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Report On

Application for Grant of Equipment Authorization of the
Harman Becker Automotive Systems, Inc.
VP3/VP4 Silverbox Automotive Infotainment Unit with
Bluetooth/WLAN

FCC CFR 47 Part 2, Part 22 and 24
IC RSS-Gen and RSS-132 and RSS-133

Report No. SD72102589-0215G

May 2015



REPORT ON Radio Testing of the
Harman Becker Automotive Systems, Inc.
Automotive Infotainment Unit with Bluetooth/WLAN

TEST REPORT NUMBER SD72102589-0215G

PREPARED FOR Harman Becker Automotive Systems, Inc.
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SECTION 1

REPORT SUMMARY

Radio Testing of the
Harman Becker Automotive Systems, Inc.
Automotive Infotainment Unit with Bluetooth/WLAN



1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Harman Becker Automotive Systems, Inc. Automotive Infotainment Unit with Bluetooth/WLAN to the requirements of the following:

- FCC CFR 47 Part 2, Part 22 and 24
- IC RSS-Gen and RSS-132 and RSS-133.

Objective	To perform Radio Testing to determine the Equipment Under Test's (EUT's) compliance with the Test Specification, for the series of tests carried out.
Manufacturer	Harman Becker Automotive Systems, Inc.
Model Number(s)	VP3 Silverbox; VP4 Silverbox
FCC ID Number	QNGBE2814
IC Number	6434C-BE2814
Serial Number(s)	SN018, SN022 and SN023
Number of Samples Tested	3
Test Specification/Issue/Date	• FCC CFR 47 Part 2, Part 22 and 24 (October 1, 2014). • RSS-132 - Cellular Telephones Employing New Technologies Operating in the Bands 824-849 MHz and 869-894 MHz (Issue 3, January 2013). • RSS-133 – 2 GHz Personal Communications Services (Issue 6, January 2013). • RSS-Gen - General Requirements and Information for the Certification of Radio Apparatus (Issue 4, November 2014).
Start of Test	April 03, 2015
Finish of Test	May 31, 2015
Name of Engineer(s)	Ferdie Custodio
Related Document(s)	• ANSI/TIA-603-C-2004 – Land Mobile FM or PM – Communications Equipment – Measurement and Performance Standards. • KDB971168 (D01 Power Meas License Digital Systems v02r02) Measurement Guidance For Certification Of Licensed Digital Transmitters • 412172 D01 Determining ERP and EIRP v01 (Guidelines for Determining the Effective Radiated Power (ERP) and Equivalent Isotropically Radiated Power (EIRP) of a RF Transmitting System. • Supporting documents for EUT certification are separate exhibits.



1.2 BRIEF SUMMARY OF RESULTS

A brief summary of the tests carried out in accordance with FCC CFR 47 Part 2, Part 22 and 24 with cross-reference to the corresponding IC RSS standard is shown below.

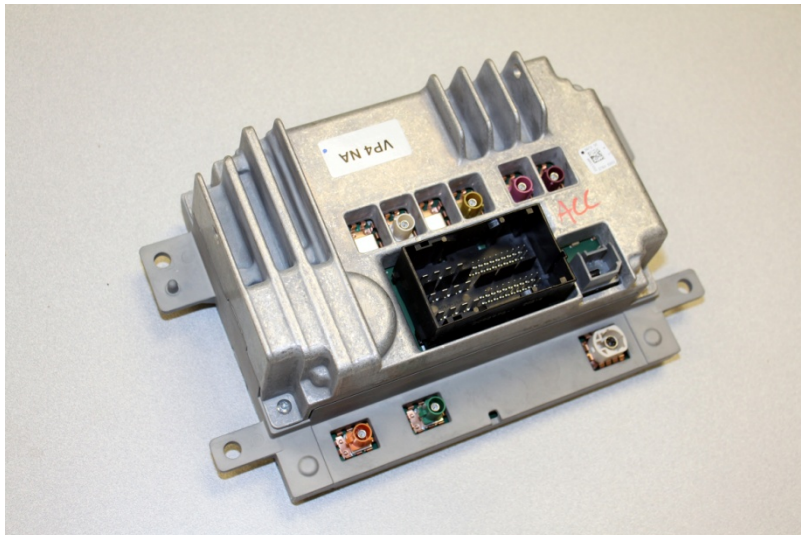
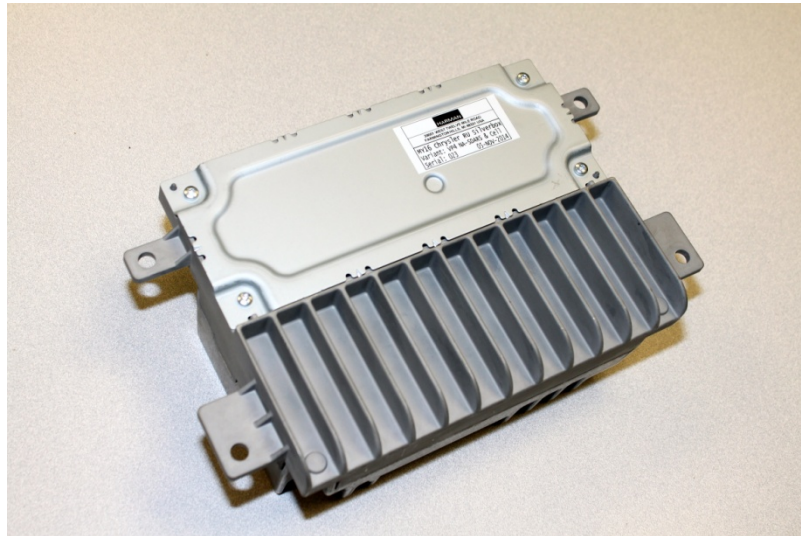
Section	FCC Part Sections(s)	RSS Section(s)	Test Description	Result
2.1	2.1046	RSS-132(5.4),RSS-133(6.4)	Transmitter Conducted Output Power	Compliant
2.2	22.913(a)(2), 2.1046	RSS-132(5.4),SRSP-503(5.1.3)	Effective Radiated Power	Compliant
2.3	24.232(c),2.1046	RSS-133(6.4),SRSP-510(5.1.2)	Equivalent Isotropic Radiated Power	Compliant
2.4	2.1049,22.917(b), 24.238(b)	RSS-Gen 6.6	Occupied Bandwidth	Compliant
2.5	24.232(d)	RRSS-133(6.4)	Peak-Average Ratio	Compliant
2.6	2.1051,22.917(a), 24.238(a)	RSS-132(5.5),RSS-133(6.5)	Band Edge/Conducted Spurious Emissions	Compliant
2.7	2.1053,22.917(a), 24.238(a)	RSS-132(5.5),RSS-133(6.5)	Field Strength Of Spurious Radiation	Compliant
2.8	2.1055,22.355,24.235	RSS-132(5.3),RSS-133(6.3)	Frequency Stability	Compliant
2.9		RSS-132(5.6),RSS-133(6.6)	Receiver Spurious Emissions	Compliant
2.10		RSS-Gen 8.8	Power Line Conducted Emission	N/A

N/A -EUT is a licensed device and for vehicular use only

1.3 PRODUCT INFORMATION

1.3.1 Technical Description

The Equipment Under Test (EUT) was a Harman Becker Automotive Systems, Inc. VP3/VP4 Silverbox VP3 Silverbox; VP4 Silverbox Automotive Infotainment Unit with Bluetooth/WLAN as shown in the photograph below. The EUT is the main unit of an automotive radio system less the display. It houses the AM/FM receiver, GPS receiver, Satellite receiver, BT/WLAN module and CDMA radio. Only the CDMA function of the EUT was verified in this test report. Both models are identical with the exception of flash MNAND size where the main operating software is stored. VP3 Silverbox uses 8 GB flash MNAND while VP4 uses 16 GB flash MNAND.



Equipment Under Test



1.3.2 EUT General Description

EUT Description	Automotive Infotainment Unit with Bluetooth/WLAN
Model Name	VP3 Silverbox; VP4 Silverbox
Model Number(s)	VP3/VP4 Silverbox
Rated Voltage	12VDC (Nominal)
Mode Verified	CDMA2000 (1xRTT)
Capability	802.11 b and g WLAN (DTS 2.4GHz), Bluetooth 3.0 + HS and CDMA2000 (1xRTT and 1xEVDO using BC0 and BC1)
Primary Unit (EUT)	☐ Production ☒ Pre-Production
Antenna Type	AM/FM/SiriusXM/GPS/CELL Sharkfin- Chrysler PN 05091352AE (FC00AAQ19963).
Manufacturer	Laird Technologies
Maximum Antenna Gain	0.13 dBi (maximum across entire cell bands supported)
RF Cable Loss (EUT to Antenna)	Coax length is ~9556mm. Antenna Loss is 3.84 dB @ 900 MHz, and 5.28 dB @ 1900 MHz

1.3.3 Transmit Frequency Table

Mode	Tx Frequency (MHz)	Emission Designator	ERP(Part 22)/EIRP(Part 24)	
			Max. Power (dBm)	Max. Power (W)
CDMA2000 Cell Band	824.7-848.31	1M54F9W	24.20	0.263
1xEV-DO Cell Band	824.7-848.31	1M53F9W	18.37	0.069
CDMA2000 Cell Band	1851.25-1908.75	1M55F9W	24.85	0.305
1xEV-DO Cell Band	1851.25-1908.75	1M53F9W	18.10	0.065

1.4 EUT TEST CONFIGURATION

1.4.1 Test Configuration Description

Test Configuration	Description
A	Conducted antenna port measurement.
B	Radiated test setup. EUT antenna port terminated with a 50Ω load.

1.4.2 EUT Exercise Software

EUT is controlled by a CMW 500 Wideband Radio Communication Tester. Client provided CMW 500 test profiles for both technologies.

1.4.3 Support Equipment and I/O cables

Manufacturer	Equipment/Cable	Description
Protek	Laboratory DC Power Supply	M/N 35010M S/N D102007S
Chrysler	Main Wiring Harness	1.1 meters, custom connector with various cables such as power, CAN-C, CAN-HIS, speakers, mics and aux input
-	USB cable	0.8 meter, shielded Type A to Mini5B connector
Chrysler	Shark Fin Antenna Assembly	P05091352AC 600517 0794 AM/FM, Sirius XM, GPS and CDMA antenna with 0.8 meter shielded Fakra SMB connector coaxial cable (x3)
Chrysler	BT/WLAN Antenna	P68227177AA 200409 1414 Prototype antenna assembly with 0.3 meter shielded Fakra SMB connector coaxial cable (x2)
Chrysler	Custom Antenna Cable	0.15 meter, shielded with Fakra SMB connector
Rhode & Schwarz	Support Wideband Radio Communication Tester	M/N CMW500 S/N 1201.0002k50/103829

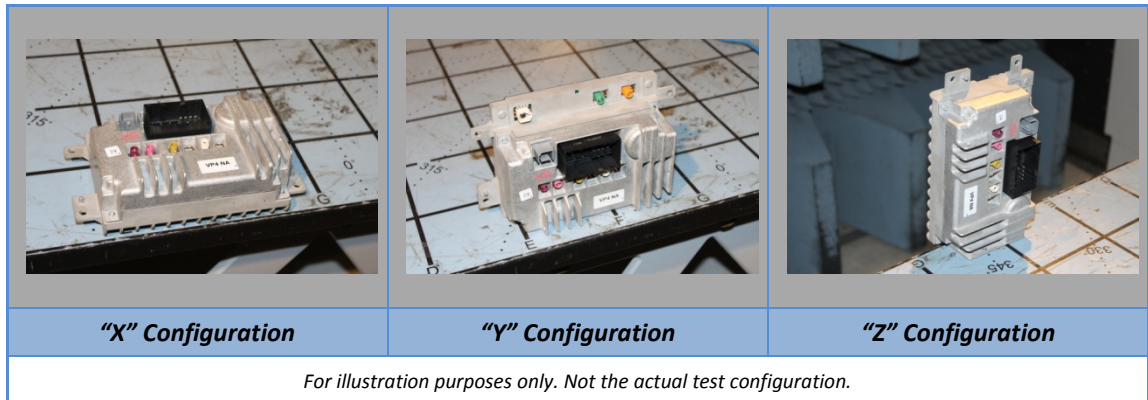
1.4.4 Worst Case Configuration

Worst-case configuration used in this test report per Transmitter Conducted Output Power (Section 2.1 of this test report). This is for single channel verification, otherwise all three channels (Low, Mid and High) are verified:

Mode	Cellular	PCS
CDMA 1xRTT	Channel 777	Channel 600
1xEV-DO Release 0	Channel 384	Channel 600

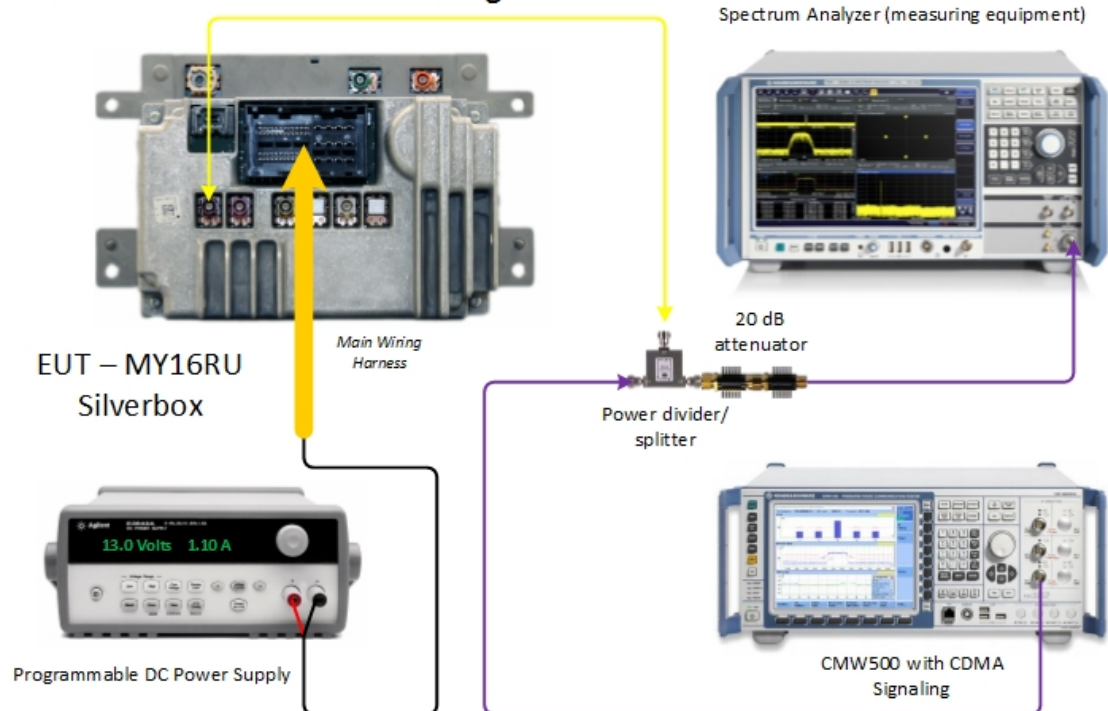
- CDMA2000 1xRTT signalling configuration is SO2 (Loopback), Radio Configuration (Forward/Reverse) of 1/1 O-QPSK. Expected Power Mode at Max. Power.
- CDMA2000 1xEvDO signalling configuration is NR (Network Release) Release 0 and A. Application is Forward Test (FTAP). Expected Power Mode at Max. Power.

EUT is a mobile device. Final installation position is unknown at the time of verification. For radiated measurements X, Y and Z orientations were verified. No major variation in emissions observed between the three (3) orientations. Verifications performed using "X" configuration.

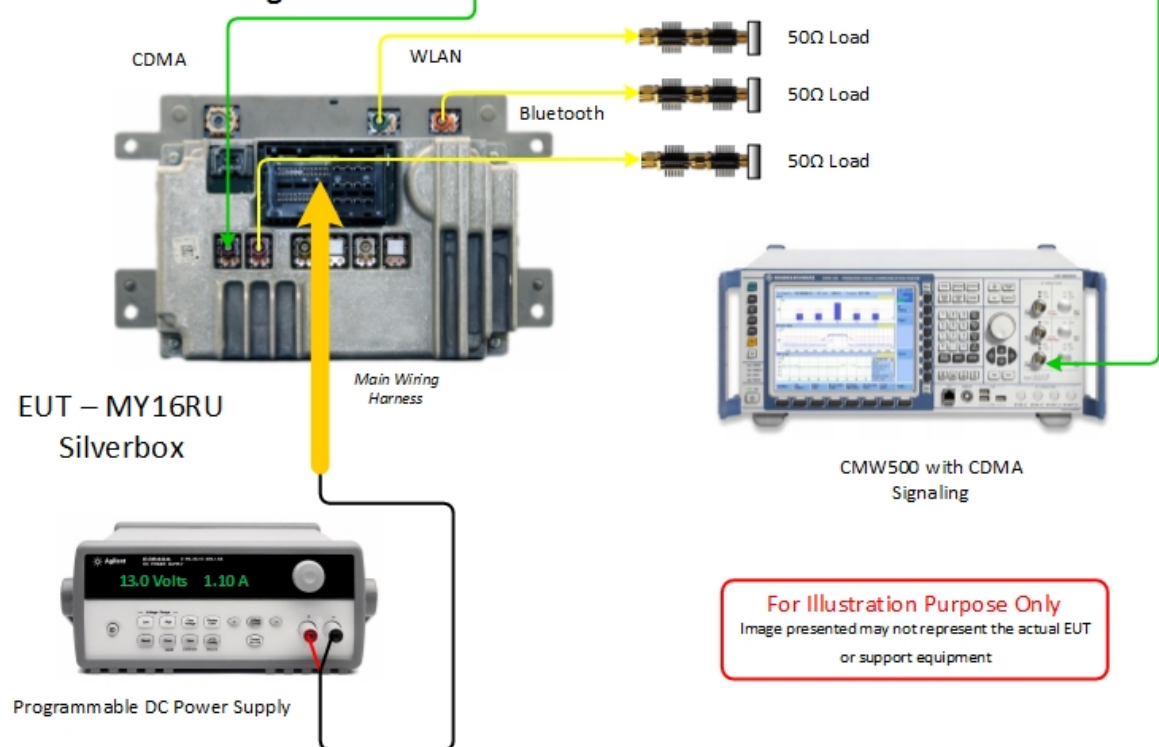


1.4.5 Simplified Test Configuration Diagram

Antenna Conducted Port Test Configuration



Radiated Test Configuration



1.5 DEVIATIONS FROM THE STANDARD

No deviations from the applicable test standards or test plan were made during testing.

1.6 MODIFICATION RECORD

Description of Modification	Modification Fitted By	Date Modification Fitted
Serial Number SN022, SN023 and SN018		
N/A		

The table above details modifications made to the EUT during the test programme. The modifications incorporated during each test (if relevant) are recorded on the appropriate test pages.

1.7 TEST METHODOLOGY

All measurements contained in this report were conducted with ANSI C63.4-2009, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

For conducted (if applicable) and radiated emissions the equipment under test (EUT) was configured to measure its highest possible emission level. This level was based on the maximized cable configuration from exploratory testing per ANSI C63.4-2009. The test modes were adapted according to the Operating Instructions provided by the manufacturer/client.

1.8 TEST FACILITY

1.8.1 FCC – Registration No.: US5296

TUV SUD America Inc. (San Diego), is an accredited test facility with the site description report on file and has met all the requirements specified in §2.498 of the FCC rules. The acceptance letter from the FCC is maintained in our files and the Registration is US5296.

1.8.2 Industry Canada (IC) Registration No.: 3067A

The 10m Semi-anechoic chamber of TUV SUD America Inc. (San Diego), has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No. 3067A.

