

FCC REPORT

FCC Certification

Applicant Name:
GS Instruments Co.,Ltd.

Address:
1385-14, Juan-Dong, Nam-Ku, Incheon, 402-200,
Korea

Date of Issue:
April 09, 2015
Test Site/Location:
HCT CO., LTD., 74, Seoicheon-ro 578beon-gil,
Majang-myeon, Icheon-si, Gyeonggi-do, Korea
Report No.: HCT-R-1503-F010-1
HCT FRN: 0005866421

FCC ID: U88-SMT-I33

FCC APPLICANT: GS Instruments Co.,Ltd.

FCC Model(s): SMT-I33
EUT Type: In-Building RF Repeater
Frequency Ranges: SMT800: Downlink : 862 MHz ~ 869 MHz
Uplink : 817 MHz ~ 824 MHz
Conducted Output Power: Downlink / Uplink: 2 W (33 dBm)
Date of Test : February 23, 2015 ~ March 03, 2015
FCC Rules Part(s): CFR 47, Part90

Engineering Statement:

The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. It is further stated that upon the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of Part 90 of the FCC Rules under normal use and maintenance.



Report prepared by
: Yong Hyun Lee
Test engineer of RF Team



Approved by
: Sang Jun Lee
Manager of RF Team

This report only responds to the tested sample and may not be reproduced, except in full, without written approval of the HCT Co., Ltd.

Version

TEST REPORT NO.	DATE	DESCRIPTION
HCT-R-1503-F010	March 16, 2015	- First Approval Report
HCT-R-1503-F010-1	April 09, 2015	- Modify uplink frequency (1 page, 4 page) - Add test results table (31 page ~ 34 page)

Table of Contents

1. CLIENT INFORMATION.....	4
2. FACILITIES AND ACCREDITATIONS	5
2.1. FACILITIES	5
2.2. EQUIPMENT	5
3. TEST SUMMARY	6
3.1. STANDARDS	6
3.2. MODE OF OPERATION DURING THE TEST.....	6
4. STANDARDS ENVIRONMENTAL TEST CONDITIONS	7
5. TEST EQUIPMENT	8
6. RF OUTPUT POWER.....	9
7. OCCUPIED BANDWIDTH.....	16
8. OUT OF BAND REJECTION	27
9. SPURIOUS AND HARMONIC EMISSION AT ANTENNA TERMINAL	30
10. RADIATED SPURIOUS EMISSIONS	59
11. FREQUENCY STABILITY OVER TEMPERATURE AND VOLTAGE VARIATIONS	62

1. CLIENT INFORMATION

The EUT has been tested by request of

Company	GS Instruments Co.,Ltd. 1385-14, Juan-Dong, Nam-Ku, Incheon, 402-200, Korea
Contact Point	Attention: Ko Sung Moo Tel./ Fax. : +82-32-870-5566/ +82-32-870-5640

- FCC ID: **U88-SMT-I33**
- APPLICANT: **GS Instruments Co.,Ltd.**
- EUT Type: **In-Building RF Repeater**
- Model: **SMT-I33**
- Frequency Ranges: **SMT800: Downlink : 862 MHz ~ 869 MHz
Uplink : 817 MHz ~ 824 MHz**
- Conducted Output Power: **2 W (33 dBm)**
- Antenna Gain(s) : **Manufacturer does not provide an antenna.**
- FCC Rules Part(s): **CFR 47, Part90**
- Measurement standard(s): **ANSI/TIA-603-C-2004, KDB 971168 D01 v02r02,
KDB 935210 D03 v02r01**
- Place of Tests: **74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Korea. (IC Recognition No. : 5944A-3)**

2. FACILITIES AND ACCREDITATIONS

2.1. FACILITIES

The SAC(Semi-Anechoic Chamber) and conducted measurement facility used to collect the radiated data are located at the 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Korea. The site is constructed in conformance with the requirements of ANSI C63.4. (Version :2003) and CISPR Publication 22. Detailed description of test facility was submitted to the Commission and accepted dated February 28, 2014 (Registration Number: 90661).

2.2. EQUIPMENT

Radiated emissions are measured with one or more of the following types of Linearly polarized antennas: tuned dipole, bi-conical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and quasi-peak detectors are used to perform radiated measurements.

Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

3. TEST SUMMARY

3.1. STANDARDS

The following tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC Part90.

Description	Reference	Results
RF Output Power	§2.1046, §90.635	Compliant
Occupied Bandwidth	§2.1049	Compliant
Out of Band Rejection	KDB 935210 D03 v02r01	Compliant
Spurious Emissions at Antenna Terminals	§2.1051, §90.691	Compliant
Radiated Spurious Emissions	§2.1053, §90.691	Compliant
Frequency Stability	§2.1055, §90.213	Compliant

3.2. MODE OF OPERATION DURING THE TEST

The EUT was operated in a manner representative of the typical usage of the equipment.

During all testing, system components were manipulated within the confines of typical usage to maximize each emission.

The device does not supply antenna(s) with the system, so the dummy loads were connected to the RF output ports for radiated spurious emission testing.

4. STANDARDS ENVIRONMENTAL TEST CONDITIONS

Temperature :	+ 15 °C to + 35 °C
Relative humidity:	30 % to 60 %
Air pressure	860 mbar to 1 060 mbar

5. TEST EQUIPMENT

Manufacturer	Model / Equipment	Cal Interval	Calibration Date	Serial No.
Agilent	E4438C /Signal Generator	Annual	09/11/2014	MY42082646
Agilent	N5182A /Signal Generator	Annual	05/22/2014	MY47070230
Agilent	N1911A /Power Meter	Annual	01/15/2015	MY45100523
Agilent	N1921A/ Power Sensor	Annual	07/09/2014	MY45241059
NANGYEUL CO., LTD.	NY-THR18750/ Temperature and Humidity Chamber	Annual	10/29/2014	NY-2009012201A
Agilent	N9020A /Signal Analyzer	Annual	04/16/2014	US46220219
WEINSCHEL	67-30-33 / Fixed Attenuator	Annual	11/04/2014	BU5347
Weinschel	AF9003-69-31 / Step Attenuator	Annual	10/24/2014	11787
HD	MA240/ Antenna Position Tower	N/A	N/A	556
EMCO	1050/ Turn Table	N/A	N/A	114
HD GmbH	HD 100/ Controller	N/A	N/A	13
HD GmbH	KMS 560/ SlideBar	N/A	N/A	12
MITEQ	AMF-6D-001180-35-20P/AMP	Annual	09/04/2014	1081666
Schwarzbeck	BBHA 9120D/ Horn Antenna	Biennial	07/05/2013	1151
Schwarzbeck	BBHA 9120D/ Horn Antenna	Biennial	09/01/2014	147
Schwarzbeck	VULB 9160/TRILOG Antenna	Biennial	11/17/2014	3150

6. RF OUTPUT POWER

FCC Rules

Test Requirements:

§ 2.1046 Measurements required: RF power output:

§ 2.1046 (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.

§ 2.1046 (b) For single sideband, independent sideband, and single channel, controlled carrier radiotelephone transmitters, the procedure specified in paragraph (a) of this section shall be employed and, in addition, the transmitter shall be modulated during the test as specified and as applicable in § 2.1046 (b) (1-5). In all tests, the input level of the modulating signal shall be such as to develop rated peak envelope power or carrier power, as appropriate, for the transmitter.

§ 2.1046 (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.

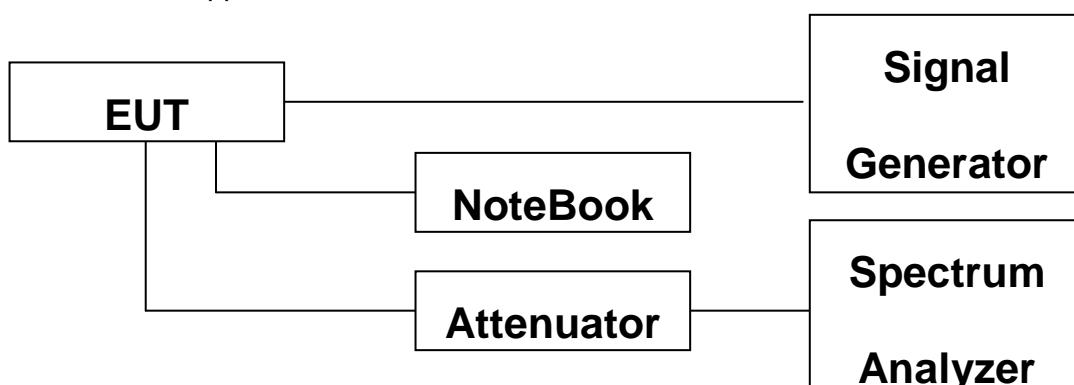
§ 90.635 Limitations on power and antenna height. (a) The effective radiated power and antenna height for base stations may not exceed 1 kilowatt (30 dBw) and 304 m. (1,000 ft.) above average terrain (AAT), respectively, or the equivalent thereof as determined from the Table. These are maximum values, and applicants will be required to justify power levels and antenna heights requested.

Antenna height (AAT) in meters (feet)	Effective radiated power (watts)
Above 1372 (4500)	65
Above 1220 (4000) To 1372 (4500)	70
Above 1067 (3500) To 1220 (4000)	75
Above 915 (3000) To 1067 (3500)	100
Above 763 (2500) To 915 (3000)	140

Above 610 (2000) To 763 (2500)	200
Above 458 (1500) To 610 (2000)	350
Above 305 (1000) To 458 (1500)	600
Up to 305 (1000)	1000

Test Procedures:

As required by 47 CFR 2.1046, RF power output measurements were made at the RF output terminals using an attenuator and spectrum analyzer or power meter. This test was performed in all applicable modulations.

**Block Diagram 1. RF Power Output Test Setup****Test Results:**

Input Signal	Input Level (dBm)	Maximum Amp Gain
CDMA		
CDMA EVDO		
LTE 5 MHz	DL/UL : -57 dBm	DL/UL : 90 dB
LTE + CMDA		

[Downlink]

	Frequency (MHz)	Output Power	
		(dBm)	(W)
CDMA	862.90	33.002	1.996
CDMA EVDO	862.90	32.969	1.981
LTE + CDMA	865.50	32.999	1.995
LTE 5 MHz	866.30	33.001	1.996

[Uplink]

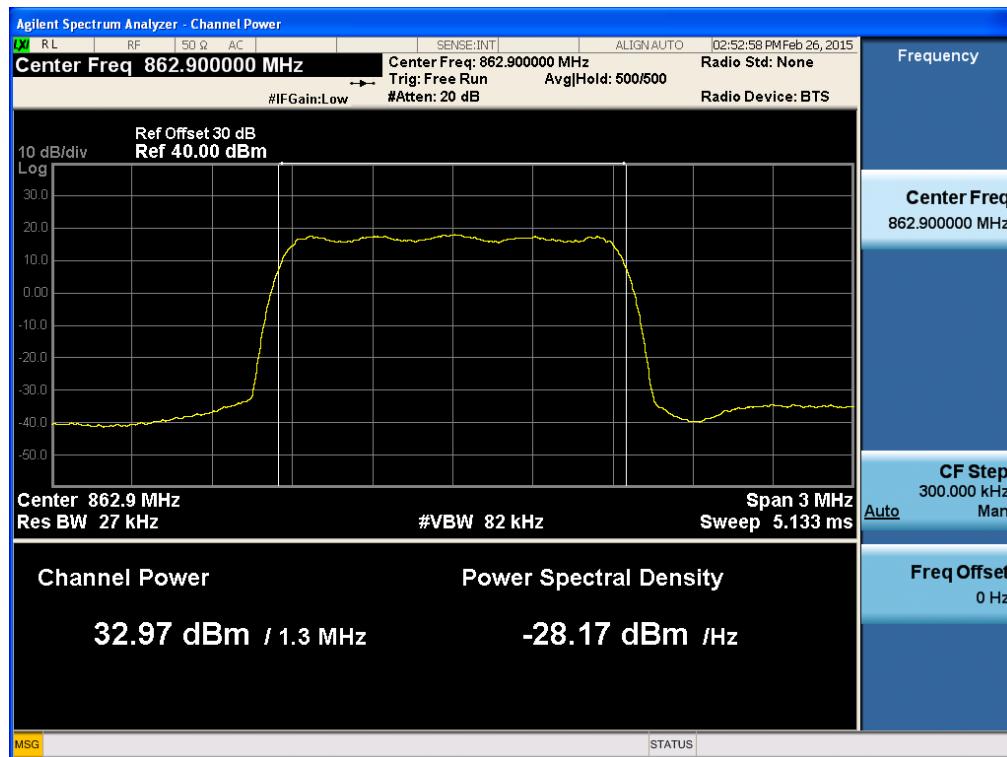
	Frequency (MHz)	Output Power	
		(dBm)	(W)
CDMA	817.90	33.010	2.000
CDMA EVDO	817.90	32.940	1.968
LTE + CDMA	820.50	33.004	1.997
LTE 5 MHz	821.30	33.004	1.997

Plots of RF Output Power _Downlink

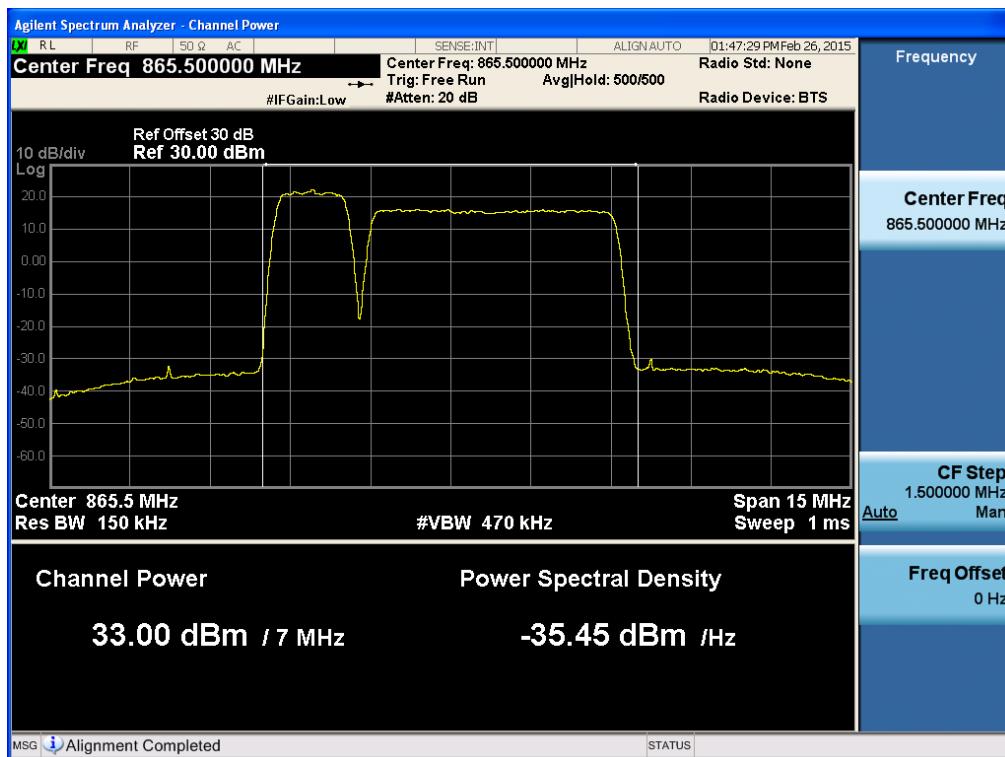
[CDMA Downlink]



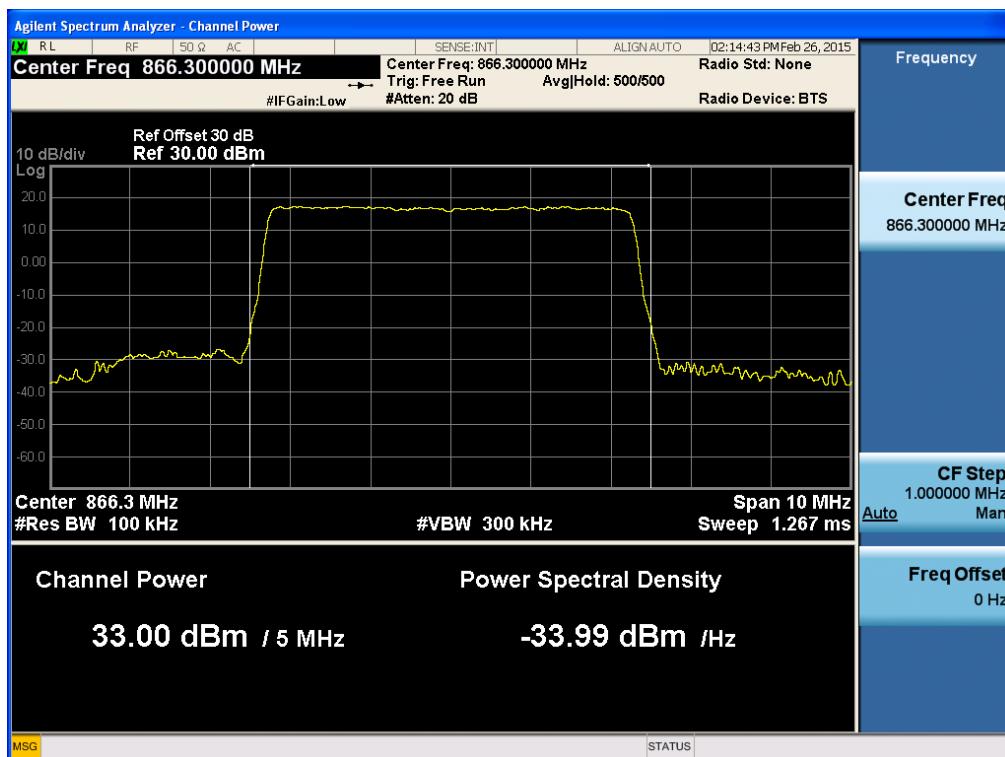
[CDMA EVDO Downlink]



[LTE + CDMA Downlink]

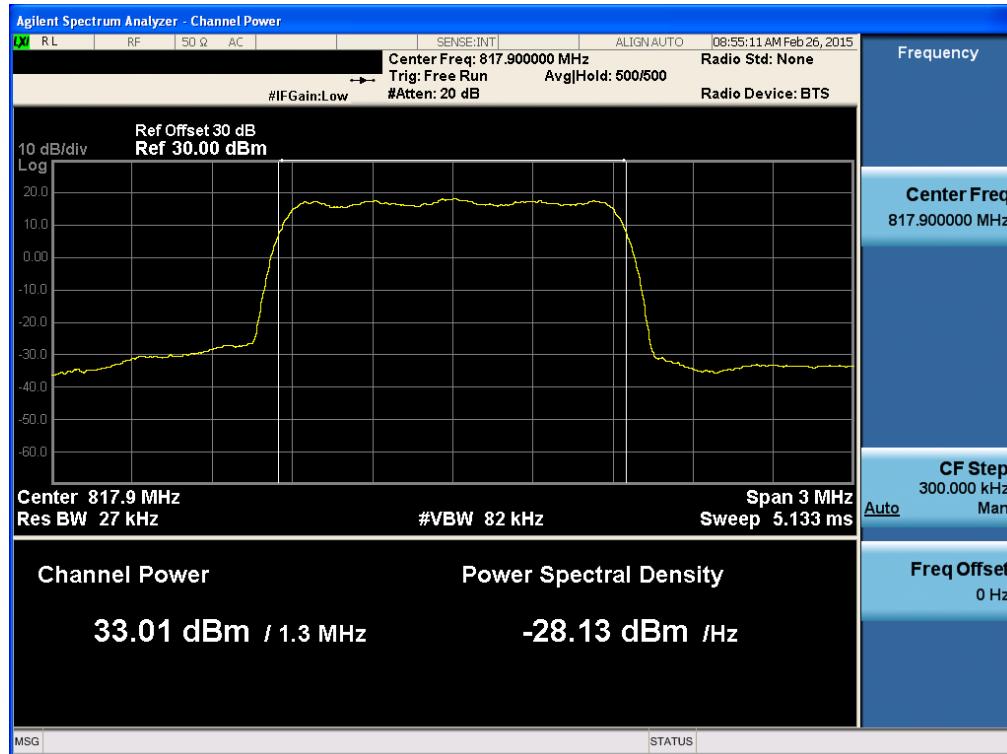


[LTE 5 MHz Downlink]



