



# **CLASS 2 PERMISSIVE CHANGE** **TEST REPORT**

**Report Number. :** 12698625-E1V1

**Applicant :** QUALCOMM TECHNOLOGIES, INC.  
5770 MOREHOUSE DRIVE,  
SAN DIEGO, CA 92121, U.S.A.

**Model :** QCL-HUB-2.0-US

**FCC ID :** J9C2NET2LTE

**IC :** 2723A-2NET2LTE

**EUT Description :** WIRELESS DATA HUB

**Test Standard(s) :** FCC CFR47 PART 22 SUBPART H  
FCC CFR47 PART 24 SUBPART E  
FCC CFR47 PART 27 SUBPART F, H, L  
INDUSTRY CANADA RSS-130 ISSUE 1  
INDUSTRY CANADA RSS-132 ISSUE 3  
INDUSTRY CANADA RSS-133 ISSUE 6  
INDUSTRY CANADA RSS-139 ISSUE 3

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NVLAP Lab code: 200065-0

Revision History

| Rev. | Issue Date | Revisions      | Revised By |
|------|------------|----------------|------------|
| V1   | 3/13/2019  | Initial Review | --         |

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## 1. ATTESTATION OF TEST RESULTS

|                            |                                                                                     |
|----------------------------|-------------------------------------------------------------------------------------|
| Applicant Name and Address | QUALCOMM TECHNOLOGIES, INC.<br>5770 MOREHOUSE DRIVE,<br>SAN DIEGO, CA 92121, U.S.A. |
| Model                      | QCL-HUB-2.0-US                                                                      |
| FCC ID                     | J9C2NET2LTE                                                                         |
| IC                         | 2723A-2NET2LTE                                                                      |
| EUT Description            | WIRELESS DATA HUB                                                                   |
| Serial Number              | QUALC001T0003133 (RADIATED)<br>G1ZCH0700179J01(CONDUCTED)                           |
| Date Tested                | FEBRUARY 04, 2019 to MARCH 06, 2019                                                 |
| Applicable Standards       | FCC CFR47 PART 22H, 24E, and 27F,H,L<br>INDUSTRY CANADA RSS-130,132,133, 139        |
| Test Results               | Complies                                                                            |

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. All samples tested were in good operating condition throughout the entire test program. Measurement Uncertainties are published for informational purposes only and were not taken into account unless noted otherwise.

This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of the U.S. government.

|                                                                                                                                                     |                                                                                                      |
|-----------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|
| Approved & Released For<br>UL Verification Services Inc. By:<br> | Prepared By:<br> |
| Frank Ibrahim<br>Operations Leader<br>Consumer Technology Division<br>UL Verification Services Inc.                                                 | Eric Yu<br>Test Engineer<br>Consumer Technology Division<br>UL Verification Services Inc.            |

## 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.26:2015, FCC CFR 47 Part 2, Part 22, Part 24, Part 27, FCC KDB 971168 D01 v02r02/ D02 v01. IC RSS-130, RSS-132, RSS-133, RSS-139.

### 3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, and 47658 Kato Road, Fremont, California, USA. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

| 47173 Benicia Street                              | 47266 Benicia Street                              | 47658 Kato Rd                                                |
|---------------------------------------------------|---------------------------------------------------|--------------------------------------------------------------|
| <input type="checkbox"/> Chamber A (ISED:2324B-1) | <input type="checkbox"/> Chamber D (ISED:22541-1) | <input checked="" type="checkbox"/> Chamber I (ISED:2324A-5) |
| <input type="checkbox"/> Chamber B (ISED:2324B-2) | <input type="checkbox"/> Chamber E (ISED:22541-2) | <input type="checkbox"/> Chamber J (ISED:2324A-6)            |
| <input type="checkbox"/> Chamber C (ISED:2324B-3) | <input type="checkbox"/> Chamber F (ISED:22541-3) | <input type="checkbox"/> Chamber K (ISED:2324A-1)            |
|                                                   | <input type="checkbox"/> Chamber G (ISED:22541-4) | <input type="checkbox"/> Chamber L (ISED:2324A-3)            |
|                                                   | <input type="checkbox"/> Chamber H (ISED:22541-5) |                                                              |

The above test sites and facilities are covered under FCC Test Firm Registration # 208313. Chambers above are covered under Industry Canada company address and respective code

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0

## 4. CALIBRATION AND UNCERTAINTY

### 4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

### 4.2. SAMPLE CALCULATION

#### RADIATED EMISSIONS

Where relevant, the following sample calculation is provided:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)  
 $36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} = 28.9 \text{ dBuV/m}$

#### MAINS CONDUCTED EMISSIONS

Where relevant, the following sample calculation is provided:

Final Voltage (dBuV) = Measured Voltage (dBuV) + Cable Loss (dB) + Limiter Factor (dB) + LISN Insertion Loss.  
 $36.5 \text{ dBuV} + 0 \text{ dB} + 10.1 \text{ dB} + 0 \text{ dB} = 46.6 \text{ dBuV}$

### 4.3. MEASUREMENT UNCERTAINTY

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

| PARAMETER                                           | UNCERTAINTY |
|-----------------------------------------------------|-------------|
| Worst Case Conducted Disturbance, 9KHz to 0.15 MHz  | 3.84 dB     |
| Worst Case Conducted Disturbance, 0.15 to 30 MHz    | 3.65 dB     |
| Worst Case Radiated Disturbance, 9KHz to 30 MHz     | 3.15 dB     |
| Worst Case Radiated Disturbance, 30 to 1000 MHz     | 5.36 dB     |
| Worst Case Radiated Disturbance, 1000 to 18000 MHz  | 4.32 dB     |
| Worst Case Radiated Disturbance, 18000 to 26000 MHz | 4.45 dB     |
| Worst Case Radiated Disturbance, 26000 to 40000 MHz | 5.24 dB     |

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

## 5. EQUIPMENT UNDER TEST

### 5.1. DESCRIPTION OF EUT

This EUT is a 2net2 device (LTE North American Version AT&T) that has the following radio modules:

- Wistron WWAN module, M14Q2F.
- Qualcomm Unlicensed Module, QCA WCN3660B.

### 5.2. MAXIMUM OUTPUT POWER

#### ERP/EIRP LIMIT

FCC: §2.1046, §22.913, §24.232, §27.50

RSS130§4.4, RSS132§5.4; RSS133§6.4, RSS139§6.5

#### EIRP/ERP TEST PROCEDURE

ANSI C63.26:2015/ TIA-603-E Clause 2.2.17

KDB 971168 D01Section 5.6

KDB 412172 D01

$ERP/EIRP = P_{Meas} + GT - LC$

where: ERP/EIRP = effective or equivalent radiated power, respectively (expressed in the same units as P<sub>Meas</sub>, typically dBW or dBm);

P<sub>Meas</sub> = measured transmitter output power or PSD, in dBm or dBW;

GT = gain of the transmitting antenna, in dBd (ERP) or dBi (EIRP);

LC = signal attenuation in the connecting cable between the transmitter and antenna, in dB.

For devices utilizing multiple antennas, KDB 662911 provides guidance for determining the effective array transmit antenna gain term to be used in the above equation.

The transmitter has a maximum average conducted and ERP / EIRP output powers as follows:

**Note:** for RF output power for WCDMA mode and for LTE bands (2, 4, 5, 12) 5 MHz BW, refer to original report number 11692709-E1V2.



## LTE BAND 2

| Part 24 / RSS 133  |            |                     |                       |                         |                    |                  |              |                     |
|--------------------|------------|---------------------|-----------------------|-------------------------|--------------------|------------------|--------------|---------------------|
| EIRP Limit (W)     |            | 2.00                |                       |                         |                    |                  |              |                     |
| Antenna Gain (dBi) |            | 2.50                |                       |                         |                    |                  |              |                     |
| Bandwidth (MHz)    | Modulation | Low Frequency (MHz) | Upper Frequency (MHz) | Conducted Average (dBm) | EIRP Average (dBm) | EIRP Average (W) | 99% BW (kHz) | Emission Designator |
| 1.4                | QPSK       | 1850.7              | 1909.3                | 23.8                    | 26.30              | 0.427            | 1100         | 1M10G7W             |
|                    | 16QAM      |                     |                       | 22.7                    | 25.20              | 0.331            | 1080         | 1M08D7W             |
| 3.0                | QPSK       | 1851.5              | 1908.5                | 23.7                    | 26.20              | 0.417            | 2690         | 2M69G7W             |
|                    | 16QAM      |                     |                       | 22.6                    | 25.10              | 0.324            | 2690         | 2M69D7W             |
| 10.0               | QPSK       | 1855.0              | 1905.0                | 23.7                    | 26.20              | 0.417            | 8930         | 8M93G7W             |
|                    | 16QAM      |                     |                       | 22.9                    | 25.40              | 0.347            | 8930         | 8M93D7W             |
| 15.0               | QPSK       | 1857.5              | 1902.5                | 24.0                    | 26.50              | 0.447            | 13370        | 13M4G7W             |
|                    | 16QAM      |                     |                       | 23.2                    | 25.70              | 0.372            | 13410        | 13M4D7W             |
| 20.0               | QPSK       | 1860.0              | 1900.0                | 24.0                    | 26.50              | 0.447            | 17850        | 17M9G7W             |
|                    | 16QAM      |                     |                       | 23.1                    | 25.60              | 0.363            | 17850        | 17M9D7W             |

## LTE BAND 4

| Part 27 / RSS 139  |            |                     |                       |                         |                    |                  |              |                     |
|--------------------|------------|---------------------|-----------------------|-------------------------|--------------------|------------------|--------------|---------------------|
| EIRP Limit (W)     |            | 1.00                |                       |                         |                    |                  |              |                     |
| Antenna Gain (dBi) |            | 0.50                |                       |                         |                    |                  |              |                     |
| Bandwidth (MHz)    | Modulation | Low Frequency (MHz) | Upper Frequency (MHz) | Conducted Average (dBm) | EIRP Average (dBm) | EIRP Average (W) | 99% BW (kHz) | Emission Designator |
| 1.4                | QPSK       | 1710.7              | 1754.3                | 23.8                    | 24.30              | 0.269            | 1090         | 1M09G7W             |
|                    | 16QAM      |                     |                       | 23.1                    | 23.60              | 0.229            | 1090         | 1M09D7W             |
| 3.0                | QPSK       | 1711.5              | 1753.5                | 23.7                    | 24.20              | 0.263            | 2690         | 2M69G7W             |
|                    | 16QAM      |                     |                       | 22.8                    | 23.30              | 0.214            | 2690         | 2M69D7W             |
| 10.0               | QPSK       | 1715.0              | 1750.0                | 23.9                    | 24.40              | 0.275            | 8940         | 8M94G7W             |
|                    | 16QAM      |                     |                       | 22.4                    | 22.90              | 0.195            | 8930         | 8M93D7W             |
| 15.0               | QPSK       | 1717.5              | 1747.5                | 24.0                    | 24.50              | 0.282            | 13400        | 13M4G7W             |
|                    | 16QAM      |                     |                       | 23.1                    | 23.60              | 0.229            | 13410        | 13M4D7W             |
| 20.0               | QPSK       | 1720.0              | 1745.0                | 24.0                    | 24.50              | 0.282            | 17880        | 17M9G7W             |
|                    | 16QAM      |                     |                       | 22.9                    | 23.40              | 0.219            | 17870        | 17M9D7W             |

### **LTE BAND 5 (FCC)**

| Part 22H           |            |                     |                       |                         |                   |                 |              |                     |
|--------------------|------------|---------------------|-----------------------|-------------------------|-------------------|-----------------|--------------|---------------------|
| ERP Limit (W)      |            | 7.00                |                       |                         |                   |                 |              |                     |
| Antenna Gain (dBi) |            | -0.90               |                       |                         |                   |                 |              |                     |
| Bandwidth (MHz)    | Modulation | Low Frequency (MHz) | Upper Frequency (MHz) | Conducted Average (dBm) | ERP Average (dBm) | ERP Average (W) | 99% BW (kHz) | Emission Designator |
| 1.4                | QPSK       | 824.7               | 848.3                 | 23.7                    | 20.65             | 0.116           | 1090         | 1M09G7W             |
|                    | 16QAM      |                     |                       | 22.4                    | 19.35             | 0.086           | 1090         | 1M09D7W             |
| 3.0                | QPSK       | 825.5               | 847.5                 | 23.5                    | 20.45             | 0.111           | 2690         | 2M69G7W             |
|                    | 16QAM      |                     |                       | 22.2                    | 19.15             | 0.082           | 2670         | 2M67D7W             |
| 10.0               | QPSK       | 829.0               | 844.0                 | 23.7                    | 20.65             | 0.116           | 8970         | 8M97G7W             |
|                    | 16QAM      |                     |                       | 22.6                    | 19.55             | 0.090           | 8940         | 8M94D7W             |

### **LTE BAND 5 (IC)**

| RSS 132            |            |                     |                       |                         |                    |                  |              |                     |
|--------------------|------------|---------------------|-----------------------|-------------------------|--------------------|------------------|--------------|---------------------|
| EIRP Limit (W)     |            | 11.50               |                       |                         |                    |                  |              |                     |
| Antenna Gain (dBi) |            | -0.90               |                       |                         |                    |                  |              |                     |
| Bandwidth (MHz)    | Modulation | Low Frequency (MHz) | Upper Frequency (MHz) | Conducted Average (dBm) | EIRP Average (dBm) | EIRP Average (W) | 99% BW (kHz) | Emission Designator |
| 1.4                | QPSK       | 824.7               | 848.3                 | 23.7                    | 22.80              | 0.191            | 1090         | 1M09G7W             |
|                    | 16QAM      |                     |                       | 22.4                    | 21.50              | 0.141            | 1090         | 1M09D7W             |
| 3.0                | QPSK       | 825.5               | 847.5                 | 23.5                    | 22.60              | 0.182            | 2690         | 2M69G7W             |
|                    | 16QAM      |                     |                       | 22.2                    | 21.30              | 0.135            | 2670         | 2M67D7W             |
| 10.0               | QPSK       | 829.0               | 844.0                 | 23.7                    | 22.80              | 0.191            | 8970         | 8M97G7W             |
|                    | 16QAM      |                     |                       | 22.6                    | 21.70              | 0.148            | 8940         | 8M94D7W             |

### LTE BAND 12 (FCC)

| Part 27            |            |                     |                       |                         |                   |                 |              |                     |
|--------------------|------------|---------------------|-----------------------|-------------------------|-------------------|-----------------|--------------|---------------------|
| ERP Limit (W)      |            | 3.00                |                       |                         |                   |                 |              |                     |
| Antenna Gain (dBi) |            | -2.80               |                       |                         |                   |                 |              |                     |
| Bandwidth (MHz)    | Modulation | Low Frequency (MHz) | Upper Frequency (MHz) | Conducted Average (dBm) | ERP Average (dBm) | ERP Average (W) | 99% BW (kHz) | Emission Designator |
| 1.4                | QPSK       | 699.7               | 715.3                 | 23.9                    | 18.95             | 0.079           | 1090         | 1M09G7W             |
|                    | 16QAM      |                     |                       | 23.3                    | 18.35             | 0.068           | 1080         | 1M08D7W             |
| 3.0                | QPSK       | 700.5               | 714.5                 | 23.8                    | 18.85             | 0.077           | 2690         | 2M69G7W             |
|                    | 16QAM      |                     |                       | 22.9                    | 17.95             | 0.062           | 2690         | 2M69D7W             |
| 10.0               | QPSK       | 704.0               | 711.0                 | 23.7                    | 18.75             | 0.075           | 8950         | 8M95G7W             |
|                    | 16QAM      |                     |                       | 22.8                    | 17.85             | 0.061           | 8940         | 8M94D7W             |

### LTE BAND 12 (IC)

| RSS 130            |            |                     |                       |                         |                    |                  |              |                     |
|--------------------|------------|---------------------|-----------------------|-------------------------|--------------------|------------------|--------------|---------------------|
| EIRP Limit (W)     |            | 5.00                |                       |                         |                    |                  |              |                     |
| Antenna Gain (dBi) |            | -2.80               |                       |                         |                    |                  |              |                     |
| Bandwidth (MHz)    | Modulation | Low Frequency (MHz) | Upper Frequency (MHz) | Conducted Average (dBm) | EIRP Average (dBm) | EIRP Average (W) | 99% BW (kHz) | Emission Designator |
| 1.4                | QPSK       | 699.7               | 715.3                 | 23.9                    | 21.10              | 0.129            | 1090         | 1M09G7W             |
|                    | 16QAM      |                     |                       | 23.3                    | 20.50              | 0.112            | 1080         | 1M08D7W             |
| 3.0                | QPSK       | 700.5               | 714.5                 | 23.8                    | 21.00              | 0.126            | 2690         | 2M69G7W             |
|                    | 16QAM      |                     |                       | 22.9                    | 20.10              | 0.102            | 2690         | 2M69D7W             |
| 10.0               | QPSK       | 704.0               | 711.0                 | 23.7                    | 20.90              | 0.123            | 8950         | 8M95G7W             |
|                    | 16QAM      |                     |                       | 22.8                    | 20.00              | 0.100            | 8940         | 8M94D7W             |

### 5.3. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was version MSM8909.LA.1.3-00073.1\_27\_43.

### 5.4. MAXIMUM ANTENNA GAIN

Please see table below:

| LTE Bands                   | Antenna Gain (dBi) |
|-----------------------------|--------------------|
| LTE BAND 2, 1850 - 1910 MHz | 2.5                |
| LTE BAND 4, 1710 - 1755 MHz | 0.5                |
| LTE BAND 5, 824 - 849 MHz   | -0.9               |
| LTE BAND 12, 699 - 716 MHz  | -2.8               |

### 5.5. WORST-CASE CONFIGURATION AND MODE

The EUT supports:

LTE Bands: Band 2, Band 4, Band 5, Band 12.

The worst-case scenario for all measurements is based on the average conducted output power measurement investigation results.

The EUT was investigated in three orthogonal orientations X/Y/Z, it was determined that X (Flatbed) orientation was worst-case orientation for cell bands; X (Flatbed) orientation was worst-case orientation for PCS/AWS bands.

## 5.6. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

| Support Equipment List |              |       |               |
|------------------------|--------------|-------|---------------|
| Description            | Manufacturer | Model | Serial Number |
| N/A                    | N/A          | N/A   | N/A           |

### I/O CABLES (RF Conducted Test)

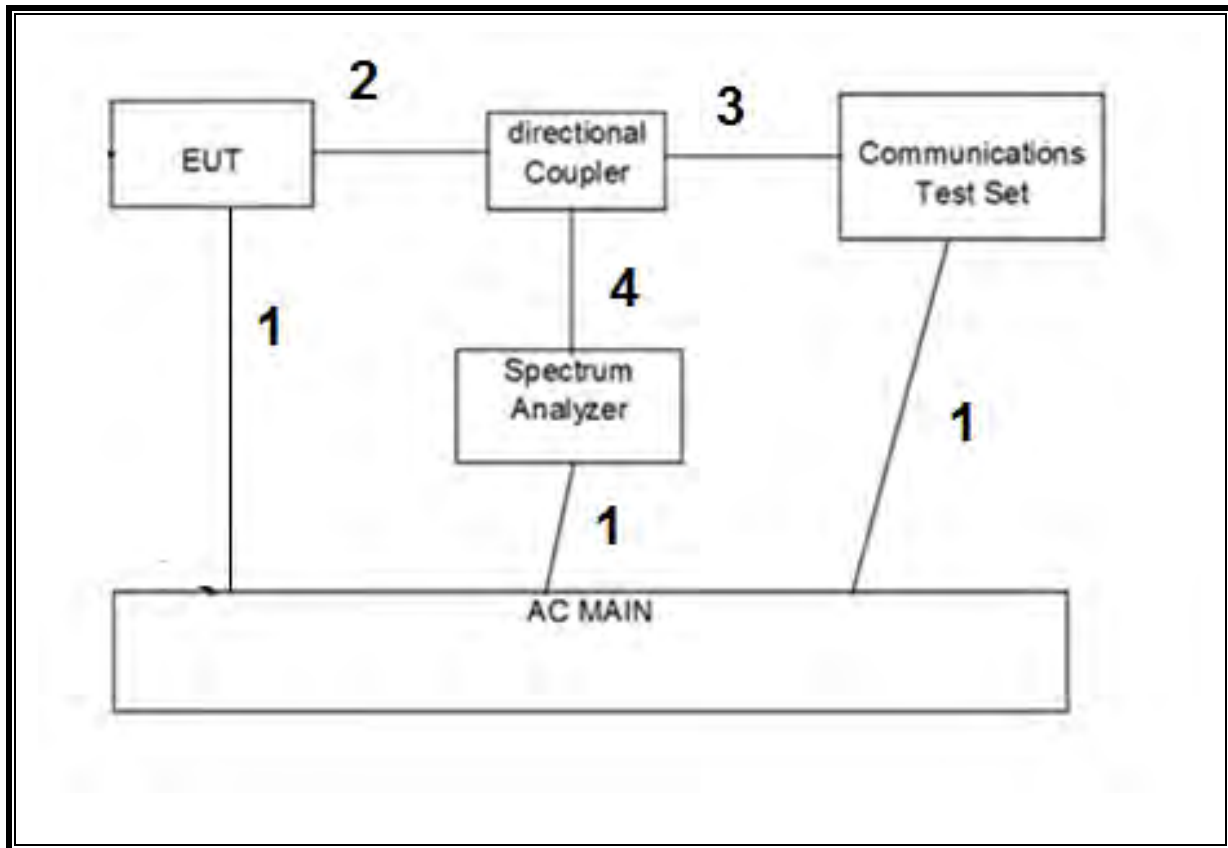
| I/O Cable List |           |                      |                        |             |                  |         |
|----------------|-----------|----------------------|------------------------|-------------|------------------|---------|
| Cable No       | Port      | # of identical ports | Connector Type         | Cable Type  | Cable Length (m) | Remarks |
| 1              | AC        | 1                    | US 115V                | Un-shielded | 2.0m             | N/A     |
| 2              | RF In/Out | 1                    | EUT                    | Un-shielded | 0.6m             | N/A     |
| 3              | RF In/Out | 1                    | Communication Test Set | Un-shielded | 1.2m             | N/A     |
| 4              | RF In/Out | 1                    | Barrel                 | N/A         | N/A              | N/A     |

### I/O CABLES (RF Radiated Test)

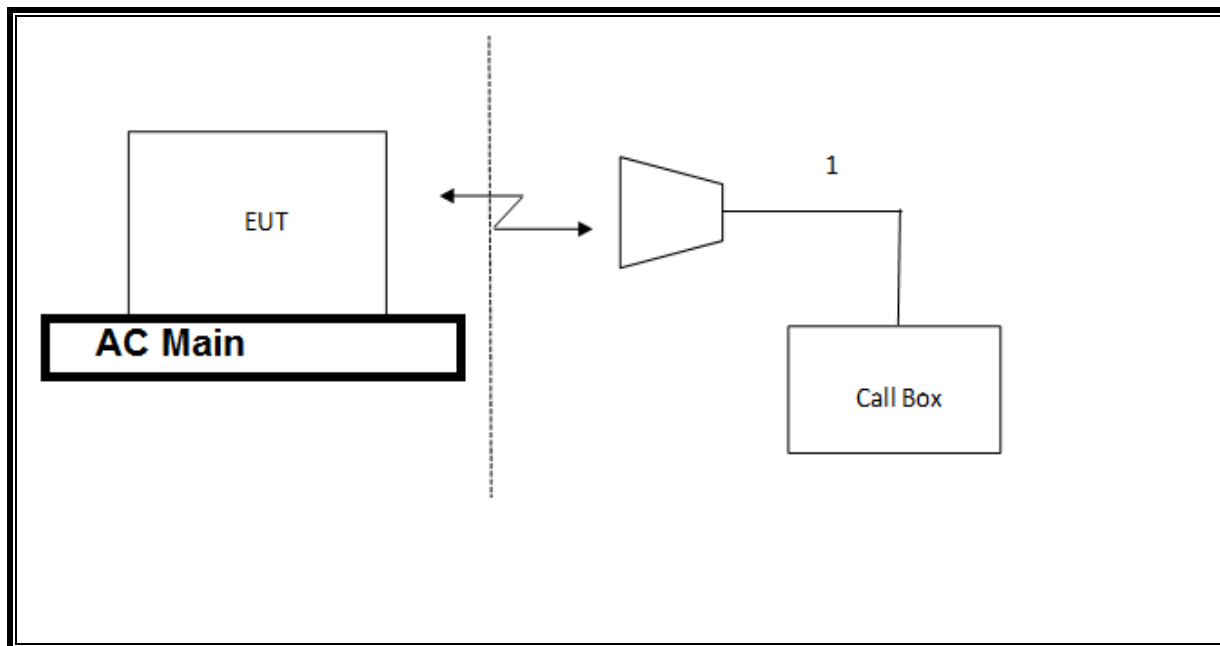
| I/O Cable List |           |                      |                |             |                  |         |
|----------------|-----------|----------------------|----------------|-------------|------------------|---------|
| Cable No       | Port      | # of identical ports | Connector Type | Cable Type  | Cable Length (m) | Remarks |
| 1              | RF In/Out | 1                    | Antenna        | Un-shielded | 5.0m             | N/A     |

**SETUP DIAGRAM**

**CONDUCTED SETUP**



**RADIATED SETUP**



## 6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment were utilized for the tests documented in this report:

| Test Equipment List                       |                                 |                        |            |            |            |
|-------------------------------------------|---------------------------------|------------------------|------------|------------|------------|
| Description                               | Manufacturer                    | Model                  | ID Number  | Cal Date   | Cal Due    |
| Antenna, Horn 1-18GHz                     | ETS Lindgren                    | 3117                   | T862       | 05/24/2018 | 05/24/2019 |
| Amplifier, 1 to 18GHz                     | MITEQ                           | AFS42-00101800-25-S-42 | PRE1782151 | 08/01/2018 | 08/01/2019 |
| Wideband Communication Test Set, Call Box | R&S                             | CMW500                 | T948       | 02/17/2018 | 02/17/2019 |
| High pass Filter, 2.7 GHz                 | Micro-Circuits                  | H2G518G6               | T772       | 07/05/2018 | 07/05/2019 |
| High pass Filter, 1.2 GHz                 | Micro-Tronics                   | HPM50108               | T1737      | 04/17/2018 | 04/17/2019 |
| High pass Filter, 1.5 GHz                 | Micro-Tronics                   | HPM50114               | T1852      | 07/16/2018 | 07/16/2019 |
| Wideband Communication Test Set, Call Box | R&S                             | CMW500                 | T1871      | 02/18/2018 | 02/18/2019 |
| Directional Coupler                       | Krytar                          | 152610                 | T922       | 06/18/2018 | 06/18/2019 |
| Spectrum Analyzer, PXA, 3Hz to 44GHz      | Agilent (Keysight) Technologies | N9030A                 | T917       | 10/05/2018 | 10/05/2019 |
| Spectrum Analyzer, PXA, 3Hz to 44GHz      | Agilent (Keysight) Technologies | N9030A                 | T1466      | 04/16/2018 | 04/16/2019 |
| Power Meter                               | Keysight                        | N1911A                 | T1268      | 06/25/2018 | 06/25/2019 |
| Power Sensor                              | Keysight                        | N1921A                 | T1228      | 07/10/2018 | 07/10/2019 |
| Chamber, Environmental                    | Thermotron                      | SE-600-10-10           | T80        | 02/22/2018 | 02/22/2019 |

### UL AUTOMATION SOFTWARE

|                            |    |       |                            |
|----------------------------|----|-------|----------------------------|
| CLT Software               | UL | UL RF | Ver 7.6, November 11, 2017 |
| Power Measurement Software | UL | UL RF | Ver 2.2, June 2017         |

### NOTES:

- Equipment listed above that calibrated during the testing period was set for test after the calibration.
- Equipment listed above that has a calibration due date during the testing period, the testing is completed before equipment expiration date.



## 7. RF OUTPUT POWER VERIFICATION

### CONDUCTED OUTPUT POWER MEASUREMENT PROCEDURE

All LTE bands conducted average power is obtained from the CMW500 telecommunication test set.

The following tests were conducted according to the test requirements outlined in section 6.2 of the 3GPP TS36.101 specification.

UE Power Class: 3 (23 +/- 2dBm). The allowed Maximum Power Reduction (MPR) for the maximum output power due to higher order modulation and transmit bandwidth configuration (resource blocks) is specified in Table 6.2.3-1 of the 3GPP TS36.101.

**Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 1, 2 and 3**

| Modulation | Channel bandwidth / Transmission bandwidth ( $N_{RB}$ ) |         |       |        |        |        | MPR (dB) |
|------------|---------------------------------------------------------|---------|-------|--------|--------|--------|----------|
|            | 1.4 MHz                                                 | 3.0 MHz | 5 MHz | 10 MHz | 15 MHz | 20 MHz |          |
| QPSK       | > 5                                                     | > 4     | > 8   | > 12   | > 16   | > 18   | ≤ 1      |
| 16 QAM     | ≤ 5                                                     | ≤ 4     | ≤ 8   | ≤ 12   | ≤ 16   | ≤ 18   | ≤ 1      |
| 64 QAM     | > 5                                                     | > 4     | > 8   | > 12   | > 16   | > 18   | ≤ 2      |
| 64 QAM     | ≤ 5                                                     | ≤ 4     | ≤ 8   | ≤ 12   | ≤ 16   | ≤ 18   | ≤ 2      |
| 64 QAM     | > 5                                                     | > 4     | > 8   | > 12   | > 16   | > 18   | ≤ 3      |

The allowed A-MPR values specified below in Table 6.2.4.-1 of 3GPP TS36.101 are in addition to the allowed MPR requirements. All the measurements below were performed with A-MPR disabled, by using Network Signaling Value of "NS\_01".<sup>3</sup>

**Table 6.2.4-1: Additional Maximum Power Reduction (A-MPR)**

| Network Signalling value | Requirements (sub-clause) | E-UTRA Band              | Channel bandwidth (MHz) | Resources Blocks ( $N_{RB}$ ) | A-MPR (dB)    |
|--------------------------|---------------------------|--------------------------|-------------------------|-------------------------------|---------------|
| NS_01                    | 6.6.2.1.1                 | Table 5.5-1              | 1.4, 3, 5, 10, 15, 20   | Table 5.6-1                   | NA            |
| NS_03                    | 6.6.2.2.1                 | 2, 4, 10, 23, 25, 35, 36 | 3                       | >5                            | ≤ 1           |
|                          |                           |                          | 5                       | >6                            | ≤ 1           |
|                          |                           |                          | 10                      | >6                            | ≤ 1           |
|                          |                           |                          | 15                      | >8                            | ≤ 1           |
|                          |                           |                          | 20                      | >10                           | ≤ 1           |
| NS_04                    | 6.6.2.2.2                 | 41                       | 5                       | >6                            | ≤ 1           |
|                          |                           |                          | 10, 15, 20              | See Table 6.2.4-4             |               |
| NS_05                    | 6.6.3.3.1                 | 1                        | 10, 15, 20              | ≥ 50                          | ≤ 1           |
| NS_06                    | 6.6.2.2.3                 | 12, 13, 14, 17           | 1.4, 3, 5, 10           | Table 5.6-1                   | n/a           |
| NS_07                    | 6.6.2.2.3<br>6.6.3.3.2    | 13                       | 10                      | Table 6.2.4-2                 | Table 6.2.4-2 |
| NS_08                    | 6.6.3.3.3                 | 19                       | 10, 15                  | > 44                          | ≤ 3           |
| NS_09                    | 6.6.3.3.4                 | 21                       | 10, 15                  | > 40                          | ≤ 1           |
|                          |                           |                          |                         | > 55                          | ≤ 2           |
| NS_10                    |                           | 20                       | 15, 20                  | Table 6.2.4-3                 | Table 6.2.4-3 |
| NS_11                    | 6.6.2.2.1                 | 23 <sup>1</sup>          | 1.4, 3, 5, 10           | Table 6.2.4-5                 | Table 6.2.4-5 |
| ...                      |                           |                          |                         |                               |               |
| NS_32                    | -                         | -                        | -                       | -                             | -             |

Note 1: Applies to the lower block of Band 23, i.e. a carrier placed in the 2000-2010 MHz region.

Modes Tested:

- LTE 2
- LTE 4
- LTE 5
- LTE 12

RESULTS

## 7.1. LTE 2

|            |       |              |        |
|------------|-------|--------------|--------|
| <b>ID:</b> | 39004 | <b>Date:</b> | 2/4/19 |
|------------|-------|--------------|--------|

### OUTPUT POWER FOR LTE BAND 2 (1.4 MHz)

| Bandwidth (MHz) | Modulation | RB Allocation | RB Offset | Power                   |            |            |
|-----------------|------------|---------------|-----------|-------------------------|------------|------------|
|                 |            |               |           | Conducted Average (dBm) |            |            |
|                 |            |               |           | 18607                   | 18900      | 19193      |
|                 |            |               |           | 1850.7 MHz              | 1880.0 MHz | 1909.3 MHz |
| 1.4             | QPSK       | 1             | 0         | 23.2                    | 23.5       | 23.4       |
|                 |            | 1             | 2         | 23.1                    | 23.8       | 23.4       |
|                 |            | 1             | 5         | 23.1                    | 23.5       | 23.4       |
|                 |            | 3             | 0         | 23.0                    | 23.7       | 23.3       |
|                 |            | 3             | 1         | 23.1                    | 23.6       | 23.4       |
|                 |            | 3             | 2         | 23.1                    | 23.7       | 23.5       |
|                 |            | 6             | 0         | 22.1                    | 22.6       | 22.6       |
|                 | 16QAM      | 1             | 0         | 22.1                    | 22.3       | 22.3       |
|                 |            | 1             | 2         | 22.0                    | 22.0       | 22.5       |
|                 |            | 1             | 5         | 22.0                    | 22.0       | 22.4       |
|                 |            | 3             | 0         | 21.7                    | 22.4       | 22.7       |
|                 |            | 3             | 1         | 21.8                    | 22.4       | 22.6       |
|                 |            | 3             | 2         | 22.0                    | 22.5       | 22.6       |
|                 |            | 6             | 0         | 21.0                    | 21.4       | 21.6       |

### OUTPUT POWER FOR LTE BAND 2 (3.0 MHz)

| Bandwidth (MHz) | Modulation | RB Allocation | RB Offset | Power                   |            |            |
|-----------------|------------|---------------|-----------|-------------------------|------------|------------|
|                 |            |               |           | Conducted Average (dBm) |            |            |
|                 |            |               |           | 18615                   | 18900      | 19185      |
|                 |            |               |           | 1851.5 MHz              | 1880.0 MHz | 1908.5 MHz |
| 3.0             | QPSK       | 1             | 0         | 23.1                    | 23.6       | 23.4       |
|                 |            | 1             | 7         | 23.0                    | 23.7       | 23.5       |
|                 |            | 1             | 14        | 23.2                    | 23.6       | 23.5       |
|                 |            | 8             | 0         | 22.2                    | 22.6       | 22.6       |
|                 |            | 8             | 4         | 22.1                    | 22.6       | 22.5       |
|                 |            | 8             | 7         | 22.1                    | 22.6       | 22.4       |
|                 |            | 15            | 0         | 22.1                    | 22.6       | 22.5       |
|                 | 16QAM      | 1             | 0         | 21.9                    | 22.4       | 22.2       |
|                 |            | 1             | 7         | 22.1                    | 22.5       | 22.6       |
|                 |            | 1             | 14        | 21.8                    | 22.6       | 22.3       |
|                 |            | 8             | 0         | 20.9                    | 21.6       | 21.5       |
|                 |            | 8             | 4         | 20.9                    | 21.6       | 21.6       |
|                 |            | 8             | 7         | 20.9                    | 21.6       | 21.6       |
|                 |            | 15            | 0         | 20.9                    | 21.6       | 21.5       |

### OUTPUT POWER FOR LTE BAND 2 (10.0 MHz)

| Bandwidth (MHz) | Modulation | RB Allocation | RB Offset | Power                   |            |            |
|-----------------|------------|---------------|-----------|-------------------------|------------|------------|
|                 |            |               |           | Conducted Average (dBm) |            |            |
|                 |            |               |           | 18650                   | 18900      | 19150      |
|                 |            |               |           | 1855.0 MHz              | 1880.0 MHz | 1905.0 MHz |
| 10.0            | QPSK       | 1             | 0         | 23.3                    | 23.5       | 23.6       |
|                 |            | 1             | 24        | 23.6                    | 23.7       | 23.7       |
|                 |            | 1             | 49        | 23.2                    | 23.3       | 23.4       |
|                 |            | 25            | 0         | 22.2                    | 22.7       | 22.5       |
|                 |            | 25            | 12        | 22.2                    | 22.7       | 22.5       |
|                 |            | 25            | 24        | 22.2                    | 22.6       | 22.4       |
|                 |            | 50            | 0         | 22.2                    | 22.6       | 22.4       |
|                 | 16QAM      | 1             | 0         | 22.0                    | 22.4       | 22.4       |
|                 |            | 1             | 24        | 22.2                    | 22.9       | 22.2       |
|                 |            | 1             | 49        | 22.0                    | 22.3       | 22.4       |
|                 |            | 25            | 0         | 21.2                    | 21.7       | 21.4       |
|                 |            | 25            | 12        | 21.3                    | 21.8       | 21.5       |
|                 |            | 25            | 24        | 21.1                    | 21.5       | 21.5       |
|                 |            | 50            | 0         | 21.1                    | 21.5       | 21.3       |

### OUTPUT POWER FOR LTE BAND 2 (15.0 MHz)

| Bandwidth (MHz) | Modulation | RB Allocation | RB Offset | Power                   |            |            |
|-----------------|------------|---------------|-----------|-------------------------|------------|------------|
|                 |            |               |           | Conducted Average (dBm) |            |            |
|                 |            |               |           | 18675                   | 18900      | 19125      |
|                 |            |               |           | 1857.5 MHz              | 1880.0 MHz | 1902.5 MHz |
| 15.0            | QPSK       | 1             | 0         | 23.1                    | 23.5       | 23.4       |
|                 |            | 1             | 37        | 23.1                    | 24.0       | 23.5       |
|                 |            | 1             | 74        | 23.1                    | 23.8       | 23.3       |
|                 |            | 36            | 0         | 22.6                    | 22.7       | 22.8       |
|                 |            | 36            | 16        | 22.1                    | 22.6       | 22.4       |
|                 |            | 36            | 35        | 22.1                    | 22.5       | 22.3       |
|                 |            | 75            | 0         | 22.1                    | 22.6       | 22.4       |
|                 | 16QAM      | 1             | 0         | 22.2                    | 22.5       | 22.4       |
|                 |            | 1             | 37        | 22.4                    | 23.2       | 22.5       |
|                 |            | 1             | 74        | 21.8                    | 23.0       | 21.6       |
|                 |            | 36            | 0         | 21.9                    | 21.9       | 22.0       |
|                 |            | 36            | 16        | 21.6                    | 21.6       | 21.6       |
|                 |            | 36            | 35        | 21.5                    | 21.6       | 21.4       |
|                 |            | 75            | 0         | 21.8                    | 21.7       | 22.1       |