1.9 SAMPLE CALCULATIONS

1.9.1 CDMA Emission Designator

Emission Designator = 1M30F9W
 F = Frequency Modulation
 9= Composite Digital Info
 W = Combination (Audio/Data)

1.9.2 Spurious Radiated Emission (below 1GHz)

Measuring equipment raw measurement (dBμV/m) @ 30 MHz			24.4
Correction Factor (dB)	Asset# 1066 (cable)	0.3	-12.6
	Asset# 1172 (cable)	0.3	
	Asset# 1016 (preamplifier)	-30.7	
	Asset# 1175(cable)	0.3	
	Asset# 1002 (antenna)	17.2	
Reported QuasiPeak Final Measurement (dBμV/m) @ 30MHz			11.8

1.9.3 Spurious Radiated Emission – Substitution Method

Example = 84dBμV/m @ 1413 MHz (numerical sample only)

The field strength reading of 84dBμV/m @ 1413 MHz (2nd Harmonic of 706.5 MHz) is the maximized measurement when the EUT is on the turntable measured at 3 meters. The gain of the substituted antenna is 7.8dBi while the transmit cable loss is 1.0 dB (cable between signal generator and the substituted antenna). The signal generator level is adjusted until the 84dBμV/m level at the receiving end is replicated (identical test setup, i.e. same antenna, cable/s and preamp). If the adjusted signal generator level is -18dBm, then we have the following for both EIRP and ERP as required:

$$\begin{aligned}
 P_{\text{EIRP}} &= -18 \text{ dBm} + 7.8 \text{ dBi} - 1\text{dB} \\
 &= 11.2 \text{ dBm} \\
 P_{\text{ERP}} &= P_{\text{EIRP}} - 2.15 \text{ dB} \\
 &= 11.2 \text{ dBm} - 2.15 \text{ dB} \\
 &= 9.05 \text{ dBm}
 \end{aligned}$$



SECTION 2

TEST DETAILS

Radio Testing of the
Harman Becker Automotive Systems, Inc.
Automotive Infotainment Unit with Bluetooth/WLAN



2.1 TRANSMITTER CONDUCTED OUTPUT POWER

2.1.1 Specification Reference

Part 2.1046 (a) and (c)

2.1.2 Standard Applicable

(a) For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in §2.1033(c)(8). The electrical characteristics of the radio frequency load attached to the output terminals when this test is made shall be stated.

(c) For measurements conducted pursuant to paragraphs (a) and (b) of this section, all calculations and methods used by the applicant for determining carrier power or peak envelope power, as appropriate, on the basis of measured power in the radio frequency load attached to the transmitter output terminals shall be shown. Under the test conditions specified, no components of the emission spectrum shall exceed the limits specified in the applicable rule parts as necessary for meeting occupied bandwidth or emission limitations.

2.1.3 Equipment Under Test and Modification State

Serial No: SN022 and SN018 / Test Configuration A

2.1.4 Date of Test/Initial of test personnel who performed the test

April 03, 2015 and May 31, 2015/FSC

2.1.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.1.6 Environmental Conditions

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility.

Ambient Temperature	24.7 - 25.0 °C
Relative Humidity	28.2 – 44.5 %
ATM Pressure	98.6 – 99.9 kPa

2.1.7 Additional Observations

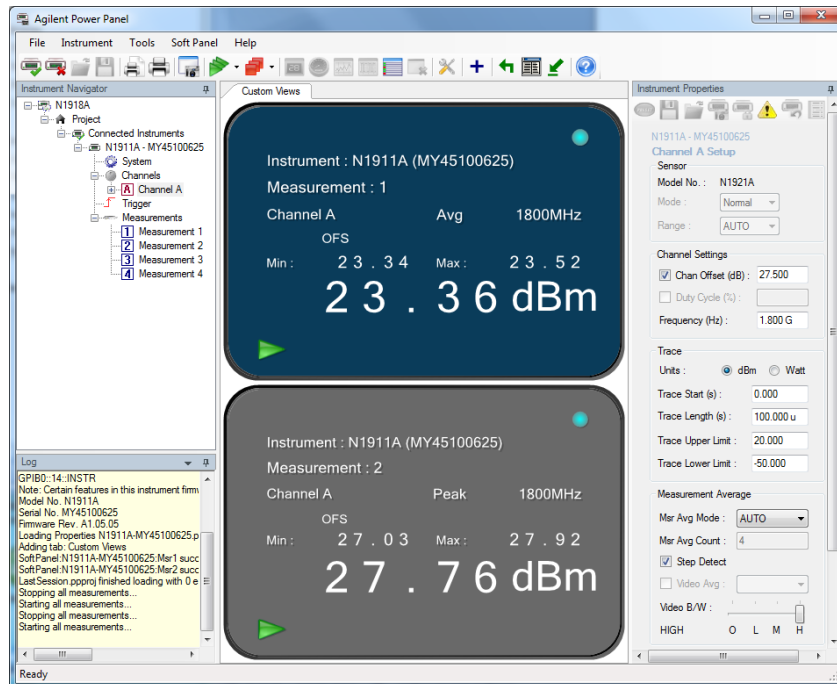
- This is a conducted test using an average power meter.
- A 27.5dB power meter offset was used for the power splitter, external attenuator and cable used when verifying CDMA2000, while 18.5dB and 19.5 dB were used respectively for 1xEV-DO verification (Cell and PCS bands inside a shield room using a long RF test cable).

- Both Peak and Average measurements presented.
- Only the worst case Radio Configuration (RC) and Service Option (SO) presented for CDMA2000.
- Only Release A measurements presented for 1xEV-DO (worst case).

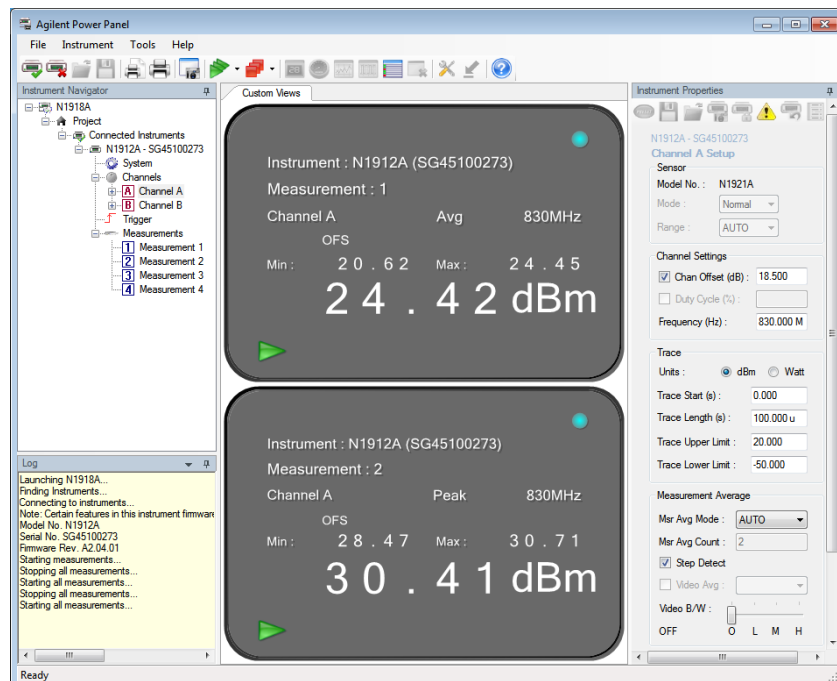
2.1.8 Test Results

Band	Channel	CDMA2000		1xEV-DO	
		SO 2 RC1/1 O-QPSK (dBm)		Release A (dBm)	
		Average	Peak	Average	Peak
Cellular	1013	24.81	29.87	24.40	30.28
	384	24.80	29.91	24.45	30.71
	777	24.53	30.06	24.20	30.57
PCS	25	23.19	27.91	23.11	29.39
	600	23.52	27.92	23.25	29.23
	1175	22.99	27.13	22.74	28.43

2.1.9 Sample Test Plot



Mid Channel CDMA PCS Band



Mid Channel 1xEV-DO Cell Band

2.2 EFFECTIVE RADIATED POWER

2.2.1 Specification Reference

Part 22 Subpart H §22.913(a)(2)

2.2.2 Standard Applicable

The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.

2.2.3 Equipment Under Test and Modification State

Serial No: SN022 and SN018

2.2.4 Date of Test/Initial of test personnel who performed the test

May 31, 2015/FSC

2.2.5 Additional Observations

- ERP was calculated as per Section 1.3.2 of KDB412172 D01 (Determining ERP and EIRP v01).
- Calculation formula in logarithmic terms:

$$\text{ERP} = P_T + G_T - L_C - 2.15\text{dB}$$

Where:

P_T = transmitter conducted output power dBm (Section 2.1 of this test report)

G_T = gain of the transmitting antenna, in dBi (EIRP: the -2.15 in the formula is to convert EIRP to ERP);

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

2.2.6 Sample Computation

$$\begin{aligned}\text{ERP} &= P_T + G_T - L_C - 2.15\text{dB} \\ &= 29.87 \text{ (Peak)} + 0.13 \text{ (max. gain)} - 3.84 \text{ (cable loss)} - 2.15 \\ &= 24.01 \text{ dBm}\end{aligned}$$

2.2.7 Test Results

Compliant. See attached table.



CDMA2000 (Peak)							
Frequency (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	Signal Attenuation (L _C in dB)	ERP (dBm)	ERP (Watts)	ERP Limit (dBm)	Margin (dB)
824.70	29.87	0.13	3.84	24.01	0.252	38.45	14.44
836.52	29.91	0.13	3.84	24.05	0.254	38.45	14.40
848.31	30.06	0.13	3.84	24.20	0.263	38.45	14.25

1xEV-DO (Peak)							
Frequency (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	Signal Attenuation (L _C in dB)	ERP (dBm)	ERP (Watts)	ERP Limit (dBm)	Margin (dB)
824.70	30.28	0.13	3.84	24.42	0.277	38.45	14.03
836.52	30.71	0.13	3.84	24.85	0.305	38.45	13.60
848.31	30.57	0.13	3.84	24.71	0.296	38.45	13.74

2.3 EQUIVALENT ISOTROPIC RADIATED POWER

2.3.1 Specification Reference

Part 24 Subpart E §24.234(c)

2.3.2 Standard Applicable

Mobile and portable stations are limited to 2 watts EIRP and the equipment must employ a means for limiting power to the minimum necessary for successful communications.

2.3.3 Equipment Under Test and Modification State

Serial No: SN022 and SN018

2.3.4 Date of Test/Initial of test personnel who performed the test

May 31, 2015/FSC

2.3.5 Additional Observations

- EIRP was calculated as per Section 1.3.2 of KDB412172 D01 (Determining ERP and EIRP v01).
- Calculation formula in logarithmic terms:

$$\text{EIRP} = P_T + G_T - L_C$$

Where:

P_T = transmitter conducted output power dBm (Section 2.1 of this test report)

G_T = gain of the transmitting antenna, in dBi (EIRP);

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

2.3.6 Sample Computation

$$\begin{aligned}\text{ERP} &= P_T + G_T - L_C \\ &= 23.19 \text{ (Average)} + 0.13 \text{ (max. gain)} - 5.28 \text{ (cable loss)} \\ &= 18.04 \text{ dBm}\end{aligned}$$

2.3.7 Test Results

Compliant. See attached table.



CDMA2000 (Average)							
Frequency (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	Signal Attenuation (L _C in dB)	EIRP (dBm)	EIRP (Watts)	EIRP Limit (dBm)	Margin (dB)
1851.25	23.19	0.13	5.28	18.04	0.064	33	14.96
1880.00	23.52	0.13	5.28	18.37	0.069	33	14.63
1908.75	22.99	0.13	5.28	17.84	0.061	33	15.16

1xEV-DO (Average)							
Frequency (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	Signal Attenuation (L _C in dB)	EIRP (dBm)	EIRP (Watts)	EIRP Limit (dBm)	Margin (dB)
1851.25	23.11	0.13	5.28	17.96	0.063	33	15.04
1880.00	23.25	0.13	5.28	18.10	0.065	33	14.90
1908.75	22.74	0.13	5.28	17.59	0.057	33	15.41



2.4 OCCUPIED BANDWIDTH

2.4.1 Specification Reference

Part 22 Subpart H §22.917(b) and Part 24 Subpart E §24.238(b)

2.4.2 Standard Applicable

The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

2.4.3 Equipment Under Test and Modification State

Serial No: SN022 and SN018 / Test Configuration A

2.4.4 Date of Test/Initial of test personnel who performed the test

April 03, 2015 and May 31, 2015/FSC

2.4.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.4.6 Environmental Conditions

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility.

Ambient Temperature	24.7 - 25.0 °C
Relative Humidity	28.2 – 44.5 %
ATM Pressure	98.6 – 99.9 kPa

2.4.7 Additional Observations

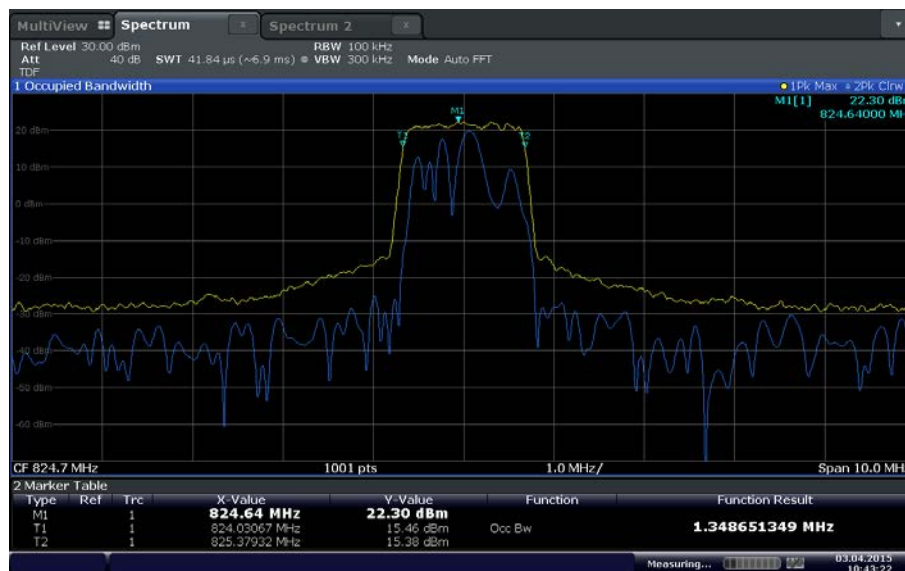
- This is a conducted test. Both 26dB bandwidth and 99% bandwidth presented.
- All channels for emission bandwidth verification verified.
- The RBW is set to 1% of the span while the VBW is 3X RBW.
- Only worst case configuration presented (see Section 1.4.4 of this test report for details).
- The SA built-in emission bandwidth measurement feature is utilized. The power level setting is set to 99% while “x dB” is set to -26.

2.4.8 Test Results

See attached table and plots.

Mode	Band	Channel	Frequency (MHz)	OBW (MHz)	-26dB BW (MHz)
CDMA2000	Cell Band	1013	824.70	1.349	1.54
		384	836.52	1.329	1.54
		777	848.31	1.339	1.54
	PCS Band	25	1851.25	1.359	1.55
		600	1880.00	1.339	1.53
		1175	1908.75	1.339	1.54
1xEV-DO	Cell Band	1013	824.70	1.302	1.53
		384	836.52	1.317	1.53
		777	848.31	1.302	1.53
	PCS Band	25	1851.25	1.317	1.53
		600	1880.00	1.317	1.53
		1175	1908.75	1.302	1.53

CDMA2000 Cell Band Low Channel 99% OBW



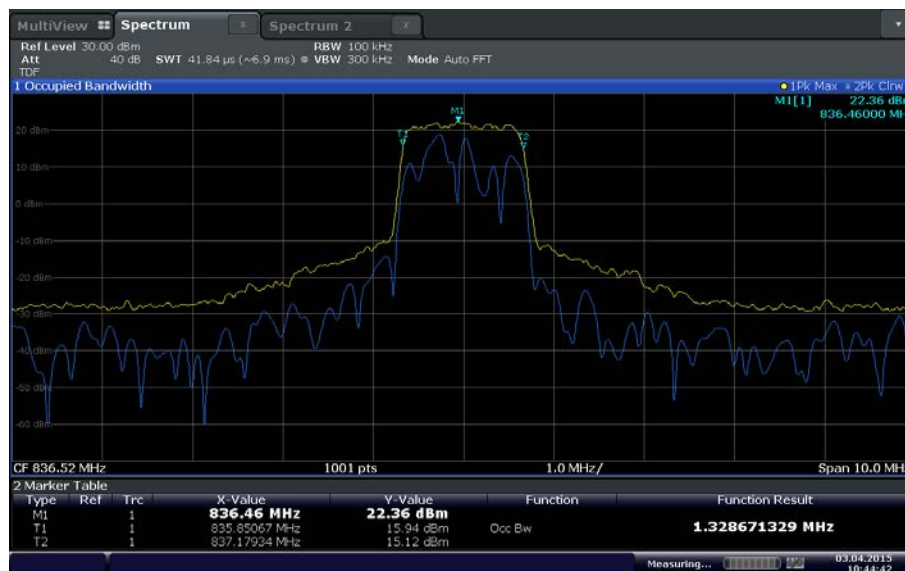
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CDMA2000 Cell Band Low Channel -26dB BW



