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REPORT

FCC Class II Permissive Change

Manufacture; **10, 9th Floor, SOLiD Space, Pangyoyeok-ro 220, Bundang-gu, Seongnam-si, Gyeonggi-do, 463-400** **SOLiD, Inc**	**Date of Issue :December 12, 2014** **Test Report No.: HCT-R-1411-F024-2** **Test Site: HCT CO., LTD.** **IC Recognition No.: 5944A-3**

FCC ID: **IC:** **APPLICANT:**	**W6UHM80I85C** **9354A-HM80I85C** **SOLiD, Inc**
FCC/ IC Model Name:	**MRDU-800IDEN/850CEL**
EUT Type:	**RDU (Remote Drive Unit)**
Frequency Ranges:	**Part 22 : 869 MHz – 894 MHz** **Part 90 : 862 MHz – 869 MHz**
Conducted Output Power:	**5 W (37 dBm)**
Date of Test :	**November 06, 2014 ~ November 10, 2014**
FCC Rules Part(s):	**CFR 47, Part 22 and 90**
IC Rules :	**RSS-Gen (Issue 3, December 2010) , RSS-131 (Issue 2, July 2003)**
Note:	**This report is the test results of the model with MRF8HP21130HSR3 RF Power Transistors.**

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 22, 90 of the FCC Rules under normal use and maintenance.

Report prepared by : Yong Hyun Lee
Engineer of RF Team

Report approved by : Chang Seok Choi
Manager of RF Team

Report Revision

TEST REPORT NO.	DATE	DESCRIPTION
HCT-R-1411-F024	November 25, 2014	- First Approval Report
HCT-R-1411-F024-1	December 09,2014	- Delete HAAT Calculation value
HCT-R-1411-F024-2	December 12,2014	-Add note on page 1

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1. CLIENT INFORMATION

The EUT has been tested by request of

Company	SOLiD, Inc 10, 9th Floor, SOLiD Space, Pangyoyeok-ro 220, Bundang-gu, Seongnam-si, Gyeonggi-do, 463-400

- **FCC ID:** **W6UHM80I85C**
- **IC:** **9354A-HM80I85C**
- **APPLICANT:** **SOLiD, Inc**
- **EUT Type:** **RDU (Remote Drive Unit)**
- **Model:** **MRDU-800IDEN/850CEL**
- **Frequency Ranges:** **Part 22 : 869 MHz – 894 MHz**
  Part 90 : 862 MHz – 869 MHz
- **Conducted Output Power:** **5 W (37 dBm)**
- **Antenna Gain(s) :** **Manufacturer does not provide an antenna.**
- **FCC Rules Part(s):** **CFR Title 47 Part 22 and 90**
- **IC Rules Part(s):** **RSS-Gen (Issue3, December 2010), RSS-131(Issue 2, July 2003)**
- **Measurement standard(s):** **ANSI/TIA-603-C-2004, KDB 971168 D01 v02r02,**
  KDB 935210 D03 v02r01, RSS-131(Issue 2, July 2003)
- **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 Part 22 and 90, RSS-GEN, RSS-131.

Description	Reference (FCC)	Reference (IC)	Results
RF Output Power	§2.1046, §22.913, §90.635	RSS-131, Section 4.3 RSS-131, Section 6.2	Compliant
Occupied Bandwidth	§2.1049	RSS-GEN, Section 4.6.1	Compliant
Passband Gain and Bandwidth & Out of Band Rejection	KDB 935210 D03 v02r01	RSS-131, Section 4.2 RSS-131, Section 6.1	Compliant
Spurious Emissions at Antenna Terminals	§2.1051, §22.917, §90.691	RSS-131, Section 4.4 RSS-131, Section 6.3 RSS-131, Section 6.4	Compliant
Radiated Spurious Emissions	§2.1053, §22.917, §90.691	-	Compliant
Frequency Stability	§2.1055, §22.355, §90.213	RSS-131, Section 4.5 RSS-131, Section 6.5	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 ℃ to + 35 ℃**
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	01/24/2014	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	07/05/2013	1151
Schwarzbeck	VULB 9160/TRILOG Antenna	Biennial	12/17/2012	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.

§ 22.913 Effective radiated power limits. The effective radiated power (ERP) of transmitters in the Cellular Radiotelephone Service must not exceed the limits in this section.

(a) Maximum ERP. In general, the effective radiated power (ERP) of base transmitters and cellular repeaters must not exceed 500 Watts. However, for those systems operating in areas more than 72 km (45 miles) from international borders that:

(1) Are located in counties with population densities of 100 persons or fewer per square mile, based upon the most recently available population statistics from the Bureau of the Census; or,

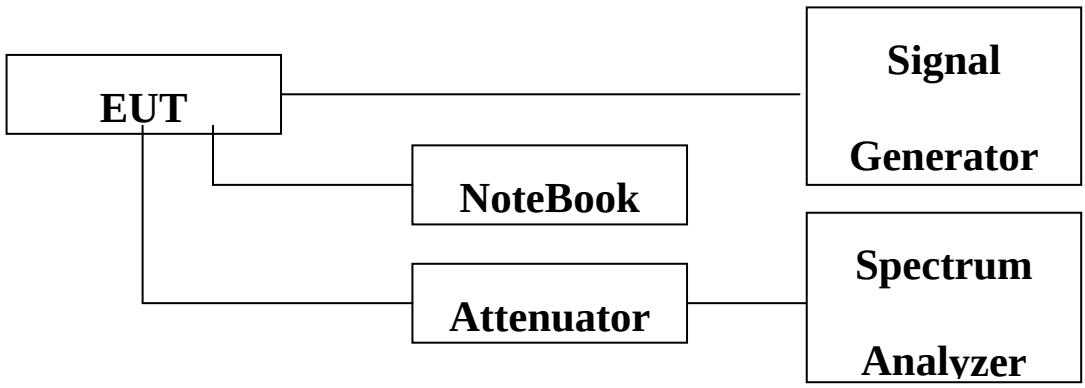
(2) Extend coverage on a secondary basis into cellular unserved areas, as those areas are defined in § 22.949, the ERP of base transmitters and cellular repeaters of such systems must not exceed 1000 Watts. The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.

§ 90.635 Power and antenna height limits. (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	DL : -10 dBm	DL : 47 dB
WCDMA		
GSM		
LTE 5 MHz		

IC Rules

Test Requirements: RSS-131 6.2

The manufacturer's output power rating Prated MUST NOT be greater than Pmean for all types of enhancers.

Additional Power Back-off Condition for Multiple Carrier Operations:

An example of a single carrier operation is a band translator that incorporates an (IF) filter of a passband equal to one channel bandwidth. Another example of a single carrier operation is the use of an enhancer, before the connection to the antenna, to boost a low power transmitter (single carrier) to a higher power.

An example of a multiple carrier operation is the use of an enhancer to amplify off-air signals that contain the wanted carrier and two (or more) adjacent band carriers. If the enhancer passband is wide enough to pass more than the wanted channel bandwidth, the enhancer output stage will be loaded by the multiple carriers.

Examination: with 3 carrier signals (of assumed equal level), the peak voltage will be 3 times the single carrier voltage. The corresponding Peak Envelope Power (PEP) will be 3^2 times greater than a single carrier or 9/4 = 2.25 times greater than 2 tones PEP. Therefore the permissible wanted signal operating point has to be backed off by 3.5 dB (i.e. **Ppermissible = Prated - 3.5 dB**).

Note 1: All enhancers will be classified in the Radio Equipment List (REL) for a single carrier operation.

Note 2: For a multiple carrier operation, the rating must be reduced by 3.5 dB or more.

Note 3: If there are more than 3 carriers present at the amplifier input point, greater power back-off may be required. This can be examined on a case-by-case basis.

Test Procedures: RSS-131 4.3

4.3.1 Multi-channel Enhancer

The following subscript "o" denotes a parameter at the enhancer output point.

Connect two signal generators to the input of the Device Under Test (DUT), via a proper impedance matching network (and preferably via a variable attenuator) so that the two input signals are equal sinusoids (and can be raised equally).

Connect a dummy load of suitable load rating to the enhancer output point. Connect also a spectrum analyser to this output point via a coupling network and attenuator, so that only a portion of the output signal is coupled to the spectrum analyser. The coupling attenuation shall be stated in the test report.

Set the two generator frequencies f1 and f2 such that they and their third-order intermodulation product frequencies, f3= 2f1-f2 and f4 = 2f2 - f1, are all within the passband of the DUT.

Raise the input level to the DUT while observing the output tone levels, Po1 and Po2, and the intermodulation product levels, Po3 and Po4.

For enhancers rated 500 watts or less: Raise the input level to the DUT until the greater level of the intermodulation products at the enhancer output terminals, Po3 or Po4, equals -43 dBW.

For enhancers rated over 500 watts: Raise the input level to the DUT until the greater level of the intermodulation products at the enhancer output terminals, Po3 or Po4, is 67 dB below the level of either output tone level, Po1 or Po2.

Record all signal levels and their frequencies. Calculate the mean output power (Pmean) under this testing condition using Pmean = Po1 + 3 dB.

4.3.2 Single Channel Enhancer

A suitably modulated signal, representative of the technology for which certification is sought, is applied to the input of the amplifier. The input power level is increased until the manufacturer's rated input power level is achieved or until a 2 dB increase in input level results in a 1 dB increase in output level (i.e. compression begins). Record the output power in the 99% emission bandwidth using any suitable means.

Single channel Enhancer

* Due to EUT's ALC function (Auto Level Control), even if input signal is increased,

The same output power is transmit.

[Downlink]

	Channel	Frequency (MHz)	Output Power	
			(dBm)	(W)
CDMA	Low	862.75	37.00	5.012
	Middle	878.00	37.00	5.010
	High	893.25	36.98	4.988
EVDO	Low	862.75	37.00	5.012
	Middle	878.00	37.00	5.008
	High	893.25	36.99	5.005
WCDMA	Low	864.40	37.00	5.011
	Middle	878.00	37.00	5.012
	High	891.60	37.00	5.011

[Downlink]

	Channel	Frequency (MHz)	Output Power	
			(dBm)	(W)
GSM	Low	862.40	37.02	5.038
	Middle	878.00	37.00	5.015
	High	893.60	37.02	5.034
EDGE	Low	862.40	37.01	5.019
	Middle	878.00	37.01	5.019
	High	893.60	36.99	5.003
LTE 5 MHz	Low	864.50	37.00	5.007
	Middle	881.50	37.00	5.011
	High	891.50	37.00	5.016

Multi-channel Enhancer for IC

* Due to EUT's ALC function (Auto Level Control), even if input signal is increased,

The same output power is transmit.

[Downlink]

	Channel	Frequency (MHz)	Output Power	
			Po1(dBm)	Pmean(dBm)
Unmodulated	Low	862.40	34.006	37.006
	Middle	878.00	34.008	37.008
	High	893.60	34.004	37.004

Additional Power Back-off Condition for Multiple Carrier Operations for IC

[Downlink]

	1 Carrier (dBm)	3 Carrier (dBm)	Power Back-off (dB)
LTE 5 MHz	37.00	32.18	4.82

Plots of RF Output Power

[CDMA Downlink Low]

[CDMA Downlink Middle]

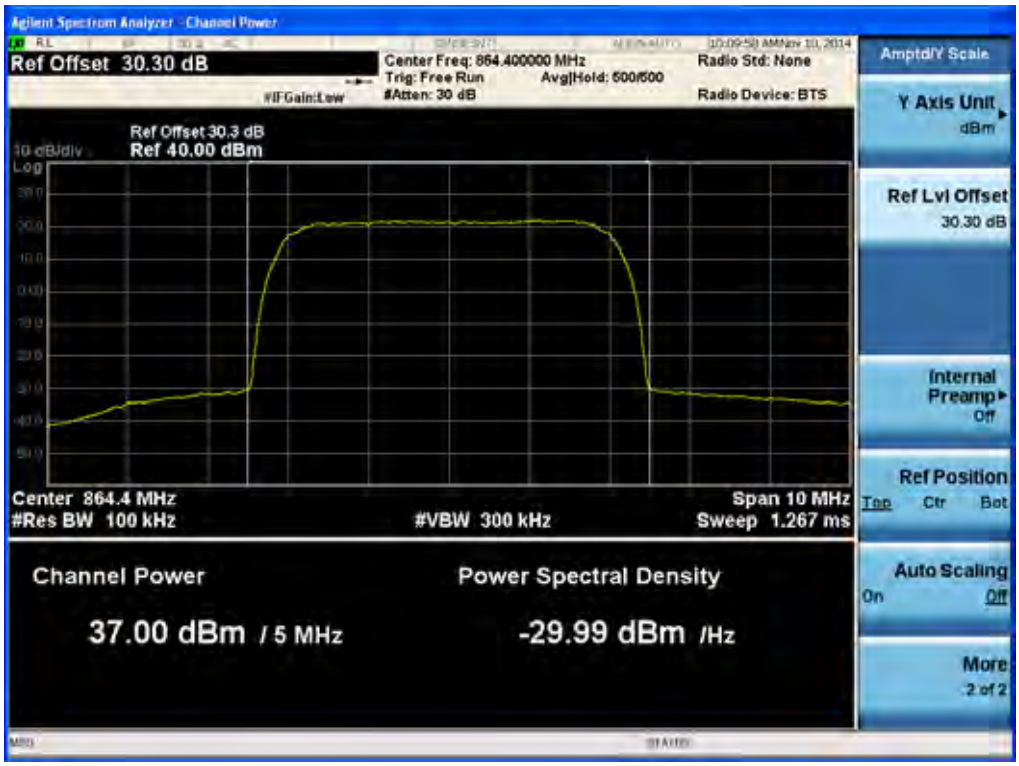
[CDMA Downlink High]

[EVDO Downlink Low]

[EVDO Downlink Middle]

[EVDO Downlink High]

[WCDMA Downlink Low]



[WCDMA Downlink Middle]

[WCDMA Downlink High]

[GSM Downlink Low]

[GSM Downlink Middle]

[GSM Downlink High]

[EDGE Downlink Low]

[EDGE Downlink Middle]

[EDGE Downlink High]

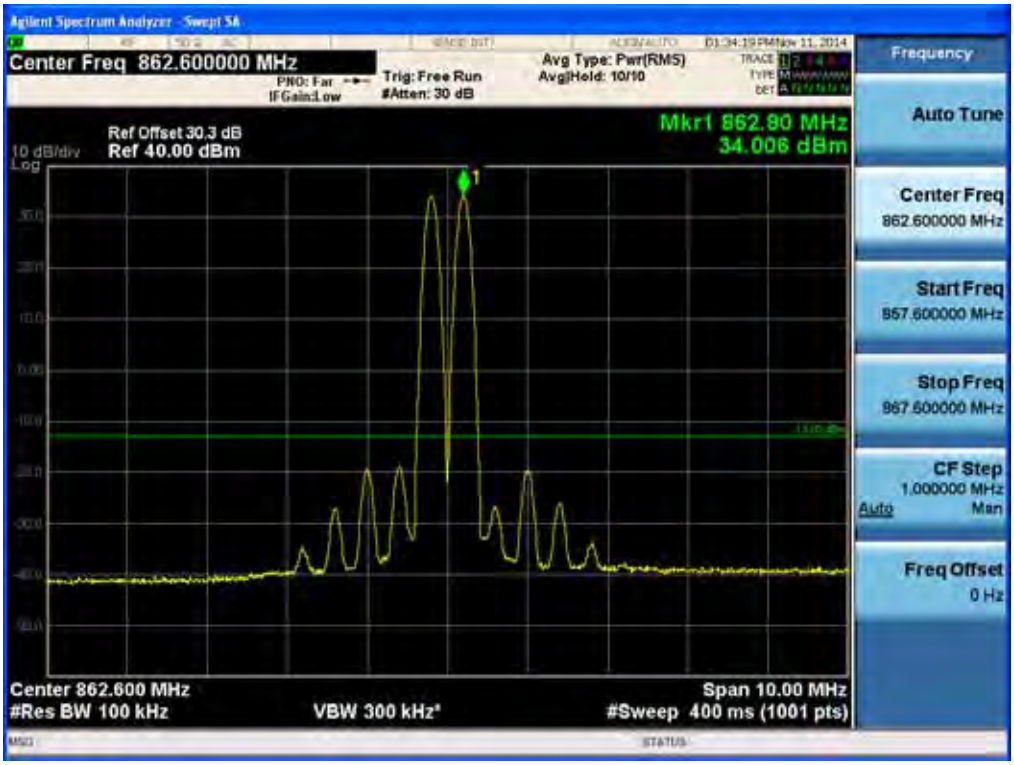
[LTE Downlink 5 MHz Low]

[LTE Downlink 5 MHz Middle]

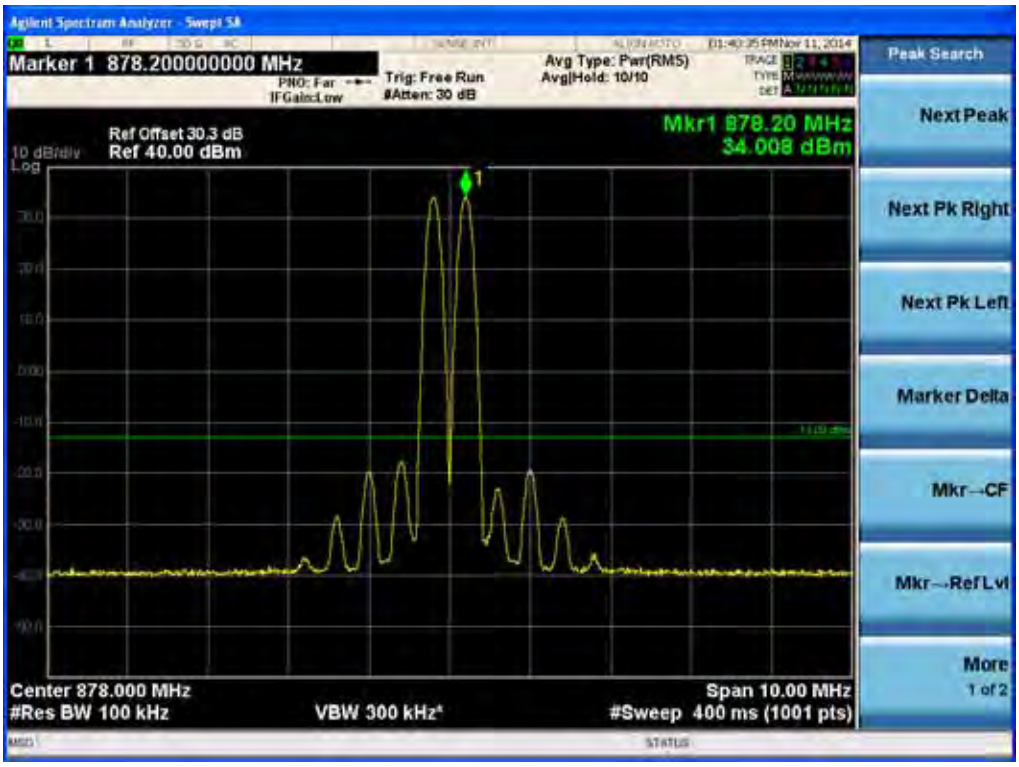
[LTE Downlink 5 MHz High]

Multi-channel Enhancer for IC

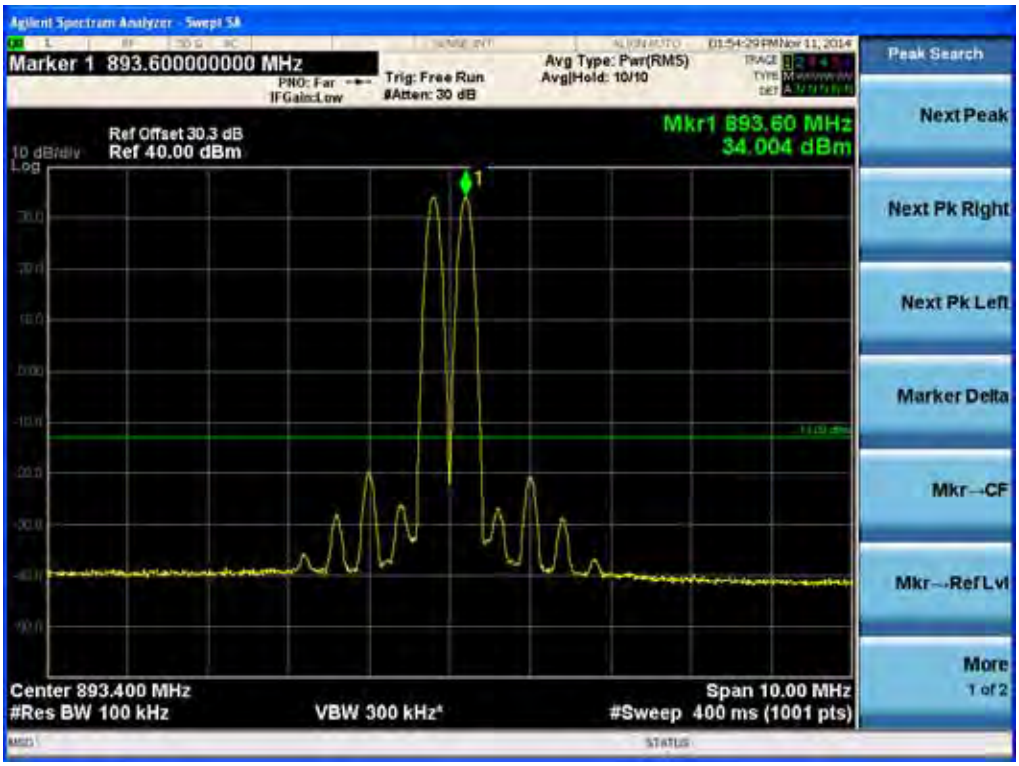
[Downlink Low]



[Downlink Middle]



[Downlink High]



*** Power Back-off for IC**

[LTE 5MHz 3 Carrier Middle]

Antenna height limitation

ERP/MHz Calculation

Max Peak output Power	5.038	W
Max Peak output Power	37.023	dBm
Antenna Gain	17.00	dBi
ERP	153.92	W
EIRP	252.52	W

It applies the normal antenna gain with 17.00 dBi for ERP Calculation because this system is the manufacturer does not provide an antenna.

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	DL : -10 dBm	DL : 47 dB
WCDMA		
GSM		
LTE 5 MHz		

IC Rules

Test Requirements: RSS-GEN 4.6.1

When an occupied bandwidth value is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be its 99% emission bandwidth, as calculated or measured.

Test Procedures: RSS-GEN 4.6.1

The transmitter shall be operated at its maximum carrier power measured under normal test conditions.
The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts. The resolution bandwidth shall be set to as close to 1% of the selected span as is possible without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth.
Video averaging is not permitted. Where practical, a sampling detector shall be used given that a peak or peak hold may produce a wider bandwidth than actual.
The trace data points are recovered and directly summed in linear terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points. This frequency is recorded. The span between the two recorded frequencies is the occupied bandwidth.

[Downlink Output]

	Channel	Frequency (MHz)	OBW (MHz)
CDMA	Low	862.75	1.266
	Middle	878.00	1.264
	High	893.25	1.262
EVDO	Low	862.75	1.262
	Middle	878.00	1.257
	High	893.25	1.259
WCDMA	Low	864.40	4.142
	Middle	878.00	4.139
	High	891.60	4.143

[Downlink Input]

	Channel	Frequency (MHz)	OBW (MHz)
CDMA	Low	862.75	1.267
	Middle	878.00	1.262
	High	893.25	1.264
EVDO	Low	862.75	1.260
	Middle	878.00	1.260
	High	893.25	1.262
WCDMA	Low	864.40	4.120
	Middle	878.00	4.135
	High	891.60	4.129

[Downlink Output]

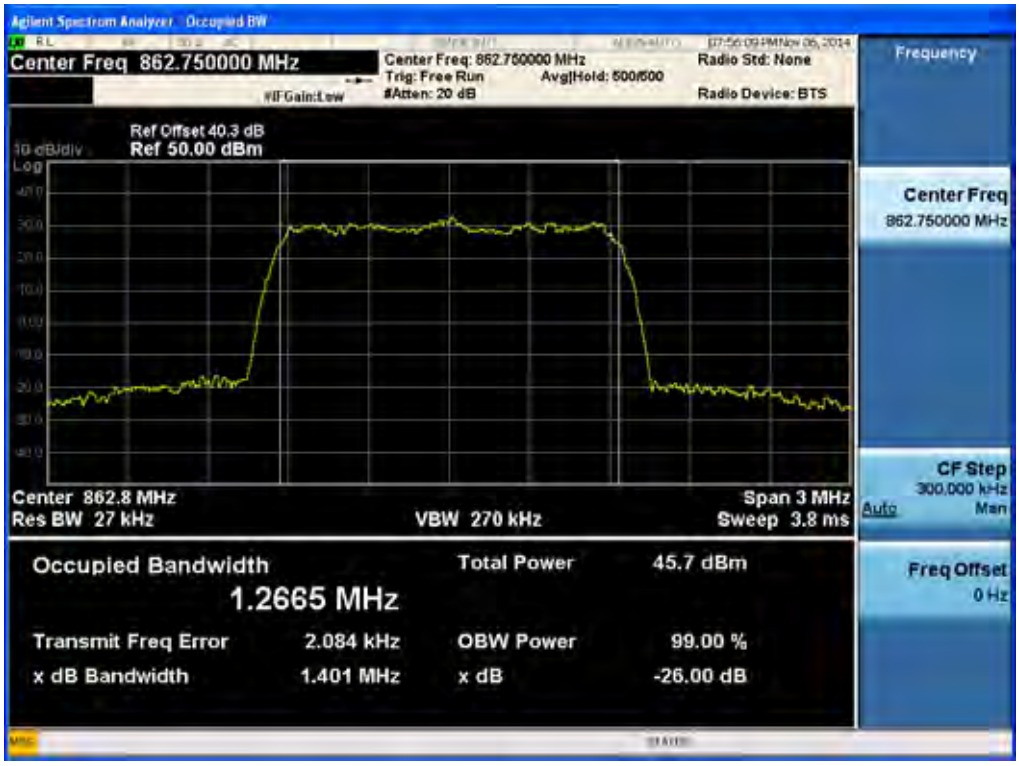
	Channel	Frequency (MHz)	OBW (MHz)
GSM	Low	862.40	246.1
	Middle	878.00	244.0
	High	893.60	244.5
EDGE	Low	862.40	243.6
	Middle	878.00	244.3
	High	893.60	243.8
LTE 5 MHz	Low	864.50	4.518
	Middle	881.50	4.519
	High	891.50	4.513

[Downlink Input]

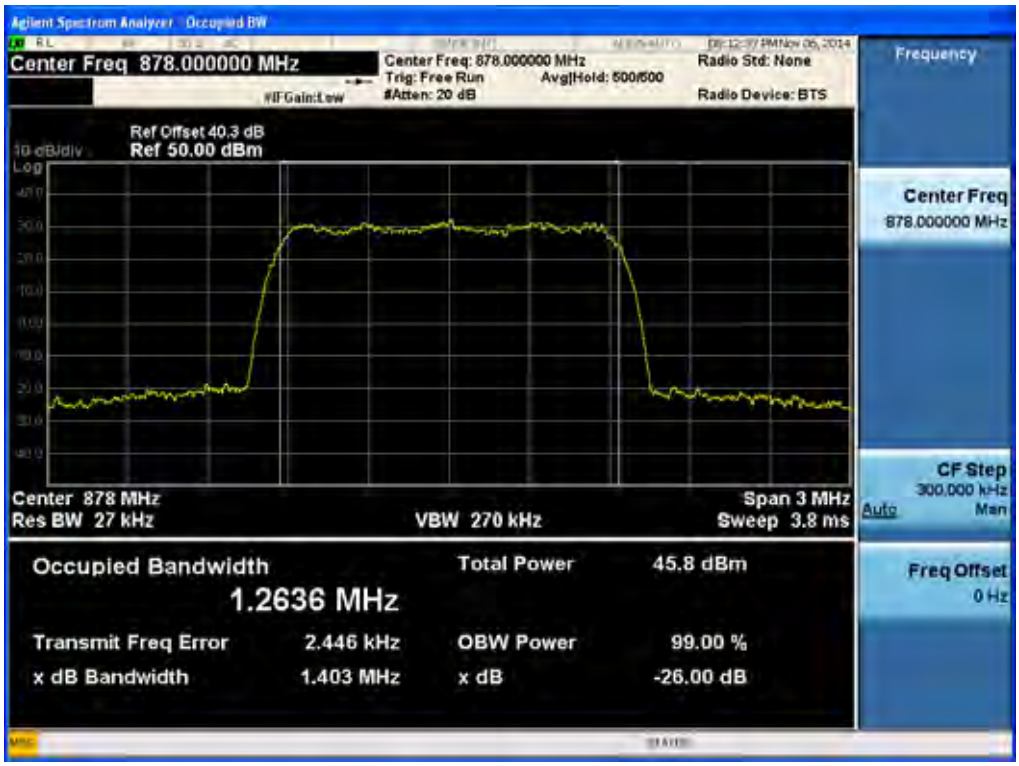
	Channel	Frequency (MHz)	OBW (MHz)
GSM	Low	862.40	247.3
	Middle	878.00	245.1
	High	893.60	245.5
EDGE	Low	862.40	243.6
	Middle	878.00	243.7
	High	893.60	243.9
LTE 5 MHz	Low	864.50	4.520
	Middle	881.50	4.510
	High	891.50	4.509

Plots of Occupied Bandwidth

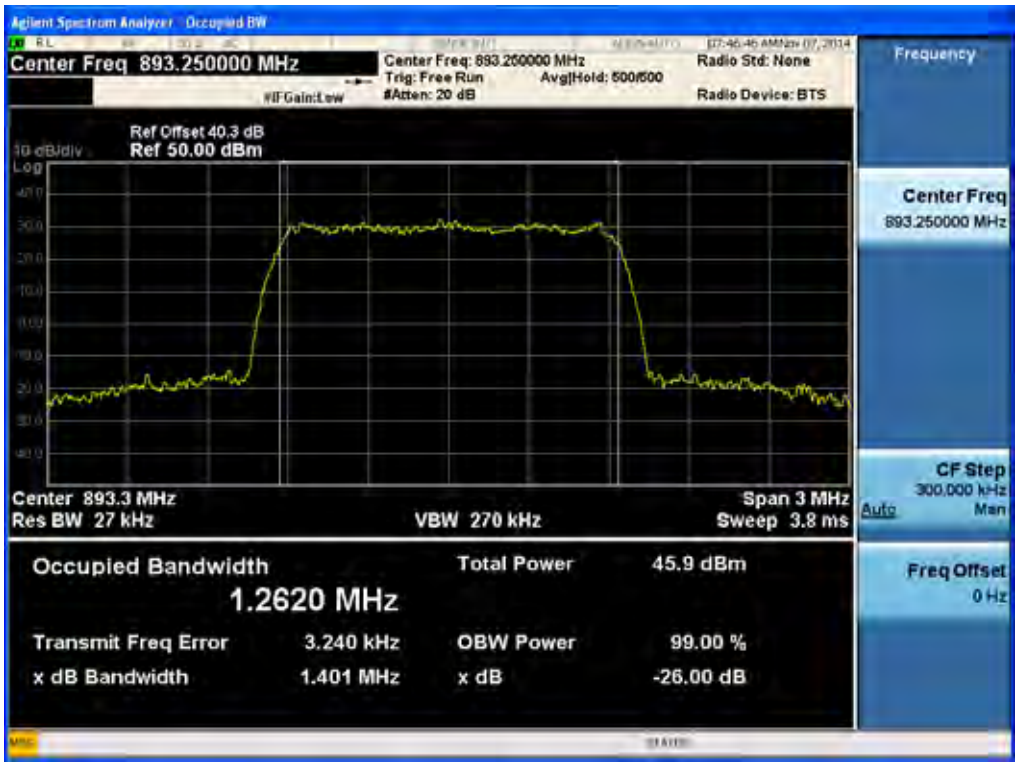
[Output CDMA Downlink Low]



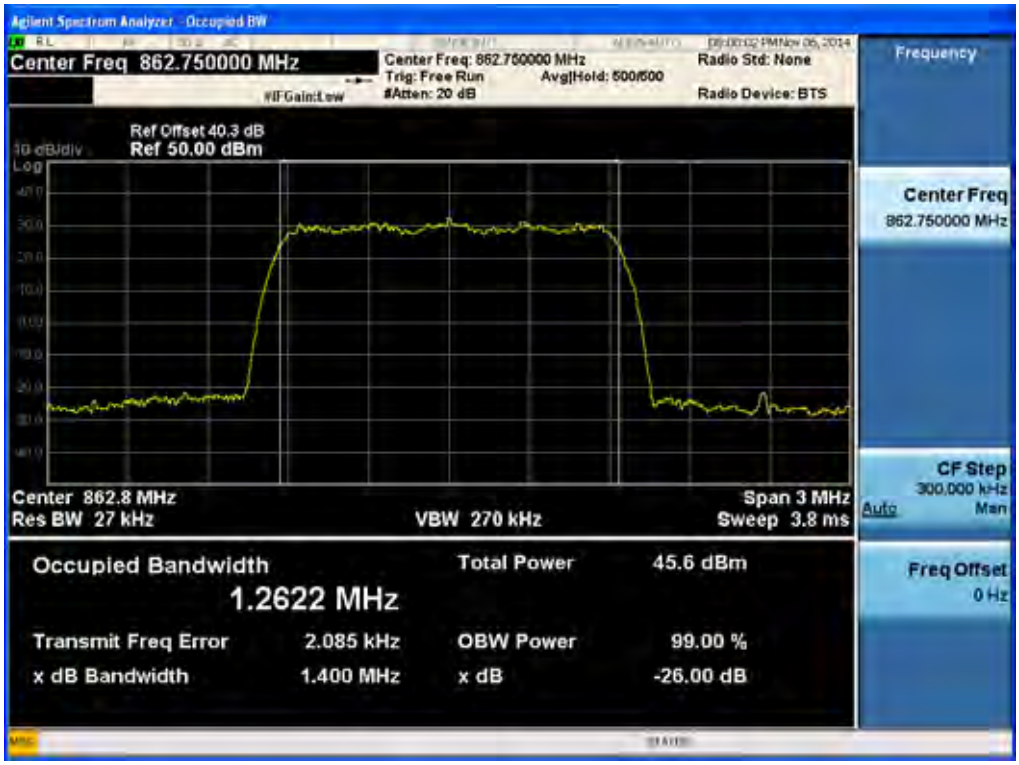
[Output CDMA Downlink Middle]



