



# REPORT

For

## **Dali Wireless, Inc.**

535 Middlefield Road, Suite 280  
Menlo Park, CA 94025

Date: 14 February 2018  
Report No.: 16898-2E  
Revision No.: **1**  
Project No.: 16898  
Equipment: Single-band Medium Power Remote Unit  
Model No.: hd33-1-PS-D-20-2N-D0  
FCC ID: HCOHD331PSD20A

### ONE STOP GLOBAL CERTIFICATION SOLUTIONS



Unit 3128 – 20800 Westminster HWY, Richmond, BC  
V6V 2W3, Canada  
Phone: 604-247-0444  
Fax: 604-247-0442  
[www.labtestcert.com](http://www.labtestcert.com)

## 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 .....                  | 5  |
| Client Equipment Used During Test.....                                        | 6  |
| Software and Firmware .....                                                   | 7  |
| Input/Output Ports .....                                                      | 7  |
| Power Interface .....                                                         | 7  |
| EUT Operation Modes.....                                                      | 8  |
| EUT Configuration Modes .....                                                 | 8  |
| Test Equipment Verified for function .....                                    | 8  |
| Measurement Uncertainty .....                                                 | 8  |
| Result Summary.....                                                           | 9  |
| Radiated Emissions.....                                                       | 9  |
| Output Power (Conducted).....                                                 | 11 |
| Test setup .....                                                              | 12 |
| Results – Output Power FCC Requirement and IC Single Channel Requirement..... | 12 |
| <b>Results – Output Power IC Multi-Channel Requirement</b> .....              | 13 |
| Occupied Bandwidth.....                                                       | 15 |
| Test setup .....                                                              | 15 |
| <b>Results</b> .....                                                          | 16 |
| Unwanted Emissions (Conducted) .....                                          | 28 |
| Test setup .....                                                              | 29 |
| <b>Results</b> .....                                                          | 30 |
| Spectrum Emission Mask.....                                                   | 38 |
| Test setup .....                                                              | 38 |
| <b>Results</b> .....                                                          | 39 |
| Frequency Stability .....                                                     | 48 |
| Passband Gain and Bandwidth & Out of Band Rejection .....                     | 49 |
| Test setup .....                                                              | 50 |
| <b>Results</b> .....                                                          | 50 |
| Intermodulation.....                                                          | 51 |
| Test setup .....                                                              | 52 |
| <b>Results</b> .....                                                          | 53 |
| Input/output Power and Amplifier/Booster Gain .....                           | 54 |
| Test setup .....                                                              | 54 |
| <b>Results</b> .....                                                          | 55 |
| Noise Figure .....                                                            | 56 |
| Test setup .....                                                              | 56 |
| <b>Results</b> .....                                                          | 57 |
| Radiated Emissions - Enclosure .....                                          | 58 |
| Test setup .....                                                              | 58 |
| <b>Measurement Procedure</b> .....                                            | 61 |
| Test Result.....                                                              | 61 |
| Graphical Representation for Emission - Radiated 30kHz to 30MHz.....          | 61 |
| Graphical Representation for Emission - Radiated 30MHz to 1GHz.....           | 62 |
| Graphical Representation for Emission - Radiated 1 to 18GHz .....             | 63 |
| APPENDIX A: ISO 17025:2005 Accreditation Certificate .....                    | 64 |

| TEST REPORT_FCC Part 2, 90     |                                                                                                                            |                                                                                     |
|--------------------------------|----------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Private Land Mobile Services   |                                                                                                                            |                                                                                     |
| Report Reference No.....:      | 16898-2E                                                                                                                   |                                                                                     |
| Report Revision History.....:  | ✓ Rev. 0: 09 February 2018<br>✓ <a href="#">Rev. 1: 14 February 2018</a>                                                   |                                                                                     |
| Compiled by (+ signature)..... | Sophie Piao,                                                                                                               |  |
|                                | David Johanson                                                                                                             |   |
| Approved by (+ signature)..... | Jeremy Lee                                                                                                                 |  |
| Date of issue .....            | 14 February 2018                                                                                                           |                                                                                     |
| Total number of pages .....    | 67                                                                                                                         |                                                                                     |
|                                |                                                                                                                            |                                                                                     |
| FCC Site Registration No.:     | CA5970                                                                                                                     |                                                                                     |
| IC Site Registration No.:      | 5970A-2                                                                                                                    |                                                                                     |
| Testing Laboratory.....:       | LabTest Certification Inc.                                                                                                 |                                                                                     |
| Address .....                  | 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                                                                      |                                                                                     |
| Manufacturer's Name .....      | Dali Wireless (Canada) Inc.                                                                                                |                                                                                     |
| Address .....                  | 8618 Commerce Court, Burnaby, B.C. V5A 4N6, Canada                                                                         |                                                                                     |
| Test specification:            |                                                                                                                            |                                                                                     |
| Standards .....                | ➤ FCC Part 2; 2018<br>➤ FCC Part 90; 2018<br>➤ RSS-131<br>➤ RSS-GEN                                                        |                                                                                     |
| Test procedure .....           | ➤ ANSI/TIA-603- E-2016<br>➤ FCC KDB 935210 D05 Indus Booster Basic Meas v01r02: October 27, 2017<br>➤ RSS-131<br>➤ RSS-GEN |                                                                                     |
| Non-standard test method.....: | N/A                                                                                                                        |                                                                                     |

|                                                     |                                          |
|-----------------------------------------------------|------------------------------------------|
| Test Report Form(s) Originator .....                | Jeremy Lee                               |
| Master TRF .....                                    | 1036_Rev2 – RF Report Template           |
| <b>Test item description :</b>                      |                                          |
| Trade Mark .....                                    | hd33™                                    |
| Model/Type reference .....                          | hd33-1-PS-D-20-2N-D0                     |
| Serial Number .....                                 | 10911104RA1B79002                        |
| FCC ID .....                                        | HCOHD331PSD20A                           |
| IC ID .....                                         | n/p                                      |
| <b>Possible test case verdicts:</b>                 |                                          |
| - 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)                                 |
| <b>Testing:</b>                                     |                                          |
| Date of receipt of test item .....                  | 19 October, 2017                         |
| Date (s) of performance of tests.....               | October 20, 2017 & January 18 - 29, 2018 |

## Revision History

| Revision | Date          | Reason For Change                      | Author(s)                   |
|----------|---------------|----------------------------------------|-----------------------------|
| 0        | 09 Feb., 2018 | Initial Data                           | Sophie Piao, David Johanson |
| 1        | Feb. 14, 2018 | Correction some info. Requested by TCB | Jeremy Lee                  |

## Device Under Test Description

|                                         |                                                  |
|-----------------------------------------|--------------------------------------------------|
| Application for .....                   | PS 150 Remote Unit, Single Band Medium Power DAS |
| Passing Transmit/Receive Frequency .... | 130 MHz – 174 MHz                                |
| Operating Transmit/Receive Frequency    | 150.8 MHz – 156.2475 MHz                         |
| FCC .....                               | 157.1875 MHz – 161.575 MHz                       |
|                                         | 161.775 MHz – 161.9625 MHz                       |
|                                         | 162. 0375 MHz – 173.4 MHz                        |
| Operating Transmit/Receive Frequency    | 138 MHz – 144 MHz                                |
| Industrial Canada .....                 | 148 MHz – 174 MHz                                |
| Number of Channels .....                | As many as which can fit                         |
| Rated RF Output(e.i.r.p.) .....         | 37 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) .....  | < 27,000g                                                                                                                                                                                                                                                                                                                                                  |
| Dimension(W X D X H)         | 434 mm X 220 mm X 696 mm                                                                                                                                                                                                                                                                                                                                   |
| <b>Nominal Voltages for:</b> | <u>48 V</u> stand-alone equipment<br><u>48 V</u> combined (or host) equipment                                                                                                                                                                                                                                                                              |
| Supply Voltage:              | _____ AC _____ Amps<br><u>48V</u> DC <u>2.5</u> Amps                                                                                                                                                                                                                                                                                                       |
| If DC Power:                 | <input type="checkbox"/> Internal Power Supply<br><input checked="" type="checkbox"/> External Power Supply<br><input type="checkbox"/> Battery<br><input type="checkbox"/> Nickel Cadmium<br><input type="checkbox"/> Alkaline<br><input type="checkbox"/> Nickel-Metal Hydride<br><input type="checkbox"/> Lithium-Ion<br><input type="checkbox"/> Other |

## Program details

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                              |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|
| <b>Summary of testing:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                              |
| <b>Tests performed (name of test and test clause):</b><br><b>Conducted Measurement</b><br><b>Radiated Emissions on Enclosure</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <b>Testing location:</b><br><b>Client Site as Witness Testing</b><br><b>In SAC, Richmond</b> |
| <p>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.</p> <p>Based on the results of our investigation, we have concluded the product tested <b>complies</b> 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.</p> |                                                                                              |

## Description of Equipment Under Test and Variant Models

|                                                                                                                                                                                           |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Description:</b><br>The hd33 150PS is a single-band remote unit that provides 5 W of output power on VHF band. The single-band unit supports one band in a type 2 sealed chassis door. |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

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 filter. The RF signals are converted into a digital data stream and then delivered over optical fiber to an 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 airHost was connected as the Auxiliary device. 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.

NONE

**Client Equipment Used During Test**

| Use* | Product Type | Manufacturer       | Model                | Comments                                                               |
|------|--------------|--------------------|----------------------|------------------------------------------------------------------------|
| EUT  | hd33, 150PS  | Dali Wireless Inc. | hd33-1-PS-D-20-2N-D0 | EUT where the RF (I/O) antenna attached via a duplexer when necessary. |

|                                                                                                                                     |                            |                    |                      |                                                                                                            |
|-------------------------------------------------------------------------------------------------------------------------------------|----------------------------|--------------------|----------------------|------------------------------------------------------------------------------------------------------------|
| AE1                                                                                                                                 | <i>airHost33, 150PS</i>    | Dali Wireless Inc. | AH33-1-PS-D-20-2N-D0 | Auxiliary equipment, which is the front end of signal booster system air interfaced to donor Base Station. |
| AE2                                                                                                                                 | <i>Dali Matrix Console</i> | Dali Wireless Inc. | UBiT-CP              | Auxiliary equipment provides the configuration and control interface to airHost and <i>hd33</i> .          |
| Abbreviations:<br>EUT - Equipment Under Test,<br>AE - Auxiliary/Associated Equipment, or<br>SIM - Simulator (Not Subjected to Test) |                            |                    |                      |                                                                                                            |

## Software and Firmware

| Use*                                                                                                                                | Description        | Version       |
|-------------------------------------------------------------------------------------------------------------------------------------|--------------------|---------------|
| EUT                                                                                                                                 | Software installed | 2.1.2-rc1.252 |
| AE1                                                                                                                                 | Software installed | 2.1.2-rc1.252 |
| AE2                                                                                                                                 | Software installed | 2.1.2-rc1.252 |
| Abbreviations:<br>EUT - Equipment Under Test,<br>AE - Auxiliary/Associated Equipment, or<br>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                                                                                                                                                                        | RF Input Ports          | I/O   | No             | No             | N-Type Coaxial            |
| 3                                                                                                                                                                        | RF Output Ports         | I/O   | No             | No             | N-Type Coaxial            |
| 4                                                                                                                                                                        | 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<br>I/O = Signal Input or Output Port (Not Involved in Process Control)<br>TP = Telecommunication Ports |                         |       |                |                |                           |

## Power Interface

| Mode | Voltage | Current | Power | Frequency | Phases | Comments |
|------|---------|---------|-------|-----------|--------|----------|
|------|---------|---------|-------|-----------|--------|----------|

| # | (V) | (A) | (W) | (DC/AC-Hz) | (#) |  |
|---|-----|-----|-----|------------|-----|--|
| 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;<br>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 | ± 4.93 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<br>FCC Part 90.219                     | ANSI TIA-603-E-2016                               | Compliant |
| Unwanted Emissions (Transmitter Conducted)    | FCC Part 2 2.1046(a)<br>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<br>- Enclosure             | FCC Part 2.1053,<br>FCC Part 90.210<br>& FCC Part 90.219 | ANSI C63.4:2014 & ANSI TIA-603-D                  |           |

| 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 |

Prepared by: LabTest Certification Inc.  
Date Issued: 14 February 2018  
Project No.: 16898

Client: Dali Wireless, Inc.  
Report No.: 16898-2E  
Revision No.: 1

|                             |                 |                 |           |
|-----------------------------|-----------------|-----------------|-----------|
| 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)<br>FCC Part 90.219(d)<br>RSS-131 Sec 6.2                                                                         | Room Temperature (°C)     | 23.6          |
| Test Procedure                                                                                                                                                                                                               | ANSI/TIA-603- E-2016;<br>FCC KDB 935210 D05,<br>v01r02;<br>RSS-131 Sec 4.3                                                            | Relative Humidity (%)     | 29.7          |
| Test Location                                                                                                                                                                                                                | Burnaby                                                                                                                               | Barometric Pressure (kPa) | 100.5         |
| Test Engineer                                                                                                                                                                                                                | Sophie Piao/Jeremy Lee                                                                                                                | Date                      | Jan 24, 2018  |
| EUT Voltage                                                                                                                                                                                                                  | <input checked="" type="checkbox"/> DC <input type="checkbox"/> 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<br>08/04/17      08/04/18<br>08/07/17      08/07/18<br>CVP              CVP                                                                                                                                      |                                                                                                                                       |                           |               |
| Note) CVP = Calibration Verification Performed internally, n/p = not provided.                                                                                                                                               |                                                                                                                                       |                           |               |
| Frequency Range:                                                                                                                                                                                                             | <input checked="" type="checkbox"/>                                                                                                   |                           |               |
| Detector:                                                                                                                                                                                                                    | <input checked="" type="checkbox"/> Peak                                                                                              |                           |               |
| Type of Facility:                                                                                                                                                                                                            | <input checked="" type="checkbox"/> Test bench                                                                                        |                           |               |
| Distance:                                                                                                                                                                                                                    | <input checked="" type="checkbox"/> Direct                                                                                            |                           |               |
| Arrangement of EUT:                                                                                                                                                                                                          | <input type="checkbox"/> Table-top only <input type="checkbox"/> Floor-standing only <input checked="" type="checkbox"/> Rack Mounted |                           |               |
| Output Power is less than 37 dBm in band 150.<br>The output total power of active dual channels is compressed to the same level due to the ALC control.<br>Each channel power is accordingly 3 dB down from the total power. |                                                                                                                                       |                           |               |
| Compliant <input checked="" type="checkbox"/> Non-Compliant <input type="checkbox"/> Not Applicable <input type="checkbox"/>                                                                                                 |                                                                                                                                       |                           |               |

### 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.



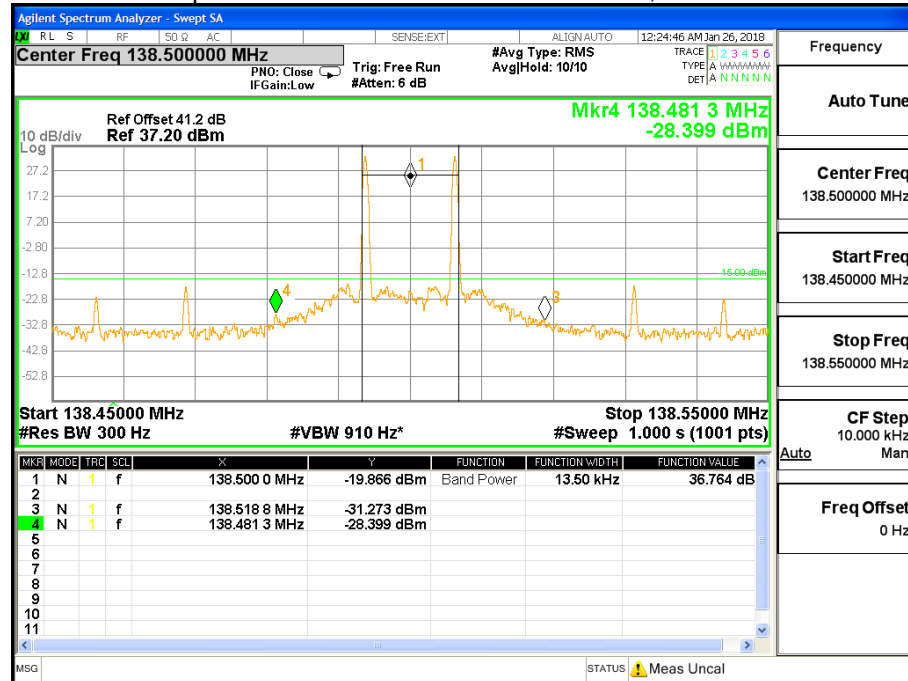
### Results – Output Power FCC Requirement and IC Single Channel Requirement

| Frequency (MHz) | Input Power Trip ALC (dBm) | Output Power (dBm) | Limit (37dBm) |
|-----------------|----------------------------|--------------------|---------------|
| 150.815         | -54                        | 37                 | PASS          |
| 157.47          | -54.5                      | 37                 | PASS          |
| 161.79          | -54.5                      | 36.7               | PASS          |
| 173.39625       | -54.5                      | 36.3               | PASS          |

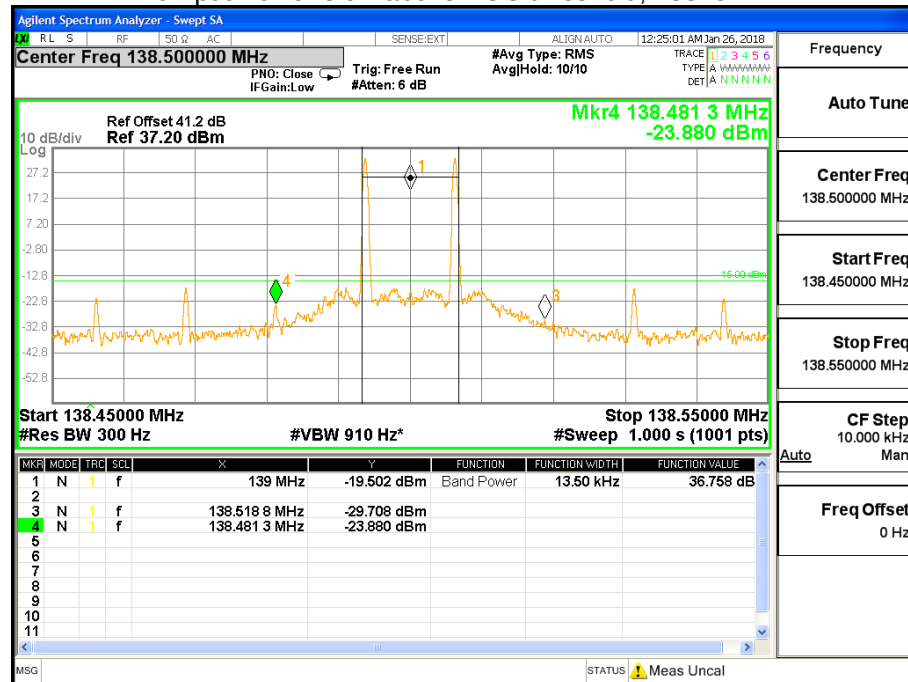
## Results – Output Power IC Multi-Channel Requirement

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.

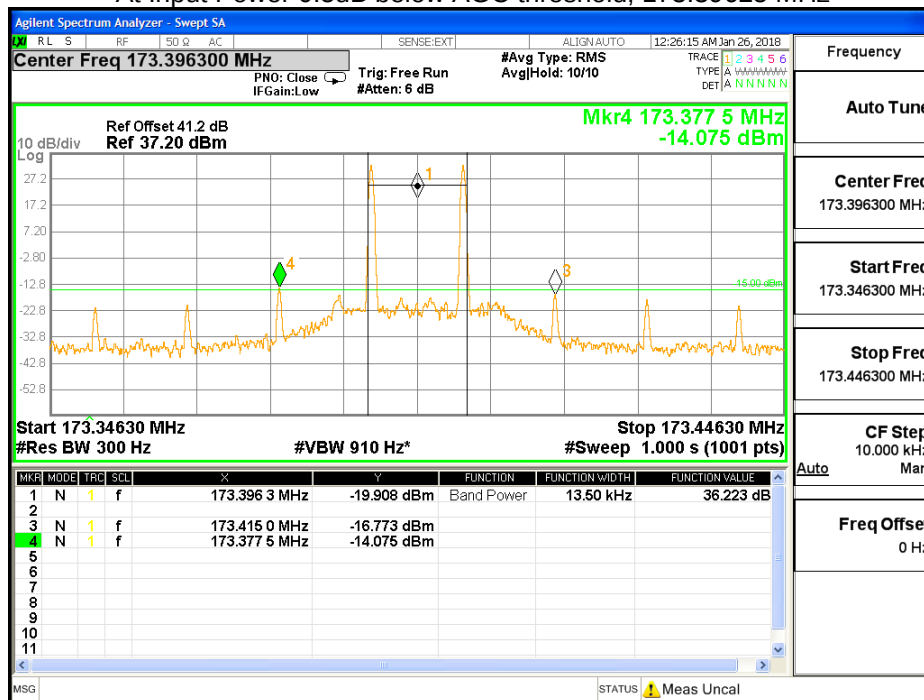
At Input Power 0.5dB below AGC threshold, 138.5 MHz



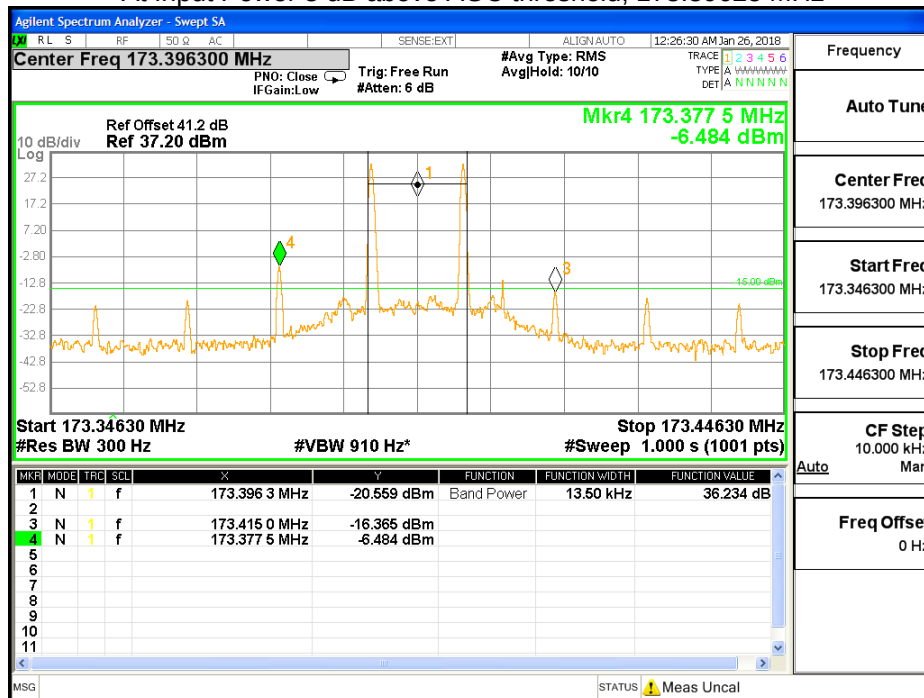
At Input Power 3 dB above AGC threshold; 138.5 MHz



At Input Power 0.5dB below AGC threshold, 173.39625 MHz



At Input Power 3 dB above AGC threshold; 173.39625 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 (%)     | 41            |
| Test Location       | Burnaby                                                                       | Barometric Pressure (kPa) | 100.5         |
| Test Engineer       | Sophie Piao/Jeremy Lee                                                        | Date                      | Jan 29, 2018  |
| EUT Voltage         | <input checked="" type="checkbox"/> DC <input type="checkbox"/> 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.**

