HCT CO.,LTD
74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Korea
TEL: +82-31-645-6300 FAX: +82-31-645-6401

# REPORT

## FCC / IC Certification

| | |
|---|---|
| **Manufacture;**<br><br>**10, 9th Floor, SOLiD Space, Pangyoyeok-ro 220, Bundang-gu, Seongnam-si, Gyeonggi-do, 463-400, South Korea**<br><br>**SOLiD. Inc.** | **Date of Issue : February 04, 2015**<br><br>**Test Report No.: HCT-R-1501-F011-1**<br><br>**Test Site: HCT CO., LTD.**<br><br>**IC Recognition No.: 5944A-3** |

| | |
|---|---|
| **FCC ID:**<br>**IC:**<br>**APPLICANT:** | **W6UHM70P80P**<br>**9354A-HM70P80P**<br>**SOLiD, Inc.** |
| **FCC/ IC Model Name:** | **MRDU-70P80P** |
| **EUT Type:** | **RDU (Remote Drive Unit)** |
| **Frequency Ranges:** | **758 MHz ~ 775 MHz (768 MHz ~ 769 MHz Guard band)**<br>**851 MHz ~ 861 MHz** |
| **Conducted Output Power:** | **5 W (37 dBm)** |
| **Date of Test :** | **September 02, 2014 ~ September 14, 2014**<br>**January 07, 2015(only Noise Figure test),**<br>**January 27, 2015(only Emission Mask test)** |
| **FCC Rules Part(s):** | **CFR 47, Part 90** |
| **IC Rules :** | **RSS-Gen (Issue 4, November 2014) , RSS-131 (Issue 2, July 2003)** |

**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**
**Engineer of RF Team**

**Report approved by : Sang Jun Lee**
**Manager of RF Team**

# Report Revision

| TEST REPORT NO. | DATE | DESCRIPTION |
|---|---|---|
| HCT-R-1501-F011 | January 13, 2015 | - First Approval Report |
| HCT-R-1501-F011-1 | February 04, 2015 | - Revised FCC Rules<br>- Added 'Mask G' test result |
| | | |
| | | |
| | | |

# Table of Contents

# 1. CLIENT INFORMATION

**The EUT has been tested by request of**

| | |
|---|---|
| Company | SOLiD, Inc.<br><br>10, 9th Floor, SOLiD Space, Pangyoyeok-ro 220, Bundang-gu, Seongnam-si, Gyeonggi-do, 463-400, South Korea |

**■ FCC ID:** **W6UHM70P80P**

**■ IC:** **9354A-HM70P80P**

**■ APPLICANT:** **SOLiD, Inc.**

**■ EUT Type:** **RDU (Remote Drive Unit)**

**■ Model:** **MRDU-70P80P**

**■ Frequency Ranges:** **758 MHz ~ 775 MHz (768 MHz ~ 769 MHz Guard band)**
**851 MHz ~ 861 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 90**

**■ IC Rules Part(s):** **RSS-Gen (Issue4, November 2014), 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 Part90, RSS-GEN, RSS-131.

| Description | Reference (FCC) | Reference (IC) | Results |
|---|---|---|---|
| Conducted RF Output Power | §2.1046, §90.541, §90.542, §90.635 | RSS-131, Section 4.3<br>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<br>RSS-131, Section 6.1 | Compliant |
| Noise Figure | §90.219 | - | Compliant |
| Emission Masks | §90.210 | - | Compliant |
| Spurious Emissions at Antenna Terminals | §2.1051, §90.543, §90.691 | RSS-131, Section 4.4<br>RSS-131, Section 6.3<br>RSS-131, Section 6.4 | Compliant |
| Radiated Spurious Emissions | §2.1053, §90.543, §90.691 | - | Compliant |
| Frequency Stability | §2.1055, §90.213, §90.539 | RSS-131, Section 4.5<br>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.

Test Frequency & Modulation

| Frequency | Modulation |
|---|---|
| 758 MHz - 768 MHz | LTE(5 MHz) |
| 758 MHz - 775 MHz<br>(768 MHz ~ 769 MHz Guard band) | iDEN(25 kHz) |
| 851 MHz - 861 MHz | iDEN(25 kHz) |

# 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 | 01/15/2015 | MY45100523 |
| Agilent | N1921A/ Power Sensor | Annual | 07/09/2014 | MY45241059 |
| NANGYEUL CO., LTD. | NY-THR18750/ Temperature and Humidity Chamber | Annual | 10/29/2014 | NY-2009012201A |
| Agilent | N9020A /Signal Analyzer | Annual | 04/16/2014 | US46220219 |
| WEINSCHEL | 67-30-33 / Fixed Attenuator | Annual | 11/04/2014 | BU5347 |
| Weinschel | AF9003-69-31 / Step Attenuator | Annual | 10/24/2014 | 11787 |
| HD | MA240/ Antenna Position Tower | N/A | N/A | 556 |
| EMCO | 1050/ Turn Table | N/A | N/A | 114 |
| HD GmbH | HD 100/ Controller | N/A | N/A | 13 |
| HD GmbH | KMS 560/ SlideBar | N/A | N/A | 12 |
| MITEQ | AMF-6D-001180-35-20P/AMP | Annual | 09/04/2014 | 1081666 |
| Schwarzbeck | BBHA 9120D/ Horn Antenna | Biennial | 07/05/2013 | 1151 |
| Schwarzbeck | BBHA 9120D/ Horn Antenna | Biennial | 07/05/2013 | 1151 |
| 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 limits.** The transmitting power 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, and must also comply with any applicable effective radiated power limits in § 90.545. (a) The transmitting power of base transmitters must not exceed the limits given in paragraphs (a), (b) and (c) of § 90.635. (b) The transmitter output power of mobile and control transmitters must not exceed 30 Watts. (c) The transmitter output power of portable (hand-held) transmitters must not exceed 3 Watts. (d) Transmitters operating on the narrowband low power channels listed in §§ 90.531(b)(3), 90.531(b)(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 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**

| Antenna height (AAT) in meters (feet) | Effective radiated power (ERP) (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 |

**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**

| Antenna height (AAT) in meters (feet) | Effective radiated power (ERP) (watts) |
|---|---|
| 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**

| Antenna height (AAT) in meters (feet) | Effective radiated power (ERP) per MHz (watts/MHz) |
|---|---|
| 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**

| Antenna height (AAT) in meters (feet) | Effective radiated power (ERP) per MHz (watts/MHz) |
|---|---|
| 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 |

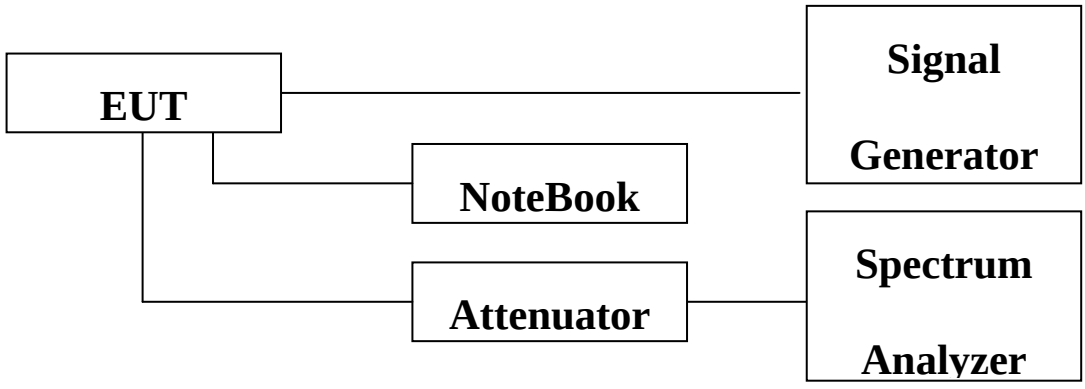
(b) For base and fixed stations operating in the 758-768 MHz band in accordance with the provisions of paragraph (a)(5) of this section, the power flux density that would be produced by such stations through a combination of antenna height and vertical gain pattern must not exceed 3000 microwatts per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

**§ 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 |
|---|---|---|
| LTE 5 MHz | DL : -10 dBm | DL : 47 dB |
| iDEN 25 kHz | | |

**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) |
| 700 Band_ LTE 5 MHz | Low | 760.50 | 37.05 | 5.070 |
| | Middle | 765.50 | 37.02 | 5.038 |
| | High | 772.50 | 37.01 | 5.023 |
| 700 Band_iDEN | Low | 758.0125 | 37.07 | 5.094 |
| | Middle | 767.9875 | 37.04 | 5.063 |
| | High | 774.9875 | 37.02 | 5.030 |
| 800 Band_iDEN | Low | 851.0125 | 37.04 | 5.058 |
| | Middle | 856.0000 | 37.04 | 5.061 |
| | High | 860.9875 | 36.99 | 5.004 |

**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) |
| 700 MHz Band | Low | 758.40 | 34.016 | 37.016 |
| | Middle | 767.60 | 34.002 | 37.002 |
| | High | 774.60 | 34.010 | 37.010 |
| 800 MHz Band | Low | 851.40 | 34.004 | 37.004 |
| | Middle | 856.00 | 34.011 | 37.011 |
| | High | 860.60 | 34.002 | 37.002 |

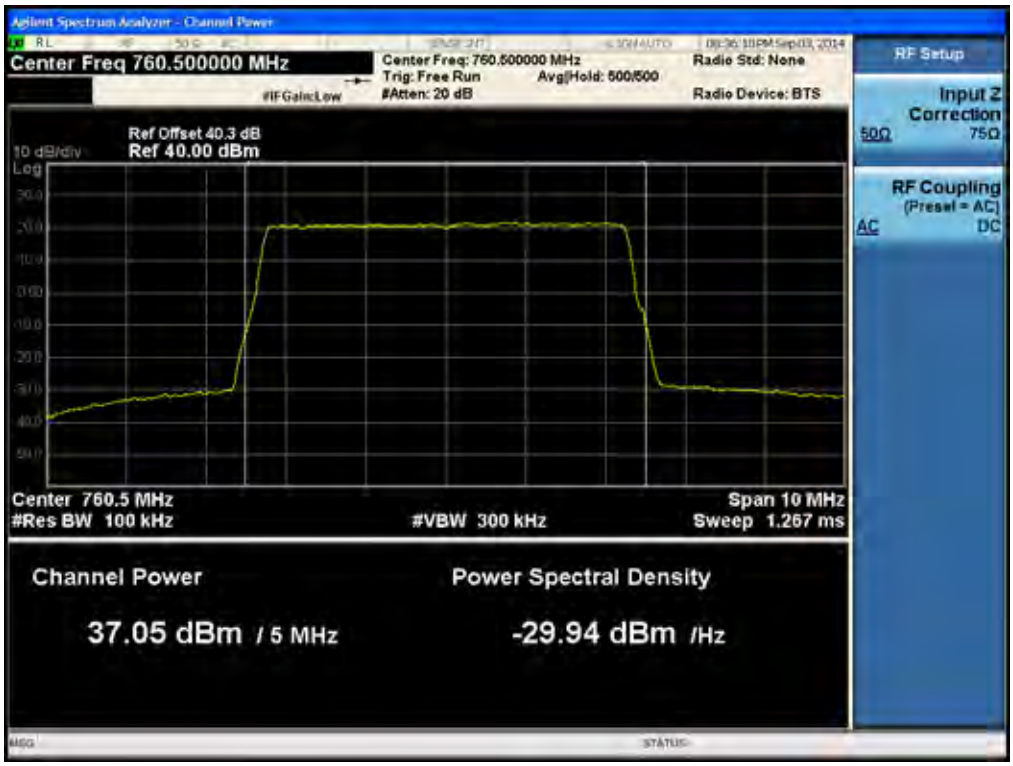
**Additional Power Back-off Condition for Multiple Carrier Operations for IC**

**[Downlink]**

| | 1 Carrier (dBm) | 3 Carrier (dBm) | Power Back-off (dB) |
|---|---|---|---|
| 700 MHz Band | 37.04 | 32.18 | 4.86 |
| 800 MHz Band | 37.04 | 32.27 | 4.77 |

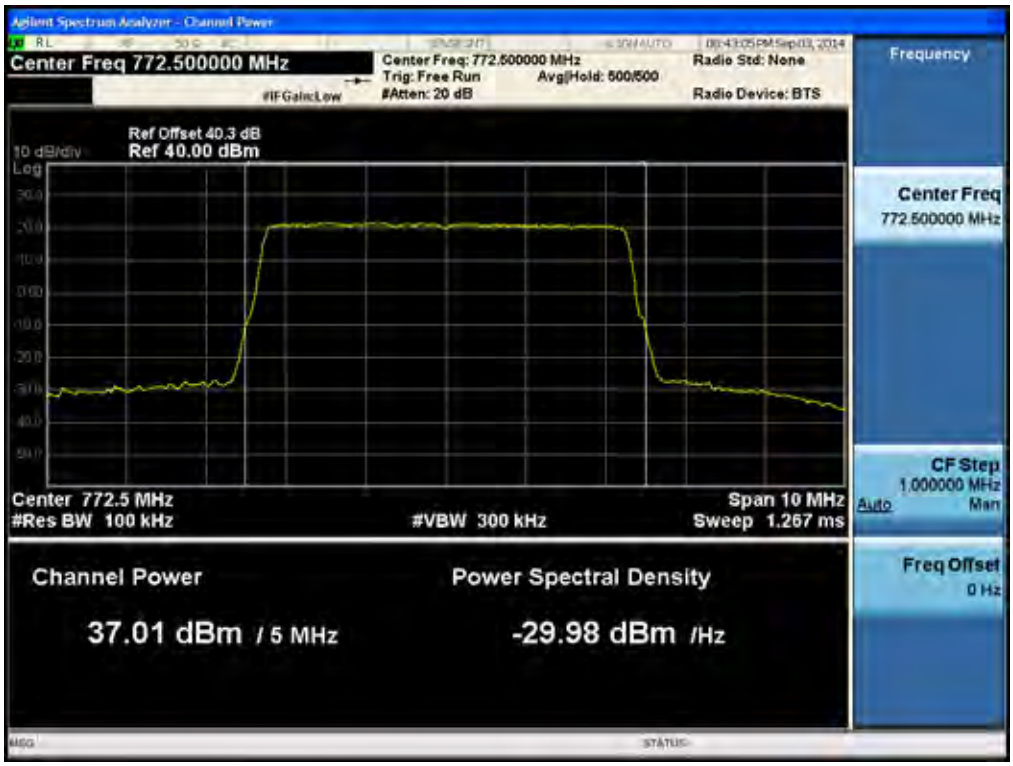
## Single channel Enhancer Plots of RF Output Power
## 700 MHz LTE Band

