**FCC CFR47 PART 27L**

# CERTIFICATION TEST REPORT

**FOR**

**IPAD WITH 802.11 abgn BT EDR / LE / GSM / WCDMA / LTE**
**MODEL NUMBER: A1430**

**FCC ID: BCGA1430**
**IC: 579C-A1430**

**REPORT NUMBER: 11U14054-2, REVISION A**

**ISSUE DATE: JANUARY 30, 2012**

*Prepared for*
**APPLE**
**1 INFINITE LOOP**
**CUPERTINO, CA 95014, U.S.A**

*Prepared by*

**COMPLIANCE CERTIFICATION SERVICES (UL CCS)**
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NVLAP LAB CODE 200065-0

Revision History

| Rev. | Issue Date | Revisions | Revised By |
|---|---|---|---|
| --- | 01/06/12 | Initial Issue | T. Chan |
| --- | 01/30/12 | Added Peak-to-Average Ratio Plots | T. Chan |

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# 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** APPLE
1 INFINITE LOOP
CUPERTINO, CA 95014, U.S.A.

**EUT DESCRIPTION:** IPAD WITH 802.11 abgn BT EDR / LE / GSM / WCDMA / LTE

**MODEL:** A1430

**SERIAL NUMBER**: PT713734

**DATE TESTED:** OCTOBER 05-DECEMBER 12, 2011 AND JANUARY 30, 2012

| APPLICABLE STANDARDS | |
|---|---|
| **STANDARD** | **TEST RESULTS** |
| FCC PART 27L | Pass |

Compliance Certification Services (UL CCS) tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL CCS based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

**Note:** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL CCS and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL CCS 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 any government.

Approved & Released For UL CCS By:

THU CHAN
ENGINEERING MANAGER
UL CCS

Tested By:

CHIN PANG
EMC ENGINEER
UL CCS

# 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with TIA-603-C, FCC CFR 47 Part 2, and FCC CFR 47 FCC Part 27.

# 3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 Benicia Street, Fremont, California, USA.

UL CCS is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at http://www.ccsemc.com.

# 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

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 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

## 4.3. MEASUREMENT UNCERTAINTY

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

| PARAMETER | UNCERTAINTY |
|---|---|
| Conducted Disturbance, 0.15 to 30 MHz | 3.52 dB |
| Radiated Disturbance, 30 to 1000 MHz | 4.94 dB |

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

# 5. EQUIPMENT UNDER TEST

## 5.1. DESCRIPTION OF EUT

The Apple iPad is a tablet device with iPod functions (music application support and video), 802.11 a/b/g/n radio, Bluetooth radio function, and cellular using GSM 2G/3G/LTE data functions. The rechargeable battery is not user accessible

## 5.2. MAXIMUM OUTPUT POWER

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

| Part 27 LTE Band 17 MODE (5.0 MHz BANDWIDTH) | | | | | |
|---|---|---|---|---|---|
| Frequency range (MHz) | Modulation | Conducted(Average) | | ERP(Average) | |
| | | dBm | mW | dBm | mW |
| 706.50 | QPSK RB1-0 | 24.30 | 269.2 | 20.00 | 100.0 |
| 710.00 | | 24.30 | 269.2 | 20.20 | 104.7 |
| 713.50 | | 24.30 | 269.2 | 19.40 | 87.1 |
| 706.50 | 16QAM, RB1-0 | 23.50 | 223.9 | 18.50 | 70.8 |
| 710.00 | | 23.40 | 218.8 | 19.60 | 91.2 |
| 713.50 | | 23.45 | 221.3 | 18.50 | 70.8 |

| Part 27 LTE Band 17 MODE (10.0 MHz BANDWIDTH) | | | | | |
|---|---|---|---|---|---|
| Frequency range (MHz) | Modulation | Conducted(Average) | | ERP(Average) | |
| | | dBm | mW | dBm | mW |
| 709.00 | QPSK RB1-0 | 24.40 | 275.4 | 19.68 | 92.9 |
| 710.00 | | 24.43 | 277.3 | 19.66 | 92.5 |
| 711.00 | | 24.40 | 275.4 | 19.10 | 81.3 |
| 709.00 | 16QAM RB1-0 | 23.50 | 223.9 | 18.80 | 75.9 |
| 710.00 | | 23.50 | 223.9 | 18.70 | 74.1 |
| 711.00 | | 23.50 | 223.9 | 18.40 | 69.2 |

| Part 27 LTE Band 4 MODE (5.0 MHz BANDWIDTH) | | | | | |
|---|---|---|---|---|---|
| Frequency range (MHz) | Modulation | Conducted(Average) | | EIRP(Average) | |
| | | dBm | mW | dBm | mW |
| 1712.5 | QPSK RB1-24 | 23.50 | 223.9 | 23.31 | 214.3 |
| 1732.5 | | 23.50 | 223.9 | 23.03 | 200.9 |
| 1752.5 | | 23.50 | 223.9 | 22.80 | 190.5 |
| 1712.5 | 16QAM RB1-24 | 22.50 | 177.8 | 22.03 | 159.6 |
| 1732.5 | | 22.50 | 177.8 | 22.58 | 181.1 |
| 1752.5 | | 22.50 | 177.8 | 22.40 | 173.8 |

| Part 27 LTE Band 4 MODE (10.0 MHz BANDWIDTH) | | | | | |
|---|---|---|---|---|---|
| Frequency range (MHz) | Modulation | Conducted(Average) | | EIRP(Average) | |
| | | dBm | mW | dBm | mW |
| 1715.0 | QPSK RB1-49 | 23.50 | 223.9 | 22.93 | 196.3 |
| 1732.5 | | 23.50 | 223.9 | 23.38 | 217.8 |
| 1750.0 | | 23.50 | 223.9 | 23.80 | 239.9 |
| 1715.0 | 16QAM RB1-49 | 22.33 | 171.0 | 21.83 | 152.4 |
| 1732.5 | | 22.31 | 170.2 | 22.08 | 161.4 |
| 1750.0 | | 22.50 | 177.8 | 22.30 | 169.8 |

## 5.3. SOFTWARE AND FIRMWARE

The test software used during testing was 9B87

The EUT is link to CMW500 during test.

## 5.4. MAXIMUM ANTENNA GAIN

Please see table below:

| | Antenna Gain (dBi) |
|---|---|
| Band 4, 5MHz Bandwidth | 1.41 |
| Band 4, 10MHz Bandwidth | 1.20 |
| Band 17, 5MHz Bandwidth | -1.21 |
| Band 17, 10MHz Bandwidth | -1.31 |

## 5.5. WORST-CASE CONFIGURATION AND MODE

The worst-case channel for RF radiated emissions below 1GHz tests is channel with highest RF output power.

Based on the investigation results, the highest peak power and enhanced data rate is the worst-case scenario for all measurements.

Worst-case modes:

- LTE Band 4 and band 17

For the fundamental investigation, the EUT is investigated for vertical and horizontal antenna orientations and the worst case was determined to be at Z-position.

## 5.6. DESCRIPTION OF TEST SETUP

**RADIATED TESTS SUPPORT EQUIPMENT**

| PERIPHERAL SUPPORT EQUIPMENT LIST | | | |
|---|---|---|---|
| **Description** | **Manufacturer** | **Model** | **Serial Number** |
| Earphone | Apple | NA | NA |
| AC adapter | Apple | A1344 | NA |

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

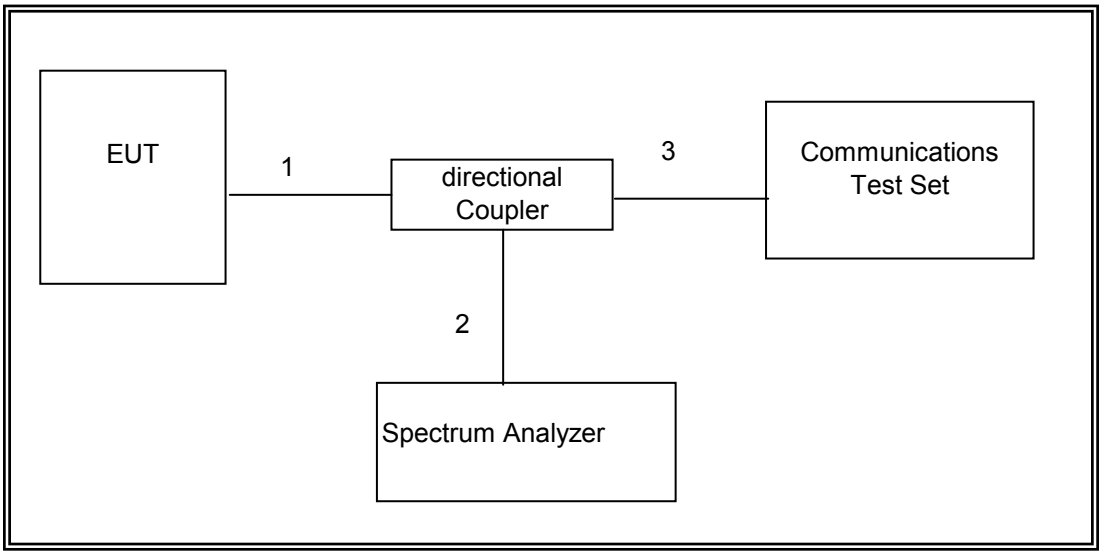
| I/O CABLE LIST | | | | | | |
|---|---|---|---|---|---|---|
| Cable No. | Port | # of Identical Ports | Connector Type | Cable Type | Cable Length | Remarks |
| 1 | RFOut | 1 | Directional Coupler | Un-shielded | 0.1m | NA |
| 2 | RF In/Out | 1 | Spectrum Analyzer | Un-shielded | None | NA |
| 3 | RF In/Out | 1 | Communications Test Set | Un-shielded | 1.2m | NA |

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

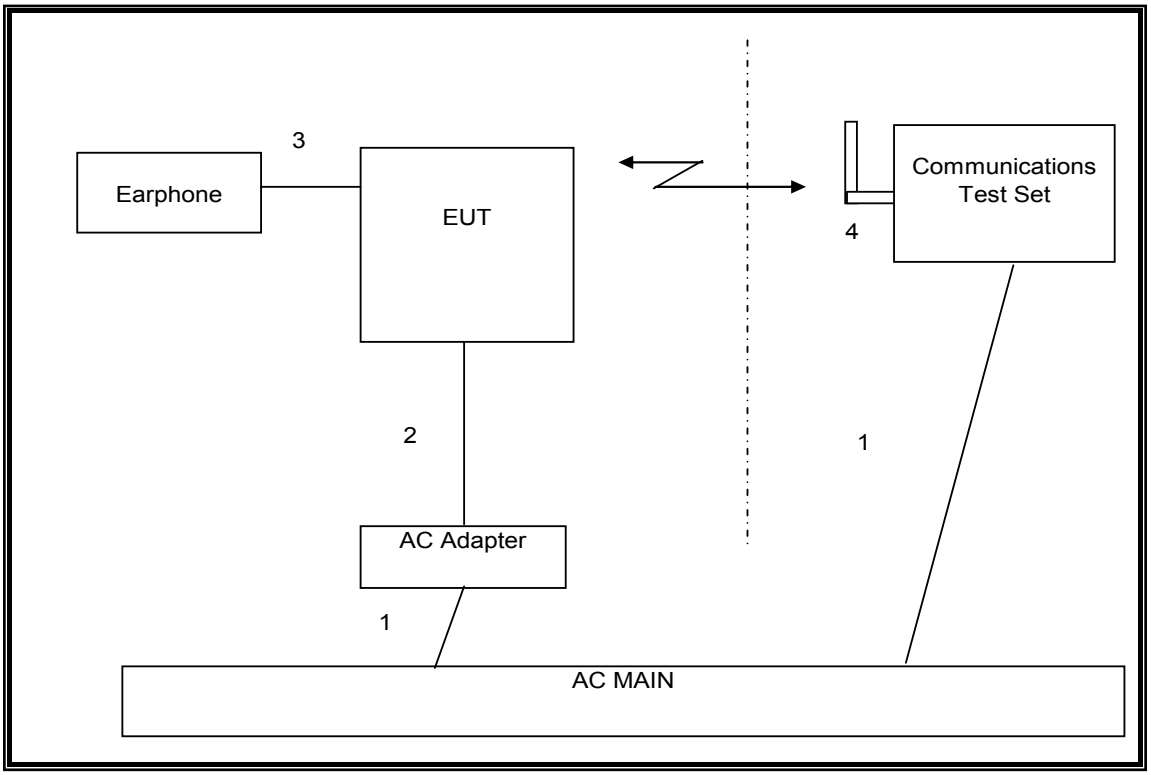
| I/O CABLE LIST | | | | | | |
|---|---|---|---|---|---|---|
| **Cable No.** | **Port** | **# of Identica Ports** | **Connector Type** | **Cable Type** | **Cable Length** | **Remarks** |
| 1 | AC | 2 | US 115V | Un-shielded | 2m | NA |
| 2 | DC | 1 | US 115V | Un-shielded | 1m | NA |
| 3 | Jack | 1 | Earphone | Un-shielded | 0.5m | NA |
| 4 | RF In/Out | 1 | Antenna | Un-shielded | none | NA |

## TEST SETUP

### CONDUCTED SETUP DIAGRAM FOR TESTS




### RADIATED SETUP DIAGRAM FOR TESTS



# 6. TEST AND MEASUREMENT EQUIPMENT

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

| TEST EQUIPMENT LIST | | | | |
|---|---|---|---|---|
| **Description** | **Manufacturer** | **Model** | **Asset** | **Cal Due** |
| Spectrum Analyzer, 26.5 GHz | Agilent / HP | E4440A | C01178 | 08/30/12 |
| Antenna, Horn, 18 GHz | EMCO | 3115 | C00945 | 06/29/12 |
| Antenna, Bilog, 2 GHz | Sunol Sciences | JB1 | C01011 | 07/16/12 |
| Preamplifier, 26.5 GHz | Agilent / HP | 8449B | C01052 | 07/12/12 |
| Preamplifier, 1300 MHz | Agilent / HP | 8447D | C00885 | 01/27/12 |
| Communication Test Set | R & S | CMW500 | N/A | 05/17/12 |
| Temperature / Humidity Chamber | Thermotron | SE 600-10-10 | C00930 | 10/20/12 |
| Highpass Filter, 1.5 GHz | Micro-Tronics | HPM13193 | N02689` | CNR |
| Highpass Filter, 2.7 GHz | Micro-Tronics | HPM13194 | N02687 | CNR |
| Directional Coupler | RF-Lambda | RDC5M06G15 | None | CNR |
| Sleeve Dipole 1730~2030 MHz | ETS | 3126-1880 | C01157 | 10/01/12 |
| Signal Generator, 20 GHz | Agilent / HP | 83732B | C00774 | 07/14/12 |
| Antenna, Tuned Dipole 400~1000 MHz | ETS | 3121C DB4 | C00993 | 07/10/12 |

# 7. RF POWER OUTPUT VERIFICATION

## 7.1. RF OUTPUT POWER FOR LTE BAND 17 (5MHz)

| Freq. (MHz) | UL Channel | BW (MHz) | RB Size | RB Offset | Modulation | MPR (dB) | Max Avg Power (dBm) | Max Pk Power (dBm) |
|---|---|---|---|---|---|---|---|---|
| 706.5 | 23755 | 5 (L) | 1 | 0 | QPSK | 0 | 24.30 | 27.65 |
| | | | 1 | 24 | | 0 | 24.30 | 27.50 |
| | | | 12 | 6 | | 1 | 23.20 | 27.80 |
| | | | 25 | 0 | | 1 | 23.30 | 28.40 |
| | | | 1 | 0 | 16-QAM | 1 | 23.50 | 27.70 |
| | | | 1 | 24 | | 1 | 23.47 | 27.50 |
| | | | 12 | 6 | | 2 | 22.40 | 27.70 |
| | | | 25 | 0 | | 2 | 22.50 | 28.30 |
| 710.0 | 23790 | 5 (M) | 1 | 0 | QPSK | 0 | 24.30 | 27.60 |
| | | | 1 | 24 | | 0 | 24.30 | 27.56 |
| | | | 12 | 6 | | 1 | 23.20 | 27.57 |
| | | | 25 | 0 | | 1 | 23.30 | 28.60 |
| | | | 1 | 0 | 16-QAM | 1 | 23.40 | 27.60 |
| | | | 1 | 24 | | 1 | 23.30 | 27.50 |
| | | | 12 | 6 | | 2 | 22.20 | 27.50 |
| | | | 25 | 0 | | 2 | 22.50 | 28.50 |
| 713.5 | 23825 | 5 (H) | 1 | 0 | QPSK | 0 | 24.30 | 27.50 |
| | | | 1 | 24 | | 0 | 24.30 | 27.60 |
| | | | 12 | 6 | | 1 | 23.20 | 27.80 |
| | | | 25 | 0 | | 1 | 23.30 | 28.50 |
| | | | 1 | 0 | 16-QAM | 1 | 23.45 | 27.60 |
| | | | 1 | 24 | | 1 | 23.40 | 27.76 |
| | | | 12 | 6 | | 2 | 22.20 | 27.70 |
| | | | 25 | 0 | | 2 | 22.50 | 28.50 |

## 7.2. RF OUTPUT POWER FOR LTE BAND 17 (10MHz)

| Freq. (MHz) | UL Channel | BW (MHz) | RB Size | RB Offset | Modulation | MPR (dB) | Max Avg Power (dBm) | Max Pk Power (dBm) |
|---|---|---|---|---|---|---|---|---|
| 709 | 23780 | 10 (L) | 1 | 0 | QPSK | 0 | 24.40 | 27.80 |
| | | | 1 | 49 | | 0 | 24.30 | 27.70 |
| | | | 25 | 12 | | 1 | 23.30 | 28.00 |
| | | | 50 | 0 | | 1 | 23.30 | 28.60 |
| | | | 1 | 0 | 16-QAM | 1 | 23.50 | 27.70 |
| | | | 1 | 49 | | 1 | 23.50 | 27.60 |
| | | | 25 | 12 | | 2 | 22.48 | 28.00 |
| | | | 50 | 0 | | 2 | 22.45 | 28.40 |
| 710.0 | 23790 | 10 (M) | 1 | 0 | QPSK | 0 | 24.43 | 27.85 |
| | | | 1 | 49 | | 0 | 24.30 | 27.80 |
| | | | 25 | 12 | | 1 | 23.30 | 27.80 |
| | | | 50 | 0 | | 1 | 23.42 | 28.74 |
| | | | 1 | 0 | 16-QAM | 1 | 23.50 | 27.70 |
| | | | 1 | 49 | | 1 | 23.48 | 27.50 |
| | | | 25 | 12 | | 2 | 22.30 | 27.80 |
| | | | 50 | 0 | | 2 | 22.42 | 28.60 |
| 711 | 23800 | 10 (H) | 1 | 0 | QPSK | 0 | 24.40 | 27.80 |
| | | | 1 | 49 | | 0 | 24.30 | 27.70 |
| | | | 25 | 12 | | 1 | 23.30 | 27.70 |
| | | | 50 | 0 | | 1 | 23.30 | 28.60 |
| | | | 1 | 0 | 16-QAM | 1 | 23.50 | 27.60 |
| | | | 1 | 49 | | 1 | 23.40 | 27.55 |
| | | | 25 | 12 | | 2 | 22.35 | 27.80 |
| | | | 50 | 0 | | 2 | 22.44 | 28.56 |

## 7.3. RF OUTPUT POWER FOR LTE BAND 4 (5 MHz)

| Freq. (MHz) | UL Channel | BW (MHz) | RB Size | RB Offset | Modulation | MPR (dB) | Max Avg Power (dBm) | Max Pk Power (dBm) |
|---|---|---|---|---|---|---|---|---|
| 1712.5 | 19975 | 5 (L) | 1 | 0 | QPSK | 0 | 23.45 | 27.56 |
| | | | 1 | 24 | | 0 | 23.50 | 27.84 |
| | | | 12 | 6 | | 1 | 22.50 | 27.40 |
| | | | 25 | 0 | | 1 | 22.40 | 28.20 |
| | | | 1 | 0 | 16-QAM | 1 | 22.5 | 27.56 |
| | | | 1 | 24 | | 1 | 22.5 | 27.83 |
| | | | 12 | 6 | | 2 | 21.41 | 27.60 |
| | | | 25 | 0 | | 2 | 21.40 | 28.25 |
| 1732.5 | 20175 | 5 (M) | 1 | 0 | QPSK | 0 | 23.45 | 27.85 |
| | | | 1 | 24 | | 0 | 23.50 | 27.80 |
| | | | 12 | 6 | | 1 | 22.40 | 27.70 |
| | | | 25 | 0 | | 1 | 22.45 | 28.25 |
| | | | 1 | 0 | 16-QAM | 1 | 22.40 | 27.87 |
| | | | 1 | 24 | | 1 | 22.50 | 27.91 |
| | | | 12 | 6 | | 2 | 21.38 | 28.06 |
| | | | 25 | 0 | | 2 | 21.48 | 28.36 |
| 1752.5 | 20375 | 5 (H) | 1 | 0 | QPSK | 0 | 23.40 | 28.01 |
| | | | 1 | 24 | | 0 | 23.50 | 28.02 |
| | | | 12 | 6 | | 1 | 22.45 | 27.73 |
| | | | 25 | 0 | | 1 | 22.50 | 28.27 |
| | | | 1 | 0 | 16-QAM | 1 | 22.47 | 28.00 |
| | | | 1 | 24 | | 1 | 22.50 | 28.01 |
| | | | 12 | 6 | | 2 | 21.50 | 27.98 |
| | | | 25 | 0 | | 2 | 21.40 | 28.60 |

## 7.4. RF OUTPUT POWER FOR LTE BAND 4 (10MHz)

| Freq. (MHz) | UL Channel | BW (MHz) | RB Size | RB Offset | Modulation | MPR (dB) | Max Avg Power (dBm) | Max Pk Power (dBm) |
|---|---|---|---|---|---|---|---|---|
| 1715 | 20000 | 10 (L) | 1 | 0 | QPSK | 0 | 23.40 | 27.18 |
| | | | 1 | 49 | | 0 | 23.50 | 27.54 |
| | | | 25 | 12 | | 1 | 22.50 | 27.59 |
| | | | 50 | 0 | | 1 | 22.50 | 28.00 |
| | | | 1 | 0 | 16-QAM | 1 | 22.20 | 27.43 |
| | | | 1 | 49 | | 1 | 22.33 | 27.83 |
| | | | 25 | 12 | | 2 | 21.50 | 27.60 |
| | | | 50 | 0 | | 2 | 21.47 | 28.24 |
| 1732.5 | 20175 | 10 (M) | 1 | 0 | QPSK | 0 | 23.45 | 27.54 |
| | | | 1 | 49 | | 0 | 23.50 | 27.62 |
| | | | 25 | 12 | | 1 | 22.43 | 28.05 |
| | | | 50 | 0 | | 1 | 22.50 | 28.60 |
| | | | 1 | 0 | 16-QAM | 1 | 22.30 | 27.94 |
| | | | 1 | 49 | | 1 | 22.31 | 27.79 |
| | | | 25 | 12 | | 2 | 21.45 | 28.22 |
| | | | 50 | 0 | | 2 | 21.50 | 28.74 |
| 1750 | 20350 | 10 (H) | 1 | 0 | QPSK | 0 | 23.45 | 27.80 |
| | | | 1 | 49 | | 0 | 23.50 | 27.75 |
| | | | 25 | 12 | | 1 | 22.40 | 27.95 |
| | | | 50 | 0 | | 1 | 22.50 | 28.50 |
| | | | 1 | 0 | 16-QAM | 1 | 22.49 | 28.02 |
| | | | 1 | 49 | | 1 | 22.50 | 28.00 |
| | | | 25 | 12 | | 2 | 21.50 | 28.03 |
| | | | 50 | 0 | | 2 | 21.45 | 28.78 |

# 8. CONDUCTED TEST RESULTS

## 8.1. OCCUPIED BANDWIDTH

**RULE PART(S)**

FCC: §2.1049

**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 low, middle and high channel in each band. The -26dB bandwidth was also measured and recorded.

**MODES TESTED**

- LTE BAND 4 and 17

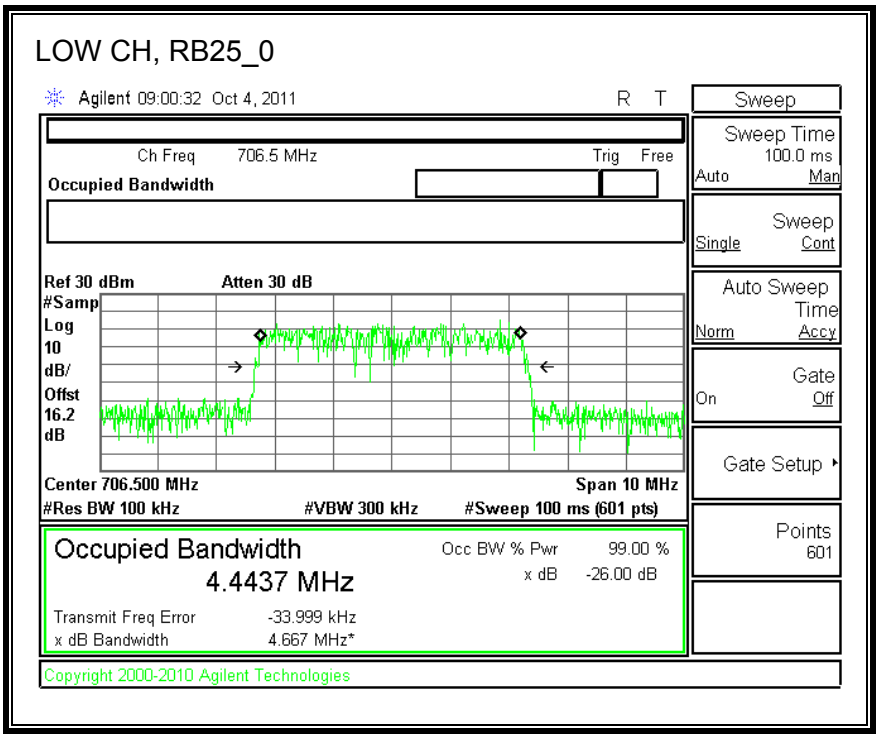
**RESULTS**

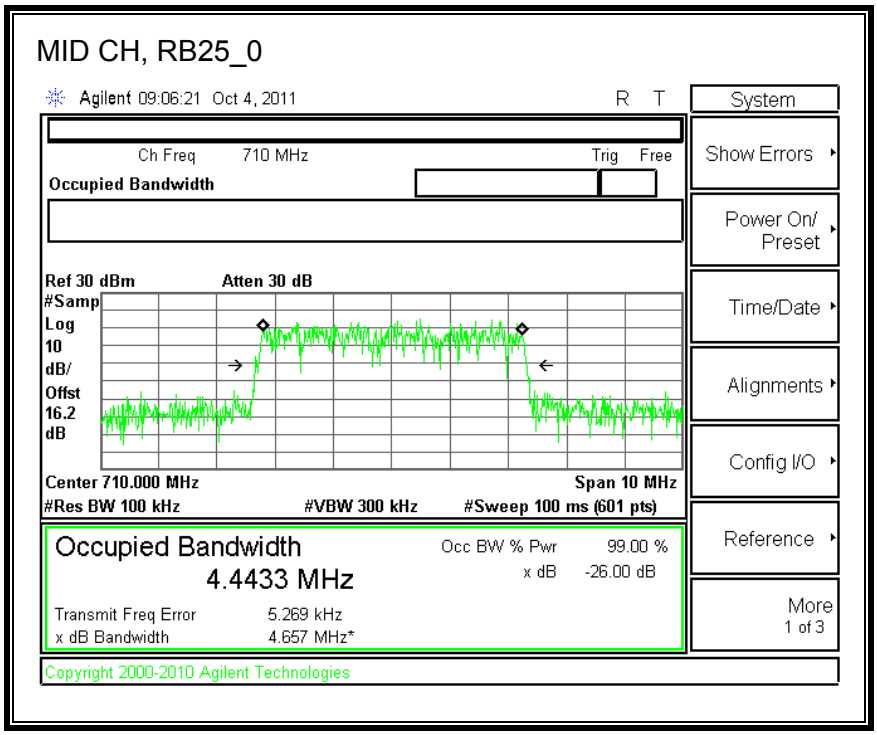
| Band | Mode | RB/RB SIZE | f (MHz) | 99% BW (MHz) | -26dB BW (MHz) |
|---|---|---|---|---|---|
| LTE BAND 17 | 5.0 MHz BAND QPSK | 25/0 | 706.5 | 4.4437 | 4.667 |
| | | | 710.0 | 4.4433 | 4.657 |
| | | | 713.5 | 4.4657 | 4.675 |
| | 5.0 MHz BAND 16QAM | | 706.5 | 4.4923 | 4.701 |
| | | | 710.0 | 4.4624 | 4.681 |
| | | | 713.5 | 4.4893 | 4.686 |
| | 10.0 MHz BAND QPSK | 50/0 | 709.0 | 8.9640 | 9.354 |
| | | | 710.5 | 8.9301 | 9.343 |
| | | | 711.0 | 8.9677 | 9.362 |
| | 10.0 MHz BAND 16QAM | | 709.0 | 8.9555 | 9.364 |
| | | | 710.5 | 8.8327 | 9.297 |
| | | | 711.0 | 8.9113 | 9.368 |

| Band | Mode | RB/RB SIZE | f (MHz) | 99% BW (MHz) | -26dB BW (MHz) |
|---|---|---|---|---|---|
| LTE BAND 4 | 5.0 MHz BAND QPSK | 25/0 | 1712.5 | 4.4435 | 4.681 |
| | | | 1732.5 | 4.4455 | 4.667 |
| | | | 1752.5 | 4.4573 | 4.678 |
| | 5.0 MHz BAND 16QAM | | 1712.5 | 4.4571 | 4.909 |
| | | | 1732.5 | 4.4420 | 4.663 |
| | | | 1752.5 | 4.4670 | 4.647 |
| | 10.0 MHz BAND QPSK | 50/0 | 1715.0 | 8.8942 | 9.289 |
| | | | 1732.5 | 8.9440 | 9.333 |
| | | | 1750.0 | 8.9774 | 9.647 |
| | 10.0 MHz BAND 16QAM | | 1715.0 | 8.8815 | 9.346 |
| | | | 1732.5 | 8.9466 | 9.321 |
| | | | 1750.0 | 8.9280 | 9.369 |

