

# TEST REPORT

FCC LTE B5 Test for TWG18ANECN  
Class II Permissive Change

**APPLICANT**  
LG Electronics Inc.

**REPORT NO.**  
HCT-RF-2107-FC029

**DATE OF ISSUE**  
July 9, 2021

**Tested by**  
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# TEST REPORT

FCC LTE Test for  
TWG18ANECN

**REPORT NO.**

HCT-RF-2107-FC029

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July 09, 2021

**Additional Model**

TWG10ANEN

**Applicant**

**LG Electronics Inc.**

222, LG-ro, Jinwi-myeon, Pyeongtaek-si, Gyeonggi-do, 451-713, Korea

**Eut Type  
Model Name**

Car telematics device

TWG18ANECN

**FCC ID**

BEJLTTWG10N

**FCC Rule Part(s):**

§ 22, § 2

**FCC Classification:**

PCS Licensed Transmitter (PCB)

The result shown in this test report refer only to the sample(s) tested unless otherwise stated.

This test results were applied only to the test methods required by the standard.

## REVISION HISTORY

The revision history for this test report is shown in table.

| Revision No. | Date of Issue | Description     |
|--------------|---------------|-----------------|
| 0            | July 09, 2021 | Initial Release |

The measurements shown in this report were made in accordance with the procedures specified in CFR47 section § 2.947. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them.

HCT CO., LTD. Certifies that no party to this application has subject to a denial of Federal benefits that includes FCC benefits pursuant to section 5301 of the Anti-Drug Abuse Act of 1998, 21 U.S. C. 853(a)

If this report is required to confirmation of authenticity, please contact to [www.hct.co.kr](http://www.hct.co.kr)

## CONTENTS

|                                                            |    |
|------------------------------------------------------------|----|
| 1. GENERAL INFORMATION                                     | 5  |
| 1.1. MAXIMUM OUTPUT POWER                                  | 6  |
| 2. INTRODUCTION                                            | 7  |
| 2.1. DESCRIPTION OF EUT                                    | 7  |
| 2.2. MEASURING INSTRUMENT CALIBRATION                      | 7  |
| 2.3. TEST FACILITY                                         | 7  |
| 3. DESCRIPTION OF TESTS                                    | 8  |
| 3.1 TEST PROCEDURE                                         | 8  |
| 3.2 CONDUCTED OUTPUT POWER                                 | 9  |
| 3.3 RADIATED POWER                                         | 10 |
| 3.4 RADIATED SPURIOUS EMISSIONS                            | 11 |
| 3.5 OCCUPIED BANDWIDTH.                                    | 12 |
| 3.6 SPURIOUS AND HARMONIC EMISSIONS AT ANTENNA TERMINAL    | 13 |
| 3.7 BAND EDGE                                              | 14 |
| 3.8 FREQUENCY STABILITY / VARIATION OF AMBIENT TEMPERATURE | 15 |
| 3.9 WORST CASE(RADIATED TEST)                              | 16 |
| 3.10 WORST CASE(CONDUCTED TEST)                            | 17 |
| 4. LIST OF TEST EQUIPMENT                                  | 18 |
| 5. MEASUREMENT UNCERTAINTY                                 | 19 |
| 6. SUMMARY OF TEST RESULTS                                 | 20 |
| 7. SAMPLE CALCULATION                                      | 21 |
| 8. TEST DATA                                               | 23 |
| 8.1 CONDUCTED OUTPUT POWER                                 | 23 |
| 8.2 EFFECTIVE RADIATED POWER                               | 27 |
| 8.3 RADIATED SPURIOUS EMISSIONS                            | 29 |
| 8.4 OCCUPIED BANDWIDTH                                     | 33 |
| 8.5 CONDUCTED SPURIOUS EMISSIONS                           | 34 |
| 8.6 BAND EDGE                                              | 34 |
| 8.7 FREQUENCY STABILITY / VARIATION OF AMBIENT TEMPERATURE | 35 |
| 9. TEST PLOTS                                              | 39 |
| 10 ANNEX A_ TEST SETUP PHOTO                               | 84 |

## MEASUREMENT REPORT

### 1. GENERAL INFORMATION

|                     |                                                                                                                                                                                                 |
|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Applicant Name:     | LG Electronics Inc.                                                                                                                                                                             |
| Address:            | 222, LG-ro, Jinwi-myeon, Pyeongtaek-si, Gyeonggi-do, 451-713, Korea                                                                                                                             |
| FCC ID:             | BEJLTTWG10N                                                                                                                                                                                     |
| Application Type:   | Class II Permissive Change                                                                                                                                                                      |
| FCC Classification: | PCS Licensed Transmitter (PCB)                                                                                                                                                                  |
| FCC Rule(s):        | § 22, § 2                                                                                                                                                                                       |
| EUT Type:           | Car telematics device                                                                                                                                                                           |
| Model(s):           | TWG18ANECN                                                                                                                                                                                      |
| Additional Model:   | TWG10ANEN                                                                                                                                                                                       |
| Tx Frequency:       | 824.7 MHz – 848.3 MHz (LTE – Band 5 (1.4 MHz))<br>825.5 MHz – 847.5 MHz (LTE – Band 5 (3 MHz))<br>826.5 MHz – 846.5 MHz (LTE – Band 5 (5 MHz))<br>829.0 MHz – 844.0 MHz (LTE – Band 5 (10 MHz)) |
| Date(s) of Tests:   | May 03, 2021 ~ June 28, 2021                                                                                                                                                                    |
| Serial number:      | Radiated: TWG18ANECN-02<br>Conducted: TWG18ANECN-01                                                                                                                                             |

### 1.1. MAXIMUM OUTPUT POWER

| Mode<br>(MHz)     | Tx Frequency<br>(MHz) | Emission<br>Designator | Modulation | ERP               |                     |
|-------------------|-----------------------|------------------------|------------|-------------------|---------------------|
|                   |                       |                        |            | Max. Power<br>(W) | Max. Power<br>(dBm) |
| LTE – Band5 (1.4) | 824.7 – 848.3         | 1M10G7D                | QPSK       | 0.098             | 19.93               |
|                   |                       | 1M09W7D                | 16QAM      | 0.078             | 18.91               |
| LTE – Band5 (3)   | 825.5 – 847.5         | 2M71G7D                | QPSK       | 0.100             | 20.01               |
|                   |                       | 2M71W7D                | 16QAM      | 0.079             | 18.95               |
| LTE – Band5 (5)   | 826.5 – 846.5         | 4M49G7D                | QPSK       | 0.103             | 20.12               |
|                   |                       | 4M50W7D                | 16QAM      | 0.080             | 19.04               |
| LTE – Band5 (10)  | 829.0 – 844.0         | 8M99G7D                | QPSK       | 0.097             | 19.85               |
|                   |                       | 8M99W7D                | 16QAM      | 0.075             | 18.73               |

## 2. INTRODUCTION

### 2.1. DESCRIPTION OF EUT

The EUT was a Car telematics device with GSM/GPRS/EGPRS/UMTS and LTE.

### 2.2. MEASURING INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.

### 2.3. TEST FACILITY

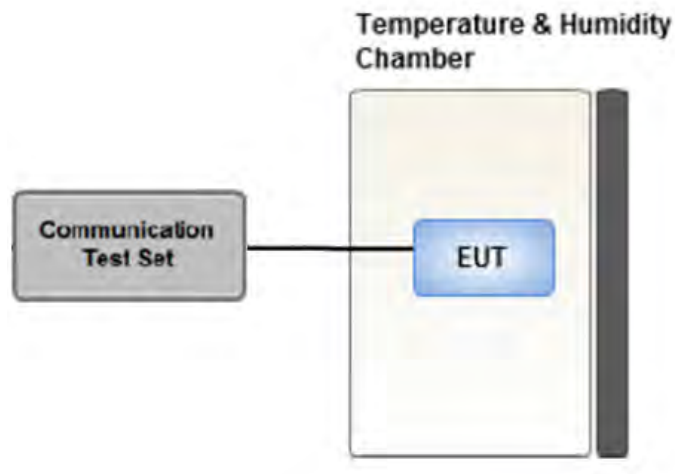
The Fully-anechoic chamber and conducted measurement facility used to collect the radiated data are located at the 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, 17383, Rep. of KOREA.

### 3. DESCRIPTION OF TESTS

#### 3.1 TEST PROCEDURE

| Test Description                                                | Test Procedure Used                                                                   |
|-----------------------------------------------------------------|---------------------------------------------------------------------------------------|
| Occupied Bandwidth                                              | - KDB 971168 D01 v03r01 – Section 4.3<br>- ANSI C63.26-2015 – Section 5.4.4           |
| Band Edge                                                       | - KDB 971168 D01 v03r01 – Section 6.0<br>- ANSI C63.26-2015 – Section 5.7             |
| Spurious and Harmonic Emissions at Antenna Terminal             | - KDB 971168 D01 v03r01 – Section 6.0<br>- ANSI C63.26-2015 – Section 5.7             |
| Conducted Output Power                                          | - KDB 971168 D01 v03r01 – Section 5.2                                                 |
| Frequency stability                                             | - ANSI C63.26-2015 – Section 5.6                                                      |
| Effective Radiated Power/<br>Effective Isotropic Radiated Power | - KDB 971168 D01 v03r01 – Section 5.2 & 5.8<br>- ANSI/TIA-603-E-2016 – Section 2.2.17 |
| Radiated Spurious and Harmonic Emissions                        | - KDB 971168 D01 v03r01 – Section 6.2<br>- ANSI/TIA-603-E-2016 – Section 2.2.12       |

### 3.2 CONDUCTED OUTPUT POWER



Test setup

#### Test Overview

When an average power meter is used to perform RF output power measurements, the fundamental condition that measurements be performed only over durations of active transmissions at maximum output power level applies.

Conducted Output Power was tested in accordance with KDB971168 D01 Power Meas License Digital Systems v03r01, Section 5.2.

### 3.3 RADIATED POWER

#### Test Overview

Radiated tests are performed in the Fully-anechoic chamber.

The equipment under test is placed on a non-conductive table 3-meters away from the receive antenna in accordance with ANSI/TIA-603-E-2016 Clause 2.2.17.

#### Test Settings

1. Radiated power measurements are performed using the signal analyzer's "channel power" measurement capability for signals with continuous operation.
2. RBW = 1 – 5% of the expected OBW, not to exceed 1MHz
3. VBW  $\geq 3 \times$  RBW
4. Span = 1.5 times the OBW
5. No. of sweep points  $> 2 \times$  span / RBW
6. Detector = RMS
7. Trigger is set to "free run" for signals with continuous operation with the sweep times set to "auto".
8. The integration bandwidth was roughly set equal to the measured OBW of the signal for signals with continuous operation.
9. Trace mode = trace averaging (RMS) over 100 sweeps
10. The trace was allowed to stabilize

#### Test Note

1. The turntable is rotated through 360 degrees, and the receiving antenna scans in order to determine the level of the maximized emission.
2. A half wave dipole is then substituted in place of the EUT. For emissions above 1GHz, a horn antenna is substituted in place of the EUT. The substitute antenna is driven by a signal generator and the previously recorded signal was duplicated.

The power is calculated by the following formula;

$$P_{d(dBm)} = P_{g(dBm)} - \text{cable loss}_{(dB)} + \text{antenna gain}_{(dB)}$$

Where:  $P_d$  is the dipole equivalent power and  $P_g$  is the generator output power into the substitution antenna.

3. The maximum value is calculated by adding the forward power to the calibrated source plus its appropriate gain value.

These steps are repeated with the receiving antenna in both vertical and horizontal polarization. the difference between the gain of the horn and an isotropic antenna are taken into consideration

4. The EUT was tested in three orthogonal planes(X, Y, Z) and in all possible test configurations and positioning.
5. All measurements are performed as RMS average measurements while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies.

### 3.4 RADIATED SPURIOUS EMISSIONS

#### Test Overview

Radiated tests are performed in the Fully-anechoic chamber.

Radiated Spurious Emission Measurements at 3 meters by Substitution Method according to ANSI/TIA-603-E-2016.

#### Test Settings

1. RBW = 100kHz for emissions below 1GHz and 1MHz for emissions above 1GHz
2. VBW  $\geq 3 \times$  RBW
3. Span = 1.5 times the OBW
4. No. of sweep points  $> 2 \times$  span / RBW
5. Detector = Peak
6. Trace mode = Max Hold
7. The trace was allowed to stabilize
8. Test channel : Low/ Middle/ High
9. Frequency range : We are performed all frequency to 10<sup>th</sup> harmonics from 9 kHz.

#### Test Note

1. Measurements value show only up to 3 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin  $> 20$  dB from the applicable limit) and considered that's already beyond the background noise floor.
2. The EUT was tested in three orthogonal planes(X, Y, Z) and in all possible test configurations and positioning. The worst case emissions are reported with the EUT positioning, modulations, RB sizes and offsets, and channel bandwidth configurations shown in the test dat
3. For spurious emissions above 1GHz, a horn antenna is substituted in place of the EUT. The substitute antenna is driven by a signal generator and the previously recorded signal was duplicated. The spurious emissions is calculated by the following formula;

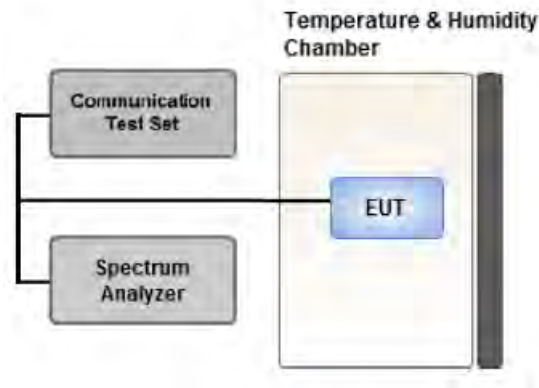
$$\text{Result}_{(\text{dBm})} = P_{g(\text{dBm})} - \text{cable loss}_{(\text{dB})} + \text{antenna gain}_{(\text{dBi})}$$

Where:  $P_g$  is the generator output power into the substitution antenna.

If the fundamental frequency is below 1GHz, RF output power has been converted to EIRP.

$$\text{EIRP}_{(\text{dBm})} = \text{ERP}_{(\text{dBm})} + 2.15$$

### 3.5 OCCUPIED BANDWIDTH.



Test setup

The width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage 0.5 % of the total mean power of a given emission.

The EUT makes a call to the communication simulator.

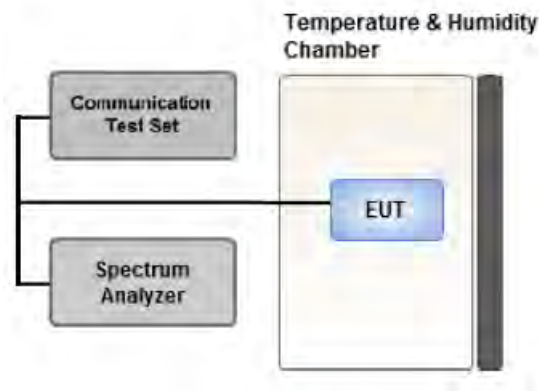
The conducted occupied bandwidth used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.

The communication simulator station system controlled a EUT to export maximum output power under transmission mode and specific channel frequency. Use OBW measurement function of Spectrum analyzer to measure 99 % occupied bandwidth

#### Test Settings

1. The signal analyzer's automatic bandwidth measurement capability was used to perform the 99% occupied bandwidth and the 26dB bandwidth. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. RBW = 1 – 5% of the expected OBW
3. VBW  $\geq 3 \times$  RBW
4. Detector = Peak
5. Trace mode = max hold
6. Sweep = auto couple
7. The trace was allowed to stabilize
8. If necessary, steps 2 – 7 were repeated after changing the RBW such that it would be within 1 – 5% of the 99% occupied bandwidth observed in Step 7

### 3.6 SPURIOUS AND HARMONIC EMISSIONS AT ANTENNA TERMINAL



Test setup

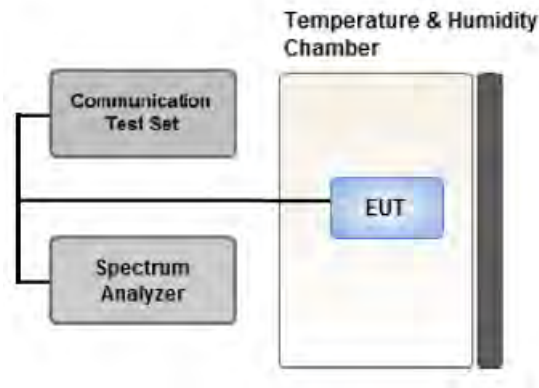
#### Test Overview

The level of the carrier and the various conducted spurious and harmonic frequencies is measured by means of a calibrated spectrum analyzer. The spectrum is scanned from the lowest frequency generated in the equipment up to a frequency including its 10th harmonic. All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

#### Test Settings

1. RBW = 1 MHz
2. VBW  $\geq$  3 MHz
3. Detector = RMS
4. Trace Mode = trace average
5. Sweep time = auto
6. Number of points in sweep  $\geq 2 \times \text{Span} / \text{RBW}$

### 3.7 BAND EDGE



Test setup

#### Test Overview

All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

#### Test Settings

1. Start and stop frequency were set such that the band edge would be placed in the center of the plot
2. Span was set large enough so as to capture all out of band emissions near the band edge
3. RBW > 1% of the emission bandwidth
4. VBW > 3 x RBW
5. Detector = RMS
6. Number of sweep points  $\geq 2 \times \text{Span/RBW}$
7. Trace mode = trace average
8. Sweep time = auto couple
9. The trace was allowed to stabilize

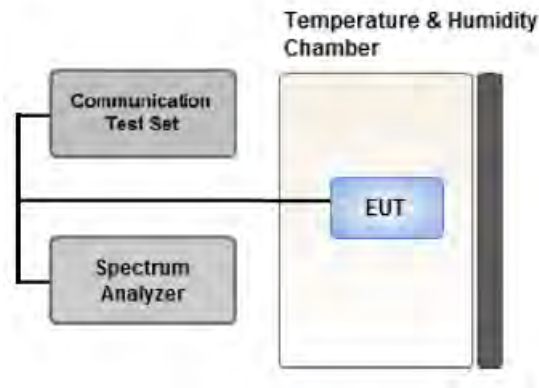
#### Test Notes

According to FCC 22.917, 24.238, 27.53 specified that power of any emission outside of The authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \times \log(P)$  dB. In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.

All measurements were done at 2 channels(low and high operational frequency range.)

The band edge measurement used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.

### 3.8 FREQUENCY STABILITY / VARIATION OF AMBIENT TEMPERATURE



Test setup

#### Test Overview

Frequency stability testing is performed in accordance with the guidelines of ANSI C63.26-2015.

The frequency stability of the transmitter is measured by:

1. Temperature:

The temperature is varied from -30°C to +50°C in 10°C increments using an environmental chamber.

2. Primary Supply Voltage:

.- Unless otherwise specified, vary primary supply voltage from 85% to 115% of the nominal value for other than hand carried battery equipment.

.- For hand carried, battery powered equipment, reduce the primary ac or dc supply voltage to the battery operating end point, which shall be specified by the manufacturer.

#### Test Settings

1. The carrier frequency of the transmitter is measured at room temperature (20°C to provide a reference).
2. The equipment is turned on in a “standby” condition for fifteen minutes before applying power to the transmitter. Measurement of the carrier frequency of the transmitter is made within one minute after applying power to the transmitter.
3. Frequency measurements are made at 10°C intervals ranging from -30°C to +50°C. A period of at least one half-hour is provided to allow stabilization of the equipment at each temperature level.

### 3.9 WORST CASE(RADIATED TEST)

- The EUT was tested in three orthogonal planes(X, Y, Z) and in all possible test configurations and positioning.
  - All modes of operation were investigated and the worst case configuration results are reported.
  - The worst case is reported with the EUT positioning, modulations, and paging service configurations shown in the test data.
  - TWG18ANECN & additional models were tested and the worst case results are reported.
- (Worst case : TWG18ANECN)

[ Worst case ]

| Test Description                         | Modulation     | RB size | RB offset | Axis |
|------------------------------------------|----------------|---------|-----------|------|
| Effective Radiated Power                 | QPSK,<br>16QAM | 1       | 0         | X    |
| Radiated Spurious and Harmonic Emissions | QPSK           | 1       | 0         | X    |

### 3.10 WORST CASE(CONDUCTED TEST)

- All modes of operation were investigated and the worst case configuration results are reported.
- TWG18ANECN & additional models were tested and the worst case results are reported.

