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INDUSTRY CANADA RSS-131/133 AND FCC PARTS 2, 24, 27 TEST REPORT

Applicant	Dali Wireless, Inc.
Address	8618 Commerce Court, Burnaby, British Columbia, V5A 4N6, Canada
FCC ID	HCOT43DPAN2
IC Label	10323A-T43DPAN2
Model Number	t43-DPA-N2N
Product Description	1.9-2.1 GHz Dual-Band Outdoor Distributed Remote Unit
Date Sample Received	February 23rd, 2012
Date Sample Tested	March 3rd to April 13th, 2012
Tested by	Bruce Balston
Approved by	Daryl Meerkerk
Report No.	T43-DPA-N2N.1.0
Test Results	Compliant

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Revision History

Revision	Date	Reason For Change	Reviewed By	Author(s)
0.1	Dec 23, 2011	Initial release		B. Balston
0.2	Dec 23, 2011	Reformatted and added notes.		D. Meerkerk
0.3	Dec.24, 2011	Address typo.		B. Balston
0.4	Mar.31, 2012	Creation template for 8 mod-s		A. Moldavanov
0.5	Apr.8, 2012	Creation template for 10 mod-s		A. Moldavanov
0.6	Apr.10, 2012	Created template for appendix		A. Moldavanov
0.7	Apr.12, 2012	Created template for title		A. Moldavanov
0.8	Apr.13, 2012	Data tables are splitted		A. Moldavanov
0.9	Apr.16, 2012	Template for Part 2 added		A. Moldavanov
0.10	May 3, 2012	Pre-final Edition		A. Moldavanov
1.0	May 3, 2012	Initial Release		A. Moldavanov
1.1	May 25, 2012	Merging of PCS & AWS reports		A. Moldavanov

Table of Contents

ACRONYMS AND ABBREVIATIONS

ACLR	Adjacent Channel Leakage Ratio
ACPR	Adjacent Channel Power Ratio
BTS	Base Transceiver Station
CDMA	Code Division Multiple Access
CW	Continuous Wave
dB	deciBel (logarithmic ratio)
dBc	deciBels related to the RF carrier amplitude
dBm	deciBels related to 1 Mw
DL	Downlink
EDGE	Enhanced Data rates for Global (GSM) Evolution
EIRP	Effective Isotropic Radiated Power
E-UTRA	Enhanced UMTS Terrestrial Radio Access
FH	Frequency High (Top edge of band)
FL	Frequency Low (Bottom edge of band)
FM	Frequency Mid (Center of band)
GSM	Groupe Spéciale Mobile, Global System for Mobile communications
IF	Intermediate Frequency
IMD	Inter-Modulation Distortion
kHz	kilo Hertz
LTE	Long Term Evolution
MHz	Mega Hertz
NF	Noise Figure
PCS	Personal Communications Service
RF	Radio Frequency
RX	Receiver
TX	Transmit
UL	Uplink
UMTS	Universal Mobile Telecommunications System
WCDMA	Wideband Code Division Multiple Access
1xEVDO	CDMA Evolution Data Optimized

1.0 Overview

1.1 Scope

The purpose of this document is to present test results in the context of a full qualification test report for FCC Part 2, 24, 27 as applicable to the equipment under test. The scope of this document is limited to the tests listed below in the downlink mode.

1.2 Attestation Statement

The device under test does fulfill the general approval requirements as identified in this test report.

This equipment has been tested in accordance with the standards identified in this test report. To the best of my knowledge and belief, these tests were performed using the measurement procedures described in this report. All instrumentation and accessories used to test products for compliance to the indicated standards are calibrated regularly in accordance with ISO 17025:2005 requirements.

I attest that the necessary measurements were made, under my supervision, at DALI WIRELESS, INC. located at 8618 Commerce Court, Burnaby, British Columbia, V5A 4N6, Canada.

Authorized Signatory:

Signature:
Bruce Balston
Function: Test Engineer
Date: May 7, 2012

1.3 Report Summary

Disclaimer	The test results relate only to the items tested.
Report Purpose	To demonstrate the DUT compliance with FCC Parts 2, 24, 27 and Industry Canada RS-131, 133 requirements for a dual band digital repeater.

Applicable Rule Parts	FCC CFR 47 Parts 2, 24, 27; RSS-131, 133
Test Procedures	ANSI/TIA-603-C: 2004

1.4 Test Environment

Test Facilities	Tests were performed by Dali Wireless Inc. located at 8618 Commerce Court, Burnaby, BC, V5A 4N6, Canada. Radiated spurious emission test was performed by QAI located at #16 - 211 Schoolhouse Street, Coquitlam, BC, V3K 4X9, Canada.
Test Conditions	Temperature: 25° C Relative Humidity: 60% Atmospheric Pressure: 98.1 kPa

1.5 Test Setup

Deviation to the rules	There was no deviation from the test standards.
Modification to the DUT	No modification was made to the DUT.
Test Exercise	The DUT was placed in continuous transmit mode of operation.

1.6 Device Under Test Information

Manufactured by	Dali Wireless Inc.
DUT Description	1.9-2.1 GHz Dual-Band Bi-directional Distributed Antenna System/Repeater.

FCC ID	HCOT43DPAN2
IC Label	10323A-T43DPAN2
Model Name	t43-DPA-N2N
Operating Frequency	Downlink 1930 – 1995 MHz. Downlink 2110 – 2155 MHz.
Emission Designators	F9W, F9X, DXW, D7W, GXW, G7W
Modulations	WCDMA, CDMA2000, LTE5M
User Power Range and Control	There are NO user power controls
Test Item	Production
DC Voltage and Current into final amplifier	Powered 115 or 230 VAC
Type of Equipment	Fixed

1.7 Measurement Uncertainty

Radio Frequency	±1 ppm
Total RF Power: Conducted	±1 dB
RF Power Density: Conducted	±2.75 dB
Spurious Emissions: Conducted	±3 dB

All Emissions: Radiated	±3.5 dB
Temperature	±1ºC
Humidity	±5 %
DC and Low Frequency Voltages	±3 %

1.8 Equipment List

Description	Manufacturer	Model	Serial Number	Cal Due Date
3 meter Semi-Anechoic Chamber	ETS Lindgren	S201	1030	N/R
Turntable	ETS Lindgren	2165	00043677	N/R
Mast	ETS Lindgren	2165	00077487	N/R
Antenna	Sunol Sciences	JB3	A120106	06-Jul-2013
EMI Receiver	Rohde & Schwarz	ESU40	100011	29-Mar-2013
Spectrum Analyzer	Agilent	MXA-N9020A	ATO 71849 MY50140401	CAL 10-26-2013
Power Meter	Agilent	U2000A	MY52010031	CAL 12-1- 2012
Signal Generator	Agilent	MXG-N5182A	MY50140401	CAL 7-19-2012

1.9 Test Procedure

General

The *t*43 remote, is connected to the *t*Host in a manner consistent with a typical installation. A digital modulation signal generator is connected to the TX_IN port of the appropriate band of the *t*Host and spectrum analyzer is connected to the appropriate downlink antenna output through an attenuator, nominally 40 dB for the band under consideration.

The PCS (1930-1995 MHz) and AWS (2110-2155 MHz) band was investigated. Measurements were performed at eight modulation types for the mid, lowest and highest frequency for declared bandwidths. The modulation types are described in detail in Table 1.

.

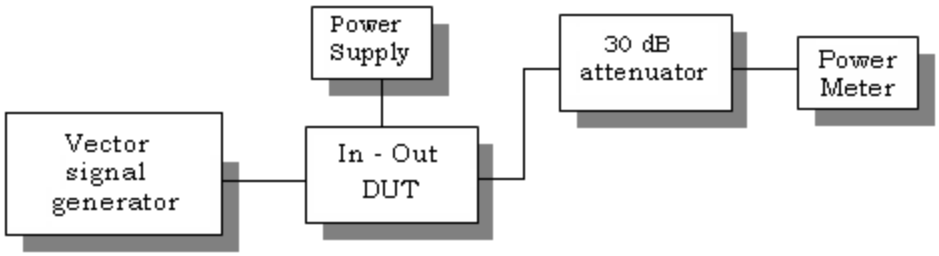
Modulation	# Carriers	Notation	Frequency (MHz)
WCDMA	1	DL1C-WCDMA	1932.4, 1962.5, 1992.6
WCDMA	2	DL2C-WCDMA	1934.9, 1962.5, 1990.1
WCDMA	3	DL3C-WCDMA	1937.4, 1962.5, 1982.6
WCDMA	4	DL4C-WCDMA	1939.9, 1962.5, 1985.1
CDMA2000	1	F1C-C2K	1931.25, 1962.5, 1988.75
CDMA2000	2	F2C-C2K	1932.50, 1962.5, 1987.50
CDMA2000	3	F3C-C2K	1933.75, 1962.5, 1986.25
LTE5M	1	LTE5M	1932.6, 1962.5, 1987.5

Modulation types, frequencies and appropriate notations.

RF Power Output

RF power is measured by connecting a 50-ohm, resistive wattmeter to the RF output connector. With a nominal voltage and the amplifier properly adjusted the RF output is measured**.**

RF Output Power Test Setup Diagram

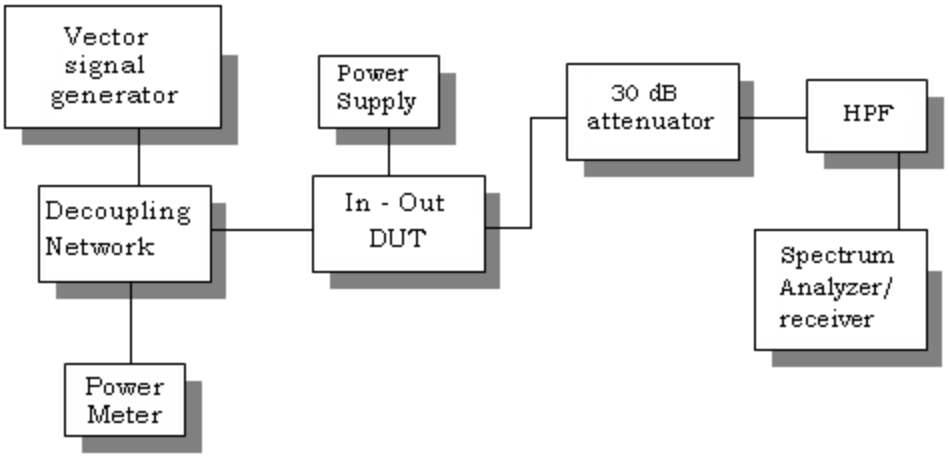


Band-Edges Compliance

RF power is measured by connecting a 50-ohm, resistive wattmeter to the RF output.
The required measurement resolution bandwidth (RBW) is 1% of the emission bandwidth. Measurements were made at an RBW sufficient to show detail at edge of band. Therefore data presented must be corrected to the measurement bandwidth using the formula below. The data calculated according to the formula below should be added to the reading in the graph for the modulation under consideration.

Corr(dB) = 20*log (measRBW / actualRBW)

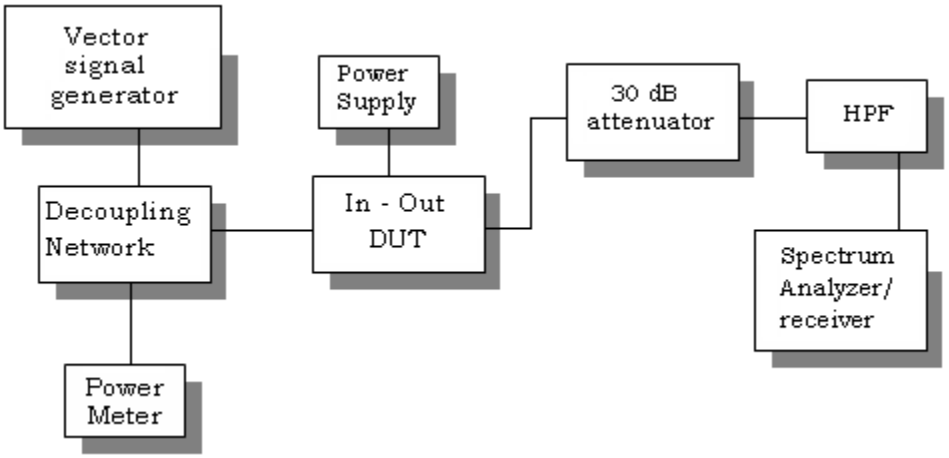
Band-Edges Test Setup Diagram



Spurious Emissions at Antenna Terminals

The procedure used was ANSI/TIA-603-C: 2004. The spectrum was scanned from 9 kHz to at least the tenth harmonic of the fundamental using a spectrum analyzer. Data on the following page shows the level of conducted spurious responses. For digital modulation, the carrier is modulated to its maximum extent. The measurements were made in accordance with standard ANSI/TIA-603-C: 2004. The maximum output power was set for each test.

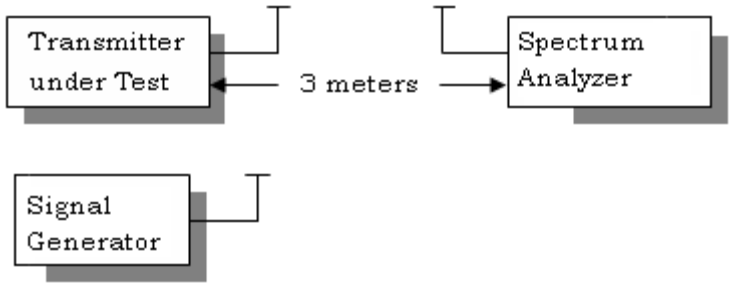
Conducted Spurious Test Setup Diagram



Radiated Spurious Emissions

The spectrum was scanned from 30 MHz to at least the tenth harmonic of the fundamental. All digital modulation signals were used to perform this test. This test was conducted per ANSI/TIA-603-C: 2004 using the substitution method.

