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**DATE: 14 August 2013**

# I.T.L. (PRODUCT TESTING) LTD.

# FCC Radio Test Report

**for**

# Corning MobileAccess

## Equipment under test:

## ONE - Optical Network Evolution DAS

## Remote Antenna Unit RAU-R-G-C85P19L70A17-ME Consisting of RAU P/N: RXU-L70A17-M, GEM and RAU P/N: RAU-C85P19L70A17

## CELL-PCS-LTE-AWS (LTE/AWS Section)

Written by: _____
R. Pinchuck, Documentation

Approved by: _____
A. Sharabi, Test Engineer

Approved by: _____
I. Raz, EMC Laboratory Manager

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# Measurement/Technical Report for

## Corning MobileAccess

## ONE - Optical Network Evolution DAS

## Remote Antenna Unit RAU-R-G-C85P19L70A17-ME Consisting of RAU P/N: RXU-L70A17-M, GEM and RAU P/N: RAU-C85P19L70A17

## (LTE-AWS Section)

### FCC ID: OJF1C85P19L70A17

| | |
|---|---|
| This report concerns: | Original Grant: X |
| | Class II change: |
| | Class I change: |
| Equipment type: | PCS Licensed Transmitter |

Limits used:
47CFR Parts 2; 27

Measurement procedure used is ANSI C63.4-2003.
Substitution Method used as in ANSI/TIA-603-C: 2004


Application for Certification prepared by:
Ishaishou Raz
ITL (Product Testing) Ltd.
Kfar Bin Nun
D.N. Shimshon 99780
Israel
e-mail sraz@itl.co.il

Applicant for this device:
(different from "prepared by")
Steve Blum
Corning MobileAccess
8391 Old Courthouse Rd., Suite #300
Vienna, VA. 22182
U.S.A.
Tel: +1-541-758-2880
Fax: +1-703-848-0260
e-mail: sblum@mobileaccess.com

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# 1. General Information

## *1.1 Administrative Information*

| | |
|---|---|
| Manufacturer: | Corning MobileAccess |
| Manufacturer's Address: | 8391 Old Courthouse Rd.<br>Suite #300<br>Vienna, VA 22182<br>U.S.A.<br>Tel: +1-541-758-2880<br>Fax: +1-703-848-0260 |
| Manufacturer's Representative: | Steve Blum |
| Equipment Under Test (E.U.T): | ONE - Optical Network Evolution DAS |
| Equipment Model No.: | Remote Antenna Unit RAU-R-G-C85P19L70A17-ME Consisting of RAU P/N: RXU-L70A17-M, GEM and RAU P/N: RAU-C85P19L70A17 |
| Equipment Serial No.: | Not Designated |
| Date of Receipt of E.U.T: | 03.04.13 |
| Start of Test: | 03.04.13 |
| End of Test: | 24.04.13 |
| Test Laboratory Location: | I.T.L (Product Testing) Ltd.<br>1 Batsheva St,<br>Lod,<br>Israel 7116002 |
| Test Specifications: | FCC Parts 2; 27 |

### *1.2 List of Accreditations*

The EMC laboratory of I.T.L. is accredited by/registered with the following bodies:

1. The American Association for Laboratory Accreditation (A2LA) (U.S.A.), Certificate No. 1152.01.
2. The Federal Communications Commission (FCC) (U.S.A.), Registration No. 861911.
3. The Israel Ministry of the Environment (Israel), Registration No. 1104/01.
4. The Voluntary Control Council for Interference by Information Technology Equipment (VCCI) (Japan), Registration Numbers: C-3006, R-2729, T-1877, G-245.
5. Industry Canada (Canada), IC File No.: 46405-4025; Site No. IC 4025A-1.
6. TUV Product Services, England, ASLLAS No. 97201.

I.T.L. Product Testing Ltd. is accredited by the American Association for Laboratory Accreditation (A2LA) and the results shown in this test report have been determined in accordance with I.T.L.'s terms of accreditation unless stated otherwise in the report.

### 1.3 Product Description

The Optical Network Platform (ONE™) by Corning provides a flexible in-building RF and network digital coverage solution based on a fiber optic transport backbone.

The fiber-optics infrastructure is easily deployable via a wide range of pre-terminated composite cables and advanced end-to-end equipment. Easy to design, Plug and Play™ connectors, significantly reduce installation cost and deployment time.

The ONE™ solution is an ideal fit for large, high-rise or campus-style deployments. It generates significant CAPEX savings and OPEX savings through the use of user configurable sectorization and an infrastructure that is simple to deploy and efficient in usage.

Dynamic sectorization management allows precise service distribution control to meet changing density needs, and provides further savings by enabling sharing of equipment at various levels for service providers.

Radio source agnostic, remote units can be used as network extenders. Ethernet capability with dedicated fiber link for Wi-Fi offload brings a higher level of granularity and support for devices and applications with very high speed requirements.

### 1.4 Test Methodology

Radiated testing was performed according to the procedures in ANSI C63.4: 2003. Radiated testing was performed at an antenna to EUT distance of 3 meters.

### 1.5 Test Facility

The radiated emissions tests were performed at I.T.L.'s testing facility in Lod, Israel. This site is a FCC listed test laboratory (FCC Registration No. 90715, date of listing November 21, 2012).
I.T.L.'s EMC Laboratory is also accredited by A2LA, certificate No. 1152.01.

### 1.6 Measurement Uncertainty

**Radiated Emission**

Radiated Emission (CISPR 11, EN 55011, CISPR 22, EN 55022, ANSI C63.4) for open site 30-1000MHz:

Expanded Uncertainty (95% Confidence, K=2):

± 4.98 dB

# 2. System Test Configuration

## 2.1 Justification

The test setup was configured to closely resemble the standard installation.
The EUT consists of the HEU, the OIU and the RAU.
All source signals are represented in the setup by appropriate signal generators.
An "Exercise" SW on the computer was used to enable / disable transmission of the RAU, while the EUT output was connected to the spectrum analyzer.
All channels transmitted during the testing.
The CELL and PCS output antenna ports are SISO bands and the LTE and AWS antenna ports are MIMO. Since the RF heads for the MIMO ports are not identical, testing was performed on each port separately.
RF input signal level was 0 dBm for all bands.
There is neither an intermediate amplifier nor donor antenna in the uplink. All components included in the UL path are connected by cables.

## 2.2 EUT Exercise Software

The HCM ver. 0.2 build 19 used for commands delivery.

**ACM** – ACM_2A00_00.62
**RIM** – RIM_6A00_00.51
**RIM-M –** RMM_5A00_00.52
**OIM** – OIM_7A00_03.50
**RAU** – RAU_8A00_03.54
**RXU –** RXU_AA00_00.44

## 2.3 Special Accessories

No special accessories were needed in order to achieve compliance.

## 2.4 Equipment Modifications

No modifications were necessary in order to achieve compliance.

## 2.5 Configuration of Tested System

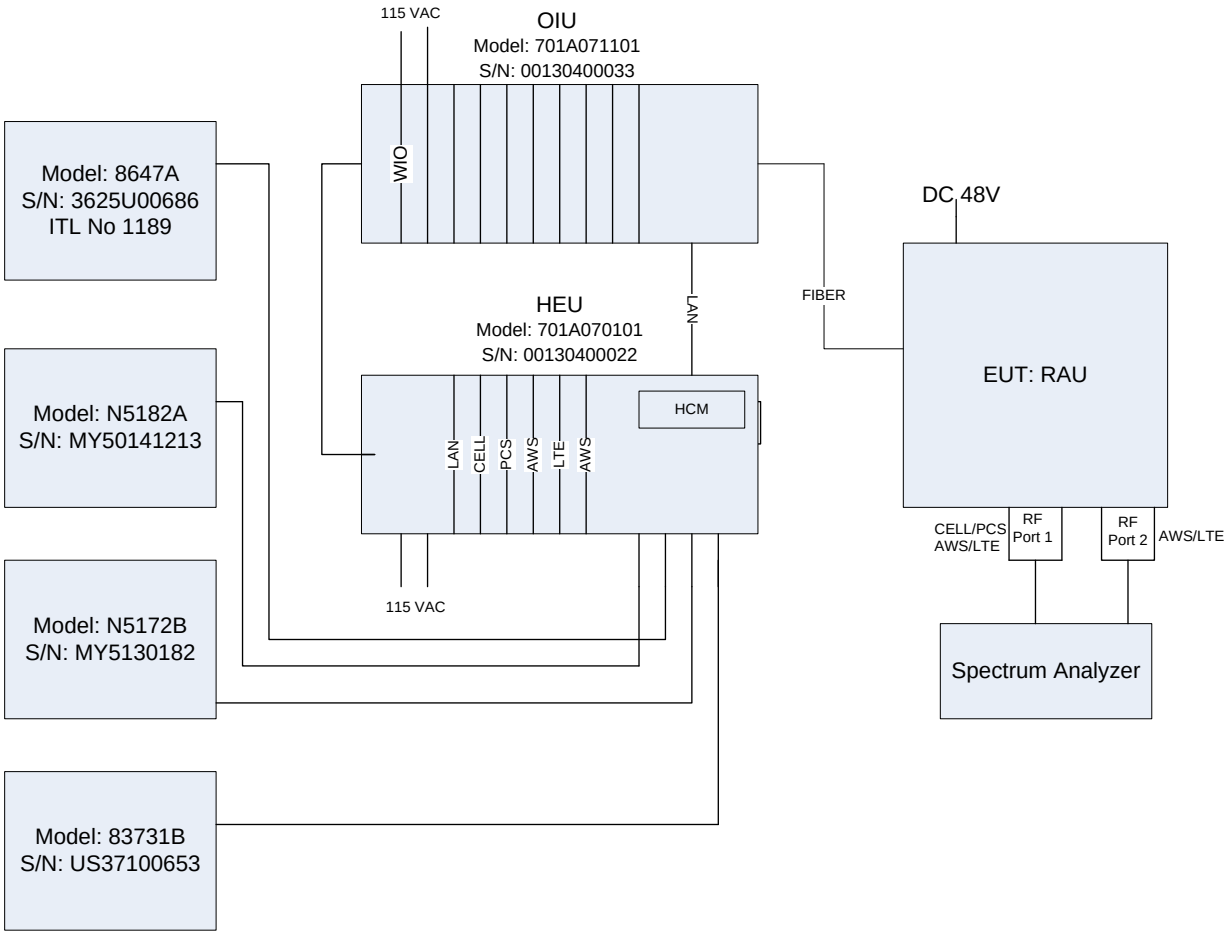


**Figure 1. Test Set-up**

# 3. Test Set-up Photos

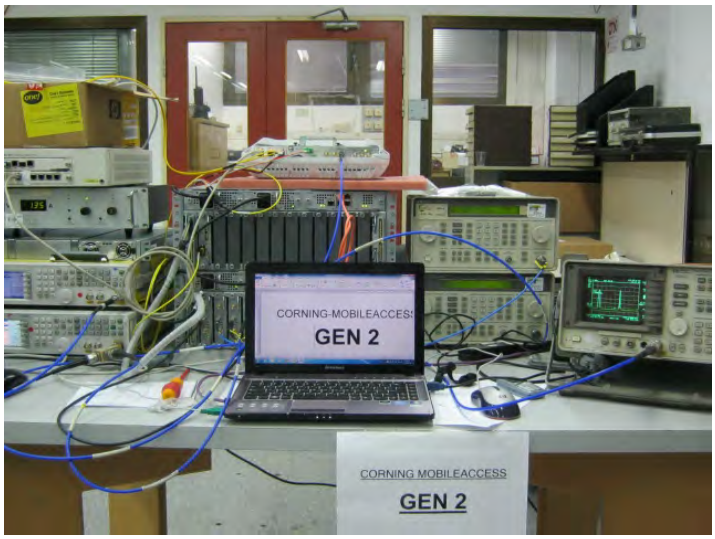


**Figure 2. Conducted Emission From Antenna Port Tests**

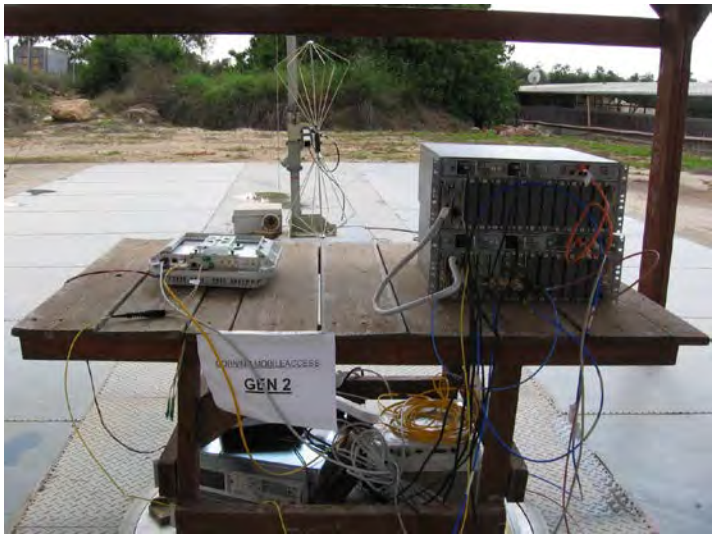


**Figure 3. Radiated Emission Test**


**Figure 4. Radiated Emission Test**

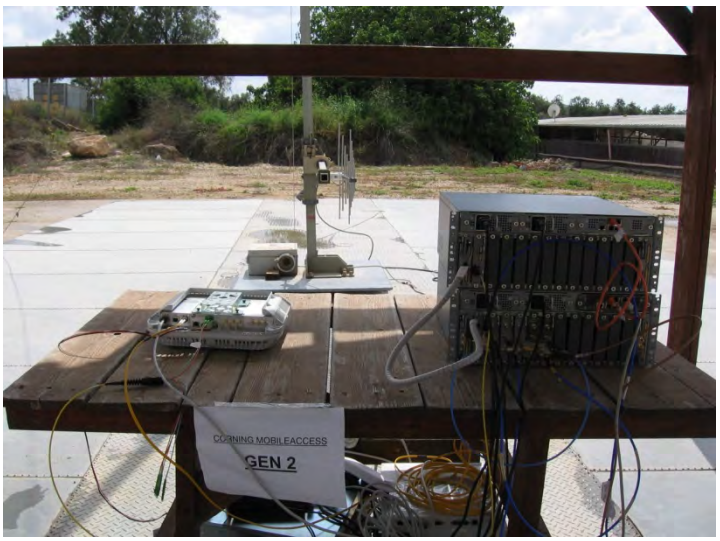


**Figure 5. Radiated Emission Test**

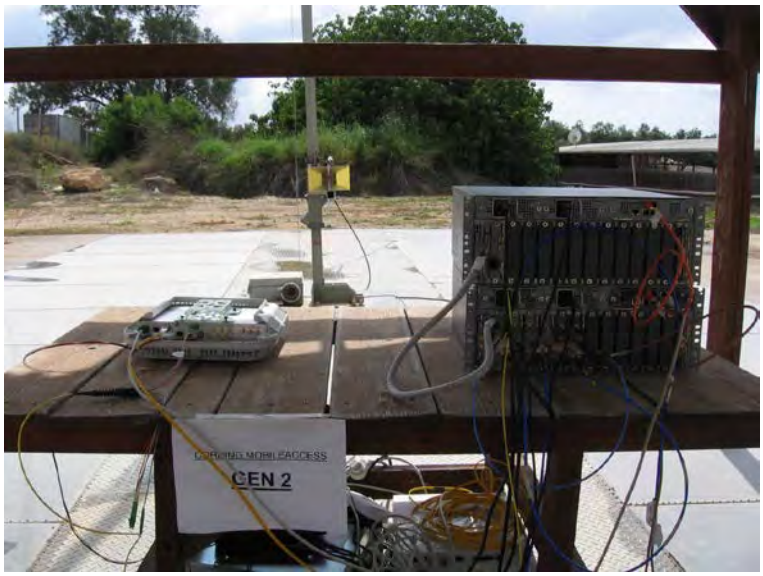


**Figure 6. Radiated Emission Test**

# 4. RF Power Output LTE

## 4.1 Test Specification

FCC Part 27, Subpart C (27.50)

## 4.2 Test procedure

Peak Power Output must not exceed 1000W. The E.U.T. antenna terminal was connected to the Spectrum Analyzer through an external attenuator (30.7 dB) and an appropriate coaxial cable. Special attention was taken to prevent Spectrum Analyzer RF input overload. The Spectrum Analyzer was set to 100 kHz RBW.

## 4.3 Test Results

| | Operation Frequency (MHz) | Reading Port 1 (dBm) | Reading Port 2 (dBm) | MIMO Calculation for Port 1 and Port 2 Readings (dBm) |
|---|---|---|---|---|
| LTE 64QAM | 733 | 14.80 | 14.33 | 17.58 |
| LTE 64QAM | 747 | 14.51 | 16.64 | 18.72 |
| LTE 64QAM | 753 | 13.23 | 15.69 | 17.64 |
| LTE 16QAM | 733 | 14.60 | 14.64 | 17.63 |
| LTE 16QAM | 747 | 14.53 | 16.60 | 18.70 |
| LTE 16QAM | 753 | 13.53 | 15.78 | 17.80 |
| LTE QPSK | 733 | 14.91 | 14.88 | 17.91 |
| LTE QPSK | 747 | 14.51 | 16.87 | 18.86 |
| LTE QPSK | 753 | 13.64 | 15.94 | 17.95 |

**Figure 7 RF Power Output LTE**

See additional information in Figure 8 to Figure 25.