Plots of RF Output Power _Uplink

[CDMA Uplink]



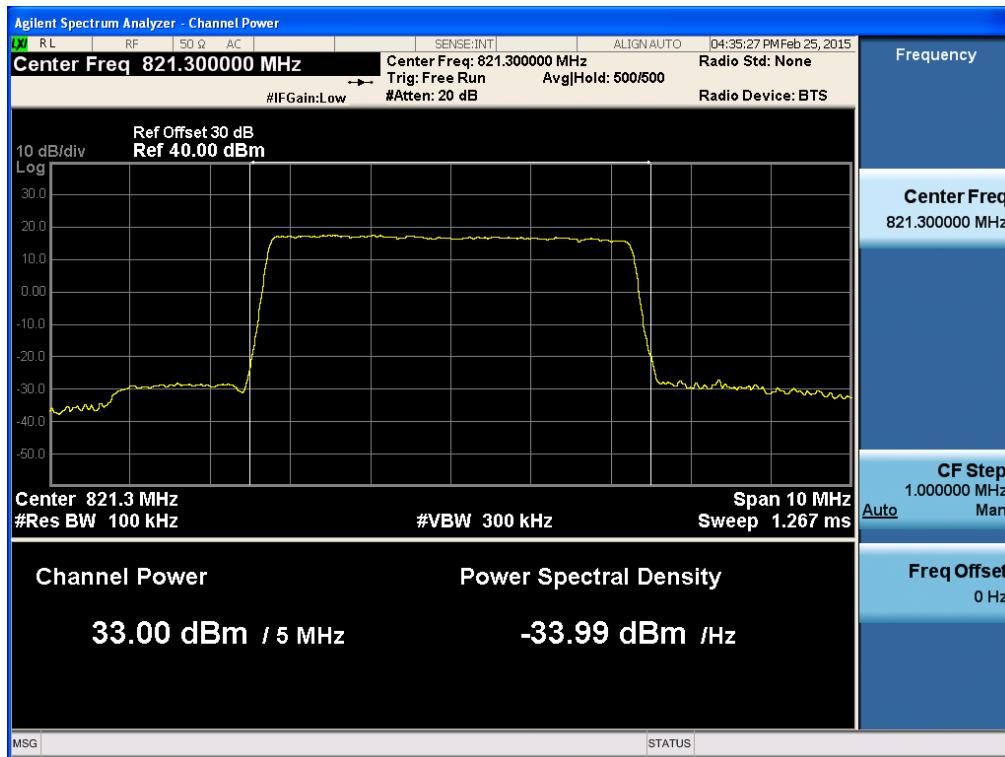
[CDMA EVDO Uplink]



[LTE + CDMA Uplink]



[LTE 5 MHz Uplink]



7. OCCUPIED BANDWIDTH

FCC Rules

Test Requirement(s):

§ 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 under the specified conditions of § 2.1049 (a) through (i) as applicable.

Test Procedures: As required by 47 CFR 2.1049, *occupied bandwidth measurements* were made with a Spectrum Analyzer connected to the RF ports for both Uplink and Downlink. The modulation characteristics of signal generator's carrier was measured first at a maximum RF level prescribed by the OEM. The signal generator was then connected to either the Uplink or Downlink input at the appropriate RF level. The resulting modulated signal through the EUT was measured and compared against the original signal.

Test Results: The EUT complies with the requirements of this section.

Input Signal	Input Level (dBm)	Maximum Amp Gain
CDMA		
CDMA EVDO		
LTE 5 MHz	DL/UL : -57 dBm	DL/UL : 90 dB
LTE + CMDA		

[Downlink Output]

	Frequency (MHz)	OBW (MHz)
CDMA	862.90	1.259
CDMA EVDO	862.90	1.258
LTE + CDMA	865.50	6.298
LTE 5 MHz	866.30	4.507

[Downlink Input]

	Frequency (MHz)	OBW (MHz)
CDMA	862.90	1.260
CDMA EVDO	862.90	1.267
LTE + CDMA	865.50	6.294
LTE 5 MHz	866.30	4.523

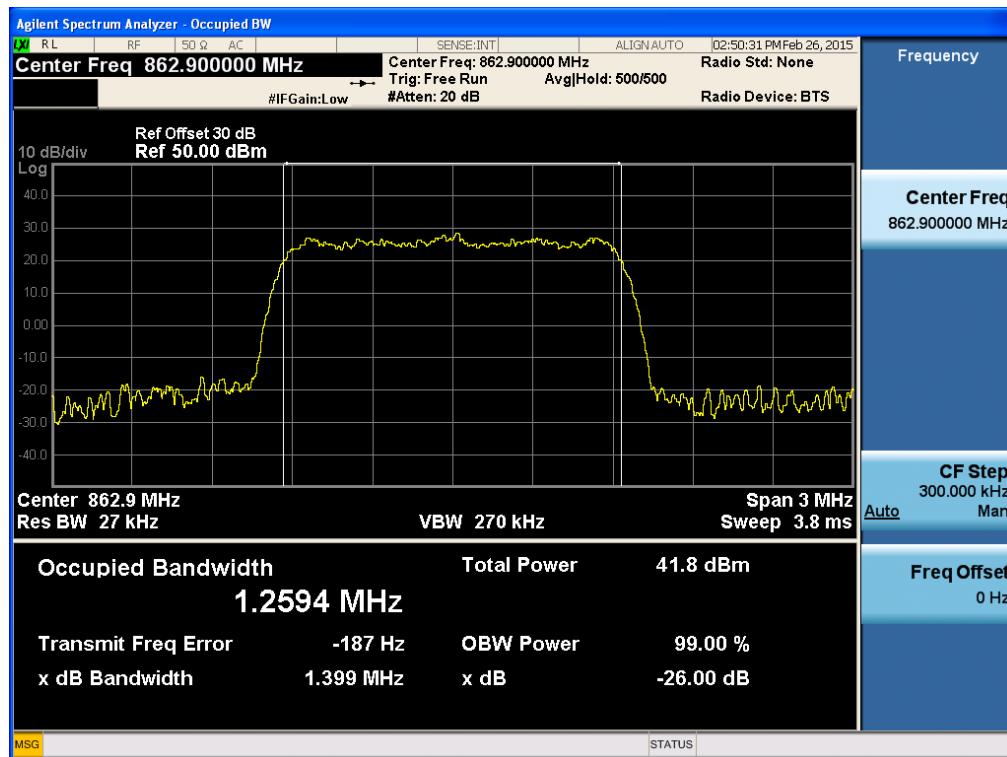
[Uplink Output]

	Frequency (MHz)	OBW (MHz)
CDMA	817.90	1.256
CDMA EVDO	817.90	1.258
LTE + CDMA	820.50	6.268
LTE 5 MHz	821.30	4.499

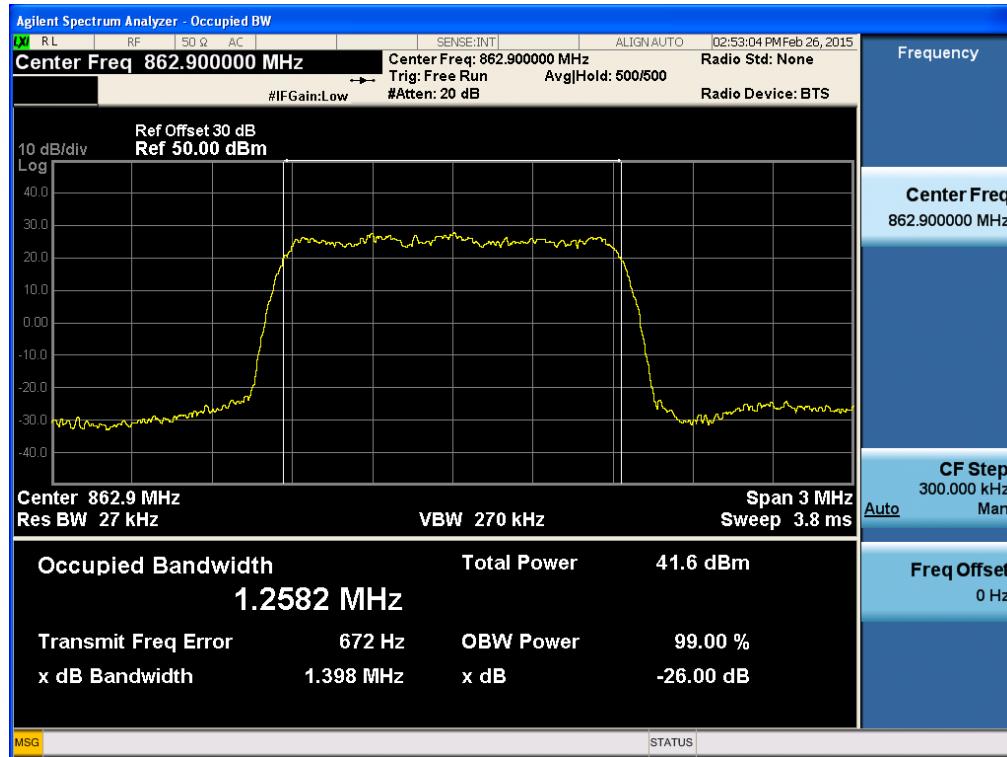
[Uplink Input]

	Frequency (MHz)	OBW (MHz)
CDMA	817.90	1.262
CDMA EVDO	817.90	1.262
LTE + CDMA	820.50	6.287
LTE 5 MHz	821.30	4.516

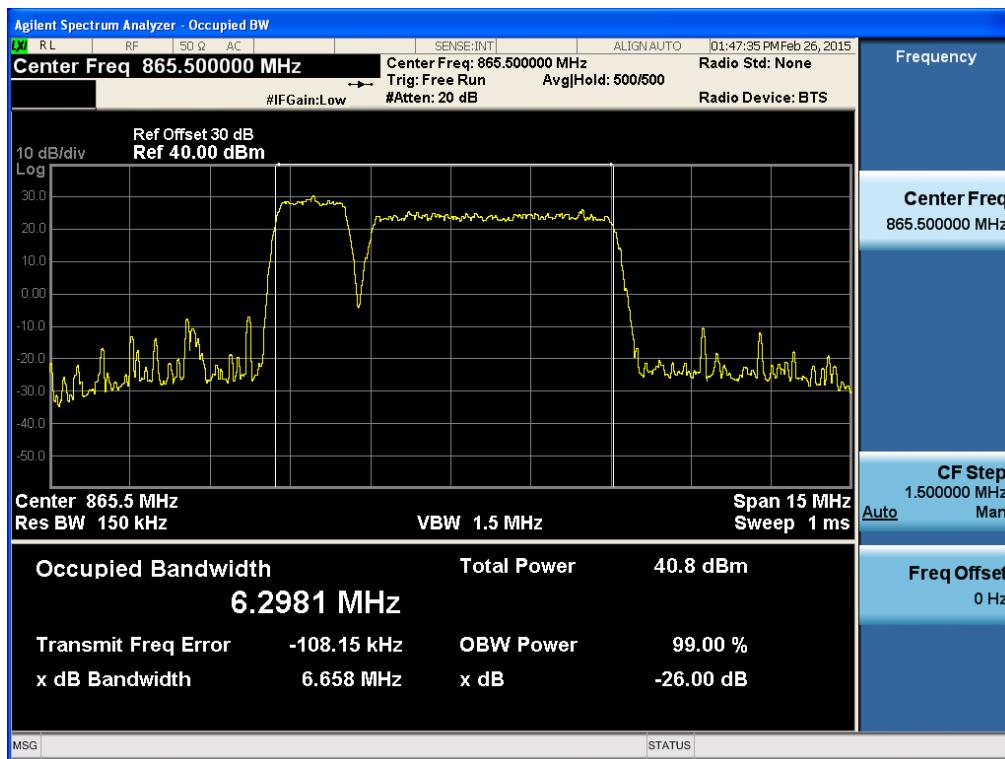
Plots of Occupied Bandwidth_Downlink [CDMA Output Downlink]



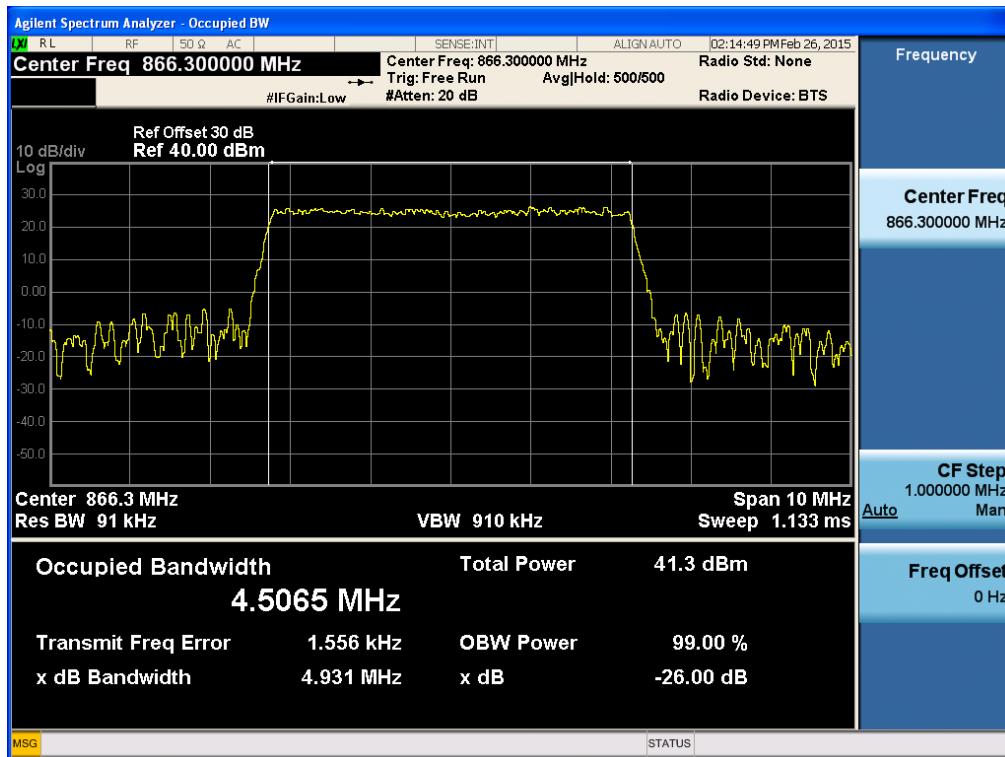
[CDMA EVDO Output Downlink]



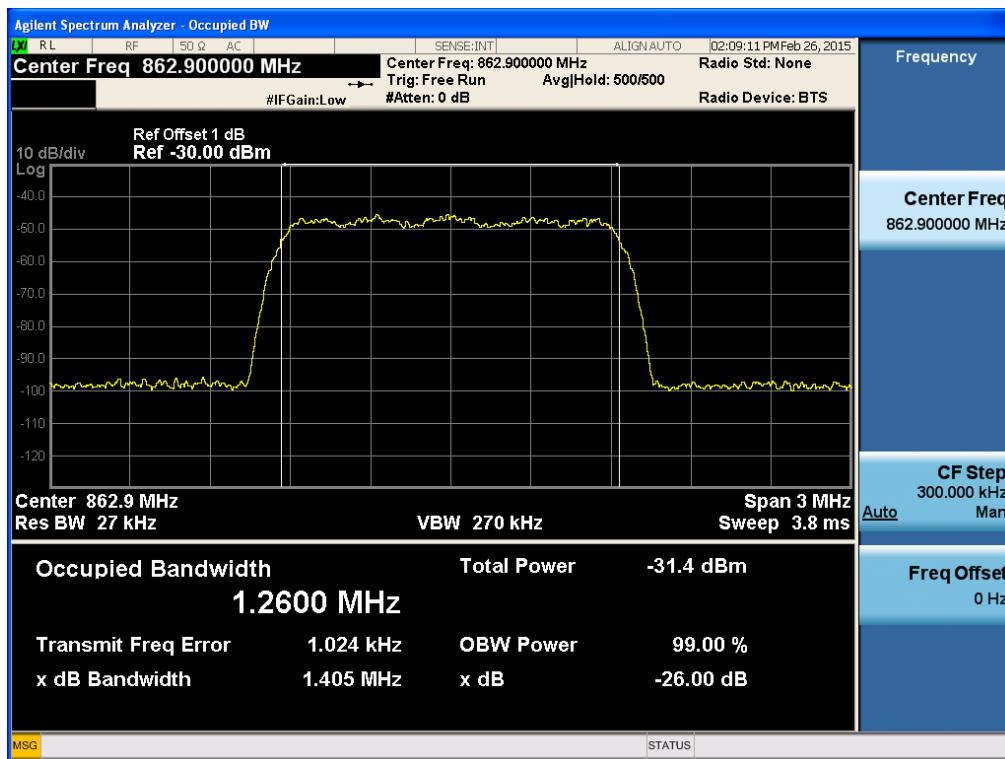
[LTE + CDMA Output Downlink]



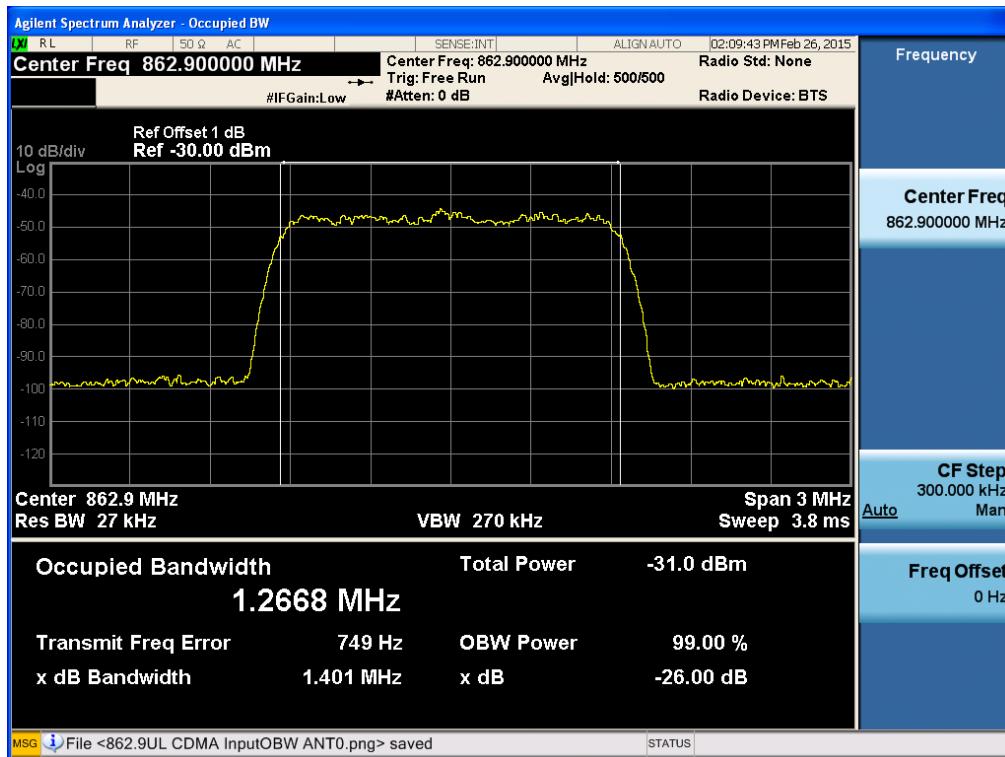
[LTE 5 MHz Output Downlink]