Radiated Spurious Test Setup Diagram



Equipment placed 80 cm above ground on a rotating table platform.

Frequency Stability

All test conditions and measurement procedures were performed in accordance with FCC CFR47 part 2 subpart J Clause 2.1055.

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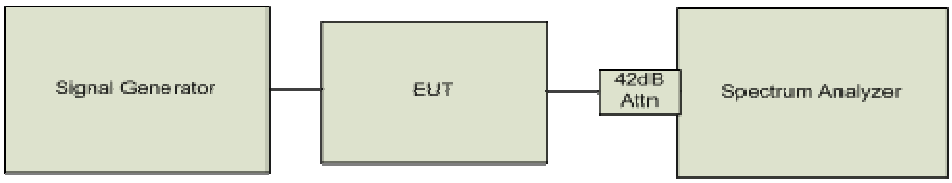
Frequency Stability Test Setup Diagram



1.10 Operational Description

The product under test is the Dali *t*43, covering PCS (1930-1995 MHz) and AWS (2110-2155 MHz) band with average output (downlink) power of 20W per band. The Dali *t43*™ is located close to the antenna, and hence helps reduce coaxial feed line RF losses, leading to increased system efficiency, reduced cooling requirements and small physical size. The product is connected to the *tHost*™ via a fiber optic link, and can be installed 15km to 40km away from the *tHost*™. It contains two optical interfaces, supported by independent optical transceivers, enabling daisy-chain connection of multiple *t43*™s to reduce total fiber deployment cost and enhance architecture flexibility.

The *t43*™ Monitoring & Control function can be performed locally using an Ethernet interface, or remotely via the *t*Host™ when M&C signals are communicated over the fiber optic link. The product remote unit enclosure is sealed to the environment. Heat generated by the electronic components is conducted to a rear heat sink and to the front lid. To increase efficiency of the heat sink, two external, long life, environmentally sealed fans are provided on

the top of the unit. Fans are controlled and monitored by remote unit main processor. In a case of fan failure alarm will be generated and reported through the GUI.

1.11 Measurement Configuration

Table 1. PCS DL Measurement Matrix

Modulation	# Carriers	Notation	Frequency (MHz)
WCDMA	1	DL1C-WCDMA	1932.4, 1962.5, 1992.6
WCDMA	2	DL2C-WCDMA	1934.9, 1962.5, 1990.1
WCDMA	3	DL3C-WCDMA	1937.4, 1962.5, 1982.6
WCDMA	4	DL4C-WCDMA	1939.9, 1962.5, 1985.1
CDMA2000	1	F1C-C2K	1931.25, 1962.5, 1988.75
CDMA2000	2	F2C-C2K	1932.50, 1962.5, 1987.50
CDMA2000	3	F3C-C2K	1933.75, 1962.5, 1986.25
LTE5M	1	LTE5M	1932.6, 1962.5, 1987.5

Table 2. AWS DL Measurement Matrix

Modulation	# Carriers	Carrier	Frequency (MHz)
WCDMA	1	DL1C-WCDMA	2112.4, 2132.5, 2152.6
WCDMA	2	DL2C-WCDMA	2114.9, 2132.5, 2150.1
WCDMA	3	DL3C-WCDMA	2117.9, 2132.5, 2147.6
WCDMA	4	DL4C-WCDMA	2119.9, 2132.5, 2145.1
CDMA2000	1	F1C-C2K	2111.25 2132.5, 2153.75
CDMA2000	2		2111.30, 2132.5, 2152.50
CDMA2000	3	F3C-C2K	2112.50 2132.5, 2151.25
LTE5M	1	LTE5M	2112.6 2132.5, 2152.5

Table 3. DL Modulation Waveforms

Notation	Waveform	Bandwidth (MHz)
DL1C-WCDMA DL2C-WCDMA DL3C-WCDMA DL4C-WCDMA	3GPP TS25 Basic W-CDMA/HSPA DL Rel 7 Test Model 1 + 64 DPCH	5, 10, 15, 20

F1C-C2K F2C-C2K F3C-C2K	3GPP2 CDMA2000 Forward Forward 9 Channel	1.25, 2.5, 3.75
LTE5M	3GPP TS36 Basic LTE FDD Downlink (2010-06) Full filled QPSK 5M (25RB)	5

2.0 Output Power

2.1 Methodology

Measurements were performed at eight modulations (F1C-C2K, F2C-C2K, F3C-C2K, DL1C-WCDMA, DL2C-WCDMA, DL3C-WCDMA, DL4C-WCDMA, LTE5M for the mid, lowest and highest frequency within the PCS (1930-1995 MHz) and AWS (2100-2155 MHz) band.

. Worst-case data is shown in section 2.3. Figures A1-8 (PCS band) and A9-16 (AWS band).

A brief summary of applicable FCC specifications is listed in the table below.

2.1046 Measurements required: RF power output.
(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.

2.2 Interpretation

Full results for output power measurements are shown in Table 3.

2.3 Results - Figures A1 - A16

The plots below are for reference purposes only. Actual measurements are made using U2000A power meter and shown in Table 3.

PCS band

Fig. A1 DL1C-WCDMA

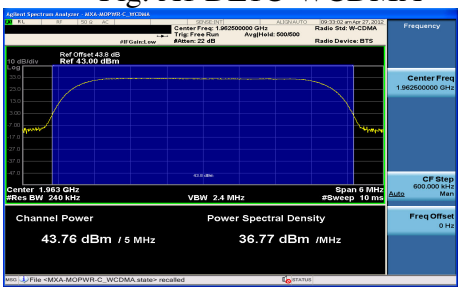


Fig. A2 DL2C-WCDMA

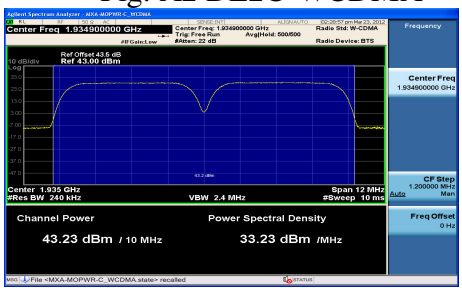


Fig. A3. DL3C-WCDMA

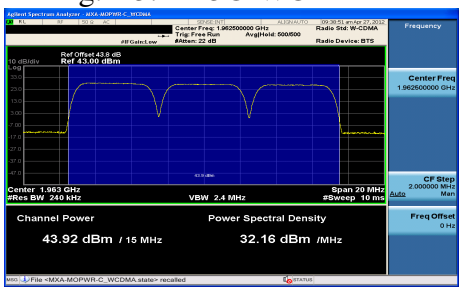


Fig. A4. DL4C-WCDMA

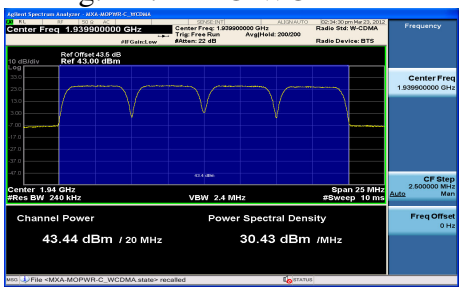


Fig. A5. F1C-C2K

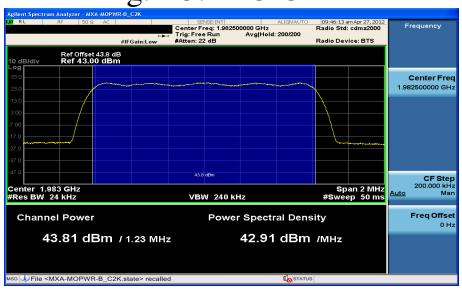


Fig. A6. F2C-C2K

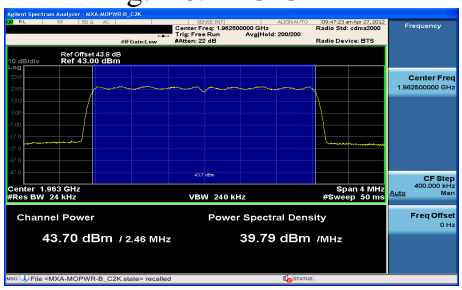


Fig. A7 F3C-C2K

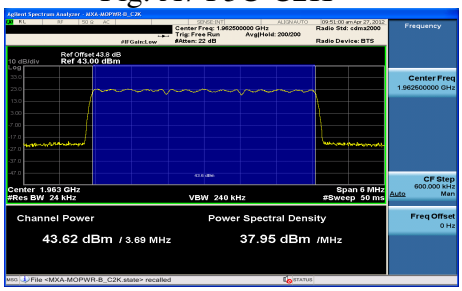
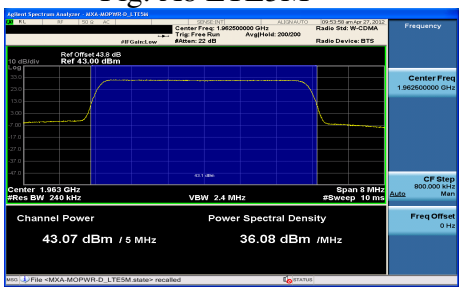


Fig. A8 LTE5M



AWS band

Fig. A9. DL1C-WCDMA

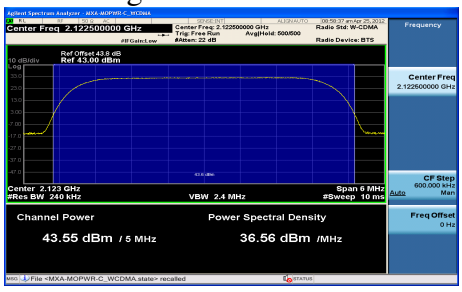


Fig. A10. DL2C-WCDMA

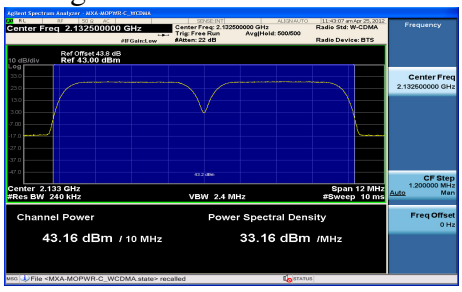


Fig. A11. DL3C-WCDMA

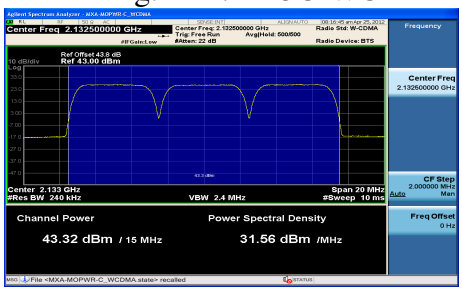


Fig. A12. DL4C-WCDMA

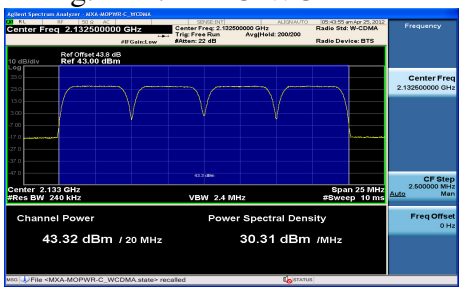


Fig. A13. F1C-C2K

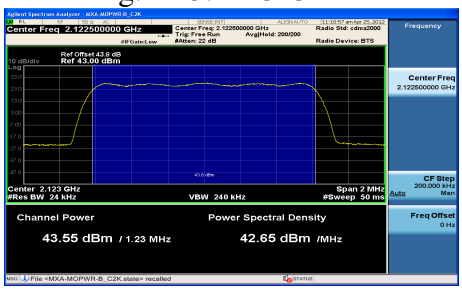


Fig. A14. F2C-C2K

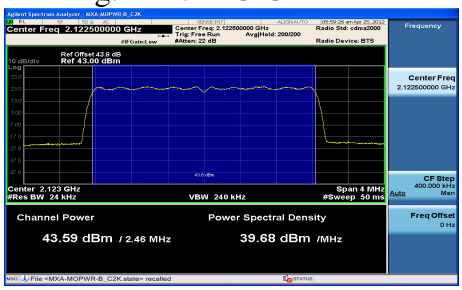


Fig. A15. F3C-C2K

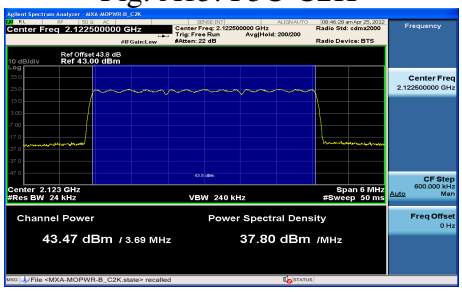


Fig. A16. LTE5M

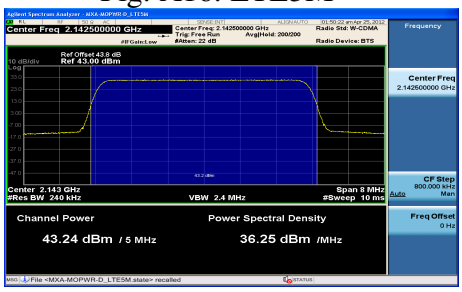


Figure A1 – A8 for PCS band, whereas A9 – A16 for AWS band. A1 - Output power for WCDMA modulation at 5MHz bandwidth, A2 - WCDMA modulation at 10MHz bandwidth, A3 - WCDMA modulation at 15MHz bandwidth, A4 - WCDMA modulation at 20MHz bandwidth, A5 – CDMA2000 modulation at 1.25MHz bandwidth, A6 - CDMA2000 modulation at 2.5MHz bandwidth, A7 - CDMA2000 modulation at 3.75MHz bandwidth, A8 – LTE5M modulation at 5MHz bandwidth;
A9 - Output power for WCDMA modulation at 5MHz bandwidth, A10 - WCDMA modulation at 10MHz bandwidth, A11 - WCDMA modulation at 15MHz bandwidth, A12 - WCDMA modulation at 20MHz bandwidth, A13 – CDMA2000 modulation at 1.25MHz bandwidth, A14 - CDMA2000 modulation at 2.5MHz bandwidth, A15 - CDMA2000 modulation at 3.75MHz bandwidth, A16 – LTE5M modulation at 5MHz bandwidth

Conclusion: As the table 3 indicates, the maximum power output value of 44.1 dBm was obtained with WCDMA modulation at 2122.5 MHz bandwidth of 5 MHz (AWS band).