(Worst case : TWG18ANECN)

[ Worst case ]

| Test Description                                       | Modulation     | Bandwidth<br>(MHz) | Frequency            | RB size | RB offset |
|--------------------------------------------------------|----------------|--------------------|----------------------|---------|-----------|
| Occupied Bandwidth                                     | QPSK,<br>16QAM | 1.4, 3, 5, 10      | Mid                  | Full RB | 0         |
| Band Edge                                              | QPSK           | 1.4                | Low                  | 1       | 0         |
|                                                        |                |                    | High                 | 1       | 5         |
|                                                        |                | 3                  | Low                  | 1       | 0         |
|                                                        |                |                    | High                 | 1       | 14        |
|                                                        |                | 5                  | Low                  | 1       | 0         |
|                                                        |                |                    | High                 | 1       | 24        |
|                                                        |                | 10                 | Low                  | 1       | 0         |
|                                                        |                |                    | High                 | 1       | 49        |
|                                                        |                | 1.4, 3, 5, 10      | Low,<br>High         | Full RB | 0         |
| Spurious and Harmonic Emissions<br>at Antenna Terminal | QPSK           | 1.4, 3, 5, 10      | Low,<br>Mid,<br>High | 1       | 0         |

#### 4. LIST OF TEST EQUIPMENT

| Manufacture      | Model/ Equipment                                     | Serial Number | Calibration Date | Calibration Interval | Calibration Due |
|------------------|------------------------------------------------------|---------------|------------------|----------------------|-----------------|
| T&M SYSTEM       | FBSR-02B(WHK1.2/15G-10EF)/H.P.F                      | -             | 03/02/2021       | Annual               | 03/02/2022      |
| T&M SYSTEM       | FBSR-02B(WHK3.3/18G-10EF)/H.P.F                      | -             | 03/02/2021       | Annual               | 03/02/2022      |
| Hewlett Packard  | 11667B / Power Splitter(DC~26.5 GHz)                 | 11275         | 04/07/2021       | Annual               | 04/07/2022      |
| Hewlett Packard  | E3632A/DC Power Supply                               | MY40004427    | 09/16/2020       | Annual               | 09/16/2021      |
| Schwarzbeck      | UHAP/ Dipole Antenna                                 | 557           | 04/05/2021       | Biennial             | 04/05/2023      |
| Schwarzbeck      | UHAP/ Dipole Antenna                                 | 558           | 04/05/2021       | Biennial             | 04/05/2023      |
| ESPEC            | SU-642 / Chamber                                     | 93008124      | 03/15/2021       | Annual               | 03/15/2022      |
| Schwarzbeck      | BBHA 9120D/ Horn Antenna(1~18GHz)                    | 147           | 08/29/2019       | Biennial             | 08/29/2021      |
| Schwarzbeck      | BBHA 9120D/ Horn Antenna(1~18GHz)                    | 9120D-1298    | 09/25/2019       | Biennial             | 09/25/2021      |
| Schwarzbeck      | BBHA 9170/ Horn Antenna(15~40GHz)                    | BBHA9170342   | 10/13/2020       | Biennial             | 10/13/2022      |
| Schwarzbeck      | BBHA 9170/ Horn Antenna(15~40GHz)                    | BBHA9170124   | 02/11/2020       | Biennial             | 02/11/2022      |
| Agilent          | N9020A/Signal Analyzer(10Hz~26.5GHz)                 | MY50200093    | 11/17/2020       | Annual               | 11/17/2021      |
| Hewlett Packard  | 8493C/ATTENUATOR(20dB)                               | 17280         | 06/01/2021       | Annual               | 06/01/2022      |
| REOHDE & SCHWARZ | FSV40/Spectrum Analyzer(10Hz~40GHz)                  | 100931        | 10/14/2020       | Annual               | 10/14/2021      |
| Agilent          | 8960 (E5515C)/ Base Station                          | MY48360800    | 08/26/2020       | Annual               | 08/26/2021      |
| Schwarzbeck      | FMZB1513/ Loop Antenna(9kHz~30MHz)                   | 1513-333      | 03/19/2020       | Biennial             | 03/19/2022      |
| Schwarzbeck      | VULB9160/ Bilog Antenna                              | 3150          | 03/03/2021       | Biennial             | 03/03/2023      |
| Schwarzbeck      | VULB9168/ Hybrid Antenna                             | 760           | 02/22/2021       | Biennial             | 02/22/2023      |
| Anritsu Corp.    | MT8821C/Wideband Radio Communication Tester          | 6262116770    | 07/22/2020       | Annual               | 07/22/2021      |
| Anritsu Corp.    | MT8820C/Wideband Radio Communication Tester          | 6201026545    | 01/07/2021       | Annual               | 01/07/2022      |
| REOHDE & SCHWARZ | SMB100A/ SIGNAL GENERATOR (100kHz~40GHz)             | 177633        | 07/13/2020       | Annual               | 07/13/2021      |
| KEYSIGHT         | N9030B / Signal Analyzer(5Hz~40.0GHz)                | MY55480167    | 06/02/2021       | Annual               | 06/02/2022      |
| HCT CO., LTD.,   | FCC LTE Mobile Conducted RF Automation Test Software | -             | -                | -                    | -               |

Note:

- Equipment listed above that has a calibration due date during the testing period, the testing is completed before equipment expiration date.
- Especially, all antenna for measurement is calibrated in accordance with the requirements of C63.5 (Version : 2017).

## 5. MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.4:2014.

All measurement uncertainty values are shown with a coverage factor of  $k=2$  to indicate a 95 % level of confidence. The measurement data shown herein meets or exceeds the  $U_{\text{CISPR}}$  measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

| Parameter                                | Expanded Uncertainty ( $\pm$ dB) |
|------------------------------------------|----------------------------------|
| Conducted Disturbance (150 kHz ~ 30 MHz) | 1.82                             |
| Radiated Disturbance (9 kHz ~ 30 MHz)    | 3.40                             |
| Radiated Disturbance (30 MHz ~ 1 GHz)    | 4.80                             |
| Radiated Disturbance (1 GHz ~ 18 GHz)    | 5.70                             |
| Radiated Disturbance (18 GHz ~ 40 GHz)   | 5.05                             |

## 6. SUMMARY OF TEST RESULTS

### 6.1 Test Condition : Conducted Test

| Test Description                                                 | FCC Part Section(s)      | Test Limit                                                                               | Test Result |
|------------------------------------------------------------------|--------------------------|------------------------------------------------------------------------------------------|-------------|
| Occupied Bandwidth                                               | § 2.1049                 | N/A                                                                                      | PASS        |
| Band Edge / Spurious and Harmonic Emissions at Antenna Terminal. | § 2.1051,<br>§ 22.917(a) | $< 43 + 10\log_{10} (P[\text{Watts}])$ at Band Edge<br>and for all out-of-band emissions | PASS        |
| Conducted Output Power                                           | § 2.1046                 | N/A                                                                                      | PASS        |
| Frequency stability / variation of ambient temperature           | § 2.1055,<br>§ 22.355    | $< 2.5 \text{ ppm}$                                                                      | PASS        |

### 6.2 Test Condition : Radiated Test

| Test Description                         | FCC Part Section(s)      | Test Limit                                                              | Test Result |
|------------------------------------------|--------------------------|-------------------------------------------------------------------------|-------------|
| Effective Radiated Power                 | § 22.913(a)(5)           | $< 7 \text{ Watts max. ERP}$                                            | PASS        |
| Radiated Spurious and Harmonic Emissions | § 2.1053,<br>§ 22.917(a) | $< 43 + 10\log_{10} (P[\text{Watts}])$ for<br>all out-of band emissions | PASS        |

## 7. SAMPLE CALCULATION

### 7.1 ERP Sample Calculation

| Ch./ Freq. |            | Measured<br>Level(dBm) | Substitute<br>Level(dBm) | Ant. Gain<br>(dBd) | C.L  | Pol. | ERP   |       |
|------------|------------|------------------------|--------------------------|--------------------|------|------|-------|-------|
| channel    | Freq.(MHz) |                        |                          |                    |      |      | W     | dBm   |
| 128        | 824.20     | -21.37                 | 38.40                    | -10.61             | 0.95 | H    | 0.483 | 26.84 |

$$\text{ERP} = \text{Substitute LEVEL(dBm)} + \text{Ant. Gain} - \text{CL(Cable Loss)}$$

- 1) The EUT mounted on a non-conductive turntable is 2.5 meter above test site ground level.
- 2) During the test , the turn table is rotated until the maximum signal is found.
- 3) Record the field strength meter's level.
- 4) Replace the EUT with dipole/Horn antenna that is connected to a calibrated signal generator.
- 5) Increase the signal generator output till the field strength meter's level is equal to the item (3).
- 6) The signal generator output level with Ant. Gain and cable loss are the rating of effective radiated power.

### 7.2 EIRP Sample Calculation

| Ch./ Freq. |            | Measured<br>Level(dBm) | Substitute<br>Level(dBm) | Ant. Gain<br>(dBi) | C.L  | Pol. | EIRP  |       |
|------------|------------|------------------------|--------------------------|--------------------|------|------|-------|-------|
| channel    | Freq.(MHz) |                        |                          |                    |      |      | W     | dBm   |
| 20175      | 1,732.50   | -15.75                 | 18.45                    | 9.90               | 1.76 | H    | 0.456 | 26.59 |

$$\text{EIRP} = \text{Substitute LEVEL(dBm)} + \text{Ant. Gain} - \text{CL(Cable Loss)}$$

- 1) The EUT mounted on a non-conductive turntable is 2.5 meter above test site ground level.
- 2) During the test , the turn table is rotated until the maximum signal is found.
- 3) Record the field strength meter's level.
- 4) Replace the EUT with dipole/Horn antenna that is connected to a calibrated signal generator.
- 5) Increase the signal generator output till the field strength meter's level is equal to the item (3).
- 6) The signal generator output level with Ant. Gain and cable loss are the rating of equivalent isotropic radiated power.

### 7.3. Emission Designator

#### GSM Emission Designator

Emission Designator = 249KGXW

GSM BW = 249 kHz

G = Phase Modulation

X = Cases not otherwise covered

W = Combination (Audio/Data)

#### EDGE Emission Designator

Emission Designator = 249KG7W

GSM BW = 249 kHz

G = Phase Modulation

7 = Quantized/Digital Info

W = Combination (Audio/Data)

#### WCDMA Emission Designator

Emission Designator = 4M17F9W

WCDMA BW = 4.17 MHz

F = Frequency Modulation

9 = Composite Digital Info

W = Combination (Audio/Data)

#### QPSK Modulation

Emission Designator = 4M48G7D

LTE BW = 4.48 MHz

G = Phase Modulation

7 = Quantized/Digital Info

D = Data transmission; telemetry; telecommand

#### QAM Modulation

Emission Designator = 4M48W7D

LTE BW = 4.48 MHz

W = Amplitude/Angle Modulated

7 = Quantized/Digital Info

D = Data transmission; telemetry; telecommand

## 8. TEST DATA

### 8.1 CONDUCTED OUTPUT POWER

| Bandwidth | Modulation | RB Size | RB Offset | Max.Average Power (dBm) |           |           |
|-----------|------------|---------|-----------|-------------------------|-----------|-----------|
|           |            |         |           | 20407                   | 20525     | 20643     |
|           |            |         |           | 824.7 MHz               | 836.5 MHz | 848.3 MHz |
| 1.4 MHz   | QPSK       | 1       | 0         | 23.42                   | 23.32     | 23.34     |
|           |            | 1       | 3         | 23.30                   | 23.27     | 23.21     |
|           |            | 1       | 5         | 23.42                   | 23.30     | 23.10     |
|           |            | 3       | 0         | 23.35                   | 23.34     | 23.25     |
|           |            | 3       | 1         | 23.34                   | 23.22     | 23.22     |
|           |            | 3       | 3         | 23.29                   | 23.25     | 23.14     |
|           |            | 6       | 0         | 22.38                   | 22.27     | 22.30     |
|           | 16QAM      | 1       | 0         | 22.38                   | 22.27     | 22.33     |
|           |            | 1       | 3         | 22.28                   | 22.17     | 22.14     |
|           |            | 1       | 5         | 22.31                   | 22.24     | 22.01     |
|           |            | 3       | 0         | 22.30                   | 22.28     | 22.34     |
|           |            | 3       | 1         | 22.29                   | 22.19     | 22.19     |
|           |            | 3       | 3         | 22.27                   | 22.23     | 22.13     |
|           |            | 6       | 0         | 21.38                   | 21.28     | 21.23     |

| Bandwidth | Modulation | RB Size | RB Offset | Max.Average Power (dBm) |           |           |
|-----------|------------|---------|-----------|-------------------------|-----------|-----------|
|           |            |         |           | 20415                   | 20525     | 20635     |
|           |            |         |           | 825.5 MHz               | 836.5 MHz | 847.5 MHz |
| 3 MHz     | QPSK       | 1       | 0         | 23.14                   | 22.93     | 23.19     |
|           |            | 1       | 7         | 23.21                   | 23.12     | 23.08     |
|           |            | 1       | 14        | 23.18                   | 23.17     | 22.95     |
|           |            | 8       | 0         | 22.13                   | 22.08     | 22.16     |
|           |            | 8       | 3         | 22.19                   | 22.13     | 22.14     |
|           |            | 8       | 7         | 22.16                   | 22.12     | 22.06     |
|           |            | 15      | 0         | 22.19                   | 22.02     | 22.15     |
|           | 16QAM      | 1       | 0         | 22.20                   | 21.92     | 22.09     |
|           |            | 1       | 7         | 22.16                   | 22.09     | 22.04     |
|           |            | 1       | 14        | 22.09                   | 22.12     | 21.83     |
|           |            | 8       | 0         | 21.20                   | 21.12     | 21.12     |
|           |            | 8       | 3         | 21.21                   | 21.07     | 21.10     |
|           |            | 8       | 7         | 21.09                   | 21.14     | 21.04     |
|           |            | 15      | 0         | 21.16                   | 21.06     | 21.08     |

| Bandwidth | Modulation | RB Size | RB Offset | Max.Average Power (dBm) |           |           |
|-----------|------------|---------|-----------|-------------------------|-----------|-----------|
|           |            |         |           | 20425                   | 20525     | 20625     |
|           |            |         |           | 826.5 MHz               | 836.5 MHz | 846.5 MHz |
| 5 MHz     | QPSK       | 1       | 0         | 23.03                   | 22.82     | 22.96     |
|           |            | 1       | 12        | 23.05                   | 22.98     | 23.02     |
|           |            | 1       | 24        | 23.01                   | 22.95     | 22.80     |
|           |            | 12      | 0         | 22.08                   | 22.10     | 22.07     |
|           |            | 12      | 6         | 22.02                   | 21.93     | 22.02     |
|           |            | 12      | 11        | 22.08                   | 22.00     | 22.01     |
|           |            | 25      | 0         | 22.10                   | 21.98     | 22.01     |
|           | 16QAM      | 1       | 0         | 22.02                   | 21.74     | 21.88     |
|           |            | 1       | 12        | 22.04                   | 21.97     | 21.99     |
|           |            | 1       | 24        | 21.95                   | 21.91     | 21.79     |
|           |            | 12      | 0         | 21.03                   | 21.02     | 21.00     |
|           |            | 12      | 6         | 21.05                   | 20.95     | 21.05     |
|           |            | 12      | 11        | 21.06                   | 21.00     | 20.99     |
|           |            | 25      | 0         | 21.09                   | 21.07     | 20.94     |

| Bandwidth | Modulation | RB Size | RB Offset | Max.Average Power (dBm) |           |         |
|-----------|------------|---------|-----------|-------------------------|-----------|---------|
|           |            |         |           | 20450                   | 20525     | 20600   |
|           |            |         |           | 829 MHz                 | 836.5 MHz | 844 MHz |
| 10 MHz    | QPSK       | 1       | 0         | 22.87                   | 22.73     | 22.83   |
|           |            | 1       | 24        | 22.95                   | 22.91     | 22.74   |
|           |            | 1       | 49        | 22.98                   | 22.79     | 22.74   |
|           |            | 25      | 0         | 21.95                   | 21.94     | 21.82   |
|           |            | 25      | 12        | 22.04                   | 21.88     | 21.84   |
|           |            | 25      | 24        | 21.97                   | 21.82     | 21.89   |
|           |            | 50      | 0         | 21.98                   | 21.75     | 21.81   |
|           | 16QAM      | 1       | 0         | 21.88                   | 21.66     | 21.90   |
|           |            | 1       | 24        | 21.99                   | 21.69     | 21.70   |
|           |            | 1       | 49        | 21.91                   | 21.70     | 21.69   |
|           |            | 25      | 0         | 20.99                   | 20.95     | 20.90   |
|           |            | 25      | 12        | 21.03                   | 20.91     | 20.79   |
|           |            | 25      | 24        | 20.97                   | 20.92     | 20.90   |
|           |            | 50      | 0         | 20.98                   | 20.84     | 20.82   |

## 8.2 EFFECTIVE RADIATED POWER

| Freq<br>(MHz) | Mod/<br>Bandwidth  | Modulation | Measured<br>Level (dBm) | Substitute<br>Level (dBm) | Ant.<br>Gain(dBd) | C.L  | Pol | Limit  | ERP   |       |
|---------------|--------------------|------------|-------------------------|---------------------------|-------------------|------|-----|--------|-------|-------|
|               |                    |            |                         |                           |                   |      |     | W      | W     | dBm   |
| 824.7         | LTE B5/<br>1.4 MHz | QPSK       | -33.14                  | 30.54                     | -10.42            | 1.40 | H   | < 7.00 | 0.074 | 18.72 |
|               |                    | 16-QAM     | -34.20                  | 29.48                     | -10.42            | 1.40 | H   |        | 0.058 | 17.66 |
| 836.5         |                    | QPSK       | -32.40                  | 31.74                     | -10.40            | 1.41 | H   |        | 0.098 | 19.93 |
|               |                    | 16-QAM     | -33.42                  | 30.72                     | -10.40            | 1.41 | H   |        | 0.078 | 18.91 |
| 848.3         |                    | QPSK       | -32.73                  | 31.65                     | -10.38            | 1.42 | H   |        | 0.097 | 19.85 |
|               |                    | 16-QAM     | -33.78                  | 30.60                     | -10.38            | 1.42 | H   |        | 0.076 | 18.80 |

| Freq<br>(MHz) | Mod/<br>Bandwidth | Modulation | Measured<br>Level (dBm) | Substitute<br>Level (dBm) | Ant.<br>Gain(dBd) | C.L  | Pol | Limit  | ERP   |       |
|---------------|-------------------|------------|-------------------------|---------------------------|-------------------|------|-----|--------|-------|-------|
|               |                   |            |                         |                           |                   |      |     | W      | W     | dBm   |
| 825.5         | LTE B5/<br>3 MHz  | QPSK       | -33.18                  | 30.51                     | -10.42            | 1.40 | H   | < 7.00 | 0.074 | 18.69 |
|               |                   | 16-QAM     | -34.22                  | 29.47                     | -10.42            | 1.40 | H   |        | 0.058 | 17.65 |
| 836.5         |                   | QPSK       | -32.57                  | 31.57                     | -10.40            | 1.41 | H   |        | 0.095 | 19.76 |
|               |                   | 16-QAM     | -33.64                  | 30.50                     | -10.40            | 1.41 | H   |        | 0.074 | 18.69 |
| 847.5         |                   | QPSK       | -32.52                  | 31.81                     | -10.39            | 1.42 | H   |        | 0.100 | 20.01 |
|               |                   | 16-QAM     | -33.58                  | 30.75                     | -10.39            | 1.42 | H   |        | 0.079 | 18.95 |

| Freq<br>(MHz) | Mod/<br>Bandwidth | Modulation | Measured<br>Level (dBm) | Substitute<br>Level (dBm) | Ant.<br>Gain(dBd) | C.L  | Pol | Limit  | ERP   |       |
|---------------|-------------------|------------|-------------------------|---------------------------|-------------------|------|-----|--------|-------|-------|
|               |                   |            |                         |                           |                   |      |     | W      | W     | dBm   |
| 826.5         | LTE B5/<br>5 MHz  | QPSK       | -33.21                  | 30.54                     | -10.42            | 1.40 | H   | < 7.00 | 0.075 | 18.73 |
|               |                   | 16-QAM     | -34.22                  | 29.53                     | -10.42            | 1.40 | H   |        | 0.059 | 17.72 |
| 836.5         |                   | QPSK       | -32.58                  | 31.56                     | -10.40            | 1.41 | H   |        | 0.094 | 19.75 |
|               |                   | 16-QAM     | -33.65                  | 30.49                     | -10.40            | 1.41 | H   |        | 0.074 | 18.68 |
| 846.5         |                   | QPSK       | -32.31                  | 31.93                     | -10.39            | 1.42 | H   |        | 0.103 | 20.12 |
|               |                   | 16-QAM     | -33.39                  | 30.85                     | -10.39            | 1.42 | H   |        | 0.080 | 19.04 |

| Freq<br>(MHz) | Mod/<br>Bandwidth | Modulation | Measured<br>Level (dBm) | Substitute<br>Level (dBm) | Ant.<br>Gain(dBd) | C.L  | Pol | Limit  | ERP   |       |
|---------------|-------------------|------------|-------------------------|---------------------------|-------------------|------|-----|--------|-------|-------|
|               |                   |            |                         |                           |                   |      |     | W      | W     | dBm   |
| 829.0         | LTE B5/<br>10 MHz | QPSK       | -33.24                  | 30.66                     | -10.41            | 1.40 | H   | < 7.00 | 0.077 | 18.85 |
|               |                   | 16-QAM     | -34.23                  | 29.67                     | -10.41            | 1.40 | H   |        | 0.061 | 17.86 |
| 836.5         |                   | QPSK       | -32.48                  | 31.66                     | -10.40            | 1.41 | H   |        | 0.097 | 19.85 |
|               |                   | 16-QAM     | -33.64                  | 30.50                     | -10.40            | 1.41 | H   |        | 0.074 | 18.69 |
| 844.0         |                   | QPSK       | -32.57                  | 31.52                     | -10.39            | 1.41 | H   |        | 0.094 | 19.72 |
|               |                   | 16-QAM     | -33.56                  | 30.53                     | -10.39            | 1.41 | H   |        | 0.075 | 18.73 |

