TEST REPORT

FCC Test for SDRC-17
Certification

APPLICANT
ADRF KOREA, Inc.

REPORT NO.
HCT-RF-2407-FC034-R1

DATE OF ISSUE
August 1, 2024

Tested by
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Technical Manager
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HCT-RF-2407-FC034-R1

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Applicant	**ADRF KOREA, Inc.** 5-5, Mojeon-Ri, Backsa-Myun, Icheon-Citi, Kyunggi-Do, Korea
Product Name Model Name	REPEATER SDRC-17
FCC ID	N52-SDRC-17
Output Power	Downlink :17 dBm Uplink : 22 dBm
Date of Test	May 21, 2024 ~ July 17, 2024
Location of Test	■ Permanent Testing Lab ☐ On Site Testing (Address: 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Republic of Korea)
Test Standard Used	CFR 47 Part 20, Part 22, Part 24, Part 27
Test Results	PASS

REVISION HISTORY

The revision history for this test report is shown in table.

Revision No.	Date of Issue	Description
0	July 23, 2024	Initial Release
1	August 1, 2024	- Added a 50Ω Termination in section 4. - Added watt values for Pout in the test results table in section 5.2.

Notice

Content
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 the FCC Rules under normal use and maintenance. The results shown in this test report only apply to the sample(s), as received, provided by the applicant, unless otherwise stated. The test results have only been applied with the test methods required by the standard(s). The laboratory is not accredited for the test results marked *. Information provided by the applicant is marked **. Test results provided by external providers are marked ***. When confirmation of authenticity of this test report is required, please contact www.hct.co.kr The test results in this test report are not associated with the ((KS Q) ISO/IEC 17025) accreditation by KOLAS (Korea Laboratory Accreditation Scheme) / A2LA (American Association for Laboratory Accreditation) that are under the ILAC (International Laboratory Accreditation Cooperation) Mutual Recognition Agreement (MRA).

CONTENTS

1. GENERAL INFORMATION

1.1. APPLICANT INFORMATION

Company Name	ADRF KOREA, Inc.
Company Address	5-5, Mojeon-Ri, Backsa-Myun, Icheon-Citi, Kyunggi-Do, Korea

1.2. PRODUCT INFORMATION

EUT Type	REPEATER
EUT Serial Number	SDRC17XXXXXXX
Power Supply	100/220V, 47~63Hz, +12V DC
Frequency Range	Band Name / Uplink (MHz) / Downlink (MHz) Lower 700 MHz / 698 ~ 716 / 728 ~ 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
Tx Output Power	Uplink : 22 dBm Downlink : 17 dBm
Antenna	Donor : Log Antenna Service (AD-OMNI-SISO-N): Indoor Serving Antenna

1.3. TEST INFORMATION

FCC Rule Parts	CFR 47 Part 20, Part 22, Part 24, Part 27
Measurement Standards	KDB 935210 D05 v01r04, KDB 971168 D01 v03r01, ANSI C63.26-2015
Test Location	74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, 17383 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 Publication22. Detailed description of test facility was submitted to the Commission and accepted dated March 11, 2024 (CAB identifier: 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 CFR 47 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

The test was generally based on the method of KDB 935210 D03 v04r04 and only followed ANSI C63.26-2015 if there was no test method in KDB standard.

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

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	0.979	1 800	1.789
700	1.057	1 900	1.847
800	1.152	2 000	1.978
900	1.232	2 100	1.971
1 600	1.676	2 200	1.978
1 700	1.798	2 300	2.050

: Coupled Path (Switch Coupled)

Correction factor table			
Frequency (MHz)	Factor (dB)	Frequency (MHz)	Factor (dB)
600	4.426	1 800	5.242
700	4.498	1 900	5.360
800	4.481	2 000	6.289
900	4.495	2 100	6.219
1 600	5.157	2 200	5.432
1 700	5.301	2 300	6.139

: Output Path (20 dB Attenuator)

Correction factor table			
Frequency (MHz)	Factor (dB)	Frequency (MHz)	Factor (dB)
2	19.414	4 000	23.158
10	19.515	4 500	23.580
50	19.521	5 000	24.827
100	19.760	5 500	24.472
200	19.760	6 000	24.670
300	20.077	6 500	25.007
400	20.327	7 000	25.366
500	20.643	7 500	25.703
600	21.187	8 000	25.981
700	21.313	8 500	26.247
800	21.272	9 000	26.265
900	21.369	9 500	26.709
1 000	21.454	10 000	26.745
1 100	21.650	11 000	27.155
1 200	21.679	12 000	27.763
1 300	21.750	13 000	28.698
1 400	21.852	14 000	28.467
1 500	21.899	15 000	28.685
1 600	22.027	16 000	29.211
1 700	22.112	17 000	29.763
1 800	22.180	18 000	30.437
1 900	22.235	19 000	30.799
2 000	22.331	20 000	31.582
2 100	22.509	21 000	31.504
2 200	22.446	22 000	32.209
2 300	22.527	23 000	33.478
2 400	22.779	24 000	35.842
2 500	22.755	25 000	36.848
3 000	23.030	26 000	36.127
3 500	23.398	26 500	35.286

3.3. MEASUREMENTUNCERTAINTY

Description	Condition	Uncertainty
Radiated Disturbance	9 kHz ~ 30 MHz	± 4.14 dB
	30 MHz ~ 1 GHz	± 5.82 dB
	1 GHz ~ 18 GHz	± 5.74 dB
	18 GHz ~ 40 GHz	± 5.76 dB

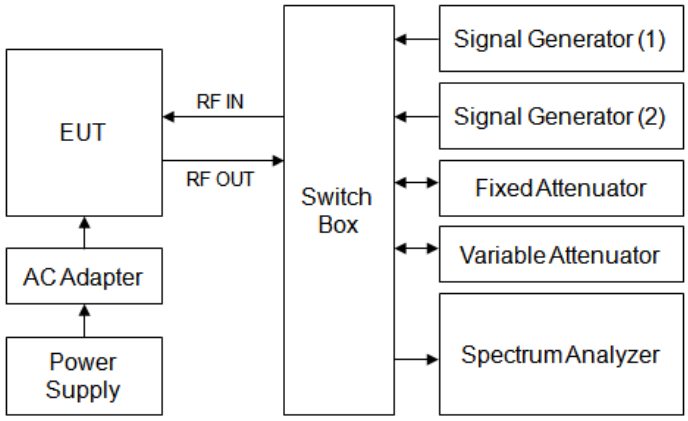
Coverage factor k = 2, Confidence levels of 95 %

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

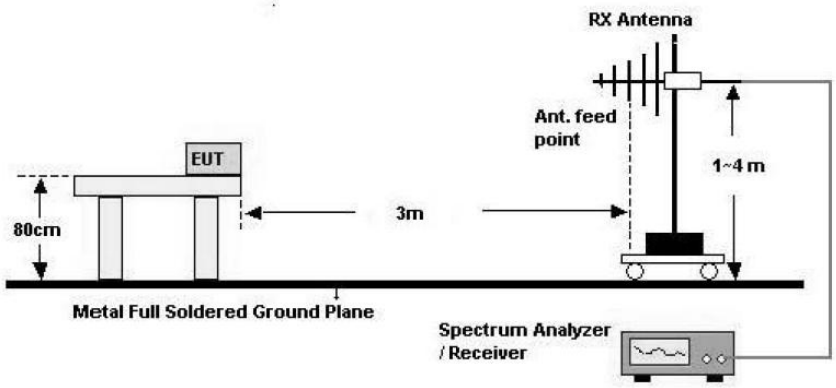
3.5. TEST DIAGRAMS

Conducted Test

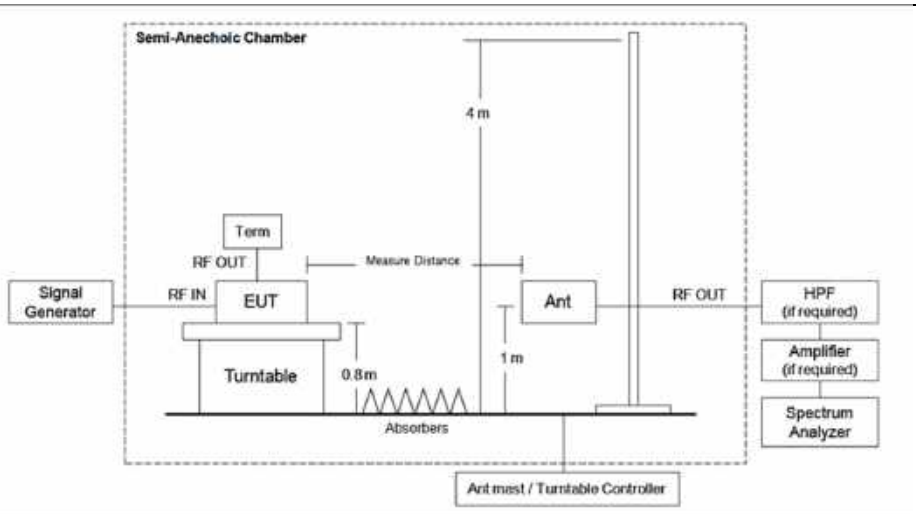


Radiated Test

30 MHz ~ 1 GHz



Above 1 GHz



※ EUT position is adopted by placement of floor-standing refer to section 5.5.2.3.2 of ANSI C63.26-2015

4. TEST EQUIPMENTS

Equipment	Model	Manufacturer	Serial No.	Due to Calibration	Calibration Interval
MXA Signal Analyzer	N9020A	Keysight	MY52350879	04/05/2025	Annual
MXG Vector Signal Generator	N5182A	Agilent	MY46240807	12/13/2024	Annual
MXG Vector Signal Generator	N5182A	Agilent	MY50141649	08/16/2024	Annual
30 dB Attenuator	WA93-30-33	Weinschel Associates	0113	11/20/2024	Annual
30 dB Attenuator	WA93-30-33	Weinschel Associates	0155	11/20/2024	Annual
30 dB Attenuator	WA93-30-33	Weinschel Associates	0184	11/20/2024	Annual
30 dB Attenuator	WA93-30-33	Weinschel Associates	0133	11/20/2024	Annual
20 dB Attenuator	FAS-23-20	MCLI	103756	05/02/2025	Annual
#50Ω Termination	908A	H.P.	N/A	N/A	N/A
Amp & Filter Bank Switch Controller	FBSM-01B	TNM system	TM20090002	N/A	N/A
Controller(Antenna Mast & Turn Table)	CO3000	Innco system	CO3000/1251/48920320/P	N/A	N/A
Antenna Position Tower	MA4640/800-XP-EP	Innco system	N/A	N/A	N/A
Turn Table	DS2000-S	Innco system	N/A	N/A	N/A
Turn Table	N/A	Ets	N/A	N/A	N/A
Loop Antenna	FMZB 1513	Rohde & Schwarz	1513-333	03/07/2026	Biennial
Hybrid Antenna	VULB 9168	Schwarzbeck	9168-0895	09/16/2024	Biennial
Horn Antenna	BBHA 9120D	Schwarzbeck	9120D-1191	11/07/2025	Biennial
Horn Antenna	BBHA9170	Schwarzbeck	BBHA9170342	09/29/2024	Biennial
RF Switching System	FBSR-04C	TNM system	S4L1	04/11/2025	Annual
Power Amplifier	CBL18265035	CERNEX	22966	11/17/2024	Annual
Power Amplifier	CBL26405040	CERNEX	25956	02/26/2025	Annual

This equipment has been used to each port, but we only listed one equipment for simplicity.

Note:

1. Equipment listed above that calibrated during the testing period was set for test after the calibration.
2. Equipment listed above that has a calibration due date during the testing period, the testing is completed before equipment expiration date.

5. TEST RESULT

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 v04r04.

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) ≥ 3 x 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.

h) Reset the spectrum analyzer span to 2 x the width of the CMRS band under test. Adjust the tuned frequency of the signal generator to sweep 2 x the width of the CMRS band using the sweep function. The AGC must be deactivated throughout the entire sweep.

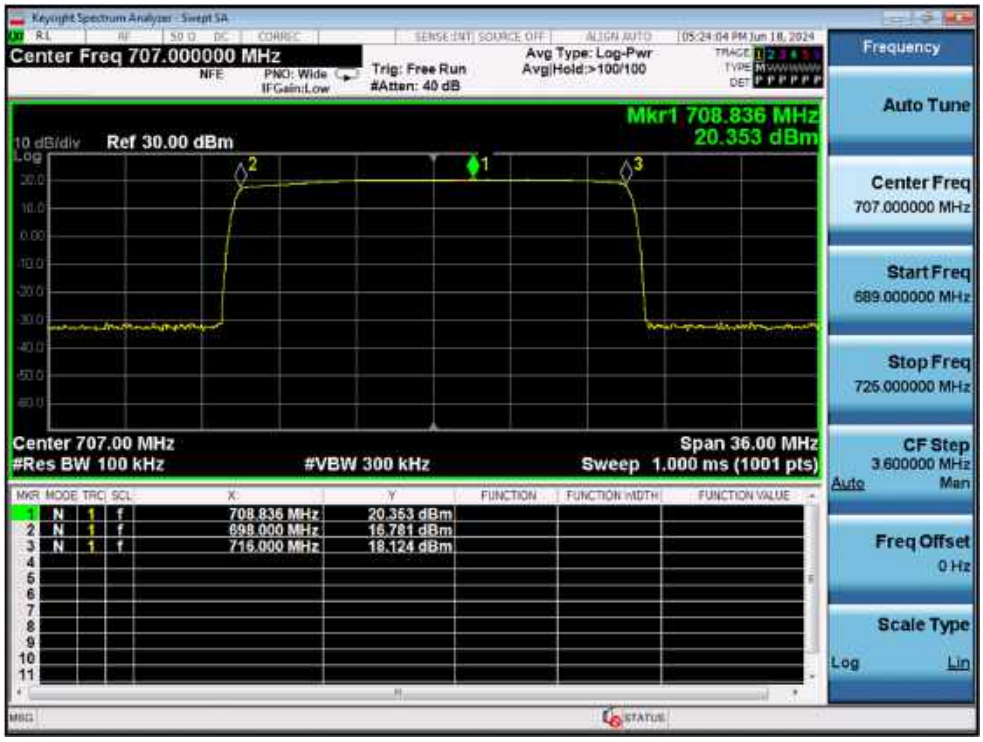
i) Using three markers, identify the CMRS band edges and the frequency with the highest power. Affirm that the values of all markers are visible on the display of the spectrum analyzer (e.g., marker table set to on).

j) Capture the spectrum analyzer trace for inclusion in the test report.

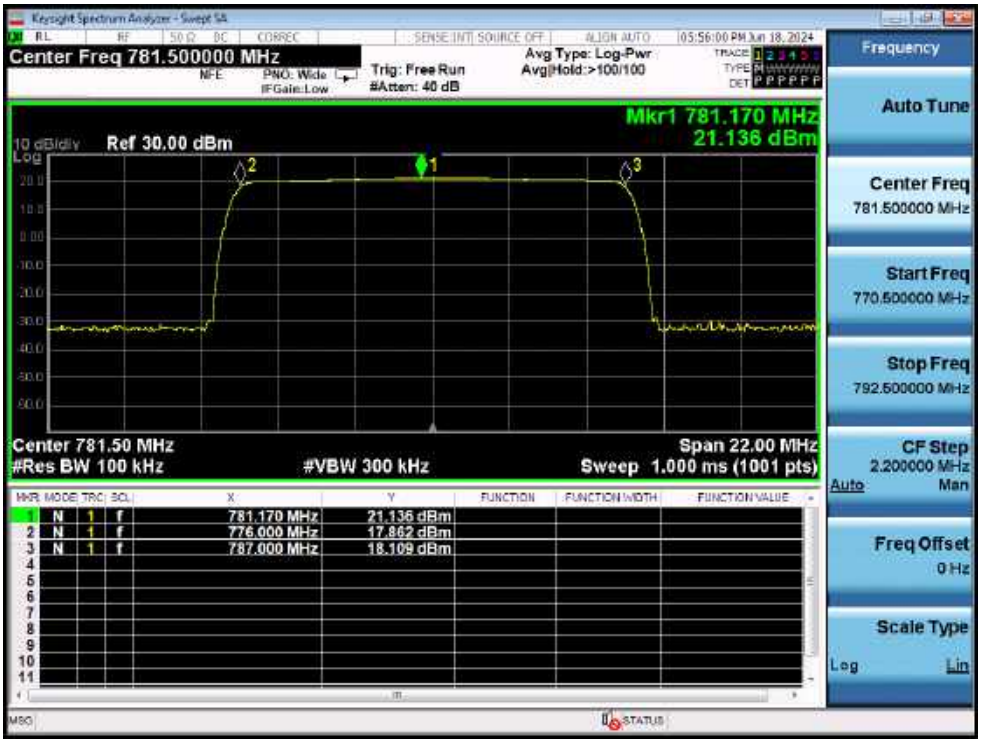
k) Repeat c) to j) for all operational uplink and downlink bands.