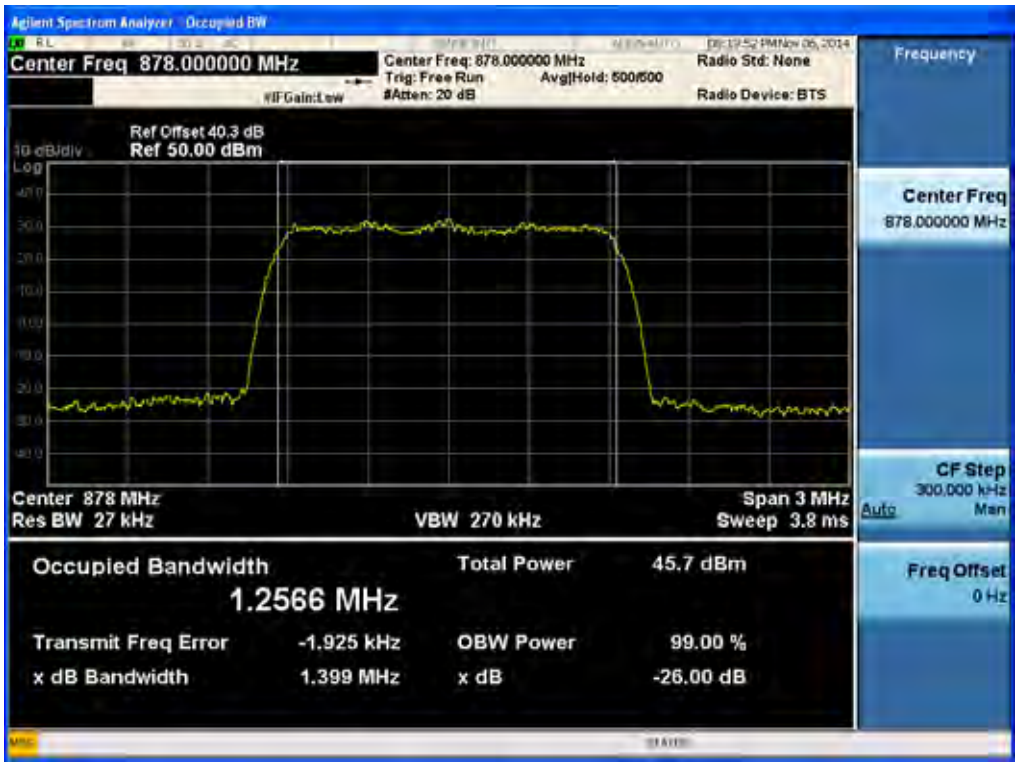
[Output CDMA Downlink High]



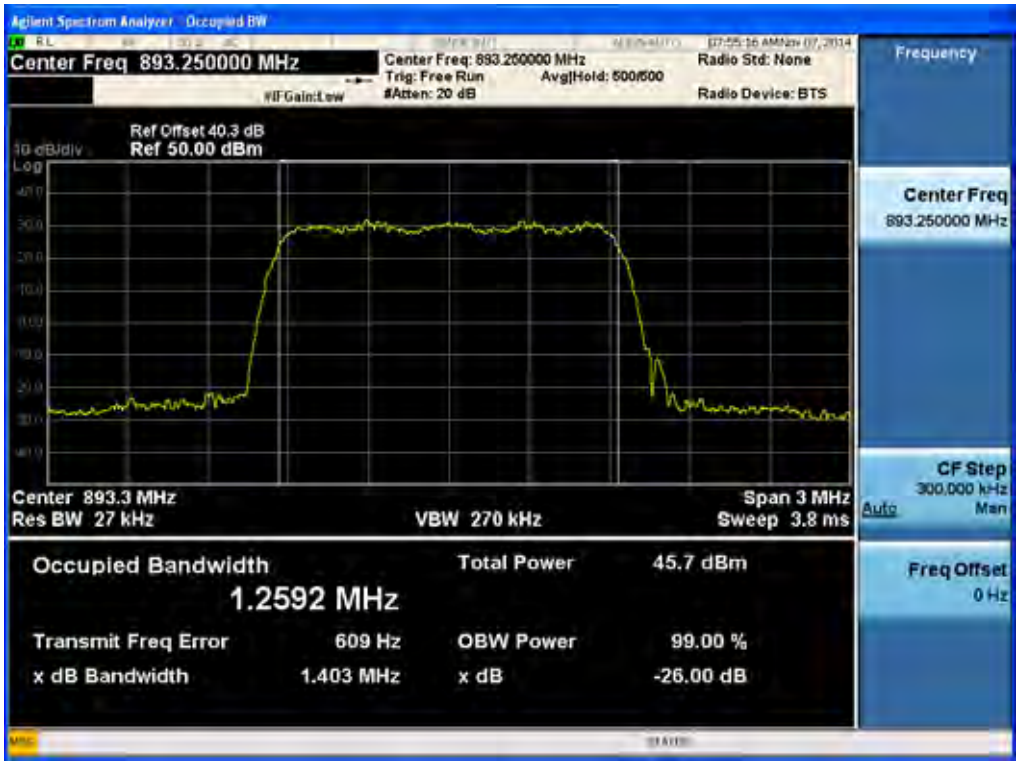
[Output EVDO Downlink Low]



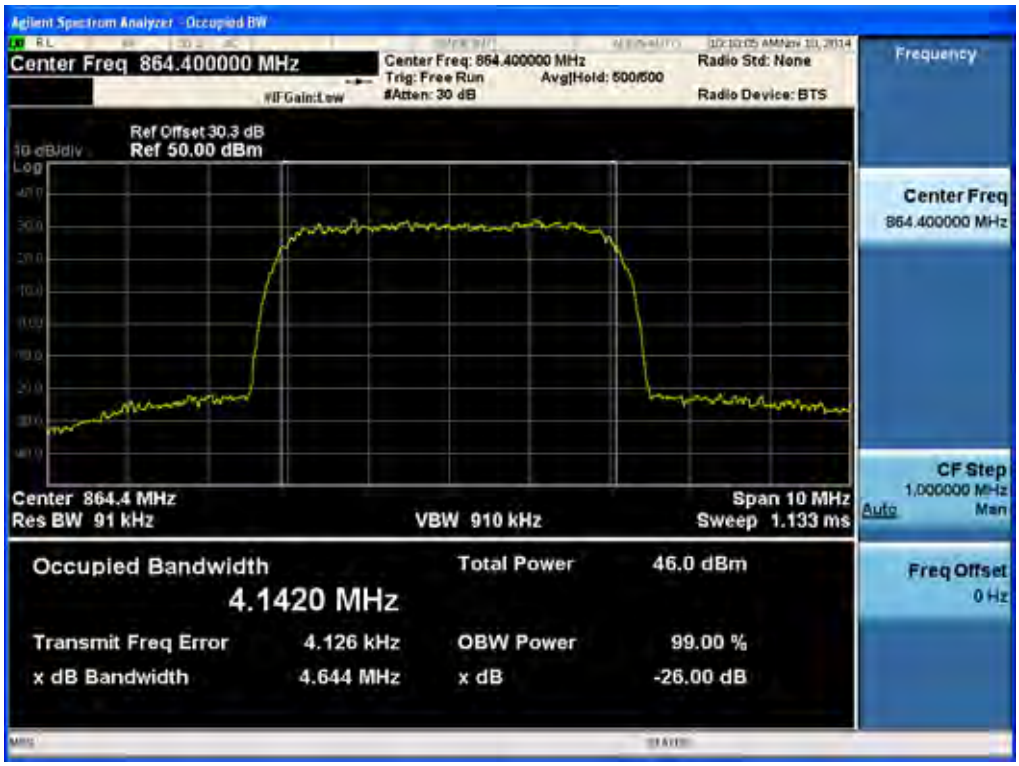
[Output EVDO Downlink Middle]



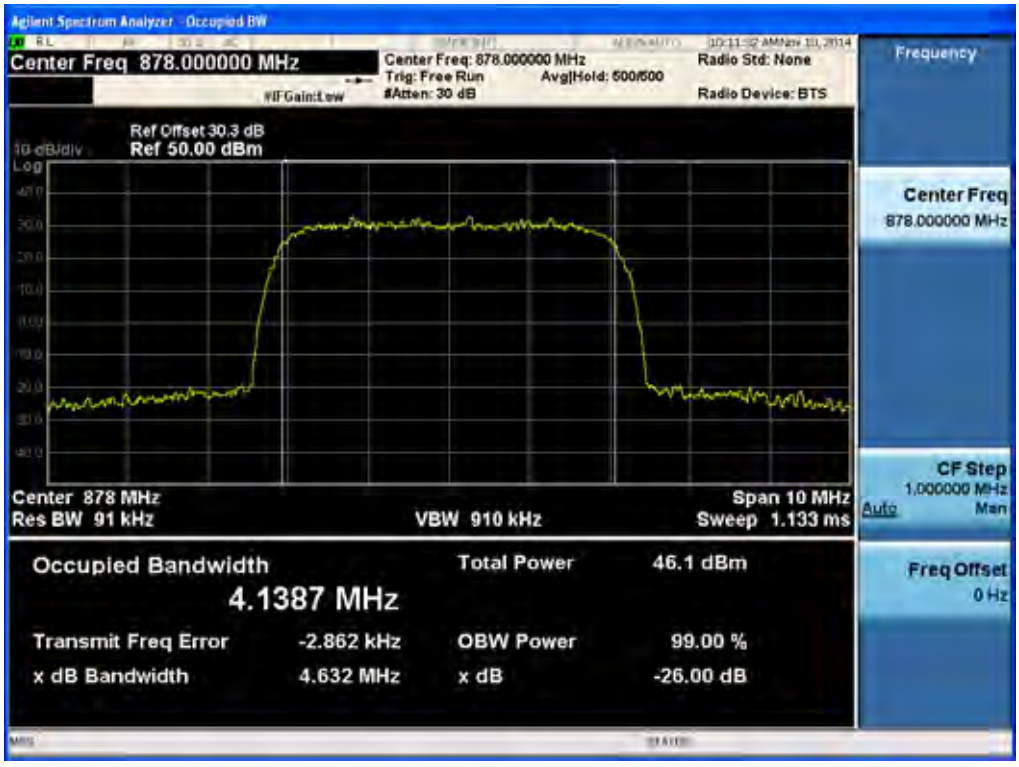
[Output EVDO Downlink High]



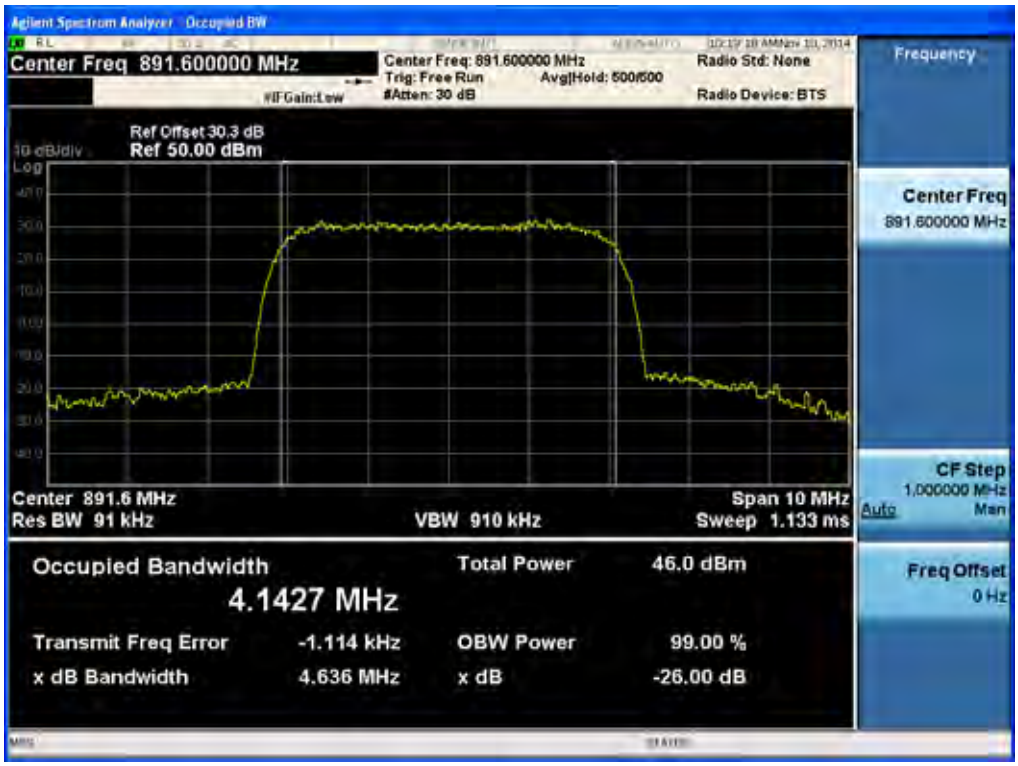
[Output WCDMA Downlink Low]



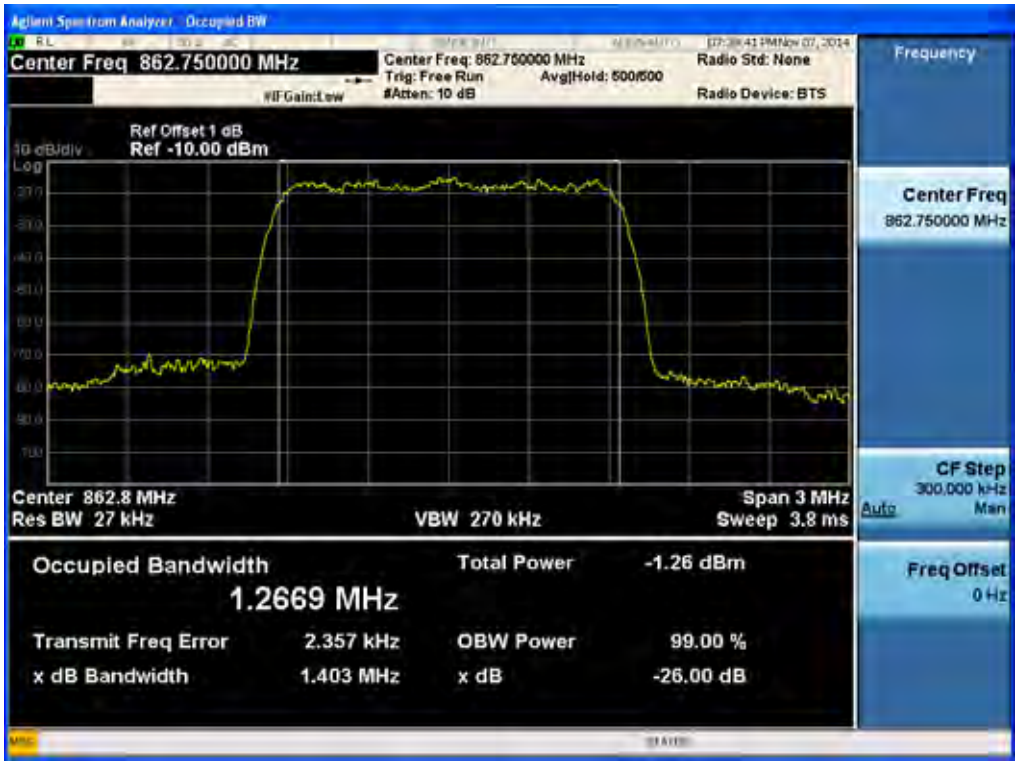
[Output WCDMA Downlink Middle]



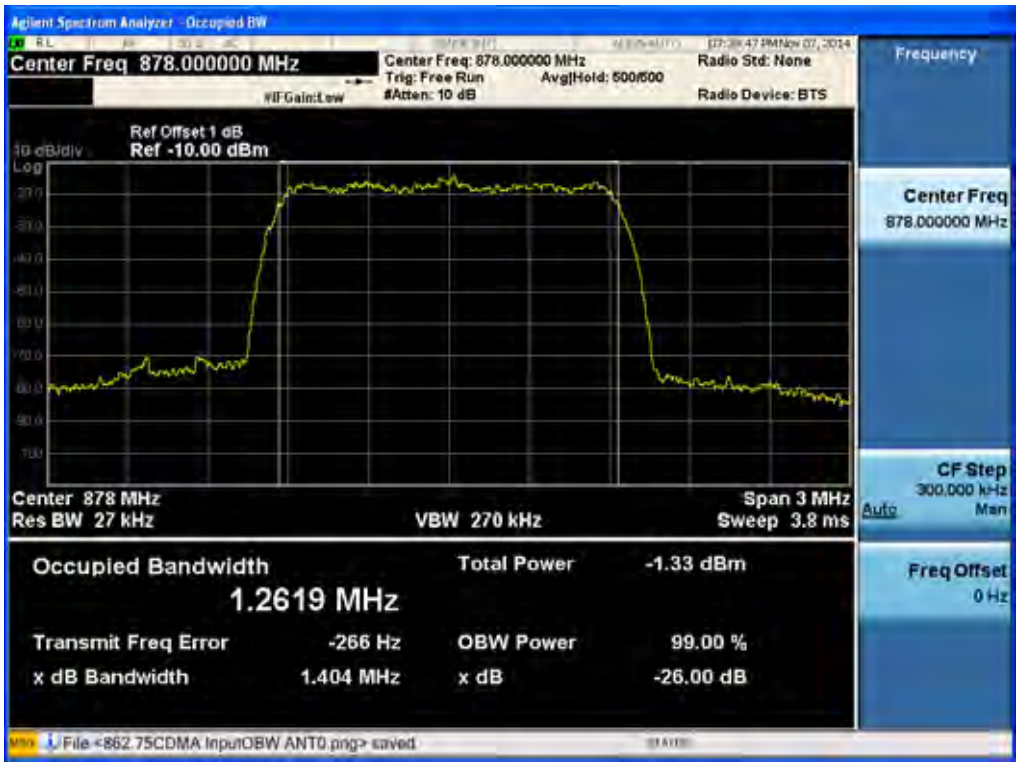
[Output WCDMA Downlink High]



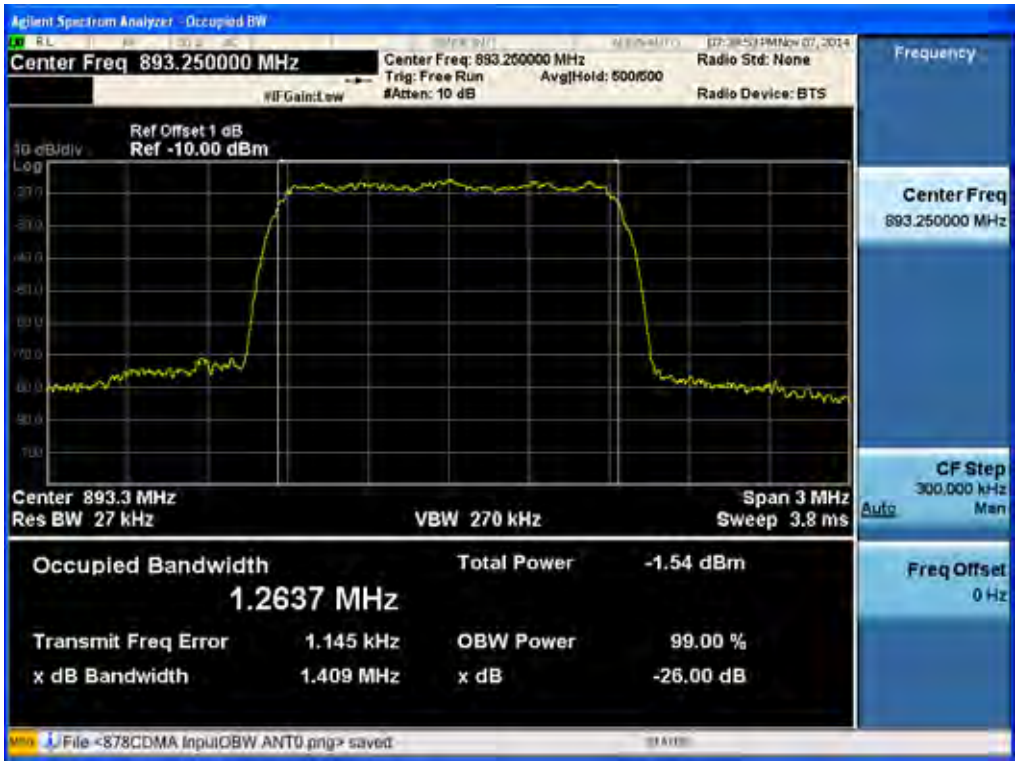
[Input CDMA Downlink Low]



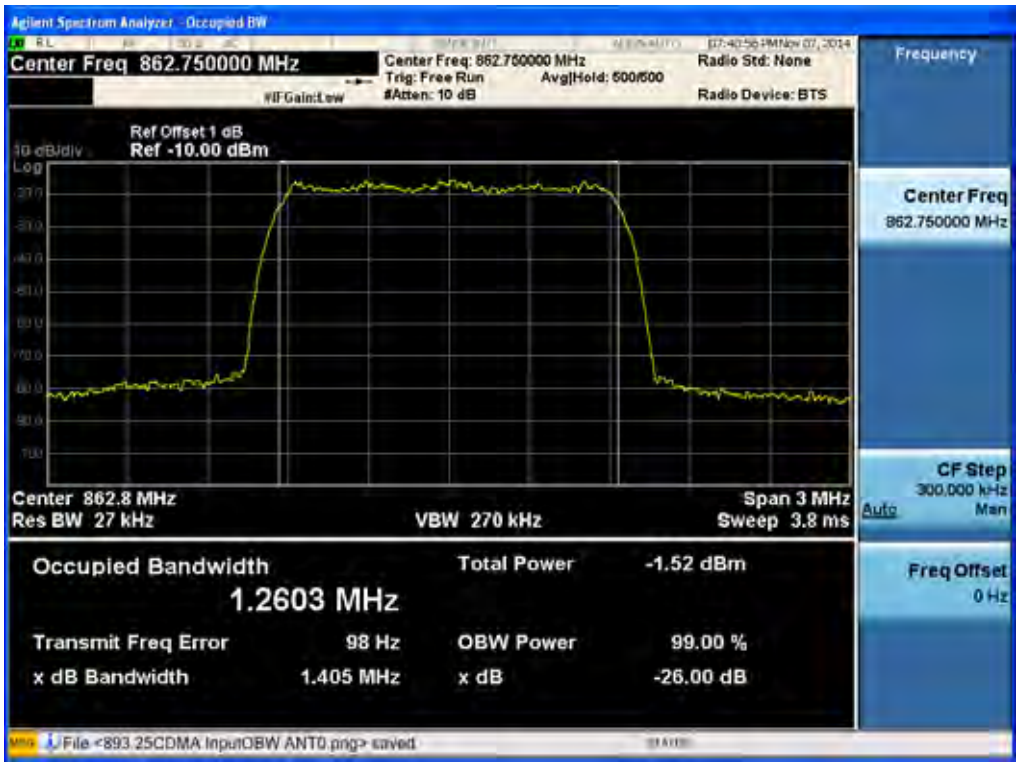
[Input CDMA Downlink Middle]



[Input CDMA Downlink High]



[Input EVDO Downlink Low]



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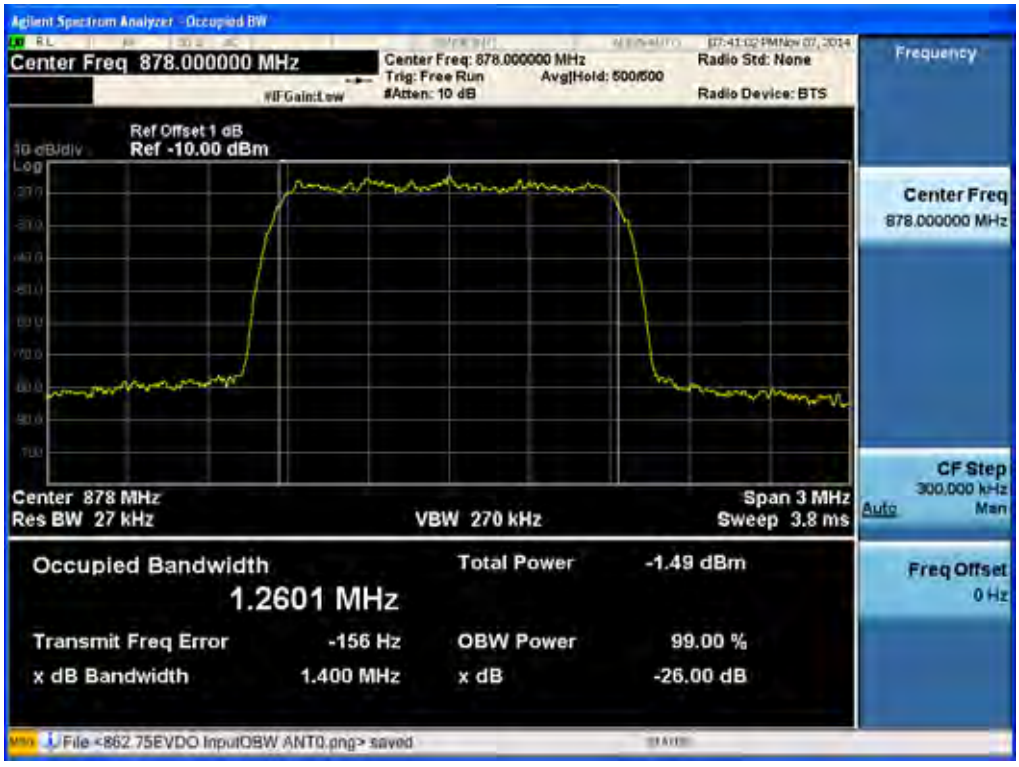
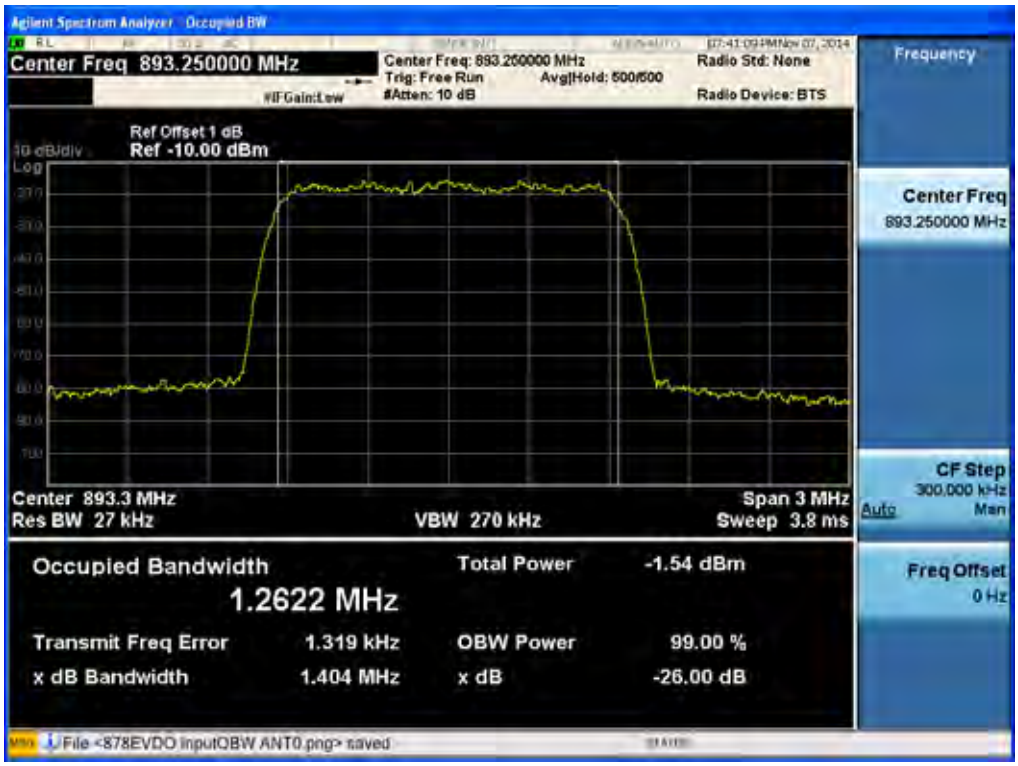
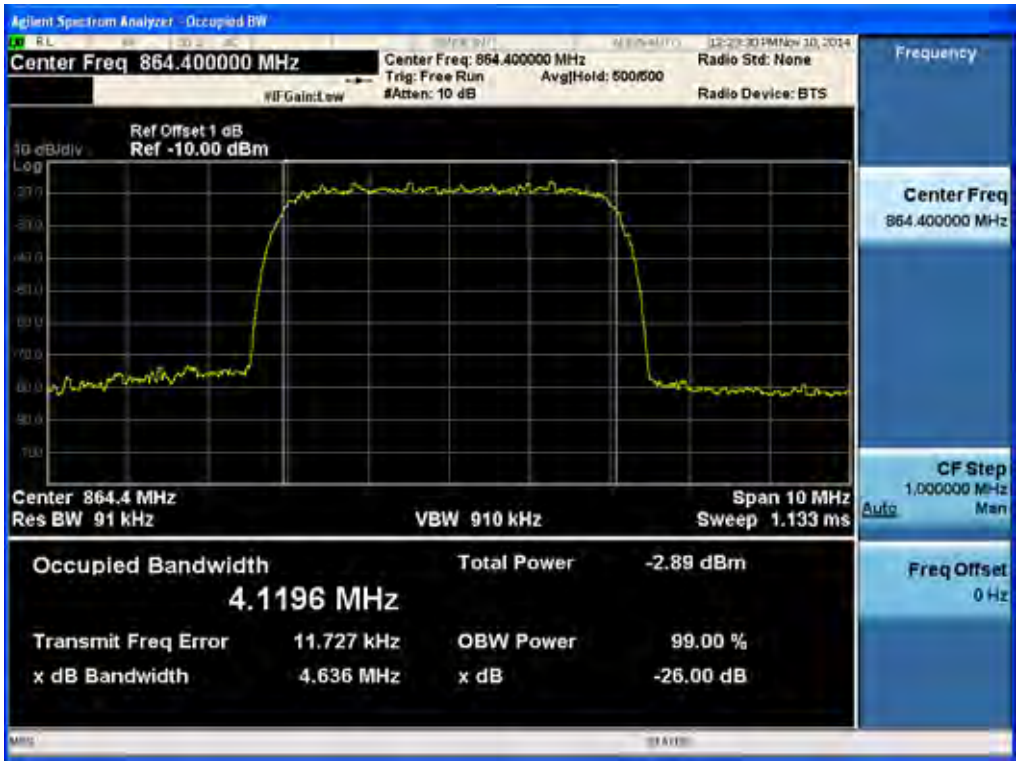


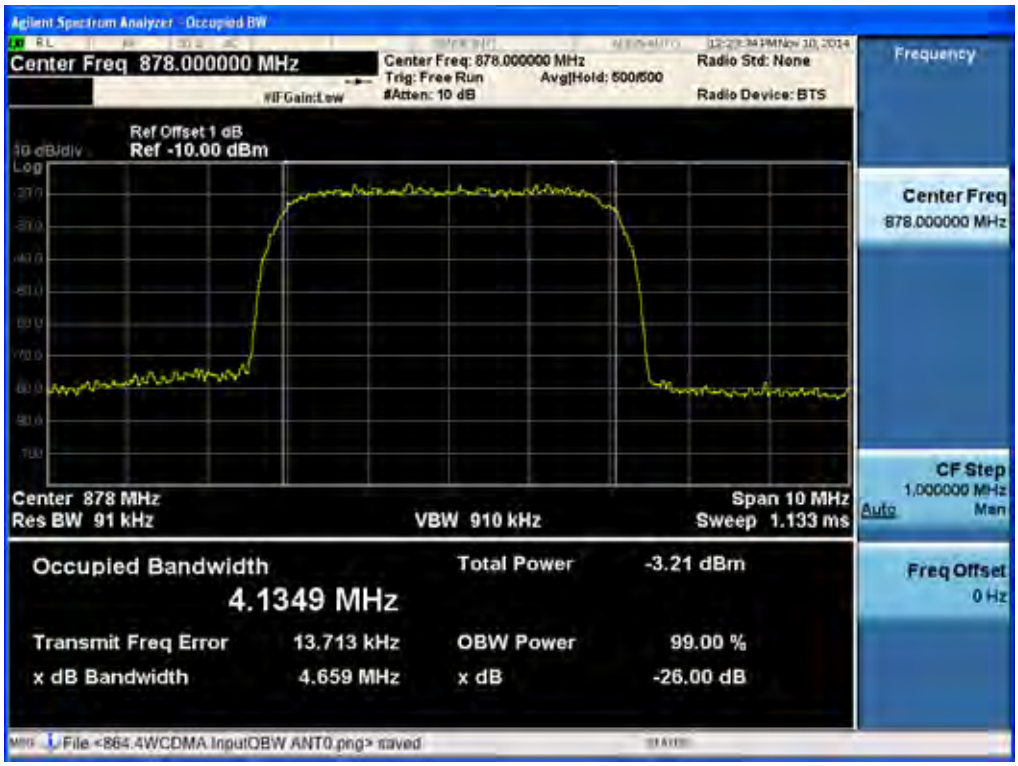
[Input EVDO Downlink High]