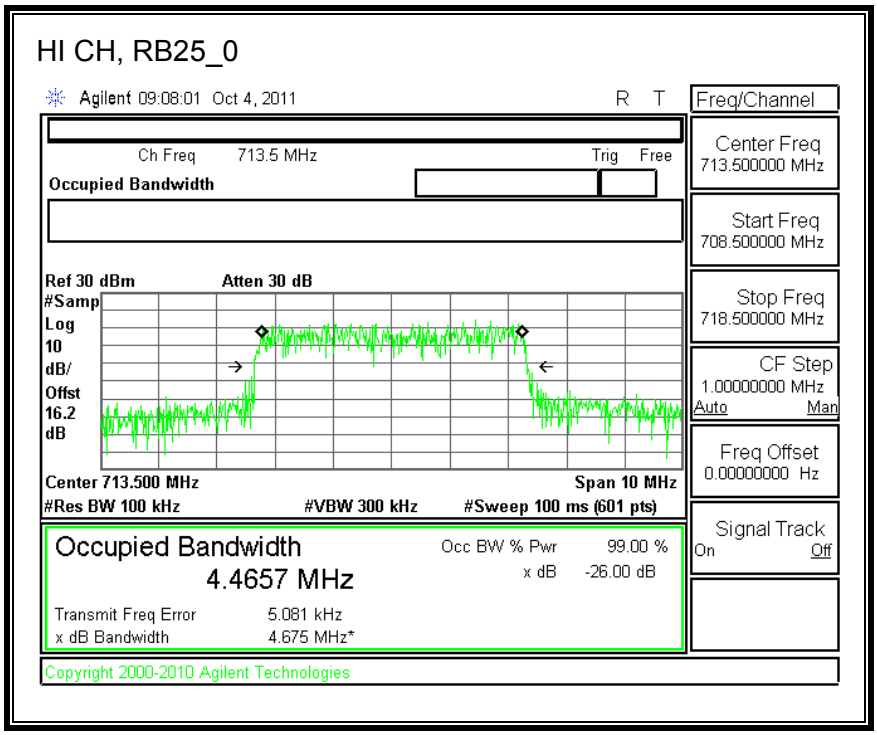
**Band 17 (5.0 MHz BAND WIDTH)**

**LTE QPSK**



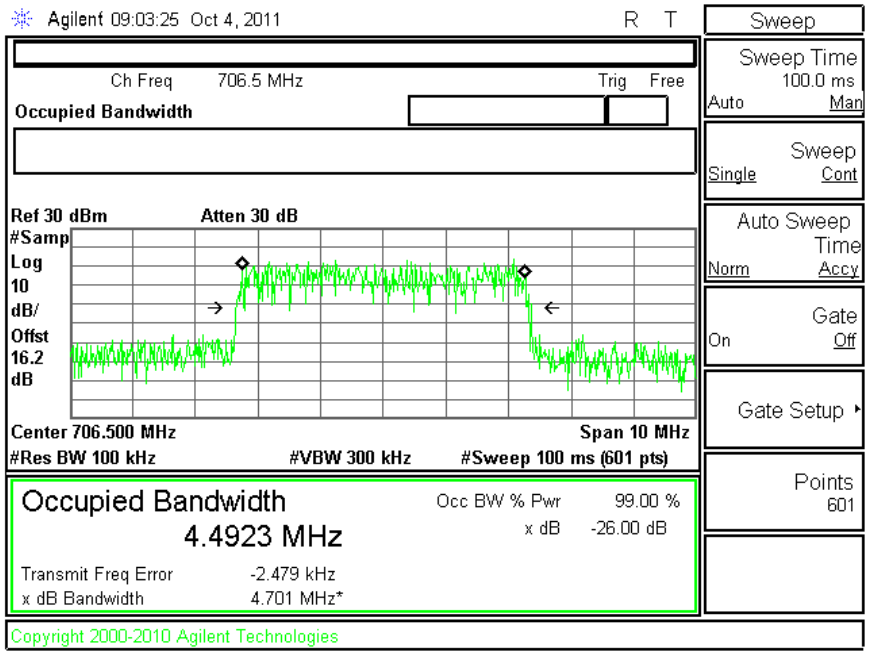



HI CH, RB25_0

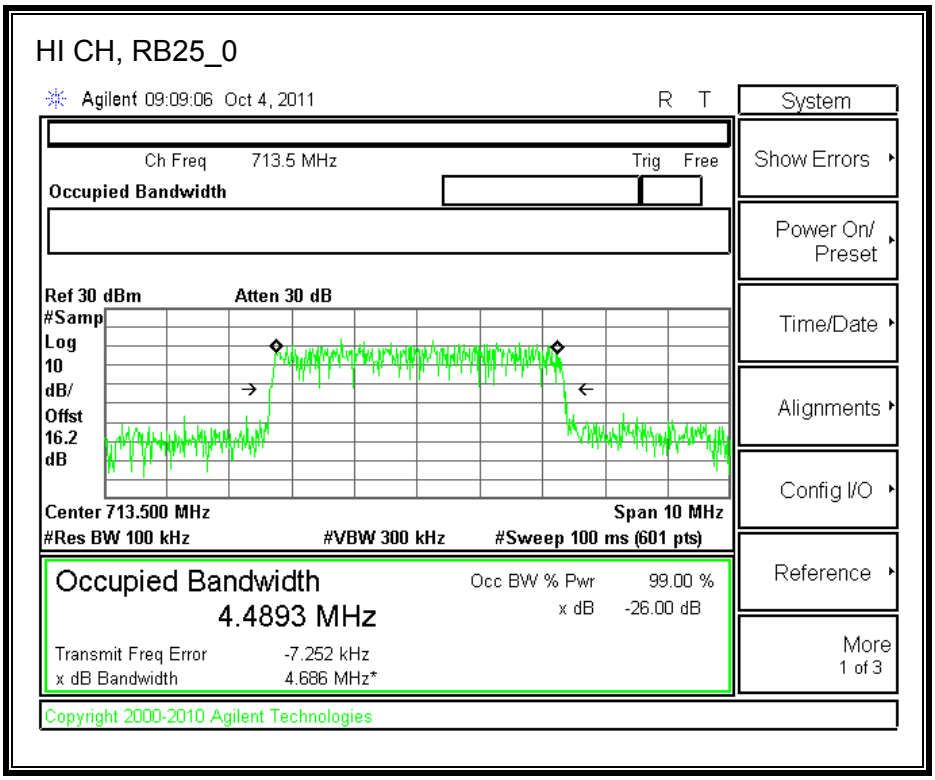


**LTE 16QAM**

LOW CH, RB25_0

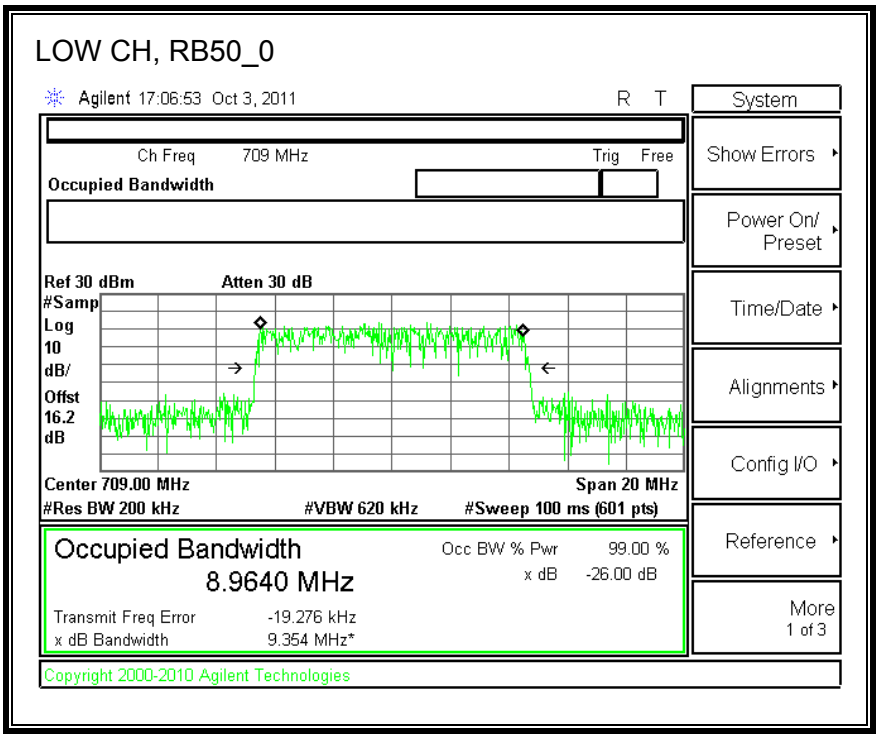


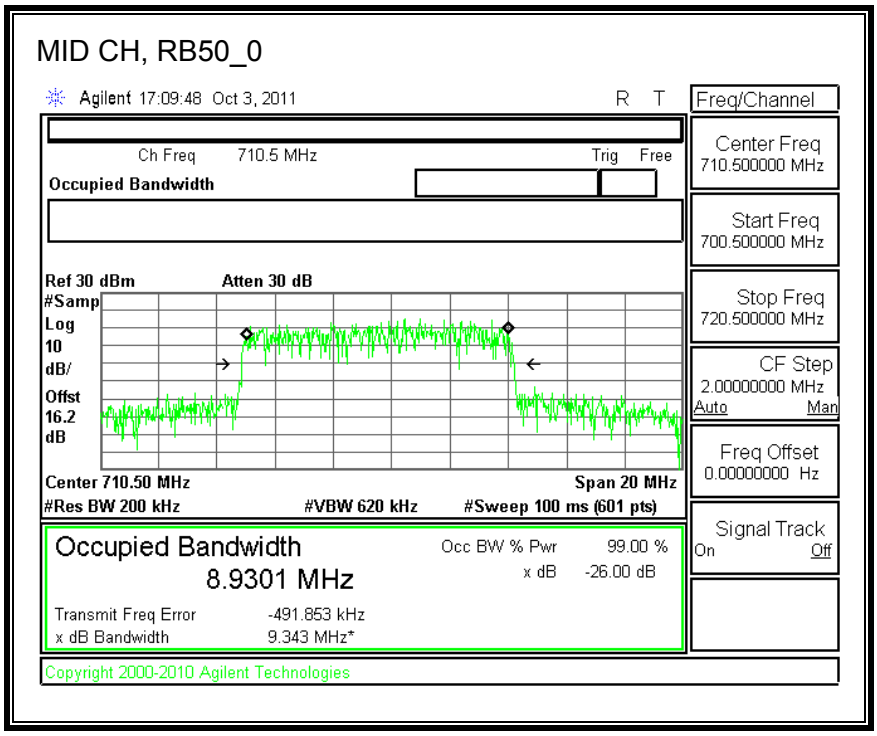

MID CH, RB25_0



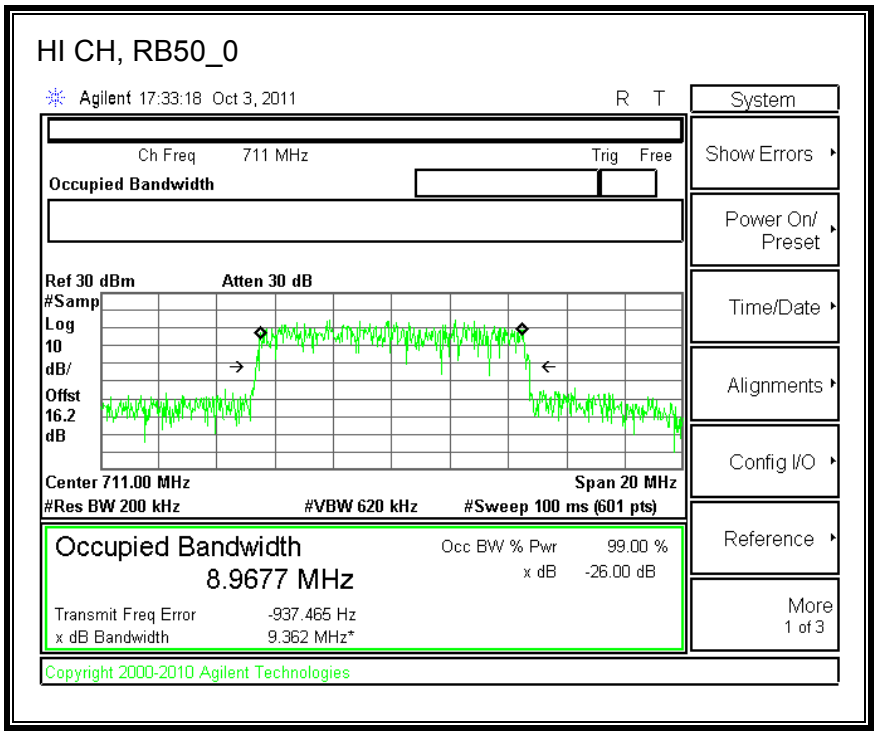
**Band 17 (10.0 MHz BAND WIDTH)**

**LTE QPSK**



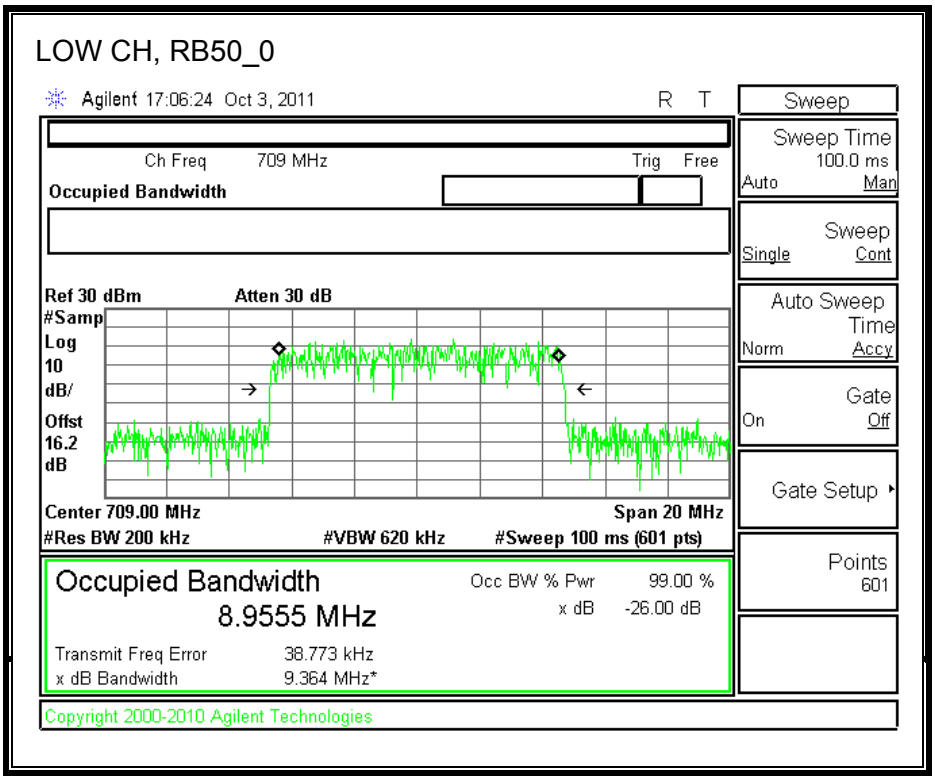



HI CH, RB50_0

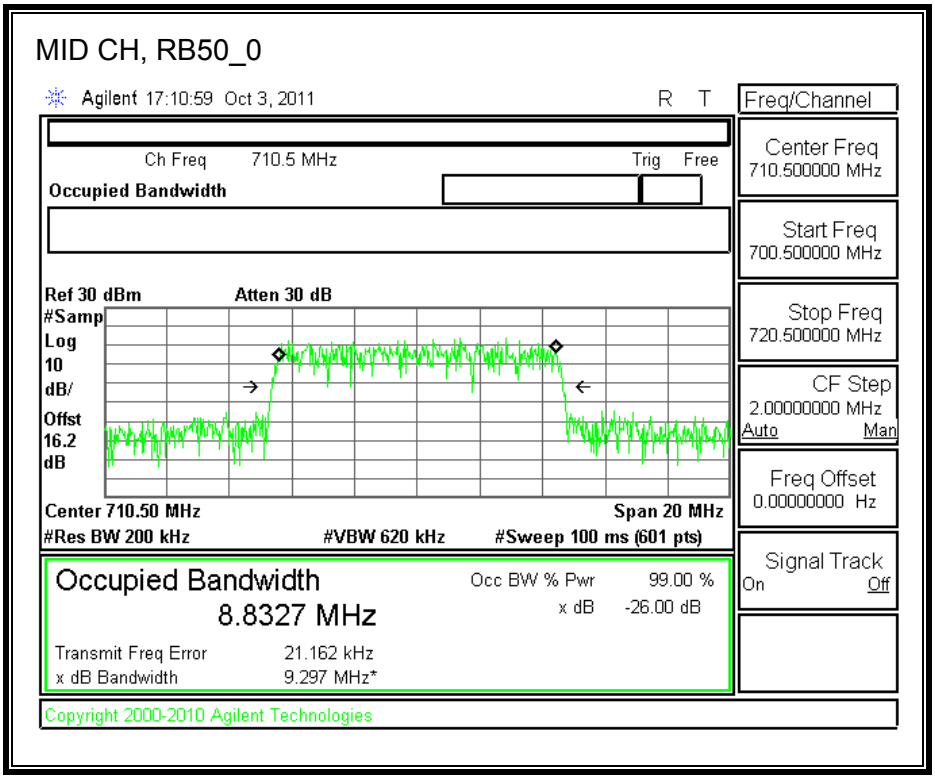


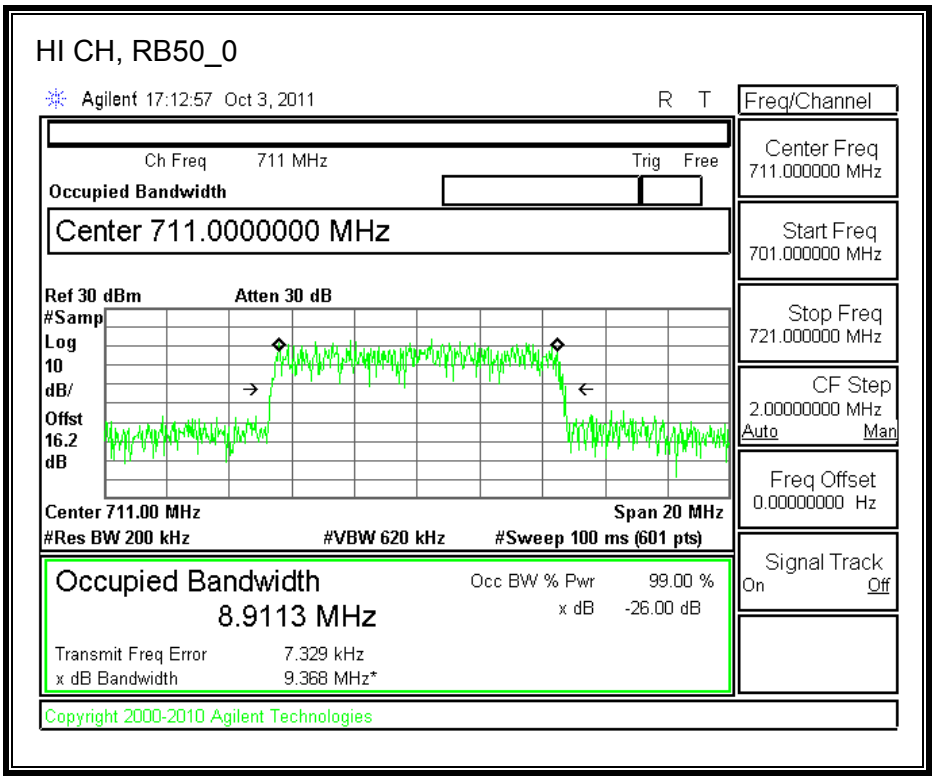
**LTE 16QAM**

LOW CH, RB50_0



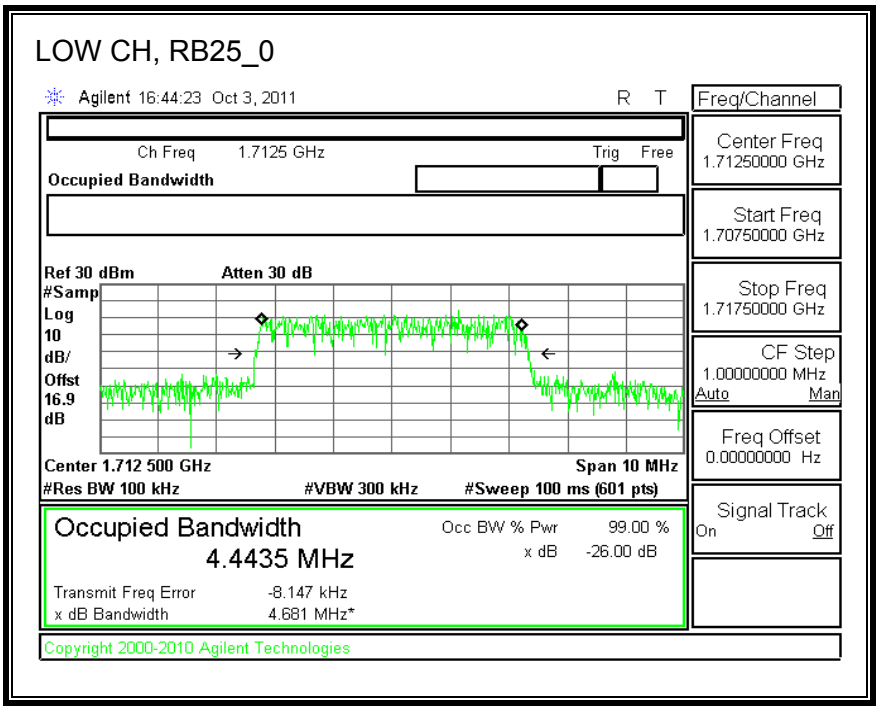

MID CH, RB50_0

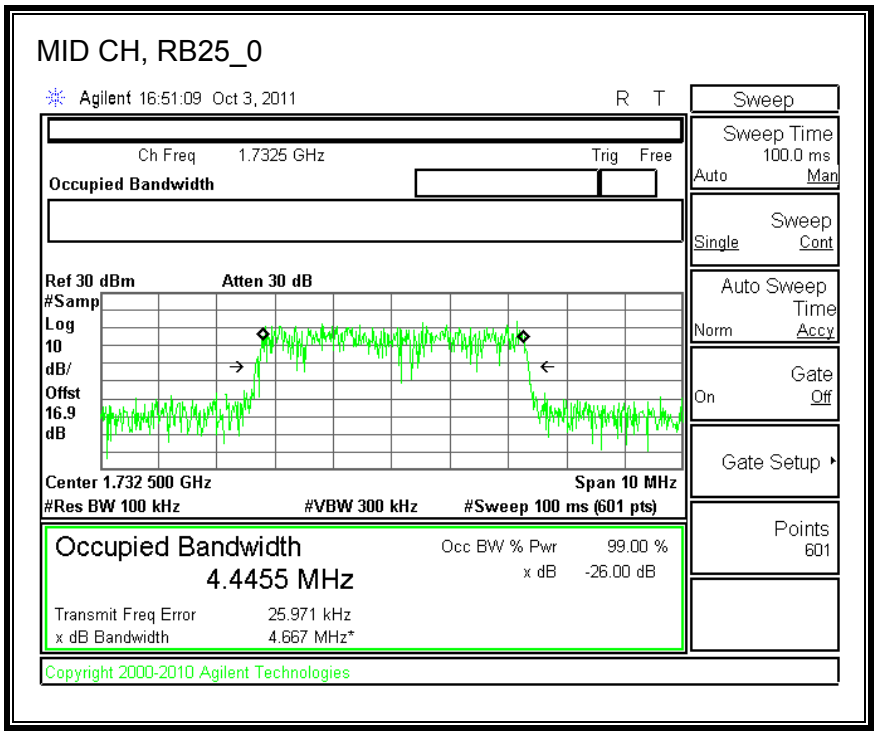




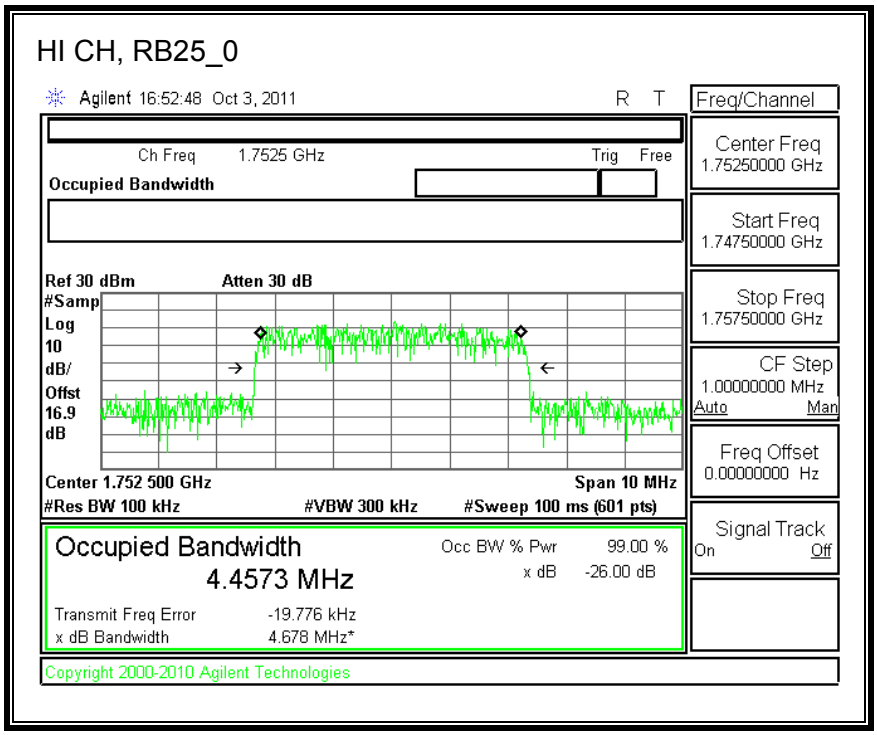
**Band 4 (5.0 MHz BAND WIDTH)**

**LTE QPSK**



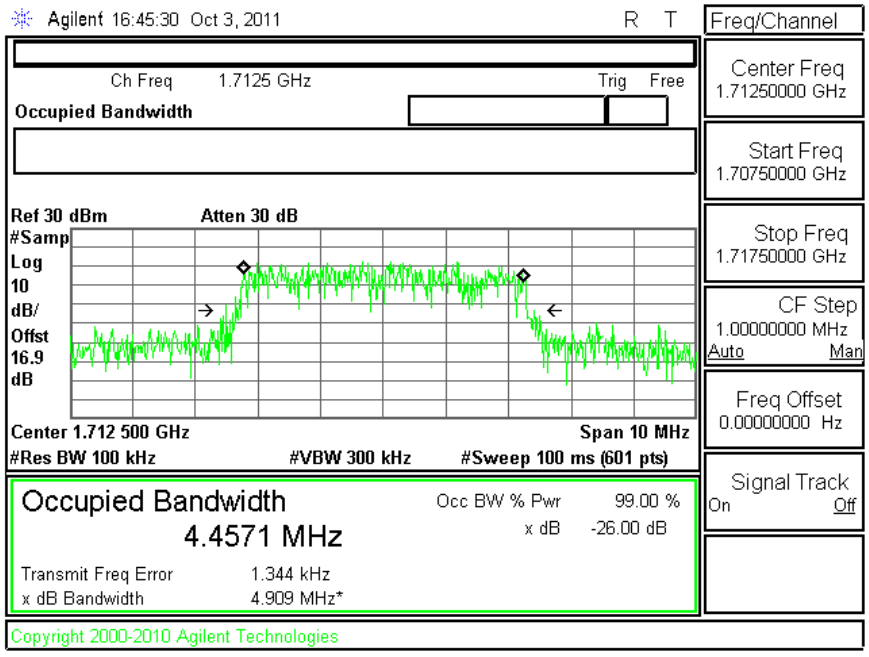



HI CH, RB25_0

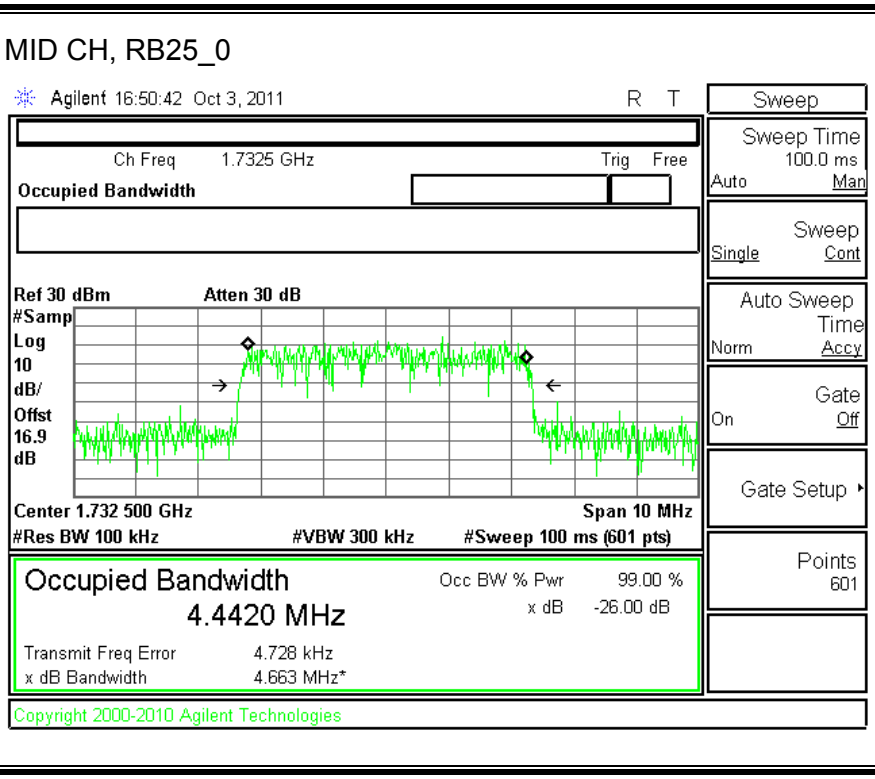


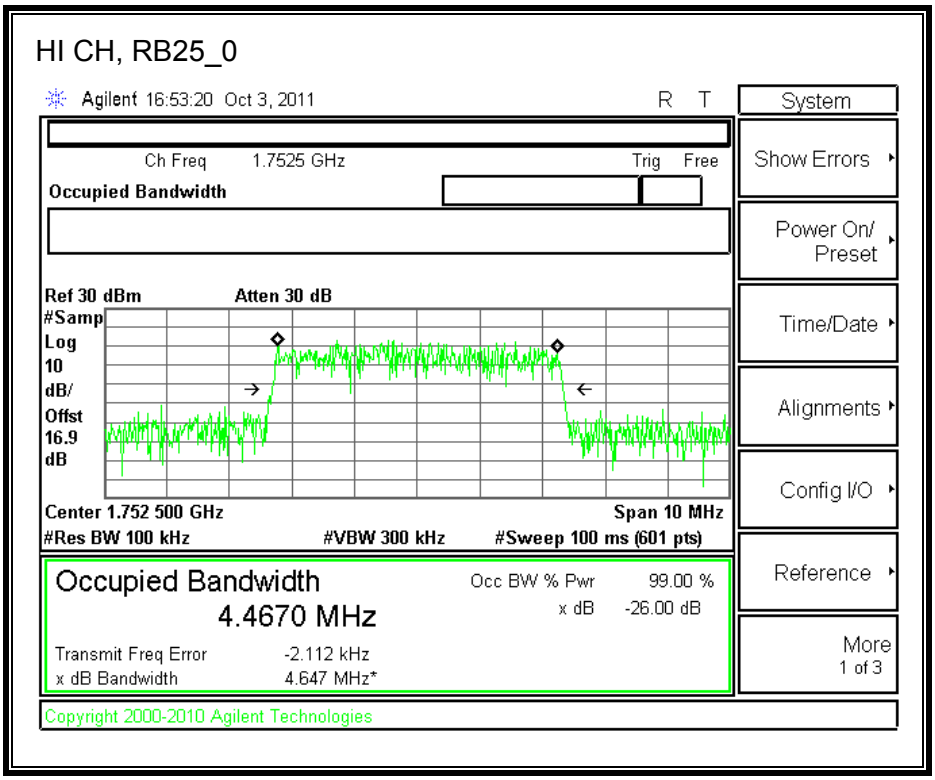
**LTE 16QAM**

LOW CH, RB25_0



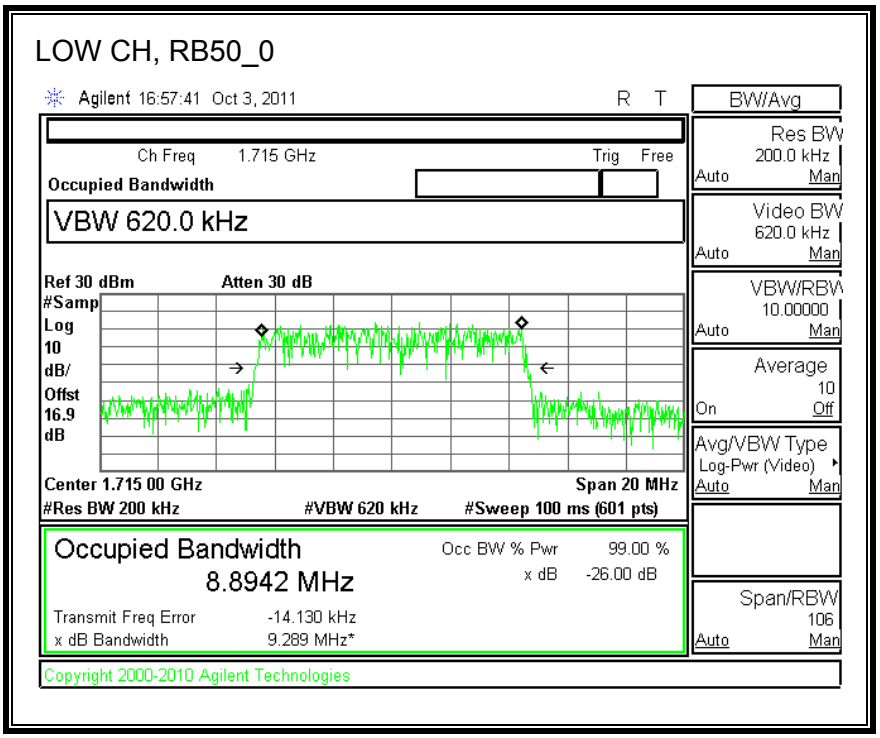

MID CH, RB25_0

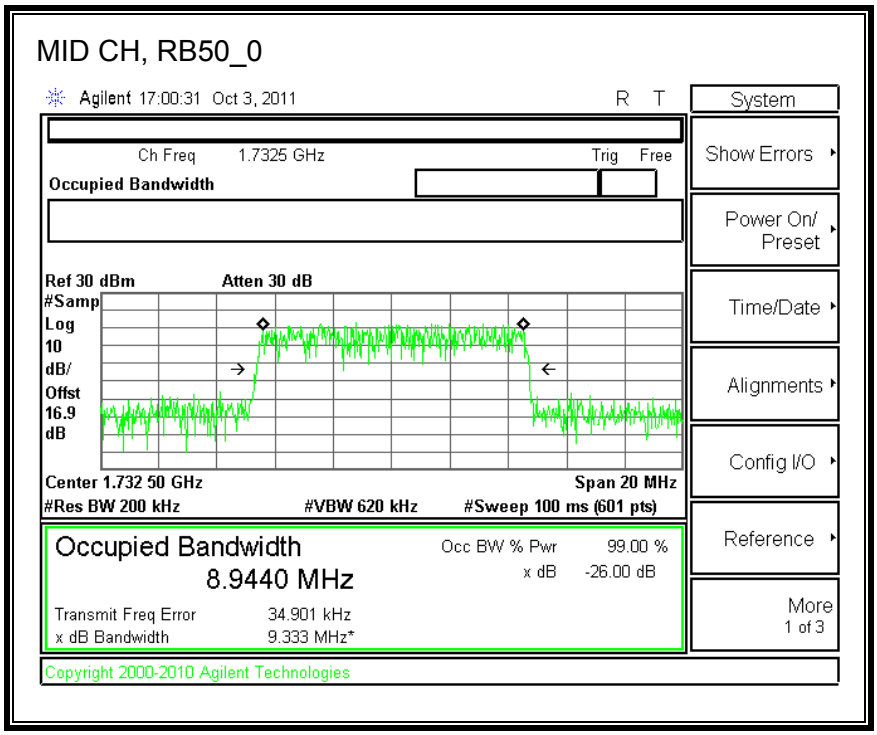




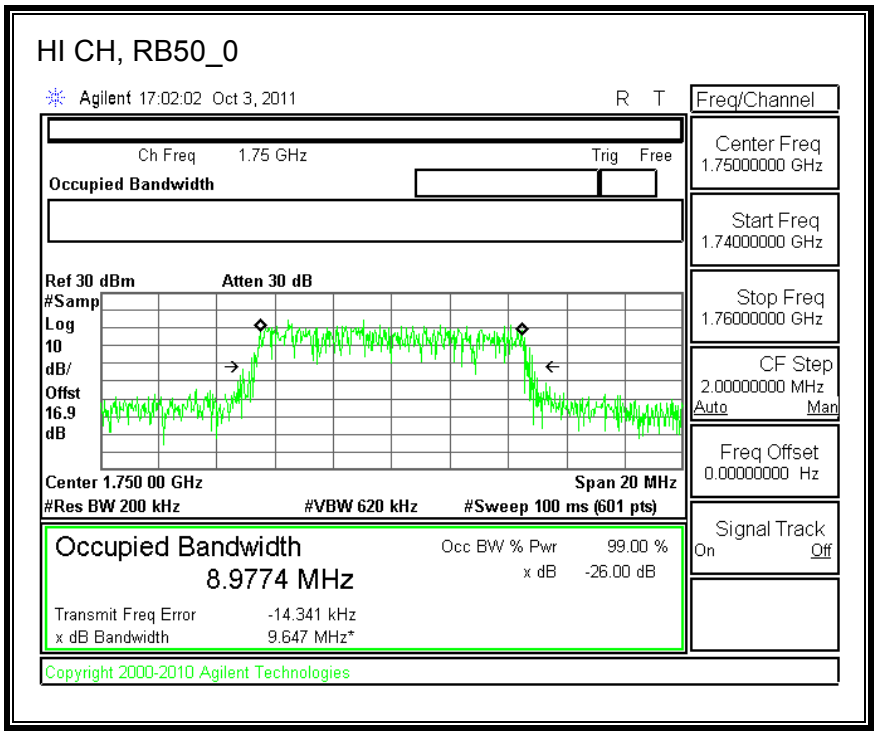
**Band 4 (10.0 MHz BAND WIDTH)**

**LTE QPSK**



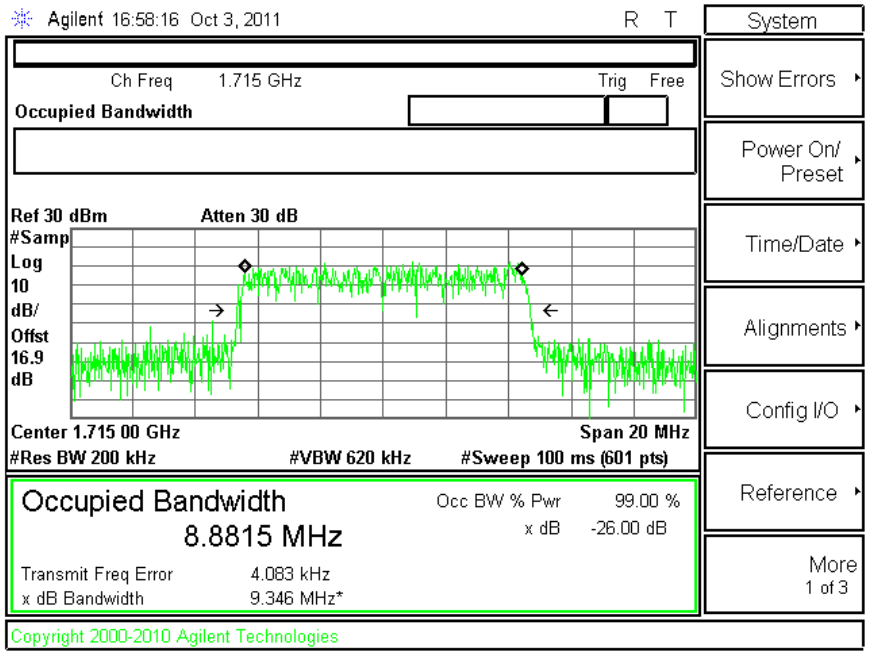



HI CH, RB50_0

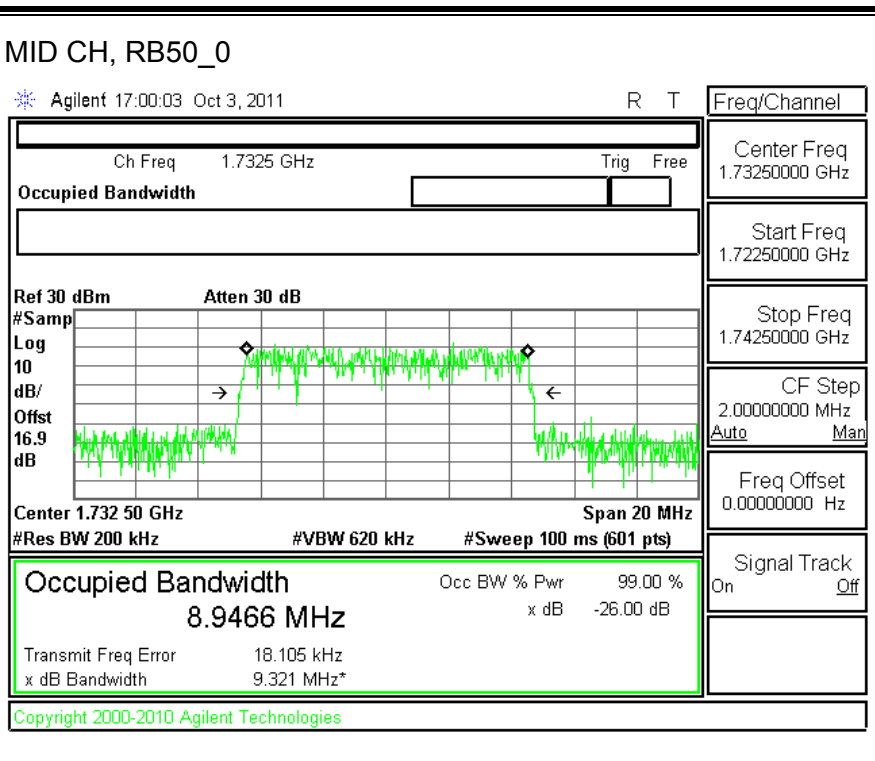


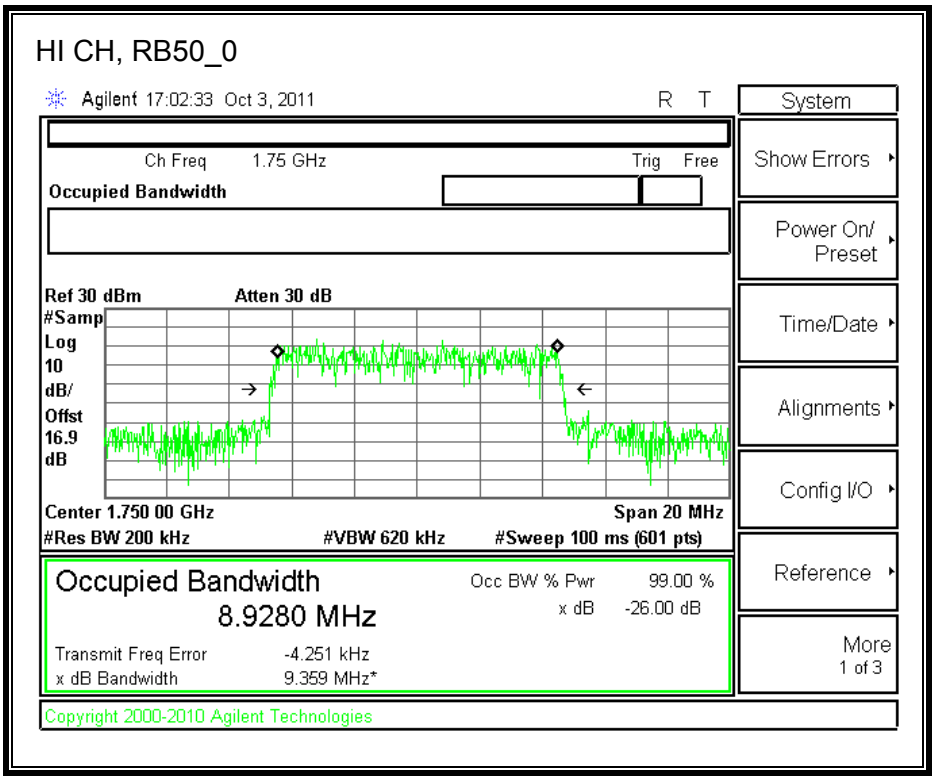
**LTE 16QAM**

LOW CH, RB50_0




MID CH, RB50_0





## 8.2. BAND EDGE

**RULE PART(S)**

FCC: 27.53

**LIMITS**

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.

**TEST PROCEDURE**

The transmitter output was connected to a CMW500Test 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:

- Set the spectrum analyzer span to include the block edge frequency (704, 716, 1710 and1755MHz)
- Set a marker to point the corresponding band edge frequency in each test case.
- Set display line at -13 dBm
- Set resolution bandwidth to at least 1% of emission bandwidth.

