

# REPORT

## FCC Certification

**Applicant Name:**  
ADRF Korea, inc

**Date of Issue:**  
March 09, 2015

**Address:**  
5-5, Mojeon-Ri, Backsa-Myun, Icheon-City, Kyunggi-Do,  
Korea

**Test Site/Location:**  
HCT CO., LTD., 74, Seoicheon-ro 578beon-gil, Majang-  
myeon, Icheon-si, Gyeonggi-do, Korea

**Report No.:** HCT-R-1502-F036-1

**HCT FRN:** 0005866421

**FCC ID:** N52-ADX-R-78P

**FCC APPLICANT:** ADRF Korea, inc

**FCC Model(s):** ADX-R-78P

**EUT Type:** DAS(Distributed Antenna System)

**Frequency Ranges:** Downlink : 758 MHz ~ 775 MHz (768 MHz ~ 769 MHz Guard band)  
Uplink : 788 MHz ~ 805 MHz (798 MHz ~ 799 MHz Guard band)

**Conducted Output Power:** 1 W (30 dBm)

**Date of Test :** February 03, 2015 ~ February 13, 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

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## Version

TEST REPORT NO.	DATE	DESCRIPTION
HCT-R-1502-F036	February 26, 2015	- First Approval Report
HCT-R-1502-F036-1	March 09, 2015	- Revised : Standard update §90.541

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## 1. CLIENT INFORMATION

The EUT has been tested by request of

Company	ADRF Korea, inc 5-5, Mojeon-Ri, Backsa-Myun, Icheon-City, Kyunggi-Do, Korea
Contact Point	Attention/ E-Mail: HK Song/ hk4464@adrfttech.com Tel./ H.P. : +82-31-637-4435/ +82-10-3191-4773

- **FCC ID:** N52-ADX-R-78P
- **APPLICANT:** ADRF Korea, inc
- **EUT Type:** DAS(Distributed Antenna System)
- **Model:** ADX-R-78P
- **Frequency Ranges:** Downlink : 758 MHz ~ 775 MHz (768 MHz ~ 769 MHz Guard band)  
Uplink : 788 MHz ~ 805 MHz (798 MHz ~ 799 MHz Guard band)
- **Conducted Output Power:** 1 W (30 dBm)
- **Antenna Gain(s) :** 2 dBi
- **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.

<b>Description</b>	<b>Reference (FCC)</b>	<b>Results</b>
Conducted RF Output Power	§2.1046, §90.541, §90.542	Compliant
Occupied Bandwidth	§2.1049	Compliant
Out of Band Rejection	KDB 935210 D03 v02r01	Compliant
Noise Figure	§90.219	Compliant
Spurious Emissions at Antenna Terminals	§2.1051, §90.543	Compliant
Radiated Spurious Emissions	§2.1053, §90.543	Compliant
Frequency Stability	§2.1055, §90.539	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.

#### Test Frequency & Modulation

Frequency	Modulation
758 MHz - 768 MHz	LTE(10 MHz)
758 MHz - 775 MHz (768 MHz ~ 769 MHz Guard band)	iDEN(25 kHz)

### 4. STANDARDS ENVIRONMENTAL TEST CONDITIONS

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

## 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
WEINSCHTEL	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.

**§ 90.541 Transmitting power and antenna height limits.** The transmitting power and antenna height of base, mobile, portable and control stations operating in the 769-775 MHz and 799-805 MHz frequency bands must not exceed the maximum limits in this section. Power limits are listed in effective radiated power (ERP). (a) The transmitting power and antenna height of base stations must not exceed the limits given in paragraph (a) of §90.635. (b) The transmitting power of a control station must not exceed 200 watts ERP. (c) The transmitting power of a mobile unit must not exceed 100 watts ERP. (d) The transmitting power of a portable (hand-held) unit must not exceed 3 watts ERP. (e) Transmitters operating on the narrowband low power channels listed in §90.531(b)(3) and (4), must not exceed 2 watts ERP.

**§ 90.542 Broadband transmitting power limits.** (a) The following power limits apply to the 758-768/788-798 MHz band:

- (1) Fixed and base stations transmitting a signal in the 758-768 MHz band with an emission bandwidth of 1 MHz or less must not exceed an ERP of 1000 watts and an

antenna height of 305 m HAAT, except that antenna heights greater than 305 m HAAT are permitted if power levels are reduced below 1000 watts ERP in accordance with Table 1 of this section. (2) Fixed and base stations located in a county with population density of 100 or fewer persons per square mile, based upon the most recently available population statistics from the Bureau of the Census, and transmitting a signal in the 758-768 MHz band with an emission bandwidth of 1 MHz or less must not exceed an ERP of 2000 watts and an antenna height of 305 m HAAT, except that antenna heights greater than 305 m HAAT are permitted if power levels are reduced below 2000 watts ERP in accordance with Table 2 of this section. (3) Fixed and base stations transmitting a signal in the 758-768 MHz band with an emission bandwidth greater than 1 MHz must not exceed an ERP of 1000 watts/MHz and an antenna height of 305 m HAAT, except that antenna heights greater than 305 m HAAT are permitted if power levels are reduced below 1000 watts/MHz ERP in accordance with Table 3 of this section. (4) Fixed and base stations located in a county with population density of 100 or fewer persons per square mile, based upon the most recently available population statistics from the Bureau of the Census, and transmitting a signal in the 758-768 MHz band with an emission bandwidth greater than 1 MHz must not exceed an ERP of 2000 watts/MHz and an antenna height of 305 m HAAT, except that antenna heights greater than 305 m HAAT are permitted if power levels are reduced below 2000 watts/MHz ERP in accordance with Table 4 of this section. (5) Licensees of fixed or base stations transmitting a signal in the 758-768 MHz band at an ERP greater than 1000 watts must comply with the provisions set forth in paragraph (b) of this section. (6) Control stations and mobile stations transmitting in the 758-768 MHz band and the 788-798 MHz band are limited to 30 watts ERP. (7) Portable stations (hand-held devices) transmitting in the 758-768 MHz band and the 788-798 MHz band are limited to 3 watts ERP. (8) For transmissions in the 758-768 MHz and 788-798 MHz bands, licensees may employ equipment operating in compliance with either of the following measurement techniques:

(i) The maximum composite transmit power shall be measured over any interval of continuous transmission using instrumentation calibrated in terms of RMS-equivalent voltage. The measurement results shall be properly adjusted for any instrument limitations, such as detector response times, limited resolution bandwidth capability when compared to the emission bandwidth, etc., so as to obtain a true maximum composite measurement for the emission in question over the full bandwidth of the channel.

(ii) A Commission-approved average power technique.

**TABLE 1 TO §90.542(a)—PERMISSIBLE POWER AND ANTENNA HEIGHTS FOR BASE AND FIXED STATIONS IN THE 758-768 MHz BAND TRANSMITTING A SIGNAL WITH AN EMISSION BANDWIDTH OF 1 MHz OR LESS**

<b>Antenna height (AAT) in meters (feet)</b>	<b>Effective radiated power (ERP) (watts)</b>
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

**TABLE 2 TO §90.542(a)—PERMISSIBLE POWER AND ANTENNA HEIGHTS FOR BASE AND FIXED STATIONS IN THE 758-768 MHz BAND TRANSMITTING A SIGNAL WITH AN EMISSION BANDWIDTH OF 1 MHz OR LESS**

<b>Antenna height (AAT) in meters (feet)</b>	<b>Effective radiated power (ERP) (watts)</b>
Above 1372 (4500)	130
Above 1220 (4000) To 1372 (4500)	140
Above 1067 (3500) To 1220 (4000)	150
Above 915 (3000) To 1067 (3500)	200
Above 763 (2500) To 915 (3000)	280
Above 610 (2000) To 763 (2500)	400
Above 458 (1500) To 610 (2000)	700
Above 305 (1000) To 458 (1500)	1200
Up to 305 (1000)	2000

**TABLE 3 TO §90.542(a)—PERMISSIBLE POWER AND ANTENNA HEIGHTS FOR BASE AND FIXED STATIONS IN THE 758-768 MHz BAND TRANSMITTING A SIGNAL WITH AN EMISSION BANDWIDTH GREATER THAN 1 MHz**

<b>Antenna height (AAT) in meters (feet)</b>	<b>Effective radiated power (ERP) per MHz (watts/MHz)</b>
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

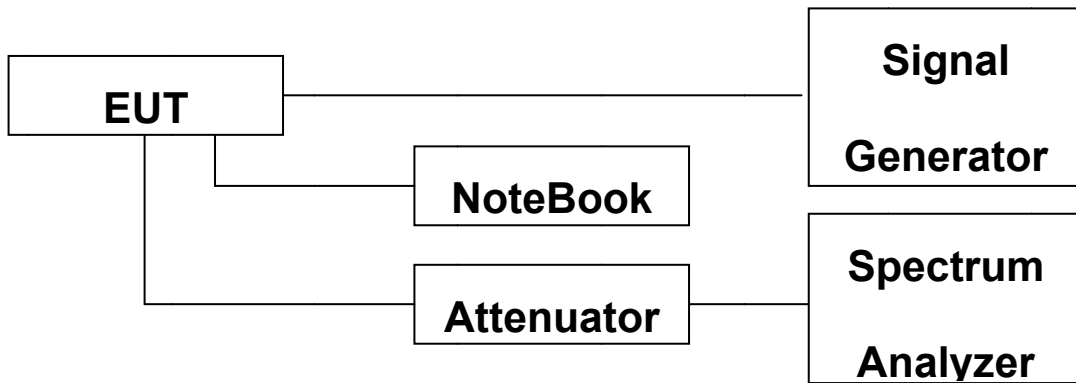
**TABLE 4 TO §90.542(a)—PERMISSIBLE POWER AND ANTENNA HEIGHTS FOR BASE AND FIXED STATIONS IN THE 758-768 MHz BAND TRANSMITTING A SIGNAL WITH AN EMISSION BANDWIDTH GREATER THAN 1 MHz**

<b>Antenna height (AAT) in meters (feet)</b>	<b>Effective radiated power (ERP) per MHz (watts/MHz)</b>
Above 1372 (4500)	130
Above 1220 (4000) To 1372 (4500)	140
Above 1067 (3500) To 1220 (4000)	150
Above 915 (3000) To 1067 (3500)	200
Above 763 (2500) To 915 (3000)	280
Above 610 (2000) To 763 (2500)	400
Above 458 (1500) To 610 (2000)	700
Above 305 (1000) To 458 (1500)	1200
Up to 305 (1000)	2000

(b) For base and fixed stations operating in the 758-768 MHz band in accordance with the provisions of paragraph (a)(5) of this section, the power flux density that would be produced by such stations through a combination of antenna height and vertical gain pattern must not exceed 3000 microwatts per square meter on the ground over the area extending to 1 km from the base of the antenna mounting structure.

**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
iDEN	DL : -25 dBm	DL : 55 dB
LTE 10 MHz	UL : -45 dBm	UL : 35 dB

**[Downlink]**

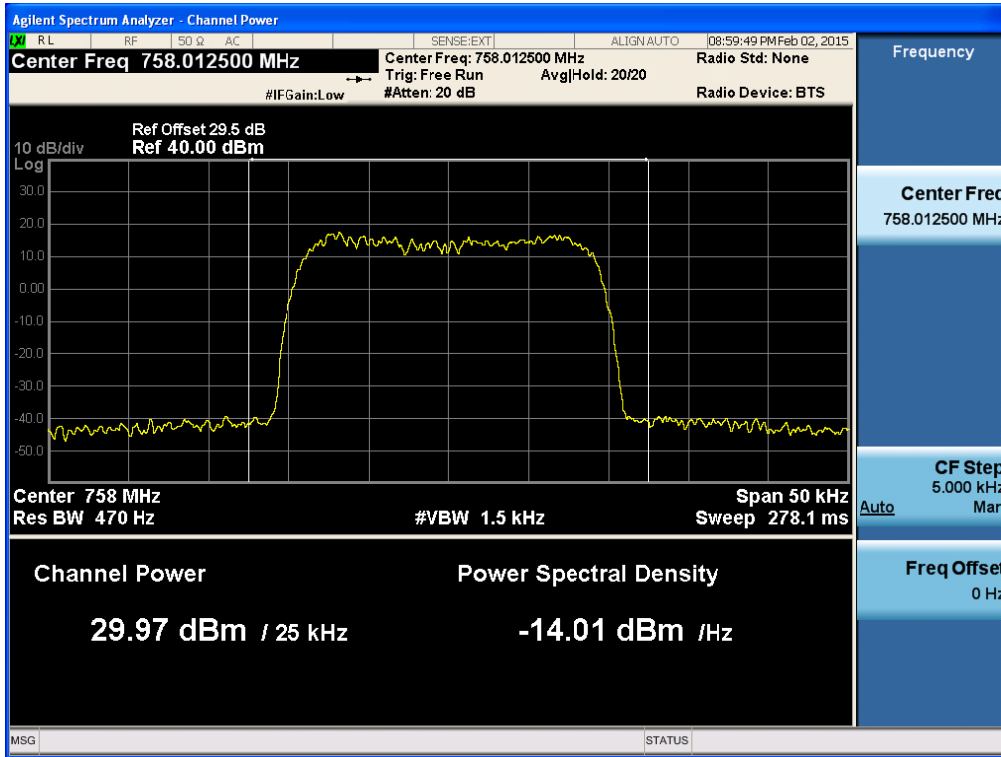
	Channel	Frequency (MHz)	Output Power	
			(dBm)	(W)
iDEN	Low	758.0125	29.97	0.992
	Middle	767.9875	29.88	0.974
	High	774.9875	28.87	0.770
LTE 10 MHz	Low	763.00	30.00	1.000

**[Uplink]**

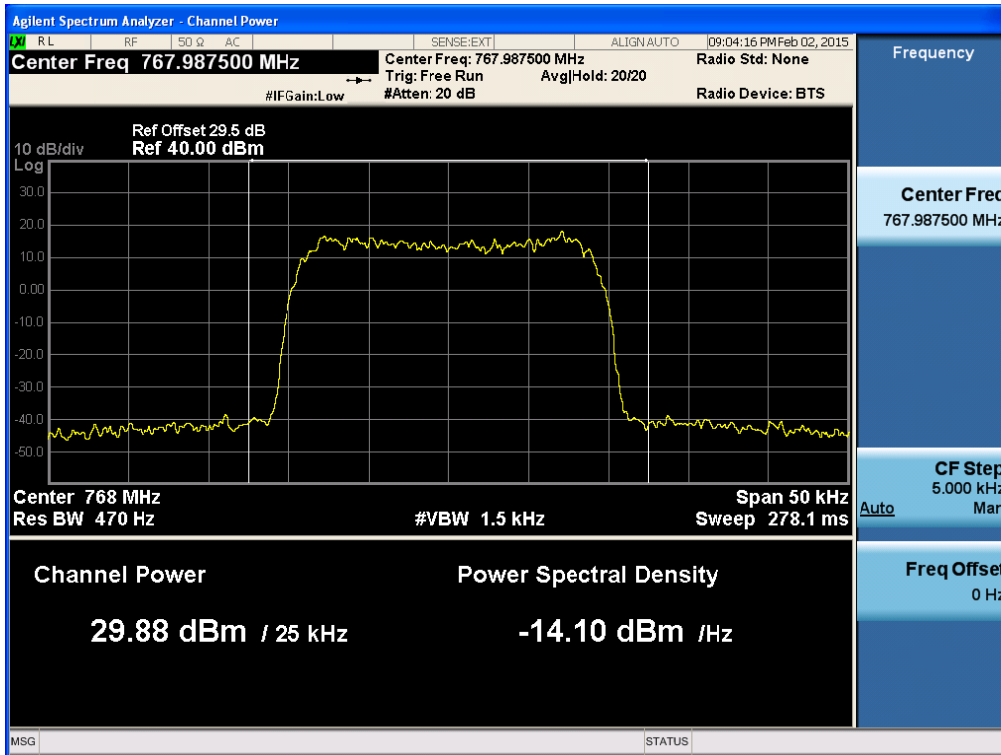
	Channel	Frequency (MHz)	Output Power	
			(dBm)	(mW)
iDEN	Low	788.0125	-10.04	0.099
	Middle	797.9875	-10.01	0.100
	High	804.9875	-10.01	0.100
LTE 10 MHz	Low	793.00	-10.01	0.100

**Plots of RF Output Power\_Downlink  
iDEN 700**

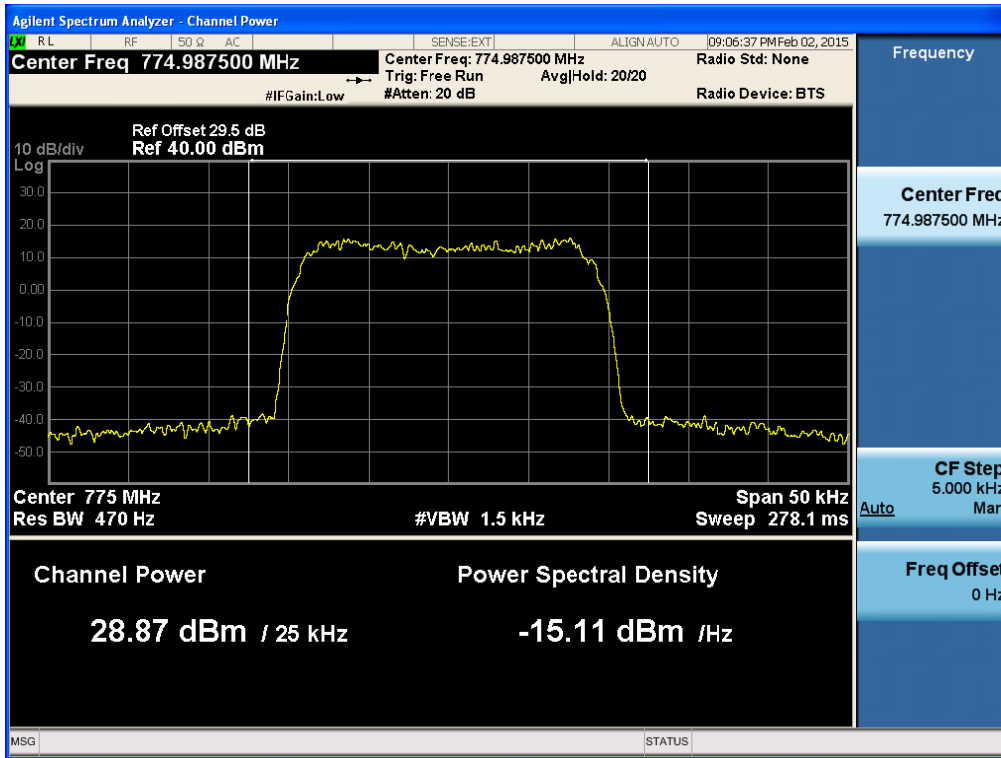
**[iDEN Downlink Low]**



**[iDEN Downlink Middle]**

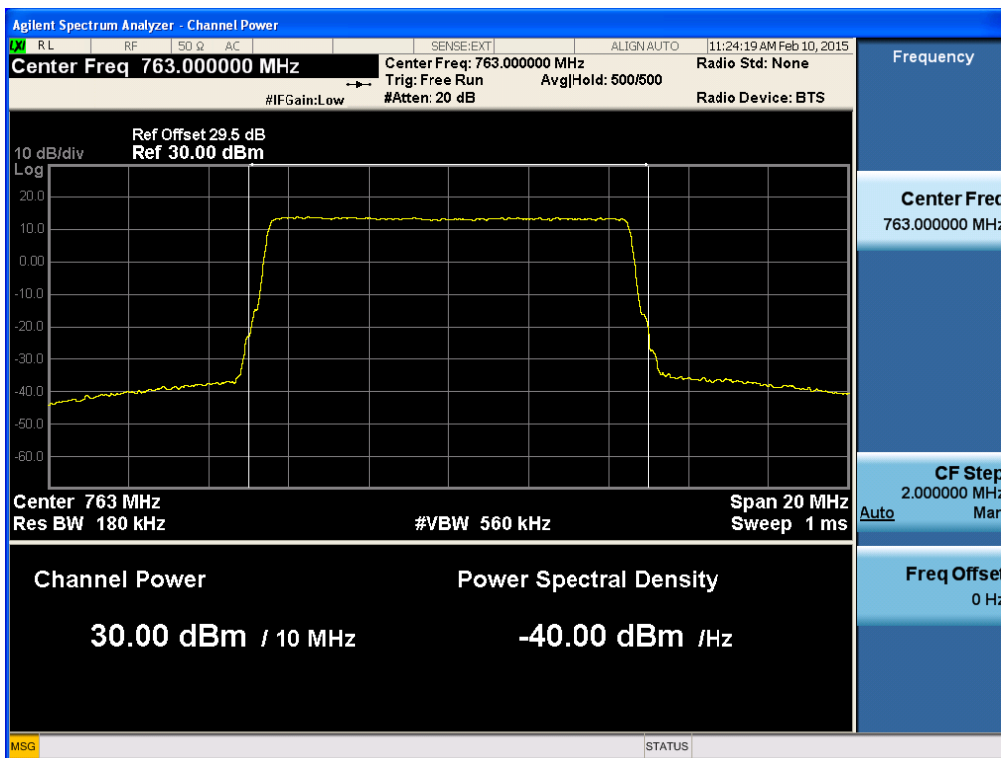


**[iDEN Downlink High]**



**LTE 10 MHz**

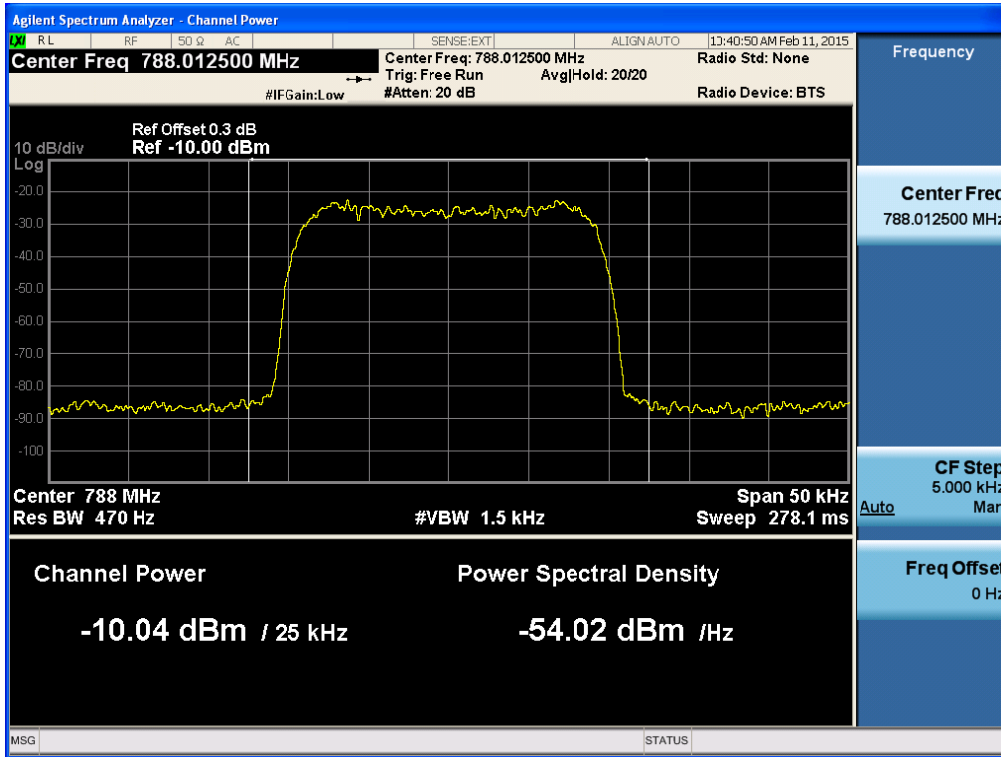
**[LTE 10 MHz Downlink Low]**



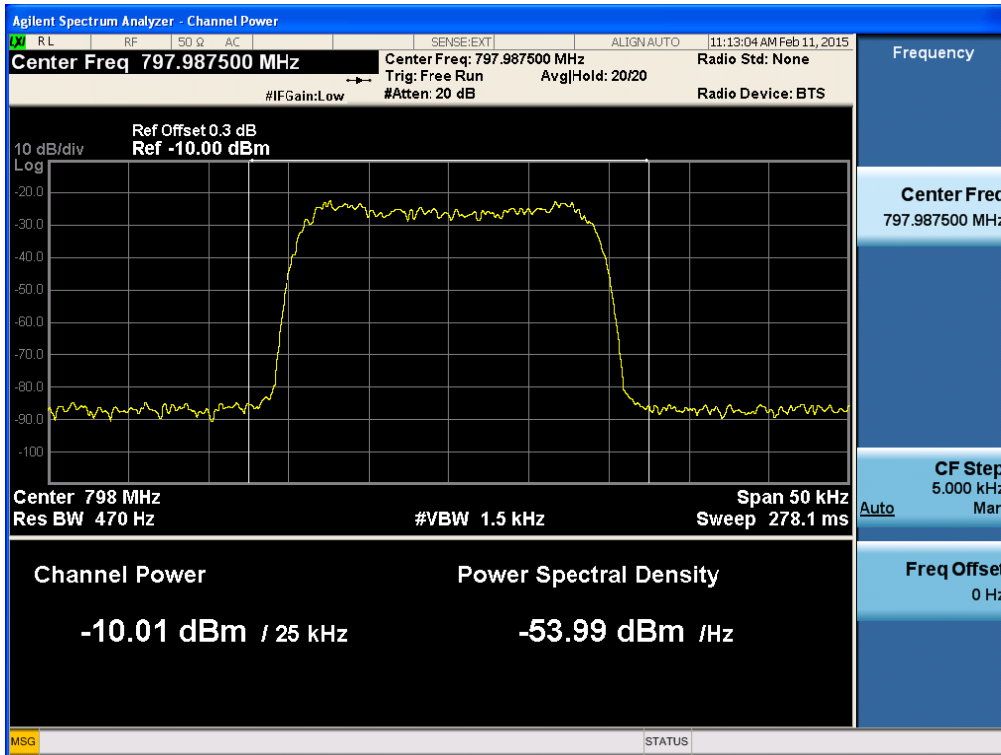


**Plots of RF Output Power\_Uplink  
iDEN 700**

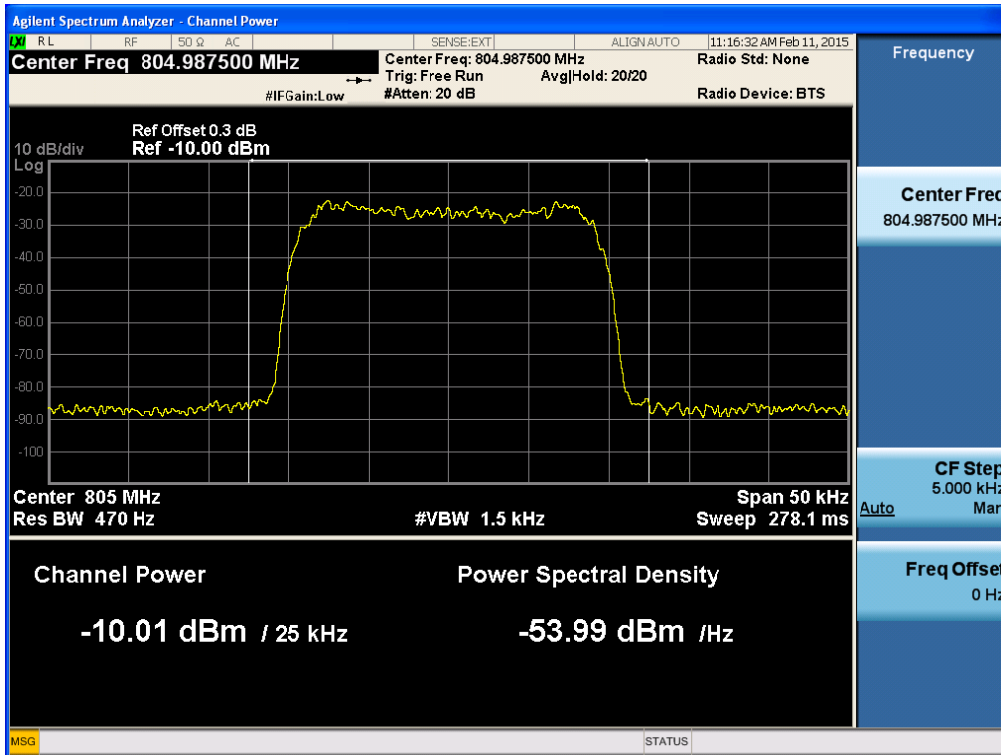
**[iDEN Uplink Low]**



**[iDEN Uplink Middle]**

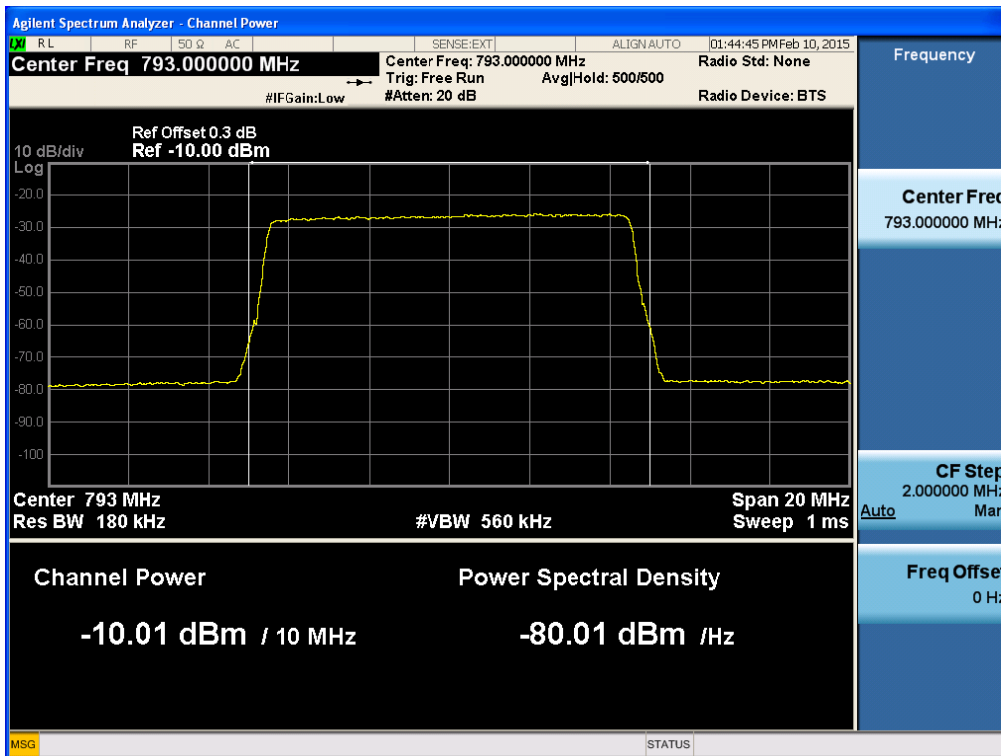


[iDEN Uplink High]



LTE 10 MHz

[LTE 10 MHz Uplink Low]



## 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
iDEN	DL : -25 dBm	DL : 55 dB
LTE 10 MHz	UL : -45 dBm	UL : 35 dB

**[Downlink Output]**

	<b>Channel</b>	<b>Frequency (MHz)</b>	<b>OBW (kHz)</b>
iDEN	Low	758.0125	18.254
	Middle	767.9875	18.177
	High	774.9875	18.185

	<b>Channel</b>	<b>Frequency (MHz)</b>	<b>OBW (MHz)</b>
LTE 10 MHz	Low	763.00	8.982

**[Downlink Input]**

	<b>Channel</b>	<b>Frequency (MHz)</b>	<b>OBW (kHz)</b>
iDEN	Low	758.0125	18.188
	Middle	767.9875	18.521
	High	774.9875	18.044

	<b>Channel</b>	<b>Frequency (MHz)</b>	<b>OBW (MHz)</b>
LTE 10 MHz	Low	763.00	9.021

**[Uplink Output]**

	<b>Channel</b>	<b>Frequency (MHz)</b>	<b>OBW (kHz)</b>
iDEN	Low	788.0125	18.400
	Middle	797.9875	18.135
	High	804.9875	18.421

	<b>Channel</b>	<b>Frequency (MHz)</b>	<b>OBW (MHz)</b>
LTE 10 MHz	Low	793.00	8.996