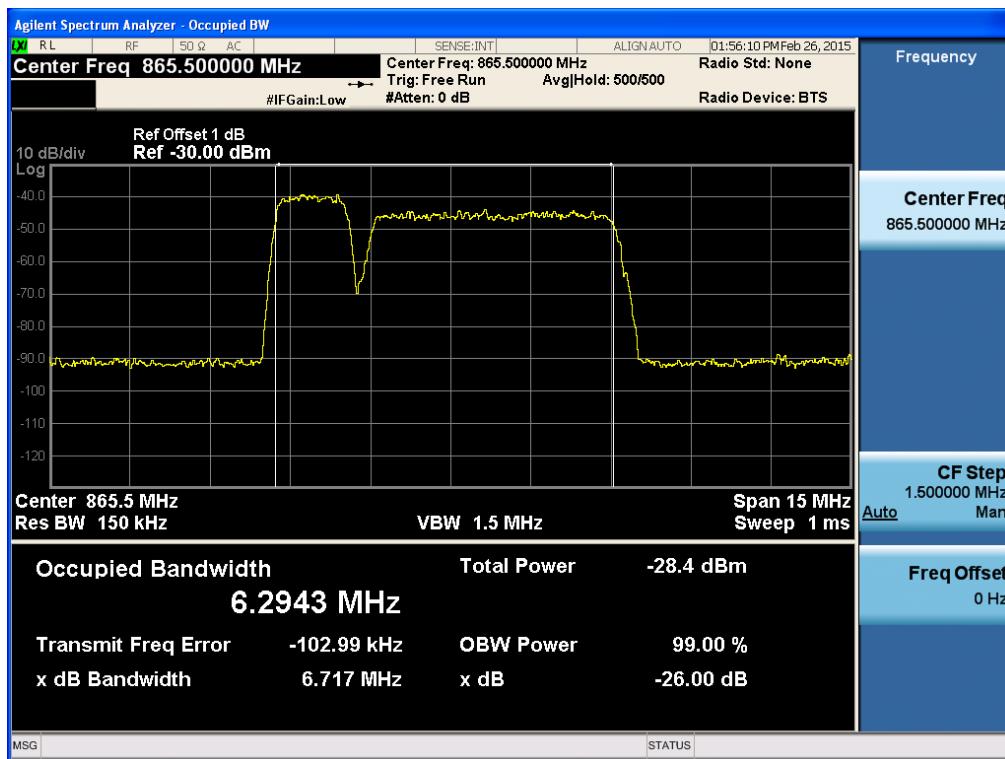
[CDMA Input Downlink]



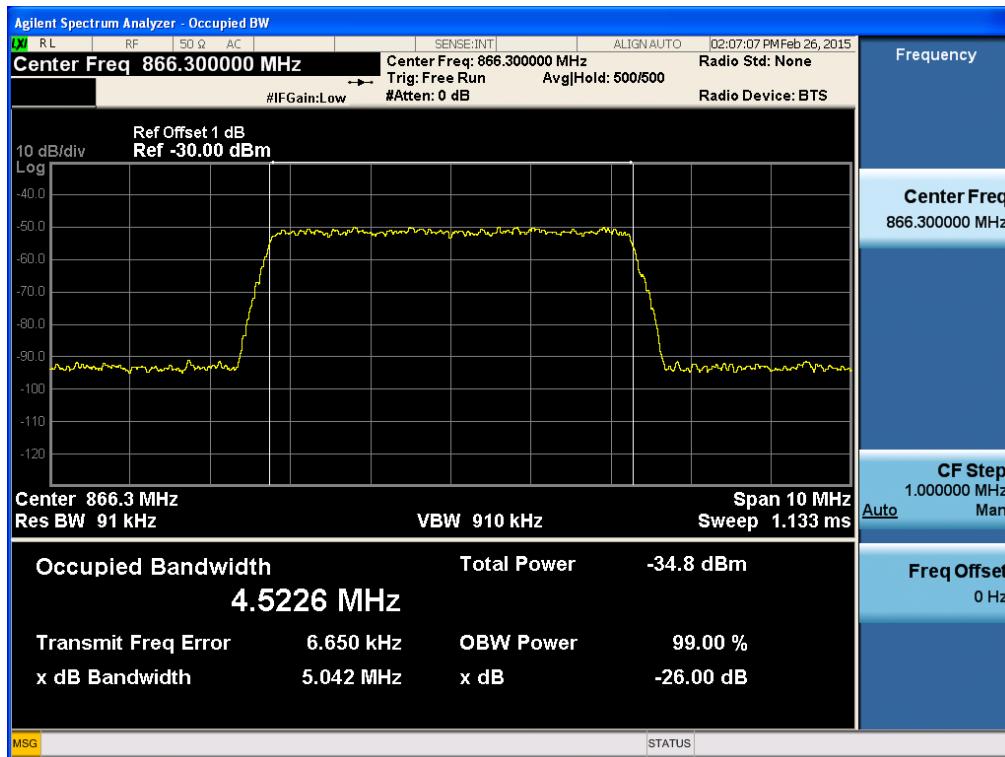
[CDMA EVDO Input Downlink]



[LTE + CDMA Input Downlink]

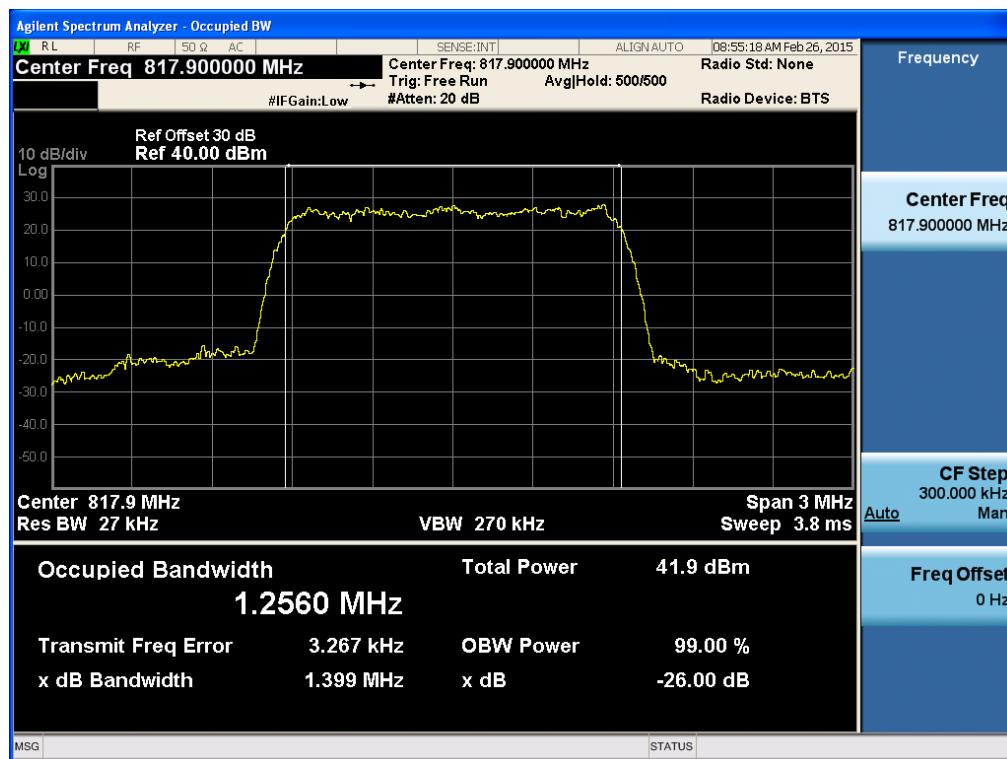


[LTE 5 MHz Input Downlink]

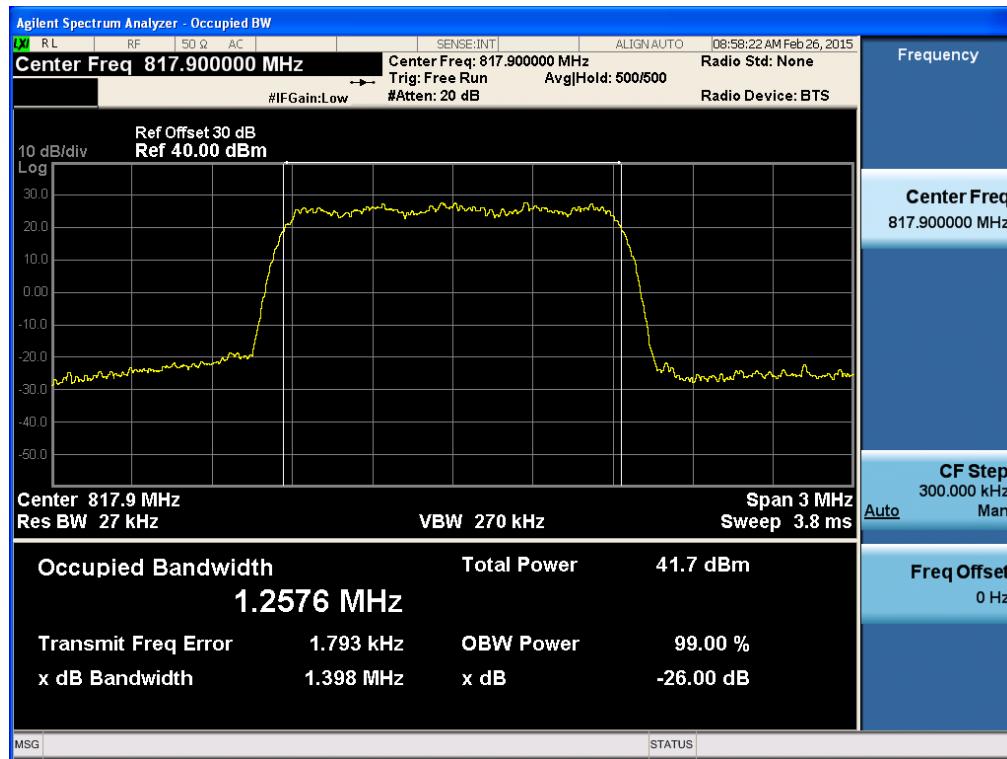


Plots of Occupied Bandwidth_Uplink

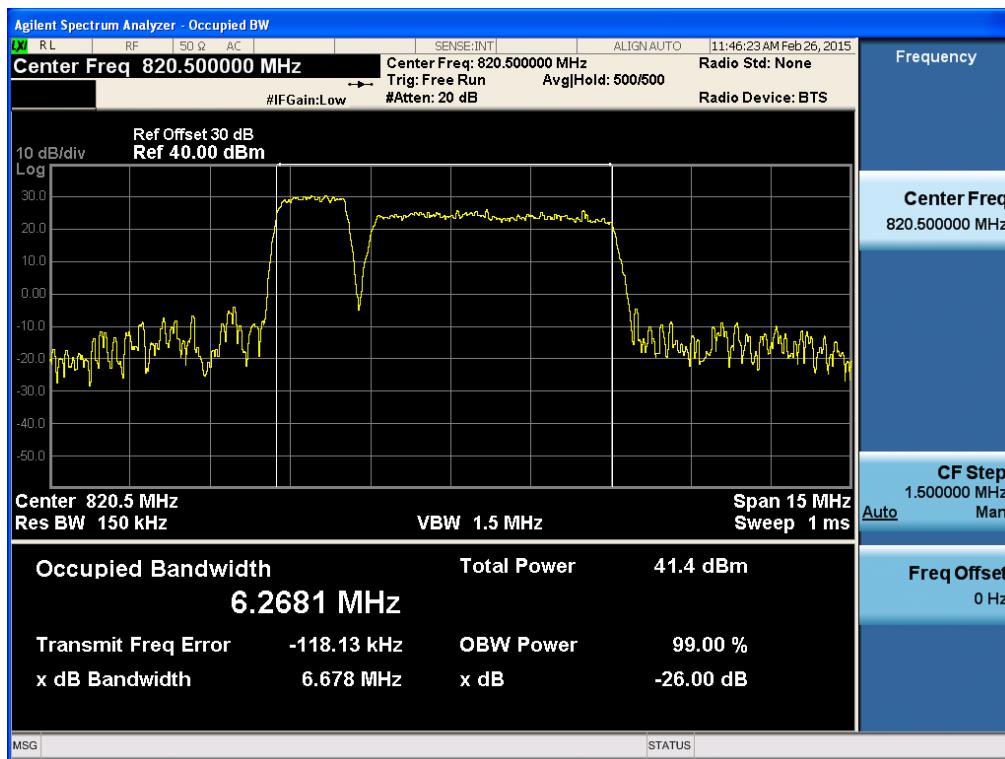
[CDMA Output Uplink]



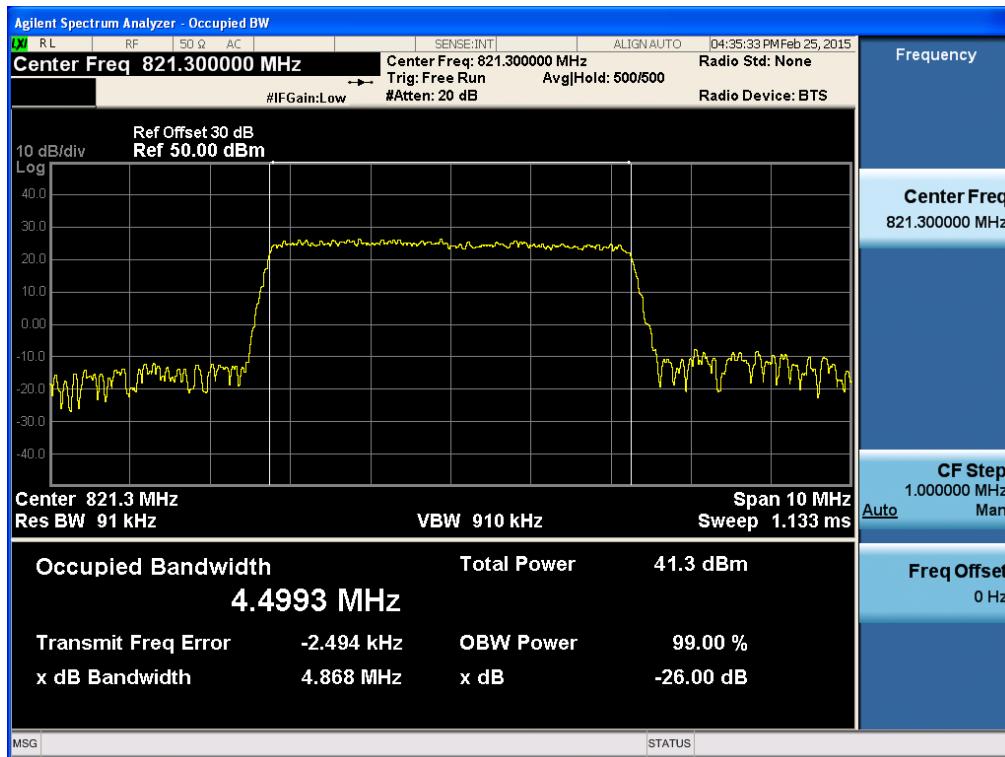
[CDMA EVDO Output Uplink]



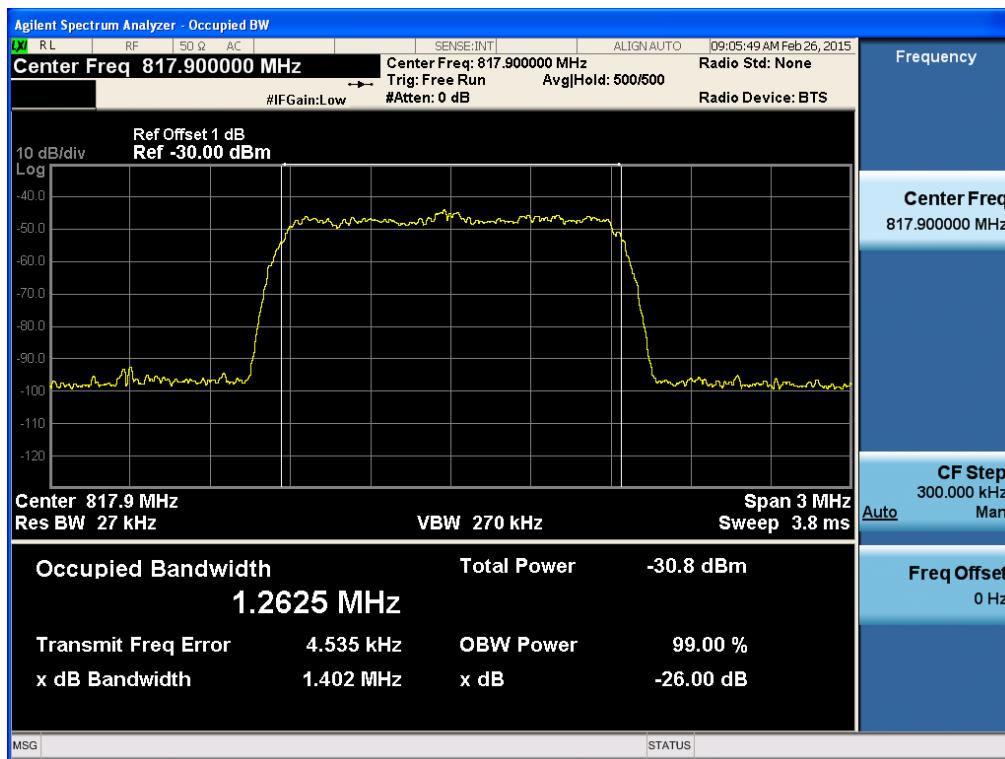
[LTE + CDMA Output Uplink]



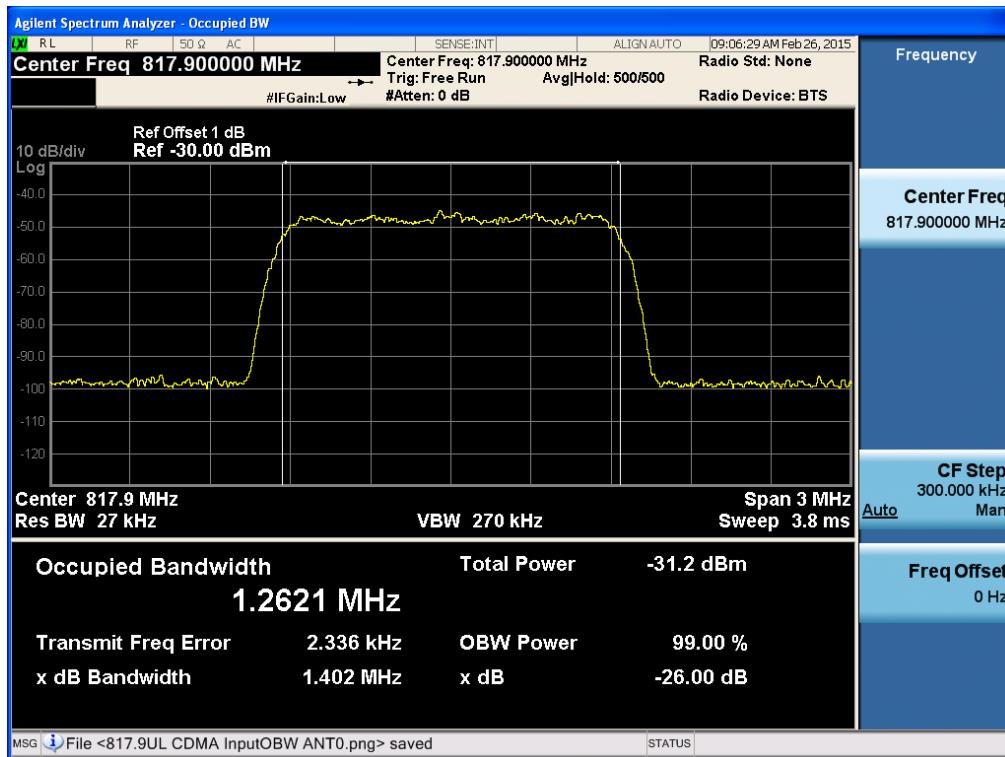
[LTE 5 MHz Output Uplink]