PCS band

DL1C-WCDMA modulation			
Frequency, MHz	**Output power, dBm**	**Bandwidth, MHz**	**Limit, dBm**
1942.5	43.6	5	44.1
1962.5	43.1		
1982.5	43.1		
DL2C-WCDMA modulation			
1942.5	43.7	10	44.1
1962.5	43.3		
1982.5	43.2		
DL3C-WCDMA modulation			
1942.5	43.7	15	44.1
1962.5	43.8		
1982.5	43.6		
DL4C-WCDMA modulation			
1942.5	43.2	20	44.1
1962.5	43.4		
1982.5	43.5		
F1C-C2K modulation			
1942.5	43.8	1.25	44.1
1962.5	43.9		
1982.5	43.7		
F2C-C2K modulation			
1942.5	43.8	2.5	44.1
1962.5	43.9		
1982.5	43.7		
F3C-C2K modulation			
1942.5	43.8	3.75	44.1
1962.5	43.9		
1982.5	43.7		
LTE5M modulation			
1942.5	43.8	5	44.1
1962.5	43.9		
1982.5	43.7		

AWS band

DL1C-WCDMA modulation			
Frequency, MHz	**Output power, dBm**	**Bandwidth, MHz**	**Limit, dBm**
2122.5	44.1	5	44.1
2132.5	43.9		
2142.5	43.7		
DL2C-WCDMA modulation			
2122.5	44.0	10	44.1
2132.5	43.8		
2142.5	43.6		
DL3C-WCDMA modulation			
2122.5	43.8	15	44.1

2132.5	43.8		
2142.5	43.7		
DL4C-WCDMA modulation			
2122.5	43.9	20	44.1
2132.5	43.6		
2142.5	43.8		
F1C-C2K modulation			
2122.5	43.7	1.25	44.1
2132.5	43.8		
2142.5	43.6		
F2C-C2K modulation			
2122.5	43.7	2.5	44.1
2132.5	43.7		
2142.5	43.7		
F3C-C2K modulation			
2122.5	43.8	3.75	44.1
2132.5	43.9		
2142.5	43.8		
LTE5M modulation			
2122.5	43.9	5	44.1
2132.5	43.9		
2142.5	43.6		

Table 3. Output power measurements.

3.0 Occupied Bandwidth

3.1 Methodology

Measurements were performed at eight modulations (F1C-C2K, F2C-C2K, F3C-C2K, DL1C-WCDMA, DL2C-WCDMA, DL3C-WCDMA, DL4C-WCDMA, LTE5M for the mid, lowest and highest frequency within the PCS (1930-1995 MHz) and AWS (2100-2155 MHz) band.

. Worst-case data is shown in the figures in sections 3.2 in Figures B1-8 (PCS band) and B9-16 (AWS band).

A brief summary of applicable FCC specifications is listed in the table below.

2.1049 Measurements required: Occupied bandwidth. The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured

The plots below are for reference purposes only. Full results for occupied bandwidth measurements are shown in Table 4.

3.2 Results - Figures B1 - B16

PCS band

Fig. B1. DL1C-WCDMA

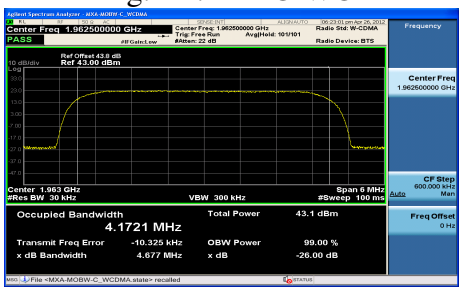


Fig. B2. DL2C-WCDMA

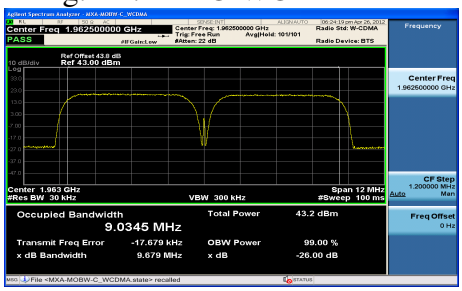


Fig. B3. DL3C-WCDMA

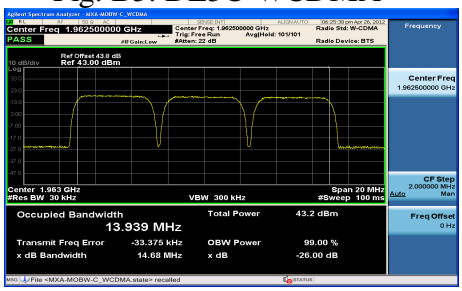


Fig. B4. DL4C-WCDMA

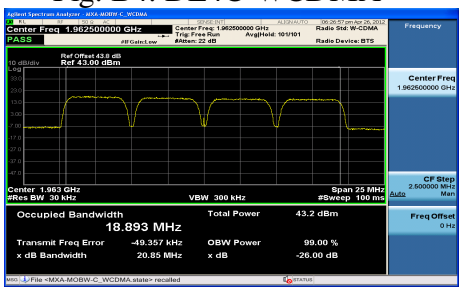


Fig. B5. F1C-C2K

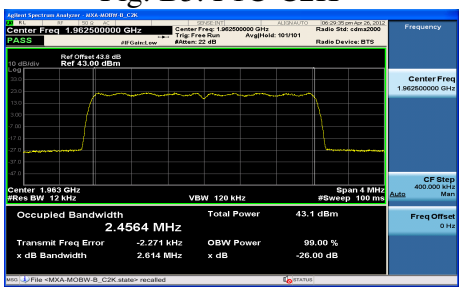


Fig. B6. F2C-C2K

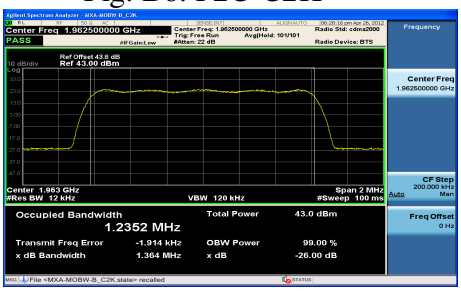


Fig. B7. F3C-C2K

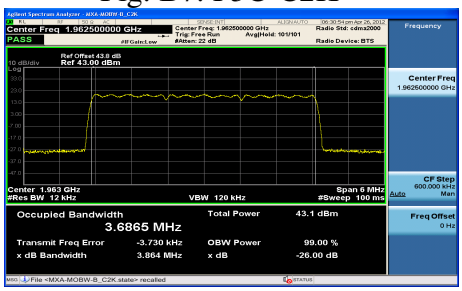


Fig. B8. LTE5M

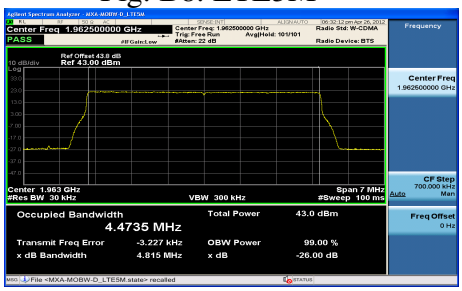


Fig. B9. DL1C-WCDMA

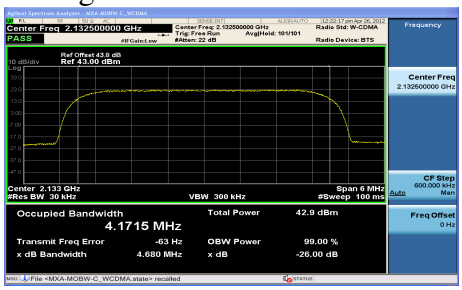


Fig. B10. DL2C-WCDMA

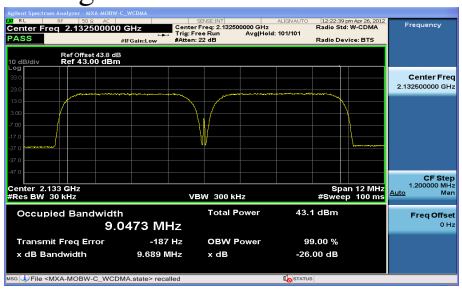


Fig. B11. DL3C-WCDMA

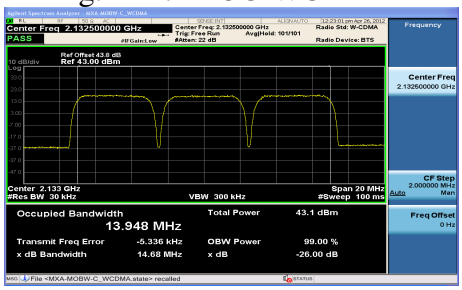


Fig. B12. DL4C-WCDMA

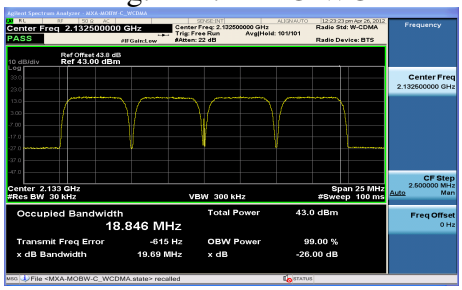


Fig. B13. F1C-C2K

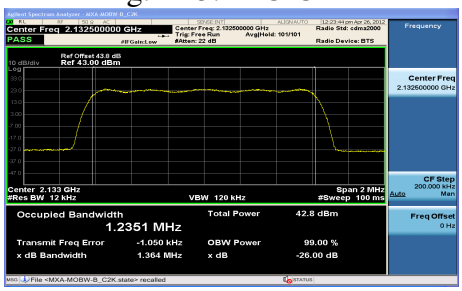


Fig. B14. F2C-C2K

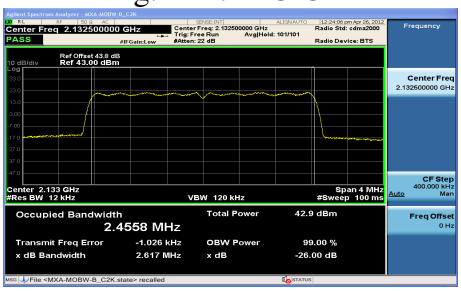


Fig. B15. F3C-C2K

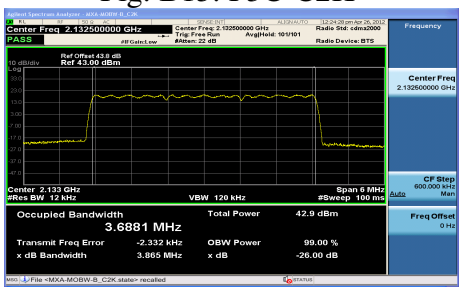


Fig. B16. LTE5M

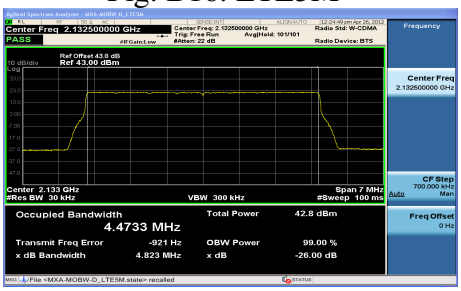


Figure B1 – occupied bandwidth for WCDMA modulation at 5MHz bandwidth, B2 - WCDMA modulation at 10MHz bandwidth, B3 - WCDMA modulation at 15MHz bandwidth, B4 - WCDMA modulation at 20MHz bandwidth, B5 – CDMA2000 modulation at 1.25MHz bandwidth, B6 - CDMA2000 modulation at 2.5MHz bandwidth, B7 - CDMA2000 modulation at 3.75MHz bandwidth, B8 – LTE5M modulation at 5MHz bandwidth.
B9 - occupied bandwidth for WCDMA modulation at 5MHz bandwidth, B10 - WCDMA modulation at 10MHz bandwidth, B11 - WCDMA modulation at 15MHz bandwidth, B12 - WCDMA modulation at 20MHz bandwidth, B13 – CDMA2000 modulation at 1.25MHz bandwidth, B14 - CDMA2000 modulation at 2.5MHz bandwidth, B15 - CDMA2000 modulation at 3.75MHz bandwidth, B16 – LTE5M modulation at 5MHz bandwidth

Conclusion: As the table 4 indicates, the maximum occupied bandwidth value of 18,893 MHz (PCS band) was obtained with WCDMA modulation (bandwidth of 20 MHz).

PCS band

Modulation	Occupied Bandwidth, MHz
DL1C-WCDMA	4.1721
DL2C-WCDMA	9.0345
DL3C-WCDMA	13.939
DL4C-WCDMA	18.893
F1C-C2K	1.2352
F2C-C2K	2.4564
F3C-C2K	3.6865
LTE5M	4.4735

AWS band

Modulation	Occupied Bandwidth, MHz
DL1C-WCDMA	4.1715
DL2C-WCDMA	9.0473
DL3C-WCDMA	13.948
DL4C-WCDMA	18.846
F1C-C2K	1.2351
F2C-C2K	2.4558
F3C-C2K	3.6881
LTE5M	4.4733

Table 4. Occupied bandwidth measurements.

4.0 Conducted Spurious Emissions

4.1 Methodology

All test conditions and measurement procedures were performed in accordance with FCC CFR47 part 2 subpart J Clause 2.1051.

The data is shown in the figures C1 – C3 (PCS band) and C4 - C6 (AWS band) in section 4.3.