Test Results: Plot data of Authorized Frequency Band

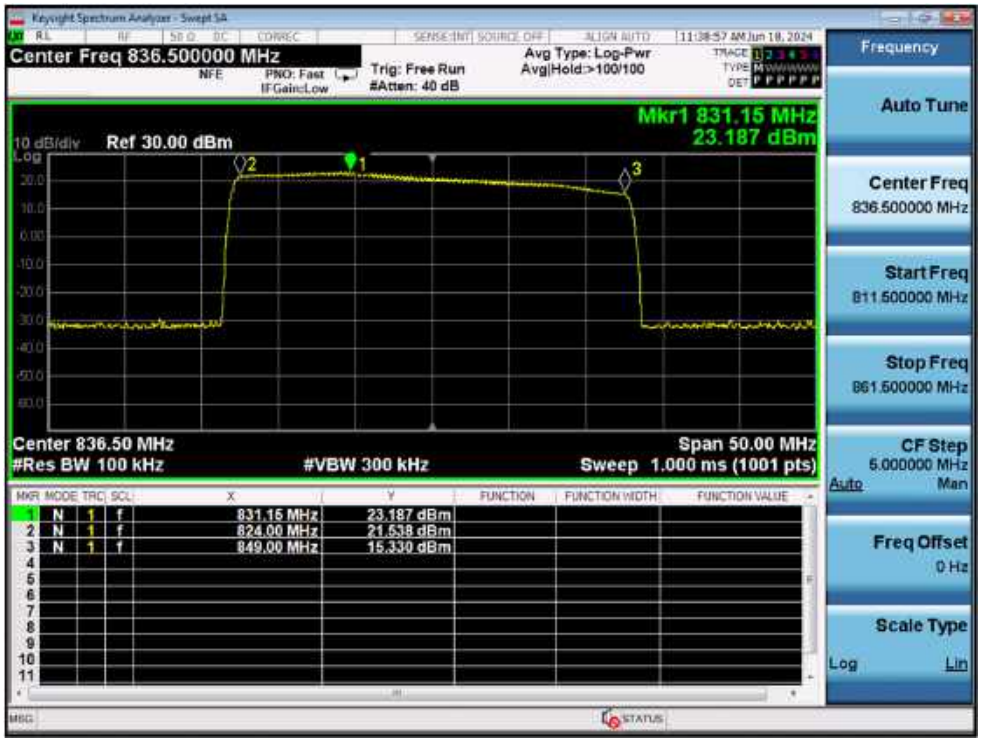
Lower 700 MHz / Uplink



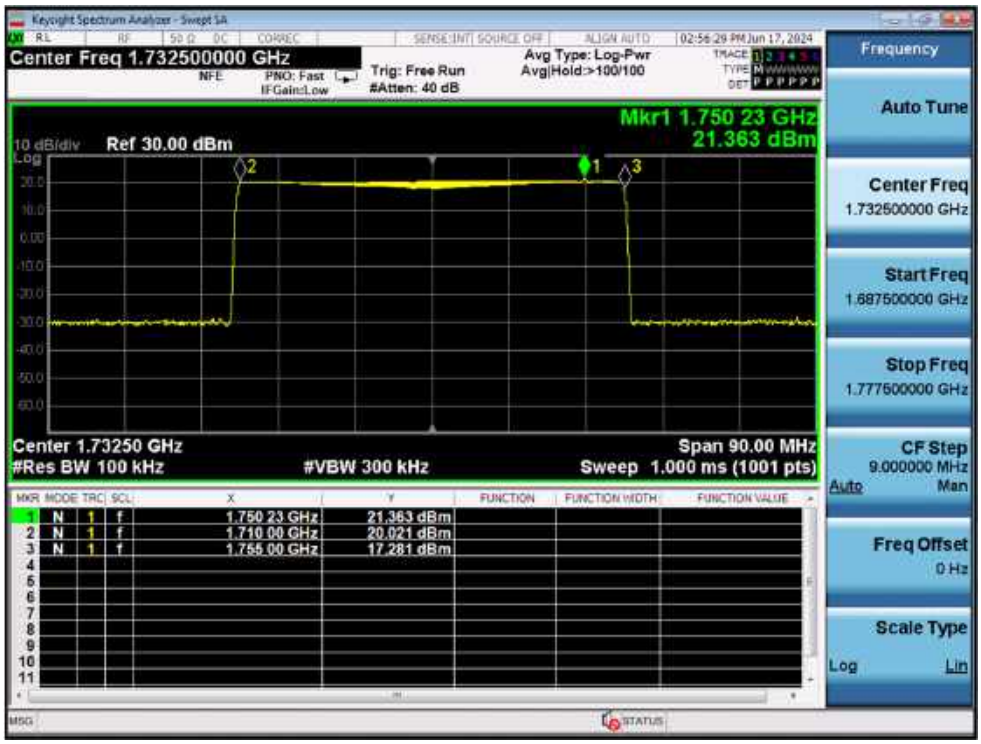
Upper 700 MHz / Uplink



Cellular / Uplink

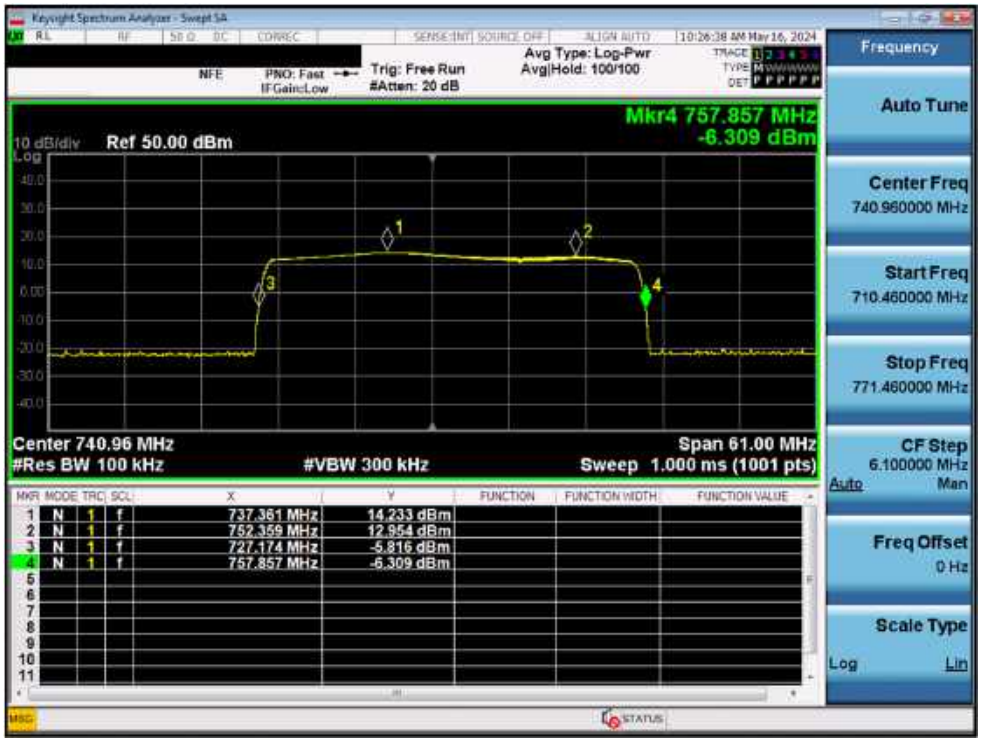


AWS-1 / Uplink

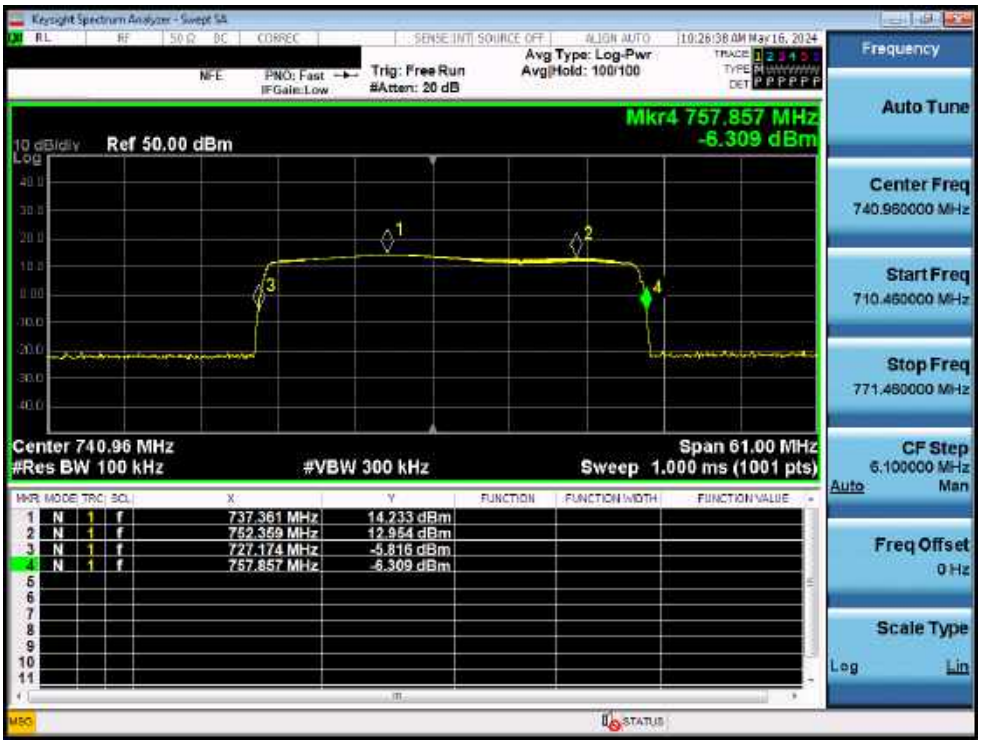


Broadband PCS / Uplink

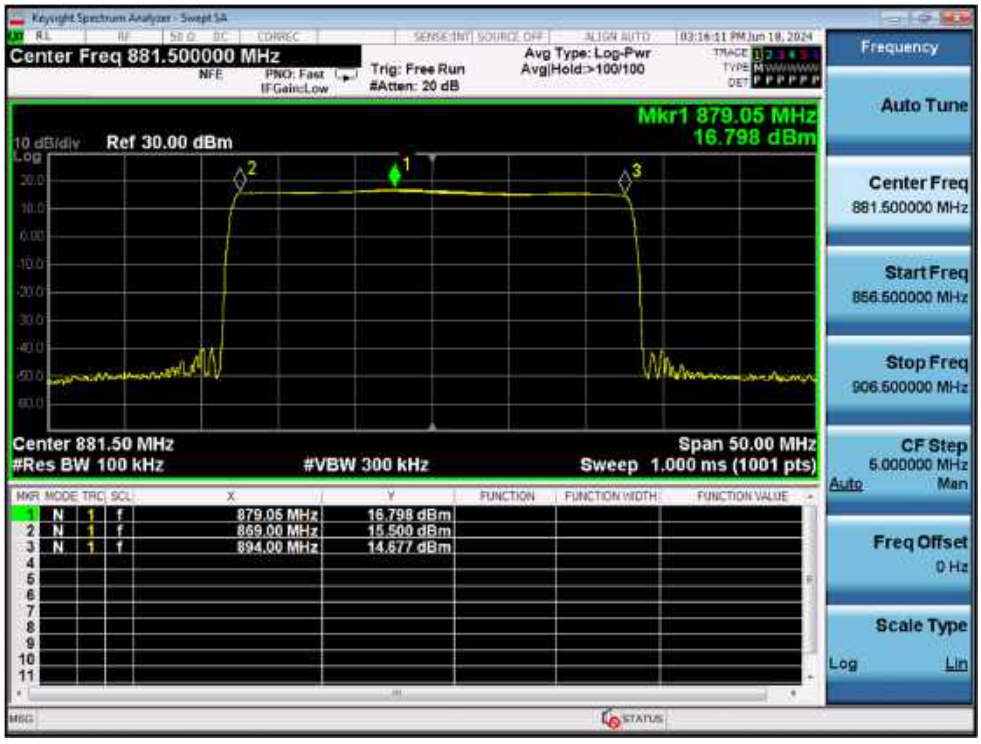
Lower 700 MHz / Downlink



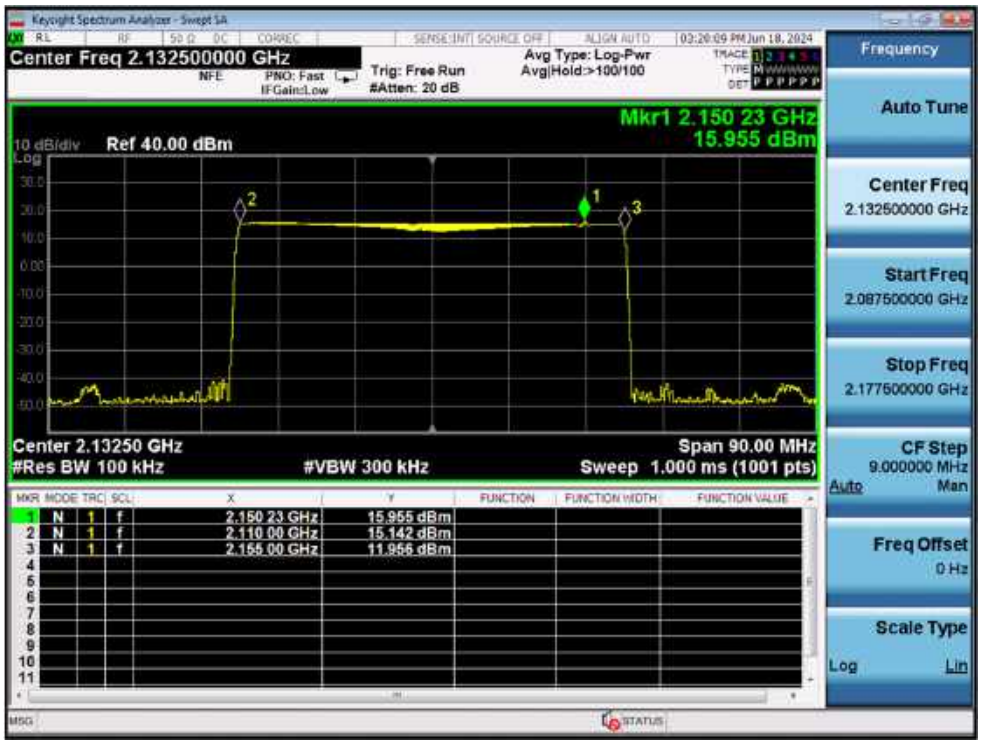
Upper 700 MHz / Downlink



Cellular / Downlink



AWS-1 / Downlink



Broadband PCS / 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 v04r04.

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 ≥ 3 x 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 ≥ (2 x span)/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 (16.99 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.

Coupled Gain = Antenna gain - 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	707	2.25	30	9.00	1.0
	781.5	2.25	30	9.00	1.0
	836.5	3.40	30	9.70	1.3
	1732.5	4.40	30	14.40	-3.4
	1882.5	4.40	30	13.70	-2.7
Server	737	10.00	30	9.00	-6.75
	751.5	10.00	30	9.00	-6.75
	881.5	11.00	30	9.70	-6.30
	2132.5	11.00	30	14.40	-10.00
	1962.5	11.00	30	13.70	-9.30

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. 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.

Note6. PAPR of each rule part is tested about AWGN signal.

Note7. EIRP is calculated according to following formula.

EIRP = Conducted Output Power + Coupling Gain

Test Results:

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

Band	Freqeuncy (MHz)	Input Signal	Pin (dBm)	Low Limit (dBm)	EIRP Limit (dBm)	Coupling Gain (dB)	P_{out}		EIRP (dBm)
							(dBm)	(W)	
Lower 700 MHz	708.836	Pulsed GSM	-36.40	16.99	30	1.00	21.39	0.138	22.39
	708.836	4.1 MHz AWGN	-35.20			1.00	21.47	0.140	22.47
Upper 700 MHz	781.620	Pulsed GSM	-36.40			1.00	21.46	0.140	23.30
	781.620	4.1 MHz AWGN	-35.10			1.00	22.03	0.160	22.56
Cellular	831.150	Pulsed GSM	-40.90			1.30	21.66	0.147	22.96
	831.150	4.1 MHz AWGN	-40.30			1.30	21.62	0.145	22.92
AWS-1	1 750.230	Pulsed GSM	-49.10			-3.40	21.96	0.157	18.56
	1 750.230	4.1 MHz AWGN	-49.20			-3.40	21.97	0.157	18.57
Broadband PCS	1 899.790	Pulsed GSM	-48.90			-2.70	21.77	0.150	19.07
	1 899.790	4.1 MHz AWGN	-48.10			-2.70	21.59	0.144	18.89

Tabulated Result of Uplink Maximum Power (AGC Threshold +10 / +2 dB input level)

Band	Freqeuncy (MHz)	Input Signal	Pin (dBm)	Low Limit (dBm)	EIRP Limit (dBm)	Coupling Gain (dB)	P_{out}		EIRP (dBm)
							(dBm)	(W)	
Lower 700 MHz	708.836	Pulsed GSM	-26.40	16.99	30	1.00	21.33	0.136	22.33
	708.836	4.1 MHz AWGN	-25.20			1.00	21.71	0.148	22.71
Upper 700 MHz	781.620	Pulsed GSM	-26.40			1.00	21.41	0.138	23.06
	781.620	4.1 MHz AWGN	-25.10			1.00	22.05	0.160	22.44
Cellular	831.150	Pulsed GSM	-30.90			1.30	21.98	0.158	23.28
	831.150	4.1 MHz AWGN	-30.30			1.30	21.59	0.144	22.89
AWS-1	1 750.230	Pulsed GSM	-39.10			-3.40	22.03	0.160	18.63
	1 750.230	4.1 MHz AWGN	-39.20			-3.40	21.96	0.157	18.56
Broadband PCS	1 899.790	Pulsed GSM	-38.90			-2.70	21.72	0.149	19.02
	1 899.790	4.1 MHz AWGN	-38.10			-2.70	21.50	0.141	18.80

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

Band	Freqeuncy (MHz)	Input Signal	Pin (dBm)	Power and EIRP Limit (dBm)	Coupling Gain (dB)	P_{out}		EIRP (dBm)
						(dBm)	(W)	
Lower 700 MHz	739.484	Pulsed GSM	-40.90	17	-6.75	16.86	0.049	10.11
	739.484	4.1 MHz AWGN	-40.10		-6.75	16.48	0.044	9.73
Upper 700 MHz	752.136	Pulsed GSM	-40.90		-6.75	16.49	0.045	9.58
	752.136	4.1 MHz AWGN	-40.20		-6.75	16.57	0.045	10.22
Cellular	879.050	Pulsed GSM	-43.40		-6.30	16.80	0.048	10.50
	879.050	4.1 MHz AWGN	-44.90		-6.30	16.83	0.048	10.53
AWS-1	2 150.230	Pulsed GSM	-53.90		-10.00	16.41	0.044	6.41
	2 150.230	4.1 MHz AWGN	-54.20		-10.00	16.87	0.049	6.87
Broadband PCS	1 968.350	Pulsed GSM	-51.40		-9.30	16.47	0.044	7.17
	1 968.350	4.1 MHz AWGN	-52.80		-9.30	16.69	0.047	7.39

Tabulated Result of Downlink Maximum Power (AGC Threshold +10 / +2 dB input level)

Band	Freqeuncy (MHz)	Input Signal	Pin (dBm)	Power and EIRP Limit (dBm)	Coupling Gain (dB)	P_{out}		EIRP (dBm)
						(dBm)	(W)	
Lower 700 MHz	739.484	Pulsed GSM	-30.90	17	-6.75	16.75	0.047	10.00
	739.484	4.1 MHz AWGN	-30.10		-6.75	16.86	0.049	10.11
Upper 700 MHz	752.136	Pulsed GSM	-30.90		-6.75	16.49	0.045	9.76
	752.136	4.1 MHz AWGN	-30.20		-6.75	16.96	0.050	9.79
Cellular	879.050	Pulsed GSM	-33.40		-6.30	16.83	0.048	10.53
	879.050	4.1 MHz AWGN	-34.90		-6.30	16.79	0.048	10.49
AWS-1	2 150.230	Pulsed GSM	-43.90		-10.00	16.43	0.044	6.43
	2 150.230	4.1 MHz AWGN	-44.20		-10.00	16.89	0.049	6.89
Broadband PCS	1 968.350	Pulsed GSM	-41.40		-9.30	16.49	0.045	7.19
	1 968.350	4.1 MHz AWGN	-42.80		-9.30	16.61	0.046	7.31

Tabulated result of Uplink PAPR

Band	Freqeuncy (MHz)	Limit (dB)	PAPR (dB)
Lower 700 MHz	708.836	13	8.28
Upper 700 MHz	781.170		8.10
Cellular	831.150		8.35
AWS-1	1 750.230		8.36
Broadband PCS	1 899.790		8.18

Tabulated result of Downlink PAPR

Band	Freqeuncy (MHz)	Limit (dB)	PAPR (dB)
Lower 700 MHz	739.484	13	8.44
Upper 700 MHz	751.962		8.43
Cellular	879.050		8.50
AWS-1	2 150.230		8.52
Broadband PCS	1 968.350		8.47

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 dB + 20 Log_{10} (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 v04r04.

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 Pout and Pin result pairs for all signal types used in maximum power measurement test in the following equation to obtain the maximum gain, G:

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

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): Mobile booster maximum gain shall not exceed 50 dB.

Test Results:

Tabulated Result of Uplink Booster Gain

Band	Freqeuncy (MHz)	Input Signal	Pin (dBm)	Pout (dBm)	Limit (dB)	Gain (dB)
Lower 700 MHz	708.836	Pulsed GSM	-36.40	21.39	63.53	57.79
	708.836	4.1 MHz AWGN	-35.20	21.47		56.67
Upper 700 MHz	781.620	Pulsed GSM	-36.40	22.30	64.36	58.70
	781.620	4.1 MHz AWGN	-35.10	21.56		56.66
Cellular	831.150	Pulsed GSM	-40.90	21.66	64.95	62.56
	831.150	4.1 MHz AWGN	-40.30	21.62		61.92
AWS-1	1 750.230	Pulsed GSM	-49.10	21.96	71.27	71.06
	1 750.230	4.1 MHz AWGN	-49.20	21.97		71.17
Broadband PCS	1 899.790	Pulsed GSM	-48.90	21.77	71.99	70.67
	1 899.790	4.1 MHz AWGN	-48.10	21.59		69.69

Tabulated Result of Downlink Booster Gain

Band	Freqeuncy (MHz)	Input Signal	Pin (dBm)	Pout (dBm)	Limit (dB)	Gain (dB)
Lower 700 MHz	739.484	Pulsed GSM	-40.90	16.86	63.53	57.76
	739.484	4.1 MHz AWGN	-40.10	16.48		56.58
Upper 700 MHz	752.136	Pulsed GSM	-40.90	16.33	64.36	57.23
	752.136	4.1 MHz AWGN	-40.20	15.17		55.37
Cellular	879.050	Pulsed GSM	-43.40	16.80	64.95	60.20
	879.050	4.1 MHz AWGN	-44.90	16.83		61.73
AWS-1	2 150.230	Pulsed GSM	-53.90	16.41	71.27	70.31
	2 150.230	4.1 MHz AWGN	-54.20	16.87		71.07
Broadband PCS	1 968.350	Pulsed GSM	-51.40	16.47	71.99	67.87
	1 968.350	4.1 MHz AWGN	-52.80	16.69		69.49

Tabulated Result of Uplink and Downlink Gain Comparison

Band	Input Signal	UL Gain (dB)	DL Gain (dB)	Limit (dB)	Difference (dB)
Lower 700 MHz	Pulsed GSM	57.79	57.76	9	0.03
	4.1 MHz AWGN	56.67	56.58		0.08
Upper 700 MHz	Pulsed GSM	58.70	57.23		1.47
	4.1 MHz AWGN	56.66	55.37		1.28
Cellular	Pulsed GSM	62.56	60.20		2.36
	4.1 MHz AWGN	61.92	61.73		0.19
AWS-1	Pulsed GSM	71.06	70.31		0.75
	4.1 MHz AWGN	71.17	71.07		0.10
Broadband PCS	Pulsed GSM	70.67	67.87		2.81
	4.1 MHz AWGN	69.69	69.49		0.20

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 v04r04.

a) Connect the signal booster to the test equipment as shown in Figure 2. Begin with the uplink output (donor) port connected to the spectrum analyzer.

b) Set the spectrum analyzer RBW = 3 kHz.

c) Set the VBW ≥ 3 x 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 ≥ (2 × span)/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 7.2

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 (if any occur) 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

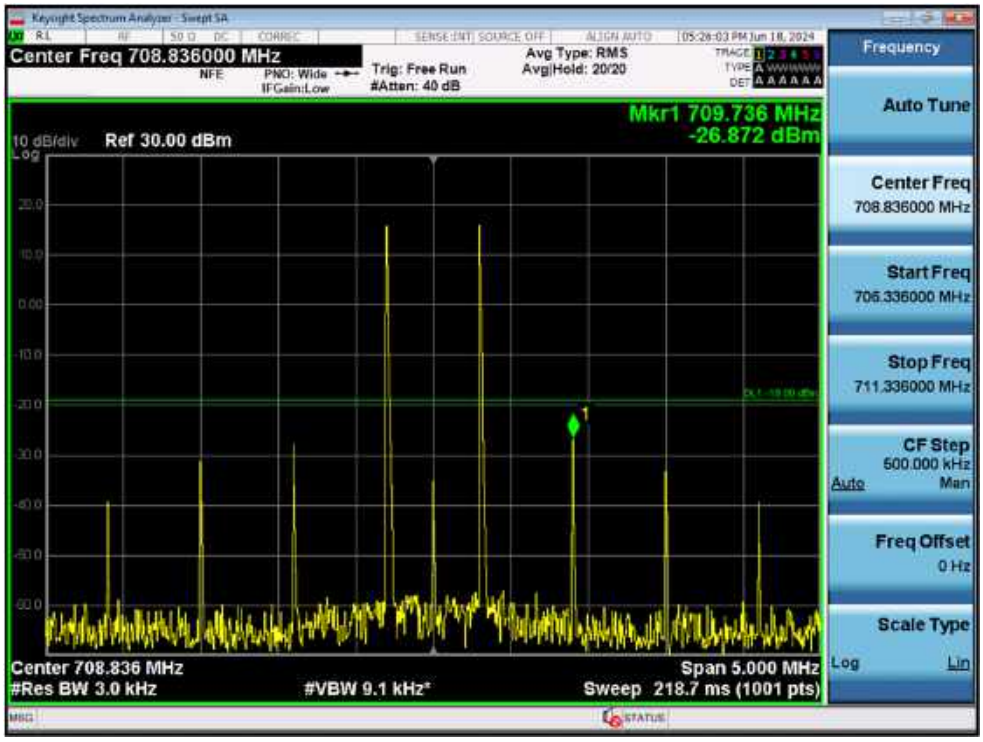
Band	Input Level	Frequency (MHz)	Limit (dBm)	Intermodulation (dBm)
Lower 700 MHz	AGC threshold	709.736	-19	-26.872
	AGC threshold +10 dB	709.736		-26.184
Upper 700 MHz	AGC threshold	782.070		-27.361
	AGC threshold +10 dB	782.070		-26.832
Cellular	AGC threshold	831.150		-24.432
	AGC threshold +10 dB	831.150		-24.268
AWS-1	AGC threshold	1 750.230		-31.939
	AGC threshold +10 dB	1 750.230		-30.954
Broadband PCS	AGC threshold	1 900.690		-26.122
	AGC threshold +10 dB	1 900.690		-24.656

Tabulated Result of Downlink Intermodulation

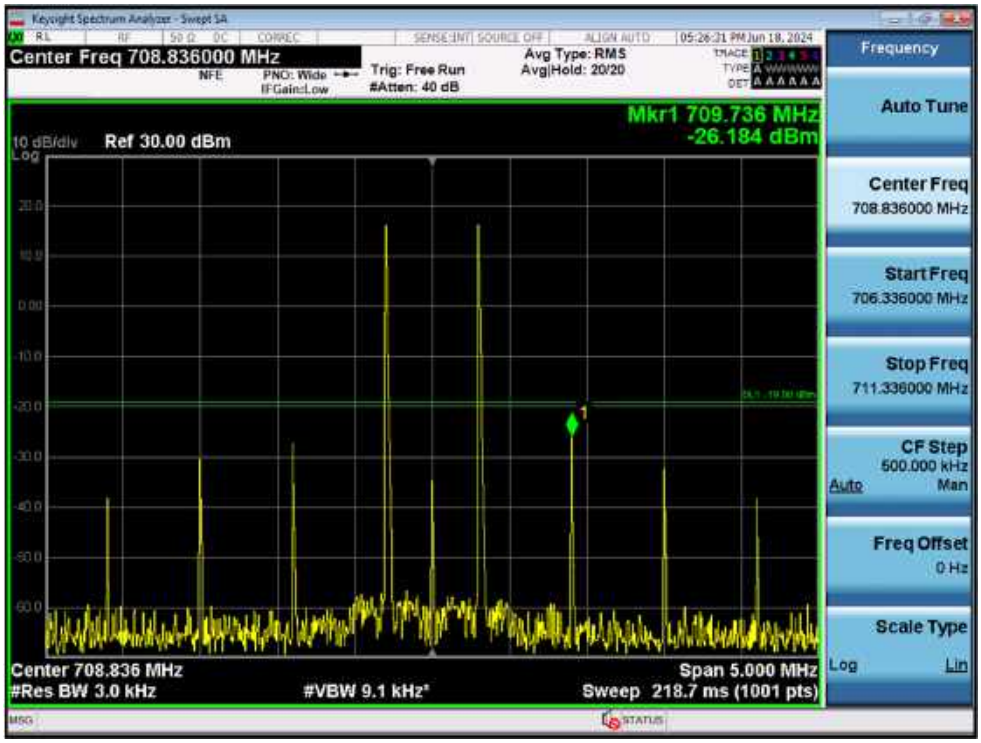
Band	Input Level	Frequency (MHz)	Limit (dB)	Intermodulation (dBm)
Lower 700 MHz	AGC threshold	738.261	-19	-34.985
	AGC threshold +10 dB	738.261		-35.000
Upper 700 MHz	AGC threshold	752.862		-36.605
	AGC threshold +10 dB	752.862		-35.244
Cellular	AGC threshold	879.050		-25.109
	AGC threshold +10 dB	879.050		-24.551
AWS-1	AGC threshold	2 150.230		-25.767
	AGC threshold +10 dB	2 150.230		-25.121
Broadband PCS	AGC threshold	1 968.350		-33.032
	AGC threshold +10 dB	1 968.350		-33.196

Plot data of Intermodulation

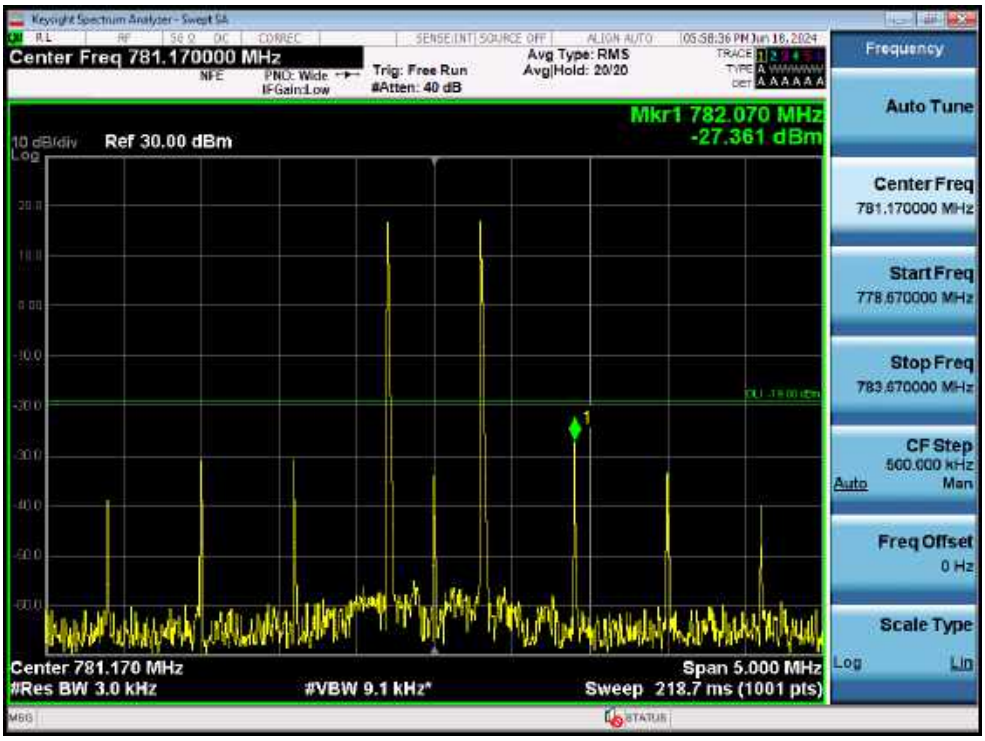
Intermodulation / Lower 700 MHz / Uplink / AGC threshold



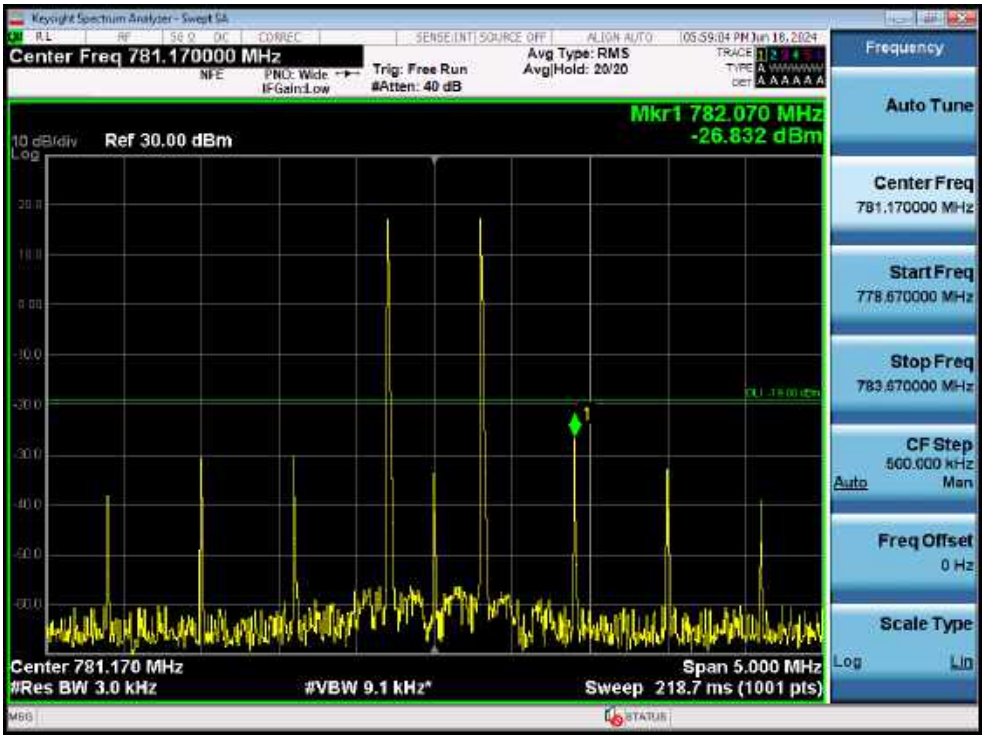
Intermodulation / Lower 700 MHz / Uplink / AGC threshold +10 dB



