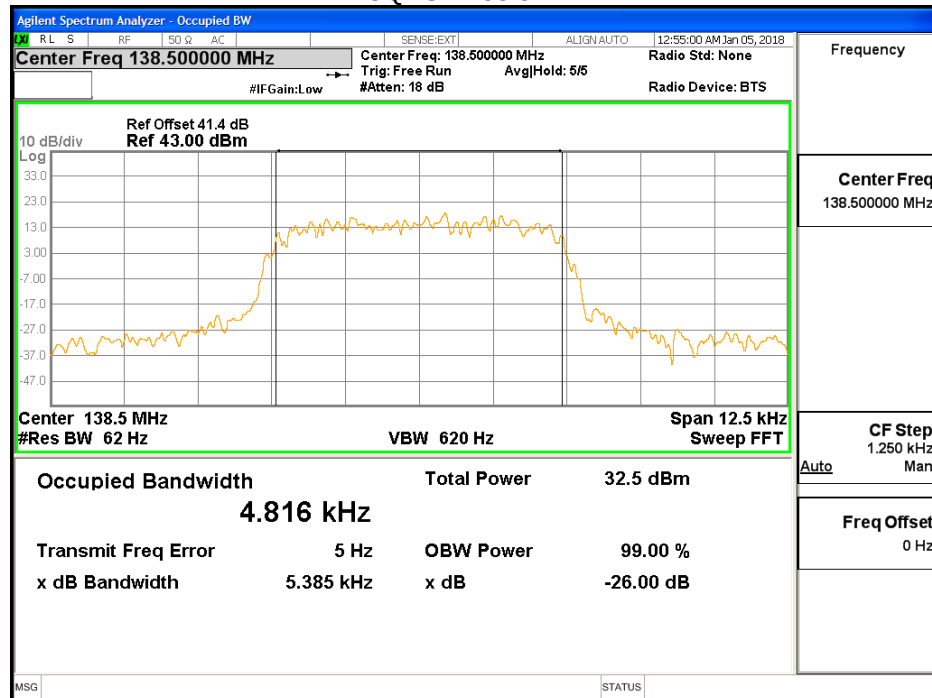


Results

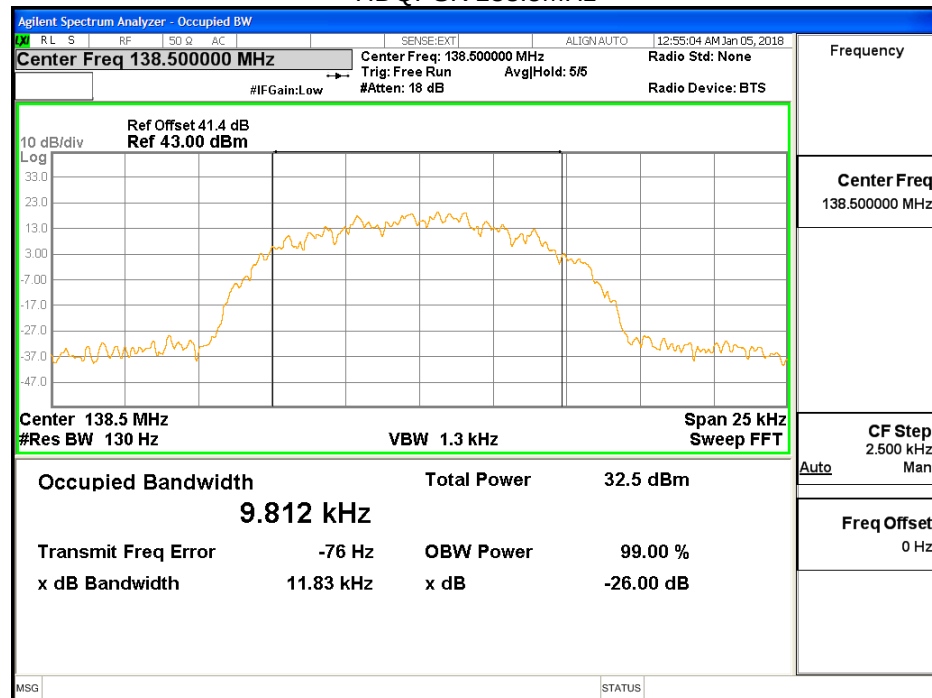
At Input Power 0.5dB below AGC threshold