**[LTE Downlink 5 MHz Low]**



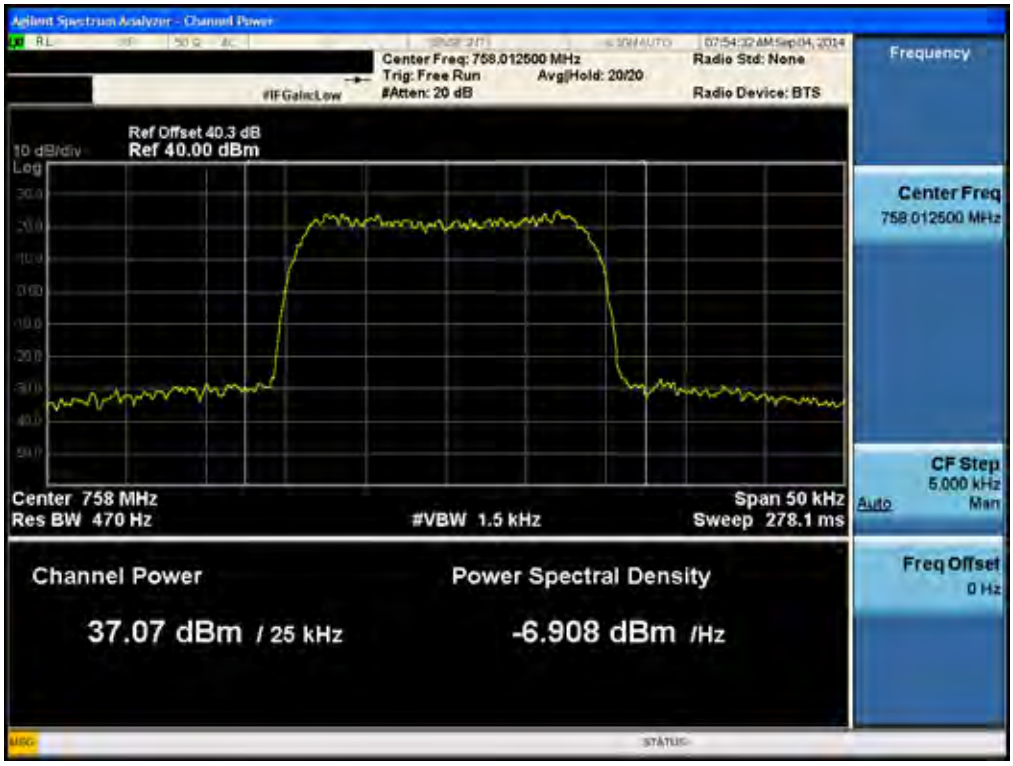

**[LTE Downlink 5 MHz Middle]**

**[LTE Downlink 5 MHz High]**

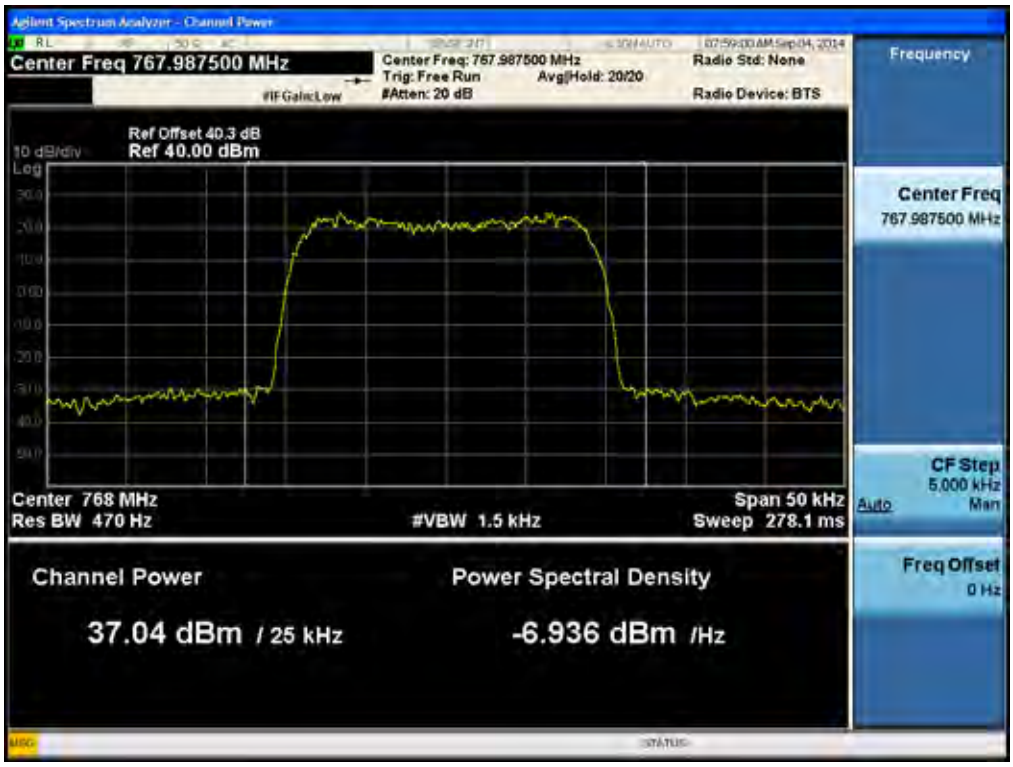


## 700 Band_iDEN

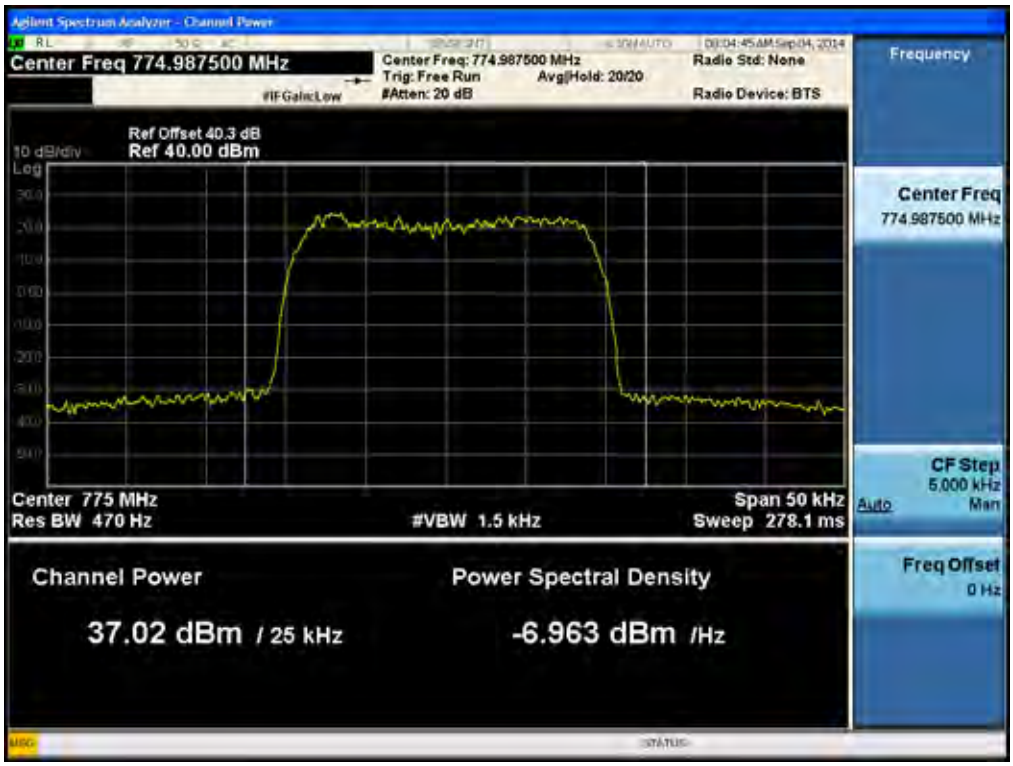
**[700 Band_iDEN Downlink Low]**




**[700 Band_iDEN Downlink Middle]**

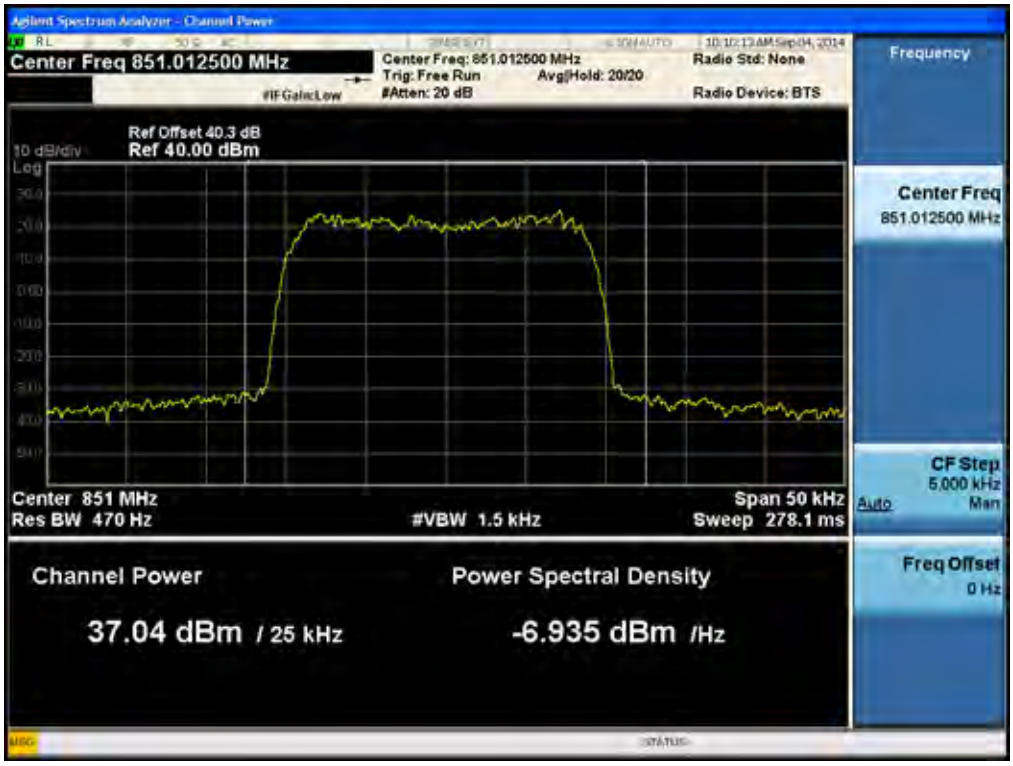


**[700 Band_iDEN Downlink High]**

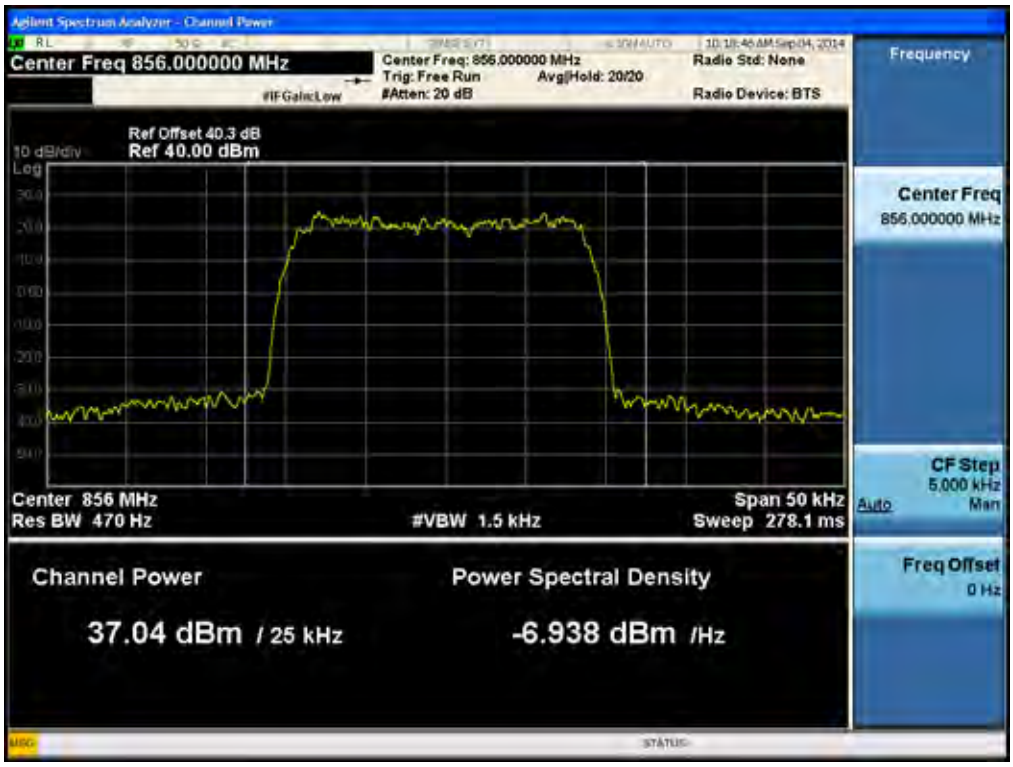


## 800 Band_iDEN

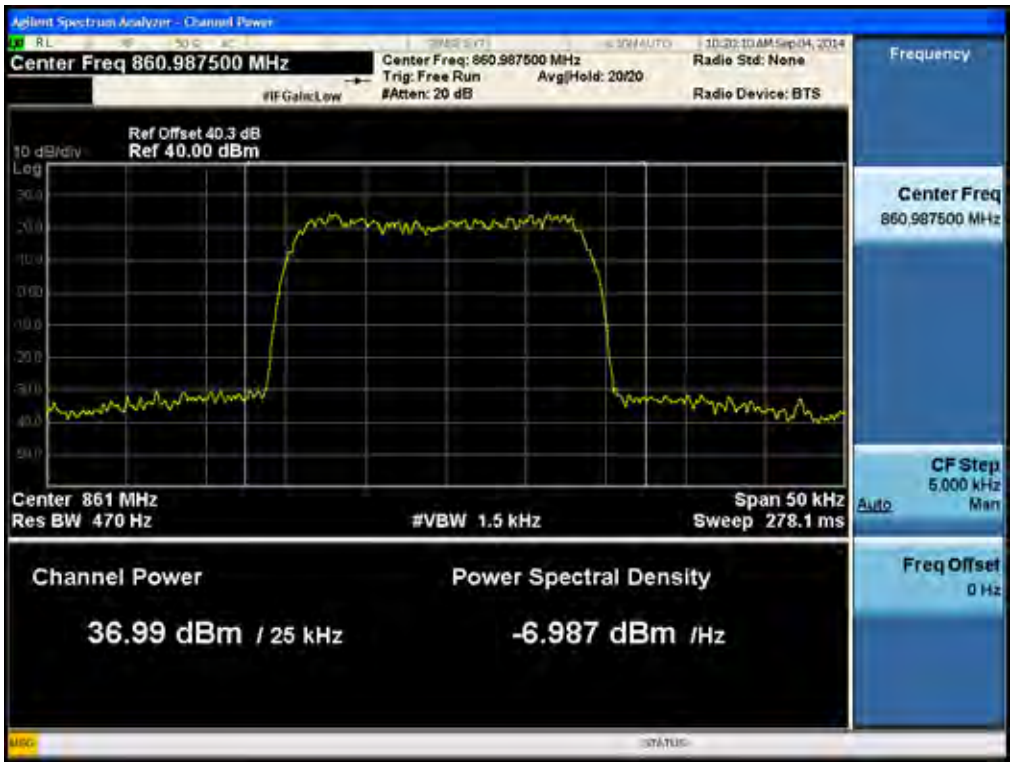
**[800 Band_iDEN Downlink Low]**




**[800 Band_iDEN Downlink Middle]**

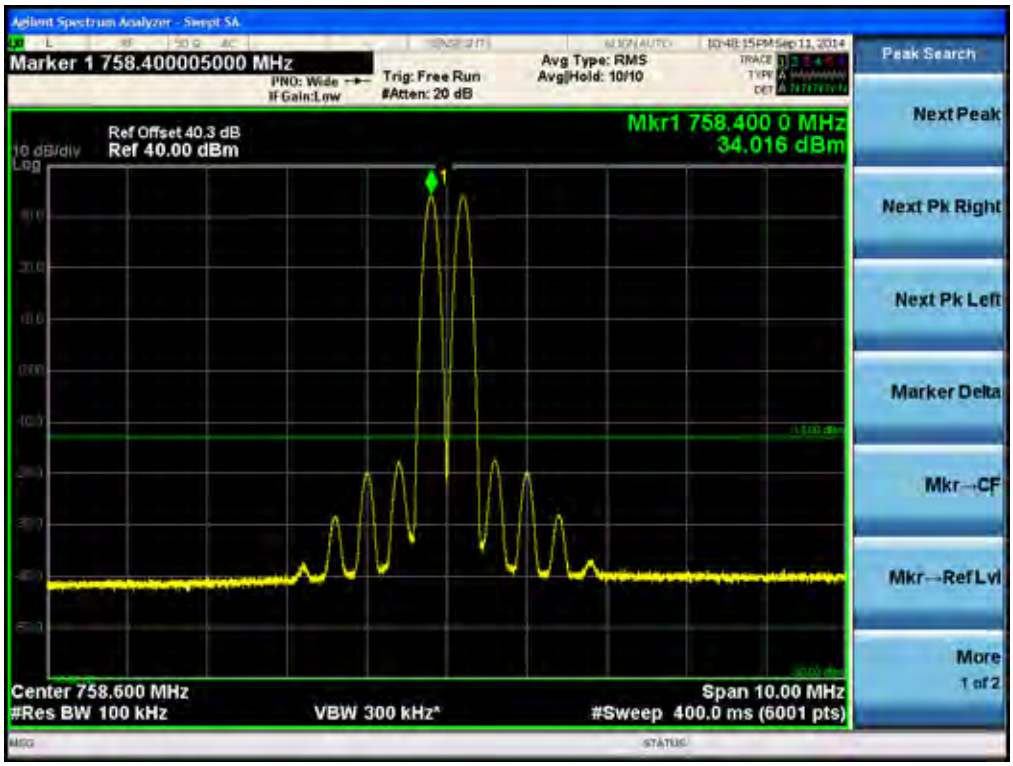


**[800 Band_iDEN Downlink High]**

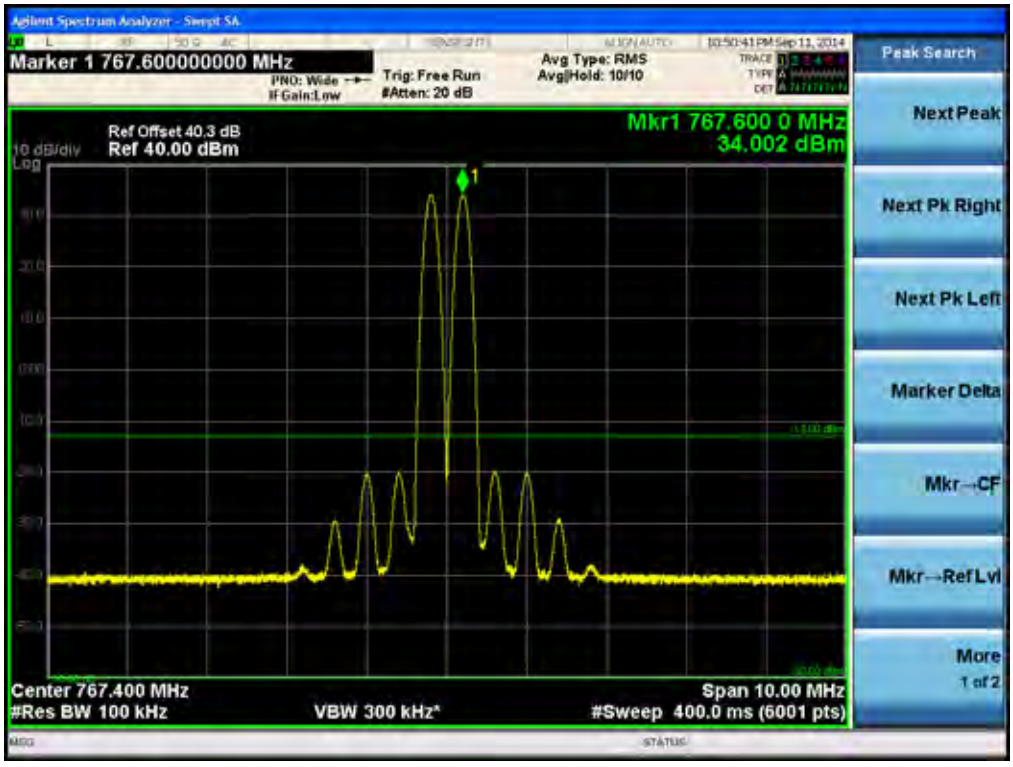


**Multi-channel Enhancer for IC**
**700 MHz Band**

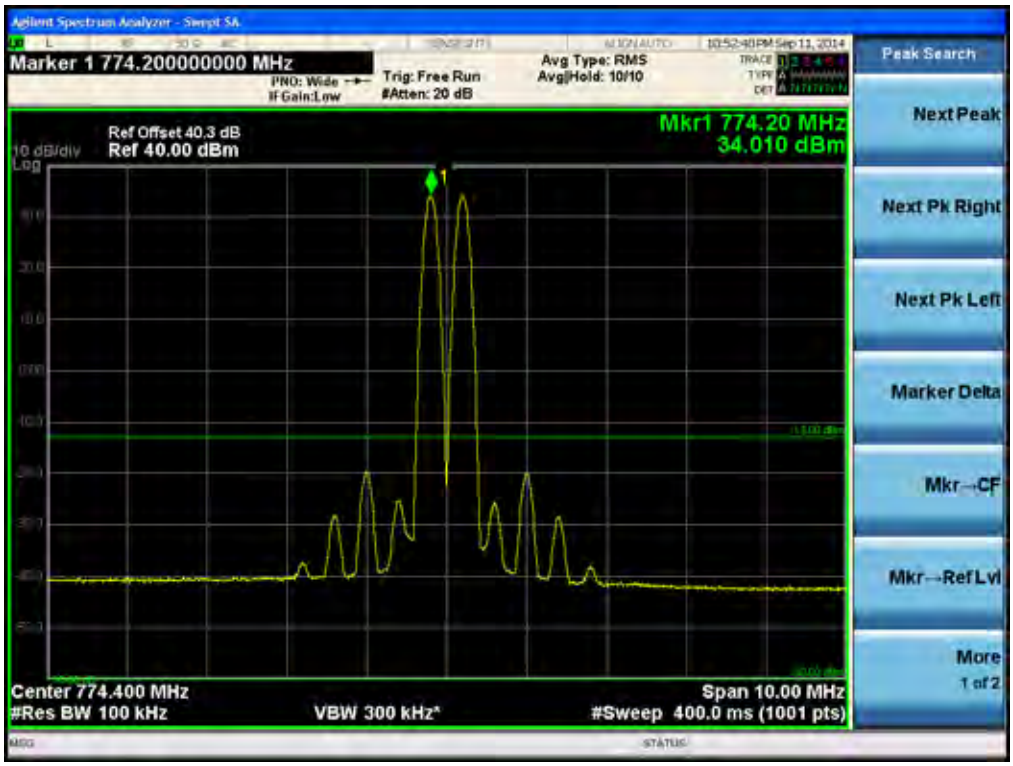
**[700 Downlink Low]**




**[700 Downlink Middle]**

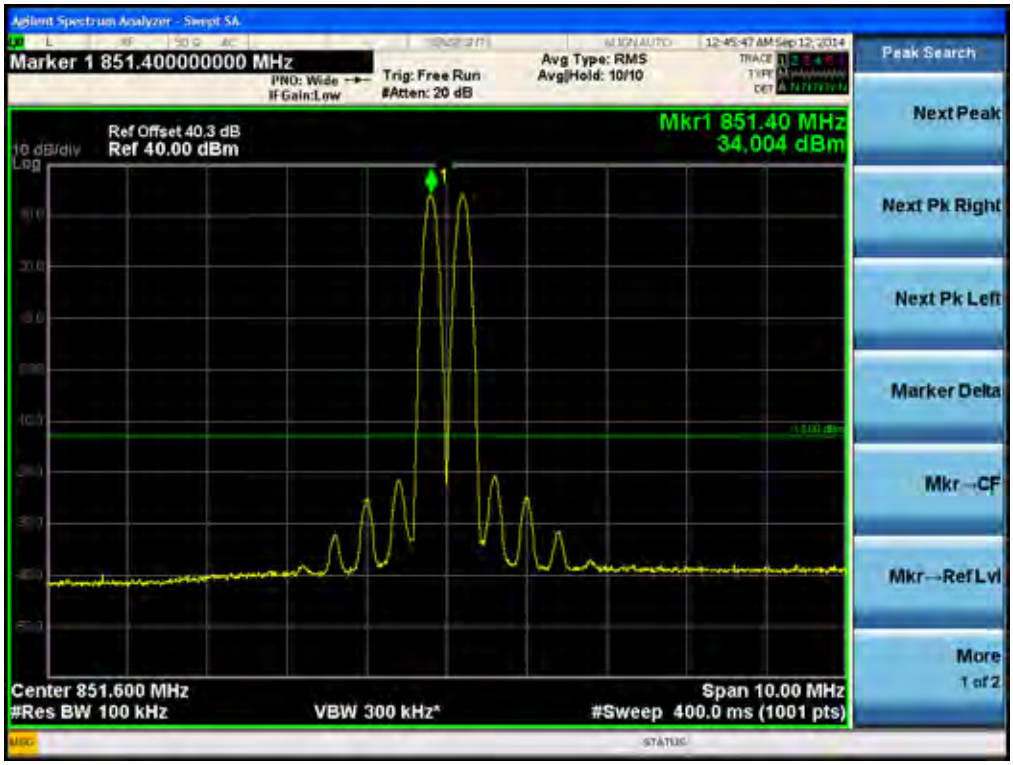


**[700 Downlink High]**

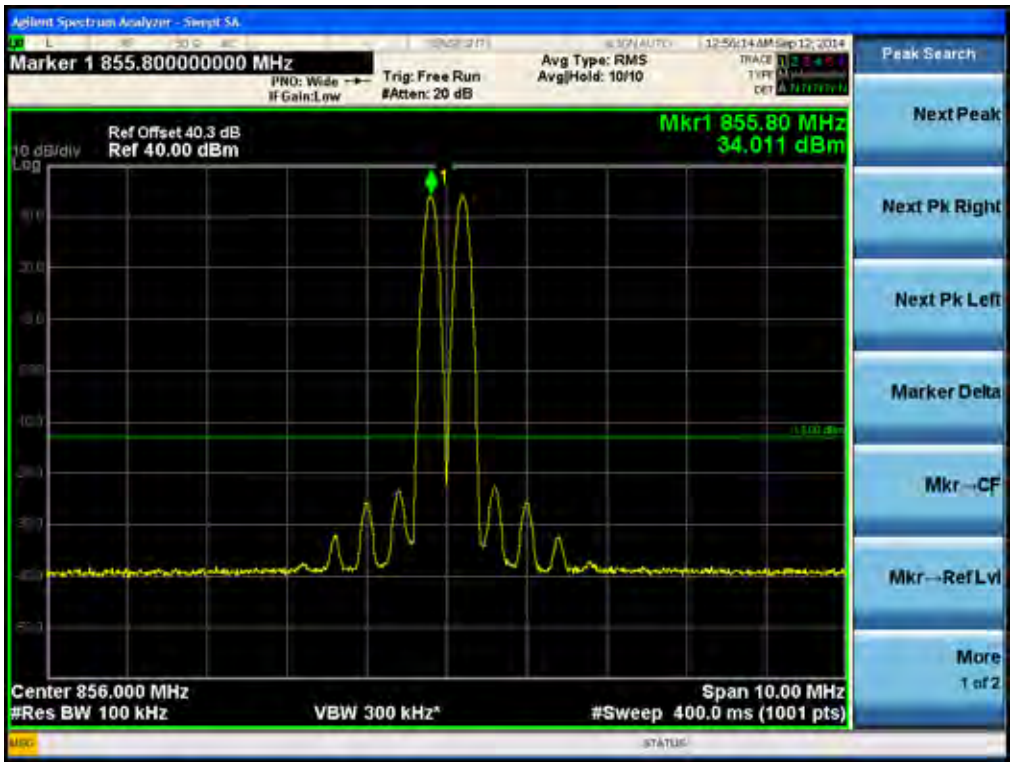


## 800 MHz Band

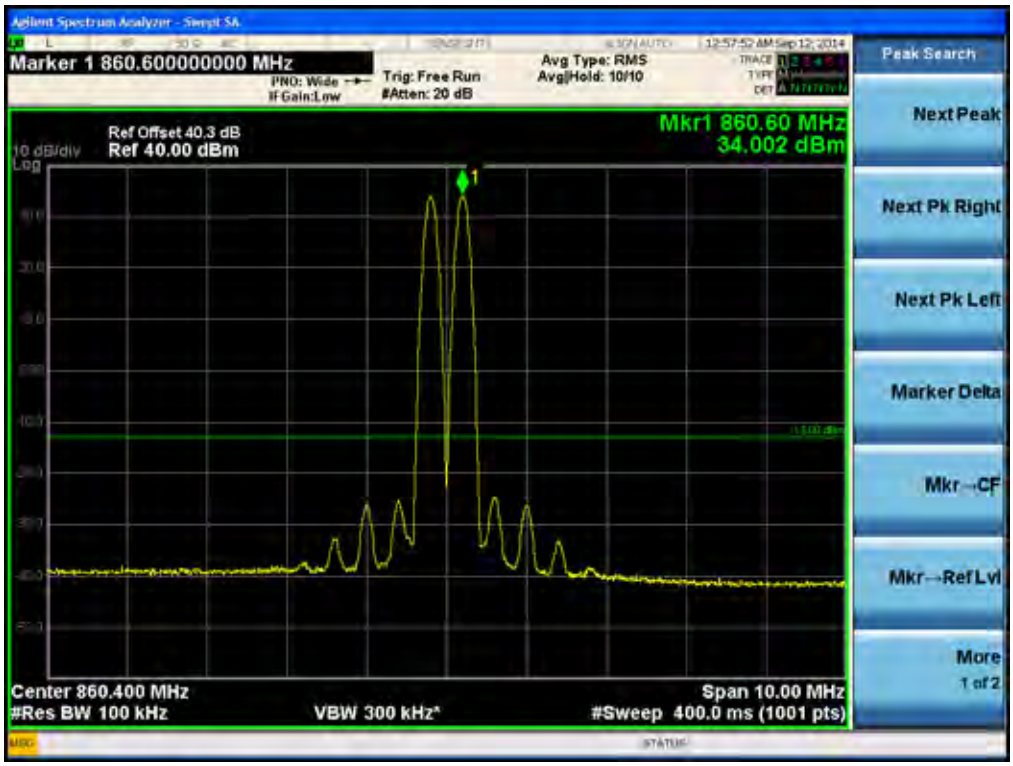
**[800 Downlink Low]**




**[800 Downlink Middle]**



**[800 Downlink High]**



**Power Back-off for IC**
**700 MHz Band**

**[3 Carrier]**


**800 MHz Band**

**[3 Carrier]**

# 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 |
|---|---|---|
| LTE 5 MHz | DL : -10 dBm | DL : 47 dB |
| iDEN 25 kHz | | |

**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) |
|---|---|---|---|
| 700 Band_ LTE 5 MHz | Low | 760.50 | 4.520 |
| | Middle | 765.50 | 4.519 |
| | High | 772.50 | 4.514 |

| | Channel | Frequency (MHz) | OBW (kHz) |
|---|---|---|---|
| 700 Band_iDEN | Low | 758.013 | 18.149 |
| | Middle | 767.988 | 18.077 |
| | High | 774.988 | 18.280 |
| 800 Band_iDEN | Low | 851.013 | 18.306 |
| | Middle | 856.000 | 18.396 |
| | High | 860.988 | 18.292 |

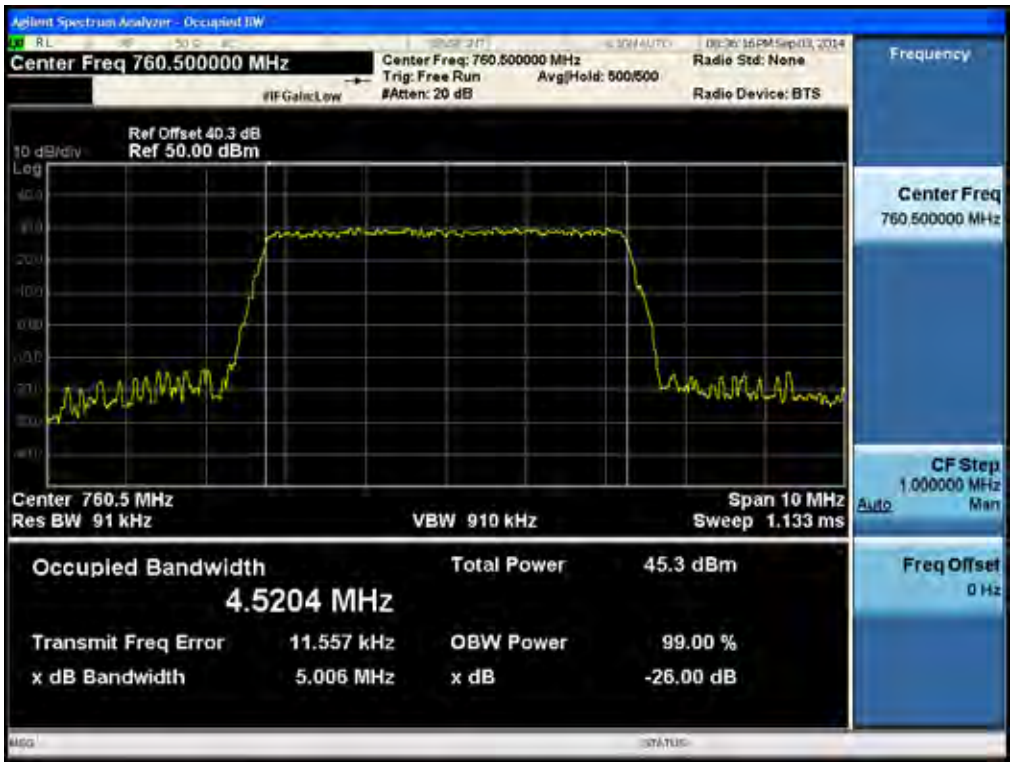
**[Downlink Input]**

| | Channel | Frequency (MHz) | OBW (MHz) |
|---|---|---|---|
| 700 Band_ LTE 5 MHz | Low | 760.50 | 4.516 |
| | Middle | 765.50 | 4.508 |
| | High | 772.50 | 4.509 |

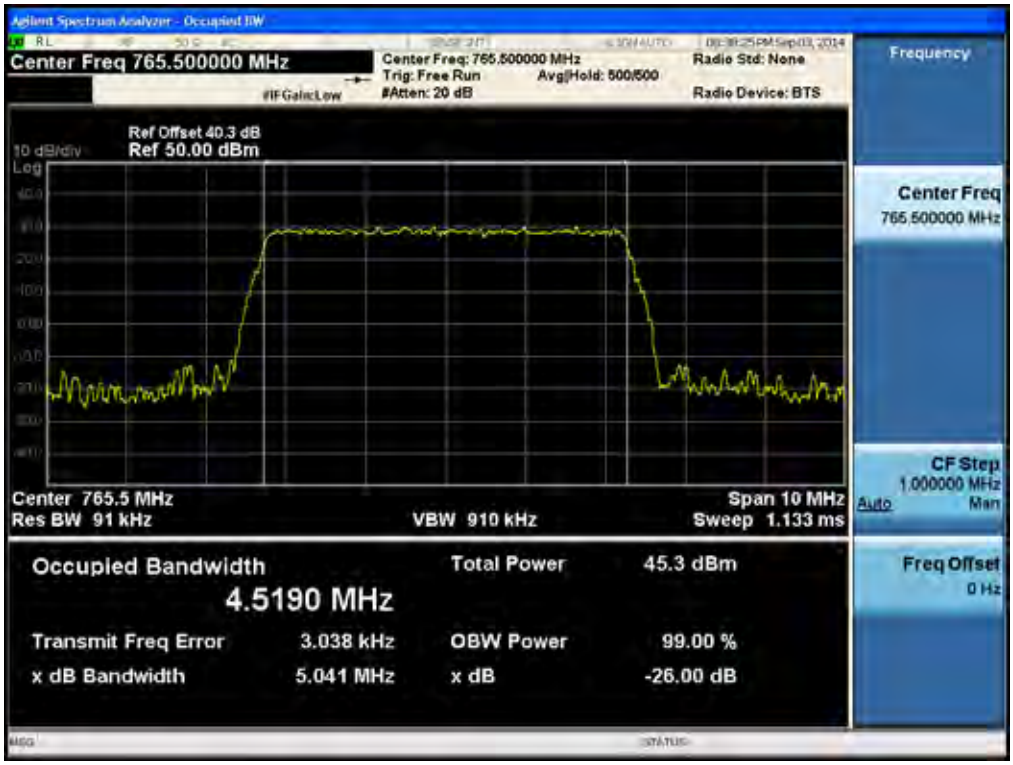
| | Channel | Frequency (MHz) | OBW (kHz) |
|---|---|---|---|
| 700 Band_iDEN | Low | 758.013 | 18.313 |
| | Middle | 767.988 | 18.121 |
| | High | 774.988 | 18.278 |
| 800 Band_iDEN | Low | 851.013 | 18.132 |
| | Middle | 856.000 | 18.304 |
| | High | 860.988 | 18.164 |