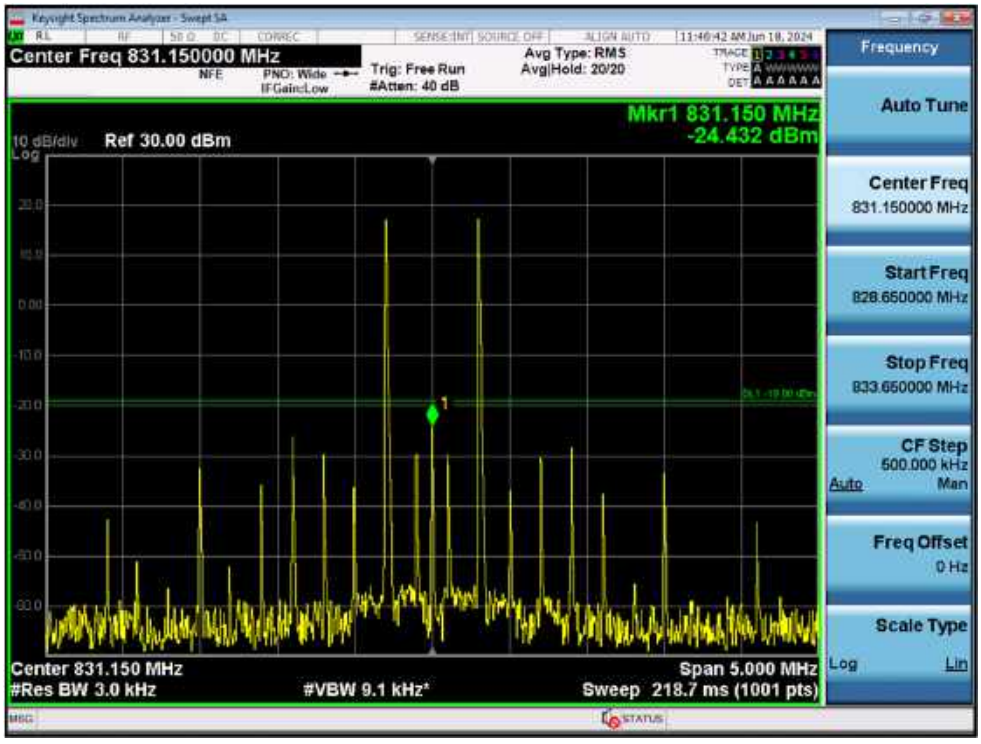
Intermodulation / Upper 700 MHz / Uplink / AGC threshold



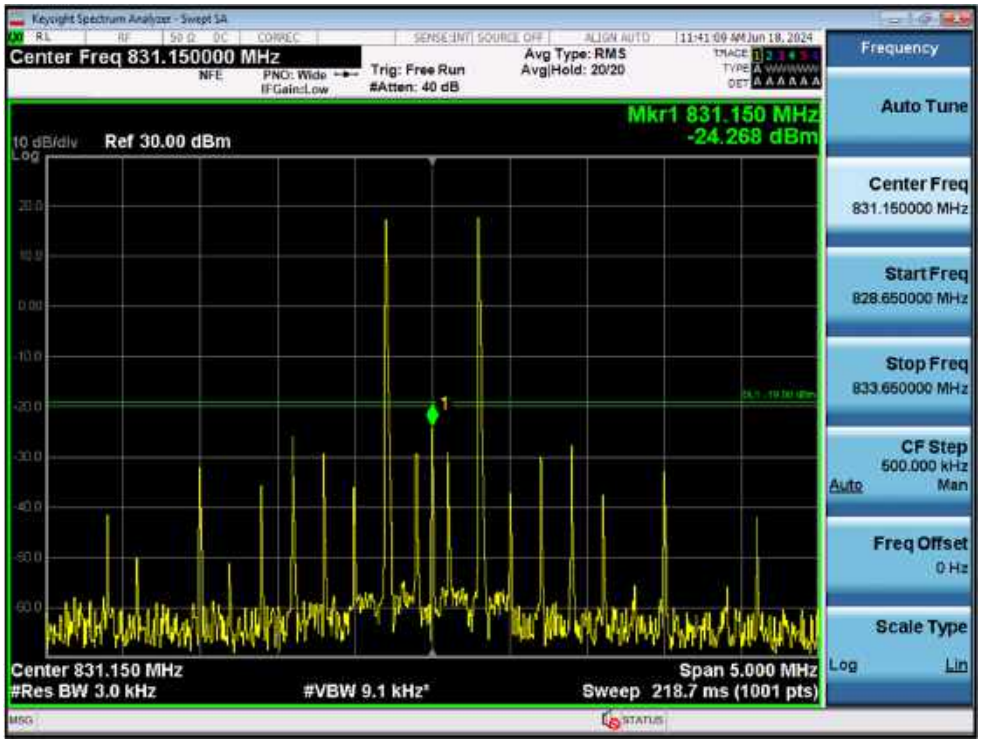
Intermodulation / Upper 700 MHz / Uplink / AGC threshold +10 dB



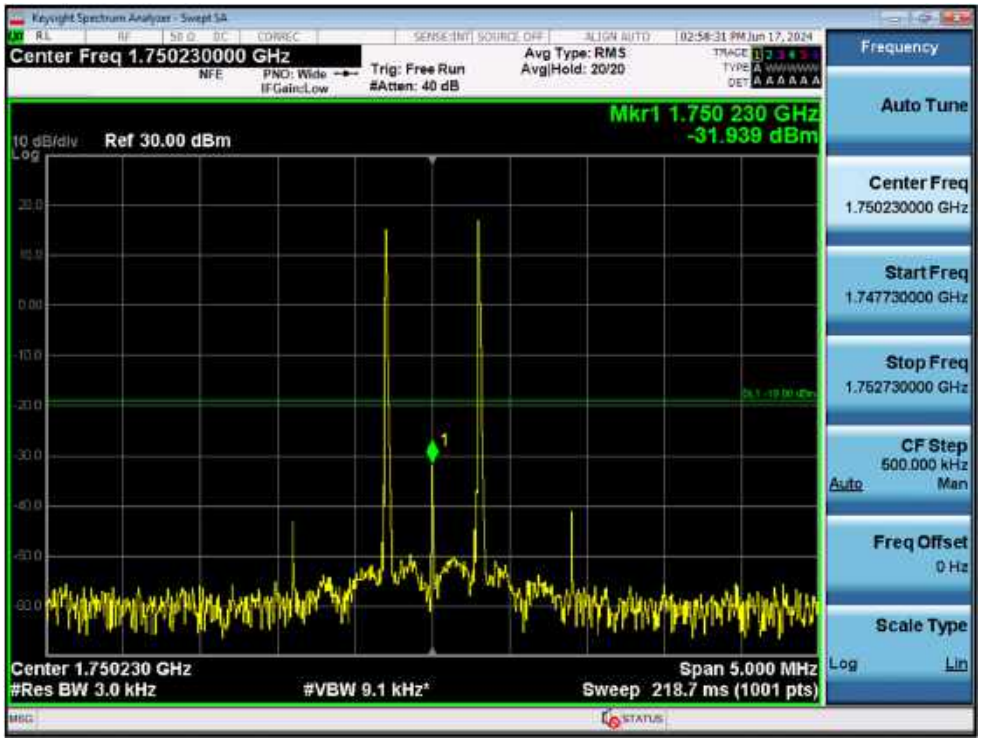
Intermodulation / Cellular / Uplink / AGC threshold



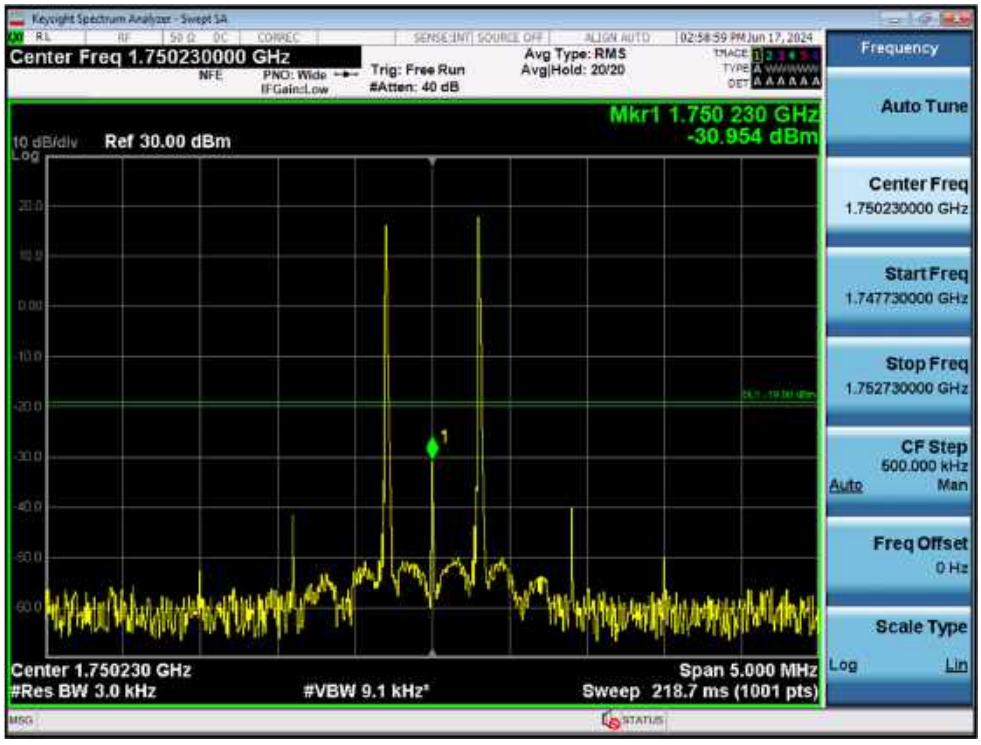
Intermodulation / Cellular / Uplink / AGC threshold +10 dB



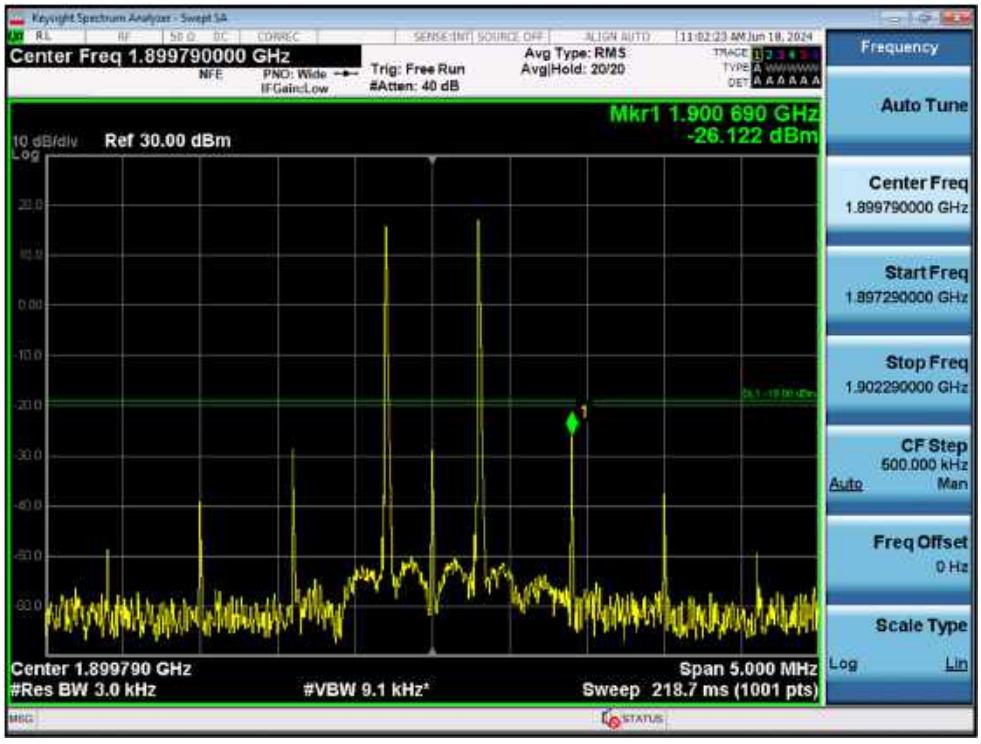
Intermodulation / AWS-1 / Uplink / AGC threshold



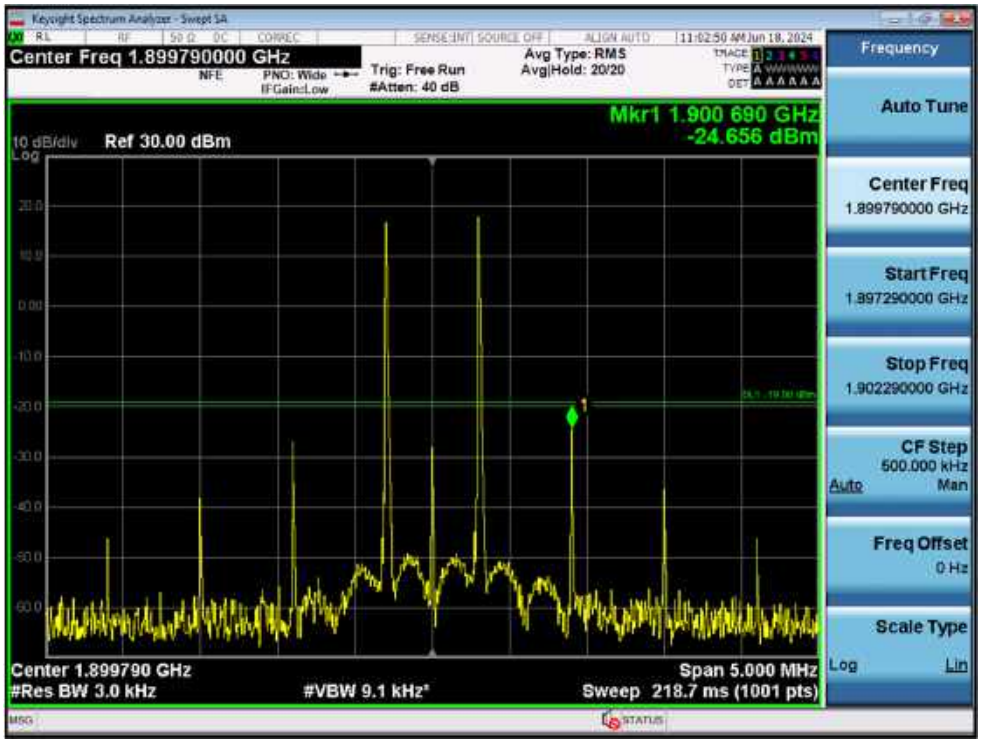
Intermodulation / AWS-1 / Uplink / AGC threshold +10 dB



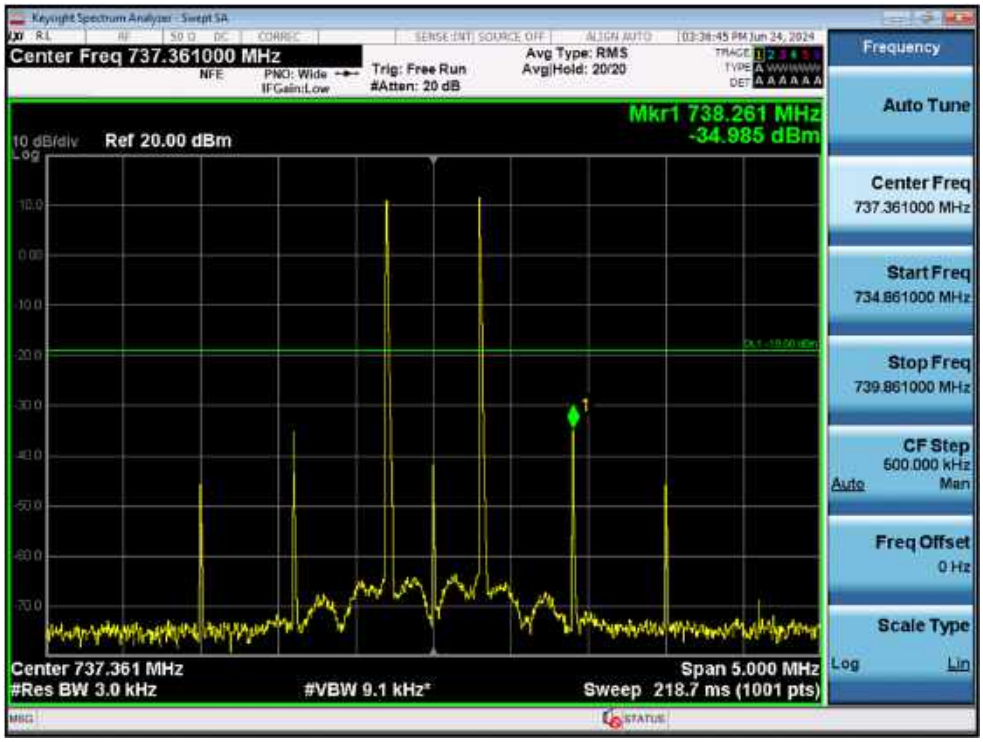
Intermodulation / Broadband PCS / Uplink / AGC threshold



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

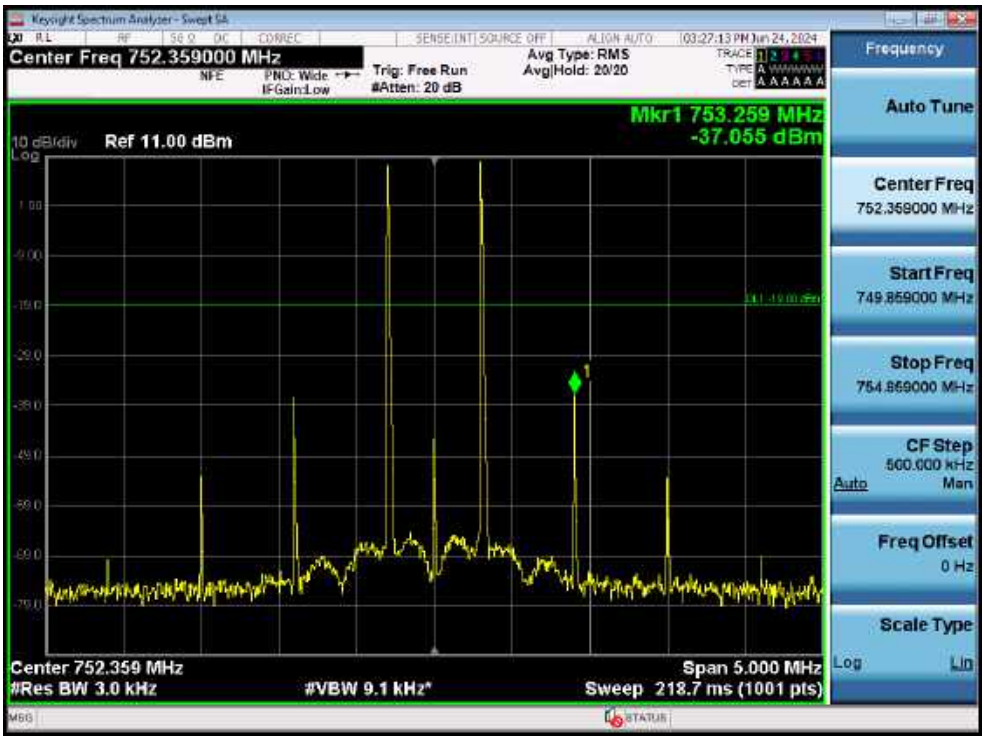


Intermodulation / Lower 700 MHz / Downlink / AGC threshold

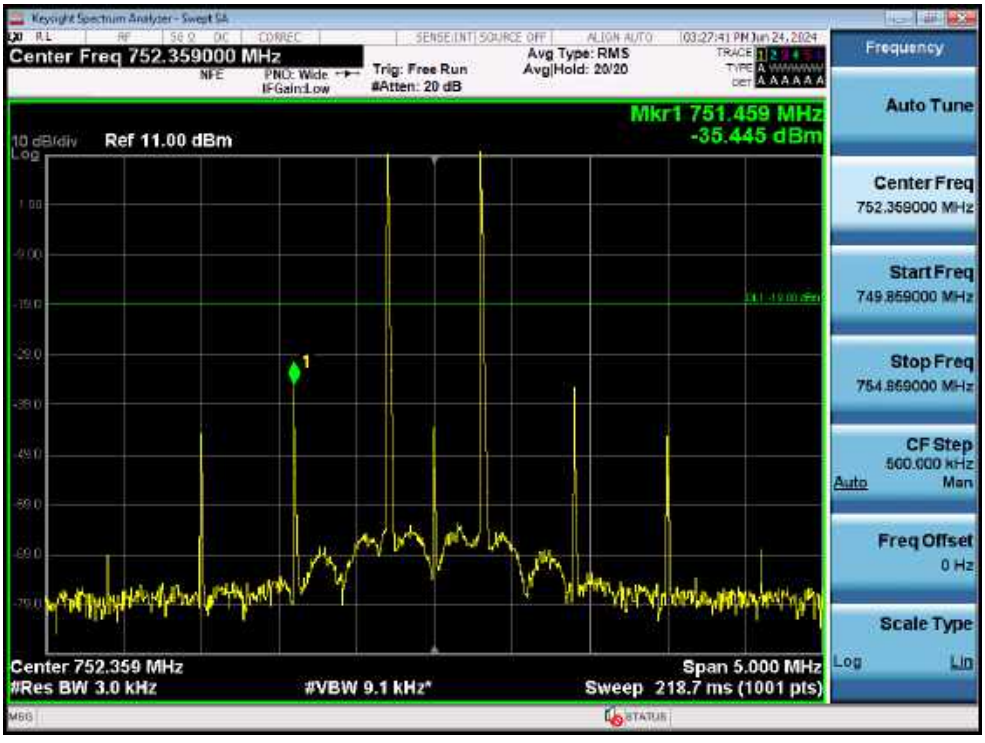


Intermodulation / Lower 700 MHz / Downlink / AGC threshold +10 dB

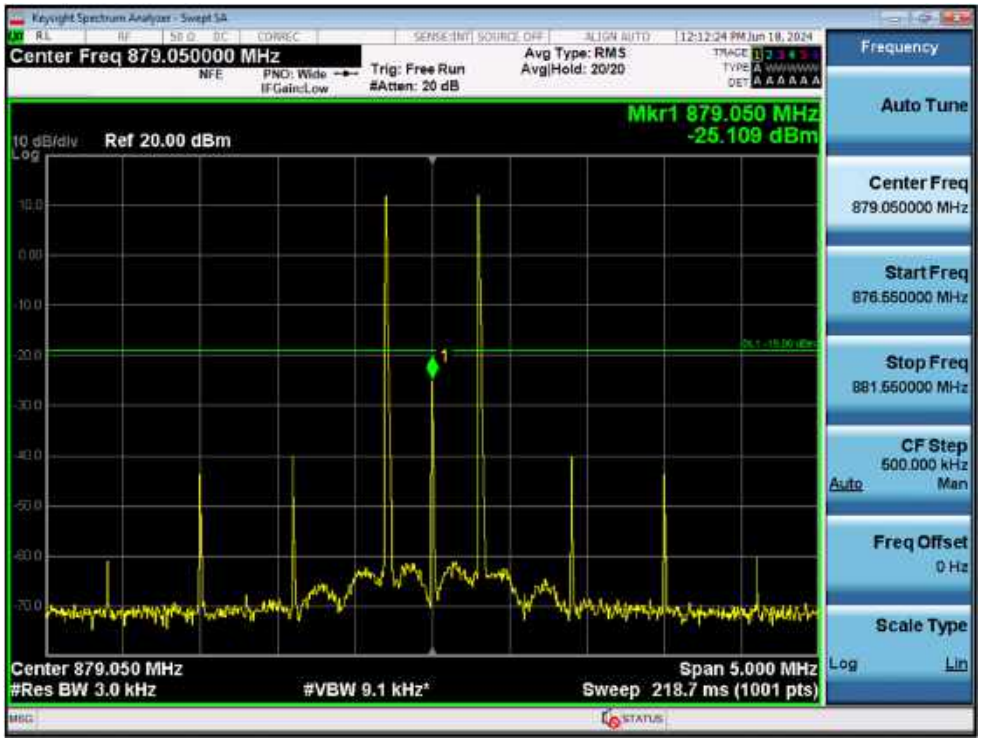
Intermodulation / Upper 700 MHz / Downlink / AGC threshold



