

FCC REPORT

Certification

Applicant Name:
GS Instech Co., Ltd.**Date of Issue:**
June 12, 2019**Address:**
70, Gilpa-ro 71beon-gil, Nam-gu, Inchen, Korea**Location of test lab:**
HCT CO., LTD.,
74, Seoicheon-ro 578beon-gil, Majang-myeon,
Icheon-si, Gyeonggi-do, 17383, Rep. of KOREA**Report No.:** HCT-RF-1905-FC026-R1

| | |
|-------------------|-----------------------------|
| FCC ID: | U88-HOME5000 |
| APPLICANT: | GS Instech Co., Ltd. |

Model: HOME 5000**EUT Type:** Cell Phone Signal Booster**Frequency Range:**

| Band Name | Uplink (MHz) | Downlink (MHz) |
|---------------|---------------|----------------|
| Lower 700 MHz | 704 ~ 716 | 734 ~ 746 |
| Upper 700 MHz | 776 ~ 787 | 746 ~ 757 |
| Cellular | 824 ~ 849 | 869 ~ 894 |
| AWS-1 | 1 710 ~ 1 755 | 2 110 ~ 2 155 |
| Broadband PCS | 1 850 ~ 1 915 | 1 930 ~ 1 995 |

Output Power: 20 dBm (UL) / 5 dBm (DL)**Date of Test:** January 9, 2019 ~ June 11, 2019**FCC Rule Parts:** CFR 47 Part 2, Part 20, Part 22, Part 24, Part 27

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 the FCC Rules under normal use and maintenance.



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Approved by : Kwon Jeong
Manager of telecommunication testing center

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Version

| TEST REPORT NO. | DATE | DESCRIPTION |
|----------------------|---------------|--|
| HCT-RF-1905-FC026 | May 20, 2019 | - First Approval Report |
| HCT-RF-1905-FC026-R1 | June 11, 2019 | - Revised the test result in Section 5.2 - Corrected typos.(Frequency: 743.5 MHz → 745.3 MHz) |
| | | |
| | | |

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1. GENERAL INFORMATION

1.1. APPLICANT INFORMATION

| | |
|-----------------|--|
| Company Name | GS Instech Co., Ltd. |
| Company Address | 70, Gilpa-ro 71beon-gil, Nam-gu, Inchen, Korea |

1.2. PRODUCT INFORMATION

| | | | |
|------------------------|---|--------------------|----------------|
| EUT Type | Cell Phone Signal Booster | | |
| Equipment Class | B2W-Part 20 Wideband Consumer Booster (CMRS) / Fixed | | |
| Power Supply | AC ADAPTER (INPUT: AC 100-240 V, 50/60 Hz, 1.0 A OUTPUT: DC 12 V, 3.0 A) | | |
| Frequency Range | Band Name | Uplink (MHz) | Downlink (MHz) |
| | Lower 700 MHz | 704 ~ 716 | 734 ~ 746 |
| | Upper 700 MHz | 776 ~ 787 | 746 ~ 757 |
| | Cellular | 824 ~ 849 | 869 ~ 894 |
| | AWS-1 | 1 710 ~ 1 755 | 2 110 ~ 2 155 |
| | Broadband PCS | 1 850 ~ 1 915 | 1 930 ~ 1 995 |
| Utilized Emission Type | Band Name | Modulation | Designator |
| | Lower 700 MHz | LTE | G7W |
| | Upper 700 MHz | LTE | G7W |
| | Cellular | CDMA, 1xEV-DO, LTE | F9W, G7W |
| | AWS-1 | LTE | G7W |
| | Broadband PCS | CDMA, 1xEV-DO, LTE | F9W, G7W |
| Tx Output Power | 20 dBm (UL) / 5 dBm (DL) | | |
| Antenna Type | Donor (AC-D0727P11): LPDA Antenna Server (AC-D7027W08): Wall Mount Antenna | | |

1.3. PROVIDED ANTENNA INFORMATION

| Port | Model Name | Frequency (MHz) | Gain (dBi) | Cable (Length) | Cable Loss (dB) |
|--------|-------------|-----------------|------------|----------------|-----------------|
| Donor | AC-D0727P11 | 710 | 9 | 5D-FB (60 ft) | 3.196 |
| | | 782 | 9 | | 3.456 |
| | | 836.5 | 11 | | 3.456 |
| | | 1732.5 | 11 | | 5.255 |
| | | 1882.5 | 11 | | 5.591 |
| Server | AC-D7027W08 | 740 | 4.50 | RG174 (25 ft) | 7.000 |
| | | 751.5 | 4.70 | | 7.750 |
| | | 881.5 | 5.66 | | 8.500 |
| | | 2 132.5 | 7.43 | | 11.398 |
| | | 1 962.5 | 8.98 | | 11.180 |

※ Donor Antenna gain is in accordance with specification.

※ Server Antenna gain is quoted from measurements provide by vendor.

1.4. TEST INFORMATION

| | |
|-----------------------|---|
| FCC Rule Parts | CFR 47 Part 2, Part 20, Part 22, Part 24, Part 27 |
| Measurement Standards | KDB 935210 D03 v04r03, ANSI C63.26-2015 |
| Test Location | HCT CO., LTD. 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, 17383, Rep. of KOREA |

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, 17383, Rep. of KOREA.

The site is constructed in conformance with the requirements of ANSI C63.4 (Version: 2014) and CISPR Publication 22.

Detailed description of test facility was submitted to the Commission and accepted dated April 02, 2018 (Registration Number: KR0032).

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 SPECIFICATIONS

3.1. STANDARDS

The following tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC Part 2, Part 20, Part 22, Part 24 and Part 27.

| Description | Reference | Results |
|--|---|-----------|
| Authorized frequency band verification | §20.21(e)(3) | Compliant |
| Maximum power measurement | §20.21(e)(8)(i)(B), §20.21(e)(8)(i)(D), §20.21(e)(8)(ii)(B), §2.1046, §22.913, §24.232, §27.50(b),(c),(d) | Compliant |
| Maximum booster gain computation | §20.21(e)(8)(i)(B), §20.21(e)(8)(i)(C)(2) | Compliant |
| Intermodulation product | §20.21(e)(8)(i)(F) | Compliant |
| Out-of-band emissions | §20.21(e)(8)(i)(E) | Compliant |
| Conducted spurious emissions | §2.1051, §22.917, §24.238, §27.53(c),(f),(g),(h) | Compliant |
| Noise limits | §20.21(e)(8)(i)(A), §20.21(e)(8)(i)(H) | Compliant |
| Uplink inactivity | §20.21(e)(8)(i)(I) | Compliant |
| Variable booster gain | §20.21(e)(8)(i)(C)(1), §20.21(e)(8)(i)(H) | Compliant |
| Occupied bandwidth | §2.1049 | Compliant |
| Oscillation detection | §20.21(e)(5), §20.21(e)(8)(ii)(A) | Compliant |
| Radiated spurious emissions | §2.1053 | Compliant |

3.2. ADDITIONAL DESCRIPTIONS ABOUT TEST

For test progress, the Inactivity function of EUT was turned off except uplink Inactivity measurement.

Function of switch was used instead of coupler in test progress.

In oscillation test, band select function of EUT GUI was used instead of using band filter.

Since EUT does not support spectrum block filtering function, the related tests was omitted.

The frequency stability measurement has been omitted because EUT does not alter the input signal.
: It can be confirmed through occupied bandwidth test.

The test was generally based on the method of KDB 935210 D03 v04r03 and only followed ANSI C63.26-2015 if there was no test method in KDB standard.

The tests results included actual loss value for attenuator and cable combination as shown in the table below.

: Output Path (Direct)

| Correction factor table | | | |
|-------------------------|-------------|-----------------|-------------|
| Frequency (MHz) | Factor (dB) | Frequency (MHz) | Factor (dB) |
| 600 | 1.046 | 1 800 | 1.735 |
| 700 | 1.156 | 1 900 | 1.730 |
| 800 | 1.178 | 2 000 | 1.888 |
| 900 | 1.156 | 2 100 | 1.924 |
| 1 600 | 1.839 | 2 200 | 2.068 |
| 1 700 | 1.717 | 2 300 | 2.064 |

: Coupled Path (Switch Coupled)

| Correction factor table | | | |
|-------------------------|-------------|-----------------|-------------|
| Frequency (MHz) | Factor (dB) | Frequency (MHz) | Factor (dB) |
| 600 | 4.833 | 1 800 | 5.180 |
| 700 | 5.155 | 1 900 | 4.852 |
| 800 | 4.857 | 2 000 | 5.476 |
| 900 | 4.699 | 2 100 | 5.794 |
| 1 600 | 4.699 | 2 200 | 5.576 |
| 1 700 | 5.586 | 2 300 | 5.999 |

: Output Path (20 dB Attenuator)

| Correction factor table | | | |
|-------------------------|-------------|-----------------|-------------|
| Frequency (MHz) | Factor (dB) | Frequency (MHz) | Factor (dB) |
| 2 | 20.356 | 4 000 | 23.249 |
| 10 | 20.415 | 4 500 | 23.172 |
| 50 | 20.222 | 5 000 | 23.536 |
| 100 | 20.279 | 5 500 | 23.835 |
| 200 | 20.438 | 6 000 | 23.796 |
| 300 | 20.809 | 6 500 | 24.599 |
| 400 | 20.966 | 7 000 | 24.017 |
| 500 | 21.094 | 7 500 | 24.300 |
| 600 | 21.193 | 8 000 | 24.138 |
| 700 | 21.315 | 8 500 | 24.498 |
| 800 | 21.355 | 9 000 | 24.470 |
| 900 | 21.361 | 9 500 | 24.450 |
| 1 000 | 21.412 | 10 000 | 26.823 |
| 1 100 | 21.495 | 11 000 | 26.158 |
| 1 200 | 21.412 | 12 000 | 25.790 |
| 1 300 | 21.495 | 13 000 | 25.600 |
| 1 400 | 21.729 | 14 000 | 26.848 |
| 1 500 | 21.777 | 15 000 | 26.295 |
| 1 600 | 21.831 | 16 000 | 26.669 |
| 1 700 | 21.931 | 17 000 | 26.769 |
| 1 800 | 22.106 | 18 000 | 27.227 |
| 1 900 | 21.983 | 19 000 | 27.037 |
| 2 000 | 22.000 | 20 000 | 29.090 |
| 2 100 | 22.022 | 21 000 | 30.044 |
| 2 200 | 22.225 | 22 000 | 28.823 |
| 2 300 | 22.233 | 23 000 | 29.549 |
| 2 400 | 22.370 | 24 000 | 30.106 |
| 2 500 | 22.372 | 25 000 | 31.273 |
| 3 000 | 22.965 | 26 000 | 31.378 |
| 3 500 | 22.987 | 26 500 | 32.387 |

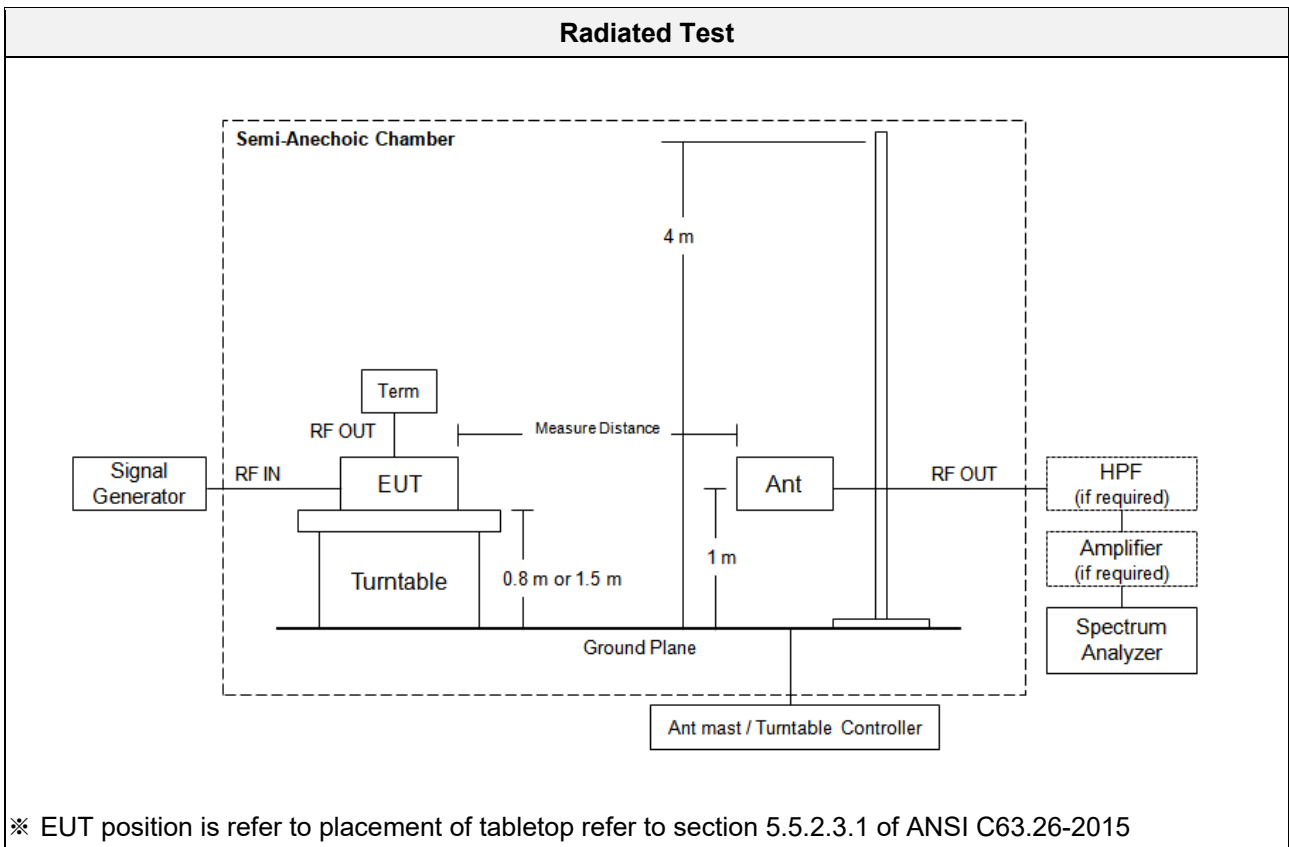
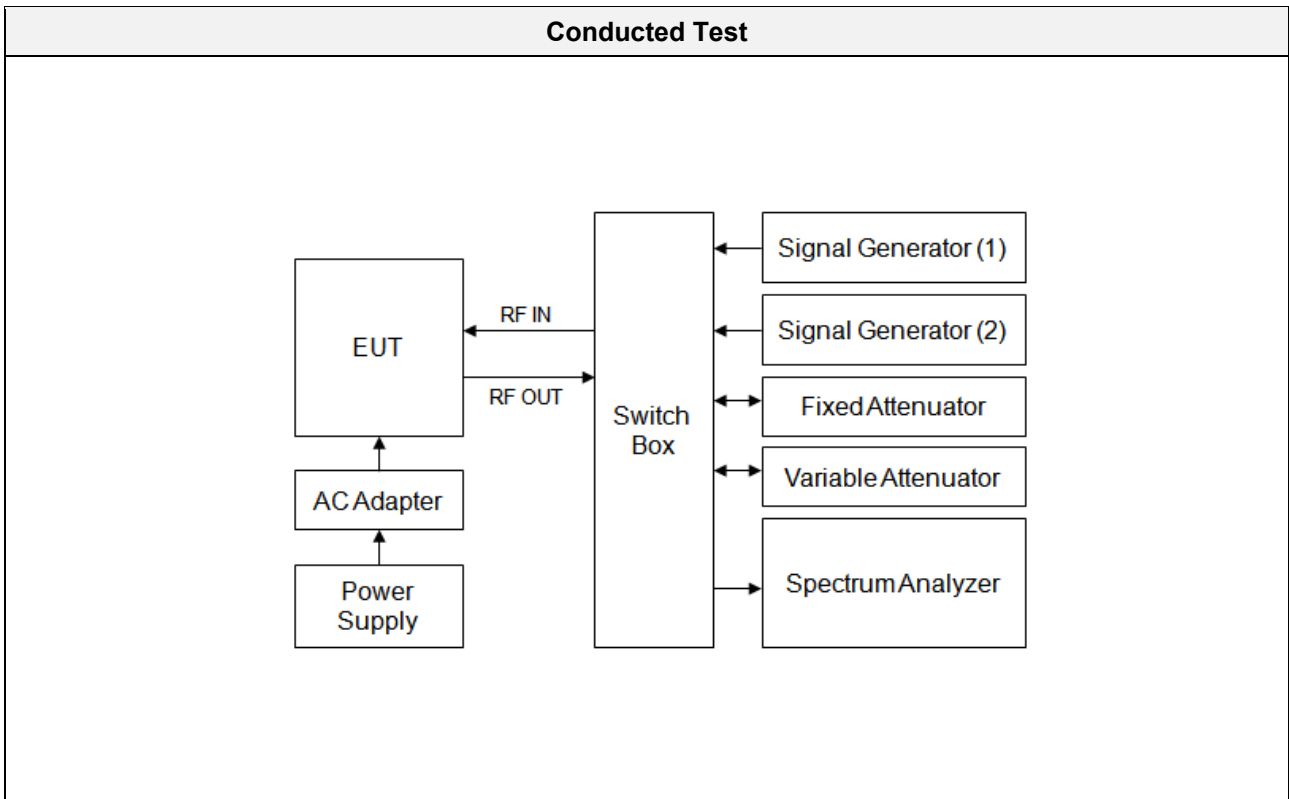
3.3. MEASUREMENT UNCERTAINTY

| Description | Reference | Results |
|--|------------------------|-----------|
| Authorized frequency band verification | - | ±0.58 MHz |
| Maximum power measurement | - | ±0.87 dB |
| Maximum booster gain computation | | |
| Intermodulation product | - | ±1.08 dB |
| Out-of-band emissions | | |
| Conducted spurious emissions | | |
| Noise limits | - | ±0.87 dB |
| Uplink inactivity | - | ±0.01 % |
| Variable booster gain | - | ±0.87 dB |
| Occupied bandwidth | - | ±0.58 MHz |
| Oscillation detection | - | ±0.01 % |
| Radiated spurious emissions | $f \leq 1 \text{ GHz}$ | ±4.80 dB |
| | $f > 1 \text{ GHz}$ | ±6.07 dB |

3.4. STANDARDS ENVIRONMENTAL TEST CONDITIONS

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

3.5. TEST DIAGRAMS



4. TEST EQUIPMENTS

| Manufacturer | Model / Equipment | Calibration Date | Calibration Interval | Serial No. |
|------------------------|--|------------------|----------------------|-------------|
| Agilent | N9020A / Spectrum Analyzer | 09/05/2018 | Annual | MY46471250 |
| Agilent | N5182A / Signal Generator | 08/09/2018 | Annual | MY50140312 |
| Agilent | N5182A / Signal Generator | 01/18/2019 | Annual | MY47070406 |
| Changwoo | 18N-20 dB / Attenuator | 09/13/2018 | Annual | 4 |
| KEITHLEY | S46 / Switch | N/A | N/A | 1088024 |
| HP | Switch Driver | N/A | N/A | 3334A11210 |
| HP | Variable Attenuator / 8496G | 06/29/2018 | Annual | 2817A14133 |
| HP | Variable Attenuator / 8494G | 06/29/2018 | Annual | 2813A14121 |
| Deayoung ENT | DFSS60 / AC Power Supply | 04/04/2019 | Annual | 1003030-1 |
| Innco system | CO3000 / Controller(Antenna mast) | N/A | N/A | CO3000-4p |
| Innco system | MA4640/800-XP-EP / Antenna Position Tower | N/A | N/A | N/A |
| Audix | EM1000 / Controller | N/A | N/A | 060520 |
| Audix | Turn Table | N/A | N/A | N/A |
| Rohde&Schwarz | - / Loop Antenna | 01/18/2019 | Biennial | 1513-175 |
| Schwarzbeck | VULB 9168 / Hybrid Antenna | 08/31/2018 | Biennial | 9168-0895 |
| Schwarzbeck | BBHA 9120D / Horn Antenna | 06/30/2017 | Biennial | 9120D-1300 |
| Schwarzbeck | BBHA9170 / Horn Antenna(15 GHz ~ 40 GHz) | 01/28/2019 | Biennial | BBHA9170124 |
| Rohde&Schwarz | FSP / Spectrum Analyzer | 07/24/2018 | Annual | 100843 |
| Wainwright Instruments | WHKX10-900-1000-15000-40SS / High Pass Filter | 07/20/2018 | Annual | 5 |
| Wainwright Instruments | WHKX10-2700-3000-18000-40SS / High Pass Filter | 07/20/2018 | Annual | 3 |
| CERNEX | CBLU1183540B-01 / Power Amplifier | 12/21/2018 | Annual | 25540 |
| CERNEX | CBL06185030 / Power Amplifier | 03/26/2019 | Annual | 28550 |
| CERNEX | CBL18265035 / Power Amplifier | 01/03/2019 | Annual | 22966 |
| CERNEX | CBL26405040 / Power Amplifier | 06/29/2018 | Annual | 25956 |

5. TEST RESULTS

5.1. AUTHORIZED FREQUENCY BAND VERIFICATION

Test Requirement:**§ 20.21(e)(3) Frequency Bands.**

Consumer Signal Boosters must be designed and manufactured such that they only operate on the frequencies used for the provision of subscriber-based services under parts 22 (Cellular), 24 (Broadband PCS), 27 (AWS-1, 700 MHz Lower A-E Blocks, and 700 MHz Upper C Block), and 90 (Specialized Mobile Radio) of this chapter. The Commission will not certificate any Consumer Signal Boosters for operation on part 90 of this chapter (Specialized Mobile Radio) frequencies until the Commission releases a public notice announcing the date Consumer Signal Boosters may be used in the band.

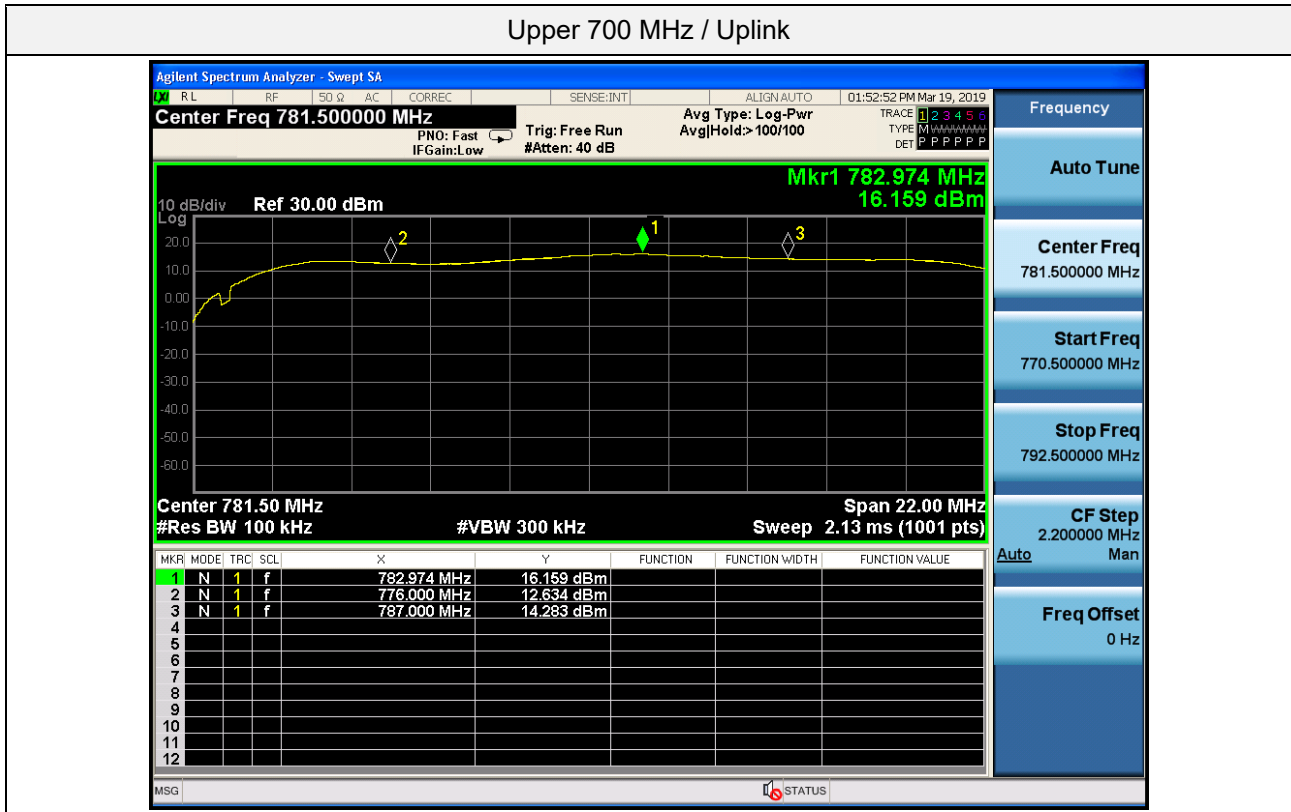
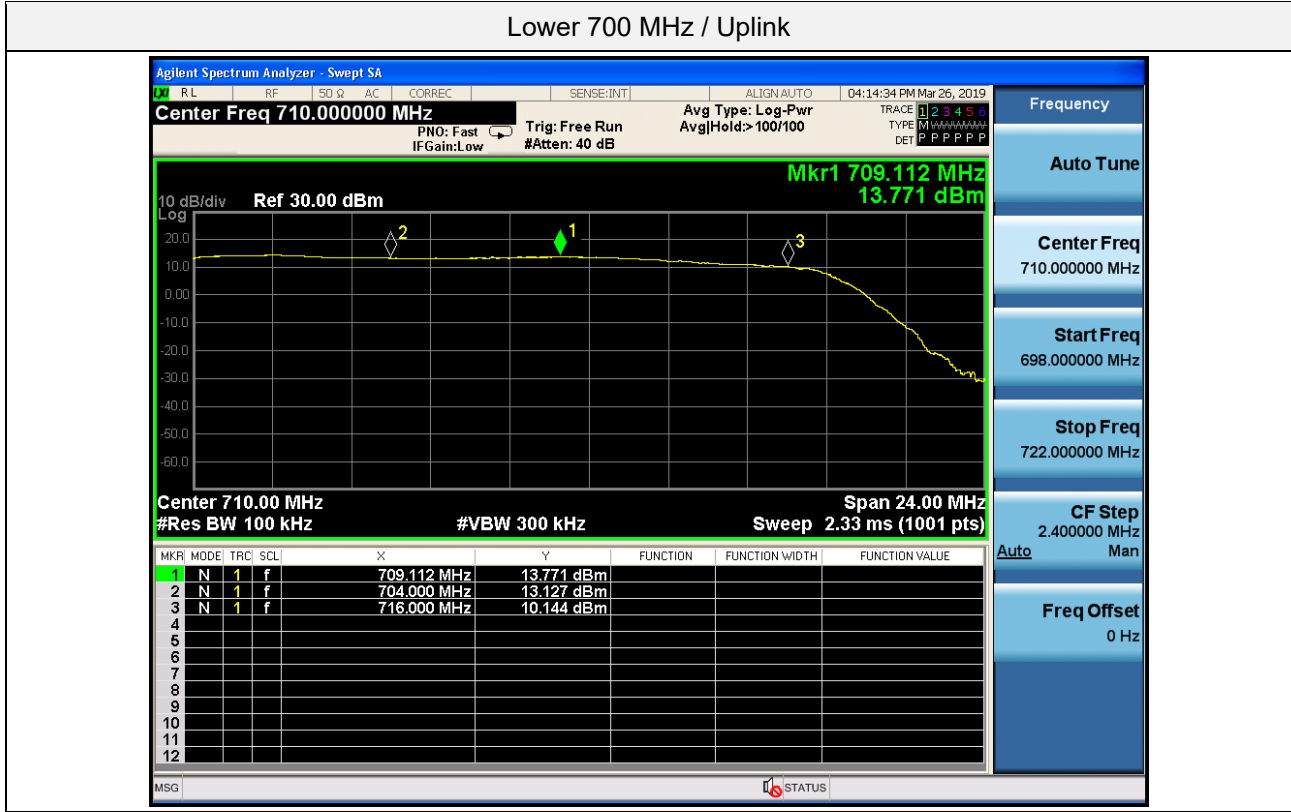
Test Procedures:

Measurements were in accordance with the test methods section 7.1 of KDB 935210 D03 v04r03.

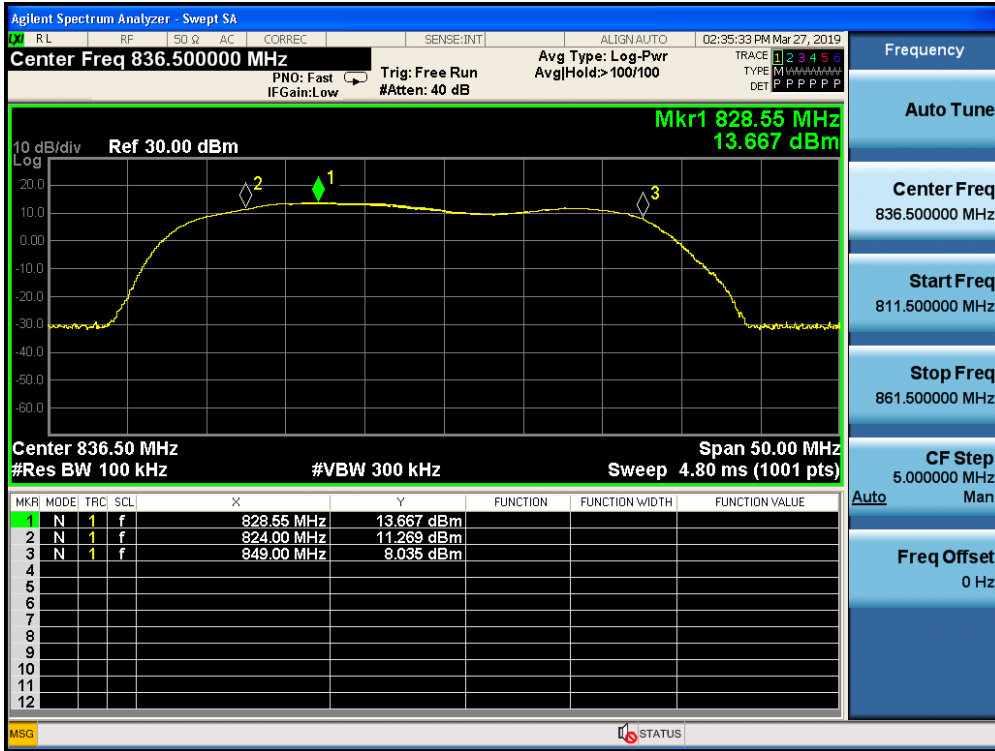
- a) Begin with the uplink output (donor) port connected to the spectrum analyzer.
- b) Set the spectrum analyzer resolution bandwidth (RBW) for 100 kHz with the video bandwidth (VBW) $\geq 3 \times$ the RBW, using a PEAK detector with the MAX HOLD function.
- c) Set the center frequency of the spectrum analyzer to the center of the operational band under test with a span of 1 MHz.
- d) Set the signal generator for CW mode and tune to the center frequency of the operational band under test.
- e) Set the initial signal generator power to a level that is at least 6 dB below the AGC level specified by the manufacturer.
- f) Slowly increase the signal generator power level until the output signal reaches the AGC operational level.
- g) Reduce the signal generator power to a level that is 3 dB below the level noted above, then manually reset the EUT (e.g., cycle ac/dc power).
- h) Reset the spectrum analyzer span to $2 \times$ the width of the CMRS band under test. Adjust the tuned frequency of the signal generator to sweep $2 \times$ the width of the CMRS band using the sweep function. The AGC must be deactivated throughout the entire sweep.
- i) Using three markers, identify the CMRS band edges and the frequency with the highest power. Affirm that the values of all markers are visible on the display of the spectrum analyzer (e.g., marker table set to on).
- j) Capture the spectrum analyzer trace for inclusion in the test report.
- k) Repeat c) to j) for all operational uplink and downlink bands.

Test Results:

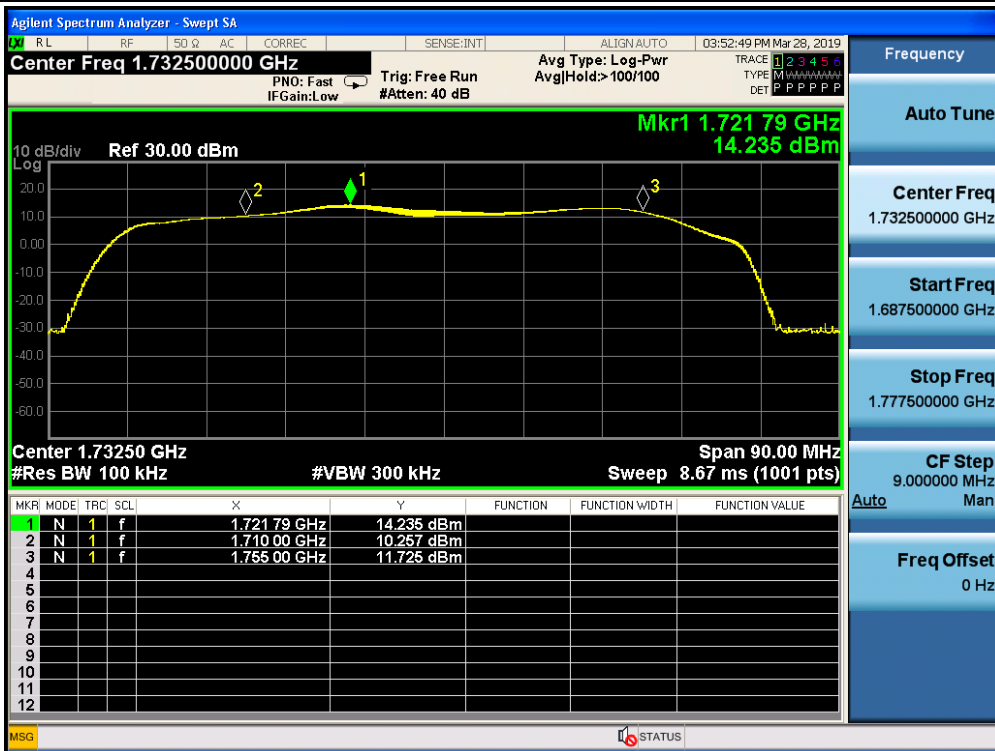
Plot data of Authorized Frequency Band

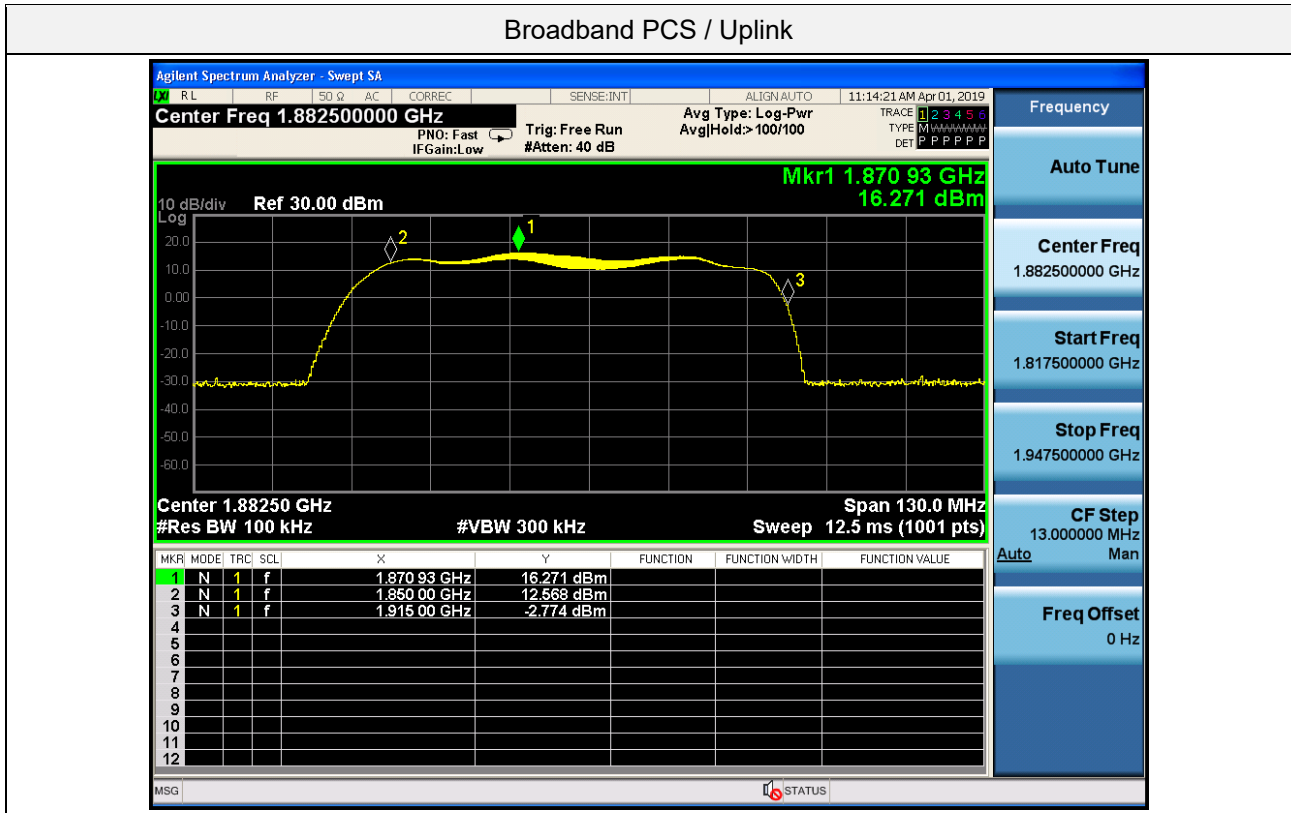


Cellular / Uplink

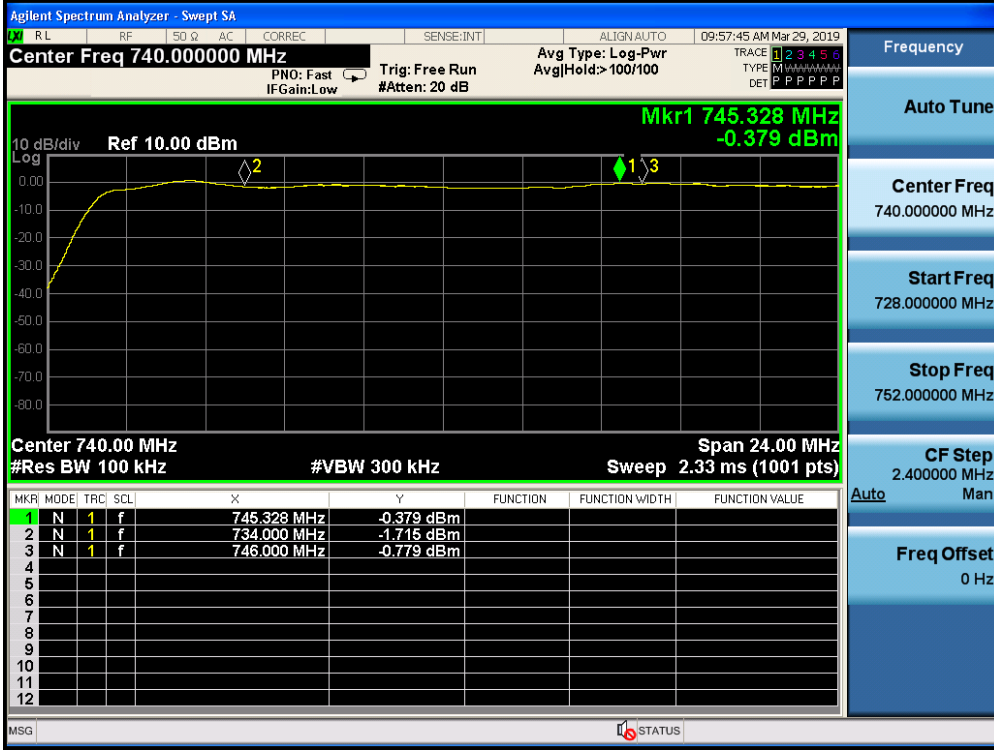


AWS-1 / Uplink

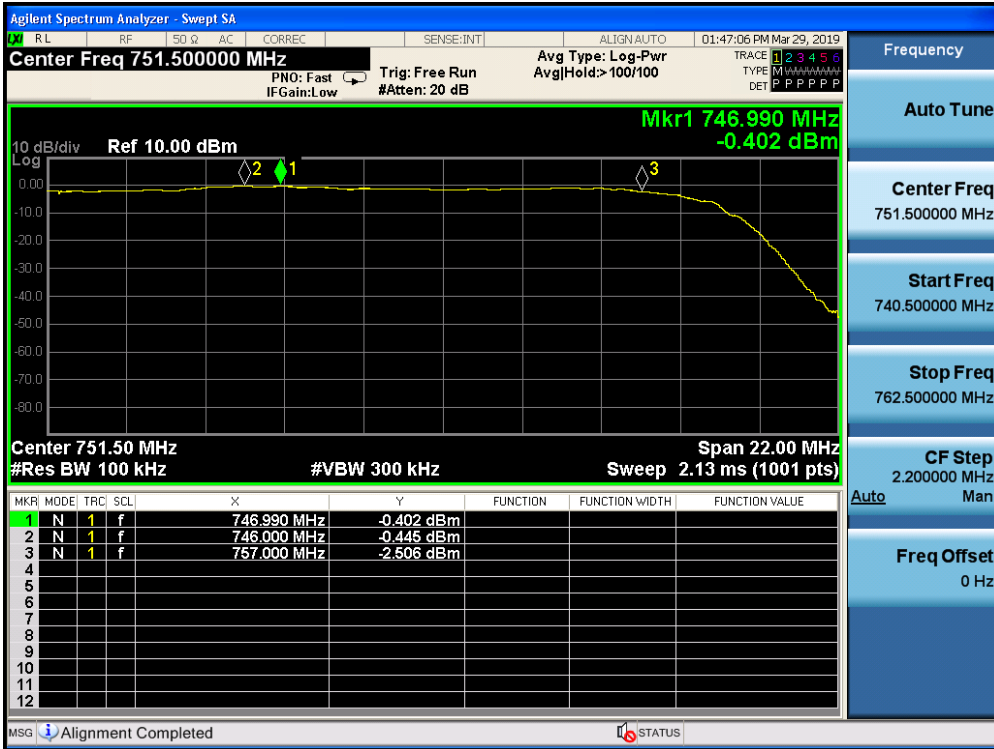




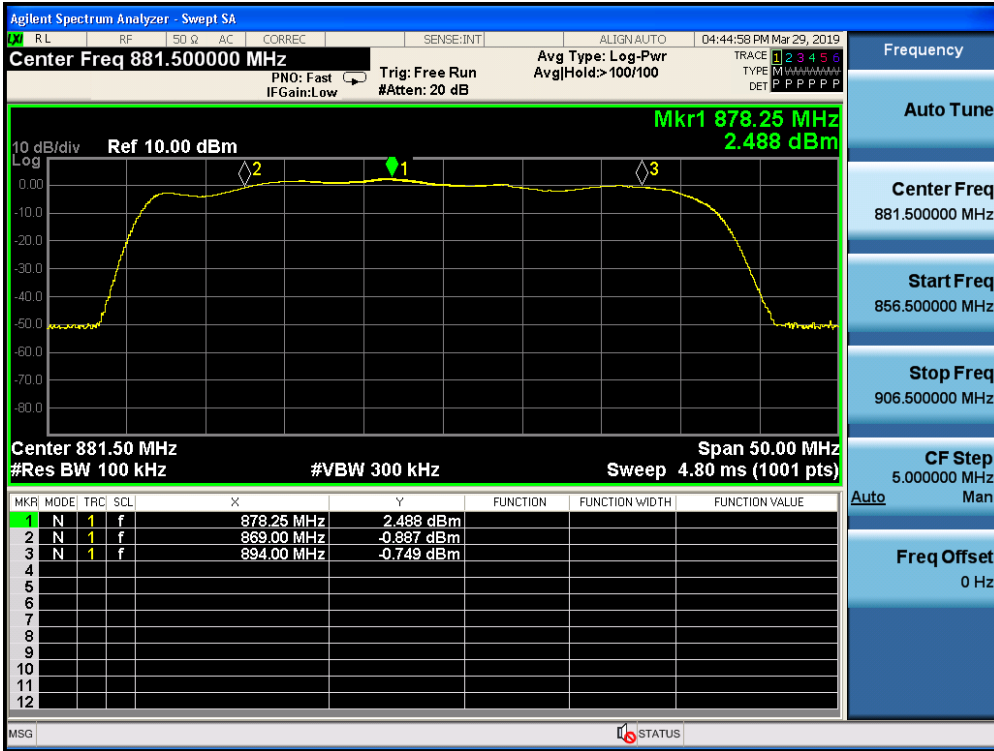
Lower 700 MHz / Downlink



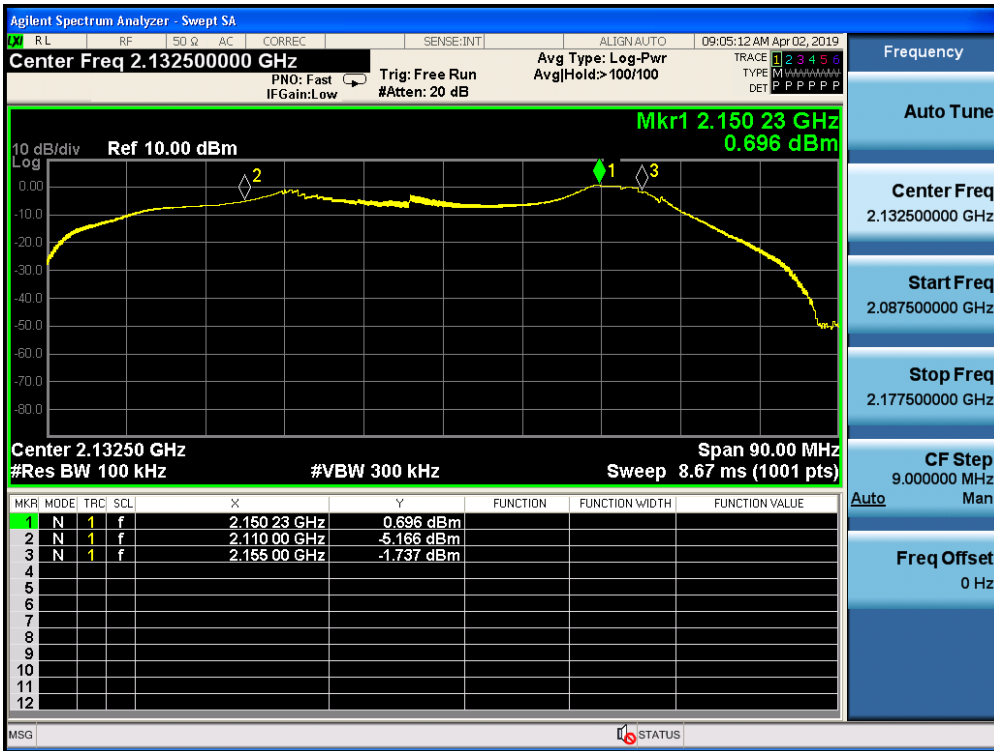
Upper 700 MHz / Downlink

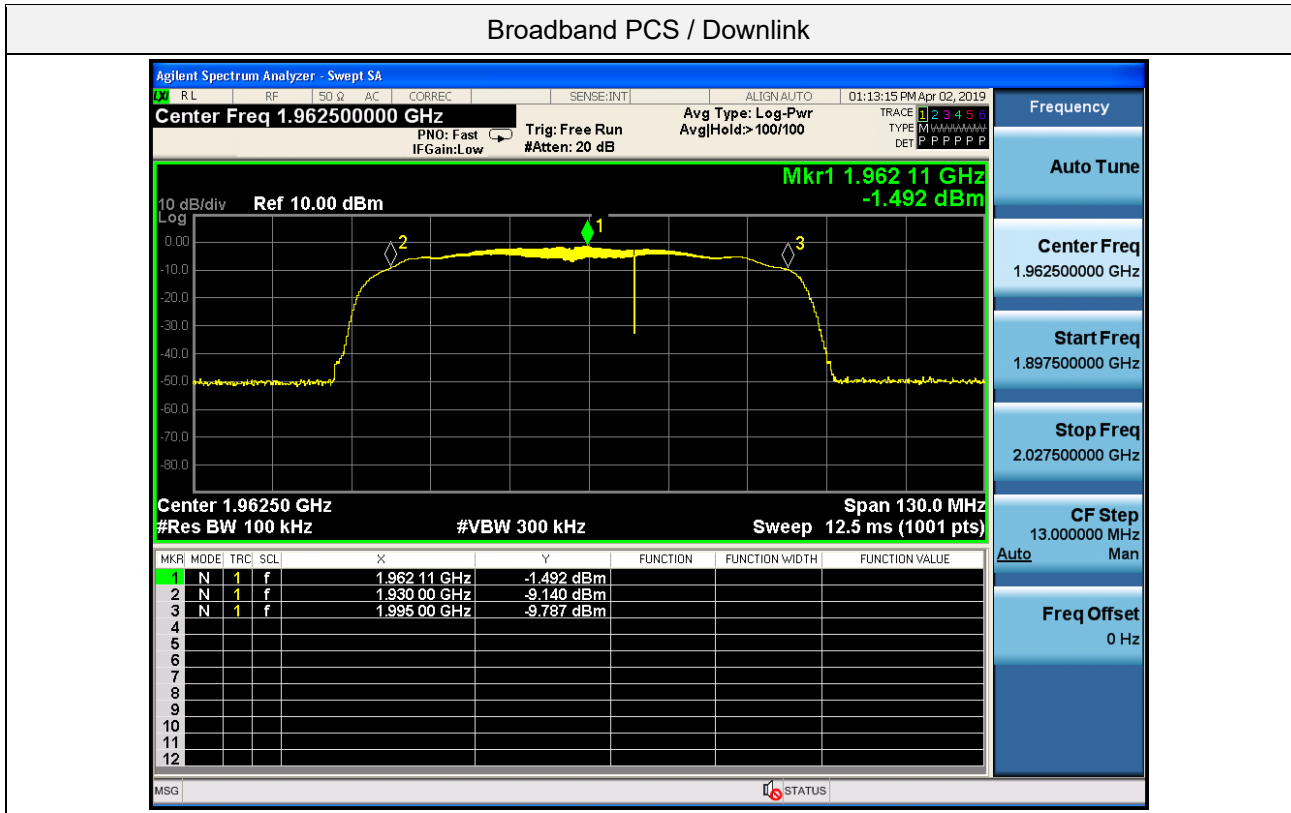


Cellular / Downlink



AWS-1 / Downlink





5.2. MAXIMUM POWER MEASUREMENT

Test Requirement:

§2.1046 Measurements required: RF power output.

(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.

(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 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.

(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.

§20.21(e)(8)(i)(B) Bidirectional Capability

Consumer Boosters must be able to provide equivalent uplink and downlink gain and conducted uplink power output that is at least 0.05 watts. One-way consumer boosters (i.e., uplink only, downlink only, uplink impaired, downlink impaired) are prohibited. Spectrum block filtering may be used provided the uplink filter attenuation is not less than the downlink filter attenuation, and where RSSI is measured after spectrum block filtering is applied referenced to the booster's input port for each band of operation.

§20.21(e)(8)(i)(D) Power Limits

A booster's uplink power must not exceed 1 watt composite conducted power and equivalent isotropic radiated power (EIRP) for each band of operation. Composite downlink power shall not exceed 0.05 watt (17 dBm) conducted and EIRP for each band of operation. Compliance with power limits will use instrumentation calibrated in terms of RMS equivalent voltage.

§20.21(e)(8)(ii)(B) Gain Control

Consumer boosters must have automatic limiting control to protect against excessive input signals that would cause output power and emissions in excess of that authorized by the Commission.

§22.913 Effective radiated power limits.

Licensees in the Cellular Radiotelephone Service are subject to the effective radiated power (ERP) limits and other requirements in this Section. See also §22.169.

(a) *Maximum ERP.* The ERP of transmitters in the Cellular Radiotelephone Service must not exceed the limits in this section.

(1) Except as described in paragraphs (a)(2), (3), and (4) of this section, the ERP of base stations and repeaters must not exceed—

- (i) 500 watts per emission; or
- (ii) 400 watts/MHz (PSD) per sector.

(d) *Power measurement.* Measurement of the ERP of Cellular base transmitters and repeaters must be made using an average power measurement technique. The peak-to-average ratio (PAR) of the transmission must not exceed 13 dB. Power measurements for base transmitters and repeaters must be made in accordance with either of the following:

- (1) A Commission-approved average power technique (see FCC Laboratory's Knowledge Database); or
- (2) For purposes of this section, peak transmit power must be measured over an interval of continuous transmission using instrumentation calibrated in terms of an 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, sensitivity, etc., so as to obtain a true peak measurement for the emission in question over the full bandwidth of the channel.

§24.232 Power and antenna height limits.

(b)(1) Base stations that are located in counties with population densities of 100 persons or fewer per square mile, based upon the most recently available population statistics from the Bureau of the Census, with an emission bandwidth of 1 MHz or less are limited to 3280 watts equivalent isotropically radiated power (EIRP) with an antenna height up to 300 meters HAAT.

(2) Base stations that are located in counties with population densities of 100 persons or fewer per square mile, based upon the most recently available population statistics from the Bureau of the Census, with an emission bandwidth greater than 1 MHz are limited to 3280 watts/MHz equivalent isotropically radiated power (EIRP) with an antenna height up to 300 meters HAAT.

(3) Base station antenna heights may exceed 300 meters HAAT with a corresponding reduction in power; see Tables 3 and 4 of this section. (d) Power measurements for transmissions by stations authorized under this section may be made either in accordance with a Commission-approved average power technique or in compliance with paragraph (e) of this section. In both instances, equipment employed must be authorized in accordance with the provisions of §24.51. In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

(e) Peak transmit power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an 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, sensitivity, etc., so as to obtain a true peak measurement for the emission in question over the full bandwidth of the channel.

Table 3—Reduced Power for Base Station Antenna Heights Over 300 Meters, With Emission Bandwidth of 1 MHz or Less

| HAAT in meters | Maximum EIRP watts |
|----------------|--------------------|
| ≤300 | 3280 |
| ≤500 | 2140 |
| ≤1000 | 980 |
| ≤1500 | 540 |
| ≤2000 | 320 |

Table 4—Reduced Power for Base Station Antenna Heights Over 300 Meters, With Emission Bandwidth Greater Than 1 MHz

| HAAT in meters | Maximum EIRP watts/MHz |
|----------------|------------------------|
| ≤300 | 3280 |
| ≤500 | 2140 |
| ≤1000 | 980 |
| ≤1500 | 540 |
| ≤2000 | 320 |

§27.50 Power limits and duty cycle.

(b) The following power and antenna height limits apply to transmitters operating in the 746-758 MHz, 775-788 MHz and 805-806 MHz bands:

(3) 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 746-757 MHz and 776-787 MHz bands 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.

(5) 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 746-757 MHz and 776-787 MHz bands 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.

(7) Licensees seeking to operate a fixed or base station 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 746-757 MHz and 776-787 MHz bands at an ERP greater than 1000 watts must:

- i) Coordinate in advance with all licensees authorized to operate in the 698-758 MHz, 775-788, and 805-806 MHz bands within 120 kilometers (75 miles) of the base or fixed station;
 - (ii) coordinate in advance with all regional planning committees, as identified in §90.527 of this chapter, with jurisdiction within 120 kilometers (75 miles) of the base or fixed station.
- (11) For transmissions in the 757-758, 775-776, 787-788, and 805-806 MHz bands, 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.
- (12) For transmissions in the 746-757 and 776-787 MHz bands, licensees may employ equipment operating in compliance with either the measurement techniques described in paragraph (b)(11) of this section or a Commission-approved average power technique. In both instances, equipment employed must be authorized in accordance with the provisions of §27.51.
- (c) The following power and antenna height requirements apply to stations transmitting in the 600 MHz band and the 698-746 MHz band:
- (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 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;
 - (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 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, except for licensees operating in the 600 MHz downlink band, seeking to operate a fixed or base station 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 at an ERP greater than 1000 watts must:
 - (i) Coordinate in advance with all licensees authorized to operate in the 698-758 MHz, 775-788, and 805-806 MHz bands within 120 kilometers (75 miles) of the base or fixed station;
 - (ii) coordinate in advance with all regional planning committees, as identified in §90.527 of this chapter, with jurisdiction within 120 kilometers (75 miles) of the base or fixed station.
- (11) Licensees may employ equipment operating in compliance with either the measurement techniques described in paragraph (b)(11) of this section or a Commission-approved average power technique. In both instances, equipment employed must be authorized in accordance with the provisions of §27.51.

(d) The following power and antenna height requirements apply to stations transmitting in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz and 2180-2200 MHz bands:

(4) Fixed, mobile, and portable (hand-held) stations operating in the 1710-1755 MHz band and mobile and portable stations operating in the 1695-1710 MHz and 1755-1780 MHz bands are limited to 1 watt EIRP. Fixed stations operating in the 1710-1755 MHz band are limited to a maximum antenna height of 10 meters above ground. Mobile and portable stations operating in these bands must employ a means for limiting power to the minimum necessary for successful communications.

(5) Equipment employed must be authorized in accordance with the provisions of §24.51. Power measurements for transmissions by stations authorized under this section may be made either in accordance with a Commission-approved average power technique or in compliance with paragraph (d)(6) of this section. In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

(6) Peak transmit power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an 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, sensitivity, etc., so as to obtain a true peak measurement for the emission in question over the full bandwidth of the channel.

Table 2 to §27.50—Permissible Power and Antenna Heights for Base and Fixed Stations in the 600 MHz, 698-757 MHz, 758-763 MHz, 776-787 MHz and 788-793 MHz Bands 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 4 to §27.50—Permissible Power and Antenna Heights for Base and Fixed Stations in the 600 MHz, 698-757 MHz, 758-763 MHz, 776-787 MHz and 788-793 MHz Bands 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 |

Test Procedures:

Measurements were in accordance with the test methods section 7.2 of KDB 935210 D03 v04r03.

- a) Begin with the uplink output (donor) port connected to the spectrum analyzer.
- b) Configure the signal generator and spectrum analyzer for operation on the frequency determined in authorized frequency band verification test with the highest power level, but with the center frequency of the signal no closer than 2.5 MHz from the band edge. The spectrum analyzer span shall be set to at least 10 MHz.
- c) Set the initial signal generator power to a level well below that which causes AGC activation.
- d) Slowly increase the signal generator power level until the output signal reaches the AGC operational limit.
- e) Reduce power sufficiently on the signal generator to ensure that the AGC is not controlling the power output.
- f) Slowly increase the signal generator power to a level just below (and within 0.5 dB of) the AGC limit without triggering the AGC. Note the signal generator power level as P_{in} .
- g) Measure the output power, P_{out} , with the spectrum analyzer as follows.
 - 1) Set RBW = 100 kHz for AWGN signal type, or 300 kHz for CW or GSM signal type.
 - 2) Set VBW $\geq 3 \times$ RBW.
 - 3) Select either the BURST POWER or CHANNEL POWER measurement mode, as required for each signal type. For AWGN, the channel power integration bandwidth shall be the 99% OBW of the 4.1 MHz signal.
 - 4) Select the power averaging (rms) detector.
 - 5) Affirm that the number of measurement points per sweep $\geq (2 \times \text{span})/\text{RBW}$.
 - 6) Set sweep time = auto couple, or as necessary (but no less than auto couple value).
 - 7) Trace average at least 100 traces in power averaging (i.e., rms) mode.
 - 8) Record the measured power level P_{out} , with one set of results for the GSM or CW input stimulus, and another set of results for the AWGN input stimulus.
- h) Repeat step g) while increasing the signal generator amplitude in 2 dB steps until the maximum input level indicated in maximum transmitter test input level is reached. If the booster has shut down at any point during the input power steps, it should be noted and step g) shall be repeated at an input level 1 dB less than that found to cause the shutdown. The test report shall include either a statement describing that the device

complies at 10 dB above AGC or at the maximum transmitter power levels, or a table showing compliance at the additional input power(s) required.

i) Repeat the entire procedure for each operational uplink and downlink frequency band supported by the booster.

j) Provide tabulated results in the test report.

Note1. Test limits apply the worst value of all applicable rule part.

- §20.21(e)(8)(i)(B): Conducted uplink power output that is at least 0.05 watt (17 dBm).

- §20.21(e)(8)(i)(D): Uplink power must not exceed 1 watt (30 dBm) for EIRP and conducted output.

Downlink power shall not exceed 0.05 watt (17 dBm) for EIRP and conducted output.

Note2. Coupling Gain is calculated according to following formula.

$$\text{Coupled Gain} = \text{Antenna gain} - \text{Cable loss}$$

Note3. Maximum Coupling Gain of each band is shown in the table below.

| Port | Frequency (MHz) | Ant. Gain (dBi) | Cable length (ft) | Cable Loss (dB) | Coupled Gain (dB) |
|--------|-----------------|-----------------|-------------------|-----------------|-------------------|
| Donor | 710 | 9 | 60 | 3.196 | 5.804 |
| | 781.5 | 9 | 60 | 3.456 | 5.544 |
| | 836.5 | 9 | 60 | 3.456 | 5.544 |
| | 1 732.5 | 11 | 60 | 5.255 | 5.745 |
| | 1 882.5 | 11 | 60 | 5.591 | 5.409 |
| Server | 740 | 4.50 | 25 | 7.000 | -2.500 |
| | 751.5 | 4.70 | 25 | 7.750 | -3.050 |
| | 881.5 | 5.66 | 25 | 8.500 | -2.840 |
| | 2 132.5 | 7.43 | 25 | 11.398 | -3.968 |
| | 1 962.5 | 8.98 | 25 | 11.180 | -2.200 |

* Donor Antenna gain is in accordance with specification.

* Server Antenna gain is quoted from measurements provide by vendor.

Note4. Following test signal is used according to KDB 935210 D02 v04r03.

| Signal | Detail | Measuring function |
|--------------|---|--------------------|
| Pulsed GSM | GSM signal with a pulse width of 570 μs and a duty cycle of 12.5% | burst power |
| 4.1 MHz AWGN | AWGN signal with a 99% occupied bandwidth of 4.1 MHz | channel power |

Note5. Following switch loss is corrected in signal generating.

| Band | Uplink generating loss (dB) | Downlink generating loss (dB) |
|---------------|-----------------------------|-------------------------------|
| Lower 700 MHz | 0.87 | 0.87 |
| Upper 700 MHz | 0.92 | 0.80 |
| Cellular | 0.85 | 0.88 |
| AWS-1 | 1.33 | 1.58 |
| Broadband PCS | 1.35 | 1.35 |

Note6. In test using pulse GSM signal, shutdown is occurred when input level is increased to 3 dB from AGC threshold. Because of it pulsed GSM power measurement is performed only up to 2 dB.

Note7. PAPR of each rule part is tested about AWGN signal.

Note8. EIRP is calculated according to following formula.

$$EIRP = \text{Conducted Output Power} + \text{Coupling Gain}$$

Test Results:

Tabulated Result of Uplink Maximum Power (AGC Threshold input level)

| Band | Frequency (MHz) | Input Signal | P _{in} (dBm) | Low Power Limit (dBm) | EIRP Limit (dBm) | Coupling Gain (dB) | P _{out} (dBm) | EIRP (dBm) |
|---------------|-----------------|--------------|-----------------------|-----------------------|------------------|--------------------|------------------------|------------|
| Lower 700 MHz | 709.112 | Pulse GSM | -38.40 | 17 | 30 | 5.80 | 20.26 | 26.06 |
| | | 4.1 MHz AWGN | -41.20 | | | | 17.64 | 23.45 |
| Upper 700 MHz | 782.974 | Pulse GSM | -36.00 | | | 5.54 | 20.75 | 26.29 |
| | | 4.1 MHz AWGN | -40.20 | | | | 17.28 | 22.83 |
| Cellular | 828.550 | Pulse GSM | -36.70 | | | 21.38 | 26.92 | |
| | | 4.1 MHz AWGN | -40.80 | | | 17.33 | 22.87 | |
| AWS-1 | 1 721.790 | Pulse GSM | -38.00 | | | 5.75 | 20.71 | 26.46 |
| | | 4.1 MHz AWGN | -41.00 | | | | 17.43 | 23.17 |
| Broadband PCS | 1 870.930 | Pulse GSM | -37.50 | 5.41 | 22.99 | 28.40 | | |
| | | 4.1 MHz AWGN | -40.30 | | 19.61 | 25.02 | | |

Tabulated Result of Uplink Maximum Power (AGC Threshold +10 dB)

| Band | Frequency (MHz) | Input Signal | P _{in} (dBm) | Low Power Limit (dBm) | EIRP Limit (dBm) | Coupling Gain (dB) | P _{out} (dBm) | EIRP (dBm) |
|---------------|-----------------|--------------|-----------------------|-----------------------|------------------|--------------------|------------------------|------------|
| Lower 700 MHz | 709.112 | Pulse GSM | -28.40 | 17 | 30 | 5.80 | 23.12 | 28.93 |
| | | 4.1 MHz AWGN | -31.20 | | | | 18.17 | 23.97 |
| Upper 700 MHz | 782.974 | Pulse GSM | -26.00 | | | 5.54 | 21.78 | 27.32 |
| | | 4.1 MHz AWGN | -30.20 | | | | 17.05 | 22.59 |
| Cellular | 828.550 | Pulse GSM | -26.70 | | | 22.61 | 28.15 | |
| | | 4.1 MHz AWGN | -30.80 | | | 17.71 | 23.25 | |
| AWS-1 | 1 721.790 | Pulse GSM | -28.00 | | | 5.75 | 22.32 | 28.07 |
| | | 4.1 MHz AWGN | -31.00 | | | | 17.15 | 22.89 |
| Broadband PCS | 1 870.930 | Pulse GSM | -27.50 | 5.41 | 22.95 | 28.36 | | |
| | | 4.1 MHz AWGN | -30.30 | | 18.88 | 24.28 | | |

Tabulated Result of Downlink Maximum Power (AGC Threshold input level)

| Band | Frequency (MHz) | Input Signal | P _{in} (dBm) | Power Limit (dBm) | Coupling Gain (dB) | P _{out} (dBm) | EIRP (dBm) |
|---------------|-----------------|--------------|-----------------------|-------------------|--------------------|------------------------|------------|
| Lower 700 MHz | 745.300 | Pulse GSM | -55.90 | 17 | -2.50 | 1.53 | -0.97 |
| | | 4.1 MHz AWGN | -58.80 | | | -1.88 | -4.38 |
| Upper 700 MHz | 748.500 | Pulse GSM | -53.40 | | -3.05 | 4.90 | 1.85 |
| | | 4.1 MHz AWGN | -58.00 | | | 1.13 | -1.92 |
| Cellular | 891.500 | Pulse GSM | -52.83 | | -2.84 | 5.13 | 2.29 |
| | 878.250 | 4.1 MHz AWGN | -58.40 | | | 1.50 | -1.34 |
| AWS-1 | 2 152.500 | Pulse GSM | -53.00 | | -3.97 | 1.52 | -2.45 |
| | 2 150.230 | 4.1 MHz AWGN | -59.40 | | | -5.03 | -9.00 |
| Broadband PCS | 1 962.110 | Pulse GSM | -55.40 | | -2.20 | 2.44 | 0.24 |
| | | 4.1 MHz AWGN | -58.80 | | | -1.51 | -3.71 |

Tabulated Result of Downlink Maximum Power (AGC Threshold +10 dB)

| Band | Frequency (MHz) | Input Signal | P _{in} (dBm) | Power Limit (dBm) | Coupling Gain (dB) | P _{out} (dBm) | EIRP (dBm) |
|---------------|-----------------|--------------|-----------------------|-------------------|--------------------|------------------------|------------|
| Lower 700 MHz | 745.300 | Pulse GSM | -45.90 | 17 | -2.50 | 2.09 | -0.41 |
| | | 4.1 MHz AWGN | -48.80 | | | -1.84 | -4.34 |
| Upper 700 MHz | 748.500 | Pulse GSM | -43.40 | | -3.05 | 5.35 | 2.30 |
| | | 4.1 MHz AWGN | -48.00 | | | 1.25 | -1.80 |
| Cellular | 891.500 | Pulse GSM | -42.83 | | -2.84 | 5.39 | 2.55 |
| | 878.250 | 4.1 MHz AWGN | -48.40 | | | 1.43 | -1.41 |
| AWS-1 | 2 152.500 | Pulse GSM | -43.00 | | -3.97 | 1.82 | -2.15 |
| | 2 150.230 | 4.1 MHz AWGN | -49.40 | | | -5.18 | -9.15 |
| Broadband PCS | 1 962.110 | Pulse GSM | -45.40 | | -2.20 | 2.66 | 0.46 |
| | | 4.1 MHz AWGN | -48.80 | | | -2.02 | -4.22 |

Tabulated result of Uplink PAPR

| Band | Frequency (MHz) | Limit (dB) | PAPR (dB) |
|---------------|-----------------|------------|-----------|
| Lower 700 MHz | 709.112 | 13 | 8.45 |
| Upper 700 MHz | 782.974 | | 8.29 |
| Cellular | 828.550 | | 8.38 |
| AWS-1 | 1 721.790 | | 7.25 |
| Broadband PCS | 1 870.930 | | 6.52 |

Tabulated result of Downlink PAPR

| Band | Frequency (MHz) | Limit (dB) | PAPR (dB) |
|---------------|-----------------|------------|-----------|
| Lower 700 MHz | 745.300 | 13 | 8.40 |
| Upper 700 MHz | 748.500 | | 8.34 |
| Cellular | 891.500 | | 8.40 |
| AWS-1 | 2 152.500 | | 8.42 |
| Broadband PCS | 1 962.110 | | 8.46 |

5.3. MAXIMUM BOOSTER GAIN COMPUTATION

Test Requirement:**§20.21(e)(8)(i)(B) Bidirectional Capability**

Consumer Boosters must be able to provide equivalent uplink and downlink gain and conducted uplink power output that is at least 0.05 watts. One-way consumer boosters (i.e., uplink only, downlink only, uplink impaired, downlink impaired) are prohibited. Spectrum block filtering may be used provided the uplink filter attenuation is not less than the downlink filter attenuation, and where RSSI is measured after spectrum block filtering is applied referenced to the booster's input port for each band of operation.

§20.21(e)(8)(i)(C)(2) Booster Gain Limits

The uplink and downlink maximum gain of a Consumer Booster referenced to its input and output ports shall not exceed the following limits:

- (i) Fixed Booster maximum gain shall not exceed $6.5 \text{ dB} + 20 \text{ Log}_{10} (\text{Frequency})$
- (ii) Where, Frequency is the uplink mid-band frequency of the supported spectrum bands in MHz.
- (iii) Mobile Booster maximum gain shall not exceed 50 dB when using an inside antenna (e.g., inside a vehicle), 23 dB when using direct contact coupling (e.g., cradle-type boosters), or 15 dB when directly connected (e.g., boosters with a physical connection to the phone).

Test Procedures:

Measurements were in accordance with the test methods section 7.3 of KDB 935210 D03 v04r03.

- a) Calculate the maximum gain of the booster as follows to demonstrate compliance to the applicable gain limits as specified.
- b) For both the uplink and downlink in each supported frequency band, use each of the P_{out} and P_{in} result pairs for all signal types used in maximum power measurement test in the following equation to obtain the maximum gain, G:

$$G \text{ (dB)} = P_{\text{out}} \text{ (dBm)} - P_{\text{in}} \text{ (dBm)}.$$

- c) Record the maximum gain of the uplink and downlink paths for each supported frequency band, and verify that the each gain value complies with the applicable limit.
- d) Provide tabulated results in the test report.

Note1. Test limits were applied as follows.

- §20.21(e)(8)(i)(B): Consumer Boosters must be able to provide equivalent uplink and downlink gain.
: 9 dB equivalent gain margin is applied by note 17 of section 7.3 in KDB 935210 D03.
- §20.21(e)(8)(i)(C)(2): Fixed booster maximum gain shall not exceed $6.5 \text{ dB} + 20 \text{ Log}_{10} (\text{Frequency})$

Test Results:
Tabulated Result of Uplink Booster Gain

| Band | Frequency (MHz) | Input Signal | Pin(dBm) | Pout (dBm) | Limit (dB) | Gain (dB) |
|---------------|-----------------|--------------|----------|------------|------------|-----------|
| Lower 700 MHz | 709.112 | Pulse GSM | -38.40 | 20.26 | 63.53 | 58.66 |
| | | 4.1 MHz AWGN | -41.20 | 17.64 | | 58.84 |
| Upper 700 MHz | 782.974 | Pulse GSM | -36.00 | 20.75 | 64.36 | 56.75 |
| | | 4.1 MHz AWGN | -40.20 | 17.28 | | 57.48 |
| Cellular | 828.550 | Pulse GSM | -36.70 | 21.38 | 64.95 | 58.08 |
| | | 4.1 MHz AWGN | -40.80 | 17.33 | | 58.13 |
| AWS-1 | 1 721.790 | Pulse GSM | -38.00 | 20.71 | 71.27 | 58.71 |
| | | 4.1 MHz AWGN | -41.00 | 17.43 | | 58.43 |
| Broadband PCS | 1 870.930 | Pulse GSM | -37.50 | 22.99 | 71.99 | 60.49 |
| | | 4.1 MHz AWGN | -40.30 | 19.61 | | 59.91 |

Tabulated Result of Downlink Booster Gain

| Band | Frequency (MHz) | Input Signal | P _{in} (dBm) | P _{out} (dBm) | Limit (dB) | Gain (dB) |
|---------------|-----------------|--------------|-----------------------|------------------------|------------|-----------|
| Lower 700 MHz | 745.300 | Pulse GSM | -55.90 | 1.53 | 63.53 | 57.43 |
| | | 4.1 MHz AWGN | -58.80 | -1.88 | | 56.92 |
| Upper 700 MHz | 748.500 | Pulse GSM | -53.40 | 4.90 | 64.36 | 58.30 |
| | | 4.1 MHz AWGN | -58.00 | 1.13 | | 59.13 |
| Cellular | 891.500 | Pulse GSM | -52.83 | 5.13 | 64.95 | 57.96 |
| | 878.250 | 4.1 MHz AWGN | -58.40 | 1.50 | | 59.90 |
| AWS-1 | 2 152.500 | Pulse GSM | -53.00 | 1.52 | 71.27 | 54.52 |
| | 2 150.230 | 4.1 MHz AWGN | -59.40 | -5.03 | | 54.37 |
| Broadband PCS | 1 962.110 | Pulse GSM | -55.40 | 2.44 | 71.99 | 57.84 |
| | | 4.1 MHz AWGN | -58.80 | -1.51 | | 57.29 |

Tabulated Result of Uplink and Downlink Gain Comparison

| Band | Input Signal | UL Gain (dB) | DL Gain (dB) | Limit (dB) | Difference (dB) |
|---------------|--------------|--------------|--------------|------------|-----------------|
| Lower 700 MHz | Pulse GSM | 58.66 | 57.43 | 9 | 1.23 |
| | 4.1 MHz AWGN | 58.84 | 56.92 | | 1.92 |
| Upper 700 MHz | Pulse GSM | 56.75 | 58.30 | | 1.55 |
| | 4.1 MHz AWGN | 57.48 | 59.13 | | 1.65 |
| Cellular | Pulse GSM | 58.08 | 57.96 | | 0.12 |
| | 4.1 MHz AWGN | 58.13 | 59.90 | | 1.77 |
| AWS-1 | Pulse GSM | 58.71 | 54.52 | | 4.19 |
| | 4.1 MHz AWGN | 58.43 | 54.37 | | 4.06 |
| Broadband PCS | Pulse GSM | 60.49 | 57.84 | | 2.66 |
| | 4.1 MHz AWGN | 59.91 | 57.29 | | 2.62 |

5.4. INTERMODULATION-PRODUCT

Test Requirement:

§ 20.21(e)(8)(i)(F) Intermodulation Limits.

The transmitted intermodulation products of a consumer booster at its uplink and downlink ports shall not exceed the power level of -19 dBm for the supported bands of operation. Compliance with intermodulation limits will use boosters operating at maximum gain and maximum rated output power, with two continuous wave (CW) input signals spaced 600 kHz apart and centered in the pass band of the booster, and with a 3 kHz measurement bandwidth.

Test Procedures:

Measurements were in accordance with the test methods section 7.4 of KDB 935210 D03 v04r03.

- a) Begin with the uplink output (donor) port connected to the spectrum analyzer.
- b) Set the spectrum analyzer RBW = 3 kHz.
- c) Set the VBW $\geq 3 \times$ RBW.
- d) Select the rms detector.
- e) Set the spectrum analyzer center frequency to the center of the supported operational band under test.
- f) Set the span to 5 MHz. Affirm that the number of measurement points per sweep $\geq (2 \times \text{span})/\text{RBW}$.
- g) Configure the two signal generators for CW operation with generator #1 tuned 300 kHz below the operational band center frequency and generator #2 tuned 300 kHz above the operational band center frequency. If the maximum output power is not at the operational-band (booster pass band) center frequency, configure the test signal pair around the frequency with maximum output power as determined per maximum power measurement test.
- h) Set the signal generator amplitudes so that the power from each into the RF combiner is equivalent, then turn on the RF output.
- i) Simultaneously increase each signal generators' amplitude equally until just before the EUT begins AGC, then affirm that all intermodulation-product emissions are below the specified limit of -19 dBm.
- j) Use the trace averaging function of the spectrum analyzer, and wait for the trace to stabilize. Place a marker at the highest amplitude intermodulation-product emission.
- k) Record the maximum intermodulation product amplitude level that is observed.
- l) Capture the spectrum analyzer trace for inclusion in the test report.
- m) Repeat e) to l) for all uplink and downlink operational bands.
- n) Increase the signal generator amplitude in 2 dB steps to 10 dB above the AGC threshold determined in i), but not exceeding the maximum input level of maximum transmitter test input, to affirm that the EUT maintains compliance with the intermodulation limit.

Note1. Limits were applied -19 dBm by § 20.21(e)(8)(i)(F)

Note2. Test is performed using one signal generator of two tone generation function.