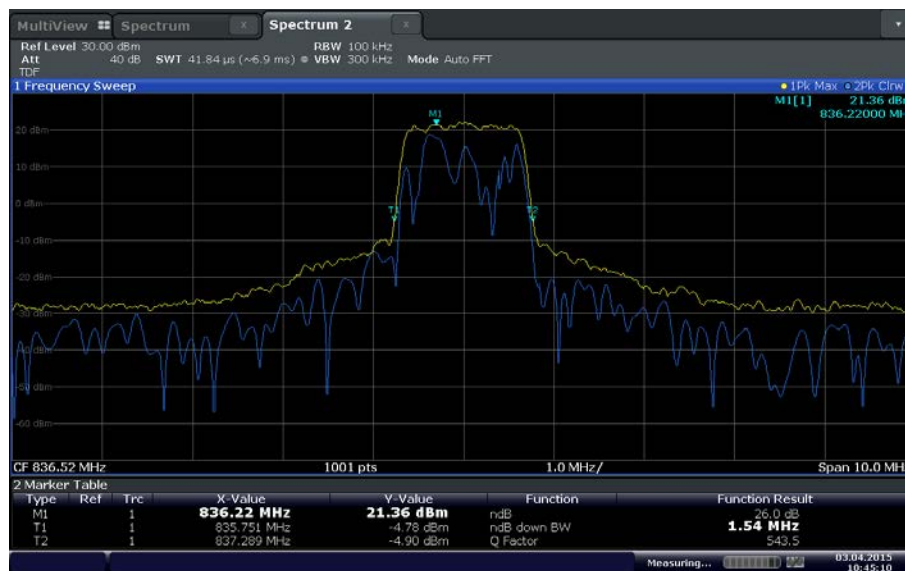
Date: 3 APR 2015 10:43:47

CDMA2000 Cell Band Mid Channel 99% OBW



Date: 3 APR 2015 10:44:42

CDMA2000 Cell Band Mid Channel -26dB BW



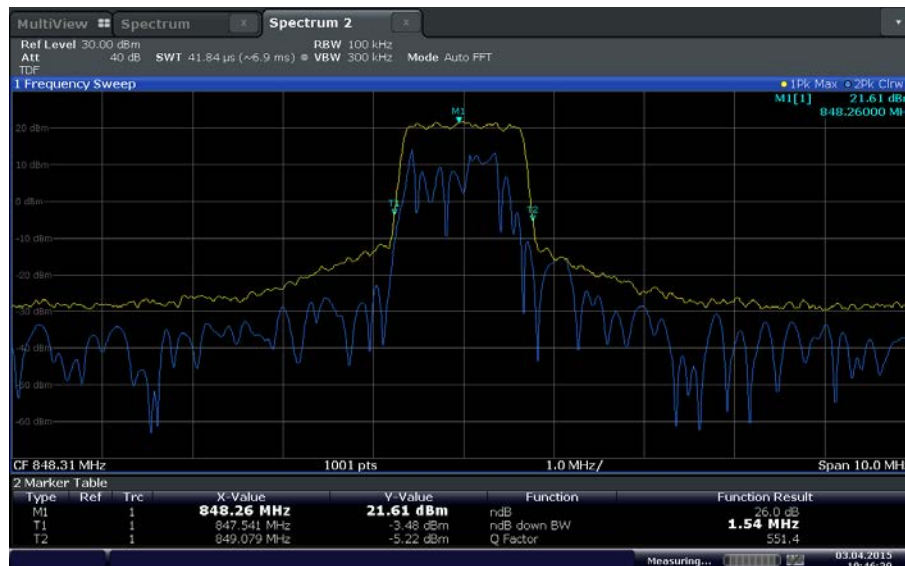
Date: 3 APR 2015 10:45:10

CDMA2000 Cell Band High Channel 99% OBW



Date: 3 APR 2015 10:46:07

CDMA2000 Cell Band High Channel -26dB BW



Date: 3 APR 2015 10:46:39

CDMA2000 PCS Band Low Channel 99% OBW



Date: 3 APR 2015 10:39:01

CDMA2000 PCS Band Low Channel -26dB BW



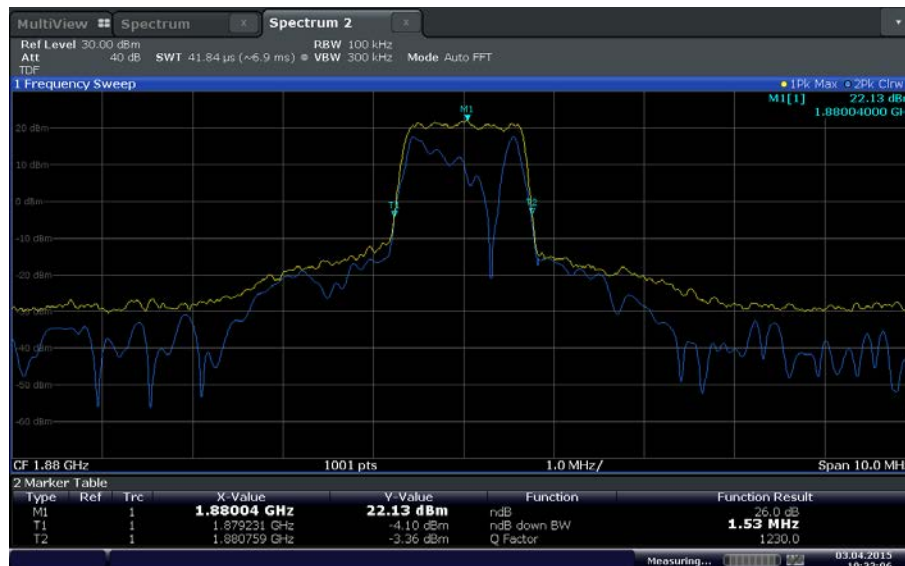
Date: 3 APR 2015 10:39:39

CDMA2000 PCS Band Mid Channel 99% OBW



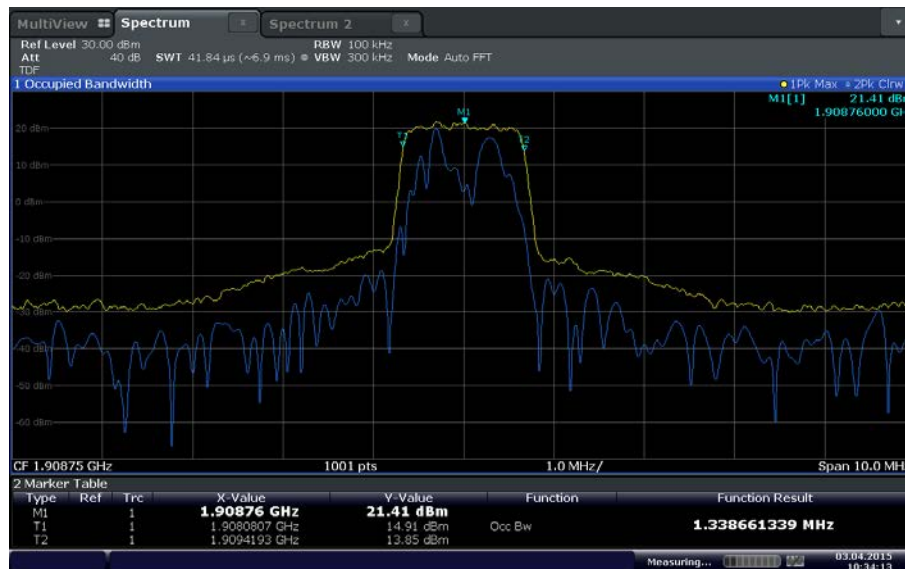
Date: 3 APR 2015 10:32:39

CDMA2000 PCS Band Mid Channel -26dB BW



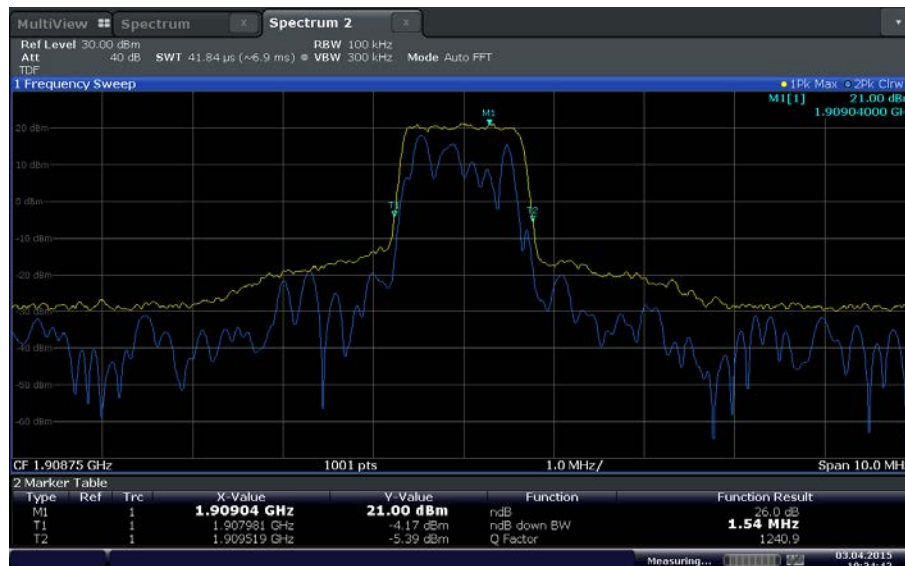
Date: 3 APR 2015 10:33:06

CDMA2000 PCS Band High Channel 99% OBW



Date: 3 APR 2015 10:34:13

CDMA2000 PCS Band High Channel -26dB BW



Date: 3 APR 2015 10:34:42

1xEV-DO Cell Band Low Channel 99% OBW



Date: 31 MAY 2015 10:03:19

1xEV-DO Cell Band Low Channel -26dB BW



Date: 31 MAY 2015 10:04:45

1xEV-DO Cell Band Mid Channel 99% OBW



Date: 31 MAY 2015 10:06:48

1xEV-DO Cell Band Mid Channel -26dB BW



Date: 31 MAY 2015 10:07:13

1xEV-DO Cell Band High Channel 99% OBW



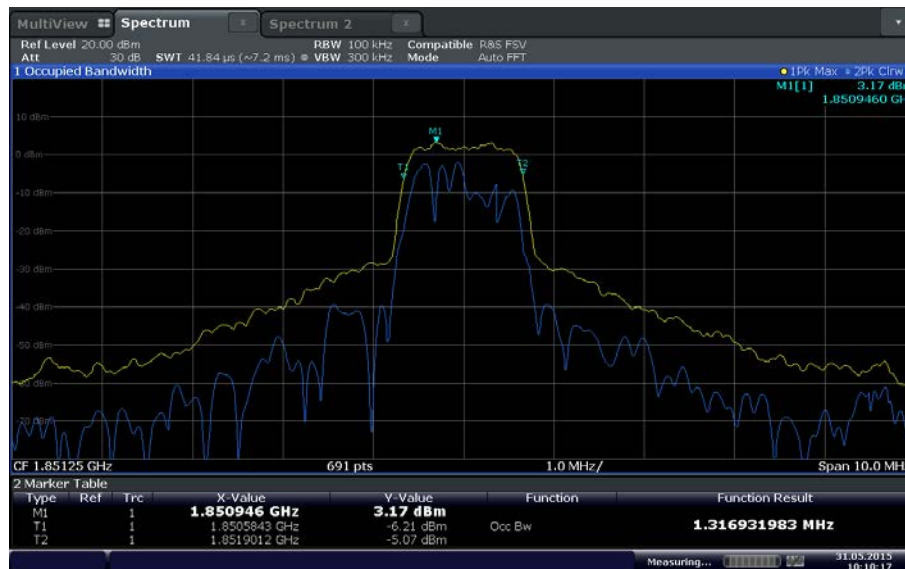
Date: 31 MAY 2015 10:07:53

1xEV-DO Cell Band High Channel -26dB BW



Date: 31 MAY 2015 10:08:22

1xEV-DO PCS Band Low Channel 99% OBW



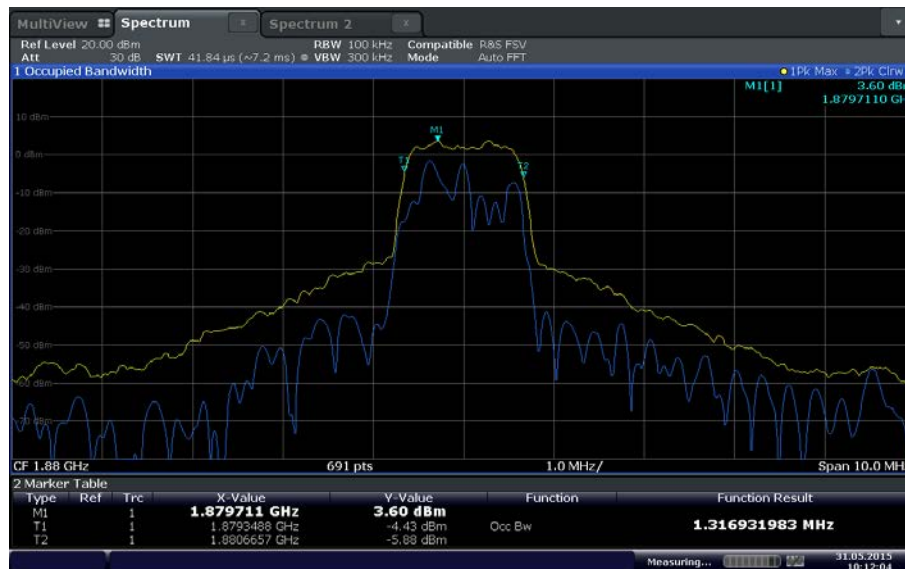
Date: 31 MAY 2015 10:10:17

1xEV-DO PCS Band Low Channel -26dB BW



Date: 31 MAY 2015 10:09:36

1xEV-DO PCS Band Mid Channel 99% OBW



Date: 31 MAY 2015 10:12:05

1xEV-DO PCS Band Mid Channel -26dB BW



Date: 31 MAY 2015 10:12:34

1xEV-DO PCS Band High Channel 99% OBW



Date: 31 MAY 2015 10:13:20

1xEV-DO PCS Band High Channel -26dB BW



Date: 31 MAY 2015 10:15:09



2.5 PEAK-AVERAGE RATIO

2.5.1 Specification Reference

Part 24 Subpart E §24.232(d)

2.5.2 Standard Applicable

Power measurements for transmissions by stations authorized under this section may be made either in accordance with a Commission-approved average power technique or in compliance with paragraph (e) of this section. In both instances, equipment employed must be authorized in accordance with the provisions of §24.51. In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB

2.5.3 Equipment Under Test and Modification State

Serial No: SN022 / Test Configuration A

2.5.4 Date of Test/Initial of test personnel who performed the test

April 03, 2015 and May 31, 2015/FSC

2.5.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.5.6 Environmental Conditions

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility.

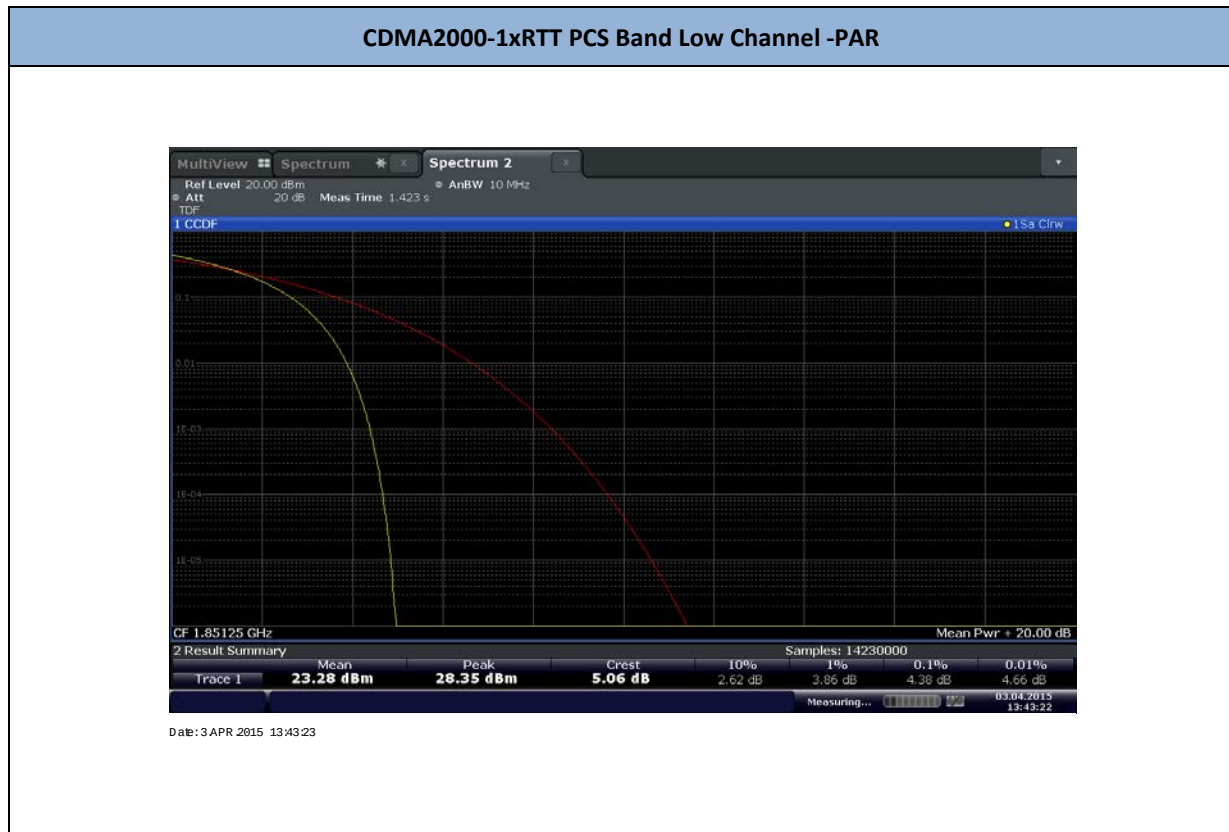
Ambient Temperature	25.0 °C
Relative Humidity	28.2 %
ATM Pressure	98.6 kPa

2.5.7 Additional Observations

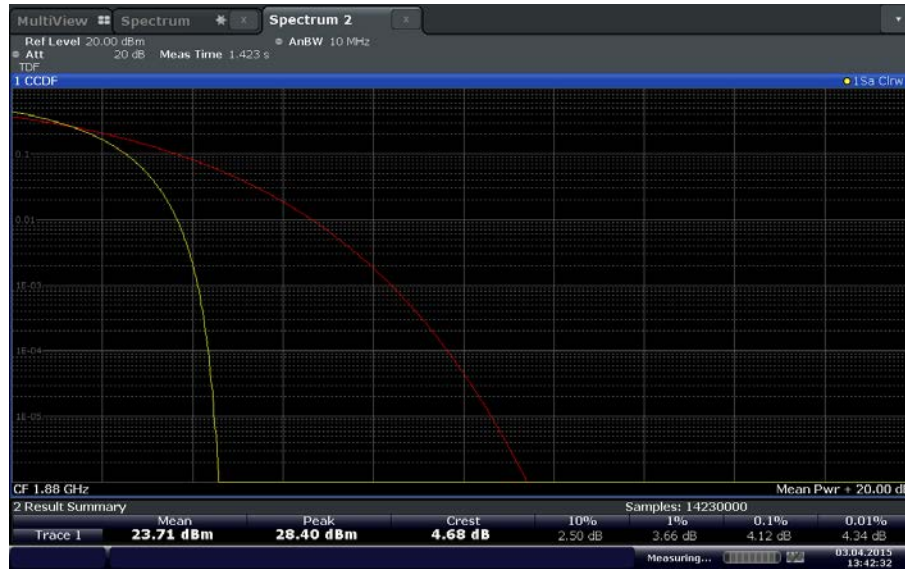
- This is a conducted test. Test procedure is per Section 5.7 of KDB971168 (D01 Power Meas License Digital Systems v02r02). Appropriate offset (line losses) applied.
- Measurement was done using the Spectrum Analyzer's Complementary Cumulative Distribution Function (CCDF) measurement profile. The built-in function is used to determine the largest deviation between the average and the peak power of the EUT in a given bandwidth (crest factor or peak-to-average ratio) The CCDF curve shows how much time the peak waveform spends at or above a given average power level. The percent of time the signals spends at or above the level defines the probability for that particular power level.
- Procedure is per Section 5.7.1 of KDB971168.
- RBW was set to maximum the SA can support.
- All channels based from worst case configuration were verified.

- The maximum PAPR level associated with a probability of 0.1% was recorded.
- There are no measured PAR levels greater than 13dB. EUT complies.

2.5.8 Test Results

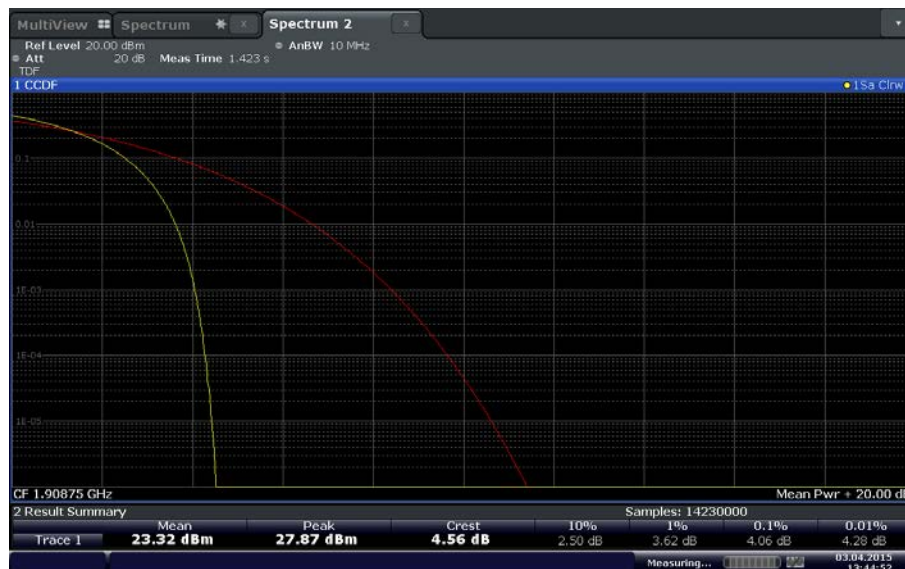


CDMA2000-1xRTT PCS Band Mid Channel -PAR



Date: 3 APR 2015 13:42:32

CDMA2000-1xRTT PCS Band High Channel -PAR



Date: 3 APR 2015 13:44:52

1xEV-DO PCS Band Low Channel -PAR



Date: 31 MAY 2015 10:28:06

1xEV-DO PCS Band Mid Channel -PAR



Date: 31 MAY 2015 10:30:25

1xEV-DO PCS Band High Channel -PAR



Date: 31 MAY 2015 10:32:54



2.6 BAND EDGE/CONDUCTED SPURIOUS EMISSIONS

2.6.1 Specification Reference

Part 22 Subpart H §22.917(a) and Part 24 Subpart E §24.238(a)

2.6.2 Standard Applicable

Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

2.6.3 Equipment Under Test and Modification State

Serial No: SN022 / Test Configuration A

2.6.4 Date of Test/Initial of test personnel who performed the test

April 03, 2015 and May 31, 2015/FSC

2.6.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.6.6 Environmental Conditions

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility.

Ambient Temperature	25.0 °C
Relative Humidity	28.2 %
ATM Pressure	98.6 kPa

2.6.7 Additional Observations

- This is a conducted test.
- Corresponding offsets was used for the power splitter, external attenuator and cable used. It could be 18.5dB for Cellular, 19.5 for PCS or TDF (Transducer Factor) to cover the whole range (9 kHz to 20GHz).
- For PCS band edge measurements, set RBW to 1% of the span or greater.
- Band power was integrated over 1% of EBW for cellular band edge measurements.
- For both band edge and out of band emissions, set the limit to -13dBm.
- Only worst case configuration for all technologies presented in this test report.

2.6.8 Test Results

See attached plots.

