# CERTIFICATION TEST REPORT

**Report Number. :** 16U23816-E6V2

| | | |
|---|---|---|
| **Applicant** | : | APPLE, INC<br>1 INFINITE LOOP<br>CUPERTINO, CA 95014, U.S.A. |
| **Model** | : | A1671, A1821 |
| **FCC ID** | : | BCGA1671 |
| **IC** | : | 579-A1671 |
| **EUT Description** | : | TABLET DEVICE |
| **Test Standard(s)** | : | FCC CFR47 PART 22H, 24E, 27L, AND 90S IC RSS-132 ISSUE 3, RSS-133 ISSUE 6 AND RSS-139 ISSUE 3 |

**Date Of Issue:**
February 28, 2017

**Prepared by:**
UL Verification Services Inc.
47173 Benicia Street
Fremont, CA 94538, U.S.A.
TEL: (510) 771-1000
FAX: (510) 661-0888

NVLAP TESTING
NVLAP LAB CODE 200065-0

## Revision History

| Rev. | Issue Date | Revisions | Revised By |
|---|---|---|---|
| V1 | 02/21/2017 | Initial Issue | Chin Pang |
| V2 | 02/28/2017 | Addressed TCB Questions | Francisco Guarnero |


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

# TABLE OF CONTENTS

**1. ATTESTATION OF TEST RESULTS ..... 5**

**2. TEST METHODOLOGY ..... 6**

**3. FACILITIES AND ACCREDITATION ..... 6**

**4. CALIBRATION AND UNCERTAINTY ..... 6**

*4.1. MEASURING INSTRUMENT CALIBRATION ..... 6*

*4.2. SAMPLE CALCULATION ..... 7*

*4.3. MEASUREMENT UNCERTAINTY ..... 7*

**5. EQUIPMENT UNDER TEST ..... 8**

*5.1. DESCRIPTION OF EUT ..... 8*

*5.2. DESCRIPTION OF MODELS DIFFERENCES ..... 8*

*5.3. MAXIMUM OUTPUT POWER ..... 8*

5.3.1. ANTENNA C ..... 9
5.3.2. ANTENNA D ..... 11

*5.4. DESCRIPTION OF AVAILABLE ANTENNAS ..... 13*

*5.5. SOFTWARE AND FIRMWARE ..... 13*

*5.6. WORST-CASE CONFIGURATION AND MODE ..... 13*

*5.7. DESCRIPTION OF TEST SETUP ..... 14*

**6. TEST AND MEASUREMENT EQUIPMENT ..... 16**

**7. RF POWER OUTPUT VERIFICATION ..... 17**

*7.1. GSM ..... 17*

7.1.1. GPRS/EGPRS ..... 19

*7.2. CDMA200 ..... 20*

7.2.1. CDMA2000 1xRTT ..... 20
7.2.2. 1xEV-DO - Release 0 (REL 0) ..... 27
7.2.3. 1xEV-DO - Revision A (REV A) ..... 30

*7.3. UMTS ..... 33*

7.3.1. UMTS REL99 ..... 33
7.3.2. HSDPA REL 5 ..... 35
7.3.3. HSPA REL 6 (HSDPA & HSUPA) ..... 38
7.3.4. DUAL CARRIER HSDPA ..... 43

**8. CONDUCTED TEST RESULTS ..... 47**

*8.1. OCCUPIED BANDWIDTH ..... 47*

8.1.1. GSM GPRS ..... 50
8.1.2. GSM EGPRS ..... 51


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

8.1.3. CDMA2000 1xRTT ....52
8.1.4. CDMA2000 EVDO REV A ....54
8.1.5. UMTS Rel99 ....56
8.1.6. UMTS HSDPA ....58

*8.2. BAND EDGE ....60*
8.2.1. GSM GPRS ....62
8.2.2. GSM EGPRS ....64
8.2.3. CDMA2000 1xRTT ....66
8.2.4. CDMA2000 1xRTT BC10 MASK ....69
8.2.5. CDMA2000 EVDO REV A ....71
8.2.6. CDMA2000 EVDO REV A BC10 MASK ....74
8.2.7. UMTS Rel99 ....76
8.2.8. UMTS HSDPA ....79

*8.3. OUT OF BAND EMISSIONS ....82*
8.3.1. GSM GPRS ....84
8.3.2. GSM EGPRS ....85
8.3.3. CDMA2000 1xRTT ....86
8.3.4. CDMA2000 EVDO REV A ....87
8.3.5. UMTS Rel99 ....89
8.3.6. UMTS HSDPA ....90

**9. FREQUENCY STABILITY ....92**

*9.1. GSM ....94*

*9.2. CDMA2000 ....96*

*9.3. UMTS ....98*

**10. PEAK-TO-AVERAGE RATIO ....100**

**11. RADIATED TEST RESULTS ....109**

*11.1. FIELD STRENGTH OF SPURIOUS RADIATION (ANTENNA C) ....109*
11.1.1. GSM ....111
11.1.2. CDMA2000 ....115
11.1.3. UMTS ....121

*11.2. FIELD STRENGTH OF SPURIOUS RADIATION (ANTENNA D) ....127*
11.2.1. GSM ....127
11.2.2. CDMA2000 ....131
11.2.3. UMTS ....137

**12. SETUP PHOTOS ....143**


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

# 1. ATTESTATION OF TEST RESULTS

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

**EUT DESCRIPTION:** TABLET DEVICE

**MODEL:** A1671, A1821

**SERIAL NUMBER:** DLX645701 (CONDUCTED); DLXST00NHPJQ (RADIATED)

**DATE TESTED:** NOVEMBER 18, 2016 – FEBRUARY 04, 2017

| APPLICABLE STANDARDS | |
|---|---|
| **STANDARD** | **TEST RESULTS** |
| CFR 47 Part 22H, 24E, 27L, AND 90S | Pass |
| IC RSS-132 ISSUE 3, RSS-133 ISSUE 6, AND RSS-139 ISSUE 3 | Pass |

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

Approved & Released For
UL Verification Services Inc. By:

CHIN PANG
SENIOR ENGINEER
UL VERIFICATION SERVICES INC.

Prepared By:

TINA CHU
LAB ENGINEER
UL VERIFICATION SERVICES INC.


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

# 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with TIA-603-D, FCC CFR 47 Part 2, FCC CFR 47 Part 22, FCC CFR Part 24, FCC Part 27, FCC Part 90 and FCC KDB 971168 D01 v02r02. RSS-132 Issue 3, RSS-133 Issue 6 and RSS-139 Issue 3 and ANSI C63.26:2015,

# 3. FACILITIES AND ACCREDITATION

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

| 47173 Benicia Street | 47266 Benicia Street |
|---|---|
| ☐ Chamber A (IC:2324B-1) | ☒ Chamber D (IC:2324B-4) |
| ☐ Chamber B (IC:2324B-2) | ☒ Chamber E (IC:2324B-5) |
| ☐ Chamber C (IC:2324B-3) | ☐ Chamber F (IC:2324B-6) |
| | ☒ Chamber G (IC:2324B-7) |
| | ☐ Chamber H (IC:2324B-8) |

The above test sites and facilities are covered under FCC Test Firm Registration # 208313. Chambers A through H are covered under Industry Canada company address code 2324B with site numbers 2324B -1 through 2324B-8, respectively.

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at http://ts.nist.gov/standards/scopes/2000650.htm.

# 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.


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

## 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, 9KHz to 0.15 MHz | 3.84 dB |
| Conducted Disturbance, 0.15 to 30 MHz | 3.65 dB |
| Radiated Disturbance, 9KHz to 30 MHz | 3.15 dB |
| Radiated Disturbance, 30 to 1000 MHz | 5.36 dB |
| Radiated Disturbance,1000 to 18000 MHz | 4.32 dB |
| Radiated Disturbance,18000 to 26000 MHz | 4.45 dB |
| Radiated Disturbance,26000 to 40000 MHz | 5.24 dB |

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


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

# 5. EQUIPMENT UNDER TEST

## 5.1. DESCRIPTION OF EUT

The EUT, model number A1671, A1821 is a tablet with multimedia functions (music, application support, and video), Cellular GSM/GPRS/EGPRS/CDMA2000 1xRTT/1x Advanced/EVDO Rev.A/WCDMA /HSPA+/DC- HSDPA/LTE FDD & Carrier Aggregation/TDD/TD-SCDMA radio, IEEE 802.11a/b/g/n/ac radio, and Bluetooth radio. The rechargeable battery is not user accessible.

## 5.2. DESCRIPTION OF MODELS DIFFERENCES

Both Model A1671 and A1821 have identical PCB layout, design and functionality, except that A1671 supports second electronic-UICC based SIM or “soft SIM” (called eSIM) beside the regular UICC based SIM and A1821 will come with eSIM removed. RF and electromagnetic characteristic are independent of the eSIM element. Both Models have exactly same technology and band support. Model A1671 is used for EMC/RSE Testing and that data will be used for both Models

## 5.3. MAXIMUM OUTPUT POWER

**EIRP/ERP TEST PROCEDURE**

ANSI C63.26:2015/ TIA / EIA 603-D Clause 2.2.17
KDB 971168 Section 5.6

ERP/EIRP = PMeas + GT − LC

where: ERP/EIRP = effective or equivalent radiated power, respectively (expressed in the same units as PMeas, typically dBW or dBm);
PMeas = measured transmitter output power or PSD, in dBm or dBW;
GT = gain of the transmitting antenna, in dBd (ERP) or dBi (EIRP);
LC = signal attenuation in the connecting cable between the transmitter and antenna, in dB.2

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

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


UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701i
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

### 5.3.1. ANTENNA C

**GSM MODES**

| **RSS 132 850MHz Band IC** | | | | | | | |
|---|---|---|---|---|---|---|---|
| Frequency range (MHz) | Modulation | Conducted (Average) (dBm) | Antenna Gain (dBi) | EIRP | | Limit (dBm) | Margin (dB) |
| | | | | dBm | mW | | |
| 824- 849 | GPRS | 33.50 | 0.24 | 33.74 | 2365.9 | 40.6 | -6.9 |
| | EGPRS | 28.00 | 0.24 | 28.24 | 666.8 | 40.6 | -12.4 |
| **Part 22 850MHz Band FCC** | | | | | | | |
| Frequency range (MHz) | Modulation | Conducted (Average) (dBm) | Antenna Gain (dBi) | ERP | | Limit (dBm) | Margin (dB) |
| | | | | dBm | mW | | |
| 824-849 | GPRS | 33.50 | 0.24 | 31.59 | 1442.1 | 38.5 | -6.9 |
| | EGPRS | 28.00 | 0.24 | 26.09 | 406.4 | 38.5 | -12.4 |
| **Part 24 / RSS 133 1900MHz Band** | | | | | | | |
| Frequency range (MHz) | Modulation | Conducted (Average) (dBm) | Antenna Gain (dBi) | EIRP | | Limit (dBm) | Margin (dB) |
| | | | | dBm | mW | | |
| 1850-1910 | GPRS | 29.50 | 1.47 | 30.97 | 1250.3 | 33.0 | -2.0 |
| | EGPRS | 27.00 | 1.47 | 28.47 | 703.1 | 33.0 | -4.5 |


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

## CDMA2000 MODES

| Part 90 800MHz Band | | | | | | | |
|---|---|---|---|---|---|---|---|
| Frequency range (MHz) | Modulation | Conducted (Average) (dBm) | Antenna Gain (dBi) | ERP | | Limit (dBm) | Margin (dB) |
| | | | | dBm | mW | | |
| 816-824 | CDMA 1xRTT | 26.00 | 0.24 | 24.09 | 256.4 | 50.0 | -25.9 |
| | CDMA EVDO Rev A | 26.00 | 0.24 | 24.09 | 256.4 | 50.0 | -25.9 |
| **RSS 132 850MHz Band IC** | | | | | | | |
| Frequency range (MHz) | Modulation | Conducted (Average) (dBm) | Antenna Gain (dBi) | EIRP | | Limit (dBm) | Margin (dB) |
| | | | | dBm | mW | | |
| 824- 849 | CDMA 1xRTT | 24.50 | 0.24 | 24.74 | 297.9 | 40.6 | -15.9 |
| | CDMA EVDO-Rev A | 24.50 | 0.24 | 24.74 | 297.9 | 40.6 | -15.9 |
| **Part 22 850MHz Band FCC** | | | | | | | |
| Frequency range (MHz) | Modulation | Conducted (Average) (dBm) | Antenna Gain (dBi) | ERP | | Limit (dBm) | Margin (dB) |
| | | | | dBm | mW | | |
| 824- 849 | CDMA 1xRTT | 24.50 | 0.24 | 22.59 | 181.6 | 38.5 | -15.9 |
| | CDMA EVDO-Rev A | 24.50 | 0.24 | 22.59 | 181.6 | 38.5 | -15.9 |
| **Part 24 / RSS 133 1900MHz Band** | | | | | | | |
| Frequency range (MHz) | Modulation | Conducted (Average) (dBm) | Antenna Gain (dBi) | EIRP | | Limit (dBm) | Margin (dB) |
| | | | | dBm | mW | | |
| 1850-1910 | CDMA 1xRTT | 26.00 | 1.47 | 27.47 | 558.5 | 33.0 | -5.5 |
| | CDMA EVDO Rev A | 26.00 | 1.47 | 27.47 | 558.5 | 33.0 | -5.5 |

## UMTS MODE

| RSS 132 850MHz Band IC | | | | | | | |
|---|---|---|---|---|---|---|---|
| Frequency range (MHz) | Modulation | Conducted (Average) (dBm) | Antenna Gain (dBi) | EIRP | | Limit (dBm) | Margin (dB) |
| | | | | dBm | mW | | |
| 824- 849 | REL 99 | 25.50 | 0.24 | 25.74 | 375.0 | 40.6 | -14.9 |
| | HSDPA | 24.50 | 0.24 | 24.74 | 297.9 | 40.6 | -15.9 |
| **Part 22 850MHz Band FCC** | | | | | | | |
| Frequency range (MHz) | Modulation | Conducted (Average) (dBm) | Antenna Gain (dBi) | ERP | | Limit (dBm) | Margin (dB) |
| | | | | dBm | mW | | |
| 824-849 | REL 99 | 25.50 | 0.24 | 23.59 | 228.6 | 38.5 | -14.9 |
| | HSDPA | 24.50 | 0.24 | 22.59 | 181.6 | 38.5 | -15.9 |
| **Part 24 / RSS 133 1900MHz Band** | | | | | | | |
| Frequency range (MHz) | Modulation | Conducted (Average) (dBm) | Antenna Gain (dBi) | EIRP | | Limit (dBm) | Margin (dB) |
| | | | | dBm | mW | | |
| 1850-1910 | REL 99 | 25.50 | 1.47 | 26.97 | 497.7 | 33.0 | -6.0 |
| | HSDPA | 24.50 | 1.47 | 25.97 | 395.4 | 33.0 | -7.0 |
| **Part 27 / RSS 139 1700MHz Band** | | | | | | | |
| Frequency range (MHz) | Modulation | Conducted (Average) (dBm) | Antenna Gain (dBi) | EIRP | | Limit (dBm) | Margin (dB) |
| | | | | dBm | mW | | |
| 1710-1755 | REL 99 | 25.50 | 0.29 | 25.79 | 379.3 | 30.0 | -4.2 |
| | HSDPA | 24.50 | 0.29 | 24.79 | 301.3 | 30.0 | -5.2 |


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

## 5.3.2. ANTENNA D

### GSM MODES

| RSS 132 850MHz Band IC | | | | | | | |
|---|---|---|---|---|---|---|---|
| Frequency range (MHz) | Modulation | Conducted (Average) (dBm) | Antenna Gain (dBi) | EIRP | | Limit (dBm) | Margin (dB) |
| | | | | dBm | mW | | |
| 824- 849 | GPRS | 32.00 | 0.51 | 32.51 | 1782.4 | 40.6 | -8.1 |
| | EGPRS | 26.00 | 0.51 | 26.51 | 447.7 | 40.6 | -14.1 |
| **Part 22 850MHz Band FCC** | | | | | | | |
| Frequency range (MHz) | Modulation | Conducted (Average) (dBm) | Antenna Gain (dBi) | ERP | | Limit (dBm) | Margin (dB) |
| | | | | dBm | mW | | |
| 824-849 | GPRS | 32.00 | 0.51 | 30.36 | 1086.4 | 38.5 | -8.1 |
| | EGPRS | 26.00 | 0.51 | 24.36 | 272.9 | 38.5 | -14.1 |
| **Part 24 / RSS 133 1900MHz Band** | | | | | | | |
| Frequency range (MHz) | Modulation | Conducted (Average) (dBm) | Antenna Gain (dBi) | EIRP | | Limit (dBm) | Margin (dB) |
| | | | | dBm | mW | | |
| 1850-1910 | GPRS | 27.50 | 1.07 | 28.57 | 719.4 | 33.0 | -4.4 |
| | EGPRS | 24.00 | 1.07 | 25.07 | 321.4 | 33.0 | -7.9 |

### CDMA2000 MODES

| Part 90 800MHz Band | | | | | | | |
|---|---|---|---|---|---|---|---|
| Frequency range (MHz) | Modulation | Conducted (Average) (dBm) | Antenna Gain (dBi) | ERP | | Limit (dBm) | Margin (dB) |
| | | | | dBm | mW | | |
| 816-824 | CDMA 1xRTT | 24.00 | 0.48 | 22.33 | 171.0 | 50.0 | -27.7 |
| | CDMA EVDO Rev A | 24.00 | 0.48 | 22.33 | 171.0 | 50.0 | -27.7 |
| **RSS 132 850MHz Band IC** | | | | | | | |
| Frequency range (MHz) | Modulation | Conducted (Average) (dBm) | Antenna Gain (dBi) | EIRP | | Limit (dBm) | Margin (dB) |
| | | | | dBm | mW | | |
| 824- 849 | CDMA 1xRTT | 24.00 | 0.51 | 24.51 | 282.5 | 40.6 | -16.1 |
| | CDMA EVDO-Rev A | 24.00 | 0.51 | 24.51 | 282.5 | 40.6 | -16.1 |
| **Part 22 850MHz Band FCC** | | | | | | | |
| Frequency range (MHz) | Modulation | Conducted (Average) (dBm) | Antenna Gain (dBi) | ERP | | Limit (dBm) | Margin (dB) |
| | | | | dBm | mW | | |
| 824- 849 | CDMA 1xRTT | 24.00 | 0.51 | 22.36 | 172.2 | 38.5 | -16.1 |
| | CDMA EVDO-Rev A | 24.00 | 0.51 | 22.36 | 172.2 | 38.5 | -16.1 |
| **Part 24 / RSS 133 1900MHz Band** | | | | | | | |
| Frequency range (MHz) | Modulation | Conducted (Average) (dBm) | Antenna Gain (dBi) | EIRP | | Limit (dBm) | Margin (dB) |
| | | | | dBm | mW | | |
| 1850-1910 | CDMA 1xRTT | 23.50 | 1.07 | 24.57 | 286.4 | 33.0 | -8.4 |
| | CDMA EVDO Rev A | 23.50 | 1.07 | 24.57 | 286.4 | 33.0 | -8.4 |


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

## UMTS MODE

| RSS 132 850MHz Band IC | | | | | | | |
|---|---|---|---|---|---|---|---|
| Frequency range (MHz) | Modulation | Conducted (Average) (dBm) | Antenna Gain (dBi) | EIRP | | Limit (dBm) | Margin (dB) |
| | | | | dBm | mW | | |
| 824- 849 | REL 99 | 25.00 | 0.51 | 25.51 | 355.6 | 40.6 | -15.1 |
| | HSDPA | 24.00 | 0.51 | 24.51 | 282.5 | 40.6 | -16.1 |
| **Part 22 850MHz Band FCC** | | | | | | | |
| Frequency range (MHz) | Modulation | Conducted (Average) (dBm) | Antenna Gain (dBi) | ERP | | Limit (dBm) | Margin (dB) |
| | | | | dBm | mW | | |
| 824-849 | REL 99 | 25.00 | 0.51 | 23.36 | 216.8 | 38.5 | -15.1 |
| | HSDPA | 24.00 | 0.51 | 22.36 | 172.2 | 38.5 | -16.1 |
| **Part 24 / RSS 133 1900MHz Band** | | | | | | | |
| Frequency range (MHz) | Modulation | Conducted (Average) (dBm) | Antenna Gain (dBi) | EIRP | | Limit (dBm) | Margin (dB) |
| | | | | dBm | mW | | |
| 1850-1910 | REL 99 | 24.50 | 1.07 | 25.57 | 360.6 | 33.0 | -7.4 |
| | HSDPA | 23.50 | 1.07 | 24.57 | 286.4 | 33.0 | -8.4 |
| **Part 27 / RSS 139 1700MHz Band** | | | | | | | |
| Frequency range (MHz) | Modulation | Conducted (Average) (dBm) | Antenna Gain (dBi) | EIRP | | Limit (dBm) | Margin (dB) |
| | | | | dBm | mW | | |
| 1710-1755 | REL 99 | 25.50 | 1.11 | 26.61 | 458.1 | 30.0 | -3.4 |
| | HSDPA | 24.50 | 1.11 | 25.61 | 363.9 | 30.0 | -4.4 |


UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701i
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

## 5.4. DESCRIPTION OF AVAILABLE ANTENNAS

| Frequency (MHz) | Antenna C Antenna Gain (dBi) | Antenna D Antenna Gain (dBi) |
|---|---|---|
| 816 - 824 | 0.24 | 0.48 |
| 824 - 849 | 0.24 | 0.51 |
| 1850 - 1910 | 1.47 | 1.07 |
| 1710 - 1755 | 0.29 | 1.11 |

## 5.5. SOFTWARE AND FIRMWARE

The EUT software installed during testing was 14E32020u and firmware was 1.54.09.

## 5.6. WORST-CASE CONFIGURATION AND MODE

The worst-case is EUT on the highest power. Based on Peak Power measurement investigations, the following modes should be considered as worst-case scenario for all other measurements.

Worst-case modes:
- GSM GPRS
- GSM EGPRS
- CDMA 2000 1xRTT
- CDMA 2000 EVDO REV. A
- UMTS REL 99
- UMTS HSDPA

The EUT was investigated in three orthogonal orientations X/Y/Z. It was determined that X (Flatbed) orientation was worst-case orientation for cell band, secondary band, AWS band and PCS band without AC/DC adapter and headset.

Radiated spurious emissions were investigated below 30 MHz, from 30 MHz – 1 GHz, and above 1 GHz. There were no emissions found on below 30 MHz and 30 MHz - 1GHz.


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

## 5.7. DESCRIPTION OF TEST SETUP

**SUPPORT EQUIPMENT**

| Support Equipment List | | | |
|---|---|---|---|
| Description | Manufacturer | Model | Serial Number |
| Laptop AC Adapter | Dell | PA-1900-02D | N/A |
| Laptop | Dell | Latitude 3540 | N/A |
| DC power supply | Sorensen | XT-20-3 | N/A |

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

| I/O Cable List | | | | | | |
|---|---|---|---|---|---|---|
| Cable No | Port | # of identical ports | Connector Type | Cable Type | Cable Length (m) | Remarks |
| 1 | AC | 3 | US 115V | Un-shielded | 2m | N/A |
| 2 | DC | 1 | DC | Un-shielded | 1.4m | N/A |
| 3 | RF In/Out | 1 | EUT | Un-shielded | 0.4m | N/A |
| 4 | RF In/Out | 1 | SMA | N/A | N/A | N/A |
| 5 | RF In/Out | 1 | SMA | Un-shielded | 1m | N/A |

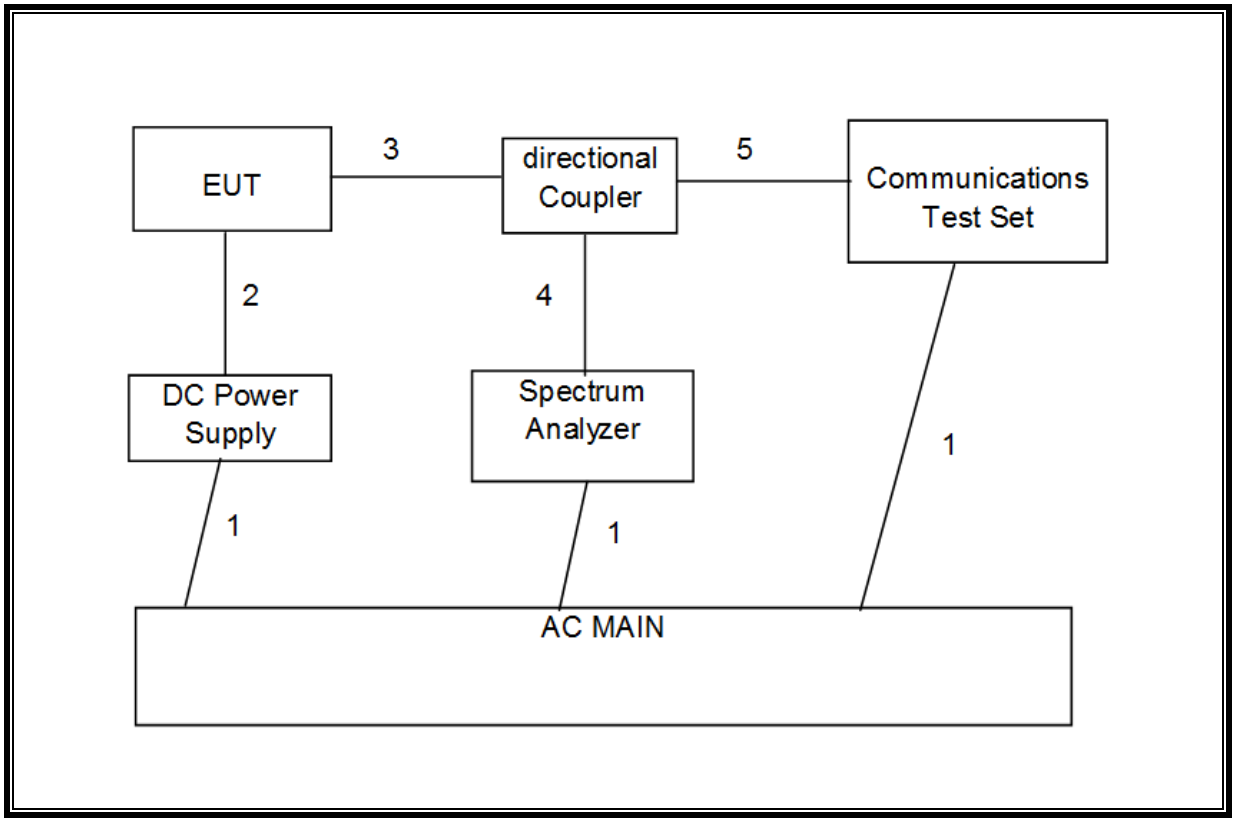
**I/O CABLES (RF Radiated Test)**

| I/O Cable List | | | | | | |
|---|---|---|---|---|---|---|
| Cable No | Port | # of identical ports | Connector Type | Cable Type | Cable Length (m) | Remarks |
| 1 | RF In/Out | 1 | Antenna | Un-shielded | 5m | NA |

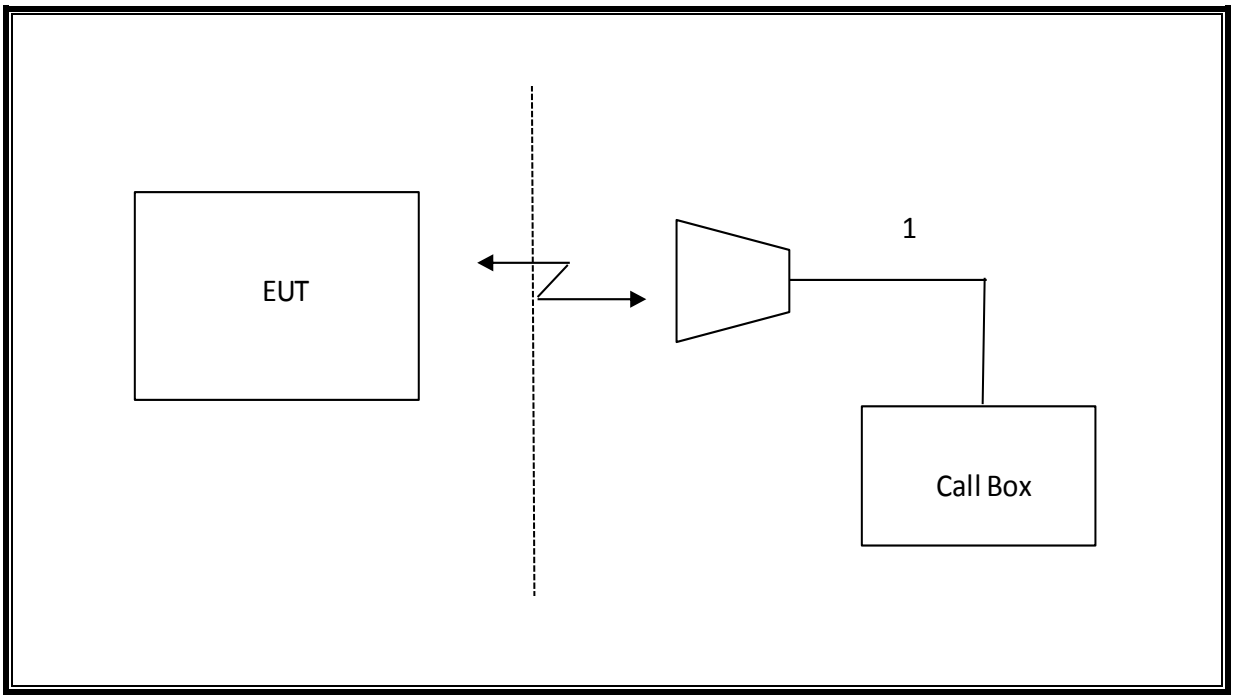
**TEST SETUP**


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

**CONDUCTED SETUP**




**RADIATED SETUP**





*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

# 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** |
| Antenna, Horn 1-18GHz | ETS Lindgren | 3117 | T863 | 04/26/2017 |
| Antenna, Broadband Hybrid, 30MHz to 2000MHz | Sunol Sciences | JB3 | T900 | 05/3/2017 |
| Amplifier, 1 to 18GHz, 35dB | Amplical | AMP1G18-35 | T1569 | 09/15/2017 |
| Amplifier, 10KHz to 1GHz, 32dB | Sonoma | 310N | T835 | 06/18/2017 |
| * Spectrum Analyzer, PXA 3Hz to 44GHz | Keysight | N9030A | T906 | 02/03/2017 |
| Directional Coupler | KRYTAR | 152610 | T1537 | 04/11/2017 |
| Power Meter, P-series single channel | Keysight | N1912A | T1245 | 05/03/2017 |
| Power Sensor, P - series, 50MHz to 18GHz, Wideband | Keysight | N1921A | T1226 | 05/18/2017 |
| Power Sensor, P - series, 50MHz to 18GHz, Wideband | Keysight | N1921A | T750 | 10/17/2017 |
| Directional Coupler | KRYTAR | 152610 | T1536 | 04/11/2017 |
| * Filter, HPF 3.0GHz | MICROTRONICS | HPM17543 | T487 | 01/26/2017 |
| Filter, HPF 1.2GHz | Micro-Tronics | WHKX1.2/15G-6ST | T1182 | 05/31/2017 |
| Spectrum Analyzer, PXA, 3Hz to 44GHz | Keysight | N9030A | T1466 | 03/09/2017 |
| Wideband Communication Test Set, Call Box | Rohde & Schwarz GmbH & Co. KG | CMW500 | T959 | 07/09/2017 |
| Wideband Communication Test Set, Call Box | Rohde & Schwarz GmbH & Co. KG | CMW500 | T971 | 08/05/2017 |
| Chamber, Environmental | Cincinnati Sub Zero | ZPHS-8-3.5-SCT/WC | T1154 | 03/12/2017 |
| Wideband Communication Test Set, Call Box | Rohde & Schwarz | CMW500 | T260 | 07/20/2017 |
| Antenna, Horn 18 to 26.5GHz | ARA | MWH-1826/B | T447 | 06/16/2017 |
| Amplifier, 1 to 26.5GHz, 23.5dB Gain minimum | Keysight | 8449B | T402 | 07/05/2017 |
| Antenna, Horn 1-18GHz | Emco | 3115 | T59 | 11/18/2017 |

NOTE: *testing is completed before equipment calibration expiration date.


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

# 7. RF POWER OUTPUT VERIFICATION

## 7.1. GSM

**Using CMW500 Communication Test Set**

Function: Menu select > GSM Mobile Station > GSM 850/900/1800/1900

Press **Connection control** to choose the different menus
Press **RESET** > choose all to reset all settings

| | | |
|---|---|---|
| Connection | Press **Signal Off** to turn off the signal and change settings<br>Network Support > GSM+GPRS or GSM+EGPRS<br>Main Service > Packet Data<br>Service selection > Test Mode A – Auto Slot Config. off | |
| MS Signal | Press Slot Config bottom on the right twice to select and change the number of time slots and power setting | |
| | > Slot configuration | > Uplink/Gamma<br>> 33 dBm for GPRS 850/900<br>> 27 dBm for EGPRS 850/900<br>> 30 dBm for GPRS1800/1900<br>> 26 dBm for EGPRS1800/1900 |
| BS Signal | Enter the same channel number for TCH channel (test channel) and BCCH channel | |
| | Frequency Offset > | + 0 Hz |
| | Mode > | BCCH and TCH |
| | BCCH Level > | -85 dBm (May need to adjust if link is not stable) |
| | BCCH Channel > | choose desire test channel [Enter the same channel number for TCH channel (test channel) and BCCH channel] |
| | Channel Type > | Off |
| | P0> | 4 dB |
| | Slot Config > | Unchanged (if already set under MS Signal) |
| | TCH > | choose desired test channel |
| | Hopping > | Off |
| | Main Timeslot > | 3 (Default) |
| Network | Coding Scheme > | CS 4 (GPRS) and MCS5-9 (EGPRS) |
| | Bit Stream > | 2E9-1PSR Bit Pattern |
| AF/RF | Enter appropriate offsets for Ext. Att. Output and Ext. Att. Input | |
| Connection | Press **Signal On** to turn on the signal and change settings | |


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

**Using Agilent 8960A Communication Test Set**

| | | |
|---|---|---|
| **System Config:** | GSM/GPRS Mobile Test | |
| | E1968A | A.06.31 |
| **Call Parms:** | BCH ➔ | Cell Band: GSM850/PCS |
| | TCH ➔ | Traffic Band: GSM850/PCS |
| | | Traffic Channel: 128/192/251 or 512/661/810 |
| | | MS Tx Level: 0 |
| | PDTCH ➔ | Traffic Band: GSM850/PCS |
| | | Traffic Channel: 128/192/251 512/661/810 |
| | | MS Tx Level: 0 |
| | | Coding Scheme: CS-4 (GPRS) |
| | | Coding Scheme: MCS-5 to 9 (EGPRS) |
| | | MultiSlot Config: 1up, 1 down (Assuming that the highest conducted power) |
| **Control:** | Active Cell ➔ | GSM/GPRS |


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

### 7.1.1. GPRS/EGPRS

**ANTENNA C**

| ID: | 50820 | Date: | 2/1/17 |
|---|---|---|---|

| Mode | Ch. | f (MHz) | 1 time slot | | 2 time slots | |
|---|---|---|---|---|---|---|
| | | | Peak (dBm) | Average (dBm) | Peak (dBm) | Average (dBm) |
| GPRS | 128 | 824.2 | 33.50 | 33.40 | 32.50 | 32.40 |
| | 190 | 836.6 | **33.60** | **33.50** | 32.60 | 32.50 |
| | 251 | 848.8 | 33.50 | 33.40 | 32.50 | 32.40 |
| EGPRS | 128 | 824.2 | 30.90 | 27.90 | 30.80 | 27.80 |
| | 190 | 836.6 | 30.90 | 27.90 | 30.80 | 27.80 |
| | 251 | 848.8 | **31.00** | **28.00** | 30.80 | 27.80 |
| GPRS | 512 | 1850.2 | 29.50 | 29.40 | 29.40 | 29.30 |
| | 661 | 1880.0 | 29.50 | 29.40 | 29.40 | 29.30 |
| | 810 | 1909.8 | **29.60** | **29.50** | 29.50 | 29.40 |
| EGPRS | 512 | 1850.2 | **30.10** | **27.00** | 29.90 | 26.80 |
| | 661 | 1880.0 | 30.00 | 26.90 | 29.80 | 26.80 |
| | 810 | 1909.8 | 29.81 | 26.80 | 29.70 | 26.70 |

**Antenna D (UAT)**

| ID: | 50820 | Date: | 2/1/17 |
|---|---|---|---|

| Mode | Ch. | f (MHz) | 1 time slot | | 2 time slots | |
|---|---|---|---|---|---|---|
| | | | Peak (dBm) | Average (dBm) | Peak (dBm) | Average (dBm) |
| GPRS | 128 | 824.2 | **32.10** | **32.00** | 31.10 | 31.00 |
| | 190 | 836.6 | 32.00 | 31.90 | 31.00 | 30.90 |
| | 251 | 848.8 | 32.00 | 31.90 | 31.00 | 30.90 |
| EGPRS | 128 | 824.2 | **29.20** | **26.00** | 29.10 | 25.90 |
| | 190 | 836.6 | 29.00 | 25.80 | 28.90 | 25.80 |
| | 251 | 848.8 | 29.00 | 25.90 | 28.90 | 25.80 |
| GPRS | 512 | 1850.2 | **27.60** | **27.50** | 26.60 | 26.50 |
| | 661 | 1880.0 | 27.40 | 27.40 | 26.50 | 26.40 |
| | 810 | 1909.8 | 27.40 | 27.30 | 26.50 | 26.40 |
| EGPRS | 512 | 1850.2 | **27.10** | **24.00** | 24.70 | 21.60 |
| | 661 | 1880.0 | 27.00 | 23.90 | 24.60 | 21.50 |
| | 810 | 1909.8 | 26.90 | 23.80 | 24.60 | 21.50 |


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

## 7.2. CDMA200

Maximum output power is verified on the Low, Middle and High channels according to procedures in section 4.4.5.2 of 3GPP2 C.S0011/TIA-98-E for 1xRTT, section 3.1.2.3.4 of 3GPP2 C.S0033-0/TIA-866 for Rel. 0 and section 4.3.4 of 3GPP2 C.S0033-A for Rev. A

### 7.2.1. CDMA2000 1xRTT

This procedure assumes the Agilent 8960 Test Set has the following applications installed and with valid license.

| Application | Rev, License |
|---|---|
| CDMA2000 Mobile Test | B.15.18, L |

- ☐ Protocol Rev > 6 (IS-2000-0)
- ☐ System ID: 18; NID: 65535, Reg. Ch. #.: 610 for Cell, 600 for PCS & 450 for AWS
- ☐ Radio Config (RC) > RC1 or RC3
- ☐ Service Option (SO) Setup > SO55 or SO32
- ☐ Traffic Data Rate > Full
- ☐ Rvs Power Ctrl > All Up bits (Maximum TxPout)

**RESULT**


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

**ANTENNA C**

| ID: | 50820 | Date: | 2/1/17 |
|---|---|---|---|

**1xRTT, BC10, SECONDARY 800**

| Radio Configuration (RC) | Service Option (SO) | Conducted Output Power (dBm) | | | | | |
|---|---|---|---|---|---|---|---|
| | | CH 450 - 817.25MHz | | CH 560 - 820MHz | | CH 670 - 822.75MHz | |
| | | Peak | Average | Peak | Average | Peak | Average |
| RC1 | 2 (Loopback) | 30.4 | 26.0 | 30.3 | 25.9 | 30.4 | 25.9 |
| | 55 (Loopback) | 30.4 | 25.9 | 30.3 | 25.8 | 30.3 | 25.7 |
| RC2 | 9 (Loopback) | 30.1 | 25.9 | 30.4 | 25.9 | 30.3 | 25.8 |
| | 55 (Loopback) | **30.5** | **26.0** | 30.4 | 25.9 | 30.3 | 25.9 |
| RC3 | 2 (Loopback) | 30.2 | 25.9 | 30.2 | 25.9 | 30.1 | 25.8 |
| | 55 (Loopback) | 30.2 | 25.8 | 30.3 | 25.9 | 30.1 | 25.9 |
| | 32 (+ F-SCH) | 30.2 | 25.8 | 30.2 | 25.8 | 30.3 | 25.9 |
| | 32 (+ SCH) | 30.4 | 25.8 | 30.2 | 25.9 | 30.1 | 25.8 |
| RC4 | 2 (Loopback) | 30.5 | 25.8 | 30.4 | 25.8 | 30.1 | 25.9 |
| | 55 (Loopback) | 30.4 | 25.8 | 30.4 | 25.8 | 30.1 | 25.9 |
| | 32 (+ F-SCH) | 30.4 | 25.8 | 30.3 | 25.8 | 30.2 | 25.9 |
| | 32 (+ SCH) | 30.4 | 25.8 | 30.4 | 25.9 | 30.2 | 25.9 |
| RC5 | 9 (Loopback) | 30.4 | 25.9 | 30.3 | 25.8 | 30.1 | 25.8 |
| | 55 (Loopback) | 30.5 | 25.8 | 30.5 | 25.9 | 30.1 | 25.9 |
| RC11 | 2 (Loopback) | 30.5 | 25.9 | 30.4 | 26.0 | 30.2 | 25.9 |
| | 75 (Loopback) | 30.5 | 25.8 | 30.3 | 25.9 | 30.2 | 25.9 |
| | 32 (+ F-SCH) | 30.4 | 25.8 | 30.4 | 25.8 | 30.1 | 25.9 |
| | 32 (+ SCH) | 30.4 | 25.8 | 30.4 | 25.8 | 30.2 | 25.8 |


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

**1xRTT, BC0, CELL BAND**

| Radio Configuration (RC) | Service Option (SO) | Conducted Output Power (dBm) | | | | | |
|---|---|---|---|---|---|---|---|
| | | CH 1013 - 824.7MHz | | CH 384 - 836.52MHz | | CH 777 - 848.31MHz | |
| | | Peak | Average | Peak | Average | Peak | Average |
| RC1 | 2 (Loopback) | 28.9 | 24.4 | 29.0 | 24.5 | 28.9 | 24.4 |
| | 55 (Loopback) | 28.7 | 24.4 | 29.1 | 24.5 | 28.8 | 24.5 |
| RC2 | 9 (Loopback) | 28.7 | 24.4 | 29.0 | 24.4 | 28.8 | 24.5 |
| | 55 (Loopback) | 28.7 | 24.4 | **29.2** | **24.5** | 29.0 | 24.4 |
| RC3 | 2 (Loopback) | 28.6 | 24.5 | 28.9 | 24.4 | 28.7 | 24.4 |
| | 55 (Loopback) | 28.6 | 24.5 | 28.9 | 24.4 | 28.7 | 24.5 |
| | 32 (+ F-SCH) | 28.7 | 24.3 | 29.0 | 24.4 | 28.8 | 24.4 |
| | 32 (+ SCH) | 28.7 | 24.3 | 29.0 | 24.4 | 28.8 | 24.4 |
| RC4 | 2 (Loopback) | 28.6 | 24.5 | 29.0 | 24.4 | 28.7 | 24.4 |
| | 55 (Loopback) | 28.6 | 24.5 | 28.9 | 24.4 | 28.7 | 24.4 |
| | 32 (+ F-SCH) | 28.7 | 24.3 | 29.1 | 24.4 | 28.8 | 24.4 |
| | 32 (+ SCH) | 28.7 | 24.3 | 28.9 | 24.4 | 28.8 | 24.3 |
| RC5 | 9 (Loopback) | 28.6 | 24.5 | 28.9 | 24.4 | 28.7 | 24.4 |
| | 55 (Loopback) | 28.6 | 24.5 | 28.9 | 24.4 | 28.7 | 24.4 |
| RC11 | 2 (Loopback) | 28.6 | 24.4 | 29.0 | 24.4 | 28.8 | 24.4 |
| | 75 (Loopback) | 28.6 | 24.4 | 29.0 | 24.4 | 28.7 | 24.4 |
| | 32 (+ F-SCH) | 28.7 | 24.5 | 29.0 | 24.4 | 28.8 | 24.5 |
| | 32 (+ SCH) | 28.6 | 24.4 | 28.9 | 24.5 | 28.7 | 24.5 |


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

**1xRTT, BC1, PCS BAND**

| Radio Configuration (RC) | Service Option (SO) | Conducted Output Power (dBm) | | | | | |
|---|---|---|---|---|---|---|---|
| | | CH 25 - 1851.25MHz | | CH 600 - 1880MHz | | CH 1175 - 1908.75MHz | |
| | | Peak | Average | Peak | Average | Peak | Average |
| RC1 | 2 (Loopback) | 29.9 | 25.8 | 30.0 | 25.8 | 29.4 | 25.9 |
| | 55 (Loopback) | 29.9 | 25.8 | 30.1 | 25.8 | 29.3 | 25.9 |
| RC2 | 9 (Loopback) | 29.9 | 25.8 | 30.1 | 25.8 | 29.3 | 25.8 |
| | 55 (Loopback) | 29.9 | 25.8 | **30.2** | **26.0** | 29.3 | 25.8 |
| RC3 | 2 (Loopback) | 29.8 | 25.9 | 29.4 | 25.7 | 29.4 | 25.9 |
| | 55 (Loopback) | 29.8 | 25.9 | 30.1 | 25.8 | 29.3 | 26.0 |
| | 32 (+ F-SCH) | 29.8 | 25.9 | 29.3 | 25.8 | 29.5 | 26.0 |
| | 32 (+ SCH) | 29.8 | 25.8 | 29.3 | 25.8 | 29.4 | 25.8 |
| RC4 | 2 (Loopback) | 29.8 | 25.8 | 29.4 | 25.8 | 29.5 | 25.9 |
| | 55 (Loopback) | 29.8 | 25.9 | 30.1 | 25.8 | 29.3 | 26.0 |
| | 32 (+ F-SCH) | 29.9 | 25.8 | 29.3 | 25.8 | 29.5 | 25.9 |
| | 32 (+ SCH) | 29.9 | 25.8 | 29.8 | 25.8 | 29.4 | 26.0 |
| RC5 | 9 (Loopback) | 29.8 | 25.9 | 30.0 | 25.8 | 29.5 | 25.9 |
| | 55 (Loopback) | 29.8 | 25.9 | 30.1 | 25.8 | 29.4 | 26.0 |
| RC11 | 2 (Loopback) | 29.8 | 25.8 | 29.8 | 25.8 | 29.4 | 25.9 |
| | 75 (Loopback) | 29.8 | 25.8 | 29.9 | 25.8 | 29.4 | 26.0 |
| | 32 (+ F-SCH) | 29.8 | 25.9 | 29.9 | 25.8 | 29.5 | 26.0 |
| | 32 (+ SCH) | 29.8 | 25.8 | 29.8 | 25.8 | 29.4 | 25.9 |


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

**ANTENNA D**

| ID: | 50820 | Date: | 2/1/17 |
|---|---|---|---|

**1xRTT, BC10, SECONDARY 800**

| Radio Configuration (RC) | Service Option (SO) | Conducted Output Power (dBm) | | | | | |
|---|---|---|---|---|---|---|---|
| | | CH 450 - 817.25MHz | | CH 560 - 820MHz | | CH 670 - 822.75MHz | |
| | | Peak | Average | Peak | Average | Peak | Average |
| RC1 | 2 (Loopback) | 28.8 | 24.0 | 28.9 | 23.8 | 28.8 | 23.9 |
| | 55 (Loopback) | 28.8 | 23.9 | 28.8 | 23.9 | 28.8 | 23.9 |
| RC2 | 9 (Loopback) | 28.8 | 23.9 | 28.8 | 23.8 | 28.8 | 23.9 |
| | 55 (Loopback) | **29.0** | **24.0** | 28.7 | 23.9 | 28.8 | 23.9 |
| RC3 | 2 (Loopback) | 28.6 | 23.8 | 28.7 | 23.9 | 28.7 | 24.0 |
| | 55 (Loopback) | 28.6 | 23.9 | 28.6 | 23.9 | 28.7 | 23.8 |
| | 32 (+ F-SCH) | 28.6 | 23.9 | 28.7 | 23.8 | 28.8 | 23.9 |
| | 32 (+ SCH) | 28.6 | 23.8 | 28.7 | 23.9 | 28.9 | 23.8 |
| RC4 | 2 (Loopback) | 28.7 | 24.0 | 28.7 | 23.9 | 28.7 | 24.0 |
| | 55 (Loopback) | 28.6 | 23.8 | 28.6 | 23.9 | 28.7 | 23.9 |
| | 32 (+ F-SCH) | 28.6 | 23.9 | 28.6 | 23.8 | 28.8 | 23.8 |
| | 32 (+ SCH) | 28.6 | 23.9 | 29.0 | 23.8 | 28.8 | 23.8 |
| RC5 | 9 (Loopback) | 28.7 | 23.9 | 28.7 | 23.9 | 28.7 | 24.0 |
| | 55 (Loopback) | 28.6 | 23.8 | 28.7 | 23.9 | 28.7 | 23.8 |
| RC11 | 2 (Loopback) | 28.6 | 23.8 | 28.7 | 23.9 | 28.7 | 24.0 |
| | 75 (Loopback) | 28.6 | 23.8 | 28.7 | 23.9 | 28.7 | 23.9 |
| | 32 (+ F-SCH) | 28.6 | 23.8 | 28.6 | 23.9 | 28.7 | 23.9 |
| | 32 (+ SCH) | 28.6 | 23.8 | 28.6 | 23.9 | 28.6 | 23.9 |


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

**1xRTT, BC0, CELL BAND**

| Radio Configuration (RC) | Service Option (SO) | Conducted Output Power (dBm) | | | | | |
|---|---|---|---|---|---|---|---|
| | | CH 1013 - 824.7MHz | | CH 384 - 836.52MHz | | CH 777 - 848.31MHz | |
| | | Peak | Average | Peak | Average | Peak | Average |
| RC1 | 2 (Loopback) | 28.3 | 23.8 | 28.0 | 23.9 | 27.9 | 23.8 |
| | 55 (Loopback) | 28.3 | 24.0 | 28.0 | 23.9 | 27.8 | 23.9 |
| RC2 | 9 (Loopback) | 28.3 | 23.9 | 28.0 | 23.9 | 27.8 | 23.9 |
| | 55 (Loopback) | **28.5** | **24.0** | 28.2 | 23.9 | 28.3 | 23.9 |
| RC3 | 2 (Loopback) | 28.3 | 23.9 | 28.0 | 24.0 | 27.7 | 23.9 |
| | 55 (Loopback) | 28.2 | 23.9 | 28.0 | 23.9 | 27.7 | 23.8 |
| | 32 (+ F-SCH) | 28.3 | 23.9 | 28.1 | 23.8 | 27.7 | 23.7 |
| | 32 (+ SCH) | 28.3 | 23.9 | 28.0 | 23.8 | 27.8 | 23.7 |
| RC4 | 2 (Loopback) | 28.2 | 23.8 | 28.0 | 23.9 | 27.7 | 23.9 |
| | 55 (Loopback) | 28.2 | 23.8 | 28.0 | 23.9 | 27.7 | 23.9 |
| | 32 (+ F-SCH) | 28.4 | 23.9 | 28.0 | 23.8 | 27.8 | 23.8 |
| | 32 (+ SCH) | 28.4 | 23.8 | 28.1 | 23.8 | 27.9 | 23.7 |
| RC5 | 9 (Loopback) | 28.2 | 23.8 | 27.9 | 23.9 | 27.7 | 23.9 |
| | 55 (Loopback) | 28.2 | 23.8 | 28.0 | 23.9 | 27.6 | 23.9 |
| RC11 | 2 (Loopback) | 28.4 | 23.9 | 28.0 | 24.0 | 27.9 | 23.8 |
| | 75 (Loopback) | 28.4 | 23.9 | 28.0 | 23.9 | 27.7 | 23.7 |
| | 32 (+ F-SCH) | 28.3 | 23.9 | 28.0 | 23.9 | 27.7 | 23.7 |
| | 32 (+ SCH) | 28.4 | 23.9 | 28.0 | 23.9 | 27.7 | 23.7 |


UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701i
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

**1xRTT, BC1, PCS BAND**

| Radio Configuration (RC) | Service Option (SO) | Conducted Output Power (dBm) | | | | | |
|---|---|---|---|---|---|---|---|
| | | CH 25 - 1851.25MHz | | CH 600 - 1880MHz | | CH 1175 - 1908.75MHz | |
| | | Peak | Average | Peak | Average | Peak | Average |
| RC1 | 2 (Loopback) | 27.8 | 23.3 | 27.9 | 23.2 | 27.8 | 23.3 |
| | 55 (Loopback) | 27.7 | 23.3 | 28.1 | 23.3 | 27.8 | 23.3 |
| RC2 | 9 (Loopback) | 27.6 | 23.3 | 28.1 | 23.2 | 27.8 | 23.3 |
| | 55 (Loopback) | **28.4** | **23.5** | 28.1 | 23.2 | 27.7 | 23.3 |
| RC3 | 2 (Loopback) | 27.5 | 23.2 | 27.7 | 23.3 | 27.6 | 23.4 |
| | 55 (Loopback) | 27.5 | 23.2 | 27.7 | 23.3 | 27.5 | 23.2 |
| | 32 (+ F-SCH) | 27.7 | 23.3 | 27.8 | 23.3 | 27.7 | 23.3 |
| | 32 (+ SCH) | 27.7 | 23.2 | 27.7 | 23.3 | 27.2 | 23.4 |
| RC4 | 2 (Loopback) | 27.4 | 23.2 | 27.7 | 23.3 | 27.5 | 23.3 |
| | 55 (Loopback) | 27.4 | 23.2 | 27.8 | 23.3 | 27.5 | 23.3 |
| | 32 (+ F-SCH) | 27.8 | 23.2 | 27.7 | 23.3 | 27.7 | 23.3 |
| | 32 (+ SCH) | 27.7 | 23.2 | 27.8 | 23.3 | 27.7 | 23.3 |
| RC5 | 9 (Loopback) | 27.4 | 23.3 | 27.8 | 23.3 | 27.5 | 23.2 |
| | 55 (Loopback) | 27.4 | 23.3 | 27.6 | 23.3 | 27.4 | 23.3 |
| RC11 | 2 (Loopback) | 27.7 | 23.3 | 27.8 | 23.3 | 27.7 | 23.4 |
| | 75 (Loopback) | 27.4 | 23.3 | 27.7 | 23.3 | 27.5 | 23.3 |
| | 32 (+ F-SCH) | 27.4 | 23.3 | 27.7 | 23.3 | 27.4 | 23.3 |
| | 32 (+ SCH) | 27.4 | 23.4 | 27.7 | 23.3 | 27.4 | 23.3 |


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

### 7.2.2. 1xEV-DO - Release 0 (REL 0)

This procedure assumes the Agilent 8960 Test Set has the following applications installed and with valid license.