## Plots of Occupied Bandwidth
## 700 MHz LTE Band

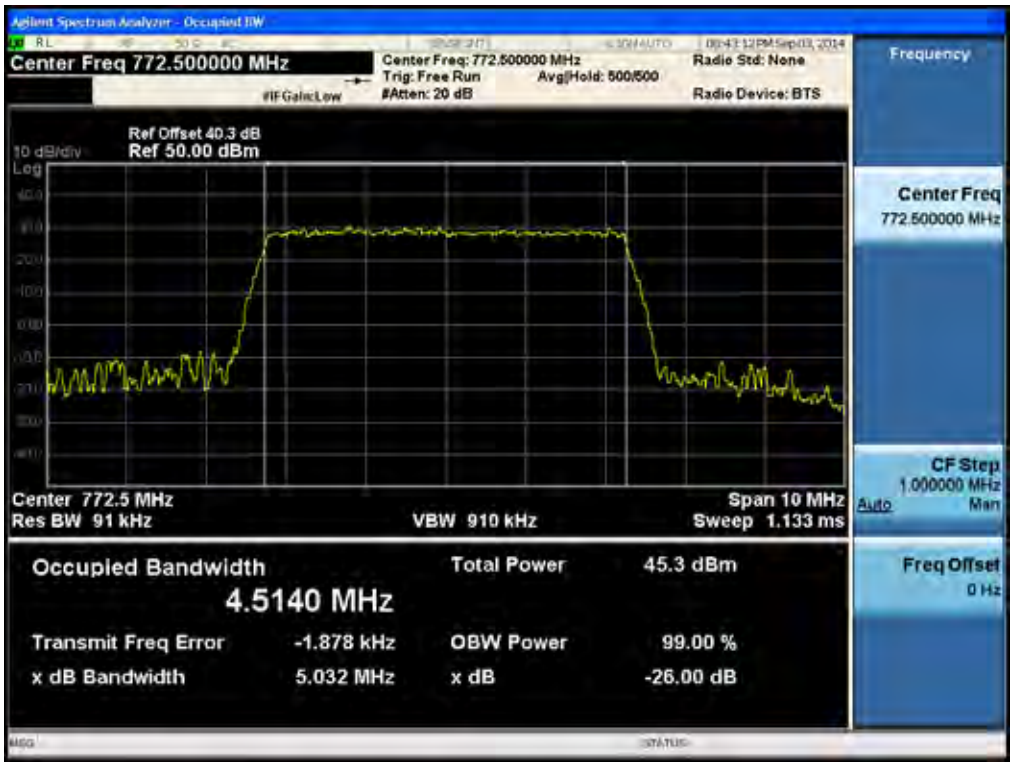
**[Output LTE Downlink 5 MHz Low]**




**[Output LTE Downlink 5 MHz Middle]**

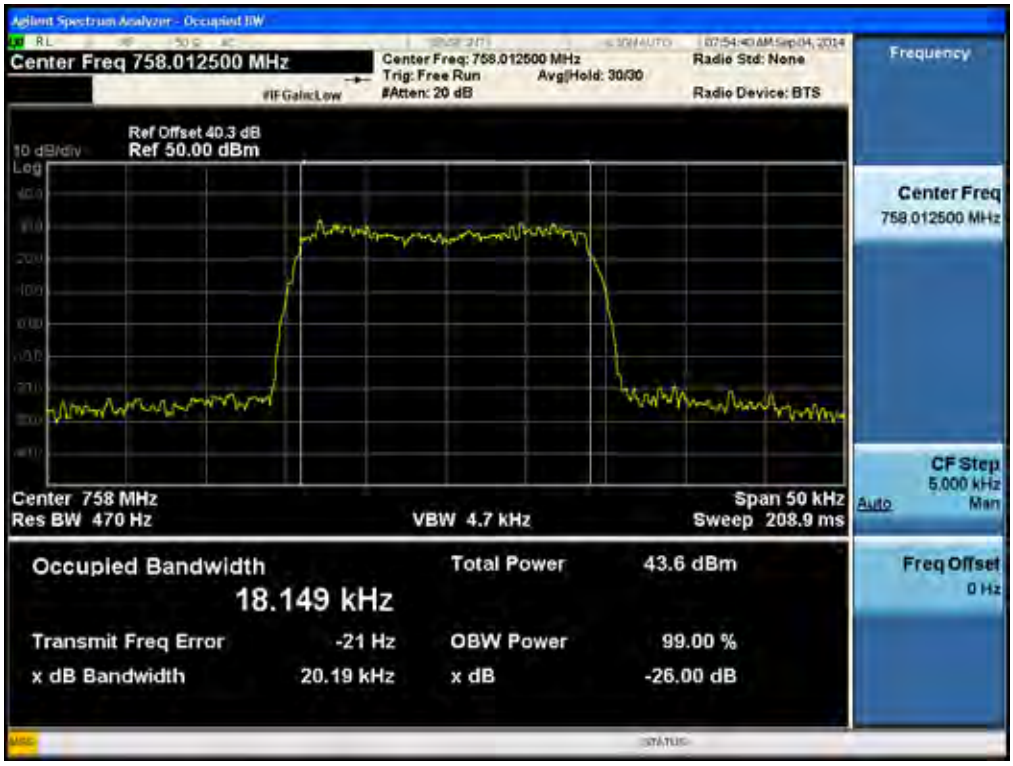


**[Output LTE Downlink 5 MHz High]**

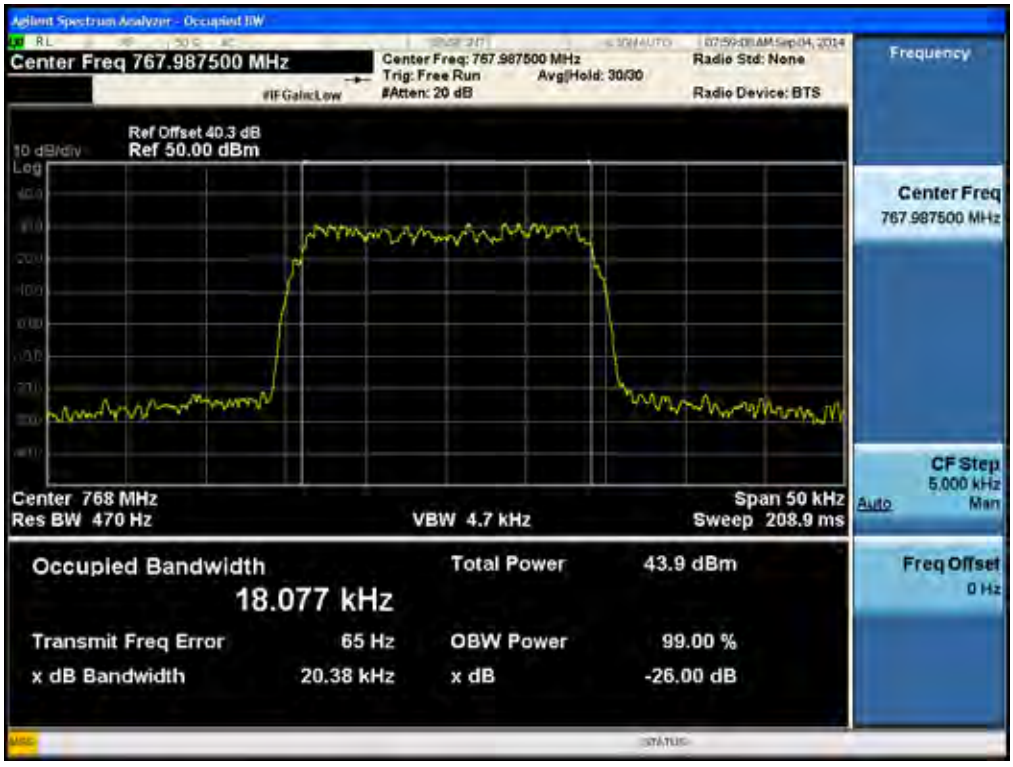


## 700 Band_iDEN

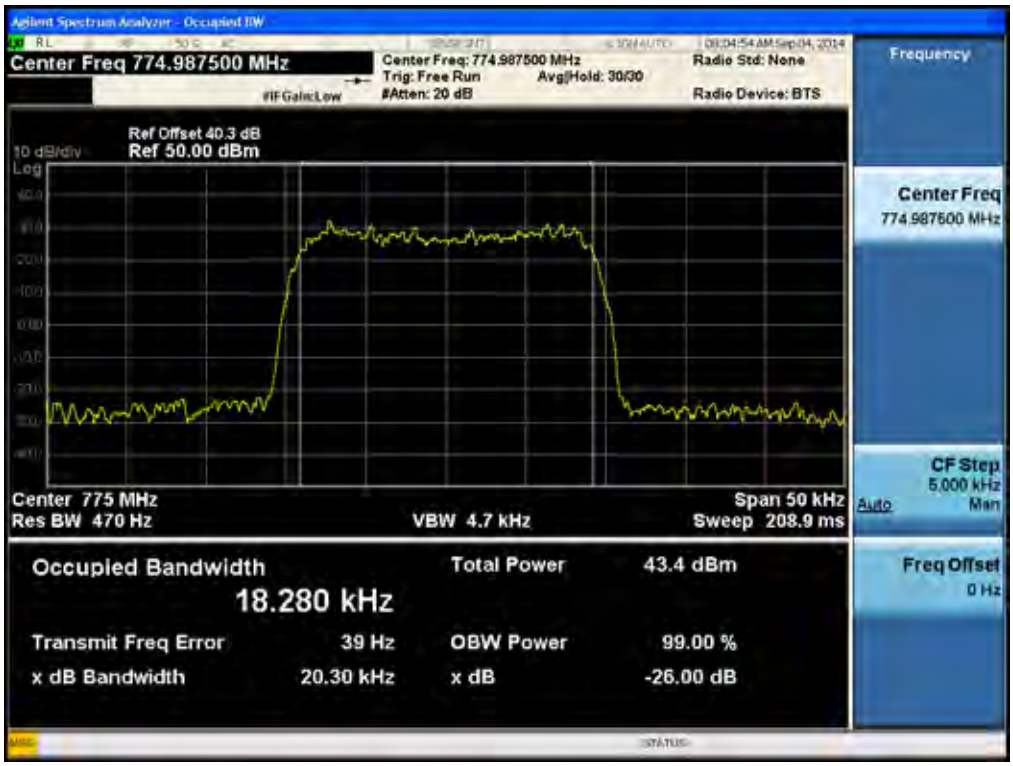
**[Output 700 Band_iDEN Downlink Low]**




**[Output 700 Band_iDEN Downlink Middle]**

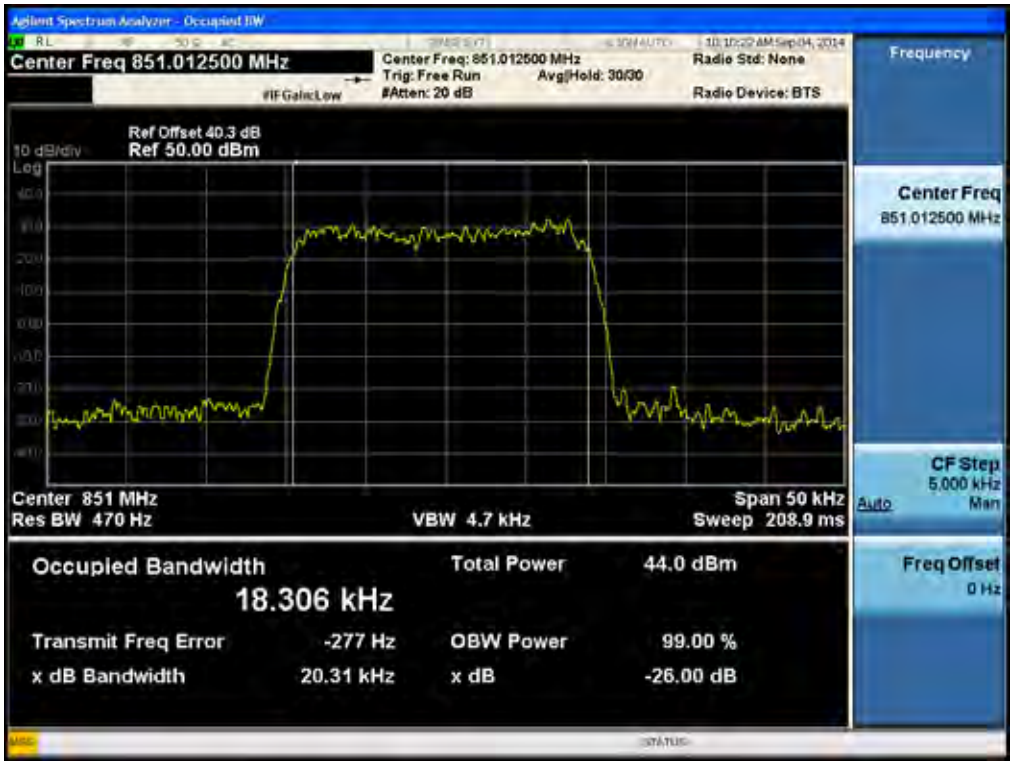


**[Output 700 Band_iDEN Downlink High]**

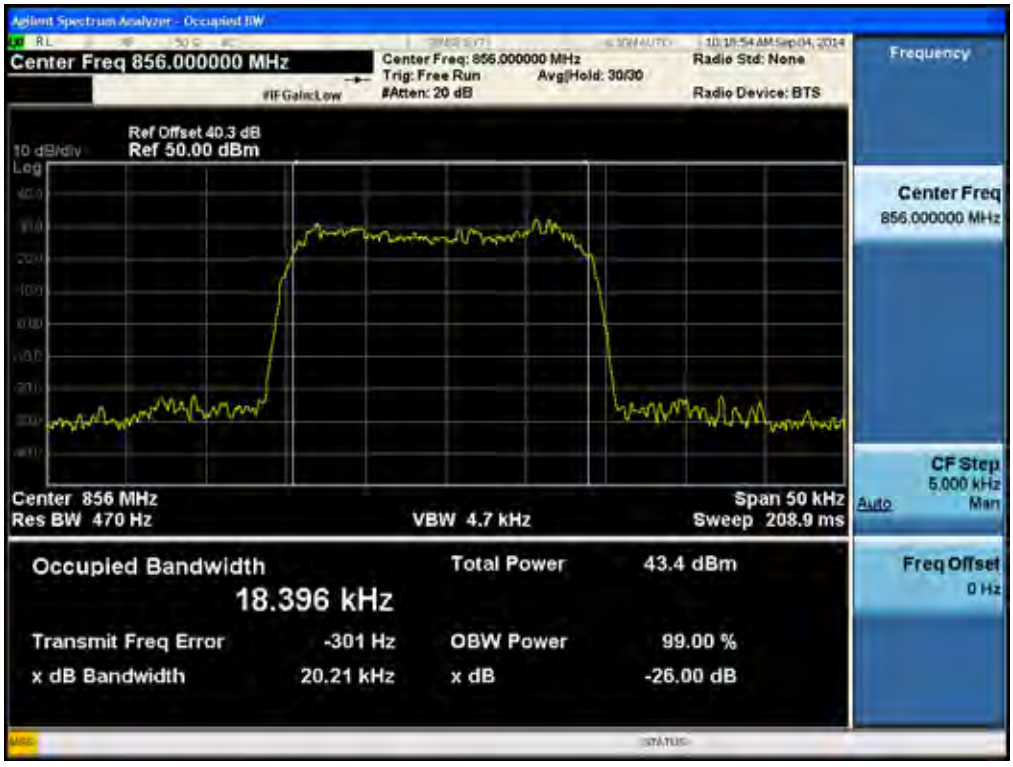


## 800 Band_iDEN

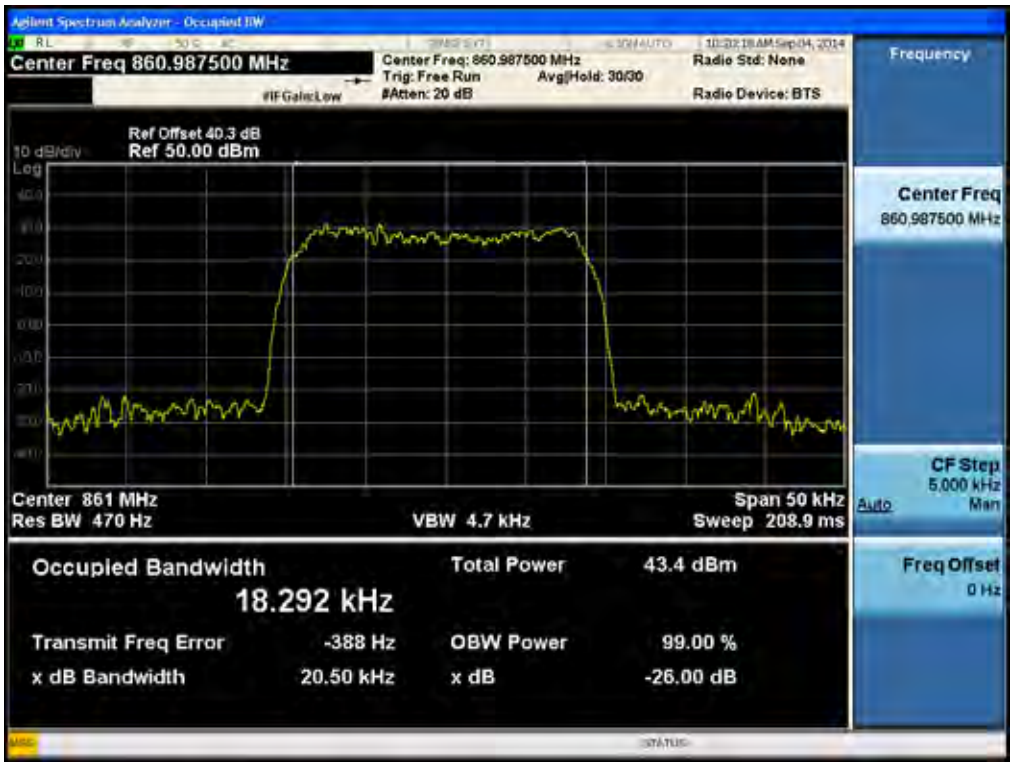
**[Output 800 Band_iDEN Downlink Low]**




**[Output 800 Band_iDEN Downlink Middle]**

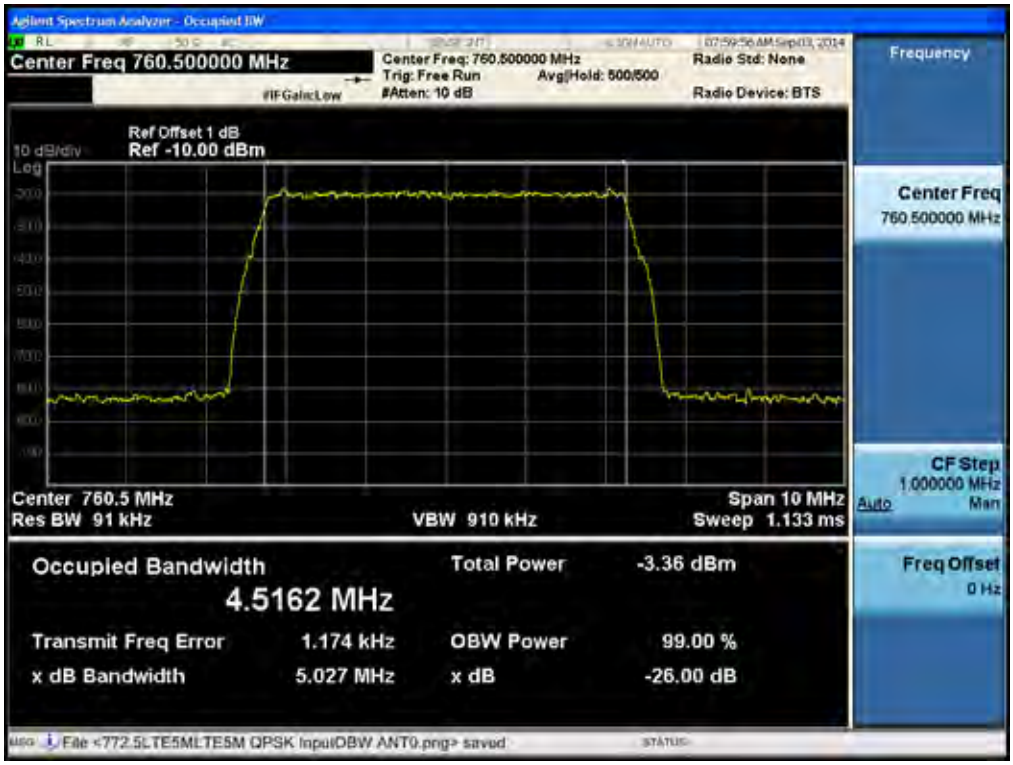


**[Output 800 Band_iDEN Downlink High]**

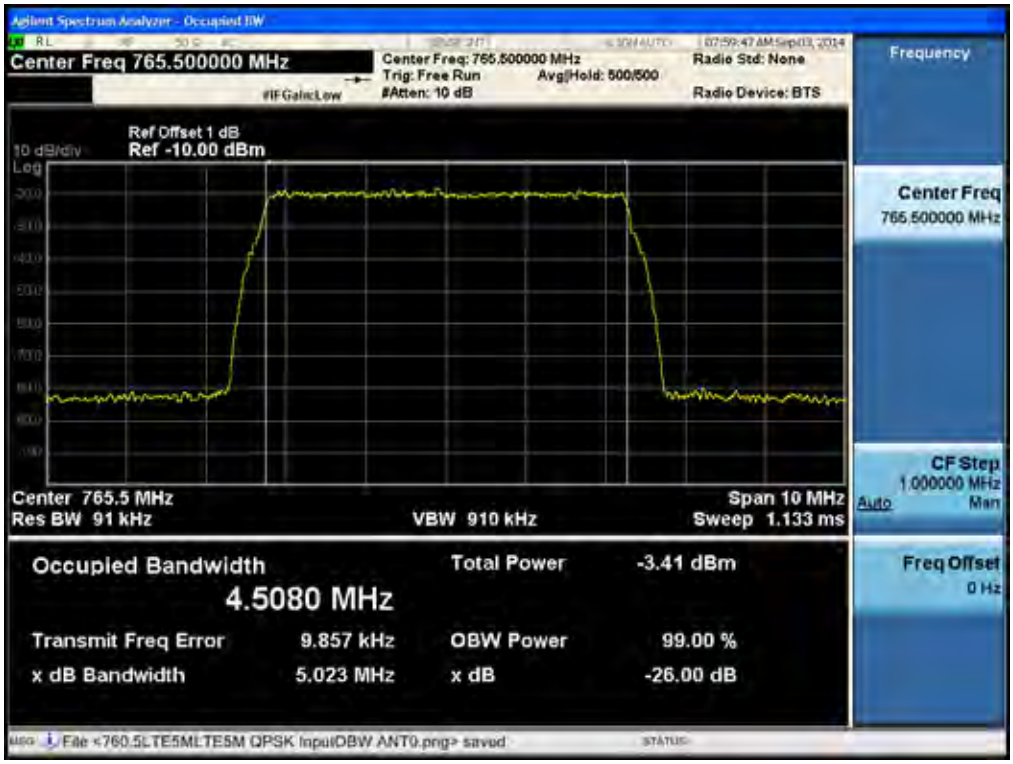


## 700 MHz LTE Band

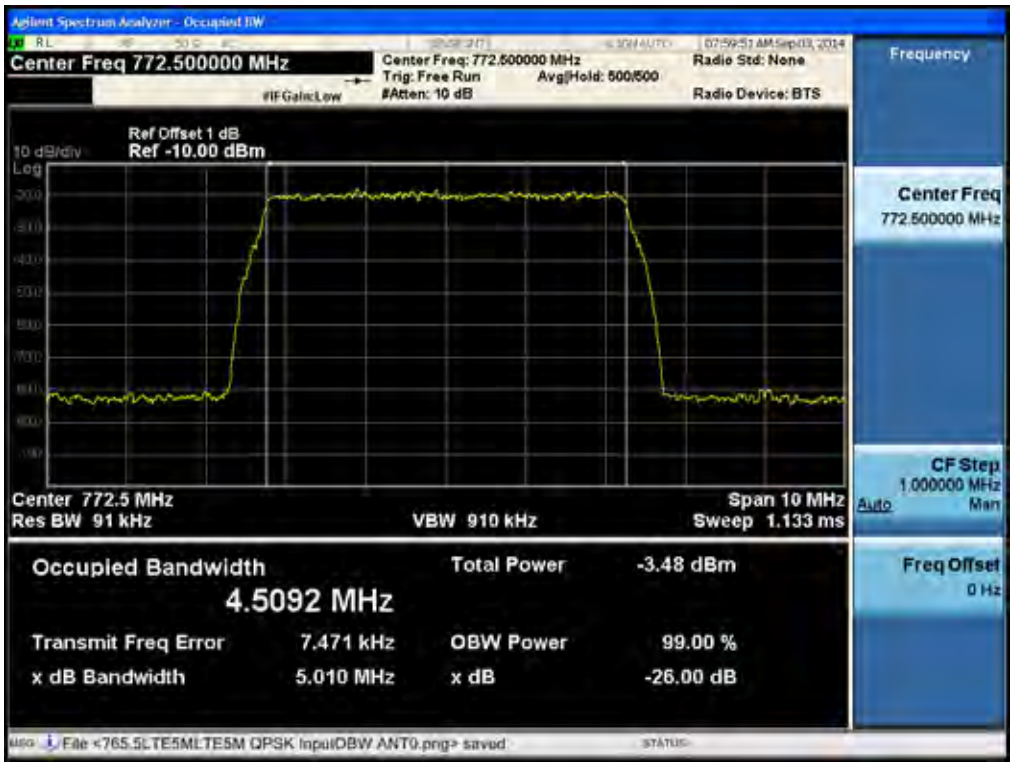
**[Input LTE Downlink 5 MHz Low]**




**[Input LTE Downlink 5 MHz Middle]**

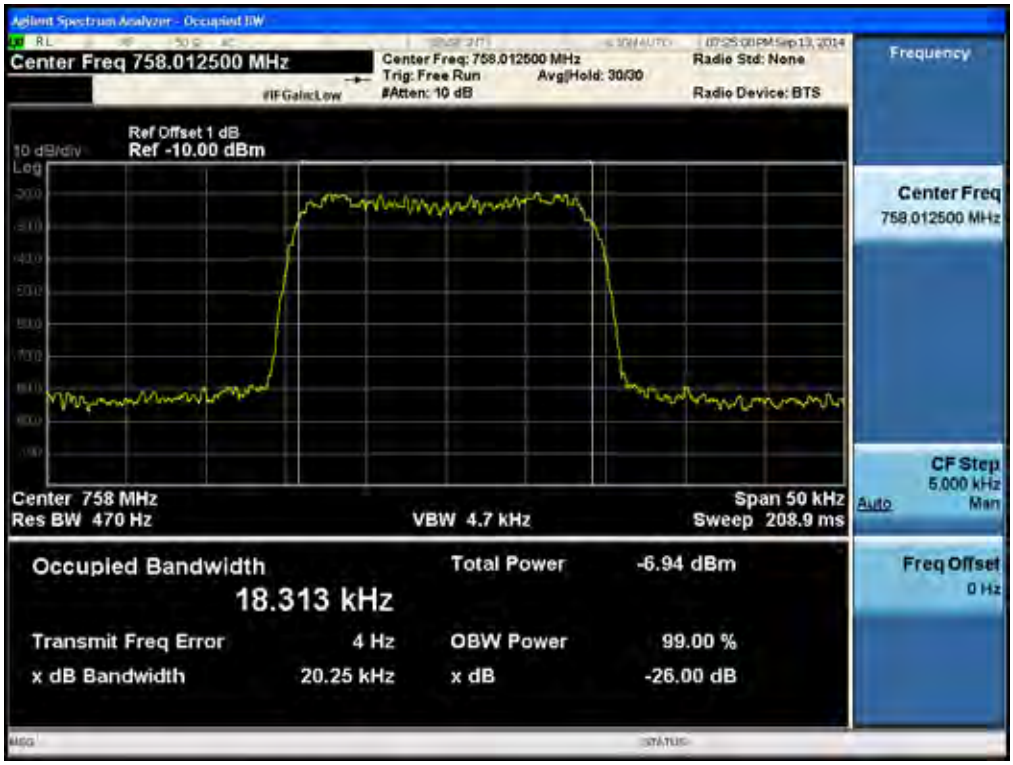


**[Input LTE Downlink 5 MHz High]**

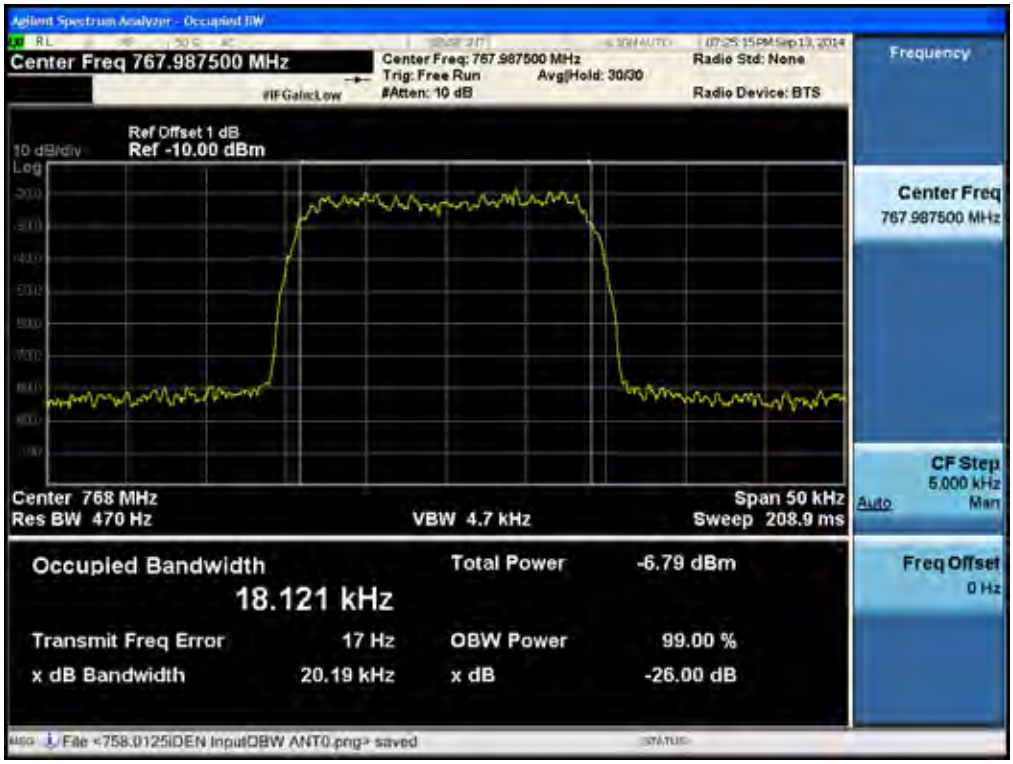


## 700 Band_iDEN

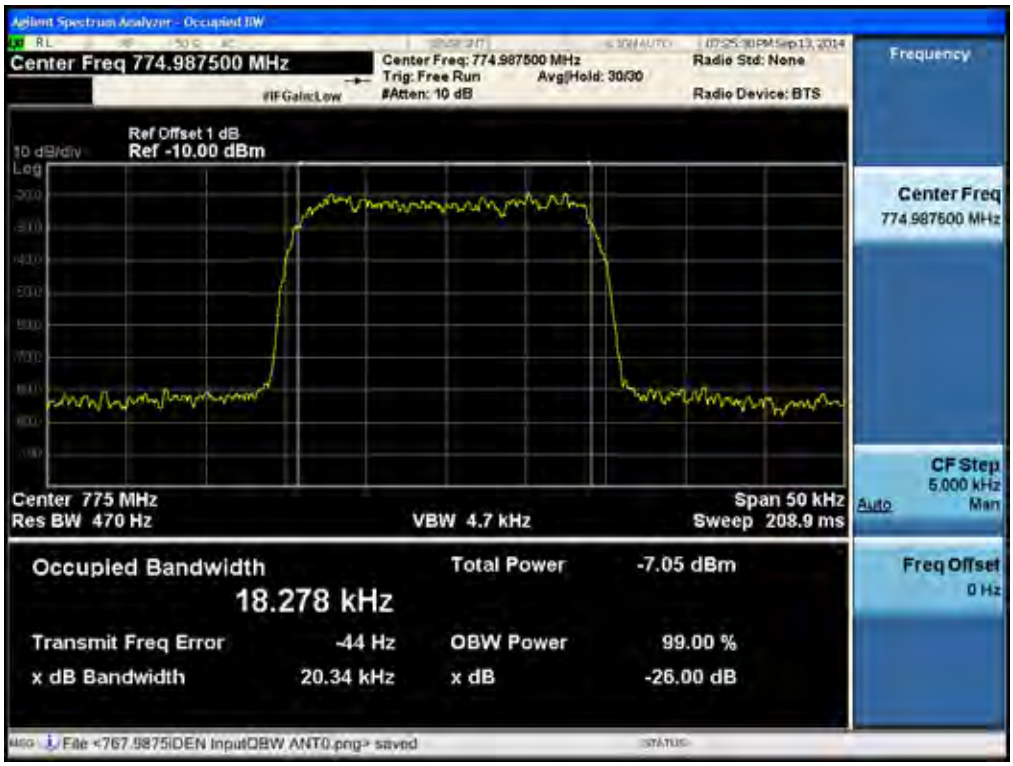
### [Input 700 Band_iDEN Downlink Low]




### [Input 700 Band_iDEN Downlink Middle]

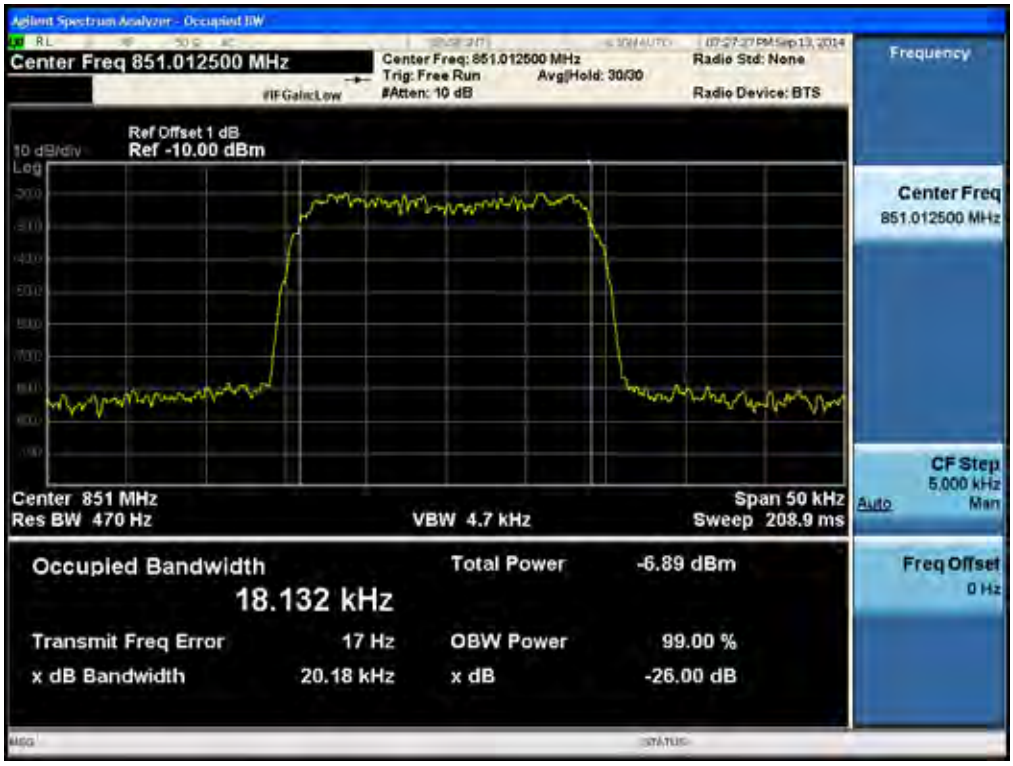


**[Input 700 Band_iDEN Downlink High]**

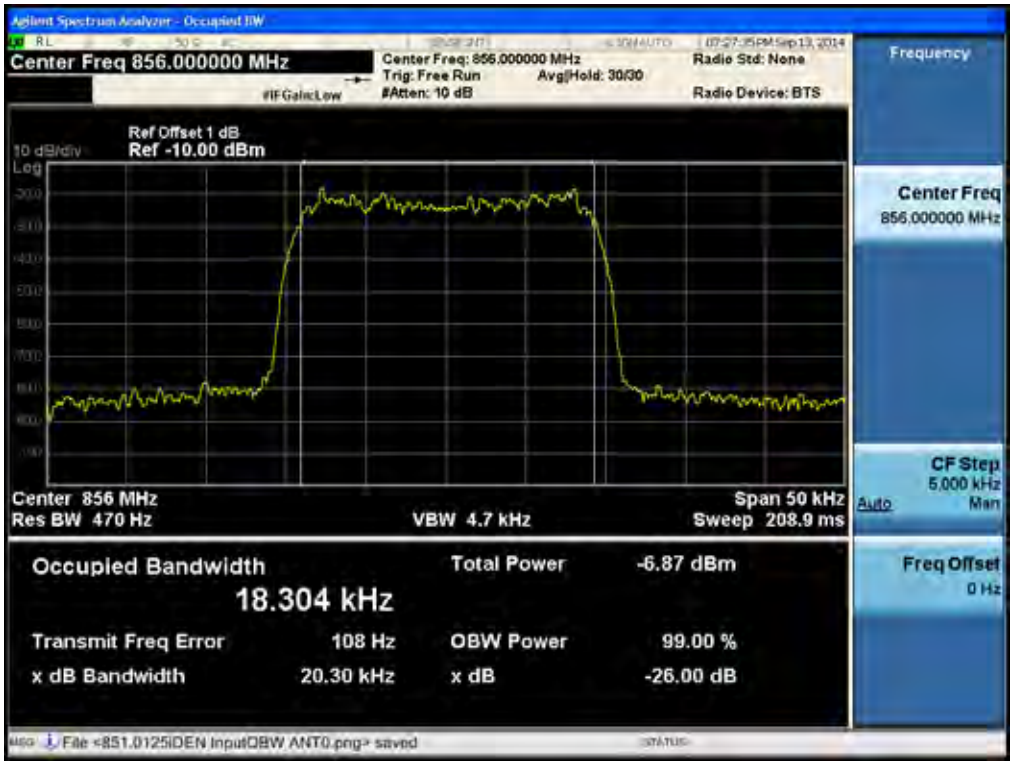


## 800 Band_iDEN

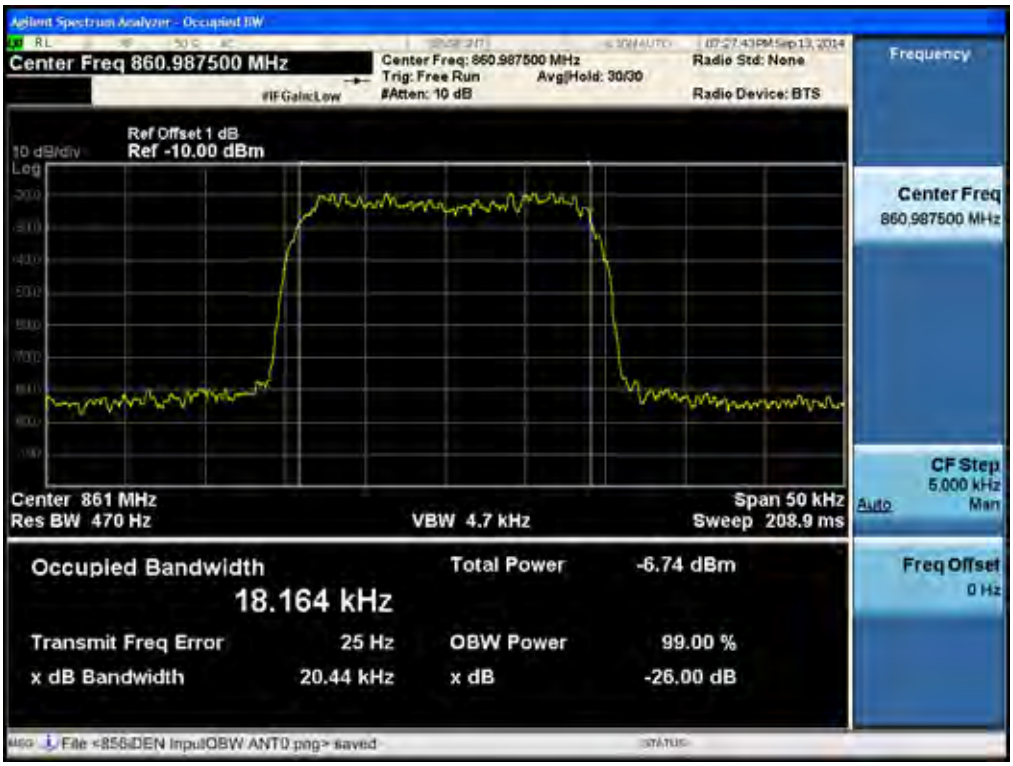
**[Input 800 Band_iDEN Downlink Low]**




**[Input 800 Band_iDEN Downlink Middle]**



**[Input 800 Band_iDEN Downlink 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)<br>Input Signal : Sinusoidal | Maximum Amp Gain |
|---|---|
| DL : -10 dBm | DL : 47 dB |

## 700 MHz Band

**[Downlink]**

| 20 dB point frequency (MHz) | Output power (dBm) | Gain (dB) |
|---|---|---|
| 756.72 ~ 776.16 | 37.03 | 47.03 |

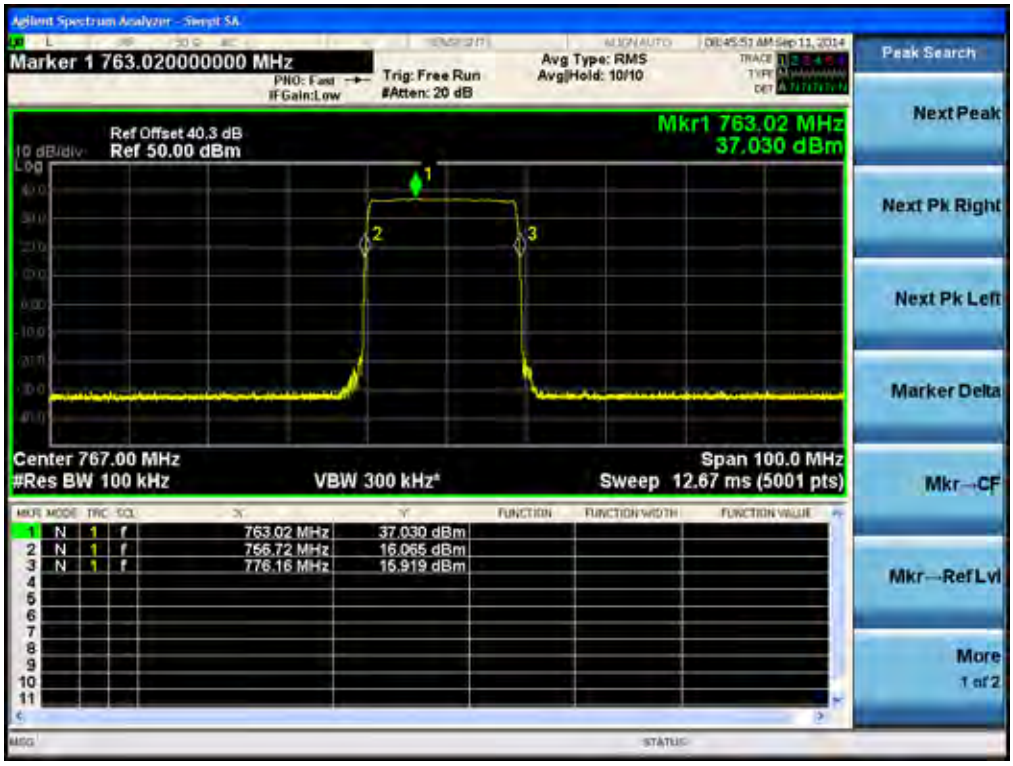
## 800 MHz Band

**[Downlink]**

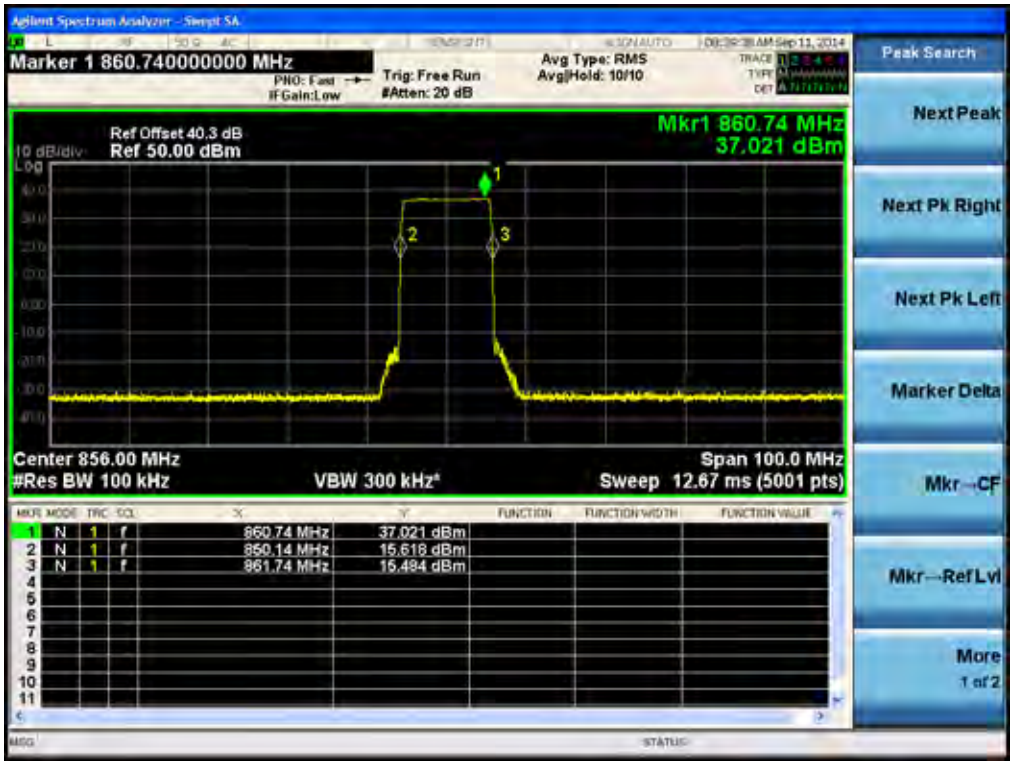
| 20 dB point frequency (MHz) | Output power (dBm) | Gain (dB) |
|---|---|---|
| 850.14 ~ 861.74 | 37.02 | 47.02 |

## Plots of Passband Gain and Bandwidth & Out of Band Rejection

**[700 MHz Band Downlink]**




**[800 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 : 47 dB |

## 700 MHz Band

Noise Figure = -59.568-47+114 = 7.432 dB

## 800 MHz Band

Noise Figure = -58.451-47+114 = 8.549 dB

## Plots of Noise power

**[700 MHz Band Downlink]**


**[800 MHz Band Downlink]**

# 10. EMISSION MASKS

**FCC Rules**

**Test Requirement(s):**

**§ 90.210 Emission masks:**

Except as indicated elsewhere in this part, transmitters used in the radio services governed by this part must comply with the emission masks outlined in this section. Unless otherwise stated, per paragraphs (d)(4), (e)(4), and (o) of this section, measurements of emission power can be expressed in either peak or average values provided that emission powers are expressed with the same parameters used to specify the unmodulated transmitter carrier power. For transmitters that do not produce a full power unmodulated carrier, reference to the unmodulated transmitter carrier power refers to the total power contained in the channel bandwidth. Unless indicated elsewhere in this part, the table in this section specifies the emission masks for equipment operating under this part.

**APPLICABLE EMISSION MASKS**

| Frequency band (MHz) | Mask for equipment with audio low pass filter | Mask for equipment without audio low pass filter |
|---|---|---|
| Below 25[1] | A or B | A or C |
| 25-50 | B | C |
| 72-76 | B | C |
| 150-174[2] | B, D, or E | C, D or E |
| 150 paging only | B | C |
| 220-222 | F | F |
| 421-512[2 5] | B, D, or E | C, D, or E |
| 450 paging only | B | G |
| 806-809/851-854 | B | H |
| 809-824/854-869[3 5] | B | G |
| 896-901/935-940 | I | J |
| 902-928 | K | K |
| 929-930 | B | G |
| 4940-4990 MHz | L or M | L or M |
| 5850-5925[4] | | |
| All other bands | B | C |

(g) *Emission Mask* G. For transmitters that are not equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power (P) as follows:
(1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 10 kHz, but no more than 250 percent of the authorized bandwidth: At least 116 log (fd/6.1) dB, or 50 + 10 log (P) dB, or 70 dB, whichever is the lesser attenuation;
(2) On any frequency removed from the center of the authorized bandwidth by more than 250 percent of the authorized bandwidth: At least 43 + 10 log (P) dB.

(h) *Emission Mask H.* For transmitters that are not equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power (P) as follows:
(1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ($f_d$ in kHz) of 4 kHz or less: Zero dB.
(2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ($f_d$ in kHz) of more than 4 kHz, but no more than 8.5 kHz: At least 107 log ($f_d$/4) dB;
(3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ($f_d$ in kHz) of more than 8.5 kHz, but no more than 15 kHz: At least 40.5 log ($f_d$/1.16) dB;
(4) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ($f_d$ in kHz) of more than 15 kHz, but no more than 25 kHz: At least 116 log ($f_d$/6.1) dB;
(5) On any frequency removed from the center of the authorized bandwidth by more than 25 kHz: At least 43 + log (P) dB.

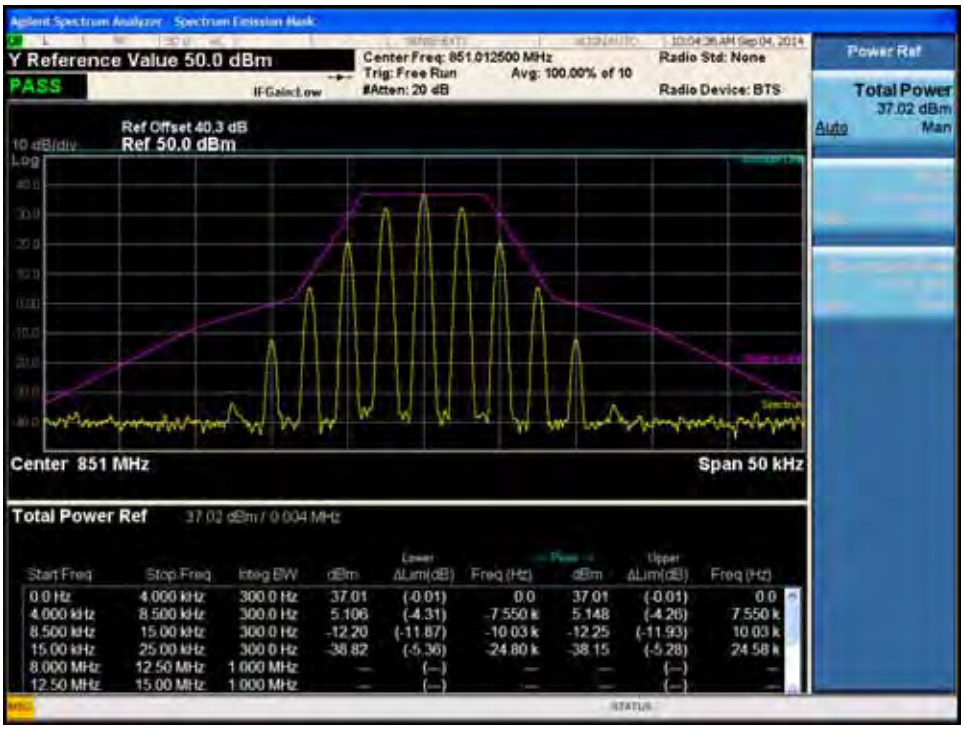
**Test Procedures:**
The RF output of the transceiver was connected to a spectrum analyzer through appropriate attenuation.
Sufficient scans were taken to show Emission Mask.

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

| Input Signal | Input Level (dBm) | Maximum Amp Gain |
|---|---|---|
| 851 MHz ~ 854 MHz<br>FM modulation | DL : -10 dBm | DL : 47 dB |
| 854 MHz ~ 861 MHz<br>iDEN 25 kHz | DL : -10 dBm | DL : 47 dB |

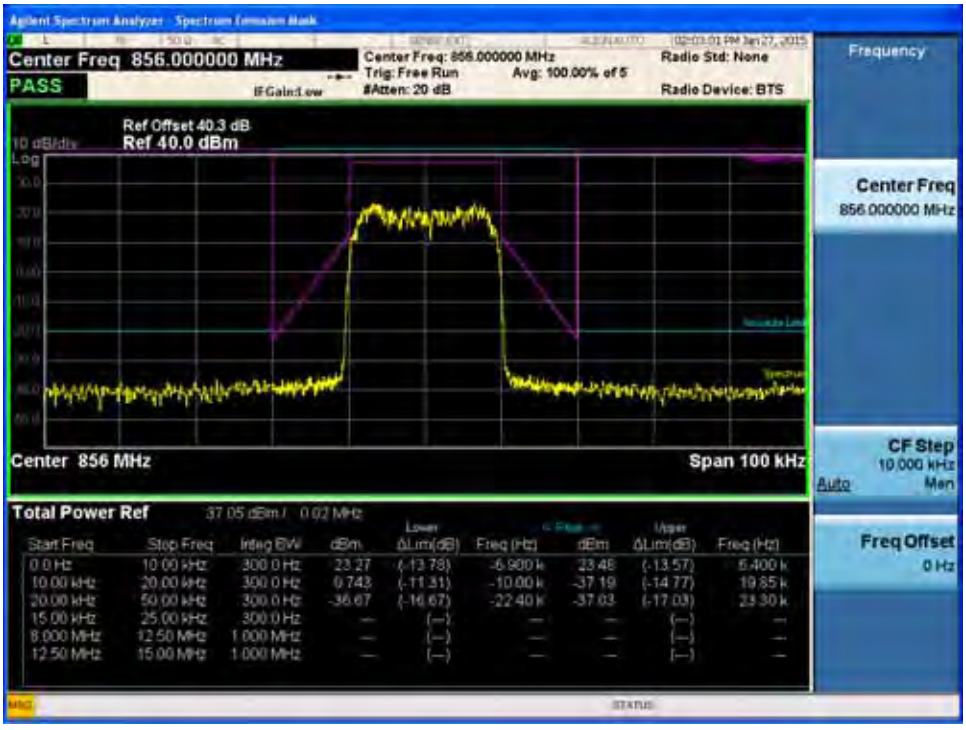
## Plots of Emission Mask H

**[851 MHz ~ 854 MHz Downlink]**




## Plots of Emission Mask G

**[854 MHz ~ 861 MHz Downlink]**



# 11. 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 ACP relative (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 + 10log (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.

**§ 90.691 Emission mask requirements for EA-based systems.**

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

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

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

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

*** Note**

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

**Test Procedures:**

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

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

**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.

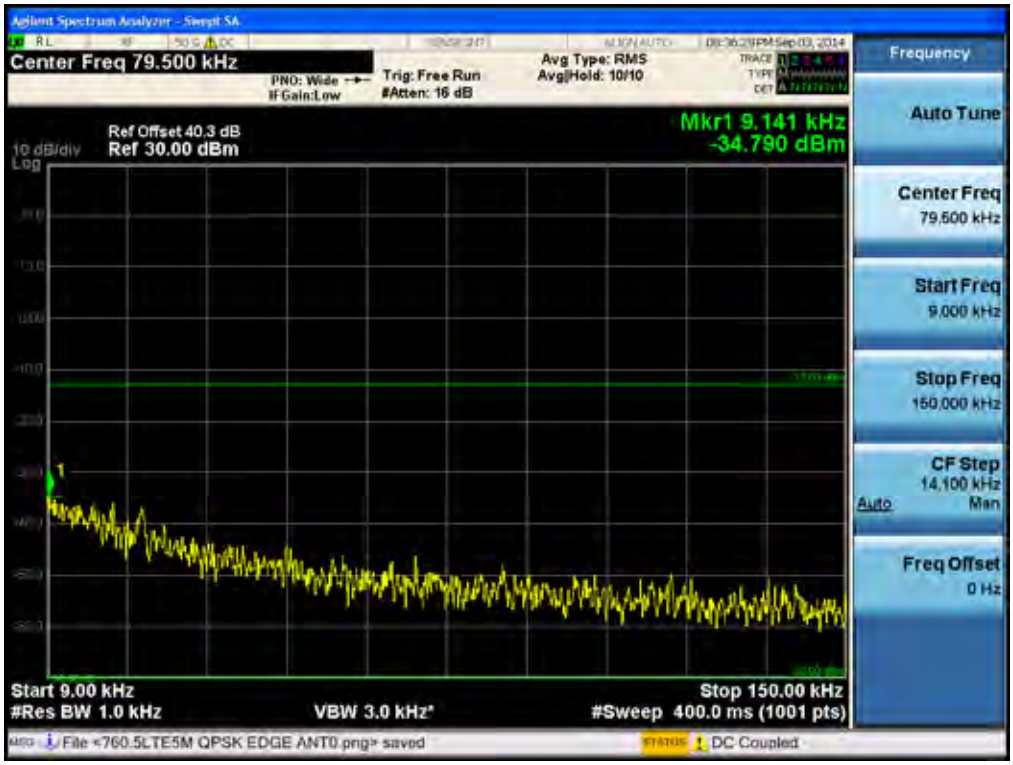
Using a spectrum analyser with a resolution bandwidth set at 100 kHz, search for spurious emissions from 30 MHz to at least 5 times the highest RF passband frequency. The search may omit the band that contains the input signal.

## Single channel Enhancer Plots of Spurious Emission

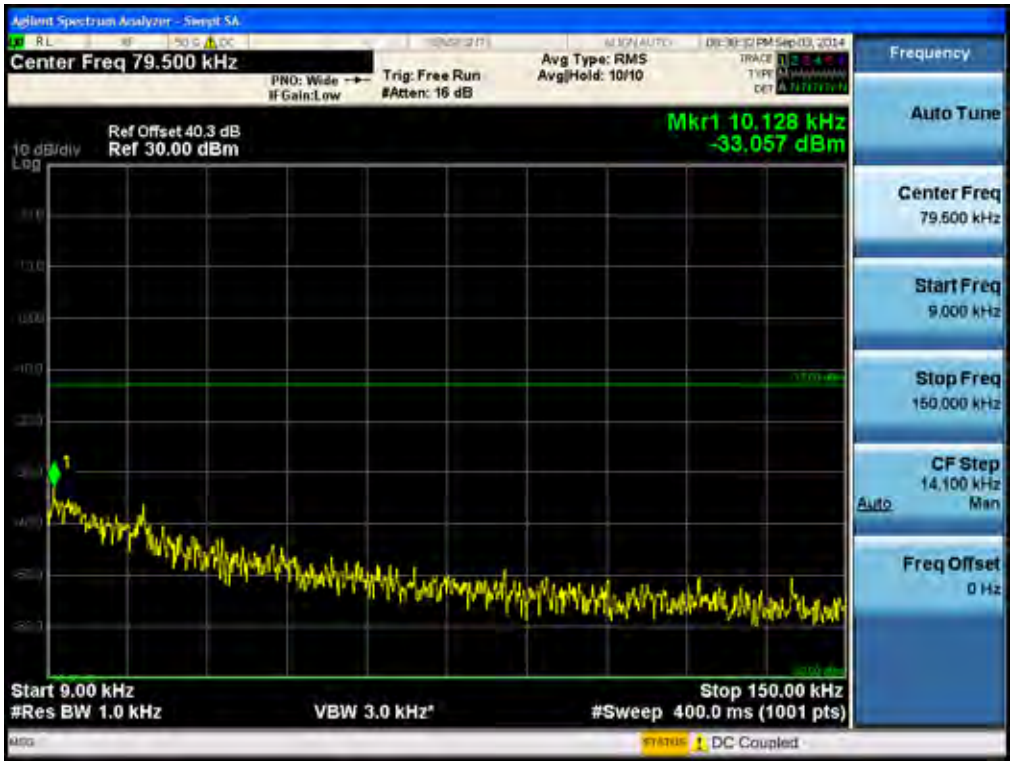
### Conducted Spurious Emissions (9 kHz – 150 kHz)

### 700 MHz LTE Band

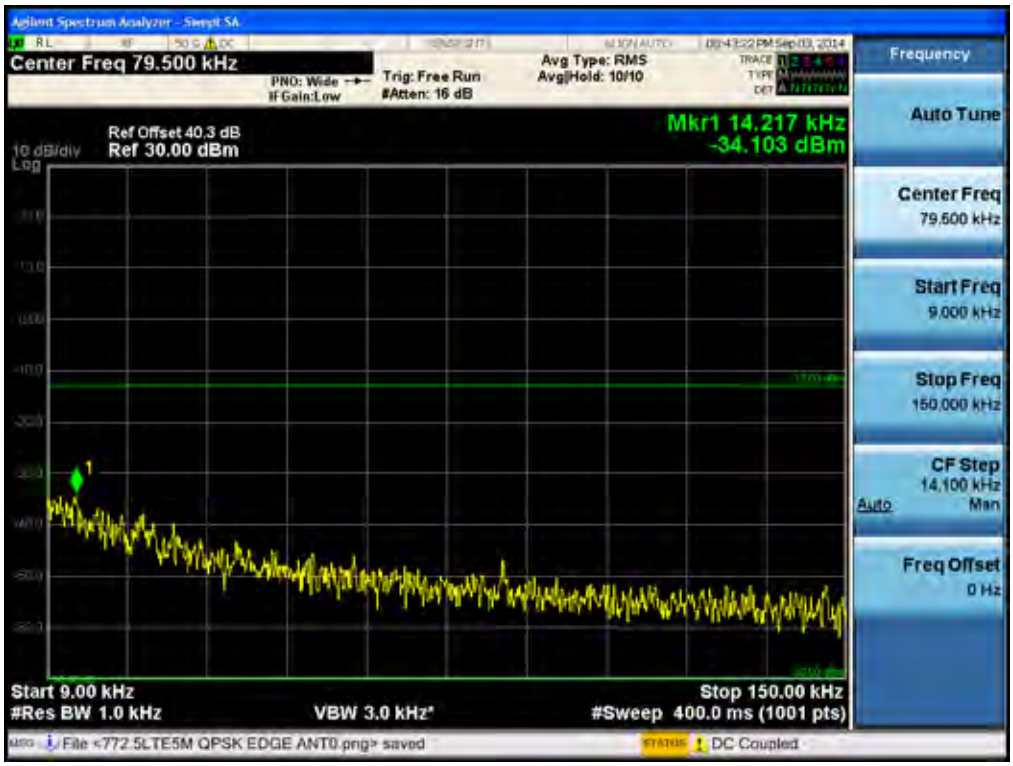
**[LTE Downlink 5 MHz Low]**




**[LTE Downlink 5 MHz Middle]**



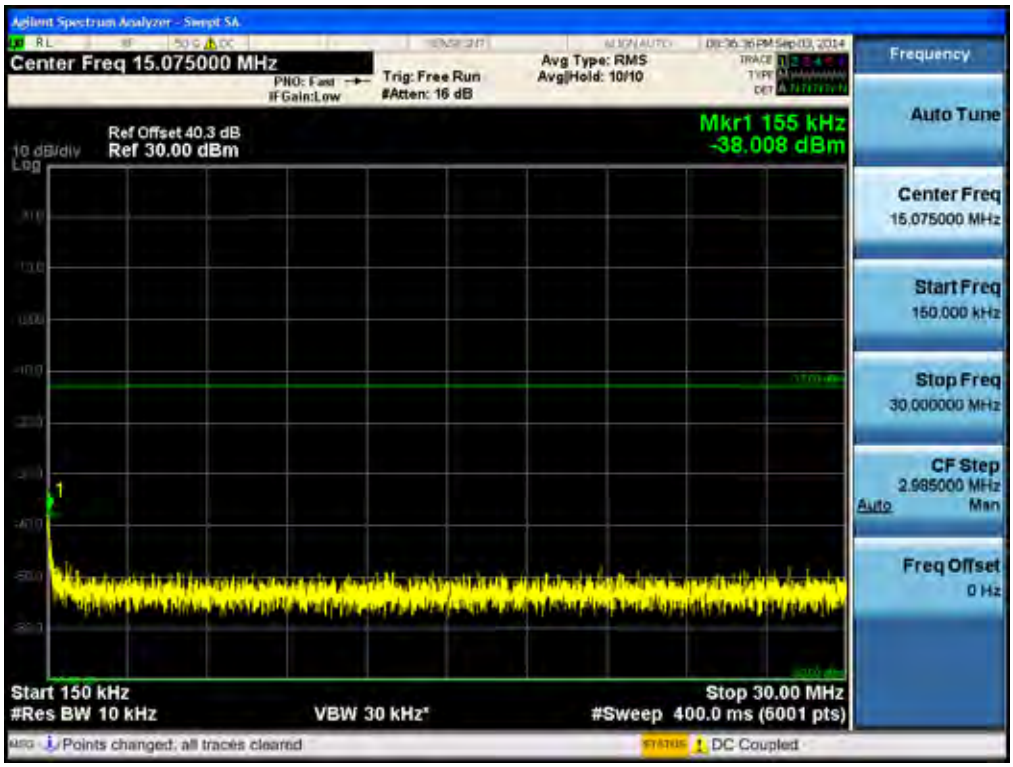
**[LTE Downlink 5 MHz High]**



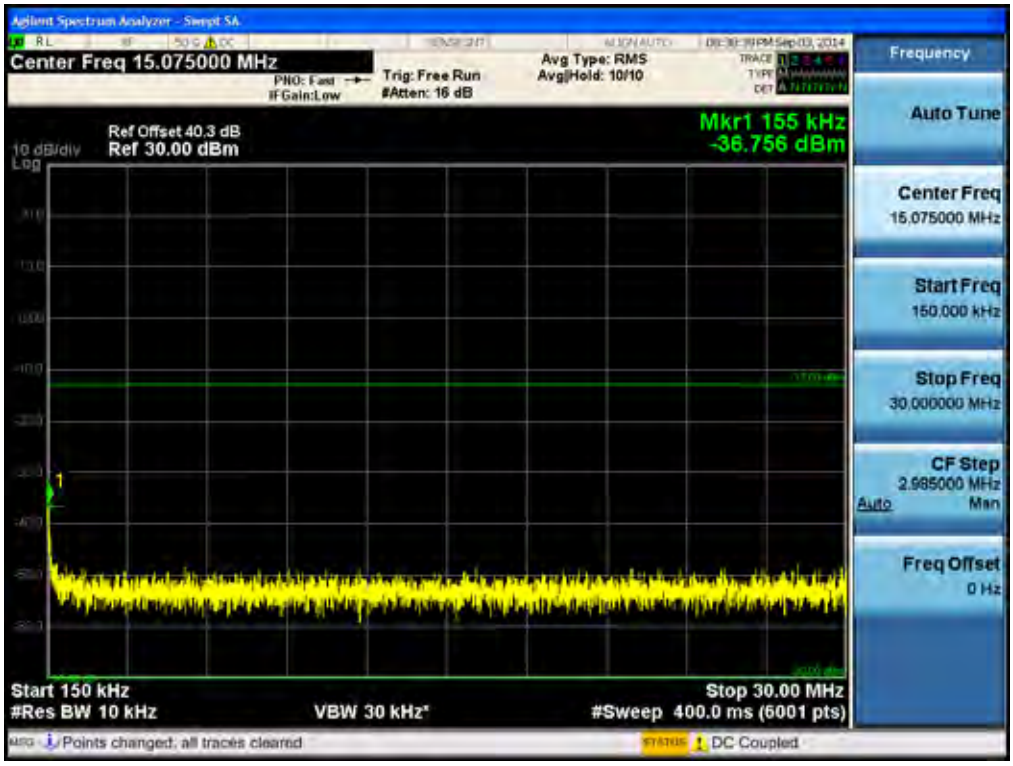
**Conducted Spurious Emissions (150 kHz – 30 MHz)**