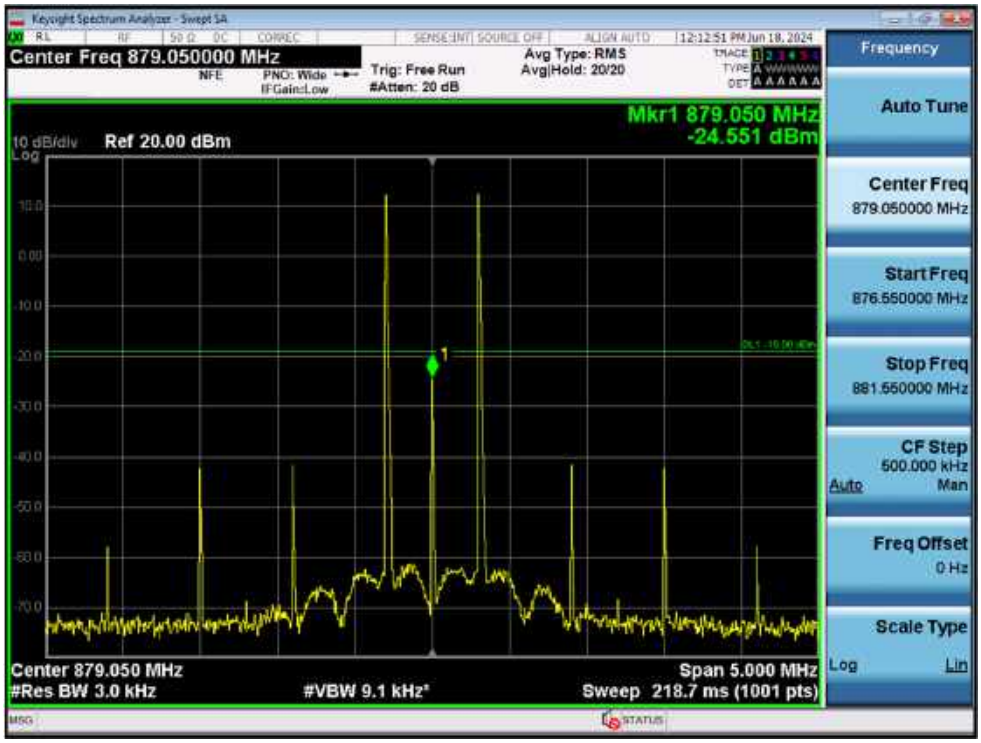
Intermodulation / Upper 700 MHz / Downlink / AGC threshold +10 dB



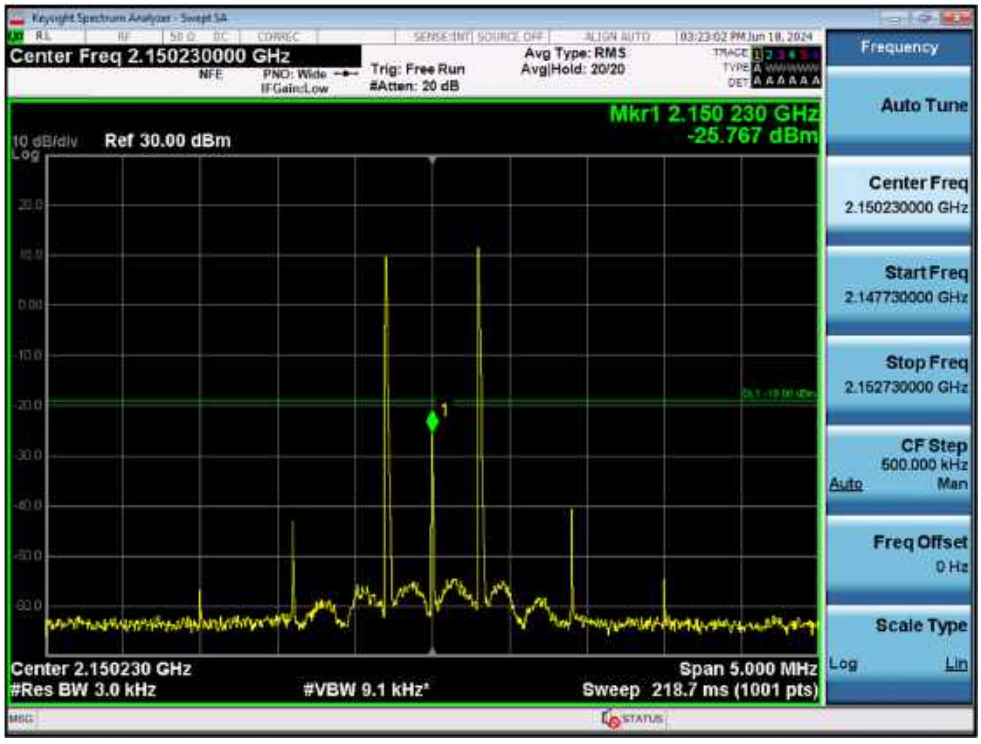
Intermodulation / Cellular / Downlink / AGC threshold



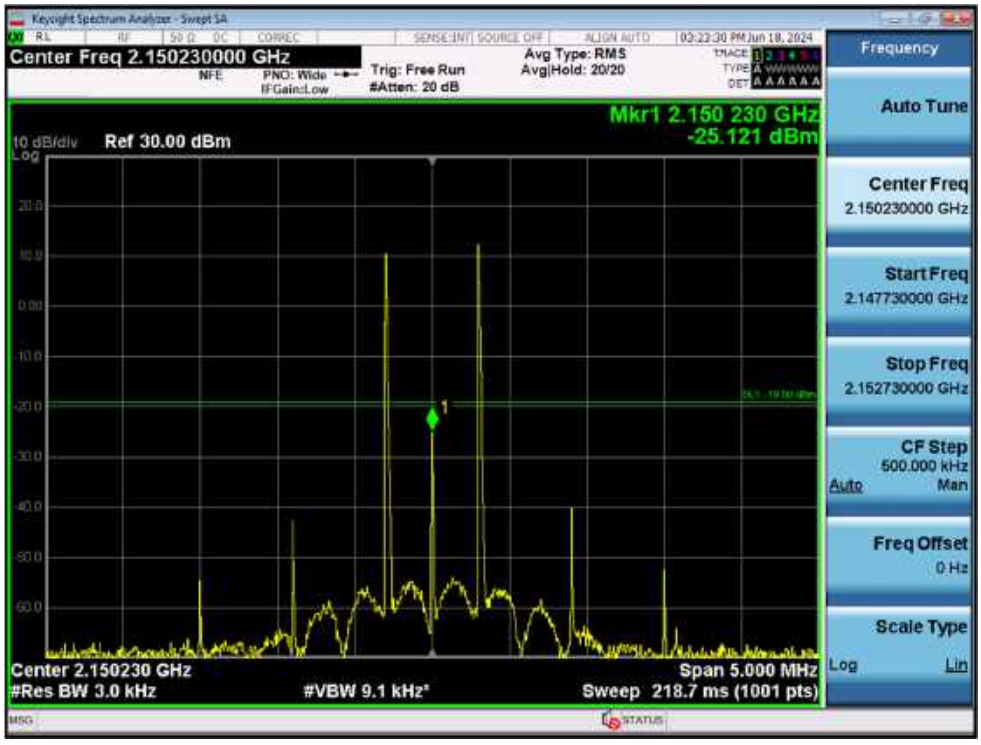
Intermodulation / Cellular / Downlink / AGC threshold +10 dB



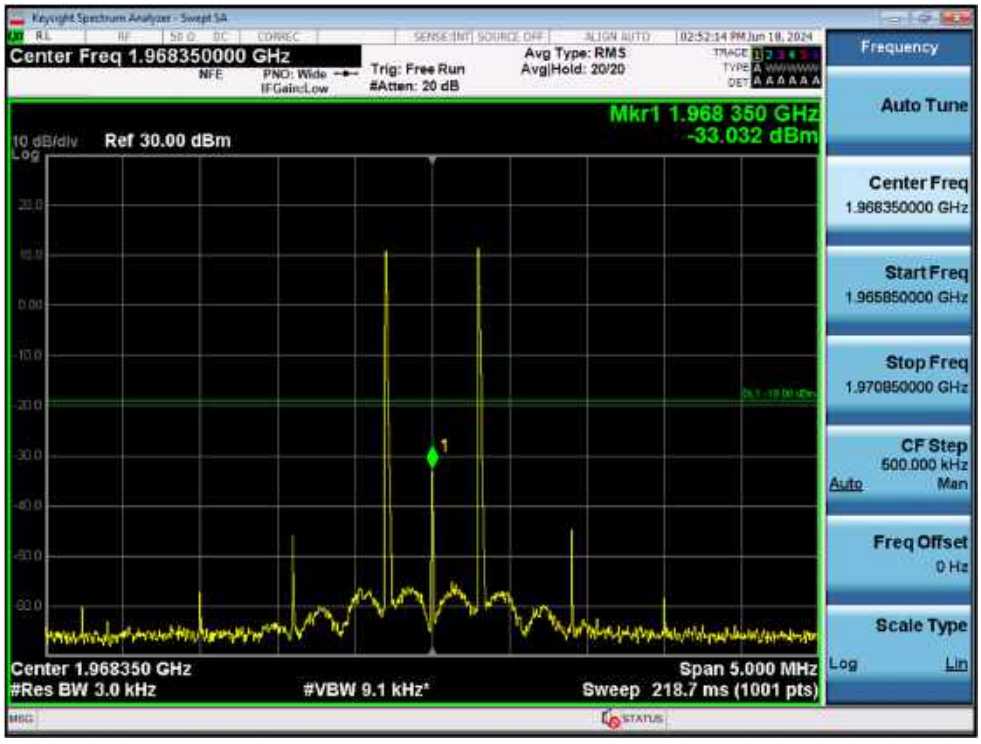
Intermodulation / AWS-1 / Downlink / AGC threshold



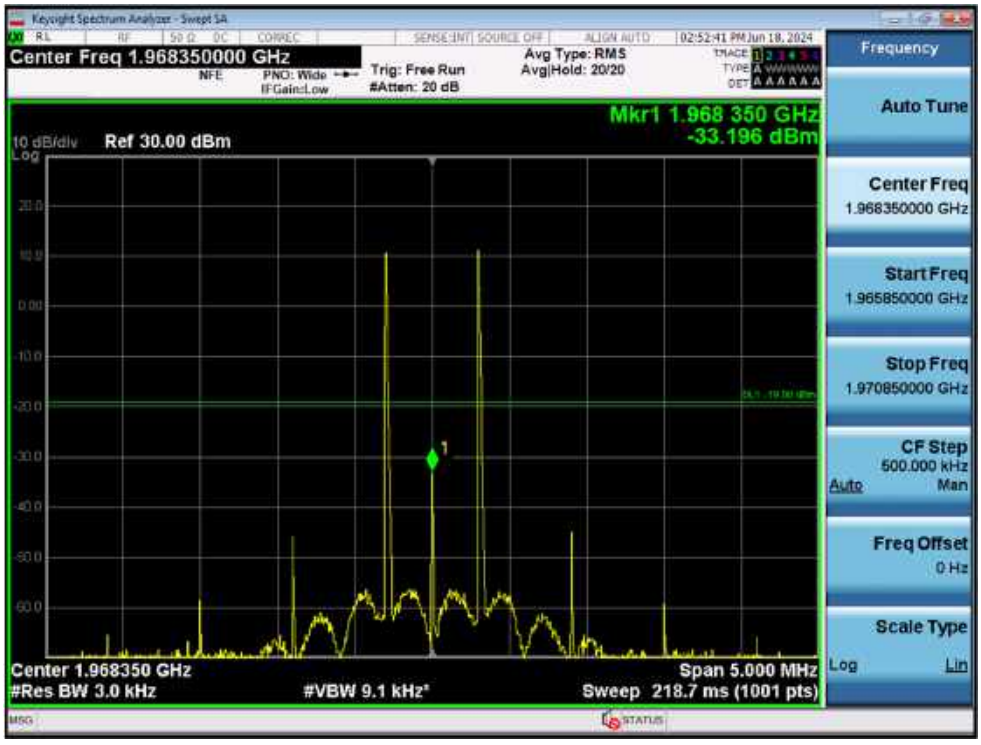
Intermodulation / AWS-1 / Downlink / AGC threshold +10 dB



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 v04r04.

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 (see Appendix A for cross-reference to applicable rule section). NOTE 3–Within 300 kHz and 3 MHz away from band edge, if smaller RBW is used (i.e., RBW < 100 kHz or 1 MHz, for above and below 1 GHz, respectively), per Parts 24 and 27 the smaller RBW is applicable only for frequencies within 100 kHz or 1 MHz (for above and below 1 GHz, respectively) away from the band edge.

.

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 5.5 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 5.5 power levels, or a table showing compliance at the additional input power(s) required.

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.

Out-of-Band Emissions Limit = 43 + 10 Log (Power) – 6 dB
= -13 dBm – 6 dB = -19 dBm

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	716.0009	-19	-30.430
			AGC + 10 dB	716.0153		-29.352
		Lower	AGC	697.9943		-32.654
			AGC + 10 dB	697.9931		-32.841
	LTE 5 MHz	Upper	AGC	716.0000		-33.650
			AGC + 10 dB	716.0000		-32.994
		Lower	AGC	697.9961		-34.799
			AGC + 10 dB	698.0000		-33.591
	CDMA	Upper	AGC	716.0045		-40.595
			AGC + 10 dB	716.0000		-41.334
		Lower	AGC	697.9862		-42.451
			AGC + 10 dB	697.9163		-40.352
Upper 700 MHz	GSM	Upper	AGC	787.0018		-36.130
			AGC + 10 dB	787.0222		-31.532
		Lower	AGC	775.9778		-31.867
			AGC + 10 dB	775.9991		-31.022
	LTE 5 MHz	Upper	AGC	787.0105		-34.759
			AGC + 10 dB	787.0099		-33.546
		Lower	AGC	775.9922		-33.789
			AGC + 10 dB	776.0000		-32.808
	CDMA	Upper	AGC	787.0096		-39.455
			AGC + 10 dB	787.0015		-38.708
		Lower	AGC	775.9964		-41.641
			AGC + 10 dB	775.9631		-39.378
Cellular	GSM	Upper	AGC	849.0171		-38.940
			AGC + 10 dB	849.0183		-40.786
		Lower	AGC	824.0000		-38.645
			AGC + 10 dB	823.9958		-39.278
	LTE 5 MHz	Upper	AGC	849.0000		-33.218
			AGC + 10 dB	849.0075		-31.539
		Lower	AGC	823.9970		-27.320
			AGC + 10 dB	824.0000		-27.524
	CDMA	Upper	AGC	849.0015		-43.390
			AGC + 10 dB	849.0387		-39.038
		Lower	AGC	823.9493		-36.544
			AGC + 10 dB	823.9643		-35.553

Band	Signal	Edge	Input Level	Frequency (MHz)	Limit (dBm)	Emission (dBm)
AWS-1	GSM	Upper	AGC	1 755.009	-19	-44.053
			AGC + 10 dB	1 755.018		-43.241
		Lower	AGC	1 709.982		-40.781
			AGC + 10 dB	1 710.000		-42.574
	LTE 5 MHz	Upper	AGC	1 755.000		-31.113
			AGC + 10 dB	1 755.000		-31.643
		Lower	AGC	1 710.000		-31.046
			AGC + 10 dB	1 709.997		-28.768
	CDMA	Upper	AGC	1 755.075		-52.969
			AGC + 10 dB	1 755.003		-52.716
		Lower	AGC	1 709.985		-49.965
			AGC + 10 dB	1 709.994		-50.752
Broadband PCS	GSM	Upper	AGC	1 915.018		-61.075
			AGC + 10 dB	1 915.018		-60.583
		Lower	AGC	1 849.994		-40.638
			AGC + 10 dB	1 849.982		-41.228
	LTE 5 MHz	Upper	AGC	1 915.000		-39.520
			AGC + 10 dB	1 915.048		-37.074
		Lower	AGC	1 850.000		-29.195
			AGC + 10 dB	1 850.000		-27.426
	CDMA	Upper	AGC	1 915.006		-47.245
			AGC + 10 dB	1 915.009		-43.646
		Lower	AGC	1 850.000		-43.316
			AGC + 10 dB	1 849.997		-42.061

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	746.0126	-19	-40.854
			AGC + 10 dB	746.0069		-36.611
		Lower	AGC	727.9949		-42.902
			AGC + 10 dB	727.9802		-40.019
	LTE 5 MHz	Upper	AGC	746.0054		-40.537
			AGC + 10 dB	746.0102		-38.568
		Lower	AGC	728.0000		-38.843
			AGC + 10 dB	728.0000		-40.610
	CDMA	Upper	AGC	746.0450		-52.039
			AGC + 10 dB	746.0084		-50.246
		Lower	AGC	727.9946		-51.774
			AGC + 10 dB	727.9934		-49.648
Upper 700 MHz	GSM	Upper	AGC	757.0117		-36.889
			AGC + 10 dB	757.0135		-34.510
		Lower	AGC	746.0000		-34.982
			AGC + 10 dB	745.9973		-36.139
	LTE 5 MHz	Upper	AGC	757.0063		-42.517
			AGC + 10 dB	757.0036		-41.030
		Lower	AGC	746.0000		-40.855
			AGC + 10 dB	745.9874		-39.888
	CDMA	Upper	AGC	757.0222		-53.597
			AGC + 10 dB	757.0000		-52.432
		Lower	AGC	745.9841		-51.420
			AGC + 10 dB	745.9988		-49.842
Cellular	GSM	Upper	AGC	894.0171		-41.545
			AGC + 10 dB	894.0177		-38.363
		Lower	AGC	868.9859		-43.262
			AGC + 10 dB	868.9994		-41.608
	LTE 5 MHz	Upper	AGC	894.0096		-34.307
			AGC + 10 dB	894.0000		-34.381
		Lower	AGC	868.9898		-34.263
			AGC + 10 dB	868.9994		-33.535
	CDMA	Upper	AGC	894.0000		-52.424
			AGC + 10 dB	894.0114		-50.576
		Lower	AGC	868.9391		-54.328
			AGC + 10 dB	868.9496		-54.085

Band	Signal	Edge	Input Level	Frequency (MHz)	Limit (dBm)	Emission (dBm)
AWS-1	GSM	Upper	AGC	2 155.009	-19	-46.677
			AGC + 10 dB	2 155.018		-40.150
		Lower	AGC	2 109.979		-44.841
			AGC + 10 dB	2 110.000		-38.754
	LTE 5 MHz	Upper	AGC	2 155.018		-38.733
			AGC + 10 dB	2 155.000		-36.774
		Lower	AGC	2 110.000		-35.489
			AGC + 10 dB	2 109.994		-34.527
	CDMA	Upper	AGC	2 155.000		-54.710
			AGC + 10 dB	2 155.000		-54.679
		Lower	AGC	2 109.997		-55.259
			AGC + 10 dB	2 109.997		-56.885
Broadband PCS	GSM	Upper	AGC	1 995.018		-48.769
			AGC + 10 dB	1 995.018		-40.446
		Lower	AGC	1 929.997		-48.114
			AGC + 10 dB	1 929.982		-39.727
	LTE 5 MHz	Upper	AGC	1 995.000		-42.065
			AGC + 10 dB	1 995.000		-43.239
		Lower	AGC	1 930.000		-37.705
			AGC + 10 dB	1 930.000		-36.980
	CDMA	Upper	AGC	1 995.006		-60.917
			AGC + 10 dB	1 995.003		-62.017
		Lower	AGC	1 929.949		-58.863
			AGC + 10 dB	1 929.949		-60.911

Plot data of Out-of-Band Emissions

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

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

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

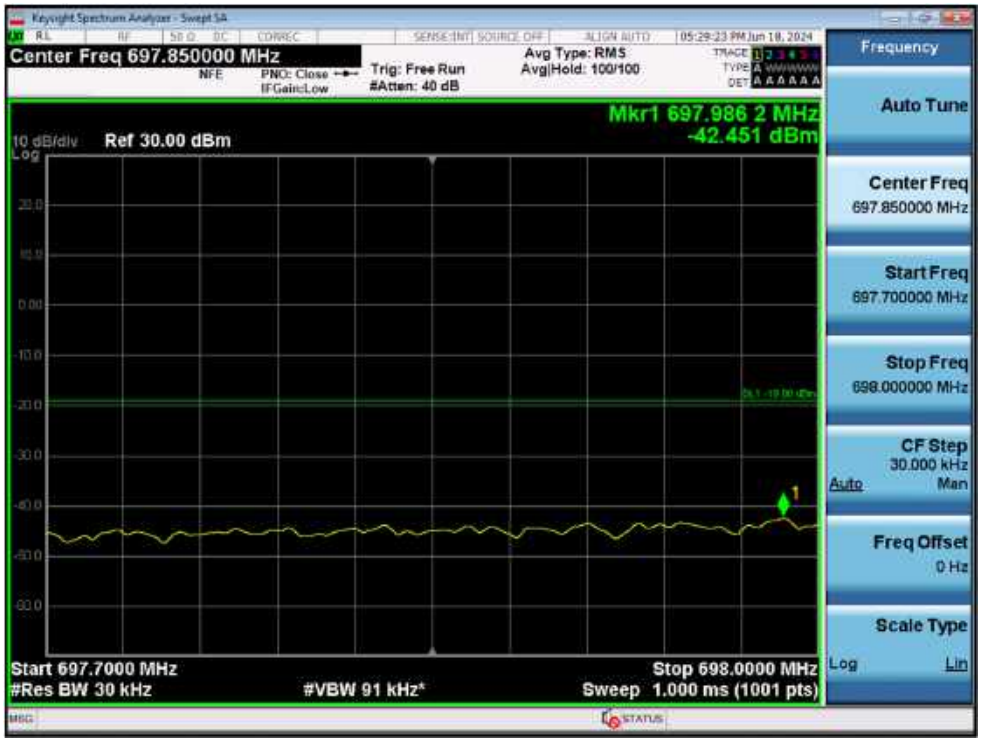
Out-of-Band Emissions / Lower 700 MHz / Uplink / LTE 5 MHz / Lower Edge / AGC threshold

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

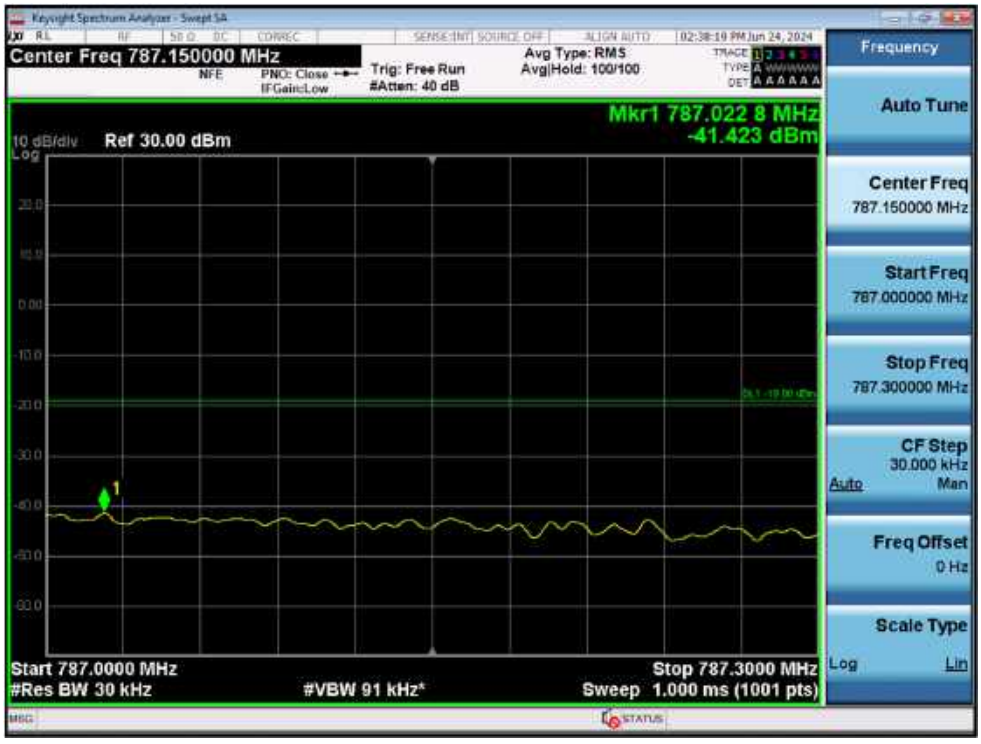
Out-of-Band Emissions / Upper 700 MHz / Uplink / LTE 5 MHz / Upper Edge / AGC threshold

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

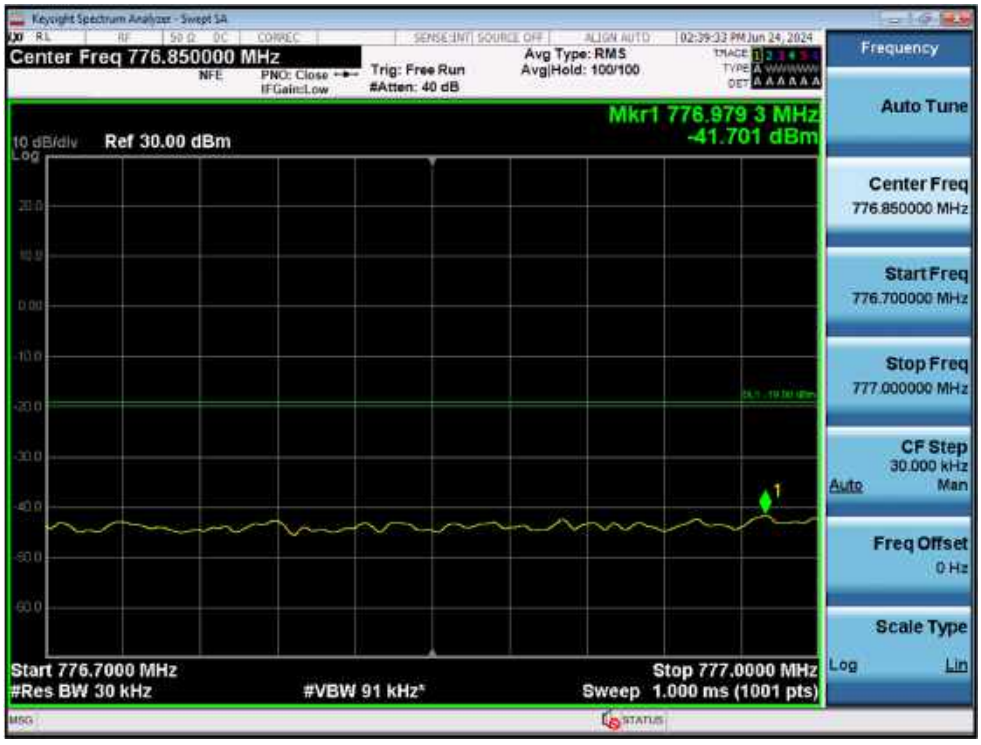
Out-of-Band Emissions / Upper 700 MHz / Uplink / CDMA / Upper Edge / AGC threshold