EVDO Release 0 - RTAP

- Call Setup > Shift & Preset
- Call Control:
  - Access Network Info > Cell Parameters > Sector ID > 00000000 : 00000000 : 00000000 : 00000000 > Subnet Mask > 0
  - Generator Info > Channel Data Info > Termination Parameters > Max Forward Packet Duration > 16 Slots
- Call Parms:
  - Cell Power > -105.5 dBm/1.23 MHz
  - Channel > (Enter channel number)
  - Application Config > Enhanced Test Application Protocol > RTAP
  - RTAP Rate > 153.6 kbps
  - Rvs Power Ctrl > Active bits
  - Protocol Rel > 0 (1xEV-DO)
- Press “Start Data Connection” when “Session Open” appear in “Active Cell”
- Rvs Power Ctrl > All Up bits (Maximum TxPout)

EVDO Release 0 - FTAP

- Call Setup > Shift & Preset
- Call Control:
  - Access Network Info > Cell Parameters > Sector ID > 00000000 : 00000000 : 00000000 : 00000000 > Subnet Mask > 0
  - Generator Info > Termination Parameters > Max Forward Packet Duration > 16 Slots
- Call Parms:
  - Cell Power > -105.5 dBm/1.23 MHz
  - Cell Band > (Select US Cellular or US PCS)
  - Channel > (Enter channel number)
  - Application Config > Enhanced Test Application Protocol > FTAP (default)
  - FTAP Rate > 307.2 kbps (2 Slot, QPSK)
  - Rvs Power Ctrl > Active bits
  - Protocol Rel > 0 (1xEV-DO)
- Press “Start Data Connection” when “Session Open” appear in “Active Cell”
- Rvs Power Ctrl > All Up bits (Maximum TxPout)

**RESULTS**


UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701i
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

**ANTENNA C**

| ID: | 50820 | Date: | 2/1/17 |
|---|---|---|---|

**EVDO REL 0 800MHz SECONDARY BAND**

| FTAP Rate | RTAP Rate | Channel | f (MHz) | Conducted Output Power (dBm) | |
|---|---|---|---|---|---|
| | | | | Peak | Average |
| 307.2 kbps (2 Slot QPSK) | 153.6 kbps | 450 | 817.25 | 30.40 | 25.80 |
| | | 560 | 820.00 | **30.60** | **25.90** |
| | | 670 | 822.75 | 30.50 | 25.85 |

**EVDO REL 0 850MHz BAND**

| FTAP Rate | RTAP Rate | Channel | Frequency (MHz) | Peak Conducted Power (dBm) | Average Conducted Power (dBm) |
|---|---|---|---|---|---|
| 307.2 Kbps (2 slot QPSK) | 153.6 Kbps | 1013 | 824.70 | 28.60 | 24.30 |
| | | 384 | 836.52 | **28.80** | **24.45** |
| | | 777 | 848.31 | 28.70 | 24.40 |

**EVDO REL 0 1900MHz BAND**

| FETAP Traffic Format | RETAP Data Payload Size | Channel | Frequency (MHz) | Peak Conducted Power (dBm) | Average Conducted Power (dBm) |
|---|---|---|---|---|---|
| 307.2k, QPSK / ACK channel is transmitted at all the slots | 4096 | 25 | 1851.25 | 30.40 | 25.85 |
| | | 600 | 1880.00 | **30.50** | **25.90** |
| | | 1175 | 1908.75 | 30.30 | 25.80 |


UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701i
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

**ANTENNA D**

| ID: | 50820 | Date: | 2/1/17 |
|---|---|---|---|

**EVDO REL 0 800MHz SECONDARY BAND**

| FTAP Rate | RTAP Rate | Channel | f (MHz) | Conducted Output Power (dBm) | |
|---|---|---|---|---|---|
| | | | | Peak | Average |
| 307.2 kbps (2 Slot QPSK) | 153.6 kbps | 450 | 817.25 | **28.20** | **23.90** |
| | | 560 | 820.00 | 27.92 | 23.80 |
| | | 670 | 822.75 | 27.90 | 23.80 |

**EVDO REL 0 850MHz BAND**

| FTAP Rate | RTAP Rate | Channel | Frequency (MHz) | Peak Conducted Power (dBm) | Average Conducted Power (dBm) |
|---|---|---|---|---|---|
| 307.2 Kbps (2 slot QPSK) | 153.6 Kbps | 1013 | 824.70 | **28.30** | **23.96** |
| | | 384 | 836.52 | 28.20 | 23.90 |
| | | 777 | 848.31 | 28.17 | 23.88 |

**EVDO REL 0 1900MHz BAND**

| FTAP Rate | RTAP Rate | Channel | Frequency (MHz) | Peak Conducted Power (dBm) | Average Conducted Power (dBm) |
|---|---|---|---|---|---|
| 307.2 Kbps (2 slot QPSK) | 153.6 Kbps | 25 | 1851.25 | **27.50** | **23.40** |
| | | 600 | 1880.00 | 27.38 | 23.30 |
| | | 1175 | 1908.75 | 27.30 | 23.30 |


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

### 7.2.3. 1xEV-DO - Revision A (REV A)

This procedure assumes the Agilent 8960 Test Set has the following applications installed and with valid license.

| Application | Rev, License |
|---|---|
| 1xEV-DO Terminal Test | A.09.13 |

EVDO Rev. A – RETAP

- Call Setup > Shift & Preset
- Cell Power > -60 dBm/1.23 MHz
- Protocol Rev > A (1xEV-DO-A)
- Application Config > Enhanced Test Application Protocol > RETAP
- R-Data Pkt Size > 4096
- Protocol Subtype Config > Release A Physical Layer Subtype > Subtype 2 > PL Subtype 2 Access Channel MAC Subtype > Default (Subtype 0)
- Access Network Info > Cell Parameters > Sector ID > 00000000: 00000000: 00000000: 00000000 > Subnet Mask > 0
- Generator Info > Termination Parameters > Max Forward Packet Duration >16 Slots > ACK R-Data After > Subpacket 0 (All ACK)
- Rvs Power Ctrl > All Up bits (to get the maximum power)

EVDO Rev. A - FETAP

- Call Setup > Shift & Preset
- Cell Power > -60 dBm/1.23 MHz
- Protocol Rev > A (1xEV-DO-A)
- Application Config > Enhanced Test Application Protocol > FETAP
- F-Traffic Format > 4 (1024, 2,128) Canonical (307.2k, QPSK)
- Protocol Subtype Config > Release A Physical Layer Subtype > Subtype 2 > PL Subtype 2 Access Channel MAC Subtype > Default (Subtype 0)
- Access Network Info > Cell Parameters > Sector ID > 00000000: 00000000: 00000000: 00000000 > Subnet Mask > 0
- Generator Info > Termination Parameters > Max Forward Packet Duration >16 Slots > ACK R-Data After > Subpacket 0 (All ACK)
- Rvs Power Ctrl > All Up bits (to get the maximum power)

**RESULTS**


UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701i
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

**ANTENNA C**

| ID: | 50820 | Date: | 2/1/17 |
|---|---|---|---|

**EVDO REV A 800MHz SECONDARY BAND**

| FETAP Traffic Format | RETAP Data Payload Size | Channel | Frequency (MHz) | Peak Conducted Power (dBm) | Average Conducted Power (dBm) |
|---|---|---|---|---|---|
| 307.2k, QPSK / ACK channel is transmitted at all the slots | 4096 | 450 | 817.25 | **30.80** | **26.00** |
| | | 560 | 820.00 | 30.70 | 25.90 |
| | | 670 | 822.75 | 30.65 | 25.85 |

**EVDO REV A 850MHz BAND**

| FETAP Traffic Format | RETAP Data Payload Size | Channel | Frequency (MHz) | Peak Conducted Power (dBm) | Average Conducted Power (dBm) |
|---|---|---|---|---|---|
| 307.2k, QPSK / ACK channel is transmitted at all the slots | 4096 | 1013 | 824.70 | 28.70 | 24.40 |
| | | 384 | 836.52 | **29.00** | **24.50** |
| | | 777 | 848.31 | 28.80 | 24.45 |

**EVDO REV A 1900MHz BAND**

| FETAP Traffic Format | RETAP Data Payload Size | Channel | Frequency (MHz) | Peak Conducted Power (dBm) | Average Conducted Power (dBm) |
|---|---|---|---|---|---|
| 307.2k, QPSK / ACK channel is transmitted at all the slots | 4096 | 25 | 1851.25 | 30.50 | 25.90 |
| | | 600 | 1880.00 | **30.60** | **26.00** |
| | | 1175 | 1908.75 | 30.50 | 25.85 |


UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701i
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

**ANTENNA D**

| ID: | 50820 | Date: | 2/1/17 |
|---|---|---|---|

**EVDO REV A 800MHz SECONDARY BAND**

| FETAP Traffic Format | RETAP Data Payload Size | Channel | Frequency (MHz) | Peak Conducted Power (dBm) | Average Conducted Power (dBm) |
|---|---|---|---|---|---|
| 307.2k, QPSK / ACK channel is transmitted at all the slots | 4096 | 450 | 817.25 | **28.90** | **24.00** |
| | | 560 | 820.00 | 28.80 | 23.90 |
| | | 670 | 822.75 | 28.75 | 23.85 |

**EVDO REV A 850MHz BAND**

| FETAP Traffic Format | RETAP Data Payload Size | Channel | Frequency (MHz) | Peak Conducted Power (dBm) | Average Conducted Power (dBm) |
|---|---|---|---|---|---|
| 307.2k, QPSK / ACK channel is transmitted at all the slots | 4096 | 1013 | 824.70 | 28.45 | 23.90 |
| | | 384 | 836.52 | **28.70** | **24.00** |
| | | 777 | 848.31 | 28.50 | 23.92 |

**EVDO REV A 1900MHz BAND**

| FETAP Traffic Format | RETAP Data Payload Size | Channel | Frequency (MHz) | Peak Conducted Power (dBm) | Average Conducted Power (dBm) |
|---|---|---|---|---|---|
| 307.2k, QPSK / ACK channel is transmitted at all the slots | 4096 | 25 | 1851.25 | 27.70 | 23.40 |
| | | 600 | 1880.00 | **27.80** | **23.50** |
| | | 1175 | 1908.75 | 27.73 | 23.46 |


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

## 7.3. UMTS

**TEST PROCEDURE**

The transmitter output was connected to the input terminal of Directional Coupler via calibrated coaxial cable. The output coupling terminal of the Directional Coupler was directly connected to a spectrum analyzer while the output through terminal connected to the communication test set via calibrated coaxial cable.

The output power was measured with the spectrum analyzer at the low, middle and high channel in each band.

- Set the spectrum analyzer span wide enough or greater than the modulated signal BW.
- Set a spectrum analyzer at peak detection mode with VBW ≥ RBW.≥ 26dB BW, typically 5MHz.
- Set a marker to point the corresponding peak value.

### 7.3.1. UMTS REL99

The following summary of these settings are illustrated below:

| | | |
|---|---|---|
| | Mode | Rel99 |
| | Subtest | - |
| WCDMA General Settings | Loopback Mode | Test Mode 1 |
| | Rel99 RMC | 12.2kbps RMC |
| | HSDPA FRC | Not Applicable |
| | HSUPA Test | Not Applicable |
| | Power Control Algorithm | Algorithm2 |
| | βc | Not Applicable |
| | βd | Not Applicable |
| | βec | Not Applicable |
| | βc/βd | 8/15 |
| | βhs | Not Applicable |
| | βed | Not Applicable |

**RESULTS**


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

**ANTENNA C**

| ID: | 29439 | Date: | 2/3/17 |
|---|---|---|---|

**Part 22 / RSS 132 850MHz Band**

| Band | UL Channel | DL Channel | Frequency (MHz) | Peak Power (dBm) | Average Power (dBm) |
|---|---|---|---|---|---|
| UMTS Rel. 99 850MHz | 4132 | 4357 | 826.4 | 29.35 | 25.45 |
| | 4183 | 4408 | 836.6 | **29.40** | **25.50** |
| | 4233 | 4458 | 846.6 | 29.30 | 25.40 |

**Part 24 / RSS 133 1900MHz Band**

| Band | UL Channel | DL Channel | Frequency (MHz) | Peak Power (dBm) | Average Power (dBm) |
|---|---|---|---|---|---|
| UMTS Rel. 99 1900MHz | 9262 | 9662 | 1852.4 | 29.32 | 25.42 |
| | 9400 | 9800 | 1880.0 | 29.35 | 25.40 |
| | 9538 | 9938 | 1907.6 | **29.42** | **25.50** |

**Part 27 / RSS 139 1700MHz Band**

| Band | UL Channel | DL Channel | Frequency (MHz) | Peak Power (dBm) | Average Power (dBm) |
|---|---|---|---|---|---|
| UMTS Rel. 99 1700MHz | 1312 | 1537 | 1712.4 | **29.46** | **25.50** |
| | 1413 | 1638 | 1732.6 | 29.44 | 25.45 |
| | 1513 | 1738 | 1752.6 | 29.34 | 25.40 |

**ANTENNA D**

| ID: | 29439 | Date: | 2/3/17 |
|---|---|---|---|

**Part 22 / RSS 132 850MHz Band**

| Band | UL Channel | DL Channel | Frequency (MHz) | Peak Power (dBm) | Average Power (dBm) |
|---|---|---|---|---|---|
| UMTS Rel. 99 850MHz | 4132 | 4357 | 826.4 | 29.20 | 24.90 |
| | 4183 | 4408 | 836.6 | **29.30** | **25.00** |
| | 4233 | 4458 | 846.6 | 29.15 | 24.85 |

**Part 24 / RSS 133 1900MHz Band**

| Band | UL Channel | DL Channel | Frequency (MHz) | Peak Power (dBm) | Average Power (dBm) |
|---|---|---|---|---|---|
| UMTS Rel. 99 1900MHz | 9262 | 9662 | 1852.4 | 28.35 | 24.40 |
| | 9400 | 9800 | 1880.0 | **28.50** | **24.50** |
| | 9538 | 9938 | 1907.6 | 28.30 | 24.35 |

**Part 27 / RSS 139 1700MHz Band**

| Band | UL Channel | DL Channel | Frequency (MHz) | Peak Power (dBm) | Average Power (dBm) |
|---|---|---|---|---|---|
| UMTS Rel. 99 1700MHz | 1312 | 1537 | 1712.4 | **29.50** | **25.50** |
| | 1413 | 1638 | 1732.6 | 29.40 | 25.40 |
| | 1513 | 1738 | 1752.6 | 29.35 | 25.42 |


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

### 7.3.2. HSDPA REL 5

The following 4 Sub-tests were completed according to Release 6 procedures in section 5.2 of 3GPP TS34.121.

Summary of settings are illustrated below:

| | Mode | Rel5 HSDPA | | | |
|---|---|---|---|---|---|
| | Subtest | 1 | 2 | 3 | 4 |
| WCDMA General Settings | Loopback Mode | Test Mode 1 | | | |
| | Rel99 RMC | 12.2kbps RMC | | | |
| | HSDPA FRC | H-Set1 | | | |
| | Power Control Algorithm | Algorithm 2 | | | |
| | βc | 2/15 | 11/15 | 15/15 | 15/15 |
| | βd | 15/15 | 15/15 | 8/15 | 4/15 |
| | Bd (SF) | 64 | | | |
| | βc/βd | 2/15 | 11/15 | 15/8 | 15/4 |
| | βhs | 4/15 | 24/15 | 30/15 | 30/15 |
| | MPR (dB) | 0 | 0 | 0.5 | 0.5 |
| HSDPA Specific Settings | $D_{ACK}$ | 8 | | | |
| | $D_{NAK}$ | 8 | | | |
| | DCQI | 8 | | | |
| | Ack-Nack repetition factor | 3 | | | |
| | CQI Feedback (Table 5.2B.4) | 4ms | | | |
| | CQI Repetition Factor (Table 5.2B.4) | 2 | | | |
| | Ahs =βhs/βc | 30/15 | | | |

**RESULT**


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

**ANTENNA C**

| ID: | 29439 | Date: | 2/3/17 |
|---|---|---|---|

**Part 22 / RSS 132 850MHz Band**

| Band | Subtest | UL Channel | DL Channel | Frequency (MHz) | Peak Power (dBm) | Average Power (dBm) |
|---|---|---|---|---|---|---|
| UMTS HSDPA 850MHz | 1 | 4132 | 4357 | 826.4 | **28.50** | **24.50** |
| | | 4183 | 4408 | 836.6 | 28.36 | 24.40 |
| | | 4233 | 4458 | 846.6 | 28.47 | 24.44 |
| | 2 | 4132 | 4357 | 826.4 | 28.36 | 24.47 |
| | | 4183 | 4408 | 836.6 | 28.45 | 24.40 |
| | | 4233 | 4458 | 846.6 | 28.40 | 24.43 |
| | 3 | 4132 | 4357 | 826.4 | 28.02 | 24.00 |
| | | 4183 | 4408 | 836.6 | 28.36 | 23.90 |
| | | 4233 | 4458 | 846.6 | 28.00 | 23.85 |
| | 4 | 4132 | 4357 | 826.4 | 28.04 | 24.00 |
| | | 4183 | 4408 | 836.6 | 28.36 | 23.95 |
| | | 4233 | 4458 | 846.6 | 28.00 | 23.92 |

**Part 24 / RSS 133 1900MHz Band**

| Band | Subtest | UL Channel | DL Channel | Frequency (MHz) | Peak Power (dBm) | Average Power (dBm) |
|---|---|---|---|---|---|---|
| UMTS HSDPA 1900MHz | 1 | 9262 | 9662 | 1852.4 | 29.30 | 24.48 |
| | | 9400 | 9800 | 1880.0 | **29.40** | **24.50** |
| | | 9538 | 9938 | 1907.6 | 29.20 | 24.40 |
| | 2 | 9262 | 9662 | 1852.4 | 29.06 | 24.40 |
| | | 9400 | 9800 | 1880.0 | 29.03 | 24.37 |
| | | 9538 | 9938 | 1907.6 | 28.85 | 24.42 |
| | 3 | 9262 | 9662 | 1852.4 | 28.70 | 24.00 |
| | | 9400 | 9800 | 1880.0 | 28.60 | 23.95 |
| | | 9538 | 9938 | 1907.6 | 28.65 | 23.90 |
| | 4 | 9262 | 9662 | 1852.4 | 28.90 | 23.85 |
| | | 9400 | 9800 | 1880.0 | 28.80 | 24.00 |
| | | 9538 | 9938 | 1907.6 | 28.70 | 23.90 |

**Part 27 / RSS 139 1700MHz Band**

| Band | Subtest | UL Channel | DL Channel | Frequency (MHz) | Peak Power (dBm) | Average Power (dBm) |
|---|---|---|---|---|---|---|
| UMTS HSDPA 1700MHz | 1 | 1312 | 1537 | 1712.4 | 29.20 | 24.49 |
| | | 1413 | 1638 | 1732.6 | **29.23** | **24.50** |
| | | 1513 | 1738 | 1752.6 | 29.18 | 24.40 |
| | 2 | 1312 | 1537 | 1712.4 | 29.12 | 24.48 |
| | | 1413 | 1638 | 1732.6 | 29.10 | 24.46 |
| | | 1513 | 1738 | 1752.6 | 29.03 | 24.40 |
| | 3 | 1312 | 1537 | 1712.4 | 28.80 | 24.00 |
| | | 1413 | 1638 | 1732.6 | 28.90 | 23.95 |
| | | 1513 | 1738 | 1752.6 | 28.70 | 24.00 |
| | 4 | 1312 | 1537 | 1712.4 | 28.67 | 23.80 |
| | | 1413 | 1638 | 1732.6 | 28.80 | 23.85 |
| | | 1513 | 1738 | 1752.6 | 28.70 | 24.00 |


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

**ANTENNA D**

| ID: | 29439 | Date: | 2/3/17 |
|---|---|---|---|

**Part 22 / RSS 132 850MHz Band**

| Band | Subtest | UL Channel | DL Channel | Frequency (MHz) | Peak Power (dBm) | Average Power (dBm) |
|---|---|---|---|---|---|---|
| UMTS HSDPA 850MHz | 1 | 4132 | 4357 | 826.4 | **28.00** | **24.00** |
| | | 4183 | 4408 | 836.6 | 27.80 | 23.80 |
| | | 4233 | 4458 | 846.6 | 27.90 | 23.85 |
| | 2 | 4132 | 4357 | 826.4 | 27.75 | 23.96 |
| | | 4183 | 4408 | 836.6 | 27.80 | 23.92 |
| | | 4233 | 4458 | 846.6 | 27.72 | 23.95 |
| | 3 | 4132 | 4357 | 826.4 | 27.20 | 23.50 |
| | | 4183 | 4408 | 836.6 | 27.30 | 23.40 |
| | | 4233 | 4458 | 846.6 | 27.20 | 23.35 |
| | 4 | 4132 | 4357 | 826.4 | 27.17 | 23.60 |
| | | 4183 | 4408 | 836.6 | 27.30 | 23.50 |
| | | 4233 | 4458 | 846.6 | 27.25 | 23.52 |

**Part 24 / RSS 133 1900MHz Band**

| Band | Subtest | UL Channel | DL Channel | Frequency (MHz) | Peak Power (dBm) | Average Power (dBm) |
|---|---|---|---|---|---|---|
| UMTS HSDPA 1900MHz | 1 | 9262 | 9662 | 1852.4 | **28.41** | **23.50** |
| | | 9400 | 9800 | 1880.0 | 28.30 | 23.40 |
| | | 9538 | 9938 | 1907.6 | 28.40 | 23.30 |
| | 2 | 9262 | 9662 | 1852.4 | 28.38 | 23.45 |
| | | 9400 | 9800 | 1880.0 | 28.10 | 23.30 |
| | | 9538 | 9938 | 1907.6 | 28.21 | 23.30 |
| | 3 | 9262 | 9662 | 1852.4 | 27.40 | 23.10 |
| | | 9400 | 9800 | 1880.0 | 27.45 | 23.00 |
| | | 9538 | 9938 | 1907.6 | 27.30 | 22.95 |
| | 4 | 9262 | 9662 | 1852.4 | 27.40 | 22.95 |
| | | 9400 | 9800 | 1880.0 | 27.60 | 22.90 |
| | | 9538 | 9938 | 1907.6 | 27.30 | 23.00 |

**Part 27 / RSS 139 1700MHz Band**

| Band | Subtest | UL Channel | DL Channel | Frequency (MHz) | Peak Power (dBm) | Average Power (dBm) |
|---|---|---|---|---|---|---|
| UMTS HSDPA 1700MHz | 1 | 1312 | 1537 | 1712.4 | **29.30** | **24.50** |
| | | 1413 | 1638 | 1732.6 | 29.00 | 24.30 |
| | | 1513 | 1738 | 1752.6 | 29.18 | 24.35 |
| | 2 | 1312 | 1537 | 1712.4 | 29.23 | 24.45 |
| | | 1413 | 1638 | 1732.6 | 29.10 | 24.40 |
| | | 1513 | 1738 | 1752.6 | 29.20 | 24.40 |
| | 3 | 1312 | 1537 | 1712.4 | 28.90 | 24.00 |
| | | 1413 | 1638 | 1732.6 | 28.95 | 24.02 |
| | | 1513 | 1738 | 1752.6 | 28.80 | 23.95 |
| | 4 | 1312 | 1537 | 1712.4 | 28.90 | 23.95 |
| | | 1413 | 1638 | 1732.6 | 28.75 | 23.95 |
| | | 1513 | 1738 | 1752.6 | 29.04 | 23.90 |


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

### 7.3.3. HSPA REL 6 (HSDPA & HSUPA)

**TEST PROCEDURE**

The following summary of these settings are illustrated below:

| | Mode | Rel6 HSUPA | Rel6 HSUPA | Rel6 HSUPA | Rel6 HSUPA | Rel6 HSUPA |
|---|---|---|---|---|---|---|
| | Subtest | 1 | 2 | 3 | 4 | 5 |
| WCDMA General Settings | Loopback Mode | Test Mode 1 | | | | |
| | Rel99 RMC | 12.2kbps RMC | | | | |
| | HSDPA FRC | H-Set1 | | | | |
| | HSUPA Test | HSUPA Loopback | | | | |
| | Power Control Algorithm | Algorithm2 | | | | |
| | βc | 11/15 | 6/15 | 15/15 | 2/15 | 15/15 |
| | βd | 15/15 | 15/15 | 9/15 | 15/15 | 0 |
| | βec | 209/225 | 12/15 | 30/15 | 2/15 | 5/15 |
| | βc/βd | 11/15 | 6/15 | 15/9 | 2/15 | 15/1 |
| | βhs | 22/15 | 12/15 | 30/15 | 4/15 | 5/15 |
| | βed | 1309/225 | 94/75 | 47/15 | 56/75 | 47/15 |
| | CM (dB) | 1 | 3 | 2 | 3 | 1 |
| | MPR (dB) | 0 | 2 | 1 | 2 | 0 |
| HSDPA Specific Settings | DACK | 8 | | | | |
| | DNAK | 8 | | | | |
| | DCQI | 8 | | | | |
| | Ack-Nack repetition factor | 3 | | | | |
| | CQI Feedback (Table 5.2B.4) | 4ms | | | | |
| | CQI Repetition Factor (Table 5.2B.4) | 2 | | | | |
| | Ahs = βhs/βc | 30/15 | | | | |
| HSUPA Specific Settings | D E-DPCCH | 6 | 8 | 8 | 5 | 7 |
| | DHARQ | 0 | 0 | 0 | 0 | 0 |
| | AG Index | 20 | 12 | 15 | 17 | 12 |
| | ETFCI (from 34.121 Table C.11.1.3) | 75 | 67 | 92 | 71 | 67 |
| | Associated Max UL Data Rate kbps | 242.1 | 174.9 | 482.8 | 205.8 | 308.9 |
| | Reference E_TFCIs | E-TFCI 11<br>E-TFCI PO 4<br>E-TFCI 67<br>E-TFCI PO 18<br>E-TFCI 71<br>E-TFCI PO 23<br>E-TFCI 75<br>E-TFCI PO 26<br>E-TFCI 81<br>E-TFCI PO 27 | | E-TFCI 11<br>E-TFCI PO 4<br>E-TFCI 92<br>E-TFCI PO 18 | E-TFCI 11<br>E-TFCI PO 4<br>E-TFCI 67<br>E-TFCI PO 18<br>E-TFCI 71<br>E-TFCI PO 23<br>E-TFCI 75<br>E-TFCI PO 26<br>E-TFCI 81<br>E-TFCI PO 27 | |

**RESULTS**


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

**ANTENNA C**

| ID: | 29439 | Date: | 2/3/17 |
|---|---|---|---|

**Part 22 / RSS 132 850MHz Band**

| Band | Subtest | UL Channel | DL Channel | Frequency (MHz) | Peak Power (dBm) | Average Power (dBm) |
|---|---|---|---|---|---|---|
| UMTS HSUPA 850MHz | 1 | 4132 | 4357 | 826.4 | 28.40 | 24.40 |
| | | 4183 | 4408 | 836.6 | **28.50** | **24.45** |
| | | 4233 | 4458 | 846.6 | 28.35 | 24.40 |
| | 2 | 4132 | 4357 | 826.4 | 26.70 | 22.50 |
| | | 4183 | 4408 | 836.6 | 26.80 | 22.40 |
| | | 4233 | 4458 | 846.6 | 26.90 | 22.45 |
| | 3 | 4132 | 4357 | 826.4 | 27.50 | 23.50 |
| | | 4183 | 4408 | 836.6 | 27.40 | 23.60 |
| | | 4233 | 4458 | 846.6 | 27.60 | 23.52 |
| | 4 | 4132 | 4357 | 826.4 | 26.65 | 22.40 |
| | | 4183 | 4408 | 836.6 | 26.70 | 22.50 |
| | | 4233 | 4458 | 846.6 | 26.73 | 22.47 |
| | 5 | 4132 | 4357 | 826.4 | 28.39 | 24.40 |
| | | 4183 | 4408 | 836.6 | 28.36 | 24.36 |
| | | 4233 | 4458 | 846.6 | 28.35 | 24.40 |

**Part 24 / RSS 133 1900MHz Band**

| Band | Subtest | UL Ch | DL Ch | Frequency | Conducted Output Power (dBm) | |
|---|---|---|---|---|---|---|
| | | | | | Peak | Average |
| UMTS HSUPA 1900MHz (Band 2) | 1 | 9262 | 9662 | 1852.4 | 28.95 | 24.50 |
| | | 9400 | 9800 | 1880.0 | 28.90 | 24.35 |
| | | 9538 | 9938 | 1907.6 | **29.10** | **24.55** |
| | 2 | 9262 | 9662 | 1852.4 | 27.10 | 22.60 |
| | | 9400 | 9800 | 1880.0 | 27.05 | 22.50 |
| | | 9538 | 9938 | 1907.6 | 27.20 | 22.50 |
| | 3 | 9262 | 9662 | 1852.4 | 28.00 | 23.60 |
| | | 9400 | 9800 | 1880.0 | 28.10 | 23.50 |
| | | 9538 | 9938 | 1907.6 | 28.15 | 23.45 |
| | 4 | 9262 | 9662 | 1852.4 | 27.20 | 22.40 |
| | | 9400 | 9800 | 1880.0 | 27.30 | 22.45 |
| | | 9538 | 9938 | 1907.6 | 27.24 | 22.50 |
| | 5 | 9262 | 9662 | 1852.4 | 29.00 | 24.50 |
| | | 9400 | 9800 | 1880.0 | 28.95 | 24.40 |
| | | 9538 | 9938 | 1907.6 | 28.90 | 24.45 |


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

**Part 27 / RSS 139 1700MHz Band**

| Band | Subtest | UL Channel | DL Channel | Frequency (MHz) | Peak Power (dBm) | Average Power (dBm) |
|---|---|---|---|---|---|---|
| UMTS HSUPA 1700MHz | 1 | 1312 | 1537 | 1712.4 | **29.35** | **24.50** |
| | | 1413 | 1638 | 1732.6 | 29.30 | 24.40 |
| | | 1513 | 1738 | 1752.6 | 29.25 | 24.40 |
| | 2 | 1312 | 1537 | 1712.4 | 28.84 | 22.40 |
| | | 1413 | 1638 | 1732.6 | 28.75 | 22.45 |
| | | 1513 | 1738 | 1752.6 | 28.83 | 22.37 |
| | 3 | 1312 | 1537 | 1712.4 | 29.19 | 23.40 |
| | | 1413 | 1638 | 1732.6 | 29.11 | 23.50 |
| | | 1513 | 1738 | 1752.6 | 29.01 | 23.37 |
| | 4 | 1312 | 1537 | 1712.4 | 28.65 | 22.40 |
| | | 1413 | 1638 | 1732.6 | 28.58 | 22.35 |
| | | 1513 | 1738 | 1752.6 | 28.69 | 22.40 |
| | 5 | 1312 | 1537 | 1712.4 | 29.25 | 24.40 |
| | | 1413 | 1638 | 1732.6 | 29.19 | 24.35 |
| | | 1513 | 1738 | 1752.6 | 29.27 | 24.40 |


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

**ANTENNA D**

| ID: | 29439 | Date: | 2/3/17 |
|---|---|---|---|

**Part 22 / RSS 132 850MHz Band**

| Band | Subtest | UL Channel | DL Channel | Frequency (MHz) | Peak Power (dBm) | Average Power (dBm) |
|---|---|---|---|---|---|---|
| UMTS HSUPA 850MHz | 1 | 4132 | 4357 | 826.4 | **28.10** | **23.95** |
| | | 4183 | 4408 | 836.6 | 28.05 | 23.90 |
| | | 4233 | 4458 | 846.6 | 27.95 | 23.85 |
| | 2 | 4132 | 4357 | 826.4 | 27.00 | 22.00 |
| | | 4183 | 4408 | 836.6 | 26.80 | 21.90 |
| | | 4233 | 4458 | 846.6 | 26.85 | 21.95 |
| | 3 | 4132 | 4357 | 826.4 | 27.65 | 23.00 |
| | | 4183 | 4408 | 836.6 | 27.70 | 22.95 |
| | | 4233 | 4458 | 846.6 | 27.80 | 23.10 |
| | 4 | 4132 | 4357 | 826.4 | 26.96 | 22.00 |
| | | 4183 | 4408 | 836.6 | 27.05 | 21.93 |
| | | 4233 | 4458 | 846.6 | 27.00 | 22.37 |
| | 5 | 4132 | 4357 | 826.4 | 27.94 | 23.92 |
| | | 4183 | 4408 | 836.6 | 27.85 | 23.87 |
| | | 4233 | 4458 | 846.6 | 27.90 | 23.90 |

**Part 24 / RSS 133 1900MHz Band**

| Band | Subtest | UL Ch | DL Ch | Frequency | Conducted Output Power (dBm) | |
|---|---|---|---|---|---|---|
| | | | | | Peak | Average |
| UMTS HSUPA 1900MHz | 1 | 9262 | 9662 | 1852.4 | 27.85 | 22.90 |
| | | 9400 | 9800 | 1880.0 | **27.92** | **22.95** |
| | | 9538 | 9938 | 1907.6 | 27.75 | 22.87 |
| | 2 | 9262 | 9662 | 1852.4 | 26.15 | 21.00 |
| | | 9400 | 9800 | 1880.0 | 26.20 | 21.05 |
| | | 9538 | 9938 | 1907.6 | 26.27 | 21.10 |
| | 3 | 9262 | 9662 | 1852.4 | 27.20 | 22.05 |
| | | 9400 | 9800 | 1880.0 | 27.25 | 22.12 |
| | | 9538 | 9938 | 1907.6 | 27.28 | 22.00 |
| | 4 | 9262 | 9662 | 1852.4 | 26.30 | 21.02 |
| | | 9400 | 9800 | 1880.0 | 26.35 | 21.00 |
| | | 9538 | 9938 | 1907.6 | 26.40 | 20.95 |
| | 5 | 9262 | 9662 | 1852.4 | 27.68 | 22.92 |
| | | 9400 | 9800 | 1880.0 | 27.85 | 22.90 |
| | | 9538 | 9938 | 1907.6 | 27.78 | 22.85 |


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

**Part 27 / RSS 139 1700MHz Band**

| Band | Subtest | UL Channel | DL Channel | Frequency (MHz) | Peak Power (dBm) | Average Power (dBm) |
|---|---|---|---|---|---|---|
| UMTS HSUPA 1700MHz | 1 | 1312 | 1537 | 1712.4 | **28.70** | **24.45** |
| | | 1413 | 1638 | 1732.6 | 28.50 | 24.40 |
| | | 1513 | 1738 | 1752.6 | 28.48 | 24.40 |
| | 2 | 1312 | 1537 | 1712.4 | 26.60 | 22.50 |
| | | 1413 | 1638 | 1732.6 | 26.50 | 22.55 |
| | | 1513 | 1738 | 1752.6 | 26.65 | 22.43 |
| | 3 | 1312 | 1537 | 1712.4 | 27.50 | 23.50 |
| | | 1413 | 1638 | 1732.6 | 27.40 | 23.40 |
| | | 1513 | 1738 | 1752.6 | 27.38 | 23.52 |
| | 4 | 1312 | 1537 | 1712.4 | 26.50 | 22.40 |
| | | 1413 | 1638 | 1732.6 | 26.62 | 22.45 |
| | | 1513 | 1738 | 1752.6 | 26.45 | 22.50 |
| | 5 | 1312 | 1537 | 1712.4 | 28.38 | 24.40 |
| | | 1413 | 1638 | 1732.6 | 28.42 | 24.40 |
| | | 1513 | 1738 | 1752.6 | 28.36 | 24.35 |


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

### 7.3.4. DUAL CARRIER HSDPA

**DC-HSDPA (Rel 8, CAT 24)**

The following tests were completed according to procedures in section 7.3.13 of 3GPP TS34.108 v9.5.0. A summary of these settings are illustrated below:
Downlink Physical Channels are set as per 3GPP TS34.121-1 v9.0.0 E.5.0

**Table E.5.0: Levels for HSDPA connection setup**

| Parameter During Connection setup | Unit | Value |
|---|---|---|
| P-CPICH_Ec/Ior | dB | -10 |
| P-CCPCH and SCH_Ec/Ior | dB | -12 |
| PICH _Ec/Ior | dB | -15 |
| HS-PDSCH | dB | off |
| HS-SCCH_1 | dB | off |
| DPCH_Ec/Ior | dB | -5 |
| OCNS_Ec/Ior | dB | -3.1 |

Call is set up as per 3GPP TS34.108 v9.5.0 sub clause 7.3.13

The configurations of the fixed reference channels for HSDPA RF tests are described in 3GPP TS 34.121, annex C for FDD and 3GPP TS 34.122.

**Table C.8.1.12: Fixed Reference Channel H-Set 12**

| Parameter | Unit | Value |
|---|---|---|
| Nominal Avg. Inf. Bit Rate | kbps | 60 |
| Inter-TTI Distance | TTI's | 1 |
| Number of HARQ Processes | Processes | 6 |
| Information Bit Payload ( $N_{INF}$ ) | Bits | 120 |
| Number Code Blocks | Blocks | 1 |
| Binary Channel Bits Per TTI | Bits | 960 |
| Total Available SML's in UE | SML's | 19200 |
| Number of SML's per HARQ Proc. | SML's | 3200 |
| Coding Rate | | 0.15 |
| Number of Physical Channel Codes | Codes | 1 |
| Modulation | | QPSK |
| Note 1: The RMC is intended to be used for DC-HSDPA mode and both cells shall transmit with identical parameters as listed in the table. | | |
| Note 2: Maximum number of transmission is limited to 1, i.e., retransmission is not allowed. The redundancy and constellation version 0 shall be used. | | |

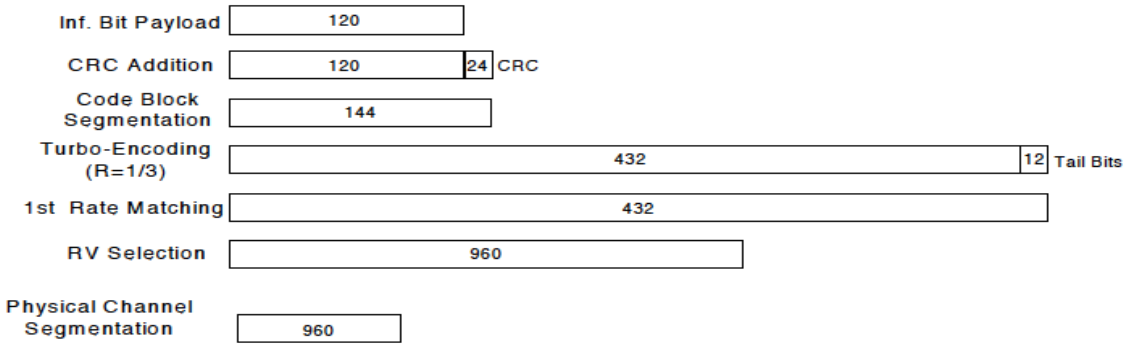



**Figure C.8.19: Coding rate for Fixed reference Channel H-Set 12 (QPSK)**


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

The following 4 Sub-tests for HSDPA were completed according to Release 6 procedures in section 5.2 of 3GPP TS34.121. A summary of subtest settings are illustrated below:

| | Mode | Rel6 HSDPA | Rel6 HSDPA | Rel6 HSDPA | Rel6 HSDPA |
|---|---|---|---|---|---|
| | Subtest | 1 | 2 | 3 | 4 |
| WCDMA General Settings | Loopback Mode | Test Mode 1 | | | |
| | Rel99 RMC | 12.2kbps RMC | | | |
| | HSDPA FRC | H-Set1 | | | |
| | Power Control Algorithm | Algorithm2 | | | |
| | βc | 2/15 | 12/15 | 15/15 | 15/15 |
| | βd | 15/15 | 15/15 | 8/15 | 4/15 |
| | βd (SF) | 64 | | | |
| | βc/βd | 2/15 | 12/15 | 15/8 | 15/4 |
| | βhs | 4/15 | 24/15 | 30/15 | 30/15 |
| | MPR | 0 | 0 | 0.5 | 0.5 |
| HSDPA Specific Settings | DACK | 8 | | | |
| | DNAK | 8 | | | |
| | DCQI | 8 | | | |
| | Ack-Nack Repetition factor | 3 | | | |
| | CQI Feedback | 4ms | | | |
| | CQI Repetition Factor | 2 | | | |
| | Ahs = βhs/ βc | 30/15 | | | |

**RESULT**


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

**ANTENNA C**

| ID: | 50820 | Date: | 2/3/17 |
|---|---|---|---|

**Part 22 / RSS 132 850MHz Band**

| Band | Subtest | UL Channel | DL Channel | Frequency (MHz) | Peak Power (dBm) | Average Power (dBm) |
|---|---|---|---|---|---|---|
| UMTS HSDPA 850MHz | 1 | 4132 | 4357 | 826.4 | 28.95 | 24.40 |
| | | 4183 | 4408 | 836.6 | **29.08** | **24.45** |
| | | 4233 | 4458 | 846.6 | 29.00 | 24.42 |
| | 2 | 4132 | 4357 | 826.4 | 28.67 | 24.37 |
| | | 4183 | 4408 | 836.6 | 28.81 | 24.40 |
| | | 4233 | 4458 | 846.6 | 28.91 | 24.40 |
| | 3 | 4132 | 4357 | 826.4 | 28.63 | 24.00 |
| | | 4183 | 4408 | 836.6 | 28.50 | 23.95 |
| | | 4233 | 4458 | 846.6 | 28.54 | 23.90 |
| | 4 | 4132 | 4357 | 826.4 | 28.45 | 24.00 |
| | | 4183 | 4408 | 836.6 | 28.63 | 24.00 |
| | | 4233 | 4458 | 846.6 | 28.50 | 23.90 |

**Part 24 / RSS 133 1900MHz Band**

| Band | Subtest | UL Channel | DL Channel | Frequency (MHz) | Peak Power (dBm) | Average Power (dBm) |
|---|---|---|---|---|---|---|
| UMTS HSDPA 1900MHz | 1 | 9262 | 9662 | 1852.4 | **28.80** | **24.50** |
| | | 9400 | 9800 | 1880.0 | 28.70 | 24.40 |
| | | 9538 | 9938 | 1907.6 | 28.75 | 24.45 |
| | 2 | 9262 | 9662 | 1852.4 | 28.68 | 24.43 |
| | | 9400 | 9800 | 1880.0 | 28.70 | 24.40 |
| | | 9538 | 9938 | 1907.6 | 28.74 | 24.46 |
| | 3 | 9262 | 9662 | 1852.4 | 28.30 | 24.00 |
| | | 9400 | 9800 | 1880.0 | 28.15 | 23.95 |
| | | 9538 | 9938 | 1907.6 | 28.20 | 24.00 |
| | 4 | 9262 | 9662 | 1852.4 | 28.05 | 23.86 |
| | | 9400 | 9800 | 1880.0 | 27.95 | 23.90 |
| | | 9538 | 9938 | 1907.6 | 28.00 | 23.96 |

**Part 27 / RSS 139 1700MHz Band**

| Band | Subtest | UL Channel | DL Channel | Frequency (MHz) | Peak Power (dBm) | Average Power (dBm) |
|---|---|---|---|---|---|---|
| UMTS HSDPA 1700MHz | 1 | 1312 | 1537 | 1712.4 | 28.80 | 24.40 |
| | | 1413 | 1638 | 1732.6 | 28.70 | 24.45 |
| | | 1513 | 1738 | 1752.6 | **28.85** | **24.50** |
| | 2 | 1312 | 1537 | 1712.4 | 28.68 | 24.42 |
| | | 1413 | 1638 | 1732.6 | 28.80 | 24.40 |
| | | 1513 | 1738 | 1752.6 | 28.65 | 24.46 |
| | 3 | 1312 | 1537 | 1712.4 | 28.10 | 24.00 |
| | | 1413 | 1638 | 1732.6 | 28.15 | 23.97 |
| | | 1513 | 1738 | 1752.6 | 28.20 | 24.00 |
| | 4 | 1312 | 1537 | 1712.4 | 28.00 | 23.95 |
| | | 1413 | 1638 | 1732.6 | 28.16 | 23.86 |
| | | 1513 | 1738 | 1752.6 | 28.23 | 23.90 |


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

**ANTENNA D**

| ID: | 50820 | Date: | 2/3/17 |
|---|---|---|---|

**Part 22 / RSS 132 850MHz Band**

| Band | Subtest | UL Channel | DL Channel | Frequency (MHz) | Peak Power (dBm) | Average Power (dBm) |
|---|---|---|---|---|---|---|
| UMTS HSDPA 850MHz | 1 | 4132 | 4357 | 826.4 | 28.60 | 23.90 |
| | | 4183 | 4408 | 836.6 | **28.65** | **23.95** |
| | | 4233 | 4458 | 846.6 | 28.57 | 23.92 |
| | 2 | 4132 | 4357 | 826.4 | 28.40 | 23.90 |
| | | 4183 | 4408 | 836.6 | 28.54 | 23.85 |
| | | 4233 | 4458 | 846.6 | 28.47 | 23.80 |
| | 3 | 4132 | 4357 | 826.4 | 28.20 | 23.50 |
| | | 4183 | 4408 | 836.6 | 28.05 | 23.40 |
| | | 4233 | 4458 | 846.6 | 28.22 | 23.35 |
| | 4 | 4132 | 4357 | 826.4 | 28.30 | 23.50 |
| | | 4183 | 4408 | 836.6 | 28.25 | 23.40 |
| | | 4233 | 4458 | 846.6 | 28.20 | 23.43 |

**Part 24 / RSS 133 1900MHz Band**

| Band | Subtest | UL Channel | DL Channel | Frequency (MHz) | Peak Power (dBm) | Average Power (dBm) |
|---|---|---|---|---|---|---|
| UMTS HSDPA 1900MHz | 1 | 9262 | 9662 | 1852.4 | **27.80** | **23.00** |
| | | 9400 | 9800 | 1880.0 | 27.75 | 22.86 |
| | | 9538 | 9938 | 1907.6 | 27.70 | 22.86 |
| | 2 | 9262 | 9662 | 1852.4 | 27.70 | 22.86 |
| | | 9400 | 9800 | 1880.0 | 27.75 | 22.85 |
| | | 9538 | 9938 | 1907.6 | 27.72 | 22.75 |
| | 3 | 9262 | 9662 | 1852.4 | 27.30 | 22.50 |
| | | 9400 | 9800 | 1880.0 | 27.23 | 22.55 |
| | | 9538 | 9938 | 1907.6 | 27.40 | 22.60 |
| | 4 | 9262 | 9662 | 1852.4 | 27.45 | 22.45 |
| | | 9400 | 9800 | 1880.0 | 27.30 | 22.40 |
| | | 9538 | 9938 | 1907.6 | 27.25 | 22.50 |

**Part 27 / RSS 139 1700MHz Band**

| Band | Subtest | UL Channel | DL Channel | Frequency (MHz) | Peak Power (dBm) | Average Power (dBm) |
|---|---|---|---|---|---|---|
| UMTS HSDPA 1700MHz | 1 | 1312 | 1537 | 1712.4 | **29.00** | **24.45** |
| | | 1413 | 1638 | 1732.6 | 28.80 | 24.30 |
| | | 1513 | 1738 | 1752.6 | 28.75 | 24.40 |
| | 2 | 1312 | 1537 | 1712.4 | 28.70 | 24.40 |
| | | 1413 | 1638 | 1732.6 | 28.92 | 24.30 |
| | | 1513 | 1738 | 1752.6 | 28.90 | 24.42 |
| | 3 | 1312 | 1537 | 1712.4 | 28.41 | 24.00 |
| | | 1413 | 1638 | 1732.6 | 28.42 | 23.95 |
| | | 1513 | 1738 | 1752.6 | 28.40 | 23.85 |
| | 4 | 1312 | 1537 | 1712.4 | 28.42 | 23.95 |
| | | 1413 | 1638 | 1732.6 | 28.45 | 23.90 |
| | | 1513 | 1738 | 1752.6 | 28.20 | 24.00 |


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

# 8. CONDUCTED TEST RESULTS

## 8.1. OCCUPIED BANDWIDTH

**RULE PART(S)**
FCC: §2.1049
IC: RSS132; RSS133§2.3; RSS139

**LIMITS**
For reporting purposes only

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

**RESULTS**

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


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

**GSM GPRS MODE PART 22 AND 24 / RSS 132 AND 133**

| Band | Mode | Channel | f(MHz) | 99% BW (KHz) | -26dB BW (KHz) |
|---|---|---|---|---|---|
| CELL | GPRS | 190 | 836.6 | 248.5569 | 313.104 |
| PCS | GPRS | 661 | 1880 | 239.6962 | 291.791 |

**GSM EGPRS MODE PART 22 AND 24 / RSS 132 AND 133**

| Band | Mode | Channel | f(MHz) | 99% BW (KHz) | -26dB BW (KHz) |
|---|---|---|---|---|---|
| CELL | EGPRS | 190 | 836.6 | 249.9044 | 308.049 |
| PCS | EGPRS | 661 | 1880 | 252.0367 | 309.740 |

**CDMA2000 1xRTT MODE PART 22, 24 AND 90 / RSS 132, 133 AND 139**

| Band | Mode | Channel | f(MHz) | 99% BW (MHz) | -26dB BW (MHz) |
|---|---|---|---|---|---|
| CELL | CDMA 2000 1xRTT | 384 | 836.5 | 1.2731 | 1.421 |
| PCS | CDMA 2000 1xRTT | 600 | 1880 | 1.2758 | 1.427 |
| 800MHz Secondary | CDMA 2000 1xRTT | 560 | 820 | 1.2739 | 1.421 |

**CDMA2000 EVDO Rev A MODE PART 22, 24 AND 90 / RSS 132, 133 AND 139**

| Band | Mode | Channel | f(MHz) | 99% BW (MHz) | -26dB BW (MHz) |
|---|---|---|---|---|---|
| CELL | CDMA 2000 EVDO Rev. A | 384 | 836.5 | 1.2781 | 1.427 |
| PCS | CDMA 2000 1xRTT | 600 | 1880 | 1.2794 | 1.410 |
| 800MHz Secondary | CDMA 2000 1xRTT | 560 | 820 | 1.2770 | 1.428 |


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

**UMTS REL 99 MODE PART 22, 24, AND 27 / RSS 132, 133 AND 139**

| Band | Mode | DL Channel | f(MHz) | 99% BW (MHz) | -26dB BW (MHz) |
|---|---|---|---|---|---|
| 850MHz | UMTS Rel. 99 | 4408 | 836.6 | 4.1460 | 4.691 |
| 1900MHz | | 9800 | 1880 | 4.1309 | 4.718 |
| 1700MHz | | 1638 | 1732.6 | 4.1287 | 4.694 |