### 8.3 RADIATED SPURIOUS EMISSIONS

□ MODE: LTE B5  
 □ MODULATION SIGNAL: 1.4 MHz QPSK  
 □ DISTANCE: 3 meters

| Ch               | Freq (MHz) | Measured Level (dBm) | Ant. Gain (dBi) | Substitute Level (dBm) | C.L  | Pol | Result (dBm) | Limit  |
|------------------|------------|----------------------|-----------------|------------------------|------|-----|--------------|--------|
| 20407<br>(824.7) | 1 649.40   | -45.28               | 9.50            | -54.89                 | 1.99 | V   | -47.38       | -13.00 |
|                  | 2 474.10   | -47.49               | 10.60           | -51.70                 | 2.47 | V   | -43.57       | -13.00 |
|                  | 3 298.80   | -58.29               | 12.30           | -59.35                 | 2.89 | H   | -49.94       | -13.00 |
| 20525<br>(836.5) | 1 673.00   | -47.00               | 9.65            | -56.77                 | 2.01 | H   | -49.13       | -13.00 |
|                  | 2 509.50   | -51.13               | 10.75           | -54.85                 | 2.50 | V   | -46.60       | -13.00 |
|                  | 3 346.00   | -58.64               | 12.48           | -59.63                 | 2.92 | H   | -50.07       | -13.00 |
| 20643<br>(848.3) | 1 696.60   | -42.81               | 9.76            | -52.40                 | 2.04 | V   | -44.68       | -13.00 |
|                  | 2 544.90   | -56.10               | 10.87           | -59.38                 | 2.52 | V   | -51.03       | -13.00 |
|                  | 3 393.20   | -58.23               | 12.65           | -59.04                 | 2.94 | H   | -49.33       | -13.00 |

□ MODE: LTE B5  
 □ MODULATION SIGNAL: 3 MHz QPSK  
 □ DISTANCE: 3 meters

| Ch               | Freq (MHz) | Measured Level (dBm) | Ant. Gain (dBi) | Substitute Level (dBm) | C.L  | Pol | Result (dBm) | Limit  |
|------------------|------------|----------------------|-----------------|------------------------|------|-----|--------------|--------|
| 20415<br>(825.5) | 1 651.00   | -44.99               | 9.50            | -54.60                 | 1.99 | V   | -47.09       | -13.00 |
|                  | 2 476.50   | -49.77               | 10.60           | -53.97                 | 2.48 | V   | -45.85       | -13.00 |
|                  | 3 302.00   | -57.93               | 12.30           | -58.99                 | 2.89 | H   | -49.58       | -13.00 |
| 20525<br>(836.5) | 1 673.00   | -48.09               | 9.65            | -57.86                 | 2.01 | V   | -50.22       | -13.00 |
|                  | 2 509.50   | -51.85               | 10.75           | -55.57                 | 2.50 | V   | -47.32       | -13.00 |
|                  | 3 346.00   | -58.84               | 12.48           | -59.83                 | 2.92 | H   | -50.27       | -13.00 |
| 20635<br>(847.5) | 1 695.00   | -47.68               | 9.76            | -57.27                 | 2.04 | V   | -49.55       | -13.00 |
|                  | 2 542.50   | -55.24               | 10.85           | -58.77                 | 2.51 | H   | -50.43       | -13.00 |
|                  | 3 390.00   | -58.85               | 12.65           | -59.66                 | 2.94 | H   | -49.95       | -13.00 |

□ MODE: LTE B5  
 □ MODULATION SIGNAL: 5 MHz QPSK  
 □ DISTANCE: 3 meters

| Ch               | Freq (MHz) | Measured Level (dBm) | Ant. Gain (dBi) | Substitute Level (dBm) | C.L  | Pol | Result (dBm) | Limit  |
|------------------|------------|----------------------|-----------------|------------------------|------|-----|--------------|--------|
| 20425<br>(826.5) | 1 653.00   | -46.56               | 9.50            | -56.17                 | 1.99 | V   | -48.66       | -13.00 |
|                  | 2 479.50   | -55.77               | 10.60           | -60.04                 | 2.48 | V   | -51.92       | -13.00 |
|                  | 3 306.00   | -58.37               | 12.33           | -59.45                 | 2.90 | H   | -50.02       | -13.00 |
| 20525<br>(836.5) | 1 673.00   | -44.42               | 9.65            | -54.19                 | 2.01 | H   | -46.55       | -13.00 |
|                  | 2 509.50   | -42.63               | 10.75           | -46.35                 | 2.50 | V   | -38.10       | -13.00 |
|                  | 3 346.00   | -58.58               | 12.48           | -59.57                 | 2.92 | H   | -50.01       | -13.00 |
| 20625<br>(846.5) | 1 693.00   | -48.79               | 9.73            | -58.47                 | 2.03 | V   | -50.77       | -13.00 |
|                  | 2 539.50   | -50.49               | 10.85           | -54.02                 | 2.51 | V   | -45.68       | -13.00 |
|                  | 3 386.00   | -58.24               | 12.63           | -59.32                 | 2.94 | V   | -49.63       | -13.00 |

□ MODE: LTE B5  
 □ MODULATION SIGNAL: 10 MHz QPSK  
 □ DISTANCE: 3 meters

| Ch               | Freq (MHz) | Measured Level (dBm) | Ant. Gain (dBi) | Substitute Level (dBm) | C.L  | Pol | Result (dBm) | Limit  |
|------------------|------------|----------------------|-----------------|------------------------|------|-----|--------------|--------|
| 20450<br>(829.0) | 1 658.00   | -44.37               | 9.58            | -54.37                 | 2.01 | V   | -46.80       | -13.00 |
|                  | 2 487.00   | -55.19               | 10.65           | -59.23                 | 2.49 | H   | -51.07       | -13.00 |
|                  | 3 316.00   | -57.11               | 12.38           | -58.09                 | 2.91 | V   | -48.62       | -13.00 |
| 20525<br>(836.5) | 1 673.00   | -45.72               | 9.65            | -55.49                 | 2.01 | V   | -47.85       | -13.00 |
|                  | 2 509.50   | -45.38               | 10.75           | -49.10                 | 2.50 | V   | -40.85       | -13.00 |
|                  | 3 346.00   | -58.11               | 12.48           | -59.10                 | 2.92 | H   | -49.54       | -13.00 |
| 20600<br>(844.0) | 1 688.00   | -47.42               | 9.73            | -57.10                 | 2.03 | V   | -49.40       | -13.00 |
|                  | 2 532.00   | -55.65               | 10.80           | -58.87                 | 2.50 | V   | -50.57       | -13.00 |
|                  | 3 376.00   | -58.58               | 12.60           | -59.71                 | 2.93 | V   | -50.04       | -13.00 |

#### 8.4 OCCUPIED BANDWIDTH

| Band | Band Width | Frequency (MHz) | Modulation | Resource Block Size | Resource Block Offset | Data ( MHz ) |
|------|------------|-----------------|------------|---------------------|-----------------------|--------------|
| 5    | 1.4 MHz    | 836.5           | QPSK       | 6                   | 0                     | 1.0965       |
|      |            |                 | 16-QAM     |                     |                       | 1.0937       |
|      | 3 MHz      |                 | QPSK       | 15                  |                       | 2.7066       |
|      |            |                 | 16-QAM     |                     |                       | 2.7108       |
|      | 5 MHz      |                 | QPSK       | 25                  |                       | 4.4907       |
|      |            |                 | 16-QAM     |                     |                       | 4.4954       |
|      | 10 MHz     |                 | QPSK       | 50                  |                       | 8.9930       |
|      |            |                 | 16-QAM     |                     |                       | 8.9848       |

**Note:**

1. Plots of the EUT's Occupied Bandwidth are shown Page 64 ~ 71.

## 8.5 CONDUCTED SPURIOUS EMISSIONS

| Band | Band Width (MHz) | Frequency (MHz) | Frequency of Maximum Harmonic (GHz) | Factor (dB) | Measurement Maximum Data (dBm) | Result (dBm) | Limit (dBm) |
|------|------------------|-----------------|-------------------------------------|-------------|--------------------------------|--------------|-------------|
| 5    | 1.4              | 824.7           | 3.6860                              | 28.976      | -66.976                        | -38.000      | -13.00      |
|      |                  | 836.5           | 3.6950                              | 28.976      | -67.077                        | -38.101      |             |
|      |                  | 848.3           | 3.7104                              | 28.976      | -67.361                        | -38.385      |             |
|      | 3                | 825.5           | 3.6815                              | 28.976      | -67.084                        | -38.108      |             |
|      |                  | 836.5           | 3.6975                              | 28.976      | -67.071                        | -38.095      |             |
|      |                  | 847.5           | 3.6980                              | 28.976      | -67.082                        | -38.106      |             |
|      | 5                | 826.5           | 3.6780                              | 28.976      | -67.266                        | -38.290      |             |
|      |                  | 836.5           | 3.7149                              | 28.976      | -67.002                        | -38.026      |             |
|      |                  | 846.5           | 3.6965                              | 28.976      | -67.131                        | -38.155      |             |
|      | 10               | 829.0           | 3.6895                              | 28.976      | -67.200                        | -38.224      |             |
|      |                  | 836.5           | 3.6920                              | 28.976      | -67.139                        | -38.163      |             |
|      |                  | 844.0           | 3.7059                              | 28.976      | -67.004                        | -38.028      |             |

### Note:

1. Plots of the EUT's Conducted Spurious Emissions are shown Page 72 ~ 83.
2. Conducted Spurious Emissions was Tested QPSK Modulation, Resource Block Size 1 and Resource Block Offset 0
3. Result (dBm) = Measurement Maximum Data (dBm) + Factor (dB)
4. Factor(dB) = Cable Loss + Attenuator + Power Splitter

| Frequency Range (GHz) | Factor [dB] |
|-----------------------|-------------|
| 0.03 – 1              | 26.270      |
| 1 – 5                 | 28.976      |
| 5 – 10                | 29.591      |
| 10 – 15               | 30.116      |
| 15 – 20               | 30.489      |
| Above 20(26.5)        | 31.131      |

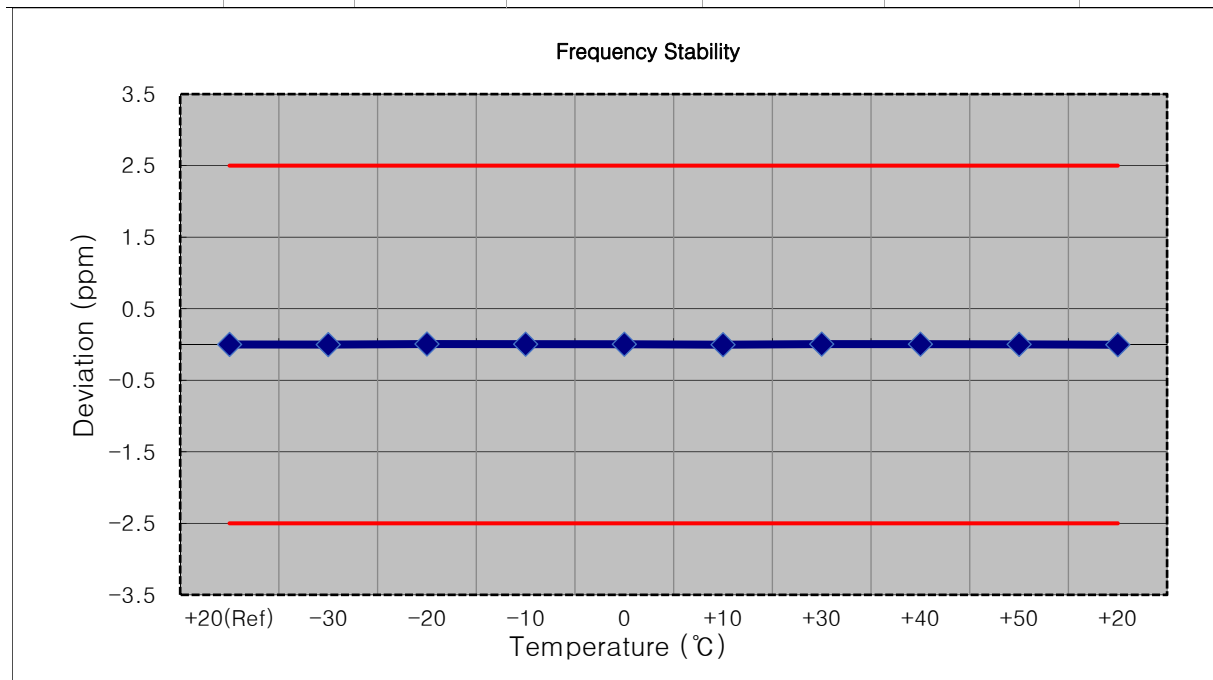
## 8.6 BAND EDGE

- Plots of the EUT's Band Edge are shown Page 40 ~ 63.

## 8.7 FREQUENCY STABILITY / VARIATION OF AMBIENT TEMPERATURE

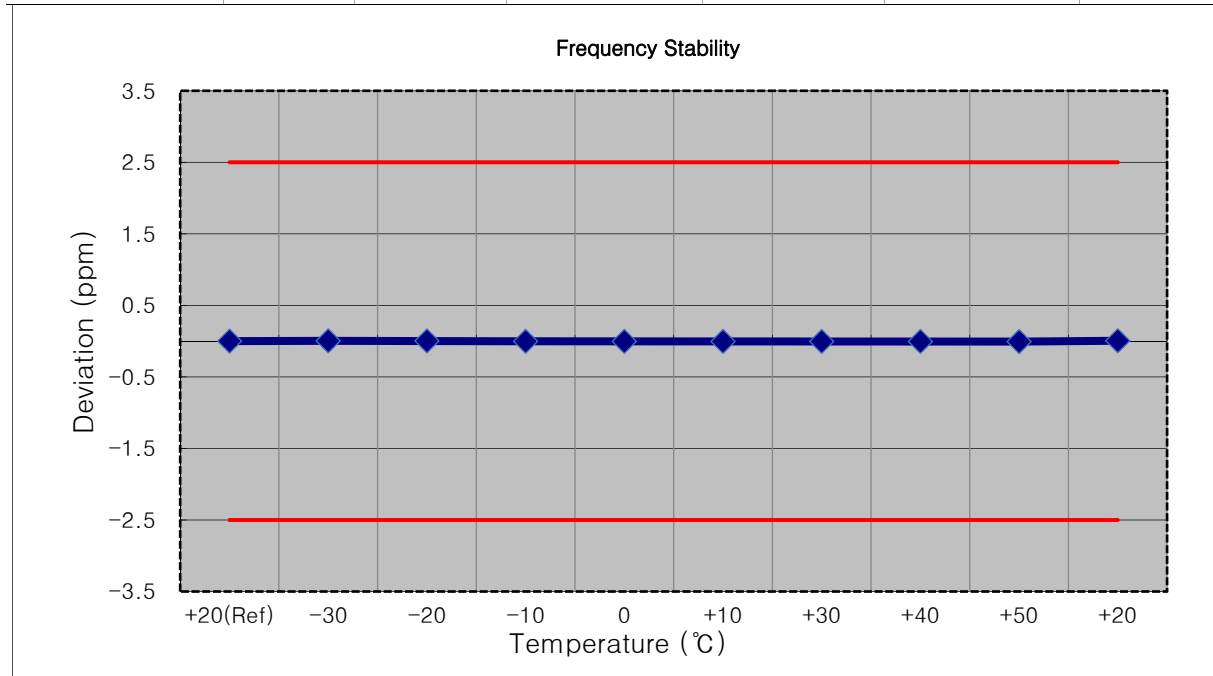
|                      |                            |
|----------------------|----------------------------|
| MODE:                | LTE B5                     |
| OPERATING FREQUENCY: | 836,500,000 Hz             |
| CHANNEL:             | 20525 (1.4 MHz)            |
| REFERENCE VOLTAGE:   | 12.000 VDC                 |
| DEVIATION LIMIT:     | $\pm 0.00025\%$ or 2.5 ppm |

| Voltage (%)    | Power (VDC) | Temp. (°C) | Frequency (Hz) | Frequency Error (Hz) | Deviation (%) | ppm    |
|----------------|-------------|------------|----------------|----------------------|---------------|--------|
| 100%           | 12.000      | +20(Ref)   | 836 500 002    | 0.0                  | 0.000 000     | 0.000  |
| 100%           |             | -30        | 836 500 001    | -1.4                 | 0.000 000     | -0.002 |
| 100%           |             | -20        | 836 500 007    | 5.0                  | 0.000 001     | 0.006  |
| 100%           |             | -10        | 836 500 006    | 3.4                  | 0.000 000     | 0.004  |
| 100%           |             | 0          | 836 500 005    | 2.4                  | 0.000 000     | 0.003  |
| 100%           |             | +10        | 836 500 000    | -2.7                 | 0.000 000     | -0.003 |
| 100%           |             | +30        | 836 500 006    | 4.0                  | 0.000 000     | 0.005  |
| 100%           |             | +40        | 836 500 006    | 3.4                  | 0.000 000     | 0.004  |
| 100%           |             | +50        | 836 500 003    | 1.2                  | 0.000 000     | 0.001  |
| Batt. Endpoint | 10.200      | +20        | 836 499 999    | -3.2                 | 0.000 000     | -0.004 |



- MODE:
LTE B5
- OPERATING FREQUENCY:
836,500,000 Hz
- CHANNEL:
18900(3MHz)
- REFERENCE VOLTAGE:
12.000 VDC
- DEVIATION LIMIT:
± 0.000 25 % or 2.5 ppm

| Voltage        | Power  | Temp.    | Frequency   | Frequency  | Deviation  | ppm    |
|----------------|--------|----------|-------------|------------|------------|--------|
| (%)            | (VDC)  | (°C)     | (Hz)        | Error (Hz) | (%)        |        |
| 100%           | 12.000 | +20(Ref) | 836 500 002 | 0.0        | 0.000 000  | 0.000  |
| 100%           |        | -30      | 836 500 006 | 3.6        | 0.000 000  | 0.004  |
| 100%           |        | -20      | 836 500 005 | 2.9        | 0.000 000  | 0.003  |
| 100%           |        | -10      | 836 500 000 | -2.5       | 0.000 000  | -0.003 |
| 100%           |        | 0        | 836 499 999 | -3.1       | 0.000 000  | -0.004 |
| 100%           |        | +10      | 836 499 999 | -3.8       | 0.000 000  | -0.005 |
| 100%           |        | +30      | 836 499 999 | -3.8       | 0.000 000  | -0.005 |
| 100%           |        | +40      | 836 499 999 | -3.7       | 0.000 000  | -0.004 |
| 100%           |        | +50      | 836 499 997 | -5.2       | -0.000 001 | -0.006 |
| Batt. Endpoint | 10.200 | +20      | 836 500 007 | 4.3        | 0.000 001  | 0.005  |



- MODE:

LTE B5
- OPERATING FREQUENCY:

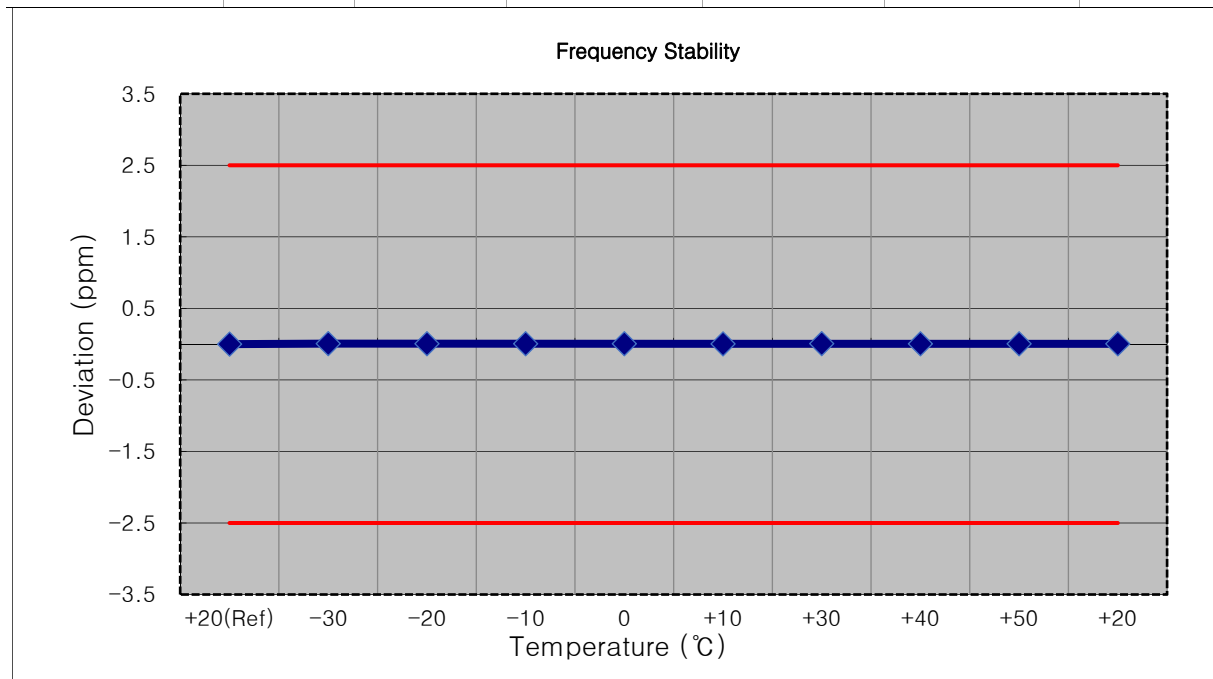
836,500,000 Hz
- CHANNEL:

18900(5MHz)
- REFERENCE VOLTAGE:

12.000 VDC
- DEVIATION LIMIT:

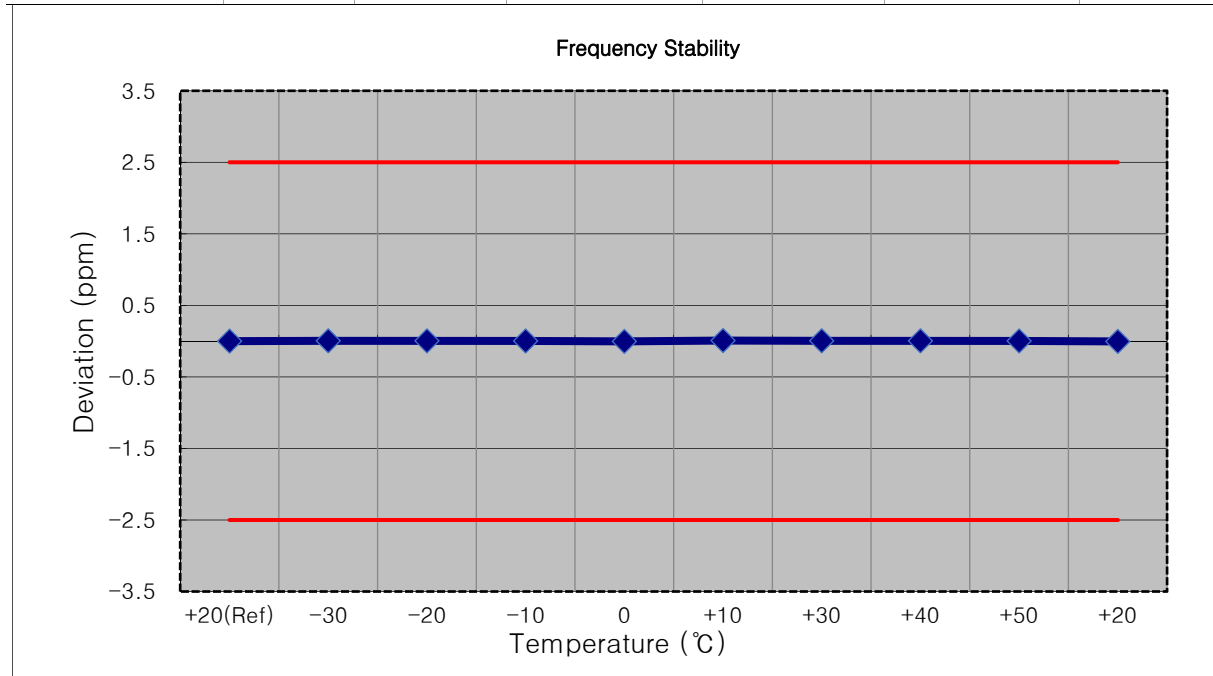
± 0.000 25 % or 2.5 ppm

| Voltage        | Power  | Temp.    | Frequency   | Frequency  | Deviation | ppm   |
|----------------|--------|----------|-------------|------------|-----------|-------|
| (%)            | (VDC)  | (°C)     | (Hz)        | Error (Hz) | (%)       |       |
| 100%           | 12.000 | +20(Ref) | 836 500 006 | 0.0        | 0.000 000 | 0.000 |
| 100%           |        | -30      | 836 500 012 | 5.8        | 0.000 001 | 0.007 |
| 100%           |        | -20      | 836 500 011 | 4.8        | 0.000 001 | 0.006 |
| 100%           |        | -10      | 836 500 011 | 4.7        | 0.000 001 | 0.006 |
| 100%           |        | 0        | 836 500 011 | 4.3        | 0.000 001 | 0.005 |
| 100%           |        | +10      | 836 500 009 | 2.9        | 0.000 000 | 0.003 |
| 100%           |        | +30      | 836 500 012 | 5.6        | 0.000 001 | 0.007 |
| 100%           |        | +40      | 836 500 010 | 3.8        | 0.000 000 | 0.005 |
| 100%           |        | +50      | 836 500 010 | 3.7        | 0.000 000 | 0.004 |
| Batt. Endpoint | 10.200 | +20      | 836 500 010 | 3.8        | 0.000 000 | 0.005 |



□ MODE: LTE B5  
 □ OPERATING FREQUENCY: 836,500,000 Hz  
 □ CHANNEL: 18900(10MHz)  
 □ REFERENCE VOLTAGE: 12.000 VDC  
 □ DEVIATION LIMIT: ± 0.000 25 % or 2.5 ppm

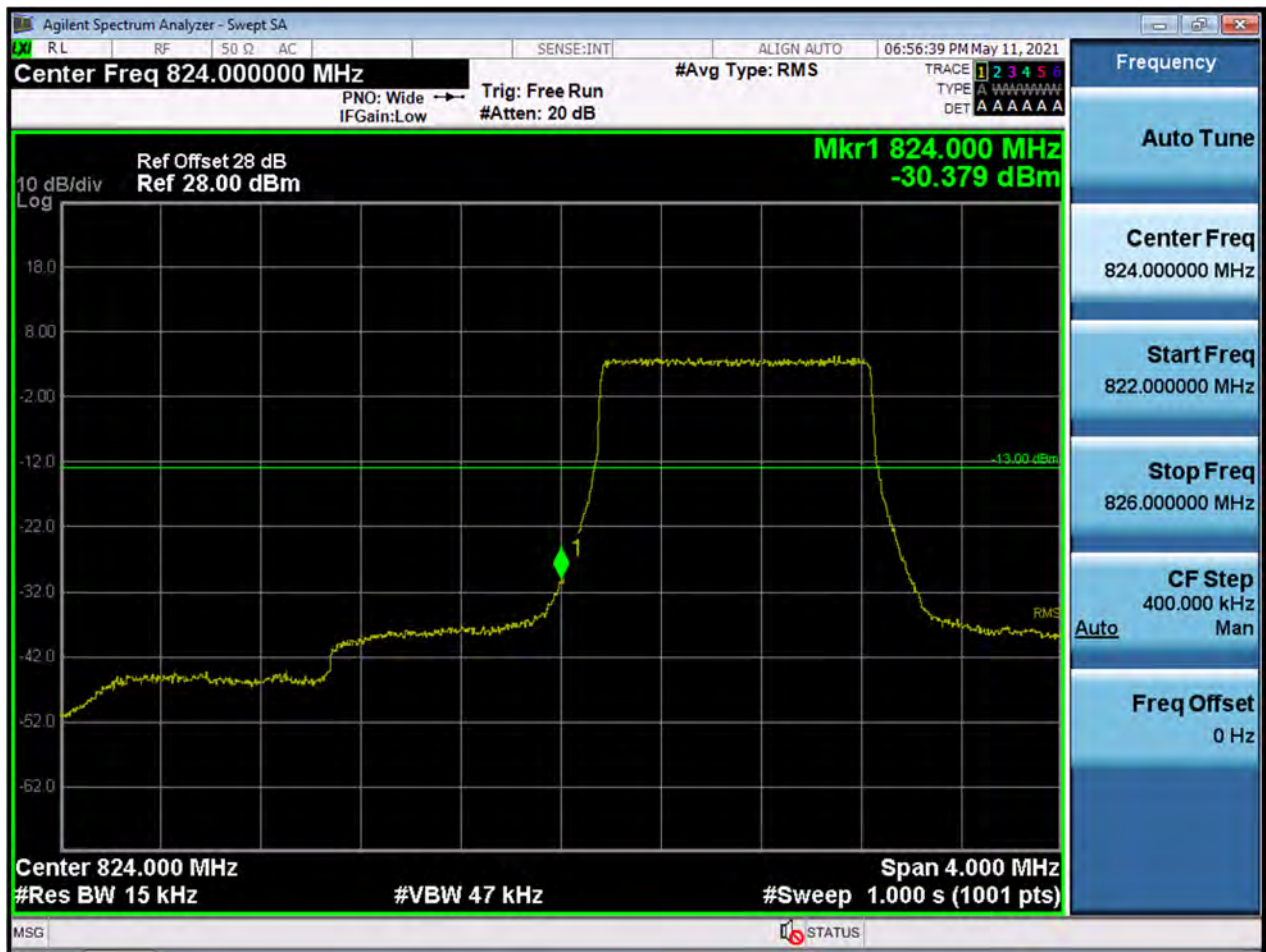
| Voltage        | Power  | Temp.    | Frequency   | Frequency  | Deviation | ppm    |
|----------------|--------|----------|-------------|------------|-----------|--------|
| (%)            | (VDC)  | (°C)     | (Hz)        | Error (Hz) | (%)       |        |
| 100%           | 12.000 | +20(Ref) | 836 499 997 | 0.0        | 0.000 000 | 0.000  |
| 100%           |        | -30      | 836 500 001 | 3.8        | 0.000 000 | 0.005  |
| 100%           |        | -20      | 836 500 001 | 3.2        | 0.000 000 | 0.004  |
| 100%           |        | -10      | 836 500 000 | 2.3        | 0.000 000 | 0.003  |
| 100%           |        | 0        | 836 499 994 | -2.9       | 0.000 000 | -0.003 |
| 100%           |        | +10      | 836 500 004 | 6.9        | 0.000 001 | 0.008  |
| 100%           |        | +30      | 836 500 001 | 3.9        | 0.000 000 | 0.005  |
| 100%           |        | +40      | 836 500 000 | 3.0        | 0.000 000 | 0.004  |
| 100%           |        | +50      | 836 500 000 | 2.2        | 0.000 000 | 0.003  |
| Batt. Endpoint | 10.200 | +20      | 836 499 994 | -3.5       | 0.000 000 | -0.004 |





## 9. TEST PLOTS

## 1.4M\_BandEdge\_Lowest Channel\_QPSK\_FullRB(1)



## 1.4M\_BandEdge\_Lowest Channel\_QPSK\_FullRB(2)



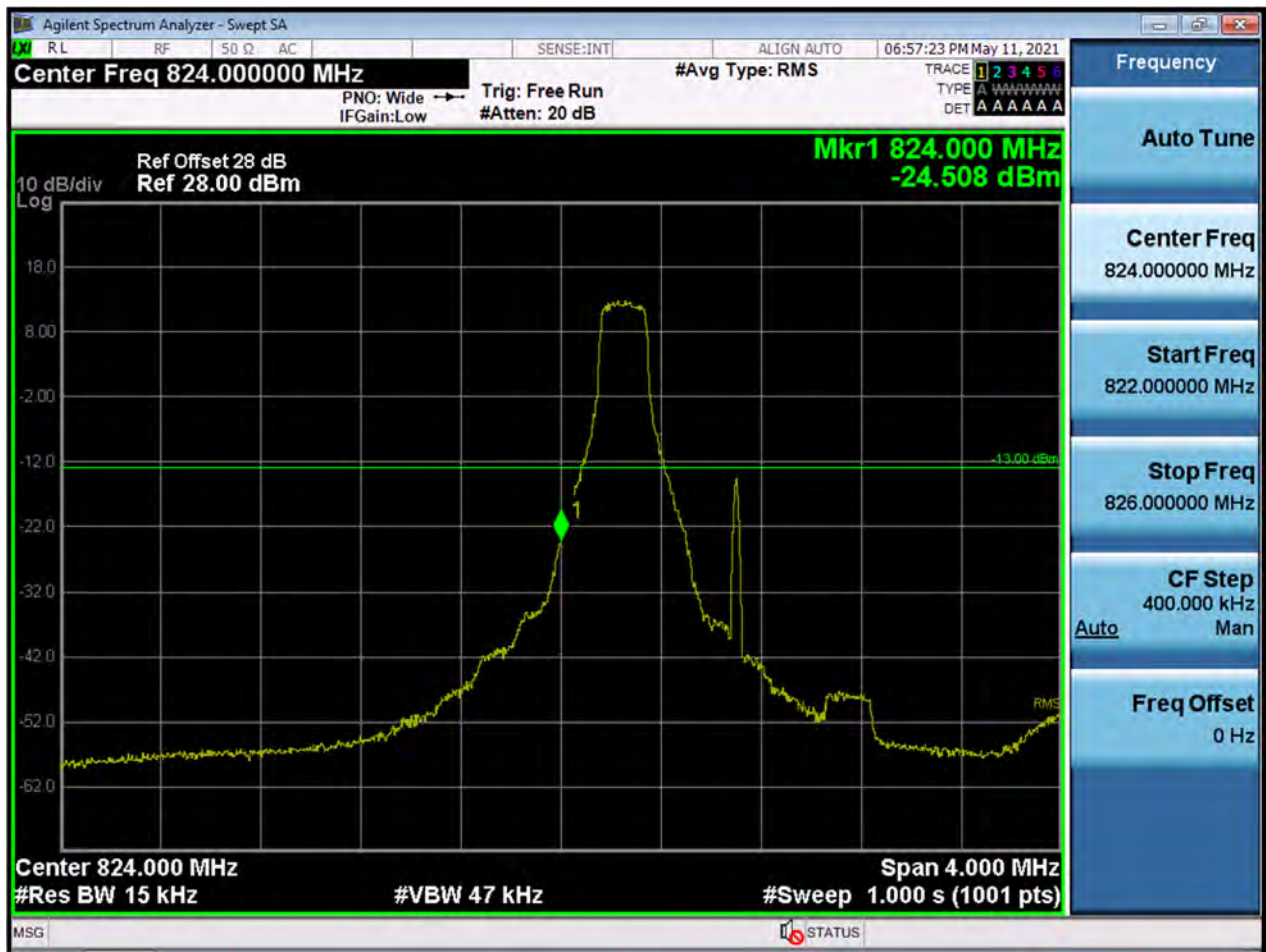
## 1.4M\_BandEdge\_Highest Channel\_QPSK\_FullRB(1)



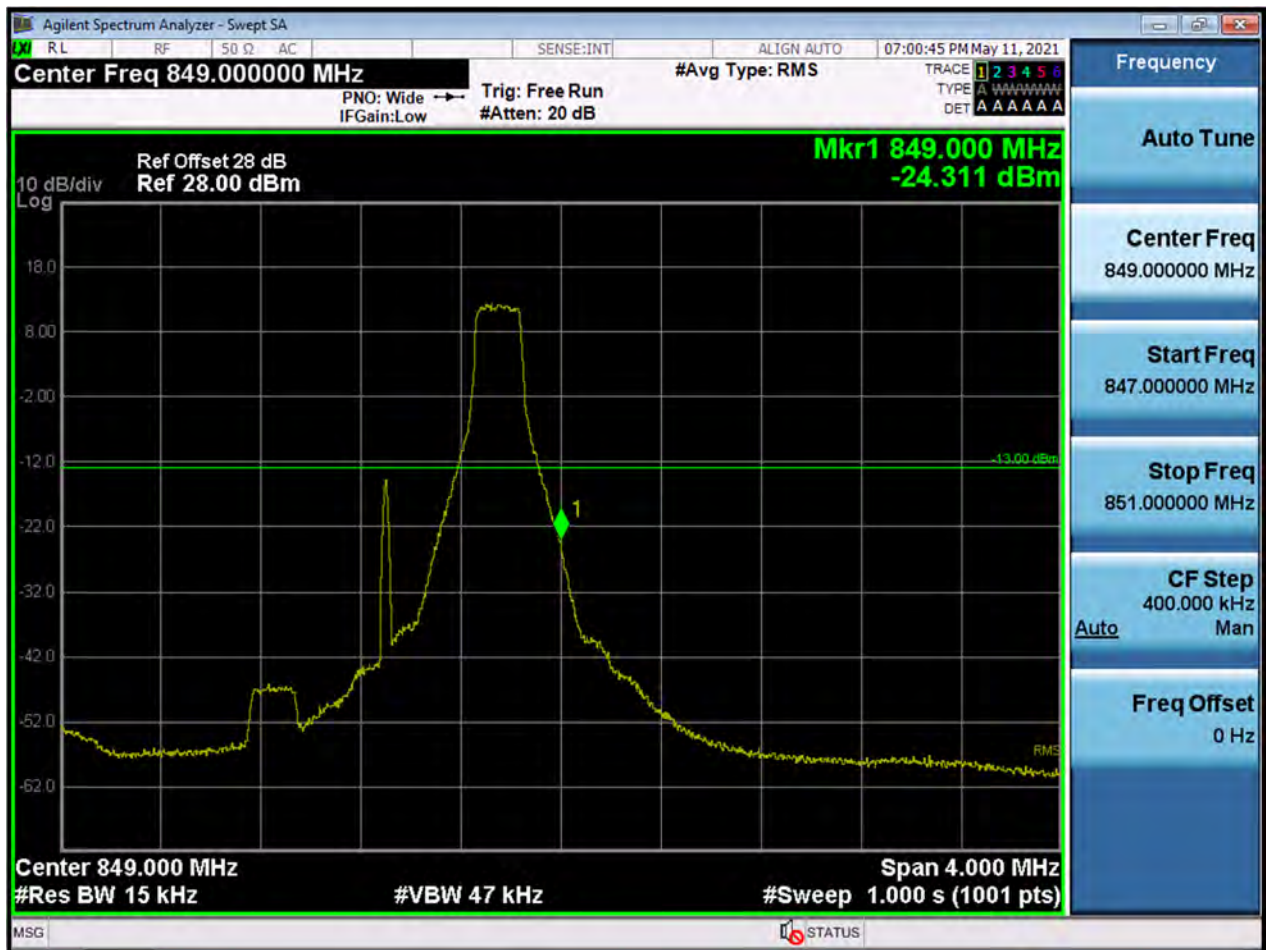
## 1.4M\_BandEdge\_Highest Channel\_QPSK\_FullRB(2)



## 1.4M\_BandEdge\_Lowest Channel\_QPSK\_1RB



## 1.4M\_BandEdge\_Highest Channel\_QPSK\_1RB



## 3M\_BandEdge\_Lowest Channel\_QPSK\_FullRB(1)



## 3M\_BandEdge\_Lowest Channel\_QPSK\_FullRB(2)



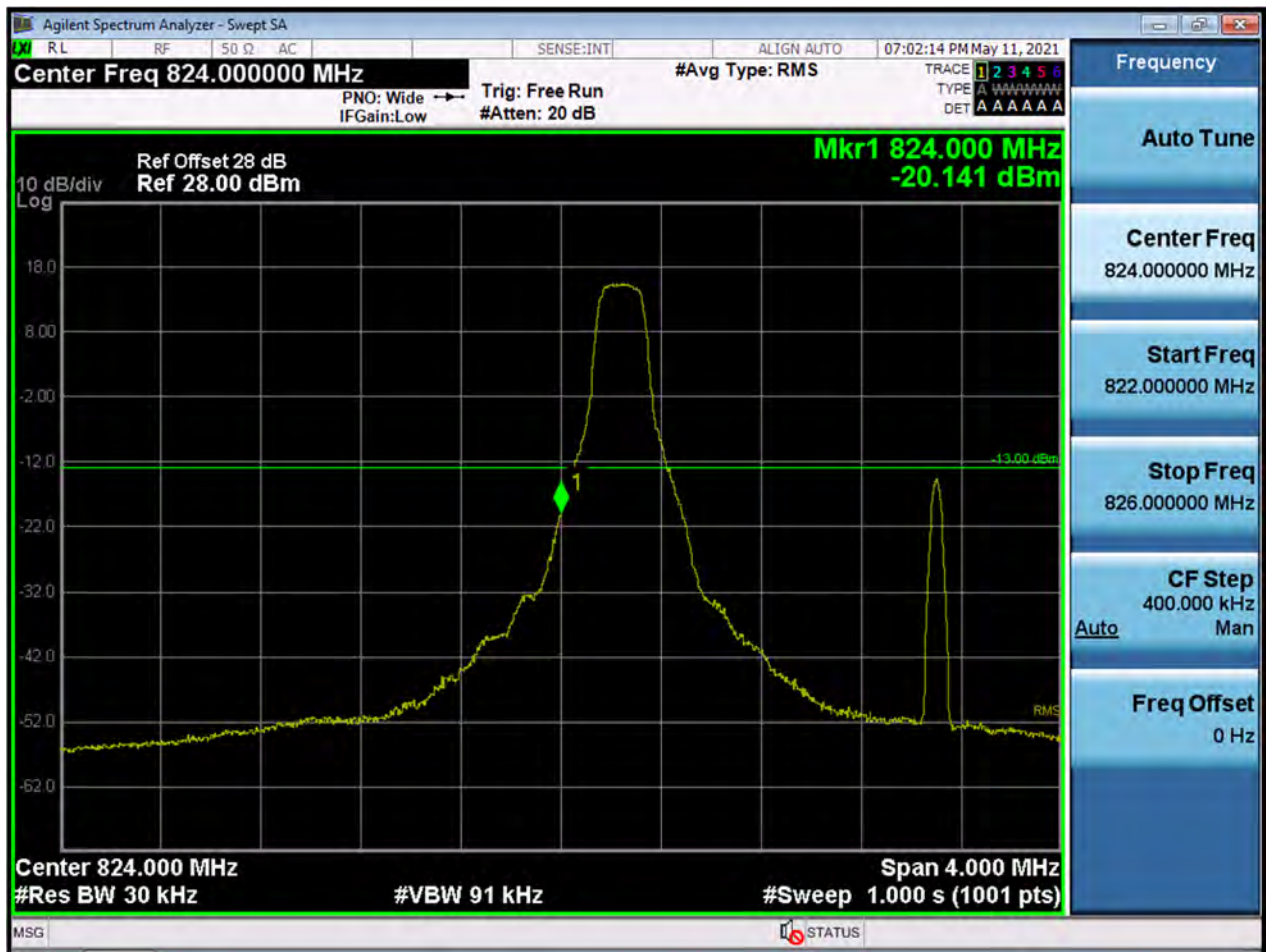
## 3M\_BandEdge\_Highest Channel\_QPSK\_FullRB(1)