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: _____ Date: 07.05.13

Typed/Printed Name: A. Sharabi

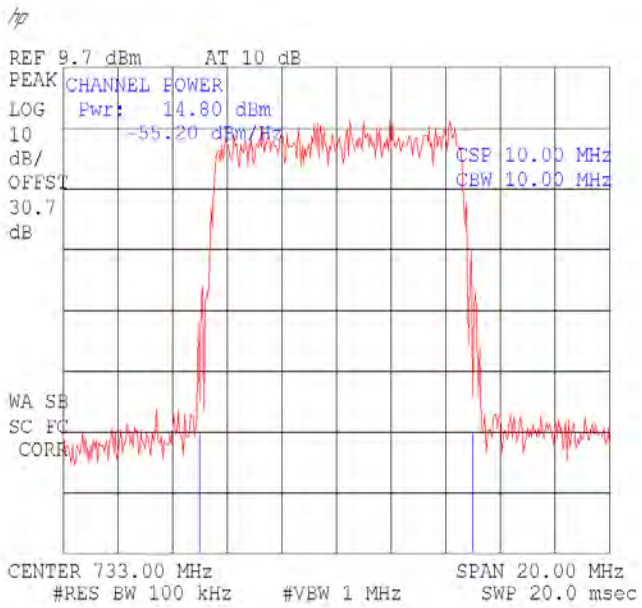


**Figure 8.— 64QAM, 733 MHz, Port 1**

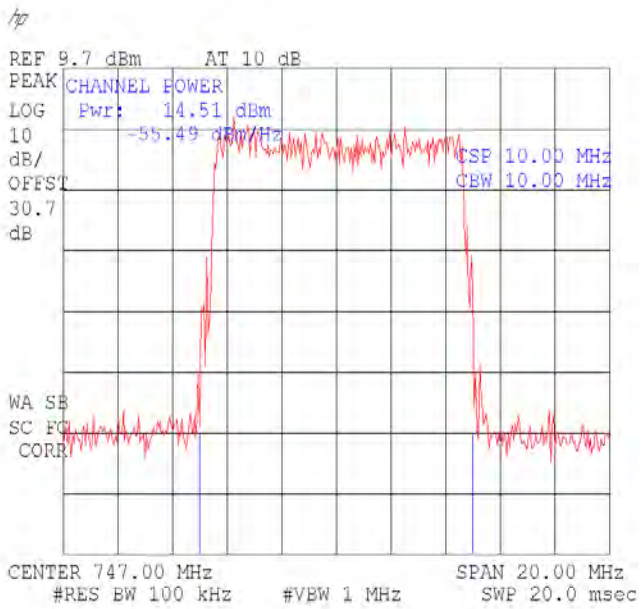


**Figure 9.— 64QAM 747 MHz, Port 1**

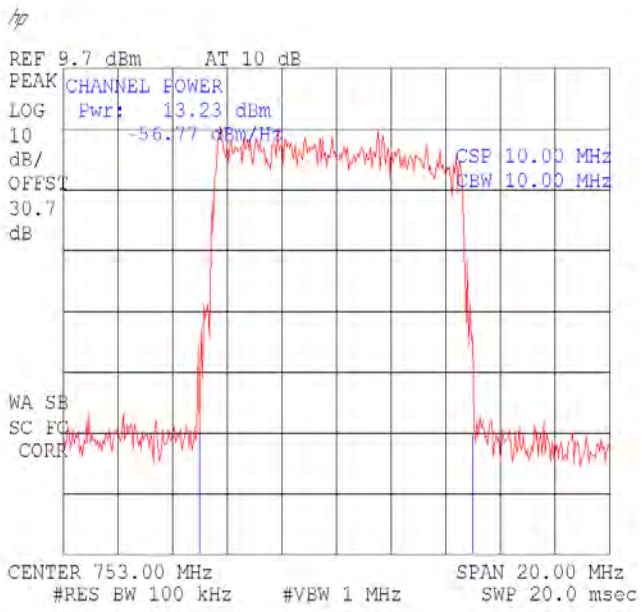


**Figure 10.— 64QAM 753 MHz, Port 1**

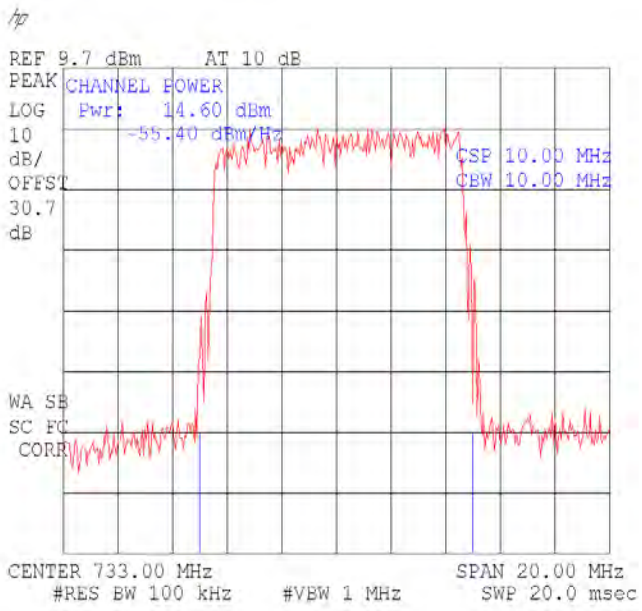


**Figure 11.— 16QAM 733 MHz , Port 1**

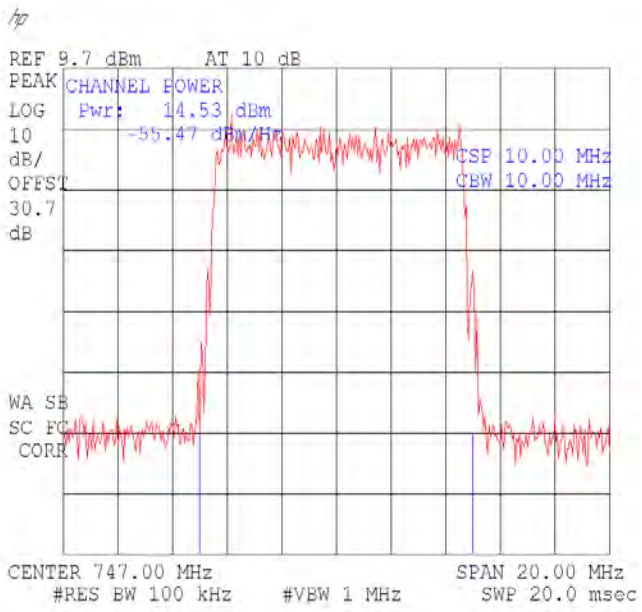


**Figure 12.— 16QAM 747 MHz, Port 1**

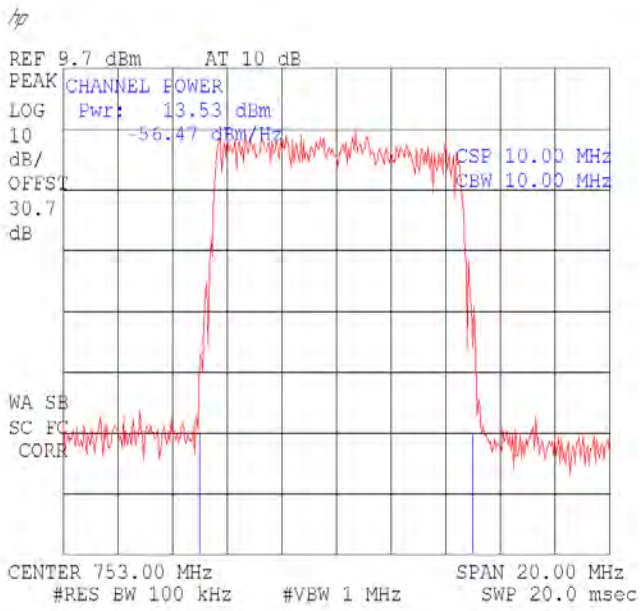


**Figure 13.— 16QAM 753 MHz, Port 1**

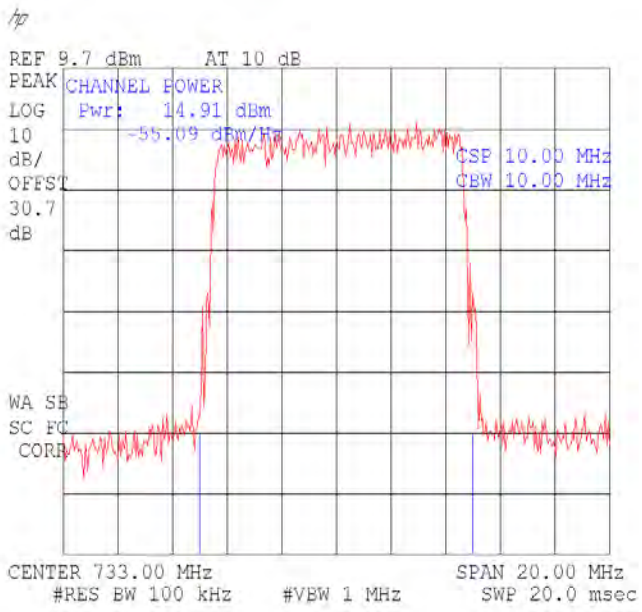


**Figure 14.— QPSK 733 MHz , Port 1**

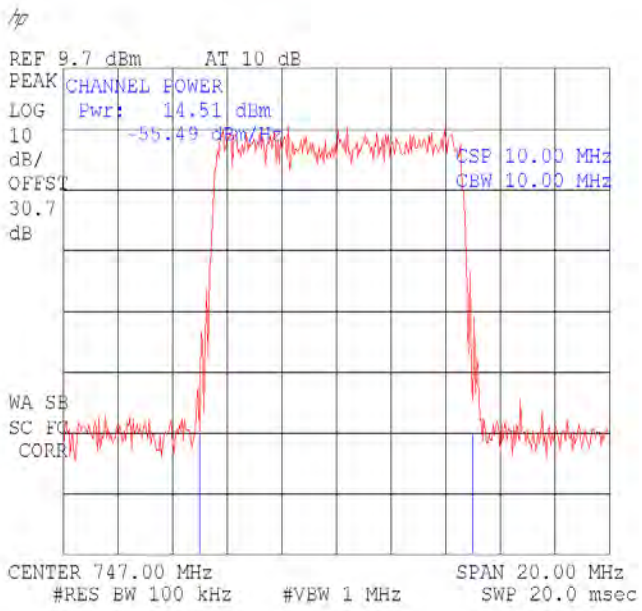


**Figure 15.— QPSK 747 MHz , Port 1**

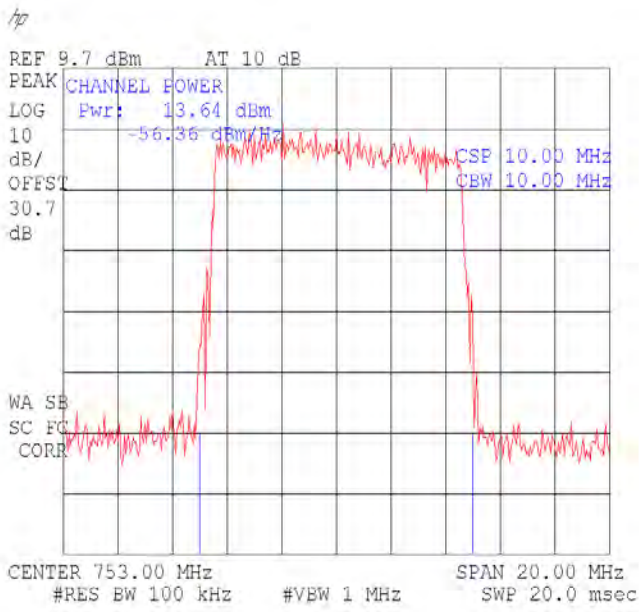


**Figure 16.— QPSK 753 MHz, Port 1**

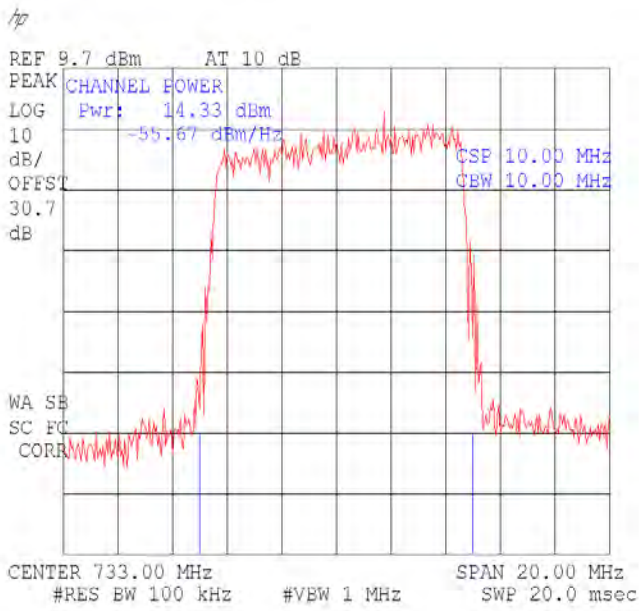


**Figure 17.— 64QAM, 733 MHz, Port 2**

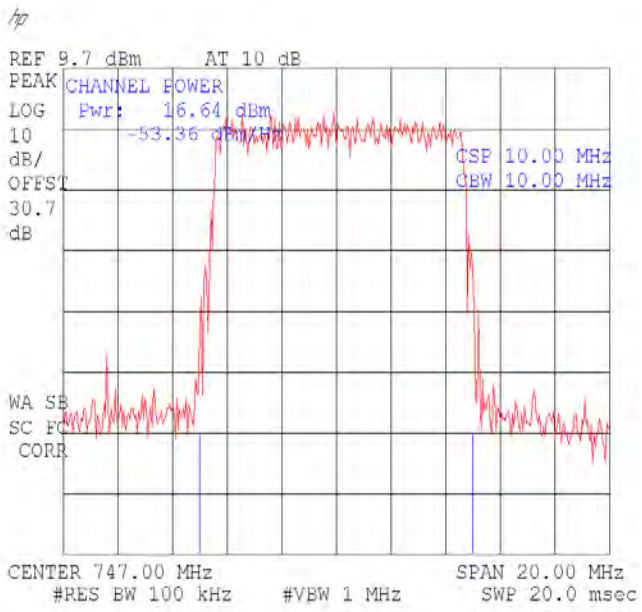


**Figure 18.— 64QAM 747 MHz, Port 2**

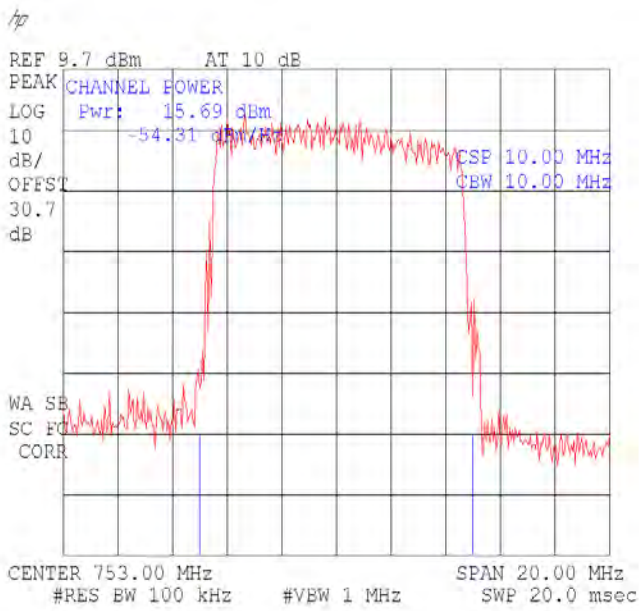


**Figure 19.— 64QAM 753 MHz, Port 2**

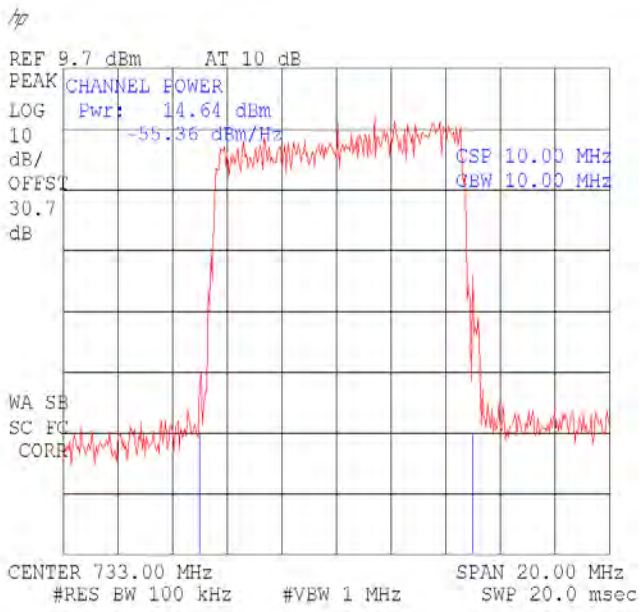


**Figure 20.— 16QAM 733 MHz , Port 2**

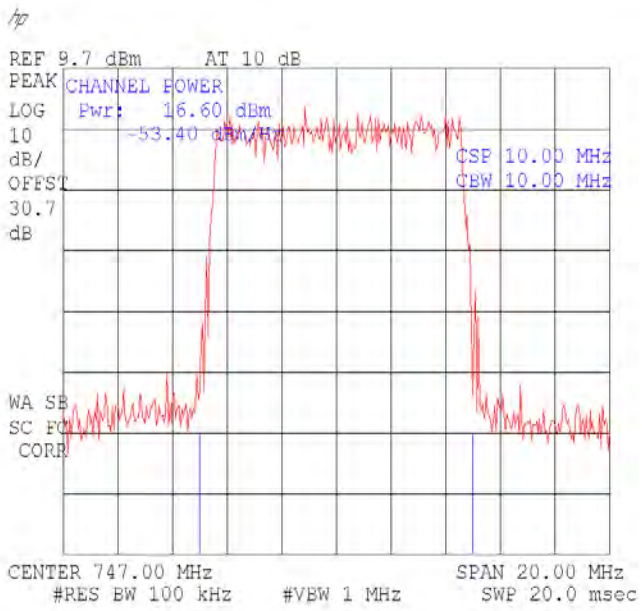


**Figure 21.— 16QAM 747 MHz, Port 2**

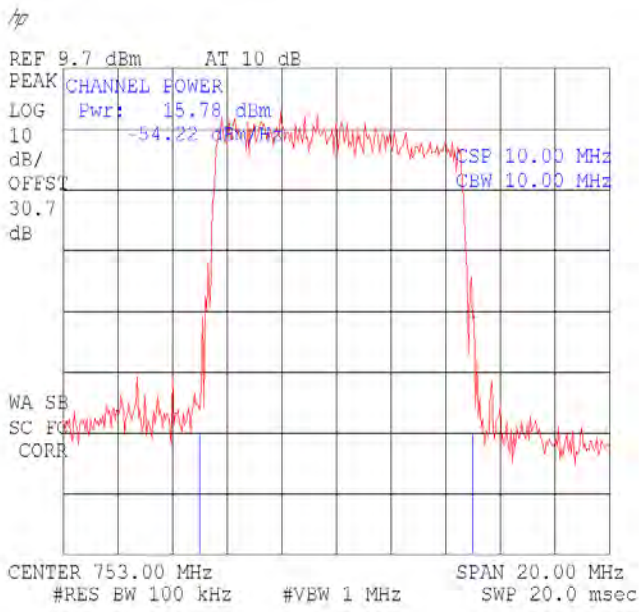


**Figure 22.— 16QAM 753 MHz, Port 2**

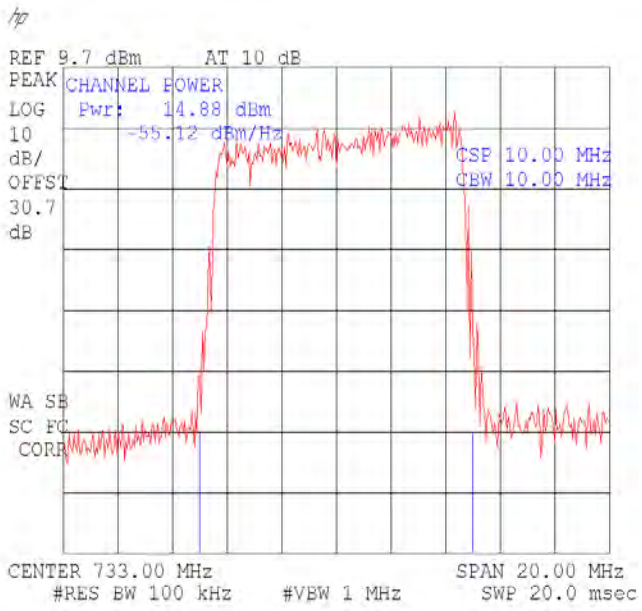


**Figure 23.— QPSK 733 MHz , Port 2**

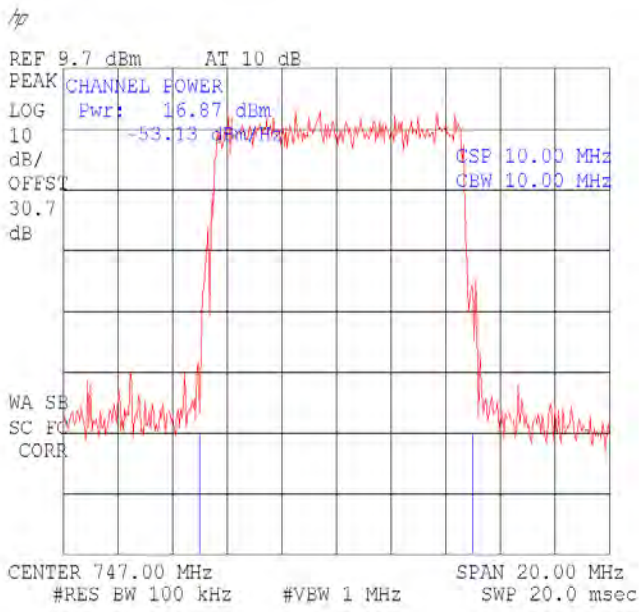


**Figure 24.— QPSK 747 MHz , Port 2**

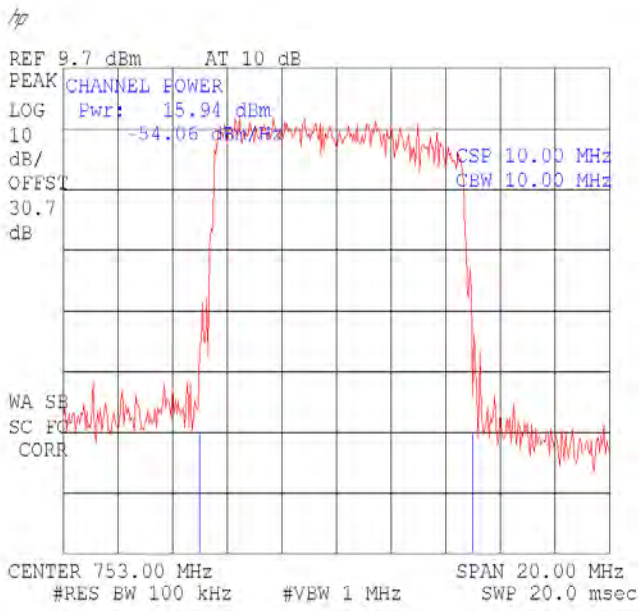


**Figure 25.— QPSK 753 MHz, Port 2**

### *4.4 Test Equipment Used.*

RF Power Output LTE

| Instrument | Manufacturer | Model | Serial Number | Calibration | |
|---|---|---|---|---|---|
| | | | | Last Calibration | Period |
| Spectrum Analyzer | HP | 8564E | 3442A00275 | February 13, 2013 | 1 year |
| Signal Generator | Agilent | N5172B ATO 10210 | MY51350182 | May 31, 2012 | 2 years |
| Attenuator | Mini-circuit | UNAT-30+ | N/A | April 3, 2013 | 1 year |
| Cable | Mini-circuit | DCB | N/A | April 3, 2013 | 1 year |
| DC Block | MIDWEST MICROWAVE | DCDB-3624-10-NNN-02 | N/A | N/A | N/A |

**Figure 26 Test Equipment Used**

# 5. Occupied Bandwidth LTE

## *5.1 Test Specification*

FCC Part 2, Section 1049

## *5.2 Test Procedure*

The E.U.T. was set to the applicable test frequency in the 728-757 MHz band. The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator (at the output test) and an appropriate coaxial cable (30.7 dB). The spectrum analyzer was set to proper resolution B.W.
The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limit, the mean powers radiated are each equal to 0.5% of the total mean power radiated by a given emission.
Occupied bandwidth measured was repeated in the input terminal of the E.U.T.

### 5.3 Test Results

| | | Operating Frequency (MHz) | Reading Port 1 (MHz) | Reading Port 2 (MHz) |
|---|---|---|---|---|
| LTE 64QAM | Input | 733 | 9.30 | 9.30 |
| LTE 64QAM | Output | 733 | 9.30 | 9.30 |
| LTE 64QAM | Input | 747 | 9.30 | 9.30 |
| LTE 64QAM | Output | 747 | 9.45 | 9.35 |
| LTE 64QAM | Input | 753 | 9.30 | 9.30 |
| LTE 64QAM | Output | 753 | 9.20 | 9.30 |
| LTE 16QAM | Input | 733 | 9.25 | 9.25 |
| LTE 16QAM | Output | 733 | 9.30 | 9.30 |
| LTE 16QAM | Input | 747 | 9.30 | 9.30 |
| LTE 16QAM | Output | 747 | 9.30 | 9.30 |
| LTE 16QAM | Input | 753 | 9.30 | 9.30 |
| LTE 16QAM | Output | 753 | 9.25 | 9.20 |
| LTE QPSK | Input | 733 | 9.25 | 9.25 |
| LTE QPSK | Output | 733 | 9.30 | 9.30 |
| LTE QPSK | Input | 747 | 9.40 | 9.40 |
| LTE QPSK | Output | 747 | 9.40 | 9.40 |
| LTE QPSK | Input | 753 | 9.35 | 9.35 |
| LTE QPSK | Output | 753 | 9.40 | 9.25 |

**Figure 27 Occupied Bandwidth LTE**

See additional information in Figure 28 to Figure 54.

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature:  Date: 07.05.13

Typed/Printed Name: A. Sharabi

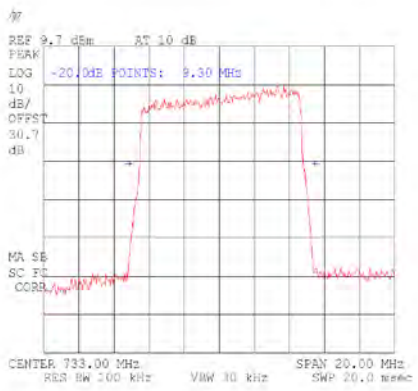


**Figure 28.— 64QAM 733 MHz IN**

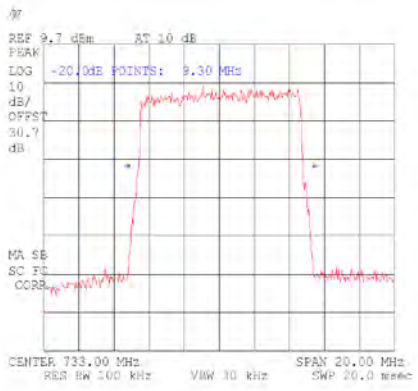


**Figure 29.— 64QAM 733 MHz OUT, Port 1**

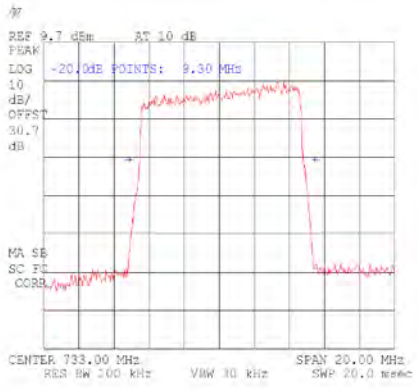


**Figure 30.— 64QAM 733 MHz OUT, Port 2**

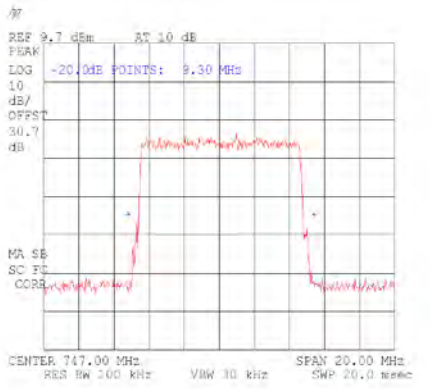


**Figure 31.— 64QAM 747 MHz IN**

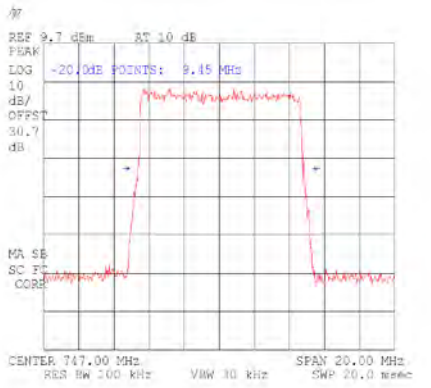


**Figure 32.— 64QAM 747 MHz OUT, Port 1**

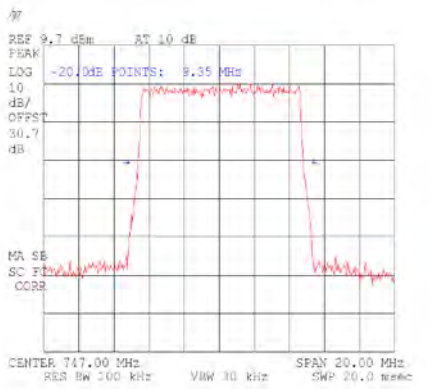


**Figure 33.— 64QAM 747 MHz OUT, Port 2**

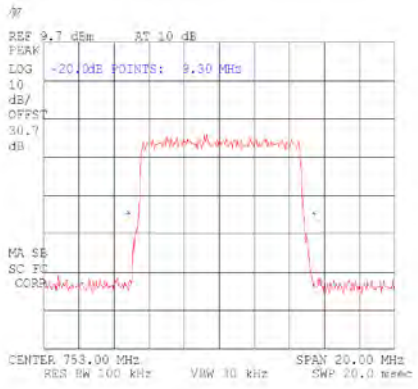


**Figure 34.— 64QAM 753 MHz IN**

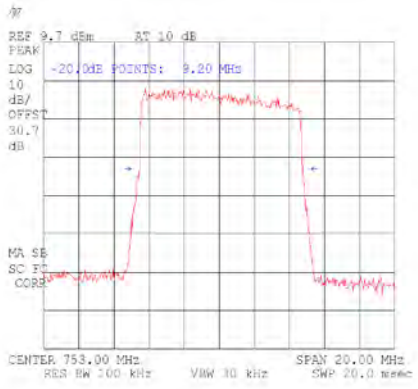


**Figure 35.— 64QAM 753 MHz OUT, Port 1**

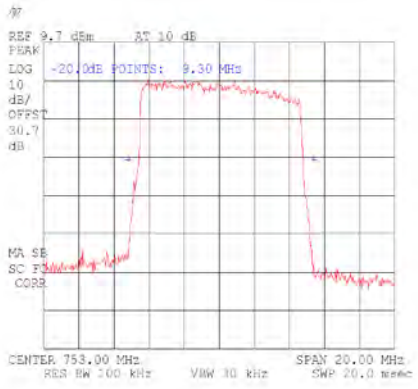


**Figure 36.— 64QAM 753 MHz OUT, Port 2**

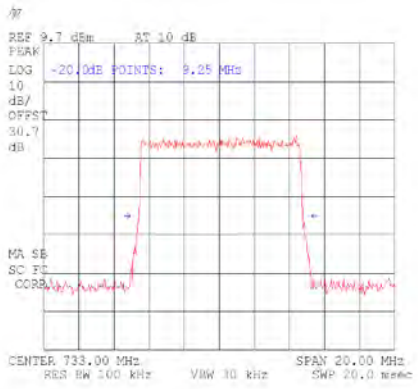


**Figure 37.— 16QAM 733 MHz IN**

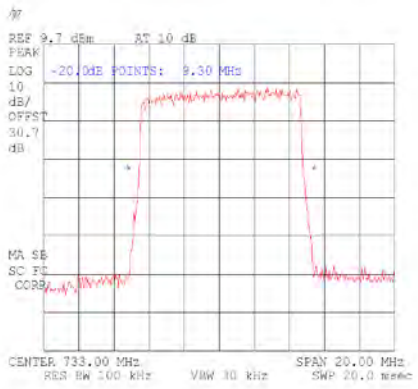


**Figure 38.— 16QAM 733 MHz OUT, Port 1**

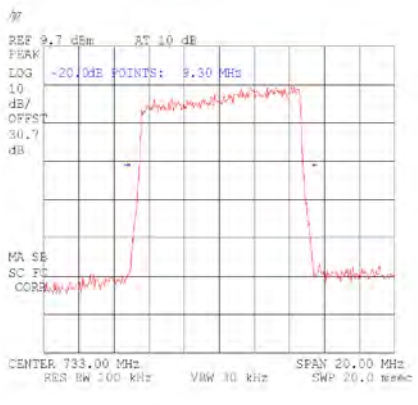


**Figure 39.— 16QAM 733 MHz OUT, Port 2**

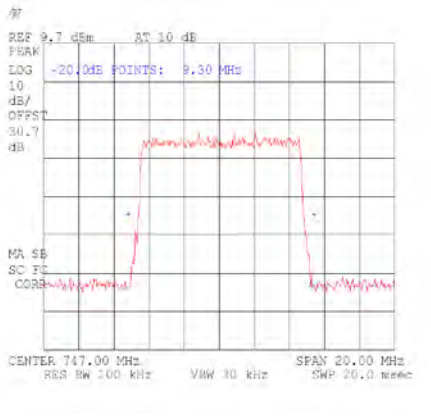


**Figure 40.— 16QAM 747 MHz IN**

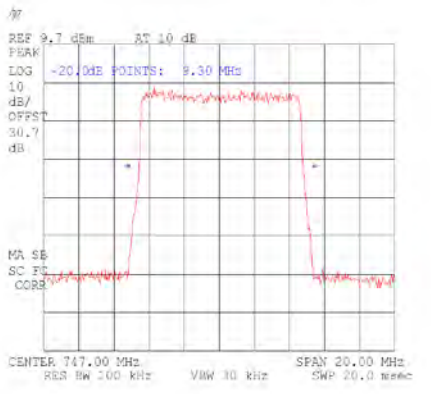


**Figure 41.— 16QAM 747 MHz OUT, Port 1**

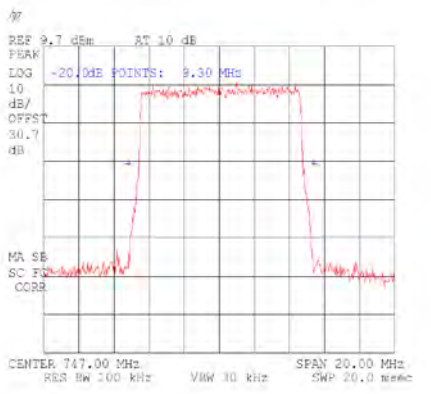


**Figure 42.— 16QAM 747 MHz OUT, Port 2**

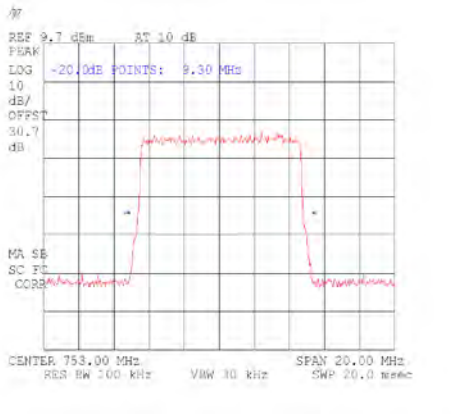


**Figure 43.— 16QAM 753 MHz IN**

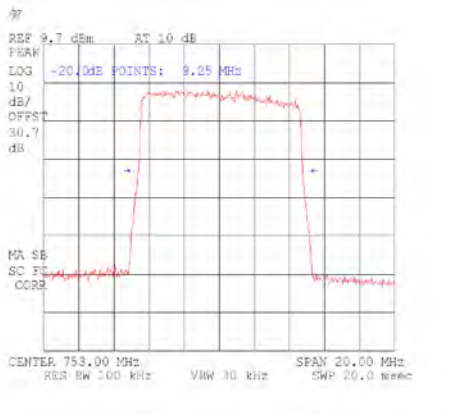


**Figure 44.— 16QAM 753 MHz OUT, Port 1**

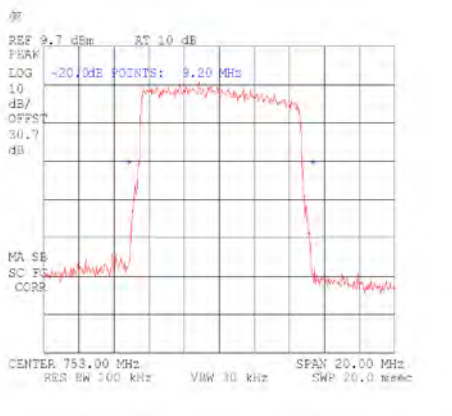


**Figure 45.— 16QAM 753 MHz OUT, Port 2**

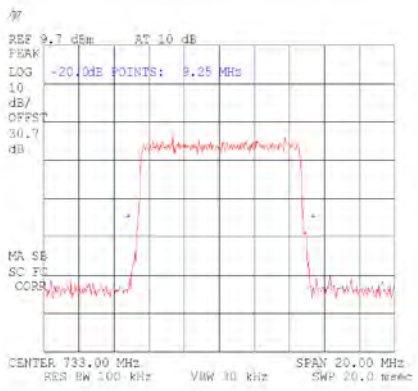


**Figure 46.— QPSK 733 MHz IN**

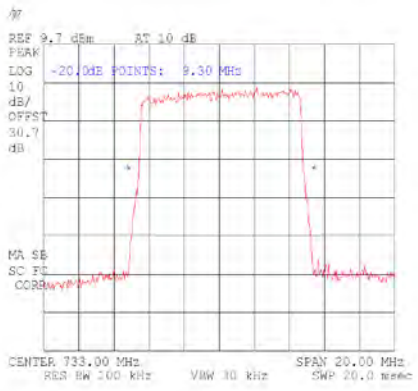


**Figure 47.— QPSK 733 MHz OUT, Port 1**

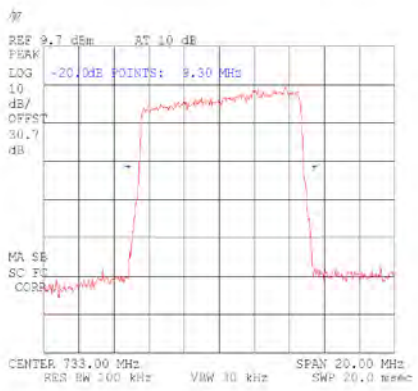


**Figure 48.— QPSK 733 MHz OUT, Port 2**

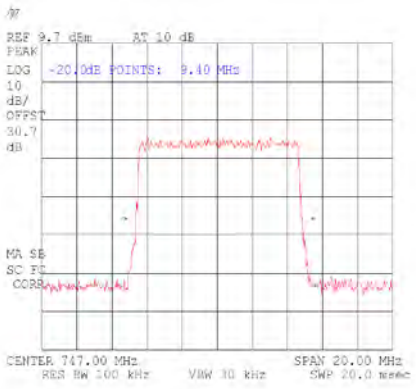


**Figure 49.— QPSK 747 MHz IN**

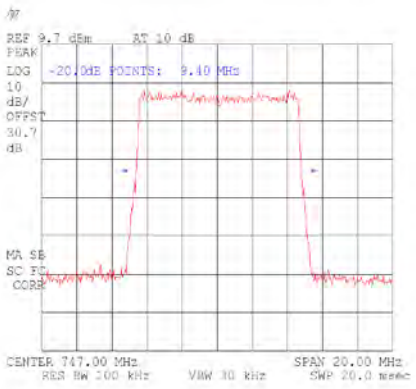


**Figure 50.— QPSK 747 MHz OUT, Port 1**

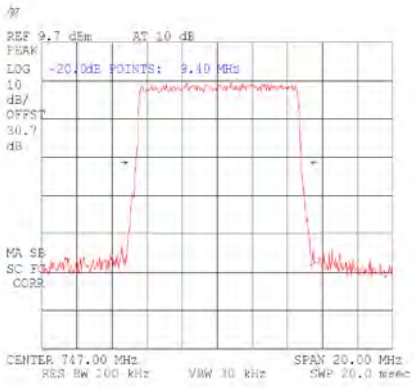


**Figure 51.— QPSK 747 MHz OUT, Port 2**

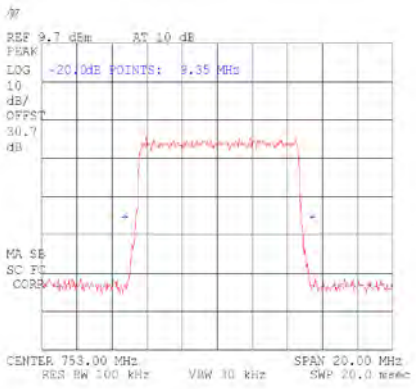


**Figure 52.— QPSK 753 MHz IN**

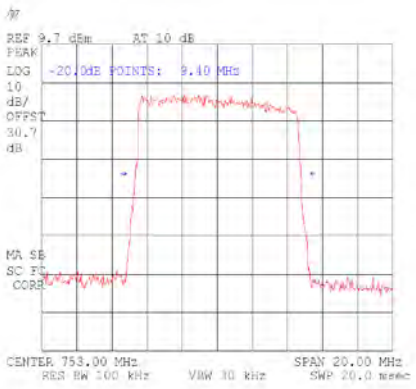


**Figure 53.— QPSK 753 MHz OUT, Port 1**

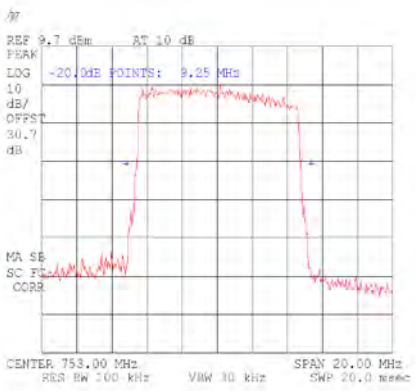


**Figure 54.— QPSK 753 MHz OUT, Port 2**

### *5.4 Test Equipment Used.*

Occupied Bandwidth LTE

| Instrument | Manufacturer | Model | Serial Number | Calibration | |
|---|---|---|---|---|---|
| | | | | Last Calibration | Period |
| Spectrum Analyzer | HP | 8564E | 3442A00275 | February 13, 2013 | 1 year |
| Signal Generator | Agilent | N5172B ATO 10210 | MY51350182 | May 31, 2012 | 2 years |
| Attenuator | Mini-circuit | UNAT-30+ | N/A | April 3, 2013 | 1 year |
| Cable | Mini-circuit | DCB | N/A | April 3, 2013 | 1 year |
| DC Block | MIDWEST MICROWAVE | DCDB-3624-10-NNN-02 | N/A | N/A | N/A |

**Figure 55 Test Equipment Used**

# 6. Spurious Emissions at Antenna Terminals LTE

## 6.1 Test Specification

FCC Part 27, Subpart C, Sections 27.53(c)(1) (3) 27.53 (g)

## 6.2 Test procedure

The power of any emission outside of the authorized operating frequency ranges 728 MHz-758 MHz must be attenuated below the transmitting power (P) by a factor of 43+ 10 log (P) dB .

The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator and an appropriate coaxial cable (31.0dB). The spectrum analyzer was set to 1 kHz resolution BW for the frequency range 9.0-150.0 kHz, 10 kHz for the frequency range 150 kHz–1.0 MHz, 100 kHz for the frequency range 1.0 MHz – 30 MHz, and 1MHz for the frequency range
1GHz - 22.0 GHz.

## 6.3 Test Results

See additional information in Figure 56 to Figure 73.