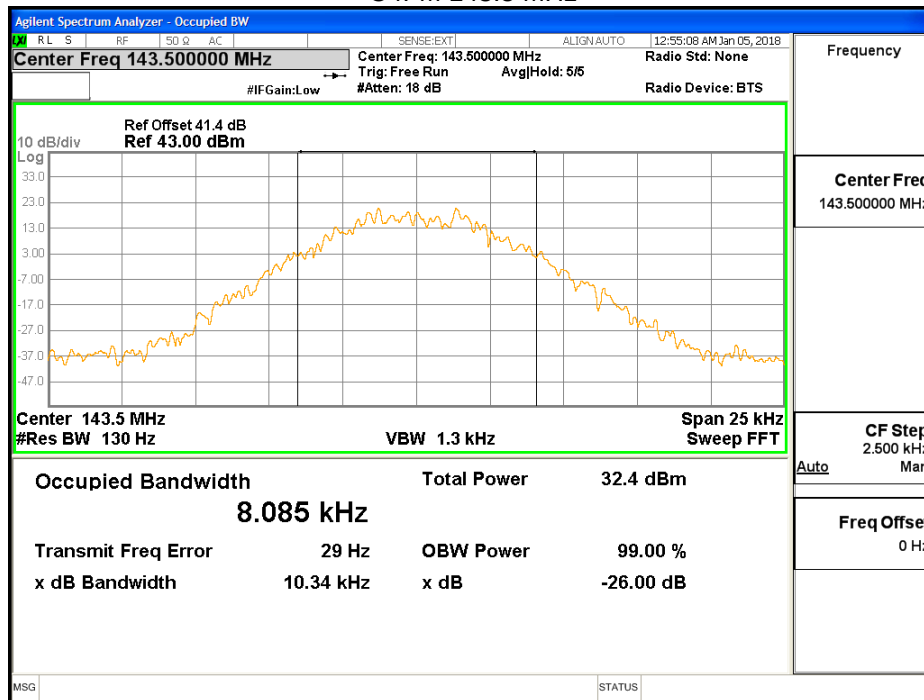
CQPSK 138.5MHz



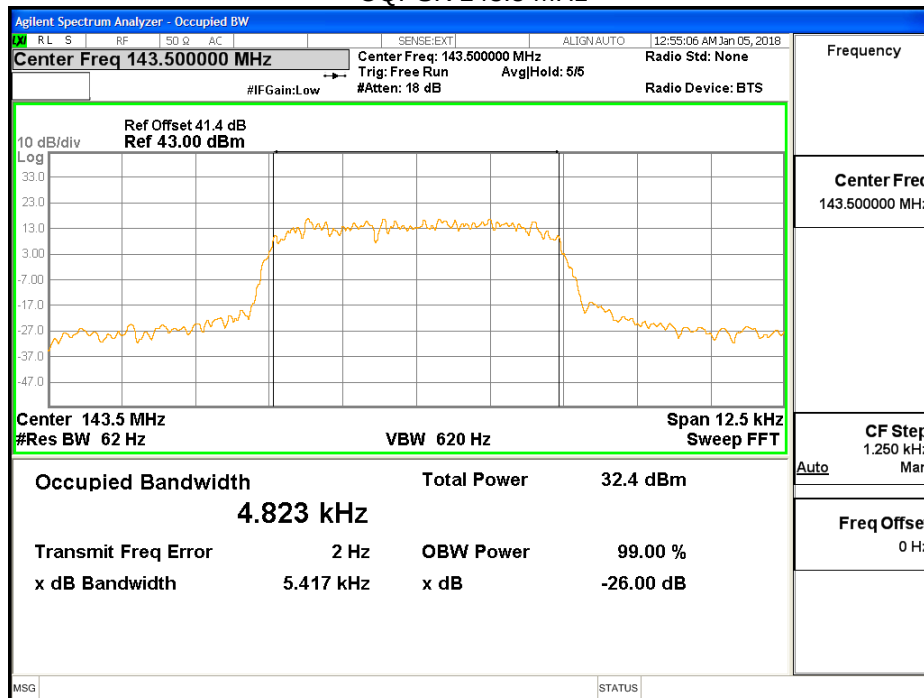
HDQPSK 138.5MHz



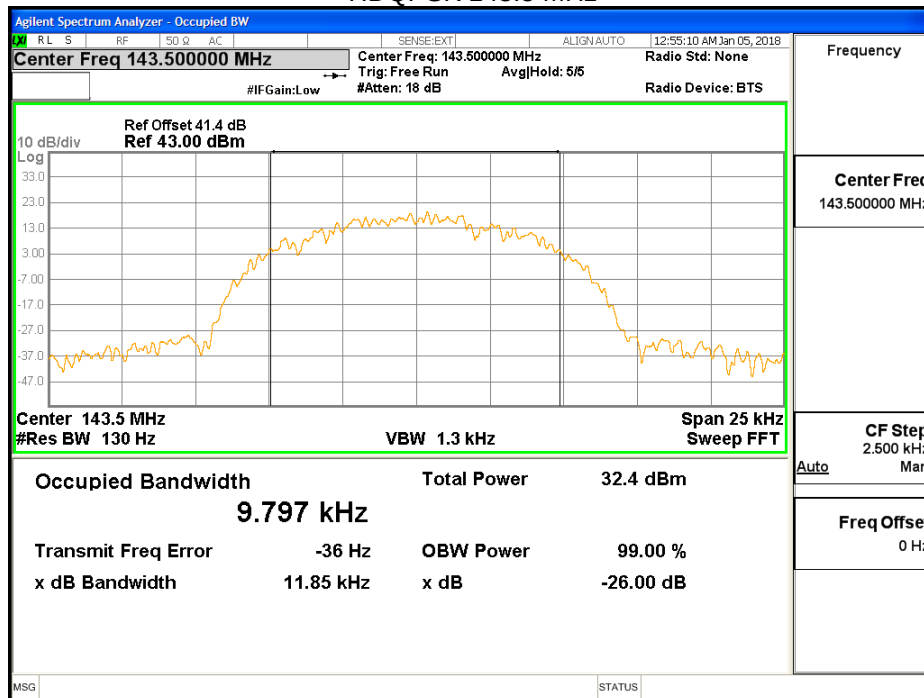
C4FM 143.5 MHz



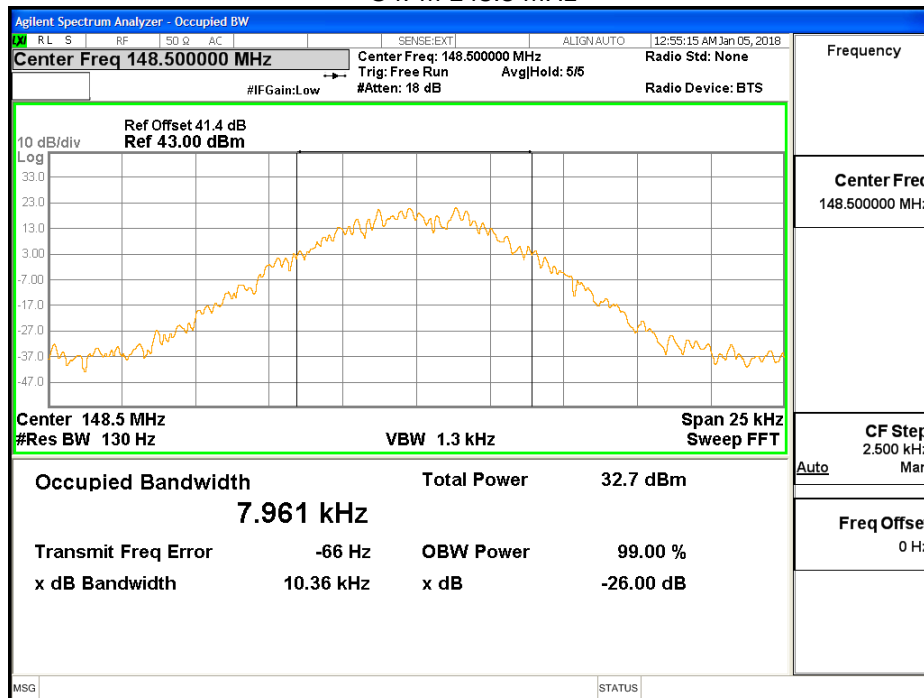
CQPSK 143.5 MHz



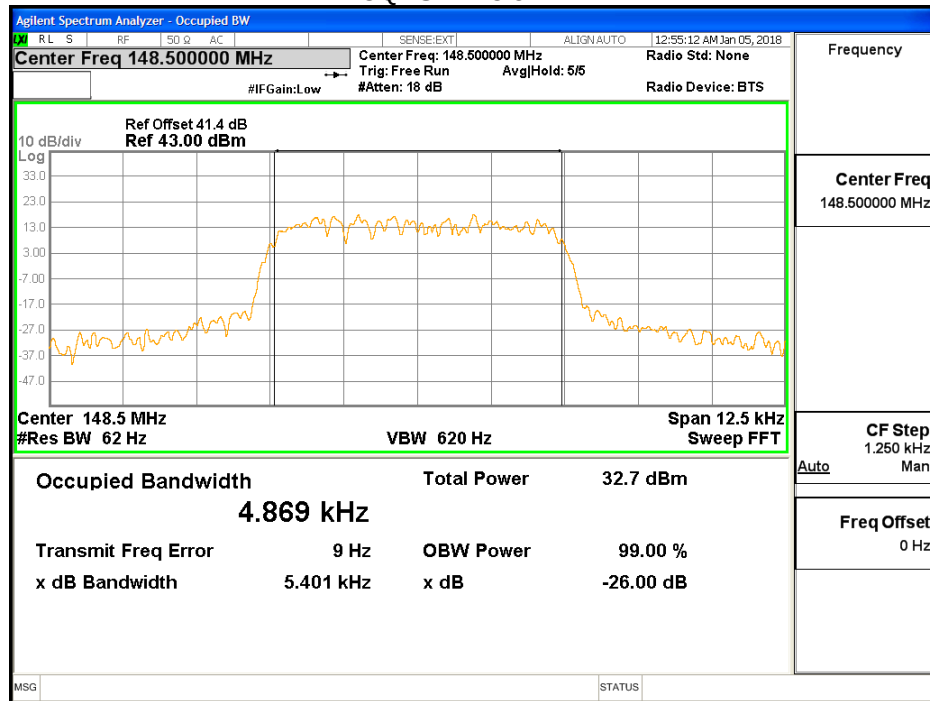
HDQPSK 143.5 MHz



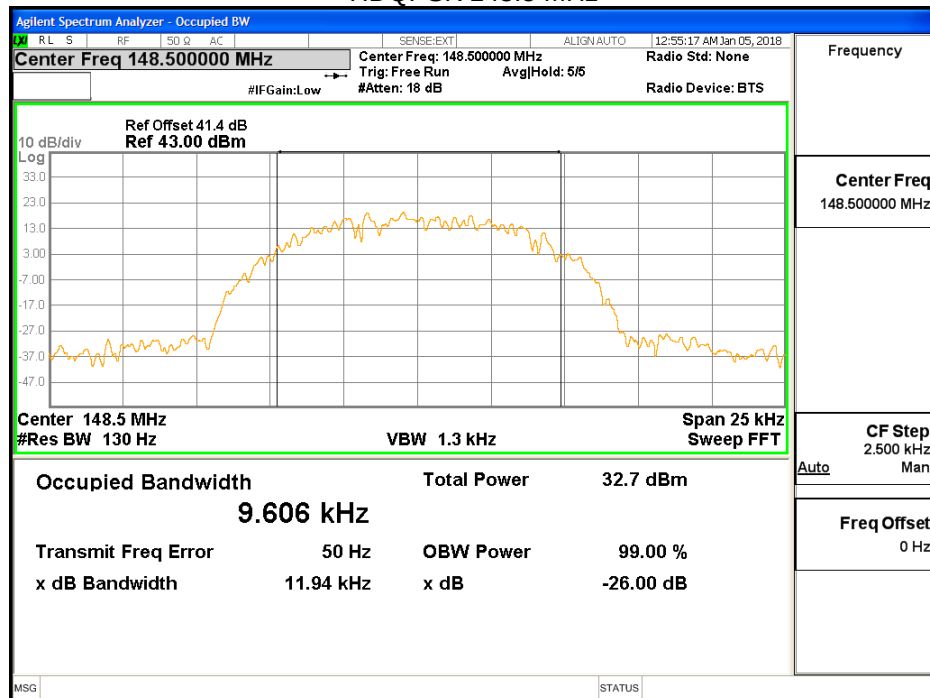
C4FM 148.5 MHz



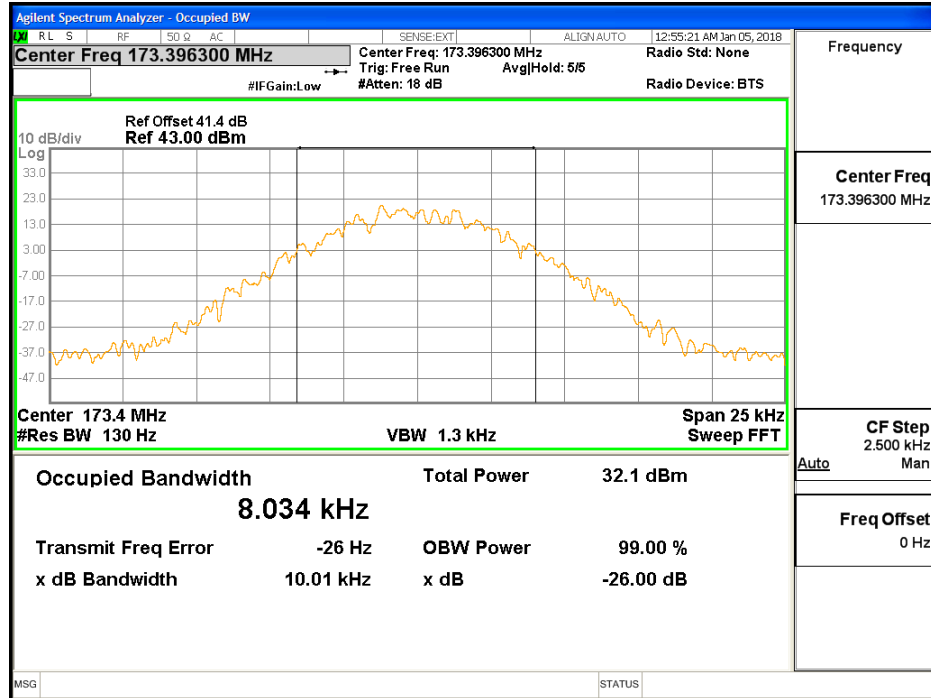
CQPSK 148.5 MHz



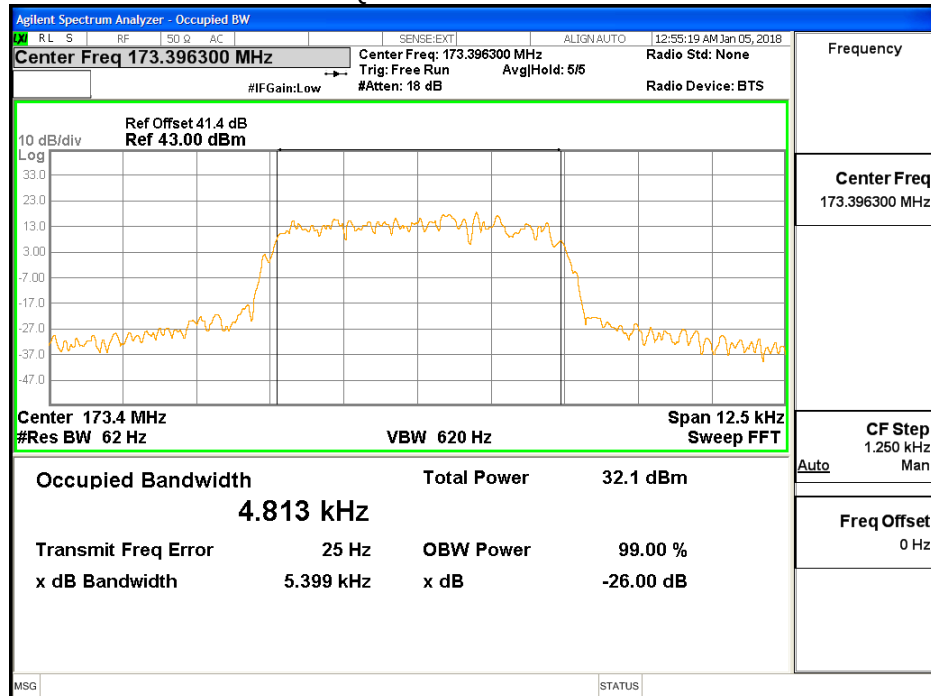
HDQPSK 148.5 MHz



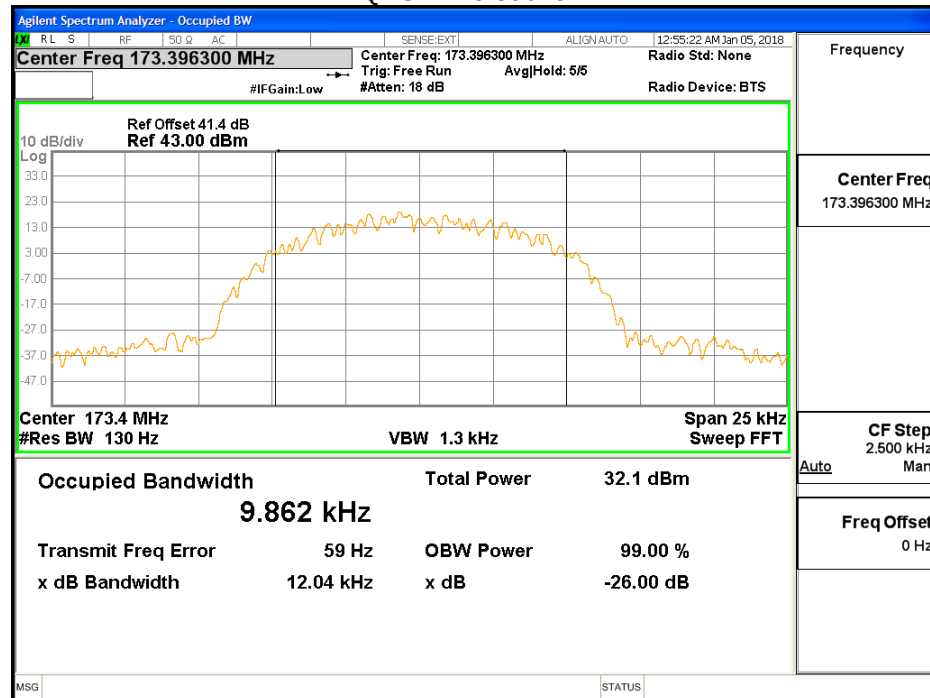
C4FM 173.39625 MHz



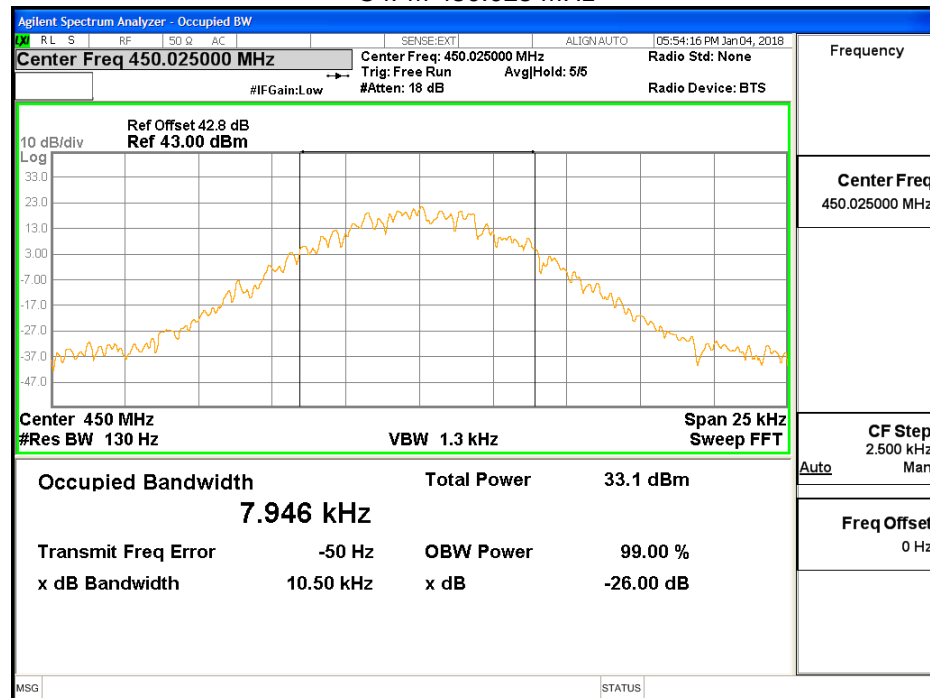
CQPSK 173.39625 MHz



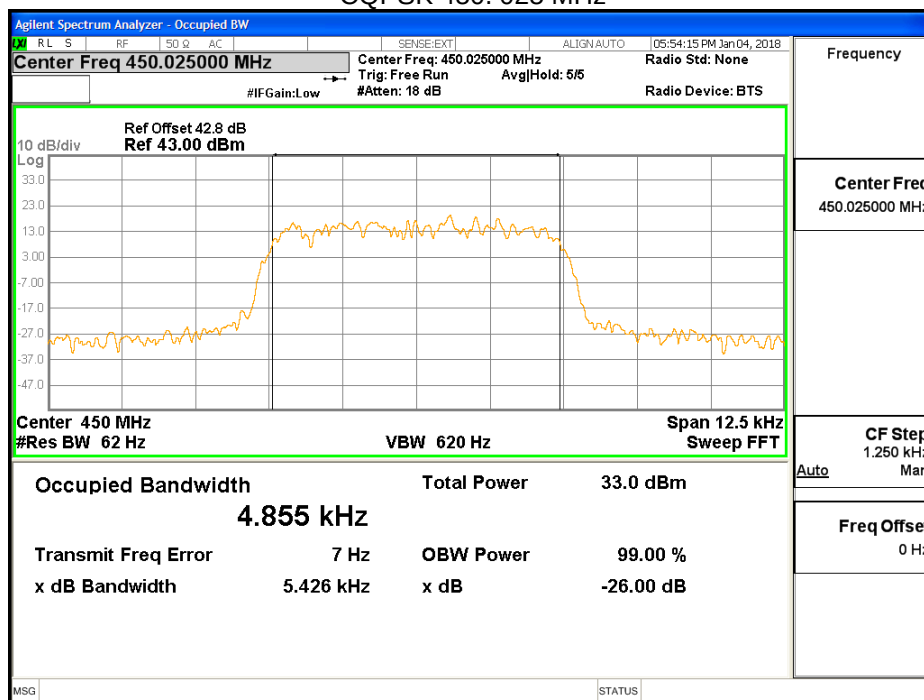
HDQPSK 173.39625 MHz



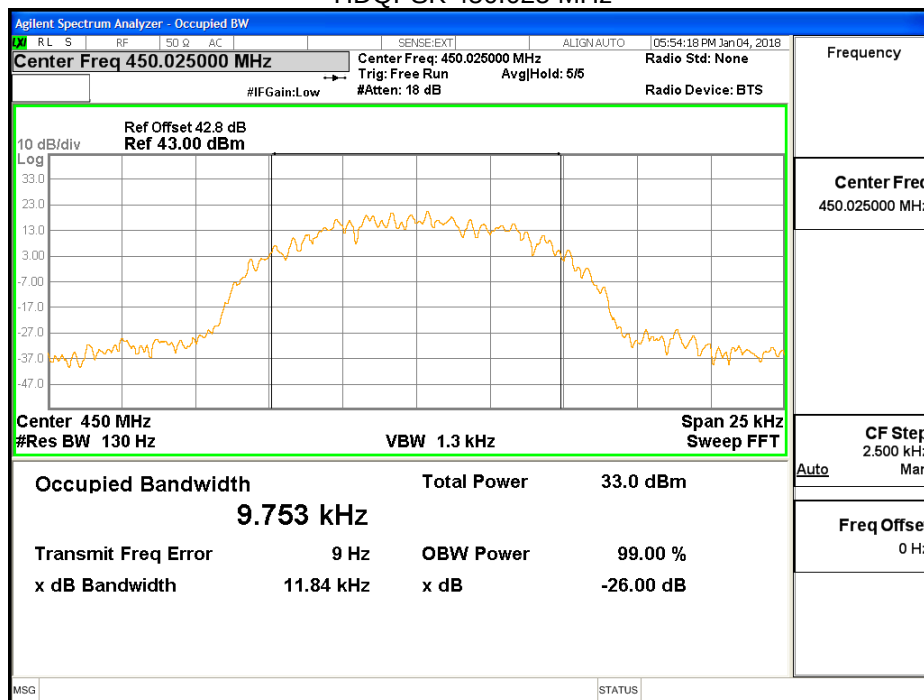
C4FM 450.025 MHz



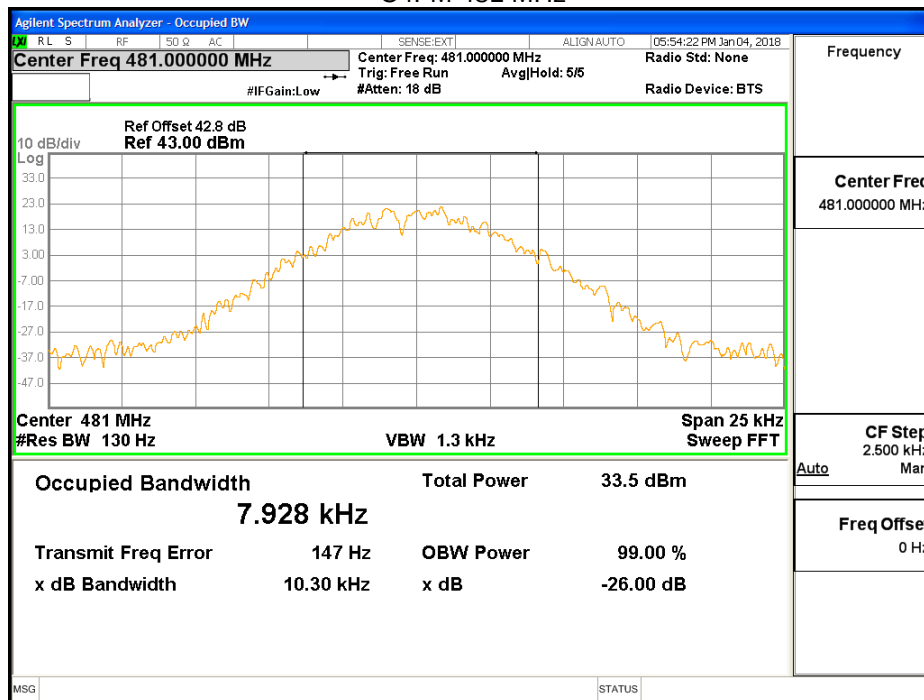
CQPSK 450.025 MHz



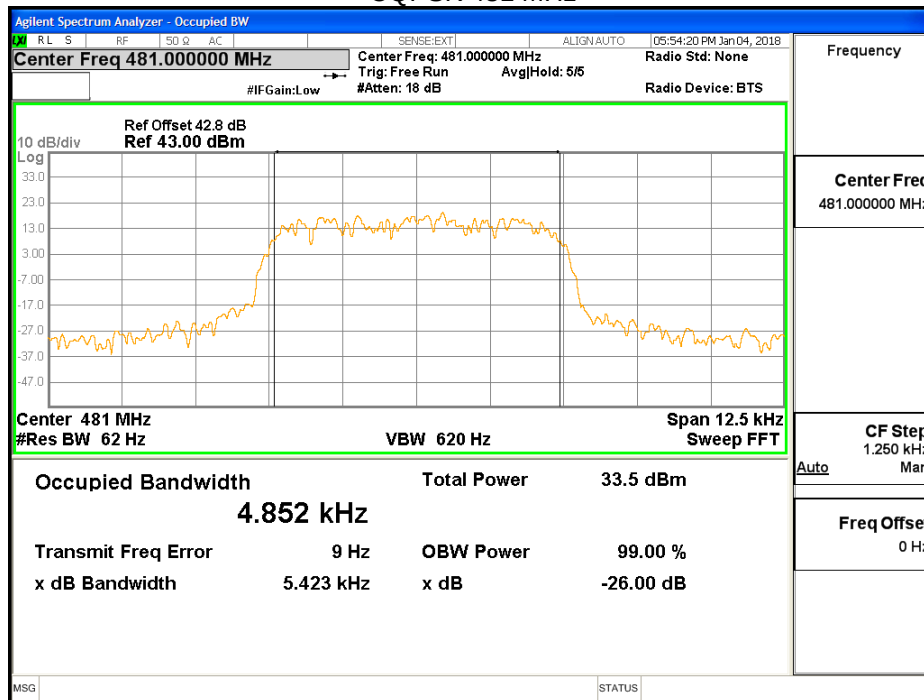
HDQPSK 450.025 MHz



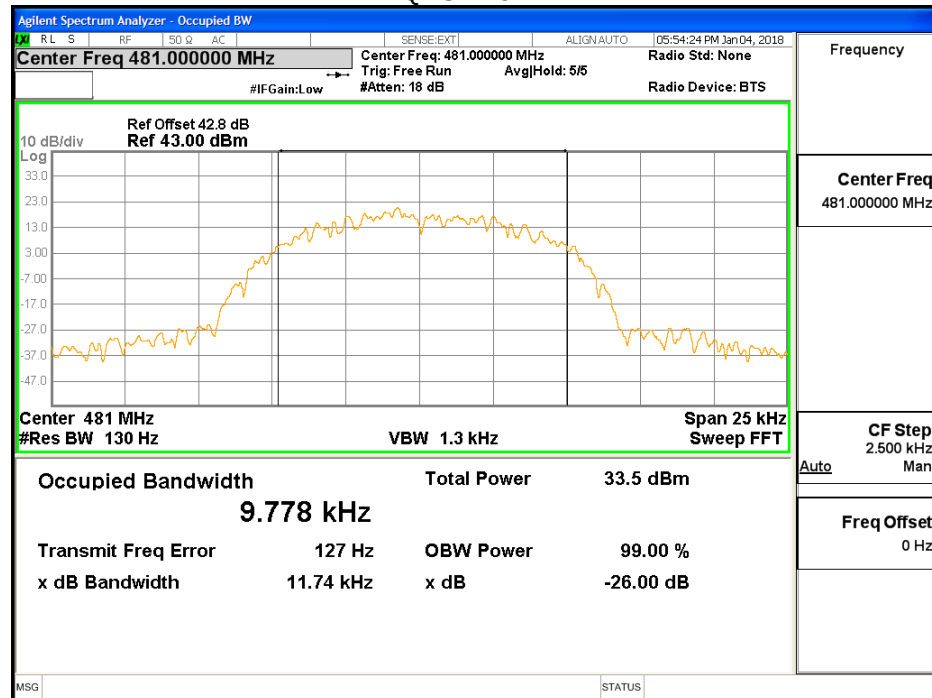
C4FM 481 MHz



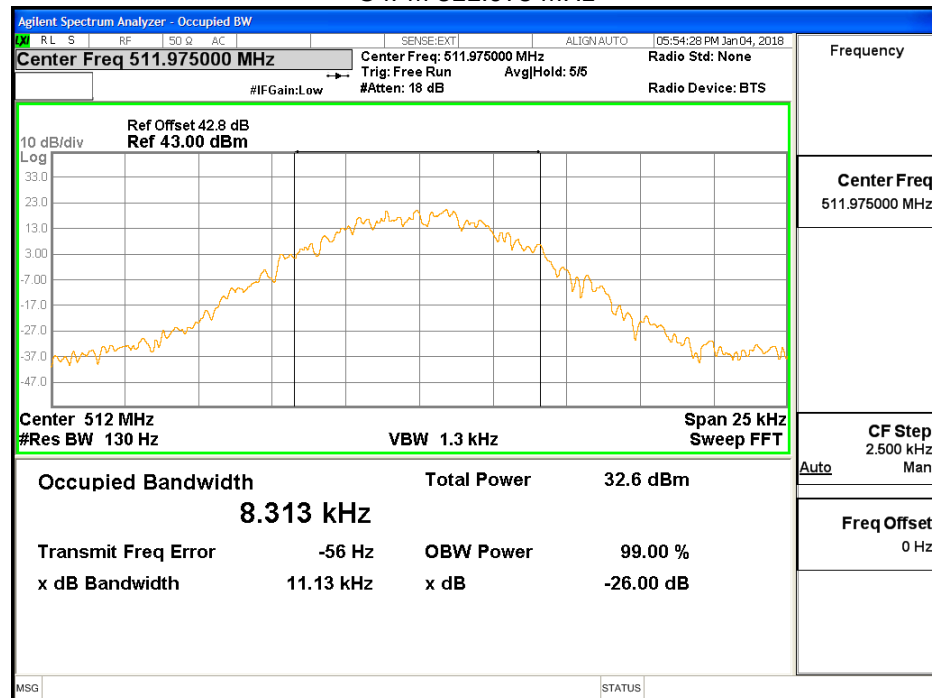
CQPSK 481 MHz



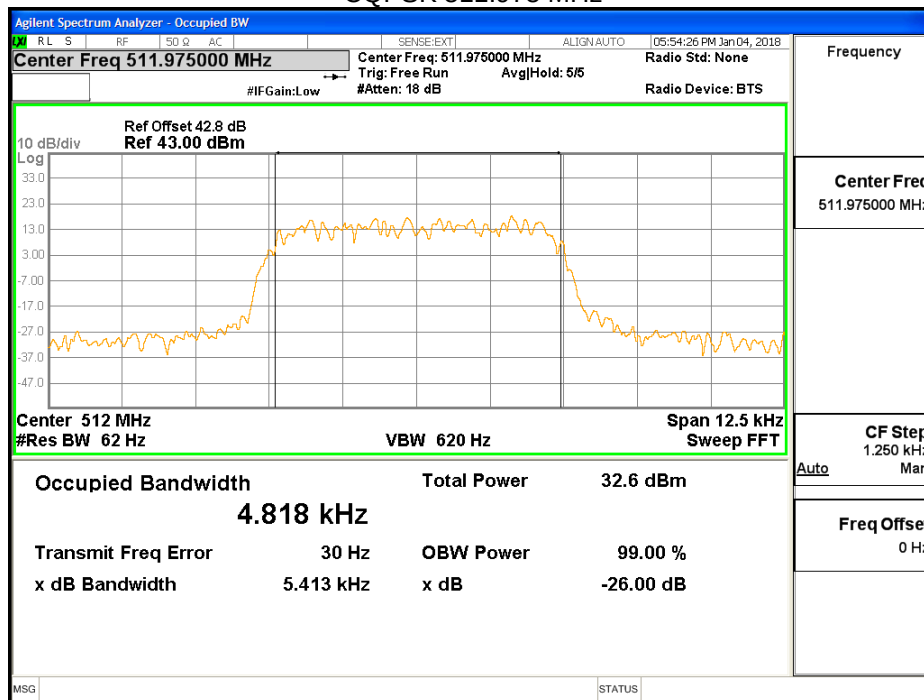