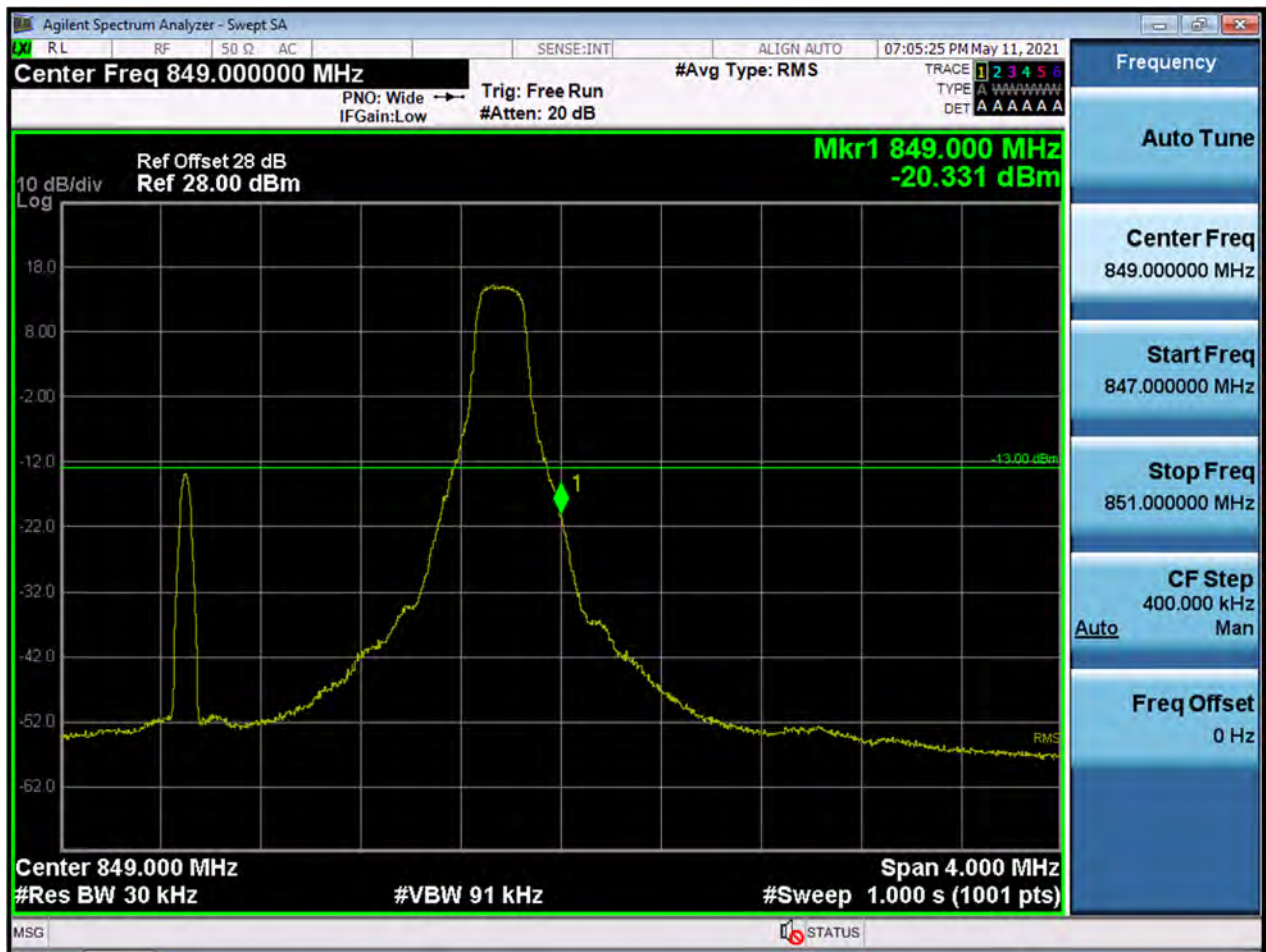
## 3M\_BandEdge\_Highest Channel\_QPSK\_FullRB(2)



## 3M\_BandEdge\_Lowest Channel\_QPSK\_1RB



## 3M\_BandEdge\_Highest Channel\_QPSK\_1RB



## 5M\_BandEdge\_Lowest Channel\_QPSK\_FullRB(1)



## 5M\_BandEdge\_Lowest Channel\_QPSK\_FullRB(2)



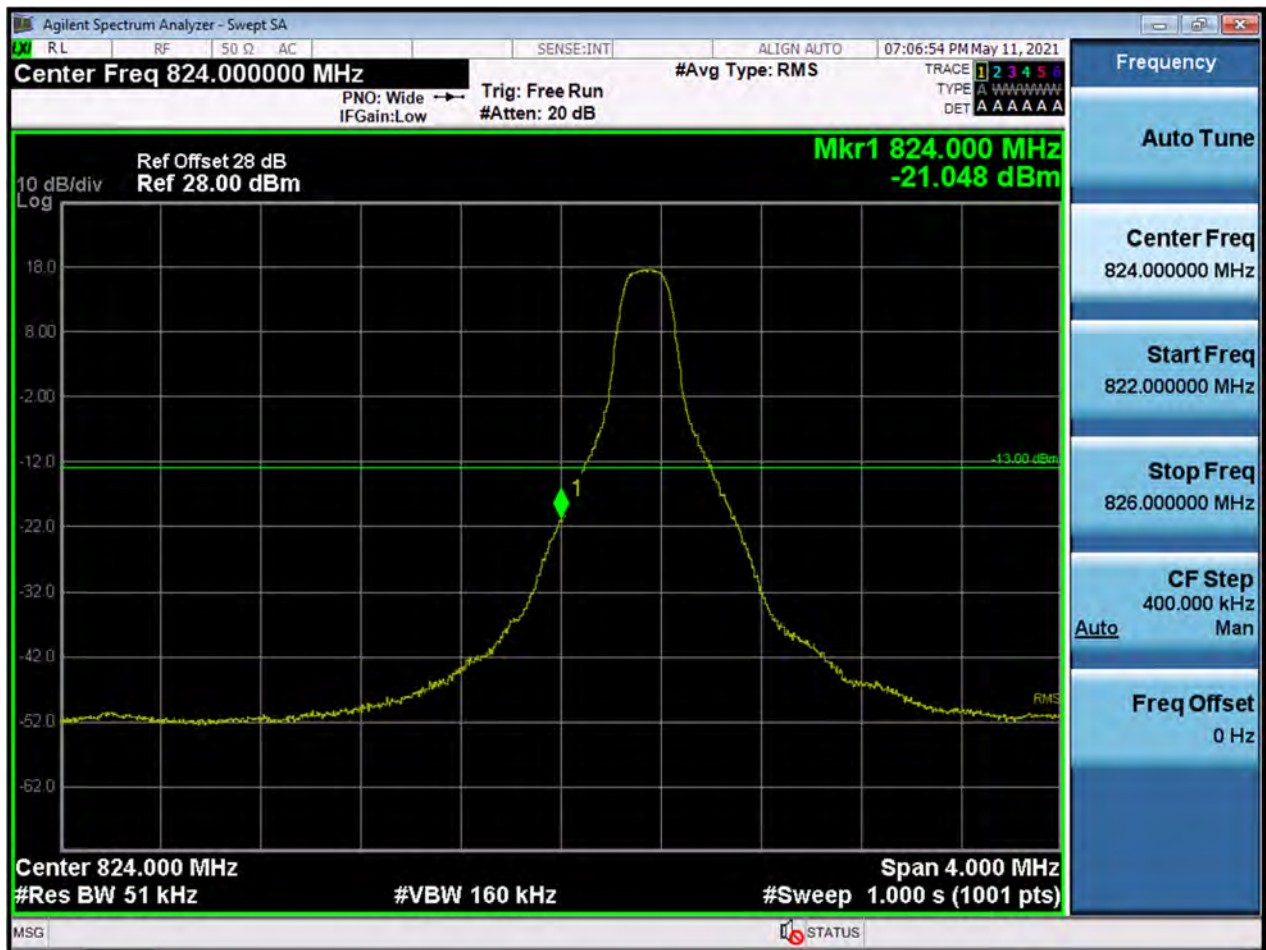
## 5M\_BandEdge\_Highest Channel\_QPSK\_FullRB(1)



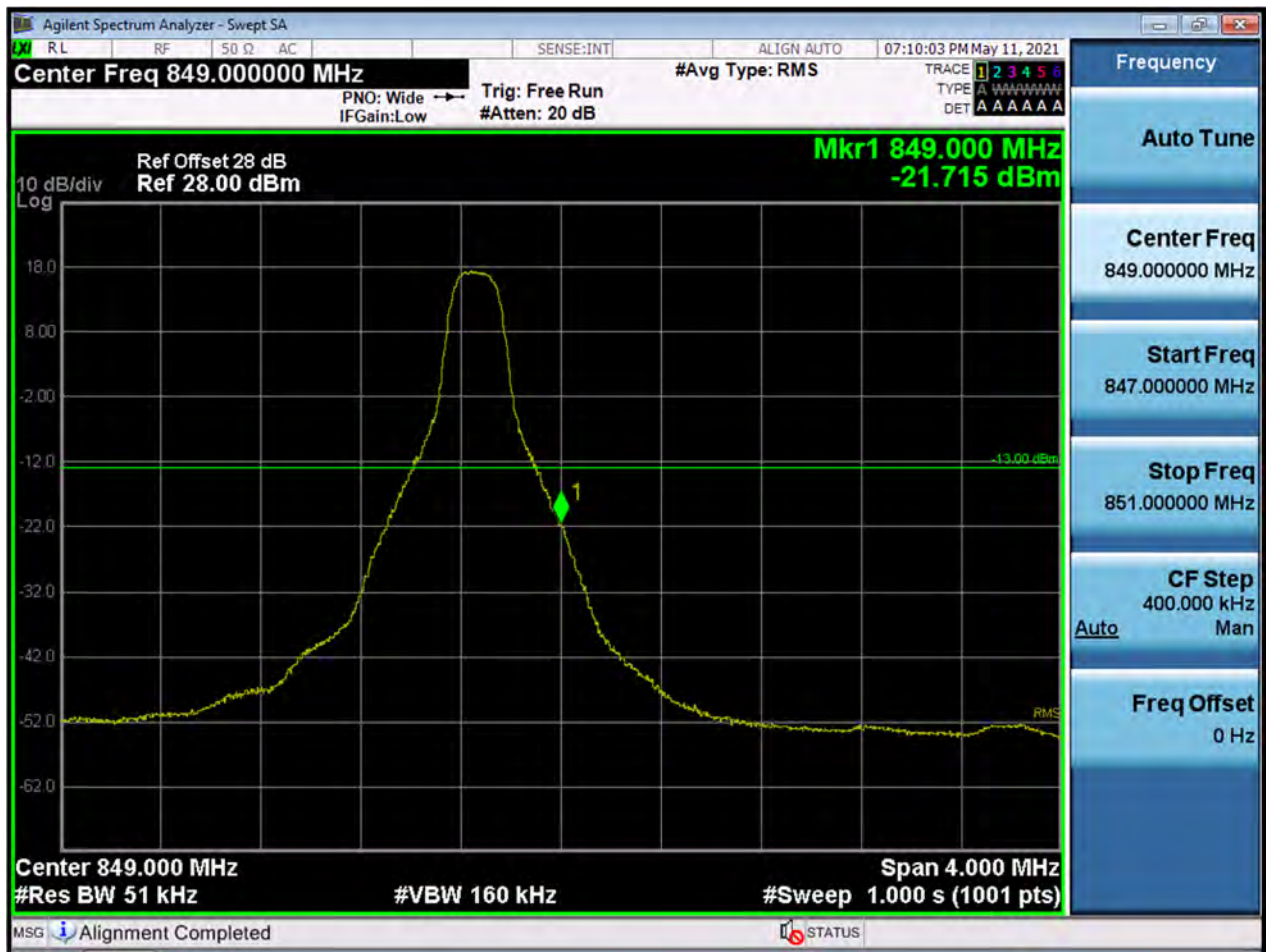
## 5M\_BandEdge\_Highest Channel\_QPSK\_FullRB(2)



## 5M\_BandEdge\_Lowest Channel\_QPSK\_1RB



## 5M\_BandEdge\_Highest Channel\_QPSK\_1RB



## 10M\_BandEdge\_Lowest Channel\_QPSK\_FullRB(1)



## 10M\_BandEdge\_Lowest Channel\_QPSK\_FullRB(2)



10M\_BandEdge\_Highest Channel\_QPSK\_FullRB(1)



## 10M\_BandEdge\_Highest Channel\_QPSK\_FullRB(2)



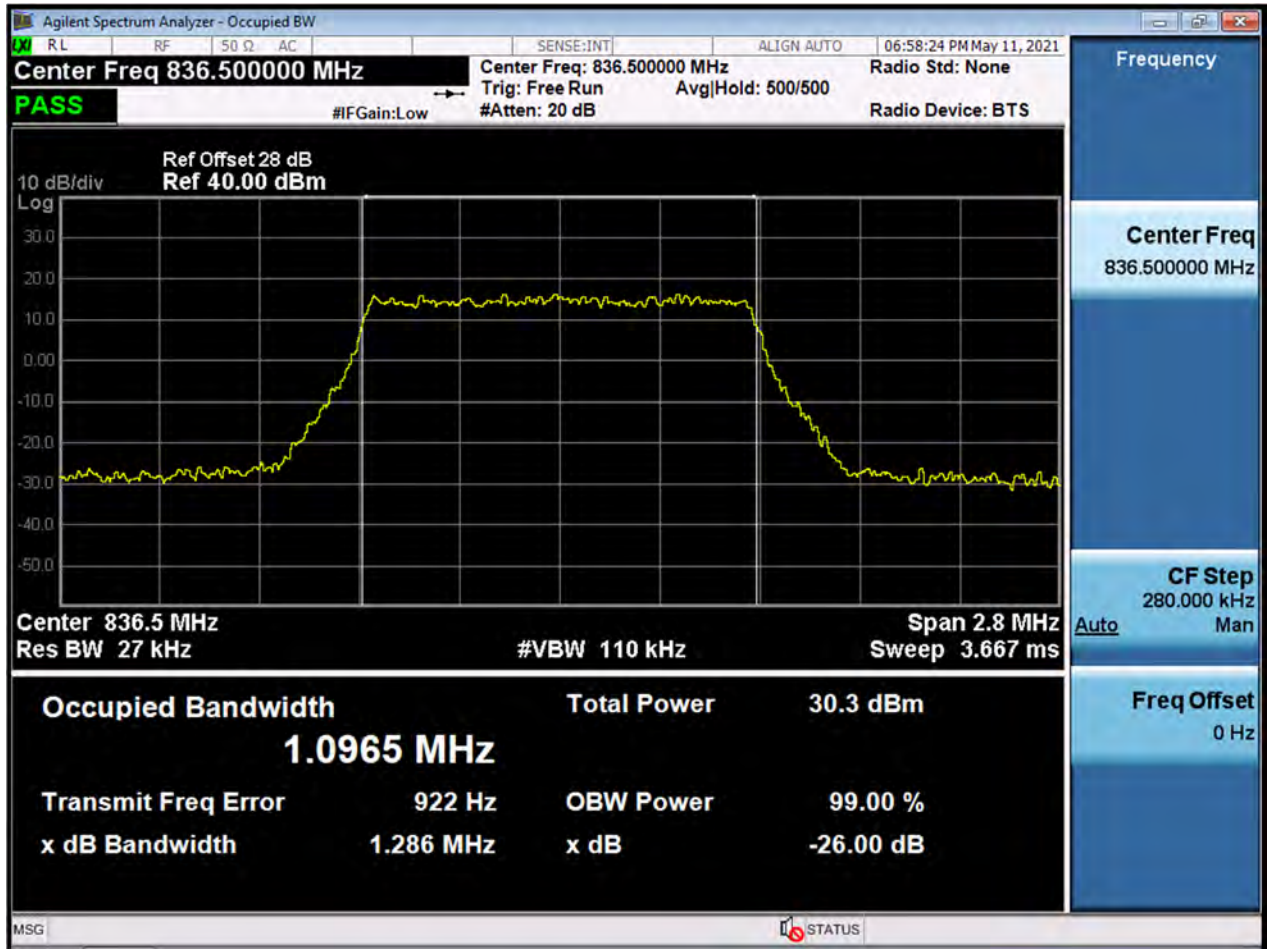
10M\_BandEdge\_Lowest Channel\_QPSK\_1RB



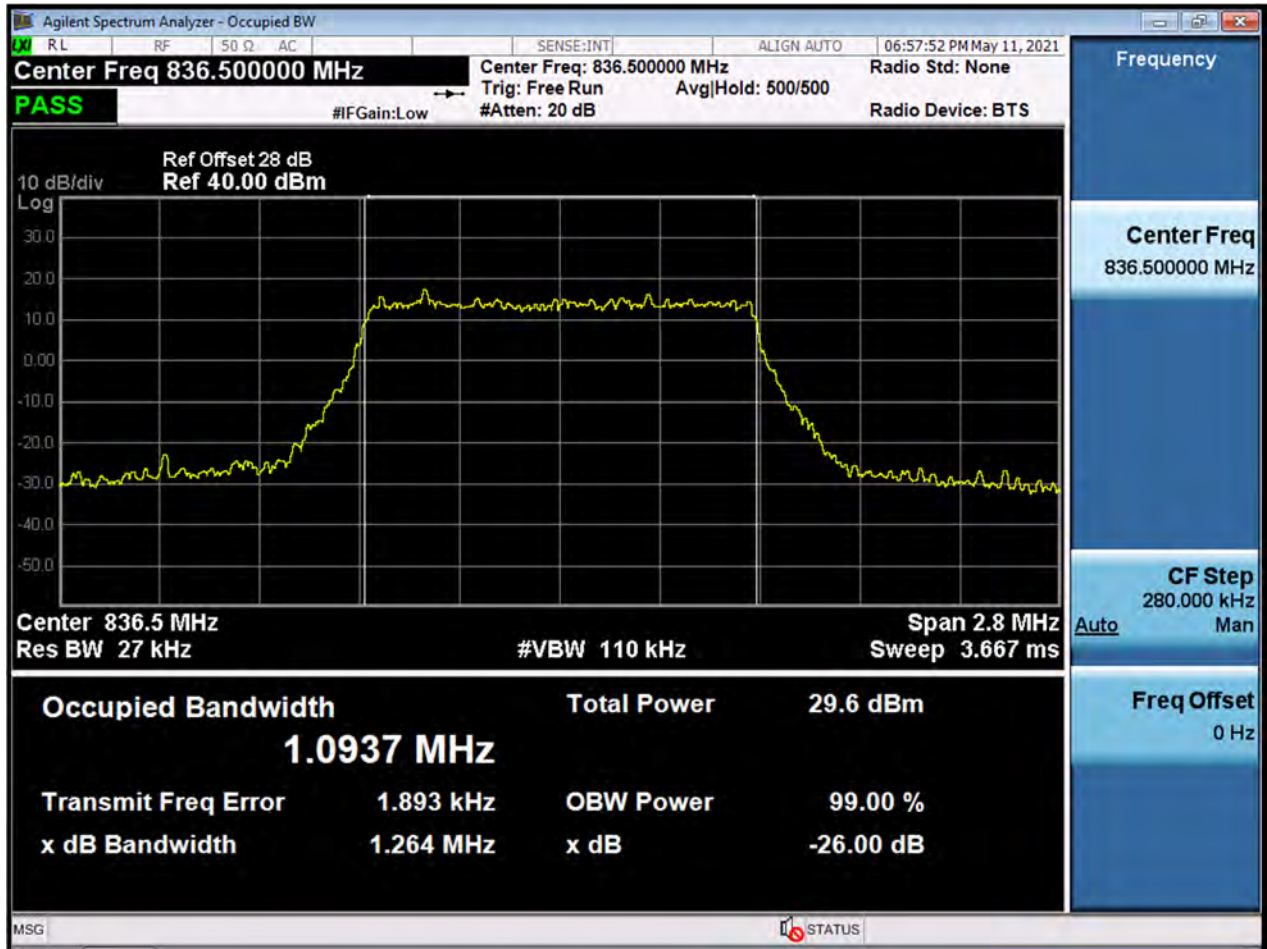
## 10M\_BandEdge\_Highest Channel\_QPSK\_1RB