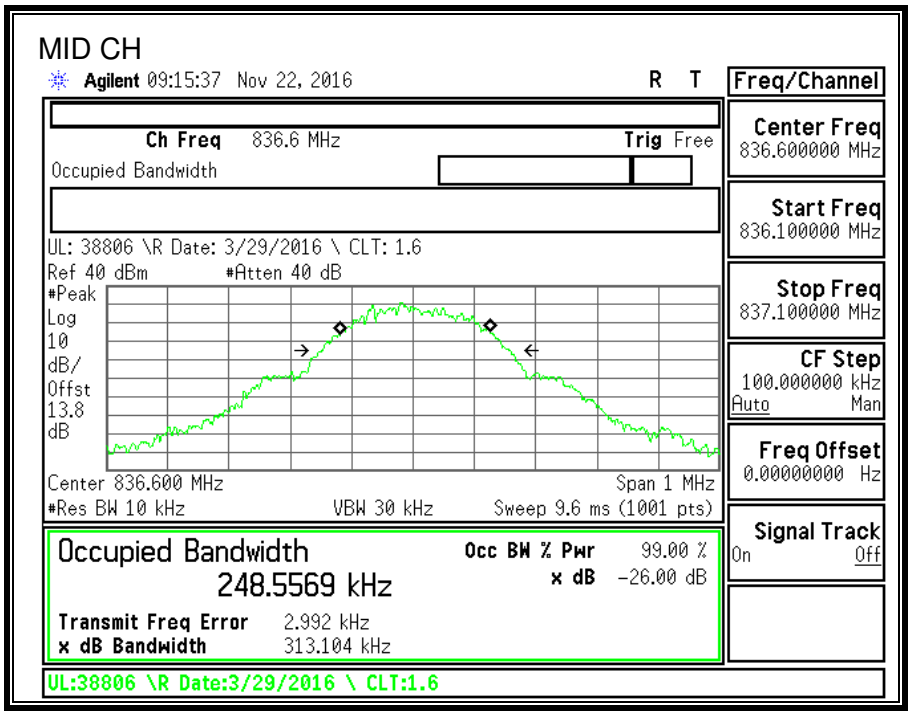
**UMTS HSDPA MODE PART 22, 24 AND 27 / RSS 132, 133 AND 139**

| Band | Mode | DL Channel | f(MHz) | 99% BW (MHz) | -26dB BW (MHz) |
|---|---|---|---|---|---|
| 850MHz | UMTS HSDPA | 4408 | 836.6 | 4.1183 | 4.694 |
| 1900MHz | | 9800 | 1880 | 4.1663 | 4.675 |
| 1700MHz | | 1638 | 1732.6 | 4.1312 | 4.678 |

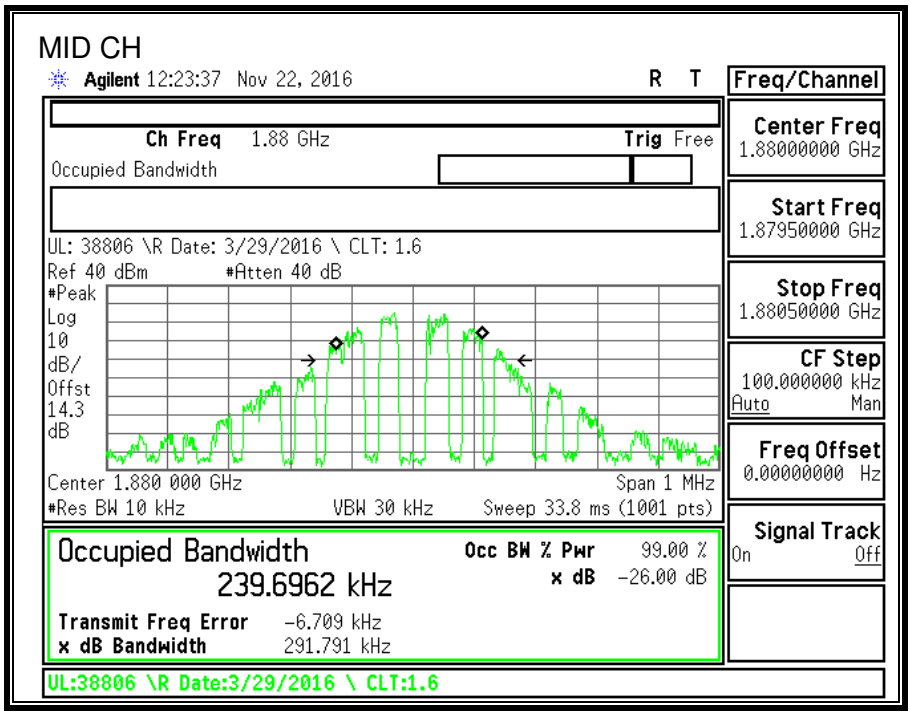

*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

### 8.1.1. GSM GPRS

**850MHz BAND**




**1900MHz BAND**

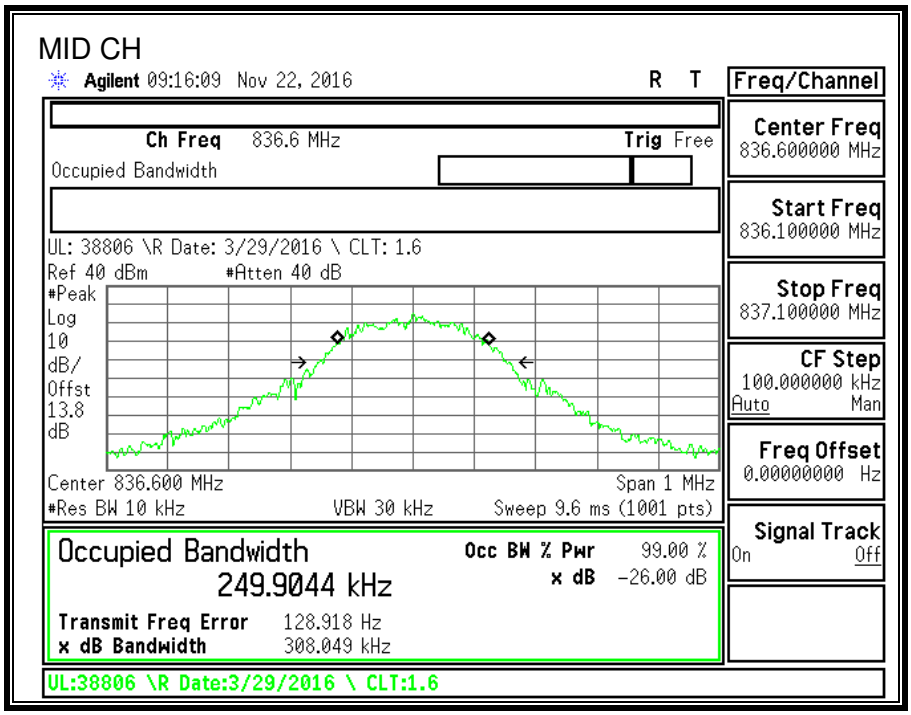




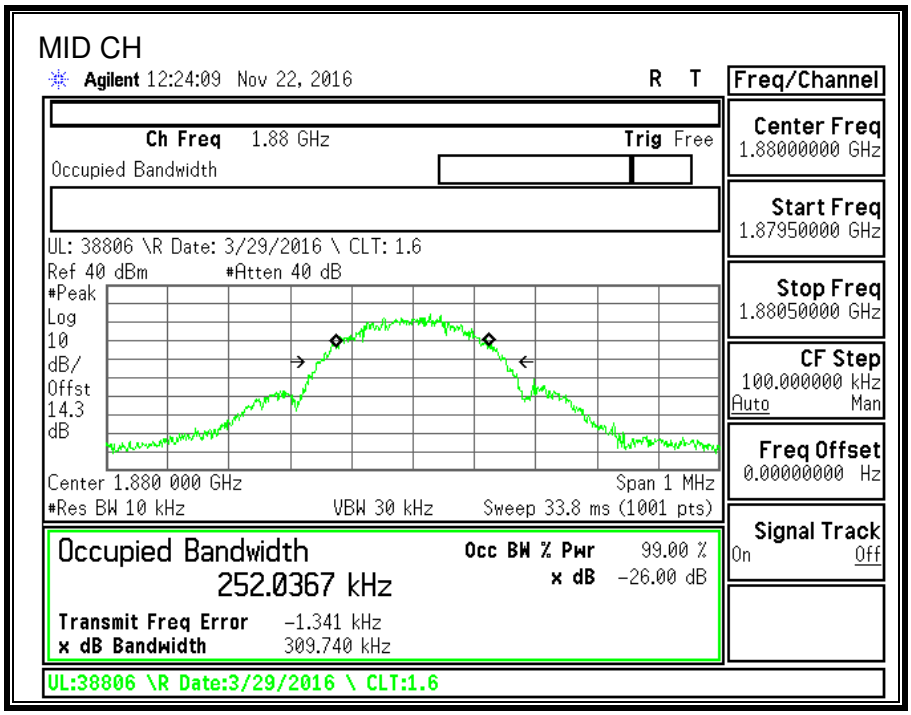
*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

### 8.1.2. GSM EGPRS

**850MHz BAND**




**1900MHz BAND**



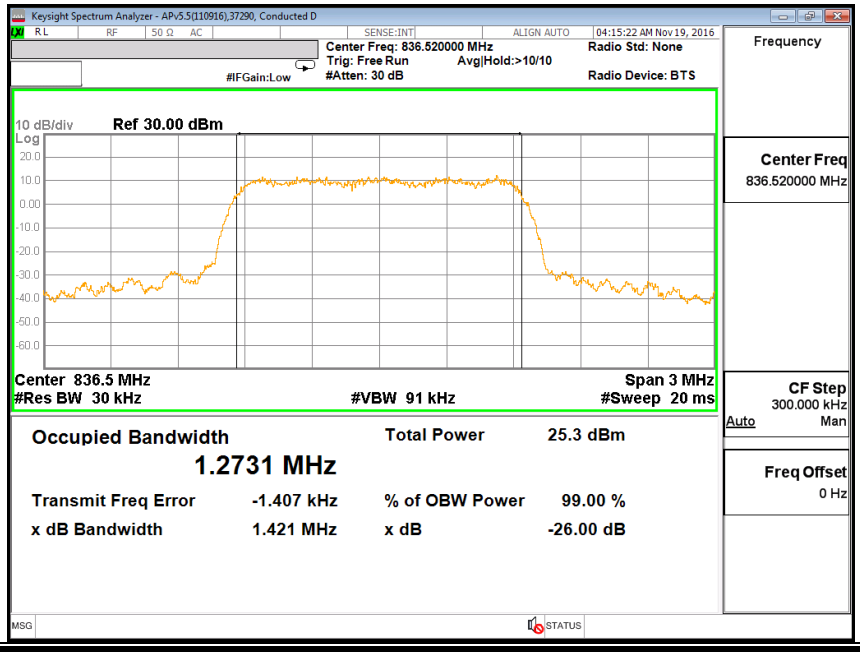


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

### 8.1.3. CDMA2000 1xRTT

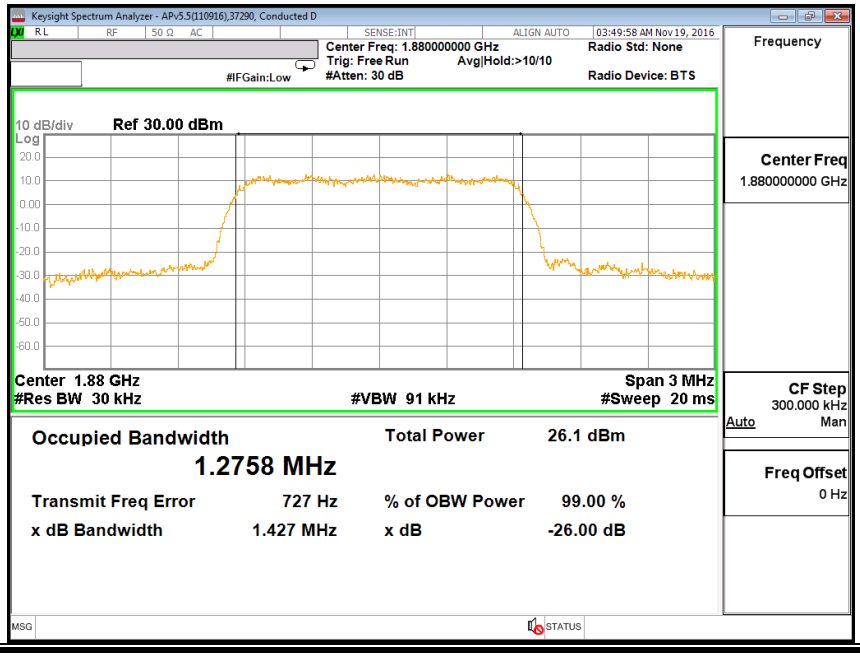
**850MHz BAND**

MID CH




**1900MHz BAND**

MID CH

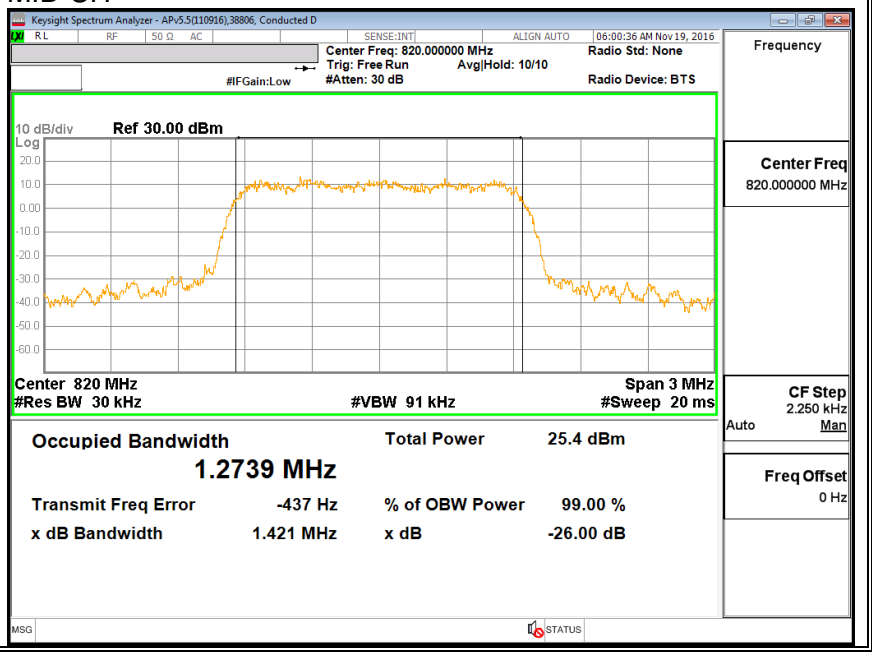




*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

**800MHz SECONDARY BAND**

MID CH

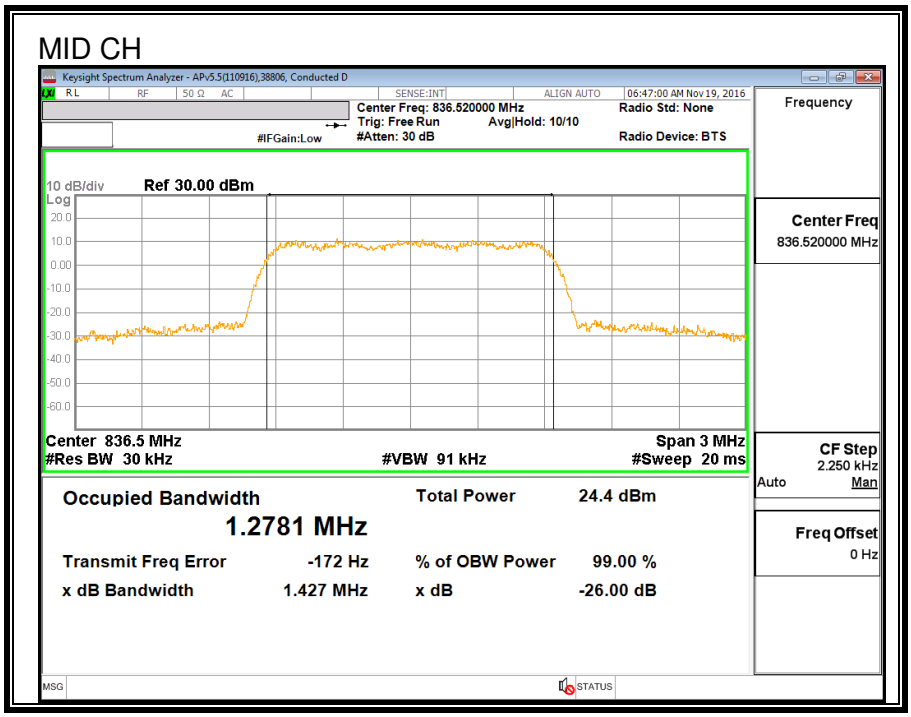




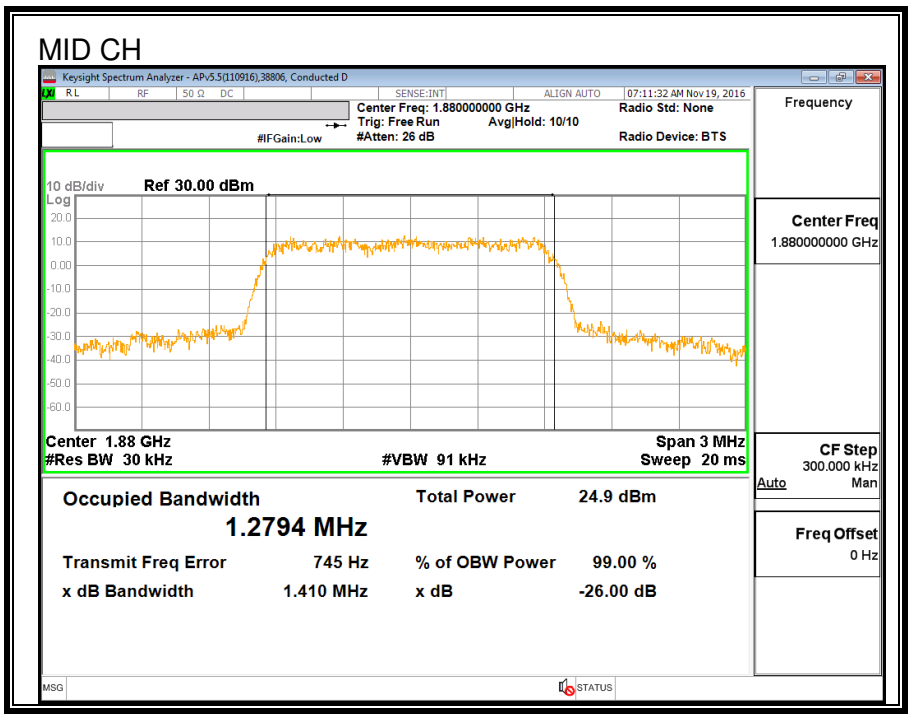
*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

## 8.1.4. CDMA2000 EVDO REV A

**850MHz BAND**




**1900MHz BAND**

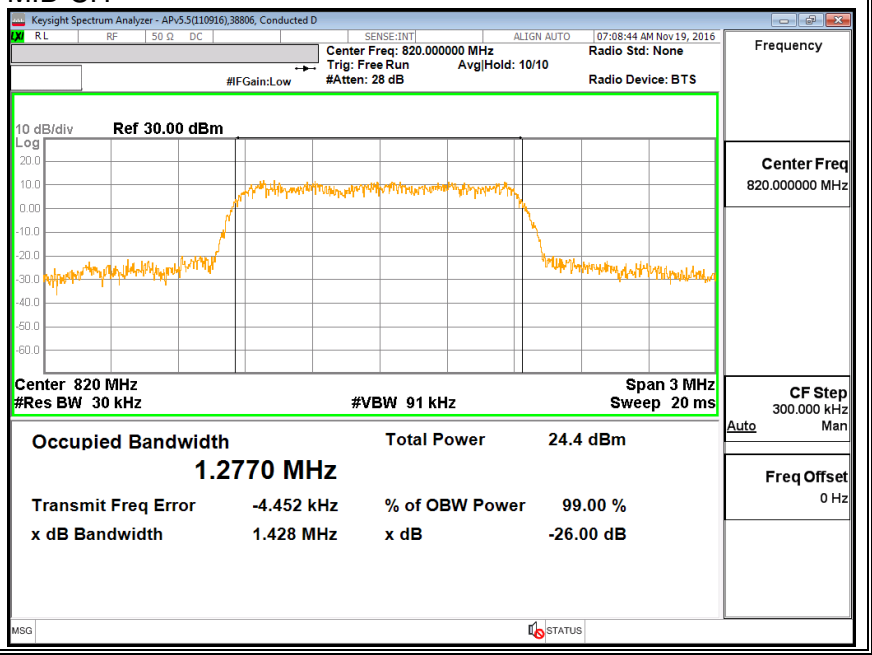




*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

**800MHz SECONDARY BAND**

MID CH

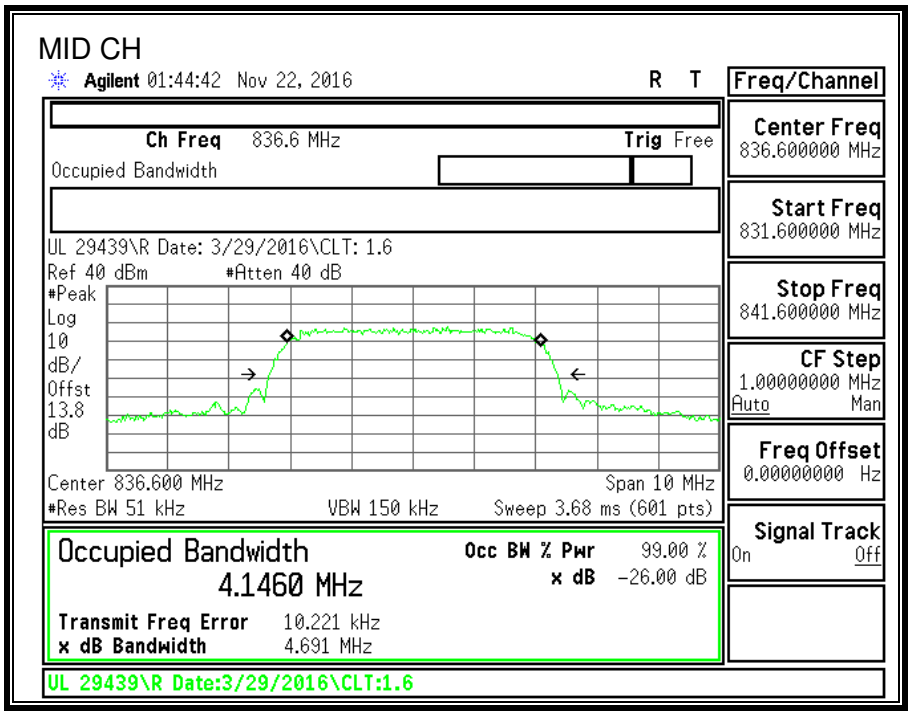




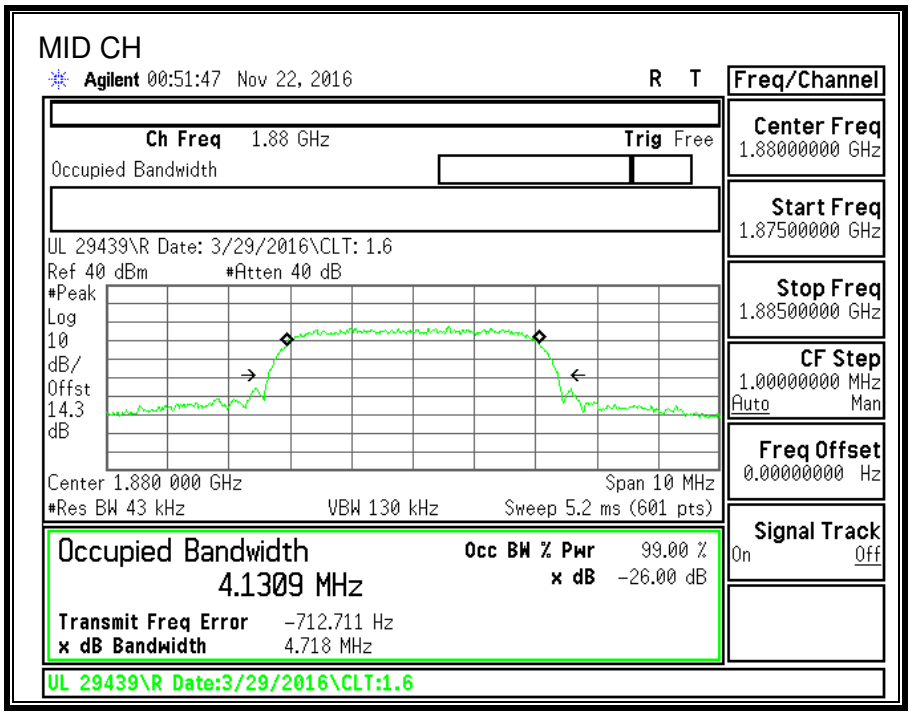
*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

### 8.1.5. UMTS Rel99

**850MHz BAND**



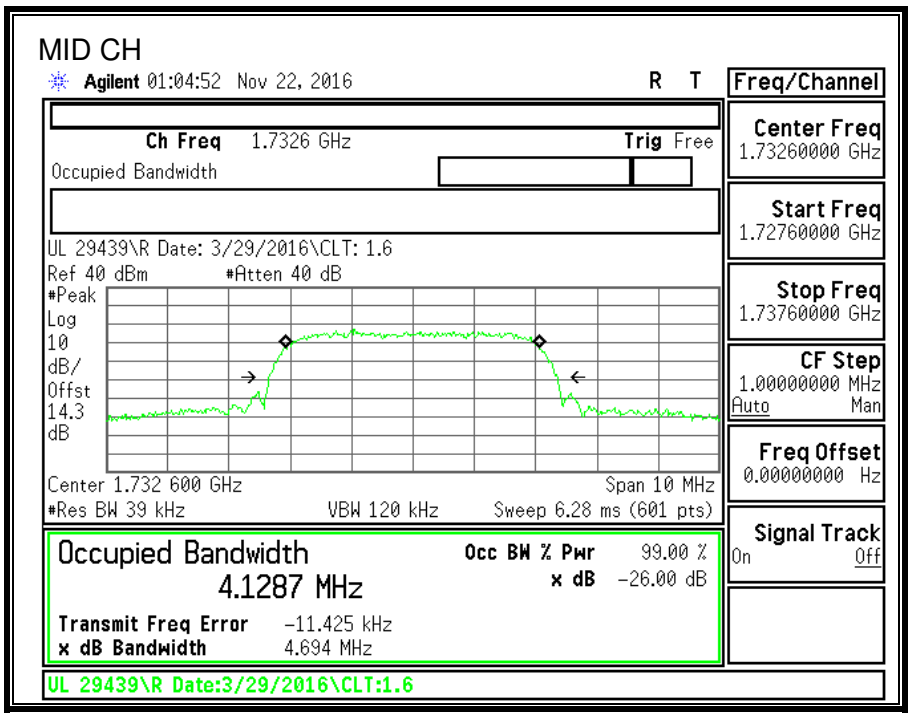

**1900MHz BAND**





*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

**1700MHz BAND**

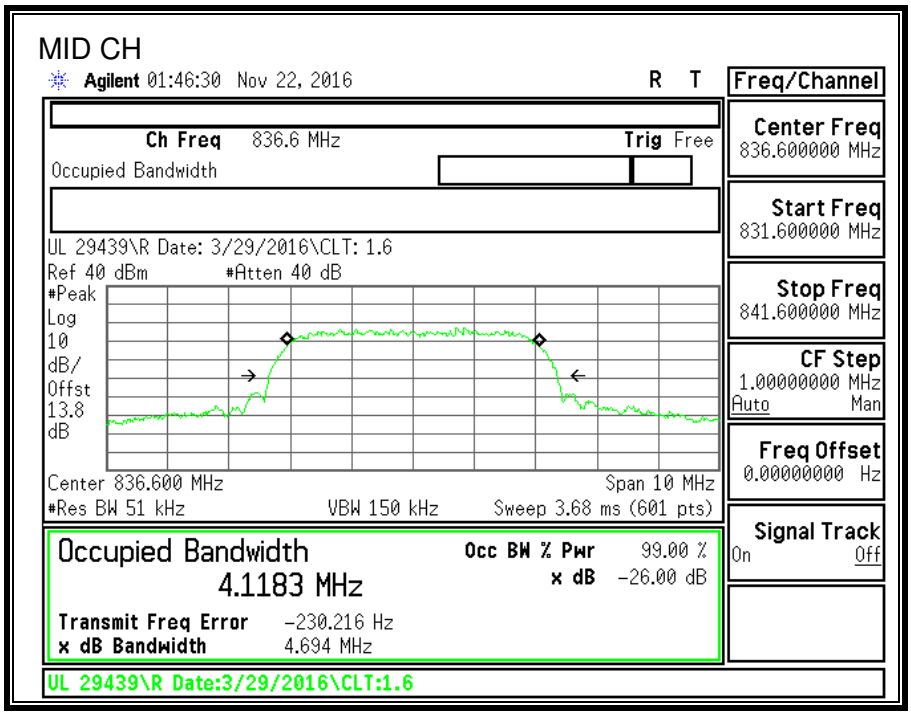




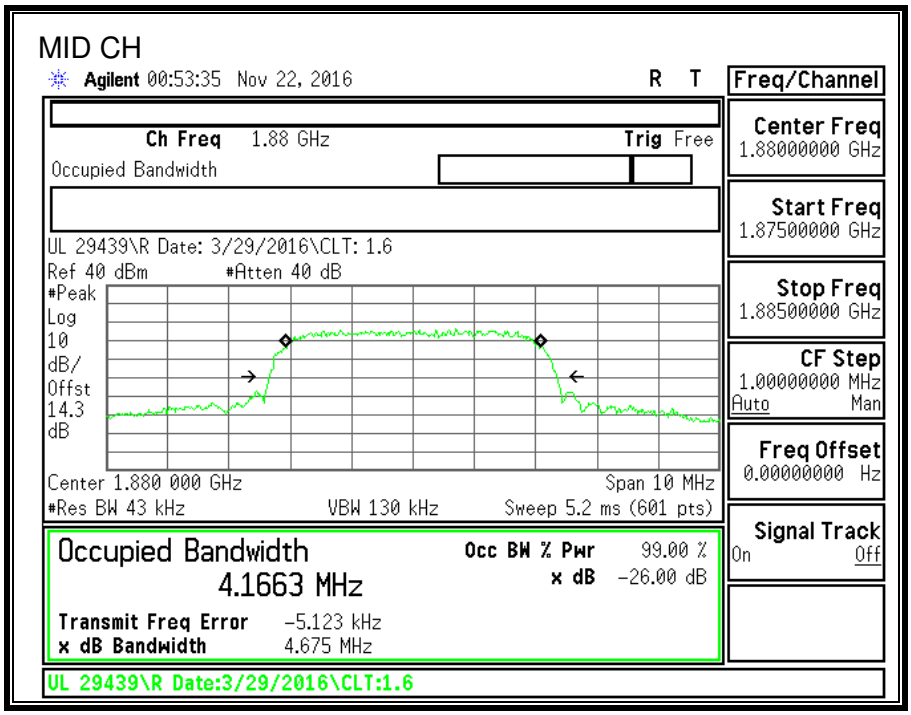
*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

### 8.1.6. UMTS HSDPA

**850MHz BAND**



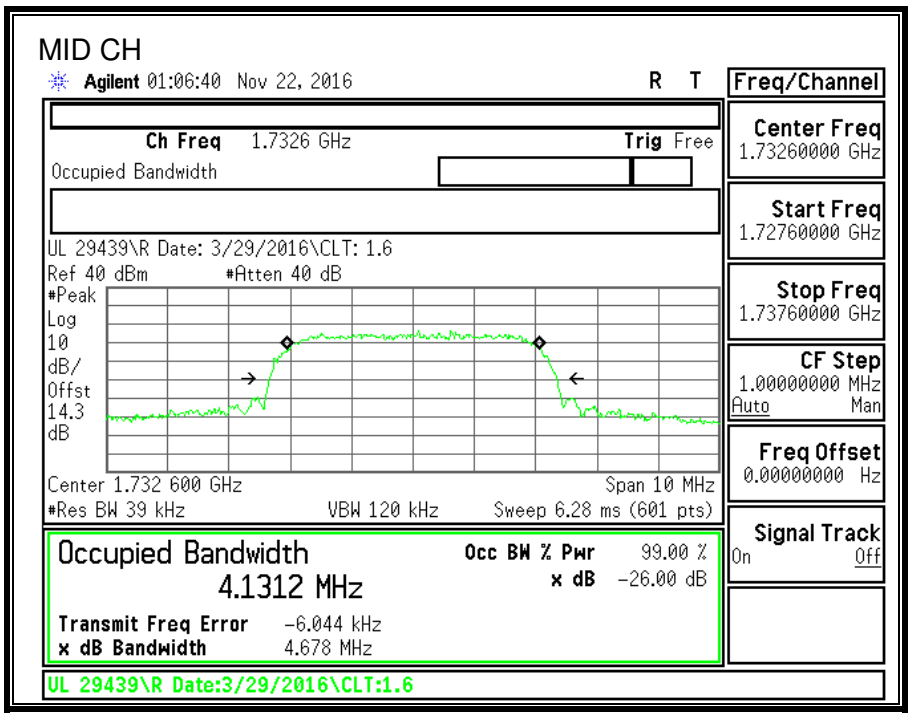

**1900MHz BAND**





*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

**1700MHz BAND**





*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

## 8.2. BAND EDGE

**RULE PART(S)**

FCC: §2.1051, §22. 359, §22.917, §24.238 and §90.691
IC: RSS132§5.5; RSS133§6.5 and RSS139§6.6

**LIMITS**

FCC: §22.359, §22.917, §24.238
The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log (P) dB.

FCC: §27.53
(c) On any frequency outside the 776–788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least 43 + 10 log (P) dB;
(1) On any frequency outside the 746-758 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least 43 + 10 log (P) dB;
(2) On any frequency outside the 776-788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least 43 + 10 log (P) dB;
(4) On all frequencies between 763-775 MHz and 793-805 MHz, by a factor not less than 65 + 10 log (P) dB in a 6.25 kHz band segment, for mobile and portable stations;
(5) Compliance with the provisions of paragraphs (c)(1) and (c)(2) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least 30 kHz may be employed;
(6) Compliance with the provisions of paragraphs (c)(3) and (c)(4) of this section is based on the use of measurement instrumentation such that the reading taken with any resolution bandwidth setting should be adjusted to indicate spectral energy in a 6.25 kHz segment.

FCC: §90.691 Emission mask requirements for EA-based systems.

(a) Out-of-band emission requirement shall apply only to the “outer” channels included in an EA license and to spectrum adjacent to interior channels used by incumbent licensees. The emission limits are as follows:

(1) For any frequency removed from the EA licensee's frequency block by up to and including 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least 116 Log10(f/6.1) decibels or 50 + 10 Log10(P) decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 12.5 kHz.

(2) For any frequency removed from the EA licensee's frequency block greater than 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least 43 + 10Log10(P) decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 37.5 kHz.

(b) When an emission outside of the authorized bandwidth causes harmful interference, the Commission may, at its discretion, require greater attenuation than specified in this section.


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

RSS132§5.5
Mobile and base station equipment shall comply with the limits in (i) and (ii) below.
In the first 1.0 MHz band immediately outside and adjacent to each of the sub-bands specified in Section 5.1, the power of emissions per any 1% of the occupied bandwidth shall be attenuated (in dB) below the transmitter output power P ( dBW) by at least 43 + 10 log10p (watts).
After the first 1.0 MHz immediately outside and adjacent to each of the sub-bands, the power of emissions in any100 kHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least43 + 10 log10 p (watts). If the measurement is performed using 1% of the occupied bandwidth, power integration over 100 kHz is required.

RSS133§6.5
Equipment shall comply with the limits in (i) and (ii) below.
(i)In the 1.0 MHz bands immediately outside and adjacent to the equipment's operating frequency block, the emission power per any 1% of the emission bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 log10p(watts).
(ii)After the first 1.0 MHz, the emission power in any 1 MHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 log10p(watts). If the measurement is performed using 1% of the emission bandwidth, power integration over 1.0 MHz is required.

RSS139§6.6
(i)In the first 1.0 MHz bands immediately outside and adjacent to the equipment's smallest operating frequency block,Footnote2 which can contain the equipment's occupied bandwidth, the emission power per any 1% of the emission bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least43 + 10 log10 p (watts) dB.
(ii)After the first 1.0 MHz outside the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power in any 1 MHz bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least 43 + 10 log10 p (watts) dB.

**TEST PROCEDURE**
The transmitter output was connected to a Agilent 8960 Test Set and configured to operate at maximum power. The band edge emissions were measured at the required operating frequencies in each band on the Spectrum Analyzer.
For each band edge measurement:

- Set the spectrum analyzer span to include the block edge frequency.
- 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.

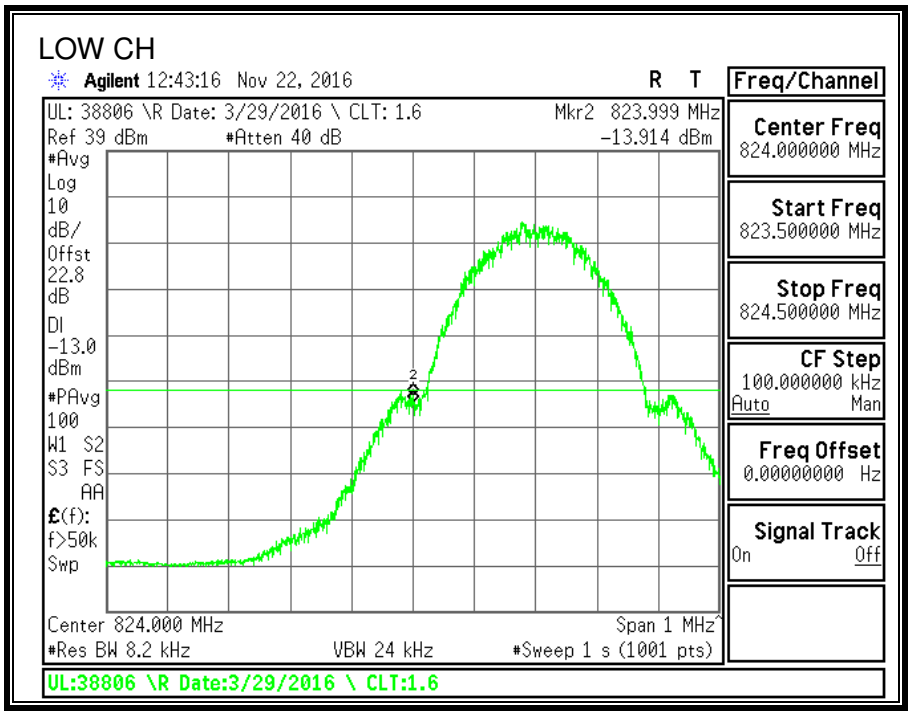
**RESULTS**


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

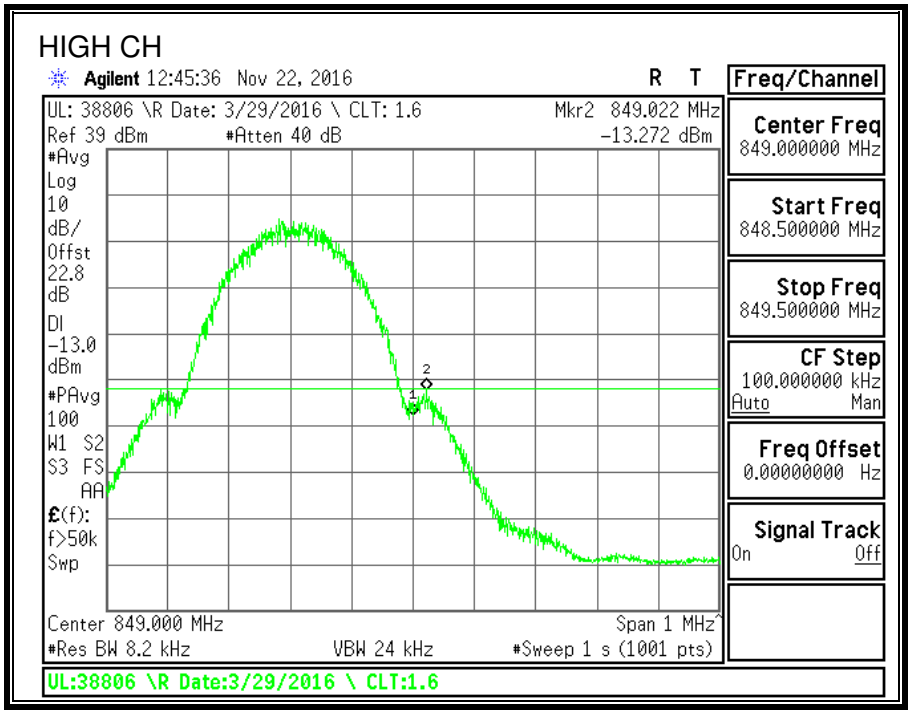
### 8.2.1. GSM GPRS

**850MHz BAND**

LOW CH




HIGH CH

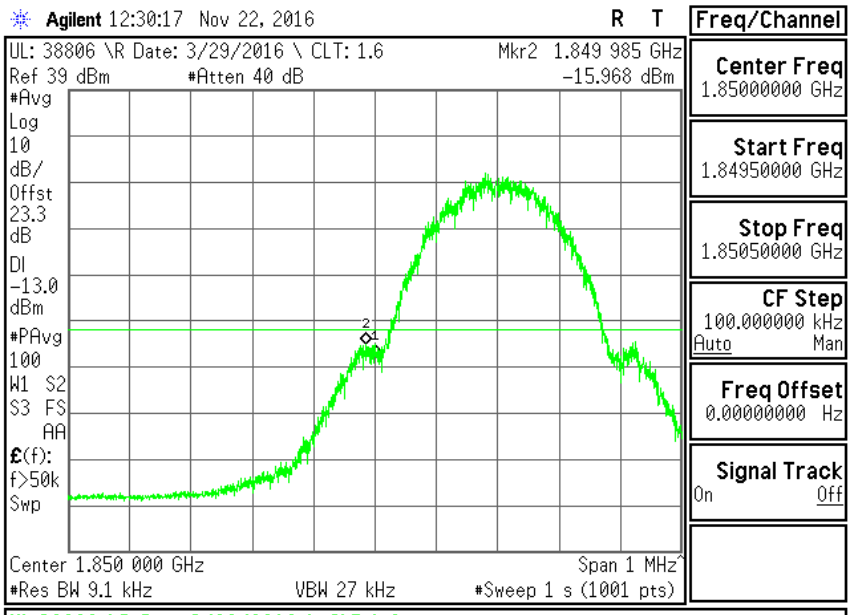




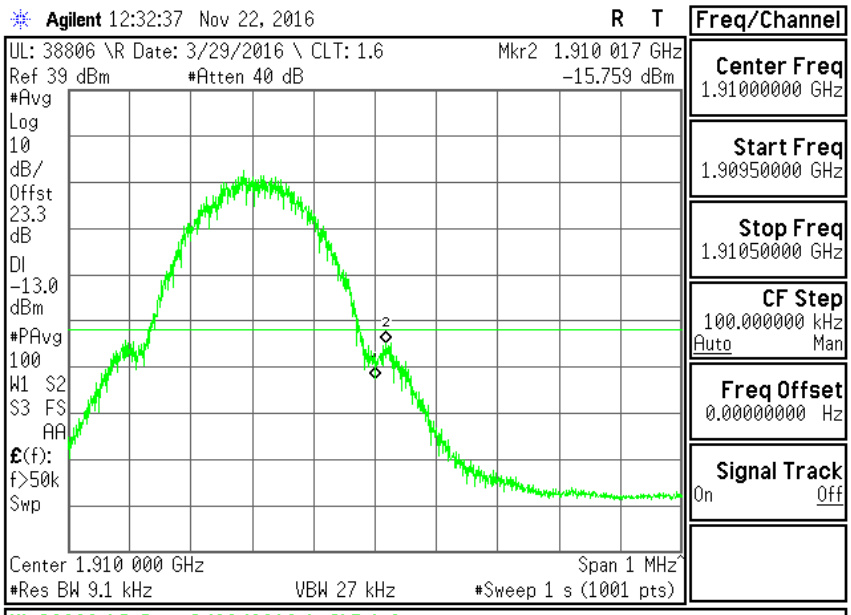
*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

**1900MHz BAND**

LOW CH




HIGH CH



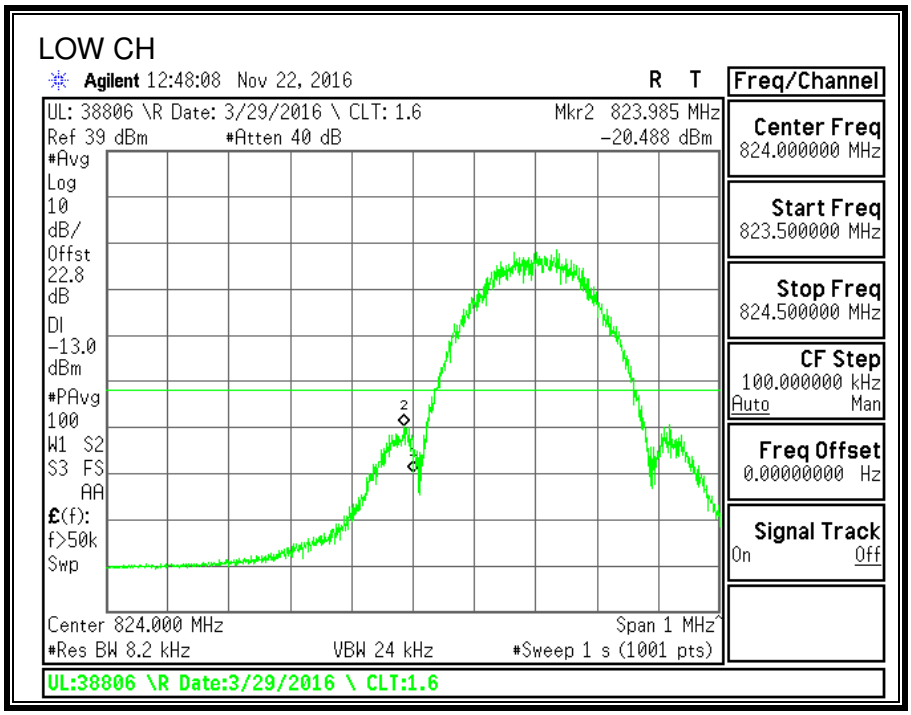


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

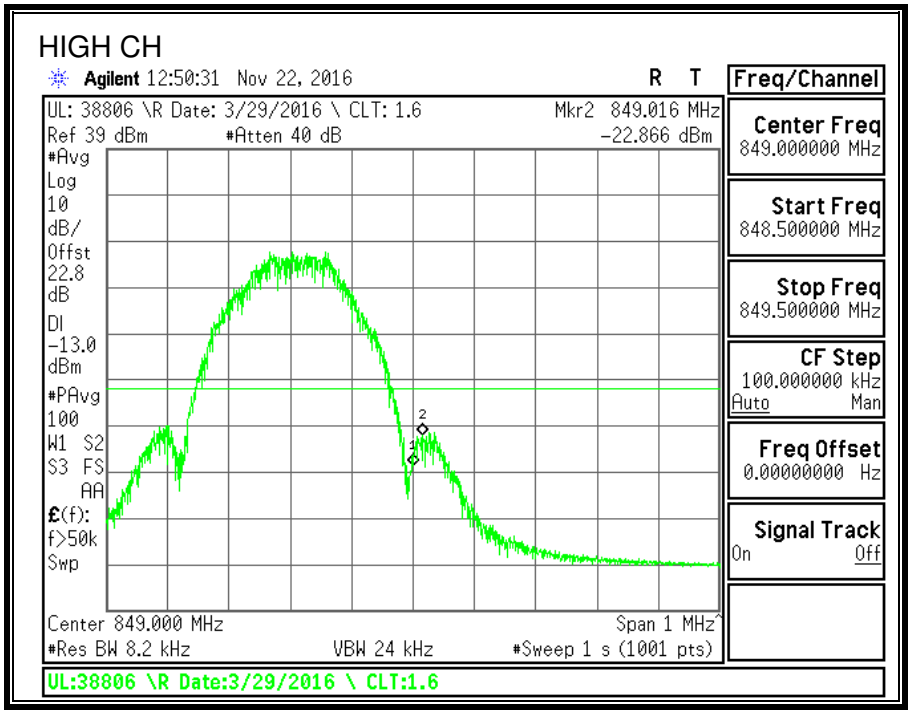
### 8.2.2. GSM EGPRS

**850MHz BAND**

LOW CH




HIGH CH

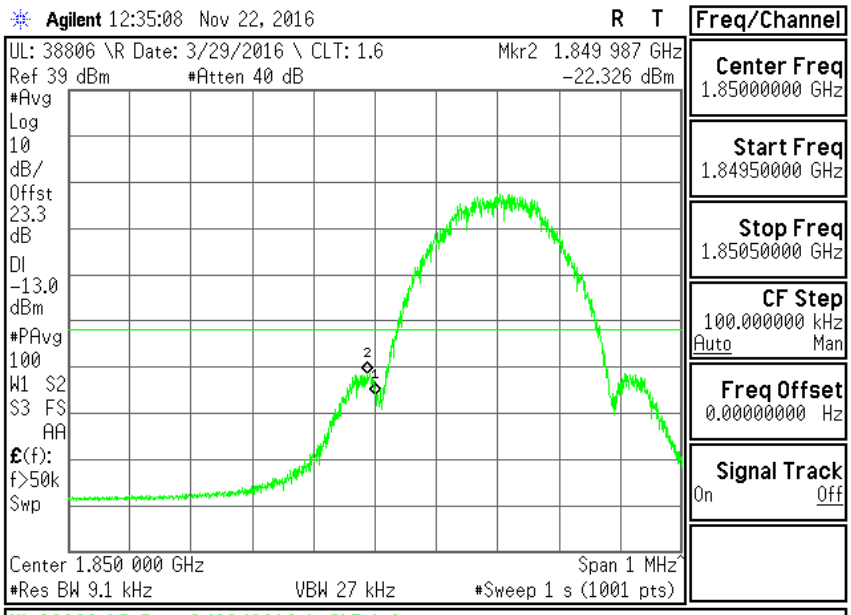




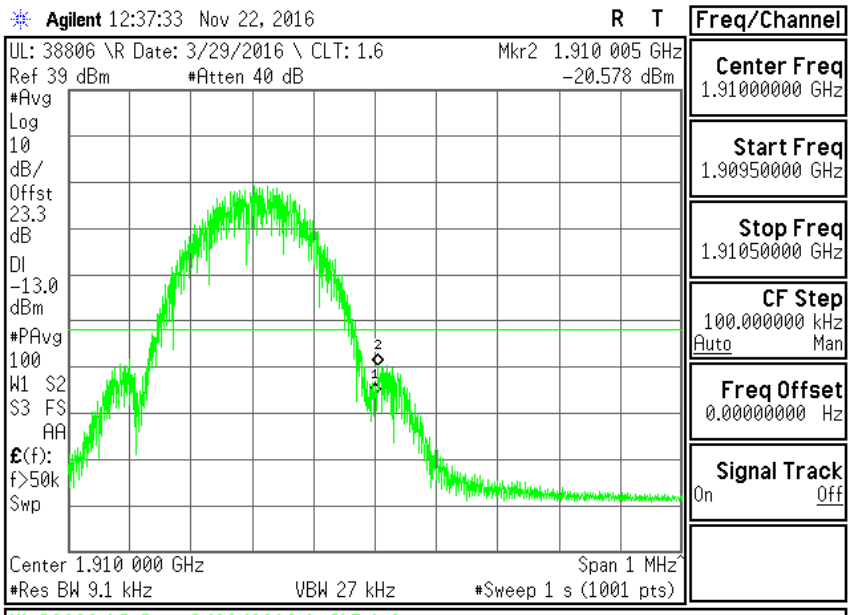
*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