HDQPSK 481 MHz



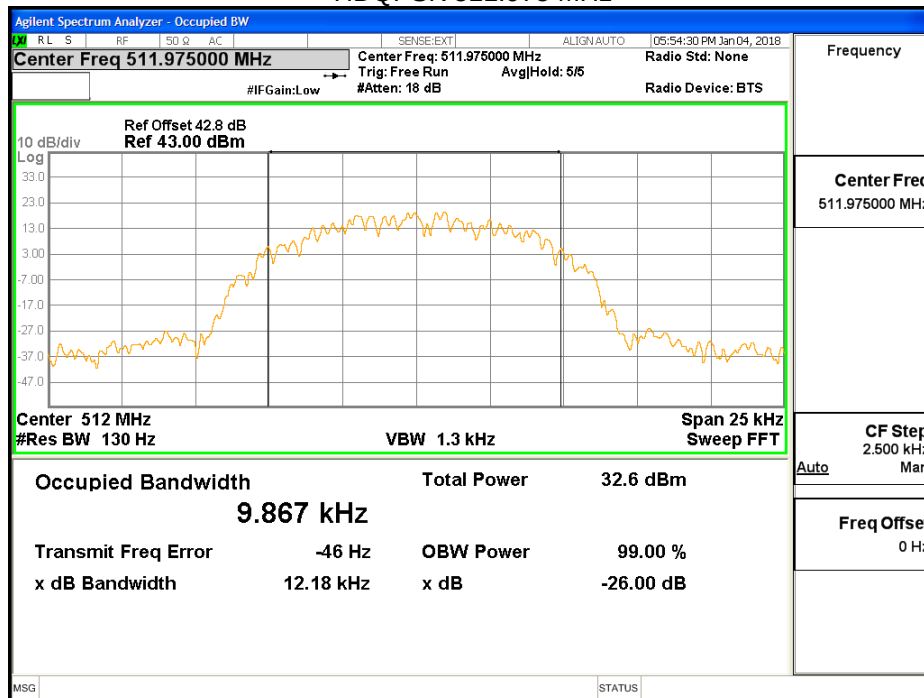
C4FM 511.975 MHz



CQPSK 511.975 MHz

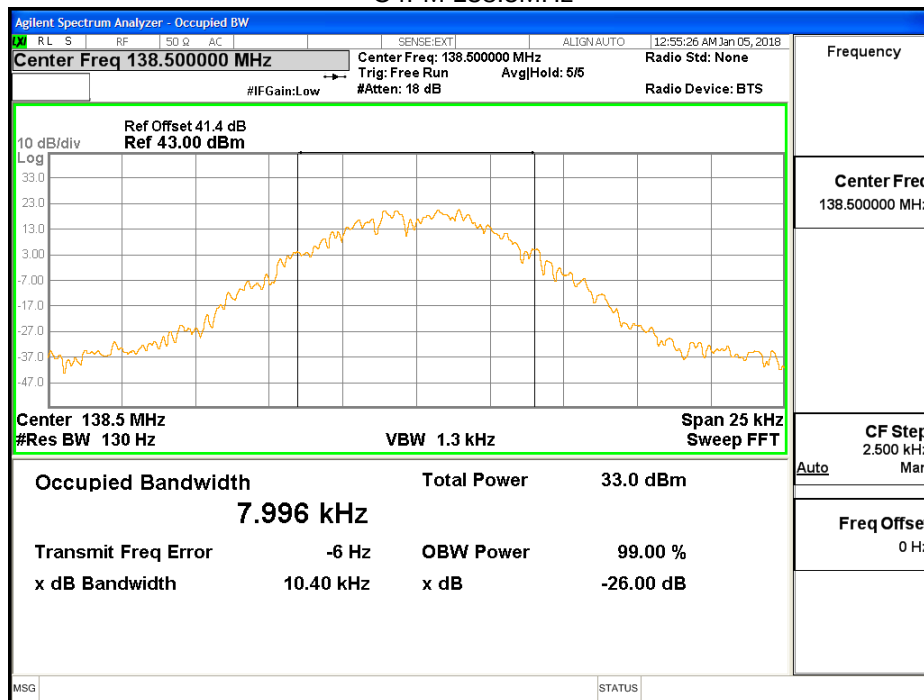


HDQPSK 511.975 MHz

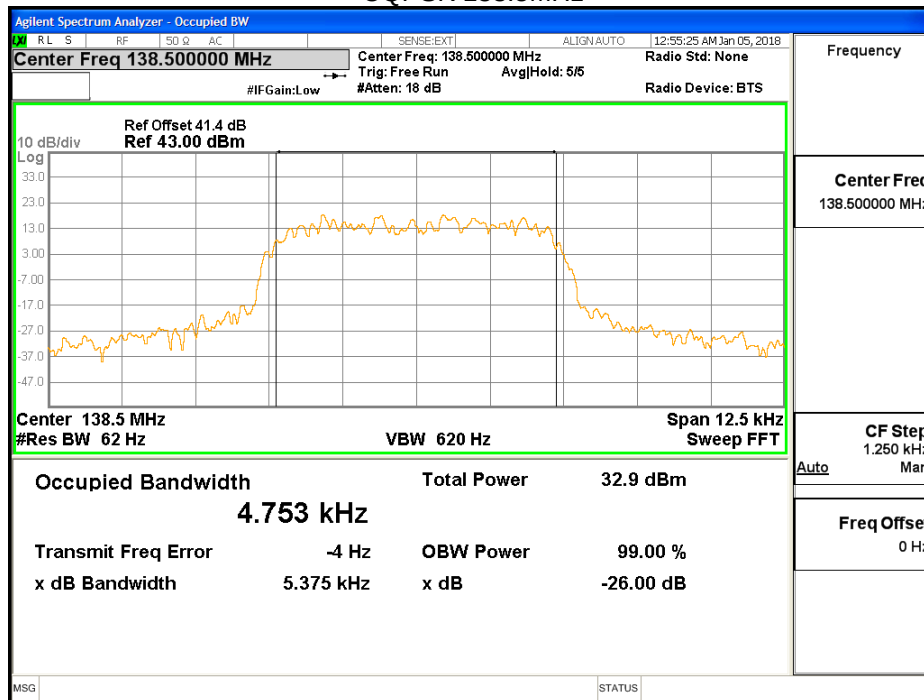


At Input Power 3 dB above AGC threshold

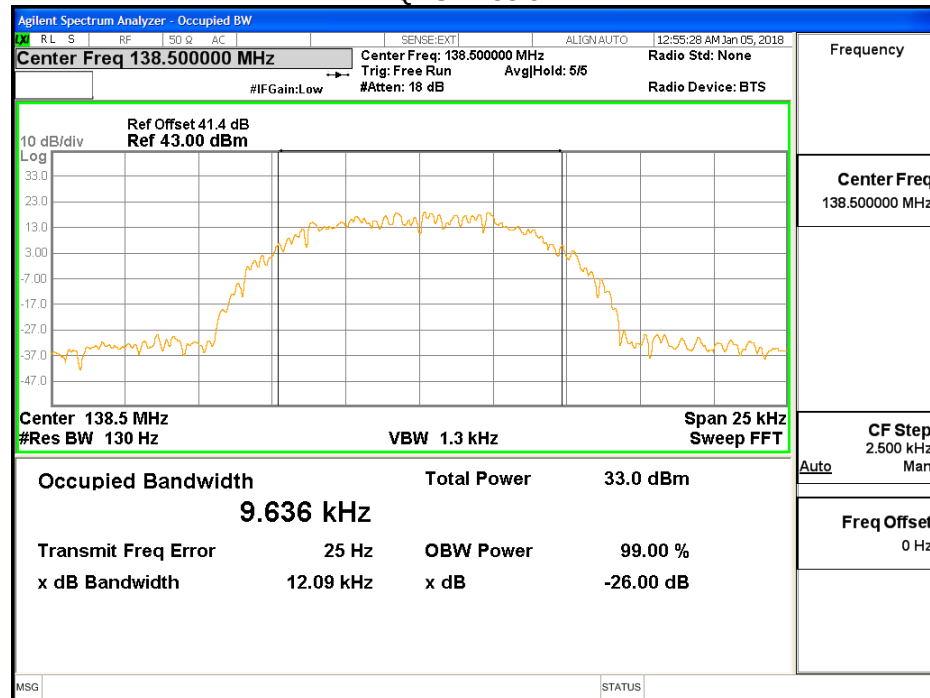
C4FM 138.5MHz



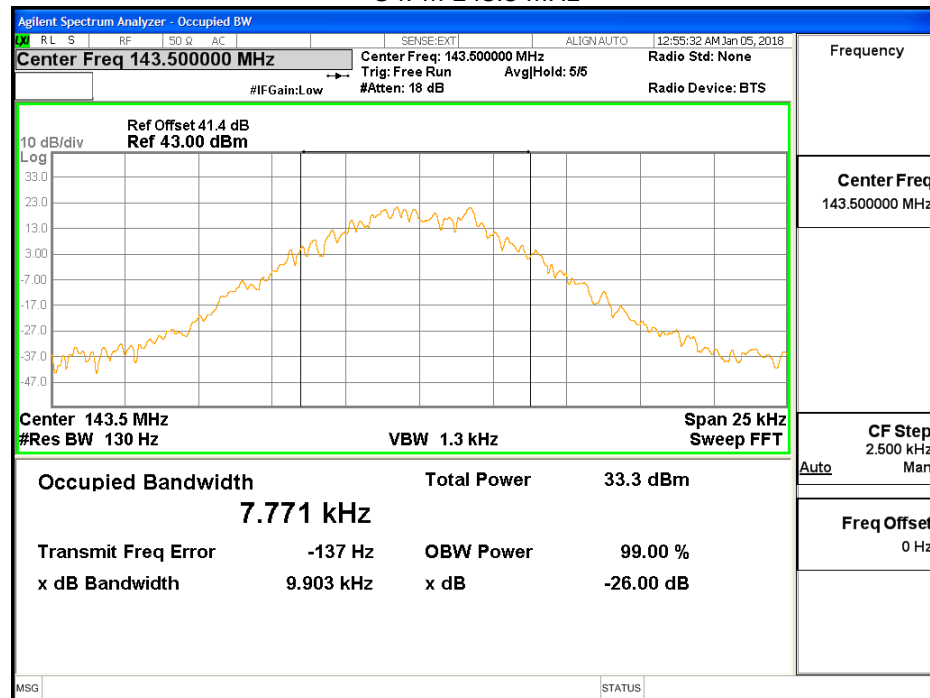
CQPSK 138.5MHz



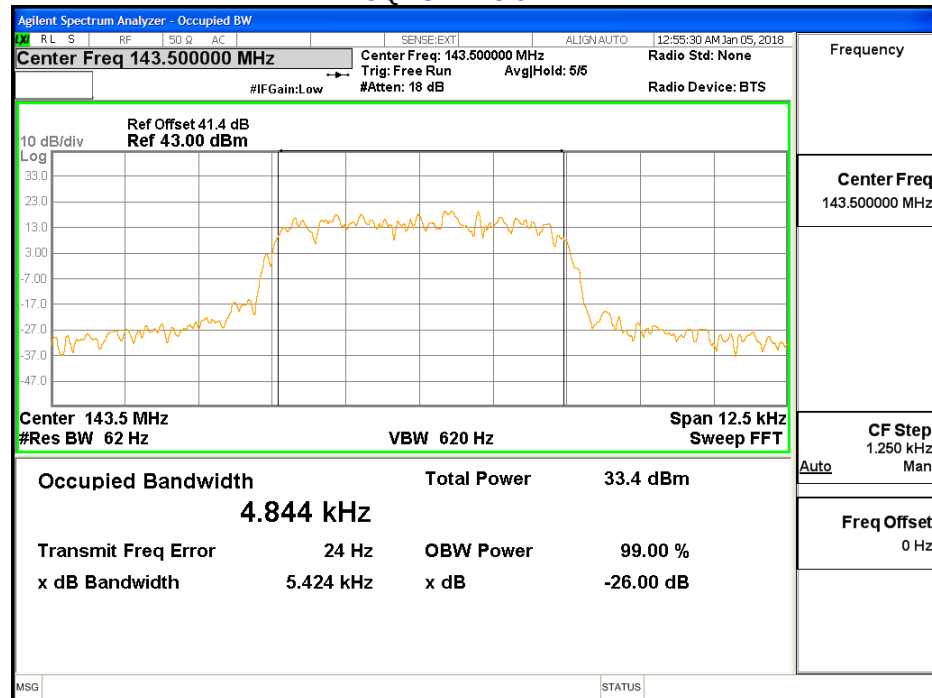
HDQPSK 138.5MHz



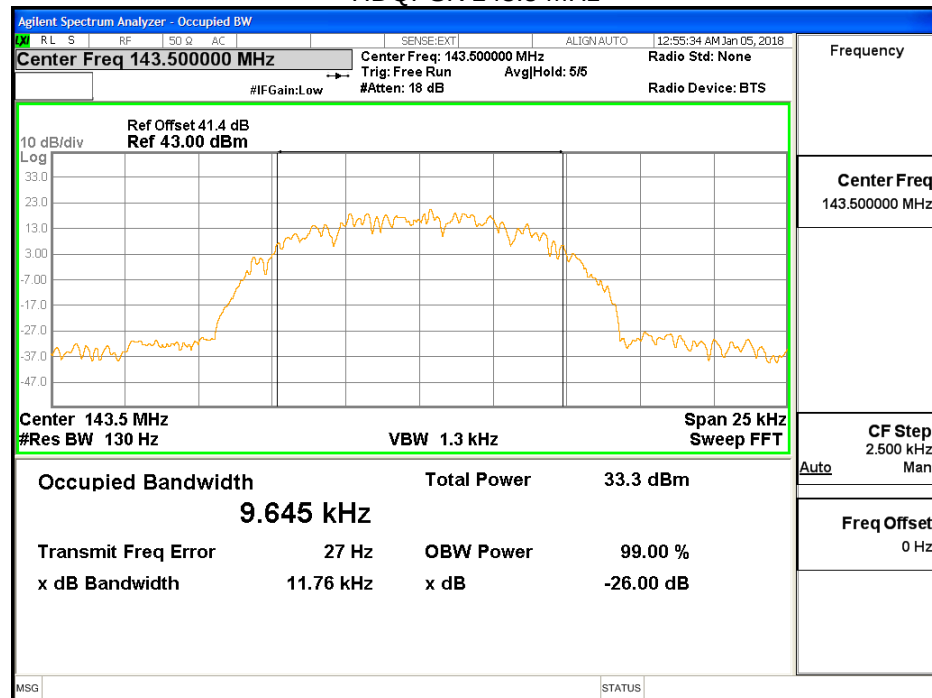
C4FM 143.5 MHz



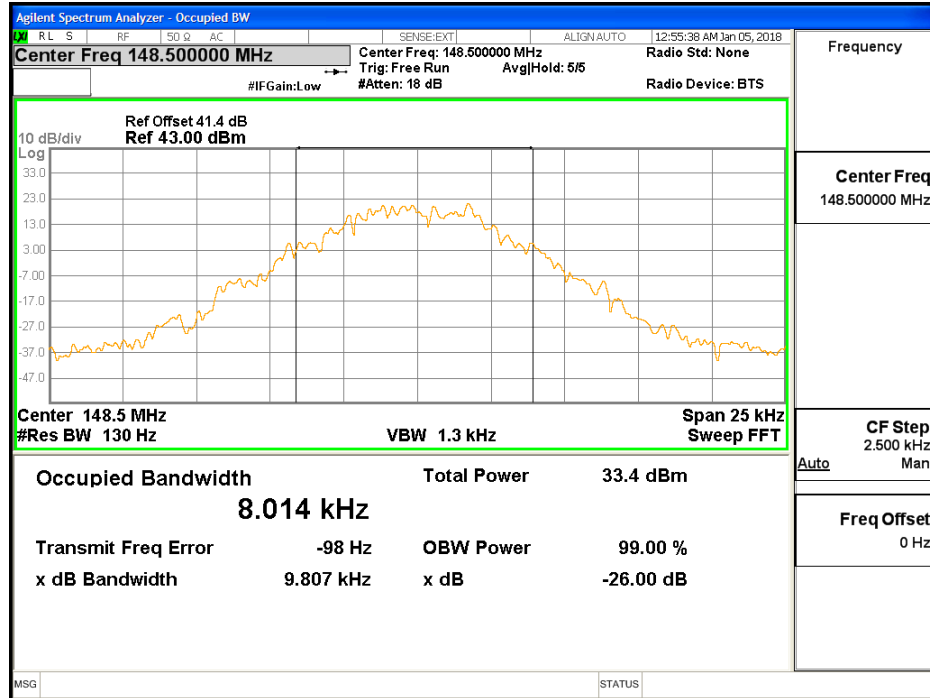
CQPSK 143.5 MHz



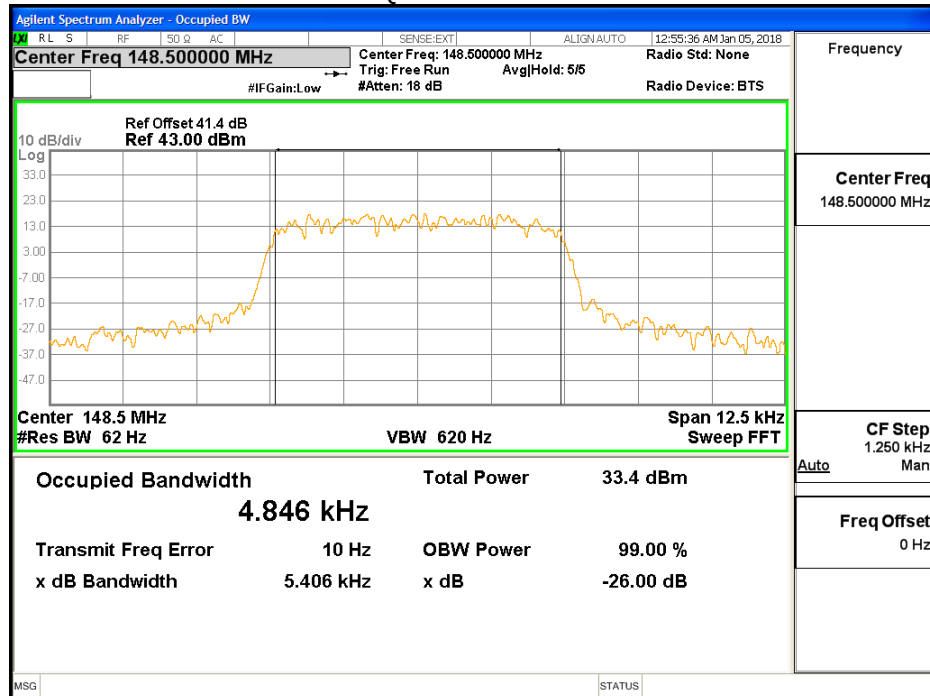
HDQPSK 143.5 MHz



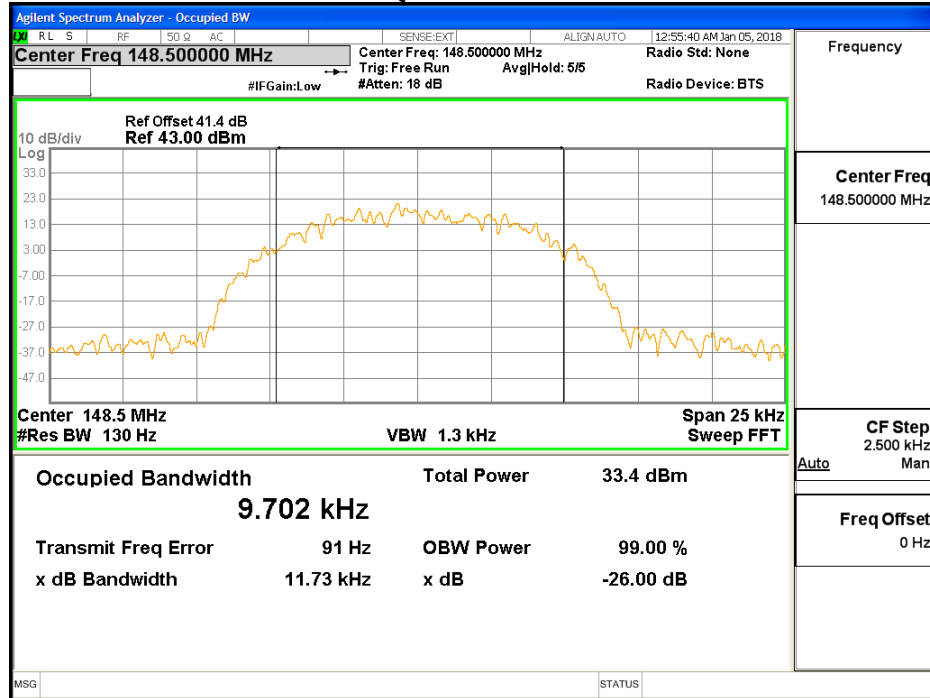
C4FM 148.5 MHz



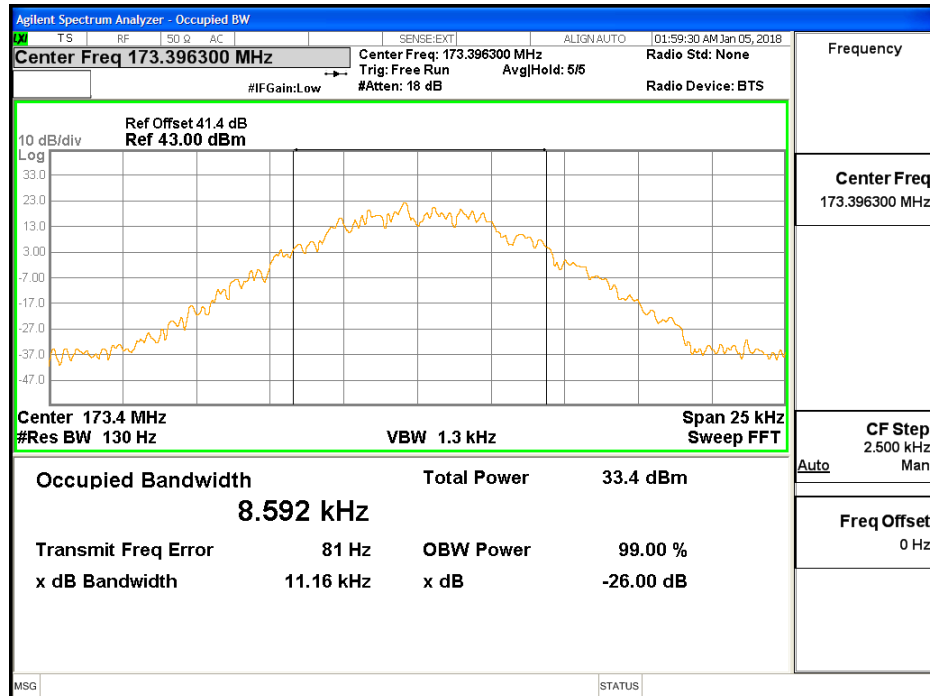
CQPSK 148.5 MHz



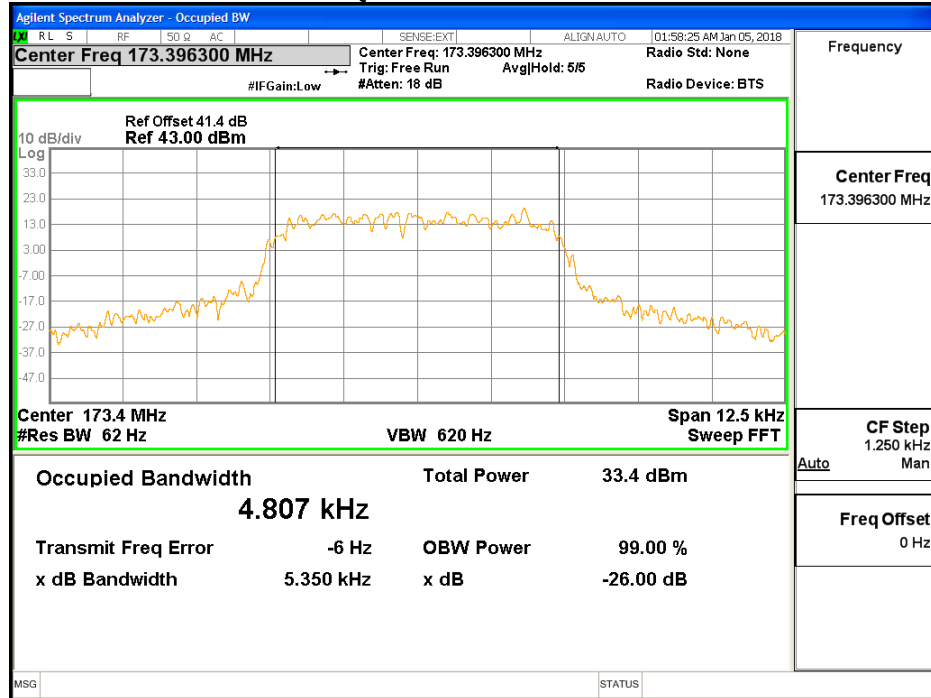
HDQPSK 148.5 MHz



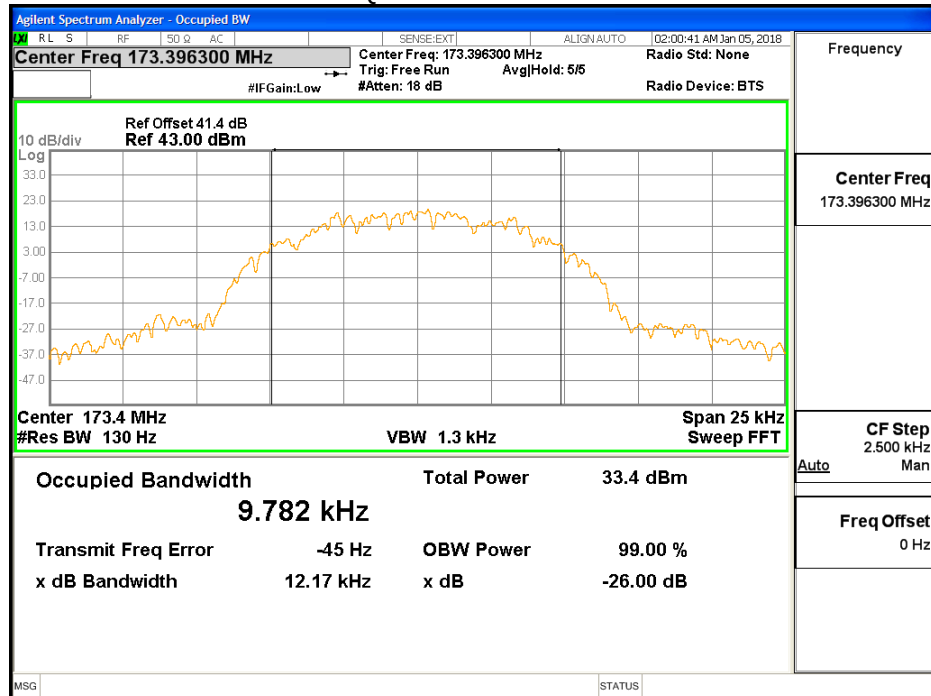
C4FM 173.39625 MHz



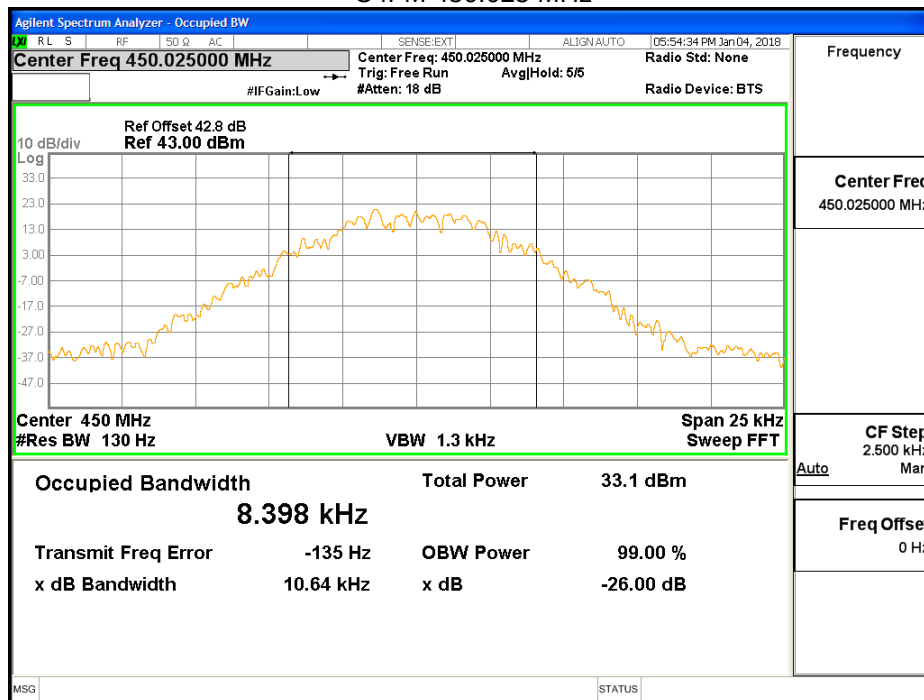
CQPSK 173.39625 MHz



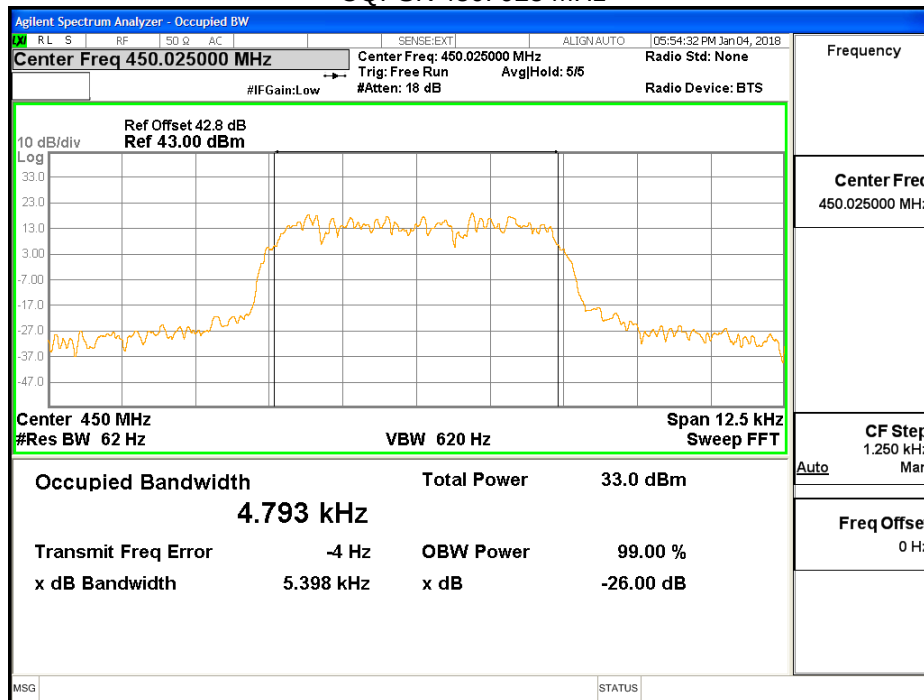
HDQPSK 173.39625 MHz



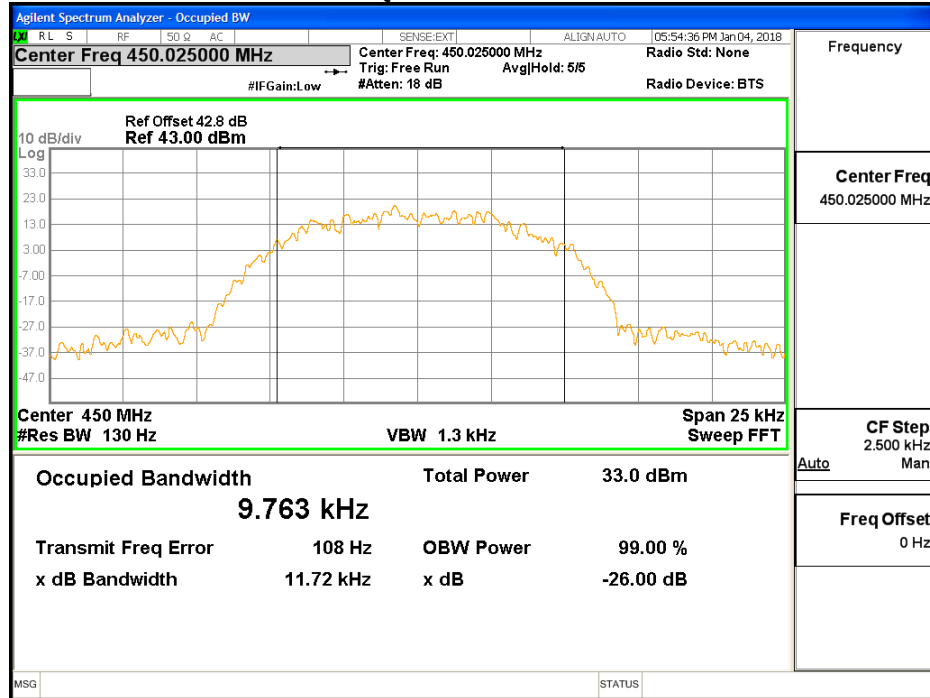