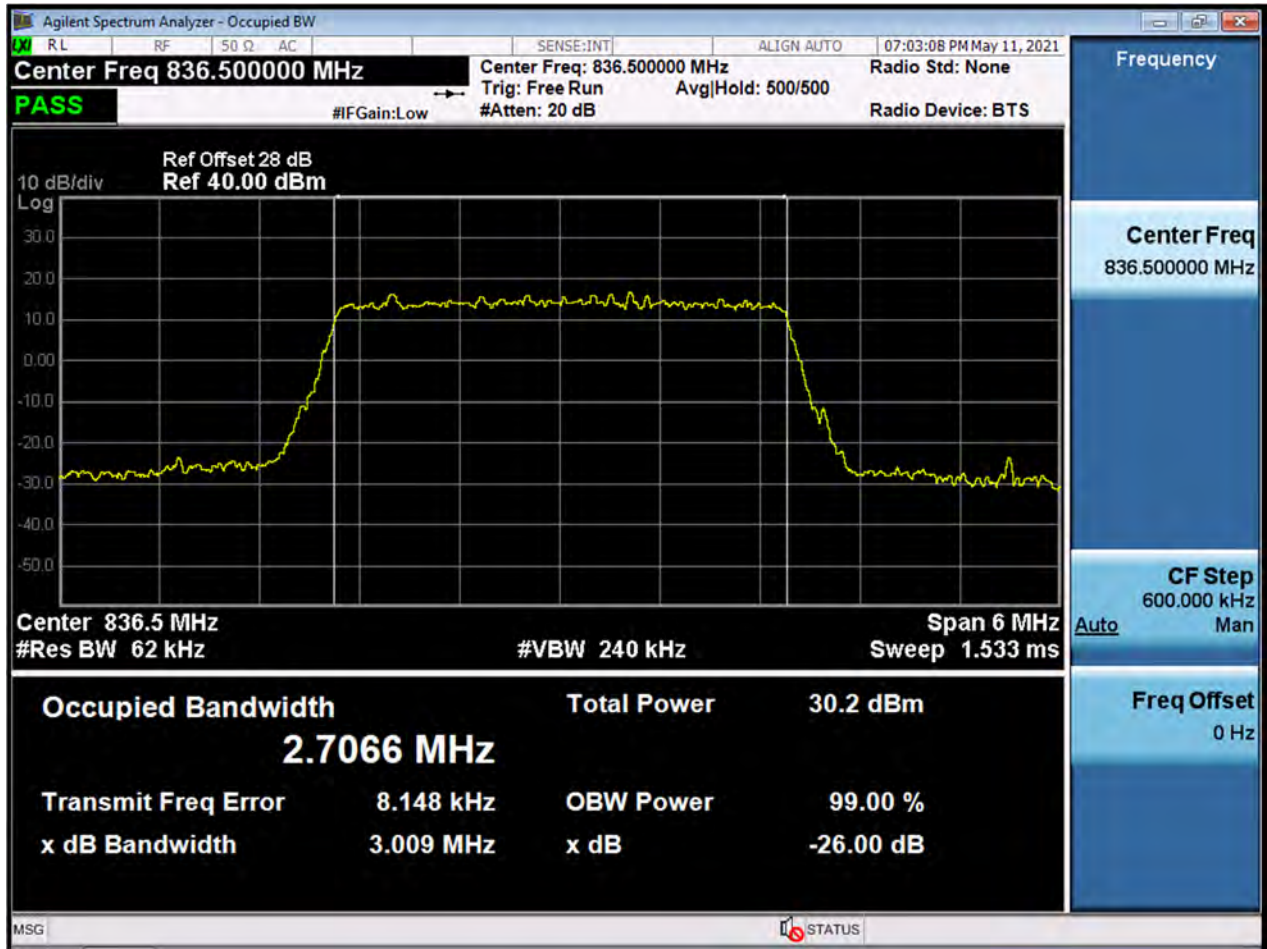
## 1.4M\_OBW\_Mid Channel\_QPSK\_FullRB



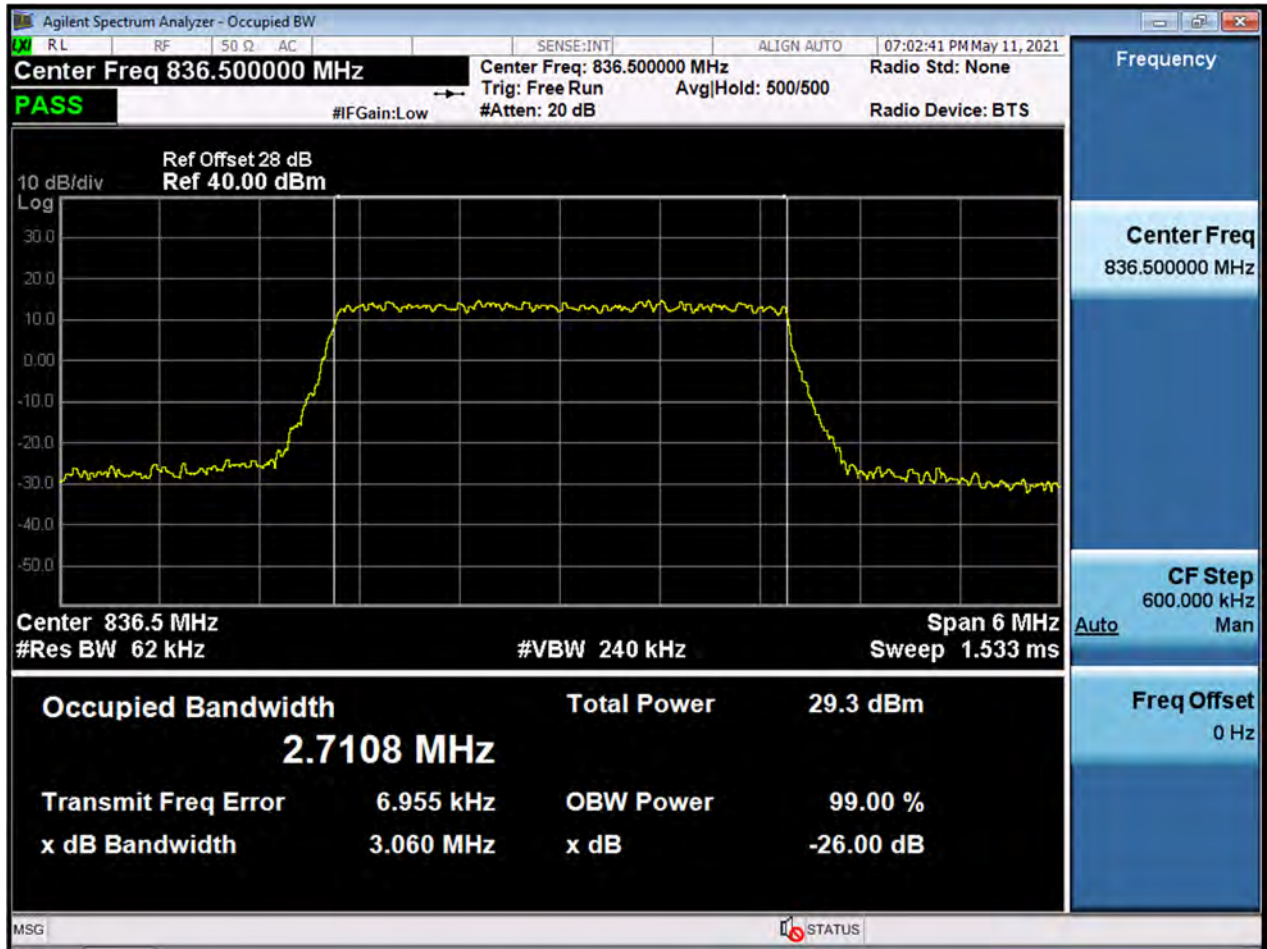
1.4M\_OBW\_Mid Channel\_16QAM\_FullRB



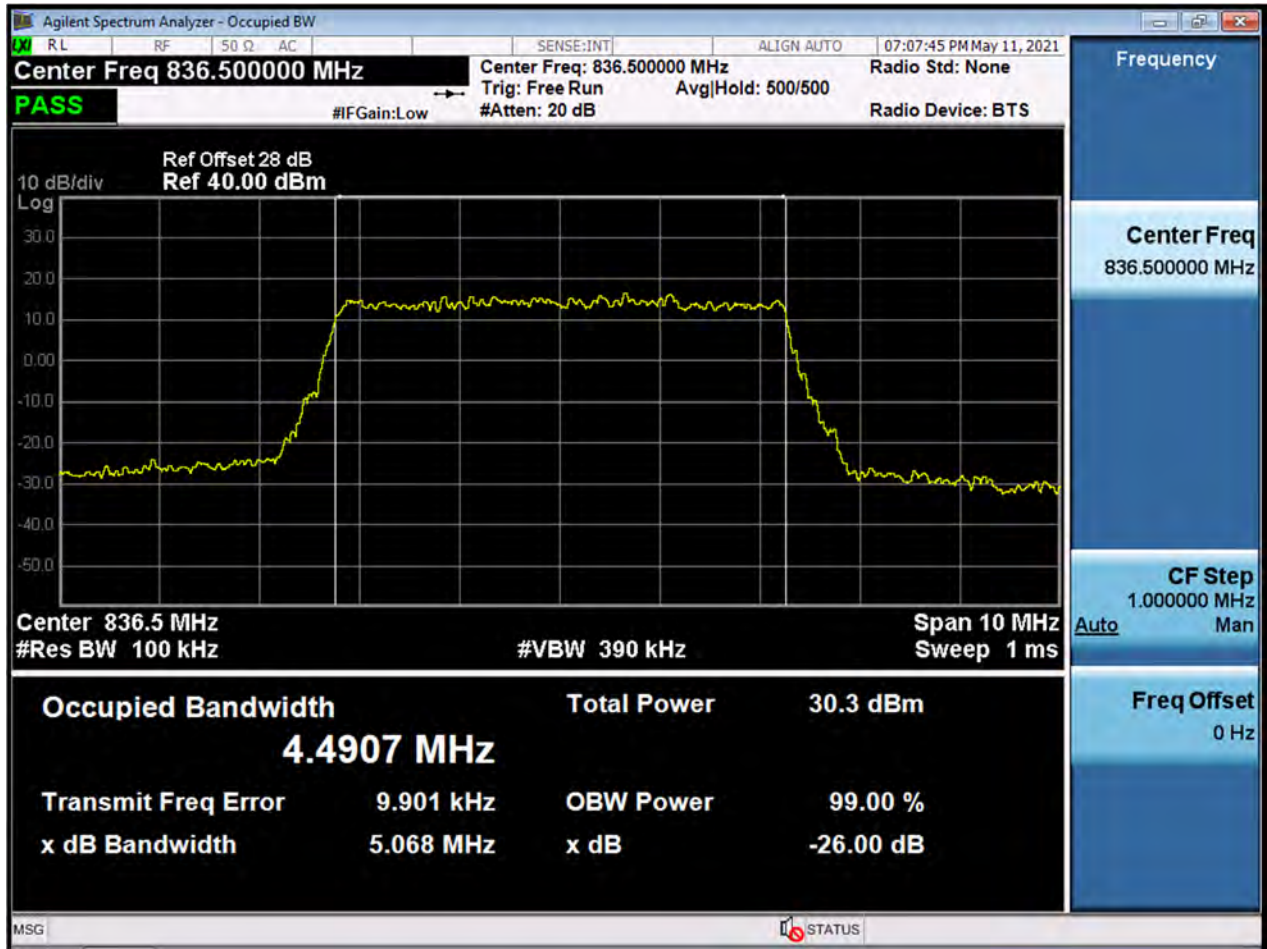
## 3M\_OBW\_Mid Channel\_QPSK\_FullRB



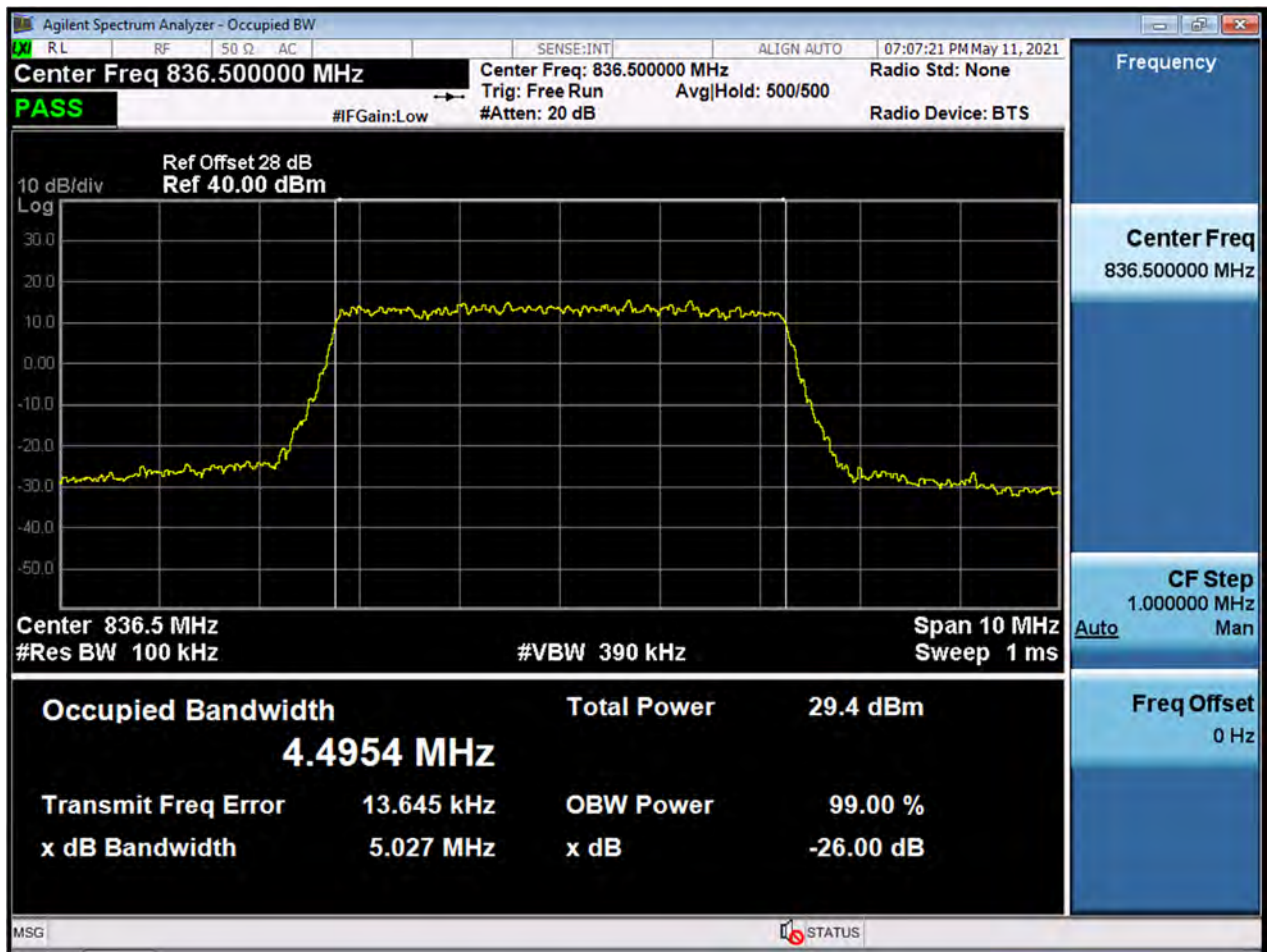
3M\_OBW\_Mid Channel\_16QAM\_FullRB



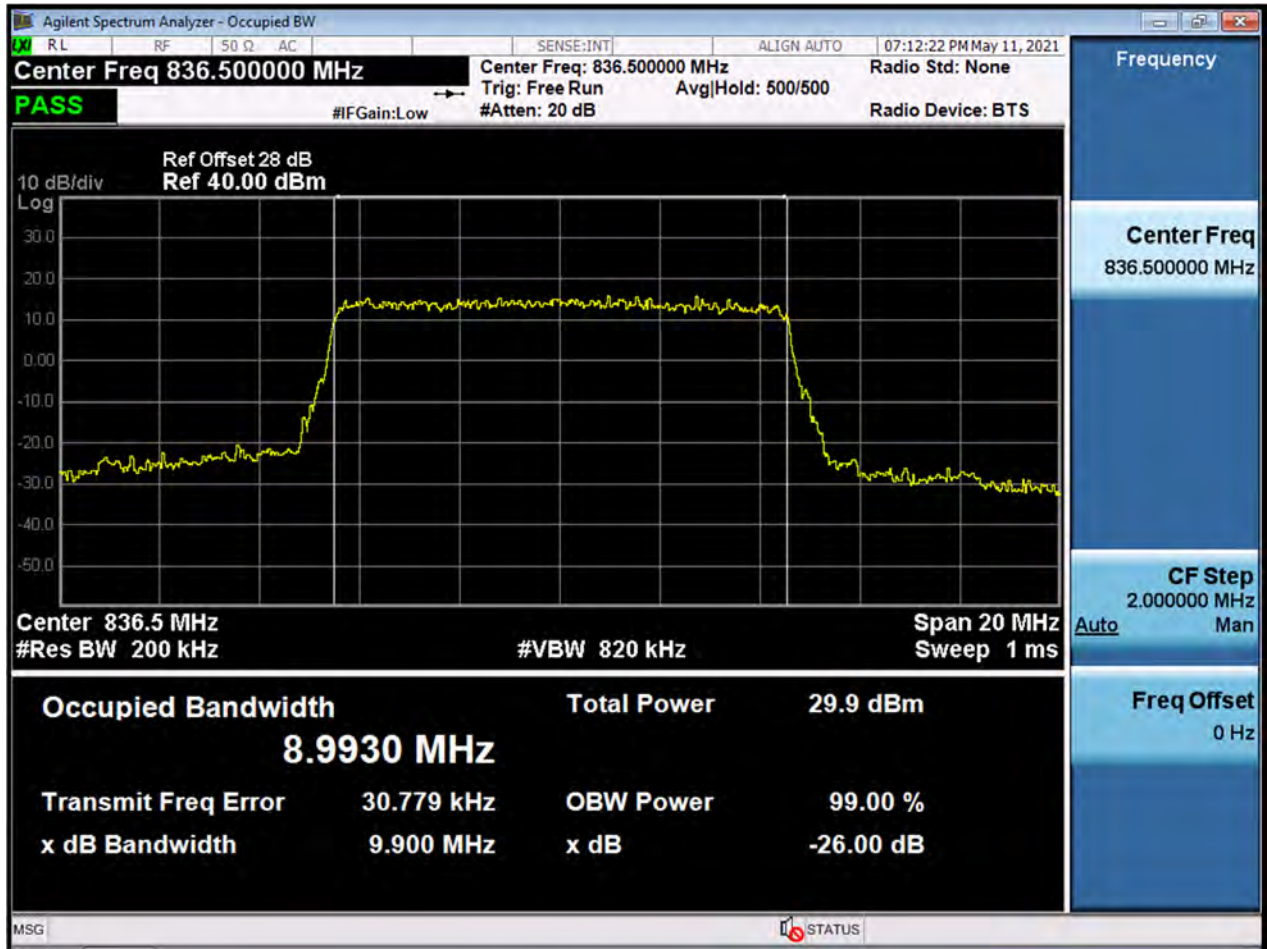
## 5M\_OBW\_Mid Channel\_QPSK\_FullRB



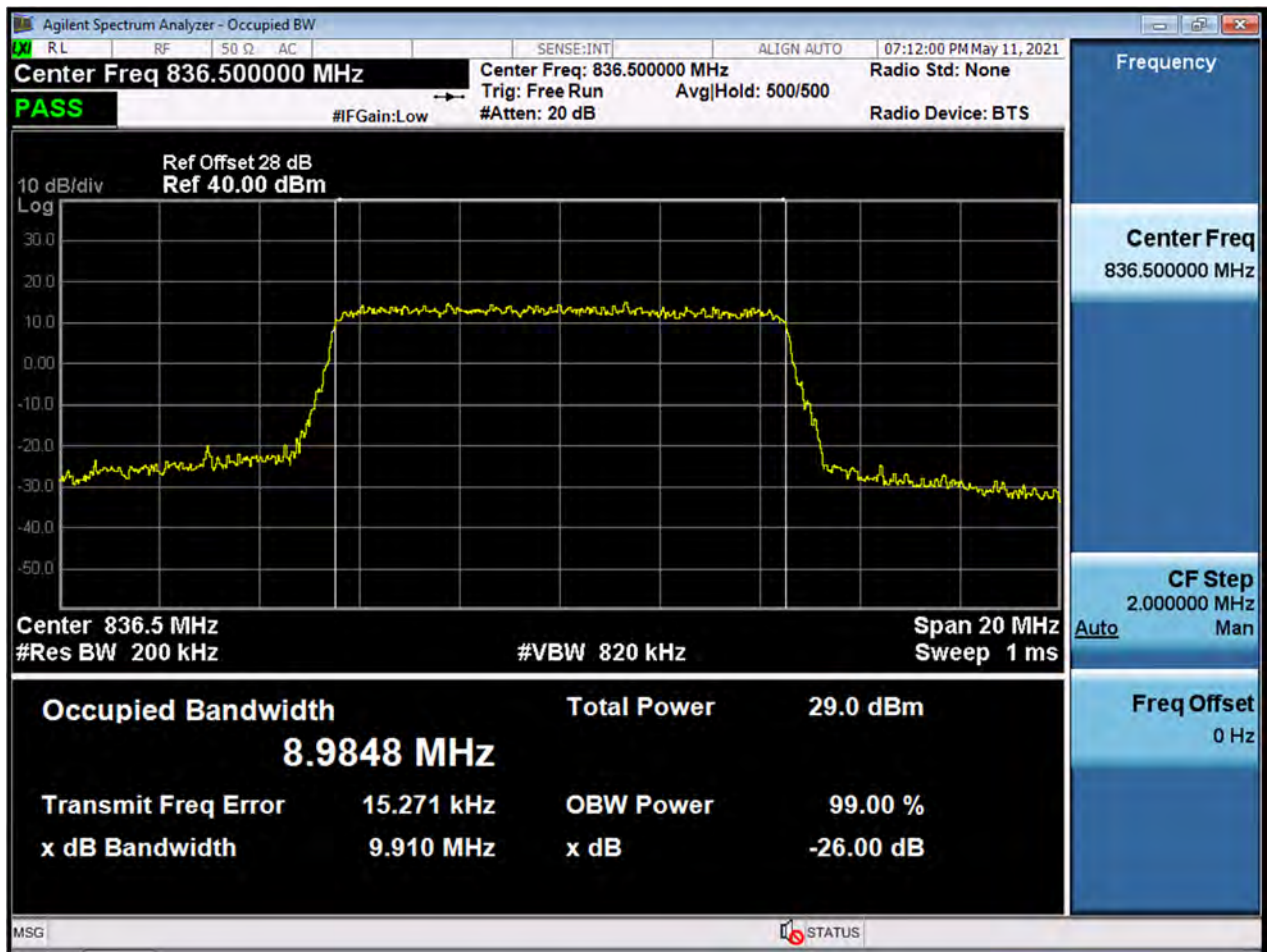
## 5M\_OBW\_Mid Channel\_16QAM\_FullRB



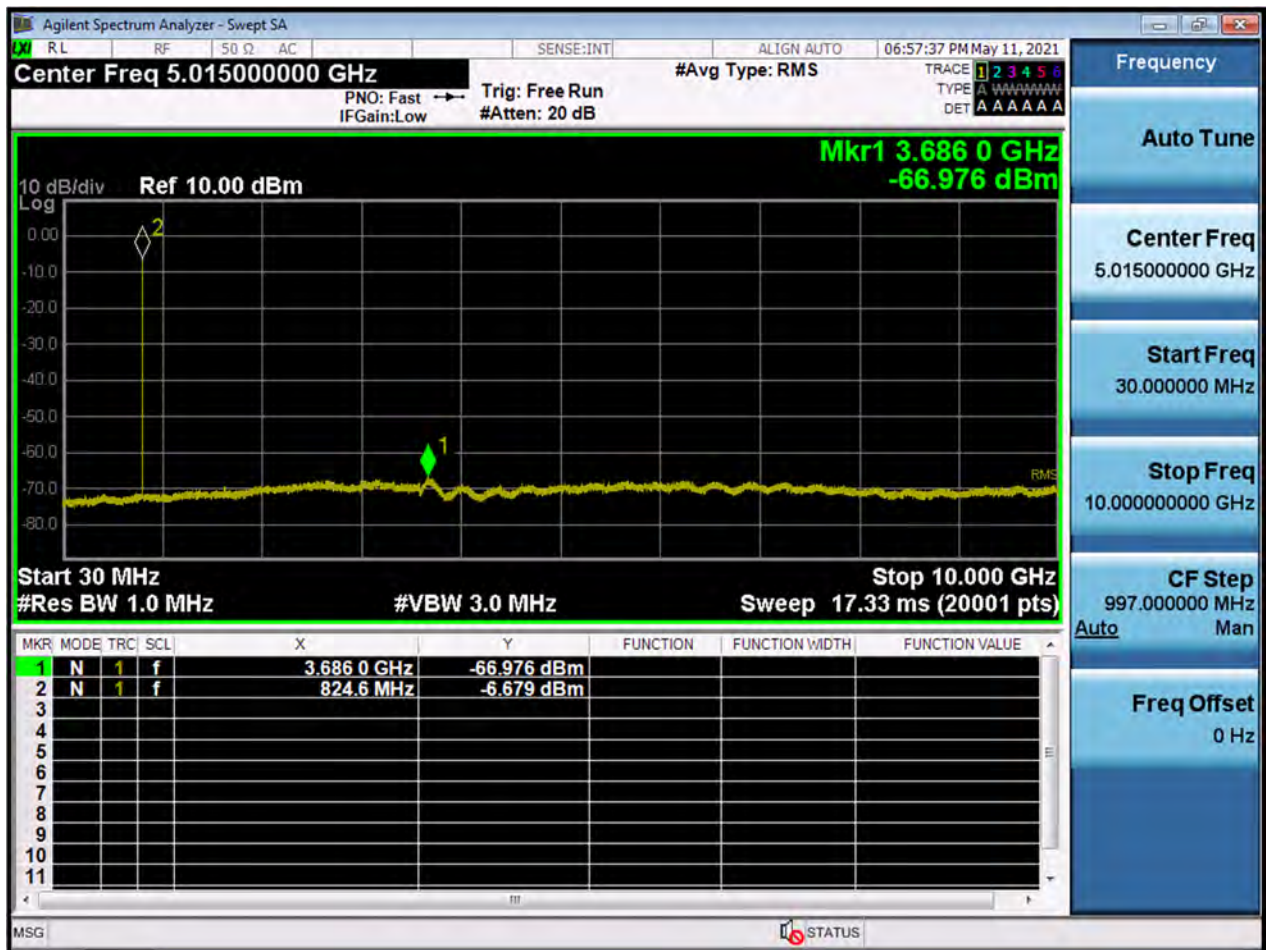