### OUTPUT POWER FOR LTE BAND 2 (20.0 MHz)

| Bandwidth (MHz) | Modulation | RB Allocation | RB Offset | Power                   |            |            |
|-----------------|------------|---------------|-----------|-------------------------|------------|------------|
|                 |            |               |           | Conducted Average (dBm) |            |            |
|                 |            |               |           | 18700                   | 18900      | 19100      |
|                 |            |               |           | 1860.0 MHz              | 1880.0 MHz | 1900.0 MHz |
| 20.0            | QPSK       | 1             | 0         | 23.0                    | 23.5       | 23.1       |
|                 |            | 1             | 49        | 23.5                    | 24.0       | 23.2       |
|                 |            | 1             | 99        | 23.2                    | 23.4       | 22.9       |
|                 |            | 50            | 0         | 22.5                    | 22.7       | 22.6       |
|                 |            | 50            | 24        | 22.5                    | 22.7       | 22.4       |
|                 |            | 50            | 49        | 22.3                    | 22.6       | 22.3       |
|                 |            | 100           | 0         | 22.3                    | 22.5       | 22.4       |
|                 | 16QAM      | 1             | 0         | 22.2                    | 22.4       | 22.2       |
|                 |            | 1             | 49        | 22.6                    | 23.1       | 22.1       |
|                 |            | 1             | 99        | 22.3                    | 22.4       | 21.1       |
|                 |            | 50            | 0         | 21.6                    | 21.8       | 21.7       |
|                 |            | 50            | 24        | 21.7                    | 21.7       | 21.4       |
|                 |            | 50            | 49        | 21.4                    | 21.5       | 21.5       |
|                 |            | 100           | 0         | 21.4                    | 21.4       | 21.4       |

## 7.2. LTE 4

|            |       |              |        |
|------------|-------|--------------|--------|
| <b>ID:</b> | 39004 | <b>Date:</b> | 2/4/19 |
|------------|-------|--------------|--------|

### OUTPUT POWER FOR LTE BAND 4 (1.4 MHz)

| Bandwidth<br>(MHz) | Modulation | RB<br>Allocation | RB Offset | Power                   |            |            |
|--------------------|------------|------------------|-----------|-------------------------|------------|------------|
|                    |            |                  |           | Conducted Average (dBm) |            |            |
|                    |            |                  |           | 19957                   | 20175      | 20393      |
|                    |            |                  |           | 1710.7 MHz              | 1732.5 MHz | 1754.3 MHz |
| 1.4                | QPSK       | 1                | 0         | 23.3                    | 23.6       | 23.3       |
|                    |            | 1                | 2         | 23.6                    | 23.5       | 23.5       |
|                    |            | 1                | 5         | 23.4                    | 23.6       | 23.5       |
|                    |            | 3                | 0         | 23.4                    | 23.6       | 23.5       |
|                    |            | 3                | 1         | 23.4                    | 23.8       | 23.7       |
|                    |            | 3                | 2         | 23.4                    | 23.6       | 23.7       |
|                    |            | 6                | 0         | 22.6                    | 22.7       | 22.5       |
|                    | 16QAM      | 1                | 0         | 22.2                    | 23.0       | 22.0       |
|                    |            | 1                | 2         | 22.5                    | 23.1       | 22.0       |
|                    |            | 1                | 5         | 22.3                    | 23.0       | 22.4       |
|                    |            | 3                | 0         | 22.6                    | 22.9       | 22.1       |
|                    |            | 3                | 1         | 22.6                    | 22.9       | 22.4       |
|                    |            | 3                | 2         | 22.6                    | 22.9       | 22.4       |
|                    |            | 6                | 0         | 21.4                    | 22.0       | 21.3       |

### OUTPUT POWER FOR LTE BAND 4 (3.0 MHz)

| Bandwidth<br>(MHz) | Modulation | RB<br>Allocation | RB Offset | Power                   |            |            |
|--------------------|------------|------------------|-----------|-------------------------|------------|------------|
|                    |            |                  |           | Conducted Average (dBm) |            |            |
|                    |            |                  |           | 19965                   | 20175      | 20385      |
|                    |            |                  |           | 1711.5 MHz              | 1732.5 MHz | 1753.5 MHz |
| 3.0                | QPSK       | 1                | 0         | 23.4                    | 23.6       | 23.5       |
|                    |            | 1                | 7         | 23.6                    | 23.6       | 23.6       |
|                    |            | 1                | 14        | 23.5                    | 23.7       | 23.5       |
|                    |            | 8                | 0         | 22.5                    | 22.8       | 22.5       |
|                    |            | 8                | 4         | 22.6                    | 22.7       | 22.6       |
|                    |            | 8                | 7         | 22.5                    | 22.7       | 22.5       |
|                    |            | 15               | 0         | 22.5                    | 22.7       | 22.5       |
|                    | 16QAM      | 1                | 0         | 22.5                    | 22.8       | 22.6       |
|                    |            | 1                | 7         | 22.4                    | 22.6       | 22.4       |
|                    |            | 1                | 14        | 22.5                    | 22.4       | 22.4       |
|                    |            | 8                | 0         | 21.3                    | 21.8       | 21.4       |
|                    |            | 8                | 4         | 21.4                    | 21.8       | 21.7       |
|                    |            | 8                | 7         | 21.4                    | 21.8       | 21.6       |
|                    |            | 15               | 0         | 21.3                    | 21.7       | 21.6       |

#### OUTPUT POWER FOR LTE BAND 4 (10.0 MHz)

| Bandwidth<br>(MHz) | Modulation | RB<br>Allocation | RB Offset | Power                   |            |            |
|--------------------|------------|------------------|-----------|-------------------------|------------|------------|
|                    |            |                  |           | Conducted Average (dBm) |            |            |
|                    |            |                  |           | 20000                   | 20175      | 20350      |
|                    |            |                  |           | 1715.0 MHz              | 1732.5 MHz | 1750.0 MHz |
| 10.0               | QPSK       | 1                | 0         | 23.6                    | 23.6       | 23.7       |
|                    |            | 1                | 24        | 23.5                    | 23.9       | 23.7       |
|                    |            | 1                | 49        | 23.5                    | 23.6       | 23.8       |
|                    |            | 25               | 0         | 22.5                    | 22.7       | 22.6       |
|                    |            | 25               | 12        | 22.6                    | 22.7       | 22.6       |
|                    |            | 25               | 24        | 22.6                    | 22.8       | 22.6       |
|                    |            | 50               | 0         | 22.6                    | 22.8       | 22.5       |
|                    | 16QAM      | 1                | 0         | 22.3                    | 22.4       | 22.3       |
|                    |            | 1                | 24        | 22.4                    | 22.4       | 22.3       |
|                    |            | 1                | 49        | 22.3                    | 22.4       | 22.2       |
|                    |            | 25               | 0         | 21.6                    | 21.7       | 21.6       |
|                    |            | 25               | 12        | 21.8                    | 21.7       | 21.6       |
|                    |            | 25               | 24        | 21.8                    | 21.8       | 21.5       |
|                    |            | 50               | 0         | 21.7                    | 21.6       | 21.5       |

#### OUTPUT POWER FOR LTE BAND 4 (15.0 MHz)

| Bandwidth<br>(MHz) | Modulation | RB<br>Allocation | RB Offset | Power                   |            |            |
|--------------------|------------|------------------|-----------|-------------------------|------------|------------|
|                    |            |                  |           | Conducted Average (dBm) |            |            |
|                    |            |                  |           | 20025                   | 20175      | 20325      |
|                    |            |                  |           | 1717.5 MHz              | 1732.5 MHz | 1747.5 MHz |
| 15.0               | QPSK       | 1                | 0         | 23.5                    | 23.6       | 23.6       |
|                    |            | 1                | 37        | 23.9                    | 23.9       | 24.0       |
|                    |            | 1                | 74        | 23.6                    | 23.5       | 23.9       |
|                    |            | 36               | 0         | 22.5                    | 22.7       | 22.6       |
|                    |            | 36               | 16        | 22.6                    | 22.6       | 22.6       |
|                    |            | 36               | 35        | 22.7                    | 22.7       | 22.7       |
|                    |            | 75               | 0         | 22.5                    | 22.7       | 22.5       |
|                    | 16QAM      | 1                | 0         | 22.6                    | 22.7       | 22.8       |
|                    |            | 1                | 37        | 23.0                    | 22.8       | 23.1       |
|                    |            | 1                | 74        | 22.6                    | 22.4       | 22.9       |
|                    |            | 36               | 0         | 21.6                    | 21.8       | 21.5       |
|                    |            | 36               | 16        | 21.7                    | 21.5       | 21.7       |
|                    |            | 36               | 35        | 21.6                    | 21.6       | 21.6       |
|                    |            | 75               | 0         | 21.6                    | 21.8       | 21.6       |

#### OUTPUT POWER FOR LTE BAND 4 (20.0 MHz)

| Bandwidth<br>(MHz) | Modulation | RB<br>Allocation | RB Offset | Power                   |            |            |
|--------------------|------------|------------------|-----------|-------------------------|------------|------------|
|                    |            |                  |           | Conducted Average (dBm) |            |            |
|                    |            |                  |           | 20050                   | 20175      | 20300      |
|                    |            |                  |           | 1720.0 MHz              | 1732.5 MHz | 1745.0 MHz |
| 20.0               | QPSK       | 1                | 0         | 23.3                    | 23.4       | 23.8       |
|                    |            | 1                | 49        | 23.7                    | 23.6       | 24.0       |
|                    |            | 1                | 99        | 23.2                    | 23.4       | 23.8       |
|                    |            | 50               | 0         | 22.6                    | 22.8       | 23.0       |
|                    |            | 50               | 24        | 22.6                    | 22.7       | 22.8       |
|                    |            | 50               | 49        | 22.5                    | 22.6       | 22.7       |
|                    |            | 100              | 0         | 22.6                    | 22.7       | 22.6       |
|                    | 16QAM      | 1                | 0         | 22.2                    | 22.3       | 22.8       |
|                    |            | 1                | 49        | 22.6                    | 22.5       | 22.9       |
|                    |            | 1                | 99        | 22.3                    | 22.5       | 22.8       |
|                    |            | 50               | 0         | 21.6                    | 21.9       | 21.9       |
|                    |            | 50               | 24        | 21.7                    | 21.8       | 21.9       |
|                    |            | 50               | 49        | 21.6                    | 21.7       | 21.8       |
|                    |            | 100              | 0         | 21.7                    | 21.8       | 21.7       |

### 7.3. LTE 5

|            |       |              |        |
|------------|-------|--------------|--------|
| <b>ID:</b> | 39004 | <b>Date:</b> | 2/4/19 |
|------------|-------|--------------|--------|

#### OUTPUT POWER FOR LTE BAND 5 (1.4 MHz)

| Bandwidth<br>(MHz) | Modulation | RB<br>Allocation | RB Offset | Power                   |           |           |
|--------------------|------------|------------------|-----------|-------------------------|-----------|-----------|
|                    |            |                  |           | Conducted Average (dBm) |           |           |
|                    |            |                  |           | 20407                   | 20525     | 20643     |
|                    |            |                  |           | 824.7 MHz               | 836.5 MHz | 848.3 MHz |
| 1.4                | QPSK       | 1                | 0         | 23.6                    | 23.3      | 23.0      |
|                    |            | 1                | 2         | 23.7                    | 23.3      | 23.0      |
|                    |            | 1                | 5         | 23.4                    | 23.3      | 23.0      |
|                    |            | 3                | 0         | 23.7                    | 23.3      | 23.1      |
|                    |            | 3                | 1         | 23.6                    | 23.3      | 23.0      |
|                    |            | 3                | 2         | 23.6                    | 23.1      | 23.0      |
|                    |            | 6                | 0         | 22.7                    | 22.2      | 22.0      |
|                    | 16QAM      | 1                | 0         | 22.3                    | 22.1      | 22.3      |
|                    |            | 1                | 2         | 22.3                    | 22.2      | 22.3      |
|                    |            | 1                | 5         | 22.1                    | 22.2      | 22.2      |
|                    |            | 3                | 0         | 22.0                    | 22.4      | 22.3      |
|                    |            | 3                | 1         | 22.2                    | 22.4      | 22.2      |
|                    |            | 3                | 2         | 22.4                    | 22.3      | 22.1      |
|                    |            | 6                | 0         | 21.2                    | 21.4      | 21.2      |

#### OUTPUT POWER FOR LTE BAND 5 (3.0 MHz)

| Bandwidth<br>(MHz) | Modulation | RB<br>Allocation | RB Offset | Power                   |           |           |
|--------------------|------------|------------------|-----------|-------------------------|-----------|-----------|
|                    |            |                  |           | Conducted Average (dBm) |           |           |
|                    |            |                  |           | 20415                   | 20525     | 20635     |
|                    |            |                  |           | 825.5 MHz               | 836.5 MHz | 847.5 MHz |
| 3.0                | QPSK       | 1                | 0         | 23.2                    | 23.2      | 22.9      |
|                    |            | 1                | 7         | 23.2                    | 23.5      | 23.1      |
|                    |            | 1                | 14        | 23.1                    | 23.2      | 22.9      |
|                    |            | 8                | 0         | 22.3                    | 22.1      | 22.0      |
|                    |            | 8                | 4         | 22.1                    | 22.1      | 22.0      |
|                    |            | 8                | 7         | 22.1                    | 22.2      | 22.0      |
|                    |            | 15               | 0         | 22.2                    | 22.1      | 21.9      |
|                    | 16QAM      | 1                | 0         | 22.2                    | 21.9      | 21.8      |
|                    |            | 1                | 7         | 22.1                    | 22.1      | 22.1      |
|                    |            | 1                | 14        | 21.8                    | 21.9      | 21.5      |
|                    |            | 8                | 0         | 21.0                    | 21.1      | 21.0      |
|                    |            | 8                | 4         | 20.9                    | 21.3      | 21.2      |
|                    |            | 8                | 7         | 20.9                    | 21.3      | 21.2      |
|                    |            | 15               | 0         | 21.1                    | 21.2      | 21.1      |

**OUTPUT POWER FOR LTE BAND 5 (10.0 MHz)**

| Bandwidth<br>(MHz) | Modulation | RB<br>Allocation | RB Offset | Power                   |           |           |
|--------------------|------------|------------------|-----------|-------------------------|-----------|-----------|
|                    |            |                  |           | Conducted Average (dBm) |           |           |
|                    |            |                  |           | 20450                   | 20525     | 20600     |
|                    |            |                  |           | 829.0 MHz               | 836.5 MHz | 844.0 MHz |
| 10.0               | QPSK       | 1                | 0         | 23.6                    | 23.3      | 23.4      |
|                    |            | 1                | 24        | 23.7                    | 23.5      | 23.6      |
|                    |            | 1                | 49        | 23.5                    | 23.3      | 23.3      |
|                    |            | 25               | 0         | 22.3                    | 22.3      | 22.2      |
|                    |            | 25               | 12        | 22.3                    | 22.4      | 22.2      |
|                    |            | 25               | 24        | 22.3                    | 22.4      | 22.2      |
|                    |            | 50               | 0         | 22.3                    | 22.3      | 22.2      |
|                    | 16QAM      | 1                | 0         | 22.3                    | 22.4      | 22.3      |
|                    |            | 1                | 24        | 22.6                    | 22.3      | 22.4      |
|                    |            | 1                | 49        | 22.1                    | 22.1      | 22.3      |
|                    |            | 25               | 0         | 21.4                    | 21.4      | 21.4      |
|                    |            | 25               | 12        | 21.5                    | 21.6      | 21.5      |
|                    |            | 25               | 24        | 21.3                    | 21.6      | 21.2      |
|                    |            | 50               | 0         | 21.2                    | 21.5      | 21.3      |



## 7.4. LTE 12

|            |       |              |        |
|------------|-------|--------------|--------|
| <b>ID:</b> | 39004 | <b>Date:</b> | 2/4/19 |
|------------|-------|--------------|--------|

### OUTPUT POWER FOR LTE BAND 12 (1.4 MHz)

| Bandwidth (MHz) | Modulation | RB Allocation | RB Offset | Power                   |                    |                    |
|-----------------|------------|---------------|-----------|-------------------------|--------------------|--------------------|
|                 |            |               |           | Conducted Average (dBm) |                    |                    |
|                 |            |               |           | 23017<br>699.7 MHz      | 23095<br>707.5 MHz | 23173<br>715.3 MHz |
| 1.4             | QPSK       | 1             | 0         | 23.4                    | 23.7               | 23.4               |
|                 |            | 1             | 2         | 23.4                    | 23.7               | 23.7               |
|                 |            | 1             | 5         | 23.4                    | 23.7               | 23.6               |
|                 |            | 3             | 0         | 23.5                    | 23.6               | 23.6               |
|                 |            | 3             | 1         | 23.7                    | 23.6               | 23.7               |
|                 |            | 3             | 2         | 23.7                    | 23.9               | 23.7               |
|                 |            | 6             | 0         | 22.5                    | 22.7               | 22.6               |
|                 | 16QAM      | 1             | 0         | 22.5                    | 22.7               | 22.7               |
|                 |            | 1             | 2         | 22.4                    | 22.8               | 22.9               |
|                 |            | 1             | 5         | 22.4                    | 22.6               | 23.0               |
|                 |            | 3             | 0         | 22.2                    | 22.8               | 22.9               |
|                 |            | 3             | 1         | 22.3                    | 23.3               | 22.7               |
|                 |            | 3             | 2         | 22.3                    | 23.2               | 22.9               |
|                 |            | 6             | 0         | 21.2                    | 21.9               | 21.9               |

### OUTPUT POWER FOR LTE BAND 12 (3.0 MHz)

| Bandwidth (MHz) | Modulation | RB Allocation | RB Offset | Power                   |                    |                    |
|-----------------|------------|---------------|-----------|-------------------------|--------------------|--------------------|
|                 |            |               |           | Conducted Average (dBm) |                    |                    |
|                 |            |               |           | 23025<br>700.5 MHz      | 23095<br>707.5 MHz | 23165<br>714.5 MHz |
| 3.0             | QPSK       | 1             | 0         | 23.4                    | 23.7               | 23.5               |
|                 |            | 1             | 7         | 23.7                    | 23.8               | 23.7               |
|                 |            | 1             | 14        | 23.6                    | 23.8               | 23.6               |
|                 |            | 8             | 0         | 22.5                    | 22.8               | 22.7               |
|                 |            | 8             | 4         | 22.6                    | 22.9               | 22.8               |
|                 |            | 8             | 7         | 22.7                    | 22.7               | 22.6               |
|                 |            | 15            | 0         | 22.6                    | 22.6               | 22.7               |
|                 | 16QAM      | 1             | 0         | 22.7                    | 22.9               | 22.4               |
|                 |            | 1             | 7         | 22.6                    | 22.7               | 22.8               |
|                 |            | 1             | 14        | 22.5                    | 22.4               | 22.5               |
|                 |            | 8             | 0         | 21.6                    | 21.8               | 21.6               |
|                 |            | 8             | 4         | 21.6                    | 21.8               | 21.8               |
|                 |            | 8             | 7         | 21.5                    | 21.7               | 21.8               |
|                 |            | 15            | 0         | 21.5                    | 21.7               | 21.7               |

**OUTPUT POWER FOR LTE BAND 12 (10.0 MHz)**

| Bandwidth<br>(MHz) | Modulation | RB<br>Allocation | RB Offset | Power                   |           |           |
|--------------------|------------|------------------|-----------|-------------------------|-----------|-----------|
|                    |            |                  |           | Conducted Average (dBm) |           |           |
|                    |            |                  |           | 23060                   | 23095     | 23130     |
|                    |            |                  |           | 704.0 MHz               | 707.5 MHz | 711.0 MHz |
| 10.0               | QPSK       | 1                | 0         | 23.4                    | 23.5      | 23.4      |
|                    |            | 1                | 24        | 23.7                    | 23.6      | 23.6      |
|                    |            | 1                | 49        | 23.4                    | 23.6      | 23.7      |
|                    |            | 25               | 0         | 22.6                    | 22.7      | 22.6      |
|                    |            | 25               | 12        | 22.7                    | 22.6      | 22.7      |
|                    |            | 25               | 24        | 22.6                    | 22.6      | 22.8      |
|                    |            | 50               | 0         | 22.6                    | 22.6      | 22.7      |
|                    | 16QAM      | 1                | 0         | 22.3                    | 22.5      | 22.5      |
|                    |            | 1                | 24        | 22.5                    | 22.6      | 22.8      |
|                    |            | 1                | 49        | 21.9                    | 22.4      | 22.3      |
|                    |            | 25               | 0         | 21.9                    | 22.8      | 21.6      |
|                    |            | 25               | 12        | 21.7                    | 21.6      | 21.6      |
|                    |            | 25               | 24        | 21.6                    | 21.5      | 21.7      |
|                    |            | 50               | 0         | 21.6                    | 21.7      | 21.8      |

## 8. CONDUCTED TEST RESULTS

### 8.1. OCCUPIED BANDWIDTH

#### RULE PART(S)

FCC: §2.1049

IC: RSS130, RSS132; RSS133 §2.3, RSS139

#### LIMITS

For reporting purposes only

#### TEST PROCEDURE

The transmitter output was connected to a calibrated coaxial cable and coupler, the other end of which was connected to a spectrum analyzer. The occupied bandwidth was measured with the spectrum analyzer at the middle channel in each band. The 99% and -26dB bandwidths was also measured and recorded.

#### MODES TESTED

- LTE Band 2
- LTE Band 4
- LTE Band 5
- LTE Band 12

#### RESULTS

There is no limit required and power is the same for low, middle and high channel; therefore, only middle channel was tested.

|            |       |              |        |
|------------|-------|--------------|--------|
| <b>ID:</b> | 39004 | <b>Date:</b> | 2/4/19 |
|------------|-------|--------------|--------|

#### **LTE2**

| Band       | Mode           | RB Allocation/RB Offset | f(MHz) | 99% BW (MHz) | -26dB BW (MHz) |
|------------|----------------|-------------------------|--------|--------------|----------------|
| LTE BAND 2 | 1.4 MHz, QPSK  | 6/0                     | 1880.0 | 1.10         | 1.27           |
|            | 1.4 MHz, 16QAM |                         |        | 1.08         | 1.27           |
|            | 3 MHz, QPSK    | 15/0                    |        | 2.69         | 2.92           |
|            | 3 MHz, 16QAM   |                         |        | 2.69         | 2.97           |
|            | 10 MHz, QPSK   | 50/0                    |        | 8.93         | 9.71           |
|            | 10 MHz, 16QAM  |                         |        | 8.93         | 9.79           |
|            | 15 MHz, QPSK   | 75/0                    |        | 13.37        | 14.66          |
|            | 15 MHz, 16QAM  |                         |        | 13.41        | 14.60          |
|            | 20 MHz, QPSK   | 100/0                   |        | 17.85        | 19.29          |
|            | 20 MHz, 16QAM  |                         |        | 17.85        | 19.29          |

#### **LTE4**

| Band       | Mode           | RB Allocation/RB Offset | f(MHz) | 99% BW (MHz) | -26dB BW (MHz) |
|------------|----------------|-------------------------|--------|--------------|----------------|
| LTE BAND 4 | 1.4 MHz, QPSK  | 6/0                     | 1732.5 | 1.09         | 1.25           |
|            | 1.4 MHz, 16QAM |                         |        | 1.09         | 1.29           |
|            | 3 MHz, QPSK    | 15/0                    |        | 2.69         | 2.96           |
|            | 3 MHz, 16QAM   |                         |        | 2.69         | 2.98           |
|            | 10 MHz, QPSK   | 50/0                    |        | 8.94         | 9.87           |
|            | 10 MHz, 16QAM  |                         |        | 8.93         | 9.75           |
|            | 15 MHz, QPSK   | 75/0                    |        | 13.40        | 14.66          |
|            | 15 MHz, 16QAM  |                         |        | 13.41        | 14.76          |
|            | 20 MHz, QPSK   | 100/0                   |        | 17.88        | 19.14          |
|            | 20 MHz, 16QAM  |                         |        | 17.87        | 19.30          |

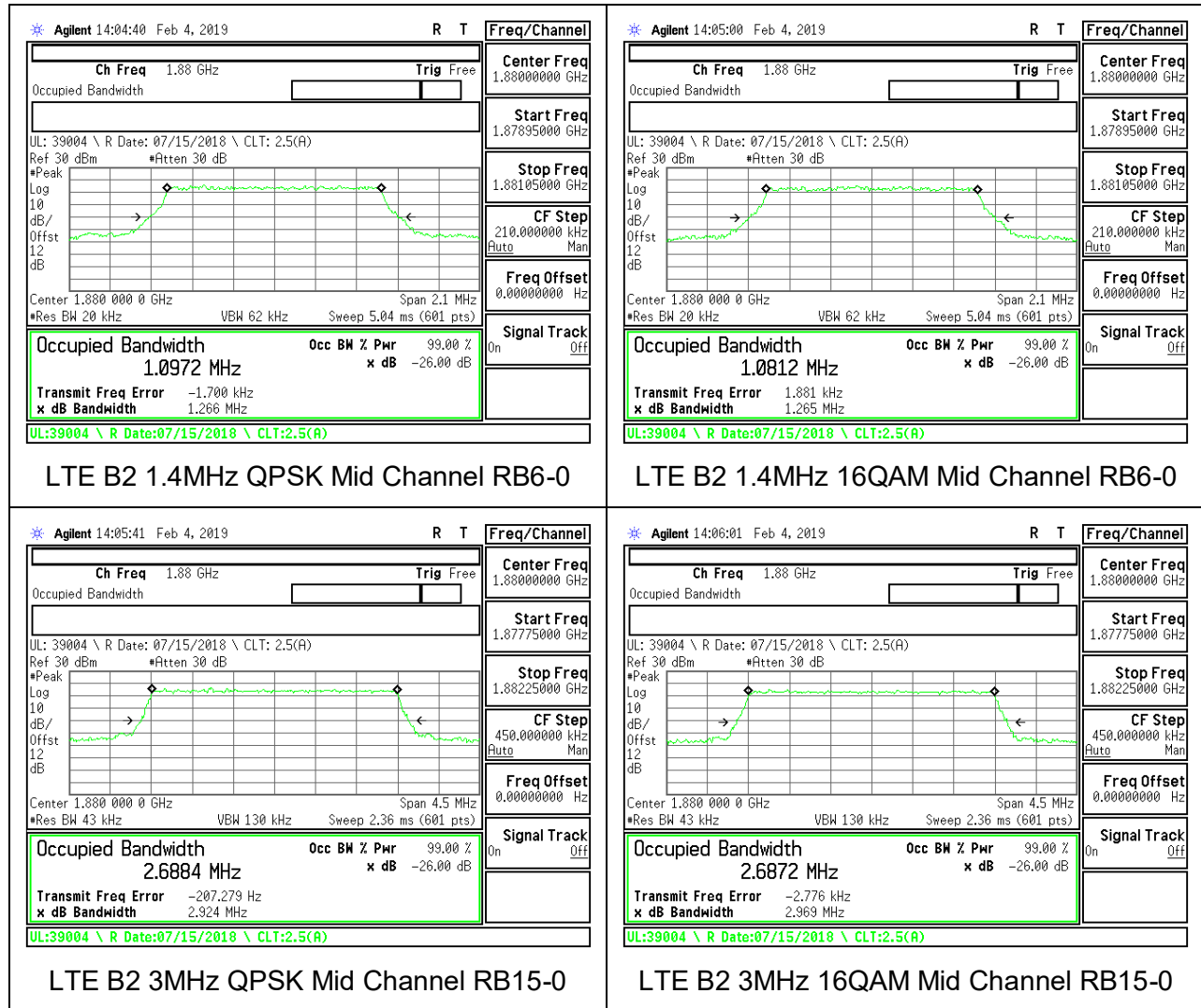
#### **LTE5**

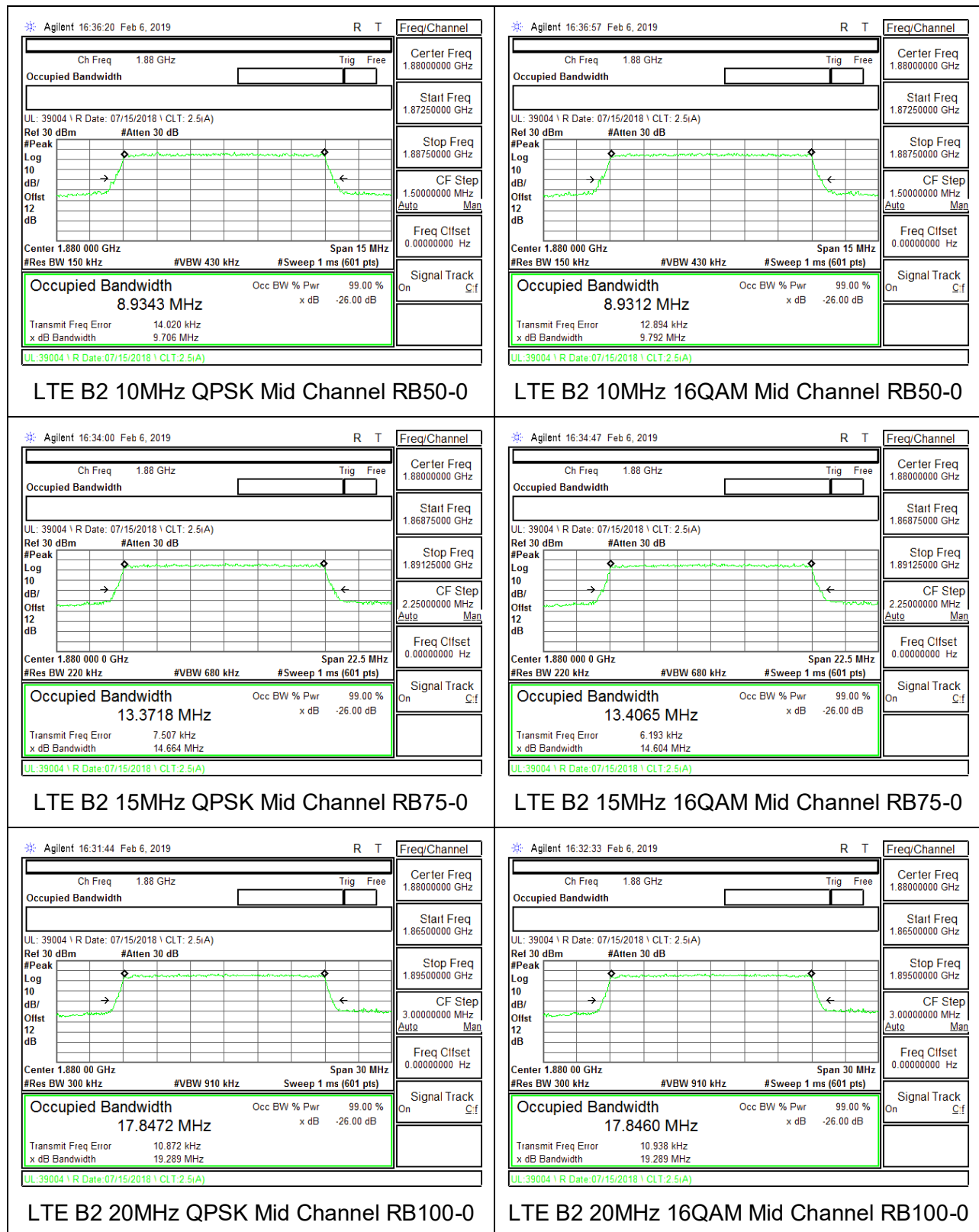
| Band       | Mode           | RB Allocation/RB Offset | f(MHz) | 99% BW (MHz) | -26dB BW (MHz) |
|------------|----------------|-------------------------|--------|--------------|----------------|
| LTE BAND 5 | 1.4 MHz, QPSK  | 6/0                     | 836.5  | 1.09         | 1.28           |
|            | 1.4 MHz, 16QAM |                         |        | 1.09         | 1.25           |
|            | 3 MHz, QPSK    | 15/0                    |        | 2.69         | 2.96           |
|            | 3 MHz, 16QAM   |                         |        | 2.67         | 2.91           |
|            | 10 MHz, QPSK   | 50/0                    |        | 8.97         | 9.89           |
|            | 10 MHz, 16QAM  |                         |        | 8.94         | 9.76           |

**LTE12**

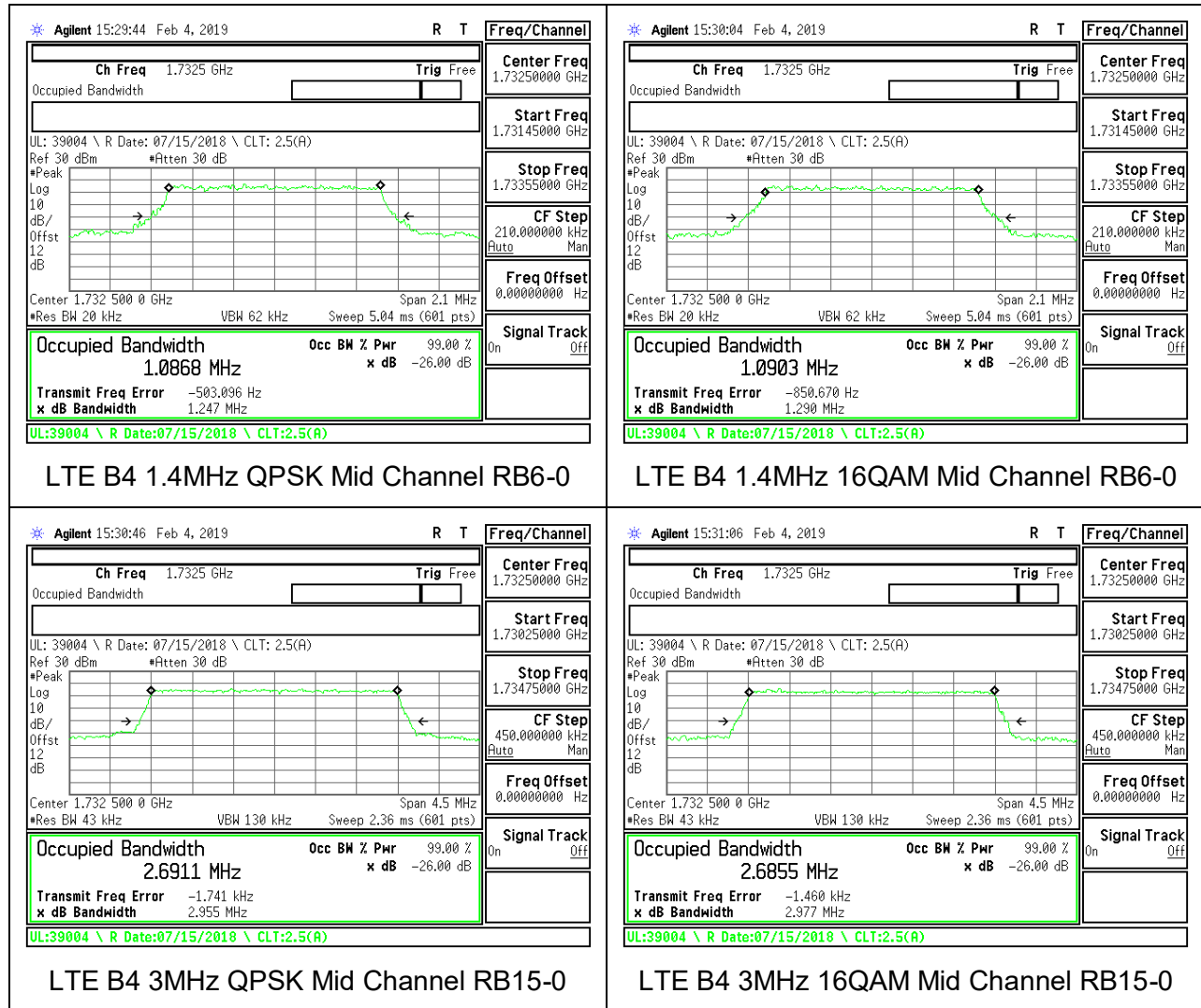
| Band        | Mode           | RB Allocation/RB Offset | f(MHz) | 99% BW (MHz) | -26dB BW (MHz) |
|-------------|----------------|-------------------------|--------|--------------|----------------|
| LTE BAND 12 | 1.4 MHz, QPSK  | 6/0                     | 707.5  | 1.09         | 1.28           |
|             | 1.4 MHz, 16QAM |                         |        | 1.08         | 1.28           |
|             | 3 MHz, QPSK    | 15/0                    |        | 2.69         | 2.98           |
|             | 3 MHz, 16QAM   |                         |        | 2.69         | 2.97           |
|             | 10 MHz, QPSK   | 50/0                    |        | 8.95         | 9.83           |
|             | 10 MHz, 16QAM  |                         |        | 8.94         | 9.92           |

