

REPORT

FCC Certification

Applicant Name:

ADRF Korea, inc

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

January 27, 5015

Test Site/Location:HCT CO., LTD., 74, Seoicheon-ro 578beon-gil,
Majang-myeon, Icheon-si, Gyeonggi-do, Korea**Report No.:** HCT-R-1501-F060**HCT FRN:** 0005866421**FCC ID:****N52-ADX-R-BT****APPLICANT:****ADRF Korea, inc****FCC Model(s):**

ADX-R-BT

EUT Type:

DAS(Distributed Antenna System)

Frequency Ranges:

2496.0 MHz ~ 2690.0 MHz

Conducted Output Power:

5 W (37 dBm)

Date of Test :December 18, 2014 ~ December 23, 2014
Radiated spurious emissions: January 18, 2015**FCC Rules Part(s):**

CFR 47, Part 27

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 27 of the FCC Rules under normal use and maintenance.

**Report prepared by****: Yong Hyun Lee****Test engineer of RF Team****Approved by****: Kyoung Houn Seo****Manager of RF Team**

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Version

| TEST REPORT NO. | DATE | DESCRIPTION |
|-----------------|------------------|-------------------------|
| HCT-R-1501-F060 | January 27, 2015 | - First Approval Report |
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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-BT
- **APPLICANT:** ADRF Korea, inc
- **EUT Type:** DAS(Distributed Antenna System)
- **Model:** ADX-R-BT
- **Frequency Ranges:** 2496.0 MHz ~ 2690.0 MHz
- **Conducted Output Power:** 5 W (37 dBm)
- **Antenna Gain(s) :** 3 dBi.
- **FCC Rules Part(s):** CFR Title 47 Part 27
- **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 Part 27.

| Description | Reference (FCC) | Results |
|---|-----------------------|-----------|
| Conducted RF Output Power | §2.1046; §27.50 | Compliant |
| Occupied Bandwidth | §2.1049 | Compliant |
| Out of Band Rejection | KDB 935210 D03 v02r01 | Compliant |
| Spurious Emissions at Antenna Terminals | §2.1051, §27.53 | Compliant |
| Radiated Spurious Emissions | §2.1053, §27.53 | Compliant |
| Frequency Stability | §2.1055, §27.54 | 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 item & Modulation

| Item | Modulation |
|---|----------------|
| Conducted RF Output Power | TD-LTE(20 MHz) |
| Occupied Bandwidth | TD-LTE(20 MHz) |
| Out of Band Rejection | Sinusoidal |
| Spurious Emissions at Antenna Terminals | FD-LTE(20 MHz) |
| Radiated Spurious Emissions | Sinusoidal |
| Frequency Stability | Sinusoidal |

4. STANDARDS ENVIRONMENTAL TEST CONDITIONS

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

5. TEST EQUIPMENT

| Manufacturer | Model / Equipment | Cal Interval | Calibration Date | Serial No. |
|--------------------|---|--------------|------------------|----------------|
| Agilent | E4438C /Signal Generator | Annual | 09/11/2014 | MY42082646 |
| Agilent | N5182A /Signal Generator | Annual | 05/22/2014 | MY47070230 |
| Agilent | N1911A /Power Meter | Annual | 01/24/2014 | MY45100523 |
| Agilent | N1921A/ Power Sensor | Annual | 07/09/2014 | MY45241059 |
| NANGYEUL CO., LTD. | NY-THR18750/ Temperature and Humidity Chamber | Annual | 10/29/2014 | NY-2009012201A |
| Agilent | N9020A /Signal Analyzer | Annual | 04/16/2014 | US46220219 |
| WEINSCHHEL | 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.

§ 27.50 Power limits and duty cycle.

(h) The following power limits shall apply in the BRS and EBS:

(1) Main, booster and base stations.

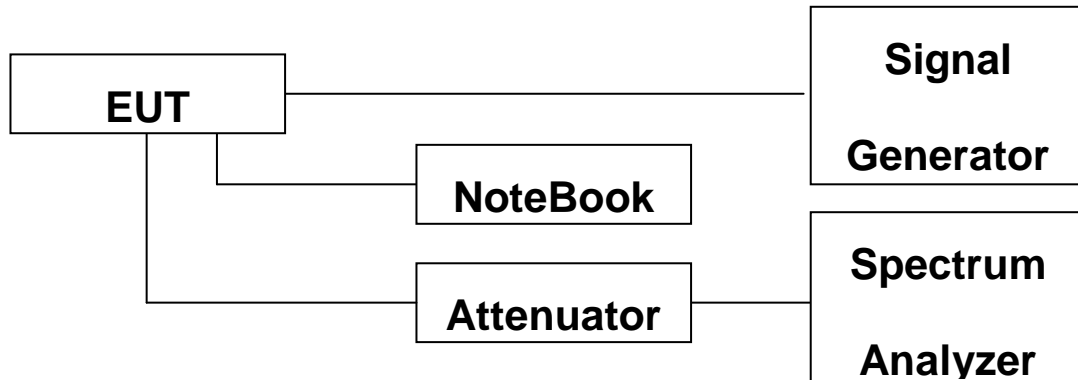
(i) The maximum EIRP of a main, booster or base station shall not exceed 33 dBW $10\log(X/Y)$ dBW, where X is the actual channel width in MHz and Y is either 6 MHz if prior to transition or the station is in the MBS following transition or 5.5 MHz if the station is in the LBS and UBS following transition, except as provided in paragraph (h)(1)(ii) of this section.

(ii) If a main or booster station sectorizes or otherwise uses one or more transmitting antennas with a non-omnidirectional horizontal plane radiation pattern, the maximum EIRP in dBW in a given direction shall be determined by the following formula: $EIRP = 33 \text{ dBW} + 10 \log(X/Y) \text{ dBW} + 10 \log(360/\text{beamwidth}) \text{ dBW}$, where X is the actual channel width in MHz, Y is either (i) 6 MHz if prior to transition or the station is in the MBS following transition or (ii) 5.5 MHz if the station is in the LBS and UBS following transition, and beamwidth is the total horizontal plane beamwidth of the individual

transmitting antenna for the station or any sector measured at the half-power points.

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 |
|---------------|-------------------|------------------|
| TD-LTE 20 MHz | DL : -23 dBm | DL : 60 dB |
| | UL : -46 dBm | DL : 38 dB |

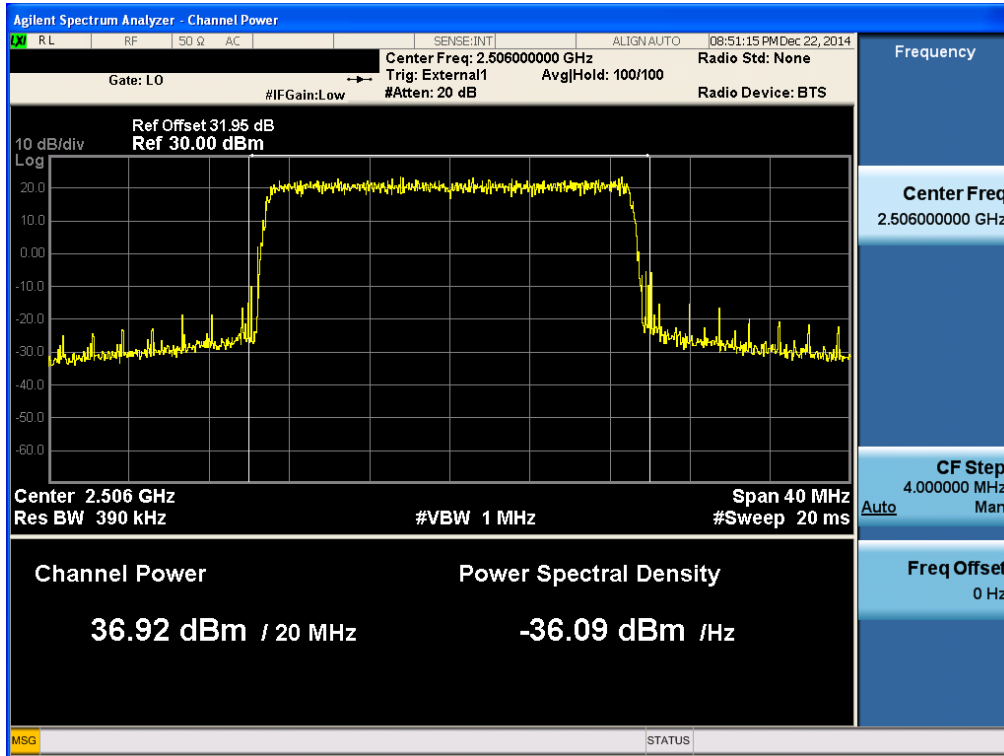
[Downlink]

| | Channel | Frequency (MHz) | Output Power | |
|------------|---------|-----------------|--------------|-------|
| | | | (dBm) | (W) |
| LTE 20 MHz | Low | 2506.0 | 36.92 | 4.920 |
| | Middle | 2593.0 | 36.94 | 4.944 |
| | High | 2680.0 | 36.91 | 4.905 |

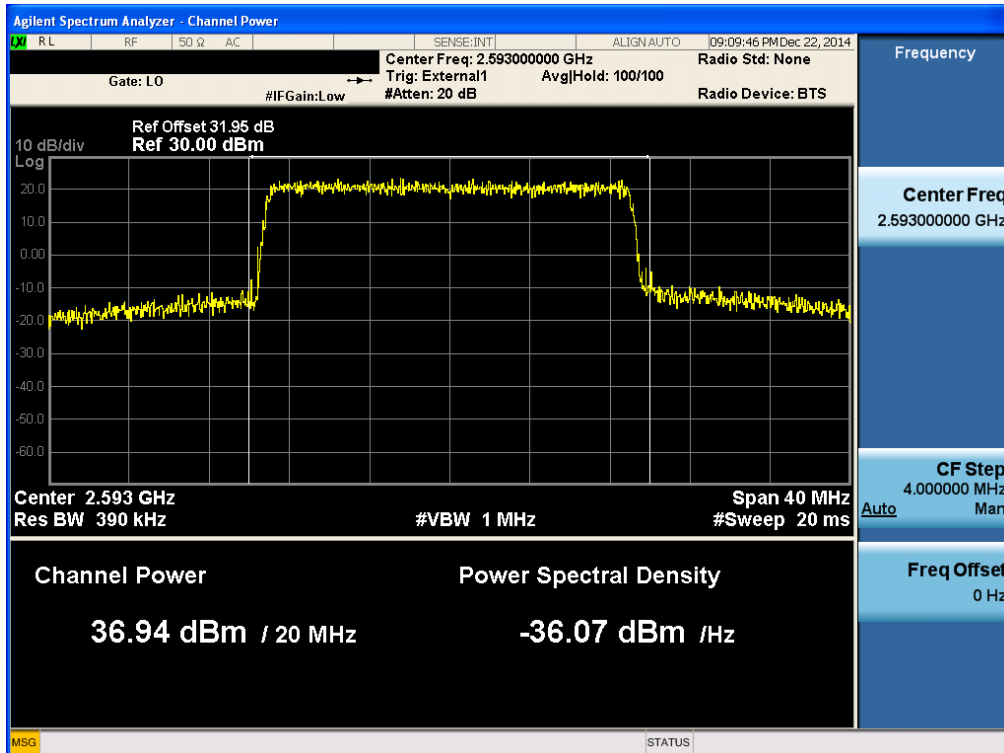
[Uplink]

| | Channel | Frequency (MHz) | Output Power | |
|---------------|---------|--------------------|--------------|-------|
| | | | (dBm) | (mW) |
| LTE 20 MHz | Low | 2506.0 | -8.10 | 0.155 |
| | Middle | 2593.0 | -8.02 | 0.158 |
| | High | 2680.0 | -8.07 | 0.156 |

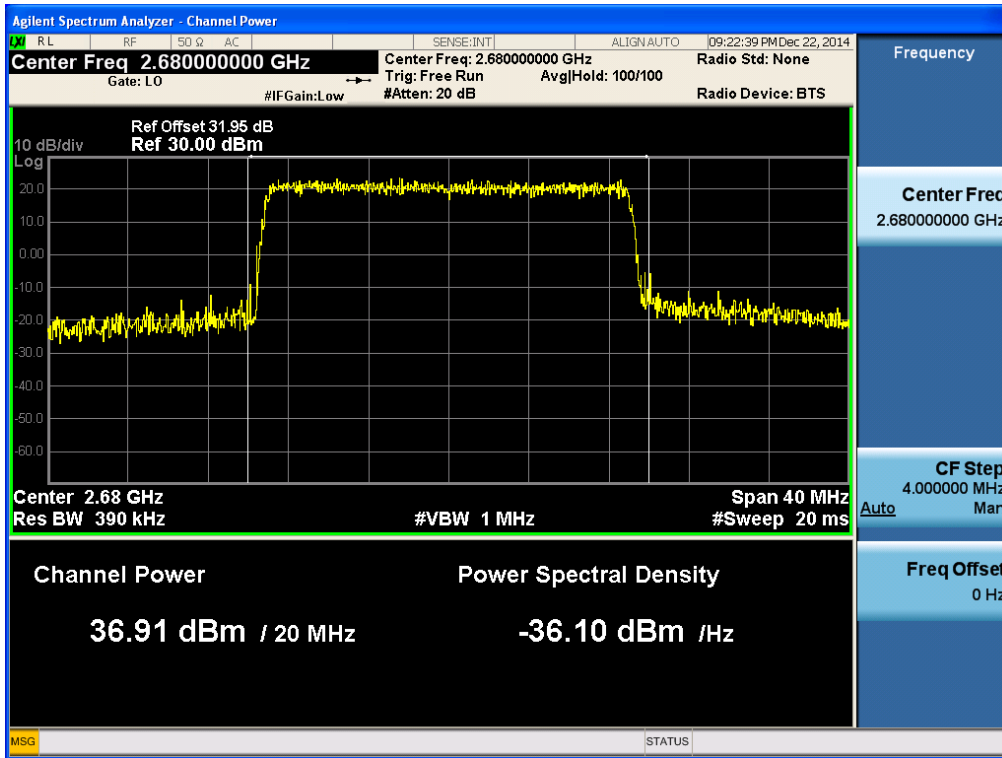
**Plots of RF Output Power [Downlink]
[LTE Downlink 20 MHz Low]**



[LTE Downlink 20 MHz Middle]

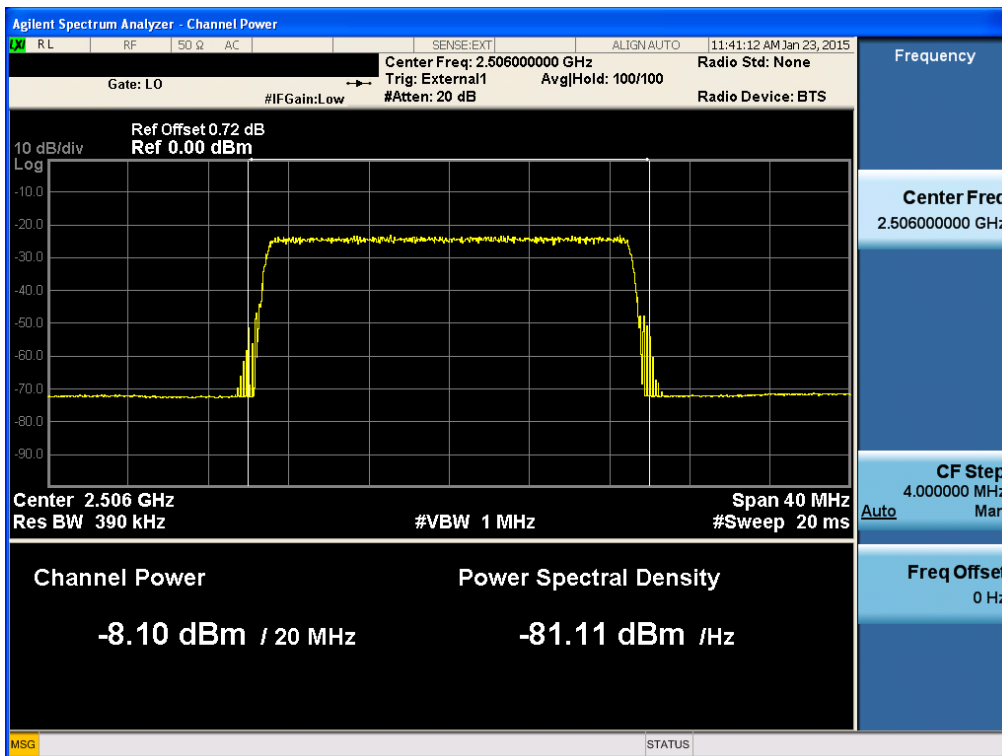


[LTE Downlink 20 MHz High]