## 700 MHz LTE Band

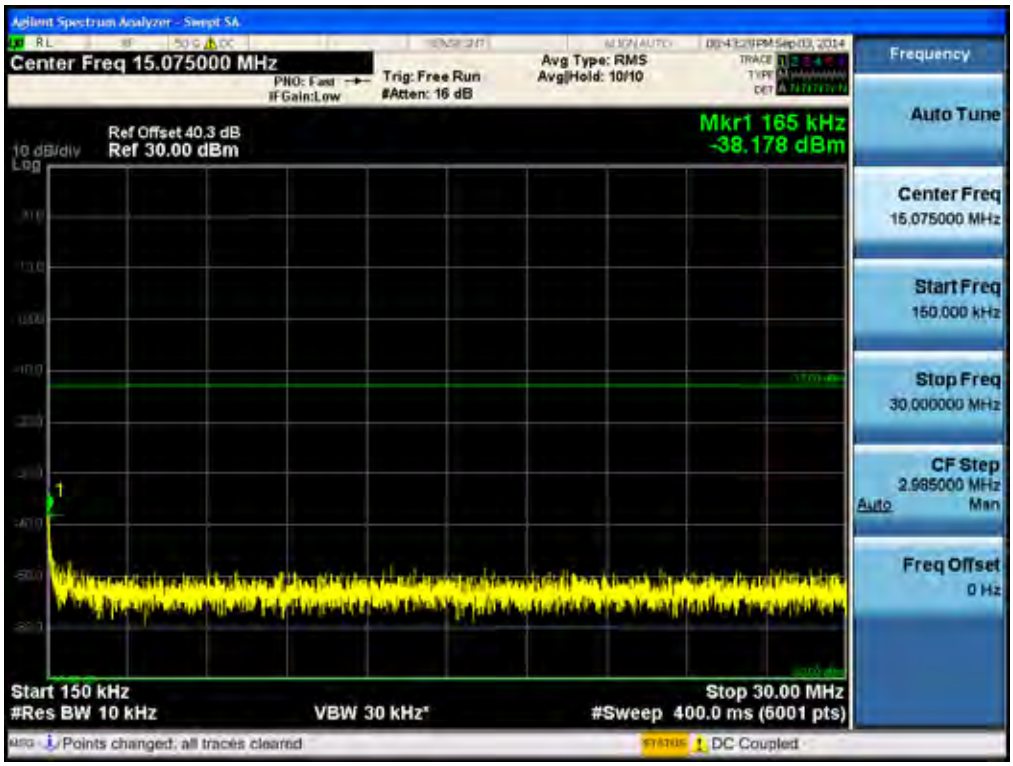
**[LTE Downlink 5 MHz Low]**




**[LTE Downlink 5 MHz Middle]**



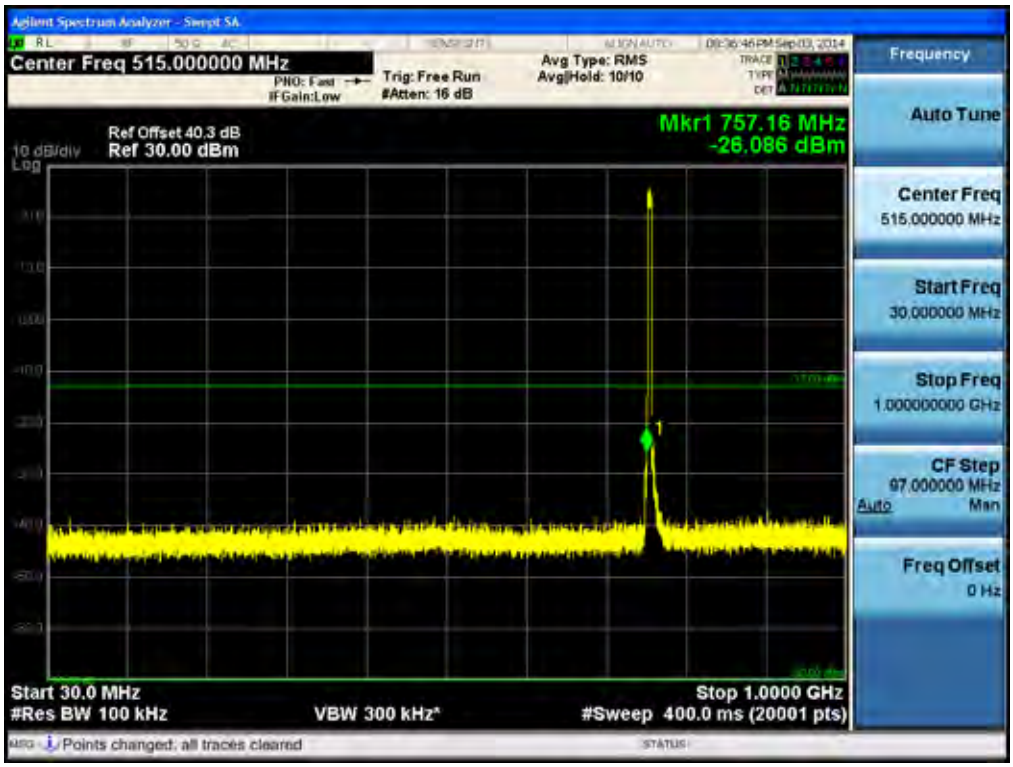
**[LTE Downlink 5 MHz High]**



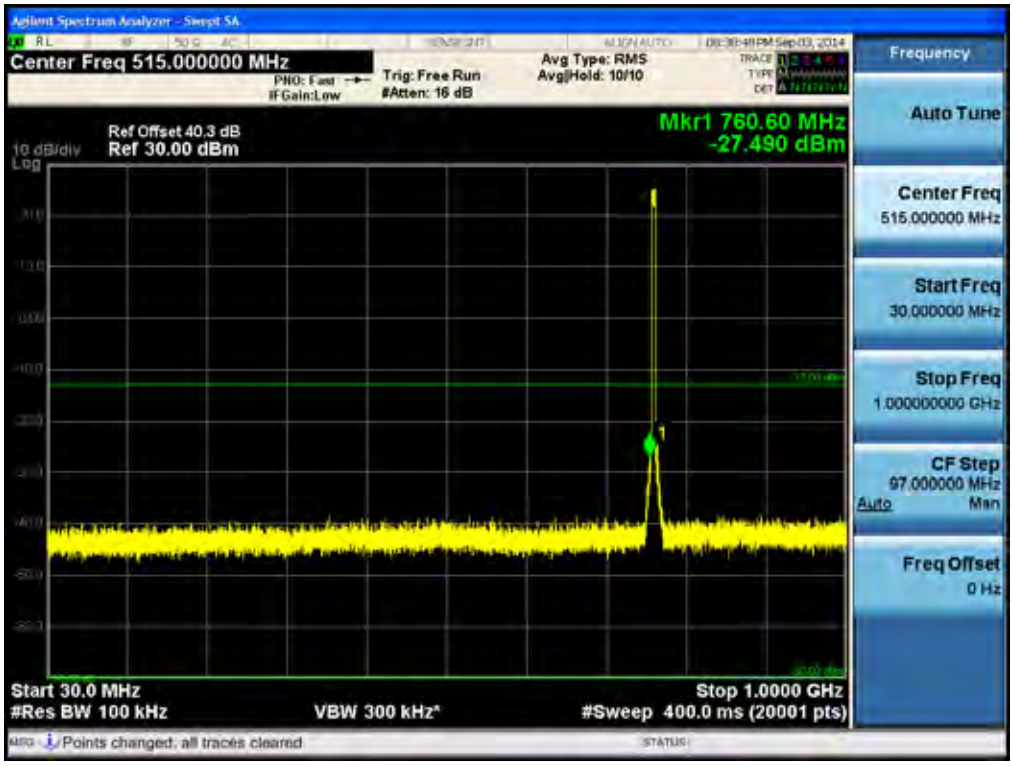
**Conducted Spurious Emissions (30 MHz – 1 GHz)**

## 700 MHz LTE Band

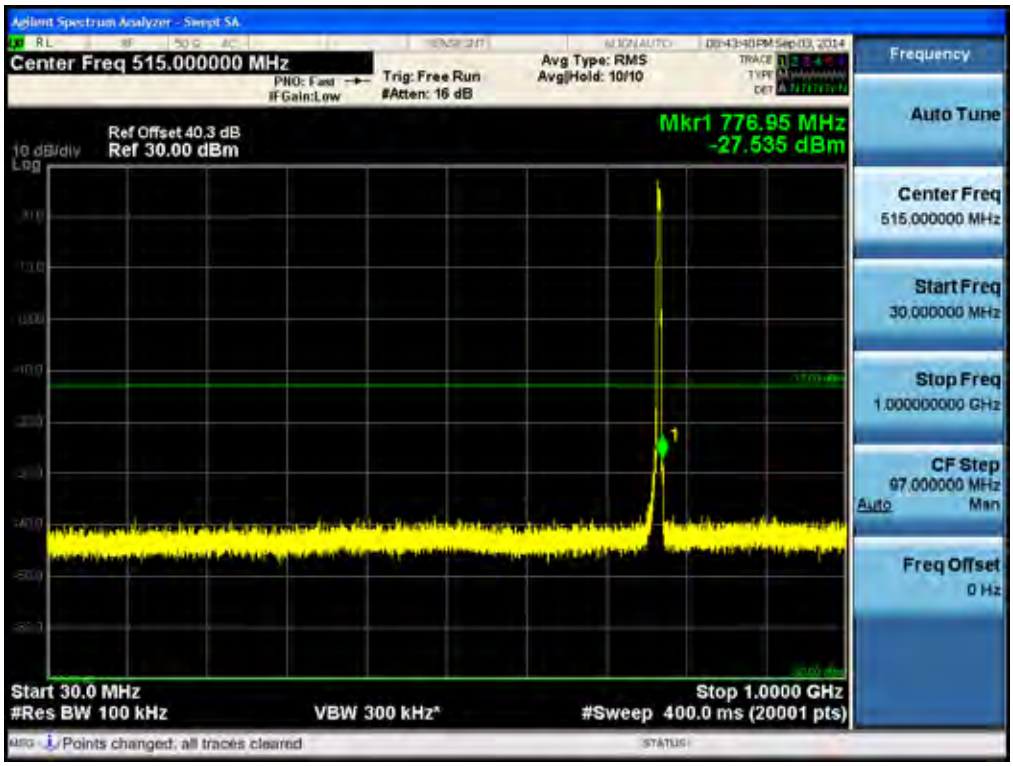
**[LTE Downlink 5 MHz Low]**




**[LTE Downlink 5 MHz Middle]**



**[LTE Downlink 5 MHz High]**



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

## 700 MHz LTE Band

**[LTE Downlink 5 MHz Low]**

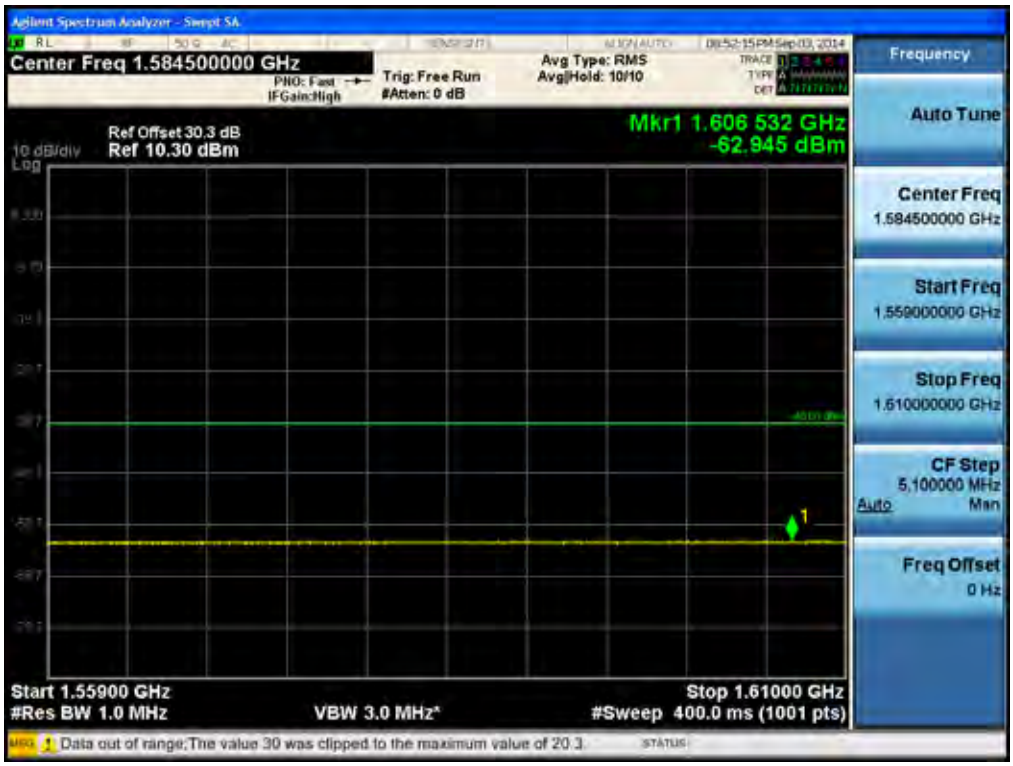

**[LTE Downlink 5 MHz Middle]**

**[LTE Downlink 5 MHz High]**

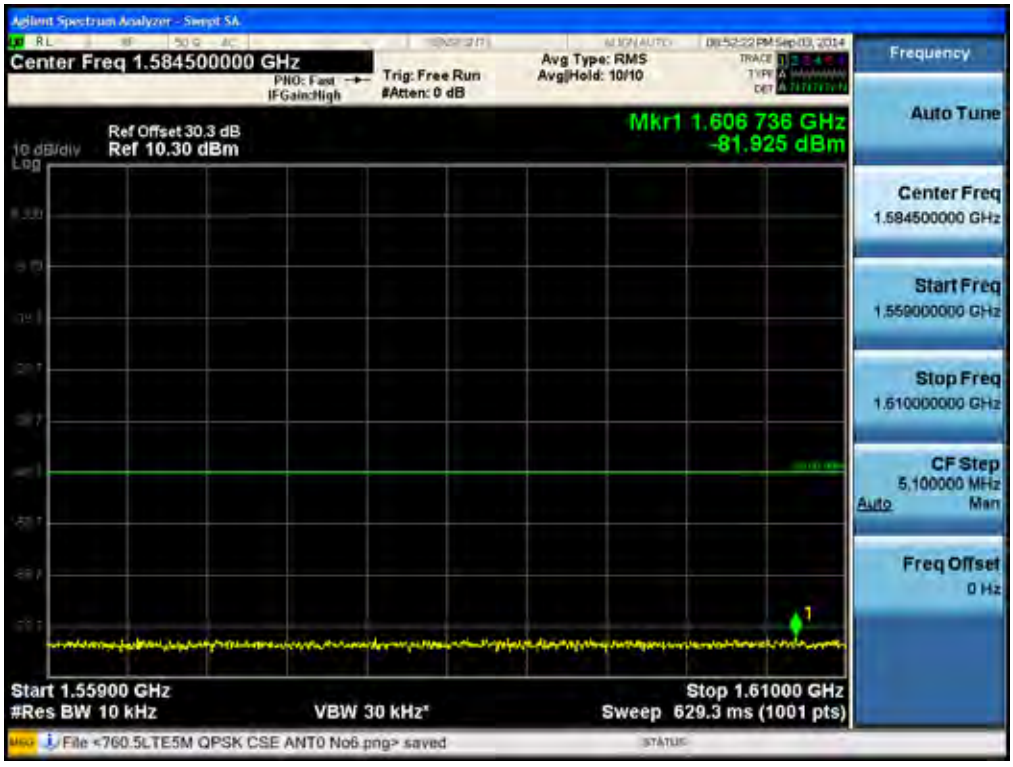
**Conducted Spurious Emissions (1559 MHz – 1610 MHz)**

## 700 MHz LTE Band

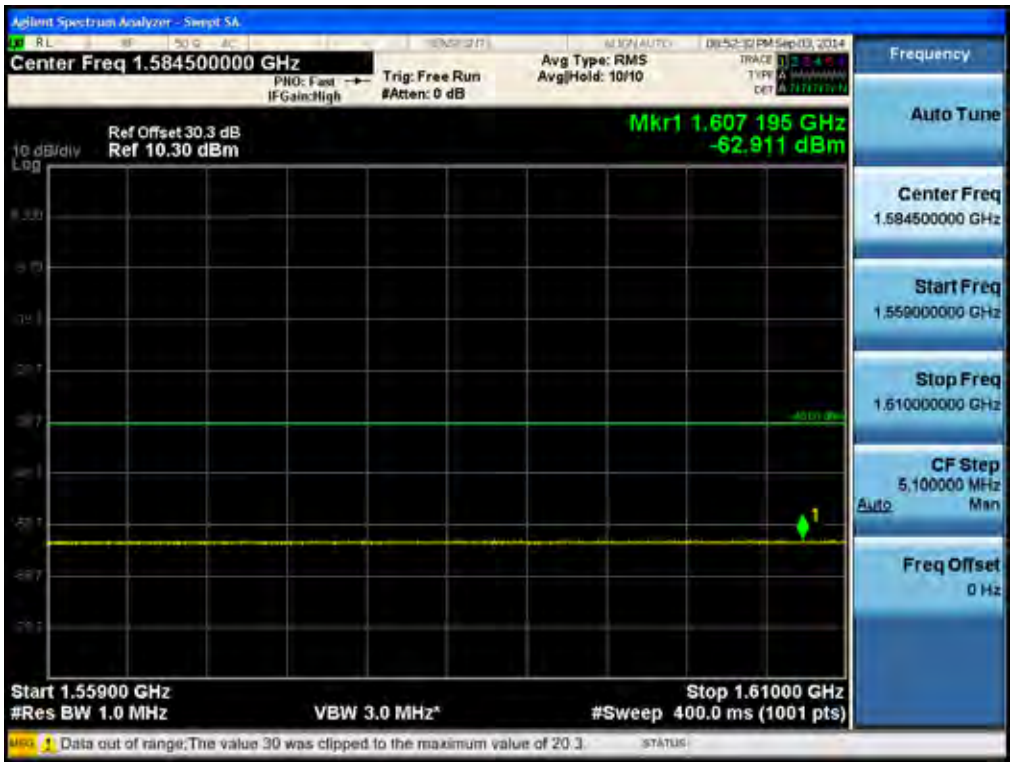
**[LTE Downlink 5 MHz Low] - RBW 1 MHz**




**[LTE Downlink 5 MHz Low] - RBW 10 kHz**



**[LTE Downlink 5 MHz Middle] - RBW 1 MHz**




**[LTE Downlink 5 MHz Middle] - RBW 10 kHz**

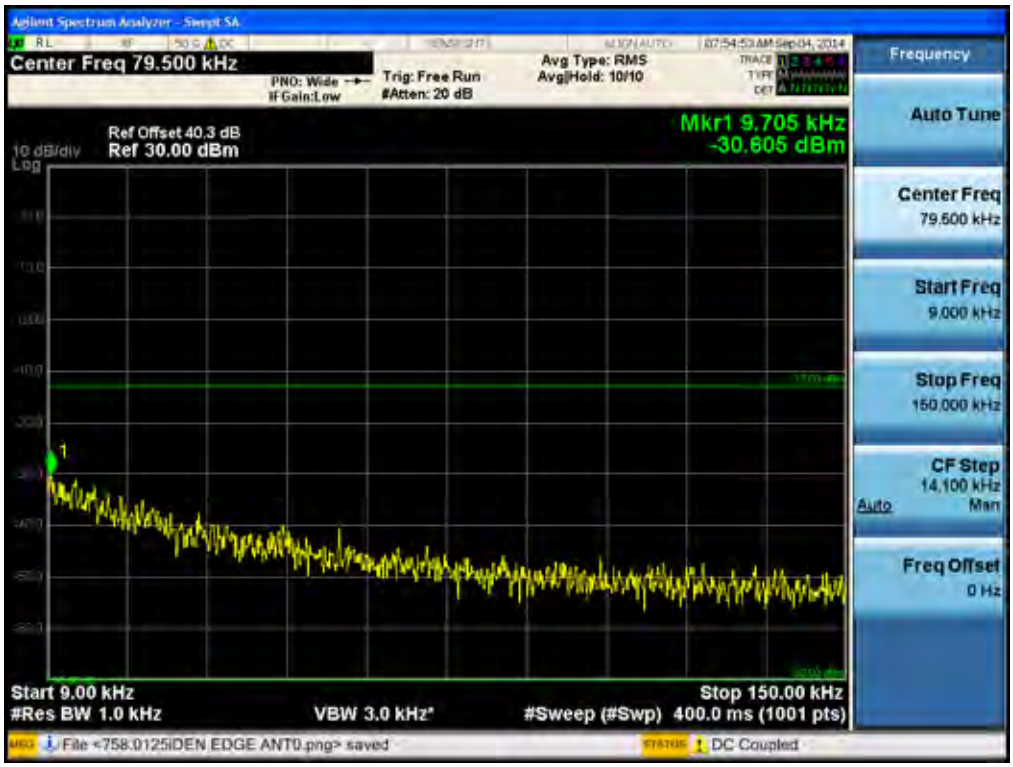
**[LTE Downlink 5 MHz High] - RBW 1 MHz**


**[LTE Downlink 5 MHz High] - RBW 10 kHz**

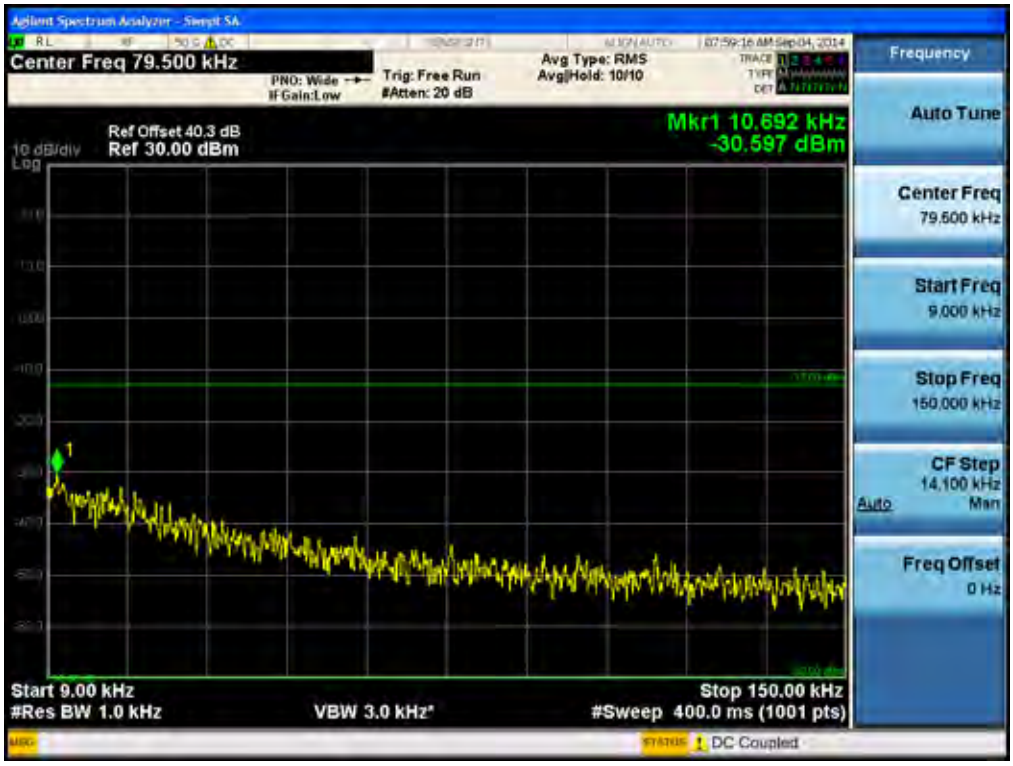
**Conducted Spurious Emissions (9 kHz – 150 kHz)**

## 700 Band_iDEN

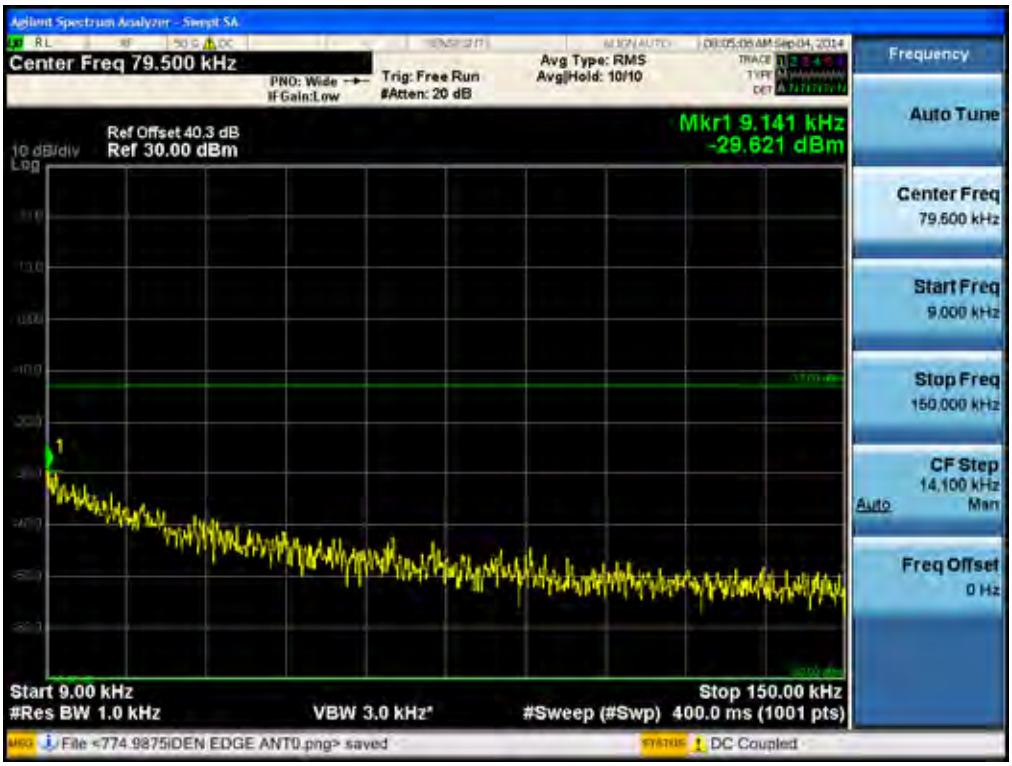
**[700 Band_iDEN Downlink Low]**




**[700 Band_iDEN Downlink Middle]**



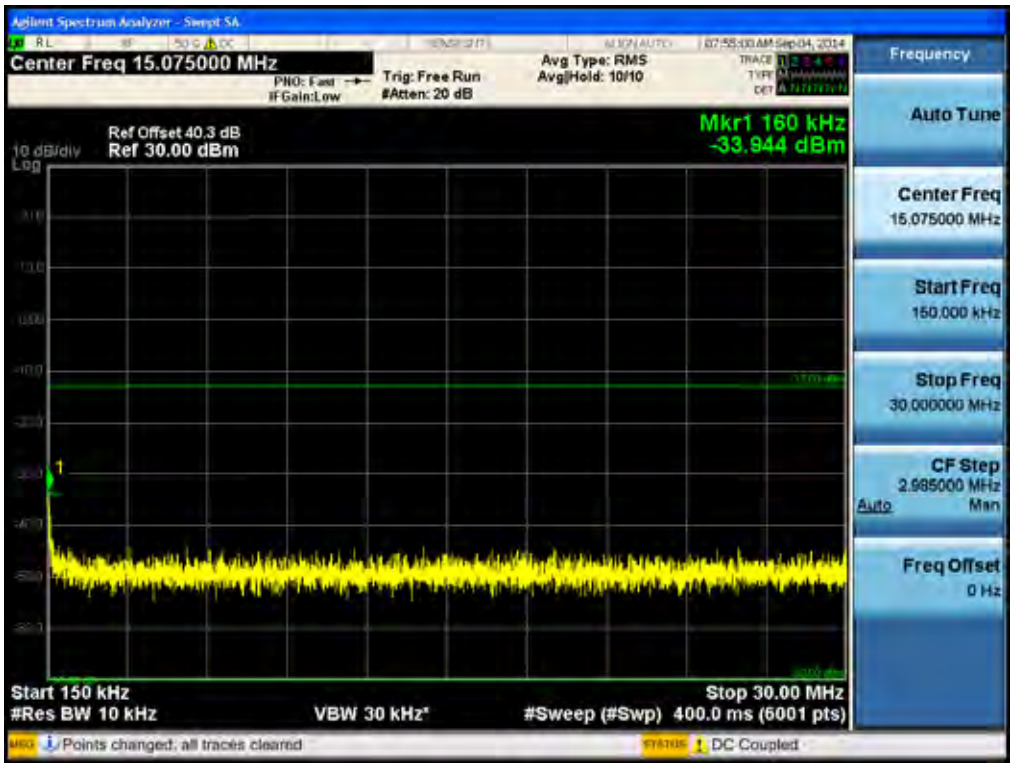
**[700 Band_iDEN Downlink High]**



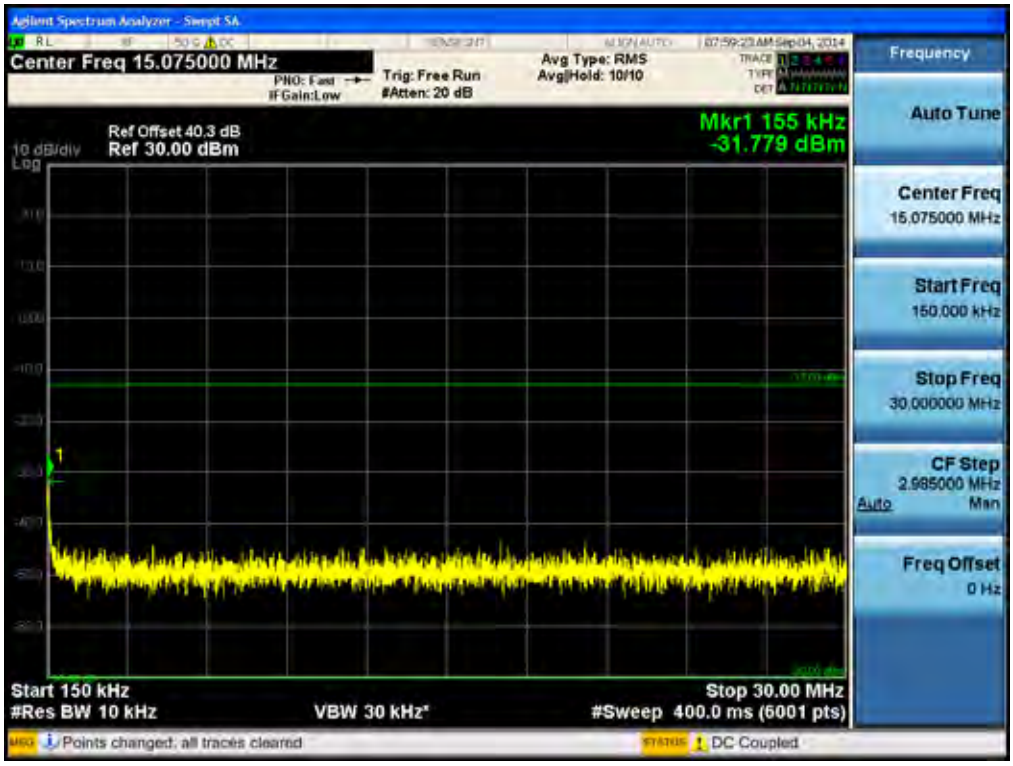
**Conducted Spurious Emissions (150 kHz – 30 MHz)**

## 700 Band_iDEN

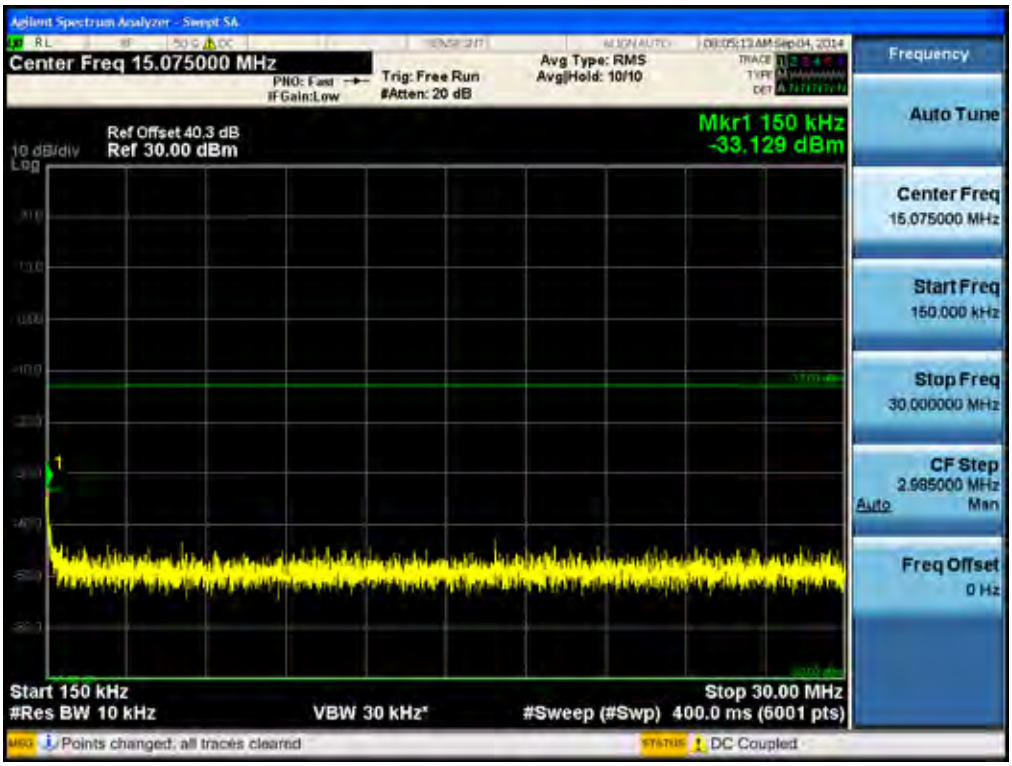
**[700 Band_iDEN Downlink Low]**




**[700 Band_iDEN Downlink Middle]**



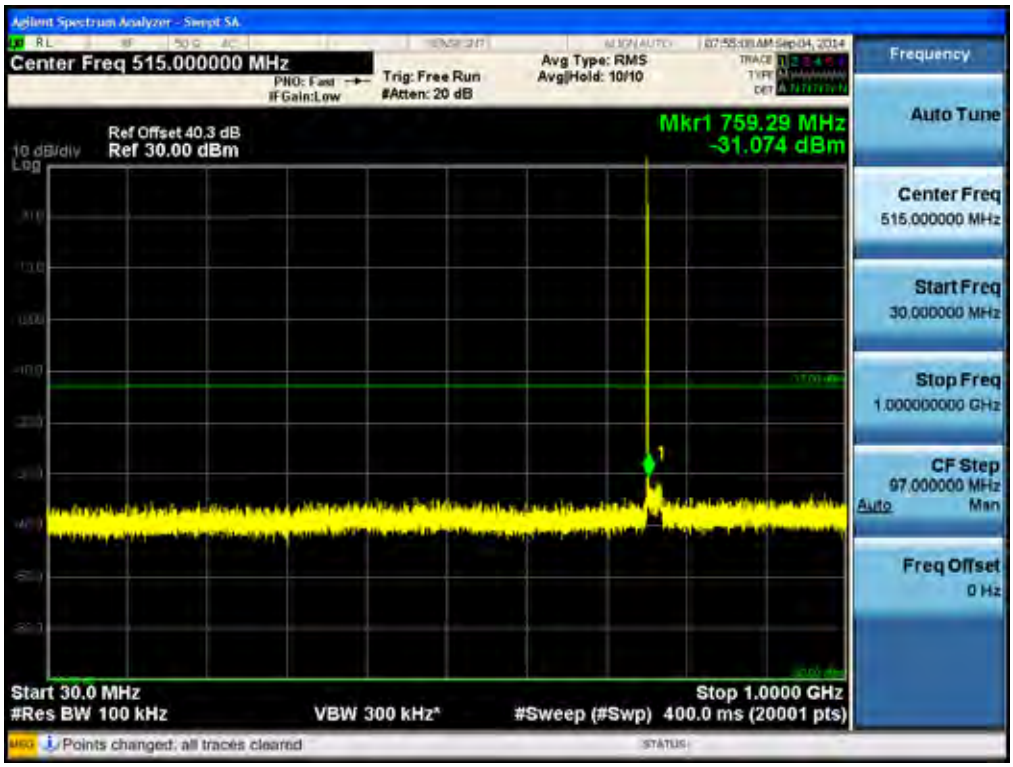
**[700 Band_iDEN Downlink High]**



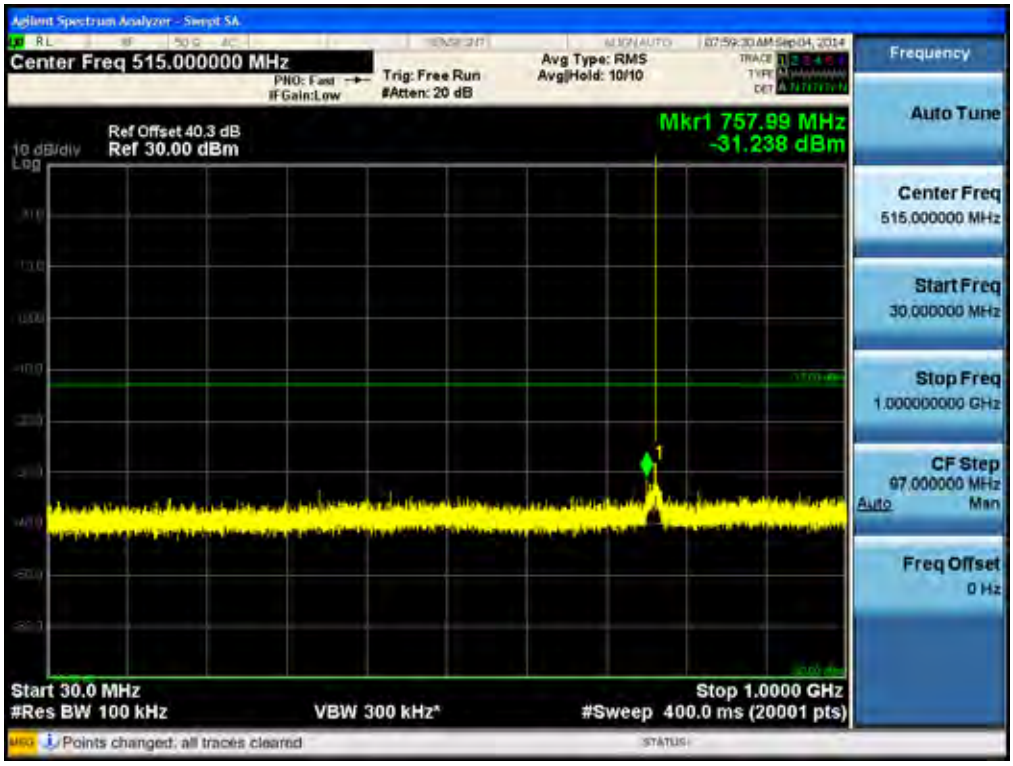
**Conducted Spurious Emissions (30 MHz – 1 GHz)**