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: _____ Date: 07.05.13

Typed/Printed Name: A. Sharabi

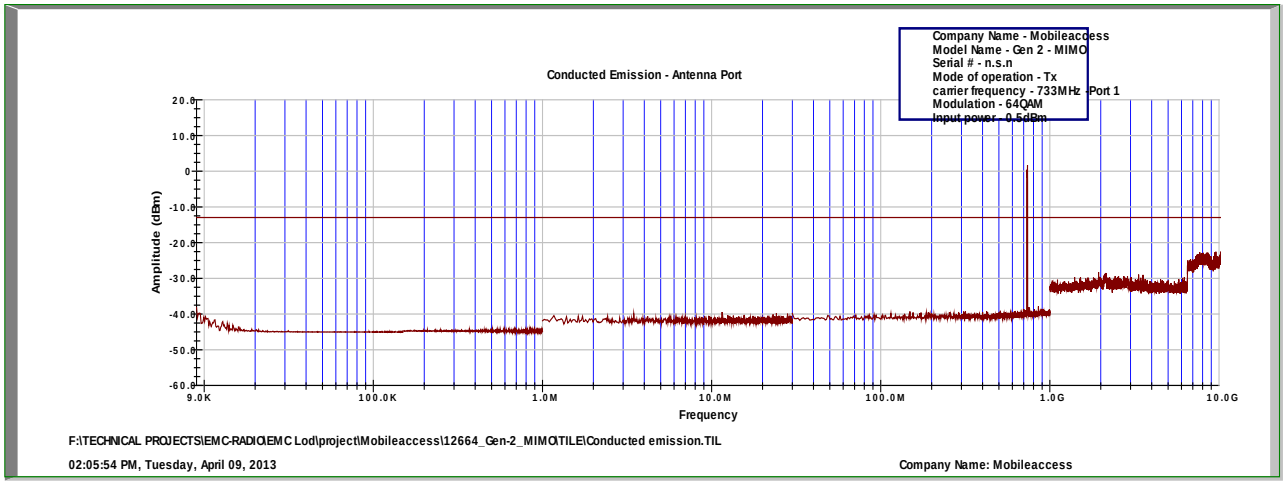


**Figure 56 Spurious Emissions at Antenna Terminals 64QAM, 733MHz, Port 1**

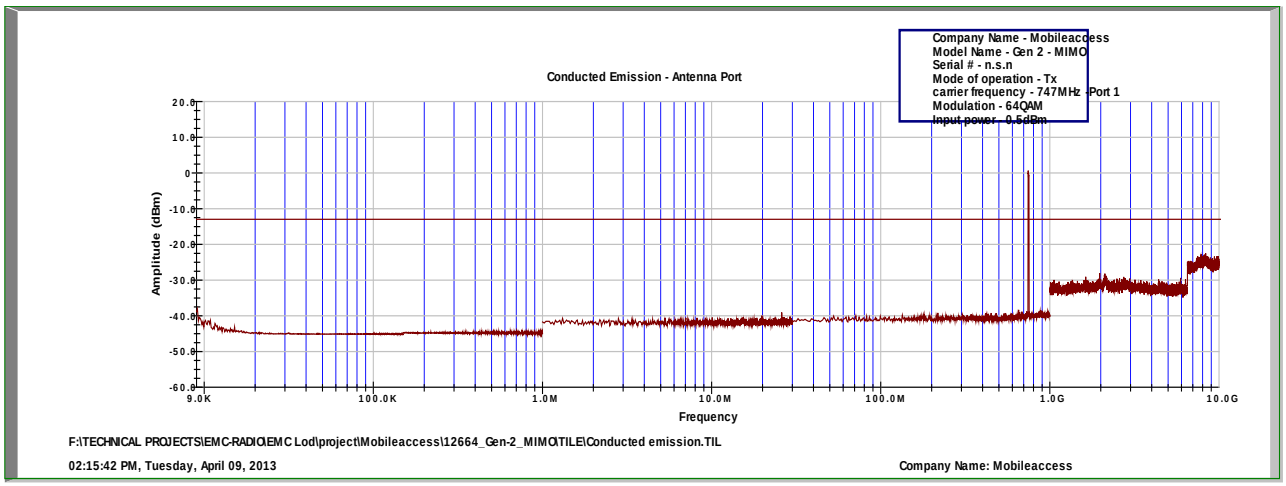


**Figure 57 Spurious Emissions at Antenna Terminals 64QAM, 747MHz, Port 1**

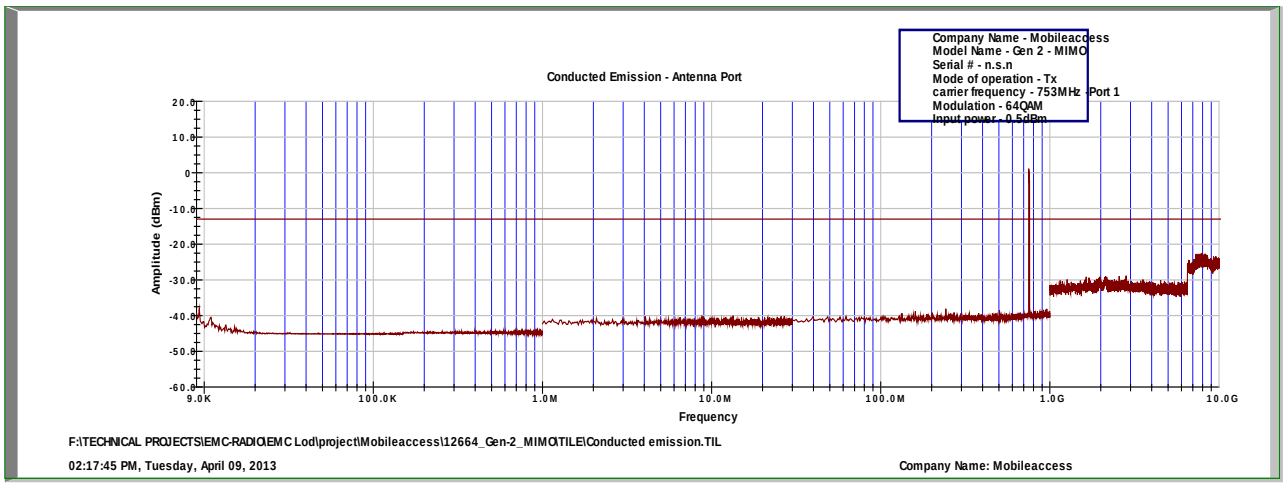


**Figure 58 Spurious Emissions at Antenna Terminals 64QAM, 753MHz, Port 1**

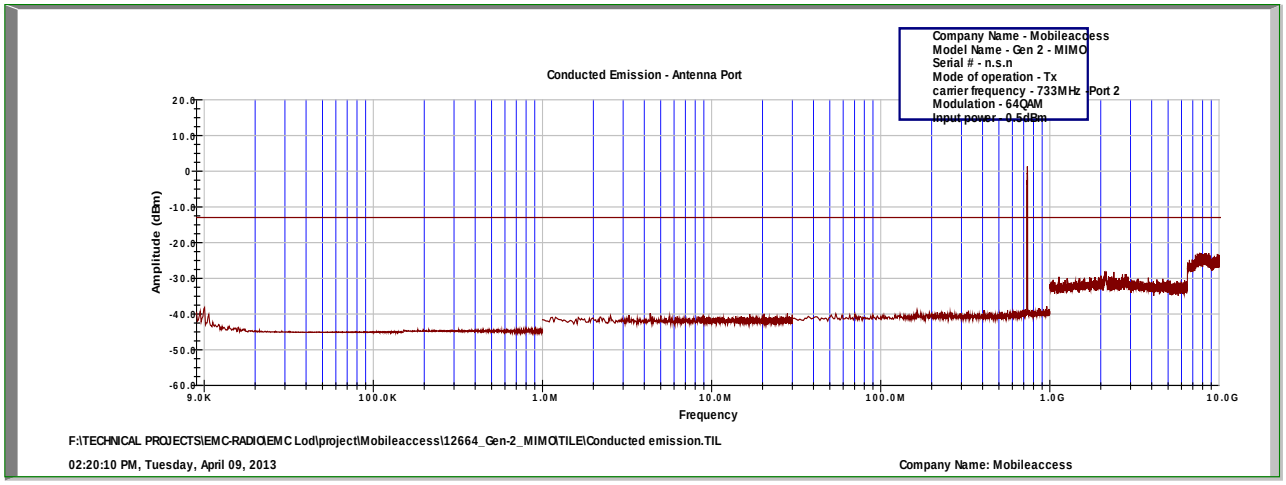


**Figure 59 Spurious Emissions at Antenna Terminals 64QAM, 733MHz, Port 2**

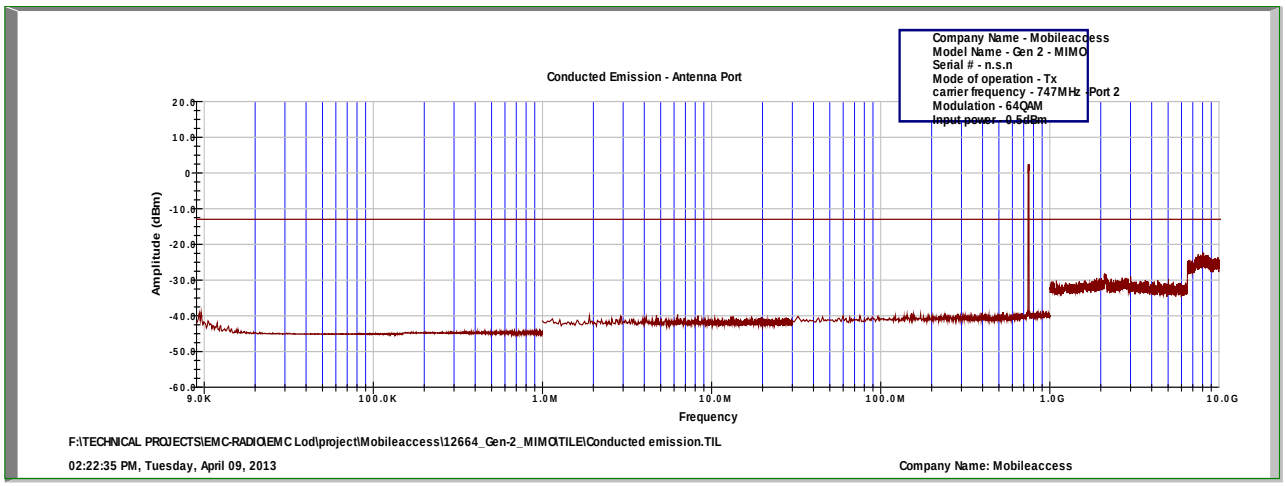


**Figure 60 Spurious Emissions at Antenna Terminals 64QAM, 747MHz, Port 2**

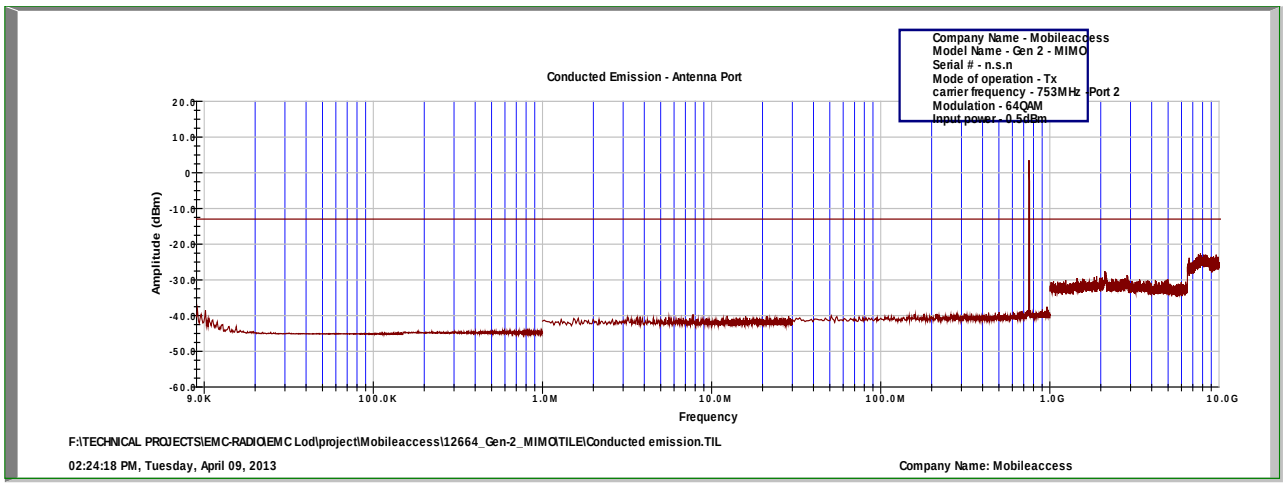


**Figure 61 Spurious Emissions at Antenna Terminals 64QAM, 753MHz, Port 2**

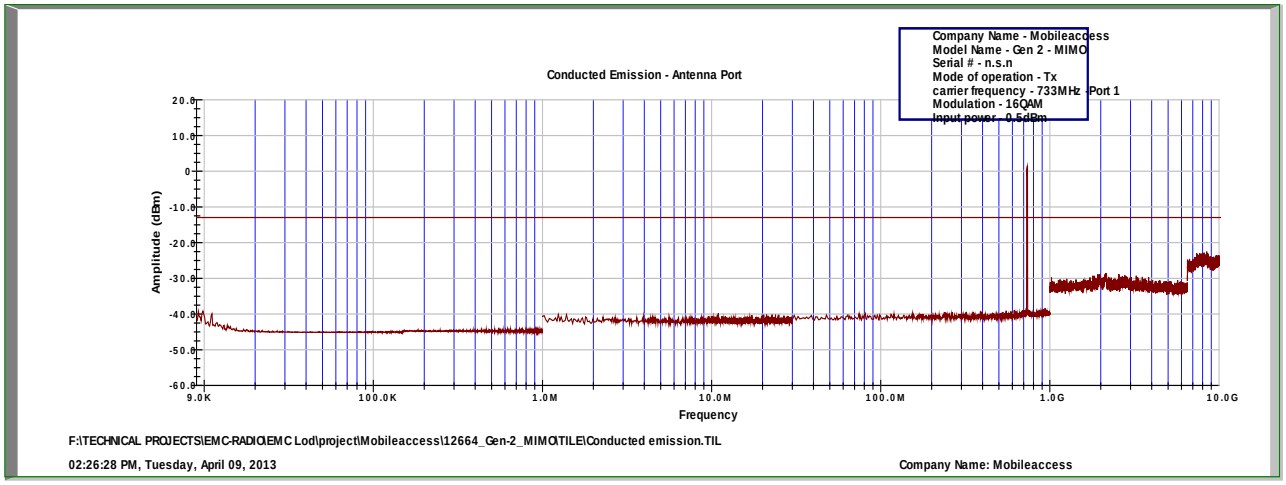


**Figure 62 Spurious Emissions at Antenna Terminals 16QAM, 733MHz, Port 1**

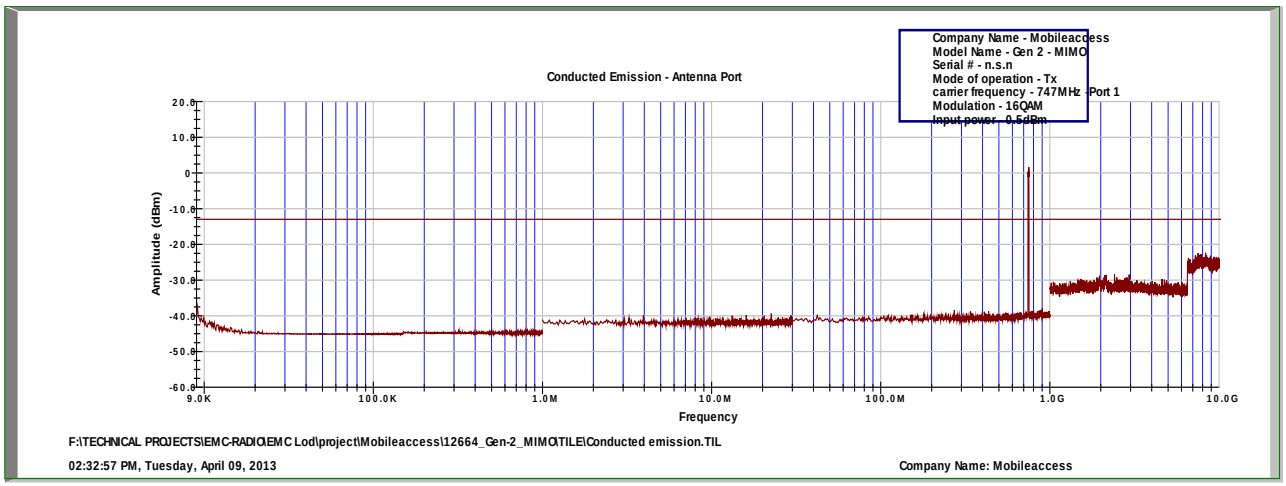


**Figure 63 Spurious Emissions at Antenna Terminals 16QAM, 747MHz, Port 1**

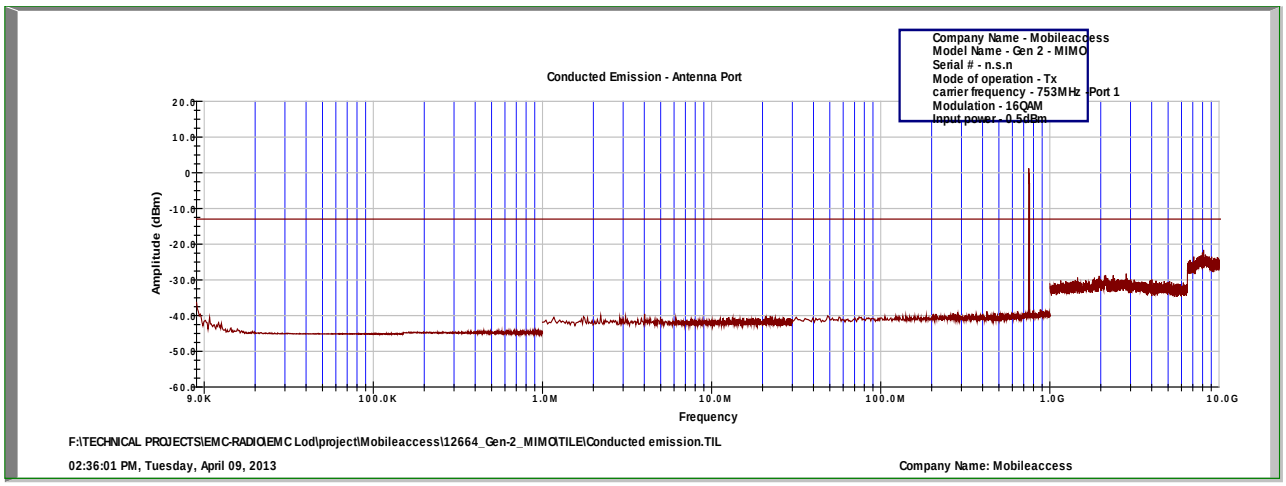


**Figure 64 Spurious Emissions at Antenna Terminals 16QAM, 753MHz, Port 1**

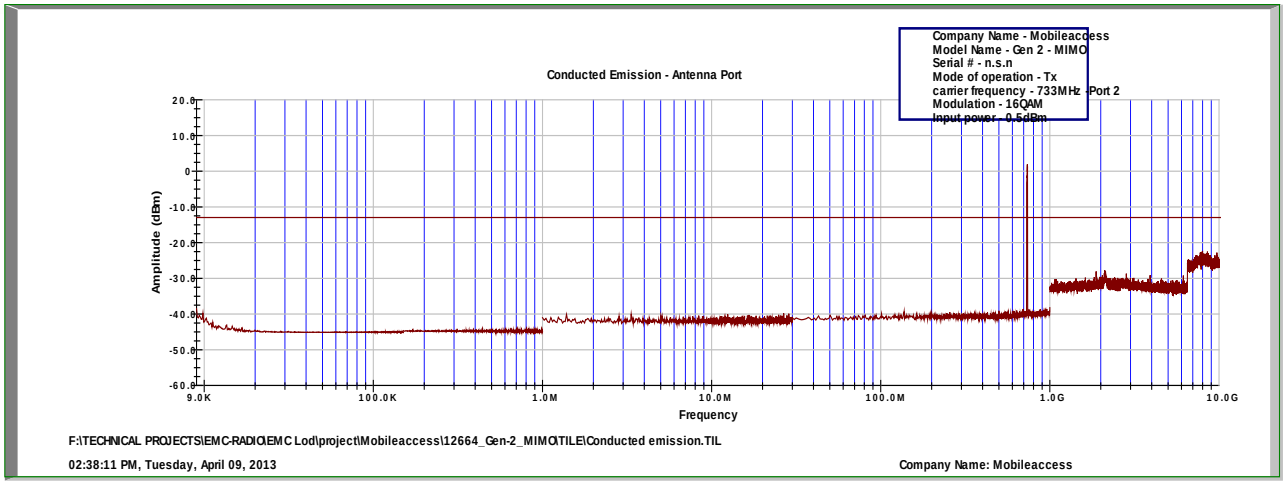


**Figure 65 Spurious Emissions at Antenna Terminals 16QAM, 733MHz, Port 2**

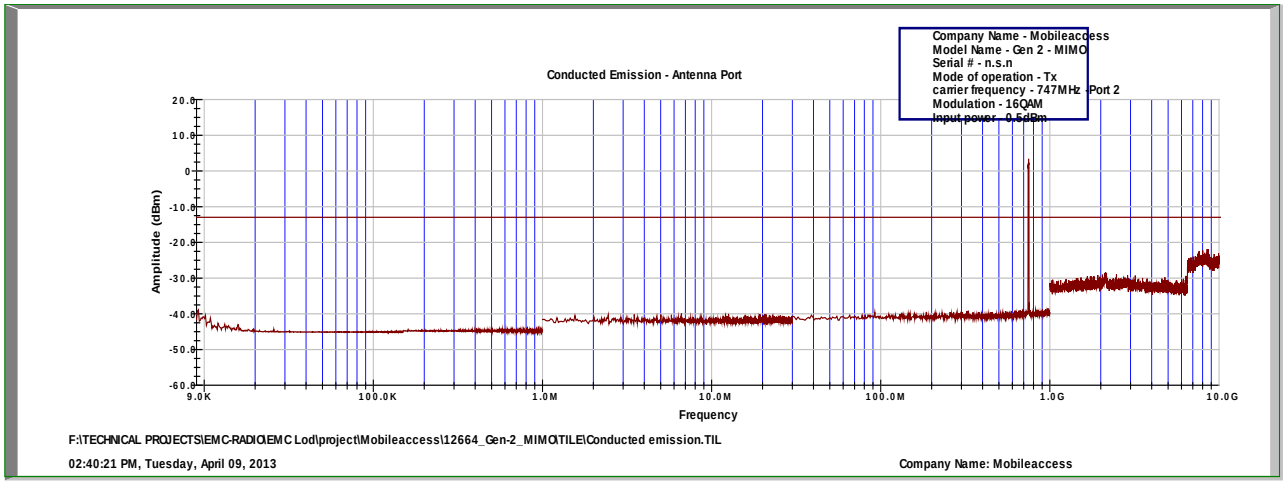


**Figure 66 Spurious Emissions at Antenna Terminals 16QAM, 747MHz, Port 2**

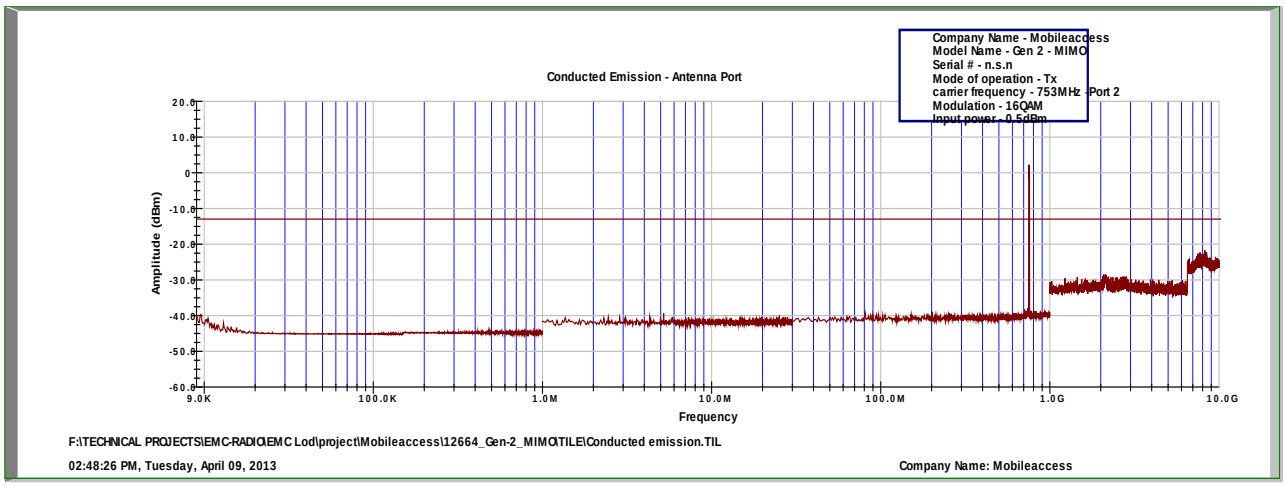


**Figure 67 Spurious Emissions at Antenna Terminals 16QAM, 753MHz, Port 2**

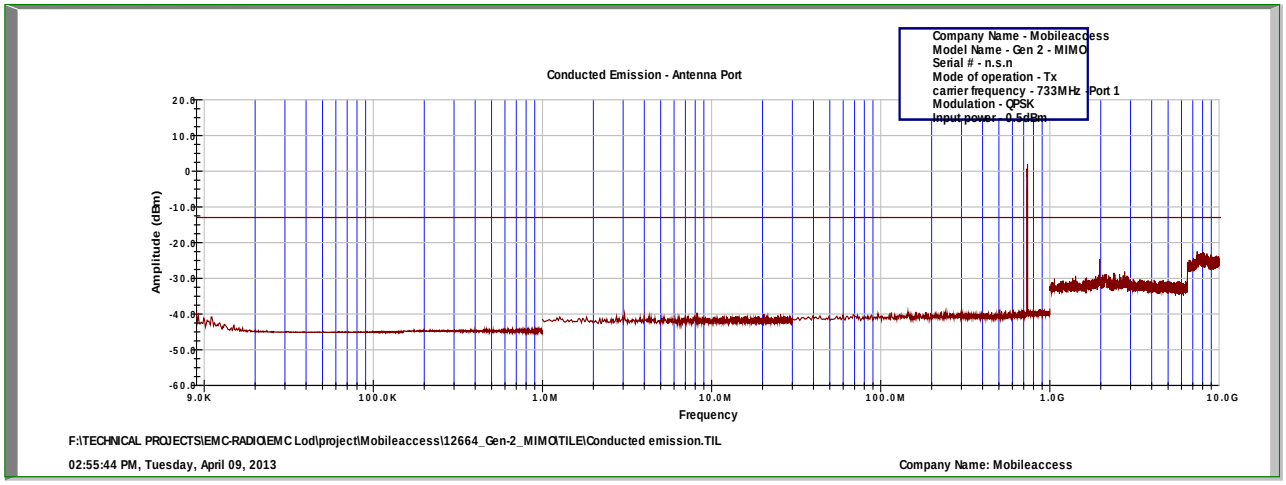


**Figure 68 Spurious Emissions at Antenna Terminals QPSK, 733MHz, Port 1**

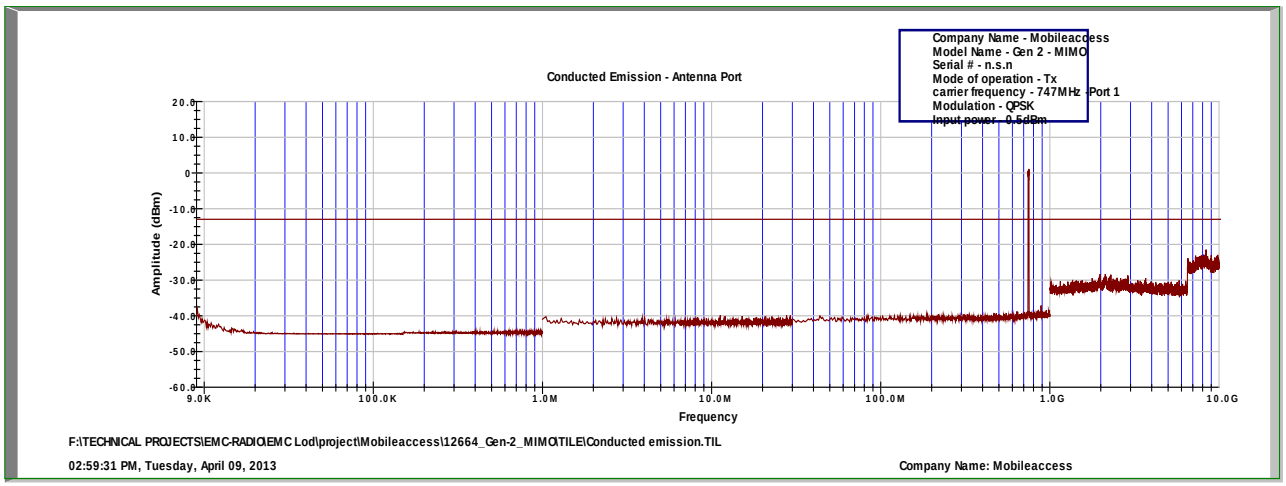


**Figure 69 Spurious Emissions at Antenna Terminals QPSK, 747MHz, Port 1**

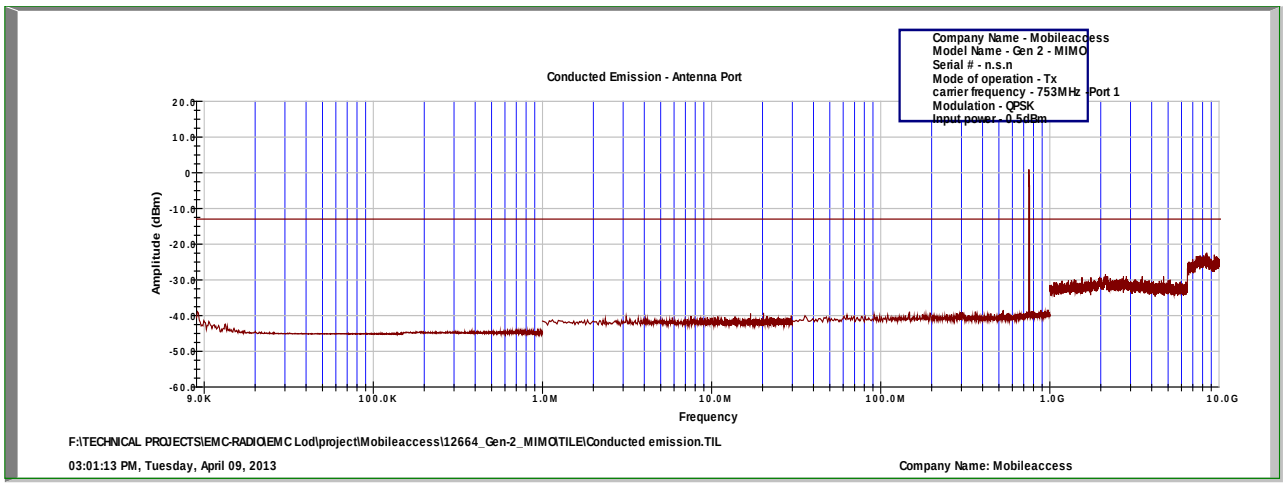


**Figure 70 Spurious Emissions at Antenna Terminals QPSK, 753MHz, Port 1**

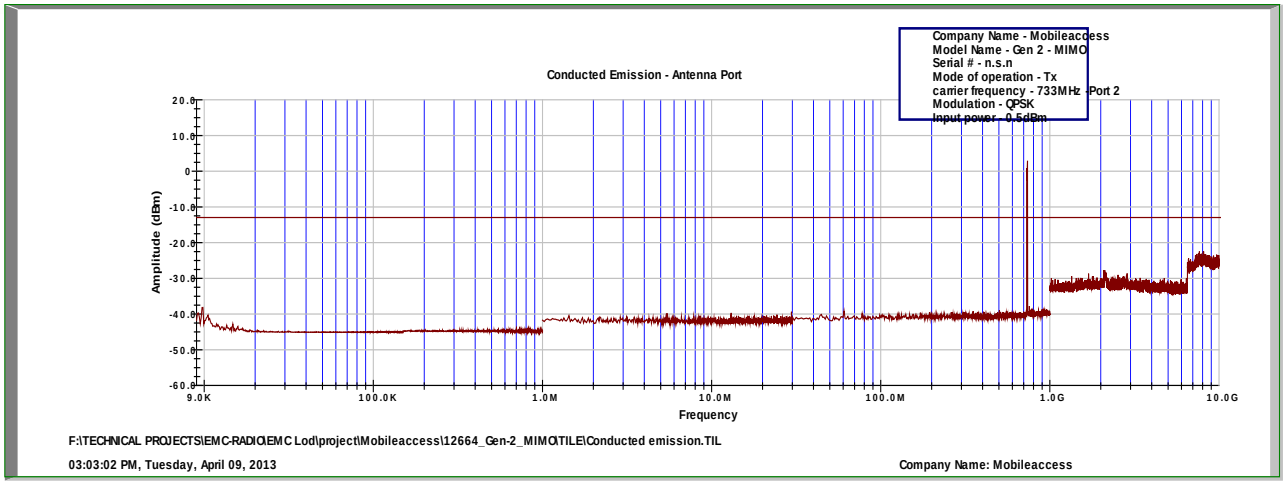


**Figure 71 Spurious Emissions at Antenna Terminals QPSK, 733MHz, Port 2**

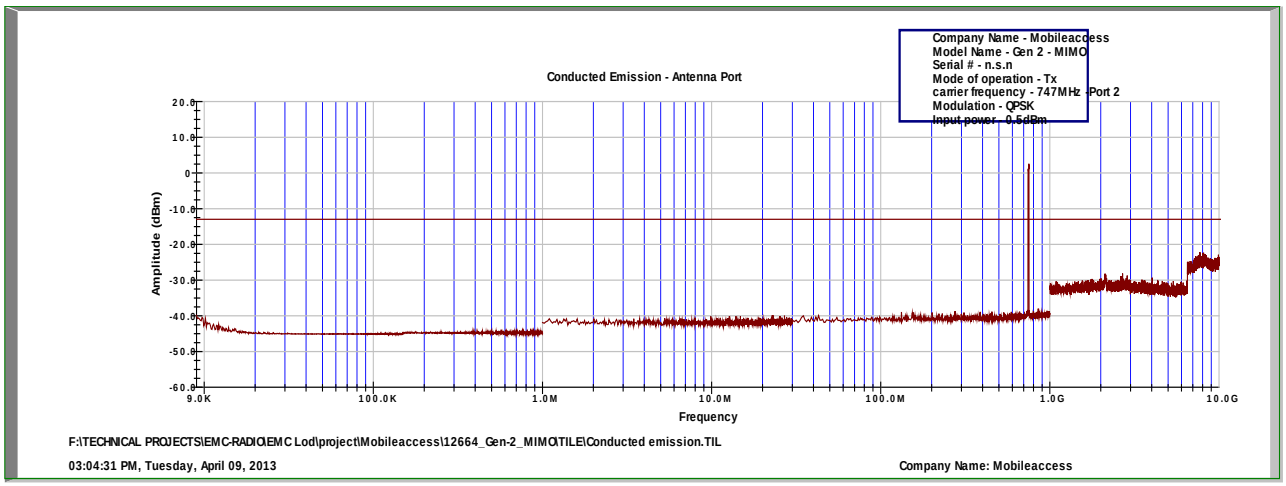


**Figure 72 Spurious Emissions at Antenna Terminals QPSK, 747MHz, Port 2**

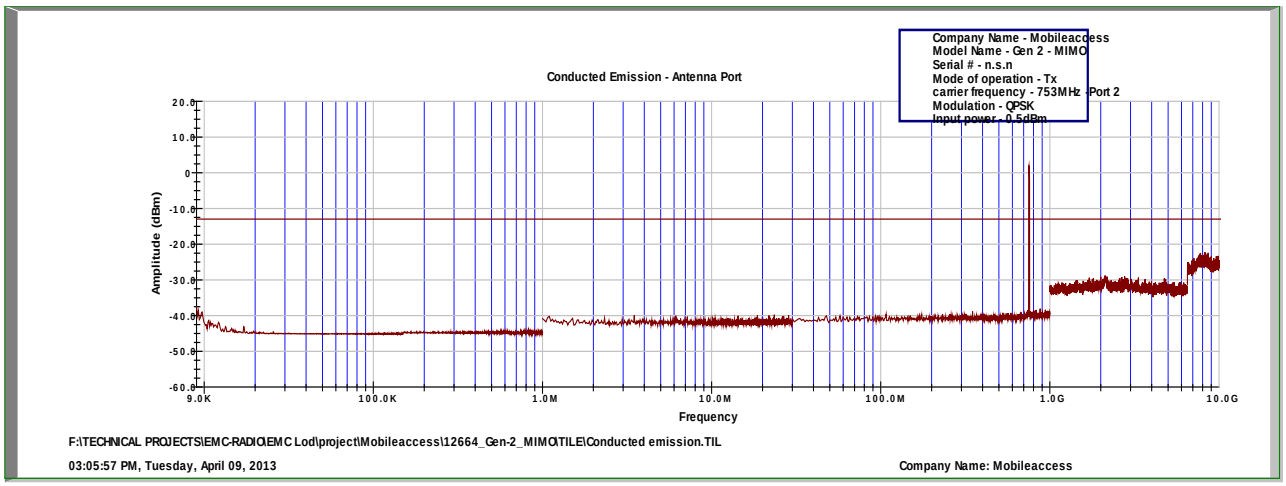


**Figure 73 Spurious Emissions at Antenna Terminals QPSK, 753MHz, Port 2**

## 6.4 Test Equipment Used

Spurious Emissions at Antenna Terminals LTE

| Instrument | Manufacturer | Model | Serial Number | Calibration | |
|---|---|---|---|---|---|
| | | | | Last Calibration | Period |
| Spectrum Analyzer | HP | 8564E | 3442A00275 | February 13, 2013 | 1 year |
| Signal Generator | Agilent | N5172B ATO 10210 | MY51350182 | May 31, 2012 | 2 years |
| Attenuator | Mini-circuit | UNAT-30+ | N/A | April 3, 2013 | 1 year |
| Cable | Mini-circuit | DCB | N/A | April 3, 2013 | 1 year |
| DC Block | MIDWEST MICROWAVE | DCDB-3624-10-NNN-02 | N/A | N/A | N/A |

**Figure 74 Test Equipment Used**

# 7. Band Edge Spectrum LTE

## 7.1 Test Specification

FCC Part 27, Subpart C, Section 27.53 (c)(1)

## 7.2 Test procedure

Enclosed are spectrum analyzer plots for the lowest operation frequency and the highest operation frequency in which the E.U.T. is planned to be used.

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 + log (P) dB, yielding –13dBm.
The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator and an appropriate coaxial cable (30.7 dB).
The spectrum analyzer was set to 30kHz R.B.W.