C4FM 450.025 MHz



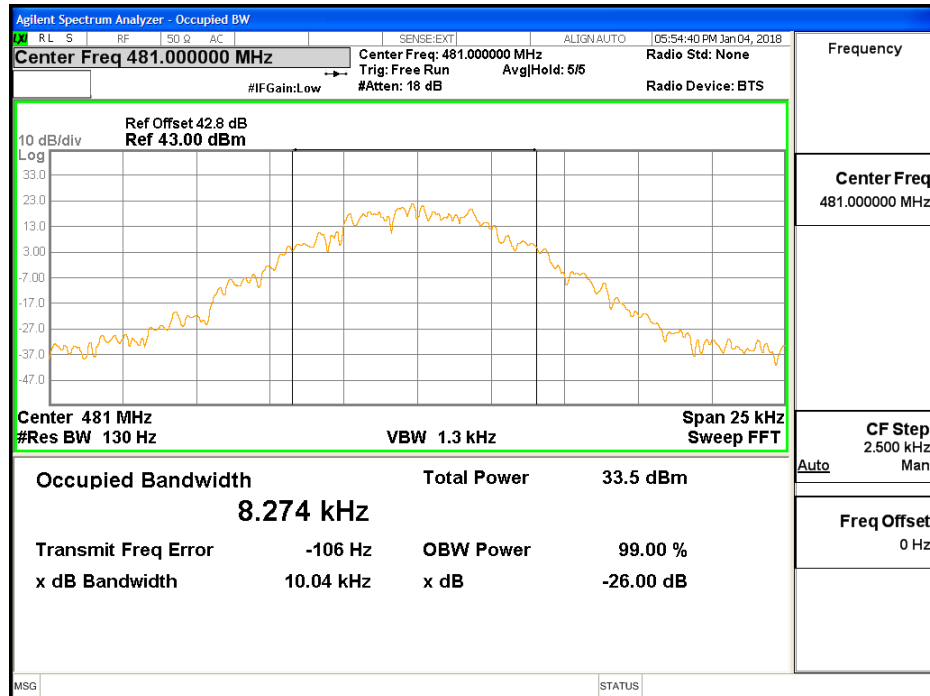
CQPSK 450.025 MHz



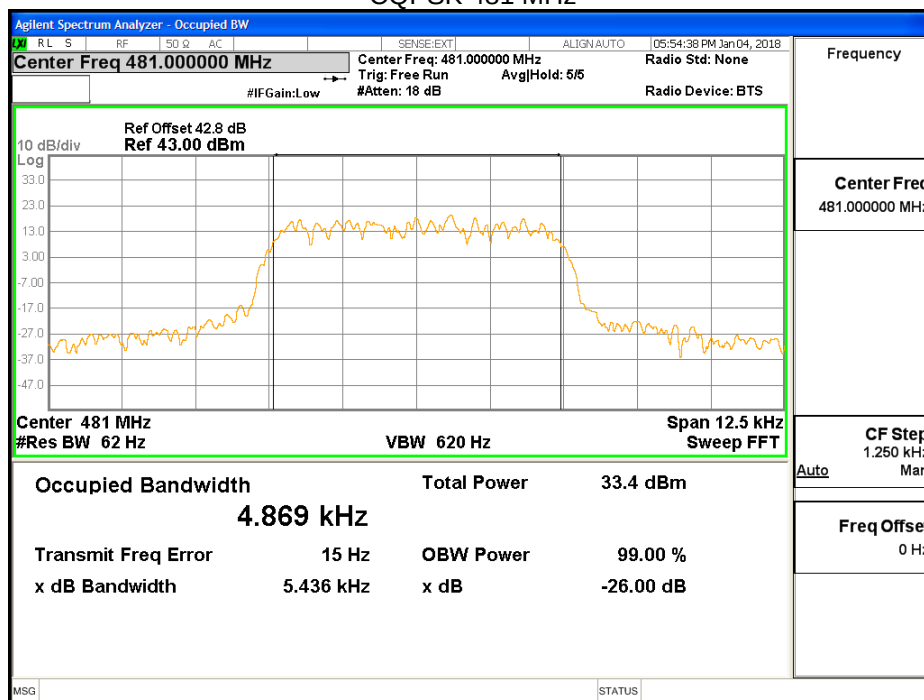
HDQPSK 450.025 MHz



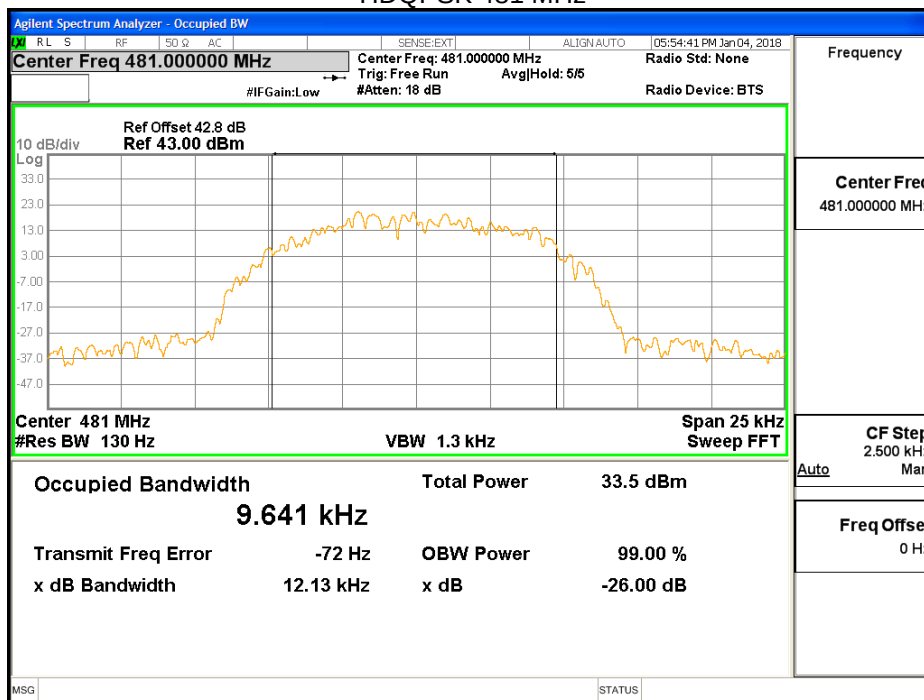
C4FM 481 MHz



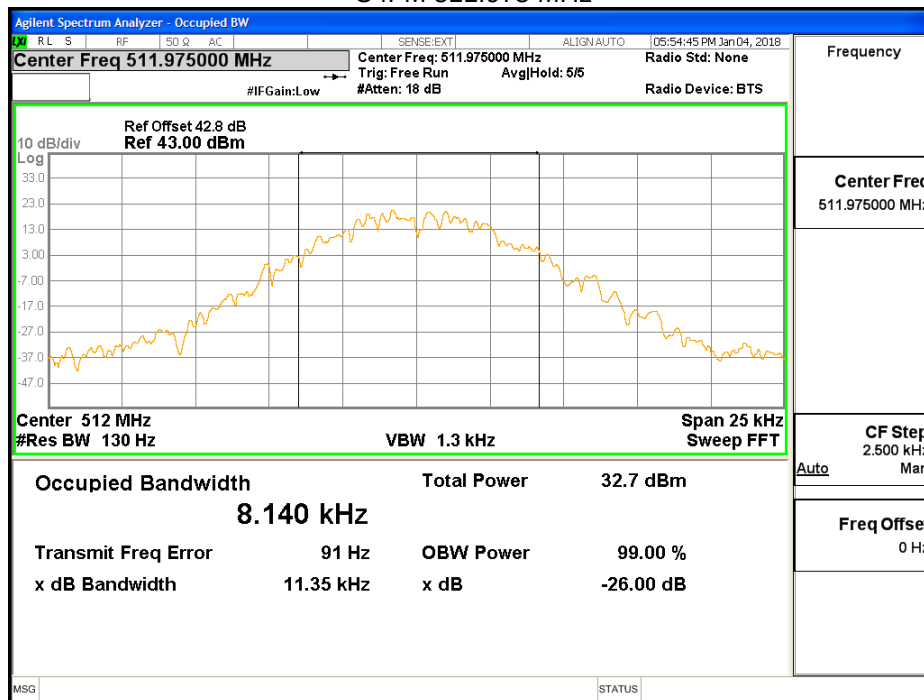
CQPSK 481 MHz



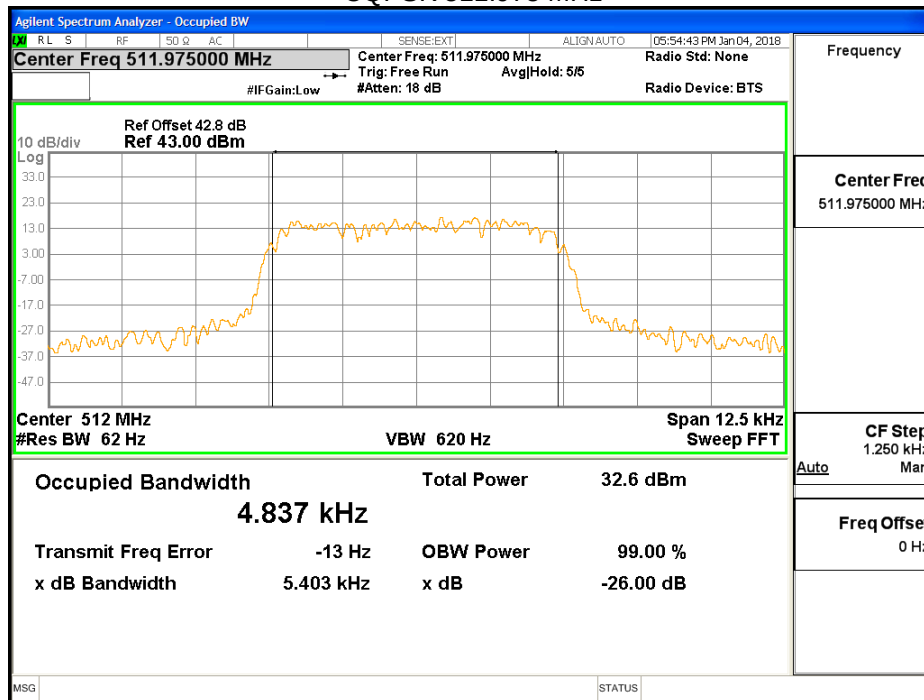
HDQPSK 481 MHz

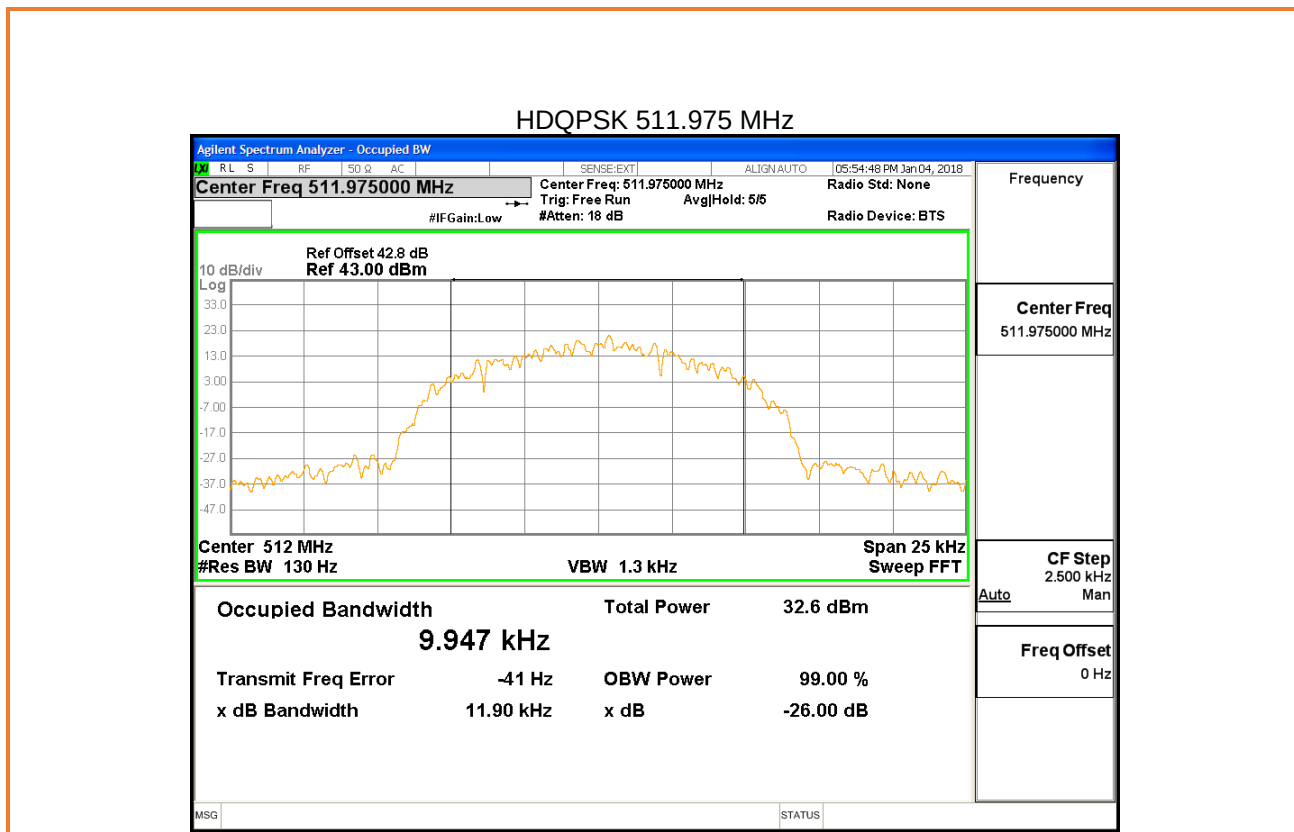


C4FM 511.975 MHz



CQPSK 511.975 MHz





Unwanted Emissions (Conducted)

Governing Doc	FCC Part 2 2.1046(a) FCC Part 90.210 RSS-131 Sec 6.4	Room Temperature (°C)	24
Test Procedure	ANSI/TIA-603- E-2016; FCC KDB 935210 D05 Indus Booster Basic Meas v01r02: October 27, 2017 RSS-131 Sec 4.4	Relative Humidity (%)	33.9
Test Location	Burnaby	Barometric Pressure (kPa)	101.3
Test Engineer	Sophie Piao/Jeremy Lee	Date	Jan 04, 2018
EUT Voltage	☒ DC ☐ 120VAC @ 60Hz		
Test Equipment Used	Manufacturer	Model	Serial Number
Signal Generator	Keysight	N5172B	MY53050270
Spectrum Analyzer	Keysight	N9010A	MY50520285
40dB Attenuator	Aeroflex Winschel	58-40-43	n/p
Calibration Calibration due 08/04/17 08/04/18 08/07/17 08/07/18 CVP CVP			
Note) CVP = Calibration Verification Performed internally, n/p = not provided.			
Frequency Range:	☒ 9 kHz – GHz		
Detector:	☒ Peak(for Formal)		
RBW/VBW:	☒ 1/10kHz for 9kHz – 150kHz; ☒ 10/100kHz for 150kHz – 30 MHz; ☒ 100/1000kHz for 30MHz – 1GHz; ☒ 1/50MHz for 1GHz – 9.4GHz		
Type of Facility:	☒ Testbench		
Distance:	☒ Direct Connection		
Arrangement of EUT:	☐ Table-top only ☐ Floor-standing only ☒ Rack Mounted		
No emission is higher than the -13 dBm emission limit.			
Compliant ☒ Non-Compliant ☐ Not Applicable ☐			

Test setup

Description of test set-up:

Unwanted emission was measured by connecting a Spectrum Analyzer to the RF output connector via 40dB Attenuator. The input power was adjusted to produce maximum output power on the antenna port and just below the AGC threshold. The CW input signal was set to the lowest channel, center channel and the highest channel of the EUT operating band.