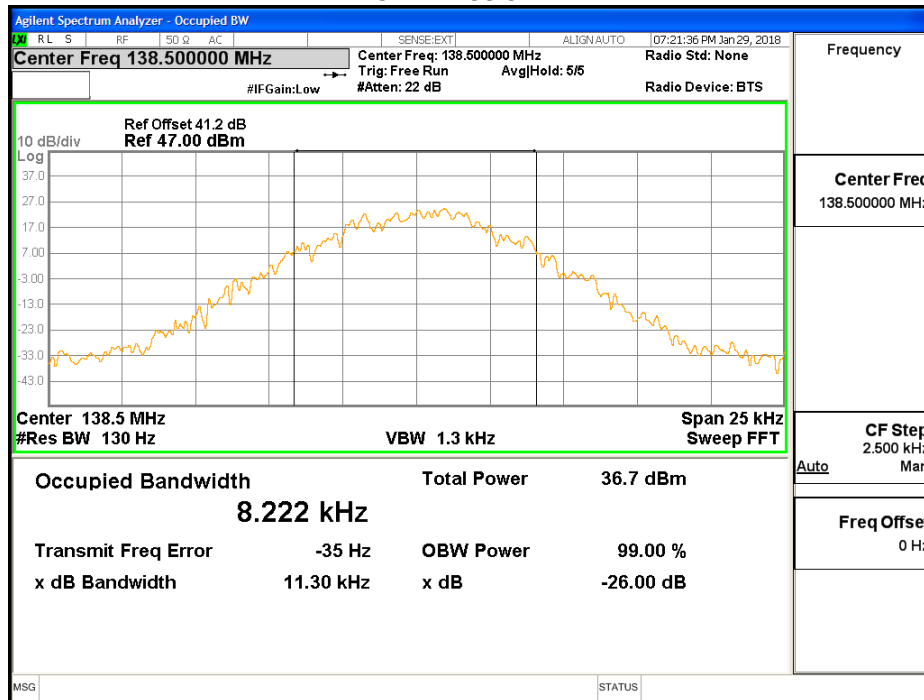
```

    graph LR
        VSG[Vector Signal Generator] --- airHost[airHost]
        airHost --- EUT[EUT]
        EUT --- Att[40dB Attenuator]
        Att --- SA[Spectrum Analyzer]
    
```