## 7.3 Results

| | Operation Frequency (MHz) | Band Edge Frequency (MHz) | Reading Port 1 (dBm) | Reading Port 2 (dBm) | Specification (dBm) | Port 1 Margin | Port 2 Margin (dB) |
|---|---|---|---|---|---|---|---|
| LTE64QAM | 733.00 | 728.00 | -37.95 | -39.32 | -13.0 | -24.95 | -26.32 |
| LTE64QAM | 753.00 | 758.00 | -40.69 | -40.64 | -13.0 | -27.69 | -27.64 |
| LTE16QAM | 733.00 | 728.00 | -40.42 | -40.61 | -13.0 | -27.42 | -27.61 |
| LTE16QAM | 753.00 | 758.00 | -43.28 | -42.04 | -13.0 | -30.28 | -29.04 |
| LTEQPSK | 733.00 | 728.00 | -39.29 | -42.38 | -13.0 | -26.29 | -29.38 |
| LTEQPSK | 753.00 | 758.00 | -43.79 | -41.78 | -13.0 | -30.79 | -28.78 |

**Figure 75 Band Edge Spectrum Results LTE**

JUDGEMENT: Passed by 24.95 dB

See additional information in Figure 76 to Figure 87.

TEST PERSONNEL:

Tester Signature: _____ Date: 07.05.13.

Typed/Printed Name: Azriel Sharabi

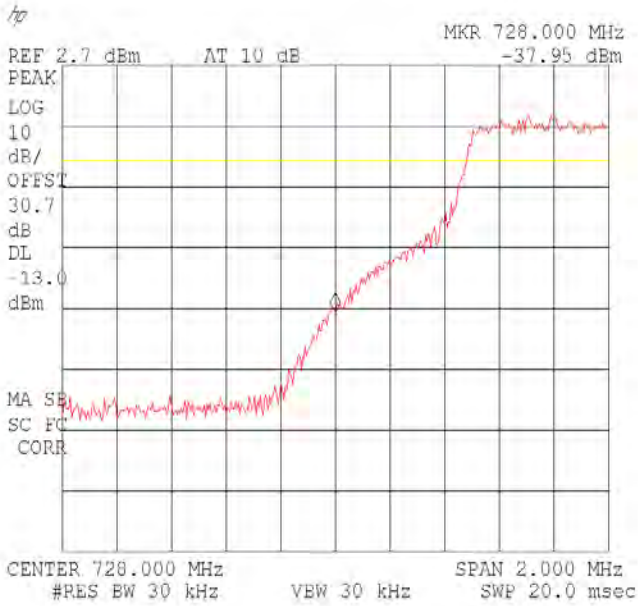


**Figure 76.—64QAM 733.0 MHz, Port 1**

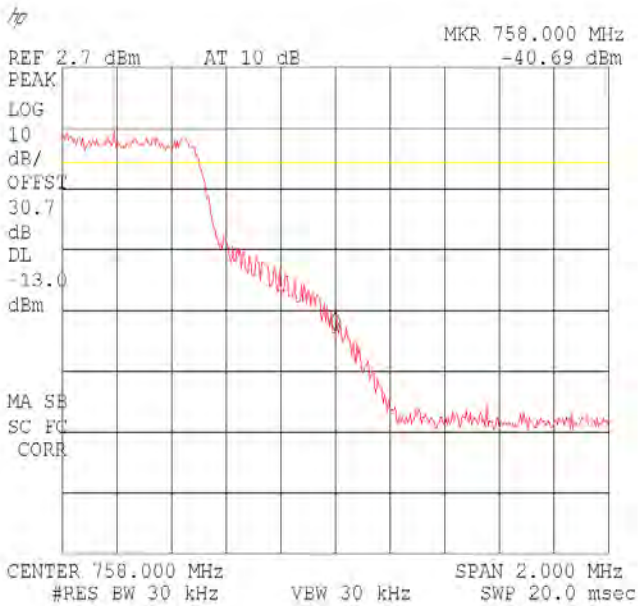


**Figure 77.— 64QAM 753.0 MHz, Port 1**

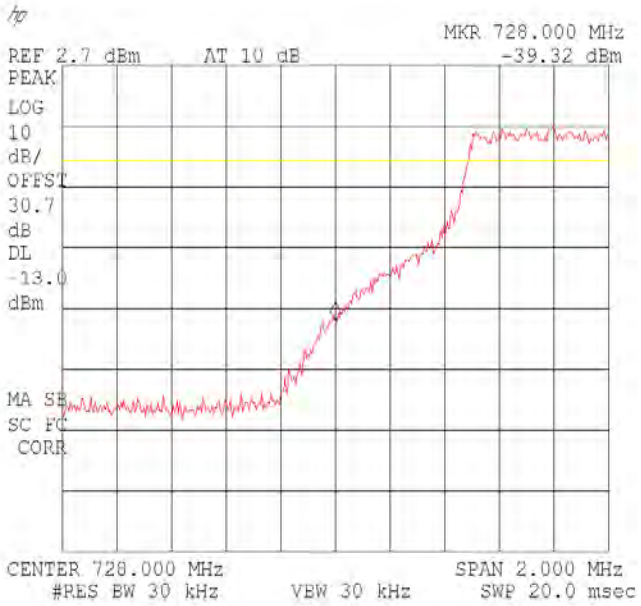


**Figure 78.—64QAM 733.0 MHz, Port 2**

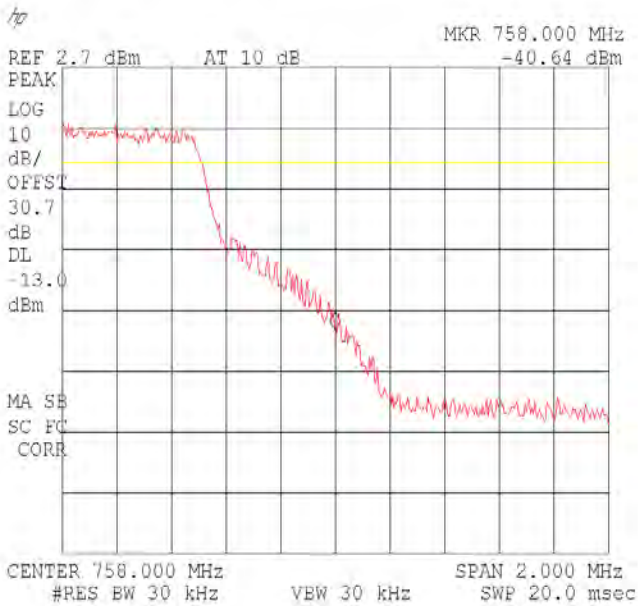


**Figure 79.— 64QAM 753.0 MHz, Port 2**

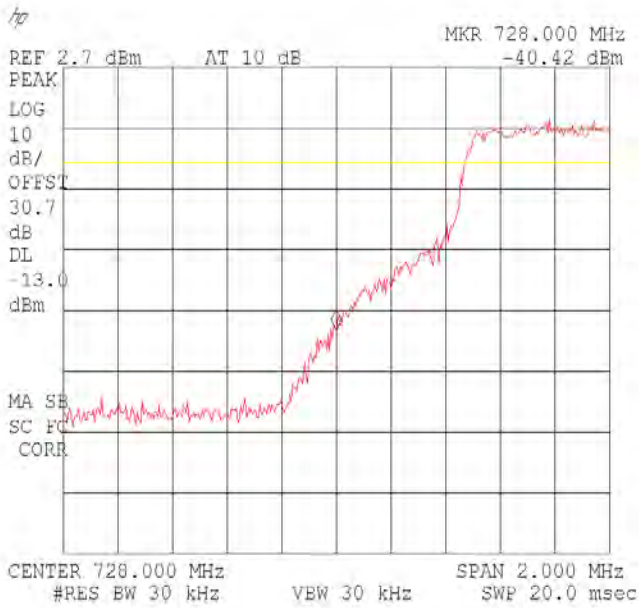


**Figure 80.—16QAM 733.0 MHz, Port 1**

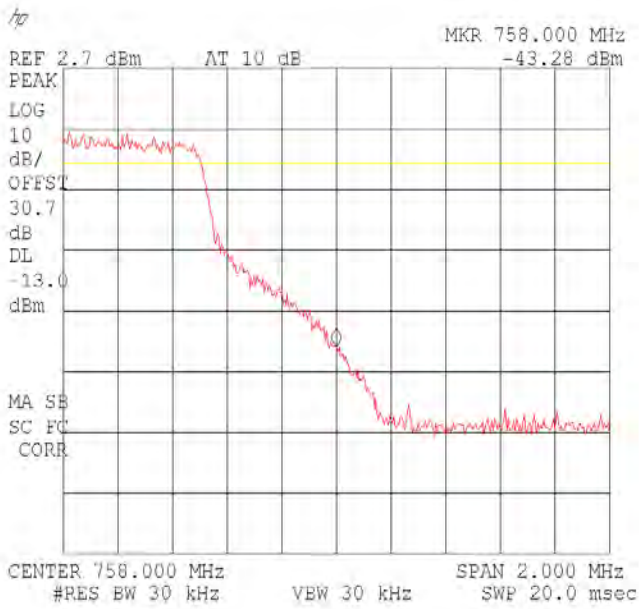


**Figure 81.— 16QAM 753.0 MHz, Port 1**

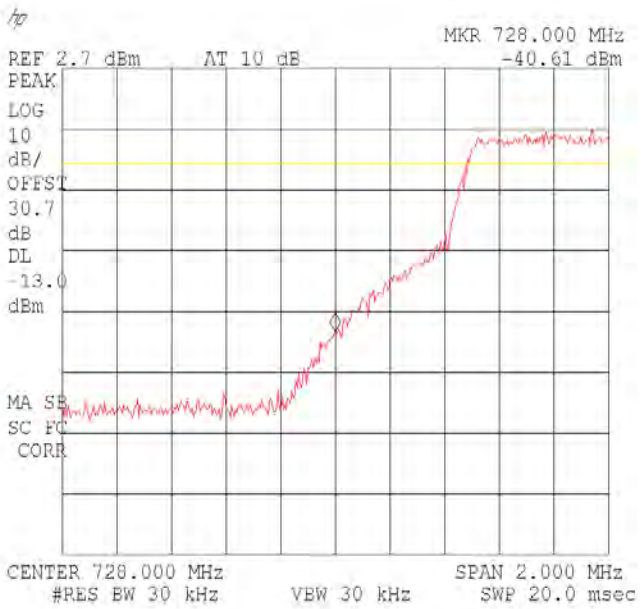


**Figure 82.—16QAM 733.0 MHz, Port 2**

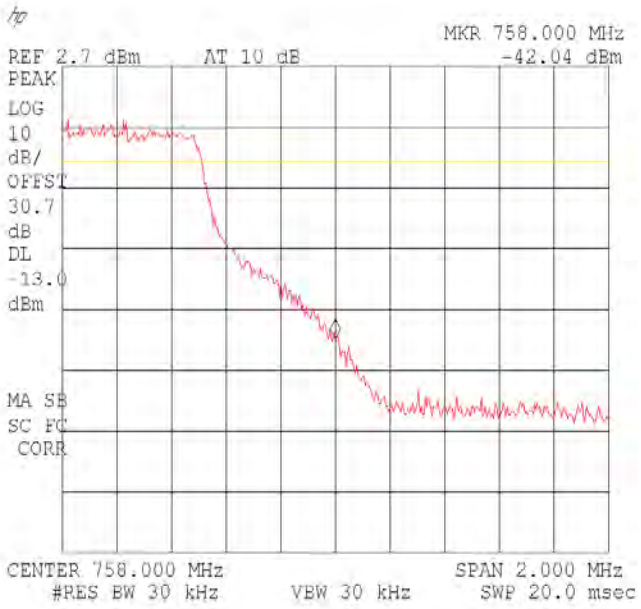


**Figure 83.— 16QAM 753.0 MHz, Port 2**

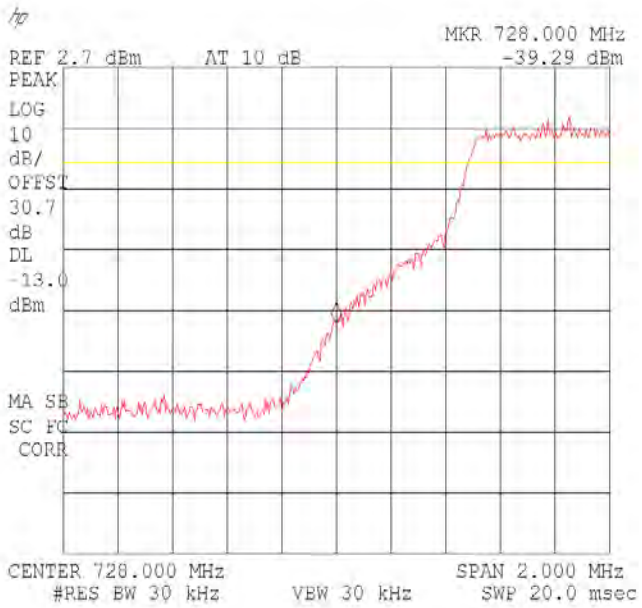


**Figure 84.— QPSK 733.0 MHz, Port 1**

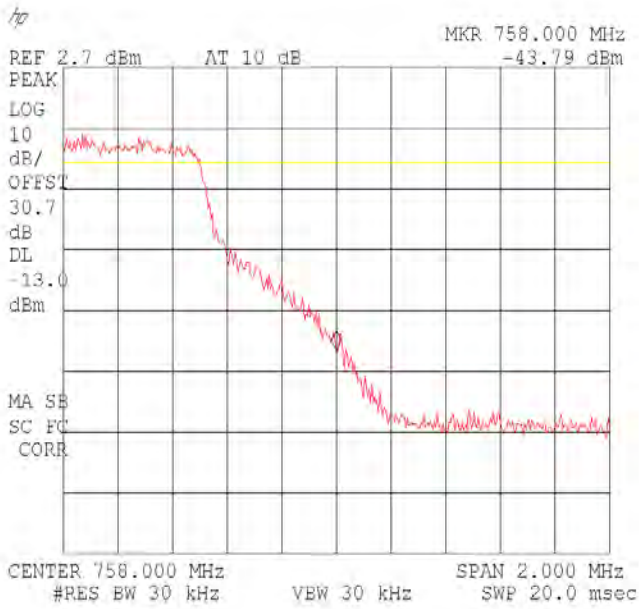


**Figure 85.—QPSK 753.0 MHz, Port 1**

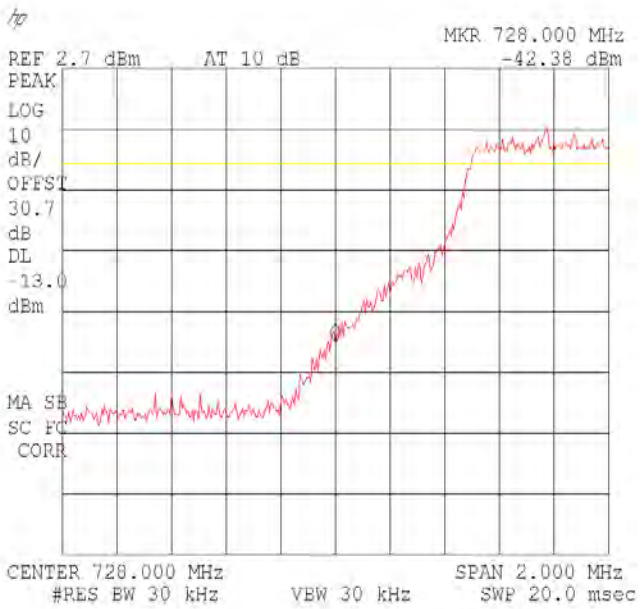


**Figure 86.— QPSK 733.0 MHz, Port 2**

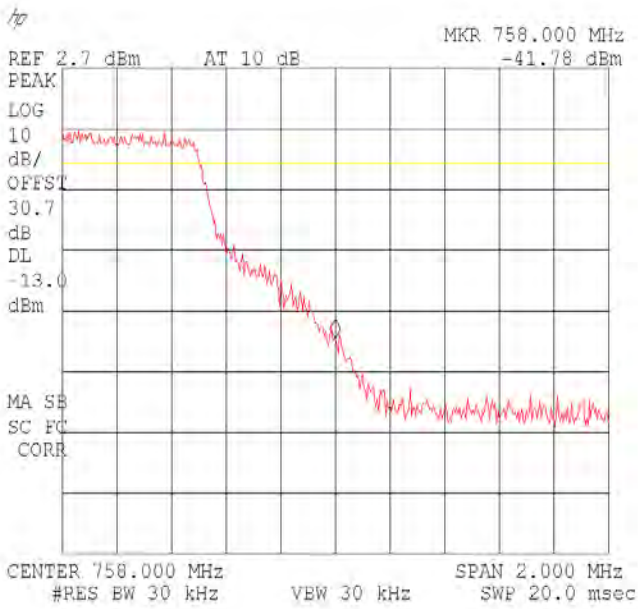


**Figure 87.—QPSK 753.0 MHz, Port 2**

### *7.4 Test Equipment Used.*

Band Edge Spectrum

| Instrument | Manufacturer | Model | Serial Number | Calibration | |
|---|---|---|---|---|---|
| | | | | Last Calibration | Period |
| Spectrum Analyzer | HP | 8564E | 3442A00275 | February 13, 2013 | 1 year |
| Signal Generator | Agilent | N5172B ATO 10210 | MY51350182 | May 31, 2012 | 2 years |
| Attenuator | Mini-circuit | UNAT-30+ | N/A | April 3, 2013 | 1 year |
| Cable | Mini-circuit | DCB | N/A | April 3, 2013 | 1 year |
| DC Block | MIDWEST MICROWAVE | DCDB-3624-10-NNN-02 | N/A | N/A | N/A |

**Figure 88 Test Equipment Used**

# 8. Spurious Radiated Emission LTE

## 8.1 Test Specification

FCC, Part 27, Subpart C Section 27.53 (g)

## 8.2 Test Procedure

The test method was based on ANSI/TIA-603-C: 2004, Section 2.2.12 Unwanted Emissions: Radiated Spurious.
The power of any emission outside of the authorized operating frequency ranges (728-758 MHz) must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log (P) dB, yielding –13dBm.

(a) The E.U.T. operation mode and test set-up are as described in Section 3. A preliminary measurement to characterize the E.U.T was performed inside the shielded room at a distance of 3 meters, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground. The configuration tested is shown in Figure 1.
The frequency range 9 kHz-20 GHz was scanned, and the list of the highest emissions was verified and updated accordingly.
The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.
The emissions were measured at a distance of 3 meters.

(b) The E.U.T. was replaced by a substitution antenna (dipole 30MHz-1GHz, Horn Antenna above 1GHz) driven by a signal generator. The height was readjusted for maximum reading. The signal generator level was adjusted to obtain the same reading on the EMI receiver as in step (a).
The signals observed in step (a) were converted to radiated power using:
$P_d$(dBm) = $P_g$(dBm) – Cable Loss (dB) + Substitution Antenna Gain (dB)
$P_d$ = Dipole equivalent power (result).
$P_g$ = Signal generator output level.

## 8.3 Test Results

| Carrier Channel (MHz) | Freq. (MHz) | Antenna Pol. | Maximum Peak Level (dBµV/m) | Signal Generator RF Output (dBm) | Cable Loss (dB) | Antenna Gain (dBi) | Effective Radiated Power Level (dBm) | Spec. (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 733.00 | 1466 | V | 48.0 | -53.29 | 5.15 | 7.6 | -50.84 | -13.00 | -37.84 |
| 733.00 | 1466 | H | 49.7 | -51.73 | 5.15 | 7.6 | -49.28 | -13.00 | -36.28 |
| 747.00 | 1494 | V | 50.6 | -50.69 | 5.15 | 7.6 | -48.24 | -13.00 | -35.24 |
| 747.00 | 1494 | H | 49.7 | -51.73 | 5.15 | 7.6 | -49.28 | -13.00 | -36.28 |
| 753.00 | 1506 | V | 47.8 | -53.49 | 5.15 | 7.6 | -51.04 | -13.00 | -38.04 |
| 753.00 | 1506 | H | 47.9 | -51.73 | 5.15 | 7.6 | -49.28 | -13.00 | -36.28 |

**Figure 89 Spurious Radiated emission LTE**

The E.U.T met the requirements of the FCC, Part 27, Subpart C, Section 27.53 (g) specifications.

JUDGEMENT: Passed by 35.24 dB

TEST PERSONNEL:

Tester Signature: _____ Date: 07.05.013

Typed/Printed Name: A. Sharabi

### *8.4 Test Instrumentation Used, Radiated Measurements*

| Instrument | Manufacturer | Model | Serial Number | Calibration | Period |
|---|---|---|---|---|---|
| Spectrum Analyzer | HP | 8564E | 3442A00275 | February 13, 2013 | 1 year |
| Signal Generator | Agilent | N5172B ATO 10210 | MY51350182 | May 31, 2012 | 2 years |
| Signal Generator | Agilent | N5182A | MY50141213 | July 9, 2012 | 1 year |
| Signal Generator | Agilent | 83731B | US37100653 | October 23, 2012 | 1 year |
| Signal Generator | Agilent | 8647A | 3625U00686 | March 5, 2012 | 2 years |
| Attenuator | Mini-circuit | UNAT-30+ | N/A | April 3, 2013 | 1 year |
| Cable | Mini-circuit | DCB | N/A | April 3, 2013 | 1 year |
| DC Block | MIDWEST MICROWAVE | DCDB-3624-10-NNN-02 | N/A | N/A | N/A |

# 9. RF Power Output AWS

## *9.1 Test Specification*

FCC Part 27, Subpart C (27.50(d))

## *9.2 Test procedure*

The E.U.T. antenna terminal was connected to the Spectrum Analyzer through an external attenuator and an appropriate coaxial cable (loss = 30.7 dB). The E.U.T. RF output was modulated as follows:

CDMA , LTE ,WCDMA and GSM.

Special attention was taken to prevent Spectrum Analyzer RF input overload.

### *9.3 Results*

| Modulation | Operation Frequency (MHz) | Reading Port 1 (dBm) | Reading Port 2 (dBm) | MIMO Calculation for Port 1 and Port 2 Readings (dBm) |
|---|---|---|---|---|
| CDMA | 2111.2 | 19.40 | 20.63 | 23.08 |
| CDMA | 2132.5 | 19.13 | 19.70 | 22.44 |
| CDMA | 2153.8 | 19.76 | 17.24 | 21.69 |
| GSM | 2111.2 | 21.51 | 22.93 | 25.29 |
| GSM | 2132.5 | 21.26 | 21.93 | 24.62 |
| GSM | 2153.8 | 19.80 | 18.98 | 22.42 |
| LTE 64QAM | 2115.0 | 19.56 | 20.93 | 23.31 |
| LTE 64QAM | 2132.5 | 19.34 | 19.73 | 22.55 |
| LTE 64QAM | 2150.0 | 20.04 | 18.48 | 22.34 |
| WCDMA | 2112.5 | 20.64 | 21.64 | 24.18 |
| WCDMA | 2132.5 | 20.45 | 20.43 | 23.44 |
| WCDMA | 2152.5 | 21.03 | 18.42 | 22.93 |

**Figure 90 RF Power Output AWS**

See additional information in Figure 97 to Figure 114.