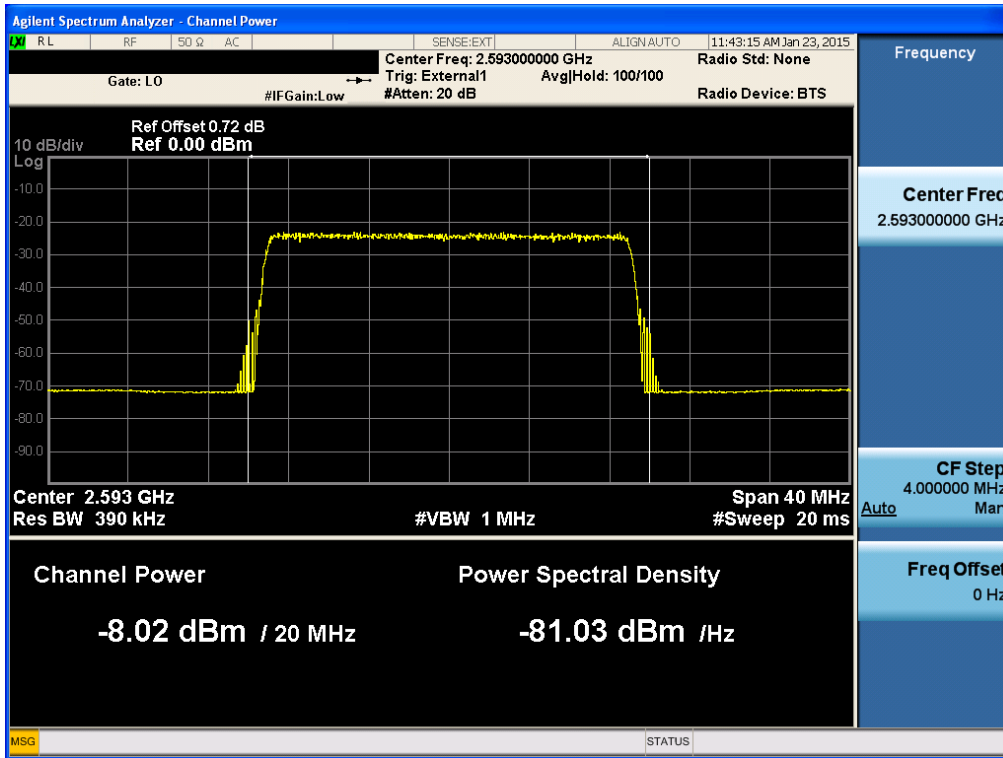


Plots of RF Output Power [Uplink]

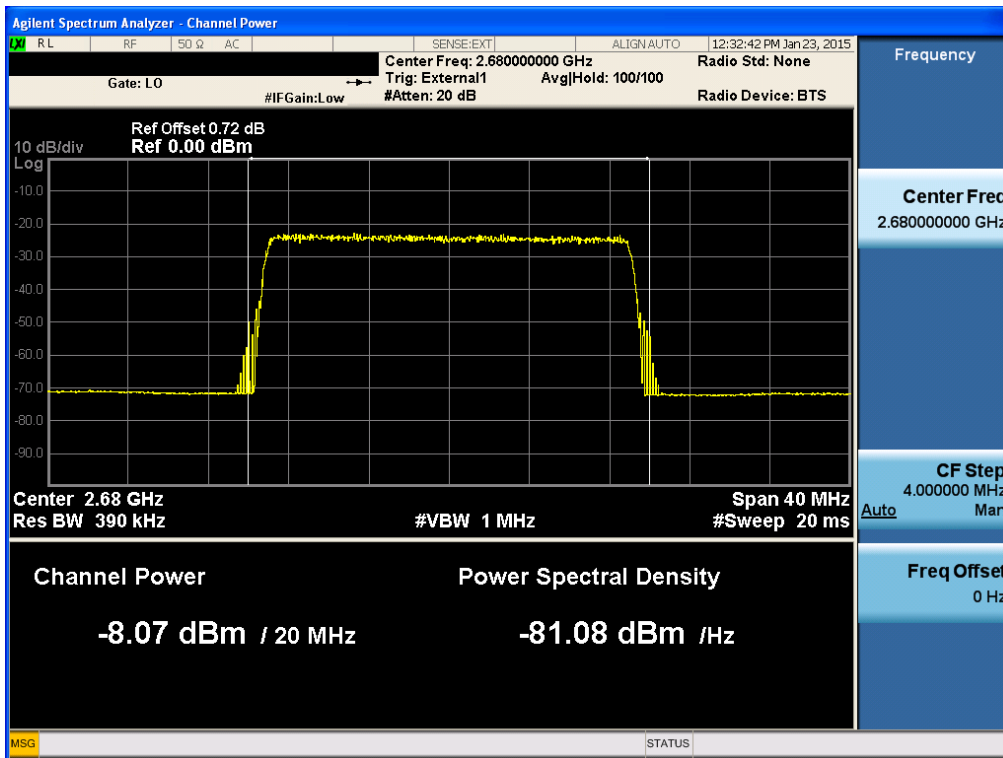
[LTE Uplink 20 MHz Low]



[LTE Uplink 20 MHz Middle]



[LTE Uplink 20 MHz High]



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 |
|---------------|-------------------|------------------|
| TD-LTE 20 MHz | DL : -23 dBm | DL : 60 dB |
| | UL : -46 dBm | DL : 38 dB |

[Downlink Output]

| | Channel | Frequency (MHz) | OBW (MHz) |
|---------------|---------|-----------------|-----------|
| LTE 20 MHz | Low | 2506.0 | 17.959 |
| | Middle | 2593.0 | 17.951 |
| | High | 2680.0 | 17.960 |

[Downlink Input]

| | Channel | Frequency (MHz) | OBW (MHz) |
|---------------|----------------|------------------------|------------------|
| LTE 20 MHz | Low | 2506.0 | 17.977 |
| | Middle | 2593.0 | 17.985 |
| | High | 2680.0 | 17.980 |

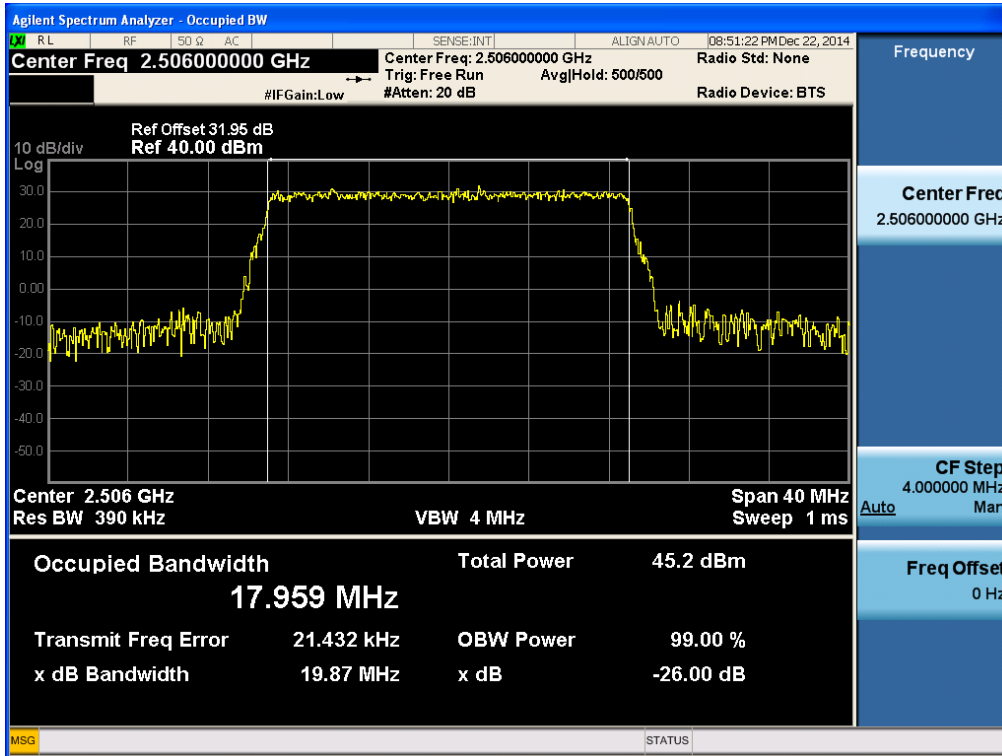
[Uplink Output]

| | Channel | Frequency (MHz) | OBW (MHz) |
|---------------|----------------|------------------------|------------------|
| LTE 20 MHz | Low | 2506.0 | 17.998 |
| | Middle | 2593.0 | 17.978 |
| | High | 2680.0 | 17.975 |

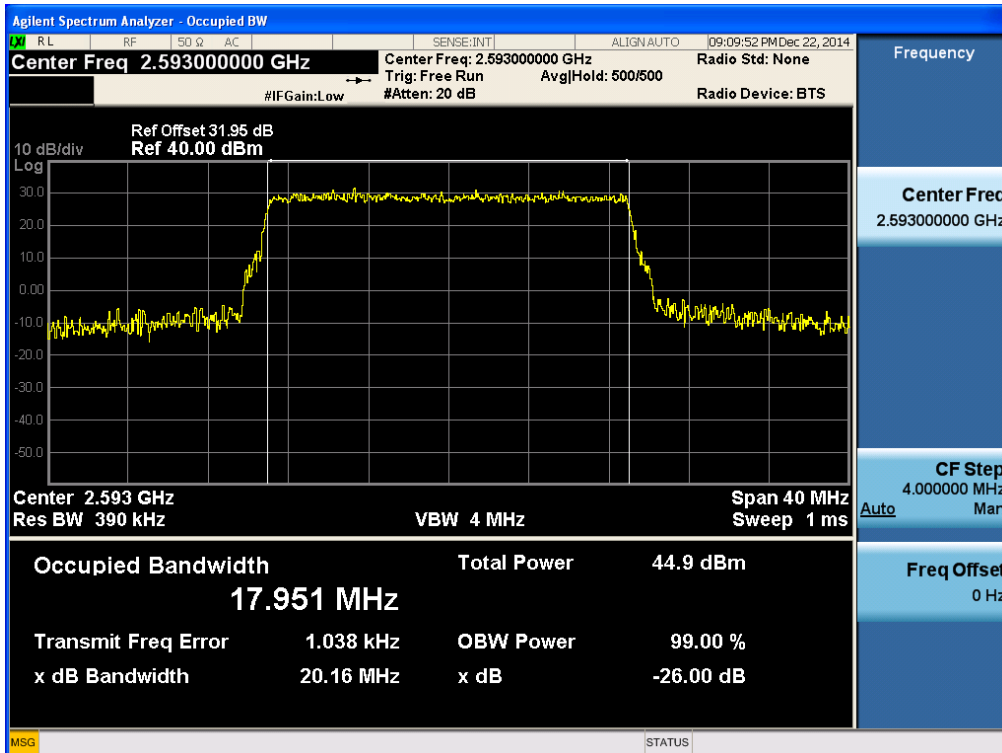
[Uplink Input]

| | Channel | Frequency (MHz) | OBW (MHz) |
|---------------|----------------|------------------------|------------------|
| LTE 20 MHz | Low | 2506.0 | 17.970 |
| | Middle | 2593.0 | 17.984 |
| | High | 2680.0 | 18.026 |

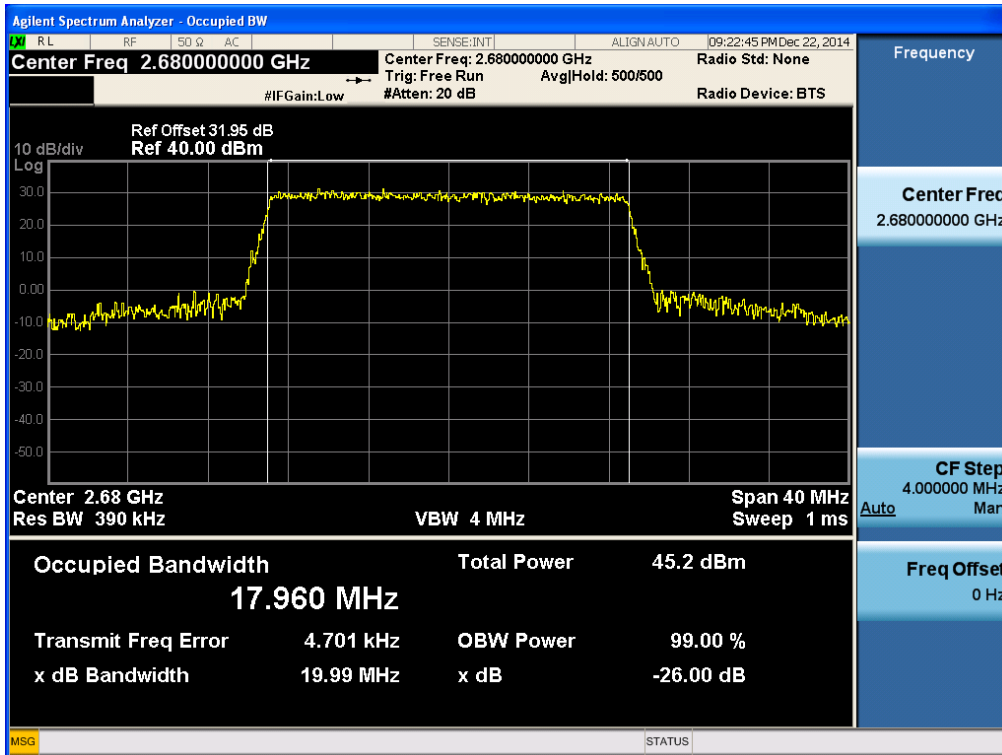
**Plots of Occupied Bandwidth [Downlink]
[Output LTE Downlink 20 MHz Low]**



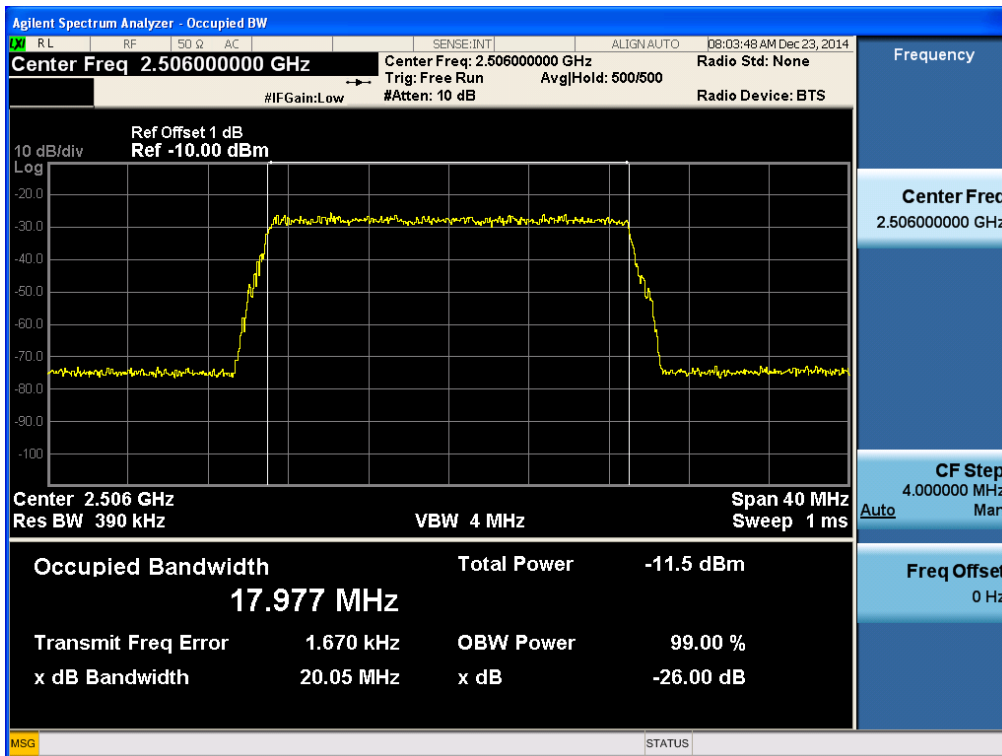
[Output LTE Downlink 20 MHz Middle]



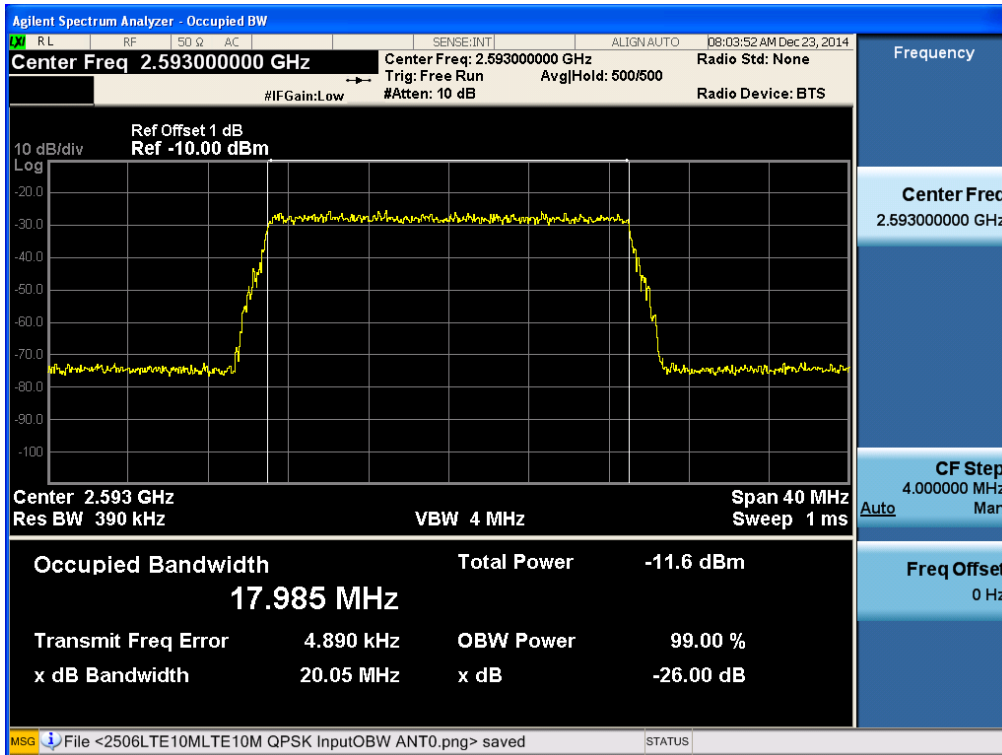
[Output LTE Downlink 20 MHz High]