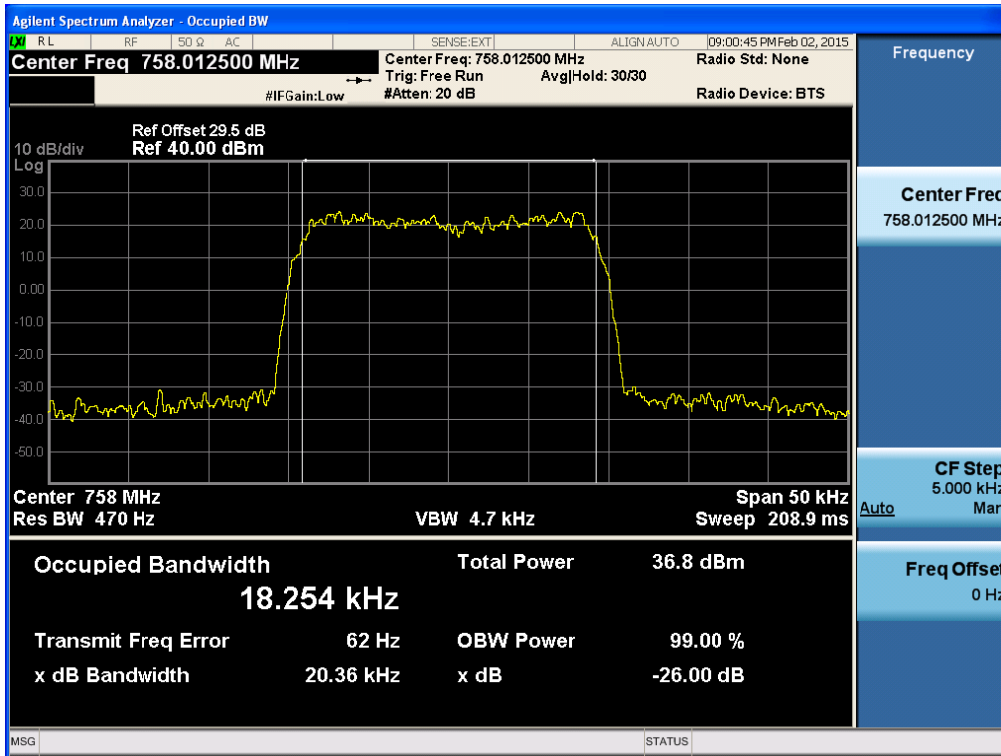
**[Uplink Input]**

	<b>Channel</b>	<b>Frequency (MHz)</b>	<b>OBW (kHz)</b>
iDEN	Low	788.0125	18.243
	Middle	797.9875	18.398
	High	804.9875	18.097

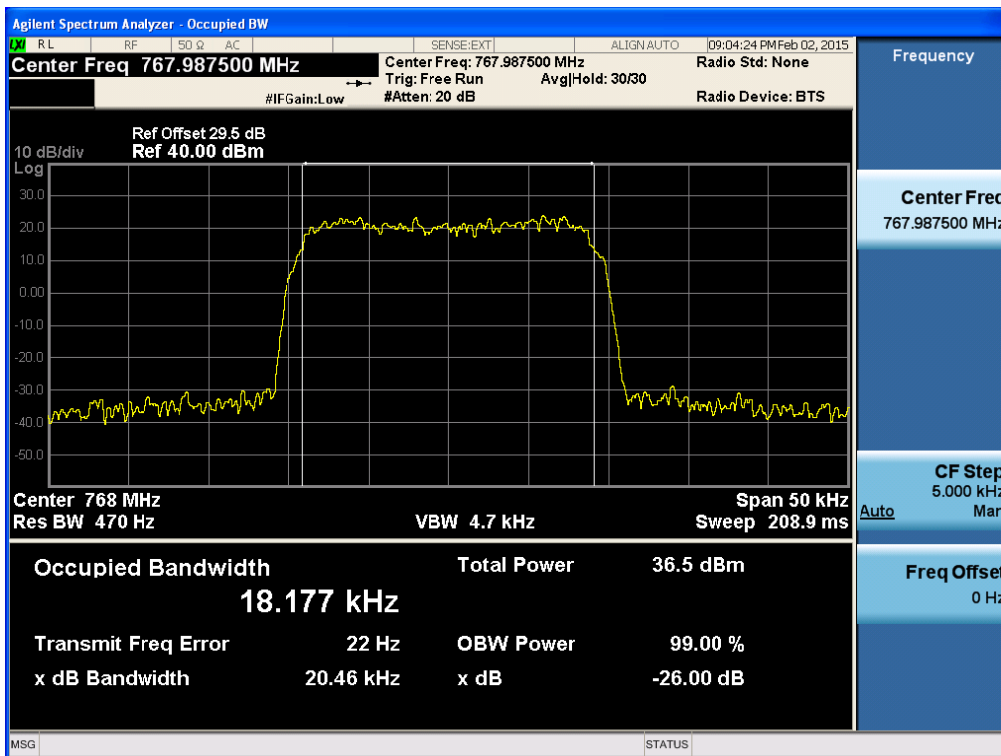
	<b>Channel</b>	<b>Frequency (MHz)</b>	<b>OBW (MHz)</b>
LTE 10 MHz	Low	793.00	8.989

**Plots of Occupied Bandwidth\_Downlink**  
**iDEN 700**

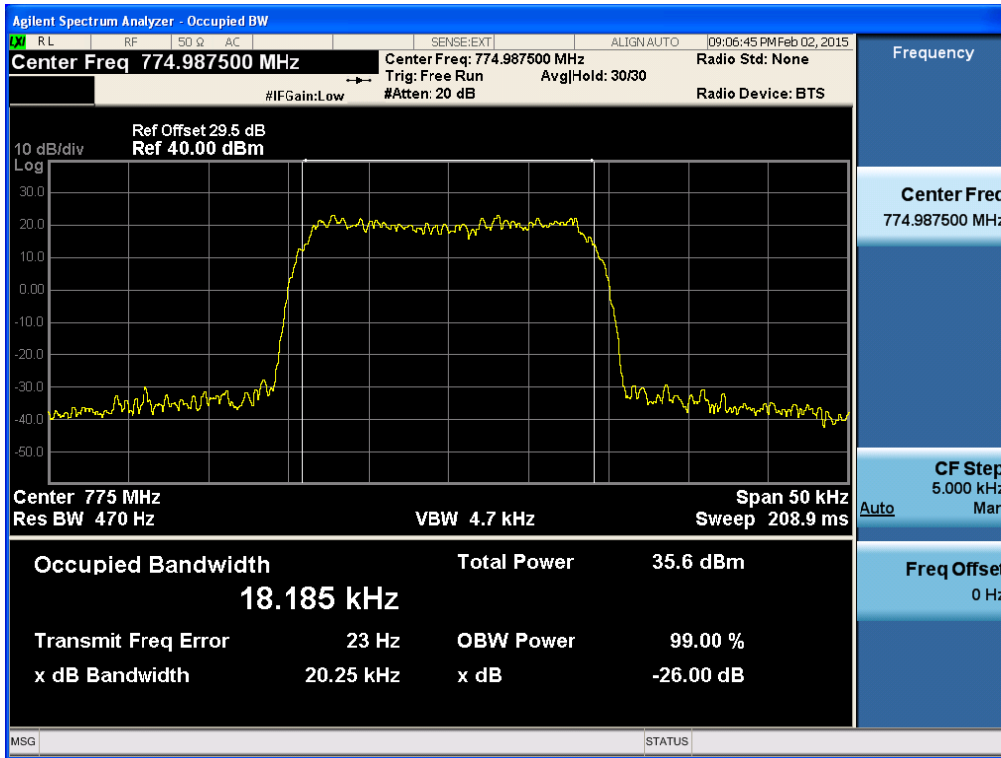
**[Output iDEN Downlink Low]**



**[Output iDEN Downlink Middle]**

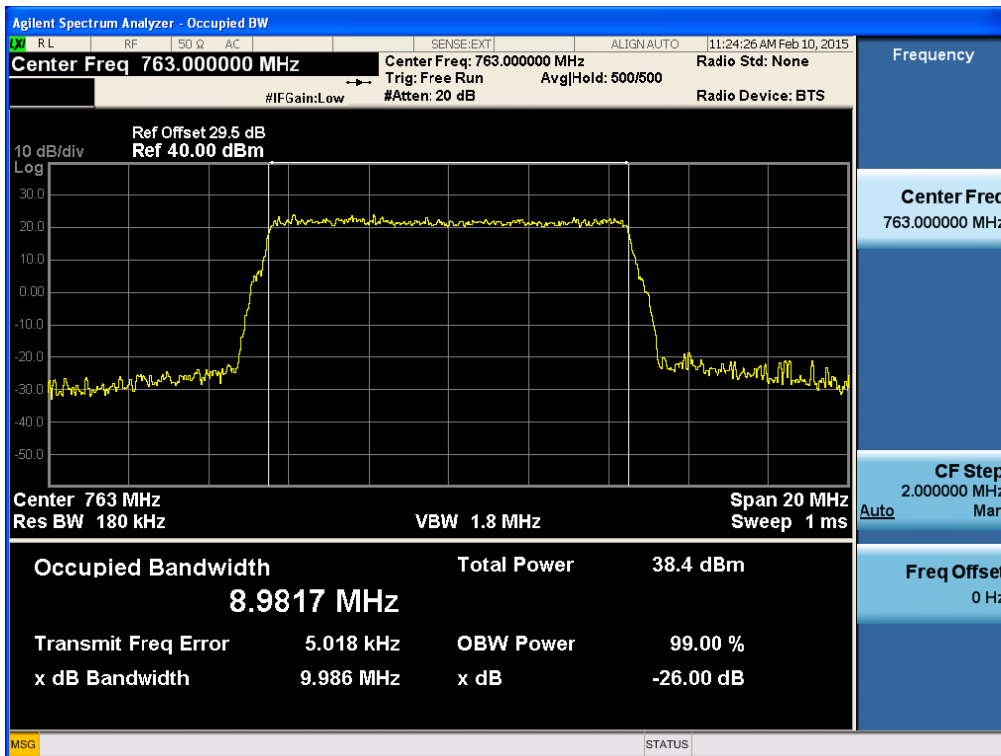


**[Output iDEN Downlink High]**



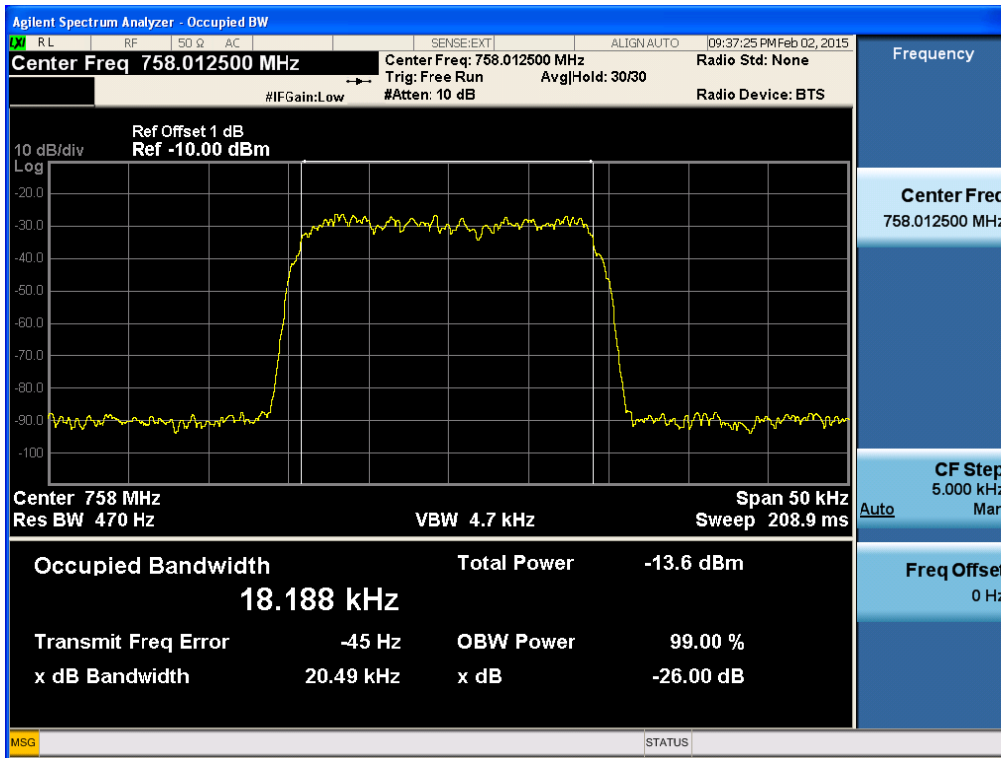
**LTE 10 MHz**

**[Output LTE 10 MHz Downlink Low]**

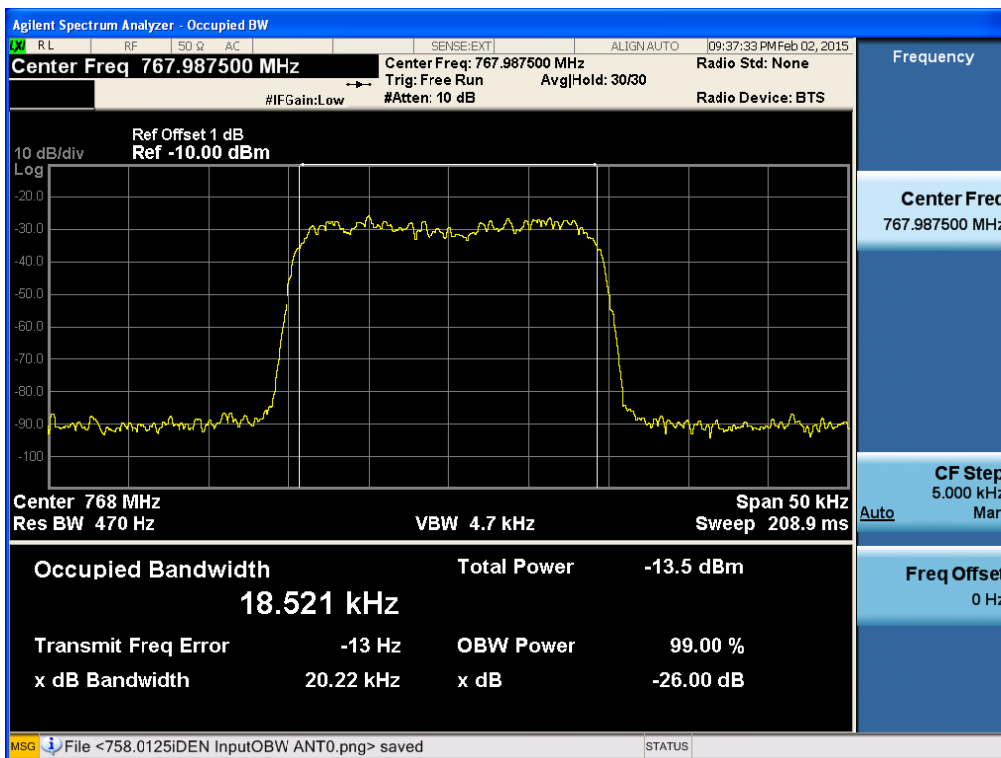


**iDEN 700**

**[Input iDEN Downlink Low]**

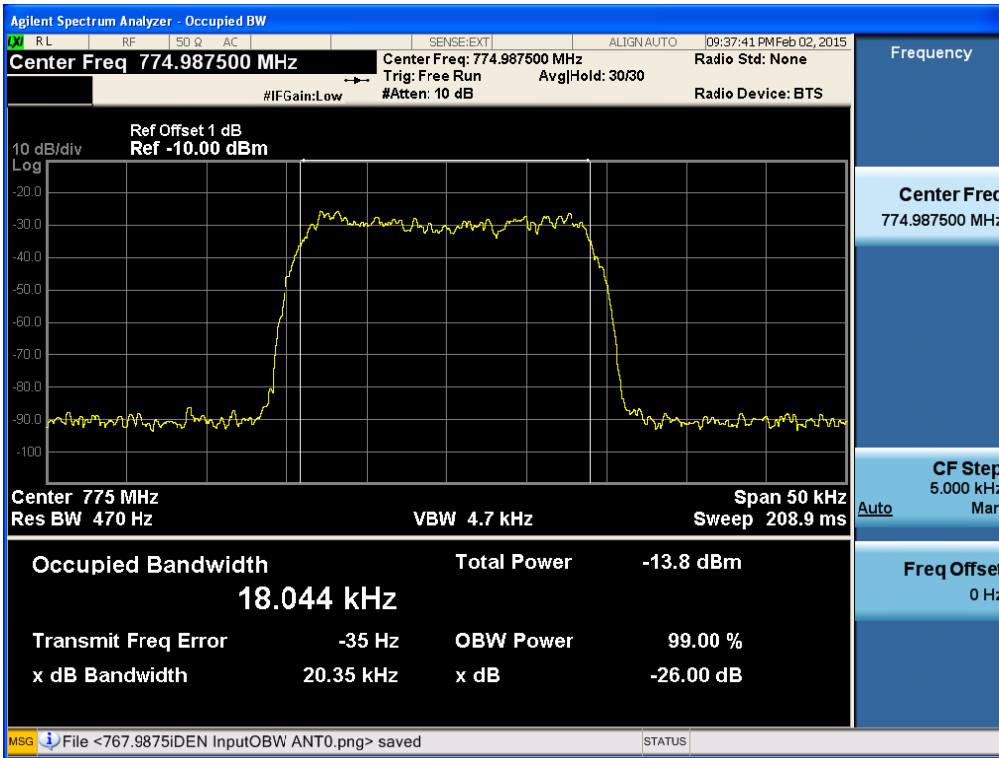


**[Input iDEN Downlink Middle]**



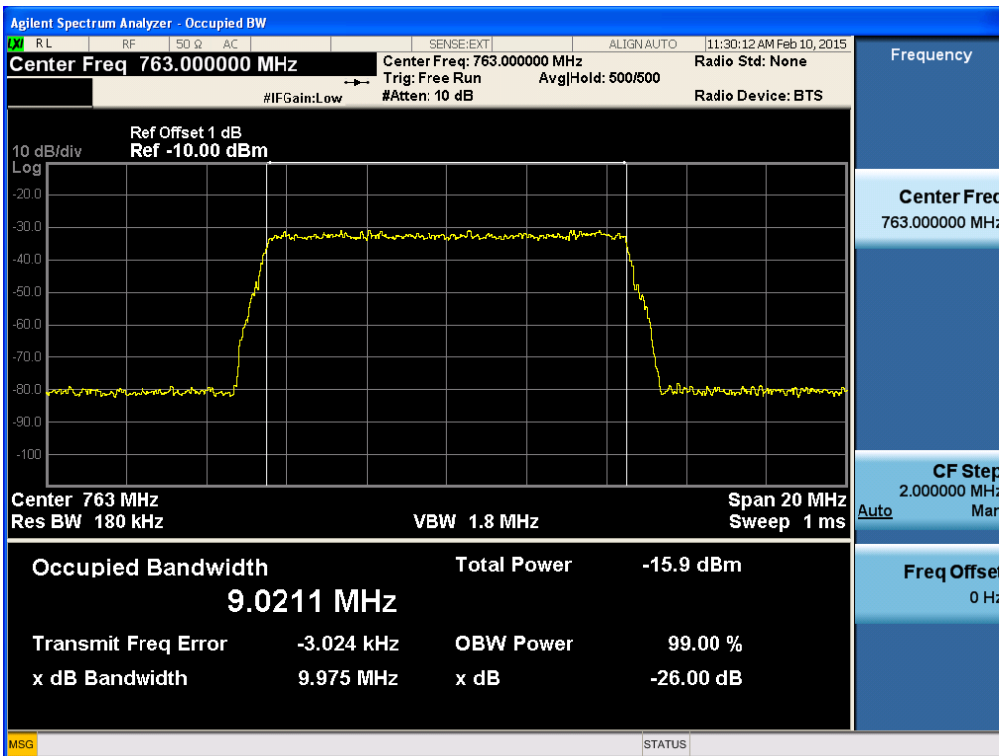


[Input iDEN Downlink High]



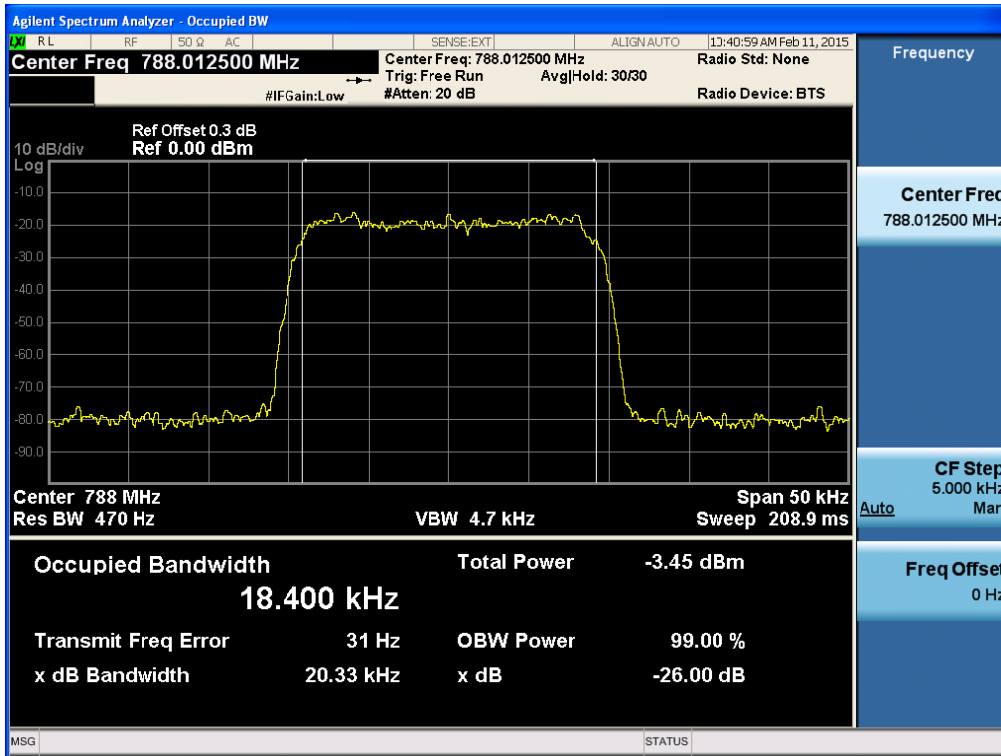
LTE 10 MHz

[Input LTE 10 MHz Downlink Low]