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

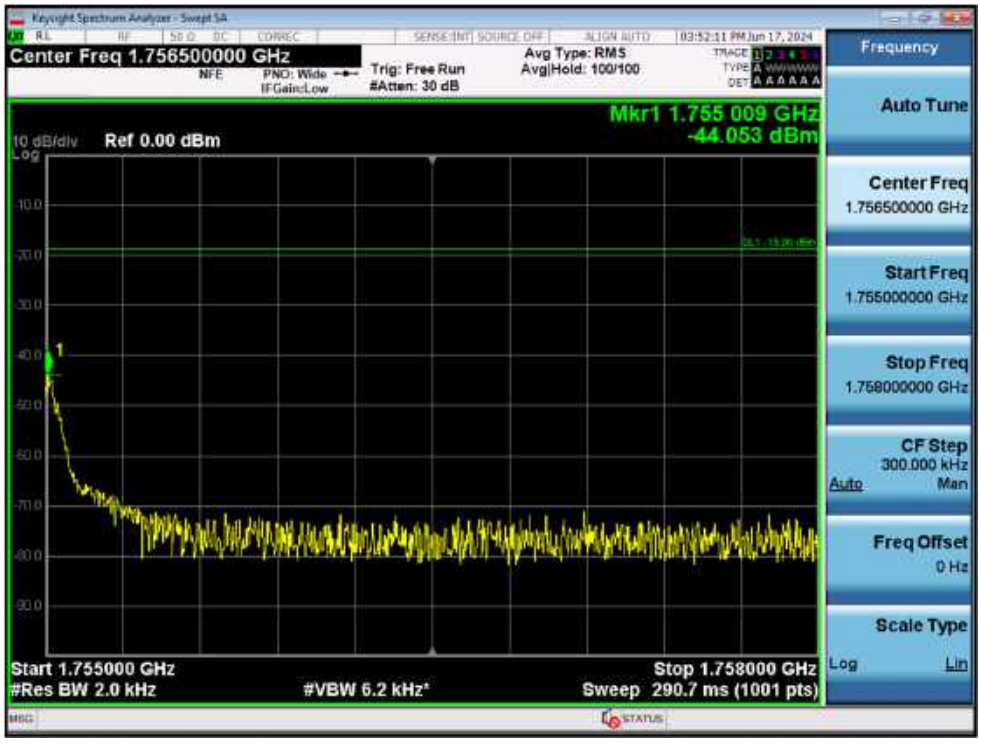
Out-of-Band Emissions / Cellular / Uplink / CDMA / Upper Edge / AGC threshold

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

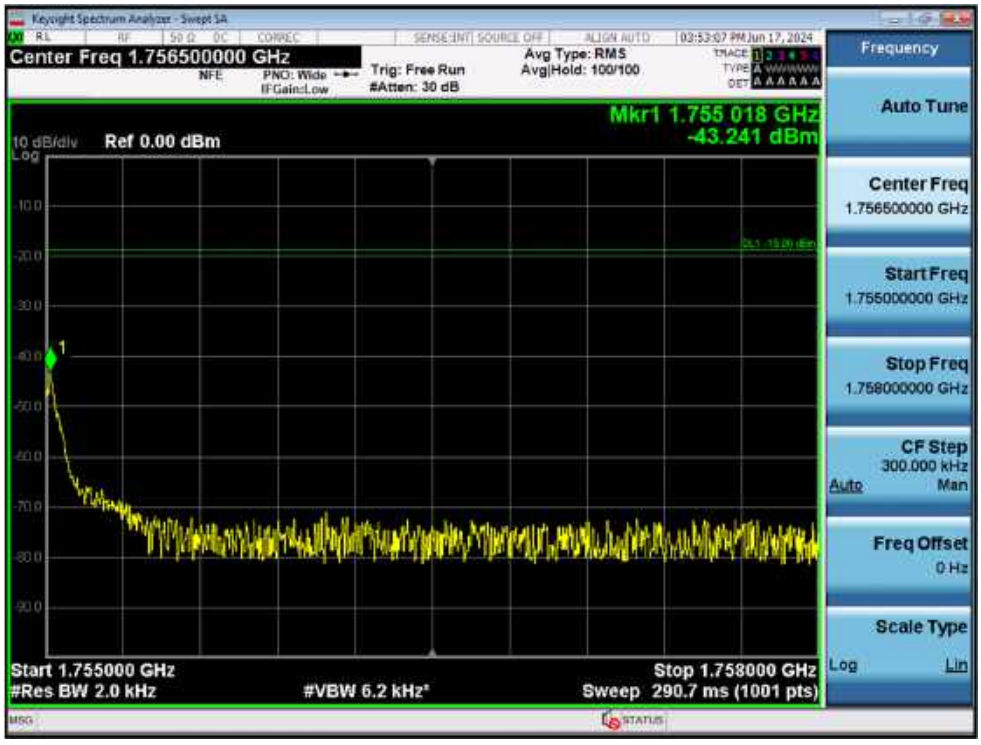
Out-of-Band Emissions / Cellular / Uplink / CDMA / Lower Edge / AGC threshold

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

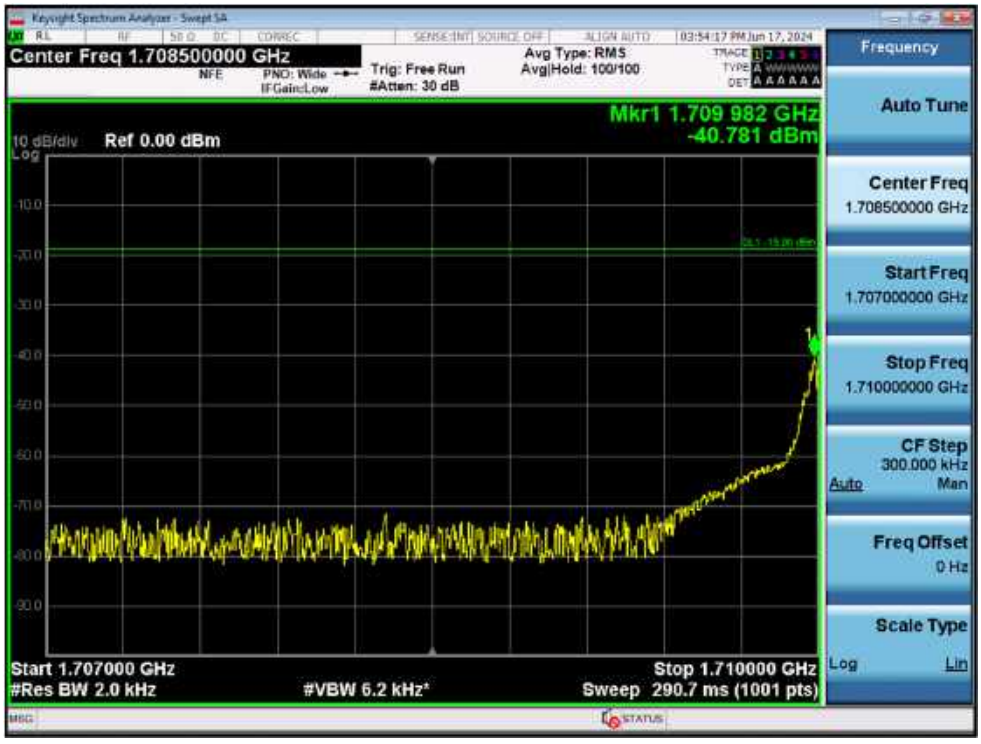
Out-of-Band Emissions / AWS-1 / Uplink / GSM / Upper Edge / AGC threshold



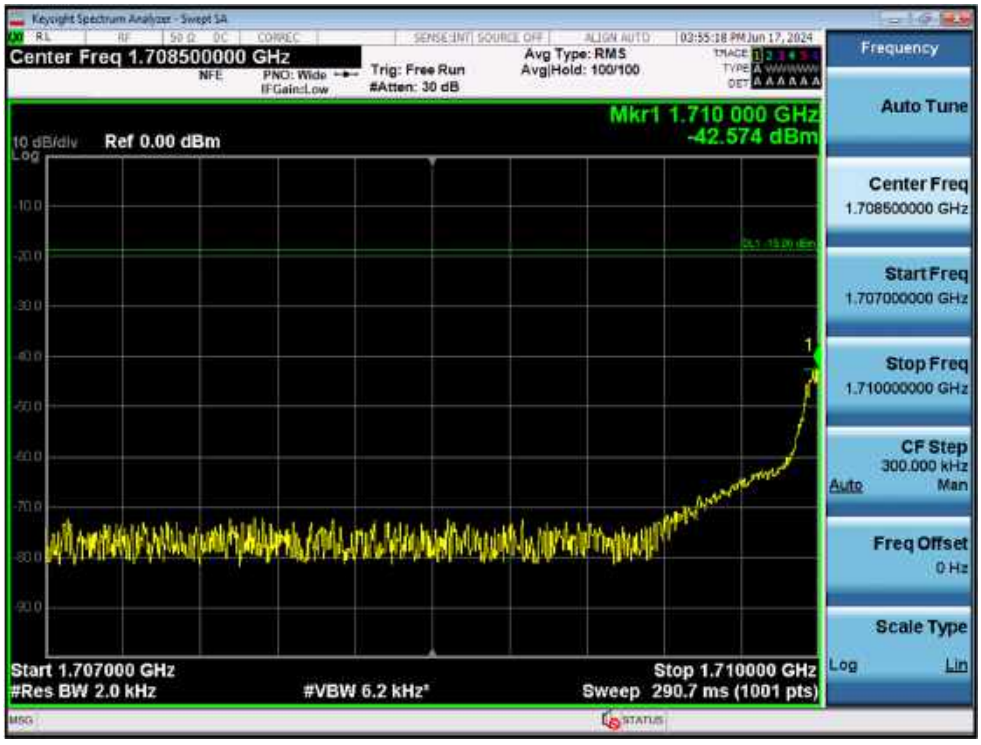
Out-of-Band Emissions / AWS-1 / Uplink / GSM / Upper Edge / AGC threshold +10 dB



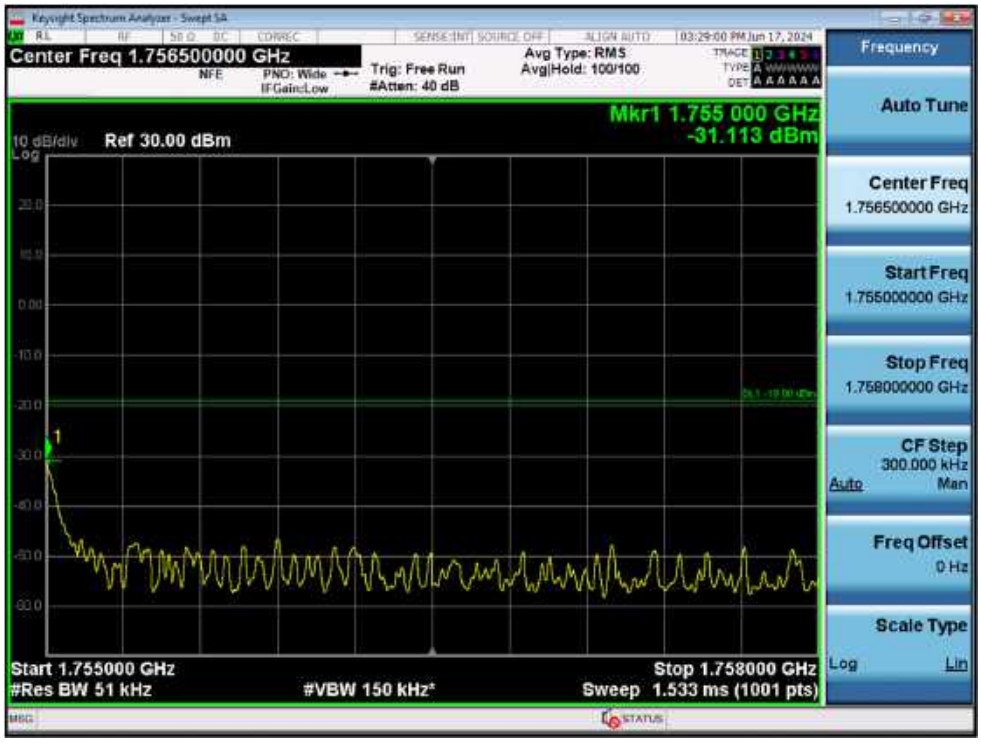
Out-of-Band Emissions / AWS-1 / Uplink / GSM / Lower Edge / AGC threshold



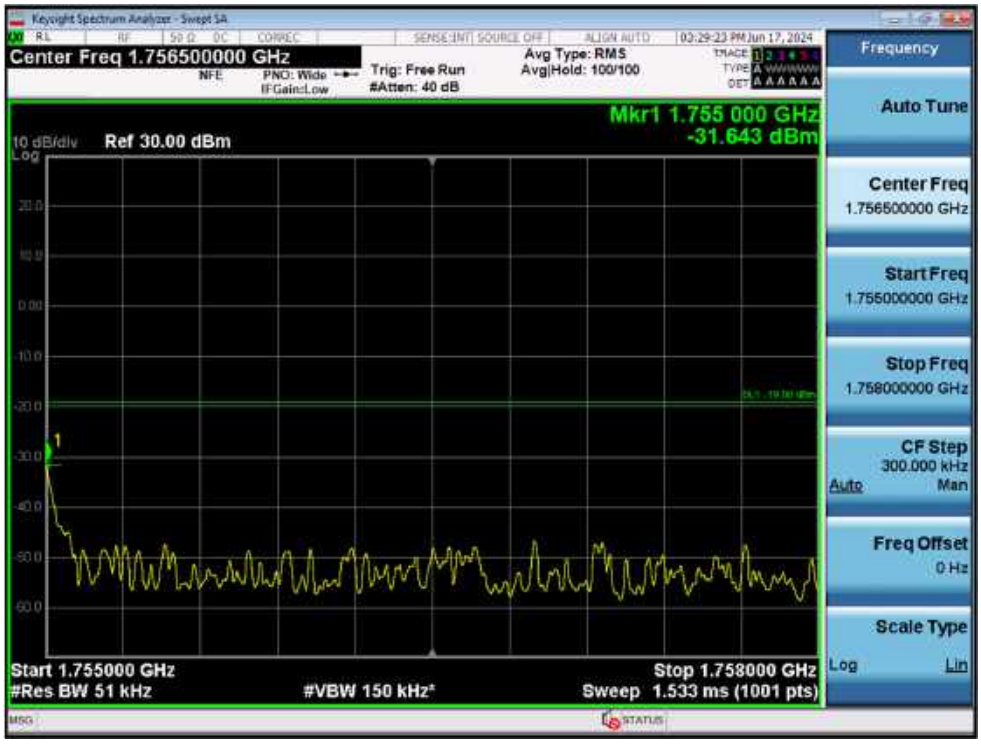
Out-of-Band Emissions / AWS-1 / Uplink / GSM / Lower Edge / AGC threshold +10 dB



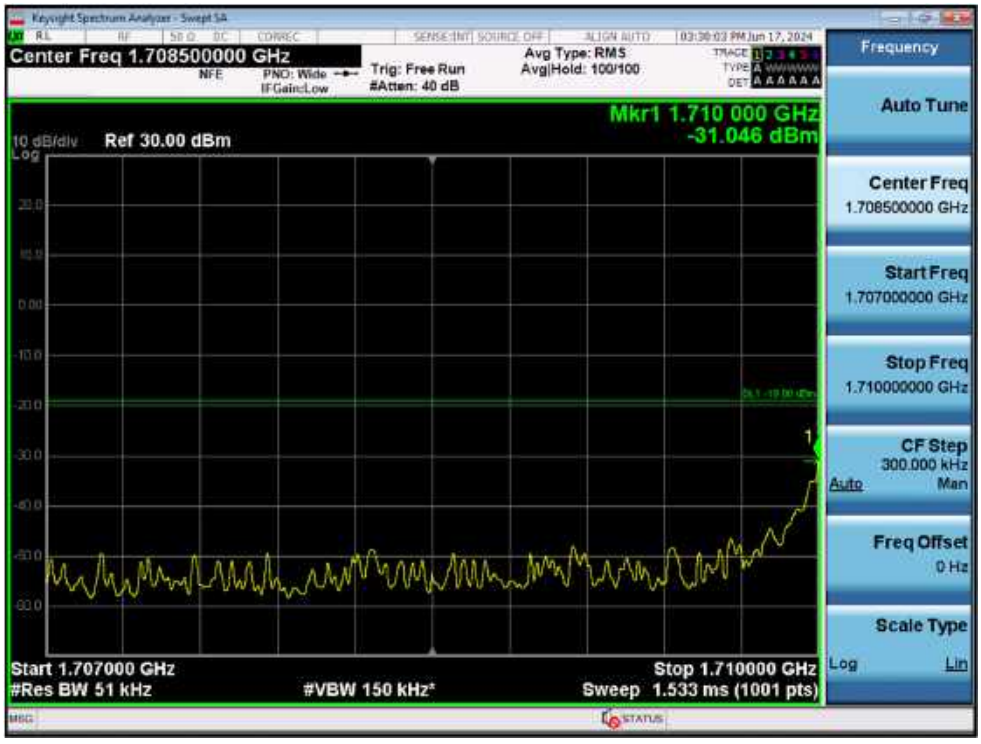
Out-of-Band Emissions / AWS-1 / Uplink / LTE 5 MHz / Upper Edge / AGC threshold



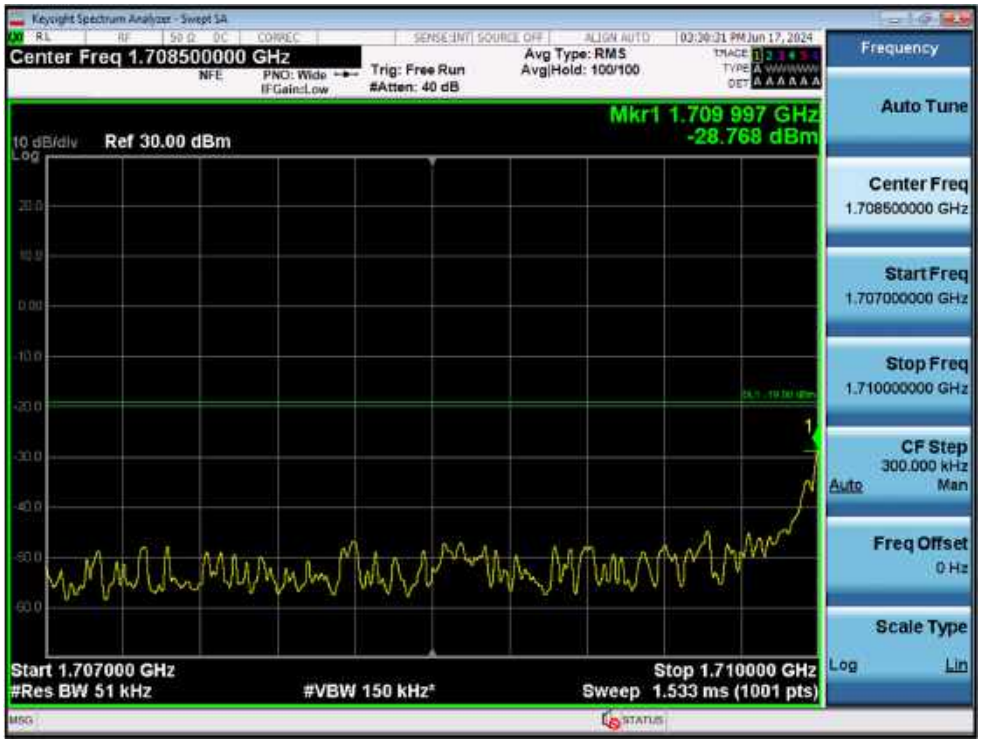
Out-of-Band Emissions / AWS-1 / Uplink / LTE 5 MHz / Upper Edge / AGC threshold +10 dB



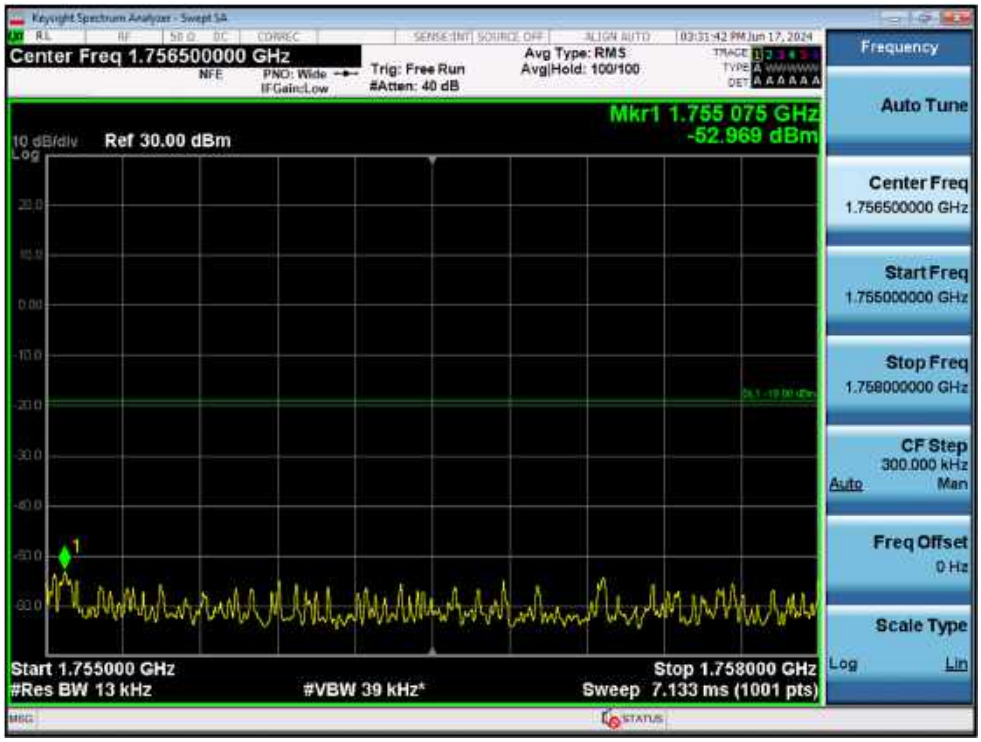
Out-of-Band Emissions / AWS-1 / Uplink / LTE 5 MHz / Lower Edge / AGC threshold



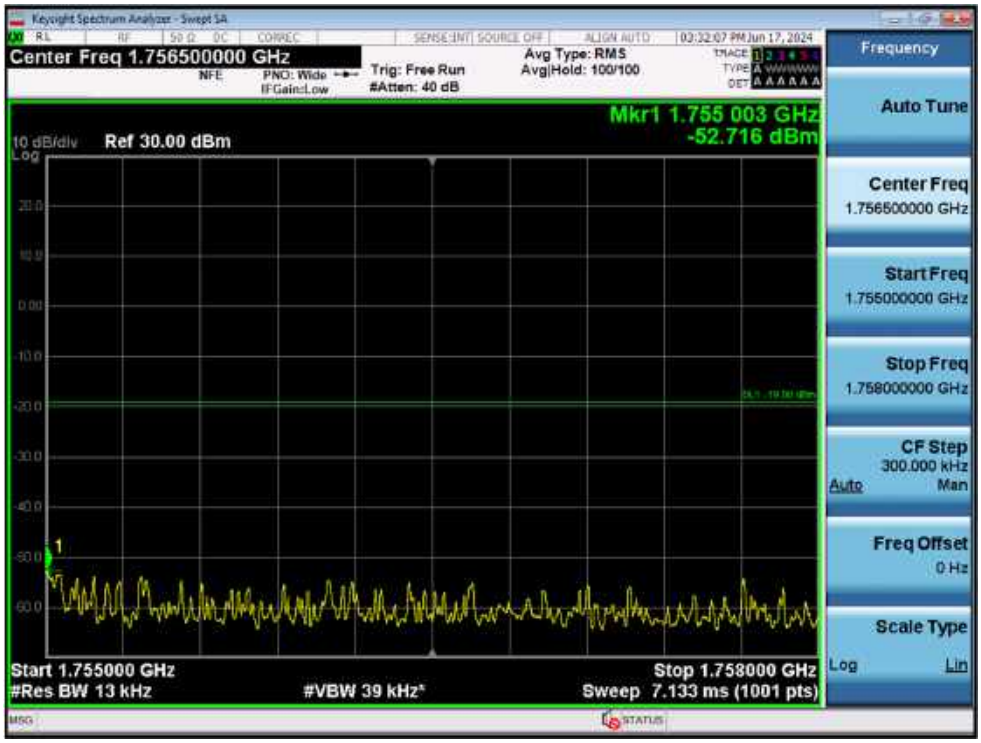
Out-of-Band Emissions / AWS-1 / Uplink / LTE 5 MHz / Lower Edge / AGC threshold +10 dB