## 700 Band_iDEN

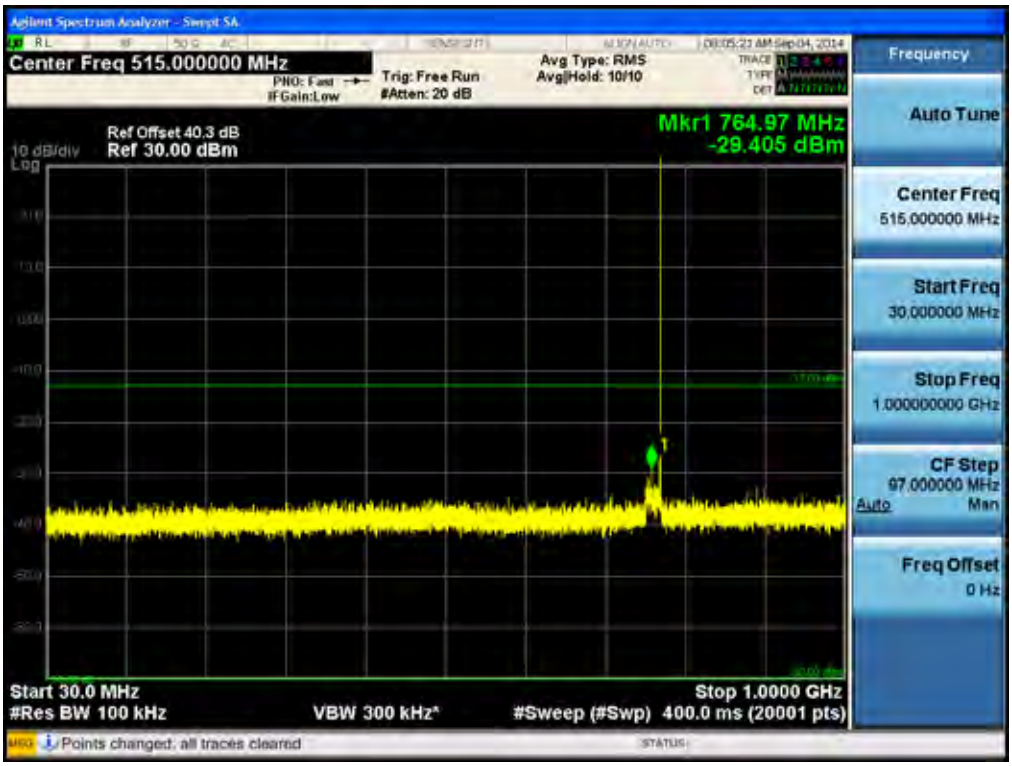
**[700 Band_iDEN Downlink Low]**




**[700 Band_iDEN Downlink Middle]**



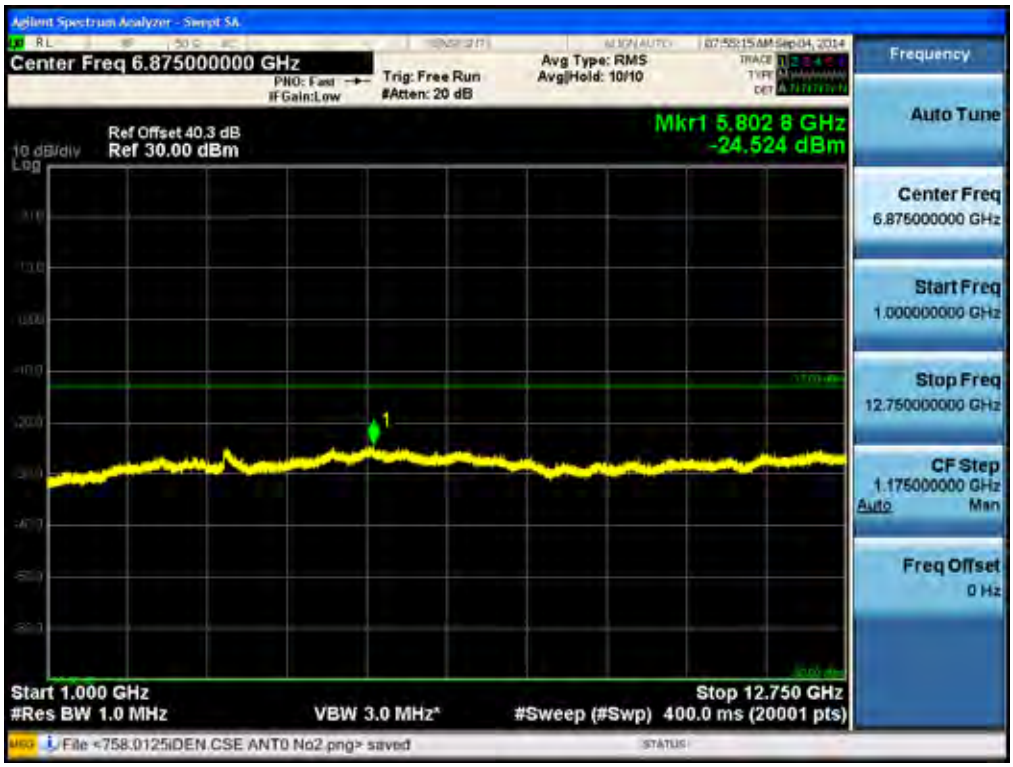
**[700 Band_iDEN Downlink High]**



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

## 700 Band_iDEN

**[700 Band_iDEN Downlink Low]**



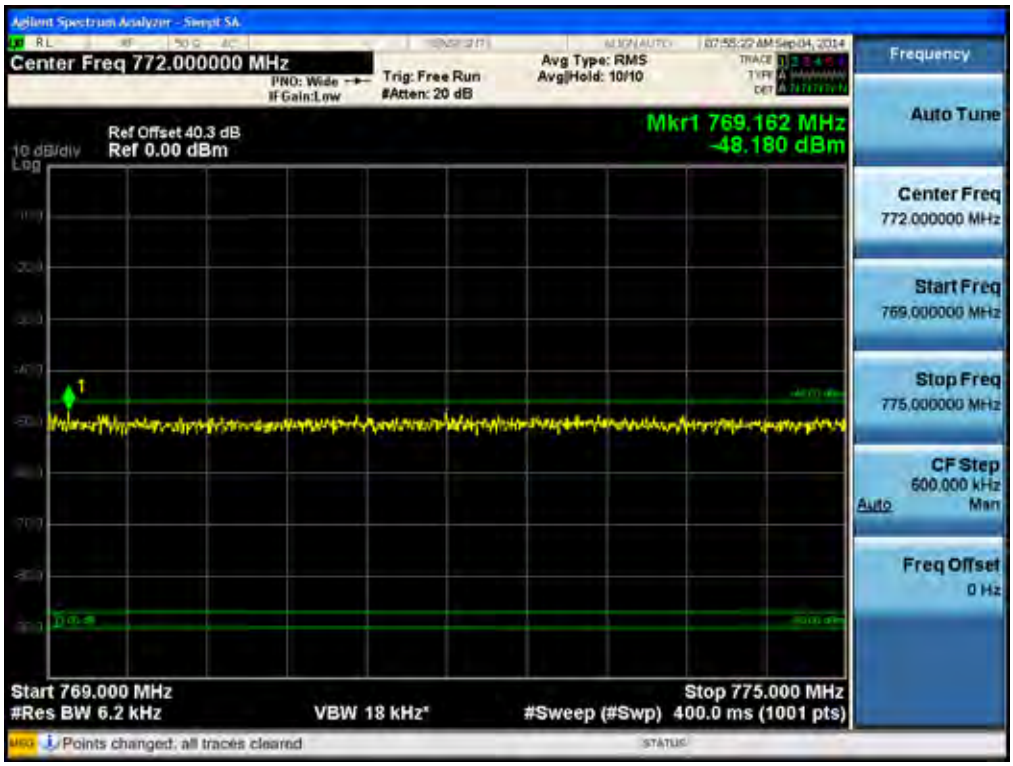

**[700 Band_iDEN Downlink Middle]**

**[700 Band_iDEN Downlink High]**

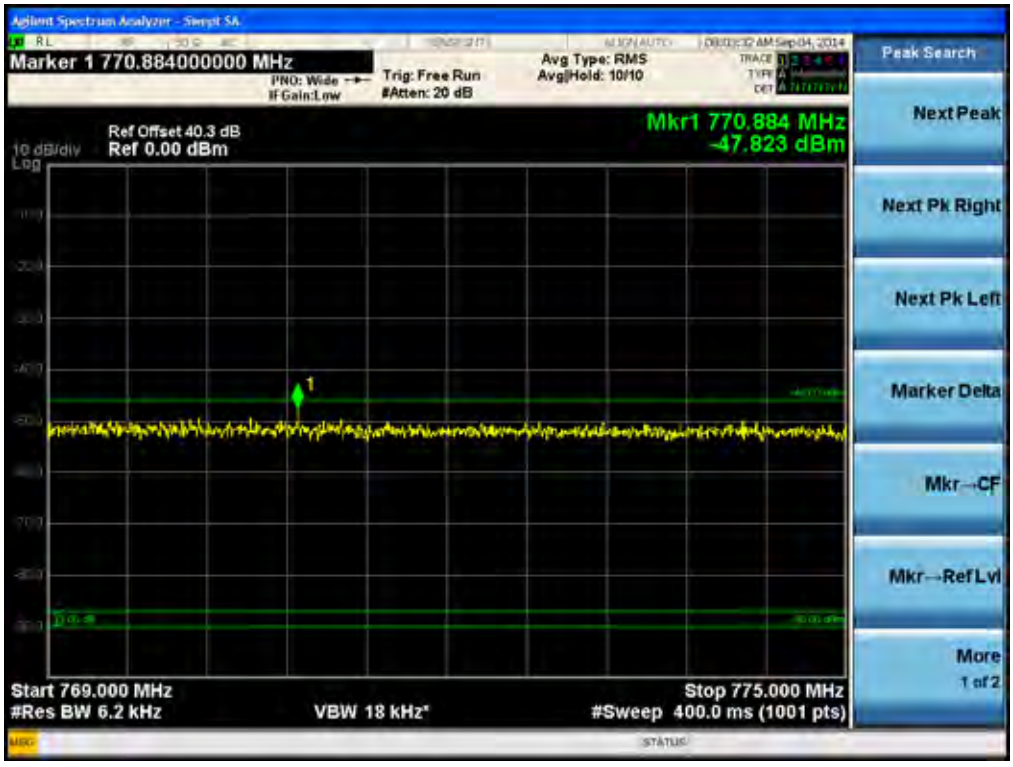
**Conducted Spurious Emissions (769 MHz – 775 MHz)**

## 700 Band_iDEN

**[700 Band_iDEN Downlink Low]**



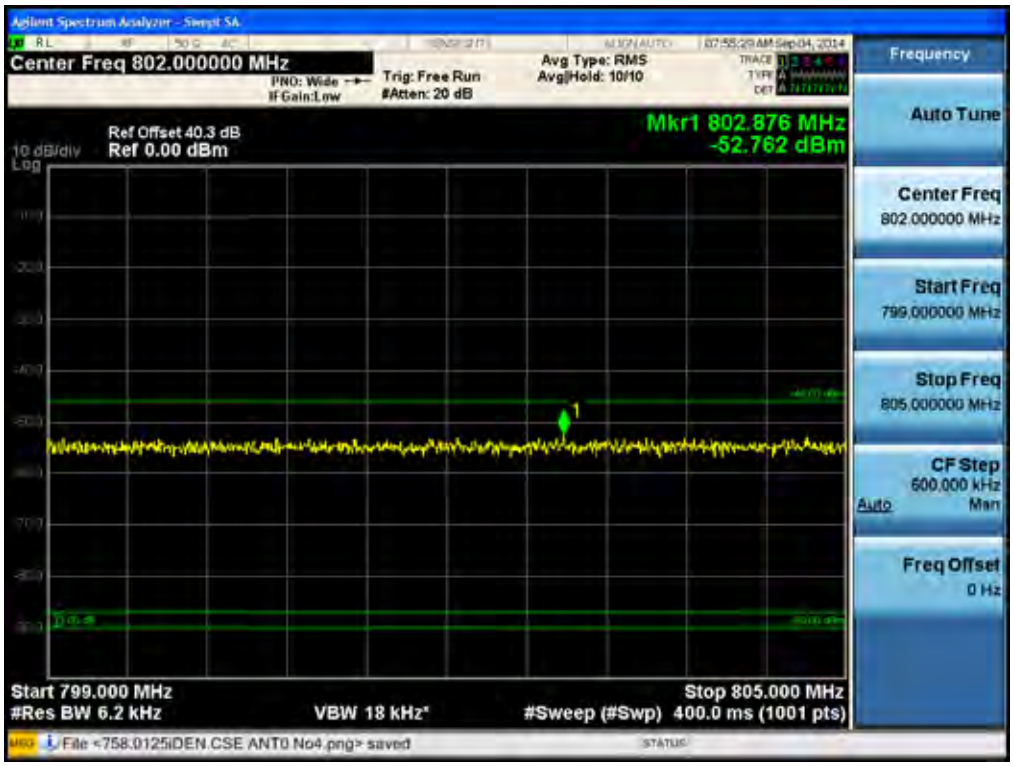

**[700 Band_iDEN Downlink Middle]**



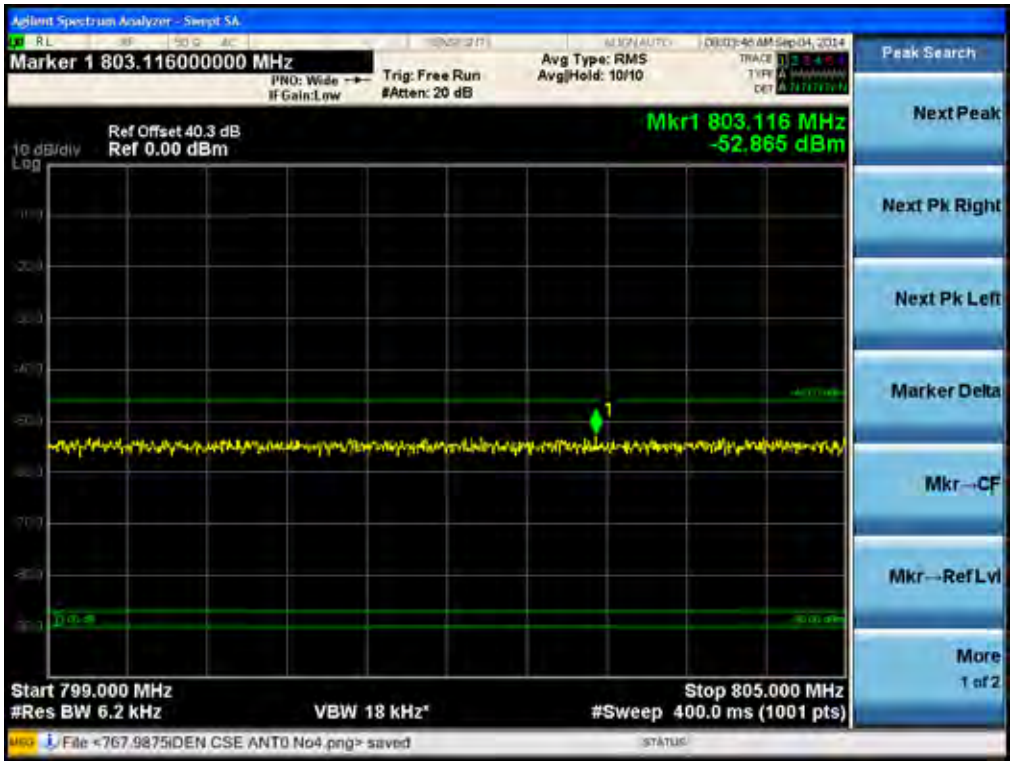
**Conducted Spurious Emissions (799 MHz – 805 MHz)**

## 700 Band_iDEN

**[700 Band_iDEN Downlink Low]**



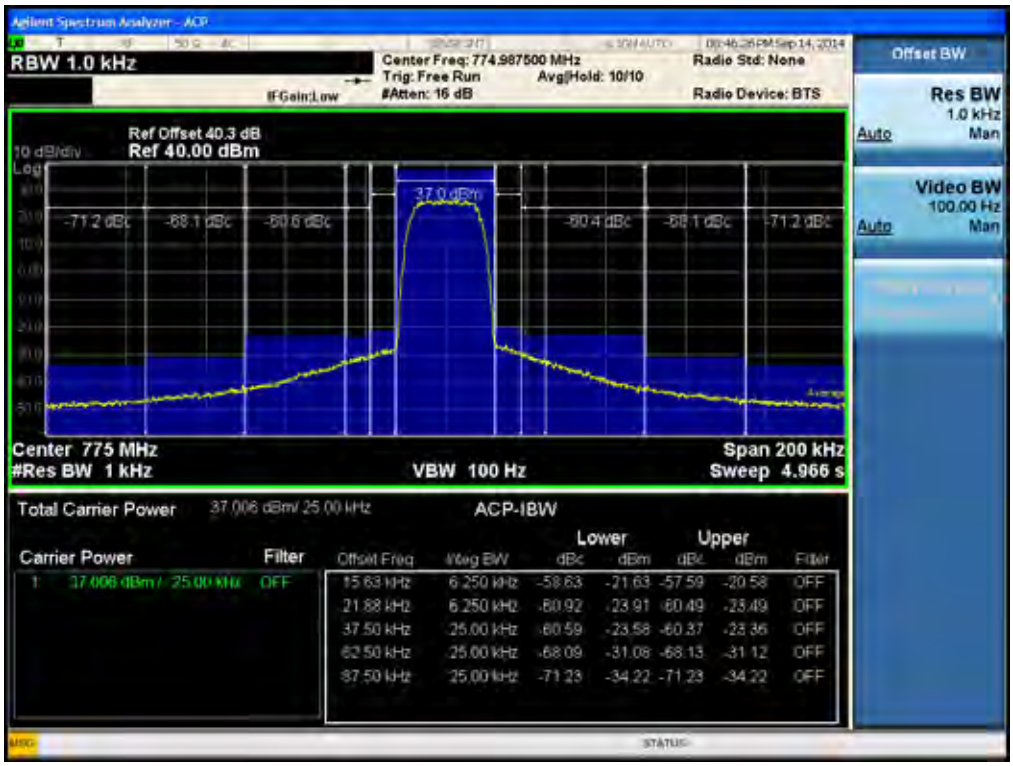

**[700 Band_iDEN Downlink Middle]**

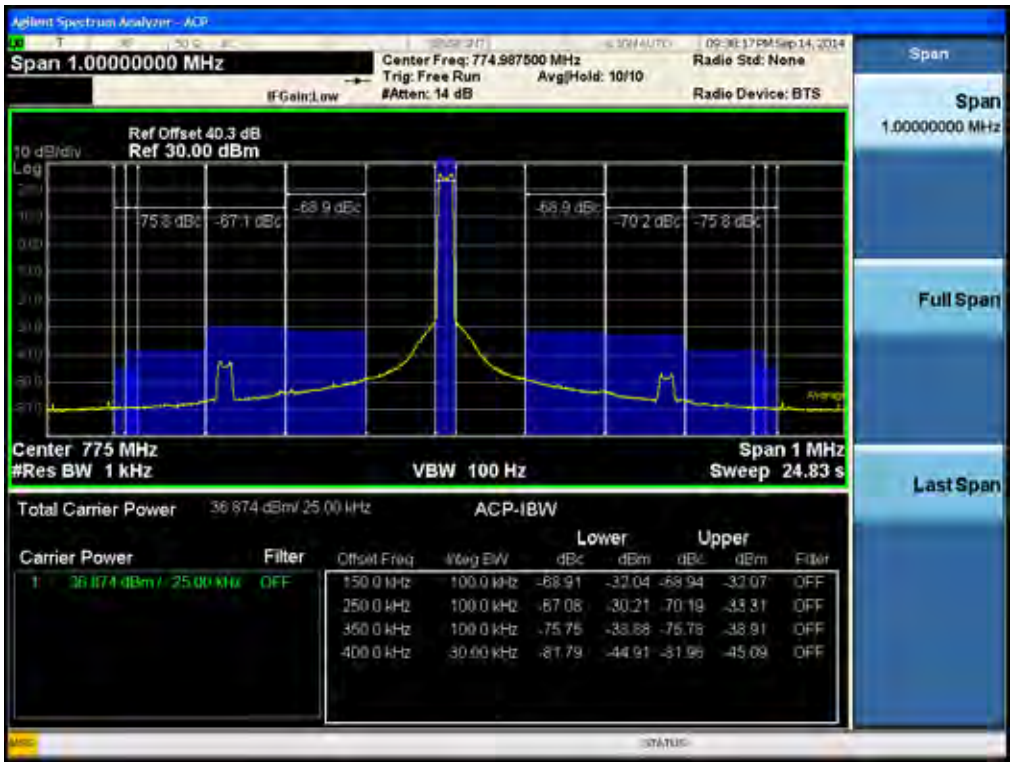


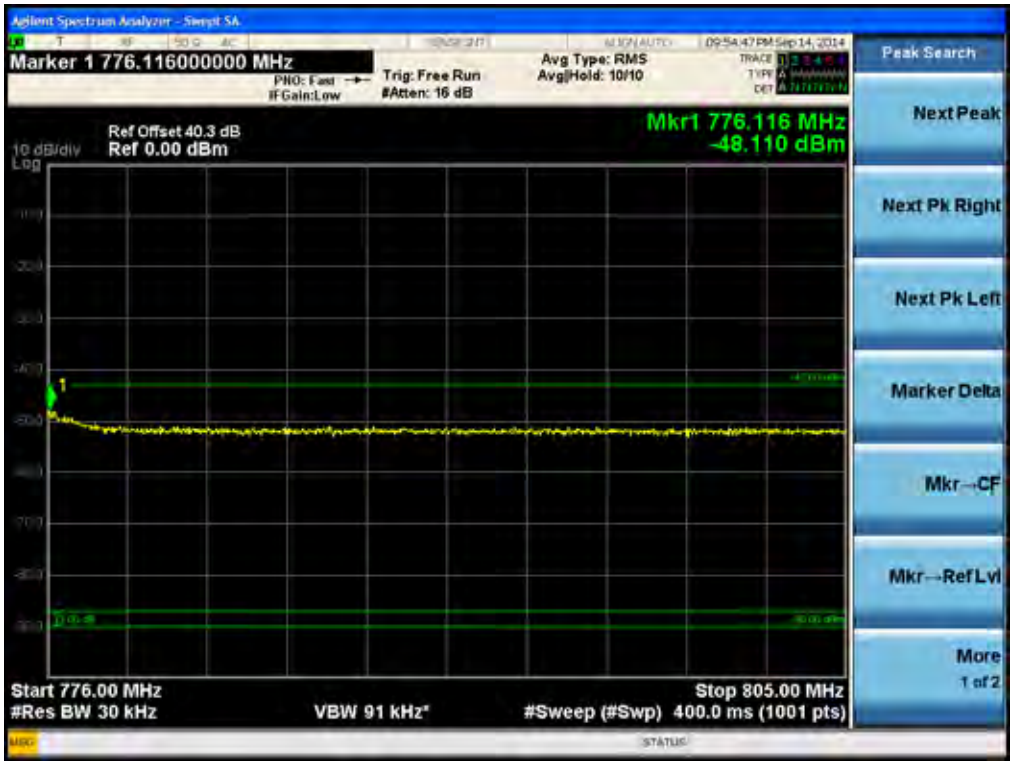
**ACP**

## 700 Band_iDEN

**[700 Band_iDEN Downlink High]**



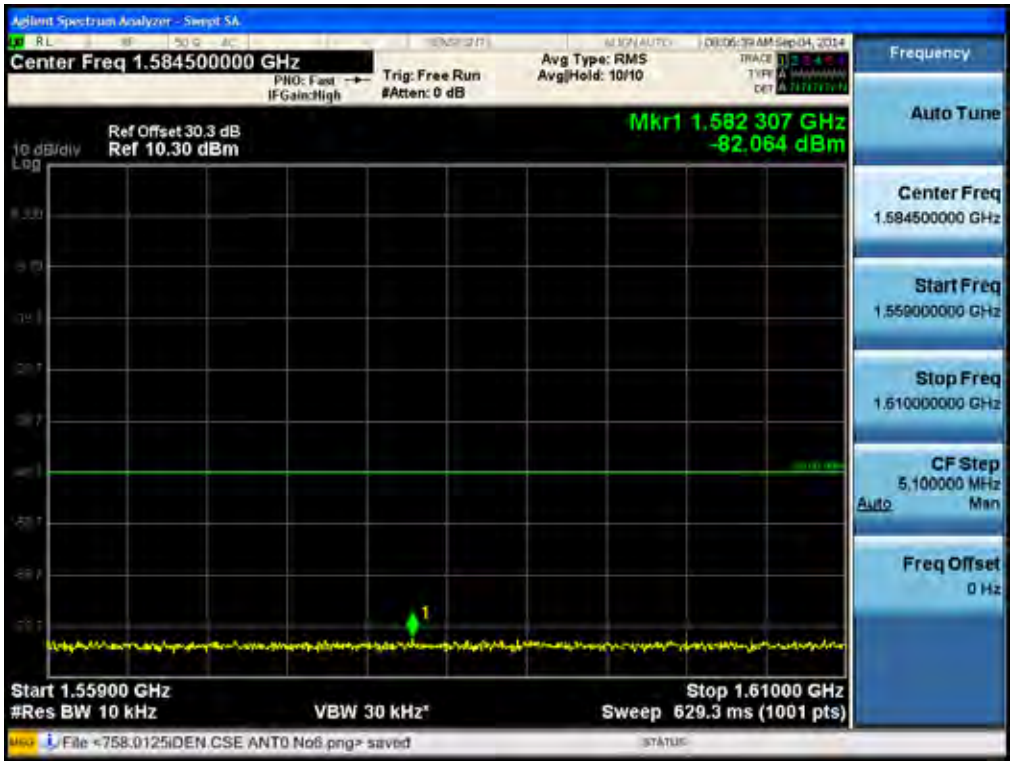

Agilent Spectrum Analyzer - Swept SA
Marker 1 776.116000000 MHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 16 dB
Avg Type: RMS
Avg|Hold: 10/10
Ref Offset 40.3 dB
10 dB/div
Ref 0.00 dBm
Log
Mkr1 776.116 MHz
-48.110 dBm
Start 776.00 MHz
#Res BW 30 kHz
VBW 91 kHz*
Stop 805.00 MHz
#Sweep (#Swp) 400.0 ms (1001 pts)
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

**Conducted Spurious Emissions (1559 MHz – 1610 MHz)**

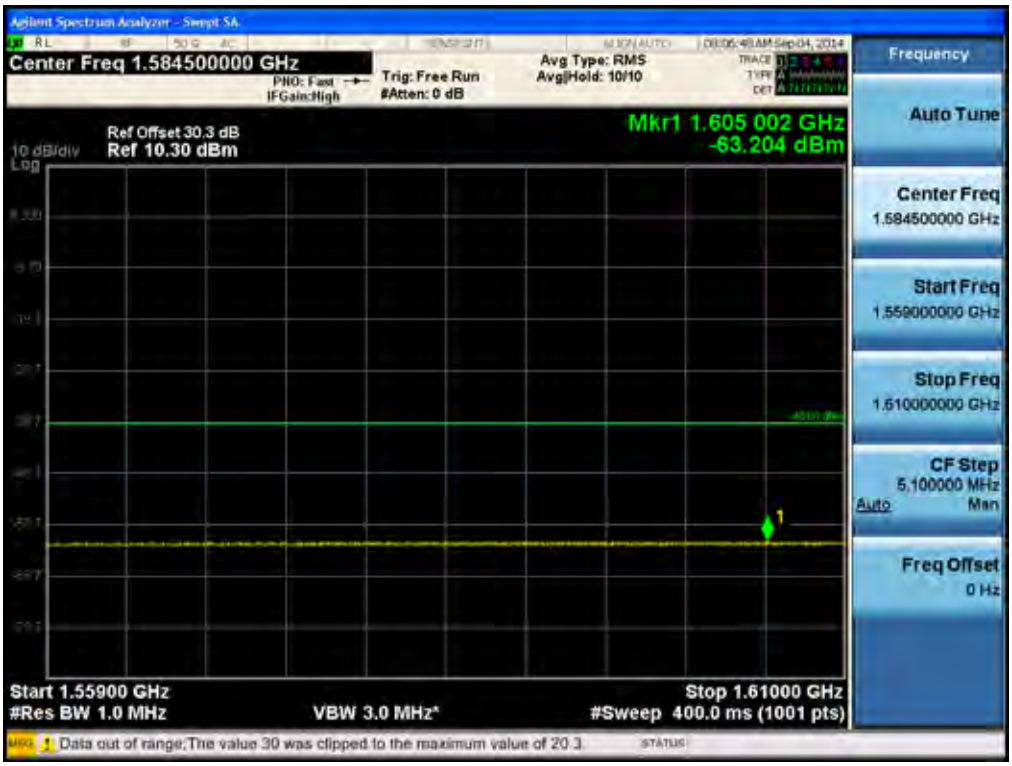
## 700 Band_iDEN

**[700 Band_iDEN Downlink Low] - RBW 1 MHz**


**[700 Band_iDEN Downlink Low] – RBW 10 kHz**

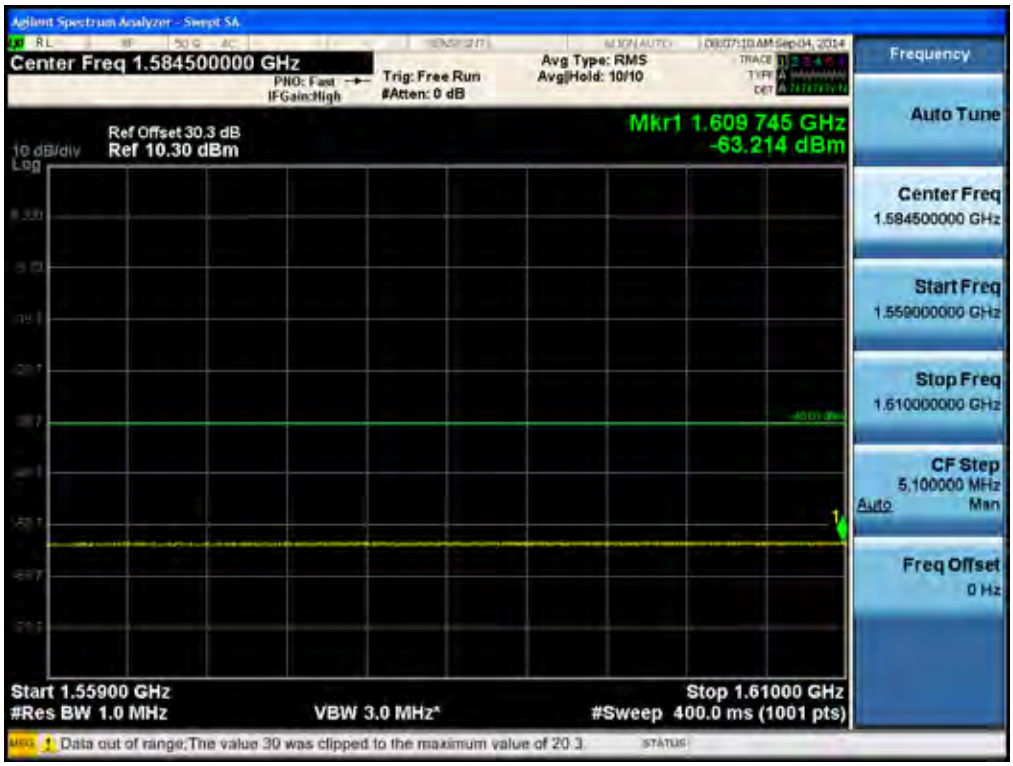


**[700 Band_iDEN Downlink Middle] - RBW 1 MHz**




**[700 Band_iDEN Downlink Middle] - RBW 10 kHz**

**[700 Band_iDEN Downlink High] - RBW 1 MHz**

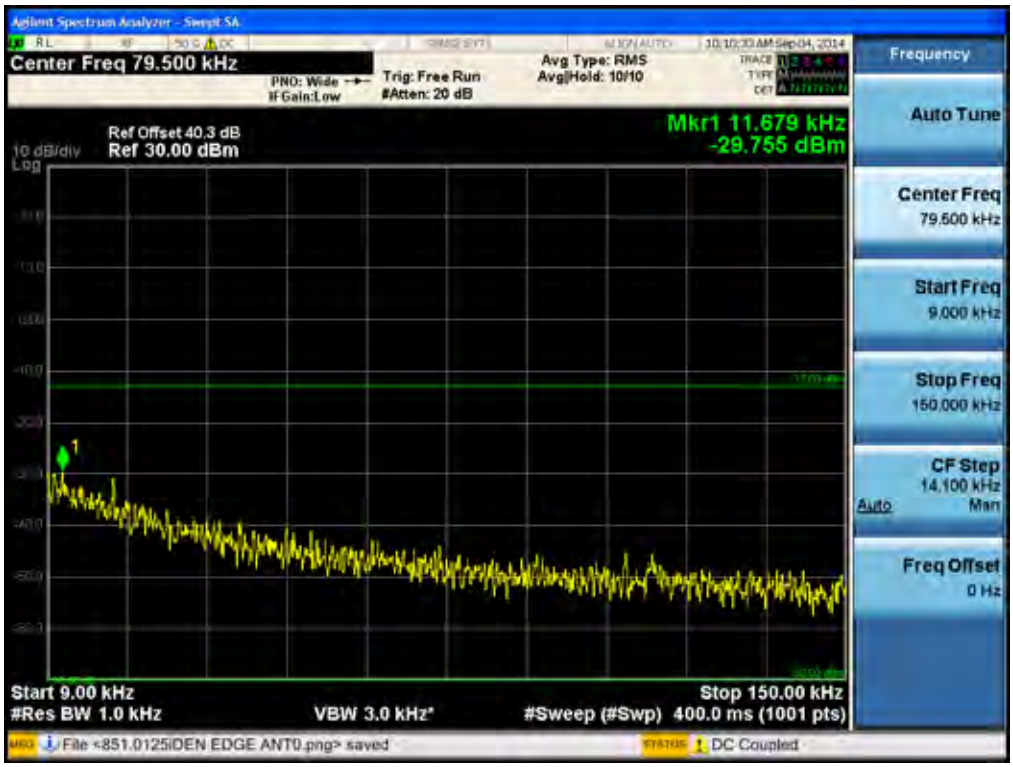



**[700 Band_iDEN Downlink High] - RBW 10 kHz**

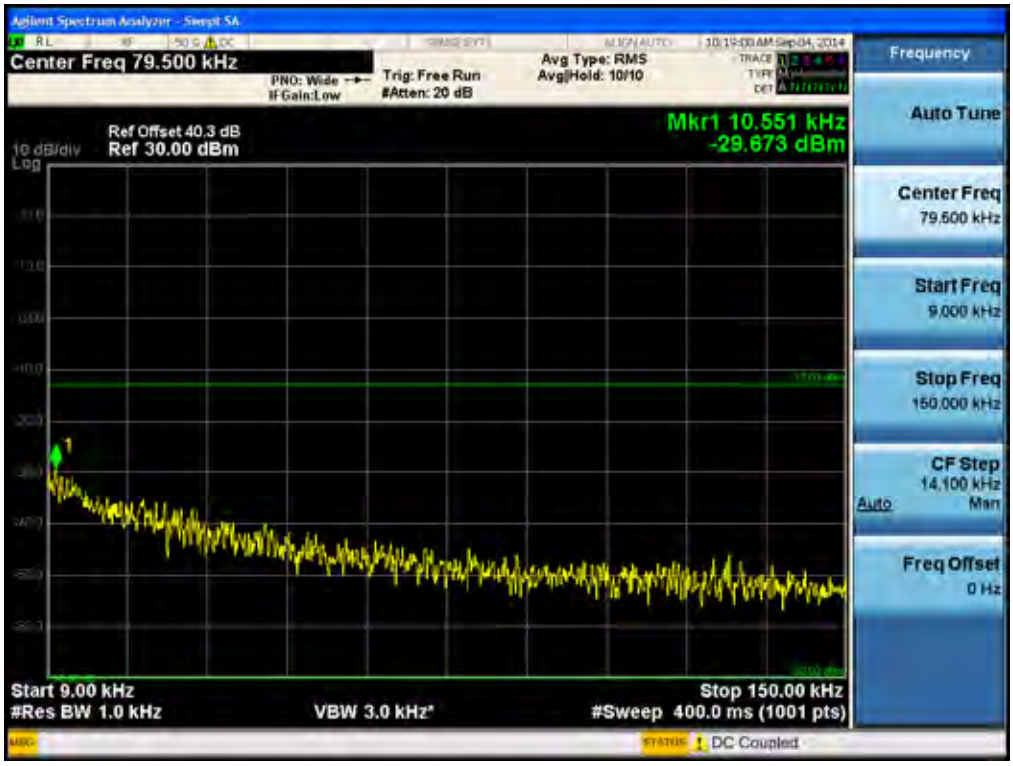
**Conducted Spurious Emissions (9 kHz – 150 kHz)**