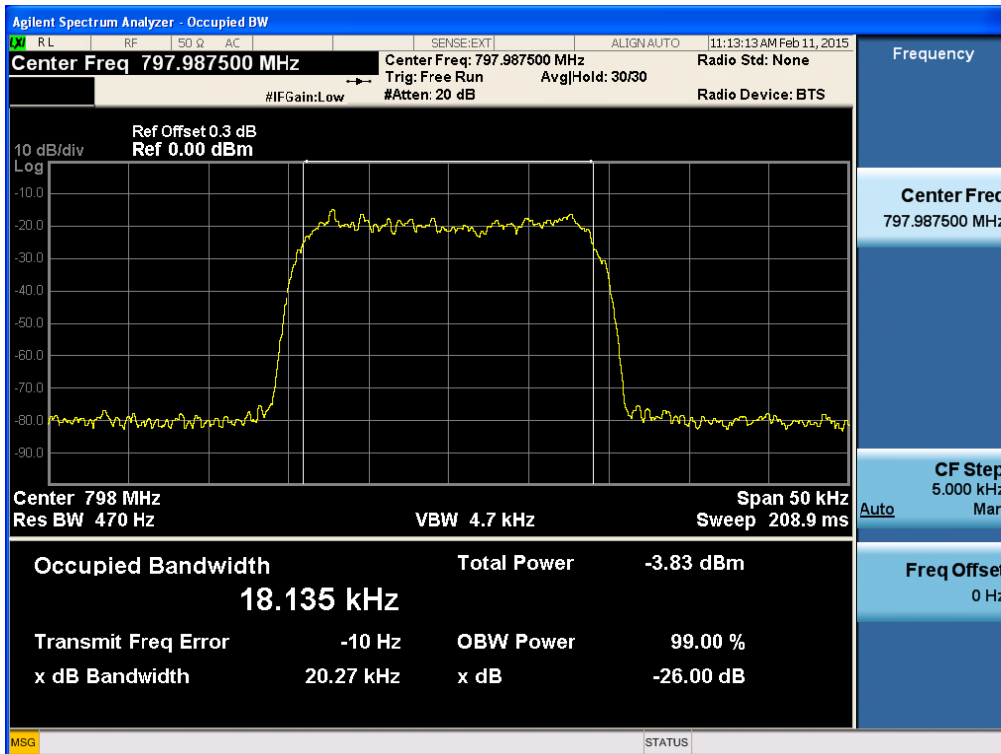


**Plots of Occupied Bandwidth\_Uplink**  
**iDEN 700**

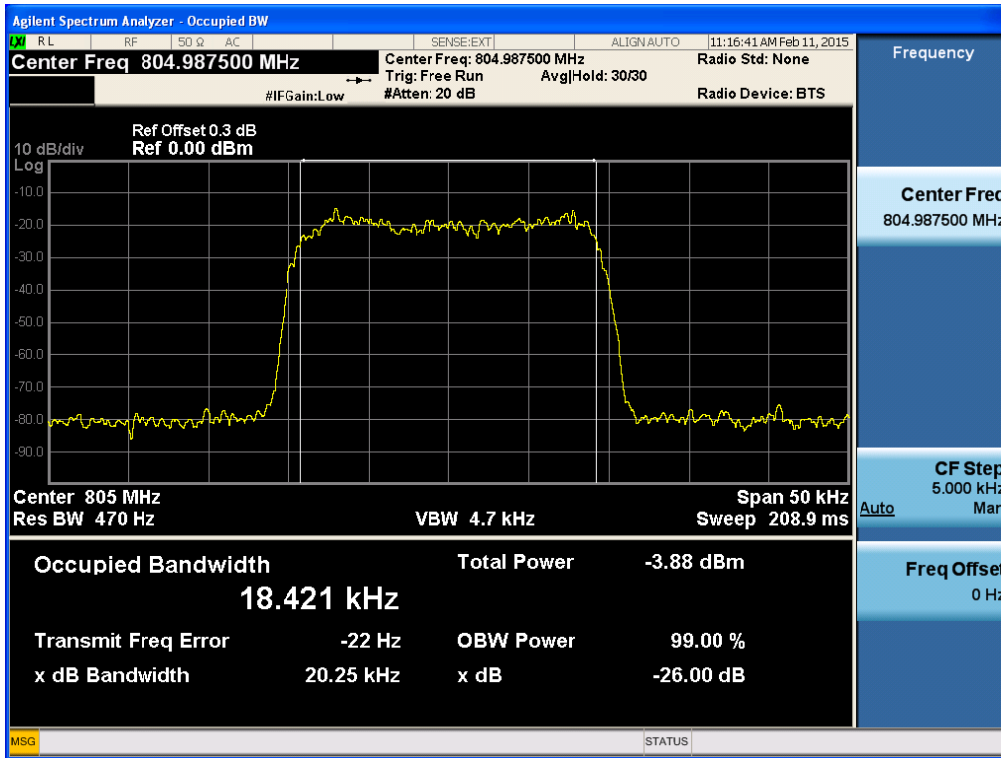
**[Output iDEN Uplink Low]**



**[Output iDEN Uplink Middle]**

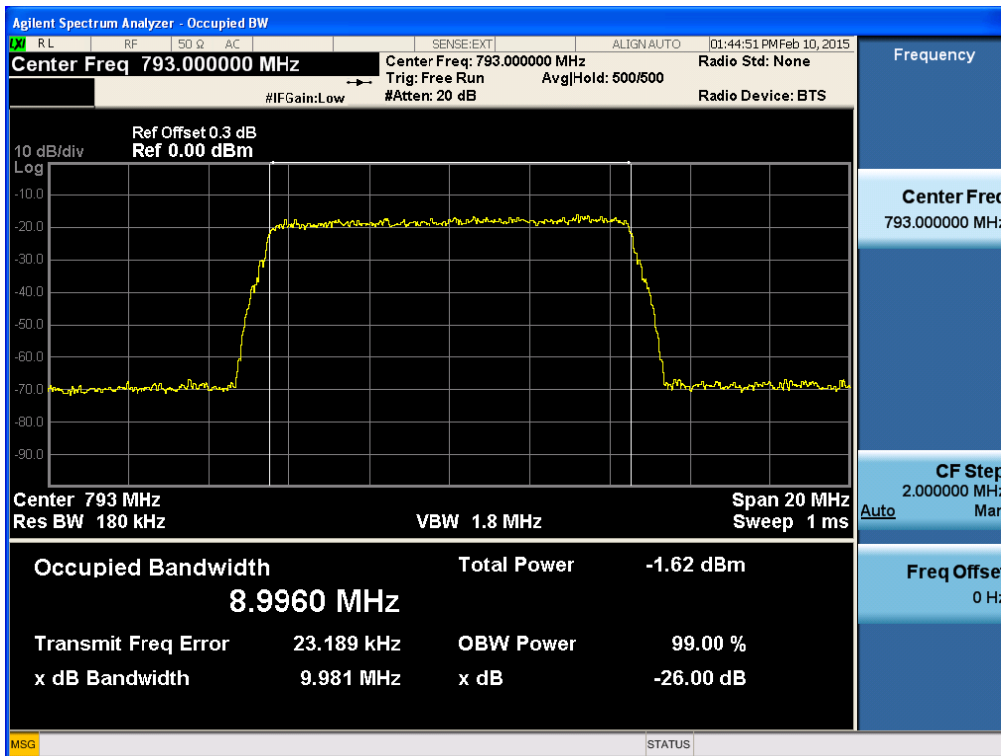


**[Output iDEN Uplink High]**



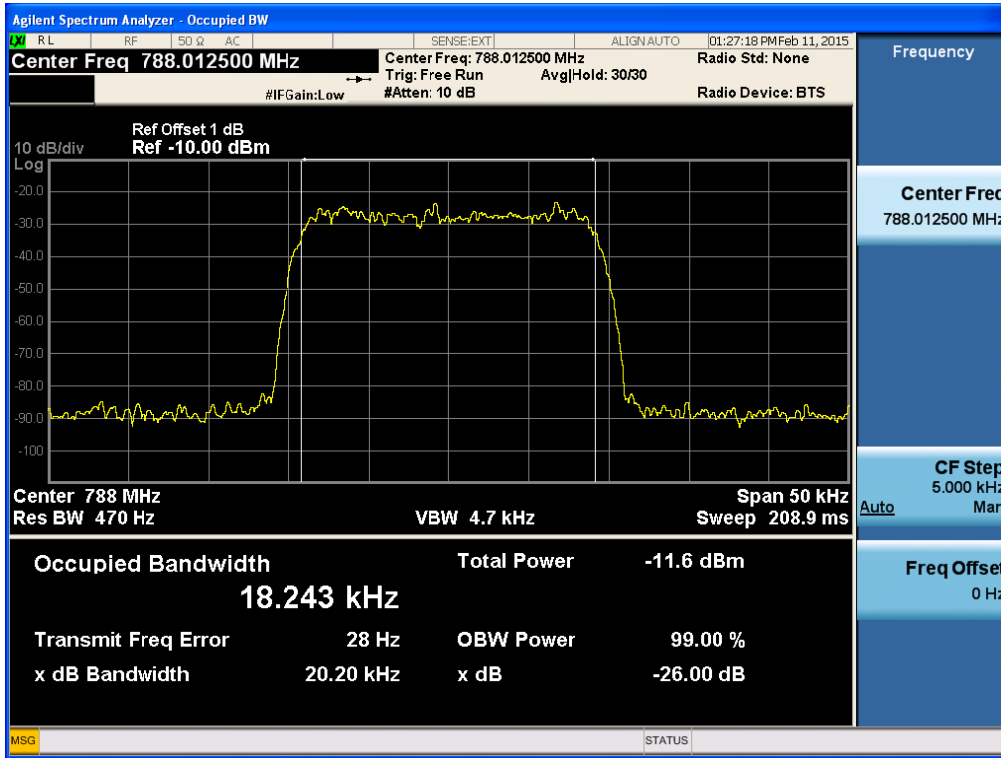
**LTE 10 MHz**

**[LTE 10 MHz Uplink Low]**

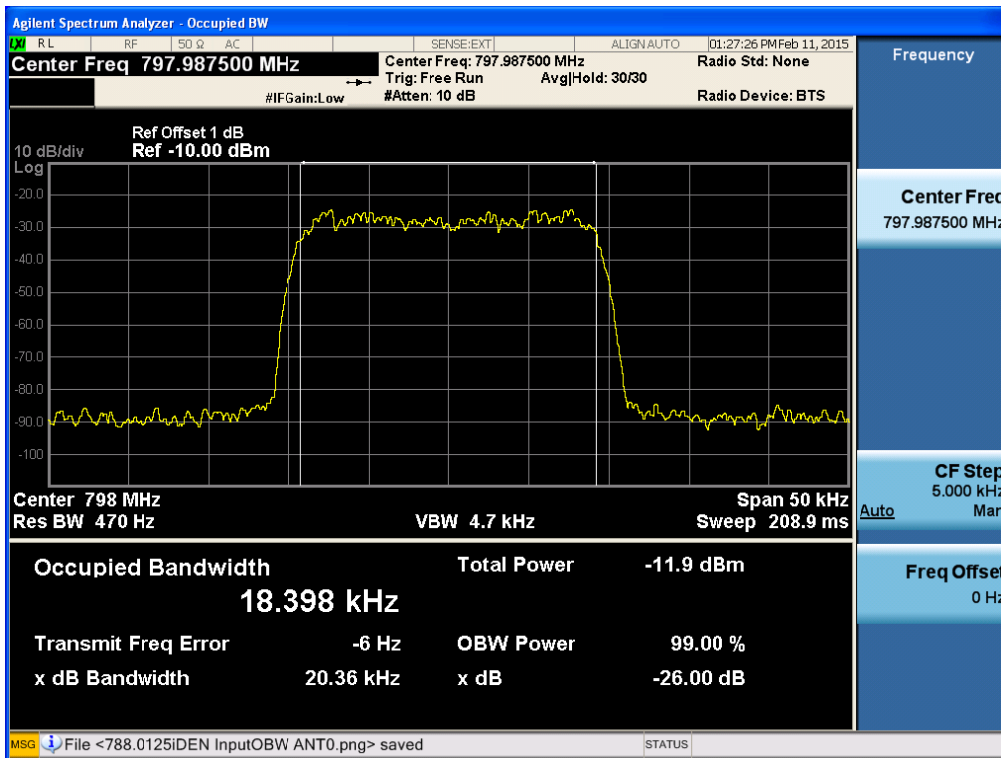


**iDEN 700**

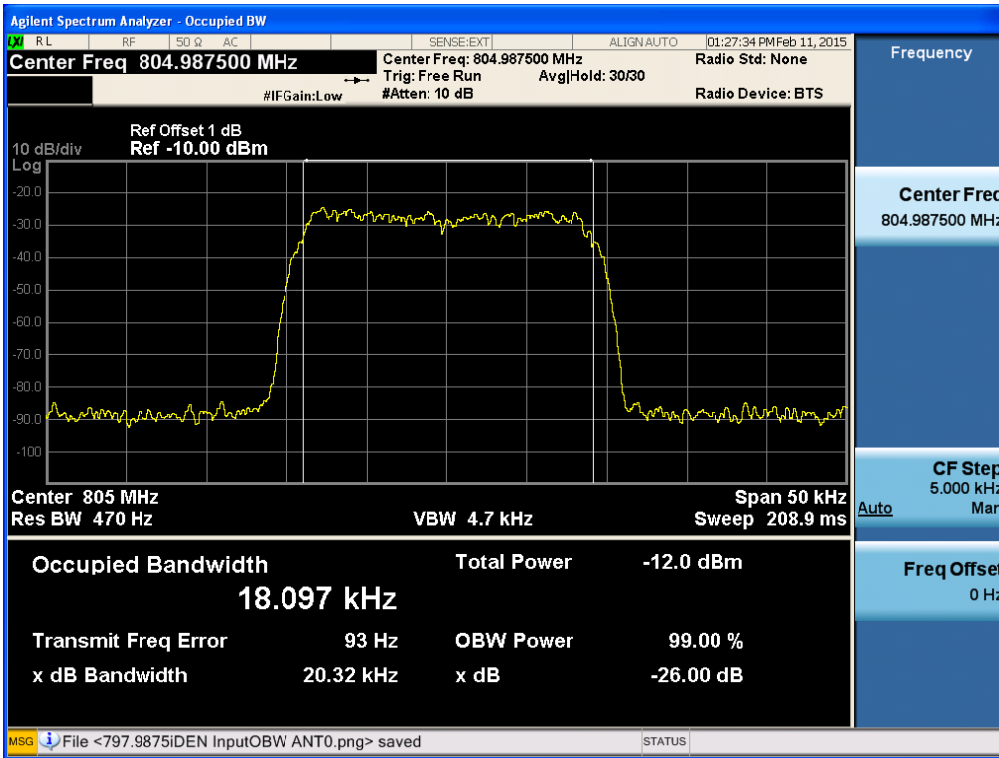
**[Input iDEN Uplink Low]**



**[Input iDEN Uplink Middle]**

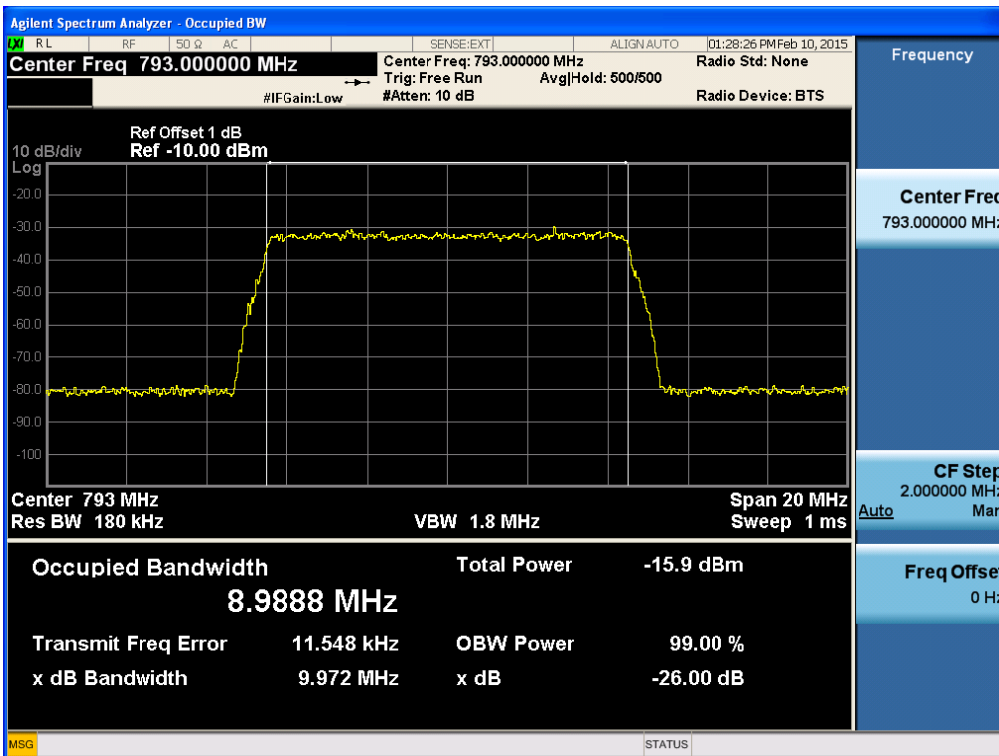


[Input iDEN Uplink High]



LTE 10 MHz

[Input LTE 10 MHz Uplink Low]



## 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 Level (dBm)	Maximum Amp Gain
Input Signal : Sinusoidal	
DL : -25 dBm	DL : 55 dB
UL : -45 dBm	UL : 35 dB

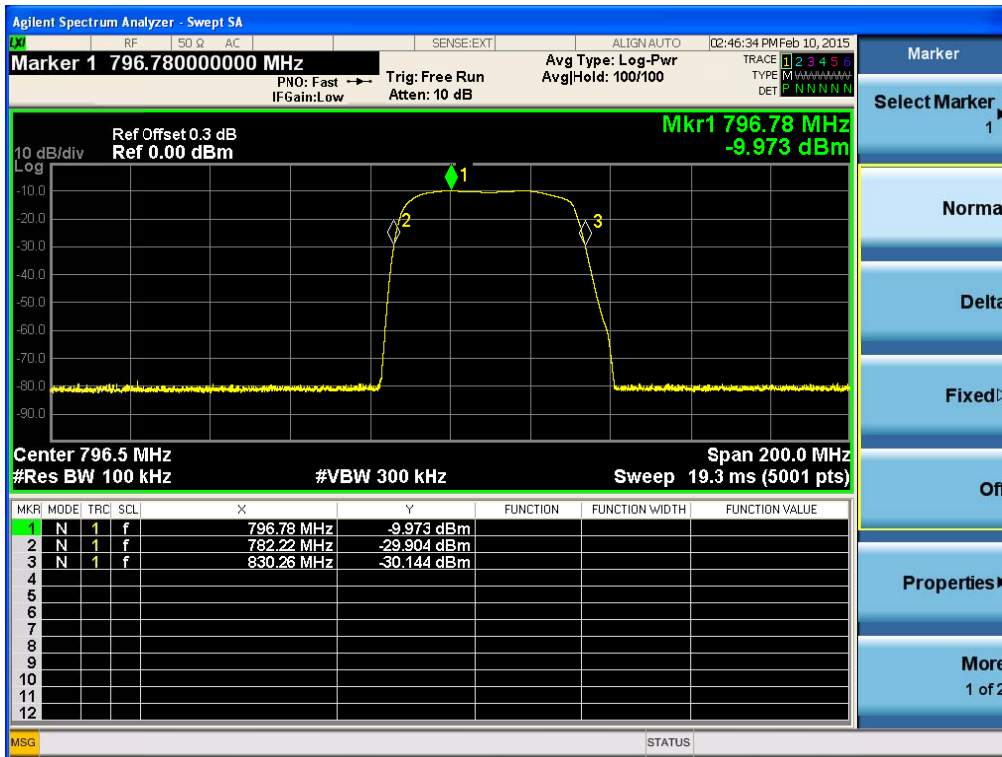
**700 MHz Band**

[Uplink]

20 dB point frequency (MHz)	Output power (dBm)	Gain (dB)
782.22 ~ 830.26	-9.97	35.03

**Plots of Out of Band Rejection \_Uplink**

[700 MHz Band Uplink]



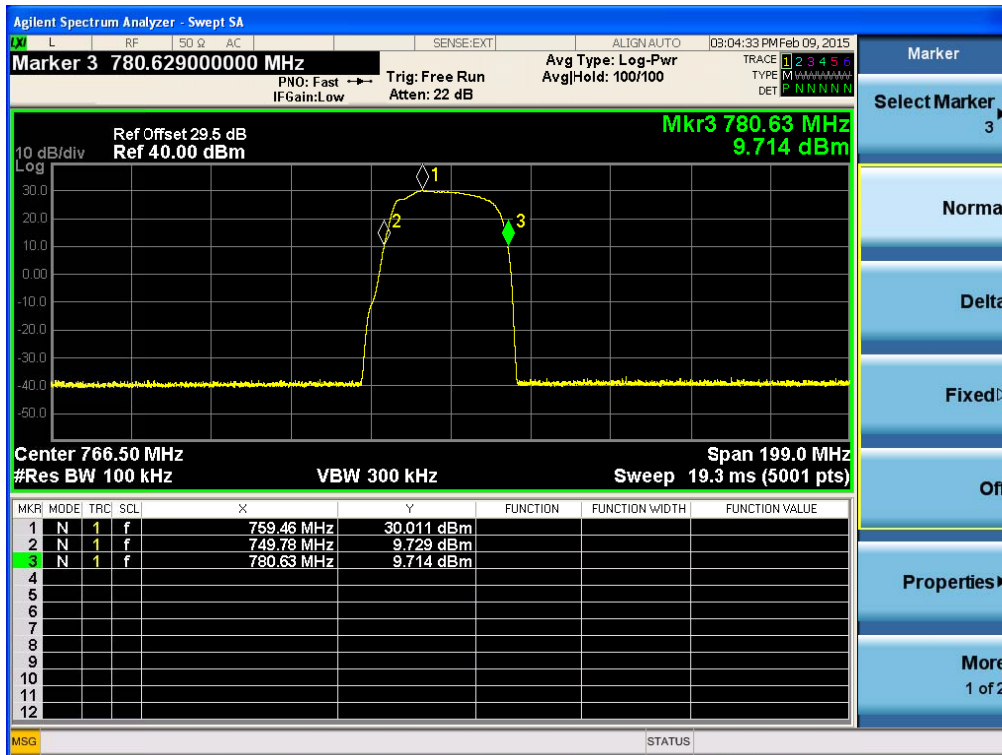
**700 MHz Band**

[Downlink]

20 dB point frequency (MHz)	Output power (dBm)	Gain (dB)
749.78 ~ 780.63	30.01	55.01

**Plots of Out of Band Rejection\_Downlink**

[700 MHz Band Downlink]





## 9. NOISE FIGURE

### FCC Rules

#### Test Requirement(s):

**§ 90.219 Use of signal boosters:**

(e) (2) The noise figure of a signal booster must not exceed 9 dB in either direction.

**Test Procedures:**

Noise figure measured in the maximum gain of the repeater state.

Without input signal.

$$NF = NP - G - BCF + PNAD$$

$$NF = NP - G - 60 + 174$$

$$NF = NP - G + 114$$

NF=Noise Figure(dB)

NP=Noise power(dBm/MHz)

G=Maximum gain

BCF=Bandwidth Correction Factor=10log(1 MHz/1 Hz)=60

PNAD=Noise Power Density=174 dBm/Hz

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

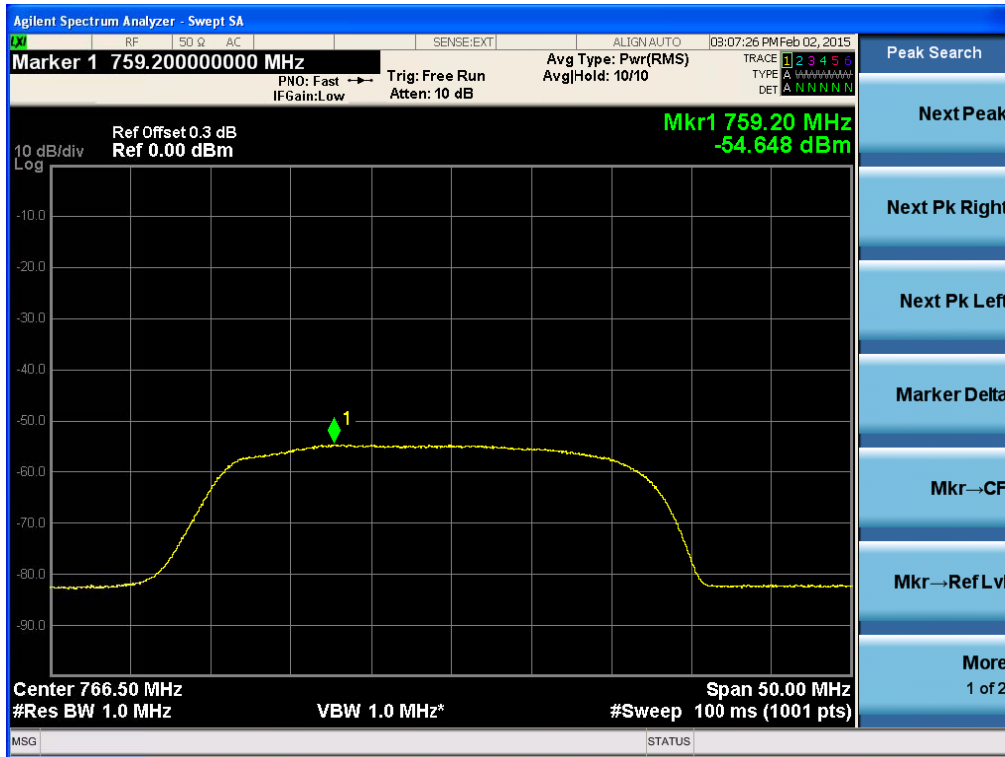
Input Signal	Maximum Amp Gain
Without input signal	DL : 55 dB

### 700 MHz Band

$$\text{Noise Figure} = -54.648 - 55 + 114 = 4.352 \text{ dB}$$

Plots of Noise power

[700 MHz Band Downlink]



## 10. 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.

**§ 90.543 Emission limitations.**

Transmitters designed to operate in 769-775 MHz and 799-805 MHz frequency bands must meet the emission limitations in paragraphs (a) through (d) of this section. Class A and Class B signal boosters retransmitting signals in the 769-775 MHz and 799-805 MHz frequency bands are exempt from the limits listed in paragraph (a) of this section when simultaneously retransmitting multiple signals and instead shall be subject to the limit listed in paragraph (c) of this section when operating in this manner. Transmitters operating in 758-768 MHz and 788-798 MHz bands must meet the emission limitations in (e) of this section.

(a) The adjacent channel power (ACP) requirements for transmitters designed for various channel sizes are shown in the following tables. Mobile station requirements apply to handheld, car mounted and control station units. The tables specify a value for the ACP as a function of the displacement from the channel center frequency and measurement bandwidth. In the following tables, "(s)" indicates a swept measurement may be used.

#### 25 KHZ MOBILE TRANSMITTER ACP REQUIREMENTS

Offset from center frequency (kHz)	Measurement bandwidth (kHz)	Maximum relative ACP (dBc)
15.625	6.25	-40
21.875	6.25	-60
37.50	25	-60

62.50	25	-65
87.50	25	-65
150.00	100	-65
250.00	100	-65
350.00	100	-65
>400 kHz to 12 MHz	30 (s)	-75
12 MHz to paired receive band	30 (s)	-75
In the paired receive band	30 (s)	-100

(b) *ACP measurement procedure.* The following are the procedures for making the transmitter ACP measurements. For all measurements modulate the transmitter as it would be modulated in normal operating conditions. For time division multiple access (TDMA) systems, the measurements are to be made under TDMA operation only during time slots when the transmitter is active. All measurements are made at the transmitter's output port. If a transmitter has an integral antenna, a suitable power coupling device shall be used to couple the RF signal to the measurement instrument. The coupling device shall substantially maintain the proper transmitter load impedance. The ACP measurements may be made with a spectrum analyzer capable of making direct ACP measurements. "Measurement bandwidth", as used for non-swept measurements, implies an instrument that measures the power in many narrow bandwidths equal to the nominal resolution bandwidth and integrates these powers to determine the total power in the specified measurement bandwidth.

(1) *Setting reference level.* Set transmitter to maximum output power. Using a spectrum analyzer capable of ACP measurements, set the measurement bandwidth to the channel size. For example, for a 6.25 kHz transmitter set the measurement bandwidth to 6.25 kHz. Set the frequency offset of the measurement bandwidth to zero and adjust the center frequency of the instrument to the assigned center frequency to measure the average power level of the transmitter. Record this power level in dBm as the "reference power level."

(2) *Non-swept power measurement.* Using a spectrum analyzer capable of ACP measurements, set the measurement bandwidth and frequency offset from the assigned center frequency as shown in the tables in §90.543 (a) above. Any value of resolution bandwidth may be used as long as it does not exceed 2 percent of the

specified measurement bandwidth. Measure the power level in dBm. These measurements should be made at maximum power. Calculate ACP by subtracting the reference power level measured in (b)(1) from the measurements made in this step. The absolute value of the calculated ACP must be greater than or equal to the absolute value of the ACP given in the table for each condition above.

(3) *Swept power measurement.* Set a spectrum analyzer to 30 kHz resolution bandwidth, 1 MHz video bandwidth and average, sample, or RMS detection. Set the reference level of the spectrum analyzer to the RMS value of the transmitter power. Sweep above and below the carrier frequency to the limits defined in the tables. Calculate ACP by subtracting the reference power level measured in (b)(1) from the measurements made in this step. The absolute value of the calculated ACP must be greater than or equal to the absolute value of the ACP given in the table for each condition above.

(c) *Out-of-band emission limit.* On any frequency outside of the frequency ranges covered by the ACP tables in this section, the power of any emission must be reduced below the mean output power (P) by at least  $43 + 10 \log (P)$  dB measured in a 100 kHz bandwidth for frequencies less than 1 GHz, and in a 1 MHz bandwidth for frequencies greater than 1 GHz.

(d) *Authorized bandwidth.* Provided that the ACP requirements of this section are met, applicants may request any authorized bandwidth that does not exceed the channel size.

(e) For operations in the 758-768 MHz and the 788-798 MHz bands, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

(1) On all frequencies between 769-775 MHz and 799-805 MHz, by a factor not less than  $76 + 10 \log (P)$  dB in a 6.25 kHz band segment, for base and fixed stations.

(2) On all frequencies between 769-775 MHz and 799-805 MHz, by a factor not less than  $65 + 10 \log (P)$  dB in a 6.25 kHz band segment, for mobile and portable stations.

(3) On any frequency between 775-788 MHz, above 805 MHz, and below 758 MHz, by at least  $43 + 10 \log (P)$  dB.

(4) Compliance with the provisions of paragraphs (e)(1) and (2) of this section is based on the use of measurement instrumentation such that the reading taken with any resolution bandwidth setting should be adjusted to indicate spectral energy in a 6.25 kHz segment.

(5) Compliance with the provisions of paragraph (e)(3) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of 30 kHz may be employed.

(f) For operations in the 758-775 MHz and 788-805 MHz bands, all emissions including harmonics in the band 1559-1610 MHz shall be limited to  $-70$  dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and  $-80$  dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

(g) 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.

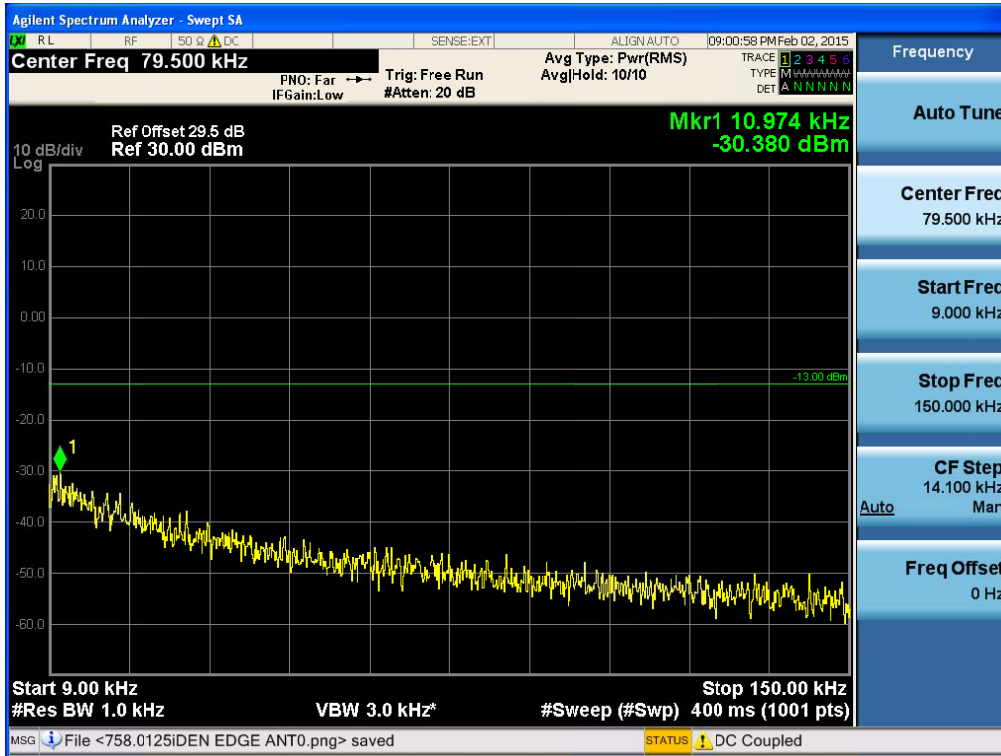
**Test Procedures:**

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

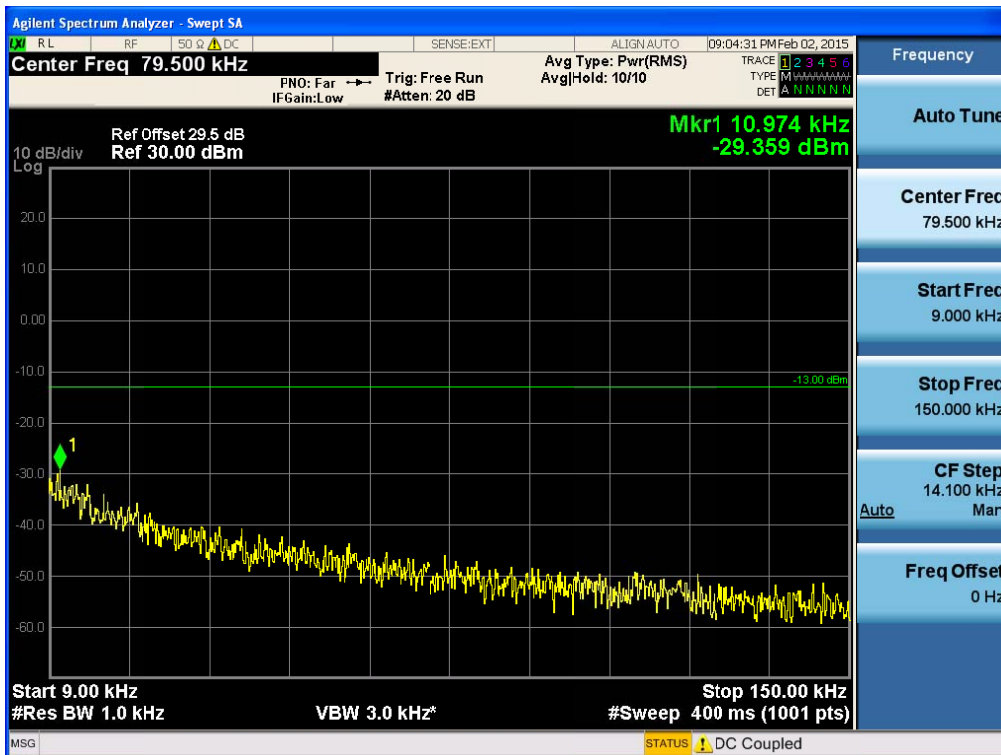
Sufficient scans were taken to show any out of band emissions up to 10th harmonics.

**Plots of Spurious Emission\_Downlink**  
**Conducted Spurious Emissions (9 kHz – 150 kHz)**  
**iDEN 700**

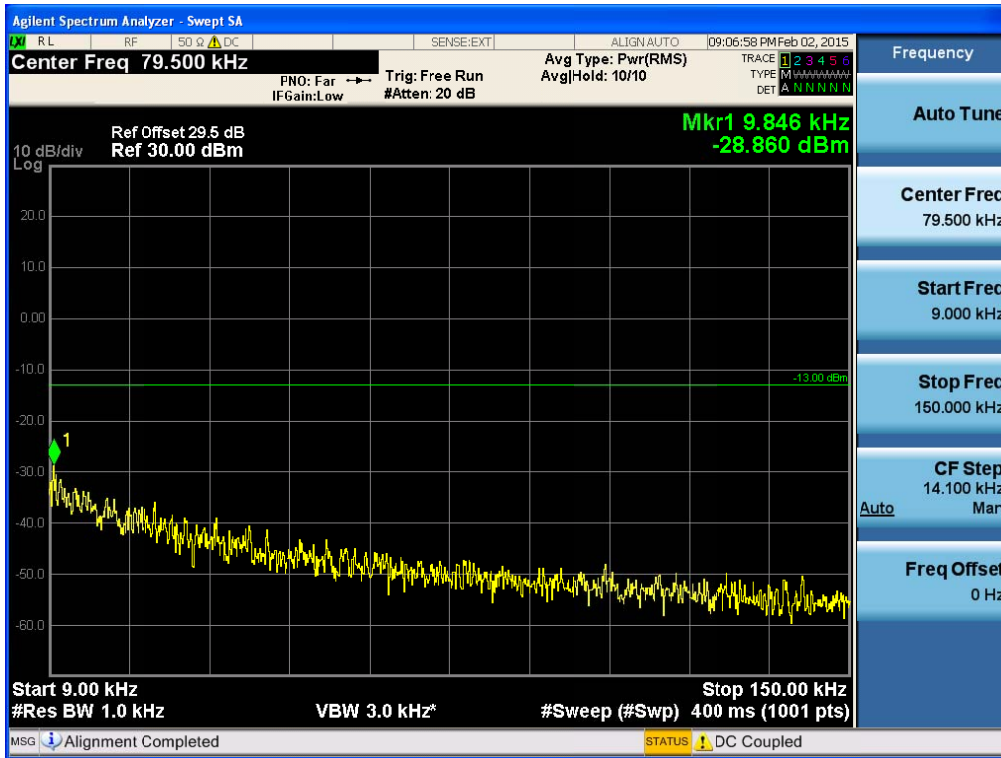
**[iDEN Downlink Low]**



**[iDEN Downlink Middle]**

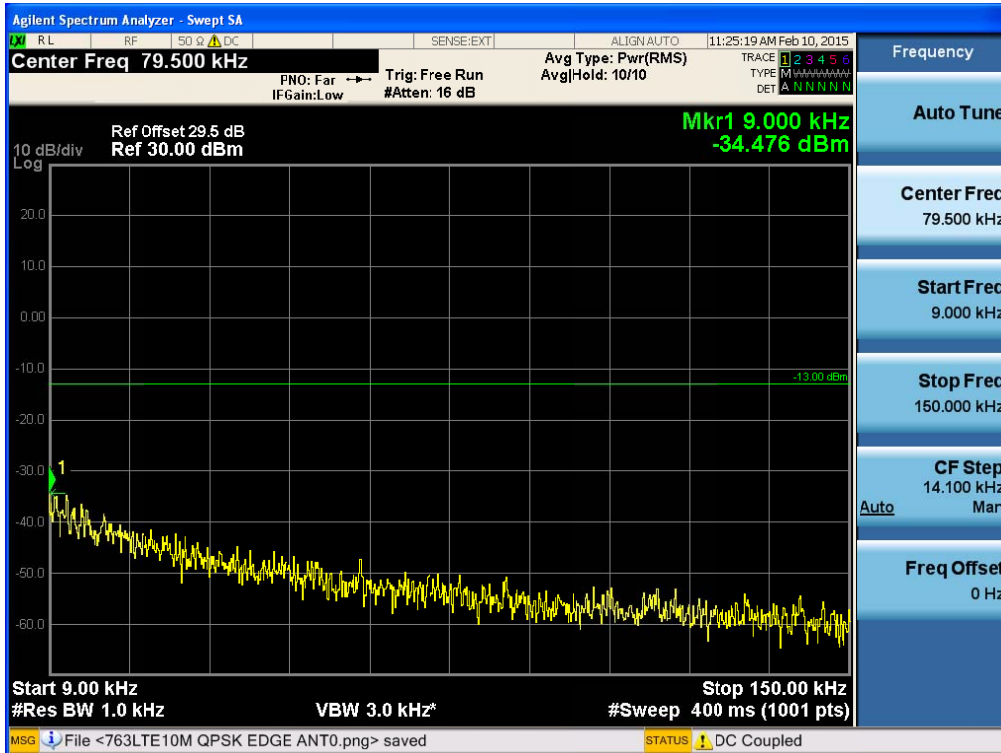


[iDEN Downlink High]



LTE 10 MHz

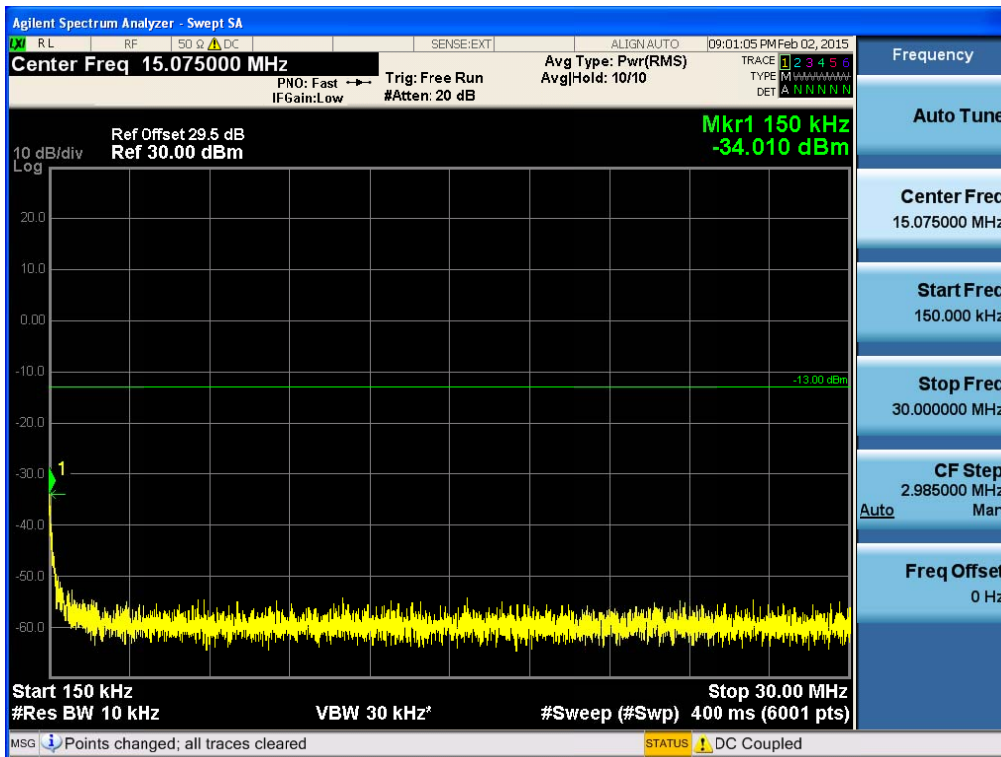
[LTE 10 MHz Downlink Low]