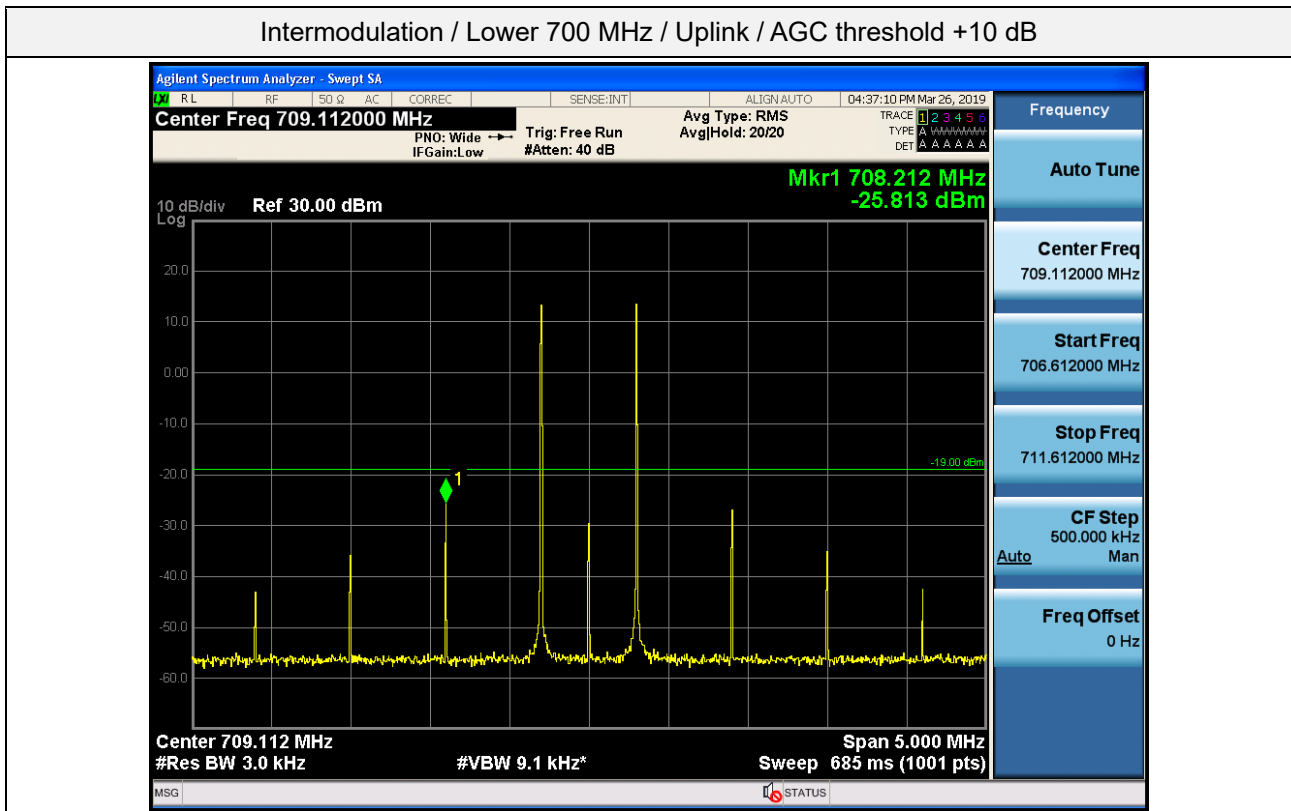
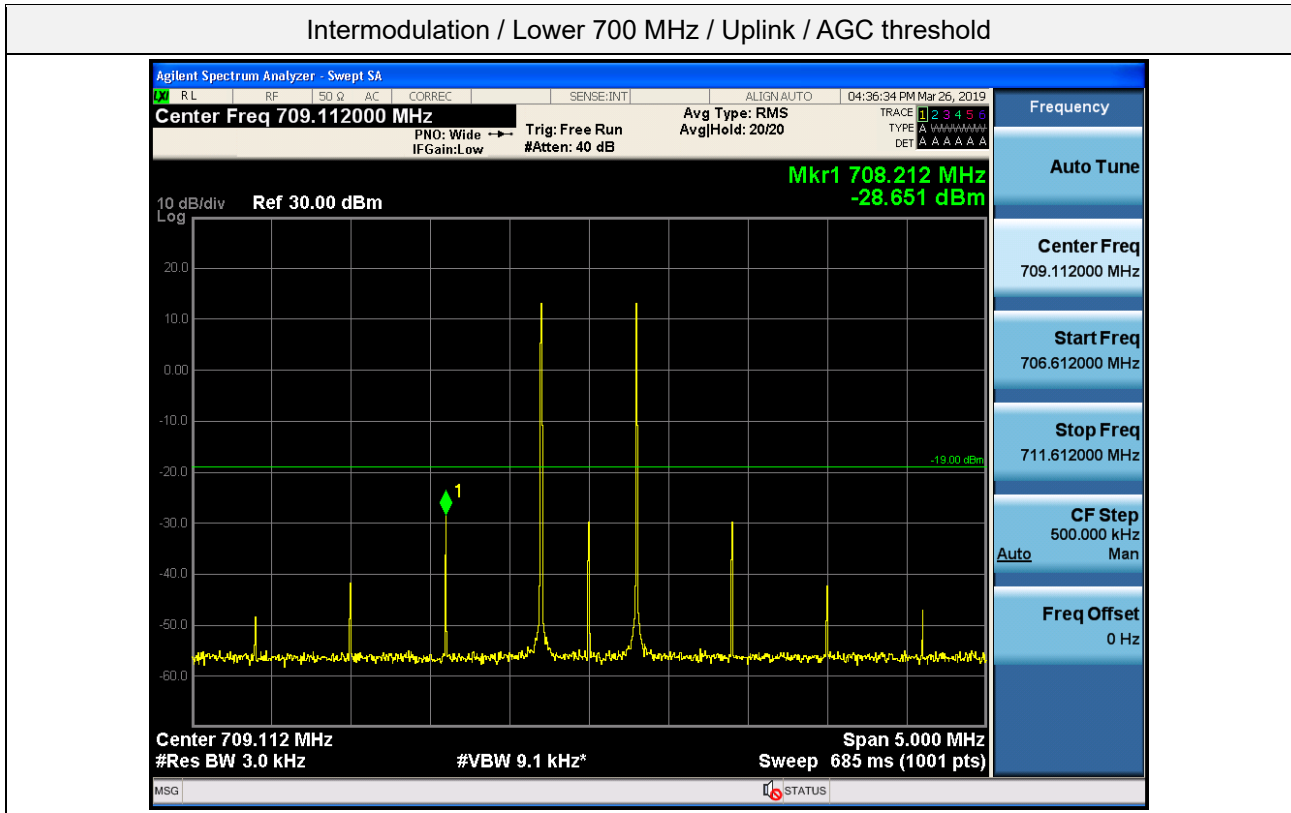
Test Results:
Tabulated Result of Uplink Intermodulation

| Band | Input level | Frequency (MHz) | Limit (dBm) | Intermodulation (dBm) |
|---------------|----------------------|-----------------|-------------|-----------------------|
| Lower 700 MHz | AGC threshold | 708.212 | -19 | -28.651 |
| | AGC threshold +10 dB | 708.212 | | -25.813 |
| Upper 700 MHz | AGC threshold | 782.074 | | -25.062 |
| | AGC threshold +10 dB | 782.074 | | -20.844 |
| Cellular | AGC threshold | 829.450 | | -22.883 |
| | AGC threshold +10 dB | 829.450 | | -21.663 |
| AWS-1 | AGC threshold | 1 722.690 | | -20.415 |
| | AGC threshold +10 dB | 1 722.690 | | -19.429 |
| Broadband PCS | AGC threshold | 1 871.830 | | -25.062 |
| | AGC threshold +10 dB | 1 871.830 | | -22.781 |

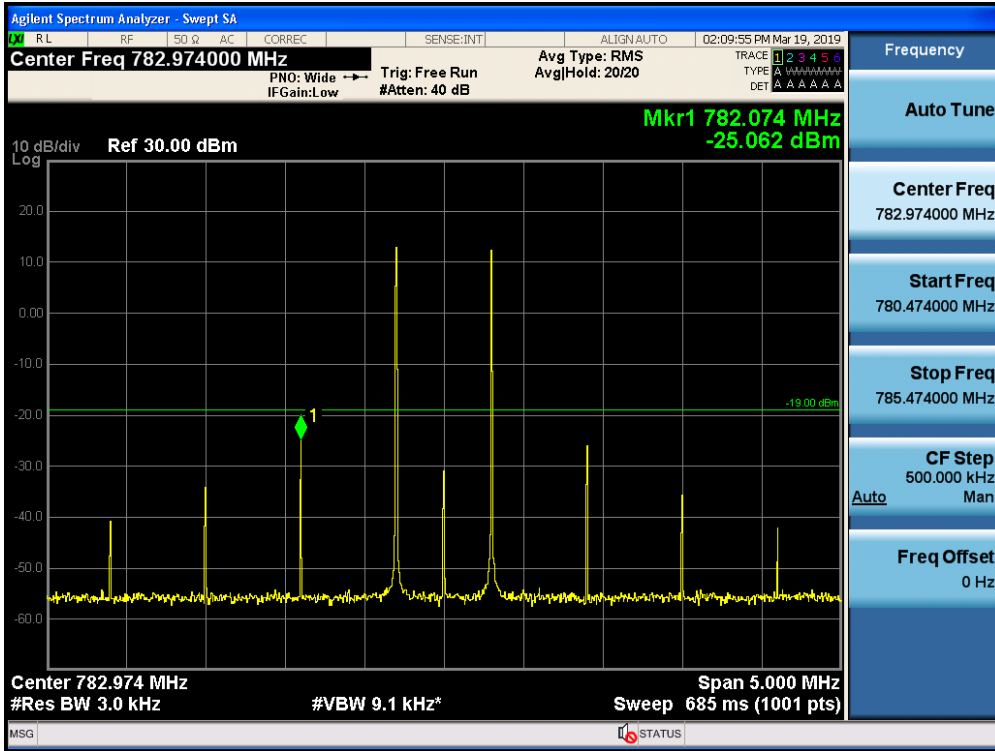
Tabulated Result of Downlink Intermodulation

| Band | Input level | Frequency (MHz) | Limit (dBm) | Intermodulation (dBm) |
|---------------|----------------------|-----------------|-------------|-----------------------|
| Lower 700 MHz | AGC threshold | 745.300 | -19 | -48.362 |
| | AGC threshold +10 dB | 745.300 | | -48.255 |
| Upper 700 MHz | AGC threshold | 748.500 | | -43.679 |
| | AGC threshold +10 dB | 748.500 | | -43.223 |
| Cellular | AGC threshold | 878.250 | | -46.038 |
| | AGC threshold +10 dB | 878.250 | | -45.699 |
| AWS-1 | AGC threshold | 2 152.500 | | -60.291 |
| | AGC threshold +10 dB | 2 152.500 | | -59.790 |
| Broadband PCS | AGC threshold | 1 962.110 | | -48.892 |
| | AGC threshold +10 dB | 1 962.110 | | -48.323 |

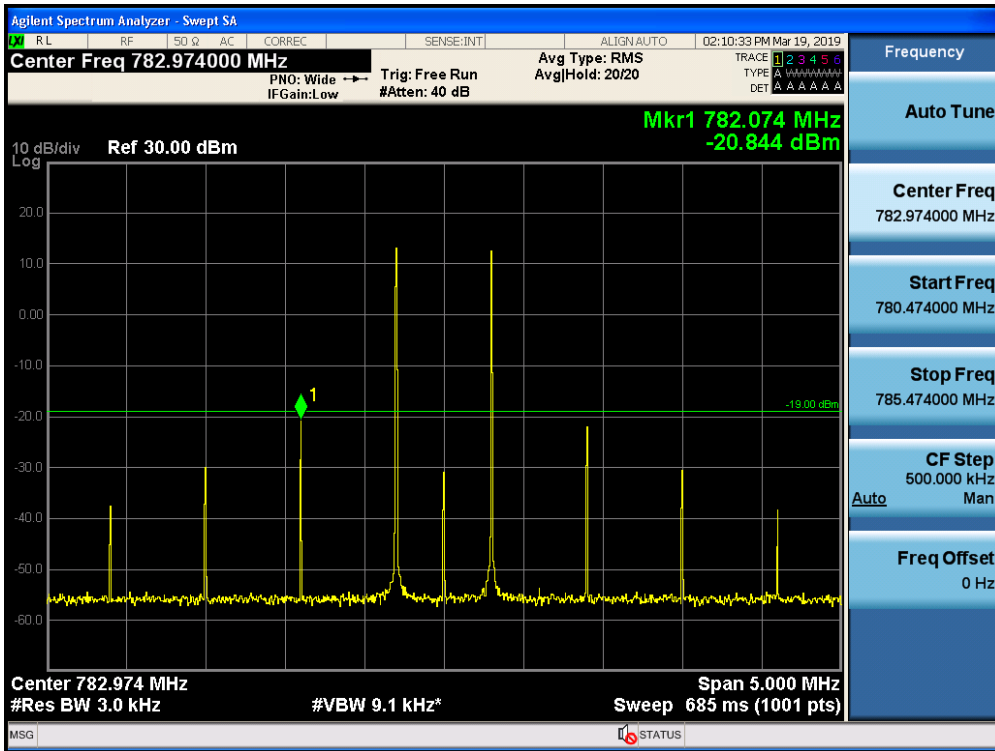
Plot data of Intermodulation



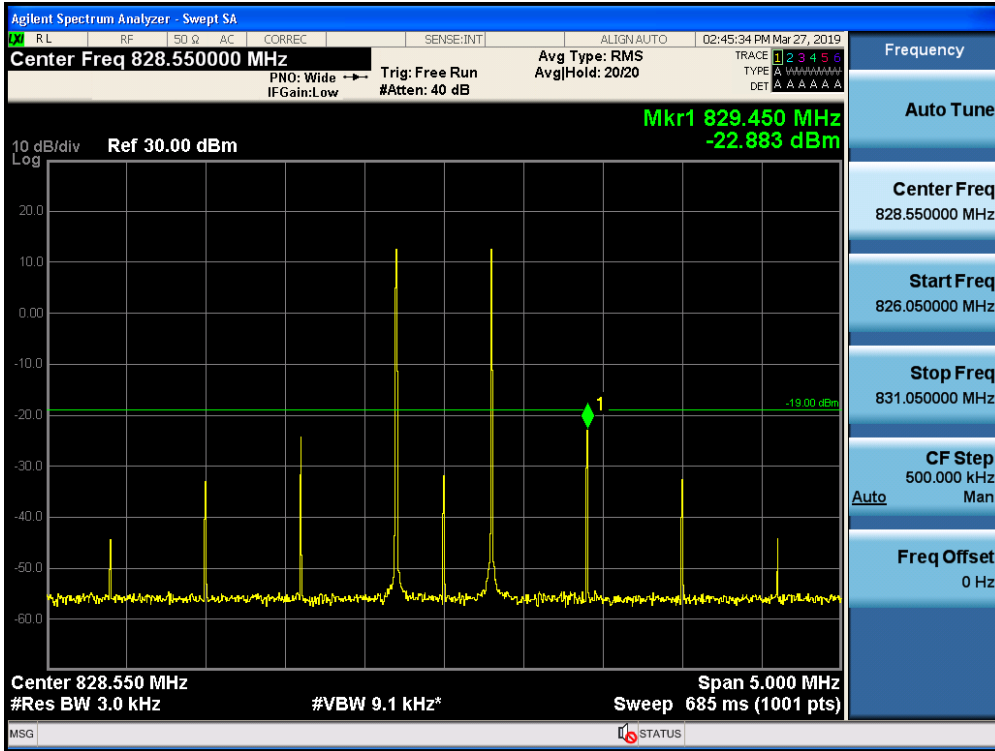
Intermodulation / Upper 700 MHz / Uplink / AGC threshold



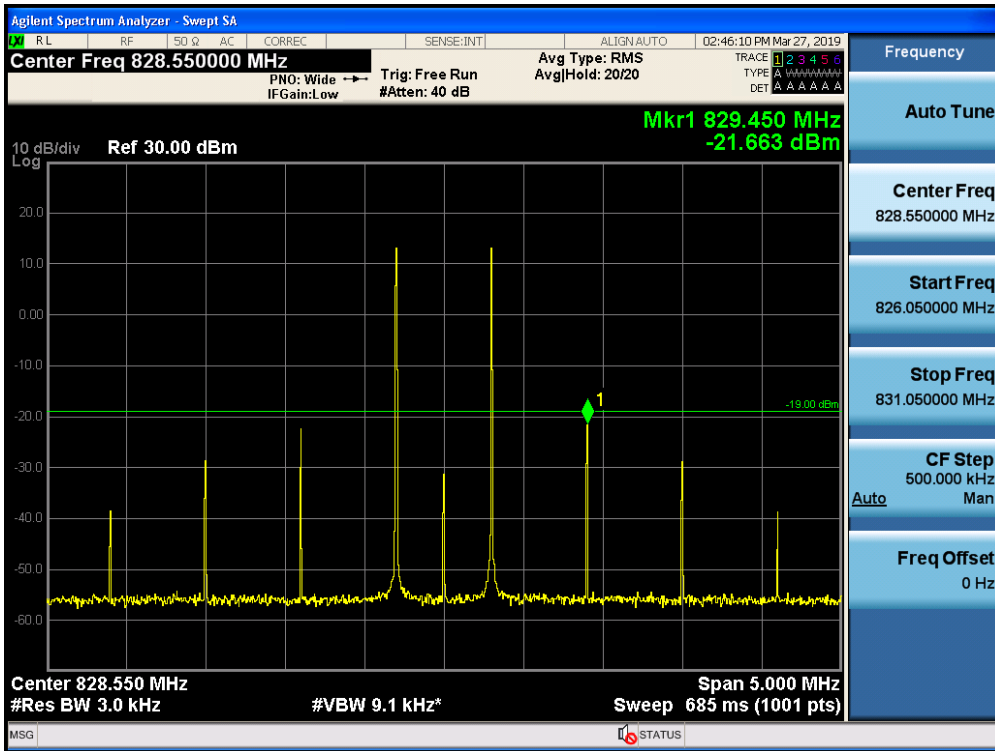
Intermodulation / Upper 700 MHz / Uplink / AGC threshold +10 dB



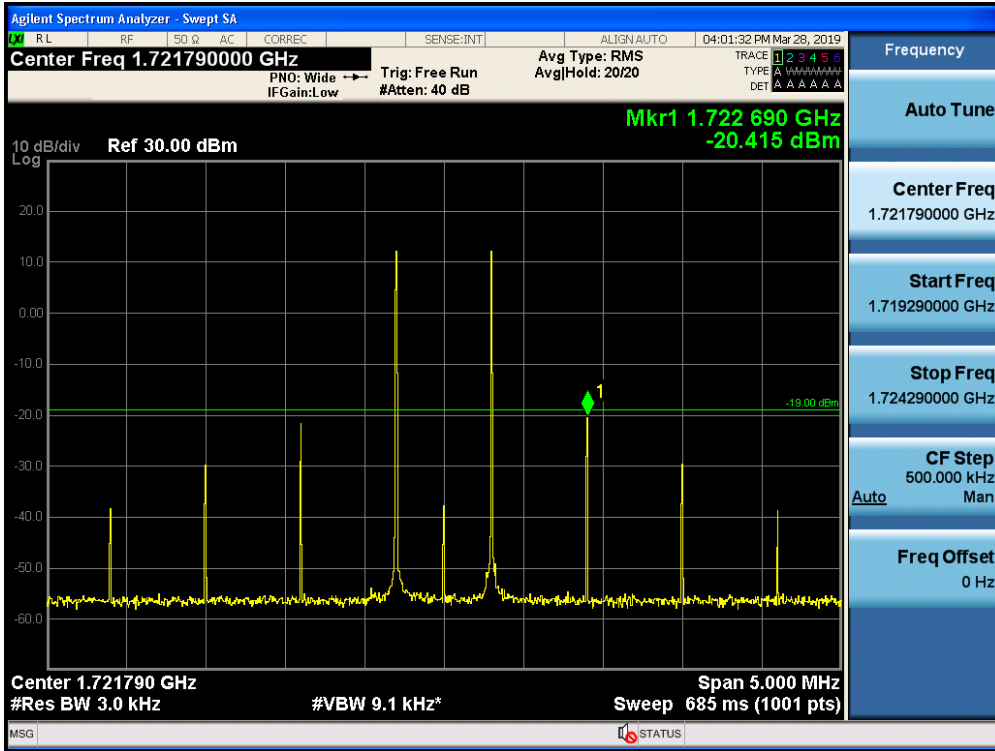
Intermodulation / Cellular / Uplink / AGC threshold



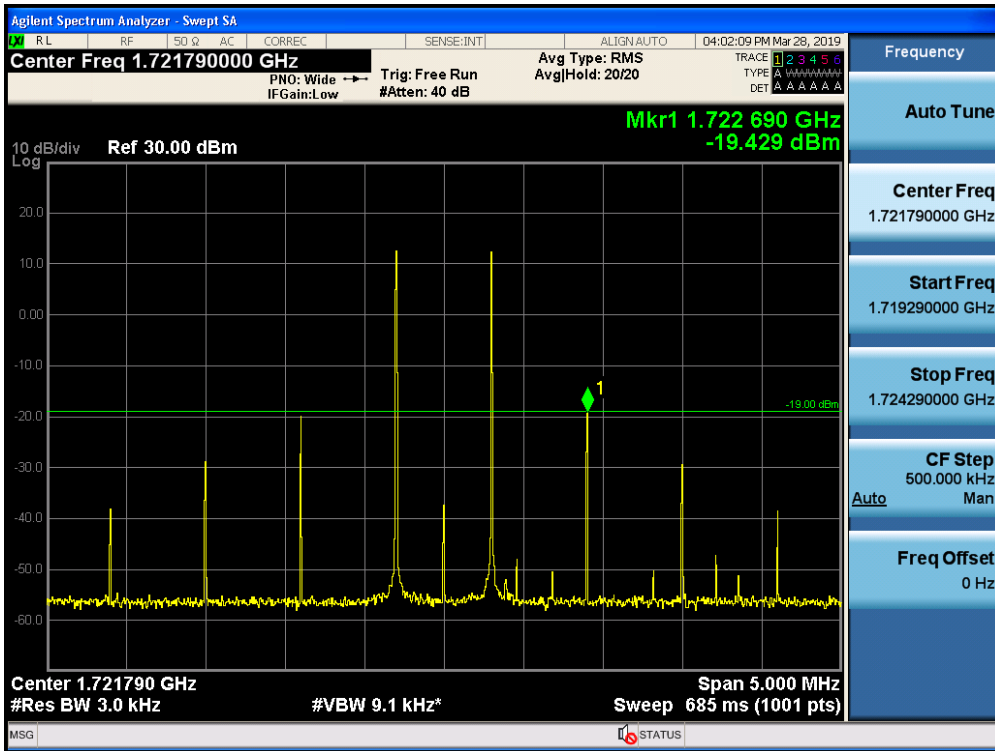
Intermodulation / Cellular / Uplink / AGC threshold +10 dB



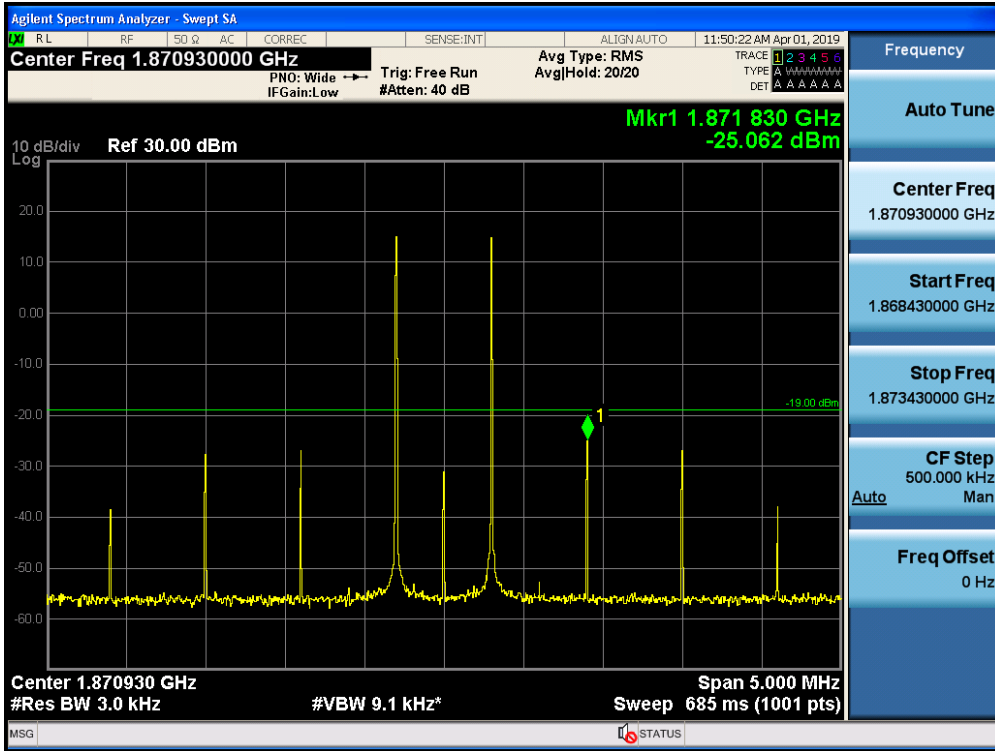
Intermodulation / AWS-1 / Uplink / AGC threshold



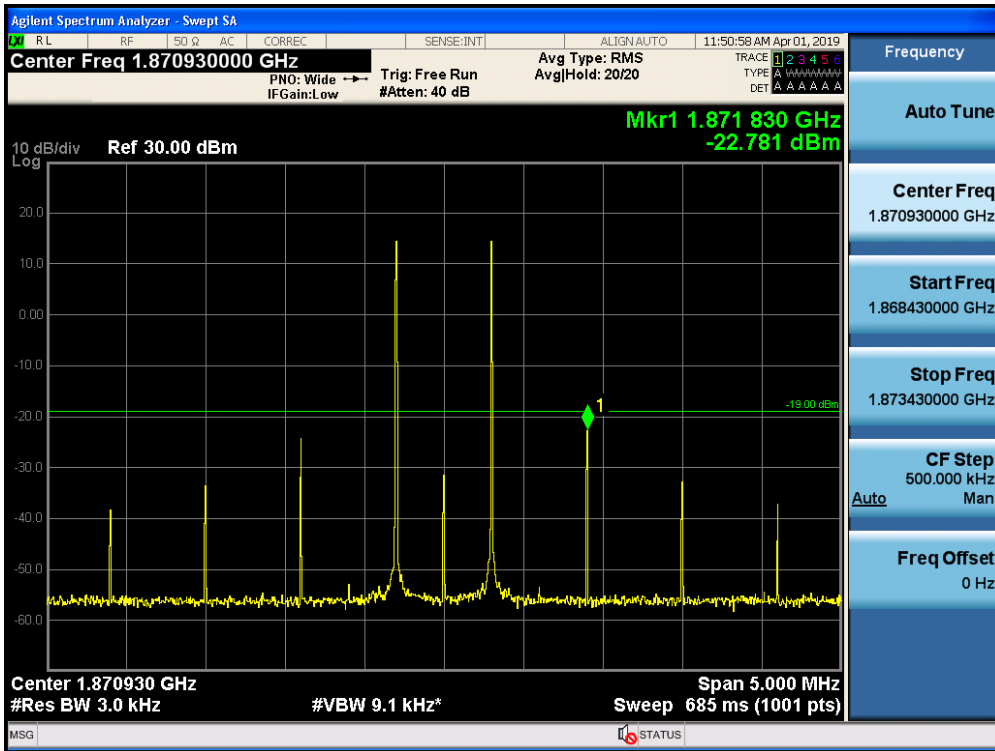
Intermodulation / AWS-1 / Uplink / AGC threshold +10 dB



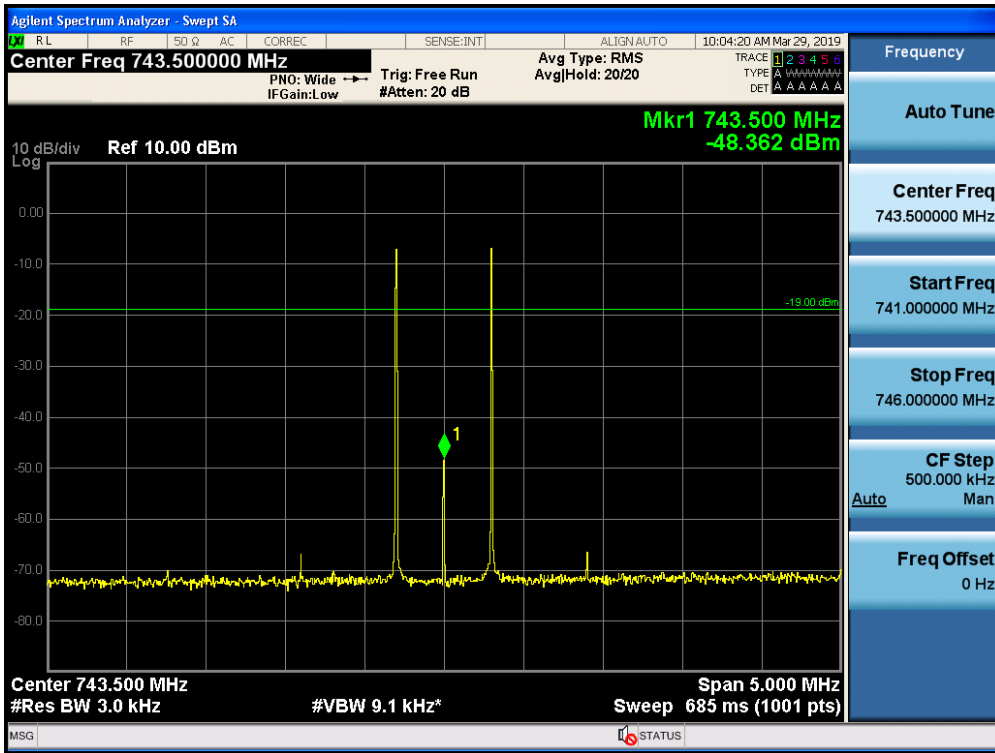
Intermodulation / Broadband PCS / Uplink / AGC threshold



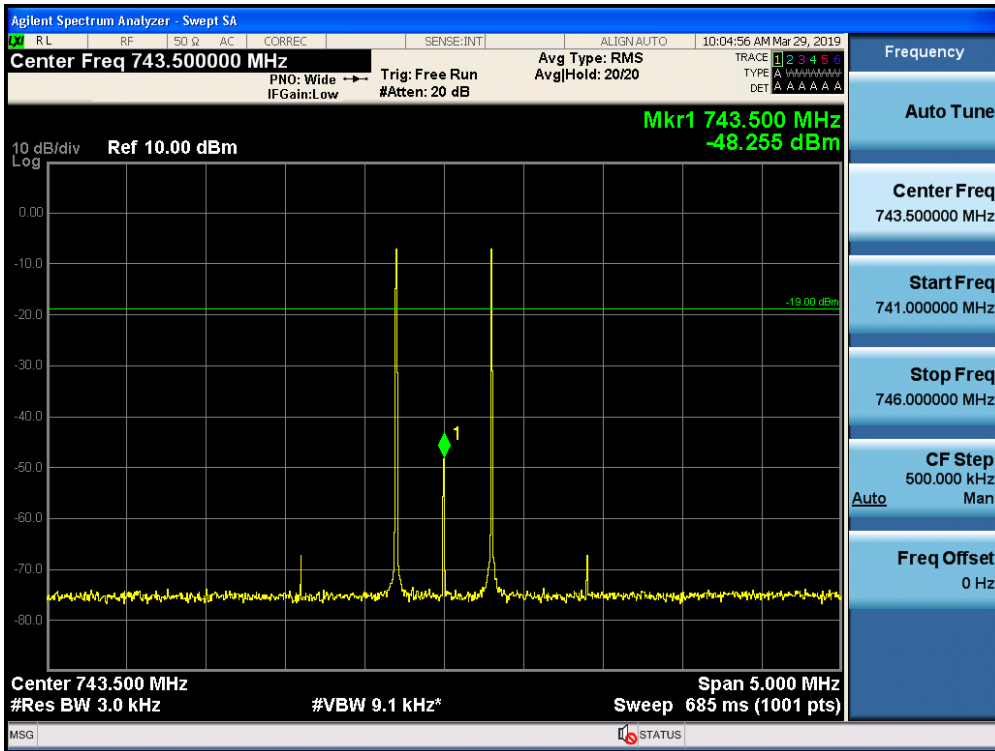
Intermodulation / Broadband PCS / Uplink / AGC threshold +10 dB



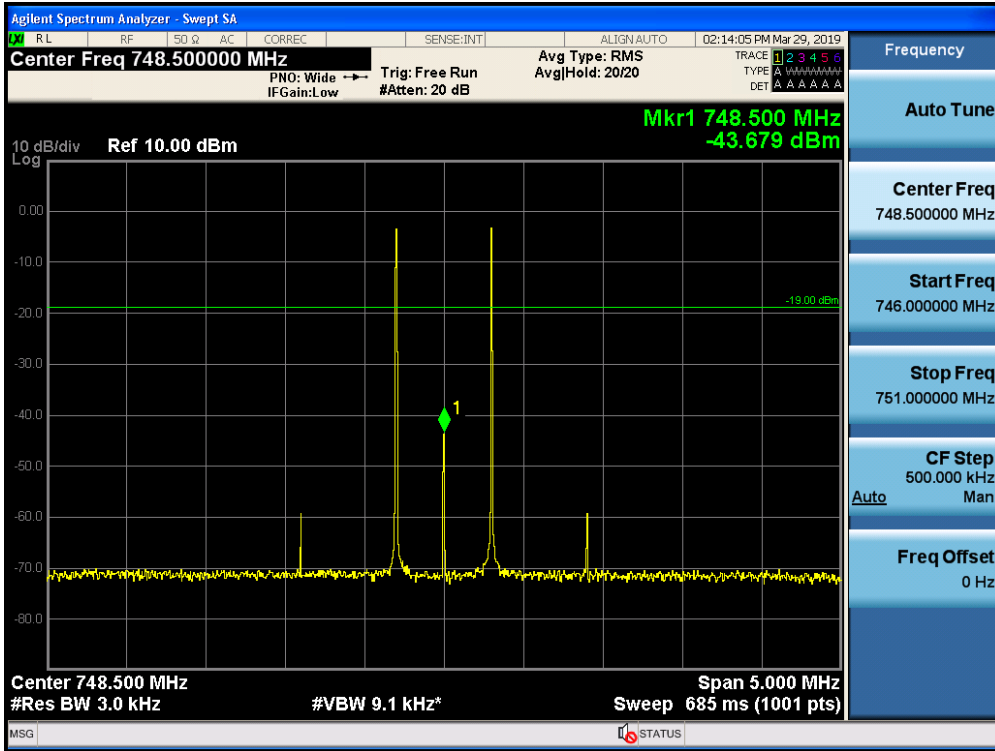
Intermodulation / Lower 700 MHz / Downlink / AGC threshold



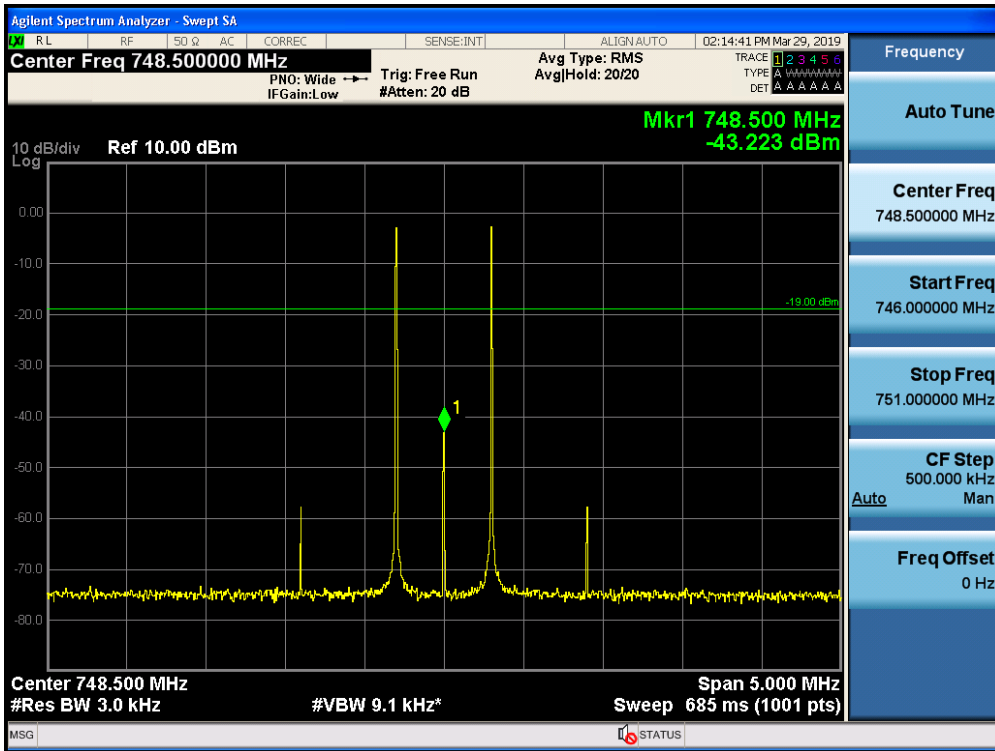
Intermodulation / Lower 700 MHz / Downlink / AGC threshold +10 dB

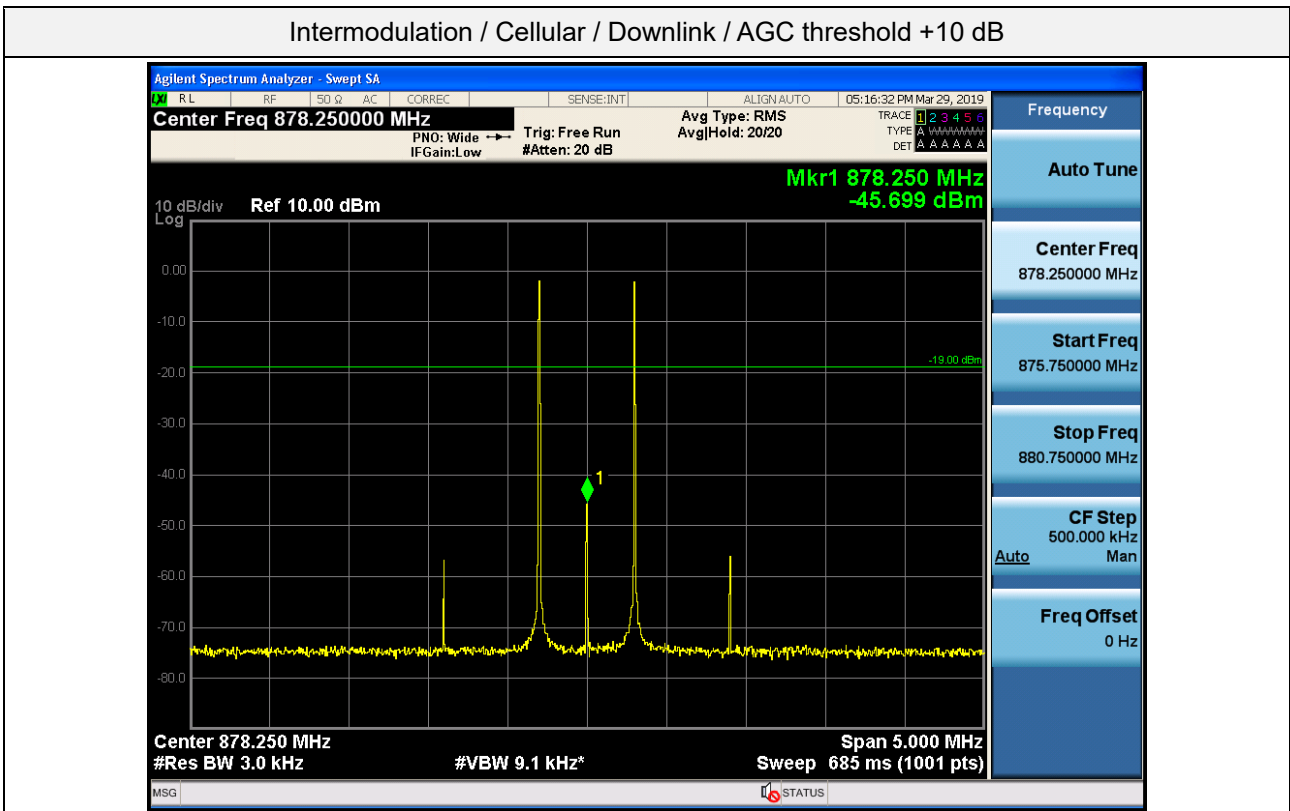
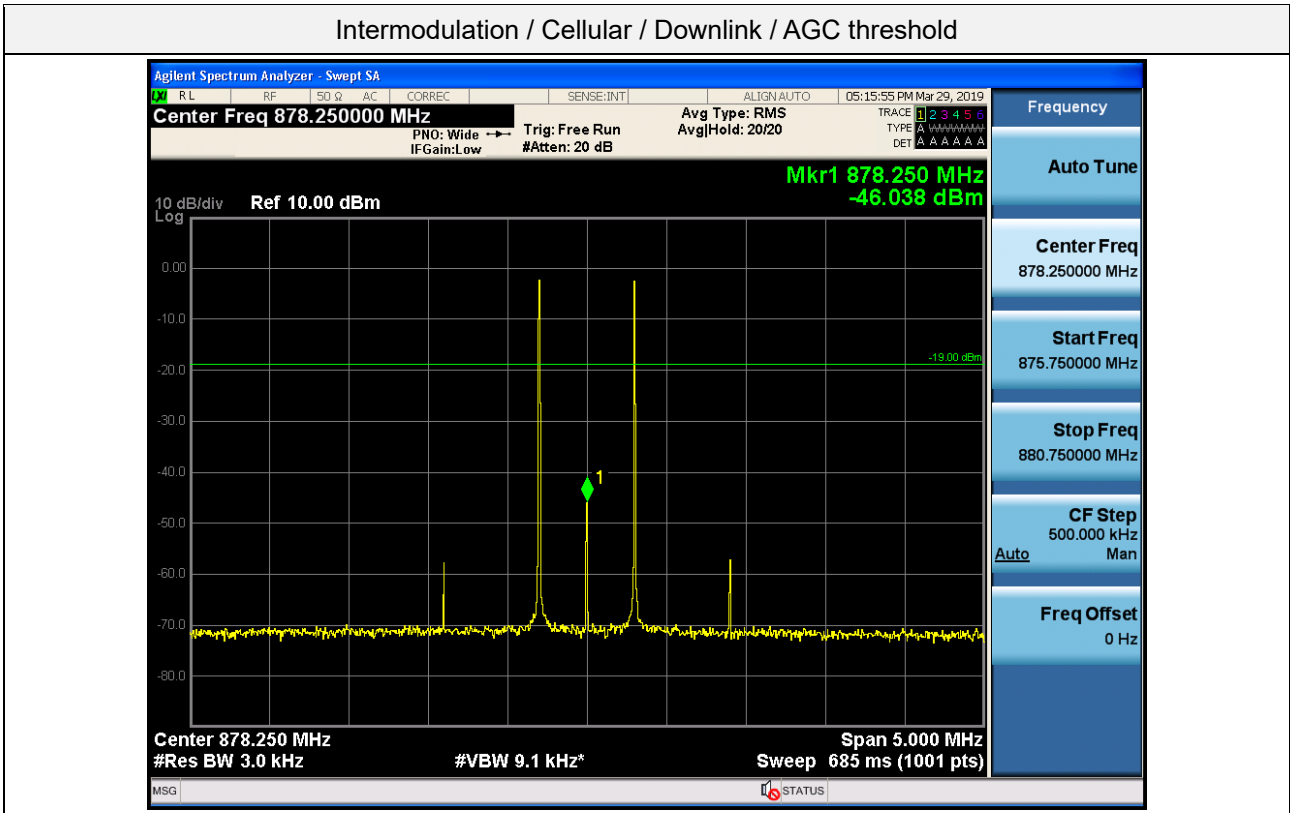


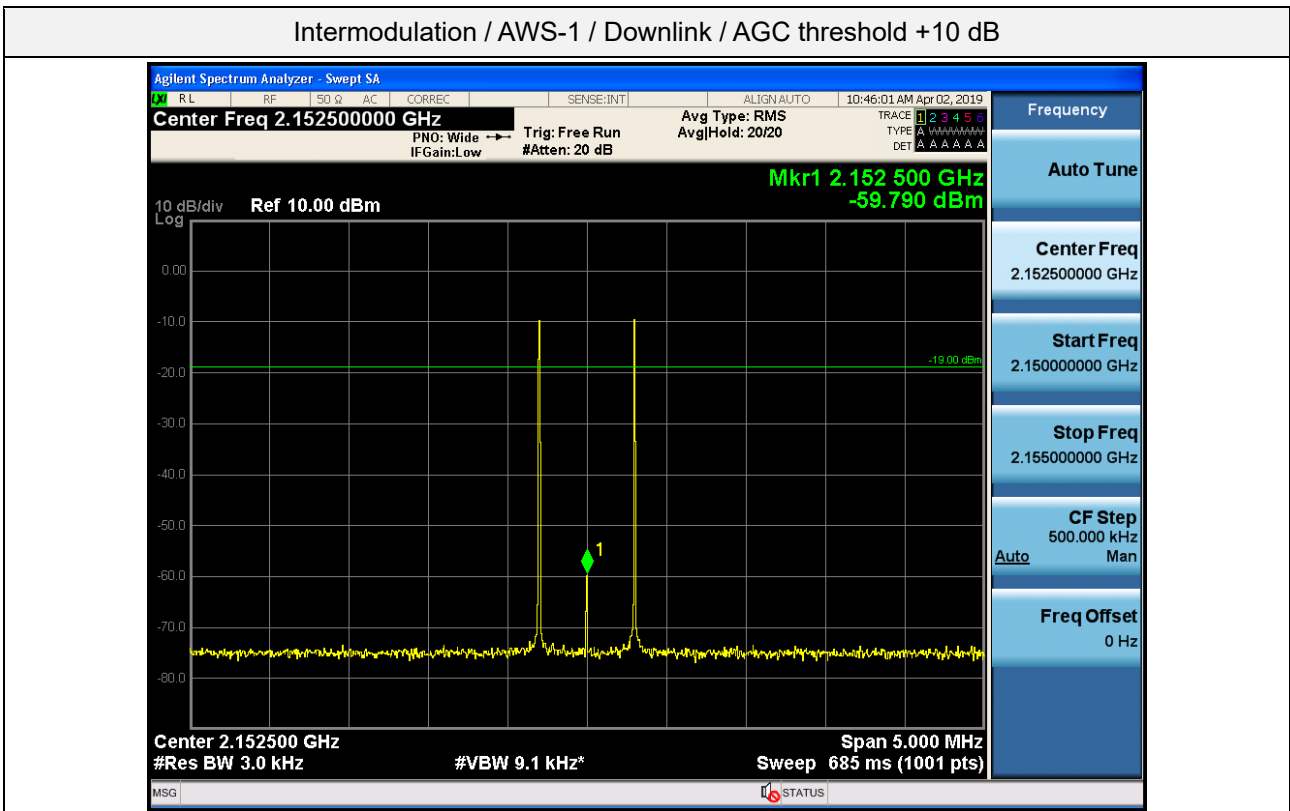
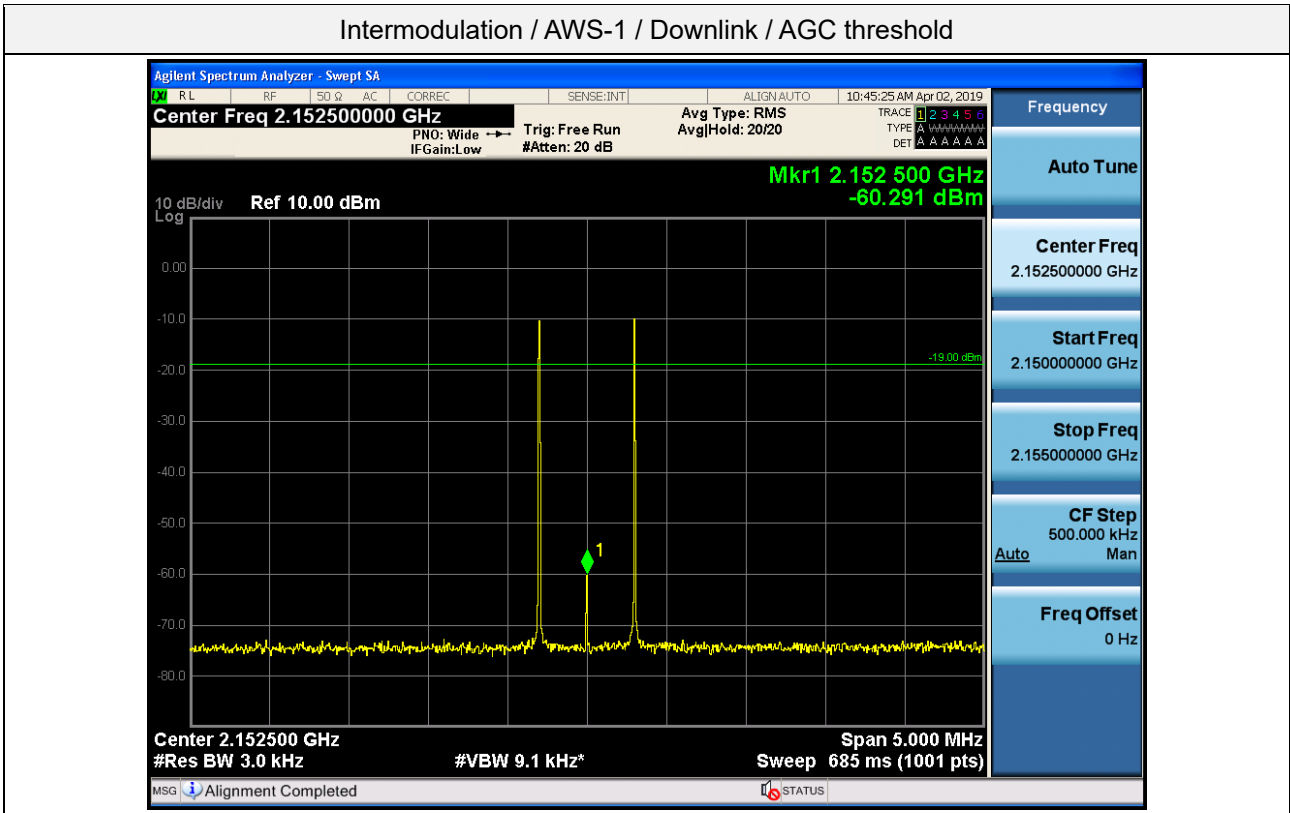
Intermodulation / Upper 700 MHz / Downlink / AGC threshold