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: _____ Date: 07.05.13

Typed/Printed Name: A. Sharabi

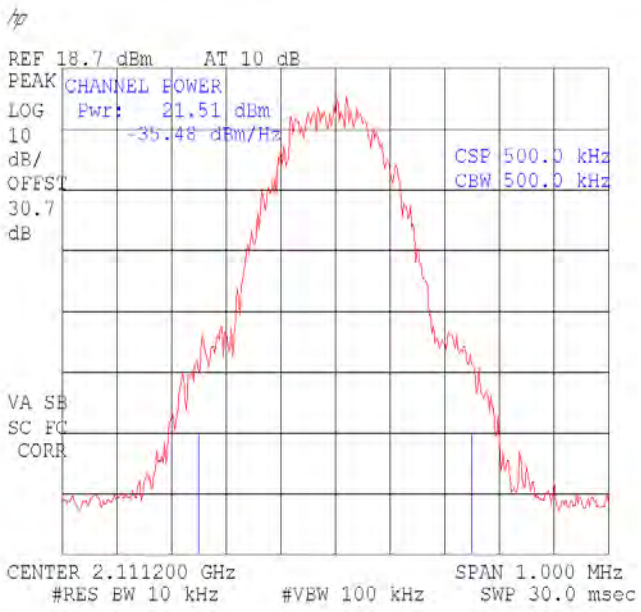


**Figure 91.— GSM (2111.2 MHz), Port 1**

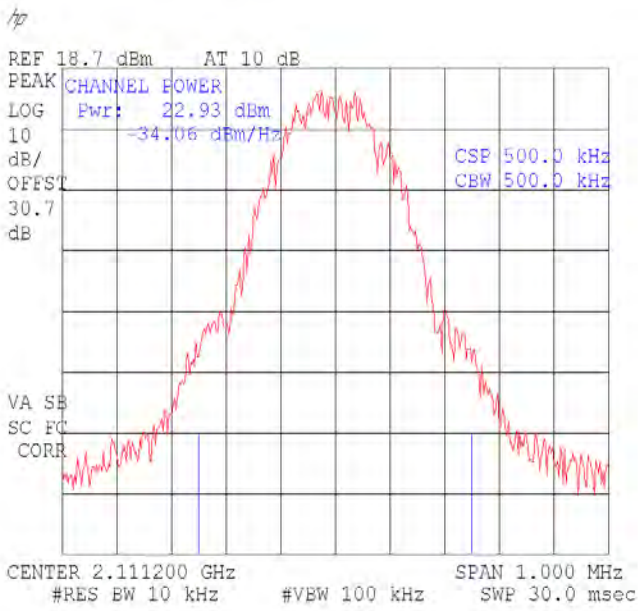


**Figure 92.— GSM (2111.2 MHz), Port 2**

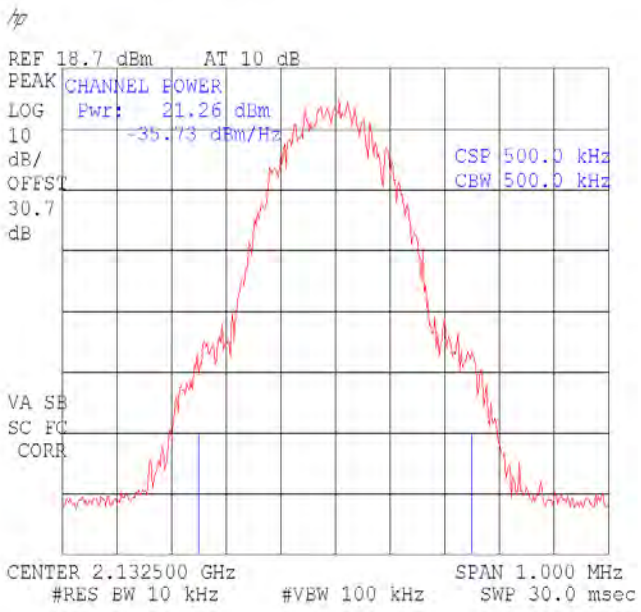


**Figure 93.— GSM (2132.5 MHz) , Port 1**

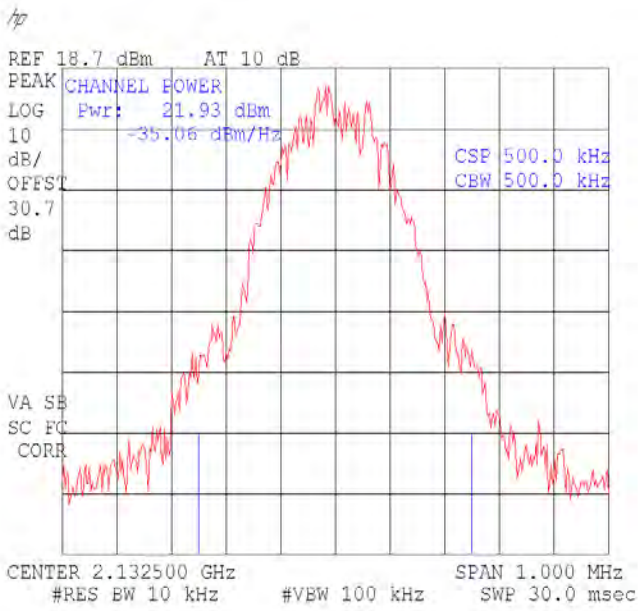


**Figure 94.— GSM (2132.5 MHz) , Port 2**

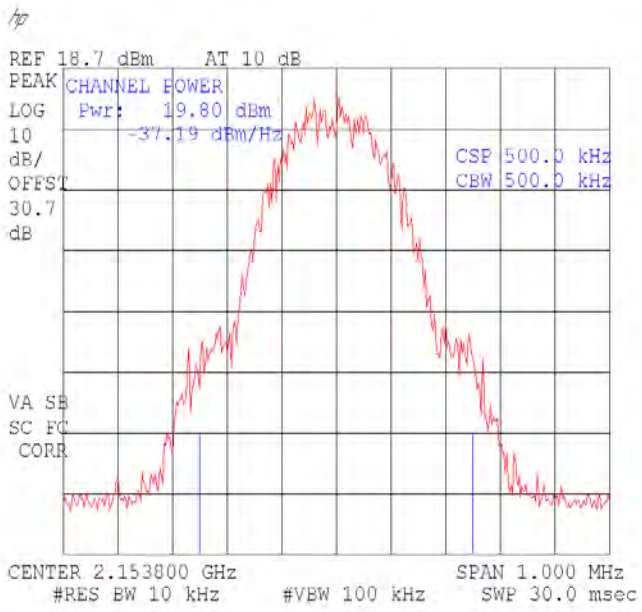


**Figure 95.— GSM (2153.8 MHz) , Port 1**

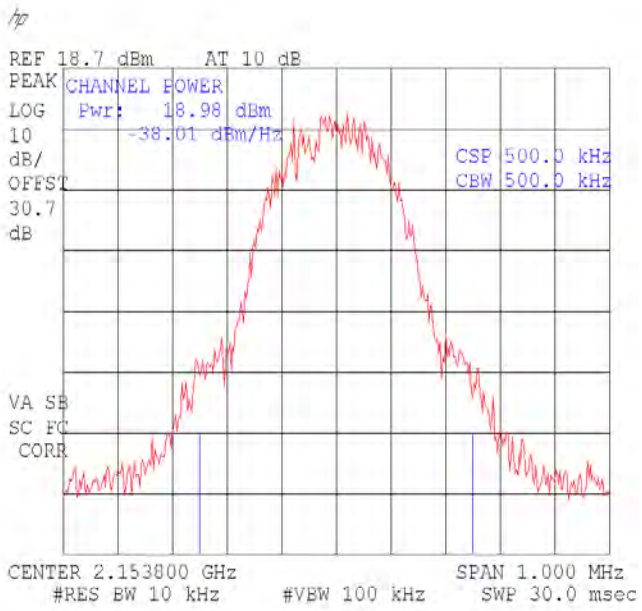


**Figure 96.— GSM (2153.8 MHz) , Port 2**

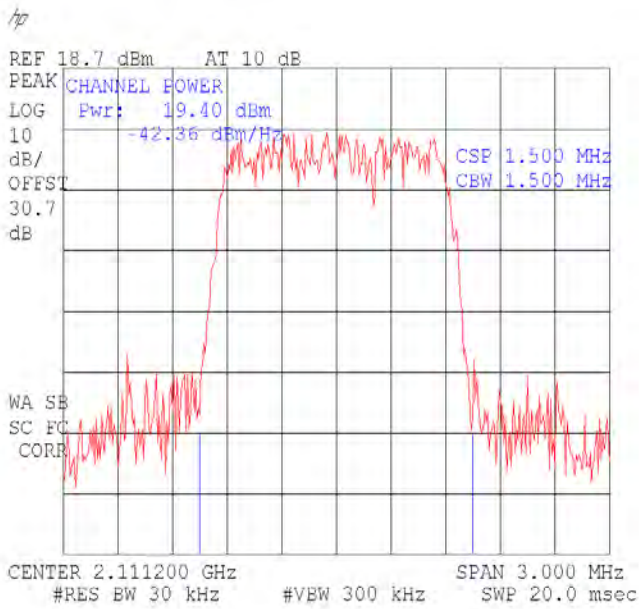


**Figure 97.— CDMA (2111.2 MHz), Port 1**

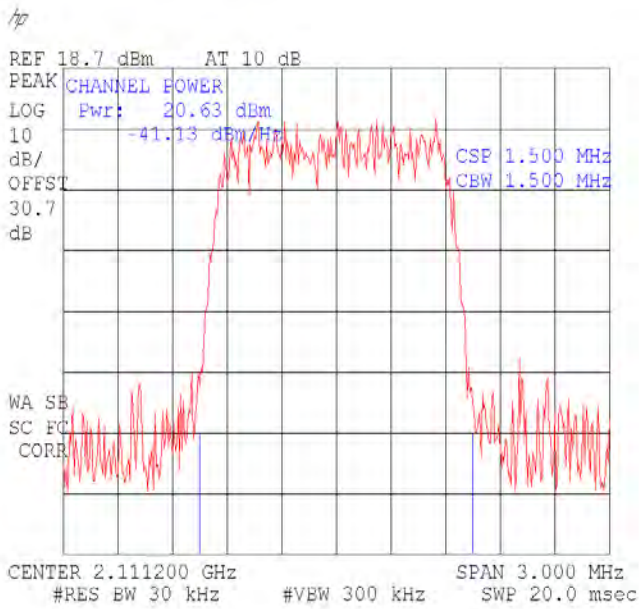


**Figure 98.— CDMA (2111.2 MHz), Port 2**

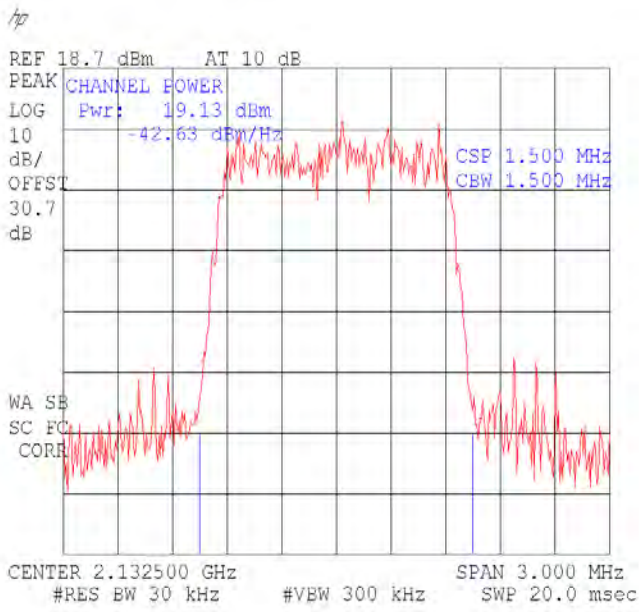


**Figure 99.— CDMA (2132.5 MHz) , Port 1**

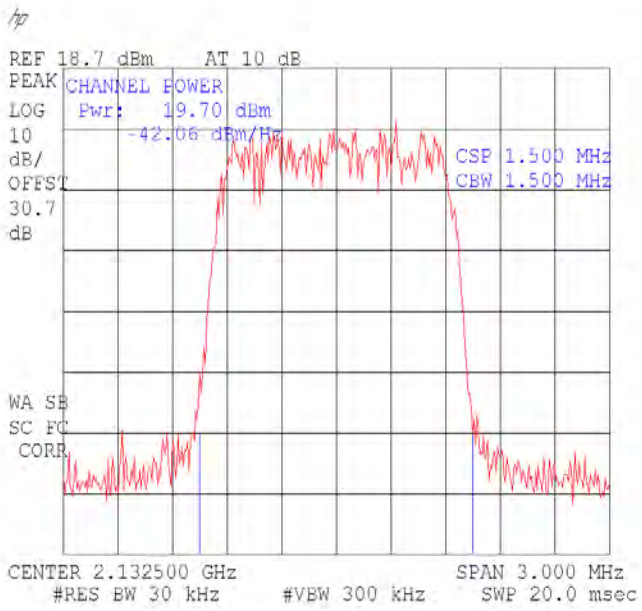


**Figure 100.— CDMA (2132.5 MHz) , Port 2**

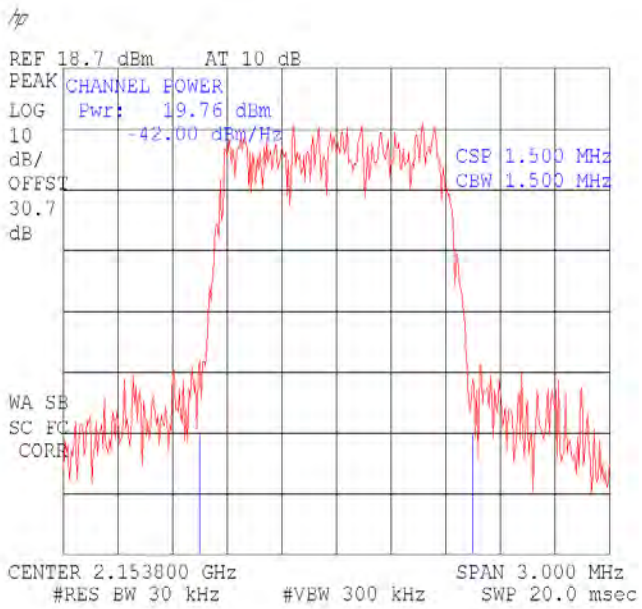


**Figure 101.— CDMA (2153.8 MHz) , Port 1**

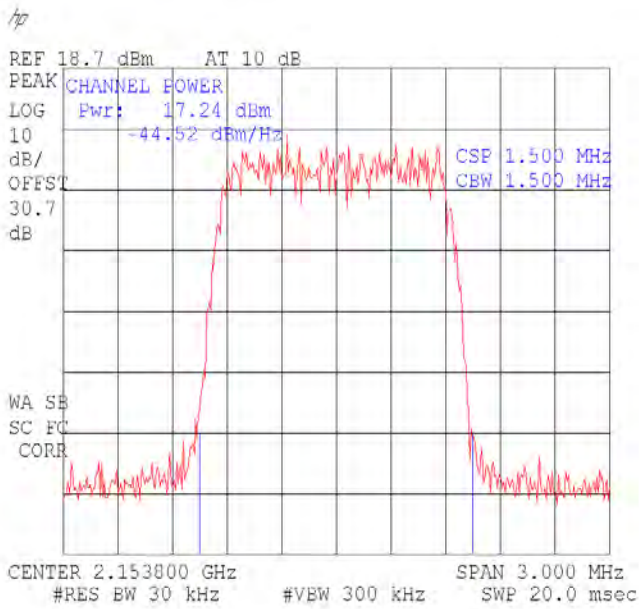


**Figure 102.— CDMA (2153.8 MHz) , Port 2**

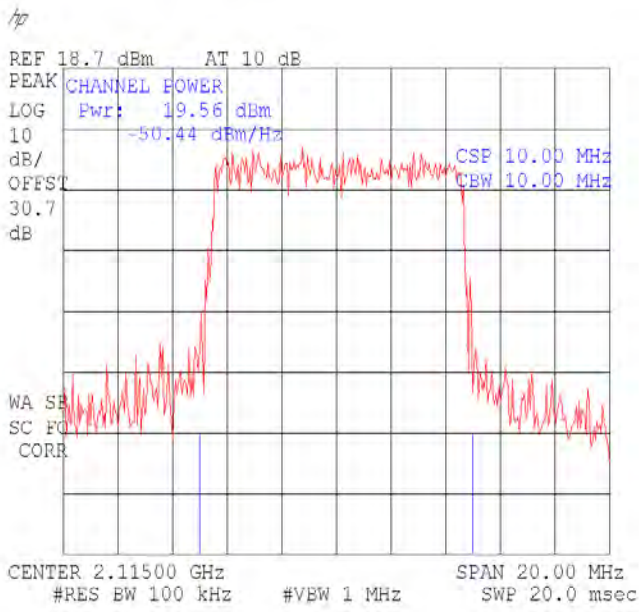


**Figure 103.— LTE 64QAM(2115.0 MHz) , Port 1**

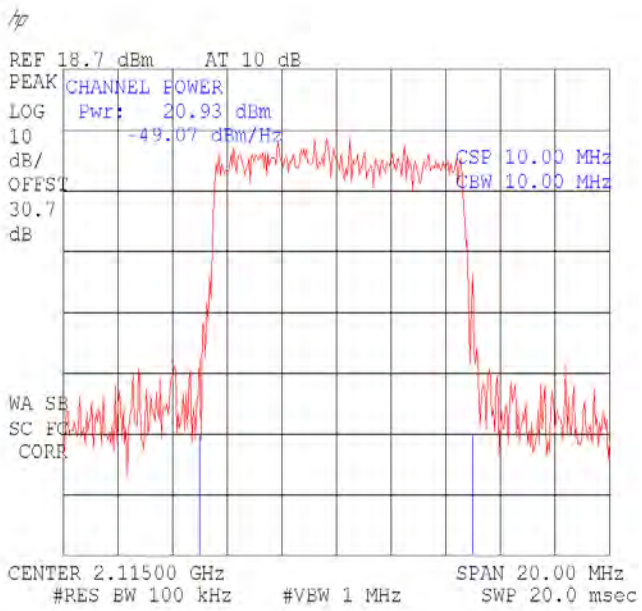


**Figure 104.— LTE 64QAM(2115.0 MHz) , Port 2**

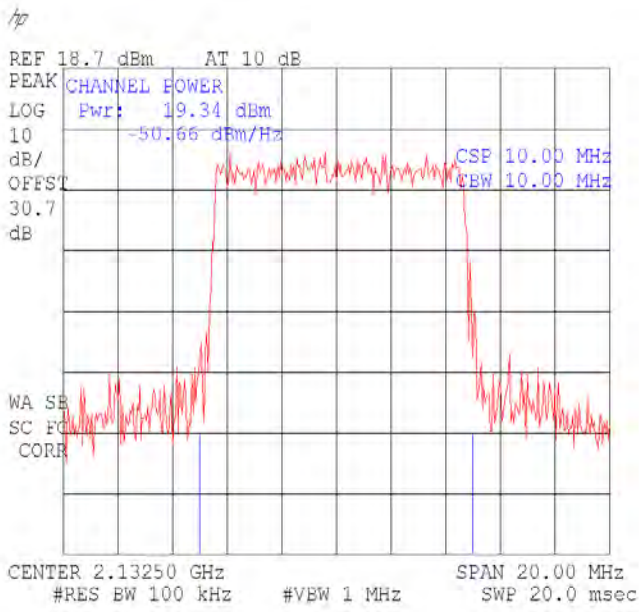


**Figure 105.— LTE 64QAM (2132.5 MHz) , Port 1**

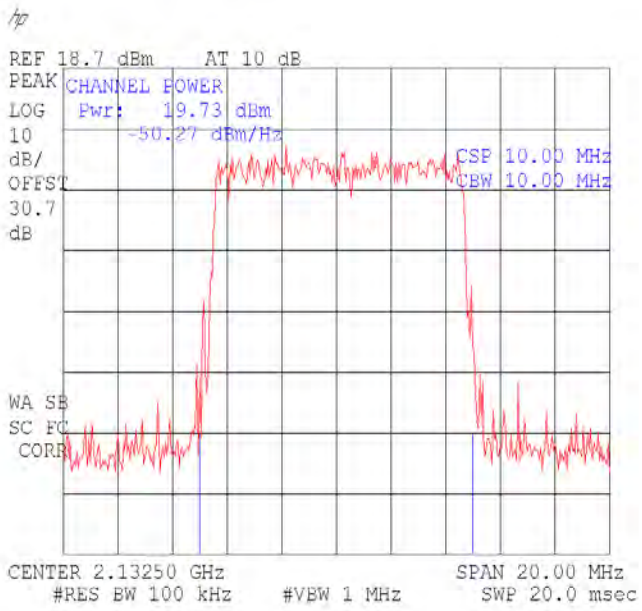


**Figure 106.— LTE 64QAM (2132.5 MHz) , Port 2**

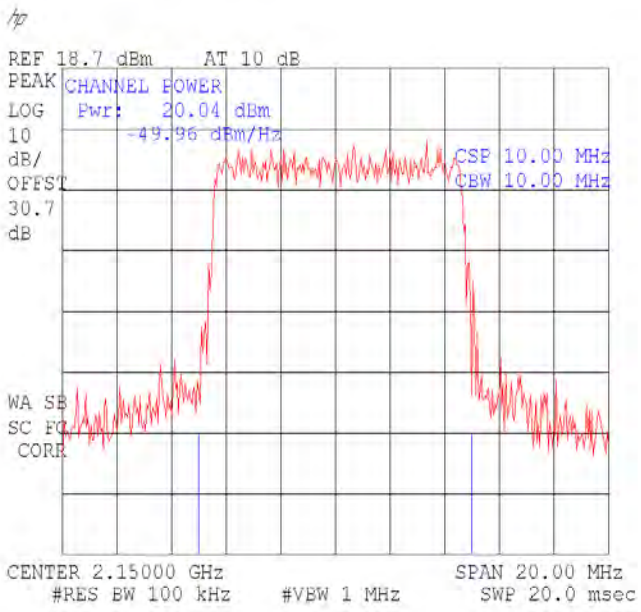


**Figure 107.— LTE 64QAM (2150.0 MHz) , Port 1**

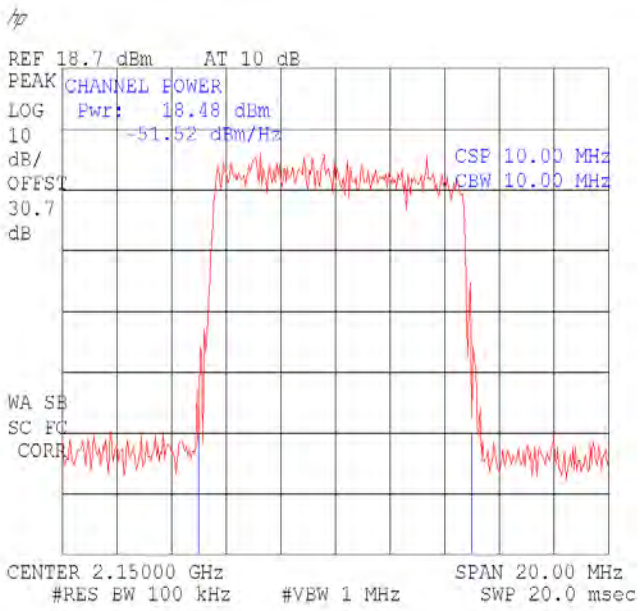


**Figure 108.— LTE 64QAM (2150.0 MHz) , Port 2**

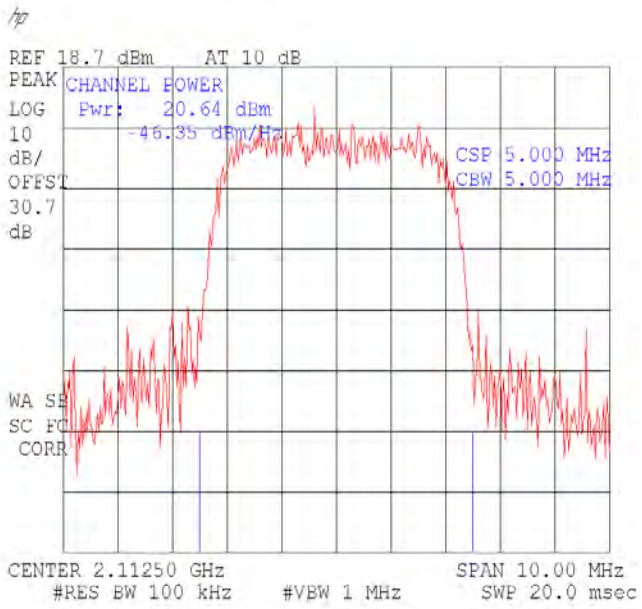


**Figure 109.— W-CDMA (2112.5 MHz) , Port 1**

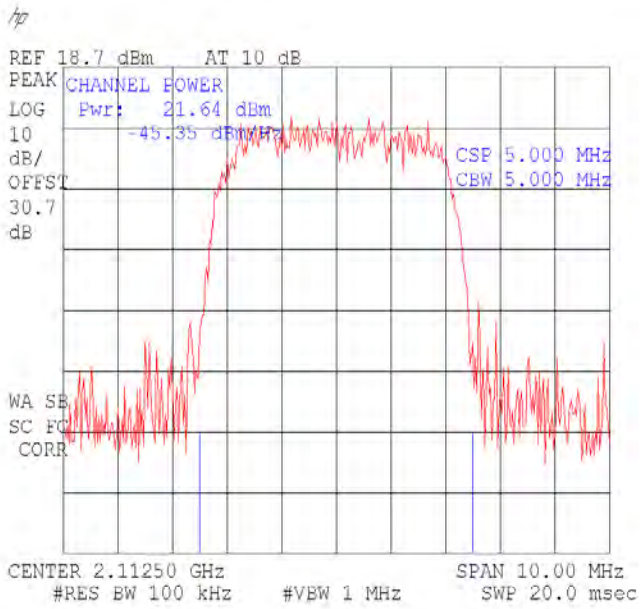


**Figure 110.— W-CDMA (2112.5 MHz) , Port 2**

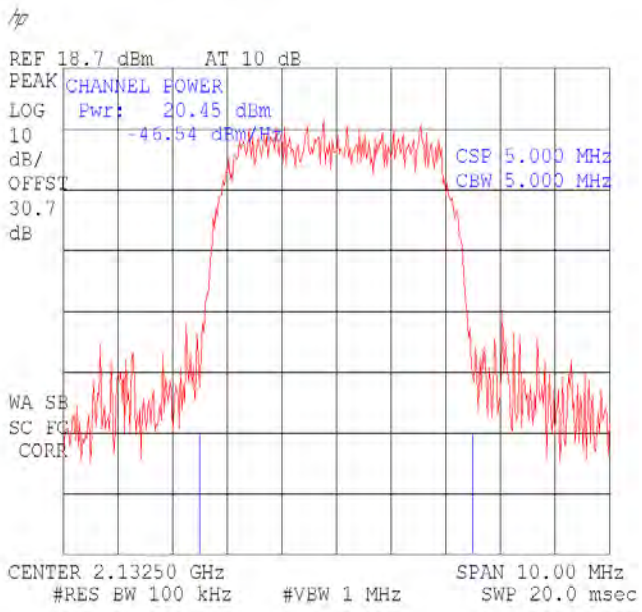


**Figure 111.— W-CDMA (2132.5 MHz) , Port 1**

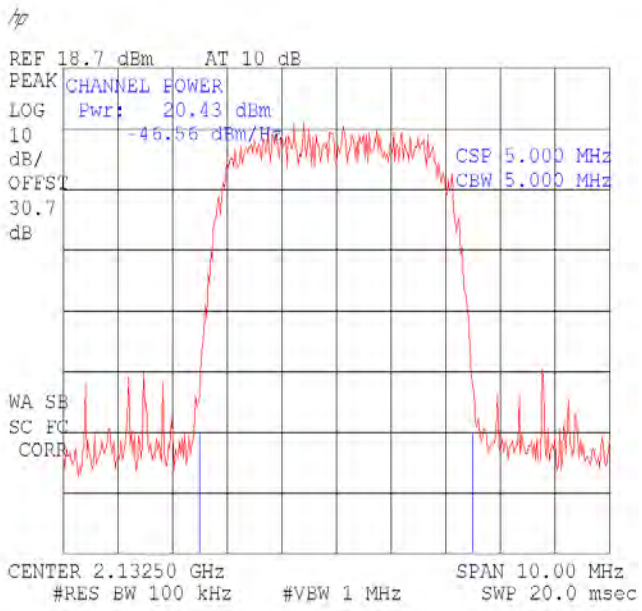


**Figure 112.— W-CDMA (2132.5 MHz) , Port 2**

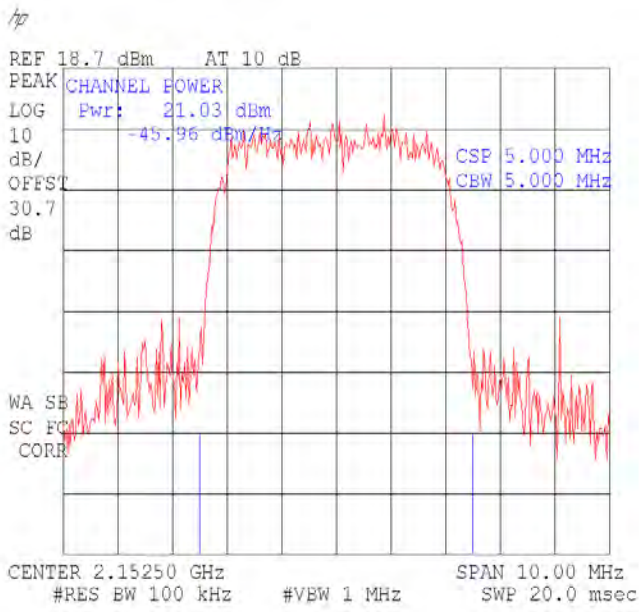


**Figure 113.— W-CDMA (2152.5 MHz) , Port 1**

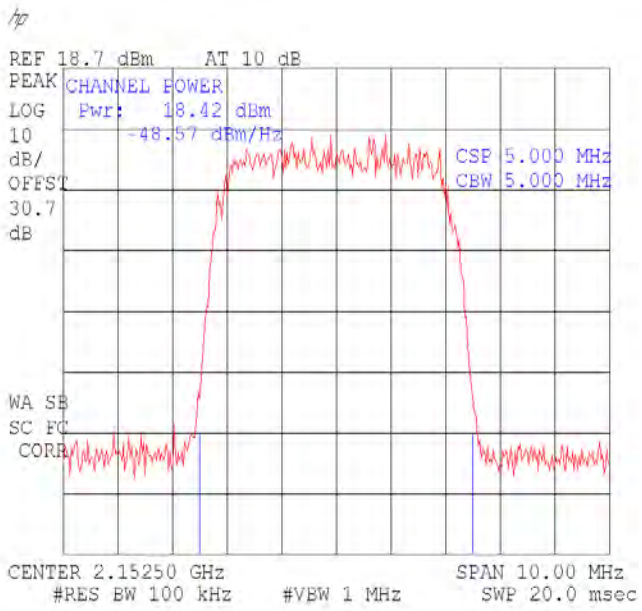


**Figure 114.— W-CDMA (2152.5 MHz) , Port 2**

## 9.4 Test Equipment Used.

RF Power Output AWS

| Instrument | Manufacturer | Model | Serial Number | Calibration | |
|---|---|---|---|---|---|
| | | | | Last Calibration | Period |
| Spectrum Analyzer | HP | 8564E | 3442A00275 | February 13, 2013 | 1 year |
| Signal Generator | Agilent | N5172B ATO 10210 | MY51350182 | May 31, 2012 | 2 years |
| Attenuator | Mini-circuit | UNAT-30+ | N/A | April 3, 2013 | 1 year |
| Cable | Mini-circuit | DCB | N/A | April 3, 2013 | 1 year |
| DC Block | MIDWEST MICROWAVE | DCDB-3624-10-NNN-02 | N/A | N/A | N/A |

**Figure 115 Test Equipment Used**

# 10. Occupied Bandwidth AWS

## *10.1 Test Specification*

FCC Part 2, Section 1049

## *10.2 Test Procedure*

The E.U.T. was set to the applicable test frequency and modulation. The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator (at the output test) and an appropriate coaxial cable. The spectrum analyzer was set to proper resolution B.W.
The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limit, the mean powers radiated are each equal to 0.5% of the total mean power radiated by a given emission.
Occupied bandwidth measured was repeated in the input terminal of the E.U.T.

### *10.3 Results*

| Modulation | | Operating Frequency (MHz) | Reading Port 1 (MHz) | Reading Port 2 (MHz) |
|---|---|---|---|---|
| CDMA | Input | 2111.2 | 1.34 | 1.34 |
| | Output | 2111.2 | 1.34 | 1.34 |
| | Input | 2132.5 | 1.34 | 1.34 |
| | Output | 2132.5 | 1.34 | 1.33 |
| | Input | 2153.8 | 1.34 | 1.34 |
| | Output | 2153.8 | 1.34 | 1.34 |
| LTE 64QAM | Input | 2115.0 | 9.70 | 9.70 |
| | Output | 2115.0 | 9.75 | 9.60 |
| | Input | 2132.5 | 9.75 | 9.75 |
| | Output | 2132.5 | 9.65 | 9.65 |
| | Input | 2150.0 | 9.60 | 9.60 |
| | Output | 2150.0 | 9.60 | 9.65 |
| GSM | Input | 2111.2 | 0.285 | 0.285 |
| | Output | 2111.2 | 0.277 | 0.275 |
| | Input | 2132.5 | 0.282 | 0.282 |
| | Output | 2132.5 | 0.277 | 0.277 |
| | Input | 2153.8 | 0.270 | 0.270 |
| | Output | 2153.8 | 0.280 | 0.282 |
| WCDMA | Input | 2112.5 | 4.58 | 4.58 |
| | Output | 2112.5 | 4.60 | 4.60 |
| | Input | 2132.5 | 4.60 | 4.60 |
| | Output | 2132.5 | 4.55 | 4.55 |
| | Input | 2152.5 | 4.55 | 4.55 |
| | Output | 2152.5 | 4.60 | 4.58 |

**Figure 116 Occupied Bandwidth AWS**

See additional information in Figure 117 to Figure 152.