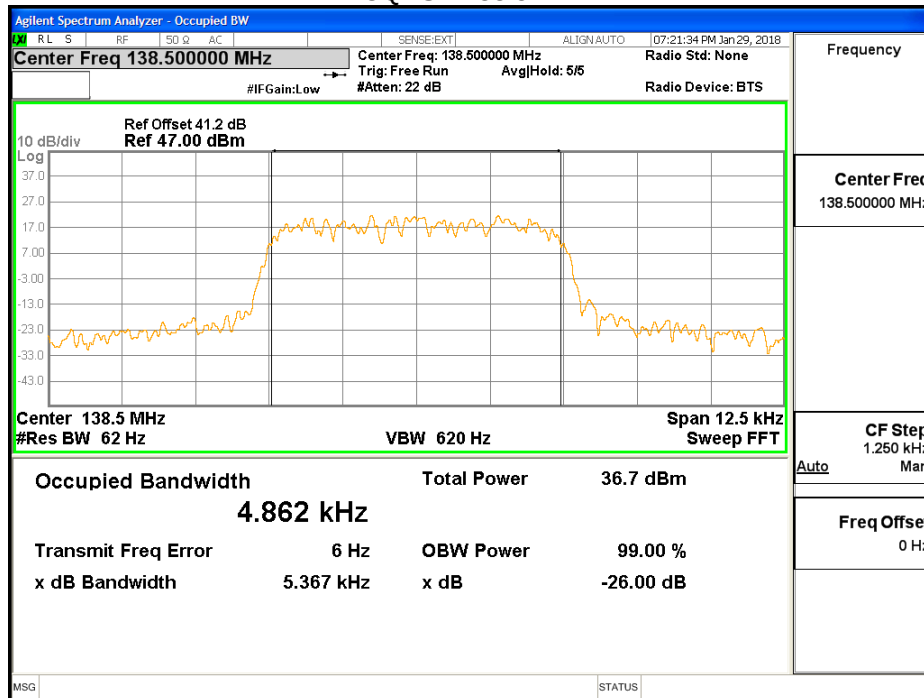
## Results

### At Input Power 0.5dB below AGC threshold

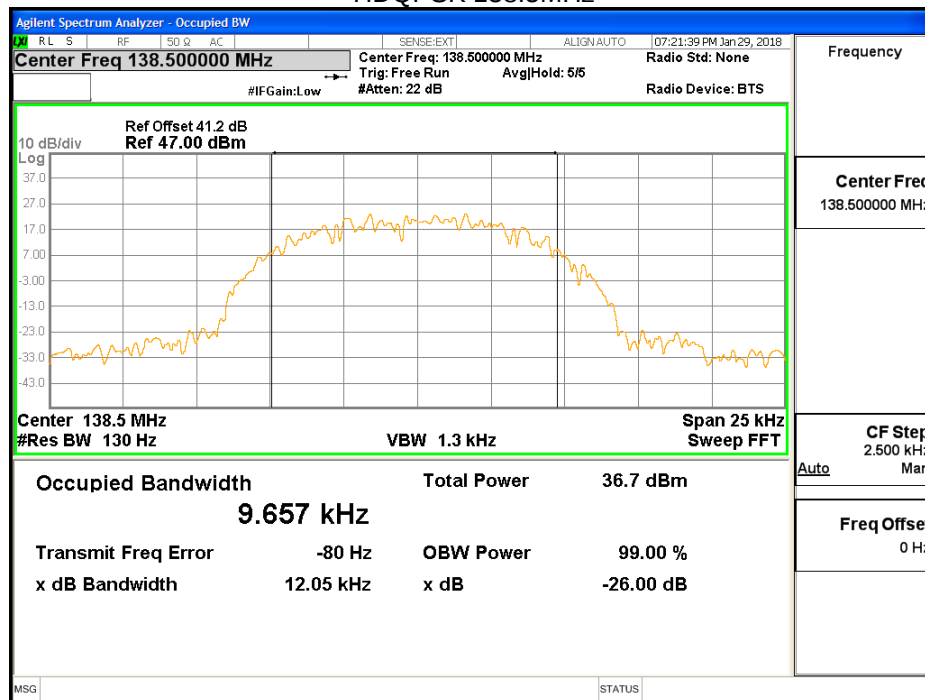
#### C4FM 138.5MHz



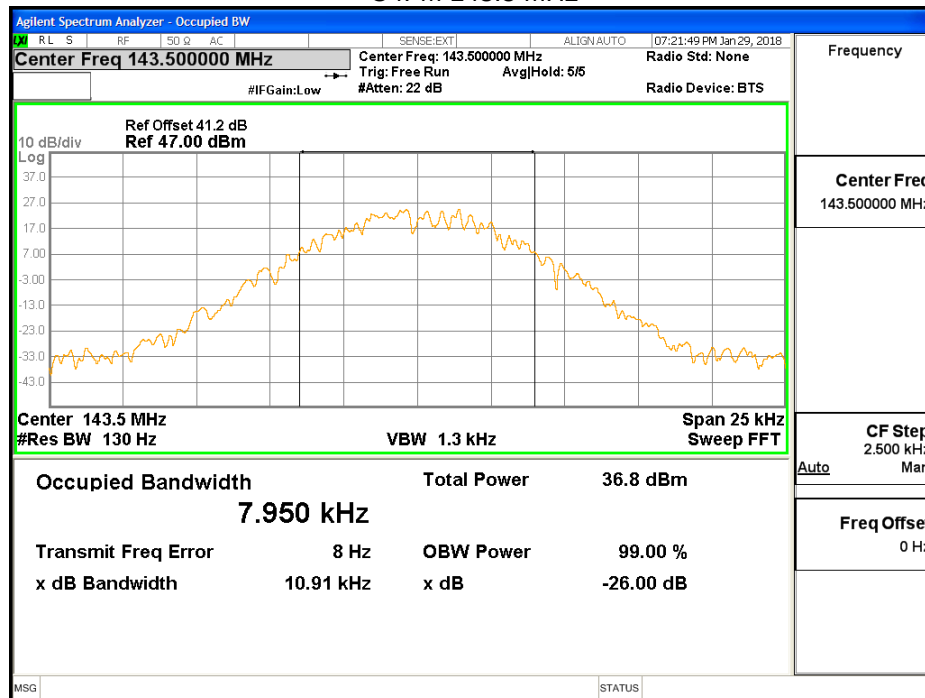
#### CQPSK 138.5MHz



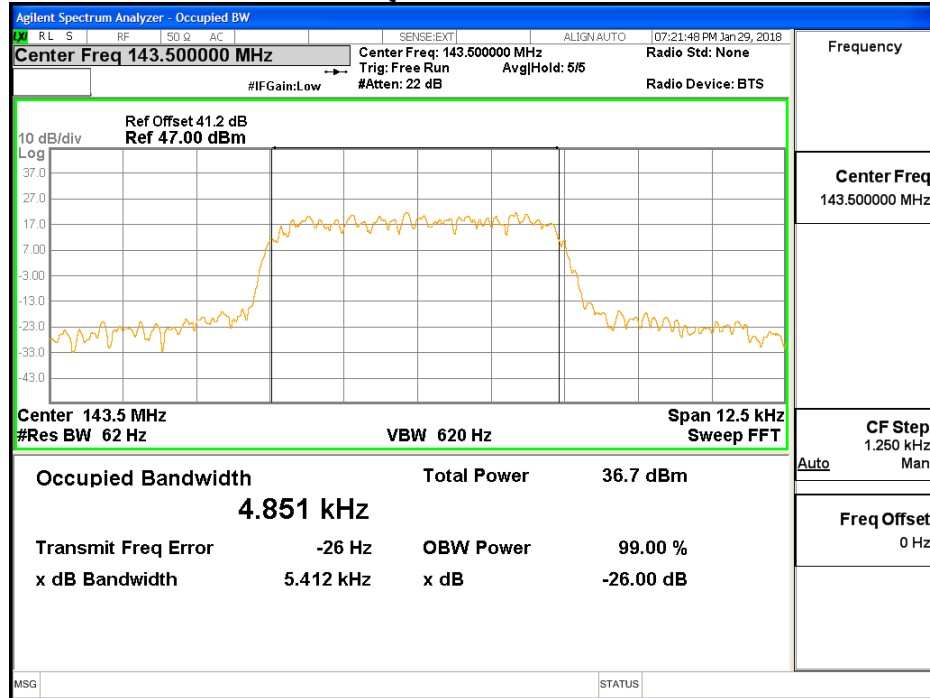
### HDQPSK 138.5MHz



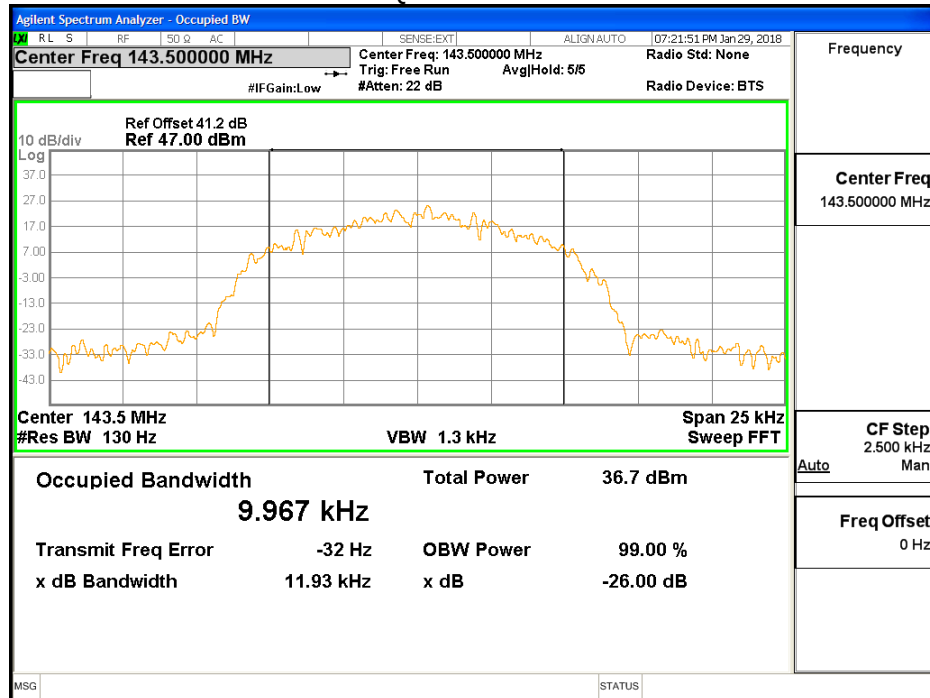
### C4FM 143.5 MHz



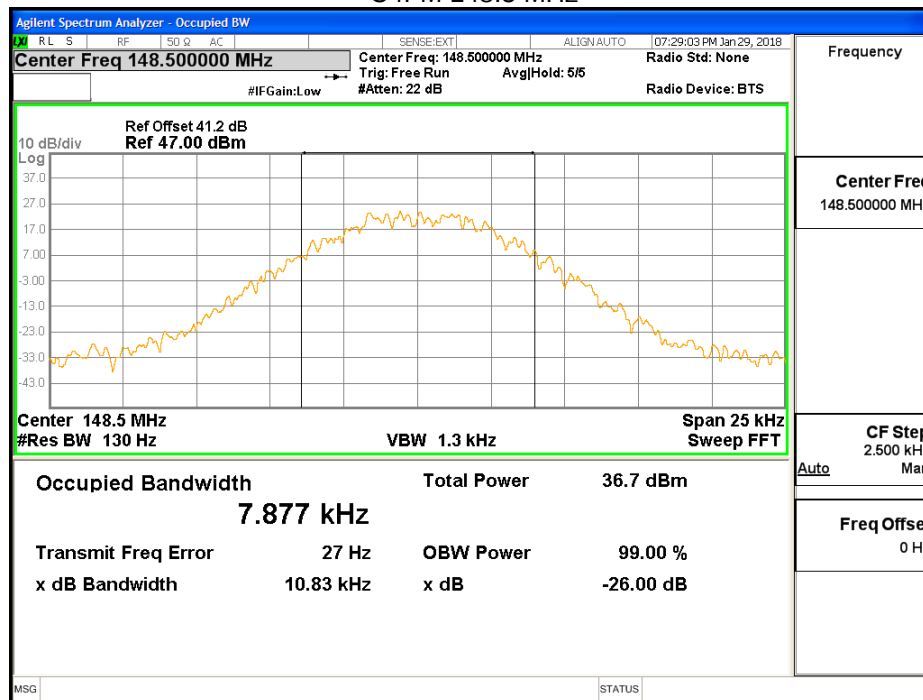
### CQPSK 143.5 MHz



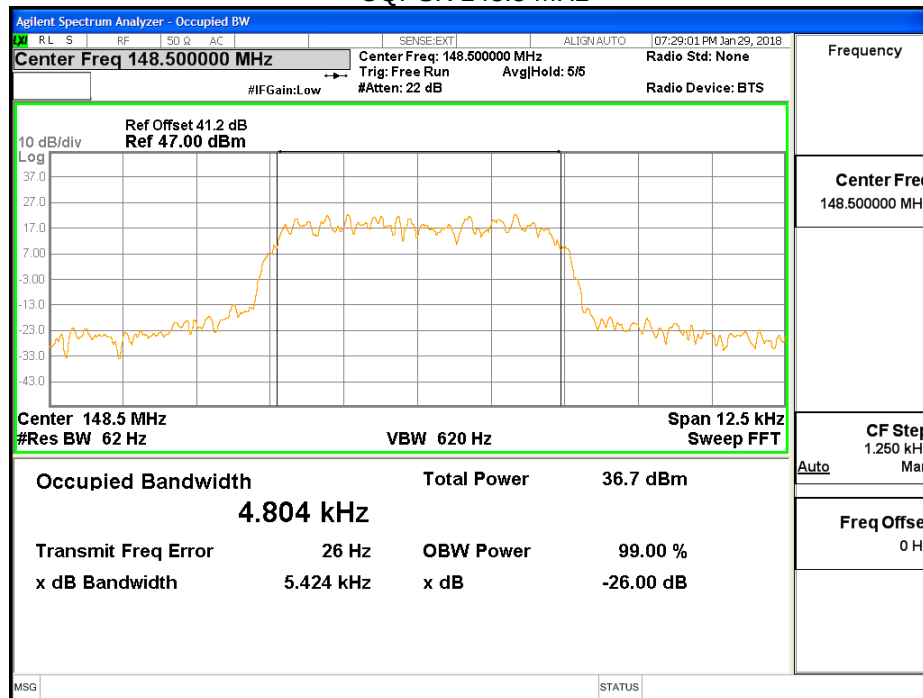
### HDQPSK 143.5 MHz



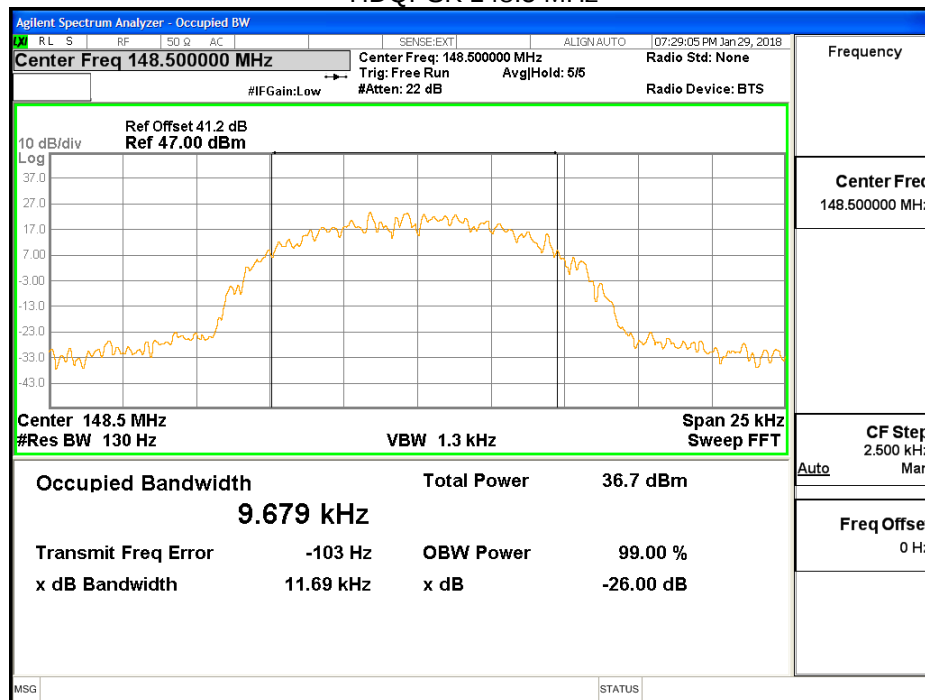
### C4FM 148.5 MHz



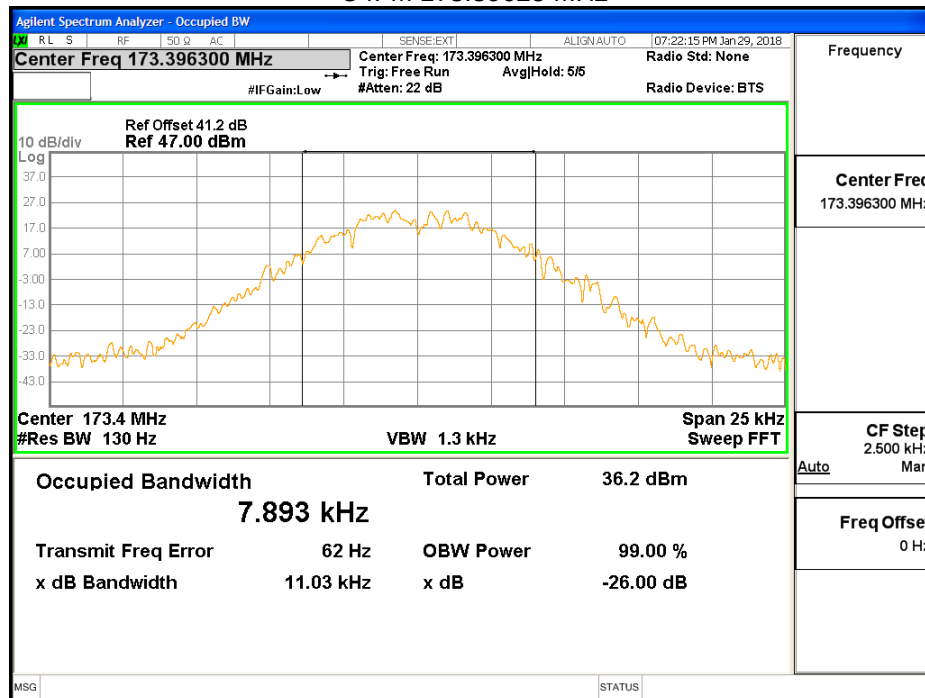
### CQPSK 148.5 MHz



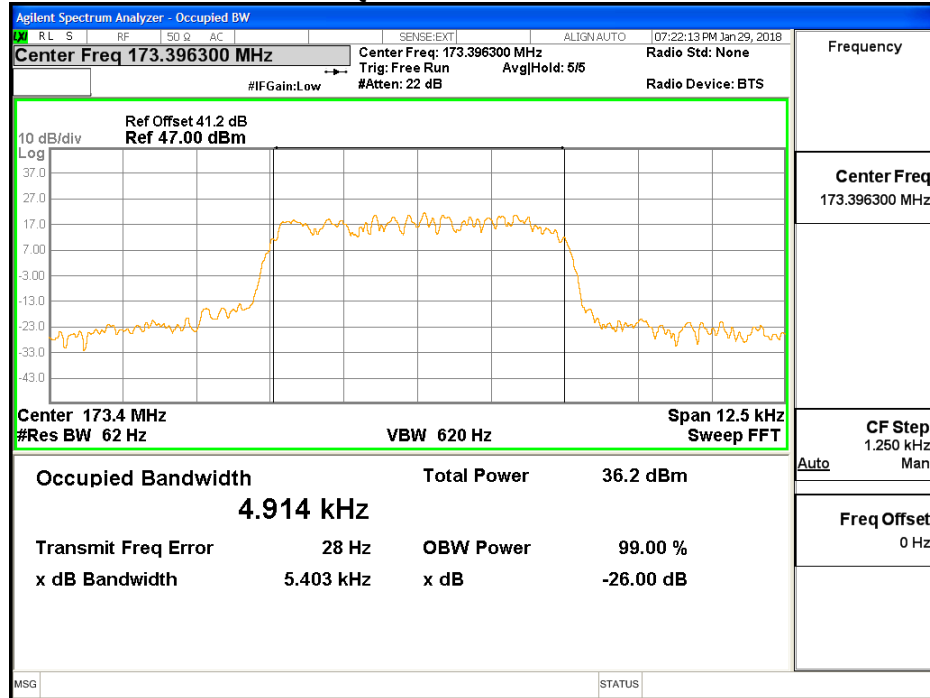
### HDQPSK 148.5 MHz



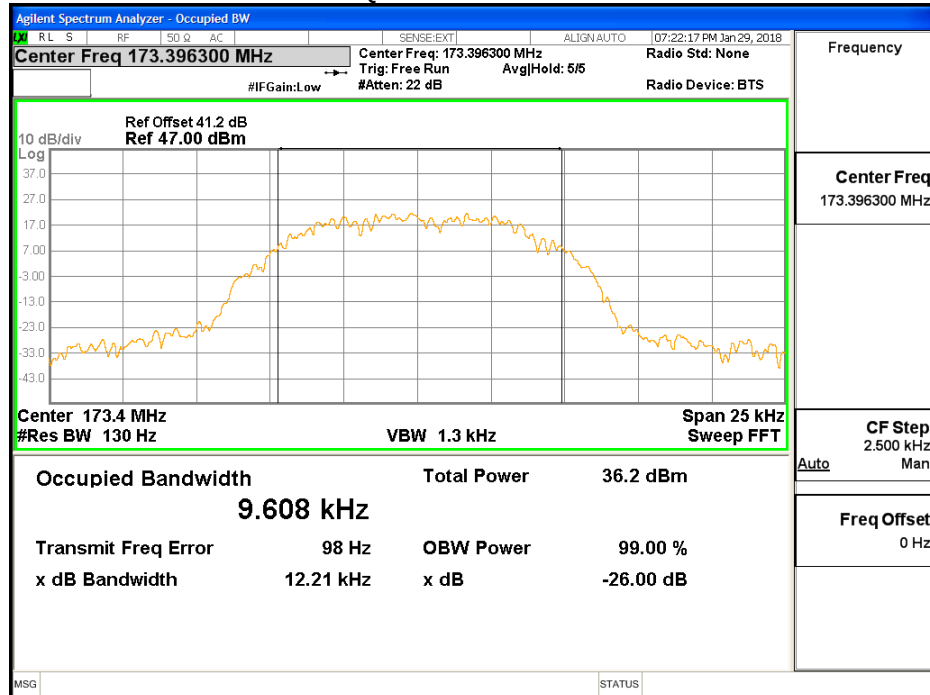
### C4FM 173.39625 MHz



### CQPSK 173.39625 MHz

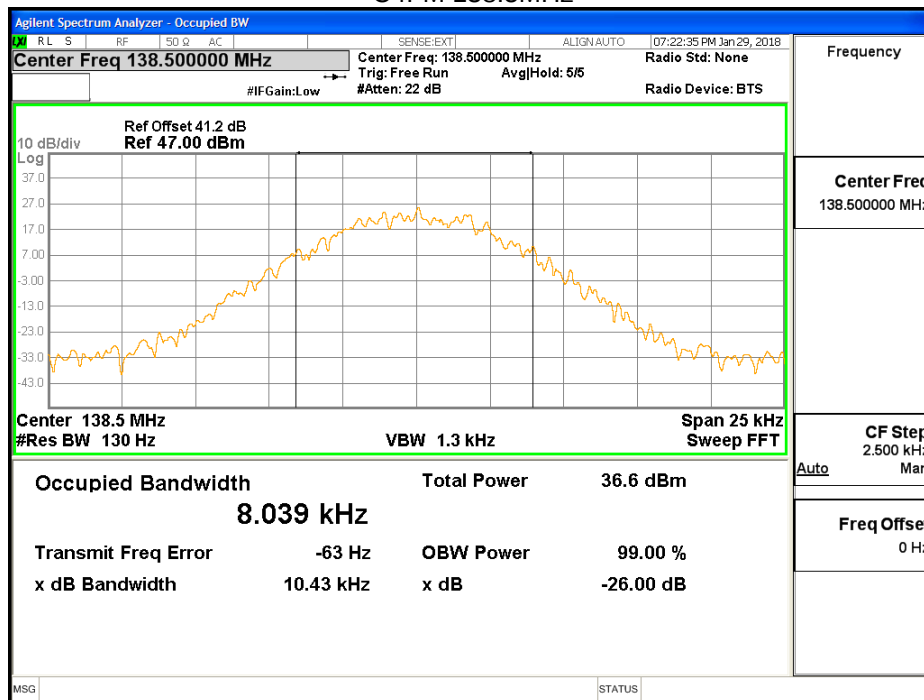


### HDQPSK 173.39625 MHz

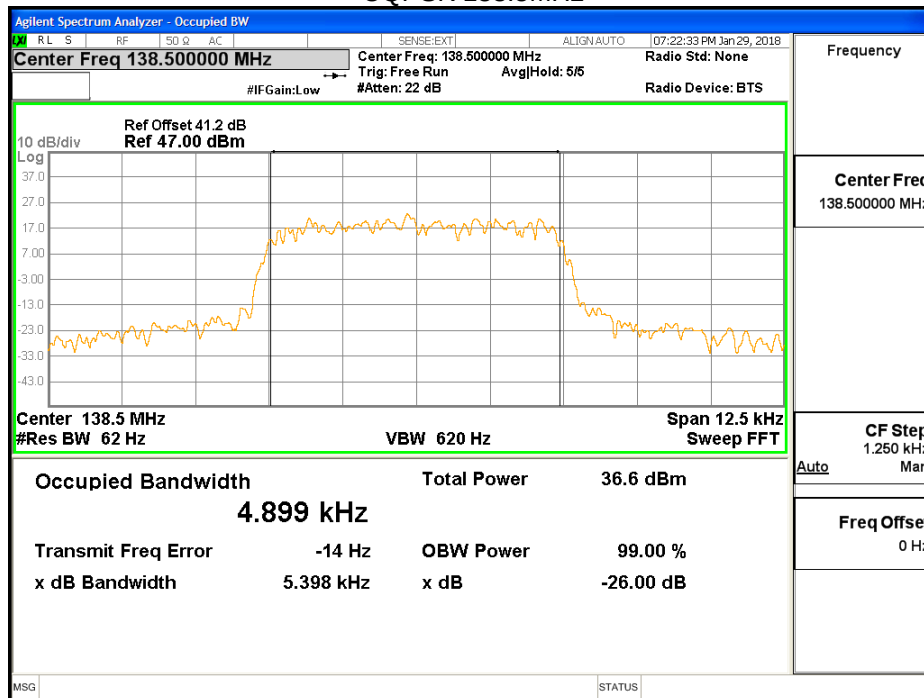


# At Input Power 3 dB above AGC threshold

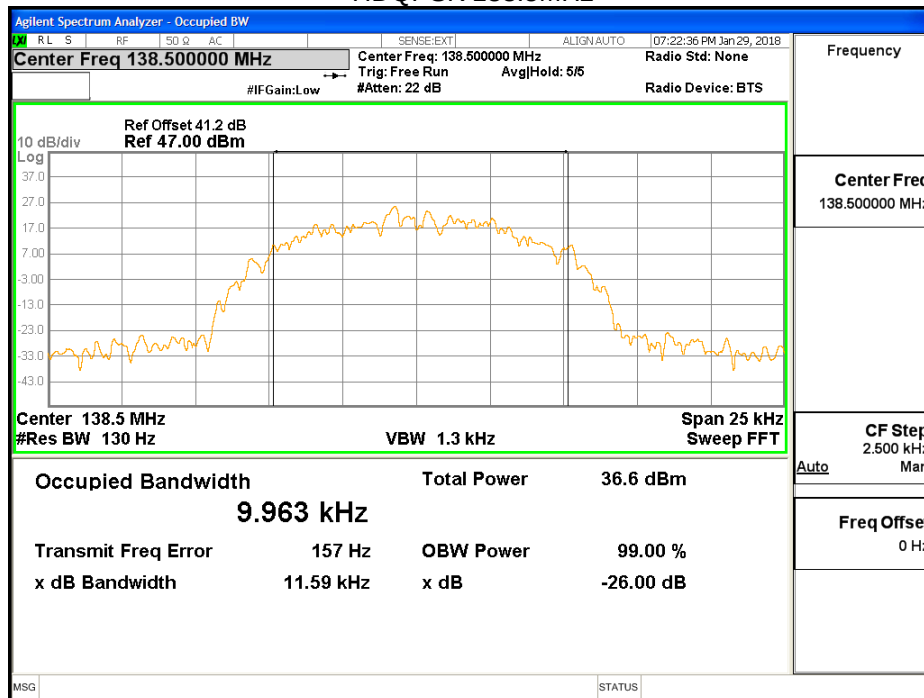
## C4FM 138.5MHz



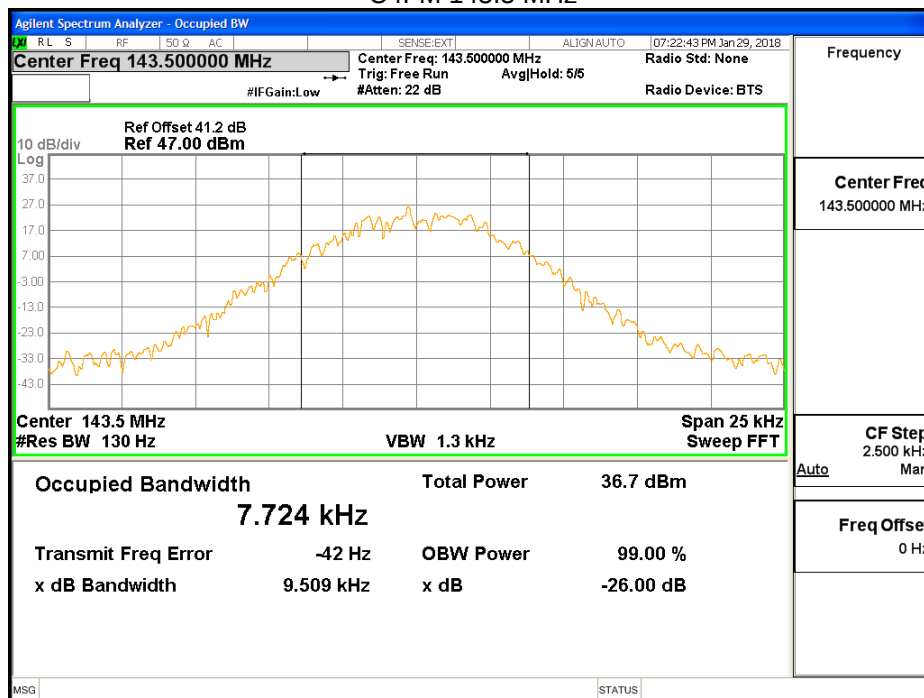
## CQPSK 138.5MHz



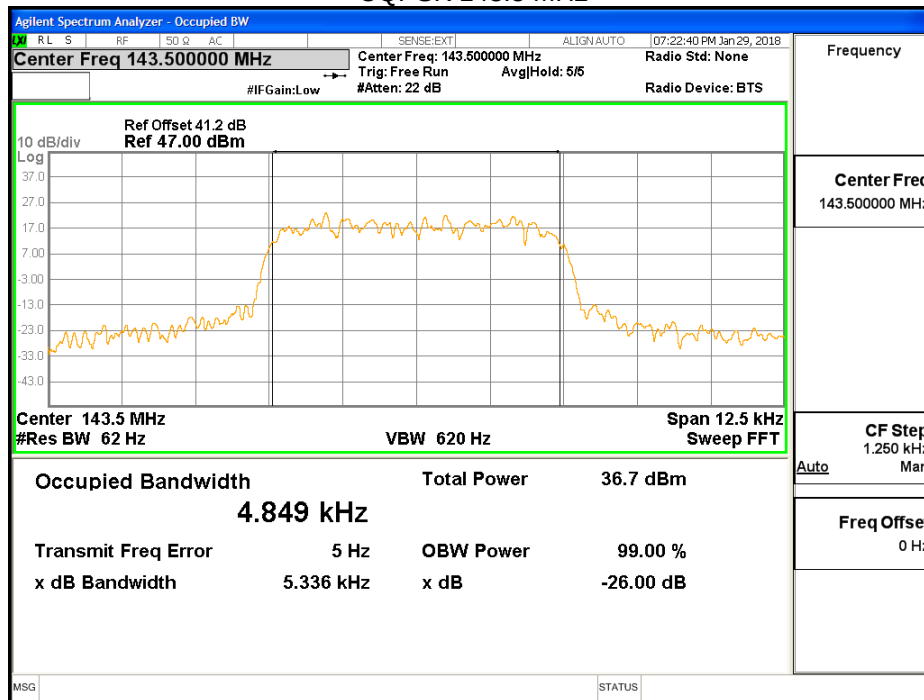
### HDQPSK 138.5MHz



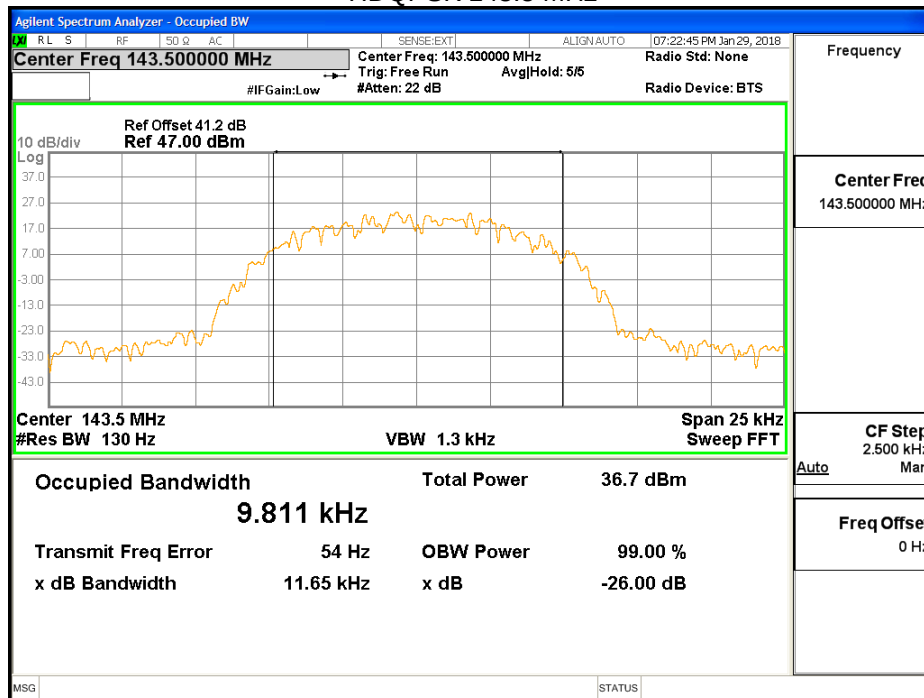
### C4FM 143.5 MHz



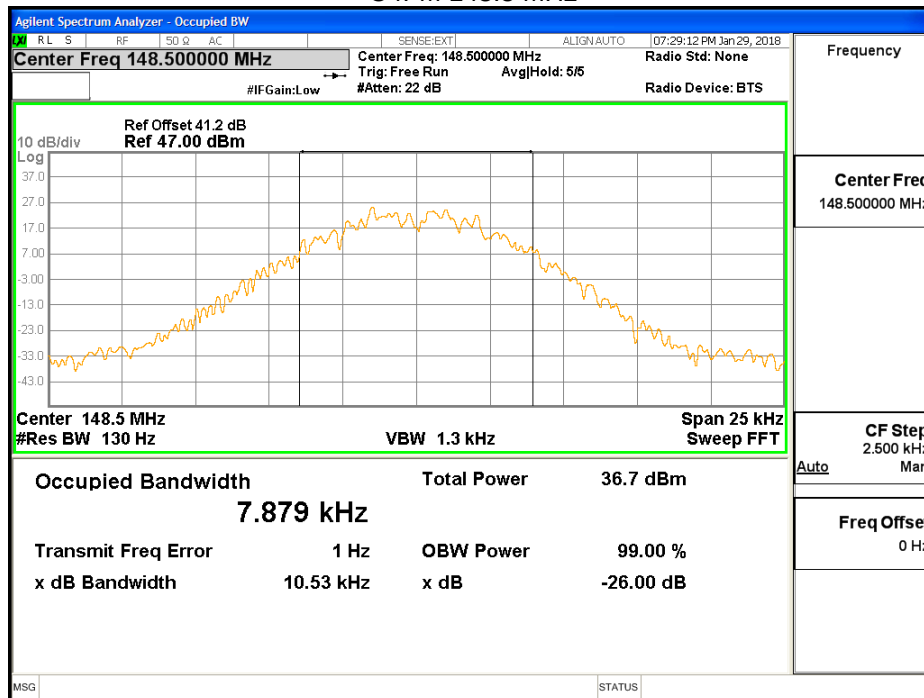
### CQPSK 143.5 MHz



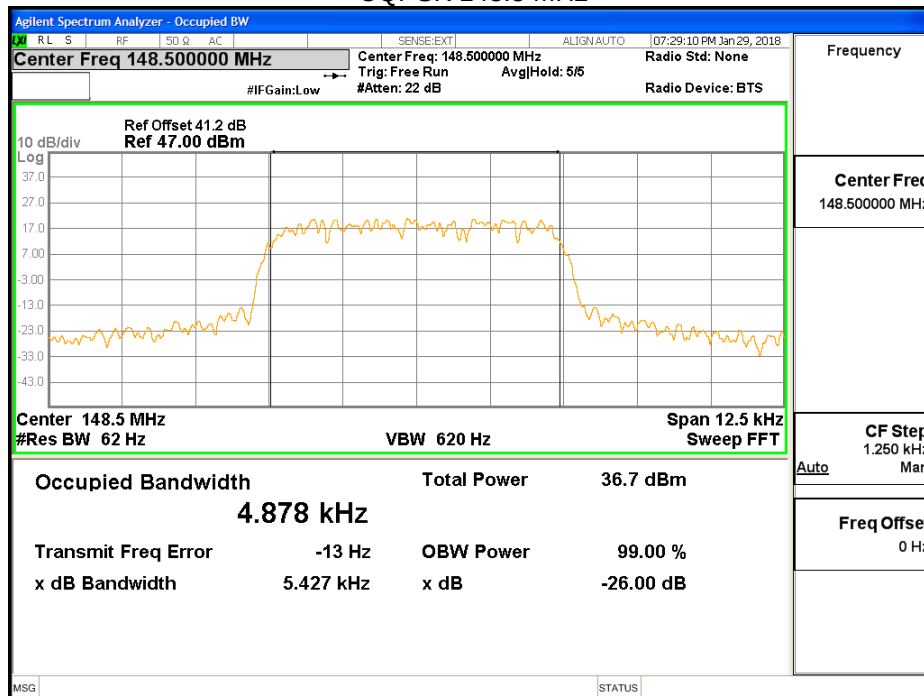
### HDQPSK 143.5 MHz



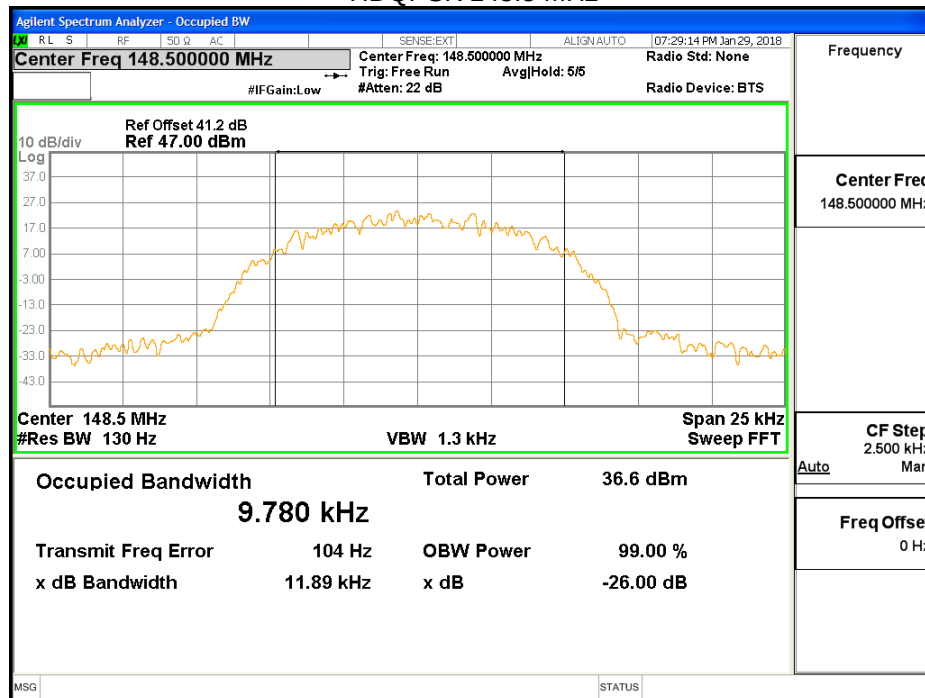
### C4FM 148.5 MHz



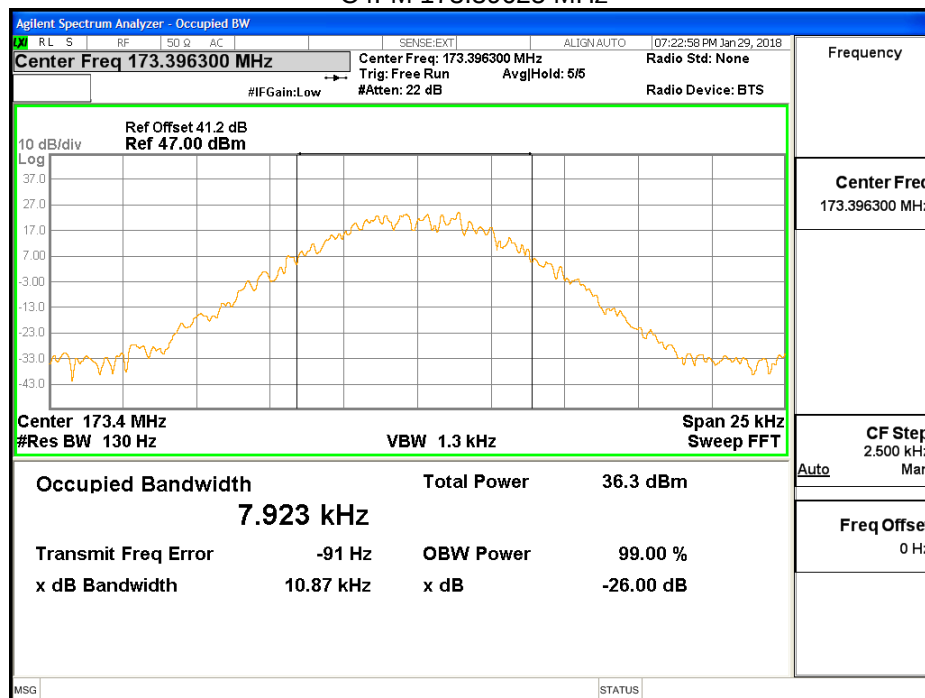
### CQPSK 148.5 MHz

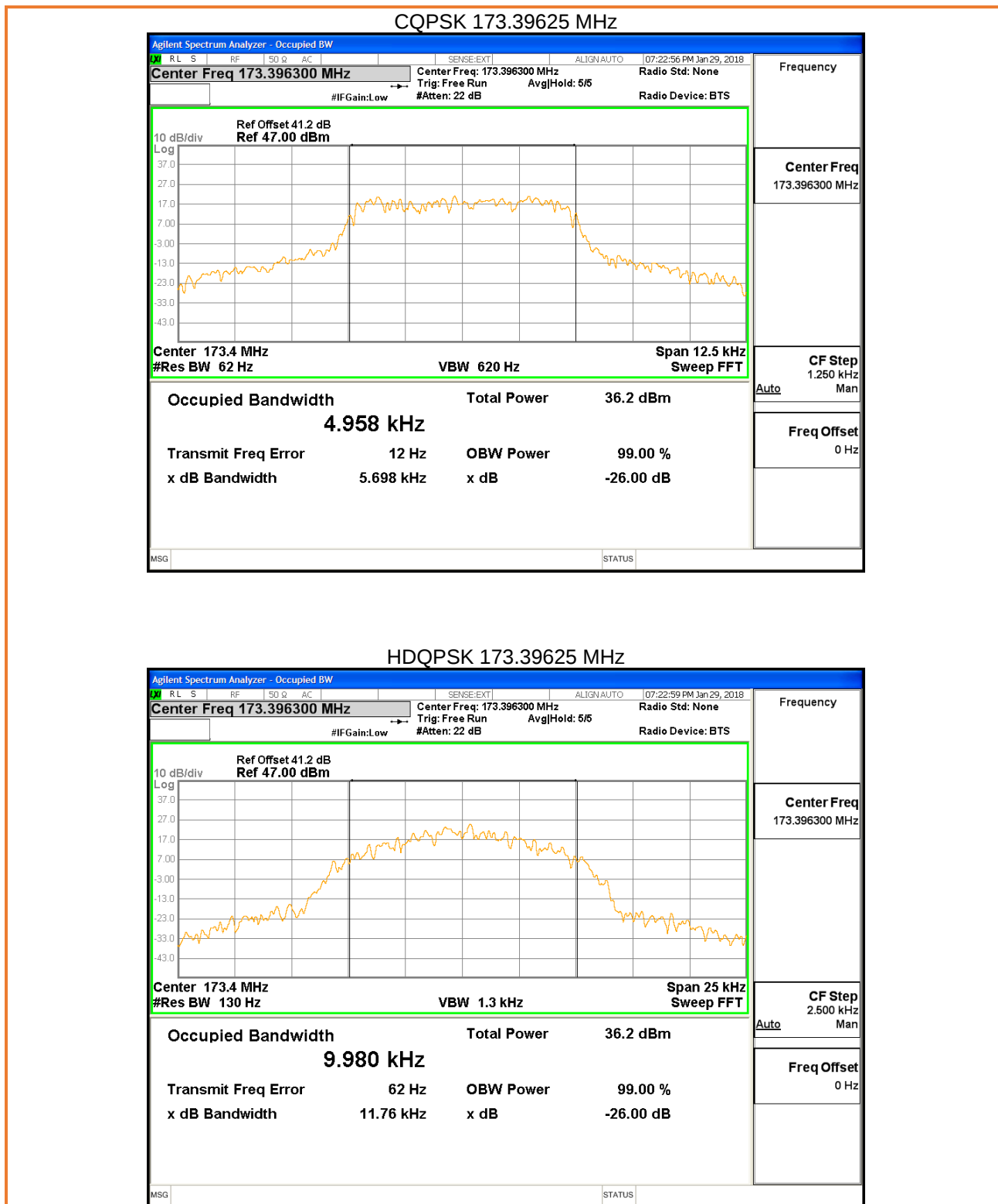


### HDQPSK 148.5 MHz



### C4FM 173.39625 MHz





## Unwanted Emissions (Conducted)

|                                                                                                                              |                                                                                                                                                                                                                                                                            |                           |               |
|------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|---------------|
| Governing Doc                                                                                                                | FCC Part 2 2.1046(a)<br>FCC Part 90.210<br>RSS-131 Sec 6.4                                                                                                                                                                                                                 | Room Temperature (°C)     | 23.6          |
| Test Procedure                                                                                                               | ANSI/TIA-603- E-2016;<br>FCC KDB 935210 D05<br>Indus Booster Basic Meas<br>v01r02: October 27, 2017<br>RSS-131 Sec 4.4                                                                                                                                                     | Relative Humidity (%)     | 29.7          |
| Test Location                                                                                                                | Burnaby                                                                                                                                                                                                                                                                    | Barometric Pressure (kPa) | 100.5         |
| Test Engineer                                                                                                                | Sophie Piao/Jeremy Lee                                                                                                                                                                                                                                                     | Date                      | Jan 24, 2018  |
| EUT Voltage                                                                                                                  | <input checked="" type="checkbox"/> DC <input type="checkbox"/> 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                                                                                                                                                                                                                                                            |                           |               |
|                                                                                                                              |                                                                                                                                                                                                                                                                            | CVP                       | CVP           |
| Note) CVP = Calibration Verification Performed internally, n/p = not provided.                                               |                                                                                                                                                                                                                                                                            |                           |               |
| Frequency Range:                                                                                                             | <input checked="" type="checkbox"/> 9 kHz – GHz                                                                                                                                                                                                                            |                           |               |
| Detector:                                                                                                                    | <input checked="" type="checkbox"/> Peak(for Formal)                                                                                                                                                                                                                       |                           |               |
| RBW/VBW:                                                                                                                     | <input checked="" type="checkbox"/> 1/10kHz for 9kHz – 150kHz;<br><input checked="" type="checkbox"/> 10/100kHz for 150kHz – 30 MHz;<br><input checked="" type="checkbox"/> 100/1000kHz for 30MHz – 1GHz;<br><input checked="" type="checkbox"/> 1/50MHz for 1GHz – 9.4GHz |                           |               |
| Type of Facility:                                                                                                            | <input checked="" type="checkbox"/> Testbench                                                                                                                                                                                                                              |                           |               |
| Distance:                                                                                                                    | <input checked="" type="checkbox"/> Direct Connection                                                                                                                                                                                                                      |                           |               |
| Arrangement of EUT:                                                                                                          | <input type="checkbox"/> Table-top only <input type="checkbox"/> Floor-standing only <input checked="" type="checkbox"/> Rack Mounted                                                                                                                                      |                           |               |
| No emission is higher than the -13 dBm emission limit.                                                                       |                                                                                                                                                                                                                                                                            |                           |               |
| Compliant <input checked="" type="checkbox"/> Non-Compliant <input type="checkbox"/> Not Applicable <input type="checkbox"/> |                                                                                                                                                                                                                                                                            |                           |               |