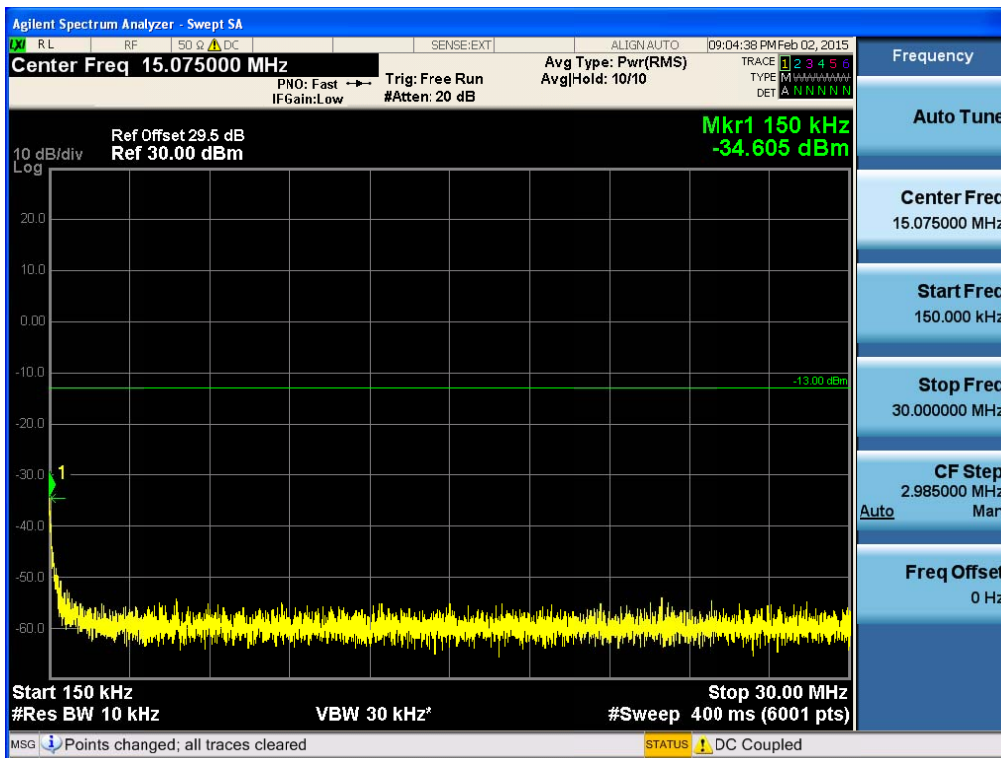


**Conducted Spurious Emissions (150 kHz – 30 MHz)  
iDEN 700**

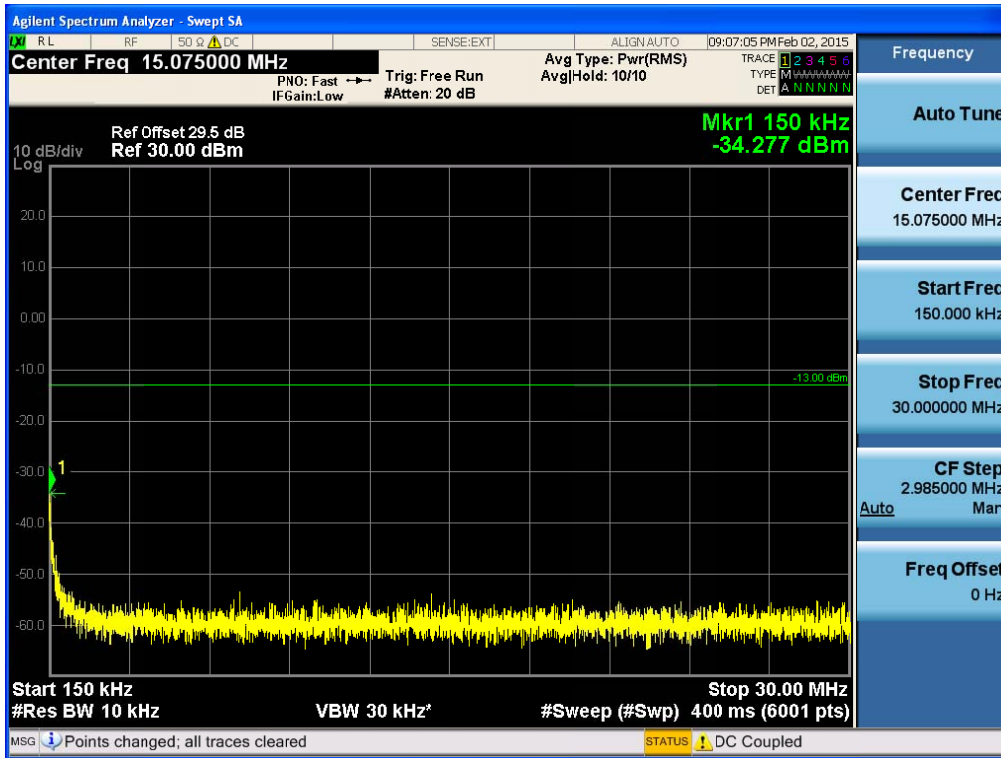
**[iDEN Downlink Low]**



**[iDEN Downlink Middle]**

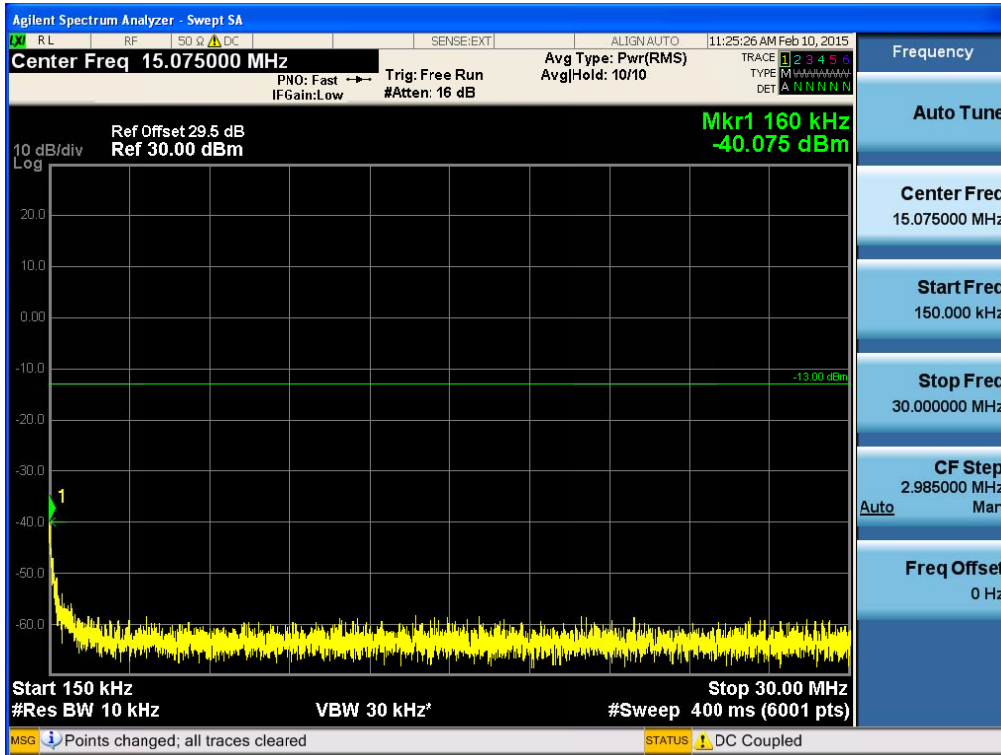


[iDEN Downlink High]



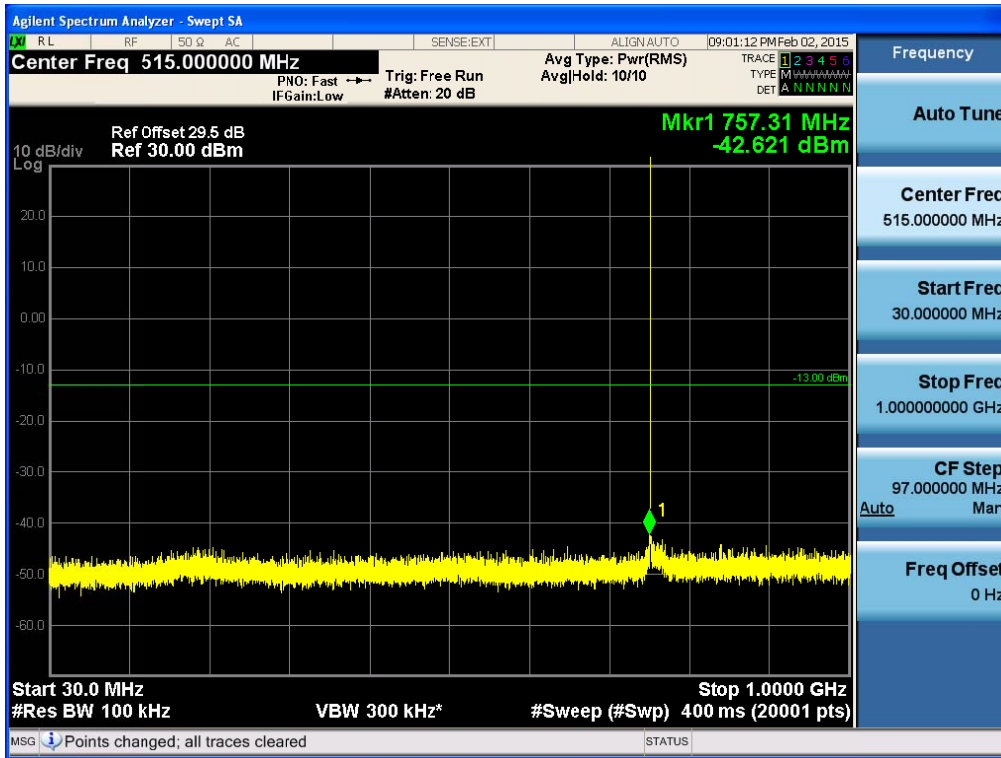
LTE 10 MHz

[LTE 10 MHz Downlink Low]

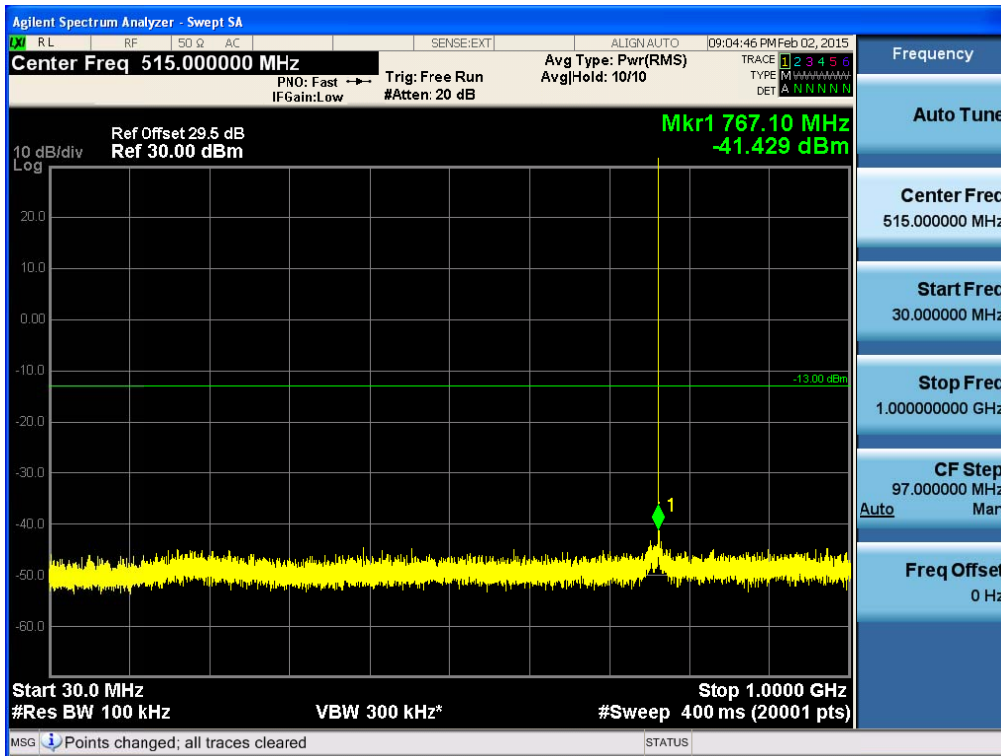


**Conducted Spurious Emissions (30 MHz – 1 GHz)  
iDEN 700**

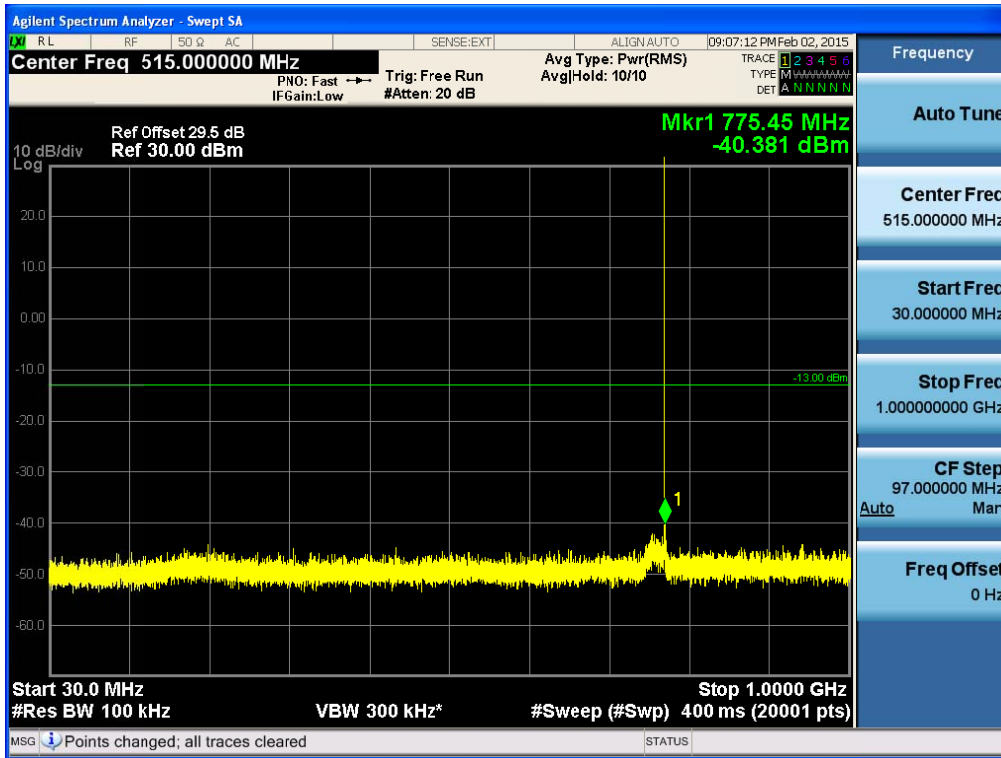
**[iDEN Downlink Low]**



**[iDEN Downlink Middle]**

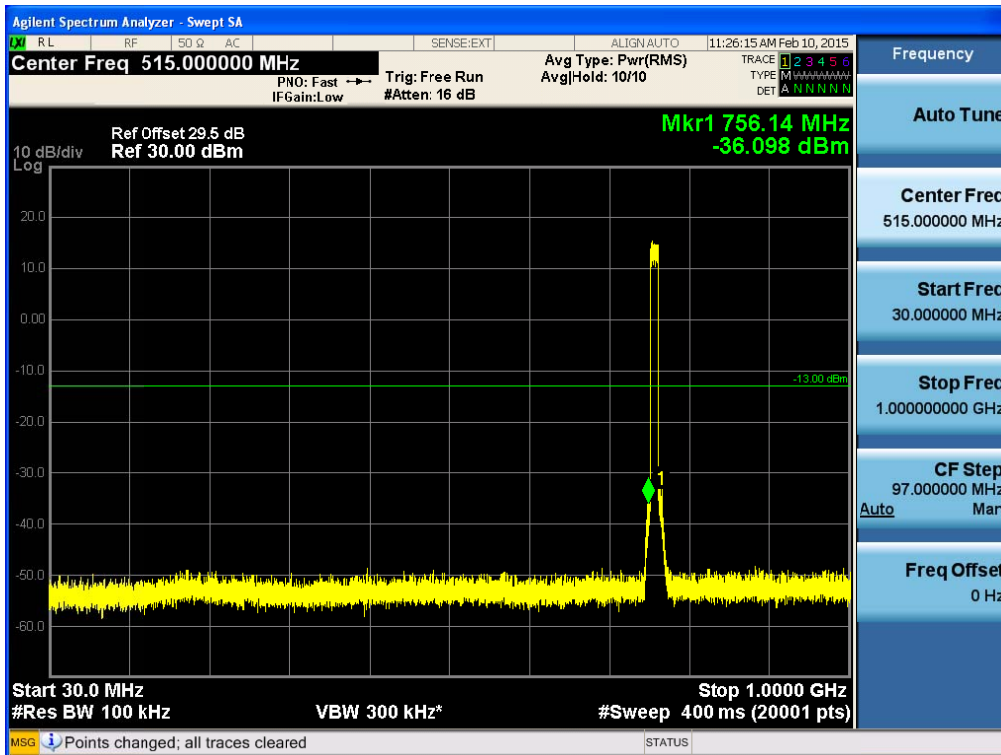


[iDEN Downlink High]



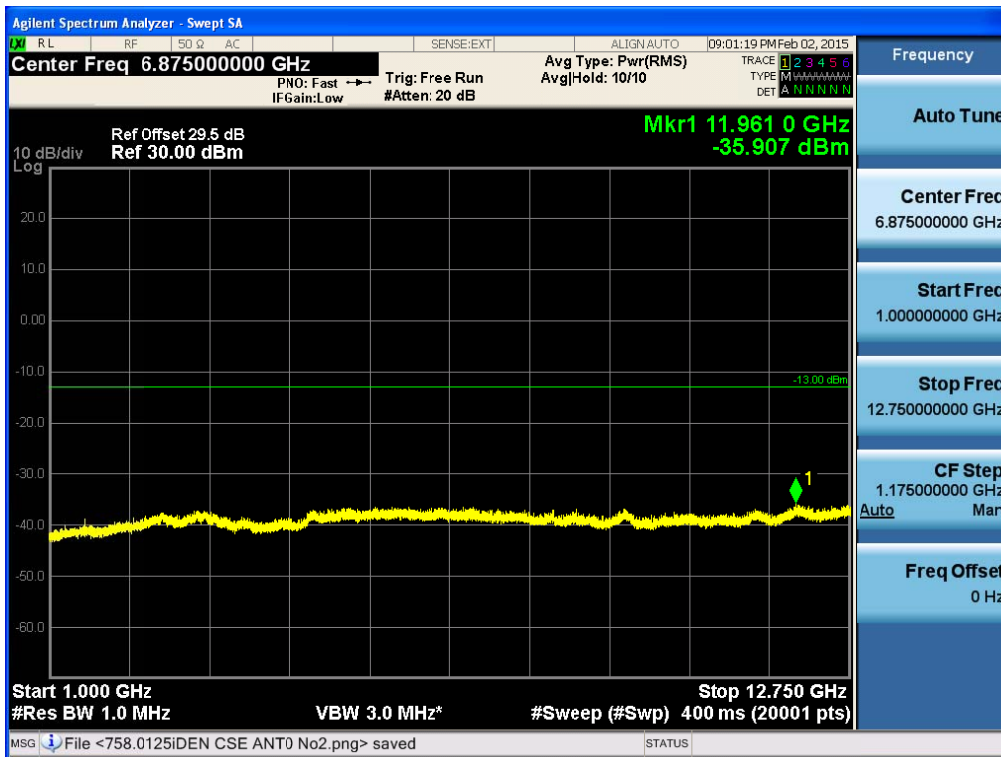
LTE 10 MHz

[LTE 10 MHz Downlink Low]



**Conducted Spurious Emissions (1 GHz –12.75 GHz)  
iDEN 700**

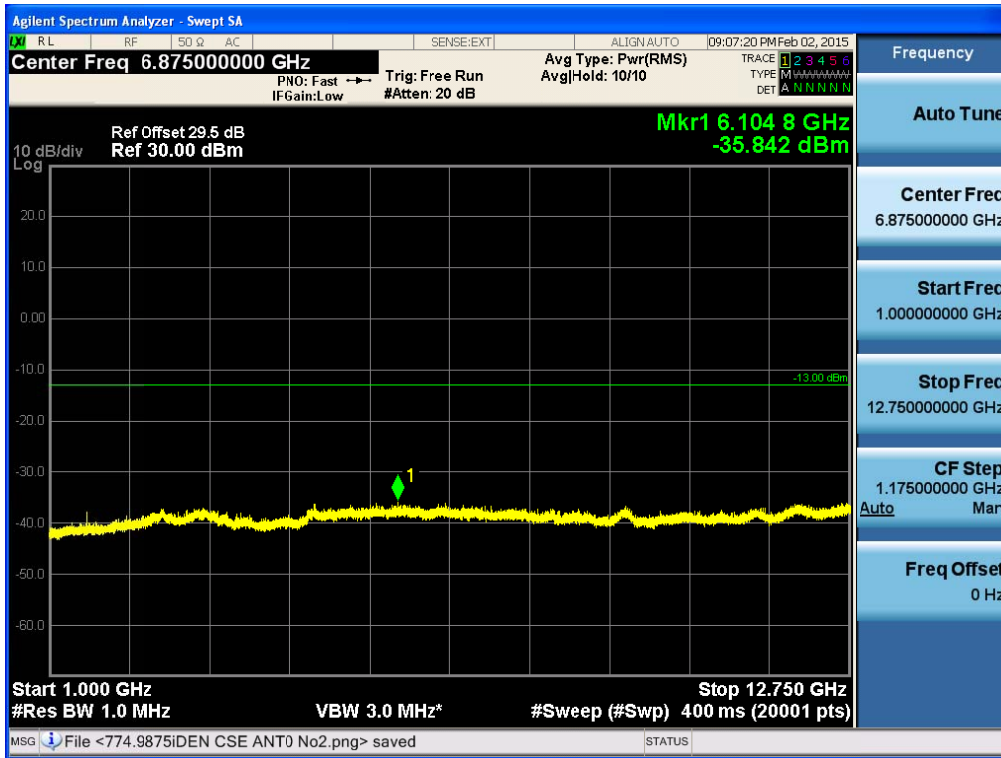
**[iDEN Downlink Low]**



**[iDEN Downlink Middle]**

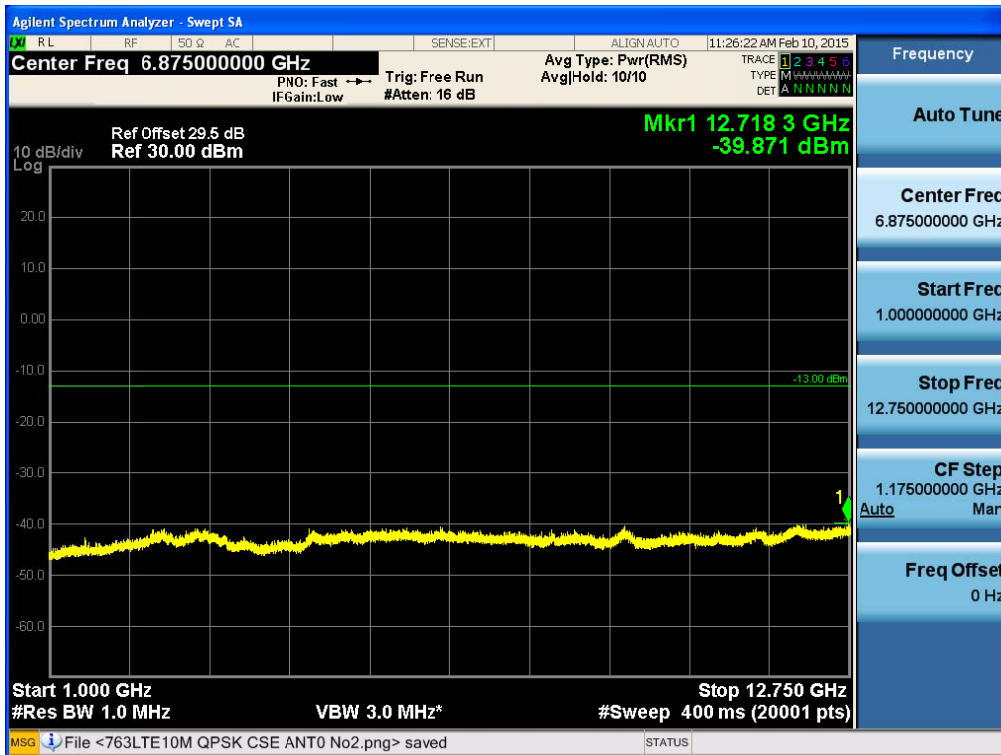


[iDEN Downlink High]



LTE 10 MHz

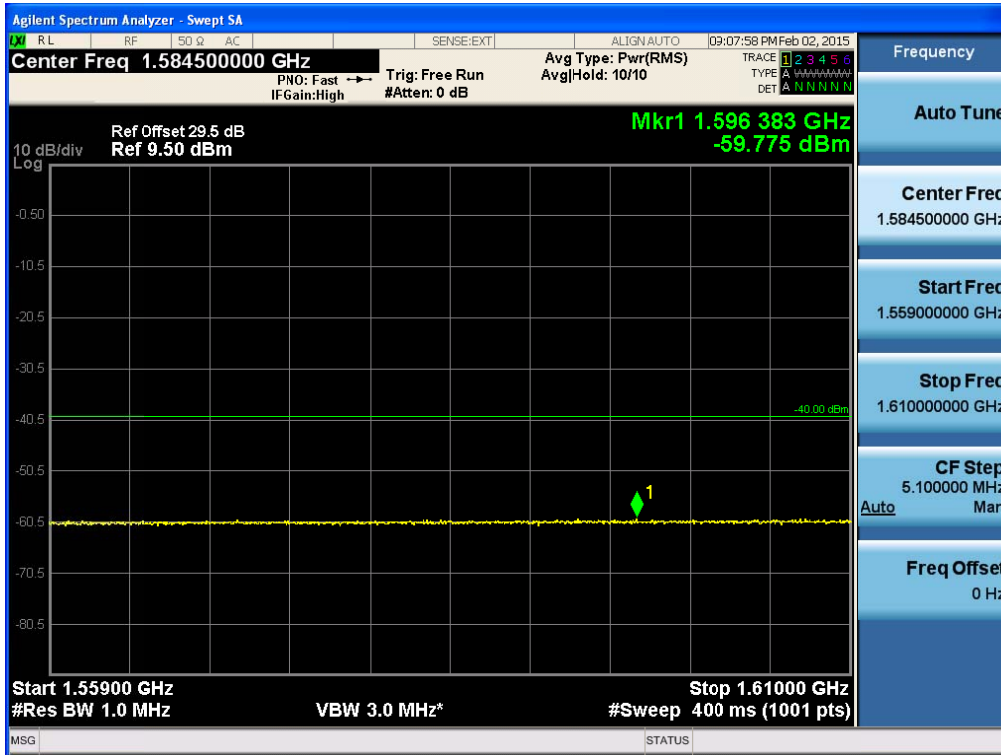
[LTE 10 MHz Downlink Low]



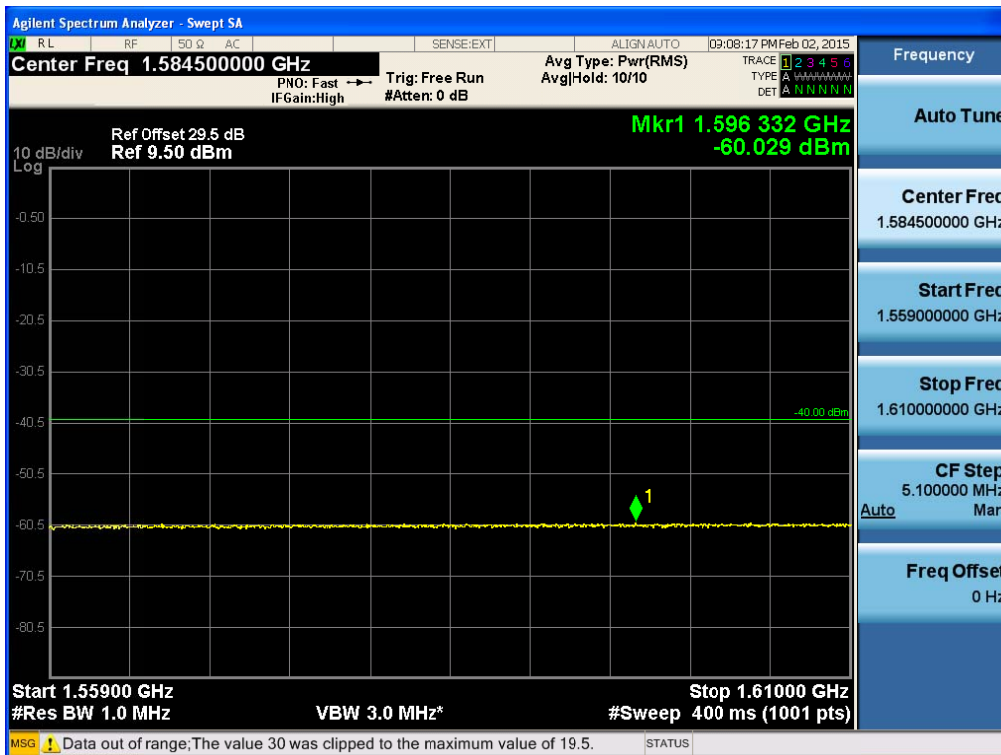
**Conducted Spurious Emissions (1559 MHz – 1610 MHz) - RBW 1 MHz**

**iDEN 700**

**[iDEN Downlink Low]**

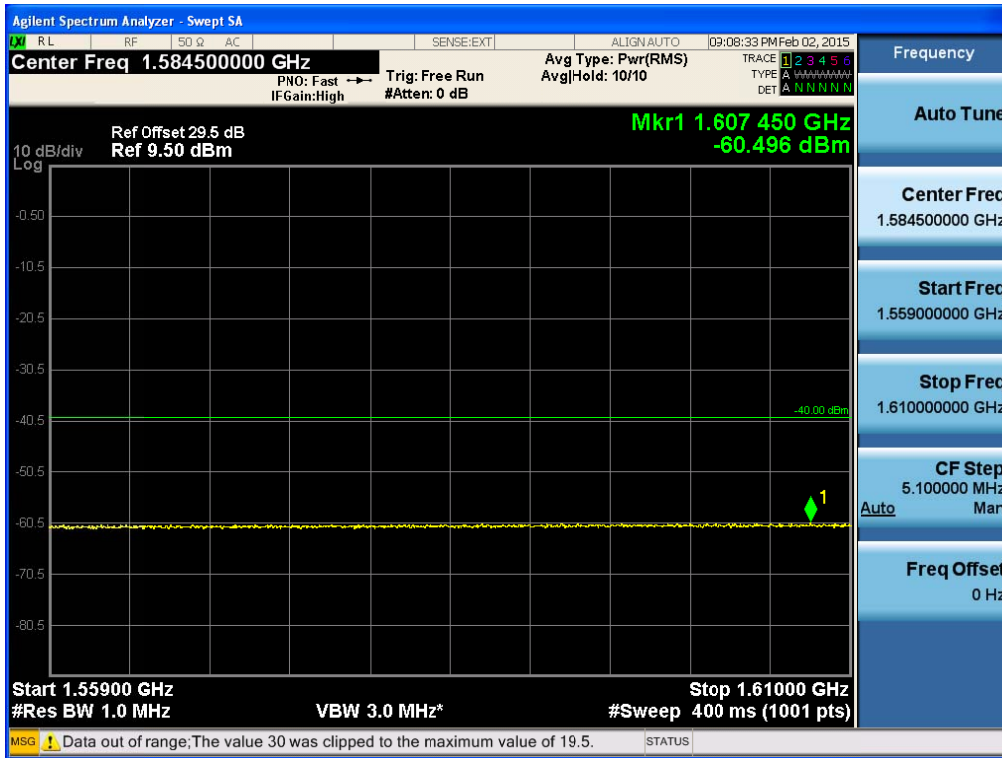


**[iDEN Downlink Middle]**



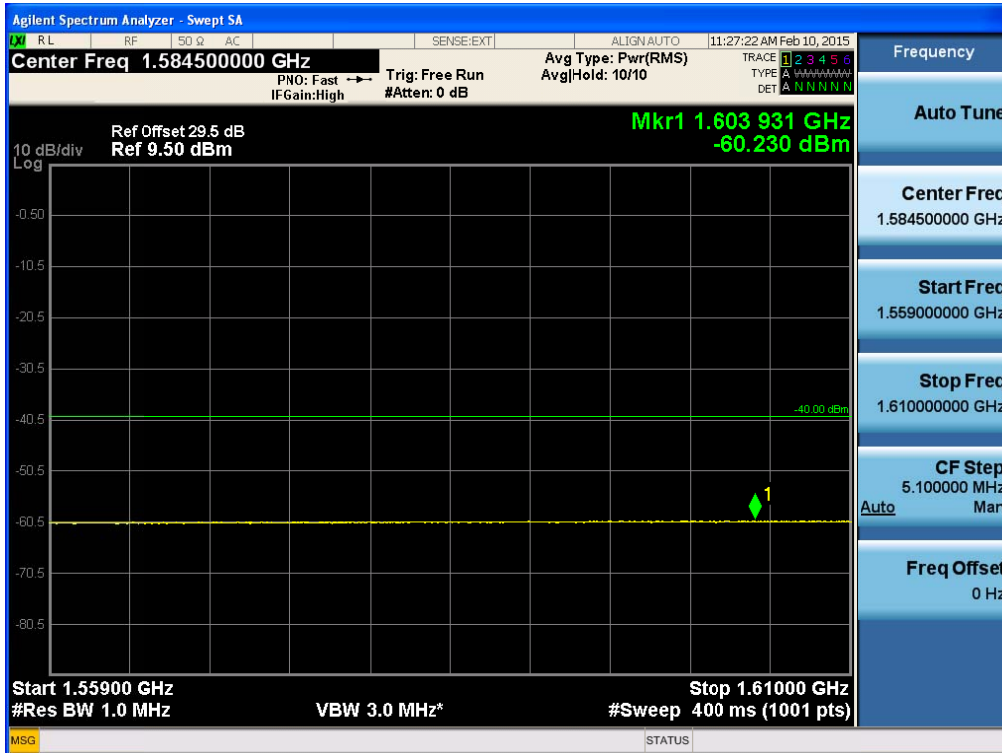


[iDEN Downlink High]



LTE 10 MHz

[LTE 10 MHz Downlink Low]