For each plot lowest, mid, and highest frequency were used and data accumulated for each plot in a max hold/pause sequence. Data was collected for all eight modulations, worst-case is shown.

The required measurement resolution bandwidth (RBW) is 1MHz. Measurements were made at other RBW. For example, if 100kHz is used the data presented must be corrected to the measurement bandwidth using the formula

$$\text{Corr(dB)} = 10*\log (\text{measRBW} / 100\text{kHz})$$

In this case, a correction of 10.0dB must be added to each data point for comparison of the data presented with the limit displayed in the figure.

In the figures provided, both the peak detector (yellow trace) and average detector (blue trace) have been used. The ”43+10*log P” limit (see below in green) is of -13dBm/1MHz and is shown in the figures Cx.

A brief summary of the applicable FCC specifications are listed in the table below.

2.1051 Measurements required: Spurious emissions at antenna terminals.
The radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in§ 2.1049 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

2.1057 Frequency spectrum to be investigated.
(a) In all of the measurements set forth in §§ 2.1051 and 2.1053, the spectrum shall be investigated from the lowest radio frequency signal generated in the equipment, without going below 9 kHz, up to at least the frequency shown below:
(1) If the equipment operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

27.53 Emission limits.
(h) For operations in the 1710–1755 MHz and 2110–2155 MHz bands, the power of any emission outside a licensee’s frequency block shall be attenuated below the transmitter power (P) by at least $43 + 10 \log_{10}(P)$ dB.
(1) Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 megahertz bands immediately outside and adjacent to the licensee’s frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. 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.

The limit is = -13 dBm.

4.2 Interpretation

Peak trace is shown in yellow, average trace in blue. Green line is a limit of -13dBm, applies to the AVG trace.

4.3 Results – Figures C1 – C6

PCS band

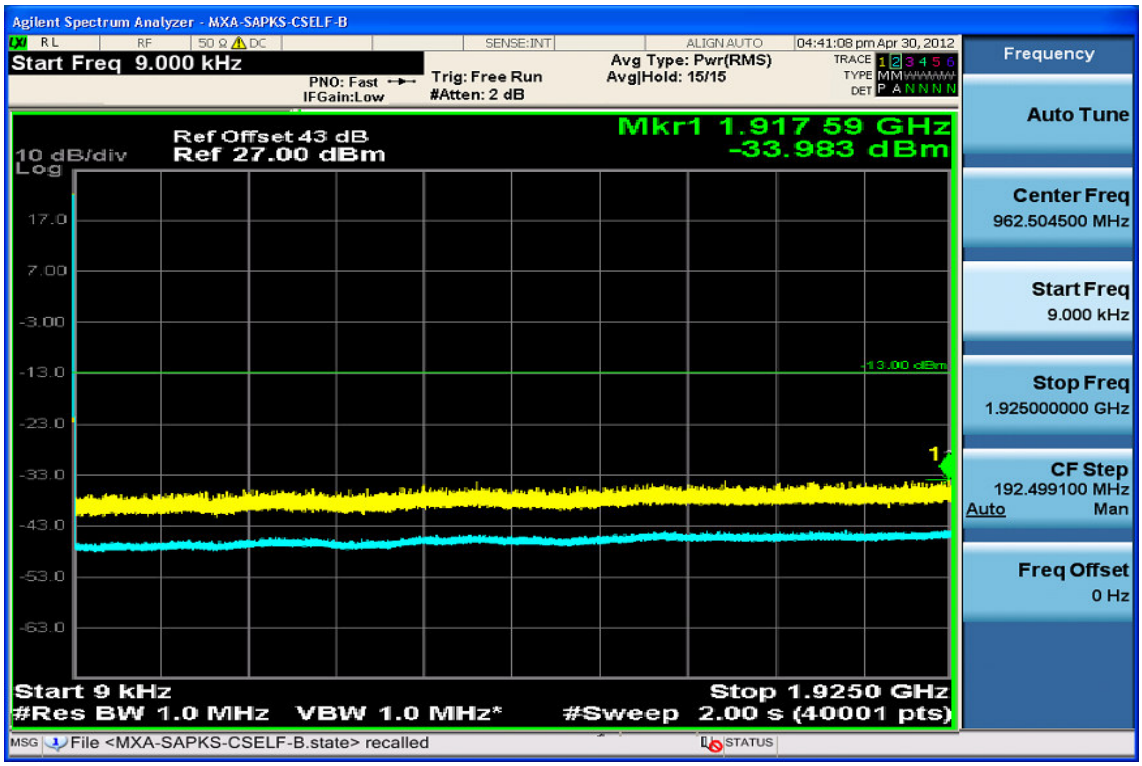


Figure C1. Data for 9kHz – 2GHz is presented.

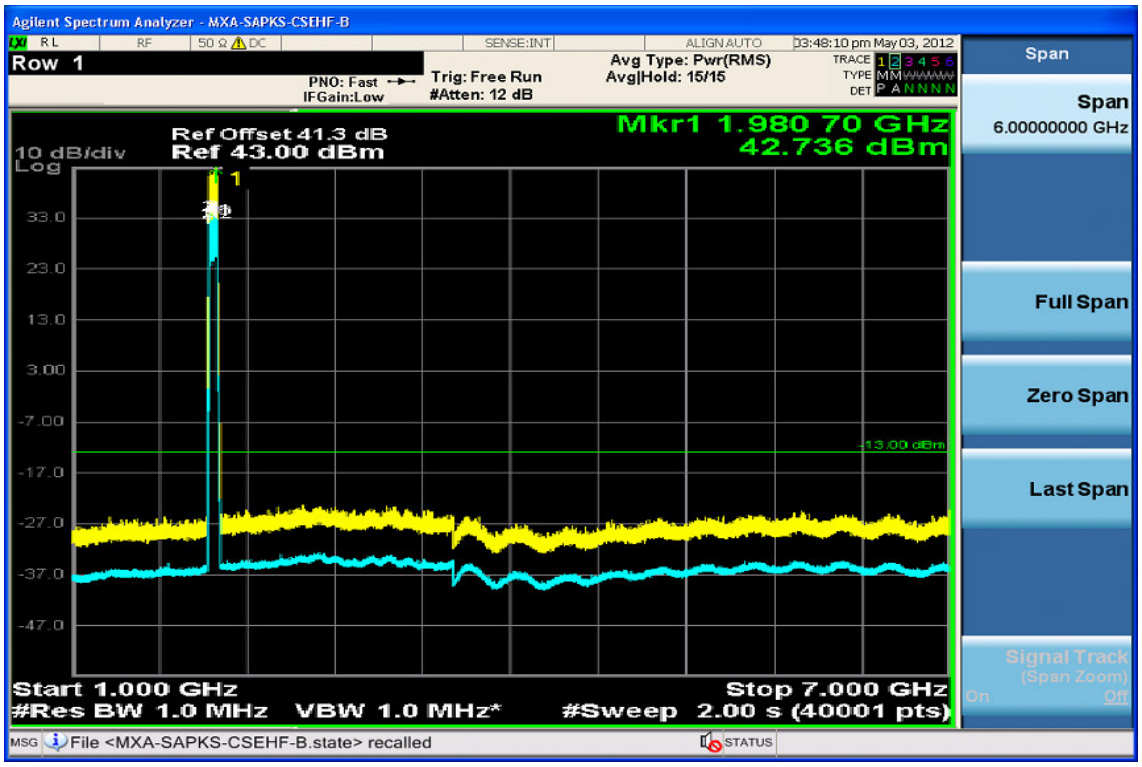


Figure C2. Data for 1GHz – 7GHz is presented. The high pass filter at 1M RBW installed.

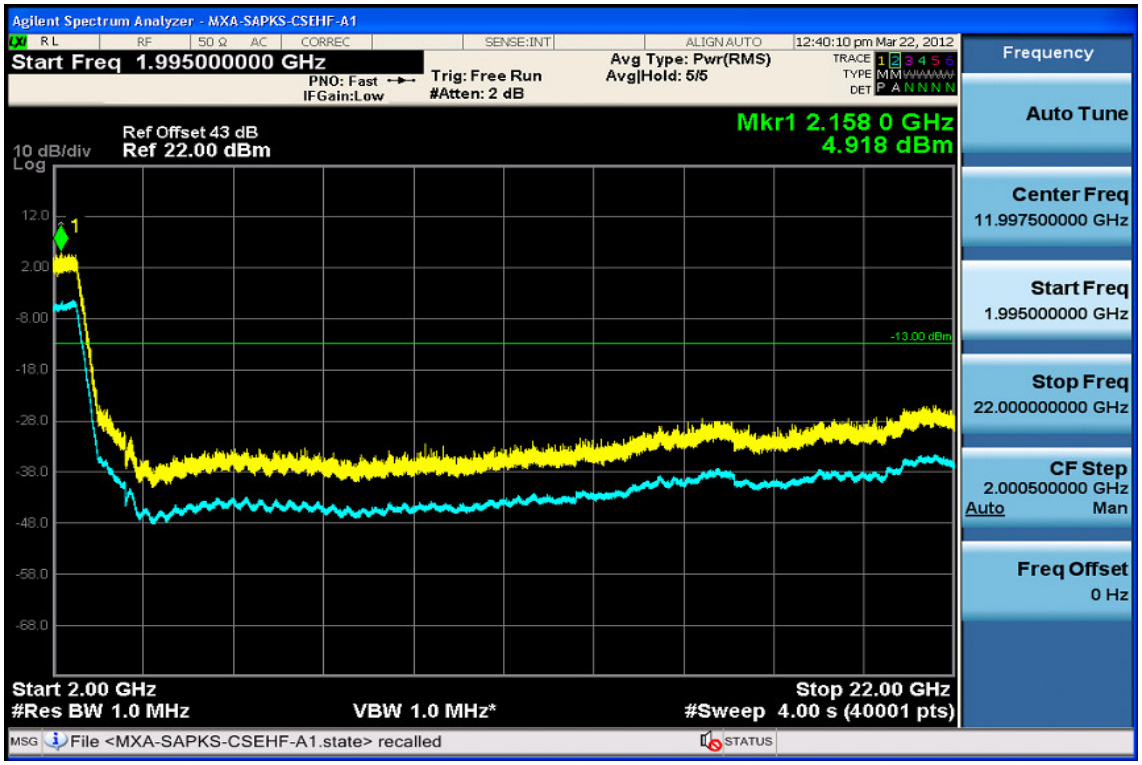


Figure C3. Data for 2GHz – 22GHz is presented.

AWS band

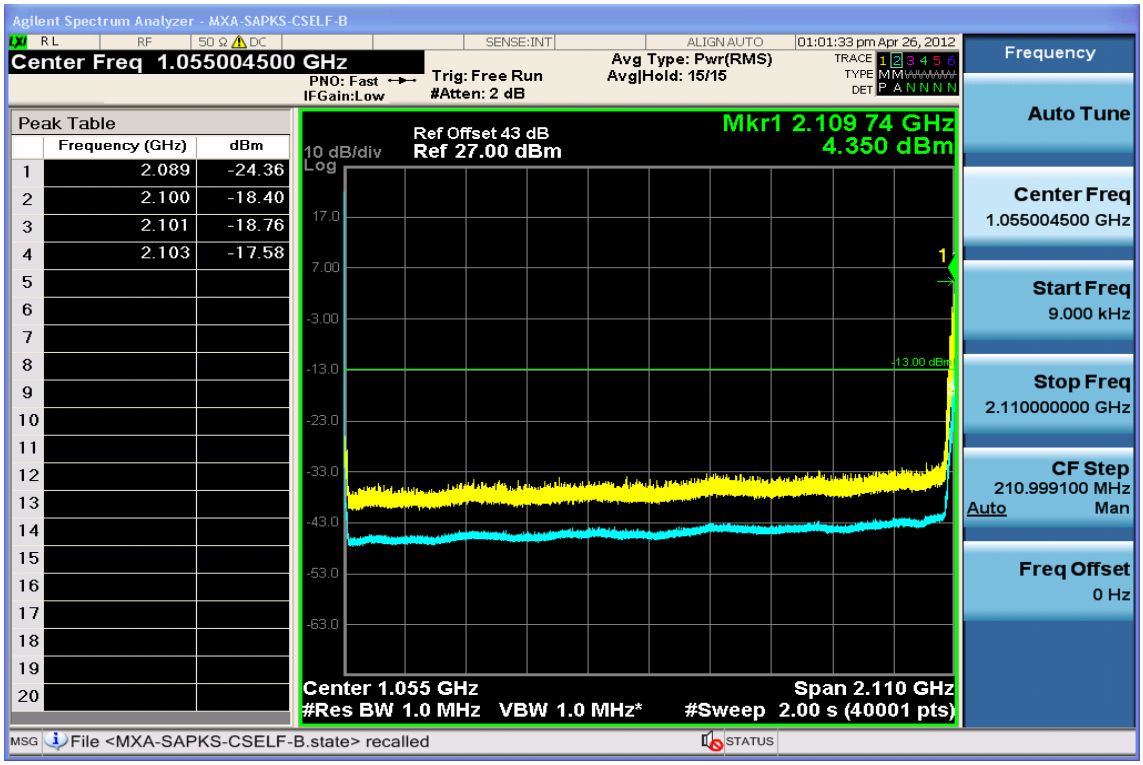


Figure C4. Data for 9kHz – 2GHz is presented.