### 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.

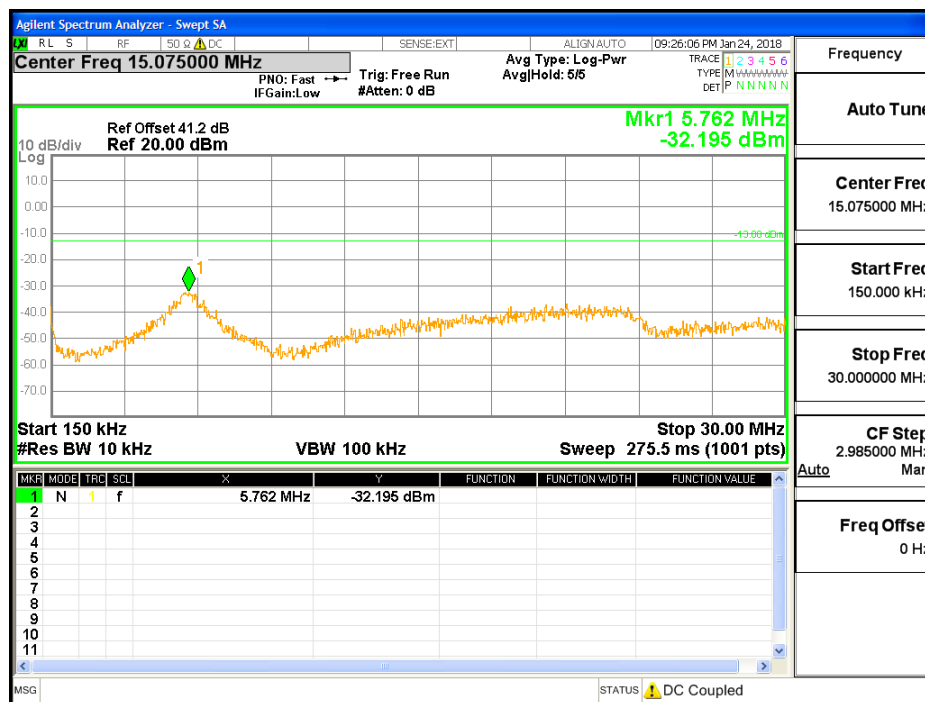
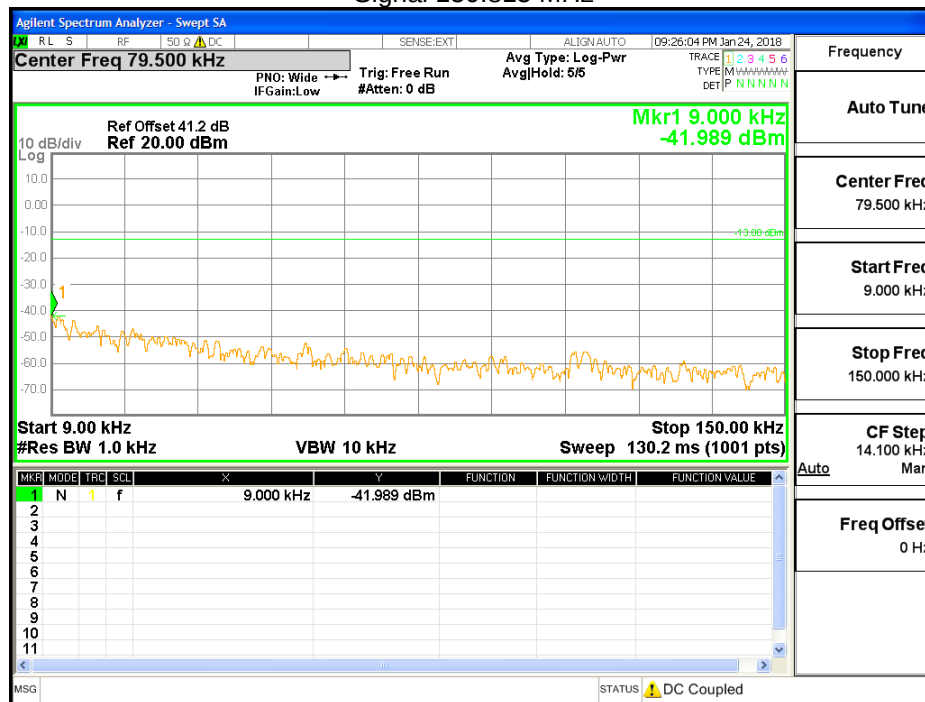
The EUT was set to **Operation Mode #1 with configuration Mode #1.**

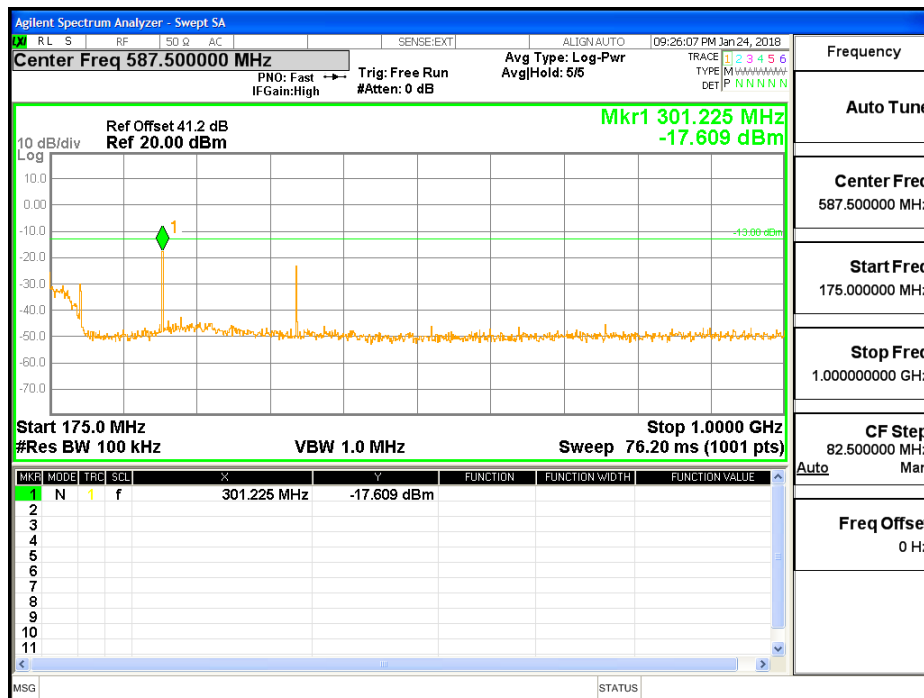
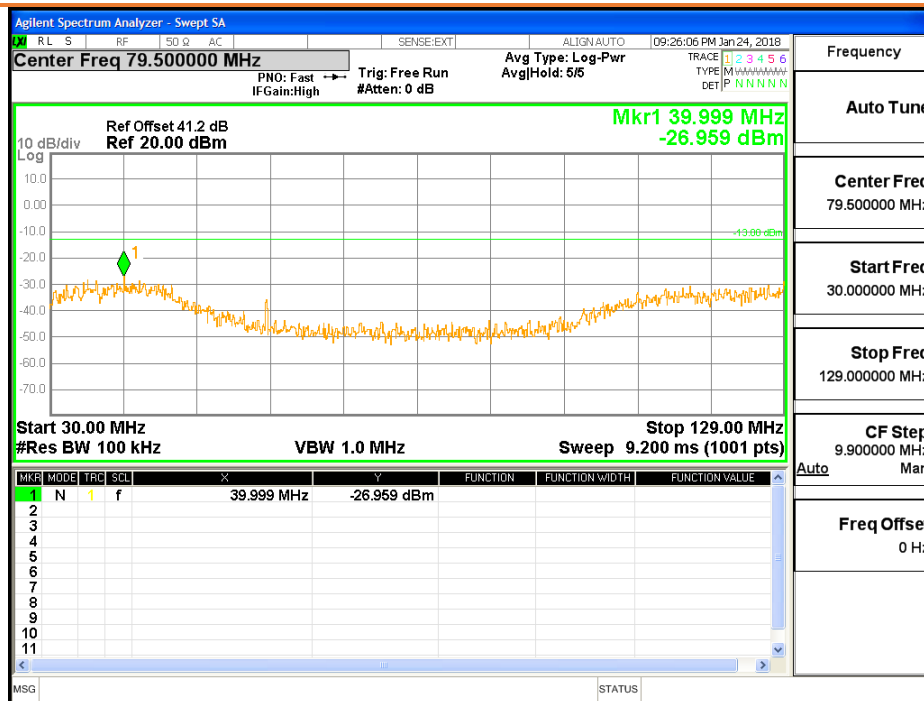


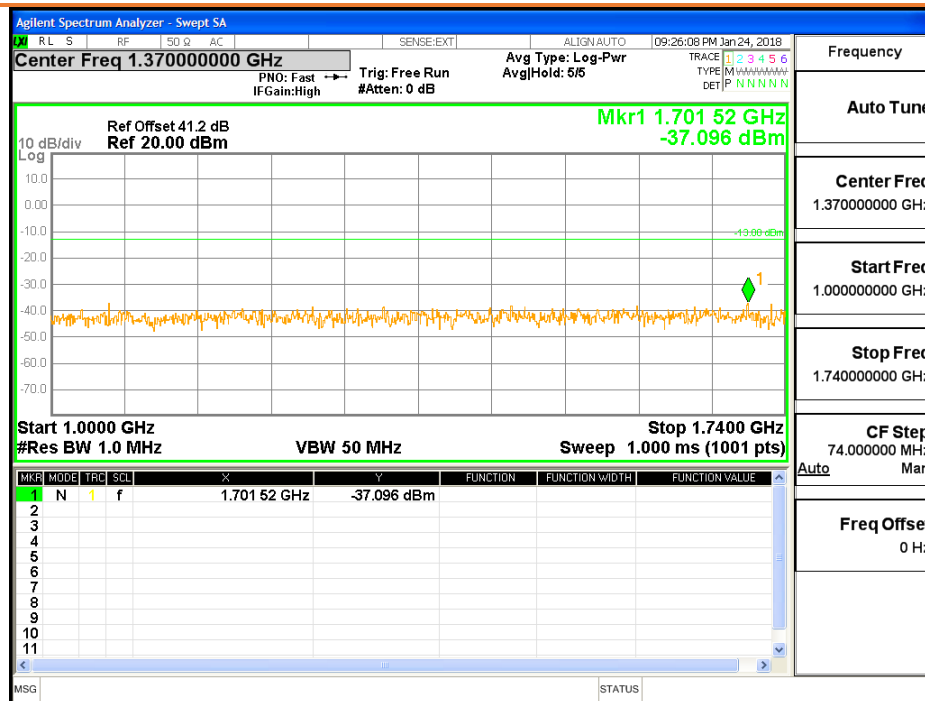
## Results

### At Input Power 0.5 dB below AGC threshold

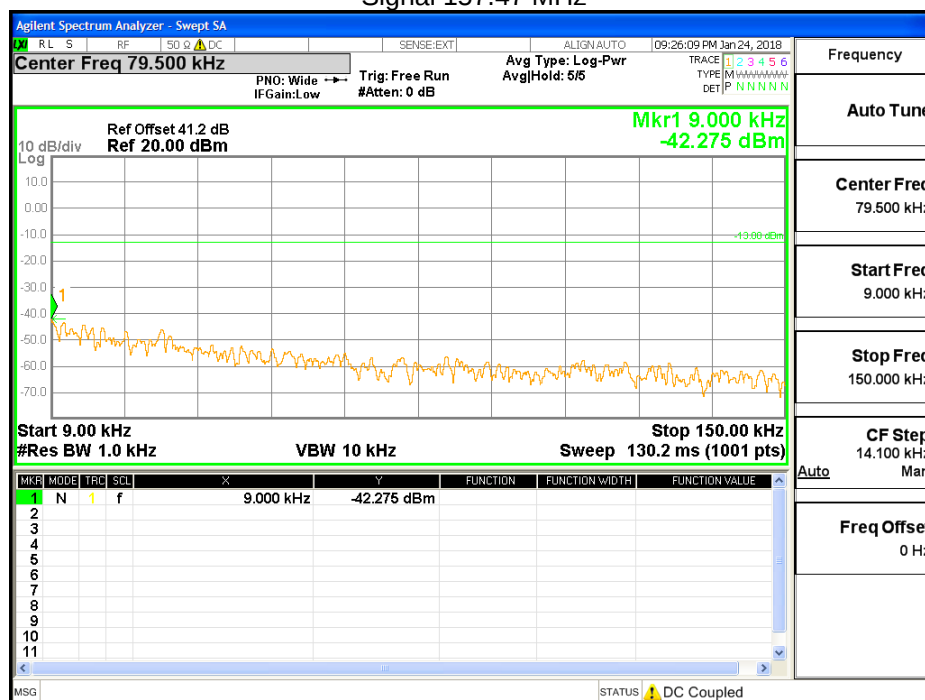
Signal 150.815 MHz

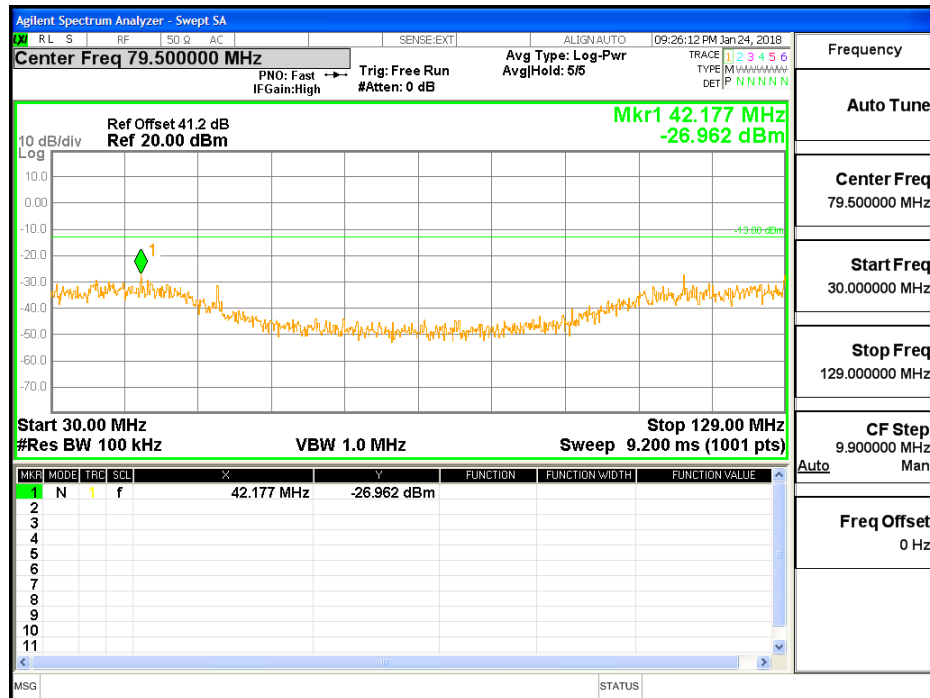
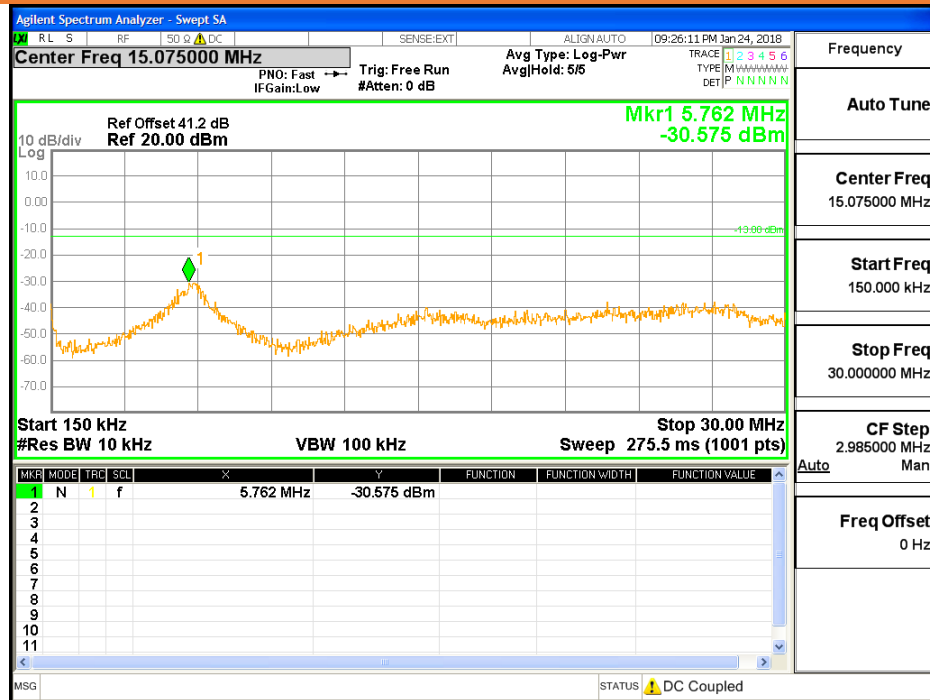


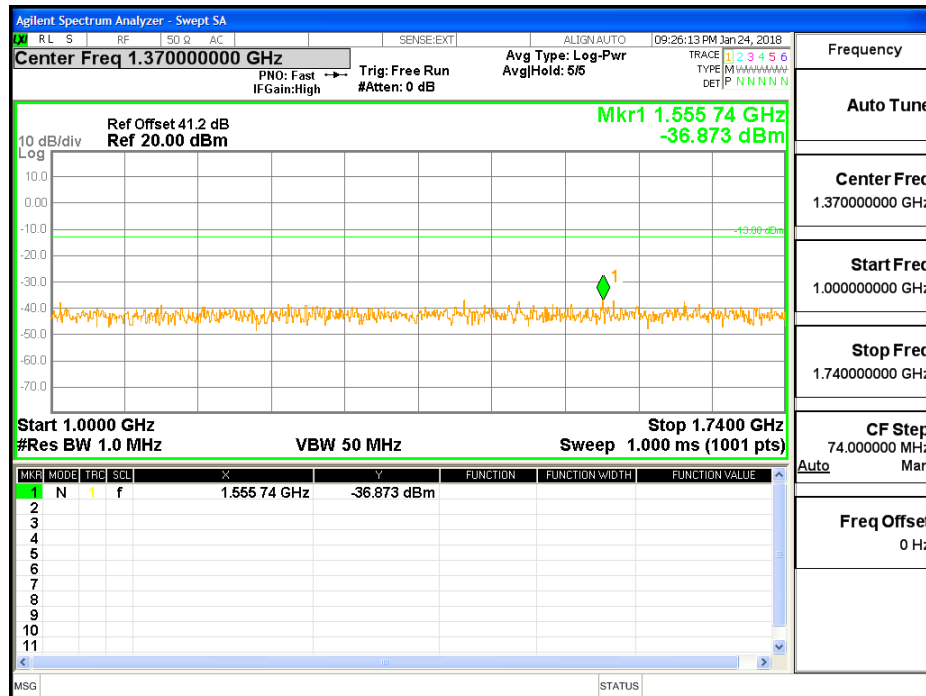
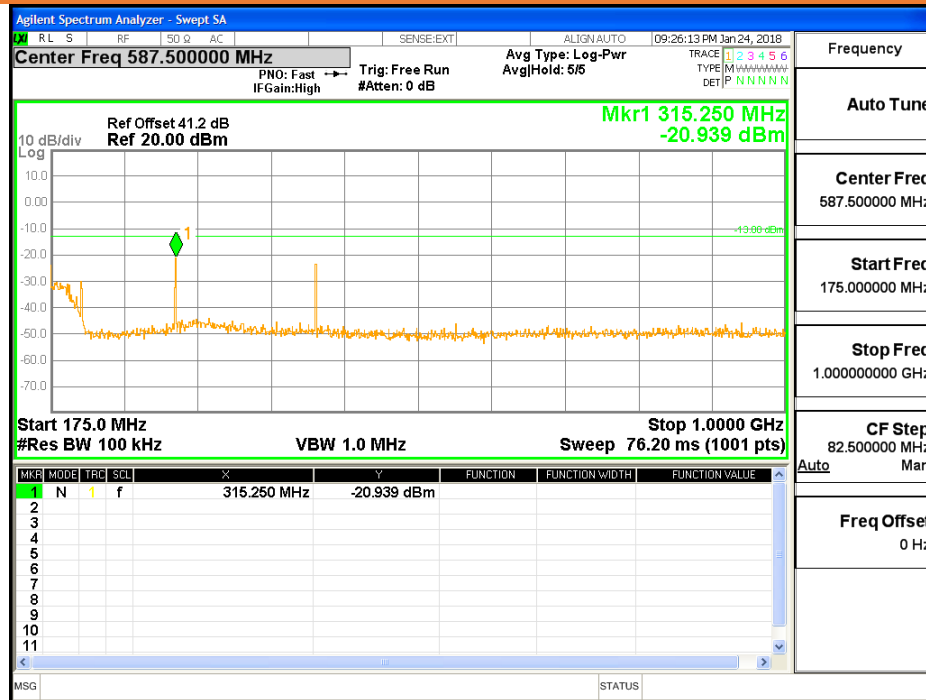