### 8.1.1. LTE BAND 2

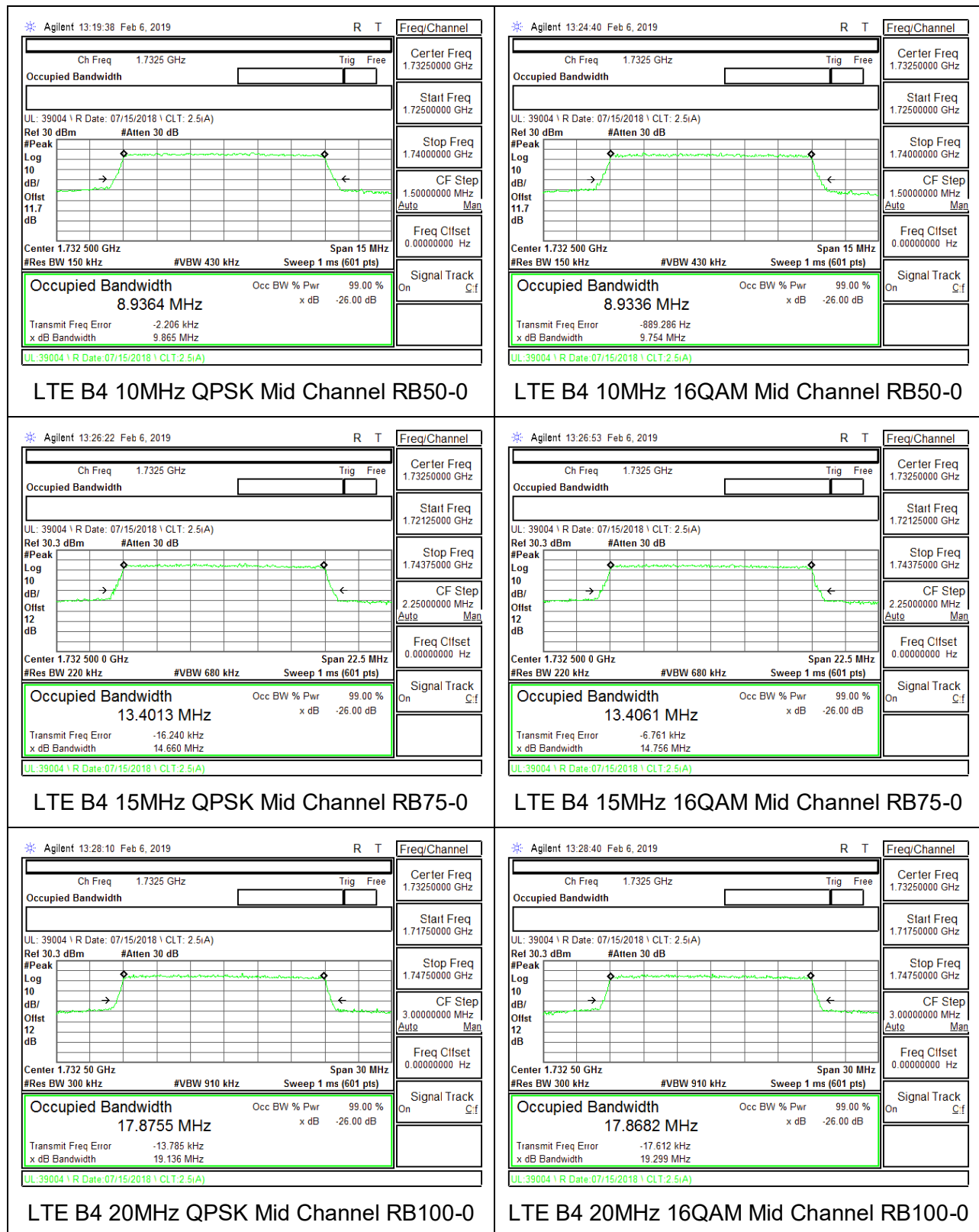




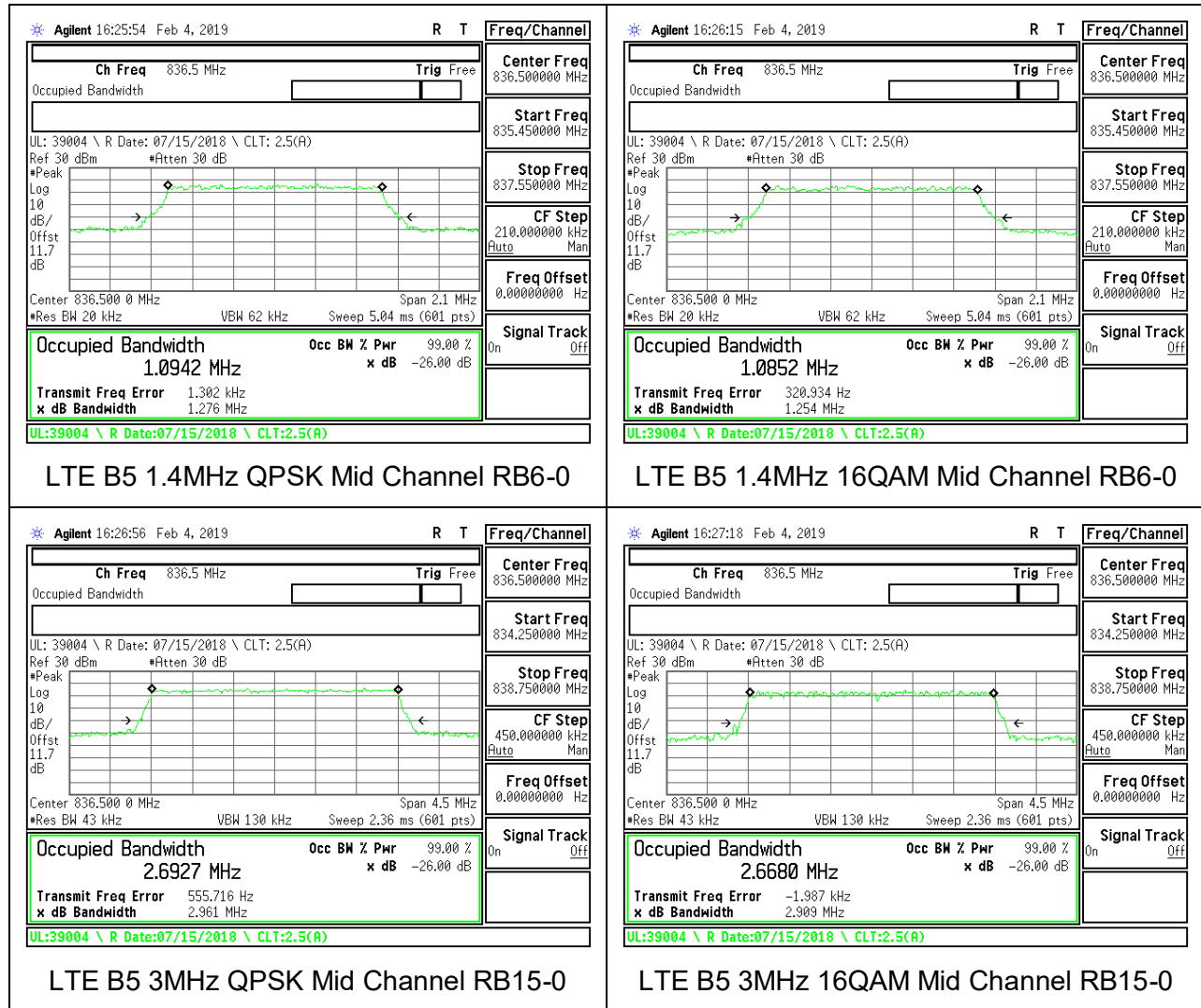
## 8.1.2. LTE BAND 4

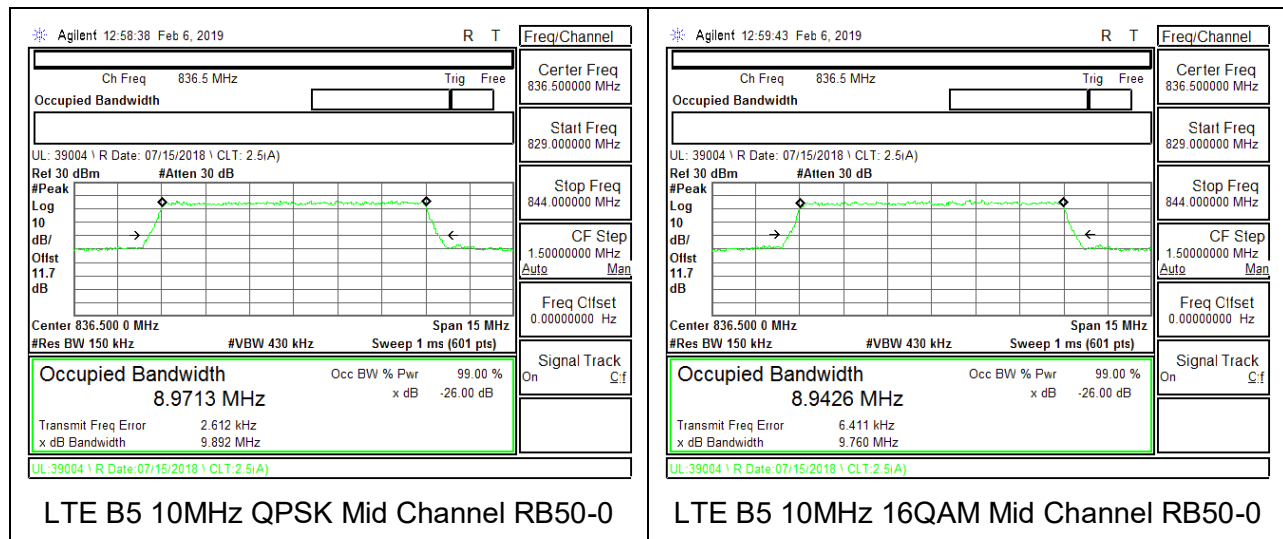






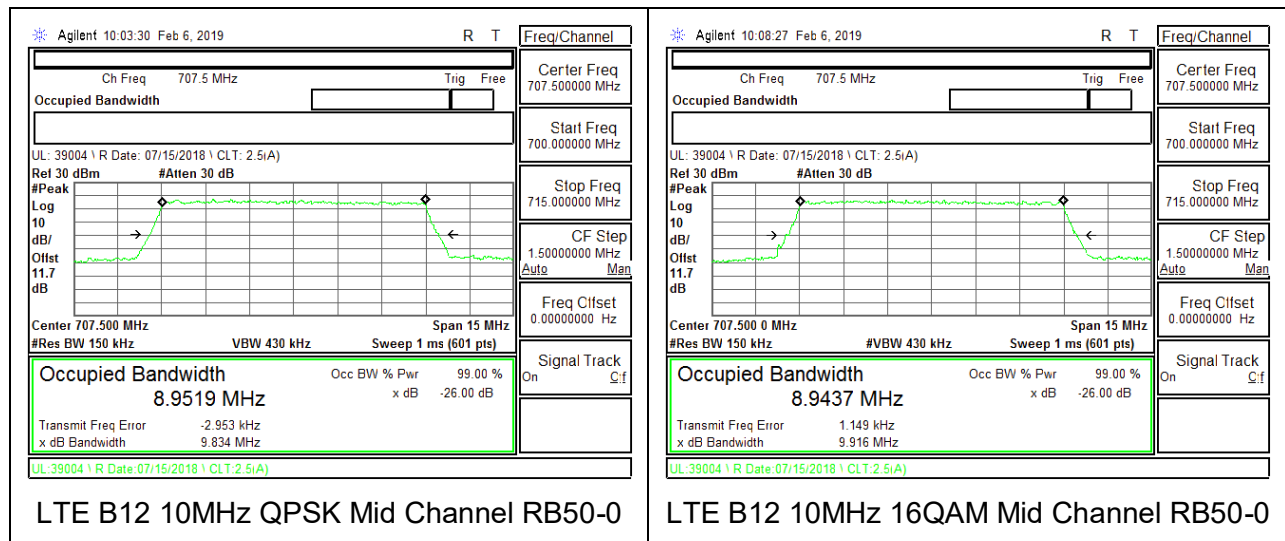
### 8.1.3. LTE BAND 5





## 8.1.4. LTE BAND 12





## 8.2. BAND EDGE AND EMISSION MASK

### RULE PART(S)

FCC: §2.1051, §22.917, §24.238, §27.53

IC: RSS130§4.6, RSS132§5.5; RSS133§6.5, RSS139§6.6

### LIMITS

FCC: §22.917, §24.238, §27.53(h)

The 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  $43 + 10 \log (P)$  dB.

FCC: §27.53 (Band 12)

(g) For operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least  $43 + 10 \log (P)$  dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

RSS130§4.6

4.6.1 The power of any unwanted emissions in any 100 kHz bandwidth on any frequency outside the frequency range(s) within which the equipment is designed to operate shall be attenuated below the transmitter power, P (dBW), by at least  $43 + 10 \log_{10} p$  (watts), dB. However, in the 100 kHz band immediately outside the equipment's operating frequency range, a resolution bandwidth of 30 kHz may be employed.

4.6.2 In addition to the limit outlined in Section 4.6.1 above, equipment operating in the frequency bands 746-756 MHz and 777-787 MHz shall also comply with the following restrictions:

(a) The power of any unwanted emissions in any 6.25 kHz bandwidth for all frequencies between 763-775 MHz and 793-806 MHz shall be attenuated below the transmitter power, P (dBW), by at least:

- (i)  $76 + 10 \log_{10} p$  (watts), dB, for base and fixed equipment, and
- (ii)  $65 + 10 \log_{10} p$  (watts), dB, for mobile and portable equipment.

RSS132§5.5

Mobile and base station equipment shall comply with the limits in (i) and (ii) below.

- (i) In the first 1.0 MHz band immediately outside and adjacent to each of the sub-bands specified in Section 5.1, the power of emissions per any 1% of the occupied bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least  $43 + 10 \log_{10} p$  (watts).
- (ii) After the first 1.0 MHz immediately outside and adjacent to each of the sub-bands, the power of emissions in any 100 kHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least  $43 + 10 \log_{10} p$  (watts). If the measurement is performed using 1% of the occupied bandwidth, power integration over 100 kHz is required.

### RSS133§6.5

Equipment shall comply with the limits in (i) and (ii) below.

- (i) In the 1.0 MHz bands immediately outside and adjacent to the equipment's operating frequency block, the emission power per any 1% of the emission bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least  $43 + 10 \log_{10} p(\text{watts})$ .
- (ii) After the first 1.0 MHz, the emission power in any 1 MHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least  $43 + 10 \log_{10} p(\text{watts})$ . If the measurement is performed using 1% of the emission bandwidth, power integration over 1.0 MHz is required.

### RSS139§6.6

- (i) In the first 1.0 MHz bands immediately outside and adjacent to the equipment's smallest operating frequency block, Footnote 2 which can contain the equipment's occupied bandwidth, the emission power per any 1% of the emission bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least  $43 + 10 \log_{10} p(\text{watts})$  dB.
- (ii) After the first 1.0 MHz outside the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power in any 1 MHz bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least  $43 + 10 \log_{10} p(\text{watts})$  dB.

### TEST PROCEDURE

The transmitter output was connected to a CMW500 Test Set and configured to operate at maximum power. The band edge emissions were measured at the required operating frequencies in each band on the Spectrum Analyzer.

For each band edge measurement:

1. Set the spectrum analyzer span to include the block edge frequency.
2. Set a marker to point the corresponding band edge frequency in each test case.
3. Set display line at -13 dBm
4. Set resolution bandwidth to at least 1% of emission bandwidth.

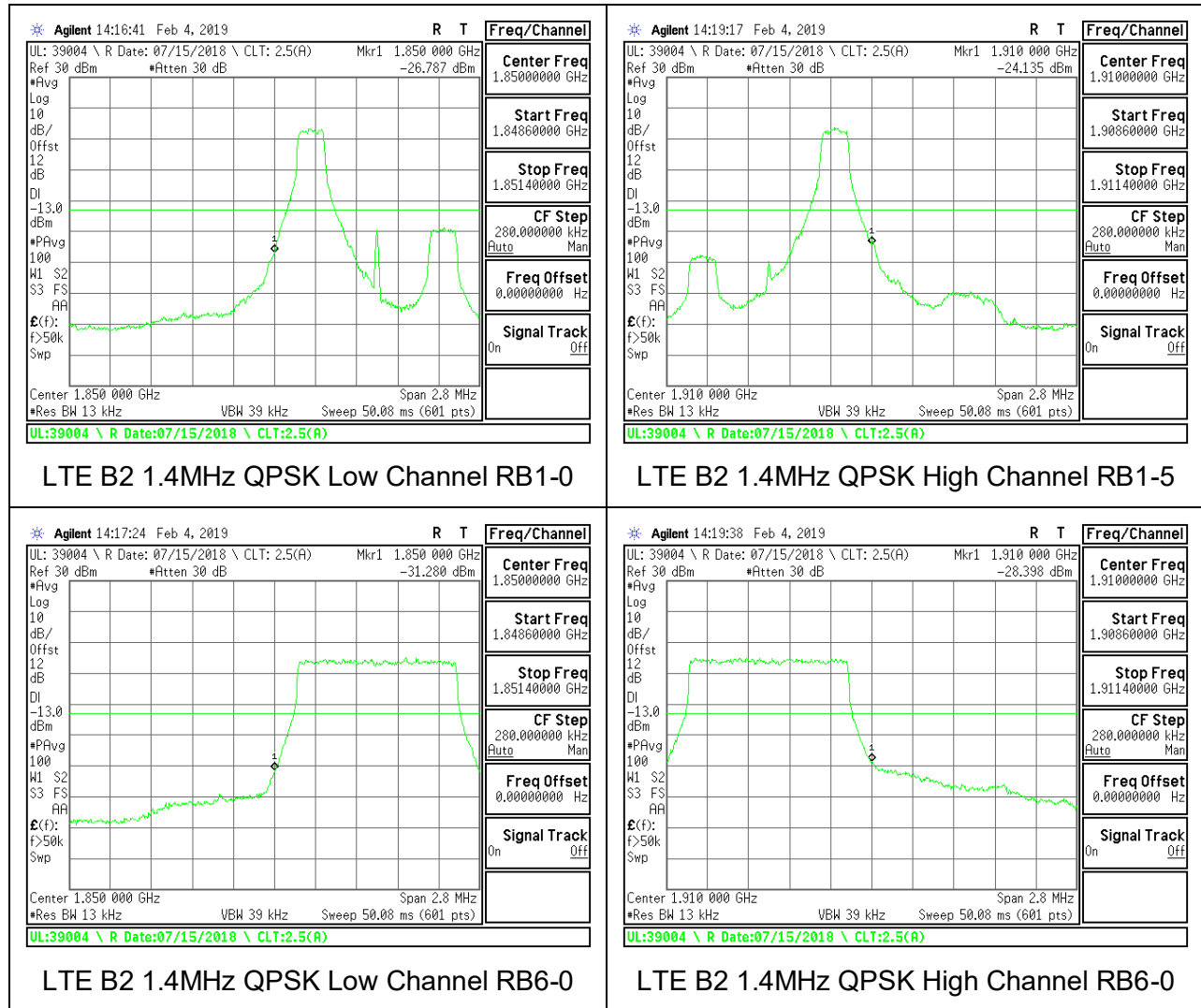
### MODES TESTED

- LTE Band 2
- LTE Band 4
- LTE Band 5
- LTE Band 12

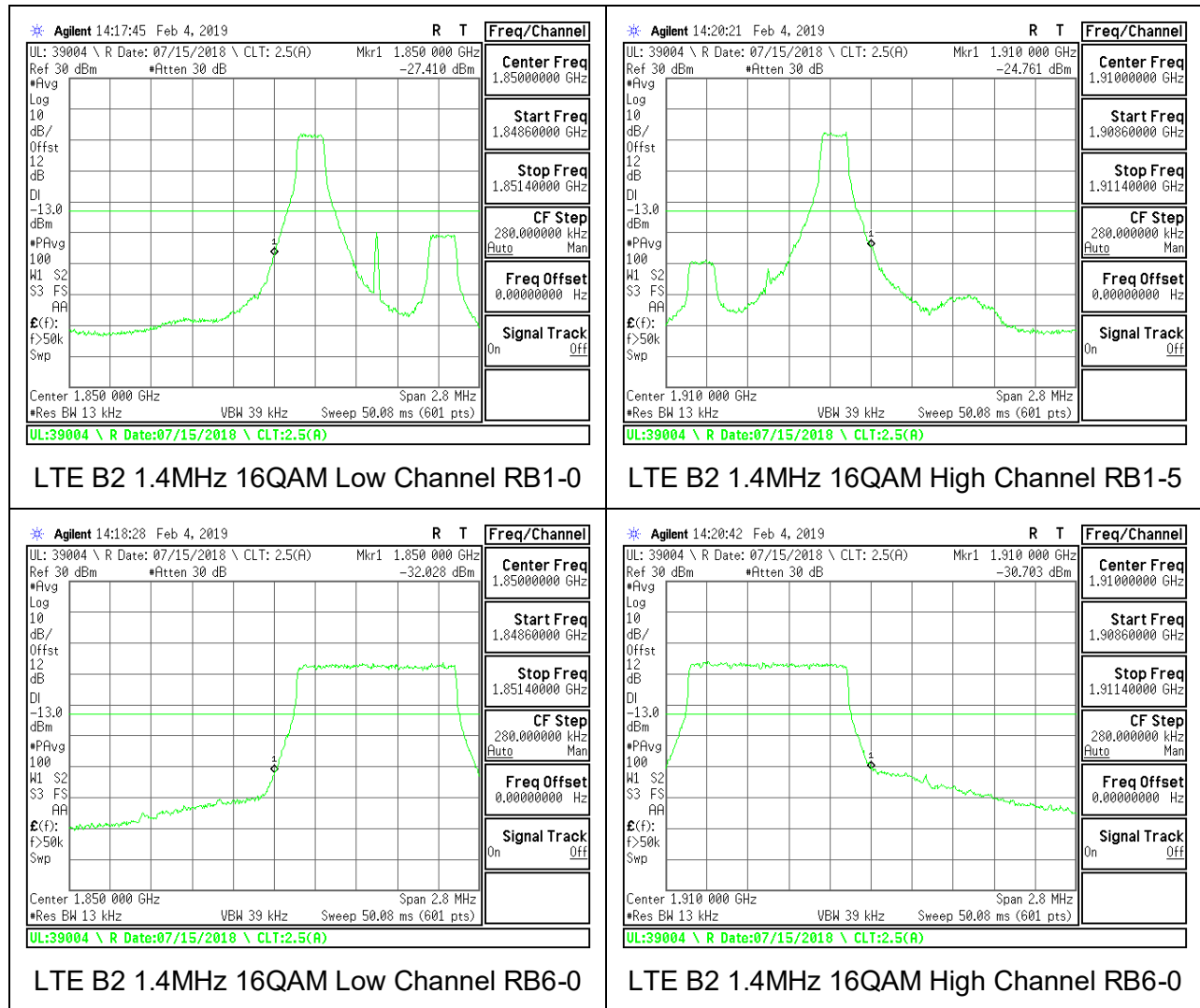
### RESULTS

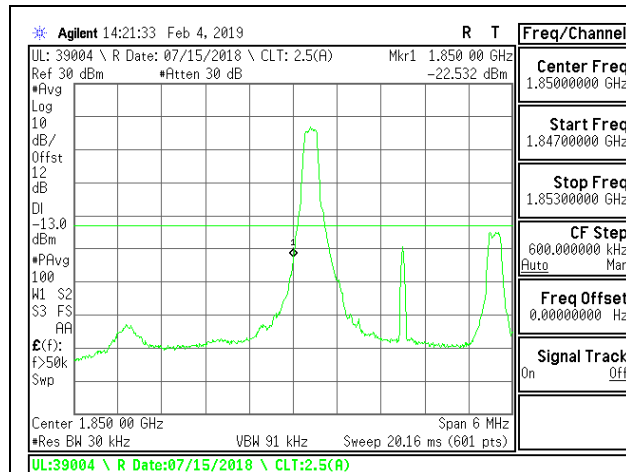
|            |       |              |        |
|------------|-------|--------------|--------|
| <b>ID:</b> | 39004 | <b>Date:</b> | 2/4/19 |
|------------|-------|--------------|--------|