**1900MHz BAND**

LOW CH




HIGH CH



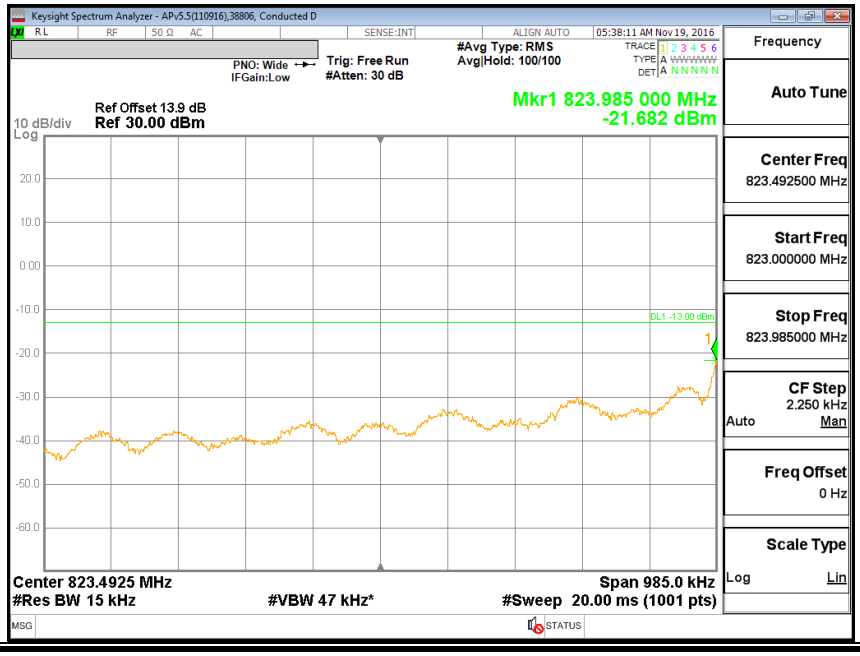


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

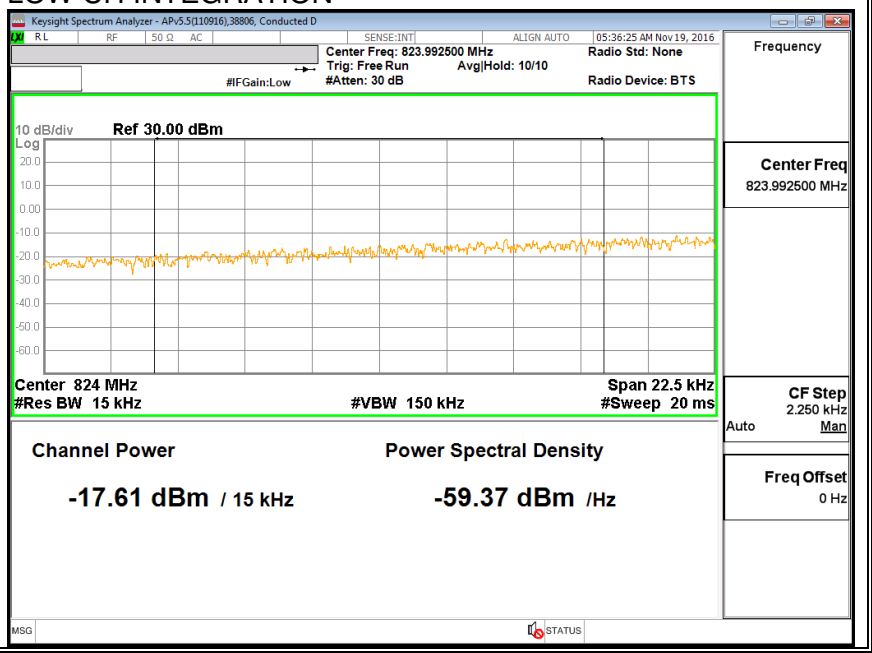
### 8.2.3. CDMA2000 1xRTT

**850MHz BAND**

LOW CH



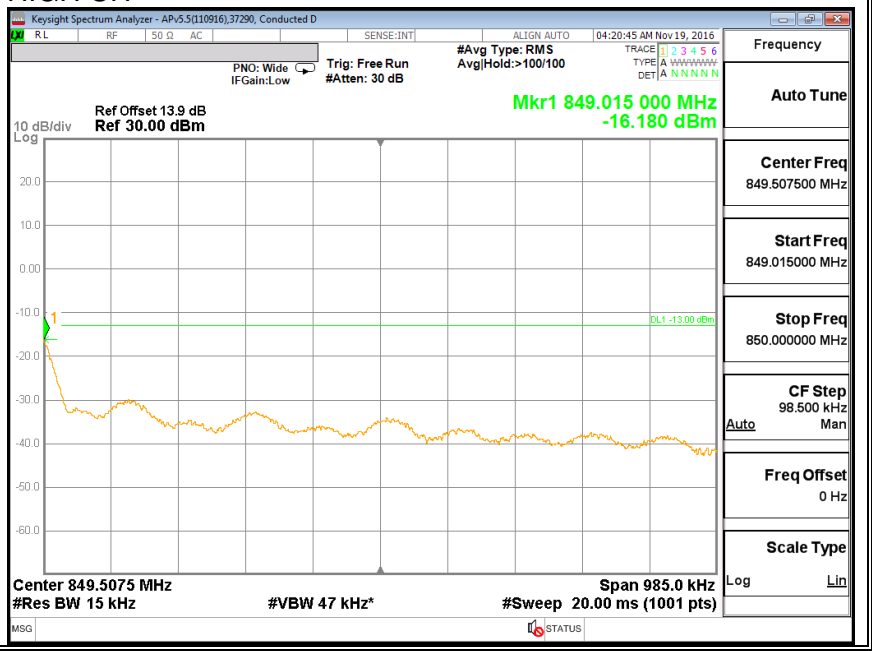

LOW CH INTEGRATION



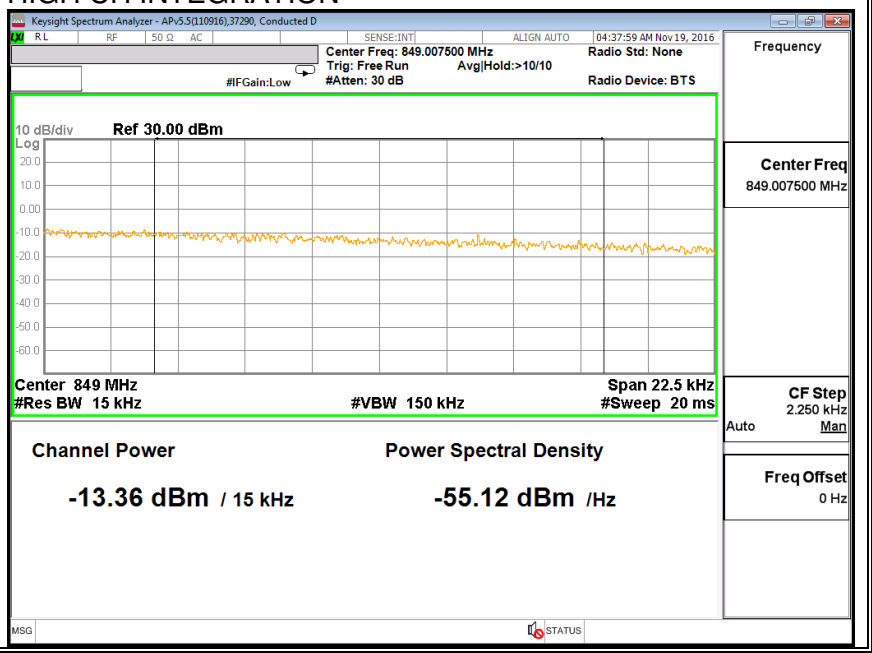


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

HIGH CH




HIGH CH INTEGRATION

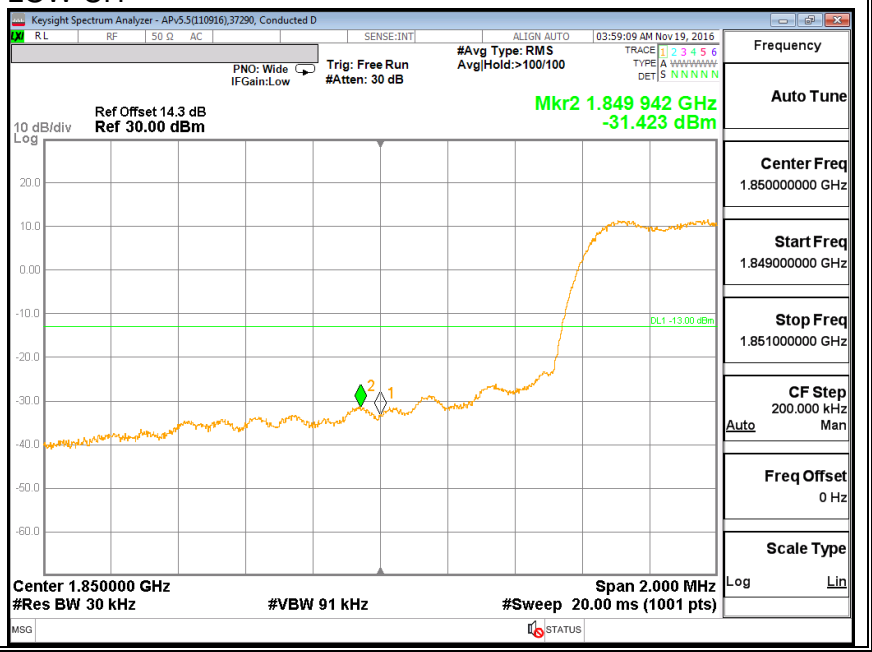




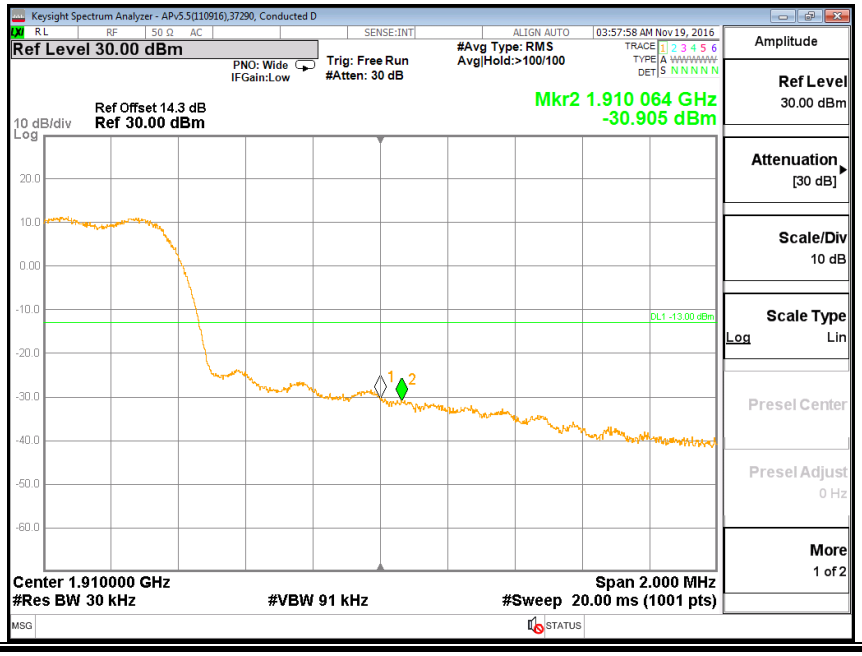
*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

**1900MHz BAND**

LOW CH



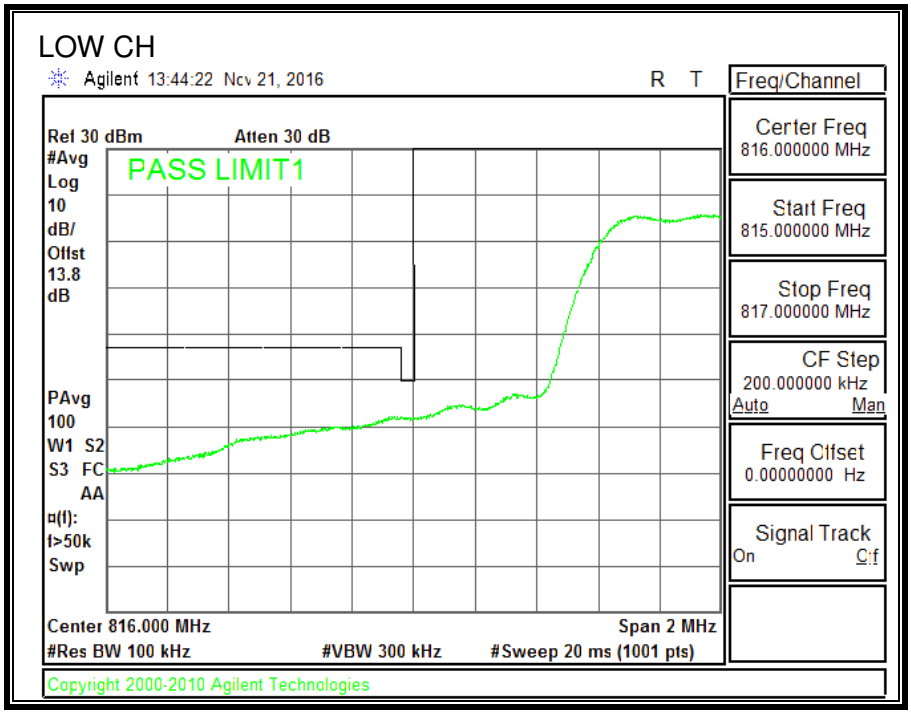

HIGH CH



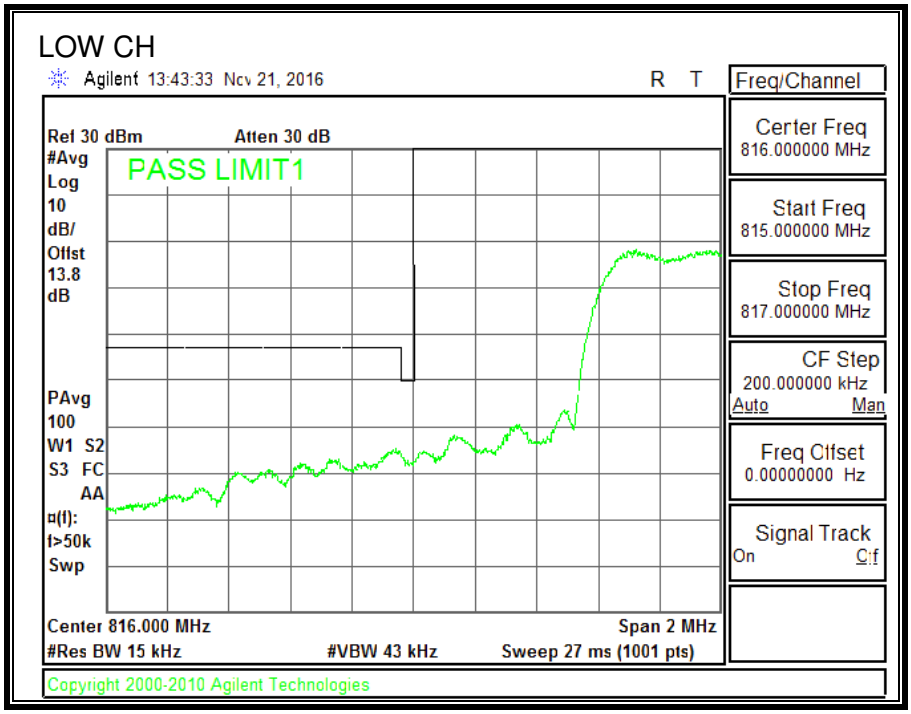


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

### 8.2.4. CDMA2000 1xRTT BC10 MASK

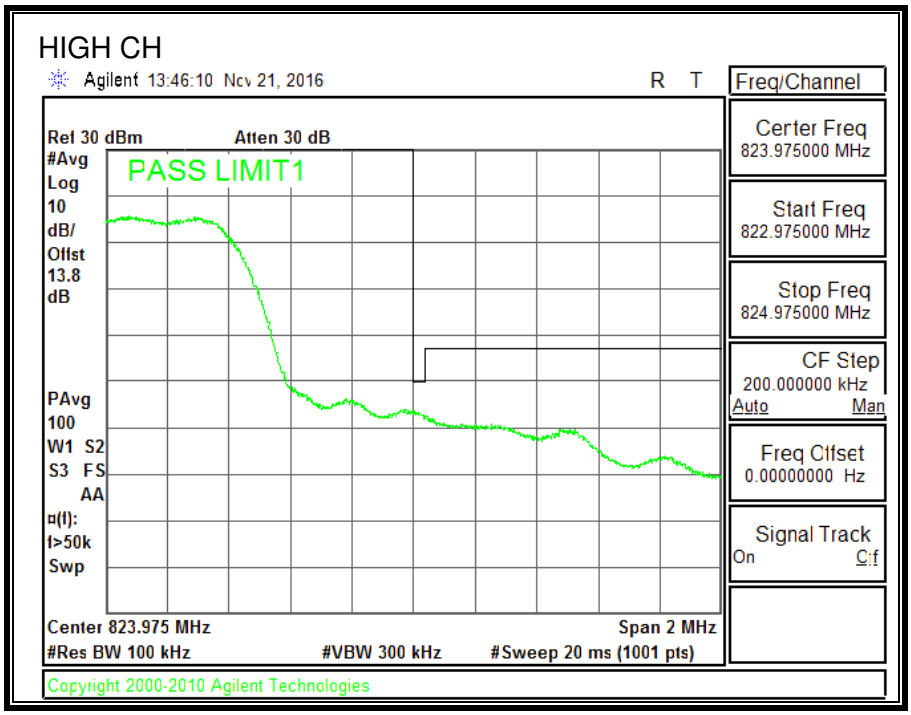



Note: RBW=1% of EBW

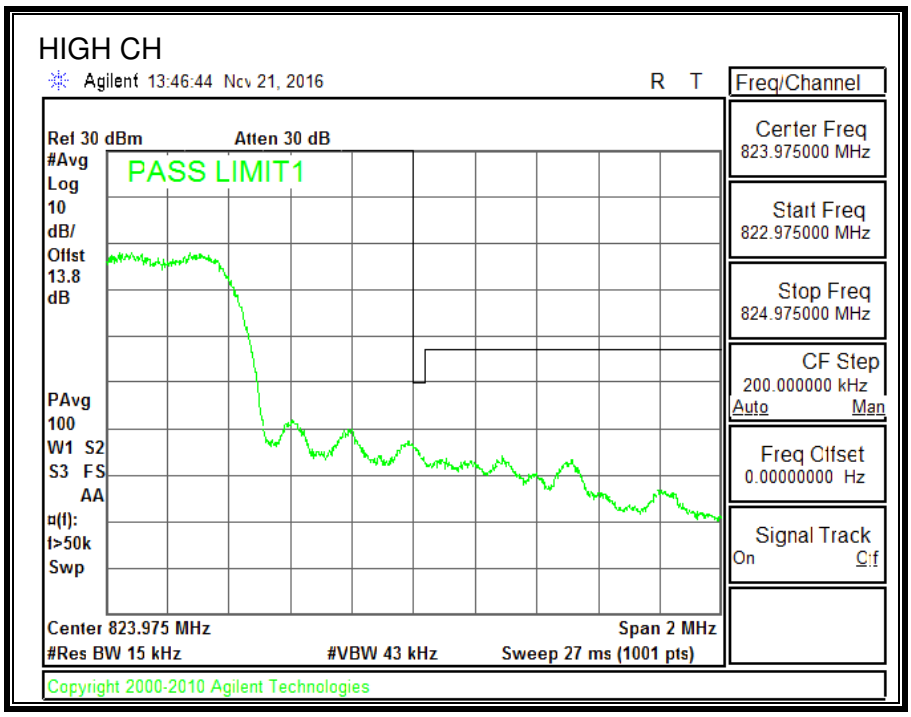



Note: RBW=1% of 37.5KHz of outer channel frequency block.


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*




Note: RBW=1% of EBW



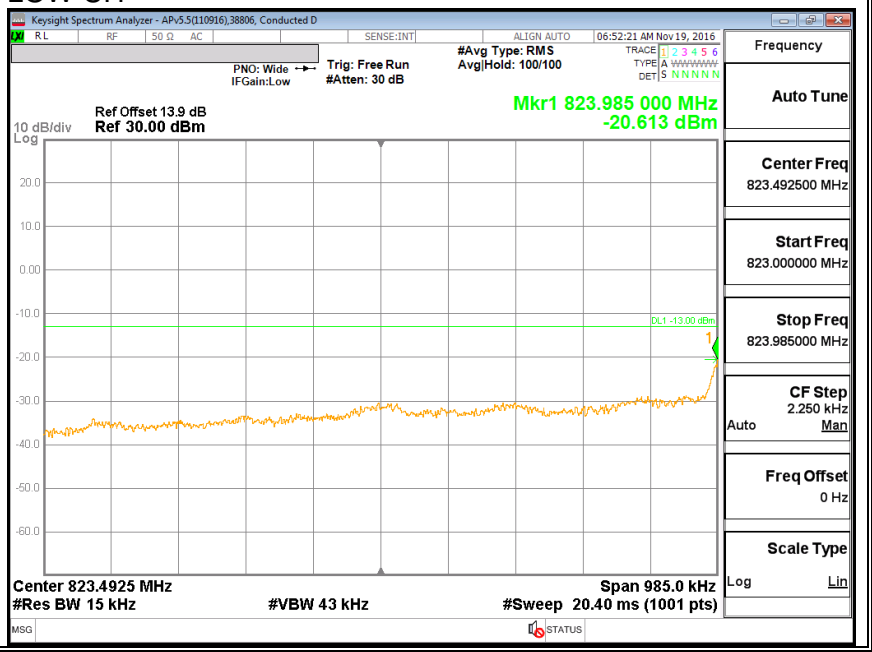

Note: RBW=1% of 37.5KHz of outer channel frequency block.


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

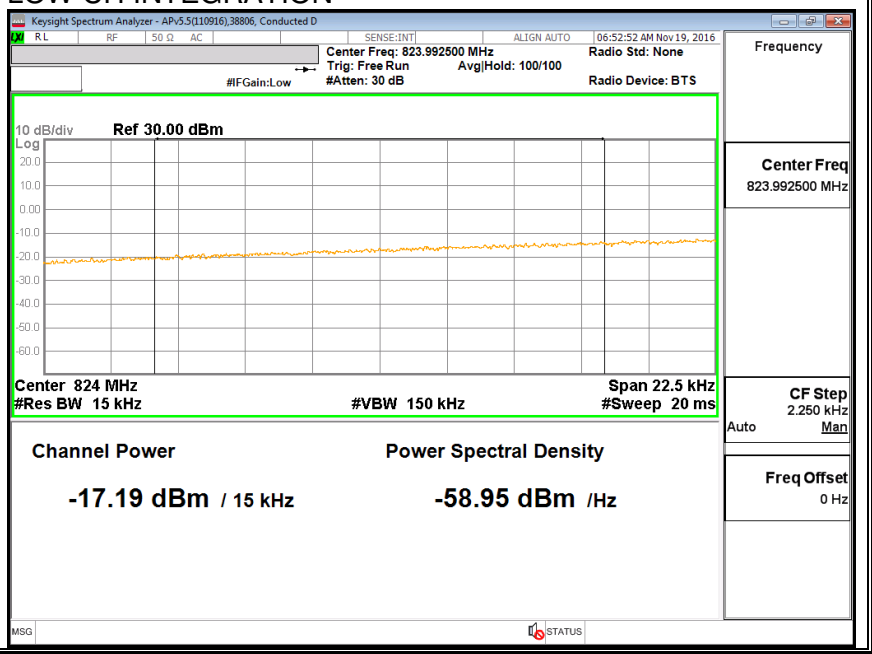
## 8.2.5. CDMA2000 EVDO REV A

**850MHz BAND**

LOW CH



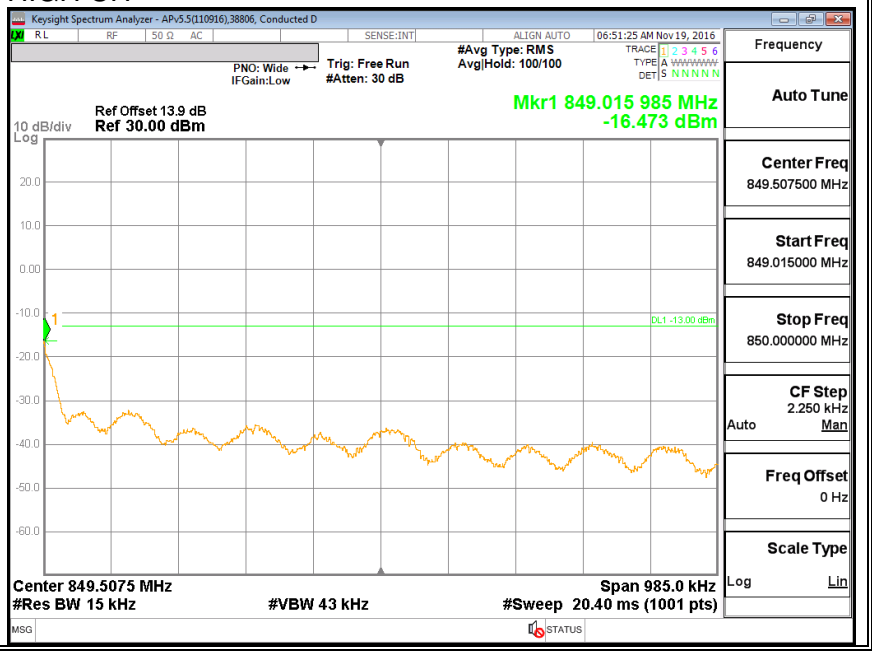

LOW CH INTEGRATION



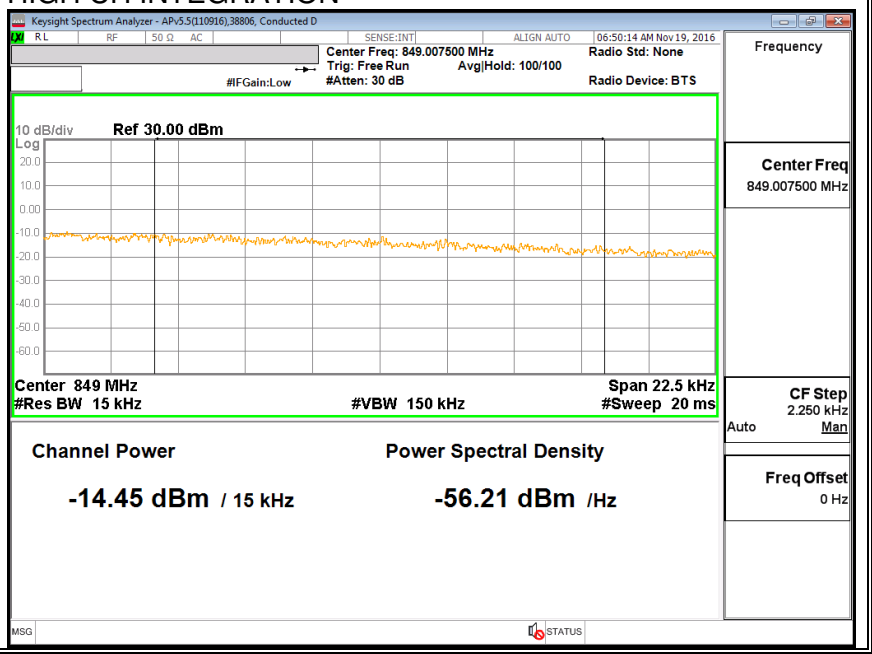


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

HIGH CH




HIGH CH INTEGRATION

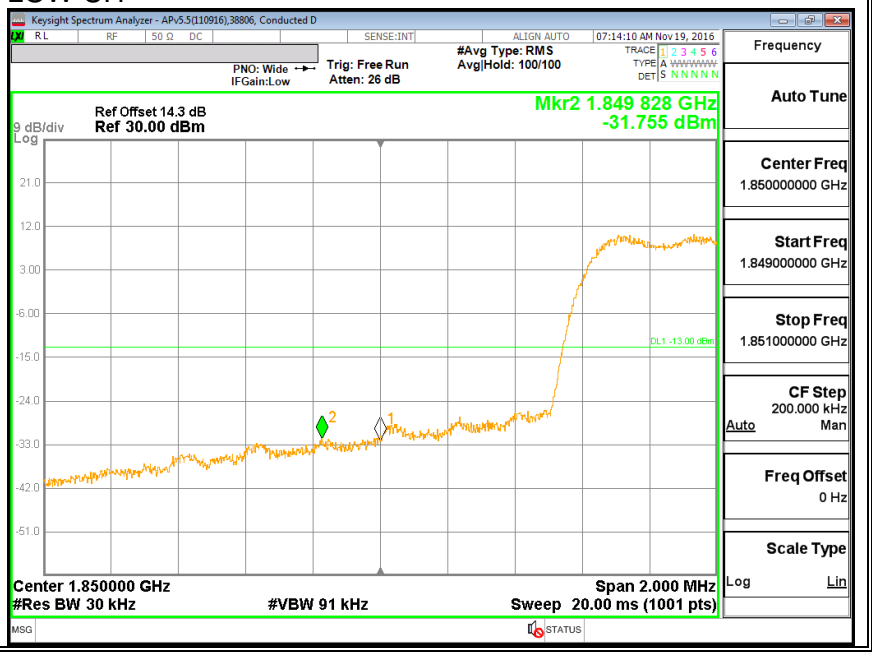




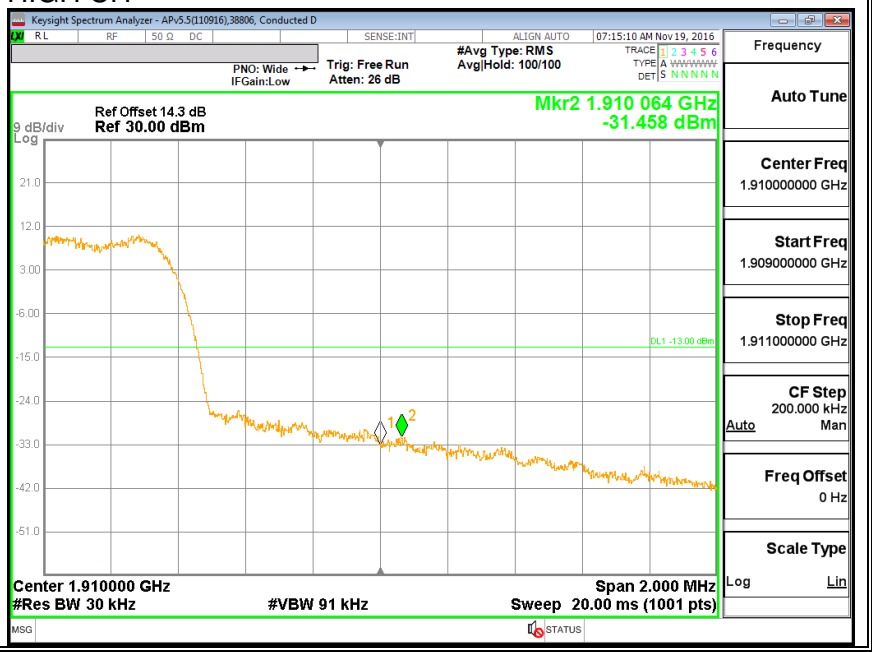
*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

**1900MHz BAND**

LOW CH



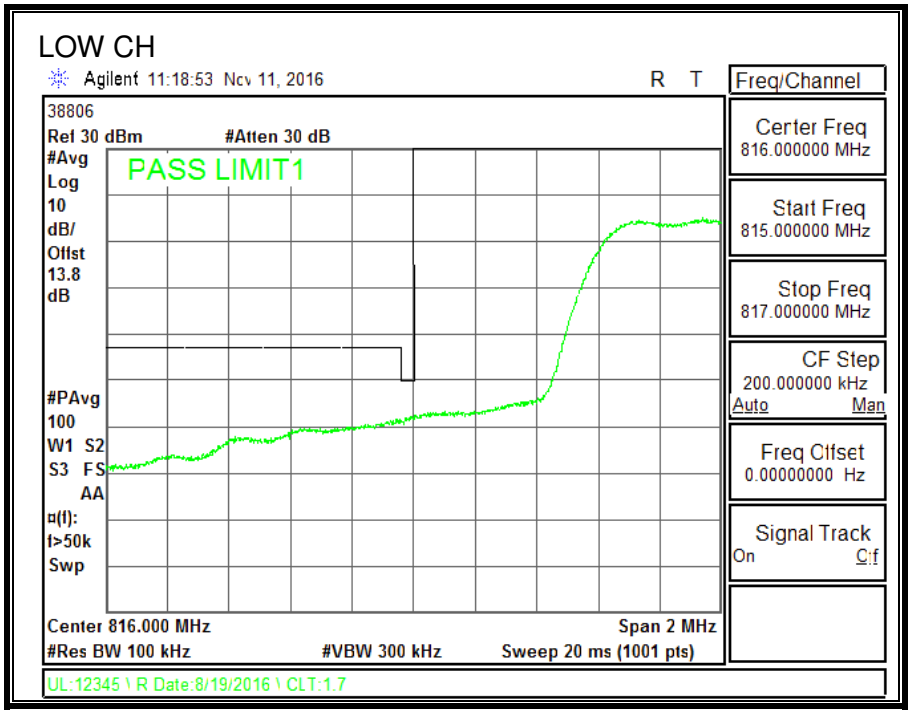

HIGH CH



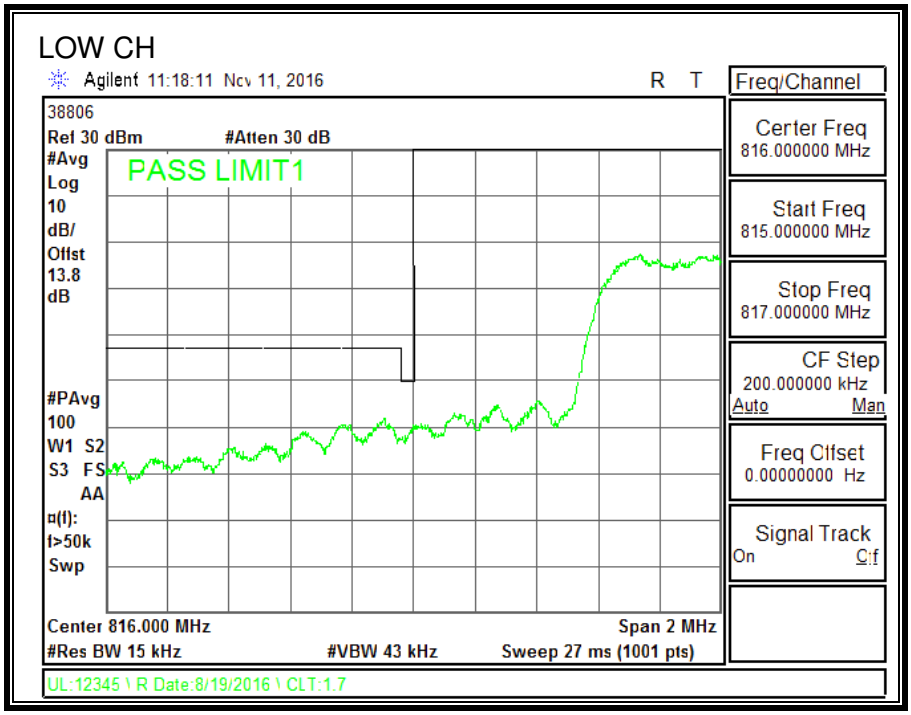


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

### 8.2.6. CDMA2000 EVDO REV A BC10 MASK

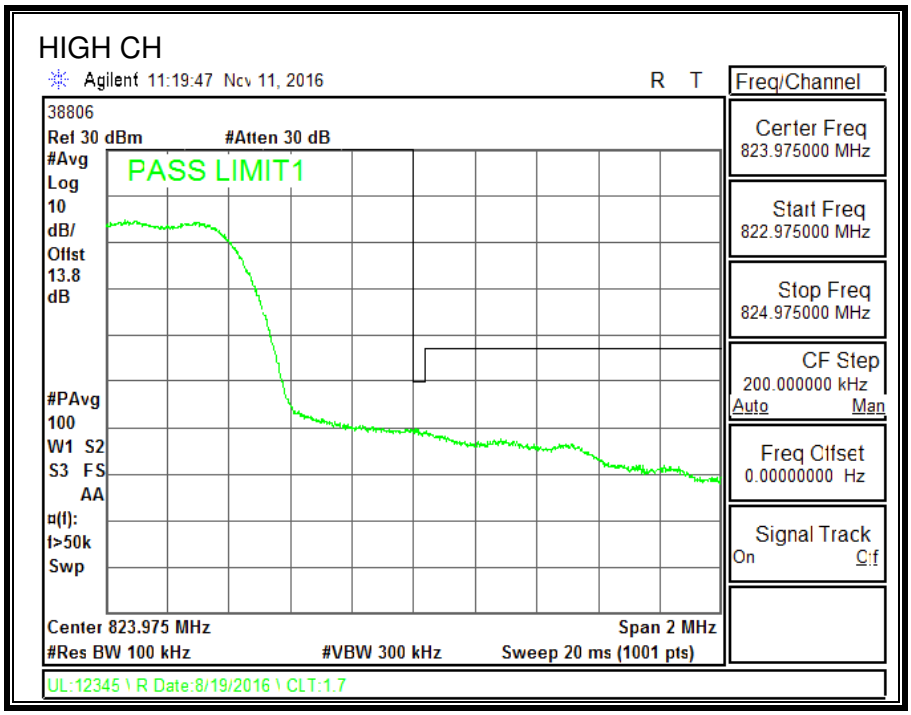



Note: RBW=1% of EBW

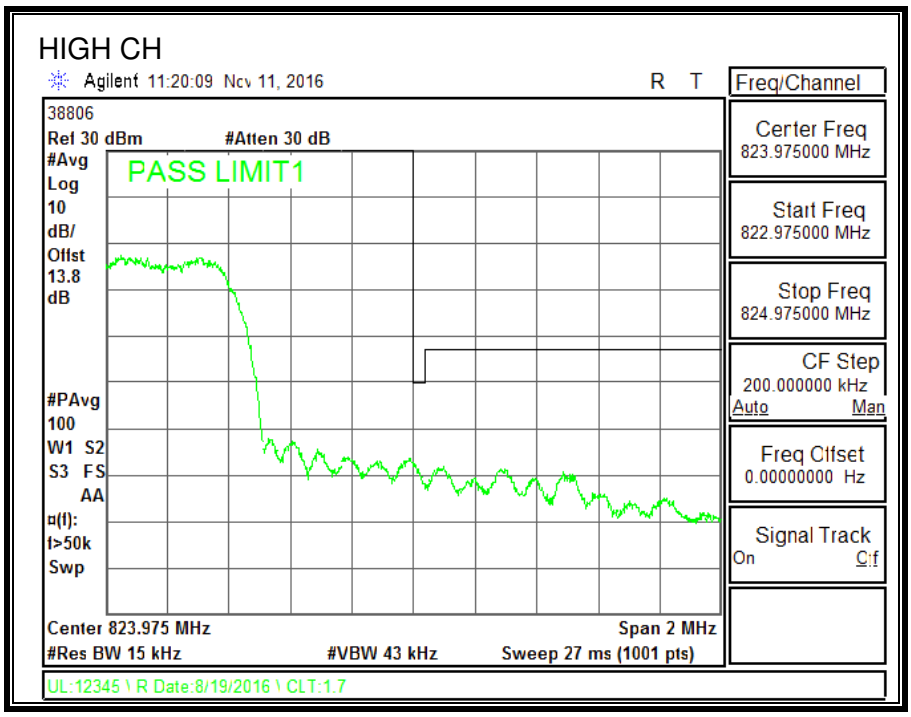



Note: RBW=1% of 37.5KHz of outer channel frequency block.


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*




Note: RBW=1% of EBW

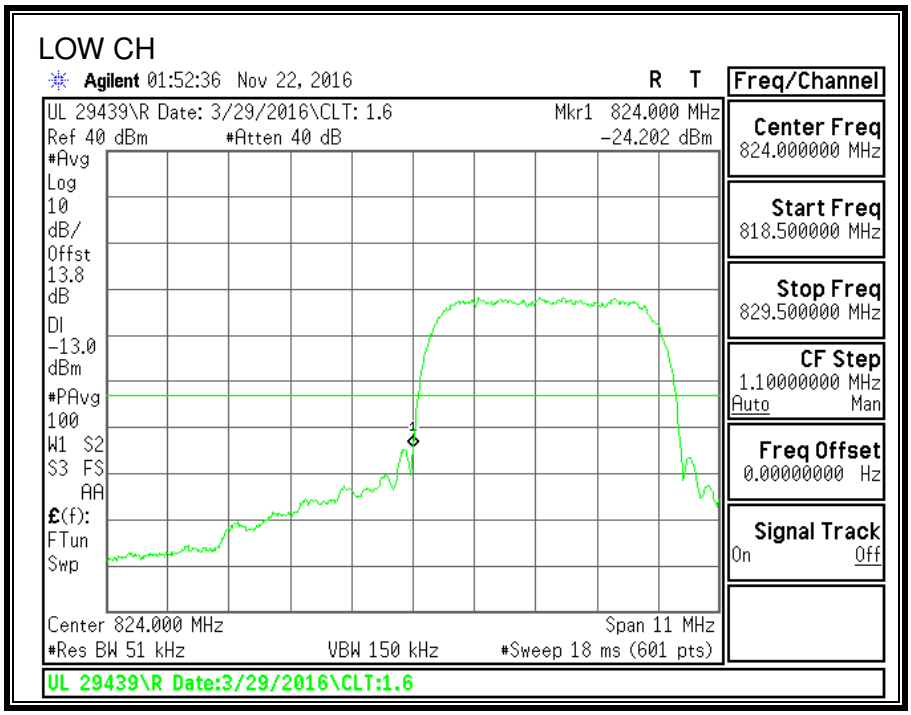


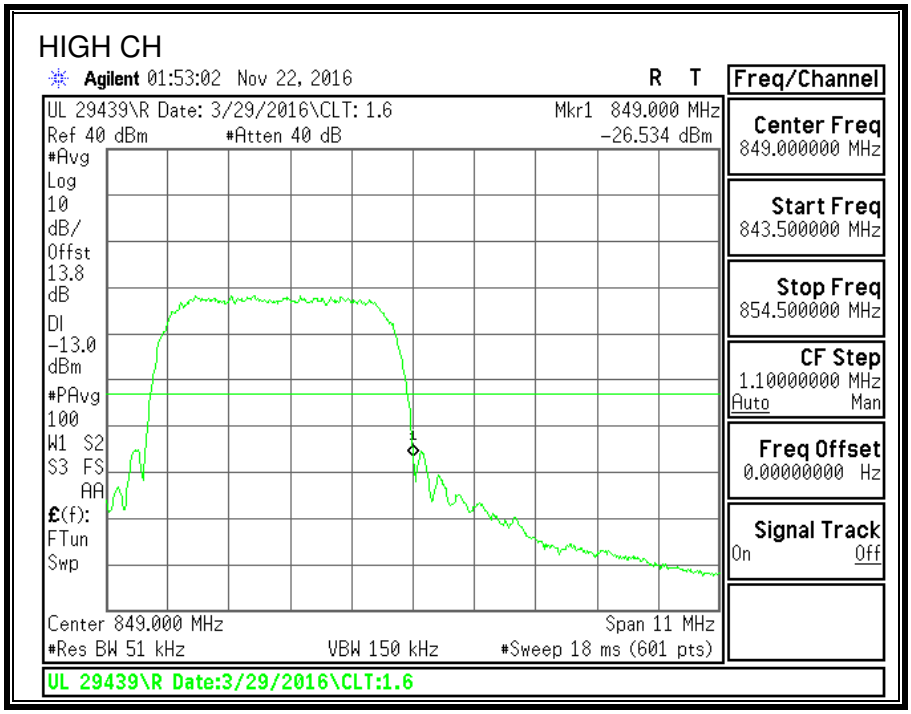

Note: RBW=1% of 37.5KHz of outer channel frequency block.


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

### 8.2.7. UMTS Rel99

**850MHz BAND**



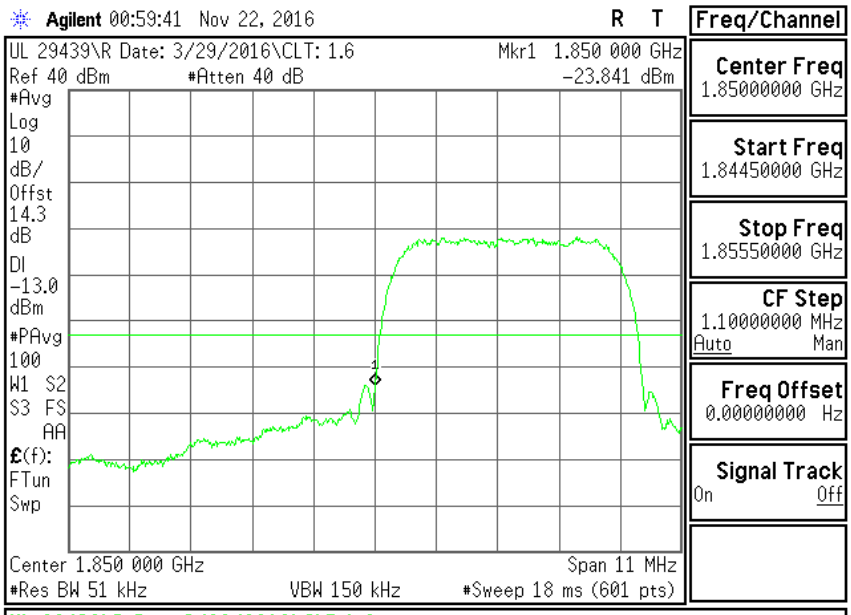





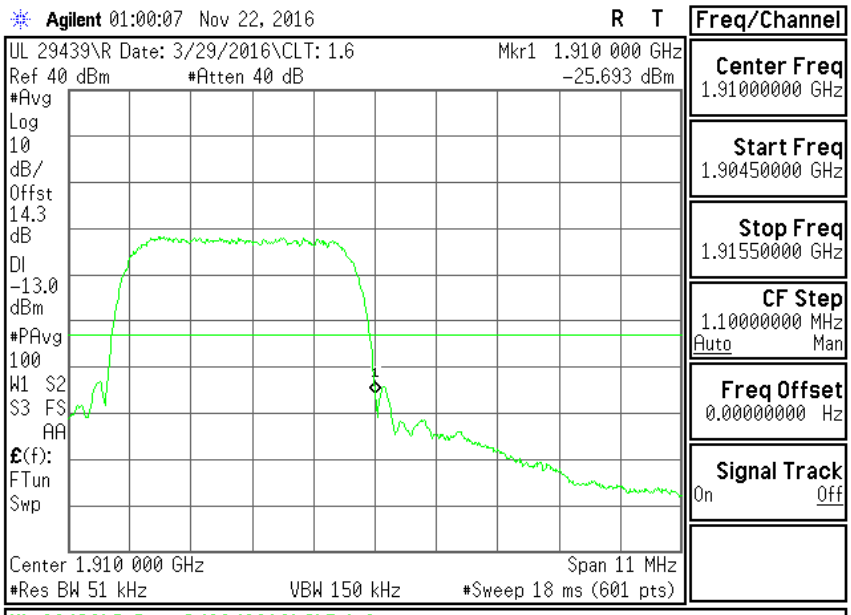
*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

**1900MHz BAND**

LOW CH




HIGH CH

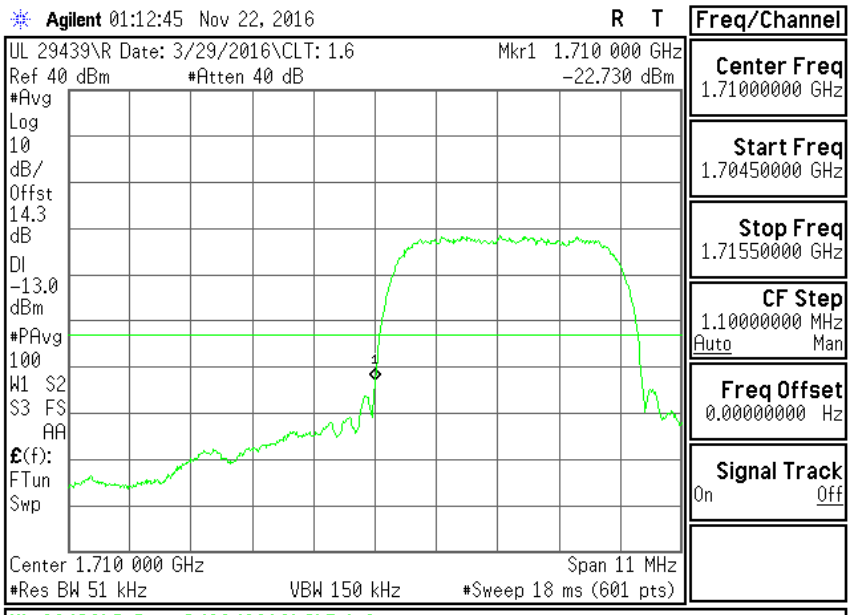




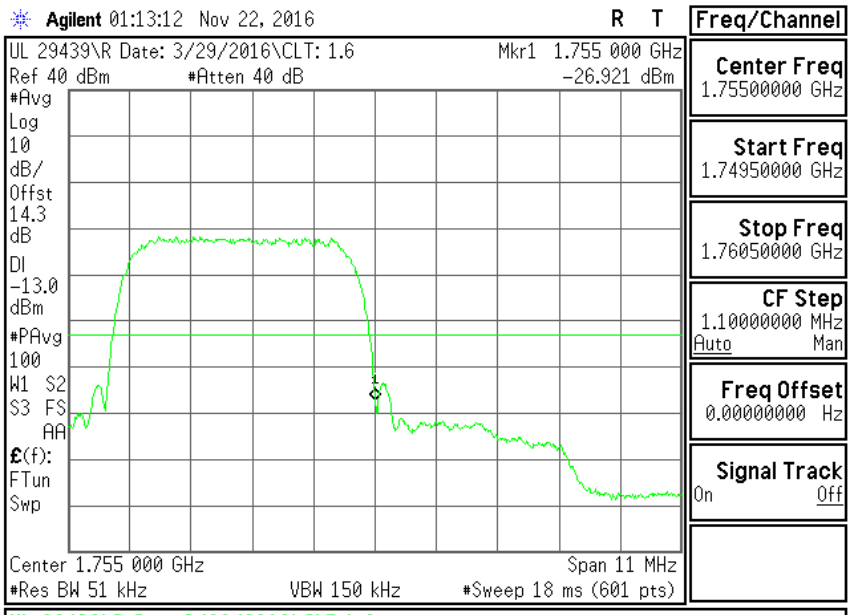
*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

**1700MHz BAND**

LOW CH




HIGH CH



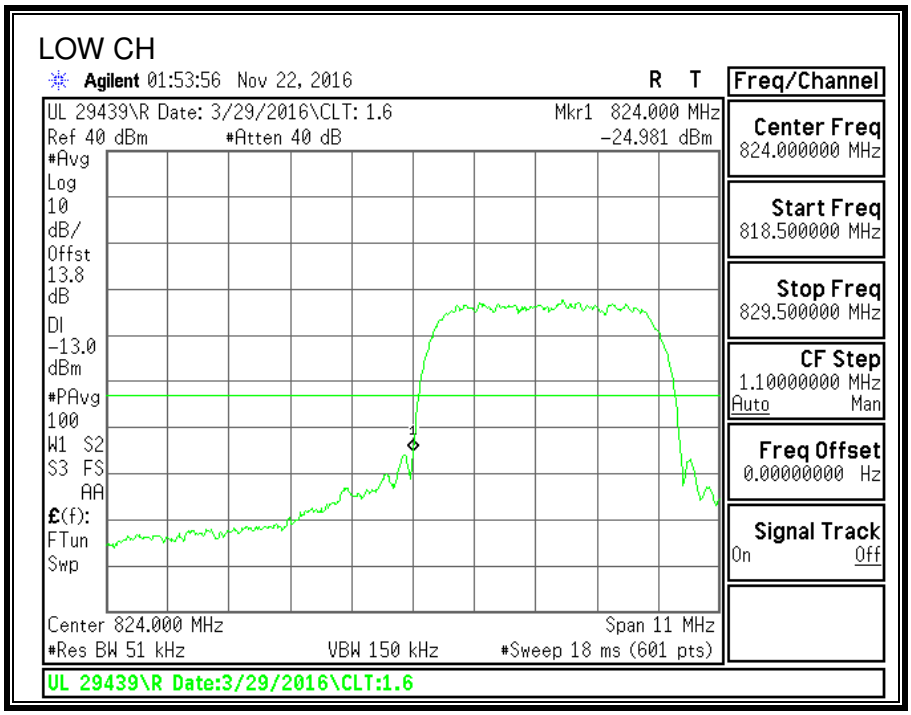


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

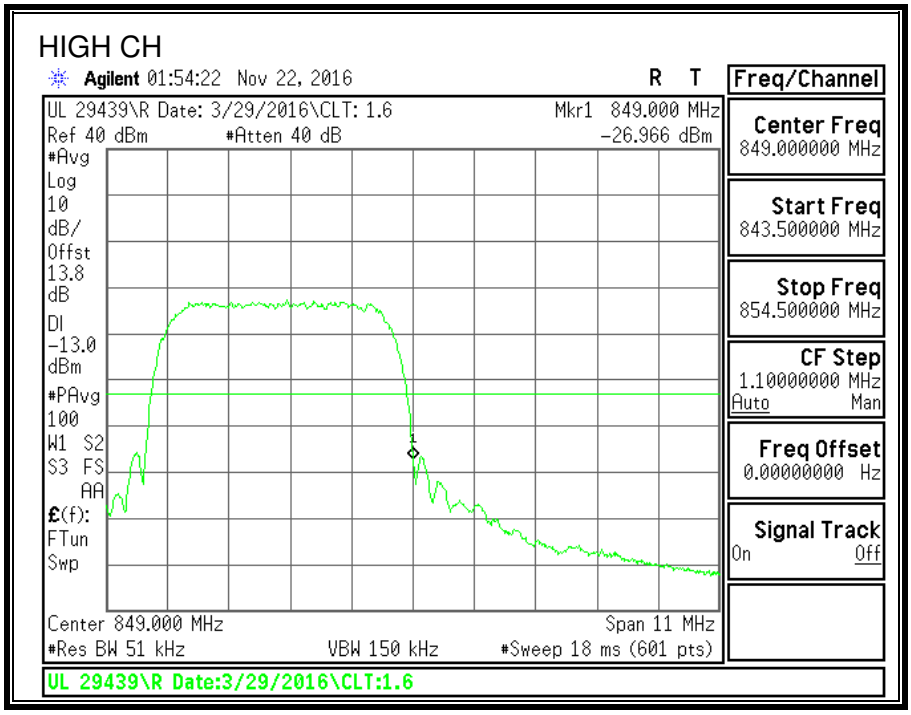
## 8.2.8. UMTS HSDPA

**850MHz BAND**

LOW CH




HIGH CH

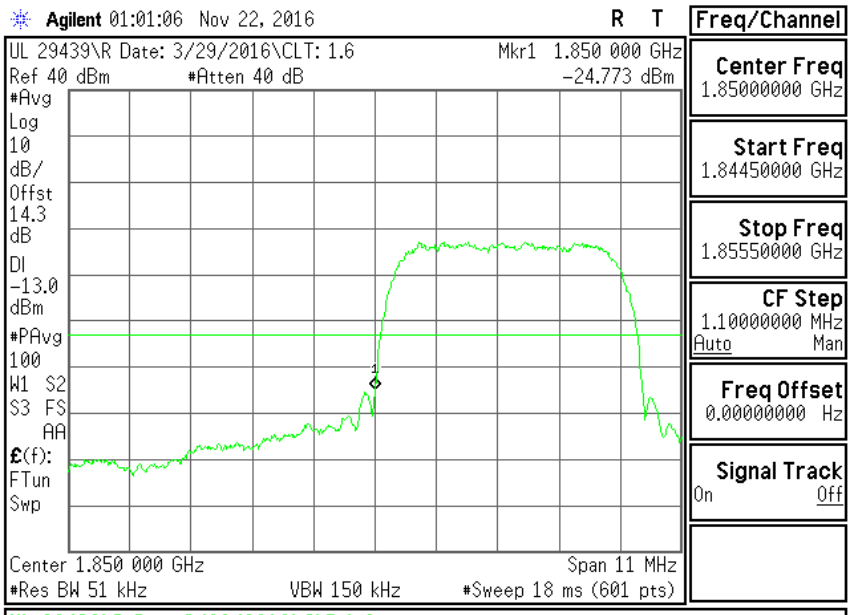




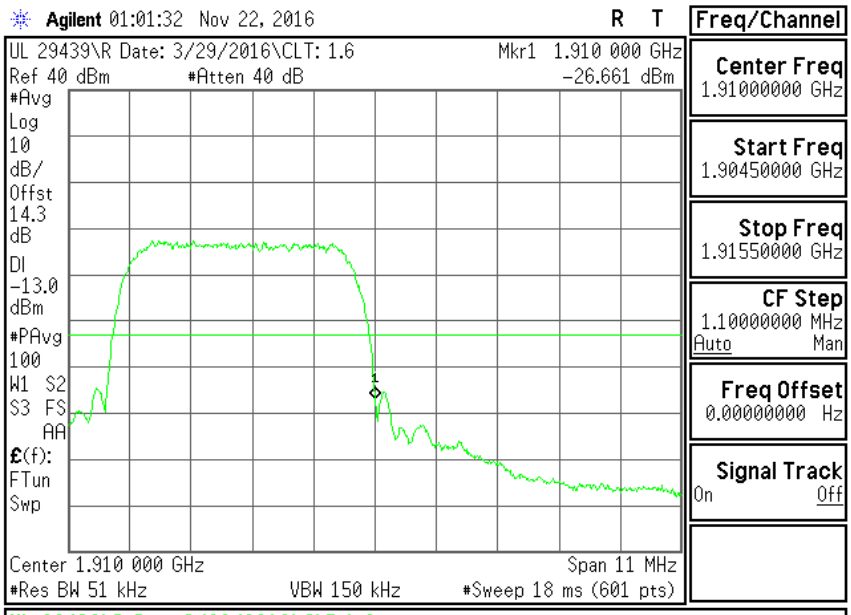
*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