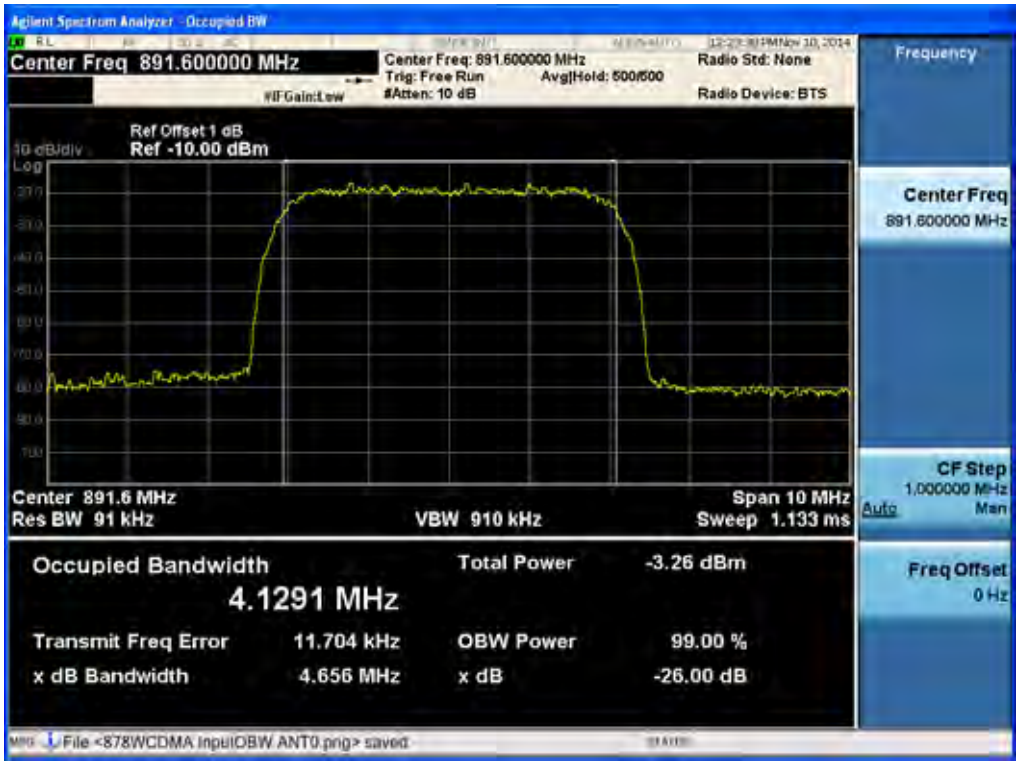
[Input WCDMA Downlink Low]



[Input WCDMA Downlink Middle]

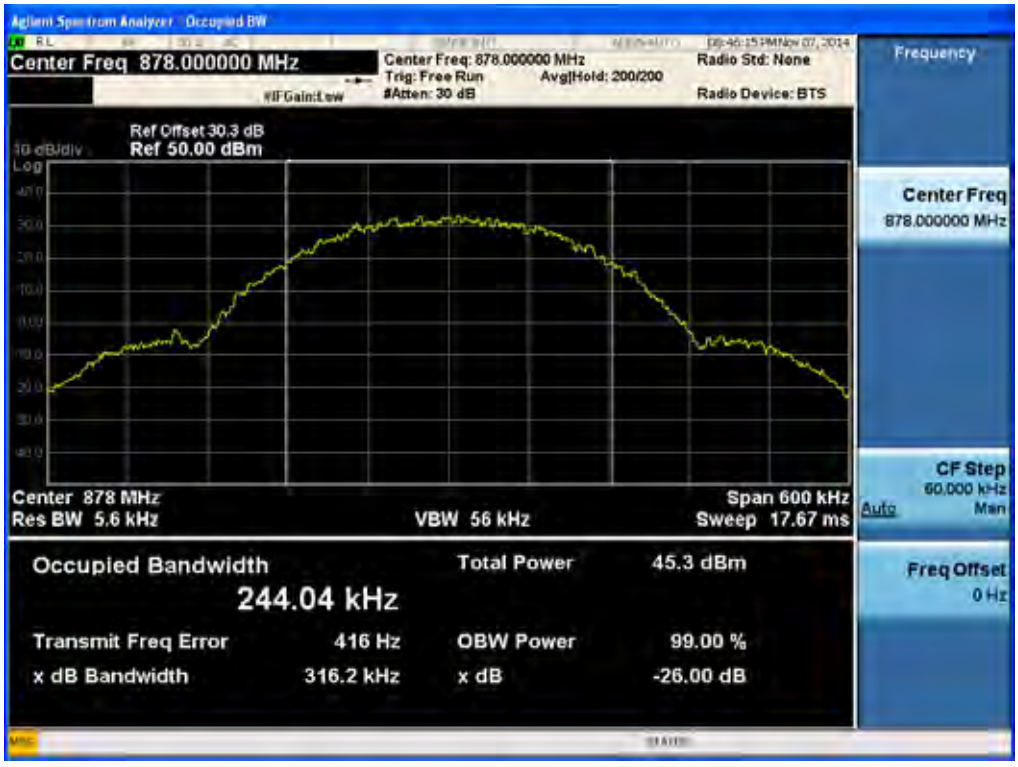


[Input WCDMA Downlink High]



[Output GSM Downlink Low]

[Output GSM Downlink Middle]



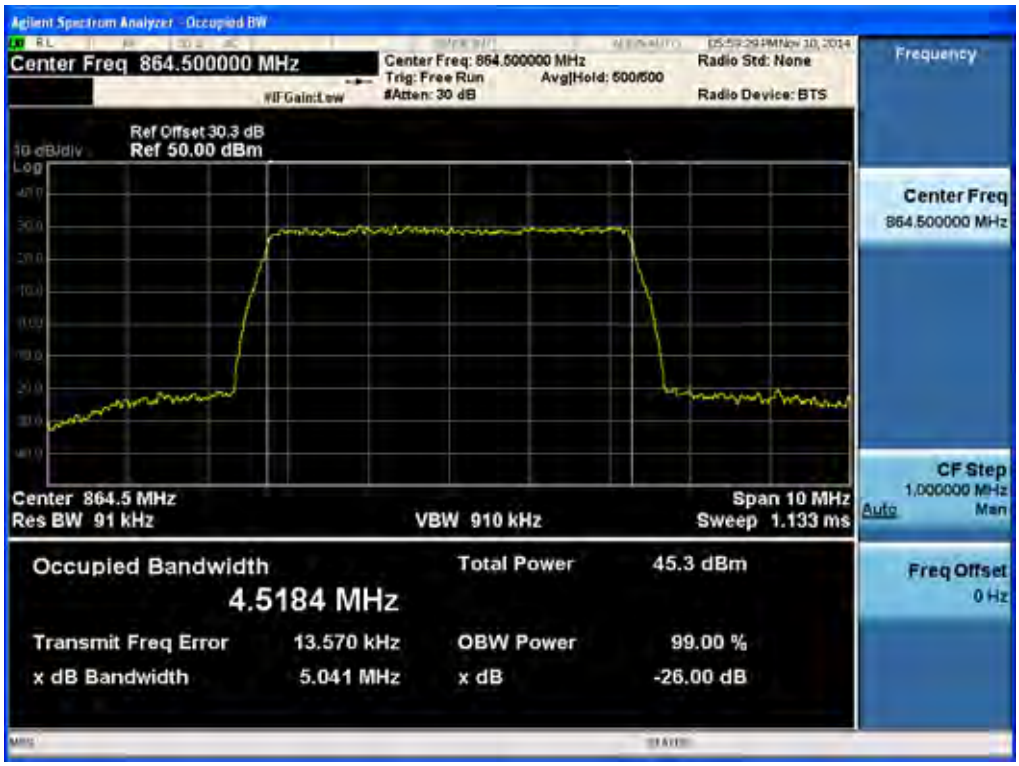
[Output GSM Downlink High]

[Output EDGE Downlink Low]

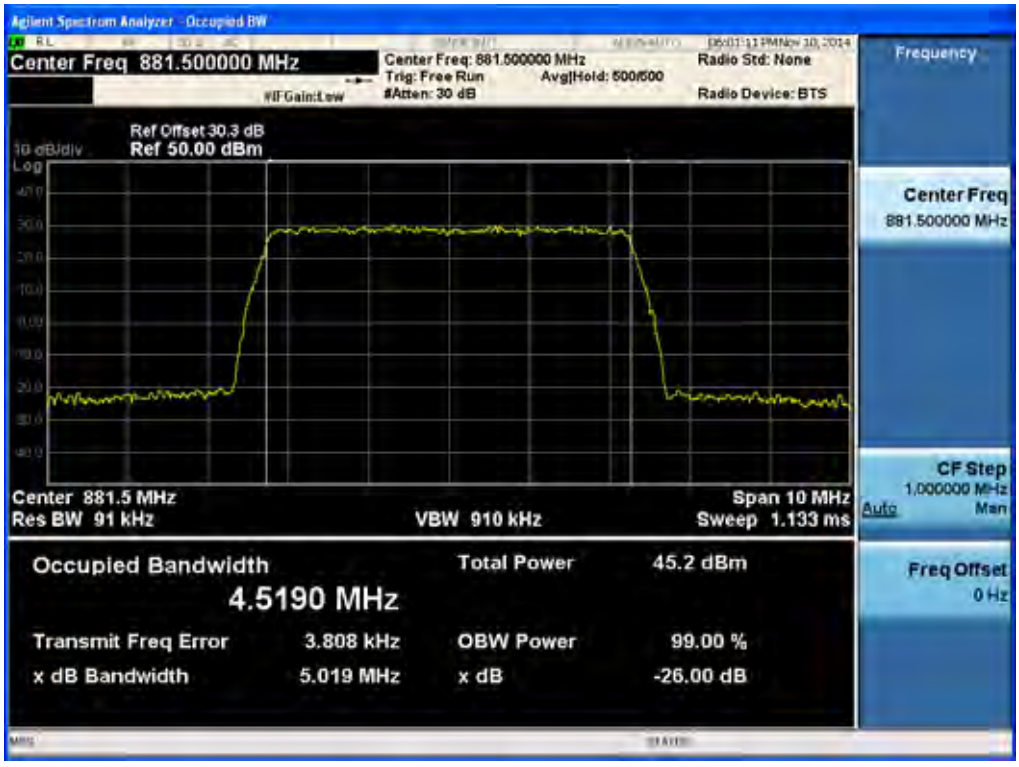
[Output EDGE Downlink Middle]

[Output EDGE Downlink High]

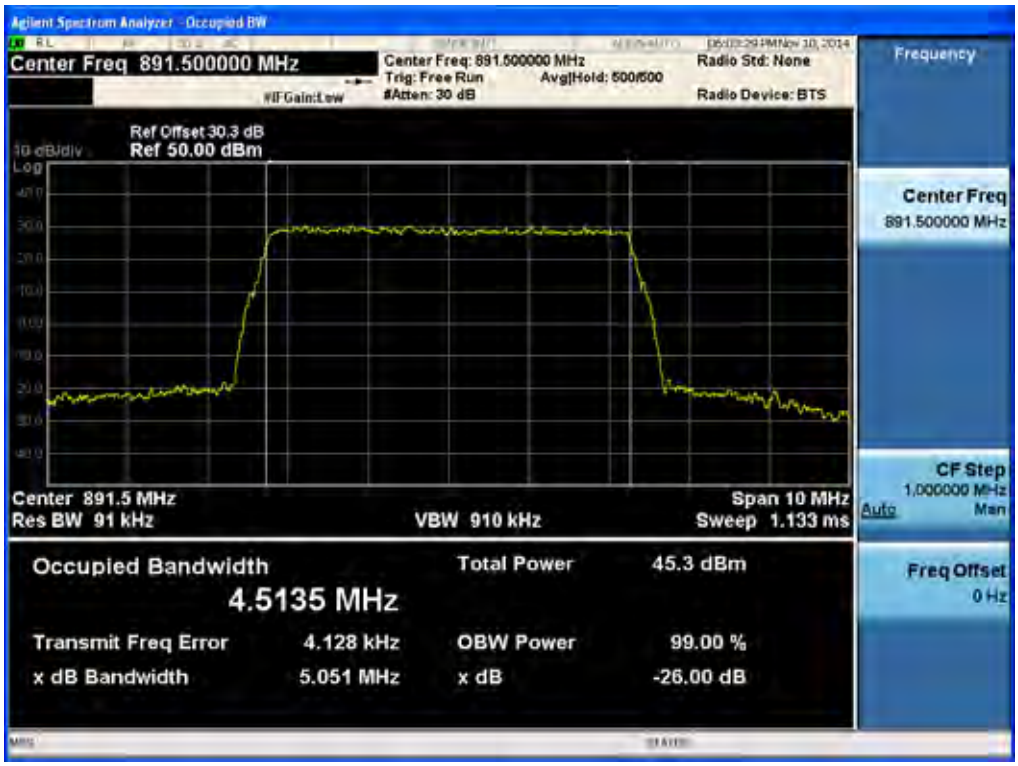
[Output LTE Downlink 5 MHz Low]



[Output LTE Downlink 5 MHz Middle]



[Output LTE Downlink 5 MHz High]



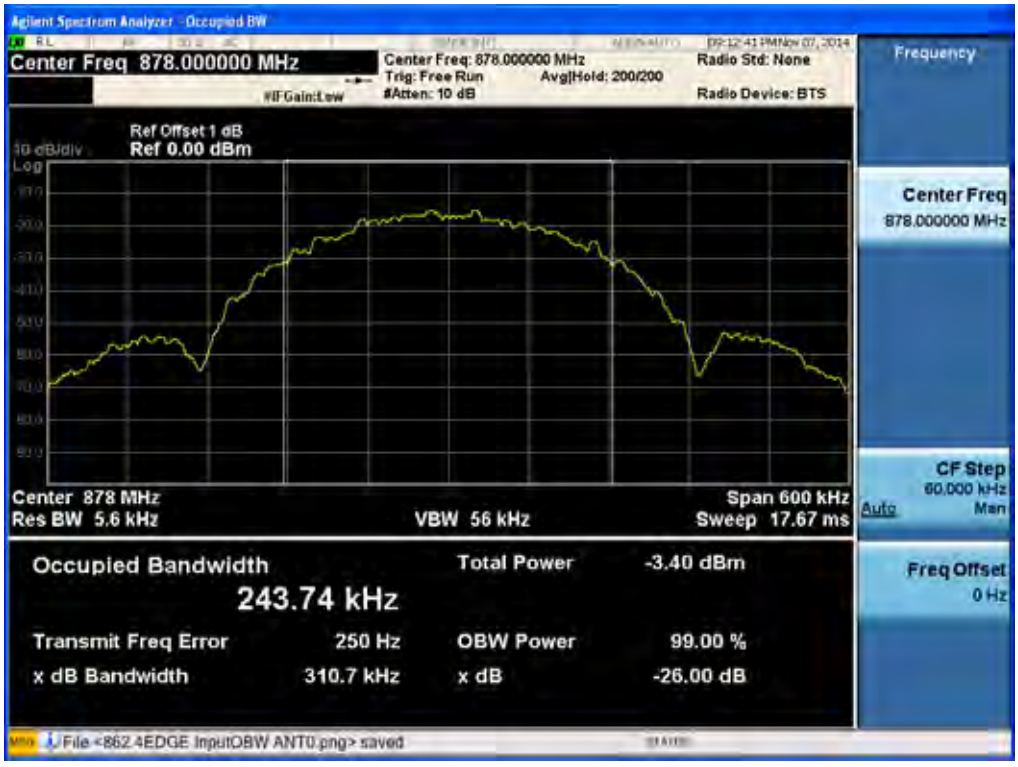
[Input GSM Downlink Low]

[Input GSM Downlink Middle]

[Input GSM Downlink High]

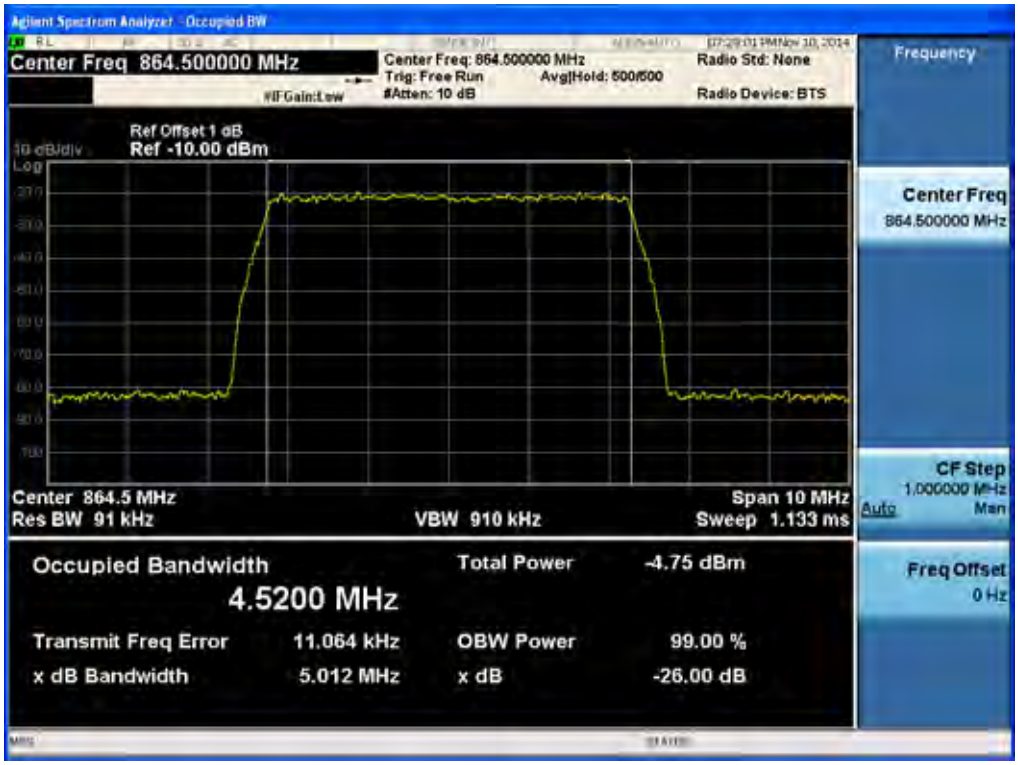
[Input EDGE Downlink Low]

[Input EDGE Downlink Middle]

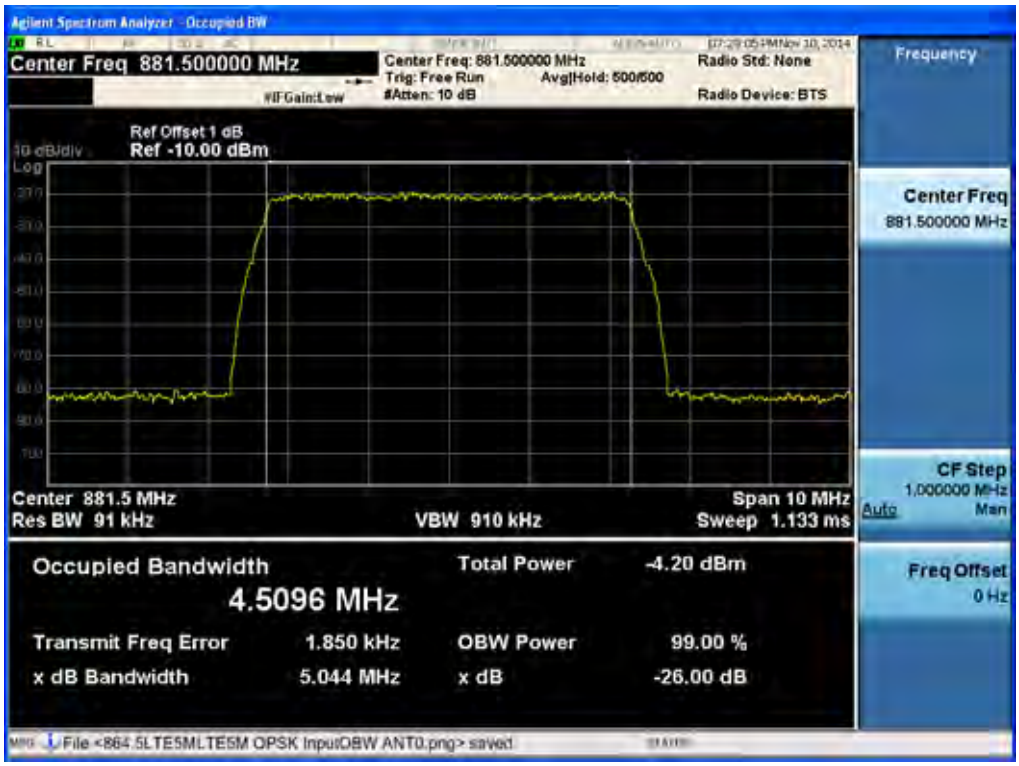


[Input EDGE Downlink High]

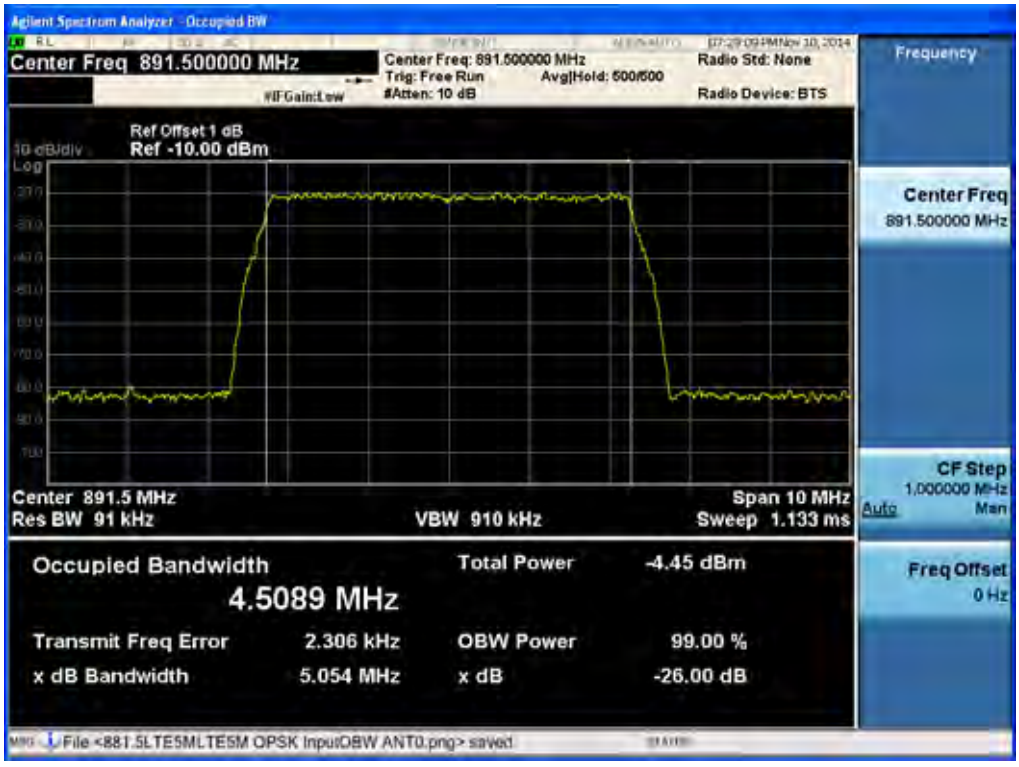
[Input LTE Downlink 5 MHz Low]



[Input LTE Downlink 5 MHz Middle]



[Input LTE Downlink 5 MHz High]



8. PASSBAND GAIN AND BANDWIDTH & 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

IC Rules

Test Requirements: RSS-131 6.1

The passband gain shall not exceed the nominal gain by more than 1.0 dB. The 20 dB bandwidth shall not exceed the nominal bandwidth that is stated by the manufacturer. Outside of the 20 dB bandwidth, the gain shall not exceed the gain at the 20 dB point.

Test Procedures: RSS-131 4.2

Adjust the internal gain control of the equipment under test to the nominal gain for which equipment certification is sought.

With the aid of a signal generator and spectrum analyzer, measure the 20 dB bandwidth of the amplifier (i.e. at the point where the gain has fallen by 20 dB). Measure the gain-versus-frequency response of the amplifier from the midband frequency f0 of the passband up to at least f0 + 250% of the 20 dB bandwidth.

Signal generator sweep from the frequency more lower than the low frequency -250% to the frequency more higher than high frequency +250%.

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

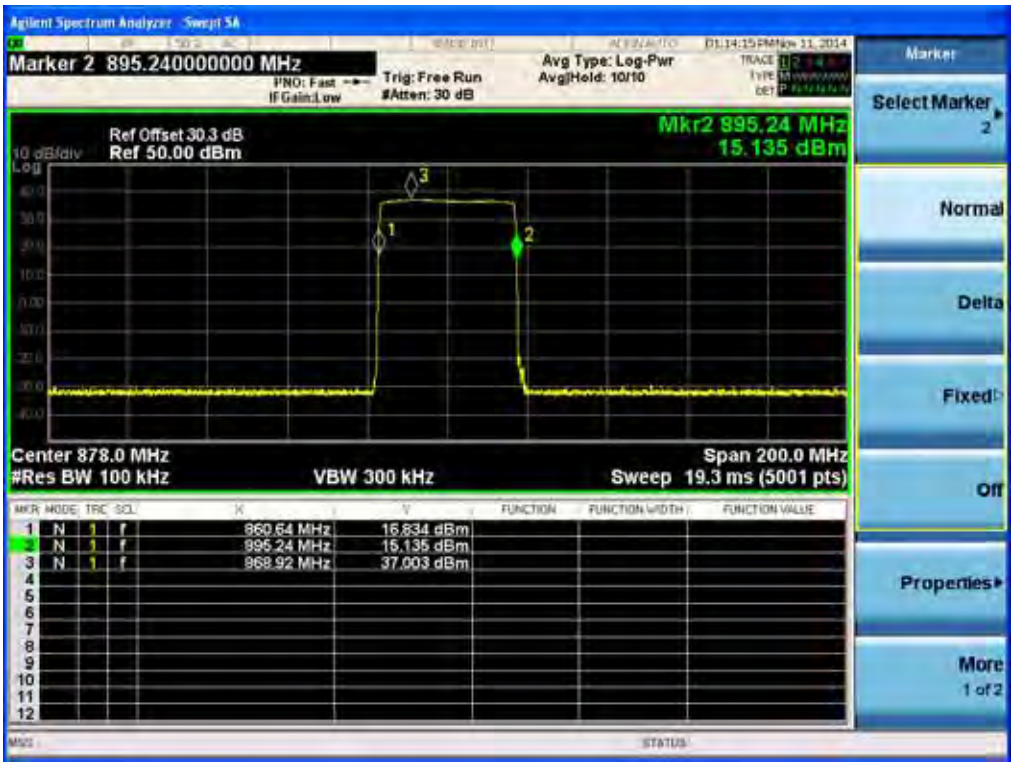
Input Level (dBm) Input Signal : Sinusoidal	Maximum Amp Gain
DL : -10 dBm	DL : 47 dB

[Downlink]

20 dB point frequency (MHz)	Output power (dBm)	Gain (dB)
860.64 ~ 895.24 MHz	37.00	47.00

Plots of Passband Gain and Bandwidth & Out of Band Rejection

[Downlink]



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.

§ 22.917 Emission limitations for cellular equipment.

The rules in this section govern the spectral characteristics of emissions in the Cellular Radiotelephone Service.

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

(b) Measurement procedure. Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 100 kHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

(c) Alternative out of band emission limit. Licensees in this service may establish an alternative out of band emission limit to be used at specified band edge(s) in specified geographical areas, in lieu of that set forth in this section, pursuant to a private contractual arrangement of all affected licensees and applicants. In this event, each party to such contract shall maintain a copy of the contract in their station files and disclose it to prospective assignees or transferees and, upon request, to the FCC.

(d) Interference caused by out of band emissions. If any emission from a transmitter operating in this service results in interference to users of another radio service, the FCC may require a greater attenuation of that emission than specified in this section.

§ 90.691 Emission mask requirements for EA-based systems.

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

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

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

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

*** 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

IC Rules

Test Requirement(s): RSS-131 6.4

Spurious emissions of zone enhancers and translators shall be suppressed as much as possible. Spurious emissions shall be attenuated below the rated power of the enhancer by at least:
43 + 10 Log10(Prated in watts), or 70 dB, whichever is less stringent.
Note: If the minimum standard is not met, check to see if the input signal generators have a high harmonic content.

Test Procedures: RSS-131 4.4

4.4.1 Multi-channel Enhancer

The spurious emissions of the equipment under test shall be measured using the two-tone method in section 4.3.1, with the two tones Po1 and Po2 set to the required levels.
Using a spectrum analyser with a resolution bandwidth set at 100 kHz, search for spurious emissions from 30 MHz to at least 5 times the highest RF passband frequency. The search may omit the band that contains the test tones and intermodulation products.

4.4.2 Single channel Enhancer

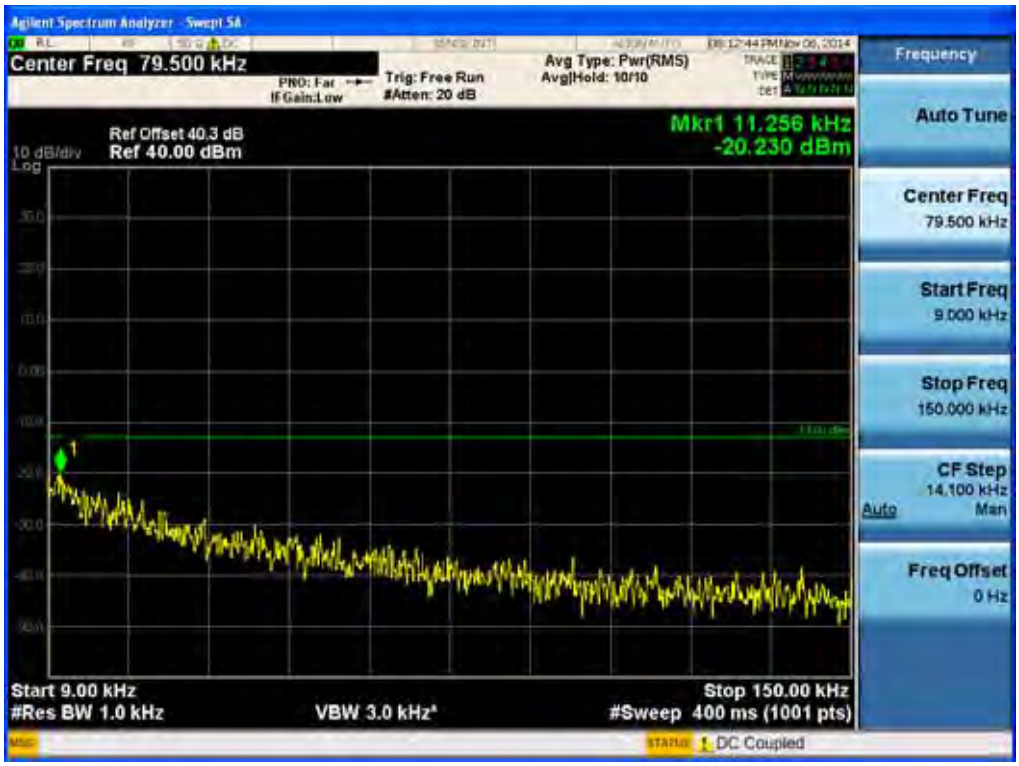
The enhancer shall be operated as described in section 4.3.2 during the search for spurious emissions.
Using a spectrum analyser with a resolution bandwidth set at 100 kHz, search for spurious emissions from 30 MHz to at least 5 times the highest RF passband frequency. The search may omit the band that contains the input signal.