## 8.2.1. LTE BAND 2 BANDEDGE

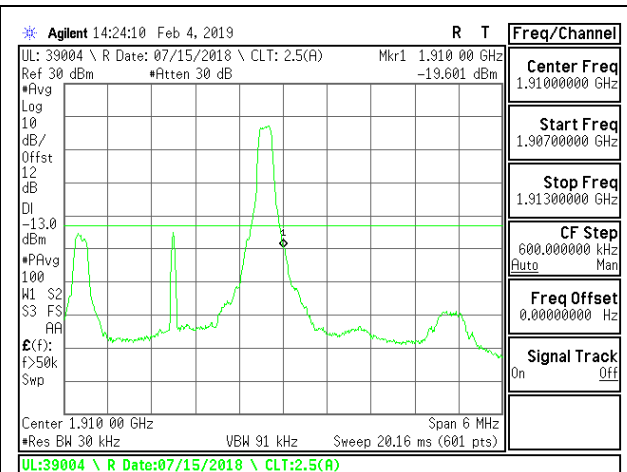




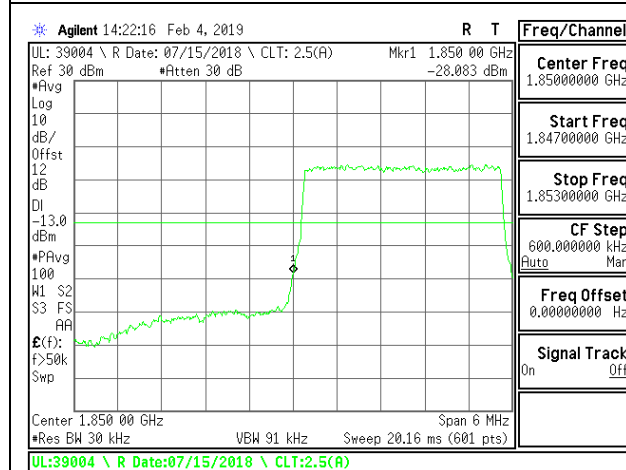




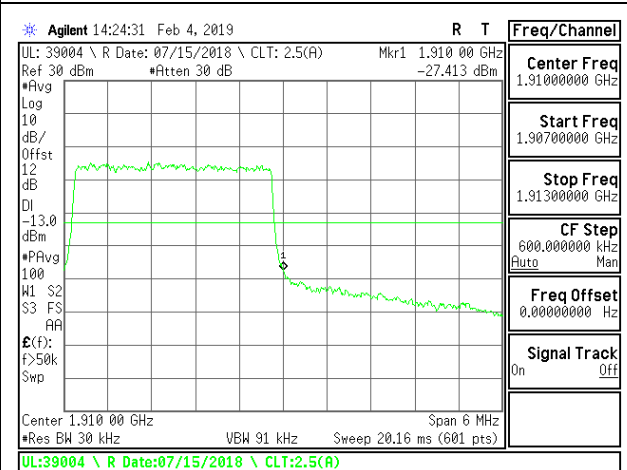
LTE B2 3MHz QPSK Low Channel RB1-0



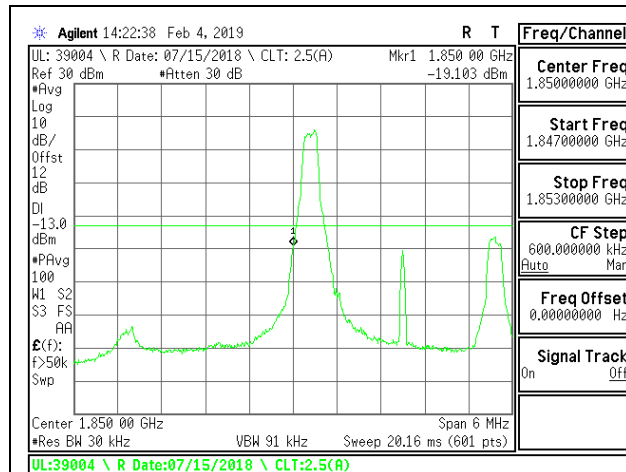
LTE B2 3MHz QPSK High Channel RB1-14



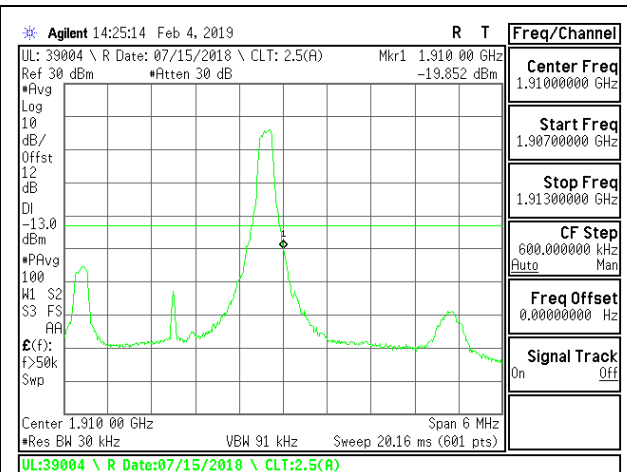
LTE B2 3MHz QPSK Low Channel RB15-0



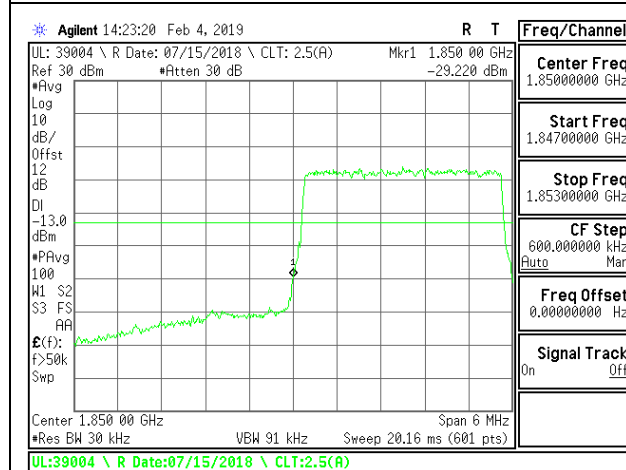
LTE B2 3MHz QPSK High Channel RB15-0



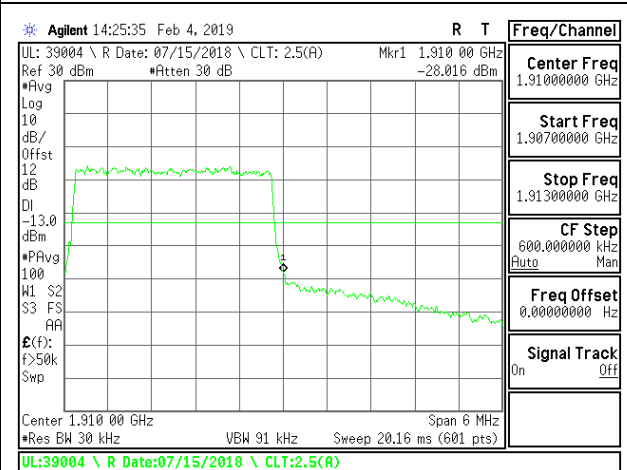
LTE B2 3MHz 16QAM Low Channel RB1-0



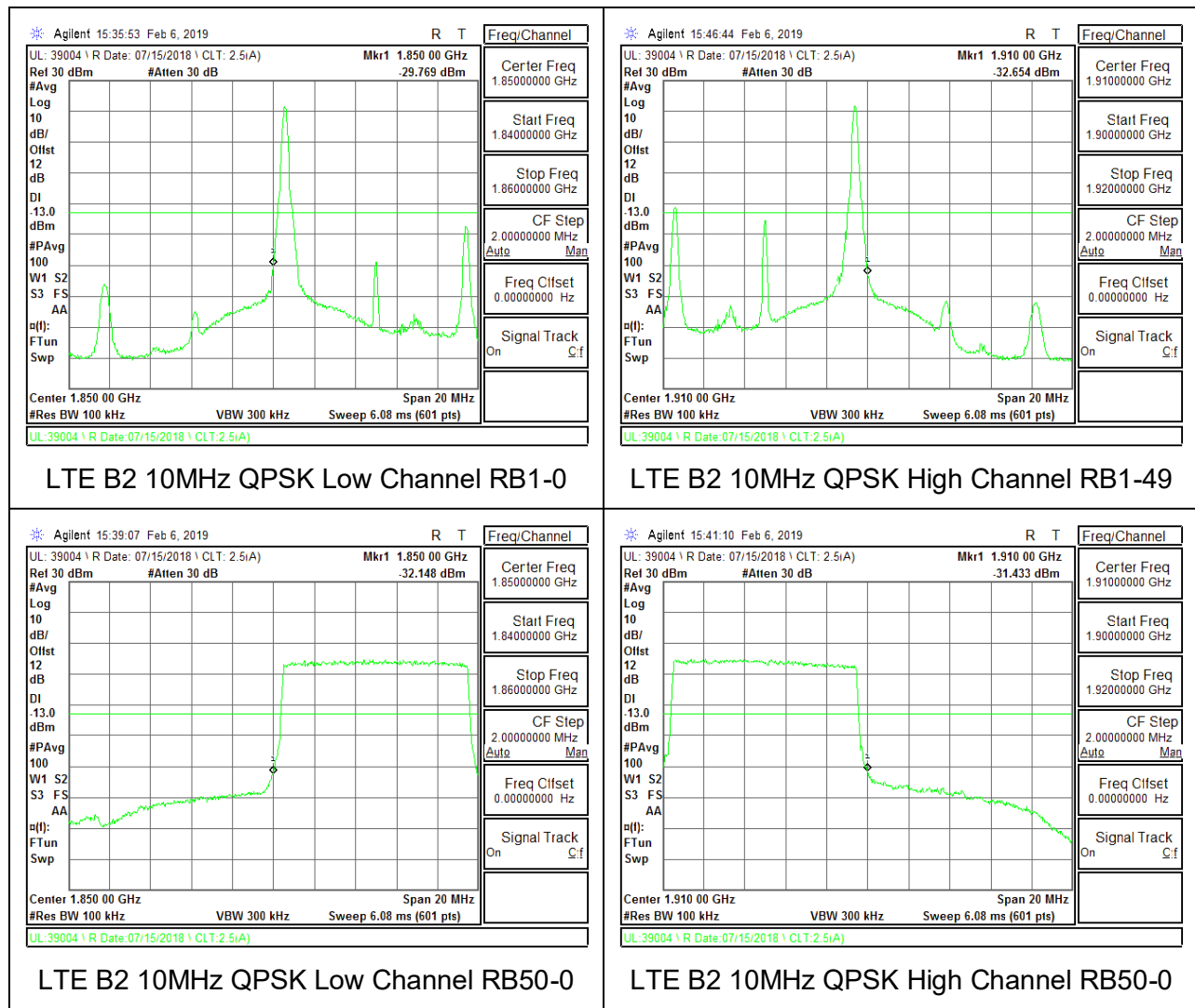
LTE B2 3MHz 16QAM High Channel RB1-14

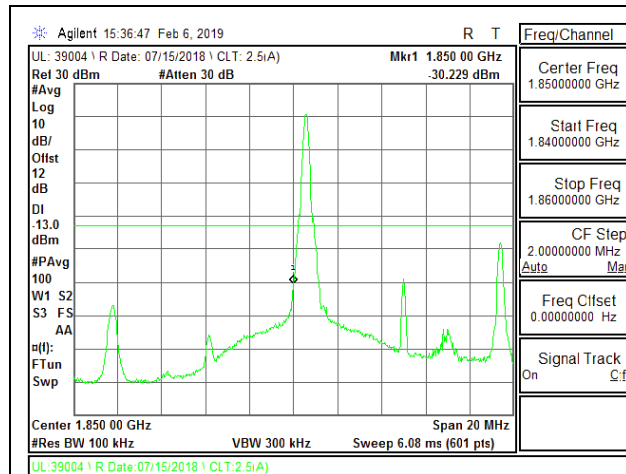


LTE B2 3MHz 16QAM Low Channel RB15-0

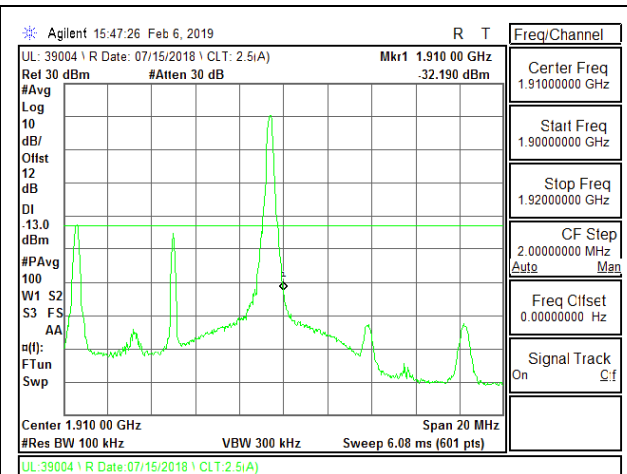


LTE B2 3MHz 16QAM High Channel RB15-0

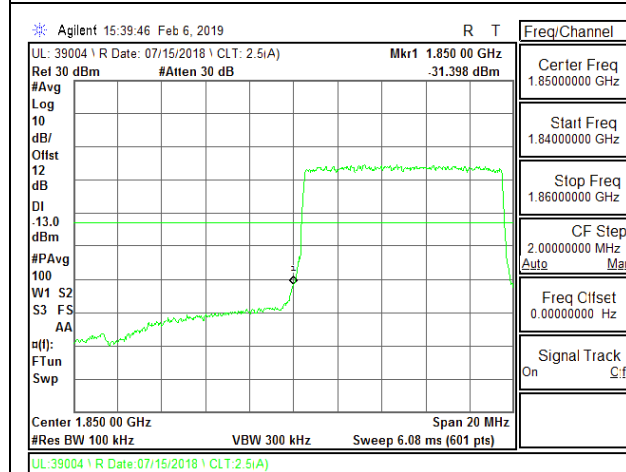




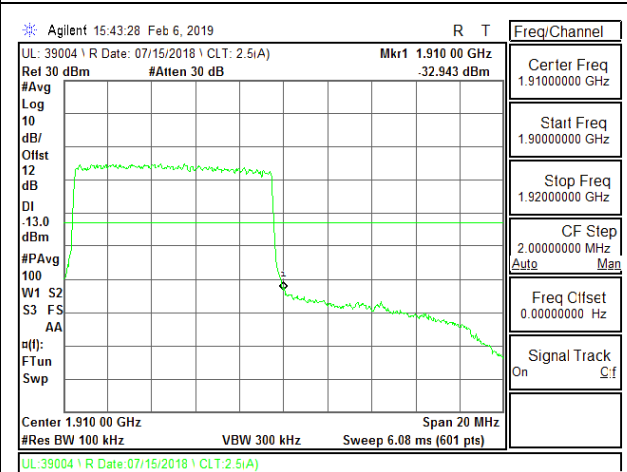
LTE B2 10MHz 16QAM Low Channel RB1-0



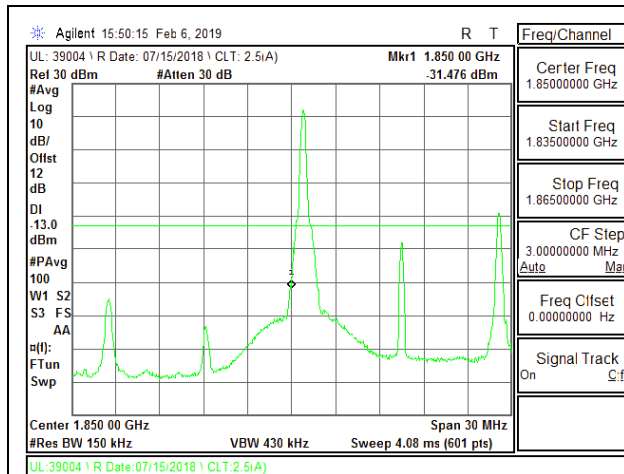
LTE B2 10MHz 16QAM High Channel RB1-49



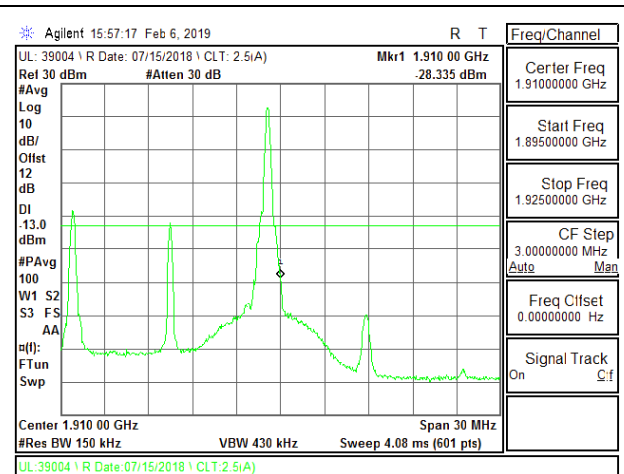
LTE B2 10MHz 16QAM Low Channel RB50-0



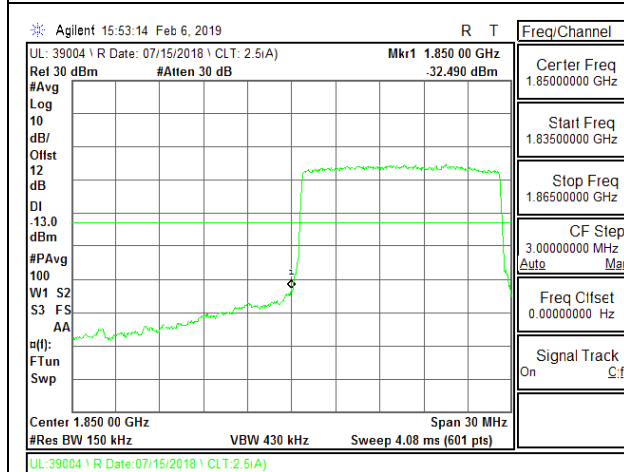
LTE B2 10MHz 16QAM High Channel RB50-0



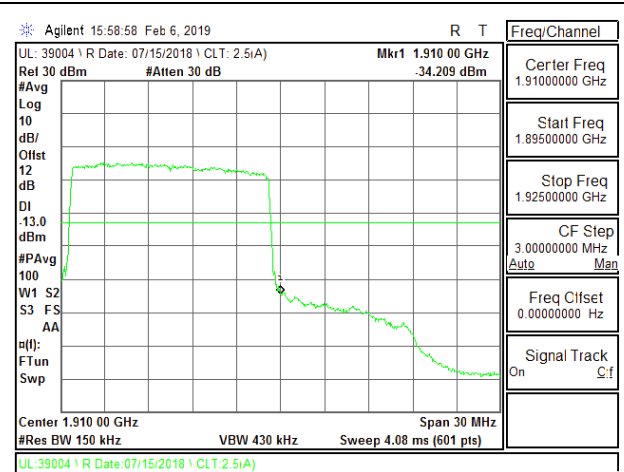
LTE B2 15MHz QPSK Low Channel RB1-0



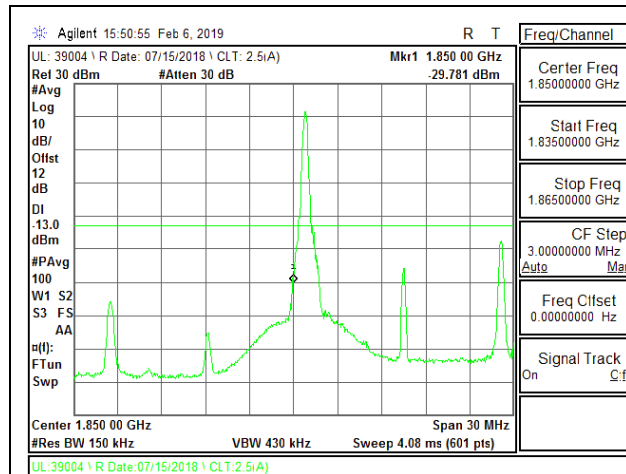
LTE B2 15MHz QPSK High Channel RB1-74



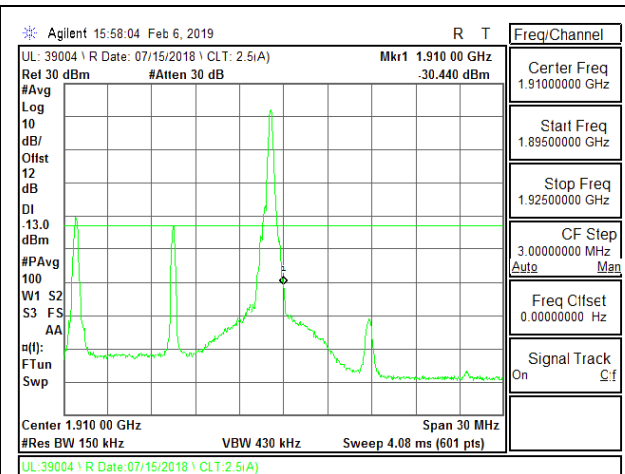
LTE B2 15MHz QPSK Low Channel RB75-0



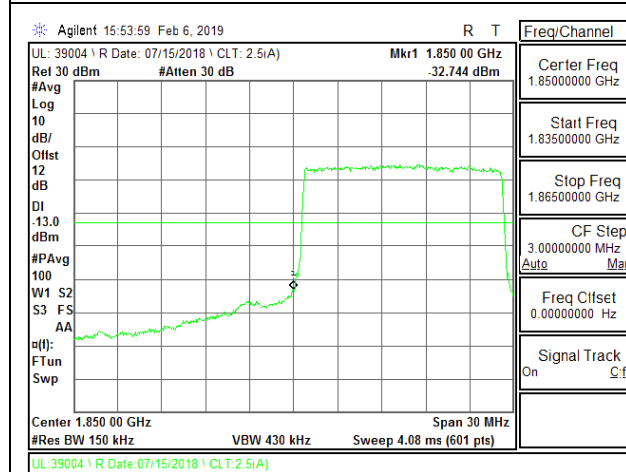
LTE B2 15MHz QPSK High Channel RB75-0



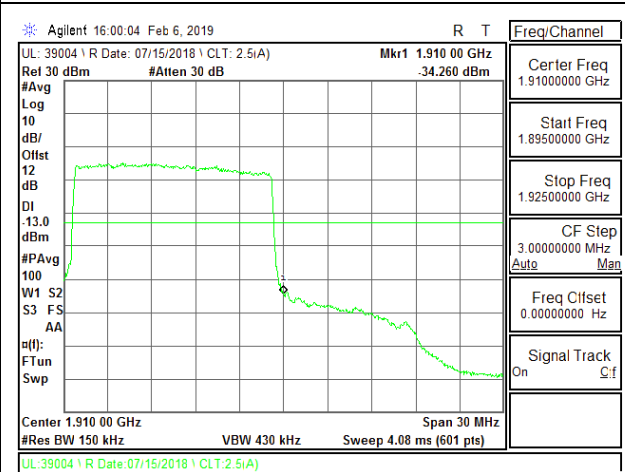
LTE B2 15MHz 16QAM Low Channel RB1-0



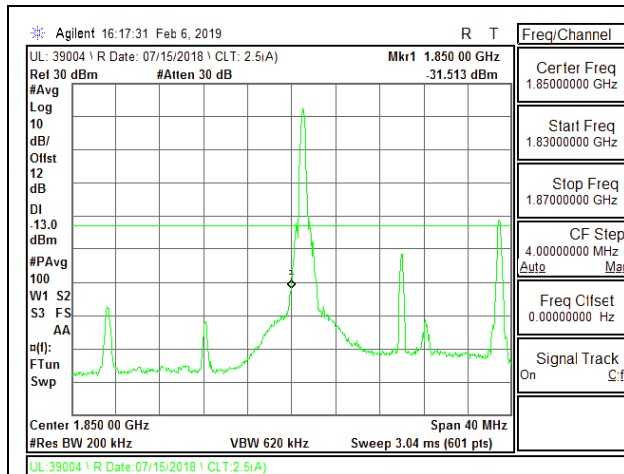
LTE B2 15MHz 16QAM High Channel RB1-74



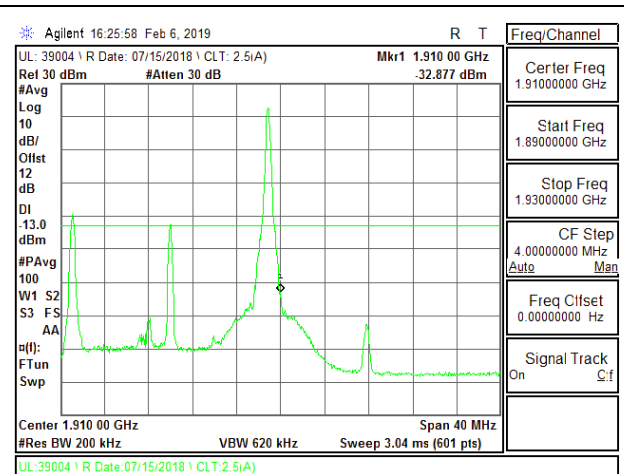
LTE B2 15MHz 16QAM Low Channel RB75-0



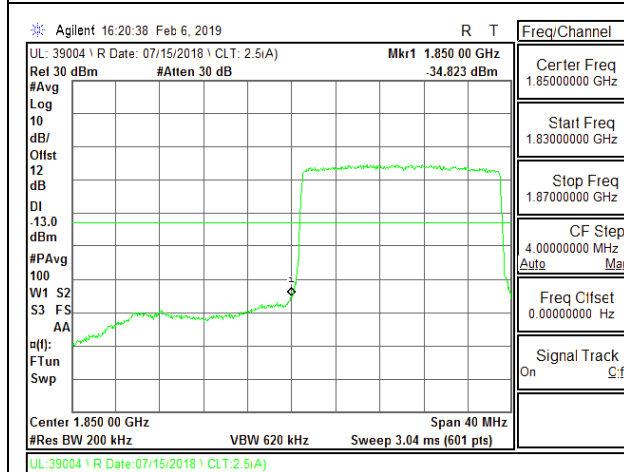
LTE B2 15MHz 16QAM High Channel RB75-0



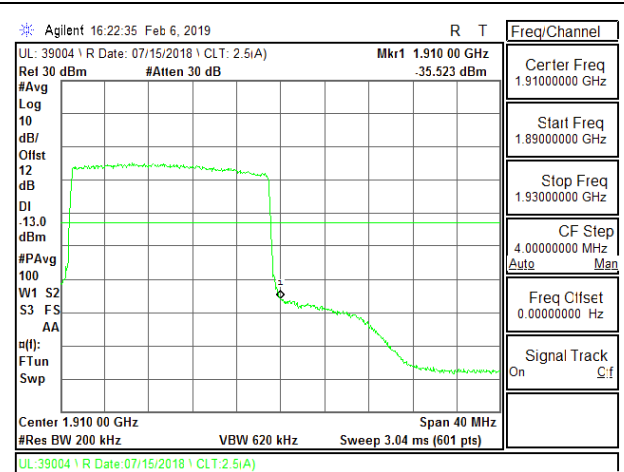
LTE B2 20MHz QPSK Low Channel RB1-0



LTE B2 20MHz QPSK High Channel RB1-99

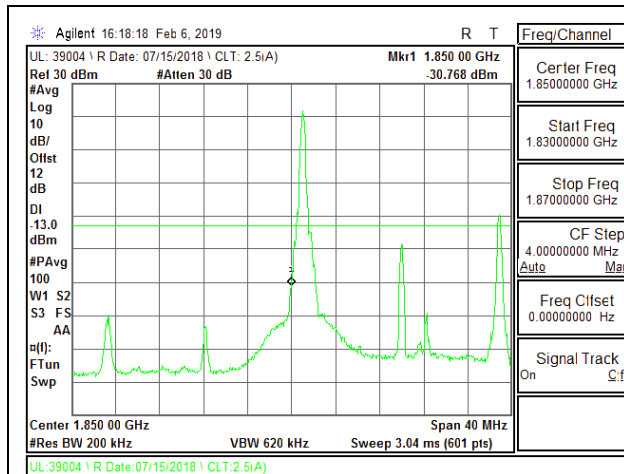


LTE B2 20MHz QPSK Low Channel RB100-0

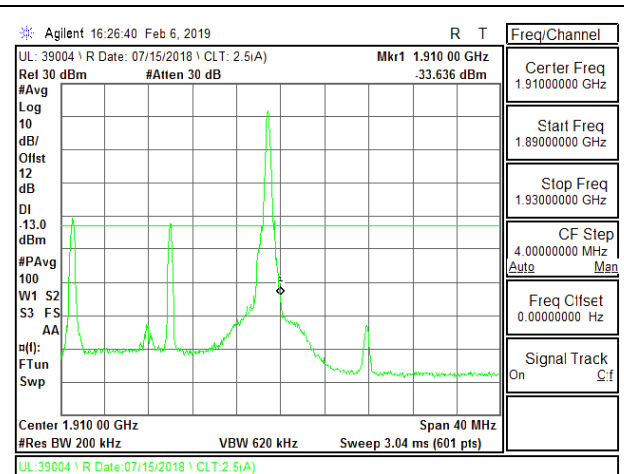


LTE B2 20MHz QPSK High Channel RB100-0

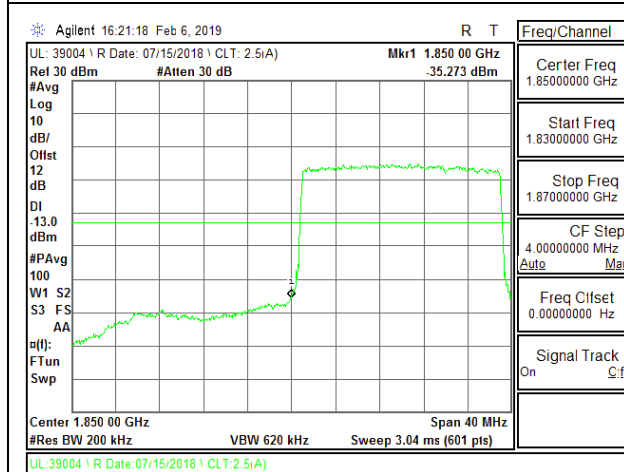




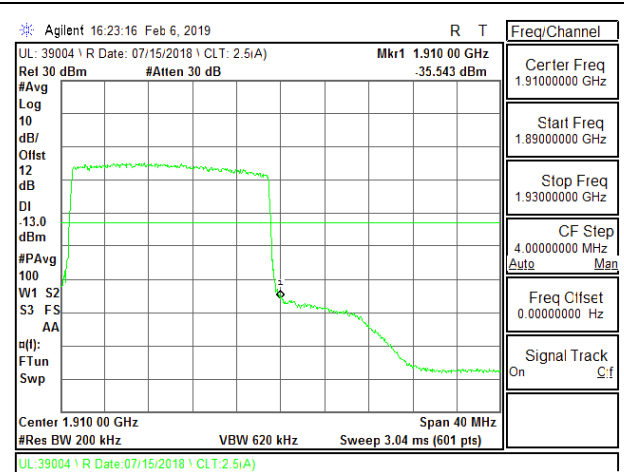
LTE B2 20MHz 16QAM Low Channel RB1-0



LTE B2 20MHz 16QAM High Channel RB1-99

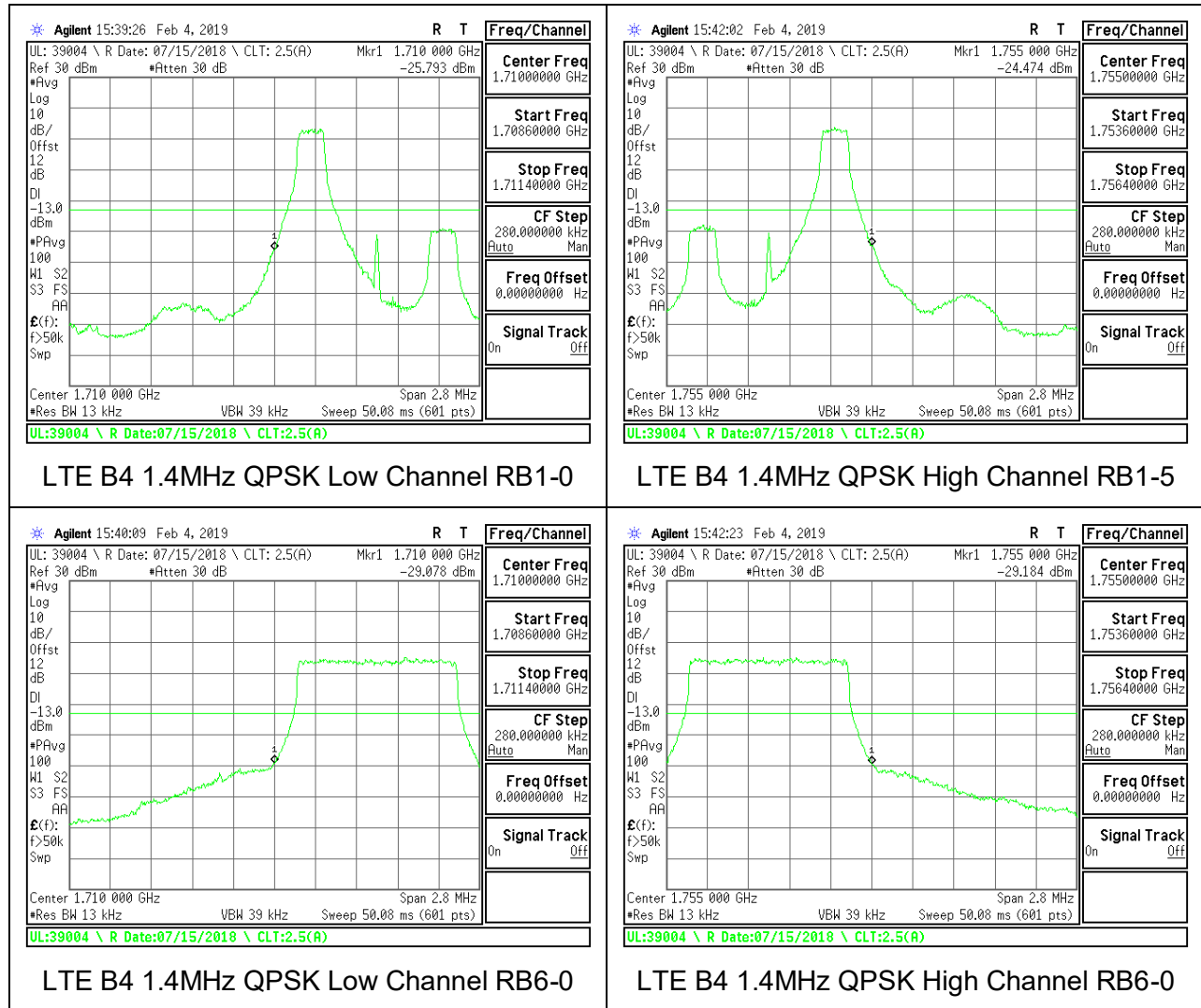


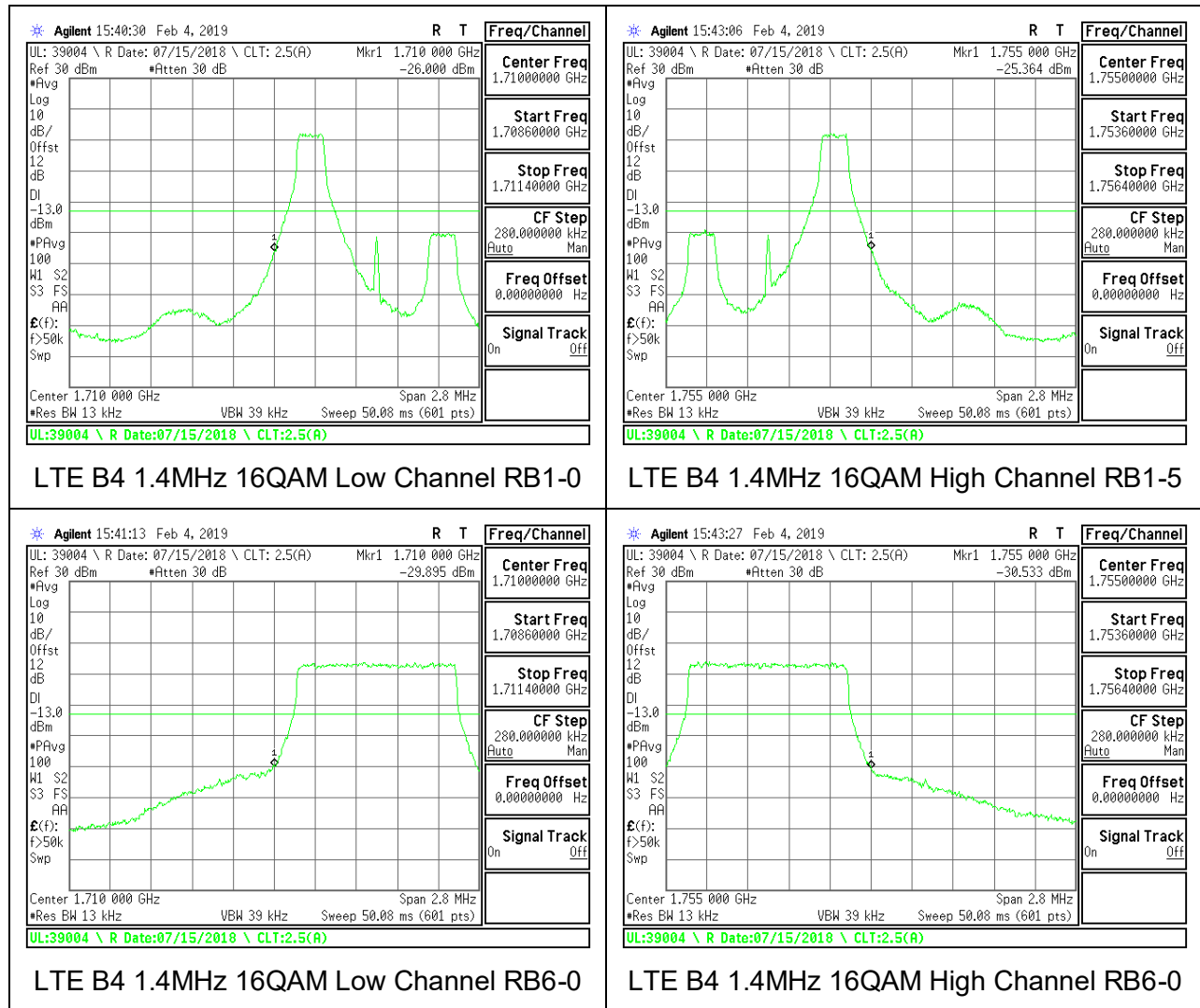
LTE B2 20MHz 16QAM Low Channel RB100-0

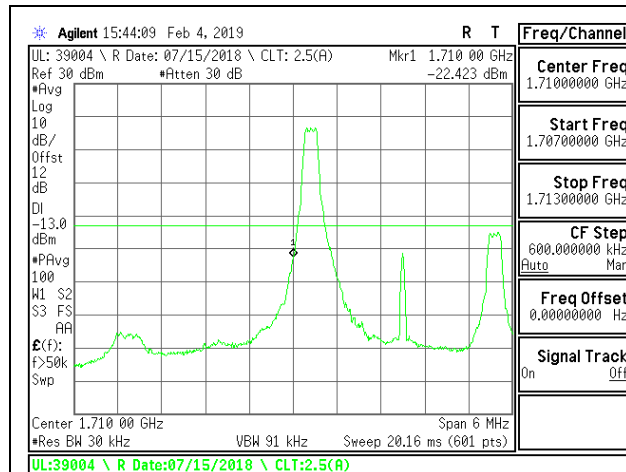


LTE B2 20MHz 16QAM High Channel RB100-0

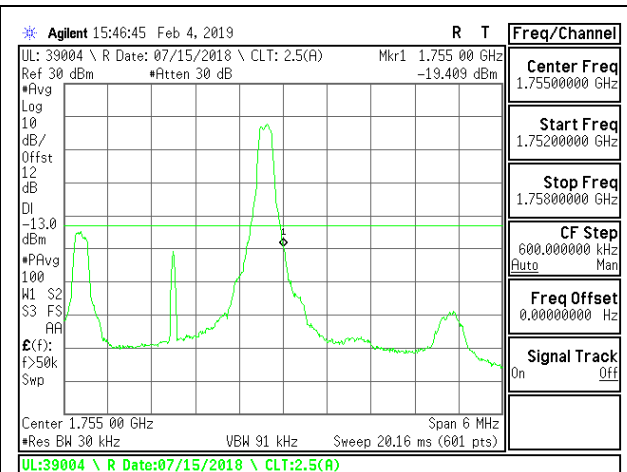
## 8.2.2. LTE BAND 4 BANDEDGE



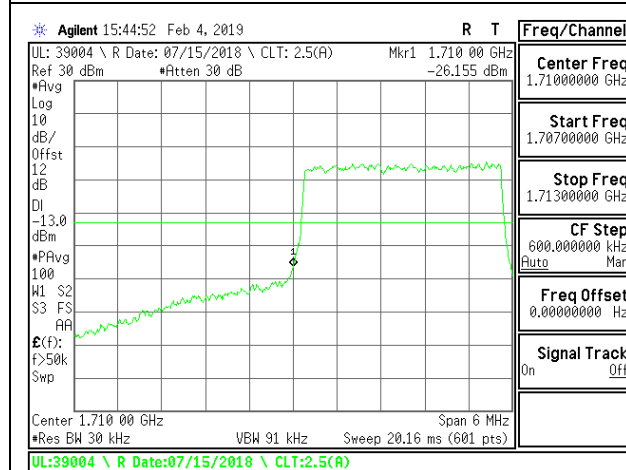




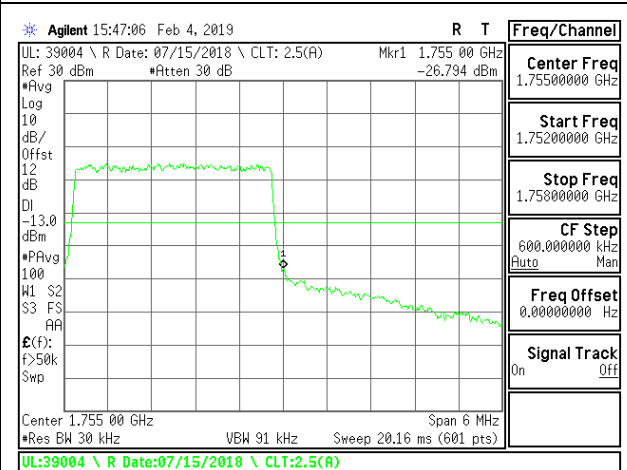
LTE B4 3MHz QPSK Low Channel RB1-0



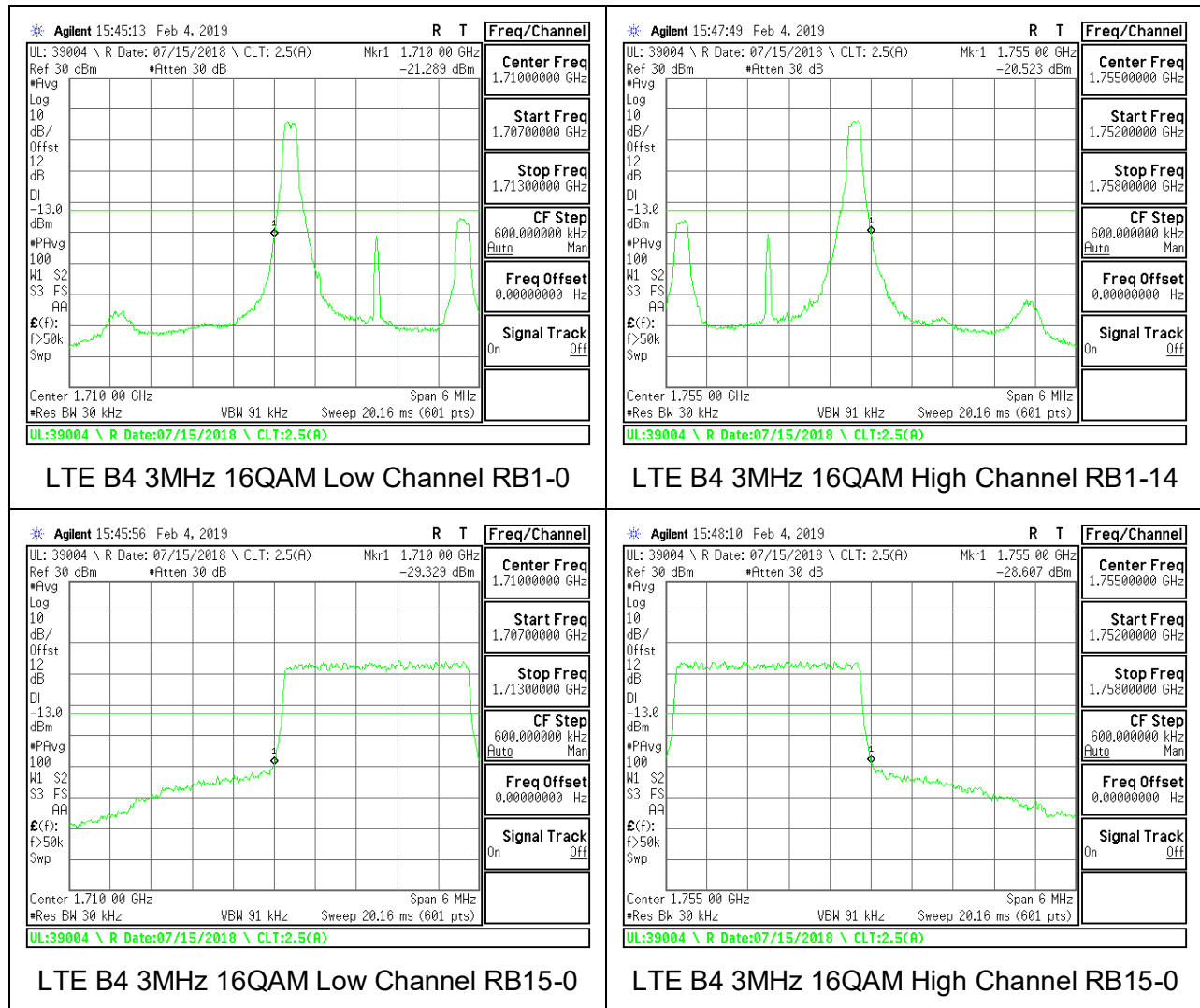