## 800 Band_iDEN

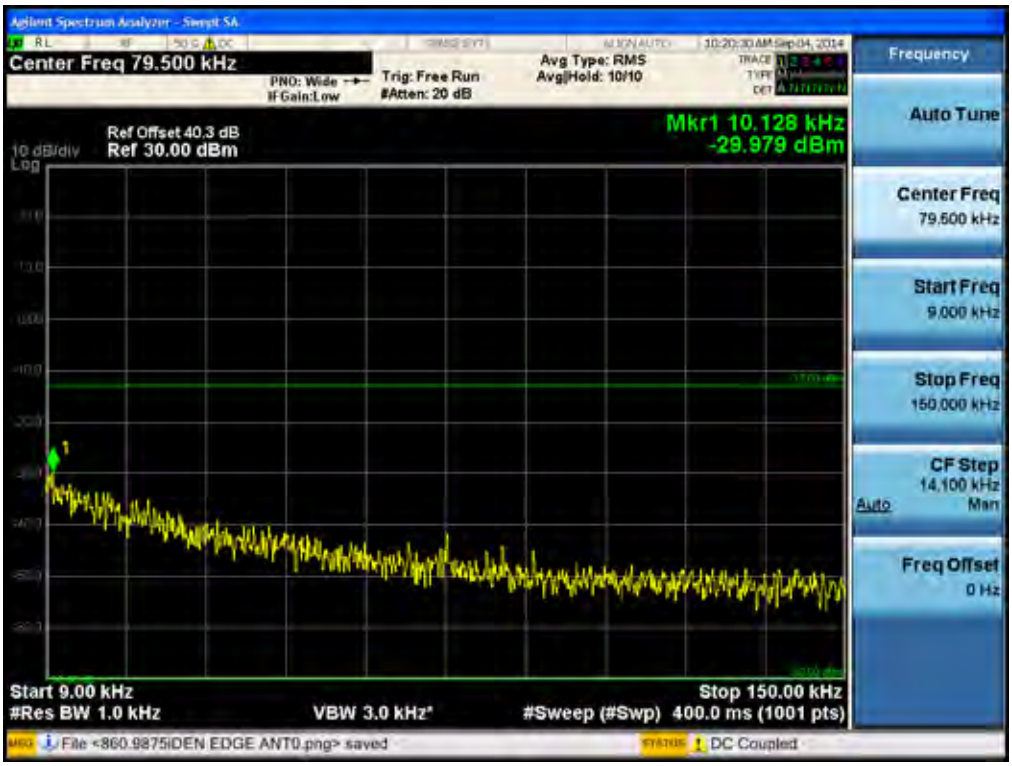
**[800 Band_iDEN Downlink Low]**




**[800 Band_iDEN Downlink Middle]**



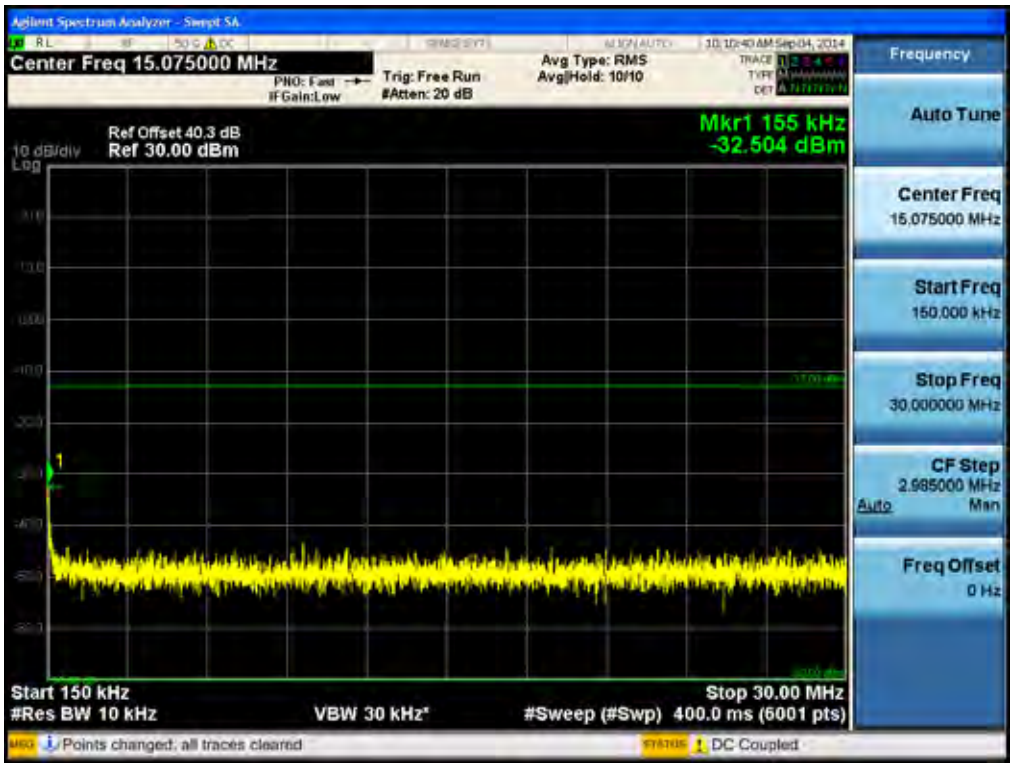
**[800 Band_iDEN Downlink High]**



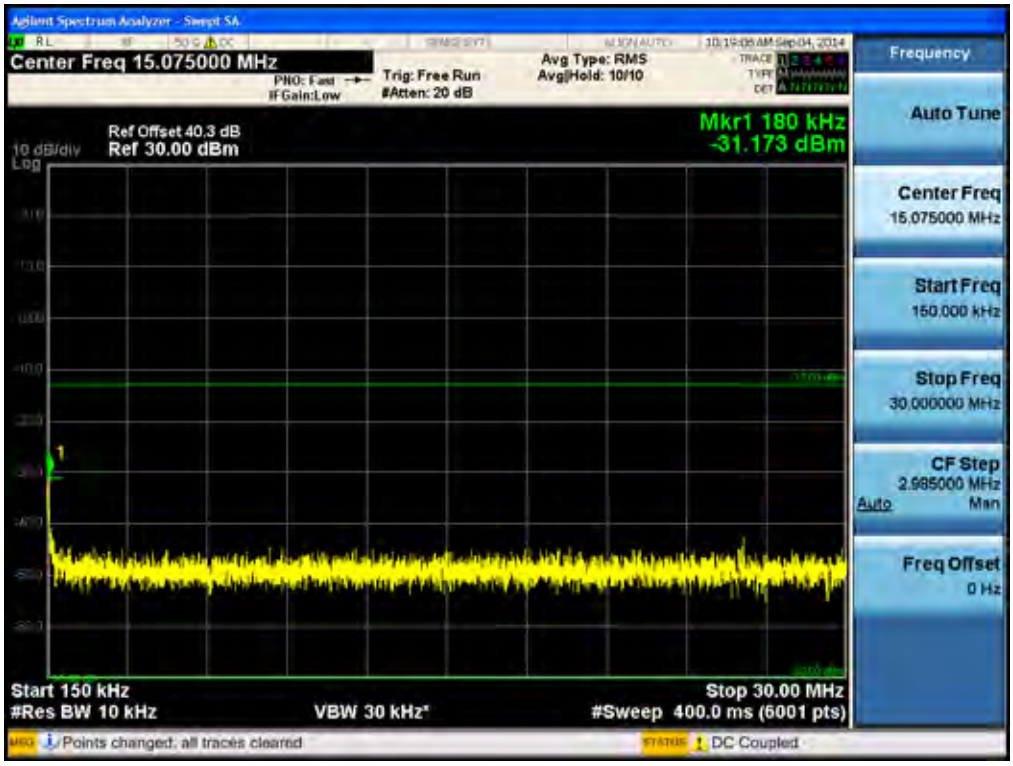
**Conducted Spurious Emissions (150 kHz – 30 MHz)**

## 800 Band_iDEN

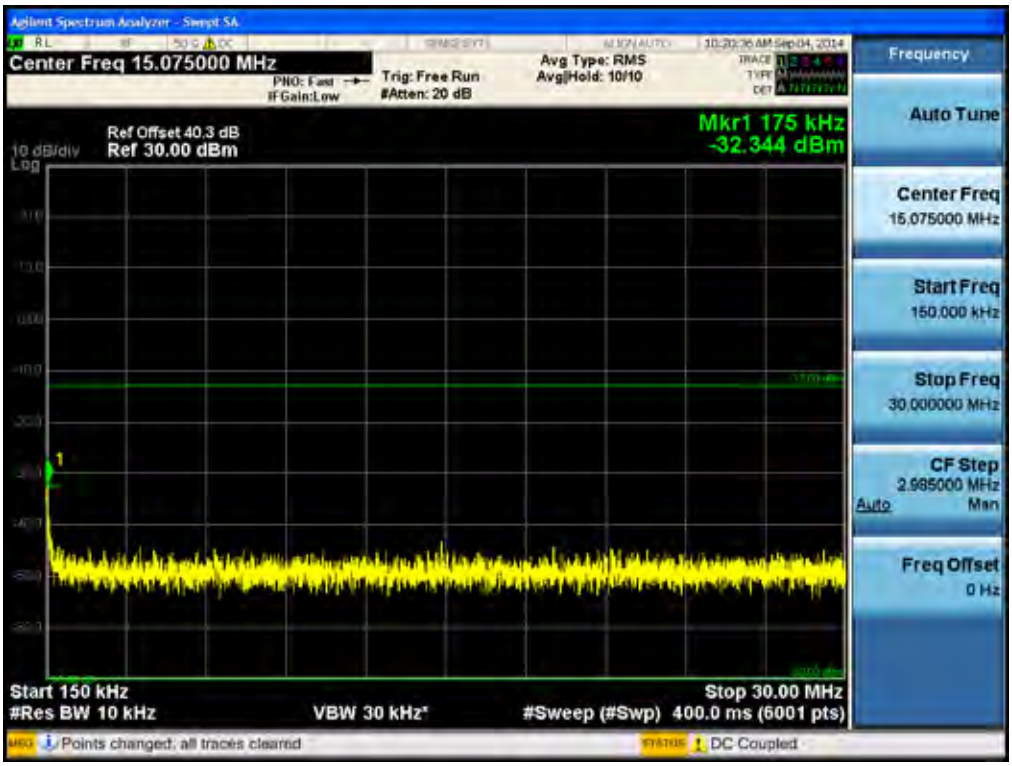
**[800 Band_iDEN Downlink Low]**




**[800 Band_iDEN Downlink Middle]**



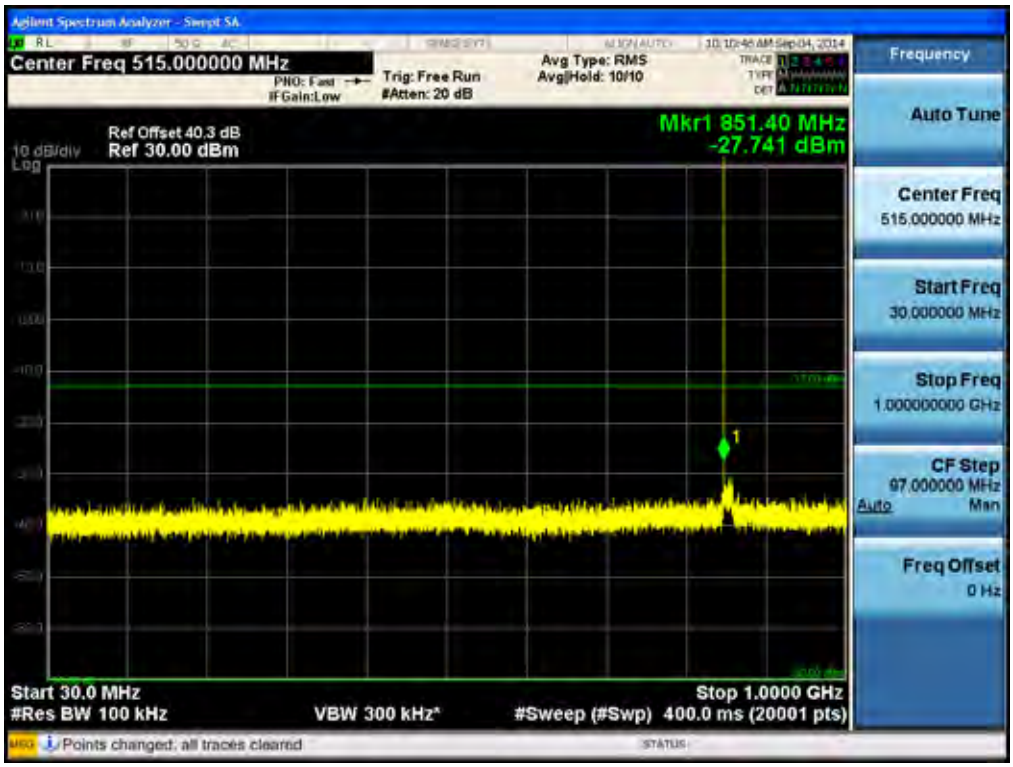
**[800 Band_iDEN Downlink High]**



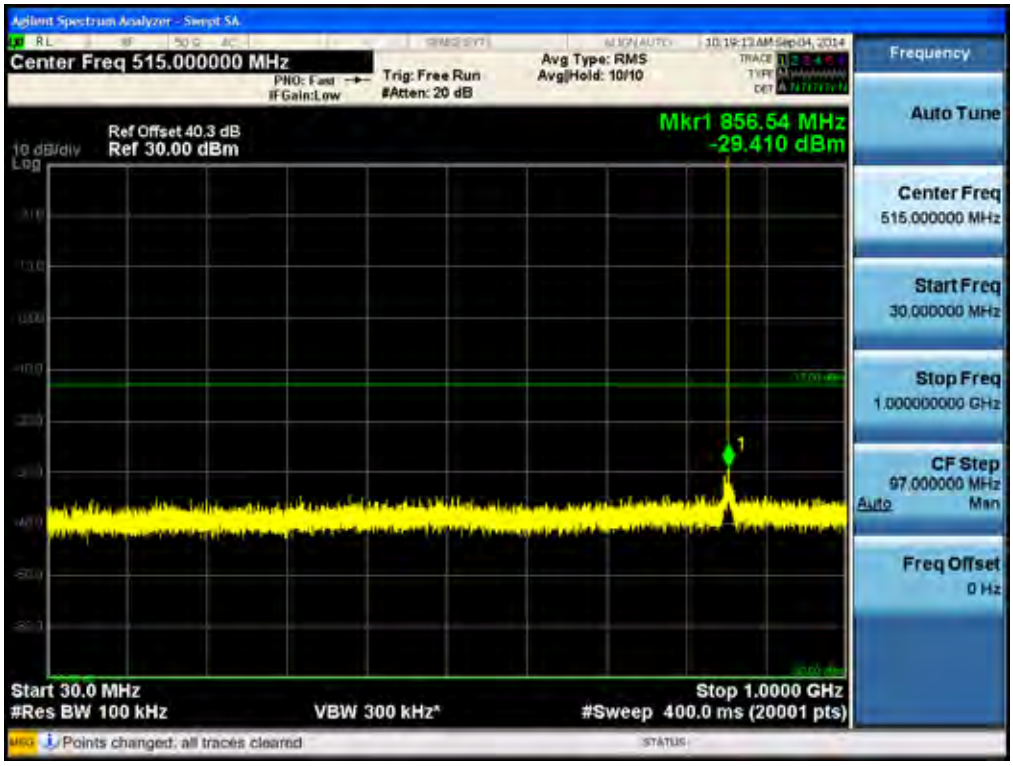
**Conducted Spurious Emissions (30 MHz – 1 GHz)**

## 800 Band_iDEN

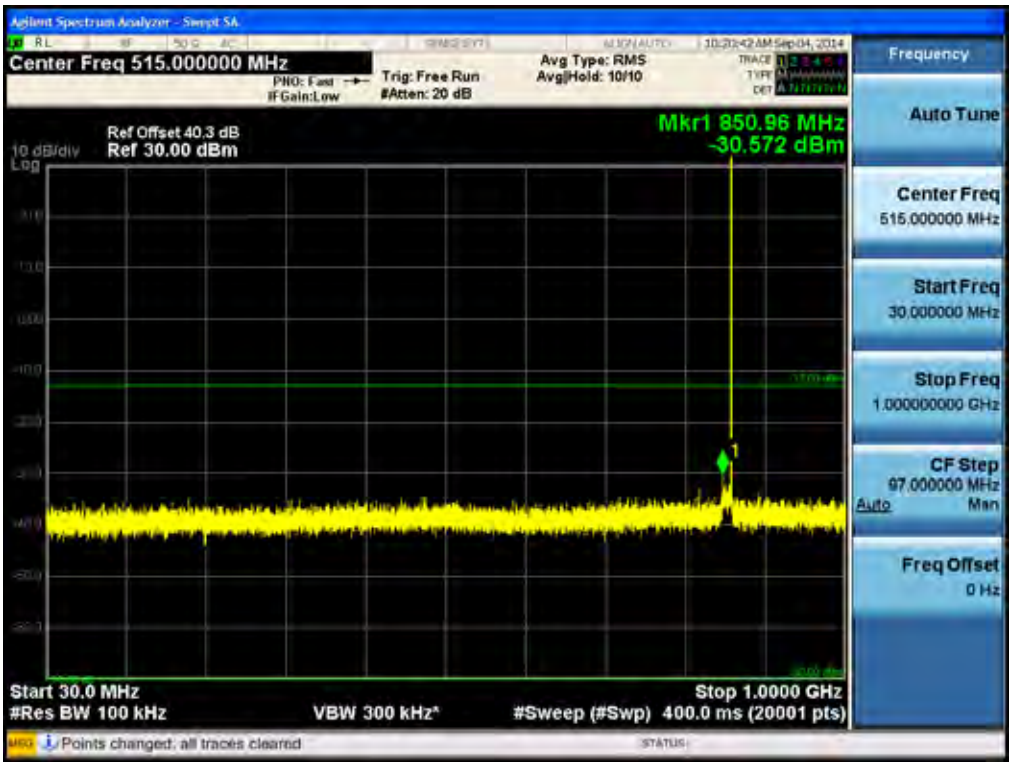
**[800 Band_iDEN Downlink Low]**




**[800 Band_iDEN Downlink Middle]**



**[800 Band_iDEN Downlink High]**



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

## 800 Band_iDEN

**[800 Band_iDEN Downlink Low]**


**[800 Band_iDEN Downlink Middle]**

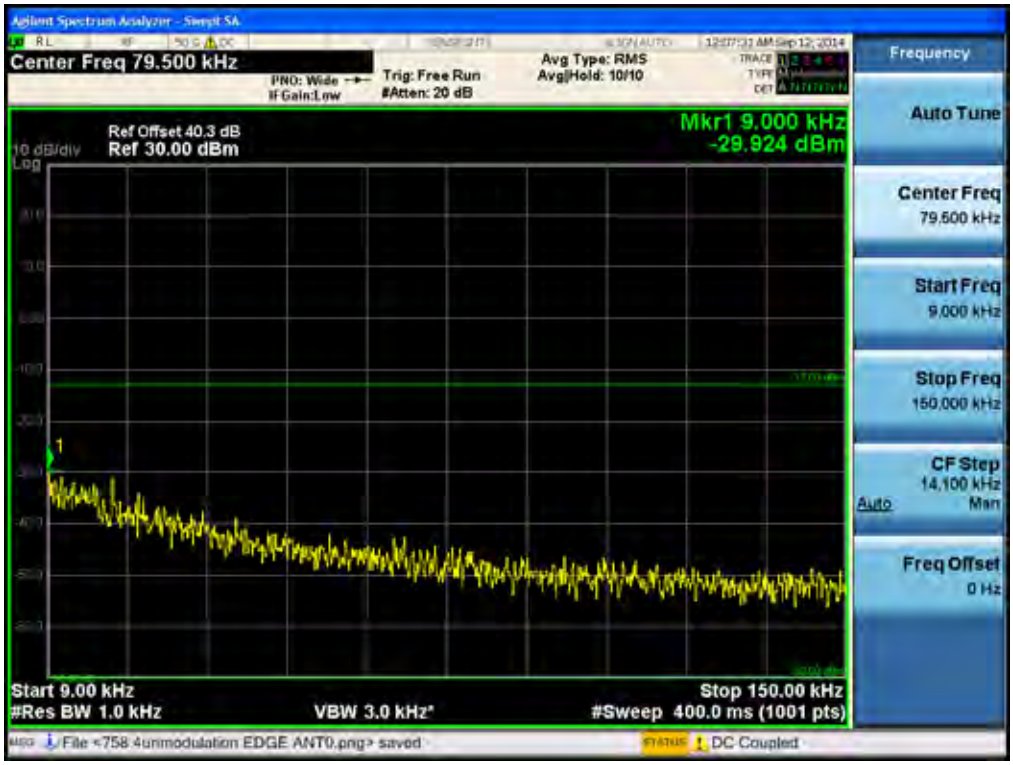
**[800 Band_iDEN Downlink High]**

## Multi channel Enhancer Plots of Spurious Emission for IC

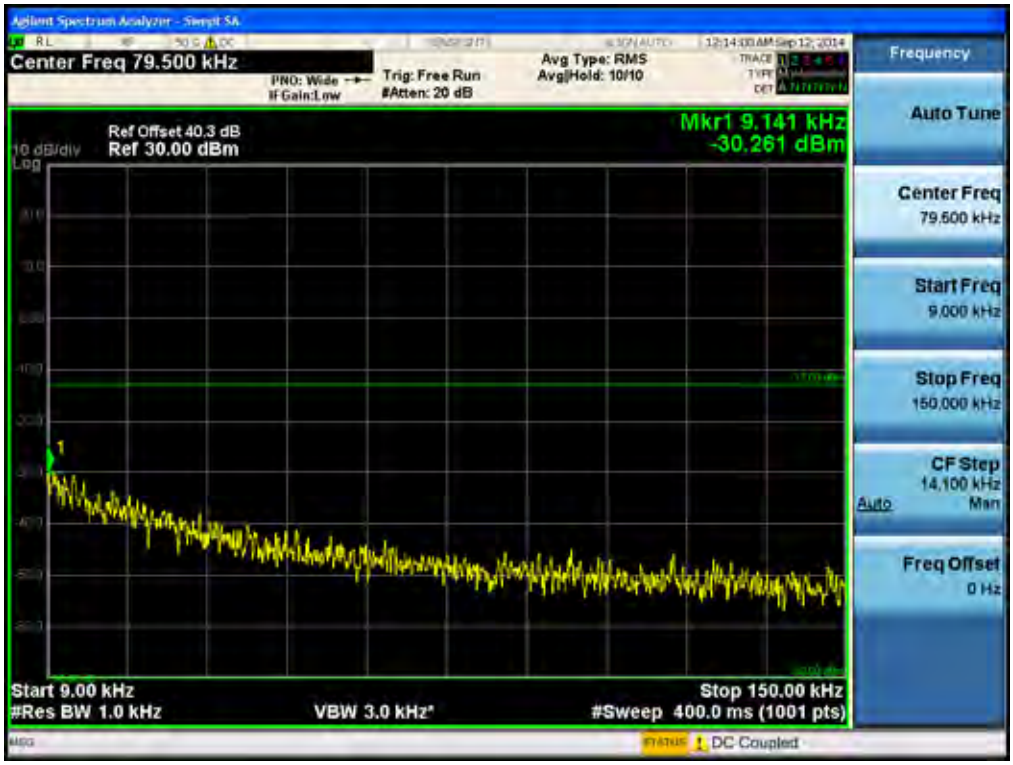
### Conducted Spurious Emissions (9 kHz – 150 kHz)

### 700 MHz Band

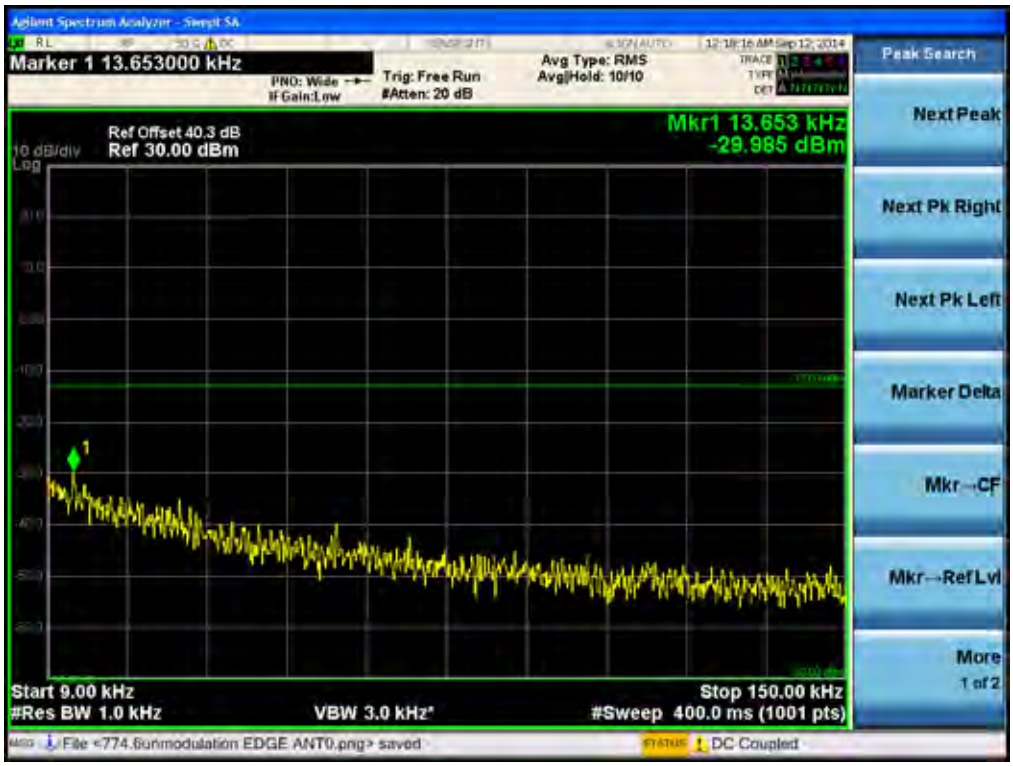
**[Downlink Low]**




**[Downlink Middle]**



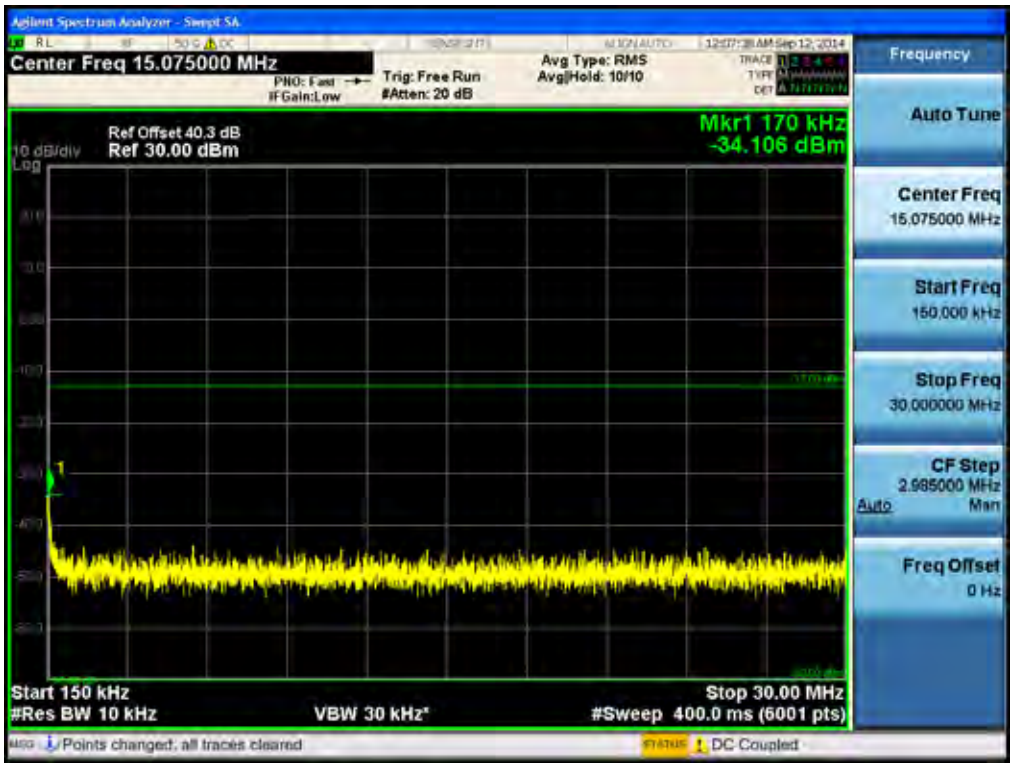
**[Downlink High]**



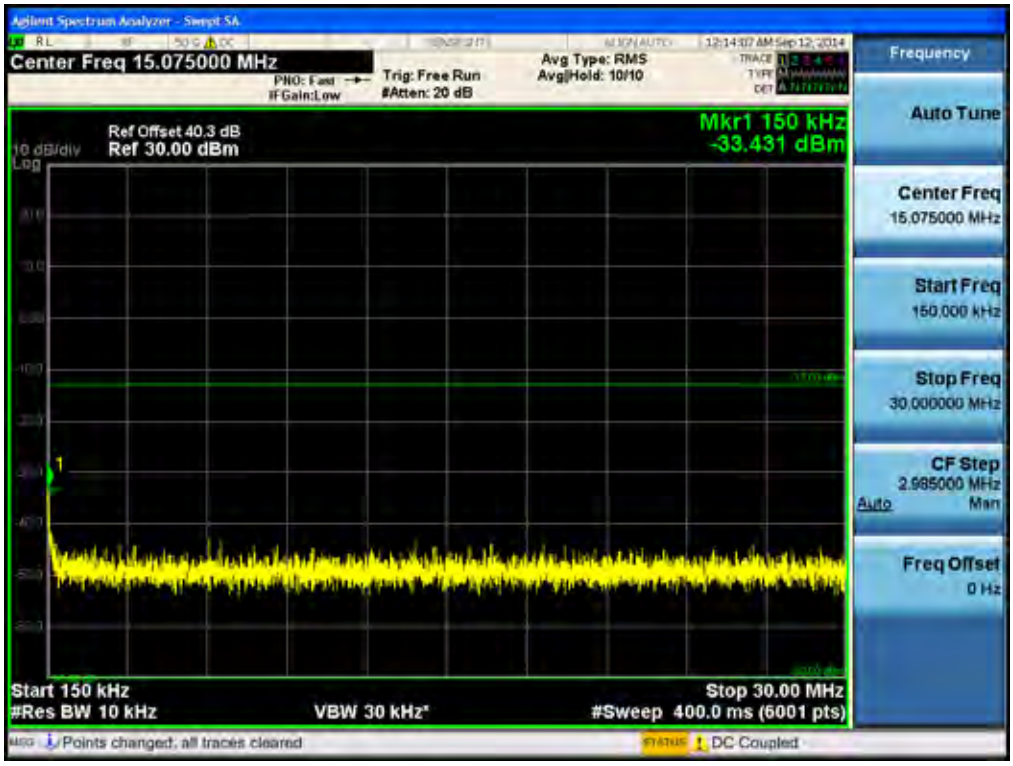
**Conducted Spurious Emissions (150 kHz – 30 MHz)**

## 700 MHz Band

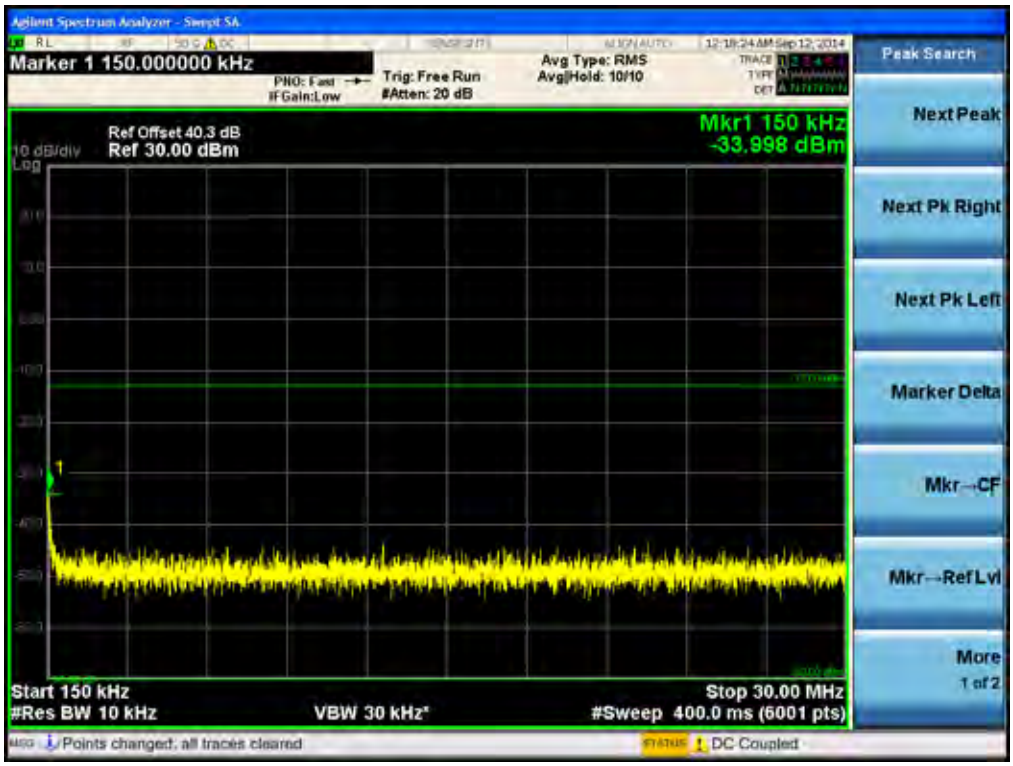
**[Downlink Low]**




**[Downlink Middle]**



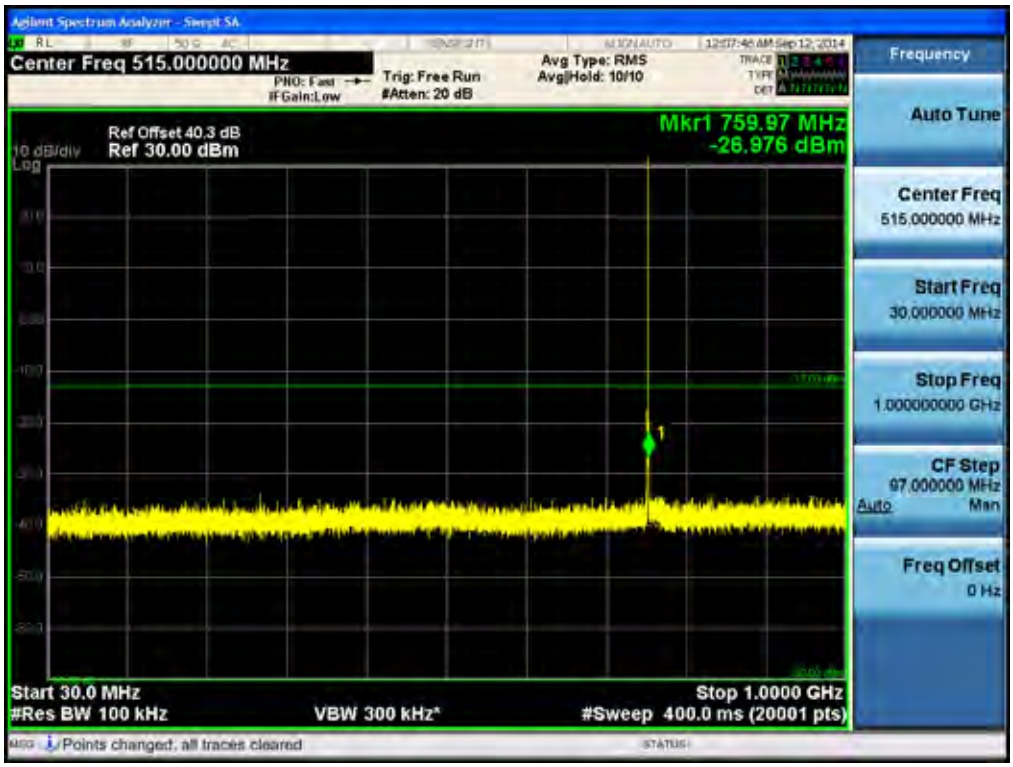
**[Downlink High]**



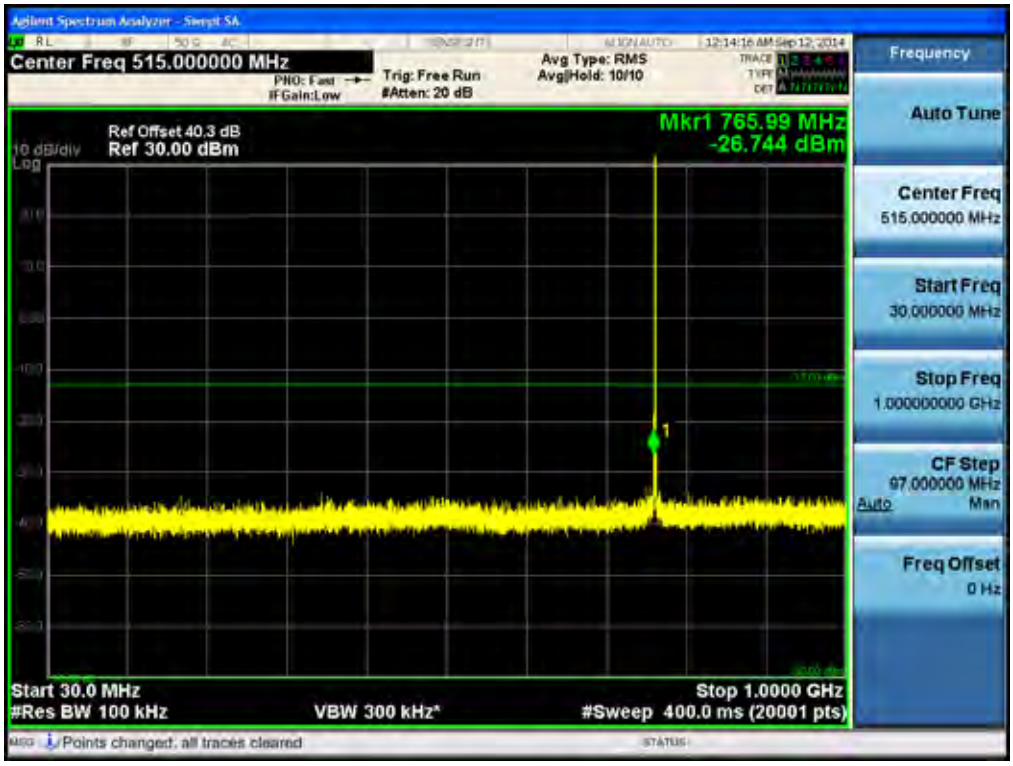
**Conducted Spurious Emissions (30 MHz – 1 GHz)**