Single channel Enhancer Plots of Spurious Emission

Conducted Spurious Emissions (9 kHz – 150 kHz)

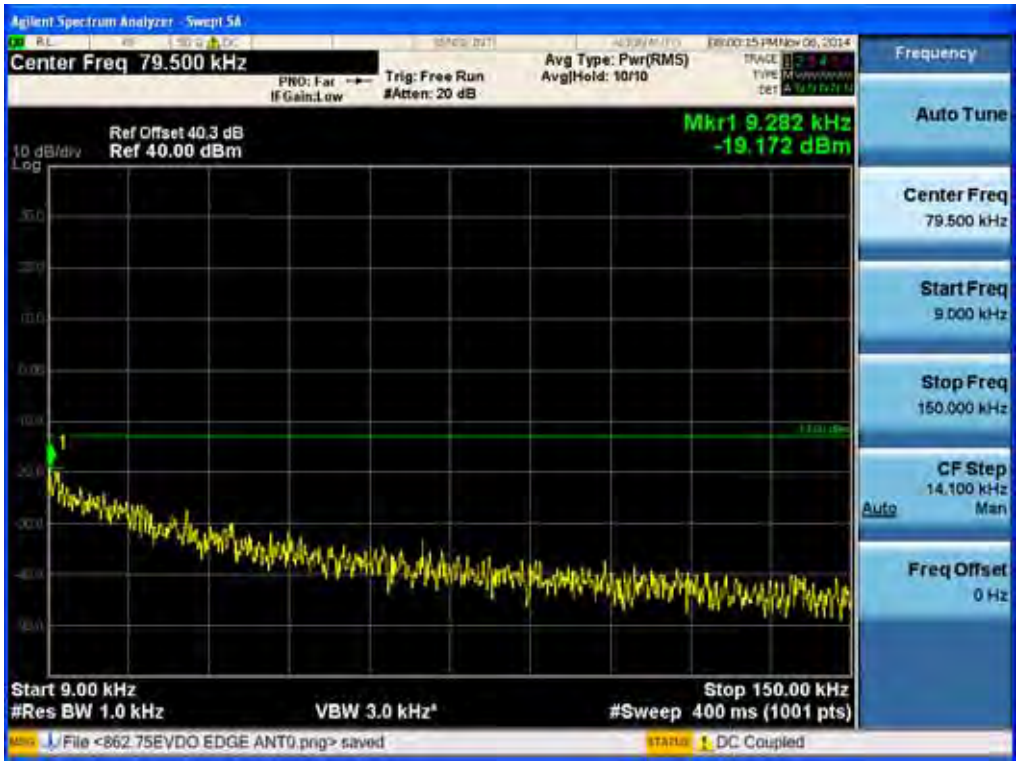
[CDMA Downlink Low]

[CDMA Downlink Middle]

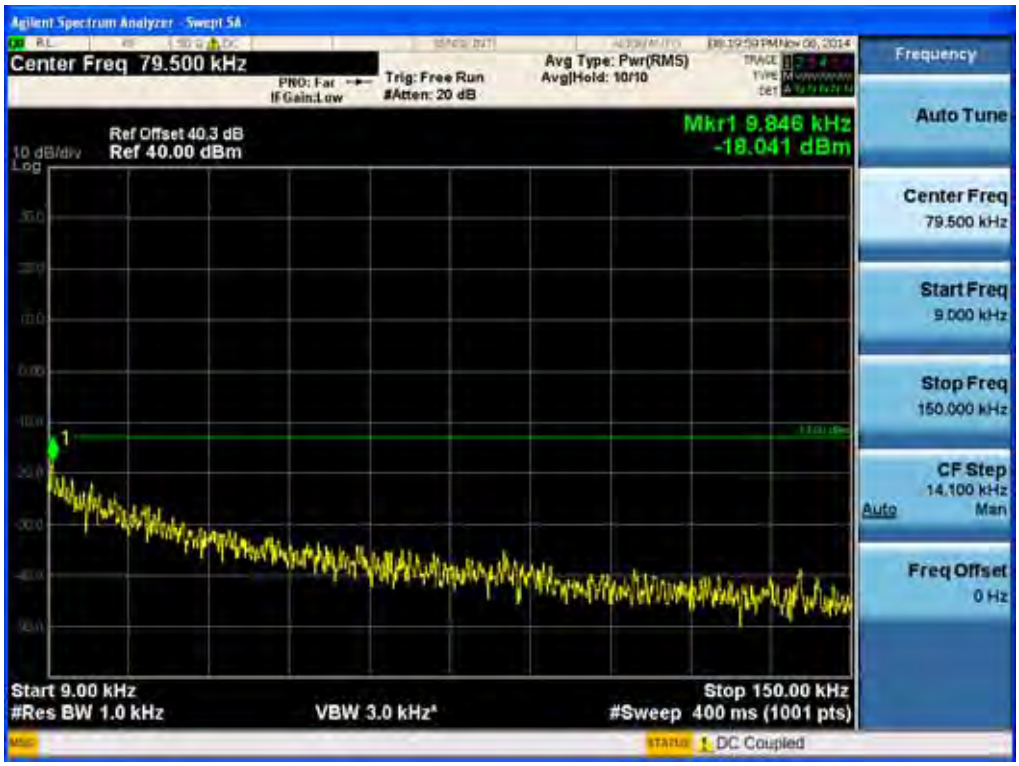


[CDMA Downlink High]

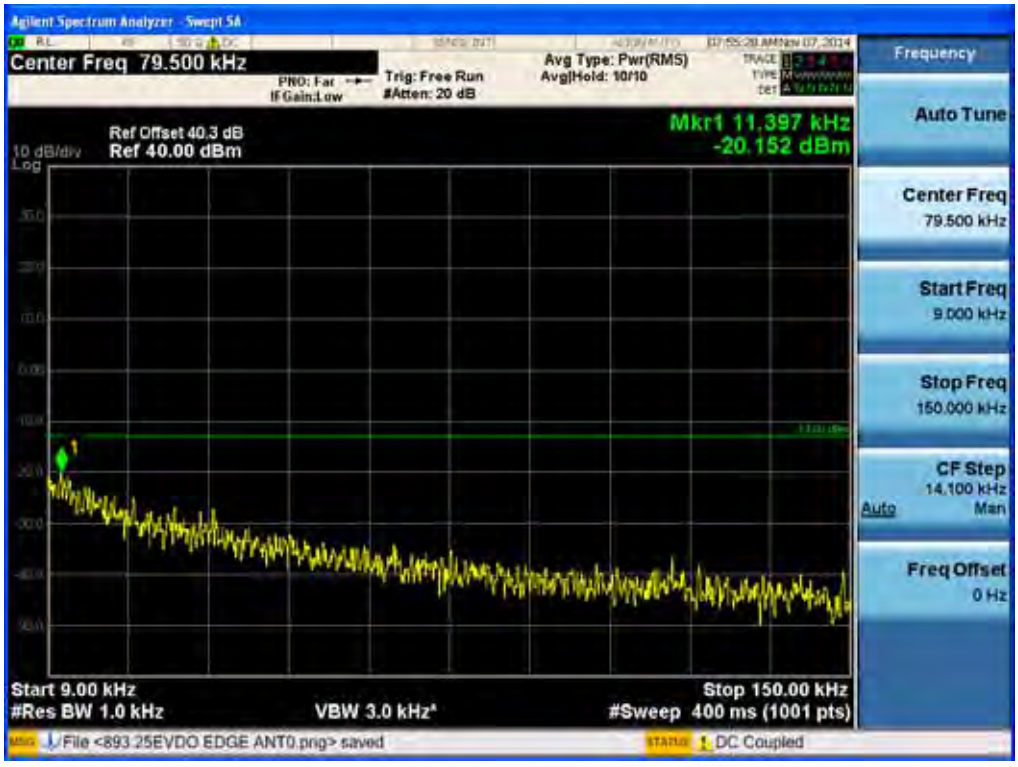
[EVDO Downlink Low]



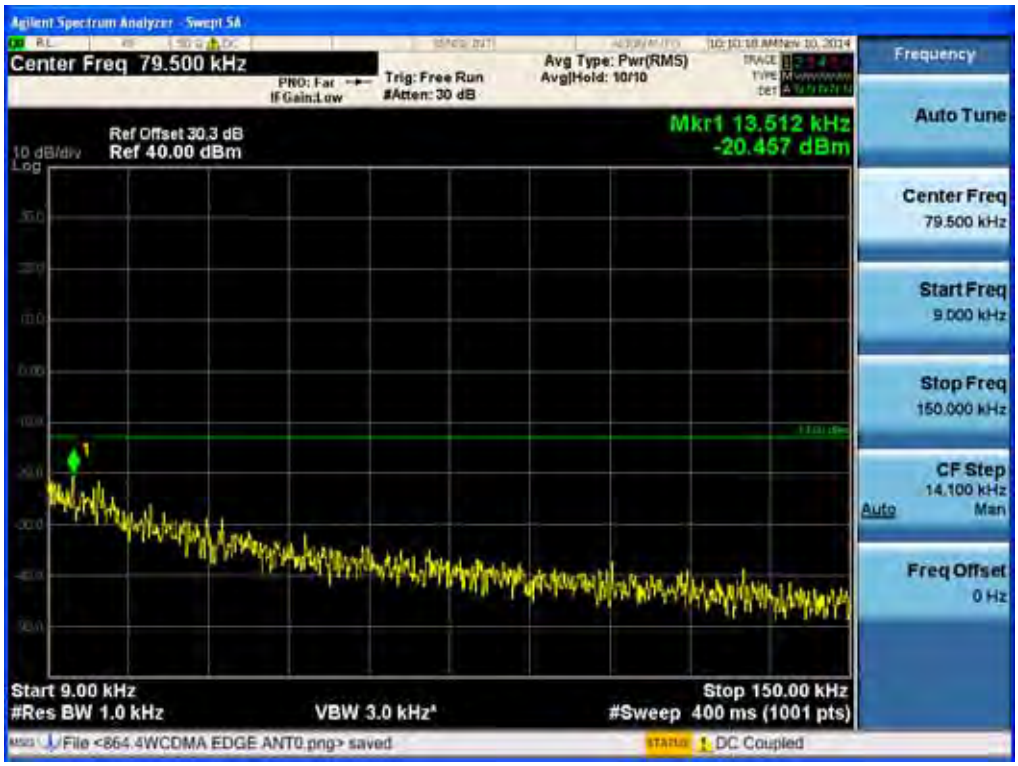
[EVDO Downlink Middle]



[EVDO Downlink High]

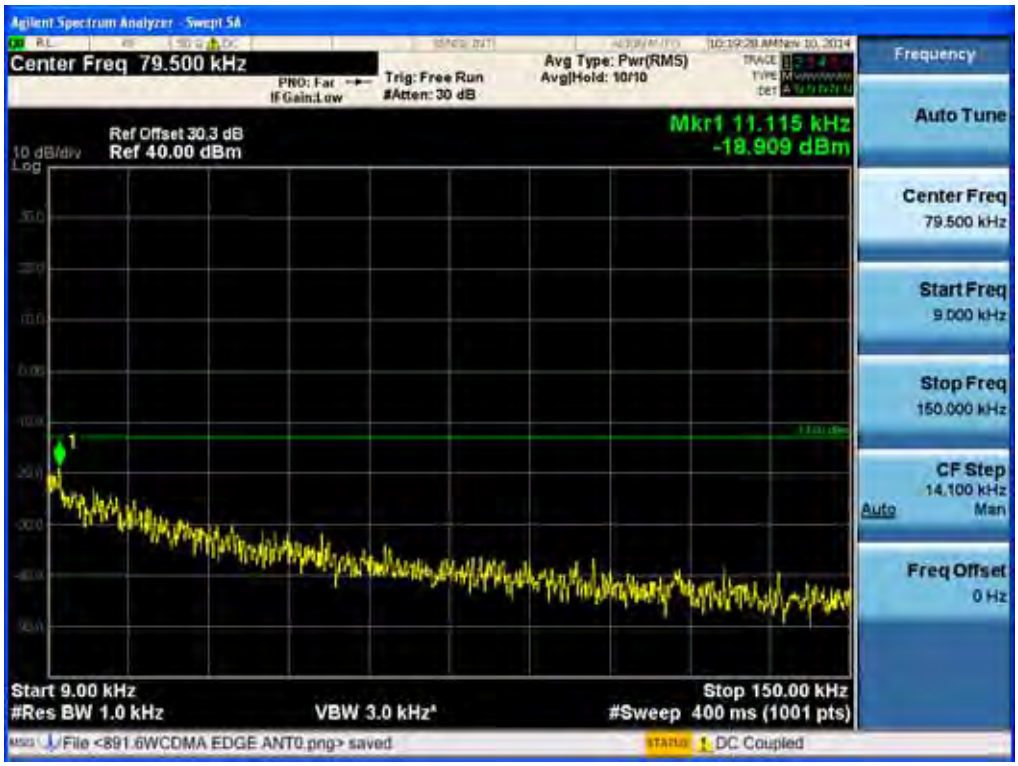


[WCDMA Downlink Low]



[WCDMA Downlink Middle]

[WCDMA Downlink High]



[GSM Downlink Low]

[GSM Downlink Middle]

[GSM Downlink High]

[EDGE Downlink Low]

[EDGE Downlink Middle]

[EDGE Downlink High]

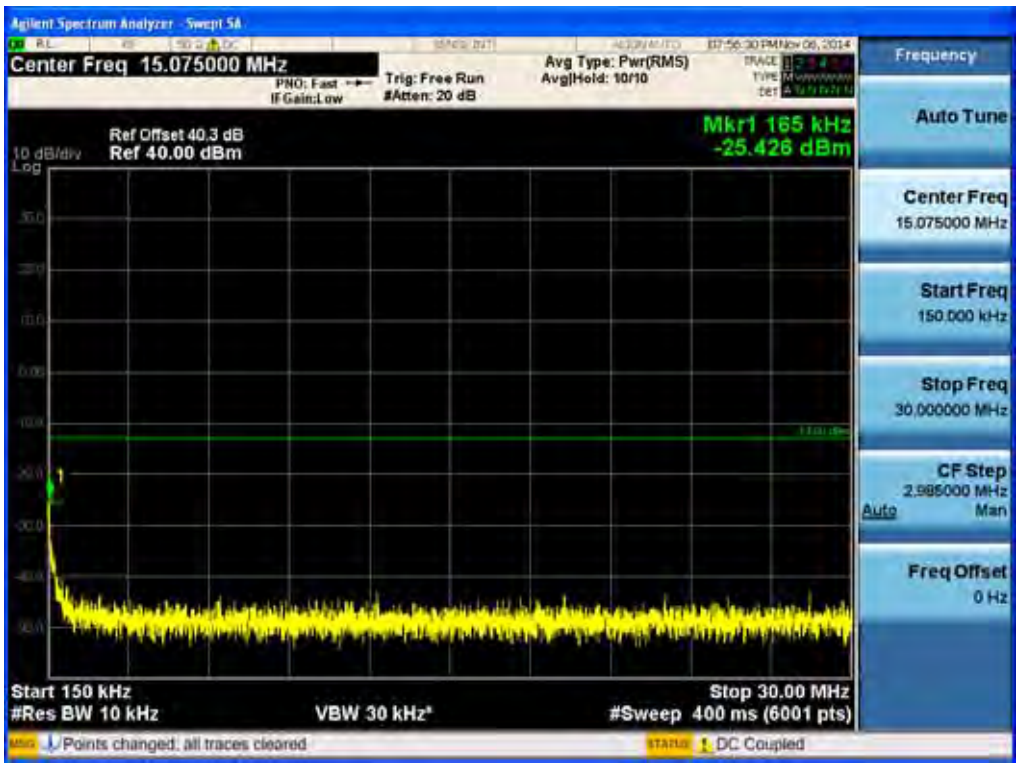
[LTE Downlink 5MHz Low]

[LTE Downlink 5MHz Middle]

[LTE Downlink 5MHz High]

Conducted Spurious Emissions (150 kHz – 30 MHz)

[CDMA Downlink Low]



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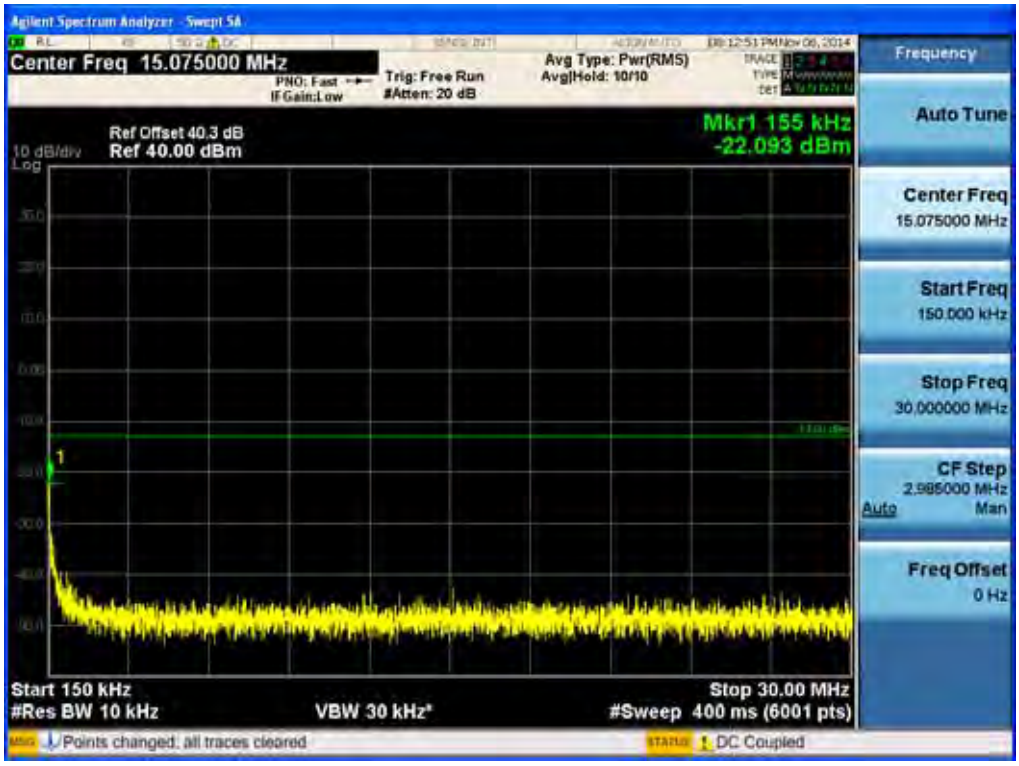

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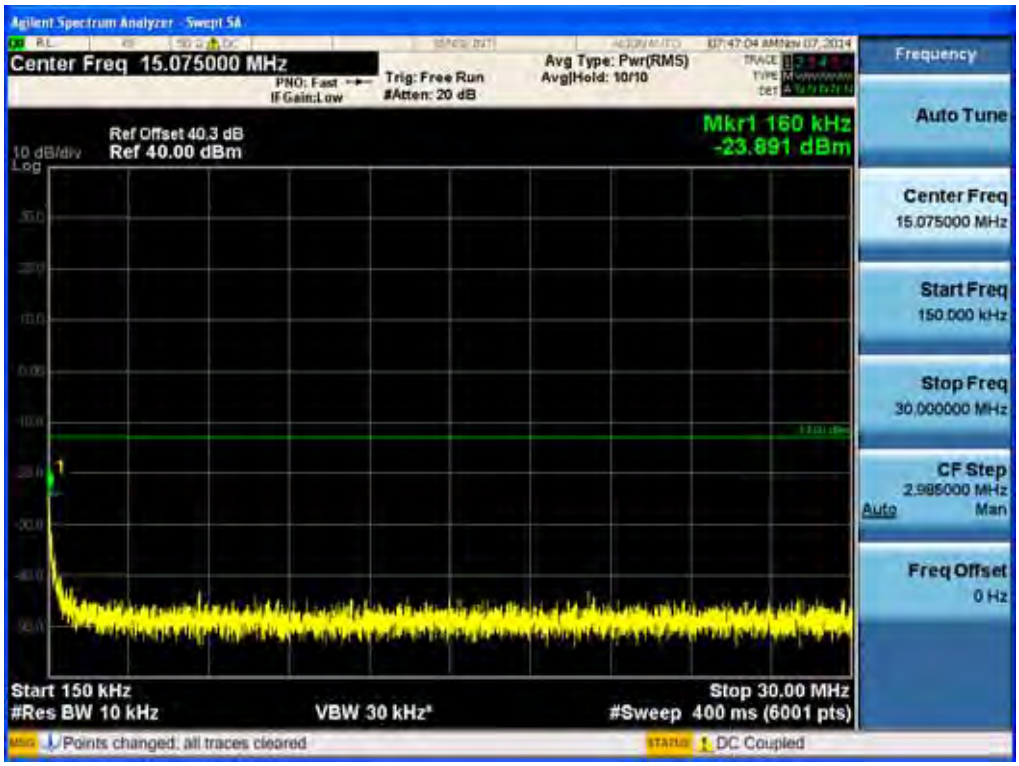

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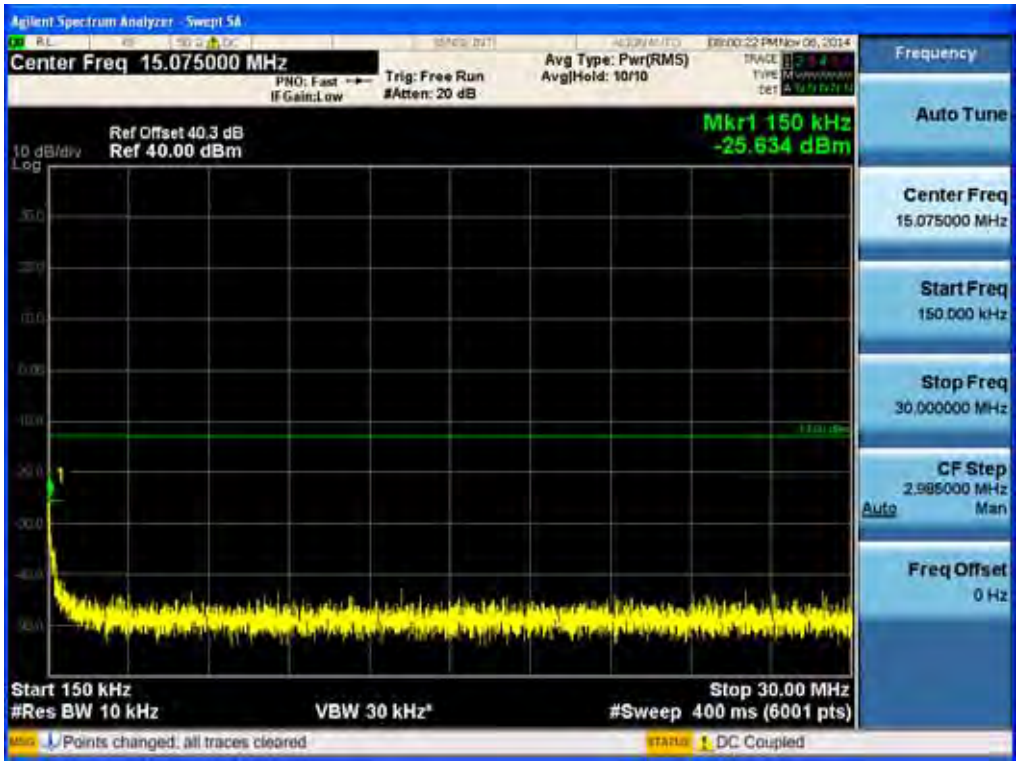
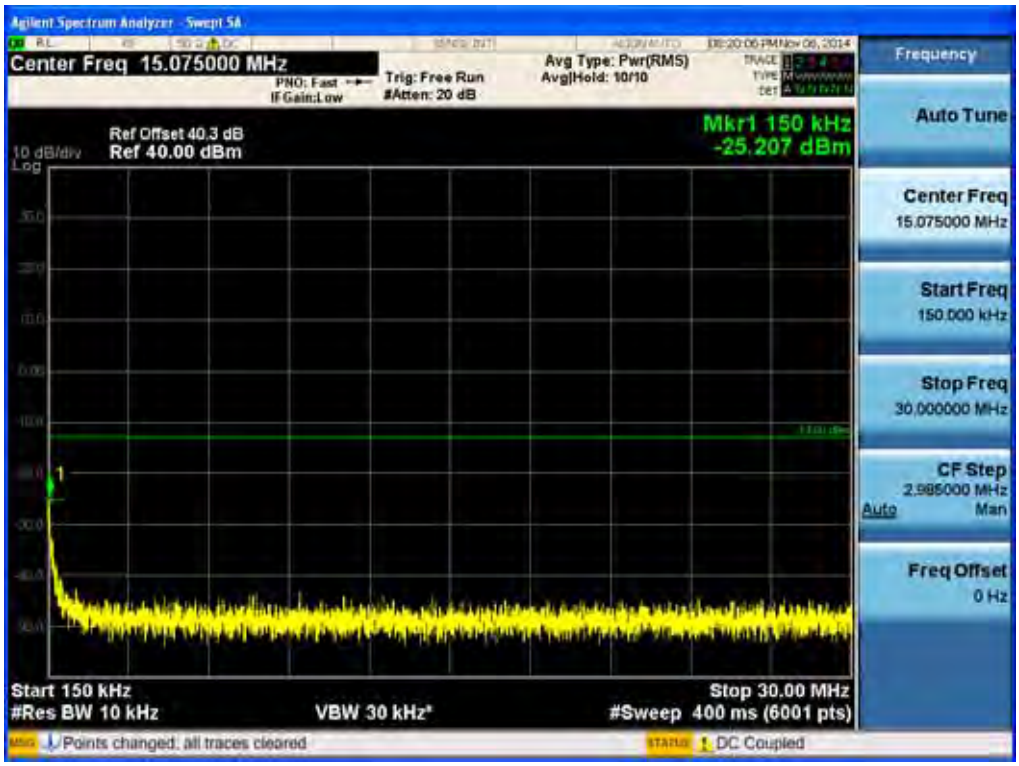
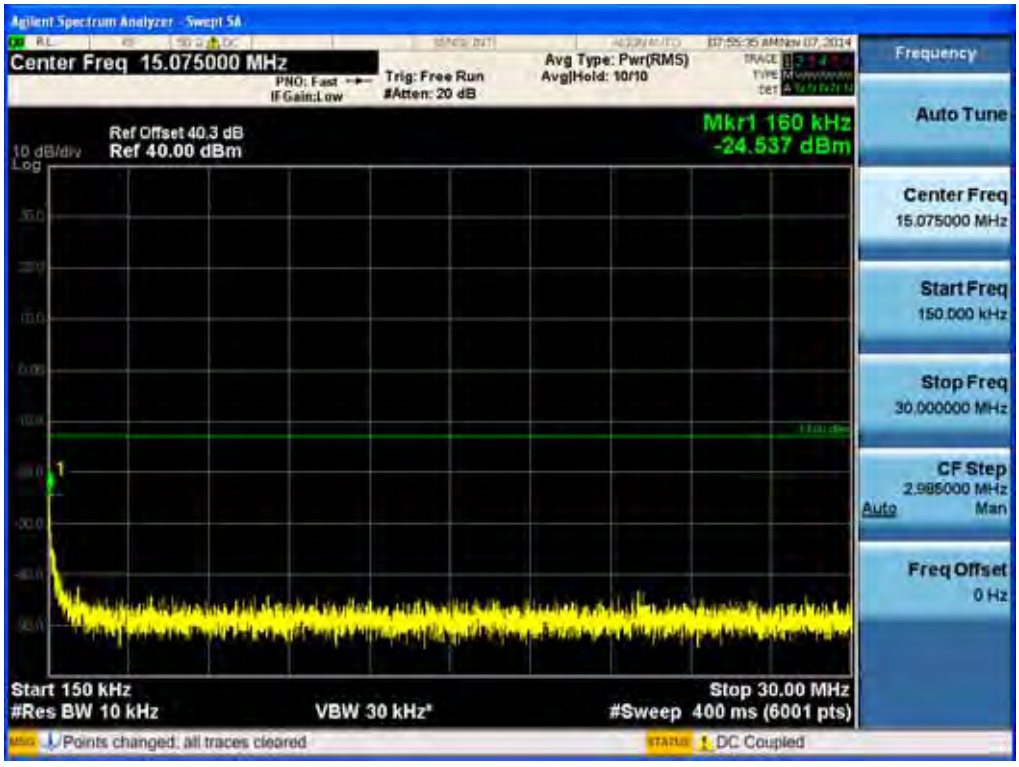


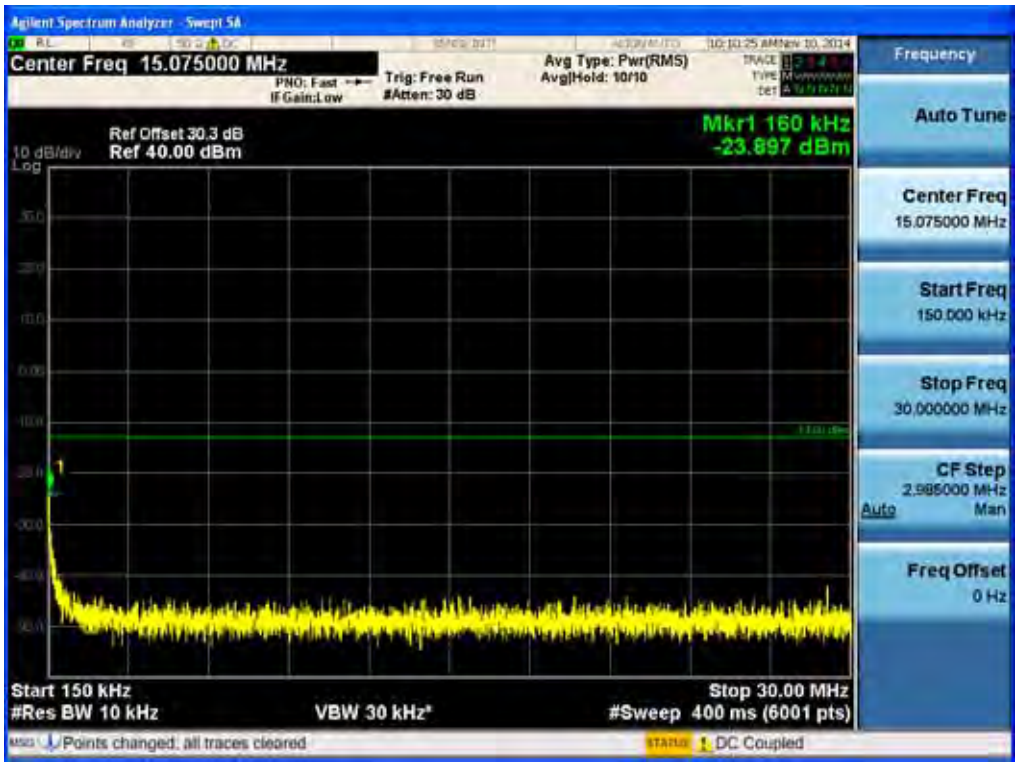
[EVDO Downlink Middle]



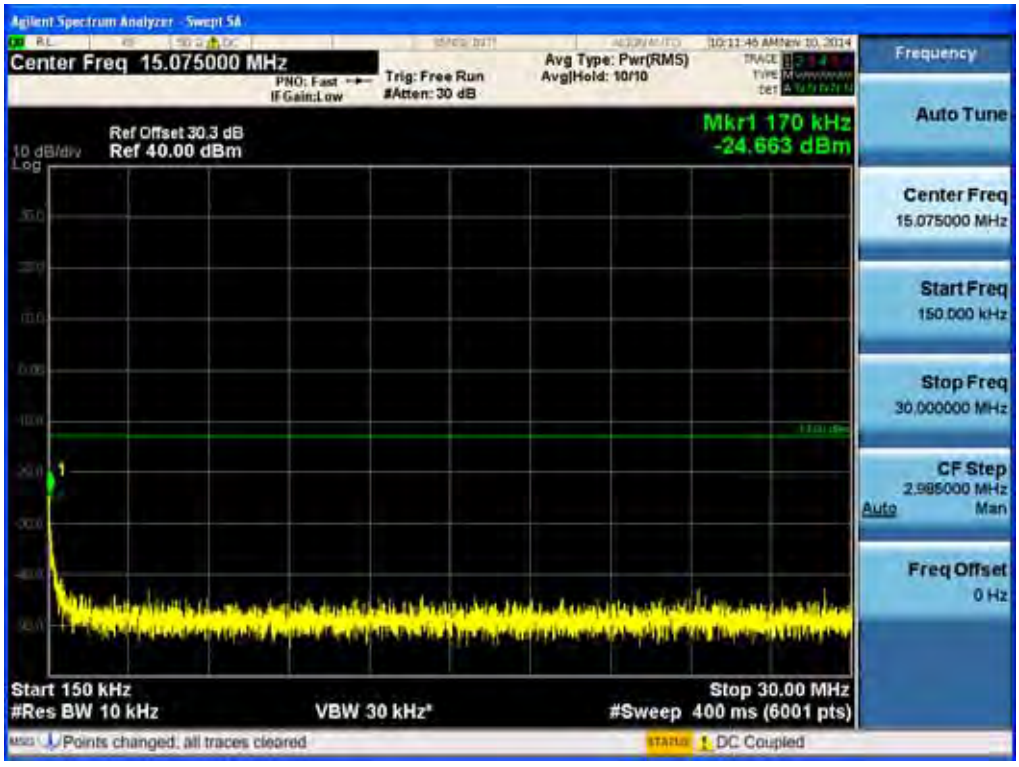
[EVDO Downlink High]