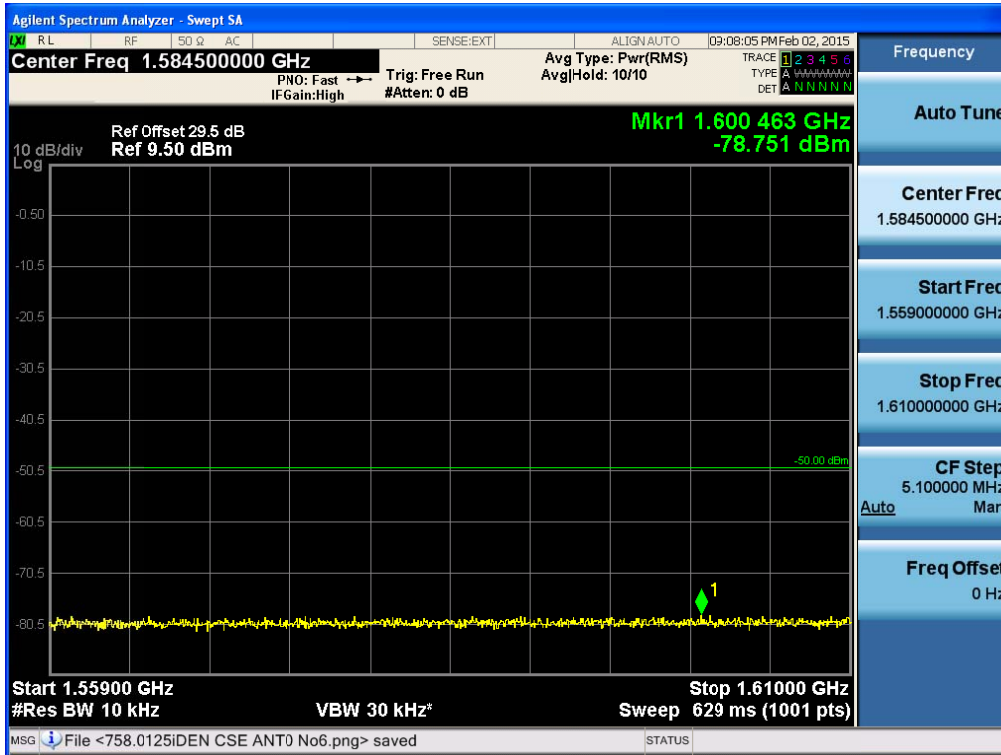




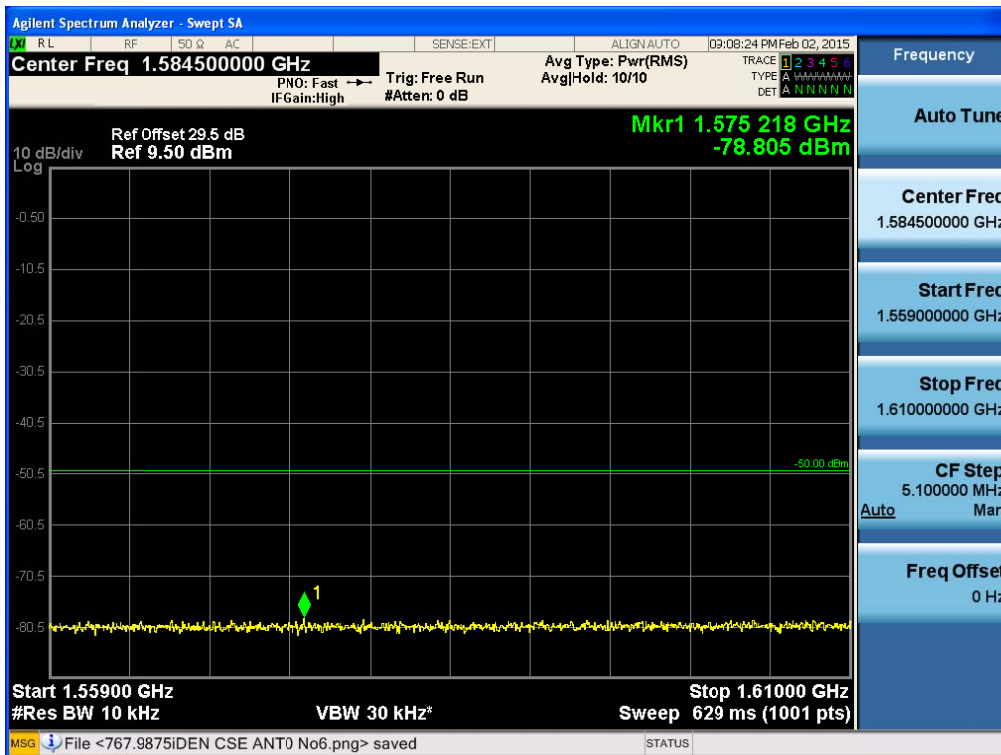
**Conducted Spurious Emissions (1559 MHz – 1610 MHz) - RBW 700 Hz**

**iDEN 700**

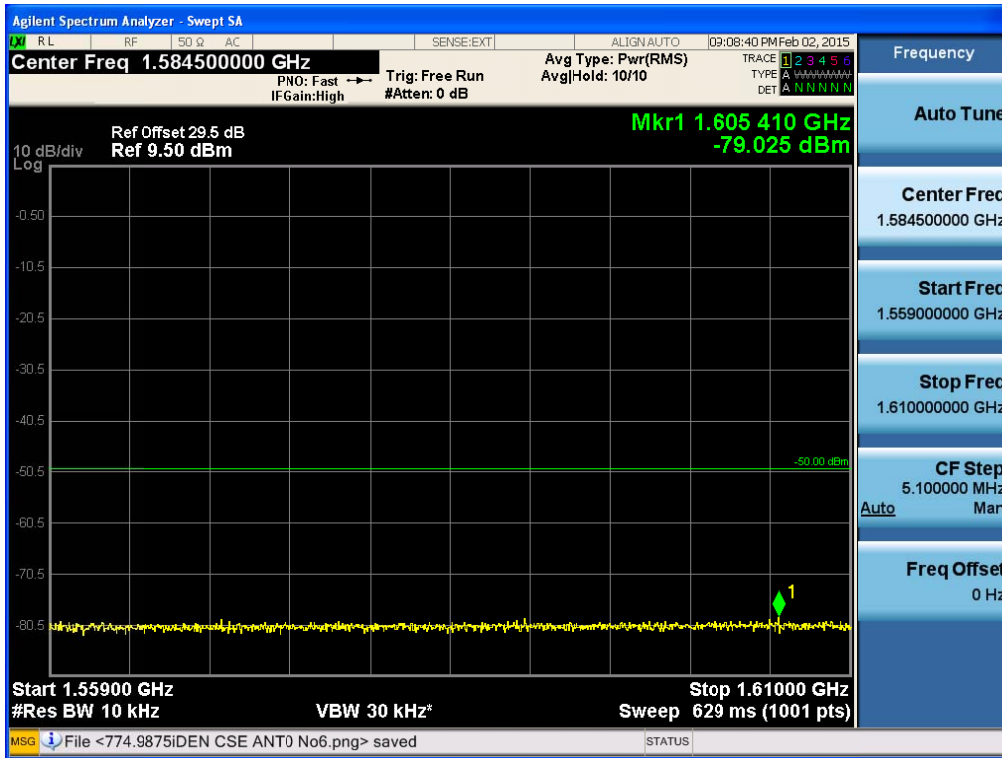
**[iDEN Downlink Low]**



**[iDEN Downlink Middle]**

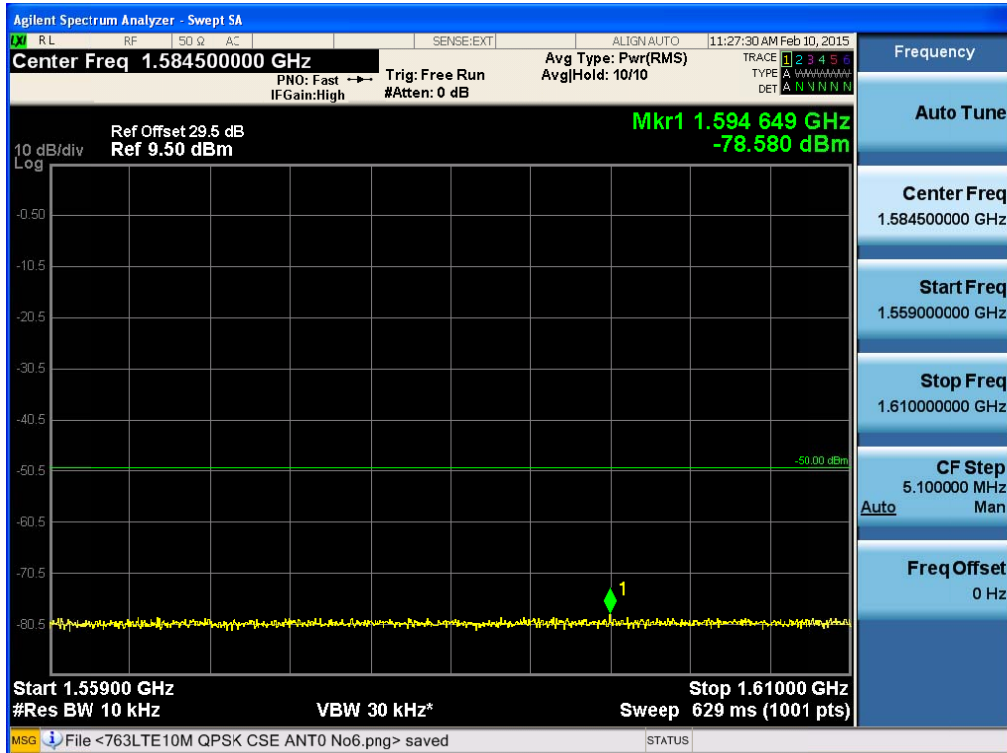


[iDEN Downlink High]



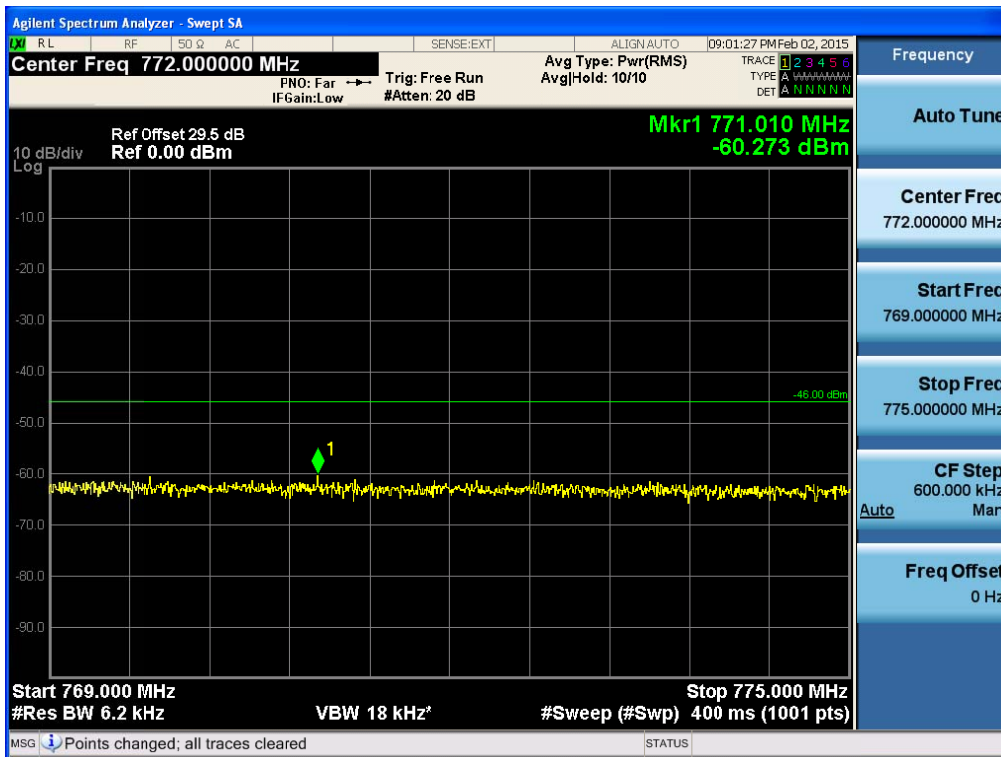
LTE 10 MHz

[LTE 10 MHz Downlink Low]

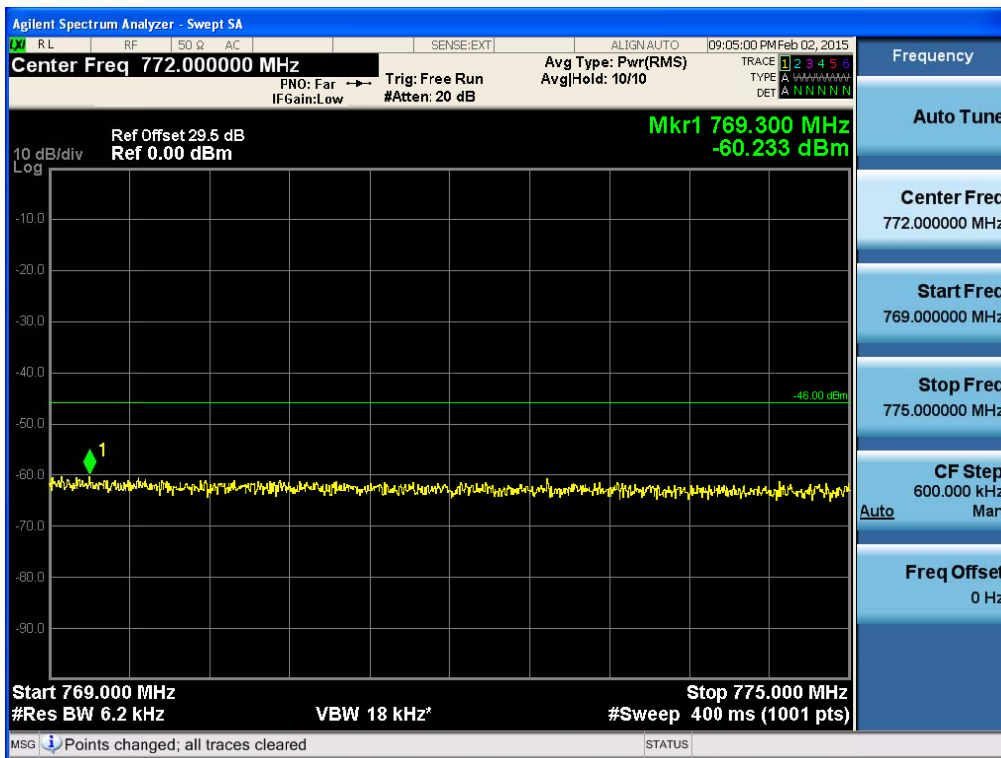


**Conducted Spurious Emissions (769 MHz – 775 MHz)  
iDEN 700**

**[iDEN Downlink Low]**

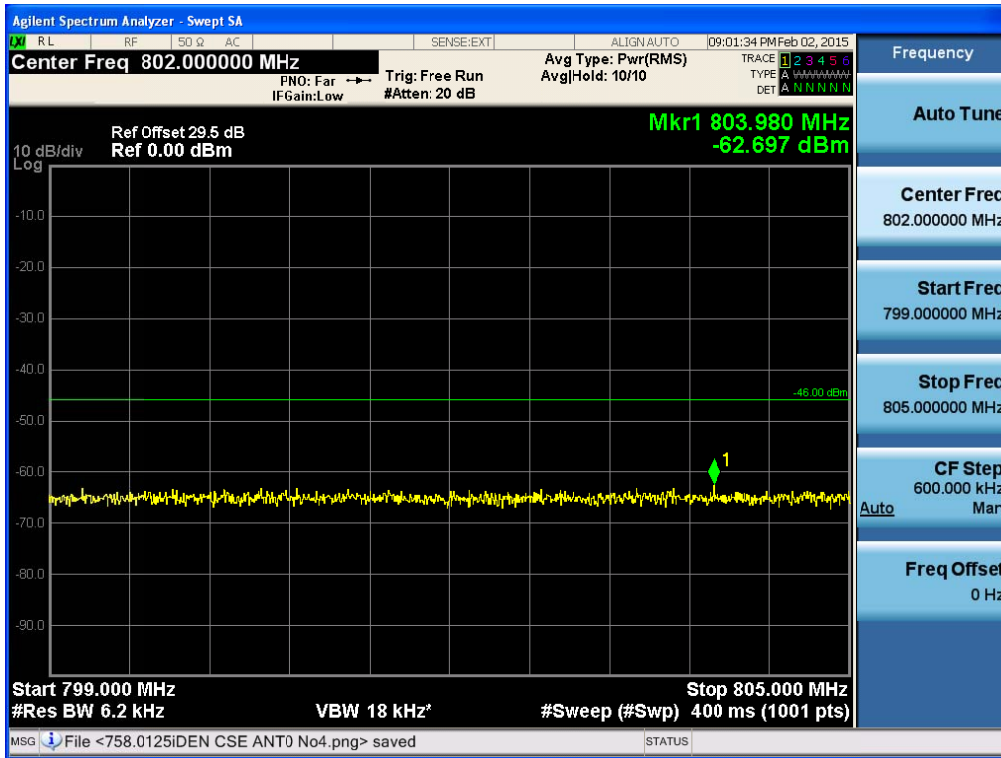


**[iDEN Downlink Middle]**

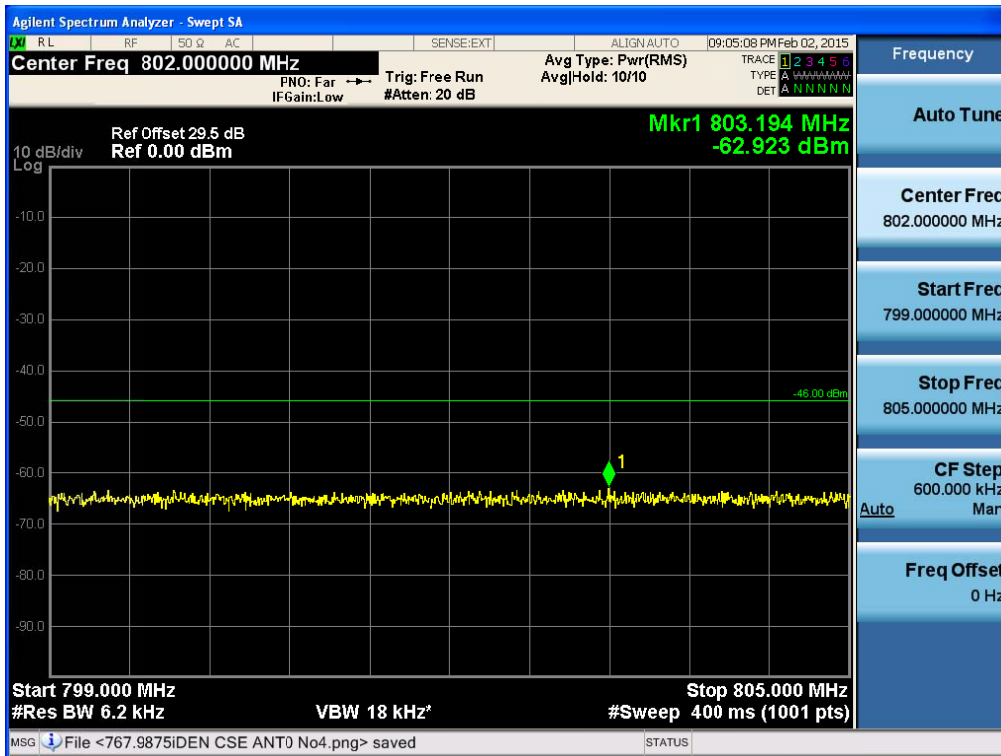


**Conducted Spurious Emissions (799 MHz – 805 MHz)  
iDEN 700**

**[iDEN Downlink Low]**

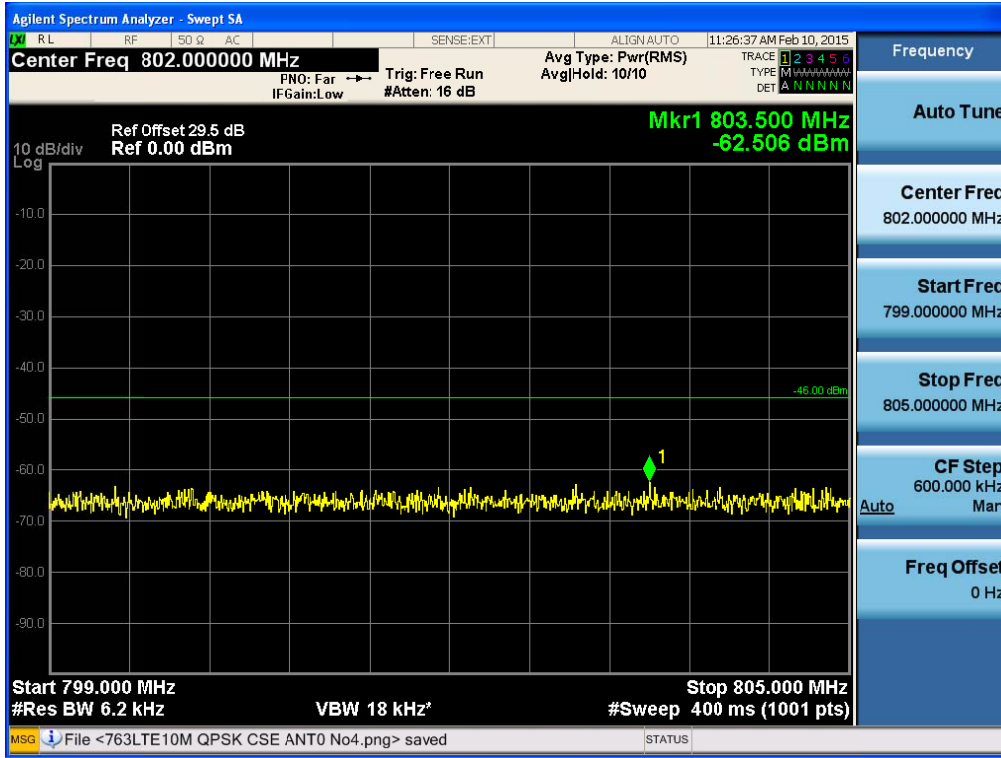


**[iDEN Downlink Middle]**



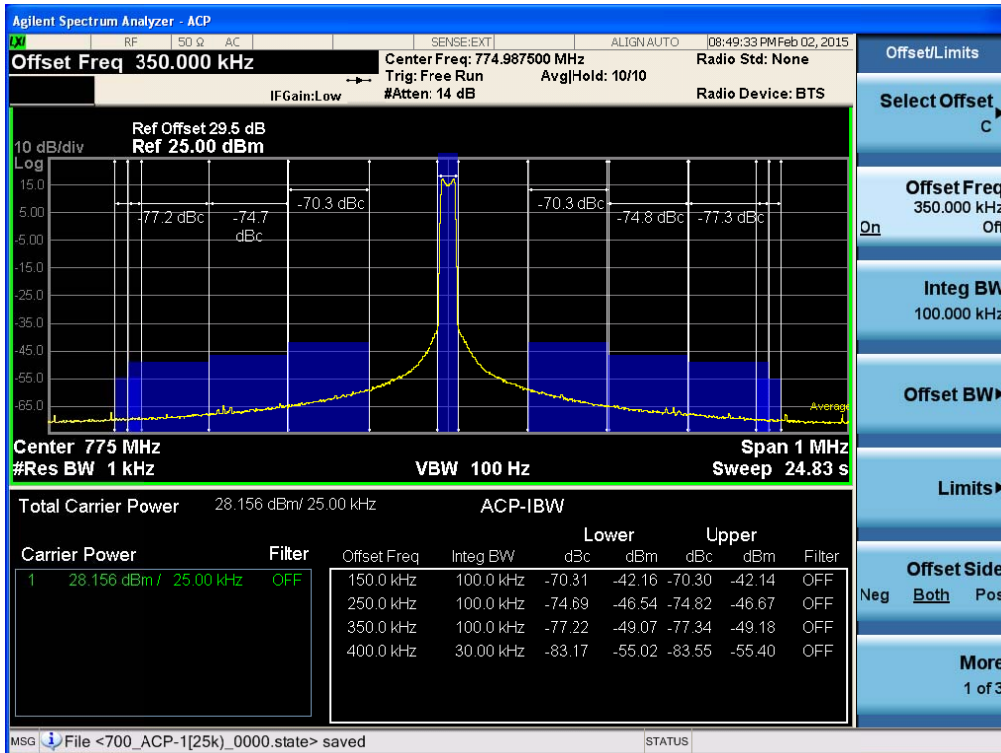
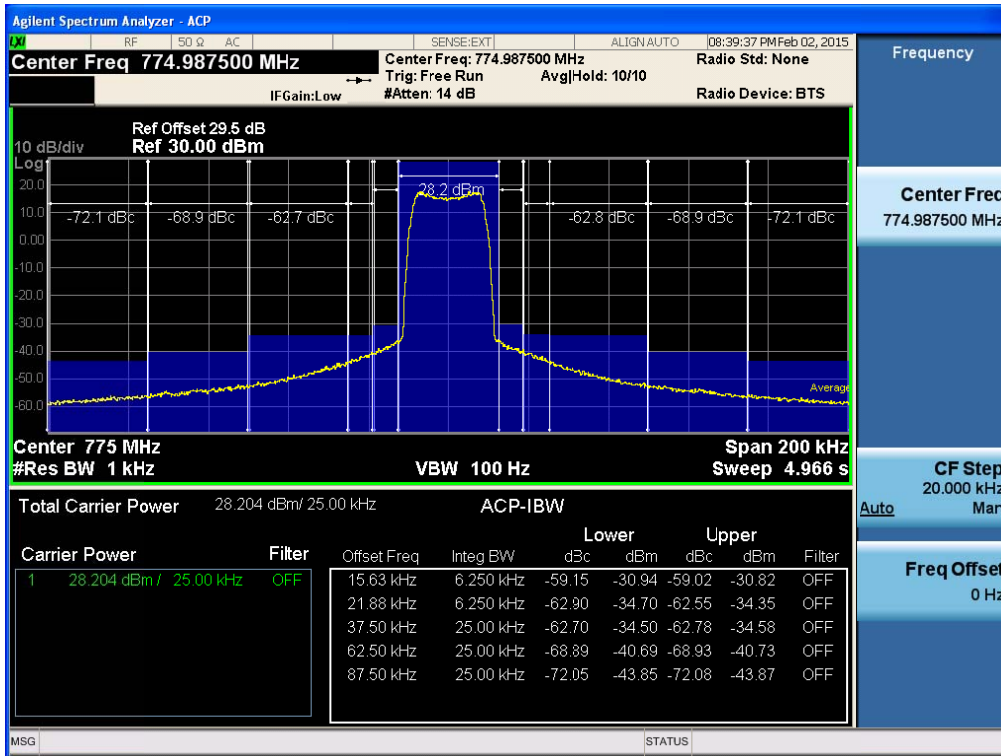
**LTE 10 MHz**

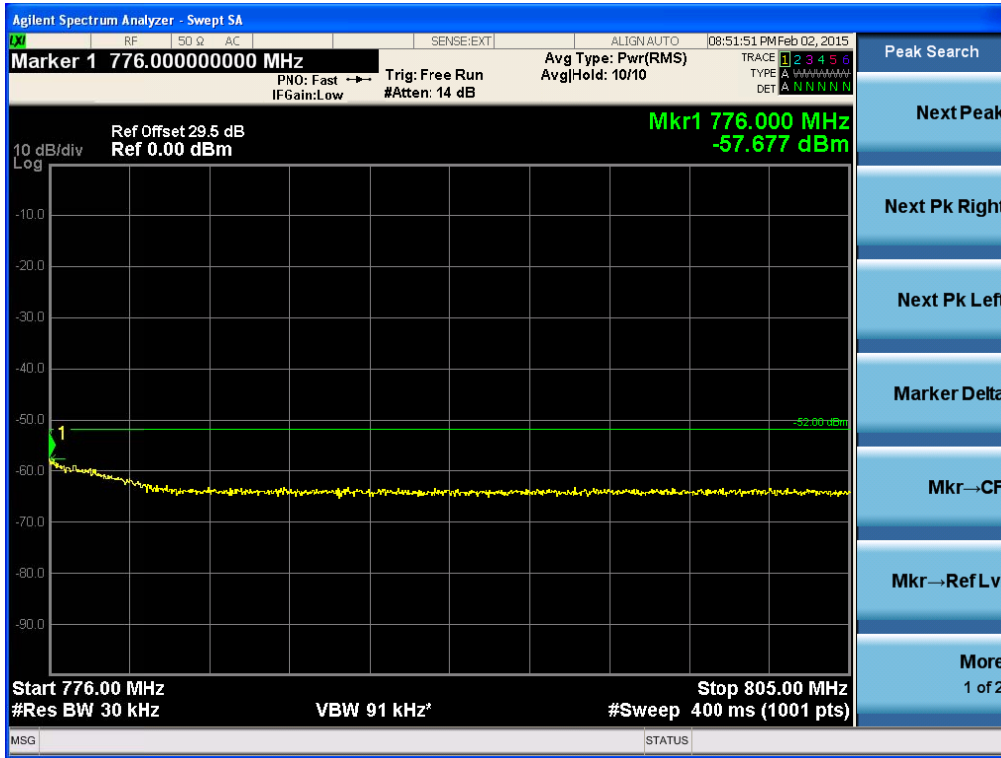
**[LTE 10 MHz Downlink Low]**



ACP  
IDEN 700

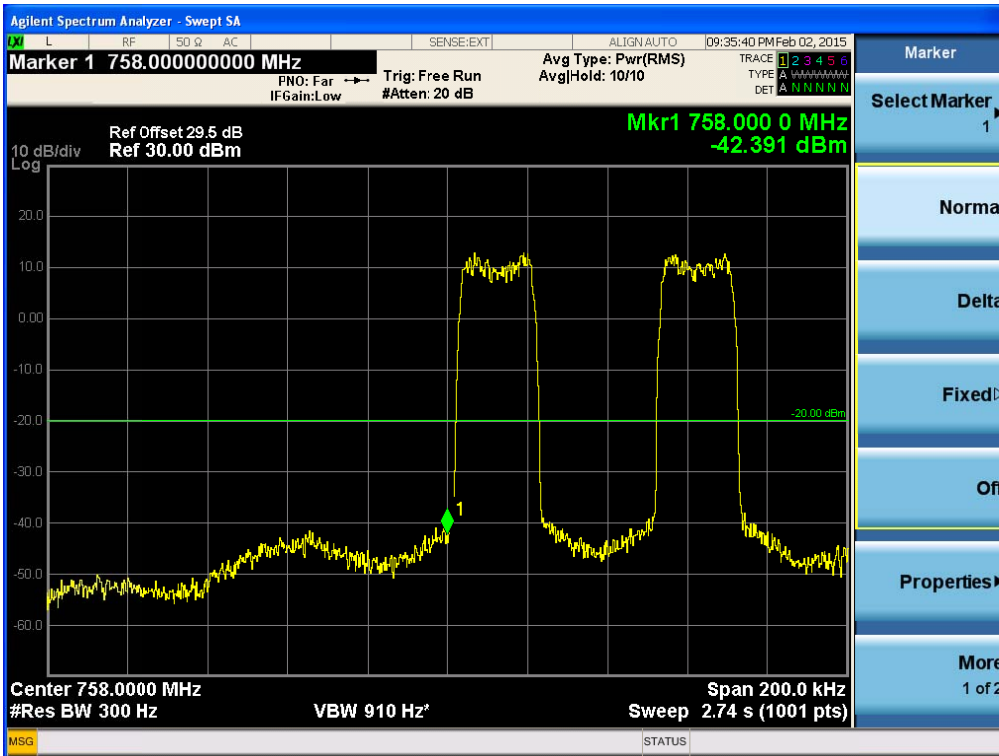
[iDEN Downlink High]