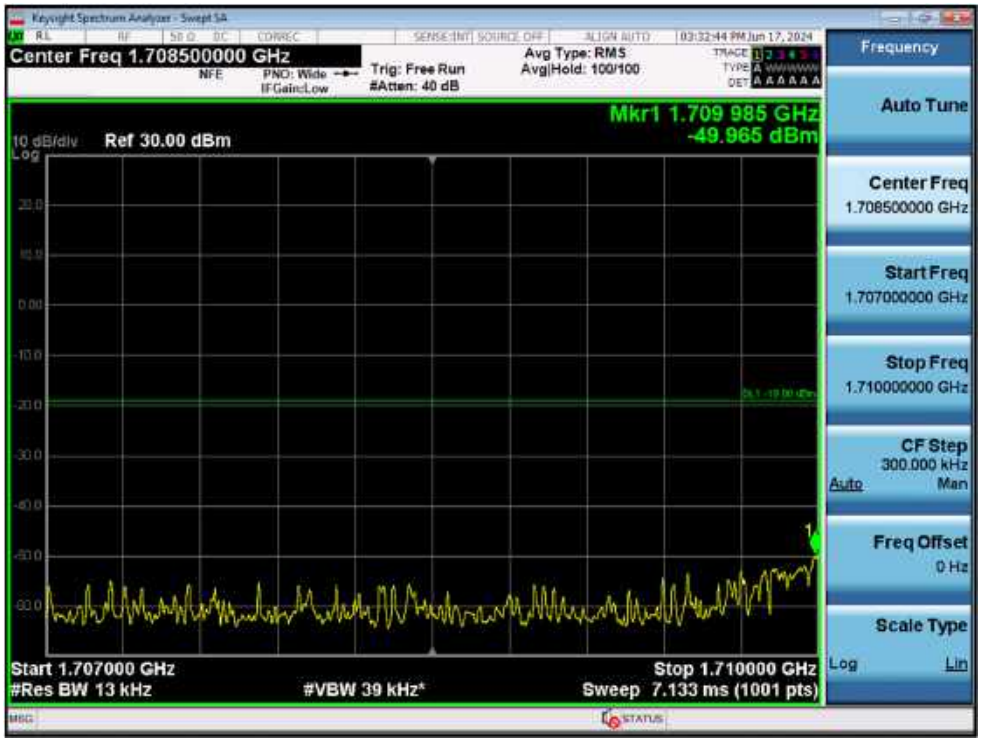
Out-of-Band Emissions / AWS-1 / Uplink / CDMA / Upper Edge / AGC threshold



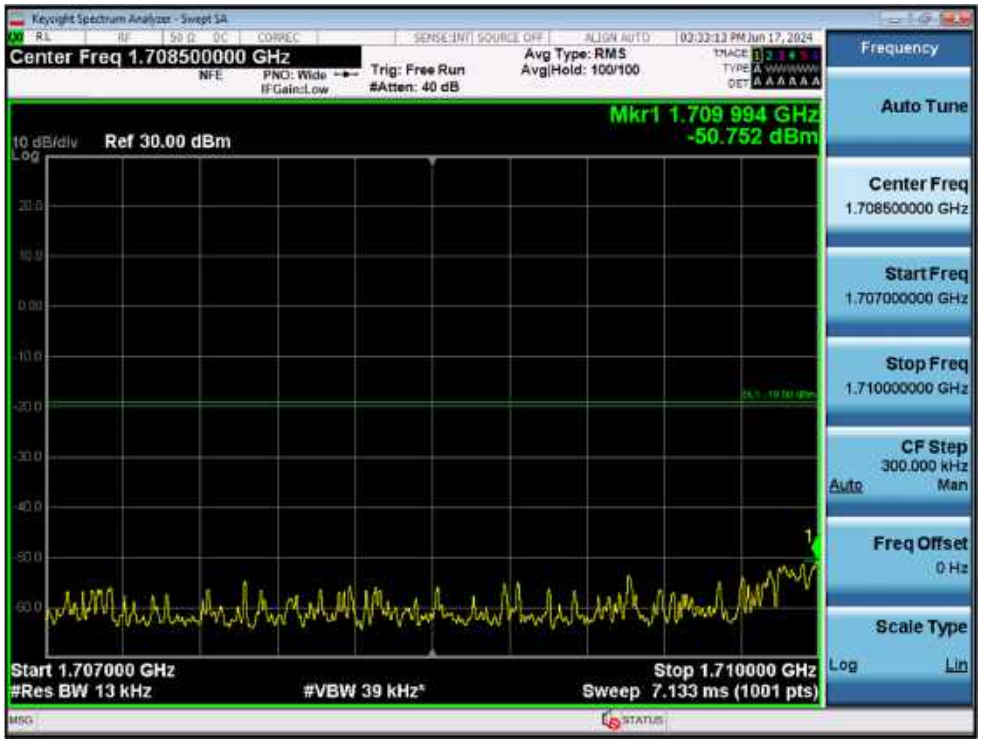
Out-of-Band Emissions / AWS-1 / Uplink / CDMA / Upper Edge / AGC threshold +10 dB



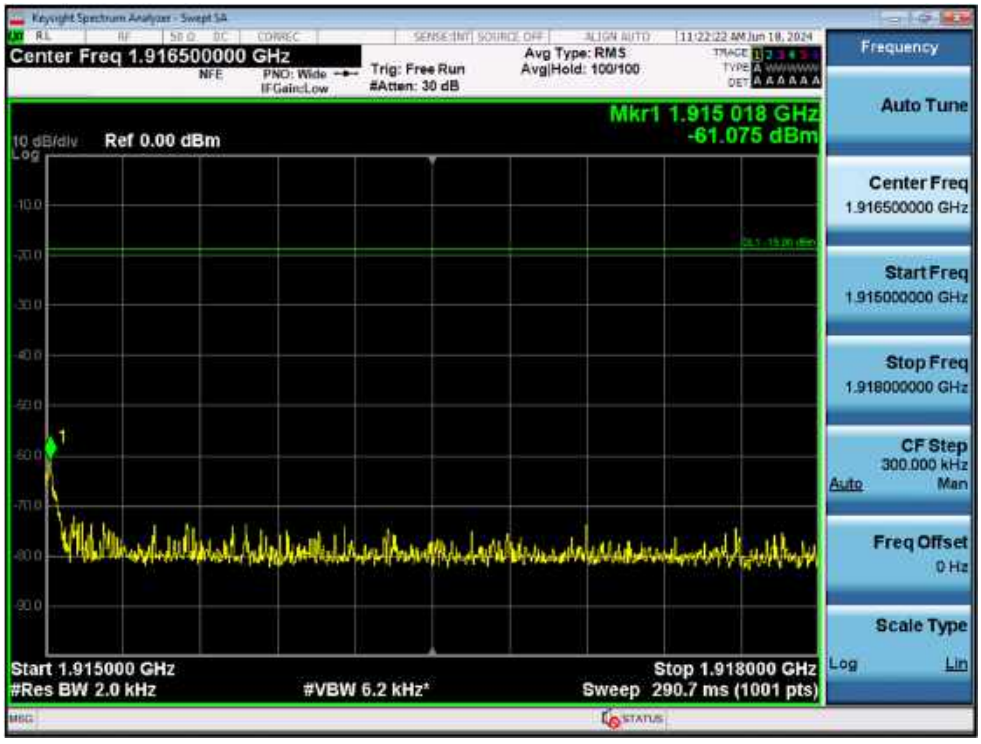
Out-of-Band Emissions / AWS-1 / Uplink / CDMA / Lower Edge / AGC threshold



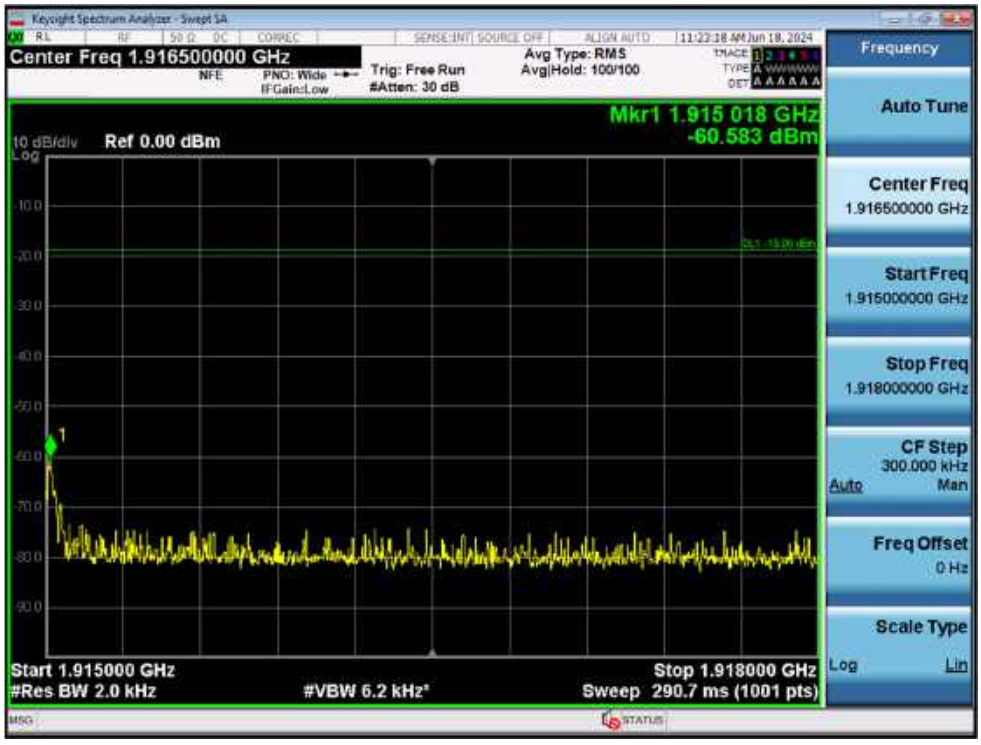
Out-of-Band Emissions / AWS-1 / Uplink / CDMA / Lower Edge / AGC threshold +10 dB



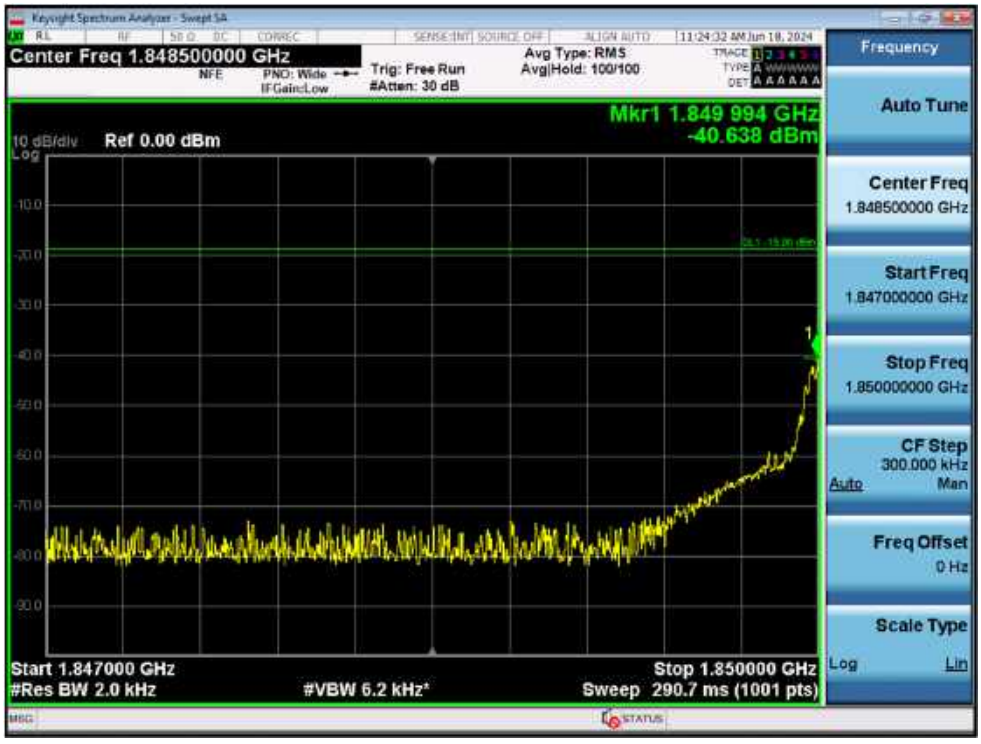
Out-of-Band Emissions / Broadband PCS / Uplink / GSM / Upper Edge / AGC threshold



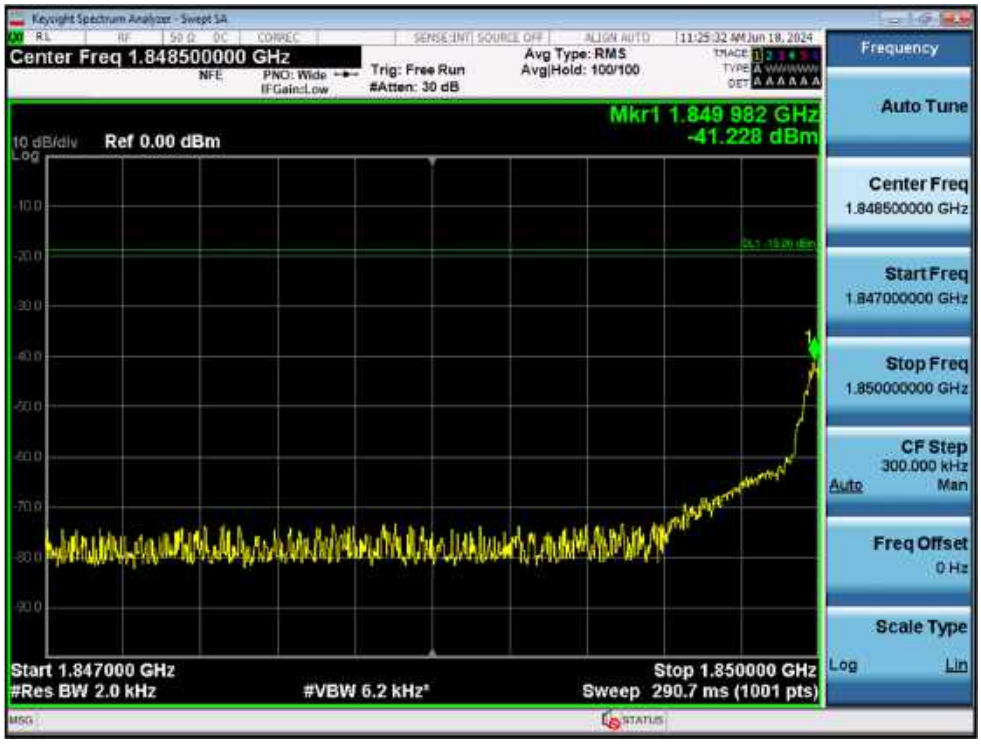
Out-of-Band Emissions / Broadband PCS / Uplink / GSM / Upper Edge / AGC threshold +10 dB



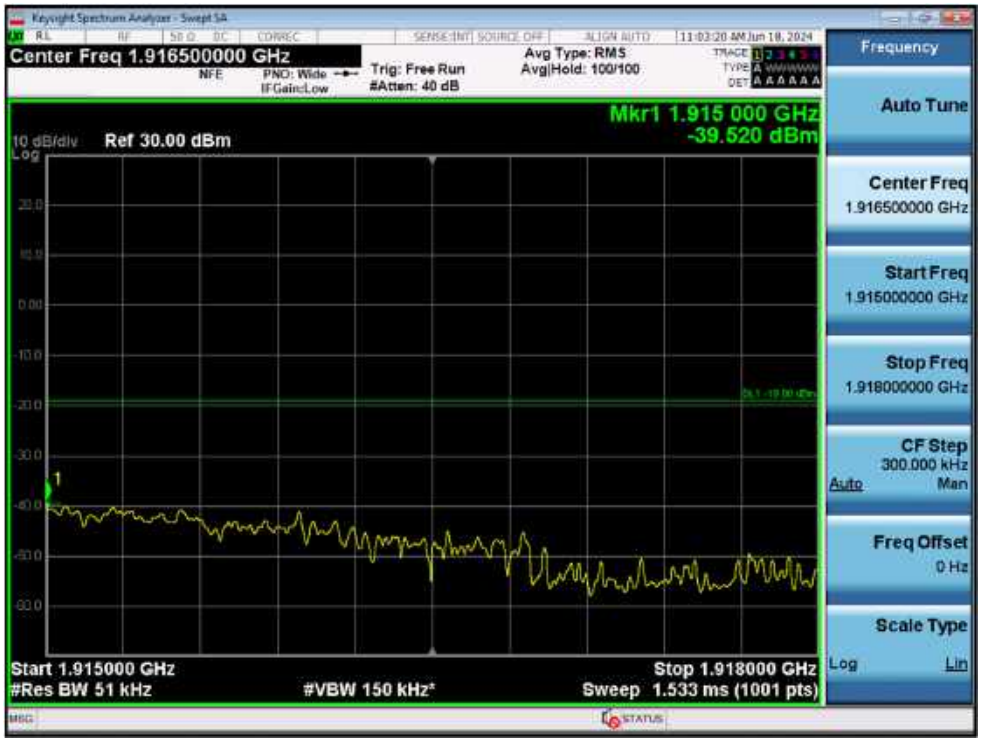
Out-of-Band Emissions / Broadband PCS / Uplink / GSM / Lower Edge / AGC threshold



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

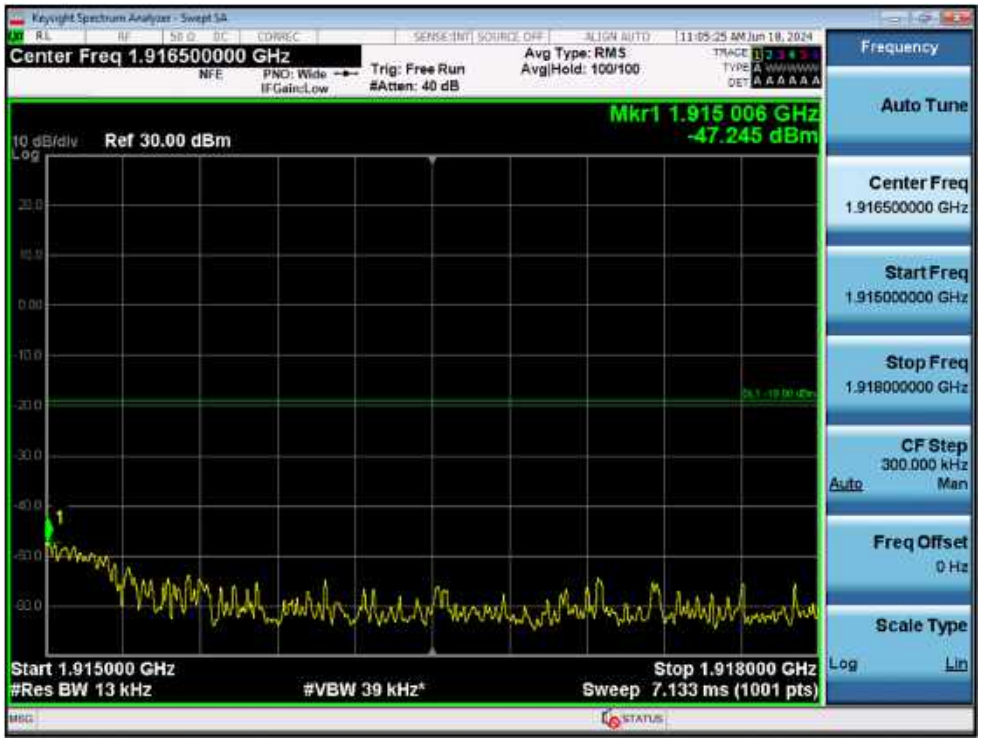


Out-of-Band Emissions / Broadband PCS / Uplink / LTE 5 MHz / Upper Edge / AGC threshold +10 dB

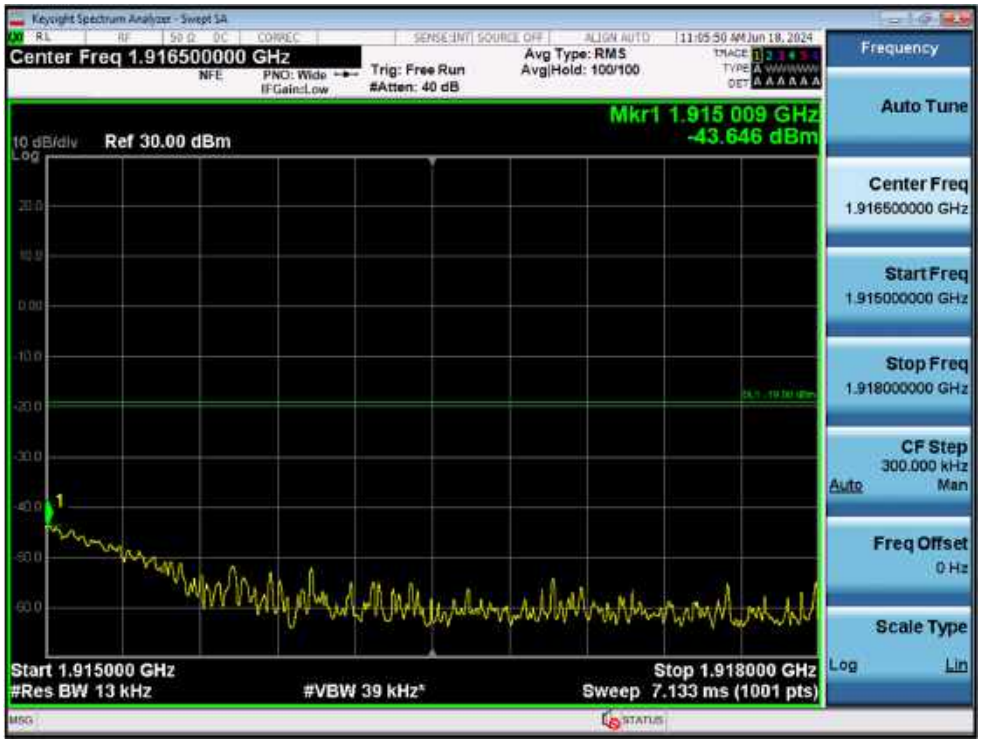
Out-of-Band Emissions / Broadband PCS / Uplink / LTE 5 MHz / Lower Edge / AGC threshold

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

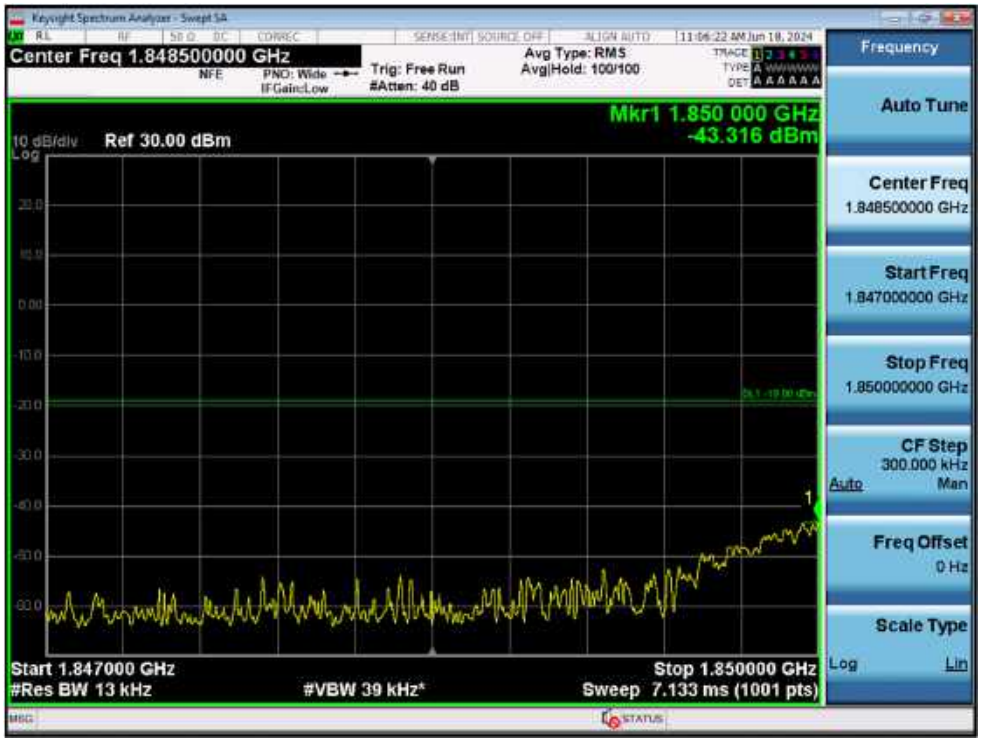
Out-of-Band Emissions / Broadband PCS / Uplink / CDMA / Upper Edge / AGC threshold