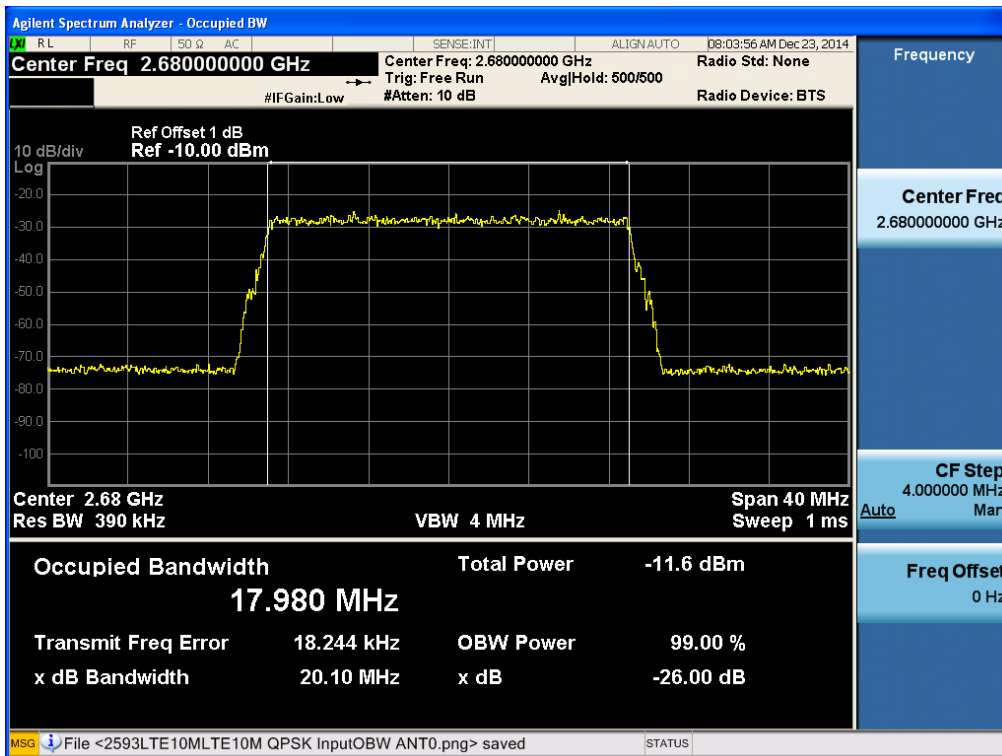
[Input LTE Downlink 20 MHz Low]



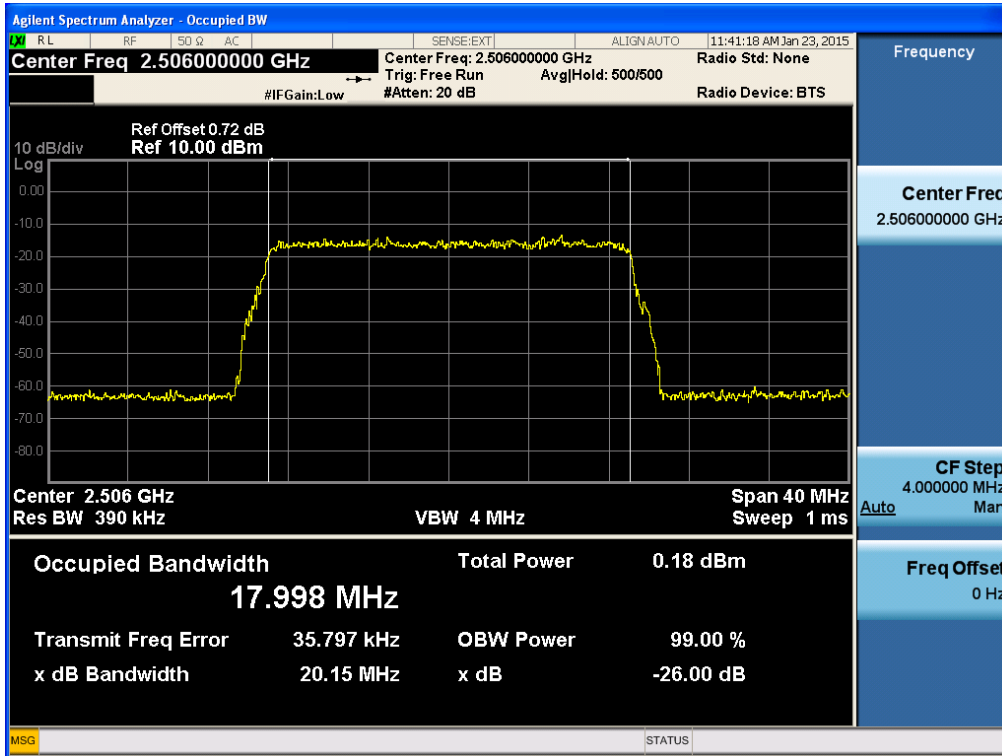
[Input LTE Downlink 20 MHz Middle]



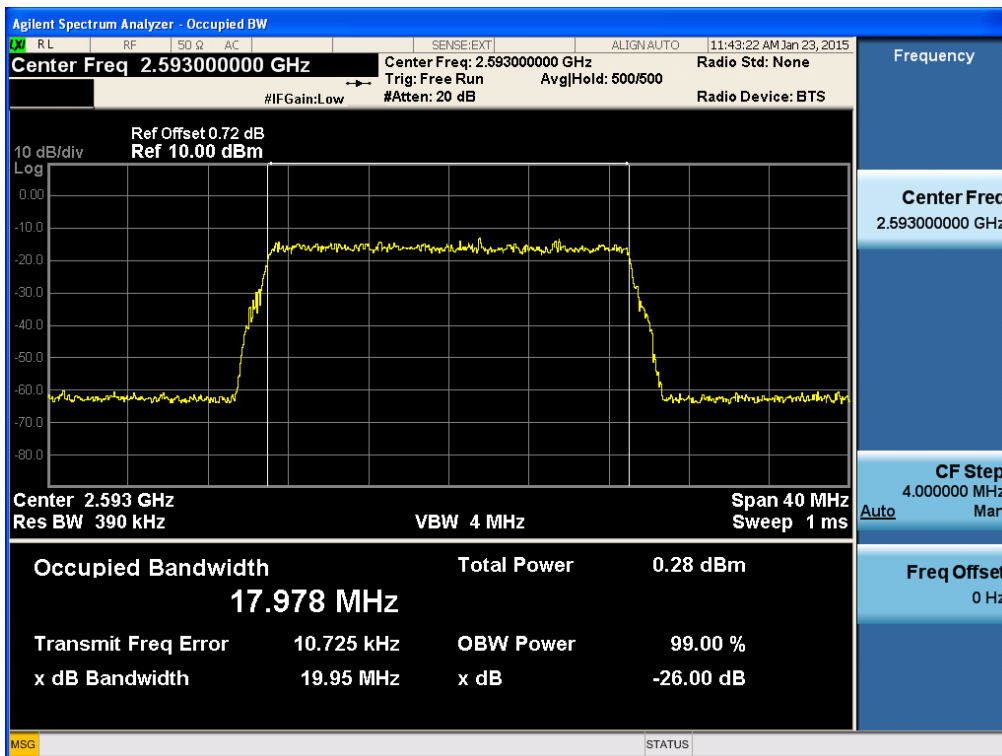
[Input LTE Downlink 20 MHz High]



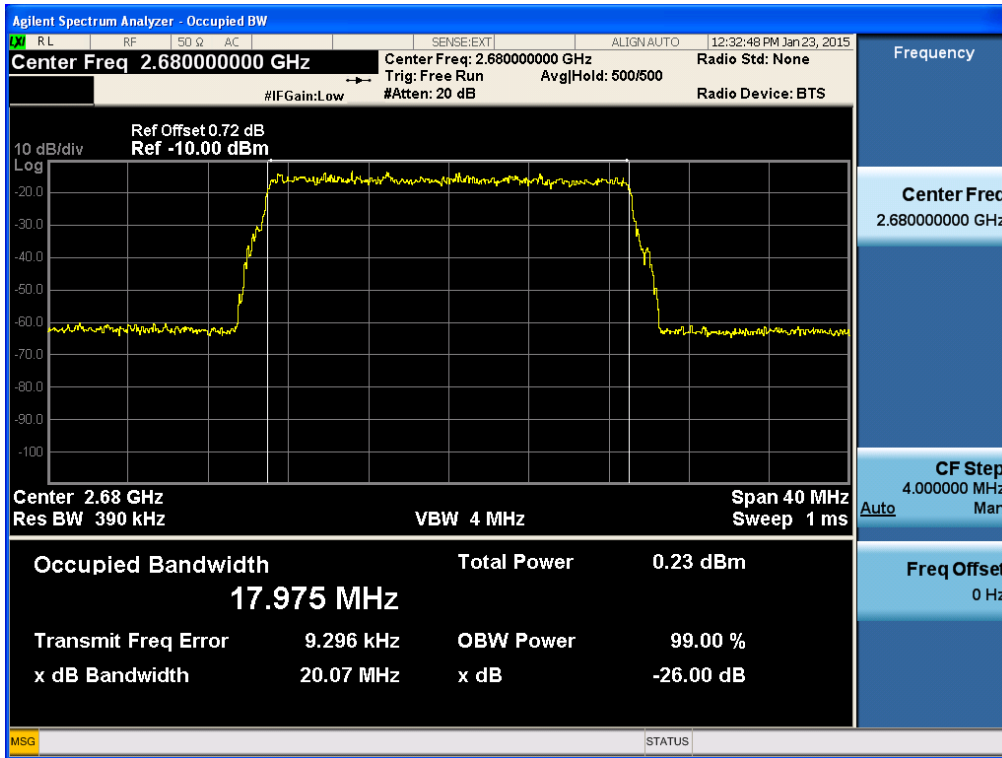
Plots of Occupied Bandwidth [Uplink]
[Output LTE Uplink 20 MHz Low]



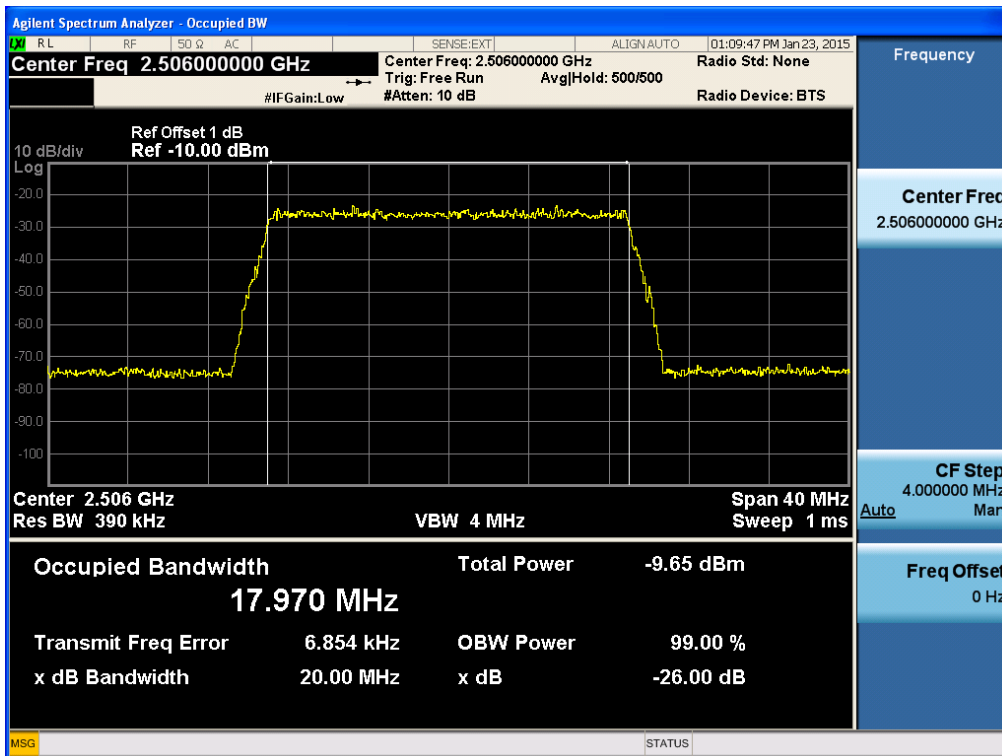
[Output LTE Uplink 20 MHz Middle]



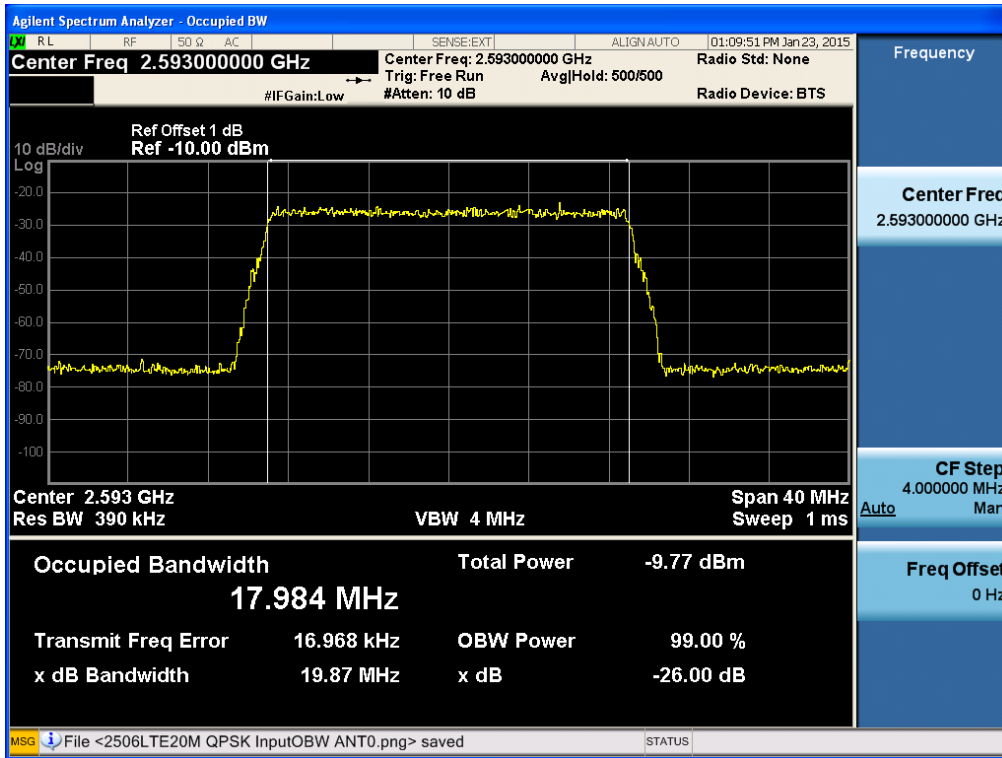
[Output LTE Uplink 20 MHz High]



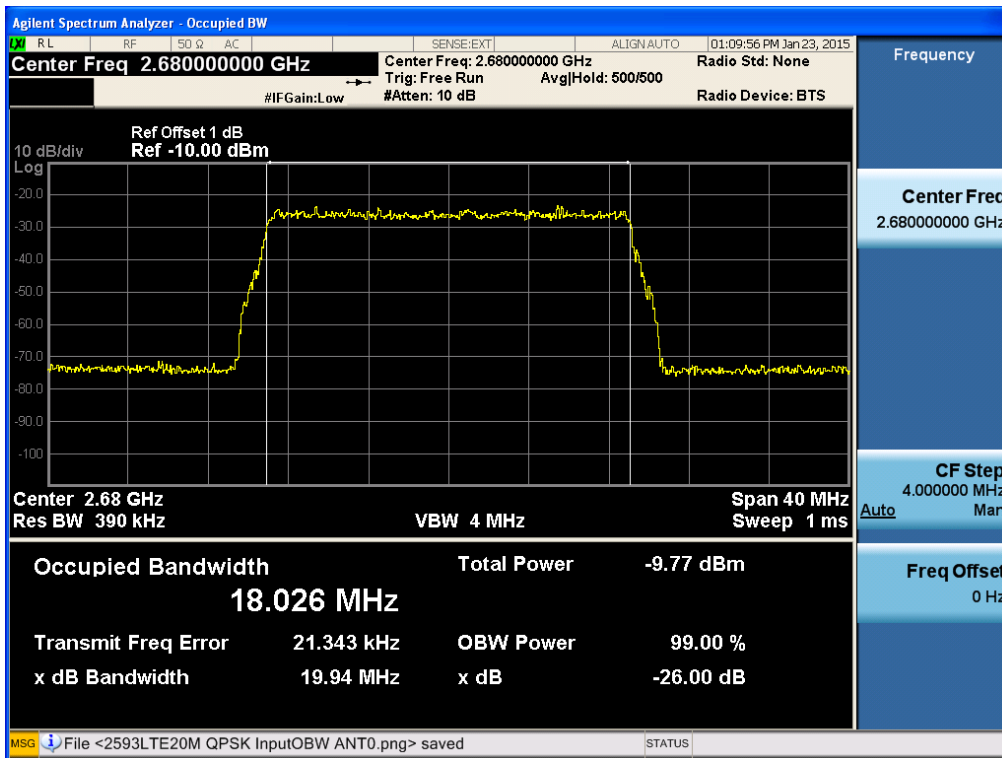
[Input LTE Uplink 20 MHz Low]



[Input LTE Uplink 20 MHz Middle]



[Input LTE Uplink 20 MHz High]



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 : -23 dBm | DL : 60 dB |
| UL : -46 dBm | DL : 38 dB |