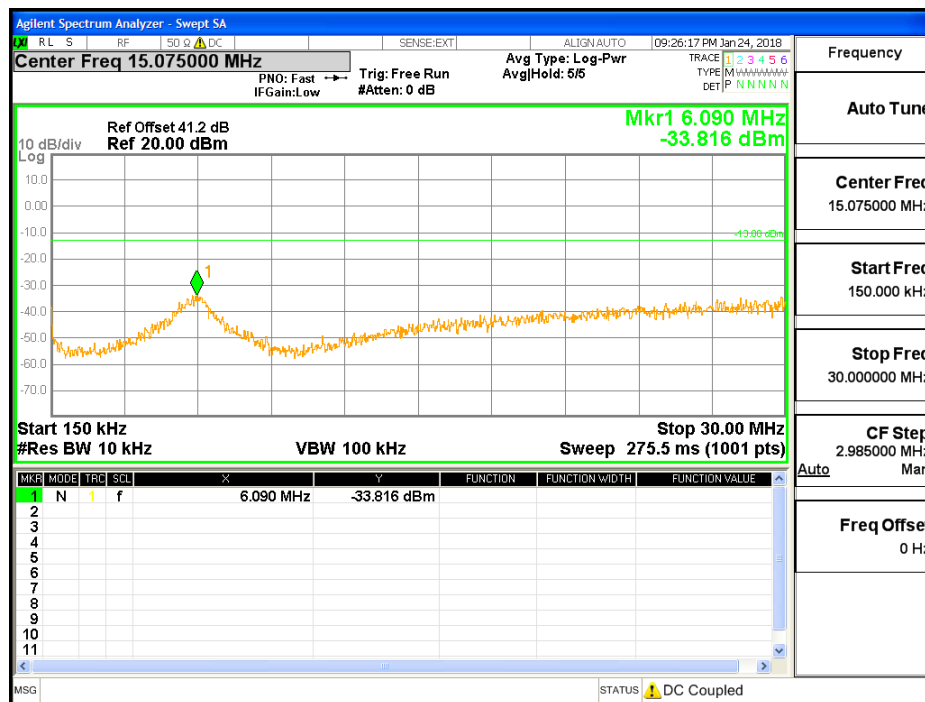
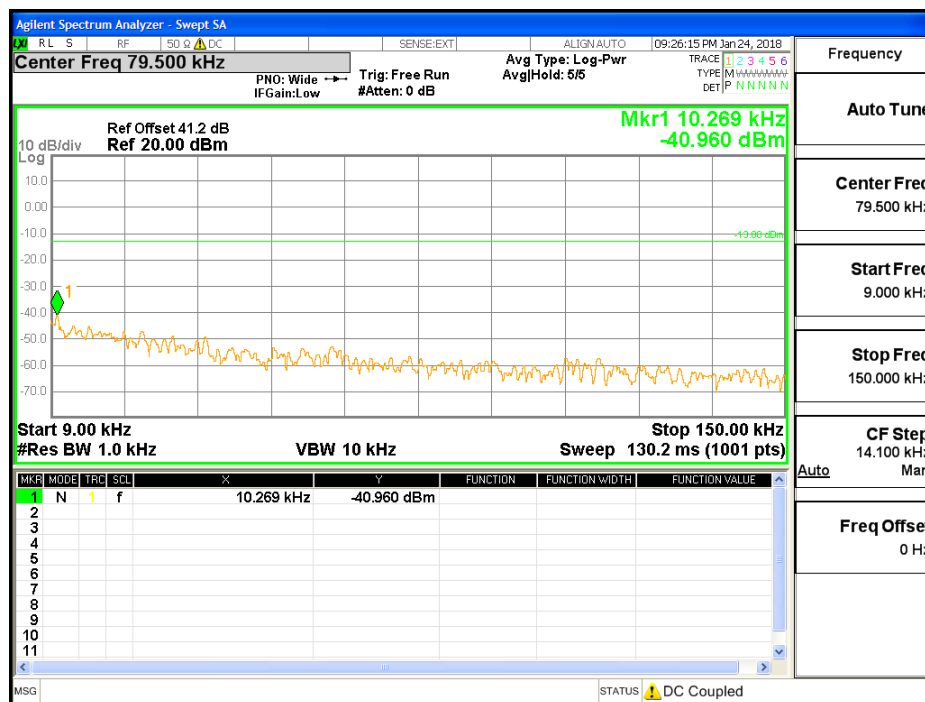
Signal 157.47 MHz

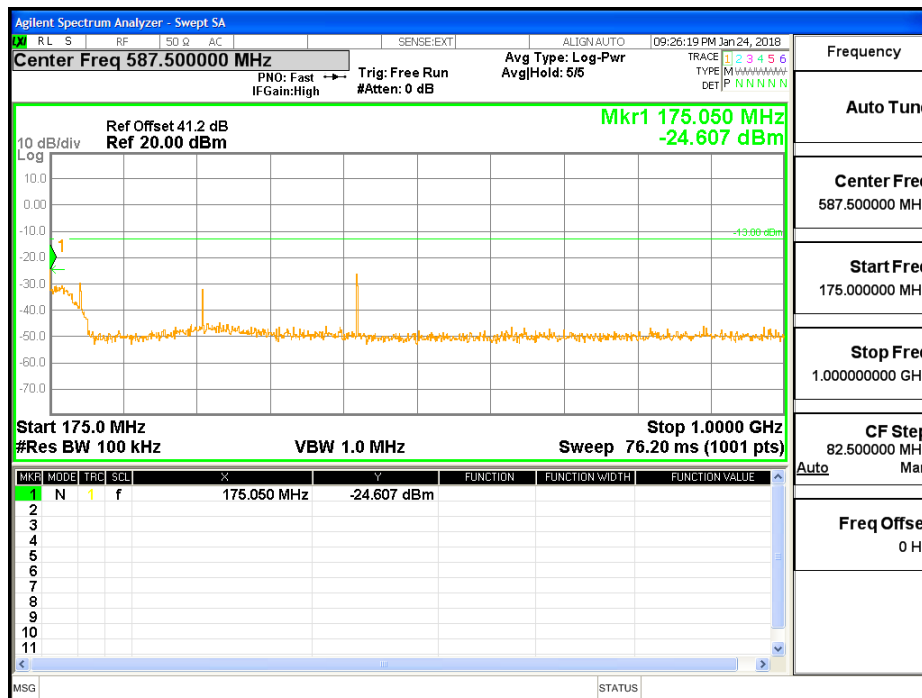
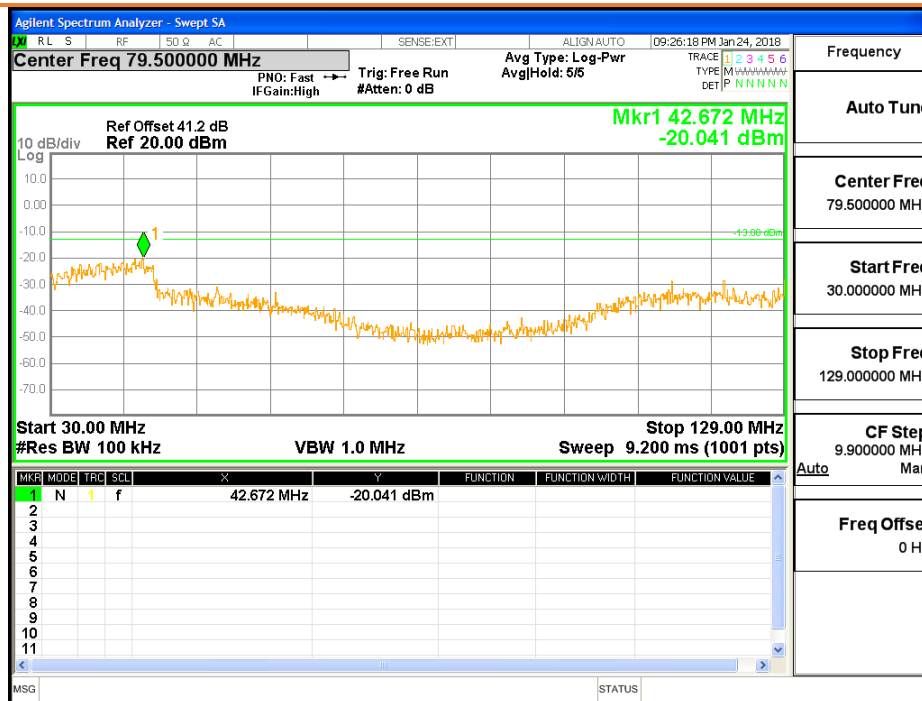


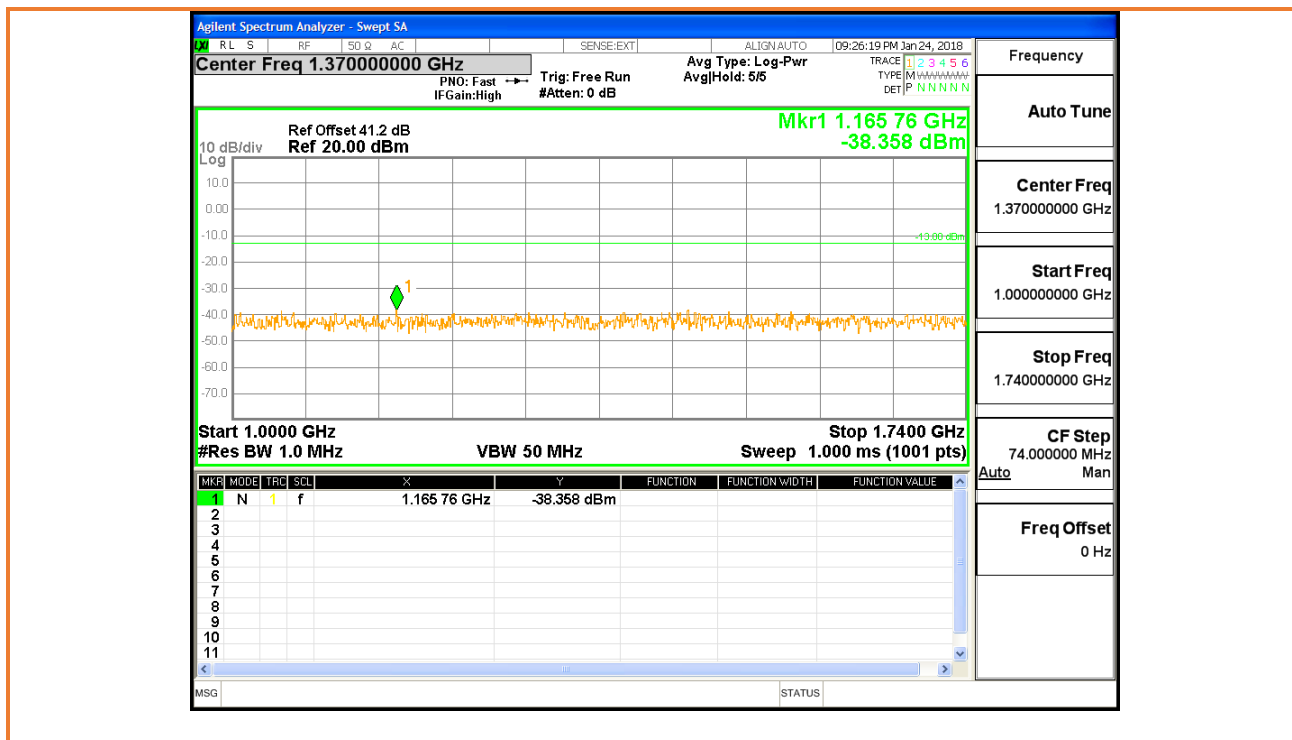




### Signal 173.39625 MHz







## Spectrum Emission Mask

|                                                                                                                              |                                                                                                                                       |                           |               |
|------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|---------------------------|---------------|
| Governing Doc                                                                                                                | FCC Part 90.210 (i)                                                                                                                   | Room Temperature (°C)     | 23.6          |
| Test Procedure                                                                                                               | ANSI/TIA-603- E-2016;<br>FCC KDB 935210 D05<br>Indus Booster Basic Meas<br>v01r02: October 27, 2017                                   | Relative Humidity (%)     | 29.7          |
| Test Location                                                                                                                | Burnaby                                                                                                                               | Barometric Pressure (kPa) | 100.5         |
| Test Engineer                                                                                                                | Sophie Piao/Jeremy Lee                                                                                                                | Date                      | Jan 24, 2018  |
| EUT Voltage                                                                                                                  | <input checked="" type="checkbox"/> DC <input type="checkbox"/> 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           |
|                                                                                                                              |                                                                                                                                       |                           | CVP           |
| Note) CVP = Calibration Verification Performed internally, n/p = not provided.                                               |                                                                                                                                       |                           |               |
| Frequency Range:                                                                                                             | <input checked="" type="checkbox"/> Center Channel                                                                                    |                           |               |
| Detector:                                                                                                                    | <input checked="" type="checkbox"/> Peak                                                                                              |                           |               |
| RBW/VBW:                                                                                                                     | <input checked="" type="checkbox"/> 100 Hz                                                                                            |                           |               |
| Type of Facility:                                                                                                            | <input checked="" type="checkbox"/> Testbench                                                                                         |                           |               |
| Distance:                                                                                                                    | <input checked="" type="checkbox"/> direct connect                                                                                    |                           |               |
| Arrangement of EUT:                                                                                                          | <input type="checkbox"/> Table-top only <input type="checkbox"/> Floor-standing only <input checked="" type="checkbox"/> Rack Mounted |                           |               |
| Signal of all types of modulation is contained within the emission mask.                                                     |                                                                                                                                       |                           |               |
| Compliant <input checked="" type="checkbox"/> Non-Compliant <input type="checkbox"/> Not Applicable <input type="checkbox"/> |                                                                                                                                       |                           |               |

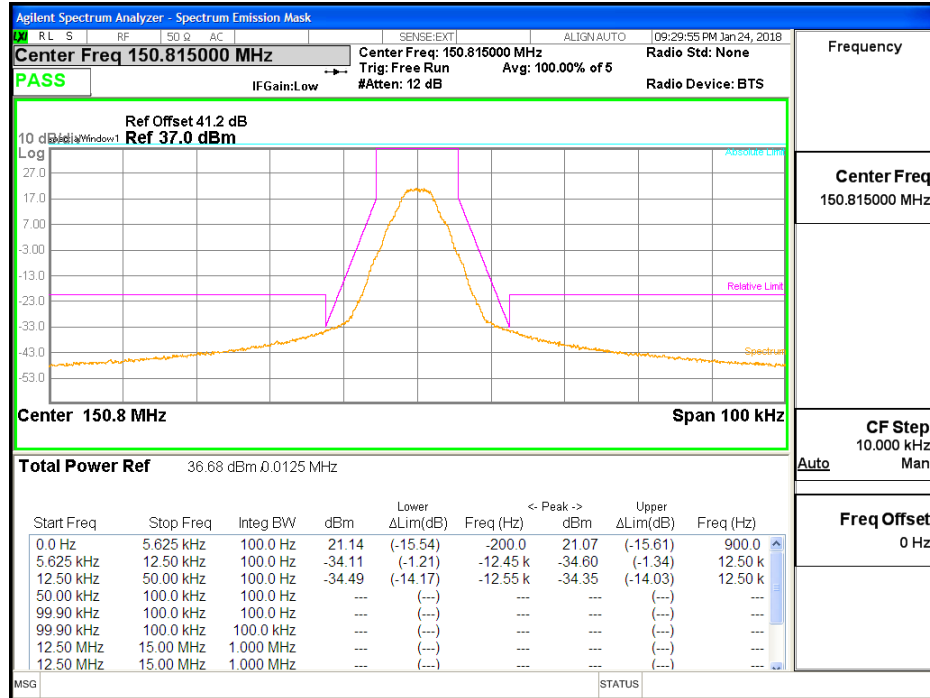
## Test setup

|                                                                                                                                                                                                                                                                                                                                                                                      |  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| 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 2 times of the channel BW. The emission was measured with RBW 100 Hz. The EUT was set to <b>Operation Mode #1 with configuration Mode #1.</b> |  |
| <pre>                     graph LR                         VSG[Vector Signal Generator] --&gt; airHost[airHost]                         airHost --&gt; EUT[EUT]                         EUT --&gt; Att[40dB Attenuator]                         Att --&gt; SA[Spectrum Analyzer]                     </pre>                                                                          |  |