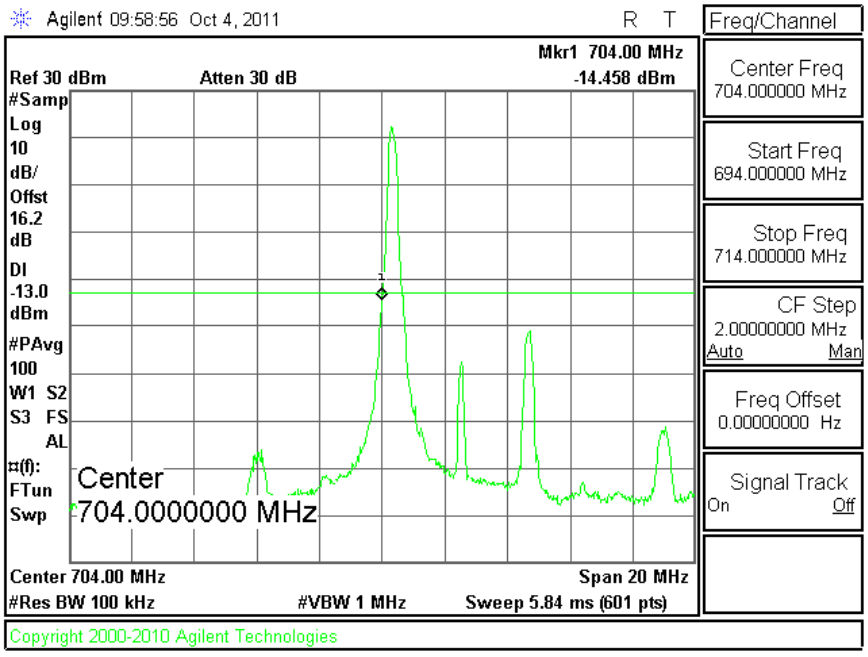
**MODES TESTED**

- LTE BAND 4 and BAND 17

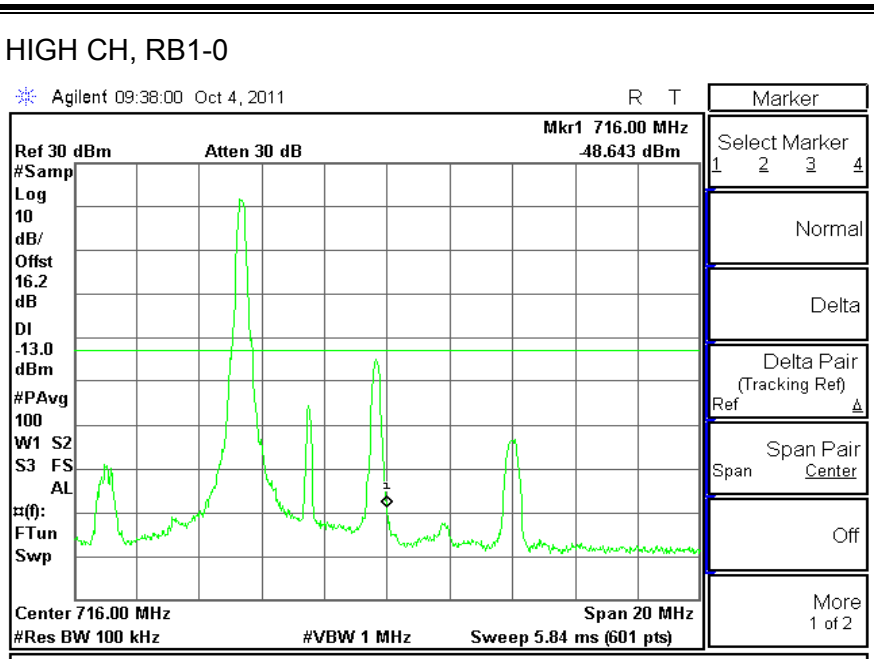
**RESULTS**

**LTE QPSK Band 17 (5.0 MHz BAND WIDTH )**

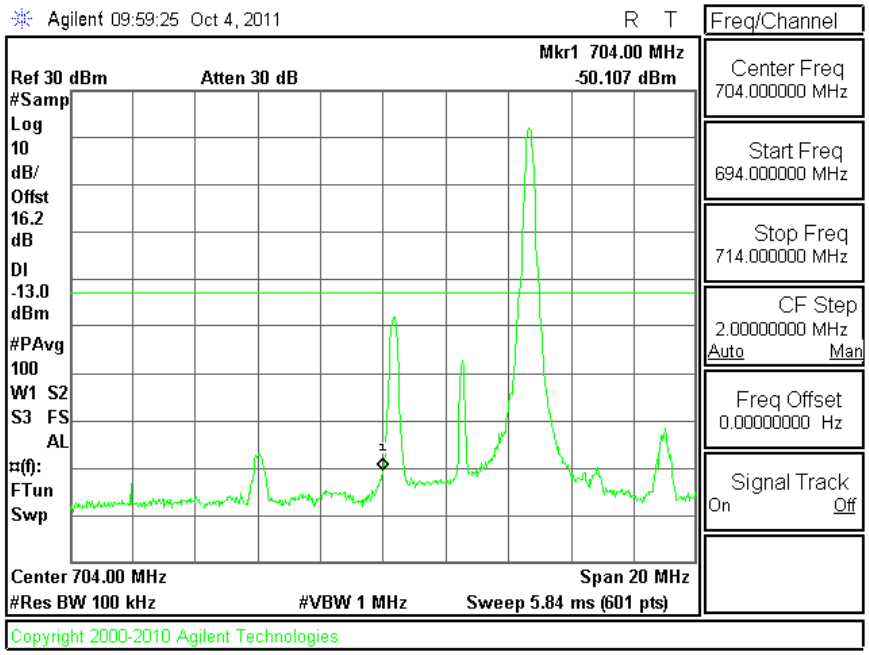
LOW CH, RB1-0



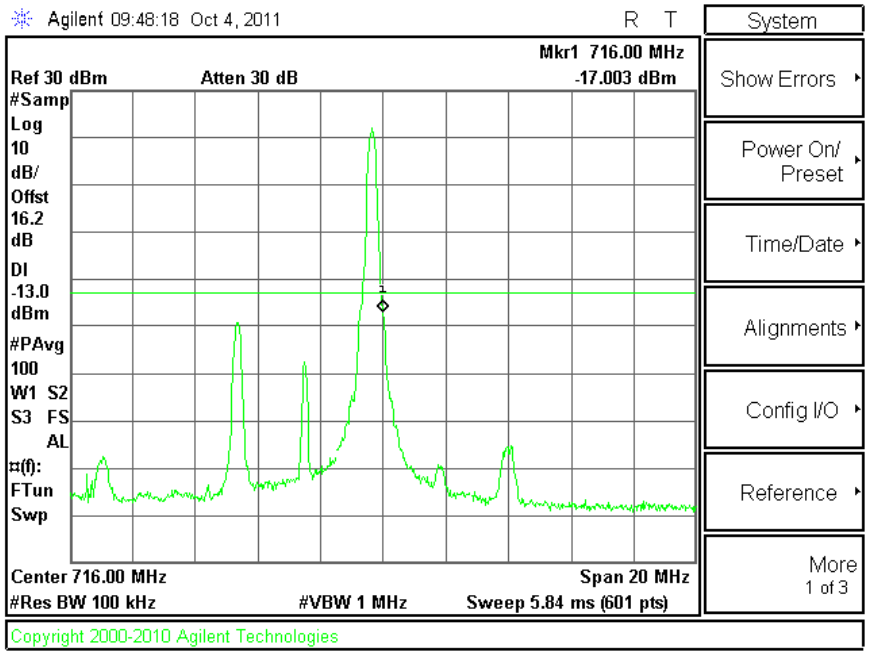

HIGH CH, RB1-0



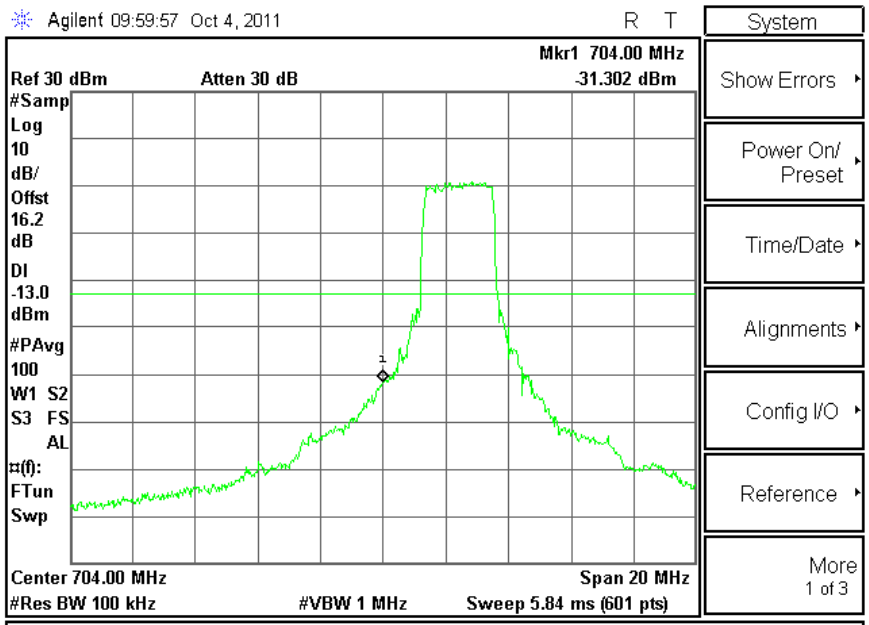
LOW CH, RB1-24



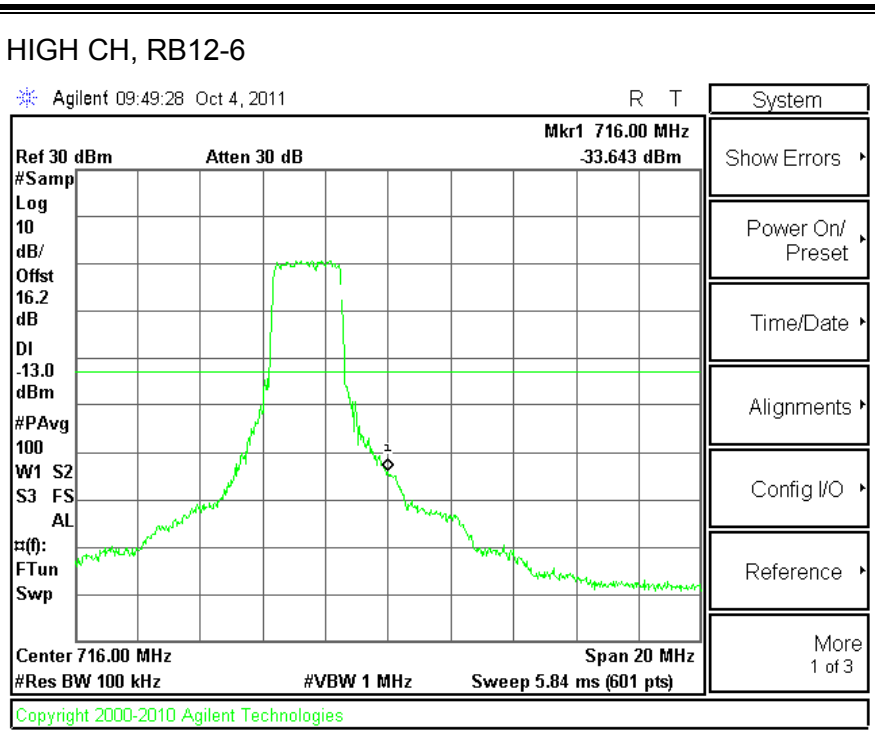

HIGH CH, RB1-24



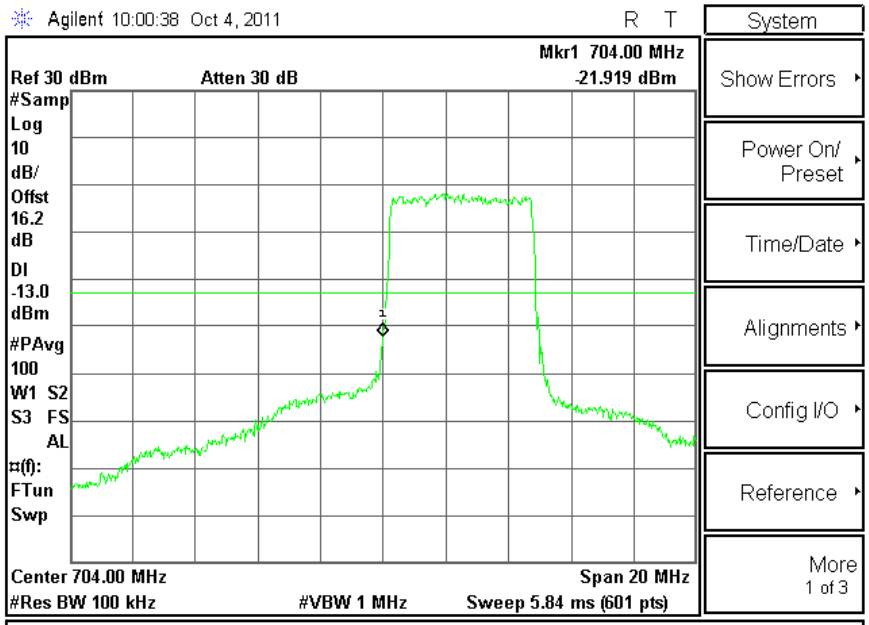
LOW CH, RB12-6



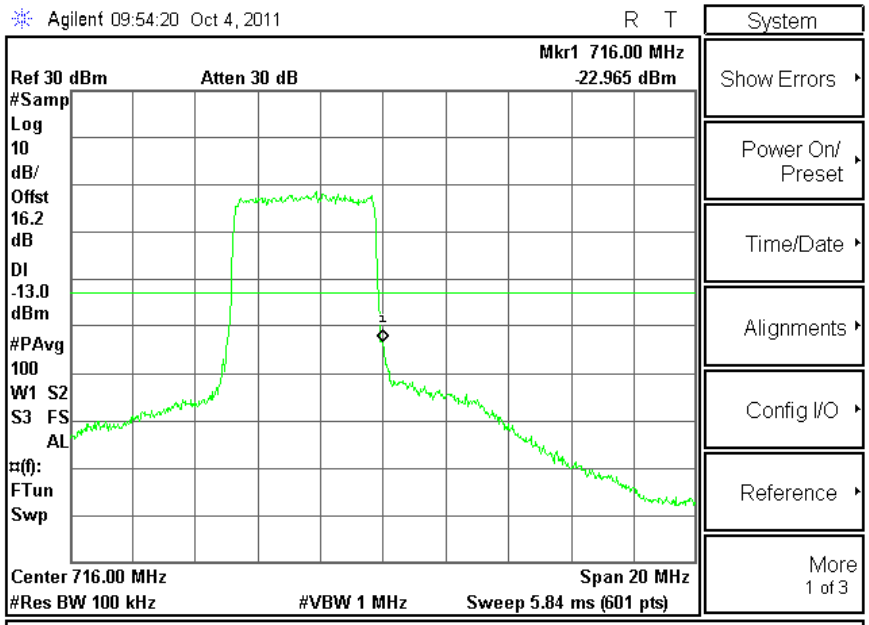

HIGH CH, RB12-6



LOW CH, RB25-0

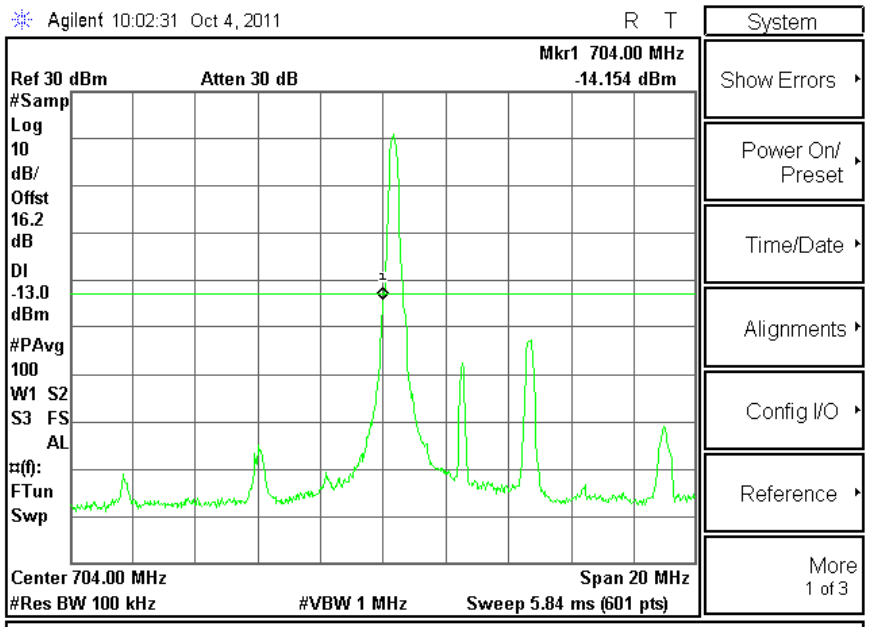



HIGH CH, RB25-0

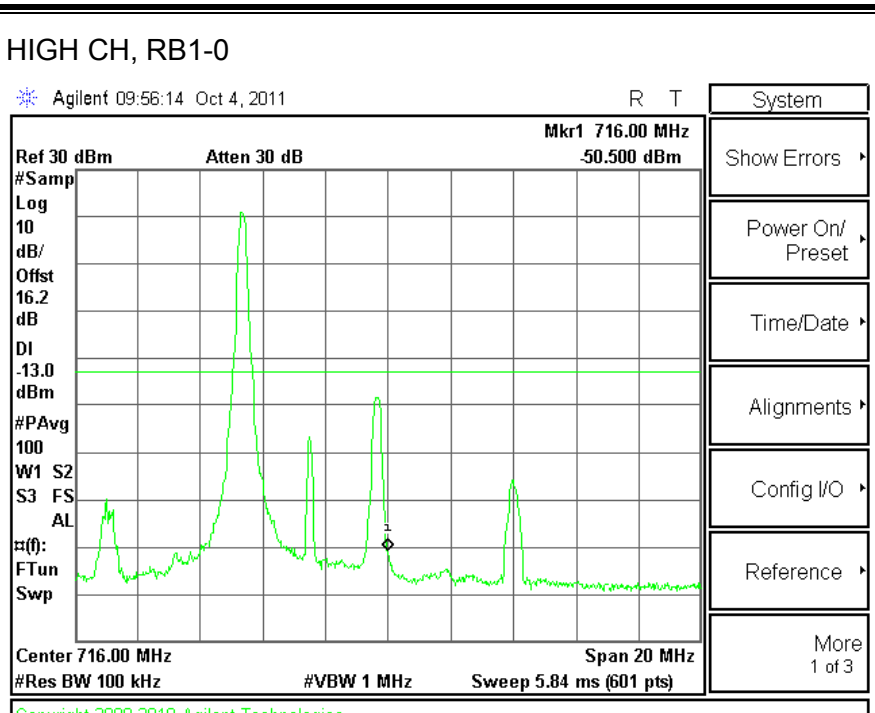


**LTE 16QAM Band 17 (5.0 MHz BAND WIDTH )**

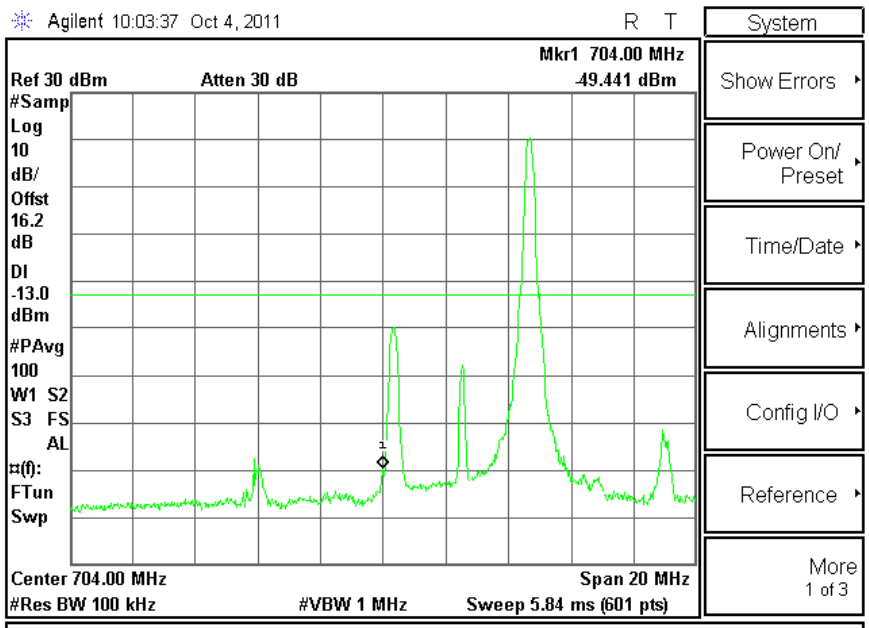
LOW CH, RB1-0



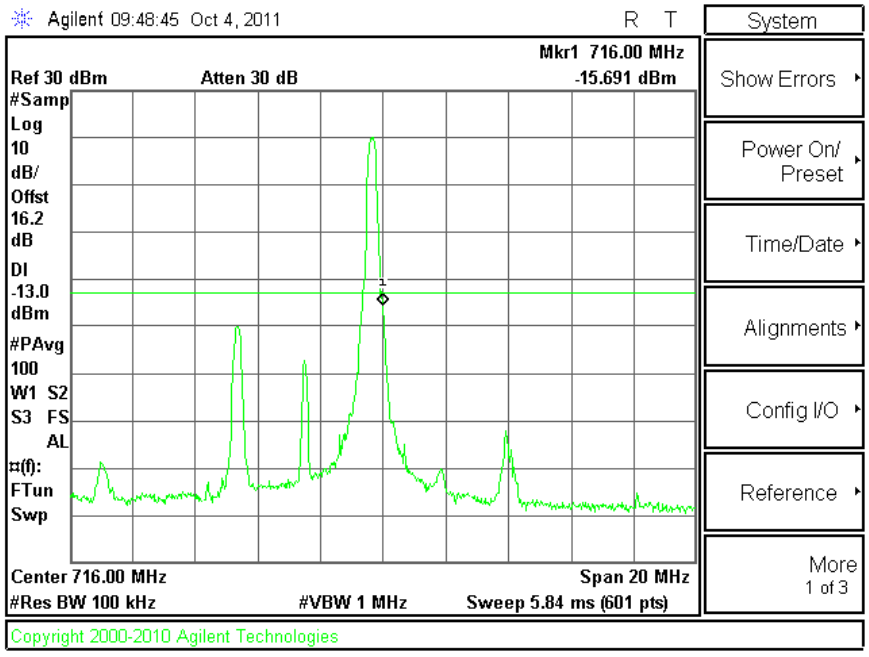

HIGH CH, RB1-0



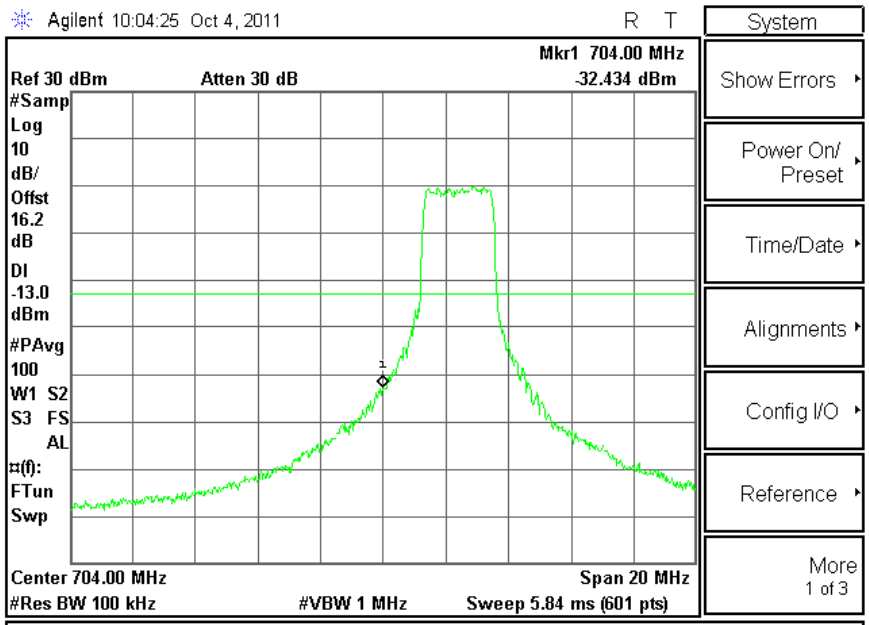
LOW CH, RB1-24



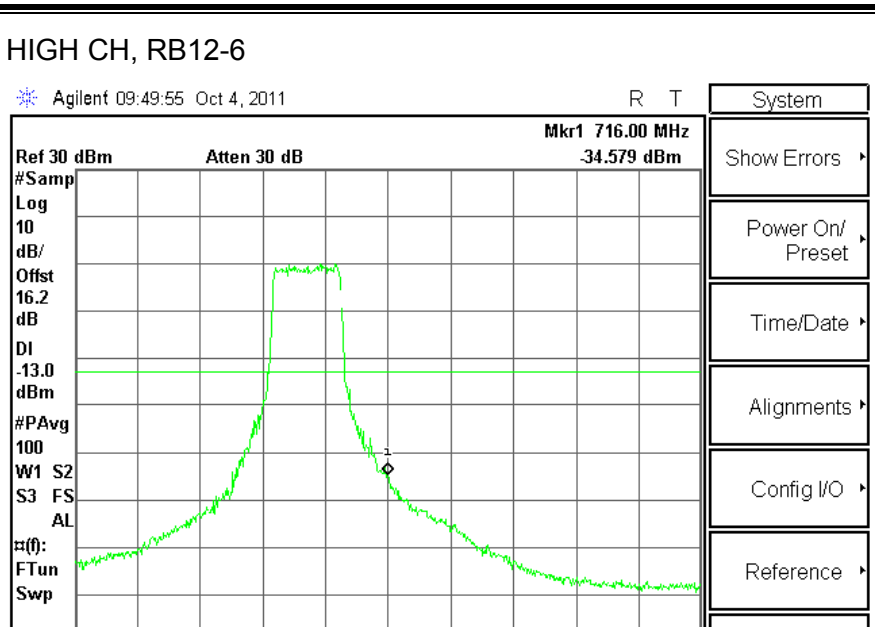

HIGH CH, RB1-24



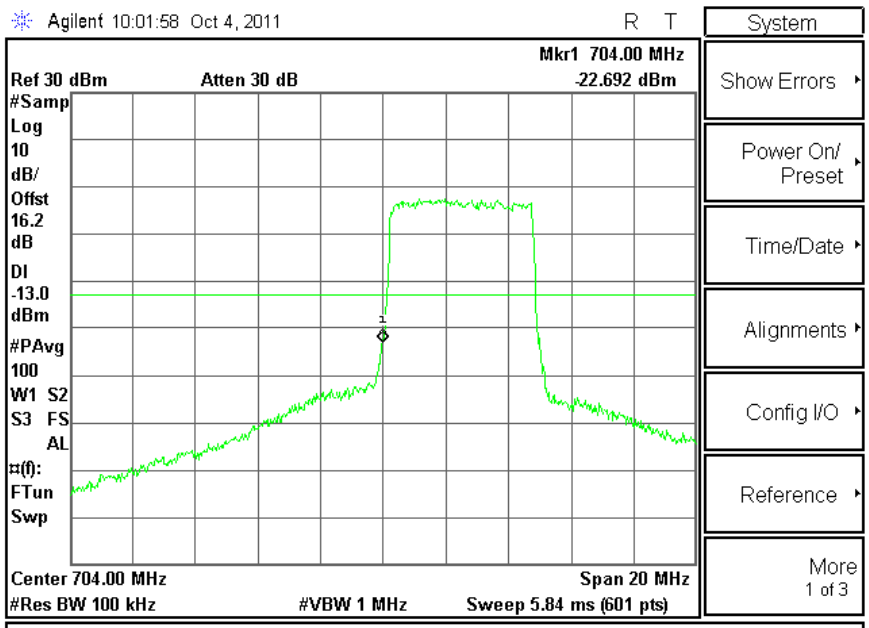
LOW CH, RB12-6



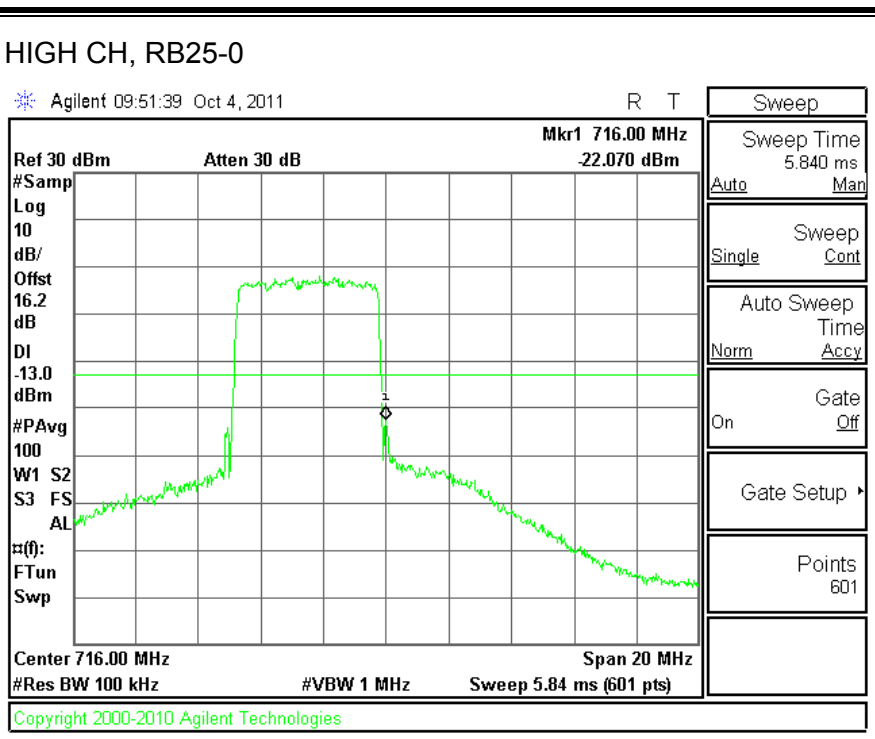

HIGH CH, RB12-6



LOW CH, RB25-0

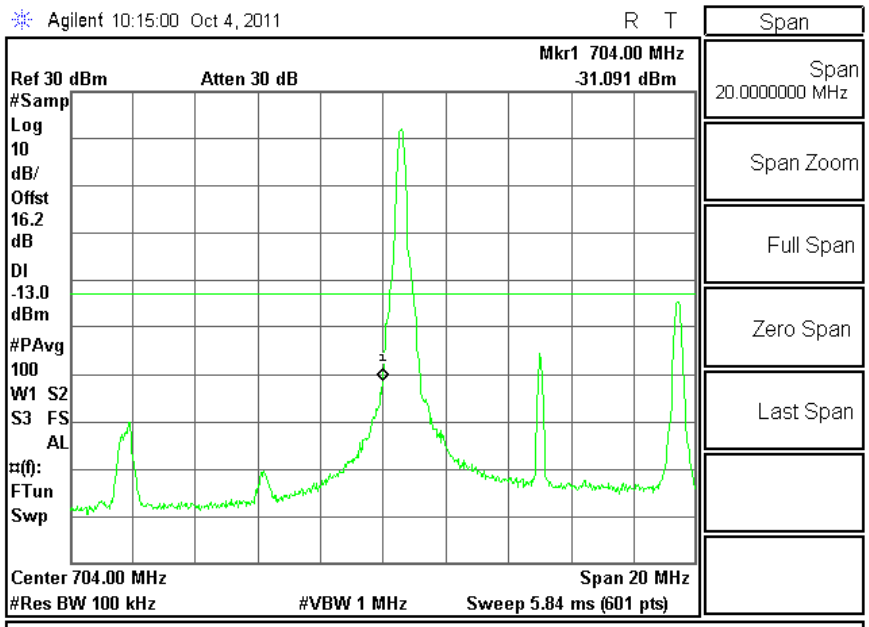



HIGH CH, RB25-0

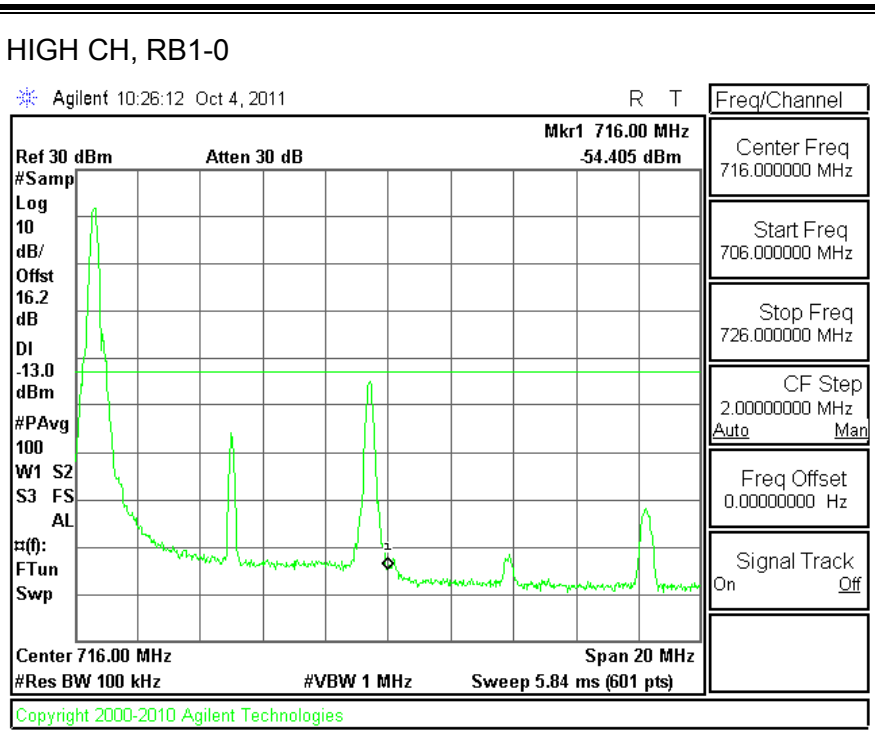


**LTE QPSK Band 17 (10.0 MHz BAND WIDTH )**

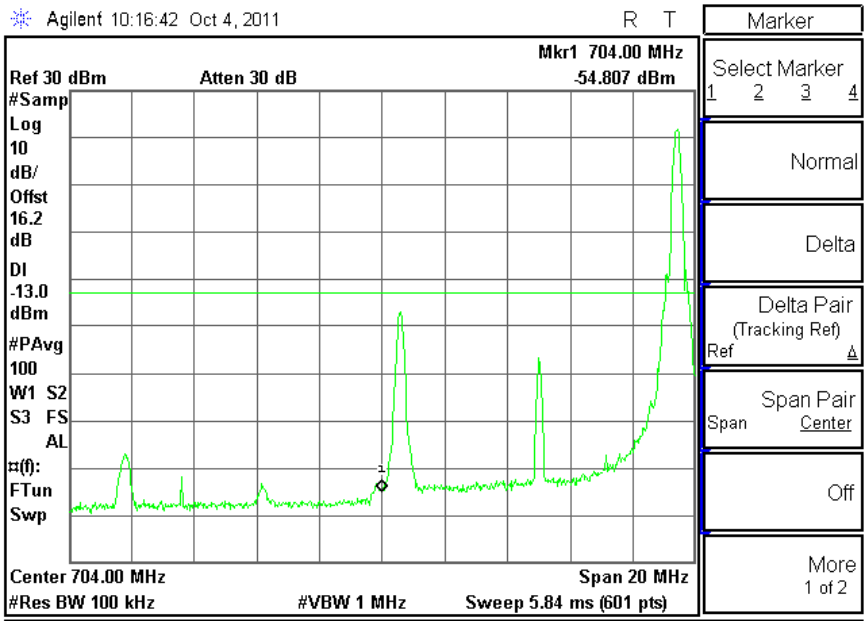
LOW CH, RB1-0



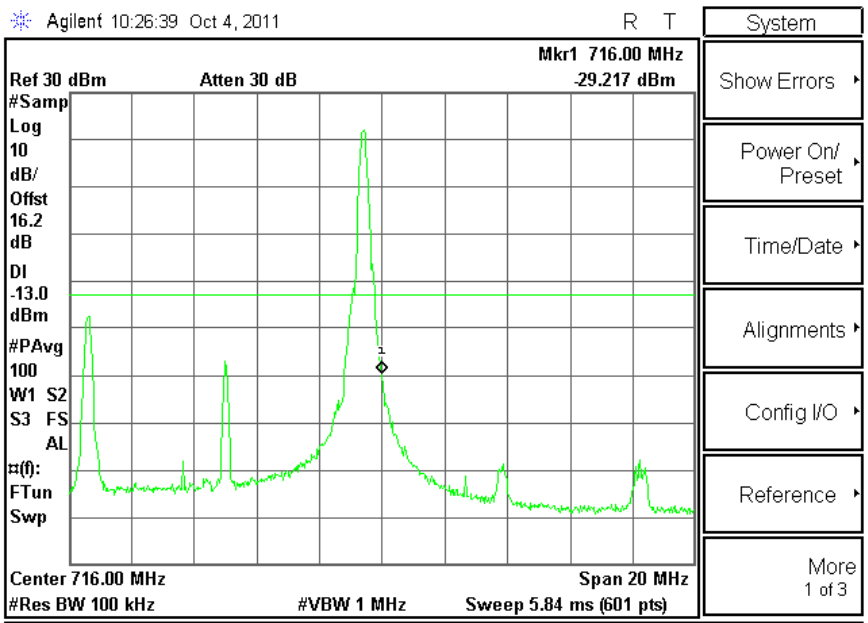

HIGH CH, RB1-0



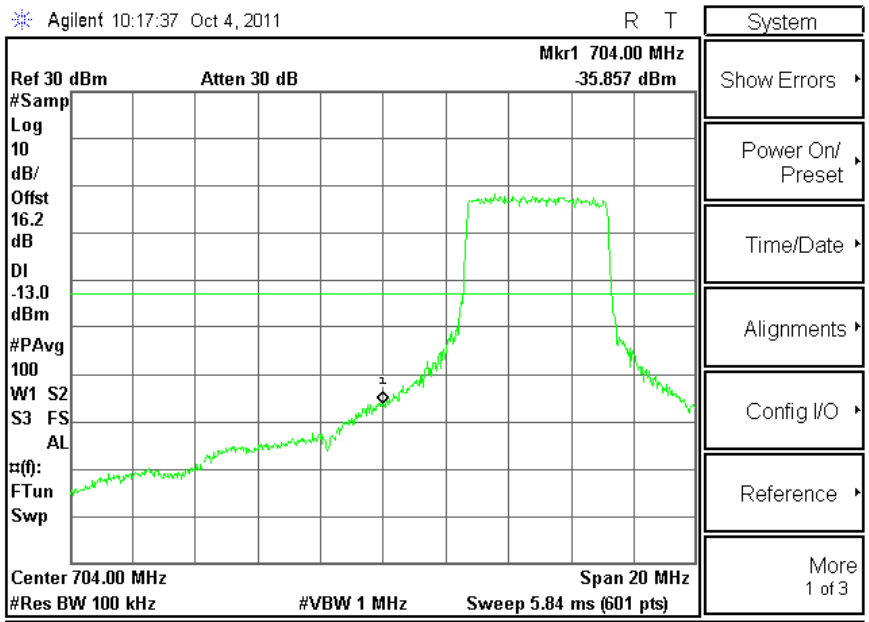
LOW CH, RB1-49



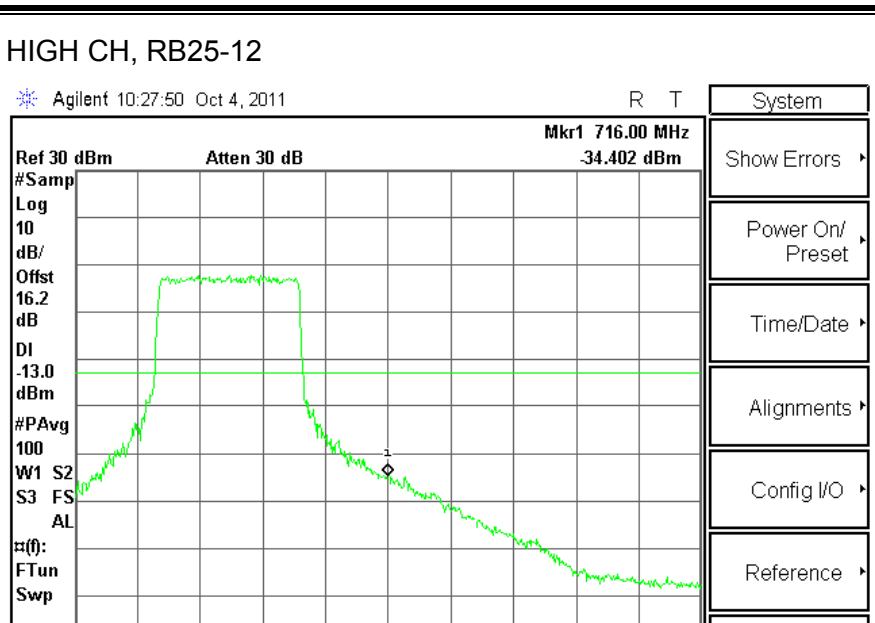

HIGH CH, RB1-49



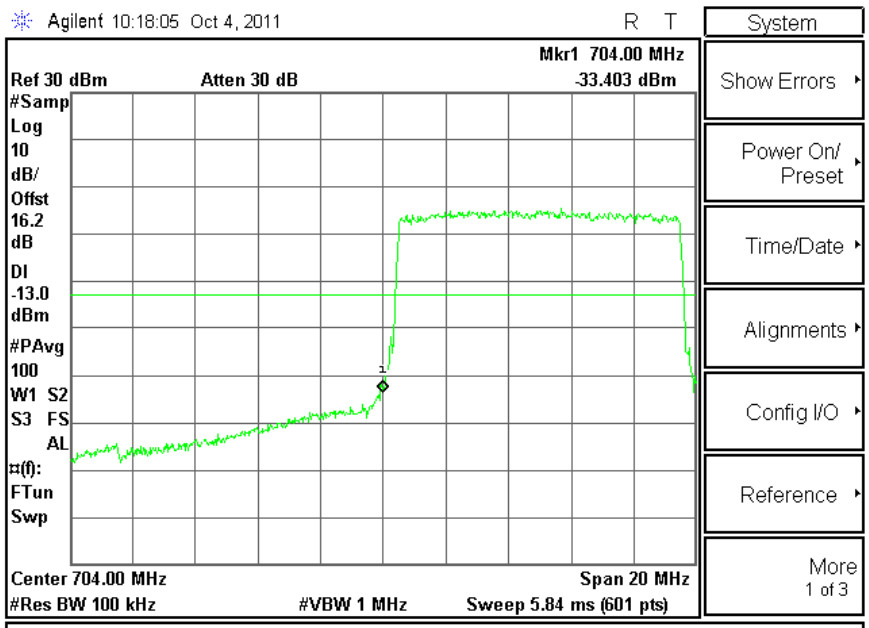
LOW CH, RB25-12



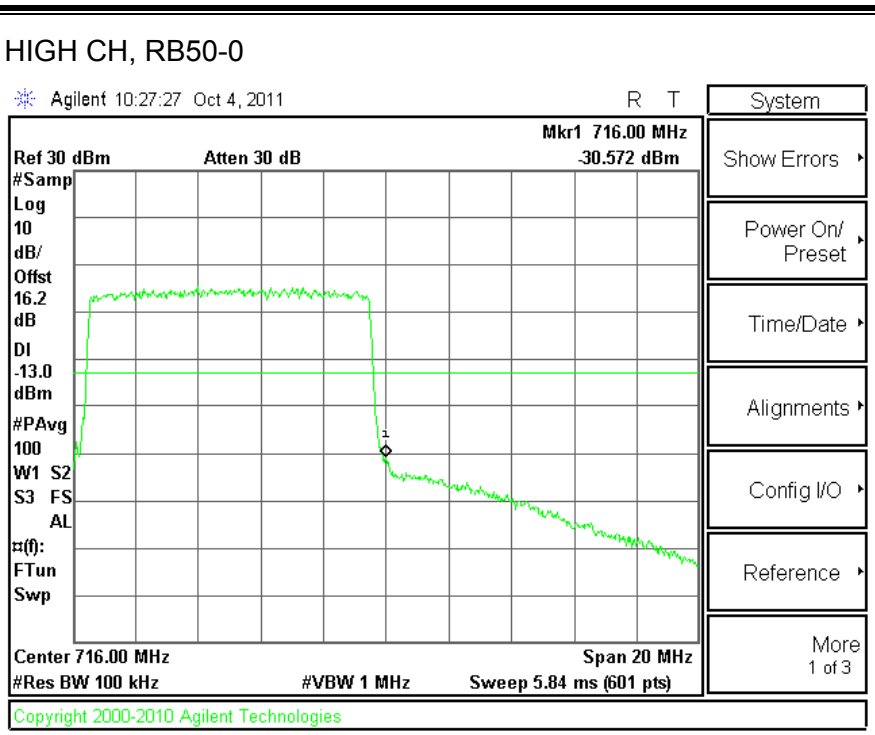

HIGH CH, RB25-12



LOW CH, RB50-0

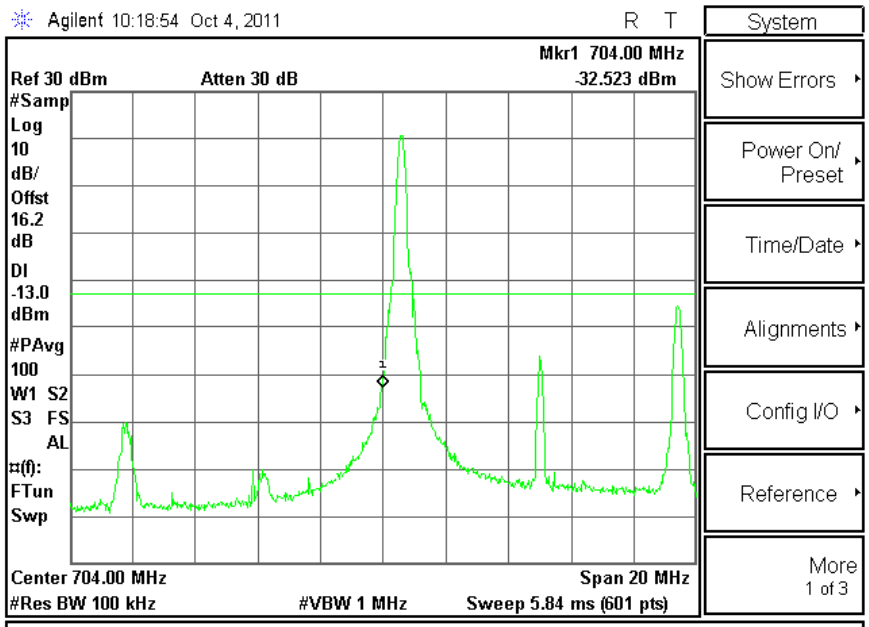



HIGH CH, RB50-0

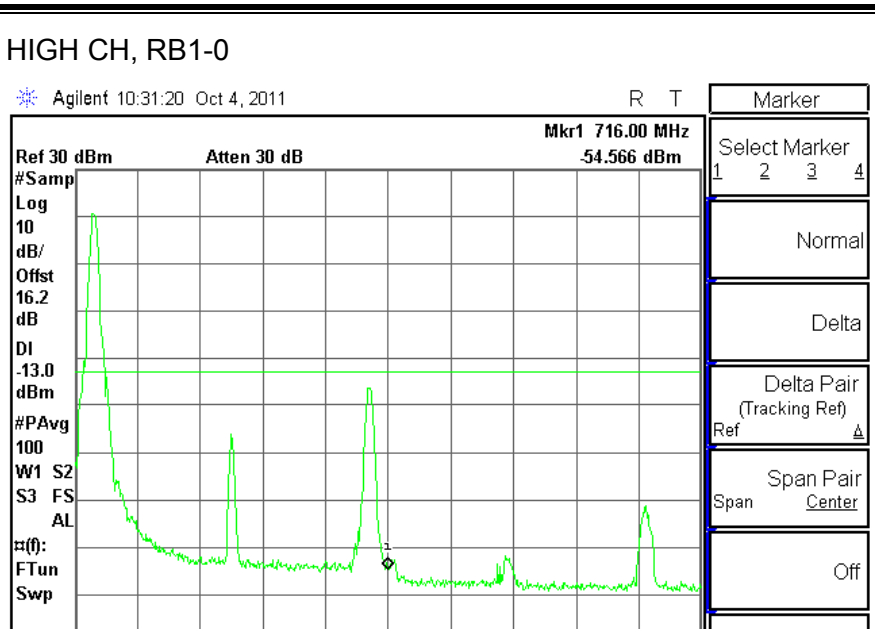


**LTE 16QAM Band 17 (10.0 MHz BAND WIDTH )**

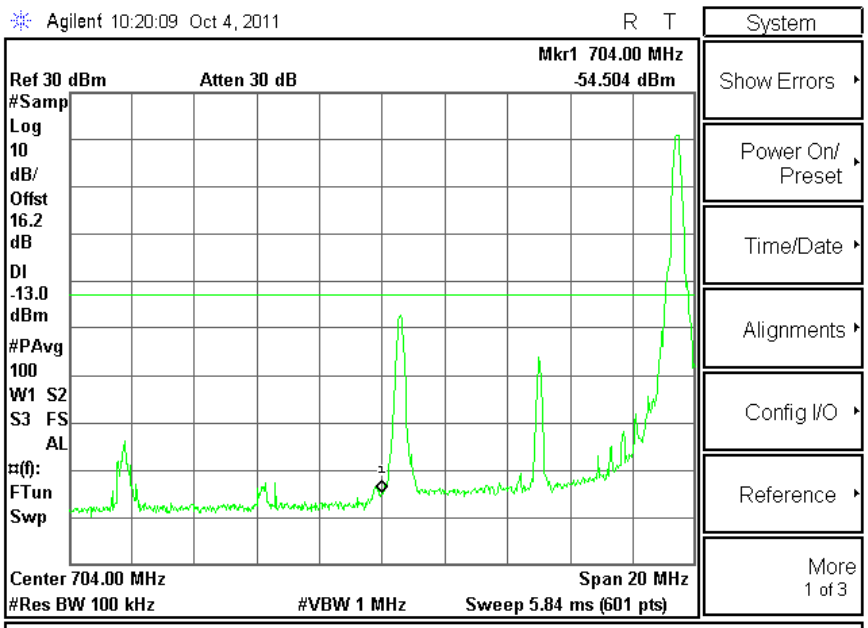
LOW CH, RB1-0



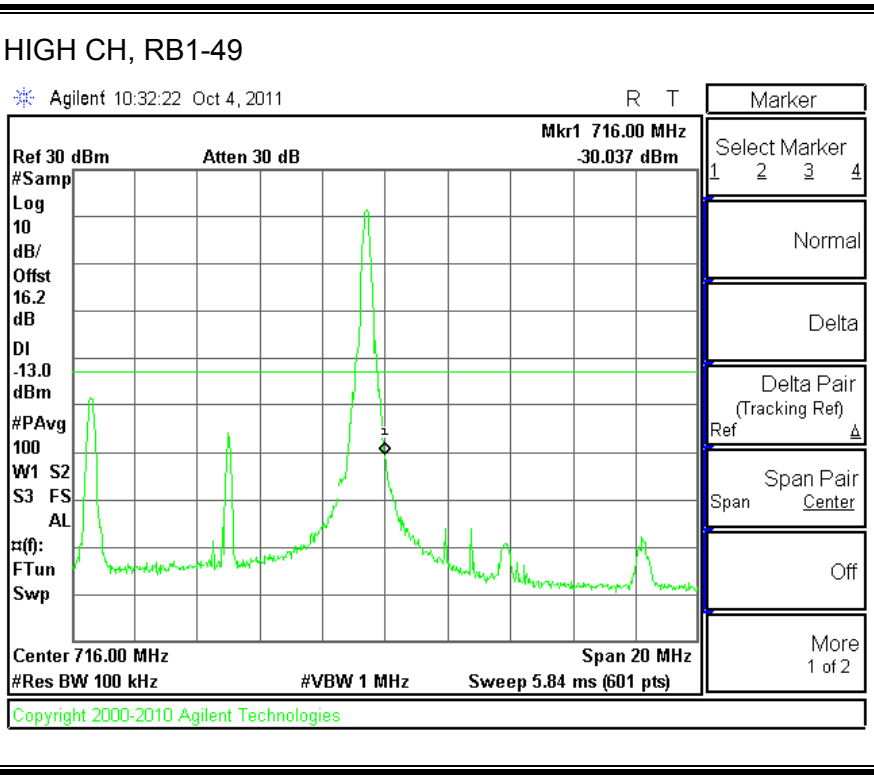

HIGH CH, RB1-0



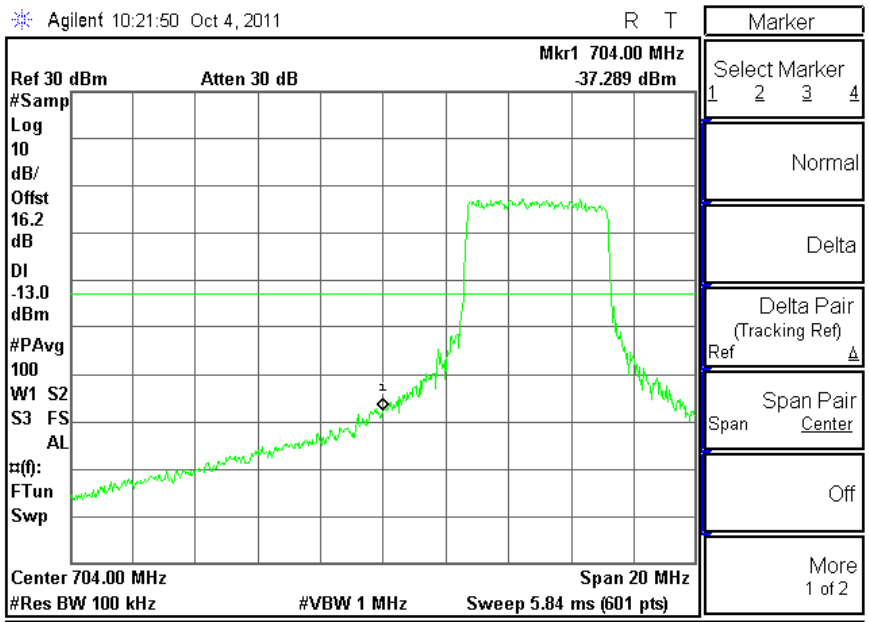
LOW CH, RB1-49



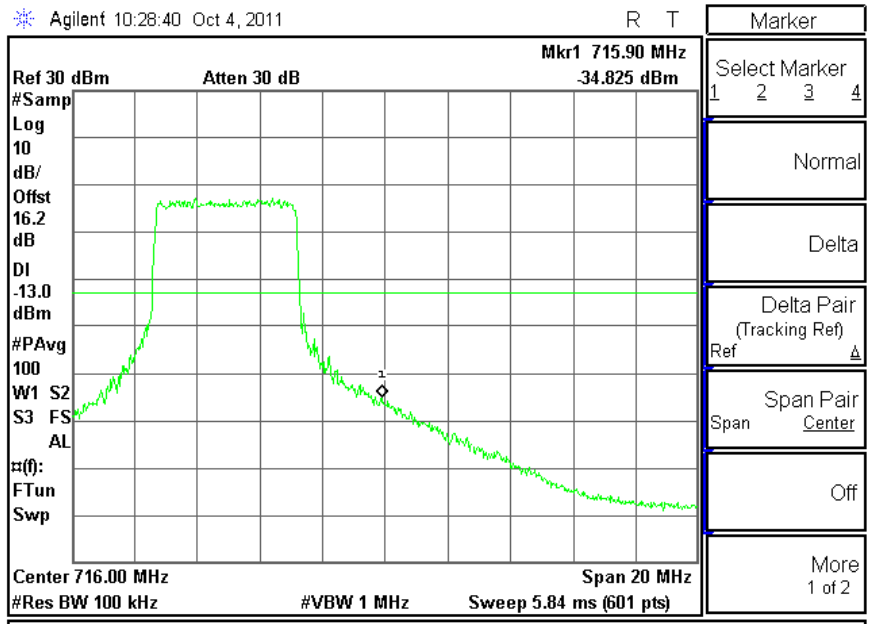

HIGH CH, RB1-49



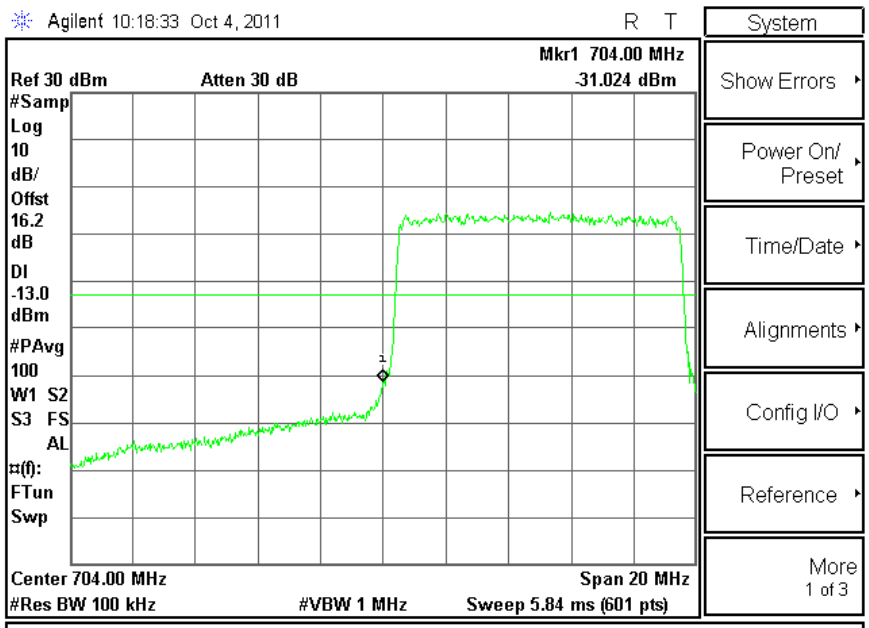
LOW CH, RB25-12



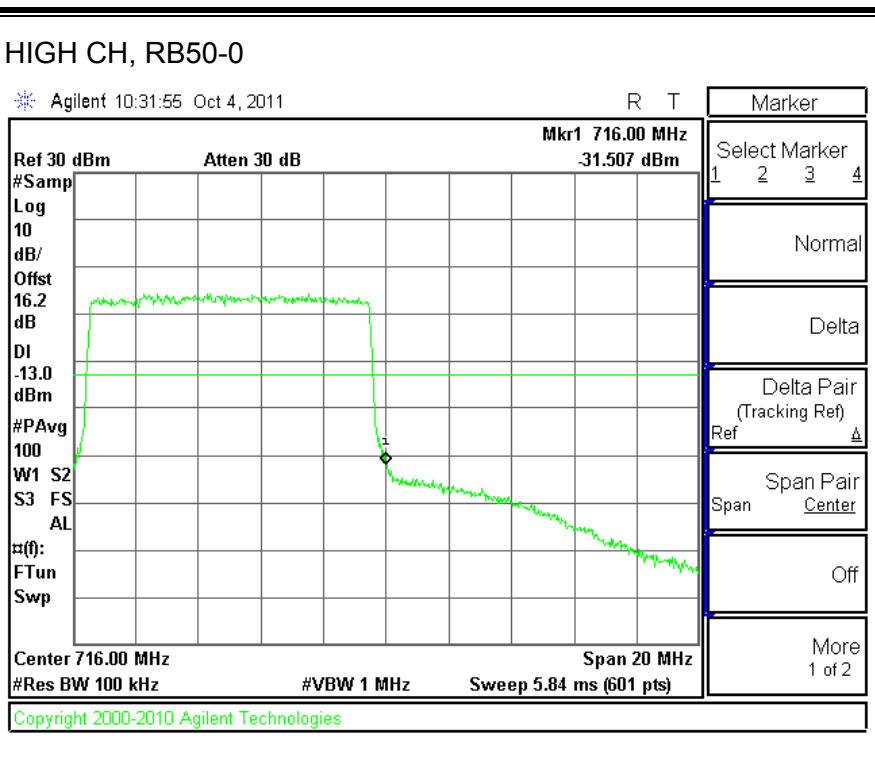

HIGH CH, RB25-12



LOW CH, RB50-0

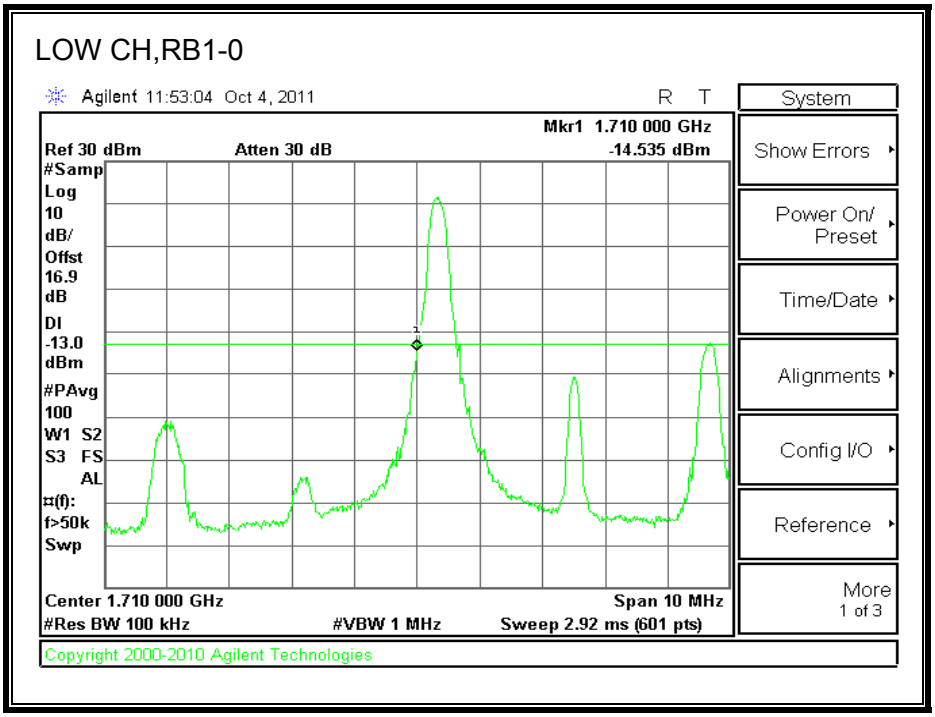



HIGH CH, RB50-0