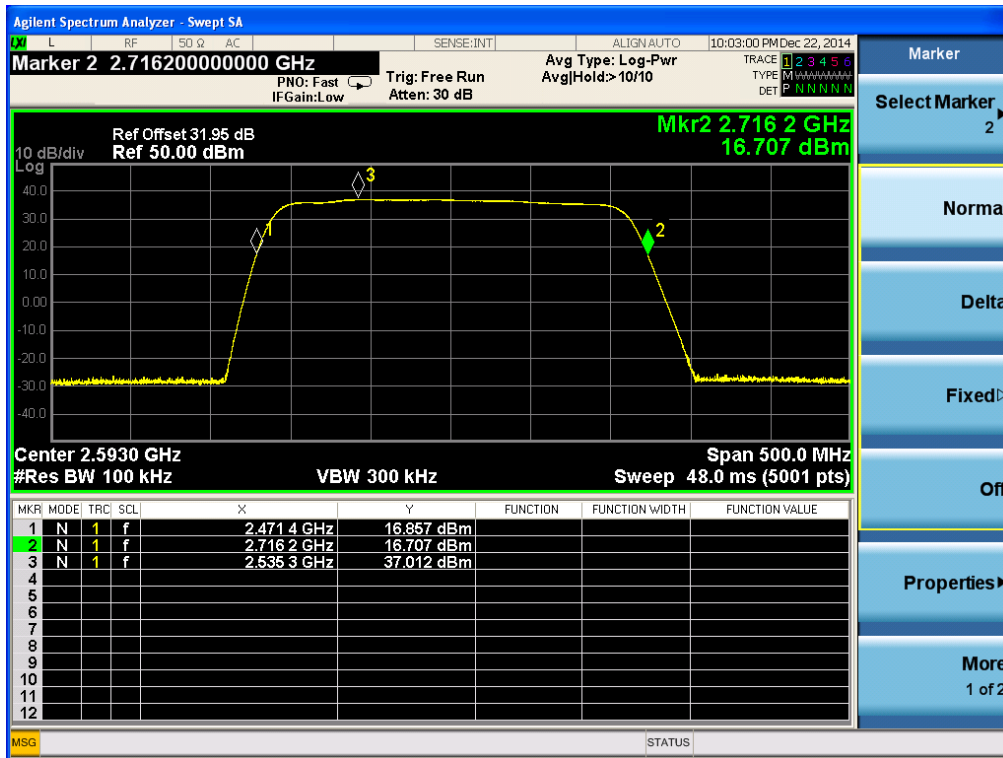
[Downlink]

| 20 dB point frequency (MHz) | Output power (dBm) | Gain (dB) |
|--|-------------------------------|------------------|
| 2471.4 MHz ~ 2716.2 MHz | 37.01 | 60.01 |

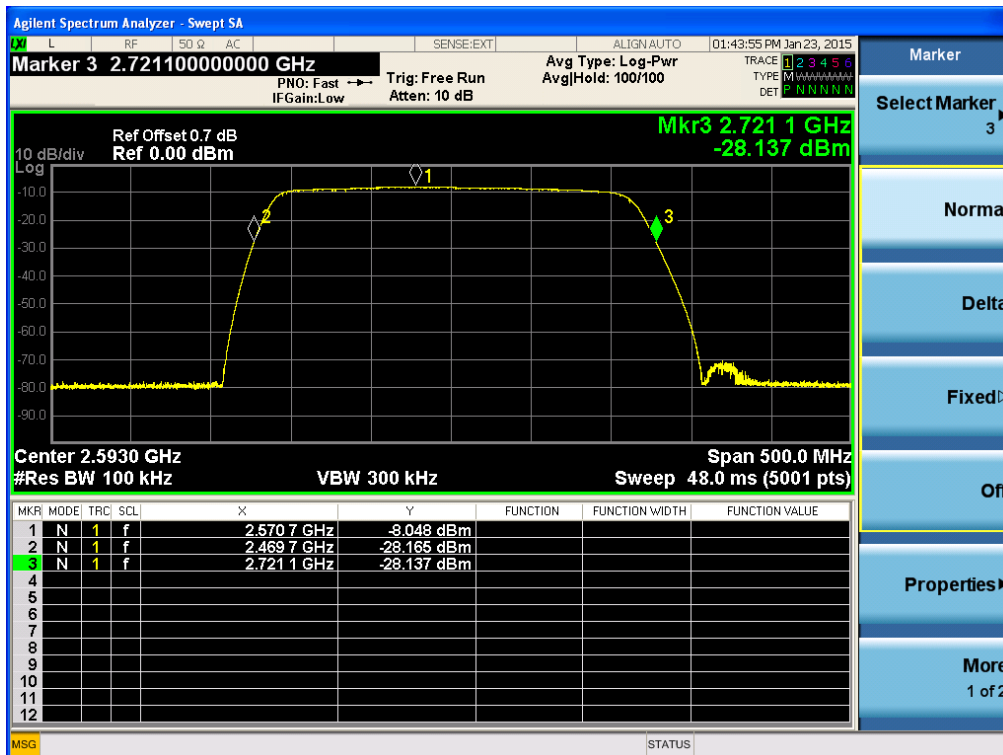
[Uplink]

| 20 dB point frequency (MHz) | Output power (dBm) | Gain (dB) |
|--|-------------------------------|------------------|
| 2570.7 MHz ~ 2721.1 MHz | -8.05 | 37.95 |

Plots of Passband Gain and Bandwidth & Out of Band Rejection [Downlink]



[Uplink]



9. SPURIOUS AND HARMONIC EMISSION AT ANTENNA TERMINAL

FCC Rules

Test Requirement(s): § 2.1051 Measurements required: Spurious emissions at antenna terminals:

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

§ 27.53 Emission limits

(m) For BRS and EBS stations, the power of any emissions outside the licensee's frequency bands of operation shall be attenuated below the transmitter power (P) measured in watts in accordance with the standards below. If a licensee has multiple contiguous channels, out-of-band emissions shall be measured from the upper and lower edges of the contiguous channels.

(2) For digital base stations, the attenuation shall be not less than $43 + 10 \log(P)$ dB, unless a documented interference complaint is received from an adjacent channel licensee with an overlapping Geographic Service Area. Mobile Satellite Service licensees operating on frequencies below 2495 MHz may also submit a documented interference complaint against BRS licensees operating on channel BRS No. 1 on the same terms and conditions as adjacent channel BRS or EBS licensees. Provided that a documented interference complaint cannot be mutually resolved between the parties prior to the applicable deadline, then the following additional attenuation requirements shall apply:

(i) If a pre-existing base station suffers harmful interference from emissions caused by a new or modified base station located 1.5 km or more away, within 24 hours of the receipt of a documented interference complaint the licensee of the new or modified base station must attenuate its emissions by at least $67 + 10 \log(P)$ dB measured at 3 megahertz, above or below, from the channel edge of its frequency block and shall immediately notify the complaining licensee upon implementation of the additional attenuation. No later than 60 days after the implementation of such additional attenuation, the licensee of the complaining base station must attenuate its base station emissions by at least $67 + 10 \log(P)$ dB measured at 3 megahertz, above or below, from the channel edge of its frequency block of the new or modified base station.

(ii) If a pre-existing base station suffers harmful interference from emissions caused by a new or modified base station located less than 1.5 km away, within 24 hours of

receipt of a documented interference complaint the licensee of the new or modified base station must attenuate its emissions by at least $67 + 10 \log (P) - 20 \log (D \text{ km} / 1.5)$ dB measured at 3 megahertz, above or below, from the channel edge of its frequency block of the complaining licensee, or if both base stations are co-located, limit its undesired signal level at the pre-existing base station receiver(s) to no more than -107 dBm measured in a 5.5 megahertz bandwidth and shall immediately notify the complaining licensee upon such reduction in the undesired signal level. No later than 60 days after such reduction in the undesired signal level, the complaining licensee must attenuate its base station emissions by at least $67 + 10 \log (P)$ dB measured at 3 megahertz, above or below, from the channel edge of its frequency block of the new or modified base station.

(iii) If a new or modified base station suffers harmful interference from emissions caused by a pre-existing base station located 1.5 km or more away, within 60 days of receipt of a documented interference complaint the licensee of each base station must attenuate its base station emissions by at least $67 + 10 \log (P)$ dB measured at 3 megahertz, above or below, from the channel edge of its frequency block of the other licensee.

(iv) If a new or modified base station suffers harmful interference from emissions caused by a pre-existing base station located less than 1.5 km away, within 60 days of receipt of a documented interference complaint: (a) The licensee of the new or modified base station must attenuate its OOB by at least $67 + 10 \log (P) - 20 \log (D \text{ km} / 1.5)$ measured 3 megahertz above or below, from the channel edge of its frequency block of the other licensee, or if the base stations are co-located, limit its undesired signal level at the other base station receiver(s) to no more than -107 dBm measured in a 5.5-megahertz bandwidth; and (b) the licensee causing the interference must attenuate its emissions by at least $67 + 10 \log (P)$ dB measured at 3 megahertz, above or below, from the channel edge of its frequency block of the new or modified base station.

(v) For all fixed digital user stations, the attenuation factor shall be not less than $43 + 10 \log (P)$ dB at the channel edge.

(4) For mobile digital stations, the attenuation factor shall be not less than $40 + 10 \log (P)$ dB on all frequencies between the channel edge and 5 megahertz from the channel edge, $43 + 10 \log (P)$ dB on all frequencies between 5 megahertz and X megahertz from the channel edge, and $55 + 10 \log (P)$ dB on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth as defined in paragraph (m)(6) of this section. In addition, the attenuation factor shall not be less than $43 + 10 \log (P)$ dB on all frequencies between 2490.5 MHz and 2496 MHz and $55 + 10 \log (P)$ dB at or below 2490.5 MHz. Mobile Satellite Service licensees operating on frequencies below 2495 MHz may also submit

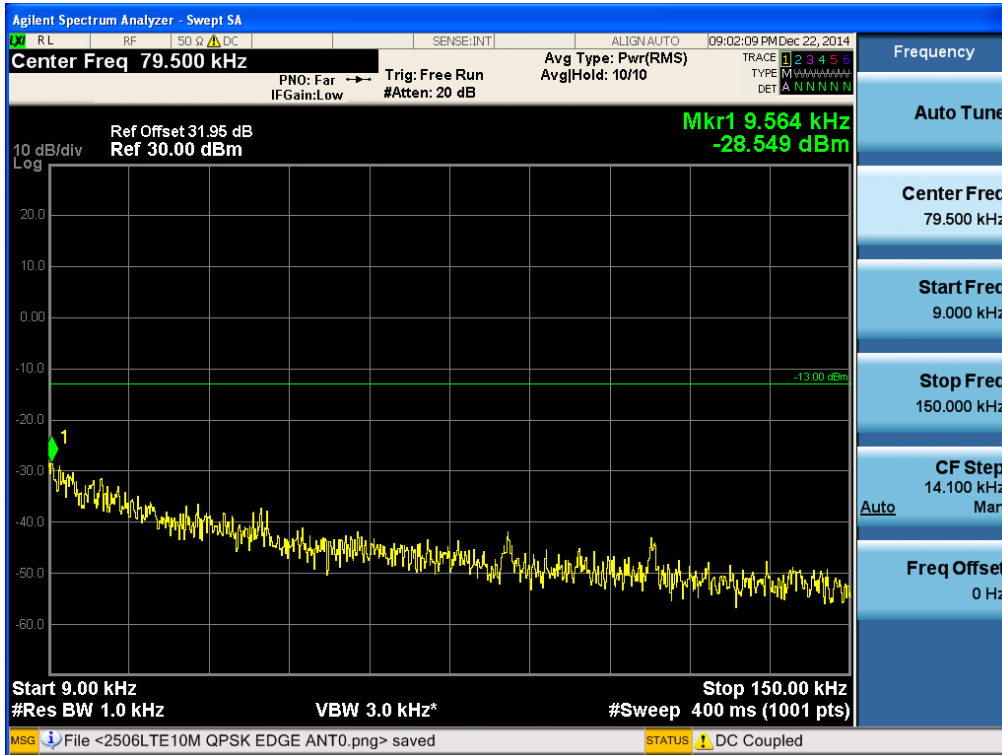
a documented interference complaint against BRS licensees operating on channel BRS Channel 1 on the same terms and conditions as adjacent channel BRS or EBS licensees.

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.

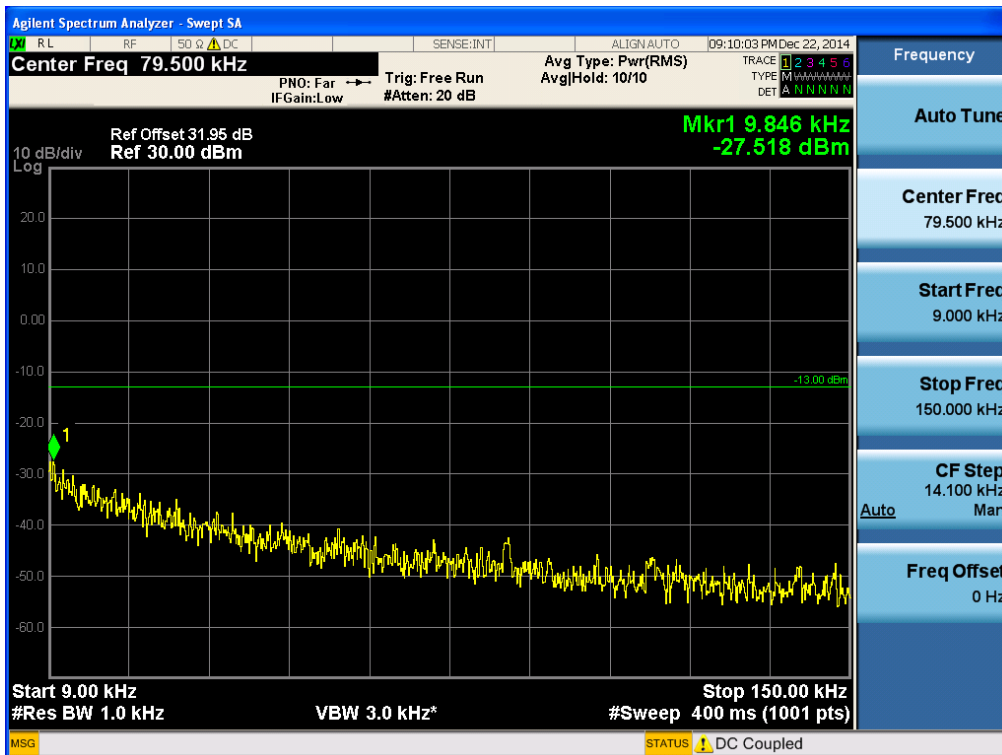
The spectrum was investigated from 9 kHz to the 26.50 of the carrier.

Test Results: The EUT complies with the requirements of this section. There were no Detectable Spurious emissions for this EUT.

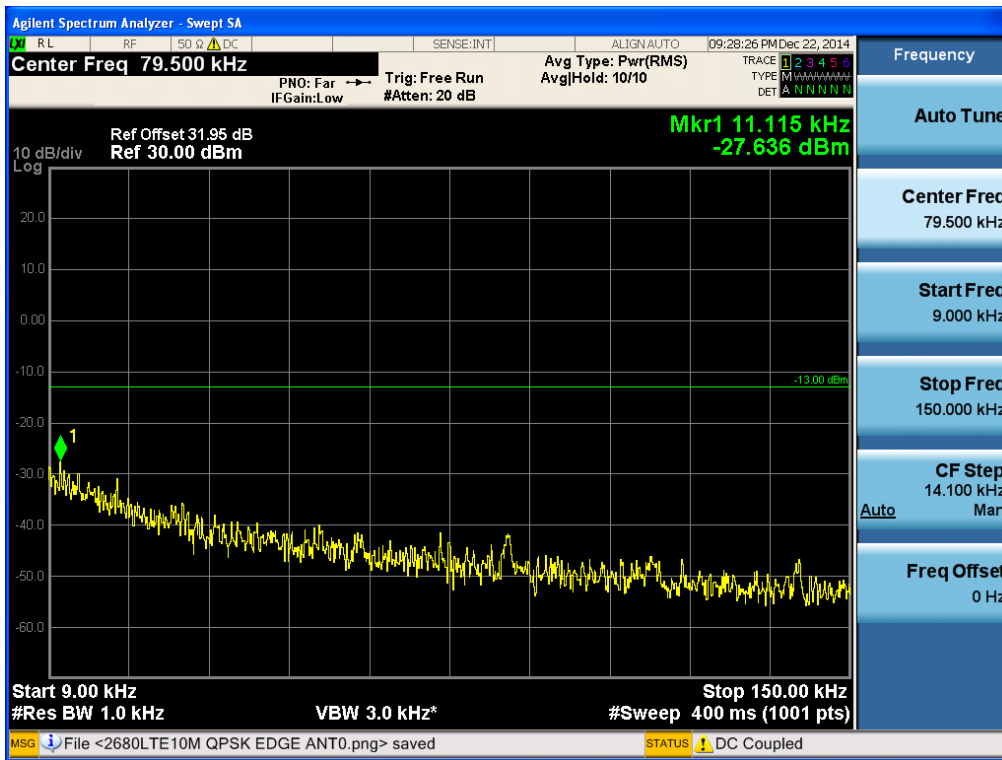
**Plots of Spurious Emission [Downlink]
Conducted Spurious Emissions (9 kHz – 150 kHz)
[LTE Downlink 20 MHz Low]**



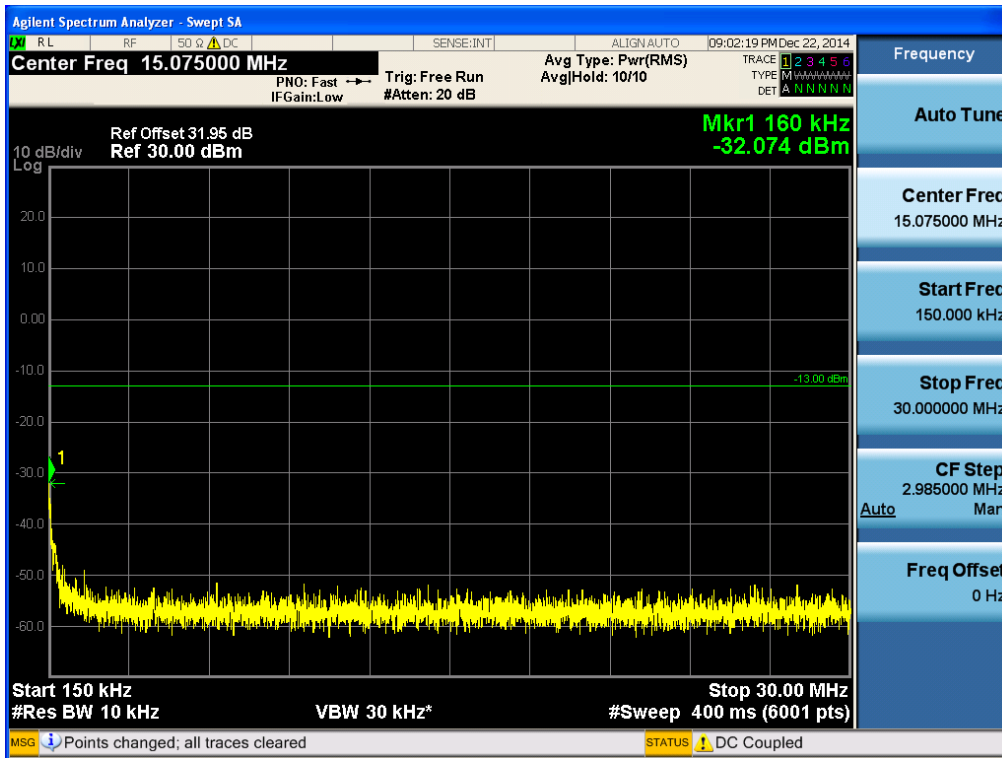
[LTE Downlink 20 MHz Middle]