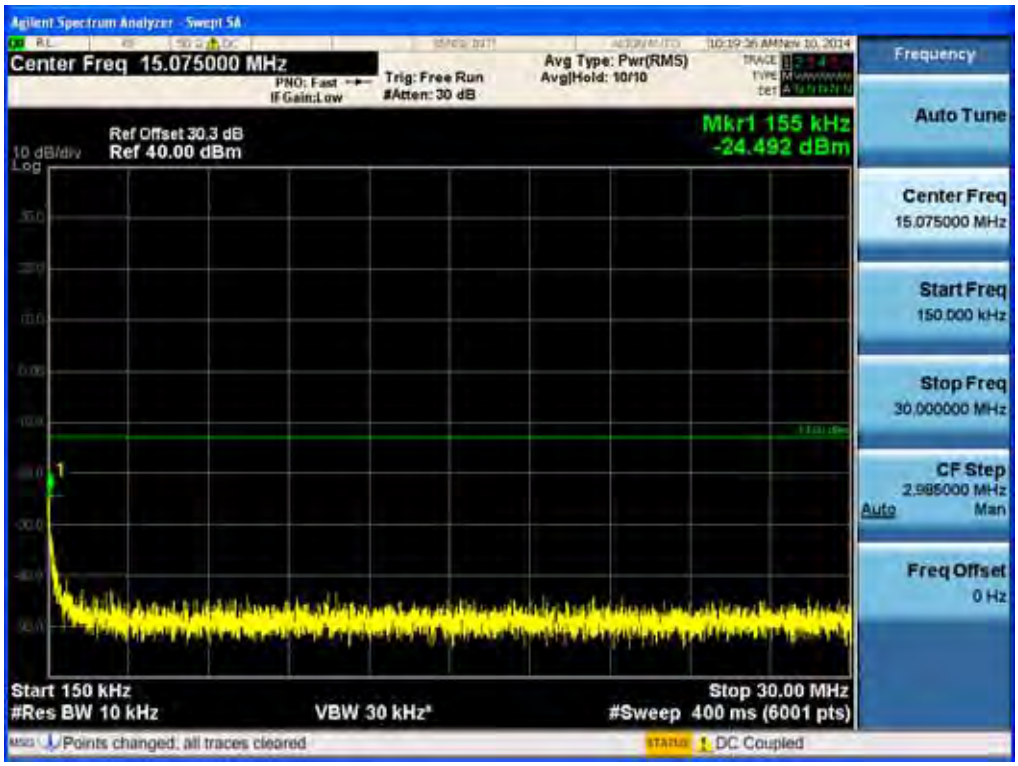
[WCDMA Downlink Low]



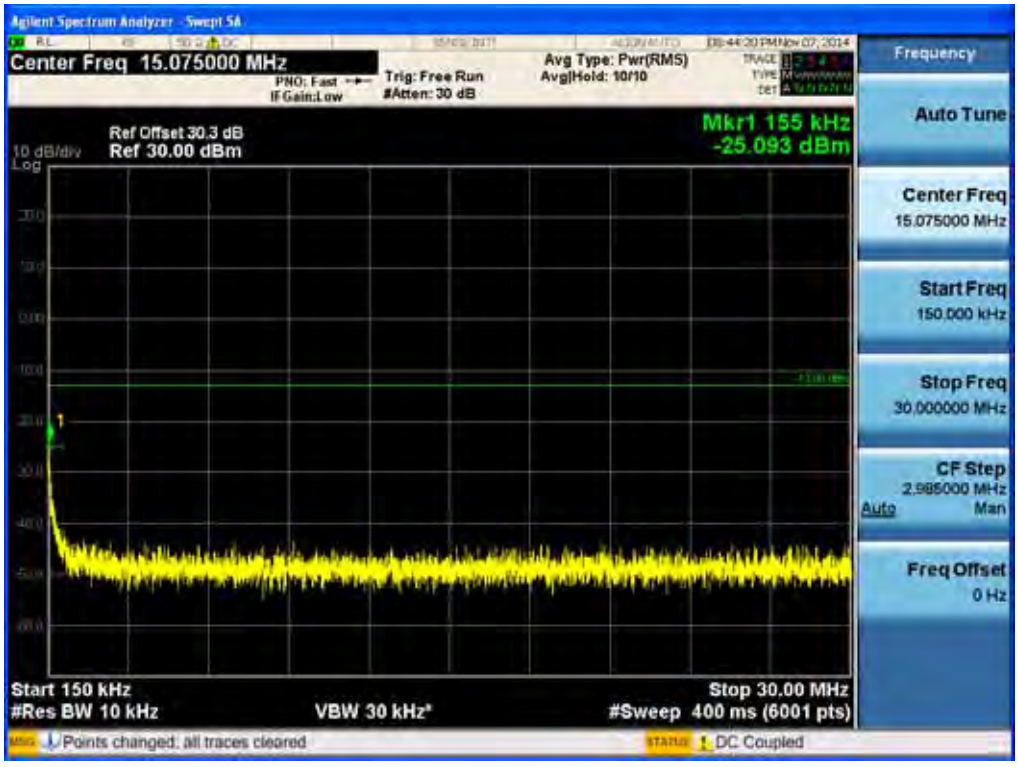
[WCDMA Downlink Middle]



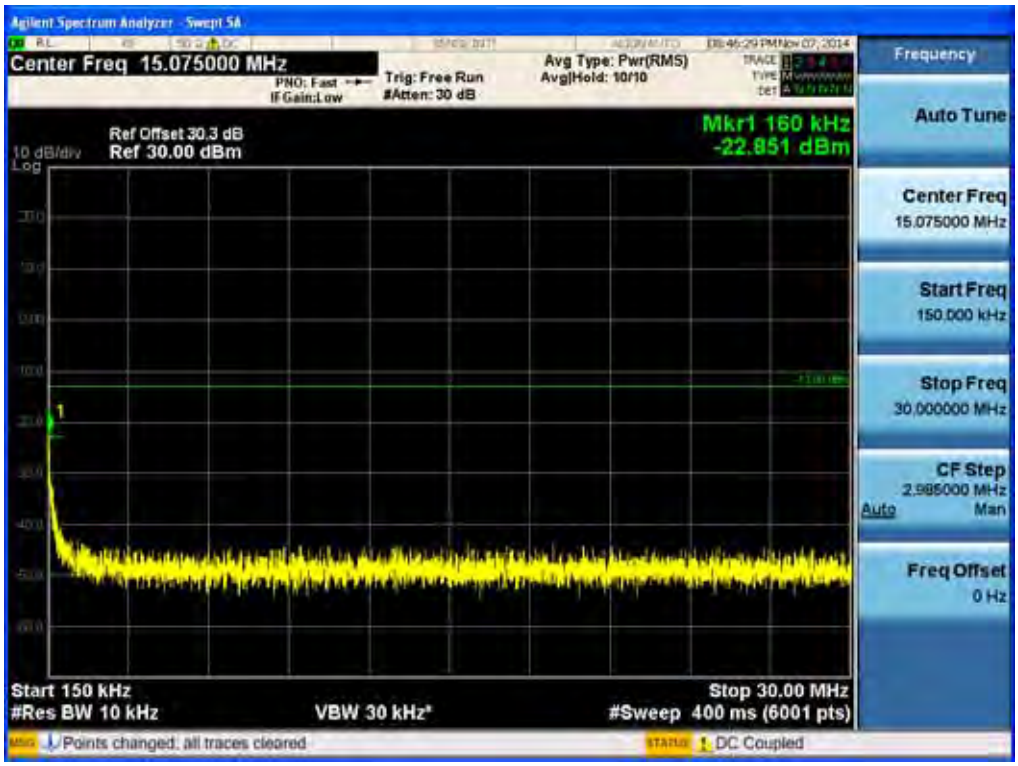
[WCDMA Downlink High]



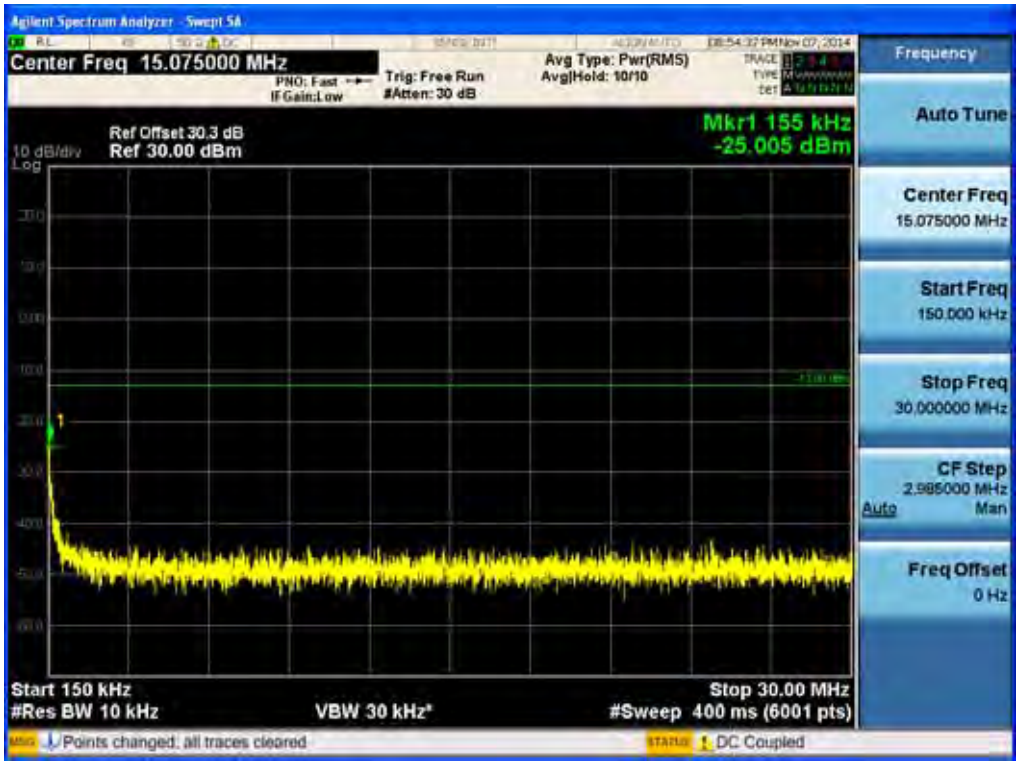
[GSM Downlink Low]



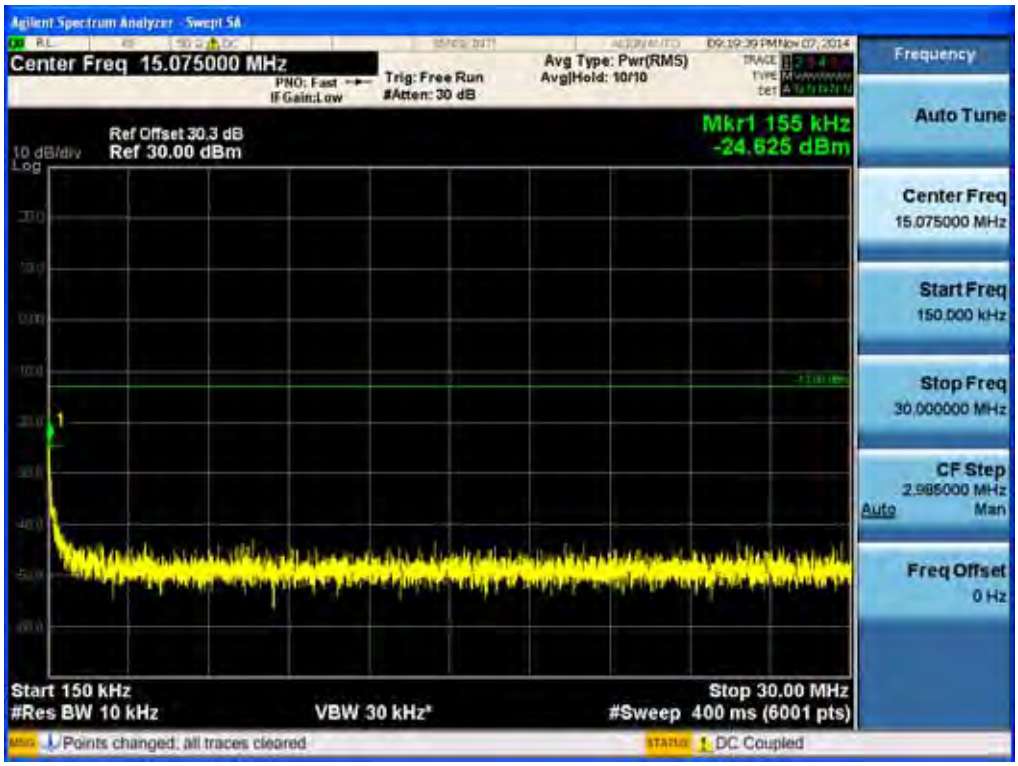
[GSM Downlink Middle]



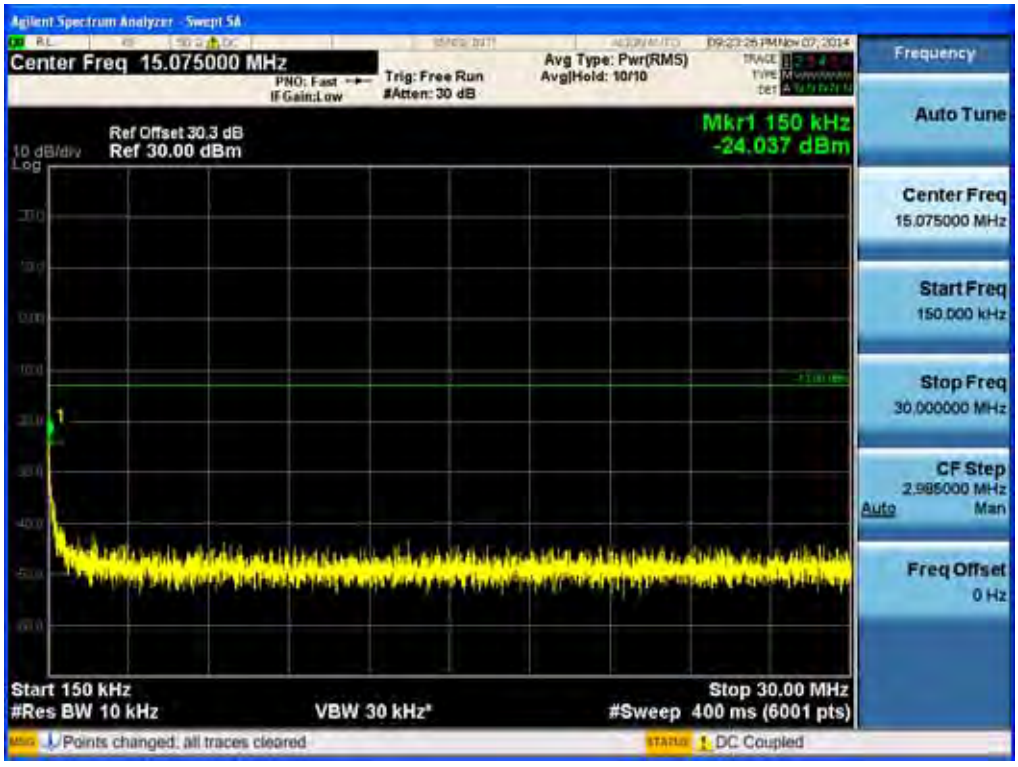
[GSM Downlink High]



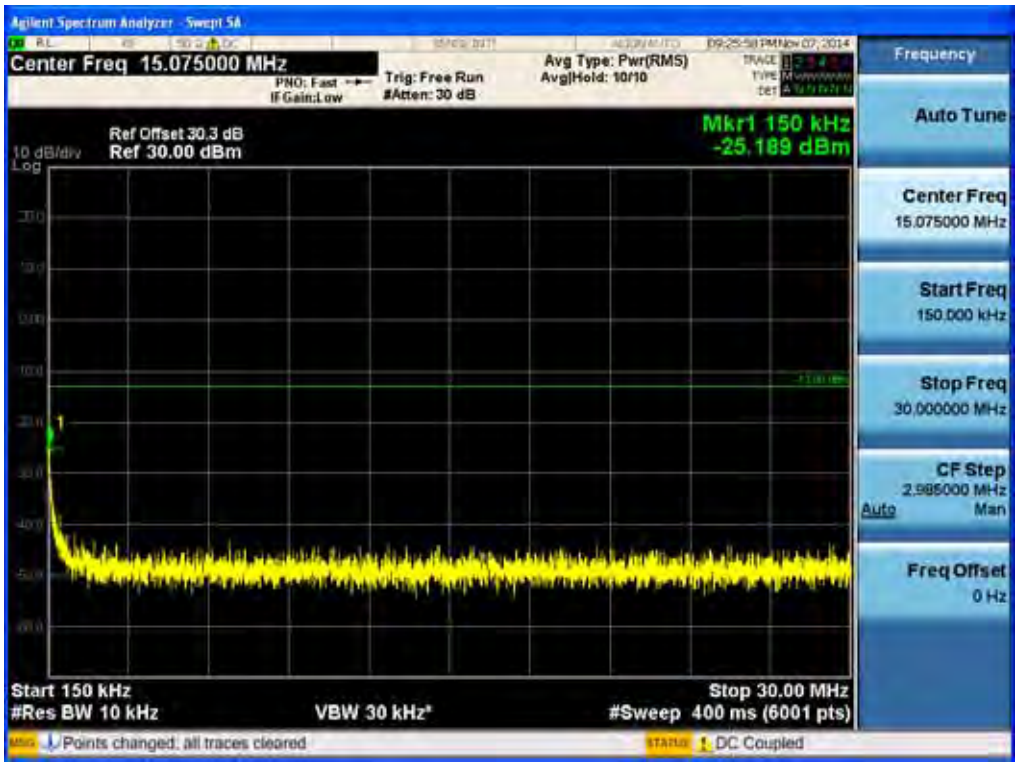
[EDGE Downlink Low]



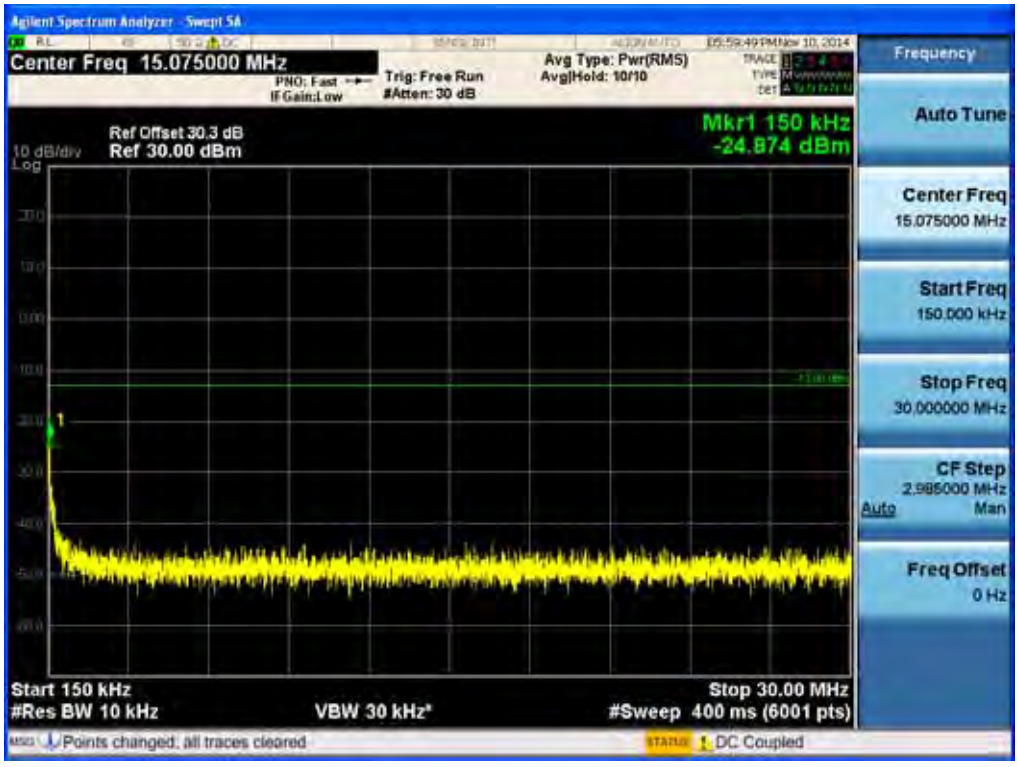
[EDGE Downlink Middle]



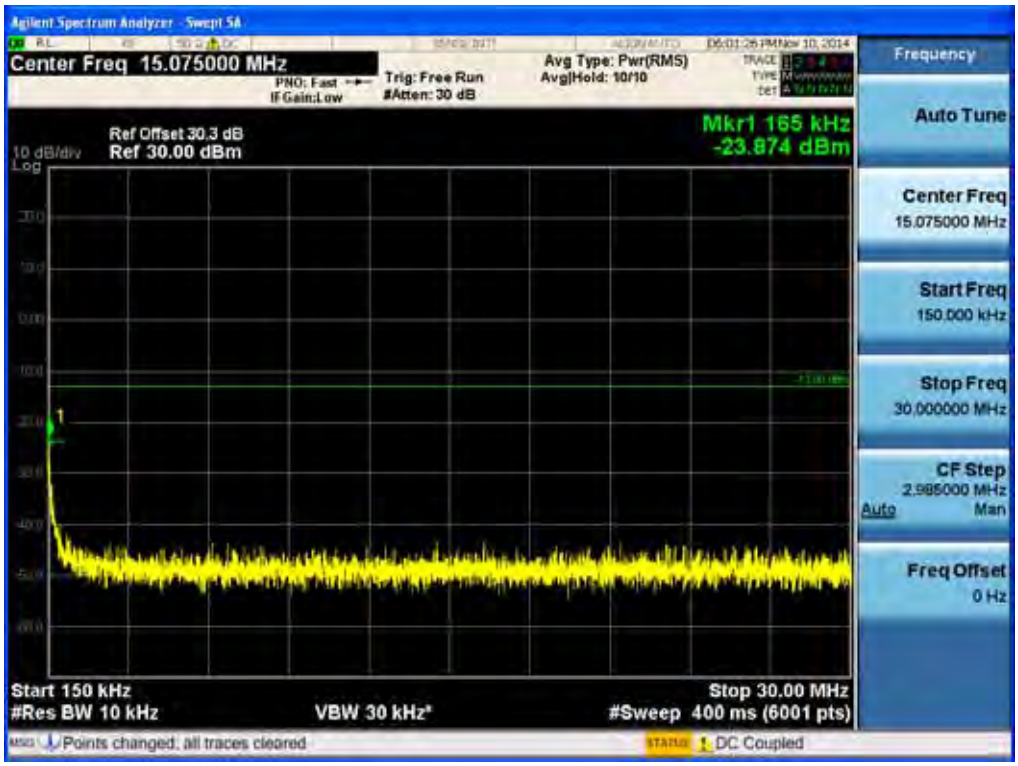
[EDGE Downlink High]



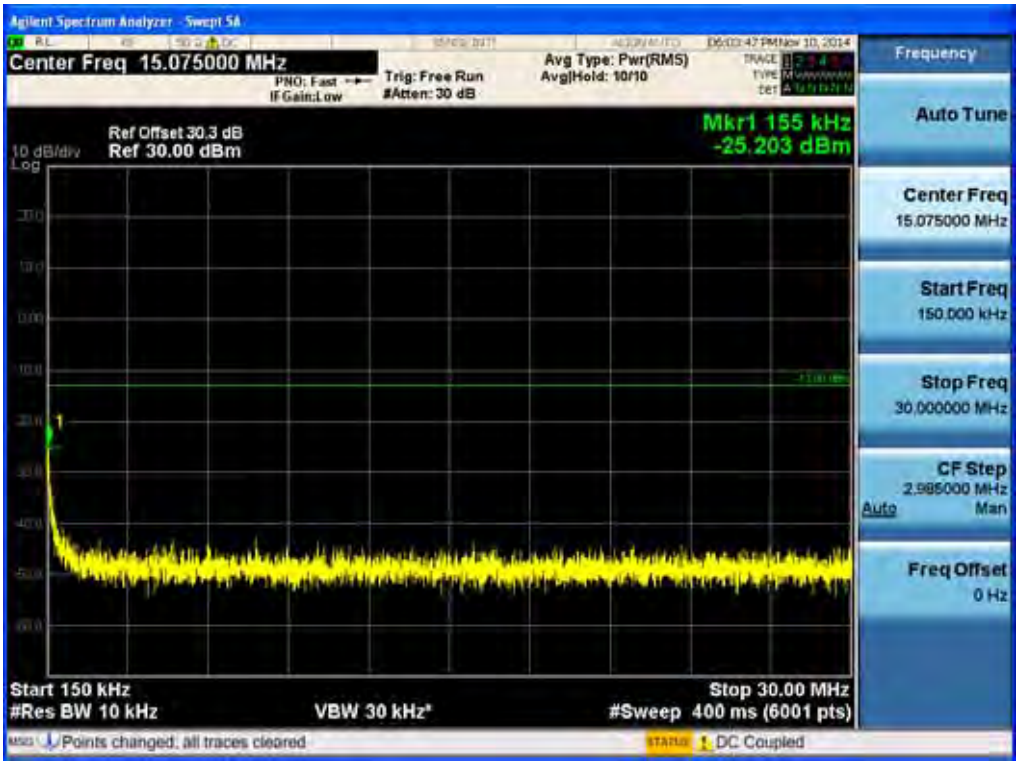
[LTE Downlink 5MHz Low]



[LTE Downlink 5MHz Middle]

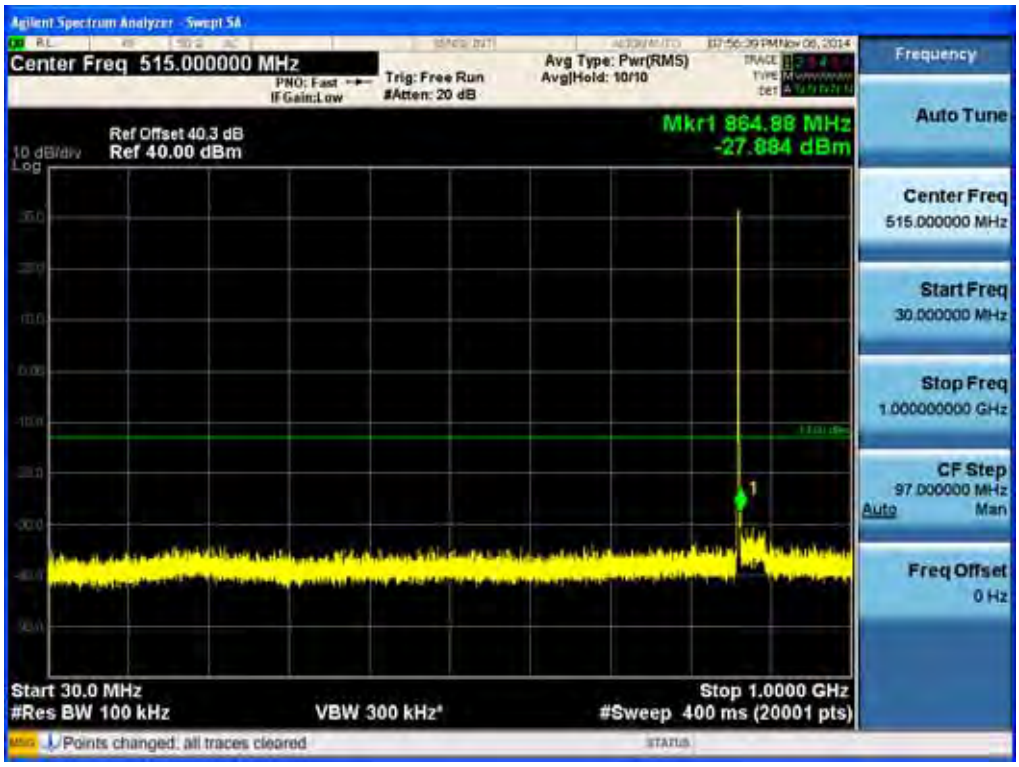


[LTE Downlink 5MHz High]

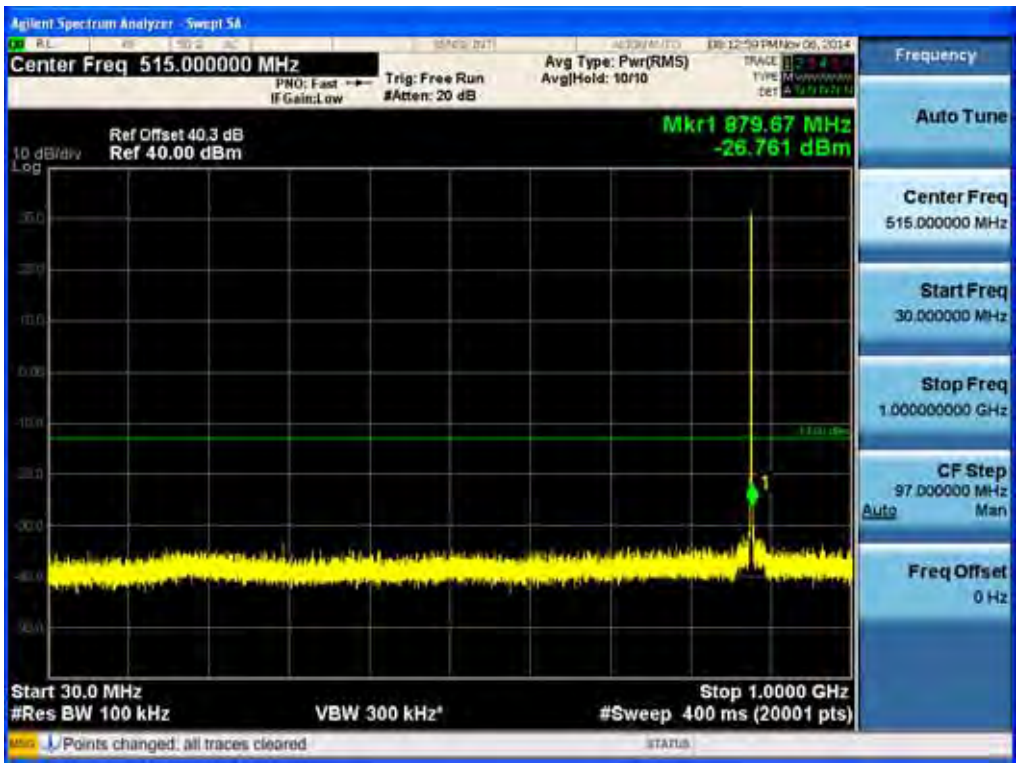


Conducted Spurious Emissions (30 MHz – 1 GHz)

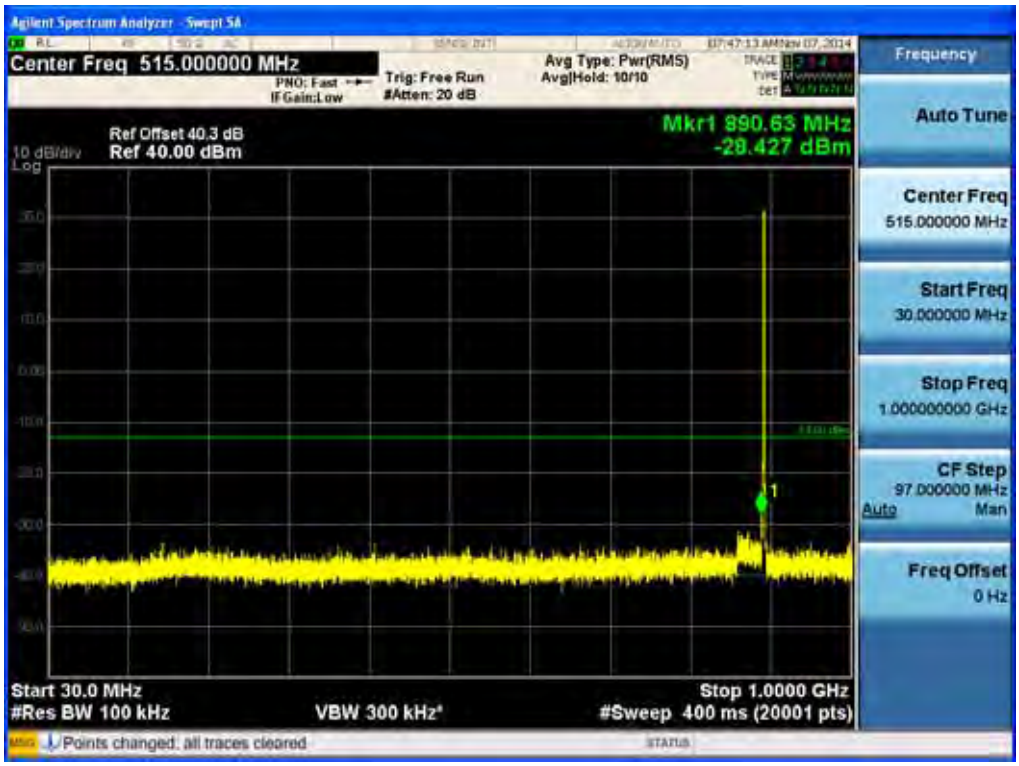
[CDMA Downlink Low]



[CDMA Downlink Middle]



[CDMA Downlink High]