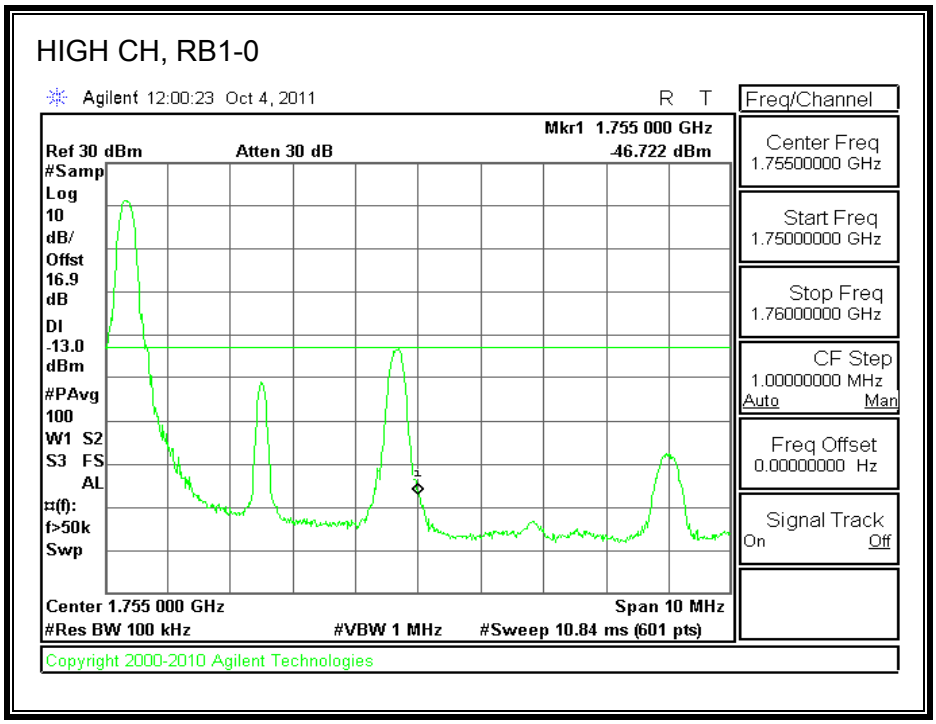


**LTE QPSK Band 4 (5.0 MHz BAND WIDTH )**

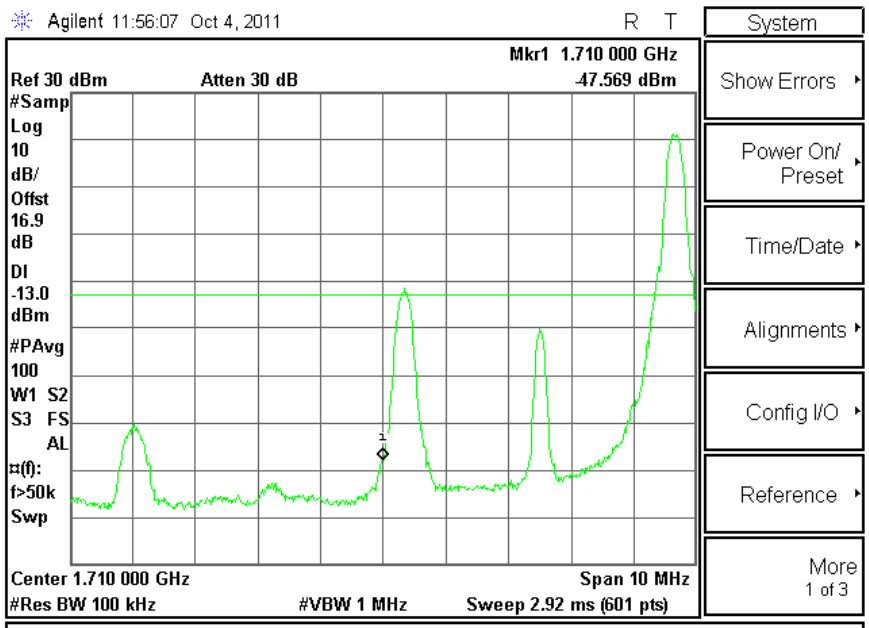
LOW CH,RB1-0



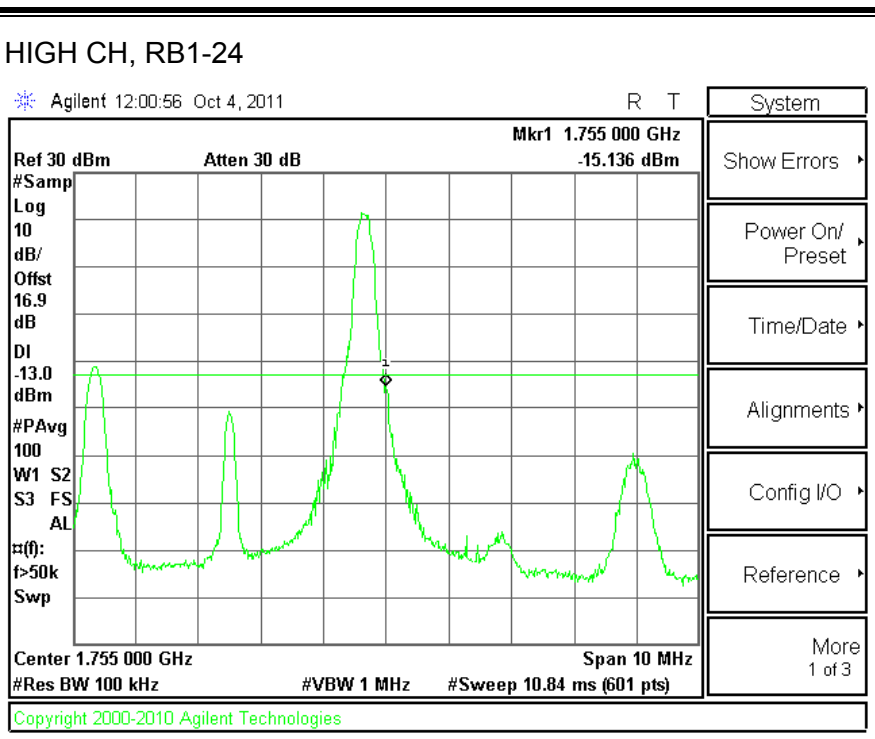

HIGH CH, RB1-0



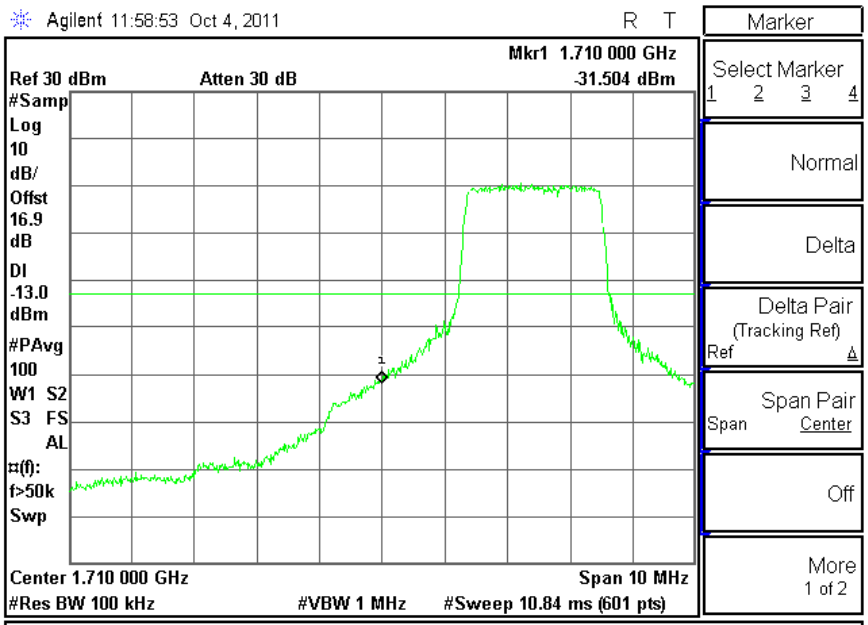
LOW CH, RB1-24



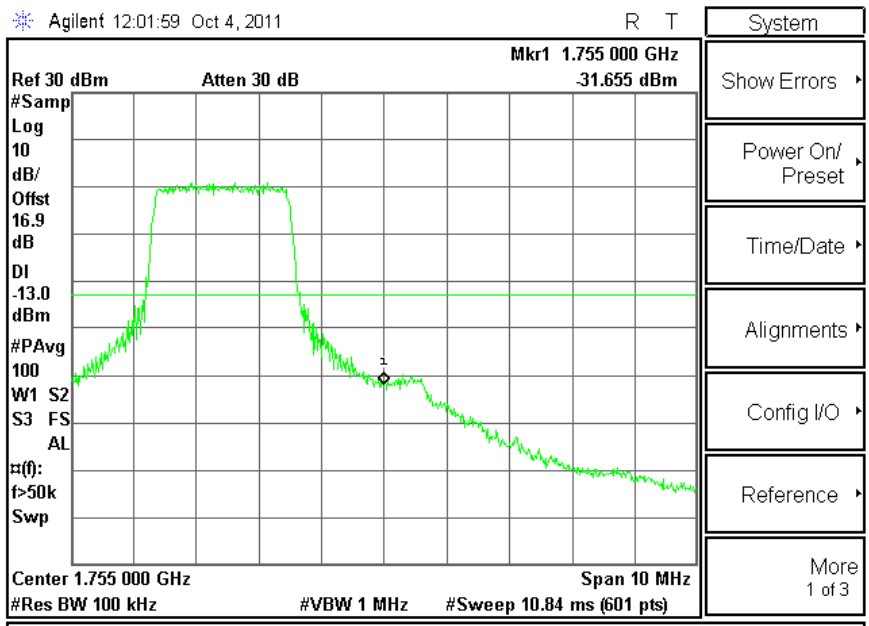

HIGH CH, RB1-24



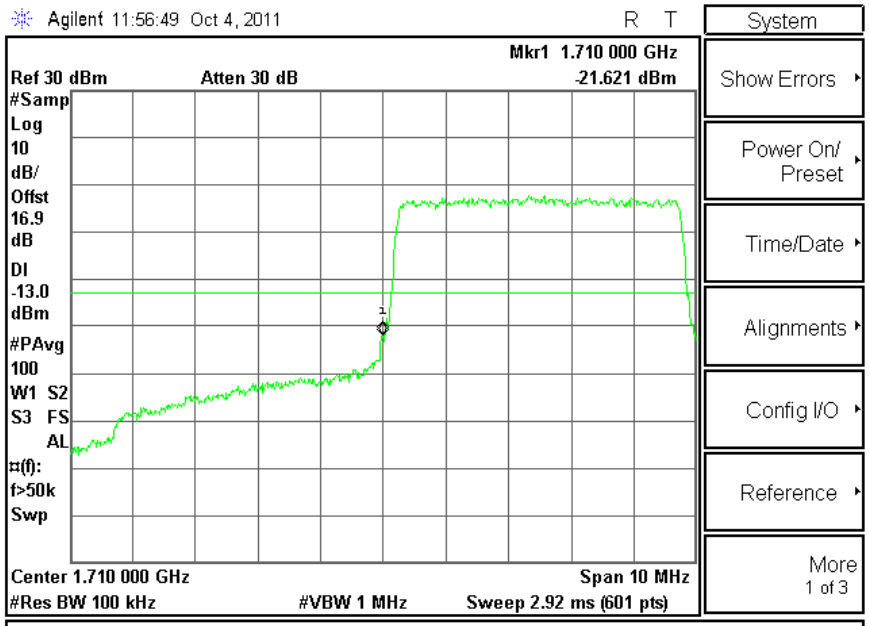
LOW CH, RB12-6



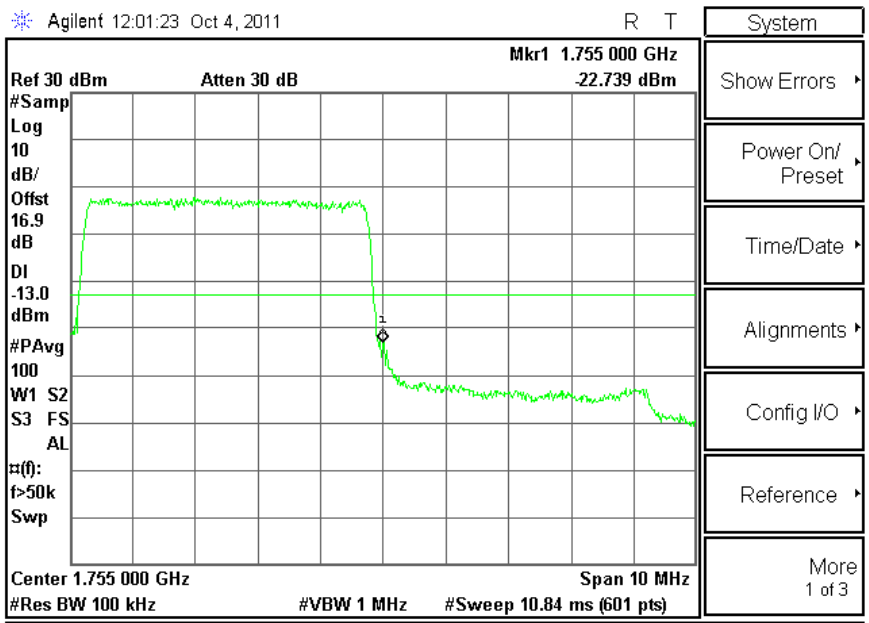

HIGH CH, RB12-6



LOW CH, RB25-0

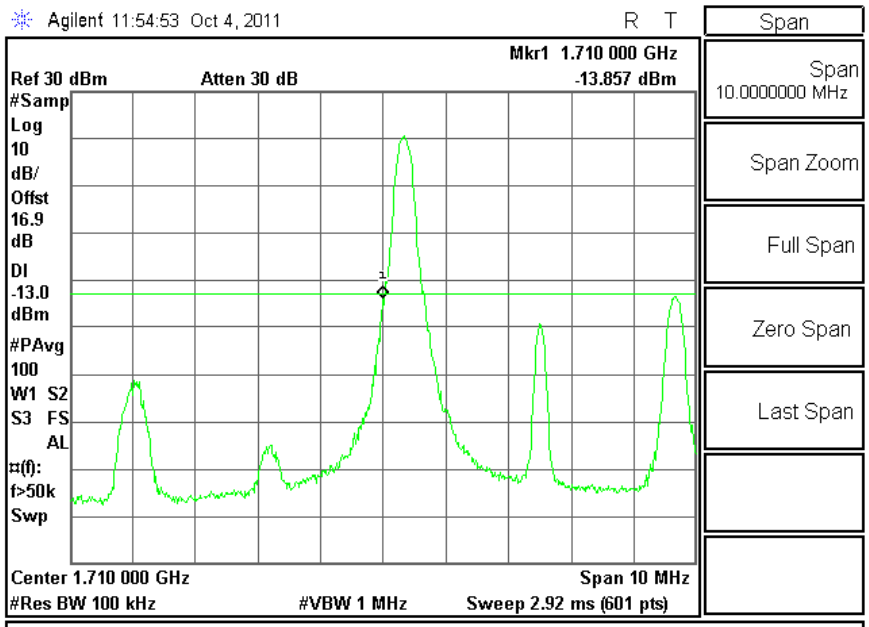



HIGH CH, RB25-0

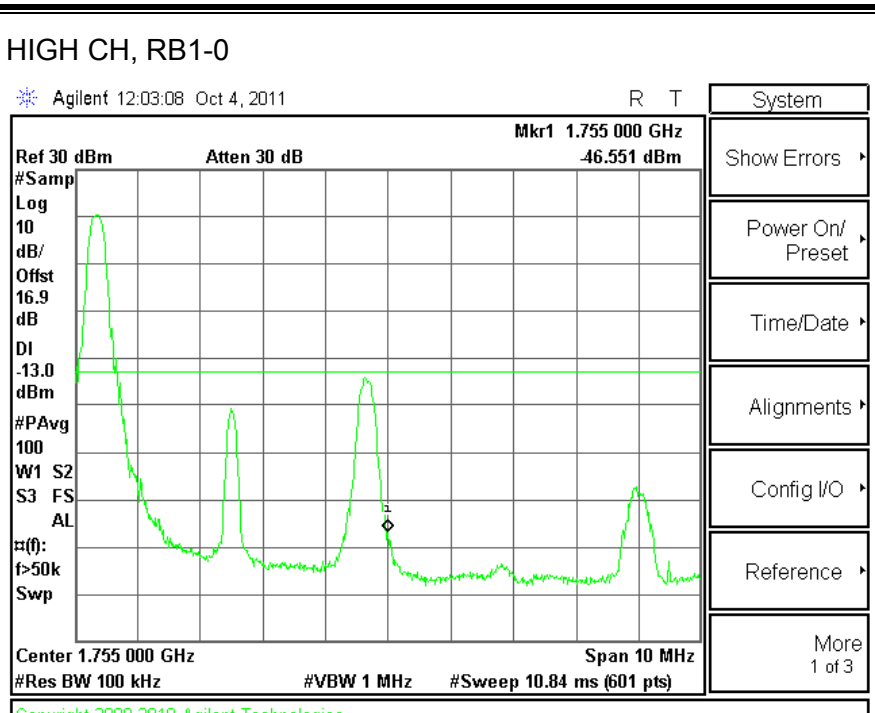


**LTE 16QAM Band 4 (5.0 MHz BAND WIDTH )**

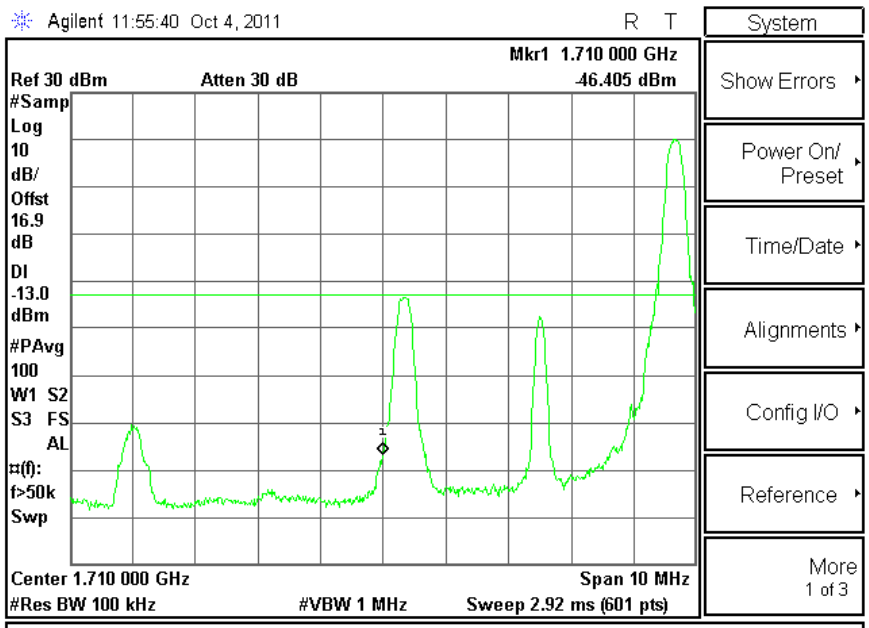
LOW CH, RB1-0



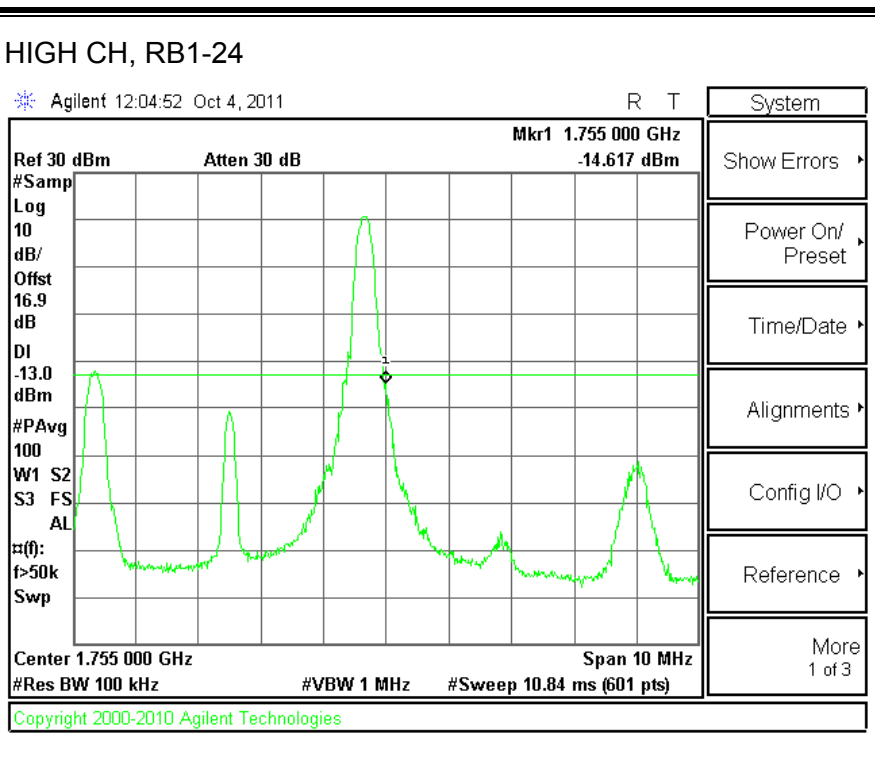

HIGH CH, RB1-0



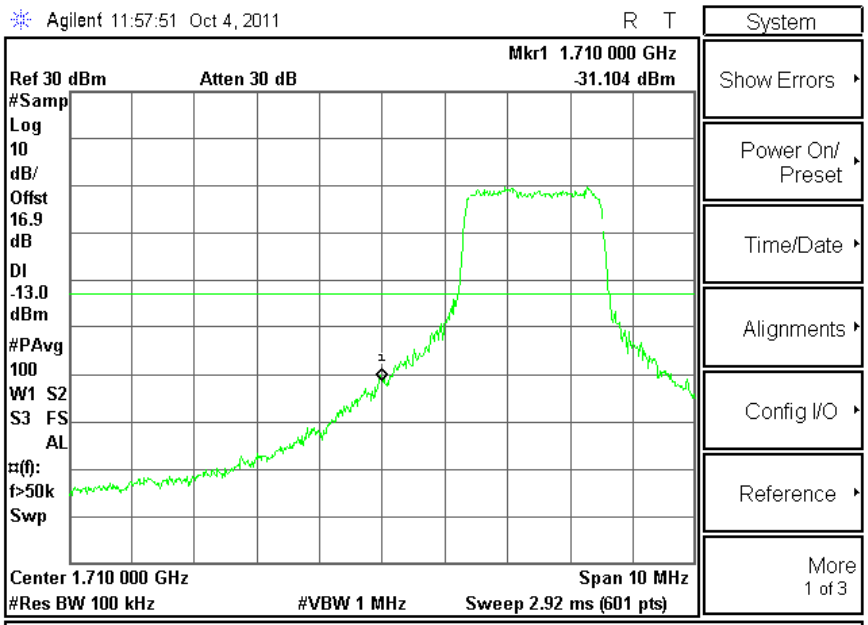
LOW CH, RB1-24



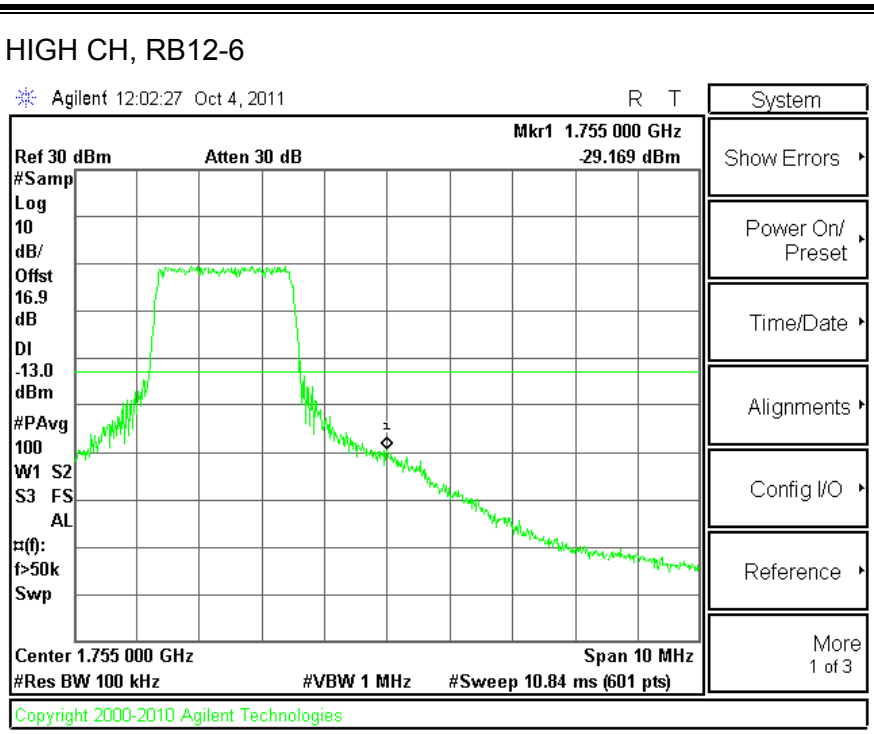

HIGH CH, RB1-24



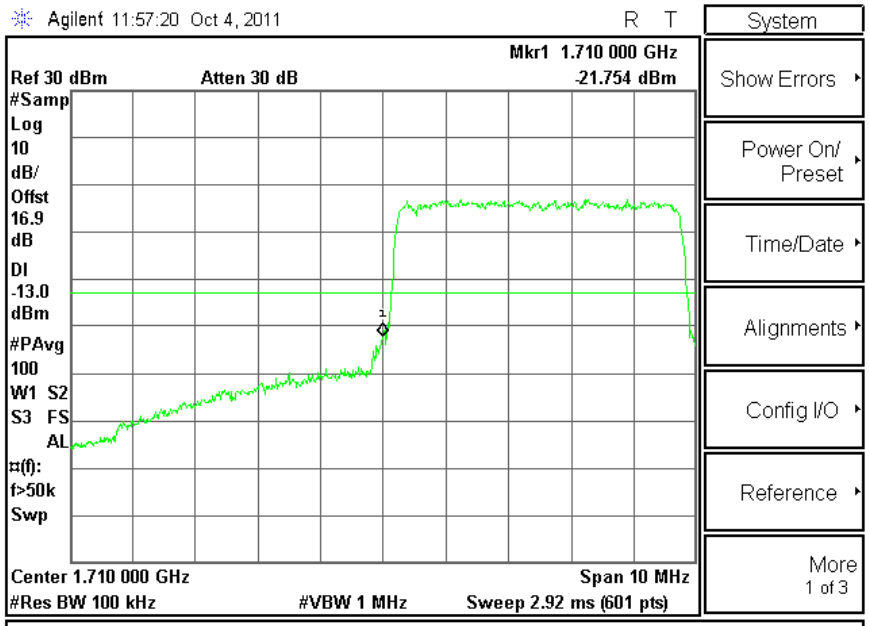
LOW CH, RB12-6



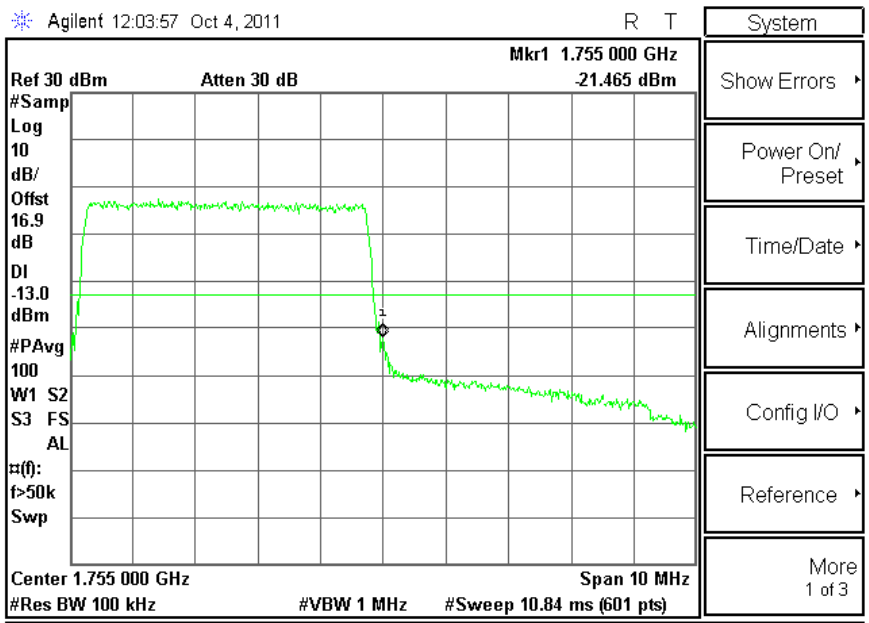

HIGH CH, RB12-6



LOW CH, RB25-0

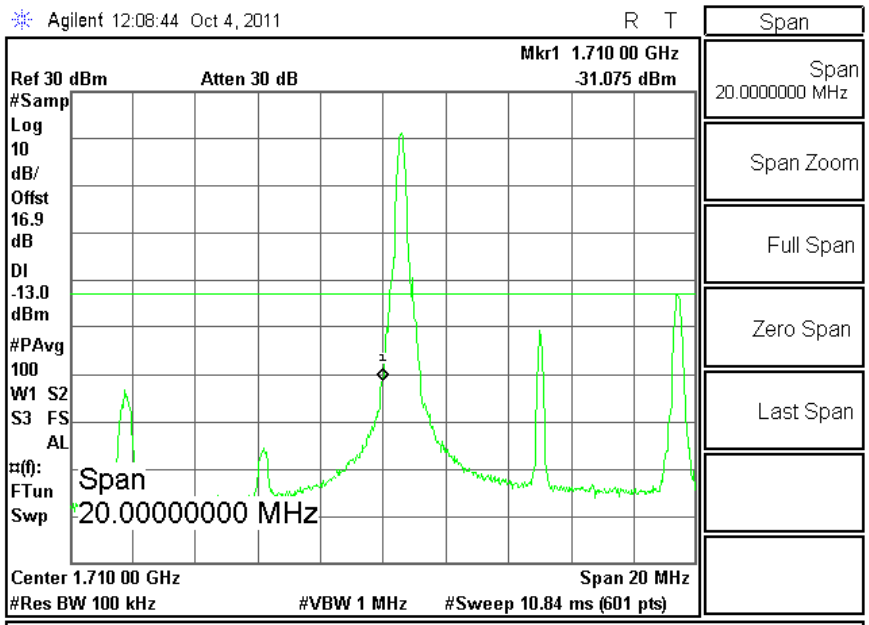



HIGH CH, RB25-0

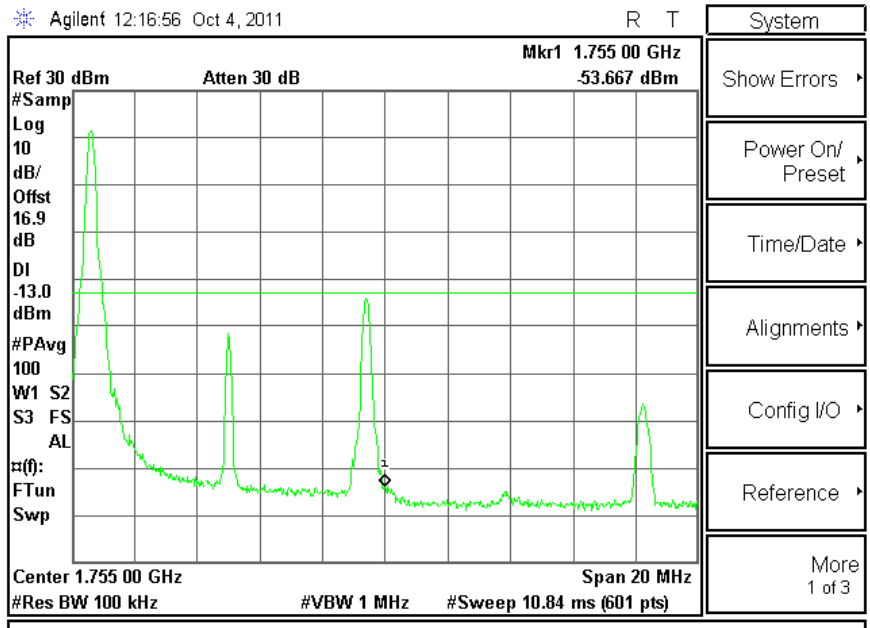


**LTE QPSK Band 4 (10.0 MHz BAND WIDTH )**

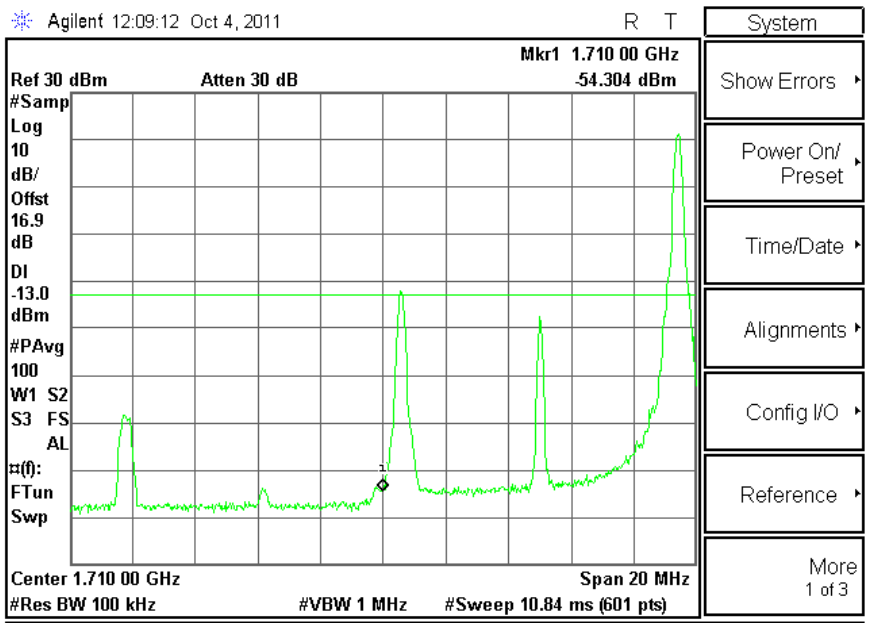
LOW CH, RB1-0



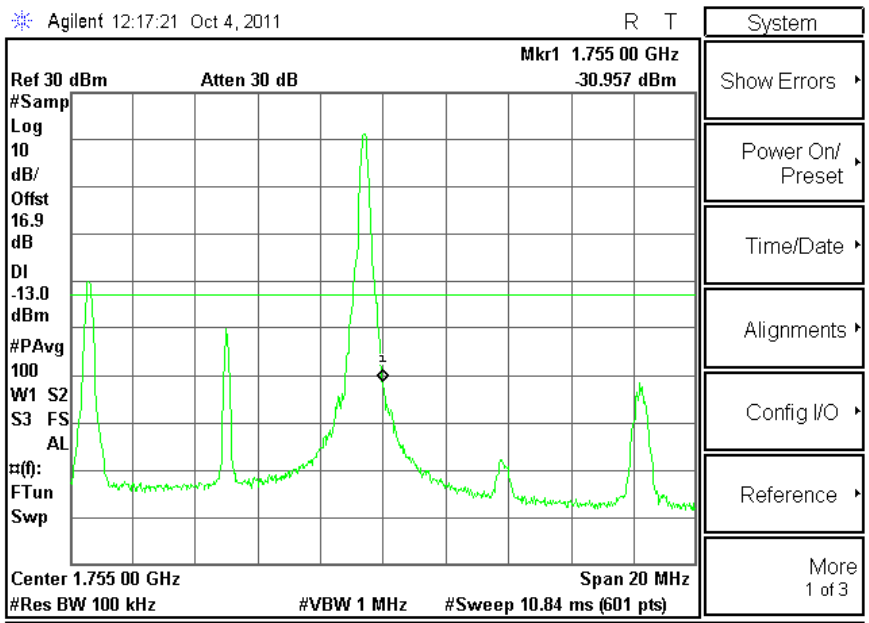

HIGH CH, RB1-0



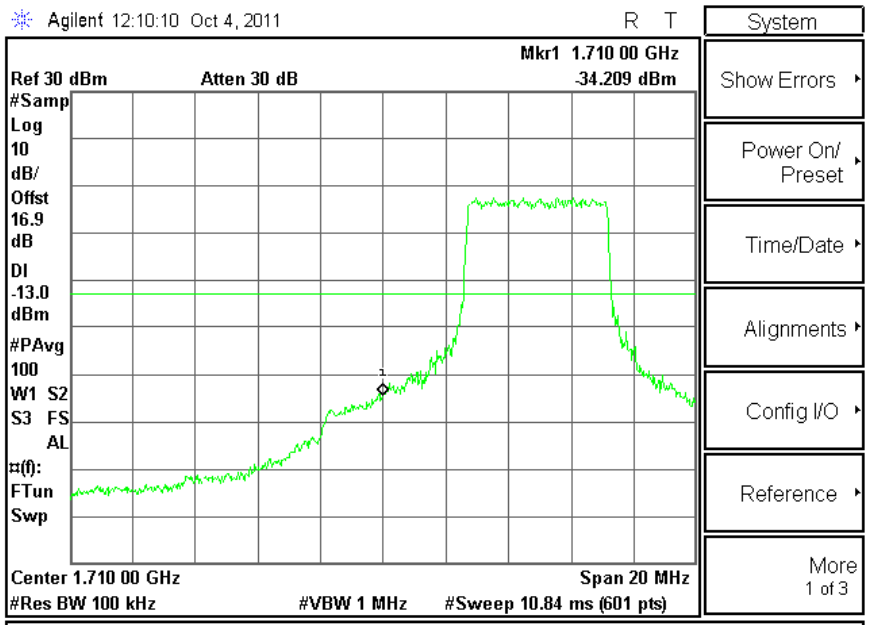
LOW CH, RB1-49



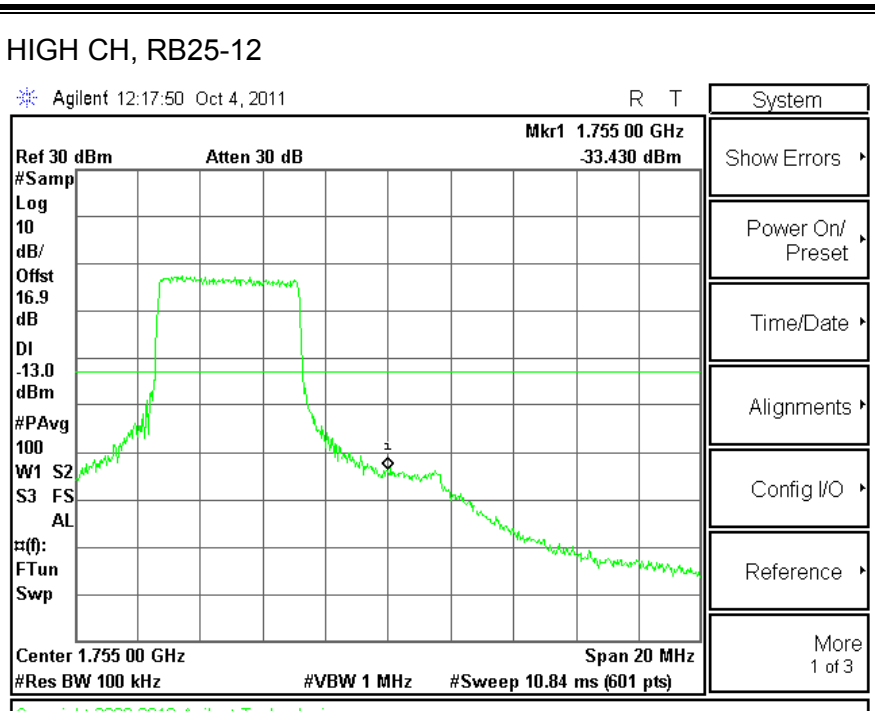

HIGH CH, RB1-49



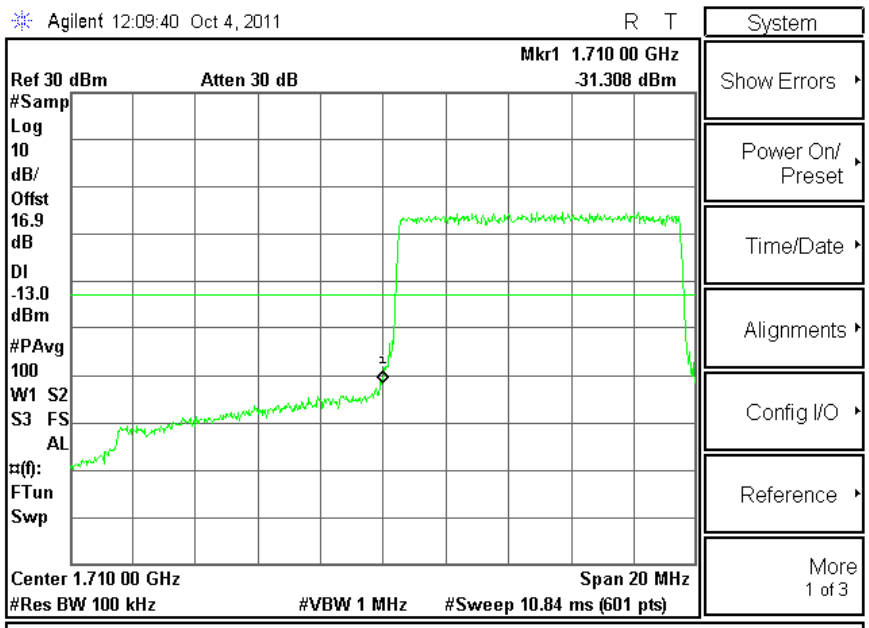
LOW CH, RB25-12



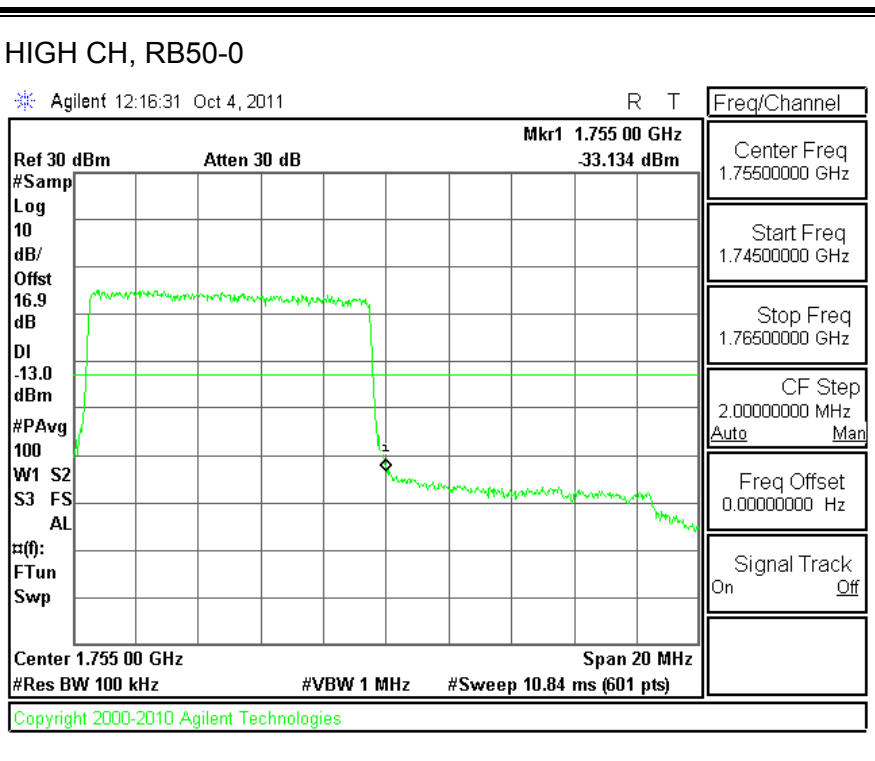

HIGH CH, RB25-12



LOW CH, RB50-0

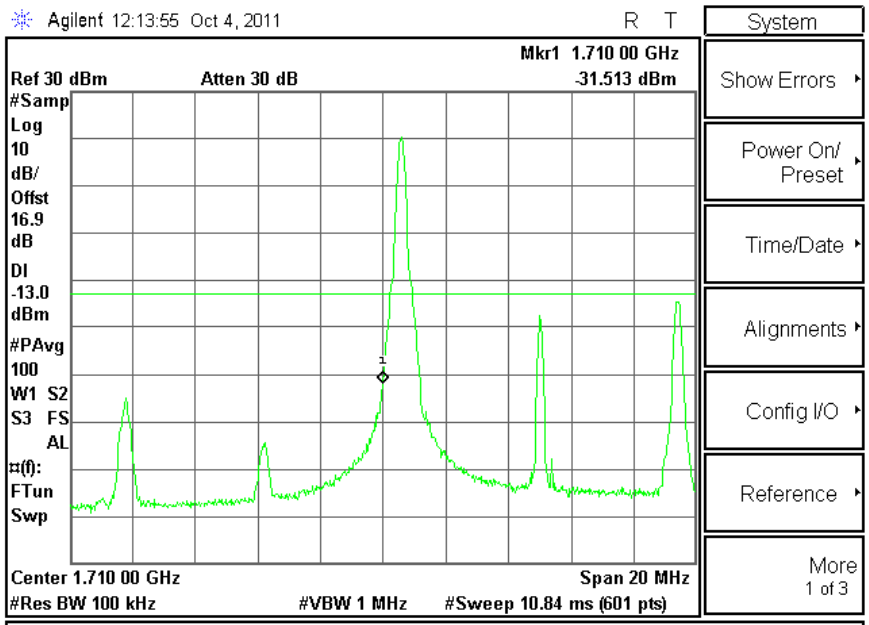



HIGH CH, RB50-0

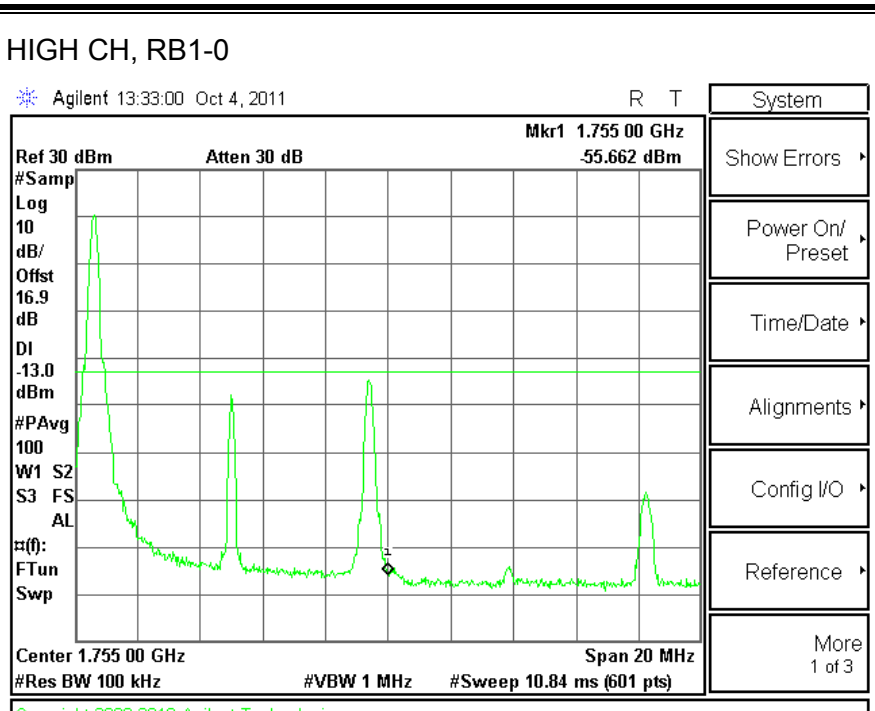


**LTE 16QAM Band 4 (10.0 MHz BAND WIDTH )**

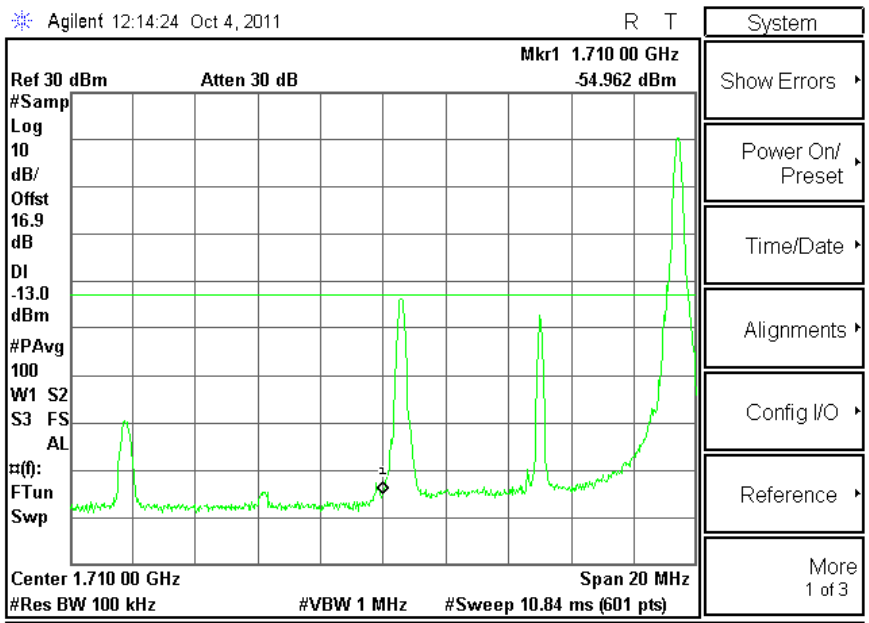
LOW CH, RB1-0



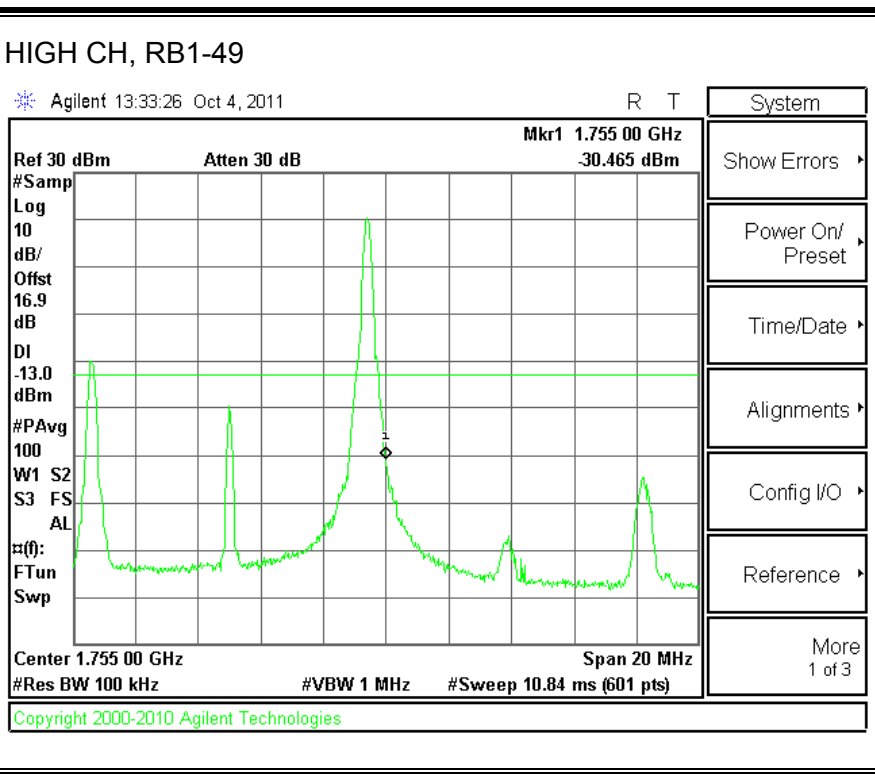

HIGH CH, RB1-0



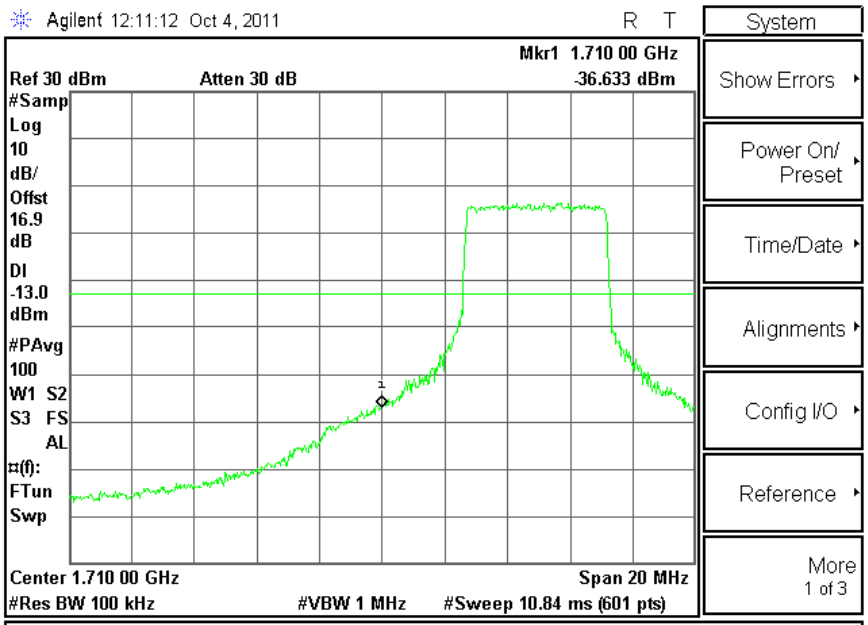
LOW CH, RB1-49



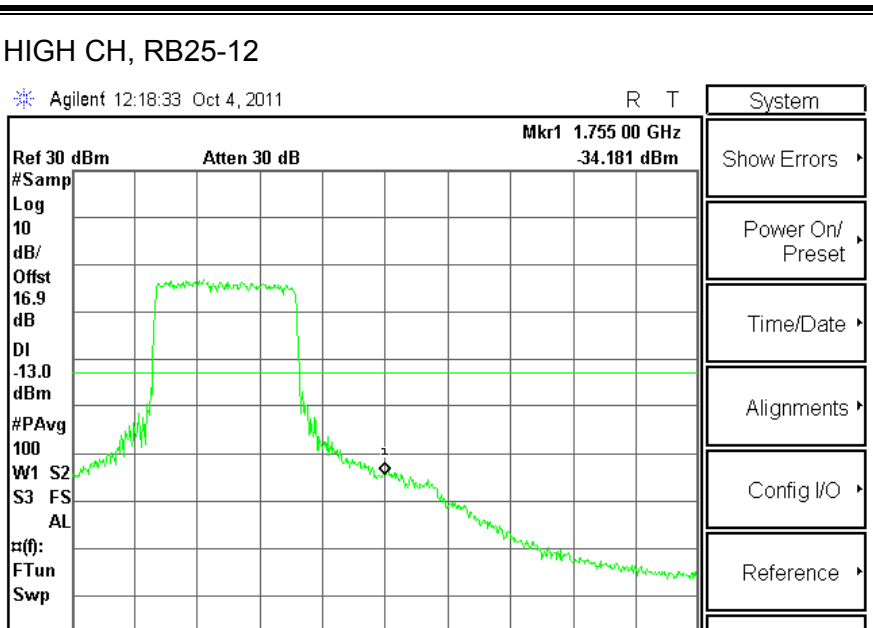

HIGH CH, RB1-49



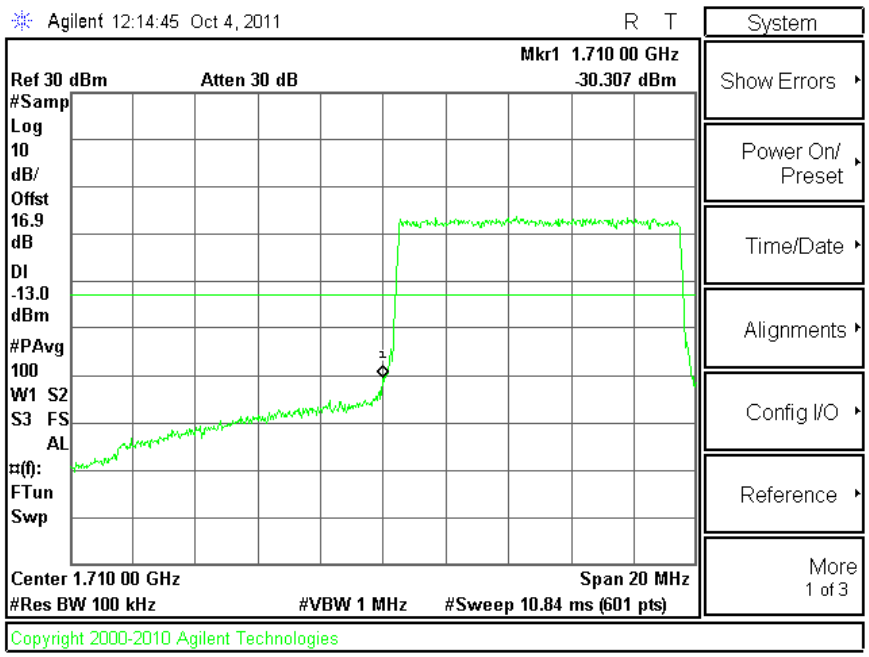
LOW CH, RB25-12



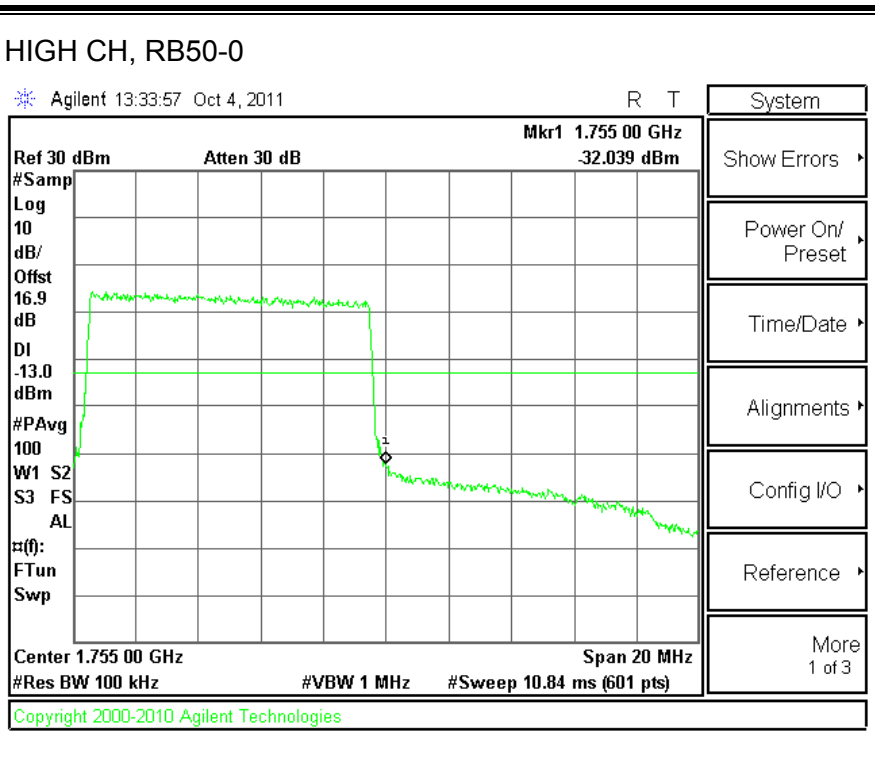

HIGH CH, RB25-12



LOW CH, RB50-0




HIGH CH, RB50-0



## 8.3. OUT OF BAND EMISSIONS

**RULE PART(S)**

FCC: §2.1051, §27.53

**LIMITS**

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.