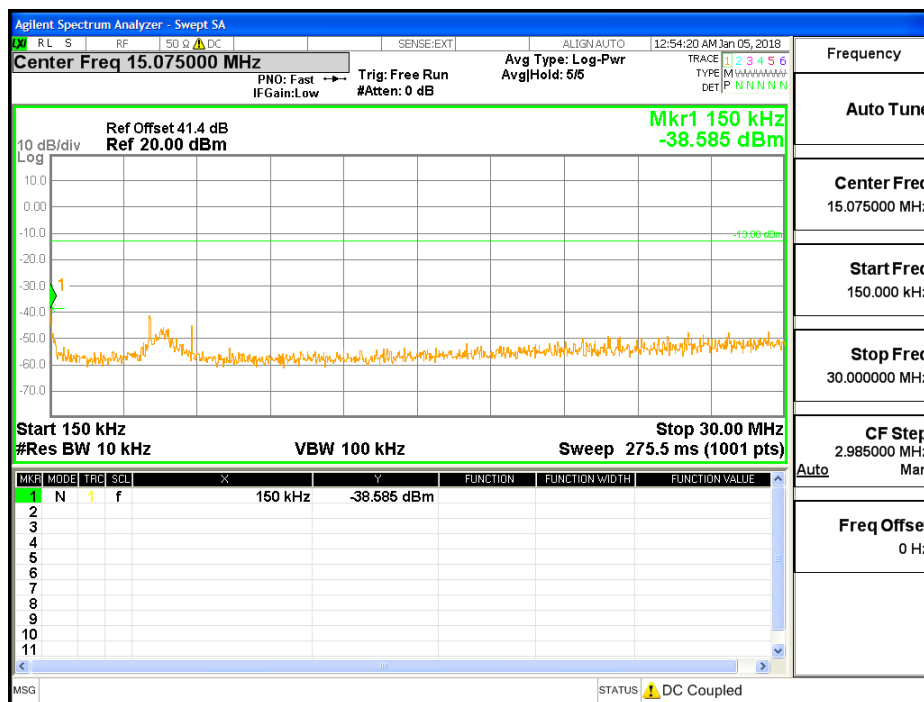
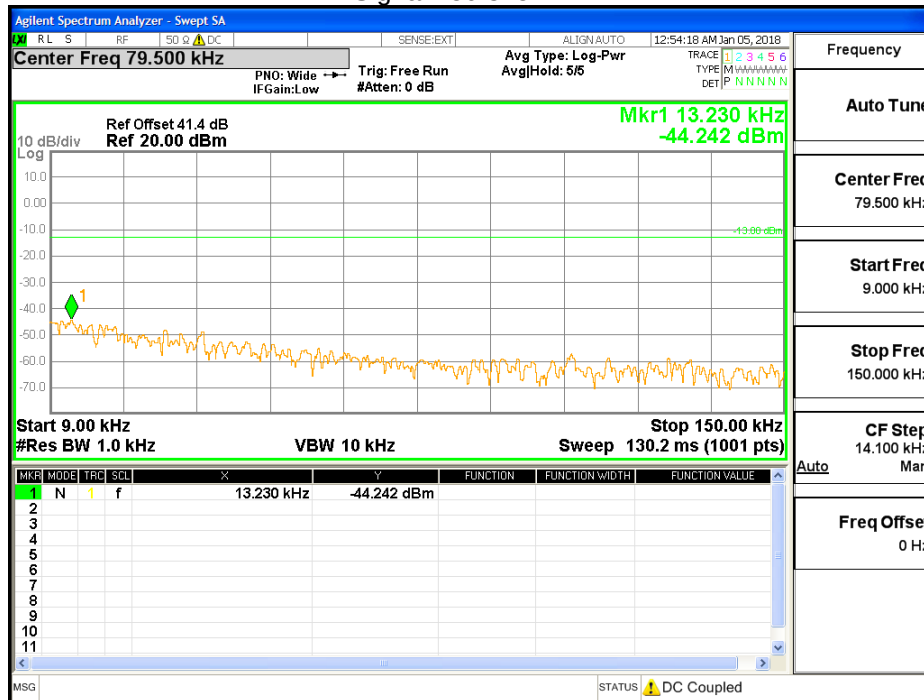
The EUT was set to **Operation Mode #1 with configuration Mode #1**.

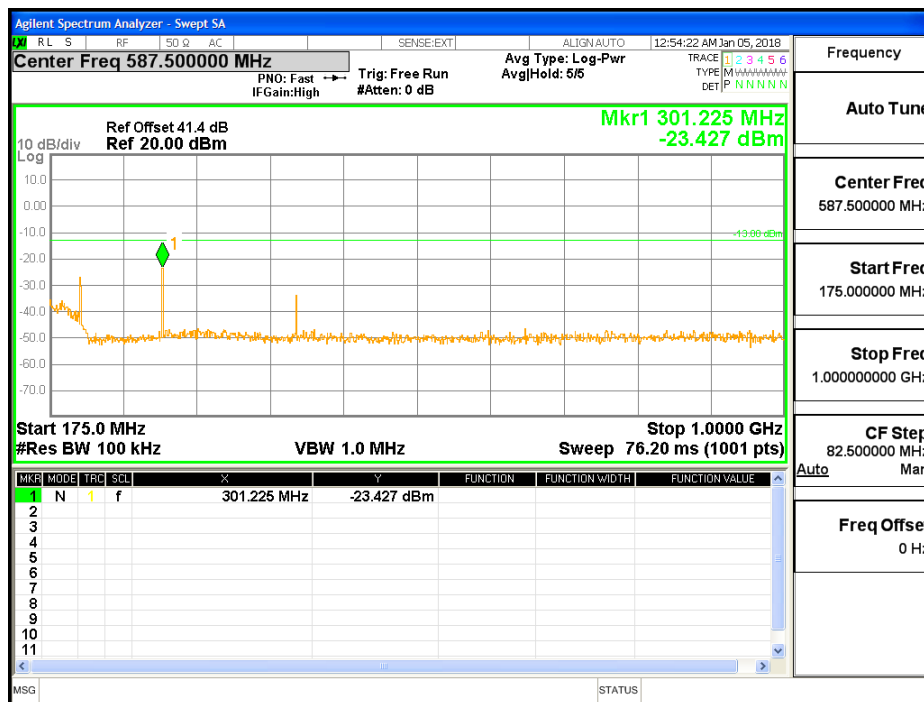
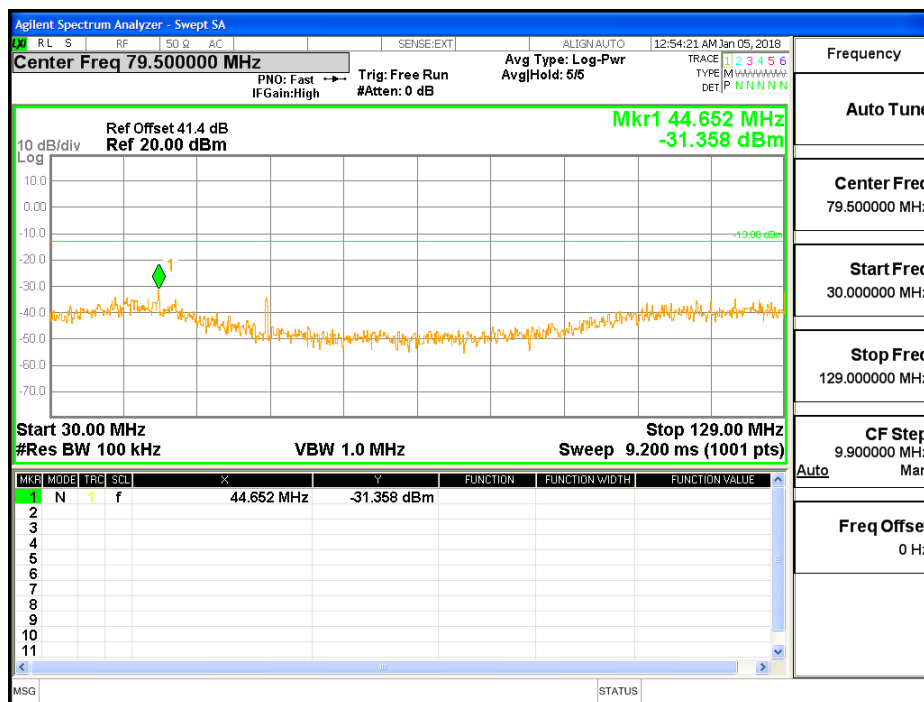


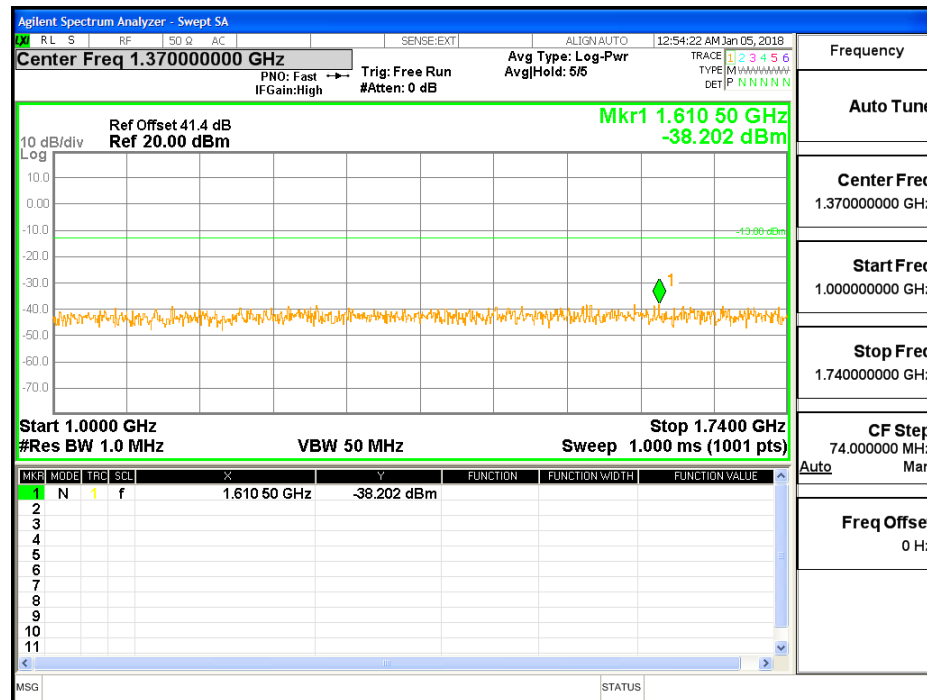
Results

At Input Power 0.5 dB below AGC threshold

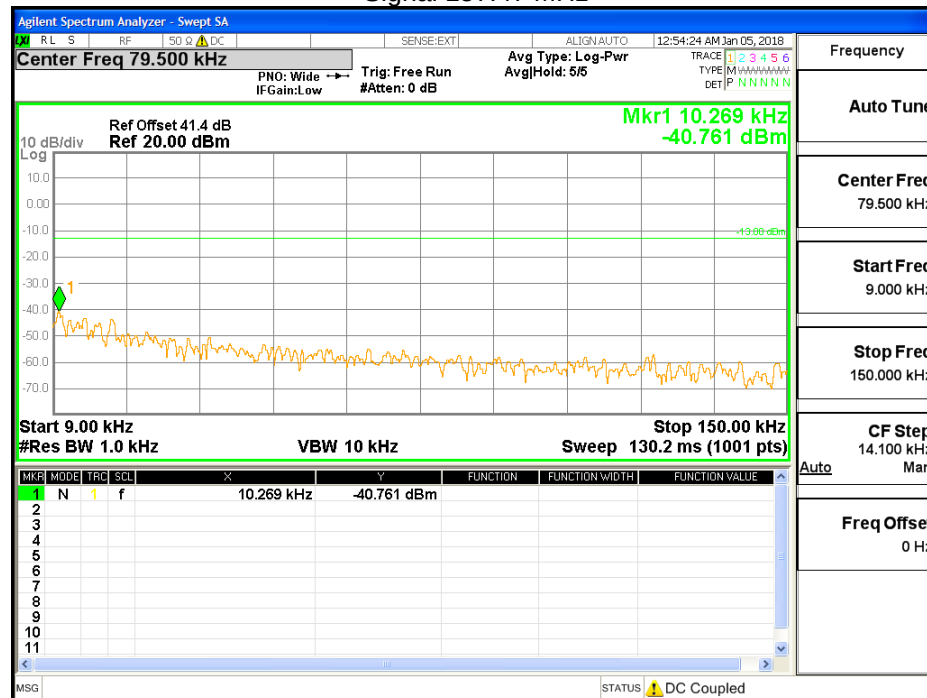
Signal 150.815 MHz

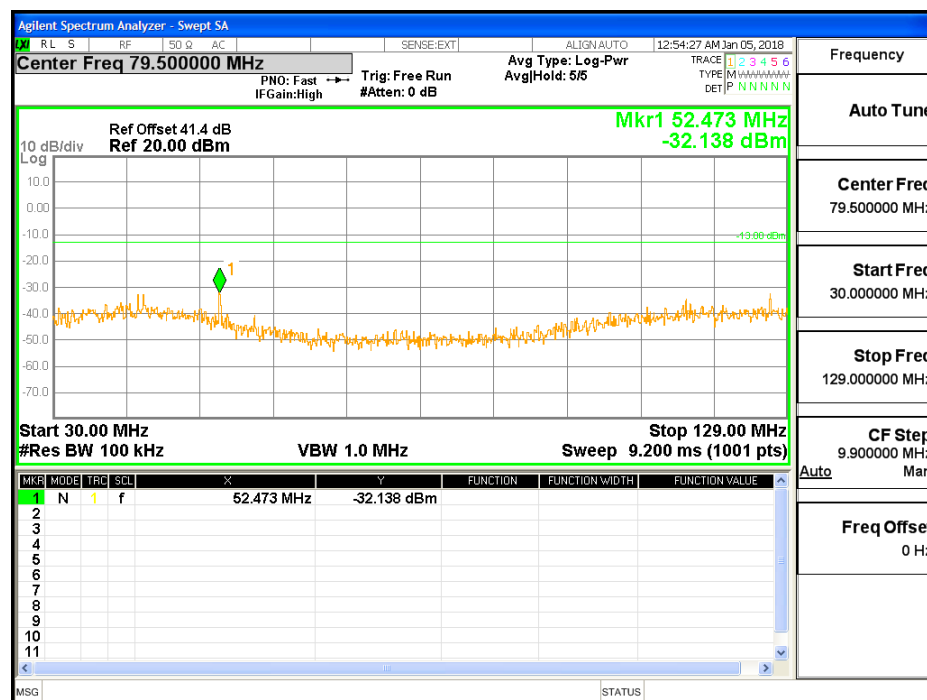
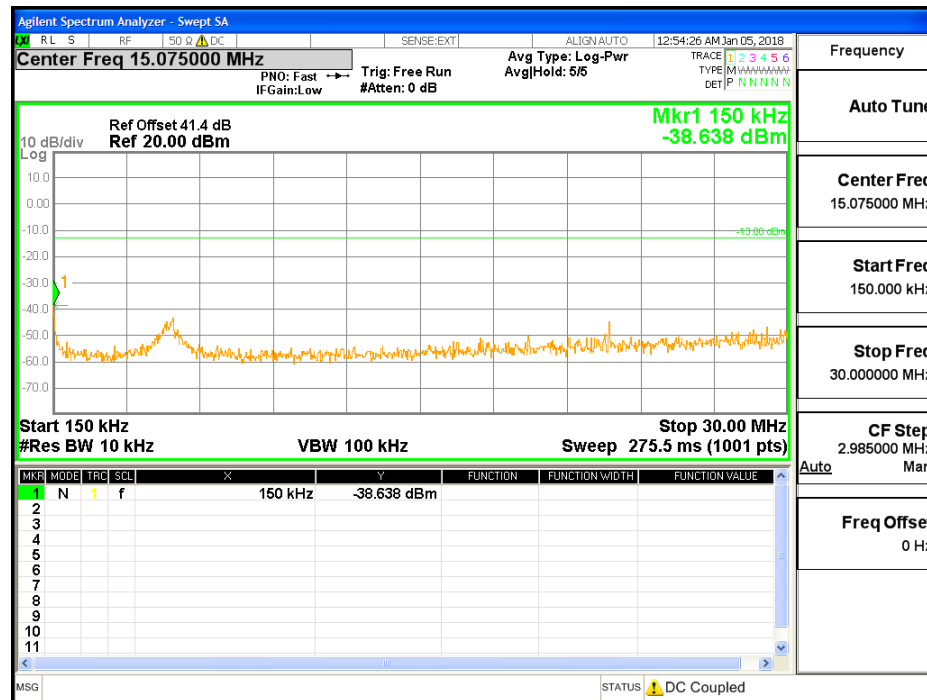