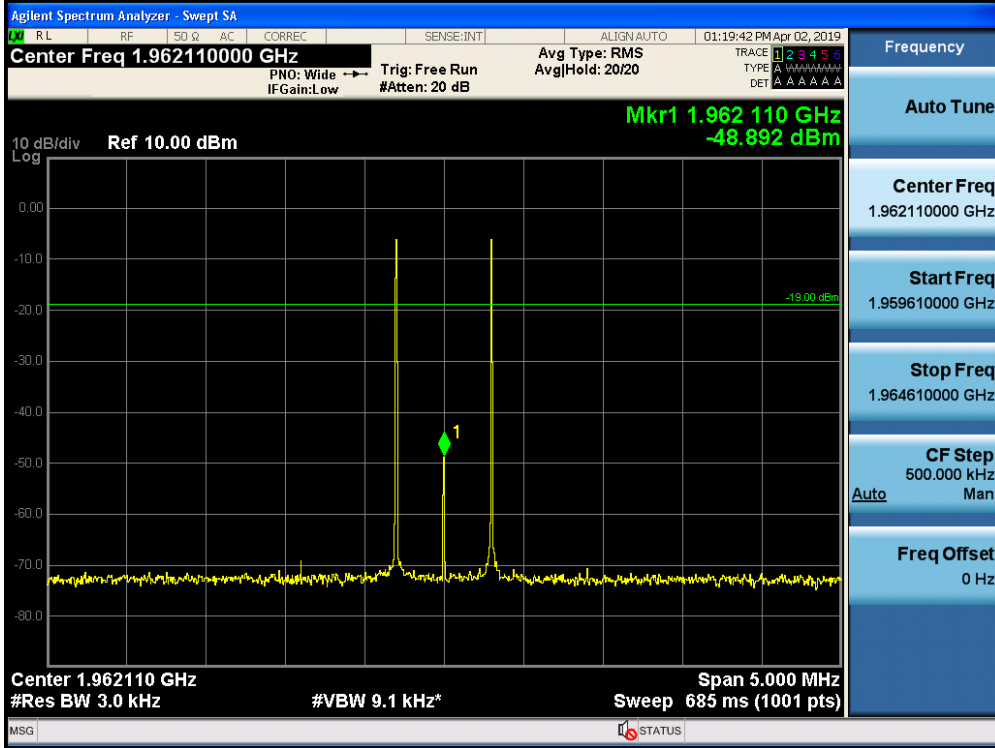
Intermodulation / Upper 700 MHz / Downlink / AGC threshold +10 dB



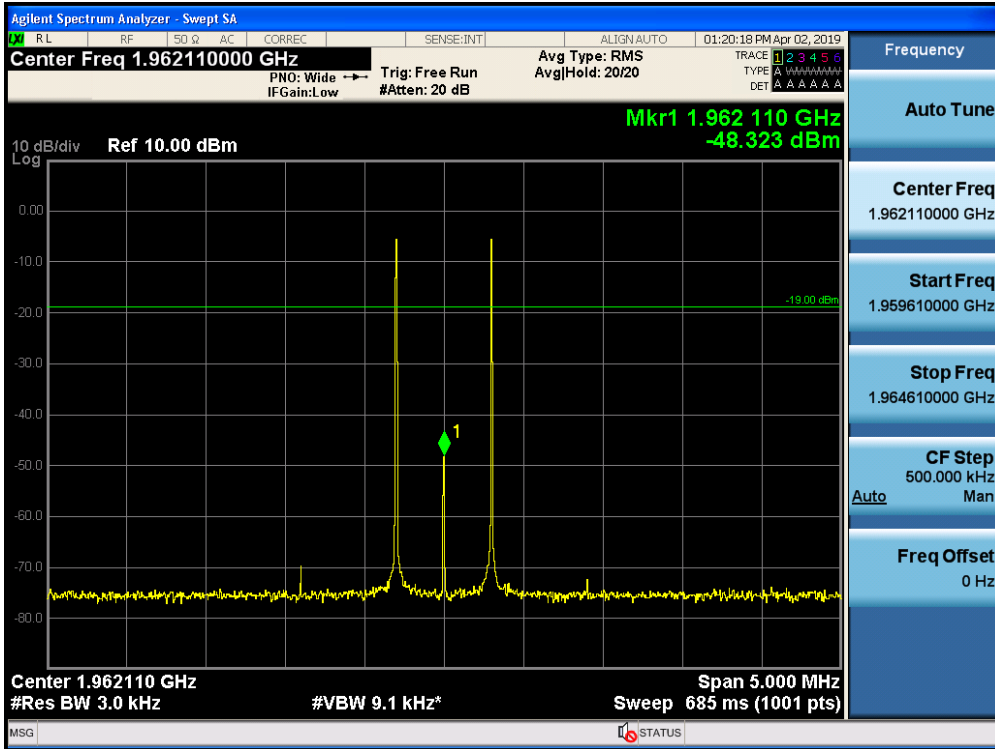




Intermodulation / Broadband PCS / Downlink / AGC threshold



Intermodulation / Broadband PCS / Downlink / AGC threshold +10 dB



5.5. OUT-OF-BAND EMISSIONS

Test Requirements:

§20.21(e)(8)(i)(E) Out of Band Emission Limits.

Booster out of band emissions (OOBE) shall be at least 6 dB below the FCC's mobile emission limits for the supported bands of operation. Compliance to OOBE limits will utilize high peak-to-average CMRS signal types.

Test Procedures:

Measurements were in accordance with the test methods section 7.5 of KDB 935210 D03 v04r03.

- a) Begin with the uplink output (donor) port connected to the spectrum analyzer.
- b) Configure the signal generator for the appropriate operation for all uplink and downlink bands:
 - 1) GSM: 0.2 MHz from upper and lower band edges.
 - 2) LTE (5 MHz): 2.5 MHz from upper and lower band edges.
 - 3) CDMA: 1.25 MHz from upper and lower band edges, except for cellular band as follows
(only the upper and lower frequencies need to be tested):
824.88 MHz, 845.73 MHz, 836.52 MHz, 848.10 MHz,
869.88 MHz, 890.73 MHz, 881.52 MHz, 893.10 MHz.
- c) Set the signal generator amplitude to the maximum power level prior to AGC similar to e) to f) of the power measurement procedures for the appropriate modulations.
- d) Set RBW = measurement bandwidth specified in the applicable rule section for the supported frequency band.
- e) Set VBW = 3 RBW.
- f) Select the power averaging (rms) detector.
- g) Sweep time = auto-couple.
- h) Set the analyzer start frequency to the upper band/block edge frequency and the stop frequency to the upper band/block edge frequency plus: 300 kHz (when operational frequency is < 1 GHz), or 3 MHz (when operational frequency is ≥ 1 GHz).
- i) Trace average at least 100 traces in power averaging (i.e., rms) mode.
- j) Use peak marker function to find the maximum power level.
- k) Capture the spectrum analyzer trace of the power level for inclusion in the test report.
- l) Increase the signal generator amplitude in 2 dB steps until the maximum input level per maximum transmitter test input is reached. Affirm that the EUT maintains compliance with the OOBE limits. The test report shall include either a statement describing that the device complies at 10 dB above AGC or at the maximum transmitter test power levels, or a table showing compliance at the additional input power(s) required.

- m) Reset the analyzer start frequency to the lower band/block edge frequency minus: 300 kHz (when operational frequency is < 1 GHz), or 3 MHz (when operational frequency is ≥ 1 GHz), and the stop frequency to the lower band/block edge frequency, then repeat i) to l).
- n) Repeat b) through m) for each uplink and downlink operational band.

Note1. For all operation band of EUT, same mobile emission limit '43 + 10 Log (Power) dB' is applied. So, test limit of Out-of-Band Emissions is calculated as follows.

$$\begin{aligned}
 \text{Out-of-Band Emissions Limit} &= 43 + 10 \text{ Log (Power)} - 6 \text{ dB} \\
 &= -13 \text{ dBm} - 6 \text{ dB} = -19 \text{ dBm}
 \end{aligned}$$

Note2. Measurement bandwidth specified in the applicable rule section for the supported frequency band.

| Band | RBW Requirements |
|---------------|--|
| Lower 700 MHz | Reference 100 kHz or greater 30 kHz in the 100 kHz bands immediately block outside |
| Upper 700 MHz | Reference 100 kHz or greater 30 kHz in the 100 kHz bands immediately block outside |
| Cellular | Reference 100 kHz or greater (below 1 GHz) Reference 1 MHz or greater (above 1 GHz) 1 % of fundamental emission bandwidth in the 1 MHz bands immediately block outside |
| AWS-1 | Reference 1 MHz or greater 1 % of fundamental emission bandwidth in the 1 MHz bands immediately block outside |
| Broadband PCS | Reference 1 MHz or greater 1 % of fundamental emission bandwidth in the 1 MHz bands immediately block outside |

Test Results:

Tabulated Result of Uplink Out-of-Band Emissions

| Band | Signal | Edge | Input Level | Frequency (MHz) | Limit (dBm) | Emission (dBm) |
|---------------|-----------|-------|-------------|-----------------|-------------|----------------|
| Lower 700 MHz | GSM | Upper | AGC | 716.000 0 | -19 | -24.808 |
| | | | AGC +10 dB | 716.021 9 | | -25.423 |
| | | Lower | AGC | 703.994 3 | | -21.937 |
| | | | AGC +10 dB | 703.993 4 | | -22.308 |
| | LTE 5 MHz | Upper | AGC | 716.000 0 | | -36.496 |
| | | | AGC +10 dB | 716.014 1 | | -36.553 |
| | | Lower | AGC | 704.000 0 | | -33.939 |
| | | | AGC +10 dB | 703.986 8 | | -33.538 |
| | CDMA | Upper | AGC | 716.026 7 | | -42.102 |
| | | | AGC +10 dB | 716.120 3 | | -39.955 |
| | | Lower | AGC | 703.993 4 | | -40.725 |
| | | | AGC +10 dB | 703.996 7 | | -37.159 |
| Upper 700 MHz | GSM | Upper | AGC | 787.012 0 | -24.326 | |
| | | | AGC +10 dB | 787.003 0 | -24.141 | |
| | | Lower | AGC | 775.991 3 | -25.780 | |
| | | | AGC +10 dB | 776.000 0 | -26.277 | |
| | LTE 5 MHz | Upper | AGC | 787.009 9 | -32.347 | |
| | | | AGC +10 dB | 787.013 5 | -31.262 | |
| | | Lower | AGC | 775.991 0 | -36.119 | |
| | | | AGC +10 dB | 775.973 9 | -35.044 | |
| | CDMA | Upper | AGC | 787.015 0 | -37.698 | |
| | | | AGC +10 dB | 787.086 1 | -35.926 | |
| | | Lower | AGC | 775.976 3 | -39.716 | |
| | | | AGC +10 dB | 775.994 6 | -37.642 | |

| Band | Signal | Edge | Input Level | Frequency (MHz) | Limit (dBm) | Emission (dBm) | |
|-----------|-----------|-------|-------------|-----------------|-------------|----------------|---------|
| Cellular | GSM | Upper | AGC | 849.010 2 | -19 | -41.457 | |
| | | | AGC +10 dB | 849.007 8 | | -41.312 | |
| | | Lower | AGC | 823.982 6 | | -37.691 | |
| | | | AGC +10 dB | 823.987 1 | | -37.538 | |
| | LTE 5 MHz | Upper | AGC | 849.006 0 | | -36.411 | |
| | | | AGC +10 dB | 849.006 9 | | -35.946 | |
| | | Lower | AGC | 823.992 2 | | -33.756 | |
| | | | AGC +10 dB | 823.992 2 | | -32.855 | |
| | CDMA | Upper | AGC | 849.051 6 | | -43.624 | |
| | | | AGC +10 dB | 849.000 0 | | -42.878 | |
| | | Lower | AGC | 823.995 8 | | -40.028 | |
| | | | AGC +10 dB | 823.946 0 | | -39.189 | |
| | AWS-1 | GSM | Upper | AGC | | 1 755.012 | -38.000 |
| | | | | AGC +10 dB | | 1 755.006 | -38.321 |
| | | | Lower | AGC | | 1 709.982 | -39.854 |
| | | | | AGC +10 dB | | 1 709.982 | -39.385 |
| LTE 5 MHz | | Upper | AGC | 1 755.000 | -30.316 | | |
| | | | AGC +10 dB | 1 755.045 | -31.777 | | |
| | | Lower | AGC | 1 709.982 | -34.314 | | |
| | | | AGC +10 dB | 1 709.994 | -33.568 | | |
| CDMA | | Upper | AGC | 1 755.015 | -40.655 | | |
| | | | AGC +10 dB | 1 755.006 | -40.364 | | |
| | | Lower | AGC | 1 709.997 | -41.753 | | |
| | | | AGC +10 dB | 1 709.955 | -42.370 | | |

| Band | Signal | Edge | Input Level | Frequency (MHz) | Limit (dBm) | Emission (dBm) |
|---------------|-----------|-------|-------------|-----------------|-------------|----------------|
| Broadband PCS | GSM | Upper | AGC | 1 915.012 | -19 | -50.818 |
| | | | AGC +10 dB | 1 915.006 | | -51.512 |
| | | Lower | AGC | 1 849.982 | | -39.857 |
| | | | AGC +10 dB | 1 849.979 | | -40.325 |
| | LTE 5 MHz | Upper | AGC | 1 915.552 | | -42.374 |
| | | | AGC +10 dB | 1 917.391 | | -42.804 |
| | | Lower | AGC | 1 850.000 | | -34.111 |
| | | | AGC +10 dB | 1 849.982 | | -34.696 |
| | CDMA | Upper | AGC | 1 916.203 | | -48.627 |
| | | | AGC +10 dB | 1 916.944 | | -48.468 |
| | | Lower | AGC | 1 849.985 | | -42.984 |
| | | | AGC +10 dB | 1 849.982 | | -44.126 |

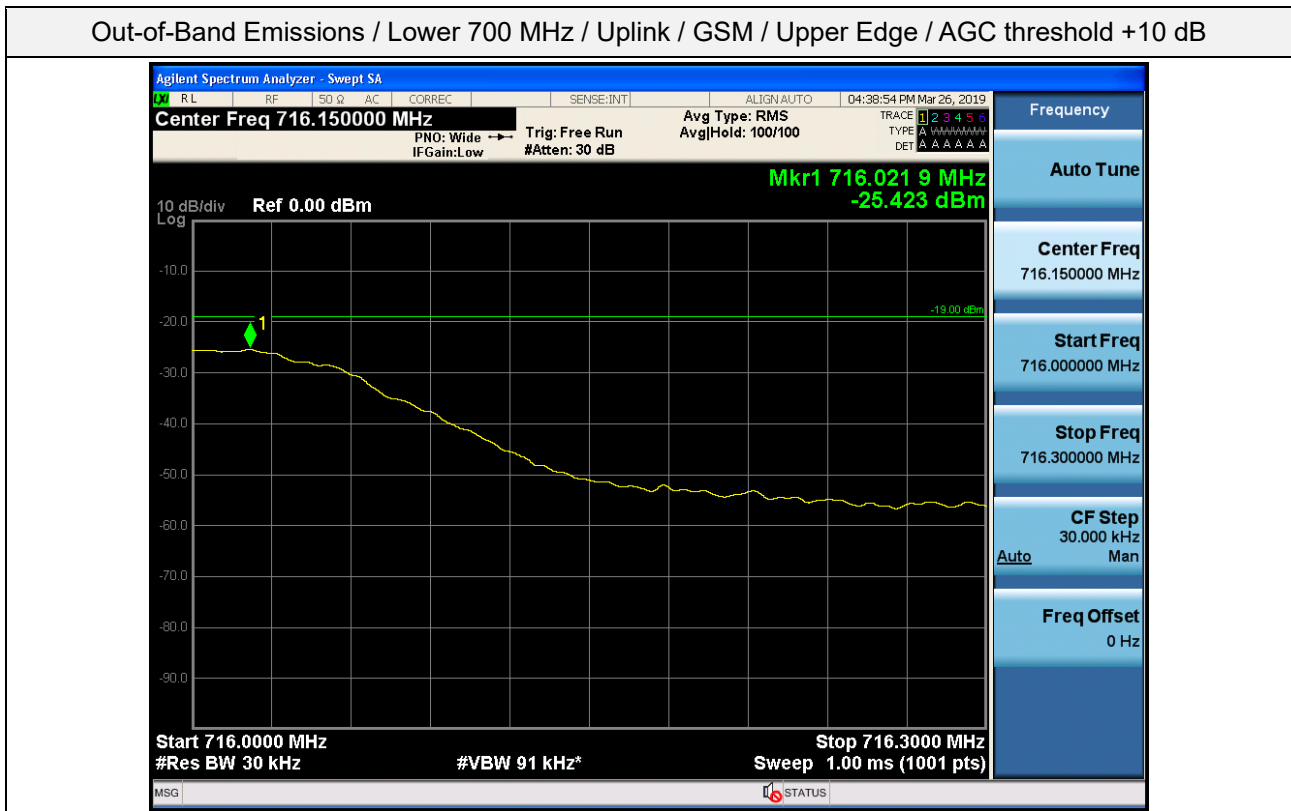
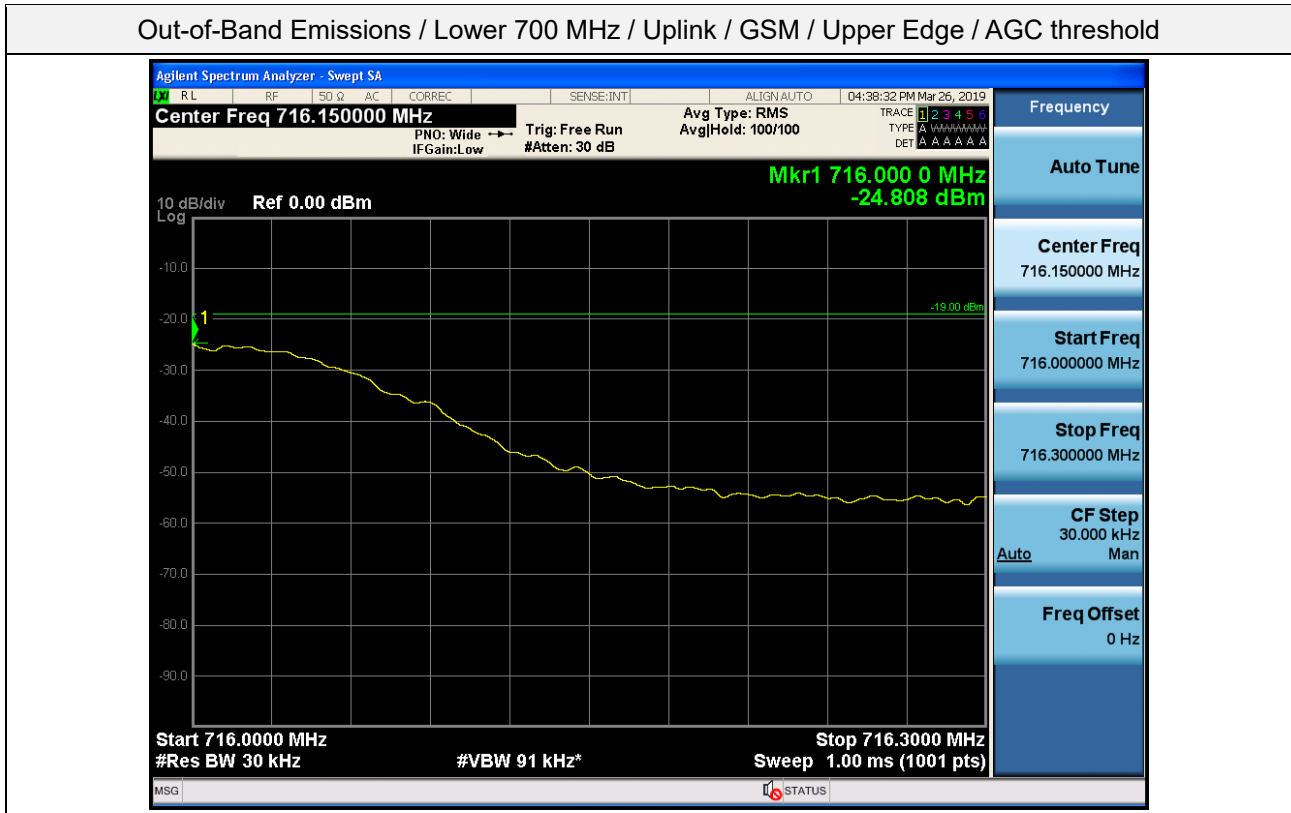
Tabulated Result of Downlink Out-of-Band Emissions

| Band | Signal | Edge | Input Level | Frequency (MHz) | Limit (dBm) | Emission (dBm) |
|---------------|-----------|-------|-------------|-----------------|-------------|----------------|
| Lower 700 MHz | GSM | Upper | AGC | 746.021 0 | -19 | -42.143 |
| | | | AGC +10 dB | 746.002 4 | | -42.179 |
| | | Lower | AGC | 733.993 4 | | -42.283 |
| | | | AGC +10 dB | 733.994 3 | | -42.841 |
| | LTE 5 MHz | Upper | AGC | 746.000 0 | | -54.208 |
| | | | AGC +10 dB | 746.000 0 | | -54.979 |
| | | Lower | AGC | 734.000 0 | | -57.032 |
| | | | AGC +10 dB | 733.997 6 | | -56.064 |
| | CDMA | Upper | AGC | 746.165 6 | | -61.480 |
| | | | AGC +10 dB | 746.040 5 | | -64.421 |
| | | Lower | AGC | 733.751 0 | | -62.164 |
| | | | AGC +10 dB | 733.736 6 | | -64.596 |
| Upper 700 MHz | GSM | Upper | AGC | 757.017 1 | -43.918 | |
| | | | AGC +10 dB | 757.004 2 | -43.124 | |
| | | Lower | AGC | 745.998 8 | -41.590 | |
| | | | AGC +10 dB | 746.000 0 | -41.665 | |
| | LTE 5 MHz | Upper | AGC | 757.000 0 | -55.966 | |
| | | | AGC +10 dB | 757.000 0 | -56.004 | |
| | | Lower | AGC | 746.000 0 | -53.010 | |
| | | | AGC +10 dB | 745.993 1 | -52.517 | |
| | CDMA | Upper | AGC | 757.034 8 | -62.767 | |
| | | | AGC +10 dB | 757.158 4 | -64.190 | |
| | | Lower | AGC | 745.733 3 | -60.575 | |
| | | | AGC +10 dB | 745.858 1 | -64.159 | |

| Band | Signal | Edge | Input Level | Frequency (MHz) | Limit (dBm) | Emission (dBm) | |
|-----------|-----------|-------|-------------|-----------------|-------------|----------------|---------|
| Cellular | GSM | Upper | AGC | 894.005 7 | -19 | -52.444 | |
| | | | AGC +10 dB | 894.008 4 | | -52.750 | |
| | | Lower | AGC | 868.978 1 | | -51.947 | |
| | | | AGC +10 dB | 868.996 7 | | -51.636 | |
| | LTE 5 MHz | Upper | AGC | 894.006 9 | | -51.160 | |
| | | | AGC +10 dB | 894.000 0 | | -49.991 | |
| | | Lower | AGC | 869.000 0 | | -51.236 | |
| | | | AGC +10 dB | 868.997 3 | | -51.907 | |
| | CDMA | Upper | AGC | 894.188 7 | | -65.633 | |
| | | | AGC +10 dB | 894.063 3 | | -68.637 | |
| | | Lower | AGC | 868.928 3 | | -65.716 | |
| | | | AGC +10 dB | 868.847 6 | | -68.566 | |
| | AWS-1 | GSM | Upper | AGC | | 2 155.012 | -54.010 |
| | | | | AGC +10 dB | | 2 155.009 | -57.781 |
| | | | Lower | AGC | | 2 109.982 | -55.421 |
| | | | | AGC +10 dB | | 2 109.979 | -55.275 |
| LTE 5 MHz | | Upper | AGC | 2 155.000 | -48.341 | | |
| | | | AGC +10 dB | 2 155.000 | -53.353 | | |
| | | Lower | AGC | 2 109.988 | -52.079 | | |
| | | | AGC +10 dB | 2 110.000 | -54.709 | | |
| CDMA | | Upper | AGC | 2 155.090 | -67.032 | | |
| | | | AGC +10 dB | 2 155.309 | -67.402 | | |
| | | Lower | AGC | 2 109.637 | -66.534 | | |
| | | | AGC +10 dB | 2 109.988 | -67.411 | | |

| Band | Signal | Edge | Input Level | Frequency (MHz) | Limit (dBm) | Emission (dBm) |
|---------------|-----------|-------|-------------|-----------------|-------------|----------------|
| Broadband PCS | GSM | Upper | AGC | 1 995.015 | -19 | -57.722 |
| | | | AGC +10 dB | 1 995.006 | | -57.564 |
| | | Lower | AGC | 1 929.985 | | -57.679 |
| | | | AGC +10 dB | 1 929.985 | | -57.387 |
| | LTE 5 MHz | Upper | AGC | 1 995.003 | | -56.711 |
| | | | AGC +10 dB | 1 995.000 | | -55.746 |
| | | Lower | AGC | 1 930.000 | | -56.657 |
| | | | AGC +10 dB | 1 929.982 | | -58.453 |
| | CDMA | Upper | AGC | 1 995.819 | | -67.493 |
| | | | AGC +10 dB | 1 997.952 | | -68.203 |
| | | Lower | AGC | 1 929.667 | | -67.480 |
| | | | AGC +10 dB | 1 929.904 | | -68.203 |

Plot data of Out-of-Band Emissions



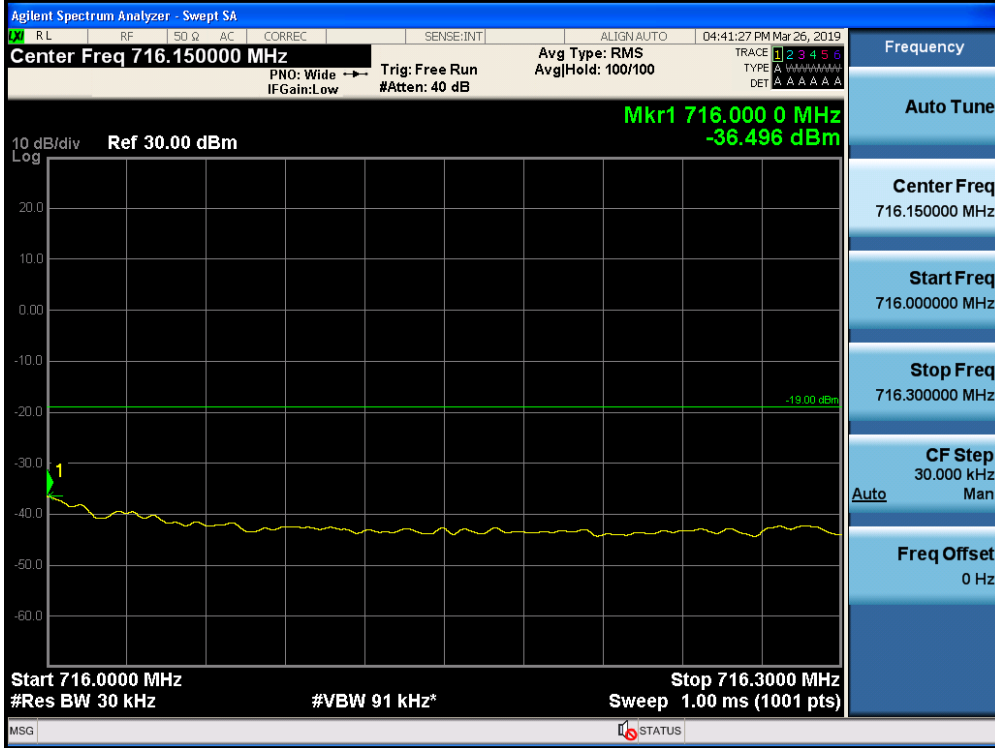
Out-of-Band Emissions / Lower 700 MHz / Uplink / GSM / Lower Edge / AGC threshold



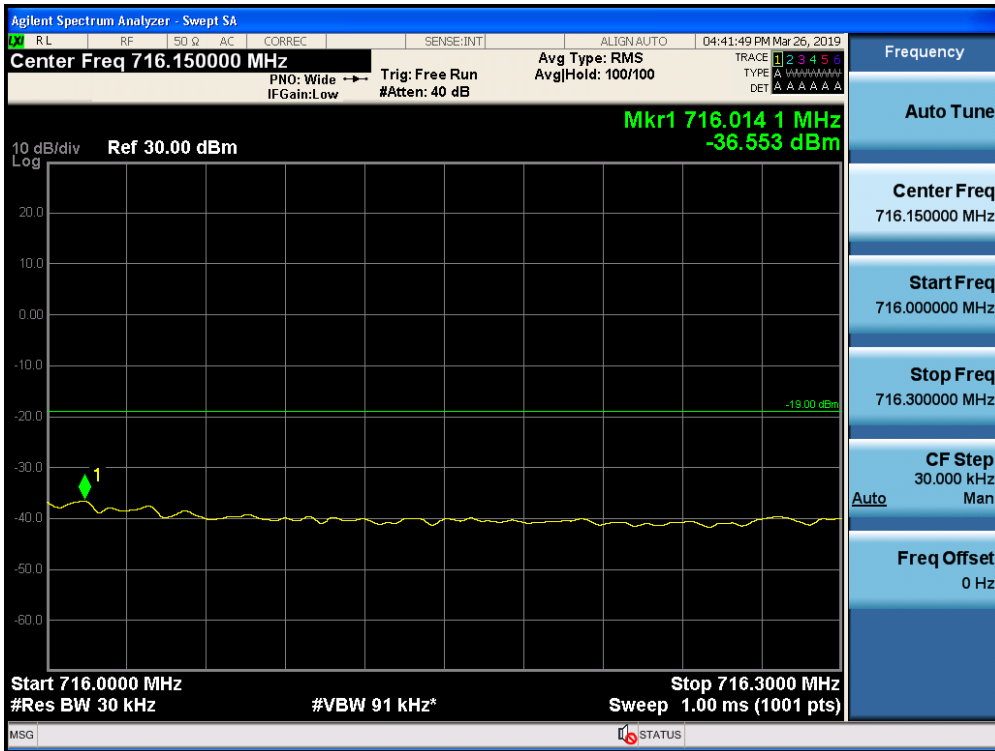
Out-of-Band Emissions / Lower 700 MHz / Uplink / GSM / Lower Edge / AGC threshold +10 dB



Out-of-Band Emissions / Lower 700 MHz / Uplink / LTE 5 MHz / Upper Edge / AGC threshold



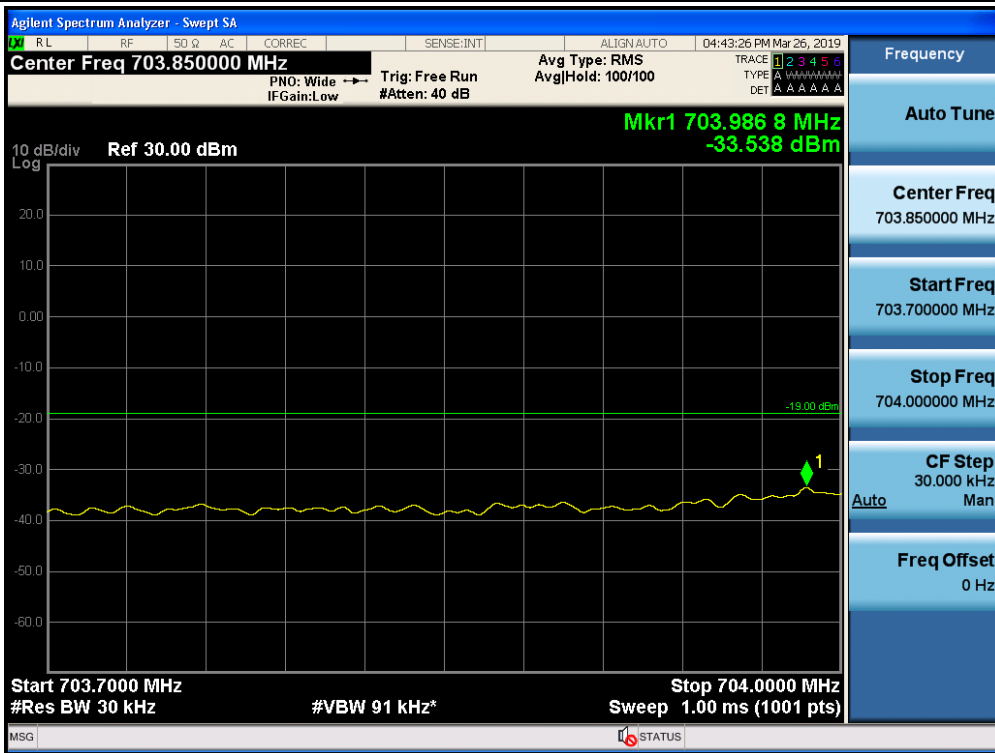
Out-of-Band Emissions / Lower 700 MHz / Uplink / LTE 5 MHz / Upper Edge / AGC threshold +10 dB



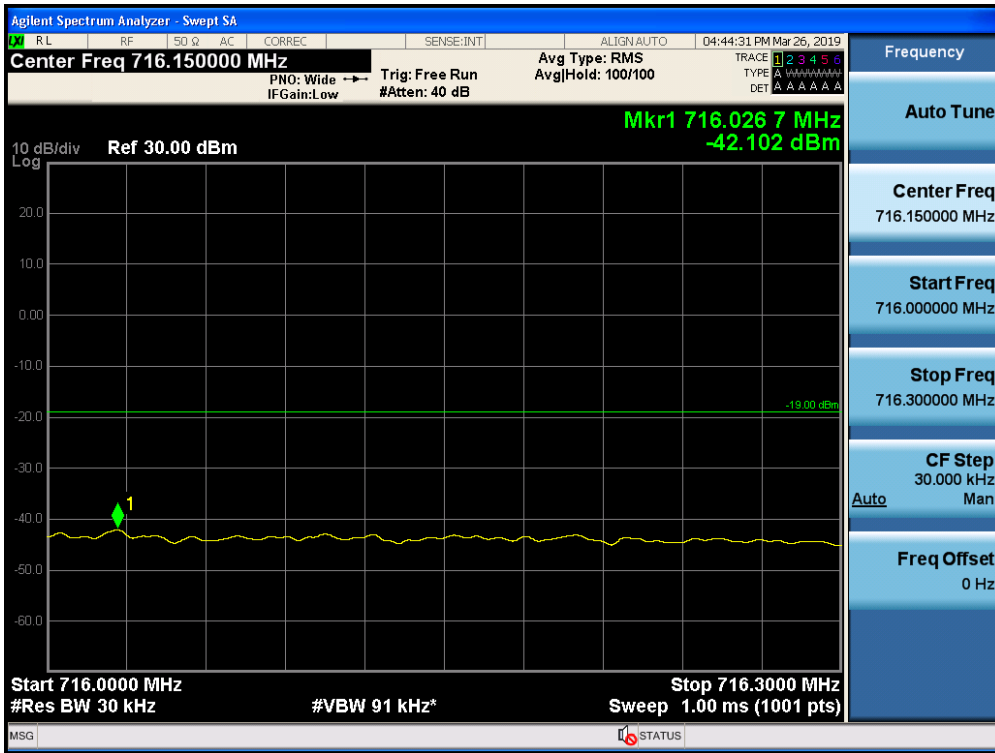
Out-of-Band Emissions / Lower 700 MHz / Uplink / LTE 5 MHz / Lower Edge / AGC threshold



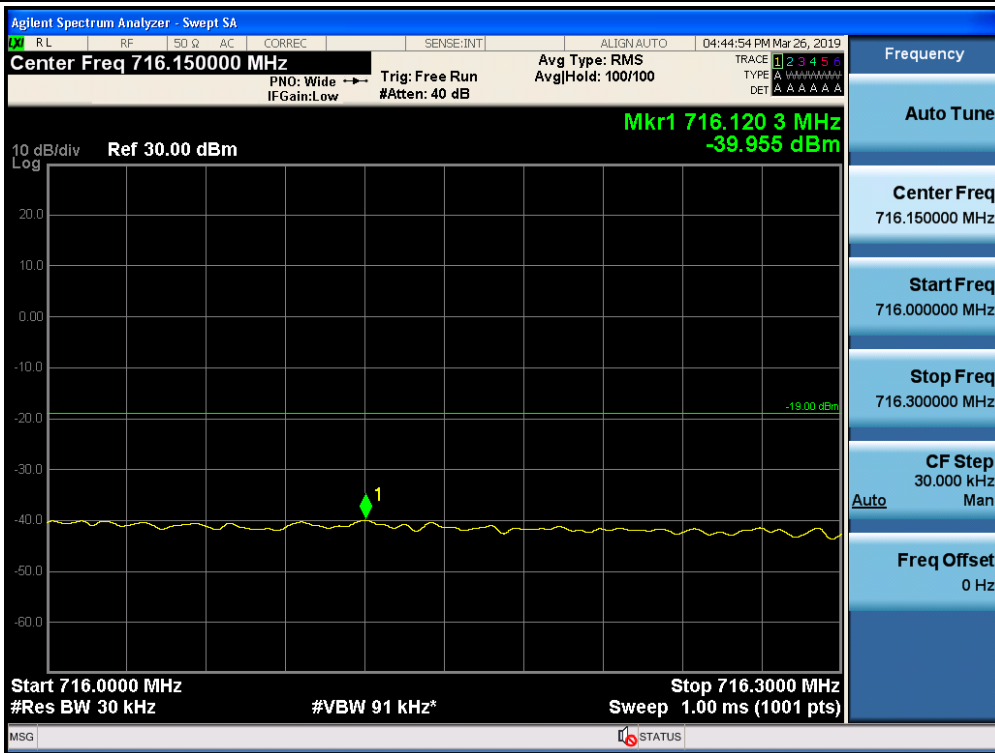
Out-of-Band Emissions / Lower 700 MHz / Uplink / LTE 5 MHz / Lower Edge / AGC threshold +10 dB



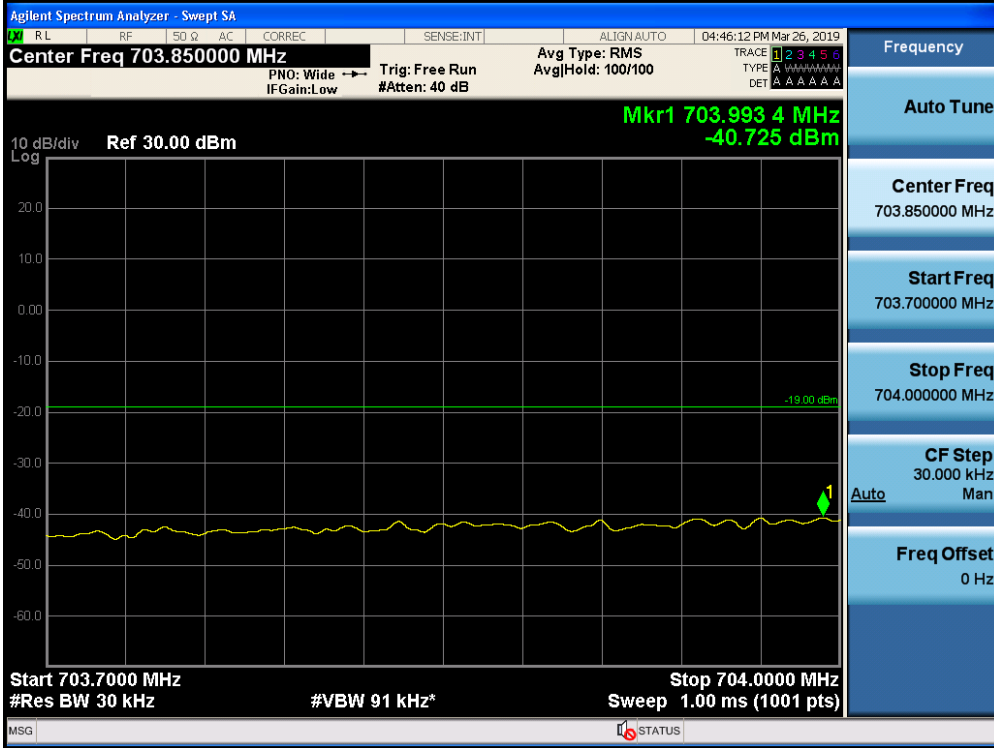
Out-of-Band Emissions / Lower 700 MHz / Uplink / CDMA / Upper Edge / AGC threshold