**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.

**MODES TESTED**

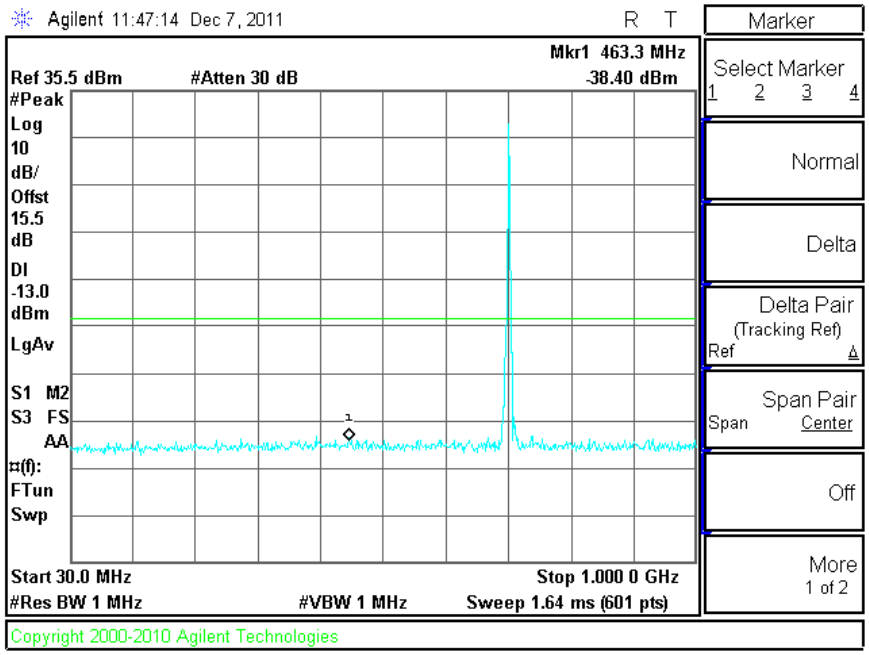
- LTE BAND 4 and BAND 17

**RESULTS**

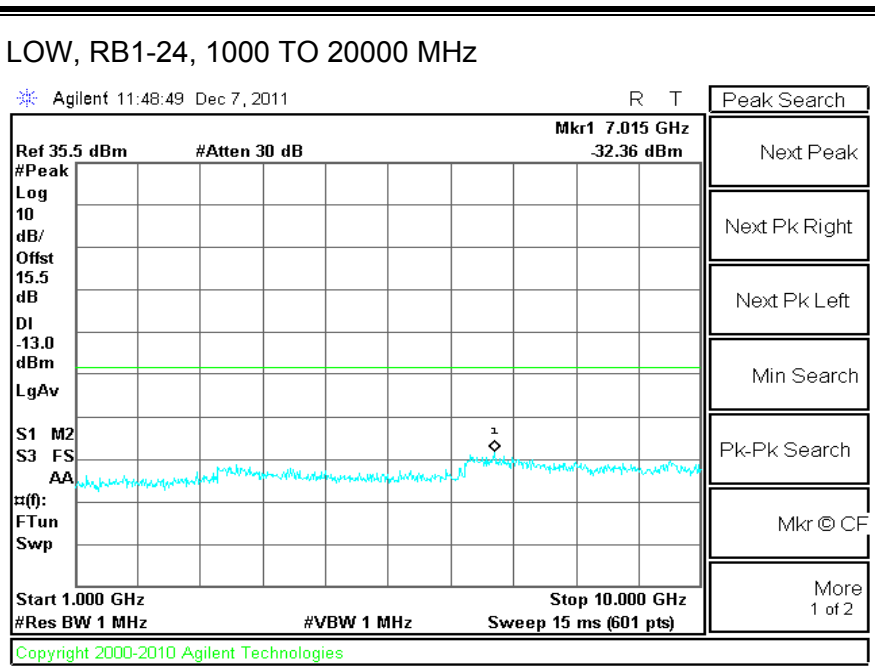
**Band 17 (5.0 MHz BAND WIDTH)**

**LTE QPSK**

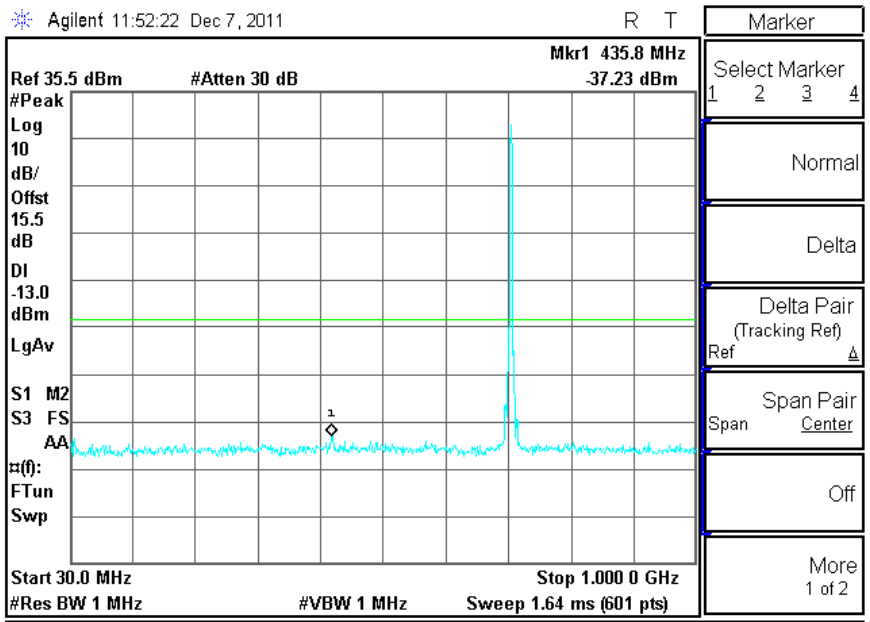
LOW, RB1-24, 30 TO 1000 MHz



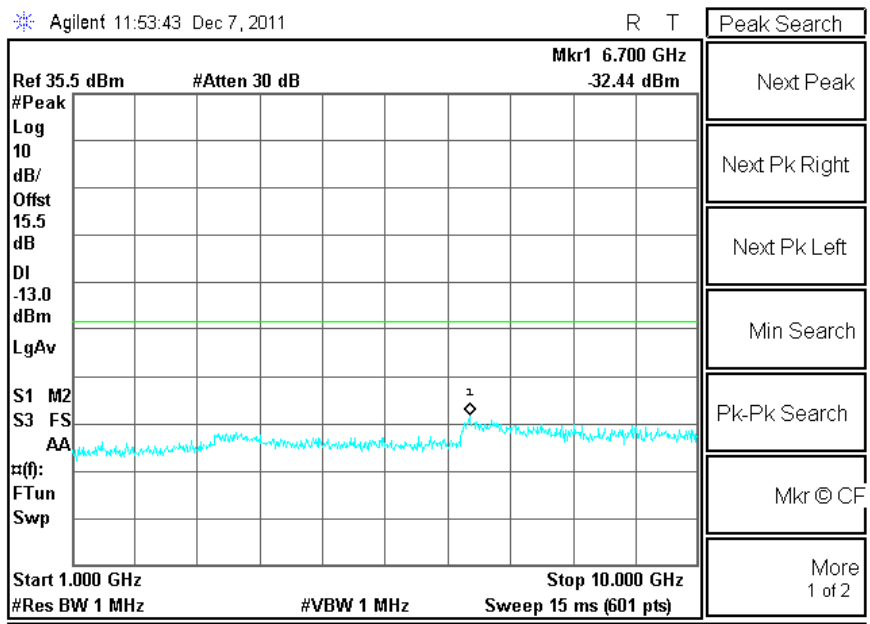

LOW, RB1-24, 1000 TO 20000 MHz



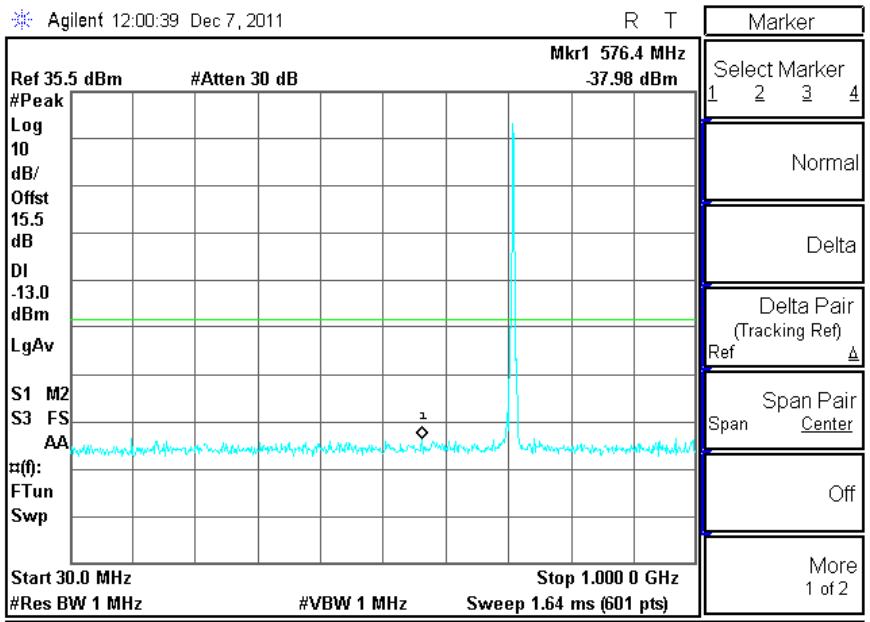
MID, RB1-24, 30 TO 1000 MHz



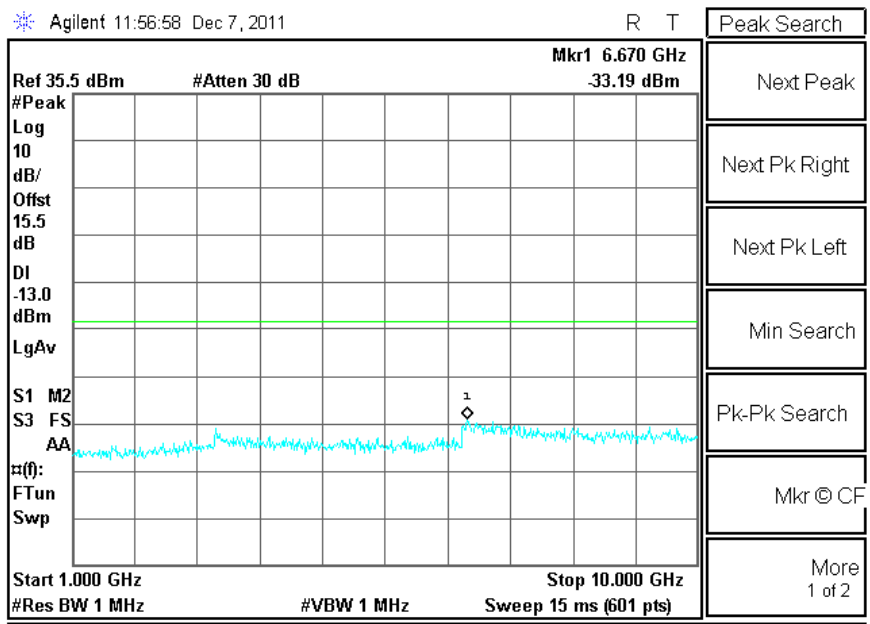

MID, RB1-24, 1000 TO 20000 MHz



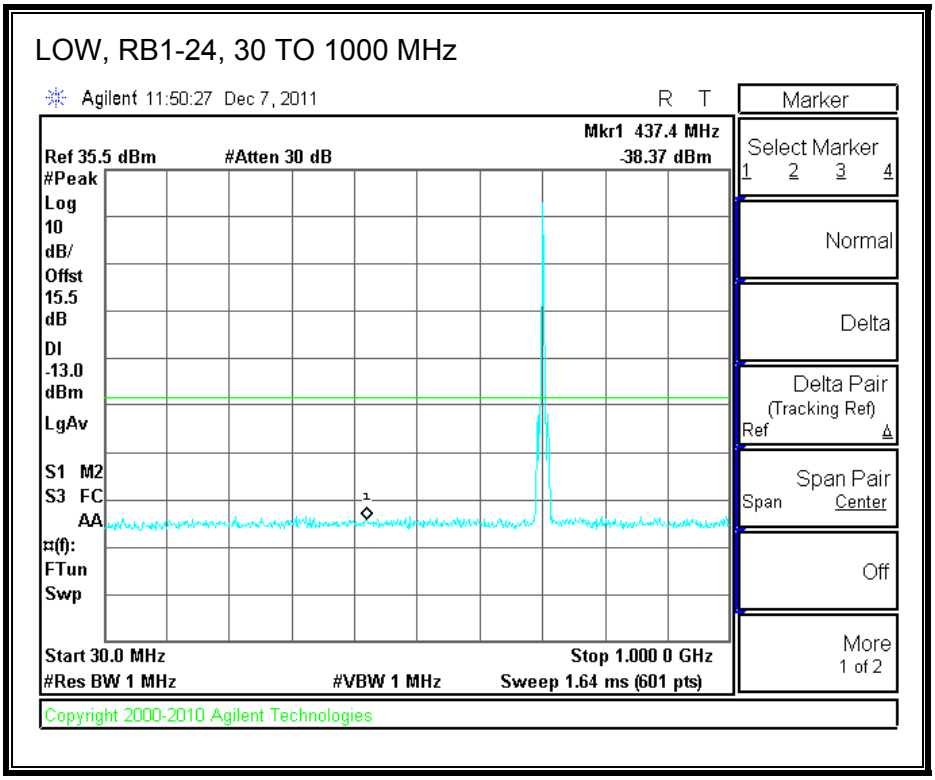
HIGH, RB1-24, 30 TO 1000 MHz

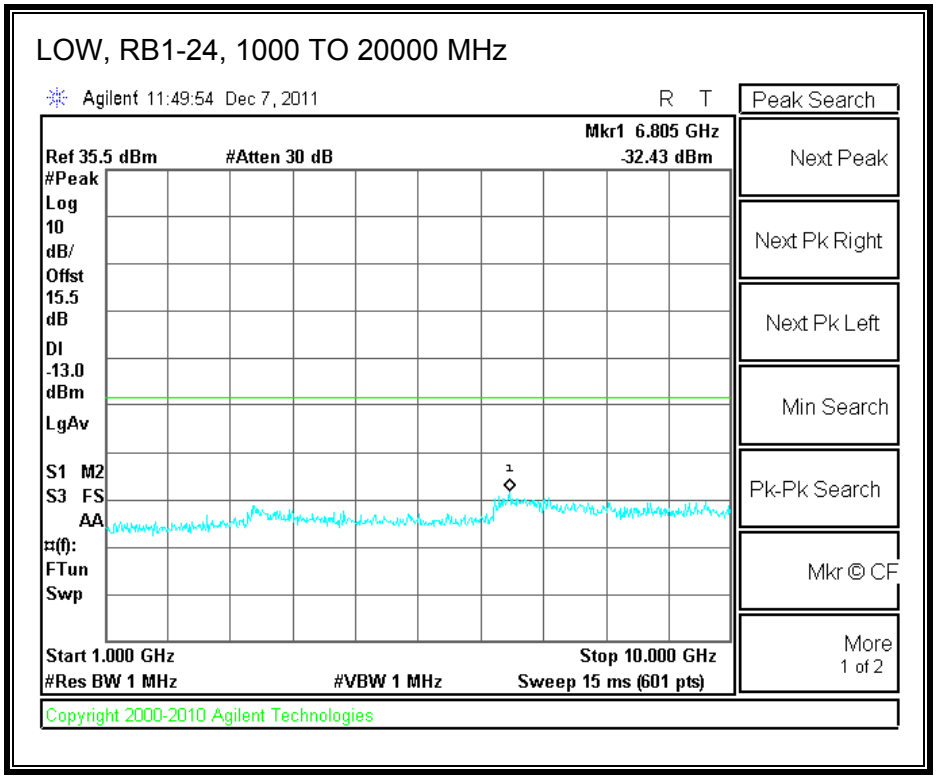



HIGH, RB1-24, 1000 TO 20000 MHz

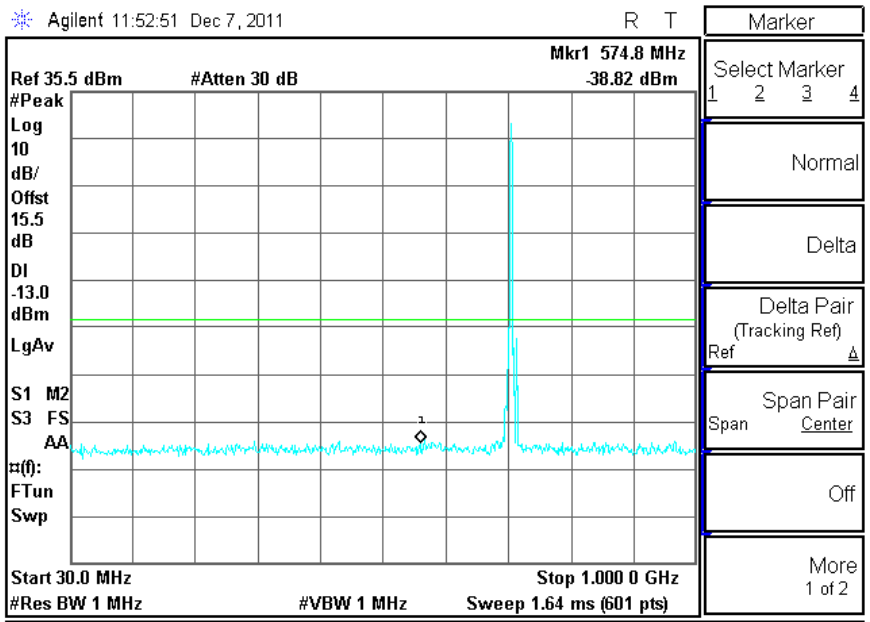


**LTE 16QAM**

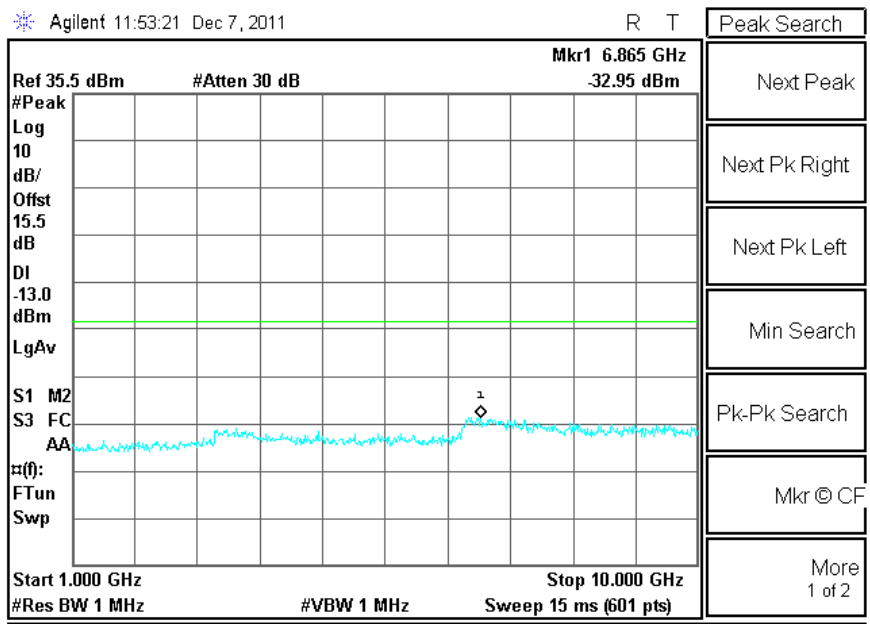


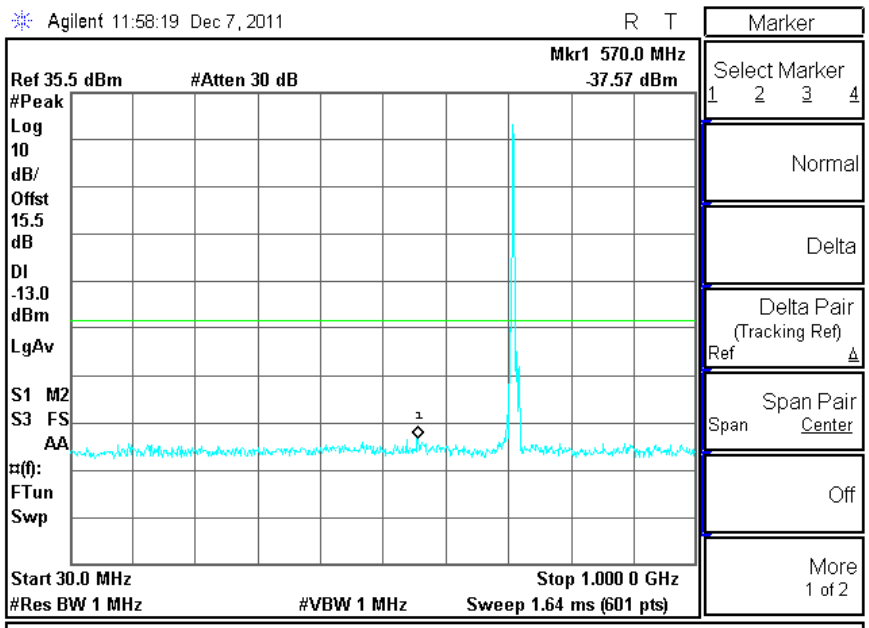
MID, RB1-24, 30 TO 1000 MHz



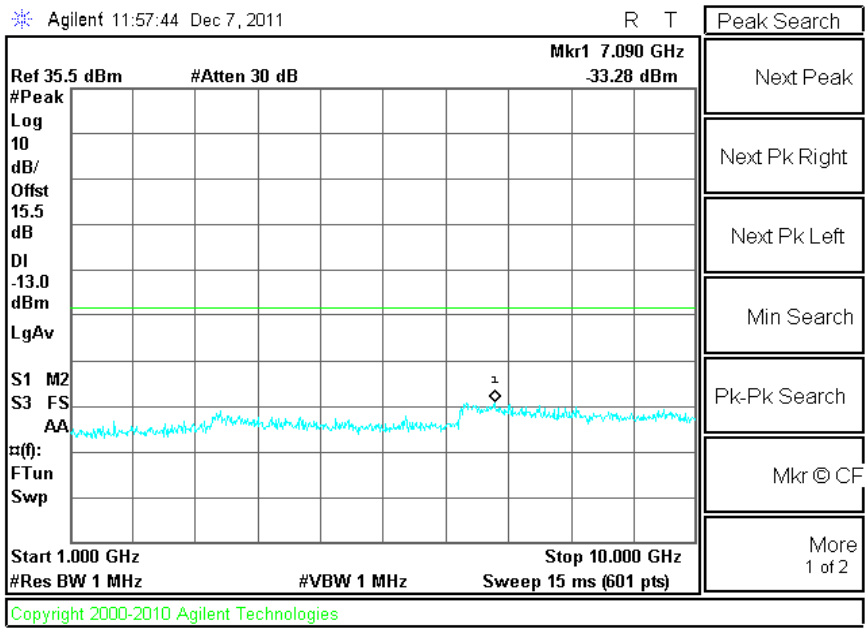

MID, RB1-24, 1000 TO 20000 MHz



HIGH, RB1-24, 30 TO 1000 MHz

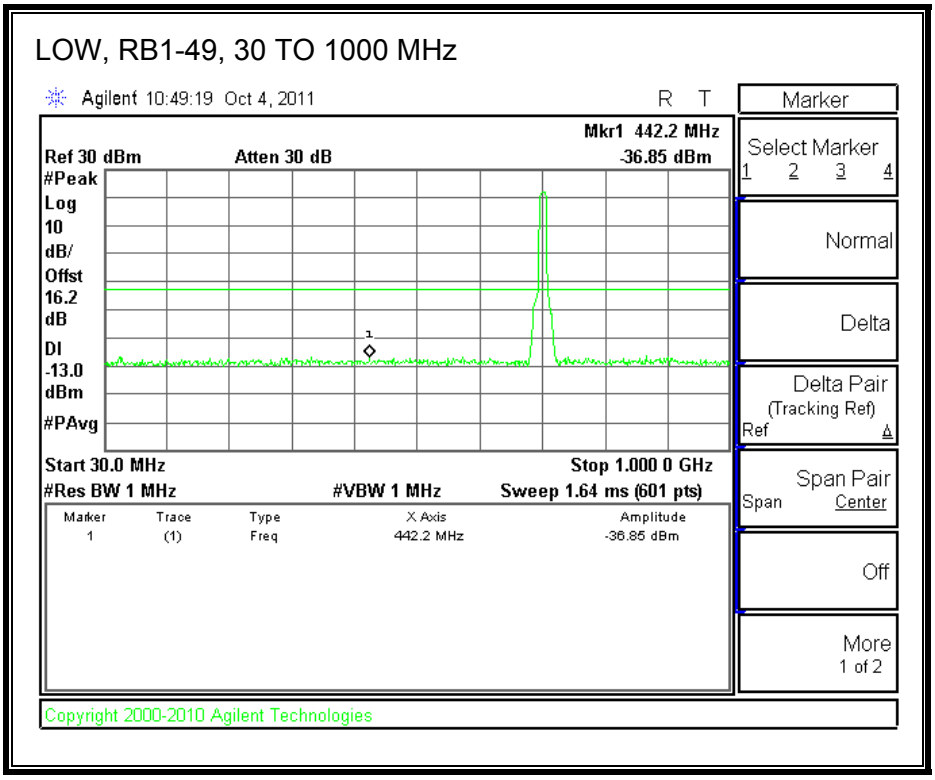


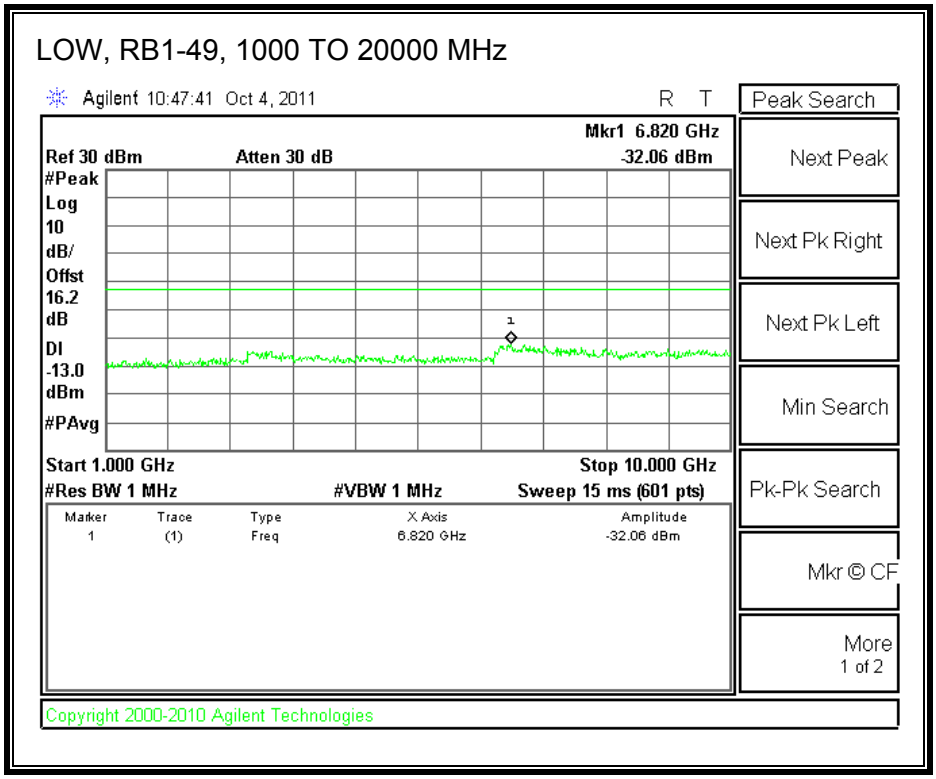

HIGH, RB1-24, 1000 TO 200000 MHz



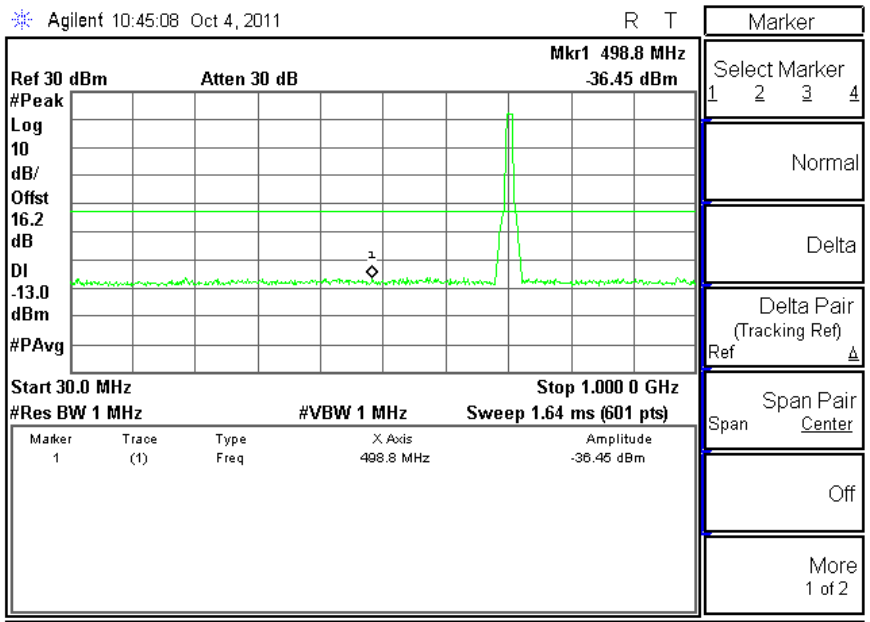
**Band 17 (10.0 MHz BAND WIDTH)**

**LTE QPSK**

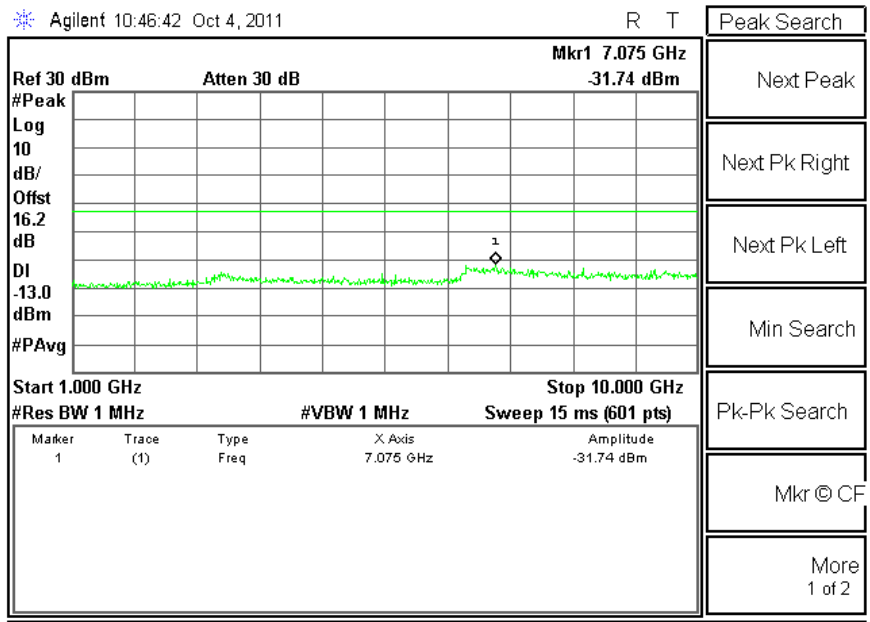


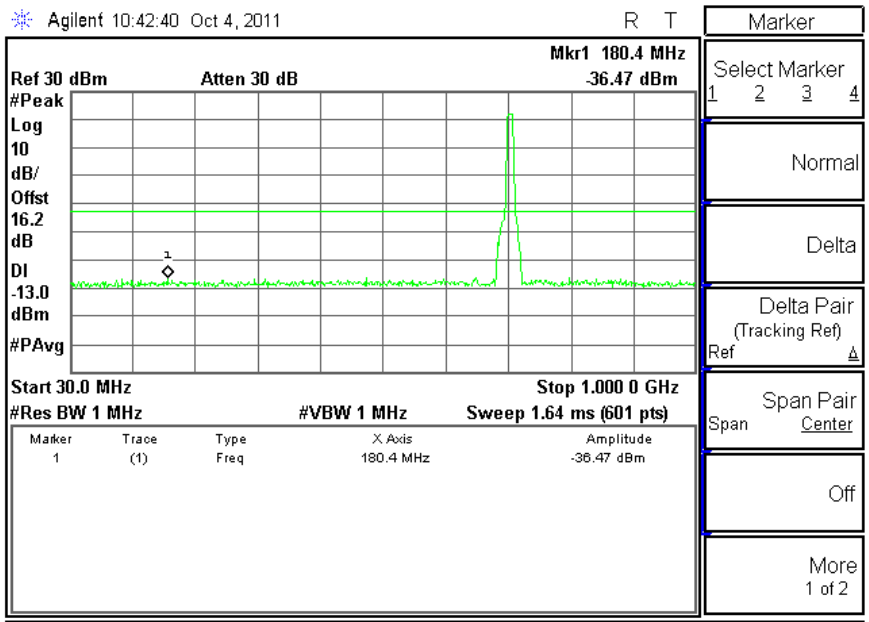
MID, RB1-49, 30 TO 1000 MHz



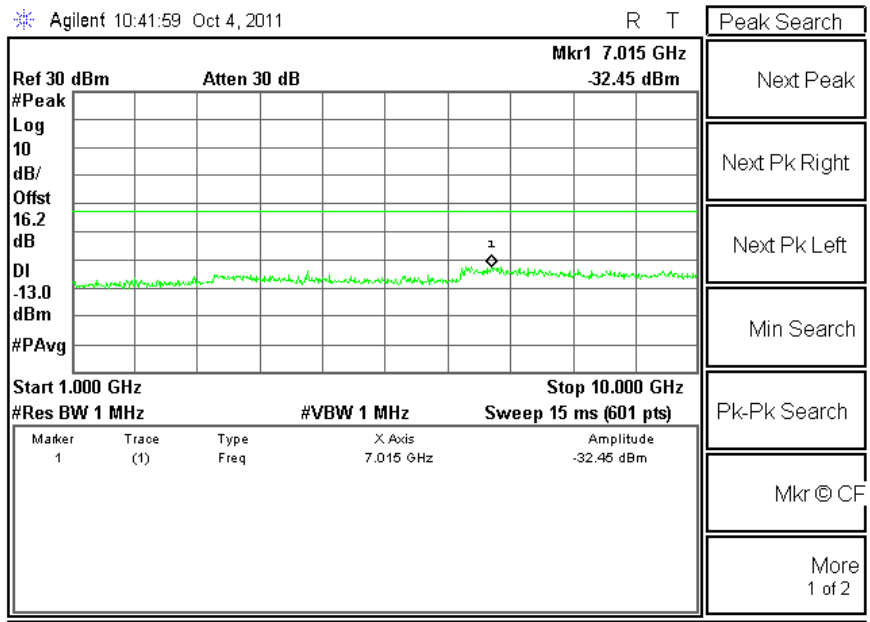

MID, RB1-49, 1000 TO 20000 MHz



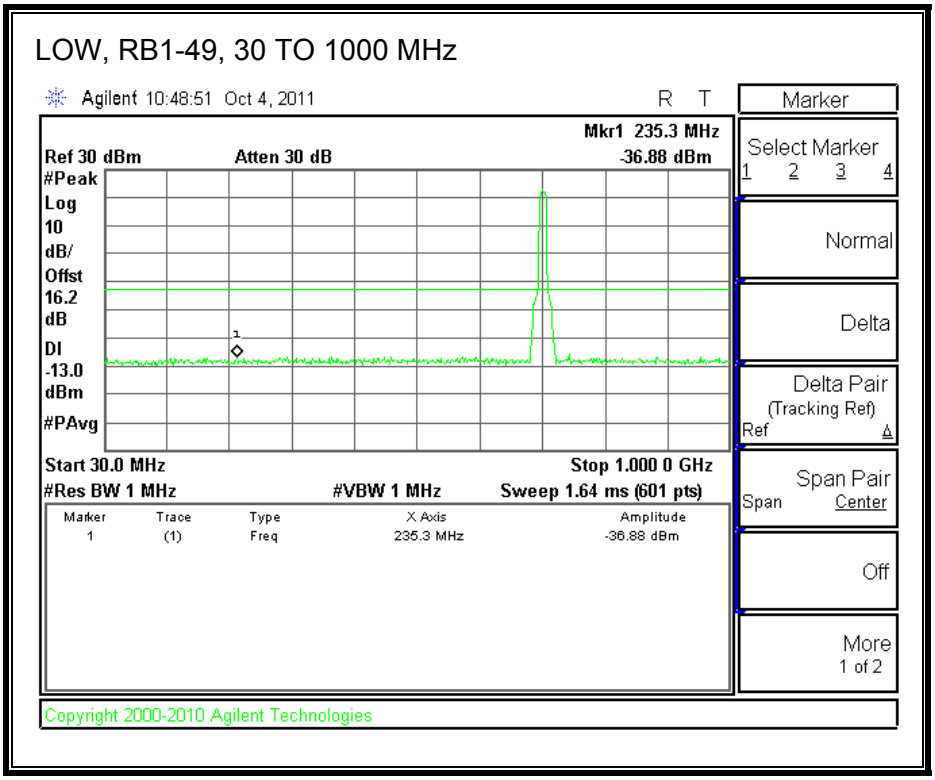
HIGH, RB1-49, 30 TO 1000 MHz

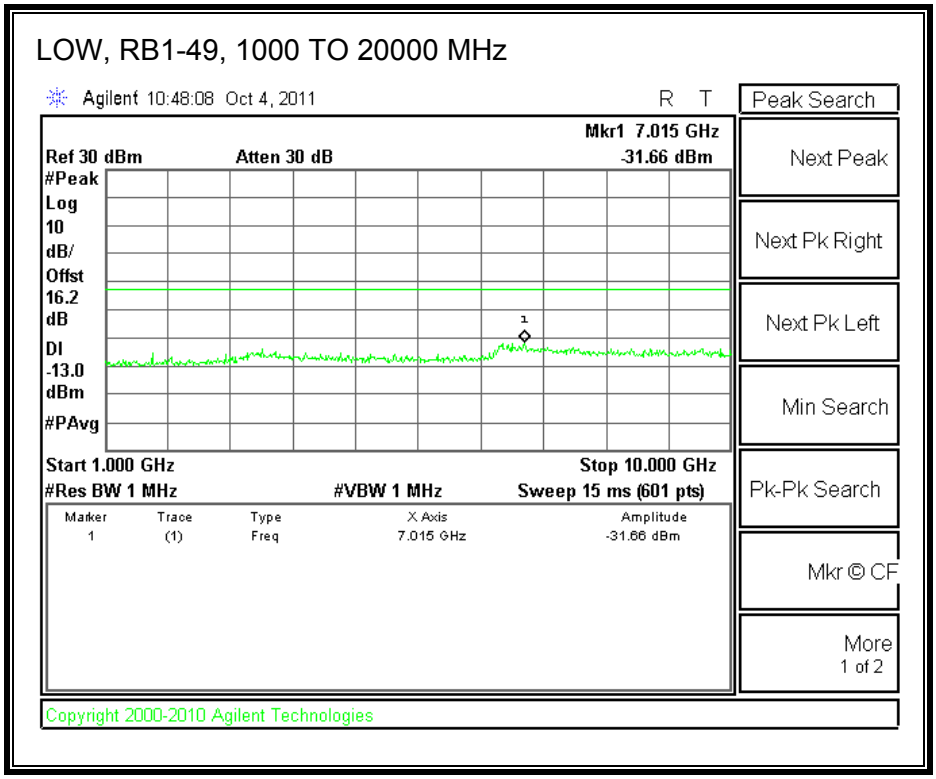



HIGH, RB1-49, 1000 TO 20000 MHz

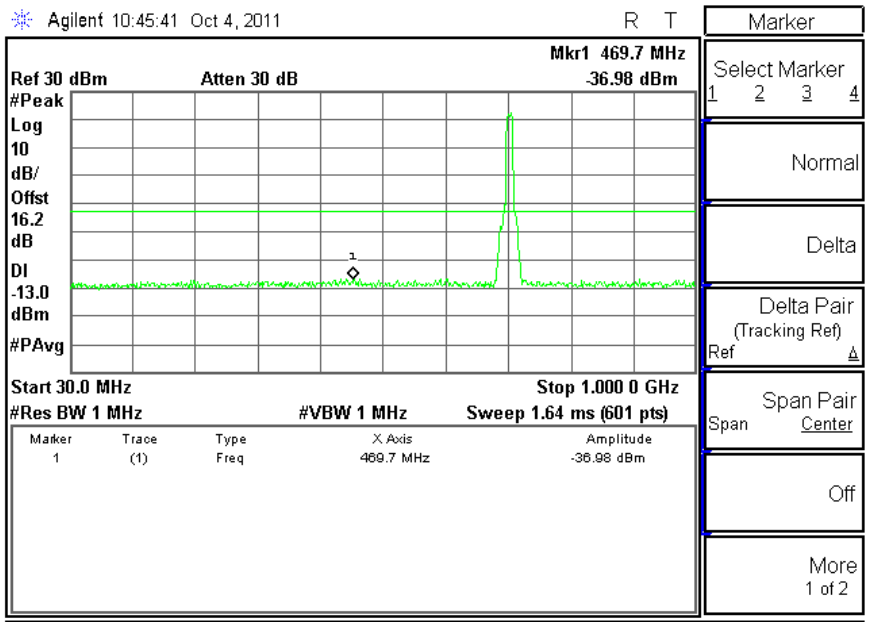


**LTE 16QAM**

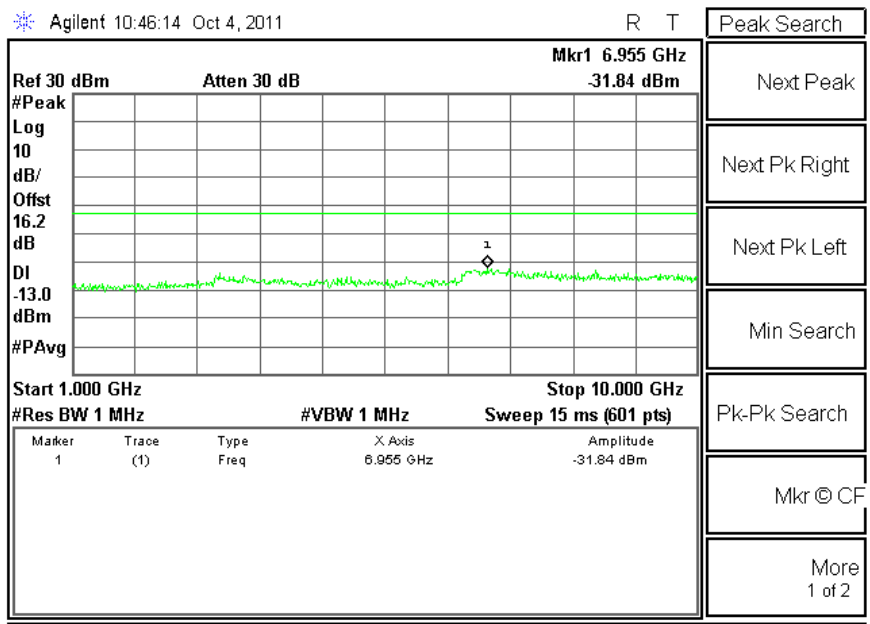


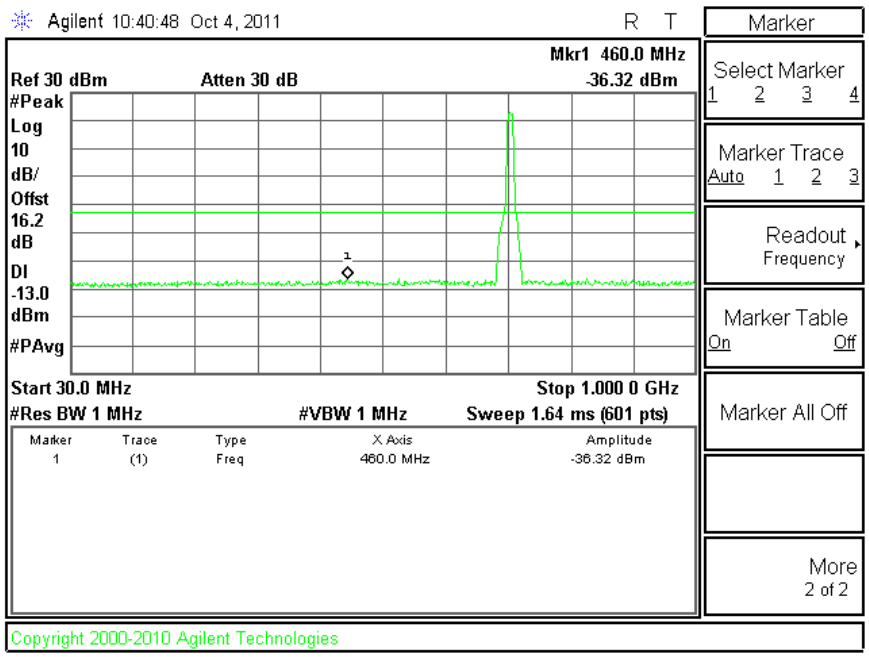
MID, RB1-49, 30 TO 1000 MHz



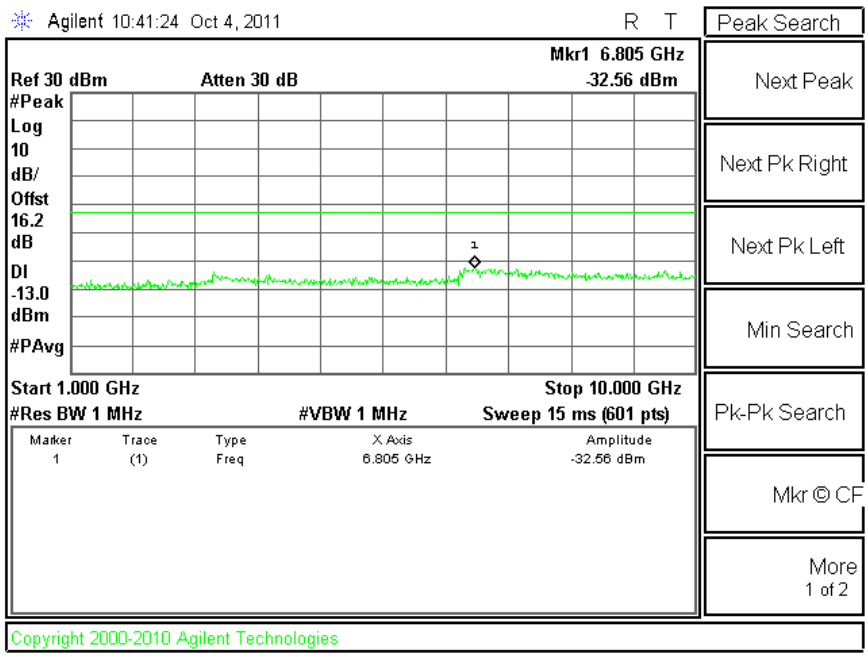

MID, RB1-49, 1000 TO 20000 MHz



HIGH, RB1-49, 30 TO 1000 MHz

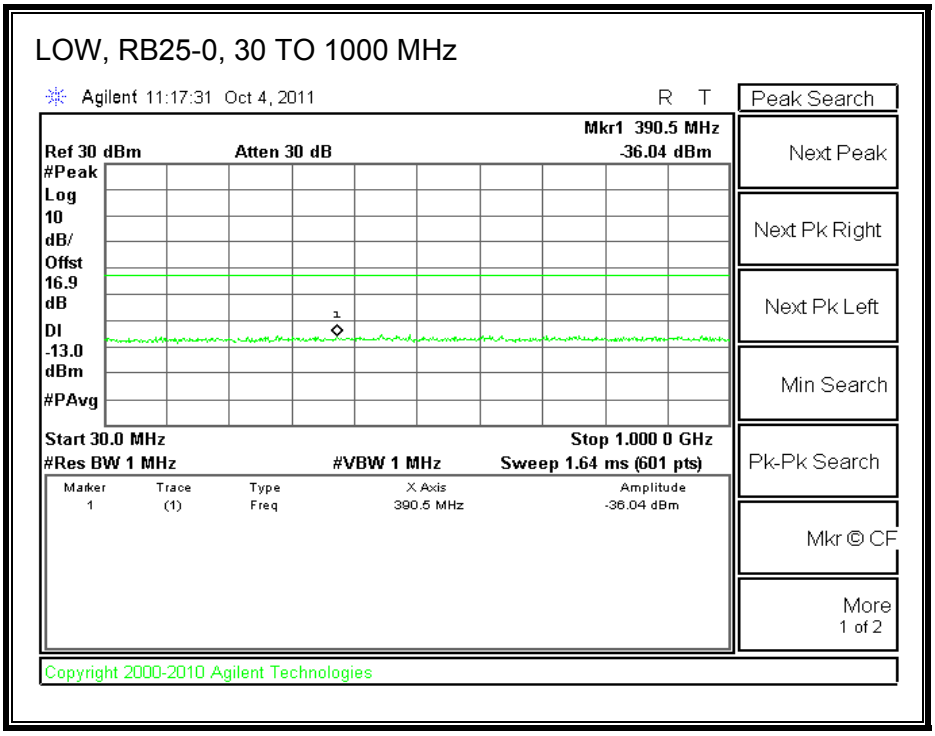


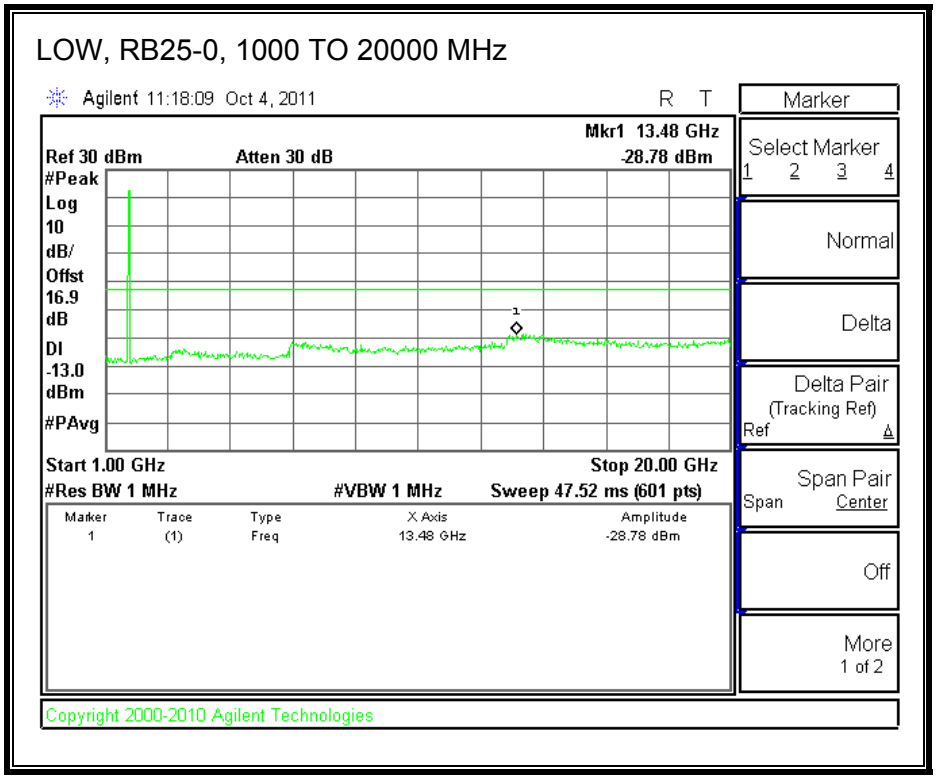

HIGH, RB1-49, 1000 TO 200000 MHz



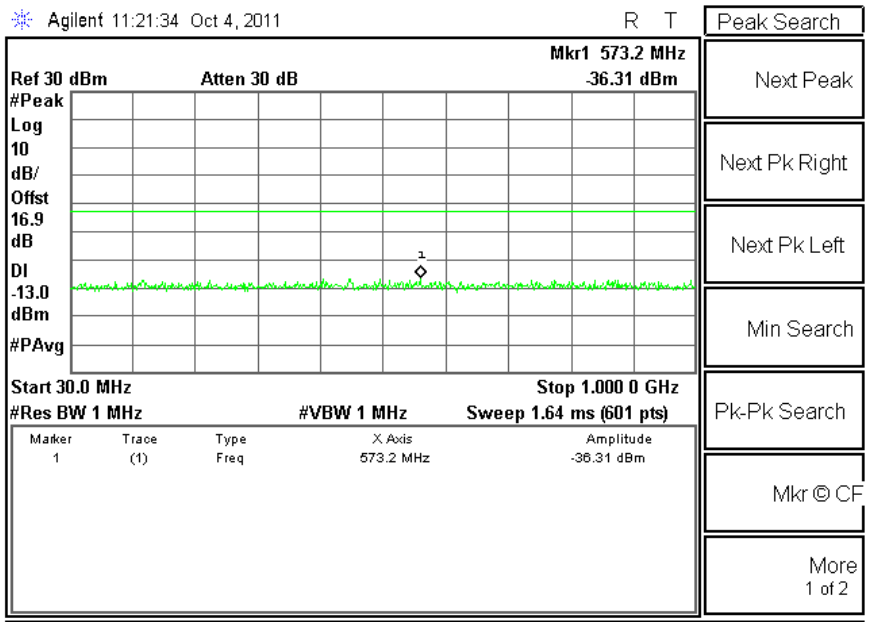
**Band 4 (5.0 MHz BAND WIDTH)**

**LTE QPSK**

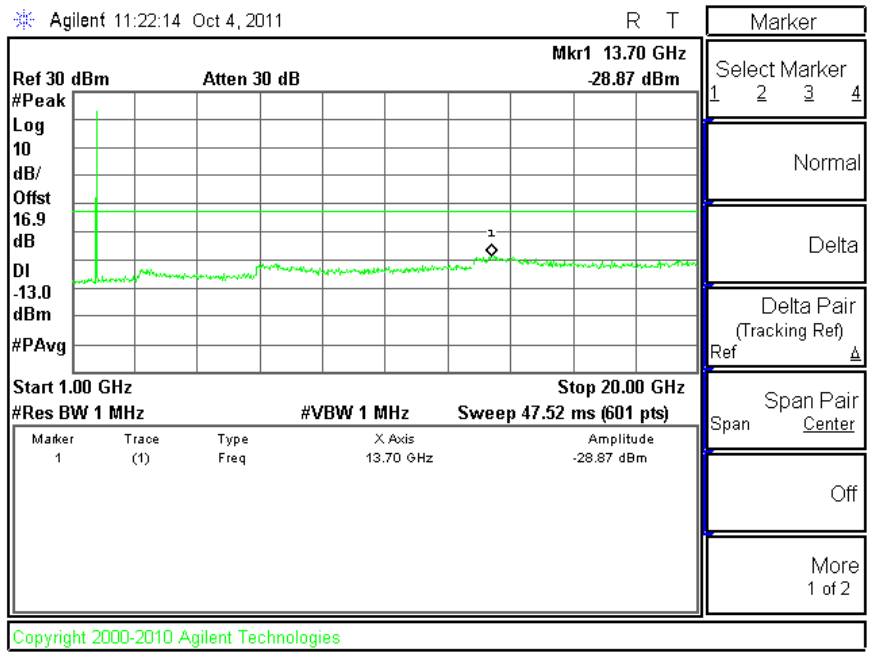


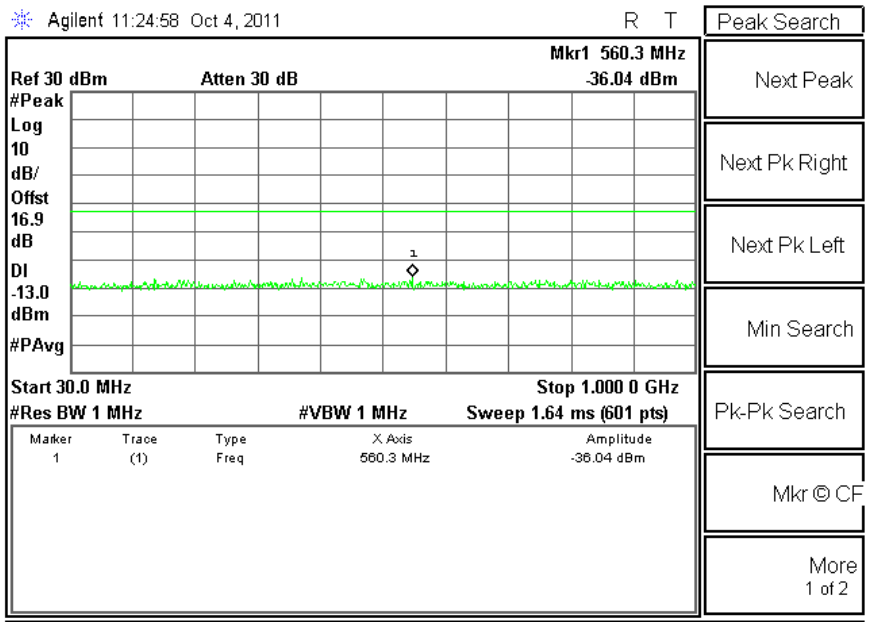
MID, RB25-0, 30 TO 1000 MHz



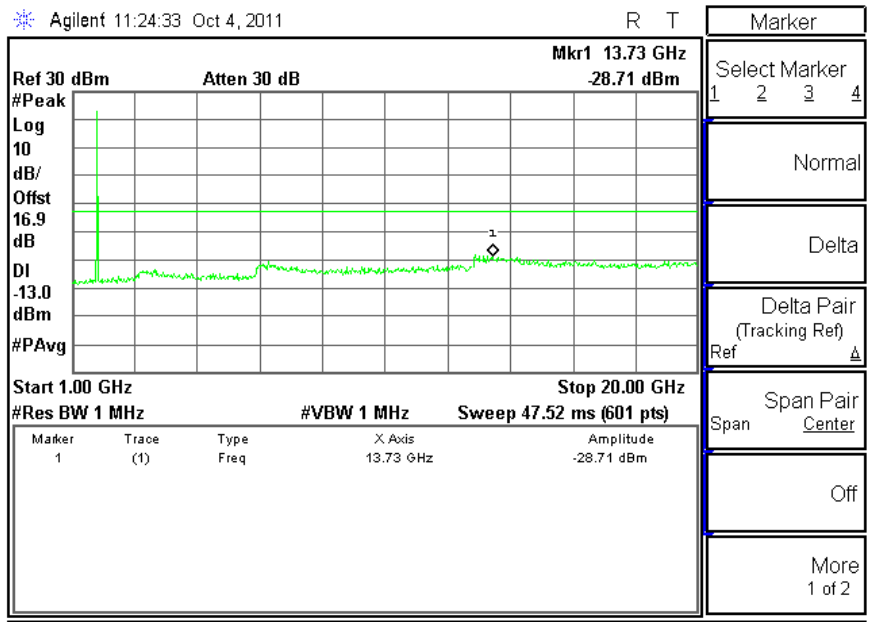

MID, RB25-0, 1000 TO 20000 MHz



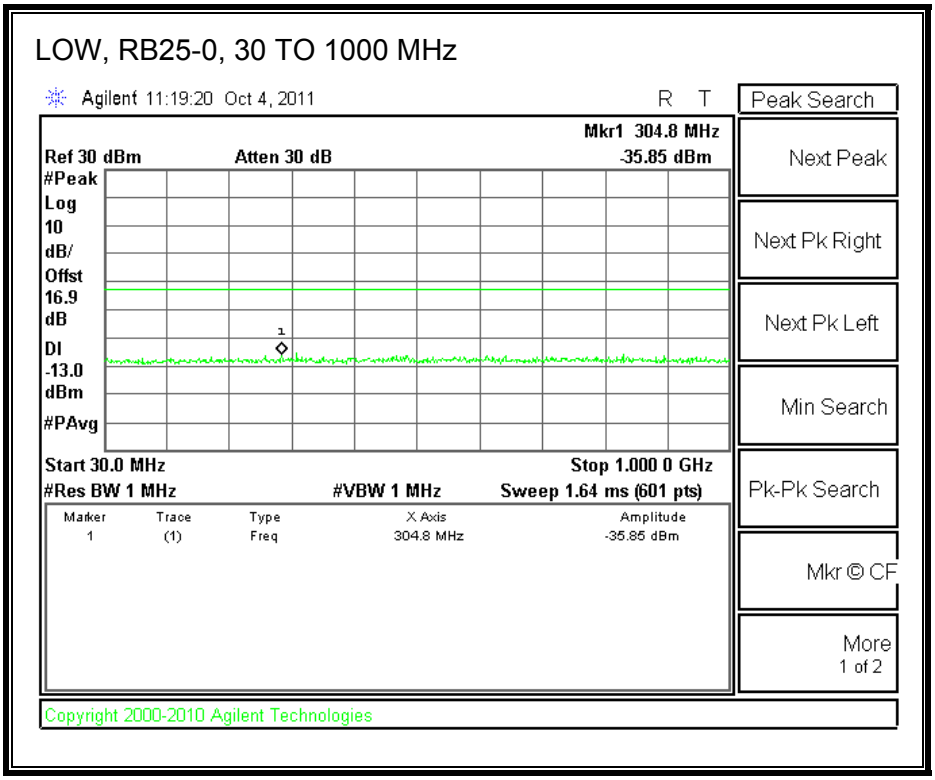
HIGH, RB25-0, 30 TO 1000 MHz

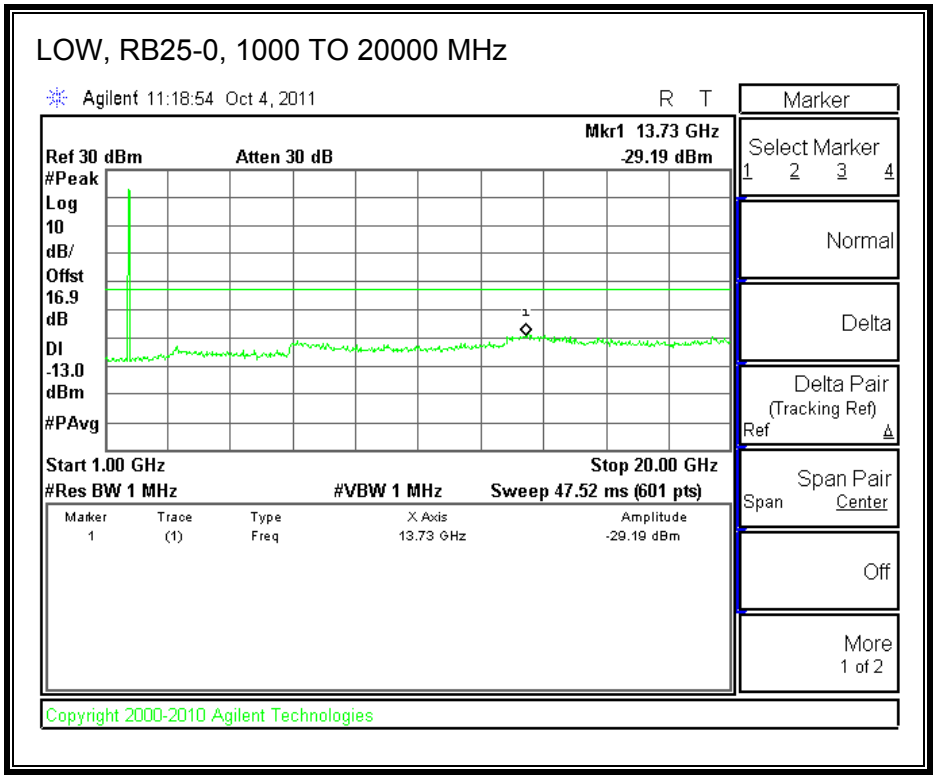



HIGH, RB25-0, 1000 TO 20000 MHz

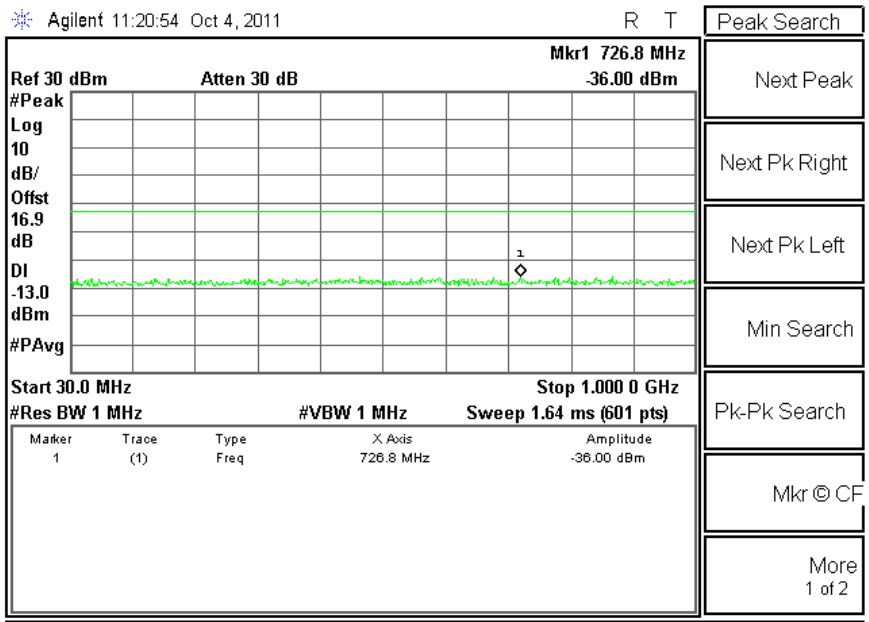


**LTE 16QAM**

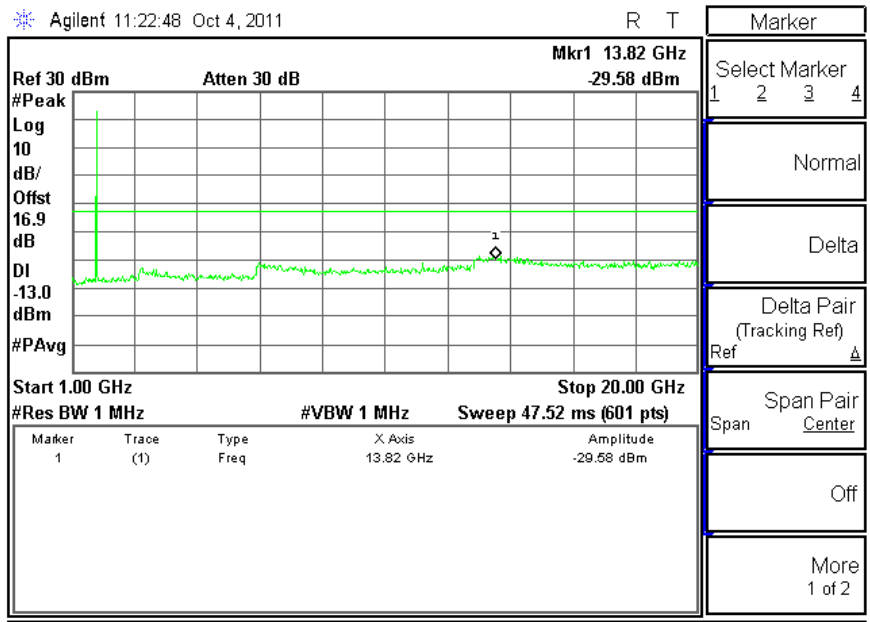


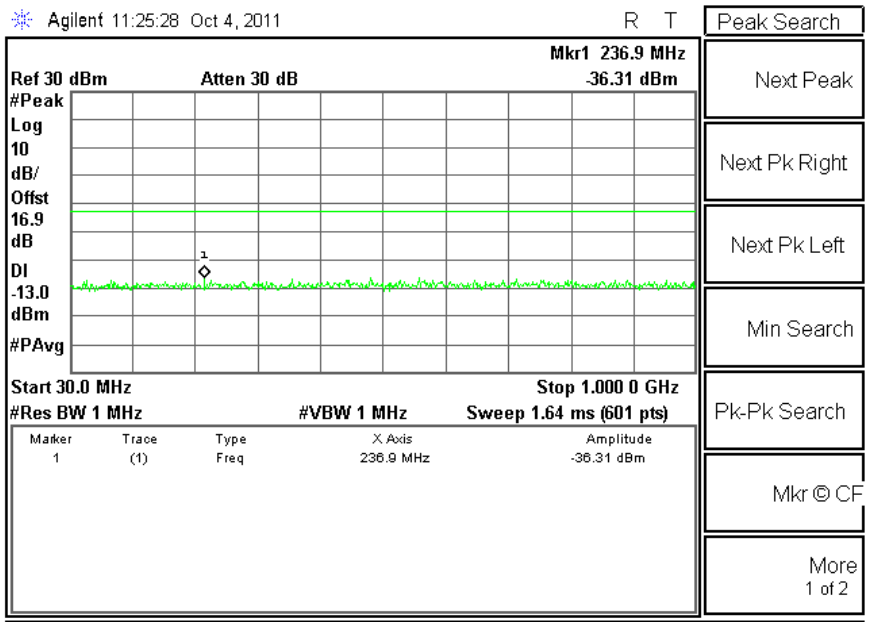
MID, RB25-0, 30 TO 1000 MHz



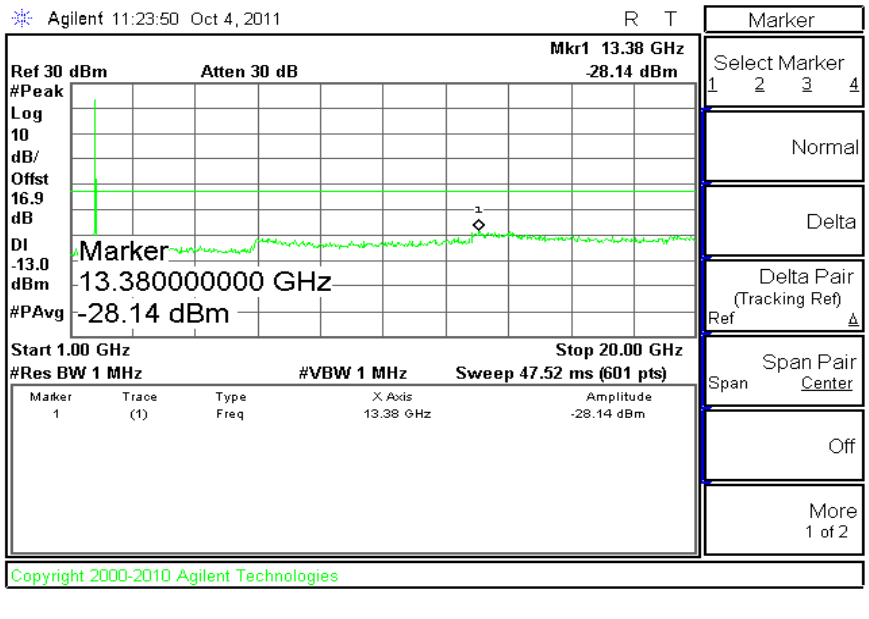

MID, RB25-0, 1000 TO 20000 MHz



HIGH, RB25-0, 30 TO 1000 MHz

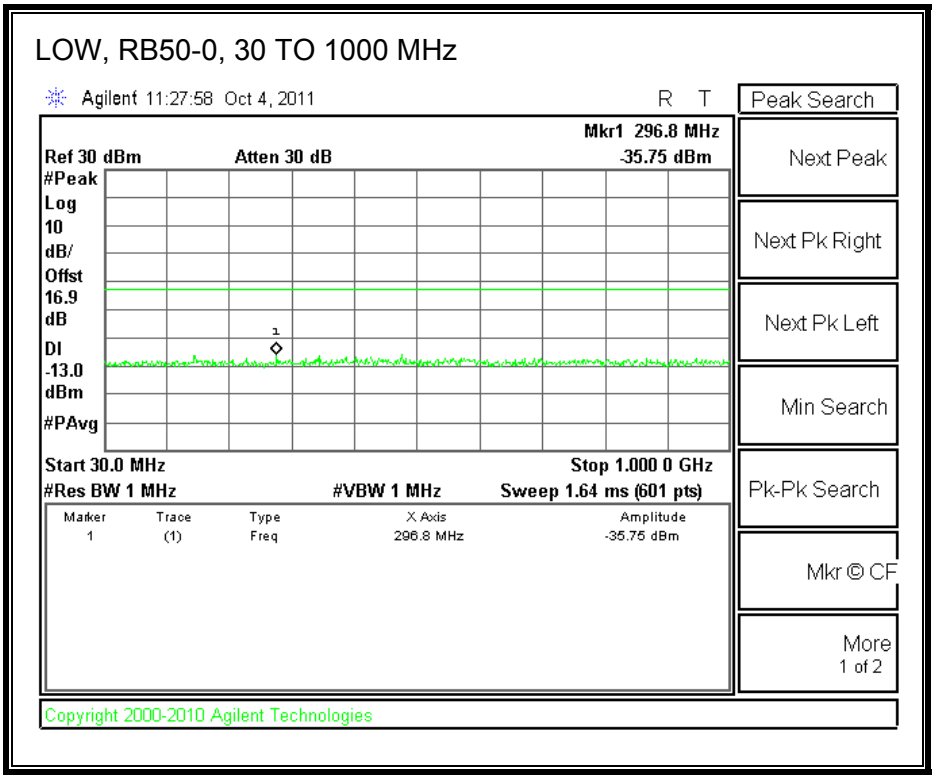


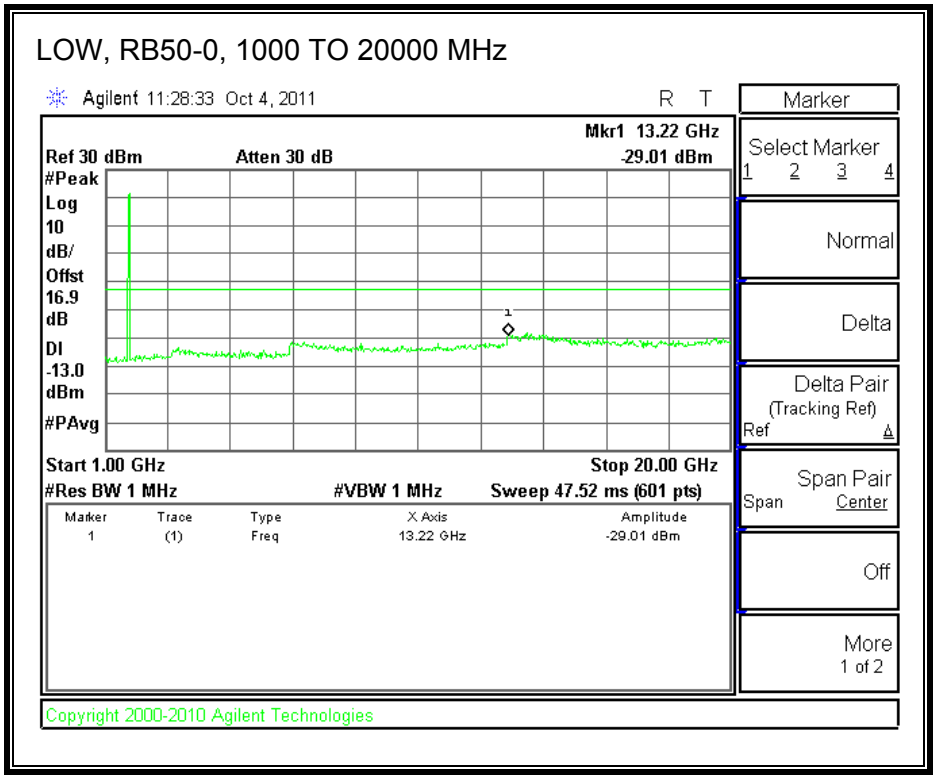

HIGH, RB25-0, 1000 TO 200000 MHz



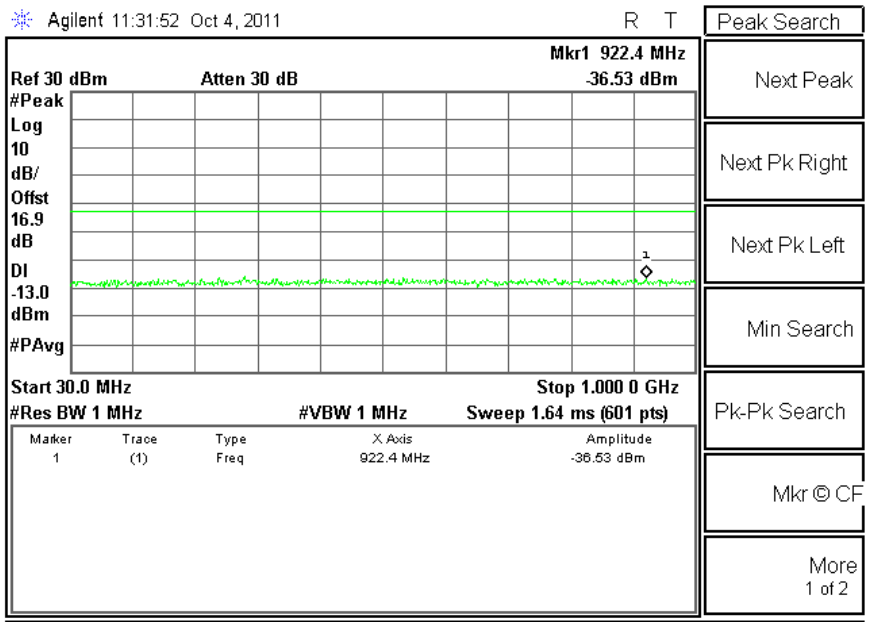
**Band 4 (10.0 MHz BAND WIDTH)**

**LTE QPSK**

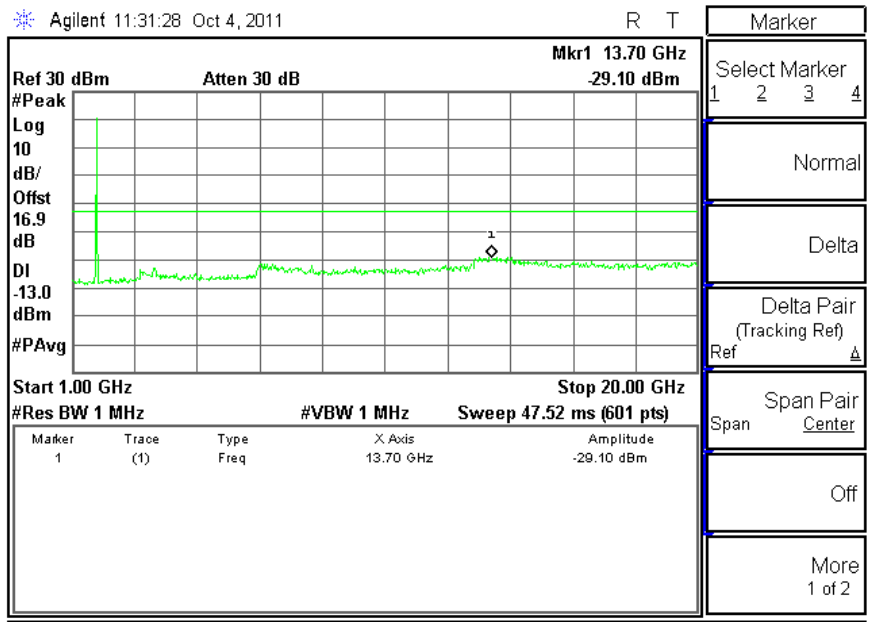


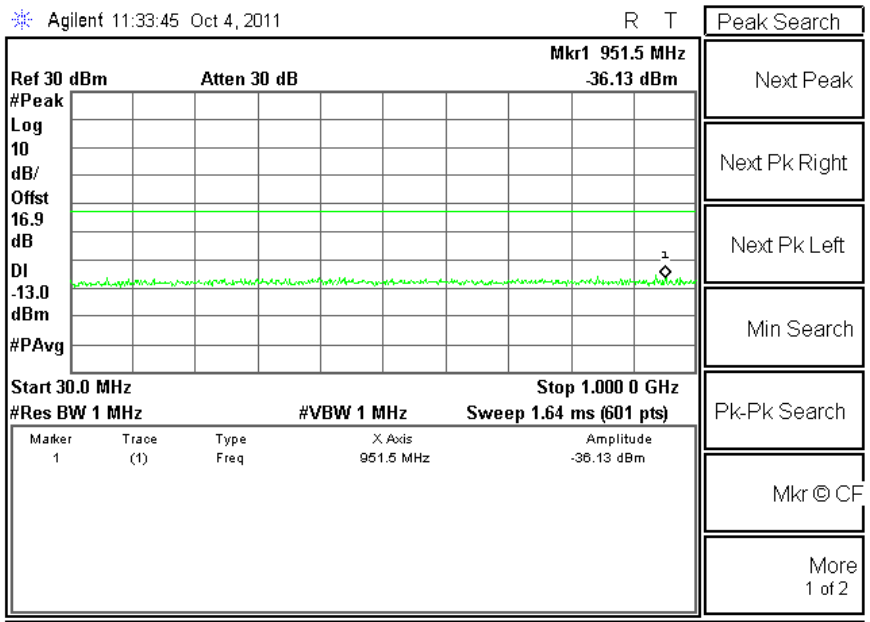
MID, RB50-0, 30 TO 1000 MHz



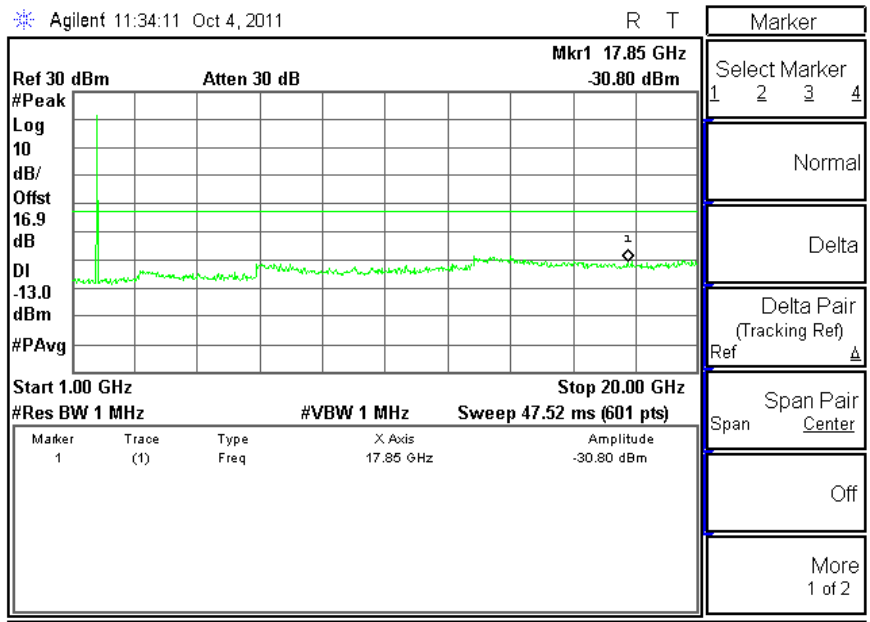

MID, RB50-0, 1000 TO 20000 MHz



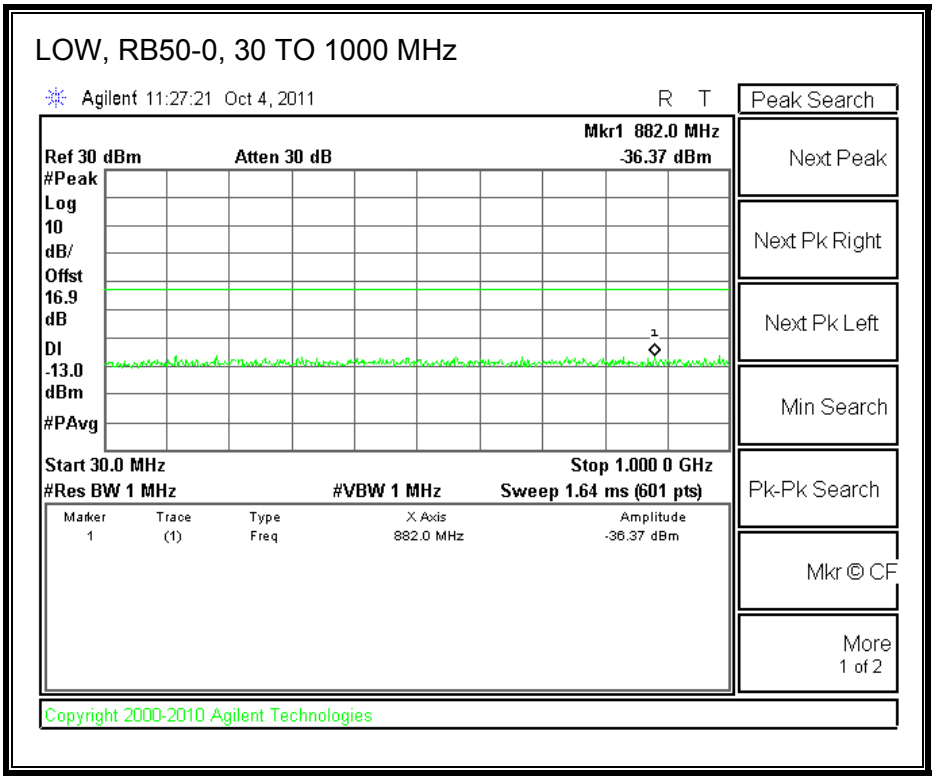
HIGH, RB50-0, 30 TO 1000 MHz

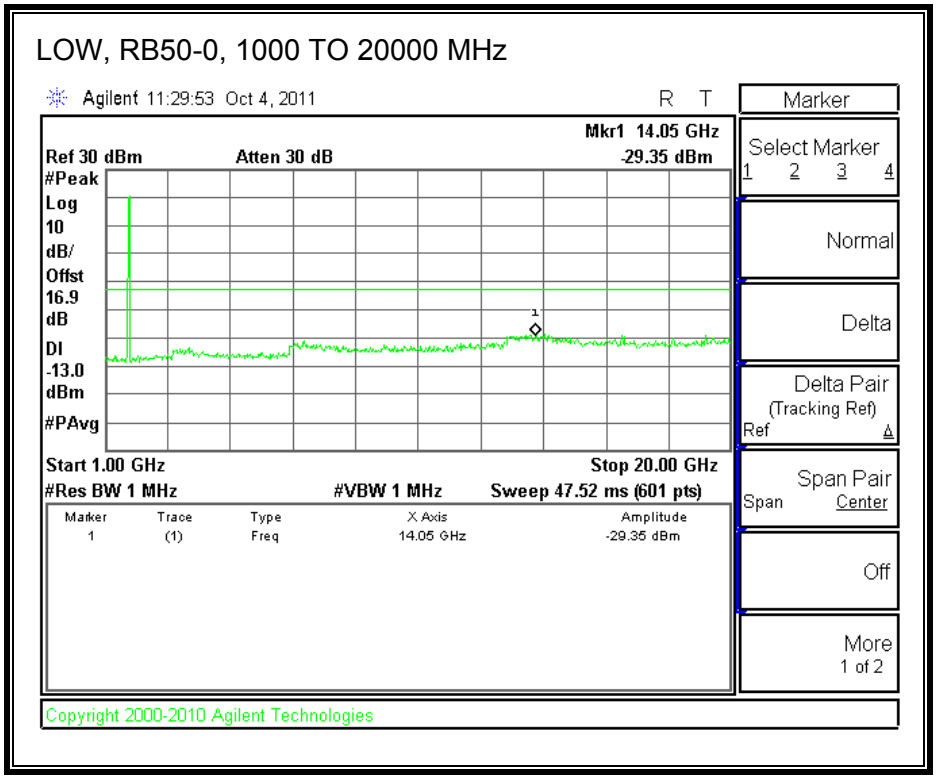



HIGH, RB50-0, 1000 TO 20000 MHz

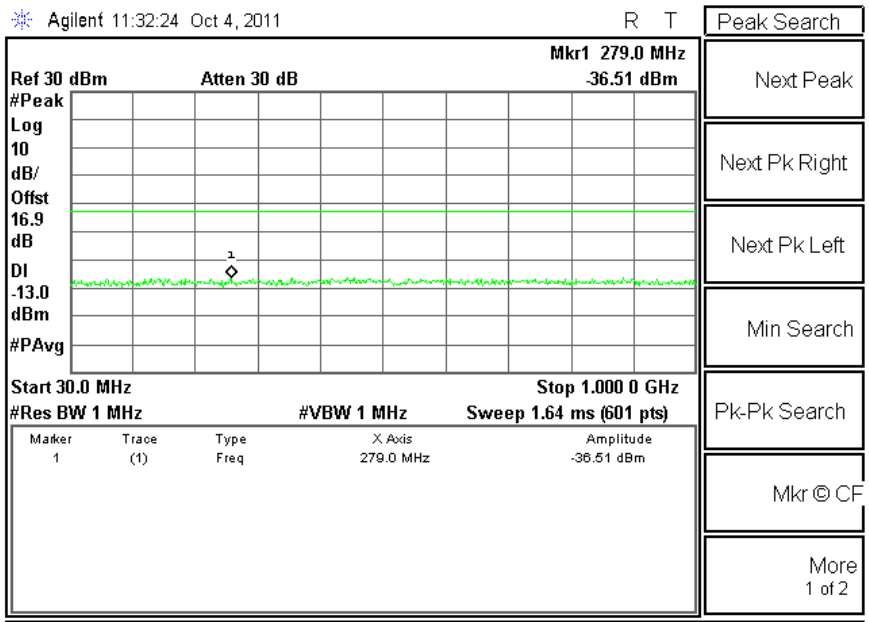


**LTE 16QAM**

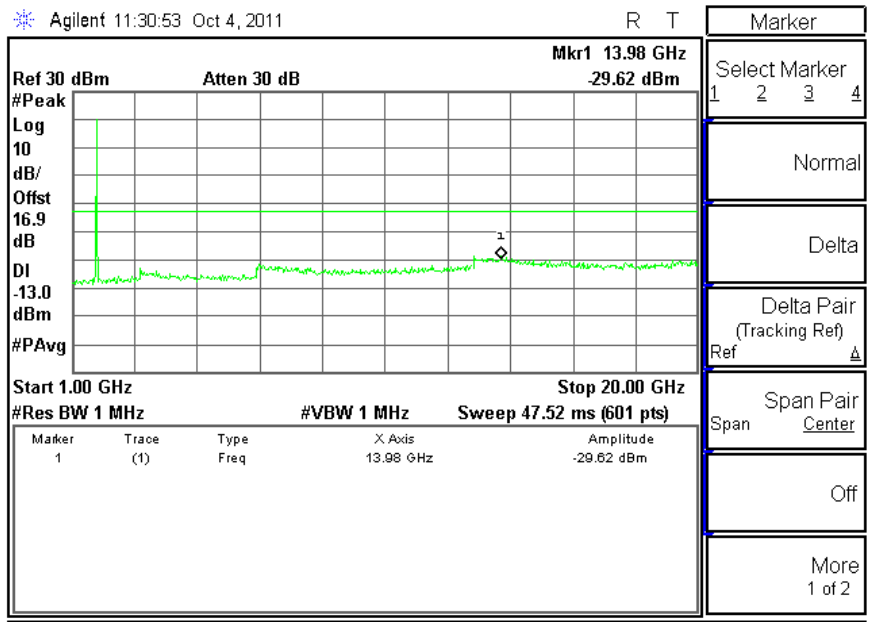


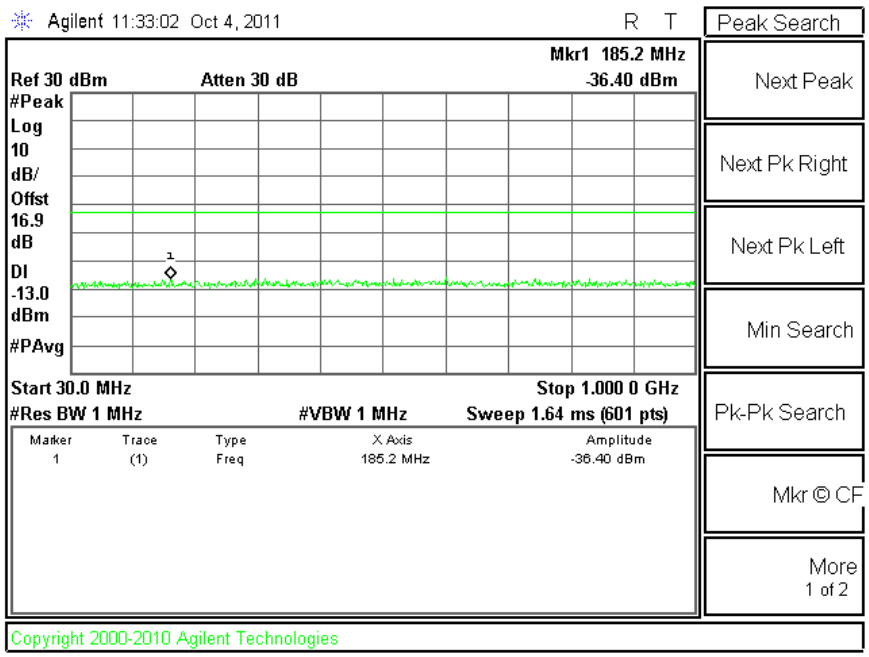
MID, RB50-0, 30 TO 1000 MHz



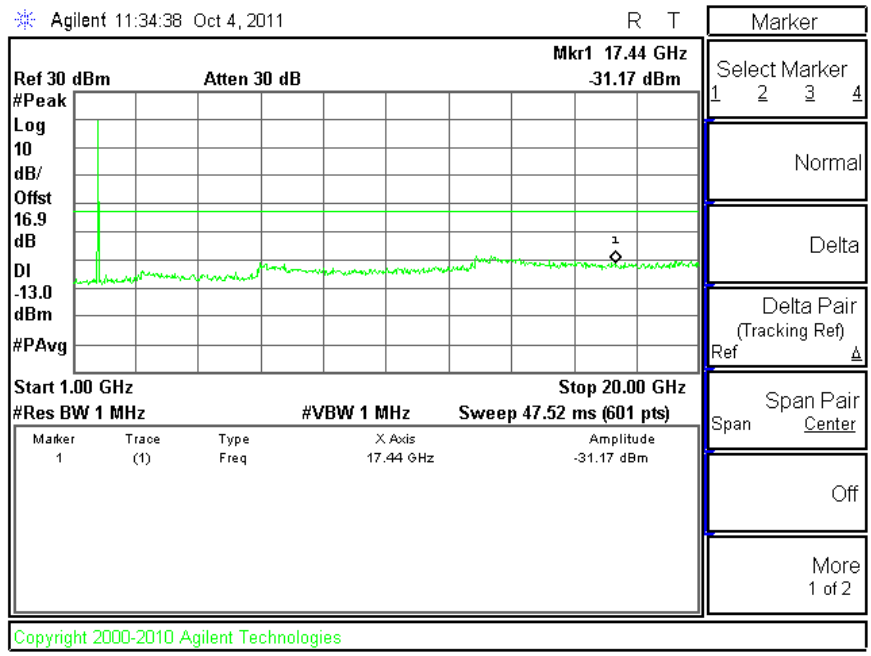

MID, RB50-0, 1000 TO 20000 MHz



HIGH, RB50-0, 30 TO 1000 MHz




HIGH, RB50-0, 1000 TO 200000 MHz



**BAND 17, Peak-To-Average Ratio:**

| Mode | Channel Band-width (MHZ) | Modulation | f (MHz) | Couducted Power (dBm) | | Peak-to-Average Ratio (PAR) |
|---|---|---|---|---|---|---|
| | | | | *Peak | Average | |
| QPSK | 5 | RB1 0 | 710 | 27.95 | 24.59 | 3.36 |

| Mode | Channel Band-width | Ch. No. | f (MHz) | Couducted Power (dBm) | | Peak-to-Average Ratio |
|---|---|---|---|---|---|---|
| | | | | *Peak | Average | |
| 16QAM | 5 | RB1 0 | 710 | 27.97 | 23.75 | 4.22 |

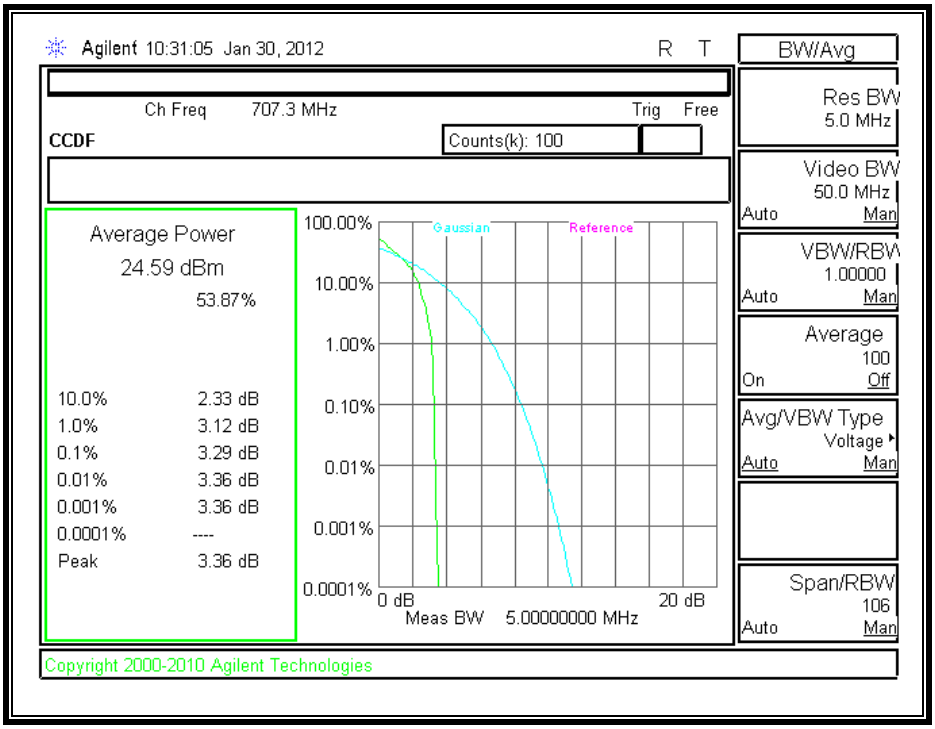