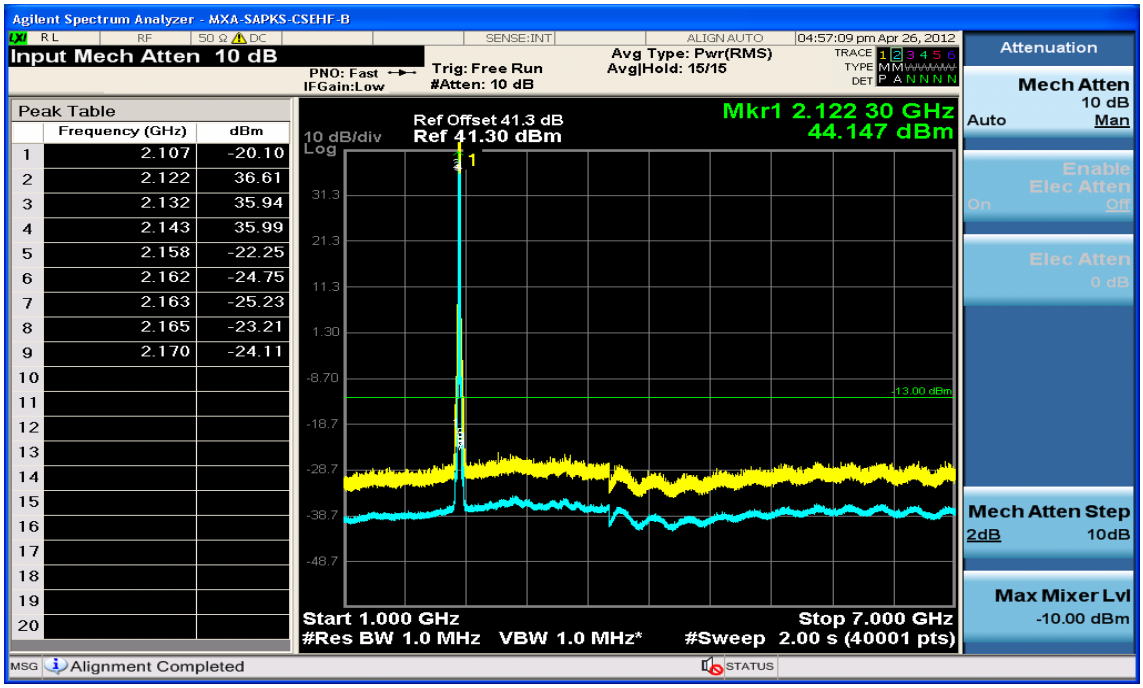


Figure C5. Data for 1GHz – 7GHz is presented. The high pass filter at 1M RBW installed.

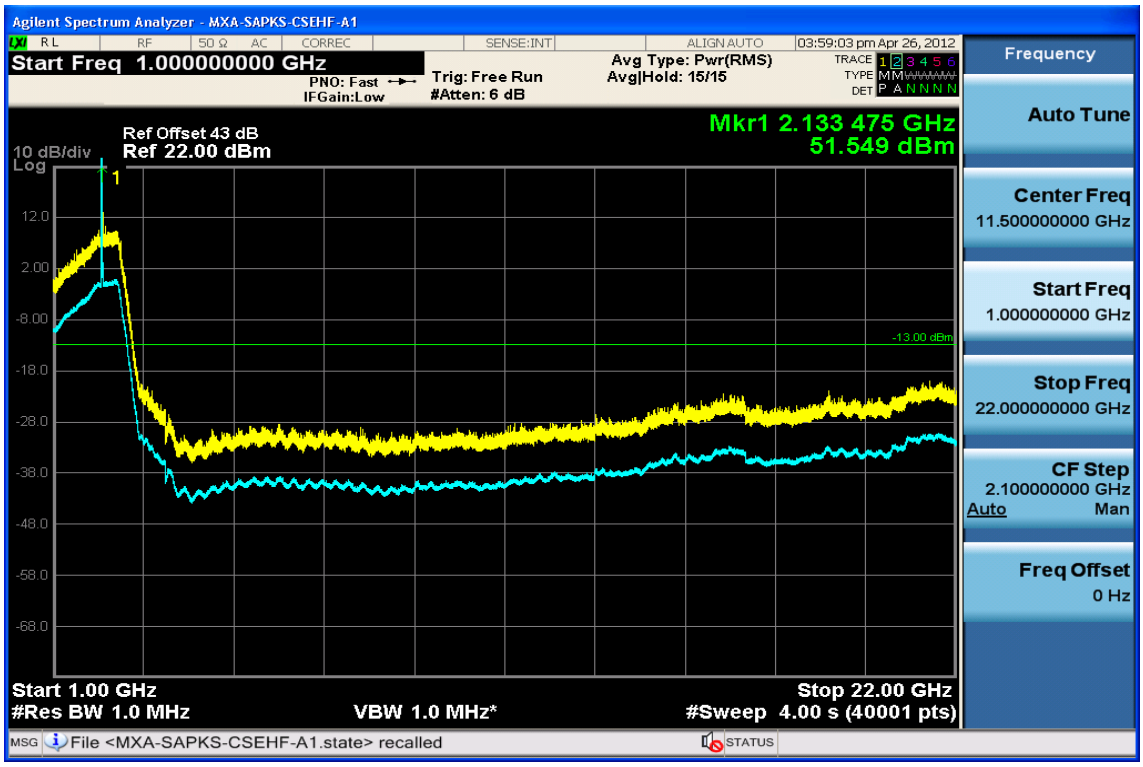


Figure C6. Data for 1GHz – 22GHz is presented.

On the plots shown the low, middle and high channel are presented.

There were no emissions detected within 20 dB of limit.
The peak trace is also shown to illustrate the peak to average ratio of approximately 12dB.

Data was collected for all signals (average measurement) within 20dB of limit.
No signals were found within 20dB of limit.

5.0 Band Edge

5.1 Methodology

Measurements were performed at three worst case modulations (WCDMA, CDMA2000, and LTE5M) for the lowest and highest frequency within the band.

Worst-case data is shown in the figures D1 – D6 (PCS band) and D7 – D12 (AWS band) in section 5.2.

27.53 Emission limits.
(h) For operations in the 1710–1755 MHz and 2110–2155 MHz bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) by at least $43 + 10 \log_{10}(P)$ dB.
(1) Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 megahertz bands immediately outside and adjacent to the licensee's frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. 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.

The required measurement resolution bandwidth (RBW) is 1% of the emission bandwidth. Measurements were made at the RBW sufficient to show detail at edge of band. Therefore data presented must be corrected to the measurement bandwidth using the formula. The data in the following table must be added to the reading in the graph for the modulation under consideration.

PCS band

Modulation	Measured RBW, kHz	Actual RBW, kHz	Correction (dB)
F1C-C2K	15	12	1.94
DL1C-WCDMA	24	42	-4.86
LTE5M	47	45	0.38

AWS band

Modulation	Measured RBW, kHz	Actual RBW, kHz	Correction (dB)
F1C-C2K	15	12.5	1.58
DL1C-WCDMA	24	46.7	-5.78
LTE5M	47	49	-0.36

5.2 Results – Figures D1- D12

PCS band

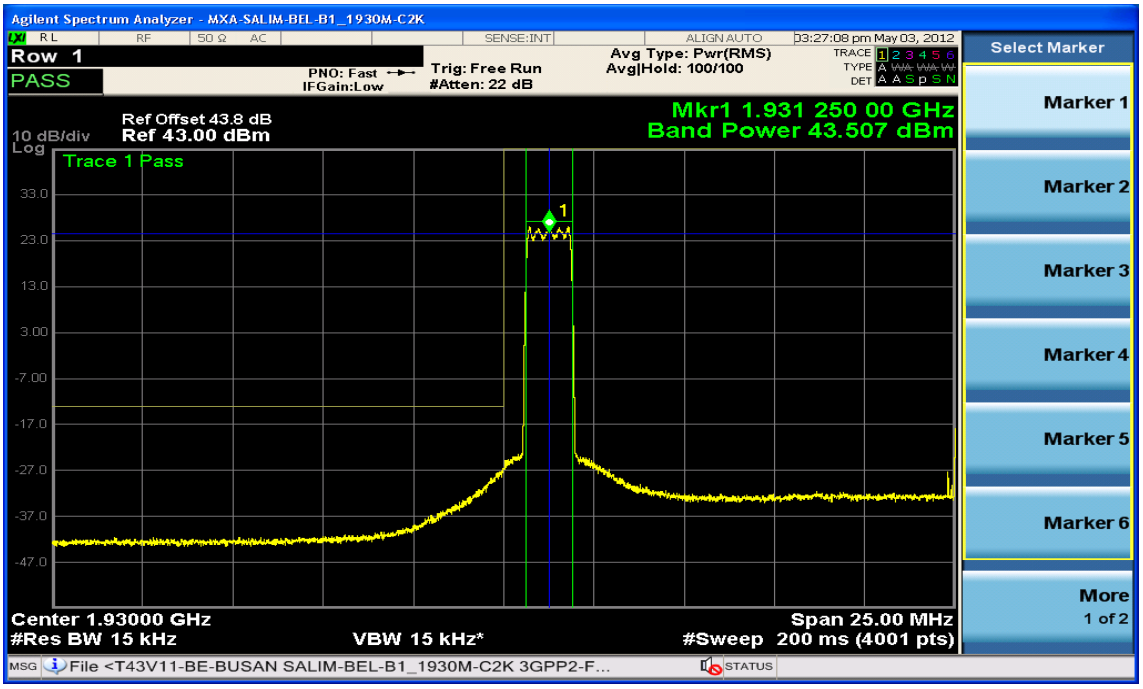


Figure D1. Data for CDMA2000 modulation at low end is presented.

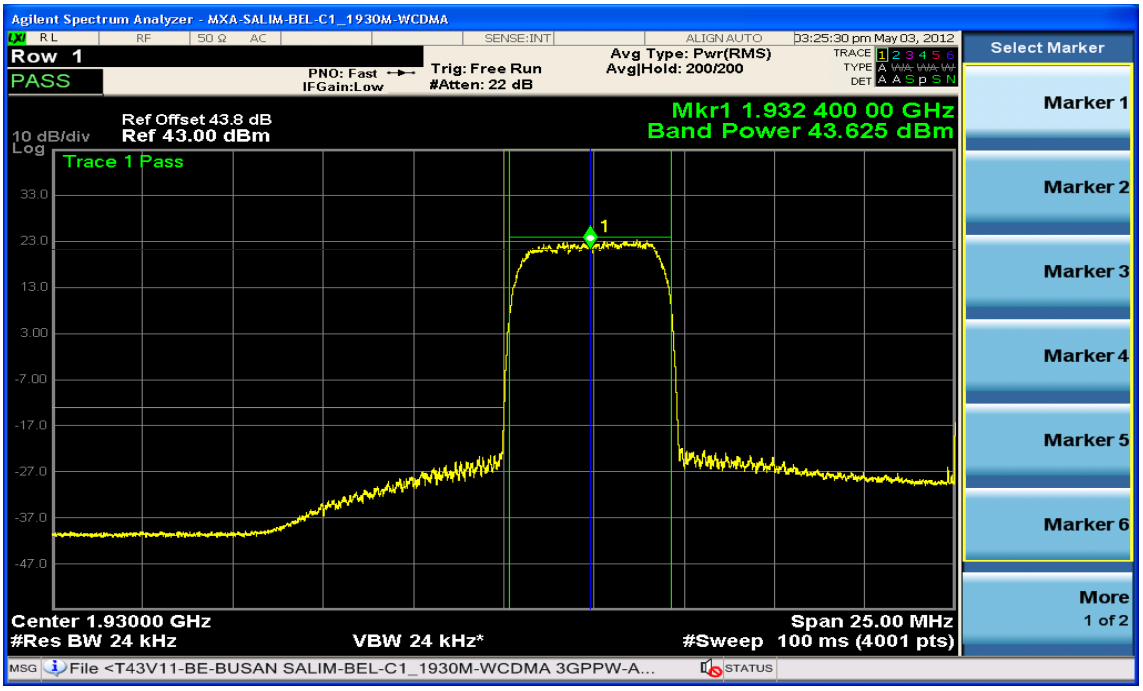


Figure D2. Data for WCDMA modulation at low end is presented.

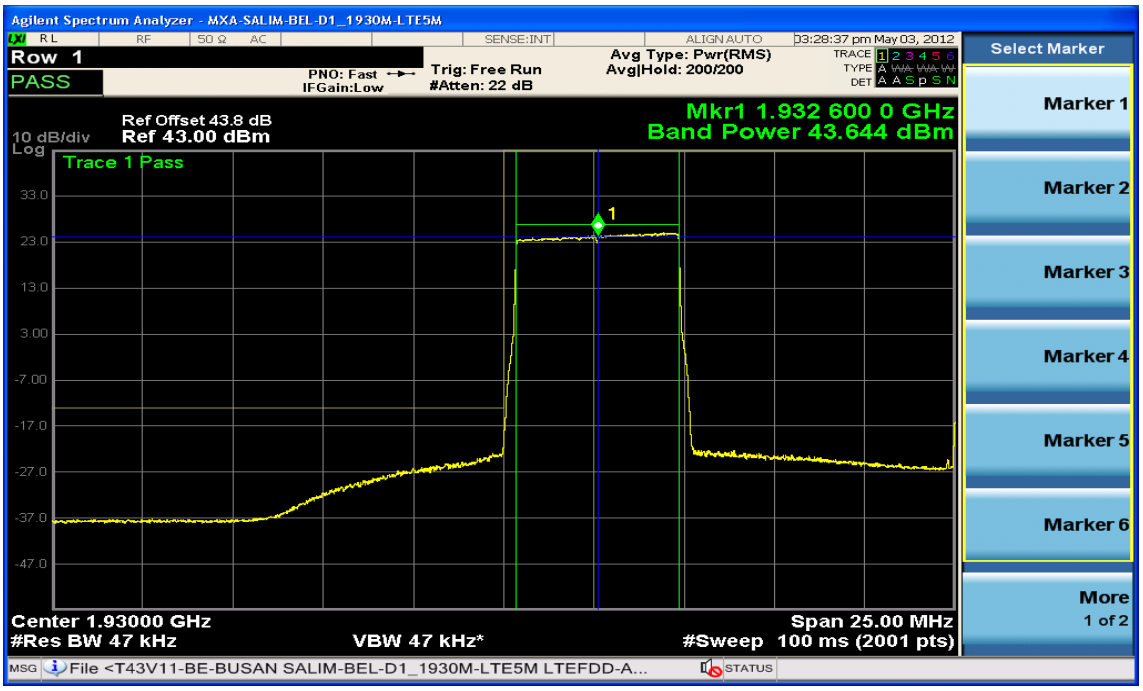


Figure D3. Data for LTE modulation at low end is presented.