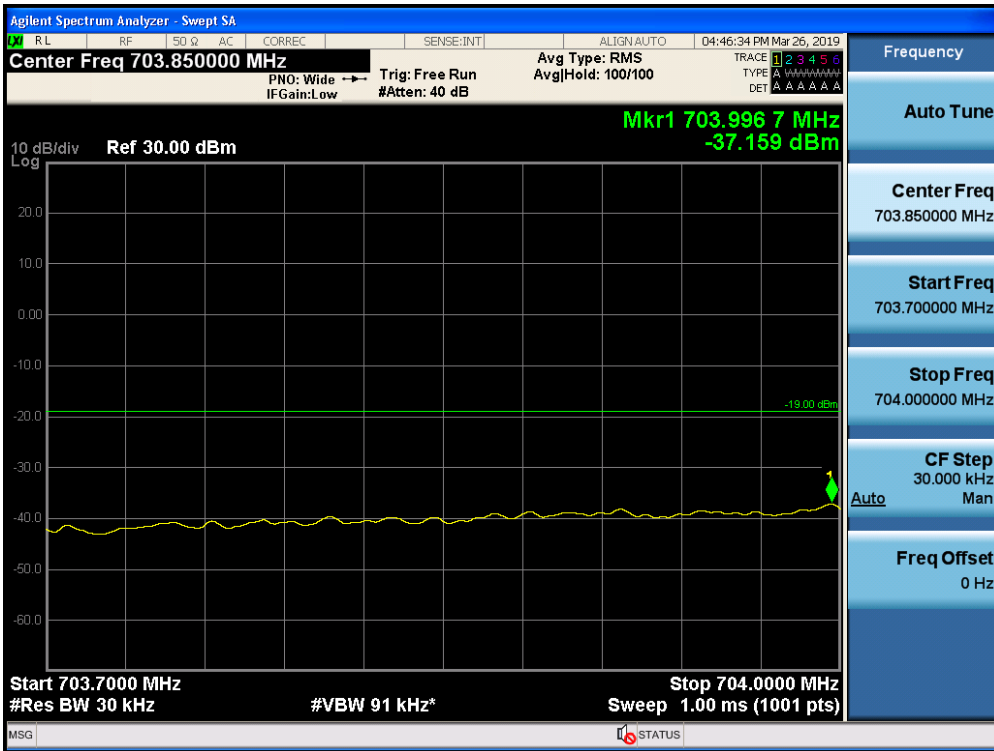
Out-of-Band Emissions / Lower 700 MHz / Uplink / CDMA / Upper Edge / AGC threshold +10 dB



Out-of-Band Emissions / Lower 700 MHz / Uplink / CDMA / Lower Edge / AGC threshold



Out-of-Band Emissions / Lower 700 MHz / Uplink / CDMA / Lower Edge / AGC threshold +10 dB



Out-of-Band Emissions / Upper 700 MHz / Uplink / GSM / Upper Edge / AGC threshold



Out-of-Band Emissions / Upper 700 MHz / Uplink / GSM / Upper Edge / AGC threshold +10 dB



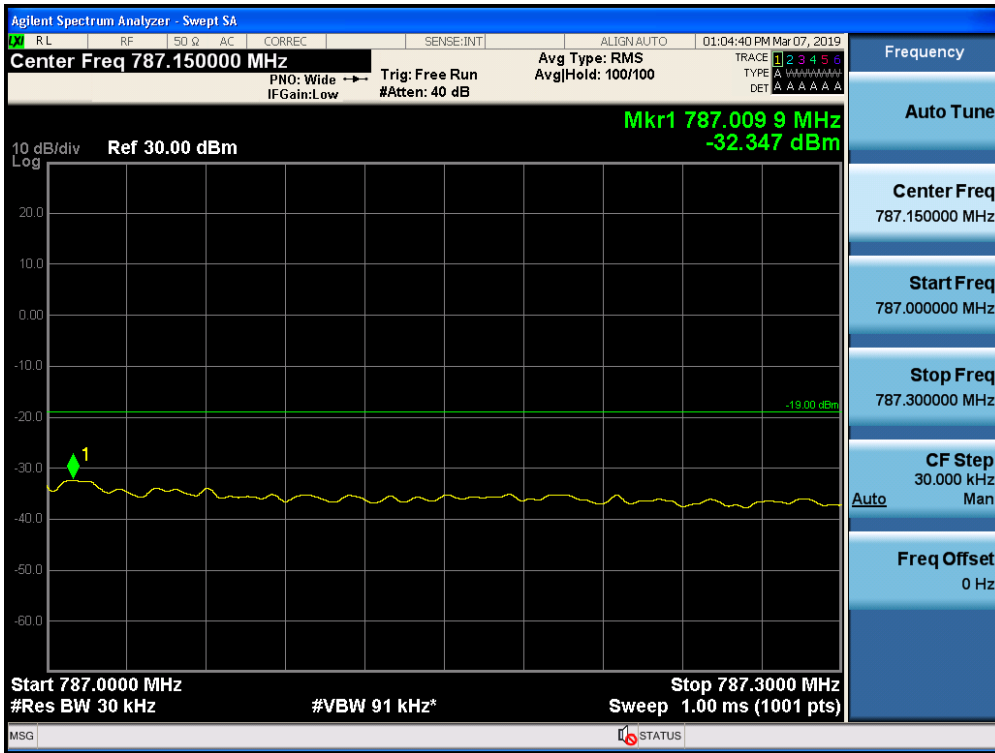
Out-of-Band Emissions / Upper 700 MHz / Uplink / GSM / Lower Edge / AGC threshold



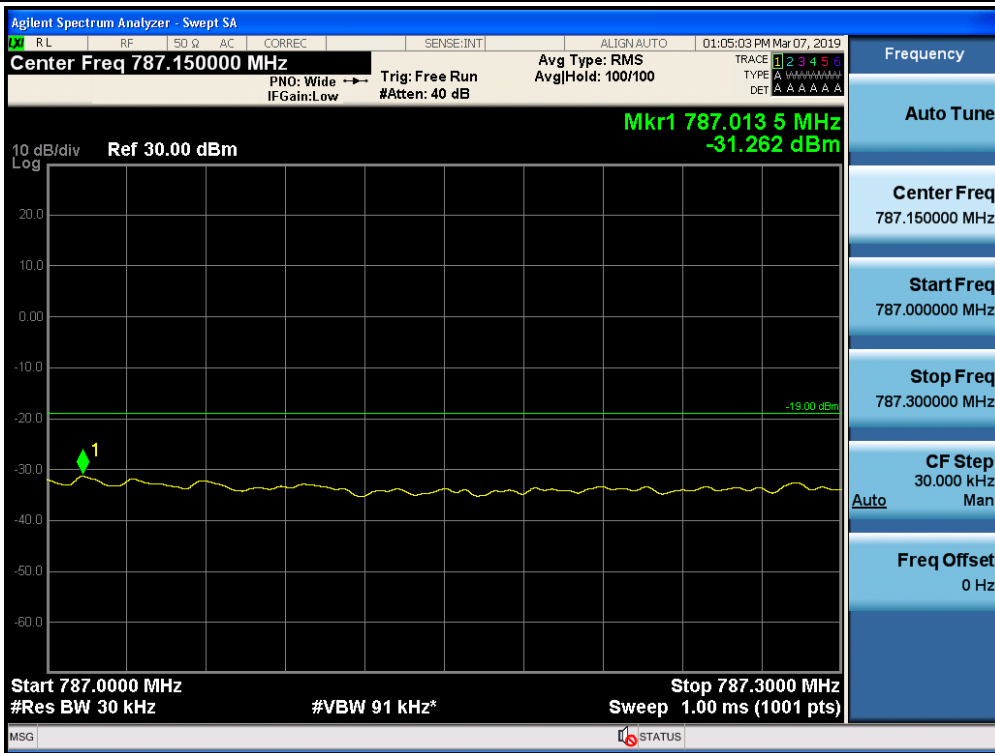
Out-of-Band Emissions / Upper 700 MHz / Uplink / GSM / Lower Edge / AGC threshold +10 dB



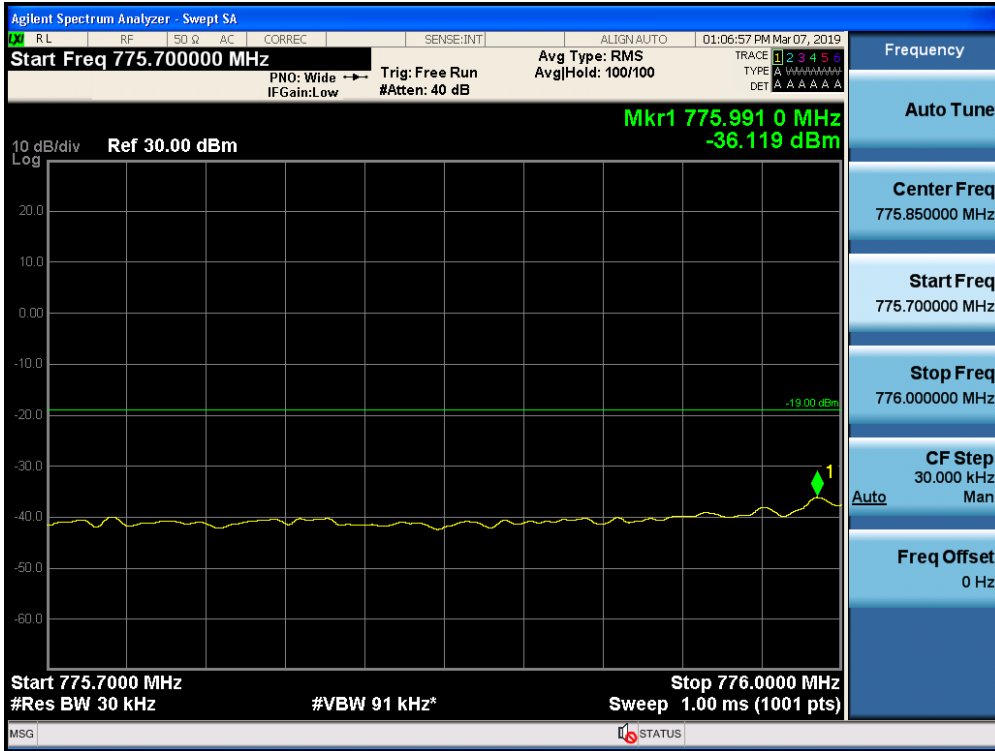
Out-of-Band Emissions / Upper 700 MHz / Uplink / LTE 5 MHz / Upper Edge / AGC threshold



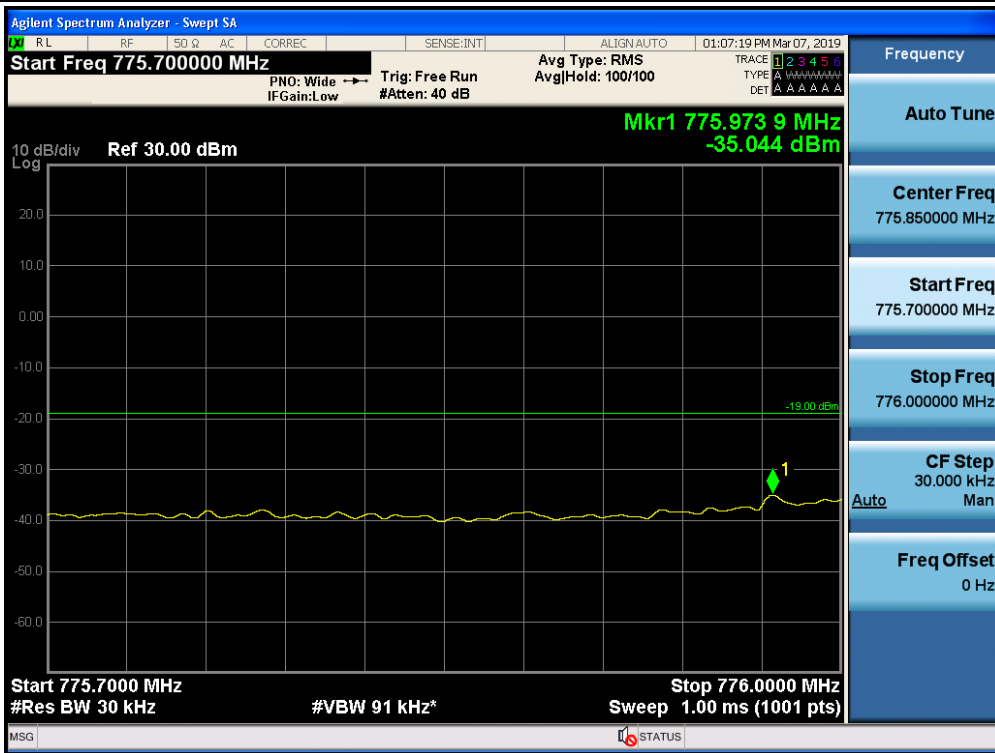
Out-of-Band Emissions / Upper 700 MHz / Uplink / LTE 5 MHz / Upper Edge / AGC threshold +10 dB



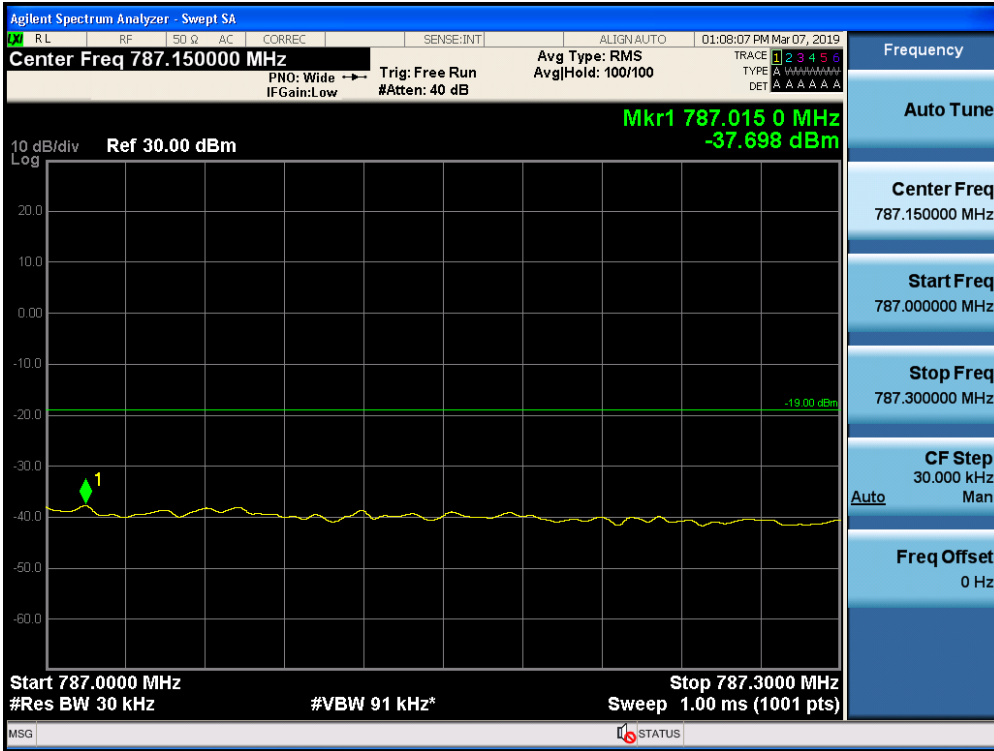
Out-of-Band Emissions / Upper 700 MHz / Uplink / LTE 5 MHz / Lower Edge / AGC threshold



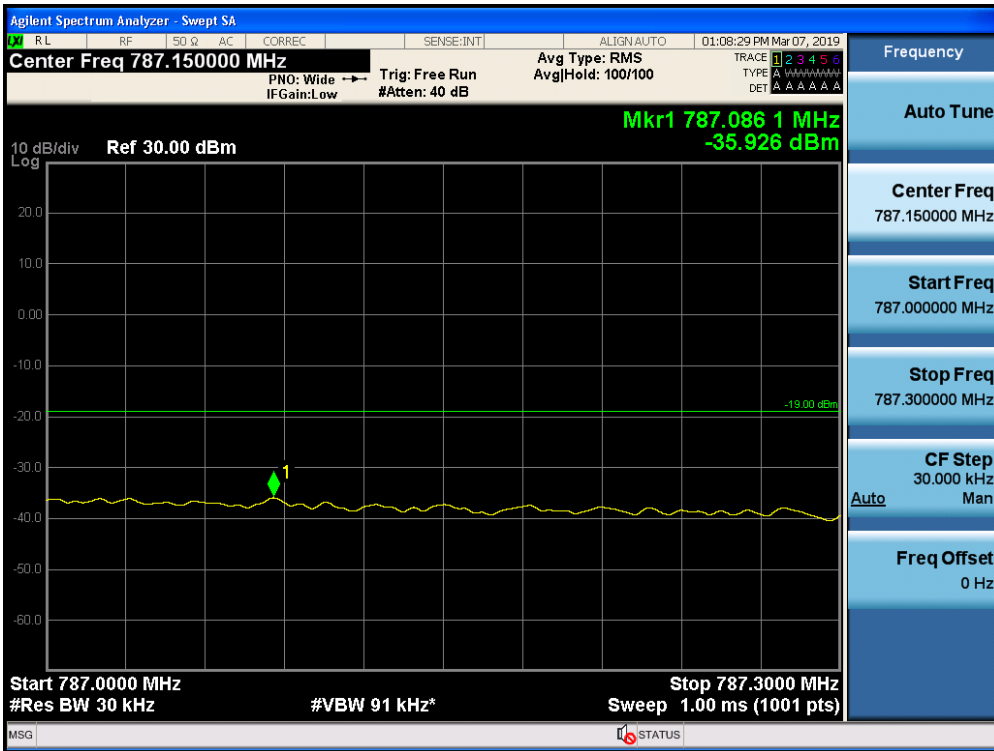
Out-of-Band Emissions / Upper 700 MHz / Uplink / LTE 5 MHz / Lower Edge / AGC threshold +10 dB



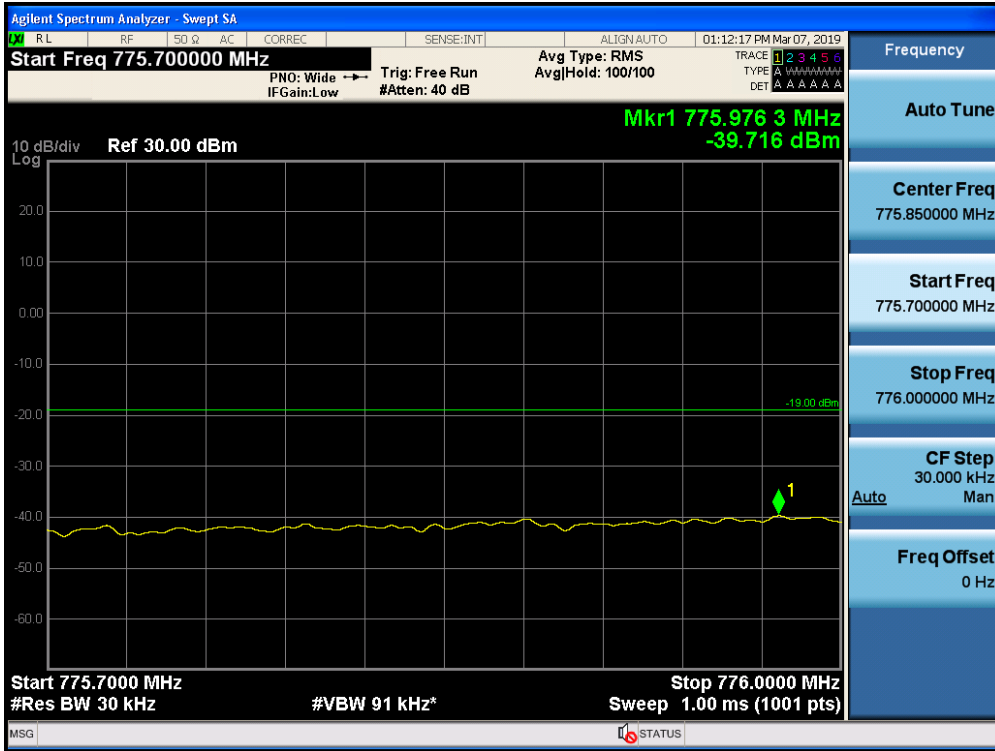
Out-of-Band Emissions / Upper 700 MHz / Uplink / CDMA / Upper Edge / AGC threshold



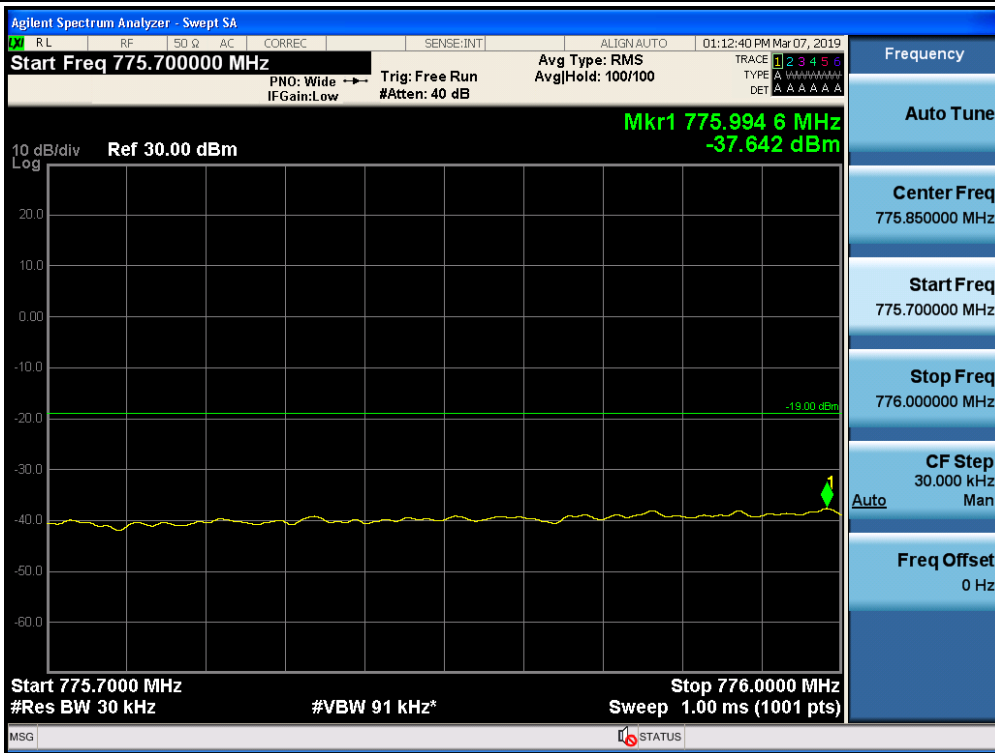
Out-of-Band Emissions / Upper 700 MHz / Uplink / CDMA / Upper Edge / AGC threshold +10 dB



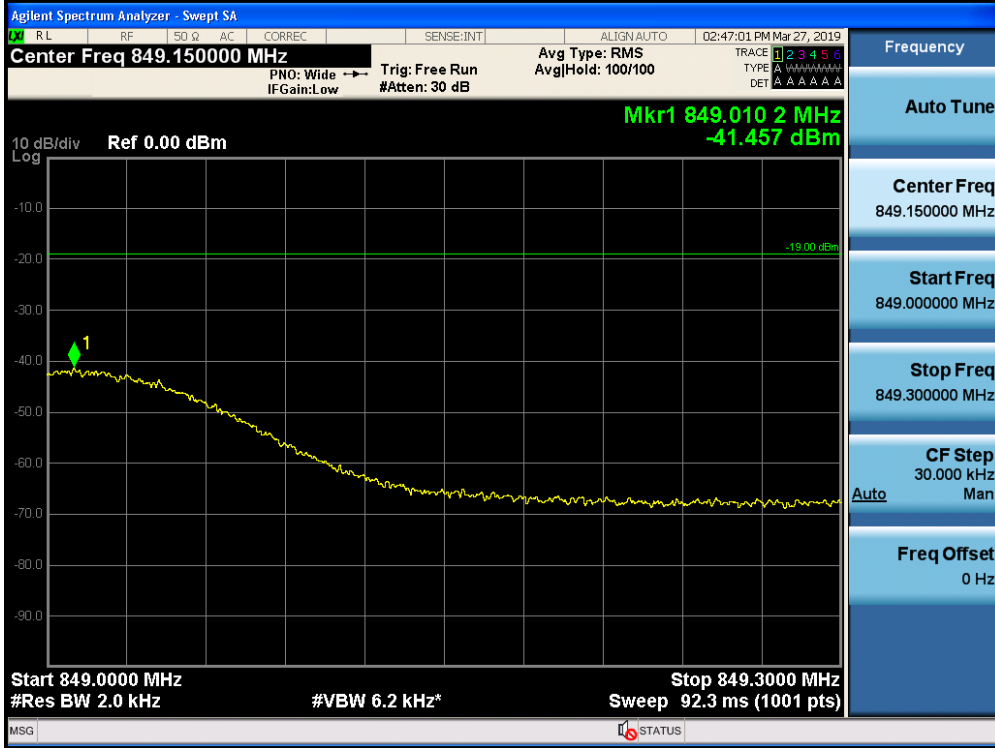
Out-of-Band Emissions / Upper 700 MHz / Uplink / CDMA / Lower Edge / AGC threshold



Out-of-Band Emissions / Upper 700 MHz / Uplink / CDMA / Lower Edge / AGC threshold +10 dB



Out-of-Band Emissions / Cellular / Uplink / GSM / Upper Edge / AGC threshold



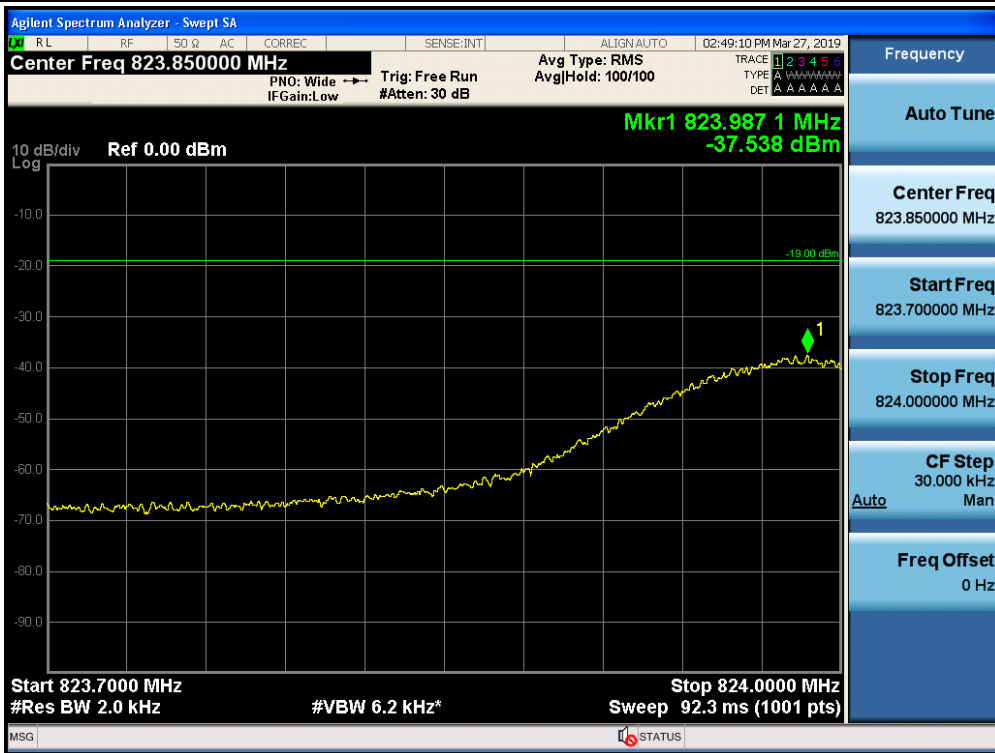
Out-of-Band Emissions / Cellular / Uplink / GSM / Upper Edge / AGC threshold +10 dB



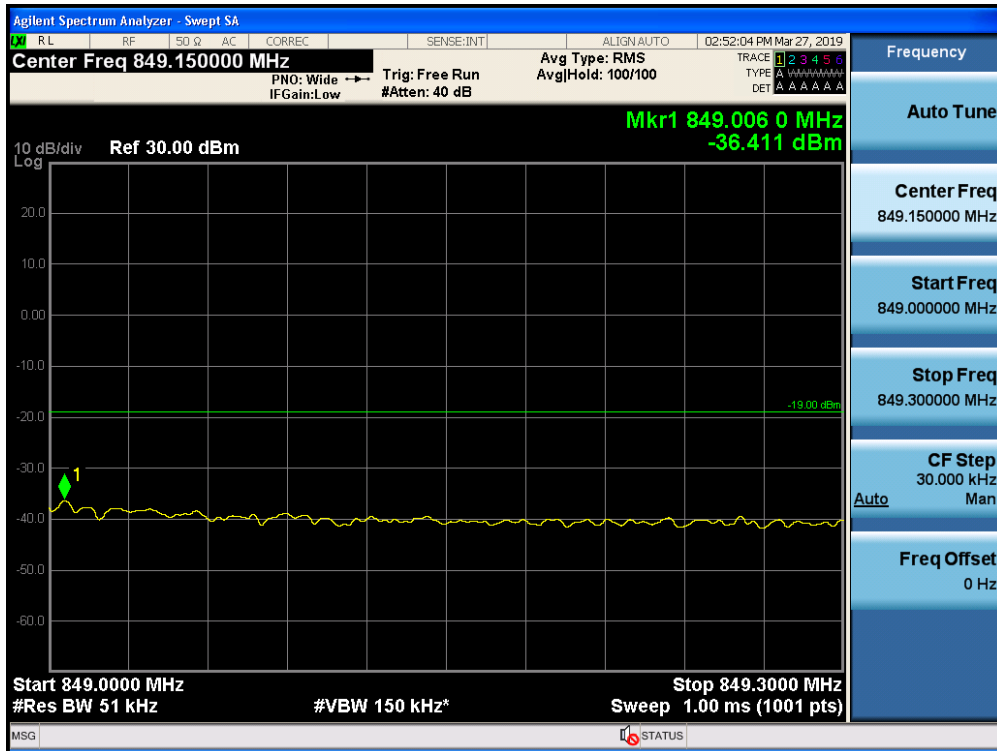
Out-of-Band Emissions / Cellular / Uplink / GSM / Lower Edge / AGC threshold



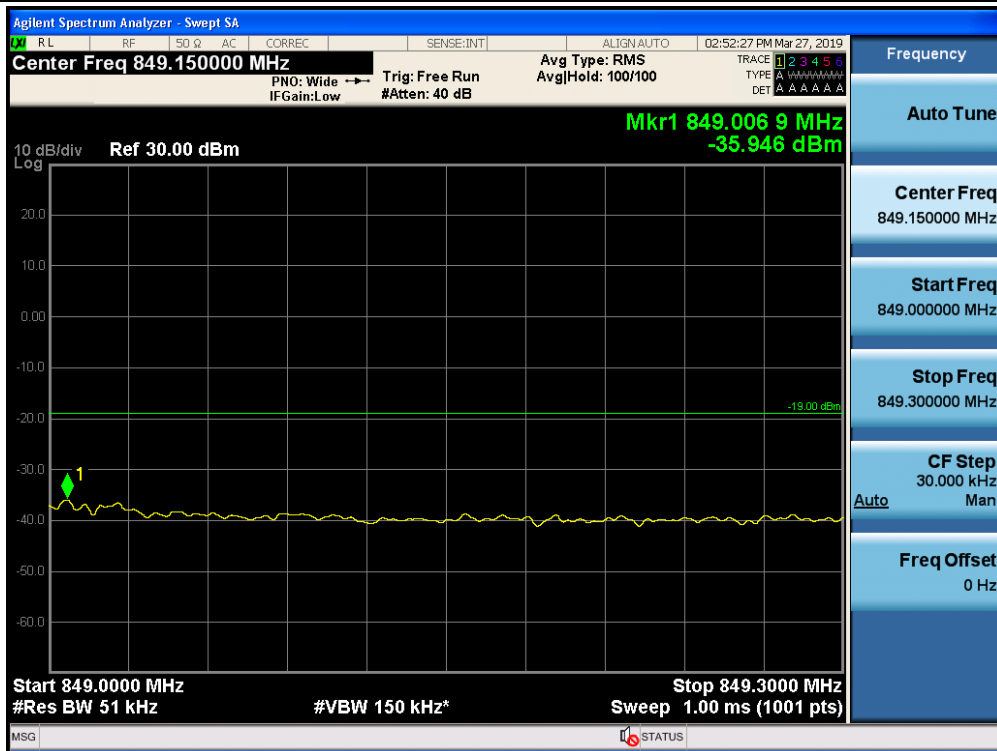
Out-of-Band Emissions / Cellular / Uplink / GSM / Lower Edge / AGC threshold +10 dB



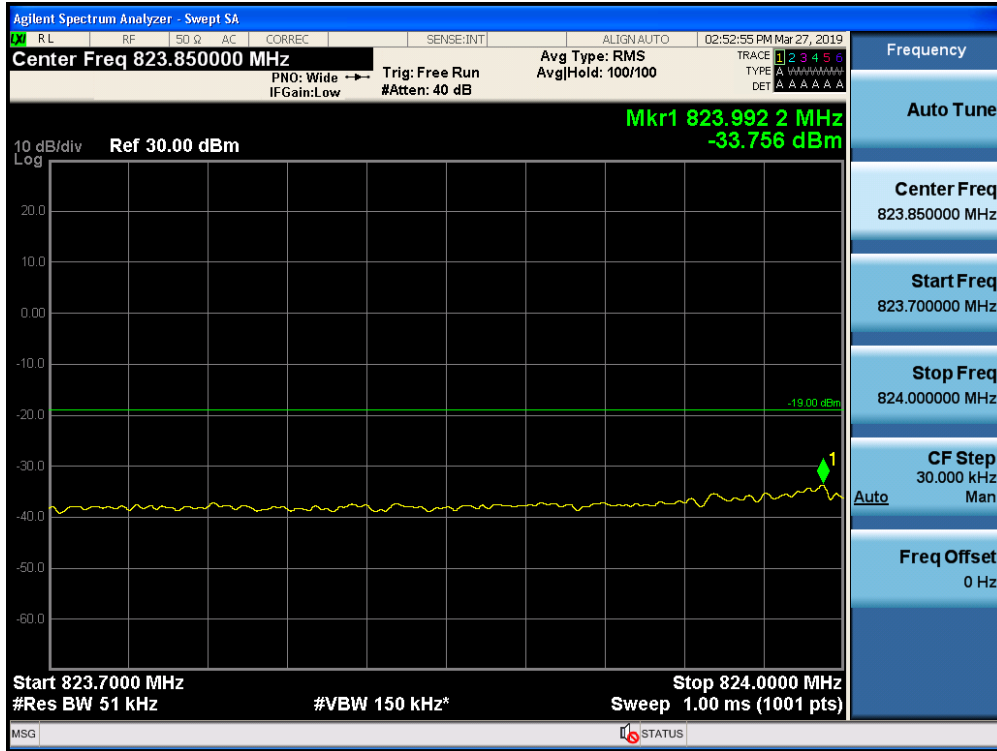
Out-of-Band Emissions / Cellular / Uplink / LTE 5 MHz / Upper Edge / AGC threshold



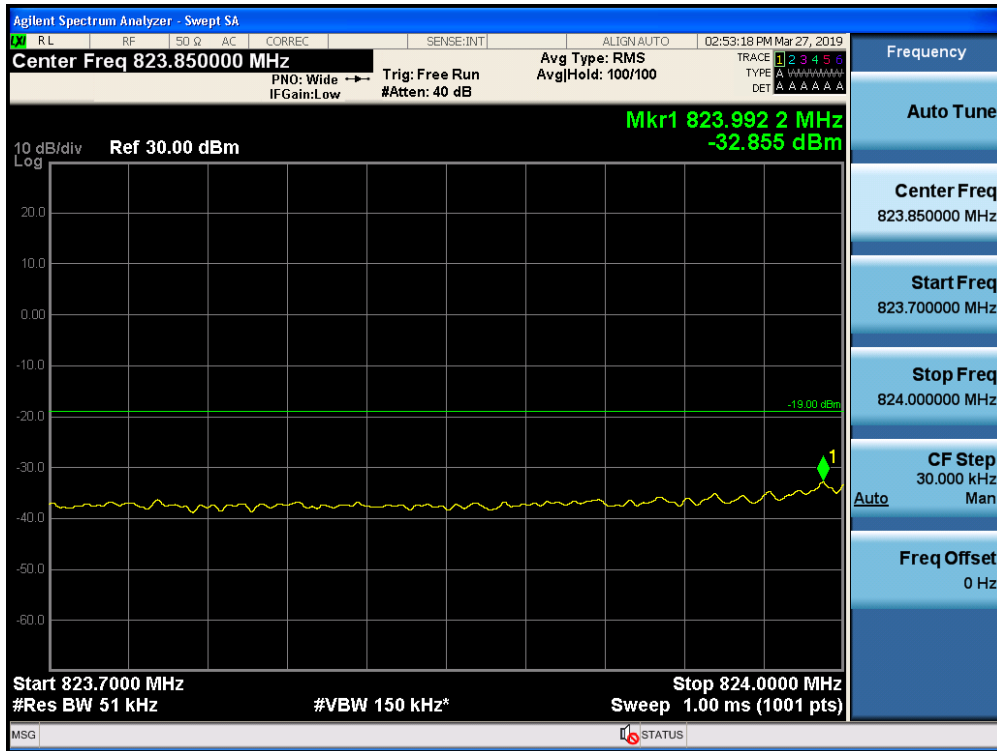
Out-of-Band Emissions / Cellular / Uplink / LTE 5 MHz / Upper Edge / AGC threshold +10 dB

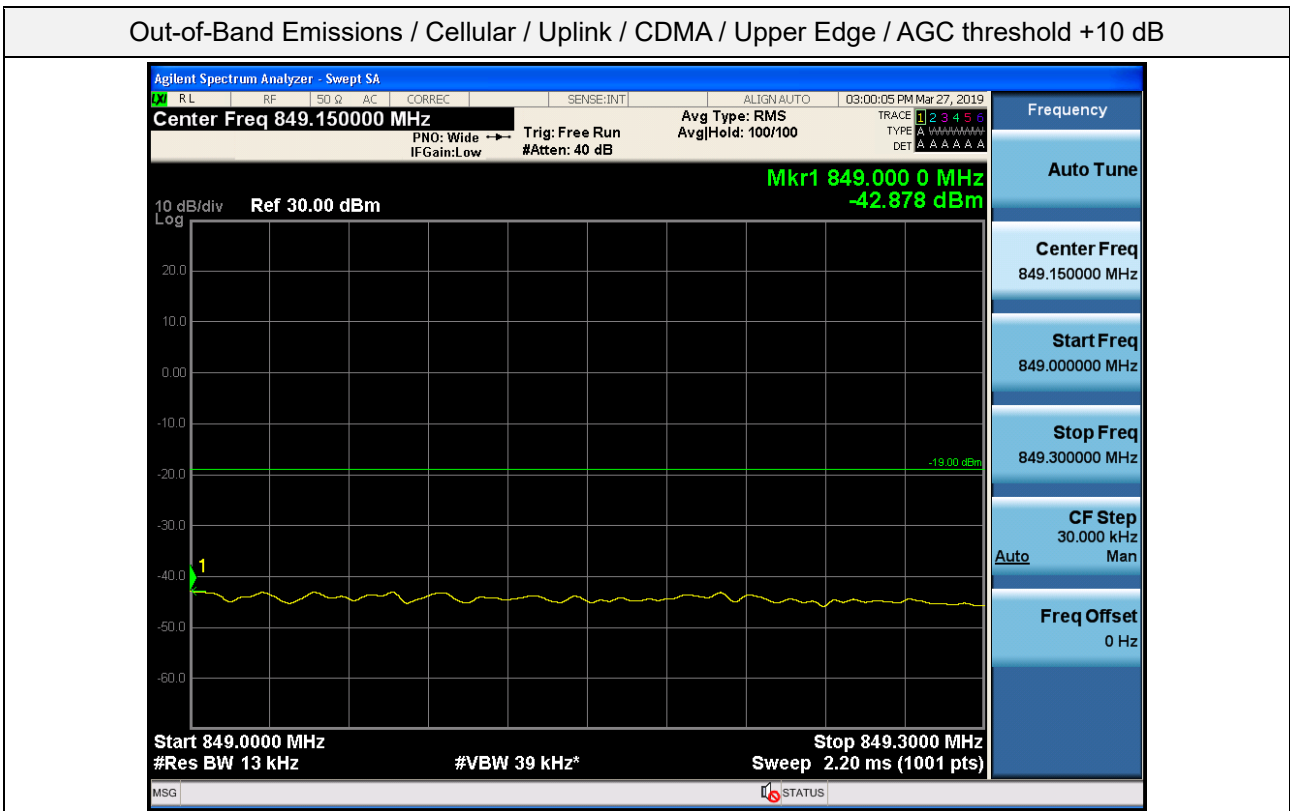
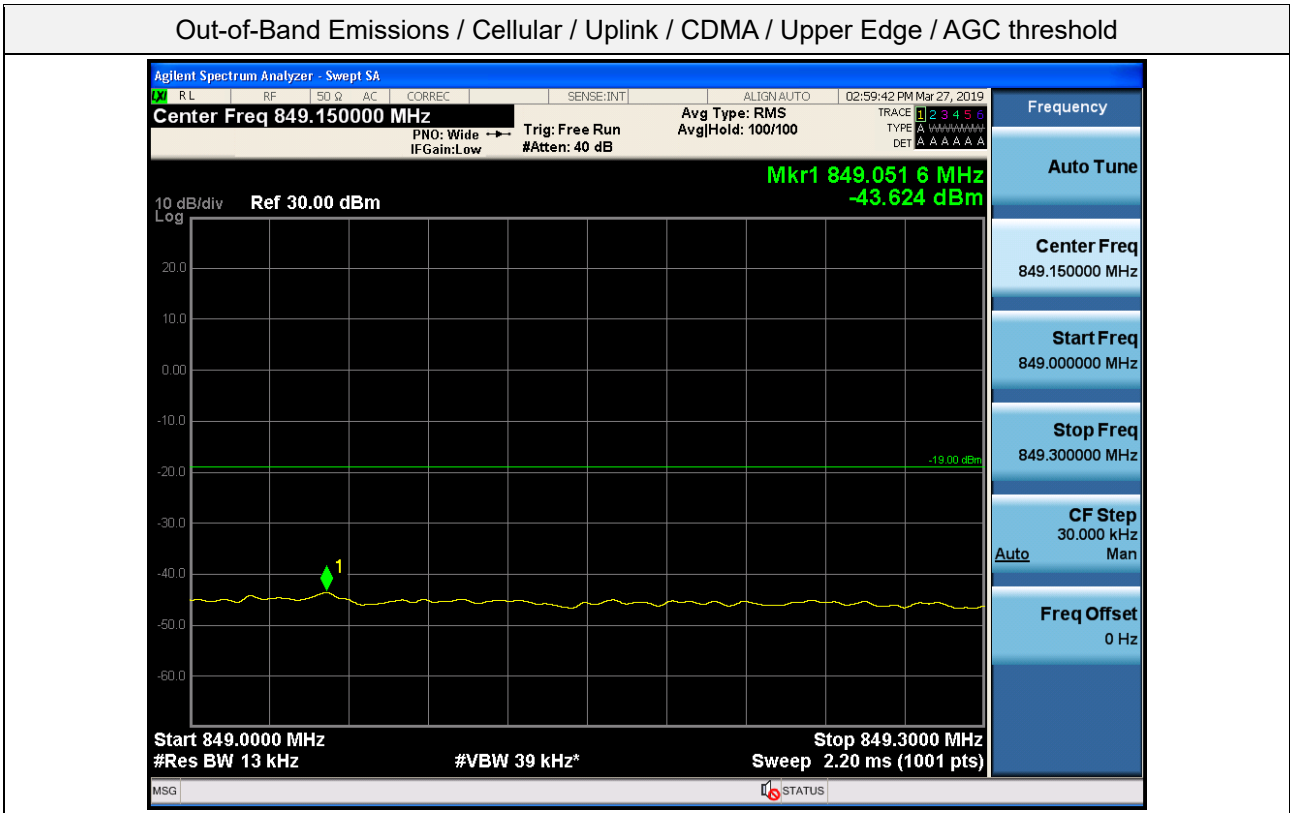