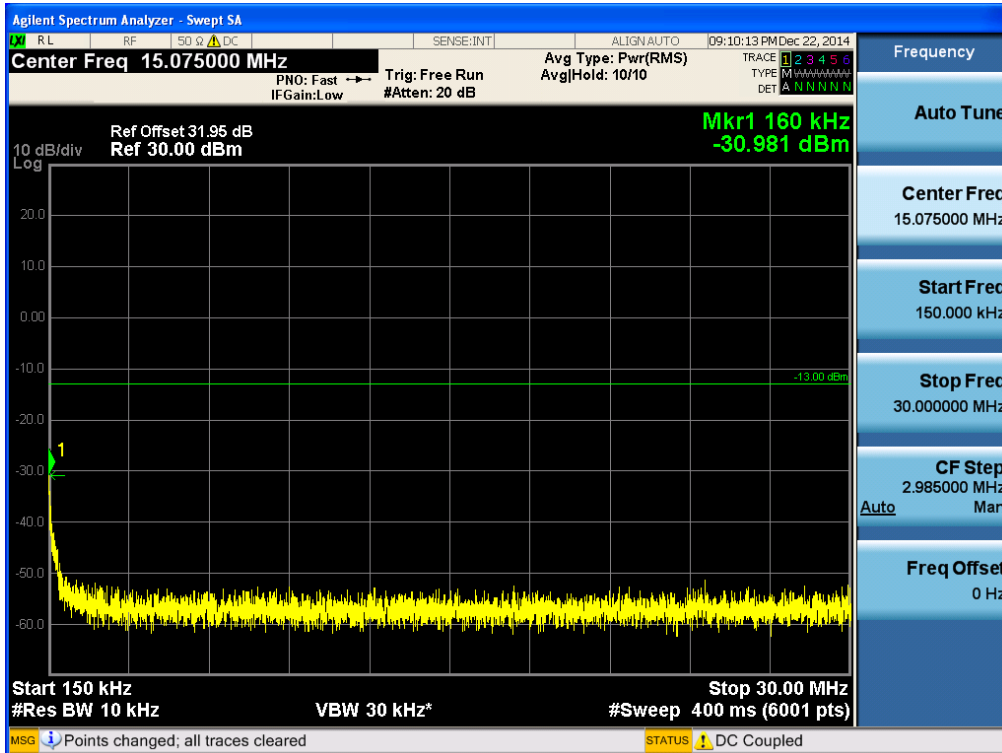
[LTE Downlink 20 MHz High]



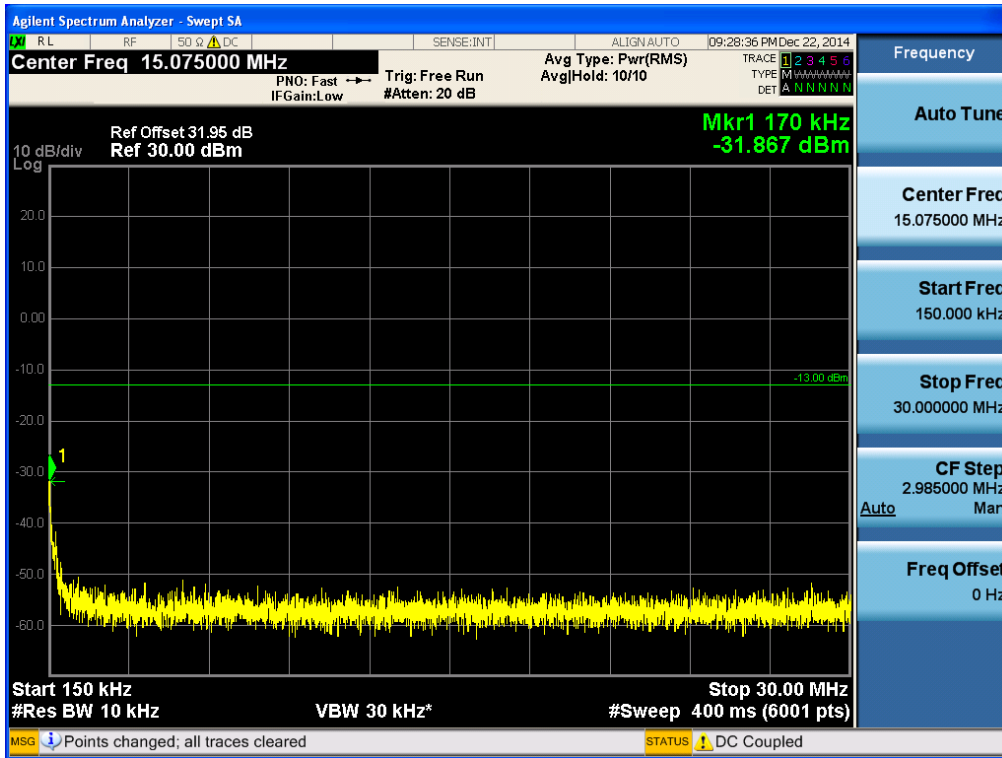
Conducted Spurious Emissions (150 kHz – 30 MHz)
[LTE Downlink 20 MHz Low]



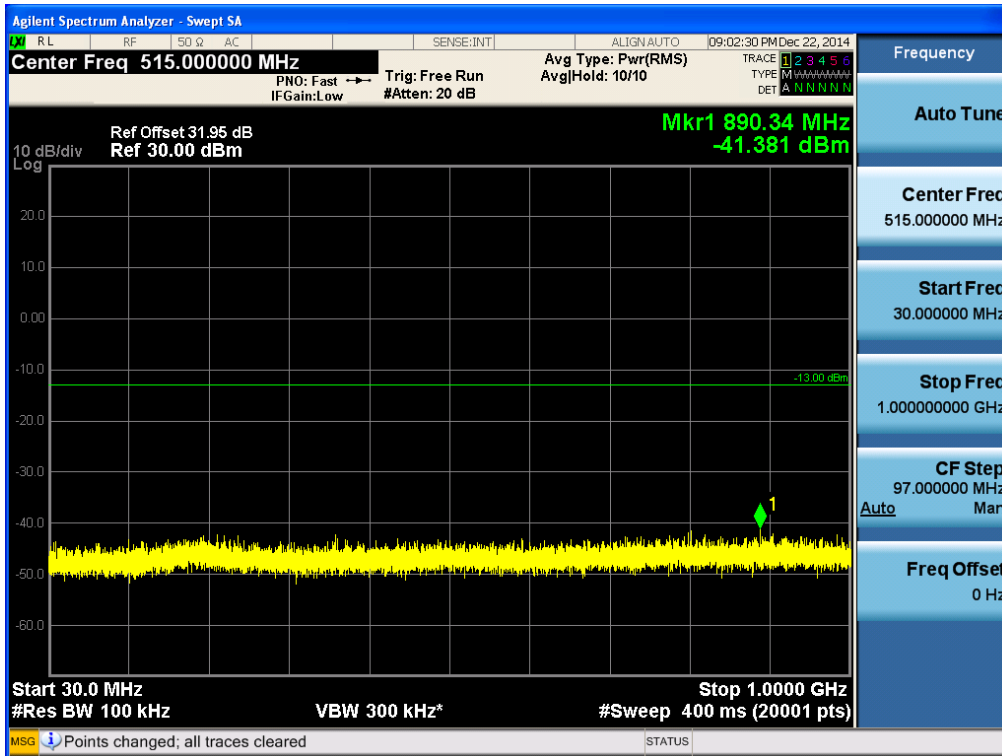
[LTE Downlink 20 MHz Middle]



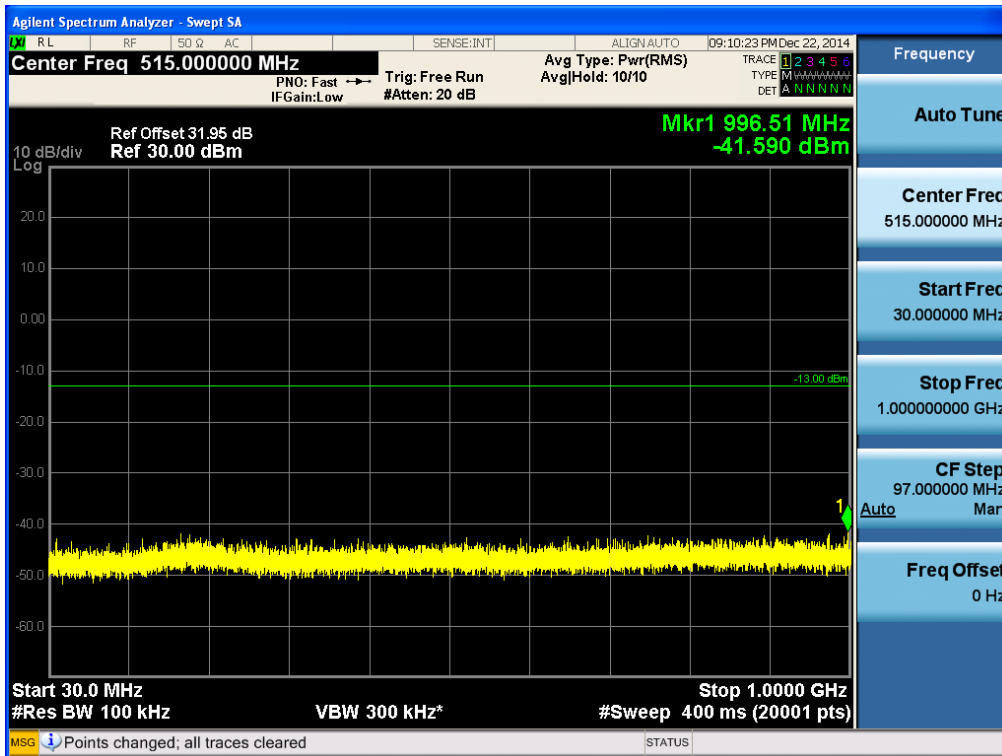
[LTE Downlink 20 MHz High]



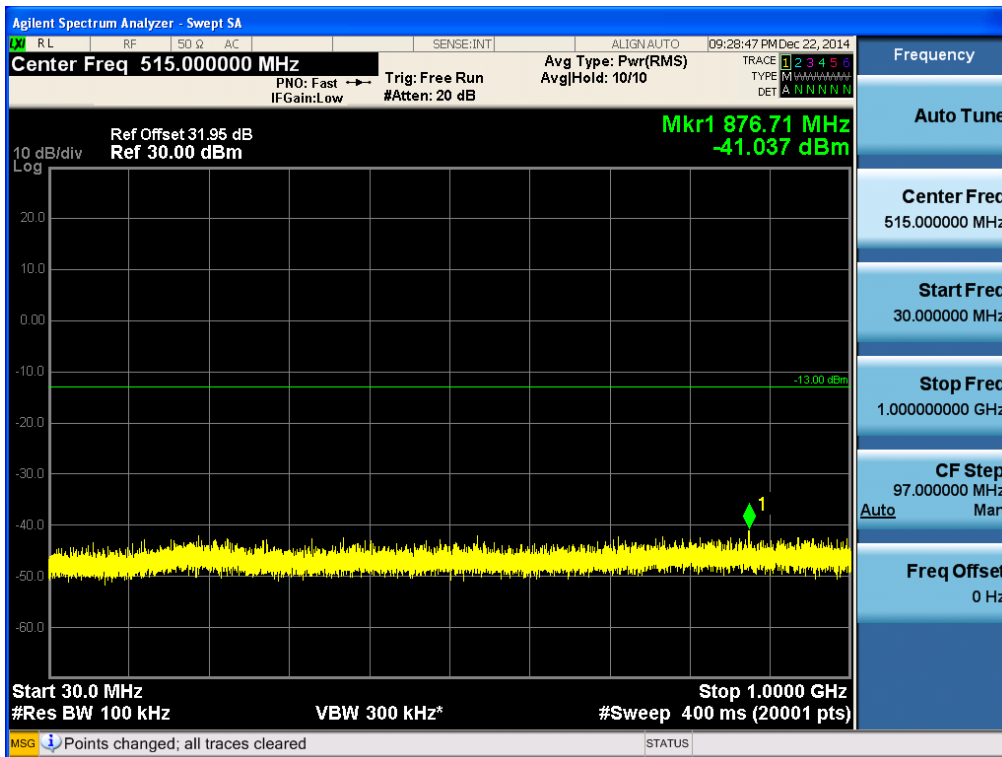
Conducted Spurious Emissions (30 MHz – 1 GHz)
[LTE Downlink 20 MHz Low]



[LTE Downlink 20 MHz Middle]



[LTE Downlink 20 MHz High]

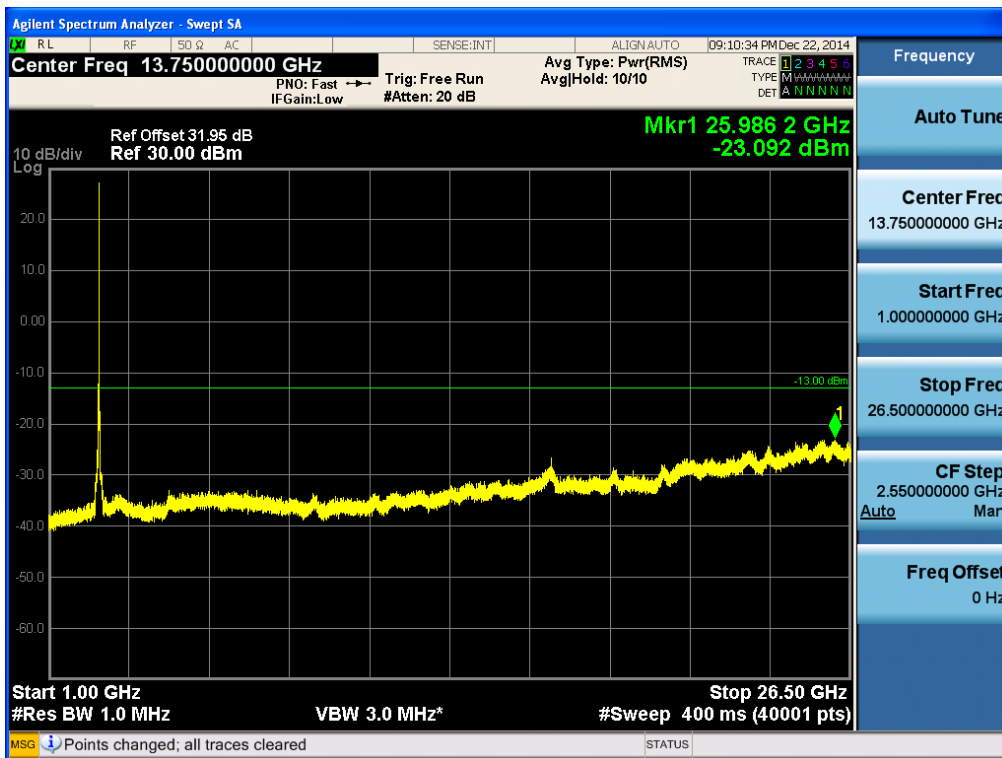


Conducted Spurious Emissions (1 GHz –26.50 GHz)

[LTE Downlink 20 MHz Low]



[LTE Downlink 20 MHz Middle]

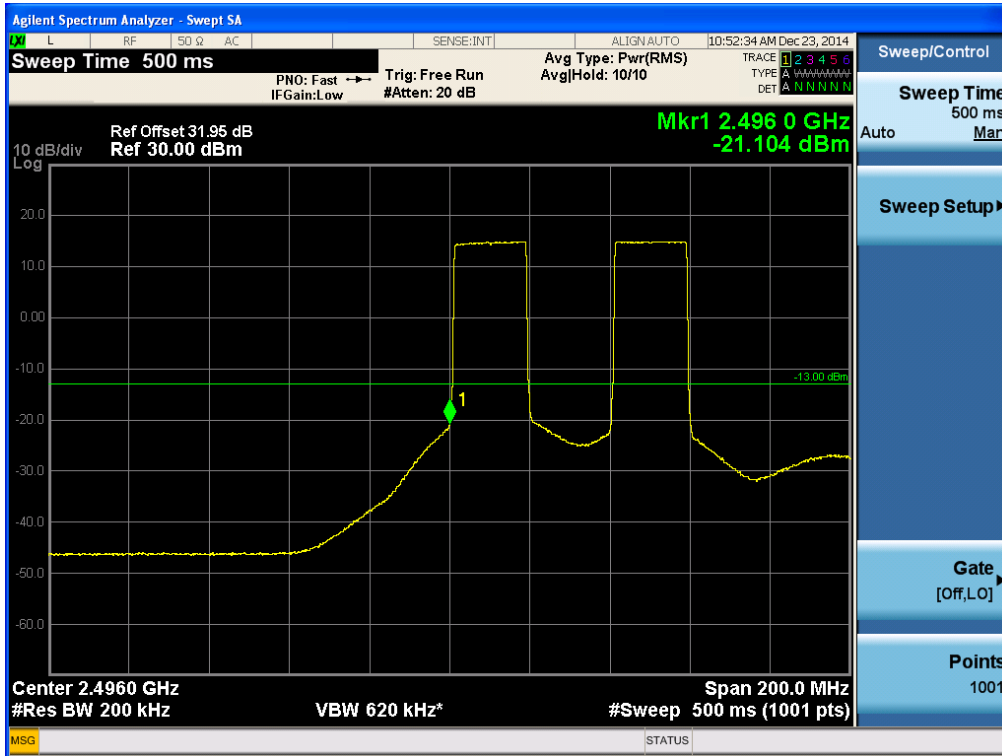


[LTE Downlink 20 MHz High]