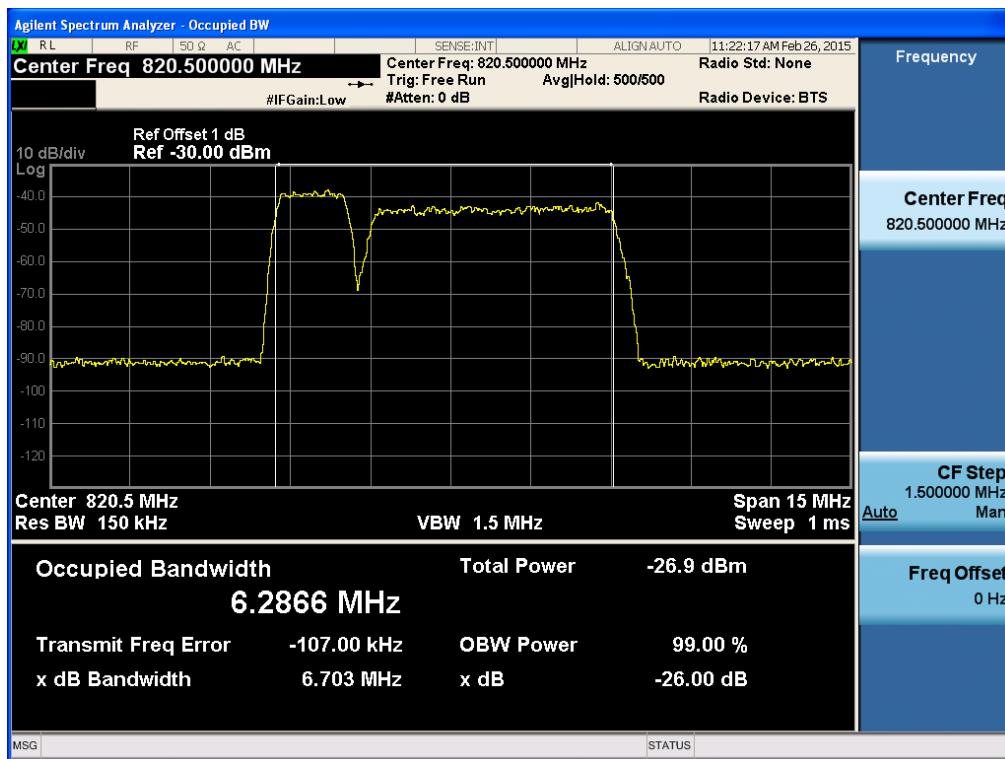
[CDMA Input Uplink]



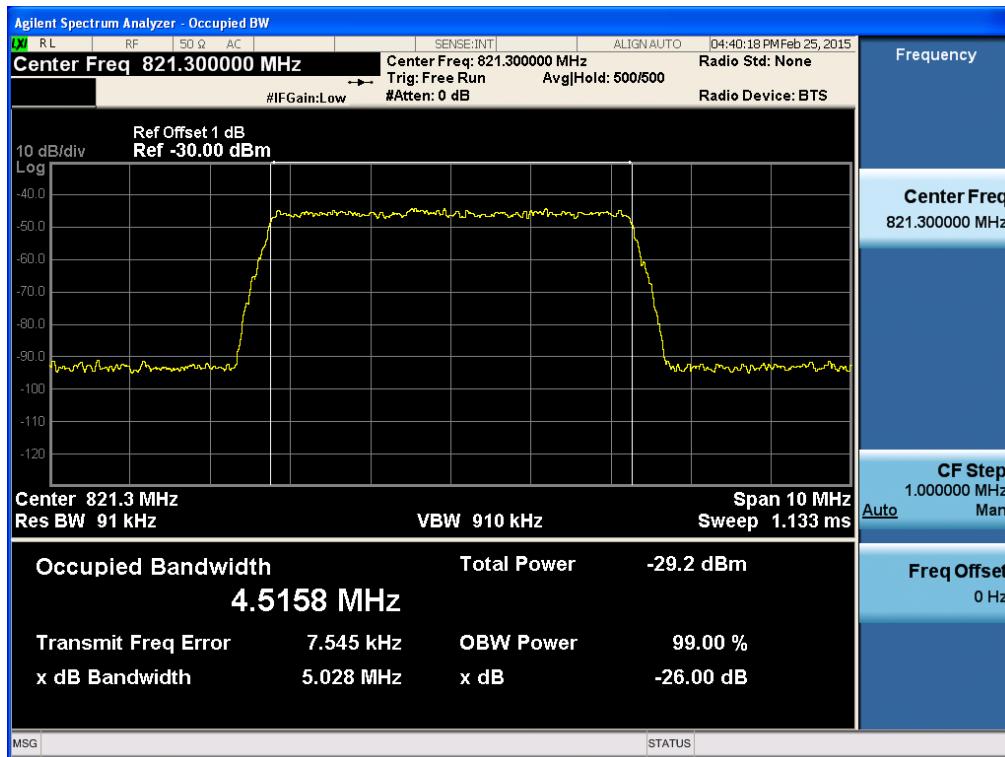
[CDMA EVDO Input Uplink]



[LTE + CDMA Input Uplink]



[LTE 5 MHz Input Uplink]



8. OUT OF BAND REJECTION

FCC Rules

Test Requirement(s): KDB 935210 D03 v02r01

Out of Band Rejection – Test for rejection of out of band signals. Filter freq. response plots are acceptable.

Test Procedures: A modulated carrier generated by the signal generator carrier was connected to either the Uplink or Downlink RF port at a maximum level as determined by the spectrum analyzer was connected to either the Uplink or Downlink port depending on the circuitry being measured. Signal generator sweep from the frequency more lower than the operating frequency to the frequency more higher than it, find the product band filter characteristic

Test Results: The EUT complies with the requirements of this section.

Input Signal	Input Level (dBm)	Maximum Amp Gain
CDMA		
CDMA EVDO		
LTE 5 MHz	DL/UL : -57 dBm	DL/UL : 90 dB
LTE + CMDA		

[Downlink]

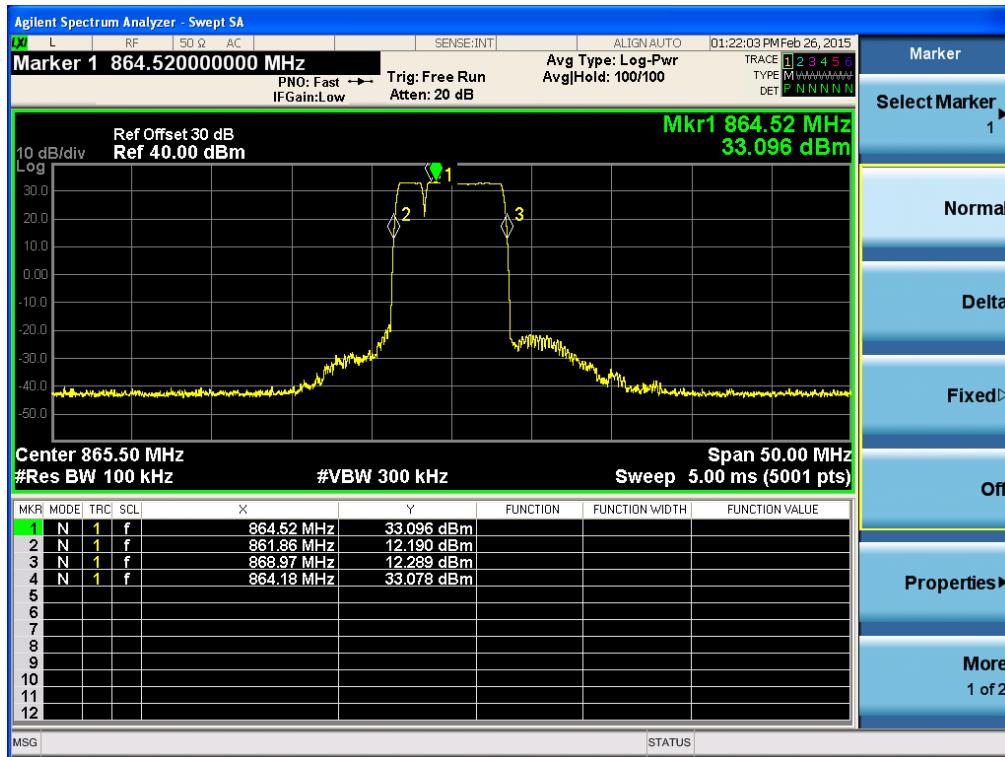
20 dB point frequency (MHz)	Output power (dBm)	Gain (dB)
861.86 ~ 868.97	33.10	90.10

[Uplink]

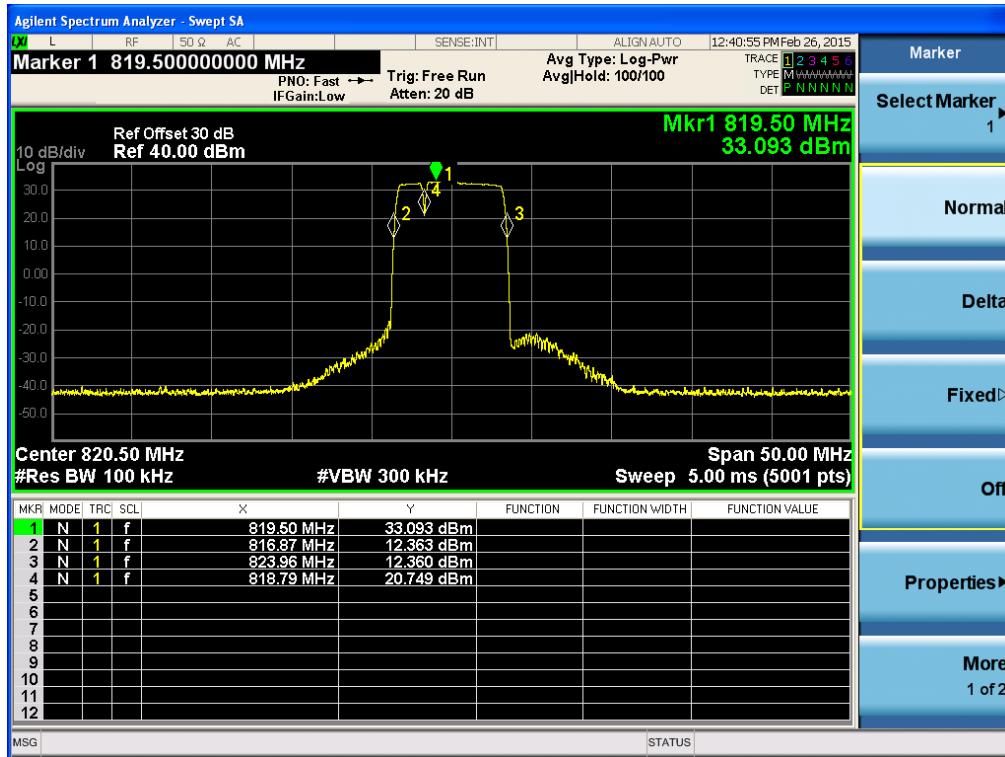
20 dB point frequency (MHz)	Output power (dBm)	Gain (dB)
816.87 ~ 823.96	33.09	90.09

Plots of Out of Band Rejection

[Downlink]



[Uplink]



9. SPURIOUS AND HARMONIC EMISSION AT ANTENNA TERMINAL

FCC Rules

Test Requirement(s):

§ 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.

§ 90.691 Emission mask requirements for EA-based systems.

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

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

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

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

* Note

Test (a)-(1) was replaced by a band edge test.

Test Procedures:

The RF output of the transceiver was connected to a spectrum analyzer through appropriate attenuation.

The resolution bandwidth of the spectrum analyzer was set at 1MHz. Sufficient scans were taken to show any out of band emissions up to 10th harmonic

Test Results:

Input Signal	Input Level (dBm)	Maximum Amp Gain
CDMA		
CDMA EVDO		
LTE 5 MHz	DL/UL : -57 dBm	DL/UL : 90 dB
LTE + CDMA		

[Downlink]

9 kHz ~ 150 kHz

	Frequency (MHz)	Spurious emission (dBm)	Limit (dBm)
CDMA	862.90	-30.98	-13.00
CDMA EVDO	862.90	-29.49	-13.00
LTE + CDMA	865.50	-30.16	-13.00
LTE 5 MHz	866.30	-29.01	-13.00

150 kHz ~ 30 MHz

	Frequency (MHz)	Spurious emission (dBm)	Limit (dBm)
CDMA	862.90	-34.75	-13.00
CDMA EVDO	862.90	-35.11	-13.00
LTE + CDMA	865.50	-33.44	-13.00
LTE 5 MHz	866.30	-33.04	-13.00

30 MHz ~ 1 GHz

	Frequency (MHz)	Spurious emission (dBm)	Limit (dBm)
CDMA	862.90	-40.32	-13.00
CDMA EVDO	862.90	-40.41	-13.00
LTE + CDMA	865.50	-41.38	-13.00
LTE 5 MHz	866.30	-40.29	-13.00

1 GHz ~ 12.75 GHz

	Frequency (MHz)	Spurious emission (dBm)	Limit (dBm)
CDMA	862.90	-34.97	-13.00
CDMA EVDO	862.90	-35.10	-13.00
LTE + CDMA	865.50	-35.13	-13.00
LTE 5 MHz	866.30	-35.11	-13.00

Band edge

	Frequency (MHz)	Band edge (dBm)	Limit (dBm)
CDMA	862.90	-34.14	-20.00
CDMA EVDO	862.90	-38.15	-20.00
LTE + CDMA	865.50	-34.35	-20.00
LTE 5 MHz	866.30	-35.46	-20.00

[Uplink]

9 kHz ~ 150 kHz

	Frequency (MHz)	Spurious emission (dBm)	Limit (dBm)
CDMA	817.90	-28.58	-13.00
CDMA EVDO	817.90	-28.40	-13.00
LTE + CDMA	820.50	-29.82	-13.00
LTE 5 MHz	821.30	-28.70	-13.00

150 kHz ~ 30 MHz

	Frequency (MHz)	Spurious emission (dBm)	Limit (dBm)
CDMA	817.90	-35.25	-13.00
CDMA EVDO	817.90	-36.13	-13.00
LTE + CDMA	820.50	-35.52	-13.00
LTE 5 MHz	821.30	-30.99	-13.00

30 MHz ~ 1 GHz

	Frequency (MHz)	Spurious emission (dBm)	Limit (dBm)
CDMA	817.90	-40.40	-13.00
CDMA EVDO	817.90	-42.33	-13.00
LTE + CDMA	820.50	-40.12	-13.00
LTE 5 MHz	821.30	-41.42	-13.00

1 GHz ~ 12.75 GHz

	Frequency (MHz)	Spurious emission (dBm)	Limit (dBm)
CDMA	817.90	-34.83	-13.00
CDMA EVDO	817.90	-35.49	-13.00
LTE + CDMA	820.50	-35.17	-13.00
LTE 5 MHz	821.30	-35.02	-13.00

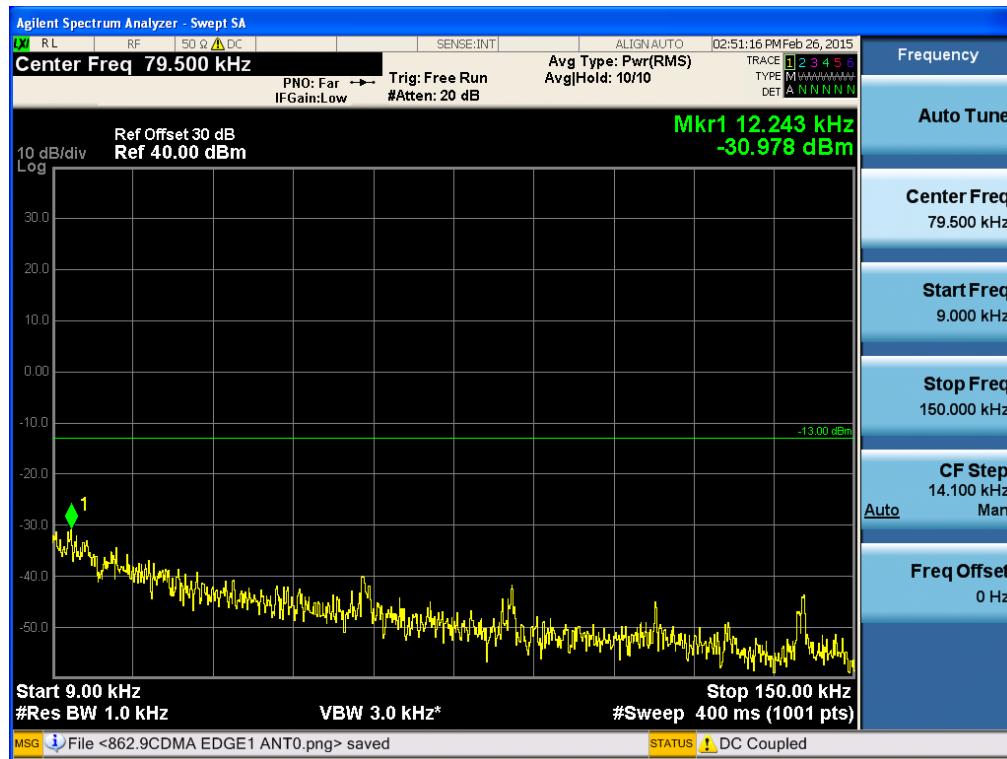
Band edge

	Frequency (MHz)	Band edge (dBm)	Limit (dBm)
CDMA	817.90	-30.64	-20.00
CDMA EVDO	817.90	-32.20	-20.00
LTE + CDMA	820.50	-32.56	-20.00
LTE 5 MHz	821.30	-31.82	-20.00

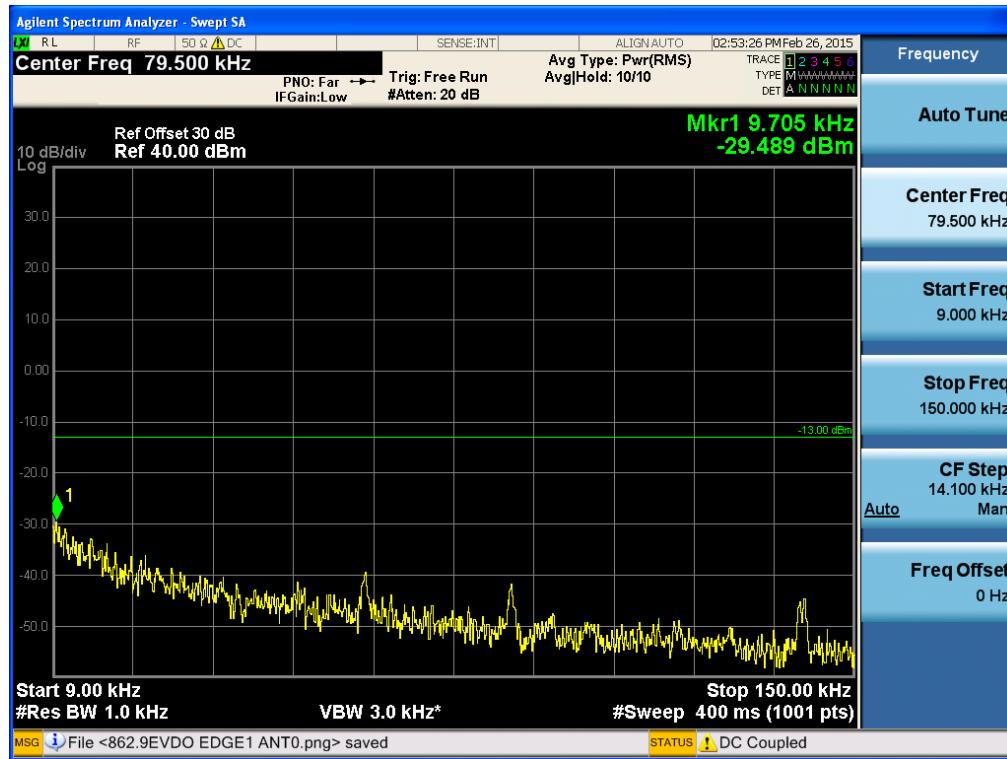
Plots of Spurious Emission_Downlink

Conducted Spurious Emissions (9 kHz – 150 kHz)