LTE B4 3MHz QPSK High Channel RB1-14

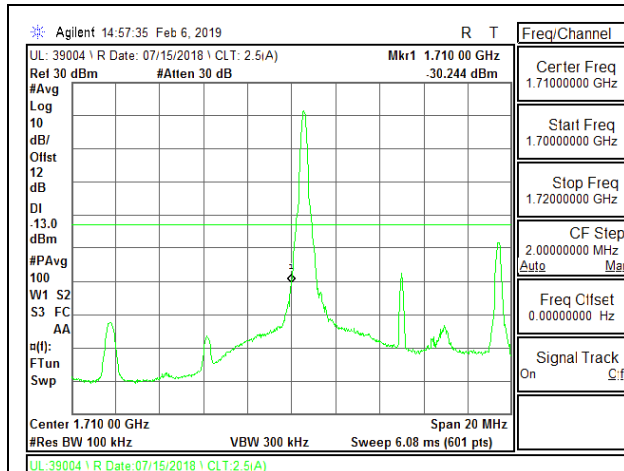


LTE B4 3MHz QPSK Low Channel RB15-0

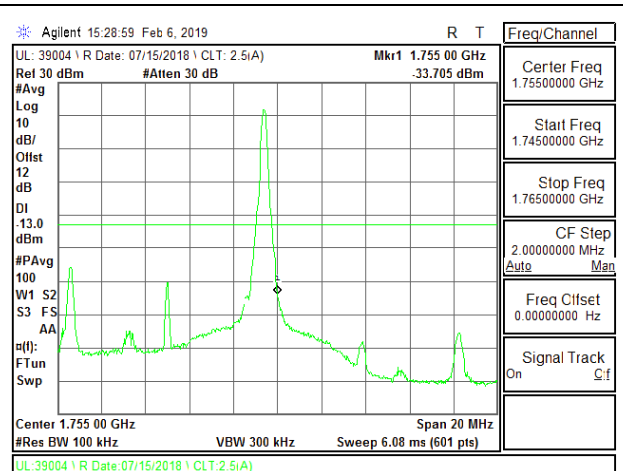


LTE B4 3MHz QPSK High Channel RB15-0

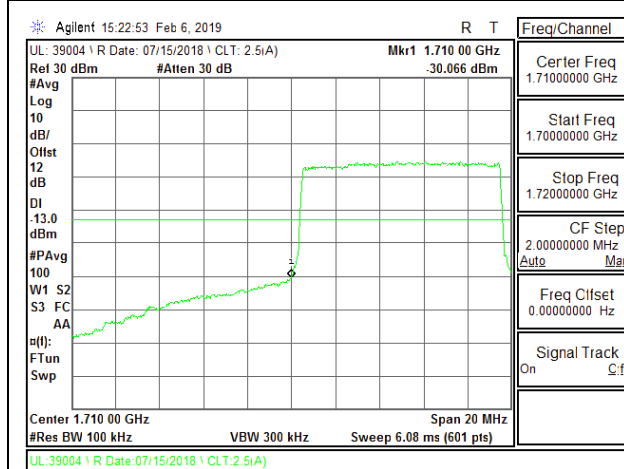




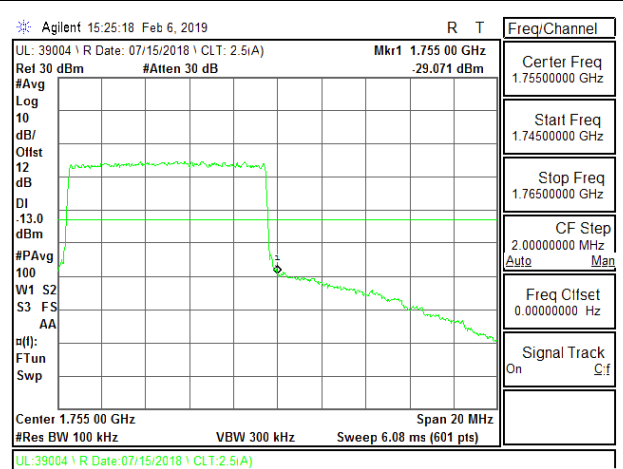
LTE B4 10MHz QPSK Low Channel RB1-0



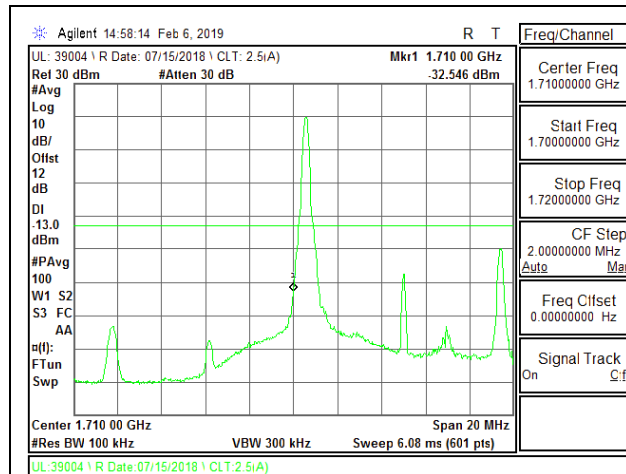
LTE B4 10MHz QPSK High Channel RB1-49



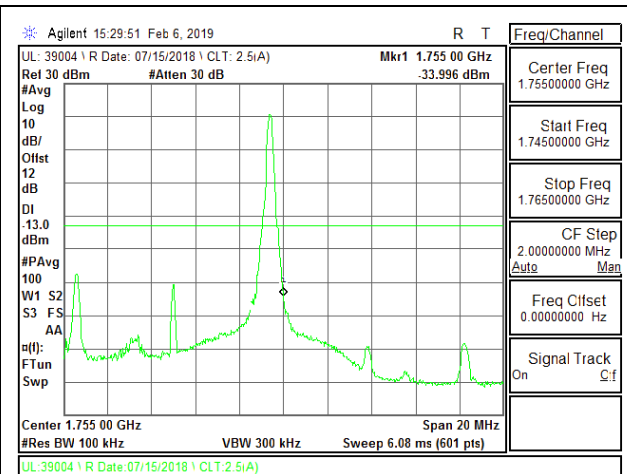
LTE B4 10MHz QPSK Low Channel RB50-0



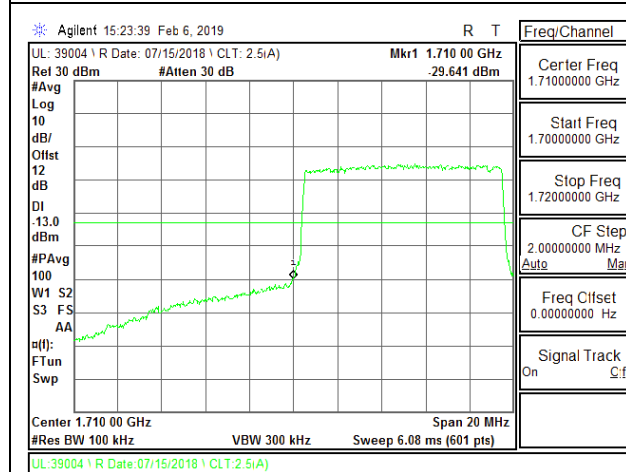
LTE B4 10MHz QPSK High Channel RB50-0



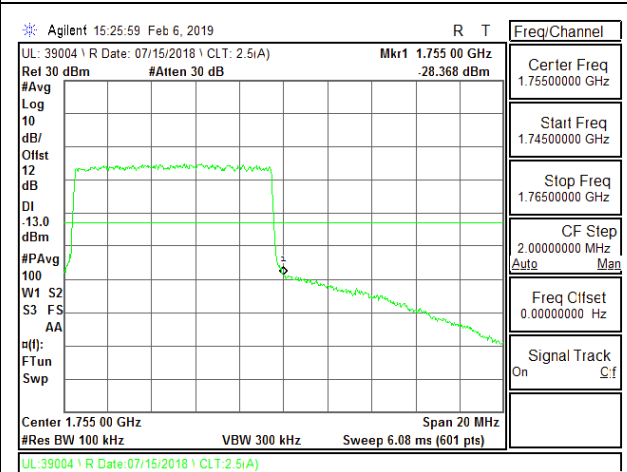
LTE B4 10MHz 16QAM Low Channel RB1-0



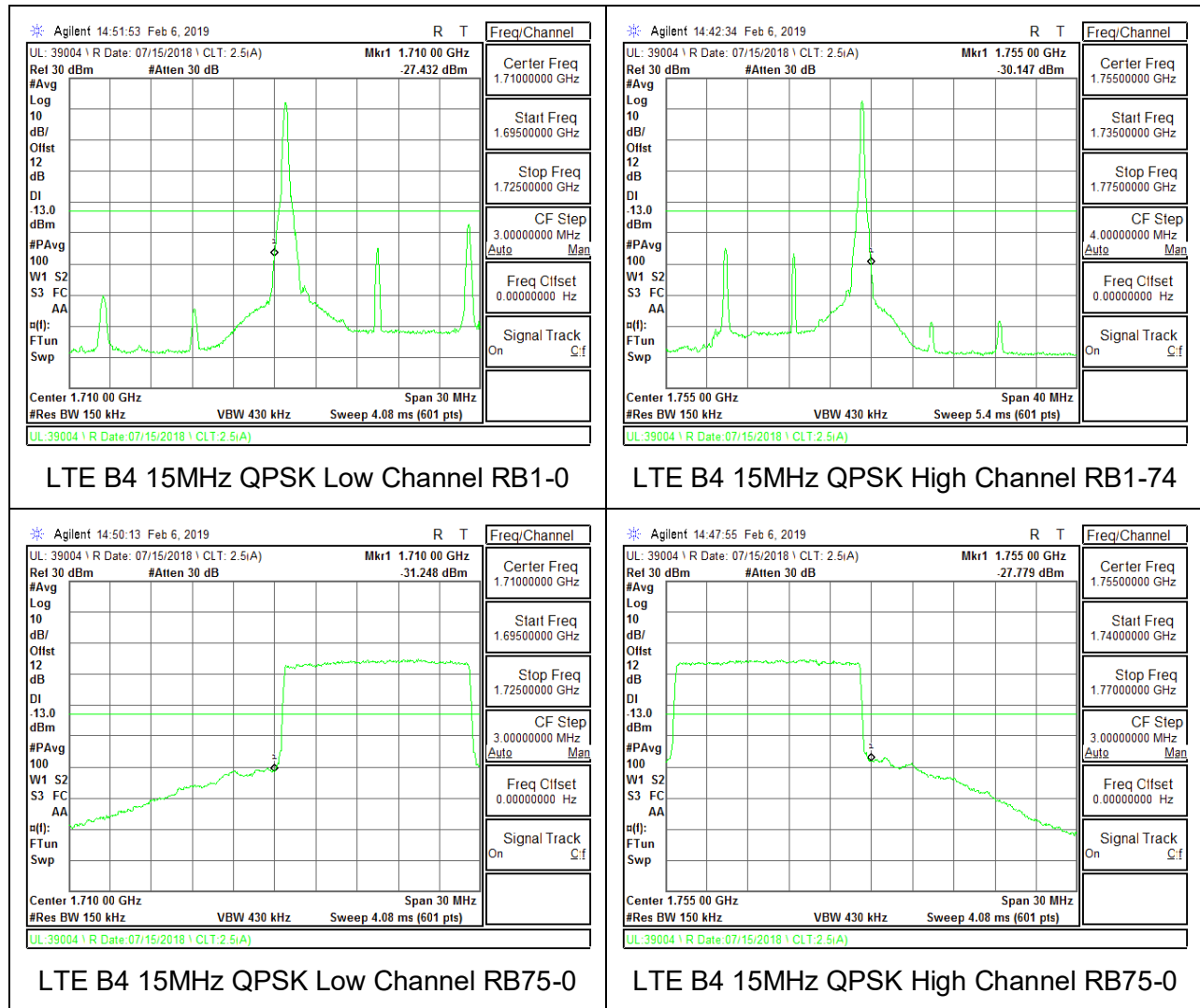
LTE B4 10MHz 16QAM High Channel RB1-49



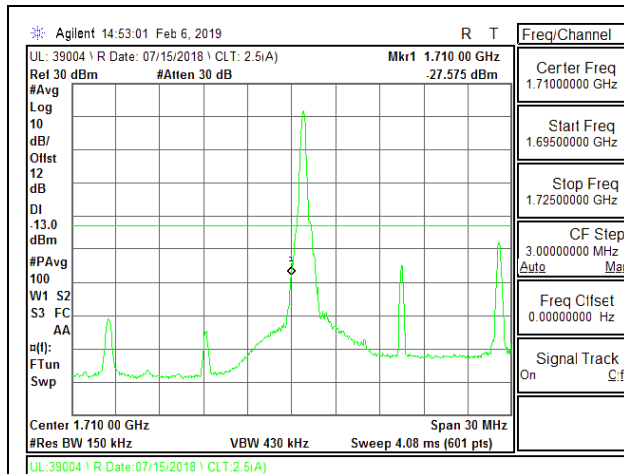
LTE B4 10MHz 16QAM Low Channel RB50-0



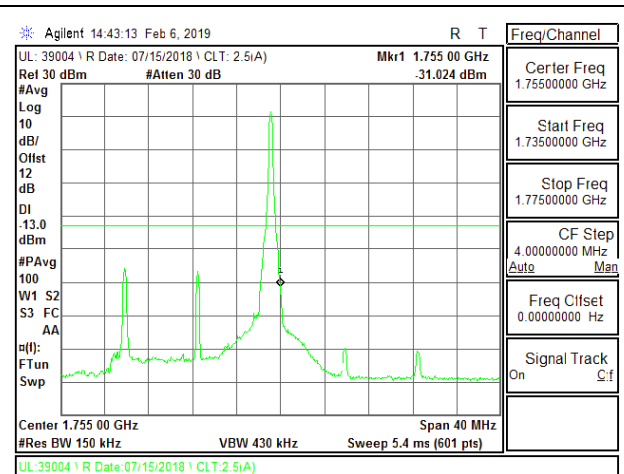
LTE B4 10MHz 16QAM High Channel RB50-0



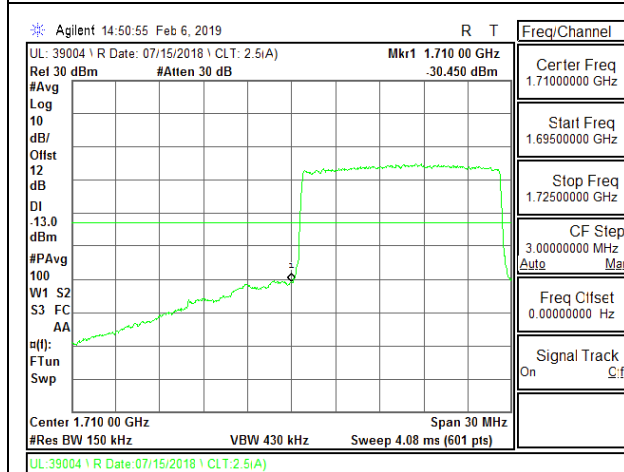




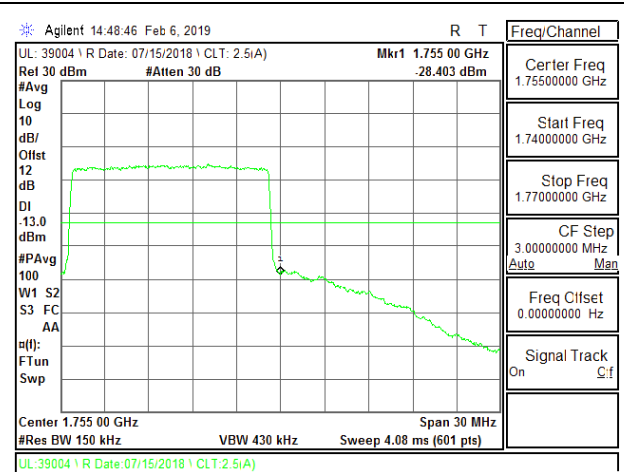
LTE B4 15MHz 16QAM Low Channel RB1-0



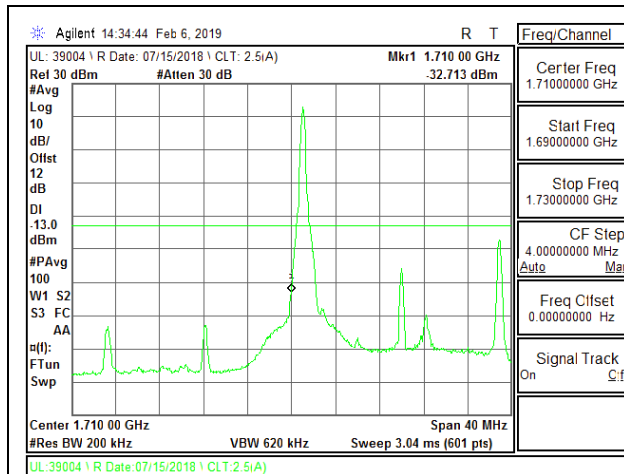
LTE B4 15MHz 16QAM High Channel RB1-74



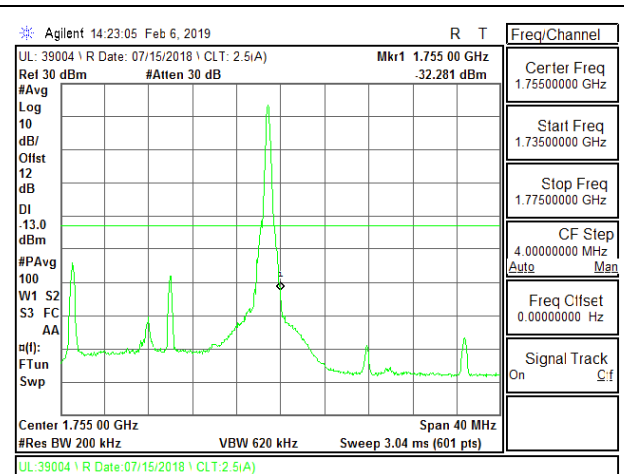
LTE B4 15MHz 16QAM Low Channel RB75-0



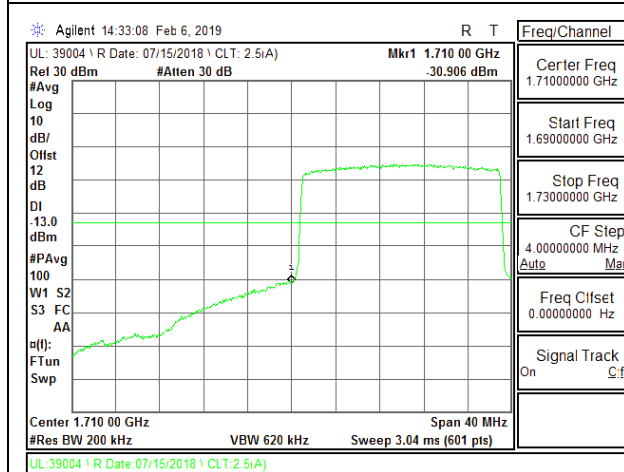
LTE B4 15MHz 16QAM High Channel RB75-0



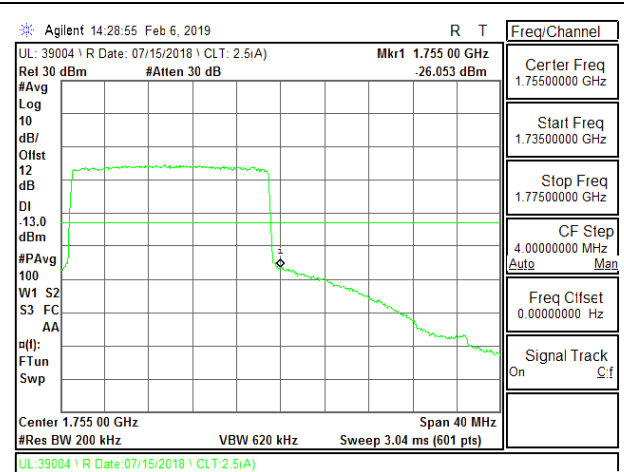
LTE B4 20MHz QPSK Low Channel RB1-0



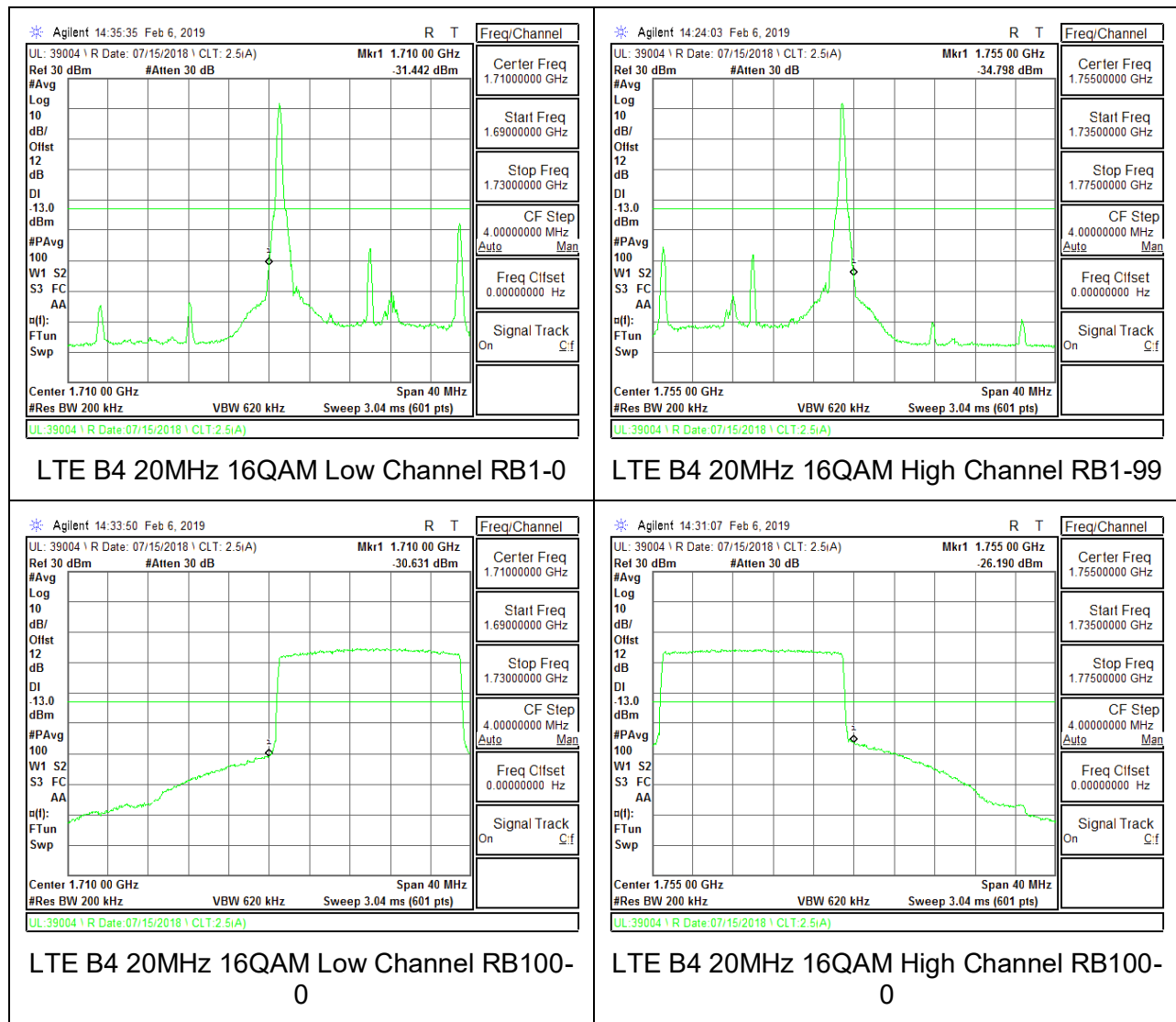
LTE B4 20MHz QPSK High Channel RB1-99



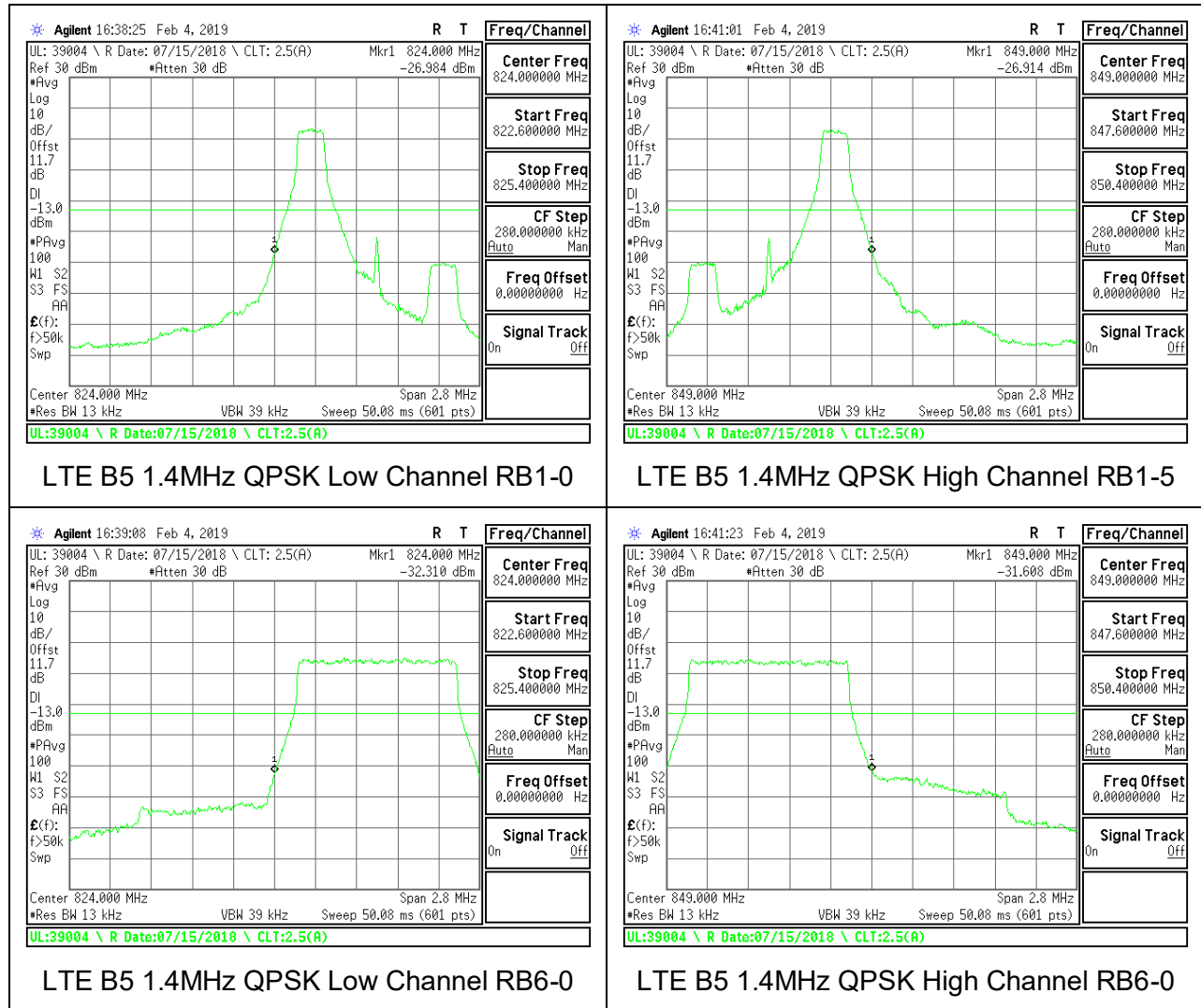
LTE B4 20MHz QPSK Low Channel RB100-0

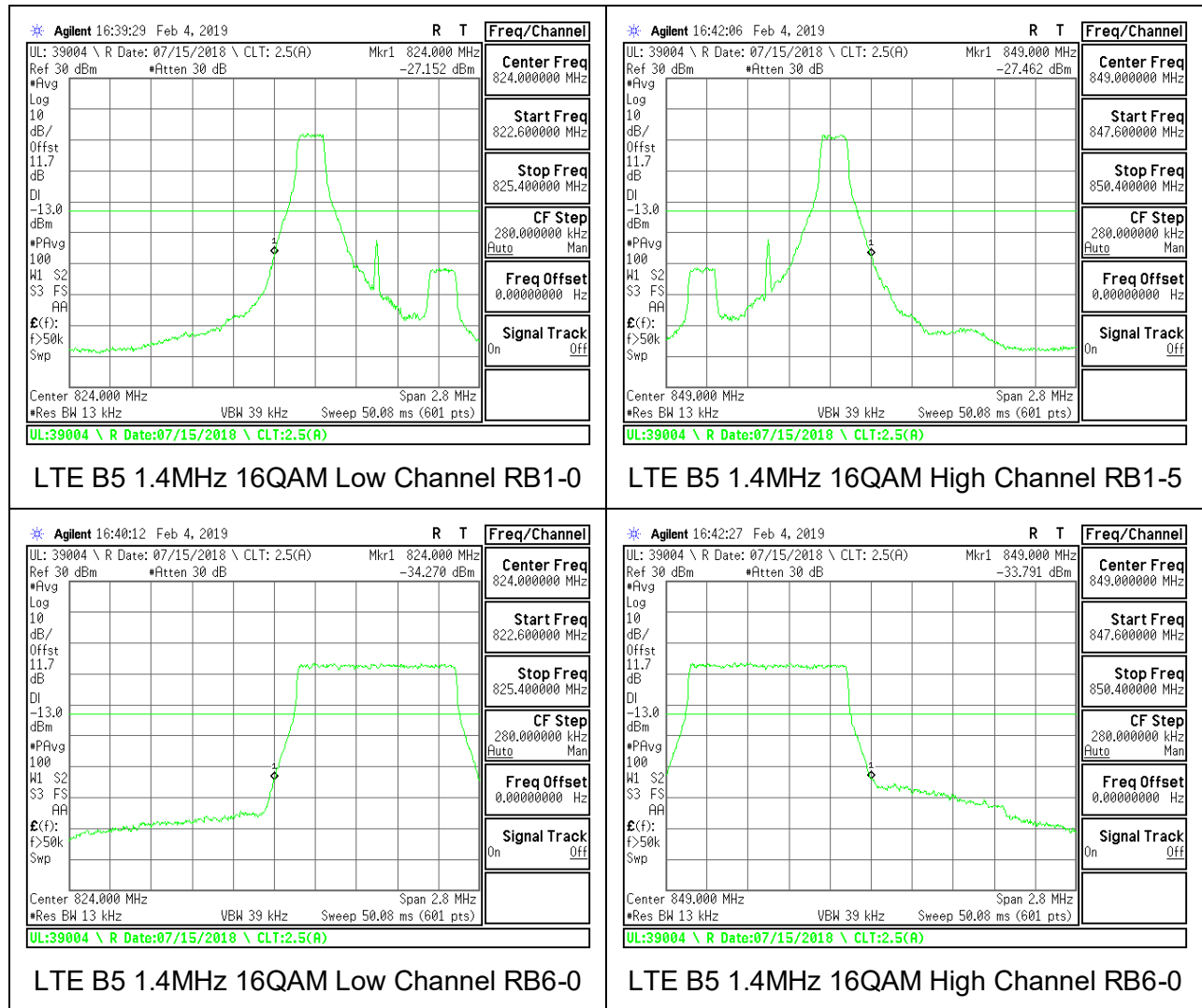


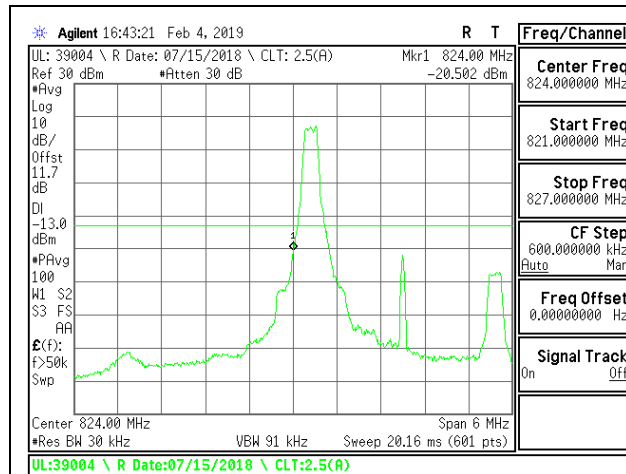
LTE B4 20MHz QPSK High Channel RB100-0



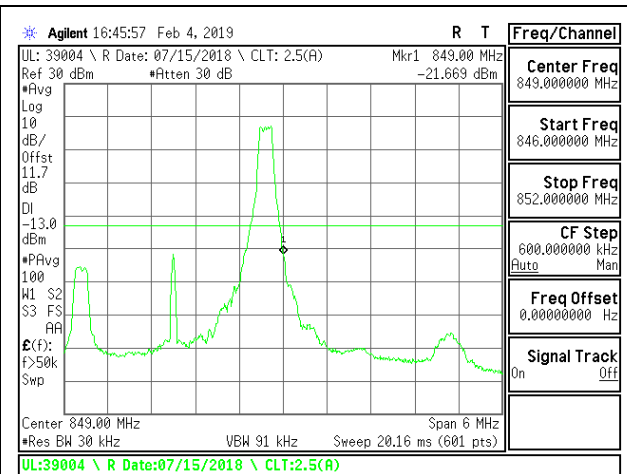
### 8.2.3. LTE BAND 5 BANDEDGE



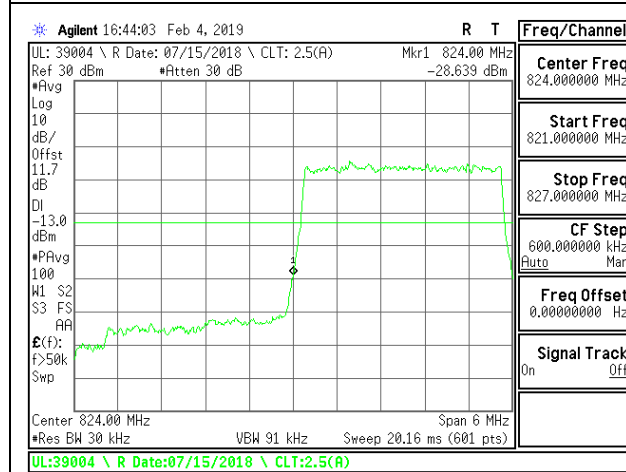




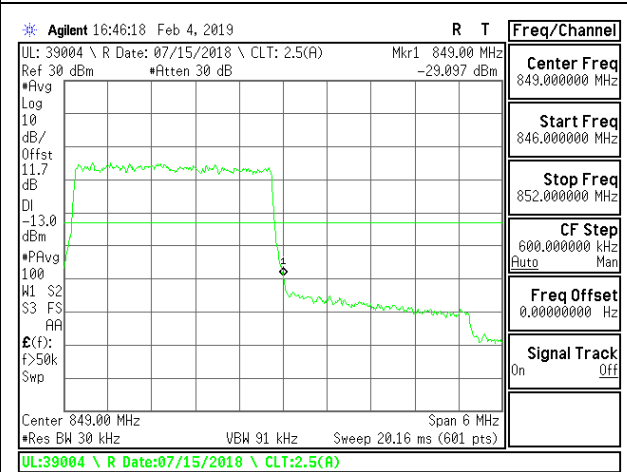
LTE B5 3MHz QPSK Low Channel RB1-0



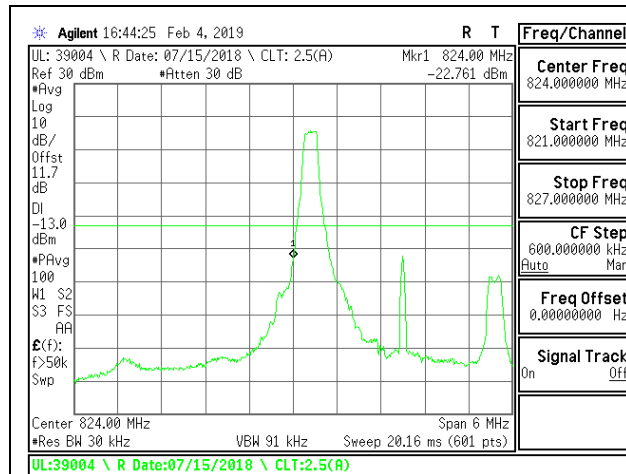
LTE B5 3MHz QPSK High Channel RB1-14



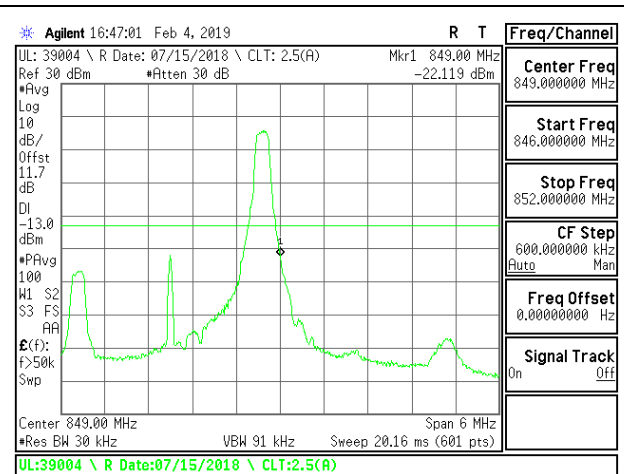
LTE B5 3MHz QPSK Low Channel RB15-0



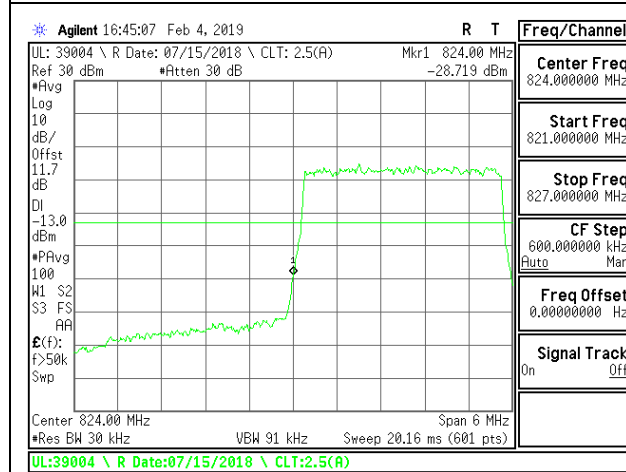
LTE B5 3MHz QPSK High Channel RB15-0



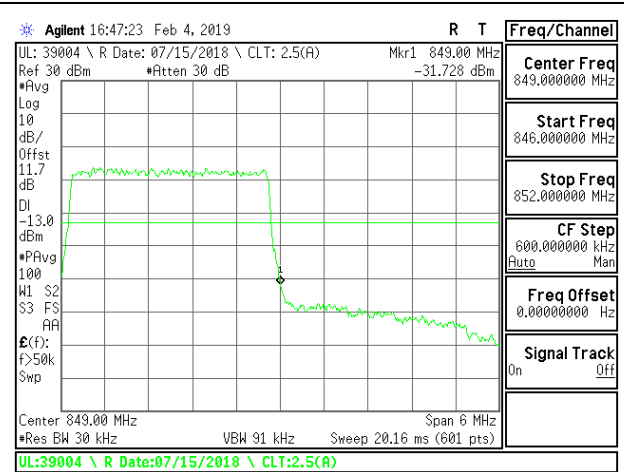
LTE B5 3MHz 16QAM Low Channel RB1-0



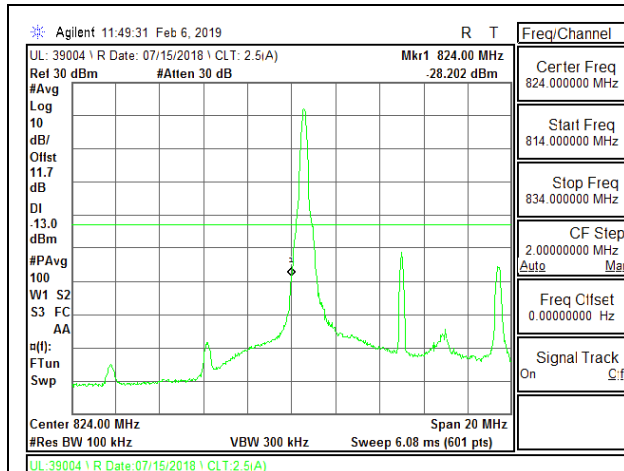
LTE B5 3MHz 16QAM High Channel RB1-14



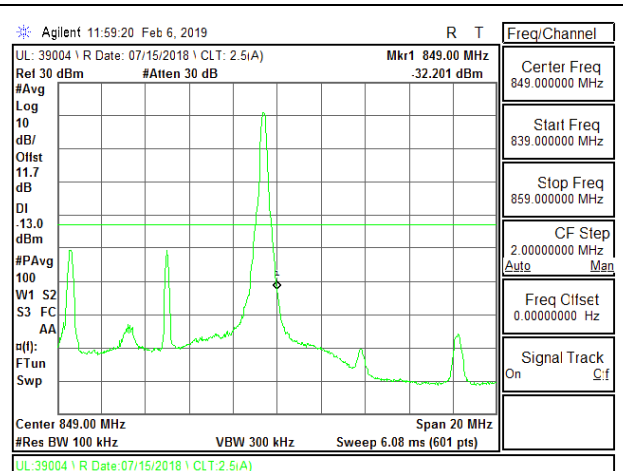
LTE B5 3MHz 16QAM Low Channel RB15-0



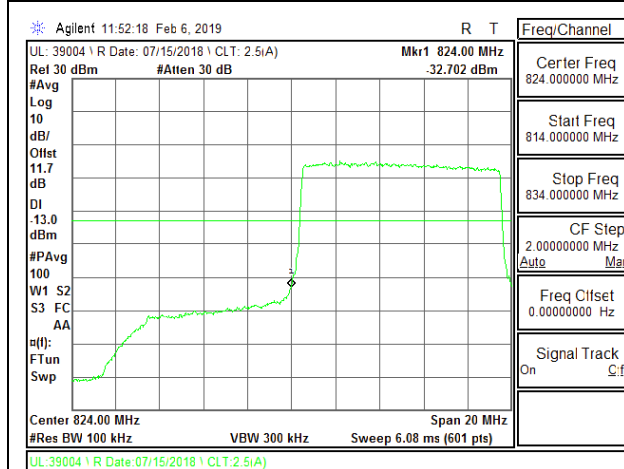
LTE B5 3MHz 16QAM High Channel RB15-0



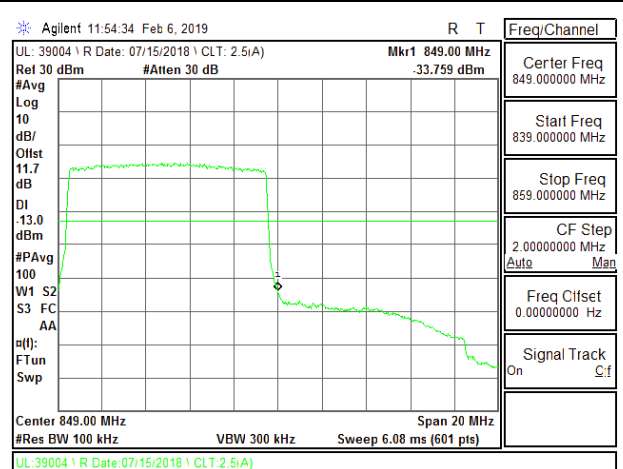
LTE B5 10MHz QPSK Low Channel RB1-0



LTE B5 10MHz QPSK High Channel RB1-49

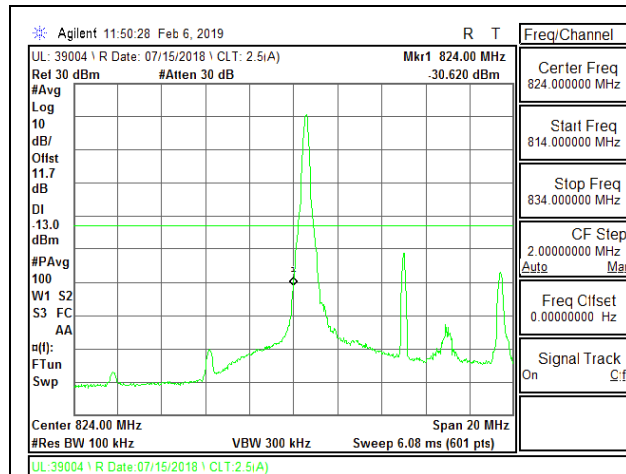


LTE B5 10MHz QPSK Low Channel RB50-0

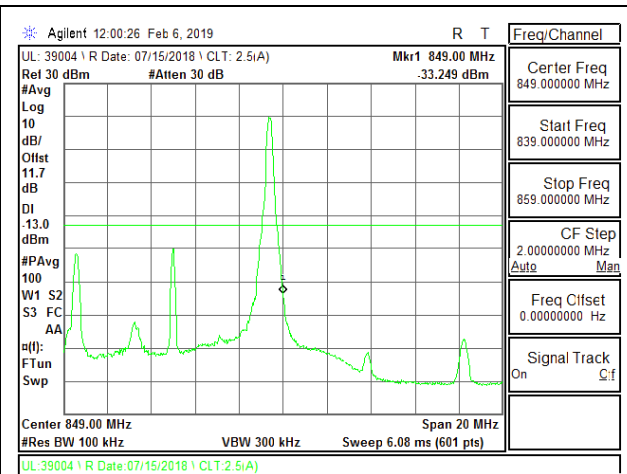


LTE B5 10MHz QPSK High Channel RB50-0