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: _____ Date: 07.05.13

Typed/Printed Name: A. Sharabi

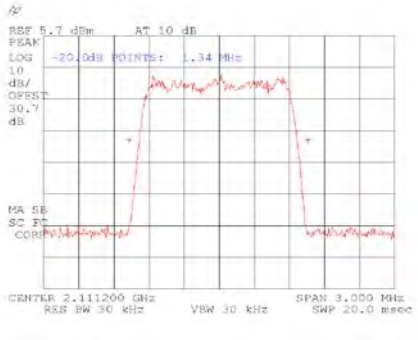


**Figure 117.— CDMA (2111.2 MHz) IN**

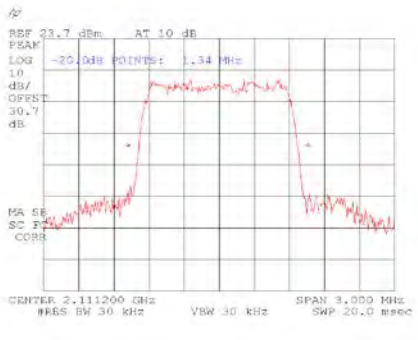


**Figure 118.— CDMA (2111.2 MHz) OUT, Port 1**

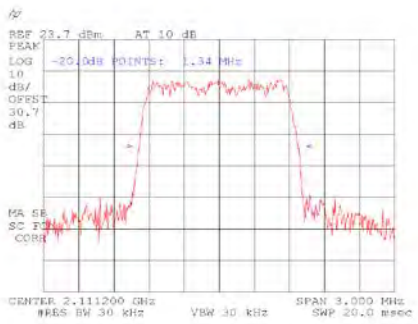


**Figure 119.— CDMA (2111.2 MHz) OUT, Port 2**

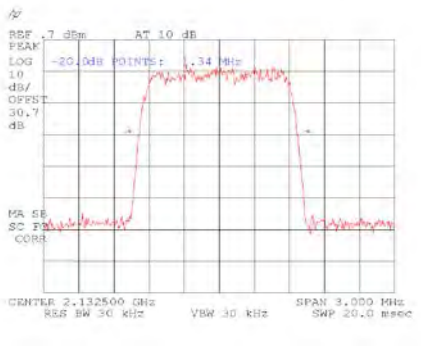


**Figure 120.— CDMA (2132.5 MHz) IN**

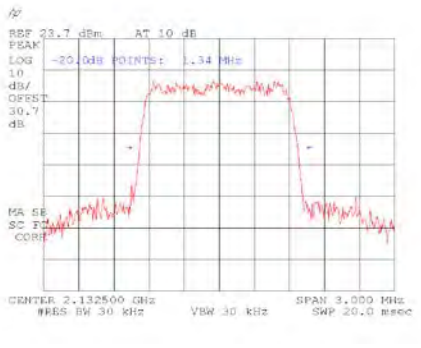


**Figure 121.— CDMA (2132.5 MHz) OUT, Port 1**

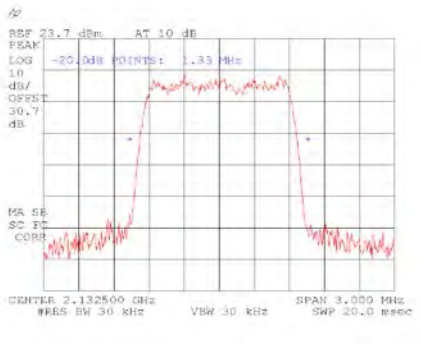


**Figure 122.— CDMA (2132.5 MHz) OUT, Port 2**

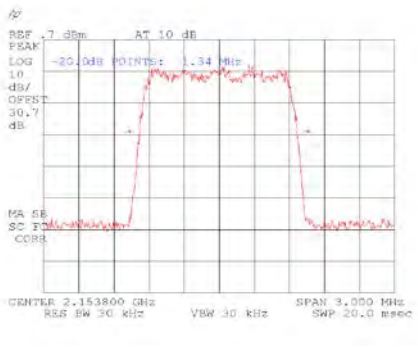


**Figure 123.— CDMA (2153.8 MHz) IN**

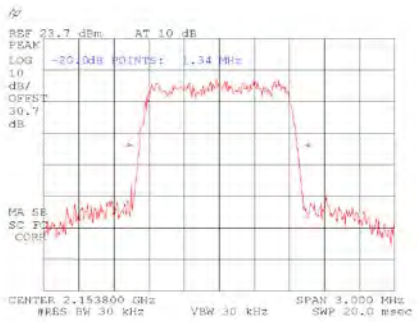


**Figure 124.— CDMA (2153.8 MHz) OUT, Port 1**

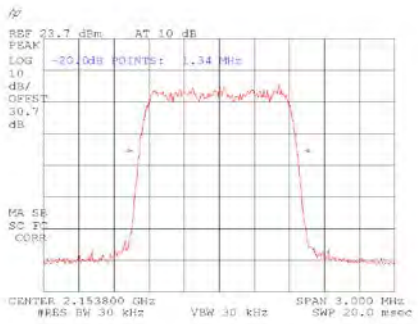


**Figure 125.— CDMA (2153.8 MHz) OUT, Port 2**

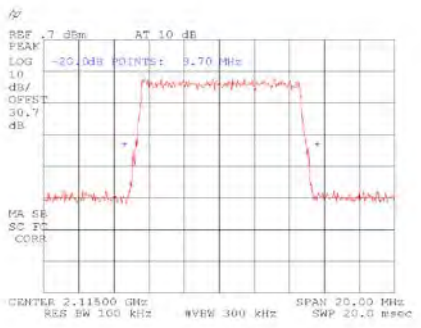


**Figure 126.— LTE 64QAM(2115.0 MHz) IN**

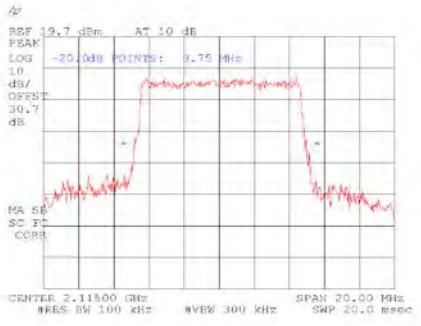


**Figure 127.— LTE 64QAM (2115.0 MHz) OUT, Port 1**

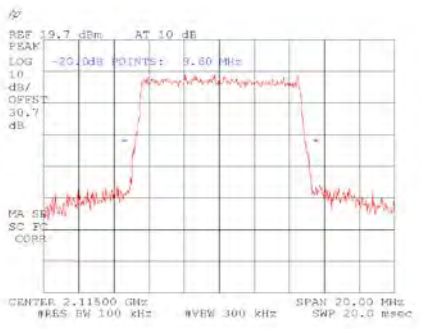


**Figure 128.— LTE 64QAM (2115.0 MHz) OUT, Port 2**

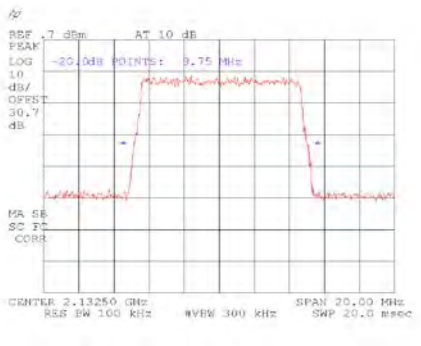


**Figure 129.— LTE 64QAM (2132.5 MHz) IN**

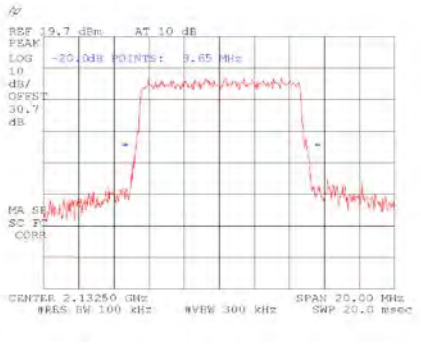


**Figure 130.— LTE 64QAM (2132.5 MHz) OUT, Port 1**

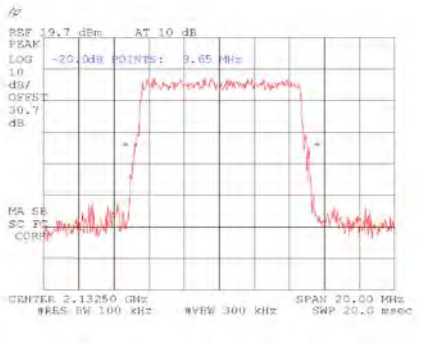


**Figure 131.— LTE 64QAM (2132.5 MHz) OUT, Port 2**

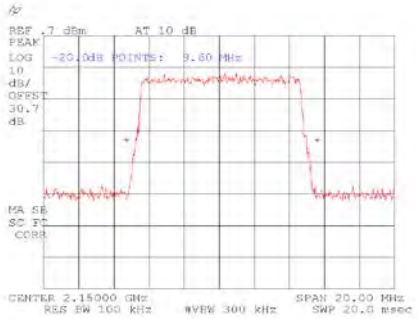


**Figure 132.— LTE 64QAM (2150.0 MHz) IN**

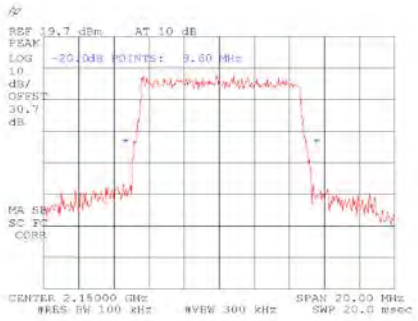


**Figure 133.— LTE 64QAM (2150.0 MHz) OUT, Port 1**

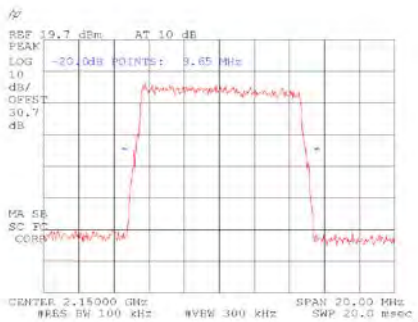


**Figure 134.— LTE 64QAM (2150.0 MHz) OUT, Port 2**

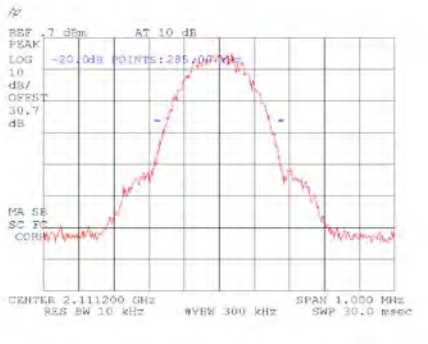


**Figure 135.— GSM (2111.2 MHz) IN**

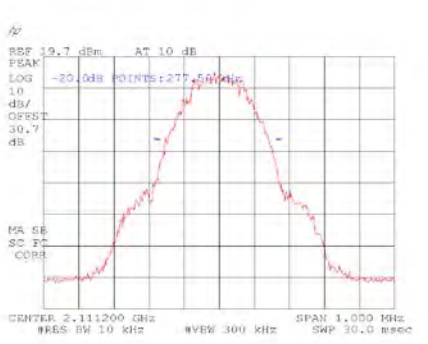


**Figure 136.— GSM (2111.2 MHz) OUT, Port 1**

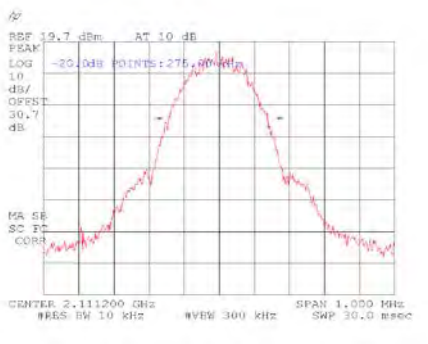


**Figure 137.— GSM (2111.2 MHz) OUT, Port 2**

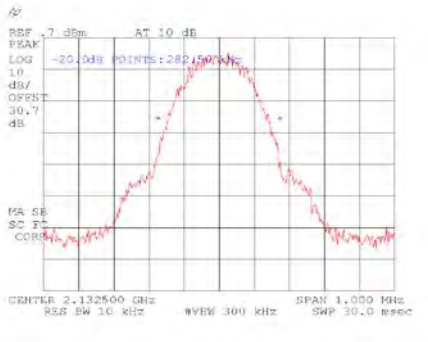


**Figure 138.— GSM (2132.5 MHz) IN**

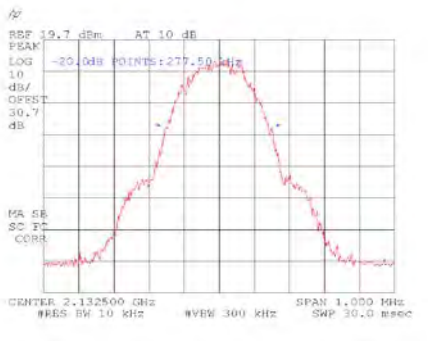


**Figure 139.— GSM (2132.5 MHz) OUT, Port 1**

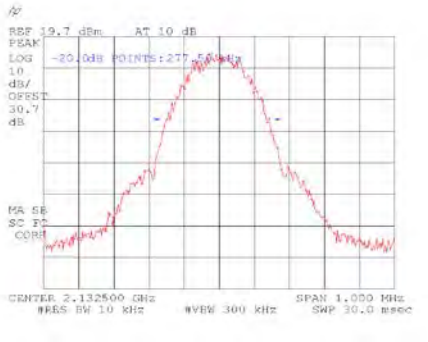


**Figure 140.— GSM (2132.5 MHz) OUT, Port 2**

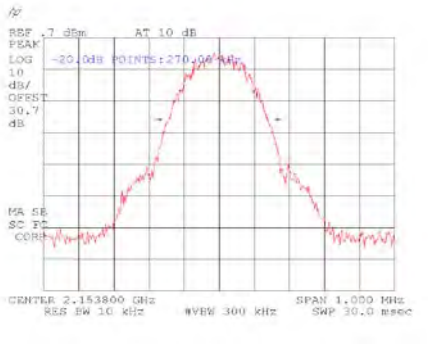


**Figure 141.— GSM (2153.8 MHz) IN**

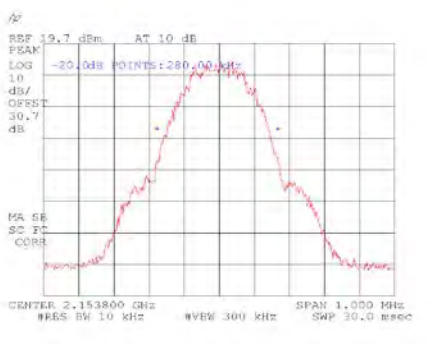


**Figure 142.— GSM (2153.8 MHz) OUT, Port 1**

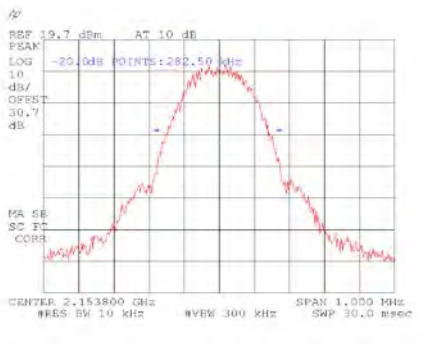


**Figure 143.— GSM (2153.8 MHz) OUT, Port 2**

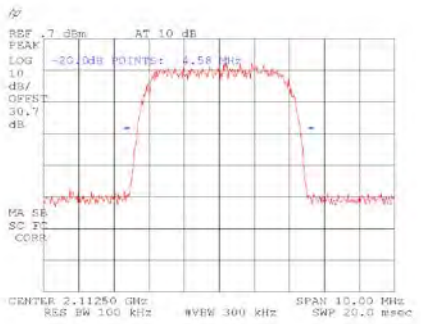


**Figure 144.— W-CDMA (2112.5 MHz) IN**

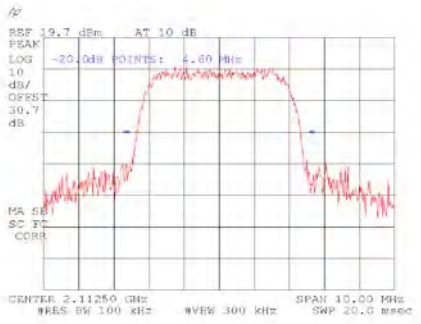


**Figure 145.— W-CDMA (2112.5 MHz) OUT, Port 1**

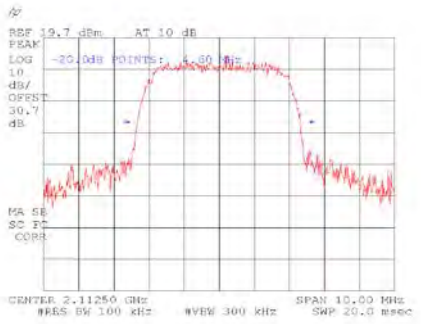


**Figure 146.— W-CDMA (2112.5 MHz) OUT, Port 2**

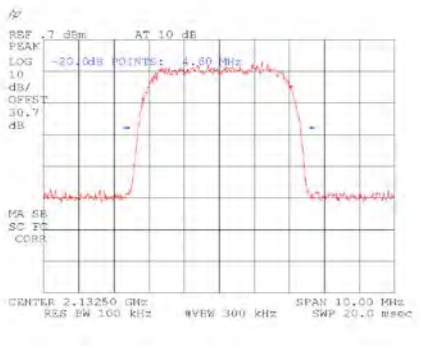


**Figure 147.— W-CDMA (2132.5 MHz) IN**

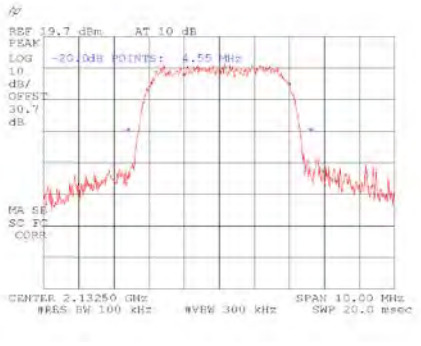


**Figure 148.— W-CDMA (2132.5 MHz) OUT, Port 1**

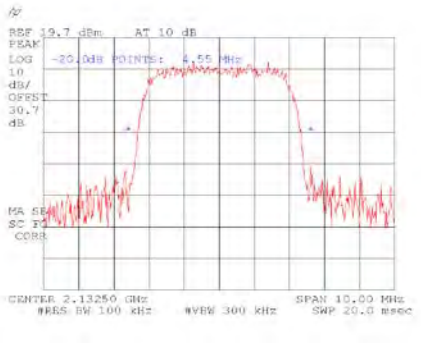


**Figure 149.— W-CDMA (2132.5 MHz) OUT, Port 2**

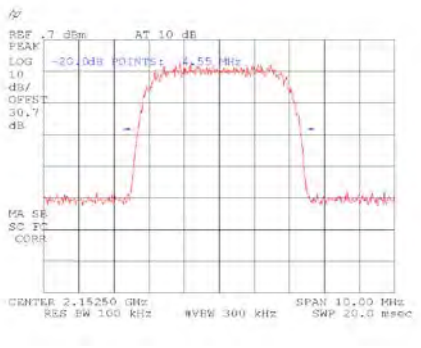


**Figure 150.— W-CDMA (2152.5 MHz) IN**

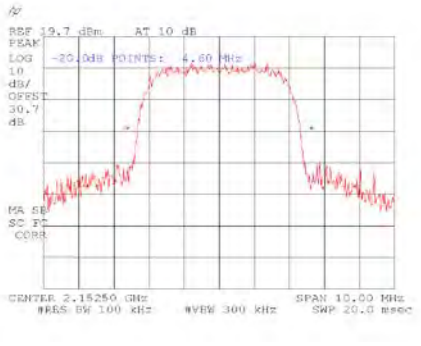


**Figure 151.— W-CDMA (2152.5 MHz) OUT, Port 1**

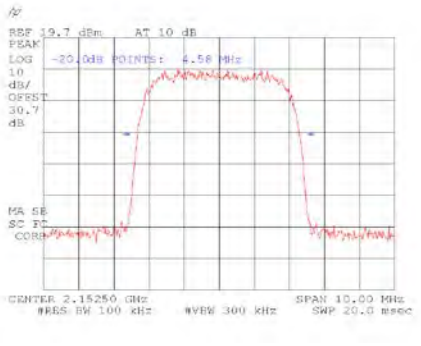


**Figure 152.— W-CDMA (2152.5 MHz) OUT, Port 2**

### *10.4 Test Equipment Used.*

Occupied Bandwidth

| Instrument | Manufacturer | Model | Serial Number | Calibration | |
|---|---|---|---|---|---|
| | | | | Last Calibration | Period |
| Spectrum Analyzer | HP | 8564E | 3442A00275 | February 13, 2013 | 1 year |
| Signal Generator | Agilent | N5172B ATO 10210 | MY51350182 | May 31, 2012 | 2 years |
| Attenuator | Mini-circuit | UNAT-30+ | N/A | April 3, 2013 | 1 year |
| Cable | Mini-circuit | DCB | N/A | April 3, 2013 | 1 year |
| DC Block | MIDWEST MICROWAVE | DCDB-3624-10-NNN-02 | N/A | N/A | N/A |

**Figure 153 Test Equipment Used**

# 11. Spurious Emissions at Antenna Terminals AWS

## *11.1 Test Specification*

FCC Part 27, Subpart C, Section 27.53 (g)

## *11.2 Test procedure*

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 + log (P) dB, yielding –13dBm. The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator and an appropriate coaxial cable (loss = 31.0 dB). The spectrum analyzer was set to 1 kHz resolution BW for the frequency range 9.0-150.0 kHz, 10 kHz for the frequency range 150 kHz–1.0 MHz, 100 kHz for the frequency range 1.0 MHz – 30 MHz, and 1MHz for the frequency range 30 MHz - 22.0 GHz.

## *11.3 Results*

See additional information in Figure 154 to Figure 177.