*Peak Reading = Average Reading + Peak-to-Average Ratio

| Mode | Channel Band-width (MHZ) | Modulation | f (MHz) | Couducted Power (dBm) | | Peak-to-Average Ratio (PAR) |
|---|---|---|---|---|---|---|
| | | | | *Peak | Average | |
| QPSK | 10 | RB1 49 | 710 | 28.15 | 24.65 | 3.5 |

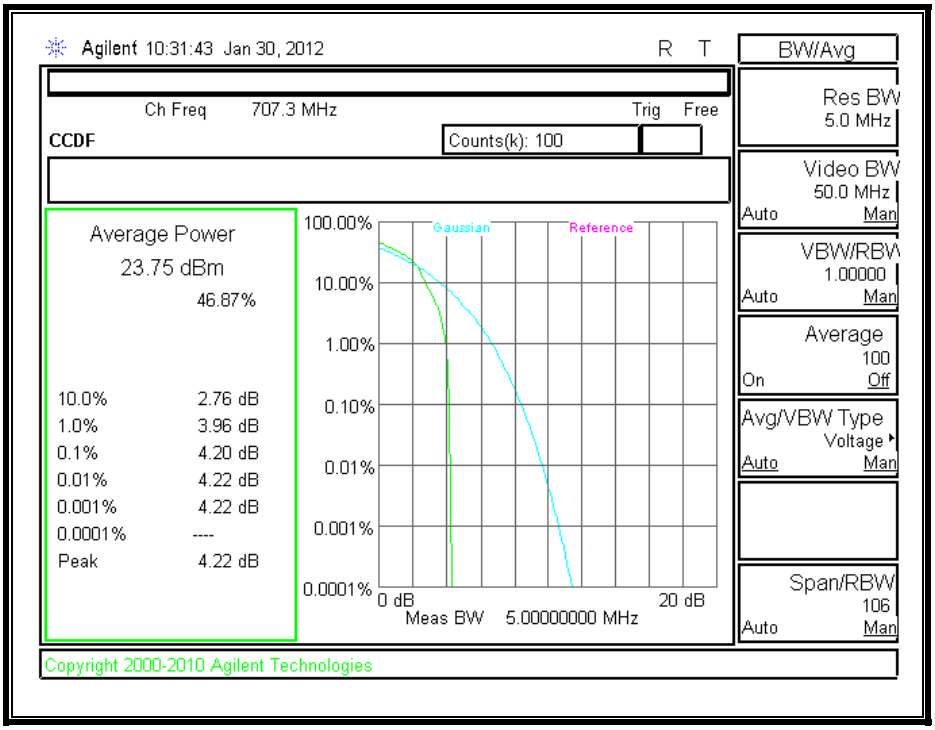
| Mode | Channel Band-width | Ch. No. | f (MHz) | Couducted Power (dBm) | | Peak-to-Average Ratio |
|---|---|---|---|---|---|---|
| | | | | *Peak | Average | |
| 16QAM | 10 | RB1 49 | 710 | 28.2 | 23.4 | 4.8 |

*Peak Reading = Average Reading + Peak-to-Average Ratio

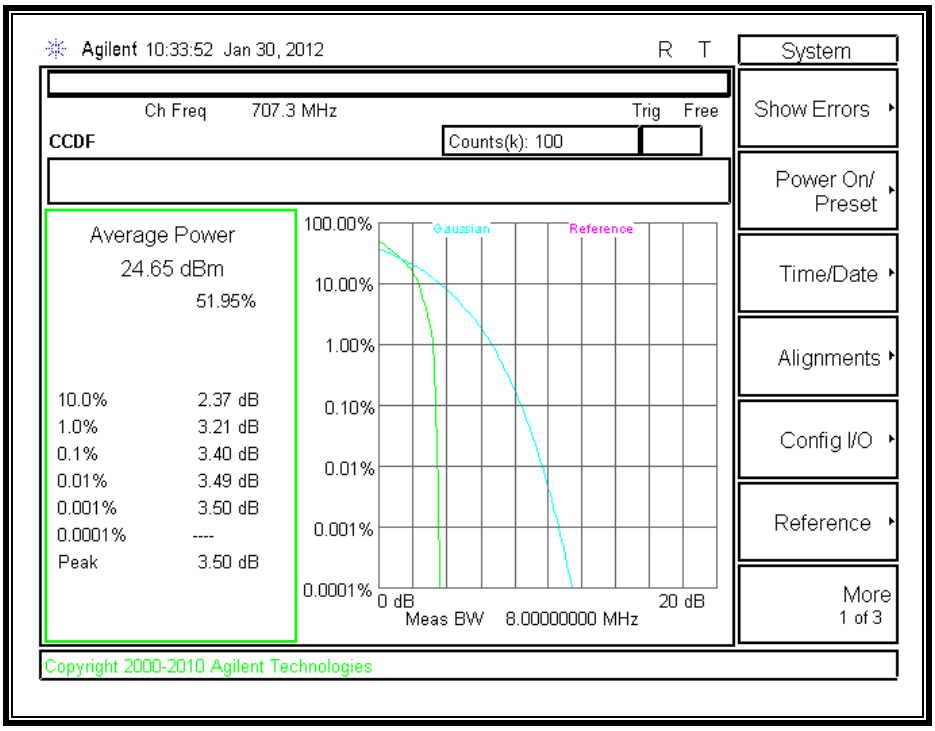
**710MHz, 5MHz_QPSK**



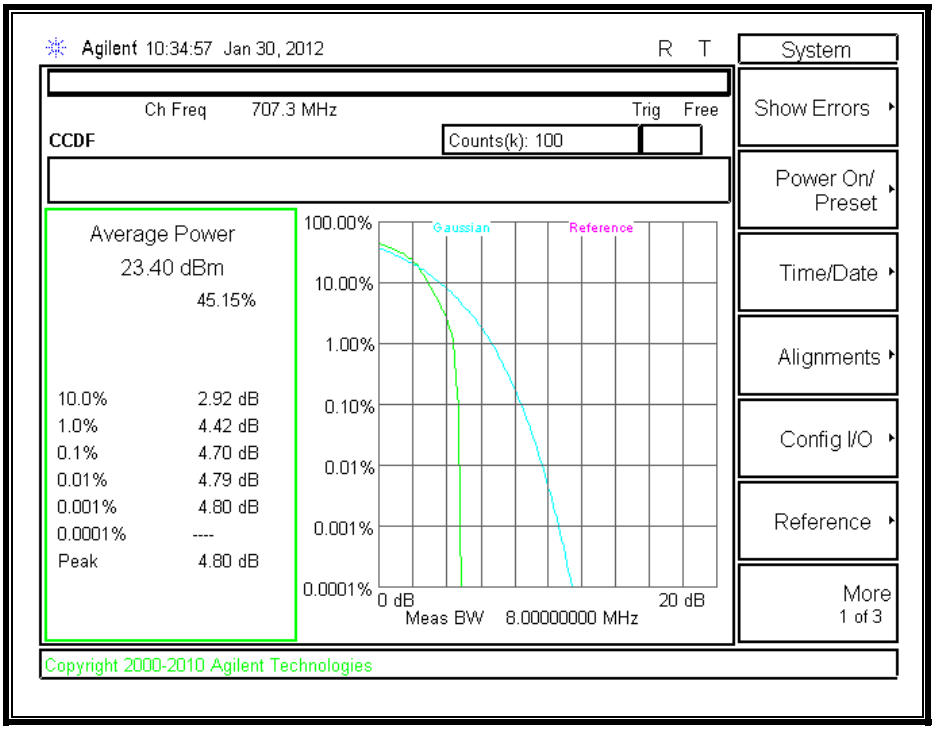

**710MHz, 5MHz_16QAM**



**710MHz, 10MHz_QPSK**




**710MHz, 10MHz_16QAM**

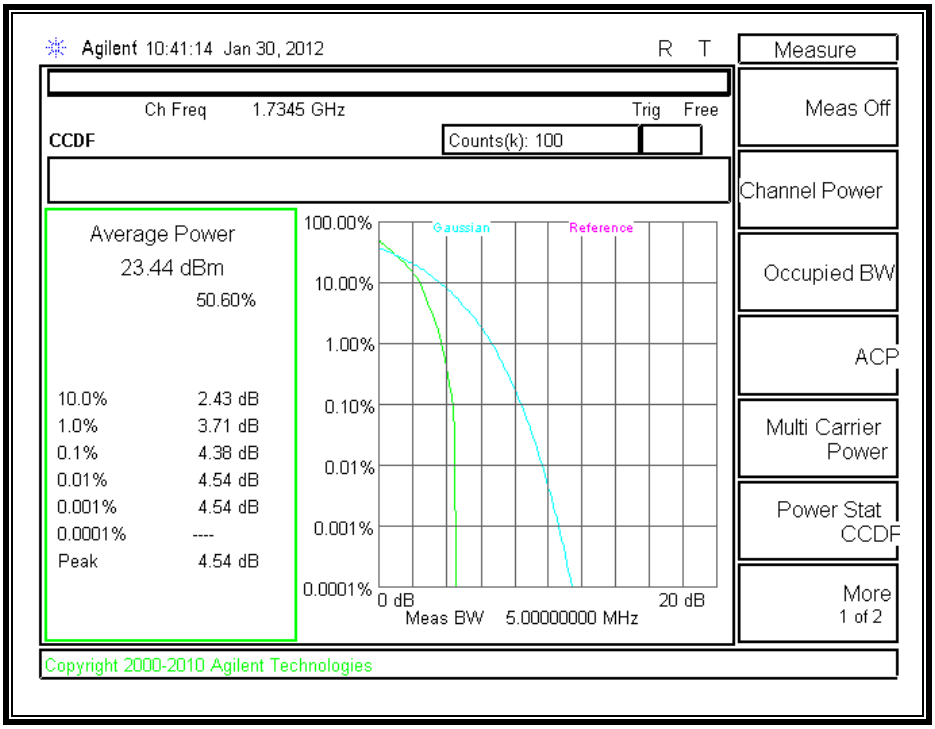


**BAND 4, Peak-To-Average Ratio:**

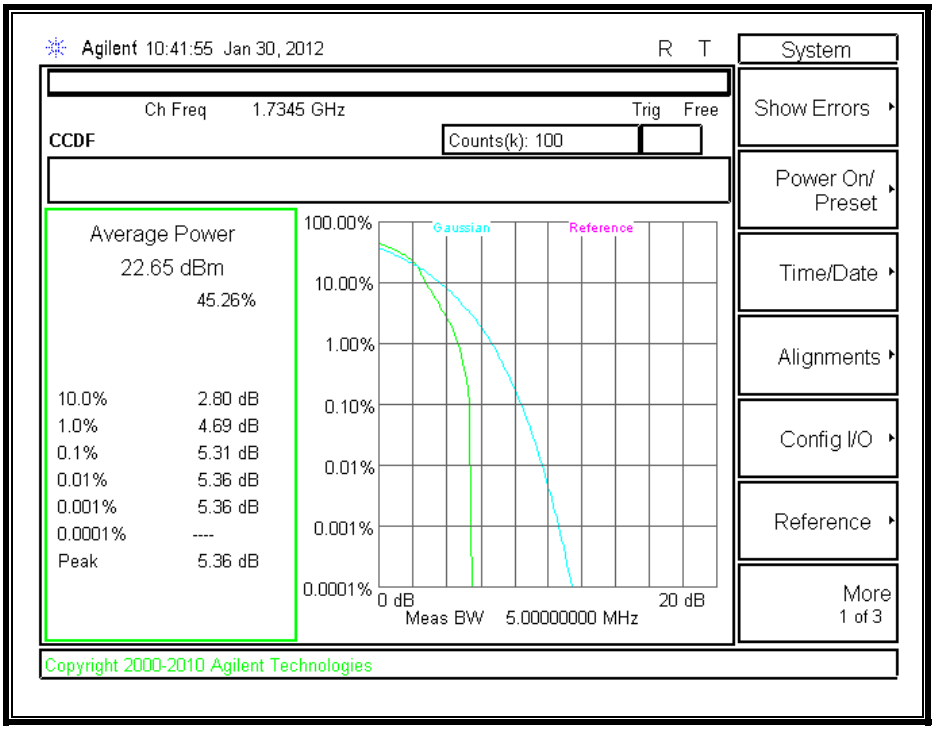
| Mode | Channel Band-width (MHZ) | Modulation | f (MHz) | Couducted Power (dBm) | | Peak-to-Average Ratio (PAR) |
|---|---|---|---|---|---|---|
| | | | | *Peak | Average | |
| QPSK | 5 | RB1 24 | 1732.5 | 27.98 | 23.44 | 4.54 |
| | | | | | | |
| Mode | Channel Band-width | Ch. No. | f (MHz) | Couducted Power (dBm) | | Peak-to-Average Ratio |
| | | | | *Peak | Average | |
| 16QAM | 5 | RB1 24 | 1732.5 | 28.01 | 22.65 | 5.36 |
| *Peak Reading = Average Reading + Peak-to-Average Ratio | | | | | | |

| Mode | Channel Band-width (MHZ) | Modulation | f (MHz) | Couducted Power (dBm) | | Peak-to-Average Ratio (PAR) |
|---|---|---|---|---|---|---|
| | | | | *Peak | Average | |
| QPSK | 10 | RB1 49 | 1732.5 | 27.83 | 23.2 | 4.63 |
| | | | | | | |
| Mode | Channel Band-width | Ch. No. | f (MHz) | Couducted Power (dBm) | | Peak-to-Average Ratio |
| | | | | *Peak | Average | |
| 16QAM | 10 | RB1 49 | 1732.5 | 28.09 | 21.94 | 6.15 |
| *Peak Reading = Average Reading + Peak-to-Average Ratio | | | | | | |

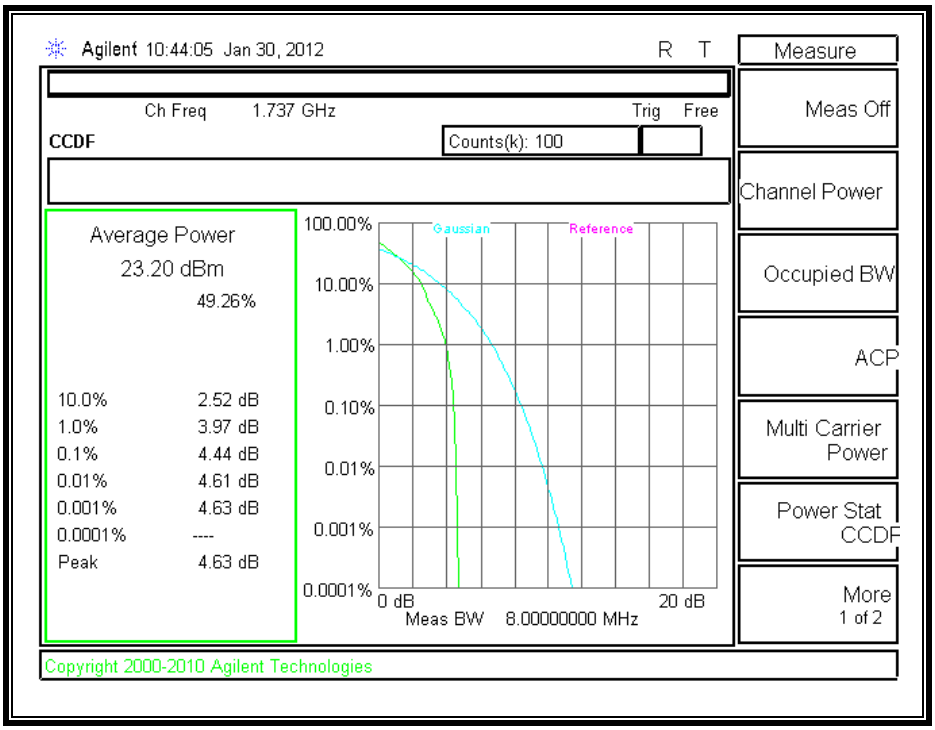
**1732MHz, 5MHz_QPSK**



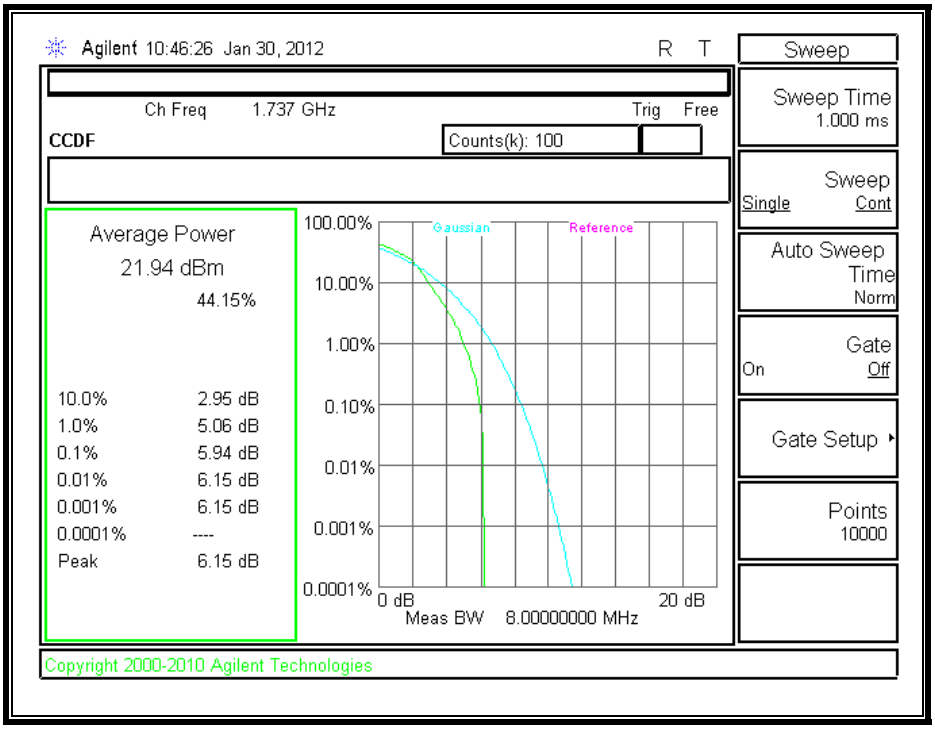

**1732MHz, 5MHz_16QAM**



**1732MHz, 10MHz_QPSK**




**1732MHz, 10MHz_16QAM**



## 8.4. FREQUENCY STABILITY

**RULE PART(S)**

FCC: §2.1055, §27.54

**LIMITS**

- § 27.54 - The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

**TEST PROCEDURE**

Use CMW 500 with Frequency Error measurement capability.

- Temp. = −30° to +50°C
- Voltage = 3.8 Vdc (85% - 115%)

**Frequency Stability vs Temperature:**
The EUT is place inside a temperature chamber. The temperature is set to 20ºC 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 +50ºC is reached.

**Frequency Stability vs Voltage:**
The peak frequency error is recorded (worst-case).

**MODES TESTED**

- LTE BAND 4 & BAND 17

**RESULTS**

See the following pages.

**LTE BAND 17 – 710 MHz, 5MHz**

| Reference Frequency: LTE Band 17_Mid Channe 710.000002MHz @ 20°C Limit: to stay +- 2.5 ppm = 1775.000 Hz | | | | |
|---|---|---|---|---|
| Power Supply (Vdc) | Environment Temperature (°C) | Frequency Deviation Measureed with Time Elapse (MHz) | Delta (ppm) | Limit (ppm) |
| 3.80 | 50 | 710.000009 | -0.009 | 2.5 |
| 3.80 | 40 | 710.000000 | 0.002 | 2.5 |
| 3.80 | 30 | 710.000004 | -0.003 | 2.5 |
| 3.80 | 20 | *710.000002* | *0* | 2.5 |
| 3.80 | 10 | 710.000004 | -0.002 | 2.5 |
| 3.80 | 0 | 709.999999 | 0.005 | 2.5 |
| 3.80 | -10 | 710.000004 | -0.003 | 2.5 |
| 3.80 | -20 | 710.000000 | 0.003 | 2.5 |
| 3.80 | -30 | 709.999998 | 0.006 | 2.5 |

| Reference Frequency: LTE Band 17_Mid channel 710.000002MHz @ 20°C Limit: to stay +- 2.5 ppm = 1775.000 Hz | | | | |
|---|---|---|---|---|
| Power Supply (Vdc) | Environment Temperature (°C) | Frequency Deviation Measureed with Time Elapse (MHz) | Delta (ppm) | Limit (ppm) |
| 3.80 | *20* | *710.000002* | *0* | *2.5* |
| 3.40 | 20 | 710.000019 | -0.024 | 2.5 |
| 4.20 | 20 | 710.000019 | -0.024 | 2.5 |
| End Voltage(3.0) | 20 | 709.999995 | 0.010 | 2.5 |

**LTE BAND 17 – 710 MHz, 10MHz**

| Reference Frequency: LTE Band 17_Mid Channel 710.999998MHz @ 20°C Limit: to stay +- 2.5 ppm = 1777.500 Hz | | | | |