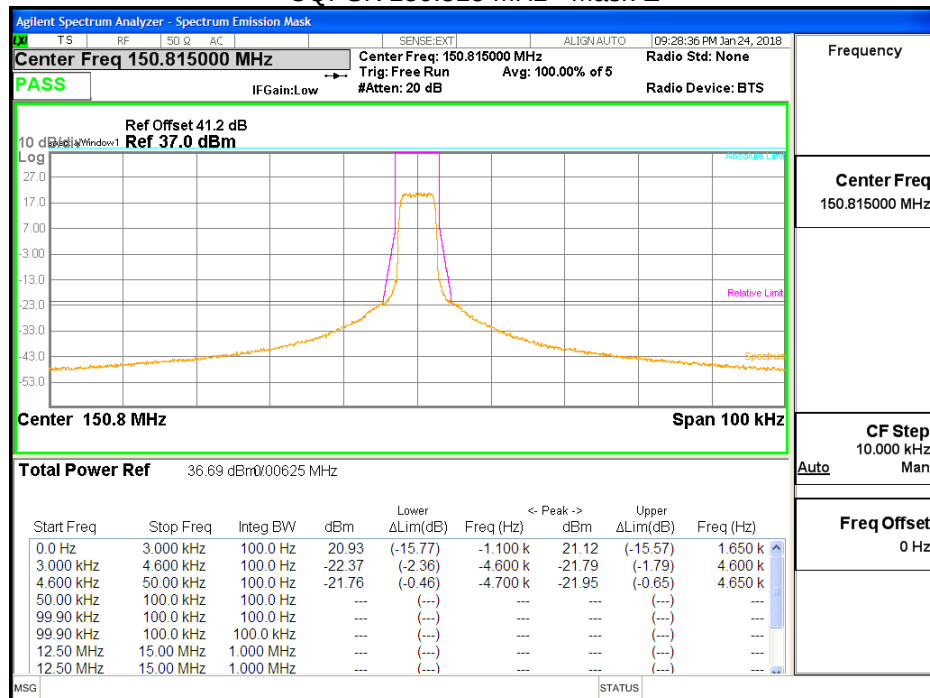
## Results

### At Input Power 0.5 dB below AGC threshold

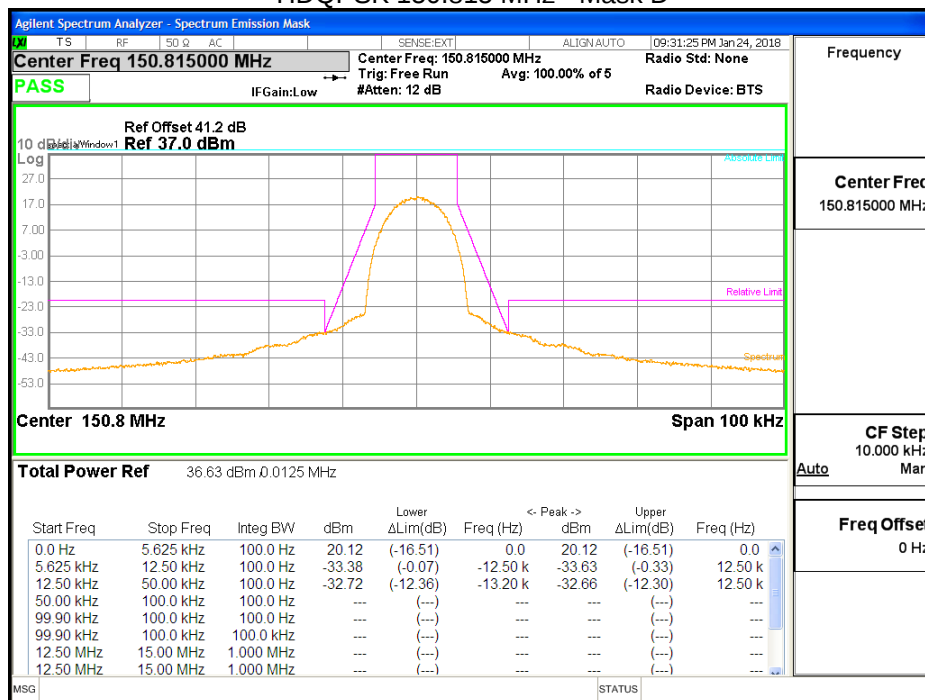
#### C4FM 150.815 MHz – Mask D



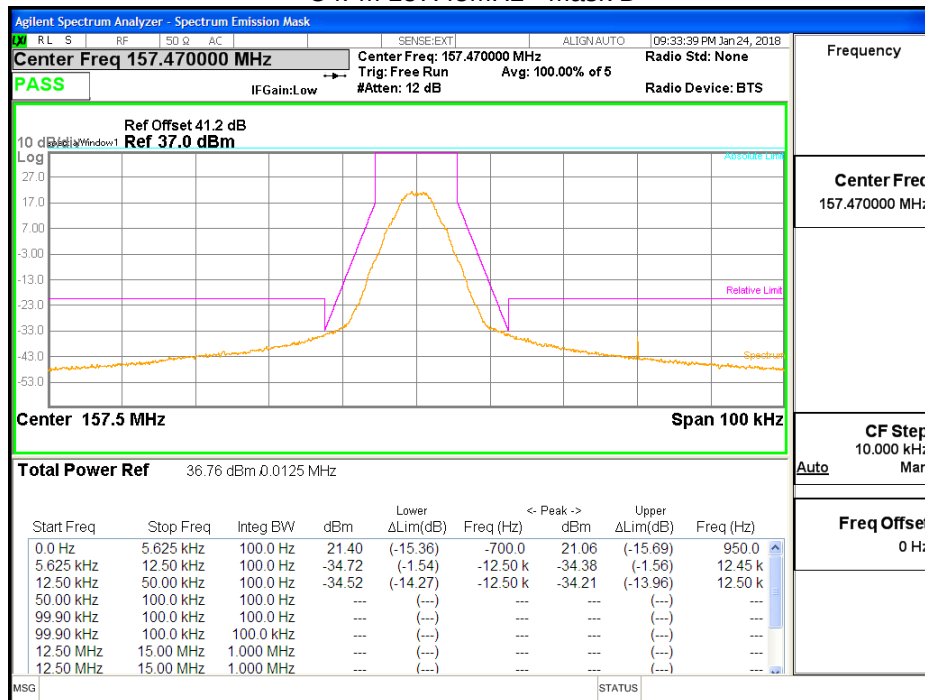
#### CQPSK 150.815 MHz - Mask E



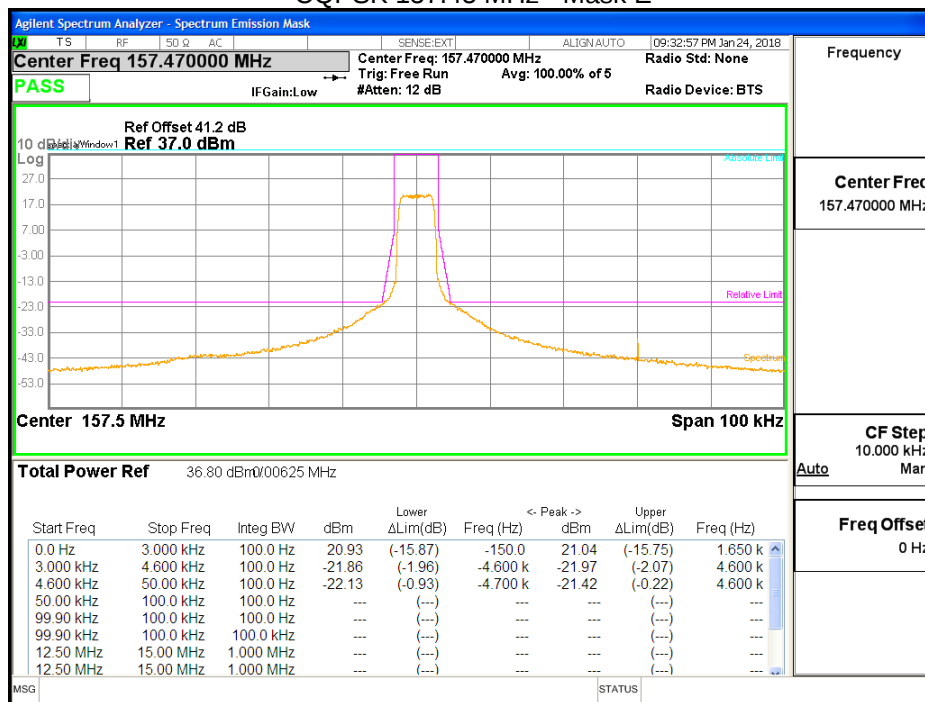
### HDQPSK 150.815 MHz - Mask D



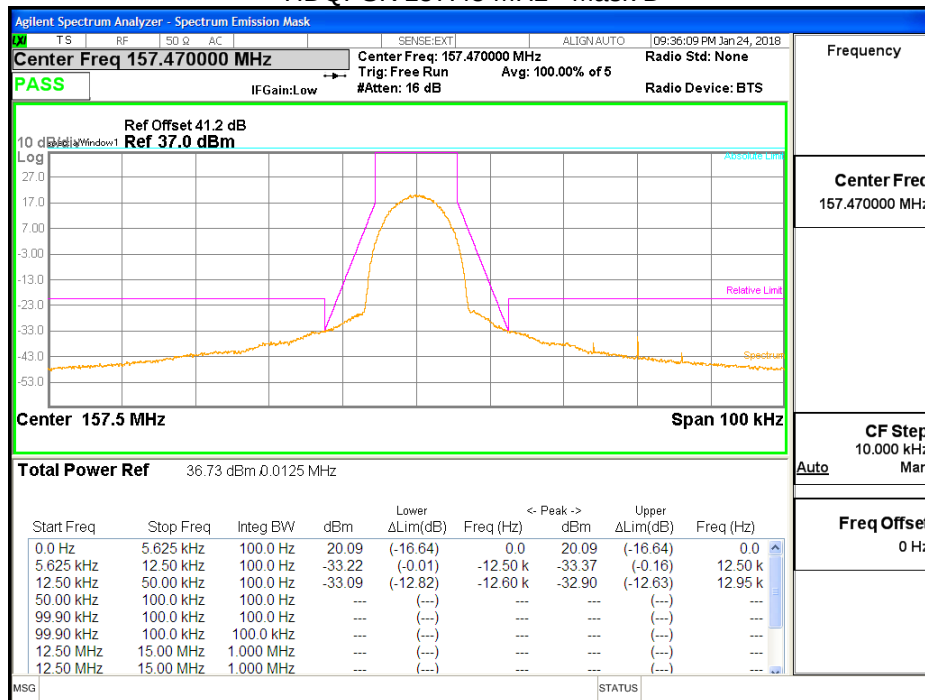
### C4FM 157.45MHz - Mask D



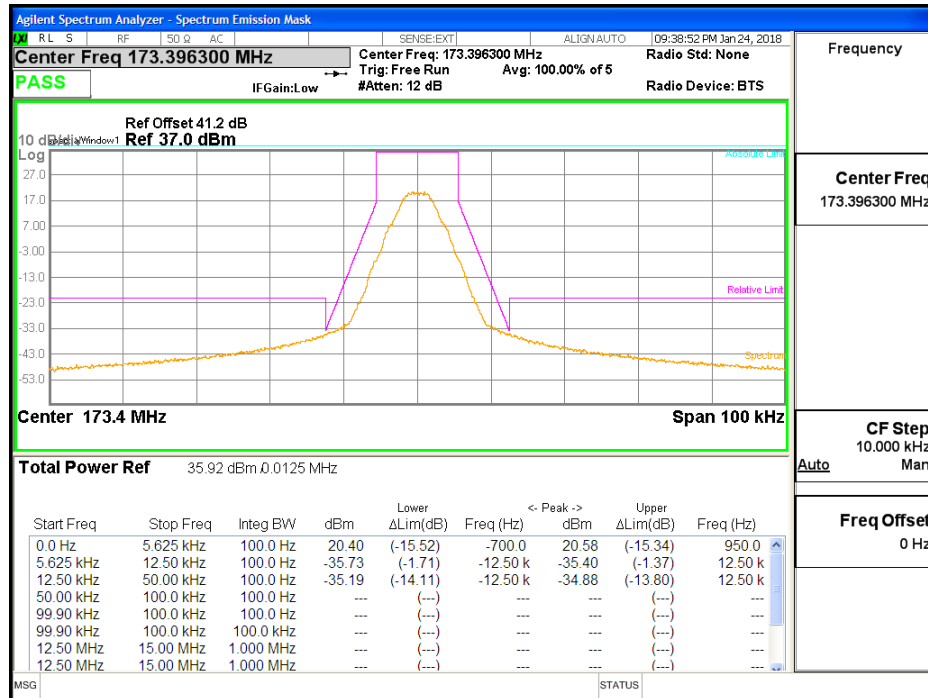
### CQPSK 157.45 MHz - Mask E



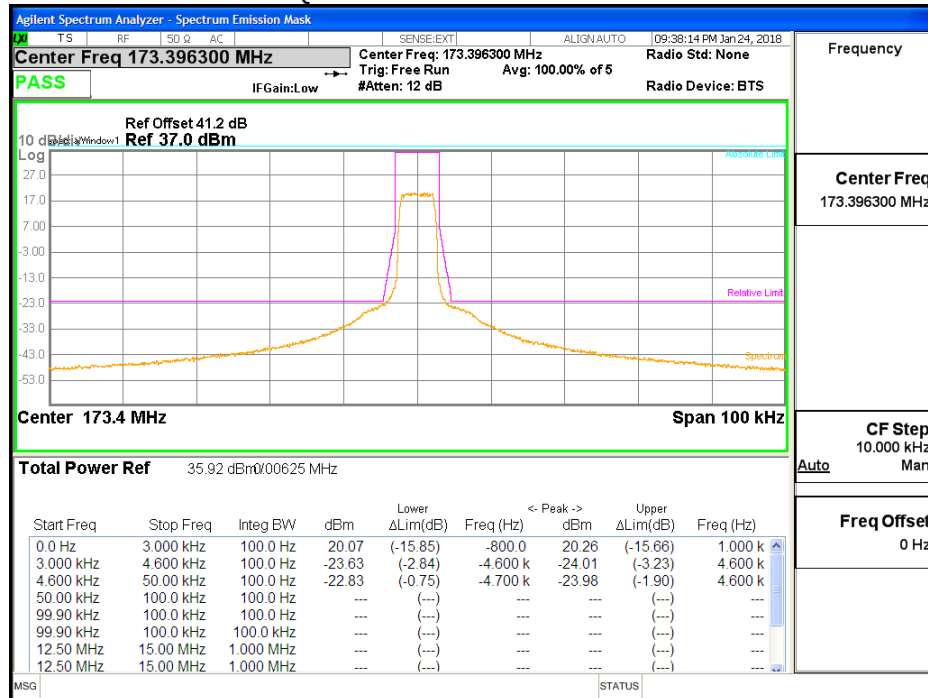
### HDQPSK 157.45 MHz - Mask D



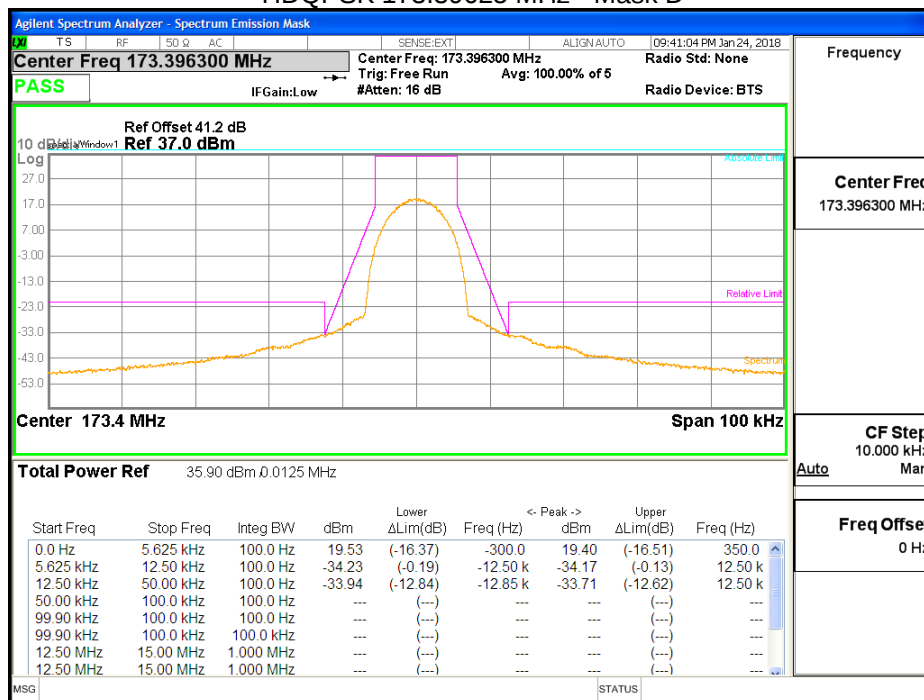
### C4FM 173.39625 MHz - Mask D



### CQPSK 173.39625 MHz - Mask E

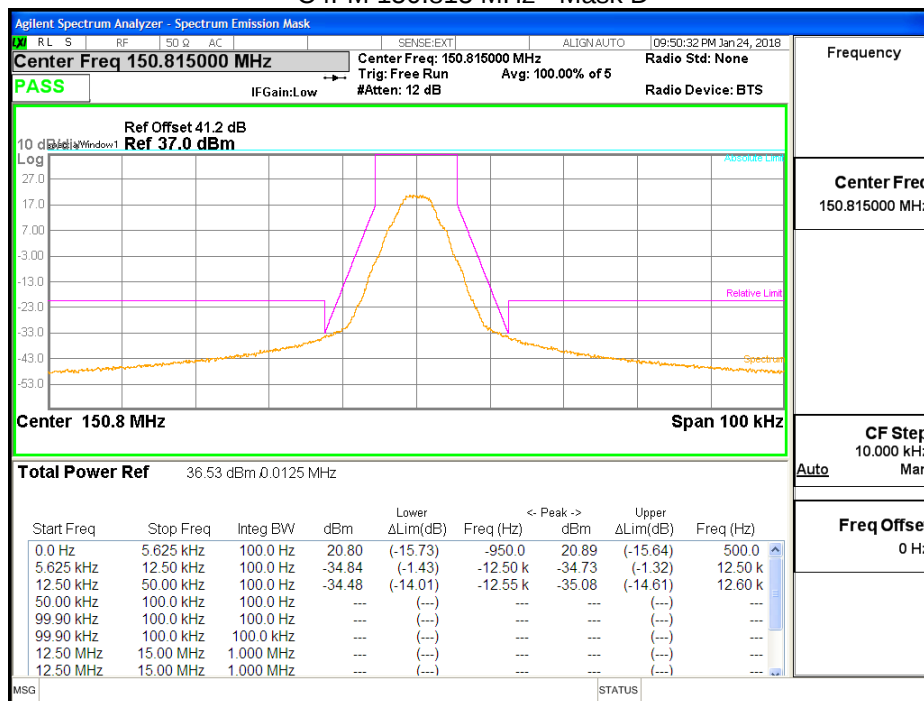


### HDQPSK 173.39625 MHz - Mask D

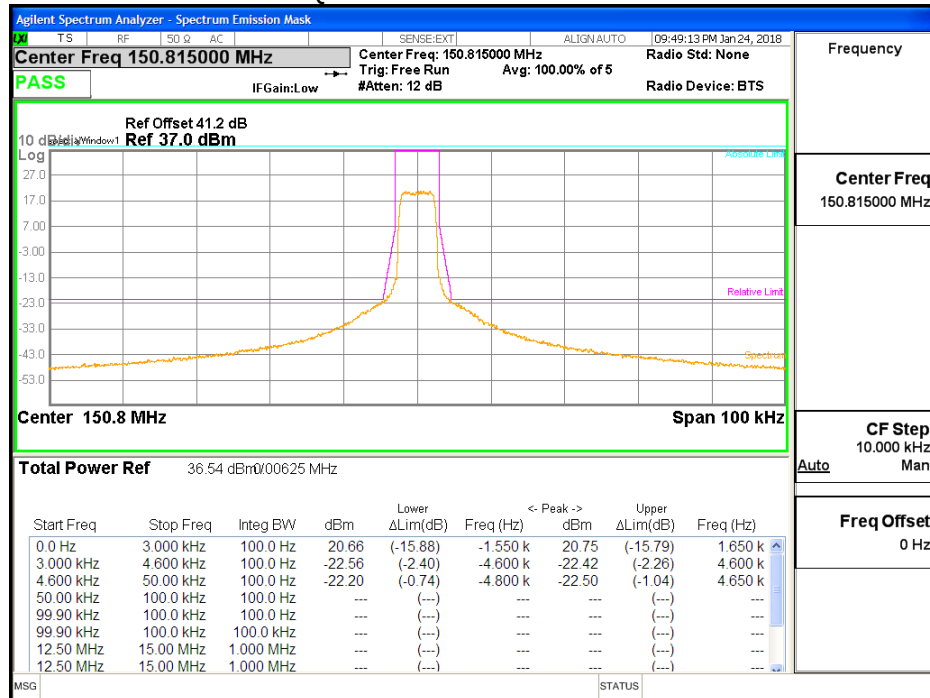


At Input Power 3 dB above AGC threshold

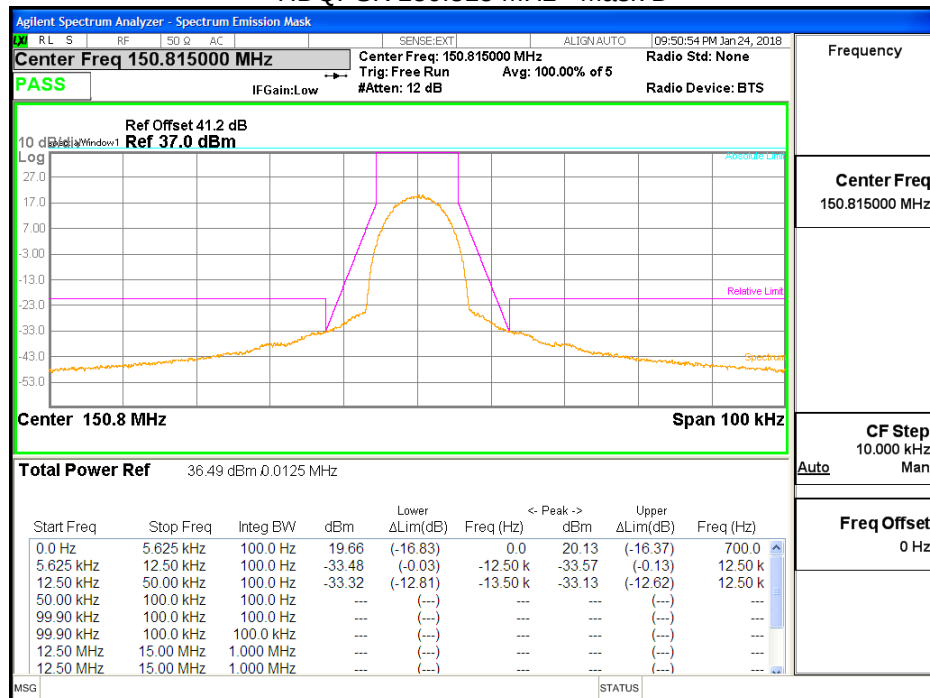
### C4FM 150.815 MHz - Mask D



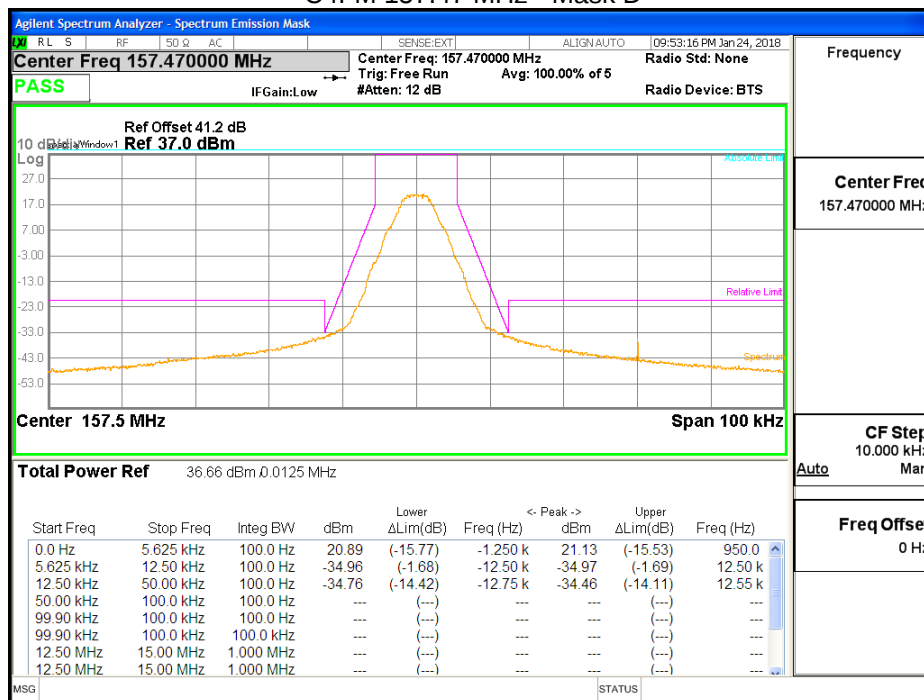
### CQPSK 150.815 MHz - Mask E



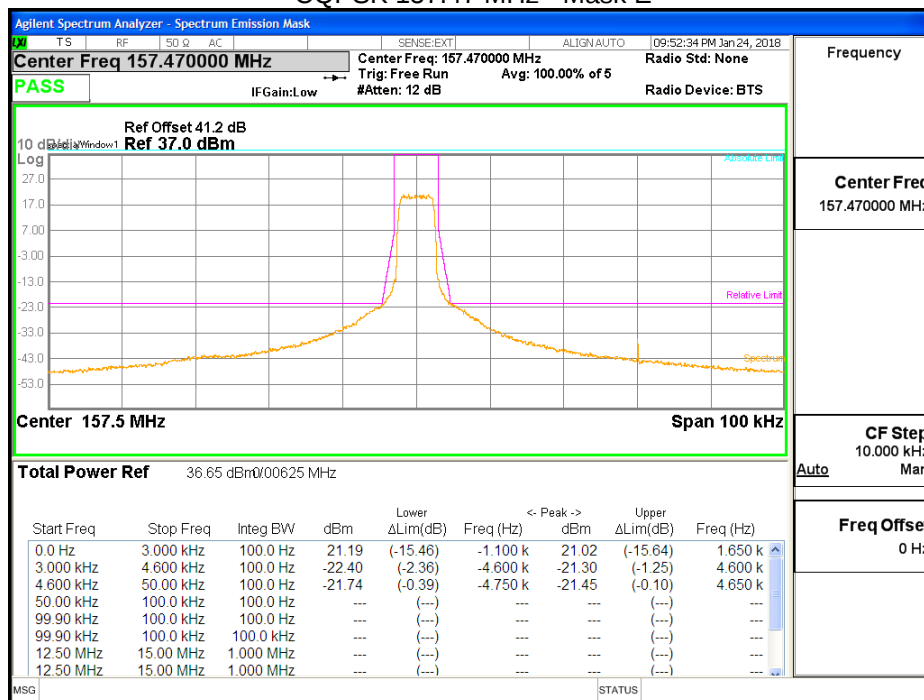
### HDQPSK 150.815 MHz - Mask D



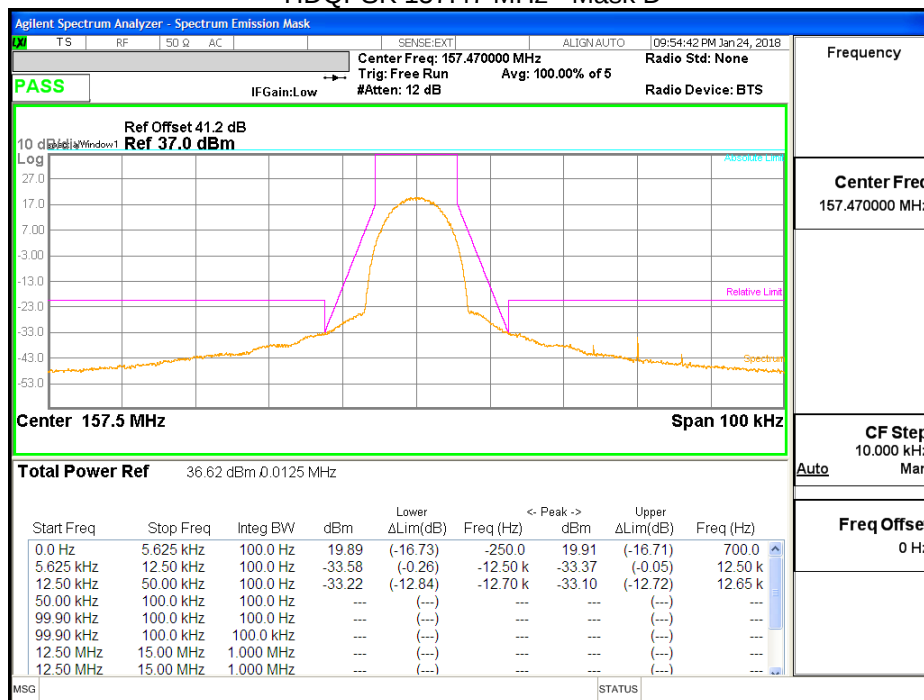
### C4FM 157.47 MHz - Mask D



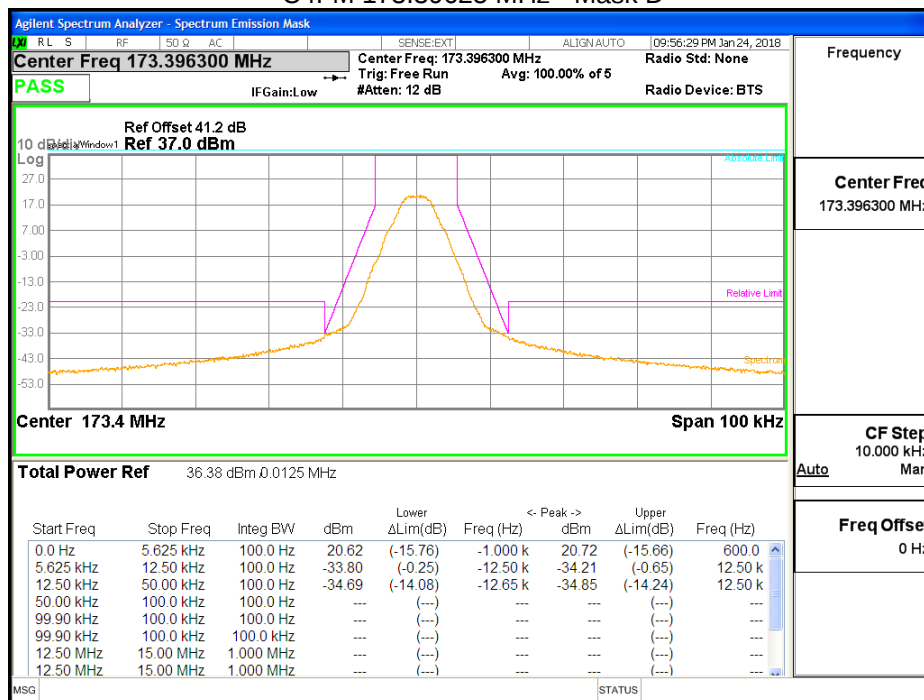
### CQPSK 157.47 MHz - Mask E



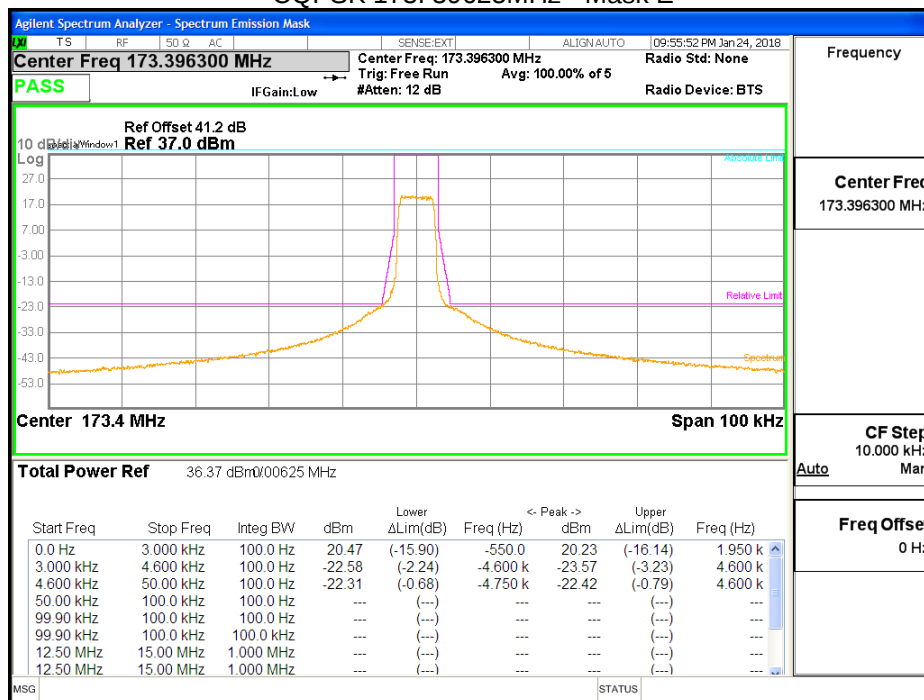
### HDQPSK 157.47 MHz - Mask D



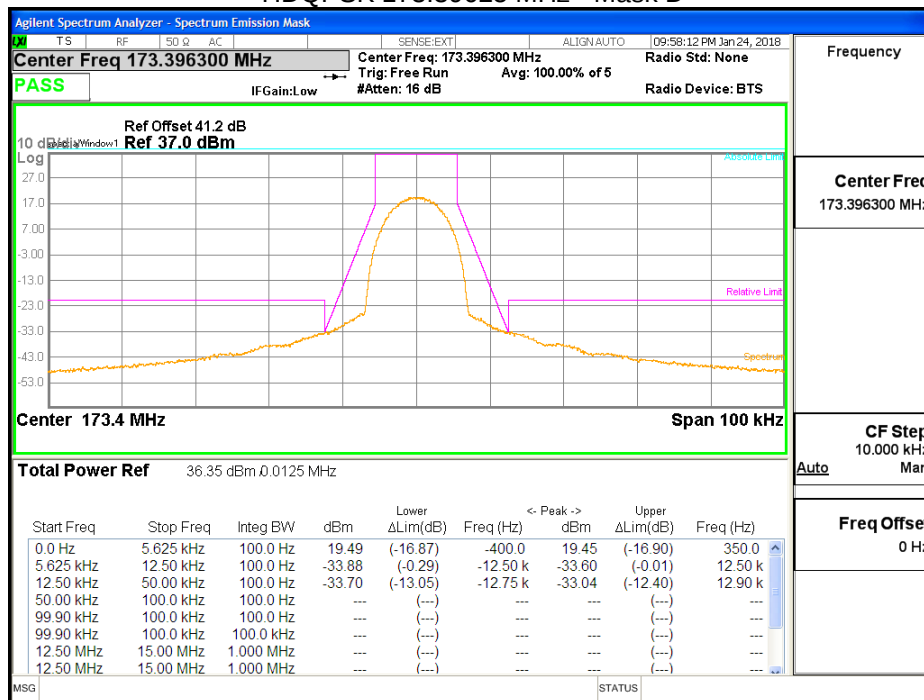
### C4FM 173.39625 MHz - Mask D



### CQPSK 173.39625MHz - Mask E



### HDQPSK 173.39625 MHz - Mask D



### **Frequency Stability**

The airHost and hd33 are synchronized to the same reference clock. Therefore there is no frequency error after down and up frequency conversion are performed.