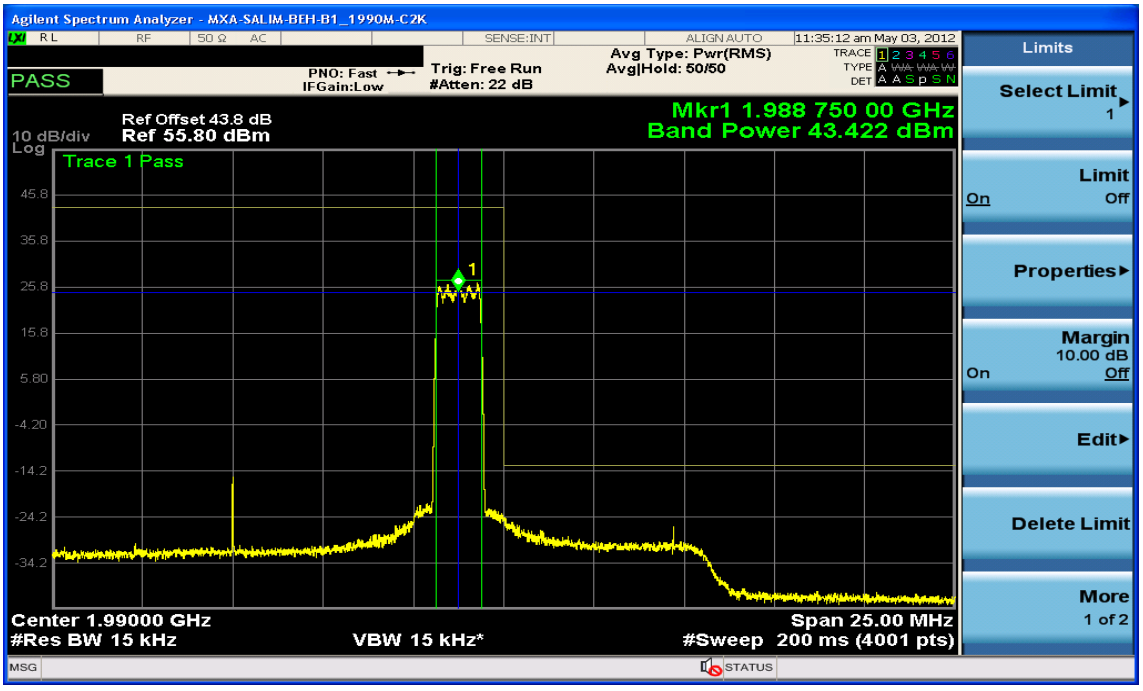


Figure D4. Data for CDMA2000 modulation at high end is presented.

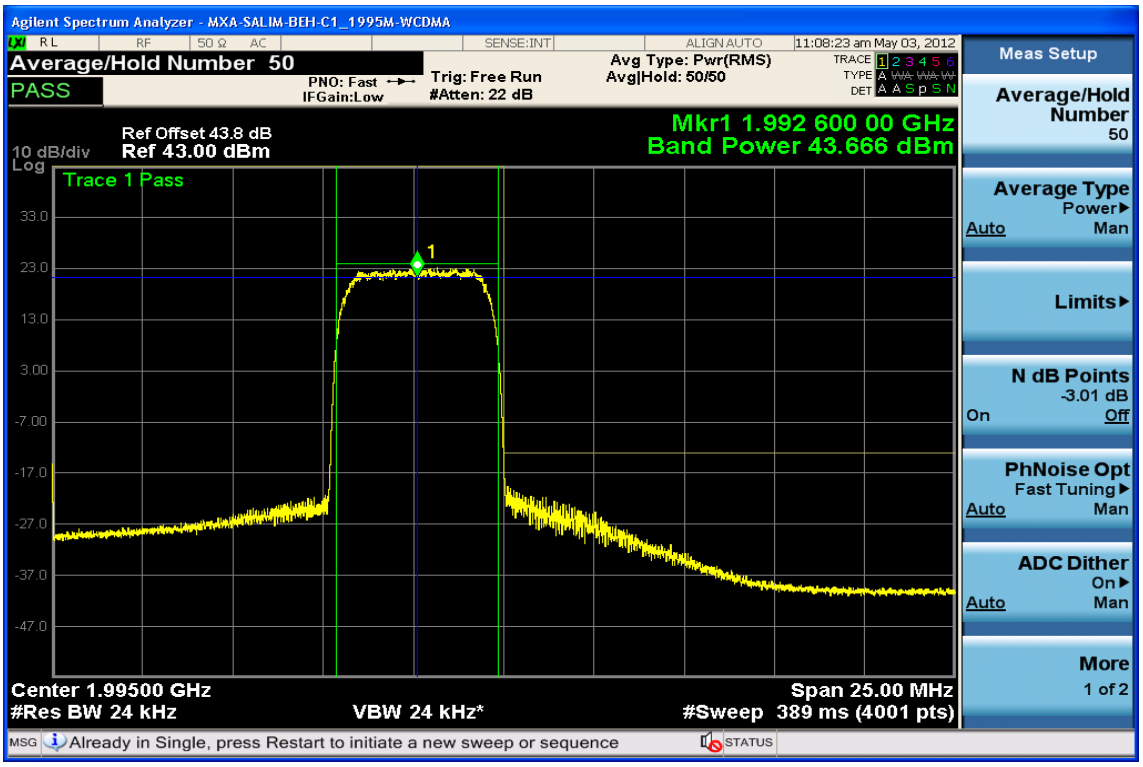


Figure D5. Data for WCDMA modulation at high end is presented.

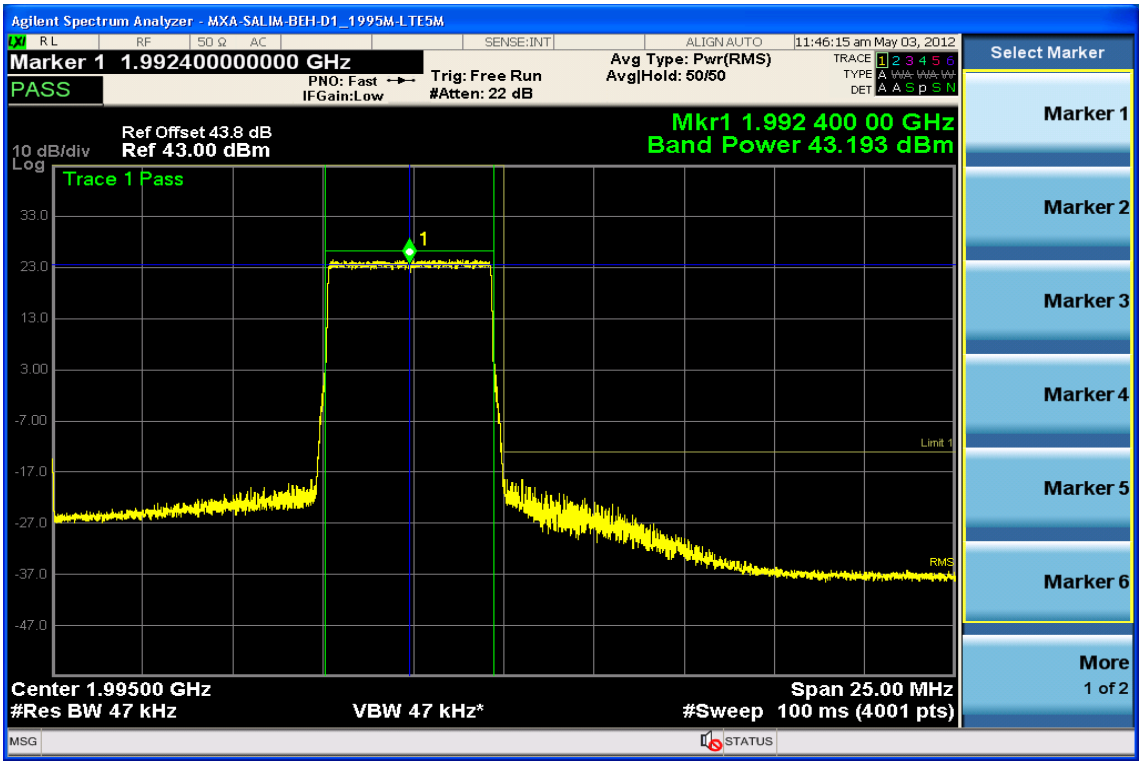


Figure D6. Data for LTE modulation at high end is presented.

AWS band

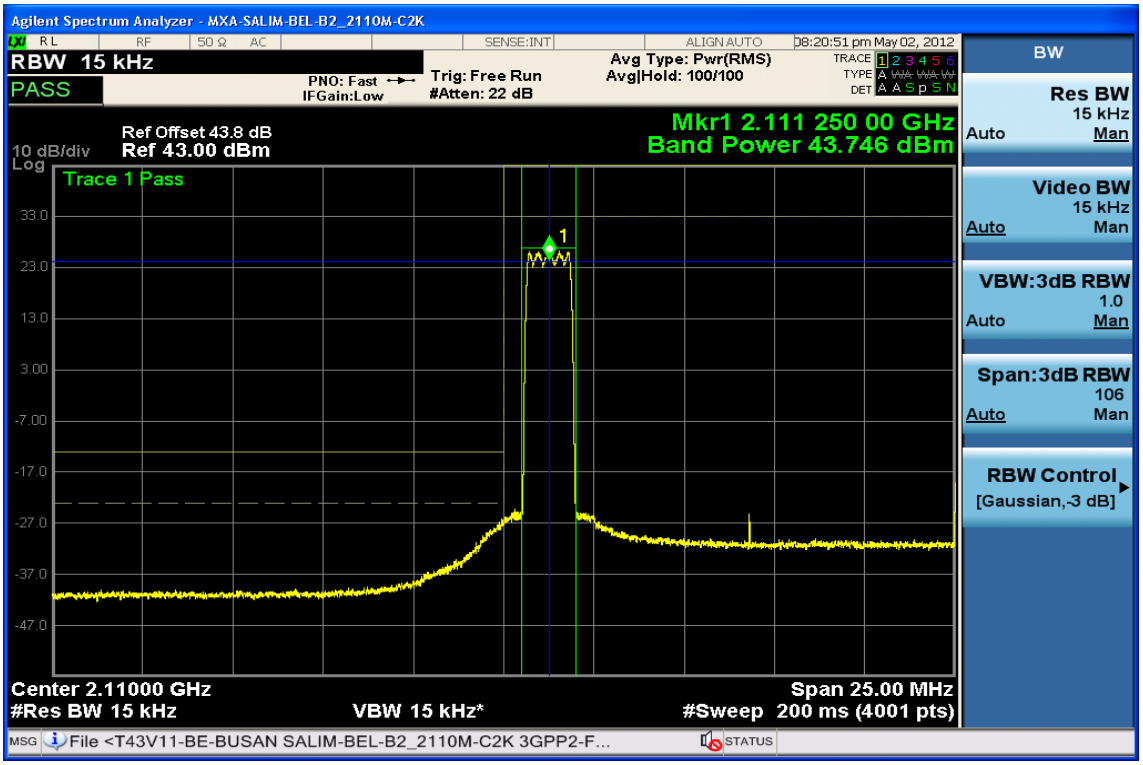


Figure D7. Data for CDMA2000 modulation at low end is presented.

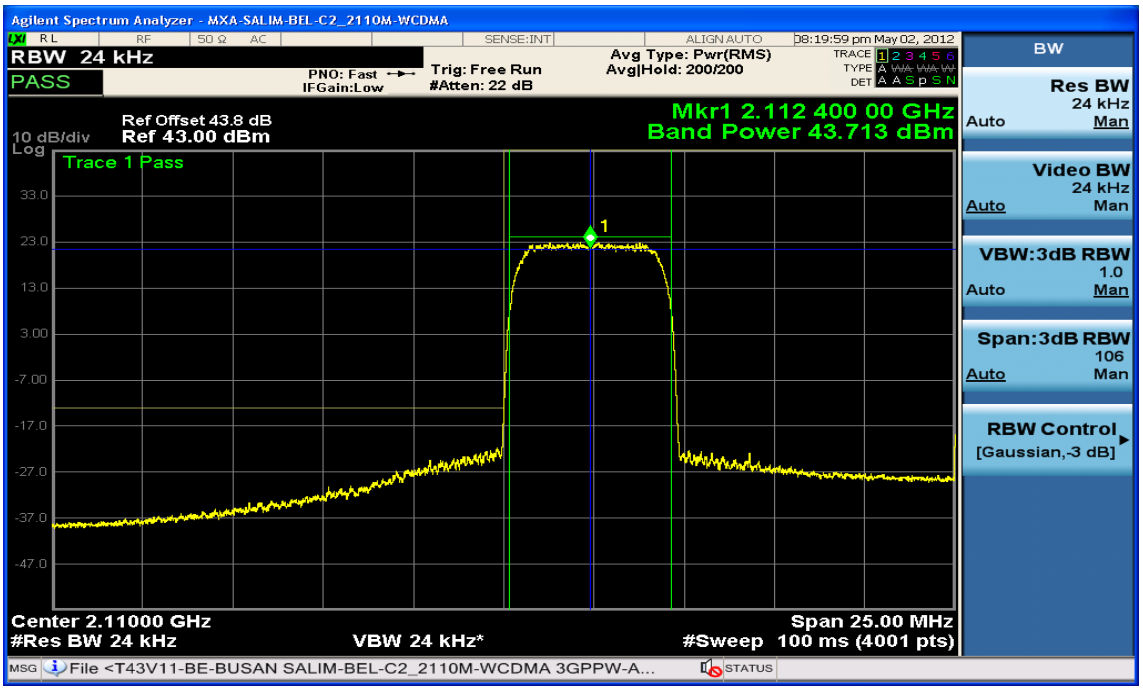


Figure D8. Data for WCDMA modulation at low end is presented.