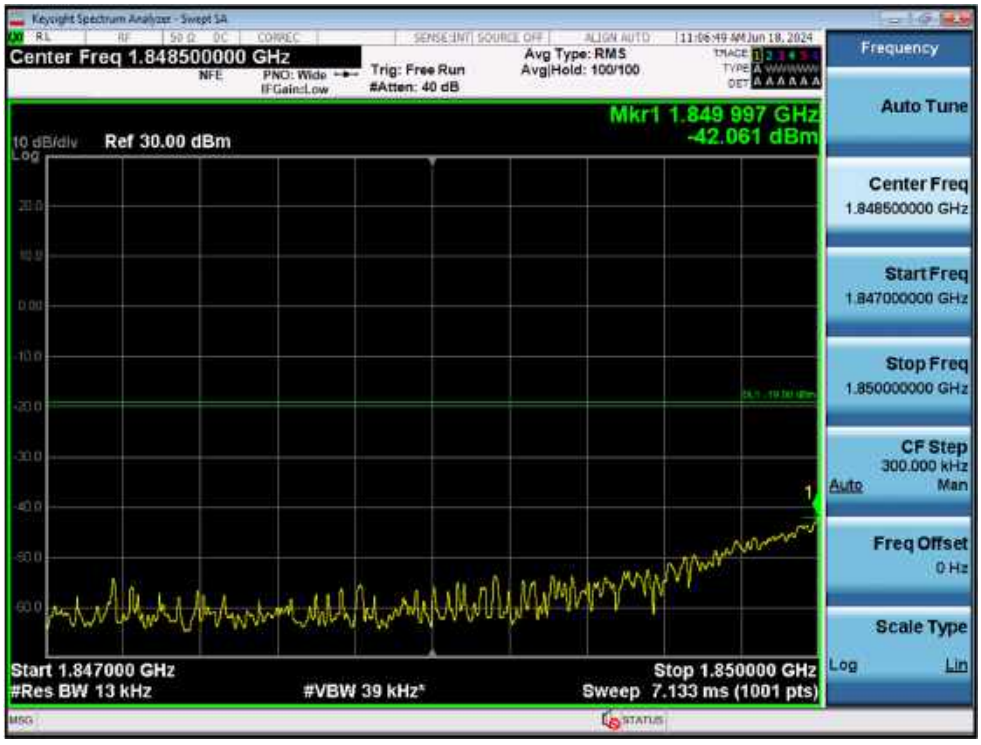
Out-of-Band Emissions / Broadband PCS / Uplink / CDMA / Upper Edge / AGC threshold +10 dB



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

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

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

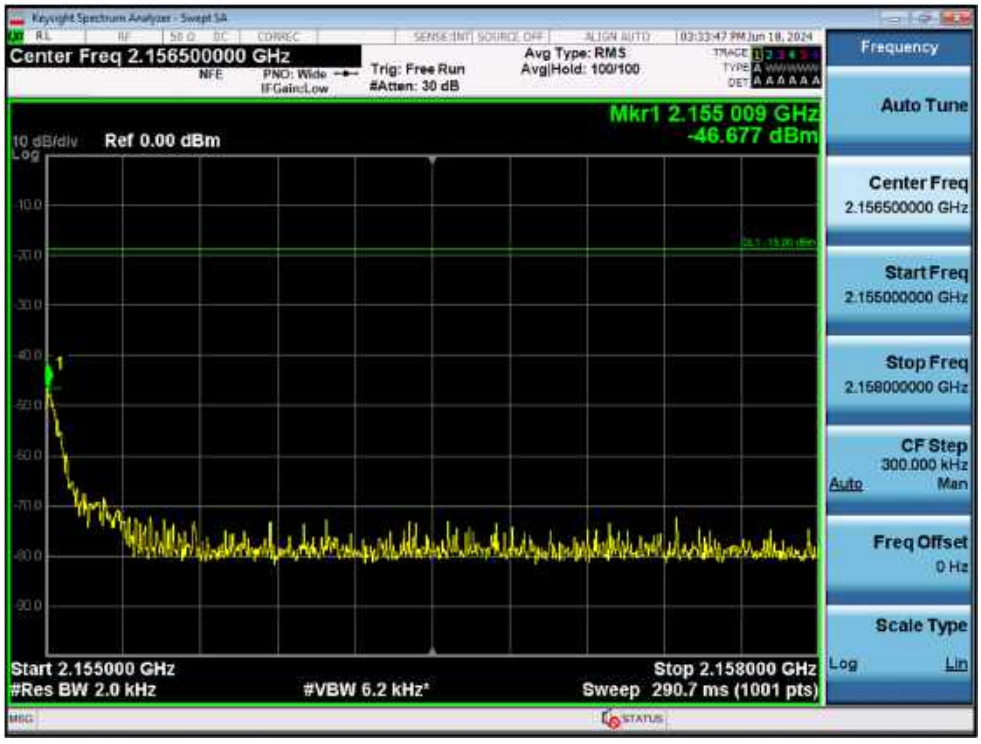
Out-of-Band Emissions / Cellular / Downlink / CDMA / Upper Edge / AGC threshold

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

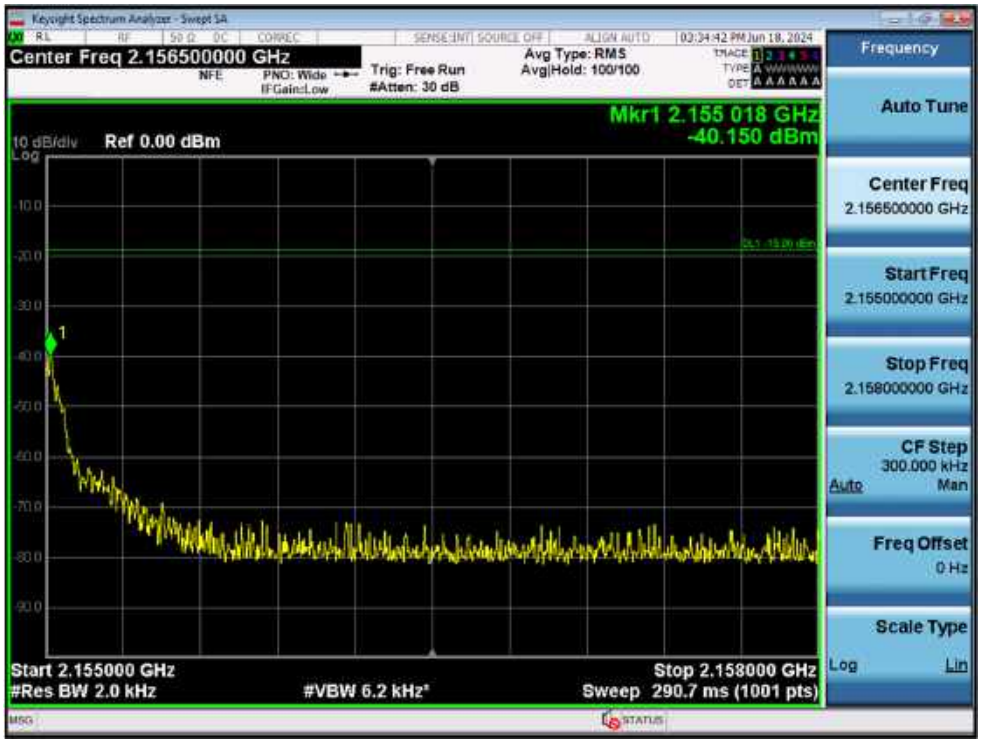
Out-of-Band Emissions / Cellular / Downlink / CDMA / Lower Edge / AGC threshold

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

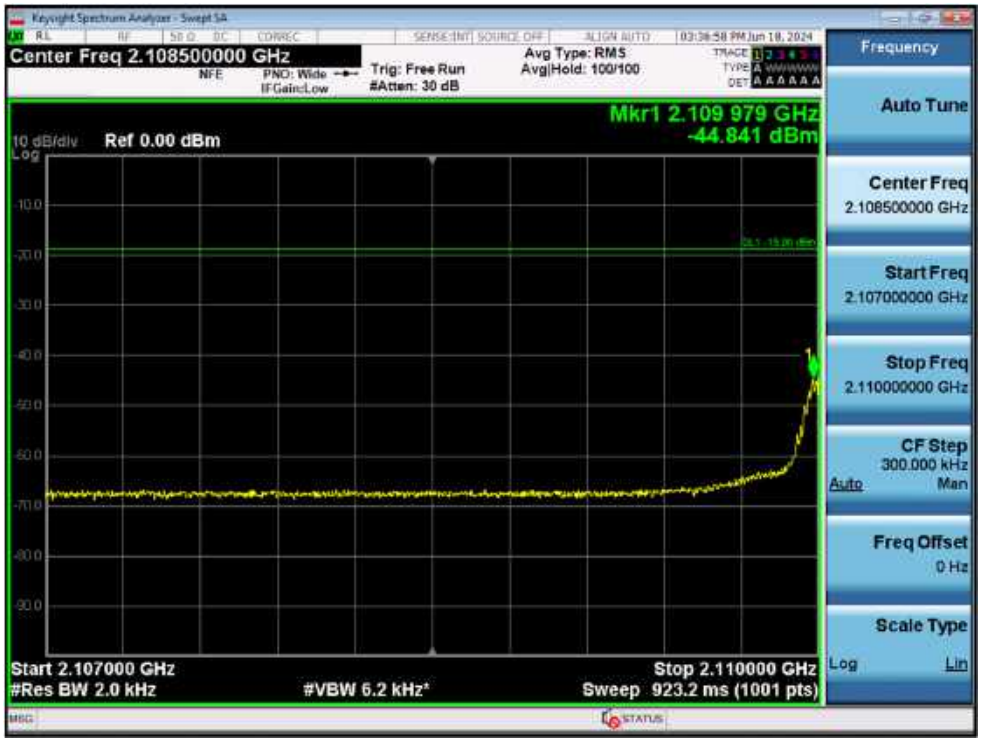
Out-of-Band Emissions / AWS-1 / Downlink / GSM / Upper Edge / AGC threshold



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



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



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

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

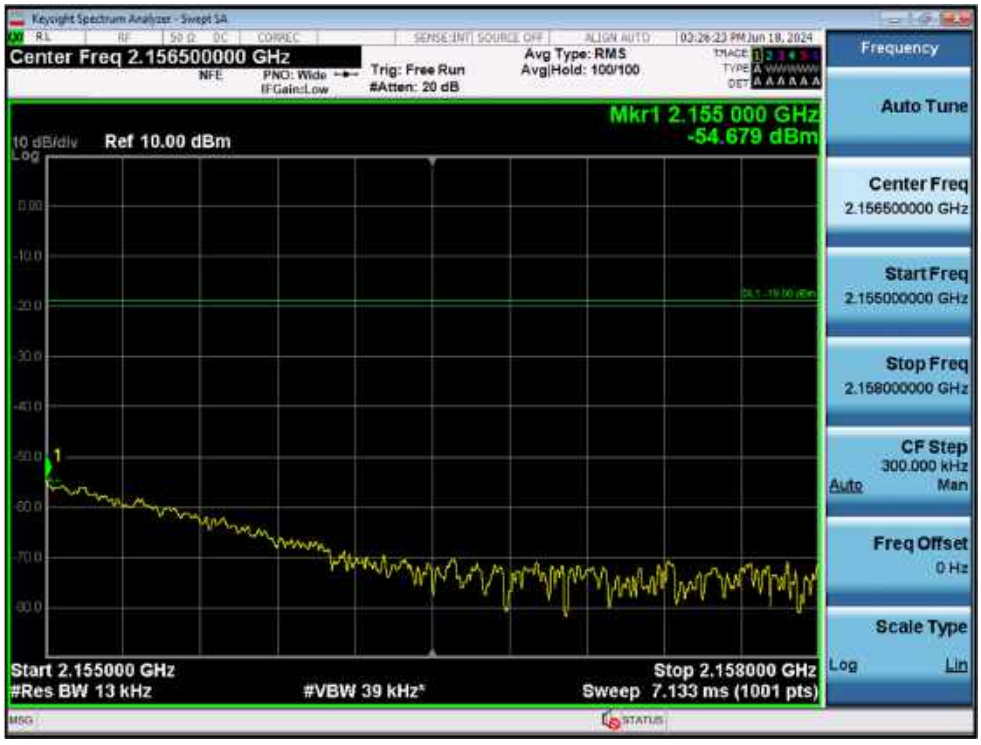
Out-of-Band Emissions / AWS-1 / Downlink / LTE 5 MHz / Upper Edge / AGC threshold +10 dB

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

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

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

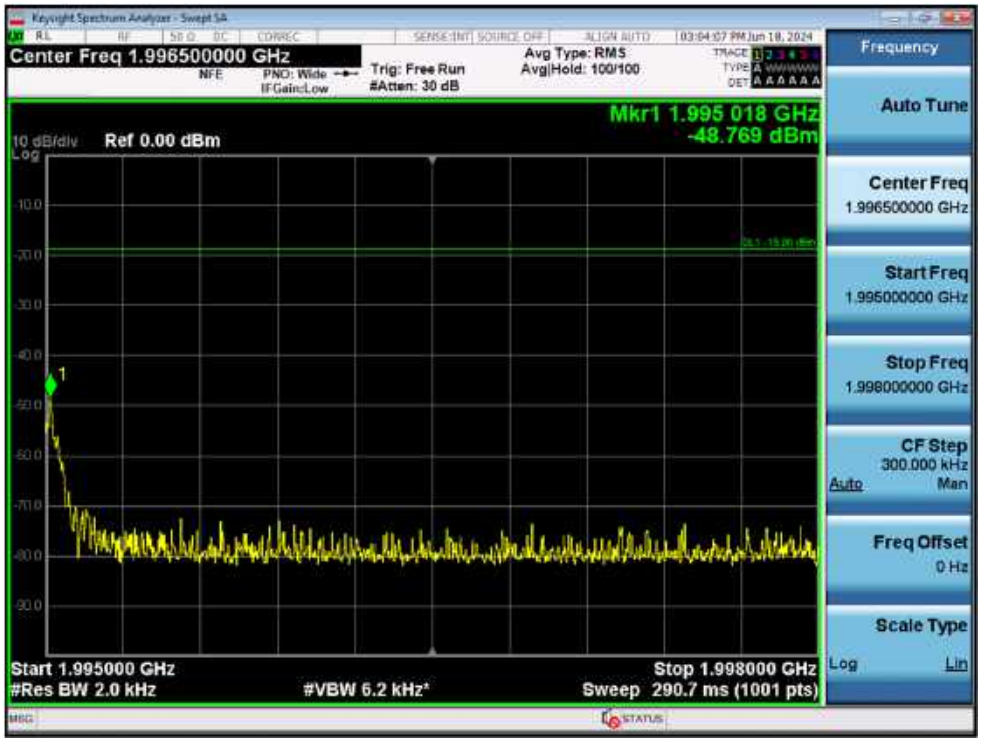
Out-of-Band Emissions / AWS-1 / Downlink / CDMA / Upper Edge / AGC threshold +10 dB



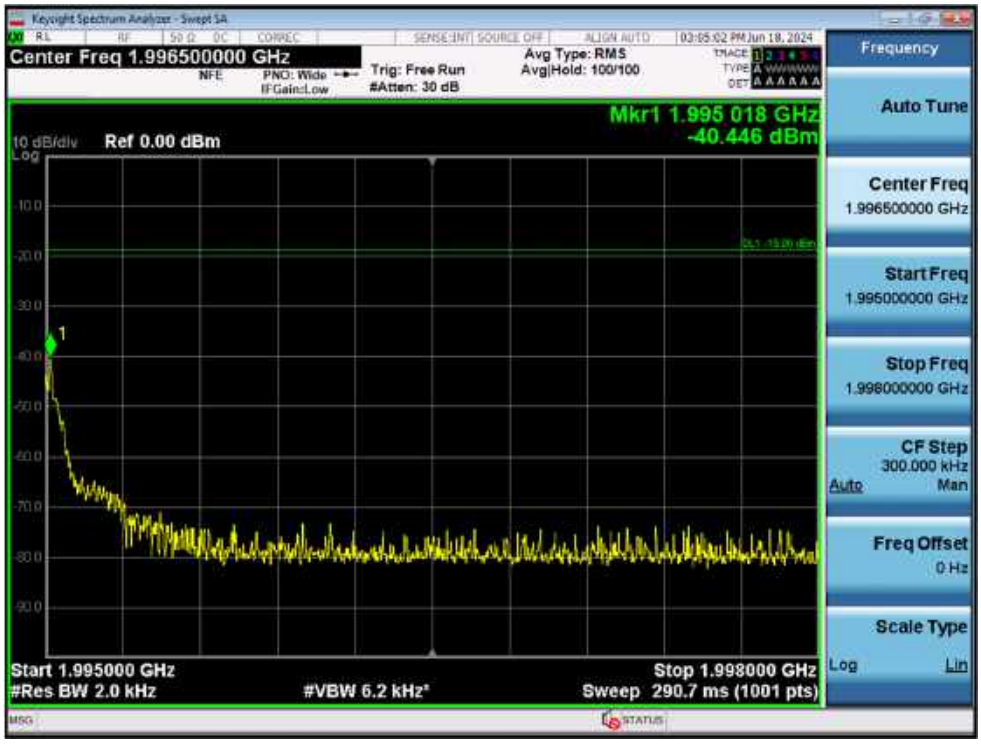
Out-of-Band Emissions / AWS-1 / Downlink / CDMA / Lower Edge / AGC threshold

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

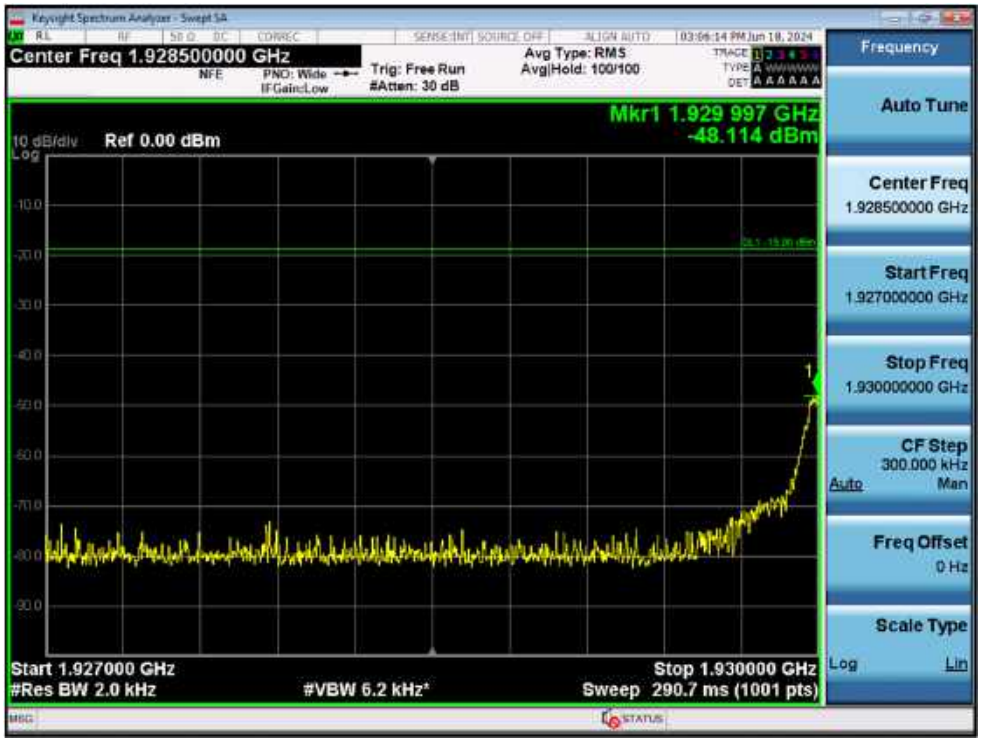
Out-of-Band Emissions / Broadband PCS / Downlink / GSM / Upper Edge / AGC threshold



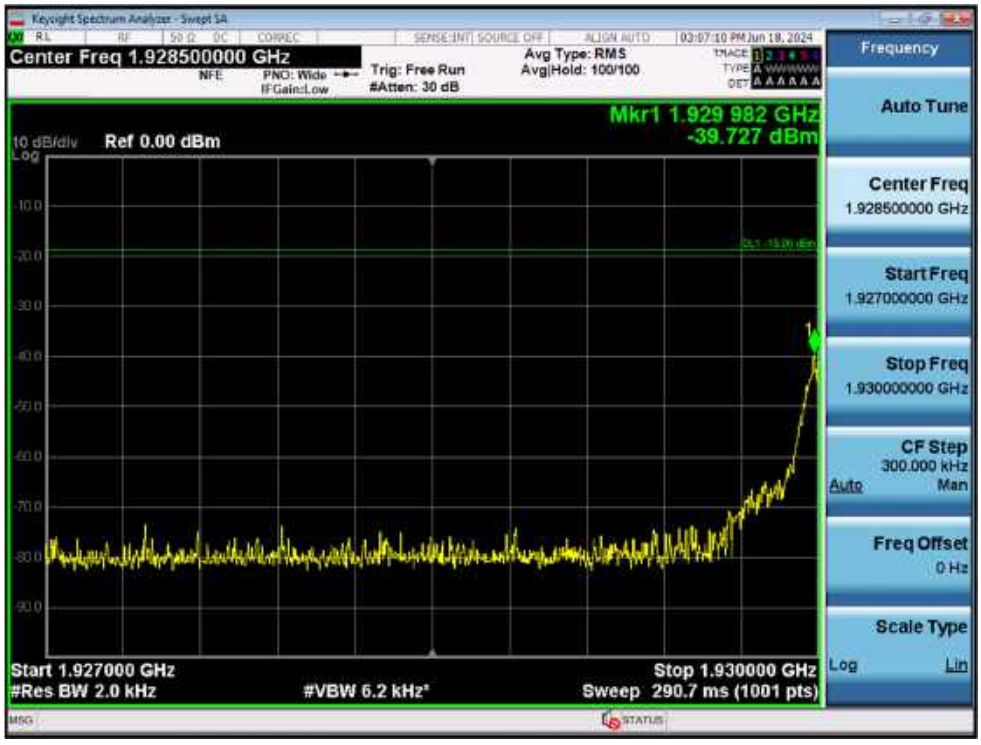
Out-of-Band Emissions / Broadband PCS / Downlink / GSM / Upper Edge / AGC threshold +10 dB



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



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



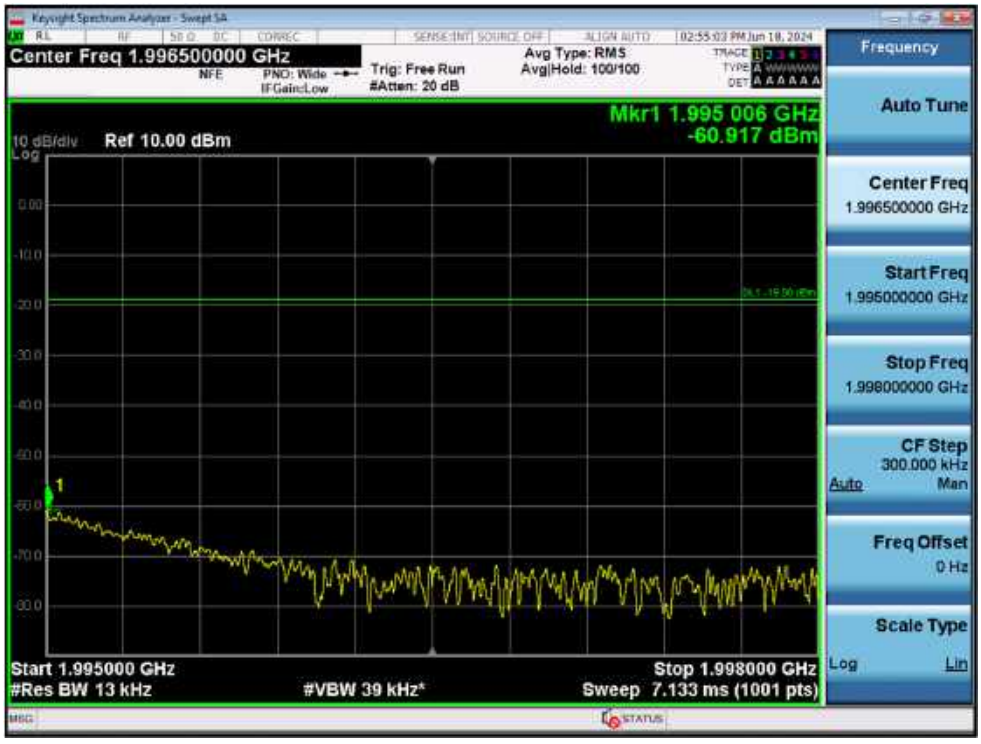
Out-of-Band Emissions / Broadband PCS / Downlink / LTE 5 MHz / Upper Edge / AGC threshold

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

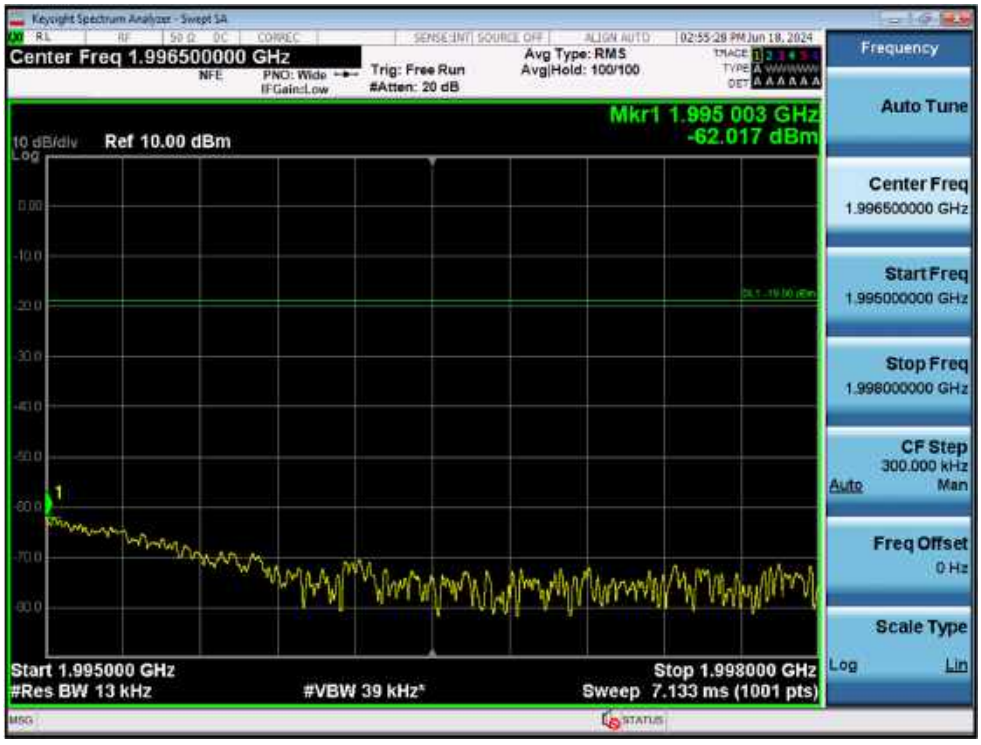
Out-of-Band Emissions / Broadband PCS / Downlink / LTE 5 MHz / Lower Edge / AGC threshold