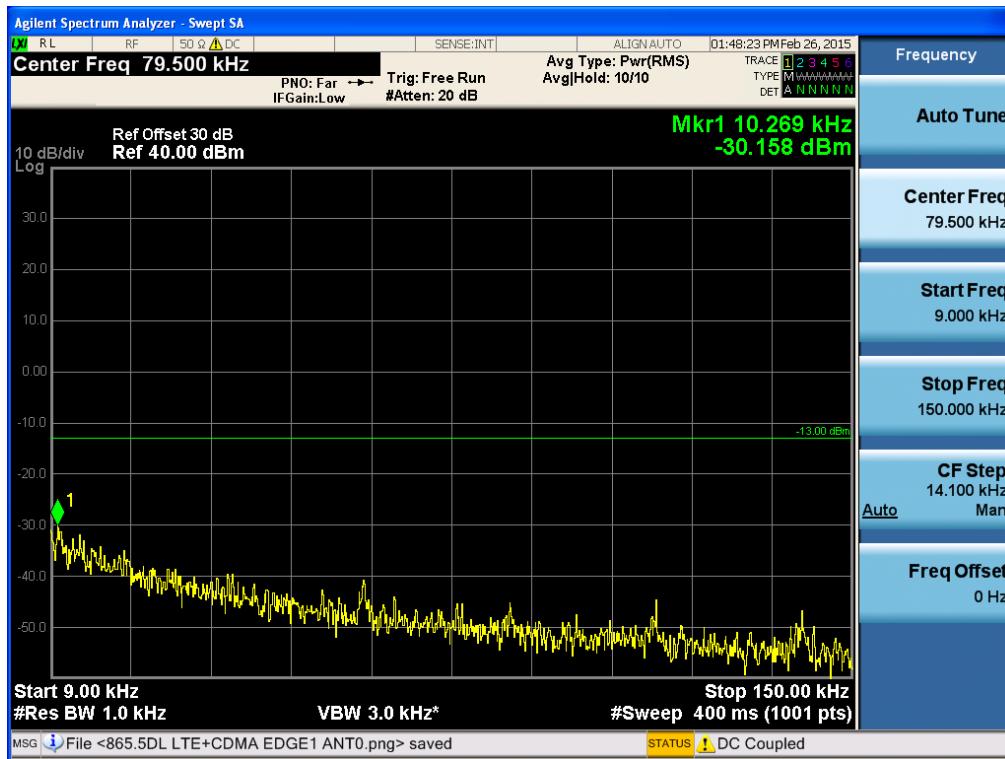
[CDMA Downlink]



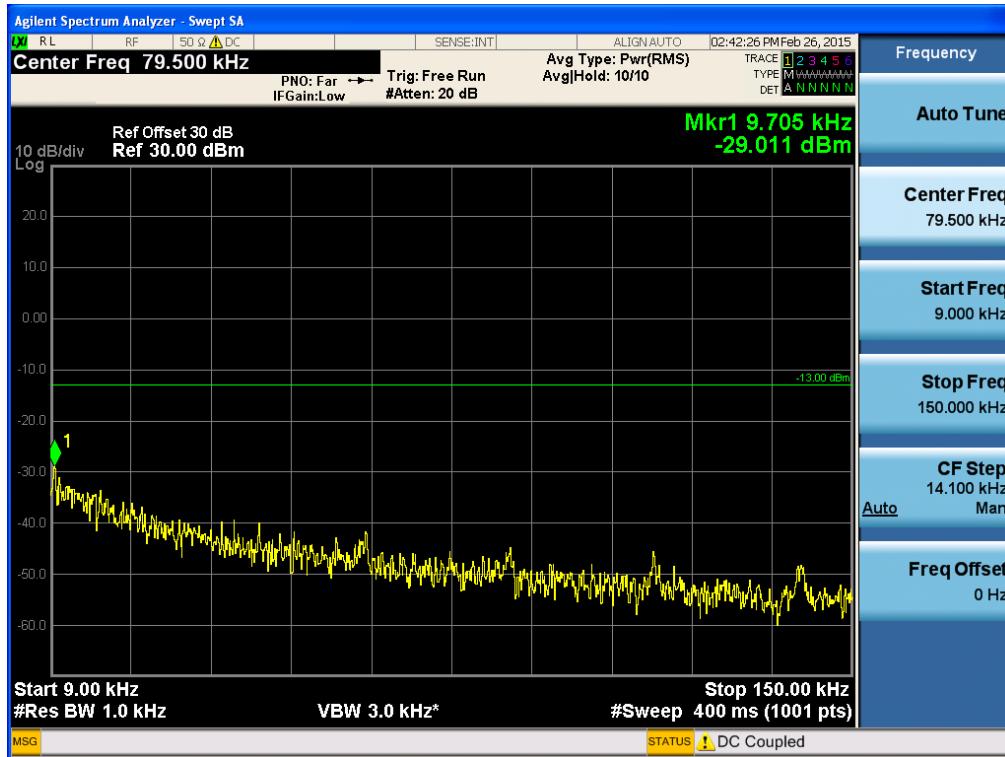
[CDMA EVDO Downlink]



[LTE + CDMA Downlink]



[LTE 5 MHz Downlink]

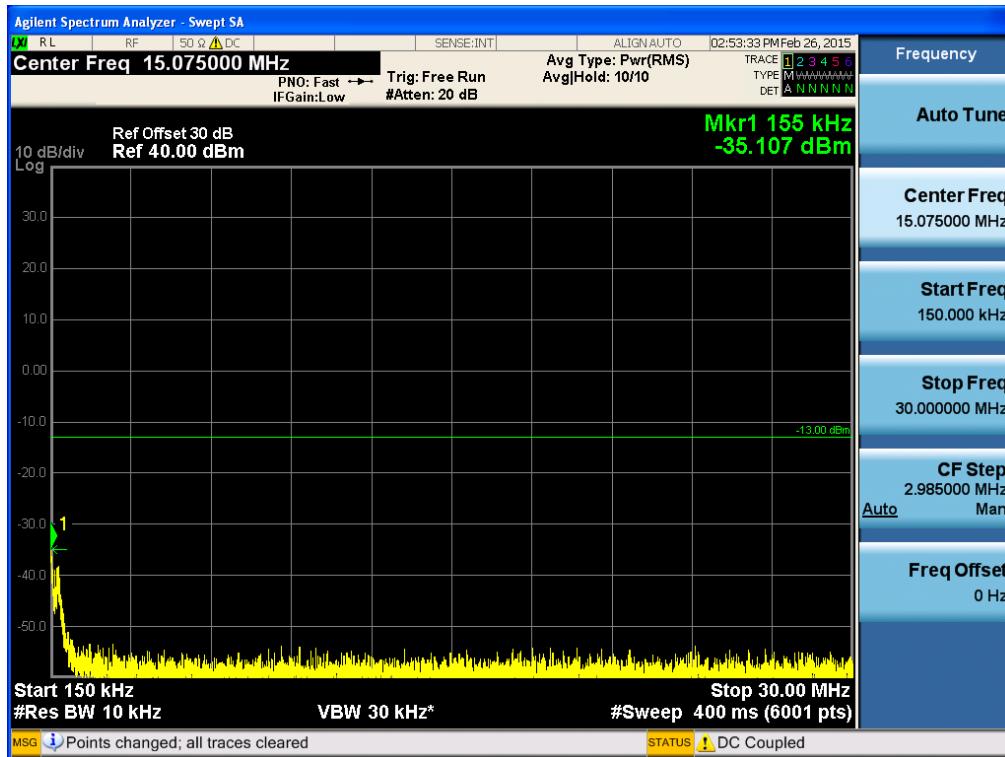


Conducted Spurious Emissions (150 kHz – 30 MHz)

[CDMA Downlink]



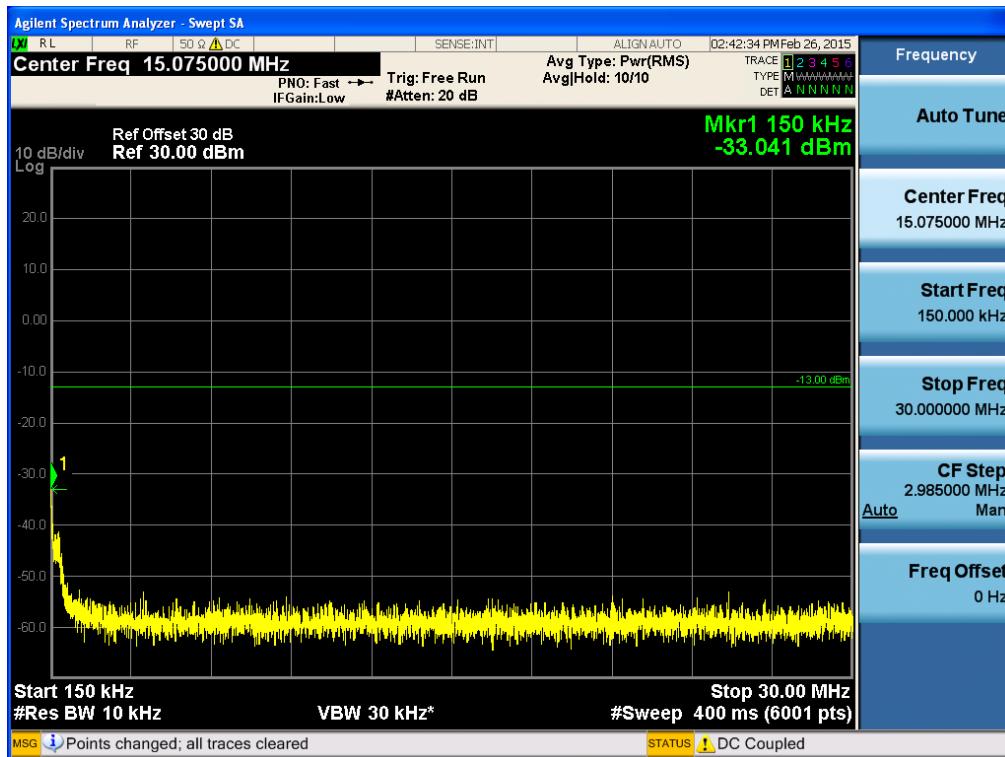
[CDMA EVDO Downlink]



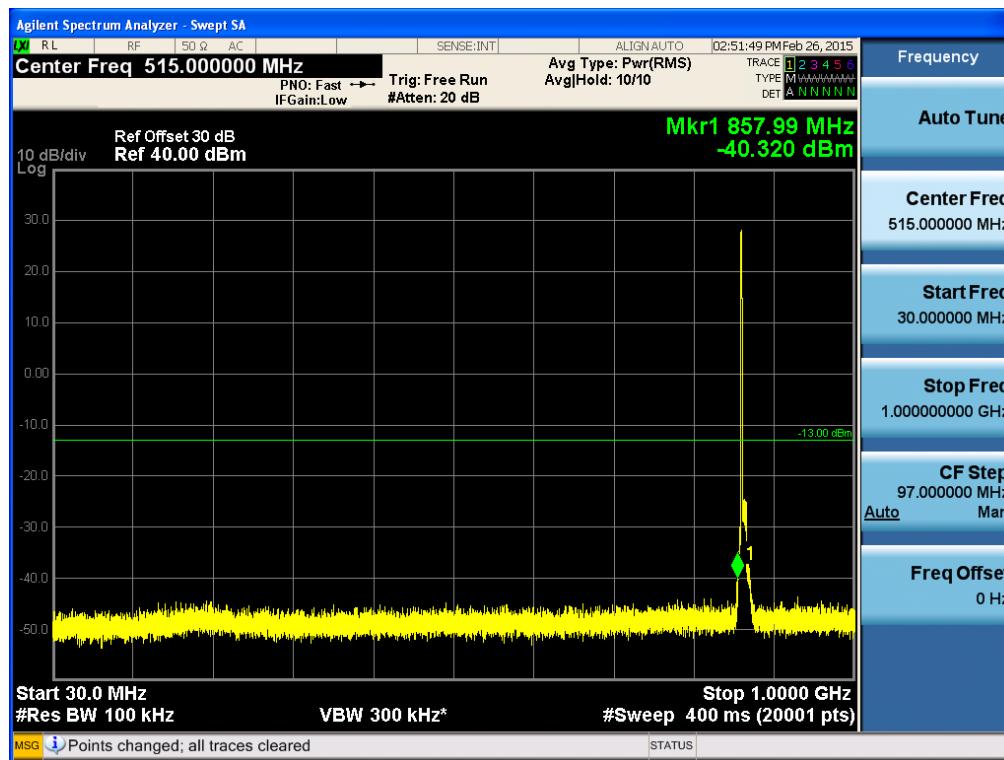
[LTE + CDMA Downlink]



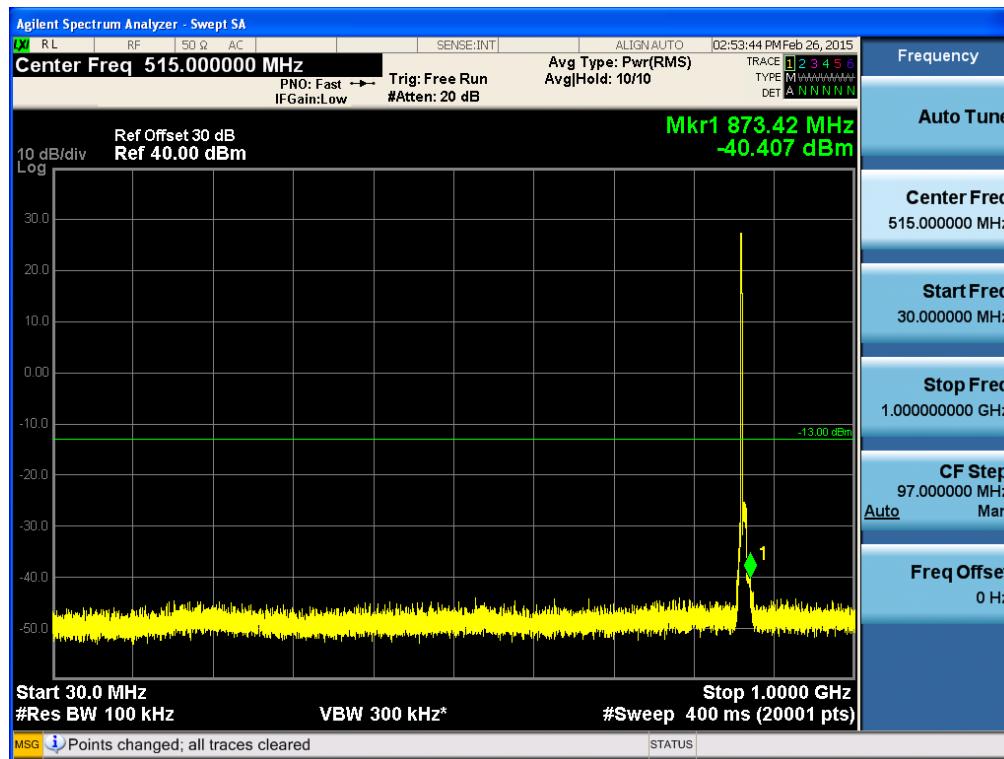
[LTE 5 MHz Downlink]



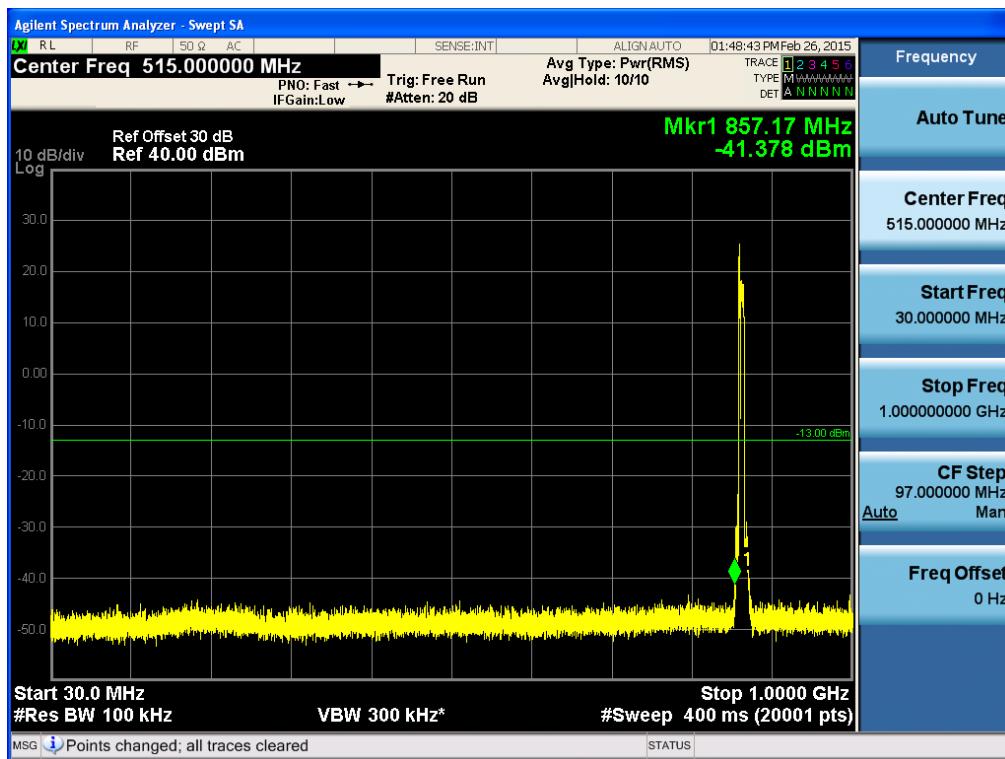
Conducted Spurious Emissions (30 MHz – 1 GHz)
[CDMA Downlink]



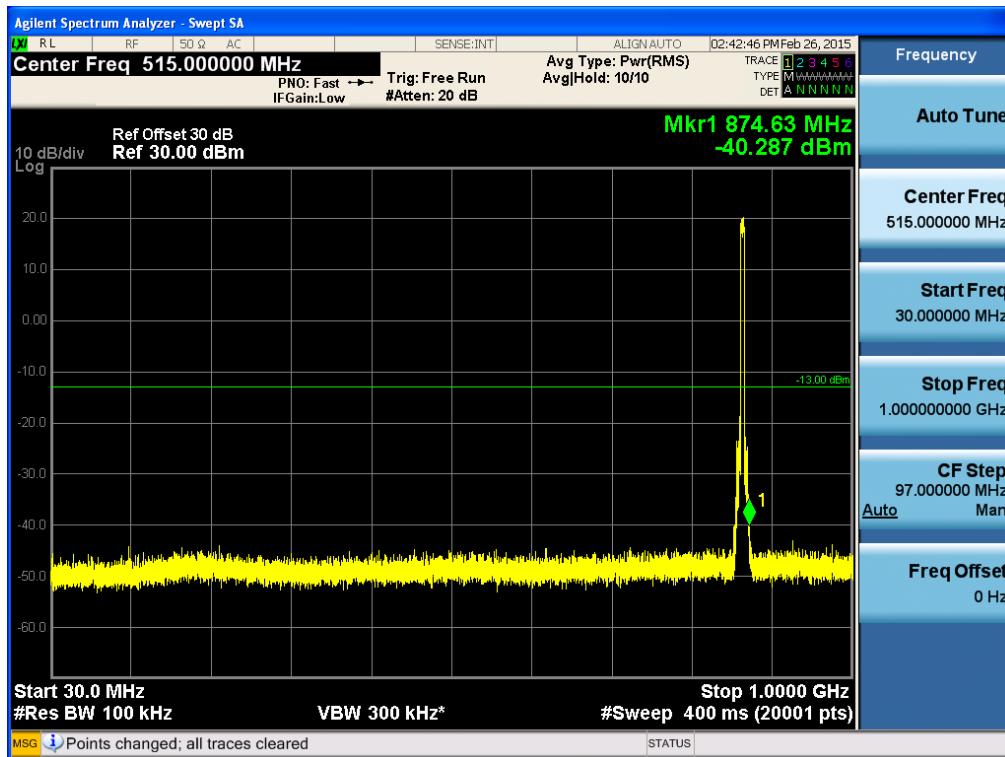
[CDMA EVDO Downlink]