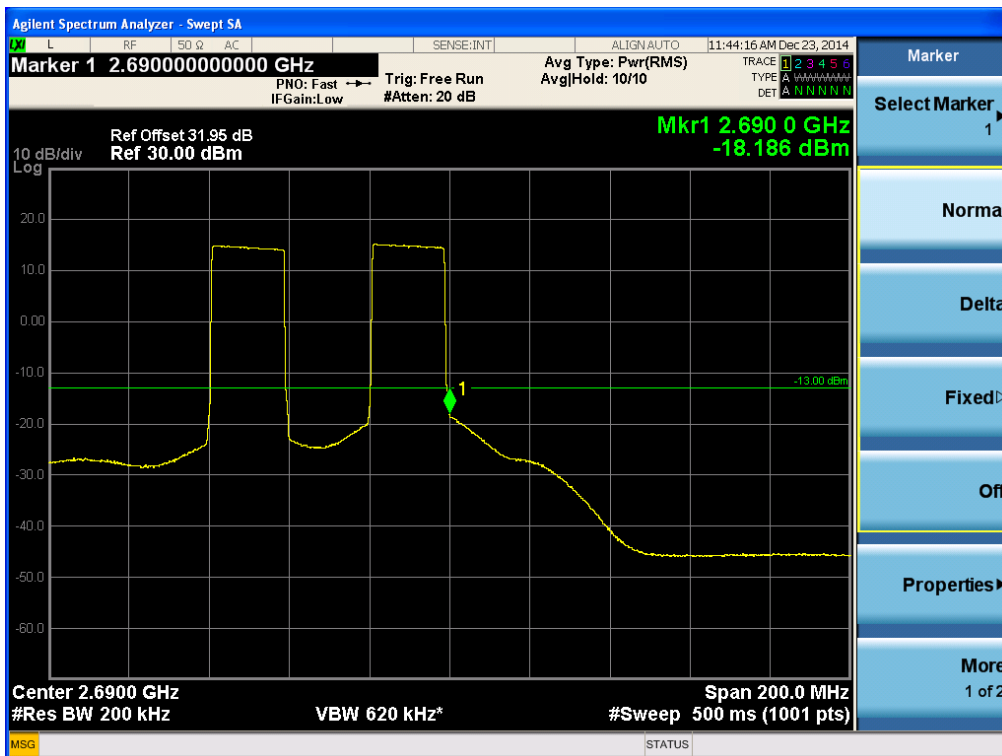


Intermodulation Spurious Emissions

[LTE Downlink 20 MHz Low]

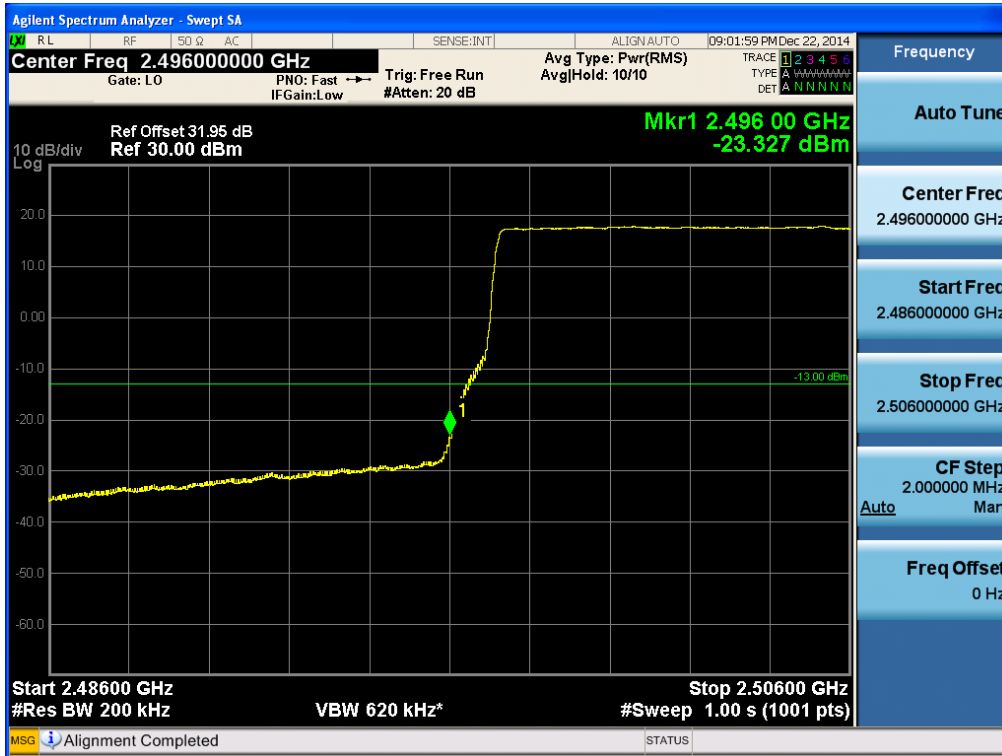


[LTE Downlink 20 MHz High]

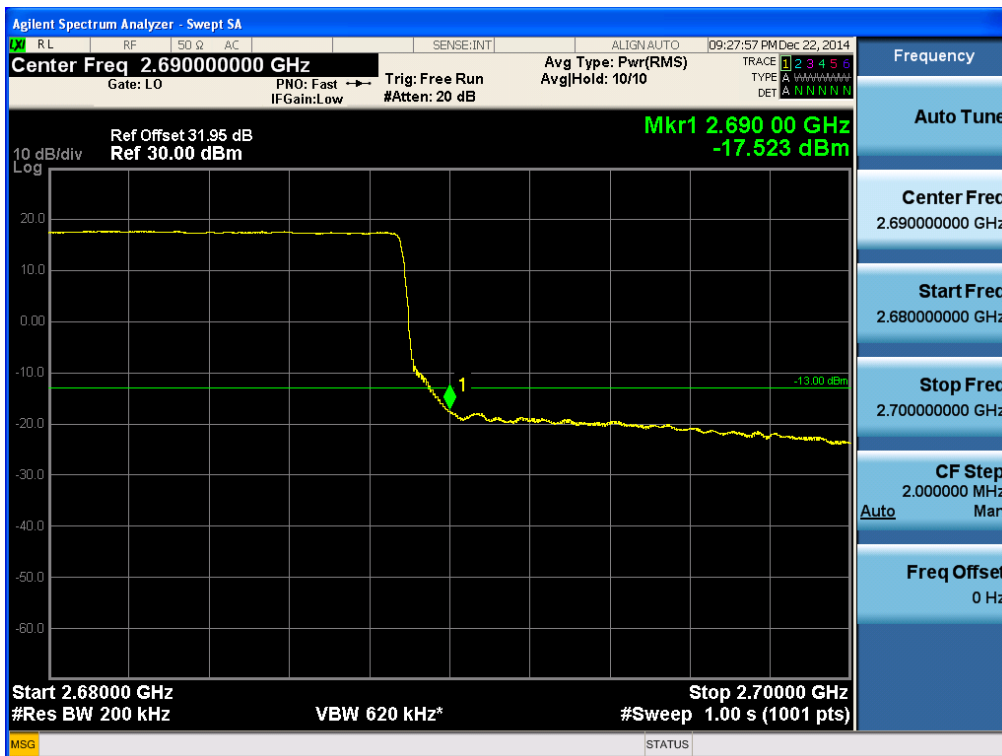


Band Edge

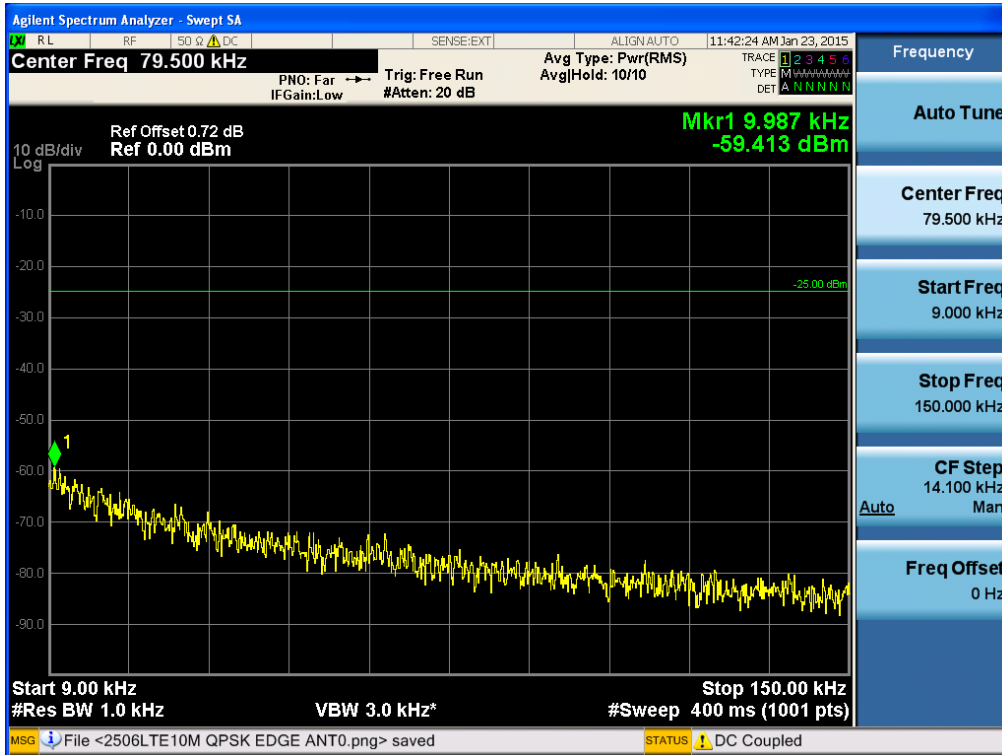
[LTE Downlink 20 MHz Low]



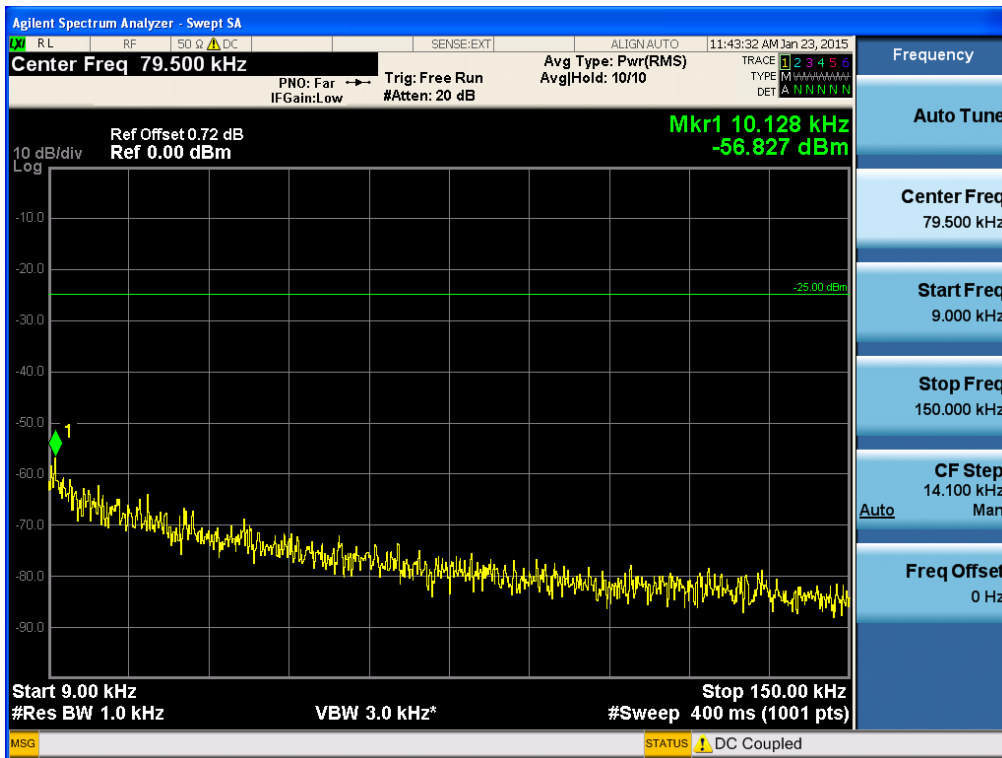
[LTE Downlink 20 MHz High]



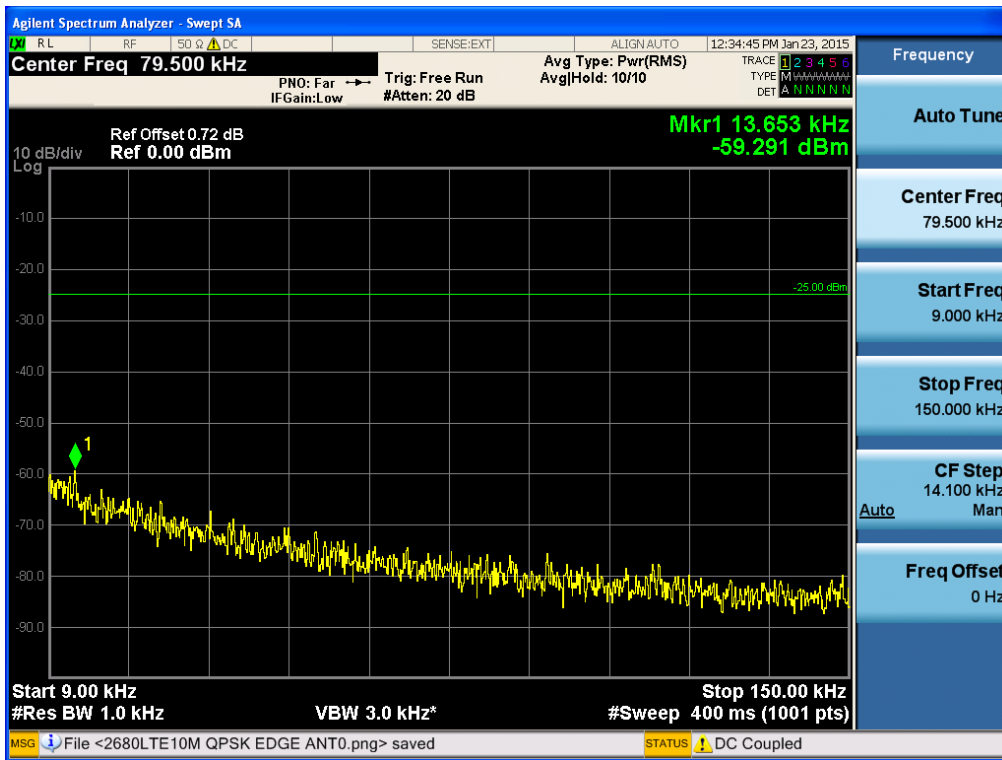
**Plots of Spurious Emission [Uplink]
Conducted Spurious Emissions (9 kHz – 150 kHz)
[LTE Uplink 20 MHz Low]**



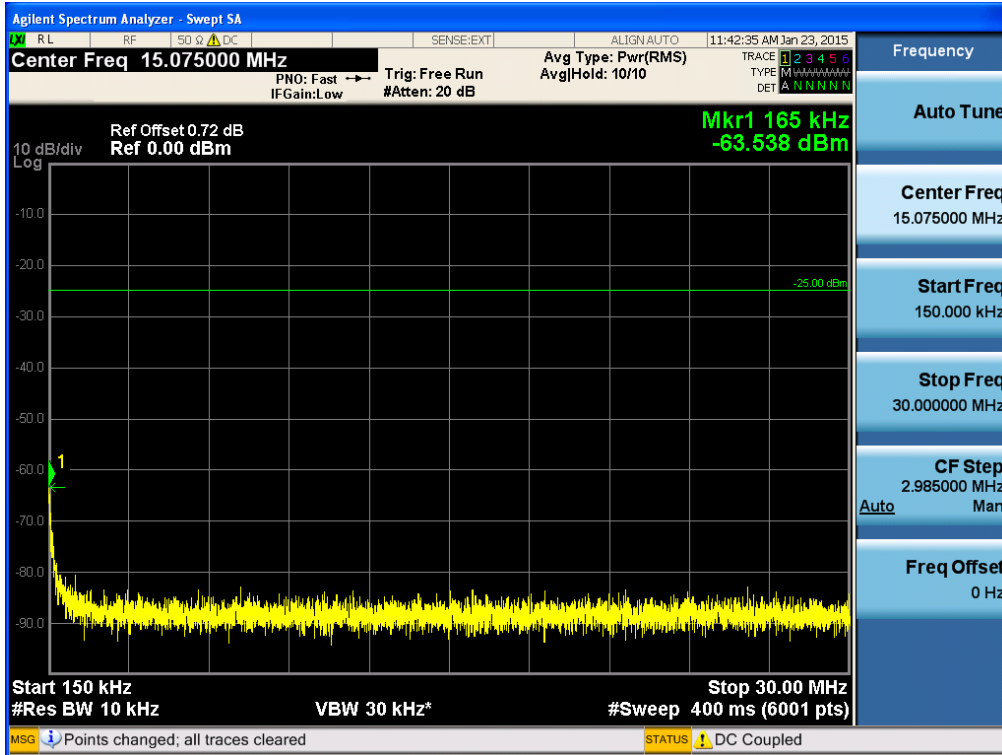
[LTE Uplink 20 MHz Middle]