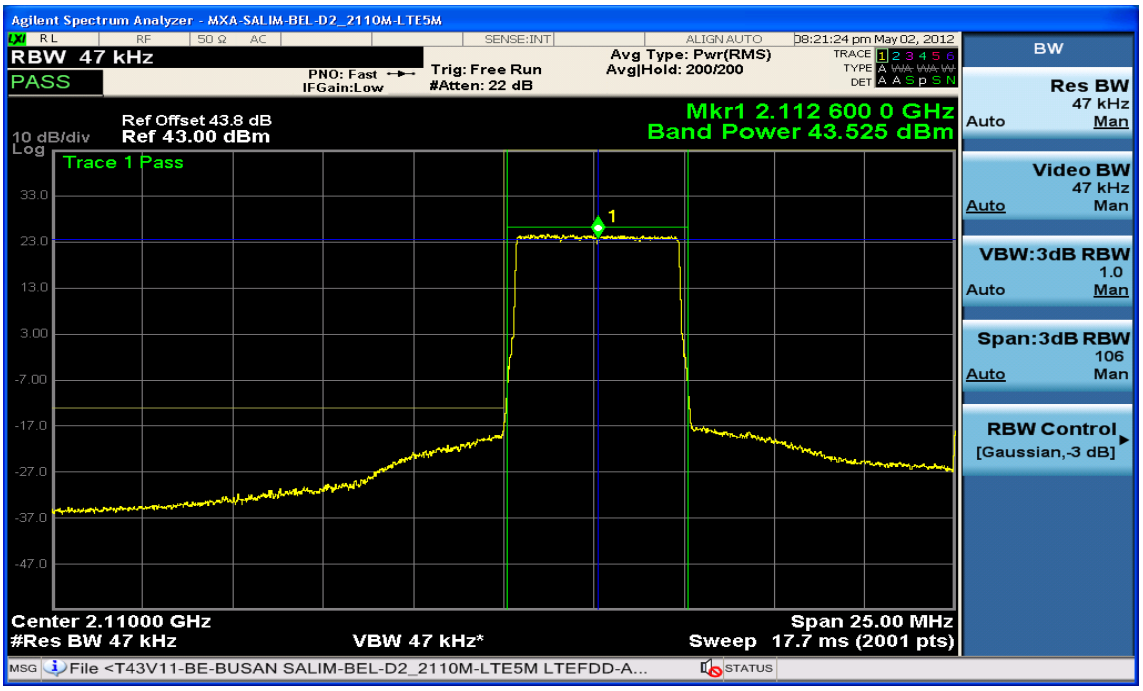


Figure D9. Data for LTE modulation at low end is presented.

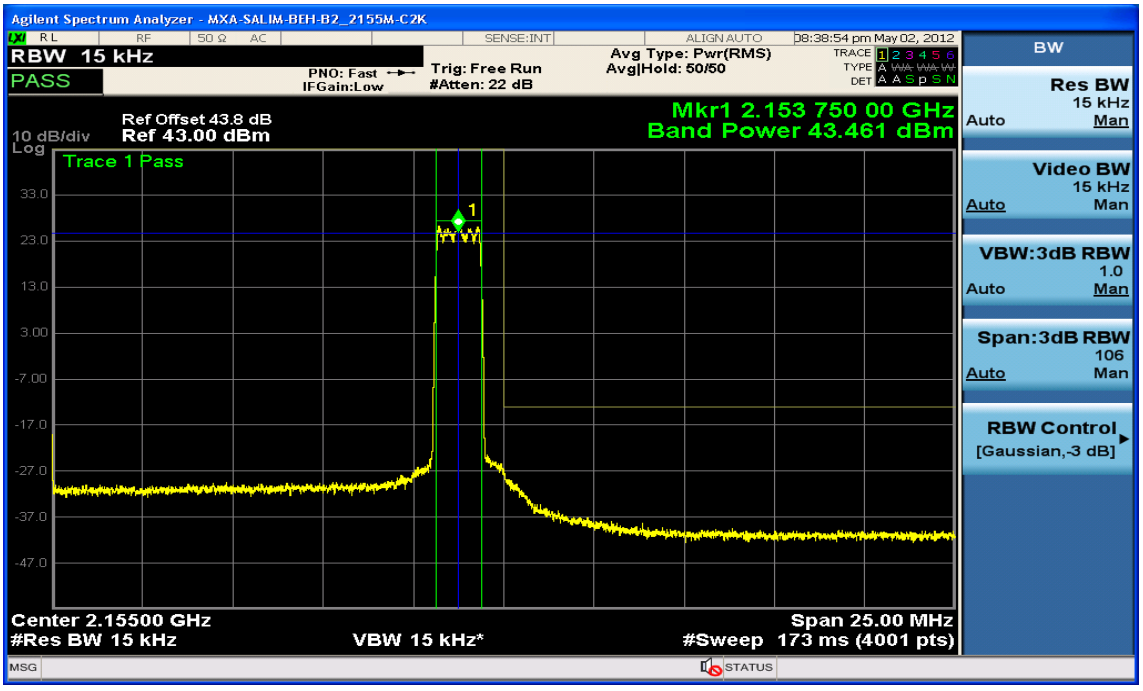


Figure D10. Data for CDMA2000 modulation at high end is presented.

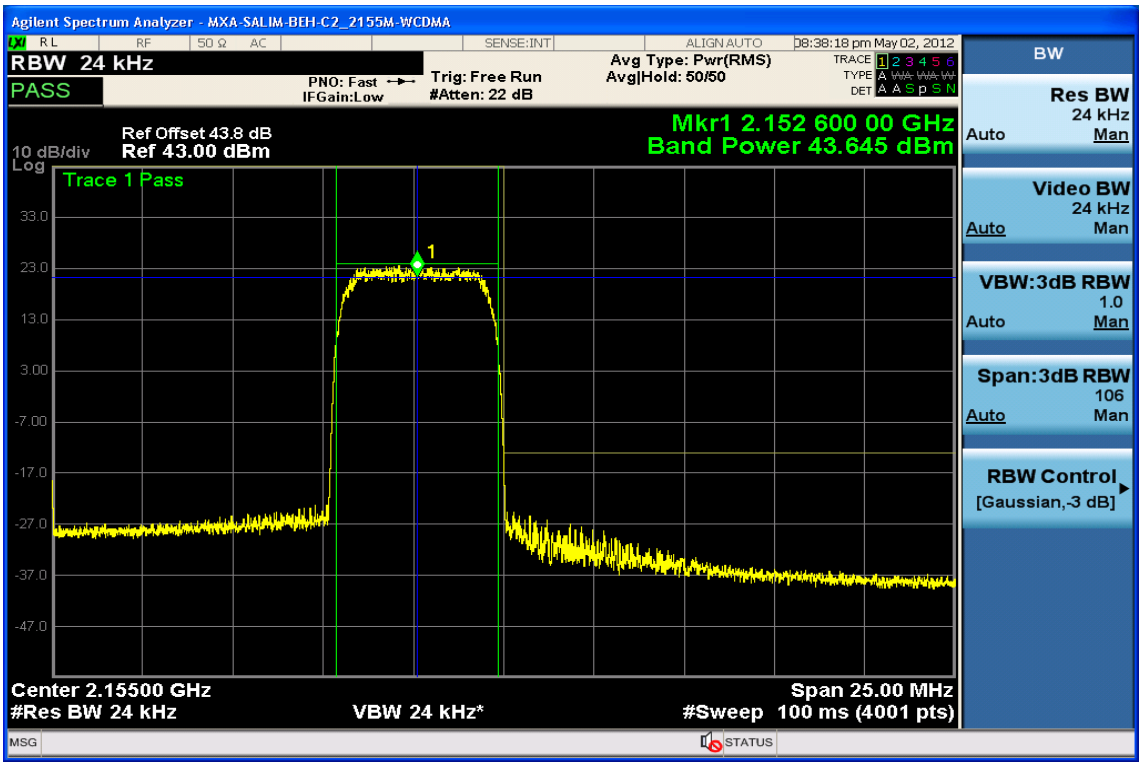


Figure D11. Data for WCDMA modulation at high end is presented.

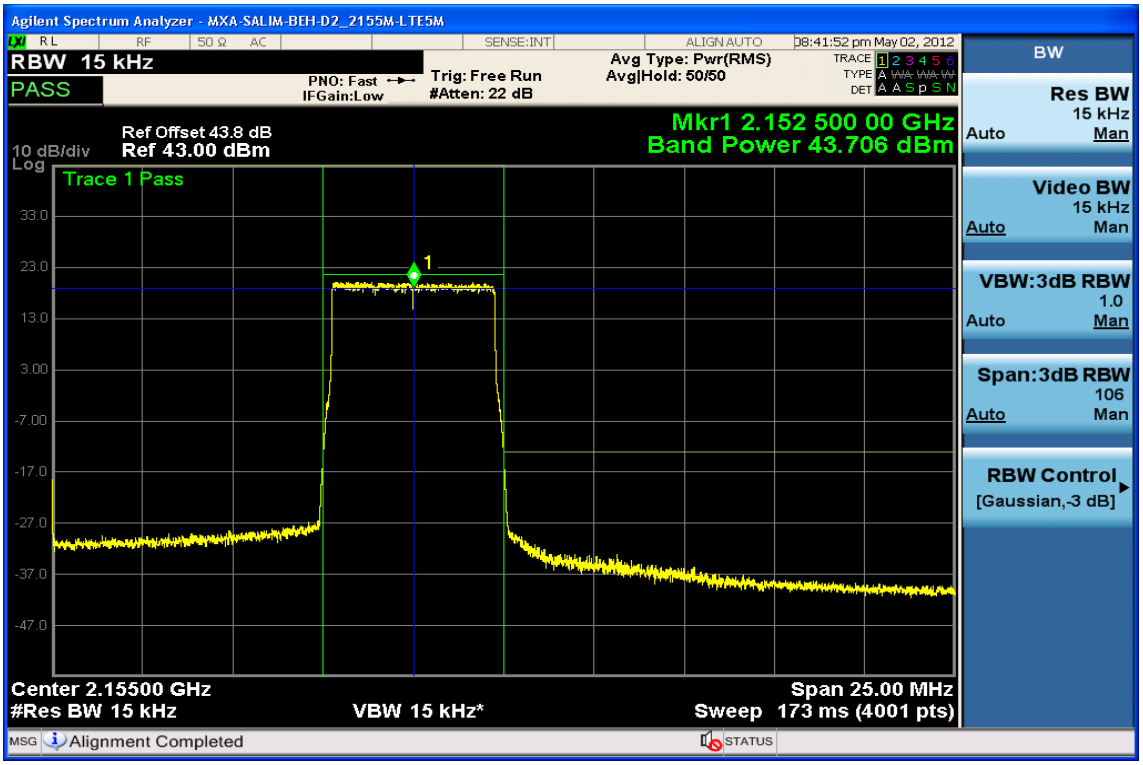


Figure D6. Data for LTE modulation at high end is presented.

PCS band

Low end

Modulation	Freq (MHz)	Reading (dBm)	Correction factor dBm	Limit (dBm)	Margin (dB)	Result
CDMA2000	1930	-25.2	1.58	-13	10.62	PASS
WCDMA	1930	-20.7	-5.78	-13	13.48	PASS
LTE5M	1930	-19.0	-0.36	-13	6.36	PASS

High end

Modulation	Freq (MHz)	Reading (dBm)	Correction factor dBm	Limit (dBm)	Margin (dB)	Result
CDMA2000	1990	-24.9	1.58	-13	10.32	PASS
WCDMA	1995	-18.8	-5.78	-13	11.58	PASS
LTE5M	1995	-21.1	-0.36	-13	8.46	PASS

AWS band

Low end

Modulation	Freq (MHz)	Reading (dBm)	Correction factor dBm	Limit (dBm)	Margin (dB)	Result
CDMA2000	2110	-25.4	1.94	-13	10.46	PASS
WCDMA	2110	-24.2	-4.86	-13	16.06	PASS
LTE5M	2110	-23.4	0.38	-13	10.02	PASS

High end

Modulation	Freq (MHz)	Reading (dBm)	Correction factor dBm	Limit (dBm)	Margin (dB)	Result
CDMA2000	2110	-23.8	1.94	-13	8.86	PASS
WCDMA	2110	-19.4	-4.86	-13	11.26	PASS
LTE5M	2110	-18.2	0.38	-13	4.82	PASS

6.0 Field Strength of Spurious Radiation

6.1 Methodology

Measurements were performed at eight modulations (F1C-C2K, F2C-C2K, F3C-C2K, DL1C-WCDMA, DL2C-WCDMA, DL3C-WCDMA, DL4C-WCDMA, LTE5M for the mid, lowest and highest frequency within the band.

Worst-case data is shown in the figures E1 – E2 (PCS band) and E3 - E4 (AWS band) in section 6.3.

A brief summary of the applicable FCC specifications are listed in the table below.

27.53 Emission limits.
(h) For operations in the 1710–1755 MHz and 2110–2155 MHz bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) by at least 43 + 10 $\log_{10}$ (P) dB.
(1) Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 megahertz bands immediately outside and adjacent to the licensee's frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. 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.