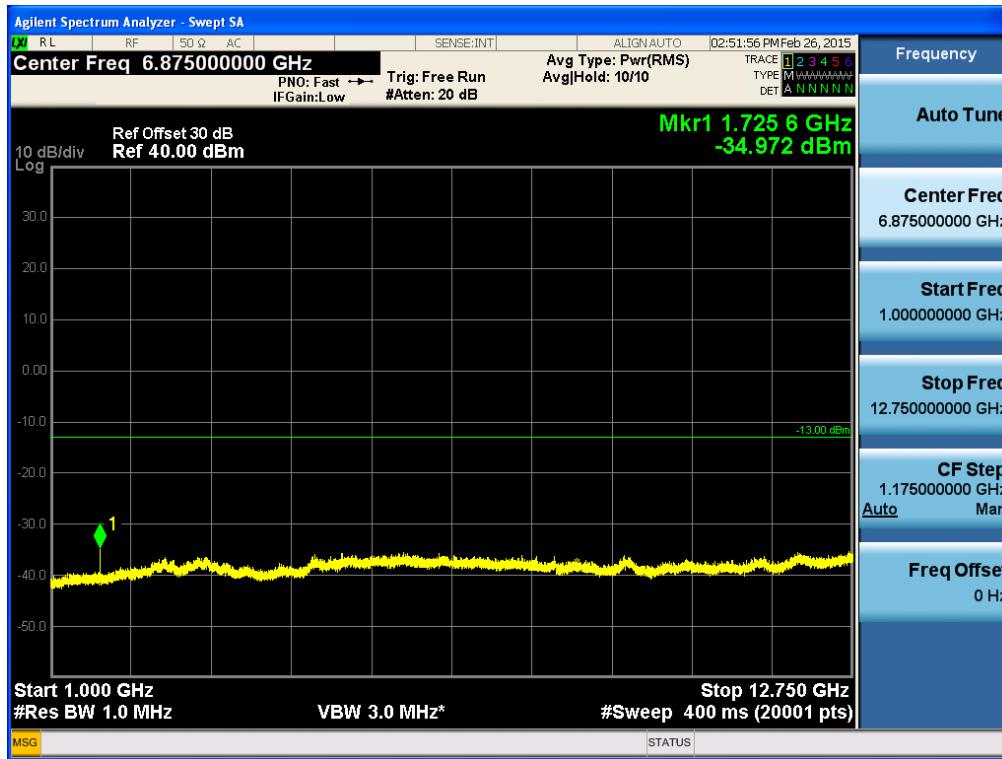
[LTE + CDMA Downlink]



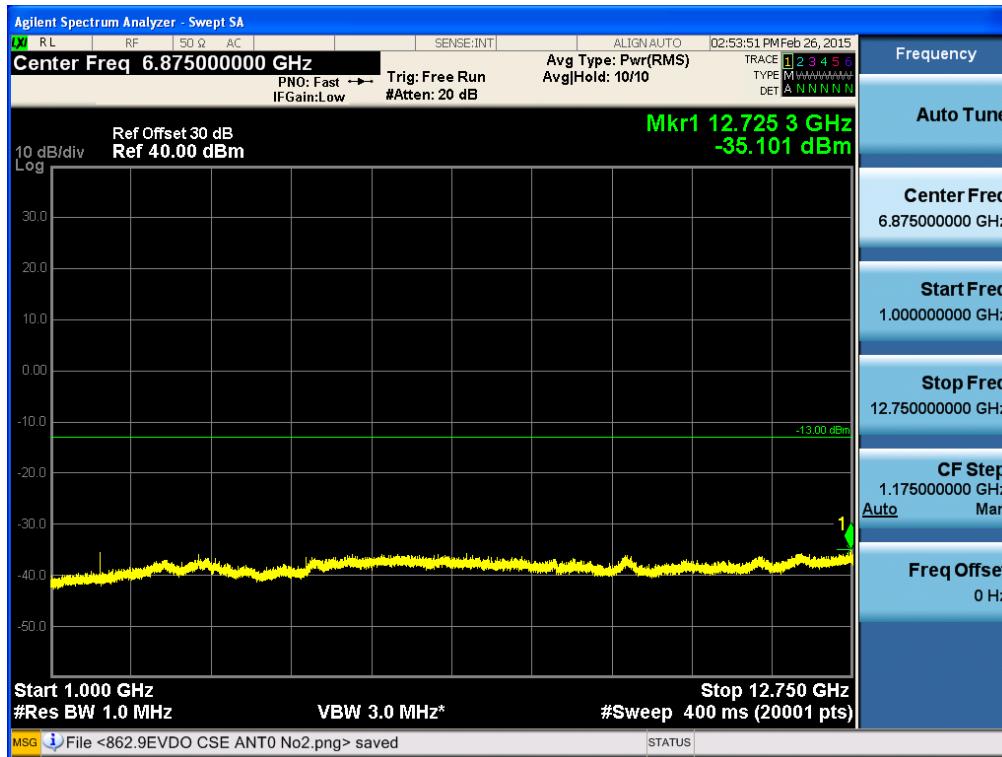
[LTE 5 MHz Downlink]



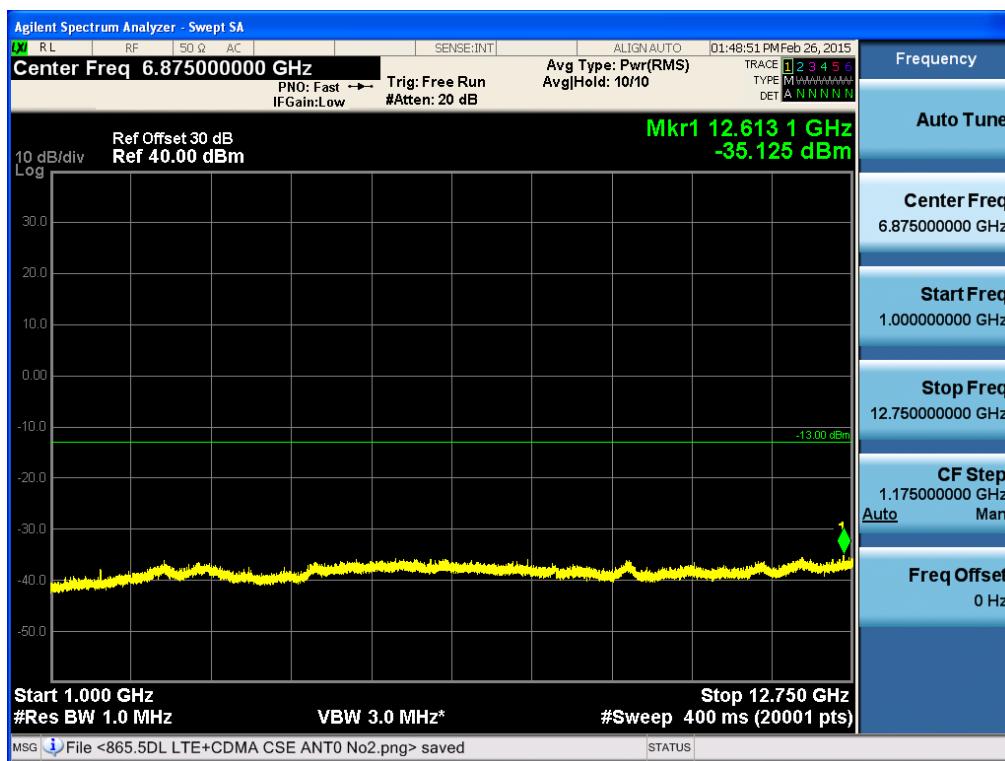
Conducted Spurious Emissions (1 GHz –12.75 GHz)
[CDMA Downlink]



[CDMA EVDO Downlink]



[LTE + CDMA Downlink]

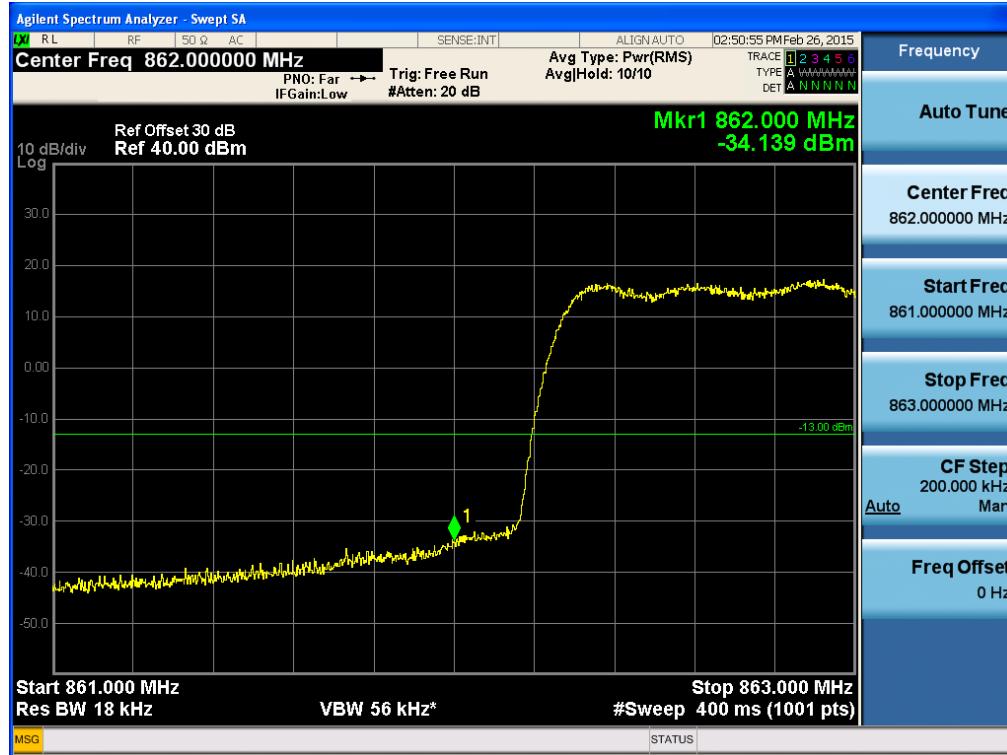


[LTE 5 MHz Downlink]



Band Edge_Downlink

[CDMA Downlink Low]



[CDMA Downlink High]



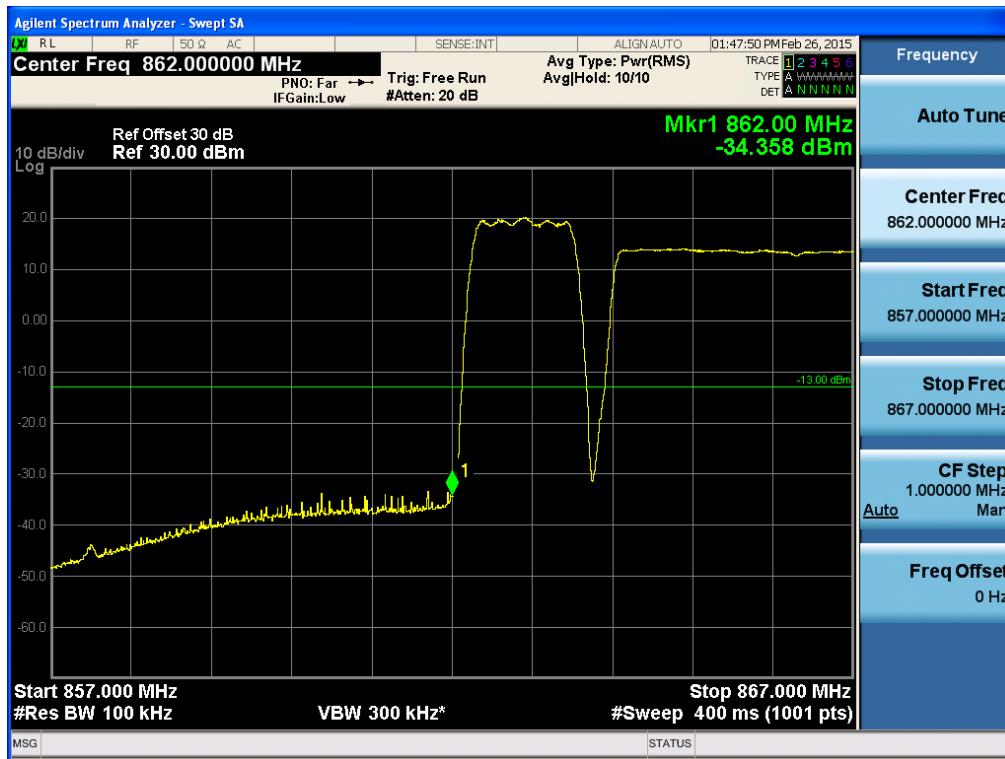
[CDMA EVDO Downlink Low]



[CDMA EVDO Downlink High]



[LTE + CDMA Downlink Low]



[LTE + CDMA Downlink High]



[LTE 5 MHz Downlink Low]



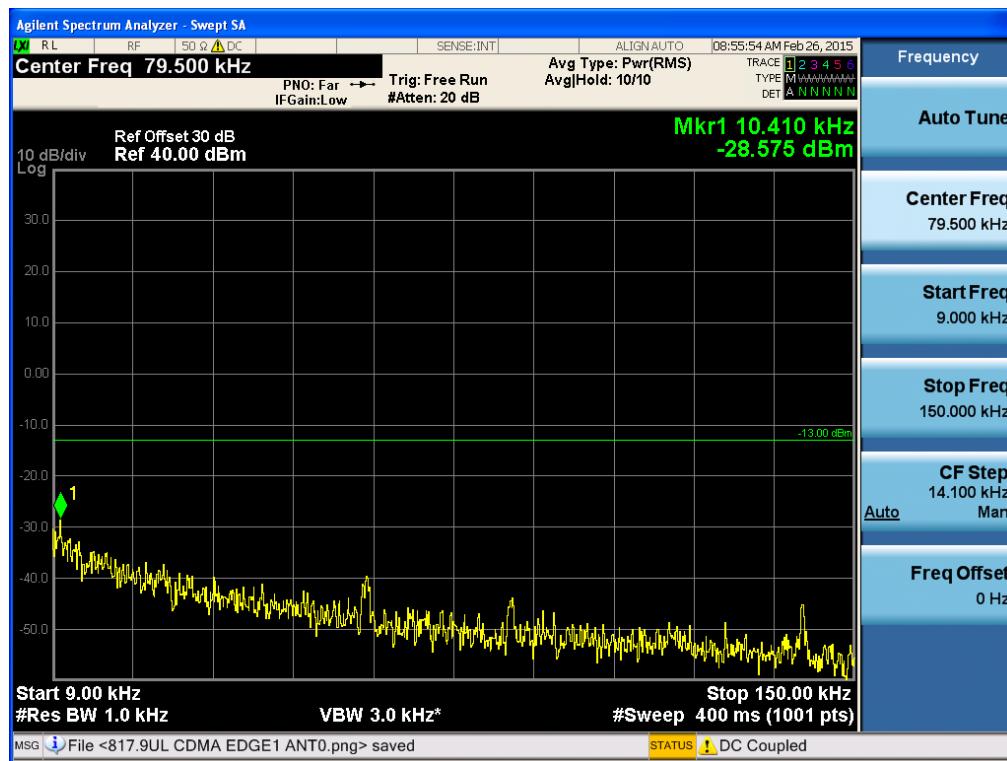
[LTE 5 MHz Downlink High]



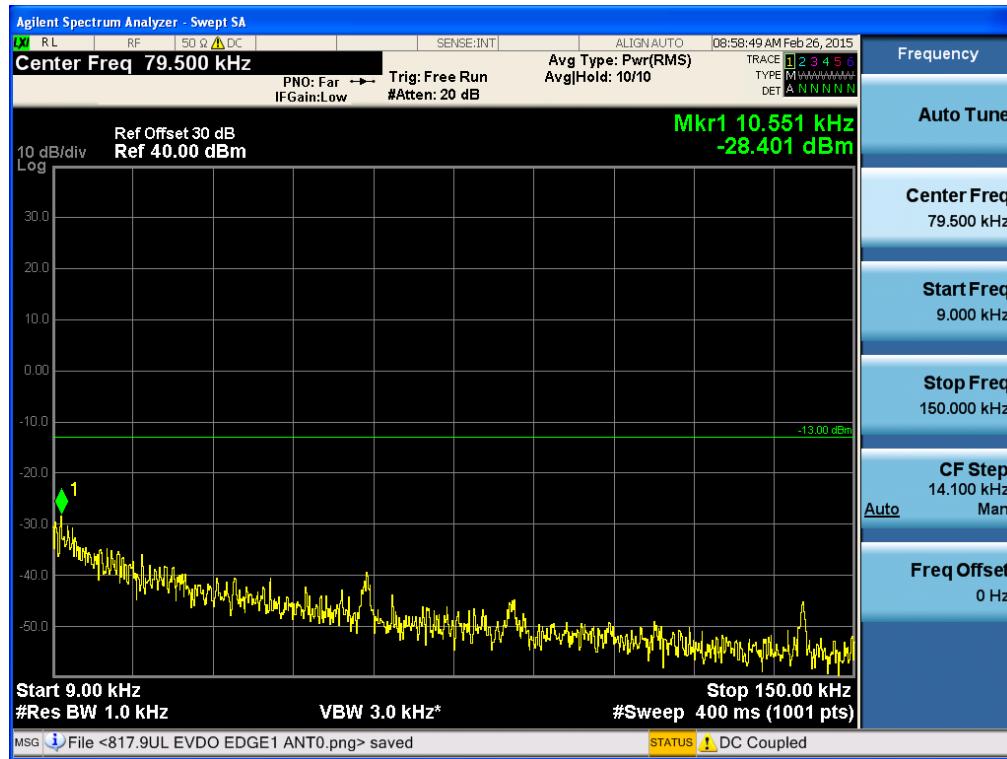
Plots of Spurious Emission_Uplink

Conducted Spurious Emissions (9 kHz – 150 kHz)

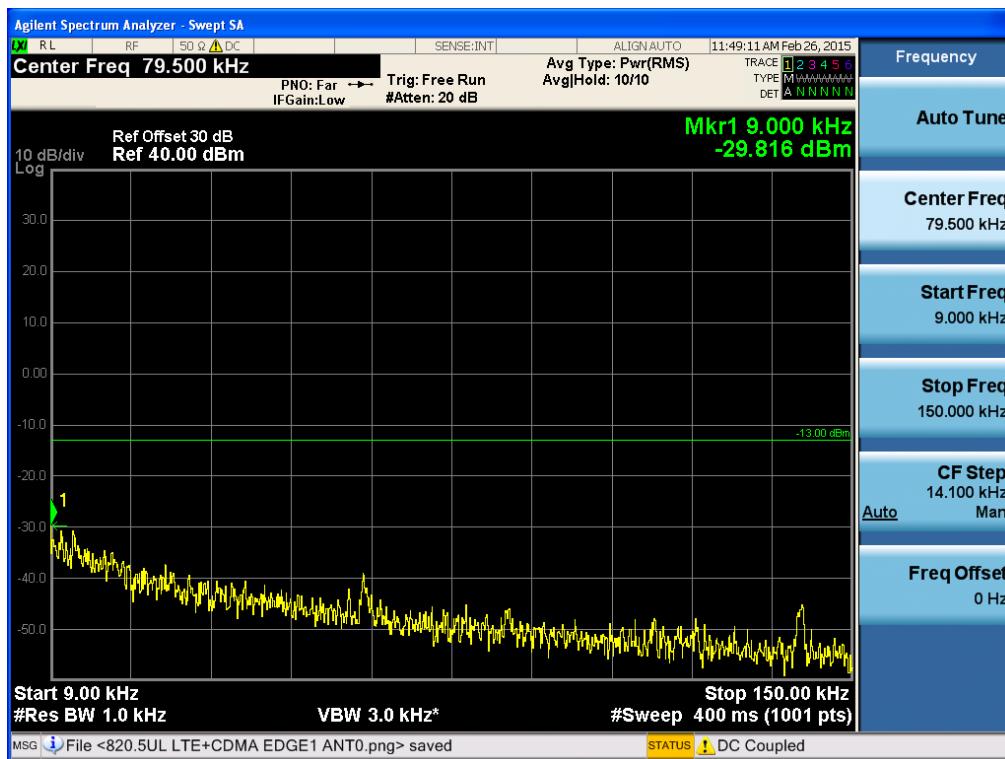
[CDMA Uplink]