**1900MHz BAND**

LOW CH




HIGH CH

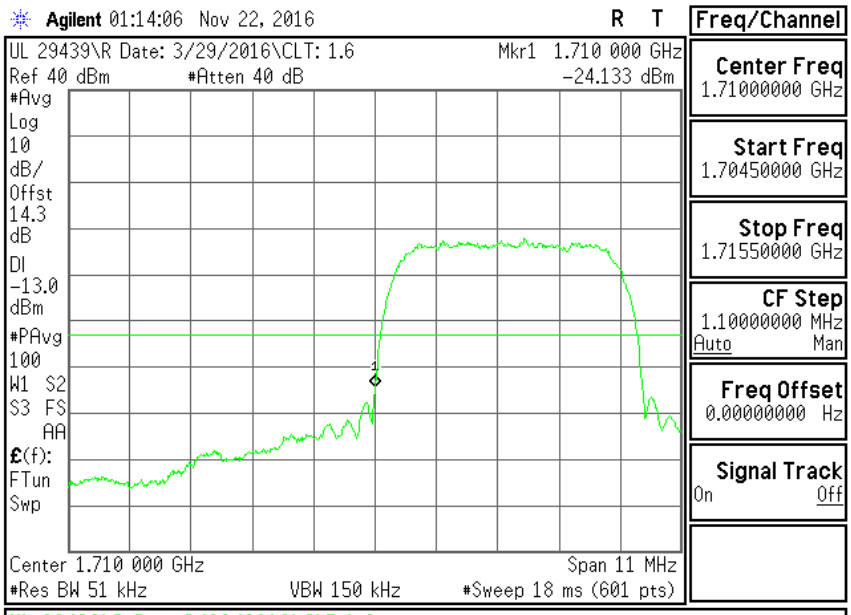




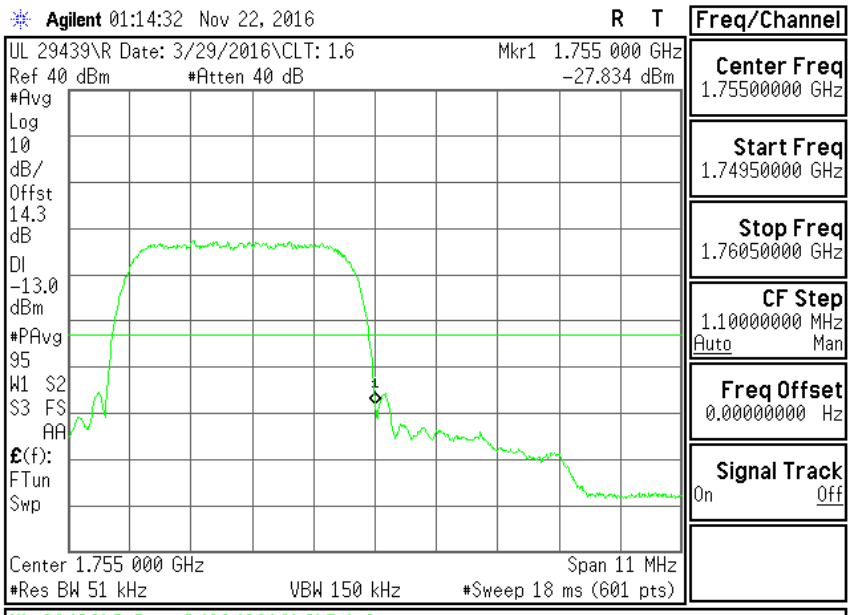
*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

**1700MHz BAND**

LOW CH




HIGH CH





*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

## 8.3. OUT OF BAND EMISSIONS

**RULE PART(S)**
FCC: §2.1051, §22. 359, §22.917, §24.238 and §90.691
IC: RSS132§5.5; RSS133§6.5 and RSS139§6.6

**LIMITS**
FCC: §22.359, §22.917, §24.238
The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log (P) dB.

FCC: §27.53
(c) On any frequency outside the 776–788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least 43 + 10 log (P) dB;
(1) On any frequency outside the 746-758 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least 43 + 10 log (P) dB;
(2) On any frequency outside the 776-788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least 43 + 10 log (P) dB;
(4) On all frequencies between 763-775 MHz and 793-805 MHz, by a factor not less than 65 + 10 log (P) dB in a 6.25 kHz band segment, for mobile and portable stations;
(5) Compliance with the provisions of paragraphs (c)(1) and (c)(2) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least 30 kHz may be employed;
(6) Compliance with the provisions of paragraphs (c)(3) and (c)(4) of this section is based on the use of measurement instrumentation such that the reading taken with any resolution bandwidth setting should be adjusted to indicate spectral energy in a 6.25 kHz segment.

FCC §90.691 Emission mask requirements for EA-based systems.

(a) Out-of-band emission requirement shall apply only to the “outer” channels included in an EA license and to spectrum adjacent to interior channels used by incumbent licensees. The emission limits are as follows:

(1) For any frequency removed from the EA licensee's frequency block by up to and including 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least 116 Log10(f/6.1) decibels or 50 + 10 Log10(P) decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 12.5 kHz.

(2) For any frequency removed from the EA licensee's frequency block greater than 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least 43 + 10Log10(P) decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 37.5 kHz.

(b) When an emission outside of the authorized bandwidth causes harmful interference, the Commission may, at its discretion, require greater attenuation than specified in this section.


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

RSS132§5.5
Mobile and base station equipment shall comply with the limits in (i) and (ii) below.
In the first 1.0 MHz band immediately outside and adjacent to each of the sub-bands specified in Section 5.1, the power of emissions per any 1% of the occupied bandwidth shall be attenuated (in dB) below the transmitter output power P ( dBW) by at least 43 + 10 log10p (watts).
After the first 1.0 MHz immediately outside and adjacent to each of the sub-bands, the power of emissions in any100 kHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least43 + 10 log10 p (watts). If the measurement is performed using 1% of the occupied bandwidth, power integration over 100 kHz is required.

RSS133§6.5
Equipment shall comply with the limits in (i) and (ii) below.
(i)In the 1.0 MHz bands immediately outside and adjacent to the equipment's operating frequency block, the emission power per any 1% of the emission bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 log10p(watts).
(ii)After the first 1.0 MHz, the emission power in any 1 MHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 log10p(watts). If the measurement is performed using 1% of the emission bandwidth, power integration over 1.0 MHz is required.

RSS139§6.6
(i)In the first 1.0 MHz bands immediately outside and adjacent to the equipment's smallest operating frequency block,Footnote2 which can contain the equipment's occupied bandwidth, the emission power per any 1% of the emission bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least43 + 10 log10 p (watts) dB.
(ii)After the first 1.0 MHz outside the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power in any 1 MHz bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least 43 + 10 log10 p (watts) 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.

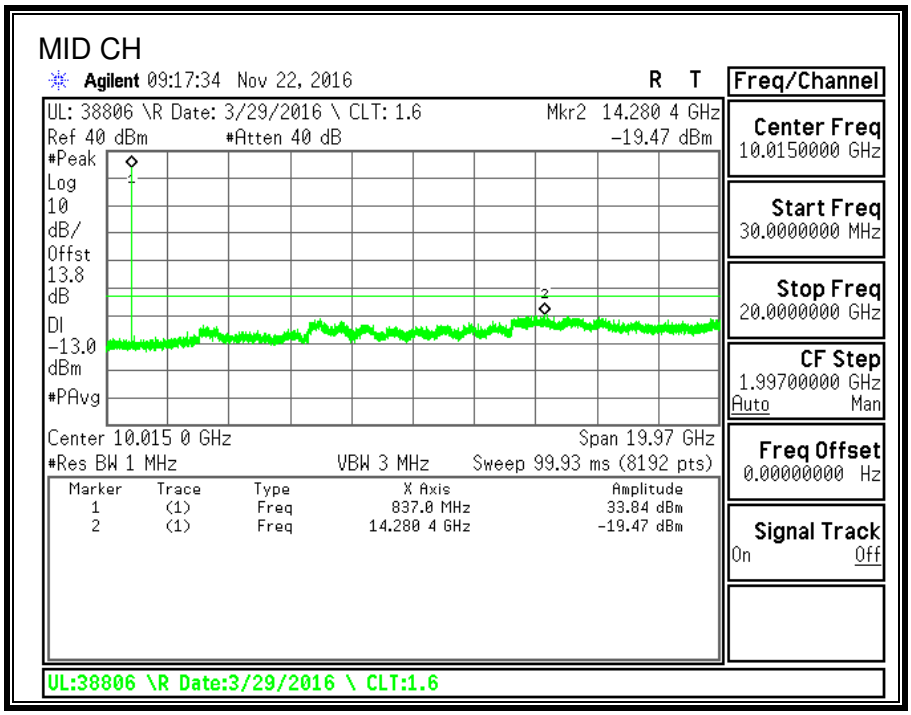
For each out of band emissions measurement:
- Set display line at -13 dBm
- Set RBW & VBW to 100 kHz for the measurement below 1 GHz, and 1 MHz for the measurement above 1 GHz.

**RESULTS**

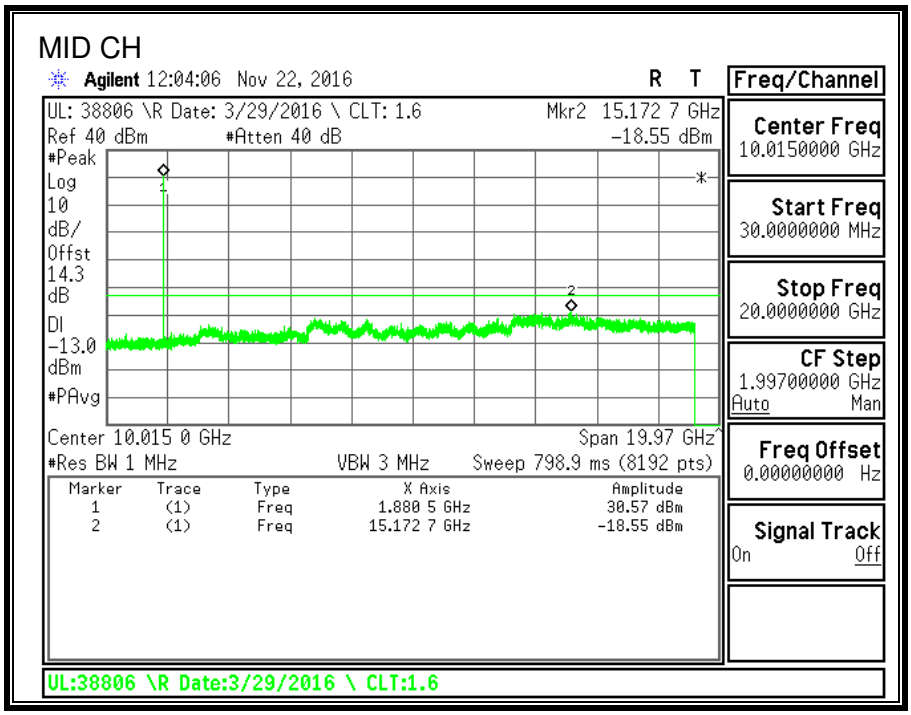

*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

### 8.3.1. GSM GPRS

**850MHz BAND**




**1900MHz BAND**

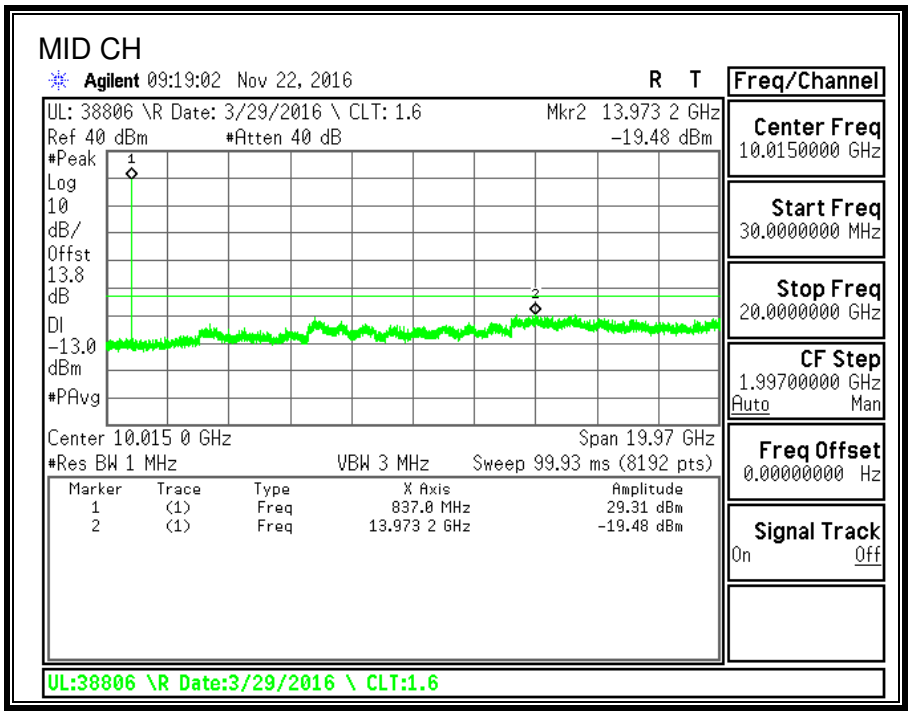




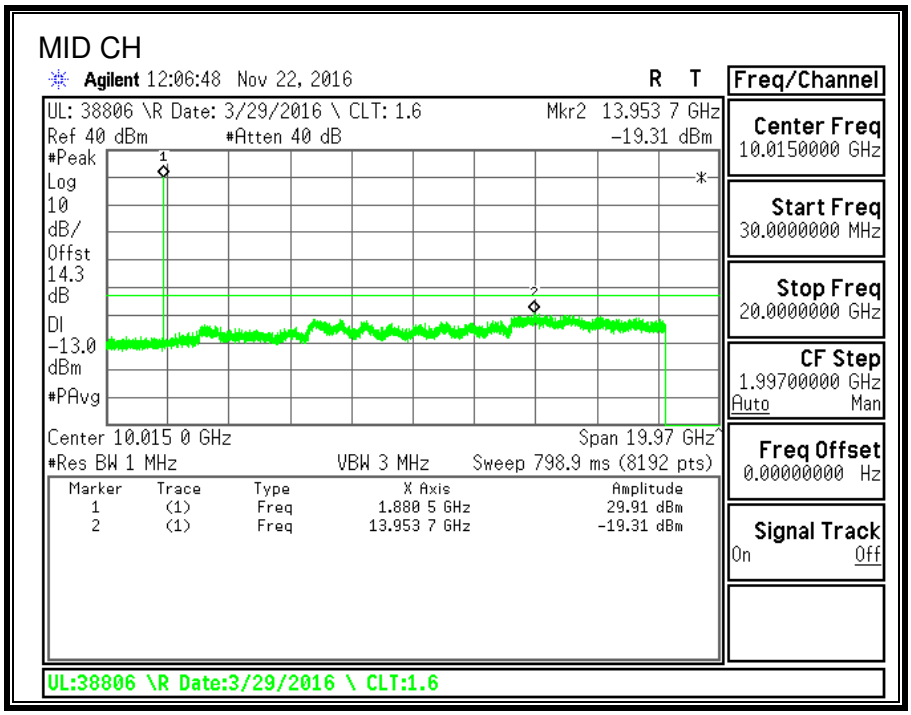
*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

### 8.3.2. GSM EGPRS

**850MHz BAND**




**1900MHz BAND**



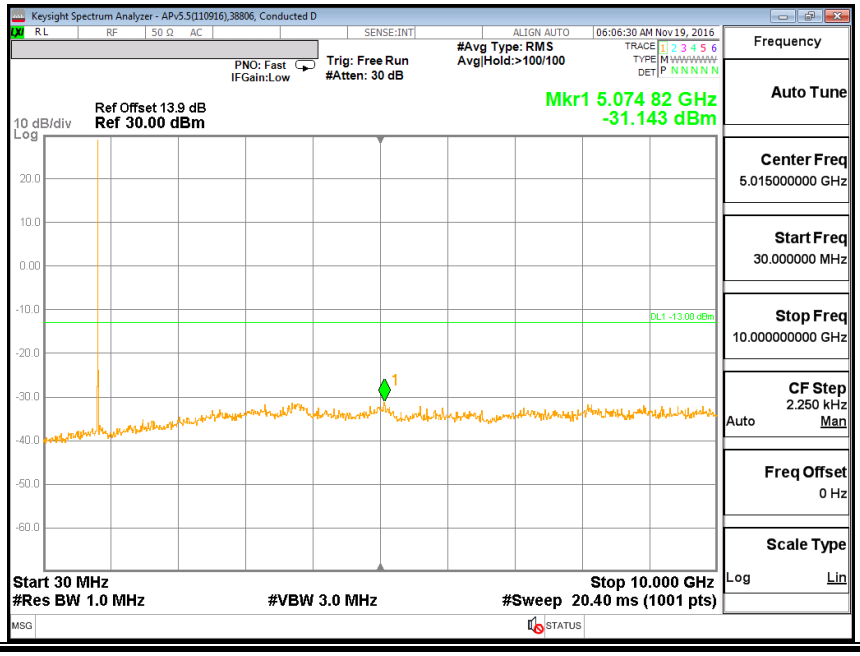


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

### 8.3.3. CDMA2000 1xRTT

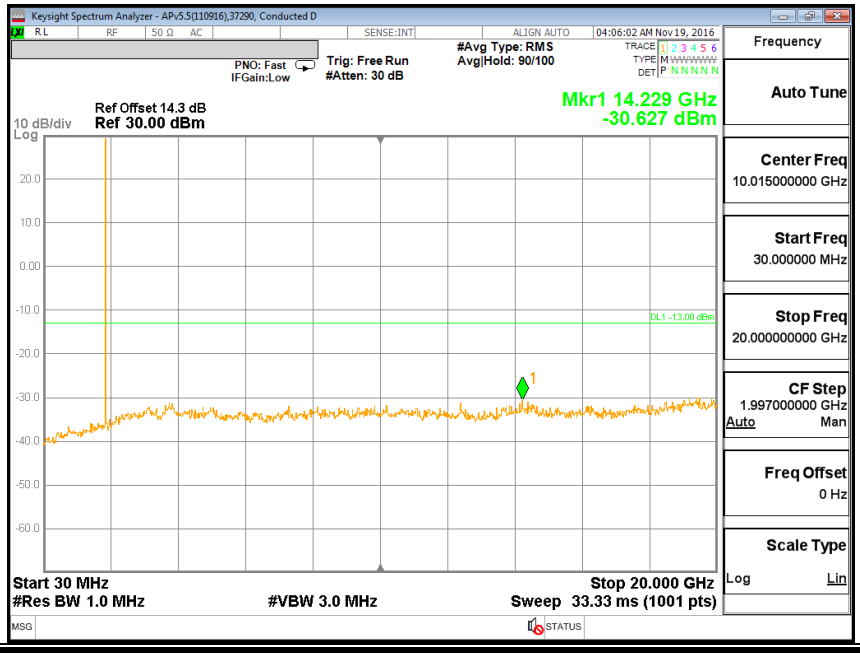
**850MHz BAND**

MID CH




**1900MHz BAND**

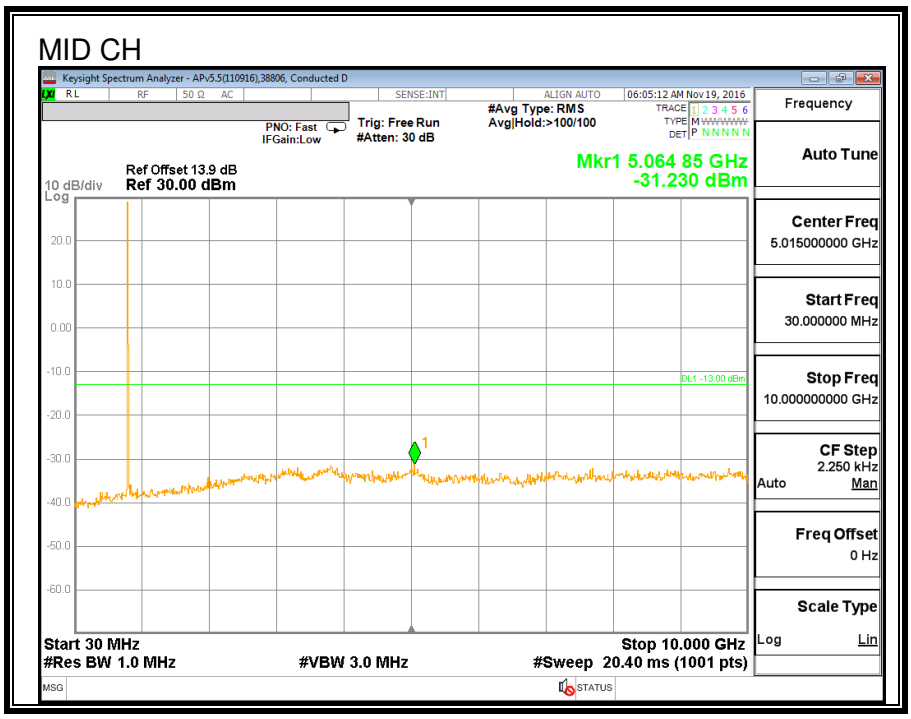
MID CH





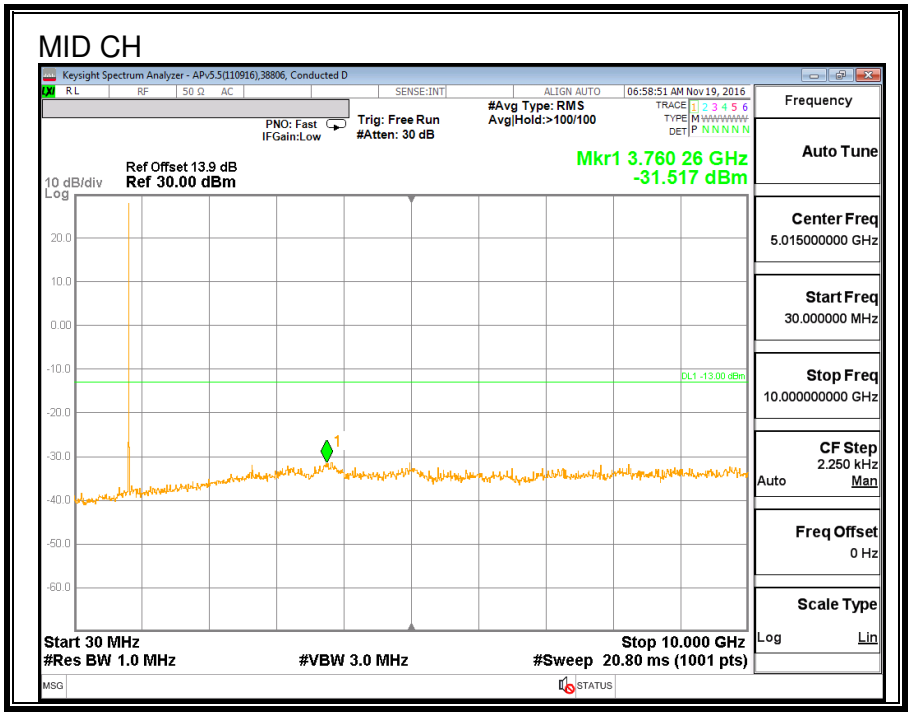
*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

**800MHz SECONDARY BAND**




## 8.3.4. CDMA2000 EVDO REV A

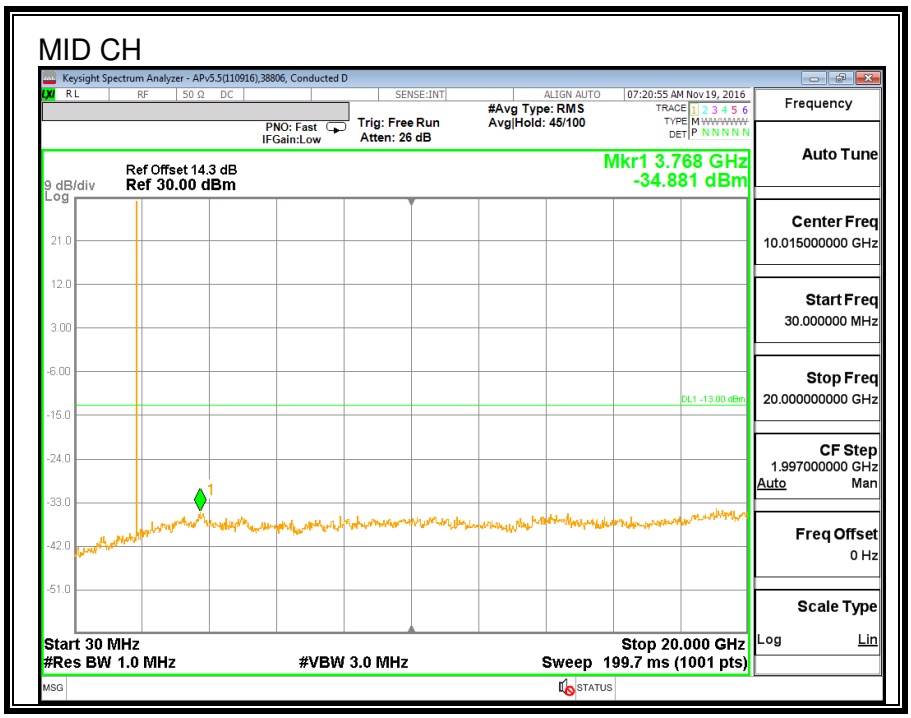
**850MHz BAND**



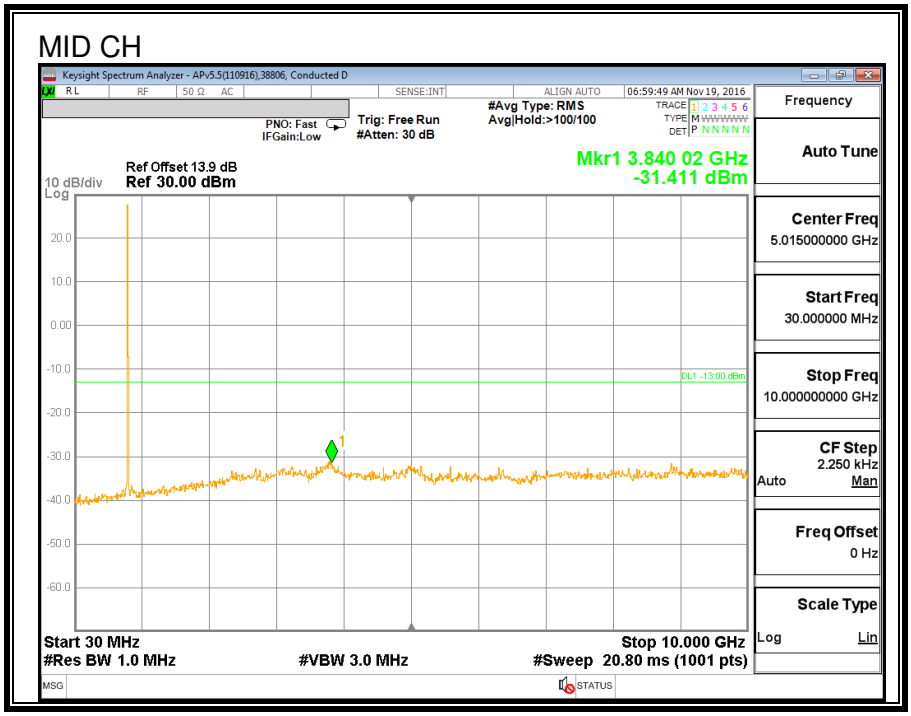


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

**1900MHz BAND**




**800MHz SECONDARY BAND**

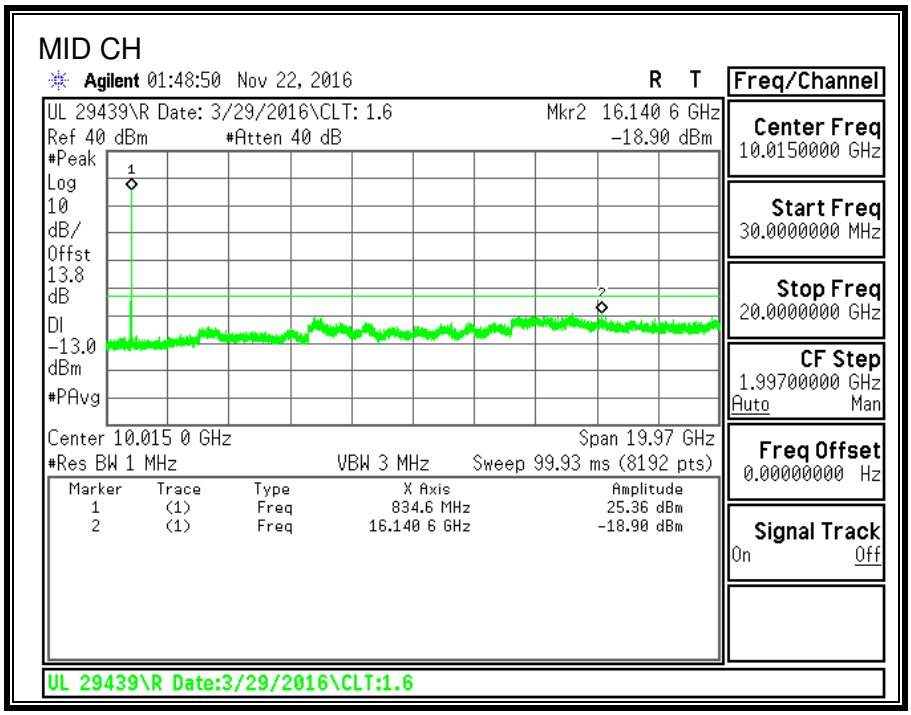




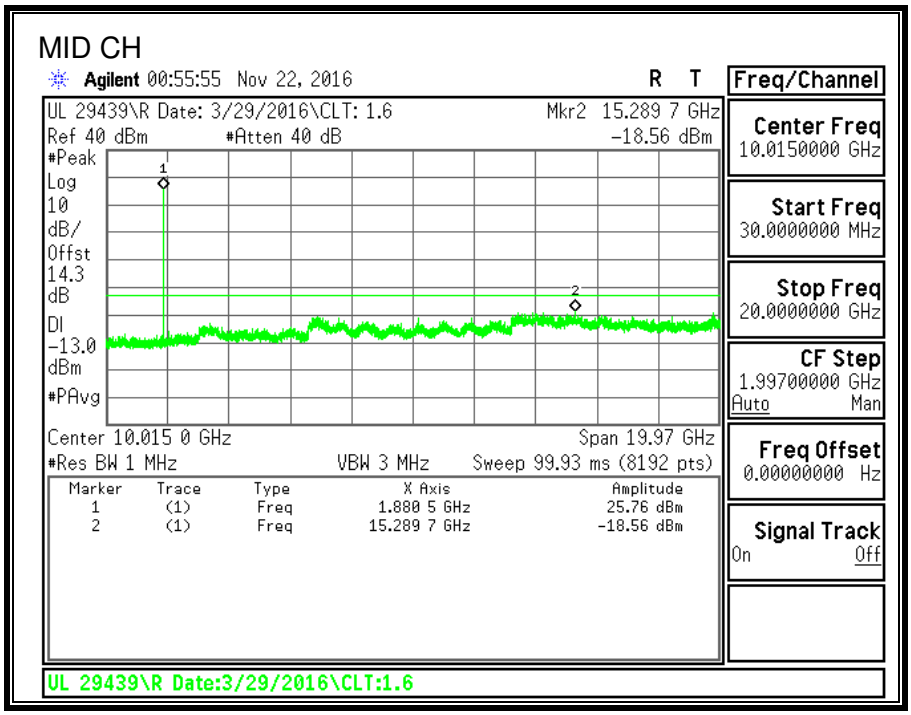
*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

### 8.3.5. UMTS Rel99

**850MHz BAND**



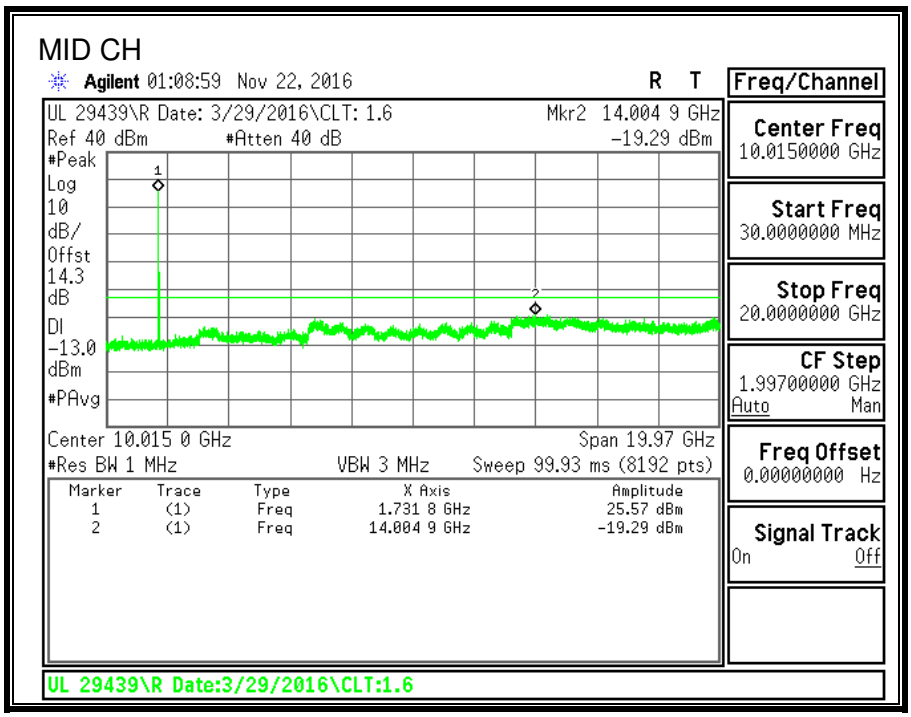

**1900MHz BAND**





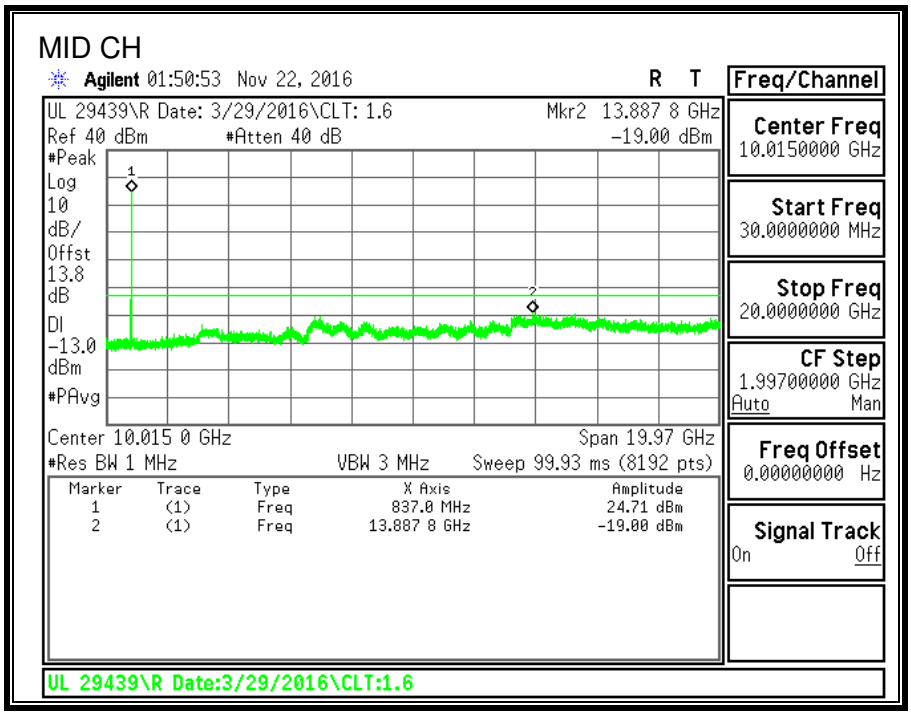
*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

**1700MHz BAND**




## 8.3.6. UMTS HSDPA

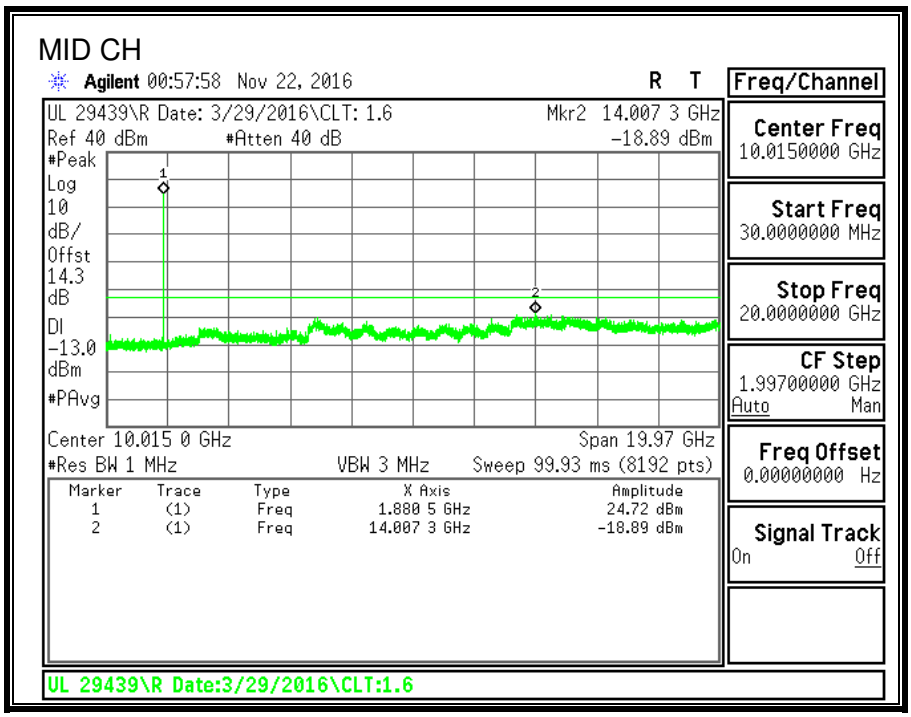
**850MHz BAND**



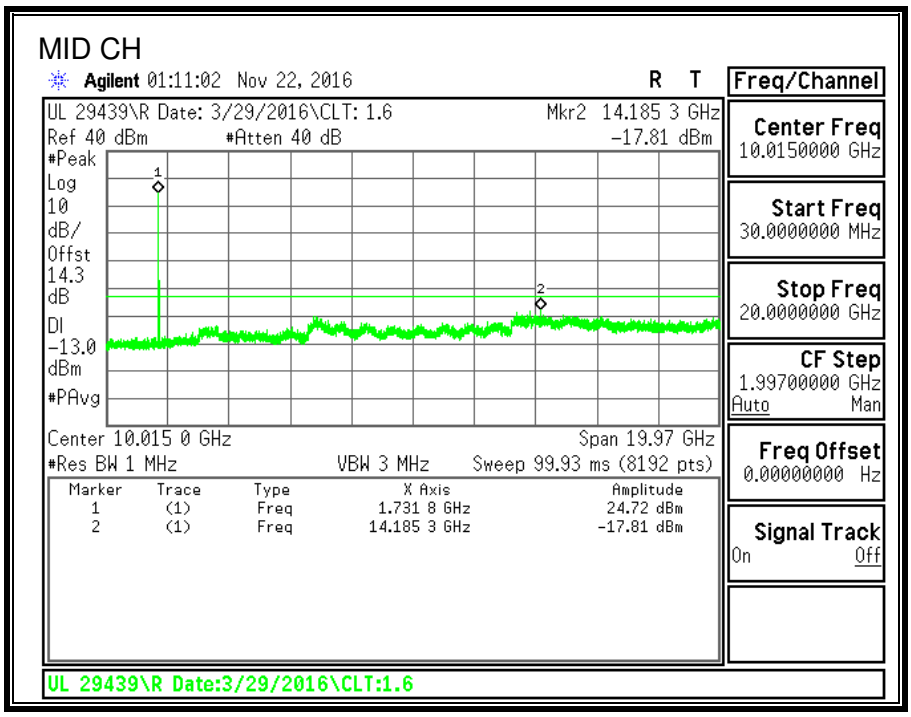


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

**1900MHz BAND**




**1700MHz BAND**





*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

# 9. FREQUENCY STABILITY

**RULE PART(S)**

FCC: §2.1055, §22.355, §24.235, §27.54 and §90.213
IC: RSS132§5.3; RSS133§6.3 and RSS139§6.4

**LIMITS**

FCC §22.355
The carrier frequency shall not depart from the reference frequency in excess of ±2.5 ppm for mobile stations.

FCC §24.235 & §27.54
The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

FCC §90.213
The carrier frequency shall not depart from the reference frequency in excess of ±2.5 ppm for mobile stations

RSS132§5.3
The carrier frequency shall not depart from the reference frequency in excess of ±2.5 SRSP for mobile stations and±1.5 ppm for base stations.
In lieu of meeting the above stability values, the test report may show that the frequency stability is sufficient to ensure that the occupied bandwidth stays within each of the sub-bands (see Section 5.1) when tested to the temperature and supply voltage variations specified in RSS-Gen.

RSS133§6.3
The carrier frequency shall not depart from the reference frequency, in excess of ±2.5 ppm for mobile stations and±1.0 ppm for base stations.
In lieu of meeting the above stability values, the test report may show that the frequency stability is sufficient to ensure that the emission bandwidth stays within the operating frequency block when tested to the temperature and supply voltage variations specified in RSS-Gen.

RSS139§6.4
The frequency stability shall be sufficient to ensure that the occupied bandwidth stays within the operating frequency block when tested to the temperature and supply voltage variations specified in RSS-Gen.


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

**TEST PROCEDURE**

Use CMW 500 with Frequency Error measurement capability.

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

  Low voltage: 3.23VDC, Normal, 3.8VDC and High voltage, 4.37VDC.
  End Voltage: 3.20VDC.

**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).

**RESULTS**

See the following pages.


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

## 9.1. GSM

| ID: | 39004 | Date: | 11/21/16 |
|---|---|---|---|

**GPRS 850**

| Limit | | 824 | 849 | Delta (Hz) | Frequency Stability (ppm) |
|---|---|---|---|---|---|
| Condition | | F low @ -13dBm | F high @ -13dBm | | |
| Temperature | Voltage | (MHz) | (MHz) | | |
| Normal (20C) | Normal | 824.0209 | 848.9853 | | |
| Extreme (50C) | | 824.0208 | 848.9853 | -11.5 | -0.01 |
| Extreme (40C) | | 824.0208 | 848.9853 | -9.8 | -0.01 |
| Extreme (30C) | | 824.0208 | 848.9853 | -8.6 | -0.01 |
| Extreme (10C) | | 824.0209 | 848.9853 | 7.6 | 0.01 |
| Extreme (0C) | | 824.0209 | 848.9853 | 12.6 | 0.02 |
| Extreme (-10C) | | 824.0209 | 848.9854 | 26.9 | 0.03 |
| Extreme (-20C) | | 824.0209 | 848.9854 | 26.2 | 0.03 |
| Extreme (-30C) | | 824.0209 | 848.9853 | 23.6 | 0.03 |
| | | | | | |
| 20C | 15% | 824.0208 | 848.9853 | -7.5 | -0.01 |
| | -15% | 824.0209 | 848.9853 | 6.8 | 0.01 |
| | End Point | 824.0208 | 848.9853 | -12.3 | -0.01 |

**EGPRS 850**

| Limit | | 824 | 849 | Delta (Hz) | Frequency Stability (ppm) |
|---|---|---|---|---|---|
| Condition | | F low @ -13dBm | F high @ -13dBm | | |
| Temperature | Voltage | (MHz) | (MHz) | | |
| Normal (20C) | Normal | 824.0437 | 848.9640 | | |
| Extreme (50C) | | 824.0437 | 848.9640 | 10.2 | 0.01 |
| Extreme (40C) | | 824.0438 | 848.9640 | 16.9 | 0.02 |
| Extreme (30C) | | 824.0438 | 848.9640 | 25.4 | 0.03 |
| Extreme (10C) | | 824.0438 | 848.9641 | 42.2 | 0.05 |
| Extreme (0C) | | 824.0438 | 848.9641 | 40.7 | 0.05 |
| Extreme (-10C) | | 824.0438 | 848.9640 | 24.9 | 0.03 |
| Extreme (-20C) | | 824.0438 | 848.9640 | 35.8 | 0.04 |
| Extreme (-30C) | | 824.0438 | 848.9640 | 29.7 | 0.04 |
| | | | | | |
| 20C | 15% | 824.0438 | 848.9640 | 24.5 | 0.03 |
| | -15% | 824.0438 | 848.9640 | 22.2 | 0.03 |
| | End Point | 824.0437 | 848.9640 | -11.0 | -0.01 |


UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701i
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

**GPRS 1900**

| Limit | | 1850 | 1910 | Delta (Hz) | Frequency Stability (ppm) |
|---|---|---|---|---|---|
| Condition | | F low @ -13dBm (MHz) | F high @ -13dBm (MHz) | | |
| Temperature | Voltage | | | | |
| Normal (20C) | Normal | 1850.030381 | 1909.970405 | | |
| Extreme (50C) | | 1850.030339 | 1909.970362 | -42.51 | -0.02 |
| Extreme (40C) | | 1850.030350 | 1909.970373 | -31.57 | -0.02 |
| Extreme (30C) | | 1850.030328 | 1909.970351 | -53.62 | -0.03 |
| Extreme (10C) | | 1850.030320 | 1909.970344 | -61.32 | -0.03 |
| Extreme (0C) | | 1850.030317 | 1909.970341 | -64.35 | -0.03 |
| Extreme (-10C) | | 1850.030422 | 1909.970446 | 40.53 | 0.02 |
| Extreme (-20C) | | 1850.030340 | 1909.970364 | -41.35 | -0.02 |
| Extreme (-30C) | | 1850.030342 | 1909.970365 | -39.78 | -0.02 |
| | | | | | |
| 20C | 15% | 1850.030350 | 1909.970374 | -31.25 | -0.02 |
| | -15% | 1850.030352 | 1909.970375 | -29.63 | -0.02 |
| | End Point | 1850.0304 | 1909.970382 | -23.34 | -0.01 |

**EGPRS 1900**

| Limit | | 1850 | 1910 | Delta (Hz) | Frequency Stability (ppm) |
|---|---|---|---|---|---|
| Condition | | F low @ -13dBm (MHz) | F high @ -13dBm (MHz) | | |
| Temperature | Voltage | | | | |
| Normal (20C) | Normal | 1850.042438 | 1909.961351 | | |
| Extreme (50C) | | 1850.042391 | 1909.961304 | -47.62 | -0.03 |
| Extreme (40C) | | 1850.042471 | 1909.961384 | 32.81 | 0.02 |
| Extreme (30C) | | 1850.042374 | 1909.961287 | -64.52 | -0.03 |
| Extreme (10C) | | 1850.042504 | 1909.961417 | 65.30 | 0.03 |
| Extreme (0C) | | 1850.042493 | 1909.961406 | 54.72 | 0.03 |
| Extreme (-10C) | | 1850.042407 | 1909.961319 | -31.84 | -0.02 |
| Extreme (-20C) | | 1850.042492 | 1909.961405 | 53.43 | 0.03 |
| Extreme (-30C) | | 1850.042491 | 1909.961404 | 52.72 | 0.03 |
| | | | | | |
| 20C | 15% | 1850.042470 | 1909.961383 | 32.11 | 0.02 |
| | -15% | 1850.042419 | 1909.961332 | -19.23 | -0.01 |
| | End Point | 1850.0424 | 1909.961330 | -21.46 | -0.01 |


UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701i
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

## 9.2. CDMA2000

**CDMA 1xRTT BC0**

| Limit | | 824 | 849 | Delta (Hz) | Frequency Stability (ppm) |
|---|---|---|---|---|---|
| Condition | | F low @ -13dBm | F high @ -13dBm | | |
| Temperature | Voltage | (MHz) | (MHz) | | |
| Normal (20C) | Normal | 824.020661 | 848.997508 | | |
| Extreme (50C) | | 824.020657 | 848.997503 | -4.61 | -0.01 |
| Extreme (40C) | | 824.020657 | 848.997504 | -3.88 | 0.00 |
| Extreme (30C) | | 824.020663 | 848.997510 | 1.76 | 0.00 |
| Extreme (10C) | | 824.020666 | 848.997512 | 4.25 | 0.01 |
| Extreme (0C) | | 824.020667 | 848.997513 | 5.42 | 0.01 |
| Extreme (-10C) | | 824.020667 | 848.997514 | 5.71 | 0.01 |
| Extreme (-20C) | | 824.020666 | 848.997513 | 5.20 | 0.01 |
| Extreme (-30C) | | 824.020666 | 848.997513 | 4.97 | 0.01 |
| | | | | | |
| 20C | 15% | 824.020658 | 848.997504 | -3.44 | 0.00 |
| | -15% | 824.020657 | 848.997504 | -4.25 | -0.01 |
| | End Point | 824.020656 | 848.99750273 | -5.12 | -0.01 |

**CDMA 1x RTT BC1**

| Limit | | 1850 | 1910 | Delta (Hz) | Frequency Stability (ppm) |
|---|---|---|---|---|---|
| Condition | | F low @ -13dBm | F high @ -13dBm | | |
| Temperature | Voltage | (MHz) | (MHz) | | |
| Normal (20C) | Normal | 1850.540000 | 1909.464000 | | |
| Extreme (50C) | | 1850.539992 | 1909.463992 | -7.91 | 0.00 |
| Extreme (40C) | | 1850.539995 | 1909.463995 | -5.42 | 0.00 |
| Extreme (30C) | | 1850.539996 | 1909.463996 | -4.17 | 0.00 |
| Extreme (10C) | | 1850.540001 | 1909.464001 | 0.59 | 0.00 |
| Extreme (0C) | | 1850.540004 | 1909.464004 | 4.32 | 0.00 |
| Extreme (-10C) | | 1850.540007 | 1909.464007 | 7.10 | 0.00 |
| Extreme (-20C) | | 1850.540010 | 1909.464010 | 9.65 | 0.01 |
| Extreme (-30C) | | 1850.540008 | 1909.464008 | 8.20 | 0.00 |
| | | | | | |
| 20C | 15% | 1850.539993 | 1909.463993 | -7.03 | 0.00 |
| | -15% | 1850.539991 | 1909.463991 | -9.30 | 0.00 |
| | End Point | 1850.539990 | 1909.463990 | -10.10 | -0.01 |


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

**CDMA 1xRTT BC10**

| Limit | | 816.35 | 823.65 | Delta (Hz) | Frequency Stability (ppm) |
|---|---|---|---|---|---|
| Condition | | F low @ -13dBm (MHz) | F high @ -13dBm (MHz) | | |
| Temperature | Voltage | | | | |
| Normal (20C) | Normal | 816.569255 | 823.433052 | | |
| Extreme (50C) | | 816.569249 | 823.433046 | -5.57 | -0.01 |
| Extreme (40C) | | 816.569251 | 823.433048 | -3.44 | 0.00 |
| Extreme (30C) | | 816.569257 | 823.433054 | 2.42 | 0.00 |
| Extreme (10C) | | 816.569258 | 823.433055 | 3.30 | 0.00 |
| Extreme (0C) | | 816.569260 | 823.433057 | 5.13 | 0.01 |
| Extreme (-10C) | | 816.569261 | 823.433058 | 6.08 | 0.01 |
| Extreme (-20C) | | 816.569260 | 823.433056 | 4.83 | 0.01 |
| Extreme (-30C) | | 816.569259 | 823.433055 | 3.81 | 0.00 |
| | | | | | |
| 20C | 15% | 816.569254 | 823.433050 | -1.25 | 0.00 |
| | -15% | 816.569251 | 823.433048 | -3.44 | 0.00 |
| | End Point | 816.5693 | 823.433047 | -4.67 | -0.01 |


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

## 9.3. UMTS

**WCDMA REL99 BAND 5**

| Limit | | 824 | 849 | Delta (Hz) | Frequency Stability (ppm) |
|---|---|---|---|---|---|
| Condition | | F low @ -13dBm | F high @ -13dBm | | |
| Temperature | Voltage | (MHz) | (MHz) | | |
| Normal (20C) | Normal | 824.14104 | 848.85301 | | |
| Extreme (50C) | | 824.14104 | 848.85301 | 3.69 | 0.00 |
| Extreme (40C) | | 824.14103 | 848.85300 | -4.63 | -0.01 |
| Extreme (30C) | | 824.14103 | 848.85300 | -6.47 | -0.01 |
| Extreme (10C) | | 824.14104 | 848.85301 | 5.91 | 0.01 |
| Extreme (0C) | | 824.14103 | 848.85300 | -7.10 | -0.01 |
| Extreme (-10C) | | 824.14104 | 848.85301 | 6.62 | 0.01 |
| Extreme (-20C) | | 824.14104 | 848.85301 | 3.27 | 0.00 |
| Extreme (-30C) | | 824.14102 | 848.85299 | -15.31 | -0.02 |
| | | | | | |
| 20C | 15% | 824.14103 | 848.85301 | -2.65 | 0.00 |
| | -15% | 824.14104 | 848.85301 | 3.29 | 0.00 |
| | End Point | 824.14104 | 848.85301 | 1.42 | 0.00 |

**WCDMA REL99 BAND 2**

| Limit | | 1850 | 1910 | Delta (Hz) | Frequency Stability (ppm) |
|---|---|---|---|---|---|
| Condition | | F low @ -13dBm | F high @ -13dBm | | |
| Temperature | Voltage | (MHz) | (MHz) | | |
| Normal (20C) | Normal | 1850.149050 | 1909.866408 | | |
| Extreme (50C) | | 1850.149080 | 1909.866438 | 30.18 | 0.02 |
| Extreme (40C) | | 1850.149099 | 1909.866457 | 48.76 | 0.03 |
| Extreme (30C) | | 1850.149088 | 1909.866446 | 37.97 | 0.02 |
| Extreme (10C) | | 1850.149000 | 1909.866358 | -50.18 | -0.03 |
| Extreme (0C) | | 1850.148994 | 1909.866352 | -55.77 | -0.03 |
| Extreme (-10C) | | 1850.148990 | 1909.866348 | -60.33 | -0.03 |
| Extreme (-20C) | | 1850.149113 | 1909.866471 | 63.07 | 0.03 |
| Extreme (-30C) | | 1850.149023 | 1909.866381 | -26.66 | -0.01 |
| | | | | | |
| 20C | 15% | 1850.149044 | 1909.866402 | -6.39 | 0.00 |
| | -15% | 1850.149040 | 1909.866398 | -10.43 | -0.01 |
| | End Point | 1850.149046 | 1909.866404 | -4.02 | 0.00 |


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

**WCDMA REL99 BAND 4**

| Limit | | 1710 | 1755 | Delta (Hz) | Frequency Stability (ppm) |
|---|---|---|---|---|---|
| Condition | | F low @ -13dBm (MHz) | F high @ -13dBm (MHz) | | |
| Temperature | Voltage | | | | |
| Normal (20C) | Normal | 1710.13198 | 1754.85544 | | |
| Extreme (50C) | | 1710.13195 | 1754.85540 | -31.31 | -0.02 |
| Extreme (40C) | | 1710.13196 | 1754.85542 | -16.24 | -0.01 |
| Extreme (30C) | | 1710.13196 | 1754.85542 | -17.07 | -0.01 |
| Extreme (10C) | | 1710.13199 | 1754.85545 | 13.30 | 0.01 |
| Extreme (0C) | | 1710.13196 | 1754.85542 | -17.64 | -0.01 |
| Extreme (-10C) | | 1710.13199 | 1754.85545 | 9.63 | 0.01 |
| Extreme (-20C) | | 1710.13196 | 1754.85542 | -16.57 | -0.01 |
| Extreme (-30C) | | 1710.13200 | 1754.85546 | 19.25 | 0.01 |
| | | | | | |
| 20C | 15% | 1710.13197 | 1754.85543 | -7.40 | 0.00 |
| | -15% | 1710.13197 | 1754.85542 | -11.74 | -0.01 |
| | End Point | 1710.13198 | 1754.85543 | -5.69 | 0.00 |


UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701i
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

# 10. PEAK-TO-AVERAGE RATIO

In addition, when the transmitter power is measured in terms of average value, the peak-to-average ratio of the power shall not exceed 13 dB.