## 700 MHz Band

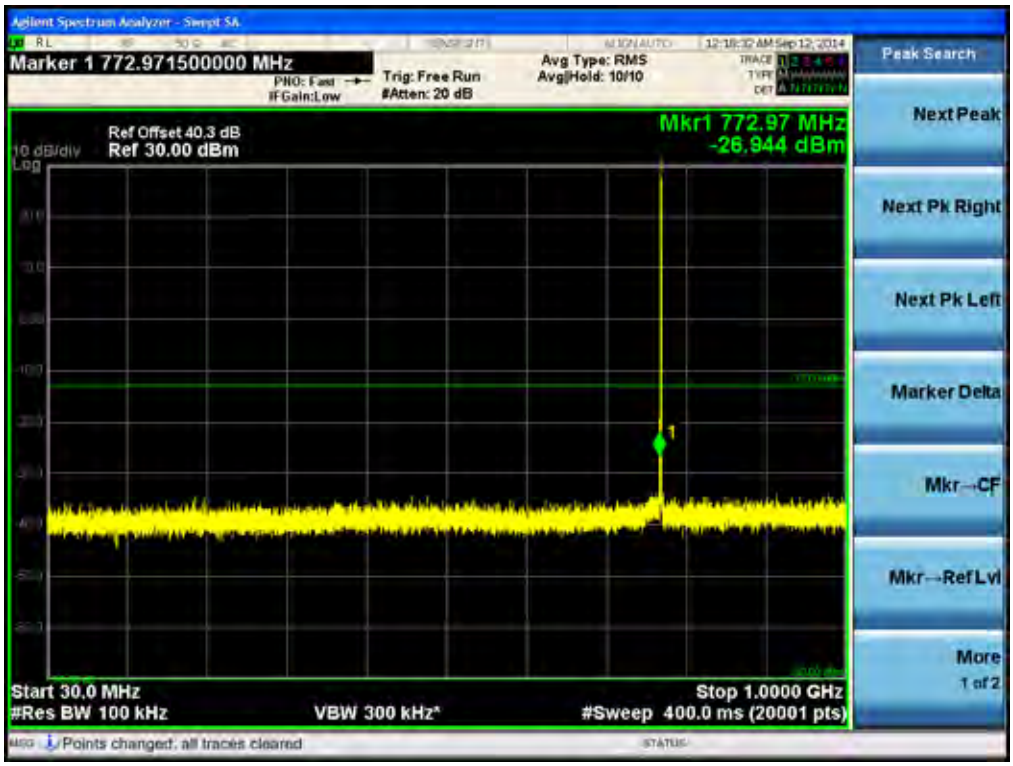
**[Downlink Low]**




**[Downlink Middle]**



**[Downlink High]**



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

## 700 MHz Band

**[Downlink Low]**

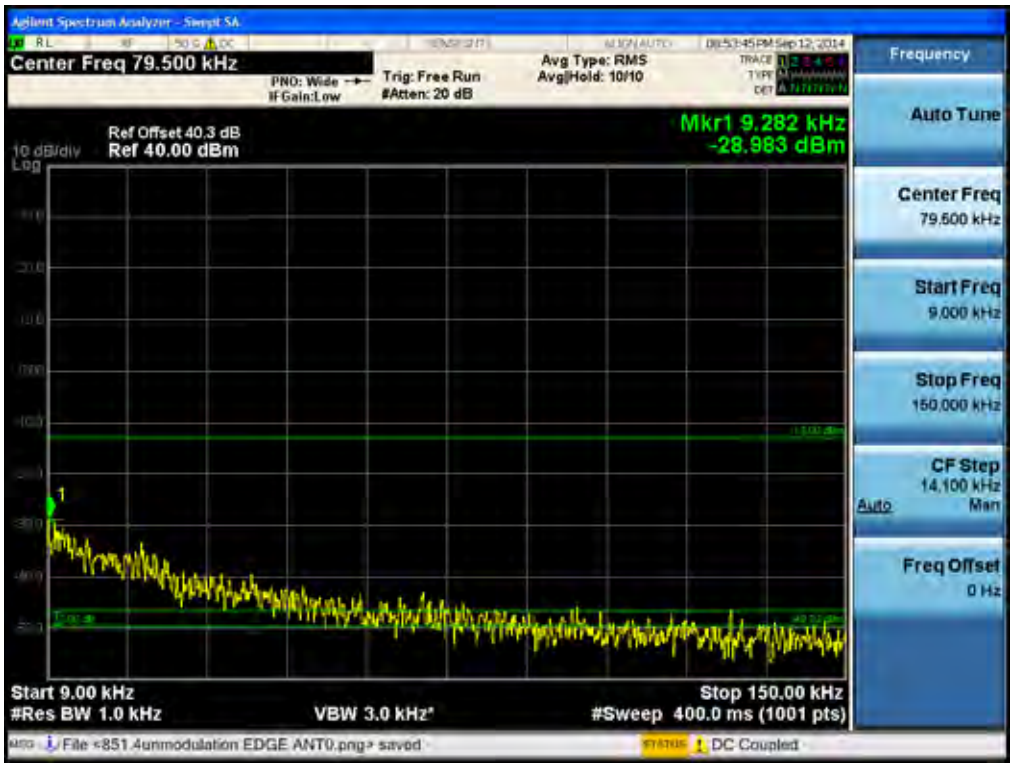

**[Downlink Middle]**

**[Downlink High]**

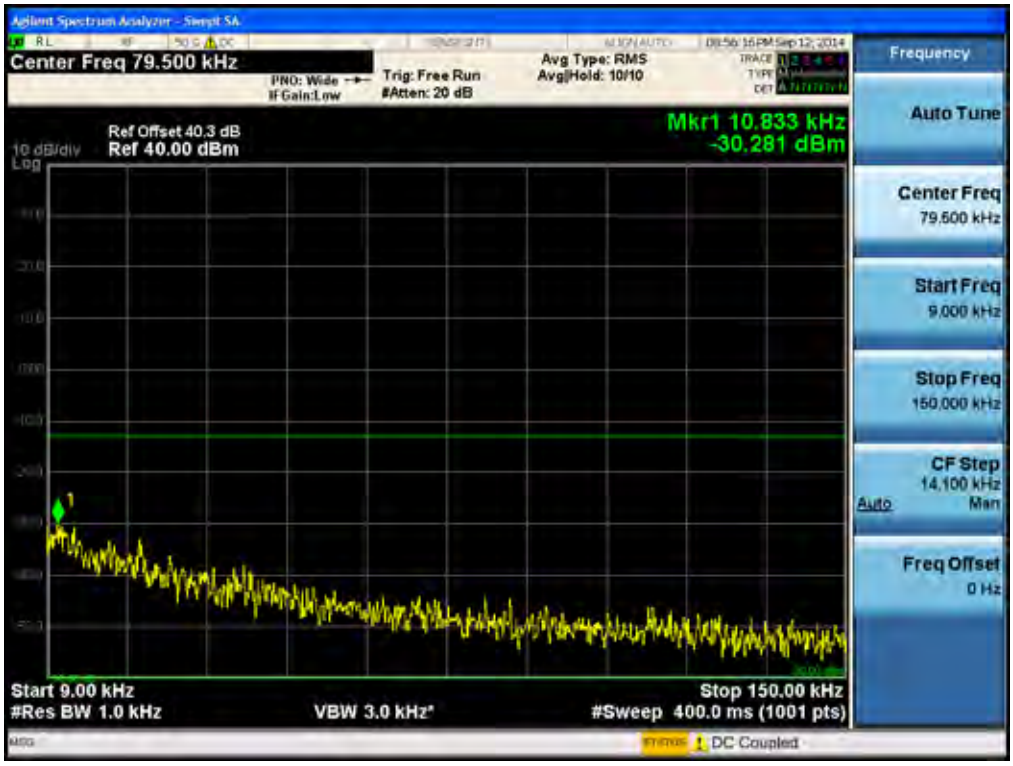
**Conducted Spurious Emissions (9 kHz – 150 kHz)**

**800 MHz Band**

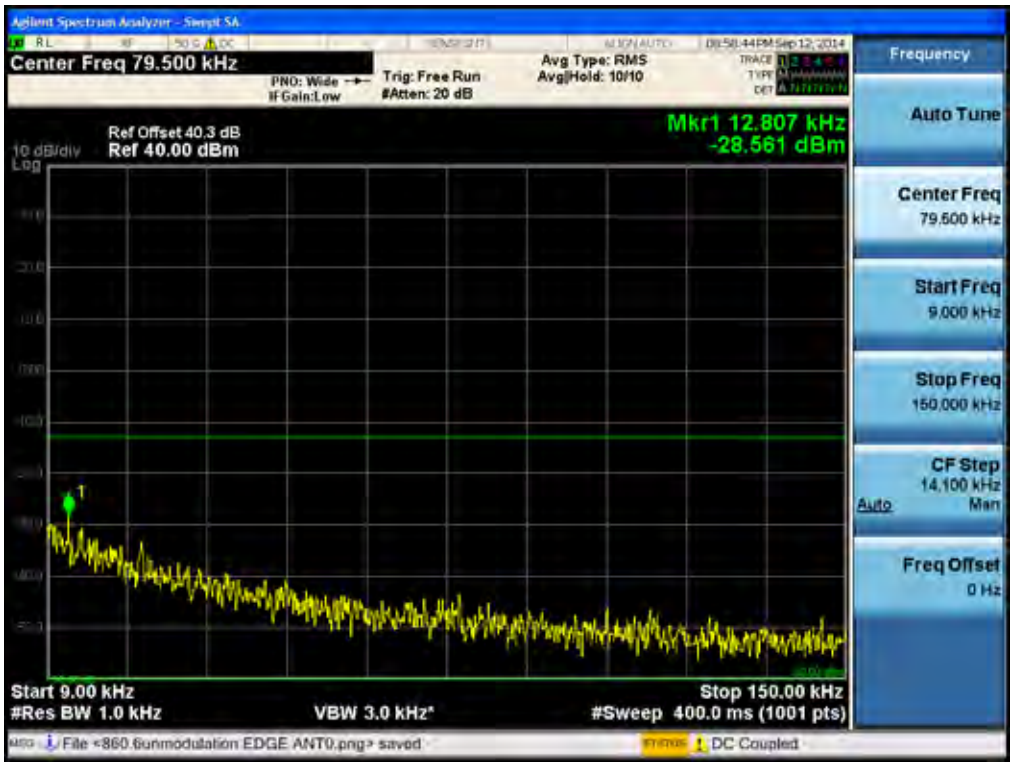
**[Downlink Low]**




**[Downlink Middle]**



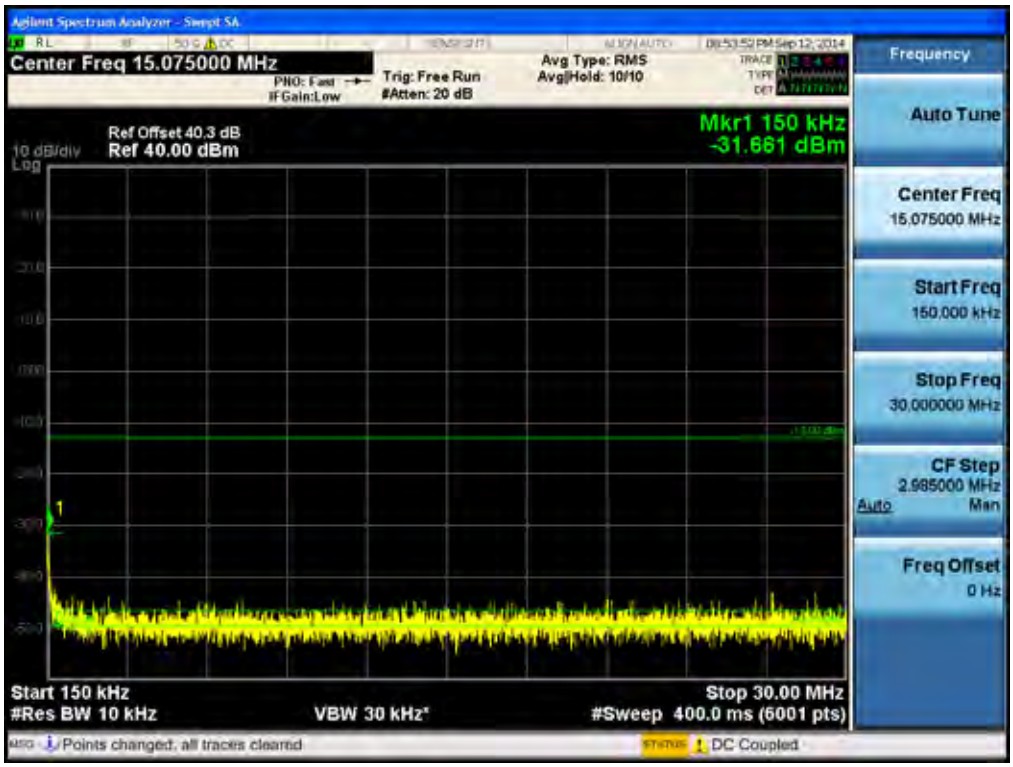
**[Downlink High]**



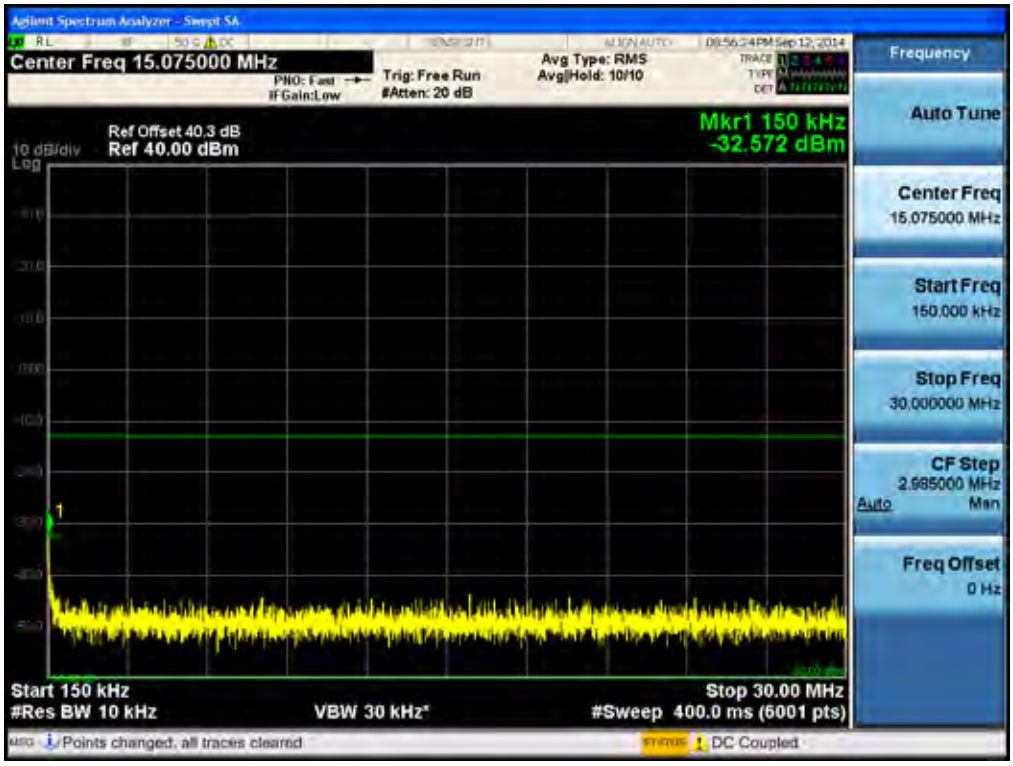
**Conducted Spurious Emissions (150 kHz – 30 MHz)**

## 800 MHz Band

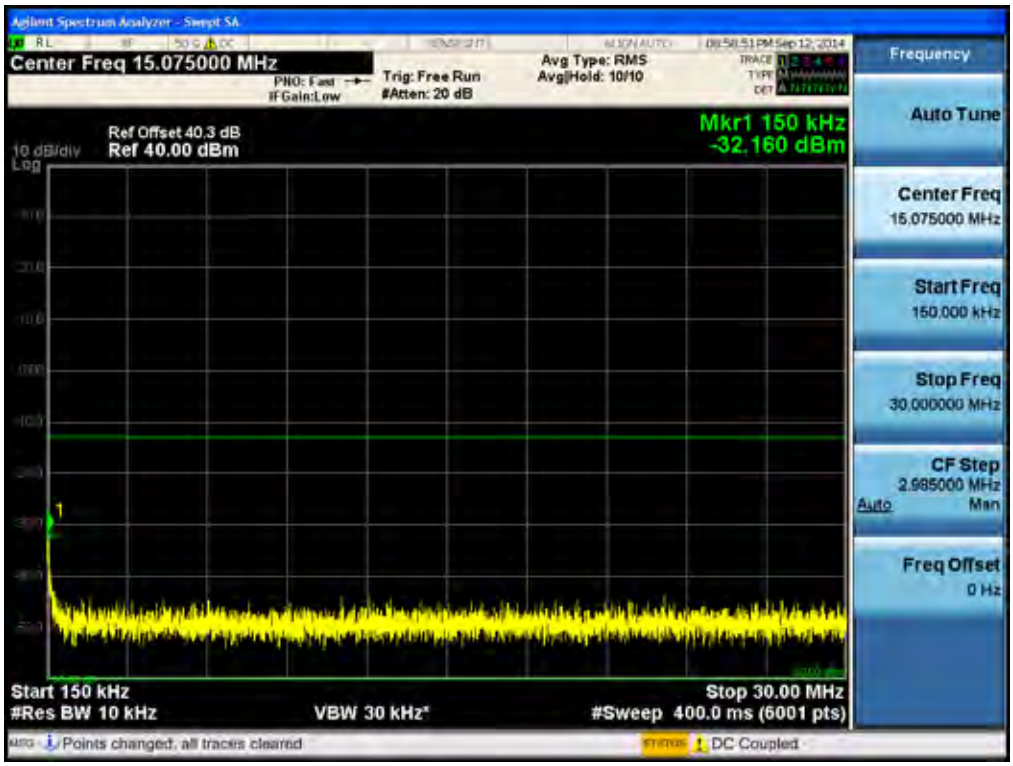
**[Downlink Low]**




**[Downlink Middle]**



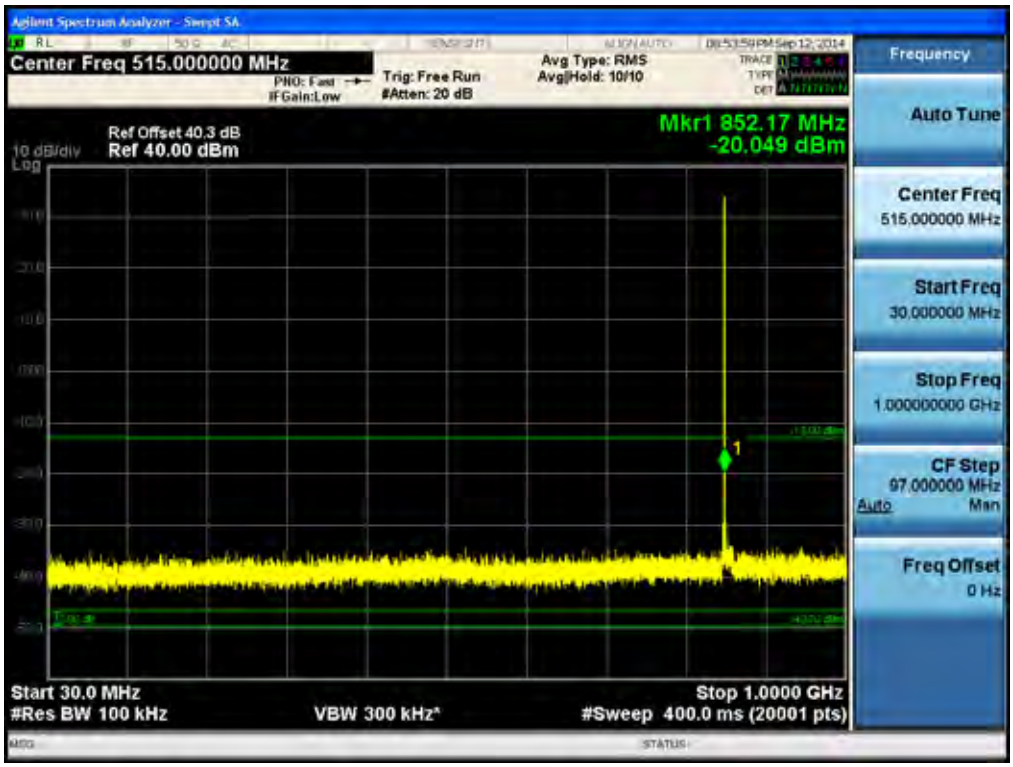
**[Downlink High]**



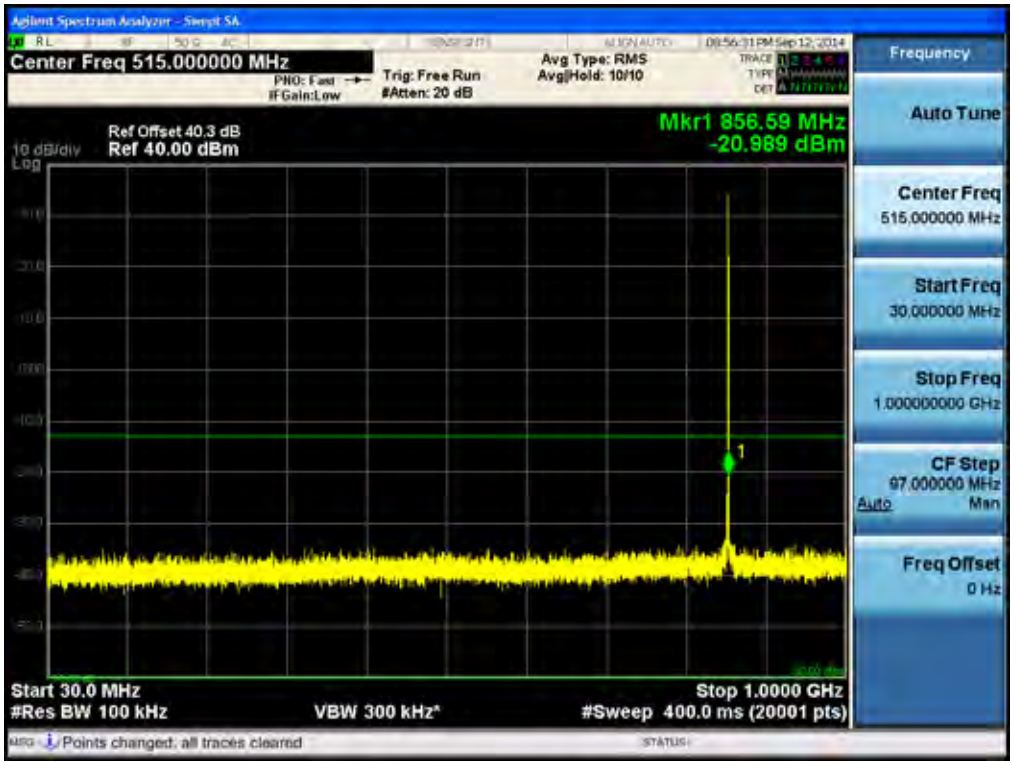
**Conducted Spurious Emissions (30 MHz – 1 GHz)**