## 10M\_OBW\_Mid Channel\_QPSK\_FullRB



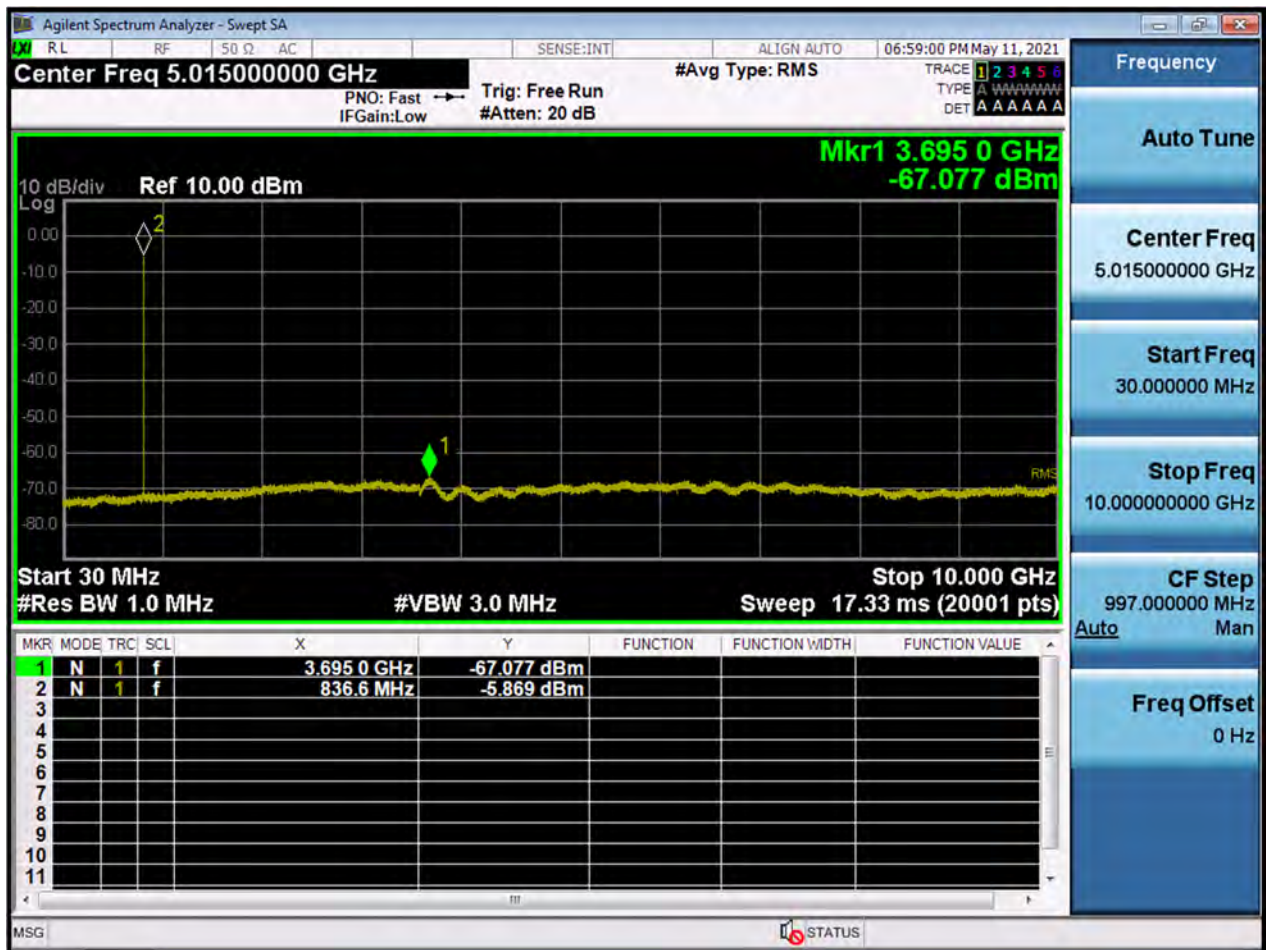
## 10M\_OBW\_Mid Channel\_16QAM\_FullRB



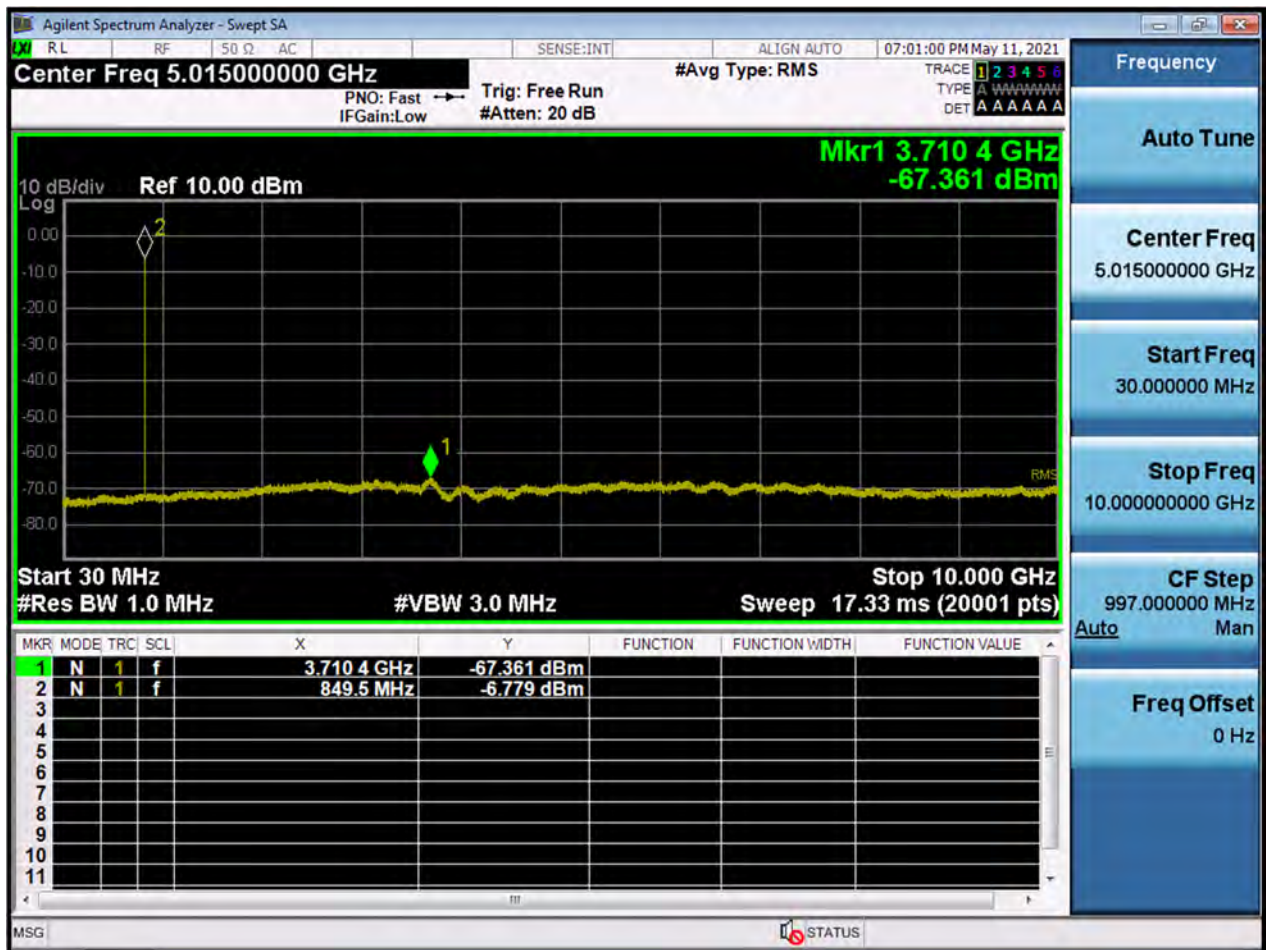
1.4M\_CSE(30M-10G)\_Lowest Channel\_QPSK\_1RB

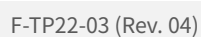


1.4M\_CSE(30M-10G)\_Mid Channel\_QPSK\_1RB

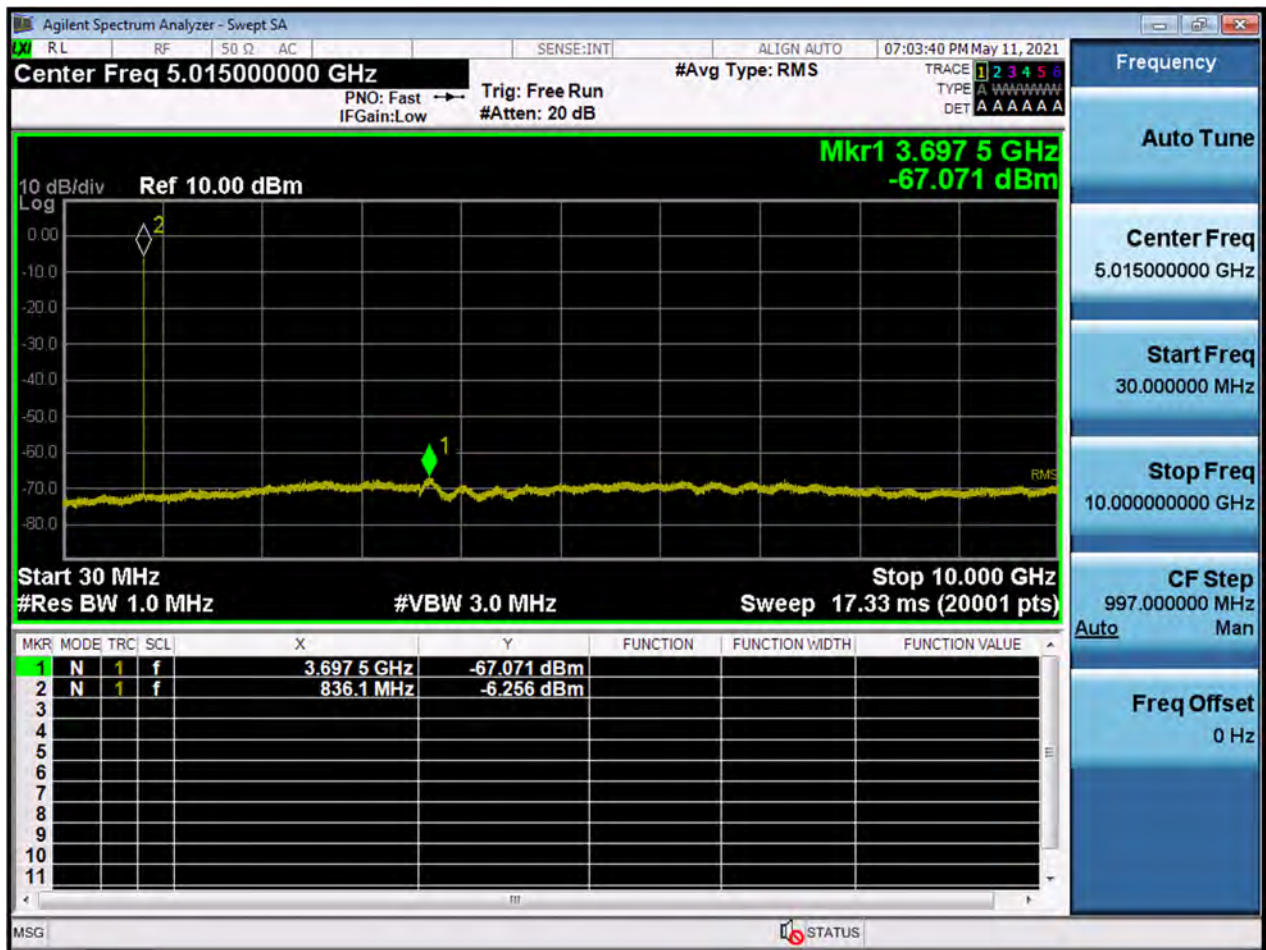


1.4M\_CSE(30M-10G)\_Highest Channel\_QPSK\_1RB

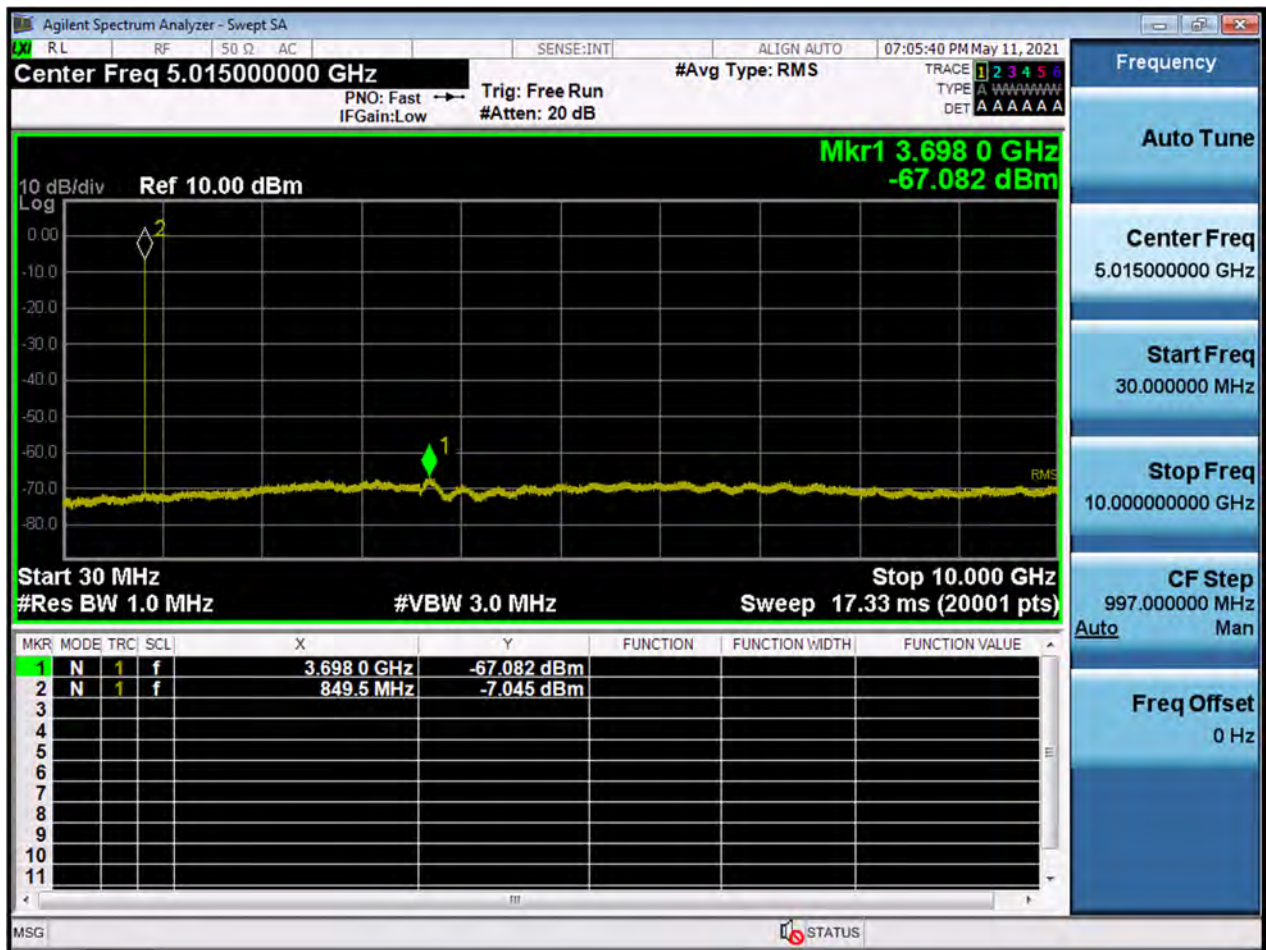




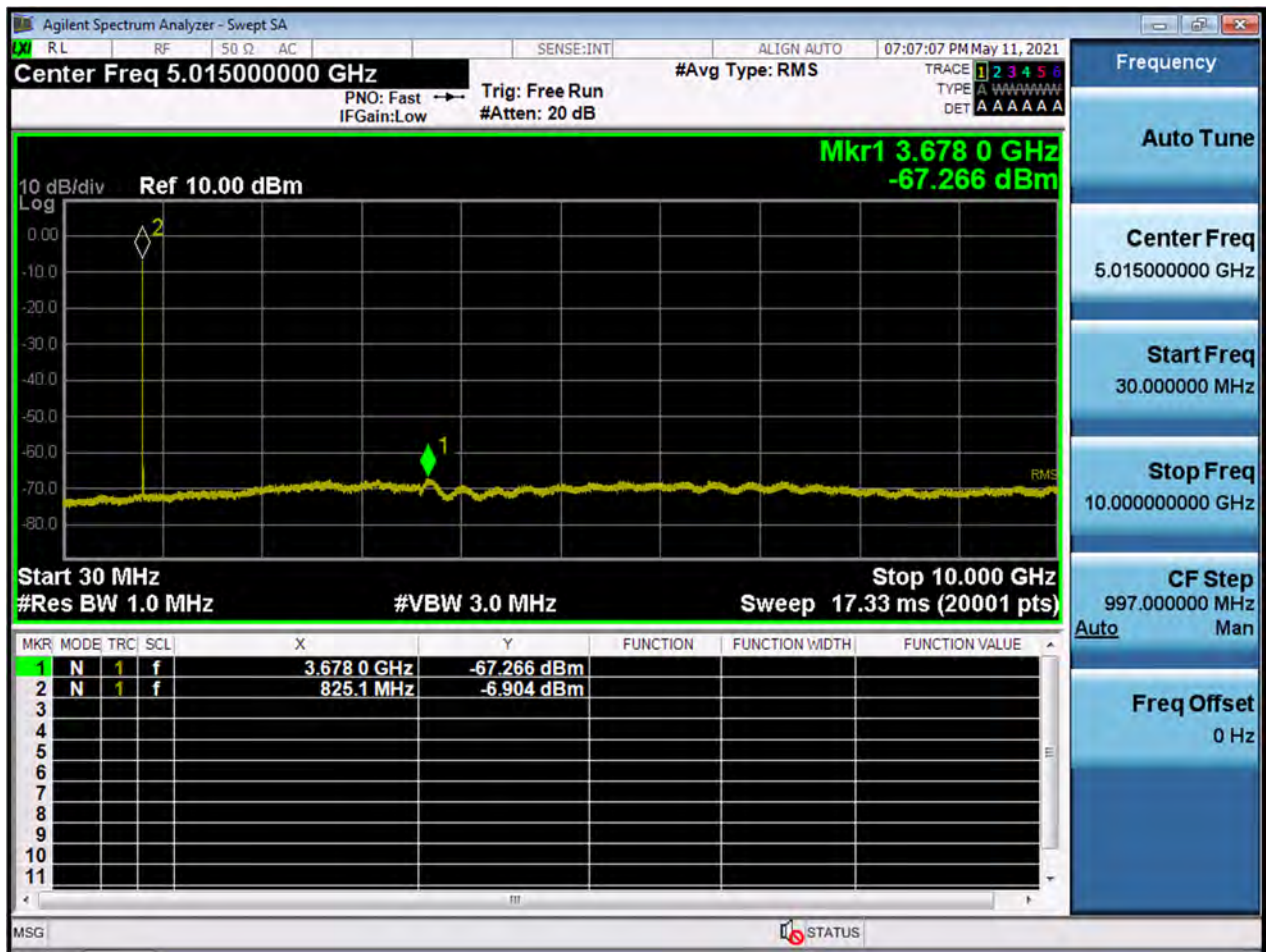
3M\_CSE(30M-10G)\_Mid Channel\_QPSK\_1RB