CDMA2000 Cell Band Edge @ 824MHz



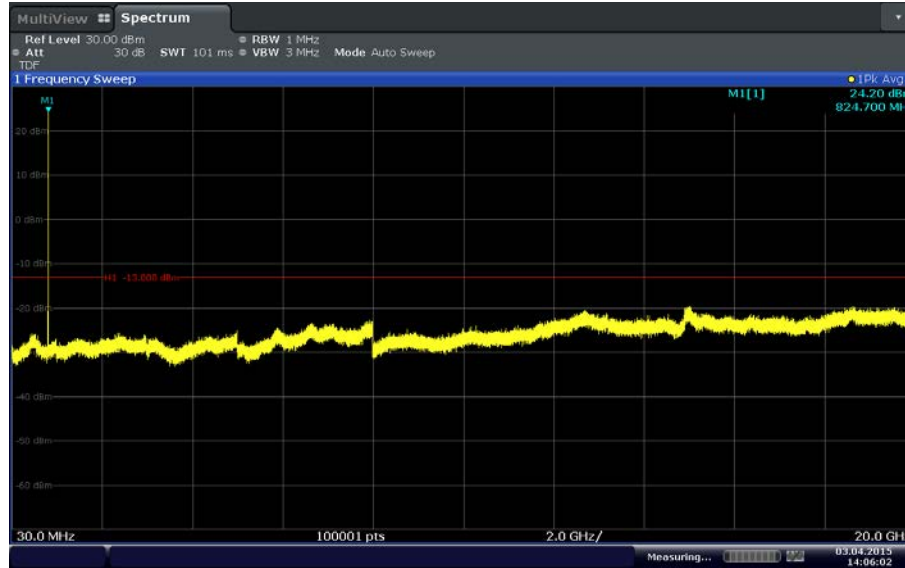
Date: 3 APR 2015 14:00:19

CDMA2000 Cell Band Edge @ 849MHz



Date: 3 APR 2015 13:58:16

CDMA2000 Cell Low Channel 30MHz to 20GHz Conducted Spurious Plot



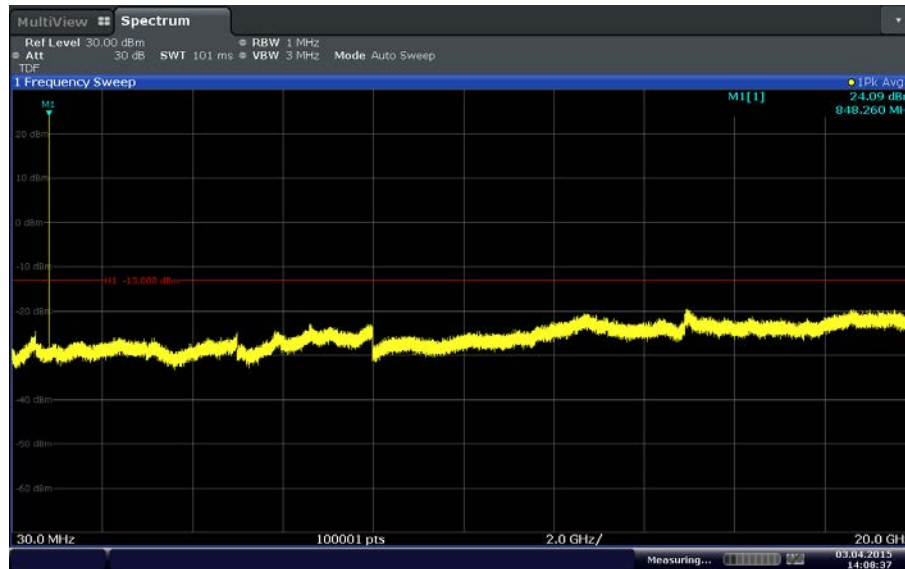
Date: 3 APR 2015 14:06:02

CDMA2000 Cell Mid Channel 30MHz to 20GHz Conducted Spurious Plot



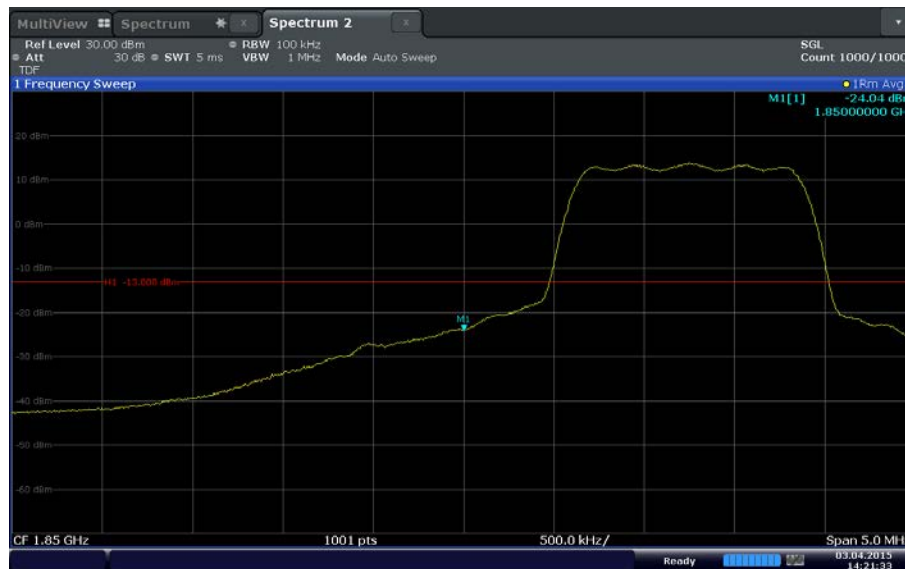
Date: 3 APR 2015 14:07:09

CDMA2000 Cell High Channel 30MHz to 20GHz Conducted Spurious Plot



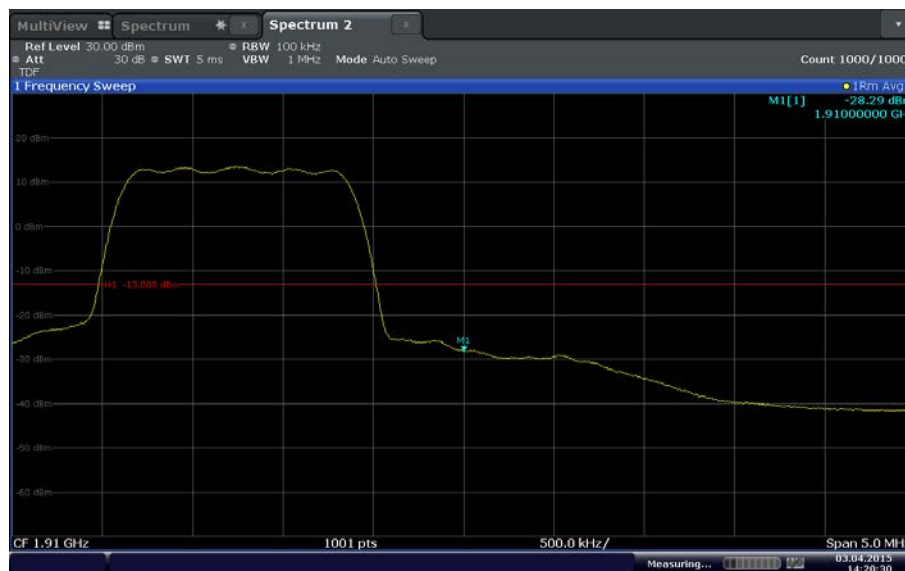
Date: 3 APR 2015 14:08:38

CDMA2000 PCS Band Edge @ 1850MHz



Date: 3 APR 2015 14:21:34

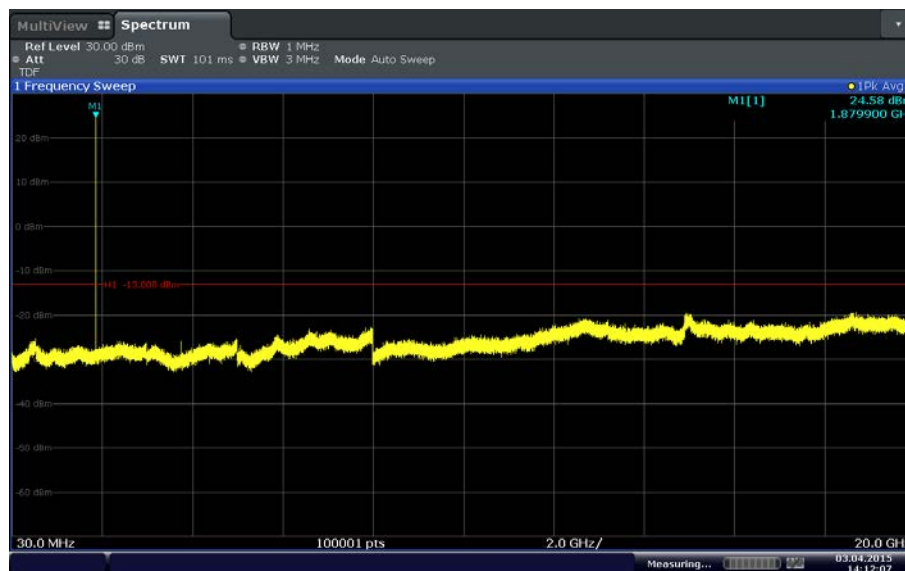
CDMA2000 PCS Band Edge @ 1910MHz



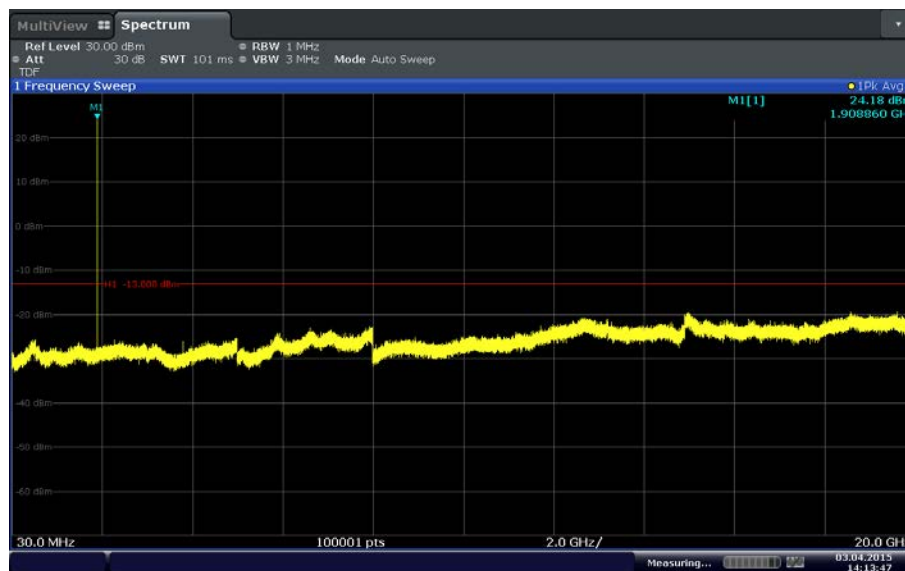
CDMA2000 PCS Low Channel 30MHz to 20GHz Conducted Spurious Plot



CDMA2000 PCS Mid Channel 30MHz to 20GHz Conducted Spurious Plot



CDMA2000 PCS High Channel 30MHz to 20GHz Conducted Spurious Plot



1xEV-DO Cell Band Edge @ 824MHz



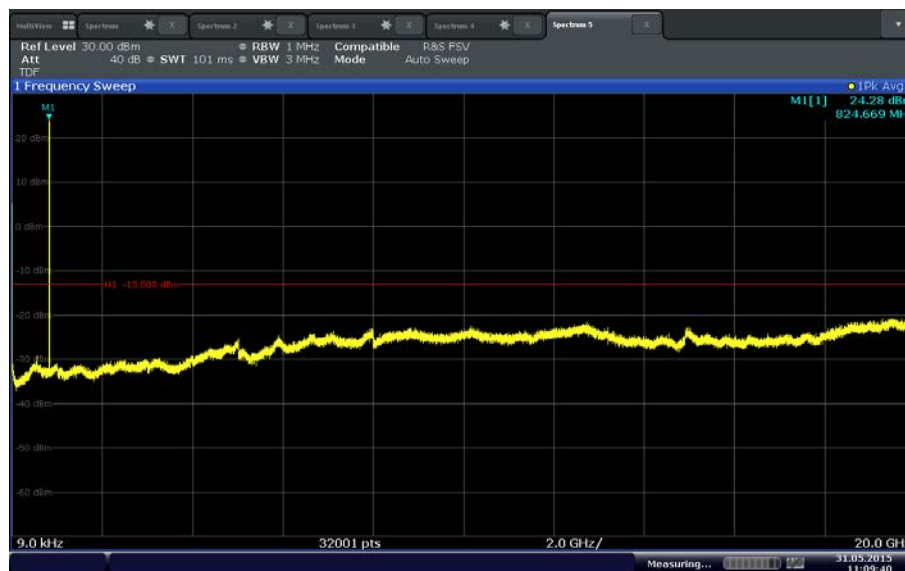
Date: 31 MAY 2015 10:43:04

1xEvDO Cell Band Edge @ 849MHz



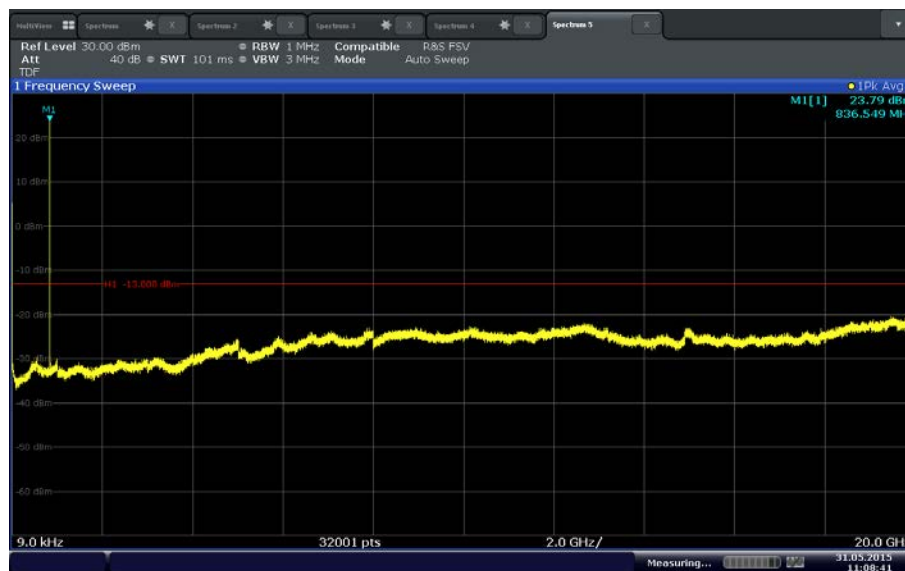
Date: 31 MAY 2015 11:01:13

1xEV-DO Cell Low Channel 30MHz to 20GHz Conducted Spurious Plot



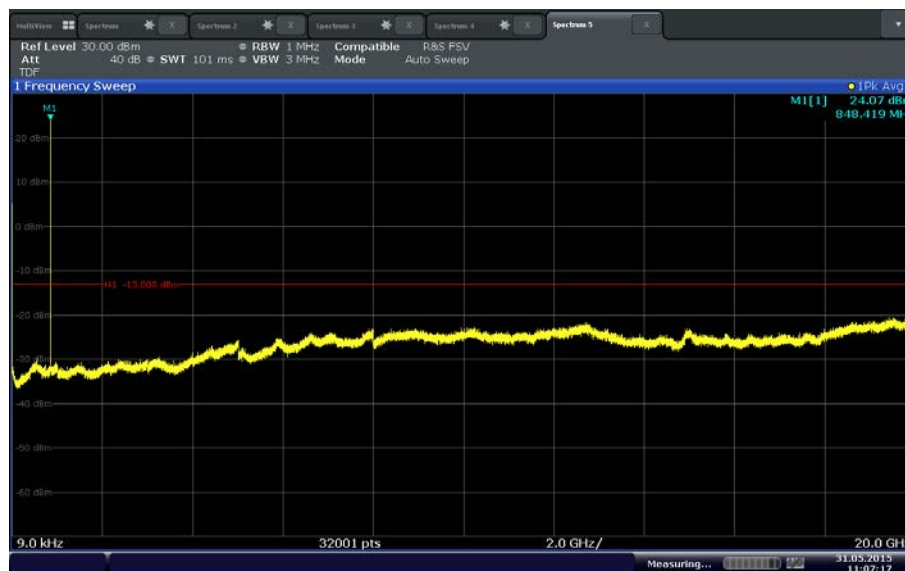
Date: 31 MAY 2015 11:09:40

1xEV-DO Cell Mid Channel 30MHz to 20GHz Conducted Spurious Plot



Date: 31 MAY 2015 11:09:42

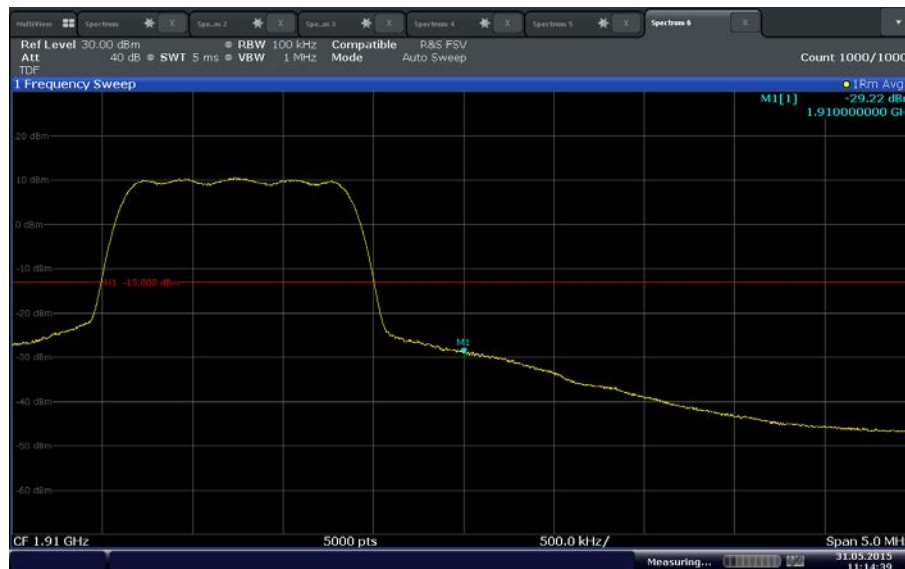
1xEV-DO Cell High Channel 30MHz to 20GHz Conducted Spurious Plot