**RESULTS**

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

| ID: | 50820 | Date: | 11/22/16 |
|---|---|---|---|

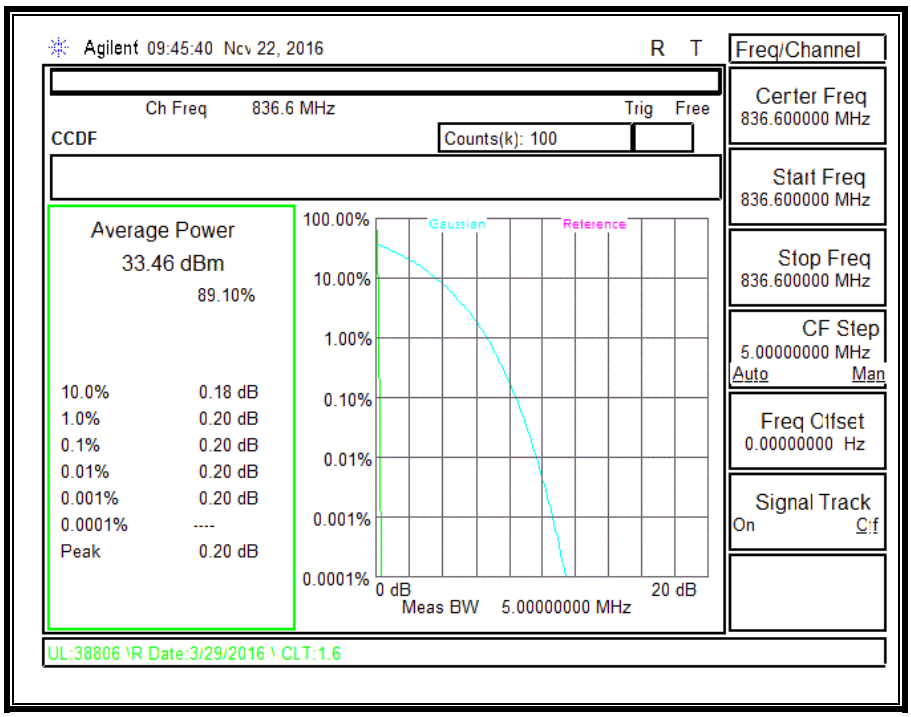
| Mode | Modulation | Conducted Power (dBm) | | Peak-to-Average Ratio |
|---|---|---|---|---|
| | | *Peak | Average | |
| GSM850 | GPRS | 33.66 | 33.46 | 0.20 |
| | EGPRS | 31.51 | 27.96 | 3.55 |
| GSM1900 | GPRS | 29.75 | 29.35 | 0.40 |
| | EGPRS | 29.93 | 26.70 | 3.23 |
| *Peak Reading = Average Reading + Peak - to - Average Ratio | | | | |

| Mode | Modulation | Conducted Power (dBm) | | Peak-to-Average Ratio |
|---|---|---|---|---|
| | | *Peak | Average | |
| CDMA2000 BC0 | 1xRTT | 28.96 | 24.48 | 4.48 |
| | EVDO A | 28.5 | 24.43 | 4.07 |
| CDMA2000 BC1 | 1xRTT | 30.03 | 25.96 | 4.07 |
| | EVDO A | 31.54 | 26.00 | 5.54 |
| CDMA2000 BC10 | 1xRTT | 30.53 | 25.99 | 4.54 |
| | EVDO A | 31.50 | 25.95 | 5.55 |
| *Peak Reading = Average Reading + Peak - to - Average Ratio | | | | |

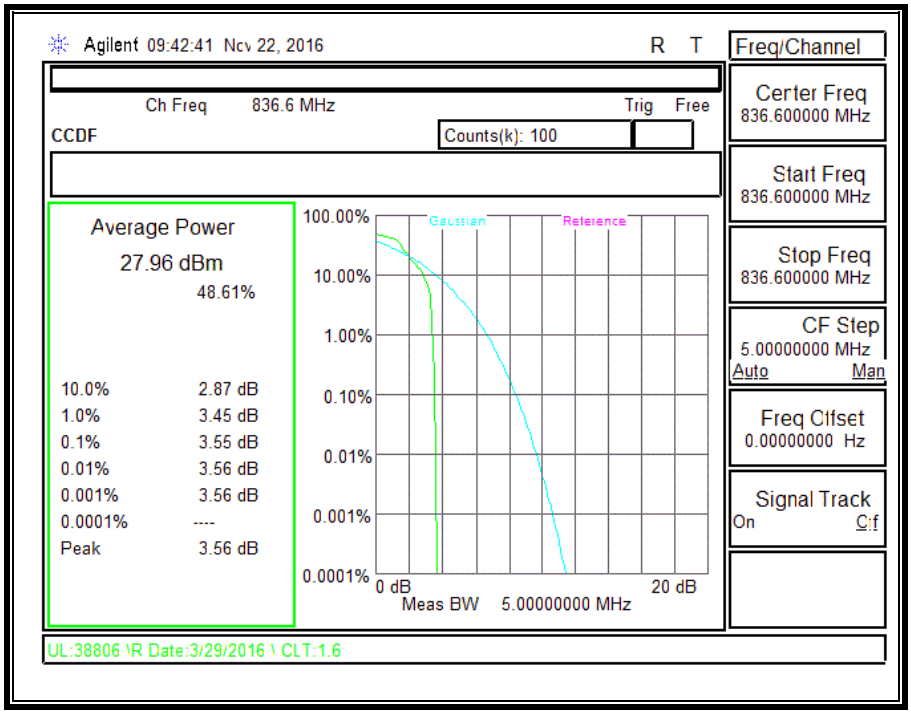
| Mode | Modulation | Conducted Power (dBm) | | Peak-to-Average Ratio |
|---|---|---|---|---|
| | | *Peak | Average | |
| UMTS Band 5 | REL99 | 28.67 | 25.43 | 3.24 |
| | HSDPA | 27.69 | 24.40 | 3.29 |
| UMTS Band 2 | REL99 | 28.3 | 25.34 | 2.96 |
| | HSDPA | 27.57 | 24.31 | 3.26 |
| UMTS Band 4 | REL99 | 28.63 | 25.41 | 3.22 |
| | HSDPA | 27.67 | 24.39 | 3.28 |
| *Peak Reading = Average Reading + Peak - to - Average Ratio | | | | |


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

**GSM850, GPRS**



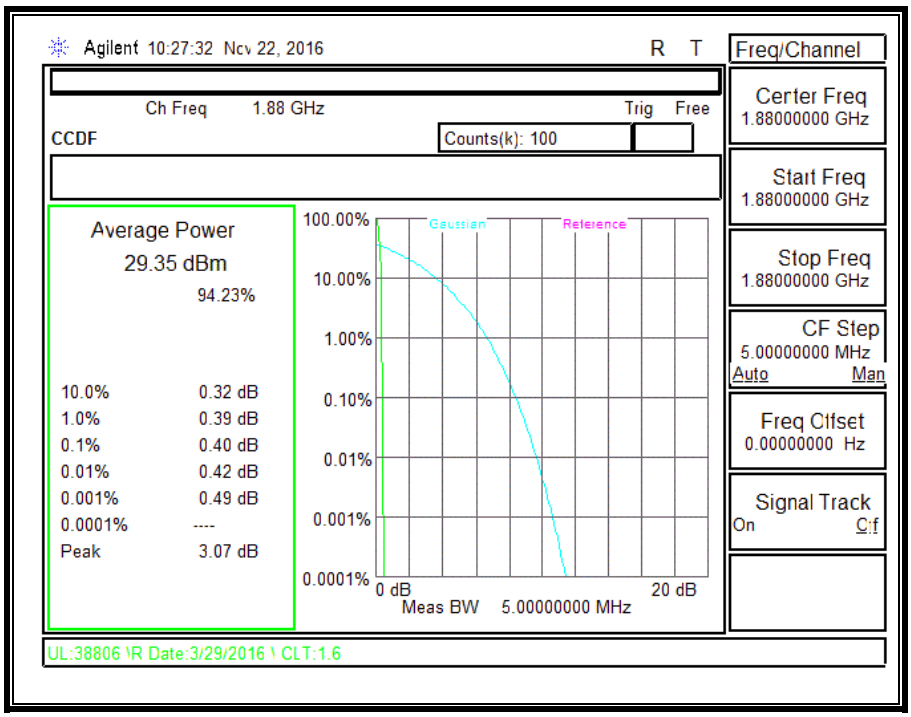

**GSM850, EGPRS**



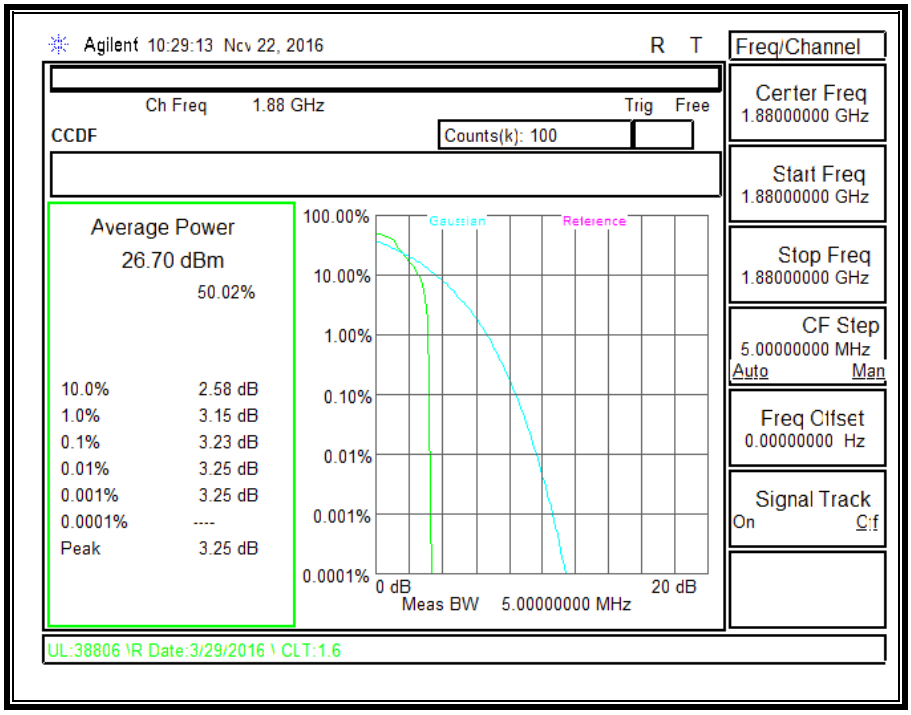


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

**GSM1900, GPRS**



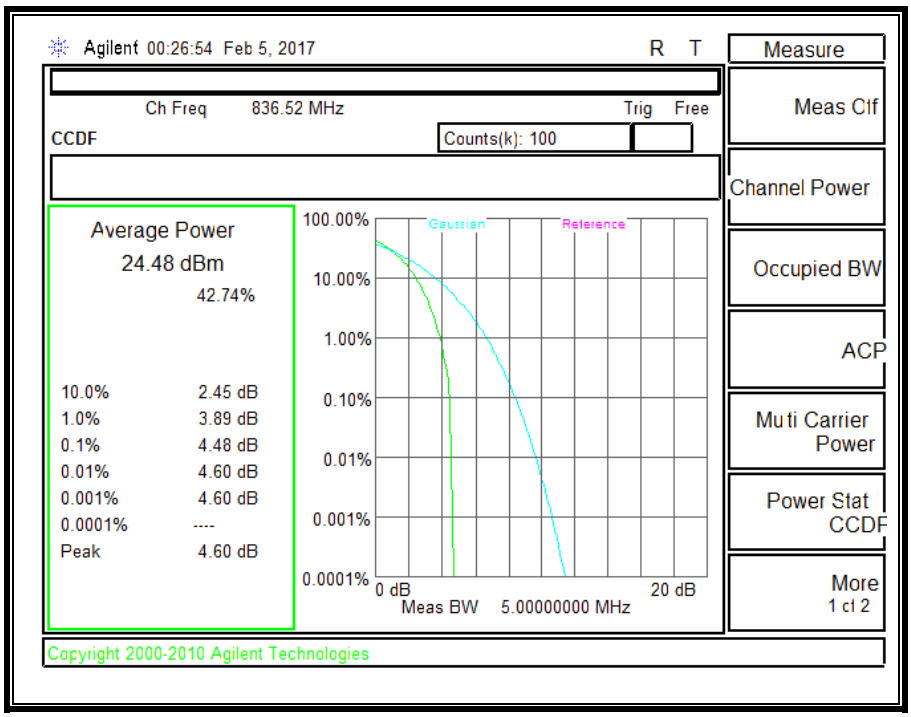

**GSM1900, EGPRS**



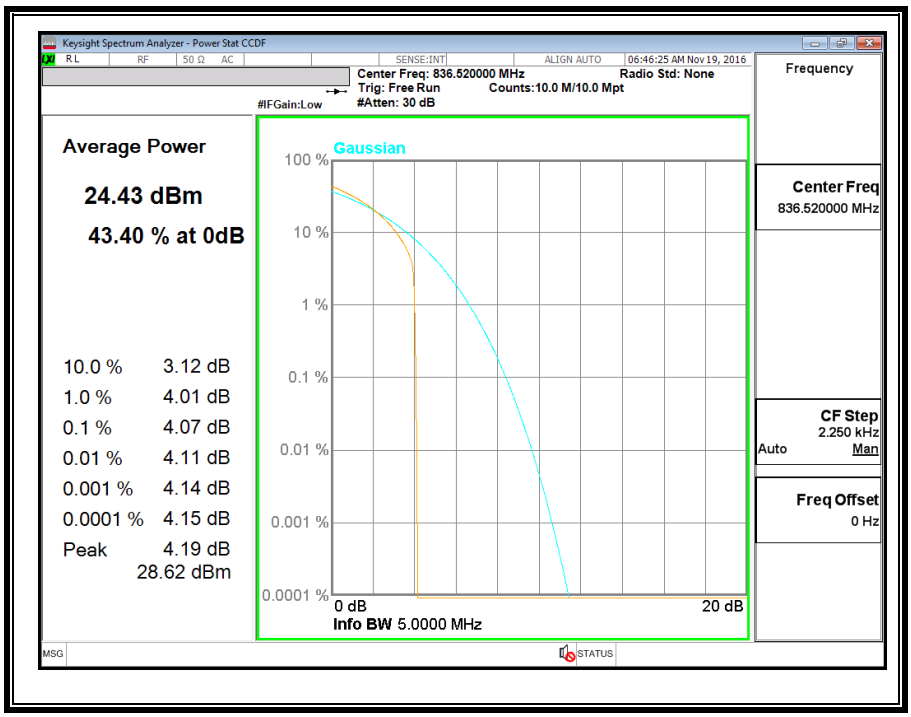


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

**BC 0, 1xRTT**



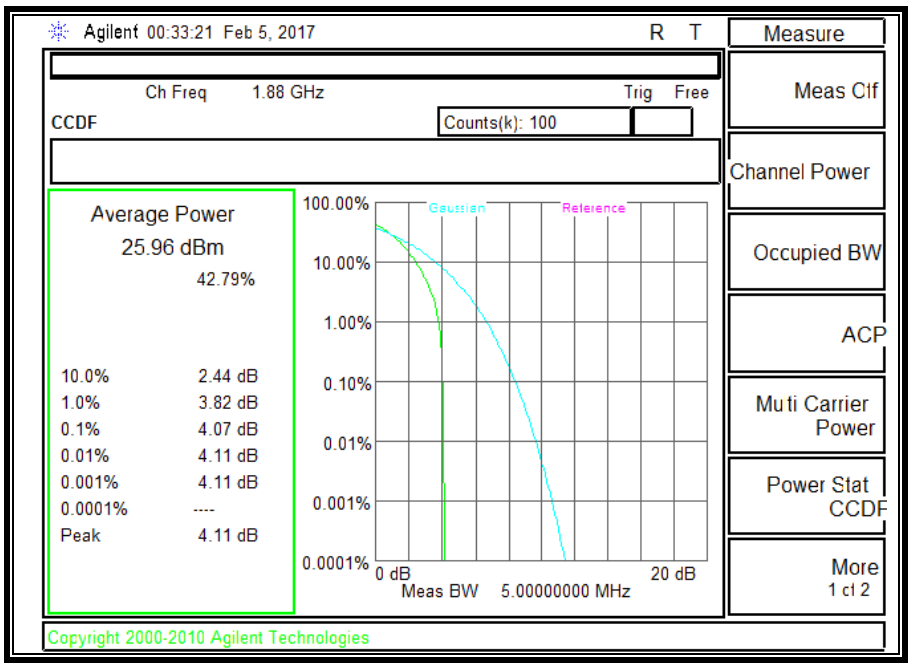

**BC 0, EVDO A**



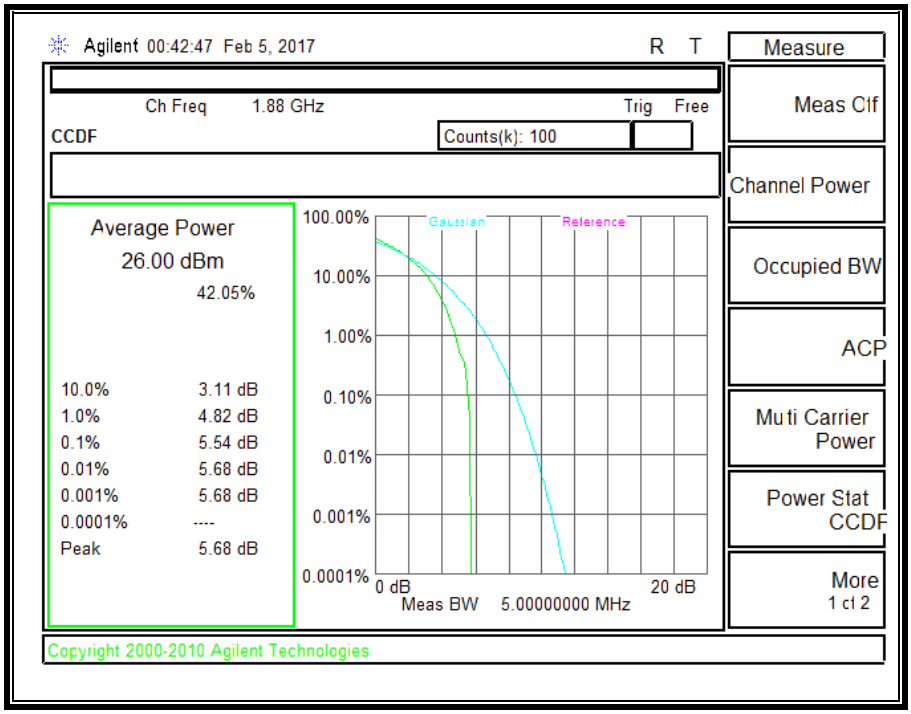


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

**BC 1, 1xRTT**



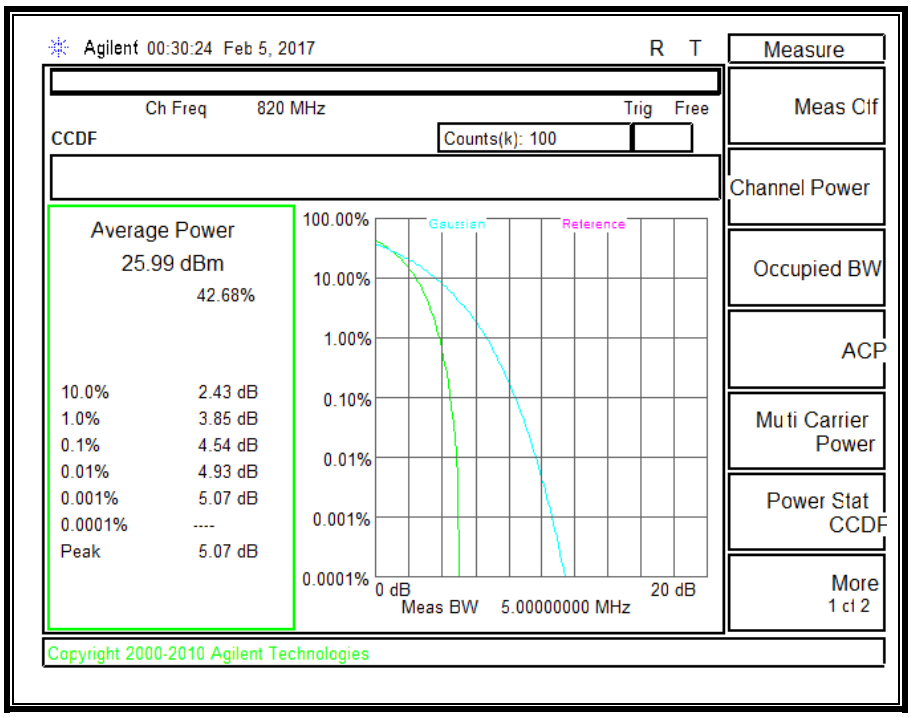

**BC 1, EVDO A**



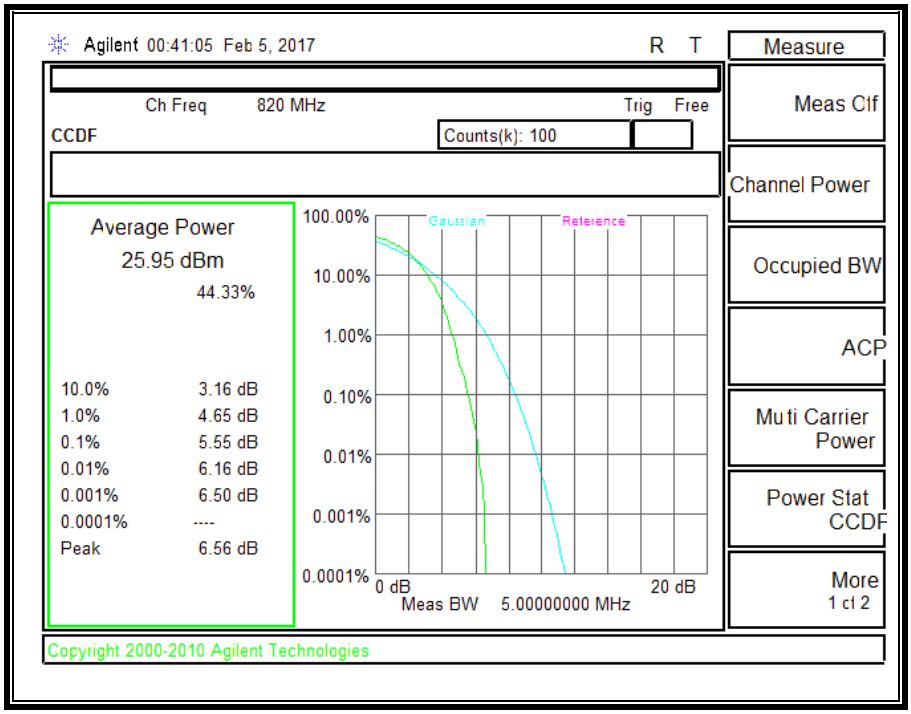


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

**BC10, 1xRTT**



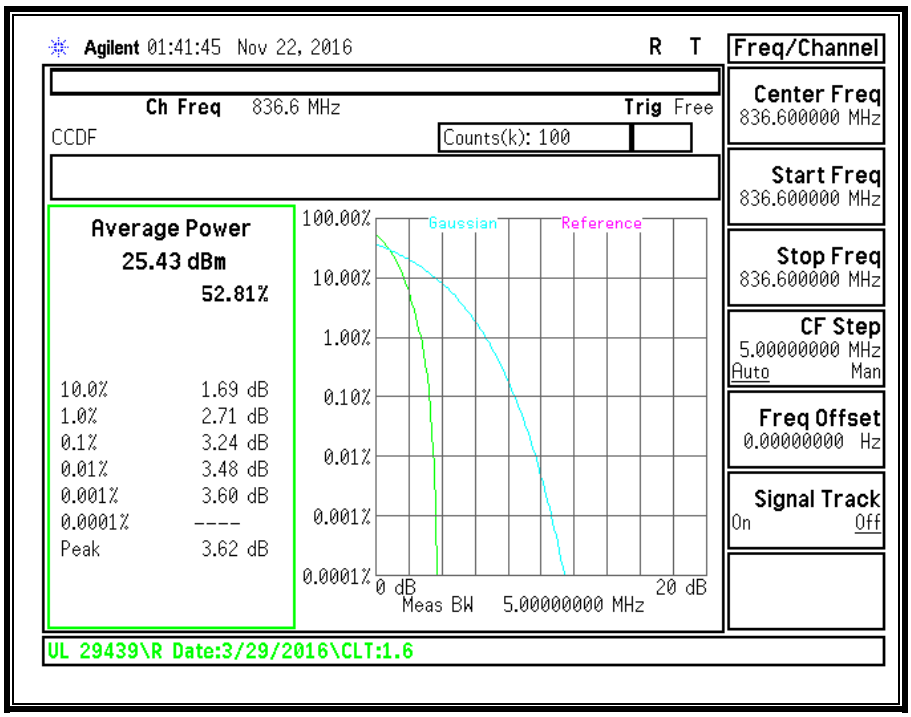

**BC10, EVDO A**



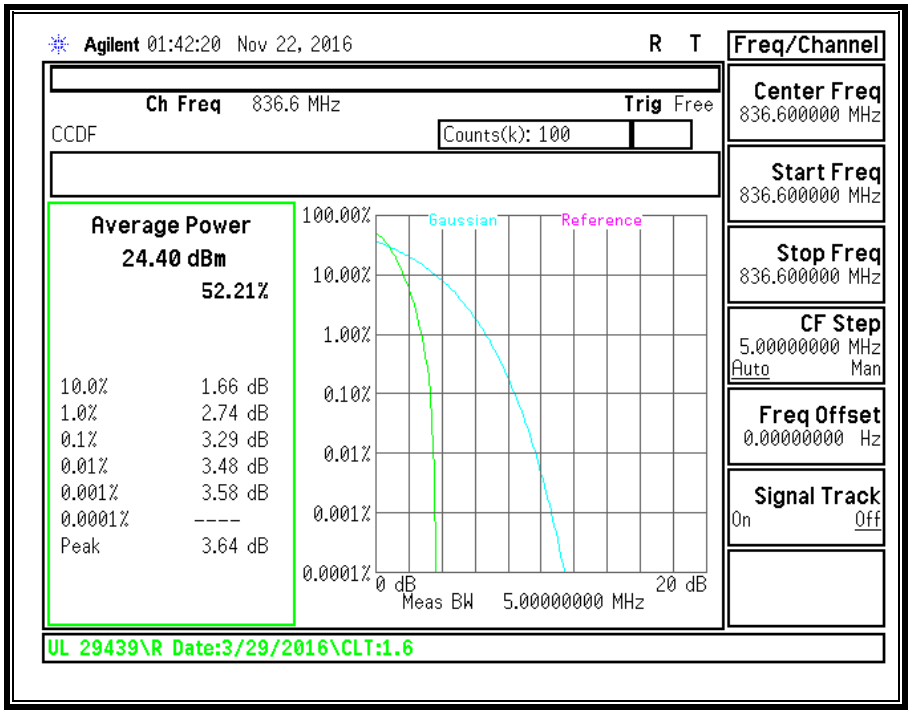


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

**UMTS 850, REL99 BAND 5**



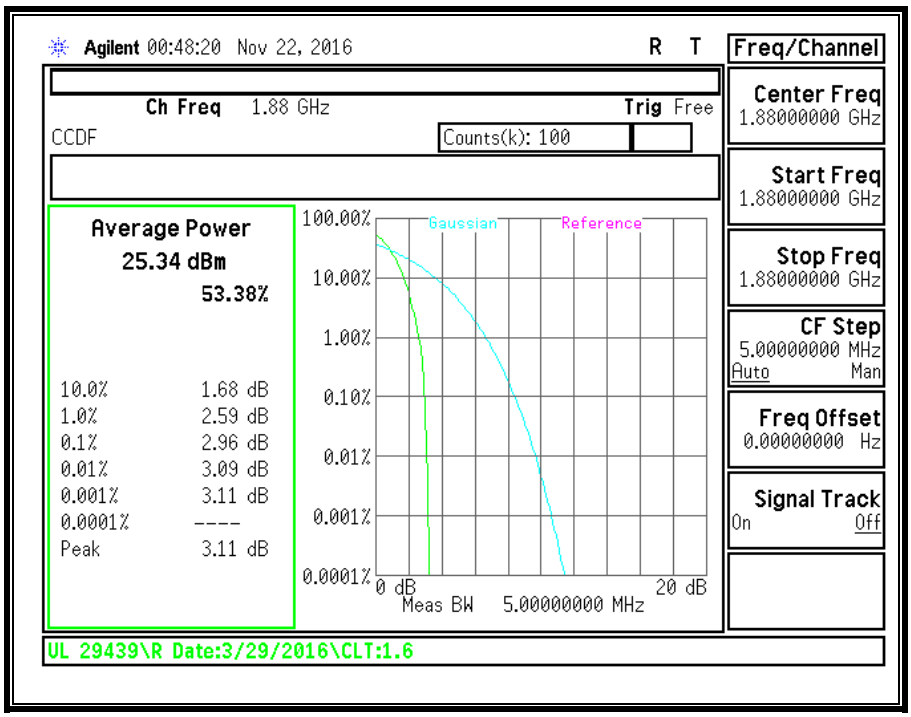

**UMTS 850, HSDPA BAND 5**



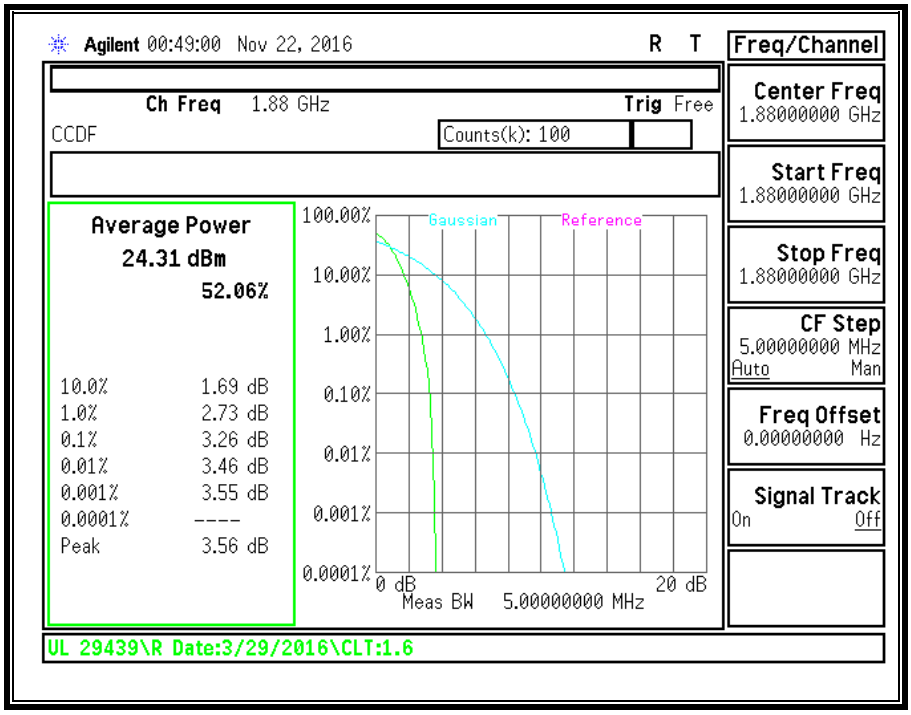


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

**UMTS 1900, REL99 BAND 2**



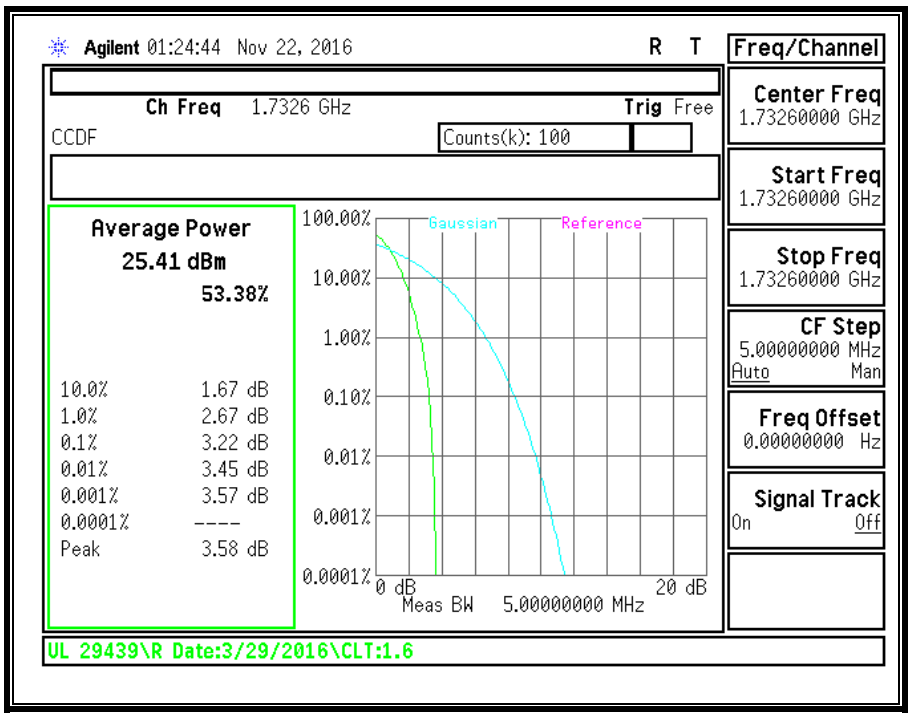

**UMTS 1900, HSDPA BAND 2**



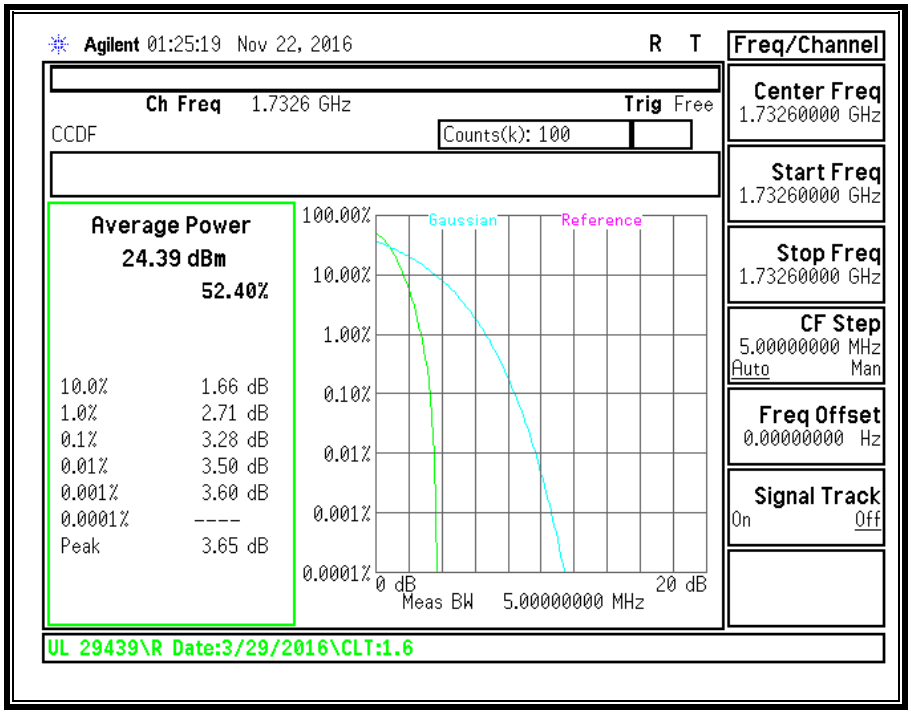


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

**UMTS 1700, REL99 BAND 4**




**UMTS 1700, HSDPA BAND 4**





*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

# 11. RADIATED TEST RESULTS

## 11.1. FIELD STRENGTH OF SPURIOUS RADIATION (ANTENNA C)

**RULE PART(S)**

FCC: §2.1053, §22.917, §24.238, §27.53 and §90.691.
IC: RSS132§5.5; RSS133§6.5 and RSS139§6.6

**LIMIT**

§22.917 (e) and §24.238 (a): Out of band emissions. 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.

§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

§90.691 Emission mask requirements for EA-based systems.

(a) Out-of-band emission requirement shall apply only to the “outer” channels included in an EA license and to spectrum adjacent to interior channels used by incumbent licensees. The emission limits are as follows:

(1) For any frequency removed from the EA licensee's frequency block by up to and including 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least 116 Log10 (f/6.1) decibels or 50 + 10 Log10 (P) decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 12.5 kHz.

(2) For any frequency removed from the EA licensee's frequency block greater than 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least 43 + 10Log10 (P) decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 37.5 kHz.

(b) When an emission outside of the authorized bandwidth causes harmful interference, the Commission may, at its discretion, require greater attenuation than specified in this section.

RSS132§5.5
Mobile and base station equipment shall comply with the limits in (i) and (ii) below.
In the first 1.0 MHz band immediately outside and adjacent to each of the sub-bands specified in Section 5.1, the power of emissions per any 1% of the occupied bandwidth shall be attenuated (in dB) below the transmitter output power P ( dBW) by at least 43 + 10 log10p (watts).
After the first 1.0 MHz immediately outside and adjacent to each of the sub-bands, the power of emissions in any100 kHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least43 + 10 log10 p (watts). If the measurement is performed using 1% of the occupied bandwidth, power integration over 100 kHz is required.

RSS133§6.5
Equipment shall comply with the limits in (i) and (ii) below.


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

(i)In the 1.0 MHz bands immediately outside and adjacent to the equipment's operating frequency block, the emission power per any 1% of the emission bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 log10p(watts).

(ii)After the first 1.0 MHz, the emission power in any 1 MHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 log10p(watts). If the measurement is performed using 1% of the emission bandwidth, power integration over 1.0 MHz is required.

RSS139§6.6

(i)In the first 1.0 MHz bands immediately outside and adjacent to the equipment's smallest operating frequency block,Footnote2 which can contain the equipment's occupied bandwidth, the emission power per any 1% of the emission bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least43 + 10 log10 p (watts) dB.

(ii)After the first 1.0 MHz outside the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power in any 1 MHz bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least 43 + 10 log10 p (watts) 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**

- GPRS/EGPRS
- UMTS, REL 99 and HSDPA
- CDMA2000, 1xRTT and EVDO, Rev A

**RESULTS**


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

### 11.1.1. GSM

**GPRS, 850MHz BAND 5**

**High Frequency Substitution Measurement**
**UL Fremont Radiated Chamber**

**Company:**
**Project #:** 16U23816
**Date:** 11/28/16
**Test Engineer:** 45200
**Configuration:** EUT only
**Mode:** GPRS 850MHz

**Test Equipment:**
**Substitution: Horn T59 Substitution, and 8ft SMA Cable**

| Chamber | Pre-amplifer | Filter | Limit |
|---|---|---|---|
| 3m Chamber E | 3m Chamber E | Filter | EIRP |

| Frequency (GHz) | SA reading (dBm) | Ant. Pol. (H/V) | Distance | EIRP @ TX Ant End (dBm) | Preamp | Attenuator | EIRP | Limit | Delta | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| Low Channel (824.2MHz) | | | | | | | | | | |
| 1.65 | -71.0 | H | 3.0 | -28.5 | 37.8 | 1.0 | -65.3 | -13.0 | -52.3 | |
| 2.47 | -69.8 | H | 3.0 | -24.8 | 38.5 | 1.0 | -62.3 | -13.0 | -49.3 | |
| 3.29 | -68.8 | H | 3.0 | -19.9 | 38.5 | 1.0 | -57.4 | -13.0 | -44.4 | |
| 1.65 | -70.9 | V | 3.0 | -28.8 | 37.8 | 1.0 | -65.6 | -13.0 | -52.6 | |
| 2.47 | -69.3 | V | 3.0 | -24.1 | 38.5 | 1.0 | -61.6 | -13.0 | -48.6 | |
| 3.30 | -68.6 | V | 3.0 | -19.9 | 38.5 | 1.0 | -57.3 | -13.0 | -44.3 | |
| Mid Channel (836.6MHz) | | | | | | | | | | |
| 1.67 | -71.6 | H | 3.0 | -29.1 | 37.8 | 1.0 | -65.9 | -13.0 | -52.9 | |
| 2.51 | -70.2 | H | 3.0 | -24.9 | 38.6 | 1.0 | -62.5 | -13.0 | -49.5 | |
| 3.35 | -68.9 | H | 3.0 | -19.8 | 38.5 | 1.0 | -57.3 | -13.0 | -44.3 | |
| 1.67 | -71.7 | V | 3.0 | -29.4 | 37.8 | 1.0 | -66.3 | -13.0 | -53.3 | |
| 2.51 | -68.7 | V | 3.0 | -23.3 | 38.6 | 1.0 | -60.9 | -13.0 | -47.9 | |
| 3.35 | -69.1 | V | 3.0 | -20.3 | 38.5 | 1.0 | -57.8 | -13.0 | -44.8 | |
| High Channel (848.8MHz) | | | | | | | | | | |
| 1.70 | -71.5 | H | 3.0 | -29.0 | 37.9 | 1.0 | -65.8 | -13.0 | -52.8 | |
| 2.54 | -70.0 | H | 3.0 | -24.6 | 38.6 | 1.0 | -62.2 | -13.0 | -49.2 | |
| 3.40 | -69.7 | H | 3.0 | -20.5 | 38.5 | 1.0 | -58.0 | -13.0 | -45.0 | |
| 1.70 | -71.2 | V | 3.0 | -28.8 | 37.9 | 1.0 | -65.6 | -13.0 | -52.6 | |
| 2.55 | -69.4 | V | 3.0 | -23.8 | 38.6 | 1.0 | -61.4 | -13.0 | -48.4 | |
| 3.39 | -69.4 | V | 3.0 | -20.4 | 38.5 | 1.0 | -57.9 | -13.0 | -44.9 | |

Rev. 03.19.15


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

## EGPRS, 850MHz BAND 5

**High Frequency Substitution Measurement**
**UL Fremont Radiated Chamber**

**Company:**
**Project #:** 16U23816
**Date:** 11/28/16
**Test Engineer:** 45200
**Configuration:** EUT only
**Mode:** EGPRS 850MHz

**Test Equipment:**
**Substitution: Horn T59 Substitution, and 8ft SMA Cable**

| Chamber | Pre-amplifer | Filter | Limit |
|---|---|---|---|
| 3m Chamber E | 3m Chamber E | Filter | EIRP |

| Frequency (GHz) | SA reading (dBm) | Ant. Pol. (H/V) | Distance | EIRP @ TX Ant End (dBm) | Preamp | Attenuator | EIRP | Limit | Delta | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| Low Channel (824.2MHz) | | | | | | | | | | |
| 1.65 | -71.2 | H | 3.0 | -28.7 | 37.8 | 1.0 | -65.6 | -13.0 | -52.6 | |
| 2.47 | -69.7 | H | 3.0 | -24.6 | 38.5 | 1.0 | -62.1 | -13.0 | -49.1 | |
| 3.30 | -69.9 | H | 3.0 | -21.0 | 38.5 | 1.0 | -58.4 | -13.0 | -45.4 | |
| 1.65 | -71.5 | V | 3.0 | -29.3 | 37.8 | 1.0 | -66.2 | -13.0 | -53.2 | |
| 2.47 | -69.1 | V | 3.0 | -24.0 | 38.5 | 1.0 | -61.4 | -13.0 | -48.4 | |
| 3.29 | -68.5 | V | 3.0 | -19.9 | 38.5 | 1.0 | -57.3 | -13.0 | -44.3 | |
| | | | | | | | | | | |
| Mid Channel (836.6MHz) | | | | | | | | | | |
| 1.67 | -71.4 | H | 3.0 | -28.9 | 37.8 | 1.0 | -65.7 | -13.0 | -52.7 | |
| 2.51 | -69.2 | H | 3.0 | -24.0 | 38.6 | 1.0 | -61.5 | -13.0 | -48.5 | |
| 3.35 | -69.3 | H | 3.0 | -20.2 | 38.5 | 1.0 | -57.7 | -13.0 | -44.7 | |
| 1.67 | -71.1 | V | 3.0 | -28.9 | 37.8 | 1.0 | -65.7 | -13.0 | -52.7 | |
| 2.51 | -69.2 | V | 3.0 | -23.9 | 38.6 | 1.0 | -61.4 | -13.0 | -48.4 | |
| 3.35 | -68.2 | V | 3.0 | -19.3 | 38.5 | 1.0 | -56.8 | -13.0 | -43.8 | |
| | | | | | | | | | | |
| High Channel (848.8MHz) | | | | | | | | | | |
| 1.69 | -70.9 | H | 3.0 | -28.3 | 37.9 | 1.0 | -65.2 | -13.0 | -52.2 | |
| 2.55 | -70.2 | H | 3.0 | -24.8 | 38.6 | 1.0 | -62.3 | -13.0 | -49.3 | |
| 3.39 | -69.8 | H | 3.0 | -20.6 | 38.5 | 1.0 | -58.1 | -13.0 | -45.1 | |
| 1.70 | -71.6 | V | 3.0 | -29.3 | 37.9 | 1.0 | -66.1 | -13.0 | -53.1 | |
| 2.54 | -69.5 | V | 3.0 | -23.9 | 38.6 | 1.0 | -61.5 | -13.0 | -48.5 | |
| 3.39 | -69.0 | V | 3.0 | -20.1 | 38.5 | 1.0 | -57.6 | -13.0 | -44.6 | |

Rev. 03.19.15


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

## GPRS, 1900MHz BAND 2

**High Frequency Substitution Measurement**
**UL Fremont Radiated Chamber**

**Company:**
**Project #:** 16U23816
**Date:** 11/28/16
**Test Engineer:** 45200
**Configuration:** EUT only
**Mode:** GPRS 1900MHz