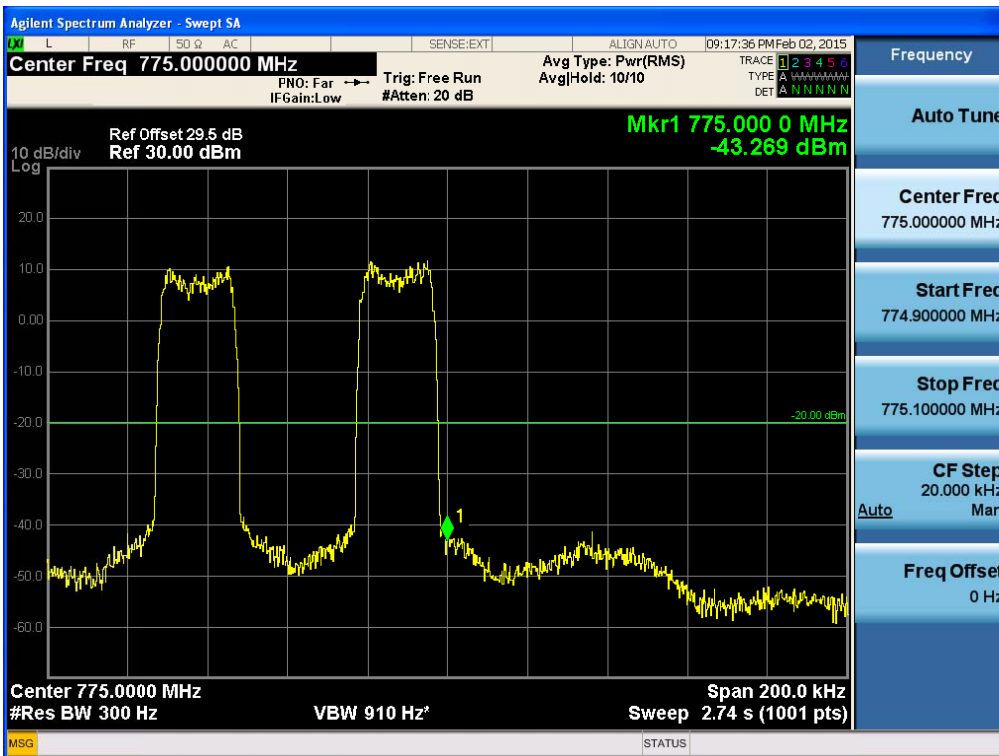


**Intermodulation Spurious Emissions for FCC**  
**iDEN 700**

**[iDEN Downlink Low]**



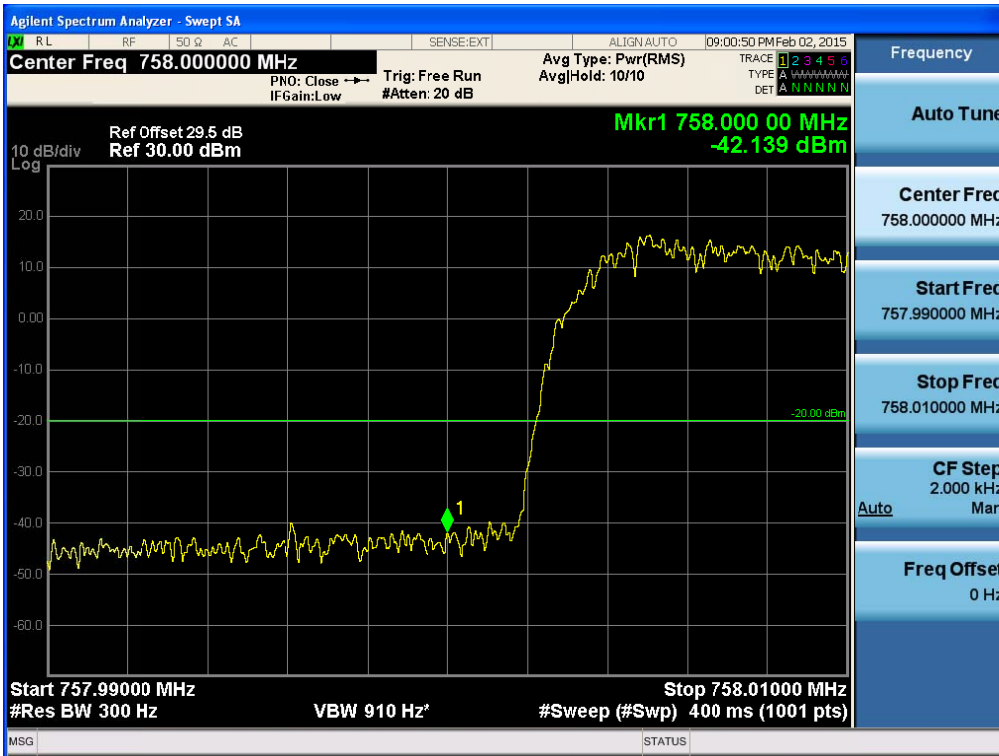
**[iDEN Downlink High]**



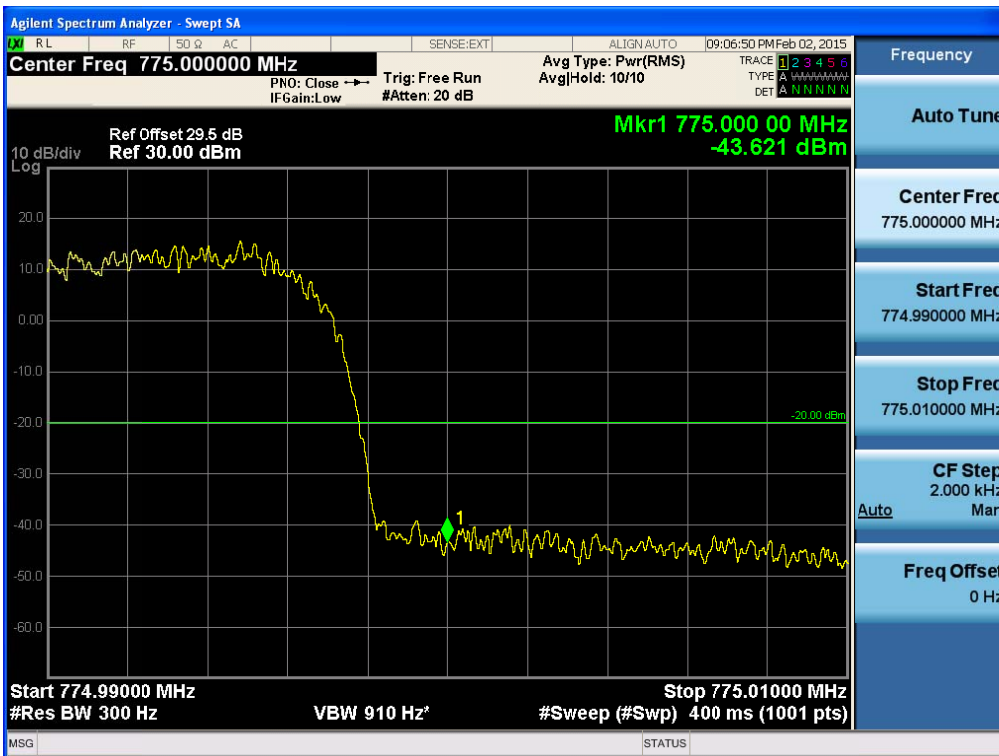


**Band Edge**  
**iDEN 700**

**[iDEN Downlink Low]**



**[iDEN Downlink High]**



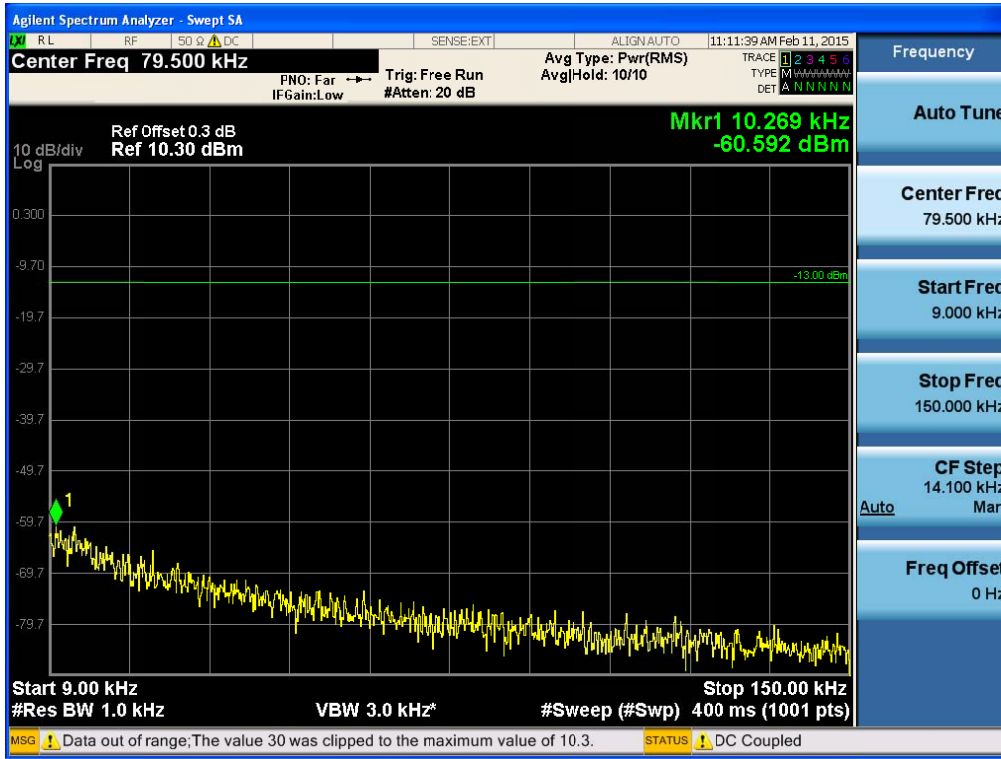
**LTE 10 MHz**

**[LTE 10 MHz Downlink Low]**

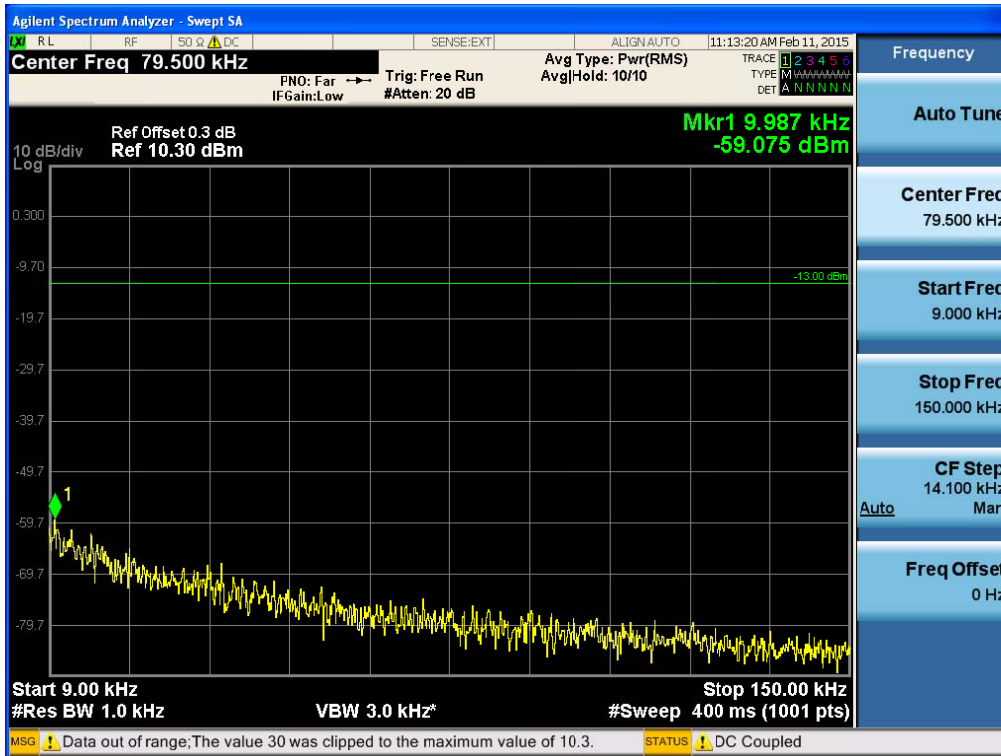


**Plots of Spurious Emission\_Uplink**  
**Conducted Spurious Emissions (9 kHz – 150 kHz)**  
**iDEN 700**

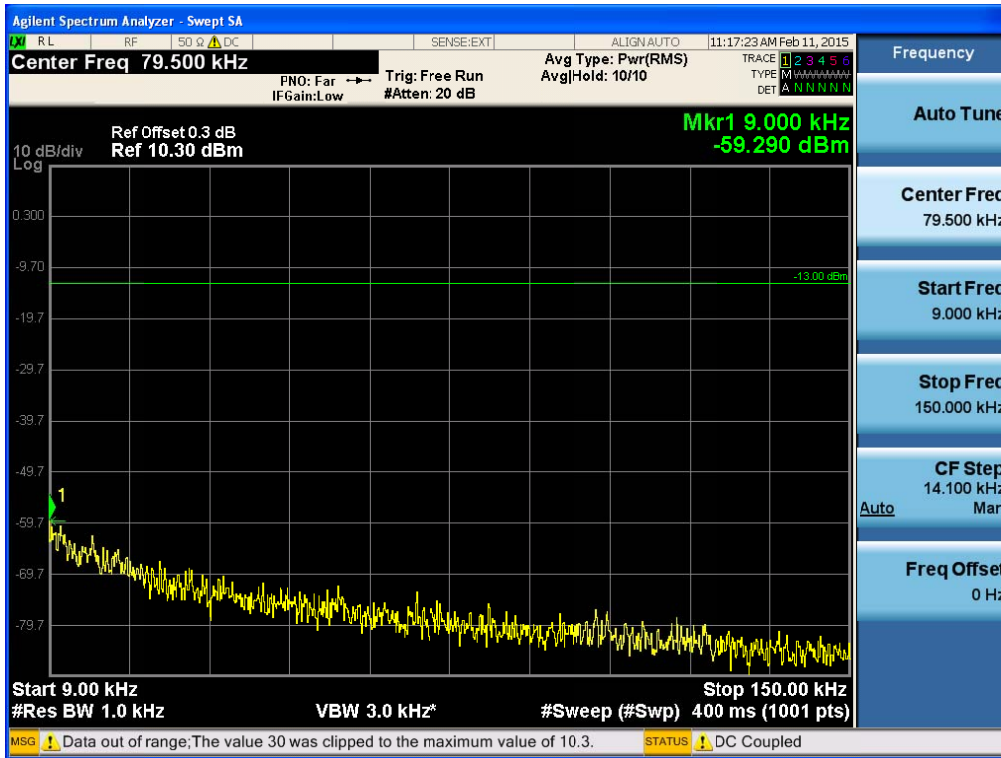
[iDEN Uplink Low]



[iDEN Uplink Middle]

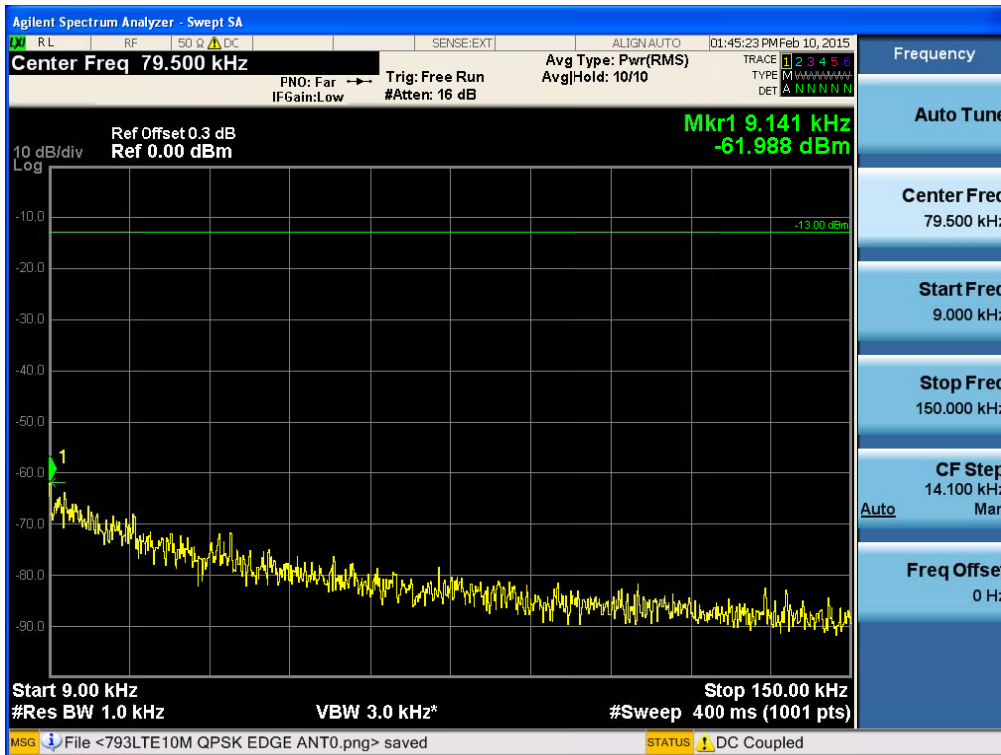


[iDEN Uplink High]



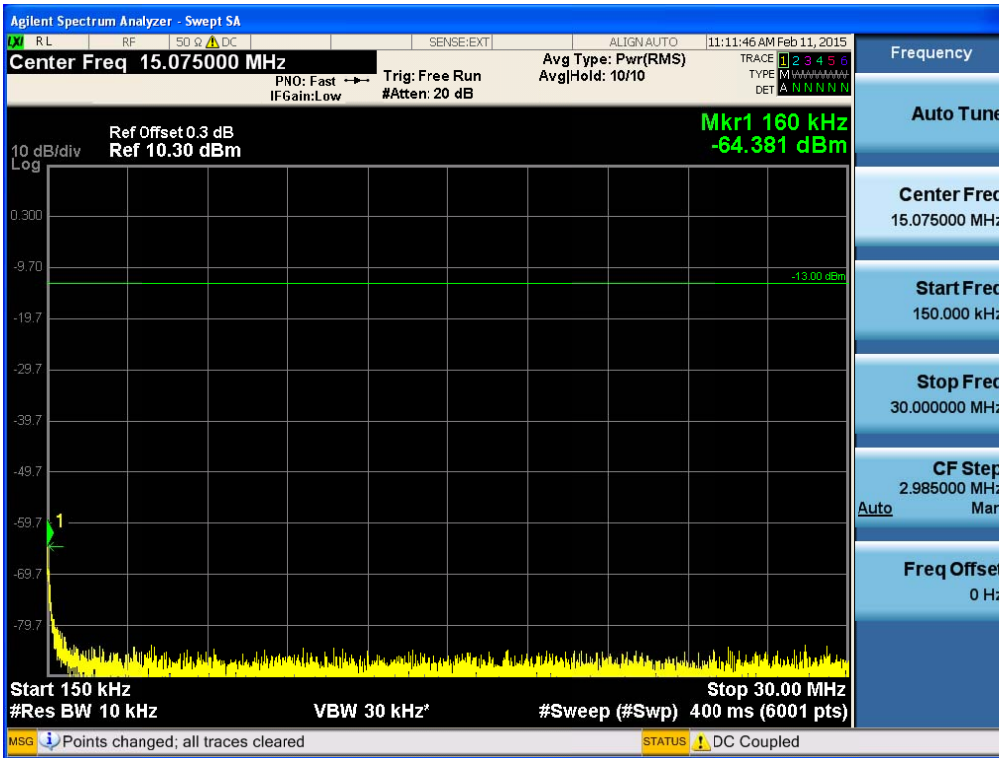
LTE 10 MHz

[LTE 10 MHz Uplink Low]

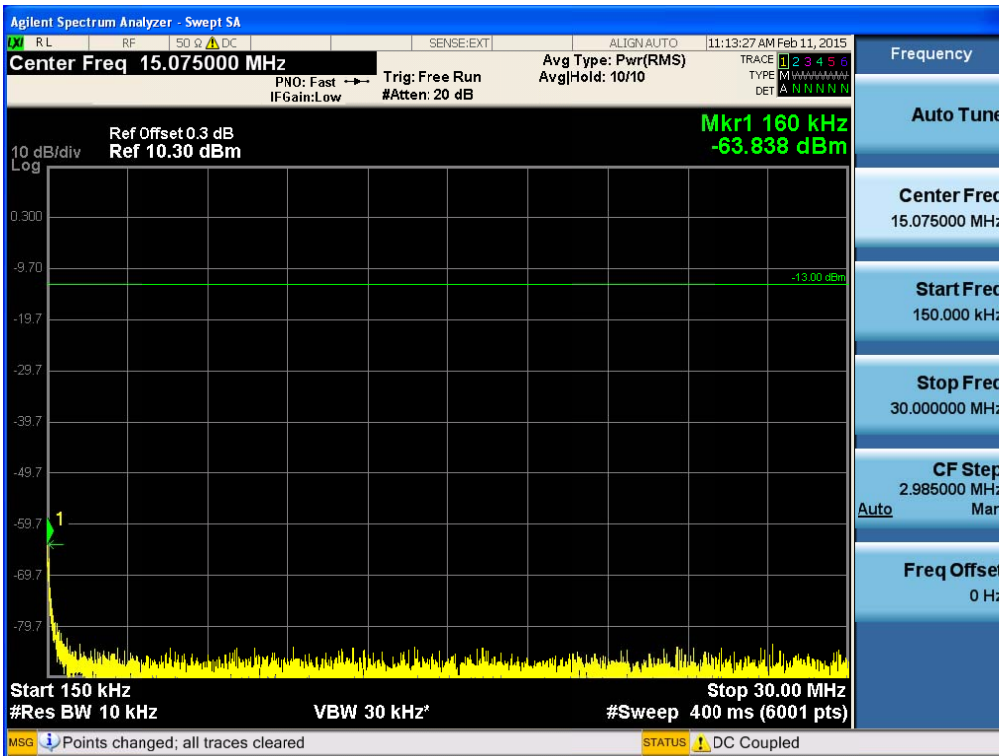


**Conducted Spurious Emissions (150 kHz – 30 MHz)  
iDEN 700**

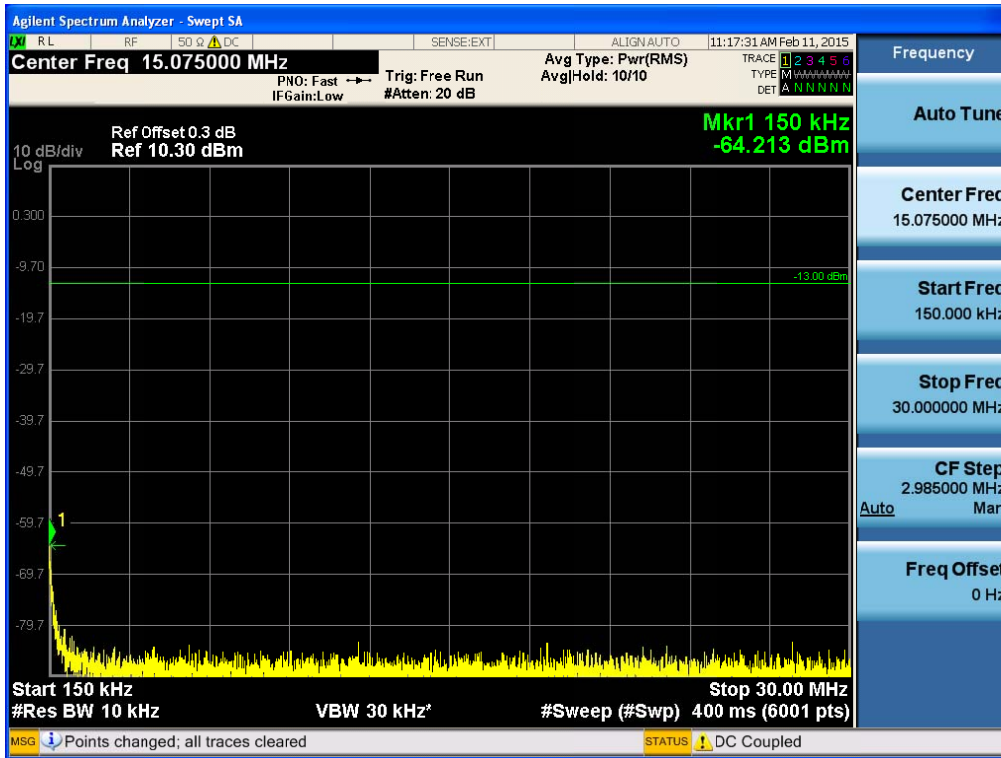
**[iDEN Uplink Low]**



**[iDEN Uplink Middle]**

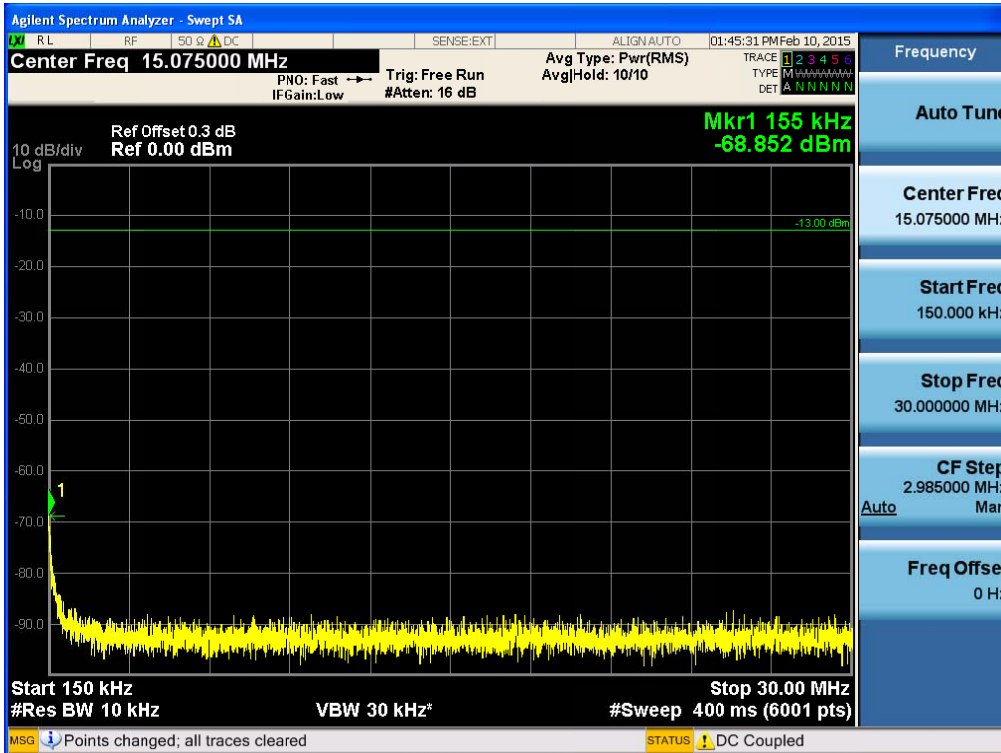


[iDEN Uplink High]



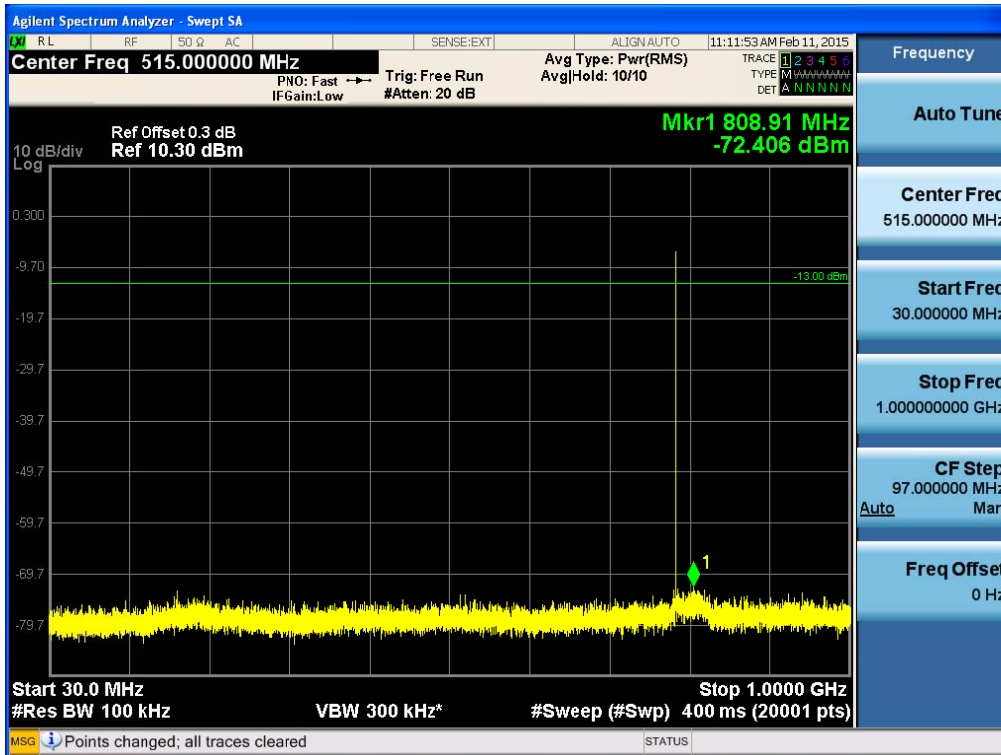
LTE 10 MHz

[LTE 10 MHz Uplink Low]

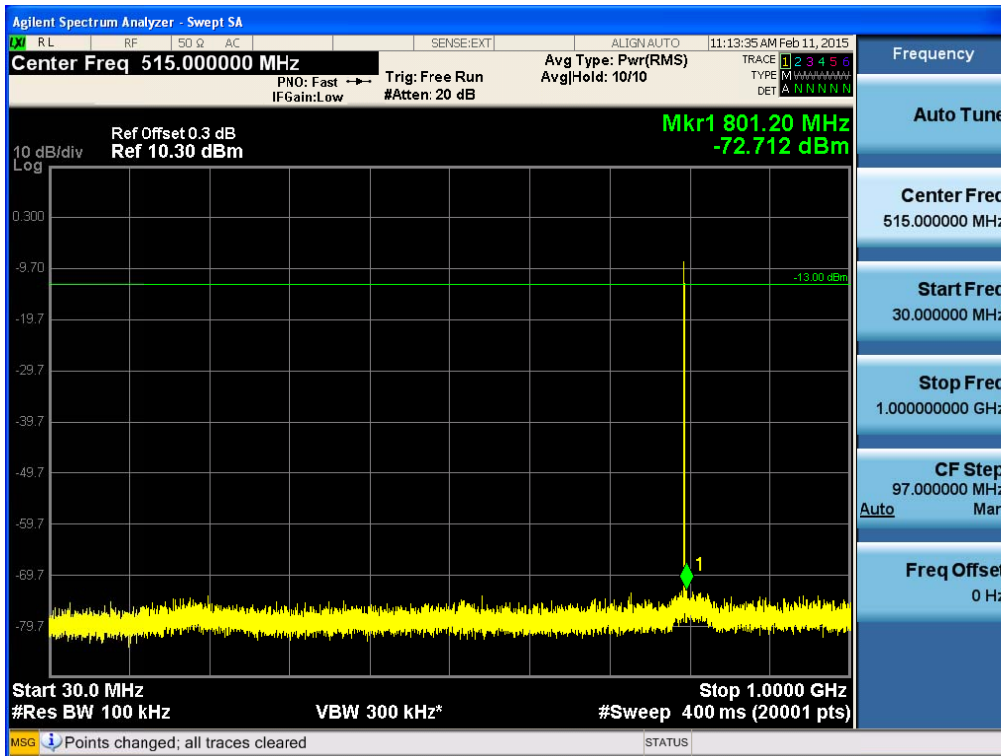


**Conducted Spurious Emissions (30 MHz – 1 GHz)  
iDEN 700**

[iDEN Uplink Low]

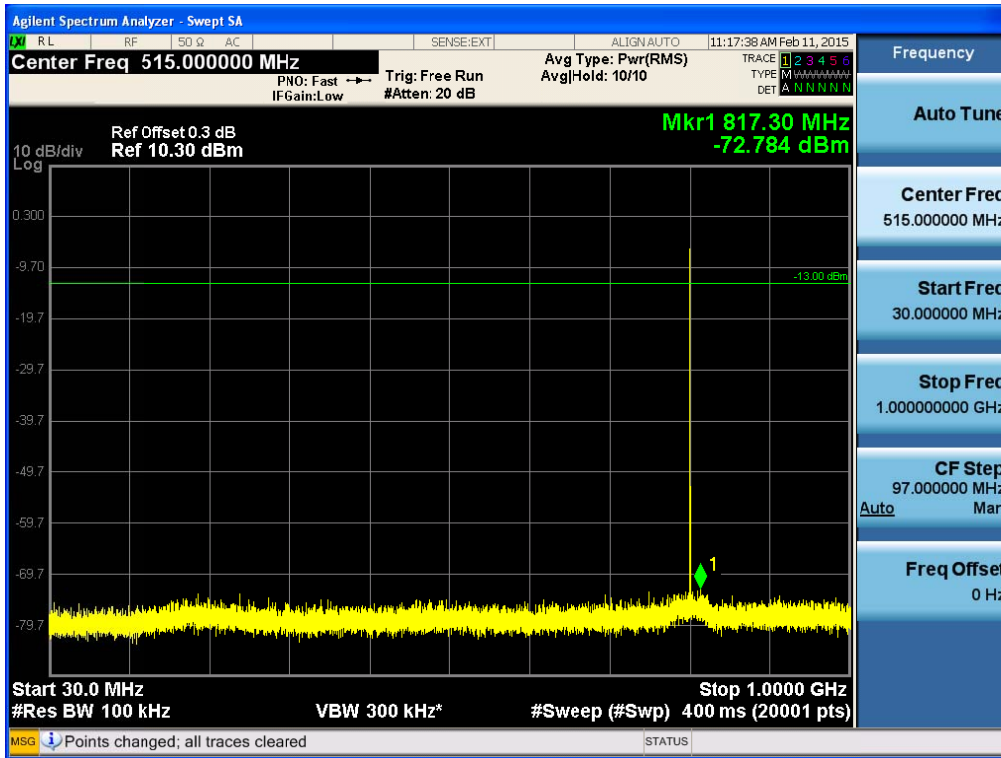


[iDEN Uplink Middle]