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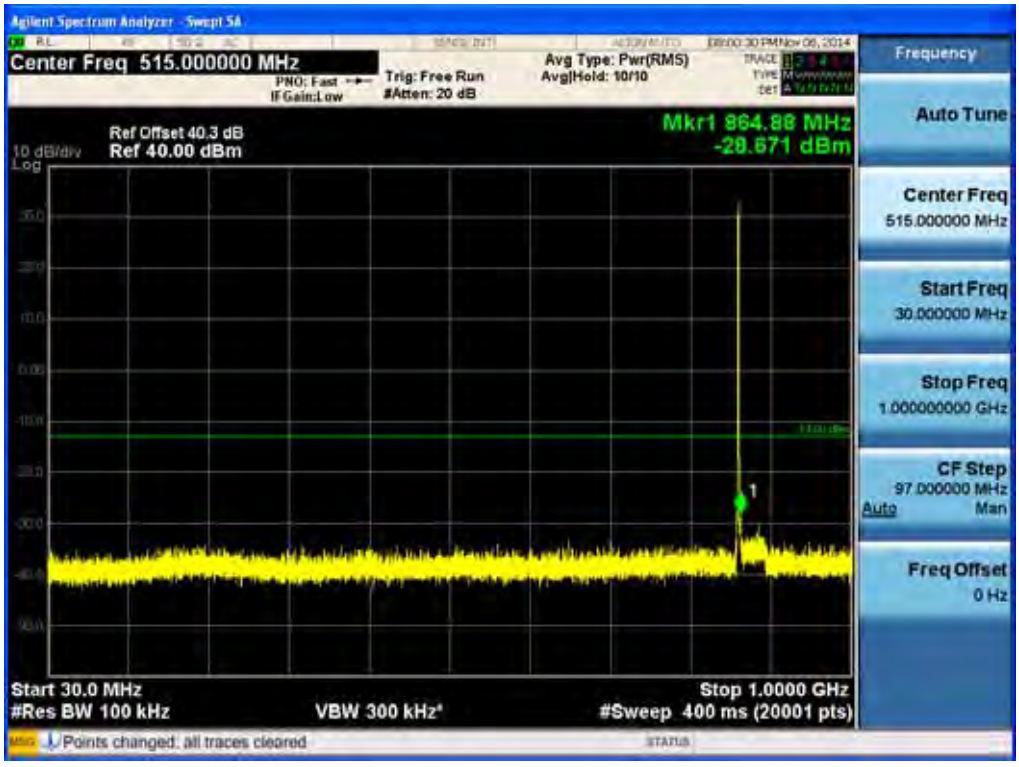

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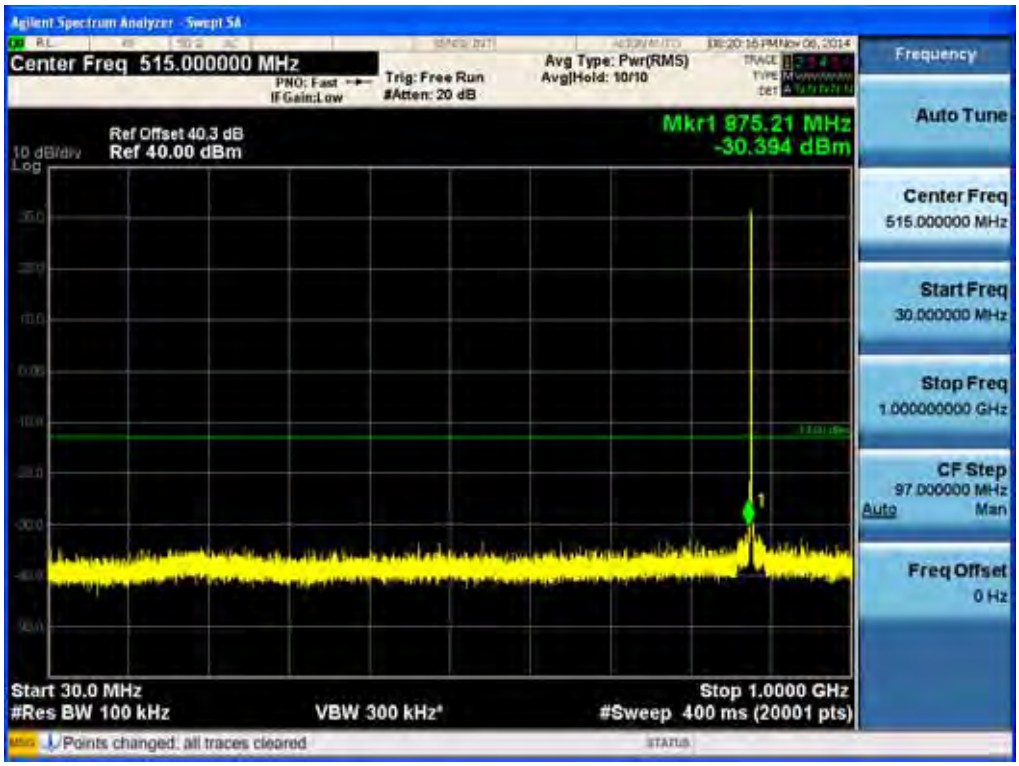

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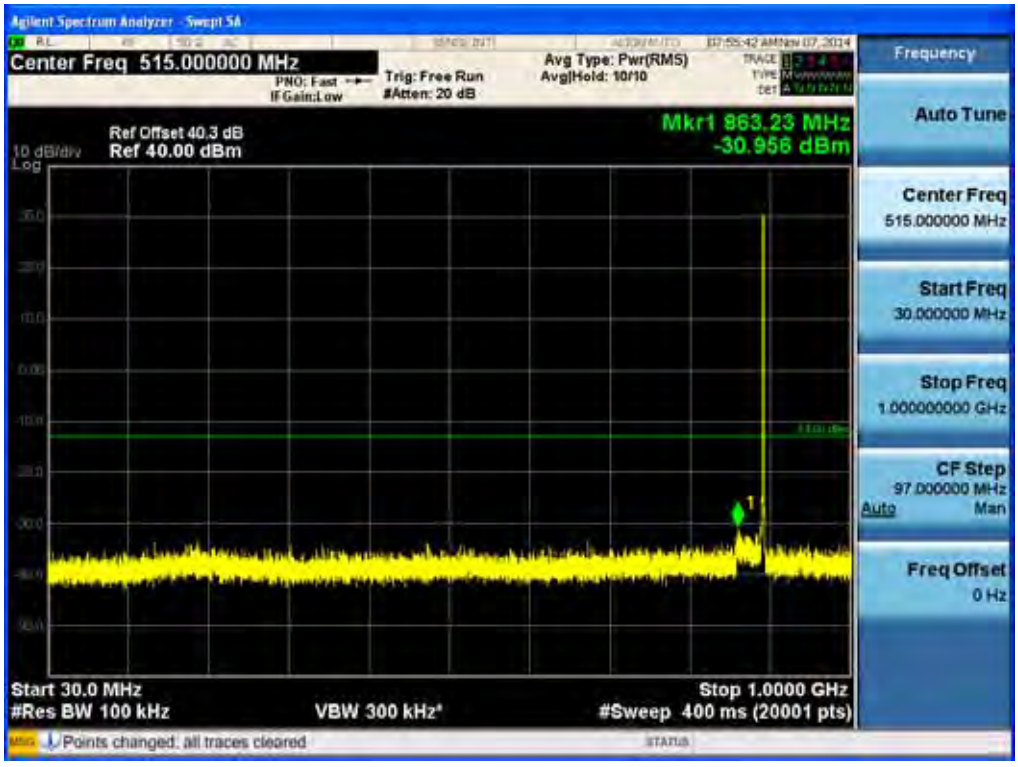

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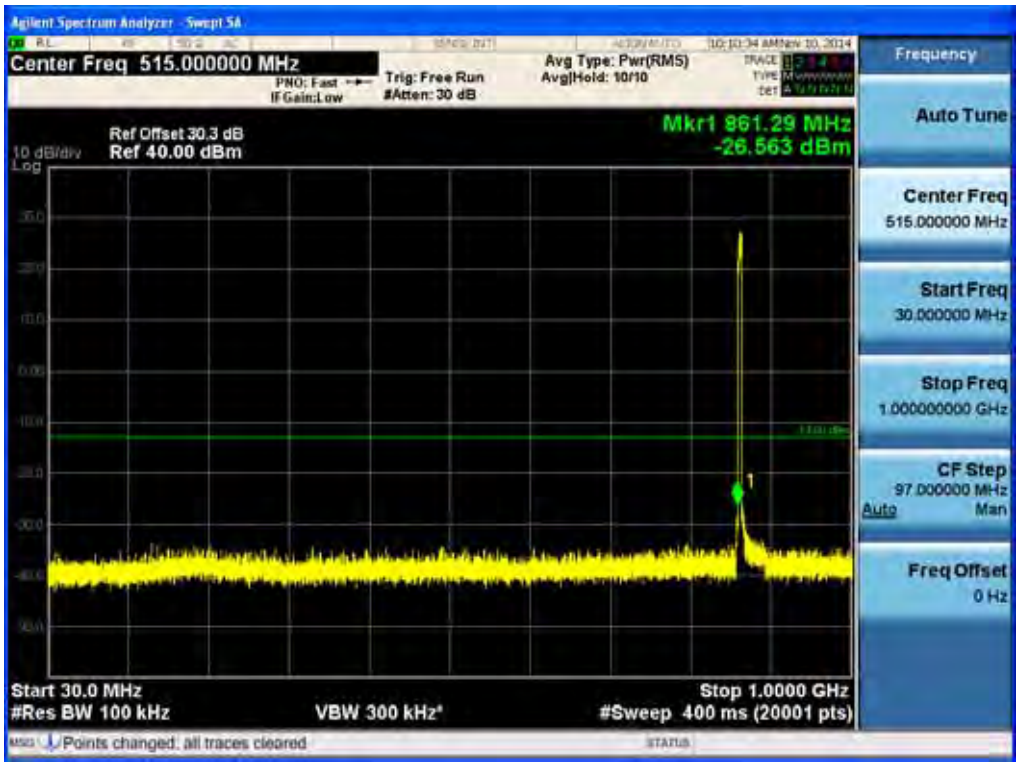

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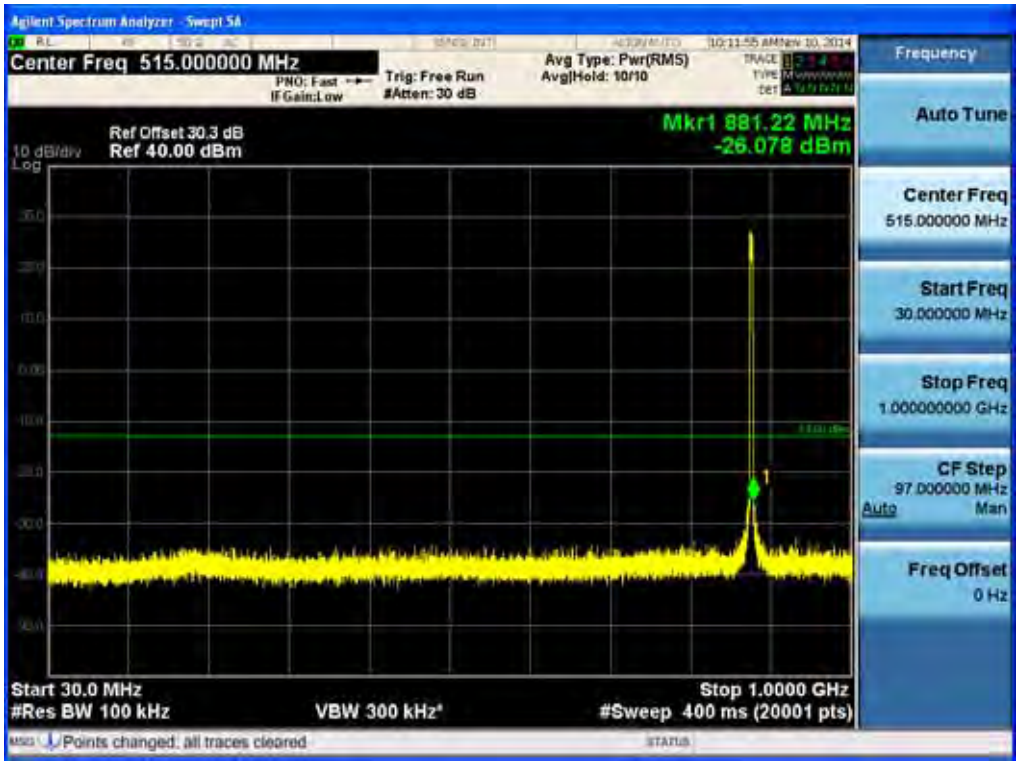

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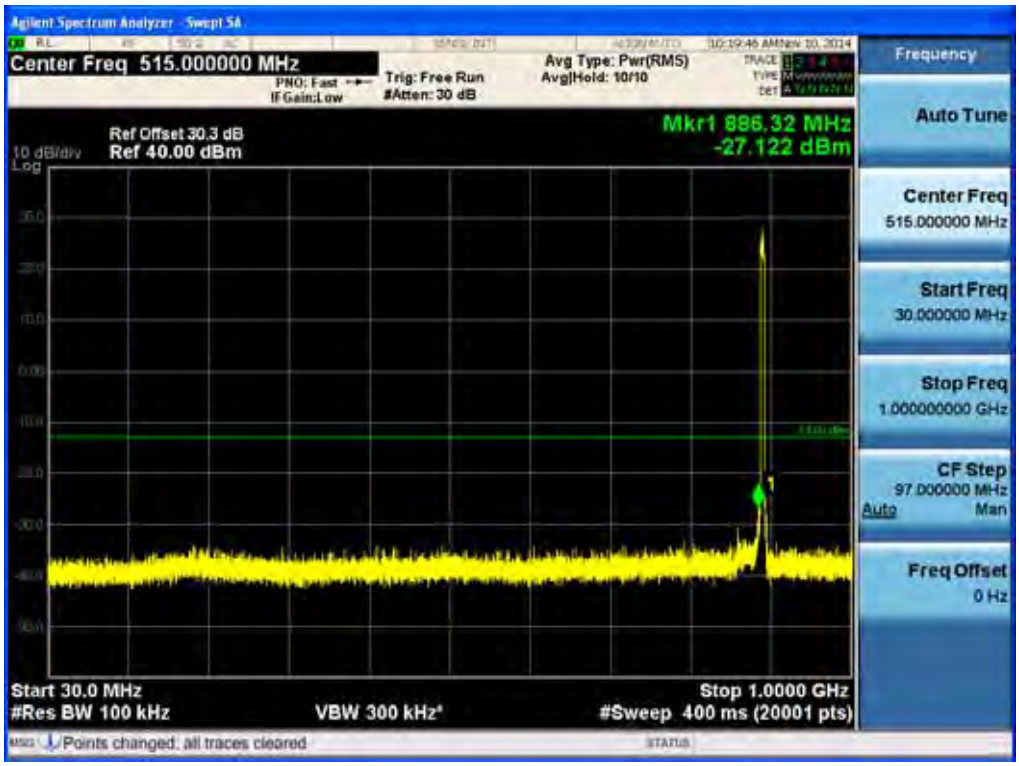

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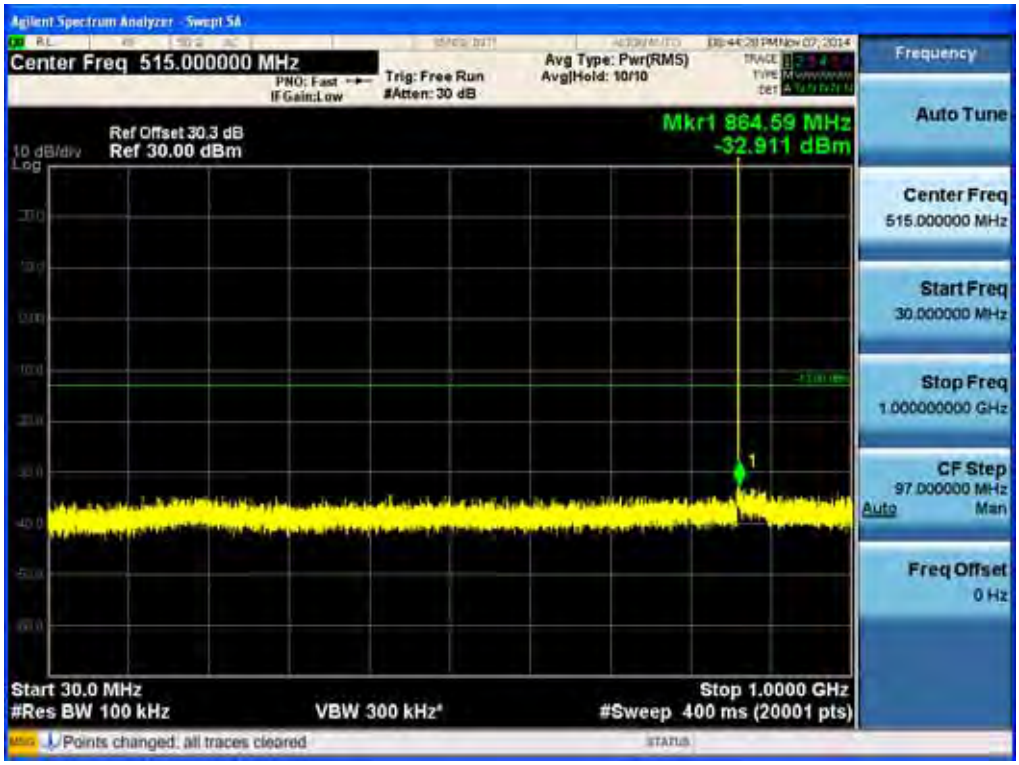

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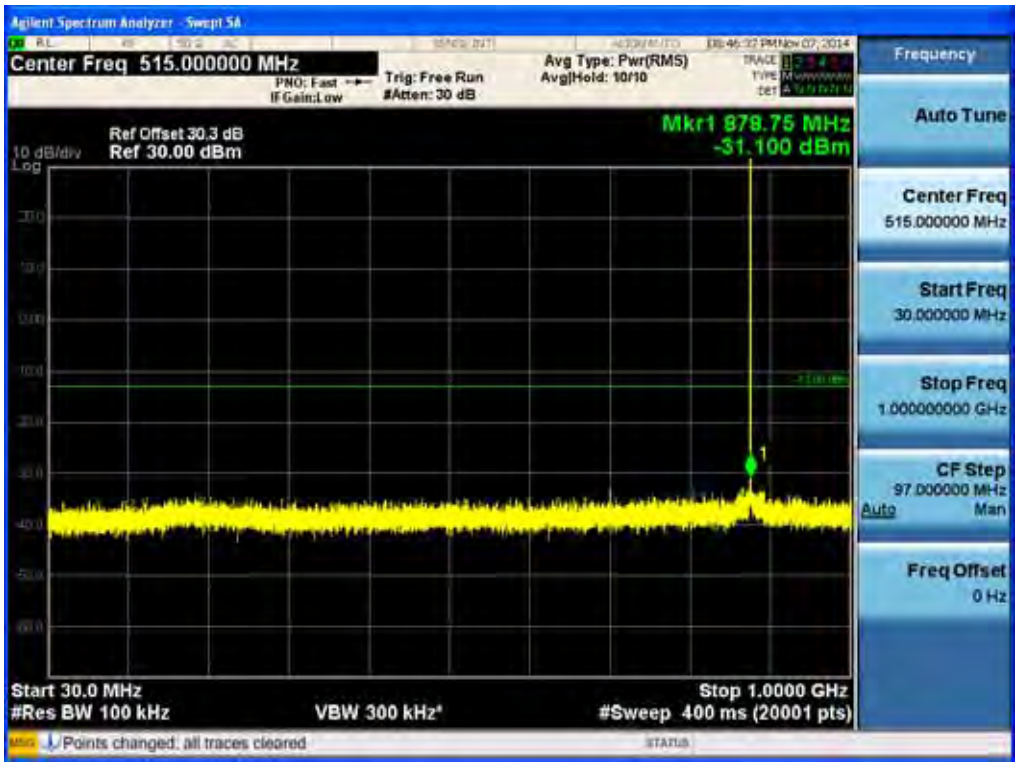

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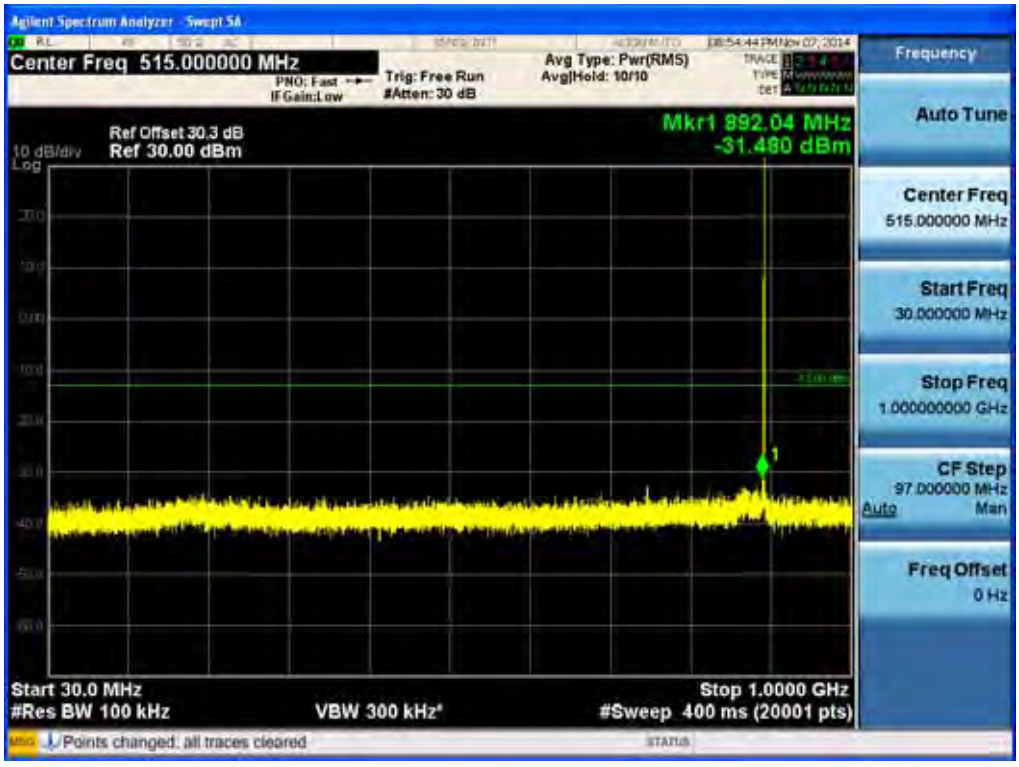
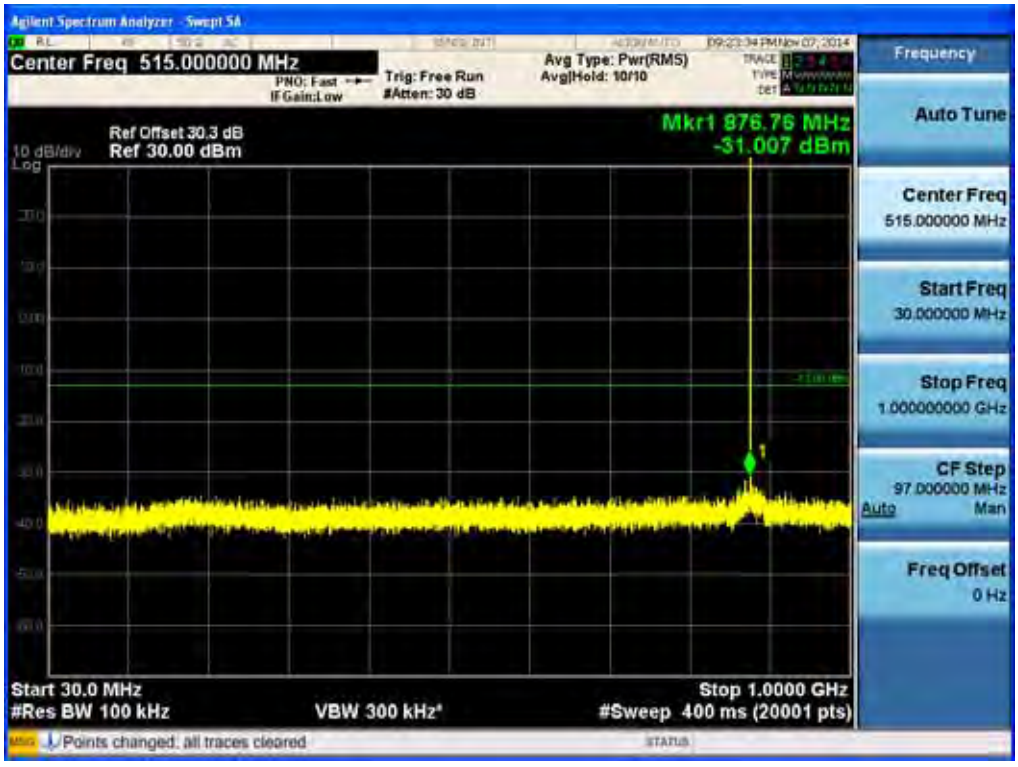
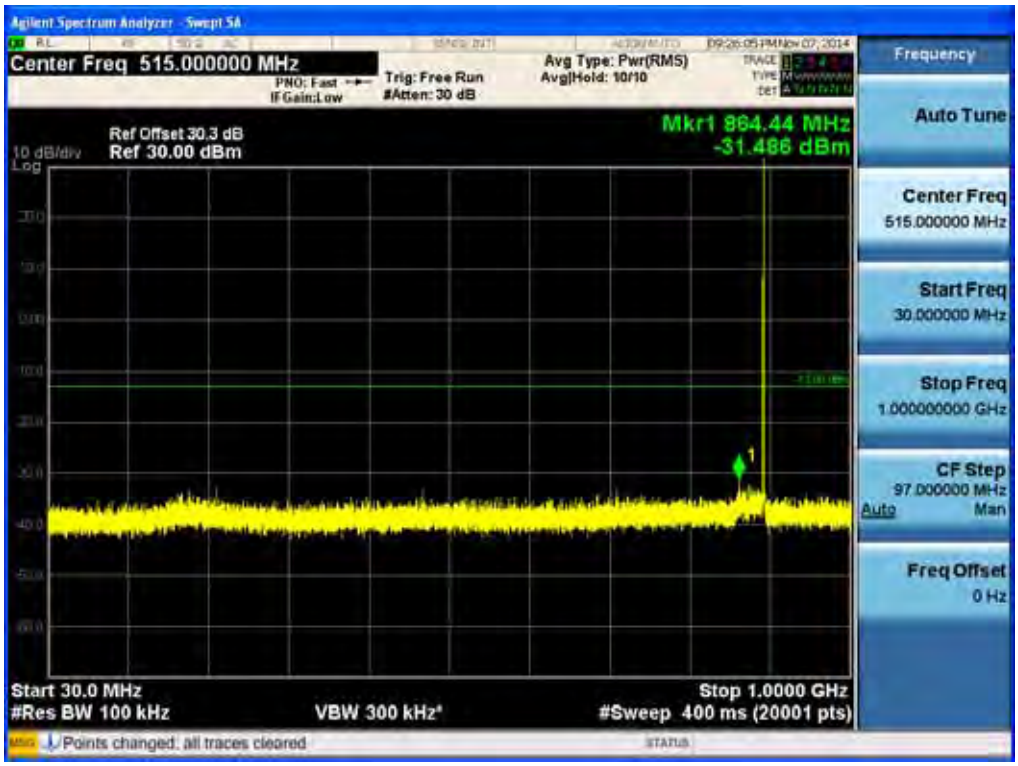


[EDGE Downlink Low]

[EDGE Downlink Middle]



[EDGE Downlink High]



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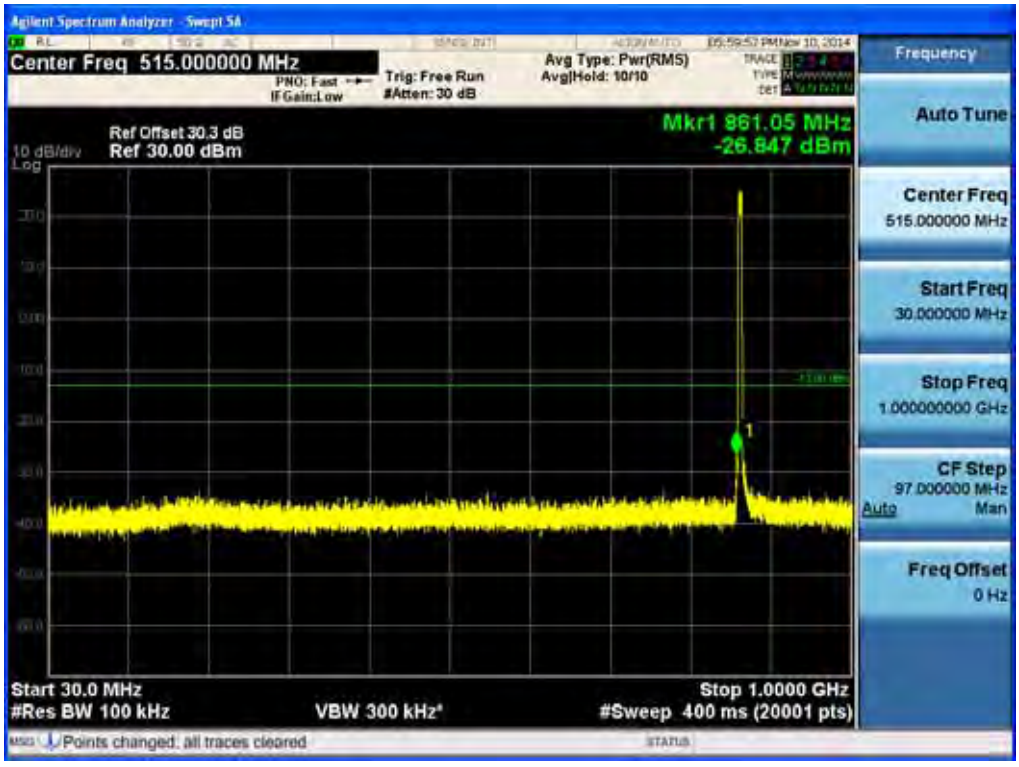

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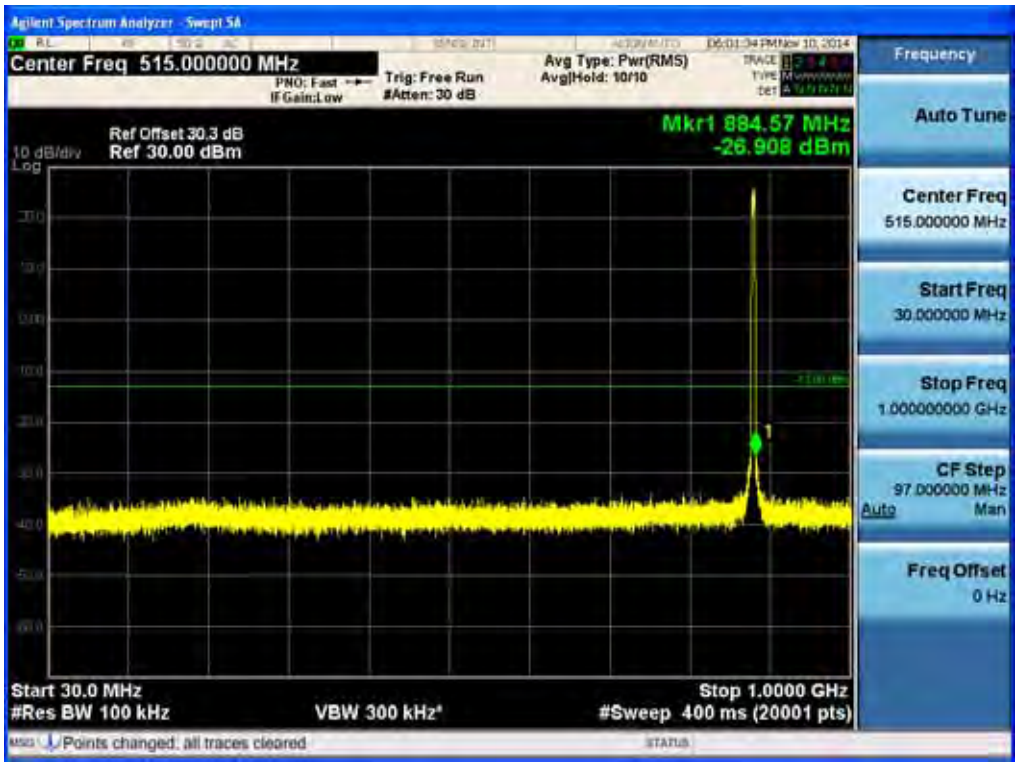