The frequency stability check is not applicable to the EUT.

## Passband Gain and Bandwidth & Out of Band Rejection

|                                                                                                                              |                                                                                                                     |                           |               |
|------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|---------------------------|---------------|
| Governing Doc                                                                                                                | FCC KDB 935210 D05<br>Indus Booster Basic Meas<br>v01r02: October, 2017<br>RSS-131 Sec 6.1                          | Room Temperature (°C)     | 23.6          |
| Test Procedure                                                                                                               | ANSI/TIA-603- E-2016;<br>FCC KDB 935210 D05<br>Indus Booster Basic Meas<br>v01r02: October, 2017<br>RSS-131 Sec 4.2 | Relative Humidity (%)     | 29.7          |
| Test Location                                                                                                                | Burnaby                                                                                                             | Barometric Pressure (kPa) | 100.5         |
| Test Engineer                                                                                                                | Sophie Piao/Jeremy Lee                                                                                              | Date                      | Jan 24, 2018  |
| EUT Voltage                                                                                                                  | <input checked="" type="checkbox"/> DC <input type="checkbox"/> 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                                                                                                              |                                                                                                                     |                           |               |
|                                                                                                                              |                                                                                                                     |                           |               |
|                                                                                                                              |                                                                                                                     |                           |               |
|                                                                                                                              |                                                                                                                     |                           |               |
| Note) CVP = Calibration Verification Performed internally, n/p = not provided.                                               |                                                                                                                     |                           |               |
| Frequency Range:                                                                                                             | <input checked="" type="checkbox"/> Product Passband $\pm$ 250%                                                     |                           |               |
| Detector:                                                                                                                    | <input checked="" type="checkbox"/> Peak                                                                            |                           |               |
| RBW/VBW:                                                                                                                     | <input checked="" type="checkbox"/> 0.1% of 5 times of passband bandwidth                                           |                           |               |
| Type of Facility:                                                                                                            | <input checked="" type="checkbox"/> Tabletop                                                                        |                           |               |
| Distance:                                                                                                                    | <input checked="" type="checkbox"/> Direct                                                                          |                           |               |
| Compliant <input checked="" type="checkbox"/> Non-Compliant <input type="checkbox"/> Not Applicable <input type="checkbox"/> |                                                                                                                     |                           |               |

### Test setup

#### Description of test set-up:

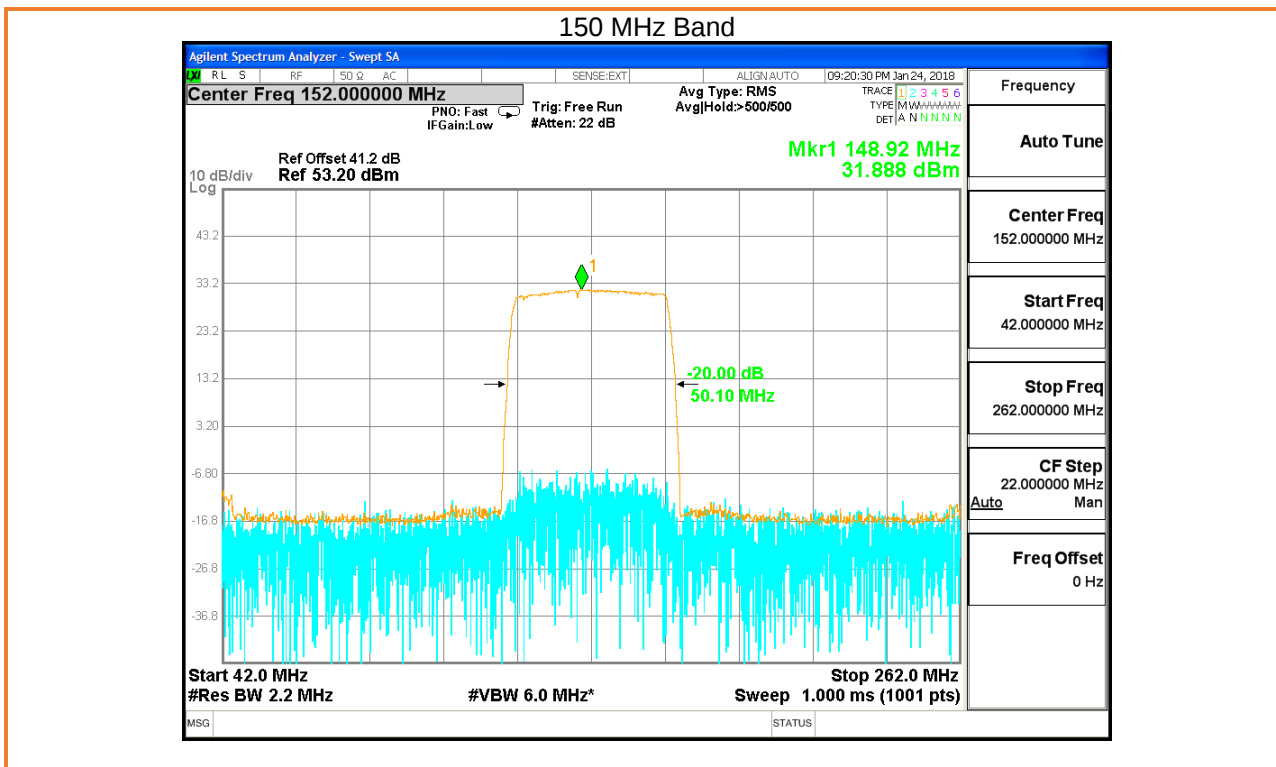
The procedure used was ANSI/TIA-603-E-2016 and FCC KDB 935210 D05 Indus Booster Basic Meas v01r02. The signal booster was set to maximum gain. A swept CW signal was set to the range of  $\pm 250\%$  of the product pass band. The CW amplitude was set to 5 dB below the AGC threshold so that the ALC should 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.**



### Results



## Intermodulation

|                                                                                                                                                                                                                  |                                                                                                  |                           |               |             |                 |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|---------------------------|---------------|-------------|-----------------|
| Governing Doc                                                                                                                                                                                                    | FCC Part 90.219                                                                                  | Room Temperature (°C)     | 23.6          |             |                 |
| Test Procedure                                                                                                                                                                                                   | ANSI/TIA-603- E-2016;<br>FCC KDB 935210 D05<br>Indus Booster Basic Meas<br>v01r02: October, 2017 | Relative Humidity (%)     | 29.7          |             |                 |
| Test Location                                                                                                                                                                                                    | Burnaby                                                                                          | Barometric Pressure (kPa) | 100.5         |             |                 |
| Test Engineer                                                                                                                                                                                                    | Sophie Piao/Jeremy Lee                                                                           | Date                      | Jan 24, 2018  |             |                 |
| EUT Voltage                                                                                                                                                                                                      | <input checked="" type="checkbox"/> DC <input type="checkbox"/> 120VAC @ 60Hz                    |                           |               |             |                 |
| Test Equipment Used                                                                                                                                                                                              | Manufacturer                                                                                     | Model                     | Serial Number | Calibration | Calibration due |
| Signal Generator                                                                                                                                                                                                 | Keysight                                                                                         | N5172B                    | MY53050270    | 08/04/17    | 08/04/18        |
| Spectrum Analyzer                                                                                                                                                                                                | Keysight                                                                                         | N9010A                    | MY50520285    | 08/07/17    | 08/07/18        |
| 40dB Attenuator                                                                                                                                                                                                  | Aeroflex Winschel                                                                                | 58-40-43                  | n/p           | CVP         | CVP             |
| Note) CVP = Calibration Verification Performed internally, n/p = not provided.                                                                                                                                   |                                                                                                  |                           |               |             |                 |
| Frequency Range:                                                                                                                                                                                                 | <input checked="" type="checkbox"/> Max Gain Frequency $\pm$ 50kHz                               |                           |               |             |                 |
| Detector:                                                                                                                                                                                                        | <input checked="" type="checkbox"/> Average                                                      |                           |               |             |                 |
| RBW/VBW:                                                                                                                                                                                                         | <input checked="" type="checkbox"/> 100/910Hz                                                    |                           |               |             |                 |
| Type of Facility:                                                                                                                                                                                                | <input checked="" type="checkbox"/> Tabletop                                                     |                           |               |             |                 |
| Distance:                                                                                                                                                                                                        | <input checked="" type="checkbox"/> Direct                                                       |                           |               |             |                 |
| The intermodulation product of 2 tone is below the -13dBm emission limit with input power <ul style="list-style-type: none"> <li>- 0.5dBm below AGC threshold and</li> <li>- 3 dB above AGC threshold</li> </ul> |                                                                                                  |                           |               |             |                 |
| Compliant <input checked="" type="checkbox"/> Non-Compliant <input type="checkbox"/> Not Applicable <input type="checkbox"/>                                                                                     |                                                                                                  |                           |               |             |                 |

### **Test setup**

#### **Description of test set-up:**

The procedure used was ANSI/TIA-603-E-2016. Two tones (CW) method was used. The input power to the amplifier was set at maximum drive level by combining the two tones. The two tones were chosen in such a way (1) the third order intermodulation product frequencies are located within the pass band of the DUT and (2) they produce the worst-case emissions out of band. All signals were modulated.

Based on FCC KDB 935210 D05 Indus Booster Basic Meas v01r02: 2017, the two tone was located on either side of the maximum gain frequency in the passing band, and separated with the available spacing, which is 12.5kHz in 150 MHz band.

Measurements were performed with modulated -tone at identical input amplitude which produced integrated maximum rated output power.

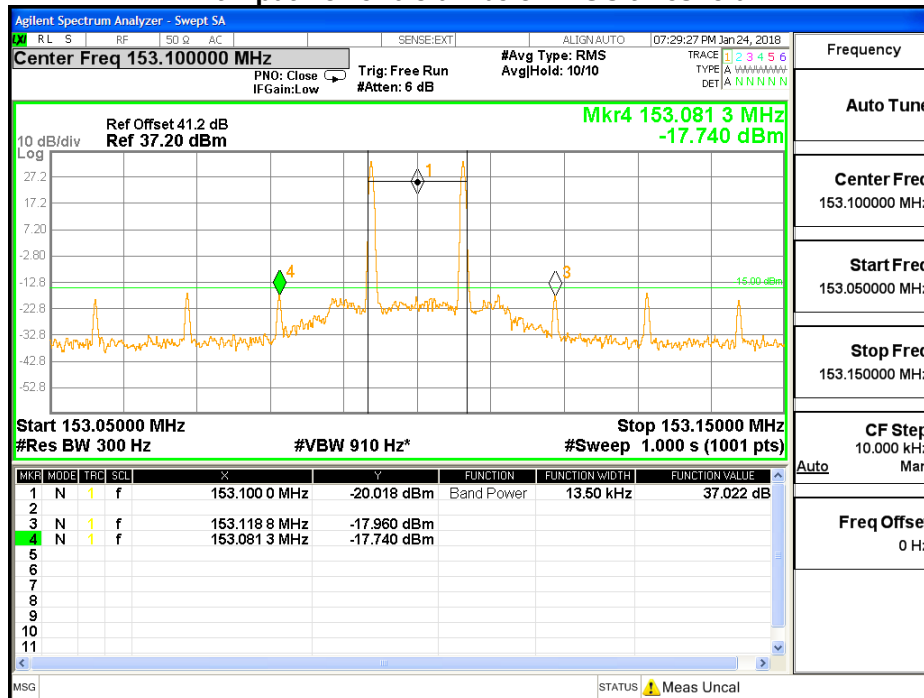
The EUT was set to **Operation Mode #1 with configuration Mode #1.**



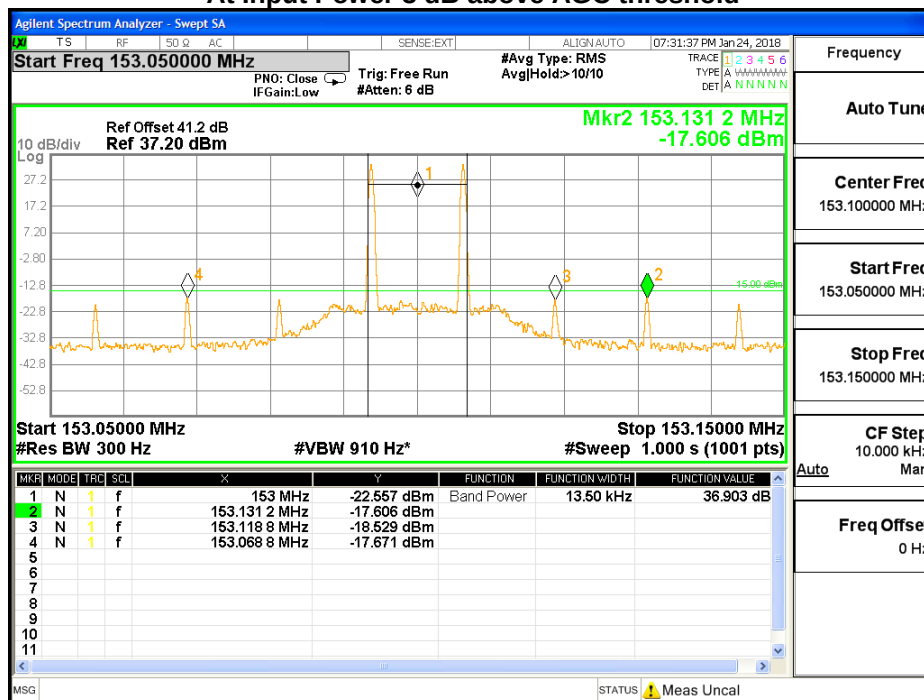
## Results

On the maximum gain channel 153.32 MHz:

### At Input Power 0.5 dB below AGC threshold



### At Input Power 3 dB above AGC threshold



## Input/output Power and Amplifier/Booster Gain

|                                                                                                                              |                                                                                                    |                           |              |
|------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|---------------------------|--------------|
| Governing Doc                                                                                                                | FCC Part 90.219                                                                                    | Room Temperature (°C)     | 23.6         |
| Test Procedure                                                                                                               | ANSI/TIA-603-E-2016;<br>FCC KDB 935210 D05<br>Indus Booster Basic Meas<br>v01r02: October 27, 2017 | Relative Humidity (%)     | 29.7         |
| Test Location                                                                                                                | Burnaby                                                                                            | Barometric Pressure (kPa) | 100.5        |
| Test Engineer                                                                                                                | Sophie Piao/Jeremy Lee                                                                             | Date                      | Jan 24, 2018 |
| EUT Voltage                                                                                                                  | <input checked="" type="checkbox"/> DC <input type="checkbox"/> 120VAC @ 60Hz                      |                           |              |
| Test Equipment Used                                                                                                          | Manufacturer                                                                                       | Model                     | Identifier   |
| 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.                                               |                                                                                                    |                           |              |
| Span:                                                                                                                        | <input checked="" type="checkbox"/> Max Gain Frequency $\pm$ 1500kHz                               |                           |              |
| Detector:                                                                                                                    | <input checked="" type="checkbox"/> Peak                                                           |                           |              |
| RBW/VBW:                                                                                                                     | <input checked="" type="checkbox"/> 100k Hz/ 300 kHz                                               |                           |              |
| Type of Facility:                                                                                                            | <input checked="" type="checkbox"/> Tabletop                                                       |                           |              |
| Distance:                                                                                                                    | <input checked="" type="checkbox"/> Direct                                                         |                           |              |
| Maximum booster gain is 91.987 dB.                                                                                           |                                                                                                    |                           |              |
| Compliant <input checked="" type="checkbox"/> Non-Compliant <input type="checkbox"/> Not Applicable <input type="checkbox"/> |                                                                                                    |                           |              |

## Test setup

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Description of test set-up:</p> <p>The procedure used was ANSI/TIA-603-E-2016 and FCC KDB 935210 D05 Indus Booster Basic Meas v01r02:. A CW tone was input at the frequency where the system gain is the maximum in the pass band, with the nominal input power level -55 dBm. The spectrum analyzer was connected to the output RF port via a 50 Ohm 40 dB attenuator. The maximum hold trace and peak detector was used to capture the output power. The output power minus the input power (-55 dBm) equals to the booster gain in dB.</p> <p>The EUT was set to <b>Operation Mode #1 with configuration Mode #1.</b></p> <pre> graph LR     VSG[Vector Signal Generator] --&gt; airHost[airHost]     airHost --&gt; EUT[EUT]     EUT --&gt; Att[40dB Attenuator]     Att --&gt; SA[Spectrum Analyzer]                 </pre> |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

**Results**

|          | DL Gain   | DL Input | DL Output  |
|----------|-----------|----------|------------|
| 150 band | 91.987 dB | -55 dBm  | 36.987 dBm |

## Noise Figure

|                                                                                                                              |                                                                                                           |                           |               |
|------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|---------------------------|---------------|
| Governing Doc                                                                                                                | FCC Part 90.219                                                                                           | Room Temperature (°C)     | 23.4          |
| Test Procedure                                                                                                               | ANSI/TIA-603-E-2016;<br>FCC KDB 935210 D05<br>Indus Booster Basic Meas<br>v01r02: October 27, 2017        | Relative Humidity (%)     | 32.7          |
| Test Location                                                                                                                | Burnaby                                                                                                   | Barometric Pressure (kPa) | 101.5         |
| Test Engineer                                                                                                                | Sophie Piao/Jeremy Lee                                                                                    | Date                      | Jan 25, 2018  |
| EUT Voltage                                                                                                                  | <input checked="" type="checkbox"/> DC <input type="checkbox"/> 120VAC @ 60Hz                             |                           |               |
| Test Equipment Used                                                                                                          | Manufacturer                                                                                              | Model                     | Serial Number |
| Spectrum Analyzer                                                                                                            | Keysight                                                                                                  | N9010A                    | MY50520285    |
|                                                                                                                              |                                                                                                           |                           |               |
|                                                                                                                              |                                                                                                           |                           |               |
| Note) CNR = Calibration not required when used with other calibrated equipment.                                              |                                                                                                           |                           |               |
| Frequency Range:                                                                                                             | <input checked="" type="checkbox"/> 100 MHz centered at the center frequency of the passband on each band |                           |               |
| Detector:                                                                                                                    | <input checked="" type="checkbox"/> Average                                                               |                           |               |
| RBW:                                                                                                                         | <input checked="" type="checkbox"/> 910 kHz                                                               |                           |               |
| Type of Facility:                                                                                                            | <input checked="" type="checkbox"/> Tabletop                                                              |                           |               |
| Distance:                                                                                                                    | <input checked="" type="checkbox"/> Direct                                                                |                           |               |
| Noise Figure on each band is less than the 9 dB required.                                                                    |                                                                                                           |                           |               |
| Compliant <input checked="" type="checkbox"/> Non-Compliant <input type="checkbox"/> Not Applicable <input type="checkbox"/> |                                                                                                           |                           |               |

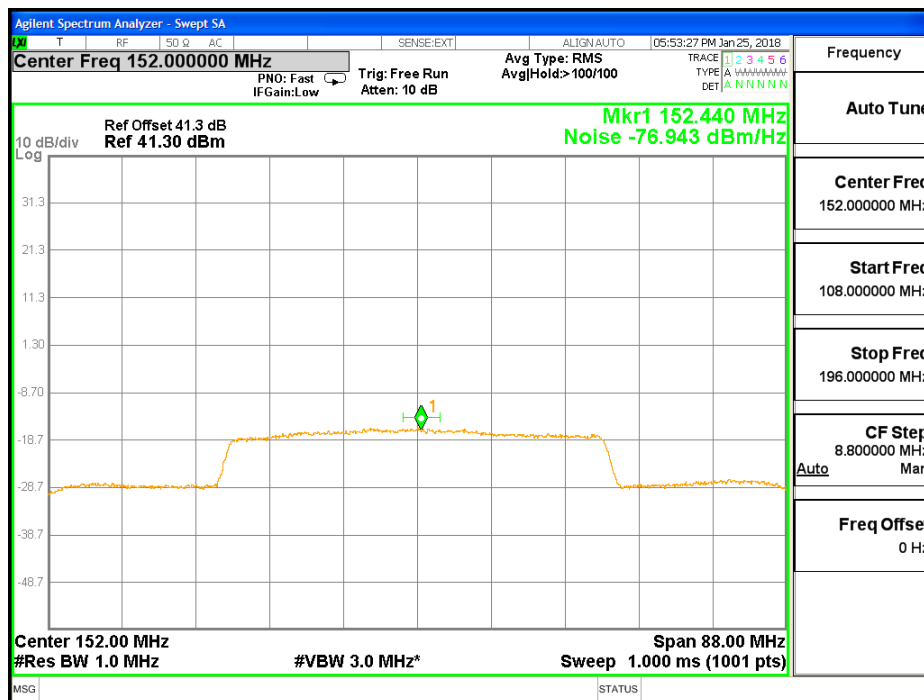
## Test setup

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Description of test set-up:</p> <p>Based on FCC KDB 935210 D05 Indus Booster Basic Meas v01r02: 2017, the system maximum gain and the noise density is measured. Measurements were performed within the EUT's passband.</p> <p>The noise figure is then calculated by <math>NF = NP - Gain + KTB \text{ Noise}</math>; where</p> <p>NP is in band noise power per Herz,</p> <p>Gain is in band booster gain, which is 91.987 dB in DL.</p> <p>KTB Noise is 174dB/Hz at room temperature.</p> <p>The EUT was set to <b>Operation Mode #1 with configuration Mode #1.</b></p> <div style="text-align: center;"> <p>For Noise Power Measurement</p> <pre> graph LR     airHost[airHost] --- Antenna(( ))     Antenna --- EUT[EUT]     EUT --- SA[Spectrum Analyzer]                     </pre> </div> |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