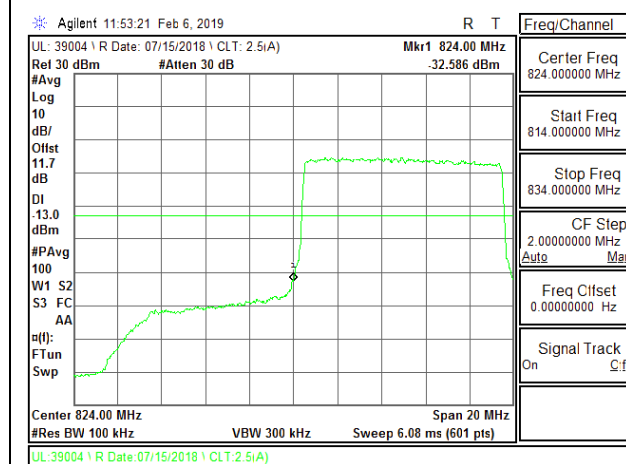




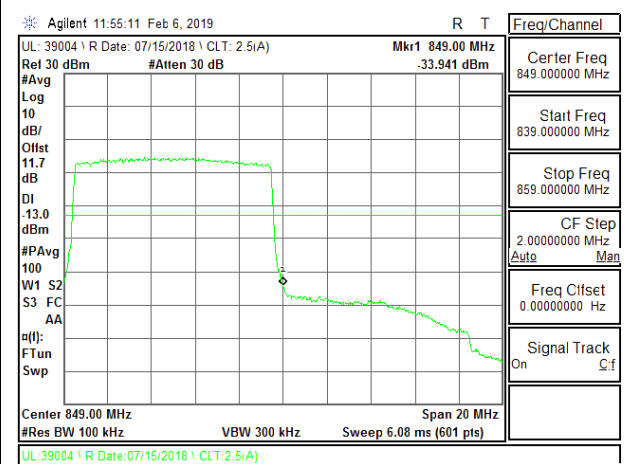
LTE B5 10MHz 16QAM Low Channel RB1-0



LTE B5 10MHz 16QAM High Channel RB1-49

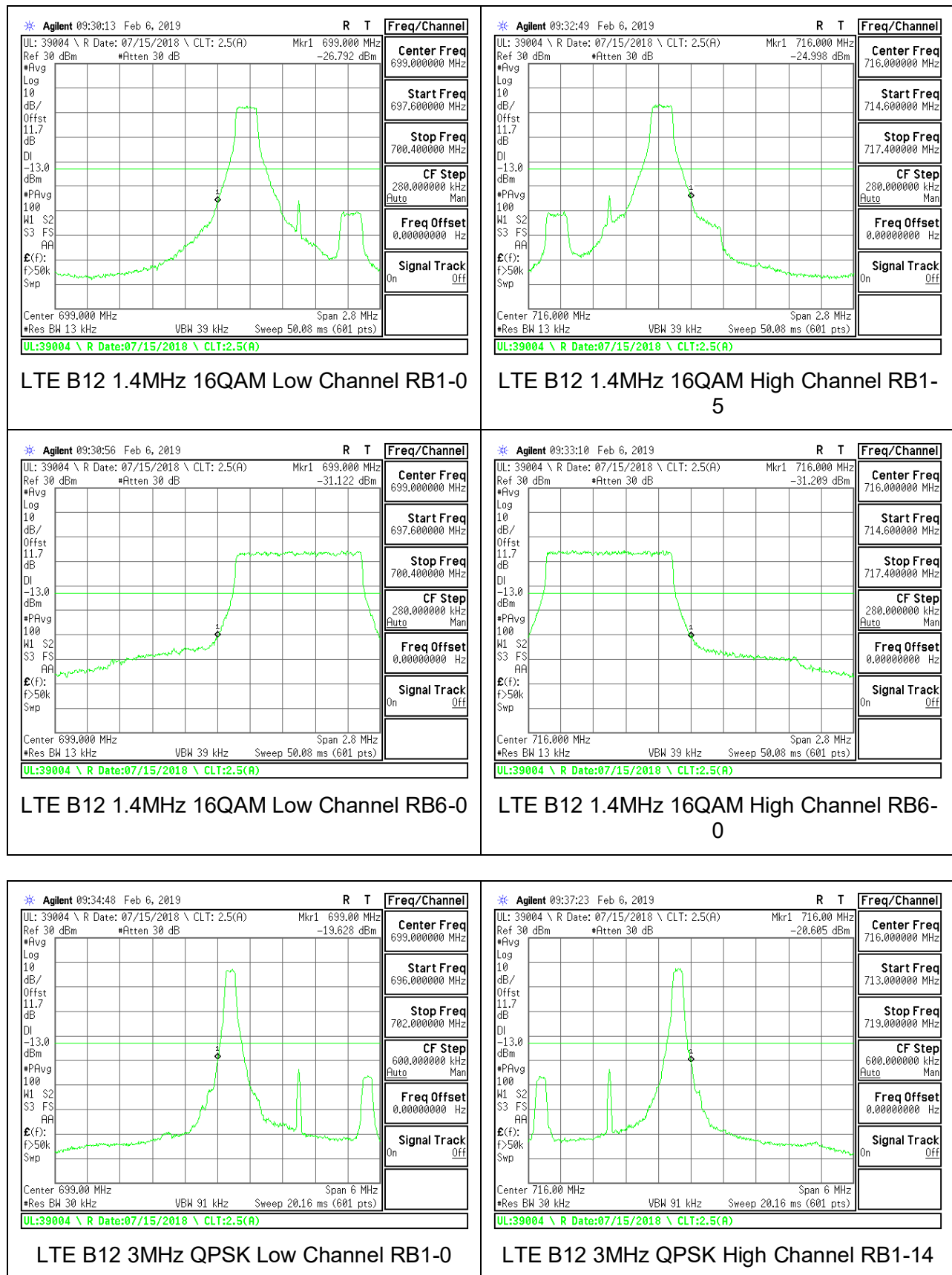


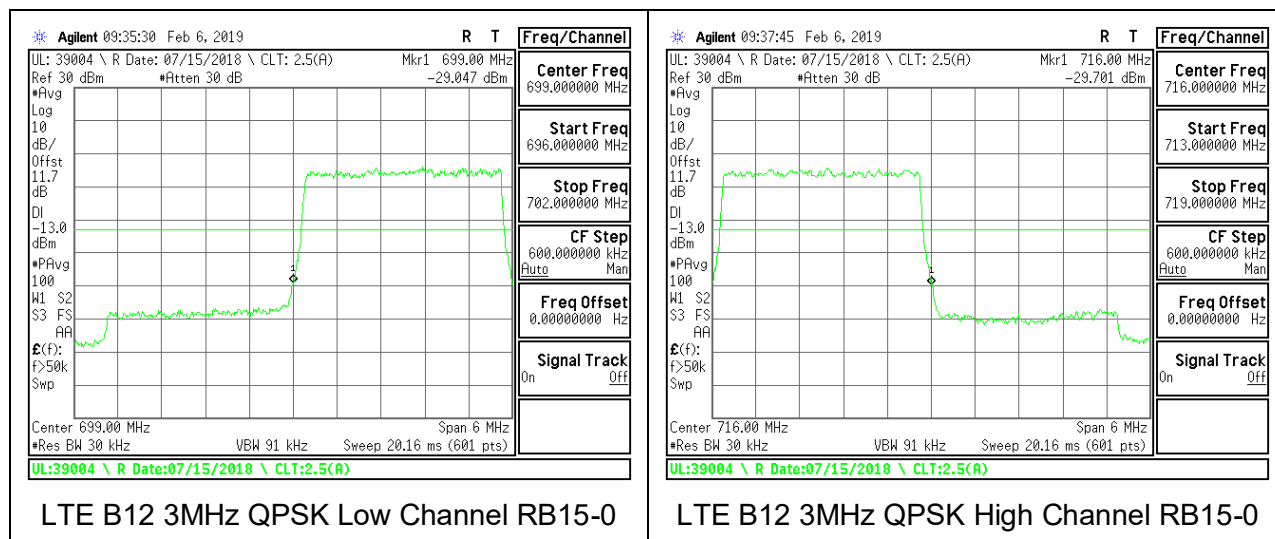
LTE B5 10MHz 16QAM Low Channel RB50-0

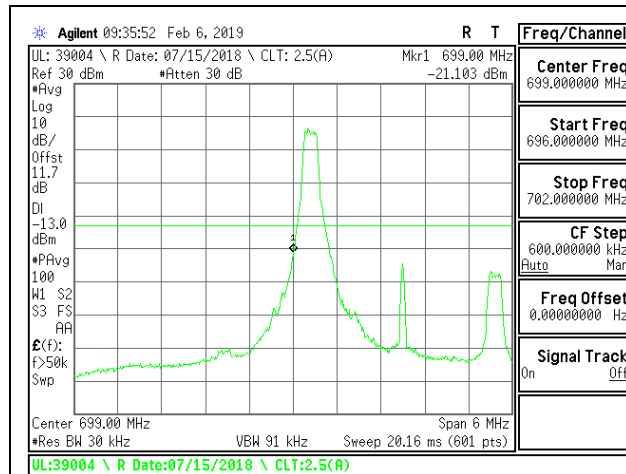


LTE B5 10MHz 16QAM High Channel RB50-0

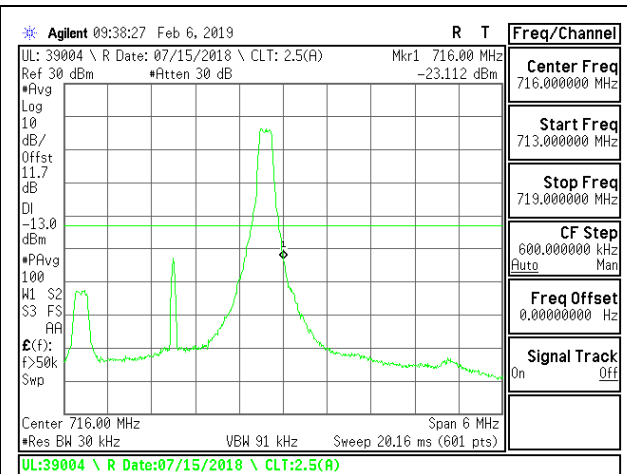




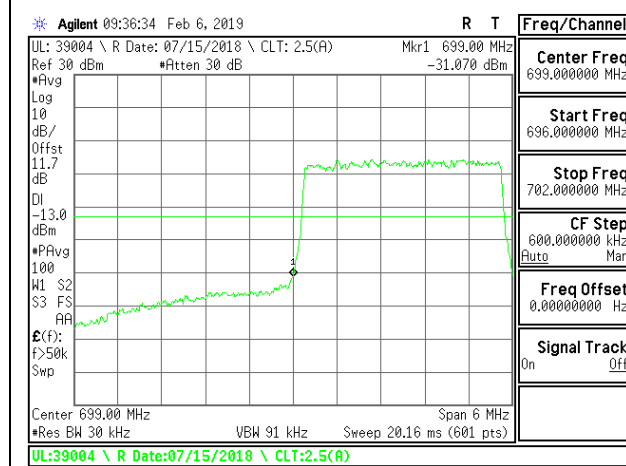




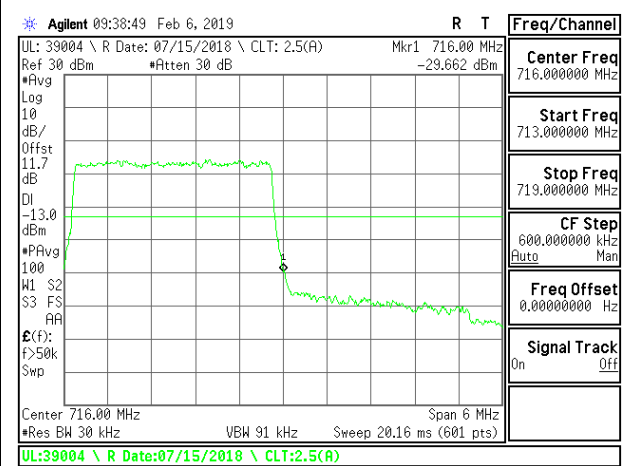
LTE B12 3MHz 16QAM Low Channel RB1-0



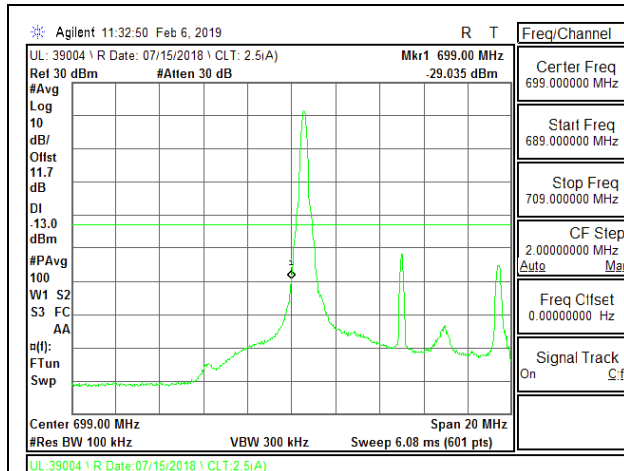
LTE B12 3MHz 16QAM High Channel RB1-14



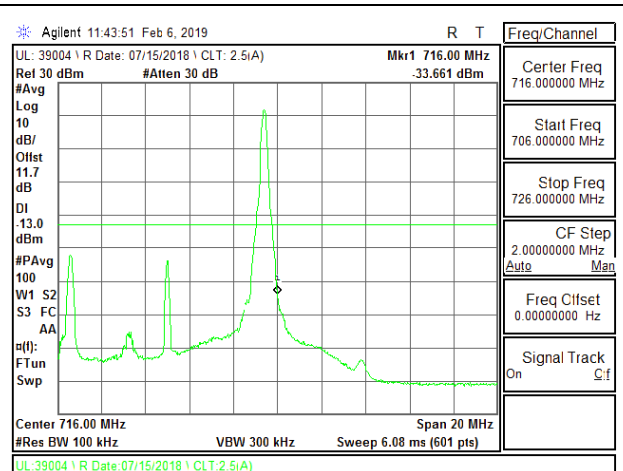
LTE B12 3MHz 16QAM Low Channel RB15-0



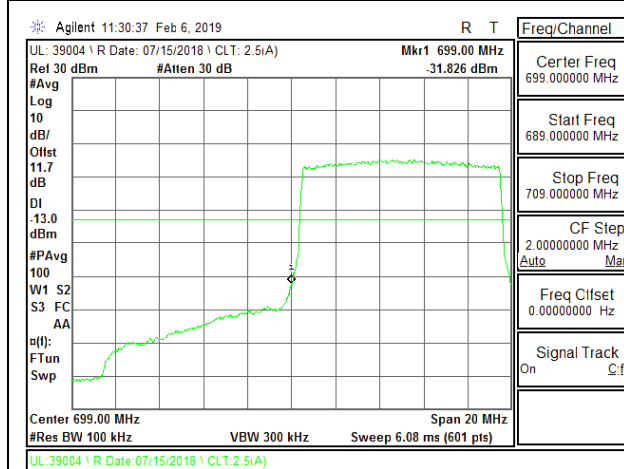
LTE B12 3MHz 16QAM High Channel RB15-0



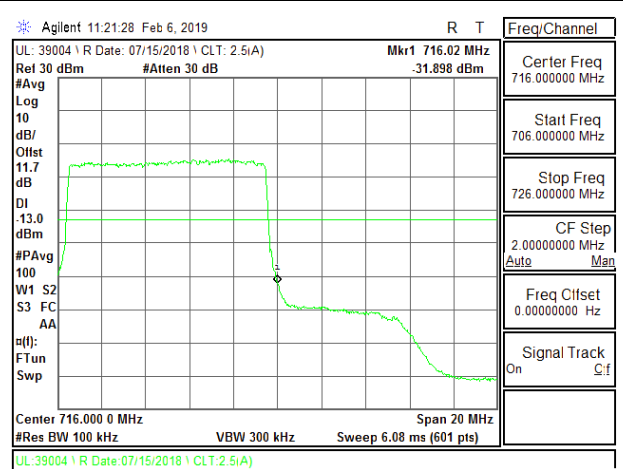
LTE B12 10MHz QPSK Low Channel RB1-0



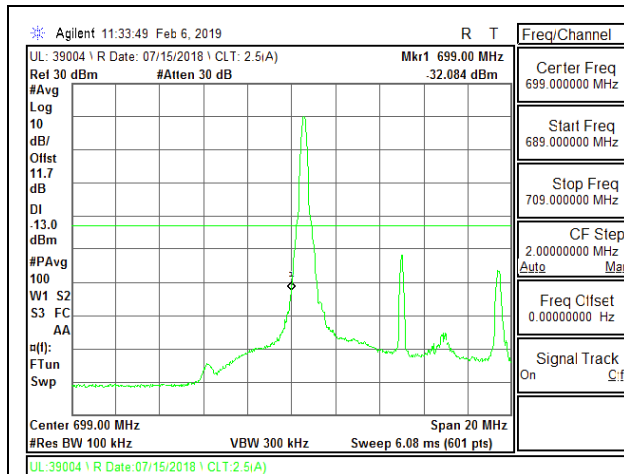
LTE B12 10MHz QPSK High Channel RB1-49



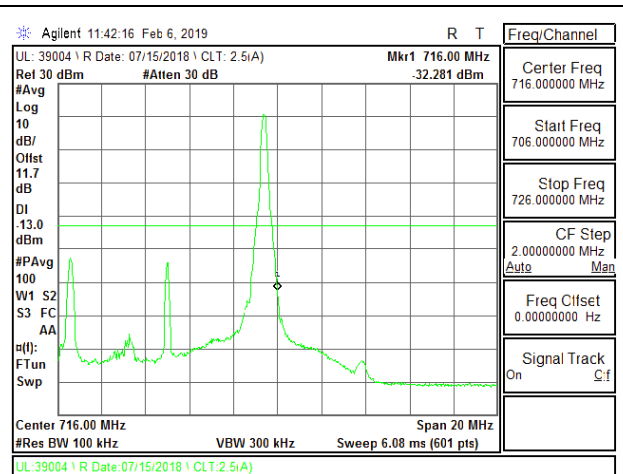
LTE B12 10MHz QPSK Low Channel RB50-0



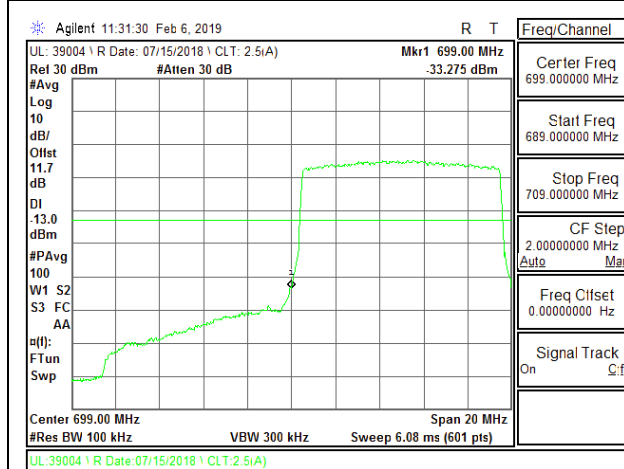
LTE B12 10MHz QPSK High Channel RB50-0



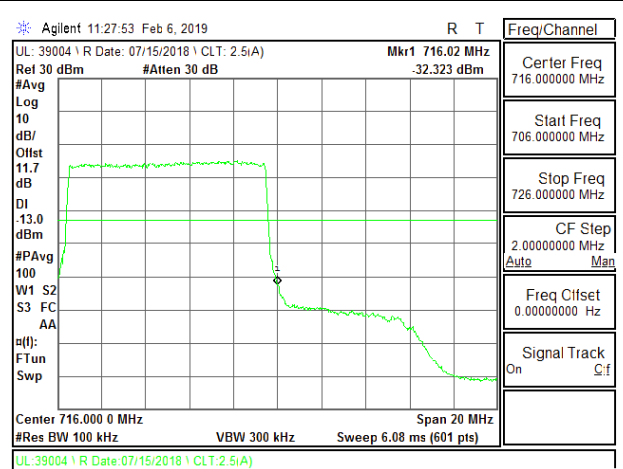
LTE B12 10MHz 16QAM Low Channel RB1-0



LTE B12 10MHz 16QAM High Channel RB1-49



LTE B12 10MHz 16QAM Low Channel RB50-0



LTE B12 10MHz 16QAM High Channel RB50-0

### 8.3. OUT OF BAND EMISSIONS

#### RULE PART(S)

FCC: §2.1051, §22.901, §22.917, §24.238, §27.53

IC:RSS130§4.6, RSS132§5.5; RSS133§6.5, RSS139§6.6

#### LIMITS

FCC: §22.917, §24.238, §27.53 (g), (h)

The minimum permissible attenuation level of any spurious emissions is  $43 + 10 \log (P)$  dB where transmitting power (P) in Watts.

RSS130§4.6, RSS132§5.5, RSS133§6.5, RSS139§6.6

The minimum permissible attenuation level of any spurious emissions is  $43 + 10 \log (P)$  dB where transmitting power (P) in Watts.

#### TEST PROCEDURE

The RF output of the transmitter was connected to a spectrum analyzer through a calibrated coaxial cable. Sufficient scans were taken to show the out-of-band Emissions, if any, up to 10th harmonic. Multiple sweeps were recorded in maximum hold mode using a peak detector to ensure that the worst-case emissions were caught.

For each out of band emissions measurement:

- Set display line at -13 dBm
- Set RBW & VBW to 100 kHz for the measurement below 1 GHz, and 1 MHz for the measurement above 1 GHz. (NOTE: Worst case set RBW/VBW to 1MHz/3MHz)

#### MODES TESTED

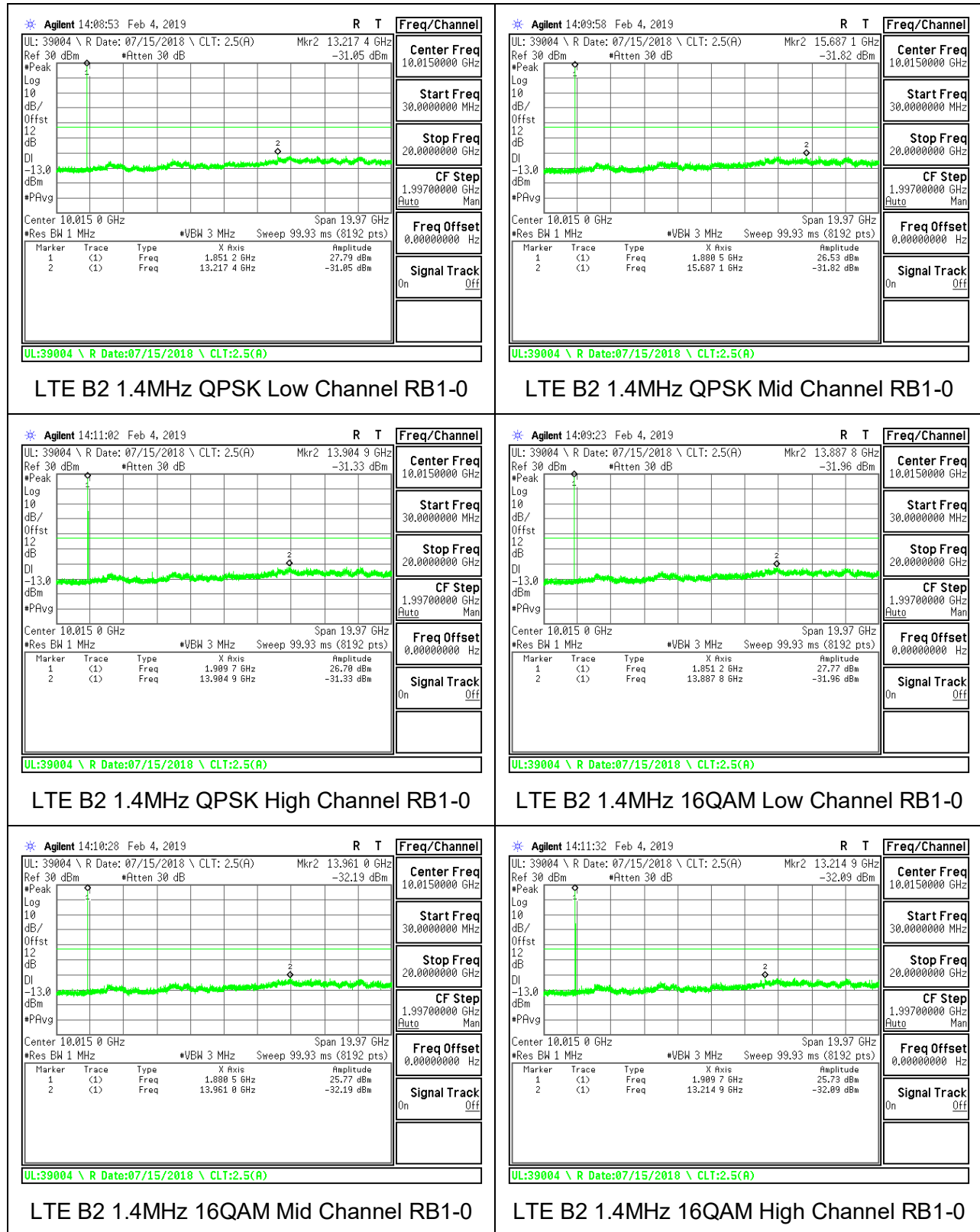
- LTE Band 2
- LTE Band 4
- LTE Band 5
- LTE Band 12

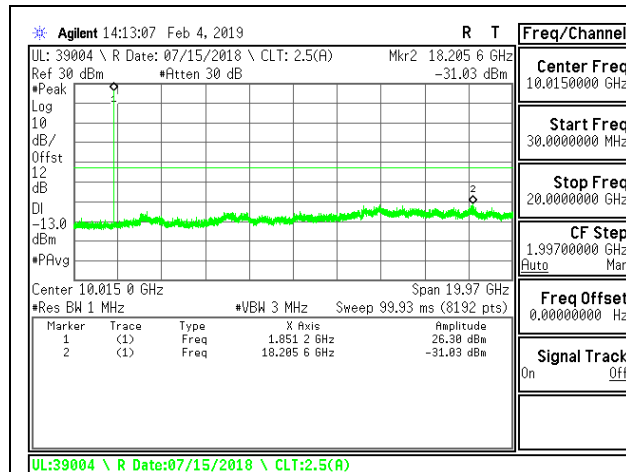
#### RESULTS

|     |       |       |        |
|-----|-------|-------|--------|
| ID: | 39004 | Date: | 2/4/19 |
|-----|-------|-------|--------|