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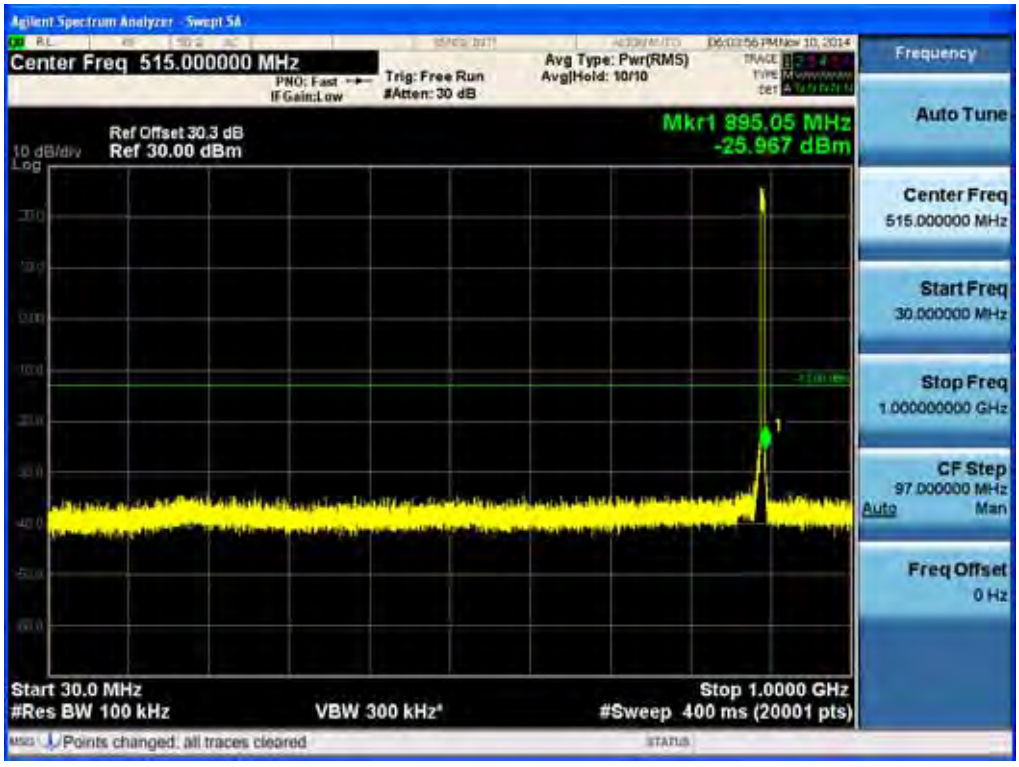


Conducted Spurious Emissions (1 GHz –12.75 GHz)

[CDMA Downlink Low]

[CDMA Downlink Middle]

[CDMA Downlink High]

[EVDO Downlink Low]

[EVDO Downlink Middle]

[EVDO Downlink High]

[WCDMA Downlink Low]

[WCDMA Downlink Middle]

[WCDMA Downlink High]

[GSM Downlink Low]

[GSM Downlink Middle]

[GSM Downlink High]

[EDGE Downlink Low]

[EDGE Downlink Middle]

[EDGE Downlink High]

[LTE Downlink 5MHz Low]

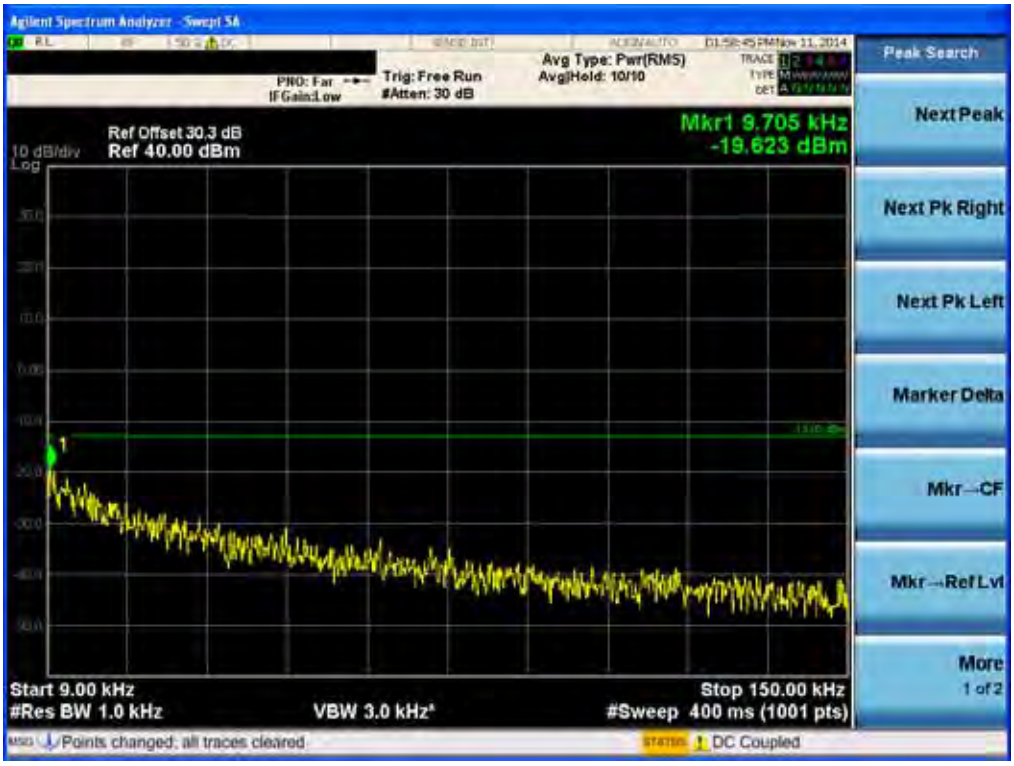
[LTE Downlink 5MHz Middle]

[LTE Downlink 5MHz High]

Multi channel Enhancer Plots of Spurious Emission for IC

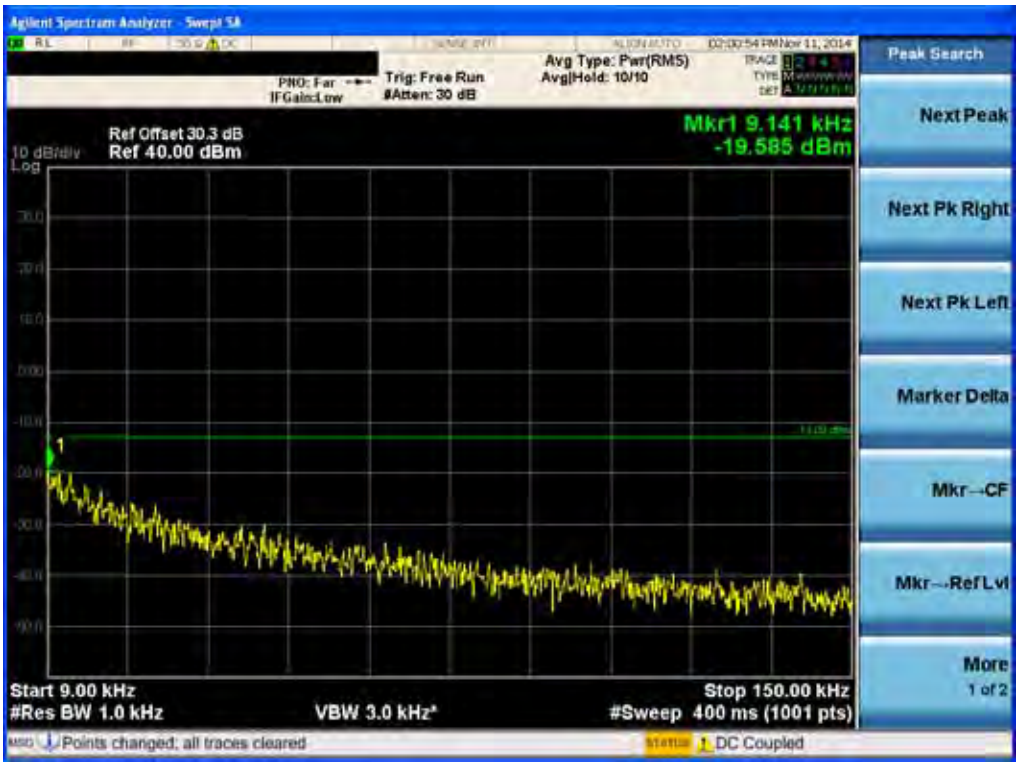
Conducted Spurious Emissions (9 kHz – 150 kHz)

[Downlink Low]



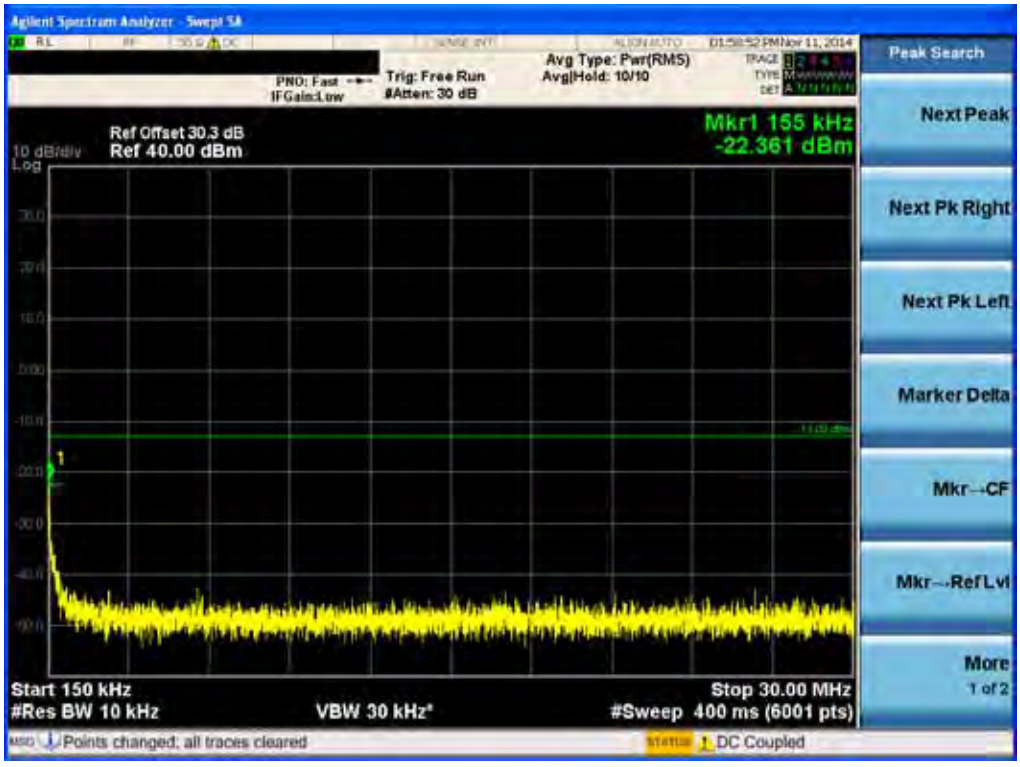
[Downlink Middle]

[Downlink High]



Conducted Spurious Emissions (150 kHz – 30 MHz)

[Downlink Low]



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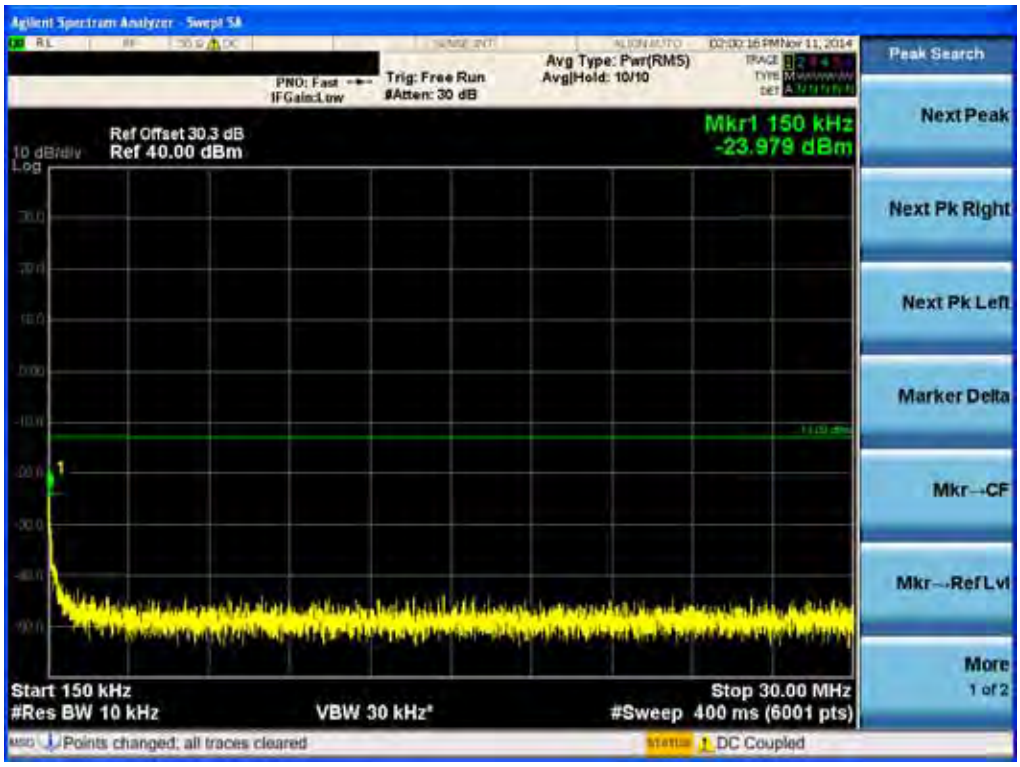

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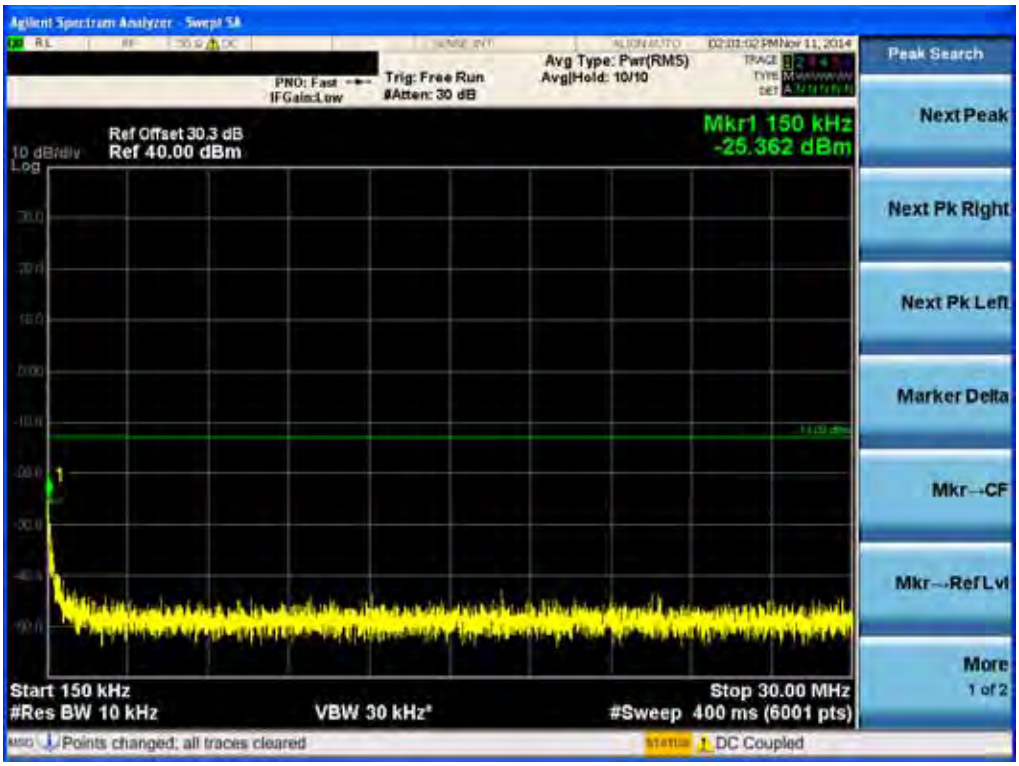
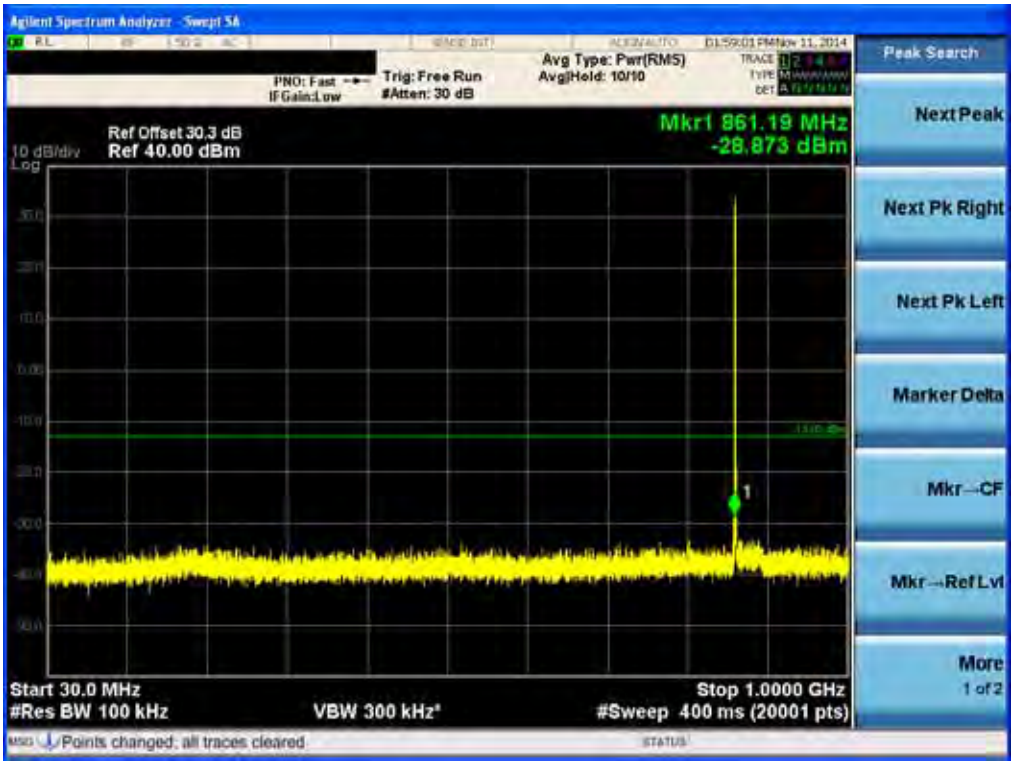
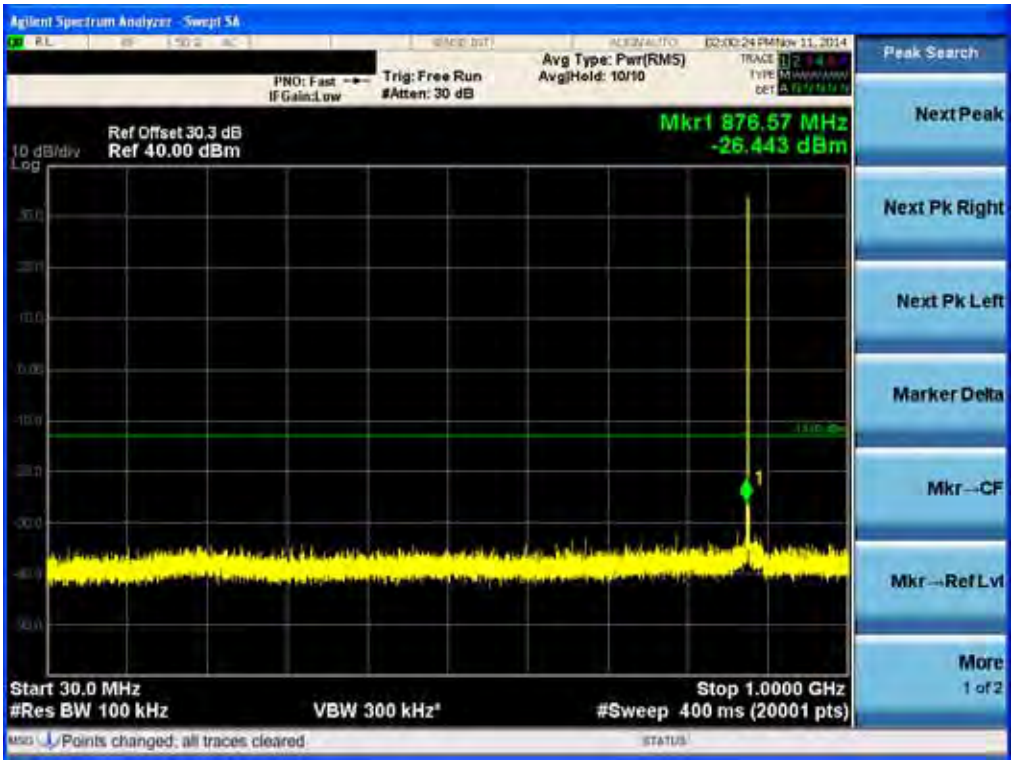


Conducted Spurious Emissions (30 MHz – 1 GHz)

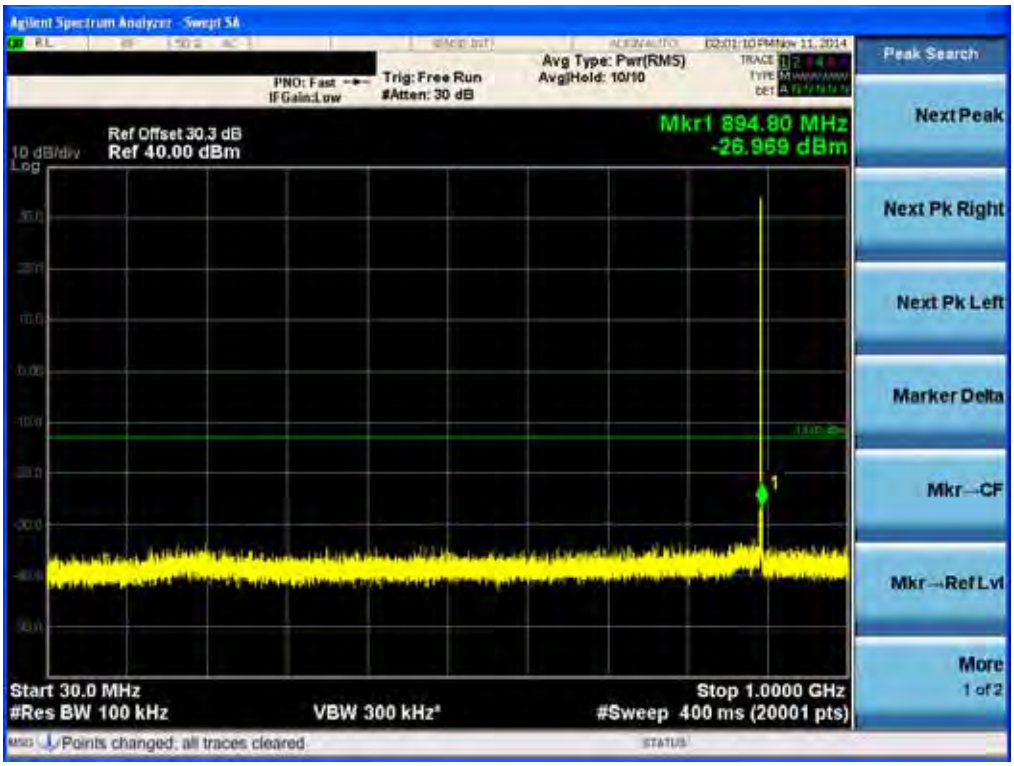
[Downlink Low]



[Downlink Middle]



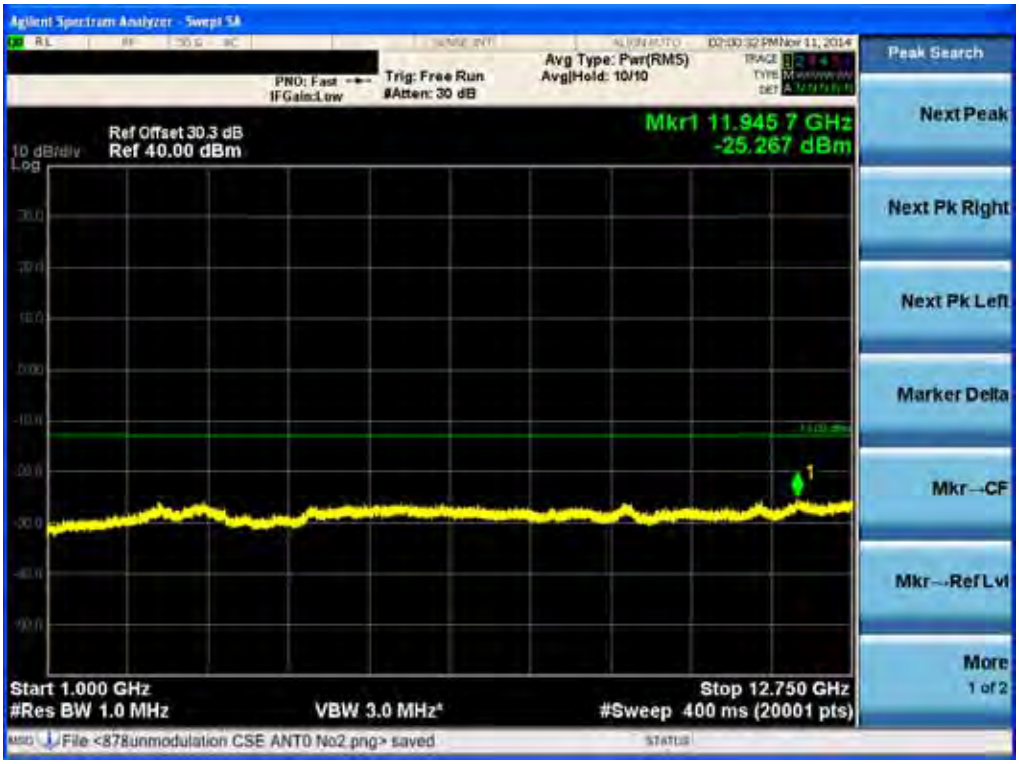
[Downlink High]



Conducted Spurious Emissions (1 GHz –12.75 GHz)

[Downlink Low]

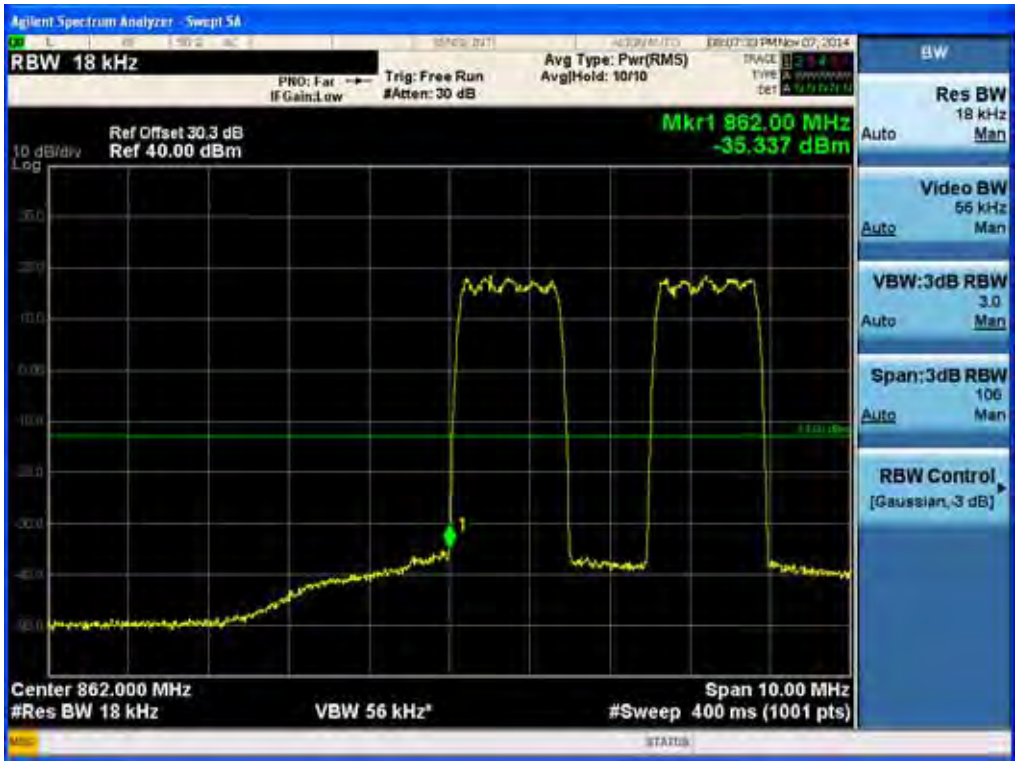
[Downlink Middle]



[Downlink High]

Intermodulation Spurious Emissions for FCC

[CDMA Downlink Low]



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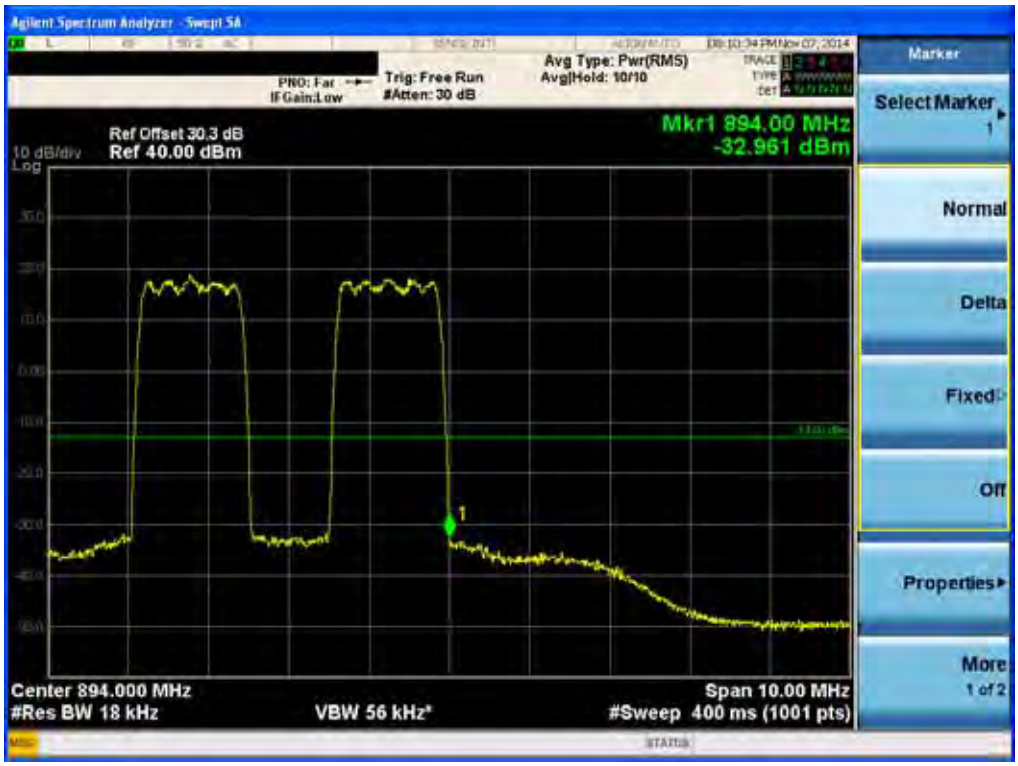

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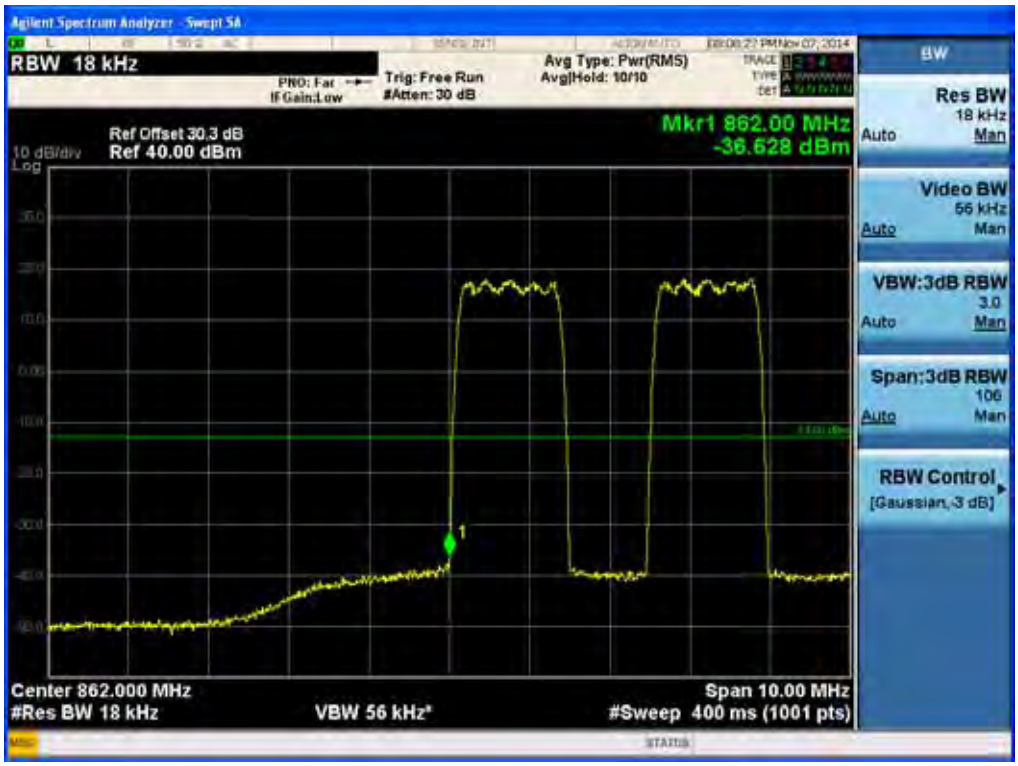