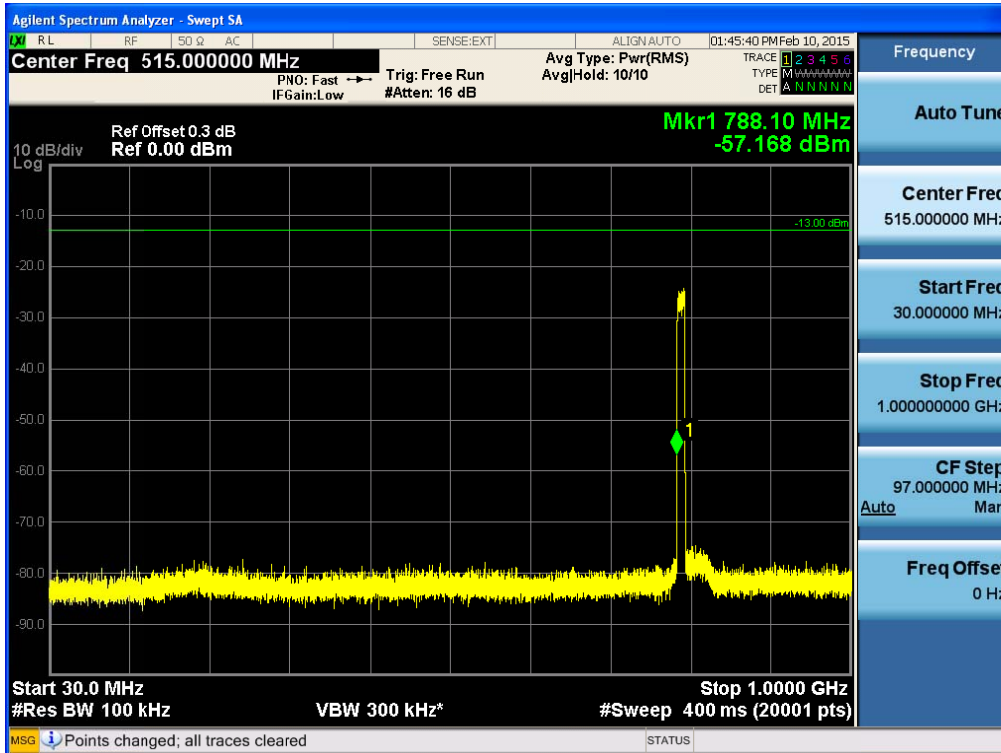


[iDEN Uplink High]



LTE 10 MHz

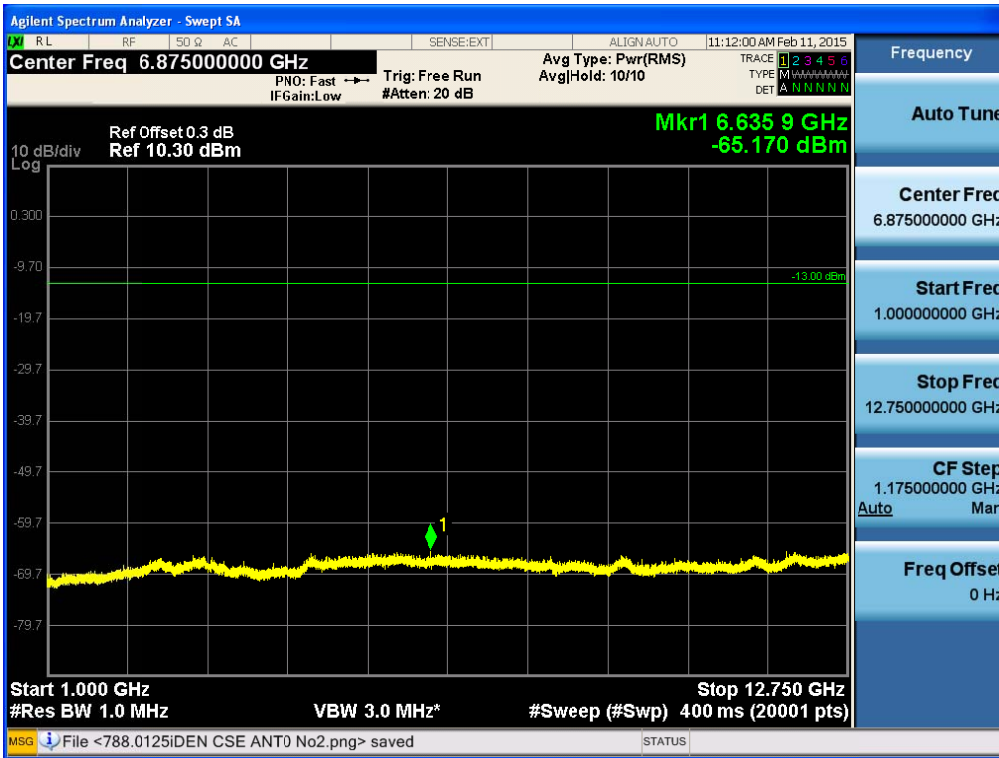
[LTE 10 MHz Uplink Low]



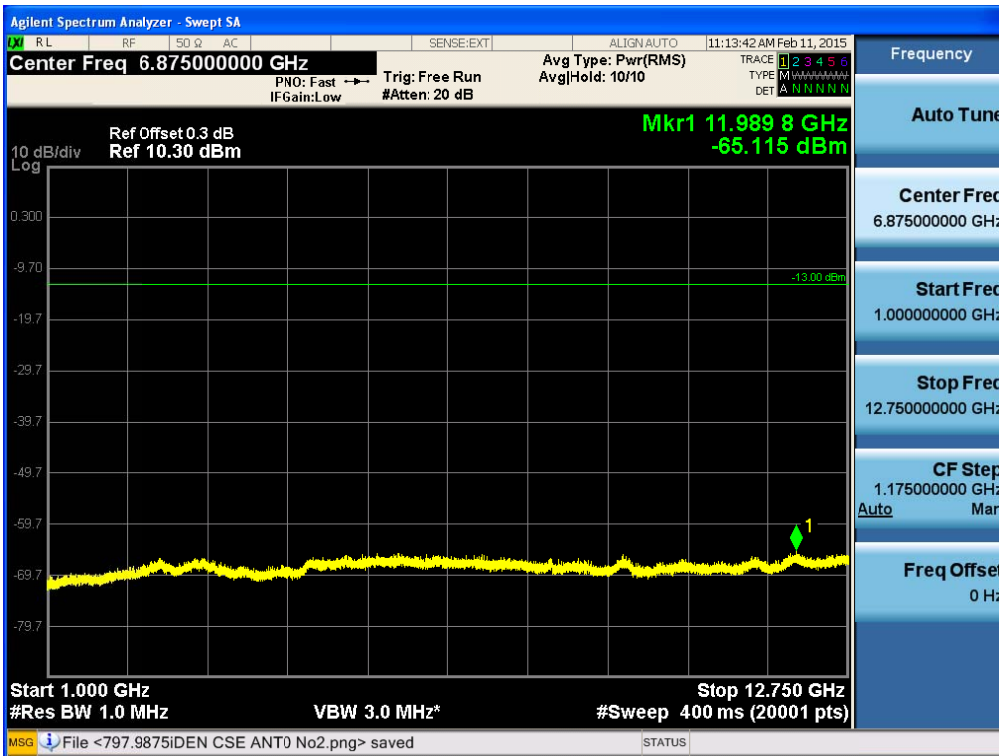


**Conducted Spurious Emissions (1 GHz –12.75 GHz)  
iDEN 700**

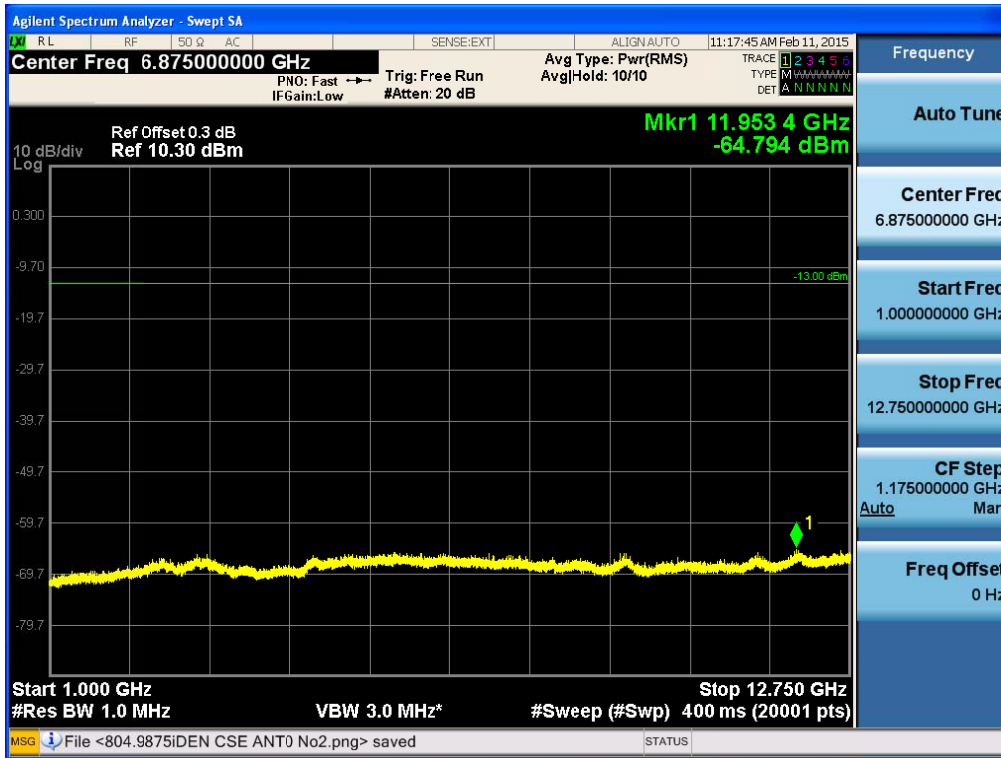
**[iDEN Uplink Low]**



**[iDEN Uplink Middle]**

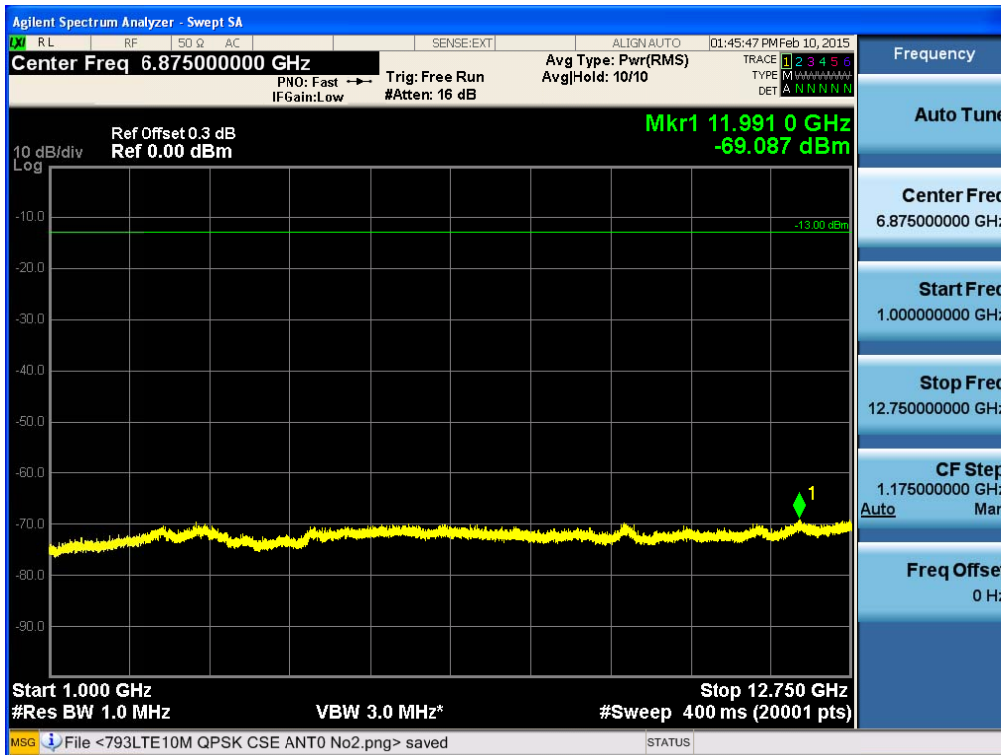


[iDEN Uplink High]



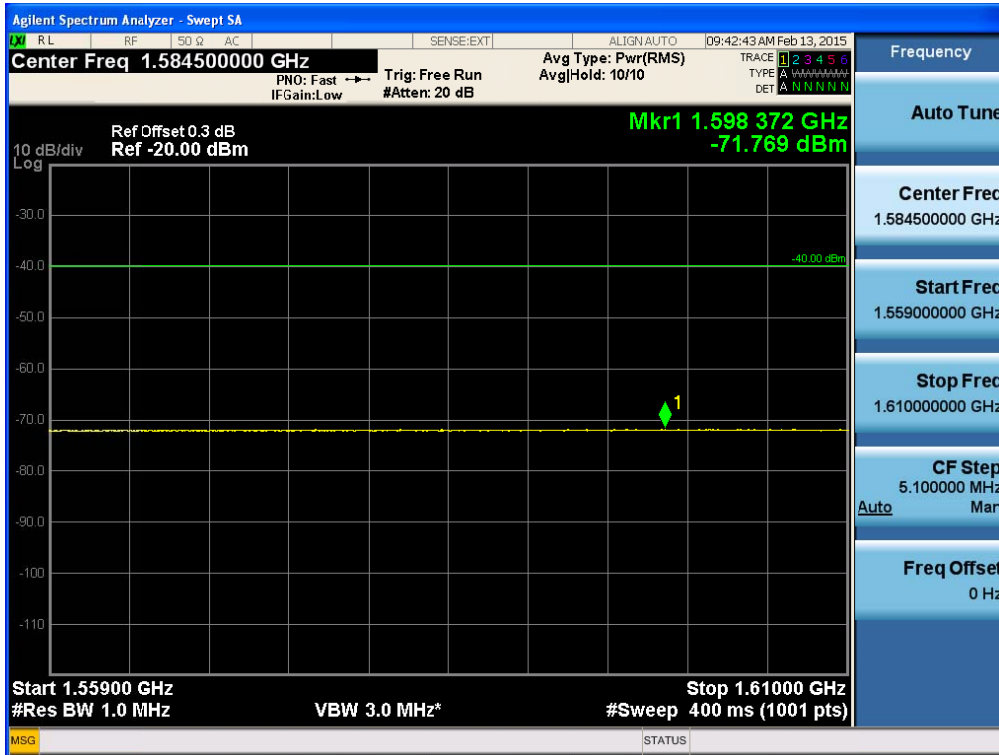
LTE 10 MHz

[LTE 10 MHz Uplink Low]

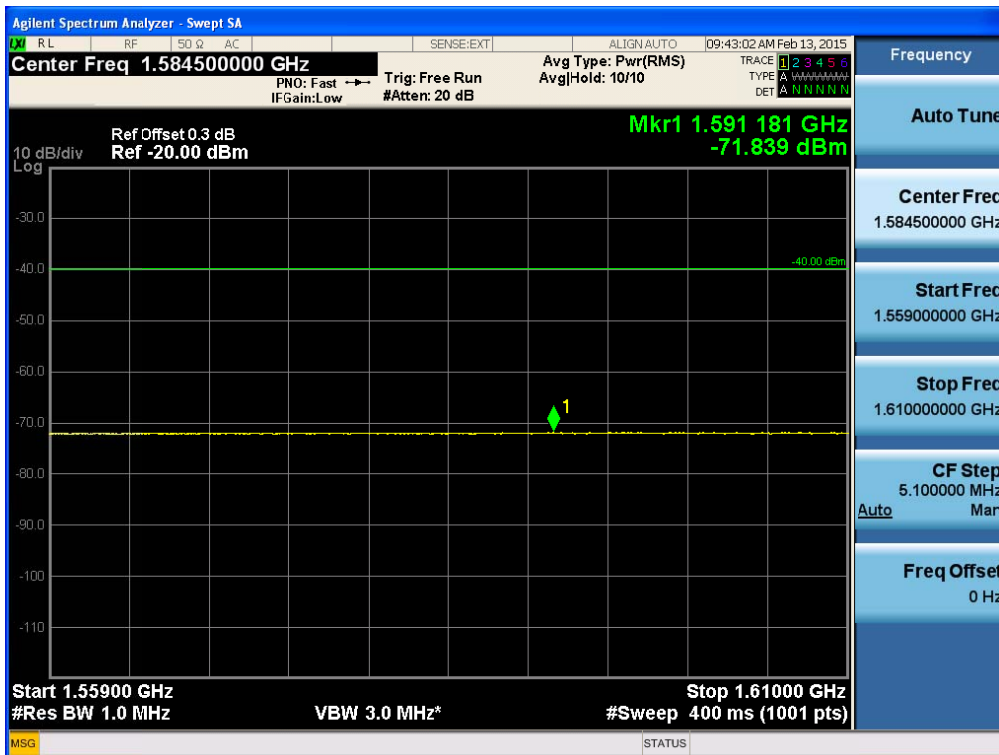


**Conducted Spurious Emissions (1559 MHz – 1610 MHz) - RBW 1 MHz  
IDEN 700**

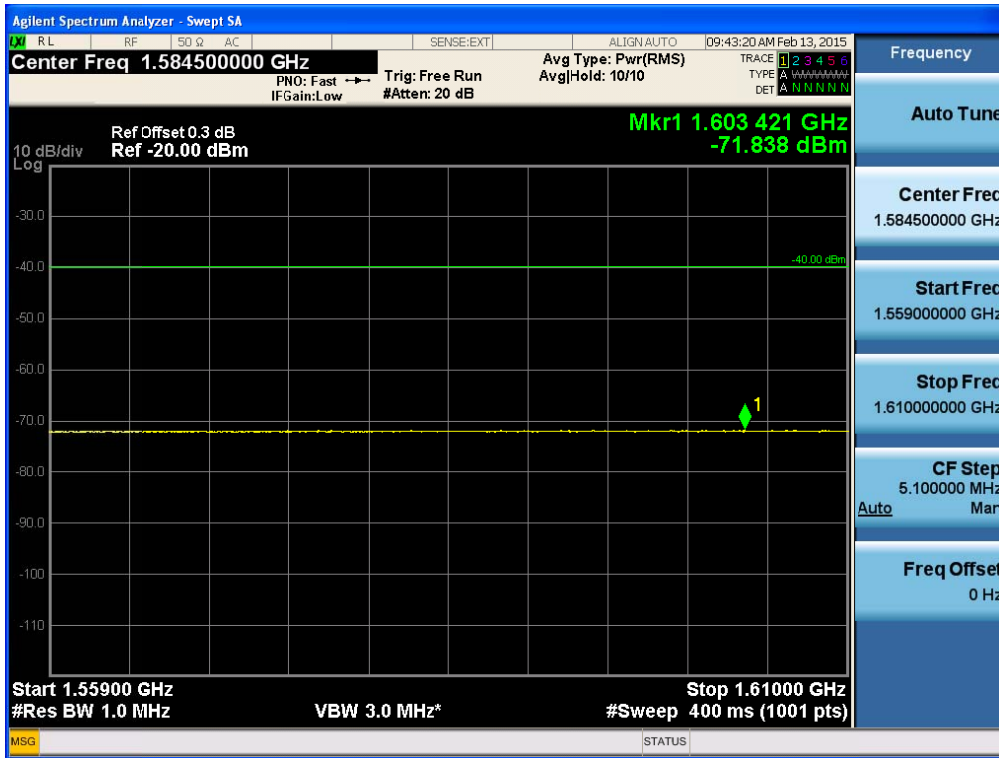
**[iDEN Uplink Low]**



**[iDEN Uplink Middle]**

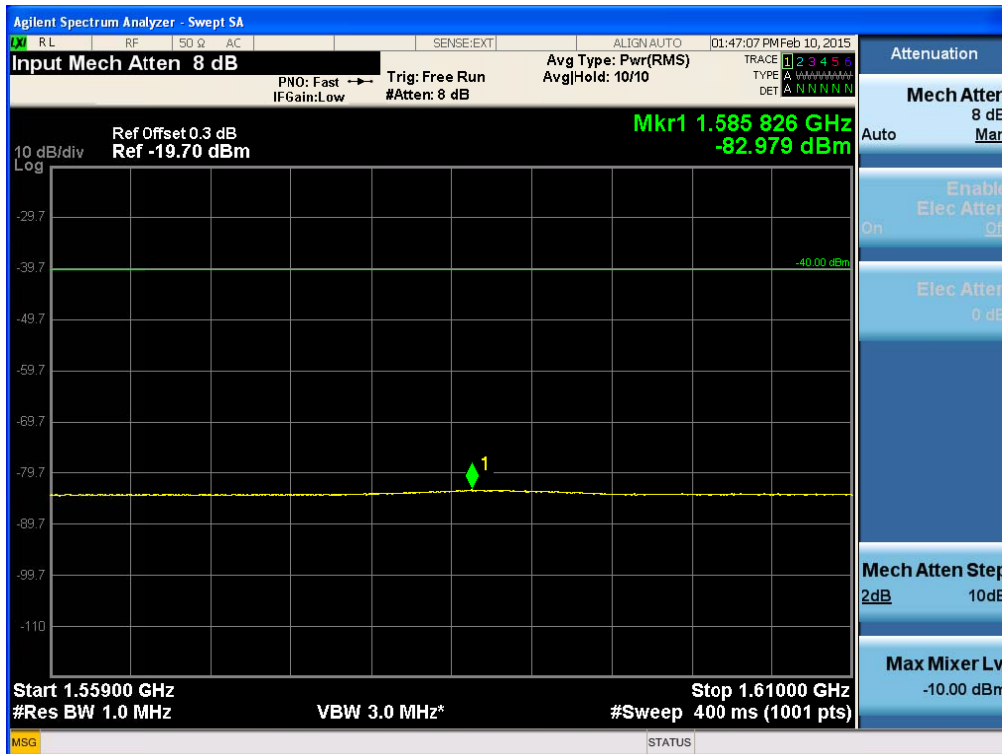


[iDEN Uplink High]



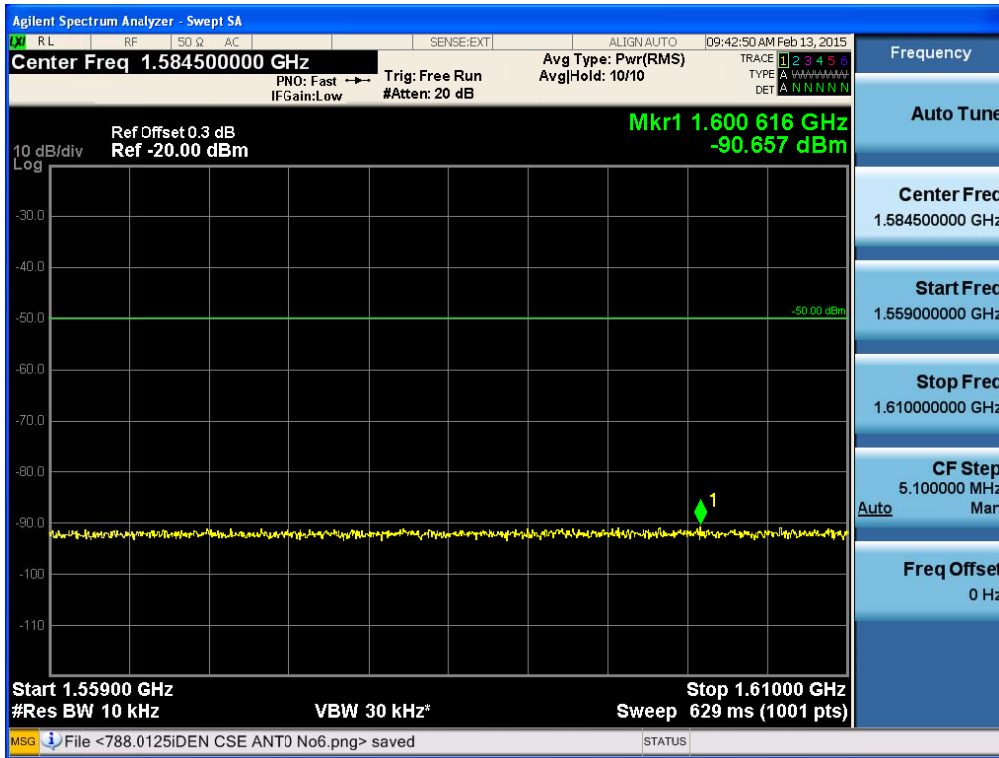
LTE 10 MHz

[LTE 10 MHz Uplink Low]

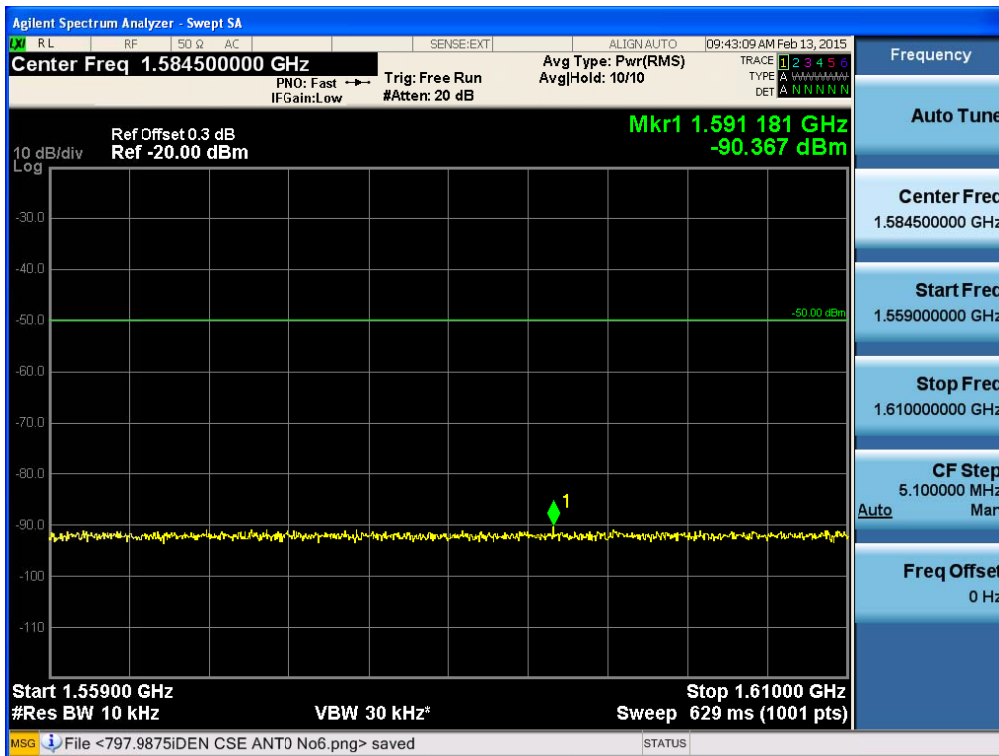


**Conducted Spurious Emissions (1559 MHz – 1610 MHz)- RBW 700 Hz  
iDEN 700**

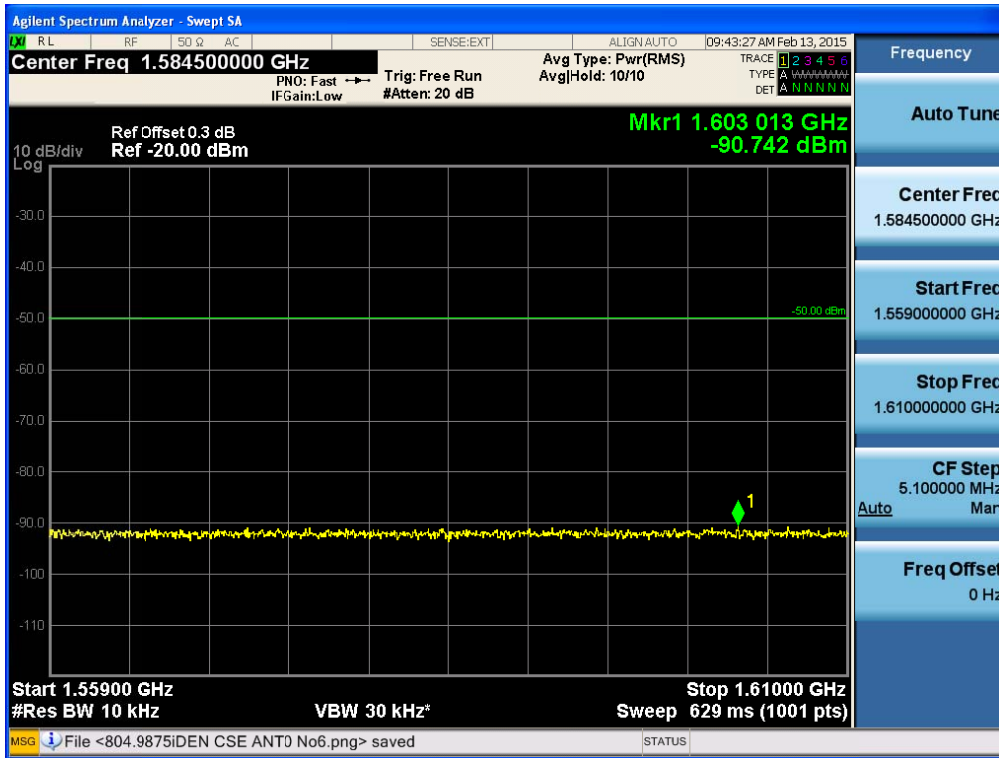
**[iDEN Uplink Low]**



**[iDEN Uplink Middle]**

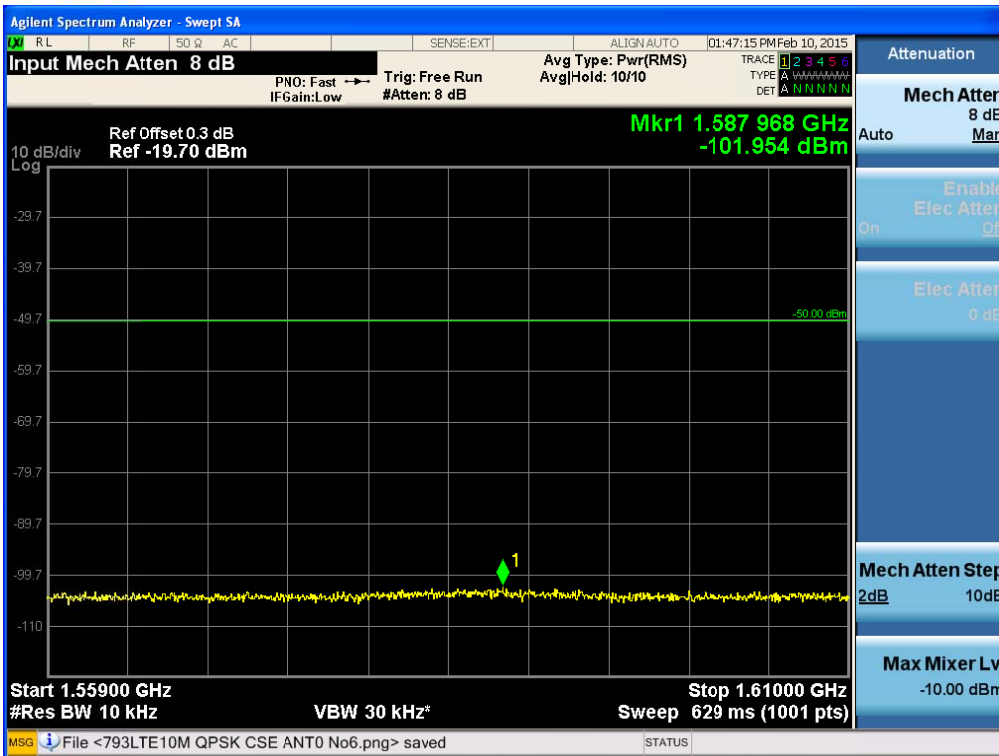


[iDEN Uplink High]



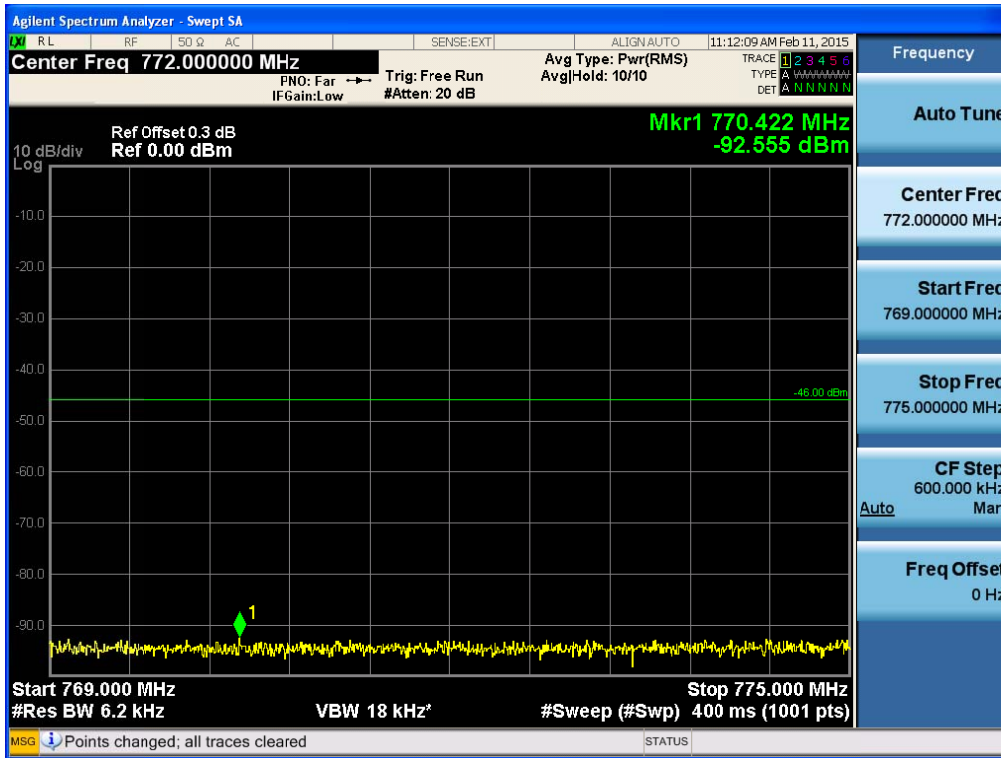
LTE 10 MHz

[LTE 10 MHz Uplink Low]