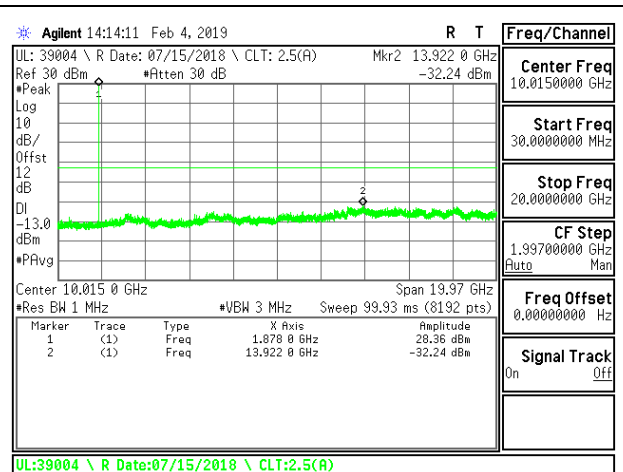


### 8.3.1. LTE BAND 2

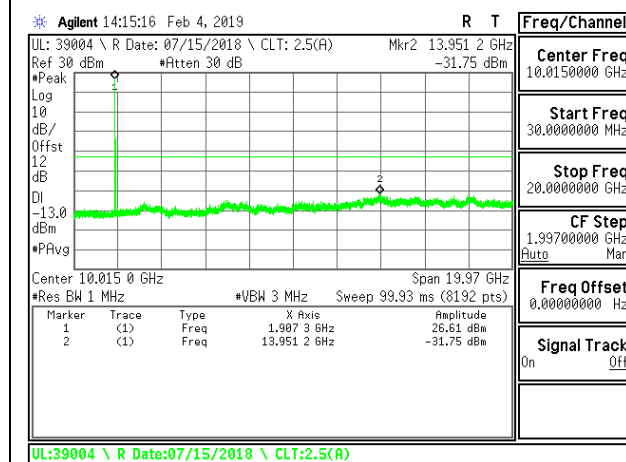




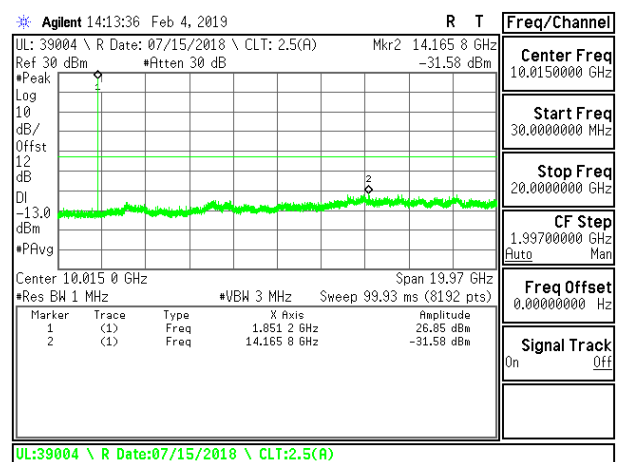
LTE B2 3MHz QPSK Low Channel RB1-0



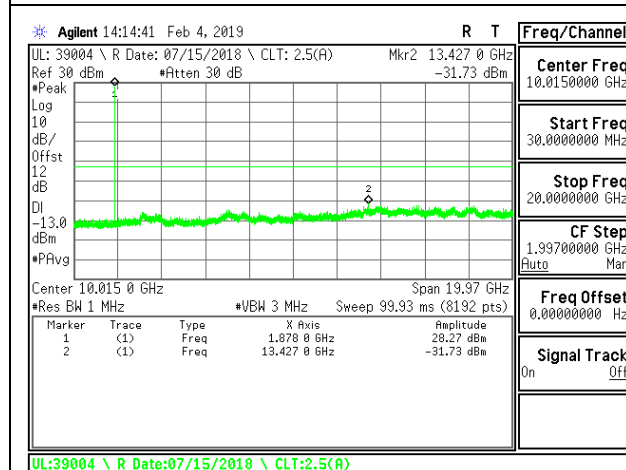
LTE B2 3MHz QPSK Mid Channel RB1-0



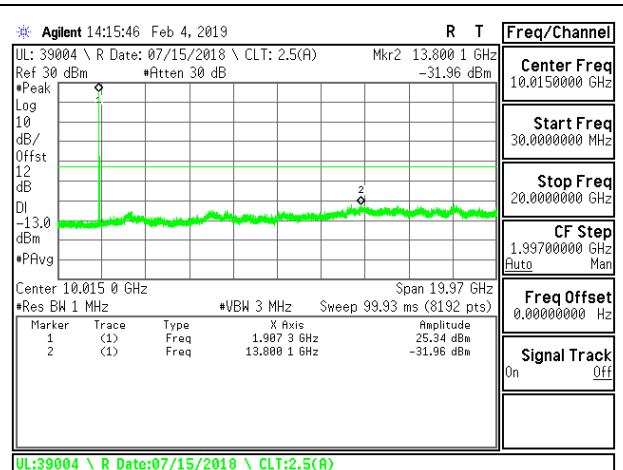
LTE B2 3MHz QPSK High Channel RB1-0



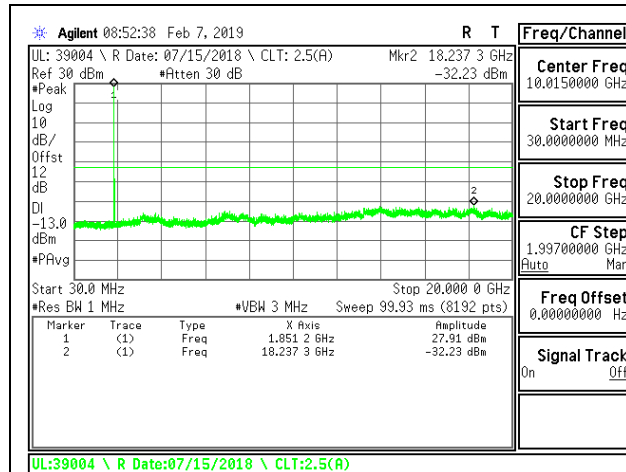
LTE B2 3MHz 16QAM Low Channel RB1-0



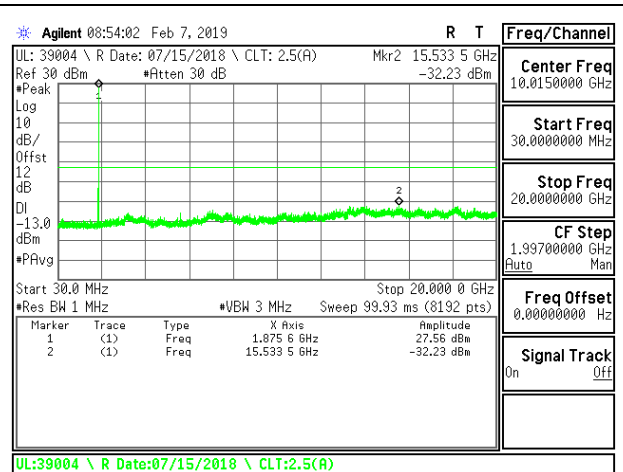
LTE B2 3MHz 16QAM Mid Channel RB1-0



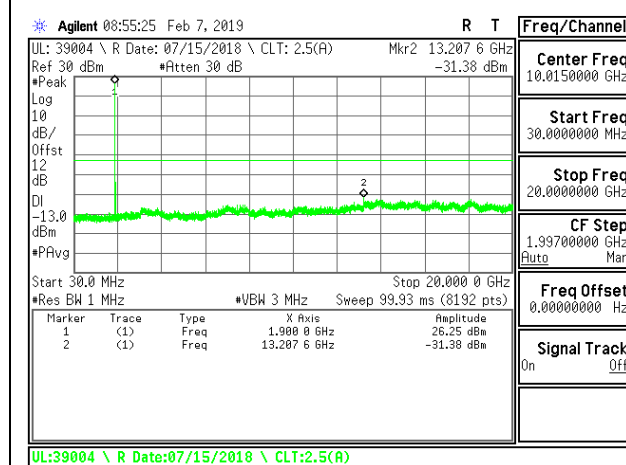
LTE B2 3MHz 16QAM High Channel RB1-0



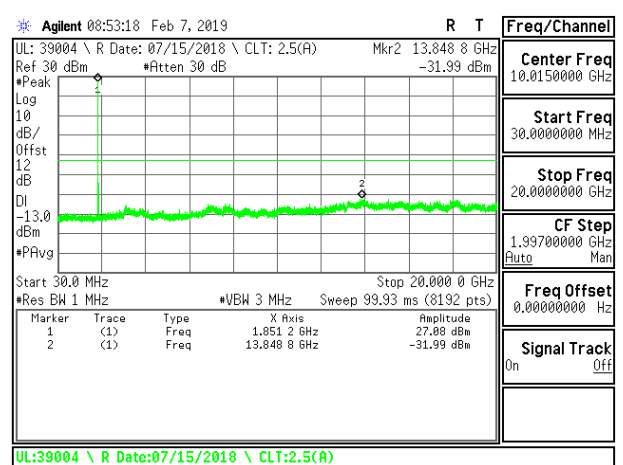
LTE B2 10MHz QPSK Low Channel RB1-0



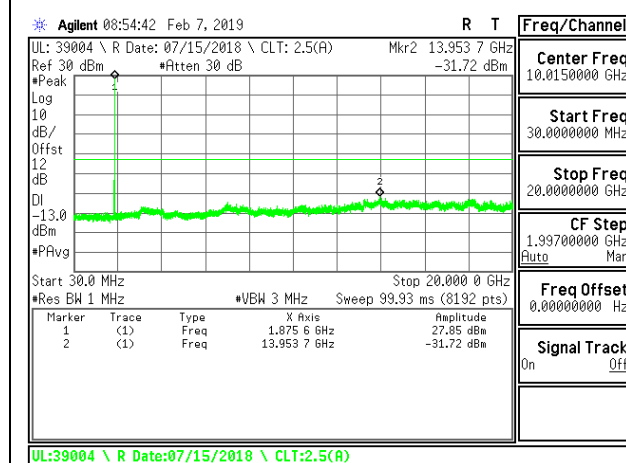
LTE B2 10MHz QPSK Mid Channel RB1-0



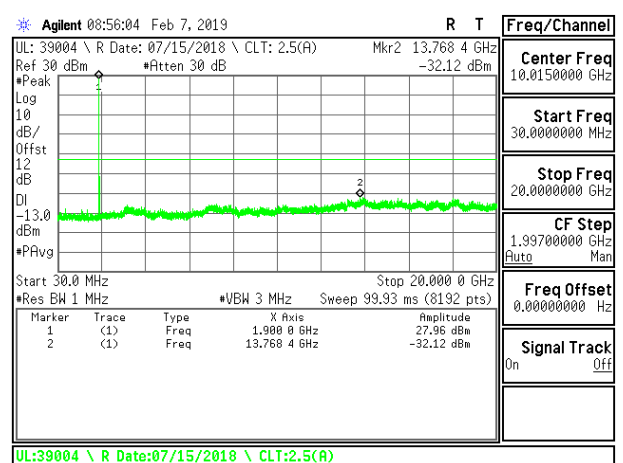
LTE B2 10MHz QPSK High Channel RB1-0



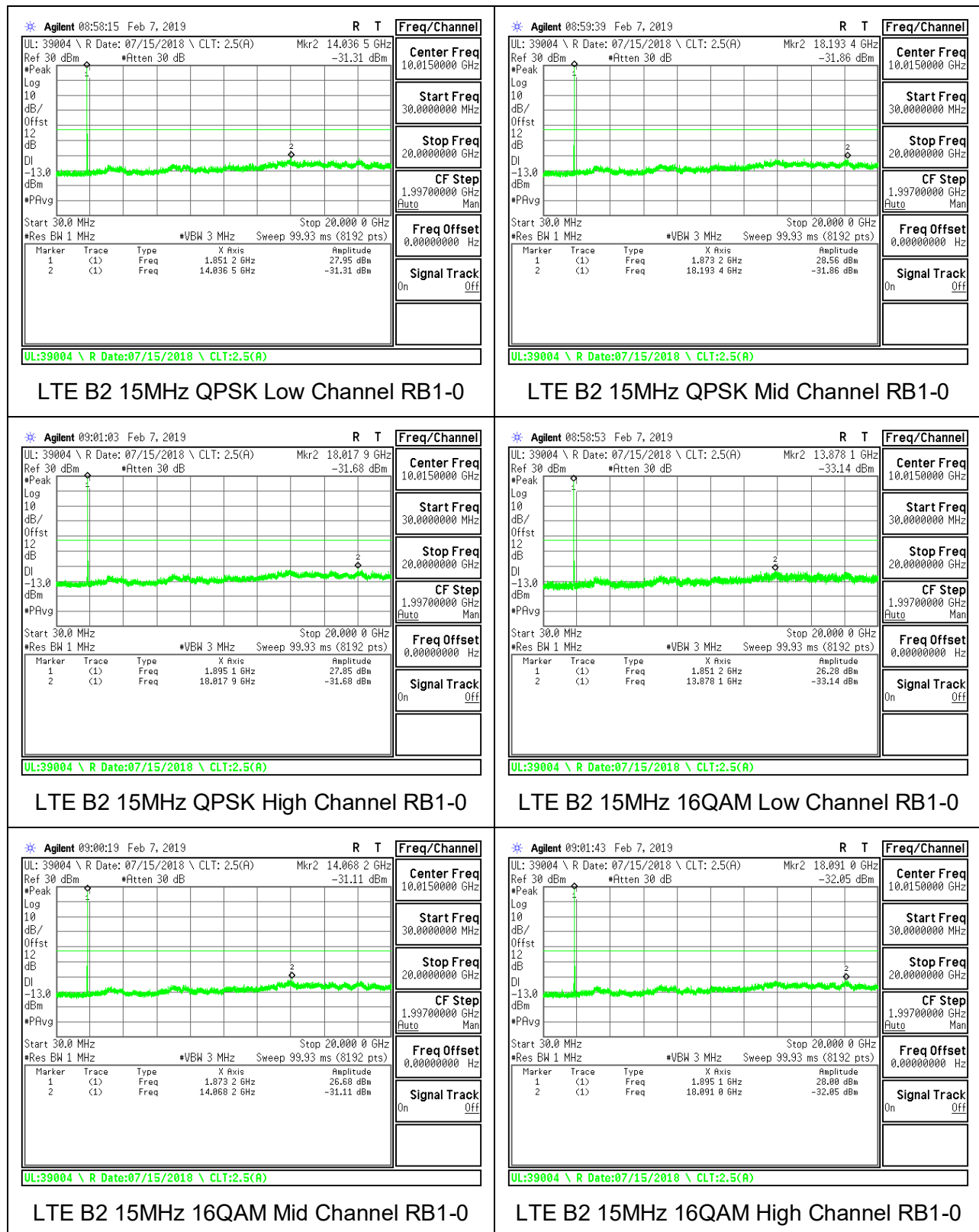
LTE B2 10MHz 16QAM Low Channel RB1-0

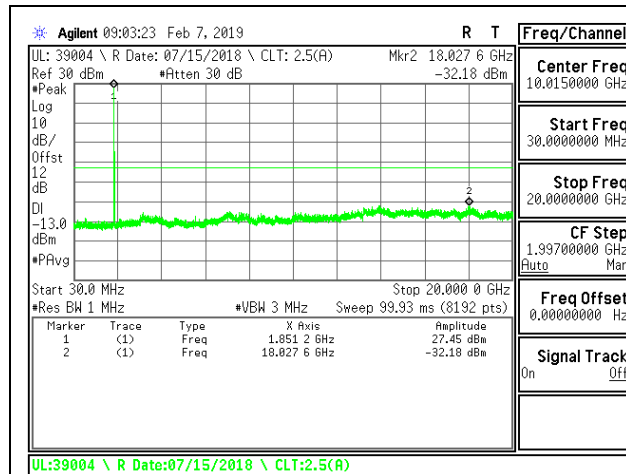


LTE B2 10MHz 16QAM Mid Channel RB1-0

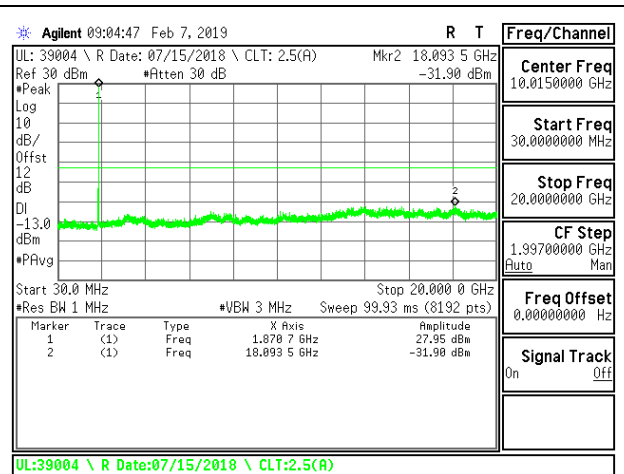


LTE B2 10MHz 16QAM High Channel RB1-0

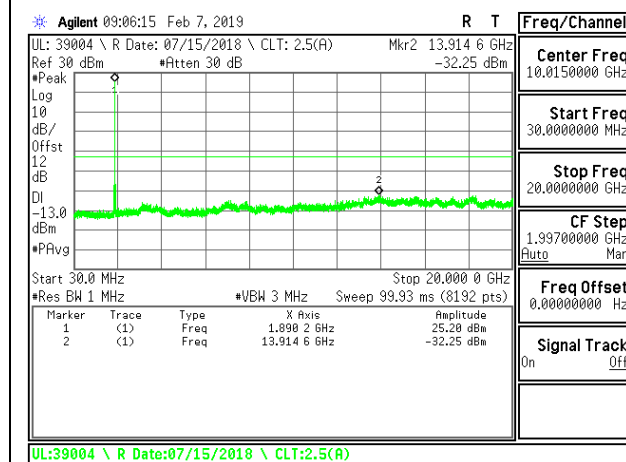




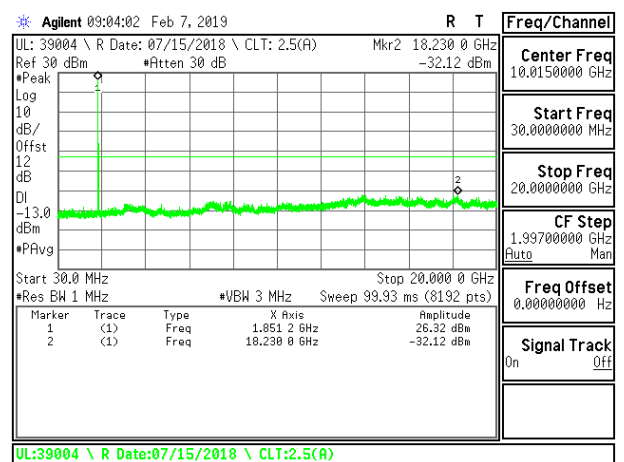
LTE B2 20MHz QPSK Low Channel RB1-0



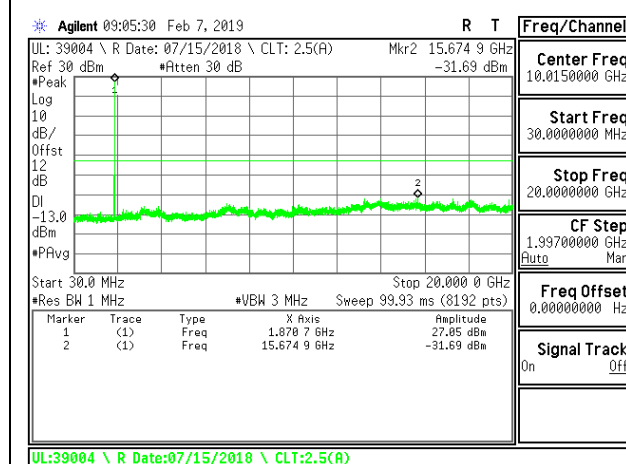
LTE B2 20MHz QPSK Mid Channel RB1-0



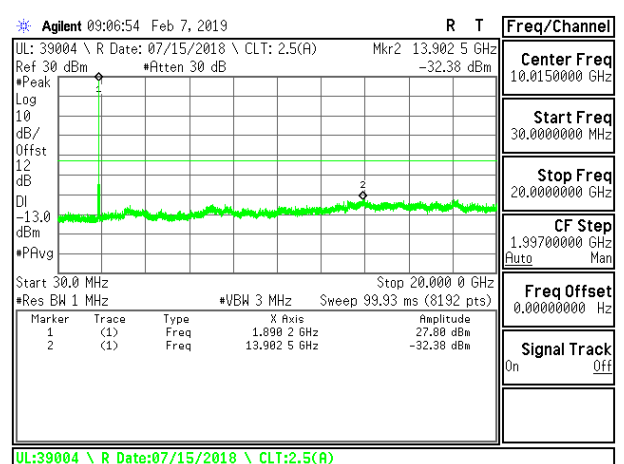
LTE B2 20MHz QPSK High Channel RB1-0



LTE B2 20MHz 16QAM Low Channel RB1-0

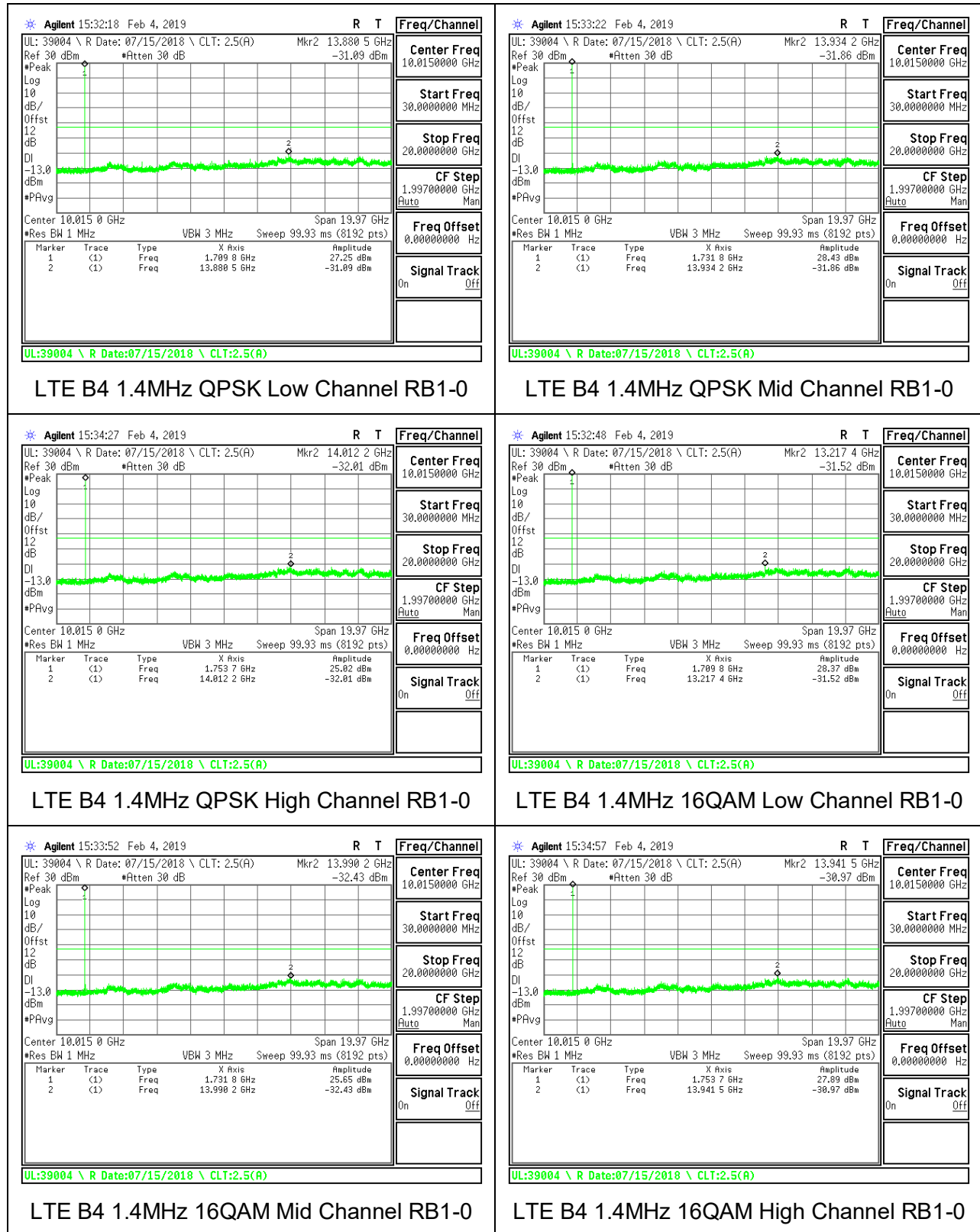


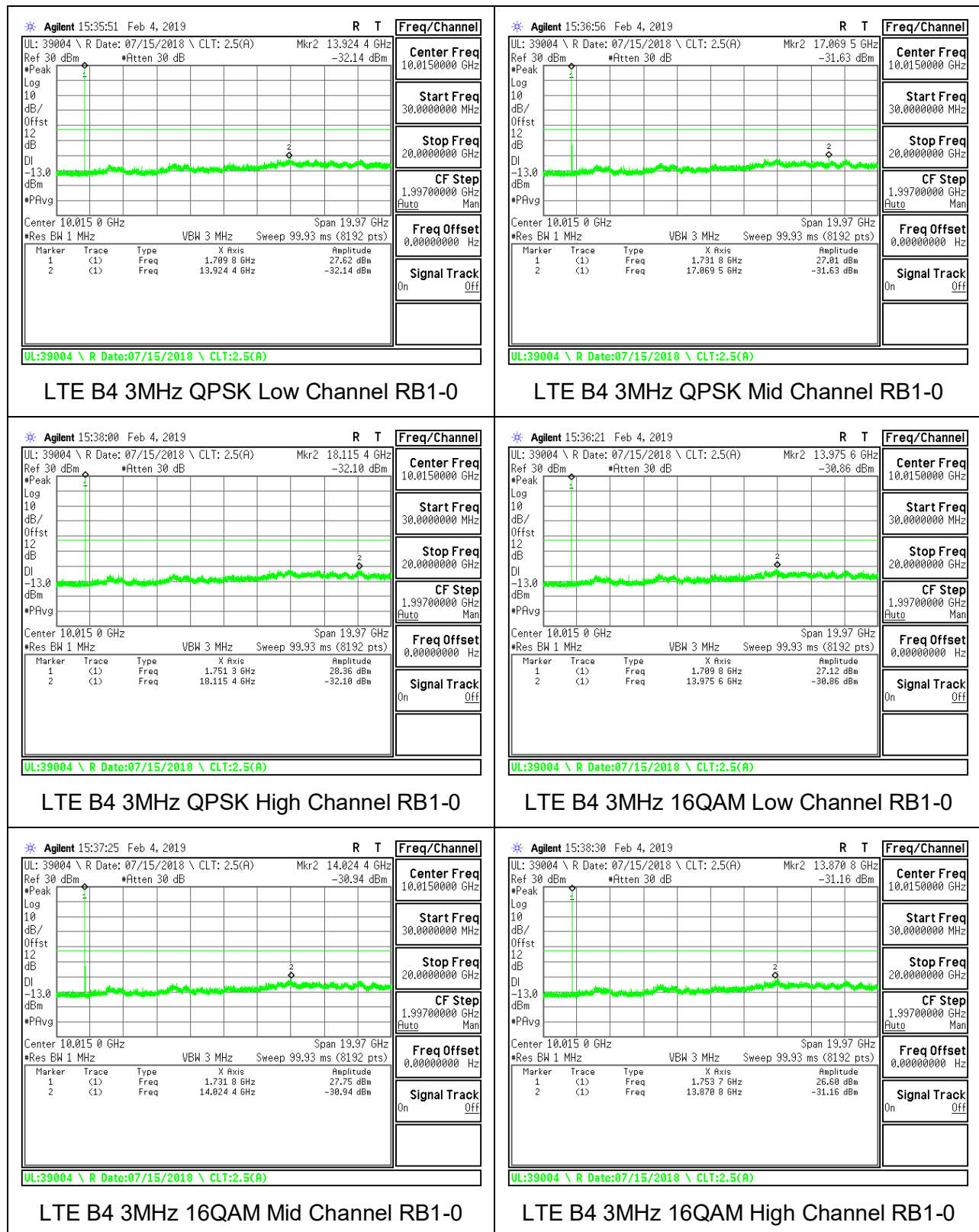
LTE B2 20MHz 16QAM Mid Channel RB1-0

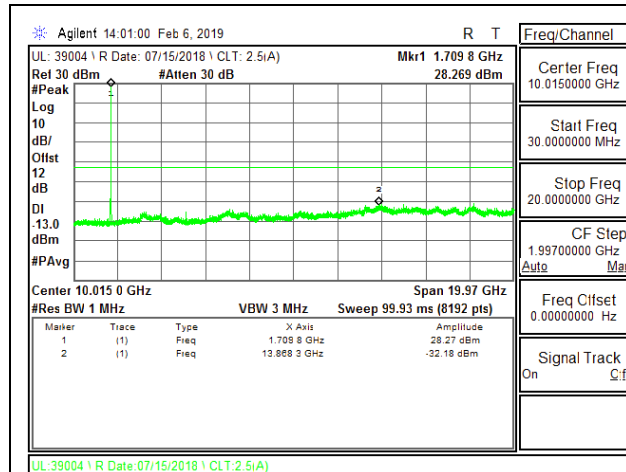


LTE B2 20MHz 16QAM High Channel RB1-0

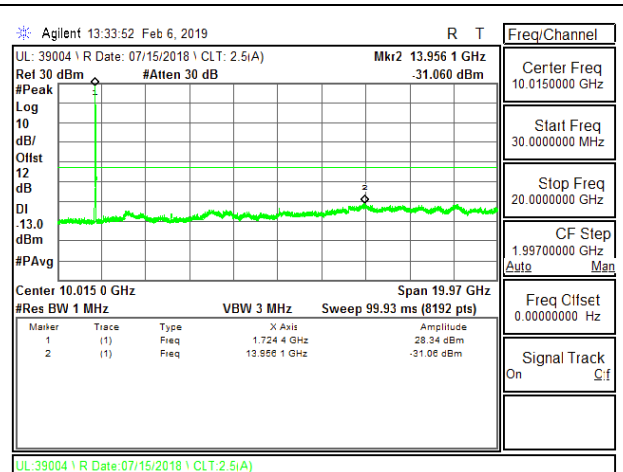
### 8.3.2. LTE BAND 4



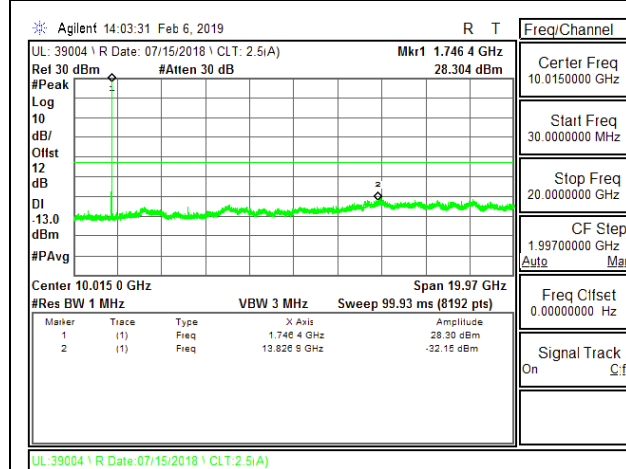




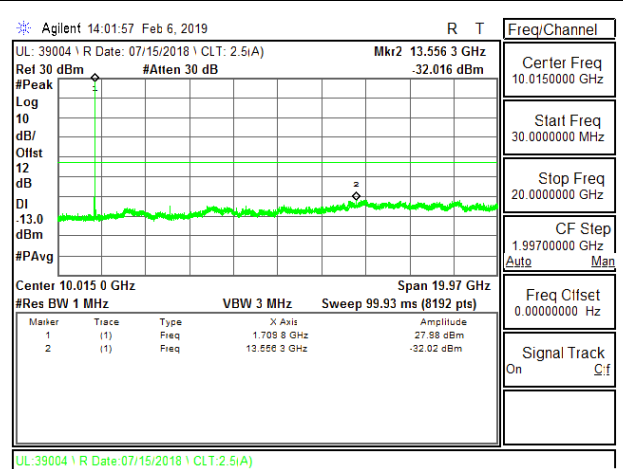
LTE B4 10MHz QPSK Low Channel RB1-0



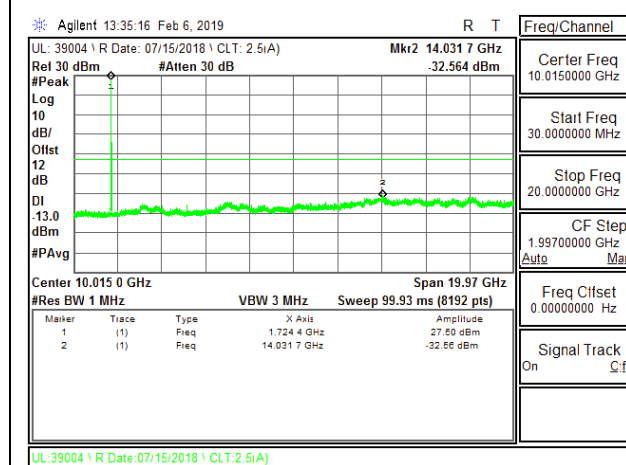
LTE B4 10MHz QPSK Mid Channel RB1-0



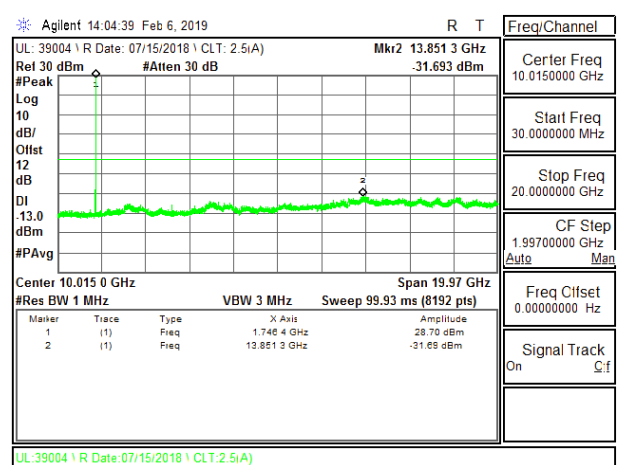
LTE B4 10MHz QPSK High Channel RB1-0



LTE B4 10MHz 16QAM Low Channel RB1-0

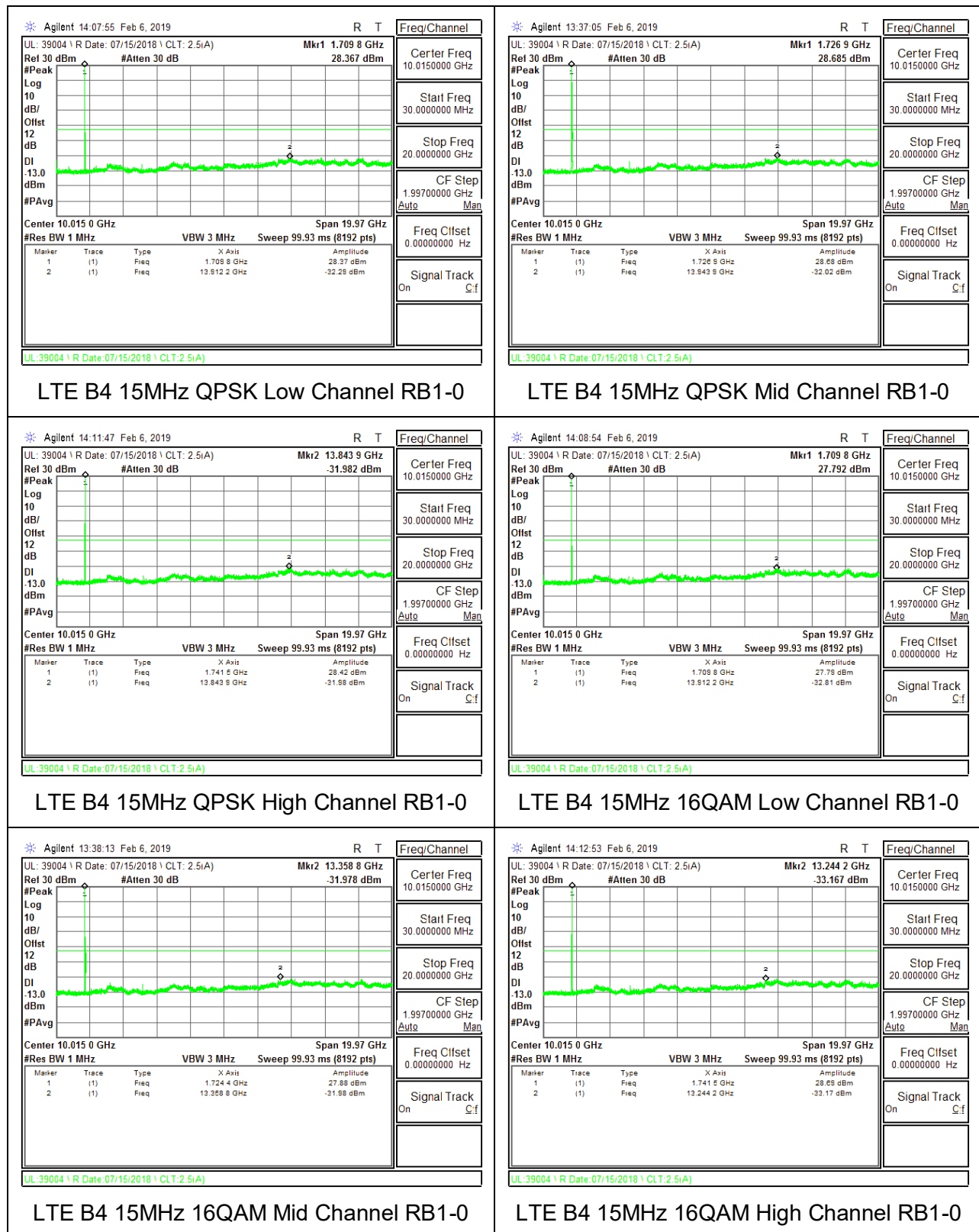


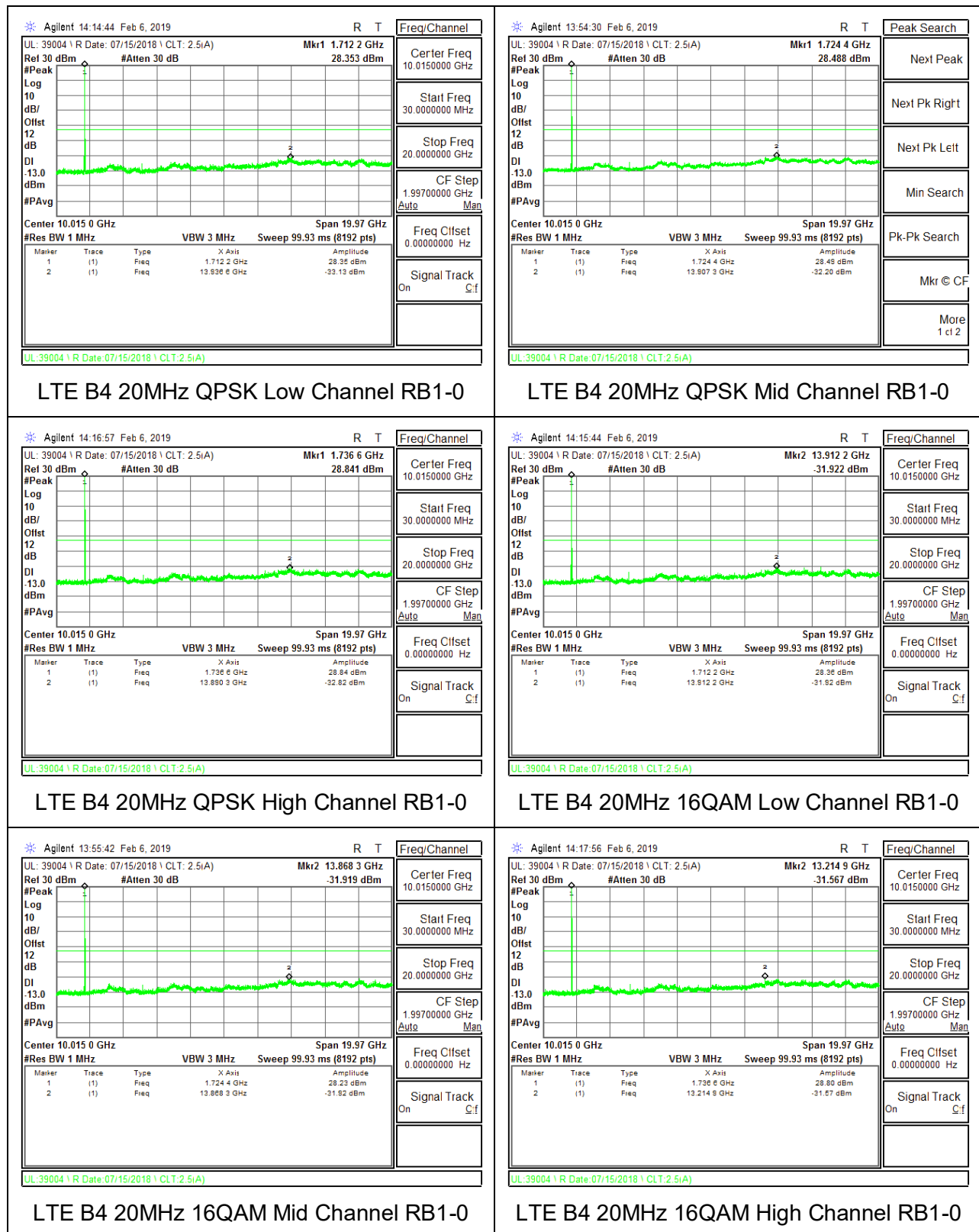
LTE B4 10MHz 16QAM Mid Channel RB1-0



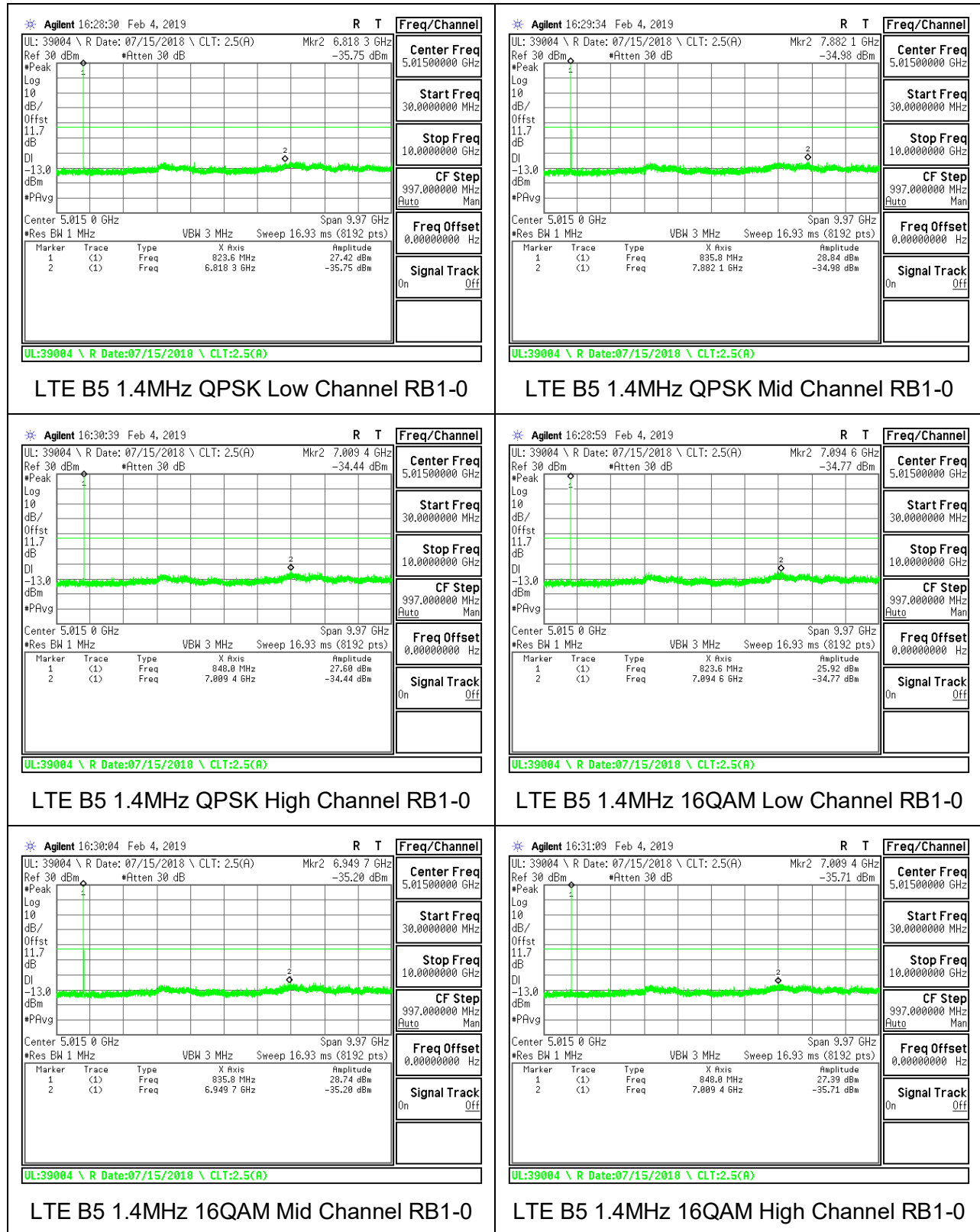
LTE B4 10MHz 16QAM High Channel RB1-0

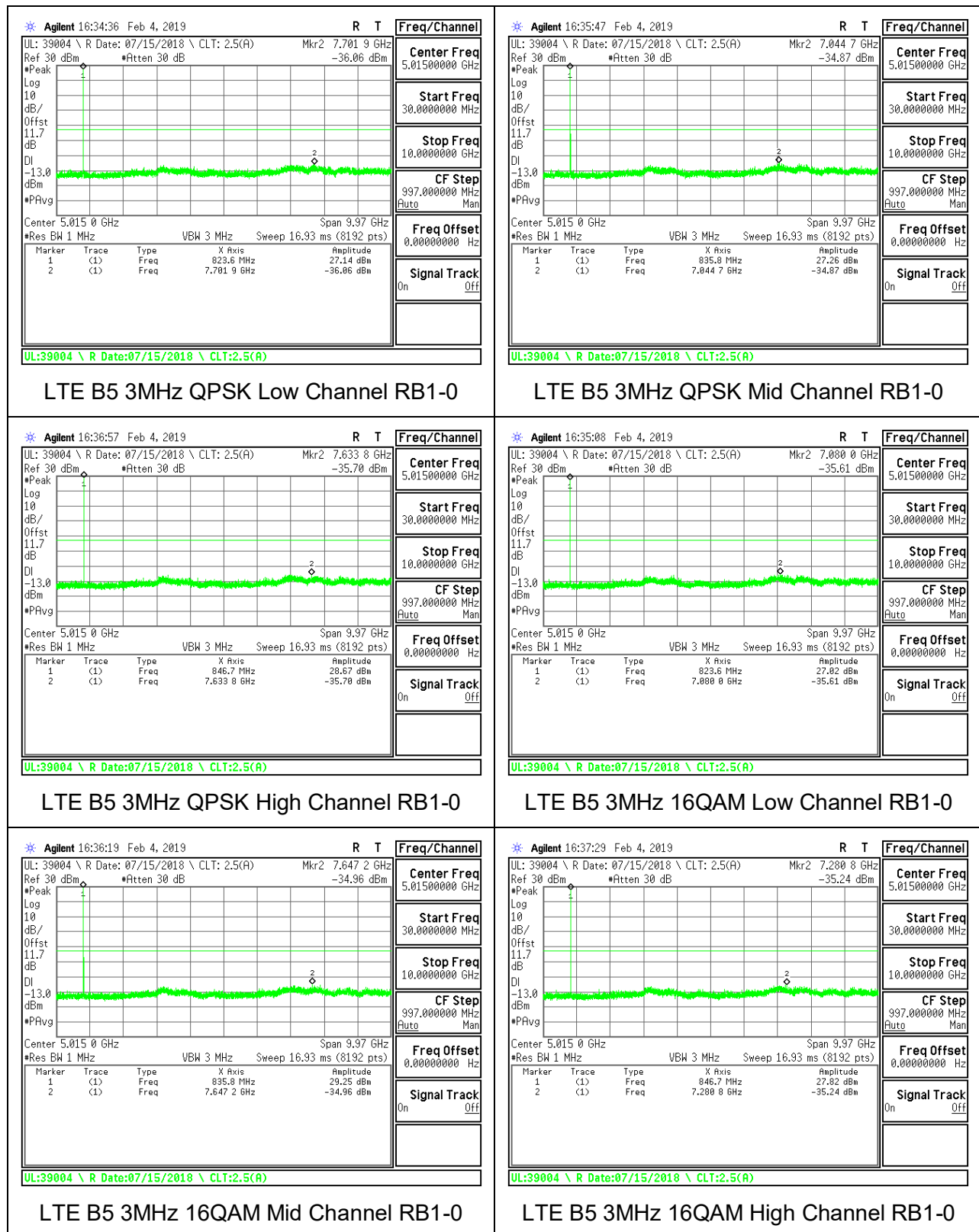


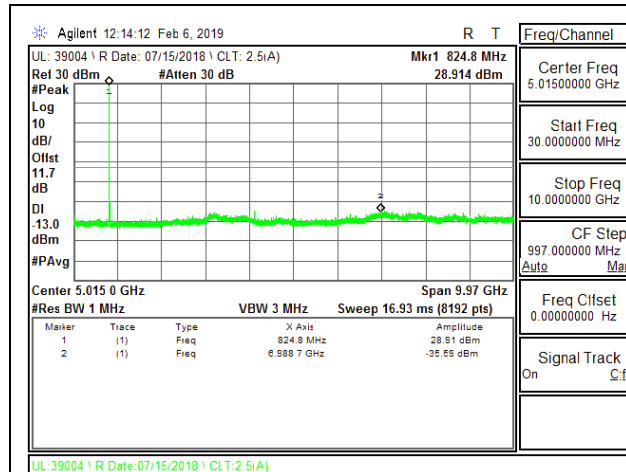




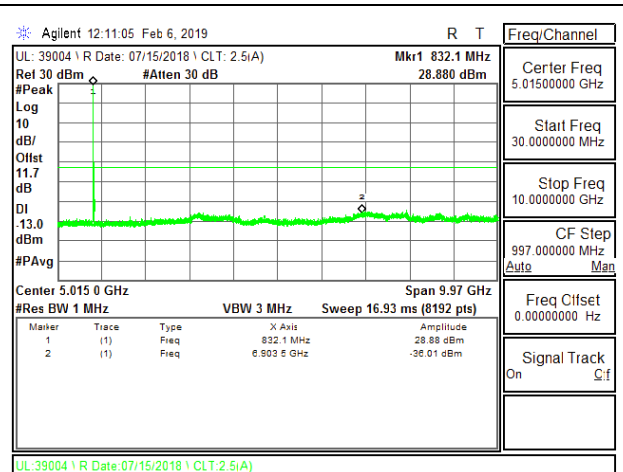
### 8.3.3. LTE BAND 5



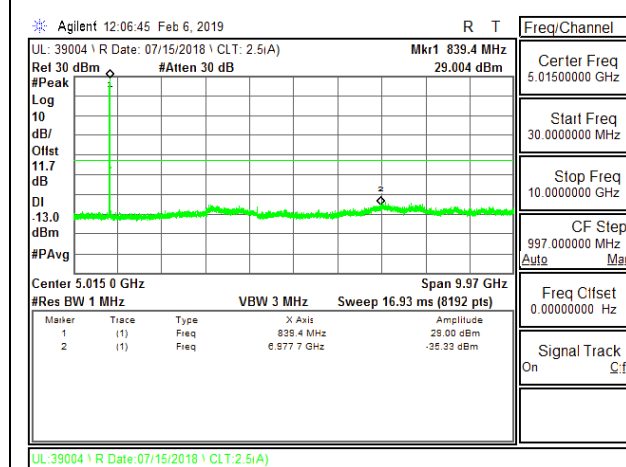




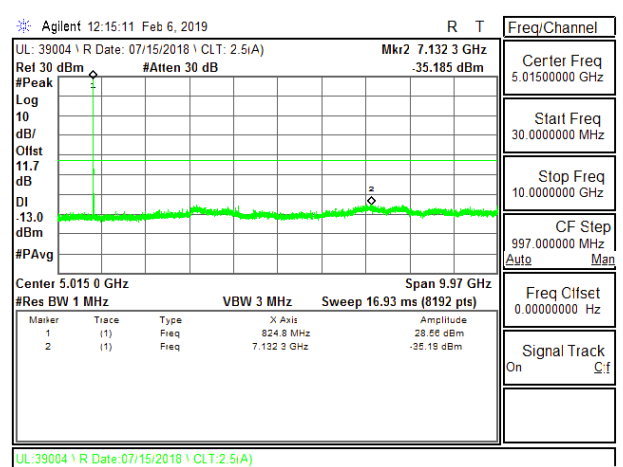
LTE B5 10MHz QPSK Low Channel RB1-0



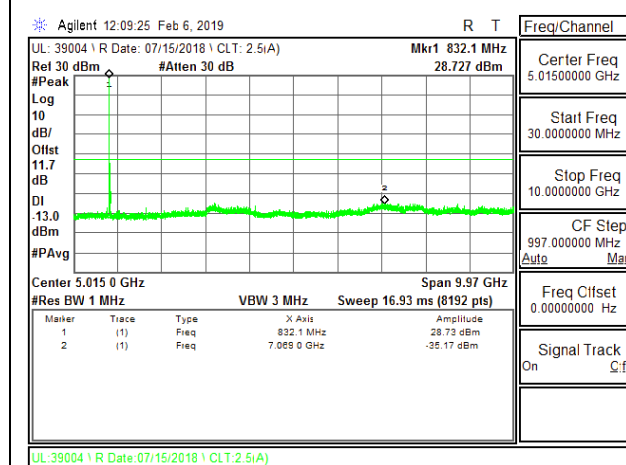
LTE B5 10MHz QPSK Mid Channel RB1-0



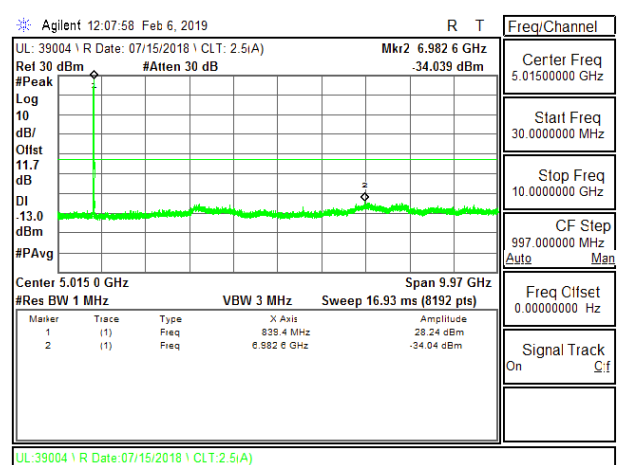
LTE B5 10MHz QPSK High Channel RB1-0



LTE B5 10MHz 16QAM Low Channel RB1-0

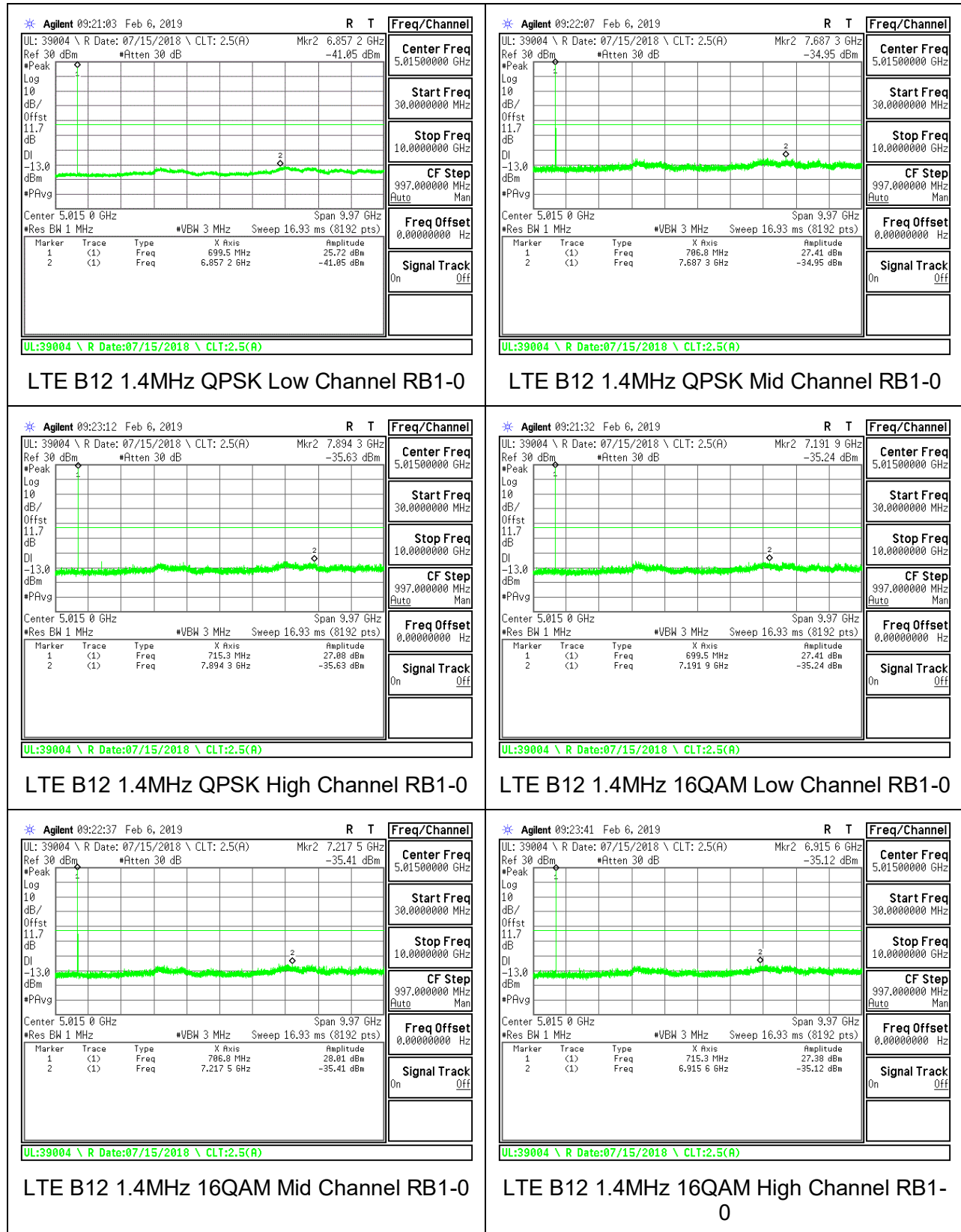


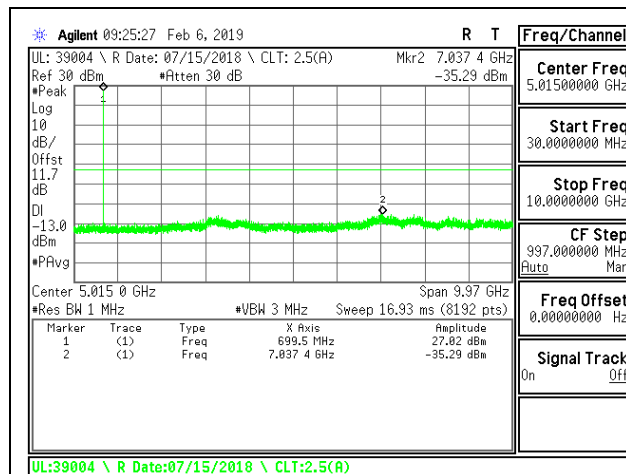
LTE B5 10MHz 16QAM Mid Channel RB1-0



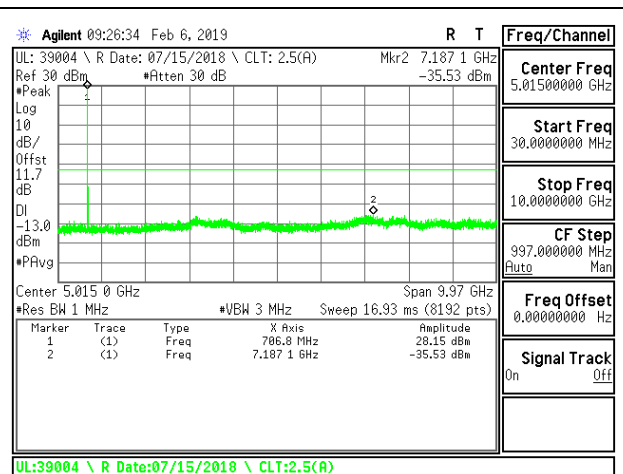
LTE B5 10MHz 16QAM High Channel RB1-0

### 8.3.4. LTE BAND 12

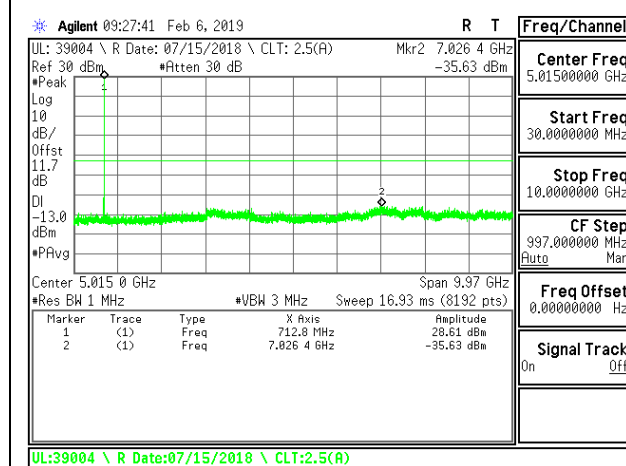




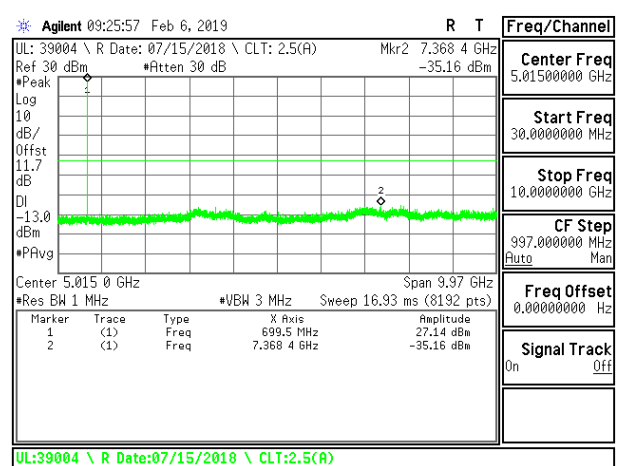
LTE B12 3MHz QPSK Low Channel RB1-0



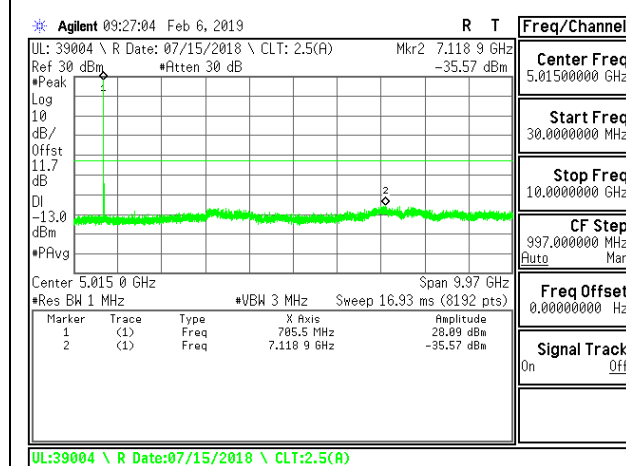
LTE B12 3MHz QPSK Mid Channel RB1-0



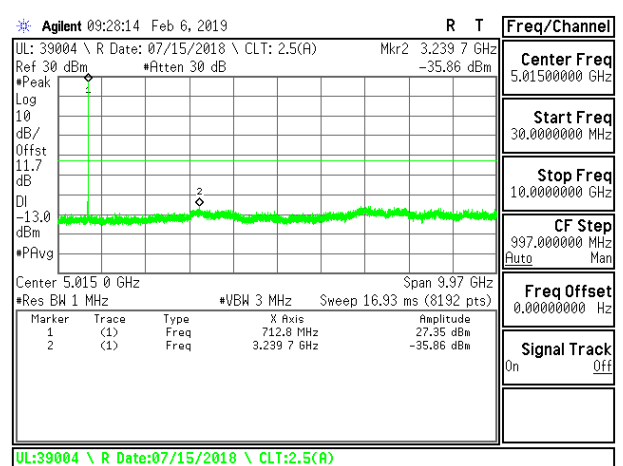
LTE B12 3MHz QPSK High Channel RB1-0



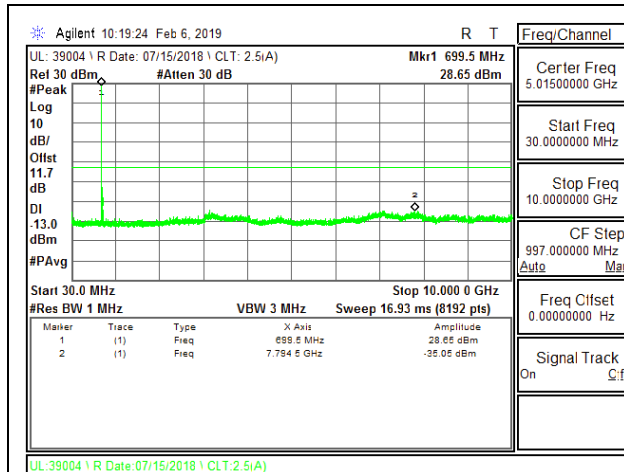
LTE B12 3MHz 16QAM Low Channel RB1-0



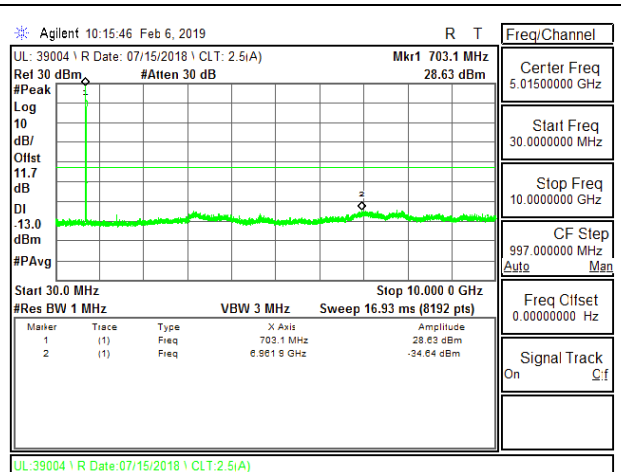
LTE B12 3MHz 16QAM Mid Channel RB1-0



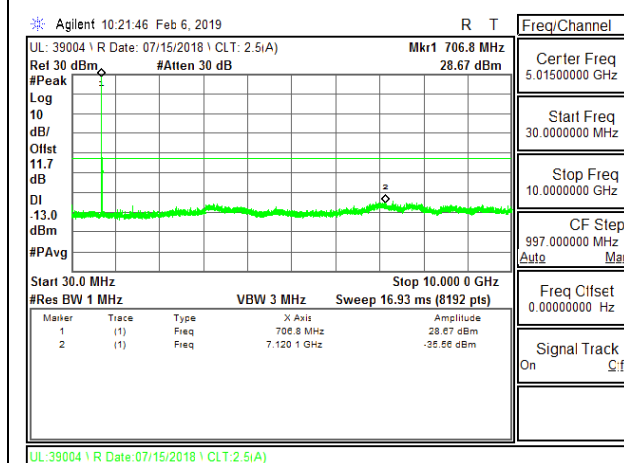
LTE B12 3MHz 16QAM High Channel RB1-0



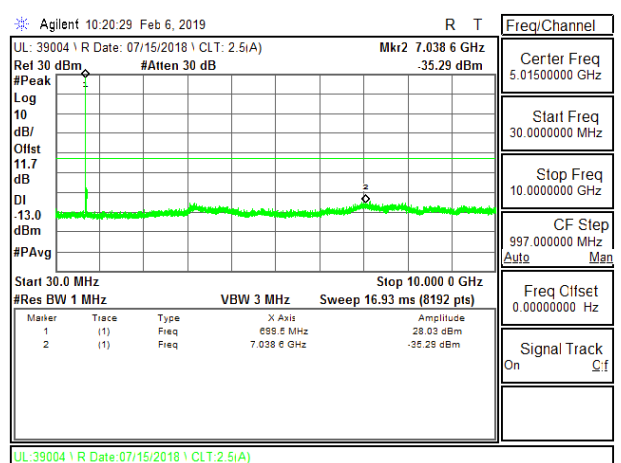
LTE B12 10MHz QPSK Low Channel RB1-0



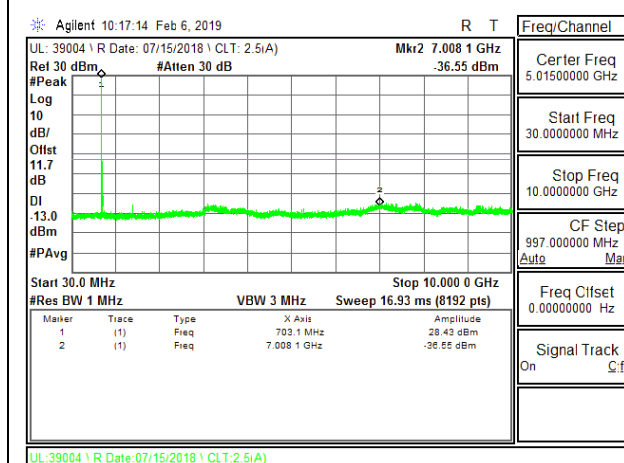
LTE B12 10MHz QPSK Mid Channel RB1-0



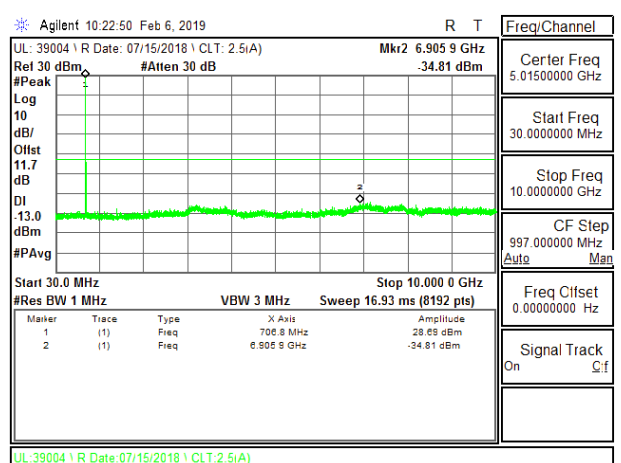
LTE B12 10MHz QPSK High Channel RB1-0



LTE B12 10MHz 16QAM Low Channel RB1-0



LTE B12 10MHz 16QAM Mid Channel RB1-0



LTE B12 10MHz 16QAM High Channel RB1-0



## 8.4. FREQUENCY STABILITY

### RULE PART(S)

FCC: §2.1055, §22.355, §24.235, §27.54

RSS130§4.3, RSS132§5.3; RSS133§6.3, RSS139§6.4

### LIMITS

FCC: §22.355

The carrier frequency shall not depart from the reference frequency in excess of  $\pm 2.5$  ppm for mobile stations.

FCC: §24.235 & §27.54

The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

RSS130§4.3

The transmitter frequency stability limit shall be determined as follows:

- a. The frequency offset shall be measured according to the procedure described in RSS-Gen and recorded;
- b. Using a resolution bandwidth of 1% of the occupied bandwidth, a reference point at the unwanted emission level which complies with the attenuation of  $43 + 10 \log_{10} p$  (watts) on the emission mask of the lowest and highest channel shall be selected, and the frequency at these points shall be recorded as  $f_L$  and  $f_H$  respectively.

The applicant shall ensure frequency stability by showing that  $f_L$  minus the frequency offset and  $f_H$  plus the frequency offset shall be within the frequency range in which the equipment is designed to operate.

RSS132§5.3

The carrier frequency shall not depart from the reference frequency in excess of  $\pm 2.5$  SRSP for mobile stations and  $\pm 1.5$  ppm for base stations.

In lieu of meeting the above stability values, the test report may show that the frequency stability is sufficient to ensure that the occupied bandwidth stays within each of the sub-bands (see Section 5.1) when tested to the temperature and supply voltage variations specified in RSS-Gen.

RSS133§6.3

The carrier frequency shall not depart from the reference frequency, in excess of  $\pm 2.5$  ppm for mobile stations and  $\pm 1.0$  ppm for base stations.

In lieu of meeting the above stability values, the test report may show that the frequency stability is sufficient to ensure that the emission bandwidth stays within the operating frequency block when tested to the temperature and supply voltage variations specified in RSS-Gen.

RSS139§6.4

The frequency stability shall be sufficient to ensure that the occupied bandwidth stays within the operating frequency block when tested to the temperature and supply voltage variations specified in RSS-Gen.

## **TEST PROCEDURE**

Use CMW 500 with Frequency Error measurement capability.

- Temp. = -30°C to +50°C
- Voltage = (85% - 115%)  
Low voltage, 102VAC, Normal, 120VAC and High voltage, 138VAC.  
End Voltage, 101VAC.

### **Frequency Stability vs Temperature:**

The EUT is placed inside a temperature chamber. The temperature is set to 20°C and allowed to stabilize. After sufficient soak time, the transmitting frequency error is measured. The temperature is increased by 10 degrees, allowed to stabilize and soak, and then the measurement is repeated. This is repeated until +50°C is reached.

### **Frequency Stability vs Voltage:**

The peak frequency error is recorded (worst-case).

## **MODES TESTED**

- LTE Band 2
- LTE Band 4
- LTE Band 5
- LTE Band 12

## **RESULTS**

See the following pages.

## 8.4.1. LTE BAND 2

### QPSK (20MHz BANDWIDTH)

|            |          |              |         |
|------------|----------|--------------|---------|
| <b>ID:</b> | 19480 BS | <b>Date:</b> | 2/12/19 |
|------------|----------|--------------|---------|

| Limit          |           | 1850                       | 1910                        | Delta<br>(Hz) | Frequency<br>Stability<br>(ppm) |
|----------------|-----------|----------------------------|-----------------------------|---------------|---------------------------------|
| Condition      |           | F low @<br>-13dBm<br>(MHz) | F high @<br>-13dBm<br>(MHz) |               |                                 |
| Temperature    | Voltage   |                            |                             |               |                                 |
| Normal (20C)   | Normal    | 1851.1064                  | 1908.8628                   |               |                                 |
| Extreme (50C)  |           | 1851.1064                  | 1908.8628                   | -7.4          | -0.004                          |
| Extreme (40C)  |           | 1851.1064                  | 1908.8628                   | -7.8          | -0.004                          |
| Extreme (30C)  |           | 1851.1064                  | 1908.8628                   | -9.2          | -0.005                          |
| Extreme (10C)  |           | 1851.1064                  | 1908.8628                   | -8.8          | -0.005                          |
| Extreme (0C)   |           | 1851.1064                  | 1908.8628                   | -8.2          | -0.004                          |
| Extreme (-10C) |           | 1851.1064                  | 1908.8628                   | -8.4          | -0.004                          |
| Extreme (-20C) |           | 1851.1064                  | 1908.8628                   | -8.6          | -0.005                          |
| Extreme (-30C) |           | 1851.1064                  | 1908.8628                   | -8.1          | -0.004                          |
|                |           |                            |                             |               |                                 |