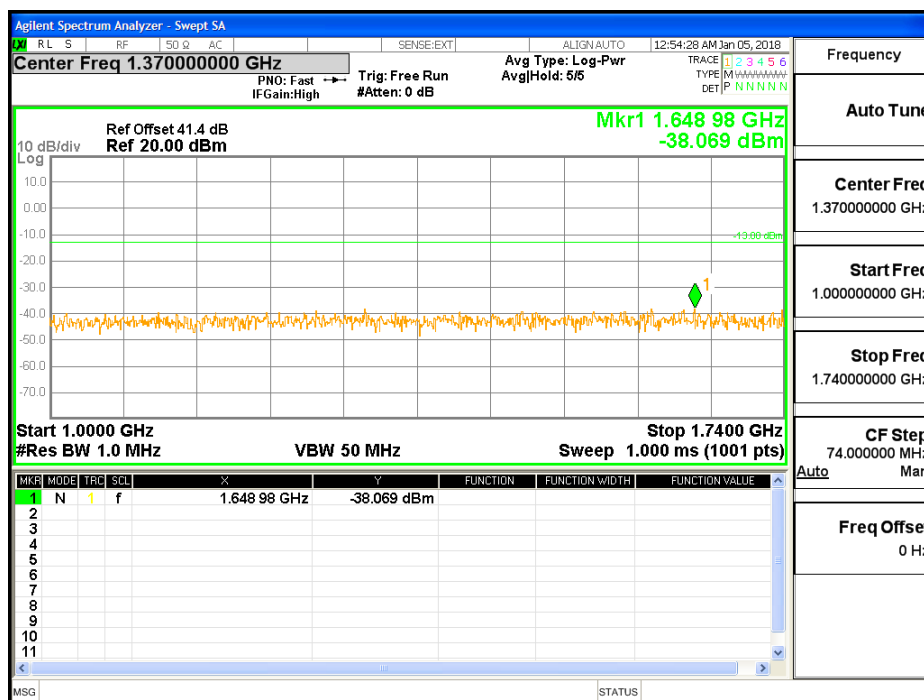
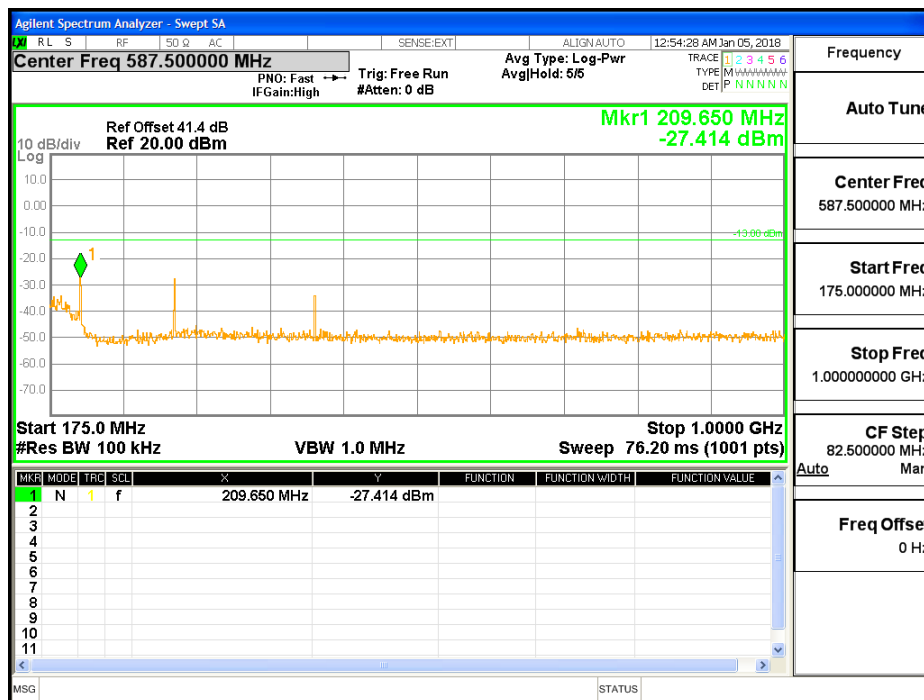




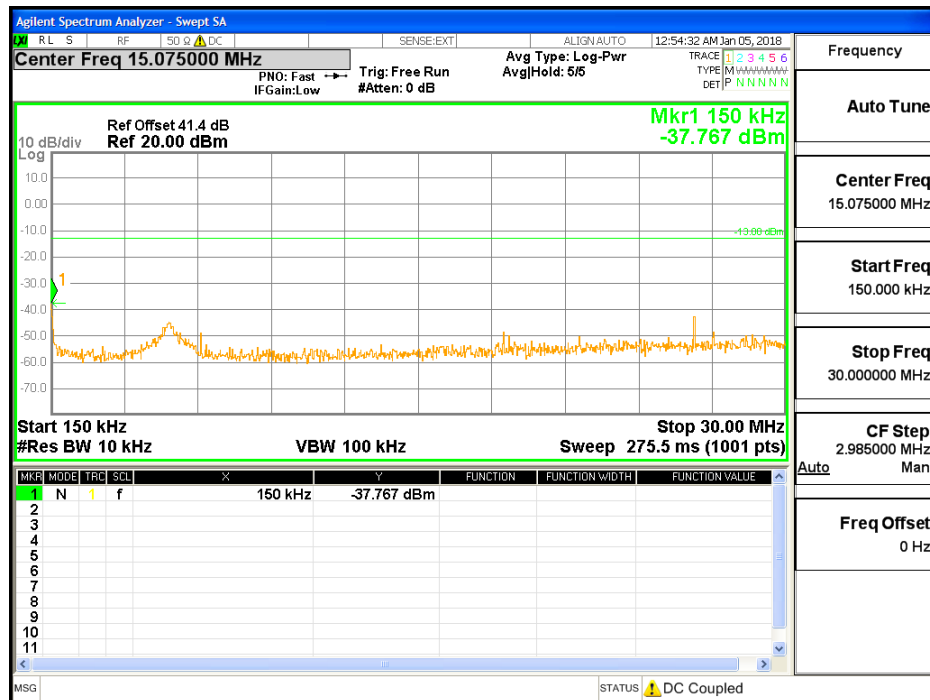
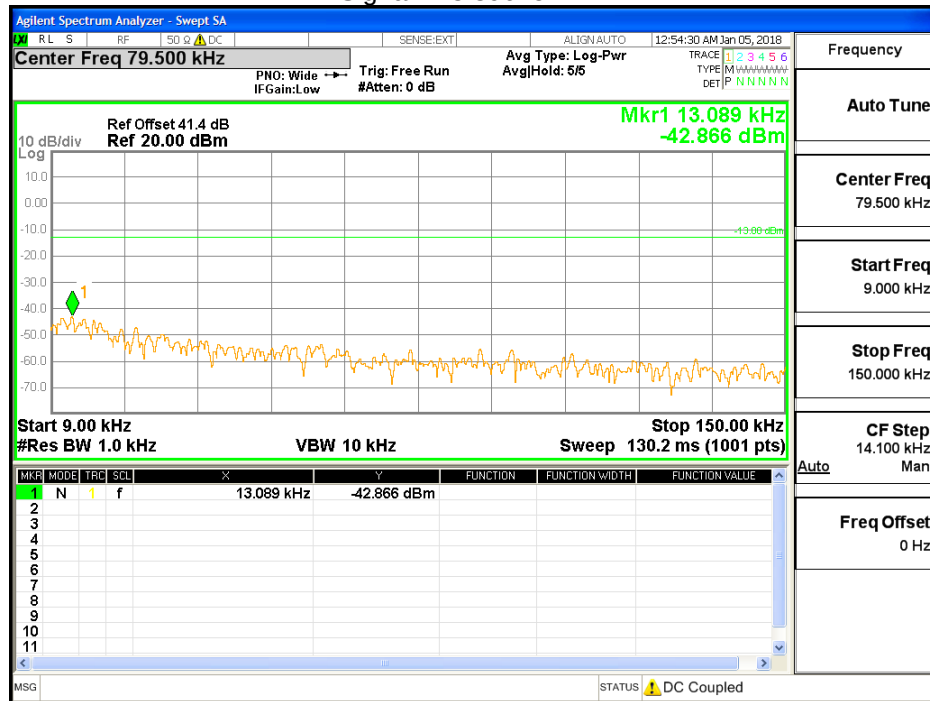
Signal 157.47 MHz

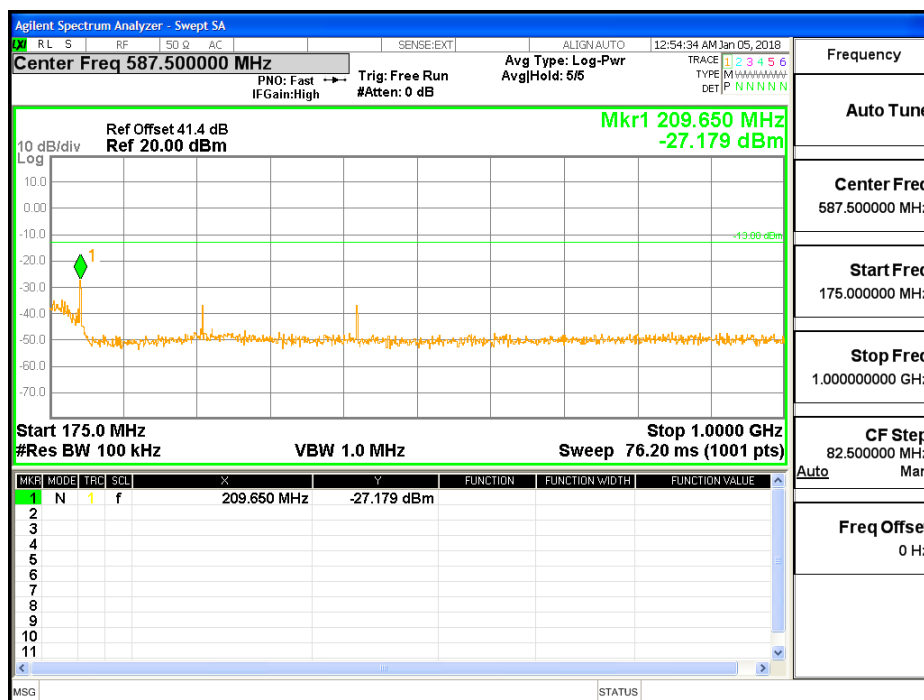
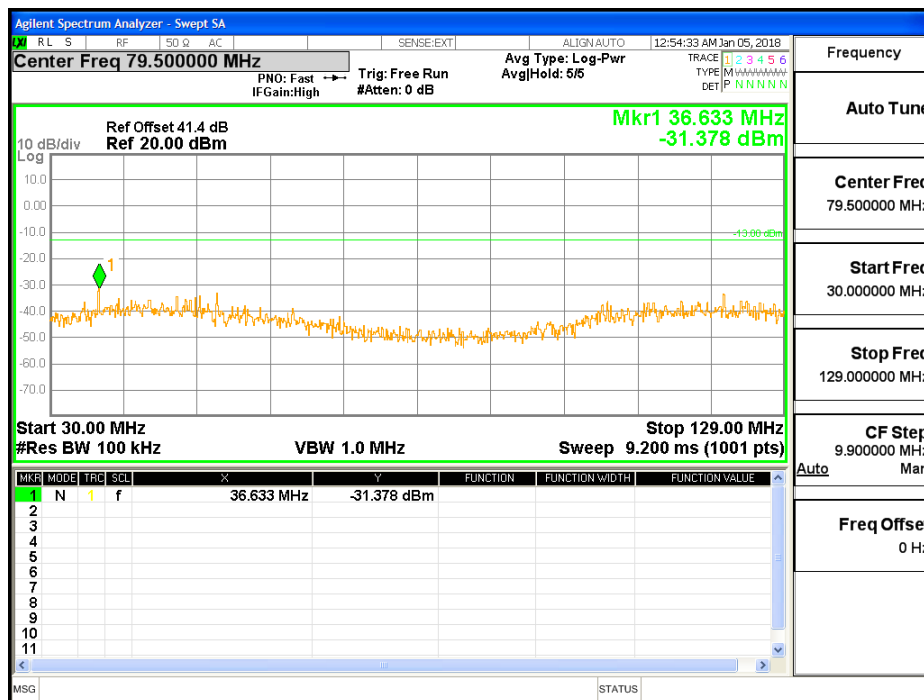