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: _____ Date: 07.05.013

Typed/Printed Name: A. Sharabi

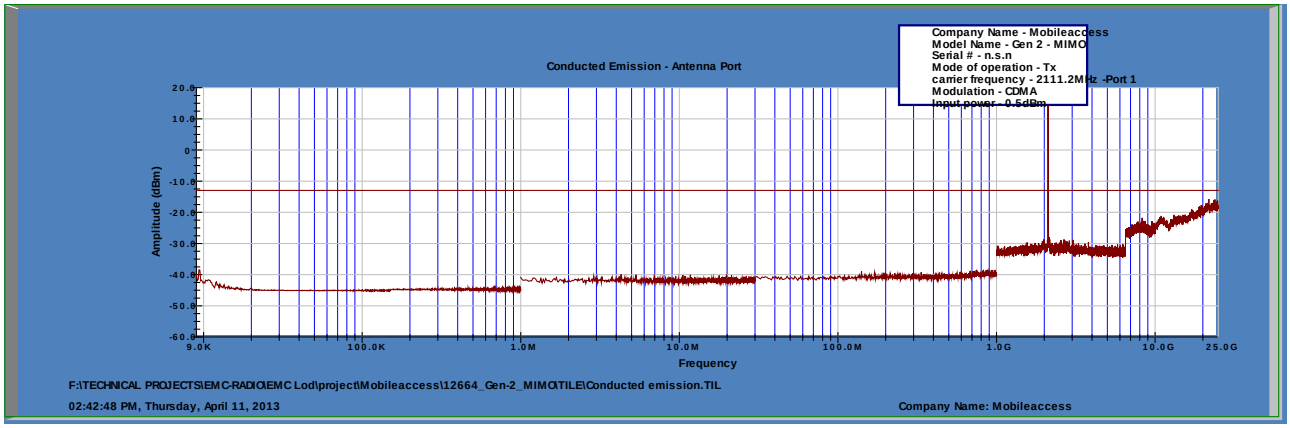


**Figure 154 Spurious Emissions at Antenna Terminals CDMA, 2111.2MHz, Port 1**

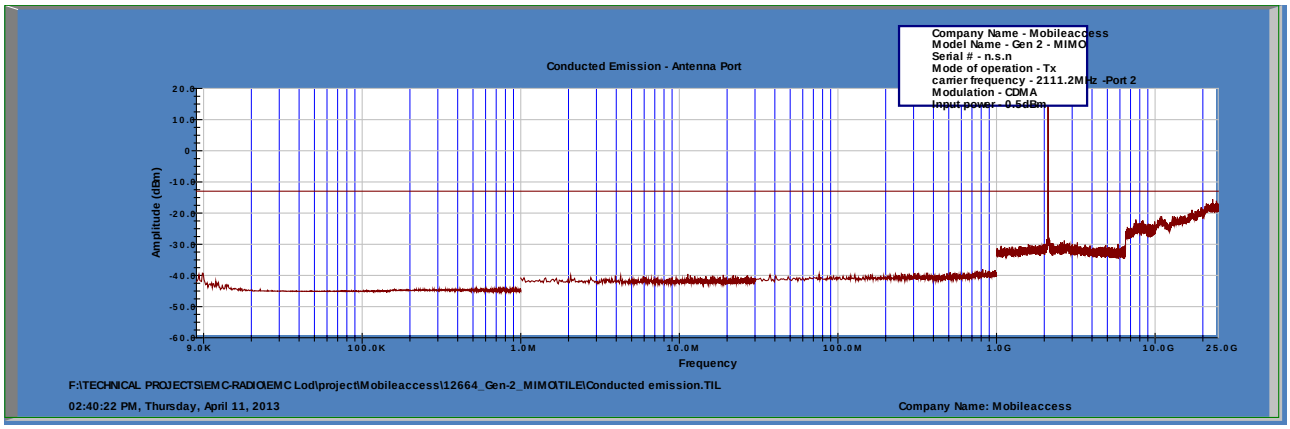


**Figure 155 Spurious Emissions at Antenna Terminals CDMA, 2111.2MHz, Port 2**

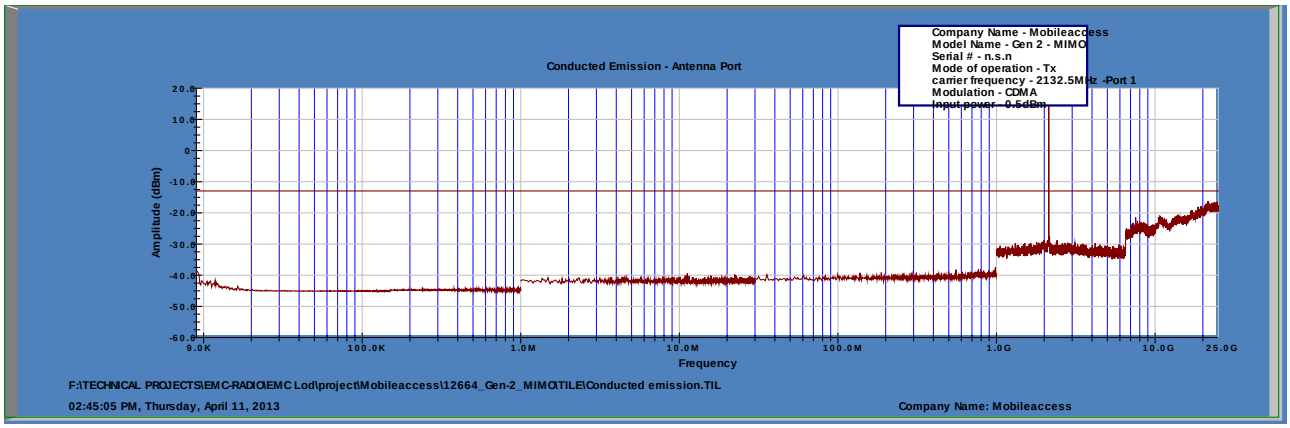


**Figure 156 Spurious Emissions at Antenna Terminals CDMA, 2132.5MHz, Port 1**

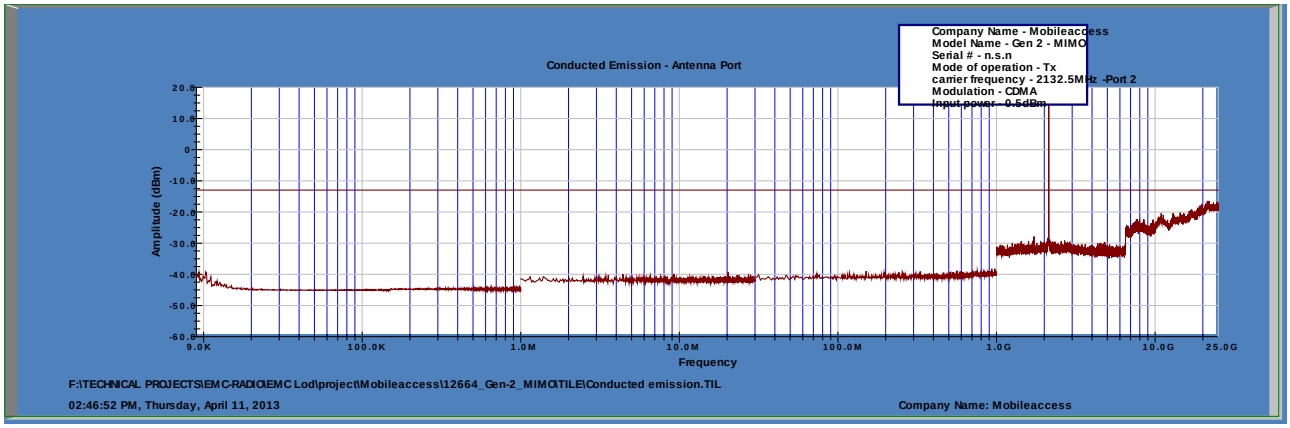


**Figure 157 Spurious Emissions at Antenna Terminals CDMA, 2132.5MHz, Port 2**

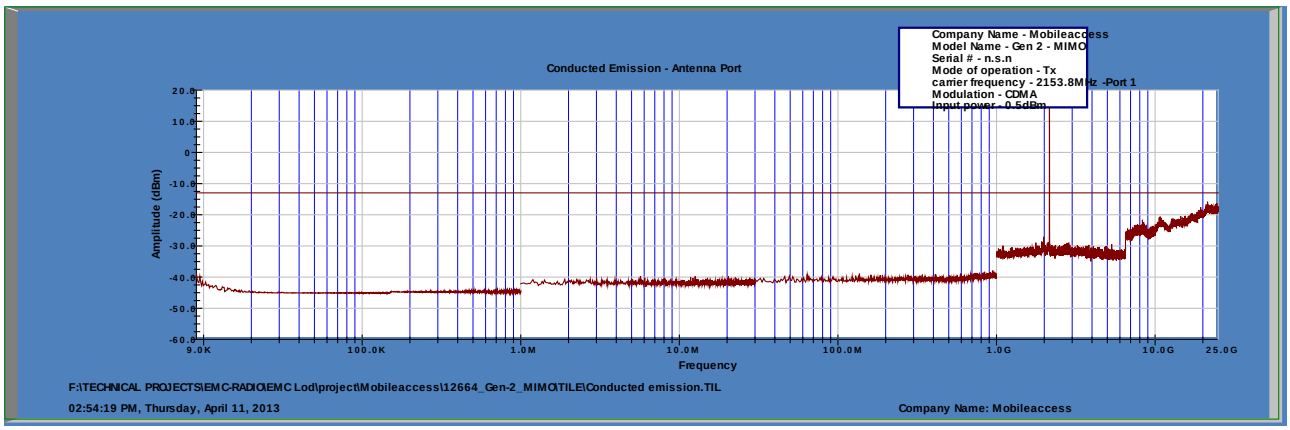


**Figure 158 Spurious Emissions at Antenna Terminals CDMA, 2153.8MHz, Port 1**

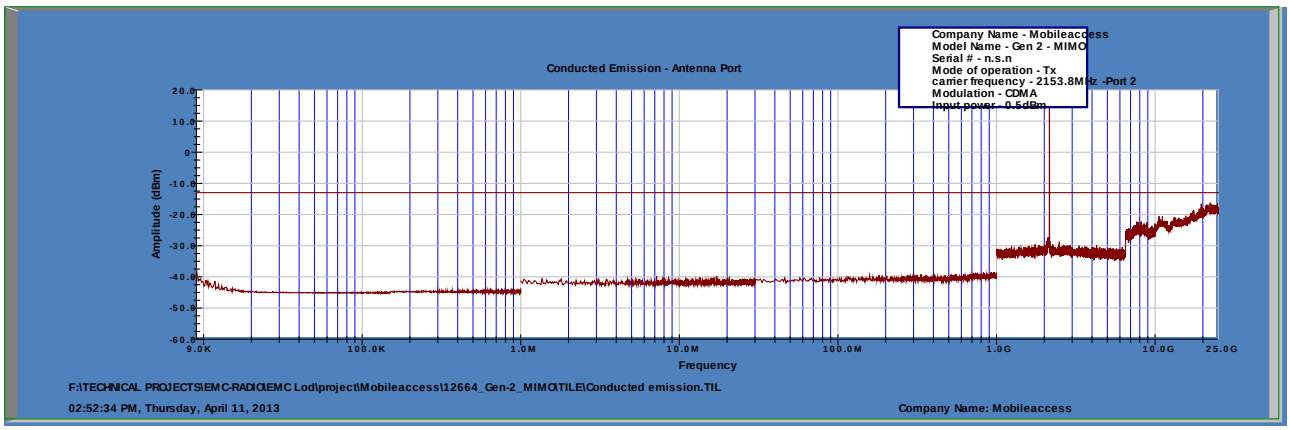


**Figure 159 Spurious Emissions at Antenna Terminals CDMA, 2153.8MHz, Port 2**

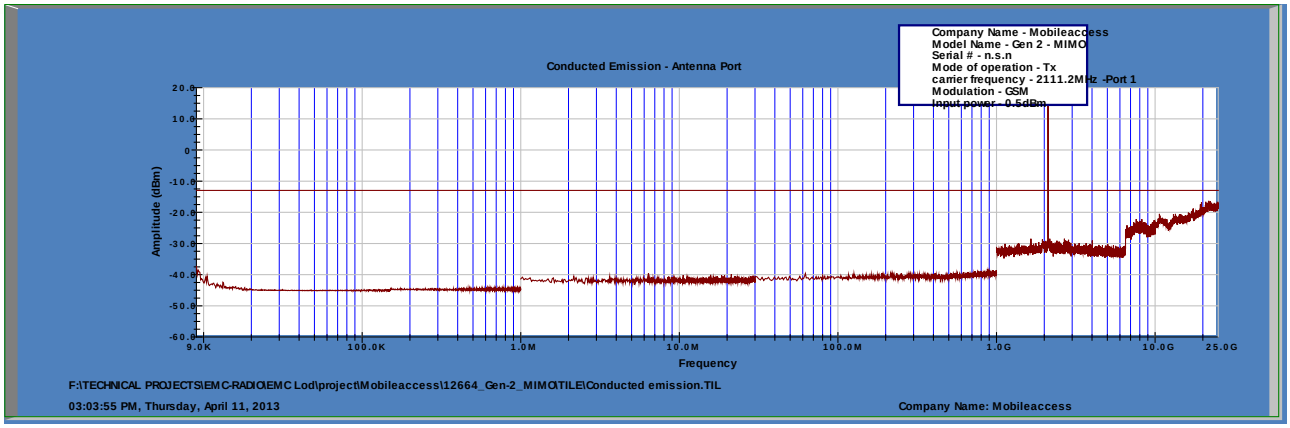


**Figure 160 Spurious Emissions at Antenna Terminals GSM, 2111.2MHz, Port 1**

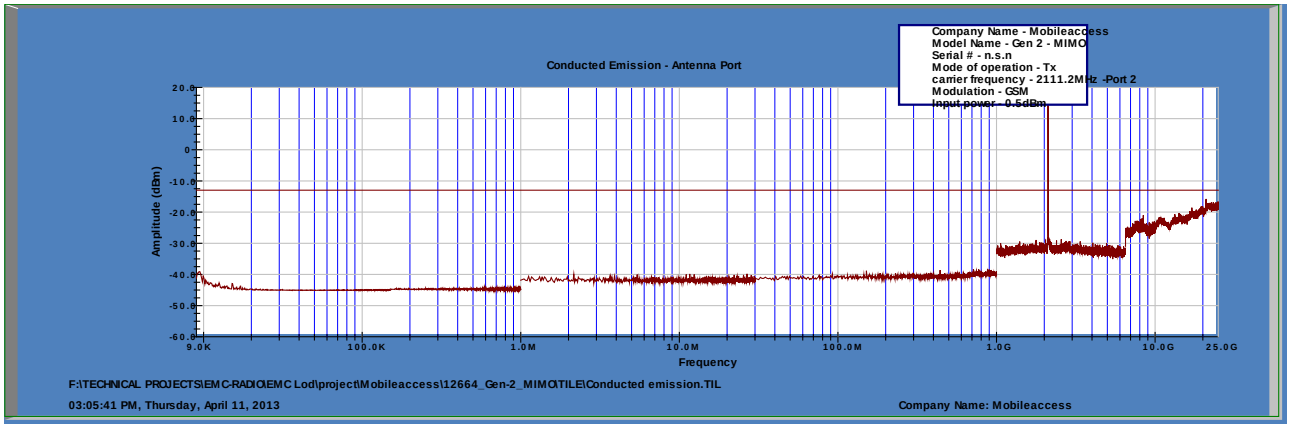


**Figure 161 Spurious Emissions at Antenna Terminals GSM, 2111.2MHz, Port 2**

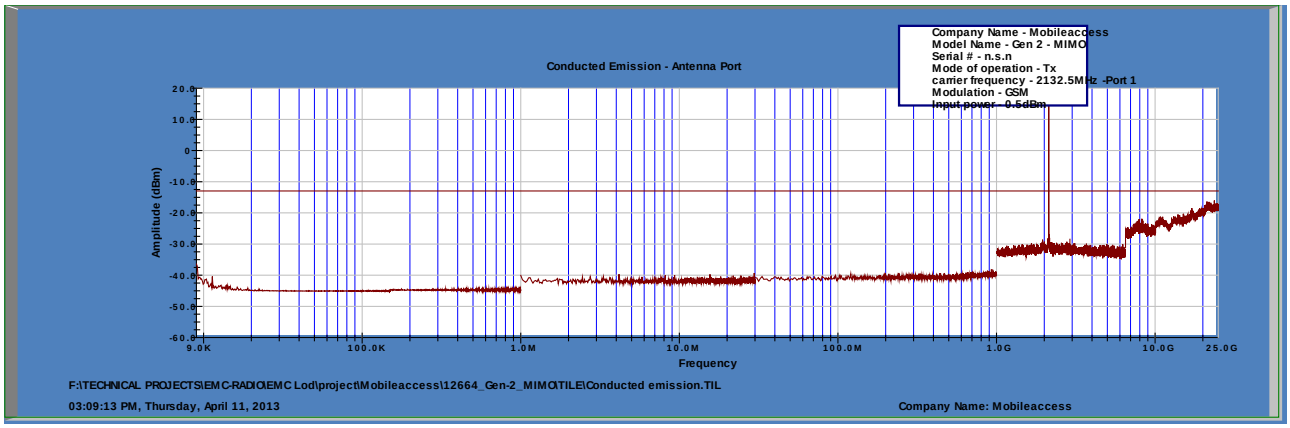


**Figure 162 Spurious Emissions at Antenna Terminals GSM, 2132.5MHz, Port 1**

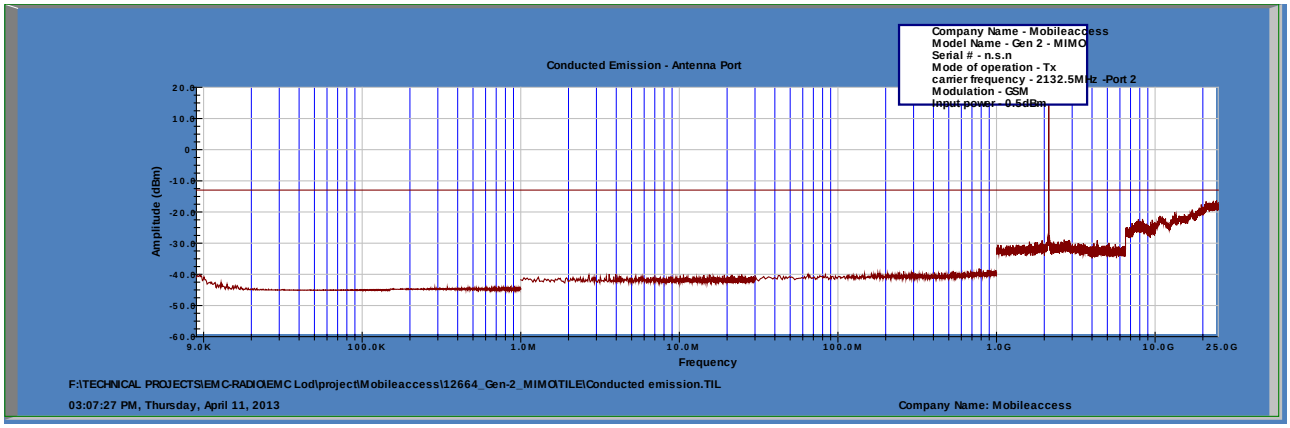


**Figure 163 Spurious Emissions at Antenna Terminals GSM, 2132.5MHz, Port 2**

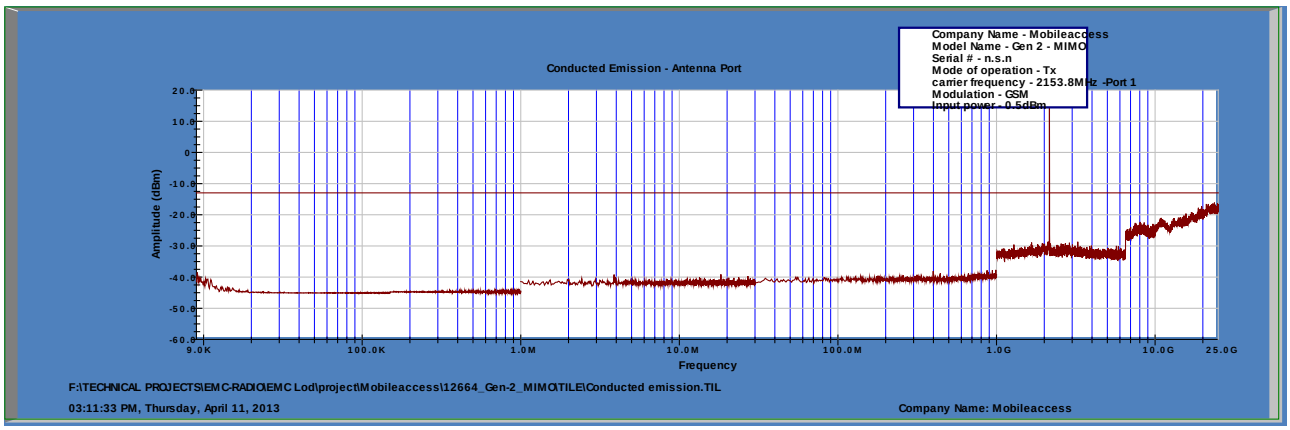


**Figure 164 Spurious Emissions at Antenna Terminals GSM, 2153.8MHz, Port 1**

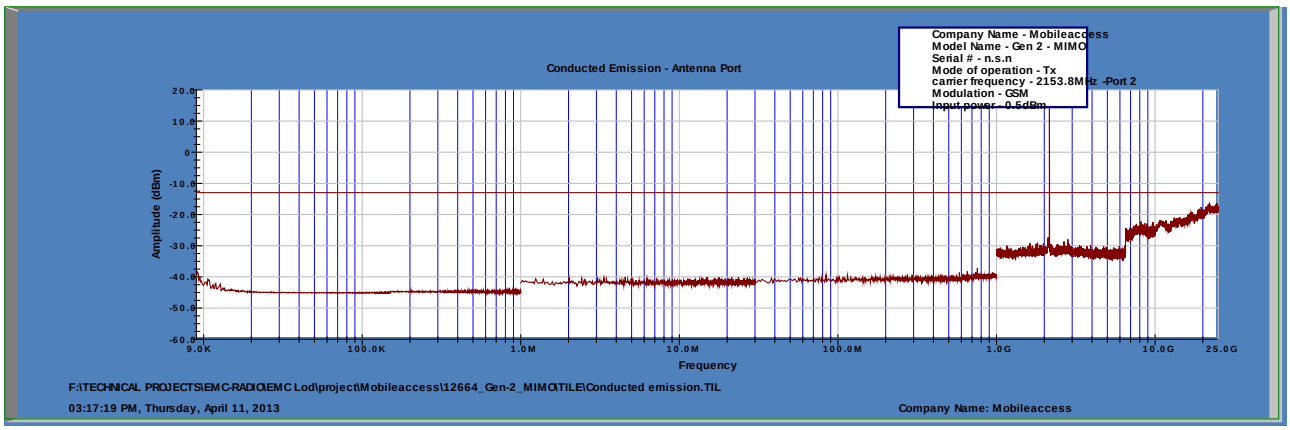


**Figure 165 Spurious Emissions at Antenna Terminals GSM, 2153.8MHz, Port 2**

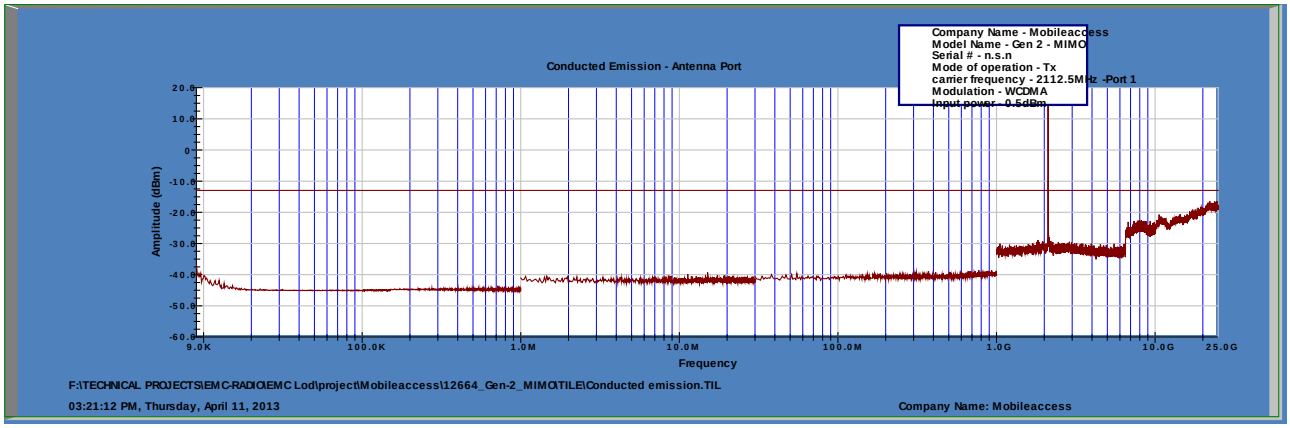


**Figure 166 Spurious Emissions at Antenna Terminals WCDMA, 2112.5MHz, Port 1**

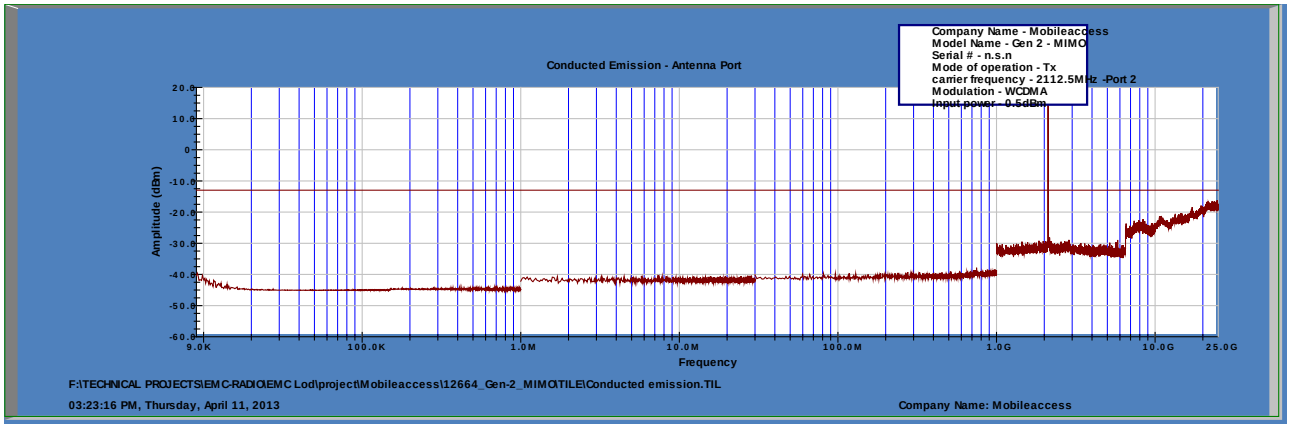


**Figure 167 Spurious Emissions at Antenna Terminals WCDMA, 2112.5MHz, Port 2**

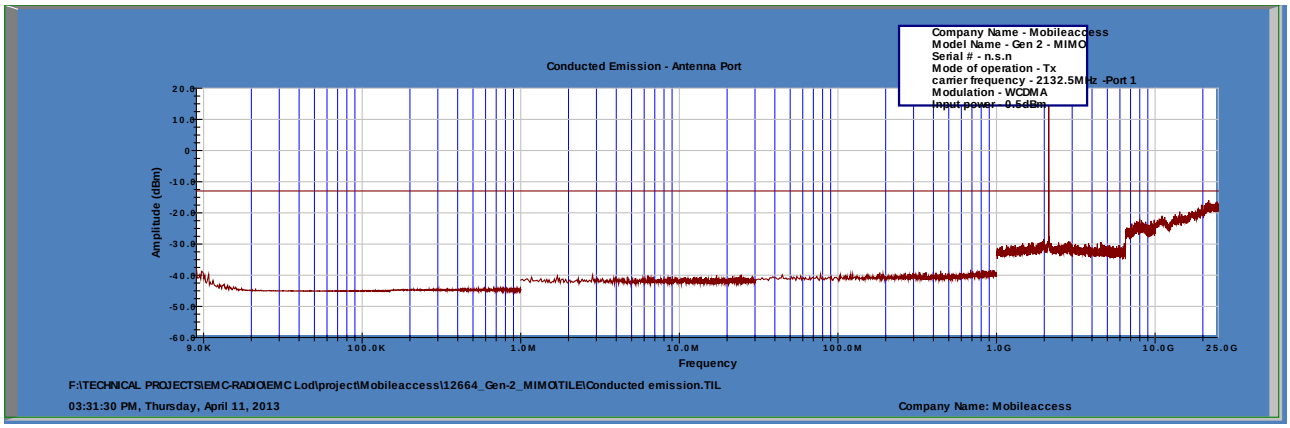


**Figure 168 Spurious Emissions at Antenna Terminals WCDMA, 2132.5MHz, Port 1**

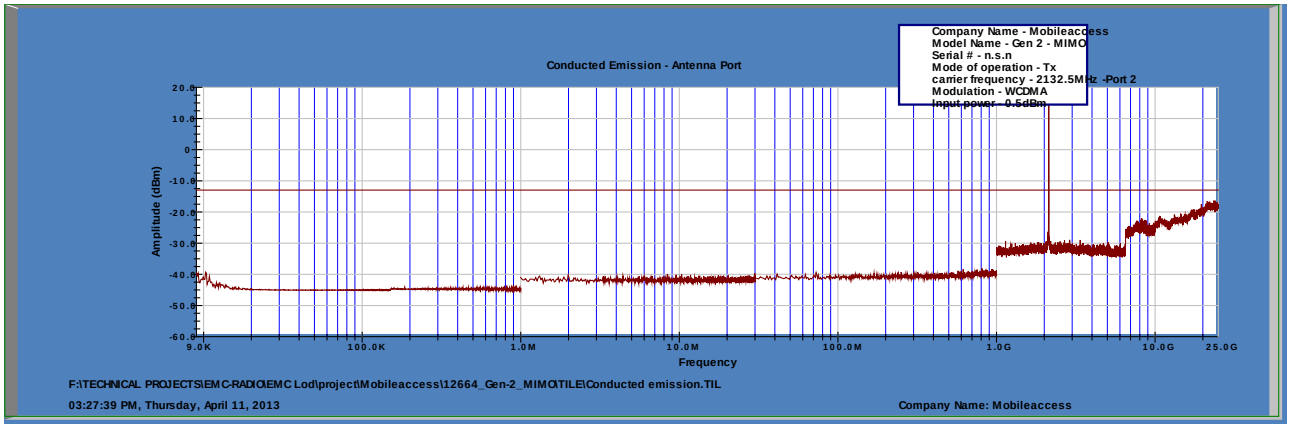


**Figure 169 Spurious Emissions at Antenna Terminals WCDMA, 2132.5MHz, Port 2**

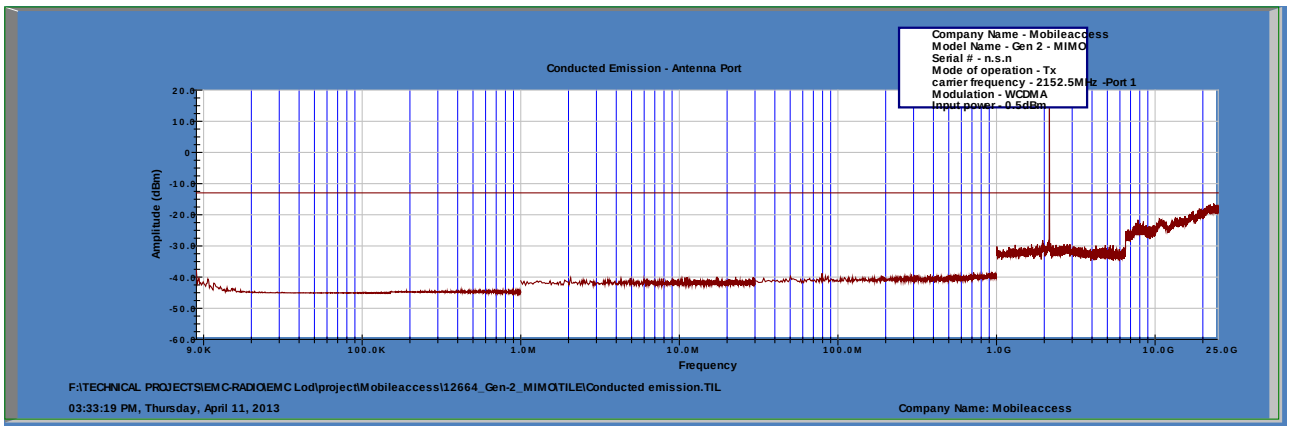


**Figure 170 Spurious Emissions at Antenna Terminals WCDMA, 2152.5MHz, Port 1**

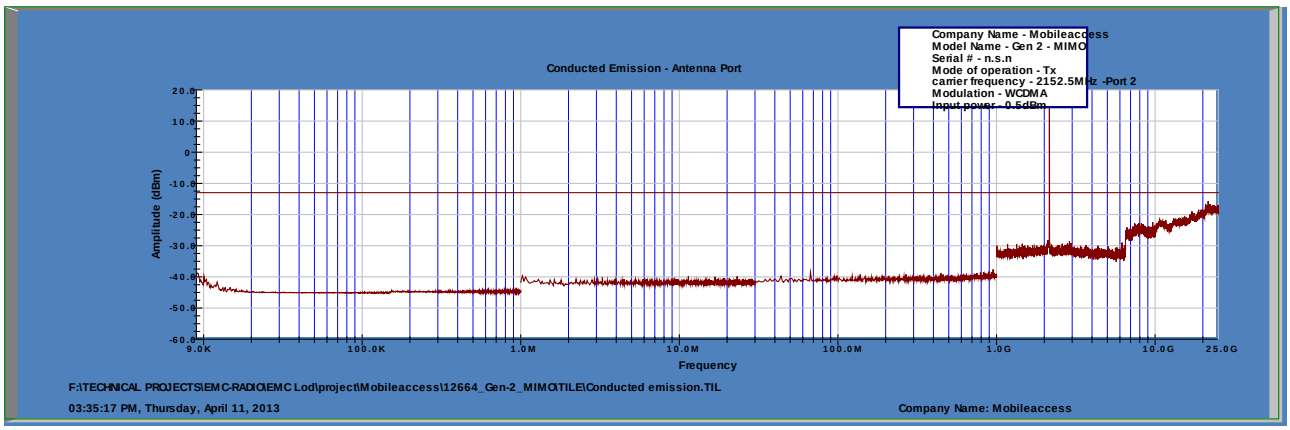


**Figure 171 Spurious Emissions at Antenna Terminals WCDMA, 2152.5MHz, Port 2**

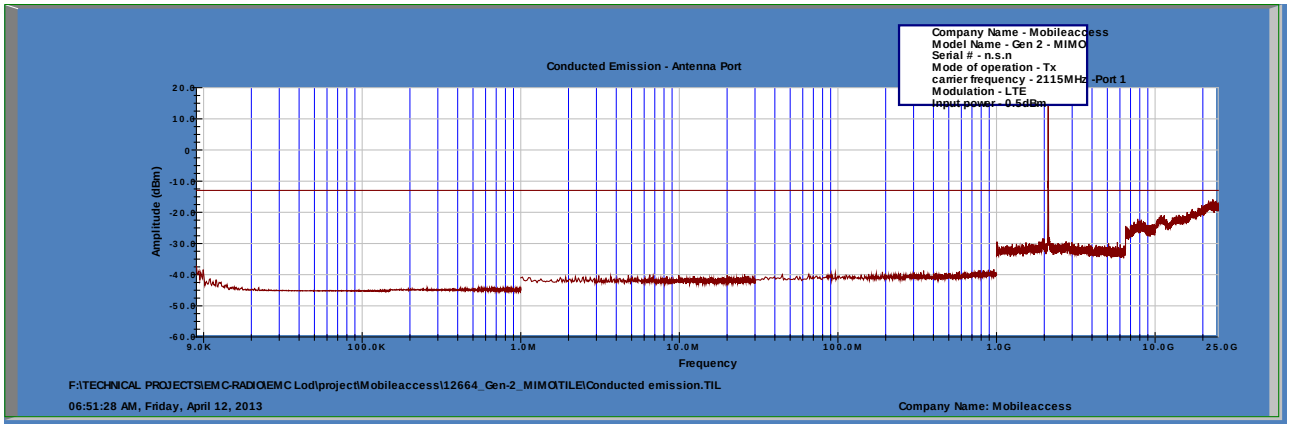


**Figure 172 Spurious Emissions at Antenna Terminals LTE, 2115.0MHz, Port 1**

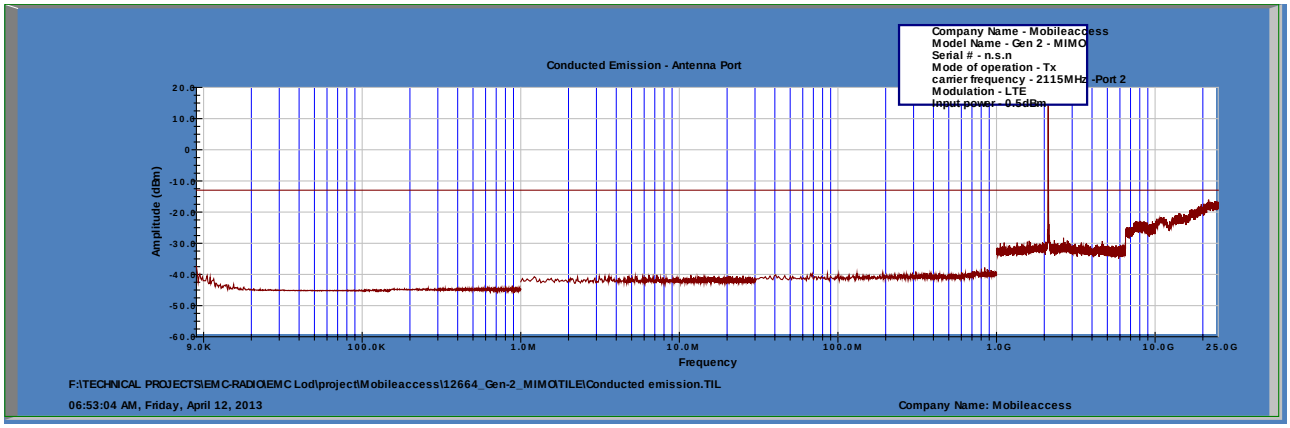


**Figure 173 Spurious Emissions at Antenna Terminals LTE, 2115.0MHz, Port 2**

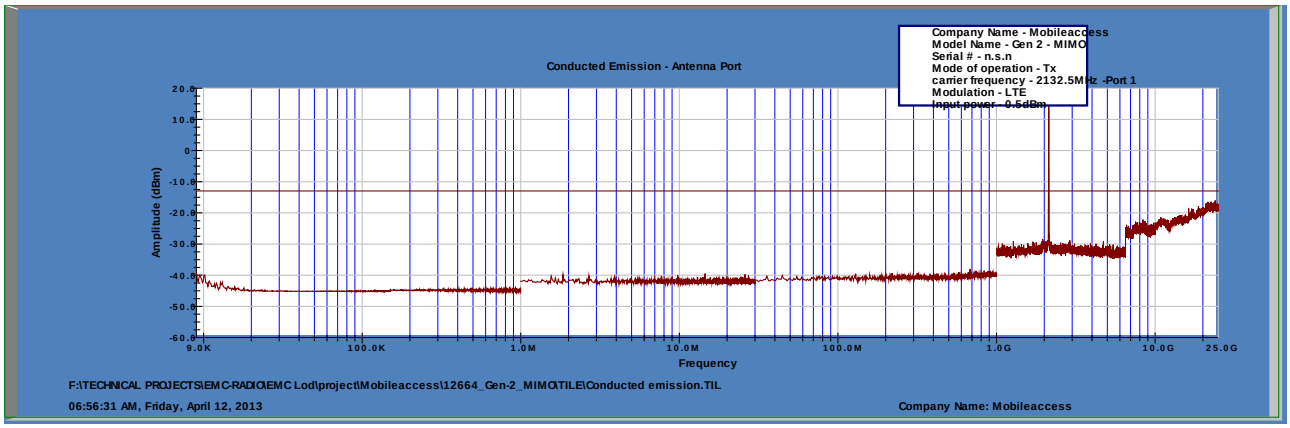


**Figure 174 Spurious Emissions at Antenna Terminals LTE, 2132.5MHz, Port 1**

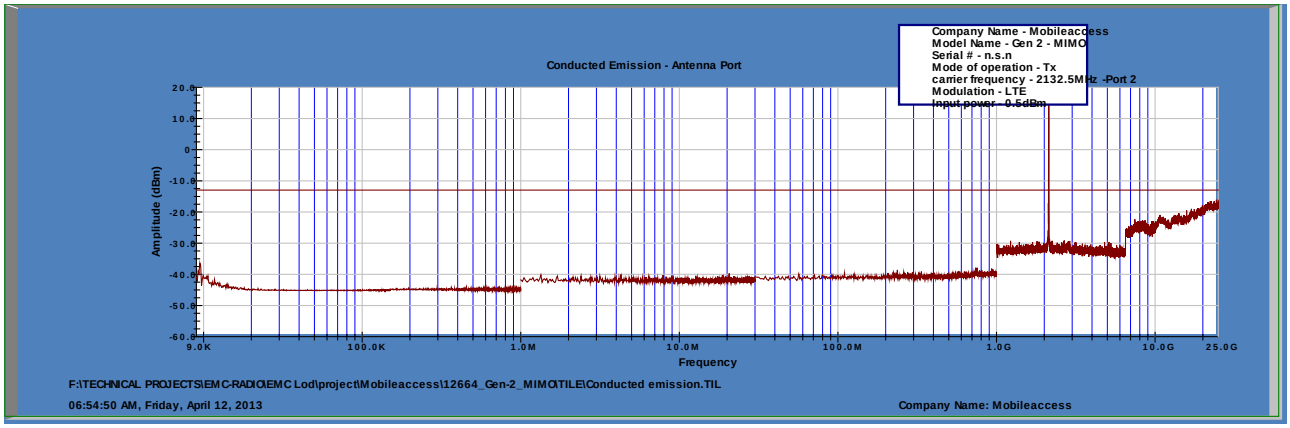


**Figure 175 Spurious Emissions at Antenna Terminals LTE, 2132.5MHz, Port 2**

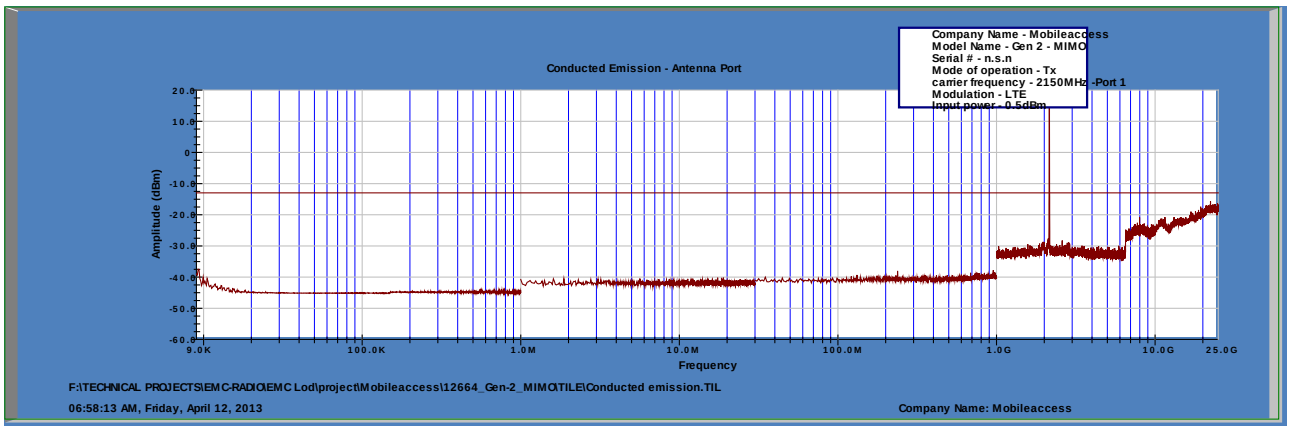


**Figure 176 Spurious Emissions at Antenna Terminals LTE, 2150.0MHz, Port 1**

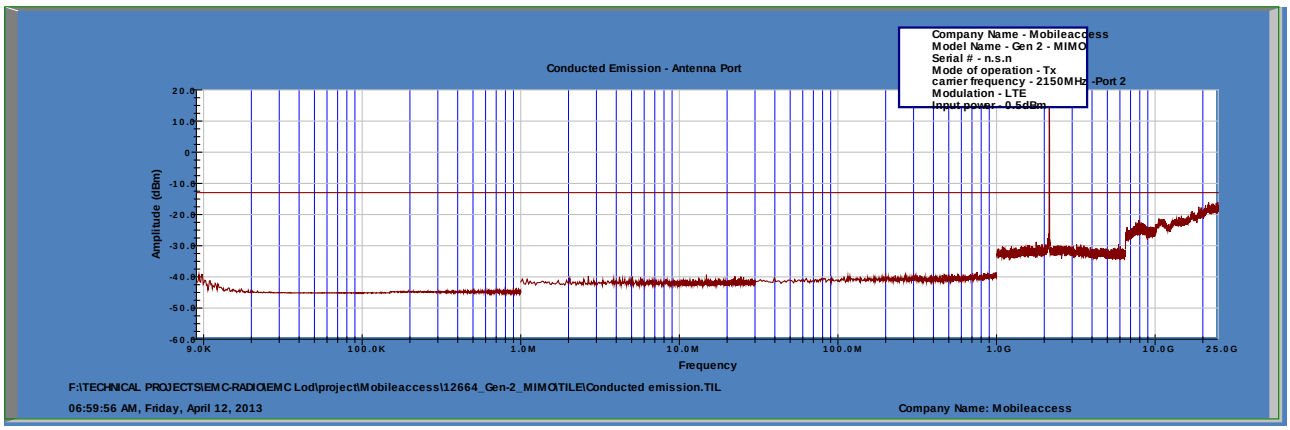


**Figure 177 Spurious Emissions at Antenna Terminals LTE, 2150.0MHz, Port 2**

### *11.4 Test Equipment Used.*

Spurious Emissions at Antenna Terminals AWS

| Instrument | Manufacturer | Model | Serial Number | Calibration | |
|---|---|---|---|---|---|
| | | | | Last Calibration | Period |
| Spectrum Analyzer | HP | 8564E | 3442A00275 | February 13, 2013 | 1 year |
| Signal Generator | Agilent | N5172B ATO 10210 | MY51350182 | May 31, 2012 | 2 years |
| Attenuator | Mini-circuit | UNAT-30+ | N/A | April 3, 2013 | 1 year |
| Cable | Mini-circuit | DCB | N/A | April 3, 2013 | 1 year |
| DC Block | MIDWEST MICROWAVE | DCDB-3624-10-NNN-02 | N/A | N/A | N/A |

**Figure 178 Test Equipment Used**

# 12. Band Edge Spectrum AWS

## 12.1 Test Specification

FCC Part 27, Subpart C, Section 27.53 (m 4-6)

## 12.2 Test procedure

Enclosed are spectrum analyzer plots for the lowest operation frequency and the highest operation frequency in which the E.U.T. is planned to be used.

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 + log (P) dB, yielding –13dBm.
The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator and an appropriate coaxial cable (loss = 30.7 dB).

## 12.3 Test Results

| Modulation | Operation Frequency (MHz) | Band Edge Frequency (MHz) | Reading Port 1 (dBm) | Reading Port 2 (dBm) | Specification (dBm) | Port 1 Margin (dB) | Port 2 Margin (dB) |
|---|---|---|---|---|---|---|---|
| CDMA | 2111.2 | 2110.00 | -19.72 | -18.74 | -13.0 | -6.72 | -5.74 |
| CDMA | 2153.8 | 2155.00 | -21.70 | -39.67 | -13.0 | -8.7 | -26.67 |
| LTE 64QAM | 2115.0 | 2110.00 | -19.28 | -19.35 | -13.0 | -6.28 | -6.35 |
| LTE 64QAM | 2150.0 | 2155.00 | -17.62 | -21.91 | -13.0 | -4.62 | -8.91 |
| GSM | 2111.2 | 2110.00 | -41.10 | -40.77 | -13.0 | -28.1 | -27.77 |
| GSM | 2153.8 | 2155.00 | -42.30 | -44.85 | -13.0 | -29.3 | -31.85 |
| W-CDMA | 2112.5 | 2110.00 | -20.85 | -18.77 | -13.0 | -7.85 | -5.77 |
| W-CDMA | 2152.5 | 2155.00 | -19.37 | -34.59 | -13.0 | -6.37 | -21.59 |

**Figure 179 Band Edge Spectrum Results AWS**

See additional information in Figure 180 to Figure 195.

JUDGEMENT: Passed by 4.62 dB

TEST PERSONNEL:

Tester Signature: _____ Date: 07.05.013

Typed/Printed Name: A. Sharabi

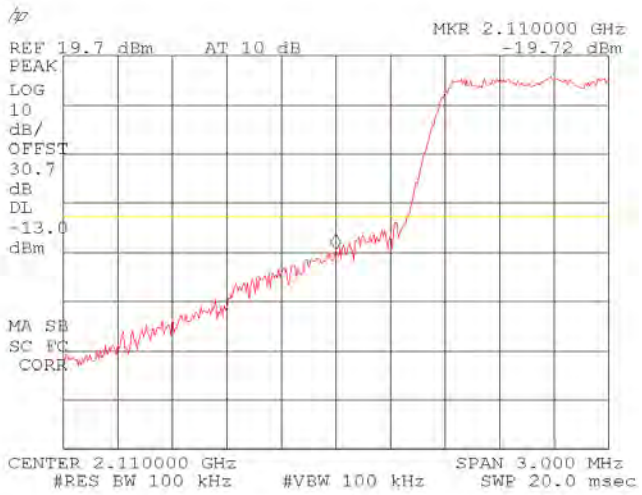


**Figure 180.— CDMA 2111.20 MHz, Port 1**

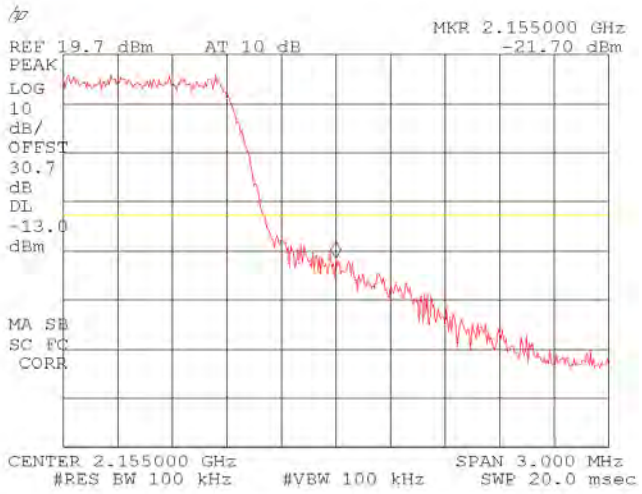


**Figure 181.— CDMA 2153.80 MHz, Port 1**

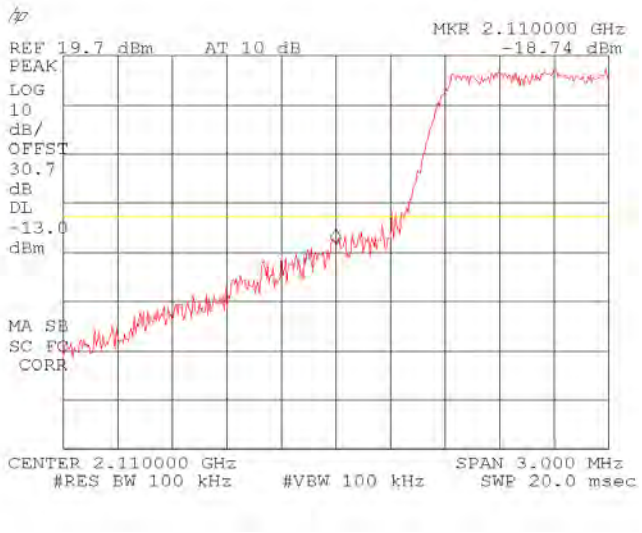


**Figure 182.— CDMA 2111.20 MHz, Port 2**

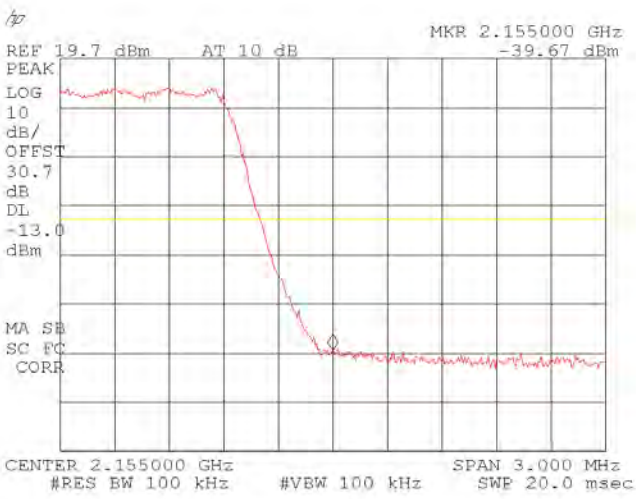


**Figure 183.— CDMA 2153.80 MHz, Port 2**

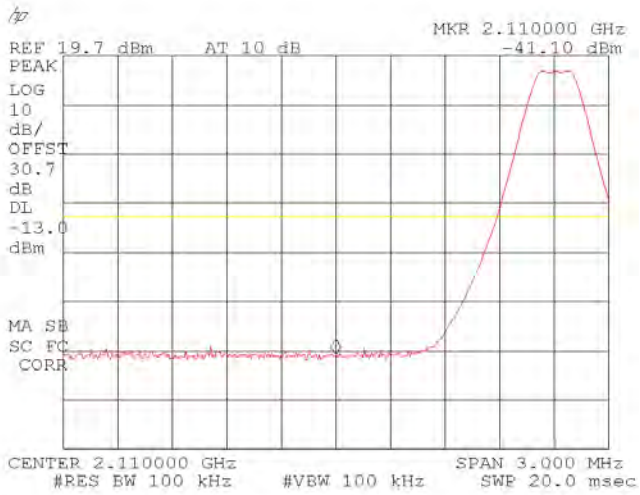


**Figure 184.— GSM 2111.20 MHz, Port 1**

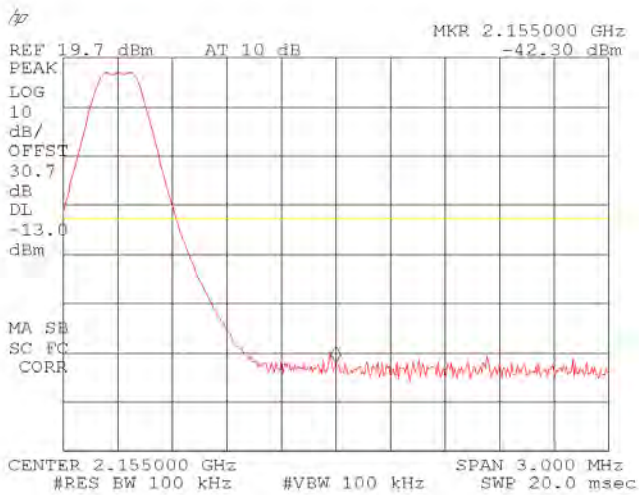


**Figure 185.— GSM 2153.80 MHz, Port 1**

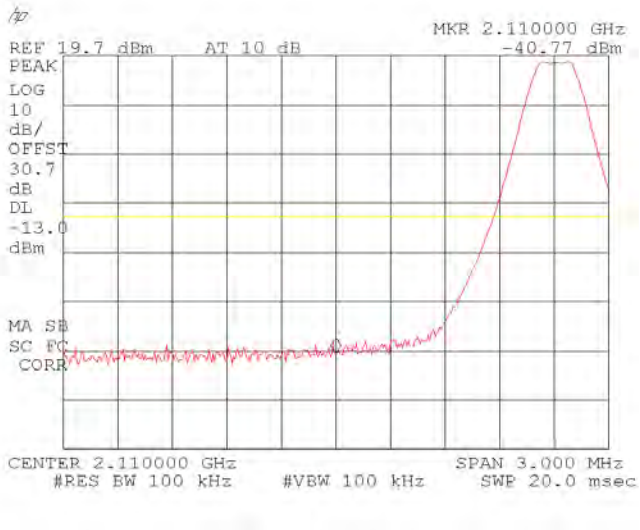


**Figure 186.— GSM 2111.20 MHz, Port 2**

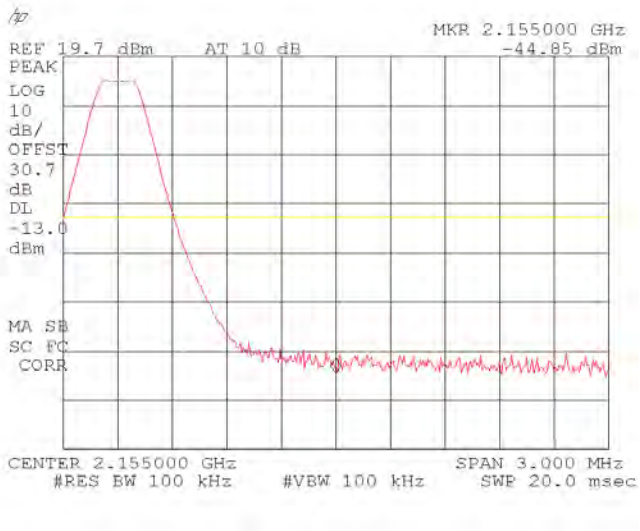


**Figure 187.— GSM 2153.80 MHz, Port 2**

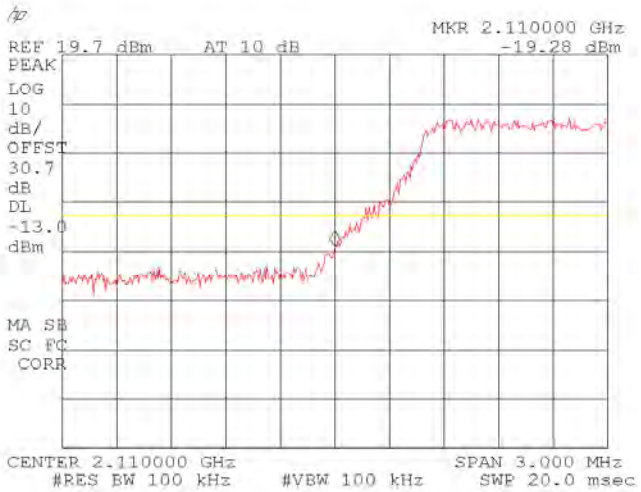


**Figure 188.— LTE 64QAM 2115.00 MHz, Port 1**

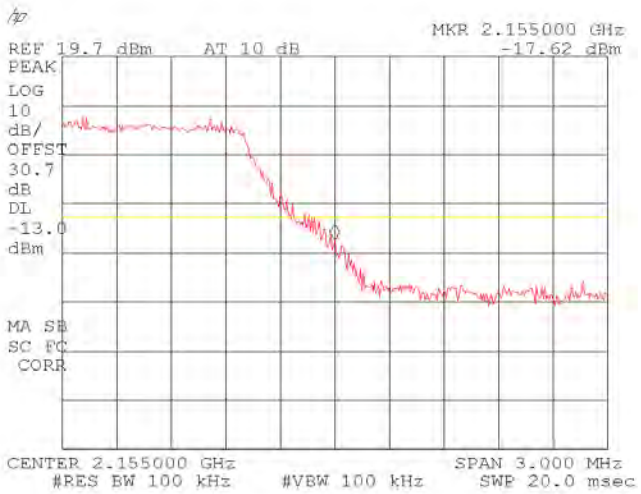


**Figure 189.— LTE 64QAM 2150.00 MHz, Port 1**

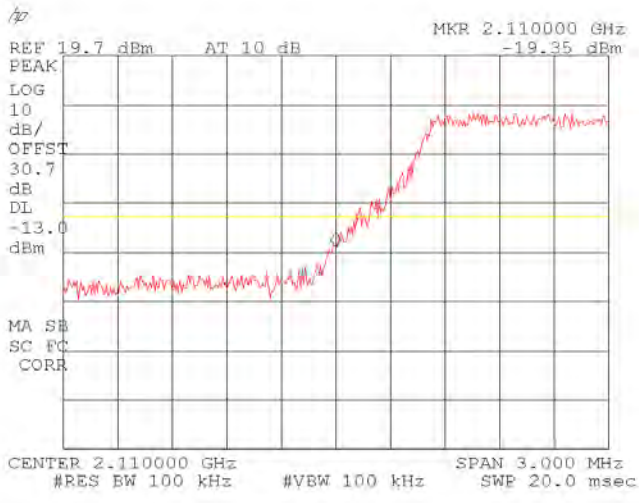


**Figure 190.— LTE 64QAM 2115.00 MHz, Port 2**

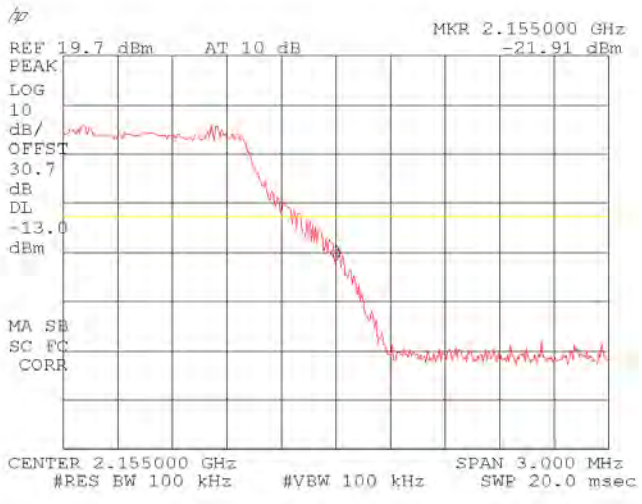


**Figure 191.— LTE 64QAM 2150.00 MHz, Port 2**

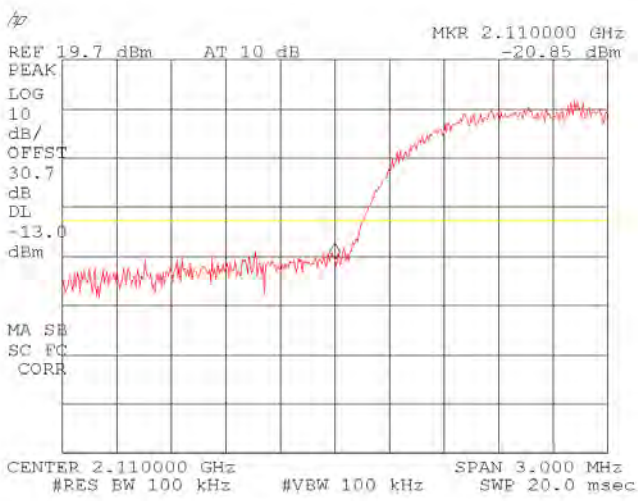


**Figure 192.— W-CDMA 2112.50 MHz, Port 1**

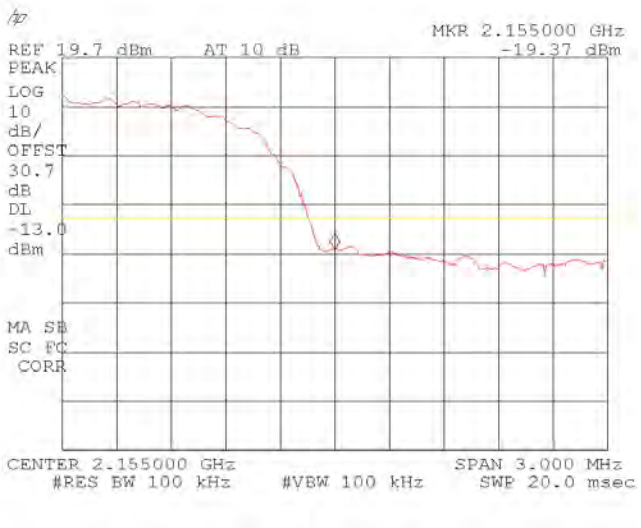


**Figure 193.— W-CDMA 2152.50 MHz, Port 1**

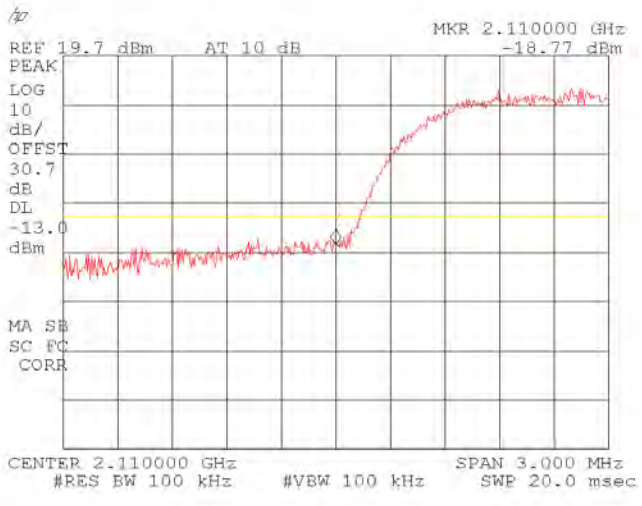


**Figure 194.— W-CDMA 2112.50 MHz, Port 2**

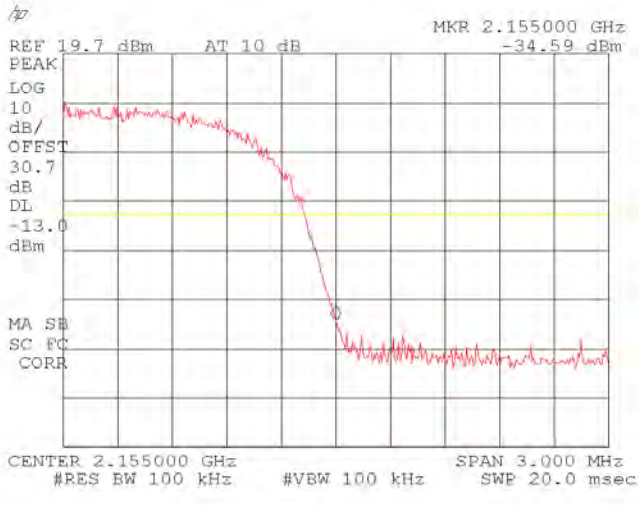


**Figure 195.— W-CDMA 2152.50 MHz, Port 2**

### *12.4 Test Equipment Used.*

Band Edge Spectrum AWS

| Instrument | Manufacturer | Model | Serial Number | Calibration | |
|---|---|---|---|---|---|
| | | | | Last Calibration | Period |
| Spectrum Analyzer | HP | 8564E | 3442A00275 | February 13, 2013 | 1 year |
| Signal Generator | Agilent | N5172B ATO 10210 | MY51350182 | May 31, 2012 | 2 years |
| Attenuator | Mini-circuit | UNAT-30+ | N/A | April 3, 2013 | 1 year |
| Cable | Mini-circuit | DCB | N/A | April 3, 2013 | 1 year |
| DC Block | MIDWEST MICROWAVE | DCDB-3624-10-NNN-02 | N/A | N/A | N/A |

**Figure 196 Test Equipment Used**

# 13. Spurious Radiated Emission AWS

## 13.1 Test Specification

FCC, Part 27, Subpart C Section 27.53 (g)

## 13.2 Test Procedure

The test method was based on ANSI/TIA-603-C: 2004, Section 2.2.12 Unwanted Emissions: Radiated Spurious.
The power of any emission outside of the authorized operating frequency ranges (2110-2155 MHz) must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log (P) dB, yielding –13dBm.

(a) The E.U.T. operation mode and test set-up are as described in Section 2. A preliminary measurement to characterize the E.U.T was performed inside the shielded room at a distance of 3 meters, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground. The configuration tested is shown in Figure 1.
The frequency range 9 kHz-20 GHz was scanned, and the list of the highest emissions was verified and updated accordingly.
The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.
The emissions were measured at a distance of 3 meters.

(c) The E.U.T. was replaced by a substitution antenna (dipole 30MHz-1GHz, Horn Antenna above 1GHz) driven by a signal generator. The height was readjusted for maximum reading. The signal generator level was adjusted to obtain the same reading on the EMI receiver as in step (a).
The signals observed in step (a) were converted to radiated power using:
$P_d(dBm) = P_g(dBm) – Cable\ Loss\ (dB) + Substitution\ Antenna\ Gain\ (dB)$
$P_d$ = Dipole equivalent power (result).
$P_g$ = Signal generator output level.

## 13.3 Test Results

| Carrier Channel (MHz) | Freq. (MHz) | Antenna Pol. | Maximum Peak Level (dBµV/m) | Signal Generator RF Output (dBm) | Cable Loss (dB) | Antenna Gain (dBi) | Effective Radiated Power Level (dBm) | Spec. (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 2111.20 | 4222.4 | V | 51.9 | -51.49 | 4.45 | 9.12 | -46.82 | -13.0 | -33.82 |
| 2111.20 | 4222.4 | H | 52.9 | -50.25 | 4.45 | 9.12 | -45.58 | -13.0 | -32.58 |
| 2135.00 | 4270.0 | V | 52.4 | -51.67 | 4.45 | 9.38 | -46.74 | -13.0 | -33.74 |
| 2135.00 | 4270.0 | H | 51.7 | -51.91 | 4.45 | 9.38 | -46.98 | -13.0 | -33.98 |
| 2153.80 | 4307.6 | V | 52.2 | -51.87 | 4.45 | 9.38 | -46.94 | -13.0 | -33.94 |
| 2153.80 | 4307.6 | H | 51.9 | -51.71 | 4.45 | 9.38 | -46.78 | -13.0 | -33.78 |

**Figure 197 Spurious Radiated Emission AWS**

JUDGEMENT: Passed by 32.58 dB

The E.U.T met the requirements of the FCC, Part 27, Subpart C, Section 27.53 (g) specifications.

TEST PERSONNEL:

Tester Signature: _____ Date: 07.05.13

Typed/Printed Name: A. Sharabi

### *13.4 Test Instrumentation Used, Radiated Measurements AWS*

| Instrument | Manufacturer | Model | Serial Number | Calibration | Period |
|---|---|---|---|---|---|
| Spectrum Analyzer | HP | 8564E | 3442A00275 | February 13, 2013 | 1 year |
| Signal Generator | Agilent | N5172B ATO 10210 | MY51350182 | May 31, 2012 | 2 years |
| Signal Generator | Agilent | N5182A | MY50141213 | July 9, 2012 | 1 year |
| Signal Generator | Agilent | 83731B | US37100653 | October 23, 2012 | 1 year |
| Signal Generator | Agilent | 8647A | 3625U00686 | March 5, 2012 | 2 years |
| Attenuator | Mini-circuit | UNAT-30+ | N/A | April 3, 2013 | 1 year |
| Cable | Mini-circuit | DCB | N/A | April 3, 2013 | 1 year |
| DC Block | MIDWEST MICROWAVE | DCDB-3624-10-NNN-02 | N/A | N/A | N/A |

**Figure 198 Test Equipment Used**

# 14. Intermodulation Conducted

## 14.1 Test procedure

The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator and an appropriate coaxial cable(loss = 31.0 dB). The spectrum analyzer was set to 1 kHz resolution BW for the frequency range 9.0-150.0 kHz, 10 kHz for the frequency range 150 kHz–1.0 MHz, 100 kHz for the frequency range 1.0 MHz – 30 MHz, and 1MHz for the frequency range 30 MHz - 22.0 GHz.

4 input signals were sent simultaneously to the E.U.T. as follows:

LTE 747 MHz QPSK 0 dBm

CELL 811 MHz CW 0 dBm

PCS 1960 MHz CW 0 dBm

AWS: 2135 MHz W-CDMA 0 dBm

The frequency range of 9 kHz – 26.0GHz was scanned for unwanted signals.

## 14.2 Test Results

See additional information in Figure 199 to Figure 200.

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: _____ Date: 07.05.13

Typed/Printed Name: A. Sharabi

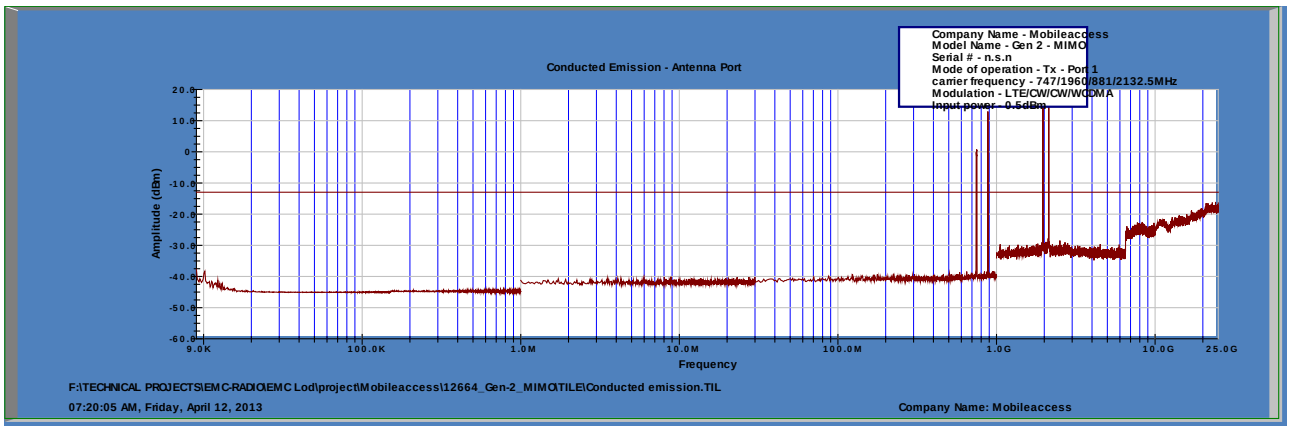


**Figure 199 Intermodulation, Port 1**

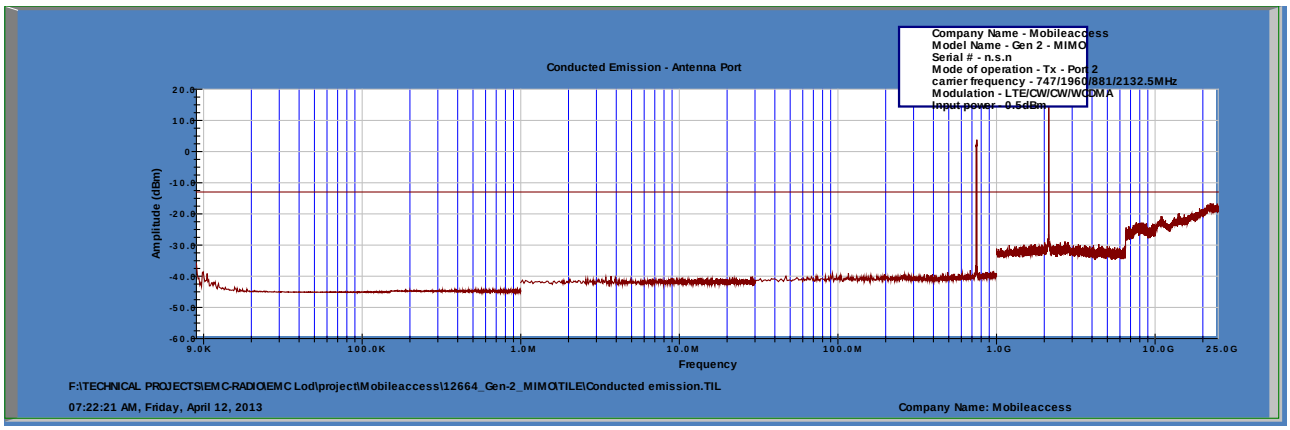


**Figure 200 Intermodulation, Port 2**

### *14.3 Test Equipment Used.*

Intermodulation Conducted

| Instrument | Manufacturer | Model | Serial Number | Calibration | |
|---|---|---|---|---|---|
| | | | | Last Calibration | Period |
| Spectrum Analyzer | HP | 8564E | 3442A00275 | February 13, 2013 | 1 year |
| Signal Generator | Agilent | N5172B ATO 10210 | MY51350182 | May 31, 2012 | 2 years |
| Attenuator | Mini-circuit | UNAT-30+ | N/A | April 3, 2013 | 1 year |
| Cable | Mini-circuit | DCB | N/A | April 3, 2013 | 1 year |
| DC Block | MIDWEST MICROWAVE | DCDB-3624-10-NNN-02 | N/A | N/A | N/A |

**Figure 201 Test Equipment Used**

# 15. Intermodulation Radiated

## 15.1 Test procedure

The test method was based on ANSI/TIA-603-C: 2004, Section 2.2.12 Unwanted Emissions: Radiated Spurious.
The power of any emission outside of the authorized operating frequency ranges (728-758; 869-894; 1930-1990; 2110-2155 MHz) must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log (P) dB, yielding –13dBm.

(a) The E.U.T. operation mode and test set-up are as described in Section 2.
A preliminary measurement to characterize the E.U.T was performed inside the shielded room at a distance of 3 meters, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground. The configuration tested is shown in Figure 1.

The E.U.T. was operated in Downlink mode at 4 different channels at center frequency of each band at the same time, transmitting at CW signal.

(b) The frequency range 9 kHz-25 GHz was scanned, and the list of the highest emissions was verified and updated accordingly. The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.
The emissions were measured at a distance of 3 meters.

(d) The E.U.T. was replaced by a substitution antenna (dipole 30MHz-1GHz, Horn Antenna above 1GHz) driven by a signal generator. The height was readjusted for maximum reading. The signal generator level was adjusted to obtain the same reading on the EMI receiver as in step (a).
The signals observed in step (a) were converted to radiated power using:
$P_d$(dBm) = $P_g$(dBm) – Cable Loss (dB) + Substitution Antenna Gain (dB)
$P_d$ = Dipole equivalent power (result).
$P_g$ = Signal generator output level.

## 15.2 Test Results

JUDGEMENT: Passed
TEST PERSONNEL:
Tester Signature: _____ Date: 07.05.13
Typed/Printed Name: A. Sharabi

| Carrier Channel (MHz) | Freq. (MHz) | Antenna Pol. | Maximum Peak Level (dBµV/m) | Signal Generator RF Output (dBm) | Cable Loss (dB) | Antenna Gain (dBi) | Effective Radiated Power Level (dBm) | Spec. (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 2*747+881 | 2375 | V | 52.7 | -47.99 | 7.4 | 8.26 | -47.13 | -13.0 | -34.13 |
| 2*747+881 | 2375 | H | 51.6 | -49.28 | 7.4 | 8.26 | -48.42 | -13.0 | -35.42 |
| 2*747-881 | 613 | V | 39.7 | -56.64 | 3.2 | 0.97 | -58.87 | -13.0 | -45.87 |
| 2*747-881 | 613 | H | 39.8 | -57.91 | 3.2 | 0.97 | -60.14 | -13.0 | -47.14 |
| 2*881-747 | 1015 | V | 51.3 | -50.49 | 4.2 | 5.4 | -49.29 | -13.0 | -36.29 |
| 2*881-747 | 1015 | H | 41.6 | -59.85 | 4.2 | 5.4 | -58.65 | -13.0 | -45.65 |
| 2*881+747 | 2509 | V | 54.6 | -46.16 | 7.7 | 8.4 | -45.46 | -13.0 | -32.46 |
| 2*881+747 | 2509 | H | 54.2 | -47.41 | 7.7 | 8.4 | -46.71 | -13.0 | -33.71 |
| 3*747-2*881 | 579 | V | 38.2 | -58.14 | 3.2 | 0.97 | -58.14 | -13.0 | -45.14 |
| 3*747-2*881 | 579 | H | 38.5 | -59.21 | 3.2 | 0.97 | -61.44 | -13.0 | -48.44 |
| 3*881-2*747 | 1149 | V | 44.2 | -57.29 | 4.45 | 5.84 | -55.90 | -13.0 | -42.90 |
| 3*881-2*747 | 1149 | H | 44.5 | -57.01 | 4.45 | 5.84 | -55.62 | -13.0 | -42.62 |
| 2*1960-2135 | 1785 | V | 48.7 | -51.09 | 5.6 | 7.66 | -49.03 | -13.0 | -36.03 |
| 2*1960-2135 | 1785 | H | 49.2 | -50.85 | 5.6 | 7.66 | -48.79 | -13.0 | -35.79 |
| 2*2135-1960 | 2310 | V | 53.9 | -47.68 | 7.1 | 8.12 | -46.66 | -13.0 | -33.66 |
| 2*2135-1960 | 2310 | H | 52.8 | -49.58 | 7.1 | 8.12 | -48.56 | -13.0 | -35.56 |
| 3*2135-2*1960 | 2485 | V | 54.0 | -46.76 | 7.7 | 8.4 | -46.06 | -13.0 | -33.06 |
| 3*2135-2*1960 | 2485 | H | 54.0 | -47.61 | 7.7 | 8.4 | -46.91 | -13.0 | -33.91 |
| 2*2135-3*1960 | 1610 | V | 50.0 | -51 | 5.3 | 7.62 | -48.68 | -13.0 | -35.68 |
| 2*2135-3*1960 | 1610 | H | 49.3 | -52.14 | 5.3 | 7.62 | -49.82 | -13.0 | -36.82 |

**Figure 202 Intermodulation Radiated Results**

### *15.3 Test Instrumentation Used, Radiated Measurements Intermodulation*

| Instrument | Manufacturer | Model | Serial Number | Calibration | Period |
|---|---|---|---|---|---|
| Spectrum Analyzer | HP | 8564E | 3442A00275 | February 13, 2013 | 1 year |
| Signal Generator | Agilent | N5172B ATO 10210 | MY51350182 | May 31, 2012 | 2 years |
| Signal Generator | Agilent | N5182A | MY50141213 | July 9, 2012 | 1 year |
| Signal Generator | Agilent | 83731B | US37100653 | October 23, 2012 | 1 year |
| Signal Generator | Agilent | 8647A | 3625U00686 | March 5, 2012 | 2 years |
| Attenuator | Mini-circuit | UNAT-30+ | N/A | April 3, 2013 | 1 year |
| Cable | Mini-circuit | DCB | N/A | April 3, 2013 | 1 year |
| DC Block | MIDWEST MICROWAVE | DCDB-3624-10-NNN-02 | N/A | N/A | N/A |

**Figure 203 Test Equipment Used**

# 16. APPENDIX A - CORRECTION FACTORS

## *16.1 Correction factors for CABLE*

**from EMI receiver to test antenna at 3 meter range.**

| FREQUENCY (MHz) | CORRECTION FACTOR (dB) |
|---|---|
| 10.0 | 0.3 |
| 20.0 | 0.6 |
| 30.0 | 0.8 |
| 40.0 | 0.9 |
| 50.0 | 1.1 |
| 60.0 | 1.2 |
| 70.0 | 1.3 |
| 80.0 | 1.4 |
| 90.0 | 1.6 |
| 100.0 | 1.7 |
| 150.0 | 2.0 |
| 200.0 | 2.3 |
| 250.0 | 2.7 |
| 300.0 | 3.1 |
| 350.0 | 3.4 |
| 400.0 | 3.7 |
| 450.0 | 4.0 |
| 500.0 | 4.3 |
| 600.0 | 4.7 |
| 700.0 | 5.3 |
| 800.0 | 5.9 |
| 900.0 | 6.3 |
| 1000.0 | 6.7 |

| FREQUENCY (MHz) | CORRECTION FACTOR (dB) |
|---|---|
| 1200.0 | 7.3 |
| 1400.0 | 7.8 |
| 1600.0 | 8.4 |
| 1800.0 | 9.1 |
| 2000.0 | 9.9 |
| 2300.0 | 11.2 |
| 2600.0 | 12.2 |
| 2900.0 | 13.0 |

*NOTES:*

*1. The cable type is RG-214.*

*2. The overall length of the cable is 27 meters.*

*3. The above data is located in file 27MO3MO.CBL on the disk marked "Radiated Emission Tests EMI Receiver".*

## *16.2 Correction factors for Bilog ANTENNA*

**Model: 3142**
***Antenna serial number: 1250***
**3 meter range**

| FREQUENCY (MHz) | AFE (dB/m) | FREQUENCY (MHz) | AFE (dB/m) |
|---|---|---|---|
| 30 | 18.4 | 1100 | 25 |
| 40 | 13.7 | 1200 | 24.9 |
| 50 | 9.9 | 1300 | 26 |
| 60 | 8.1 | 1400 | 26.1 |
| 70 | 7.4 | 1500 | 27.1 |
| 80 | 7.2 | 1600 | 27.2 |
| 90 | 7.5 | 1700 | 28.3 |
| 100 | 8.5 | 1800 | 28.1 |
| 120 | 7.8 | 1900 | 28.5 |
| 140 | 8.5 | 2000 | 28.9 |
| 160 | 10.8 | | |
| 180 | 10.4 | | |
| 200 | 10.5 | | |
| 250 | 12.7 | | |
| 300 | 14.3 | | |
| 400 | 17 | | |
| 500 | 18.6 | | |
| 600 | 19.6 | | |
| 700 | 21.1 | | |
| 800 | 21.4 | | |
| 900 | 23.5 | | |
| 1000 | 24.3 | | |

## *16.3 Correction factors for Horn ANTENNA*

**Model: 3115**
***Antenna serial number: 6142***
**3 meter range**

| FREQUENCY (MHz) | Antenna Factor (dB/m) | FREQUENCY (MHz) | Antenna Factor (dB/m) |
|---|---|---|---|
| 1000 | 23.9 | 10500 | 38.4 |
| 1500 | 25.4 | 11000 | 38.5 |
| 2000 | 27.3 | 11500 | 39.4 |
| 2500 | 28.5 | 12000 | 39.2 |
| 3000 | 30.4 | 12500 | 39.4 |
| 3500 | 31.6 | 13000 | 40.7 |
| 4000 | 33 | 14000 | 42.1 |
| 4500 | 32.7 | 15000 | 40.1 |
| 5000 | 34.1 | 16000 | 38.2 |
| 5500 | 34.5 | 17000 | 41.7 |
| 6000 | 34.9 | 17500 | 45.7 |
| 6500 | 35.1 | 18000 | 47.7 |
| 7000 | 35.9 | | |
| 7500 | 37.5 | | |
| 8000 | 37.6 | | |
| 8500 | 38.3 | | |
| 9000 | 38.5 | | |
| 9500 | 38.1 | | |
| 10000 | 38.6 | | |

## *16.4 Correction factors for Horn ANTENNA*

**Model: SWH-28**
***Antenna serial number: 1007***
**1 meter range**

| FREQUENCY | Antenna Factor |
|---|---|
| **(MHz)** | (dB/m) |
| **18000** | **33.0** |
| **18500** | **32.9** |
| **19000** | **33.1** |
| **19500** | **33.3** |
| **20000** | **33.6** |
| **20500** | **33.6** |
| **21000** | **33.4** |
| **21500** | **33.8** |
| **22000** | **33.7** |
| **22500** | **33.9** |
| **23000** | **34.8** |
| **23500** | **34.5** |
| **24000** | **34.2** |
| **24500** | **34.8** |
| **25000** | **34.4** |
| **25500** | **35.2** |
| **26000** | **35.9** |
| **26500** | **36.0** |

### *16.5 Correction factors forACTIVE LOOP ANTENNA*

**Model 6502**
**S/N 9506-2950**

| FREQUENCY | Magnetic Antenna Factor | Electric Antenna Factor |
|---|---|---|
| (MHz) | (dB) | (dB) |
| .009 | -35.1 | 16.4 |
| .010 | -35.7 | 15.8 |
| .020 | -38.5 | 13.0 |
| .050 | -39.6 | 11.9 |
| .075 | -39.8 | 11.8 |
| .100 | -40.0 | 11.6 |
| .150 | -40.0 | 11.5 |
| .250 | -40.0 | 11.6 |
| .500 | -40.0 | 11.5 |
| .750 | -40.1 | 11.5 |
| 1.000 | -39.9 | 11.7 |
| 2.000 | -39.5 | 12.0 |
| 3.000 | -39.4 | 12.1 |
| 4.000 | -39.7 | 11.9 |
| 5.000 | -39.7 | 11.8 |
| 10.000 | 40.2 | 11.3 |
| 15.000 | -40.7 | 10.8 |
| 20.000 | -40.5 | 11.0 |
| 25.000 | -41.3 | 10.2 |
| 30.000 | 42.3 | 9.2 |