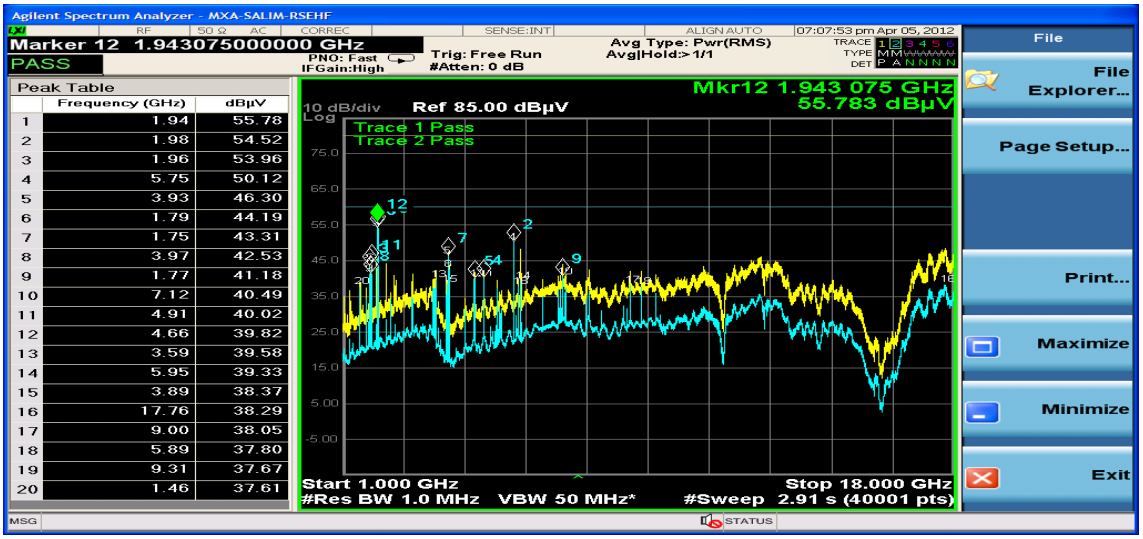
Thus the required attenuation = 43+10*Log (P) dB and the limit = -13dBm ERP for average detector.

6.2 Interpretation

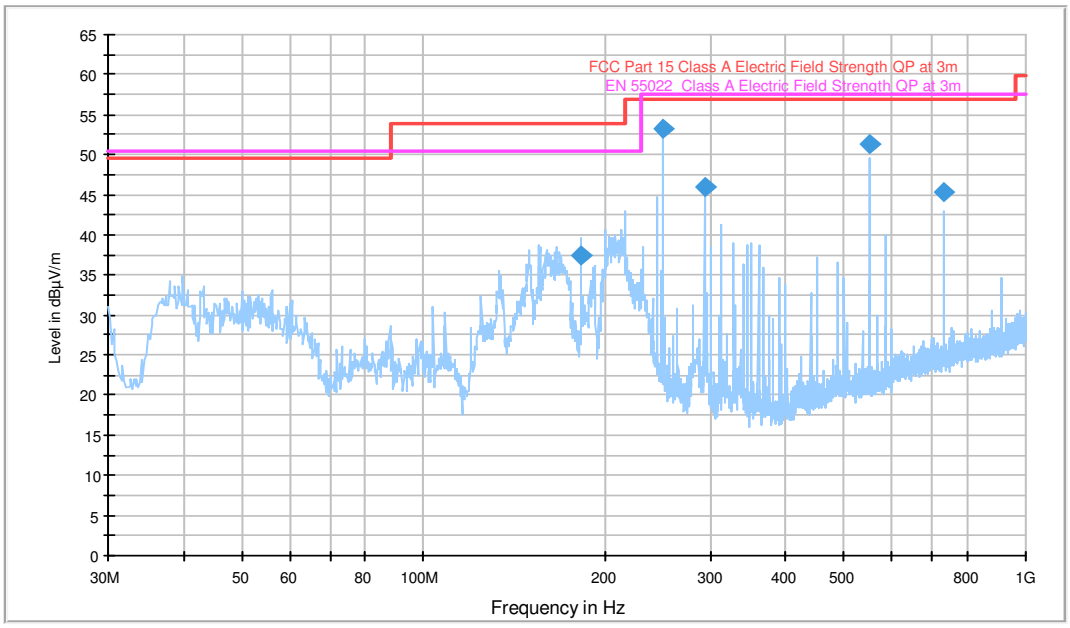
All test conditions and measurement procedures were performed in accordance with FCC CFR47 part 2 subpart J Clause 2.1053. Substitution method as prescribed under ANSI/TIA-603-C section 2.2.12 and 22.17 is not required for all signal margin exceeds 20 dB.

6.3 Results – Figure E1 - E4

PCS band



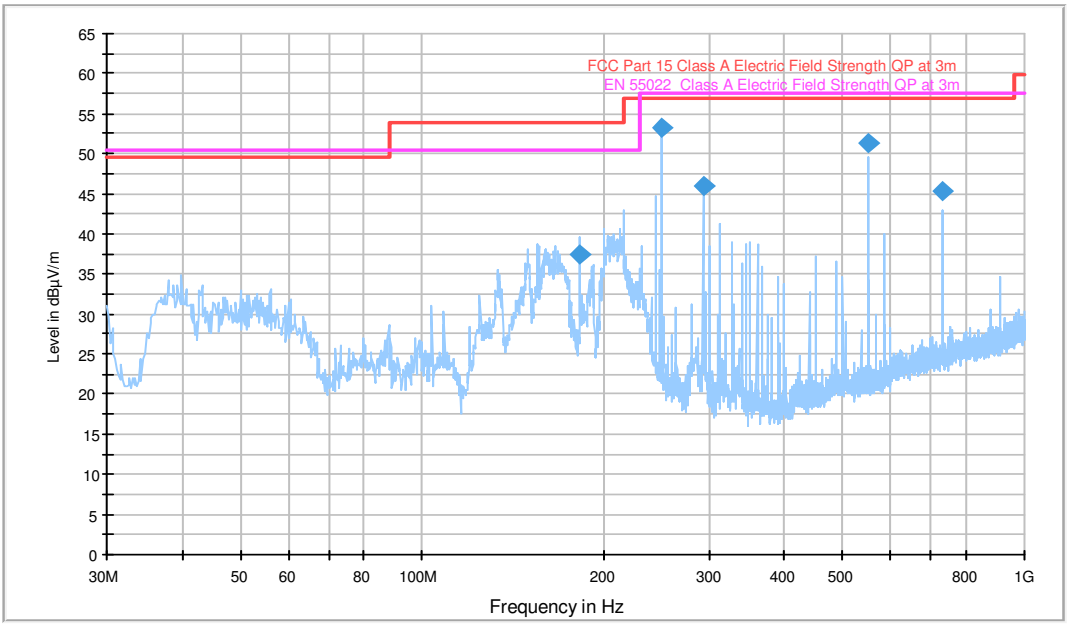
. **Figure E1**. Data for radiated spurious emission 1 – 18 GHz is presented.



. **Figure E2** Data for radiated spurious emission 30MHz – 1GHz is presented.

AWS band

. **Figure E3**. Data for radiated spurious emission 1 – 18 GHz is presented.



. **Figure E4**. Data for radiated spurious emission 30MHz – 1GHz is presented.

The plots are for reference purposes only. Actual measurements are shown in Table 5 and 6.

PCS band

T43 with TXON +43dBm MOD - DL

Frequency (GHz)	Average (dBµV/m)	Meas. Time (ms)	Band width (kHz)	Antenna height (cm)	Pol	Turntable position (deg)	Corrected Rdg (dBm)	Margin (dB)	Limit (dBm)
5.74822	63.0	1000.	1000.	100	H	278.0	-34.6	21.4	-13

Table 5.a. Spurious emissions measurements in 1-18 GHz.

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	BW (kHz)	Antenna height (cm)	Pol	Turntable position (deg)	Corr. (dB)	Adj Rdg (dBmj)	Margin (dB)	Limit (dBm)
183.000	29.2	1000.00	120.000	190.0	H	30.0	12.4	-57.7	44.7	-13
210.030	22.8	1000.00	120.000	133.0	H	30.0	13.1	-64.1	51.1	-13
244.004	32.2	1000.00	120.000	100.0	V	342.0	14.8	-54.7	41.7	-13
250.000	41.1	1000.00	120.000	121.0	H	223.0	20.1	-45.8	32.8	-13
292.870	30.8	1000.00	120.000	115.0	V	71.0	20.4	-56.1	43.1	-13
548.997	37.8	1000.00	120.000	100.0	H	252.0	22.5	-49.1	36.1	-13

Table 5.b. Spurious emissions measurements in 30MHz-1GHz.

AWS band

T43 with 2.122 – 2.142GHz TXON +43dBm MOD - DL

Frequency (GHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Pol	Turntable position (deg)	Adj Rdg (dBm)	Margin (dB)	Limit (dBm)
5.748	63.0	1000.00	1000.00	100	H	278.0	-34.4	21.4	-13
5.869	51.2	1000.00	1000.00	117	V	295.0	-46.2	33.2	-13
6.435	54.2	1000.00	1000.00	150.0	V	255.0	-43.2	30.2	-13
6.464	52.6	1000.00	1000.00	150.0	V	255.0	-44.8	31.8	-13
6.427	60.1	1000.00	1000.00	150.0	V	255.0	-37.3	24.3	-13

Table 6.a. Spurious emissions measurements in 1-18 GHz.

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	BW (kHz)	Antenna height (cm)	Pol	Turntable position (deg)	Corr. (dB)	Adj Rdg (dBmj)	Margin (dB)	Limit (dBm)
183.000	29.2	1000.00	120.000	190.0	H	30.0	12.4	-57.7	44.7	-13
210.030	22.8	1000.00	120.000	133.0	H	30.0	13.1	-64.1	51.1	-13
244.004	32.2	1000.00	120.000	100.0	V	342.0	14.8	-54.7	41.7	-13
250.000	41.1	1000.00	120.000	121.0	H	223.0	20.1	-45.8	32.8	-13
292.870	30.8	1000.00	120.000	115.0	V	71.0	20.4	-56.1	43.1	-13
548.997	37.8	1000.00	120.000	100.0	H	252.0	22.5	-49.1	36.1	-13

Table 6.b. Spurious emissions measurements in 30MHz-1GHz.

No other emissions were detected within 20dB of limit.
Radiated emissions 1-18GHz measured at 3m in SAC.

7.0 Frequency Stability

7.1 Methodology

Measurements were performed at CW.

Data plot is shown in the figure F1 in section 7.2.

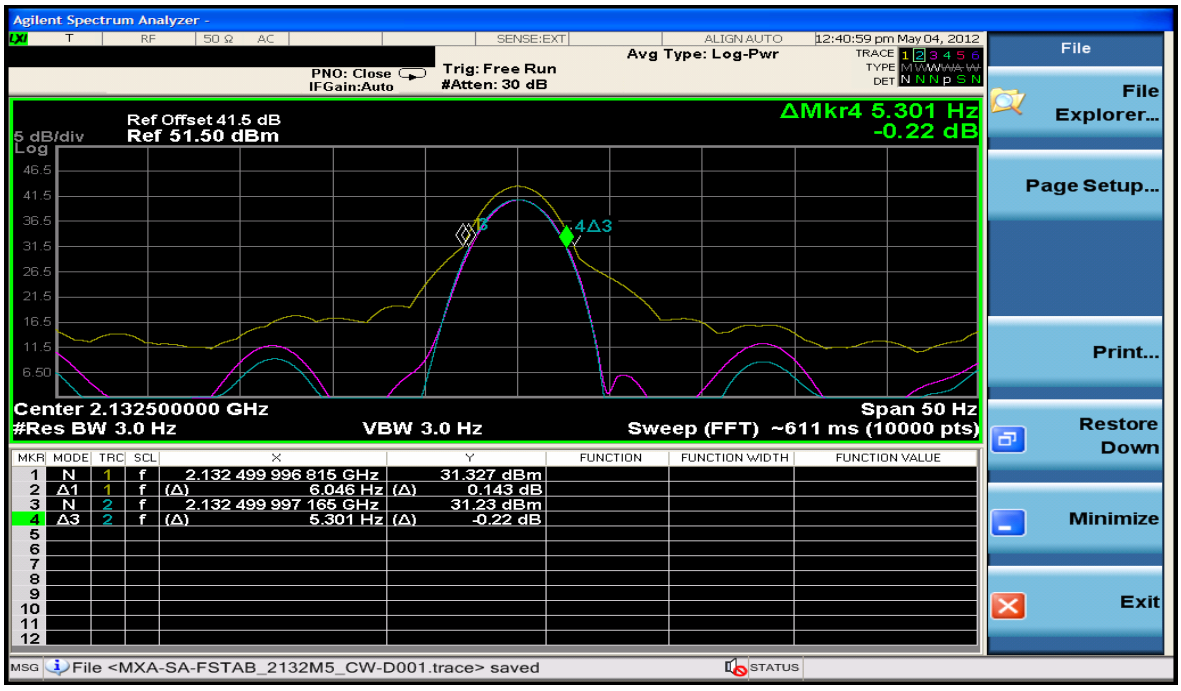
A brief summary of the applicable FCC specifications are listed in the table below.

2.1055 Frequency stability. (a) Unless noted elsewhere, transmitters used in the services governed by this part must have a minimum frequency stability as specified in the following. The frequency stability shall be measured with variation of ambient ambient temperature as follows from -30° to +50° centigrade for all equipment… Vary primary supply voltage from85 to 115 percent of the nominal value **27.54 Frequency stability.** The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

All test conditions and measurement procedures were performed in accordance with FCC CFR47 part 2 subpart J Clause 2.1055.

Data was collected continuously over temperature range of -40C to 55C using a max hold function. Worst-case data is shown on aggregate plot.

7.2 Results



. **Figure F1**. Data for frequency stability is presented.

F (MHz)	Delta A (Hz)	Delta B (Hz)	Error (Hz)	PPM
2132.5	6.046	5.301	0.745	0.003494

Table 7. Calculation of frequency deviation for aggregate plot.