1xEV-DO PCS Band Edge @ 1850MHz

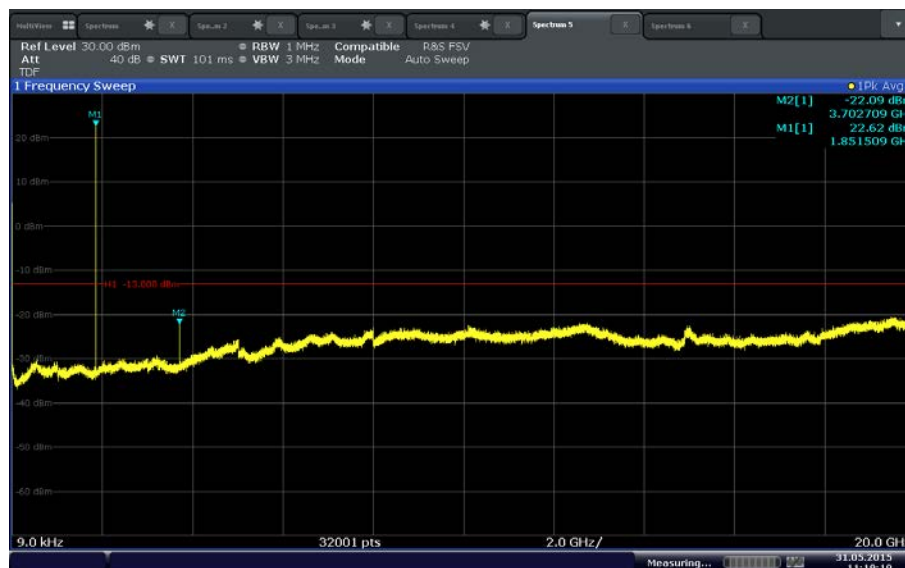


1xEV-DO PCS Band Edge @ 1910MHz



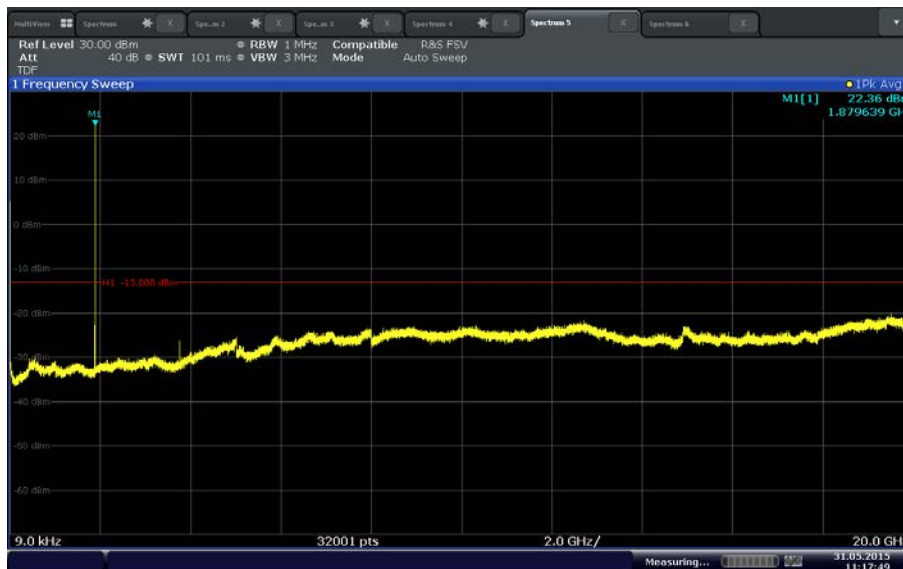
Date: 31 MAY 2015 11:14:40

1xEV-DO PCS Low Channel 30MHz to 20GHz Conducted Spurious Plot



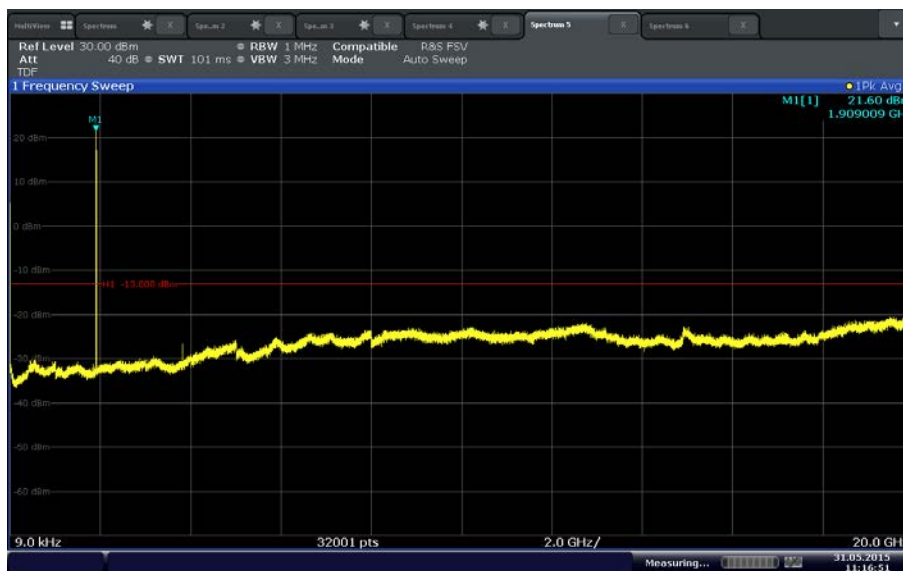
Date: 31 MAY 2015 11:19:19

1xEV-DO PCS Mid Channel 30MHz to 20GHz Conducted Spurious Plot



Date: 31 MAY 2015 11:17:49

1xEV-DO PCS High Channel 30MHz to 20GHz Conducted Spurious Plot



Date: 31 MAY 2015 11:16:51



2.7 FIELD STRENGTH OF SPURIOUS RADIATION

2.7.1 Specification Reference

Part 22 Subpart H §22.917(a) and Part 24 Subpart E §24.238(a)

2.7.2 Standard Applicable

Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

2.7.3 Equipment Under Test and Modification State

Serial No: SN018 / Test Configuration B

2.7.4 Date of Test/Initial of test personnel who performed the test

May 31, 2015/FSC

2.7.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.7.6 Environmental Conditions

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility.

Ambient Temperature	26.7 °C
Relative Humidity	40.7%
ATM Pressure	99.4 kPa

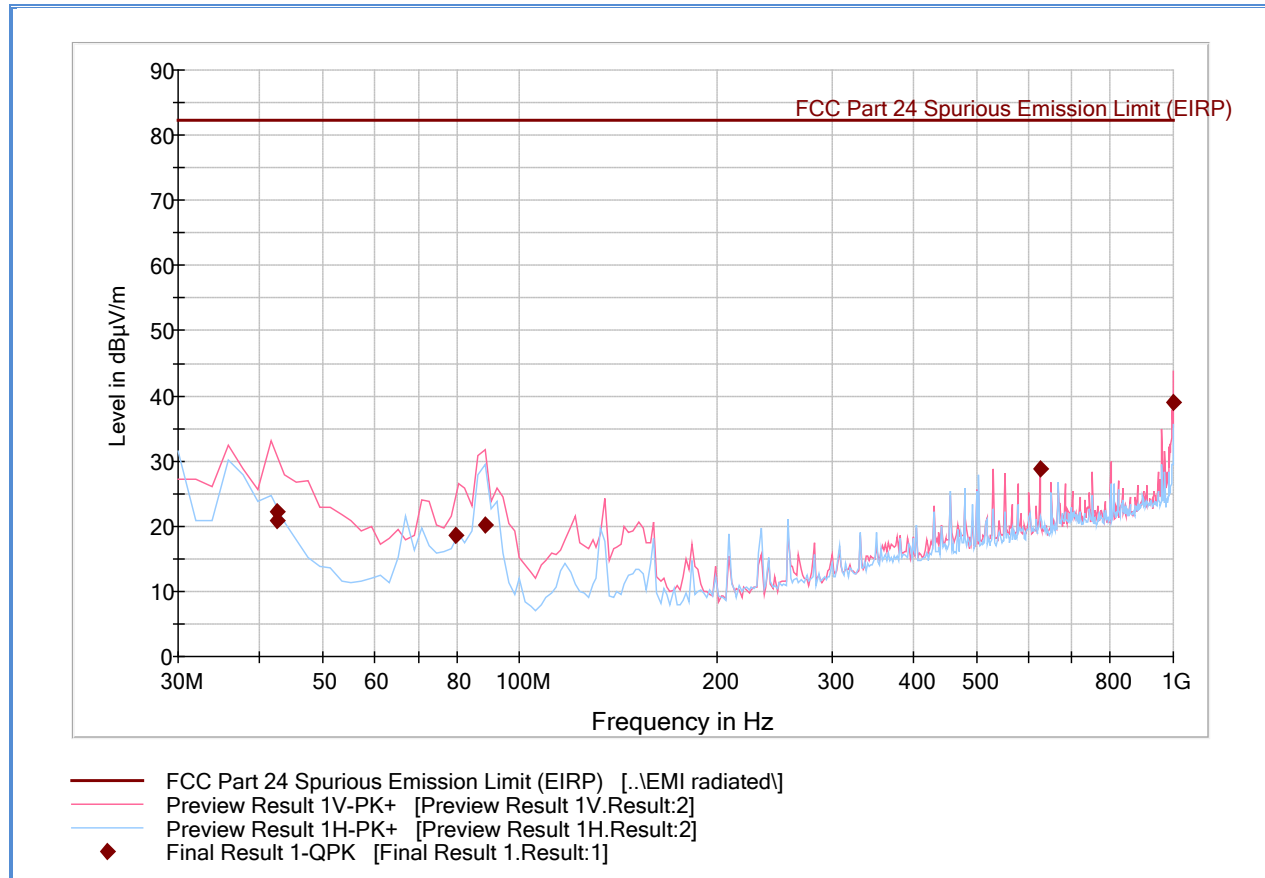
2.7.7 Additional Observations

- This is a radiated test using substitution method as per Unwanted Emissions: Radiated Spurious method of measurement of ANSI/TIA/EIA-603-C 2004, August 17, 2004.
- Only the worst case configuration presented in this test report.
- Measurement was done using EMC32 V8.53 automated software. Reported level is the actual level with all the correction factors factored in. Correction Factor column is for informational purposes only.

2.7.8 Test Results

See attached plots.

2.7.9 Test Results Below 1GHz (CDMA2000 Worst Case Configuration)

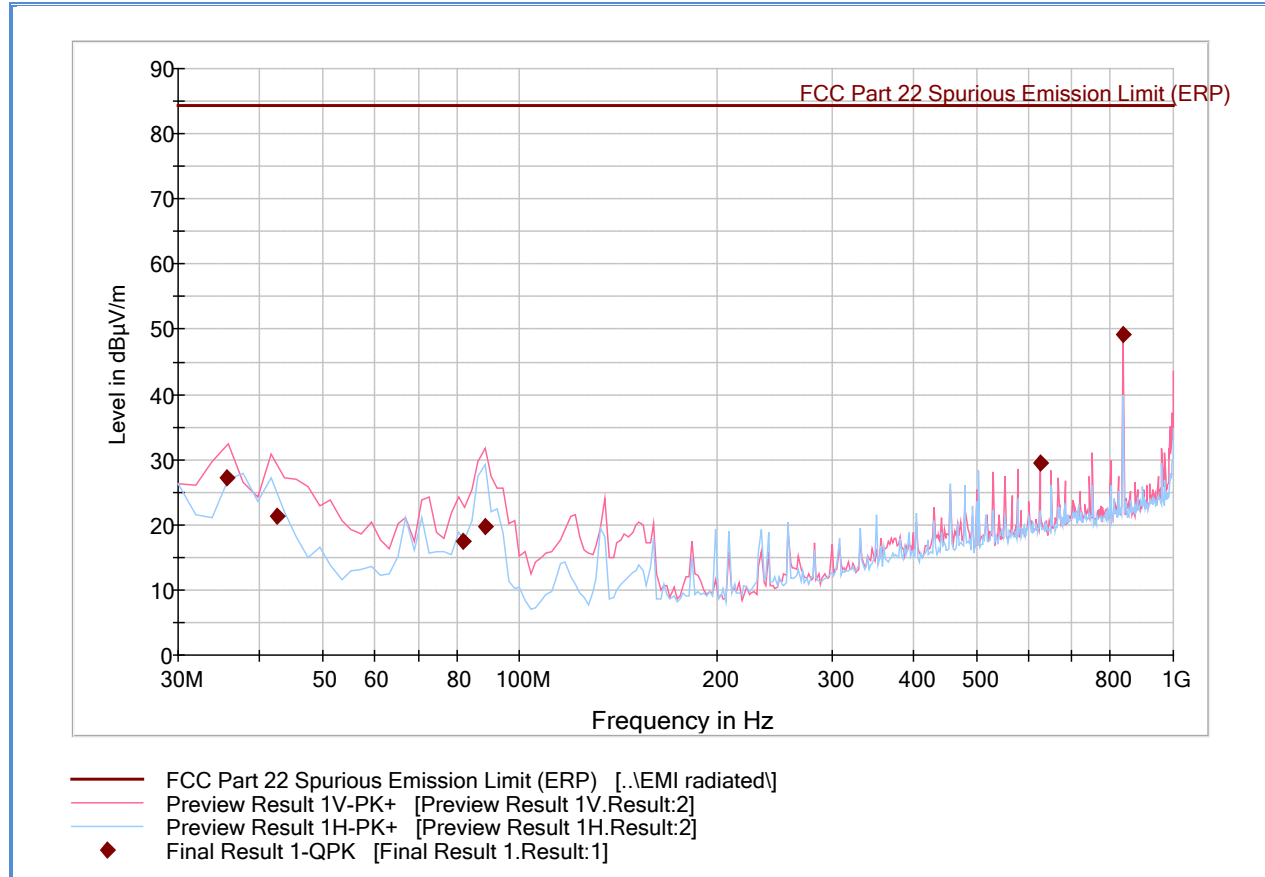


Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
42.423327	22.2	1000.0	120.000	100.0	V	-15.0	-17.7	60.0	82.2
42.527214	20.9	1000.0	120.000	115.0	V	22.0	-17.7	61.3	82.2
79.981082	18.6	1000.0	120.000	200.0	V	11.0	-22.0	63.6	82.2
88.452745	20.2	1000.0	120.000	250.0	V	11.0	-21.1	62.0	82.2
624.989659	28.7	1000.0	120.000	150.0	V	-3.0	-3.5	53.5	82.2
999.920000	39.0	1000.0	120.000	100.0	V	183.0	1.6	43.3	82.2

Test Notes: Only worst case channel presented for spurious emissions below 1GHz. Only case spurious emissions within 20db of the calculated limit will be proven by substitution method.

2.7.10 Test Results Below 1GHz (1xEV-DO Worst Case Configuration)

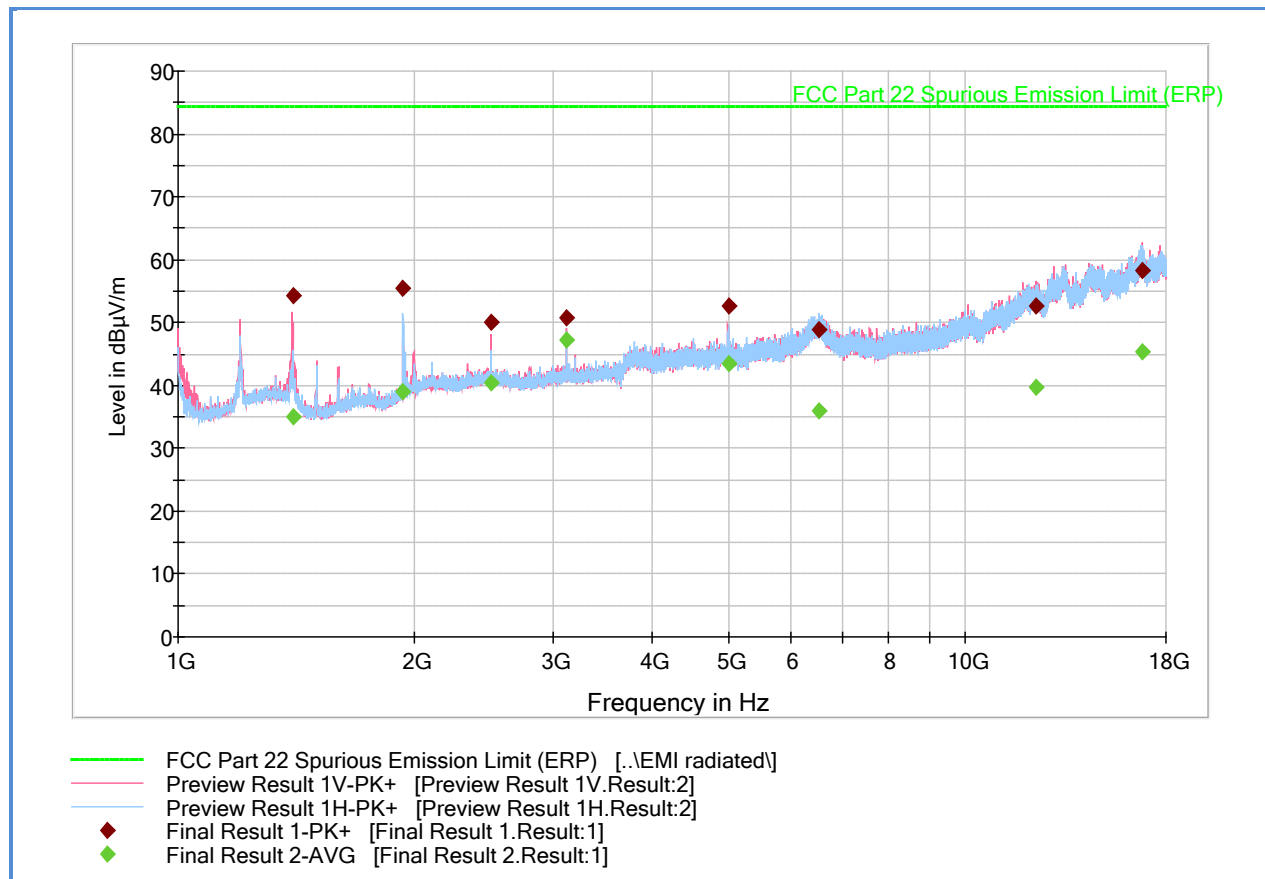


Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
35.711663	27.3	1000.0	120.000	150.0	V	54.0	-14.5	57.1	84.4
42.527214	21.4	1000.0	120.000	105.0	V	22.0	-17.7	63.0	84.4
81.788858	17.5	1000.0	120.000	209.0	V	11.0	-21.9	66.9	84.4
88.532745	19.6	1000.0	120.000	400.0	V	-15.0	-21.1	64.8	84.4
625.029659	29.5	1000.0	120.000	150.0	V	30.0	-3.5	54.9	84.4
836.793427	49.3	1000.0	120.000	109.0	V	217.0	-0.4	Fundamental	

Test Notes: Only worst case channel presented for spurious emissions below 1GHz. Only case spurious emissions within 20db of the calculated limit will be proven by substitution method.

2.7.11 Test Results Above 1GHz (CDMA2000 Cellular High Channel)



Peak Data

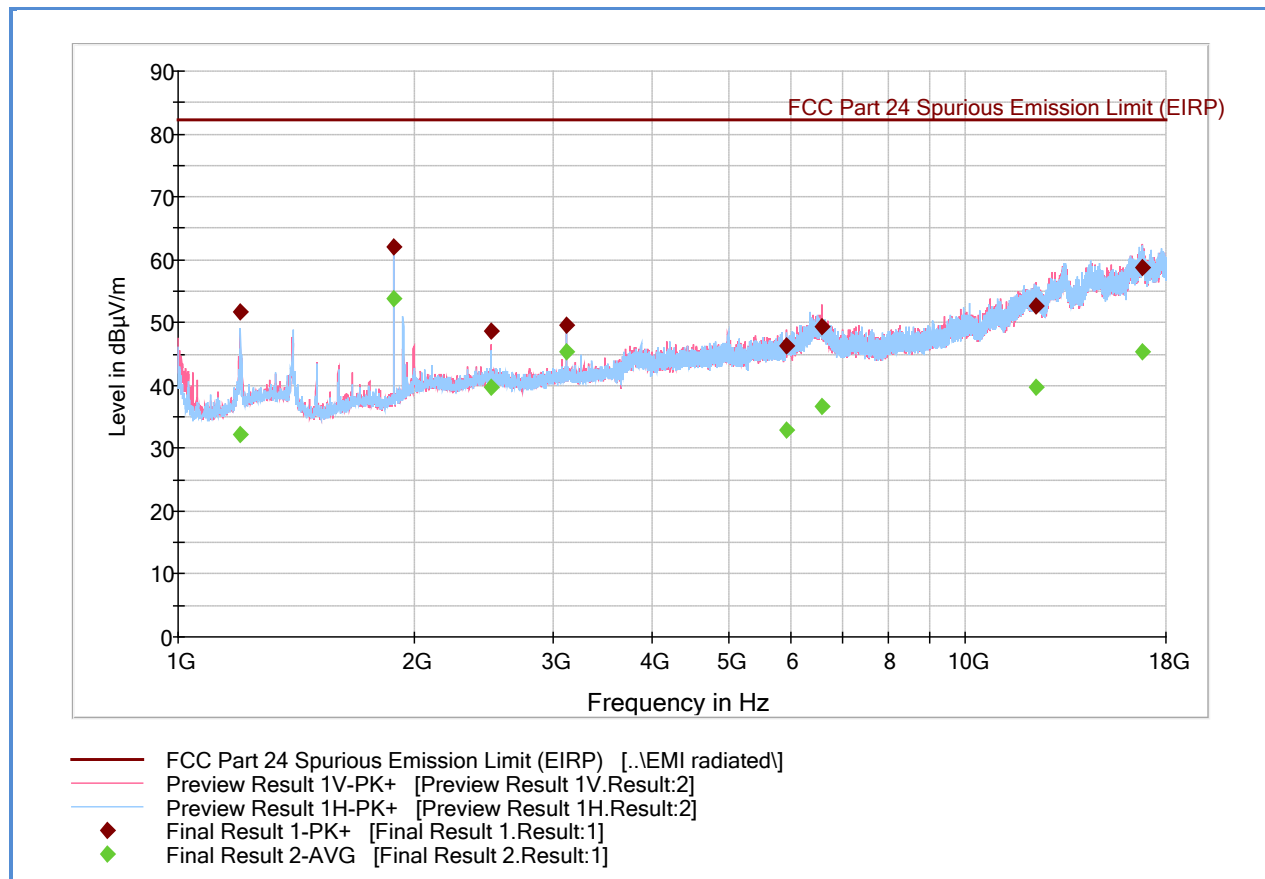
Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
1398.033333	54.4	1000.0	1000.000	106.7	V	228.0	-5.5	30.0	84.4
1932.200000	55.5	1000.0	1000.000	302.2	H	20.0	-2.3	28.9	84.4
2499.800000	50.1	1000.0	1000.000	113.7	V	336.0	-0.1	34.3	84.4
3118.400000	50.8	1000.0	1000.000	151.6	V	218.0	1.1	33.5	84.4
5000.333333	52.7	1000.0	1000.000	206.5	V	336.0	6.5	31.7	84.4
6532.733333	48.9	1000.0	1000.000	342.1	H	338.0	11.2	35.5	84.4
12288.433333	52.7	1000.0	1000.000	401.9	V	4.0	17.1	31.7	84.4
16785.633333	58.3	1000.0	1000.000	379.1	V	218.0	23.8	26.1	84.4

Substitution Data

Frequency (MHz)	Field Strength @ 3 meters (dBμV/m)	Cable Loss (dB)	Substitution Antenna Gain (dBi)	Signal Generator Level (dBm)	Substitution Data SGL+AG-CL (dBm)	Limit (dBm)	Compliance

Test Notes: Only worst case channel presented for spurious emissions above 1GHz. Substitution data not required since margin is >20dB compared to the -13dBm limit (converted to field strength @ 3 meters).