**Test Equipment:**
**Substitution: Horn T59 Substitution, and 8ft SMA Cable**

| Chamber | Pre-amplifer | Filter | Limit |
|---|---|---|---|
| 3m Chamber E | 3m Chamber E | Filter | EIRP |

| Frequency (GHz) | SA reading (dBm) | Ant. Pol. (H/V) | Distance | EIRP @ TX Ant End (dBm) | Preamp | Attenuator | EIRP | Limit | Delta | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| Low Channel (1850.2MHz) | | | | | | | | | | |
| 3.70 | -65.0 | H | 3.0 | -15.1 | 38.6 | 1.0 | -52.7 | -13.0 | -39.7 | |
| 5.56 | -64.7 | H | 3.0 | -10.7 | 38.6 | 1.0 | -48.2 | -13.0 | -35.2 | |
| 7.40 | -64.3 | H | 3.0 | -6.6 | 37.8 | 1.0 | -43.4 | -13.0 | -30.4 | |
| 3.70 | -64.0 | V | 3.0 | -14.1 | 38.6 | 1.0 | -51.7 | -13.0 | -38.7 | |
| 5.55 | -64.4 | V | 3.0 | -10.6 | 38.6 | 1.0 | -48.2 | -13.0 | -35.2 | |
| 7.40 | -64.6 | V | 3.0 | -7.2 | 37.8 | 1.0 | -44.0 | -13.0 | -31.0 | |
| Mid Channel (1880.0) | | | | | | | | | | |
| 3.75 | -63.6 | H | 3.0 | -13.5 | 38.6 | 1.0 | -51.2 | -13.0 | -38.2 | |
| 5.64 | -65.1 | H | 3.0 | -10.8 | 38.5 | 1.0 | -48.4 | -13.0 | -35.4 | |
| 7.53 | -64.5 | H | 3.0 | -6.7 | 37.7 | 1.0 | -43.4 | -13.0 | -30.4 | |
| 3.76 | -63.8 | V | 3.0 | -13.7 | 38.6 | 1.0 | -51.4 | -13.0 | -38.4 | |
| 5.64 | -64.8 | V | 3.0 | -10.9 | 38.5 | 1.0 | -48.4 | -13.0 | -35.4 | |
| 7.52 | -64.7 | V | 3.0 | -7.1 | 37.7 | 1.0 | -43.9 | -13.0 | -30.9 | |
| High Channel (1909.8MHz) | | | | | | | | | | |
| 3.82 | -63.2 | H | 3.0 | -12.9 | 38.7 | 1.0 | -50.5 | -13.0 | -37.5 | |
| 5.73 | -64.1 | H | 3.0 | -9.7 | 38.5 | 1.0 | -47.2 | -13.0 | -34.2 | |
| 7.64 | -65.3 | H | 3.0 | -7.4 | 37.7 | 1.0 | -44.0 | -13.0 | -31.0 | |
| 3.82 | -62.9 | V | 3.0 | -12.7 | 38.7 | 1.0 | -50.3 | -13.0 | -37.3 | |
| 5.73 | -63.7 | V | 3.0 | -9.6 | 38.5 | 1.0 | -47.1 | -13.0 | -34.1 | |
| 7.64 | -65.3 | V | 3.0 | -7.5 | 37.7 | 1.0 | -44.2 | -13.0 | -31.2 | |

Rev. 03.19.15


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

## EGPRS, 1900MHz BAND 2

**High Frequency Substitution Measurement**
**UL Fremont Radiated Chamber**

**Company:**
**Project #:** 16U23816
**Date:** 11/28/16
**Test Engineer:** 45200
**Configuration:** EUT only
**Mode:** EGPRS 1900MHz

**Test Equipment:**
**Substitution: Horn T59 Substitution, and 8ft SMA Cable**

| Chamber | Pre-amplifer | Filter | Limit |
|---|---|---|---|
| 3m Chamber E | 3m Chamber E | Filter | EIRP |

| Frequency (GHz) | SA reading (dBm) | Ant. Pol. (H/V) | Distance | EIRP @ TX Ant End (dBm) | Preamp | Attenuator | EIRP | Limit | Delta | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| Low Channel (1850.2MHz) | | | | | | | | | | |
| 3.70 | -63.5 | H | 3.0 | -13.5 | 38.6 | 1.0 | -51.2 | -13.0 | -38.2 | |
| 5.55 | -64.9 | H | 3.0 | -10.8 | 38.6 | 1.0 | -48.4 | -13.0 | -35.4 | |
| 7.40 | -65.1 | H | 3.0 | -7.5 | 37.8 | 1.0 | -44.3 | -13.0 | -31.3 | |
| 3.70 | -63.2 | V | 3.0 | -13.4 | 38.6 | 1.0 | -51.0 | -13.0 | -38.0 | |
| 5.55 | -64.8 | V | 3.0 | -11.1 | 38.6 | 1.0 | -48.7 | -13.0 | -35.7 | |
| 7.40 | -65.1 | V | 3.0 | -7.6 | 37.8 | 1.0 | -44.4 | -13.0 | -31.4 | |
| | | | | | | | | | | |
| Mid Channel (1880.0) | | | | | | | | | | |
| 3.76 | -63.5 | H | 3.0 | -13.4 | 38.6 | 1.0 | -51.0 | -13.0 | -38.0 | |
| 5.64 | -65.5 | H | 3.0 | -11.2 | 38.5 | 1.0 | -48.7 | -13.0 | -35.7 | |
| 7.52 | -64.3 | H | 3.0 | -6.5 | 37.7 | 1.0 | -43.3 | -13.0 | -30.3 | |
| 3.76 | -63.5 | V | 3.0 | -13.4 | 38.6 | 1.0 | -51.0 | -13.0 | -38.0 | |
| 5.64 | -65.6 | V | 3.0 | -11.6 | 38.5 | 1.0 | -49.2 | -13.0 | -36.2 | |
| 7.52 | -64.6 | V | 3.0 | -7.0 | 37.7 | 1.0 | -43.7 | -13.0 | -30.7 | |
| | | | | | | | | | | |
| High Channel (1909.8MHz) | | | | | | | | | | |
| 3.81 | -63.0 | H | 3.0 | -12.7 | 38.7 | 1.0 | -50.4 | -13.0 | -37.4 | |
| 5.73 | -63.6 | H | 3.0 | -9.1 | 38.5 | 1.0 | -46.7 | -13.0 | -33.7 | |
| 7.64 | -65.5 | H | 3.0 | -7.5 | 37.7 | 1.0 | -44.2 | -13.0 | -31.2 | |
| 3.82 | -62.5 | V | 3.0 | -12.3 | 38.7 | 1.0 | -49.9 | -13.0 | -36.9 | |
| 5.72 | -63.0 | V | 3.0 | -8.9 | 38.5 | 1.0 | -46.4 | -13.0 | -33.4 | |
| 7.64 | -65.5 | V | 3.0 | -7.8 | 37.7 | 1.0 | -44.4 | -13.0 | -31.4 | |

Rev. 03.19.15


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

### 11.1.2. CDMA2000

**CDMA2000 1xRTT, 850MHz BC0**

**High Frequency Substitution Measurement**
**UL Fremont Radiated Chamber**

**Company:**
**Project #:** 16U23814
**Date:** 11/17/16
**Test Engineer:** 37290
**Configuration:** EUT Only
**Mode:** 1xRTT 850MHz

**Test Equipment:**
**Substitution: Horn T59 Substitution, and 8ft SMA Cable**

| Chamber | Pre-amplifer | Filter | Limit |
|---|---|---|---|
| 3m Chamber E | 3m Chamber E | Filter | EIRP |

| Frequency (GHz) | SA reading (dBm) | Ant. Pol. (H/V) | Distance | EIRP @ TX Ant End (dBm) | Preamp | Attenuator | EIRP | Limit | Delta | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| Low Channel (824.7MHz) | | | | | | | | | | |
| 1.65 | -71.6 | H | 3.0 | -29.1 | 37.8 | 1.0 | -65.9 | -13.0 | -52.9 | |
| 2.48 | -69.8 | H | 3.0 | -24.8 | 38.5 | 1.0 | -62.3 | -13.0 | -49.3 | |
| 3.30 | -68.5 | H | 3.0 | -19.5 | 38.5 | 1.0 | -57.0 | -13.0 | -44.0 | |
| 1.65 | -71.4 | V | 3.0 | -29.3 | 37.8 | 1.0 | -66.1 | -13.0 | -53.1 | |
| 2.47 | -69.4 | V | 3.0 | -24.2 | 38.5 | 1.0 | -61.7 | -13.0 | -48.7 | |
| 3.30 | -68.3 | V | 3.0 | -19.6 | 38.5 | 1.0 | -57.1 | -13.0 | -44.1 | |
| Mid Channel (836.52MHz) | | | | | | | | | | |
| 1.67 | -70.9 | H | 3.0 | -28.4 | 37.8 | 1.0 | -65.2 | -13.0 | -52.2 | |
| 2.51 | -69.2 | H | 3.0 | -24.0 | 38.6 | 1.0 | -61.6 | -13.0 | -48.6 | |
| 3.35 | -69.5 | H | 3.0 | -20.5 | 38.5 | 1.0 | -57.9 | -13.0 | -44.9 | |
| 1.67 | -71.6 | V | 3.0 | -29.3 | 37.8 | 1.0 | -66.2 | -13.0 | -53.2 | |
| 2.51 | -69.3 | V | 3.0 | -23.9 | 38.6 | 1.0 | -61.5 | -13.0 | -48.5 | |
| 3.34 | -69.7 | V | 3.0 | -20.9 | 38.5 | 1.0 | -58.3 | -13.0 | -45.3 | |
| High Channel (848.31MHz) | | | | | | | | | | |
| 1.70 | -82.2 | H | 3.0 | -39.6 | 37.9 | 1.0 | -76.5 | -13.0 | -63.5 | |
| 2.54 | -69.1 | H | 3.0 | -23.7 | 38.6 | 1.0 | -61.3 | -13.0 | -48.3 | |
| 3.40 | -69.4 | H | 3.0 | -20.2 | 38.5 | 1.0 | -57.7 | -13.0 | -44.7 | |
| 1.70 | -70.6 | V | 3.0 | -28.2 | 37.9 | 1.0 | -65.1 | -13.0 | -52.1 | |
| 2.54 | -69.6 | V | 3.0 | -24.1 | 38.6 | 1.0 | -61.7 | -13.0 | -48.7 | |
| 3.39 | -68.7 | V | 3.0 | -19.8 | 38.5 | 1.0 | -57.3 | -13.0 | -44.3 | |

Rev. 03.19.15


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

**CDMA2000 EVDO Rev A, 850MHz BC0**

**High Frequency Substitution Measurement**
**UL Fremont Radiated Chamber**

**Company:**
**Project #:** 16U23816
**Date:** 11/28/16
**Test Engineer:** 52297
**Configuration:** EUT only
**Mode:** EVDO, Rev A 850MHz

**Test Equipment:**
**Substitution: Horn T59 Substitution, and 8ft SMA Cable**

| Chamber | Pre-amplifer | Filter | Limit |
|---|---|---|---|
| 3m Chamber D | 3m Chamber D | Filter | EIRP |

| Frequency (GHz) | SA reading (dBm) | Ant. Pol. (H/V) | Distance | EIRP @ TX Ant End (dBm) | Preamp | Attenuator | EIRP | Limit | Delta | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| Low Channel (824.7MHz) | | | | | | | | | | |
| 1.65 | -66.9 | H | 3.0 | -25.2 | 35.0 | 1.0 | -59.2 | -13.0 | -46.2 | |
| 2.47 | -67.7 | H | 3.0 | -23.6 | 33.9 | 1.0 | -56.5 | -13.0 | -43.5 | |
| 3.30 | -68.3 | H | 3.0 | -21.6 | 33.2 | 1.0 | -53.8 | -13.0 | -40.8 | |
| 1.65 | -65.9 | V | 3.0 | -23.9 | 35.0 | 1.0 | -57.9 | -13.0 | -44.9 | |
| 2.48 | -67.8 | V | 3.0 | -23.5 | 33.9 | 1.0 | -56.4 | -13.0 | -43.4 | |
| 3.30 | -68.9 | V | 3.0 | -22.1 | 33.2 | 1.0 | -54.3 | -13.0 | -41.3 | |
| | | | | | | | | | | |
| Mid Channel (836.52MHz) | | | | | | | | | | |
| 1.67 | -66.7 | H | 3.0 | -24.9 | 35.0 | 1.0 | -58.9 | -13.0 | -45.9 | |
| 2.51 | -67.8 | H | 3.0 | -23.5 | 33.7 | 1.0 | -56.2 | -13.0 | -43.2 | |
| 3.35 | -68.7 | H | 3.0 | -21.8 | 33.3 | 1.0 | -54.1 | -13.0 | -41.1 | |
| 1.67 | -66.9 | V | 3.0 | -24.8 | 35.0 | 1.0 | -58.9 | -13.0 | -45.9 | |
| 2.51 | -67.6 | V | 3.0 | -23.1 | 33.7 | 1.0 | -55.8 | -13.0 | -42.8 | |
| 3.35 | -68.0 | V | 3.0 | -21.0 | 33.3 | 1.0 | -53.3 | -13.0 | -40.3 | |
| | | | | | | | | | | |
| High Channel (848.31MHz) | | | | | | | | | | |
| 1.70 | -67.2 | H | 3.0 | -25.3 | 35.0 | 1.0 | -59.3 | -13.0 | -46.3 | |
| 2.55 | -67.2 | H | 3.0 | -22.7 | 33.7 | 1.0 | -55.4 | -13.0 | -42.4 | |
| 3.40 | -68.6 | H | 3.0 | -21.5 | 33.3 | 1.0 | -53.8 | -13.0 | -40.8 | |
| 1.70 | -66.8 | V | 3.0 | -24.7 | 35.0 | 1.0 | -58.7 | -13.0 | -45.7 | |
| 2.54 | -67.2 | V | 3.0 | -22.6 | 33.7 | 1.0 | -55.2 | -13.0 | -42.2 | |
| 3.40 | -67.8 | V | 3.0 | -20.7 | 33.3 | 1.0 | -53.0 | -13.0 | -40.0 | |
| | | | | | | | | | | |

Rev. 03.19.15


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

**CDMA2000 1xRTT, 1900MHz BC1**

**High Frequency Substitution Measurement**
**UL Fremont Radiated Chamber**

**Company:**
**Project #:** 16U23816
**Date:** 11/28/16
**Test Engineer:** 52297
**Configuration:** EUT only
**Mode:** 1xRTT 1900MHz

**Test Equipment:**
**Substitution: Horn T59 Substitution, and 8ft SMA Cable**

| Chamber | Pre-amplifer | Filter | Limit |
|---|---|---|---|
| 3m Chamber E | 3m Chamber E | Filter | EIRP |

| Frequency (GHz) | SA reading (dBm) | Ant. Pol. (H/V) | Distance | EIRP @ TX Ant End (dBm) | Preamp | Attenuator | EIRP | Limit | Delta | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| Low Channel (1851.25MHz) | | | | | | | | | | |
| 3.70 | -56.5 | H | 3.0 | -6.5 | 38.6 | 1.0 | -44.1 | -13.0 | -31.1 | |
| 5.56 | -66.7 | H | 3.0 | -12.6 | 38.6 | 1.0 | -50.2 | -13.0 | -37.2 | |
| 7.41 | -68.4 | H | 3.0 | -10.8 | 37.8 | 1.0 | -47.6 | -13.0 | -34.6 | |
| 3.70 | -64.1 | V | 3.0 | -14.2 | 38.6 | 1.0 | -51.9 | -13.0 | -38.9 | |
| 5.55 | -63.9 | V | 3.0 | -10.1 | 38.6 | 1.0 | -47.7 | -13.0 | -34.7 | |
| 7.40 | -64.7 | V | 3.0 | -7.2 | 37.8 | 1.0 | -44.1 | -13.0 | -31.1 | |
| Mid Channel (1880MHz) | | | | | | | | | | |
| 3.76 | -57.0 | H | 3.0 | -6.9 | 38.6 | 1.0 | -44.5 | -13.0 | -31.5 | |
| 5.64 | -64.5 | H | 3.0 | -10.2 | 38.5 | 1.0 | -47.7 | -13.0 | -34.7 | |
| 7.52 | -65.3 | H | 3.0 | -7.5 | 37.7 | 1.0 | -44.2 | -13.0 | -31.2 | |
| 3.76 | -62.0 | V | 3.0 | -11.9 | 38.6 | 1.0 | -49.5 | -13.0 | -36.5 | |
| 5.64 | -64.8 | V | 3.0 | -10.8 | 38.5 | 1.0 | -48.4 | -13.0 | -35.4 | |
| 7.52 | -64.5 | V | 3.0 | -6.9 | 37.7 | 1.0 | -43.6 | -13.0 | -30.6 | |
| High Channel (1908.75MHz) | | | | | | | | | | |
| 3.82 | -60.1 | H | 3.0 | -9.8 | 38.7 | 1.0 | -47.5 | -13.0 | -34.5 | |
| 5.73 | -64.6 | H | 3.0 | -10.2 | 38.5 | 1.0 | -47.7 | -13.0 | -34.7 | |
| 7.64 | -65.7 | H | 3.0 | -7.8 | 37.7 | 1.0 | -44.5 | -13.0 | -31.5 | |
| 3.82 | -61.6 | V | 3.0 | -11.4 | 38.7 | 1.0 | -49.1 | -13.0 | -36.1 | |
| 5.72 | -63.4 | V | 3.0 | -9.3 | 38.5 | 1.0 | -46.8 | -13.0 | -33.8 | |
| 7.63 | -65.4 | V | 3.0 | -7.6 | 37.7 | 1.0 | -44.3 | -13.0 | -31.3 | |

Rev. 03.19.15


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

**CDMA2000 EVDO Rev A, 1900MHz BC1**

**High Frequency Substitution Measurement**
**UL Fremont Radiated Chamber**

**Company:**
**Project #:** 16U23816
**Date:** 11/28/16
**Test Engineer:** 52297
**Configuration:** EUT only
**Mode:** Rev 0/A 1900MHz

**Test Equipment:**
**Substitution: Horn T59 Substitution, and 8ft SMA Cable**

| Chamber | Pre-amplifer | Filter | Limit |
|---|---|---|---|
| 3m Chamber D | 3m Chamber D | Filter | EIRP |

| Frequency (GHz) | SA reading (dBm) | Ant. Pol. (H/V) | Distance | EIRP @ TX Ant End (dBm) | Preamp | Attenuator | EIRP | Limit | Delta | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| Low Channel (1851.25MHz) | | | | | | | | | | |
| 3.70 | -60.3 | H | 3.0 | -12.4 | 33.5 | 1.0 | -44.9 | -13.0 | -31.9 | |
| 5.55 | -69.8 | H | 3.0 | -18.5 | 32.5 | 1.0 | -50.0 | -13.0 | -37.0 | |
| 7.40 | -70.8 | H | 3.0 | -16.5 | 30.4 | 1.0 | -45.9 | -13.0 | -32.9 | |
| 3.70 | -58.7 | V | 3.0 | -10.7 | 33.5 | 1.0 | -43.2 | -13.0 | -30.2 | |
| 5.55 | -69.2 | V | 3.0 | -18.2 | 32.5 | 1.0 | -49.7 | -13.0 | -36.7 | |
| 7.40 | -70.5 | V | 3.0 | -15.9 | 30.4 | 1.0 | -45.3 | -13.0 | -32.3 | |
| Mid Channel (1880MHz) | | | | | | | | | | |
| 3.76 | -59.9 | H | 3.0 | -11.8 | 33.5 | 1.0 | -44.4 | -13.0 | -31.4 | |
| 5.64 | -68.8 | H | 3.0 | -17.3 | 32.4 | 1.0 | -48.7 | -13.0 | -35.7 | |
| 7.52 | -70.3 | H | 3.0 | -15.8 | 30.3 | 1.0 | -45.0 | -13.0 | -32.0 | |
| 3.76 | -58.6 | V | 3.0 | -10.5 | 33.5 | 1.0 | -43.0 | -13.0 | -30.0 | |
| 5.64 | -69.7 | V | 3.0 | -18.5 | 32.4 | 1.0 | -49.9 | -13.0 | -36.9 | |
| 7.52 | -68.9 | V | 3.0 | -14.2 | 30.3 | 1.0 | -43.5 | -13.0 | -30.5 | |
| High Channel (1908.75MHz) | | | | | | | | | | |
| 3.82 | -64.2 | H | 3.0 | -15.9 | 33.6 | 1.0 | -48.5 | -13.0 | -35.5 | |
| 5.72 | -69.2 | H | 3.0 | -17.6 | 32.3 | 1.0 | -48.9 | -13.0 | -35.9 | |
| 7.63 | -70.4 | H | 3.0 | -15.8 | 30.1 | 1.0 | -44.9 | -13.0 | -31.9 | |
| 3.82 | -61.9 | V | 3.0 | -13.7 | 33.6 | 1.0 | -46.3 | -13.0 | -33.3 | |
| 5.73 | -68.3 | V | 3.0 | -16.9 | 32.3 | 1.0 | -48.2 | -13.0 | -35.2 | |
| 7.63 | -70.8 | V | 3.0 | -16.1 | 30.1 | 1.0 | -45.2 | -13.0 | -32.2 | |

Rev. 03.19.15


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

## CDMA2000 1xRTT, 800MHz BC10

**High Frequency Substitution Measurement**
**UL Fremont Radiated Chamber**

**Company:**
**Project #:** 16U23816
**Date:** 11/28/16
**Test Engineer:** 45200
**Configuration:** EUT only
**Mode:** 1xRTT 800MHz

**Test Equipment:**
**Substitution: Horn T59 Substitution, and 8ft SMA Cable**

| Chamber | Pre-amplifer | Filter | Limit |
|---|---|---|---|
| 3m Chamber E | 3m Chamber E | Filter | EIRP |

| Frequency (GHz) | SA reading (dBm) | Ant. Pol. (H/V) | Distance | EIRP @ TX Ant End (dBm) | Preamp | Attenuator | EIRP | Limit | Delta | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| Low Channel (817.25MHz) | | | | | | | | | | |
| 1.63 | -71.4 | H | 3.0 | -29.0 | 37.8 | 1.0 | -65.8 | -13.0 | -52.8 | |
| 2.45 | -69.4 | H | 3.0 | -24.5 | 38.4 | 1.0 | -61.9 | -13.0 | -48.9 | |
| 3.27 | -69.1 | H | 3.0 | -20.2 | 38.5 | 1.0 | -57.7 | -13.0 | -44.7 | |
| 1.63 | -71.9 | V | 3.0 | -29.9 | 37.8 | 1.0 | -66.7 | -13.0 | -53.7 | |
| 2.45 | -69.4 | V | 3.0 | -24.3 | 38.4 | 1.0 | -61.7 | -13.0 | -48.7 | |
| 3.27 | -68.8 | V | 3.0 | -20.2 | 38.5 | 1.0 | -57.7 | -13.0 | -44.7 | |
| Mid Channel (820MHz) | | | | | | | | | | |
| 1.64 | -71.1 | H | 3.0 | -28.7 | 37.8 | 1.0 | -65.5 | -13.0 | -52.5 | |
| 2.46 | -70.0 | H | 3.0 | -25.0 | 38.4 | 1.0 | -62.4 | -13.0 | -49.4 | |
| 3.28 | -68.1 | H | 3.0 | -19.1 | 38.5 | 1.0 | -56.6 | -13.0 | -43.6 | |
| 1.64 | -71.6 | V | 3.0 | -29.5 | 37.8 | 1.0 | -66.3 | -13.0 | -53.3 | |
| 2.46 | -69.5 | V | 3.0 | -24.4 | 38.4 | 1.0 | -61.8 | -13.0 | -48.8 | |
| 3.28 | -69.7 | V | 3.0 | -21.1 | 38.5 | 1.0 | -58.5 | -13.0 | -45.5 | |
| High Channel (822.75MHz) | | | | | | | | | | |
| 1.65 | -71.5 | H | 3.0 | -29.1 | 37.8 | 1.0 | -65.9 | -13.0 | -52.9 | |
| 2.47 | -70.0 | H | 3.0 | -25.0 | 38.4 | 1.0 | -62.4 | -13.0 | -49.4 | |
| 3.29 | -69.2 | H | 3.0 | -20.2 | 38.5 | 1.0 | -57.7 | -13.0 | -44.7 | |
| 1.65 | -71.8 | V | 3.0 | -29.7 | 37.8 | 1.0 | -66.5 | -13.0 | -53.5 | |
| 2.47 | -69.4 | V | 3.0 | -24.3 | 38.5 | 1.0 | -61.7 | -13.0 | -48.7 | |
| 3.29 | -68.5 | V | 3.0 | -19.8 | 38.5 | 1.0 | -57.3 | -13.0 | -44.3 | |

Rev. 03.19.15


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

**CDMA2000 EVDO Rev A, 800MHz BC10**

**High Frequency Substitution Measurement**
**UL Fremont Radiated Chamber**

**Company:**
**Project #:** 16U23816
**Date:** 11/28/16
**Test Engineer:** 52297
**Configuration:** EUT only
**Mode:** EVDO, Rev A, 800MHz

**Test Equipment:**
**Substitution: Horn T59 Substitution, and 8ft SMA Cable**

| Chamber | Pre-amplifer | Filter | Limit |
|---|---|---|---|
| 3m Chamber D | 3m Chamber D | Filter | EIRP |

| Frequency (GHz) | SA reading (dBm) | Ant. Pol. (H/V) | Distance | EIRP @ TX Ant End (dBm) | Preamp | Attenuator | EIRP | Limit | Delta | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| Low Channel (817.25MHz) | | | | | | | | | | |
| 1.63 | -66.5 | H | 3.0 | -24.8 | 35.0 | 1.0 | -58.8 | -13.0 | -45.8 | |
| 2.45 | -67.6 | H | 3.0 | -23.6 | 34.1 | 1.0 | -56.6 | -13.0 | -43.6 | |
| 3.27 | -68.1 | H | 3.0 | -21.4 | 33.2 | 1.0 | -53.6 | -13.0 | -40.6 | |
| 1.63 | -65.5 | V | 3.0 | -23.5 | 35.0 | 1.0 | -57.5 | -13.0 | -44.5 | |
| 2.45 | -67.4 | V | 3.0 | -23.2 | 34.1 | 1.0 | -56.2 | -13.0 | -43.2 | |
| 3.27 | -68.4 | V | 3.0 | -21.6 | 33.2 | 1.0 | -53.8 | -13.0 | -40.8 | |
| Mid Channel (820MHz) | | | | | | | | | | |
| 1.64 | -65.9 | H | 3.0 | -24.1 | 35.0 | 1.0 | -58.1 | -13.0 | -45.1 | |
| 2.46 | -67.3 | H | 3.0 | -23.2 | 34.0 | 1.0 | -56.2 | -13.0 | -43.2 | |
| 3.28 | -68.0 | H | 3.0 | -21.3 | 33.2 | 1.0 | -53.5 | -13.0 | -40.5 | |
| 1.64 | -65.1 | V | 3.0 | -23.1 | 35.0 | 1.0 | -57.1 | -13.0 | -44.1 | |
| 2.46 | -67.8 | V | 3.0 | -23.5 | 34.0 | 1.0 | -56.5 | -13.0 | -43.5 | |
| 3.28 | -68.3 | V | 3.0 | -21.5 | 33.2 | 1.0 | -53.7 | -13.0 | -40.7 | |
| High Channel (822.75MHz) | | | | | | | | | | |
| 1.64 | -67.2 | H | 3.0 | -25.4 | 35.0 | 1.0 | -59.4 | -13.0 | -46.4 | |
| 2.47 | -67.7 | H | 3.0 | -23.6 | 33.9 | 1.0 | -56.6 | -13.0 | -43.6 | |
| 3.29 | -67.7 | H | 3.0 | -20.9 | 33.2 | 1.0 | -53.1 | -13.0 | -40.1 | |
| 1.65 | -66.7 | V | 3.0 | -24.8 | 35.0 | 1.0 | -58.8 | -13.0 | -45.8 | |
| 2.47 | -67.9 | V | 3.0 | -23.6 | 34.0 | 1.0 | -56.5 | -13.0 | -43.5 | |
| 3.29 | -68.8 | V | 3.0 | -21.9 | 33.2 | 1.0 | -54.1 | -13.0 | -41.1 | |

Rev. 03.19.15


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

### 11.1.3. UMTS

**UMTS REL 99, 850MHz BAND 5**

**High Frequency Substitution Measurement**
**UL Fremont Radiated Chamber**

**Company:**
**Project #:** 16U23816
**Date:** 11/28/16
**Test Engineer:** 45200
**Configuration:** EUT only
**Mode:** REL 99, 850MHz

**Test Equipment:**
**Substitution: Horn T59 Substitution, and 8ft SMA Cable**

| Chamber | Pre-amplifer | Filter | Limit |
|---|---|---|---|
| 3m Chamber E | 3m Chamber E | Filter | EIRP |

| Frequency (GHz) | SA reading (dBm) | Ant. Pol. (H/V) | Distance | EIRP @ TX Ant End (dBm) | Preamp | Attenuator | EIRP | Limit | Delta | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| Low Channel (826.4MHz) | | | | | | | | | | |
| 1.65 | -70.2 | H | 3.0 | -27.8 | 37.8 | 1.0 | -64.6 | -13.0 | -51.6 | |
| 2.47 | -69.9 | H | 3.0 | -24.9 | 38.5 | 1.0 | -62.4 | -13.0 | -49.4 | |
| 3.30 | -68.8 | H | 3.0 | -19.9 | 38.5 | 1.0 | -57.4 | -13.0 | -44.4 | |
| 1.65 | -71.2 | V | 3.0 | -29.1 | 37.8 | 1.0 | -65.9 | -13.0 | -52.9 | |
| 2.47 | -68.9 | V | 3.0 | -23.7 | 38.5 | 1.0 | -61.2 | -13.0 | -48.2 | |
| 3.31 | -68.9 | V | 3.0 | -20.2 | 38.5 | 1.0 | -57.6 | -13.0 | -44.6 | |
| Mid Channel (836.6MHz) | | | | | | | | | | |
| 1.67 | -70.9 | H | 3.0 | -28.4 | 37.8 | 1.0 | -65.2 | -13.0 | -52.2 | |
| 2.50 | -69.7 | H | 3.0 | -24.5 | 38.6 | 1.0 | -62.1 | -13.0 | -49.1 | |
| 3.35 | -68.7 | H | 3.0 | -19.6 | 38.5 | 1.0 | -57.1 | -13.0 | -44.1 | |
| 1.66 | -71.5 | V | 3.0 | -29.3 | 37.8 | 1.0 | -66.2 | -13.0 | -53.2 | |
| 2.51 | -69.6 | V | 3.0 | -24.2 | 38.6 | 1.0 | -61.8 | -13.0 | -48.8 | |
| 3.34 | -69.1 | V | 3.0 | -20.3 | 38.5 | 1.0 | -57.8 | -13.0 | -44.8 | |
| High Channel (846.6MHz) | | | | | | | | | | |
| 1.70 | -71.5 | H | 3.0 | -28.9 | 37.9 | 1.0 | -65.8 | -13.0 | -52.8 | |
| 2.55 | -69.1 | H | 3.0 | -23.6 | 38.6 | 1.0 | -61.2 | -13.0 | -48.2 | |
| 3.40 | -68.6 | H | 3.0 | -19.4 | 38.5 | 1.0 | -56.9 | -13.0 | -43.9 | |
| 1.70 | -71.3 | V | 3.0 | -28.9 | 37.9 | 1.0 | -65.8 | -13.0 | -52.8 | |
| 2.53 | -68.8 | V | 3.0 | -23.3 | 38.6 | 1.0 | -60.9 | -13.0 | -47.9 | |
| 3.38 | -68.9 | V | 3.0 | -20.0 | 38.5 | 1.0 | -57.5 | -13.0 | -44.5 | |

Rev. 03.19.15


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

## UMTS HSDPA, 850MHz BAND 5

**High Frequency Substitution Measurement**
**UL Fremont Radiated Chamber**

**Company:**
**Project #:** 16U23816
**Date:** 11/28/16
**Test Engineer:** 45200
**Configuration:** EUT only
**Mode:** HSDPA 850MHz

**Test Equipment:**
**Substitution: Horn T59 Substitution, and 8ft SMA Cable**

| Chamber | Pre-amplifer | Filter | Limit |
|---|---|---|---|
| 3m Chamber E | 3m Chamber E | Filter | EIRP |

| Frequency (GHz) | SA reading (dBm) | Ant. Pol. (H/V) | Distance | EIRP @ TX Ant End (dBm) | Preamp | Attenuator | EIRP | Limit | Delta | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| Low Channel (826.4MHz) | | | | | | | | | | |
| 1.65 | -71.4 | H | 3.0 | -29.0 | 37.8 | 1.0 | -65.8 | -13.0 | -52.8 | |
| 2.49 | -69.3 | H | 3.0 | -24.3 | 38.5 | 1.0 | -61.8 | -13.0 | -48.8 | |
| 3.30 | -69.1 | H | 3.0 | -20.1 | 38.5 | 1.0 | -57.6 | -13.0 | -44.6 | |
| 1.64 | -71.5 | V | 3.0 | -29.4 | 37.8 | 1.0 | -66.3 | -13.0 | -53.3 | |
| 2.48 | -69.2 | V | 3.0 | -24.0 | 38.5 | 1.0 | -61.4 | -13.0 | -48.4 | |
| 3.31 | -69.1 | V | 3.0 | -20.4 | 38.5 | 1.0 | -57.9 | -13.0 | -44.9 | |
| Mid Channel (836.6MHz) | | | | | | | | | | |
| 1.68 | -70.9 | H | 3.0 | -28.4 | 37.9 | 1.0 | -65.2 | -13.0 | -52.2 | |
| 2.51 | -69.4 | H | 3.0 | -24.1 | 38.6 | 1.0 | -61.7 | -13.0 | -48.7 | |
| 3.34 | -69.1 | H | 3.0 | -20.0 | 38.5 | 1.0 | -57.5 | -13.0 | -44.5 | |
| 1.68 | -71.7 | V | 3.0 | -29.4 | 37.9 | 1.0 | -66.3 | -13.0 | -53.3 | |
| 2.50 | -69.2 | V | 3.0 | -23.8 | 38.6 | 1.0 | -61.4 | -13.0 | -48.4 | |
| 3.34 | -69.2 | V | 3.0 | -20.4 | 38.5 | 1.0 | -57.9 | -13.0 | -44.9 | |
| High Channel (846.6MHz) | | | | | | | | | | |
| 1.70 | -71.6 | H | 3.0 | -29.0 | 37.9 | 1.0 | -65.9 | -13.0 | -52.9 | |
| 2.53 | -69.6 | H | 3.0 | -24.2 | 38.6 | 1.0 | -61.8 | -13.0 | -48.8 | |
| 3.38 | -69.1 | H | 3.0 | -20.0 | 38.5 | 1.0 | -57.5 | -13.0 | -44.5 | |
| 1.69 | -71.0 | V | 3.0 | -28.7 | 37.9 | 1.0 | -65.5 | -13.0 | -52.5 | |
| 2.54 | -69.2 | V | 3.0 | -23.7 | 38.6 | 1.0 | -61.2 | -13.0 | -48.2 | |
| 3.38 | -69.2 | V | 3.0 | -20.3 | 38.5 | 1.0 | -57.8 | -13.0 | -44.8 | |

Rev. 03.19.15


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

## UMTS REL 99, 1900MHz BAND 2

**High Frequency Substitution Measurement**
**UL Fremont Radiated Chamber**

**Company:**
**Project #:** 16U23816
**Date:** 11/28/16
**Test Engineer:** 45200
**Configuration:** EUT only
**Mode:** REL 99, 1900MHz

**Test Equipment:**
**Substitution: Horn T59 Substitution, and 8ft SMA Cable**

| Chamber | Pre-amplifer | Filter | Limit |
|---|---|---|---|
| 3m Chamber E | 3m Chamber E | Filter | EIRP |

| Frequency (GHz) | SA reading (dBm) | Ant. Pol. (H/V) | Distance | EIRP @ TX Ant End (dBm) | Preamp | Attenuator | EIRP | Limit | Delta | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| Low Channel (1852.4MHz) | | | | | | | | | | |
| 3.71 | -61.3 | H | 3.0 | -11.3 | 38.6 | 1.0 | -48.9 | -13.0 | -35.9 | |
| 5.55 | -63.4 | H | 3.0 | -9.4 | 38.6 | 1.0 | -46.9 | -13.0 | -33.9 | |
| 7.41 | -64.2 | H | 3.0 | -6.5 | 37.8 | 1.0 | -43.3 | -13.0 | -30.3 | |
| 3.71 | -64.3 | V | 3.0 | -14.4 | 38.6 | 1.0 | -52.0 | -13.0 | -39.0 | |
| 5.55 | -63.7 | V | 3.0 | -9.9 | 38.6 | 1.0 | -47.5 | -13.0 | -34.5 | |
| 7.41 | -65.0 | V | 3.0 | -7.6 | 37.8 | 1.0 | -44.4 | -13.0 | -31.4 | |
| Mid Channel (1880MHz) | | | | | | | | | | |
| 3.76 | -60.3 | H | 3.0 | -10.2 | 38.6 | 1.0 | -47.9 | -13.0 | -34.9 | |
| 5.64 | -64.6 | H | 3.0 | -10.4 | 38.5 | 1.0 | -47.9 | -13.0 | -34.9 | |
| 7.52 | -64.9 | H | 3.0 | -7.1 | 37.7 | 1.0 | -43.8 | -13.0 | -30.8 | |
| 3.76 | -63.3 | V | 3.0 | -13.3 | 38.6 | 1.0 | -50.9 | -13.0 | -37.9 | |
| 5.64 | -64.4 | V | 3.0 | -10.5 | 38.5 | 1.0 | -48.0 | -13.0 | -35.0 | |
| 7.52 | -64.4 | V | 3.0 | -6.7 | 37.7 | 1.0 | -43.5 | -13.0 | -30.5 | |
| High Channel (1907.6MHz) | | | | | | | | | | |
| 3.81 | -61.4 | H | 3.0 | -11.2 | 38.7 | 1.0 | -48.8 | -13.0 | -35.8 | |
| 5.72 | -64.0 | H | 3.0 | -9.6 | 38.5 | 1.0 | -47.1 | -13.0 | -34.1 | |
| 7.63 | -64.8 | H | 3.0 | -6.9 | 37.7 | 1.0 | -43.6 | -13.0 | -30.6 | |
| 3.81 | -62.9 | V | 3.0 | -12.7 | 38.7 | 1.0 | -50.4 | -13.0 | -37.4 | |
| 5.72 | -63.6 | V | 3.0 | -9.5 | 38.5 | 1.0 | -47.0 | -13.0 | -34.0 | |
| 7.63 | -65.6 | V | 3.0 | -7.9 | 37.7 | 1.0 | -44.6 | -13.0 | -31.6 | |

Rev. 03.19.15


UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701i
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

## UMTS HSDPA, 1900MHz BAND 2

**High Frequency Substitution Measurement**
**UL Fremont Radiated Chamber**

**Company:**
**Project #:** 16U23816
**Date:** 11/28/16
**Test Engineer:** 45200
**Configuration:** EUT only
**Mode:** HSDPA 1900MHz

**Test Equipment:**
**Substitution: Horn T59 Substitution, and 8ft SMA Cable**

| Chamber | Pre-amplifer | Filter | Limit |
|---|---|---|---|
| 3m Chamber E | 3m Chamber E | Filter | EIRP |

| Frequency (GHz) | SA reading (dBm) | Ant. Pol. (H/V) | Distance | EIRP @ TX Ant End (dBm) | Preamp | Attenuator | EIRP | Limit | Delta | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| Low Channel (1852.4MHz) | | | | | | | | | | |
| 3.71 | -62.5 | H | 3.0 | -12.5 | 38.6 | 1.0 | -50.1 | -13.0 | -37.1 | |
| 5.55 | -63.8 | H | 3.0 | -9.7 | 38.6 | 1.0 | -47.3 | -13.0 | -34.3 | |
| 7.41 | -64.9 | H | 3.0 | -7.2 | 37.8 | 1.0 | -44.0 | -13.0 | -31.0 | |
| 3.71 | -62.3 | V | 3.0 | -12.4 | 38.6 | 1.0 | -50.0 | -13.0 | -37.0 | |
| 5.55 | -64.1 | V | 3.0 | -10.4 | 38.6 | 1.0 | -48.0 | -13.0 | -35.0 | |
| 7.41 | -64.4 | V | 3.0 | -6.9 | 37.8 | 1.0 | -43.8 | -13.0 | -30.8 | |
| Mid Channel (1880MHz) | | | | | | | | | | |
| 3.76 | -61.8 | H | 3.0 | -11.7 | 38.6 | 1.0 | -49.3 | -13.0 | -36.3 | |
| 5.64 | -64.4 | H | 3.0 | -10.2 | 38.5 | 1.0 | -47.7 | -13.0 | -34.7 | |
| 7.52 | -64.3 | H | 3.0 | -6.5 | 37.7 | 1.0 | -43.2 | -13.0 | -30.2 | |
| 3.76 | -61.0 | V | 3.0 | -10.9 | 38.6 | 1.0 | -48.6 | -13.0 | -35.6 | |
| 5.64 | -65.2 | V | 3.0 | -11.3 | 38.5 | 1.0 | -48.8 | -13.0 | -35.8 | |
| 7.52 | -65.5 | V | 3.0 | -7.8 | 37.7 | 1.0 | -44.6 | -13.0 | -31.6 | |
| High Channel (1907.6MHz) | | | | | | | | | | |
| 3.81 | -60.7 | H | 3.0 | -10.5 | 38.7 | 1.0 | -48.1 | -13.0 | -35.1 | |
| 5.72 | -64.1 | H | 3.0 | -9.7 | 38.5 | 1.0 | -47.2 | -13.0 | -34.2 | |
| 7.63 | -65.5 | H | 3.0 | -7.5 | 37.7 | 1.0 | -44.2 | -13.0 | -31.2 | |
| 3.81 | -61.3 | V | 3.0 | -11.1 | 38.7 | 1.0 | -48.7 | -13.0 | -35.7 | |
| 5.72 | -63.5 | V | 3.0 | -9.4 | 38.5 | 1.0 | -46.9 | -13.0 | -33.9 | |
| 7.63 | -65.7 | V | 3.0 | -8.0 | 37.7 | 1.0 | -44.6 | -13.0 | -31.6 | |

Rev. 03.19.15


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

## UMTS REL 99, 1700MHz BAND 4

**High Frequency Substitution Measurement**
**UL Fremont Radiated Chamber**

**Company:**
**Project #:** 16U23816
**Date:** 11/28/16
**Test Engineer:** 45200
**Configuration:** EUT only
**Mode:** REL 99, 1700MHz

**Test Equipment:**
**Substitution: Horn T59 Substitution, and 8ft SMA Cable**

| Chamber | Pre-amplifer | Filter | Limit |
|---|---|---|---|
| 3m Chamber E | 3m Chamber E | Filter | EIRP |

| Frequency (GHz) | SA reading (dBm) | Ant. Pol. (H/V) | Distance | EIRP @ TX Ant End (dBm) | Preamp | Attenuator | EIRP | Limit | Delta | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| Low Channel (1712.4MHz) | | | | | | | | | | |
| 3.43 | -63.6 | H | 3.0 | -14.4 | 38.5 | 1.0 | -51.9 | -13.0 | -38.9 | |
| 5.13 | -64.3 | H | 3.0 | -11.1 | 38.7 | 1.0 | -48.8 | -13.0 | -35.8 | |
| 6.85 | -64.8 | H | 3.0 | -7.9 | 38.1 | 1.0 | -45.1 | -13.0 | -32.1 | |
| 3.43 | -62.7 | V | 3.0 | -13.6 | 38.5 | 1.0 | -51.1 | -13.0 | -38.1 | |
| 5.14 | -64.2 | V | 3.0 | -11.4 | 38.7 | 1.0 | -49.1 | -13.0 | -36.1 | |
| 6.85 | -64.4 | V | 3.0 | -7.8 | 38.1 | 1.0 | -44.9 | -13.0 | -31.9 | |
| Mid Channel (1732.6MHz) | | | | | | | | | | |
| 3.47 | -64.2 | H | 3.0 | -14.8 | 38.5 | 1.0 | -52.4 | -13.0 | -39.4 | |
| 5.19 | -64.3 | H | 3.0 | -11.0 | 38.7 | 1.0 | -48.7 | -13.0 | -35.7 | |
| 6.93 | -64.2 | H | 3.0 | -7.1 | 38.1 | 1.0 | -44.2 | -13.0 | -31.2 | |
| 3.46 | -63.8 | V | 3.0 | -14.6 | 38.5 | 1.0 | -52.2 | -13.0 | -39.2 | |
| 5.20 | -63.4 | V | 3.0 | -10.5 | 38.7 | 1.0 | -48.2 | -13.0 | -35.2 | |
| 6.94 | -63.9 | V | 3.0 | -7.1 | 38.1 | 1.0 | -44.2 | -13.0 | -31.2 | |
| High Channel (1752.6MHz) | | | | | | | | | | |
| 3.50 | -63.0 | H | 3.0 | -13.5 | 38.5 | 1.0 | -51.1 | -13.0 | -38.1 | |
| 5.26 | -64.0 | H | 3.0 | -10.5 | 38.7 | 1.0 | -48.2 | -13.0 | -35.2 | |
| 7.01 | -66.0 | H | 3.0 | -8.8 | 38.1 | 1.0 | -45.8 | -13.0 | -32.8 | |
| 3.50 | -60.9 | V | 3.0 | -11.6 | 38.5 | 1.0 | -49.2 | -13.0 | -36.2 | |
| 5.26 | -63.9 | V | 3.0 | -10.8 | 38.7 | 1.0 | -48.4 | -13.0 | -35.4 | |
| 7.01 | -65.1 | V | 3.0 | -8.1 | 38.1 | 1.0 | -45.2 | -13.0 | -32.2 | |

Rev. 03.19.15


UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701i
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

## UMTS HSDPA, 1700MHz BAND 4

**High Frequency Substitution Measurement**
**UL Fremont Radiated Chamber**

**Company:**
**Project #:** 16U23816
**Date:** 11/28/16
**Test Engineer:** 45200
**Configuration:** EUT only
**Mode:** HSDPA 1700MHz

**Test Equipment:**
**Substitution: Horn T59 Substitution, and 8ft SMA Cable**

| Chamber | Pre-amplifer | Filter | Limit |
|---|---|---|---|
| 3m Chamber E | 3m Chamber E | Filter | EIRP |

| Frequency (GHz) | SA reading (dBm) | Ant. Pol. (H/V) | Distance | EIRP @ TX Ant End (dBm) | Preamp | Attenuator | EIRP | Limit | Delta | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| Low Channel (1712.4MHz) | | | | | | | | | | |
| 3.43 | -62.6 | H | 3.0 | -13.4 | 38.5 | 1.0 | -50.9 | -13.0 | -37.9 | |
| 5.14 | -63.2 | H | 3.0 | -10.0 | 38.7 | 1.0 | -47.7 | -13.0 | -34.7 | |
| 6.85 | -64.3 | H | 3.0 | -7.5 | 38.1 | 1.0 | -44.6 | -13.0 | -31.6 | |
| 3.42 | -62.3 | V | 3.0 | -13.2 | 38.5 | 1.0 | -50.7 | -13.0 | -37.7 | |
| 5.14 | -64.1 | V | 3.0 | -11.3 | 38.7 | 1.0 | -49.0 | -13.0 | -36.0 | |
| 6.85 | -64.1 | V | 3.0 | -7.5 | 38.1 | 1.0 | -44.6 | -13.0 | -31.6 | |
| Mid Channel (1732.6MHz) | | | | | | | | | | |
| 3.47 | -62.8 | H | 3.0 | -13.5 | 38.5 | 1.0 | -51.0 | -13.0 | -38.0 | |
| 5.20 | -63.6 | H | 3.0 | -10.3 | 38.7 | 1.0 | -48.0 | -13.0 | -35.0 | |
| 6.93 | -64.0 | H | 3.0 | -7.0 | 38.1 | 1.0 | -44.1 | -13.0 | -31.1 | |
| 3.46 | -64.4 | V | 3.0 | -15.2 | 38.5 | 1.0 | -52.7 | -13.0 | -39.7 | |
| 5.20 | -63.8 | V | 3.0 | -10.9 | 38.7 | 1.0 | -48.5 | -13.0 | -35.5 | |
| 6.93 | -64.0 | V | 3.0 | -7.3 | 38.1 | 1.0 | -44.4 | -13.0 | -31.4 | |
| High Channel (1752.6MHz) | | | | | | | | | | |
| 3.50 | -61.4 | H | 3.0 | -12.0 | 38.5 | 1.0 | -49.5 | -13.0 | -36.5 | |
| 5.25 | -64.2 | H | 3.0 | -10.8 | 38.7 | 1.0 | -48.4 | -13.0 | -35.4 | |
| 7.01 | -65.3 | H | 3.0 | -8.1 | 38.1 | 1.0 | -45.1 | -13.0 | -32.1 | |
| 3.50 | -61.7 | V | 3.0 | -12.4 | 38.5 | 1.0 | -50.0 | -13.0 | -37.0 | |
| 5.26 | -63.3 | V | 3.0 | -10.2 | 38.7 | 1.0 | -47.9 | -13.0 | -34.9 | |
| 7.01 | -65.4 | V | 3.0 | -8.5 | 38.1 | 1.0 | -45.6 | -13.0 | -32.6 | |

Rev. 03.19.15


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

## 11.2. FIELD STRENGTH OF SPURIOUS RADIATION (ANTENNA D)

### 11.2.1. GSM

**GPRS, 850MHz BAND 5**

**High Frequency Substitution Measurement**
**UL Fremont Radiated Chamber**

**Company:**
**Project #:** 16U23816
**Date:** 12/08/16
**Test Engineer:** 43574
**Configuration:** EUT only
**Mode:** GPRS 850MHz

**Test Equipment:**
**Substitution: Horn T59 Substitution, and 8ft SMA Cable**

| Chamber | Pre-amplifer | Filter | Limit |
|---|---|---|---|
| 3m Chamber G | 3m Chamber G | Filter | EIRP |

| Frequency (GHz) | SA reading (dBm) | Ant. Pol. (H/V) | Distance | EIRP @ TX Ant End (dBm) | Preamp | Attenuator | EIRP | Limit | Delta | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| Low Channel (824.2MHz) | | | | | | | | | | |
| 1.65 | -67.4 | H | 3.0 | -26.0 | 37.8 | 1.0 | -62.8 | -13.0 | -49.8 | |
| 2.47 | -66.9 | H | 3.0 | -23.8 | 36.6 | 1.0 | -59.4 | -13.0 | -46.4 | |
| 3.29 | -68.9 | H | 3.0 | -22.9 | 36.5 | 1.0 | -58.5 | -13.0 | -45.5 | |
| 1.65 | -67.5 | V | 3.0 | -25.7 | 37.8 | 1.0 | -62.5 | -13.0 | -49.5 | |
| 2.47 | -66.8 | V | 3.0 | -22.8 | 36.6 | 1.0 | -58.3 | -13.0 | -45.3 | |
| 3.30 | -68.9 | V | 3.0 | -23.0 | 36.5 | 1.0 | -58.5 | -13.0 | -45.5 | |
| Mid Channel (836.6MHz) | | | | | | | | | | |
| 1.67 | -67.6 | H | 3.0 | -26.1 | 37.8 | 1.0 | -62.9 | -13.0 | -49.9 | |
| 2.51 | -68.7 | H | 3.0 | -25.5 | 36.4 | 1.0 | -60.8 | -13.0 | -47.8 | |
| 3.35 | -69.3 | H | 3.0 | -23.2 | 36.5 | 1.0 | -58.7 | -13.0 | -45.7 | |
| 1.67 | -67.5 | V | 3.0 | -25.7 | 37.8 | 1.0 | -62.5 | -13.0 | -49.5 | |
| 2.51 | -68.2 | V | 3.0 | -23.9 | 36.4 | 1.0 | -59.3 | -13.0 | -46.3 | |
| 3.35 | -70.0 | V | 3.0 | -23.9 | 36.5 | 1.0 | -59.4 | -13.0 | -46.4 | |
| High Channel (848.8MHz) | | | | | | | | | | |
| 1.70 | -67.3 | H | 3.0 | -25.8 | 37.8 | 1.0 | -62.6 | -13.0 | -49.6 | |
| 2.54 | -68.6 | H | 3.0 | -25.3 | 36.4 | 1.0 | -60.7 | -13.0 | -47.7 | |
| 3.40 | -69.8 | H | 3.0 | -23.7 | 36.4 | 1.0 | -59.1 | -13.0 | -46.1 | |
| 1.70 | -67.5 | V | 3.0 | -25.7 | 37.8 | 1.0 | -62.5 | -13.0 | -49.5 | |
| 2.55 | -68.3 | V | 3.0 | -24.1 | 36.4 | 1.0 | -59.5 | -13.0 | -46.5 | |
| 3.39 | -69.5 | V | 3.0 | -23.3 | 36.4 | 1.0 | -58.8 | -13.0 | -45.8 | |

Rev. 03.19.15


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

**EGPRS, 850MHz BAND 5**

**High Frequency Substitution Measurement**
**UL Fremont Radiated Chamber**

**Company:**
**Project #:** 16U23816
**Date:** 12/08/16
**Test Engineer:** 43574
**Configuration:** EUT Only
**Mode:** EGPRS 850MHz