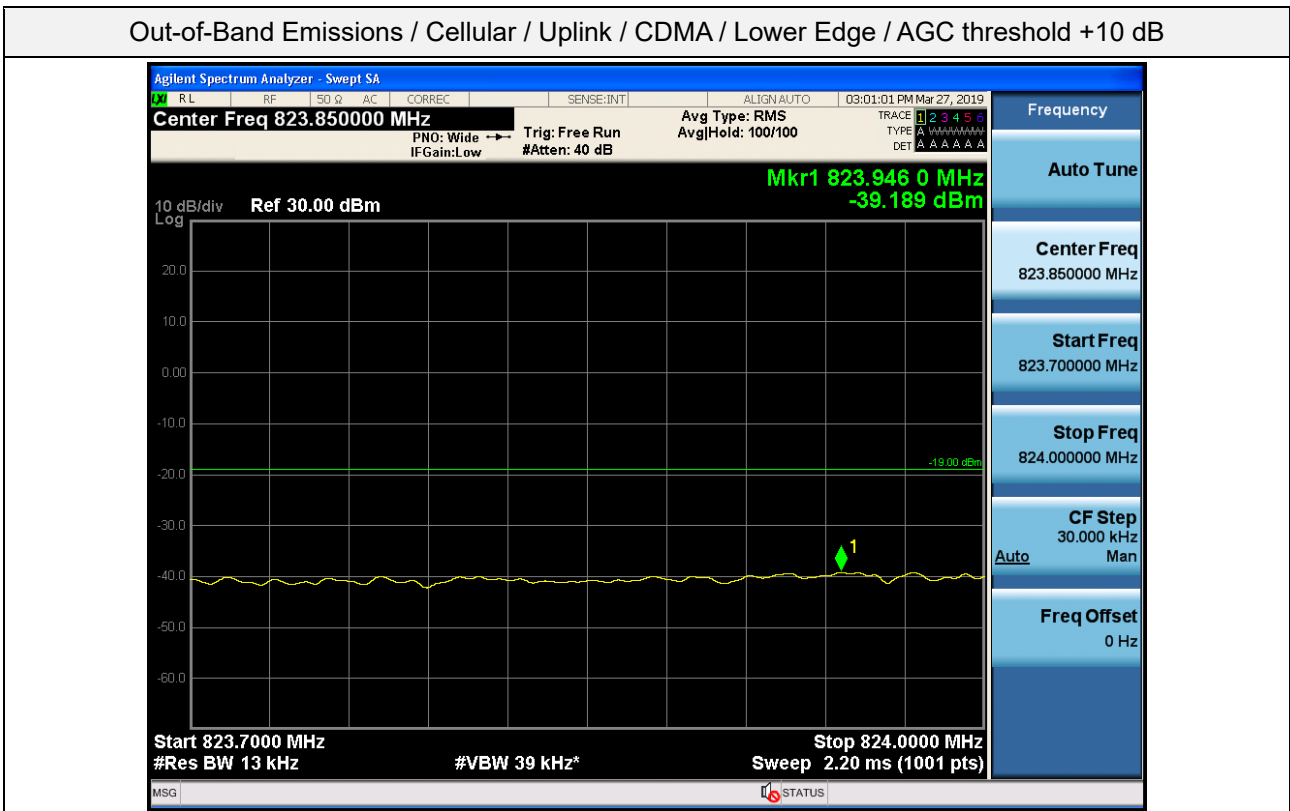
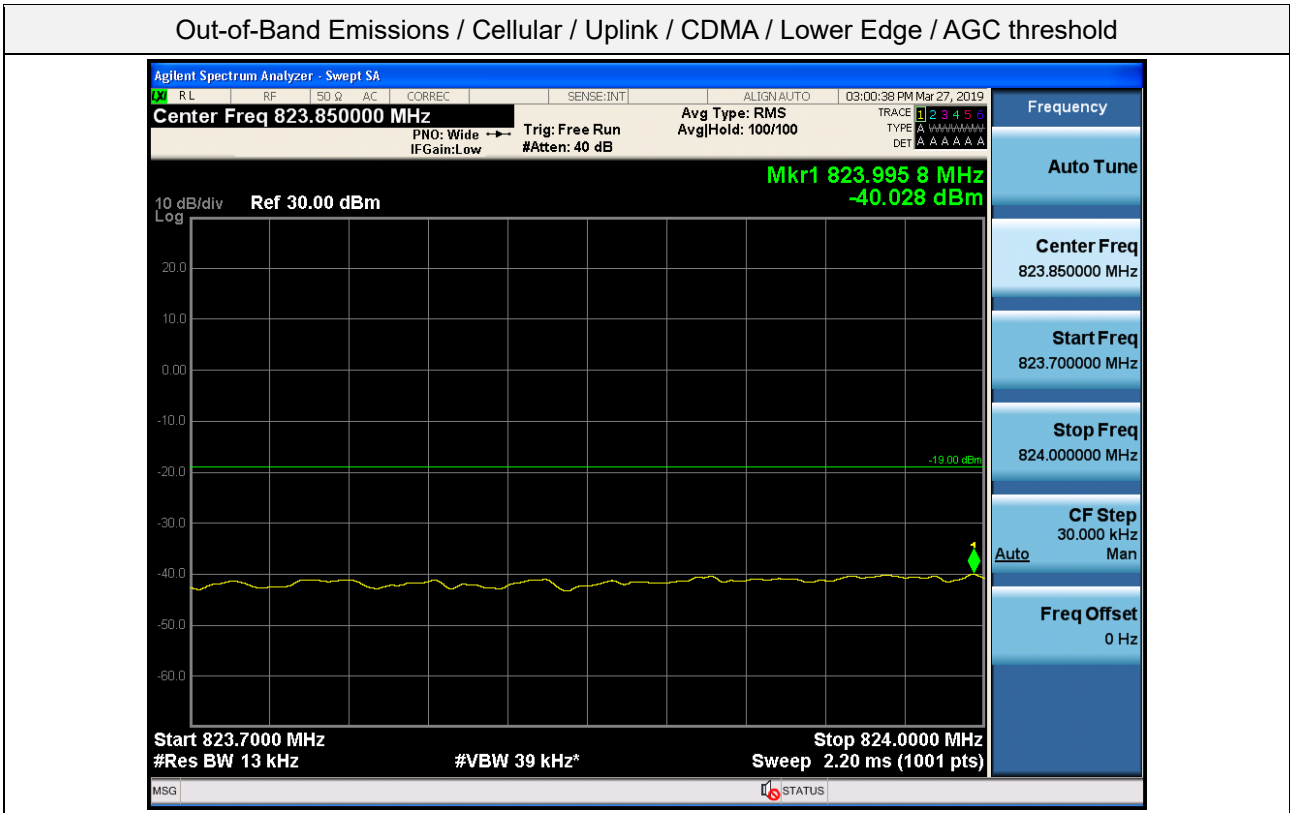
Out-of-Band Emissions / Cellular / Uplink / LTE 5 MHz / Lower Edge / AGC threshold



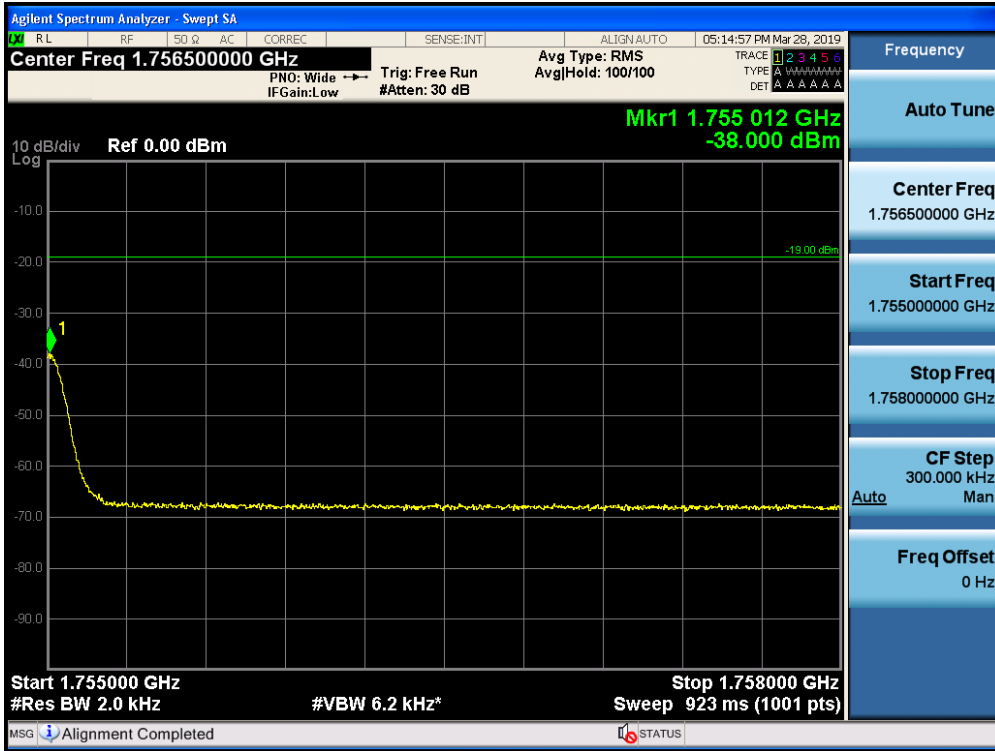
Out-of-Band Emissions / Cellular / Uplink / LTE 5 MHz / Lower Edge / AGC threshold +10 dB



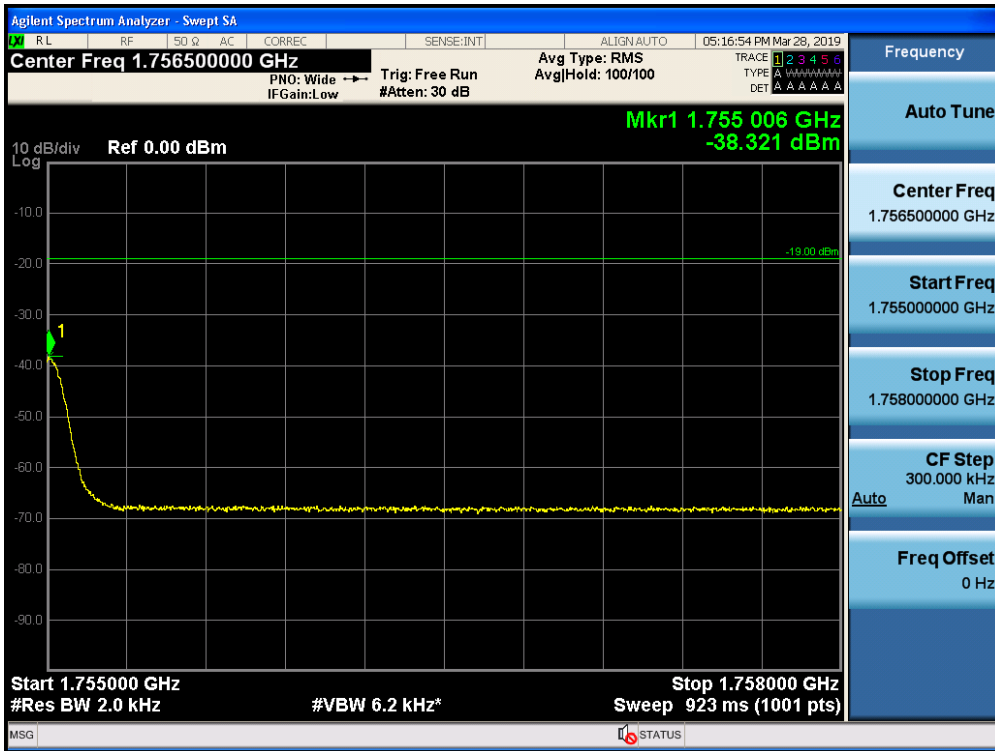




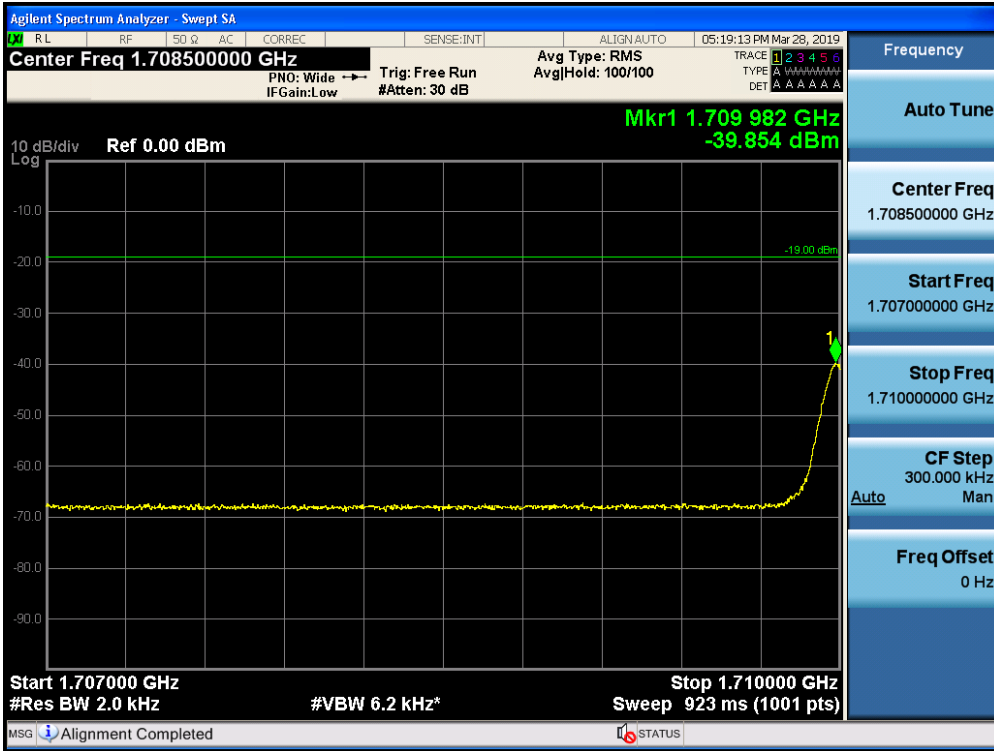
Out-of-Band Emissions / AWS-1 / Uplink / GSM / Upper Edge / AGC threshold



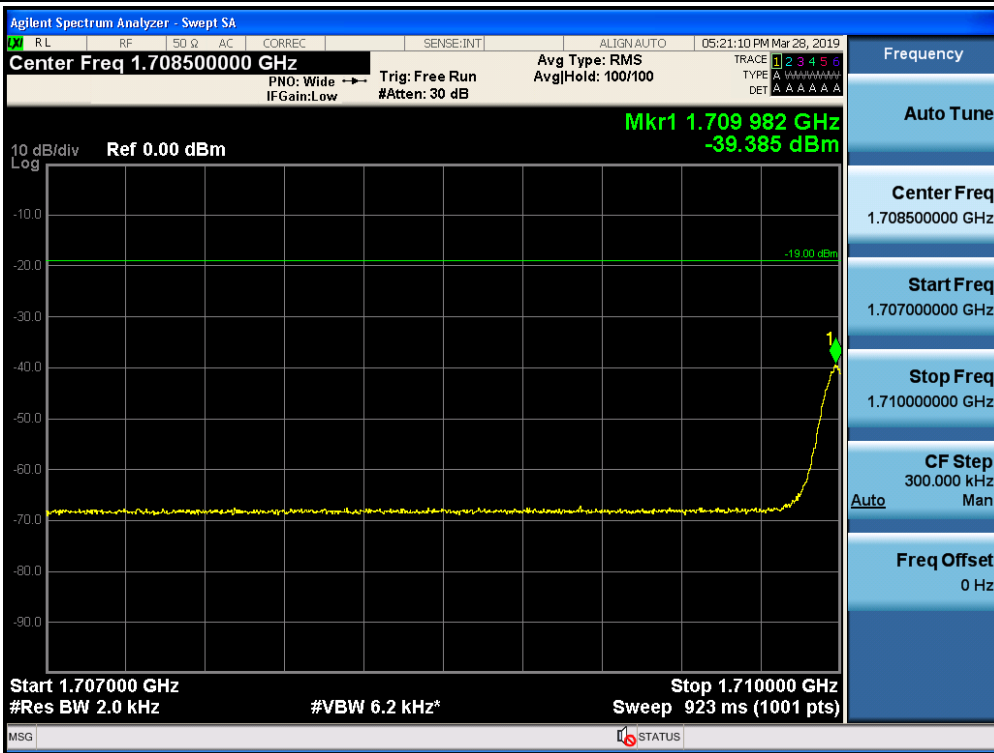
Out-of-Band Emissions / AWS-1 / Uplink / GSM / Upper Edge / AGC threshold +10 dB



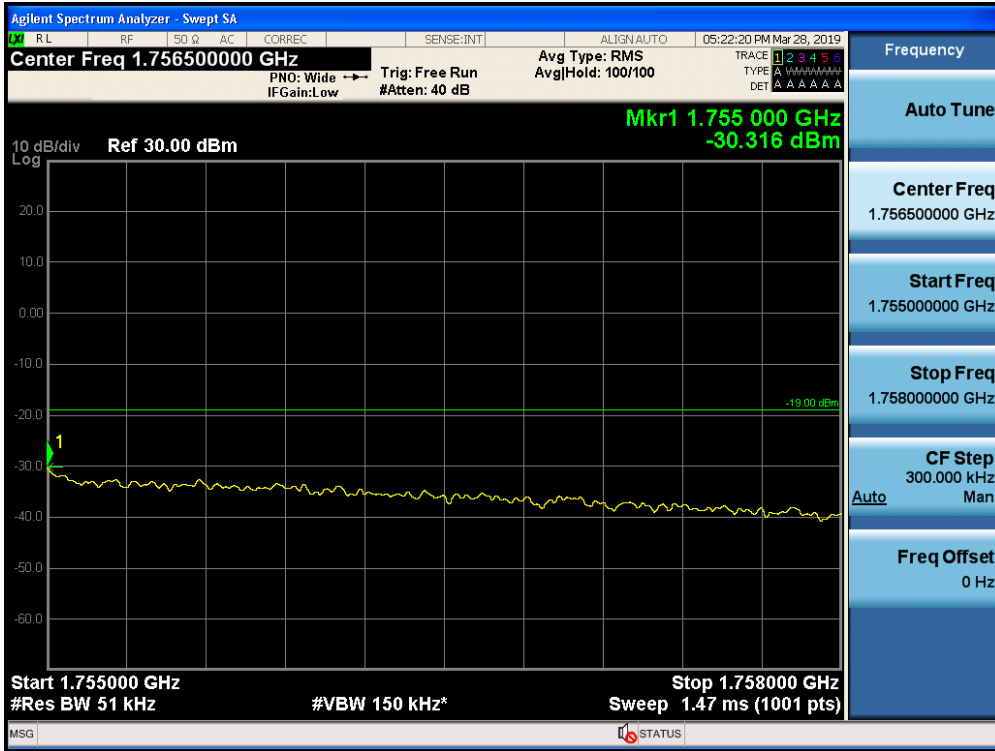
Out-of-Band Emissions / AWS-1 / Uplink / GSM / Lower Edge / AGC threshold



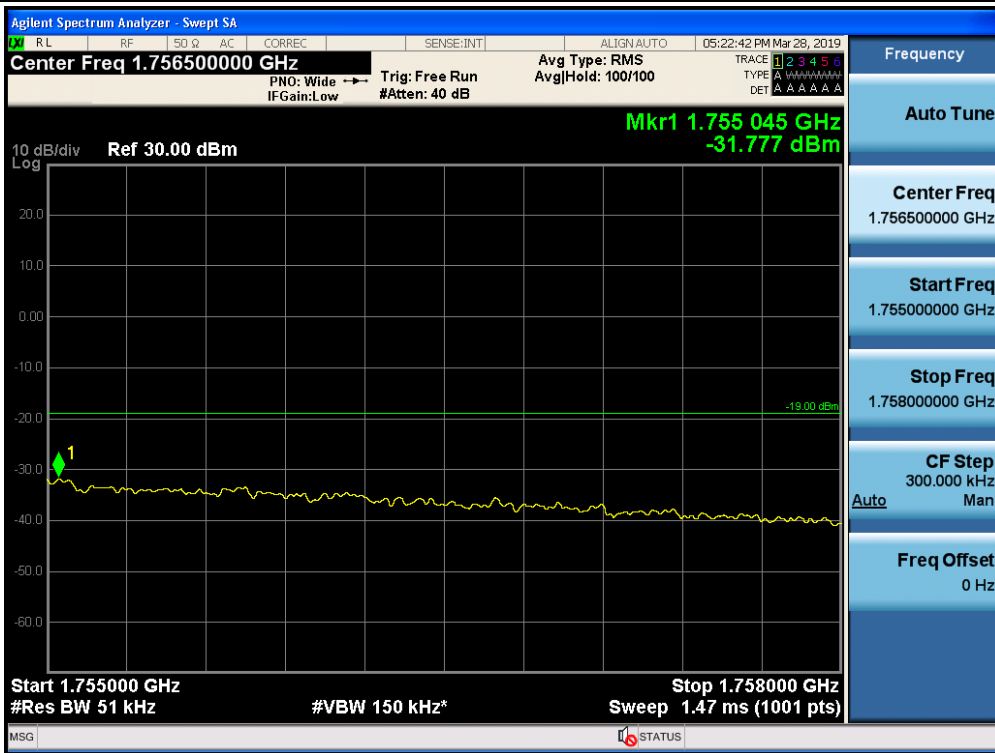
Out-of-Band Emissions / AWS-1 / Uplink / GSM / Lower Edge / AGC threshold +10 dB



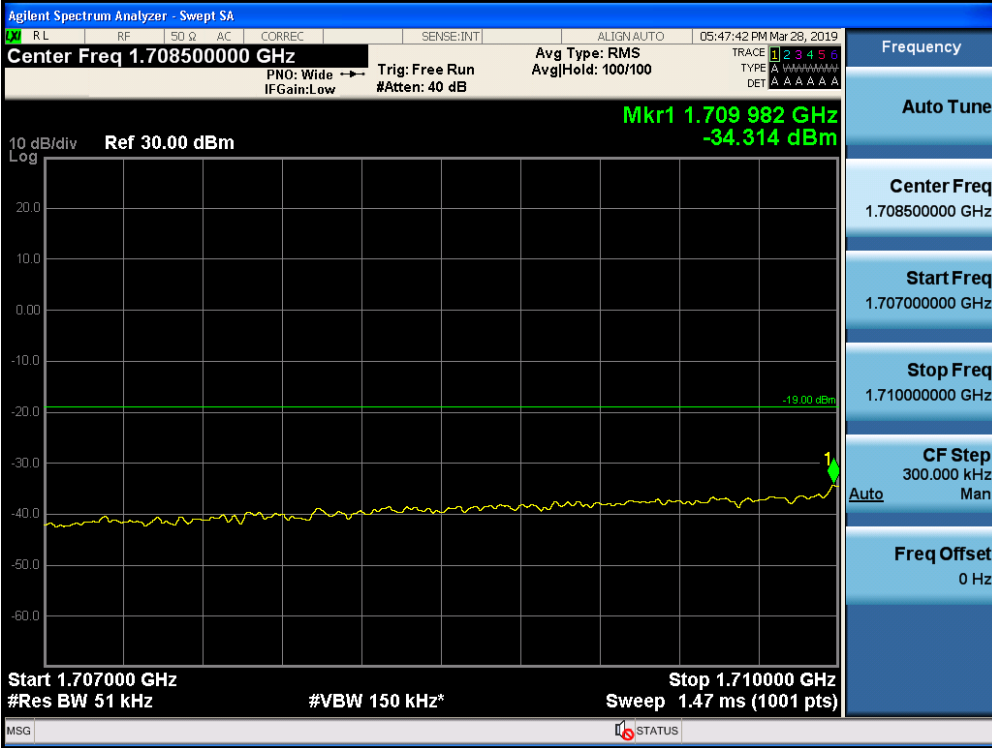
Out-of-Band Emissions / AWS-1 / Uplink / LTE 5 MHz / Upper Edge / AGC threshold



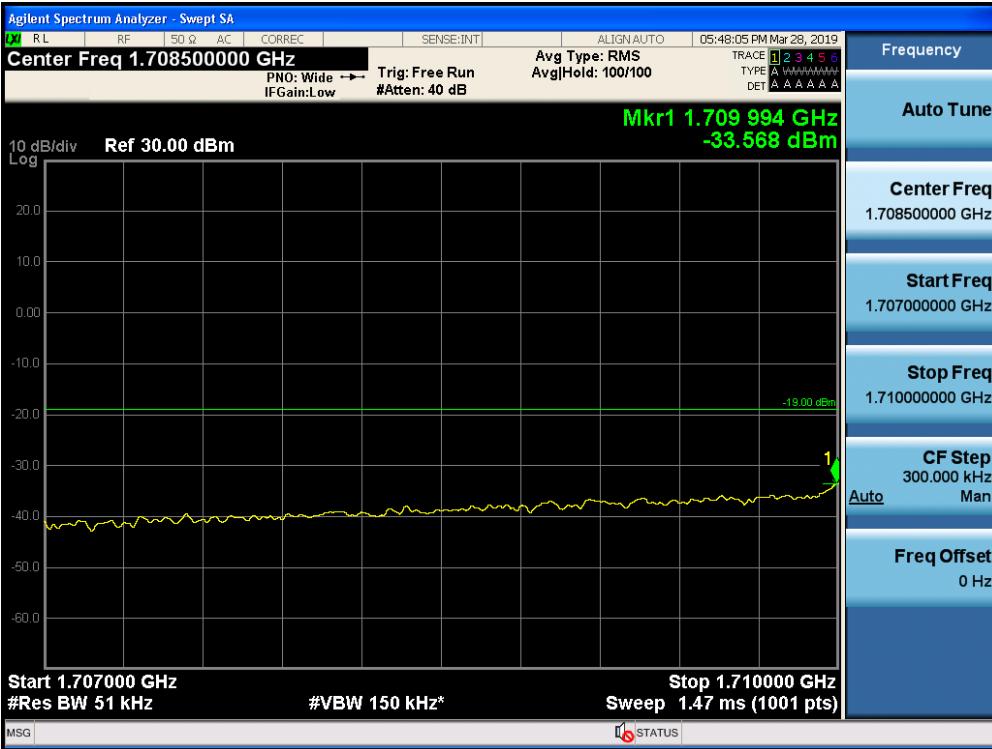
Out-of-Band Emissions / AWS-1 / Uplink / LTE 5 MHz / Upper Edge / AGC threshold +10 dB



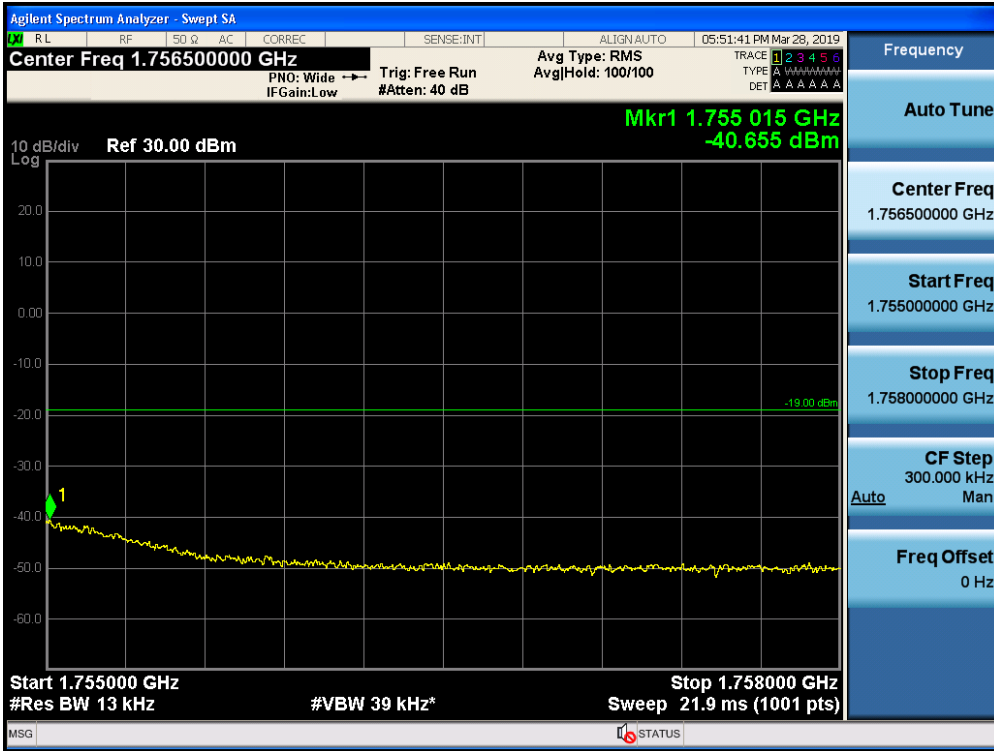
Out-of-Band Emissions / AWS-1 / Uplink / LTE 5 MHz / Lower Edge / AGC threshold



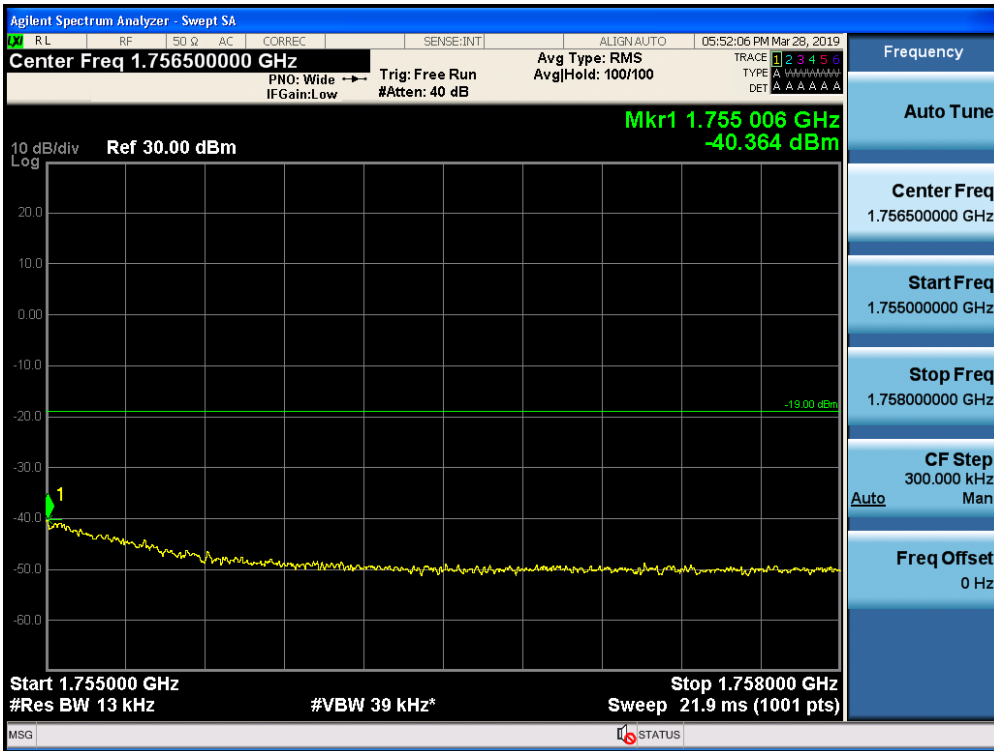
Out-of-Band Emissions / AWS-1 / Uplink / LTE 5 MHz / Lower Edge / AGC threshold +10 dB



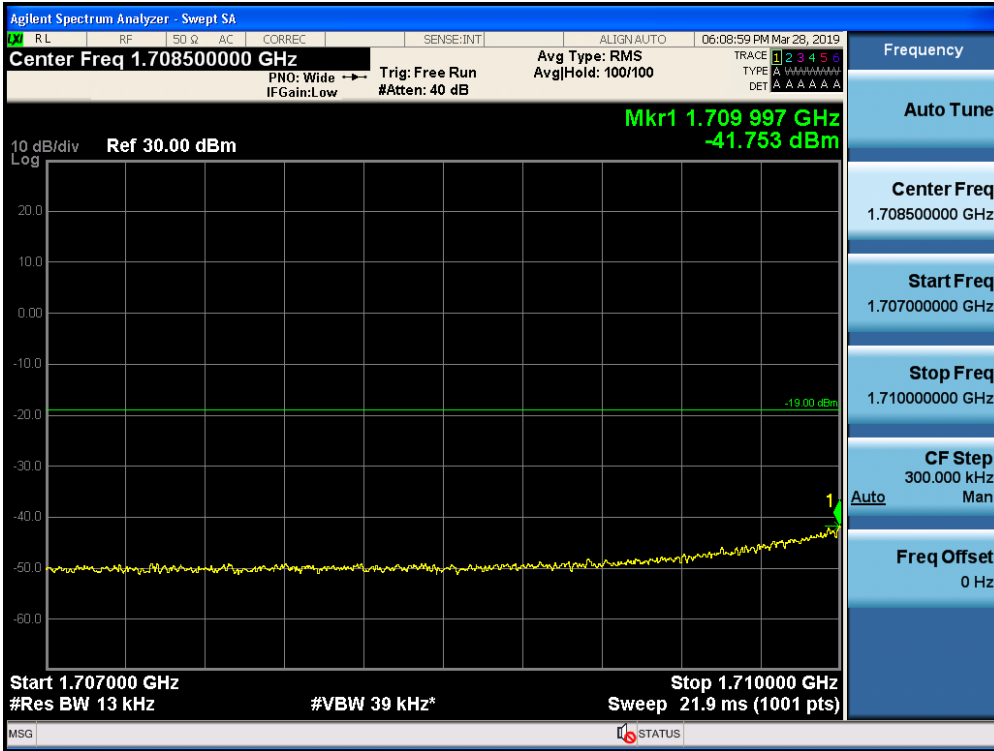
Out-of-Band Emissions / AWS-1 / Uplink / CDMA / Upper Edge / AGC threshold



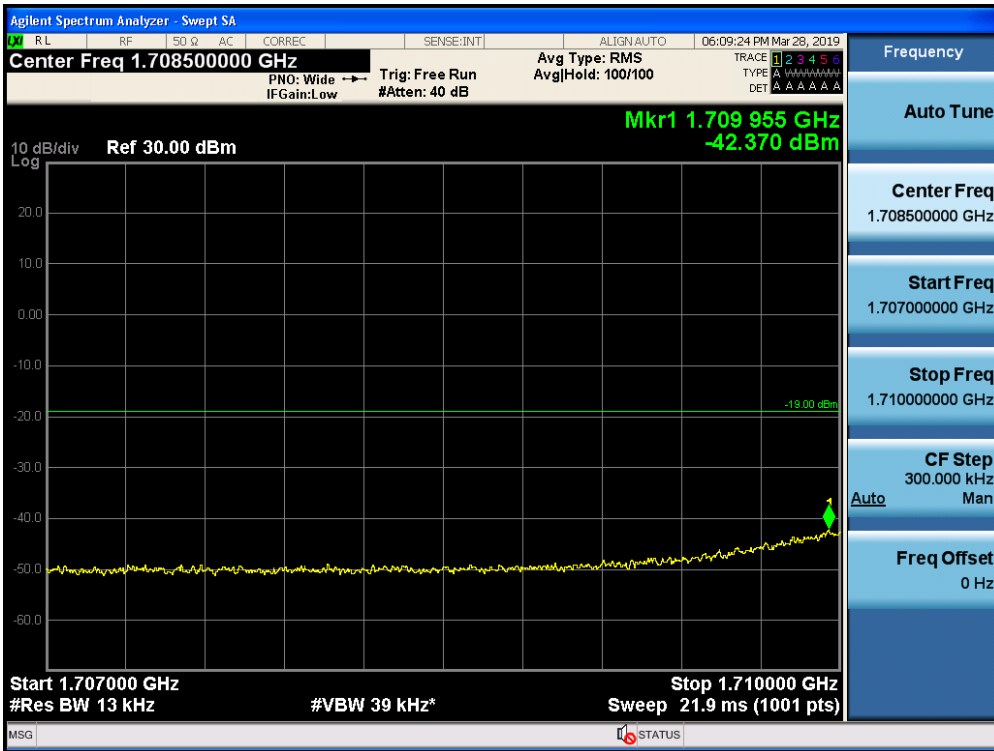
Out-of-Band Emissions / AWS-1 / Uplink / CDMA / Upper Edge / AGC threshold +10 dB



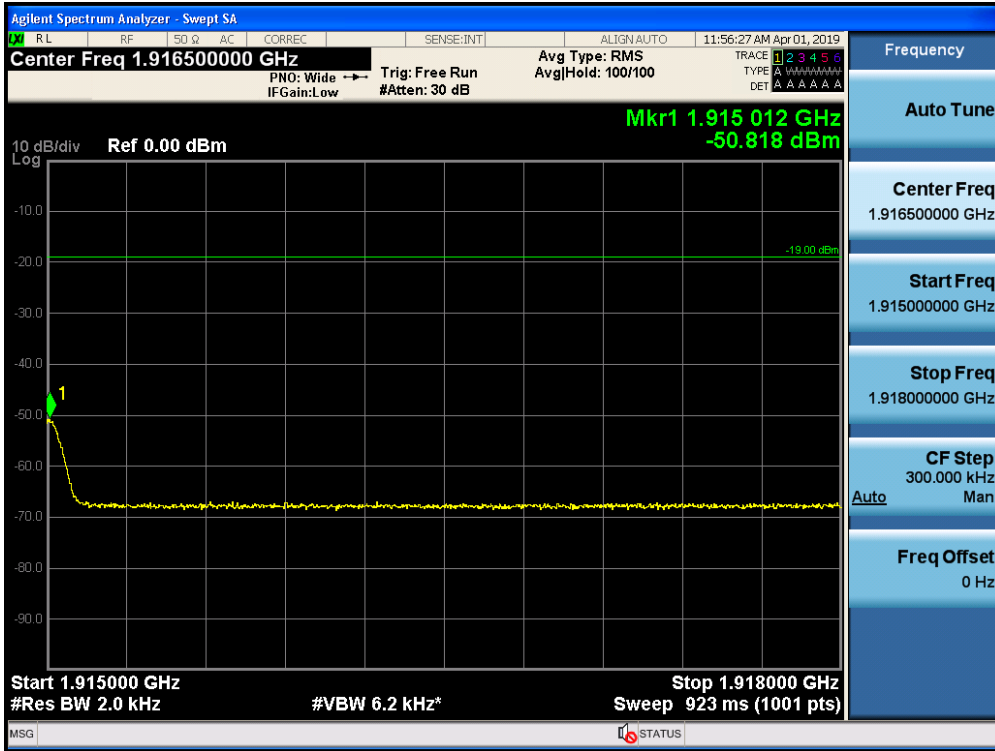
Out-of-Band Emissions / AWS-1 / Uplink / CDMA / Lower Edge / AGC threshold