2.7.12 Test Results Above 1GHz (CDMA2000 PCS Mid Channel)



Peak Data

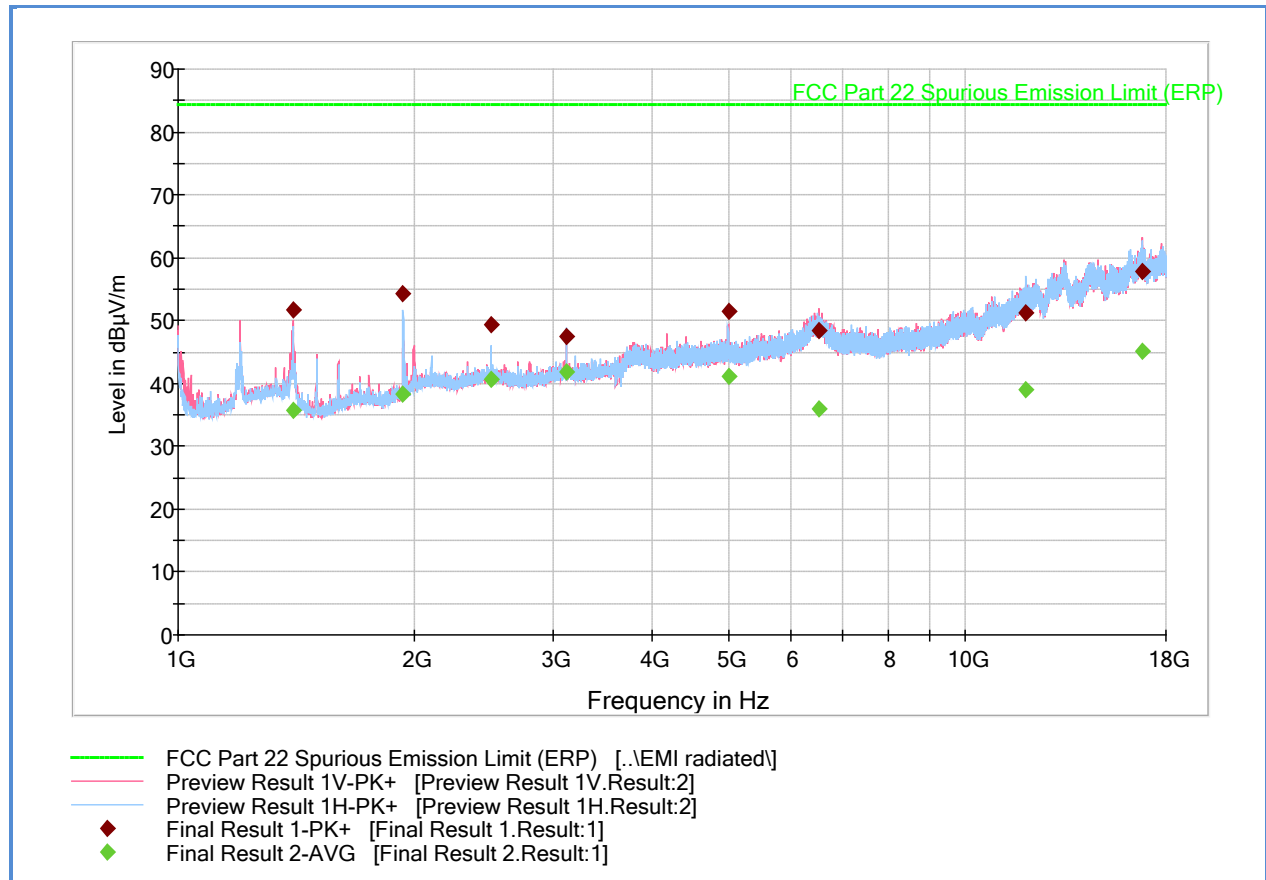
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1200.166667	51.7	1000.0	1000.000	103.7	H	223.0	-6.2	30.6	82.2
1880.266667	61.9	1000.0	1000.000	300.2	V	261.0	-2.8	Fundamental	
2500.200000	48.7	1000.0	1000.000	102.7	V	86.0	-0.1	33.5	82.2
3118.400000	49.6	1000.0	1000.000	188.5	H	-3.0	1.1	32.6	82.2
5934.366667	46.2	1000.0	1000.000	202.3	V	3.0	8.6	36.0	82.2
6566.766667	49.3	1000.0	1000.000	101.7	V	16.0	11.3	32.9	82.2
12320.866667	52.7	1000.0	1000.000	149.6	V	253.0	17.1	29.5	82.2
16796.233333	58.7	1000.0	1000.000	401.9	V	258.0	23.8	23.5	82.2

Substitution Data

Frequency (MHz)	Field Strength @ 3 meters (dBµV/m)	Cable Loss (dB)	Substitution Antenna Gain (dBi)	Signal Generator Level (dBm)	Substitution Data SGL+AG-CL (dBm)	Limit (dBm)	Compliance

Test Notes: Only worst case channel presented for spurious emissions above 1GHz. Substitution data not required since margin is >20dB compared to the -13dBm limit (converted to field strength @ 3 meters).

2.7.13 Test Results Above 1GHz (1xEV-DO Cellular Mid Channel)



Peak Data

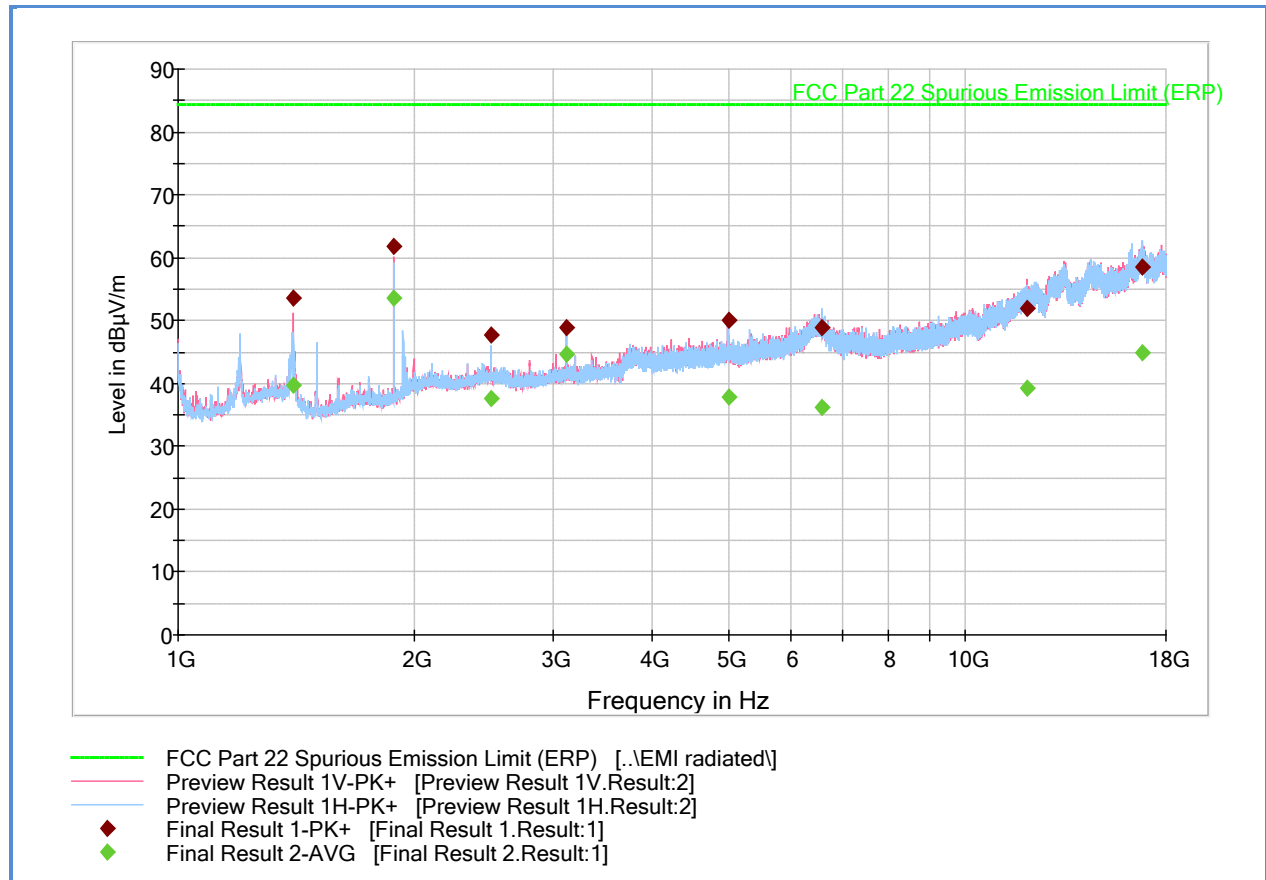
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1400.500000	51.6	1000.0	1000.000	103.7	V	238.0	-5.5	32.8	84.4
1932.366667	54.4	1000.0	1000.000	302.2	H	20.0	-2.3	30.0	84.4
2500.166667	49.3	1000.0	1000.000	147.7	H	265.0	-0.1	35.1	84.4
3118.400000	47.4	1000.0	1000.000	156.6	H	261.0	1.1	37.0	84.4
5000.300000	51.5	1000.0	1000.000	301.5	V	15.0	6.5	32.9	84.4
6531.433333	48.5	1000.0	1000.000	302.2	V	218.0	11.2	35.9	84.4
11965.133333	51.3	1000.0	1000.000	401.9	H	35.0	17.6	33.1	84.4
16809.633333	57.8	1000.0	1000.000	323.6	V	20.0	23.7	26.6	84.4

Substitution Data

Frequency (MHz)	Field Strength @ 3 meters (dBµV/m)	Cable Loss (dB)	Substitution Antenna Gain (dBi)	Signal Generator Level (dBm)	Substitution Data SGL+AG-CL (dBm)	Limit (dBm)	Compliance

Test Notes: Only worst case channel presented for spurious emissions above 1GHz. Substitution data not required since margin is >20dB compared to the -13dBm limit (converted to field strength @ 3 meters).

2.7.14 Test Results Above 1GHz (1xEV-DO PCS Mid Channel)



Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1398.933333	53.7	1000.0	1000.000	117.7	V	225.0	-5.5	28.6	82.2
1878.466667	61.7	1000.0	1000.000	201.3	V	9.0	-2.8	20.5	82.2
2500.366667	47.8	1000.0	1000.000	115.8	H	-3.0	-0.1	34.5	82.2
3118.400000	48.9	1000.0	1000.000	188.6	H	-3.0	1.1	33.3	82.2
4999.933333	50.0	1000.0	1000.000	146.7	H	5.0	6.5	32.2	82.2
6590.966667	48.9	1000.0	1000.000	123.7	H	350.0	11.2	33.4	82.2
11969.366667	52.0	1000.0	1000.000	235.4	V	124.0	17.6	30.2	82.2
16797.166667	58.5	1000.0	1000.000	189.5	H	153.0	23.8	23.8	82.2

Substitution Data

Frequency (MHz)	Field Strength @ 3 meters (dBµV/m)	Cable Loss (dB)	Substitution Antenna Gain (dBi)	Signal Generator Level (dBm)	Substitution Data SGL+AG-CL (dBm)	Limit (dBm)	Compliance

Test Notes: Only worst case channel presented for spurious emissions above 1GHz. Substitution data not required since margin is >20dB compared to the -13dBm limit (converted to field strength @ 3 meters).



2.8 FREQUENCY STABILITY

2.8.1 Specification Reference

Part 22 Subpart H §22.355 and Part 24 Subpart E §24.235

2.8.2 Standard Applicable

(§22.355) Except as otherwise provided in this part, the carrier frequency of each transmitter in the Public Mobile Services must be maintained within the tolerances given in Table C–1 of this section.

Table C–1—Frequency Tolerance for Transmitters in the Public Mobile Services

Frequency range (MHz)	Mobile ≤3 watts (ppm)
821 to 896	2.5 (0.00025%)

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

2.8.3 Equipment Under Test and Modification State

Serial No: SN022 and SN018 / Test Configuration A

2.8.4 Date of Test/Initial of test personnel who performed the test

April 03, 2015 and May 31, 2015/FSC

2.8.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.8.6 Environmental Conditions

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility.

Ambient Temperature	24.7 - 25.0 °C
Relative Humidity	28.2 – 44.5 %
ATM Pressure	98.6 – 99.9 kPa

2.8.7 Additional Observations

- This is a conducted test. The EUT was operated at 12.0VDC nominal voltage and was placed in the temperature chamber for the series of evaluations performed. The EUT was controlled by a CMW500 and the maximum frequency error was monitored using the built-in carrier frequency error TX Measurement application.



- The Temperature was reduced to -30°C and allowed to sit for 1 hour to allow the equipment and chamber temperature to stabilize. The measurements on both cellular and PCS channels were then performed. The temperature was then increased by 10°C steps and allowed to settle before taking the next set of measurements.
- Voltage variation was also performed at 85% and 115% of the nominal voltage.
- Only worst case configuration presented. See Section 1.4.4 of this test report for details.
- For PCS measurements, the maximum frequency deviation was verified against the frequency band edges using the EBW data. Sample calculation:

CDMA 2000 PCS High Channel worst case frequency error: 4.69Hz
Worst case EBW (-26dB) of CDMA 2000 PCS: 1.55MHz
Edge of fundamental emission (1908.75+(1.55/2)) : 1909.525MHz
Max. fundamental frequency error (1909.525+ 0.00000469): 1909.525005 MHz
EUT complies. 1909.525005 MHZ < 1910 MHZ (edge of authorized band)

2.8.8 Test Results Summary

Mode	Frequency (MHz)	Deviation (Hz)	Deviation (ppm)
CDMA2000 Cellular (Low Channel 1013)	824.700	-5.05	0.0061
CDMA2000 PCS (Mid Channel 600)	1880.00	4.69	0.0025
1xEV-DO Cellular (Mid Channel 384)	836.520	3.66	0.0044
1xEV-DO PCS (Mid Channel 600)	1880.00	2.96	0.0016

See attached tables for detailed test results.

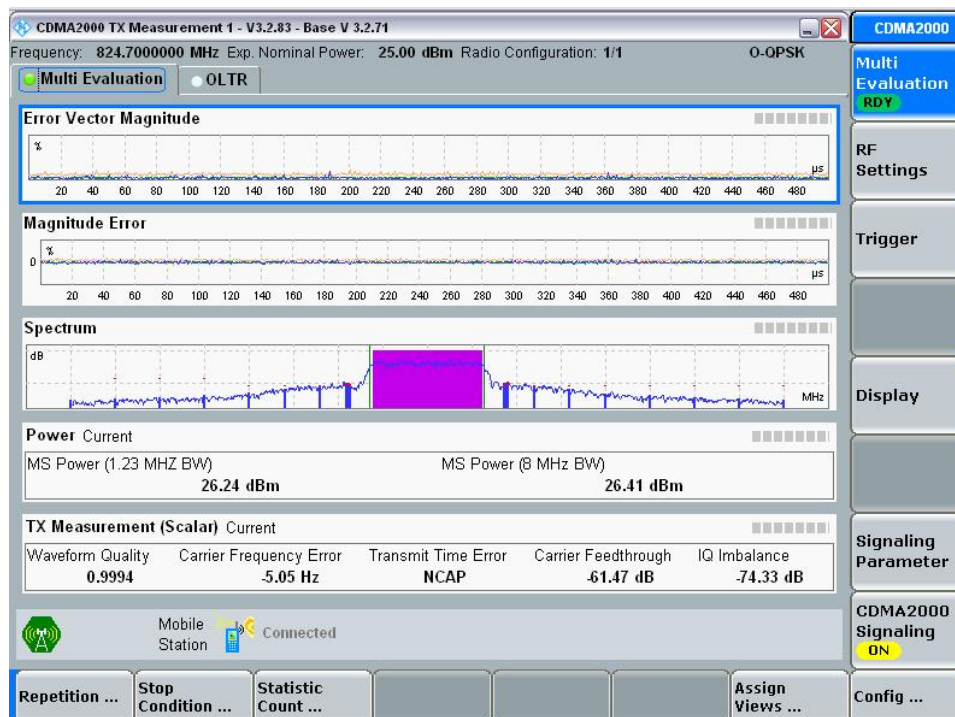
CDMA2000 Cellular Worst Case Configuration (Low Channel 1013)					
Voltage (%)	Power (VDC)	Temp (°C)	Frequency (MHz)	Max. Frequency Deviation (Hz)	Deviation Limit (Hz)
100	12.0	-30	824.7	-5.05	2061.75
100		-20		-0.44	2061.75
100		-10		-1.68	2061.75
100		0		1.10	2061.75
100		+10		1.46	2061.75
100		+20		0.07	2061.75
100		+30		2.34	2061.75
100		+40		-1.17	2061.75
100		+50		-0.22	2061.75
115	13.8	+20		-0.44	2061.75
85	10.2	+20		1.90	2061.75

CDMA2000 PCS Worst Case Configuration (Mid Channel 600)					
Voltage (%)	Power (VDC)	Temp (°C)	Frequency (MHz)	Max. Frequency Deviation (Hz)	Deviation Limit (Hz)
100	12.0	-30	1880.0	4.69	EUT complies. See Section 2.8.7 for sample calculation
100		-20		4.17	
100		-10		2.93	
100		0		-3.96	
100		+10		0.73	
100		+20		-1.32	
100		+30		-3.66	
100		+40		2.56	
100		+50		-2.56	
115	13.8	+20		-1.25	
85	10.2	+20		-0.51	

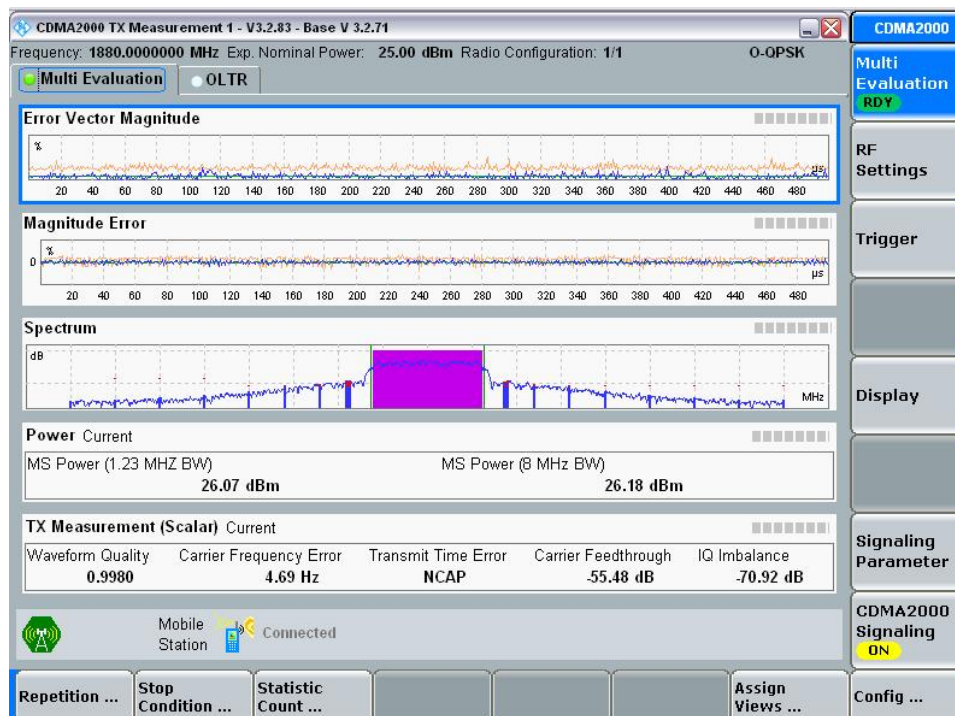
1xEV-DO Cellular Worst Case Configuration (Mid Channel 384)					
Voltage (%)	Power (VDC)	Temp (°C)	Frequency (MHz)	Max. Frequency Deviation (Hz)	Deviation Limit (Hz)
100	13.5	-30	836.520	-1.46	2091.3
100		-20		3.66	2091.3
100		-10		-1.56	2091.3
100		0		-0.98	2091.3
100		+10		1.23	2091.3
100		+20		0.03	2091.3
100		+30		-1.69	2091.3
100		+40		-2.98	2091.3
100		+50		-1.98	2091.3
115	15.525	+20		0.12	2091.3
85	11.475	+20		-0.07	2091.3