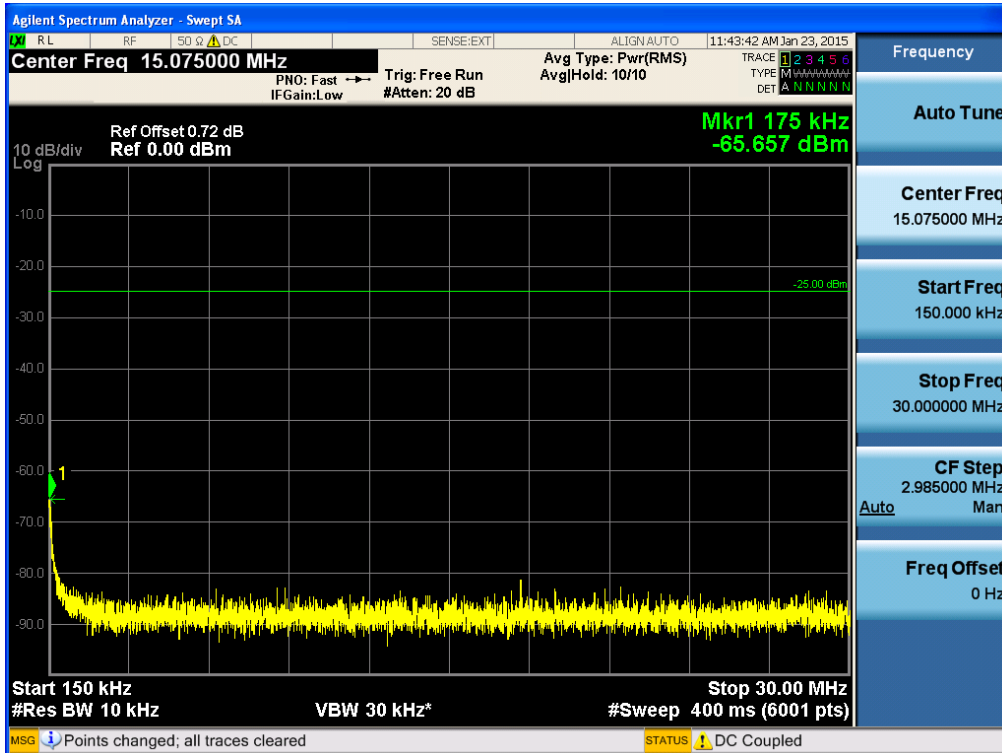
[LTE Uplink 20 MHz High]



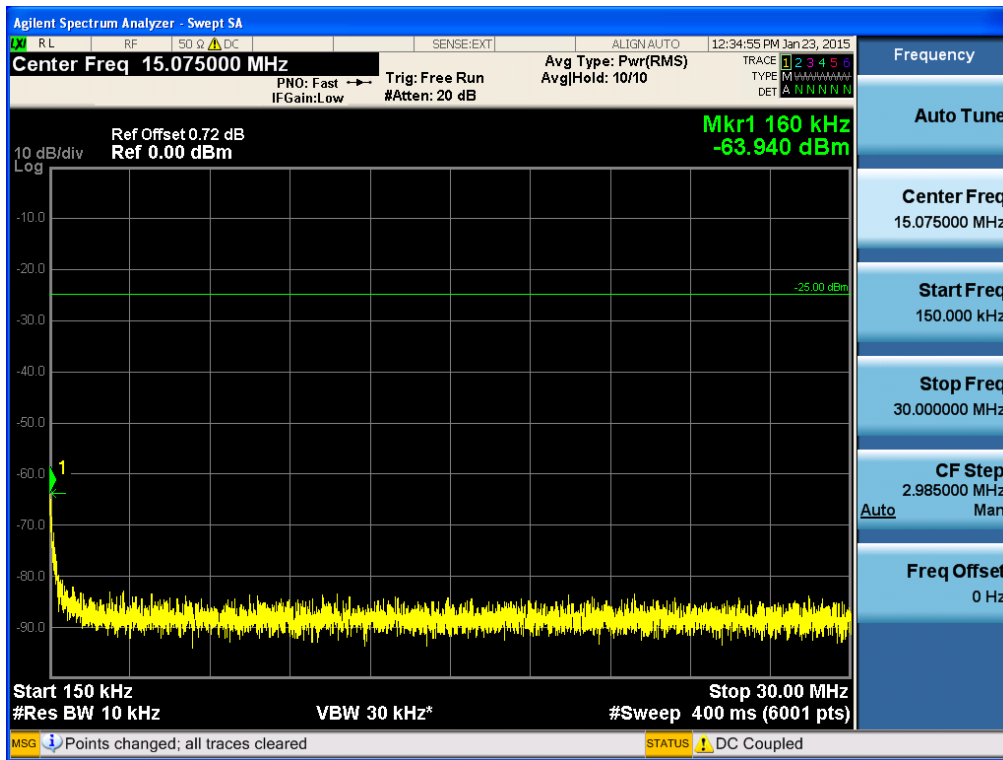
Conducted Spurious Emissions (150 kHz – 30 MHz)
[LTE Uplink 20 MHz Low]



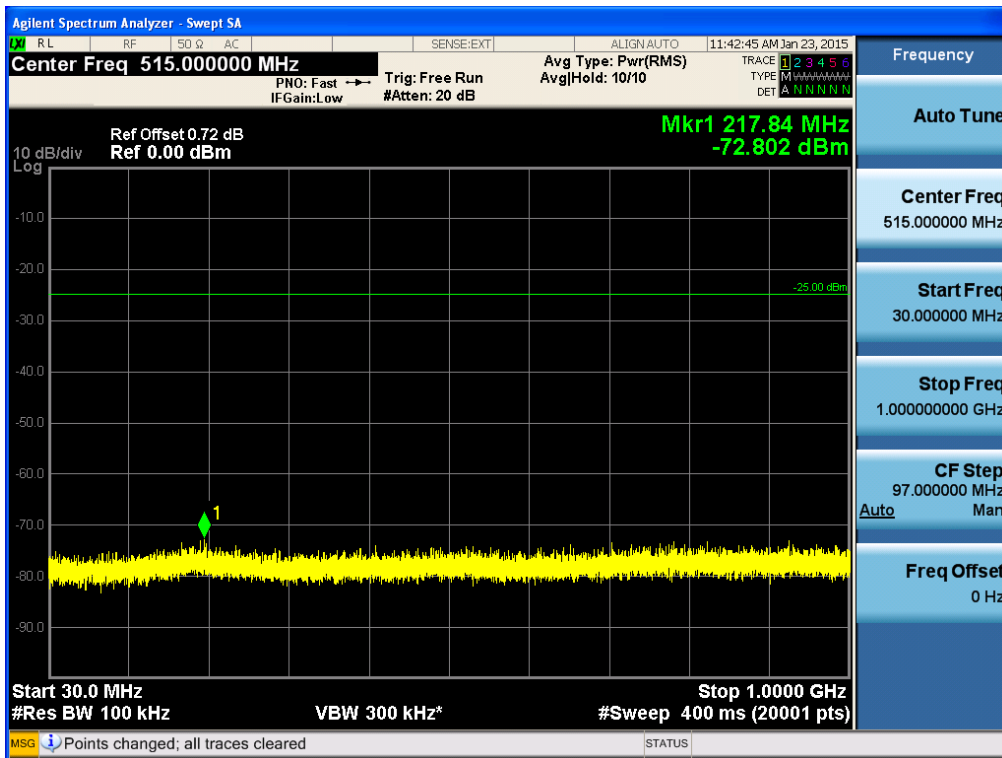
[LTE Uplink 20 MHz Middle]



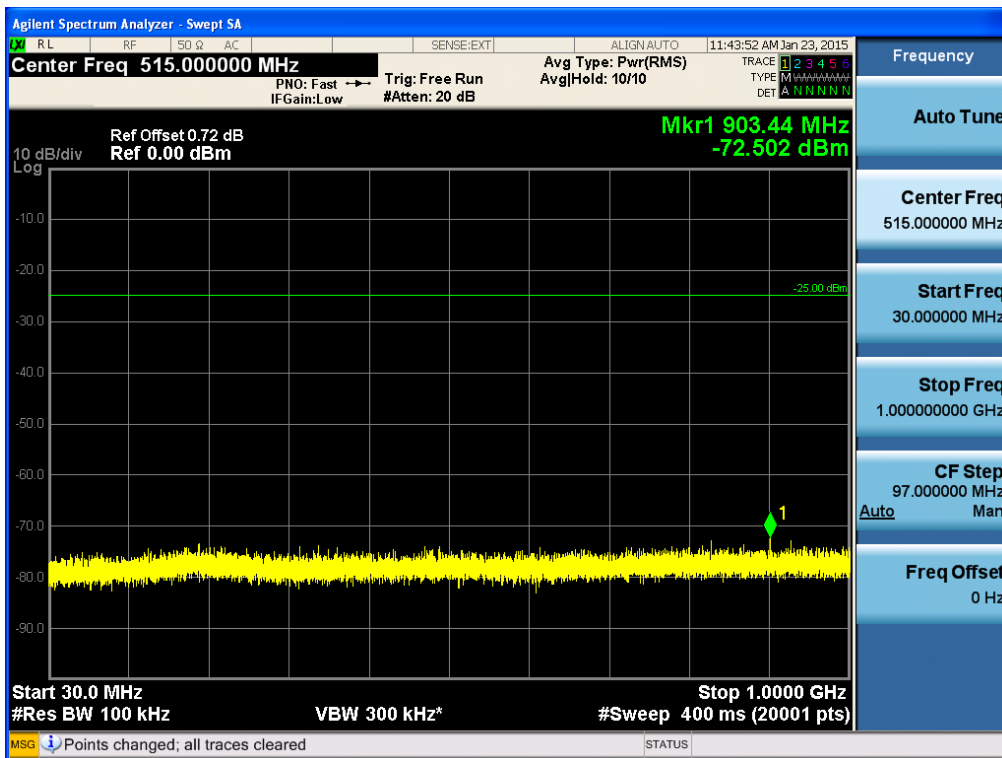
[LTE Uplink 20 MHz High]



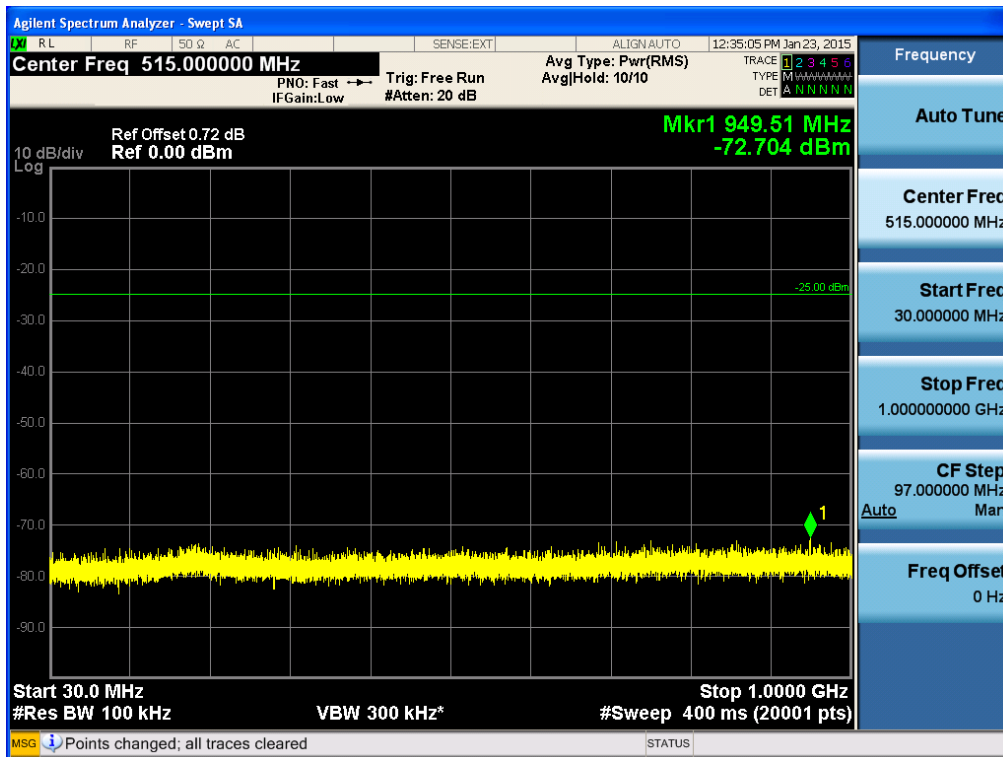
Conducted Spurious Emissions (30 MHz – 1 GHz)
[LTE Uplink 20 MHz Low]



[LTE Uplink 20 MHz Middle]

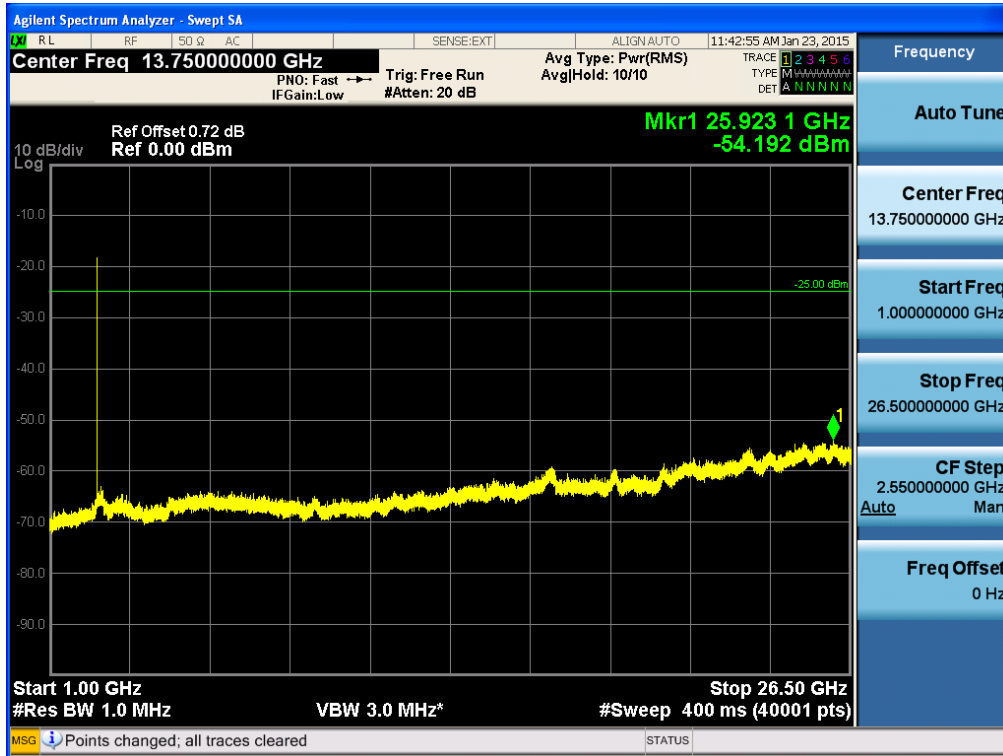


[LTE Uplink 20 MHz High]

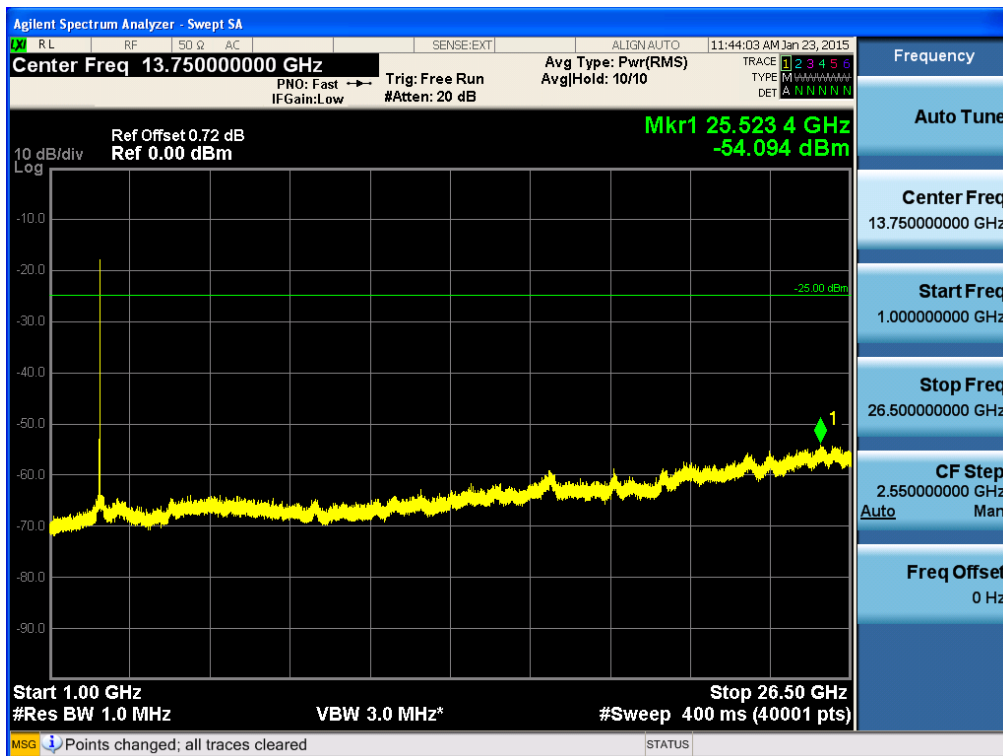


Conducted Spurious Emissions (1 GHz –26.50 GHz)

[LTE Uplink 20 MHz Low]



[LTE Uplink 20 MHz Middle]