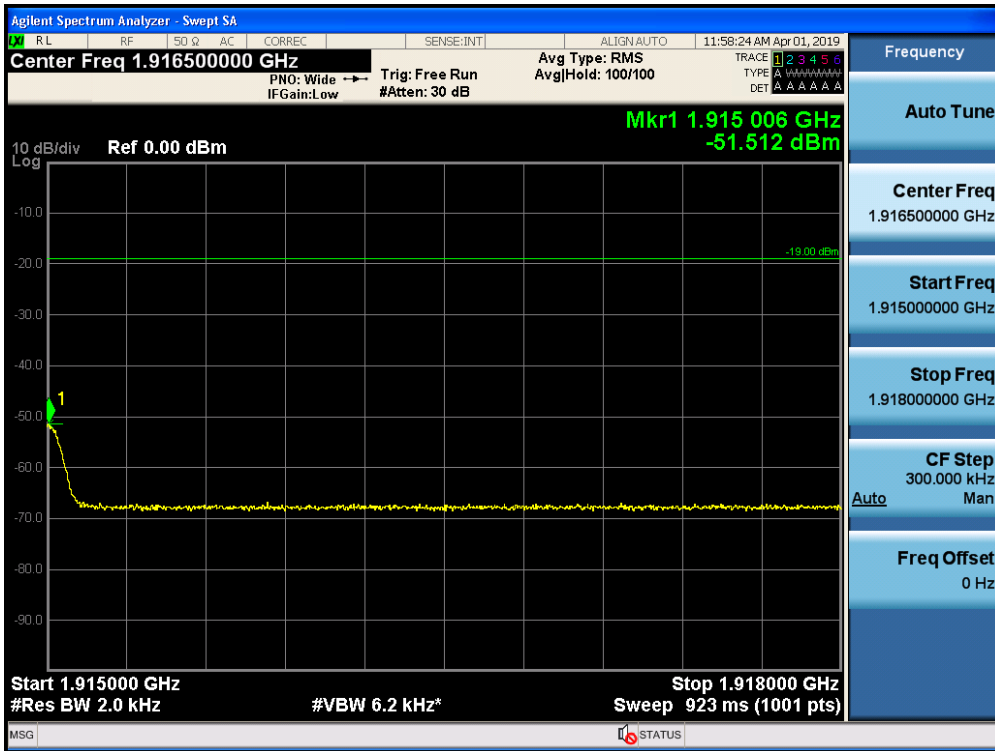
Out-of-Band Emissions / AWS-1 / Uplink / CDMA / Lower Edge / AGC threshold +10 dB



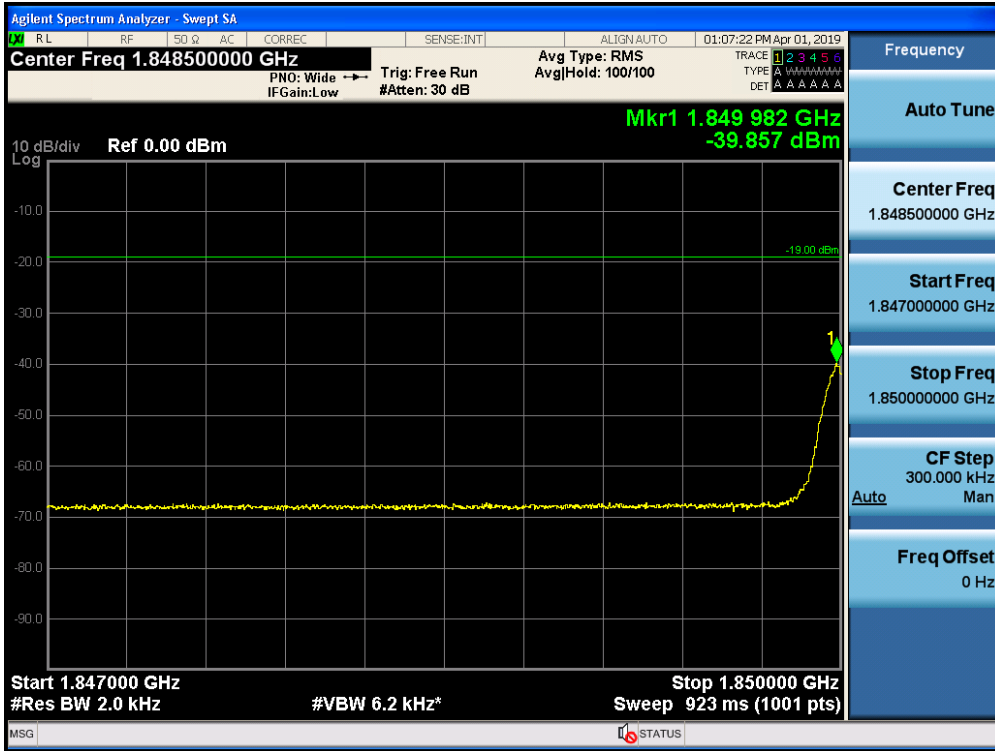
Out-of-Band Emissions / Broadband PCS / Uplink / GSM / Upper Edge / AGC threshold



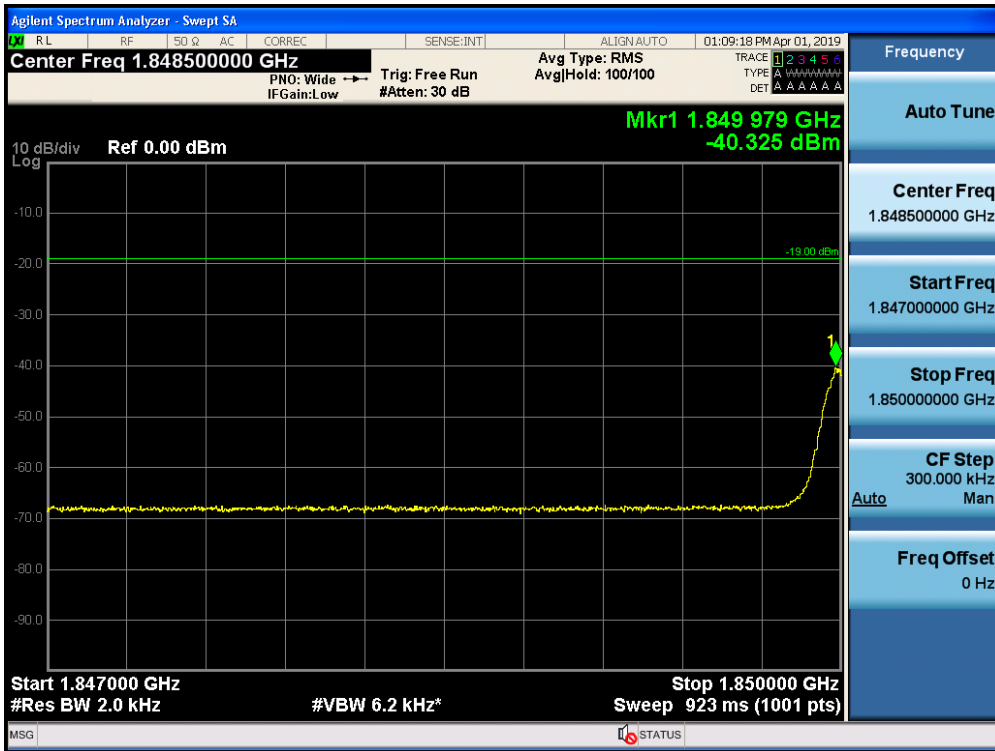
Out-of-Band Emissions / Broadband PCS / Uplink / GSM / Upper Edge / AGC threshold +10 dB



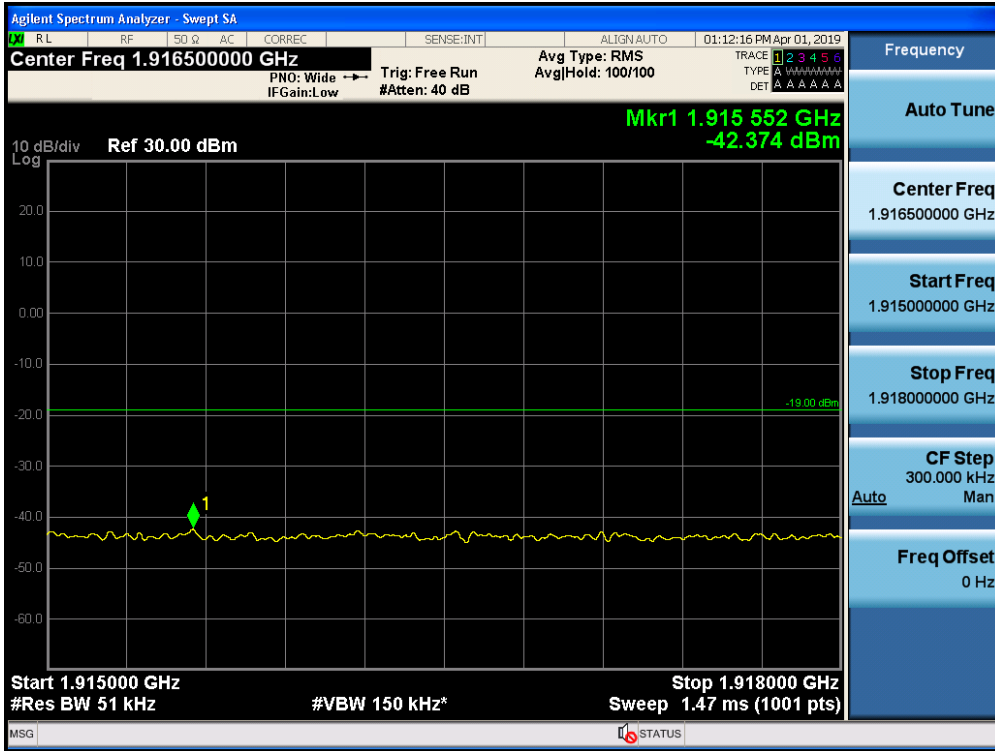
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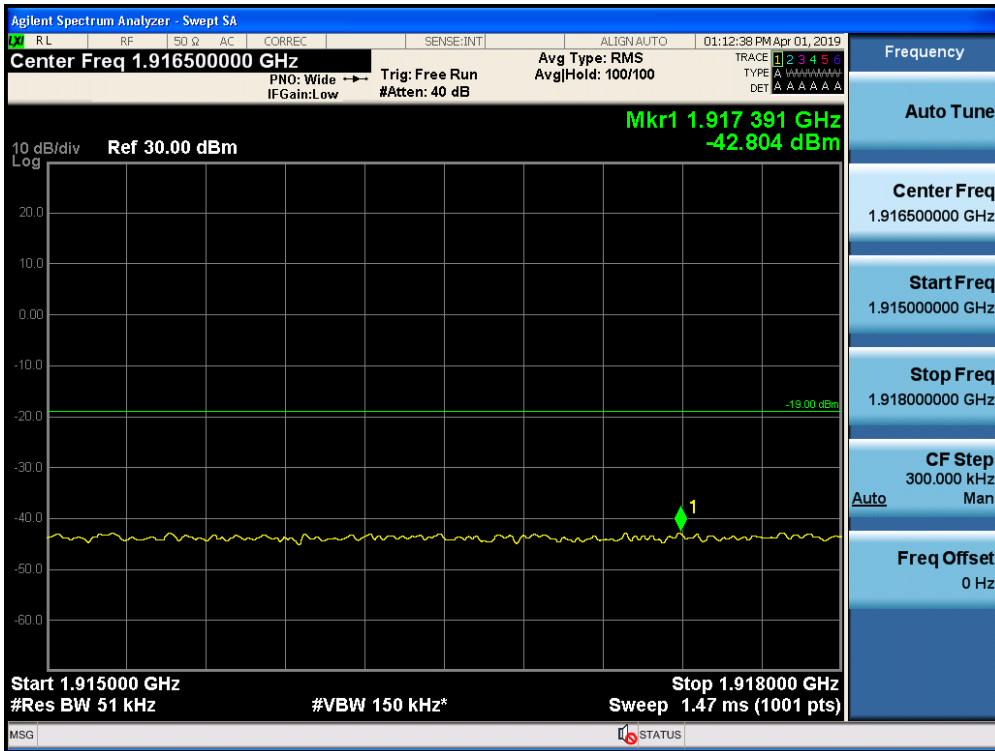
Out-of-Band Emissions / Broadband PCS / Uplink / GSM / Lower Edge / AGC threshold +10 dB



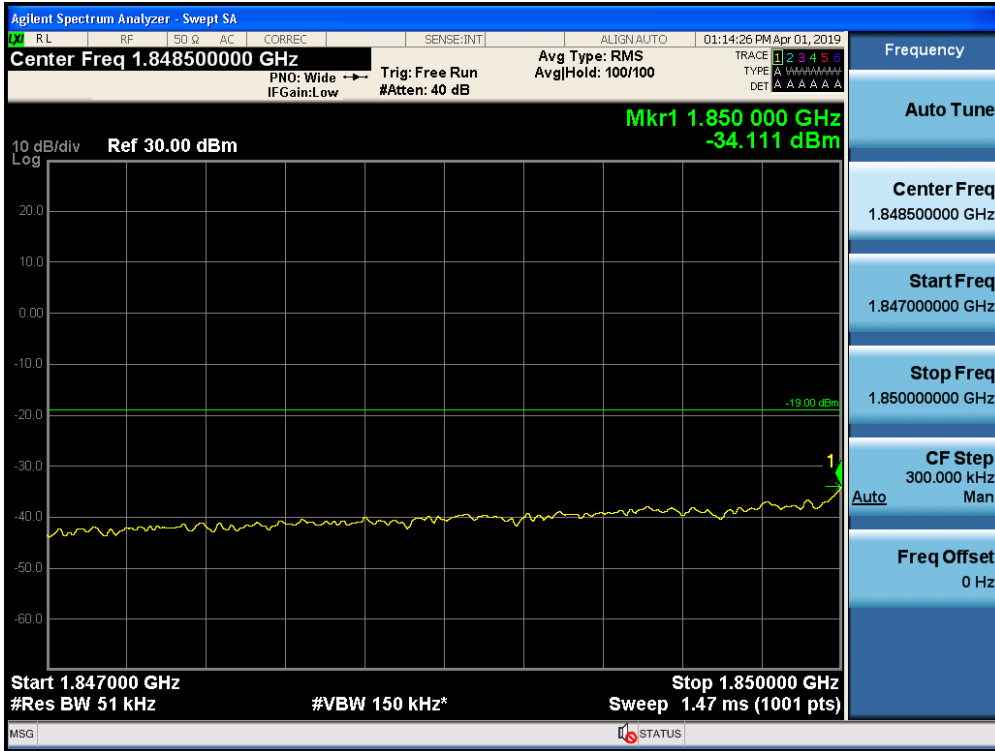
Out-of-Band Emissions / Broadband PCS / Uplink / LTE 5 MHz / Upper Edge / AGC threshold



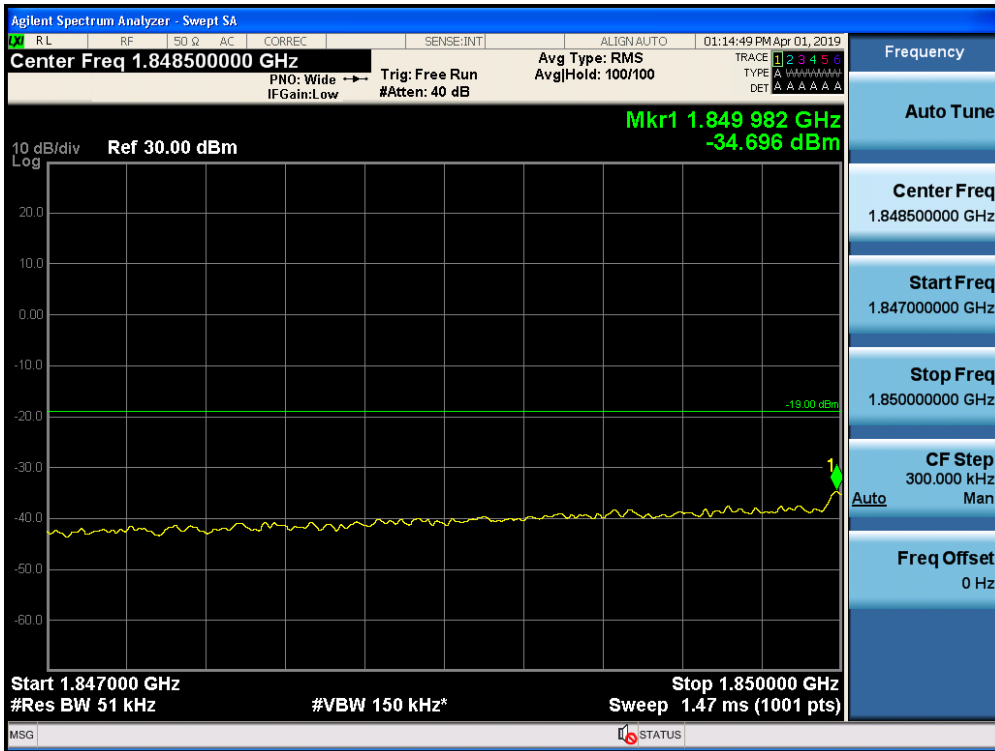
Out-of-Band Emissions / Broadband PCS / Uplink / LTE 5 MHz / Upper Edge / AGC threshold +10 dB



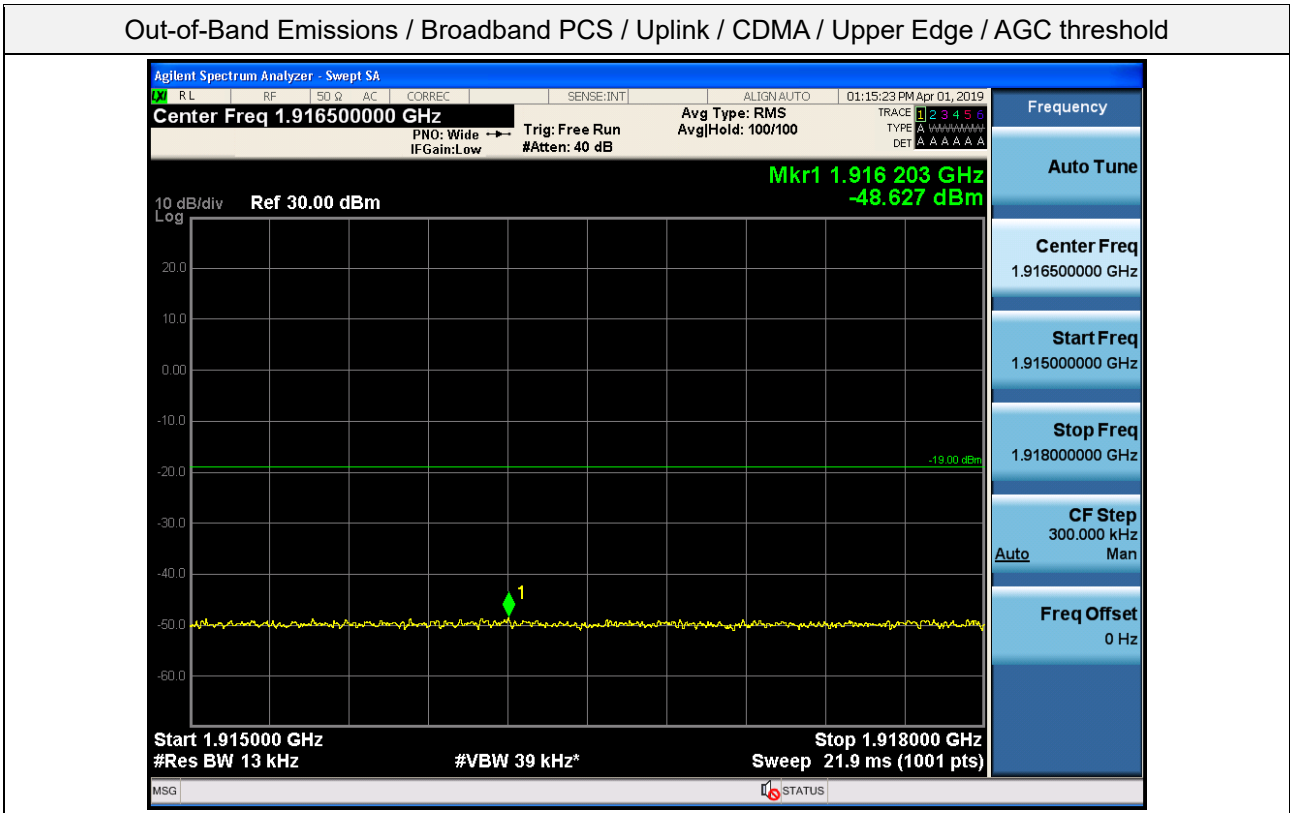
Out-of-Band Emissions / Broadband PCS / Uplink / LTE 5 MHz / Lower Edge / AGC threshold



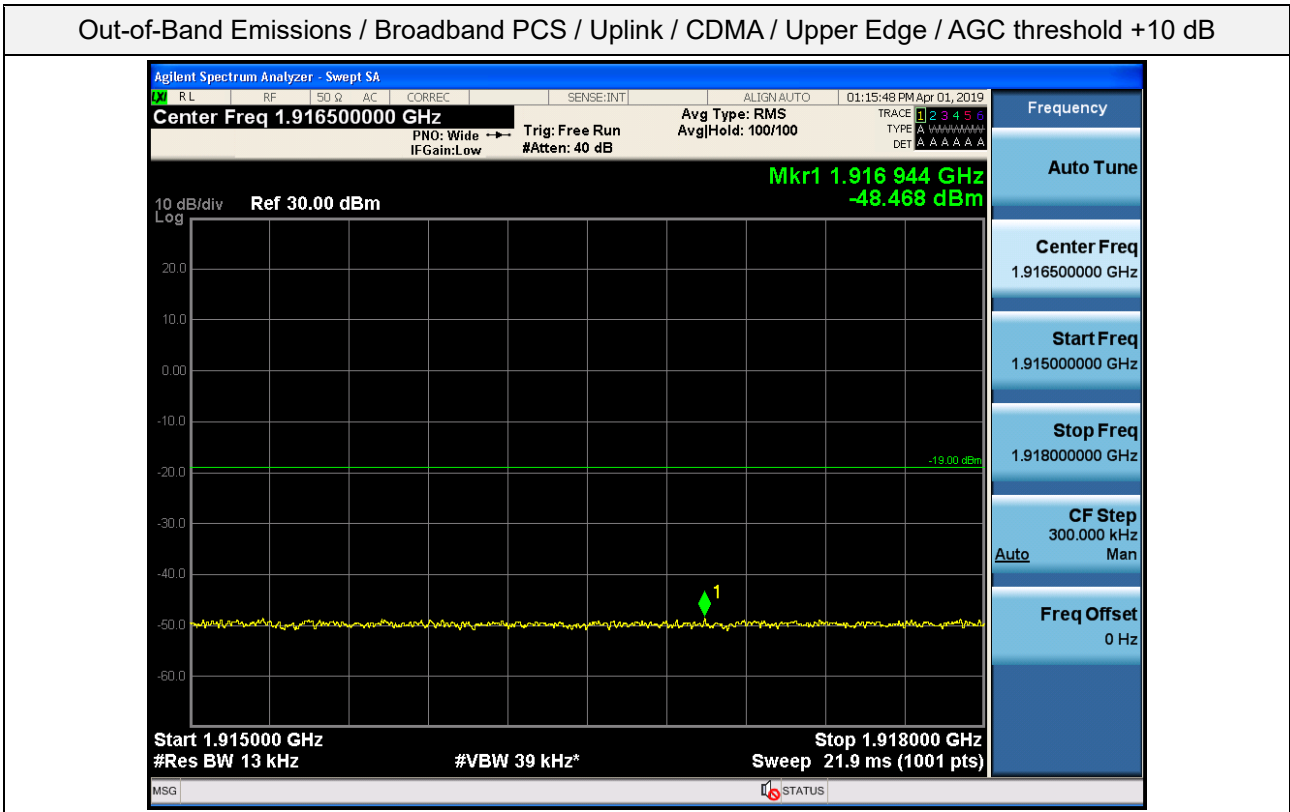
Out-of-Band Emissions / Broadband PCS / Uplink / LTE 5 MHz / Lower Edge / AGC threshold +10 dB



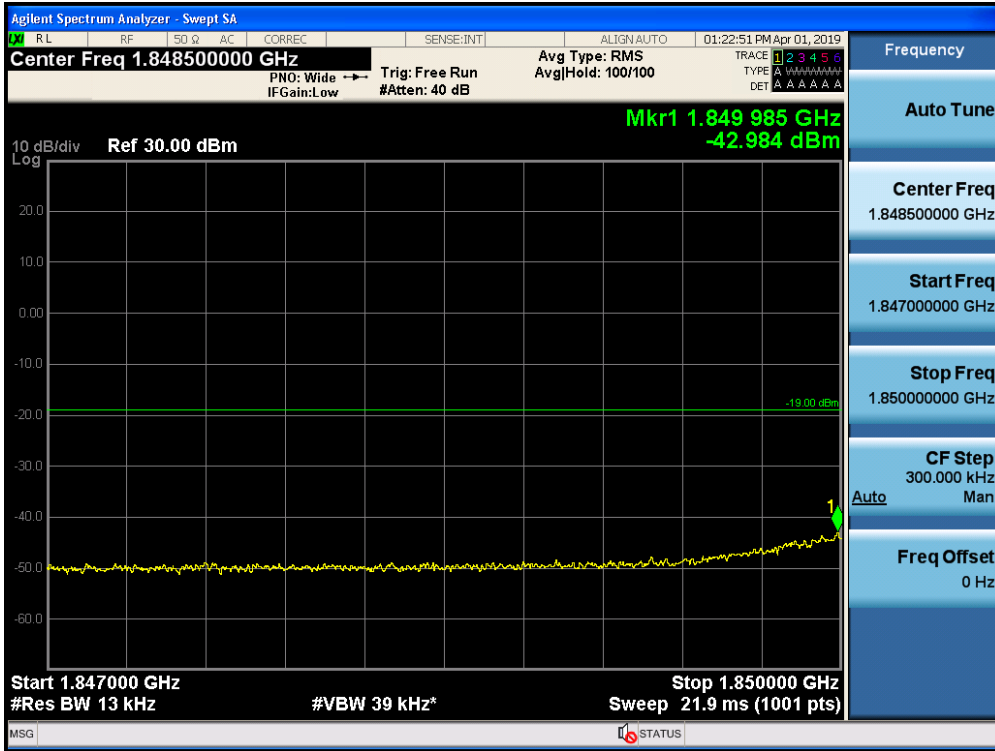
Out-of-Band Emissions / Broadband PCS / Uplink / CDMA / Upper Edge / AGC threshold



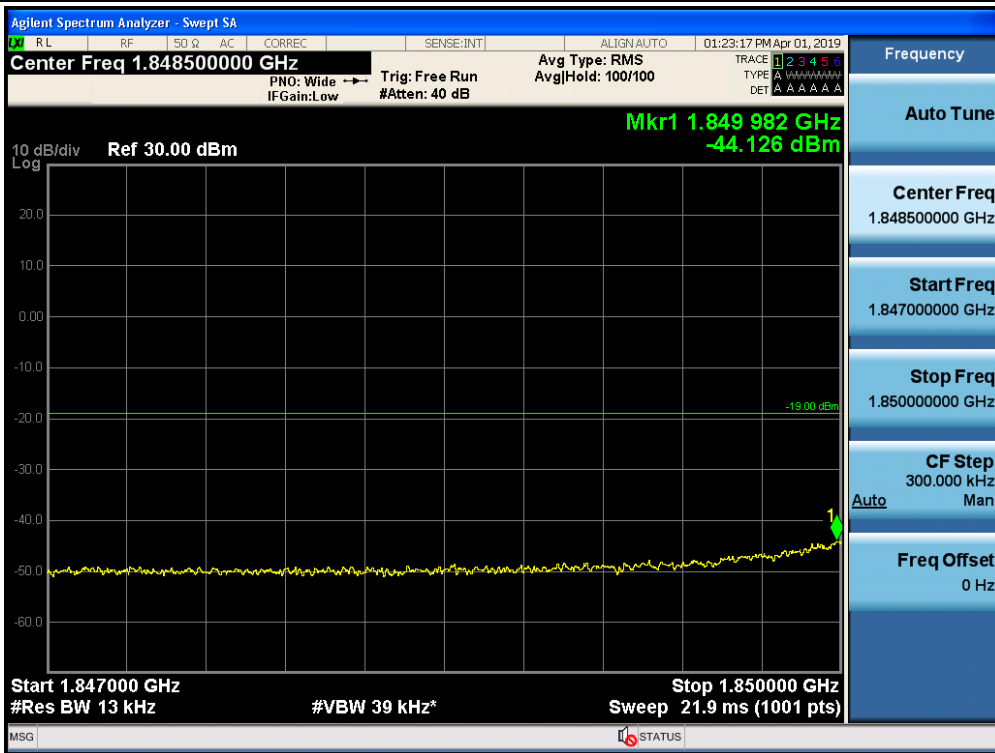
Out-of-Band Emissions / Broadband PCS / Uplink / CDMA / Upper Edge / AGC threshold +10 dB



Out-of-Band Emissions / Broadband PCS / Uplink / CDMA / Lower Edge / AGC threshold



Out-of-Band Emissions / Broadband PCS / Uplink / CDMA / Lower Edge / AGC threshold +10 dB



Out-of-Band Emissions / Lower 700 MHz / Downlink / GSM / Upper Edge / AGC threshold



Out-of-Band Emissions / Lower 700 MHz / Downlink / GSM / Upper Edge / AGC threshold +10 dB



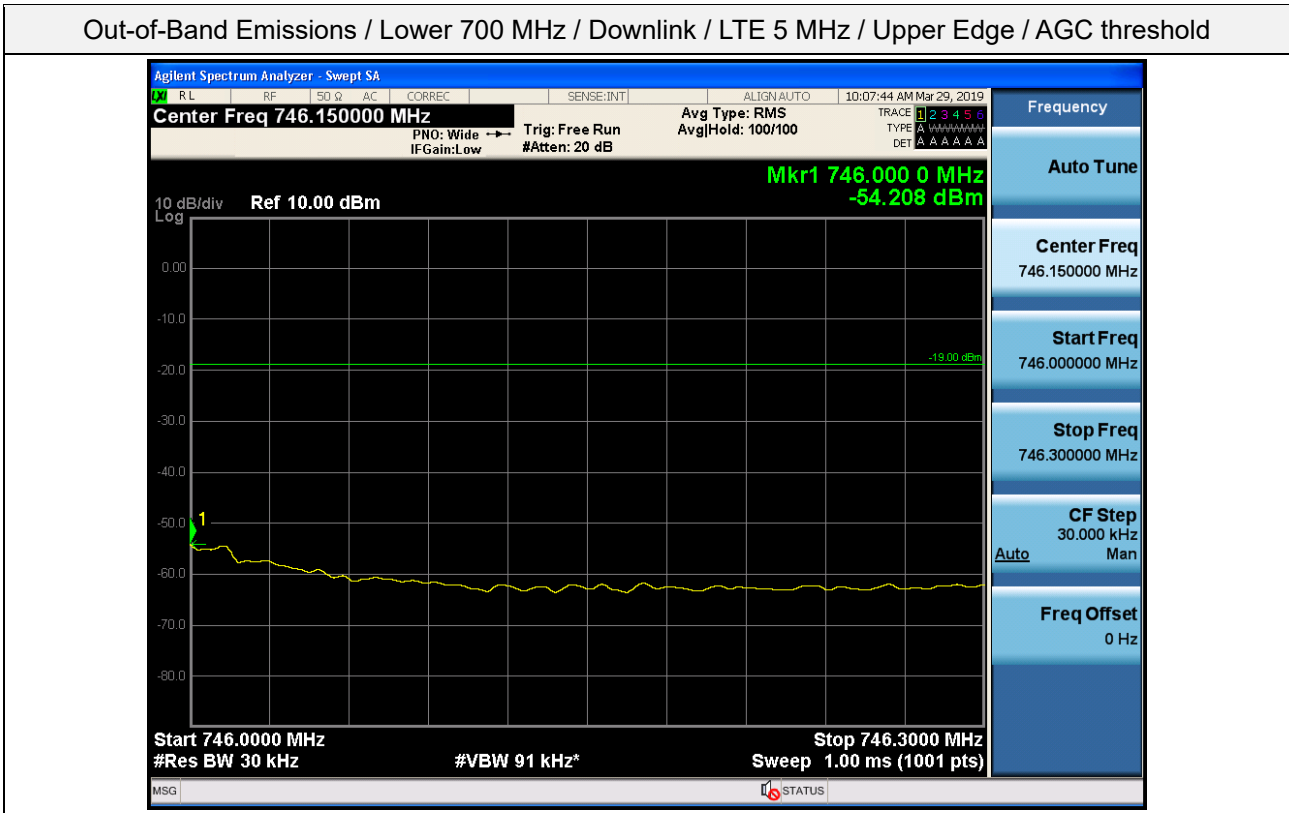
Out-of-Band Emissions / Lower 700 MHz / Downlink / GSM / Lower Edge / AGC threshold



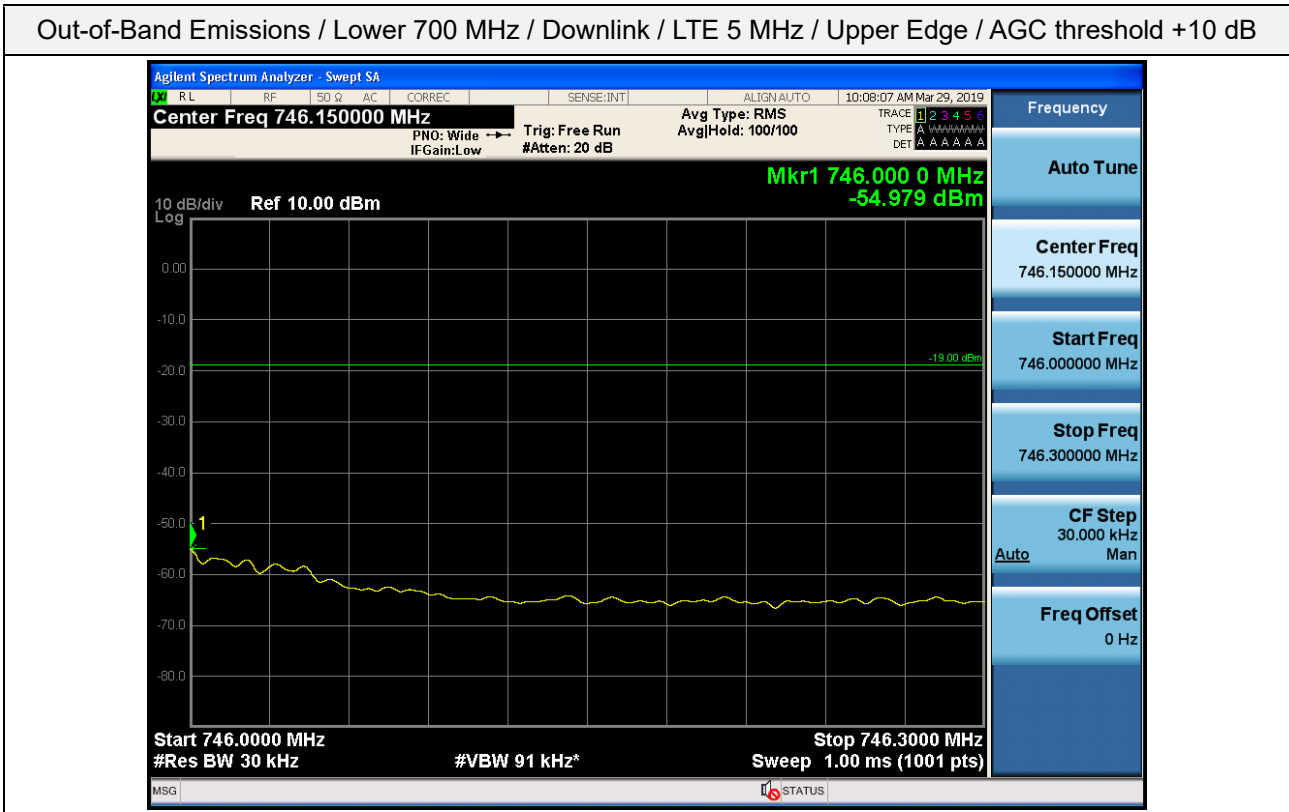
Out-of-Band Emissions / Lower 700 MHz / Downlink / GSM / Lower Edge / AGC threshold +10 dB



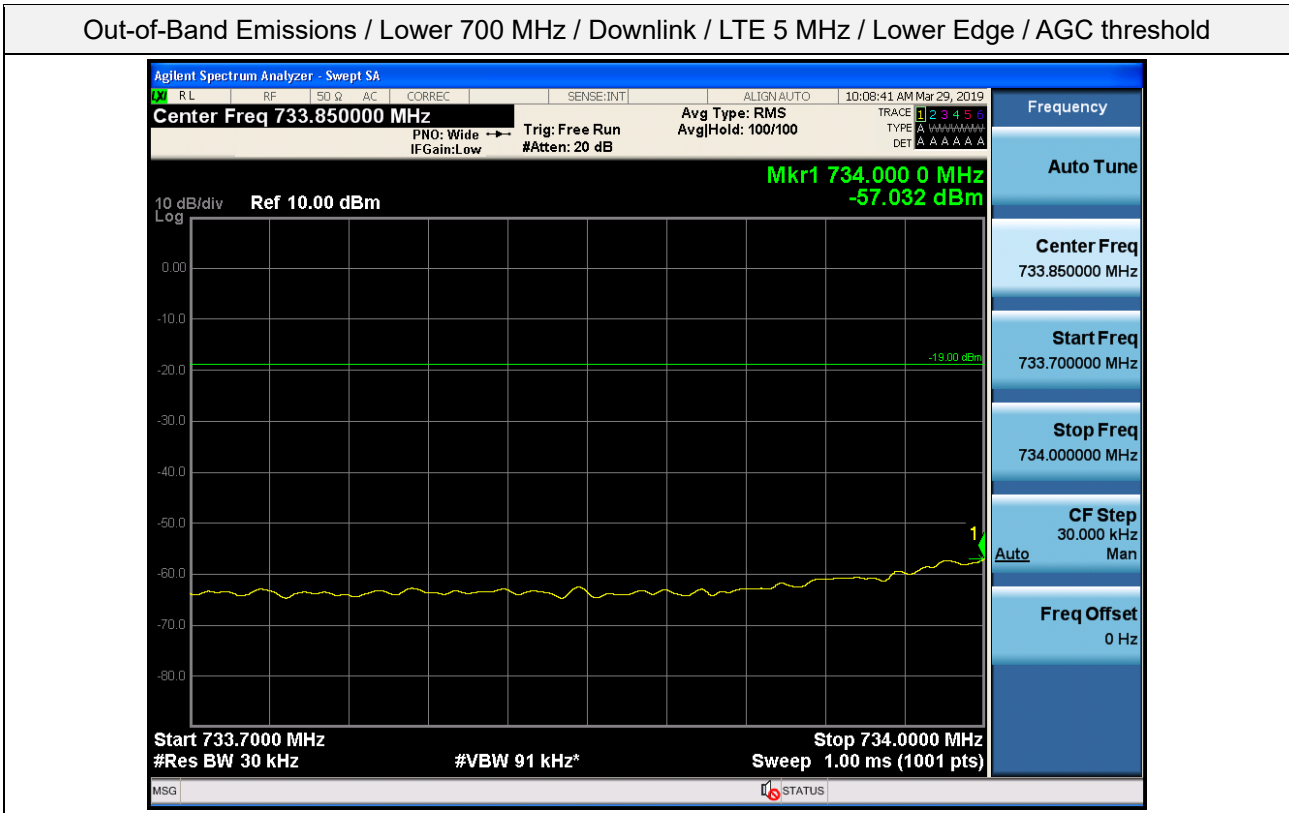
Out-of-Band Emissions / Lower 700 MHz / Downlink / LTE 5 MHz / Upper Edge / AGC threshold



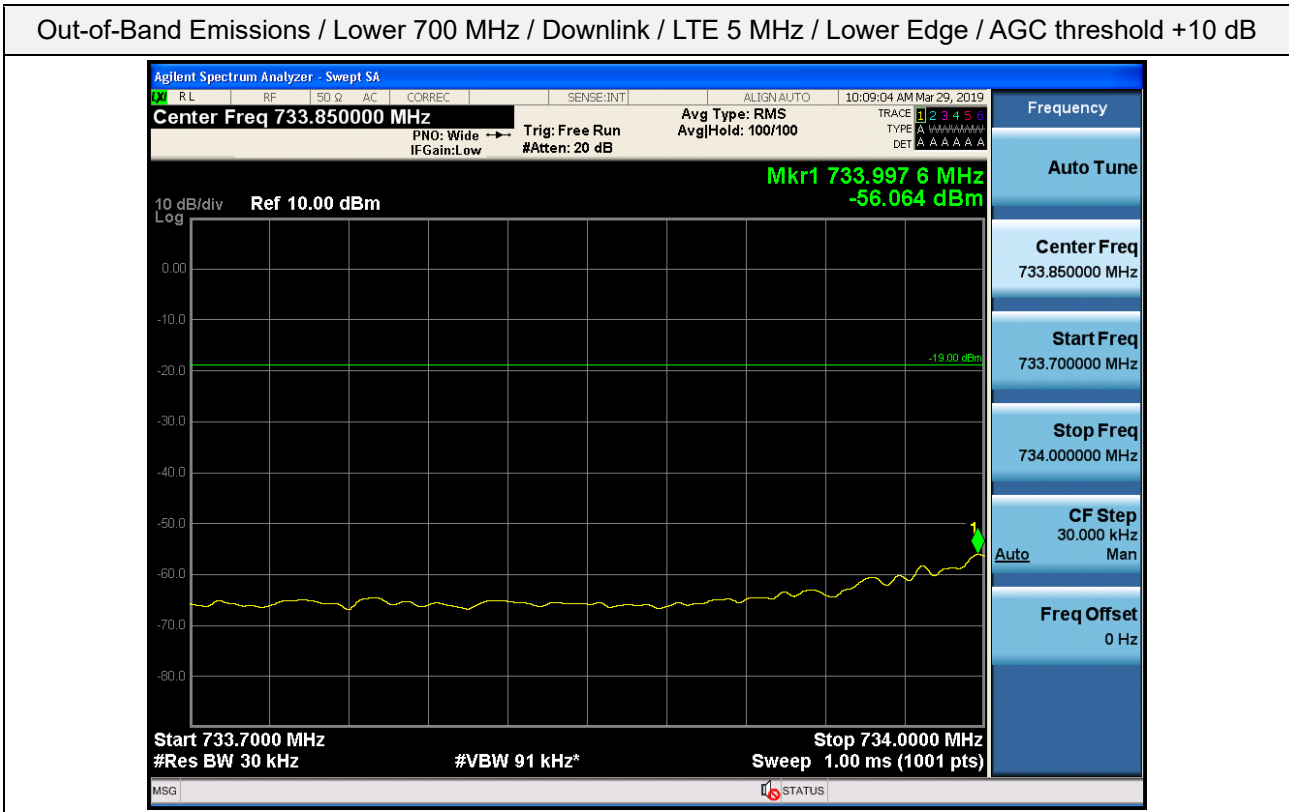
Out-of-Band Emissions / Lower 700 MHz / Downlink / LTE 5 MHz / Upper Edge / AGC threshold +10 dB