1xEV-DO PCS Worst Case Configuration (Mid Channel 600)					
Voltage (%)	Power (VDC)	Temp (°C)	Frequency (MHz)	Max. Frequency Deviation (Hz)	Deviation Limit (Hz)
100	13.5	-30	1880.0	2.96	EUT complies. See Section 2.8.7 for sample calculation
100		-20		-1.03	
100		-10		-1.45	
100		0		2.33	
100		+10		1.94	
100		+20		0.12	
100		+30		0.45	
100		+40		-1.33	
100		+50		-0.51	
115	15.525	+20		0.23	
85	11.475	+20		-1.43	

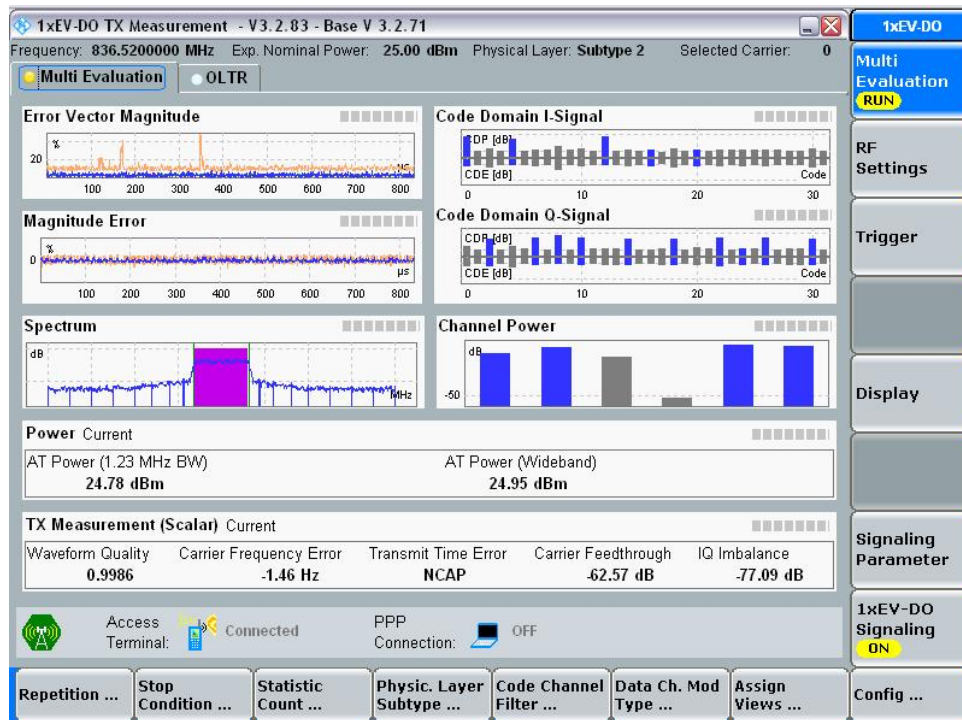
2.8.9 Sample Test Plots



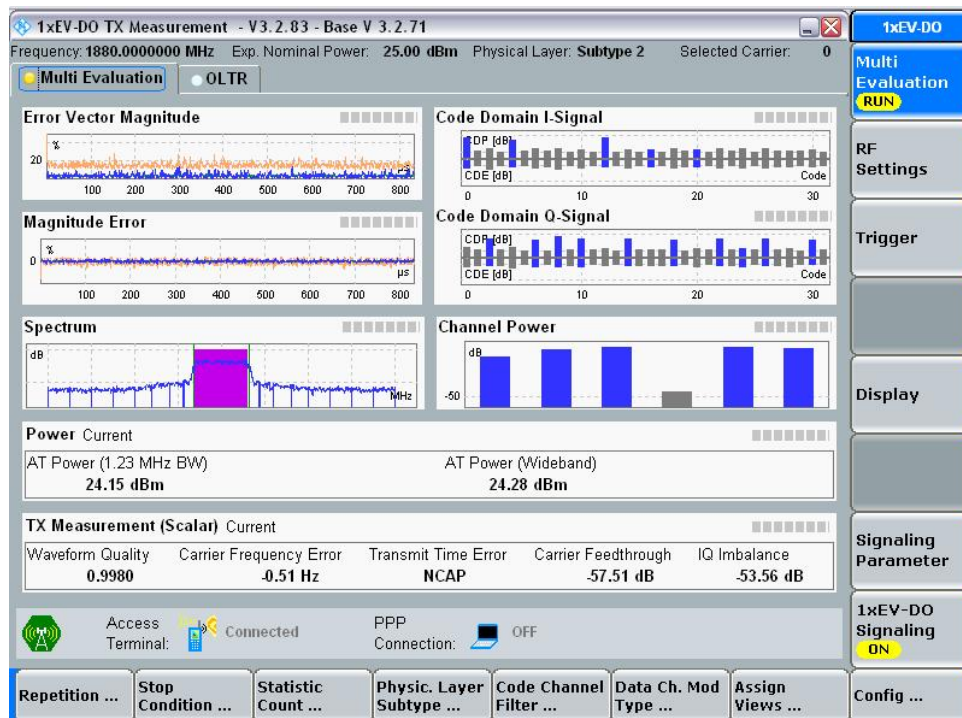
CDMA2000 Cellular (Low Channel 1013) 12VDC @ -30°C



CDMA2000 PCS (Mid Channel 600) 12VDC @ -30°C



1xEV-DO Cellular (Mid Channel 384) 12VDC @ -30°C



1xEV-DO PCS (Mid Channel 600) 12VDC @ 50°C



2.9 RECEIVER SPURIOUS EMISSIONS

2.9.1 Specification Reference

RSS-132(4.6) and RSS-133(6.6)

2.9.2 Standard Applicable

Receiver spurious emissions shall comply with the limits specified in RSS-Gen.

2.9.3 Equipment Under Test and Modification State

Serial No: SN023 / Test Configuration B

2.9.4 Date of Test/Initial of test personnel who performed the test

March 01 and 02, 2015 /FSC

2.9.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.9.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	20.4 – 20.6 °C
Relative Humidity	49.6 - 52.0 %
ATM Pressure	100 - 100.1 kPa

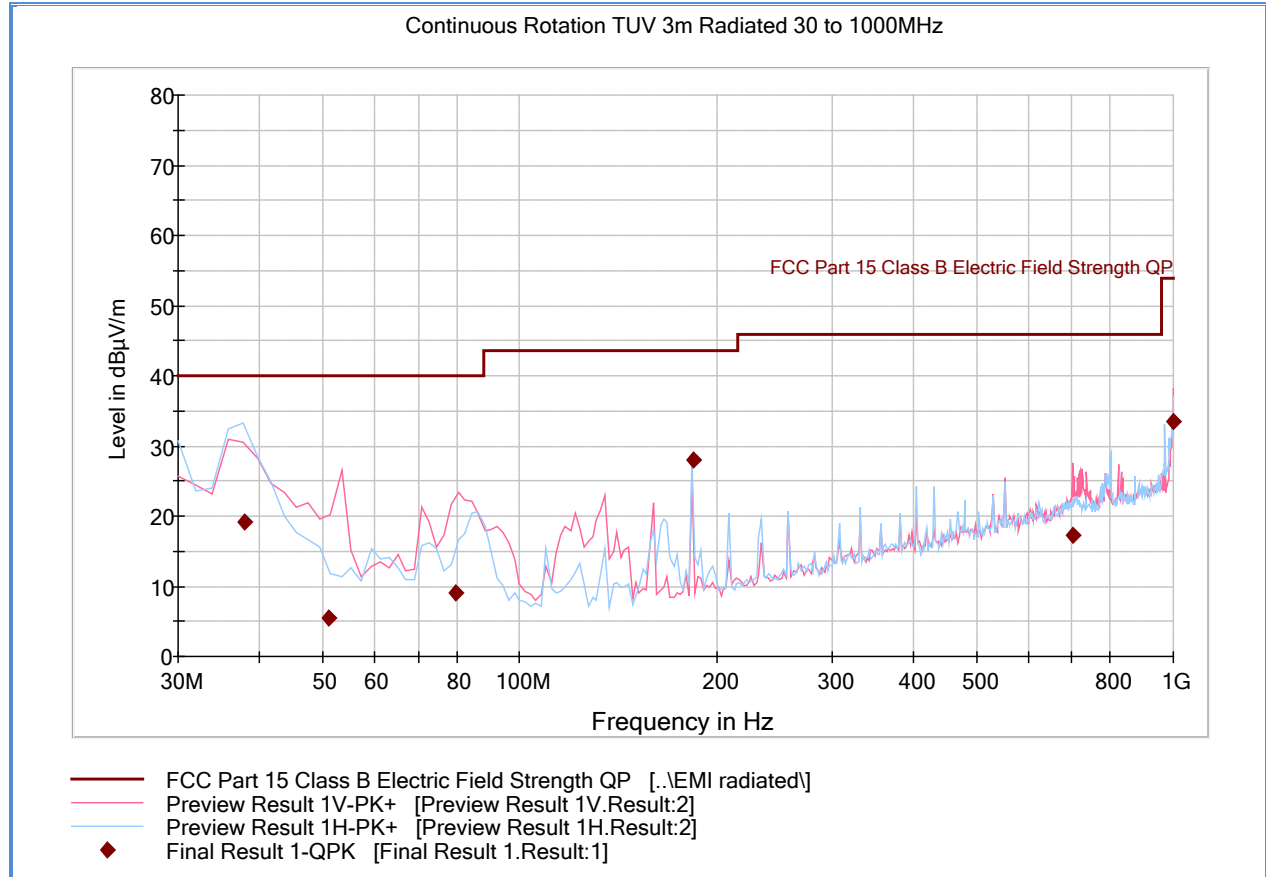
2.9.7 Additional Observations

- This is a radiated test. The spectrum was searched from 30MHz to the 18GHz (6GHz as per requirement).
- Limit used is from FCC §15.209 which is identical to RSS-Gen limits.
- All emissions observed above 1GHz are noise floor measurements.
- Measurement was done using EMC32 automated software. Reported level is the actual level with all the correction factors factored in. Correction Factor column is for informational purposes only.

2.9.8 Test Results

See attached plots.

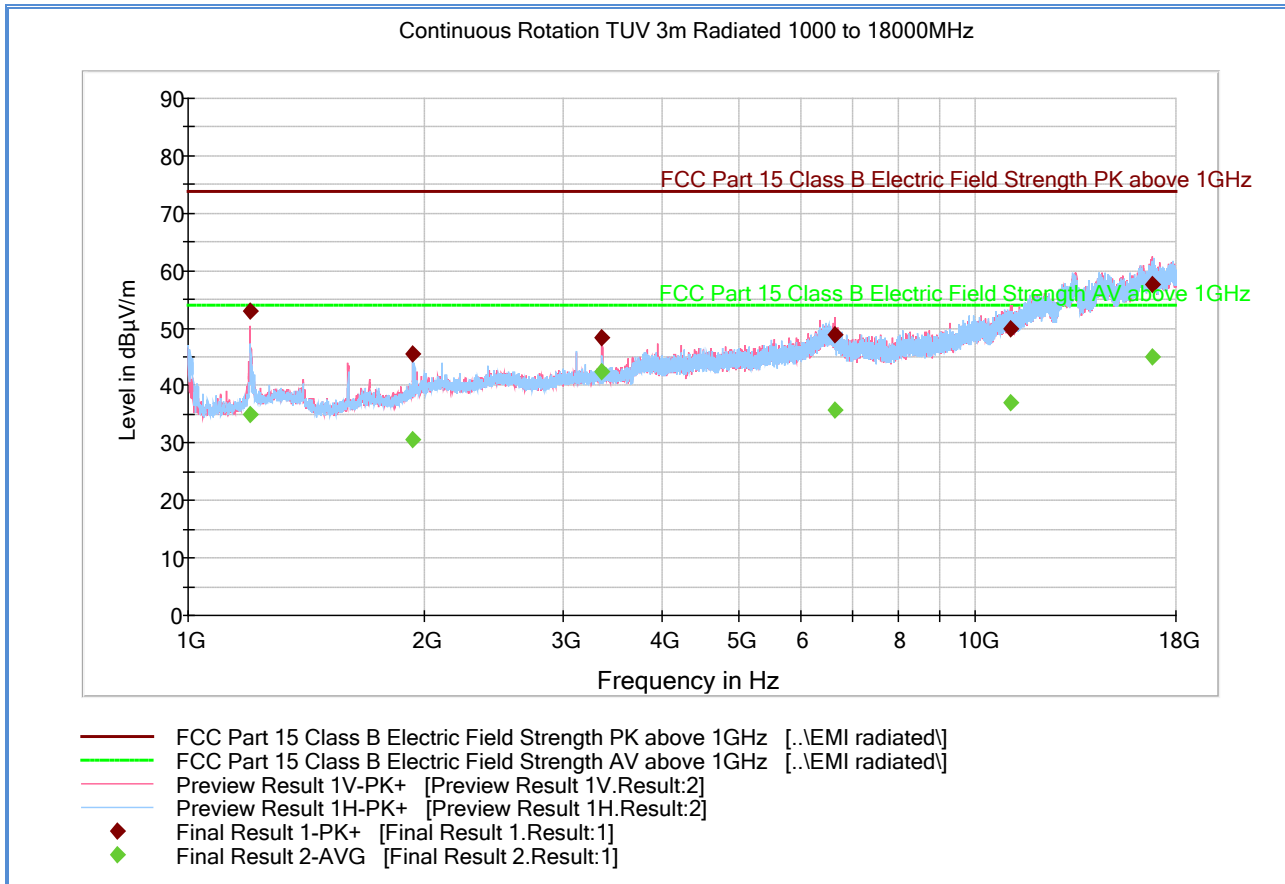
2.9.9 Test Results Below 1GHz (Receive Mode)



Quasi Peak Data

Frequency (MHz)	QuasiPeak (dB μ V/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dB μ V/m)
37.815551	19.1	1000.0	120.000	400.0	H	15.0	-15.1	20.9	40.0
51.006653	5.5	1000.0	120.000	150.0	V	106.0	-19.7	34.5	40.0
79.981082	9.1	1000.0	120.000	100.0	V	232.0	-21.6	30.9	40.0
184.287134	28.0	1000.0	120.000	177.0	H	157.0	-16.8	15.5	43.5
700.321283	17.2	1000.0	120.000	122.0	V	338.0	-1.4	28.8	46.0
999.560000	33.5	1000.0	120.000	212.0	V	220.0	1.7	20.4	53.9

2.9.10 Test Results Above 1GHz (Receive Mode)



Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1200.600000	52.9	1000.0	1000.000	206.5	V	85.0	-6.2	21.0	73.9
1932.566667	45.6	1000.0	1000.000	277.3	H	88.0	-2.0	28.3	73.9
3359.600000	48.3	1000.0	1000.000	200.5	V	188.0	1.5	25.6	73.9
6631.933333	48.8	1000.0	1000.000	155.7	V	74.0	10.9	25.1	73.9
11092.133333	50.0	1000.0	1000.000	139.7	V	167.0	14.5	23.9	73.9
16814.900000	57.7	1000.0	1000.000	375.1	V	-20.0	23.5	16.2	73.9

Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1200.600000	35.1	1000.0	1000.000	206.5	V	85.0	-6.2	18.8	53.9
1932.566667	30.7	1000.0	1000.000	277.3	H	88.0	-2.0	23.2	53.9
3359.600000	42.4	1000.0	1000.000	200.5	V	188.0	1.5	11.5	53.9
6631.933333	35.7	1000.0	1000.000	155.7	V	74.0	10.9	18.2	53.9
11092.133333	36.9	1000.0	1000.000	139.7	V	167.0	14.5	17.0	53.9
16814.900000	44.9	1000.0	1000.000	375.1	V	-20.0	23.5	9.0	53.9

Test Notes: No significant emissions observed.

2.10 POWER LINE CONDUCTED EMISSIONS

2.10.1 Specification Reference

RSS-Gen 8.8

2.10.2 Standard Applicable

A radio apparatus that is designed to be connected to the public utility (AC) power line shall ensure that the radio frequency voltage, which is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz-30 MHz, shall not exceed the limits in table below.

Unless the requirements applicable to a given device state otherwise, for any radio apparatus equipped to operate from the public utility AC power supply either directly or indirectly (such as with a battery charger), the radio frequency voltage of emissions conducted back onto the AC power lines in the frequency range of 0.15 MHz to 30 MHz shall not exceed the limits shown in table below. The more stringent limit applies at the frequency range boundaries.

Frequency of emission (MHz)	Conducted limit (dBμV)	
	Quasi-peak	Average
0.15–0.5	66 to 56*	56 to 46*
0.5–5	56	46
5–30	60	50

**Decreases with the logarithm of the frequency.*

2.10.3 Equipment Under Test and Modification State

Not applicable. EUT is a licensed device and not designed to operate from the public utility AC power supply.



SECTION 3

TEST EQUIPMENT USED



3.1 TEST EQUIPMENT USED

List of absolute measuring and other principal items of test equipment.