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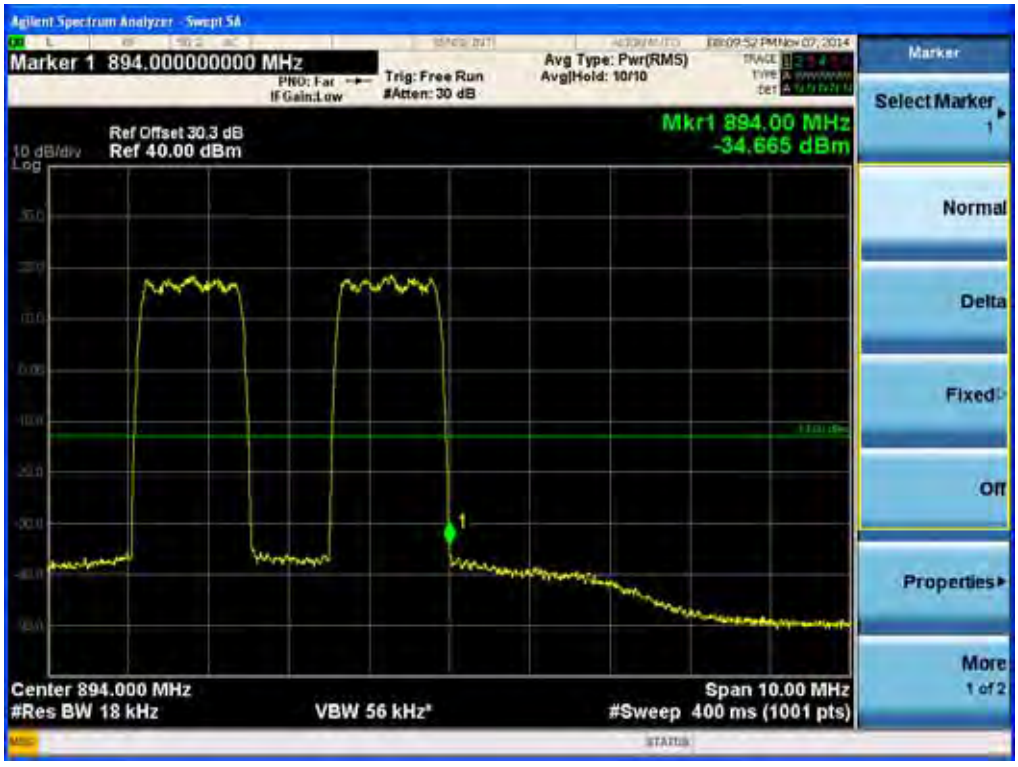
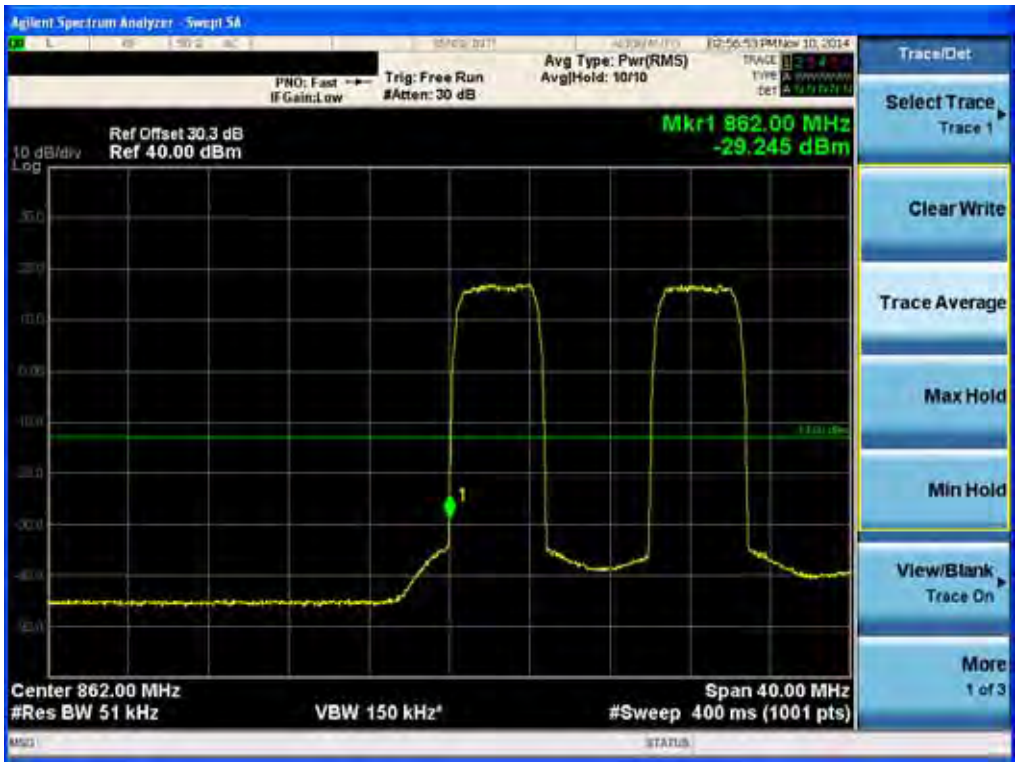


[WCDMA Downlink Low]



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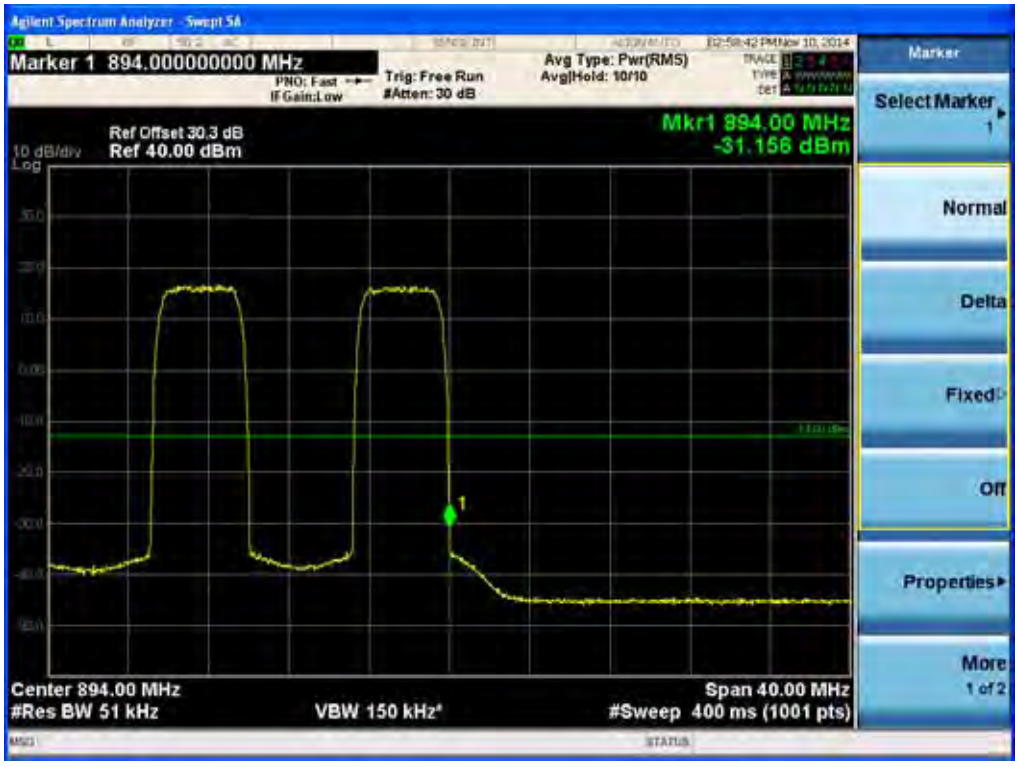

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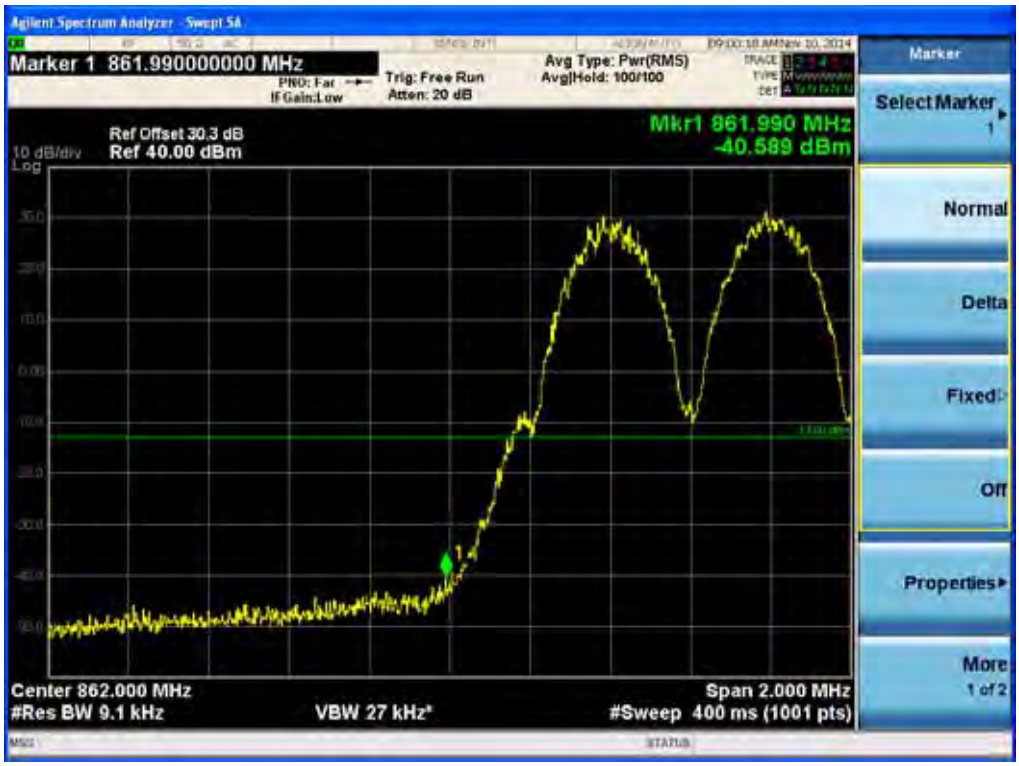

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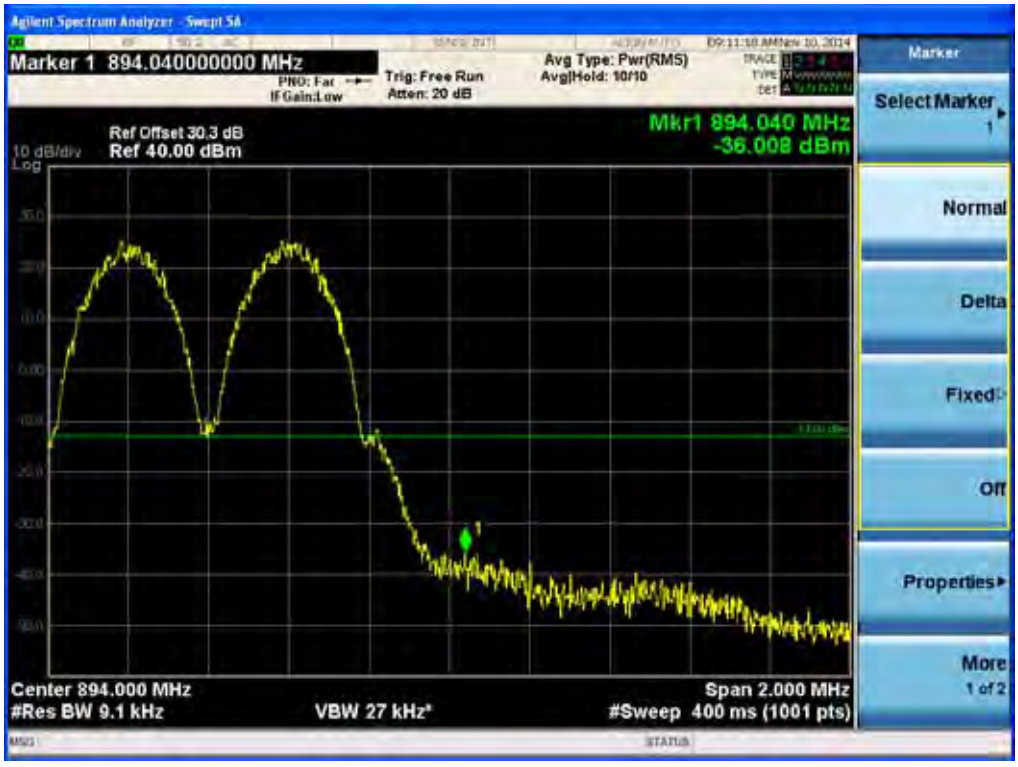
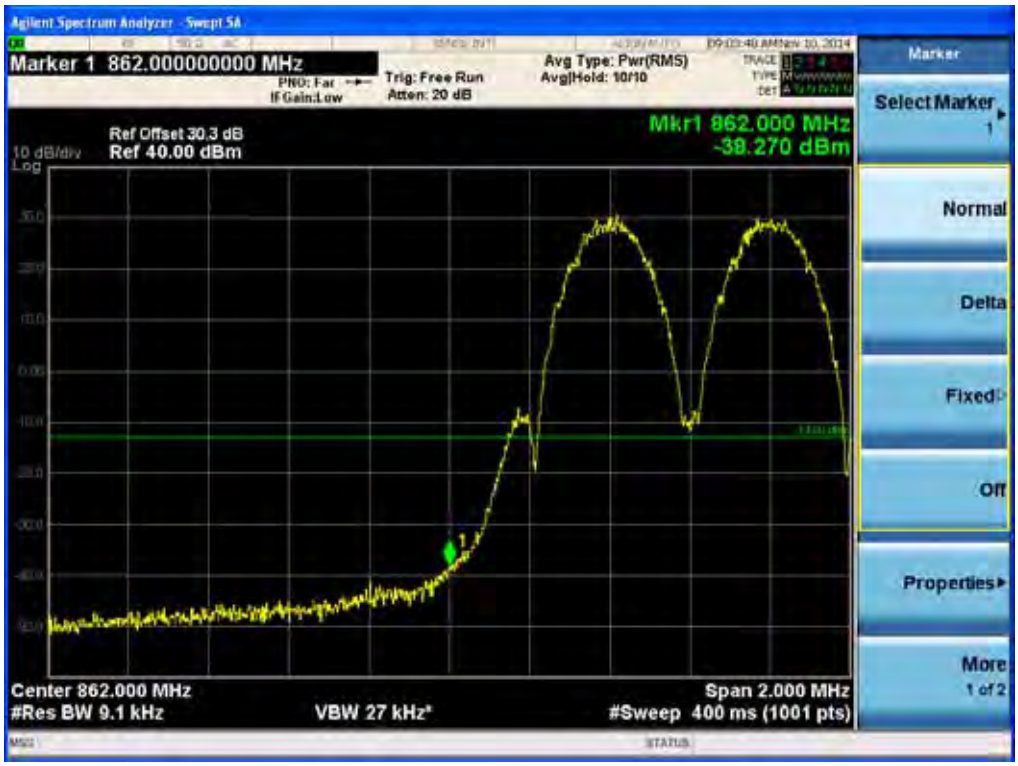
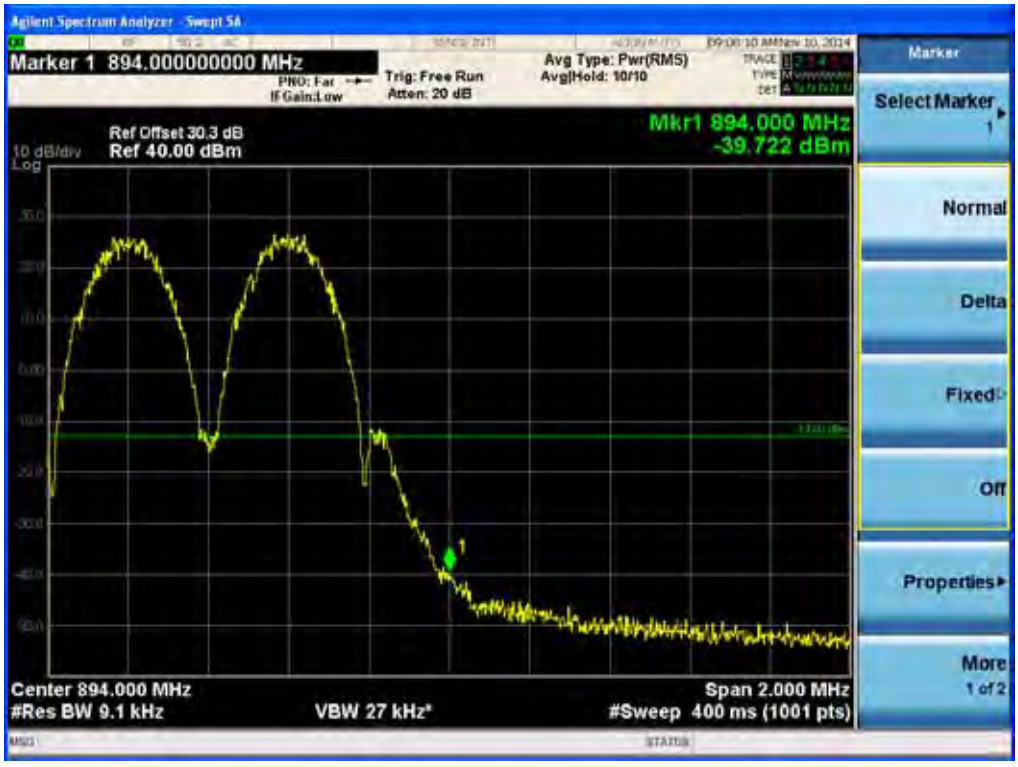


[EDGE Downlink Low]



[EDGE Downlink High]



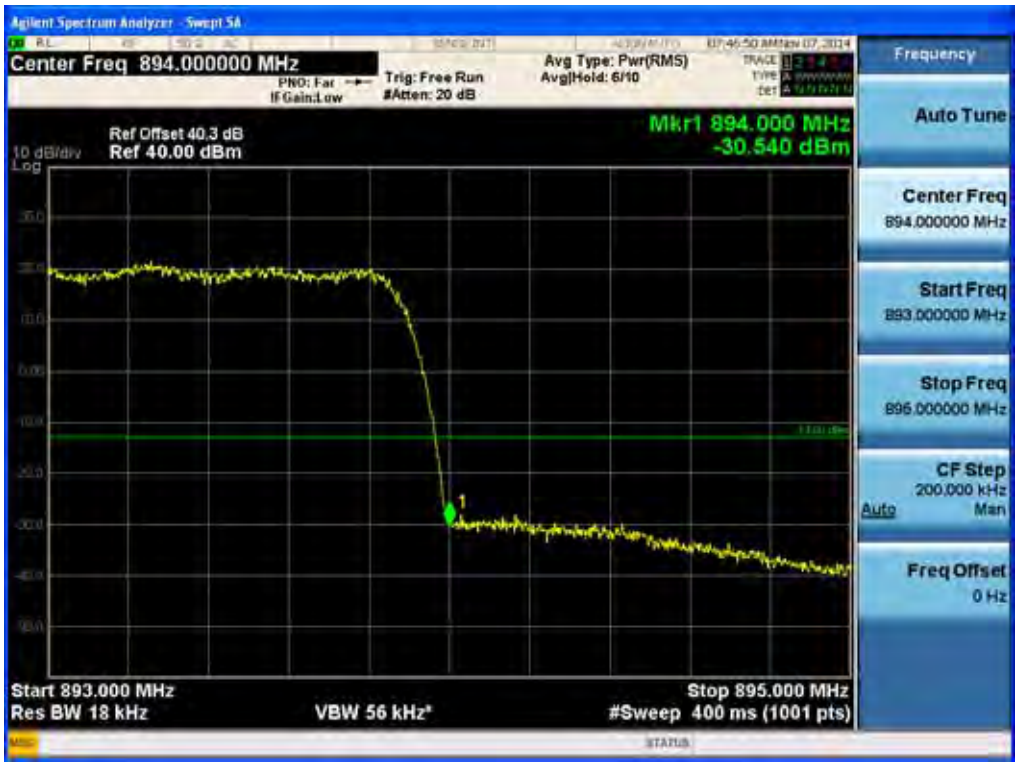
[LTE Downlink 5MHz Low]

[LTE Downlink 5MHz High]

Single channel Enhancer Band Edge

[CDMA Downlink Low]

[CDMA Downlink High]



[EVDO Downlink Low]

[EVDO Downlink High]

[WCDMA Downlink Low]

[WCDMA Downlink High]

[GSM Downlink Low]

[GSM Downlink High]

[EDGE Downlink Low]

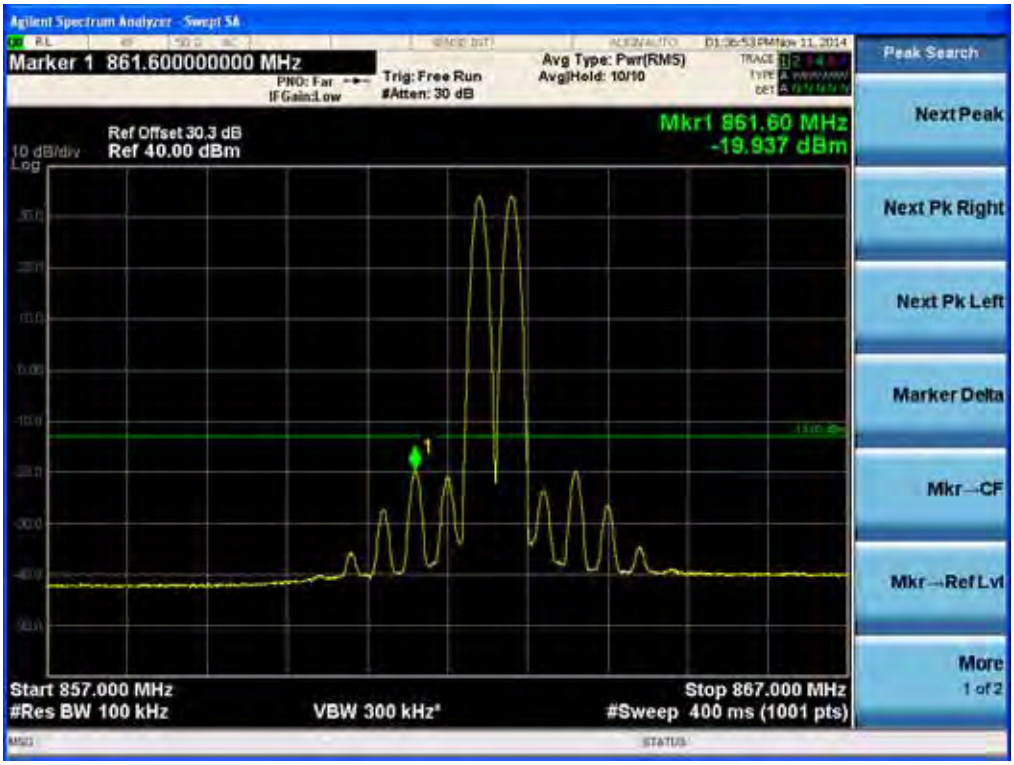
[EDGE Downlink High]

[LTE Downlink 5MHz Low]

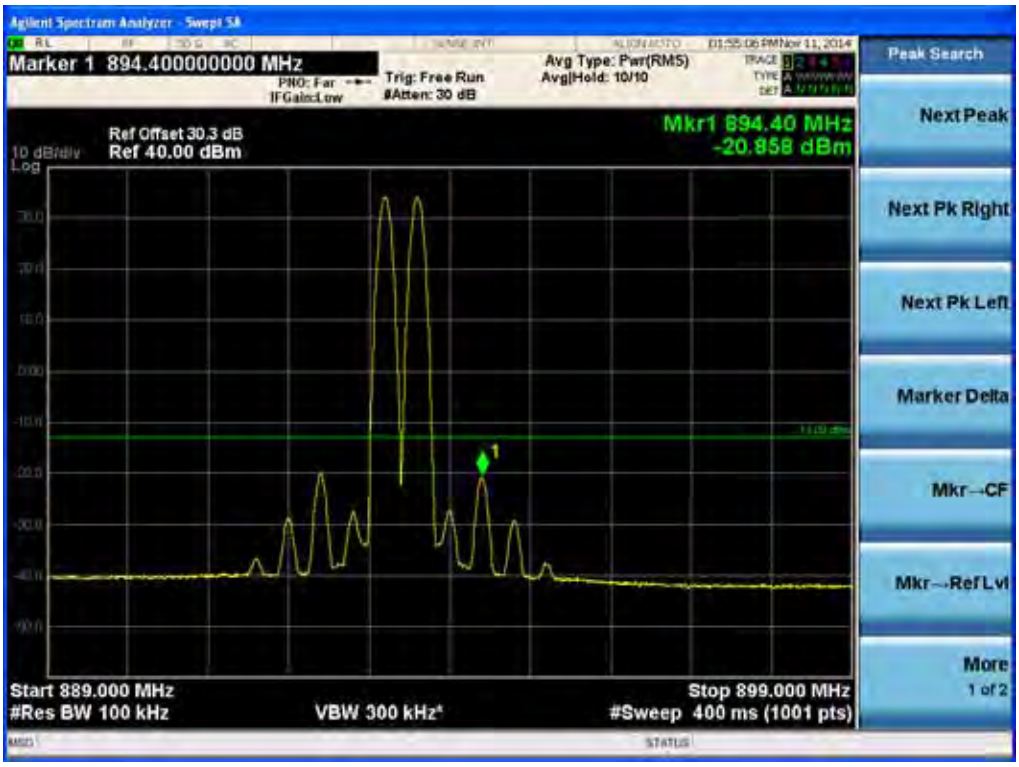
[LTE Downlink 5MHz High]

Multi channel Enhancer Band Edge for IC

[Downlink Low]



[Downlink 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 40GHz, whichever was the lesser, were investigated.

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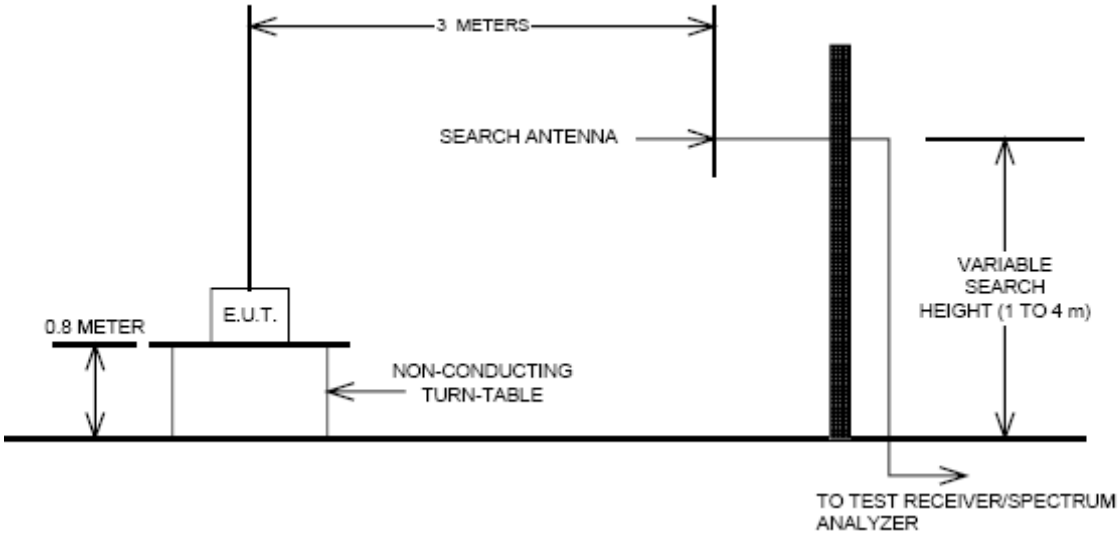
Radiated Spurious Emissions Test Setup



Test Result:

Note.

Input signal is the CW signal.

Harmonics were not found.

[Downlink]

Voltage supplied to EUT	Tx Freq.(MHz)	Freq.(MHz)	Substitute Level [dBm]	Ant. Gain (dBi)	C.L	Pol.	EIRP (dBm)	Margin (dB)
120 Vac	862.4	No Peak Found						
	878.0							
	893.6							

Voltage supplied to EUT	Tx Freq.(MHz)	Freq.(MHz)	Substitute Level [dBm]	Ant. Gain (dBi)	C.L	Pol.	EIRP (dBm)	Margin (dB)
-48 Vdc	862.4	No Peak Found						
	878.0							
	893.6							

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.

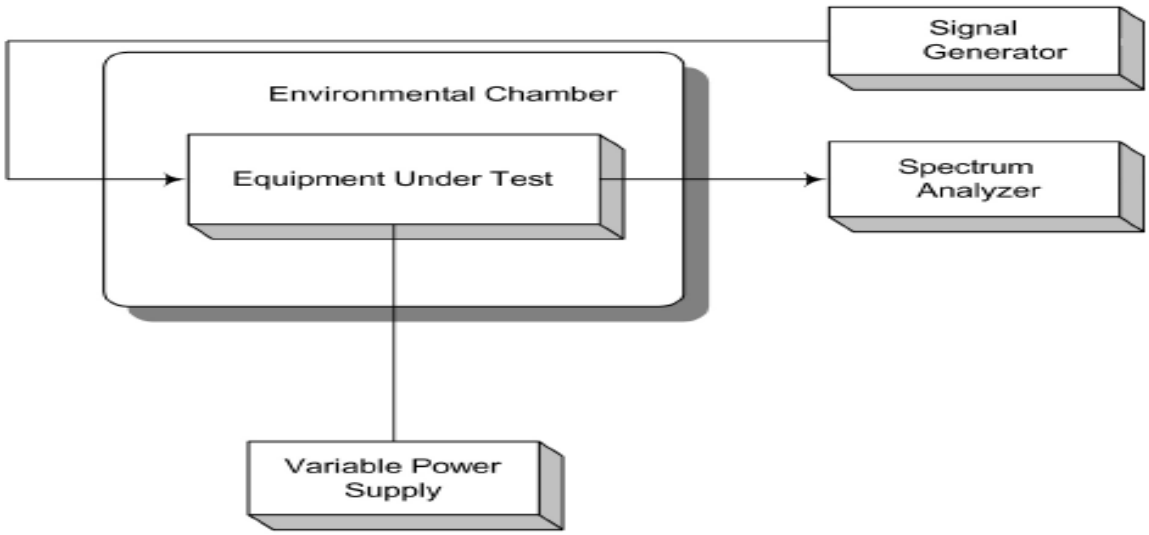
A CW signal was injected into the EUT at the appropriate RF level. The frequency counter option on the Spectrum Analyzer was used to measure frequency deviations.

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 120 Vac & -48 Vdc, 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

IC Rules

Test Requirement(s): RSS-131 6.5

A band translator is essentially a repeater station and should introduce as little frequency error as possible. The frequency stability should therefore meet the objectives of the overall land mobile or cellular service for which it serves. Better frequency stability than the minimum standard cited below will therefore be required in some cases.

The frequency stability shall be within 1.5 parts per million (0.00015%).

Test Procedures: RSS-131 4.5

In addition, the local oscillator frequency stability of the band translator shall be reported.

Frequency stability is a measure of the frequency drift due to temperature and supply voltage variations, with reference to the frequency measured at +20 °C and rated supply voltage.

The following temperature and supply voltage ranges apply:

(a) at 10 degree intervals of temperatures between -30 °C and +50 °C, and at the manufacturer's rated-supply voltage; and

(b) at +20 °C temperature and 15% supply voltage variations.

Frequency Stability and Voltage Test Results

Reference: 120 Vac at 20°C **Freq.** = 881.5 MHz

Voltage (%)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (Hz)	ppm
100%	+20(Ref)	881500000. 0	0.0	0.0	0.0000
	-30	881500000. 0	0.0	0.0	0.0000
	-20	881500000. 0	0.0	0.0	0.0000
	-10	881500000. 0	0.0	0.0	0.0000
	0	881500000. 0	0.0	0.0	0.0000
	+10	881500000. 0	0.0	0.0	0.0000
	+30	881500000. 0	0.0	0.0	0.0000
	+40	881500000. 0	0.0	0.0	0.0000
	+50	881500000. 0	0.0	0.0	0.0000
115%	+20	881500000. 0	0.0	0.0	0.0000
85%	+20	881500000. 0	0.0	0.0	0.0000

Reference: -48 Vdc at 20°C **Freq.** = 881.5 MHz

Voltage (%)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (Hz)	ppm
100%	+20(Ref)	881500000. 0	0.0	0.0	0.0000
	-30	881500000. 0	0.0	0.0	0.0000
	-20	881500000. 0	0.0	0.0	0.0000
	-10	881500000. 0	0.0	0.0	0.0000
	0	881500000. 0	0.0	0.0	0.0000
	+10	881500000. 0	0.0	0.0	0.0000
	+30	881500000. 0	0.0	0.0	0.0000
	+40	881500000. 0	0.0	0.0	0.0000
	+50	881500000. 0	0.0	0.0	0.0000
115%	+20	881500000. 0	0.0	0.0	0.0000
85%	+20	881500000. 0	0.0	0.0	0.0000