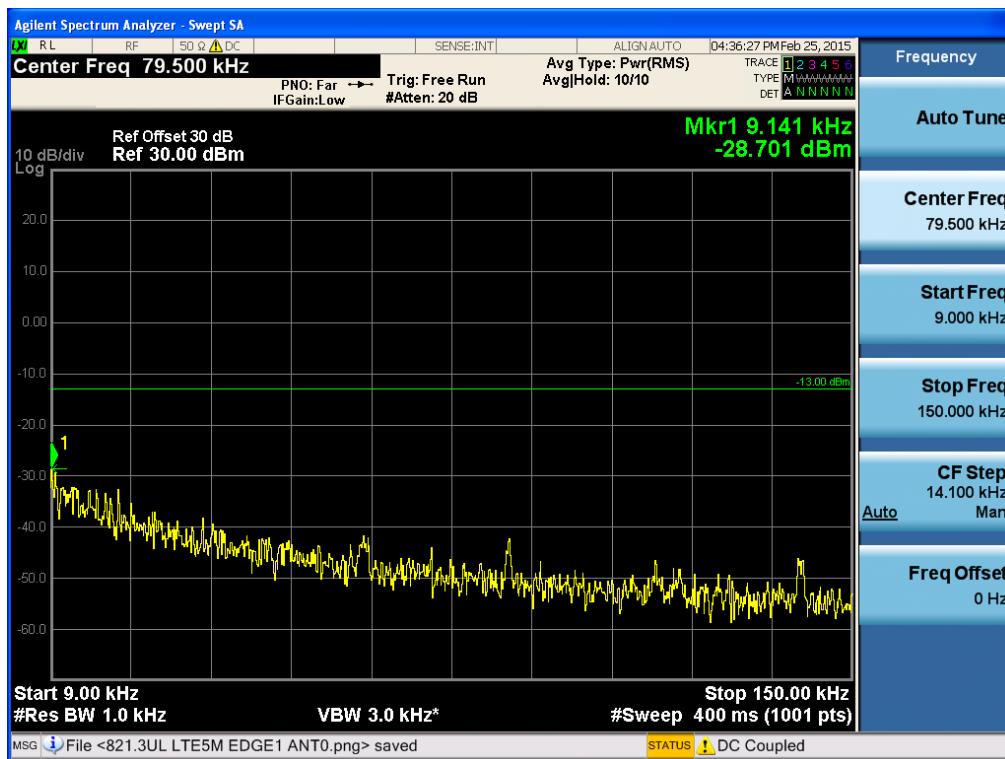
[CDMA EVDO Uplink]



[LTE + CDMA Uplink]



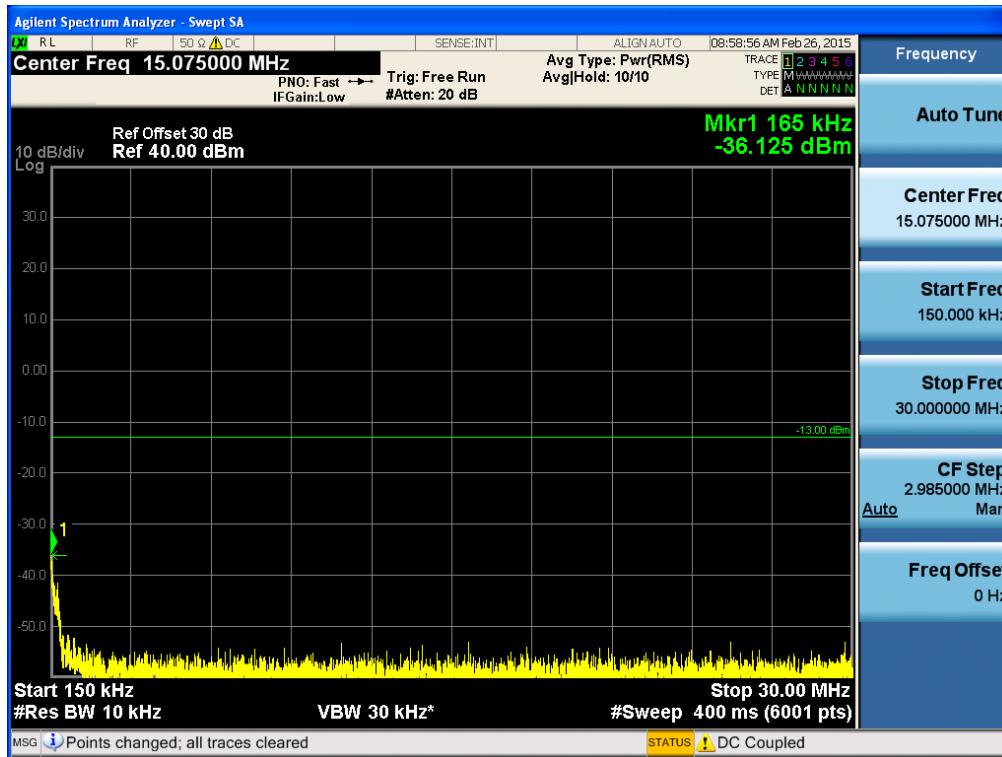
[LTE 5 MHz Uplink]



**Conducted Spurious Emissions (150 kHz – 30 MHz)
[CDMA Uplink]**



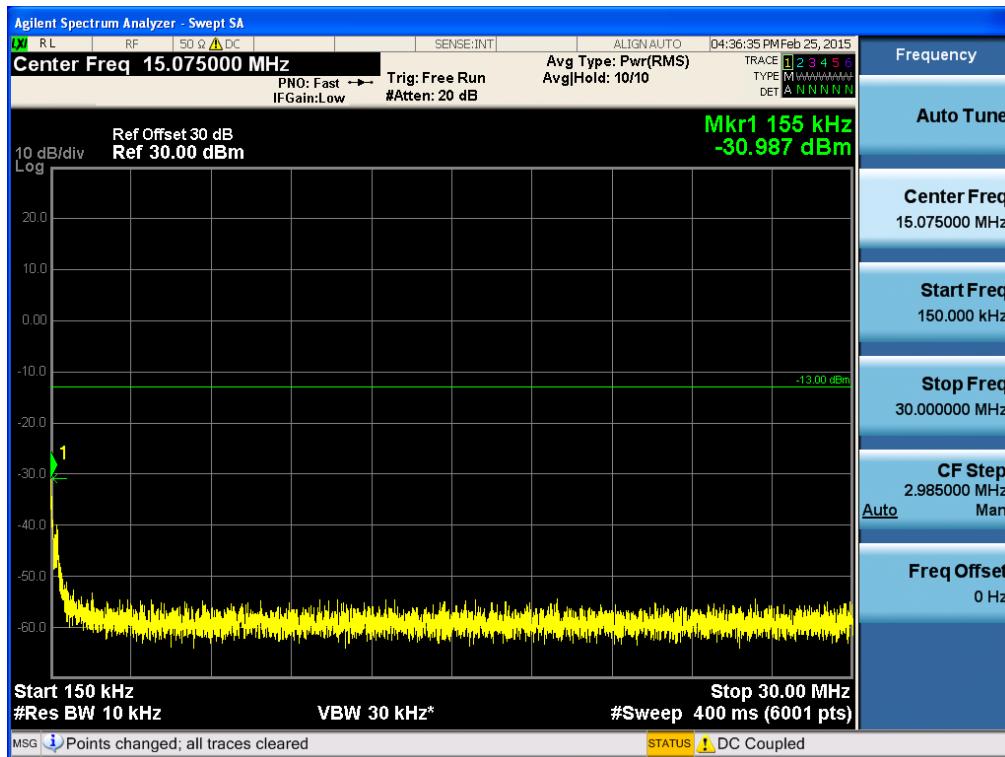
[CDMA EVDO Uplink]



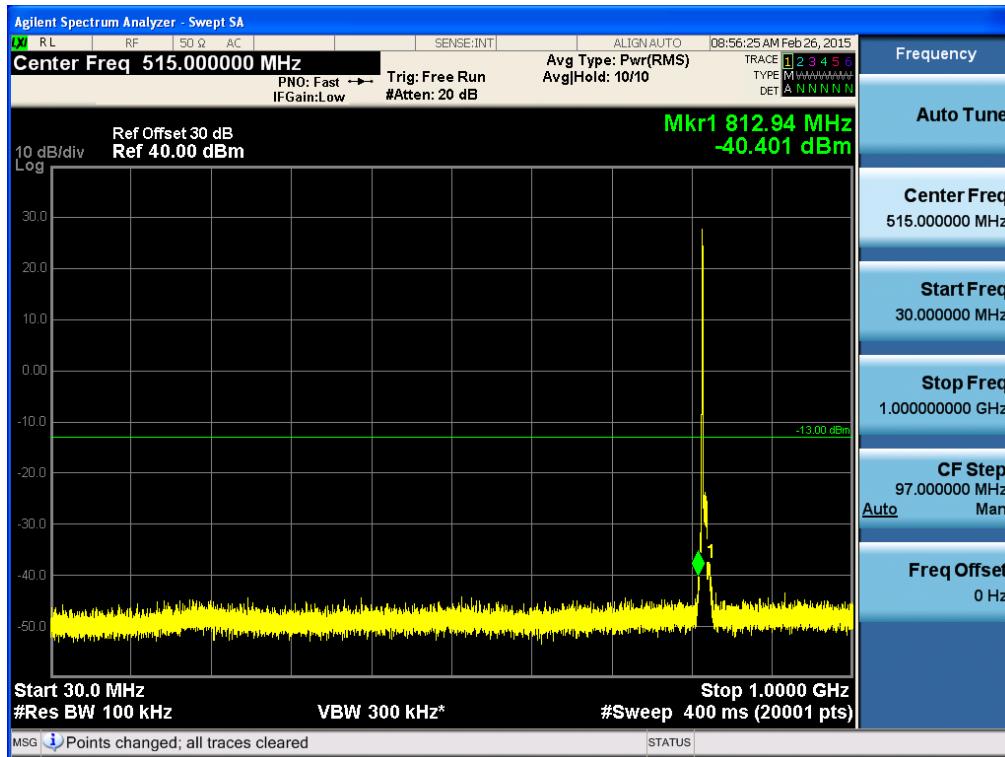
[LTE + CDMA Uplink]



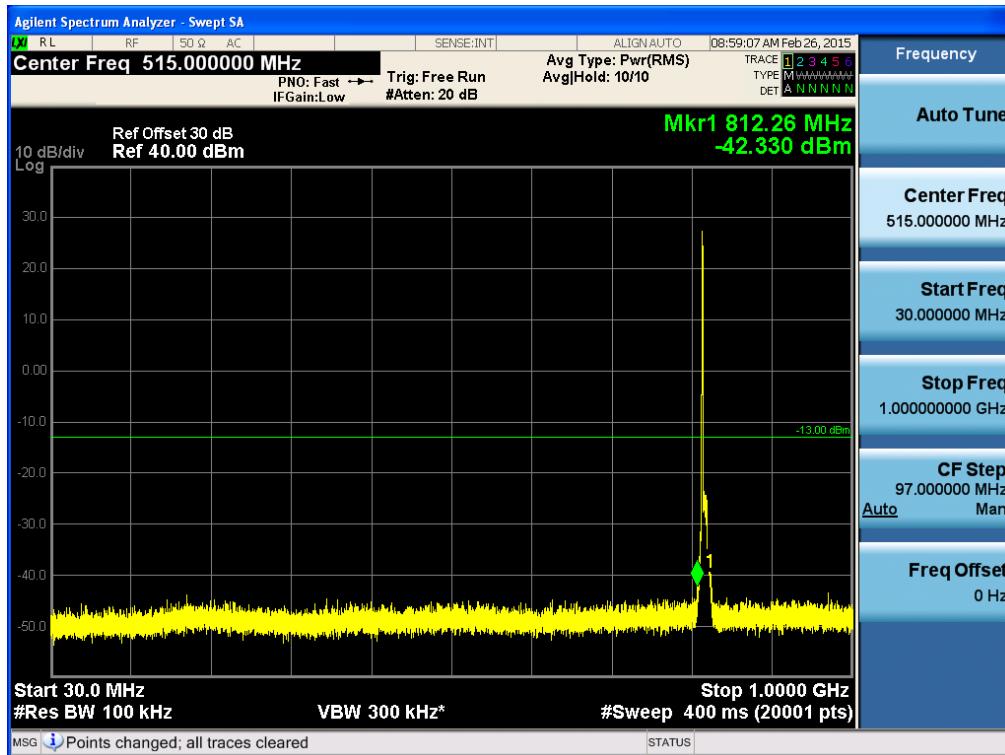
[LTE 5 MHz Uplink]



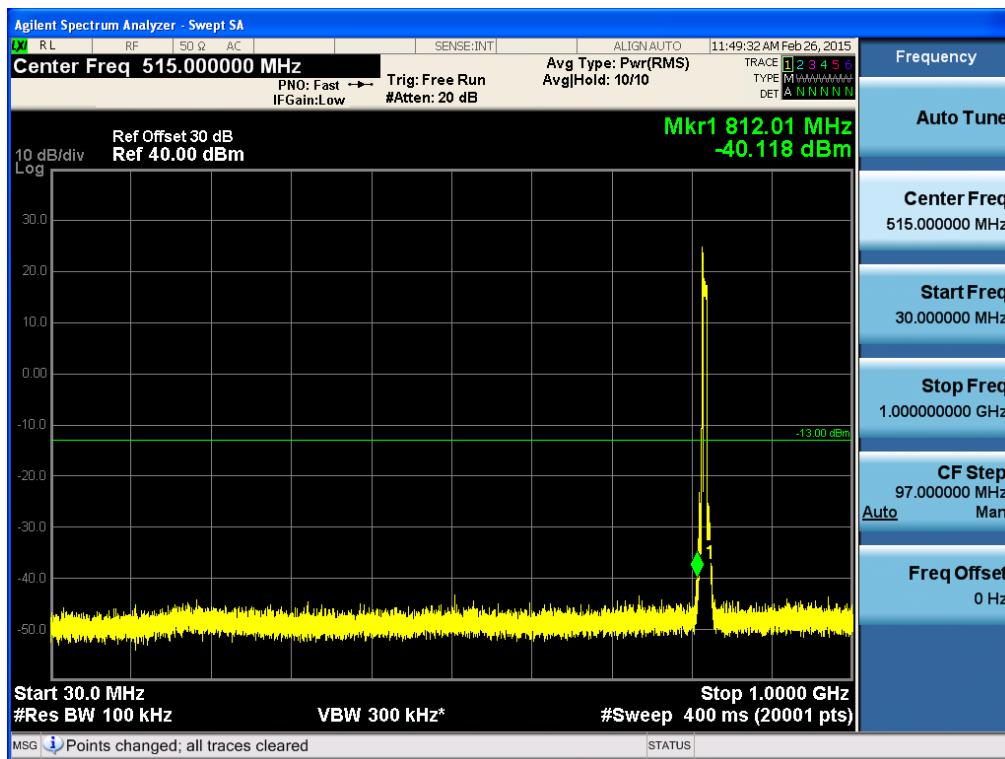
Conducted Spurious Emissions (30 MHz – 1 GHz)
[CDMA Uplink]



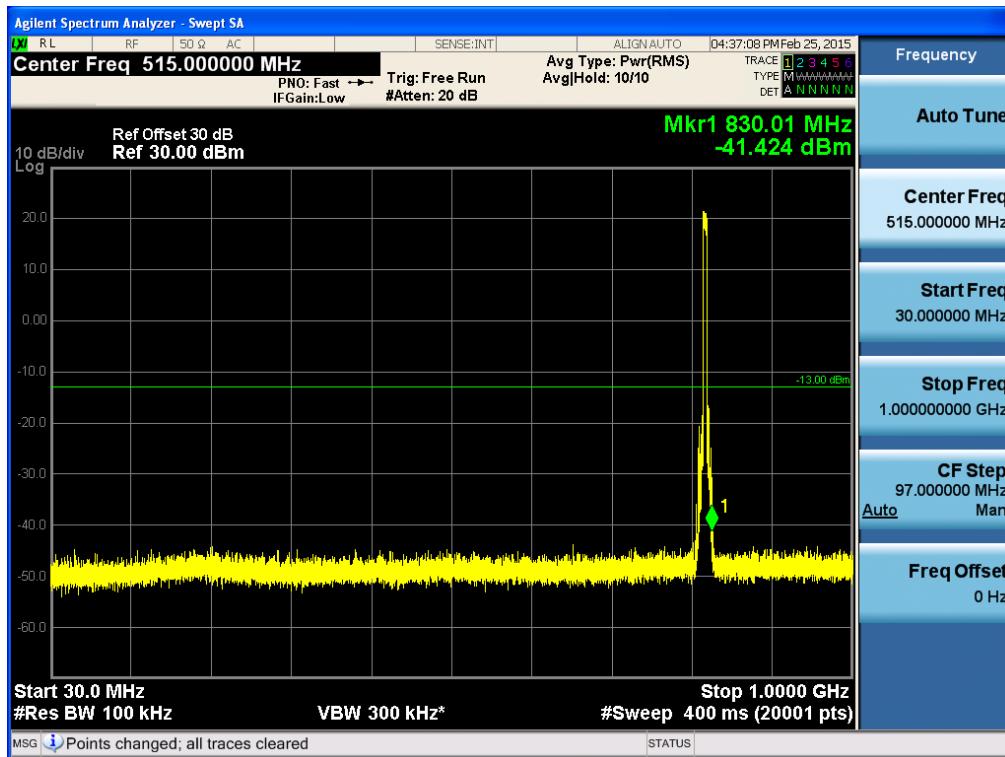
[CDMA EVDO Uplink]



[LTE + CDMA Uplink]



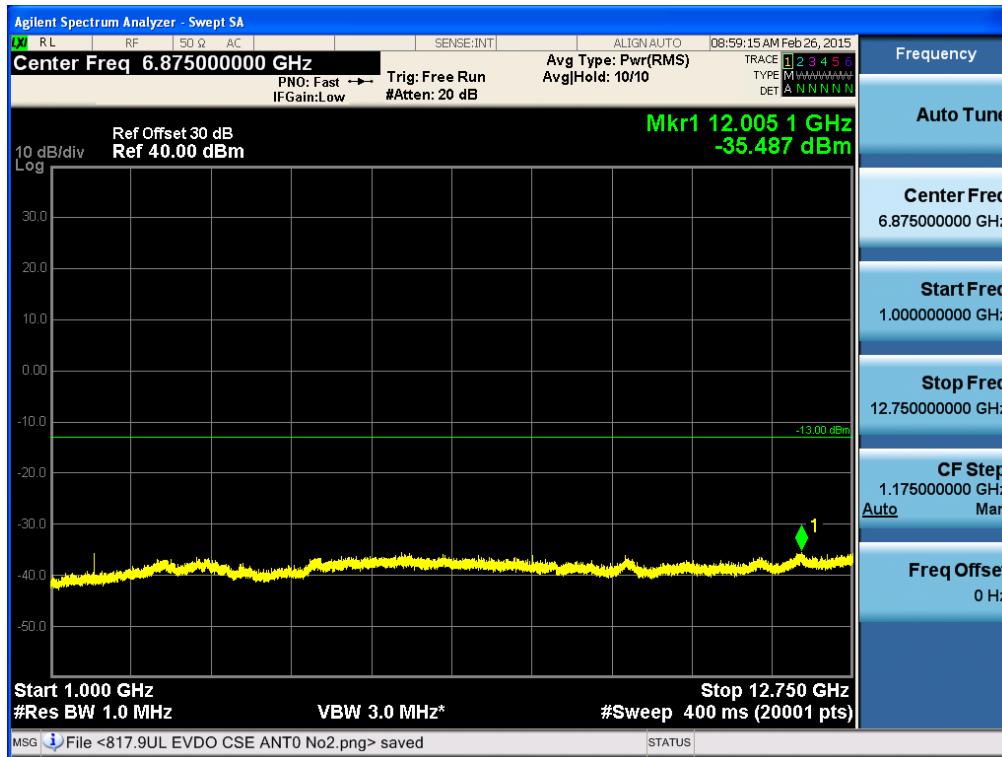
[LTE 5 MHz Uplink]