ID Number (SDGE/SDRB)	Test Equipment	Type	Serial Number	Manufacturer	Cal Date	Cal Due Date
Antenna Conducted Port Setup						
7604	P-Series Power Meter	N1912A	SG45100273	Agilent	05/27/15	05/27/16
7605	50MHz-18GHz Wideband Power Sensor	N1921A	MY51100054	Agilent	04/10/15	04/10/16
7582	Signal/Spectrum Analyzer	FSW26	101614	Rhode & Schwarz	12/22/14	12/22/15
7608	Vector Signal Generator	SMBV100A	259021	Rhode & Schwarz	06/06/14	06/06/15
7562	Wideband Radio Communication Tester	CMW 500	1201.0002k50 /103829	Rhode & Schwarz	10/09/13	10/09/15
8825	20dB Attenuator	46-20-34	BK5773	Weinschel Corp.	Verified by 7582 and 7608	
8832	20dB Attenuator	34-20-34	BP4150	MCE/Weinschel	Verified by 7582 and 7608	
Radiated Emissions						
1002	Bilog Antenna	3142C	00058717	ETS-Lindgren	01/30/14	01/30/16
7575	Double-ridged waveguide horn antenna	3117	00155511	EMCO	04/27/15	04/27/16
8628	Pre-amplifier	QLJ 01182835-JO	8986002	QuinStar Technologies Inc.	03/20/15	03/20/16
1040	EMI Test Receiver	ESIB40	100292	Rhode & Schwarz	08/29/14	08/29/15
1049	EMI Test Receiver	ESU	100133	Rhode & Schwarz	03/11/15	03/11/16
1016	Pre-amplifier	PAM-0202	187	PAM	12/10/14	12/10/15
1153	High-frequency cable	SucoFlex 100 SX	N/A	Suhner	04/03/15	04/03/16
8543	High-frequency cable	Micropore 19057793	N/A	United Microwave Products	09/04/14	09/04/15
1150	Horn antenna	3160-09	012054-004	ETS	04/26/13	05/26/15
1151	Pre-amplifier	TS-PR26	100026	Rhode & Schwarz	05/03/15	05/03/16
Miscellaneous						
6792	Multimeter	3478A	2911A70964	Hewlett Packard	08/12/14	08/12/15
11312	Mini Environmental Quality Meter	850027	CF099-56010-340	Sper Scientific	04/09/15	04/09/16
	DC Power Supply	35010M	D102007S	Protek	Verified by 6792	
	Test Software	EMC32	V8.53	Rhode & Schwarz	N/A	

3.2 MEASUREMENT UNCERTAINTY

For a 95% confidence level, the measurement uncertainties for defined systems are:

3.2.1 Radiated Emission Measurements (Below 1GHz)

Contribution		Probability Distribution Type	Probability Distribution x_i	Standard Uncertainty $u(x_i)$	$[u(x_i)]^2$
1	Receiver/Spectrum Analyzer	Rectangular	0.45	0.26	0.07
2	Cables	Rectangular	0.50	0.29	0.08
3	Preamp	Rectangular	0.50	0.29	0.08
4	Antenna	Rectangular	0.75	0.43	0.19
5	Site	Rectangular	3.55	2.05	4.20
6	EUT Setup	Rectangular	1.00	0.58	0.33
Combined Uncertainty (u_c):					2.23
Coverage Factor (k):					2
Expanded Uncertainty:					4.45

3.2.2 Radiated Emission Measurements (Above 1GHz)

Contribution		Probability Distribution Type	Probability Distribution x_i	Standard Uncertainty $u(x_i)$	$[u(x_i)]^2$
1	Receiver/Spectrum Analyzer	Rectangular	0.57	0.33	0.11
2	Cables	Rectangular	0.70	0.40	0.16
3	Preamp	Rectangular	0.50	0.29	0.08
4	Antenna	Rectangular	0.37	0.21	0.05
5	Site	Rectangular	3.55	2.05	4.20
6	EUT Setup	Rectangular	1.00	0.58	0.33
Combined Uncertainty (u_c):					2.22
Coverage Factor (k):					2
Expanded Uncertainty:					4.44

3.2.3 Conducted Antenna Port Measurement

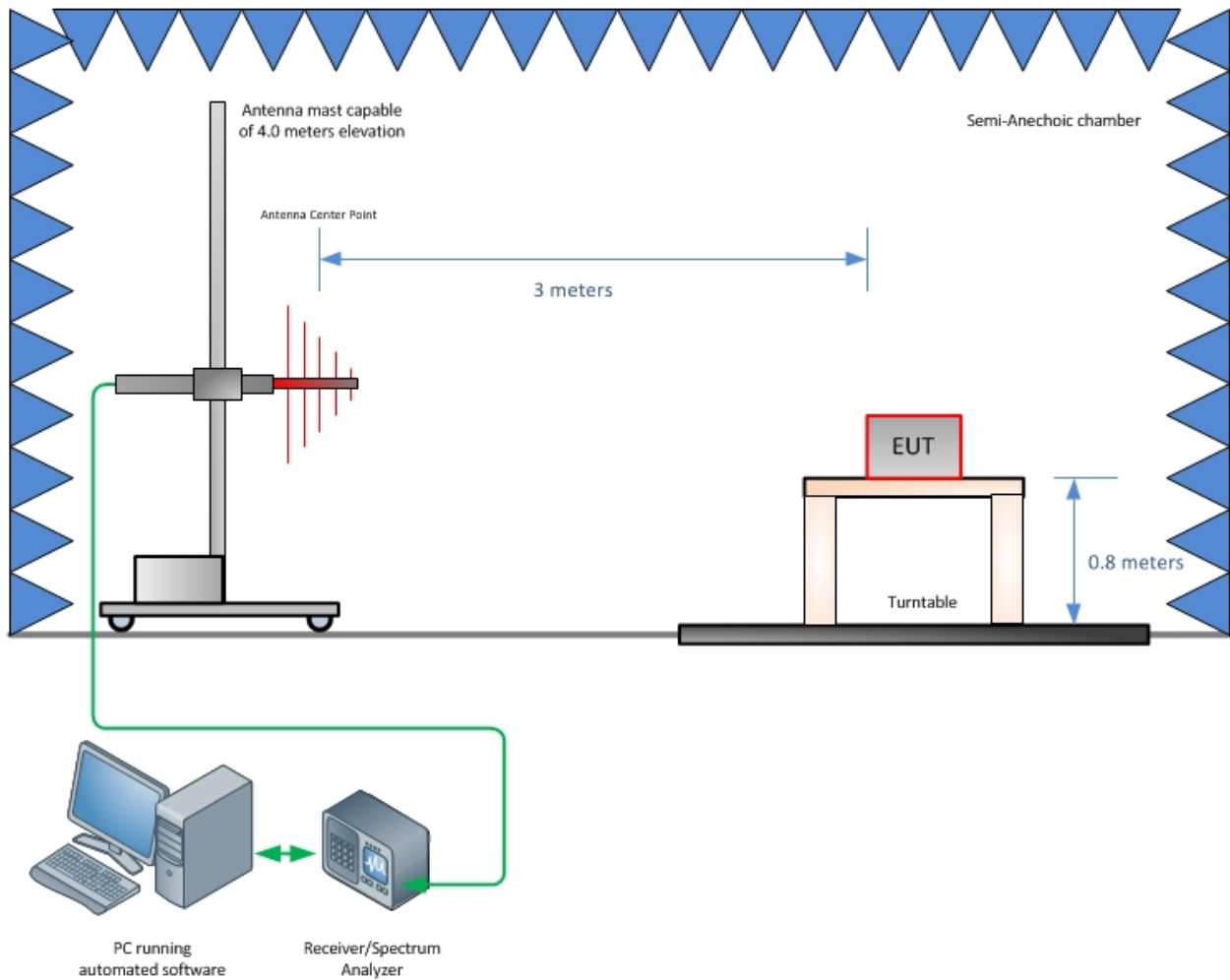
Contribution		Probability Distribution Type	Probability Distribution x_i	Standard Uncertainty $u(x_i)$	$[u(x_i)]^2$
1	Receiver/Spectrum Analyzer	Rectangular	0.57	0.33	0.11
2	Cables	Rectangular	0.50	0.29	0.08
3	EUT Setup	Rectangular	1.00	0.58	0.33
Combined Uncertainty (u_c):					0.72
Coverage Factor (k):					2
Expanded Uncertainty:					1.45



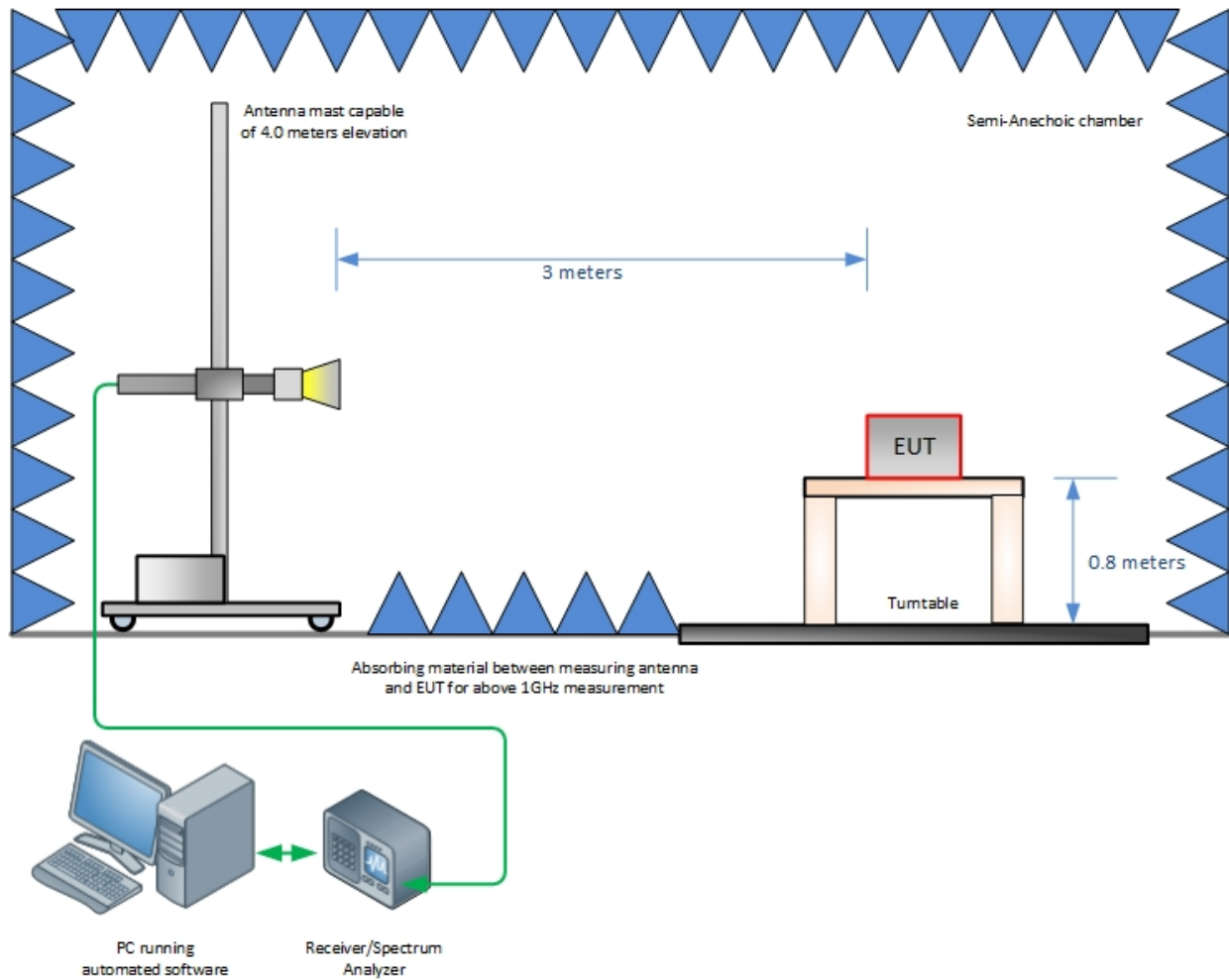
SECTION 4

DIAGRAM OF TEST SETUP

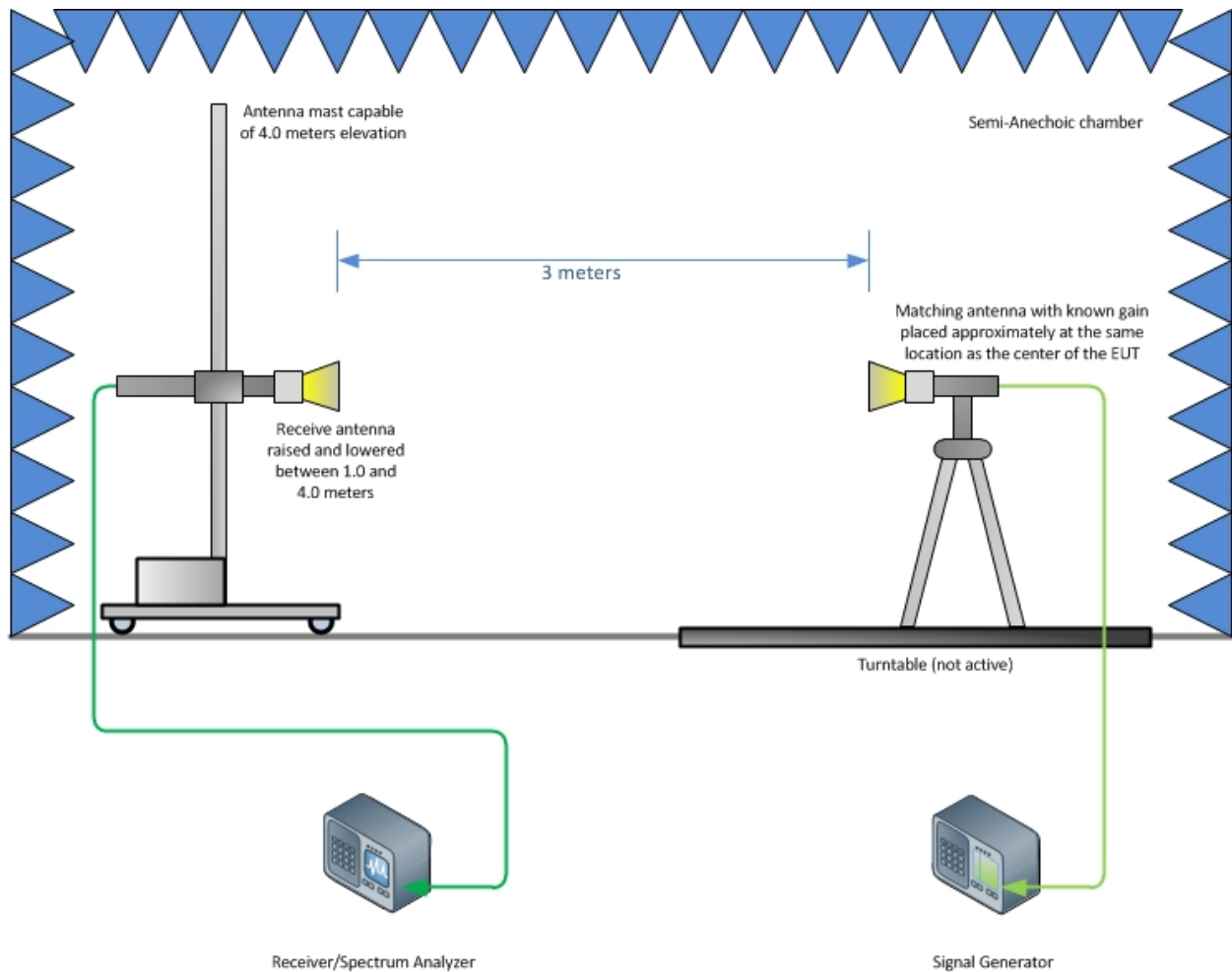
4.1 TEST SETUP DIAGRAM



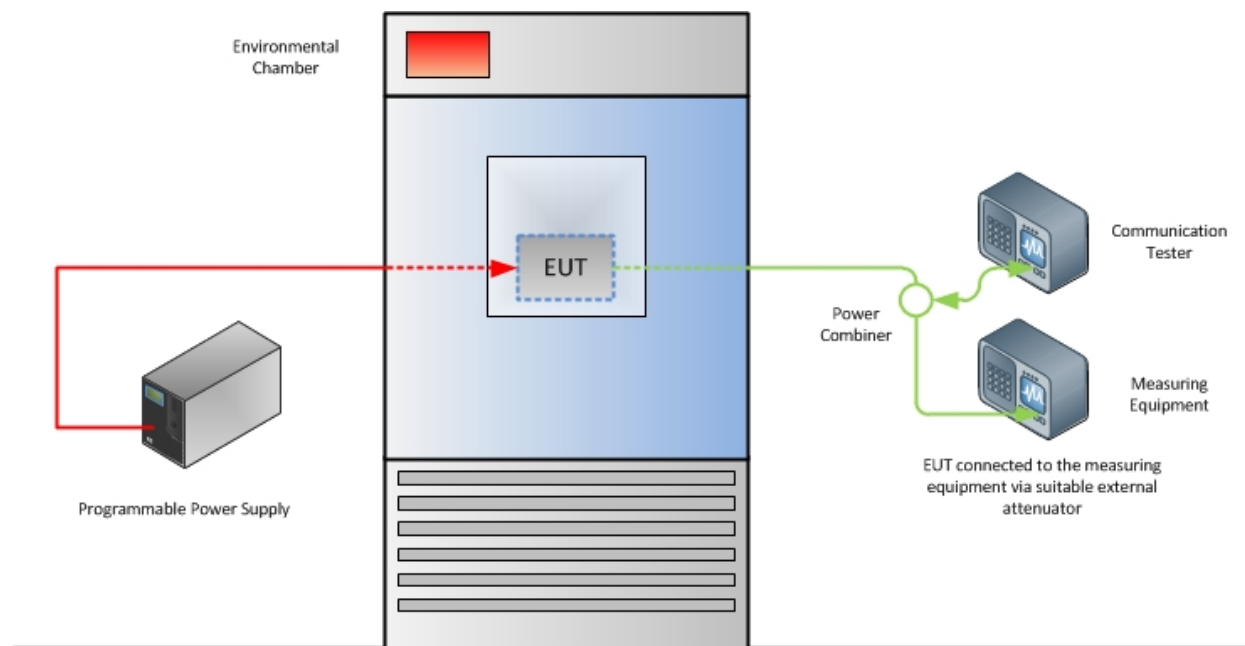
Radiated Emission Test Setup (Below 1GHz)



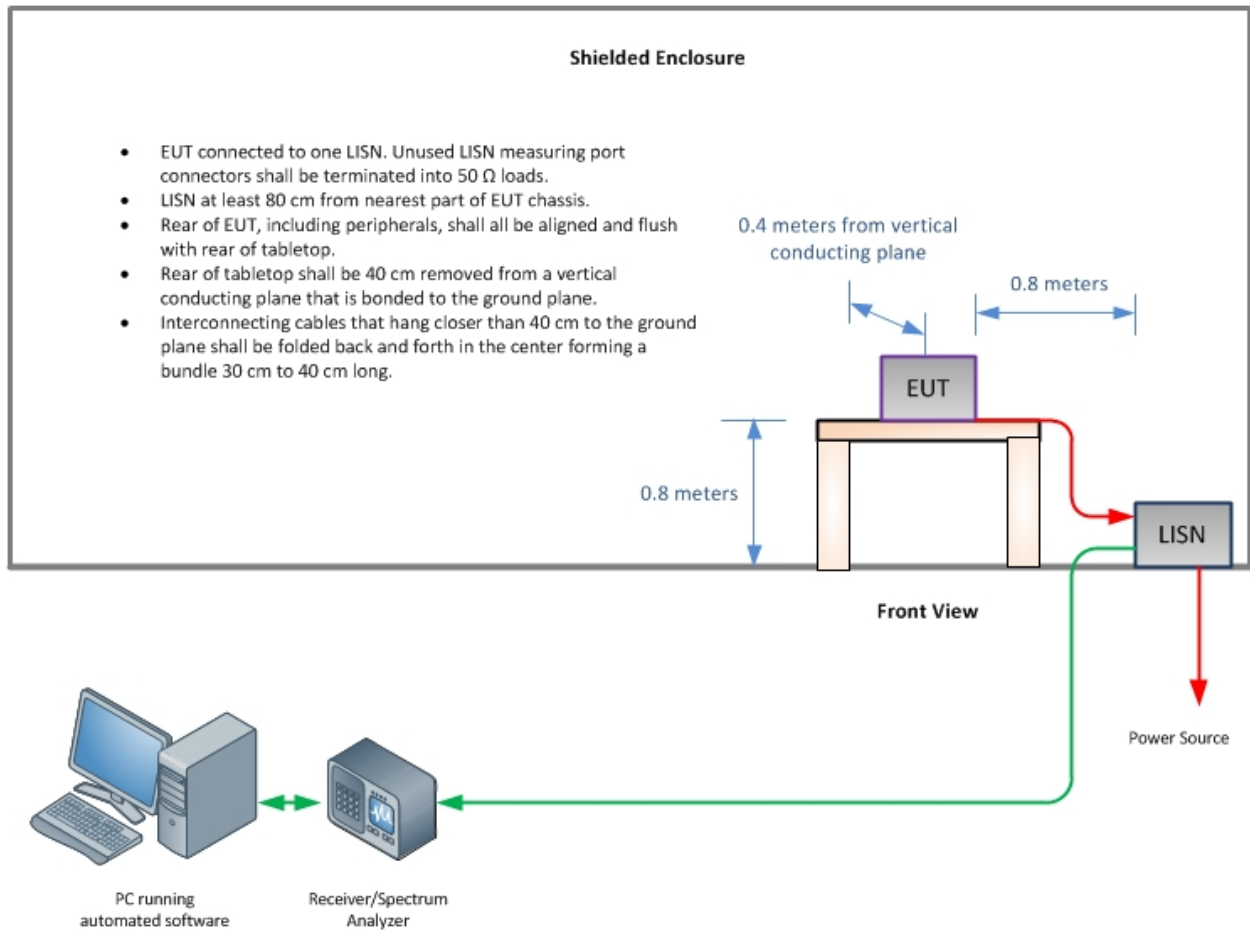
Radiated Emission Test Setup (Above 1GHz)



Substitution Test Method (Above 1GHz, if applicable)



Frequency Stability Test Configuration



Conducted Emissions Test Configuration (if applicable)



SECTION 5

ACCREDITATION, DISCLAIMERS AND COPYRIGHT

5.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT

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