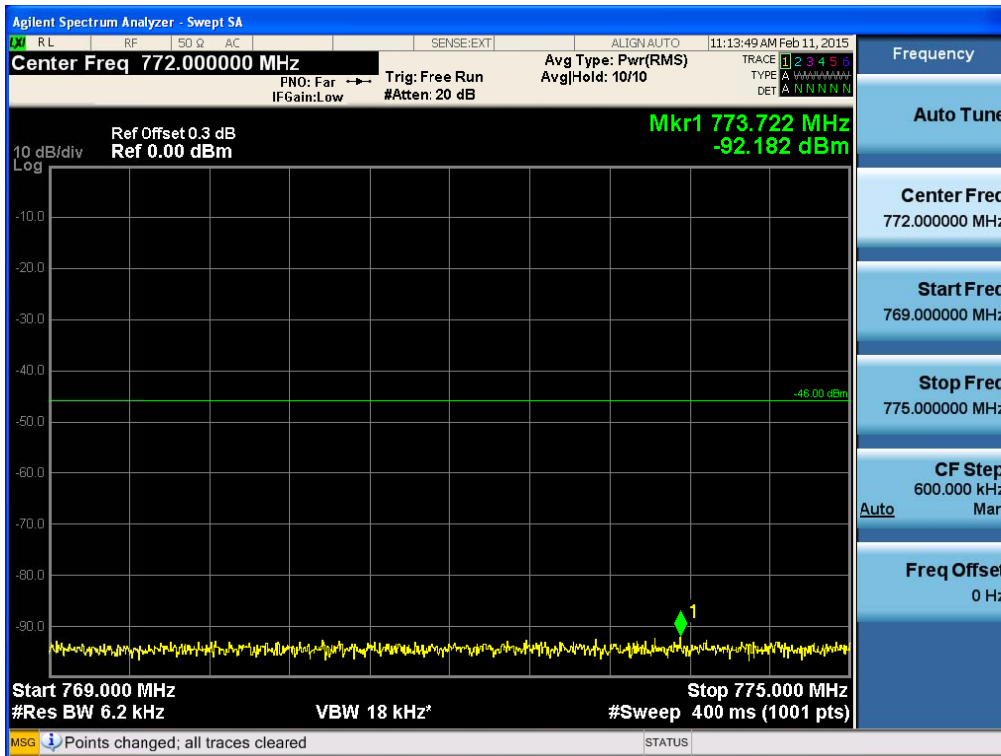


**Conducted Spurious Emissions (769 MHz – 775 MHz)  
iDEN 700**

**[iDEN Uplink Low]**

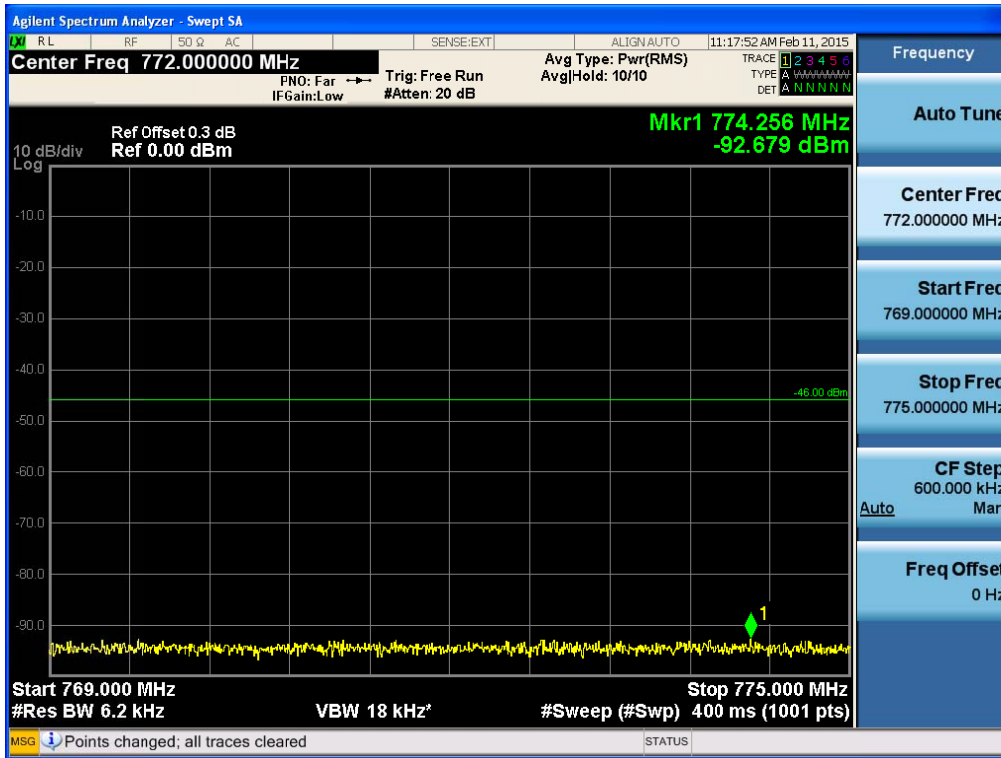


**[iDEN Uplink Middle]**



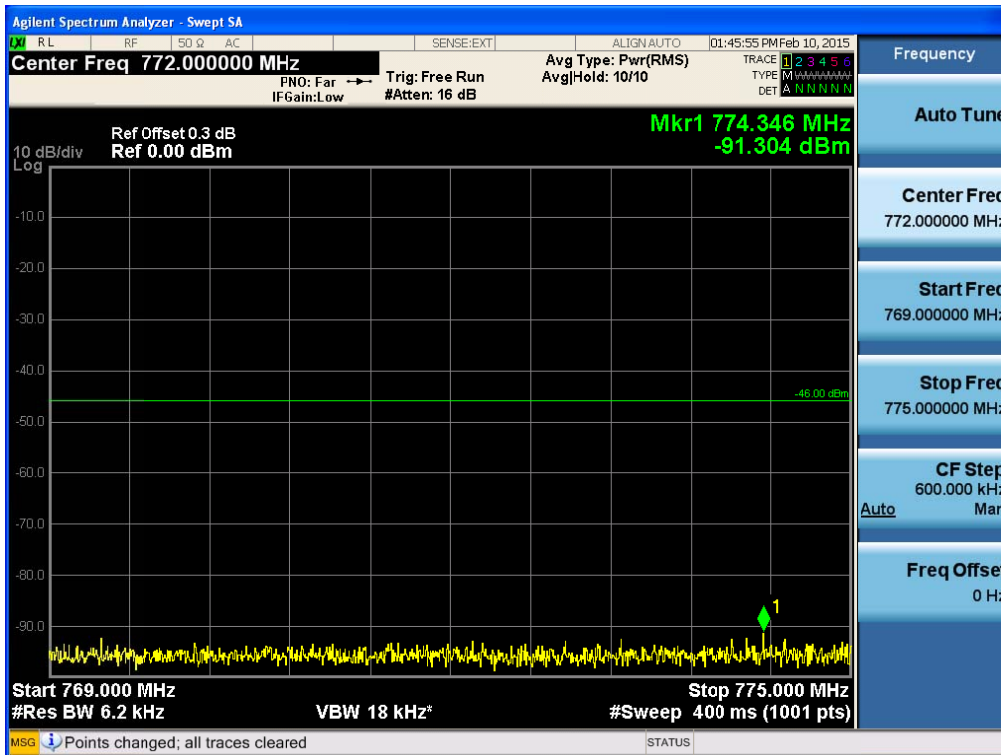


[iDEN Uplink High]



LTE 10 MHz

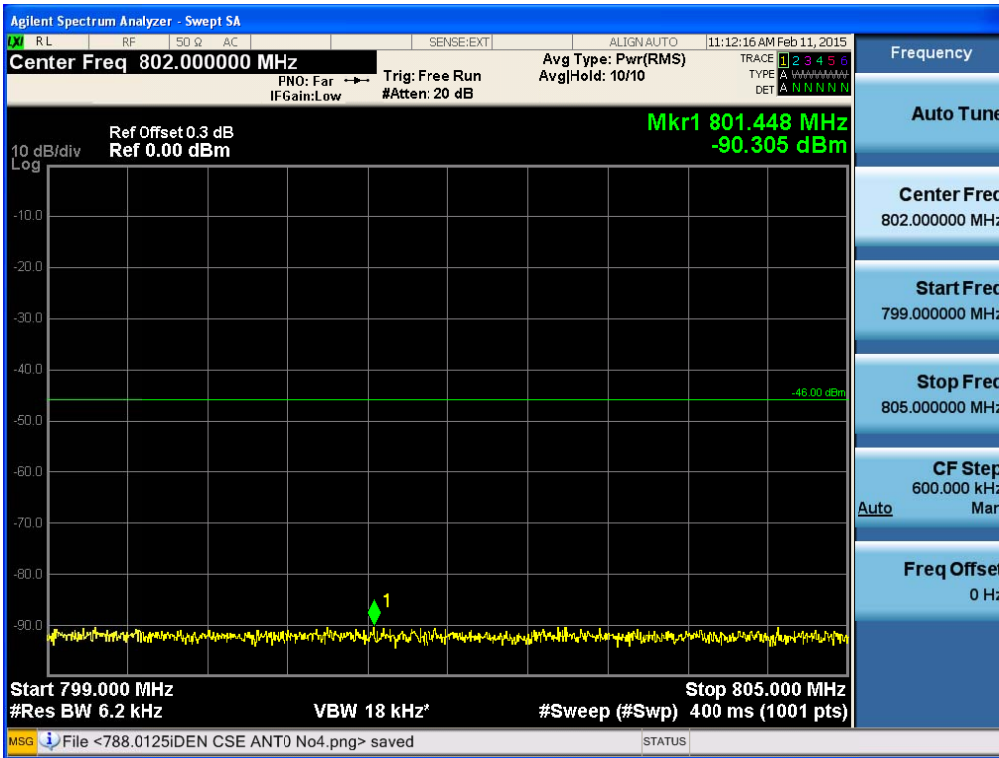
[LTE 10 MHz Uplink Low]



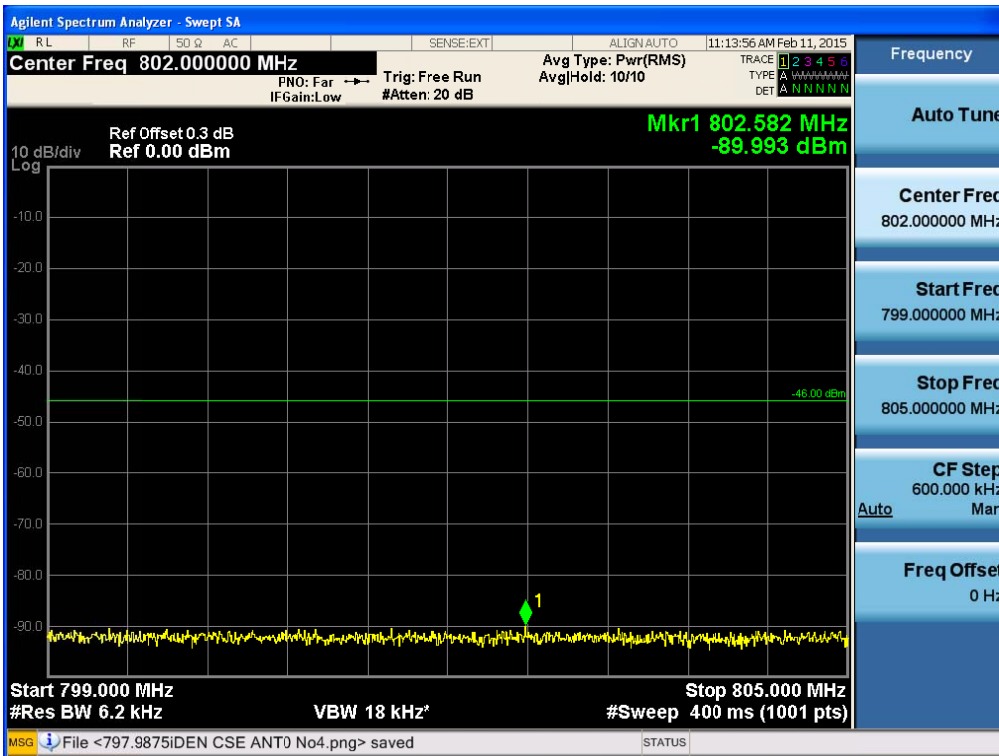


**Conducted Spurious Emissions (799 MHz – 805 MHz)  
iDEN 700**

**[iDEN Uplink Low]**

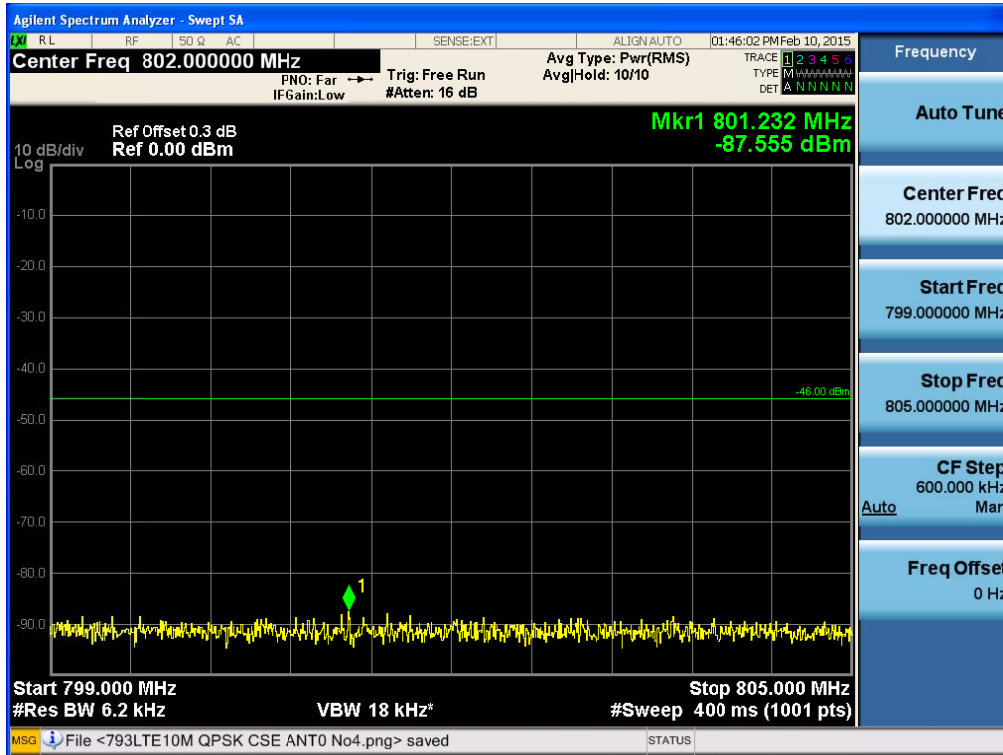


**[iDEN Uplink Middle]**



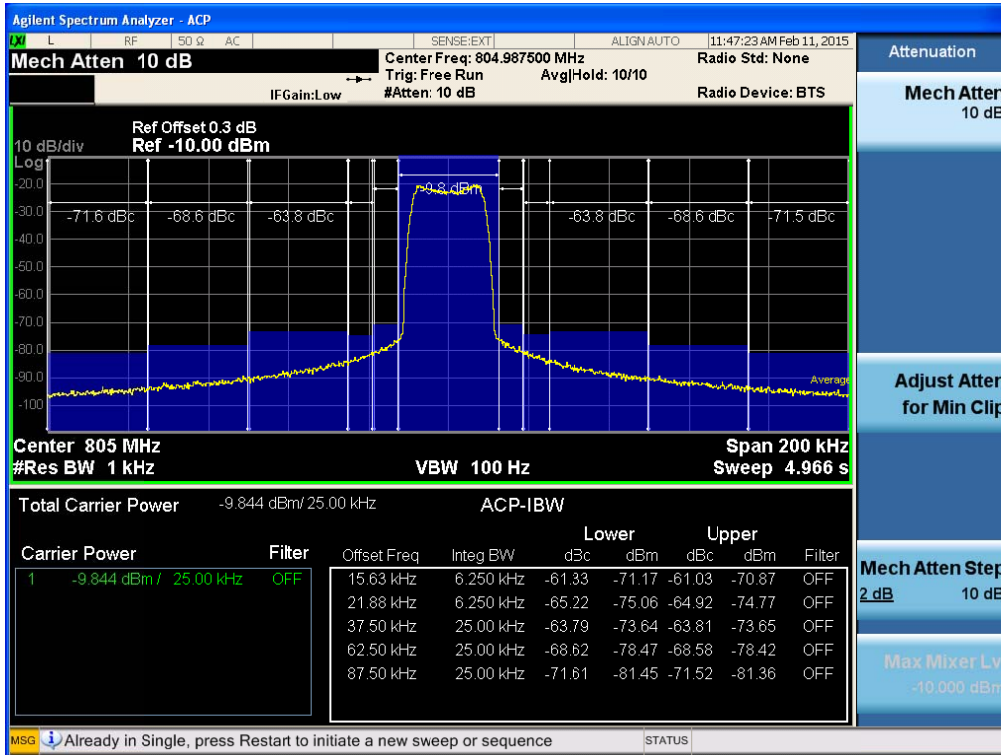
**LTE 10 MHz**

**[LTE 10 MHz Uplink Low]**



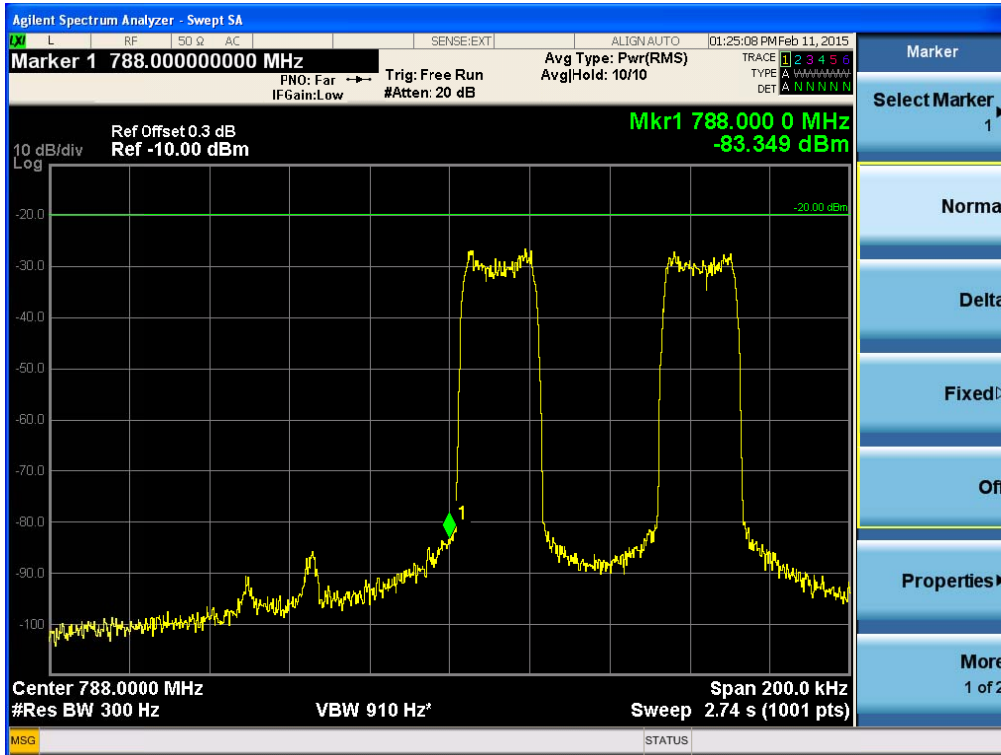
**ACP**  
**iDEN 700**

**[iDEN Uplink High]**

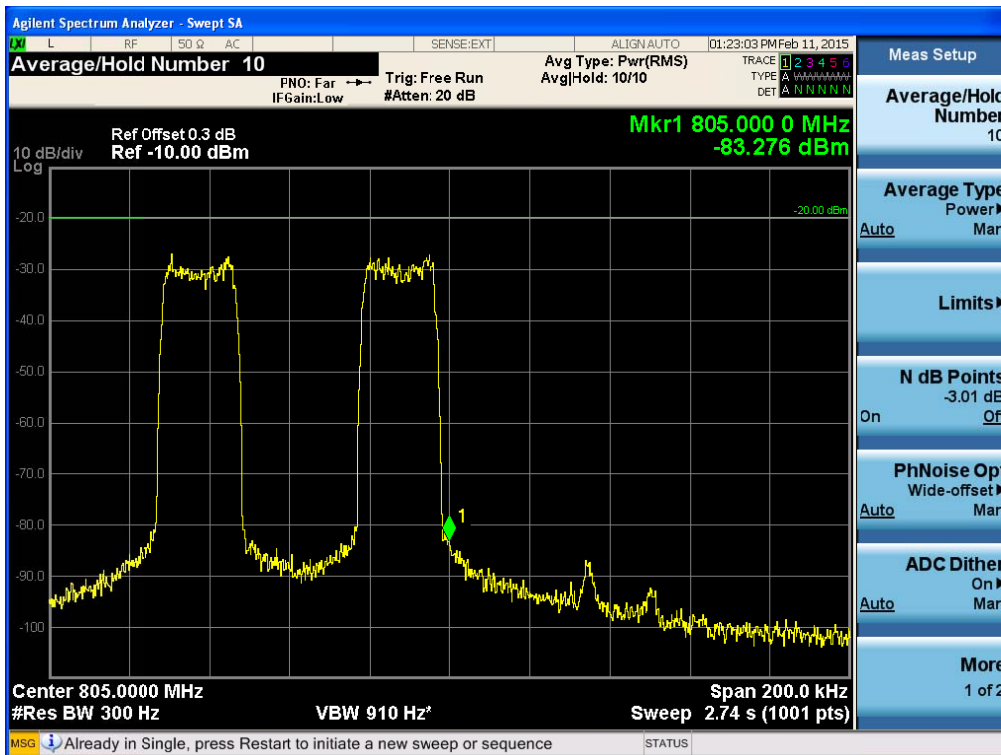


**Intermodulation Spurious Emissions for FCC  
iDEN 700**

[iDEN Uplink Low]

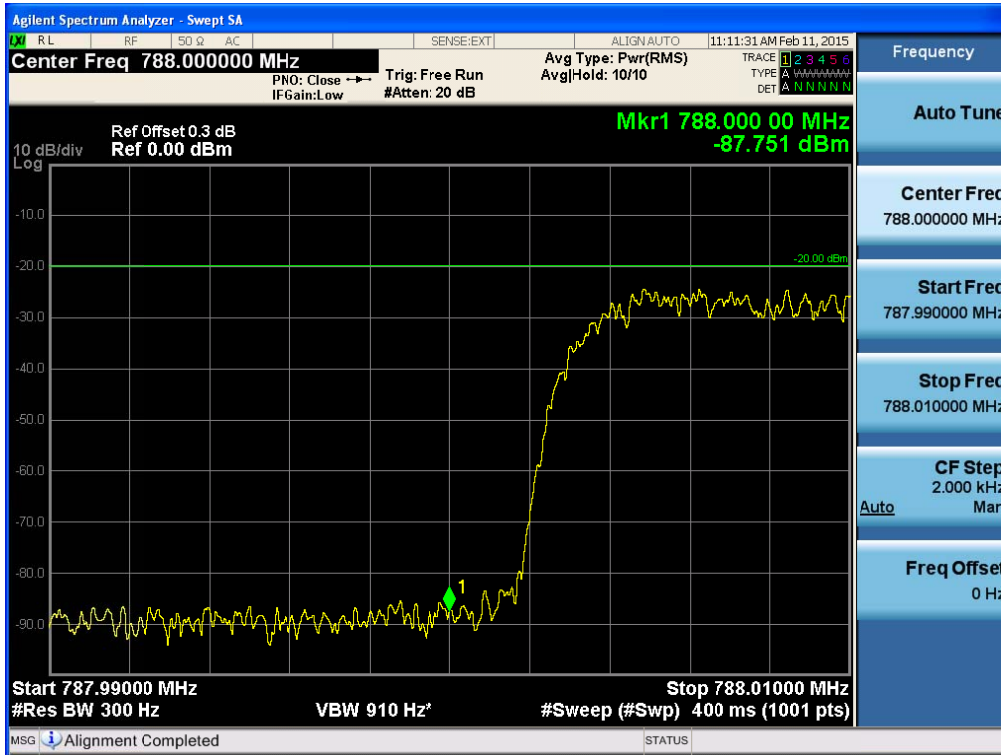


[iDEN Uplink High]



**Single channel Enhancer Band Edge  
iDEN 700**

[iDEN Uplink Low]

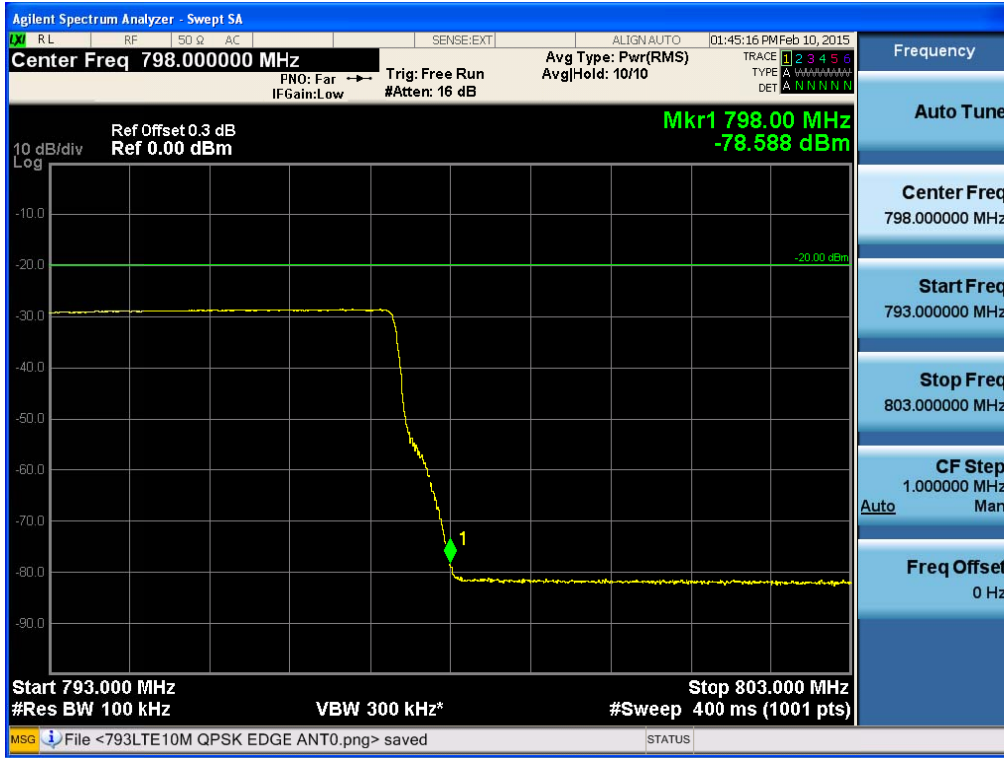


[iDEN Uplink High]



**LTE 10 MHz**

**[LTE 10 MHz Uplink Low]**



## 11. 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.

#### Emission limit

On any frequency outside the operating band, the power of any emission shall be attenuated outside the band below the transmitter power(P) by at least  $43 + 10 \log (P)$  dB;

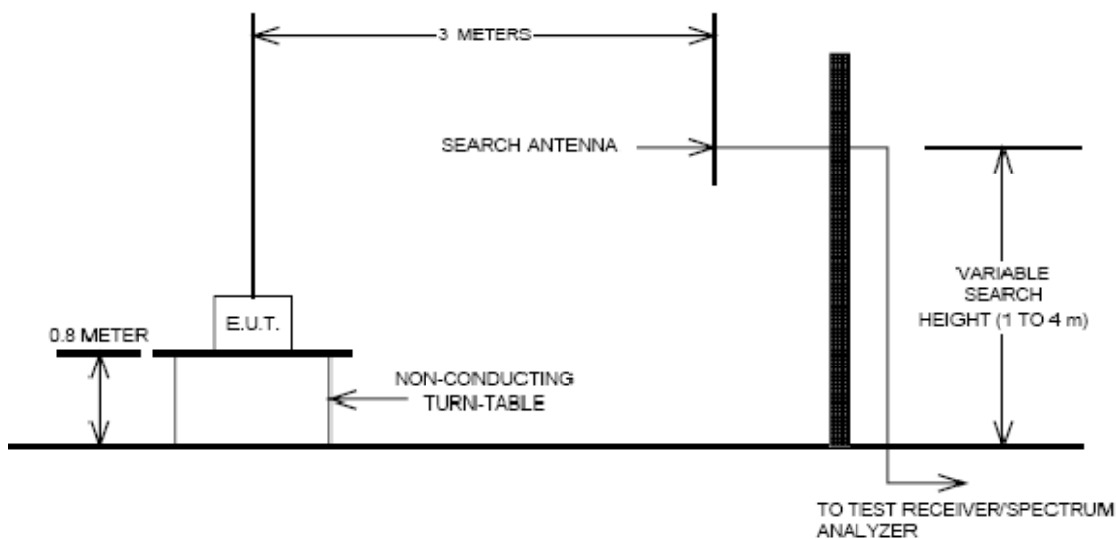
**Test Procedures:** As required by 47 CFR 2.1053, *field strength of radiated spurious measurements* were made in accordance with the procedures of ANSI/TIA-603-C-2004 "Land Mobile FM or PM Communications Equipment Measurement and Performance Standards".

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.

**700 MHz band**

**[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	758.0125	No Peak Found						
	767.9875							
	774.9875							

**[Uplink]**

Voltage supplied to EUT	Tx Freq.(MHz)	Freq.(MHz)	Substitute Level [dBm]	Ant. Gain (dBi)	C.L	Pol.	EIRP (dBm)	Margin (dB)
120 Vac	788.0125	No Peak Found						
	797.9875							
	804.9875							

## 12. FREQUENCY STABILITY OVER TEMPERATURE AND VOLTAGE VARIATIONS

### FCC Rules

**Test Requirement(s):** §2.1055(a)(1), § 90.539

### 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.

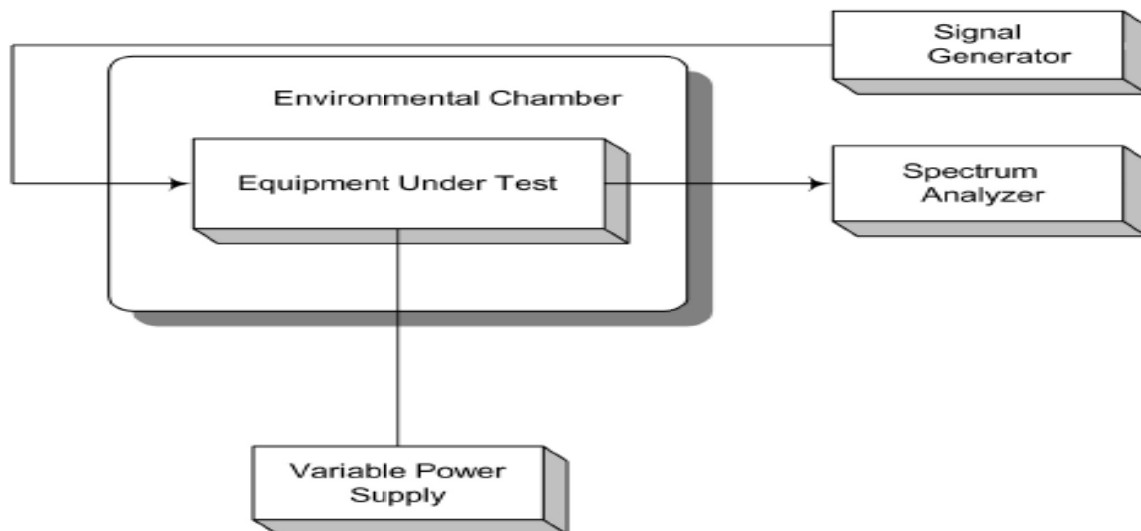
A CW signal was injected into the EUT at the appropriate RF level. The frequency counter option on the Spectrum Analyzer was used to measure frequency deviations.

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  $\pm 15\%$  of nominal

### Test Setup:



**Test Results:**

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

Note.

The E.U.T does not perform frequency translation.

Simply amplifies all signals within its passband.

Therefore, the frequency stability of both the output signal and input signal is the same.

**Frequency Stability and Voltage Test Results**

**Reference:** 120 Vac at 20°C    **Freq.** = 769 MHz

Voltage (%)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (Hz)	ppm
100%	+20(Ref)	769000000.0	0.0	0.0	0.0000
	-30	769000000.0	0.0	0.0	0.0000
	-20	769000000.0	0.0	0.0	0.0000
	-10	769000000.0	0.0	0.0	0.0000
	0	769000000.0	0.0	0.0	0.0000
	+10	769000000.0	0.0	0.0	0.0000
	+30	769000000.0	0.0	0.0	0.0000
	+40	769000000.0	0.0	0.0	0.0000
	+50	769000000.0	0.0	0.0	0.0000
115%	+20	769000000.0	0.0	0.0	0.0000
85%	+20	769000000.0	0.0	0.0	0.0000

[Downlink]