**Test Equipment:**
**Substitution: Horn T59 Substitution, and 8ft SMA Cable**

| Chamber | Pre-amplifer | Filter | Limit |
|---|---|---|---|
| 3m Chamber G | 3m Chamber G | Filter | EIRP |

| Frequency (GHz) | SA reading (dBm) | Ant. Pol. (H/V) | Distance | EIRP @ TX Ant End (dBm) | Preamp | Attenuator | EIRP | Limit | Delta | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| Low Channel (824.2MHz) | | | | | | | | | | |
| 1.65 | -68.0 | H | 3.0 | -26.6 | 37.8 | 1.0 | -63.4 | -13.0 | -50.4 | |
| 2.47 | -67.8 | H | 3.0 | -24.7 | 36.6 | 1.0 | -60.3 | -13.0 | -47.3 | |
| 3.30 | -69.9 | H | 3.0 | -24.0 | 36.5 | 1.0 | -59.5 | -13.0 | -46.5 | |
| 1.65 | -68.1 | V | 3.0 | -26.3 | 37.8 | 1.0 | -63.2 | -13.0 | -50.2 | |
| 2.47 | -67.2 | V | 3.0 | -23.2 | 36.6 | 1.0 | -58.8 | -13.0 | -45.8 | |
| 3.29 | -69.8 | V | 3.0 | -23.9 | 36.5 | 1.0 | -59.5 | -13.0 | -46.5 | |
| | | | | | | | | | | |
| Mid Channel (836.6MHz) | | | | | | | | | | |
| 1.67 | -67.8 | H | 3.0 | -26.4 | 37.8 | 1.0 | -63.2 | -13.0 | -50.2 | |
| 2.51 | -68.6 | H | 3.0 | -25.4 | 36.4 | 1.0 | -60.8 | -13.0 | -47.8 | |
| 3.35 | -69.6 | H | 3.0 | -23.5 | 36.5 | 1.0 | -59.0 | -13.0 | -46.0 | |
| 1.67 | -67.8 | V | 3.0 | -26.0 | 37.8 | 1.0 | -62.8 | -13.0 | -49.8 | |
| 2.51 | -68.5 | V | 3.0 | -24.3 | 36.4 | 1.0 | -59.7 | -13.0 | -46.7 | |
| 3.35 | -70.2 | V | 3.0 | -24.1 | 36.5 | 1.0 | -59.6 | -13.0 | -46.6 | |
| | | | | | | | | | | |
| High Channel (848.8MHz) | | | | | | | | | | |
| 1.69 | -68.2 | H | 3.0 | -26.6 | 37.8 | 1.0 | -63.5 | -13.0 | -50.5 | |
| 2.55 | -68.4 | H | 3.0 | -25.1 | 36.4 | 1.0 | -60.5 | -13.0 | -47.5 | |
| 3.39 | -70.1 | H | 3.0 | -24.0 | 36.4 | 1.0 | -59.5 | -13.0 | -46.5 | |
| 1.70 | -66.6 | V | 3.0 | -24.8 | 37.8 | 1.0 | -61.6 | -13.0 | -48.6 | |
| 2.54 | -68.2 | V | 3.0 | -23.9 | 36.4 | 1.0 | -59.3 | -13.0 | -46.3 | |
| 3.39 | -69.9 | V | 3.0 | -23.7 | 36.4 | 1.0 | -59.2 | -13.0 | -46.2 | |

Rev. 03.19.15


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

## GPRS, 1900MHz BAND 2

**High Frequency Substitution Measurement**
**UL Fremont Radiated Chamber**

**Company:**
**Project #:** 16U23816
**Date:** 12/07/16
**Test Engineer:** 39005
**Configuration:** EUT only
**Mode:** GPRS 1900MHz

**Test Equipment:**
**Substitution: Horn T59 Substitution, and 8ft SMA Cable**

| Chamber | Pre-amplifer | Filter | Limit |
|---|---|---|---|
| 3m Chamber G | 3m Chamber G | Filter | EIRP |

| Frequency (GHz) | SA reading (dBm) | Ant. Pol. (H/V) | Distance | EIRP @ TX Ant End (dBm) | Preamp | Attenuator | EIRP | Limit | Delta | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| Low Channel (1850.2MHz) | | | | | | | | | | |
| 3.70 | -65.9 | H | 3.0 | -19.1 | 36.2 | 1.0 | -54.4 | -13.0 | -41.4 | |
| 5.55 | -65.6 | H | 3.0 | -15.2 | 36.1 | 1.0 | -50.4 | -13.0 | -37.4 | |
| 7.40 | -66.5 | H | 3.0 | -13.5 | 35.2 | 1.0 | -47.7 | -13.0 | -34.7 | |
| 3.70 | -65.4 | V | 3.0 | -18.2 | 36.2 | 1.0 | -53.5 | -13.0 | -40.5 | |
| 5.55 | -65.3 | V | 3.0 | -15.2 | 36.1 | 1.0 | -50.3 | -13.0 | -37.3 | |
| 7.40 | -65.9 | V | 3.0 | -12.9 | 35.2 | 1.0 | -47.2 | -13.0 | -34.2 | |
| Mid Channel (1880.0) | | | | | | | | | | |
| 3.76 | -65.9 | H | 3.0 | -19.0 | 36.2 | 1.0 | -54.2 | -13.0 | -41.2 | |
| 5.64 | -64.2 | H | 3.0 | -13.8 | 36.1 | 1.0 | -48.9 | -13.0 | -35.9 | |
| 7.52 | -66.5 | H | 3.0 | -13.3 | 35.1 | 1.0 | -47.5 | -13.0 | -34.5 | |
| 3.76 | -65.8 | V | 3.0 | -18.5 | 36.2 | 1.0 | -53.7 | -13.0 | -40.7 | |
| 5.64 | -63.6 | V | 3.0 | -13.3 | 36.1 | 1.0 | -48.4 | -13.0 | -35.4 | |
| 7.52 | -66.1 | V | 3.0 | -13.0 | 35.1 | 1.0 | -47.1 | -13.0 | -34.1 | |
| High Channel (1909.8MHz) | | | | | | | | | | |
| 3.82 | -65.6 | H | 3.0 | -18.6 | 36.1 | 1.0 | -53.7 | -13.0 | -40.7 | |
| 5.73 | -64.4 | H | 3.0 | -13.7 | 36.1 | 1.0 | -48.8 | -13.0 | -35.8 | |
| 7.64 | -66.6 | H | 3.0 | -13.3 | 35.0 | 1.0 | -47.3 | -13.0 | -34.3 | |
| 3.82 | -65.8 | V | 3.0 | -18.3 | 36.1 | 1.0 | -53.5 | -13.0 | -40.5 | |
| 5.73 | -63.5 | V | 3.0 | -13.1 | 36.1 | 1.0 | -48.2 | -13.0 | -35.2 | |
| 7.64 | -65.9 | V | 3.0 | -12.7 | 35.0 | 1.0 | -46.7 | -13.0 | -33.7 | |

Rev. 03.19.15


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

## EGPRS, 1900MHz BAND 2

**High Frequency Substitution Measurement**
**UL Fremont Radiated Chamber**

**Company:**
**Project #:** 16U23816
**Date:** 12/07/16
**Test Engineer:** 39005
**Configuration:** EUT only
**Mode:** EGPRS 1900MHz

**Test Equipment:**
**Substitution: Horn T59 Substitution, and 8ft SMA Cable**

| Chamber | Pre-amplifer | Filter | Limit |
|---|---|---|---|
| 3m Chamber G | 3m Chamber G | Filter | EIRP |

| Frequency (GHz) | SA reading (dBm) | Ant. Pol. (H/V) | Distance | EIRP @ TX Ant End (dBm) | Preamp | Attenuator | EIRP | Limit | Delta | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| Low Channel (1850.2MHz) | | | | | | | | | | |
| 3.70 | -66.0 | H | 3.0 | -19.2 | 36.2 | 1.0 | -54.4 | -13.0 | -41.4 | |
| 5.55 | -65.5 | H | 3.0 | -15.2 | 36.1 | 1.0 | -50.3 | -13.0 | -37.3 | |
| 7.40 | -66.6 | H | 3.0 | -13.5 | 35.2 | 1.0 | -47.7 | -13.0 | -34.7 | |
| 3.70 | -65.0 | V | 3.0 | -17.8 | 36.2 | 1.0 | -53.0 | -13.0 | -40.0 | |
| 5.55 | -65.6 | V | 3.0 | -15.5 | 36.1 | 1.0 | -50.6 | -13.0 | -37.6 | |
| 7.40 | -66.0 | V | 3.0 | -13.0 | 35.2 | 1.0 | -47.2 | -13.0 | -34.2 | |
| Mid Channel (1880.0) | | | | | | | | | | |
| 3.76 | -65.8 | H | 3.0 | -18.9 | 36.2 | 1.0 | -54.1 | -13.0 | -41.1 | |
| 5.64 | -65.4 | H | 3.0 | -14.9 | 36.1 | 1.0 | -50.0 | -13.0 | -37.0 | |
| 7.52 | -66.6 | H | 3.0 | -13.4 | 35.1 | 1.0 | -47.5 | -13.0 | -34.5 | |
| 3.76 | -65.8 | V | 3.0 | -18.5 | 36.2 | 1.0 | -53.7 | -13.0 | -40.7 | |
| 5.64 | -64.3 | V | 3.0 | -14.0 | 36.1 | 1.0 | -49.1 | -13.0 | -36.1 | |
| 7.52 | -65.9 | V | 3.0 | -12.8 | 35.1 | 1.0 | -46.9 | -13.0 | -33.9 | |
| High Channel (1909.8MHz) | | | | | | | | | | |
| 3.82 | -65.5 | H | 3.0 | -18.5 | 36.1 | 1.0 | -53.7 | -13.0 | -40.7 | |
| 5.73 | -64.5 | H | 3.0 | -13.9 | 36.1 | 1.0 | -48.9 | -13.0 | -35.9 | |
| 7.64 | -66.4 | H | 3.0 | -13.1 | 35.0 | 1.0 | -47.1 | -13.0 | -34.1 | |
| 3.82 | -66.2 | V | 3.0 | -18.7 | 36.1 | 1.0 | -53.9 | -13.0 | -40.9 | |
| 5.73 | -64.3 | V | 3.0 | -13.9 | 36.1 | 1.0 | -48.9 | -13.0 | -35.9 | |
| 7.64 | -66.0 | V | 3.0 | -12.7 | 35.0 | 1.0 | -46.8 | -13.0 | -33.8 | |

Rev. 03.19.15


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

### 11.2.2. CDMA2000

**CDMA2000 1xRTT, 850MHz BC0**

**High Frequency Substitution Measurement**
**UL Fremont Radiated Chamber**

**Company:**
**Project #:** 16U23814
**Date:** 01/12/17
**Test Engineer:** 29435
**Configuration:** EUT Only
**Mode:** 1xRTT 850MHz

**Test Equipment:**
**Substitution: Horn T59 Substitution, and 8ft SMA Cable**

| Chamber | Pre-amplifer | Filter | Limit |
|---|---|---|---|
| 3m Chamber D | 3m Chamber D | Filter | EIRP |

| Frequency (GHz) | SA reading (dBm) | Ant. Pol. (H/V) | Distance | EIRP @ TX Ant End (dBm) | Preamp | Attenuator | EIRP | Limit | Delta | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| Low Channel (824.7MHz) | | | | | | | | | | |
| 1.65 | -68.3 | H | 3.0 | -26.5 | 35.0 | 1.0 | -60.5 | -13.0 | -47.5 | |
| 2.48 | -67.3 | H | 3.0 | -23.2 | 33.9 | 1.0 | -56.1 | -13.0 | -43.1 | |
| 3.30 | -68.1 | H | 3.0 | -21.3 | 33.2 | 1.0 | -53.5 | -13.0 | -40.5 | |
| 1.65 | -68.5 | V | 3.0 | -26.5 | 35.0 | 1.0 | -60.5 | -13.0 | -47.5 | |
| 2.47 | -69.6 | V | 3.0 | -25.3 | 33.9 | 1.0 | -58.2 | -13.0 | -45.2 | |
| 3.30 | -70.0 | V | 3.0 | -23.1 | 33.2 | 1.0 | -55.4 | -13.0 | -42.4 | |
| Mid Channel (836.52MHz) | | | | | | | | | | |
| 1.67 | -68.7 | H | 3.0 | -26.9 | 35.0 | 1.0 | -60.9 | -13.0 | -47.9 | |
| 2.51 | -69.1 | H | 3.0 | -24.8 | 33.7 | 1.0 | -57.5 | -13.0 | -44.5 | |
| 3.35 | -69.2 | H | 3.0 | -22.2 | 33.3 | 1.0 | -54.5 | -13.0 | -41.5 | |
| 1.67 | -66.6 | V | 3.0 | -24.6 | 35.0 | 1.0 | -58.6 | -13.0 | -45.6 | |
| 2.51 | -68.5 | V | 3.0 | -24.0 | 33.7 | 1.0 | -56.7 | -13.0 | -43.7 | |
| 3.34 | -69.4 | V | 3.0 | -22.4 | 33.3 | 1.0 | -54.7 | -13.0 | -41.7 | |
| High Channel (848.31MHz) | | | | | | | | | | |
| 1.70 | -68.5 | H | 3.0 | -26.6 | 35.0 | 1.0 | -60.6 | -13.0 | -47.6 | |
| 2.54 | -68.7 | H | 3.0 | -24.3 | 33.7 | 1.0 | -57.0 | -13.0 | -44.0 | |
| 3.40 | -69.3 | H | 3.0 | -22.2 | 33.3 | 1.0 | -54.5 | -13.0 | -41.5 | |
| 1.70 | -68.9 | V | 3.0 | -26.8 | 35.0 | 1.0 | -60.8 | -13.0 | -47.8 | |
| 2.54 | -67.9 | V | 3.0 | -23.3 | 33.7 | 1.0 | -56.0 | -13.0 | -43.0 | |
| 3.39 | -69.0 | V | 3.0 | -21.9 | 33.3 | 1.0 | -54.2 | -13.0 | -41.2 | |

Rev. 03.19.15


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

## CDMA2000 EVDO Rev A, 850MHz BC0

**High Frequency Substitution Measurement**
**UL Fremont Radiated Chamber**

**Company:**
**Project #:** 16U23816
**Date:** 01/17/17
**Test Engineer:** 37290
**Configuration:** EUT only
**Mode:** EVDO, Rev A 850MHz

**Test Equipment:**
**Substitution: Horn T59 Substitution, and 8ft SMA Cable**

| Chamber | Pre-amplifer | Filter | Limit |
|---|---|---|---|
| 3m Chamber D | 3m Chamber D | Filter | EIRP |

| Frequency (GHz) | SA reading (dBm) | Ant. Pol. (H/V) | Distance | EIRP @ TX Ant End (dBm) | Preamp | Attenuator | EIRP | Limit | Delta | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| Low Channel (824.7MHz) | | | | | | | | | | |
| 1.65 | -65.5 | H | 3.0 | -23.8 | 35.0 | 1.0 | -57.8 | -13.0 | -44.8 | |
| 2.47 | -66.8 | H | 3.0 | -22.6 | 33.9 | 1.0 | -55.6 | -13.0 | -42.6 | |
| 3.30 | -67.4 | H | 3.0 | -20.7 | 33.2 | 1.0 | -52.9 | -13.0 | -39.9 | |
| 1.65 | -63.1 | V | 3.0 | -21.1 | 35.0 | 1.0 | -55.1 | -13.0 | -42.1 | |
| 2.48 | -67.2 | V | 3.0 | -22.8 | 33.9 | 1.0 | -55.7 | -13.0 | -42.7 | |
| 3.30 | -67.1 | V | 3.0 | -20.2 | 33.2 | 1.0 | -52.5 | -13.0 | -39.5 | |
| | | | | | | | | | | |
| Mid Channel (836.52MHz) | | | | | | | | | | |
| 1.67 | -68.1 | H | 3.0 | -26.3 | 35.0 | 1.0 | -60.3 | -13.0 | -47.3 | |
| 2.51 | -67.6 | H | 3.0 | -23.3 | 33.7 | 1.0 | -56.1 | -13.0 | -43.1 | |
| 3.35 | -67.1 | H | 3.0 | -20.2 | 33.3 | 1.0 | -52.5 | -13.0 | -39.5 | |
| 1.67 | -66.9 | V | 3.0 | -24.9 | 35.0 | 1.0 | -58.9 | -13.0 | -45.9 | |
| 2.51 | -65.8 | V | 3.0 | -21.3 | 33.7 | 1.0 | -54.0 | -13.0 | -41.0 | |
| 3.35 | -67.2 | V | 3.0 | -20.2 | 33.3 | 1.0 | -52.5 | -13.0 | -39.5 | |
| | | | | | | | | | | |
| High Channel (848.31MHz) | | | | | | | | | | |
| 1.70 | -67.6 | H | 3.0 | -25.7 | 35.0 | 1.0 | -59.7 | -13.0 | -46.7 | |
| 2.55 | -66.4 | H | 3.0 | -22.0 | 33.7 | 1.0 | -54.7 | -13.0 | -41.7 | |
| 3.40 | -67.6 | H | 3.0 | -20.5 | 33.3 | 1.0 | -52.8 | -13.0 | -39.8 | |
| 1.70 | -67.3 | V | 3.0 | -25.2 | 35.0 | 1.0 | -59.2 | -13.0 | -46.2 | |
| 2.54 | -66.8 | V | 3.0 | -22.2 | 33.7 | 1.0 | -54.9 | -13.0 | -41.9 | |
| 3.40 | -67.4 | V | 3.0 | -20.3 | 33.3 | 1.0 | -52.5 | -13.0 | -39.5 | |
| | | | | | | | | | | |

Rev. 03.19.15


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

**CDMA2000 1xRTT, 1900MHz BC1**

**High Frequency Substitution Measurement**
**UL Fremont Radiated Chamber**

**Company:**
**Project #:** 16U23816
**Date:** 01/12/17
**Test Engineer:** 29435
**Configuration:** EUT only
**Mode:** 1xRTT 1900MHz

**Test Equipment:**
**Substitution: Horn T59 Substitution, and 8ft SMA Cable**

| Chamber | Pre-amplifer | Filter | Limit |
|---|---|---|---|
| 3m Chamber D | 3m Chamber D | Filter | EIRP |

| Frequency (GHz) | SA reading (dBm) | Ant. Pol. (H/V) | Distance | EIRP @ TX Ant End (dBm) | Preamp | Attenuator | EIRP | Limit | Delta | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| Low Channel (1851.25MHz) | | | | | | | | | | |
| 3.70 | -68.3 | H | 3.0 | -20.4 | 33.5 | 1.0 | -52.9 | -13.0 | -39.9 | |
| 5.56 | -68.9 | H | 3.0 | -17.6 | 32.5 | 1.0 | -49.1 | -13.0 | -36.1 | |
| 7.41 | -71.3 | H | 3.0 | -16.9 | 30.4 | 1.0 | -46.3 | -13.0 | -33.3 | |
| 3.70 | -67.0 | V | 3.0 | -19.1 | 33.5 | 1.0 | -51.6 | -13.0 | -38.6 | |
| 5.55 | -69.7 | V | 3.0 | -18.7 | 32.5 | 1.0 | -50.1 | -13.0 | -37.1 | |
| 7.40 | -70.7 | V | 3.0 | -16.1 | 30.4 | 1.0 | -45.5 | -13.0 | -32.5 | |
| Mid Channel (1880MHz) | | | | | | | | | | |
| 3.76 | -66.6 | H | 3.0 | -18.5 | 33.5 | 1.0 | -51.0 | -13.0 | -38.0 | |
| 5.64 | -68.9 | H | 3.0 | -17.4 | 32.4 | 1.0 | -48.8 | -13.0 | -35.8 | |
| 7.52 | -68.2 | H | 3.0 | -13.7 | 30.3 | 1.0 | -43.0 | -13.0 | -30.0 | |
| 3.76 | -66.5 | V | 3.0 | -18.4 | 33.5 | 1.0 | -50.9 | -13.0 | -37.9 | |
| 5.64 | -68.9 | V | 3.0 | -17.7 | 32.4 | 1.0 | -49.1 | -13.0 | -36.1 | |
| 7.52 | -70.1 | V | 3.0 | -15.4 | 30.3 | 1.0 | -44.7 | -13.0 | -31.7 | |
| High Channel (1908.75MHz) | | | | | | | | | | |
| 3.82 | -67.9 | H | 3.0 | -19.6 | 33.6 | 1.0 | -52.2 | -13.0 | -39.2 | |
| 5.73 | -69.4 | H | 3.0 | -17.8 | 32.3 | 1.0 | -49.1 | -13.0 | -36.1 | |
| 7.64 | -71.0 | H | 3.0 | -16.4 | 30.1 | 1.0 | -45.5 | -13.0 | -32.5 | |
| 3.82 | -67.7 | V | 3.0 | -19.4 | 33.6 | 1.0 | -52.0 | -13.0 | -39.0 | |
| 5.72 | -69.1 | V | 3.0 | -17.7 | 32.3 | 1.0 | -49.0 | -13.0 | -36.0 | |
| 7.63 | -70.1 | V | 3.0 | -15.3 | 30.1 | 1.0 | -44.4 | -13.0 | -31.4 | |

Rev. 03.19.15


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

**CDMA2000 EVDO Rev A, 1900MHz BC1**

**High Frequency Substitution Measurement**
**UL Fremont Radiated Chamber**

**Company:**
**Project #:** 16U23816
**Date:** 01/17/17
**Test Engineer:** 37290
**Configuration:** EUT only
**Mode:** Rev 0/A 1900MHz

**Test Equipment:**
**Substitution: Horn T59 Substitution, and 8ft SMA Cable**

| Chamber | Pre-amplifer | Filter | Limit |
|---|---|---|---|
| 3m Chamber D | 3m Chamber D | Filter | EIRP |

| Frequency (GHz) | SA reading (dBm) | Ant. Pol. (H/V) | Distance | EIRP @ TX Ant End (dBm) | Preamp | Attenuator | EIRP | Limit | Delta | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| Low Channel (1851.25MHz) | | | | | | | | | | |
| 3.70 | -65.6 | H | 3.0 | -17.7 | 33.5 | 1.0 | -50.2 | -13.0 | -37.2 | |
| 5.55 | -67.5 | H | 3.0 | -16.2 | 32.5 | 1.0 | -47.7 | -13.0 | -34.7 | |
| 7.40 | -67.7 | H | 3.0 | -13.3 | 30.4 | 1.0 | -42.7 | -13.0 | -29.7 | |
| 3.70 | -64.6 | V | 3.0 | -16.7 | 33.5 | 1.0 | -49.2 | -13.0 | -36.2 | |
| 5.55 | -66.8 | V | 3.0 | -15.8 | 32.5 | 1.0 | -47.2 | -13.0 | -34.2 | |
| 7.40 | -67.7 | V | 3.0 | -13.1 | 30.4 | 1.0 | -42.6 | -13.0 | -29.6 | |
| | | | | | | | | | | |
| Mid Channel (1880MHz) | | | | | | | | | | |
| 3.76 | -65.2 | H | 3.0 | -17.0 | 33.5 | 1.0 | -49.6 | -13.0 | -36.6 | |
| 5.64 | -62.0 | H | 3.0 | -10.5 | 32.4 | 1.0 | -41.9 | -13.0 | -28.9 | |
| 7.52 | -67.1 | H | 3.0 | -12.6 | 30.3 | 1.0 | -41.9 | -13.0 | -28.9 | |
| 3.76 | -65.2 | V | 3.0 | -17.1 | 33.5 | 1.0 | -49.7 | -13.0 | -36.7 | |
| 5.64 | -67.3 | V | 3.0 | -16.1 | 32.4 | 1.0 | -47.5 | -13.0 | -34.5 | |
| 7.52 | -67.7 | V | 3.0 | -13.0 | 30.3 | 1.0 | -42.3 | -13.0 | -29.3 | |
| | | | | | | | | | | |
| High Channel (1908.75MHz) | | | | | | | | | | |
| 3.82 | -65.3 | H | 3.0 | -17.0 | 33.6 | 1.0 | -49.6 | -13.0 | -36.6 | |
| 5.72 | -67.8 | H | 3.0 | -16.2 | 32.3 | 1.0 | -47.5 | -13.0 | -34.5 | |
| 7.63 | -69.0 | H | 3.0 | -14.4 | 30.1 | 1.0 | -43.5 | -13.0 | -30.5 | |
| 3.82 | -65.4 | V | 3.0 | -17.1 | 33.6 | 1.0 | -49.7 | -13.0 | -36.7 | |
| 5.73 | -68.5 | V | 3.0 | -17.1 | 32.3 | 1.0 | -48.4 | -13.0 | -35.4 | |
| 7.63 | -68.4 | V | 3.0 | -13.6 | 30.1 | 1.0 | -42.8 | -13.0 | -29.8 | |

Rev. 03.19.15


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

## CDMA2000 1xRTT, 800MHz BC10

**High Frequency Substitution Measurement**
**UL Fremont Radiated Chamber**

**Company:**
**Project #:** 16U23816
**Date:** 01/12/17
**Test Engineer:** 29435
**Configuration:** EUT only
**Mode:** 1xRTT 800MHz

**Test Equipment:**
**Substitution: Horn T59 Substitution, and 8ft SMA Cable**

| Chamber | Pre-amplifer | Filter | Limit |
|---|---|---|---|
| 3m Chamber D | 3m Chamber D | Filter | EIRP |

| Frequency (GHz) | SA reading (dBm) | Ant. Pol. (H/V) | Distance | EIRP @ TX Ant End (dBm) | Preamp | Attenuator | EIRP | Limit | Delta | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| Low Channel (817.25MHz) | | | | | | | | | | |
| 1.63 | -67.9 | H | 3.0 | -26.2 | 35.0 | 1.0 | -60.2 | -13.0 | -47.2 | |
| 2.45 | -68.8 | H | 3.0 | -24.8 | 34.1 | 1.0 | -57.8 | -13.0 | -44.8 | |
| 3.27 | -67.3 | H | 3.0 | -20.6 | 33.2 | 1.0 | -52.8 | -13.0 | -39.8 | |
| 1.63 | -67.8 | V | 3.0 | -25.8 | 35.0 | 1.0 | -59.9 | -13.0 | -46.9 | |
| 2.45 | -68.8 | V | 3.0 | -24.5 | 34.1 | 1.0 | -57.6 | -13.0 | -44.6 | |
| 3.27 | -69.3 | V | 3.0 | -22.5 | 33.2 | 1.0 | -54.7 | -13.0 | -41.7 | |
| Mid Channel (820MHz) | | | | | | | | | | |
| 1.64 | -68.5 | H | 3.0 | -26.7 | 35.0 | 1.0 | -60.8 | -13.0 | -47.8 | |
| 2.46 | -68.1 | H | 3.0 | -24.0 | 34.0 | 1.0 | -57.1 | -13.0 | -44.1 | |
| 3.28 | -69.3 | H | 3.0 | -22.6 | 33.2 | 1.0 | -54.8 | -13.0 | -41.8 | |
| 1.64 | -67.8 | V | 3.0 | -25.8 | 35.0 | 1.0 | -59.8 | -13.0 | -46.8 | |
| 2.46 | -66.0 | V | 3.0 | -21.7 | 34.0 | 1.0 | -54.7 | -13.0 | -41.7 | |
| 3.28 | -67.7 | V | 3.0 | -20.9 | 33.2 | 1.0 | -53.1 | -13.0 | -40.1 | |
| High Channel (822.75MHz) | | | | | | | | | | |
| 1.65 | -67.9 | H | 3.0 | -26.1 | 35.0 | 1.0 | -60.1 | -13.0 | -47.1 | |
| 2.47 | -68.4 | H | 3.0 | -24.3 | 34.0 | 1.0 | -57.3 | -13.0 | -44.3 | |
| 3.29 | -68.7 | H | 3.0 | -22.0 | 33.2 | 1.0 | -54.2 | -13.0 | -41.2 | |
| 1.65 | -69.0 | V | 3.0 | -27.0 | 35.0 | 1.0 | -61.0 | -13.0 | -48.0 | |
| 2.47 | -69.6 | V | 3.0 | -25.3 | 33.9 | 1.0 | -58.2 | -13.0 | -45.2 | |
| 3.29 | -68.7 | V | 3.0 | -21.9 | 33.2 | 1.0 | -54.1 | -13.0 | -41.1 | |

Rev. 03.19.15


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

**CDMA2000 EVDO Rev A, 800MHz BC10**

**High Frequency Substitution Measurement**
**UL Fremont Radiated Chamber**

**Company:**
**Project #:** 16U23816
**Date:** 01/17/17
**Test Engineer:** 37290
**Configuration:** EUT only
**Mode:** EVDO, Rev A, 800MHz

**Test Equipment:**
**Substitution: Horn T59 Substitution, and 8ft SMA Cable**

| Chamber | Pre-amplifer | Filter | Limit |
|---|---|---|---|
| 3m Chamber D | 3m Chamber D | Filter | EIRP |

| Frequency (GHz) | SA reading (dBm) | Ant. Pol. (H/V) | Distance | EIRP @ TX Ant End (dBm) | Preamp | Attenuator | EIRP | Limit | Delta | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| Low Channel (817.25MHz) | | | | | | | | | | |
| 1.63 | -66.5 | H | 3.0 | -24.8 | 35.0 | 1.0 | -58.8 | -13.0 | -45.8 | |
| 2.45 | -67.7 | H | 3.0 | -23.7 | 34.1 | 1.0 | -56.8 | -13.0 | -43.8 | |
| 3.27 | -67.6 | H | 3.0 | -20.9 | 33.2 | 1.0 | -53.1 | -13.0 | -40.1 | |
| 1.63 | -64.3 | V | 3.0 | -22.3 | 35.0 | 1.0 | -56.4 | -13.0 | -43.4 | |
| 2.45 | -68.0 | V | 3.0 | -23.7 | 34.1 | 1.0 | -56.8 | -13.0 | -43.8 | |
| 3.27 | -66.8 | V | 3.0 | -20.0 | 33.2 | 1.0 | -52.2 | -13.0 | -39.2 | |
| Mid Channel (820MHz) | | | | | | | | | | |
| 1.64 | -67.4 | H | 3.0 | -25.6 | 35.0 | 1.0 | -59.6 | -13.0 | -46.6 | |
| 2.46 | -67.7 | H | 3.0 | -23.6 | 34.0 | 1.0 | -56.6 | -13.0 | -43.6 | |
| 3.28 | -67.9 | H | 3.0 | -21.2 | 33.2 | 1.0 | -53.4 | -13.0 | -40.4 | |
| 1.64 | -66.6 | V | 3.0 | -24.6 | 35.0 | 1.0 | -58.6 | -13.0 | -45.6 | |
| 2.46 | -66.0 | V | 3.0 | -21.7 | 34.0 | 1.0 | -54.7 | -13.0 | -41.7 | |
| 3.28 | -66.3 | V | 3.0 | -19.5 | 33.2 | 1.0 | -51.7 | -13.0 | -38.7 | |
| High Channel (822.75MHz) | | | | | | | | | | |
| 1.64 | -66.0 | H | 3.0 | -24.2 | 35.0 | 1.0 | -58.3 | -13.0 | -45.3 | |
| 2.47 | -67.4 | H | 3.0 | -23.3 | 33.9 | 1.0 | -56.2 | -13.0 | -43.2 | |
| 3.29 | -65.9 | H | 3.0 | -19.1 | 33.2 | 1.0 | -51.3 | -13.0 | -38.3 | |
| 1.65 | -67.1 | V | 3.0 | -25.1 | 35.0 | 1.0 | -59.1 | -13.0 | -46.1 | |
| 2.47 | -67.2 | V | 3.0 | -22.9 | 34.0 | 1.0 | -55.8 | -13.0 | -42.8 | |
| 3.29 | -66.9 | V | 3.0 | -20.1 | 33.2 | 1.0 | -52.3 | -13.0 | -39.3 | |

Rev. 03.19.15


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

### 11.2.3. UMTS

**UMTS REL 99, 850MHz BAND 5**

**High Frequency Substitution Measurement**
**UL Fremont Radiated Chamber**

**Company:**
**Project #:** 16U23816
**Date:** 12/08/16
**Test Engineer:** 43574
**Configuration:** EUT only
**Mode:** REL 99, 850MHz

**Test Equipment:**
**Substitution: Horn T59 Substitution, and 8ft SMA Cable**

| Chamber | Pre-amplifer | Filter | Limit |
|---|---|---|---|
| 3m Chamber E | 3m Chamber E | Filter | EIRP |

| Frequency (GHz) | SA reading (dBm) | Ant. Pol. (H/V) | Distance | EIRP @ TX Ant End (dBm) | Preamp | Attenuator | EIRP | Limit | Delta | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| Low Channel (826.4MHz) | | | | | | | | | | |
| 1.65 | -65.9 | H | 3.0 | -23.5 | 37.8 | 1.0 | -60.3 | -13.0 | -47.3 | |
| 2.47 | -65.2 | H | 3.0 | -20.2 | 38.5 | 1.0 | -57.6 | -13.0 | -44.6 | |
| 3.30 | -69.0 | H | 3.0 | -20.0 | 38.5 | 1.0 | -57.5 | -13.0 | -44.5 | |
| 1.65 | -66.3 | V | 3.0 | -24.2 | 37.8 | 1.0 | -61.0 | -13.0 | -48.0 | |
| 2.47 | -64.9 | V | 3.0 | -19.8 | 38.5 | 1.0 | -57.2 | -13.0 | -44.2 | |
| 3.31 | -69.1 | V | 3.0 | -20.4 | 38.5 | 1.0 | -57.9 | -13.0 | -44.9 | |
| Mid Channel (836.6MHz) | | | | | | | | | | |
| 1.67 | -65.4 | H | 3.0 | -22.9 | 37.8 | 1.0 | -59.7 | -13.0 | -46.7 | |
| 2.50 | -64.7 | H | 3.0 | -19.6 | 38.6 | 1.0 | -57.1 | -13.0 | -44.1 | |
| 3.35 | -69.0 | H | 3.0 | -19.9 | 38.5 | 1.0 | -57.4 | -13.0 | -44.4 | |
| 1.66 | -65.8 | V | 3.0 | -23.6 | 37.8 | 1.0 | -60.4 | -13.0 | -47.4 | |
| 2.51 | -65.2 | V | 3.0 | -19.8 | 38.6 | 1.0 | -57.4 | -13.0 | -44.4 | |
| 3.34 | -68.2 | V | 3.0 | -19.4 | 38.5 | 1.0 | -56.8 | -13.0 | -43.8 | |
| High Channel (846.6MHz) | | | | | | | | | | |
| 1.70 | -65.6 | H | 3.0 | -23.0 | 37.9 | 1.0 | -59.8 | -13.0 | -46.8 | |
| 2.55 | -65.3 | H | 3.0 | -19.8 | 38.6 | 1.0 | -57.4 | -13.0 | -44.4 | |
| 3.40 | -67.4 | H | 3.0 | -18.3 | 38.5 | 1.0 | -55.8 | -13.0 | -42.8 | |
| 1.70 | -66.5 | V | 3.0 | -24.1 | 37.9 | 1.0 | -61.0 | -13.0 | -48.0 | |
| 2.53 | -64.4 | V | 3.0 | -18.9 | 38.6 | 1.0 | -56.4 | -13.0 | -43.4 | |
| 3.38 | -66.7 | V | 3.0 | -17.7 | 38.5 | 1.0 | -55.2 | -13.0 | -42.2 | |

Rev. 03.19.15


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

## UMTS HSDPA, 850MHz BAND 5

**High Frequency Substitution Measurement**
**UL Fremont Radiated Chamber**

**Company:**
**Project #:** 16U23816
**Date:** 12/8/2016
**Test Engineer:** 43574
**Configuration:** EUT only
**Mode:** HSDPA 850MHz

**Test Equipment:**
**Substitution: Horn T59 Substitution, and 8ft SMA Cable**

| Chamber | Pre-amplifer | Filter | Limit |
|---|---|---|---|
| 3m Chamber E | 3m Chamber E | Filter | EIRP |

| Frequency (GHz) | SA reading (dBm) | Ant. Pol. (H/V) | Distance | EIRP @ TX Ant End (dBm) | Preamp | Attenuator | EIRP | Limit | Delta | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| Low Channel (826.4MHz) | | | | | | | | | | |
| 1.65 | -65.7 | H | 3.0 | -23.3 | 37.8 | 1.0 | -60.1 | -13.0 | -47.1 | |
| 2.49 | -64.9 | H | 3.0 | -19.8 | 38.5 | 1.0 | -57.4 | -13.0 | -44.4 | |
| 3.30 | -69.1 | H | 3.0 | -20.1 | 38.5 | 1.0 | -57.6 | -13.0 | -44.6 | |
| 1.64 | -66.2 | V | 3.0 | -24.1 | 37.8 | 1.0 | -60.9 | -13.0 | -47.9 | |
| 2.48 | -65.1 | V | 3.0 | -19.9 | 38.5 | 1.0 | -57.4 | -13.0 | -44.4 | |
| 3.31 | -68.8 | V | 3.0 | -20.1 | 38.5 | 1.0 | -57.6 | -13.0 | -44.6 | |
| Mid Channel (836.6MHz) | | | | | | | | | | |
| 1.68 | -65.7 | H | 3.0 | -23.1 | 37.9 | 1.0 | -60.0 | -13.0 | -47.0 | |
| 2.51 | -64.5 | H | 3.0 | -19.3 | 38.6 | 1.0 | -56.9 | -13.0 | -43.9 | |
| 3.34 | -68.7 | H | 3.0 | -19.7 | 38.5 | 1.0 | -57.2 | -13.0 | -44.2 | |
| 1.68 | -65.8 | V | 3.0 | -23.5 | 37.9 | 1.0 | -60.4 | -13.0 | -47.4 | |
| 2.50 | -63.1 | V | 3.0 | -17.7 | 38.6 | 1.0 | -55.3 | -13.0 | -42.3 | |
| 3.34 | -68.6 | V | 3.0 | -19.8 | 38.5 | 1.0 | -57.3 | -13.0 | -44.3 | |
| High Channel (846.6MHz) | | | | | | | | | | |
| 1.70 | -66.3 | H | 3.0 | -23.7 | 37.9 | 1.0 | -60.6 | -13.0 | -47.6 | |
| 2.53 | -64.9 | H | 3.0 | -19.6 | 38.6 | 1.0 | -57.1 | -13.0 | -44.1 | |
| 3.38 | -66.3 | H | 3.0 | -17.2 | 38.5 | 1.0 | -54.7 | -13.0 | -41.7 | |
| 1.69 | -66.7 | V | 3.0 | -24.4 | 37.9 | 1.0 | -61.2 | -13.0 | -48.2 | |
| 2.54 | -65.4 | V | 3.0 | -19.9 | 38.6 | 1.0 | -57.5 | -13.0 | -44.5 | |
| 3.38 | -67.7 | V | 3.0 | -18.8 | 38.5 | 1.0 | -56.3 | -13.0 | -43.3 | |

Rev. 03.19.15


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

## UMTS REL 99, 1900MHz BAND 2

**High Frequency Substitution Measurement**
**UL Fremont Radiated Chamber**

**Company:**
**Project #:** 16U23816
**Date:** 12/07/16
**Test Engineer:** 39005
**Configuration:** EUT only
**Mode:** REL 99, 1900MHz

**Test Equipment:**
**Substitution: Horn T59 Substitution, and 8ft SMA Cable**

| Chamber | Pre-amplifer | Filter | Limit |
|---|---|---|---|
| 3m Chamber G | 3m Chamber G | Filter | EIRP |

| Frequency (GHz) | SA reading (dBm) | Ant. Pol. (H/V) | Distance | EIRP @ TX Ant End (dBm) | Preamp | Attenuator | EIRP | Limit | Delta | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| Low Channel (1852.4MHz) | | | | | | | | | | |
| 3.70 | -65.5 | H | 3.0 | -18.8 | 36.2 | 1.0 | -54.0 | -13.0 | -41.0 | |
| 5.56 | -67.0 | H | 3.0 | -16.7 | 36.1 | 1.0 | -51.8 | -13.0 | -38.8 | |
| 7.41 | -66.2 | H | 3.0 | -13.2 | 35.2 | 1.0 | -47.4 | -13.0 | -34.4 | |
| 3.70 | -65.4 | V | 3.0 | -18.3 | 36.2 | 1.0 | -53.5 | -13.0 | -40.5 | |
| 5.56 | -65.4 | V | 3.0 | -15.3 | 36.1 | 1.0 | -50.4 | -13.0 | -37.4 | |
| 7.41 | -66.8 | V | 3.0 | -13.8 | 35.2 | 1.0 | -48.0 | -13.0 | -35.0 | |
| Mid Channel (1880MHz) | | | | | | | | | | |
| 3.76 | -65.2 | H | 3.0 | -18.3 | 36.2 | 1.0 | -53.5 | -13.0 | -40.5 | |
| 5.64 | -65.4 | H | 3.0 | -14.9 | 36.1 | 1.0 | -50.0 | -13.0 | -37.0 | |
| 7.52 | -67.0 | H | 3.0 | -13.8 | 35.1 | 1.0 | -47.9 | -13.0 | -34.9 | |
| 3.76 | -65.5 | V | 3.0 | -18.2 | 36.2 | 1.0 | -53.4 | -13.0 | -40.4 | |
| 5.64 | -66.4 | V | 3.0 | -16.1 | 36.1 | 1.0 | -51.2 | -13.0 | -38.2 | |
| 7.52 | -66.7 | V | 3.0 | -13.6 | 35.1 | 1.0 | -47.7 | -13.0 | -34.7 | |
| High Channel (1907.6MHz) | | | | | | | | | | |
| 3.82 | -65.8 | H | 3.0 | -18.8 | 36.1 | 1.0 | -53.9 | -13.0 | -40.9 | |
| 5.72 | -66.5 | H | 3.0 | -15.8 | 36.1 | 1.0 | -50.9 | -13.0 | -37.9 | |
| 7.63 | -66.6 | H | 3.0 | -13.3 | 35.0 | 1.0 | -47.4 | -13.0 | -34.4 | |
| 3.82 | -65.7 | V | 3.0 | -18.2 | 36.1 | 1.0 | -53.3 | -13.0 | -40.3 | |
| 5.72 | -66.2 | V | 3.0 | -15.8 | 36.1 | 1.0 | -50.9 | -13.0 | -37.9 | |
| 7.63 | -66.5 | V | 3.0 | -13.3 | 35.0 | 1.0 | -47.4 | -13.0 | -34.4 | |

Rev. 03.19.15


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

## UMTS HSDPA, 1900MHz BAND 2

**High Frequency Substitution Measurement**
**UL Fremont Radiated Chamber**

**Company:**
**Project #:** 16U23816
**Date:** 12/07/16
**Test Engineer:** 39005
**Configuration:** EUT only
**Mode:** HSDPA 1900MHz

**Test Equipment:**
**Substitution: Horn T59 Substitution, and 8ft SMA Cable**

| Chamber | Pre-amplifer | Filter | Limit |
|---|---|---|---|
| 3m Chamber G | 3m Chamber G | Filter | EIRP |

| Frequency (GHz) | SA reading (dBm) | Ant. Pol. (H/V) | Distance | EIRP @ TX Ant End (dBm) | Preamp | Attenuator | EIRP | Limit | Delta | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| Low Channel (1852.4MHz) | | | | | | | | | | |
| 3.70 | -65.6 | H | 3.0 | -18.9 | 36.2 | 1.0 | -54.1 | -13.0 | -41.1 | |
| 5.56 | -66.8 | H | 3.0 | -16.5 | 36.1 | 1.0 | -51.6 | -13.0 | -38.6 | |
| 7.41 | -66.5 | H | 3.0 | -13.4 | 35.2 | 1.0 | -47.6 | -13.0 | -34.6 | |
| 3.70 | -65.6 | V | 3.0 | -18.5 | 36.2 | 1.0 | -53.7 | -13.0 | -40.7 | |
| 5.56 | -65.6 | V | 3.0 | -15.5 | 36.1 | 1.0 | -50.6 | -13.0 | -37.6 | |
| 7.41 | -66.8 | V | 3.0 | -13.7 | 35.2 | 1.0 | -48.0 | -13.0 | -35.0 | |
| Mid Channel (1880MHz) | | | | | | | | | | |
| 3.76 | -65.5 | H | 3.0 | -18.6 | 36.2 | 1.0 | -53.8 | -13.0 | -40.8 | |
| 5.64 | -65.7 | H | 3.0 | -15.2 | 36.1 | 1.0 | -50.3 | -13.0 | -37.3 | |
| 7.52 | -66.5 | H | 3.0 | -13.3 | 35.1 | 1.0 | -47.5 | -13.0 | -34.5 | |
| 3.76 | -65.6 | V | 3.0 | -18.3 | 36.2 | 1.0 | -53.5 | -13.0 | -40.5 | |
| 5.64 | -66.5 | V | 3.0 | -16.2 | 36.1 | 1.0 | -51.3 | -13.0 | -38.3 | |
| 7.52 | -66.7 | V | 3.0 | -13.6 | 35.1 | 1.0 | -47.7 | -13.0 | -34.7 | |
| High Channel (1907.6MHz) | | | | | | | | | | |
| 3.82 | -65.8 | H | 3.0 | -18.8 | 36.1 | 1.0 | -53.9 | -13.0 | -40.9 | |
| 5.72 | -66.5 | H | 3.0 | -15.9 | 36.1 | 1.0 | -51.0 | -13.0 | -38.0 | |
| 7.63 | -66.8 | H | 3.0 | -13.5 | 35.0 | 1.0 | -47.5 | -13.0 | -34.5 | |
| 3.82 | -65.8 | V | 3.0 | -18.3 | 36.1 | 1.0 | -53.5 | -13.0 | -40.5 | |
| 5.72 | -66.4 | V | 3.0 | -16.0 | 36.1 | 1.0 | -51.1 | -13.0 | -38.1 | |
| 7.63 | -66.6 | V | 3.0 | -13.4 | 35.0 | 1.0 | -47.4 | -13.0 | -34.4 | |

Rev. 03.19.15


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

## UMTS REL 99, 1700MHz BAND 4

**High Frequency Substitution Measurement**
**UL Fremont Radiated Chamber**

**Company:**
**Project #:** 16U23816
**Date:** 12/07/16
**Test Engineer:** 39005
**Configuration:** EUT only
**Mode:** REL 99, 1700MHz

**Test Equipment:**
**Substitution: Horn T59 Substitution, and 8ft SMA Cable**

| Chamber | Pre-amplifer | Filter | Limit |
|---|---|---|---|
| 3m Chamber G | 3m Chamber G | Filter | EIRP |

| Frequency (GHz) | SA reading (dBm) | Ant. Pol. (H/V) | Distance | EIRP @ TX Ant End (dBm) | Preamp | Attenuator | EIRP | Limit | Delta | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| Low Channel (1712.4MHz) | | | | | | | | | | |
| 3.42 | -65.2 | H | 3.0 | -19.0 | 36.4 | 1.0 | -54.5 | -13.0 | -41.5 | |
| 5.14 | -65.3 | H | 3.0 | -15.7 | 36.3 | 1.0 | -51.0 | -13.0 | -38.0 | |
| 6.85 | -65.0 | H | 3.0 | -12.5 | 35.6 | 1.0 | -47.1 | -13.0 | -34.1 | |
| 3.42 | -65.3 | V | 3.0 | -19.0 | 36.4 | 1.0 | -54.5 | -13.0 | -41.5 | |
| 5.14 | -64.9 | V | 3.0 | -15.4 | 36.3 | 1.0 | -50.7 | -13.0 | -37.7 | |
| 6.85 | -65.3 | V | 3.0 | -12.9 | 35.6 | 1.0 | -47.5 | -13.0 | -34.5 | |
| Mid Channel (1732.6MHz) | | | | | | | | | | |
| 3.47 | -65.2 | H | 3.0 | -19.0 | 36.4 | 1.0 | -54.3 | -13.0 | -41.3 | |
| 5.20 | -65.3 | H | 3.0 | -15.6 | 36.3 | 1.0 | -50.8 | -13.0 | -37.8 | |
| 6.93 | -65.3 | H | 3.0 | -12.7 | 35.5 | 1.0 | -47.3 | -13.0 | -34.3 | |
| 3.47 | -65.2 | V | 3.0 | -18.8 | 36.4 | 1.0 | -54.2 | -13.0 | -41.2 | |
| 5.20 | -65.4 | V | 3.0 | -15.9 | 36.3 | 1.0 | -51.2 | -13.0 | -38.2 | |
| 6.93 | -66.3 | V | 3.0 | -13.8 | 35.5 | 1.0 | -48.3 | -13.0 | -35.3 | |
| High Channel (1752.6MHz) | | | | | | | | | | |
| 3.51 | -65.3 | H | 3.0 | -19.0 | 36.4 | 1.0 | -54.3 | -13.0 | -41.3 | |
| 5.26 | -65.3 | H | 3.0 | -15.5 | 36.3 | 1.0 | -50.7 | -13.0 | -37.7 | |
| 7.01 | -65.9 | H | 3.0 | -13.2 | 35.5 | 1.0 | -47.7 | -13.0 | -34.7 | |
| 3.51 | -65.3 | V | 3.0 | -18.8 | 36.4 | 1.0 | -54.1 | -13.0 | -41.1 | |
| 5.26 | -64.9 | V | 3.0 | -15.3 | 36.3 | 1.0 | -50.5 | -13.0 | -37.5 | |
| 7.01 | -65.1 | V | 3.0 | -12.5 | 35.5 | 1.0 | -47.0 | -13.0 | -34.0 | |

Rev. 03.19.15


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*

## UMTS HSDPA, 1700MHz BAND 4

**High Frequency Substitution Measurement**
**UL Fremont Radiated Chamber**

**Company:**
**Project #:** 16U23816
**Date:** 12/07/16
**Test Engineer:** 39005
**Configuration:** EUT only
**Mode:** HSDPA 1700MHz

**Test Equipment:**
**Substitution: Horn T59 Substitution, and 8ft SMA Cable**

| Chamber | Pre-amplifer | Filter | Limit |
|---|---|---|---|
| 3m Chamber G | 3m Chamber G | Filter | EIRP |

| Frequency (GHz) | SA reading (dBm) | Ant. Pol. (H/V) | Distance | EIRP @ TX Ant End (dBm) | Preamp | Attenuator | EIRP | Limit | Delta | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| Low Channel (1712.4MHz) | | | | | | | | | | |
| 3.42 | -65.5 | H | 3.0 | -19.3 | 36.4 | 1.0 | -54.7 | -13.0 | -41.7 | |
| 5.14 | -65.7 | H | 3.0 | -16.1 | 36.3 | 1.0 | -51.4 | -13.0 | -38.4 | |
| 6.85 | -65.1 | H | 3.0 | -12.7 | 35.6 | 1.0 | -47.2 | -13.0 | -34.2 | |
| 3.42 | -65.2 | V | 3.0 | -18.9 | 36.4 | 1.0 | -54.3 | -13.0 | -41.3 | |
| 5.14 | -65.0 | V | 3.0 | -15.5 | 36.3 | 1.0 | -50.8 | -13.0 | -37.8 | |
| 6.85 | -65.3 | V | 3.0 | -12.9 | 35.6 | 1.0 | -47.5 | -13.0 | -34.5 | |
| Mid Channel (1732.6MHz) | | | | | | | | | | |
| 3.47 | -65.4 | H | 3.0 | -19.1 | 36.4 | 1.0 | -54.5 | -13.0 | -41.5 | |
| 5.20 | -65.4 | H | 3.0 | -15.7 | 36.3 | 1.0 | -50.9 | -13.0 | -37.9 | |
| 6.93 | -65.4 | H | 3.0 | -12.8 | 35.5 | 1.0 | -47.3 | -13.0 | -34.3 | |
| 3.47 | -65.4 | V | 3.0 | -18.9 | 36.4 | 1.0 | -54.3 | -13.0 | -41.3 | |
| 5.20 | -65.5 | V | 3.0 | -16.0 | 36.3 | 1.0 | -51.2 | -13.0 | -38.2 | |
| 6.93 | -66.0 | V | 3.0 | -13.5 | 35.5 | 1.0 | -48.0 | -13.0 | -35.0 | |
| High Channel (1752.6MHz) | | | | | | | | | | |
| 3.51 | -65.3 | H | 3.0 | -19.0 | 36.4 | 1.0 | -54.3 | -13.0 | -41.3 | |
| 5.26 | -65.4 | H | 3.0 | -15.6 | 36.3 | 1.0 | -50.8 | -13.0 | -37.8 | |
| 7.01 | -65.3 | H | 3.0 | -12.6 | 35.5 | 1.0 | -47.1 | -13.0 | -34.1 | |
| 3.51 | -65.7 | V | 3.0 | -19.1 | 36.4 | 1.0 | -54.5 | -13.0 | -41.5 | |
| 5.26 | -65.3 | V | 3.0 | -15.7 | 36.3 | 1.0 | -51.0 | -13.0 | -38.0 | |
| 7.01 | -65.3 | V | 3.0 | -12.6 | 35.5 | 1.0 | -47.1 | -13.0 | -34.1 | |

Rev. 03.19.15


*This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.*