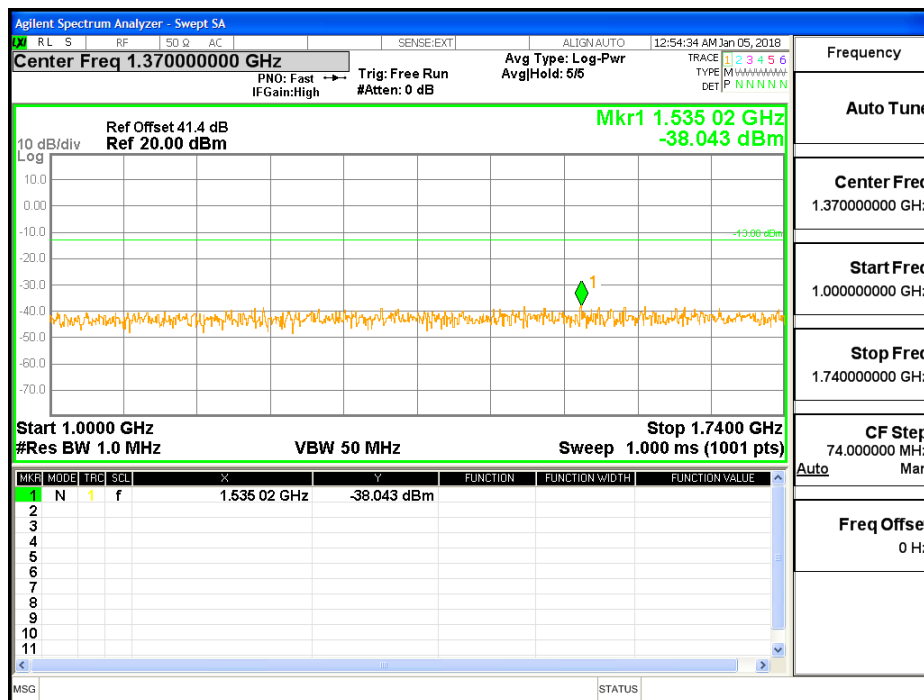




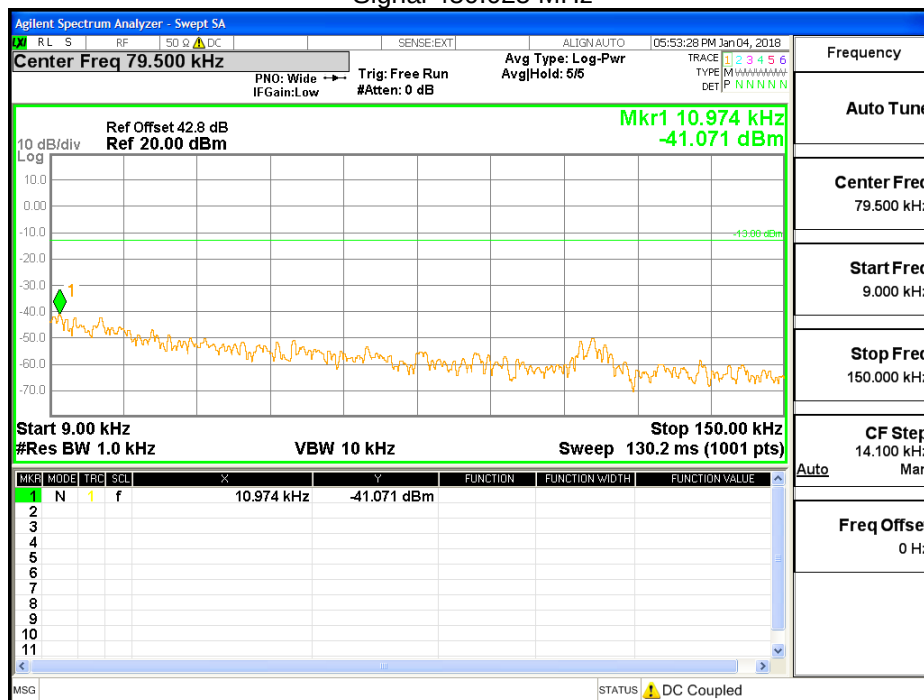
Signal 173.39625 MHz

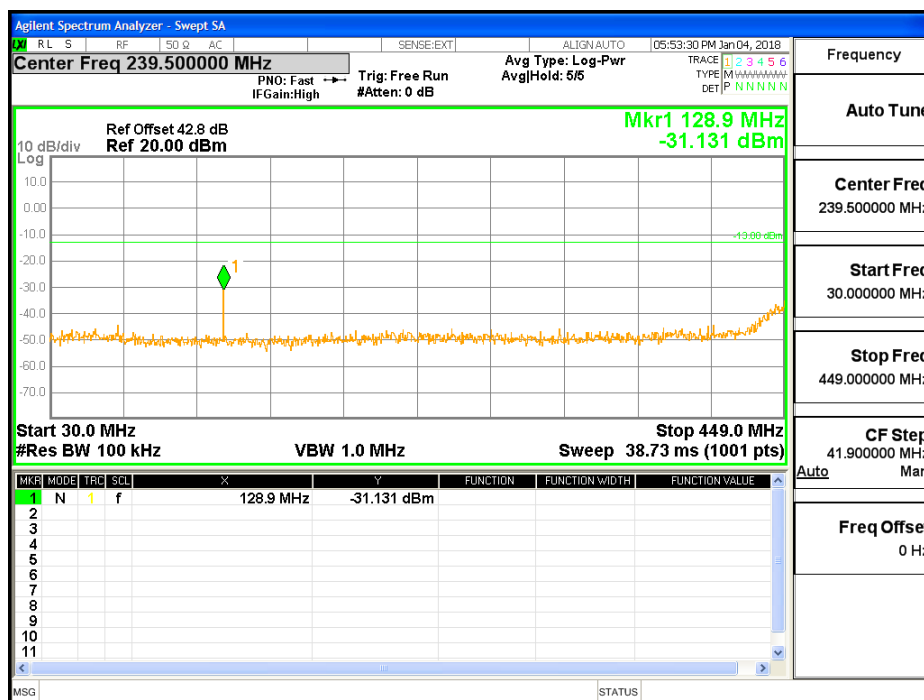
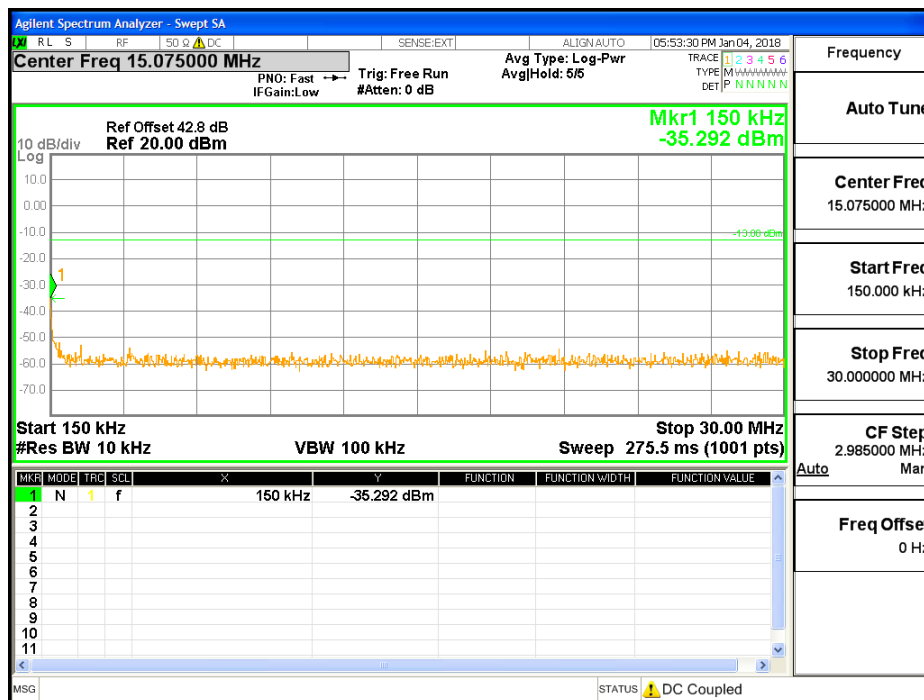


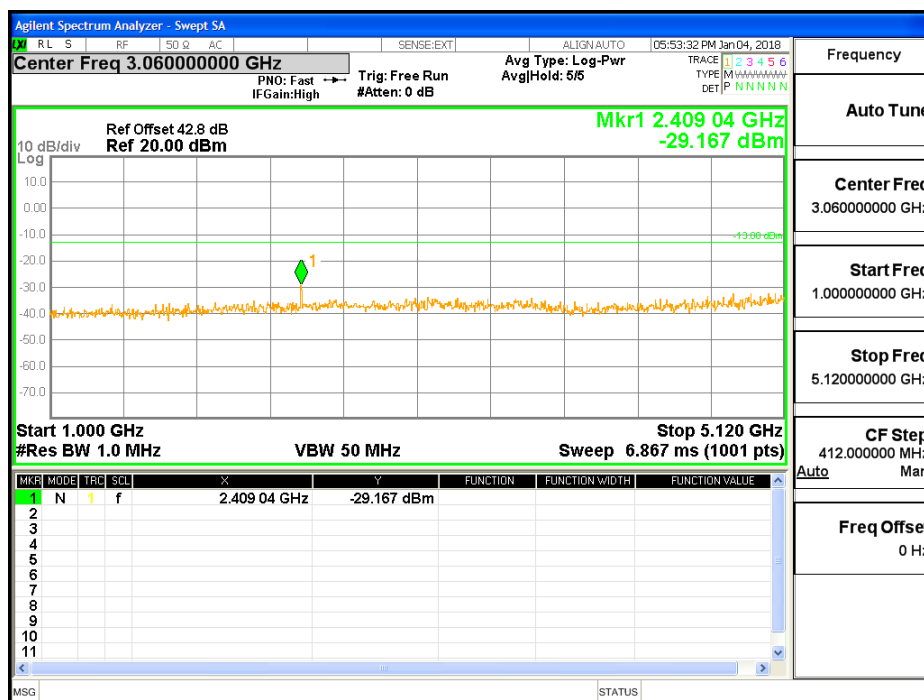
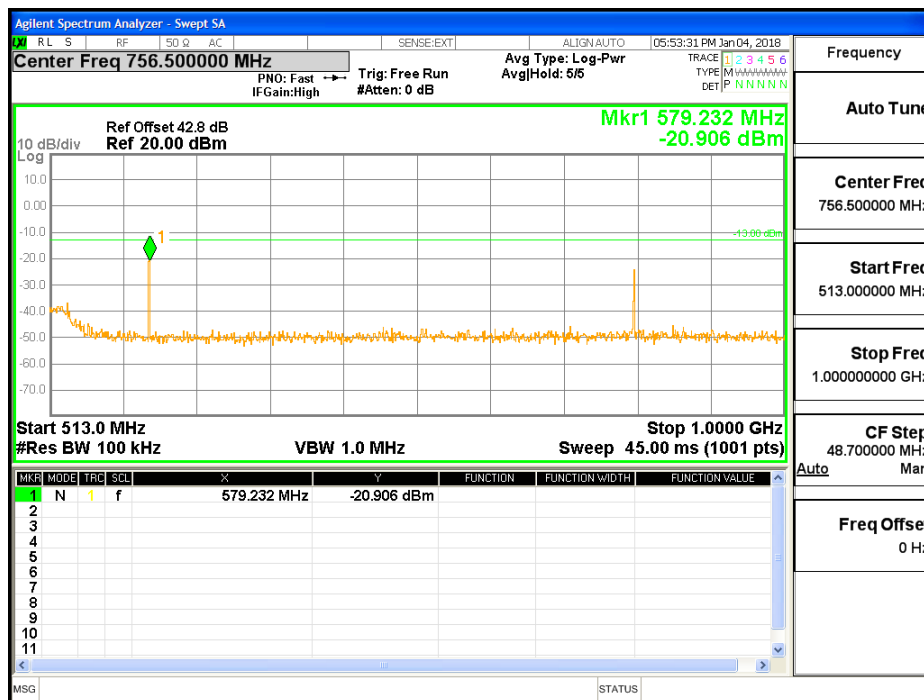




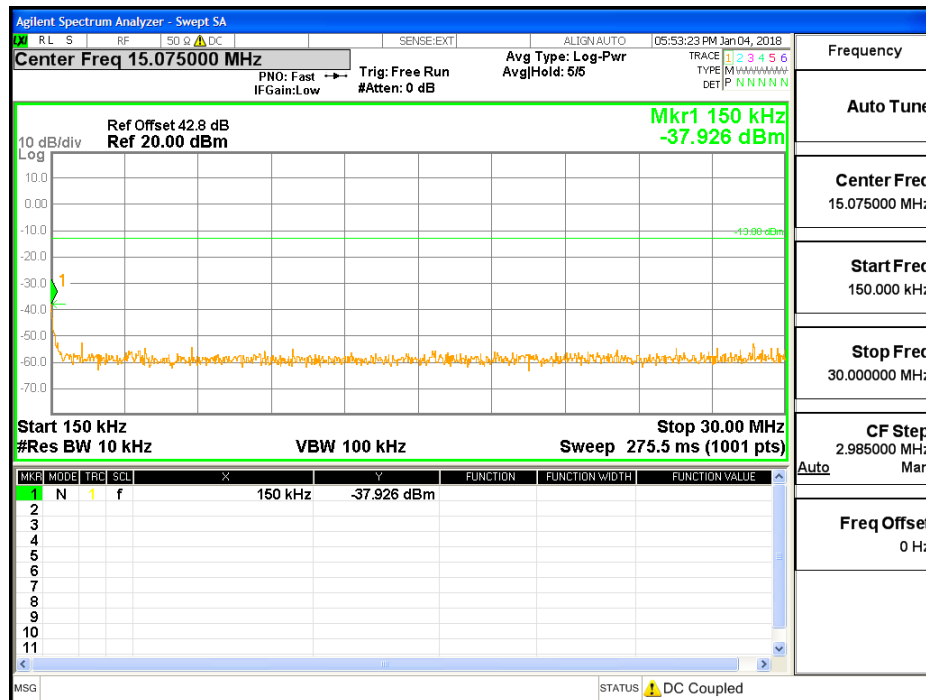
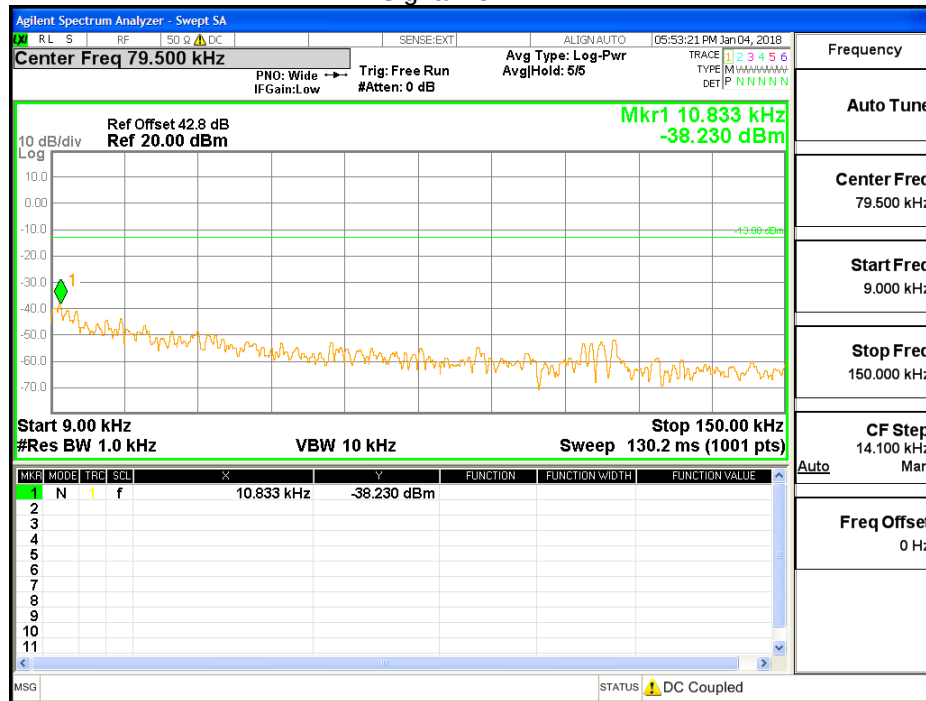
Signal 450.025 MHz

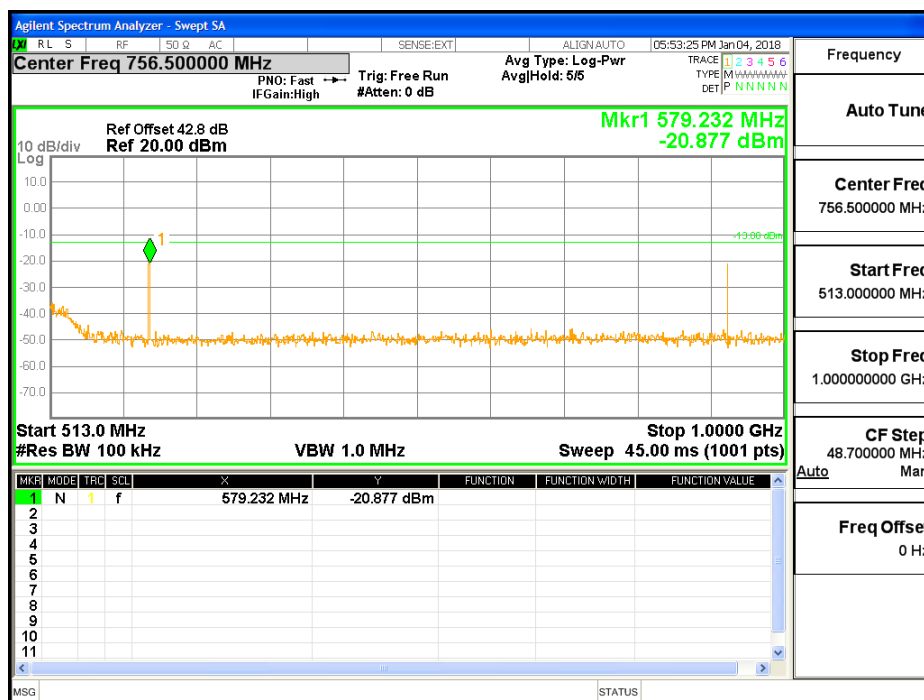
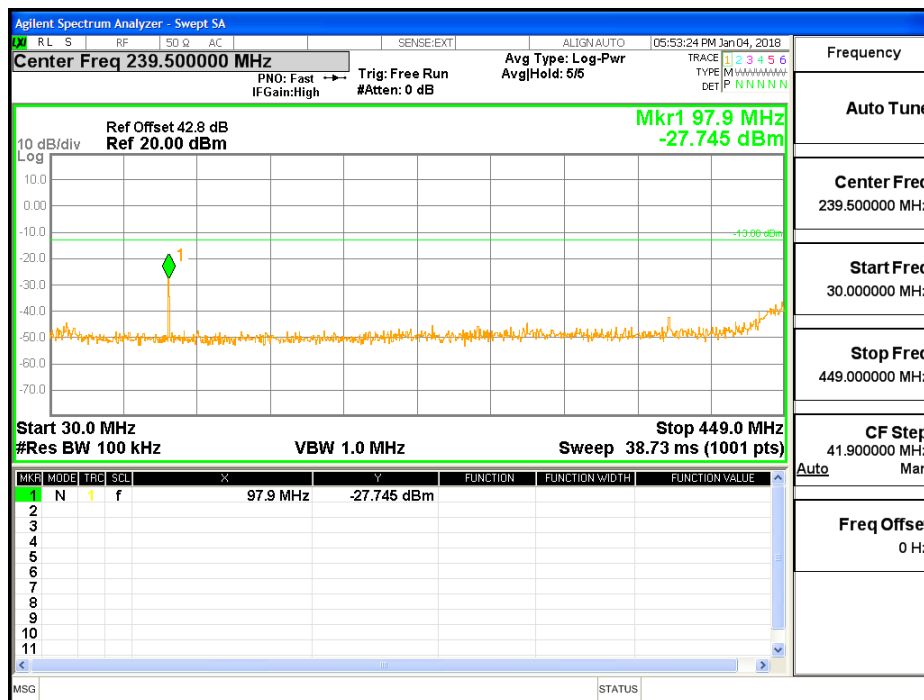


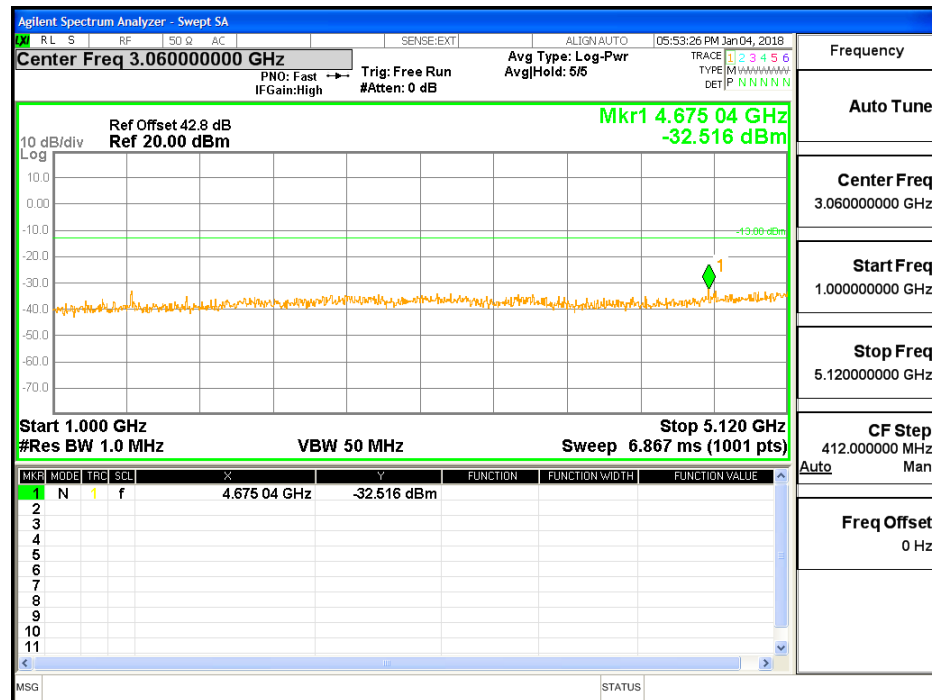




Signal 481 MHz







Signal 511.9875