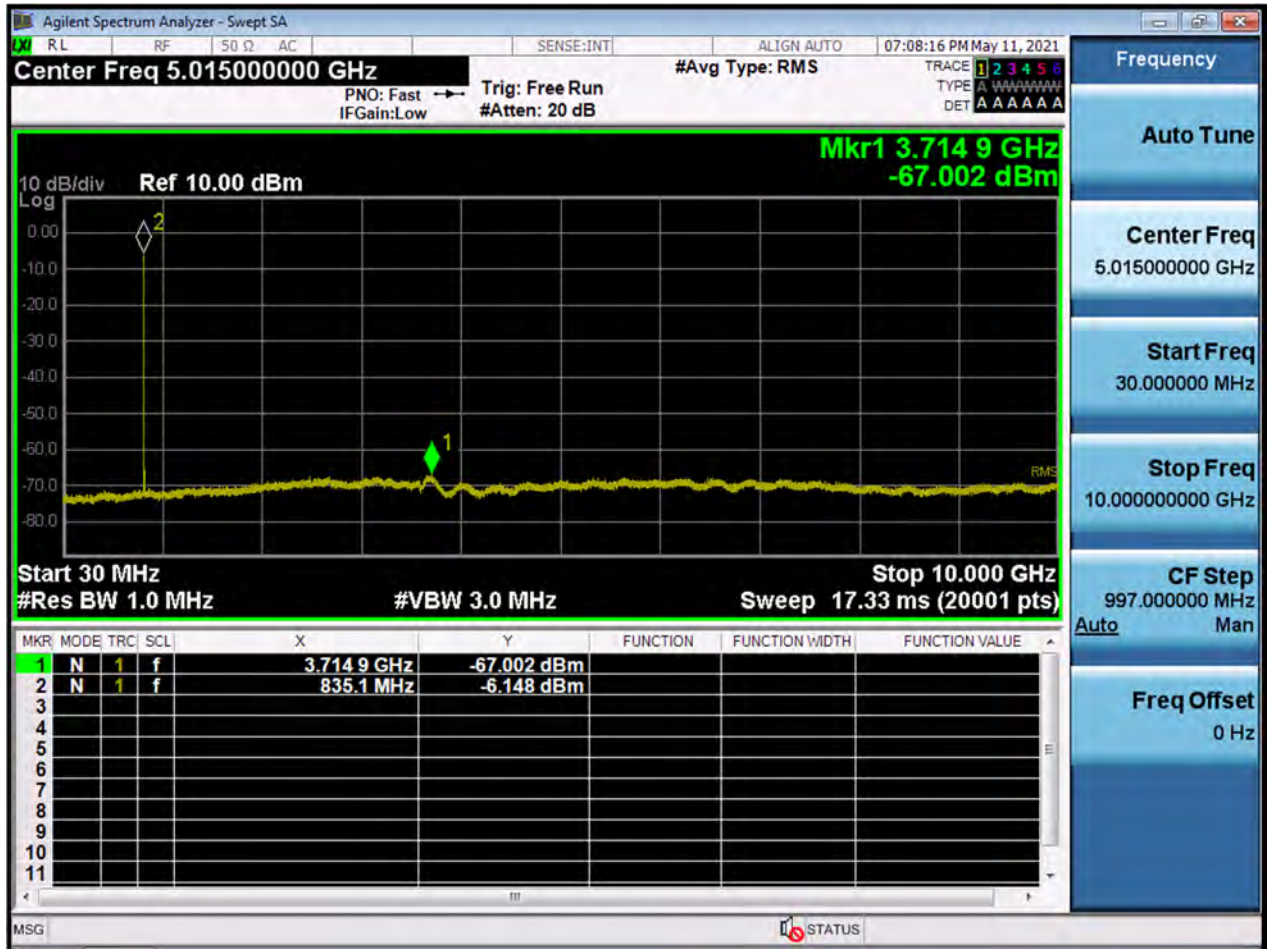
3M\_CSE(30M-10G)\_Highest Channel\_QPSK\_1RB



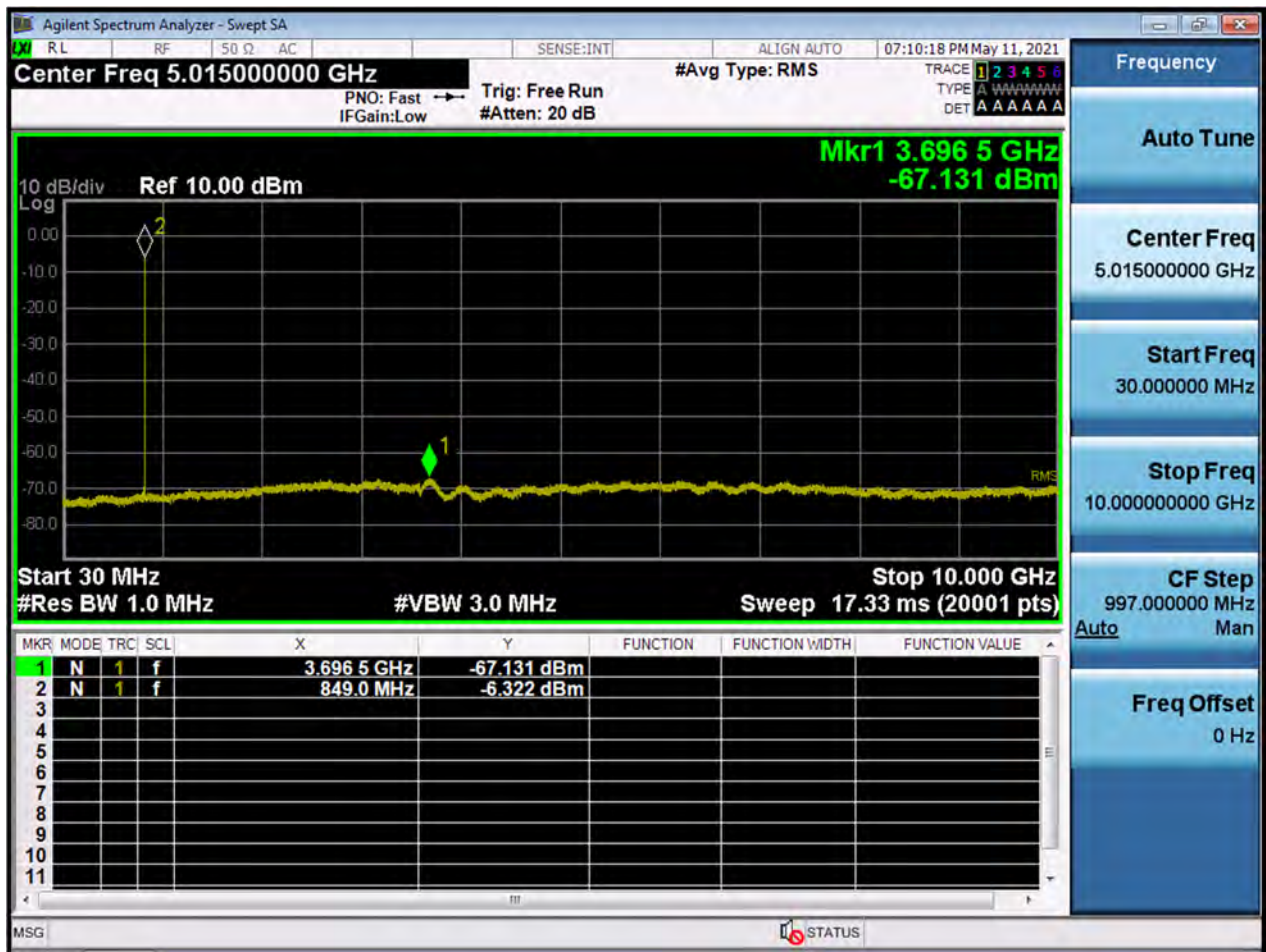
5M\_CSE(30M-10G)\_Lowest Channel\_QPSK\_1RB



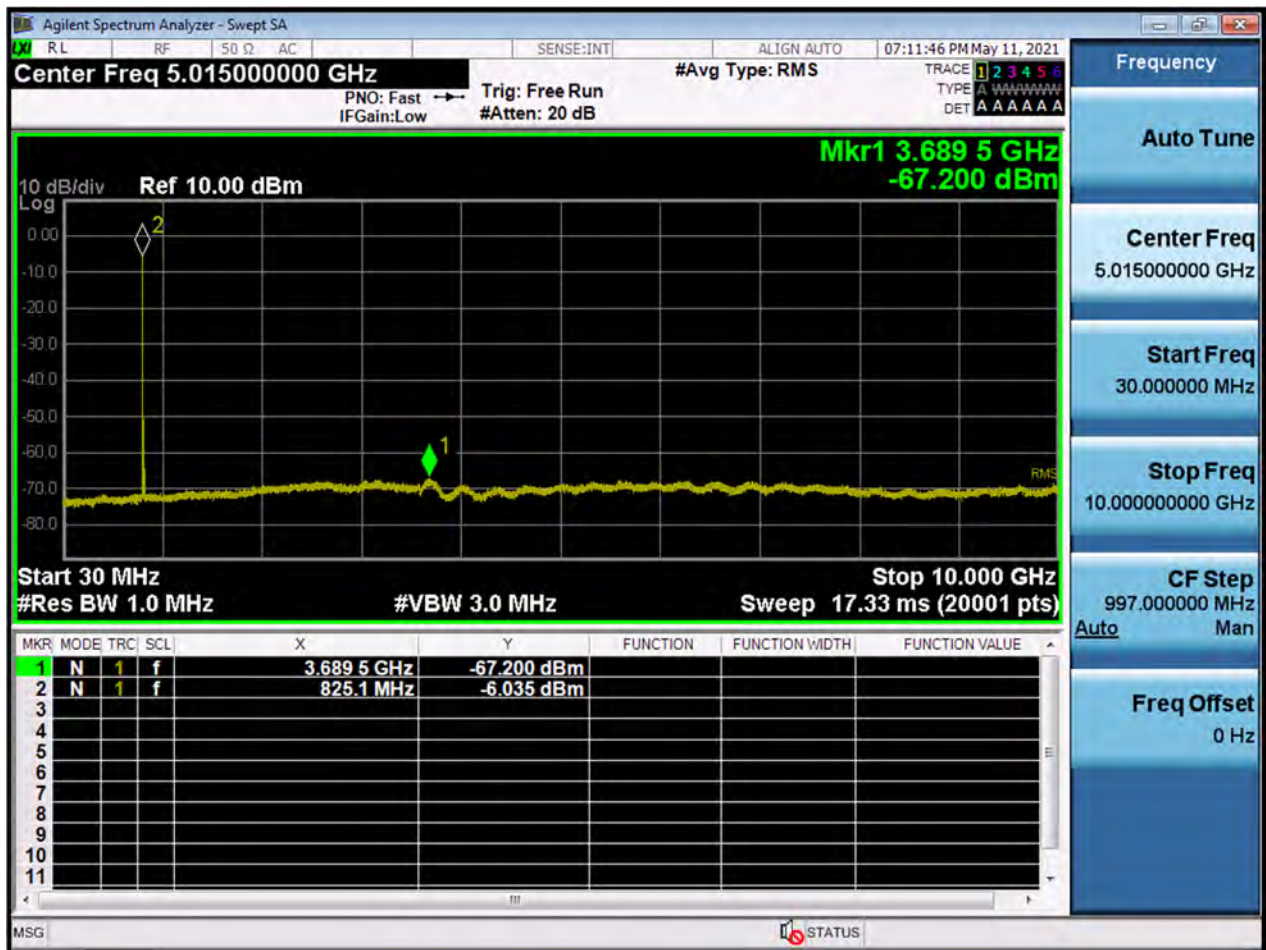
5M\_CSE(30M-10G)\_Mid Channel\_QPSK\_1RB



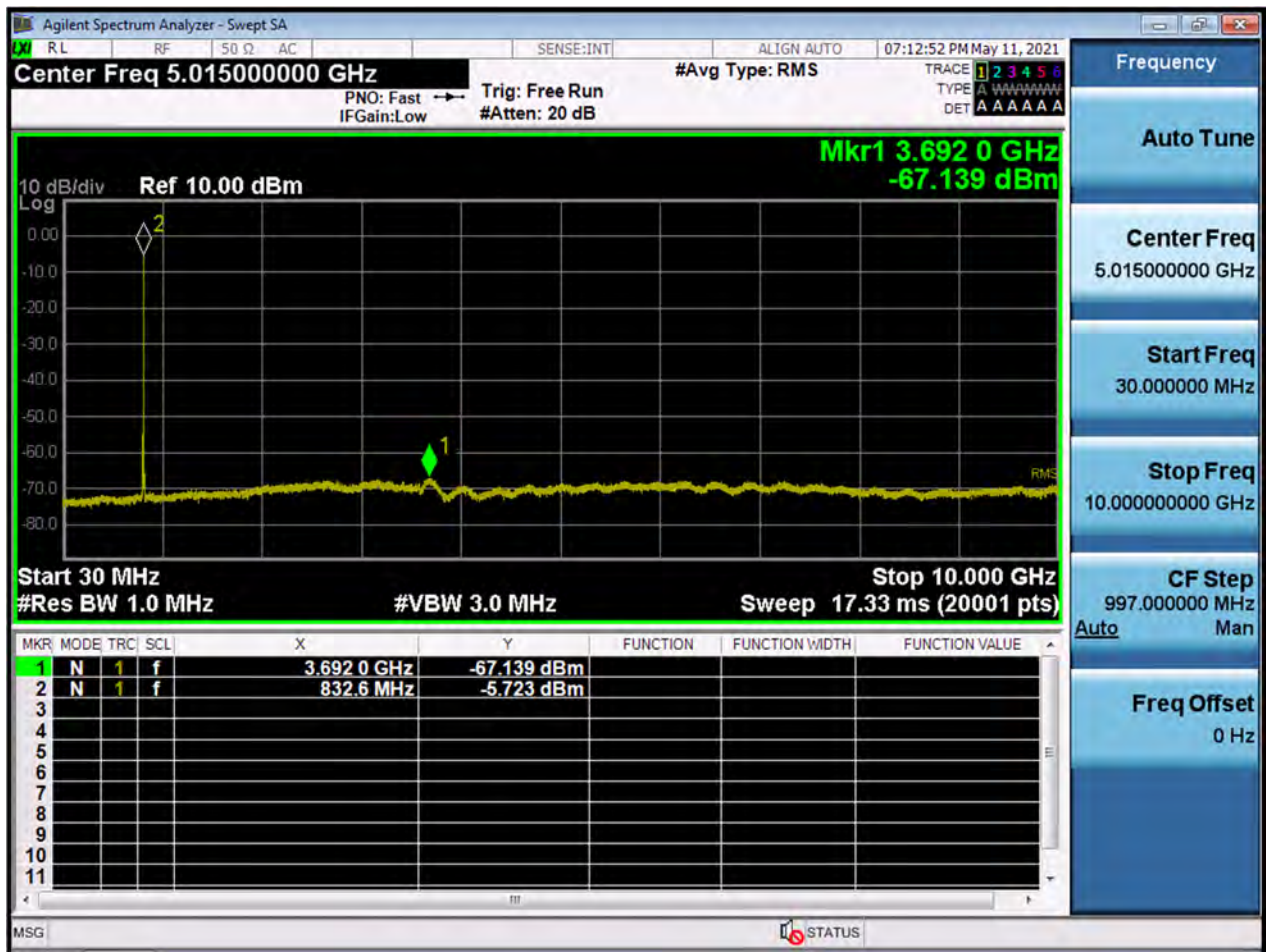
5M\_CSE(30M-10G)\_Highest Channel\_QPSK\_1RB



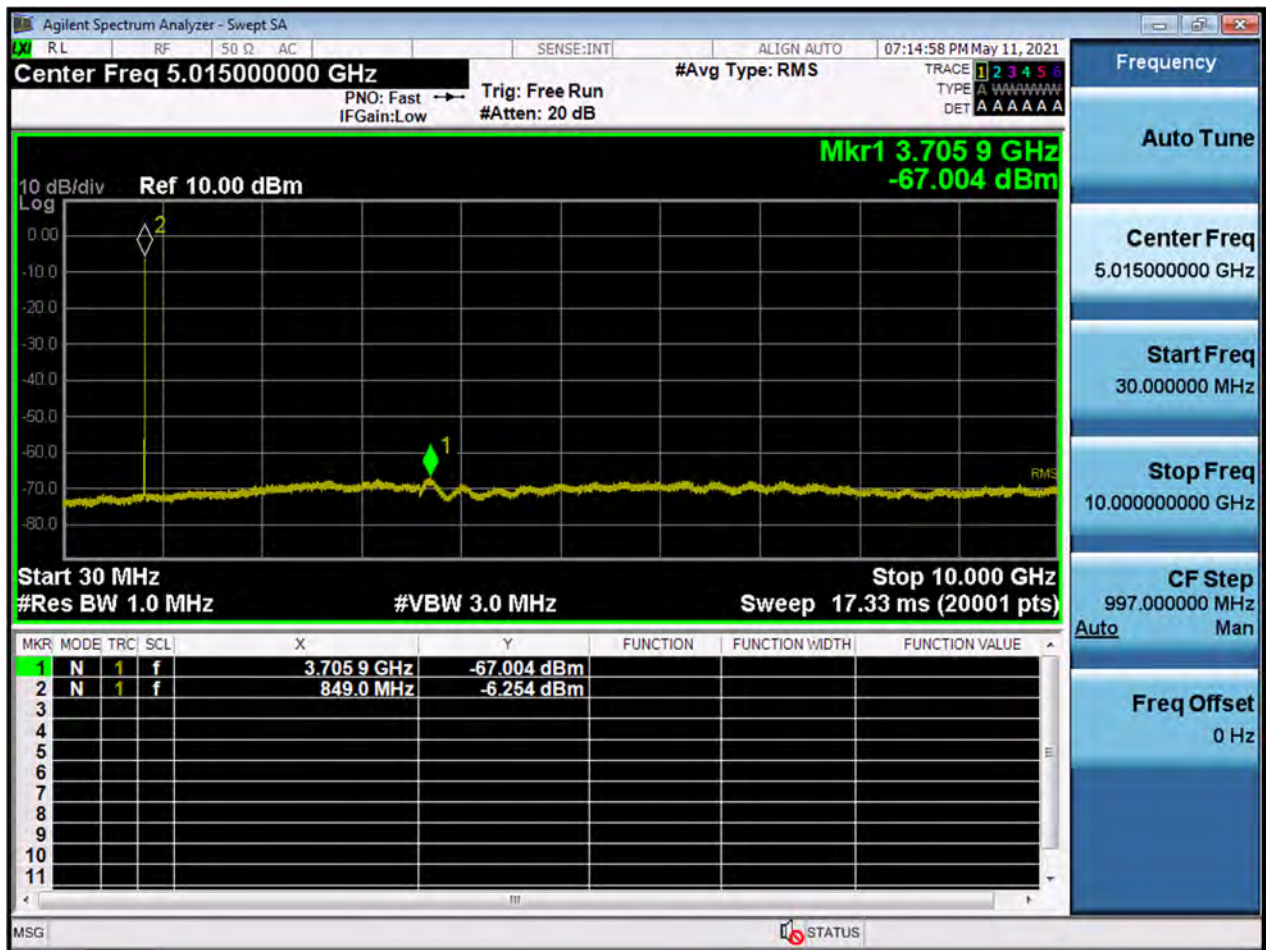
10M\_CSE(30M-10G)\_Lowest Channel\_QPSK\_1RB



10M\_CSE(30M-10G)\_Mid Channel\_QPSK\_1RB



10M\_CSE(30M-10G)\_Highest Channel\_QPSK\_1RB



## 10 ANNEX A\_ TEST SETUP PHOTO

Please refer to test setup photo file no. as follows;

| No. | Description         |
|-----|---------------------|
| 1   | HCT-RF-2107-FC029-P |