|---|---|---|---|---|
| Power Supply (Vac) | Environment Temperature (°C) | Frequency Deviation Measureed with Time Elapse (MHz) | Delta (ppm) | Limit (ppm) |
| 3.80 | 50 | 711.000002 | -0.006 | 2.5 |
| 3.80 | 40 | 711.000002 | -0.005 | 2.5 |
| 3.80 | 30 | 711.000000 | -0.002 | 2.5 |
| 3.80 | 20 | 710.999998 | *0* | 2.5 |
| 3.80 | 10 | 711.000001 | -0.005 | 2.5 |
| 3.80 | 0 | 710.999996 | 0.003 | 2.5 |
| 3.80 | -10 | 710.999996 | 0.003 | 2.5 |
| 3.80 | -20 | 710.999995 | 0.004 | 2.5 |
| 3.80 | -30 | 710.999995 | 0.005 | 2.5 |

| Reference Frequency: LTE Band 17_Mid Channel 710.999998MHz @ 20°C Limit: to stay +- 2.5 ppm = 1777.500 Hz | | | | |
|---|---|---|---|---|
| Power Supply (Vac) | Environment Temperature (°C) | Frequency Deviation Measureed with Time Elapse (MHz) | Delta (ppm) | Limit (ppm) |
| 3.80 | 20 | 710.999998 | *0.000* | 2.5 |
| 3.40 | 20 | 711.000010 | *-0.017* | 2.5 |
| 4.20 | 20 | 711.000010 | *-0.017* | 2.5 |
| End Voltage(3.0) | 20 | 710.999991 | *0.009* | 2.5 |

**LTE BAND 4 ( 5MHz) – 1732.5 MHz**

| Reference Frequency: LTE Band 4_Mid Channle 1732.499995MHz @ 20°C Limit: to stay +- 2.5 ppm = 4331.250 Hz | | | | |
|---|---|---|---|---|
| Power Supply (Vdc) | Environment Temperature (°C) | Frequency Deviation Measureed with Time Elapse | | |
| | | (MHz) | Delta (ppm) | Limit (ppm) |
| 3.80 | 50 | 1732.499991 | 0.0023 | 2.5 |
| 3.80 | 40 | 1732.499992 | 0.0017 | 2.5 |
| 3.80 | 30 | 1732.499994 | 0.0006 | 2.5 |
| 3.80 | 20 | 1732.499995 | 0.0000 | 2.5 |
| 3.80 | 10 | 1732.499993 | 0.0012 | 2.5 |
| 3.80 | 0 | 1732.499989 | 0.0035 | 2.5 |
| 3.80 | -10 | 1732.499993 | 0.0012 | 2.5 |
| 3.80 | -20 | 1732.499990 | 0.0029 | 2.5 |
| 3.80 | -30 | 1732.500010 | -0.0087 | 2.5 |

| Reference Frequency: LTE Band 4_Mid Channle 1732.499995MHzMHz @ 20°C Limit: to stay +- 2.5 ppm = 4331.250 Hz | | | | |
|---|---|---|---|---|
| Power Supply (Vdc) | Environment Temperature (°C) | Frequency Deviation Measureed with Time Elapse | | |
| | | (MHz) | Delta (ppm) | Limit (ppm) |
| 3.80 | 20 | 1732.499995 | *0.0000* | 2.5 |
| 3.40 | 20 | 1732.499998 | *-0.0017* | 2.5 |
| 4.20 | 20 | 1732.500004 | *-0.0052* | 2.5 |
| End Voltage(3.0) | 20 | 1732.500006 | *-0.0063* | 2.5 |

**LTE BAND 4 (10MHz) – 1732.5 MHZ,**

| Reference Frequency: LTE Band 4_Mid Channel 1732.499995MHz @ 20°C Limit: to stay +- 2.5 ppm = 4331.250 Hz | | | | |
|---|---|---|---|---|
| Power Supply (Vdc) | Environment Temperature (°C) | Frequency Deviation Measureed with Time Elapse | | |
| | | (MHz) | Delta (ppm) | Limit (ppm) |
| 3.80 | 50 | 1732.499994 | 0.0006 | 2.5 |
| 3.80 | 40 | 1732.500003 | -0.0046 | 2.5 |
| 3.80 | 30 | 1732.500004 | -0.0052 | 2.5 |
| 3.80 | 20 | 1732.499995 | 0.0000 | 2.5 |
| 3.80 | 10 | 1732.500008 | -0.0075 | 2.5 |
| 3.80 | 0 | 1732.499996 | -0.0006 | 2.5 |
| 3.80 | -10 | 1732.499993 | 0.0012 | 2.5 |
| 3.80 | -20 | 1732.500002 | -0.0040 | 2.5 |
| 3.80 | -30 | 1732.500005 | -0.0058 | 2.5 |

| Reference Frequency: LTE Band 4_Mid Channel 1732.499995MHz @ 20°C Limit: to stay +- 2.5 ppm = 4331.250 Hz | | | | |
|---|---|---|---|---|
| Power Supply (Vdc) | Environment Temperature (°C) | Frequency Deviation Measureed with Time Elapse | | |
| | | (MHz) | Delta (ppm) | Limit (ppm) |
| 3.80 | *20* | 1732.499995 | *0.0000* | 2.5 |
| 3.40 | 20 | 1732.500002 | *-0.0040* | 2.5 |
| 4.20 | 20 | 1732.499989 | *0.0038* | 2.5 |
| End voltage (3.0) | 20 | 1732.500005 | *-0.0058* | 2.5 |

# 9. RADIATED TEST RESULTS

## 9.1. RADIATED POWER (ERP & EIRP)

**RULE PART(S)**

FCC: §27.50(d) (2)

**LIMITS:**

27.50 (c)(10) Portable stations (hand-held devices) transmitting in the 746–757 MHz, 758–763 MHz, 776–793 MHz, and 805–806 MHz bands are limited to 3 watts ERP.

27.50 (d)(4) The following power and antenna height requirements apply to stations transmitting in the 1710–1755 MHz and 2110–2155 MHz bands: Fixed, mobile, and portable (hand-held) stations operating in the 1710–1755 MHz band are limited to 1 watt EIRP.