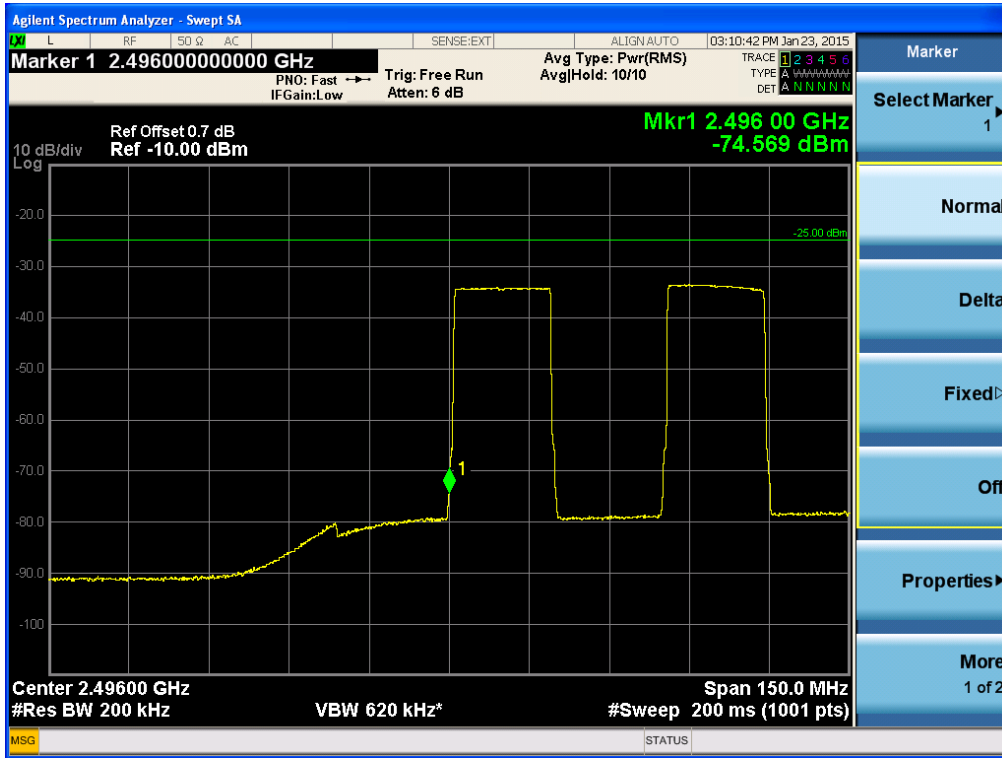


[LTE Uplink 20 MHz High]

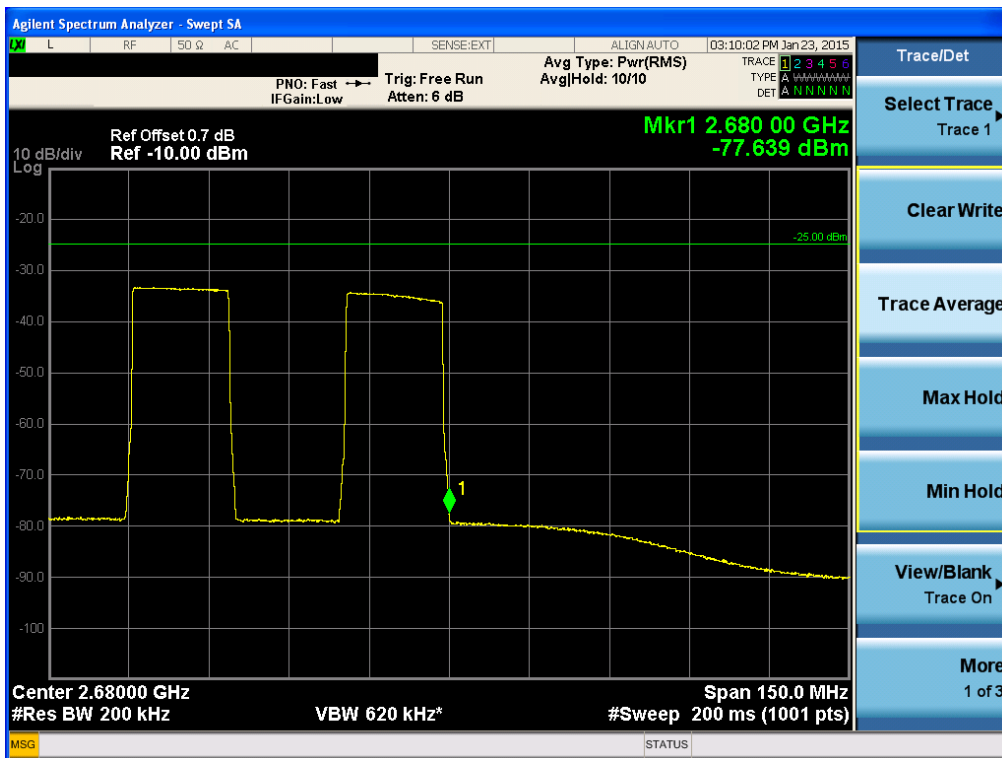


Intermodulation Spurious Emissions

[LTE Uplink 20 MHz Low]

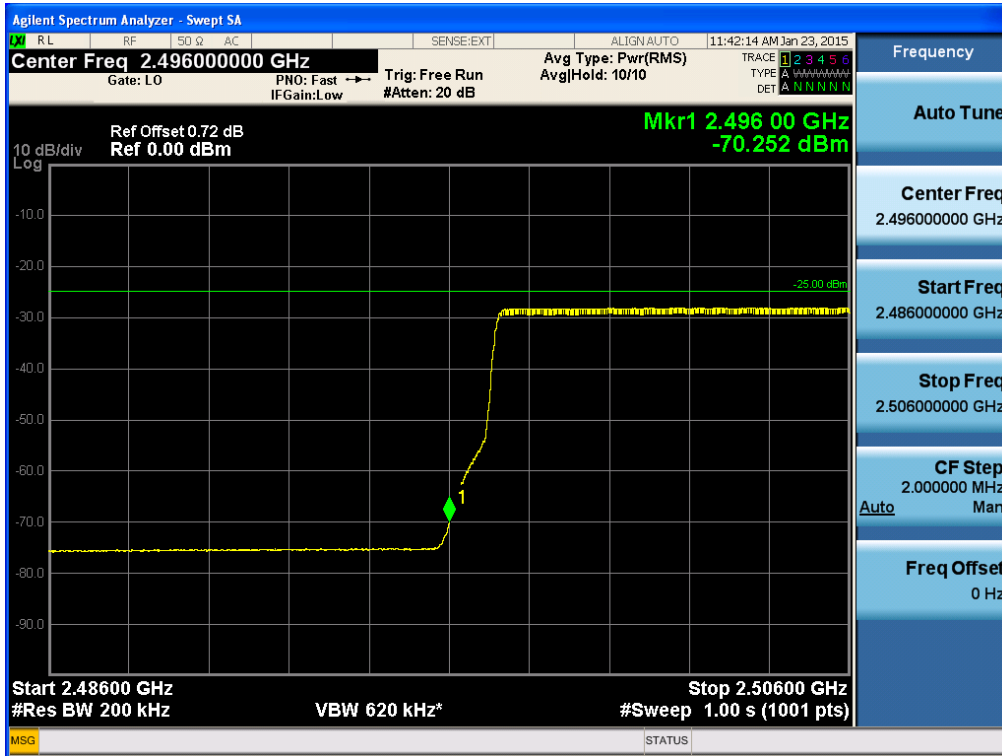


[LTE Uplink 20 MHz High]

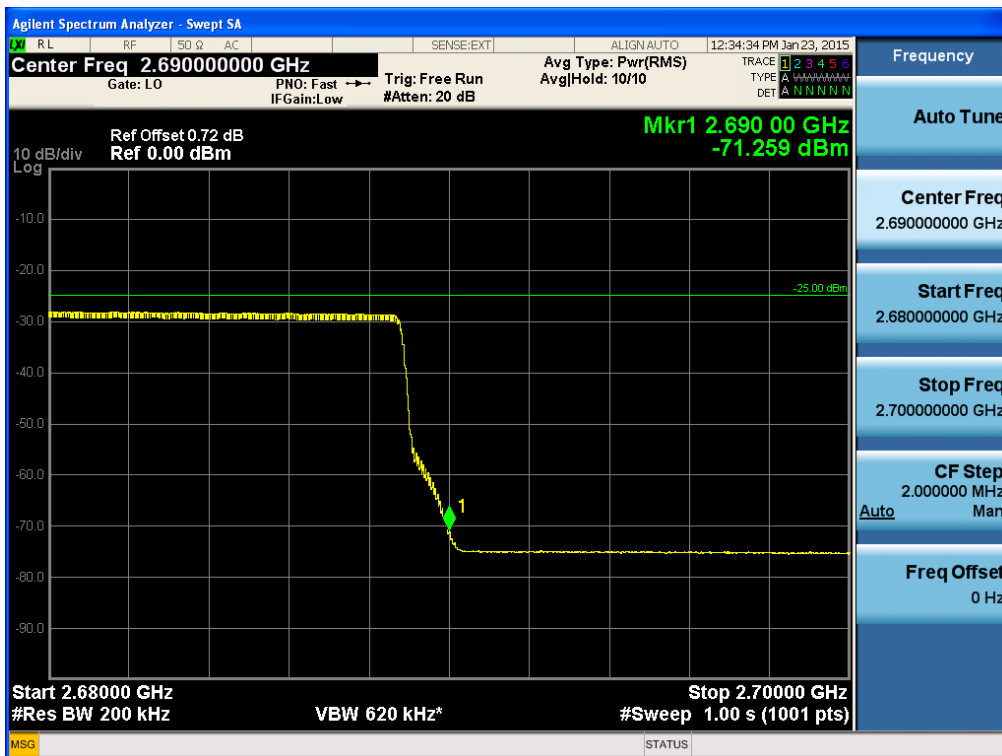


Band Edge

[LTE Uplink 20 MHz Low]



[LTE Uplink 20 MHz High]



10. RADIATED SPURIOUS EMISSIONS

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

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

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

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

Emission limit

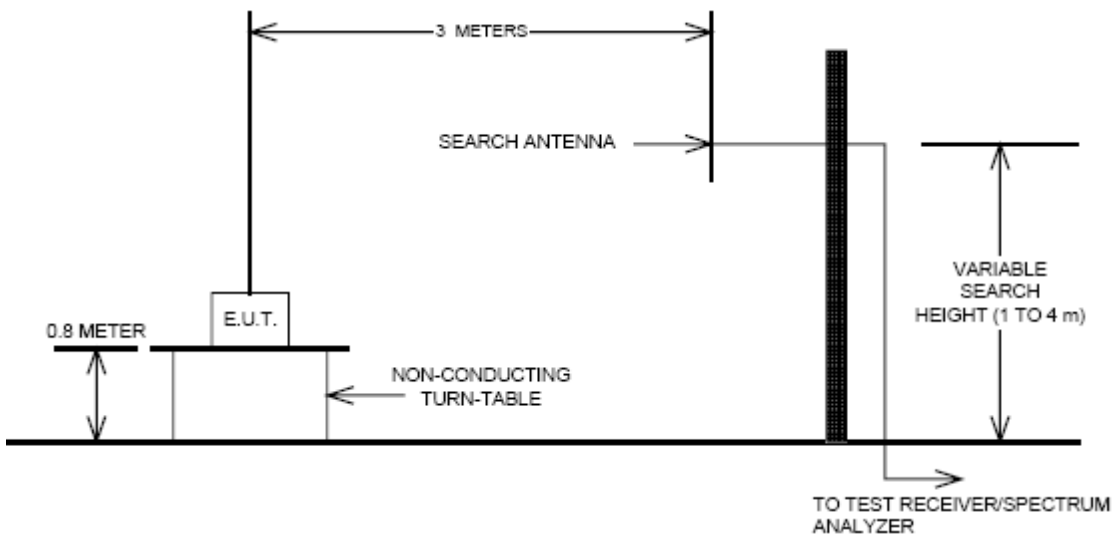
On any frequency outside the operating band, the power of any emission shall be attenuated outside the band below the transmitter power(P) by at least $43 + 10 \log (P)$ dB;

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 40GHz, whichever was the lesser, were investigated.

Radiated Spurious Emissions Test Setup



Test Result:

Note.

Input signal is the CW signal.

[Downlink]

| Tx Freq.(MHz) | Freq.(MHz) | Substitute Level [dBm] | Ant. Gain (dBi) | C.L | Pol. | EIRP (dBm) | Margin (dB) |
|---------------|------------|------------------------|-----------------|------|------|------------|-------------|
| 2496.4 | 4992.8 | -42.88 | 12.55 | 5.81 | H | -36.15 | 23.15 |
| | 7489.2 | -42.32 | 11.11 | 6.60 | H | -37.81 | 24.81 |
| | 9985.6 | -39.12 | 11.71 | 8.34 | V | -35.75 | 22.75 |
| 2689.6 | 5379.2 | -45.64 | 12.75 | 5.88 | V | -38.77 | 25.77 |
| | 8068.8 | -40.61 | 10.92 | 7.33 | H | -37.01 | 24.01 |
| | 10758.4 | -29.88 | 11.73 | 8.72 | H | -26.88 | 13.88 |

[Uplink]

| Tx Freq.(MHz) | Freq.(MHz) | Substitute Level [dBm] | Ant. Gain (dBi) | C.L | Pol. | EIRP (dBm) | Margin (dB) |
|---------------|---------------|------------------------|-----------------|-----|------|------------|-------------|
| 2496.4 | No Peak found | | | | | | |
| 2689.6 | | | | | | | |

11. FREQUENCY STABILITY OVER TEMPERATURE AND VOLTAGE VARIATIONS

FCC Rules

Test Requirement(s): §2.1055(a)(1), § 27.54

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.

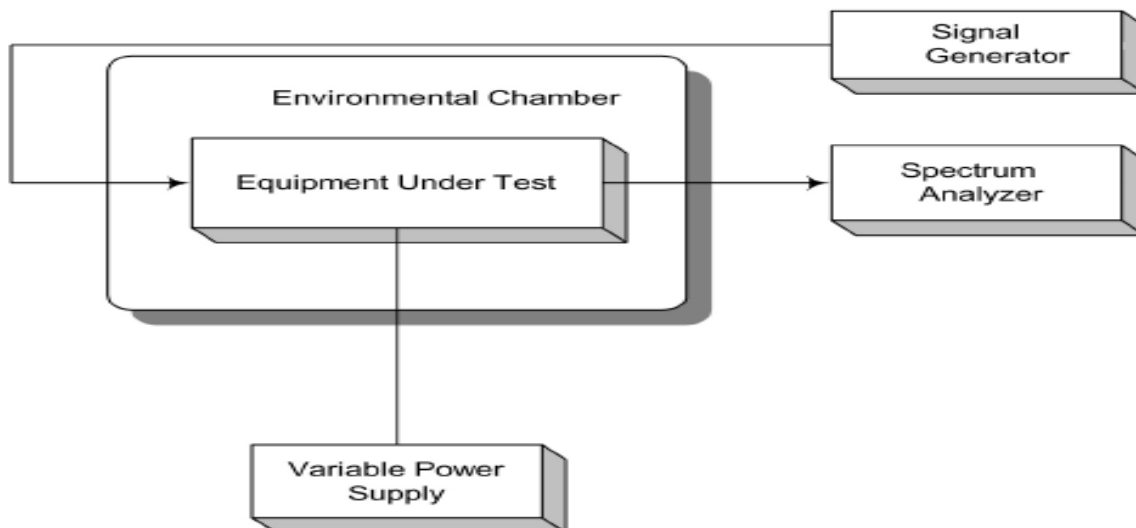
A CW signal was injected into the EUT at the appropriate RF level. The frequency counter option on the Spectrum Analyzer was used to measure frequency deviations.

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

Frequency Stability and Voltage Test Results

Reference: 120 Vac at 20°C Freq. = 2593.0 MHz

| Voltage (%) | Temp. (°C) | Frequency (Hz) | Frequency Error (Hz) | Deviation (Hz) | ppm |
|-------------|------------|----------------|----------------------|----------------|--------|
| 100% | +20(Ref) | 2593000000.0 | 0.0 | 0.0 | 0.0000 |
| | -30 | 2593000000.0 | 0.0 | 0.0 | 0.0000 |
| | -20 | 2593000000.0 | 0.0 | 0.0 | 0.0000 |
| | -10 | 2593000000.0 | 0.0 | 0.0 | 0.0000 |
| | 0 | 2593000000.0 | 0.0 | 0.0 | 0.0000 |
| | +10 | 2593000000.0 | 0.0 | 0.0 | 0.0000 |
| | +30 | 2593000000.0 | 0.0 | 0.0 | 0.0000 |
| | +40 | 2593000000.0 | 0.0 | 0.0 | 0.0000 |
| 115% | +20 | 2593000000.0 | 0.0 | 0.0 | 0.0000 |
| | 85% | +20 | 2593000000.0 | 0.0 | 0.0000 |

[Downlink]

Reference: 120 Vac at 20°C Freq. = 2593.0 MHz

| Voltage (%) | Temp. (°C) | Frequency (Hz) | Frequency Error (Hz) | Deviation (Hz) | ppm |
|-------------|------------|----------------|----------------------|----------------|--------|
| 100% | +20(Ref) | 2593000000.0 | 0.0 | 0.0 | 0.0000 |
| | -30 | 2593000000.0 | 0.0 | 0.0 | 0.0000 |
| | -20 | 2593000000.0 | 0.0 | 0.0 | 0.0000 |
| | -10 | 2593000000.0 | 0.0 | 0.0 | 0.0000 |
| | 0 | 2593000000.0 | 0.0 | 0.0 | 0.0000 |
| | +10 | 2593000000.0 | 0.0 | 0.0 | 0.0000 |
| | +30 | 2593000000.0 | 0.0 | 0.0 | 0.0000 |
| | +40 | 2593000000.0 | 0.0 | 0.0 | 0.0000 |
| 115% | +20 | 2593000000.0 | 0.0 | 0.0 | 0.0000 |
| | 85% | +20 | 2593000000.0 | 0.0 | 0.0000 |

[Uplink]