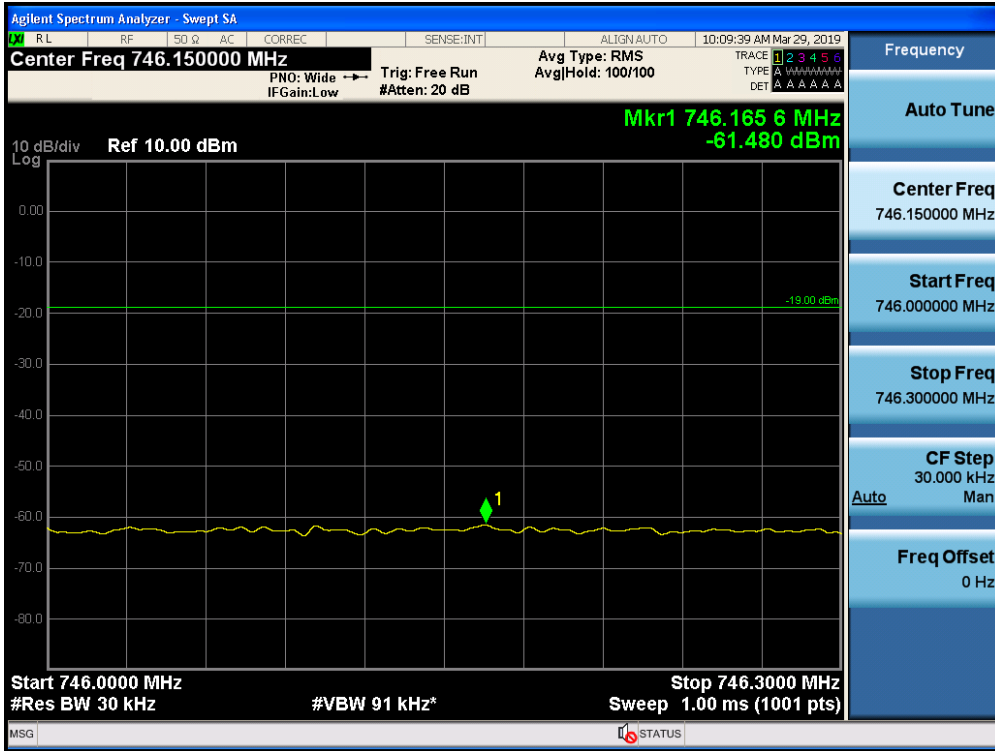
Out-of-Band Emissions / Lower 700 MHz / Downlink / LTE 5 MHz / Lower Edge / AGC threshold



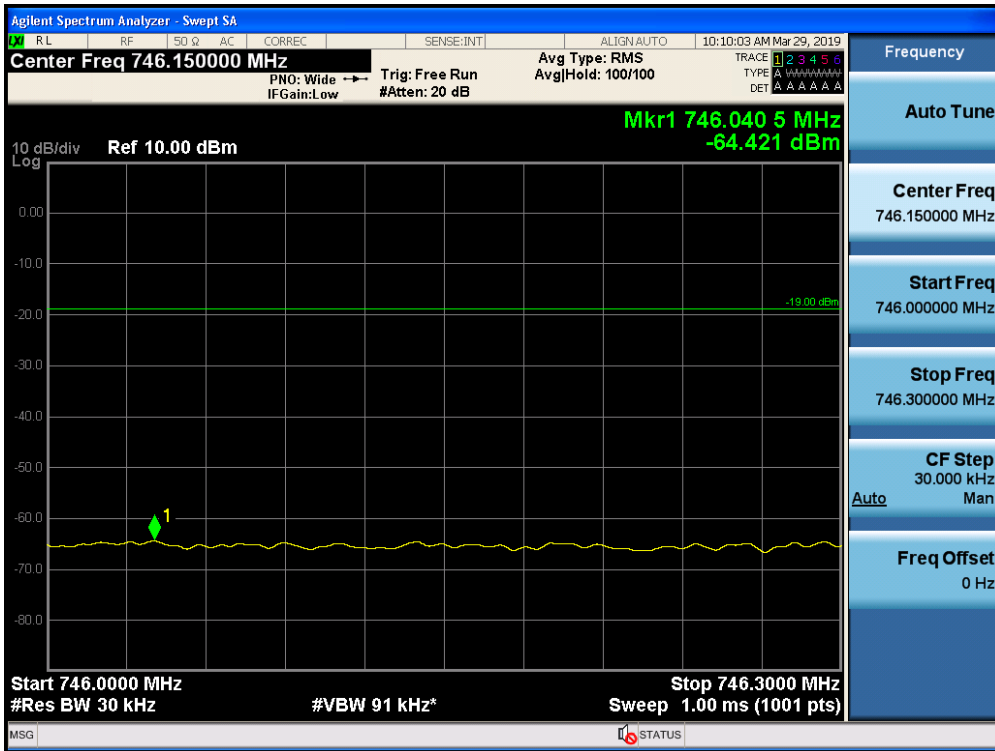
Out-of-Band Emissions / Lower 700 MHz / Downlink / LTE 5 MHz / Lower Edge / AGC threshold +10 dB



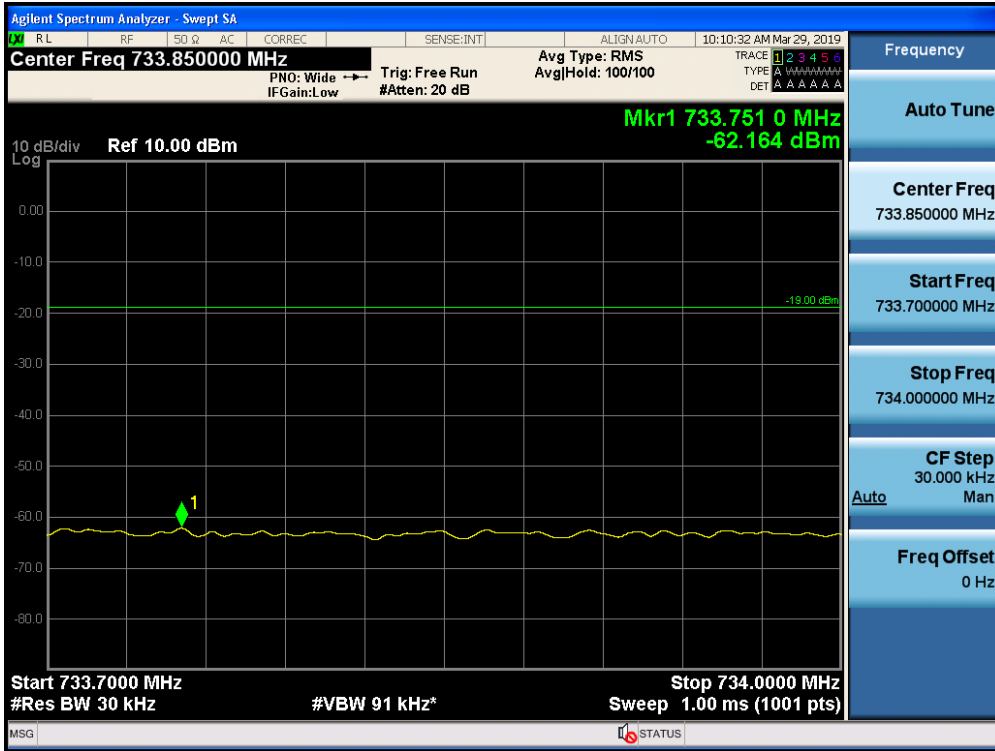
Out-of-Band Emissions / Lower 700 MHz / Downlink / CDMA / Upper Edge / AGC threshold



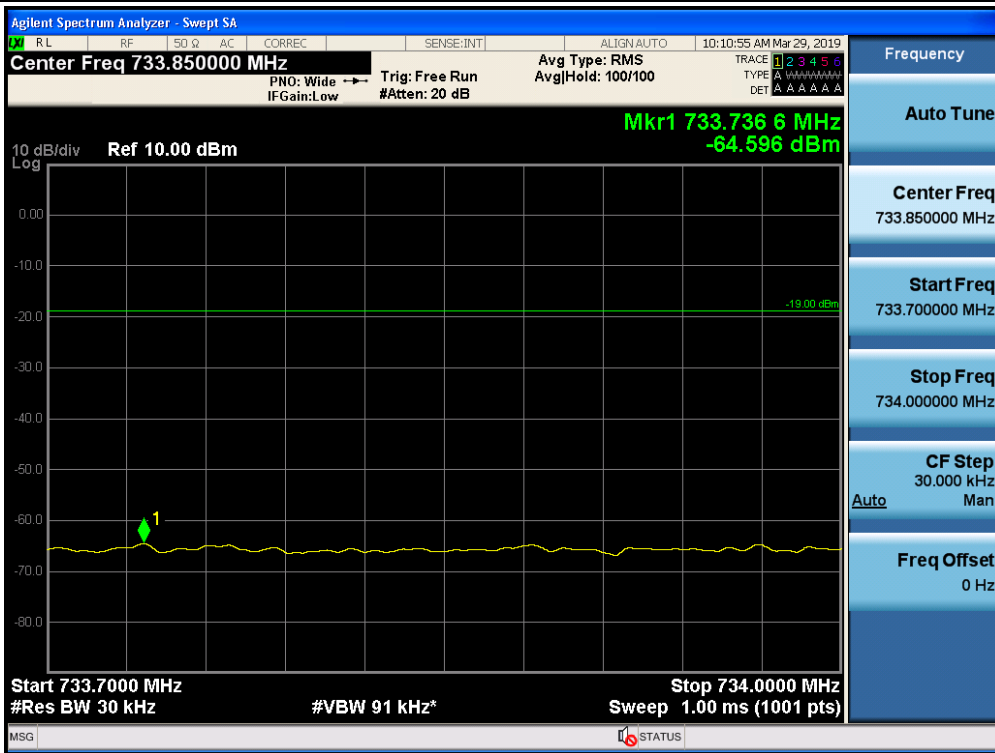
Out-of-Band Emissions / Lower 700 MHz / Downlink / CDMA / Upper Edge / AGC threshold +10 dB



Out-of-Band Emissions / Lower 700 MHz / Downlink / CDMA / Lower Edge / AGC threshold



Out-of-Band Emissions / Lower 700 MHz / Downlink / CDMA / Lower Edge / AGC threshold +10 dB



Out-of-Band Emissions / Upper 700 MHz / Downlink / GSM / Upper Edge / AGC threshold



Out-of-Band Emissions / Upper 700 MHz / Downlink / GSM / Upper Edge / AGC threshold +10 dB



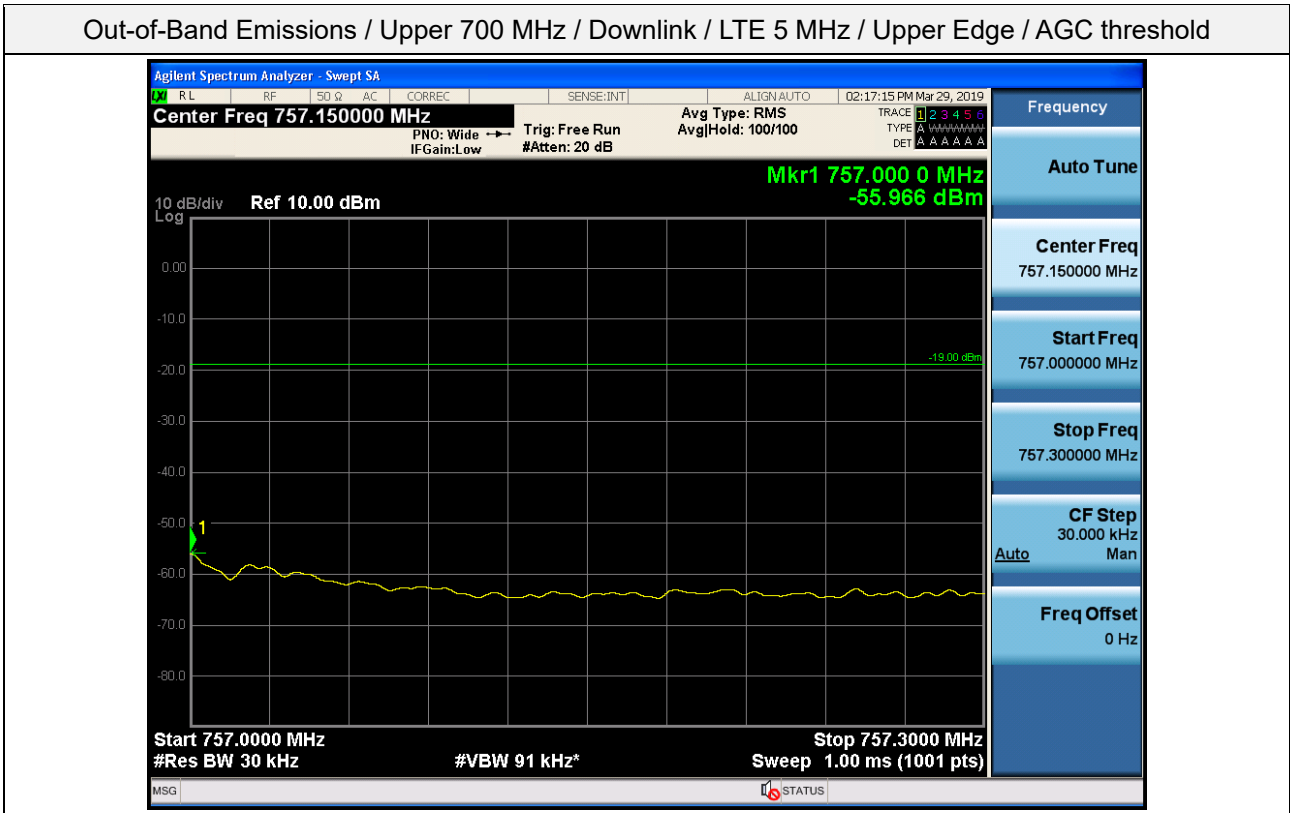
Out-of-Band Emissions / Upper 700 MHz / Downlink / GSM / Lower Edge / AGC threshold



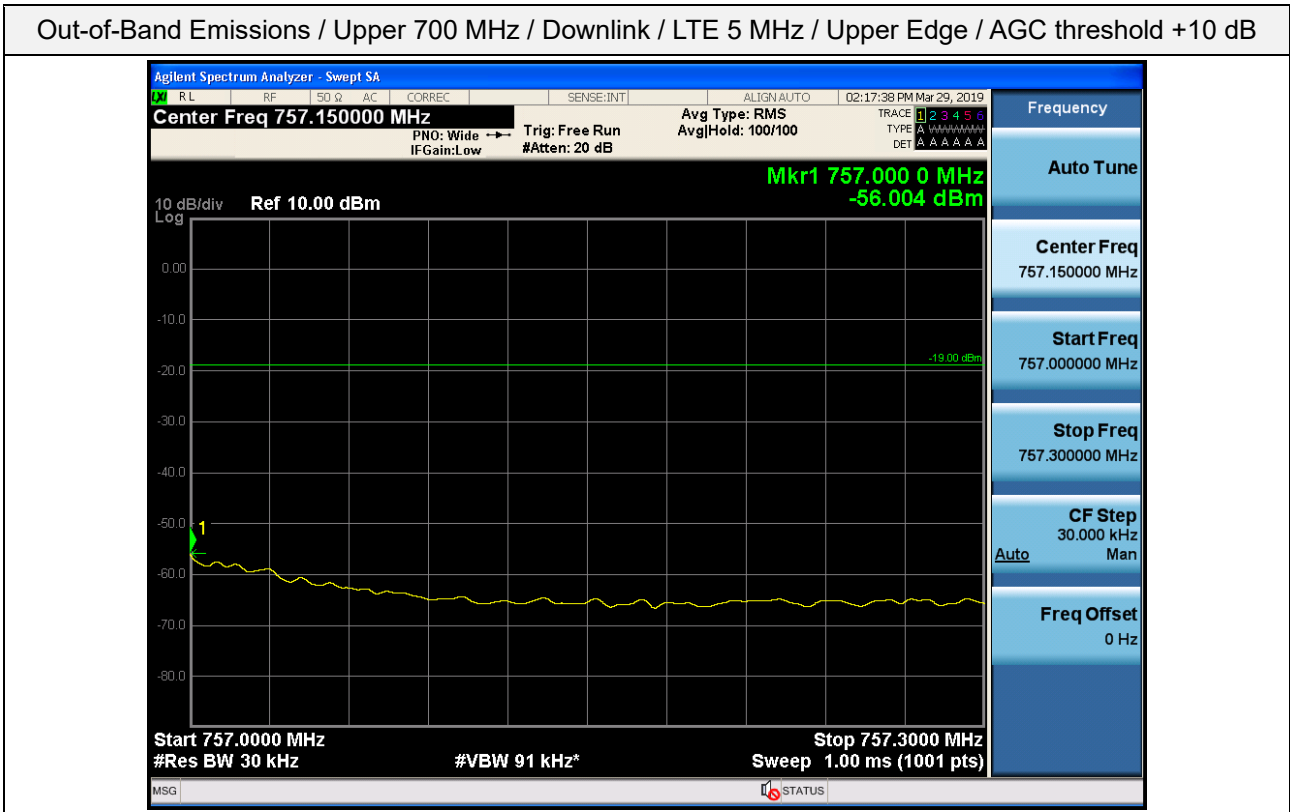
Out-of-Band Emissions / Upper 700 MHz / Downlink / GSM / Lower Edge / AGC threshold +10 dB



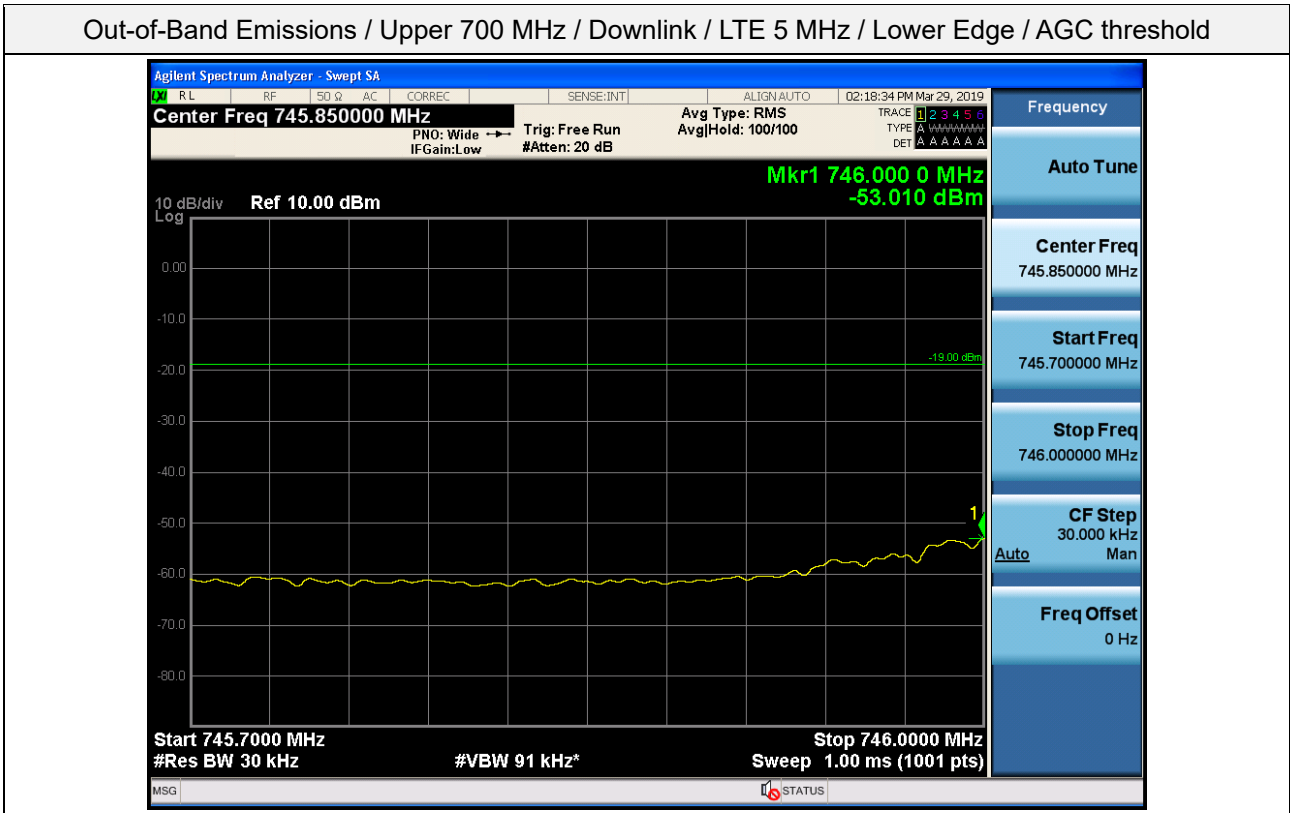
Out-of-Band Emissions / Upper 700 MHz / Downlink / LTE 5 MHz / Upper Edge / AGC threshold



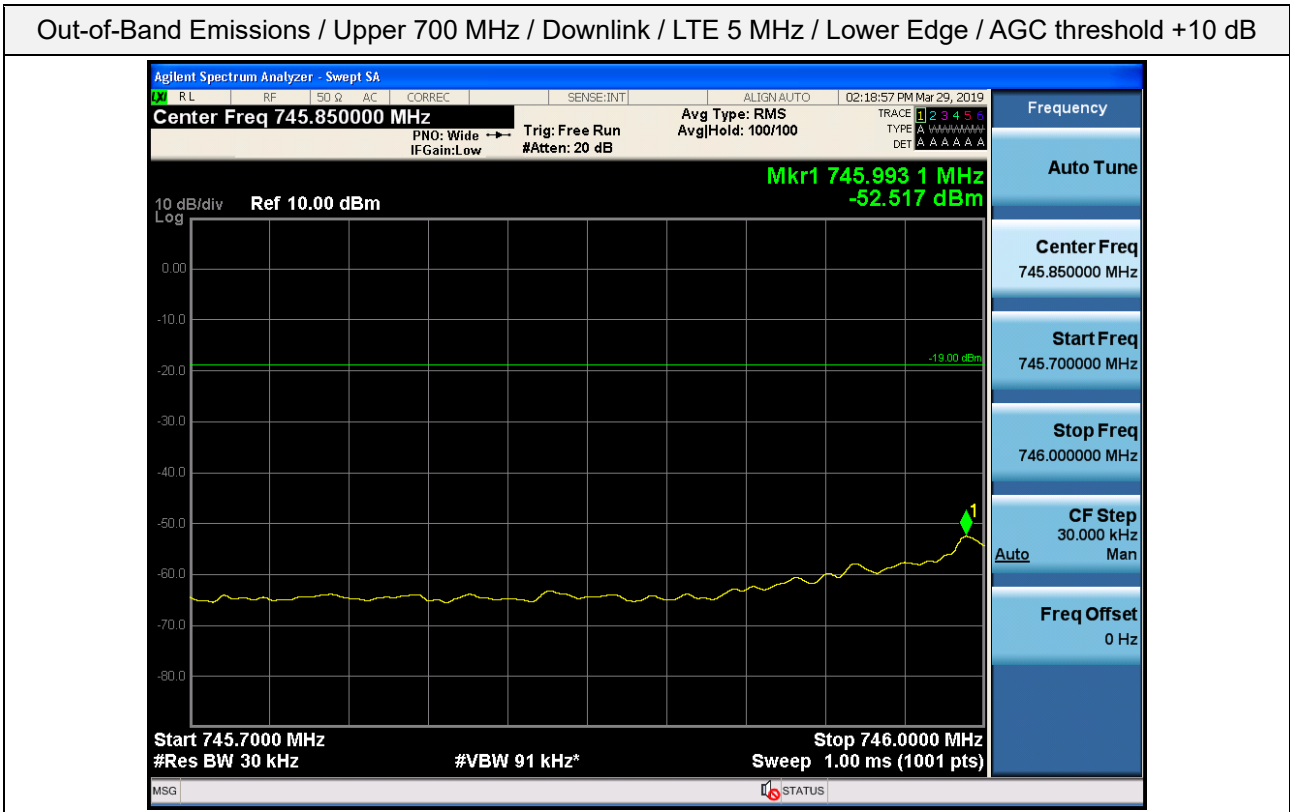
Out-of-Band Emissions / Upper 700 MHz / Downlink / LTE 5 MHz / Upper Edge / AGC threshold +10 dB



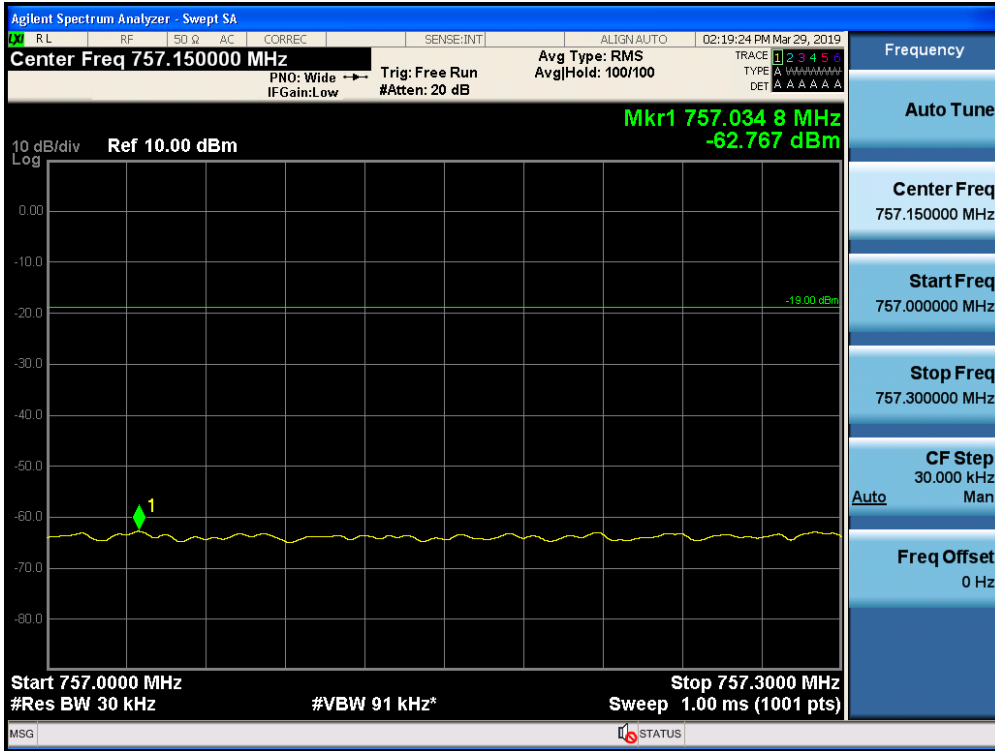
Out-of-Band Emissions / Upper 700 MHz / Downlink / LTE 5 MHz / Lower Edge / AGC threshold



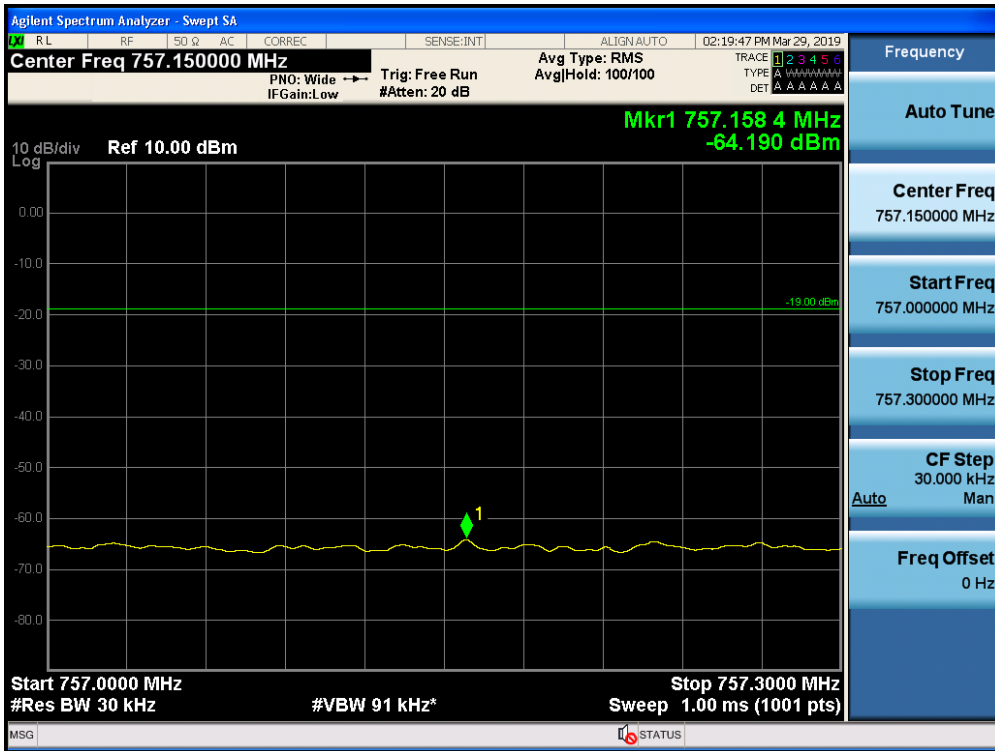
Out-of-Band Emissions / Upper 700 MHz / Downlink / LTE 5 MHz / Lower Edge / AGC threshold +10 dB



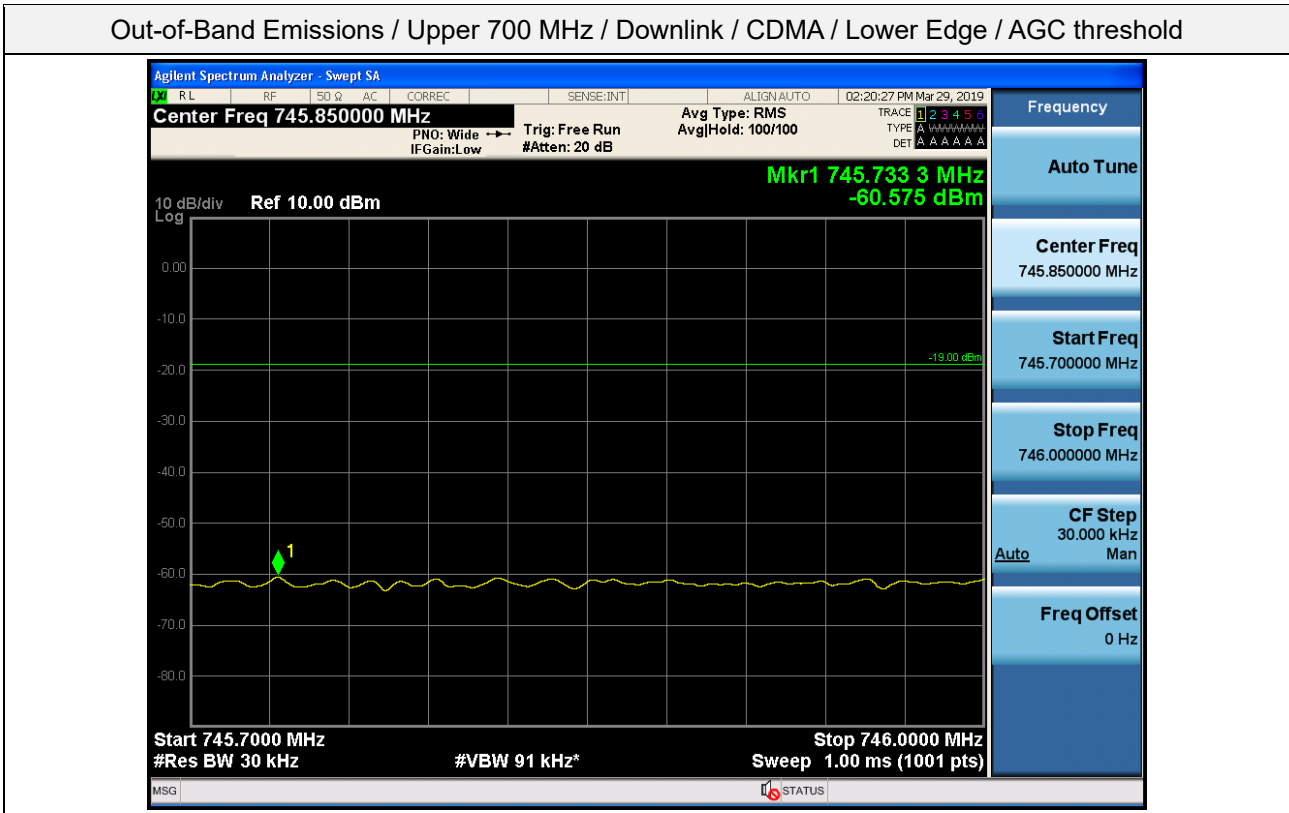
Out-of-Band Emissions / Upper 700 MHz / Downlink / CDMA / Upper Edge / AGC threshold



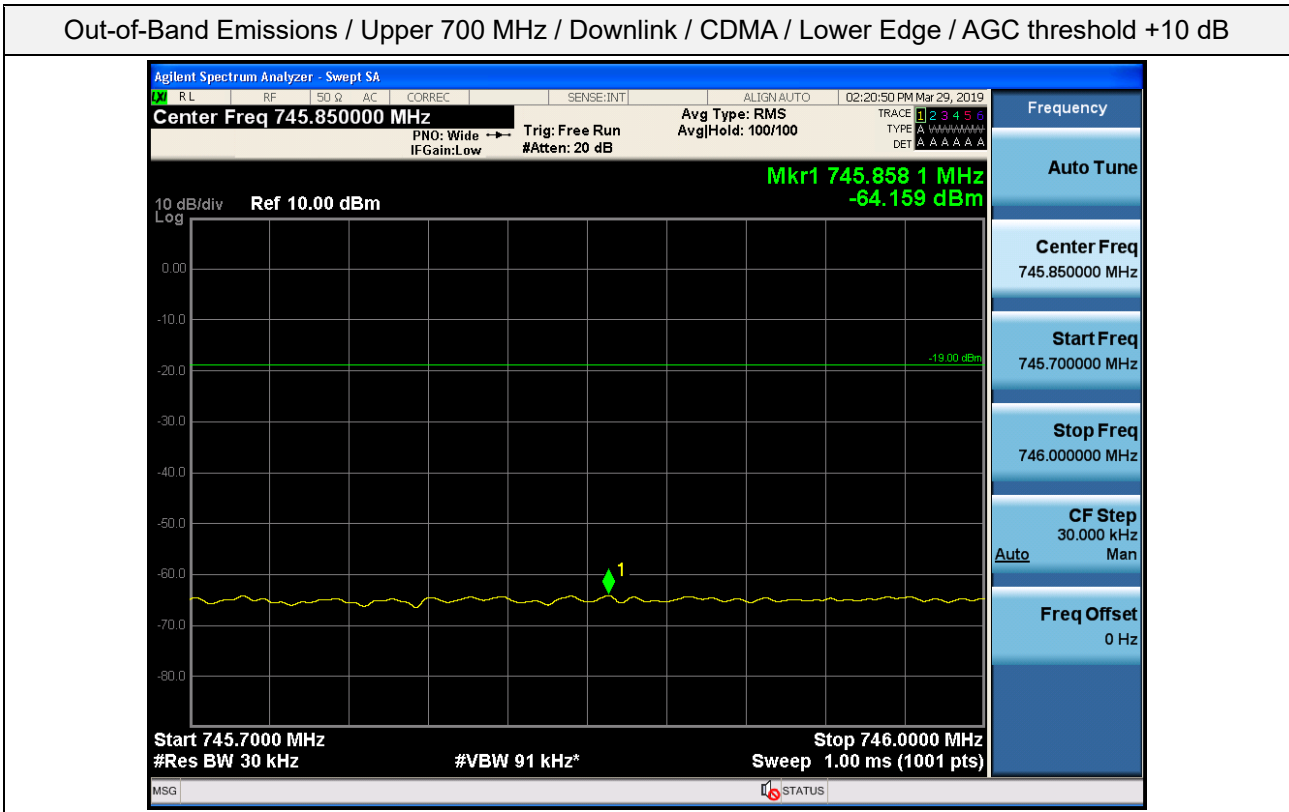
Out-of-Band Emissions / Upper 700 MHz / Downlink / CDMA / Upper Edge / AGC threshold +10 dB



Out-of-Band Emissions / Upper 700 MHz / Downlink / CDMA / Lower Edge / AGC threshold



Out-of-Band Emissions / Upper 700 MHz / Downlink / CDMA / Lower Edge / AGC threshold +10 dB



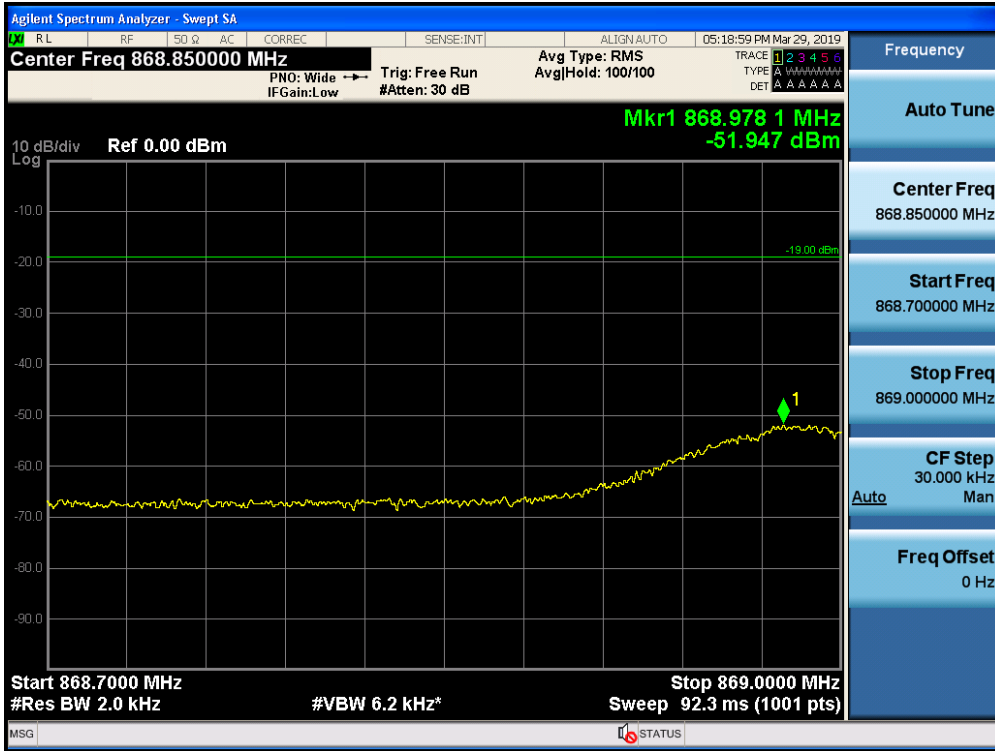
Out-of-Band Emissions / Cellular / Downlink / GSM / Upper Edge / AGC threshold



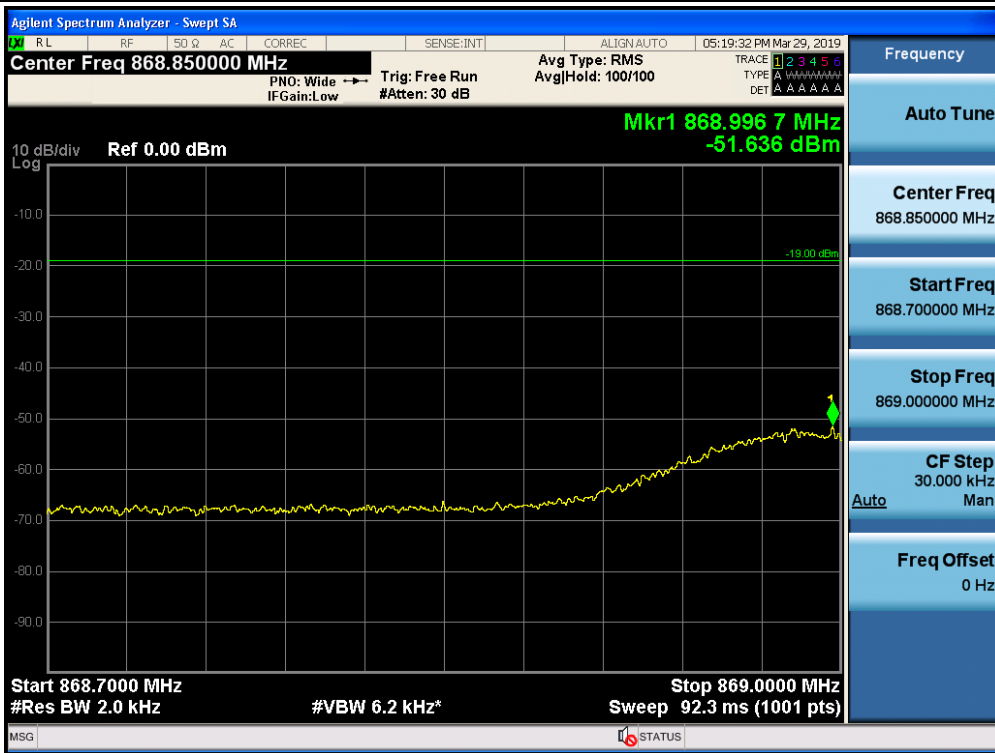
Out-of-Band Emissions / Cellular / Downlink / GSM / Upper Edge / AGC threshold +10 dB



Out-of-Band Emissions / Cellular / Downlink / GSM / Lower Edge / AGC threshold



Out-of-Band Emissions / Cellular / Downlink / GSM / Lower Edge / AGC threshold +10 dB



Out-of-Band Emissions / Cellular / Downlink / LTE 5 MHz / Upper Edge / AGC threshold



Out-of-Band Emissions / Cellular / Downlink / LTE 5 MHz / Upper Edge / AGC threshold +10 dB