**TEST PROCEDURE**

ANSI / TIA / EIA 603C Clause 2.2.17

**MODES TESTED**

- LTE BAND 4 & BAND 17

**RESULTS**

**ERP LTE Band 17 (5.0 MHz BAND WIDTH)**

| Mode | RB/RB SIZE | f (MHz) | ERP | |
|---|---|---|---|---|
| | | | dBm | mW |
| 5MHz Band QASK | 1/0 | 706.5 | 20.00 | 100.00 |
| | | 710.0 | 20.20 | 104.71 |
| | | 713.5 | 19.40 | 87.10 |
| 5MHz Band 16QAM | 1/0 | 706.5 | 18.50 | 70.79 |
| | | 710.0 | 19.60 | 91.20 |
| | | 713.5 | 18.50 | 70.79 |

**ERP LTE Band 17 (10.0 MHz BAND WIDTH)**

| Mode | RB/RB SIZE | f (MHz) | ERP | |
|---|---|---|---|---|
| | | | dBm | mW |
| 10.0 MHZ BAND QPSK | 1/49 | 709.0 | 19.68 | 92.90 |
| | | 710.0 | 19.66 | 92.47 |
| | | 711.0 | 19.10 | 81.28 |
| 10.0 MHZ BAND 16QAM | 1/49 | 709.0 | 18.80 | 75.86 |
| | | 710.0 | 18.70 | 74.13 |
| | | 711.0 | 18.40 | 69.18 |

**EIRP LTE Band 4 (5.0 MHz BAND WIDTH)**

| Mode | RB/RB SIZE | f (MHz) | ERP( AVERAGE) | |
|---|---|---|---|---|
| | | | dBm | mW |
| 5.0 MHZ BAND QPSK | 1/24 | 1712.5 | 23.31 | 214.29 |
| | | 1732.5 | 23.03 | 200.91 |
| | | 1752.5 | 22.80 | 190.55 |
| 5.0 MHZ BAND 16QAM | 1/24 | 1712.5 | 22.03 | 159.59 |
| | | 1732.5 | 22.58 | 181.13 |
| | | 1752.5 | 22.40 | 173.78 |

**EIRP LTE Band 4 (10.0 MHz BAND WIDTH)**

| Mode | RB/RB SIZE | f (MHz) | EIRP(AVERAGE) | |
|---|---|---|---|---|
| | | | dBm | mW |
| 10.0 MHZ BAND QPSK | 1/49 | 1715.0 | 22.93 | 196.34 |
| | | 1732.5 | 23.38 | 217.77 |
| | | 1750.0 | 23.80 | 239.88 |
| 10.0 MHZ BAND 16QAM | 1/49 | 1715.0 | 21.83 | 152.41 |
| | | 1732.5 | 22.08 | 161.44 |
| | | 1750.0 | 22.30 | 169.82 |

**ERP LTE QPSK Band 17 (5.0 MHz BAND WIDTH)**

**RB1-0**

High Frequency Substitution Measurement
Compliance Certification Services Chamber B

**Company:** Apple
**Project #:** 11U14054
**Date:** 12/06/11
**Test Engineer:** Chin Pang
**Configuration:** EUT only
**Mode:** TX, LTE BAND 17
5MHz BW

**Test Equipment:**
**Receiving: Sunol T130, and 3m Chamber N-type Cable (Setup this one for testing EUT)**
**Substitution: Dipole S/N: 00022117, 6ft SMA Cable (SN # 208947003) Warehouse.**

| f MHz | SG reading (dBm) | Ant. Pol. (H/V) | Cable Loss (dB) | Antenna Gain (dBd) | ERP (dBm) | Limit (dBm) | Margin (dB) | Notes |
|---|---|---|---|---|---|---|---|---|
| RB=1 & SRB=0, QPSK | | | | | | | | |
| 706.50 | 20.50 | V | 0.5 | 0.0 | 20.00 | 34.8 | -14.8 | |
| 706.50 | 14.70 | H | 0.5 | 0.0 | 14.20 | 34.8 | -20.6 | |
| RB=1 & SRB=0, QPSK | | | | | | | | |
| 710.00 | 20.70 | V | 0.5 | 0.0 | 20.20 | 34.8 | -14.6 | |
| 710.00 | 15.30 | H | 0.5 | 0.0 | 14.80 | 34.8 | -20.0 | |
| RB=1 & SRB=0, QPSK | | | | | | | | |
| 713.50 | 19.90 | V | 0.5 | 0.0 | 19.40 | 34.8 | -15.4 | |
| 713.50 | 15.30 | H | 0.5 | 0.0 | 14.80 | 34.8 | -20.0 | |

Rev. 3.17.11

**ERP LTE 16QAM Band 17 (5.0 MHz BAND WIDTH)**

**RB1-0**

High Frequency Substitution Measurement
Compliance Certification Services Chamber B

| | |
|---|---|
| **Company:** | Apple |
| **Project #:** | 11U14054 |
| **Date:** | 12/62011 |
| **Test Engineer:** | Chin Pang |
| **Configuration:** | EUT only |
| **Mode:** | TX, LTE BAND 17 |
| | 5MHz BW |

**Test Equipment:**

**Receiving: Sunol T130, and 3m Chamber N-type Cable (Setup this one for testing EUT)**
**Substitution: Dipole S/N: 00022117, 6ft SMA Cable (SN # 208947003) Warehouse.**

| f MHz | SG reading (dBm) | Ant. Pol. (H/V) | Cable Loss (dB) | Antenna Gain (dBd) | ERP (dBm) | Limit (dBm) | Margin (dB) | Notes |
|---|---|---|---|---|---|---|---|---|
| RB=1 & SRB=0, 16QAM | | | | | | | | |
| 706.50 | 19.00 | V | 0.5 | 0.0 | 18.50 | 34.8 | -16.3 | |
| 706.50 | 14.30 | H | 0.5 | 0.0 | 13.80 | 34.8 | -21.0 | |
| RB=1 & SRB=0, 16QAM | | | | | | | | |
| 710.00 | 20.10 | V | 0.5 | 0.0 | 19.60 | 34.8 | -15.2 | |
| 710.00 | 14.30 | H | 0.5 | 0.0 | 13.80 | 34.8 | -21.0 | |
| RB=1 & SRB=0, 16QAM | | | | | | | | |
| 713.50 | 19.00 | V | 0.5 | 0.0 | 18.50 | 34.8 | -16.3 | |
| 713.50 | 14.80 | H | 0.5 | 0.0 | 14.30 | 34.8 | -20.5 | |

Rev. 3.17.11

**ERP LTE QPSK Band 17 (10.0 MHz BAND WIDTH )**

**RB1-49**

High Frequency Substitution Measurement
Compliance Certification Services Chamber B

**Company:** Apple
**Project #:** 11U14054
**Date:** 12/01/11
**Test Engineer:** Chin Pang
**Configuration:** EUT only
**Mode:** TX, LTE BAND 17 , 10MHz BW
Average

**Test Equipment:**
**Receiving: Sunol T130, and 3m Chamber N-type Cable (Setup this one for testing EUT)**
**Substitution: Dipole S/N: 00022117, 6ft SMA Cable (SN # 208947003) Warehouse.**

| f MHz | SG reading (dBm) | Ant. Pol. (H/V) | Cable Loss (dB) | Antenna Gain (dBd) | ERP (dBm) | Limit (dBm) | Margin (dB) | Notes |
|---|---|---|---|---|---|---|---|---|
| RB=1 & SRB=49, QPSK | | | | | | | | |
| 709.00 | 20.18 | V | 0.5 | 0.0 | 19.68 | 34.8 | -15.1 | |
| 709.00 | 17.20 | H | 0.5 | 0.0 | 16.70 | 34.8 | -18.1 | |
| | | | | | | | | |
| RB=1 & SRB=49, QPSK | | | | | | | | |
| 710.00 | 20.16 | V | 0.5 | 0.0 | 19.66 | 34.8 | -15.1 | |
| 710.00 | 15.10 | H | 0.5 | 0.0 | 14.60 | 34.8 | -20.2 | |
| | | | | | | | | |
| RB=1 & SRB=0, QPSK | | | | | | | | |
| 711.00 | 19.60 | V | 0.5 | 0.0 | 19.10 | 34.8 | -15.7 | |
| 711.00 | 15.00 | H | 0.5 | 0.0 | 14.50 | 34.8 | -20.3 | |
| | | | | | | | | |

Rev. 3.17.11

**ERP LTE 16QAM Band 17 (10.0 MHz BAND WIDTH)**

**RB1-49**

High Frequency Substitution Measurement
Compliance Certification Services Chamber B

| | |
|---|---|
| **Company:** | Apple |
| **Project #:** | 11U14054 |
| **Date:** | 11/18/11 |
| **Test Engineer:** | Chin Pang |
| **Configuration:** | EUT only |
| **Mode:** | TX, LTE BAND 17 , 10MHz BW |
| | Average |

**Test Equipment:**
**Receiving: Sunol T130, and 3m Chamber N-type Cable (Setup this one for testing EUT)**
**Substitution: Dipole S/N: 00022117, 6ft SMA Cable (SN # 208947003) Warehouse.**

| f MHz | SG reading (dBm) | Ant. Pol. (H/V) | Cable Loss (dB) | Antenna Gain (dBd) | ERP (dBm) | Limit (dBm) | Margin (dB) | Notes |
|---|---|---|---|---|---|---|---|---|
| RB=1 & SRB=49, 16QAM | | | | | | | | |
| 709.00 | 19.30 | V | 0.5 | 0.0 | 18.80 | 34.5 | -15.7 | |
| 709.00 | 14.00 | H | 0.5 | 0.0 | 13.50 | 34.5 | -21.0 | |
| | | | | | | | | |
| RB=1 & SRB=49, 16QAM | | | | | | | | |
| 710.00 | 19.20 | V | 0.5 | 0.0 | 18.70 | 34.5 | -15.8 | |
| 710.00 | 14.30 | H | 0.5 | 0.0 | 13.80 | 34.5 | -20.7 | |
| | | | | | | | | |
| RB=1 & SRB=0, 16QAM | | | | | | | | |
| 711.00 | 18.90 | V | 0.5 | 0.0 | 18.40 | 34.5 | -16.1 | |
| 711.00 | 14.00 | H | 0.5 | 0.0 | 13.50 | 34.5 | -21.0 | |
| | | | | | | | | |

Rev. 3.17.11

**EIRP LTE QPSK Band 4 (5.0 MHz BAND WIDTH)**

**RB1-24**

High Frequency Fundamental Measurement
Compliance Certification Services Chamber B

**Company:** Apple
**Project #:** 11U14054
**Date:** 12/06/11
**Test Engineer:** Chin Pang
**Configuration:** EUT ALONE
**Mode:** TX, LTE BAND 4_5.0 MHz BW
Average

**Test Equipment:**
**Receiving: Horn T59, and Camber B SMA Cables**
**Substitution: Horn T60 Substitution, 6ft SMA Cable (244640002) Warehouse**

| f GHz | SG reading (dBm) | Ant. Pol. (H/V) | Cable Loss (dB) | Antenna Gain (dBi) | EIRP (dBm) | Limit (dBm) | Delta (dB) | Notes |
|---|---|---|---|---|---|---|---|---|
| RB1 24, QPSK | | | | | | | | |
| 1.713 | 15.6 | V | 0.67 | 8.40 | 23.31 | 30.0 | -6.7 | |
| 1.713 | 9.3 | H | 0.67 | 8.50 | 17.13 | 30.0 | -12.9 | |
| | | | | | | | | |
| RB1 24, QPSK | | | | | | | | |
| 1.733 | 15.3 | V | 0.67 | 8.45 | 23.03 | 30.0 | -7.0 | |
| 1.733 | 11.3 | H | 0.67 | 8.54 | 19.17 | 30.0 | -10.8 | |
| | | | | | | | | |
| RB1 24, QPSK | | | | | | | | |
| 1.753 | 15.0 | V | 0.67 | 8.47 | 22.80 | 30.0 | -7.2 | |
| 1.753 | 11.0 | H | 0.67 | 8.50 | 18.83 | 30.0 | -11.2 | |
| | | | | | | | | |

Rev. 1.24.7

**EIRP LTE 16QAM Band 4 (5.0 MHz BAND WIDTH)**

**RB1-24**

High Frequency Fundamental Measurement
Compliance Certification Services Chamber B

**Company:** Apple
**Project #:** 11U14054
**Date:** 12/06/11
**Test Engineer:** Chin Pang
**Configuration:** EUT ALONE
**Mode:** TX, LTE BAND 4_5.0 MHz BW
Average

**Test Equipment:**
**Receiving: Horn T59, and Camber B SMA Cables**
**Substitution: Horn T60 Substitution, 6ft SMA Cable (244640002) Warehouse**

| f GHz | SG reading (dBm) | Ant. Pol. (H/V) | Cable Loss (dB) | Antenna Gain (dBi) | EIRP (dBm) | Limit (dBm) | Delta (dB) | Notes |
|---|---|---|---|---|---|---|---|---|
| RB1 24, 16QAM | | | | | | | | |
| 1.713 | 14.3 | V | 0.67 | 8.40 | 22.03 | 30.0 | -8.0 | |
| 1.713 | 8.4 | H | 0.67 | 8.50 | 16.23 | 30.0 | -13.8 | |
| | | | | | | | | |
| RB1 24, 16QAM | | | | | | | | |
| 1.733 | 14.8 | V | 0.67 | 8.45 | 22.58 | 30.0 | -7.4 | |
| 1.733 | 9.7 | H | 0.67 | 8.54 | 17.57 | 30.0 | -12.4 | |
| | | | | | | | | |
| RB1 24, 16QAM | | | | | | | | |
| 1.753 | 14.6 | V | 0.67 | 8.47 | 22.40 | 30.0 | -7.6 | |
| 1.753 | 9.7 | H | 0.67 | 8.50 | 17.53 | 30.0 | -12.5 | |
| | | | | | | | | |

Rev. 1.24.7

**EIRP LTE QPSK Band 4 (10MHz BANDWIDTH )**

**RB1-49**

High Frequency Fundamental Measurement
Compliance Certification Services Chamber B

**Company:** Apple
**Project #:** 11U14054
**Date:** 12/01/11
**Test Engineer:** Chin Pang
**Configuration:** EUT ALONE
**Mode:** TX, LTE BAND 4_10.0 MHz BW
Average

**Test Equipment:**
**Receiving: Horn T59, and Camber B SMA Cables**
**Substitution: Horn T60 Substitution, 6ft SMA Cable (244640002) Warehouse**

| f GHz | SG reading (dBm) | Ant. Pol. (H/V) | Cable Loss (dB) | Antenna Gain (dBi) | EIRP (dBm) | Limit (dBm) | Delta (dB) | Notes |
|---|---|---|---|---|---|---|---|---|
| RB1 49, QPSK | | | | | | | | |
| 1.715 | 15.2 | V | 0.67 | 8.40 | 22.93 | 30.0 | -7.1 | |
| 1.715 | 7.9 | H | 0.67 | 8.50 | 15.73 | 30.0 | -14.3 | |
| | | | | | | | | |
| RB1 49, QPSK | | | | | | | | |
| 1.733 | 15.6 | V | 0.67 | 8.45 | 23.38 | 30.0 | -6.6 | |
| 1.733 | 5.3 | H | 0.67 | 8.54 | 13.17 | 30.0 | -16.8 | |
| | | | | | | | | |
| RB1 49, QPSK | | | | | | | | |
| 1.750 | 16.0 | V | 0.67 | 8.47 | 23.80 | 30.0 | -6.2 | |
| 1.750 | 10.7 | H | 0.67 | 8.50 | 18.53 | 30.0 | -11.5 | |
| | | | | | | | | |

Rev. 1.24.7

**EIRP LTE 16QAM Band 4 (10MHz BAND WIDTH)**

**RB1-49**

High Frequency Fundamental Measurement
Compliance Certification Services Chamber B

**Company:** Apple
**Project #:** 11U14054
**Date:** 12/01/11
**Test Engineer:** Chin Pang
**Configuration:** EUT ALONE
**Mode:** TX, LTE BAND 4_10.0 MHz BW
Average

**Test Equipment:**
**Receiving: Horn T59, and Camber B SMA Cables**
**Substitution: Horn T60 Substitution, 6ft SMA Cable (244640002) Warehouse**

| f GHz | SG reading (dBm) | Ant. Pol. (H/V) | Cable Loss (dB) | Antenna Gain (dBi) | EIRP (dBm) | Limit (dBm) | Delta (dB) | Notes |
|---|---|---|---|---|---|---|---|---|
| RB1 49, 16QAM | | | | | | | | |
| 1.715 | 14.1 | V | 0.67 | 8.40 | 21.83 | 30.0 | -8.2 | |
| 1.715 | 7.3 | H | 0.67 | 8.50 | 15.13 | 30.0 | -14.9 | |
| | | | | | | | | |
| RB1 49, 16QAM | | | | | | | | |
| 1.733 | 14.3 | V | 0.67 | 8.45 | 22.08 | 30.0 | -7.9 | |
| 1.733 | 4.8 | H | 0.67 | 8.54 | 12.67 | 30.0 | -17.3 | |
| | | | | | | | | |
| RB1 49, 16QAM | | | | | | | | |
| 1.750 | 14.5 | V | 0.67 | 8.47 | 22.30 | 30.0 | -7.7 | |
| 1.750 | 9.8 | H | 0.67 | 8.50 | 17.63 | 30.0 | -12.4 | |

Rev. 1.24.7

# 9.1. FIELD STRENGTH OF SPURIOUS RADIATION

**RULE PART(S)**

FCC: §27.53.

**LIMIT**

§27.53 (g) For operations in 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.

§27.53 (h) For operations in the 1710–1755 MHz and 2110–2155 MHz bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) by at least 43 + 10 log10(P) dB.

**TEST PROCEDURE**

For Cellular equipment - Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth ( i.e. 100 kHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

For PCS equipment - Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth ( i.e. 1 MHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

**MODES TESTED**

- LTE BAND 4 & 17

**RESULTS**

**ERP LTE QPSK Band 17 (5.0 MHz BANDWIDTH)**

Compliance Certification Services
Above 1GHz High Frequency Substitution Measurement

| | |
|---|---|
| **Company:** | Apple |
| **Project #:** | 11U14054 |
| **Date:** | 12-06-11 |
| **Test Engineer:** | Chin pang |
| **Configuration:** | EUT only |
| **Mode:** | LTE Band 17_5MHz BW_QPSK |
| | Worst Case |

| Chamber | Pre-amplifer | Filter | Limit |
|---|---|---|---|
| 5m Chamber B | T145 8449B | Filter 1 | Part 27 |

| f GHz | SG reading (dBm) | Ant. Pol. (H/V) | Distance (m) | Preamp (dB) | Filter (dB) | ERP (dBm) | Limit (dBm) | Delta (dB) | Notes |
|---|---|---|---|---|---|---|---|---|---|
| Low Ch (706.5 MHz) QPSK | | | | | | | | | |
| 1.418 | -20.9 | V | 3.0 | 35.7 | 1.0 | -55.6 | -13.0 | -42.6 | |
| 2.126 | -18.5 | V | 3.0 | 35.4 | 1.0 | -52.9 | -13.0 | -39.9 | |
| 1.418 | -23.8 | H | 3.0 | 35.7 | 1.0 | -58.6 | -13.0 | -45.6 | |
| 2.126 | -20.6 | H | 3.0 | 35.4 | 1.0 | -55.0 | -13.0 | -42.0 | |
| | | | | | | | | | |
| Mid Ch (710.0 MHz), QPSK | | | | | | | | | |
| 1.424 | -19.0 | V | 3.0 | 35.7 | 1.0 | -53.8 | -13.0 | -40.8 | |
| 2.136 | -17.5 | V | 3.0 | 35.4 | 1.0 | -51.9 | -13.0 | -38.9 | |
| 1.424 | -22.8 | H | 3.0 | 35.7 | 1.0 | -57.5 | -13.0 | -44.5 | |
| 2.136 | -20.2 | H | 3.0 | 35.4 | 1.0 | -54.5 | -13.0 | -41.5 | |
| | | | | | | | | | |
| Hi Ch (713.5 MHz) QPSK | | | | | | | | | |
| 1.431 | -21.8 | V | 3.0 | 35.7 | 1.0 | -56.5 | -13.0 | -43.5 | |
| 2.146 | -15.1 | V | 3.0 | 35.4 | 1.0 | -49.4 | -13.0 | -36.4 | |
| 1.431 | -22.7 | H | 3.0 | 35.7 | 1.0 | -57.5 | -13.0 | -44.5 | |
| 2.146 | -16.7 | H | 3.0 | 35.4 | 1.0 | -51.1 | -13.0 | -38.1 | |
| | | | | | | | | | |

Rev. 03.03.09
Note: No other emissions were detected above the system noise floor.

**ERP LTE 16QAM Band 17 (5.0 MHz BANDWIDTH)**

Compliance Certification Services
Above 1GHz High Frequency Substitution Measurement

| | |
|---|---|
| **Company:** | Apple |
| **Project #:** | 11U14054 |
| **Date:** | 12-06-11 |
| **Test Engineer:** | Chin pang |
| **Configuration:** | EUT only |
| **Mode:** | LTE Band 17_5MHz BW_16QAM |
| | Worst Case |

| Chamber | Pre-amplifer | Filter | Limit |
|---|---|---|---|
| 5m Chamber B | T145 8449B | Filter 1 | Part 27 |

| f GHz | SG reading (dBm) | Ant. Pol. (H/V) | Distance (m) | Preamp (dB) | Filter (dB) | ERP (dBm) | Limit (dBm) | Delta (dB) | Notes |
|---|---|---|---|---|---|---|---|---|---|
| Low Ch (706.5 MHz), 16QAM | | | | | | | | | |
| 1.418 | -21.9 | V | 3.0 | 35.7 | 1.0 | -56.6 | -13.0 | -43.6 | |
| 2.126 | -19.7 | V | 3.0 | 35.4 | 1.0 | -54.1 | -13.0 | -41.1 | |
| 1.418 | -24.8 | H | 3.0 | 35.7 | 1.0 | -59.6 | -13.0 | -46.6 | |
| 2.126 | -21.6 | H | 3.0 | 35.4 | 1.0 | -56.0 | -13.0 | -43.0 | |
| | | | | | | | | | |
| Mid Ch (710.0 MHz), 16QAM | | | | | | | | | |
| 1.420 | -17.9 | V | 3.0 | 35.7 | 1.0 | -52.6 | -13.0 | -39.6 | |
| 2.130 | -16.5 | V | 3.0 | 35.4 | 1.0 | -50.9 | -13.0 | -37.9 | |
| 1.420 | -24.8 | H | 3.0 | 35.7 | 1.0 | -59.6 | -13.0 | -46.6 | |
| 2.130 | -16.8 | H | 3.0 | 35.4 | 1.0 | -51.2 | -13.0 | -38.2 | |
| | | | | | | | | | |
| Hi Ch (713.5 MHz) 16QAM | | | | | | | | | |
| 1.427 | -22.0 | V | 3.0 | 35.7 | 1.0 | -56.7 | -13.0 | -43.7 | |
| 2.141 | -13.6 | V | 3.0 | 35.4 | 1.0 | -47.9 | -13.0 | -34.9 | |
| 1.427 | -22.9 | H | 3.0 | 35.7 | 1.0 | -57.6 | -13.0 | -44.6 | |
| 2.141 | -16.7 | H | 3.0 | 35.4 | 1.0 | -51.0 | -13.0 | -38.0 | |
| | | | | | | | | | |

Rev. 03.03.09
Note: No other emissions were detected above the system noise floor.

**ERP LTE QPSK Band 17 (10.0 MHz BANDWIDTH)**

Compliance Certification Services
Above 1GHz High Frequency Substitution Measurement

| | |
|---|---|
| **Company:** | Apple |
| **Project #:** | 11U14054 |
| **Date:** | 12-06-11 |
| **Test Engineer:** | Chin pang |
| **Configuration:** | EUT only |
| **Mode:** | LTE Band 17_10MHz BW_QPSK |
| | Worst Case |

| Chamber | Pre-amplifer | Filter | Limit |
|---|---|---|---|
| 5m Chamber B | T145 8449B | Filter 1 | Part 27 |

| f GHz | SG reading (dBm) | Ant. Pol. (H/V) | Distance (m) | Preamp (dB) | Filter (dB) | ERP (dBm) | Limit (dBm) | Delta (dB) | Notes |
|---|---|---|---|---|---|---|---|---|---|
| Low Ch (709 MHz) QPSK | | | | | | | | | |
| 1.418 | -17.9 | V | 3.0 | 35.7 | 1.0 | -52.6 | -13.0 | -39.6 | |
| 2.141 | -18.6 | V | 3.0 | 35.4 | 1.0 | -52.9 | -13.0 | -39.9 | |
| 1.418 | -21.8 | H | 3.0 | 35.7 | 1.0 | -56.6 | -13.0 | -43.6 | |
| 2.141 | -18.7 | H | 3.0 | 35.4 | 1.0 | -53.0 | -13.0 | -40.0 | |
| | | | | | | | | | |
| Mid Ch (710.0 MHz), QPSK | | | | | | | | | |
| 1.429 | -19.8 | V | 3.0 | 35.7 | 1.0 | -54.5 | -13.0 | -41.5 | |
| 2.144 | -17.6 | V | 3.0 | 35.4 | 1.0 | -51.9 | -13.0 | -38.9 | |
| 1.429 | -23.3 | H | 3.0 | 35.7 | 1.0 | -58.1 | -13.0 | -45.1 | |
| 2.144 | -18.7 | H | 3.0 | 35.4 | 1.0 | -53.1 | -13.0 | -40.1 | |
| | | | | | | | | | |
| Hi Ch (711 MHz) QPSK | | | | | | | | | |
| 1.431 | -22.8 | V | 3.0 | 35.7 | 1.0 | -57.5 | -13.0 | -44.5 | |
| 2.146 | -15.2 | V | 3.0 | 35.4 | 1.0 | -49.5 | -13.0 | -36.5 | |
| 1.431 | -23.0 | H | 3.0 | 35.7 | 1.0 | -57.8 | -13.0 | -44.8 | |
| 2.146 | -18.7 | H | 3.0 | 35.4 | 1.0 | -53.1 | -13.0 | -40.1 | |
| | | | | | | | | | |

Rev. 03.03.09
Note: No other emissions were detected above the system noise floor.

**ERP LTE 16QAM Band 17 (10.0 MHz BANDWIDTH)**

Compliance Certification Services
Above 1GHz High Frequency Substitution Measurement

| | |
|---|---|
| **Company:** | Apple |
| **Project #:** | 11U14054 |
| **Date:** | 12-06-11 |
| **Test Engineer:** | Chin pang |
| **Configuration:** | EUT only |
| **Mode:** | LTE Band 17_10MHz BW_16QAM |
| | Worst Case |

| Chamber | Pre-amplifer | Filter | Limit |
|---|---|---|---|
| 5m Chamber B | T145 8449B | Filter 1 | Part 27 |

| f GHz | SG reading (dBm) | Ant. Pol. (H/V) | Distance (m) | Preamp (dB) | Filter (dB) | ERP (dBm) | Limit (dBm) | Delta (dB) | Notes |
|---|---|---|---|---|---|---|---|---|---|
| Low Ch (709 MHz), 16QAM | | | | | | | | | |
| 1.418 | -17.5 | V | 3.0 | 35.7 | 1.0 | -52.2 | -13.0 | -39.2 | |
| 2.141 | -18.4 | V | 3.0 | 35.4 | 1.0 | -52.7 | -13.0 | -39.7 | |
| 1.418 | -21.8 | H | 3.0 | 35.7 | 1.0 | -56.6 | -13.0 | -43.6 | |
| 2.141 | -17.8 | H | 3.0 | 35.4 | 1.0 | -52.1 | -13.0 | -39.1 | |
| | | | | | | | | | |
| Mid Ch (710.0 MHz), 16QAM | | | | | | | | | |
| 1.429 | -19.4 | V | 3.0 | 35.7 | 1.0 | -54.1 | -13.0 | -41.1 | |
| 2.144 | -16.8 | V | 3.0 | 35.4 | 1.0 | -51.1 | -13.0 | -38.1 | |
| 1.429 | -21.7 | H | 3.0 | 35.7 | 1.0 | -56.5 | -13.0 | -43.5 | |
| 2.144 | -18.3 | H | 3.0 | 35.4 | 1.0 | -52.7 | -13.0 | -39.7 | |
| | | | | | | | | | |
| High Ch (711 MHz), 16QAM | | | | | | | | | |
| 1.427 | -22.6 | V | 3.0 | 35.7 | 1.0 | -57.3 | -13.0 | -44.3 | |
| 2.141 | -14.2 | V | 3.0 | 35.4 | 1.0 | -48.5 | -13.0 | -35.5 | |
| 1.427 | -23.8 | H | 3.0 | 35.7 | 1.0 | -58.5 | -13.0 | -45.5 | |
| 2.141 | -17.7 | H | 3.0 | 35.4 | 1.0 | -52.0 | -13.0 | -39.0 | |

Rev. 03.03.09
Note: No other emissions were detected above the system noise floor.

**EIRP LTE QPSK Band 4 (5.0 MHz BANDWIDTH)**

**Compliance Certification Services**
**Above 1GHz High Frequency Substitution Measurement**

**Company:** Apple
**Project #:** 11U14054
**Date:** 12/07/11
**Test Engineer:** Chin Pang
**Configuration:** EUT ALONE
**Mode:** TX, QPSK_5 MHz_RB#1_24 MODE

| Chamber | Pre-amplifer | Filter | Limit |
|---|---|---|---|
| 5m Chamber B | T145 8449B | Filter 1 | Part 27 |

| f GHz | SG reading (dBm) | Ant. Pol. (H/V) | Distance (m) | Preamp (dB) | Filter (dB) | EIRP (dBm) | Limit (dBm) | Delta (dB) | Notes |
|---|---|---|---|---|---|---|---|---|---|
| Low Ch, 1712.5MHz | | | | | | | | | |
| 3.429 | -0.5 | V | 3.0 | 35.5 | 1.0 | -35.0 | -13.0 | -22.0 | |
| 10.288 | -7.2 | V | 3.0 | 35.3 | 1.0 | -41.5 | -13.0 | -28.5 | |
| 12.003 | -3.0 | V | 3.0 | 34.2 | 1.0 | -36.2 | -13.0 | -23.2 | |
| 3.429 | -2.6 | H | 3.0 | 35.5 | 1.0 | -37.1 | -13.0 | -24.1 | |
| 10.288 | 6.4 | H | 3.0 | 35.3 | 1.0 | -27.9 | -13.0 | -14.9 | |
| 12.003 | 1.1 | H | 3.0 | 34.2 | 1.0 | -32.1 | -13.0 | -19.1 | |
| 13.718 | -0.3 | H | 3.0 | 33.8 | 1.0 | -33.2 | -13.0 | -20.2 | |
| | | | | | | | | | |
| Mid Ch, 1732.5MHz | | | | | | | | | |
| 3.469 | -6.4 | V | 3.0 | 35.5 | 1.0 | -40.9 | -13.0 | -27.9 | |
| 10.408 | -3.0 | V | 3.0 | 35.3 | 1.0 | -37.3 | -13.0 | -24.3 | |
| 3.469 | -9.5 | H | 3.0 | 35.5 | 1.0 | -43.9 | -13.0 | -30.9 | |
| 10.408 | 10.0 | H | 3.0 | 35.3 | 1.0 | -24.3 | -13.0 | -11.3 | |
| | | | | | | | | | |
| High Ch, 1752.5MHz | | | | | | | | | |
| 3.469 | -18.0 | V | 3.0 | 35.5 | 1.0 | -52.5 | -13.0 | -39.5 | |
| 5.184 | -12.9 | V | 3.0 | 35.3 | 1.0 | -47.2 | -13.0 | -34.2 | |
| 3.469 | -17.5 | H | 3.0 | 35.5 | 1.0 | -51.9 | -13.0 | -38.9 | |
| 5.184 | -10.6 | H | 3.0 | 35.3 | 1.0 | -45.0 | -13.0 | -32.0 | |
| | | | | | | | | | |

Rev. 03.03.09
Note: No other emissions were detected above the system noise floor.

**EIRP LTE 16QAM Band 4 (5.0 MHz BANDWIDTH)**

Compliance Certification Services
Above 1GHz High Frequency Substitution Measurement

**Company:** Apple
**Project #:** 11U14054
**Date:** 12/07/11
**Test Engineer:** Chin Pang
**Configuration:** EUT ALONE
**Mode:** TX, 16QAM_5 MHz_RB#1_24 MODE

| Chamber | Pre-amplifer | Filter | Limit |
|---|---|---|---|
| 5m Chamber B | T145 8449B | Filter 1 | Part 27 |

| f GHz | SG reading (dBm) | Ant. Pol. (H/V) | Distance (m) | Preamp (dB) | Filter (dB) | EIRP (dBm) | Limit (dBm) | Delta (dB) | Notes |
|---|---|---|---|---|---|---|---|---|---|
| Low Ch, 1712.5MHz | | | | | | | | | |
| 3.429 | -1.0 | V | 3.0 | 35.5 | 1.0 | -35.5 | -13.0 | -22.5 | |
| 10.288 | -9.2 | V | 3.0 | 35.3 | 1.0 | -43.5 | -13.0 | -30.5 | |
| 12.003 | -4.0 | V | 3.0 | 34.2 | 1.0 | -37.2 | -13.0 | -24.2 | |
| 3.429 | -3.6 | H | 3.0 | 35.5 | 1.0 | -38.1 | -13.0 | -25.1 | |
| 10.288 | 6.9 | H | 3.0 | 35.3 | 1.0 | -27.4 | -13.0 | -14.4 | |
| 12.003 | 3.1 | H | 3.0 | 34.2 | 1.0 | -30.1 | -13.0 | -17.1 | |
| 13.718 | 0.5 | H | 3.0 | 33.8 | 1.0 | -32.4 | -13.0 | -19.4 | |
| | | | | | | | | | |
| Mid Ch, 1732.5MHz | | | | | | | | | |
| 3.469 | -8.4 | V | 3.0 | 35.5 | 1.0 | -42.9 | -13.0 | -29.9 | |
| 10.408 | -3.6 | V | 3.0 | 35.3 | 1.0 | -37.9 | -13.0 | -24.9 | |
| 3.469 | -10.5 | H | 3.0 | 35.5 | 1.0 | -44.9 | -13.0 | -31.9 | |
| 10.408 | 10.4 | H | 3.0 | 35.3 | 1.0 | -23.9 | -13.0 | -10.9 | |
| | | | | | | | | | |
| High Ch, 1752.5MHz | | | | | | | | | |
| 3.469 | -18.4 | V | 3.0 | 35.5 | 1.0 | -52.9 | -13.0 | -39.9 | |
| 5.184 | -13.3 | V | 3.0 | 35.3 | 1.0 | -47.6 | -13.0 | -34.6 | |
| 3.469 | -19.0 | H | 3.0 | 35.5 | 1.0 | -53.4 | -13.0 | -40.4 | |
| 5.184 | -14.6 | H | 3.0 | 35.3 | 1.0 | -49.0 | -13.0 | -36.0 | |
| | | | | | | | | | |

Rev. 03.03.09
Note: No other emissions were detected above the system noise floor.

**EIRP LTE QPSK Band 4 (10.0 MHz BANDWIDTH)**

Compliance Certification Services
Above 1GHz High Frequency Substitution Measurement

**Company:** Apple
**Project #:** 11U14054
**Date:** 12/07/11
**Test Engineer:** Chin Pang
**Configuration:** EUT ALONE
**Mode:** TX, QPSK_10 MHz_RB#1_49 MODE

| Chamber | Pre-amplifer | Filter | Limit |
|---|---|---|---|
| 5m Chamber B | T145 8449B | Filter 1 | Part 27 |

| f GHz | SG reading (dBm) | Ant. Pol. (H/V) | Distance (m) | Preamp (dB) | Filter (dB) | EIRP (dBm) | Limit (dBm) | Delta (dB) | Notes |
|---|---|---|---|---|---|---|---|---|---|
| Low Ch, 1715MHz | | | | | | | | | |
| 3.439 | -5.0 | V | 3.0 | 35.5 | 1.0 | -39.5 | -13.0 | -26.5 | |
| 5.519 | -13.9 | V | 3.0 | 35.4 | 1.0 | -48.3 | -13.0 | -35.3 | |
| 3.439 | -6.6 | H | 3.0 | 35.5 | 1.0 | -41.0 | -13.0 | -28.0 | |
| 10.318 | 4.9 | H | 3.0 | 35.3 | 1.0 | -29.4 | -13.0 | -16.4 | |
| 12.304 | 1.6 | H | 3.0 | 34.2 | 1.0 | -31.6 | -13.0 | -18.6 | |
| | | | | | | | | | |
| Mid Ch, 1732.5MHz | | | | | | | | | |
| 3.473 | -8.4 | V | 3.0 | 35.5 | 1.0 | -42.9 | -13.0 | -29.9 | |
| 10.421 | -5.0 | V | 3.0 | 35.2 | 1.0 | -39.2 | -13.0 | -26.2 | |
| 3.473 | -8.5 | H | 3.0 | 35.5 | 1.0 | -42.9 | -13.0 | -29.9 | |
| 10.421 | 7.0 | H | 3.0 | 35.2 | 1.0 | -27.3 | -13.0 | -14.3 | |
| 12.156 | -0.6 | H | 3.0 | 34.2 | 1.0 | -33.8 | -13.0 | -20.8 | |
| | | | | | | | | | |
| High Ch, 1750MHz | | | | | | | | | |
| 3.509 | -18.3 | V | 3.0 | 35.4 | 1.0 | -52.8 | -13.0 | -39.8 | |
| 10.528 | -3.9 | V | 3.0 | 35.2 | 1.0 | -38.0 | -13.0 | -25.0 | |
| 3.509 | -16.3 | H | 3.0 | 35.4 | 1.0 | -50.8 | -13.0 | -37.8 | |
| 5.184 | -11.6 | H | 3.0 | 35.3 | 1.0 | -46.0 | -13.0 | -33.0 | |
| 10.528 | 11.0 | H | 3.0 | 35.2 | 1.0 | -23.2 | -13.0 | -10.2 | |
| 12.283 | -6.4 | H | 3.0 | 34.2 | 1.0 | -39.6 | -13.0 | -26.6 | |
| | | | | | | | | | |

Rev. 03.03.09
Note: No other emissions were detected above the system noise floor.

**EIRP LTE 16QAM Band 4 (10.0 MHz BANDWIDTH)**

Compliance Certification Services
Above 1GHz High Frequency Substitution Measurement

**Company:** Apple
**Project #:** 11U14054
**Date:** 12/07/11
**Test Engineer:** Chin Pang
**Configuration:** EUT ALONE
**Mode:** TX, 16QAM_10 MHz_RB#1_49 MODE

| Chamber | Pre-amplifer | Filter | Limit |
|---|---|---|---|
| 5m Chamber B | T145 8449B | Filter 1 | Part 27 |

| f GHz | SG reading (dBm) | Ant. Pol. (H/V) | Distance (m) | Preamp (dB) | Filter (dB) | EIRP (dBm) | Limit (dBm) | Delta (dB) | Notes |
|---|---|---|---|---|---|---|---|---|---|
| Low Ch, 1715MHz | | | | | | | | | |
| 3.439 | -5.5 | V | 3.0 | 35.5 | 1.0 | -40.0 | -13.0 | -27.0 | |
| 5.519 | -13.5 | V | 3.0 | 35.4 | 1.0 | -47.9 | -13.0 | -34.9 | |
| 3.439 | -7.1 | H | 3.0 | 35.5 | 1.0 | -41.5 | -13.0 | -28.5 | |
| 10.318 | 3.9 | H | 3.0 | 35.3 | 1.0 | -30.4 | -13.0 | -17.4 | |
| 12.304 | -0.4 | H | 3.0 | 34.2 | 1.0 | -33.6 | -13.0 | -20.6 | |
| | | | | | | | | | |
| Mid Ch, 1732.5MHz | | | | | | | | | |
| 3.473 | -7.4 | V | 3.0 | 35.5 | 1.0 | -41.9 | -13.0 | -28.9 | |
| 10.421 | -5.0 | V | 3.0 | 35.2 | 1.0 | -39.2 | -13.0 | -26.2 | |
| 3.473 | -8.7 | H | 3.0 | 35.5 | 1.0 | -43.1 | -13.0 | -30.1 | |
| 10.421 | 8.0 | H | 3.0 | 35.2 | 1.0 | -26.3 | -13.0 | -13.3 | |
| 12.156 | -1.6 | H | 3.0 | 34.2 | 1.0 | -34.8 | -13.0 | -21.8 | |
| | | | | | | | | | |
| High Ch, 1750MHz | | | | | | | | | |
| 3.509 | -18.1 | V | 3.0 | 35.4 | 1.0 | -52.6 | -13.0 | -39.6 | |
| 10.528 | -4.9 | V | 3.0 | 35.2 | 1.0 | -39.0 | -13.0 | -26.0 | |
| 3.509 | -16.8 | H | 3.0 | 35.4 | 1.0 | -51.3 | -13.0 | -38.3 | |
| 5.184 | -12.3 | H | 3.0 | 35.3 | 1.0 | -46.7 | -13.0 | -33.7 | |
| 10.528 | 12.0 | H | 3.0 | 35.2 | 1.0 | -22.2 | -13.0 | -9.2 | |
| 12.283 | -6.4 | H | 3.0 | 34.2 | 1.0 | -39.6 | -13.0 | -26.6 | |
| | | | | | | | | | |

Rev. 03.03.09
Note: No other emissions were detected above the system noise floor.

## 9.2. RECEIVER SPURIOUS EMISSIONS

**RULE PART(S)**

FCC: N/A

**LIMIT**

Spurious Emission Limits for Receivers:

| Spurious Frequency (MHz) | Field Strength (microvolts/m at 3 metres) |
|---|---|
| 30-88 | 100 |
| 88-216 | 150 |
| 216-960 | 200 |
| Above 960 | 500 |

**TEST PROCEDURE**

The search for spurious emissions shall be from the lowest frequency internally generated or used in the receiver (local oscillator frequency, intermediate frequency or carrier frequency),

or 30 MHz, whichever is the higher, to at least 3 times the highest tunable and local oscillator frequencies.

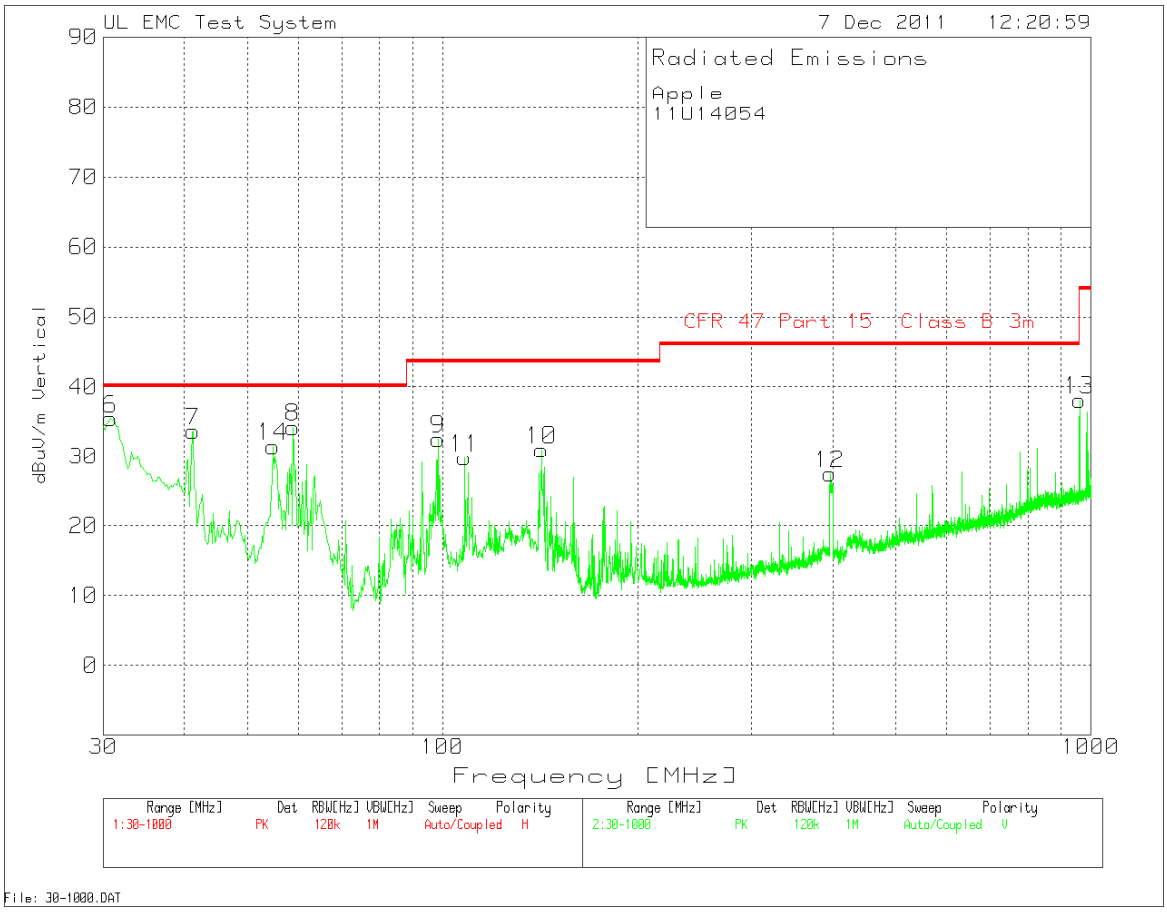
**RESULTS**

**RECEIVER SPURIOUS EMISSIONS FOR 30 TO 1000 MHz, HORIZONTAL**

HORIZONTAL PLOT

**RECEIVER SPURIOUS EMISSIONS FOR 30 TO 1000 MHz, VERTICAL**

VERTICAL PLOT



## HORIZONTAL AND VERTICAL DATA

| Apple | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 11U14054 | | | | | | | | |
| Engineer: Chin Pang | | | | | | | | |
| Date: Dec 7, 2011 | | | | | | | | |
| | | | | | | | | |
| Range 1 30 - 1000MHz | | | | | | | | |
| Frequency | Reading | Detector | ChmbrB Amp [dB] | Ant Factors.[dB] | dBuV/m | Part 15 B | Margin | Polarity |
| 40.8553 | 36.63 | PK | -29.2 | 13.6 | 21.03 | 40 | -18.97 | Horz |
| 55.5875 | 46.58 | PK | -29 | 7.9 | 25.48 | 40 | -14.52 | Horz |
| 142.2362 | 46.65 | PK | -28.1 | 13.1 | 31.65 | 43.5 | -11.85 | Horz |
| 186.8205 | 42.38 | PK | -27.7 | 11.1 | 25.78 | 43.5 | -17.72 | Horz |
| 633.0516 | 37.26 | PK | -26.5 | 18.6 | 29.36 | 46 | -16.64 | Horz |
| | | | | | | | | |
| Range 2 30 - 1000MHz | | | | | | | | |
| Frequency | Reading | Detector | ChmbrB Amp [dB] | Ant Factors.[dB] | dBuV/m | Part 15 B | Margin | Polarity |
| 30.7754 | 44.75 | PK | -29.3 | 20 | 35.45 | 40 | -4.55 | Vert |
| 41.243 | 49.54 | PK | -29.2 | 13.3 | 33.64 | 40 | -6.36 | Vert |
| 58.8829 | 55.37 | PK | -29 | 7.9 | 34.27 | 40 | -5.73 | Vert |
| 98.6211 | 51.47 | PK | -28.6 | 9.7 | 32.57 | 43.5 | -10.93 | Vert |
| 142.2362 | 45.93 | PK | -28.1 | 13.1 | 30.93 | 43.5 | -12.57 | Vert |
| 108.3133 | 46.75 | PK | -28.5 | 11.6 | 29.85 | 43.5 | -13.65 | Vert |
| 395.9792 | 39.38 | PK | -26.9 | 15 | 27.48 | 46 | -18.52 | Vert |
| 961.0372 | 40.27 | PK | -24.3 | 22.2 | 38.17 | 54 | -15.83 | Vert |
| 54.8122 | 52.56 | PK | -29 | 7.9 | 31.46 | 40 | -8.54 | Vert |

**RECEIVER SPURIOUS EMISSIONS ABOVE 1000 MHz**

Note: No emissions were detected above the system noise floor.