## 800 MHz Band

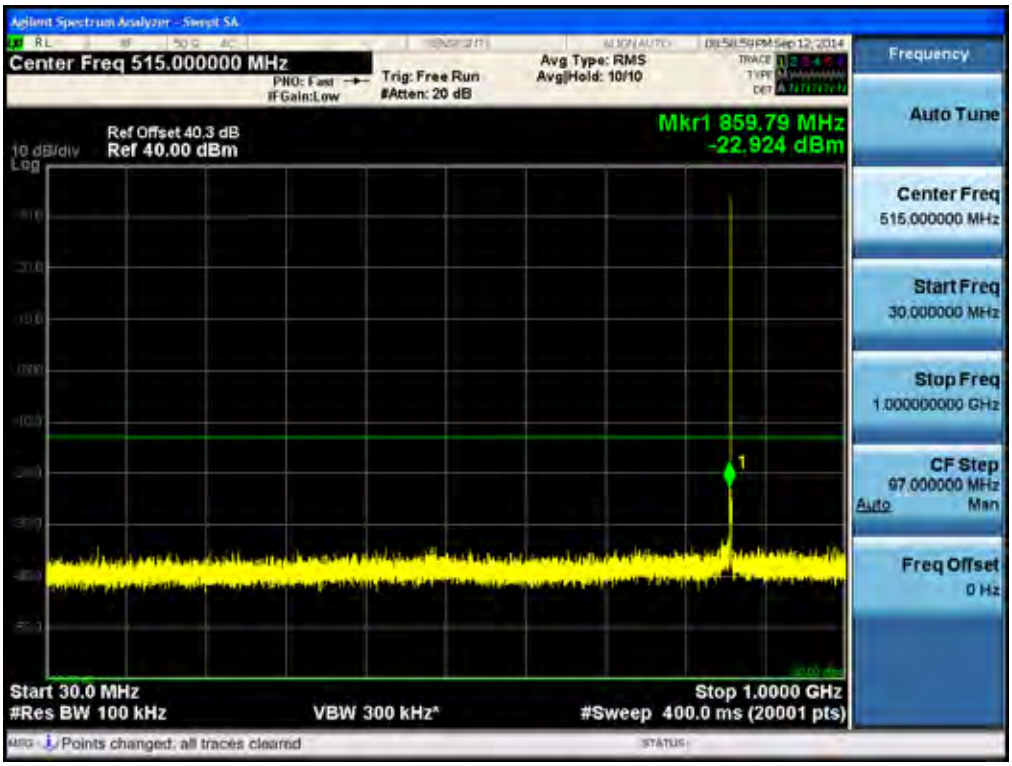
**[Downlink Low]**




**[Downlink Middle]**



**[Downlink High]**

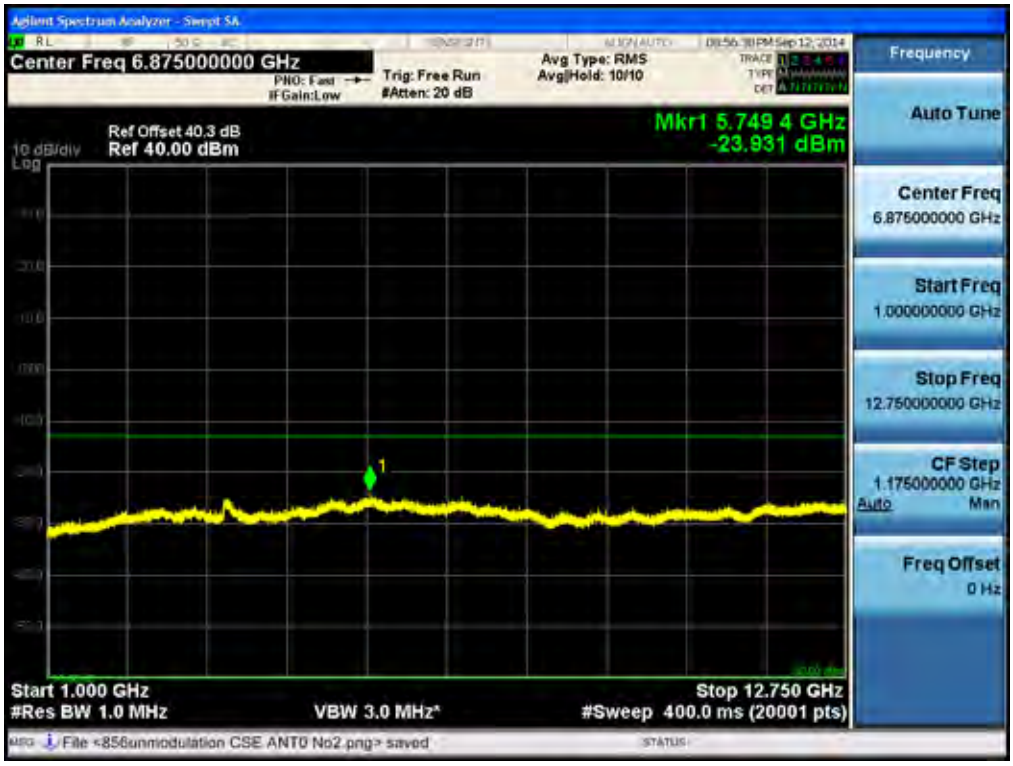


**Conducted Spurious Emissions (1 GHz –12.75 GHz)**

## 800 MHz Band

**[Downlink Low]**


**[Downlink Middle]**



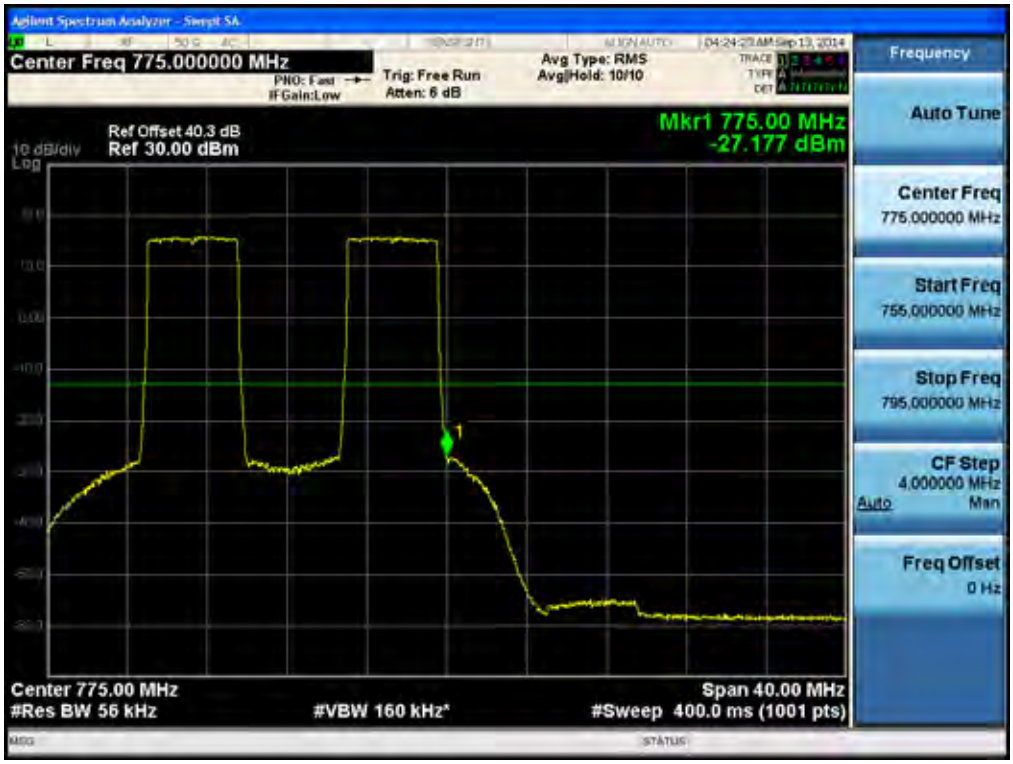
**[Downlink High]**

**Intermodulation Spurious Emissions for FCC**

**700 MHz LTE Band**

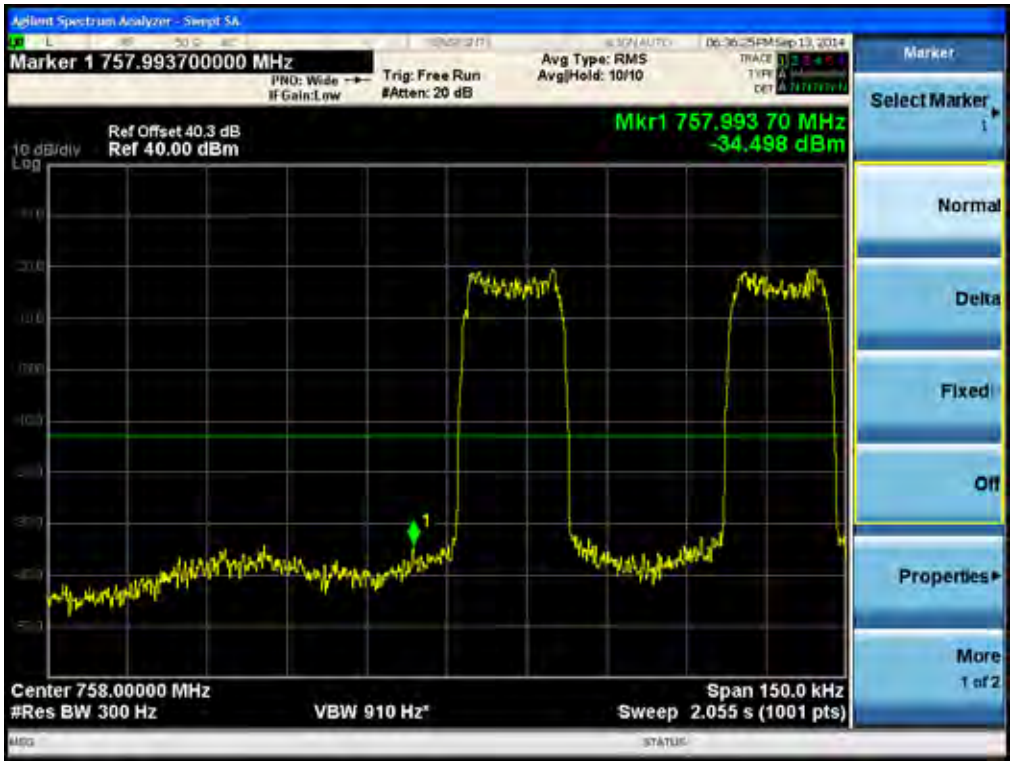
**[LTE Downlink 5 MHz Low]**


**[LTE Downlink 5 MHz High]**

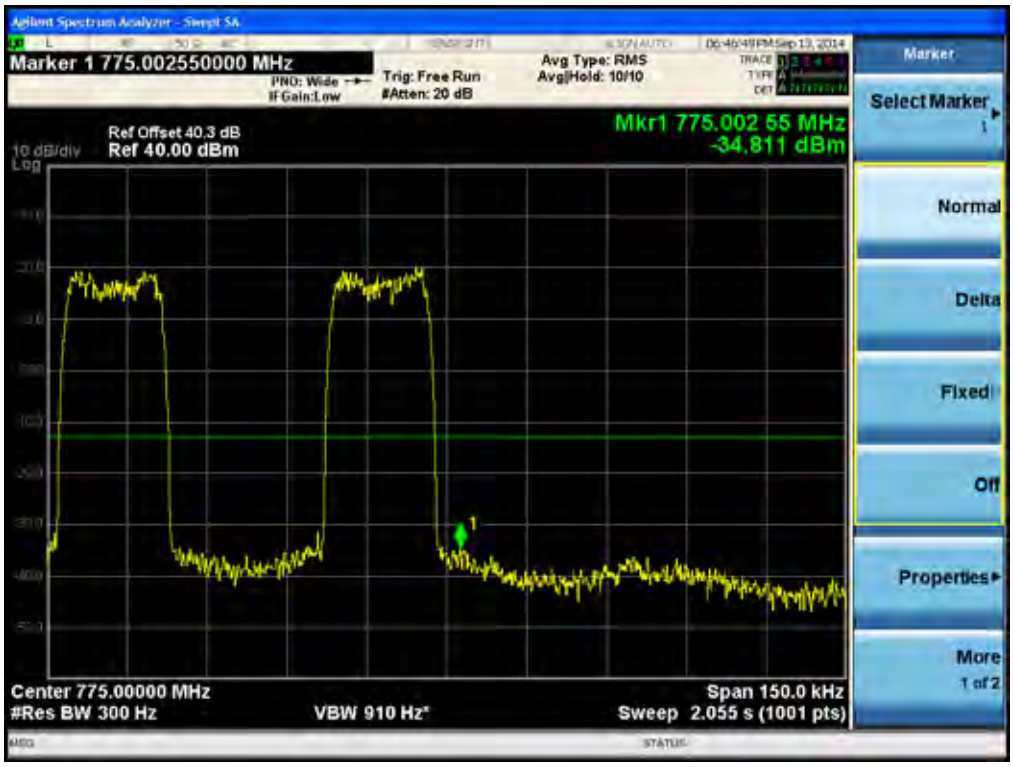


## 700 Band_iDEN

**[700 Band_iDEN Downlink Low]**

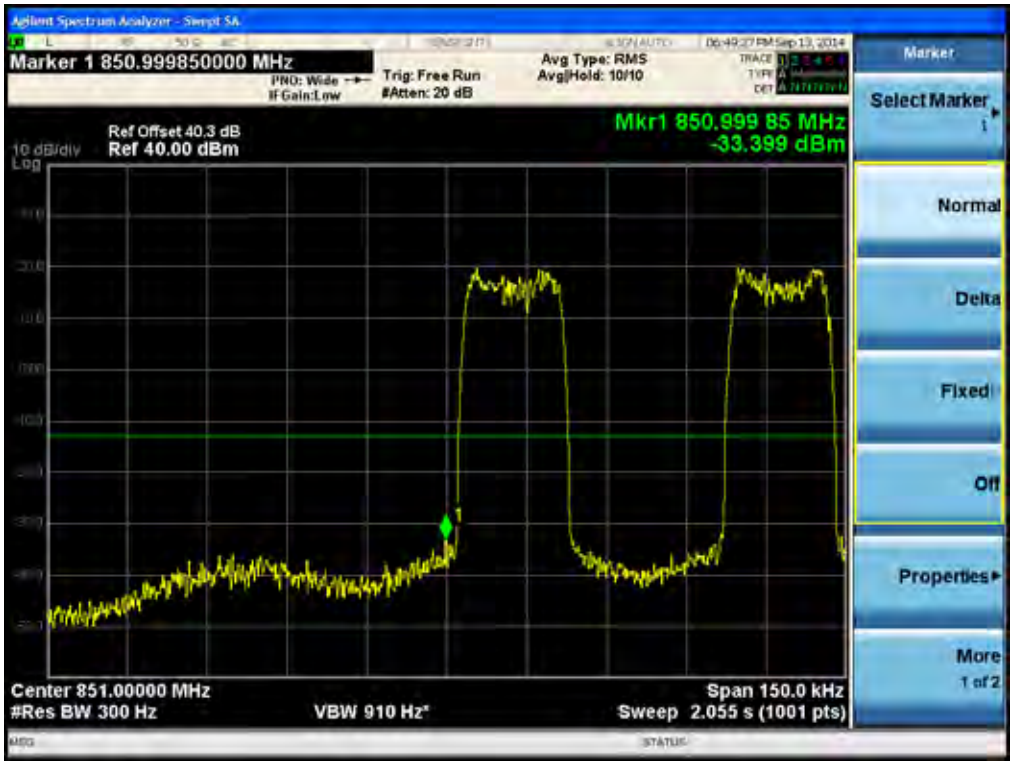



**[700 Band_iDEN Downlink High]**

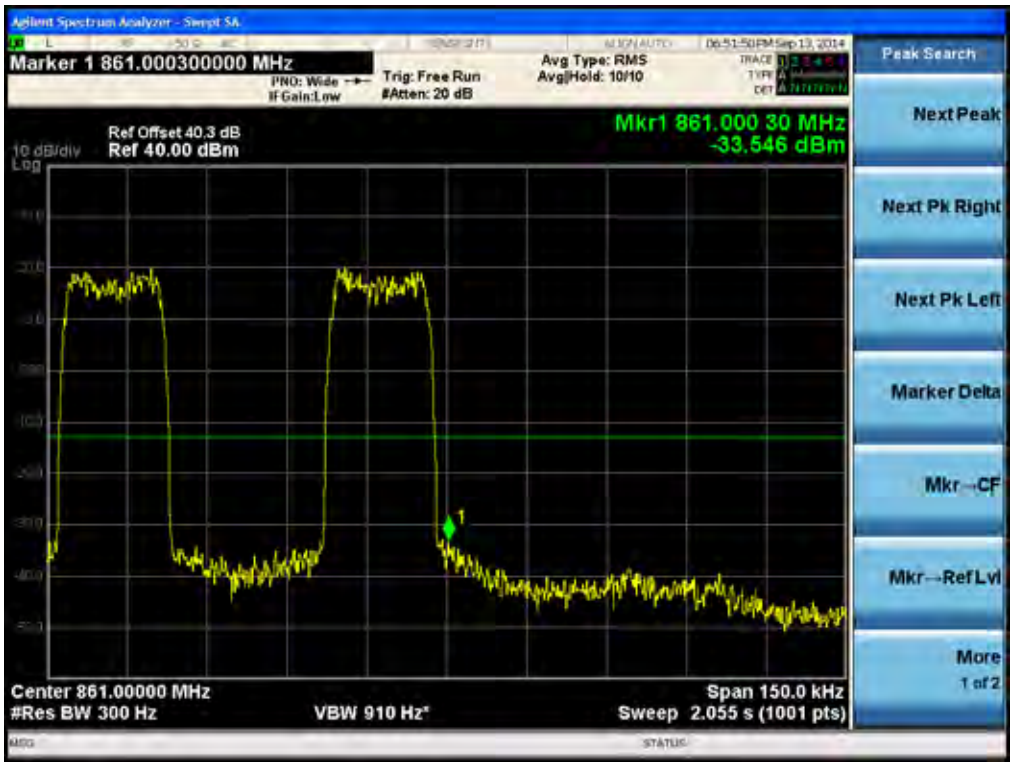


## 800 Band_iDEN

**[800 Band_iDEN Downlink Low]**



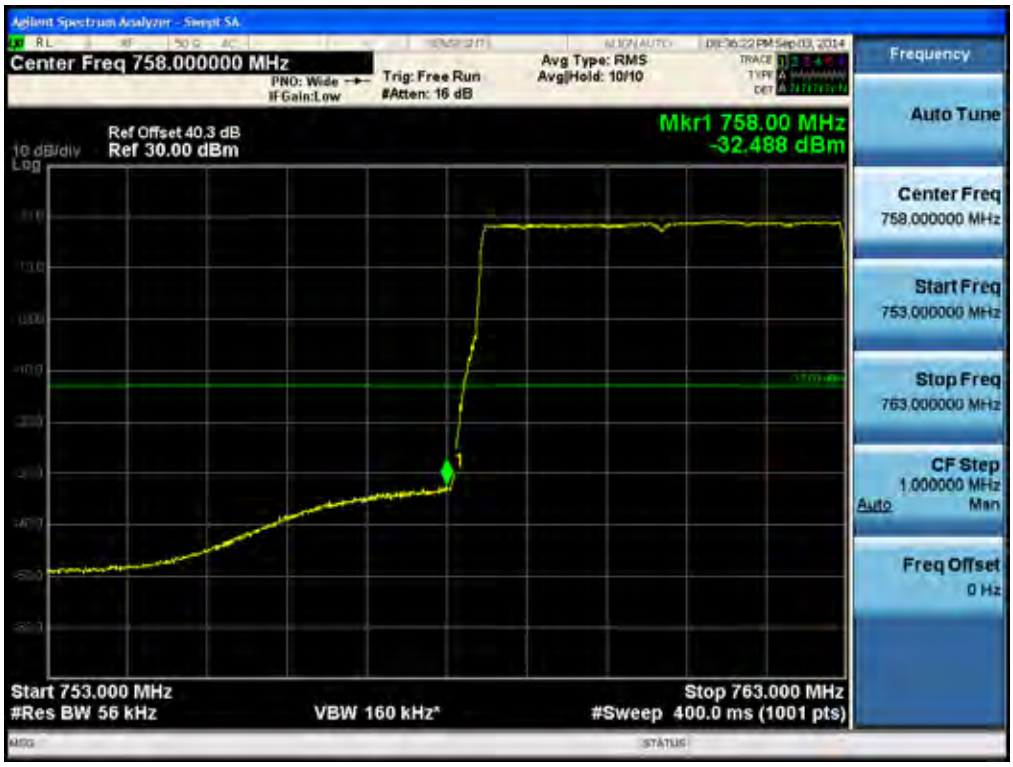

**[800 Band_iDEN Downlink High]**



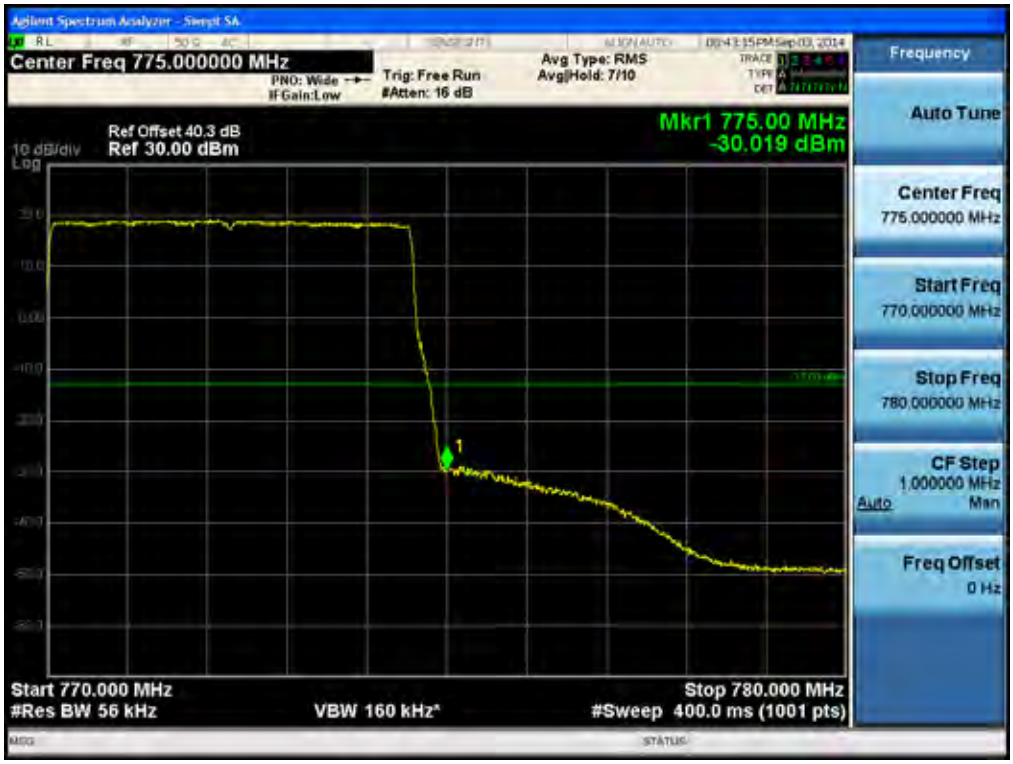
## Single channel Enhancer Band Edge

## 700 MHz LTE Band

**[LTE Downlink 5 MHz Low]**

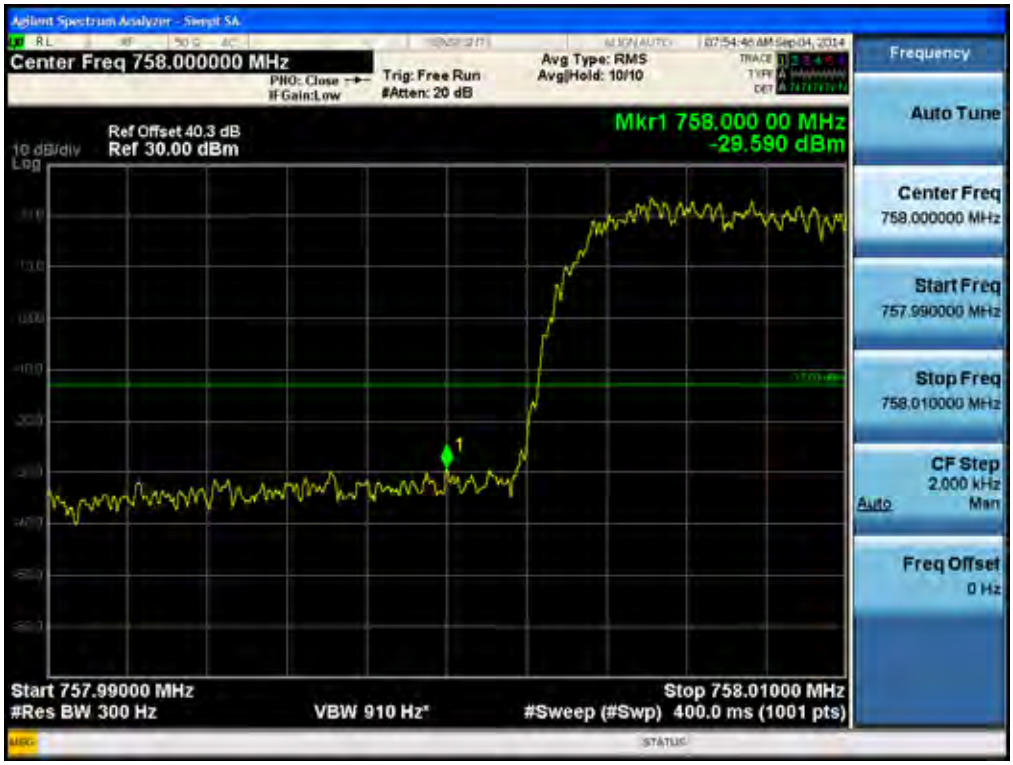



**[LTE Downlink 5 MHz High]**

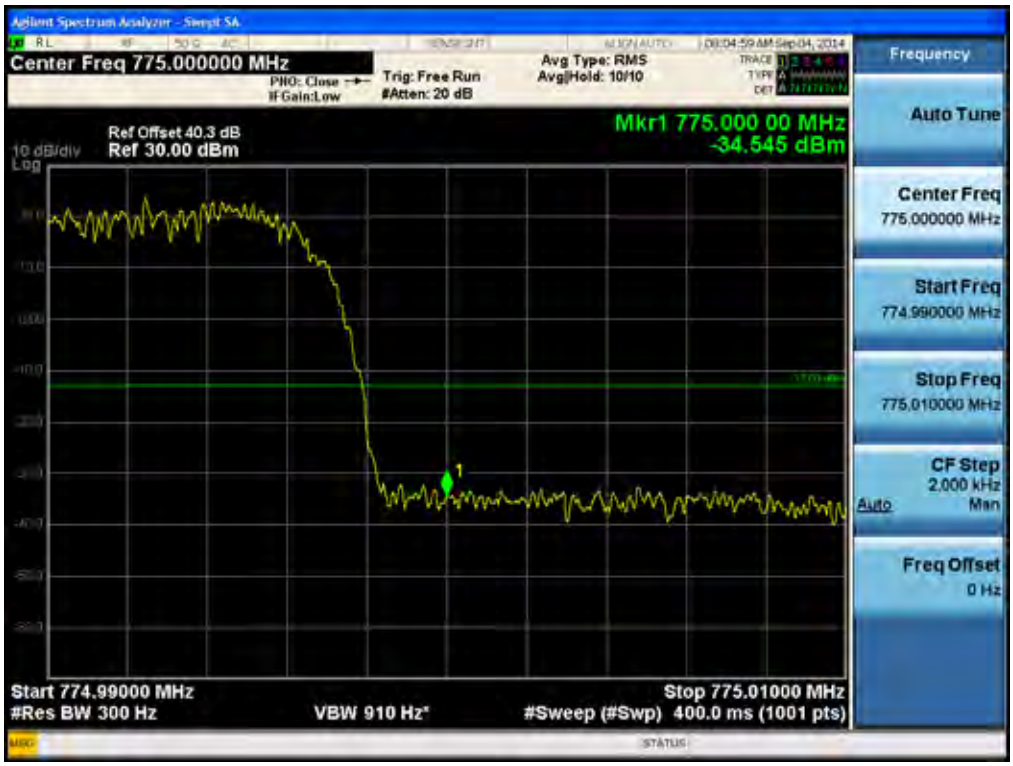


## 700 Band_iDEN

**[700 Band_iDEN Downlink Low]**

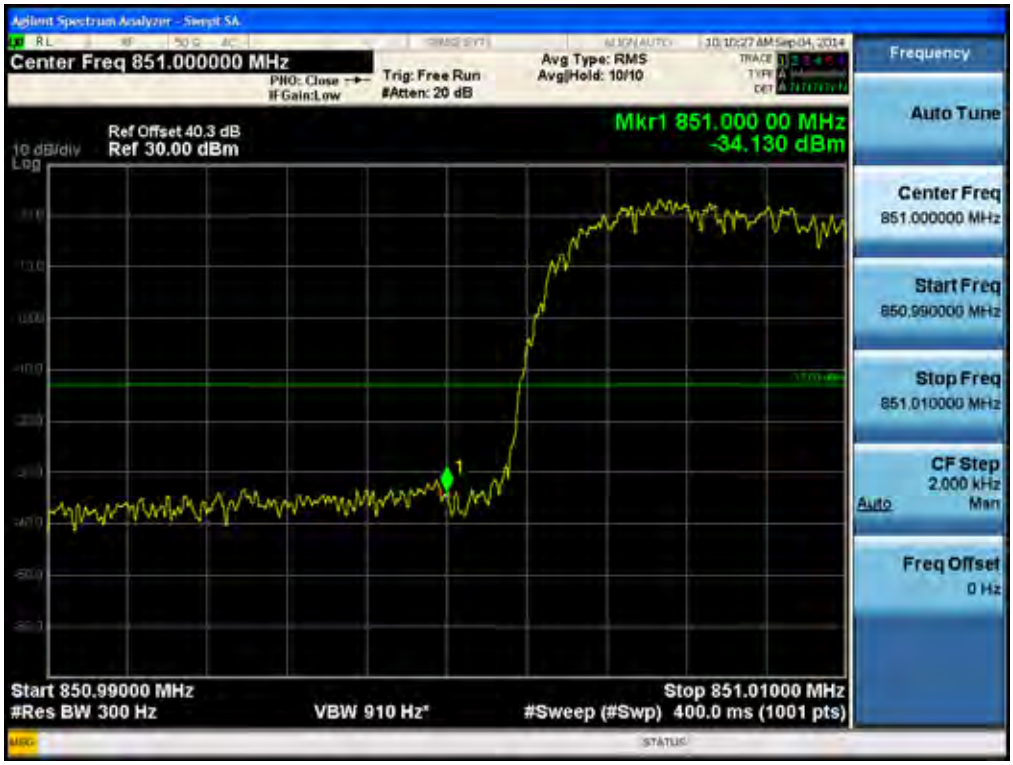



**[700 Band_iDEN Downlink High]**

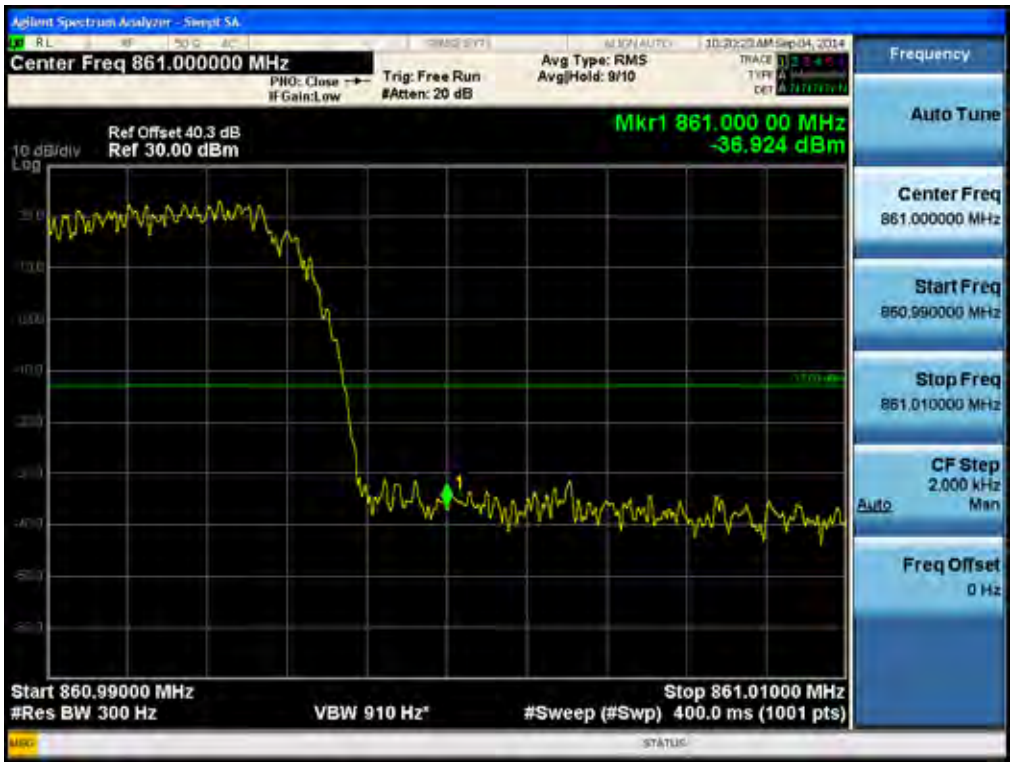


## 800 Band_iDEN

**[800 Band_iDEN Downlink Low]**



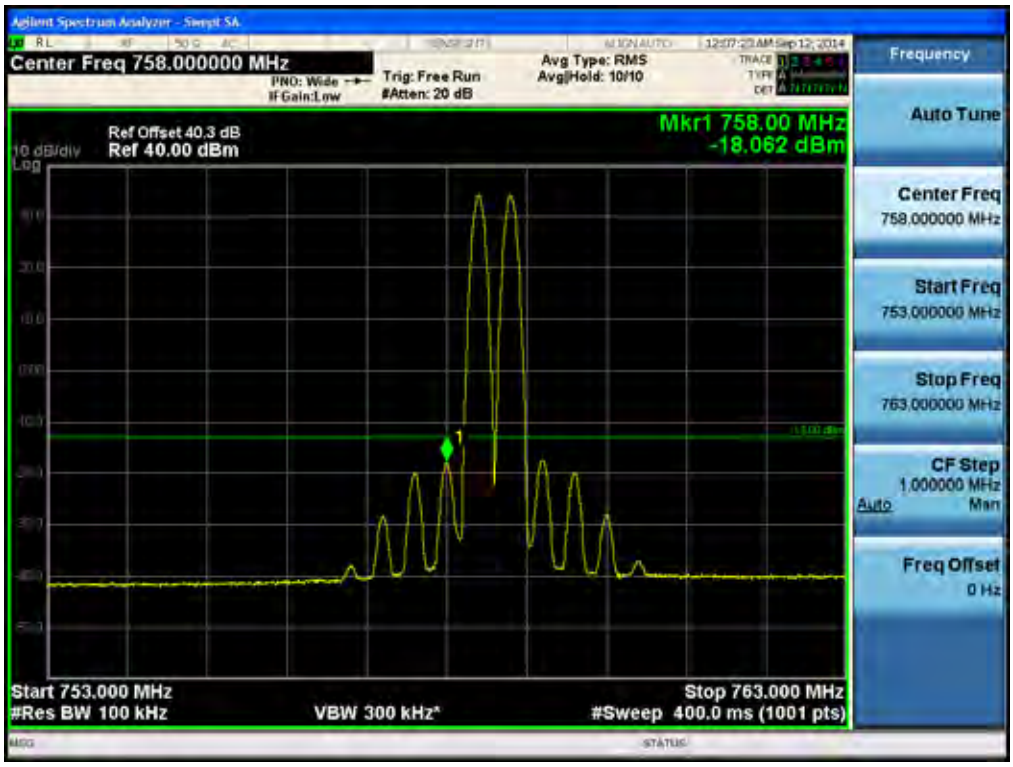

**[800 Band_iDEN Downlink High]**



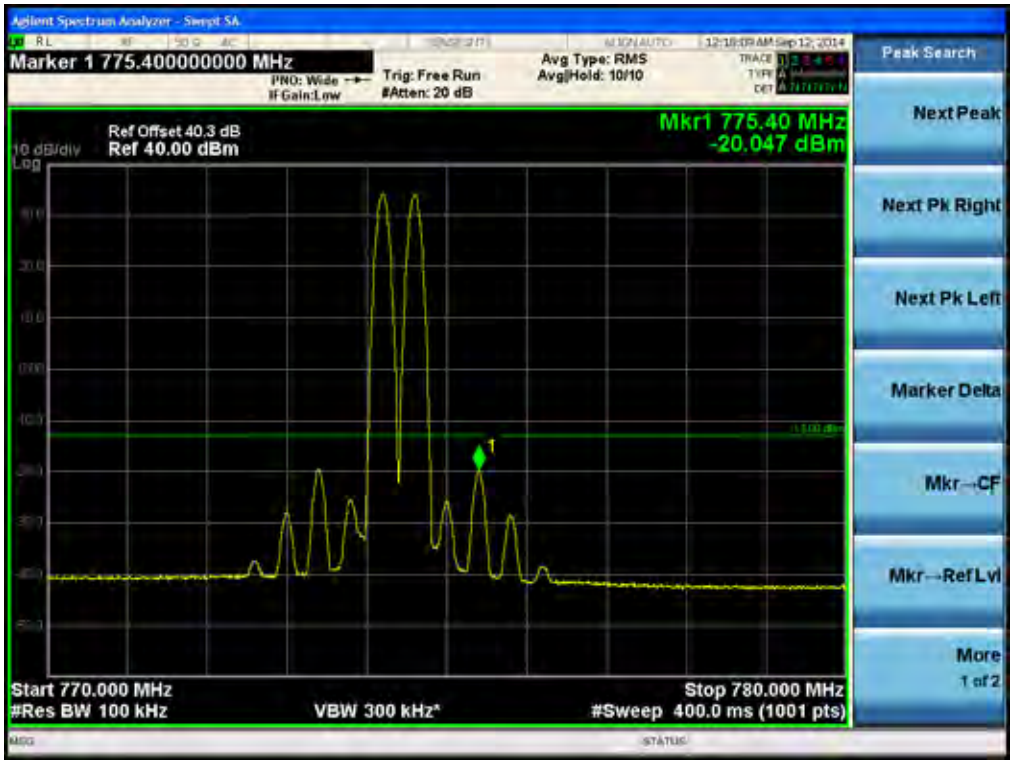
**Multi channel Enhancer Band Edge for IC**

**700 MHz Band**

**[700 MHz Downlink Low]**

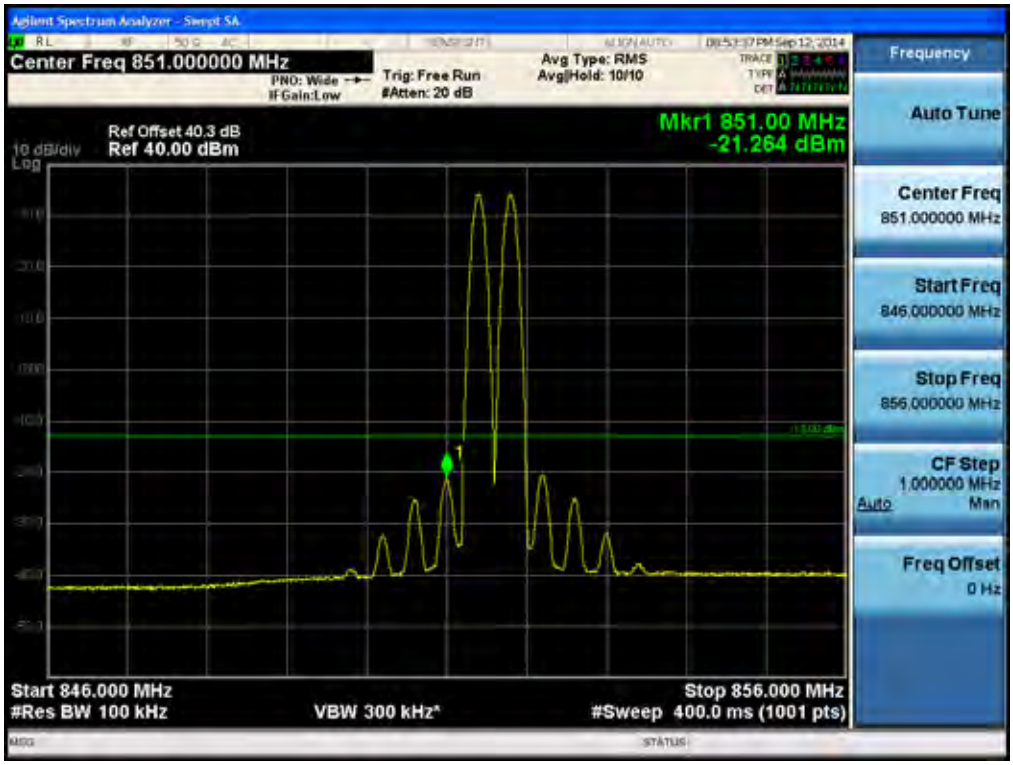



**[700 MHz Downlink High]**

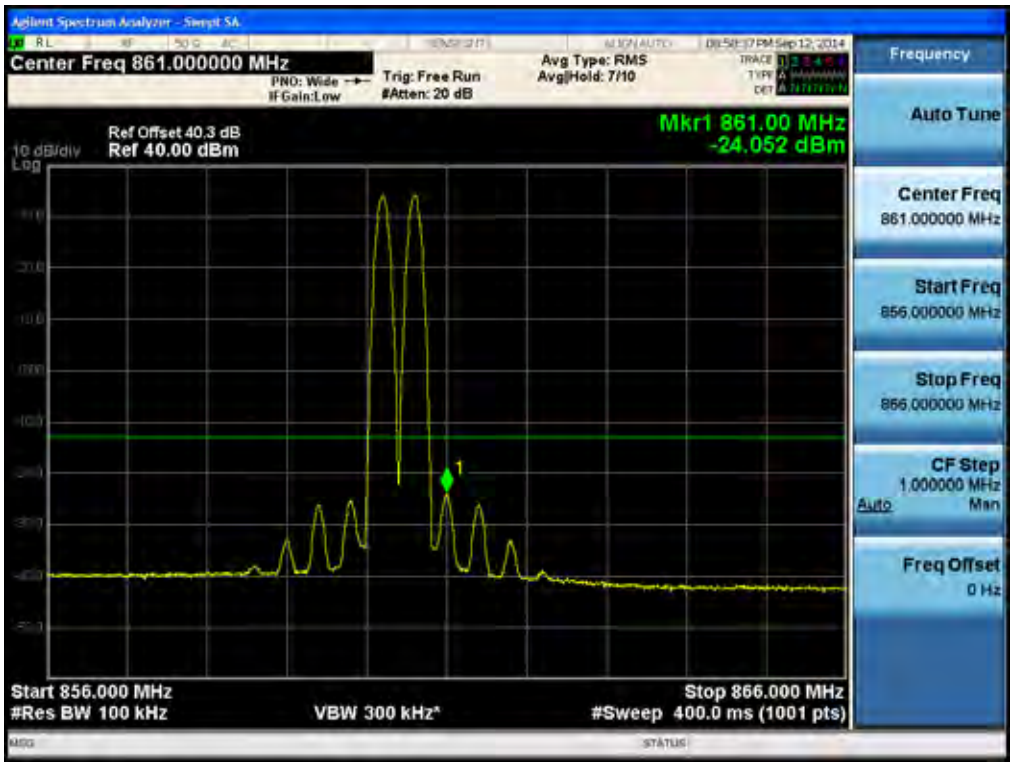


## 800 MHz Band

**[800 MHz Downlink Low]**




**[800 MHz Downlink High]**



# 12. 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**

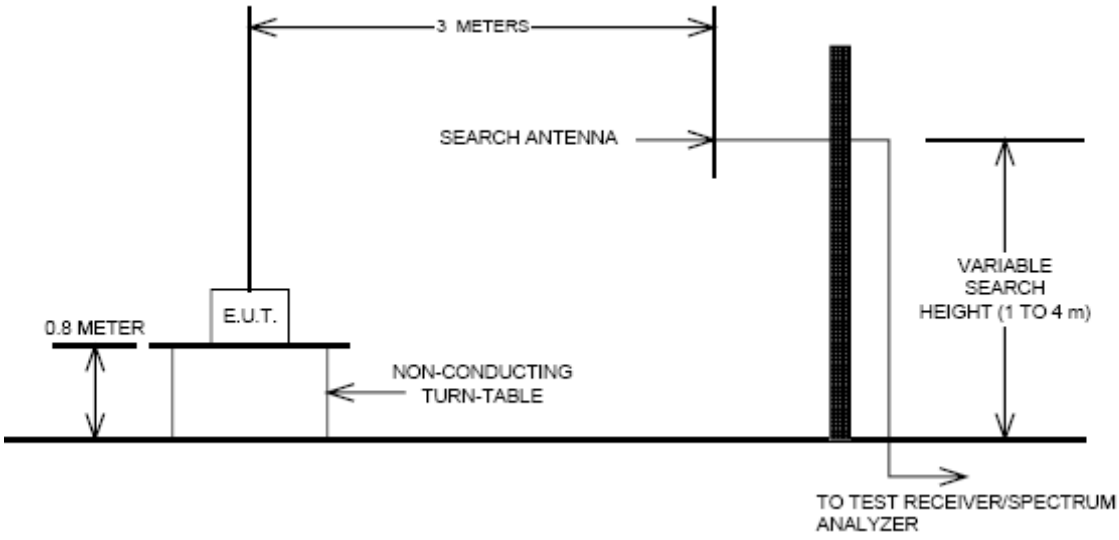
On any frequency outside the operating band, the power of any emission shall be attenuated outside the band below the transmitter power(P) by at least 43 + 10 log (P) dB;

**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 | | | | | | | |

| Voltage supplied to EUT | Tx Freq.(MHz) | Freq.(MHz) | Substitute Level [dBm] | Ant. Gain (dBi) | C.L | Pol. | EIRP (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|
| -48 Vdc | 758.0125 | No Peak Found | | | | | | |
| | 767.9875 | | | | | | | |
| | 774.9875 | | | | | | | |

**800 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 | 851.0125 | No Peak Found | | | | | | |
| | 856.0000 | | | | | | | |
| | 860.9875 | | | | | | | |

| Voltage supplied to EUT | Tx Freq.(MHz) | Freq.(MHz) | Substitute Level [dBm] | Ant. Gain (dBi) | C.L | Pol. | EIRP (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|
| -48 Vdc | 851.0125 | No Peak Found | | | | | | |
| | 856.0000 | | | | | | | |
| | 860.9875 | | | | | | | |

# 13. FREQUENCY STABILITY OVER TEMPERATURE AND VOLTAGE VARIATIONS

**FCC Rules**

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

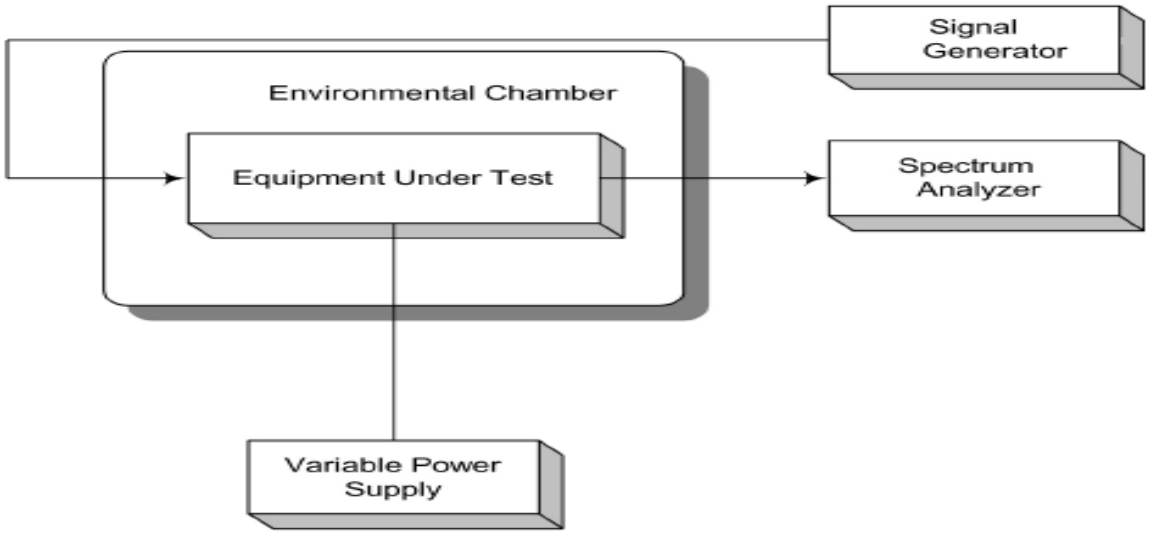
A CW signal was injected into the EUT at the appropriate RF level. The frequency counter option on the Spectrum Analyzer was used to measure frequency deviations.

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 ± 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.

**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.

## AC power. Frequency Stability and Voltage Test Results

**Reference:** 120 Vac at 20°C **Freq.** = 767.9875 MHz

| Voltage (%) | Temp. (°C) | Frequency (Hz) | Frequency Error (Hz) | Deviation (Hz) | ppm |
|---|---|---|---|---|---|
| 100% | +20(Ref) | 767987500. 0 | 0.0 | 0.0 | 0.0000 |
| | -30 | 767987500. 0 | 0.0 | 0.0 | 0.0000 |
| | -20 | 767987500. 0 | 0.0 | 0.0 | 0.0000 |
| | -10 | 767987500. 0 | 0.0 | 0.0 | 0.0000 |
| | 0 | 767987500. 0 | 0.0 | 0.0 | 0.0000 |
| | +10 | 767987500. 0 | 0.0 | 0.0 | 0.0000 |
| | +30 | 767987500. 0 | 0.0 | 0.0 | 0.0000 |
| | +40 | 767987500. 0 | 0.0 | 0.0 | 0.0000 |
| | +50 | 767987500. 0 | 0.0 | 0.0 | 0.0000 |
| 115% | +20 | 767987500. 0 | 0.0 | 0.0 | 0.0000 |
| 85% | +20 | 767987500. 0 | 0.0 | 0.0 | 0.0000 |

[Downlink]

**Reference:** 120 Vac at 20°C **Freq.** = 856.0000 MHz

| Voltage (%) | Temp. (°C) | Frequency (Hz) | Frequency Error (Hz) | Deviation (Hz) | ppm |
|---|---|---|---|---|---|
| 100% | +20(Ref) | 856000000. 0 | 0.0 | 0.0 | 0.0000 |
| | -30 | 856000000. 0 | 0.0 | 0.0 | 0.0000 |
| | -20 | 856000000. 0 | 0.0 | 0.0 | 0.0000 |
| | -10 | 856000000. 0 | 0.0 | 0.0 | 0.0000 |
| | 0 | 856000000. 0 | 0.0 | 0.0 | 0.0000 |
| | +10 | 856000000. 0 | 0.0 | 0.0 | 0.0000 |
| | +30 | 856000000. 0 | 0.0 | 0.0 | 0.0000 |
| | +40 | 856000000. 0 | 0.0 | 0.0 | 0.0000 |
| | +50 | 856000000. 0 | 0.0 | 0.0 | 0.0000 |
| 115% | +20 | 856000000. 0 | 0.0 | 0.0 | 0.0000 |
| 85% | +20 | 856000000. 0 | 0.0 | 0.0 | 0.0000 |

[Downlink]

## DC power. Frequency Stability and Voltage Test Results

**Reference:** -48 Vdc at 20°C **Freq.** = 767.9875 MHz

| Voltage (%) | Temp. (°C) | Frequency (Hz) | Frequency Error (Hz) | Deviation (Hz) | ppm |
|---|---|---|---|---|---|
| 100% | +20(Ref) | 767987500. 0 | 0.0 | 0.0 | 0.0000 |
| | -30 | 767987500. 0 | 0.0 | 0.0 | 0.0000 |
| | -20 | 767987500. 0 | 0.0 | 0.0 | 0.0000 |
| | -10 | 767987500. 0 | 0.0 | 0.0 | 0.0000 |
| | 0 | 767987500. 0 | 0.0 | 0.0 | 0.0000 |
| | +10 | 767987500. 0 | 0.0 | 0.0 | 0.0000 |
| | +30 | 767987500. 0 | 0.0 | 0.0 | 0.0000 |
| | +40 | 767987500. 0 | 0.0 | 0.0 | 0.0000 |
| | +50 | 767987500. 0 | 0.0 | 0.0 | 0.0000 |
| 115% | +20 | 767987500. 0 | 0.0 | 0.0 | 0.0000 |
| 85% | +20 | 767987500. 0 | 0.0 | 0.0 | 0.0000 |

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**Reference:** -48 Vdc at 20°C **Freq.** = 856.0000 MHz

| Voltage (%) | Temp. (°C) | Frequency (Hz) | Frequency Error (Hz) | Deviation (Hz) | ppm |
|---|---|---|---|---|---|
| 100% | +20(Ref) | 856000000. 0 | 0.0 | 0.0 | 0.0000 |
| | -30 | 856000000. 0 | 0.0 | 0.0 | 0.0000 |
| | -20 | 856000000. 0 | 0.0 | 0.0 | 0.0000 |
| | -10 | 856000000. 0 | 0.0 | 0.0 | 0.0000 |
| | 0 | 856000000. 0 | 0.0 | 0.0 | 0.0000 |
| | +10 | 856000000. 0 | 0.0 | 0.0 | 0.0000 |
| | +30 | 856000000. 0 | 0.0 | 0.0 | 0.0000 |
| | +40 | 856000000. 0 | 0.0 | 0.0 | 0.0000 |
| | +50 | 856000000. 0 | 0.0 | 0.0 | 0.0000 |
| 115% | +20 | 856000000. 0 | 0.0 | 0.0 | 0.0000 |
| 85% | +20 | 856000000. 0 | 0.0 | 0.0 | 0.0000 |

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