| 20C            | 15%       | 1851.1064                  | 1908.8628                   | -9.3          | -0.005                          |
|                | -15%      | 1851.1064                  | 1908.8628                   | -8.6          | -0.005                          |
|                | End Point | 1851.1064                  | 1908.8628                   | -9.3          | -0.005                          |

## 8.4.2. LTE BAND 4

### QPSK (20MHz BANDWIDTH)

|            |          |              |         |
|------------|----------|--------------|---------|
| <b>ID:</b> | 19480 BS | <b>Date:</b> | 2/12/19 |
|------------|----------|--------------|---------|

| Limit          |           | 1710                       | 1755                        | Delta<br>(Hz) | Frequency<br>Stability<br>(ppm) |
|----------------|-----------|----------------------------|-----------------------------|---------------|---------------------------------|
| Condition      |           | F low @<br>-13dBm<br>(MHz) | F high @<br>-13dBm<br>(MHz) |               |                                 |
| Temperature    | Voltage   |                            |                             |               |                                 |
| Normal (20C)   | Normal    | 1711.1258                  | 1753.8680                   |               |                                 |
| Extreme (50C)  |           | 1711.1258                  | 1753.8680                   | 6.4           | 0.004                           |
| Extreme (40C)  |           | 1711.1258                  | 1753.8680                   | 5.7           | 0.003                           |
| Extreme (30C)  |           | 1711.1258                  | 1753.8680                   | 6.1           | 0.004                           |
| Extreme (10C)  |           | 1711.1258                  | 1753.8680                   | -7.0          | -0.004                          |
| Extreme (0C)   |           | 1711.1258                  | 1753.8680                   | 6.1           | 0.004                           |
| Extreme (-10C) |           | 1711.1258                  | 1753.8680                   | 6.2           | 0.004                           |
| Extreme (-20C) |           | 1711.1258                  | 1753.8680                   | 8.0           | 0.005                           |
| Extreme (-30C) |           | 1711.1258                  | 1753.8680                   | 6.9           | 0.004                           |
|                |           |                            |                             |               |                                 |
| 20C            | 15%       | 1711.1258                  | 1753.8680                   | -5.6          | -0.003                          |
|                | -15%      | 1711.1258                  | 1753.8680                   | 5.8           | 0.003                           |
|                | End Point | 1711.1258                  | 1753.8680                   | 5.5           | 0.003                           |

### 8.4.3. LTE BAND 5

#### QPSK (10MHz BANDWIDTH)

|            |          |              |         |
|------------|----------|--------------|---------|
| <b>ID:</b> | 19480 BS | <b>Date:</b> | 2/12/19 |
|------------|----------|--------------|---------|

| Limit          |           | 824                        | 849                         | Delta<br>(Hz) | Frequency<br>Stability<br>(ppm) |
|----------------|-----------|----------------------------|-----------------------------|---------------|---------------------------------|
| Condition      |           | F low @<br>-13dBm<br>(MHz) | F high @<br>-13dBm<br>(MHz) |               |                                 |
| Temperature    | Voltage   |                            |                             |               |                                 |
| Normal (20C)   | Normal    | 824.5497                   | 848.4376                    |               |                                 |
| Extreme (50C)  |           | 824.5497                   | 848.4376                    | 4.5           | 0.005                           |
| Extreme (40C)  |           | 824.5497                   | 848.4376                    | -4.1          | -0.005                          |
| Extreme (30C)  |           | 824.5497                   | 848.4376                    | -4.5          | -0.005                          |
| Extreme (10C)  |           | 824.5497                   | 848.4376                    | -4.7          | -0.006                          |
| Extreme (0C)   |           | 824.5497                   | 848.4376                    | 3.6           | 0.004                           |
| Extreme (-10C) |           | 824.5497                   | 848.4376                    | 3.8           | 0.005                           |
| Extreme (-20C) |           | 824.5497                   | 848.4376                    | 3.8           | 0.005                           |
| Extreme (-30C) |           | 824.5497                   | 848.4376                    | -4.5          | -0.005                          |
|                |           |                            |                             |               |                                 |
| 20C            | 15%       | 824.5497                   | 848.4376                    | -4.4          | -0.005                          |
|                | -15%      | 824.5497                   | 848.4376                    | -4.5          | -0.005                          |
|                | End Point | 824.5497                   | 848.4376                    | -4.4          | -0.005                          |

#### 8.4.4. LTE BAND 12

##### QPSK (10MHz BANDWIDTH)

|            |          |              |         |
|------------|----------|--------------|---------|
| <b>ID:</b> | 19480 BS | <b>Date:</b> | 2/12/19 |
|------------|----------|--------------|---------|

| Limit          |           | 699                        | 716                         | Delta<br>(Hz) | Frequency<br>Stability<br>(ppm) |
|----------------|-----------|----------------------------|-----------------------------|---------------|---------------------------------|
| Condition      |           | F low @<br>-13dBm<br>(MHz) | F high @<br>-13dBm<br>(MHz) |               |                                 |
| Temperature    | Voltage   |                            |                             |               |                                 |
| Normal (20C)   | Normal    | 699.5581                   | 715.4589                    |               |                                 |
| Extreme (50C)  |           | 699.5581                   | 715.4589                    | 4.2           | 0.006                           |
| Extreme (40C)  |           | 699.5581                   | 715.4589                    | -3.7          | -0.005                          |
| Extreme (30C)  |           | 699.5581                   | 715.4589                    | -4.5          | -0.006                          |
| Extreme (10C)  |           | 699.5581                   | 715.4589                    | -4.6          | -0.006                          |
| Extreme (0C)   |           | 699.5581                   | 715.4589                    | -3.2          | -0.005                          |
| Extreme (-10C) |           | 699.5581                   | 715.4589                    | -3.9          | -0.005                          |
| Extreme (-20C) |           | 699.5581                   | 715.4589                    | 4.9           | 0.007                           |
| Extreme (-30C) |           | 699.5581                   | 715.4589                    | 4.0           | 0.006                           |
|                |           |                            |                             |               |                                 |
| 20C            | 15%       | 699.5581                   | 715.4589                    | -3.8          | -0.005                          |
|                | -15%      | 699.5581                   | 715.4589                    | -4.2          | -0.006                          |
|                | End Point | 699.5581                   | 715.4589                    | -4.3          | -0.006                          |

## 8.5. PEAK TO AVERAGE RATIO

### LIMITS

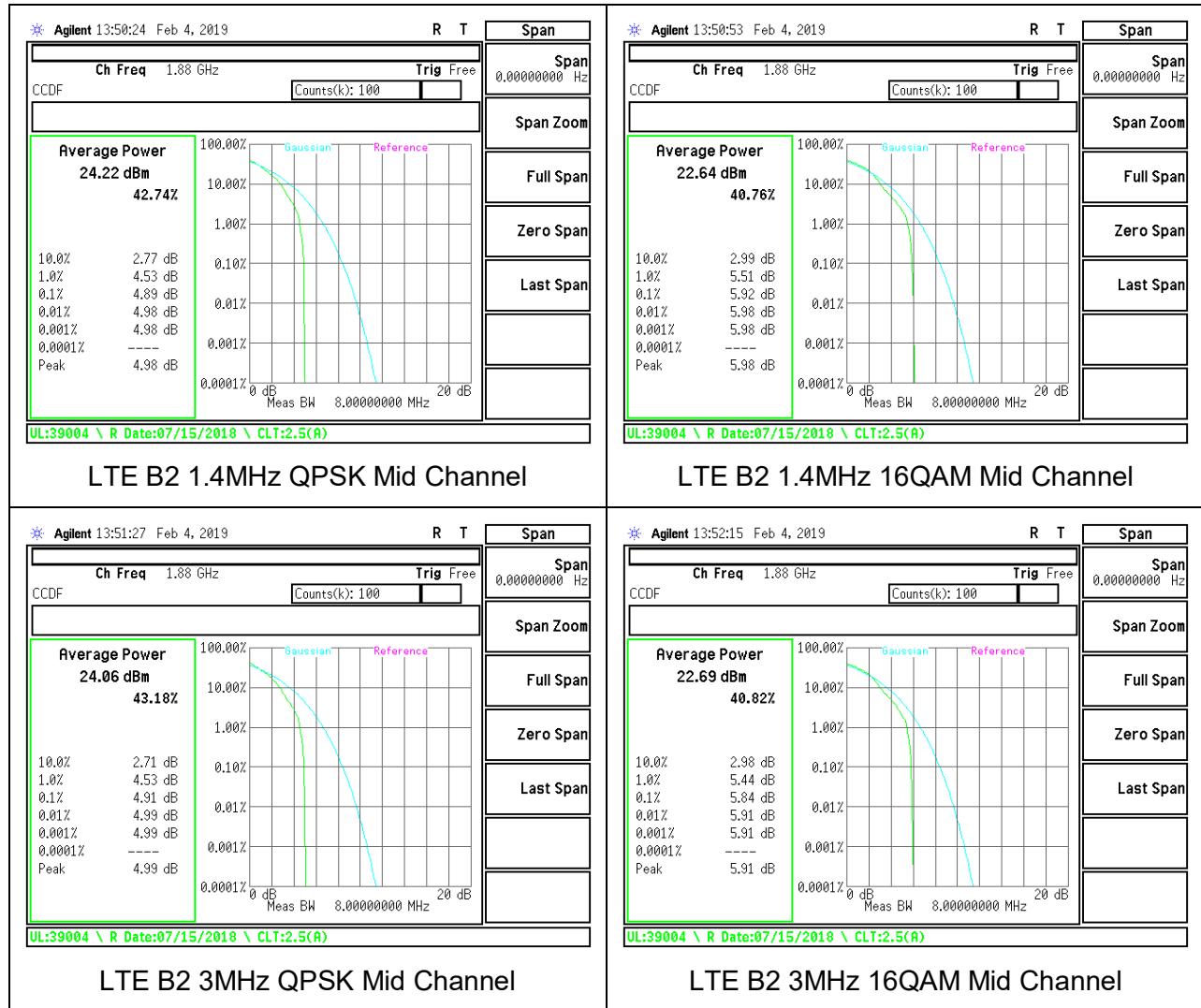
In addition, the peak to average power ratio (PAPR) of the transmitter shall not exceed 13 dB for more than 0.1% of the time and shall use a signal corresponding to the highest PAPR during periods of continuous transmission.

### RESULT

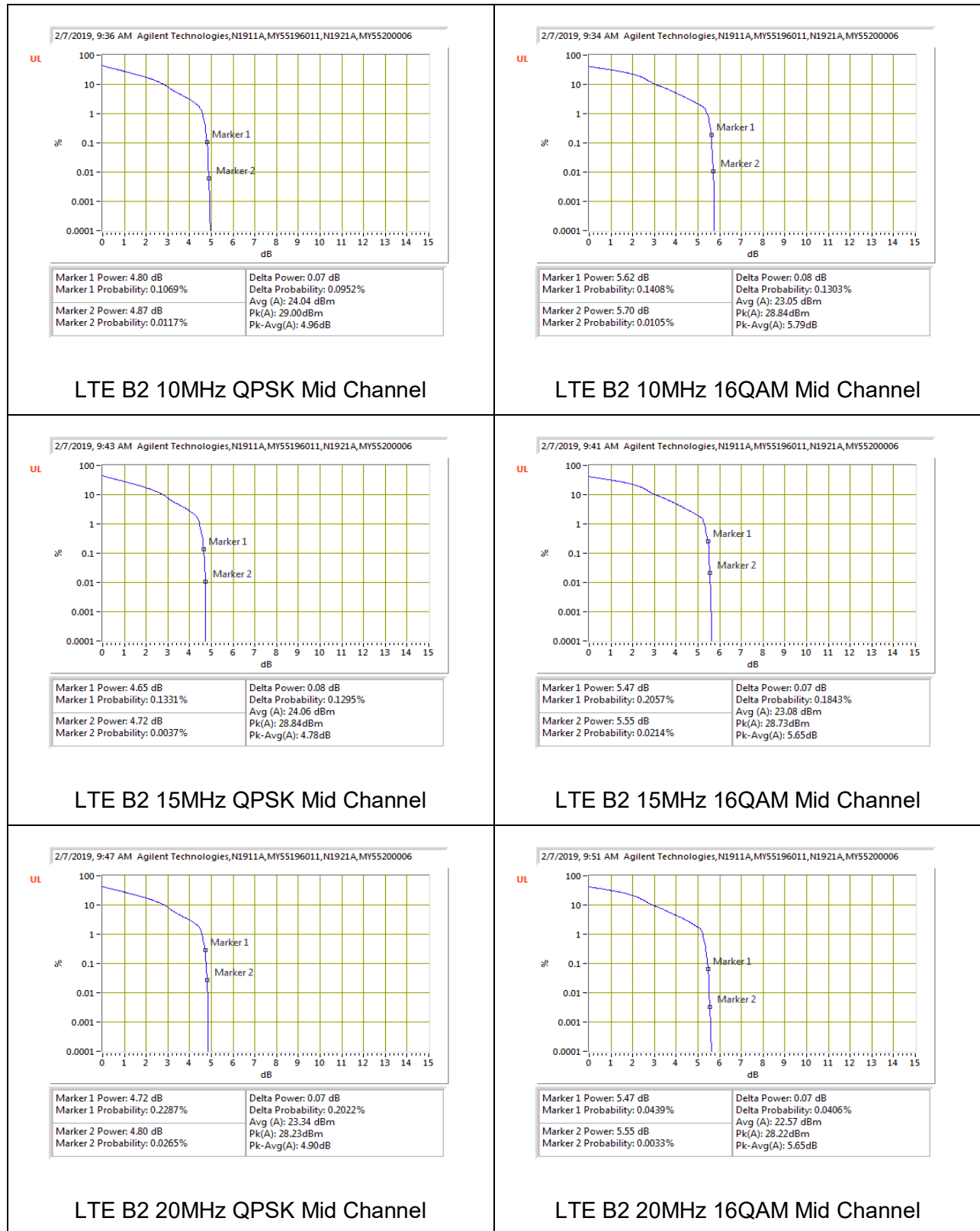
LAT 1 antenna was used to measure as the worst case. The results from all CCDF plots are passed with 13dB peak-to-average power ratio criteria.

|            |       |              |        |
|------------|-------|--------------|--------|
| <b>ID:</b> | 39004 | <b>Date:</b> | 2/4/19 |
|------------|-------|--------------|--------|

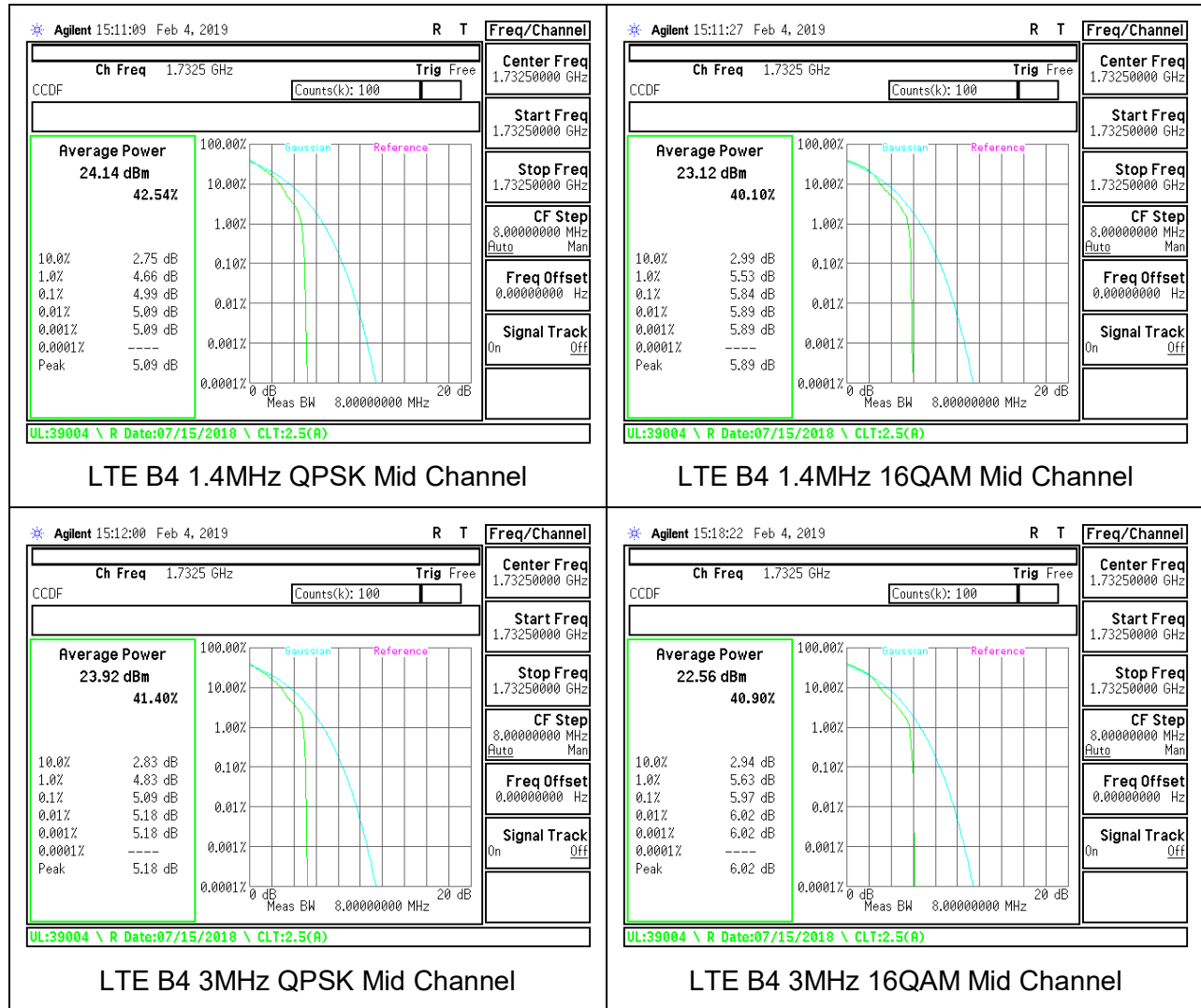
## 8.5.1. LTE BAND 2

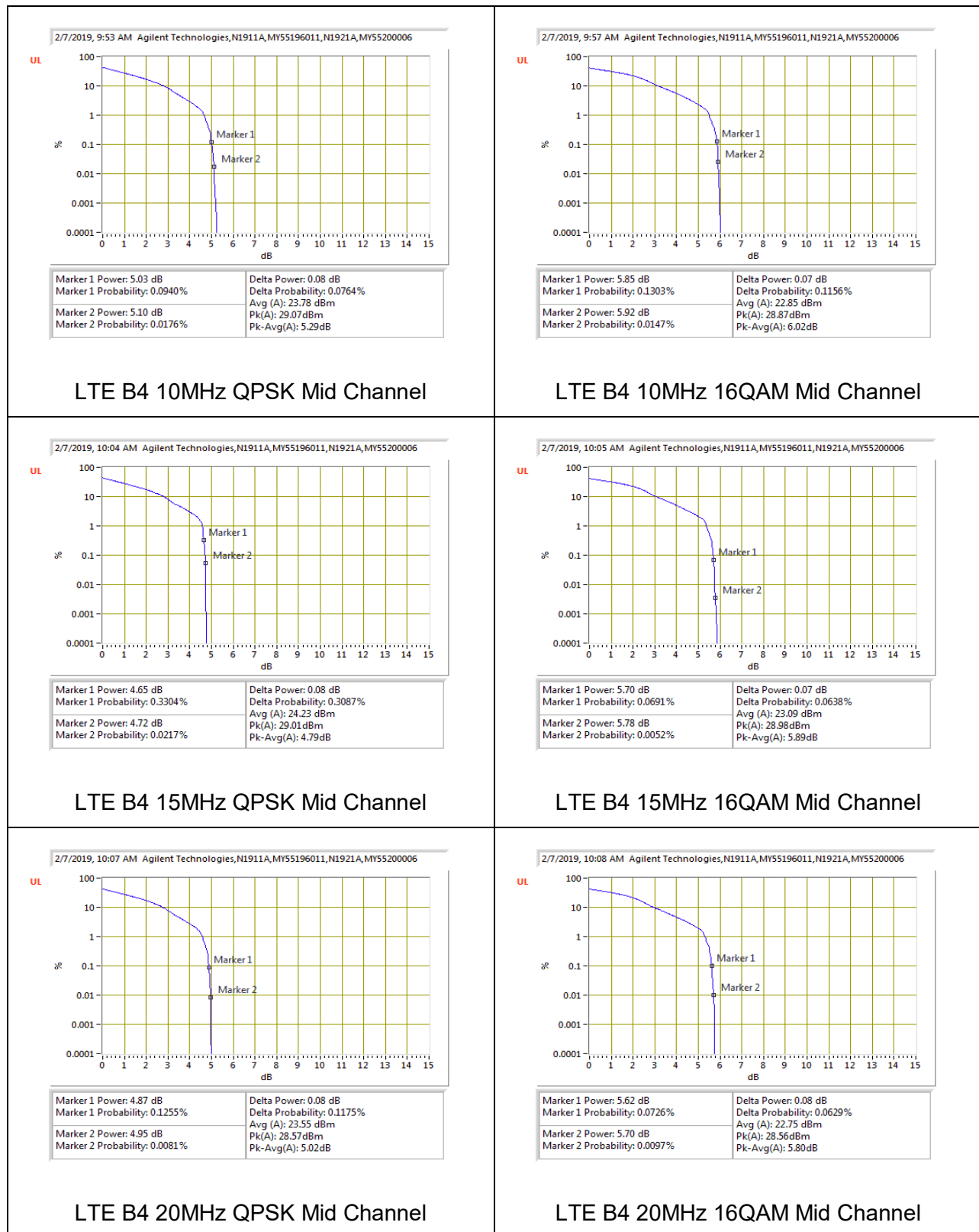






## 8.5.2. LTE BAND 4





### 8.5.3. LTE BAND 5