## Results

### 150MHz band

$$NF = -76.94 - 91.987 + 174 = 5.07 \text{ dB}$$



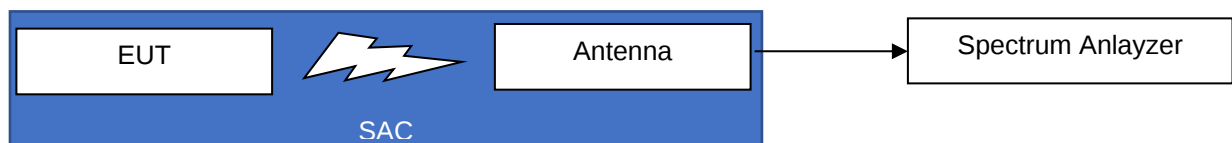
## Radiated Emissions - Enclosure

|                                                                                                                              |                                                                               |                           |                                                            |                  |                                                         |
|------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|---------------------------|------------------------------------------------------------|------------------|---------------------------------------------------------|
| Governing Doc                                                                                                                | FCC 15.209                                                                    | Room Temperature (°C)     | 20.6                                                       |                  |                                                         |
| Test Procedure                                                                                                               | ANSI C63.4                                                                    | Relative Humidity (%)     | 48                                                         |                  |                                                         |
| Test Location                                                                                                                | Richmond                                                                      | Barometric Pressure (kPa) | 100.4                                                      |                  |                                                         |
| Test Engineer                                                                                                                | David Johanson                                                                | Date                      | 20 October 2017                                            |                  |                                                         |
| EUT Voltage                                                                                                                  | <input checked="" type="checkbox"/> DC <input type="checkbox"/> 120VAC @ 60Hz |                           |                                                            |                  |                                                         |
| Test Equipment Used                                                                                                          | Manufacturer                                                                  | Model                     | Identifier                                                 | Calibration date | Calibration                                             |
| Spectrum Analyzer                                                                                                            | KeySight                                                                      | N9038A                    | 702                                                        | 18-Apr-2017      | 18-Apr-2018                                             |
| Broadband Antenna                                                                                                            | Sunol                                                                         | JB1                       | 371                                                        | 29-Mar-2016      | 29-Mar-2018                                             |
| Loop Antenna                                                                                                                 | ComPower                                                                      | AL-130                    | 241                                                        | 28-Oct-2015      | 28-Oct-2017                                             |
| Loop Antenna                                                                                                                 | ComPower                                                                      | AL-130                    | 241                                                        | 11-Nov-2017      | 11-Nov-2019                                             |
| Horn Antenna                                                                                                                 | A.H Systems                                                                   | SAS-571                   | 227C                                                       | 22-Sep-2016      | 22-Sep-2018                                             |
| RF Preamplifier                                                                                                              | Agilent                                                                       | 8449B                     | 273                                                        | NCR              | NCR                                                     |
| EMC Shielded Enclosure                                                                                                       | USC                                                                           | USC-26                    | 374                                                        | NCR <sup>1</sup> | NCR <sup>1</sup>                                        |
| Note1) NCR = No Calibration Required, but NSA was done at 2016.                                                              |                                                                               |                           |                                                            |                  |                                                         |
| Frequency Range:                                                                                                             | <input checked="" type="checkbox"/> 9kHz-30MHz                                |                           | <input checked="" type="checkbox"/> 30-1000MHz             |                  | <input checked="" type="checkbox"/> 1-18GHz             |
| Detector:                                                                                                                    | <input checked="" type="checkbox"/> Peak (for Prescan)                        |                           | <input checked="" type="checkbox"/> Quasi-Peak(for Formal) |                  | <input checked="" type="checkbox"/> Average(for Formal) |
| RBW/VBW:                                                                                                                     | <input checked="" type="checkbox"/> 9/30kHz                                   |                           | <input checked="" type="checkbox"/> 120/300kHz             |                  | <input checked="" type="checkbox"/> 1/3MHz              |
| Type of Facility:                                                                                                            | <input checked="" type="checkbox"/> SAC                                       |                           | <input type="checkbox"/> FSOATS                            |                  | <input type="checkbox"/> in-situ                        |
| Distance:                                                                                                                    | <input checked="" type="checkbox"/> 3meter                                    |                           | <input type="checkbox"/> 10meter                           |                  | <input type="checkbox"/> 1meter                         |
| Arrangement of EUT:                                                                                                          | <input checked="" type="checkbox"/> Table-top only                            |                           | <input type="checkbox"/> Floor-standing only               |                  | <input type="checkbox"/> Rack Mounted                   |
| Compliant <input checked="" type="checkbox"/> Non-Compliant <input type="checkbox"/> Not Applicable <input type="checkbox"/> |                                                                               |                           |                                                            |                  |                                                         |

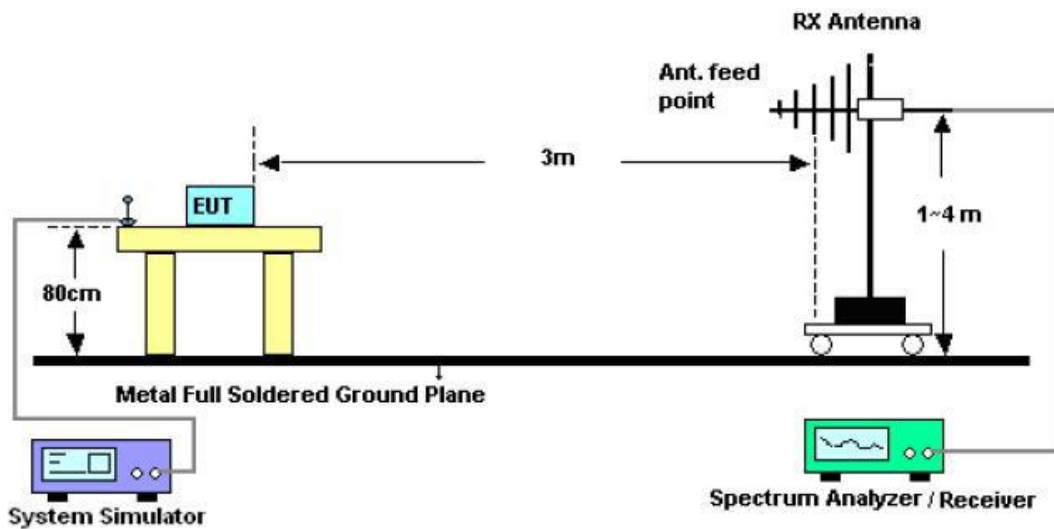
## Test setup

### Description of test set-up:

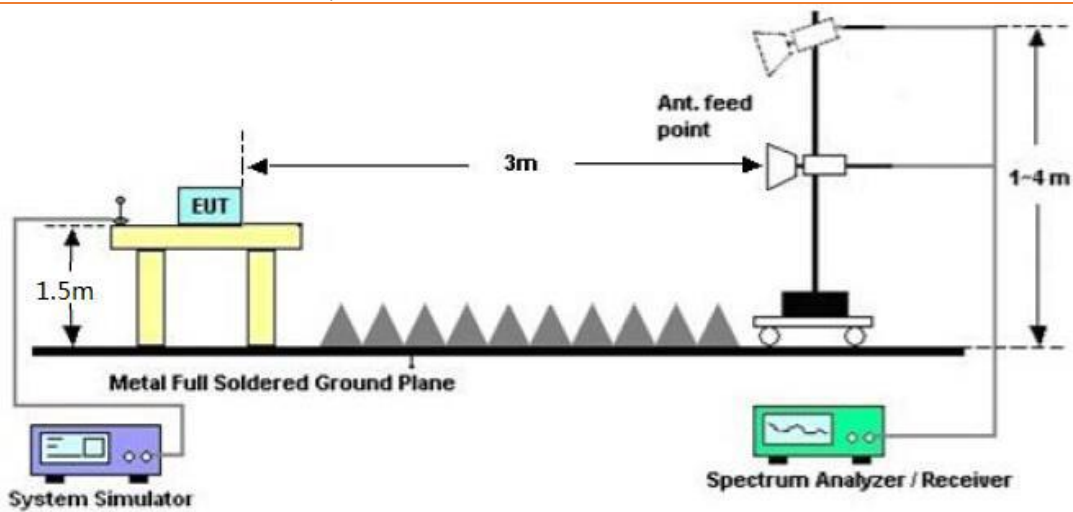
The EUT was placed on a nonconducting platform (i.e., an "EUT support table"), of nominal size 1 m by 1.5 m, whose top surface is nominally 80 cm above the reference ground plane. The EUT was set up on 3 meters away from the EUT. The EUT was set continually on its Radio, **5W** Max., which was downlinked from [airHost](#). And the output of RF was terminated via 40dB attenuator, for rejecting the high power of carrier. The lowest, middle and highest channels were used for measuring of all radiated spurious emissions . The EUT was set to **Operation Mode #1 with configuration Mode #1**.



- Radiated Emission 30 to 1,000MHz, with JB-1



- Radiated Emission 1 to 18GHz, with SAS-571



### Measurement Procedure

Testing was performed in accordance with the test standard(s) referenced in the test summary section of this report. The Equipment Under Test (EUT) was configured based upon the requirements of the applicable test standard. Initially, the primary emission frequencies are identified by positioning a broadband receive antenna three meter from the EUT.

Scans were made with an EMC Analyzer, controlled by EMC Test Software, Tile7!, from 30kHz to 18GHz with the receiver in the peak mode. The receiver IF bandwidth was 9kHz, 120 kHz or 1MHz as appropriate for the frequency and scan step was about 30kHz. To ensure that the maximum emission at each discrete frequency of interest is observed, the receive antenna is varied in height from one to four meters and rotated to produce horizontal and vertical polarities while the turntable is rotated to determine the worst emitting configuration. Under 30MHz was only tested at 1meter height and Antenna was changed both polarization, Horizontal and Vertical. Measurements were then made using CISPR quasi peak when the peak readings were within 10dB of the limit line. The numerical results are included herein to demonstrate compliance.

#### Test Result

The output of EUT was set to 5 Watt(+37dBm),  
The PASS level of Spurious is:  $43 + 10\log(P) = 43 + 10\log(1) = 49.99\text{dB}$  attenuation = -13dBm

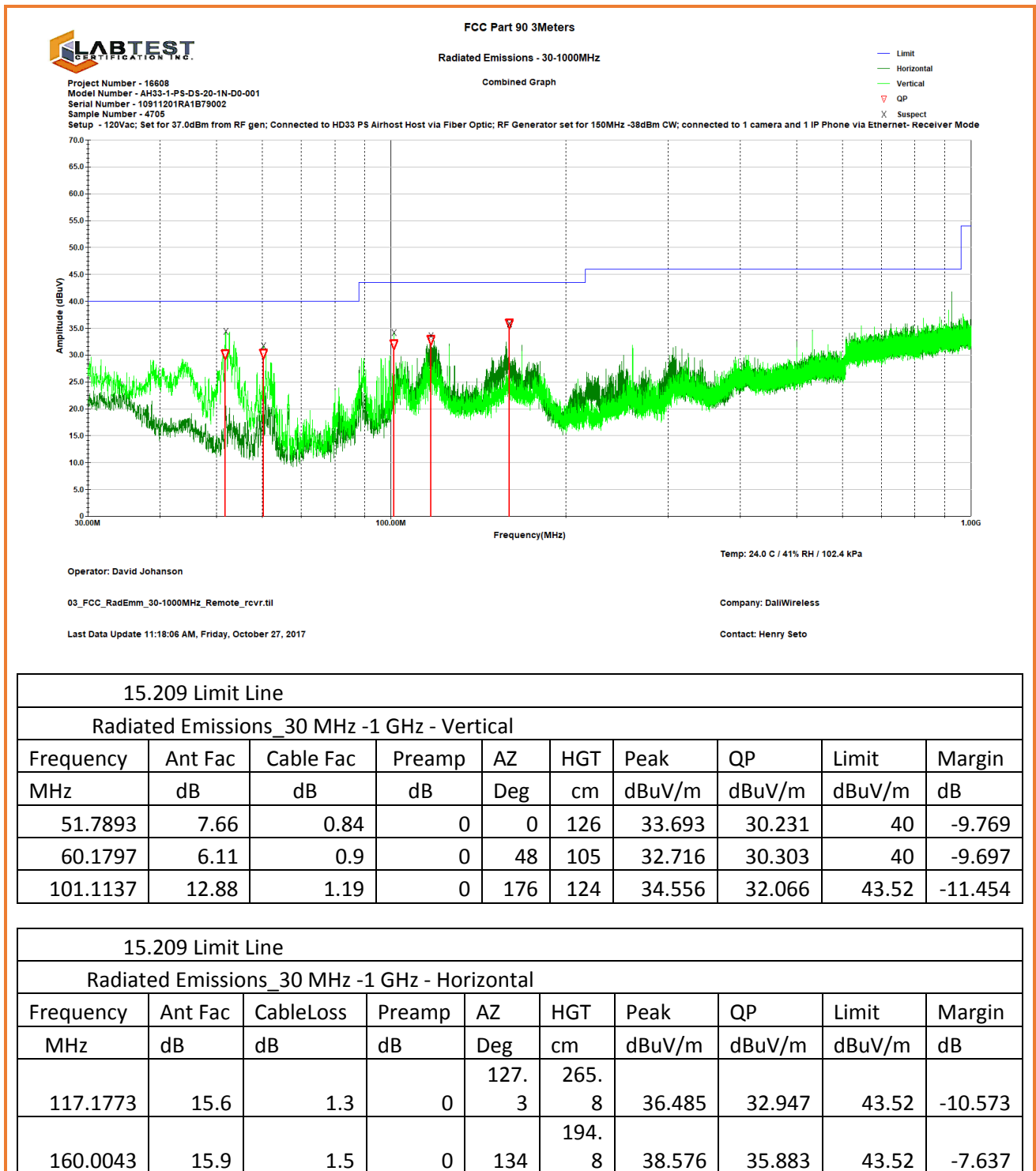
Since of radiated measurement was performed at 3 meters, the limit line was converted to dBuV/m using the formulas as outlined in KDB 971168 (5.8.4): -13 dBm ERP = 84.38 dBuV/m at 3 meters.

Spurious Emission level (dBuV/m) = Detected level (dBuV) + Path Loss(dB) + Antenna Factor (dB/m) - Preamplifier's Gain (dB)

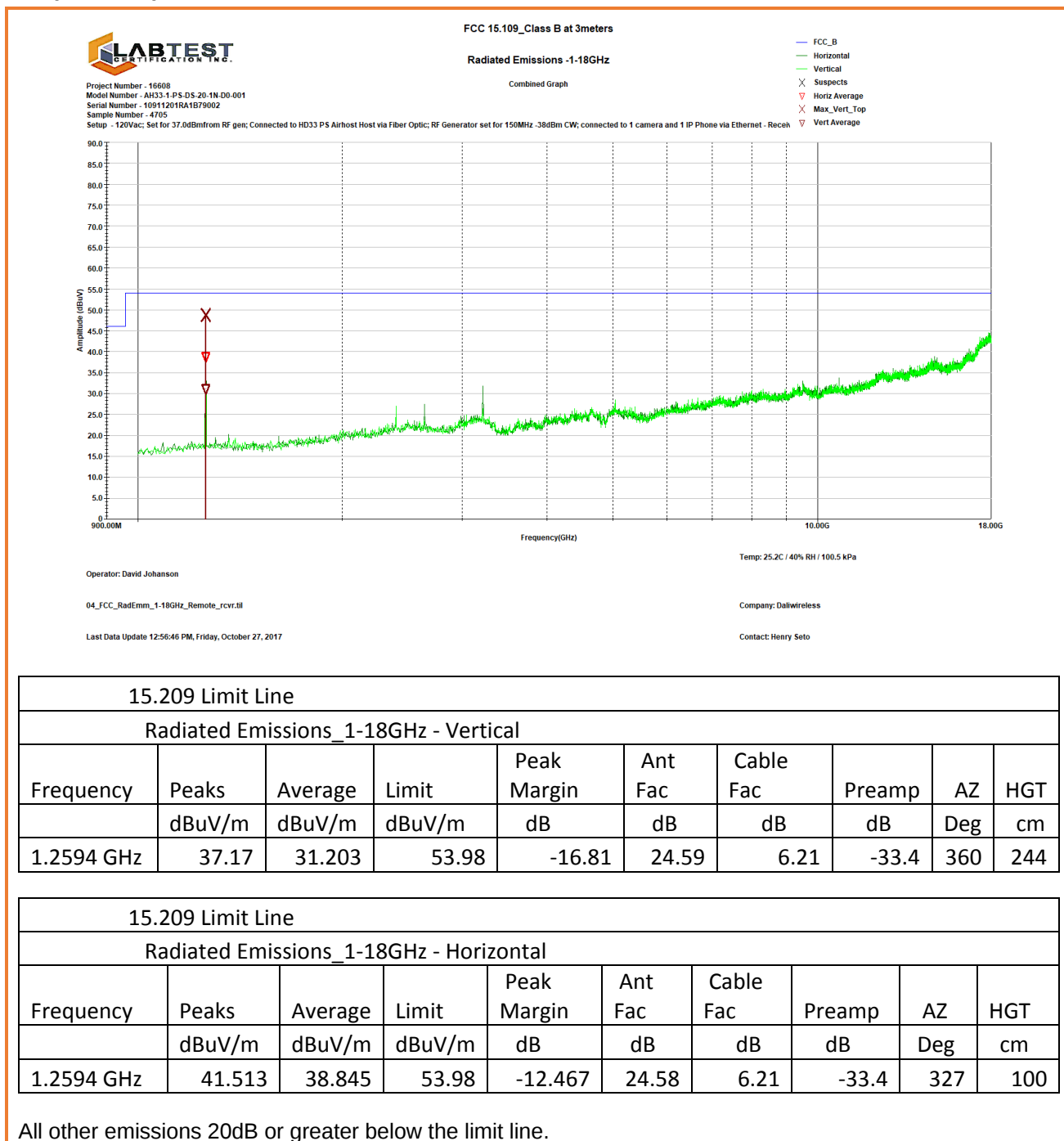
### Graphical Representation for Emission - Radiated 30kHz to 30MHz

Spectrum was scanned manually from 30kHz to 30MHz. No automated plot is available for this frequency range. No spurious emissions from the product were detectable

**Graphical Representation for Emission - Radiated 30MHz to 1GHz**



### Graphical Representation for Emission - Radiated 1 to 18GHz



## APPENDIX A: ISO 17025:2005 Accreditation Certificate



# CERTIFICATE OF ACCREDITATION

## ANSI-ASQ National Accreditation Board

500 Montgomery Street, Suite 625, Alexandria, VA 22314, 877-344-3044

This is to certify that

**Labtest Certification, Inc.**  
**3128, 20800 Westminster HWY**  
**Richmond B.C. V6V 2W3**

has been assessed by ANAB  
and meets the requirements of international standard

**ISO/IEC 17025:2005**

while demonstrating technical competence in the field of

**TESTING**

Refer to the accompanying Scope of Accreditation for information regarding the types of tests to which this accreditation applies.

AT-2033

Certificate Number

  
ANAB Approval

Certificate Valid: 08/07/2017-03/04/2018  
Version No. 004 Issued: 08/07/2017



This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005.  
This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated April 2017).



## SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

**Labtest Certification, Inc.**  
 3128, 20800 Westminster HWY  
 Richmond, B.C. V6V 2W3  
 Kavinder Dhillon Ruben Ugarte Phone: 604-247-0444  
 kdhillon@labtestcert.com rubenUgarte@labtestcert.com  
 www.labtestcert.com

### TESTING

Valid to: **March 4, 2018**

Certificate Number: **A-T-2033**

#### Testing performed in support of FCC DoC and Certification approval procedures

| Type of Device Examples                                                                               | Scope of Accreditation                                                                        | Supporting FCC Guidance | Comments |
|-------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|-------------------------|----------|
| Unintentional Radiators (FCC Part 15, Subpart B)                                                      | • ANSI C63.4-2014                                                                             |                         |          |
| Industrial, Scientific, and Medical Equipment (FCC Part 18)                                           | • FCC MP-5, (February 1986)                                                                   |                         |          |
| • Consumer ISM equipment                                                                              |                                                                                               |                         |          |
| Intentional Radiators (FCC Part 15 Subpart C)                                                         | • ANSI C63.10-2013                                                                            |                         |          |
| UPCS (FCC Part 15, Subpart D)                                                                         | • ANSI C63.17-2013                                                                            |                         |          |
| • Unlicensed Personal Communication Systems devices                                                   |                                                                                               |                         |          |
| U-NII without DFS Intentional Radiators (FCC Part 15, Subpart E)                                      | • ANSI C63.10-2013                                                                            | KDB Publication 789033  |          |
| • Unlicensed National Information Infrastructure Devices (U-NII without DFS)                          |                                                                                               |                         |          |
| U-NII with DFS Intentional Radiators (FCC Part 15 Subpart E)                                          | • FCC KDB Publication 905462 D02 UNII DFS Compliance Procedures New Rules v01 (April 8, 2016) |                         |          |
| • Unlicensed National Information Infrastructure U-NII Devices with Dynamic Frequency Selection (DFS) |                                                                                               |                         |          |
| UWB Intentional Radiators (FCC Part 15, Subpart F)                                                    | • ANSI C63.10-2013                                                                            |                         |          |
| • Ultra-wideband Operation                                                                            |                                                                                               |                         |          |
| BPL Intentional Radiators (FCC Part 15, Subpart G)                                                    | • ANSI C63.10-2013                                                                            |                         |          |
| • Access Broadband Over Power Line (Access BPL)                                                       |                                                                                               |                         |          |
| White Space Device Intentional Radiators (FCC Part 15, Subpart H)                                     | • ANSI C63.10-2013                                                                            |                         |          |
| • White Space Devices                                                                                 |                                                                                               |                         |          |

Version 003 Issued: 08/07/2017

[www.anab.org](http://www.anab.org)



Page 1 of 8



**Testing performed in support of FCC DoC and Certification approval procedures**

| Type of Device Examples                                                                                                                                                          | Scope of Accreditation                       | Supporting FCC Guidance                          | Comments                                                                                 |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|--------------------------------------------------|------------------------------------------------------------------------------------------|
| Commercial Mobile Services (FCC Licensed Radio Service Equipment)<br>•Part 22 (cellular)<br>•Part 24<br>•Part 25 (non-microwave)<br>•Part 27                                     | • ANSI/TIA-603-D<br>• TIA-102.CAAA-D         | KDB Publication 971168                           |                                                                                          |
| General Mobile Radio Services (FCC Licensed Radio Service Equipment)<br>•Part 22 (non-cellular)<br>•Part 90 (non-microwave)<br>•Part 95<br>•Part 97<br>•Part 101 (non-microwave) | • ANSI/TIA-603-D<br>• TIA-102.CAAA-D         |                                                  | Microwave Frequencies, as used in this part, refers to frequencies of 890 MHz and above. |
| Citizens Broadband Radio Services (FCC Licensed Radio Service Equipment)<br>•Part 96                                                                                             | • ANSI/TIA-603-D<br>• TIA-102.CAAA-D         | KDB Publication 971168                           |                                                                                          |
| Maritime and Aviation Radio Services (FCC Licensed Radio Service Equipment)<br>•Part 80<br>•Part 87                                                                              | • ANSI/TIA-603-D                             |                                                  |                                                                                          |
| Microwave and Millimeter Bands Radio Services (FCC Licensed Radio Service Equipment)<br>•Part 25<br>•Part 74<br>•Part 90 (90Y, 90Z, D SRC)<br>•Part 101                          | • ANSI/TIA-603-D<br>• TIA-102.CAAA-D         |                                                  |                                                                                          |
| Broadcast Radio Services (FCC Licensed Radio Service Equipment)<br>•Part 73<br>•Part 74 (non-microwave)                                                                          | • ANSI/TIA-603-D<br>• TIA-102.CAAA-D         |                                                  |                                                                                          |
| RF Exposure<br>•Devices subject to SAR requirements                                                                                                                              | • IEEE Std 1528™-2013                        | KDB Publication 865664<br>KDB Publication 447498 |                                                                                          |
| Hearing Aid Compatibility (Part 20)<br>•HAC for Commercial mobile services                                                                                                       | • ANSI C63.19-2007; or<br>• ANSI C63.19-2011 |                                                  |                                                                                          |



**Testing performed in support of FCC DoC and Certification approval procedures**

| Type of Device Examples                                                                                                              | Scope of Accreditation                                                                                                                                                                                                                                                                                                                  | Supporting FCC Guidance | Comments |
|--------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|----------|
| Signal Boosters (Part 20)<br>•Wideband Consumer signal boosters<br>•Provider-specific signal boosters<br>•Industrial signal boosters | <ul style="list-style-type: none"> <li>FCC KDB Publication 935210 D03 Signal Booster Measurements v04 (February 12, 2016)</li> <li>FCC KDB Publication 935210 D04 Provider Specific Booster Measurements v02 (February 12, 2016)</li> <li>FCC KDB Publication 935210 D05 Indus Booster Basic Meas v01r01 (February 12, 2016)</li> </ul> |                         |          |

**Electromagnetic Compatibility (EMC)**

| Test Method                      | Test Specification(s)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Range           | Comments |
|----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|----------|
| Unintentional Radiators          | ANSI C63.4-2003<br>ANSI C63.4-2009<br>ANSI C63.4:2014;                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 |          |
| Radiated and Conducted Emissions | FCC O STMP-05 (1986); ICES-001(2006);<br>ICES-002(2013);<br>ICES-003(2016);<br>ICES-005(2009);<br>CISPR 16-1-1(2015); CISPR 16-1-2(2014);<br>CISPR 16-1-3(2006); CISPR 16-2-1(2014);<br>CISPR 16-2-2(2010); CISPR 16-2-3(2014);<br>CISPR 16-2-5(2008); CISPR 16-4-2(2014);<br>EN 55016-1-1(2010);<br>EN 55016-1-2(2014);<br>EN 55016-1-3(2006);<br>EN 55016-1-4(2010);<br>EN 55016-2-1(2014);<br>EN 55016-2-2(2011);<br>EN 55016-2-3(2014);<br>EN 55016-4-2(2014); CISPR 11(2012);<br>EN 55011(2013);<br>AS/NZS CISPR 11(2013); KN 11 (RRA<br>Announce 2015-110, Dec, 03, 2015);<br>VCCI V-3 (up to 6 GHz); VCCI V-5;<br>CNS 13438 | 9 kHz to 40 GHz |          |



**END OF REPORT**

Page 67 of 67