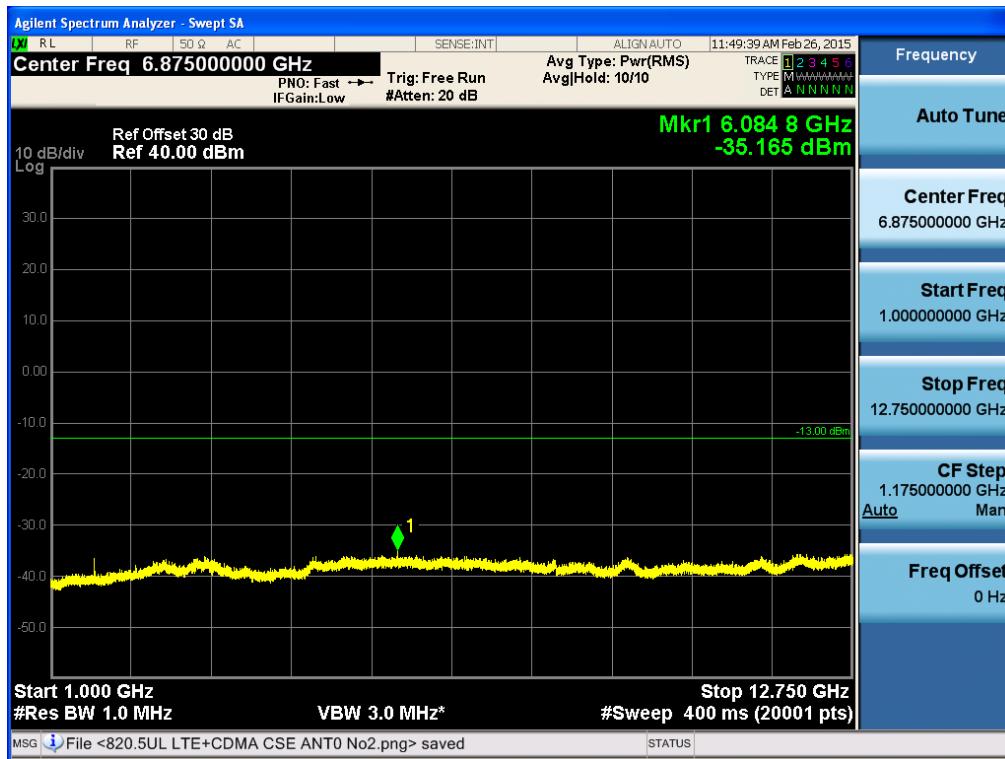
**Conducted Spurious Emissions (1 GHz –12.75 GHz)
[CDMA Uplink]**



[CDMA EVDO Uplink]



[LTE + CDMA Uplink]

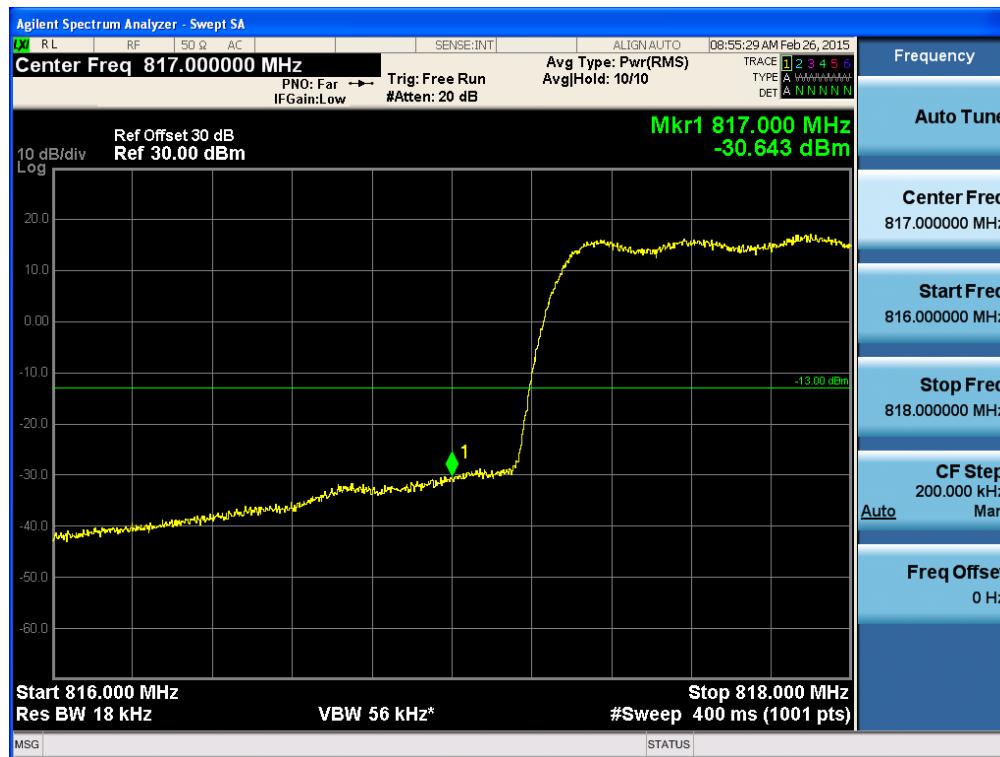


[LTE 5 MHz Uplink]



Band Edge_Uplink

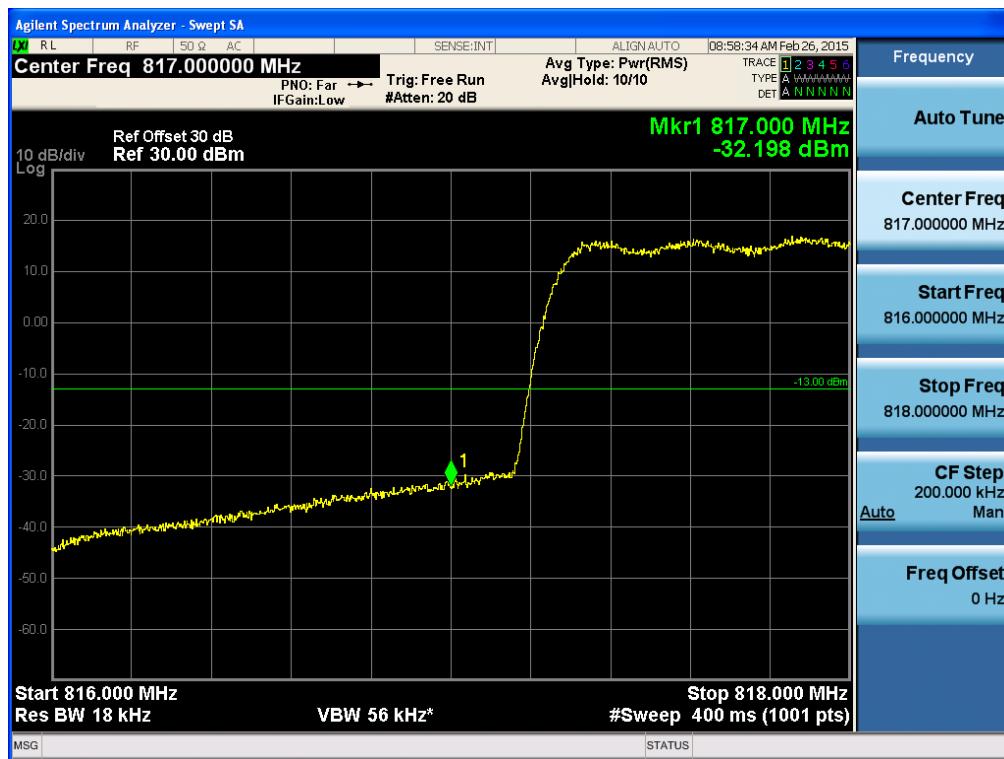
[CDMA Uplink Low]



[CDMA Uplink High]



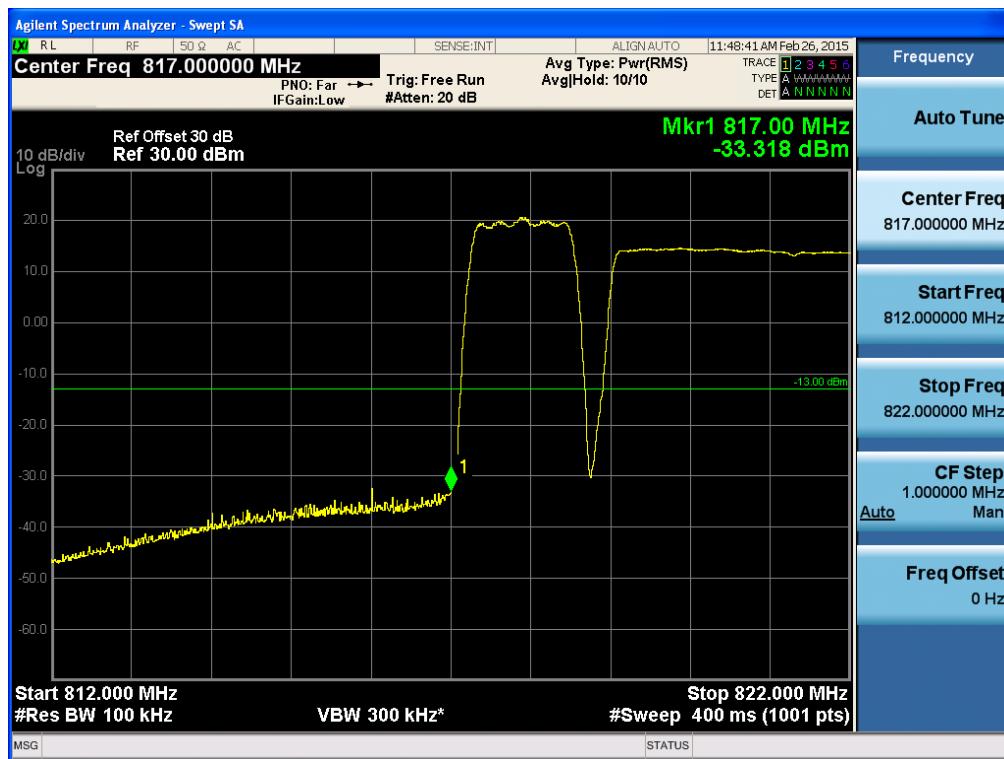
[CDMA EVDO Uplink Low]



[CDMA EVDO Uplink High]



[LTE + CDMA Uplink Low]



[LTE + CDMA Uplink High]



[LTE 5 MHz Uplink Low]



[LTE 5 MHz Uplink High]



10. RADIATED SPURIOUS EMISSIONS

Test Requirement(s): § 2.1053 Measurements required: Field strength of spurious radiation.

§ 2.1053 (a) Measurements shall be made to detect spurious emissions that may be Radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph (c) of § 2.1049, as appropriate. For equipment operating on frequencies below 890 MHz, an open field test is normally required with the measuring instrument antenna located in the far-field at all test frequencies. In the event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurements will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from half-wave dipole antennas.

§ 2.1053 (b): The measurements specified in paragraph (a) of this section shall be made for the following equipment:

- (1) Those in which the spurious emissions are required to be 60 dB or more below the mean power of the transmitter.
- (2) All equipment operating on frequencies higher than 25 MHz.
- (3) All equipment where the antenna is an integral part of, and attached directly to The transmitter.
- (4) Other types of equipment as required, when deemed necessary by the Commission.

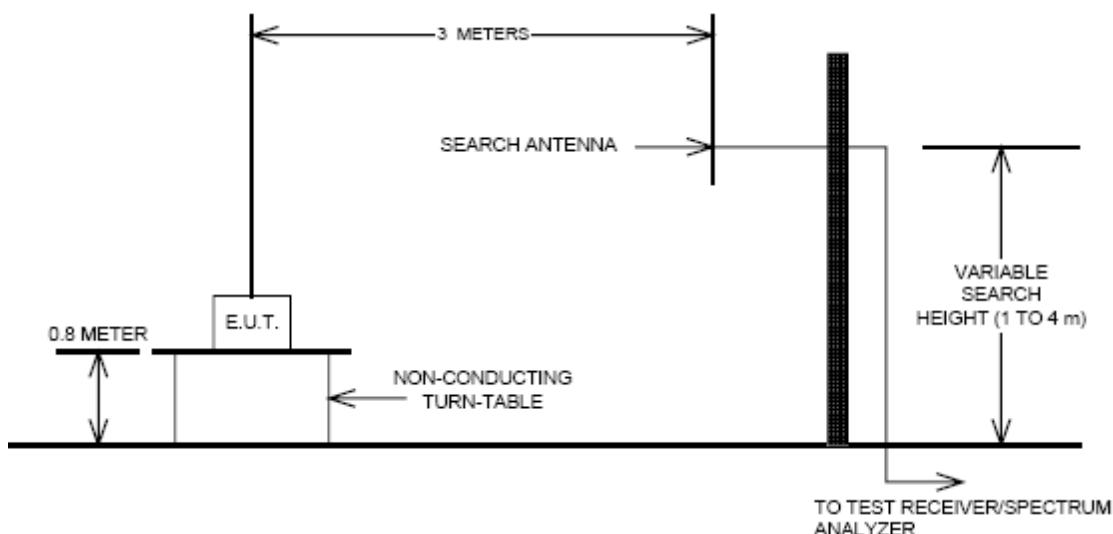
Test Procedures: As required by 47 CFR 2.1053, *field strength of radiated spurious measurements* were made in accordance with the procedures of ANSI/TIA-603-C-2004 "Land Mobile FM or PM Communications Equipment Measurement and Performance Standards".

Radiated emission measurements were performed inside a 3 meter semi-anechoic chamber.

The EUT was set at a distance of 3m from the receiving antenna. The EUT's RF ports were terminated to 50ohm load. The EUT was set to transmit at the low, mid and high channels of the transmitter frequency range at its maximum power level. The EUT was rotated about 360 and the receiving antenna scanned from 1-3m in order to capture the

maximum emission. A calibrated antenna source was positioned in place of the EUT and the previously recorded signal was duplicated. The maximum EIRP of the emission was calculated by adding the forward power to the calibrated source plus its appropriate gain value. These steps were carried out with the receiving antenna in both vertical and horizontal polarization. Harmonic emissions up to the 10th or 40 GHz, whichever was the lesser, were investigated.

Radiated Spurious Emissions Test Setup



Test Result:

Note.

Input signal is the CW signal.

Harmonics were not found.

[Downlink]

Mode	Test Frequency	Freq.(MHz)	Measured Level [dBuV/m]	SigGen Level [dBm]	Ant. Gain (dBd)	C.L	Pol.	ERP (dBm)	Margin (dB)
ERP	862.4	2156	57.48	-47.56	8.17	3.59	H	-42.97	29.97
		2885	55.76	-46.96	8.73	4.22	H	-42.45	29.45
	865.5	2156	57.38	-47.66	8.17	3.59	H	-43.07	30.07
		2885	55.6	-47.12	8.73	4.22	H	-42.61	29.61
	868.6	2156	58.12	-46.92	8.17	3.59	H	-42.33	29.33
		2885	55.59	-47.13	8.73	4.22	H	-42.62	29.62

[Uplink]

Mode	Test Frequency	Freq.(MHz)	Measured Level [dBuV/m]	SigGen Level [dBm]	Ant. Gain (dBd)	C.L	Pol.	ERP (dBm)	Margin (dB)
ERP	817.4	2156	57.63	-47.41	8.17	3.59	H	-42.82	29.82
		2885	55.71	-47.01	8.73	4.22	H	-42.50	29.50
	820.5	2156	58.24	-46.80	8.17	3.59	H	-42.21	29.21
		2885	55.76	-46.96	8.73	4.22	H	-42.45	29.45
	823.6	2156	57.90	-47.14	8.17	3.59	H	-42.55	29.55
		2885	55.58	-47.14	8.73	4.22	H	-42.63	29.63

11. FREQUENCY STABILITY OVER TEMPERATURE AND VOLTAGE VARIATIONS

FCC Rules

Test Requirement(s): §2.1055(a)(1), § 90.213

Test Procedures:

As required by 47 CFR 2.1055, *Frequency Stability measurements* were made at the RF output terminals using a Spectrum Analyzer.

The EUT was placed in the Environmental Chamber.

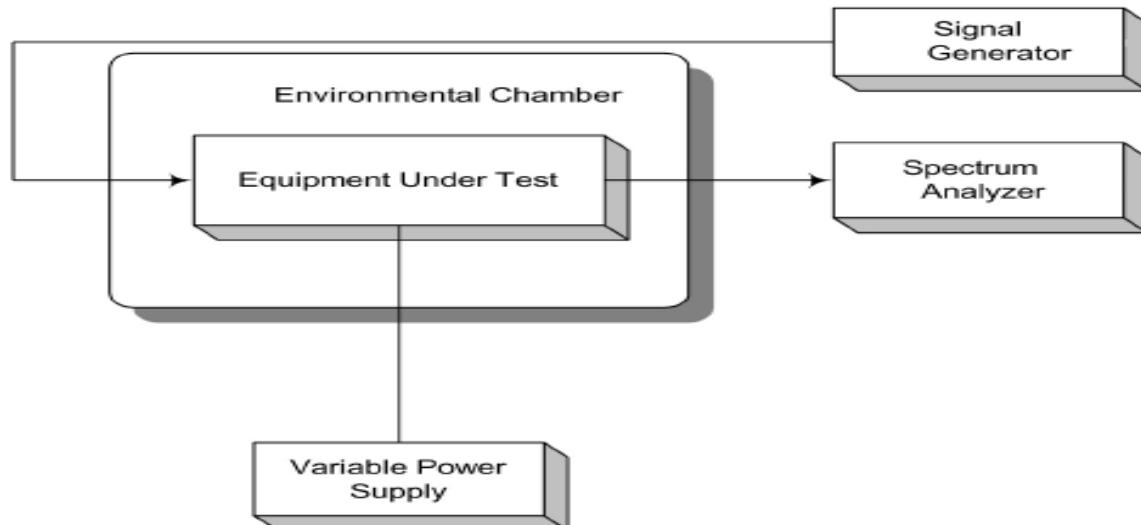
A CW signal was injected into the EUT at the appropriate RF level. The frequency counter option on the Spectrum Analyzer was used to measure frequency deviations.

The frequency drift was investigated for every 10 °C increment until the unit is stabilized then recorded the reading in tabular format with the temperature range of -30 to 50 °C.

Voltage supplied to EUT is 110 Vac reference temperature was done at 20°C.

The voltage was varied by ± 15 % of nominal

Test Setup:



Test Results:

The E.U.T was found in compliance for Frequency Stability and Voltage Test

AC power, Frequency Stability and Voltage Test Results

Reference: 120 Vac at 20°C **Freq.** = 865.5000 MHz

Voltage (%)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (Hz)	ppm
100%	+20(Ref)	865500000. 0	0.0	0.0	0.0
	-30	865500000. 0	0.0	0.0	0.0
	-20	865500000. 0	0.0	0.0	0.0
	-10	865500000. 0	0.0	0.0	0.0
	0	865500000. 0	0.0	0.0	0.0
	+10	865500000. 0	0.0	0.0	0.0
	+30	865500000. 0	0.0	0.0	0.0
	+40	865500000. 0	0.0	0.0	0.0
	+50	865500000. 0	0.0	0.0	0.0
	115%	865500000. 0	0.0	0.0	0.0
85%	+20	865500000. 0	0.0	0.0	0.0

[Downlink]

Reference: 120 Vac at 20°C **Freq.** = 820.5000 MHz

Voltage (%)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (Hz)	ppm
100%	+20(Ref)	820500000. 0	0.0	0.0	0.0
	-30	820500000. 0	0.0	0.0	0.0
	-20	820500000. 0	0.0	0.0	0.0
	-10	820500000. 0	0.0	0.0	0.0
	0	820500000. 0	0.0	0.0	0.0
	+10	820500000. 0	0.0	0.0	0.0
	+30	820500000. 0	0.0	0.0	0.0
	+40	820500000. 0	0.0	0.0	0.0
	+50	820500000. 0	0.0	0.0	0.0
	115%	820500000. 0	0.0	0.0	0.0
85%	+20	820500000. 0	0.0	0.0	0.0

[Uplink]