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

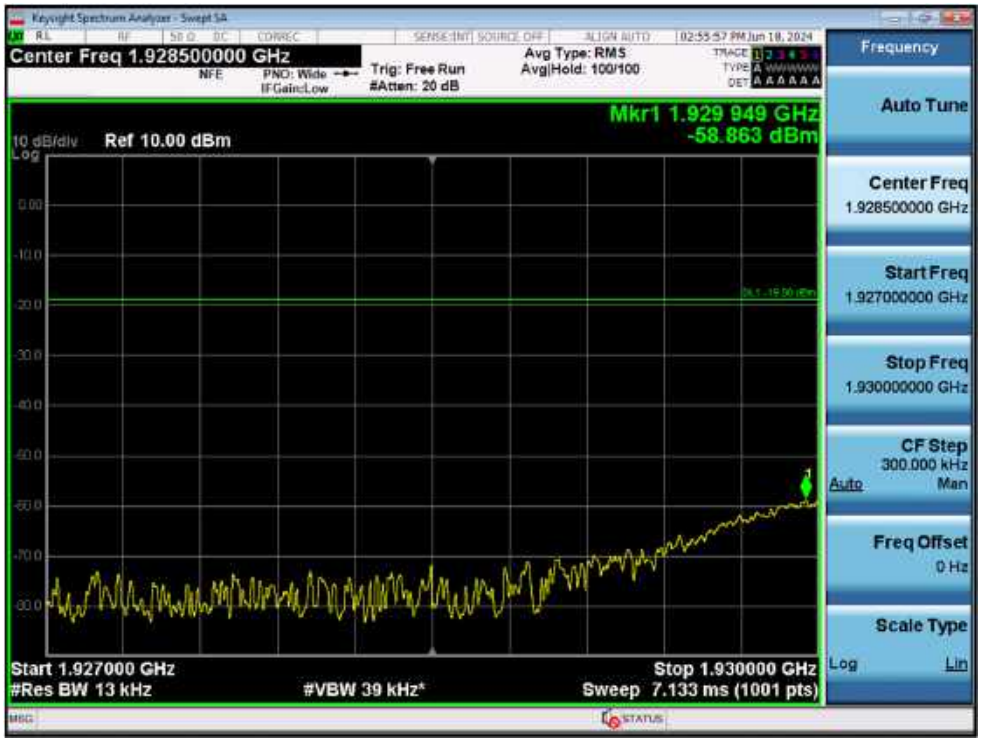
Out-of-Band Emissions / Broadband PCS / Downlink / CDMA / Upper Edge / AGC threshold



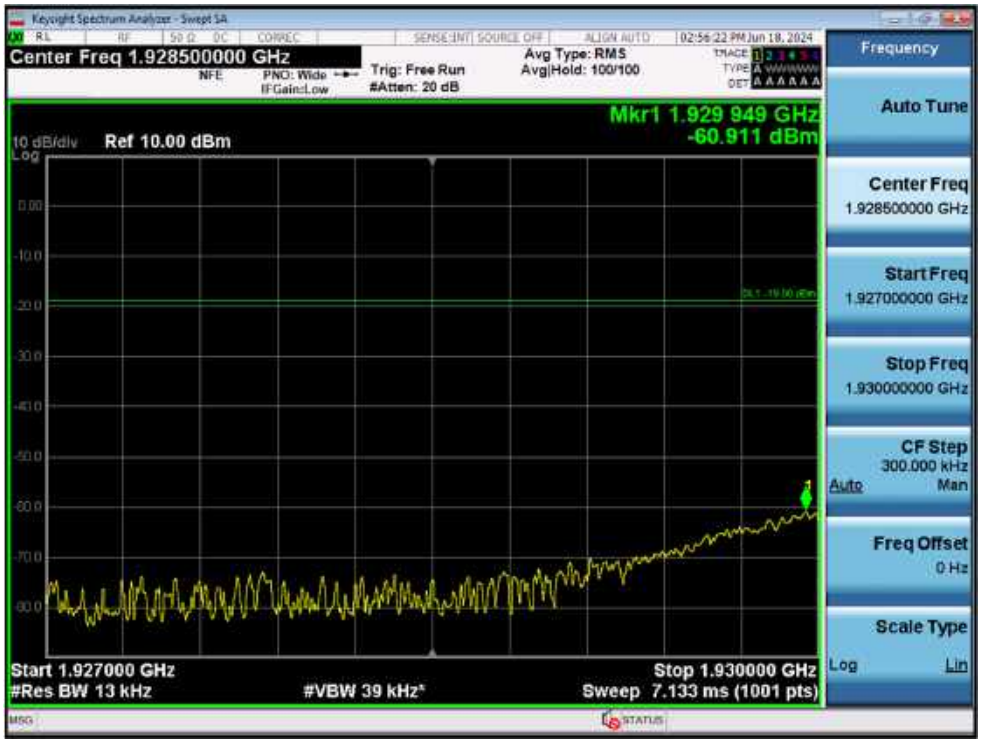
Out-of-Band Emissions / Broadband PCS / Downlink / CDMA / Upper Edge / AGC threshold +10 dB



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



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



5.6. CONDUCTED SPURIOUS EMISSIONS

Test Requirements:

§ 2.1051 Measurements required: Spurious emissions at antenna terminals.

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

§ 22.917 Emission limitations for cellular equipment.

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

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

(b) Measurement procedure. Compliance with these rules is based on the use of measurement instrumentation employing a reference bandwidth as follows:

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

(2) In the spectrum above 1 GHz, instrumentation should employ a reference bandwidth of 1 MHz.

§ 24.238 Emission limitations for Broadband PCS equipment.

The rules in this section govern the spectral characteristics of emissions in the Broadband Personal Communications Service.

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

(b) Measurement procedure. Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required

measurement bandwidth (i.e. 1 MHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

§ 27.53 Emission limits.

(c) For operations in the 746-758 MHz band and the 776-788 MHz band, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

(1) On any frequency outside the 746-758 MHz 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;

(2) On any frequency outside the 776-788 MHz 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;

(3) On all frequencies between 763-775 MHz and 793-805 MHz, by a factor not less than 76 + 10 log (P) dB in a 6.25 kHz band segment, for base and fixed stations;

(5) Compliance with the provisions of paragraphs (c)(1) and (c)(2) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least 30 kHz may be employed;

(6) Compliance with the provisions of paragraphs (c)(3) and (c)(4) of this section is based on the use of measurement instrumentation such that the reading taken with any resolution bandwidth setting should be adjusted to indicate spectral energy in a 6.25 kHz segment.

(f) For operations in the 746-758 MHz, 775-788 MHz, and 805-806 MHz bands, emissions in the band 1559-1610 MHz shall be limited to －70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and －80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

(g) For operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least 43 + 10 log (P) dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

(h) AWS emission limits

(1) General protection levels. Except as otherwise specified below, for operations 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 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least 43 + 10 log10 (P) dB.

(3) Measurement procedure.

(i) Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 megahertz bands immediately outside and adjacent to the licensee's frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

(ii) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the licensee's frequency block edges, both upper and lower, as the design permits.

(iii) The measurements of emission power can be expressed in peak or average values, provided they are expressed in the same parameters as the transmitter power.

Test Procedures:

Measurements were in accordance with the test methods section 7.6 of KDB 935210 D03 v04r04.

a) Begin with the uplink output (donor) port connected to the spectrum analyzer.

b) Configure the signal generator for AWGN with a 99% OBW of 4.1 MHz, with a center frequency corresponding to the center of the CMRS band under test.

c) Set the signal generator amplitude to the level determined in the power measurement procedure in 7.2.

d) Turn on the signal generator RF output and measure the spurious emission power levels with an appropriate measuring instrument as follows.

1) Set RBW = measurement bandwidth specified in the applicable rule section for the operational frequency band under consideration (see Appendix A for relevant cross-references). Note that many of the individual rule sections permit the use of a narrower RBW [typically ≥ 1% of the emission bandwidth (EBW)] to enhance measurement accuracy, but the result must then be integrated over the specified measurement bandwidth.

2) Set VBW = 3 x RBW.

3) Select the power averaging (rms) detector.

4) Sweep time = auto-couple.

5) Set the analyzer start frequency to the lowest radio frequency signal generated in the equipment, without going below 9 kHz, and the stop frequency to the lower band/block edge frequency minus 100 kHz or 1 MHz, as specified in the applicable rule part. Note that the number of measurement points in each sweep must be ≥ (2 x span/RBW), which may require that the measurement range defined by the preceding start and stop frequencies be subdivided, depending on the available number of measurement points of the spectrum analyzer. Trace average at least 10 traces in power averaging (i.e., rms) mode.

6) Use the peak marker function to identify the highest amplitude level over each measured frequency range. Record the frequency and amplitude and capture a plot for inclusion in the test report.

7) Reset the analyzer start frequency to the upper band/block edge frequency plus 100 kHz or 1 MHz, as specified in the applicable rule part, and the analyzer stop frequency to 10 times the highest frequency of the fundamental emission. Note that the number of measurement points in each sweep must be ≥ (2 x span/RBW) which may

require that the measurement range defined by the start and stop frequencies above be subdivided, depending on the available number of measurement points provided by the spectrum analyzer.

8) Use the peak marker function to identify the highest amplitude level over each of the measured frequency ranges. Record the frequency and amplitude and capture a plot for inclusion in the test report.

e) Repeat b) through d) for each supported frequency band of operation.

Note1. Except band of upper 700 MHz, '43 + 10 Log (Power) = -13 dBm' limit is applied for all spurious test.
For upper 700 MHz band, in 763-775 MHz and 793-805 MHz '76 + 10 log (Power) = -46 dBm (6.25 kHz RBW)' limit is applied. Additionally in 1559-1610 MHz shall be limited to －70 dBW/MHz (-40 dBm, 1 MHz RBW) EIRP for wideband signals.

Note2. Coupling In 9 kHz-150 kHz and 150 kHz-30 MHz bands, RBW was reduced to 1 kHz and 10 kHz and correction factor was applied according to section 5.7.2 of ANSI C63.26-2015.

Band	9 ~ 150 kHz Correction	150 kHz ~ 30 MHz Correction
Below 1 GHz (Ref.RBW: 100 kHz)	20 dB	10 dB
Above 1 GHz (Ref.RBW: 1 MHz)	30 dB	20 dB

Note3. RBW and Band Separation is according to note 1 of out-of-band emissions test in this report

Test Results:

Tabulated Result of Uplink Conducted Spurious Emissions

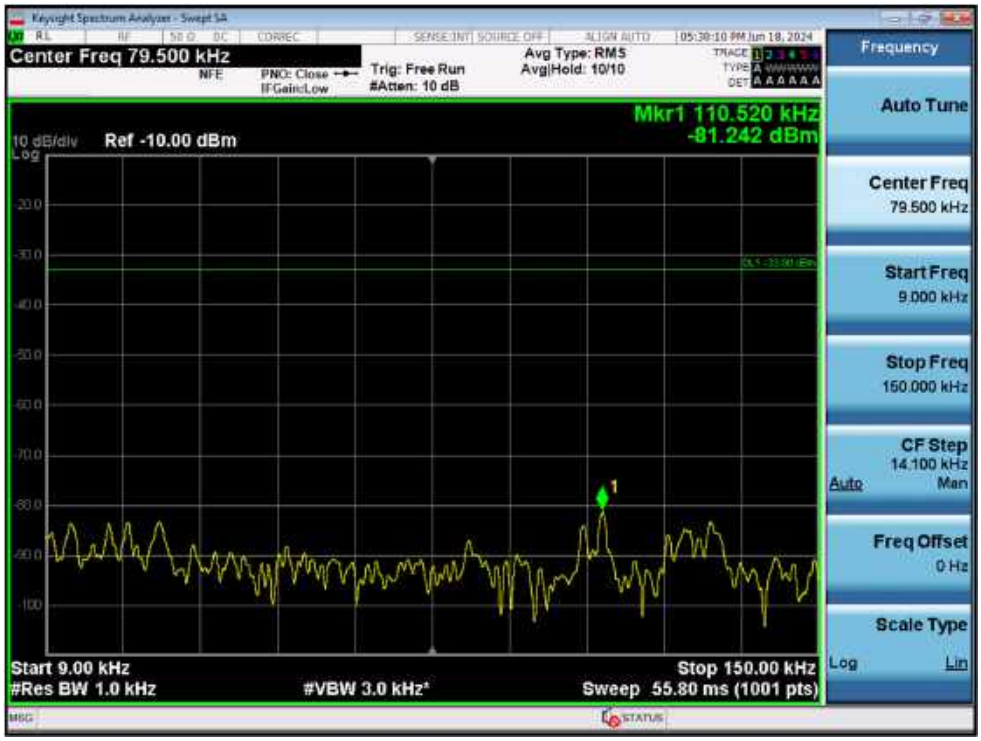
Band	Range (MHz)	Frequency (MHz)	Limit (dBm)	Spurious Emission (dBm)
Lower 700 MHz	0.009 ~ 0.15	0.110520	-13	-61.242
	0.15 ~ 30	0.175		-70.429
	30 ~ 697.9	697.63		-51.375
	716.1 ~ 2,000	780.38		-48.243
	2,000 ~ 4,000	2 120.65		-56.099
	4,000 ~ 6,000	4 980.60		-58.769
	6,000 ~ 8,000	6 008.65		-58.360
Upper 700 MHz	0.009 ~ 0.15	0.012243		-58.234
	0.15 ~ 30	0.657		-67.965
	30 ~ 776.9	775.97		-43.215
	787.1 ~ 2,000	787.26		-41.525
	2,000 ~ 4,000	2 344.95		-58.480
	4,000 ~ 6,000	4 945.00		-58.394
	6,000 ~ 8,000	6 342.30		-57.885
	763 ~ 775	774.91	-46	-59.081
	793 ~ 805	793.07		-69.046
	1,559 ~ 1,610 (1 MHz)	1 563.90	-40	-48.378
	1,559 ~ 1,610 (700 Hz)-1	1 563.94	-50	-77.572
	1,559 ~ 1,610 (700 Hz)-2	1 579.75		-89.461
	1,559 ~ 1,610 (700 Hz)-3	1 587.35		-90.389
	1,559 ~ 1,610 (700 Hz)-4	1 609.86		-90.473
Cellular	0.009 ~ 0.15	0.024510	-13	-61.081
	0.15 ~ 30	0.155		-67.188
	30 ~ 823	817.01		-54.105
	850 ~ 1,000	850.23		-57.184
	1,000 ~ 10,000	8 967.25		-39.392
AWS-1	0.009 ~ 0.15	0.110520		-36.388
	0.15 ~ 30	0.737		-52.549
	30 ~ 1709	1 705.14		-43.627
	1756 ~ 10,000	8 917.98		-39.054
	10,000 ~ 26,500	26 108.54		-25.080
Broadband PCS	0.009 ~ 0.15	0.026202		-46.177
	0.15 ~ 30	0.329		-61.060
	30 ~ 1849	1 848.82		-44.357
	1916 ~ 10,000	8 614.00		-39.928
	10,000 ~ 26,500	26 101.11		-27.426

Tabulated Result of Downlink Conducted Spurious Emissions

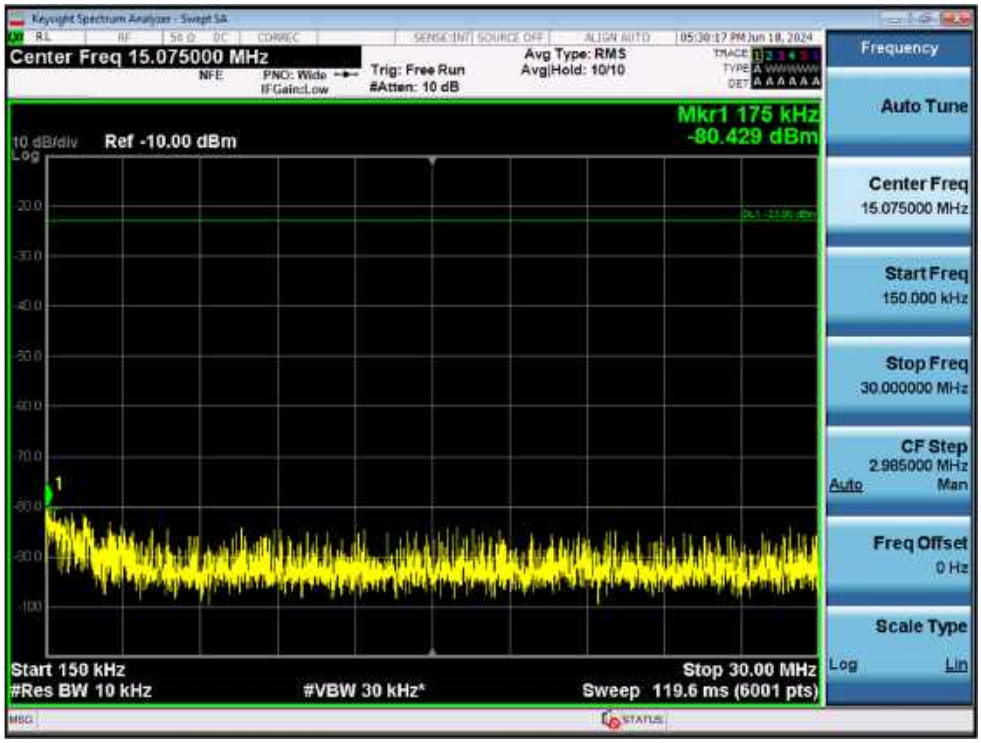
Band	Range (MHz)	Frequency (MHz)	Limit (dBm)	Spurious Emission (dBm)
Lower 700 MHz	0.009 ~ 0.15	0.027189	-13	-56.757
	0.15 ~ 30	0.444		-72.691
	30 ~ 727.9	727.90		-59.614
	746.1 ~ 2,000	1 946.25		-57.104
	2,000 ~ 4,000	3 775.85		-59.467
	4,000 ~ 6,000	4 937.25		-58.639
	6,000 ~ 8,000	6 041.75		-58.057
Upper 700 MHz	0.009 ~ 0.15	0.013794		-59.424
	0.15 ~ 30	0.175		-69.279
	30 ~ 745.9	745.54		-51.031
	756.1 ~ 2,000	756.10		-51.427
	2,000 ~ 4,000	3 788.85		-57.560
	4,000 ~ 6,000	4 871.00		-58.533
	6,000 ~ 8,000	7 742.95		-58.862
	763 ~ 775	765.33	-46	-83.291
	793 ~ 805	795.29		-82.356
	1,559 ~ 1,610 (1 MHz)	1 583.02	-40	-61.807
	1,559 ~ 1,610 (700 Hz)-1	1 566.11	-50	-90.362
	1,559 ~ 1,610 (700 Hz)-2	1 586.24		-90.049
	1,559 ~ 1,610 (700 Hz)-3	1 591.96		-90.468
	1,559 ~ 1,610 (700 Hz)-4	1 604.29		-89.967
Cellular	0.009 ~ 0.15	0.025920	-13	-59.073
	0.15 ~ 30	0.334		-70.988
	30 ~ 868	863.89		-59.387
	895 ~ 1,000	896.16		-59.123
	1,000 ~ 10,000	9 981.10		-39.001
AWS-1	0.009 ~ 0.15	0.024792		-49.646
	0.15 ~ 30	2.210		-63.952
	30 ~ 2109	2 081.45		-45.635
	2156 ~ 10,000	8 047.24		-38.983
	10,000 ~ 26,500	26 109.36		-27.495
Broadband PCS	0.009 ~ 0.15	0.026484		-49.475
	0.15 ~ 30	0.374		-60.671
	30 ~ 1929	1 836.80		-46.496
	1996 ~ 10,000	7 206.60		-39.276
	10,000 ~ 26,500	26 122.98		-27.159

Plot data of Conducted Spurious Emissions

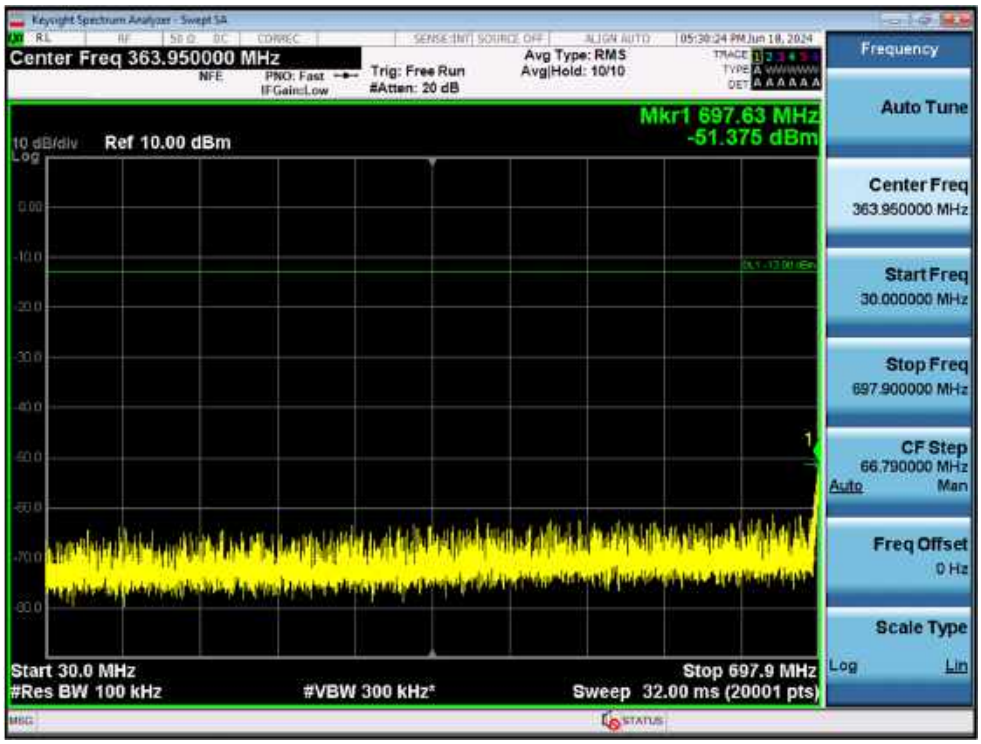
Conducted Spurious Emissions / Lower 700 MHz / Uplink / 9 kHz ~ 150 kHz



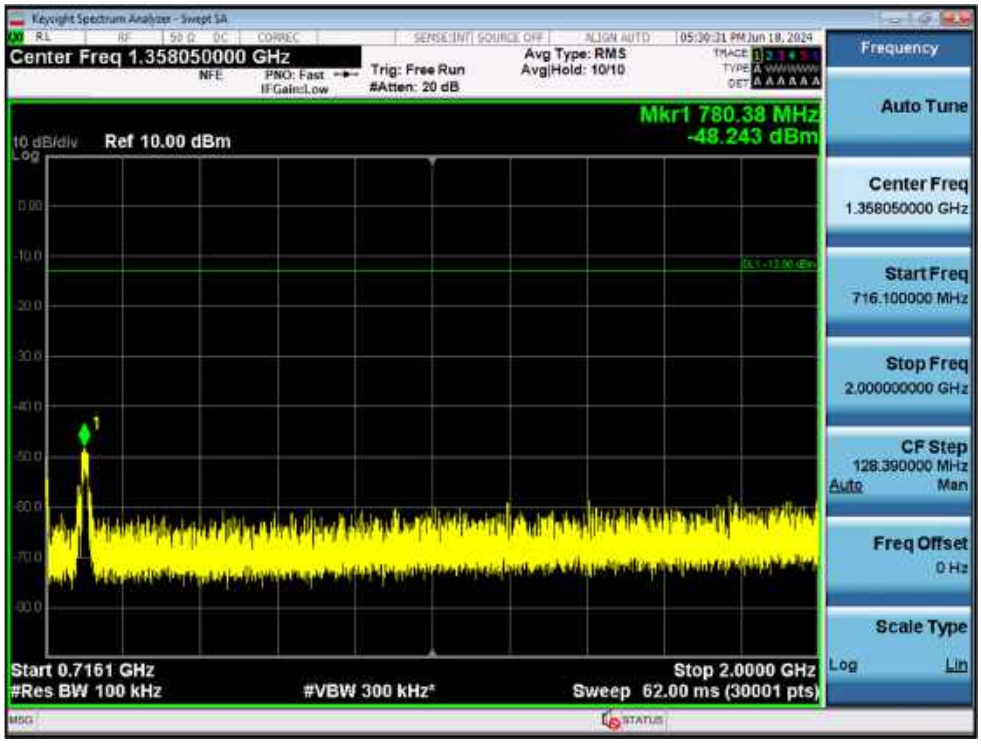
Conducted Spurious Emissions / Lower 700 MHz / Uplink / 150 kHz ~ 30 MHz



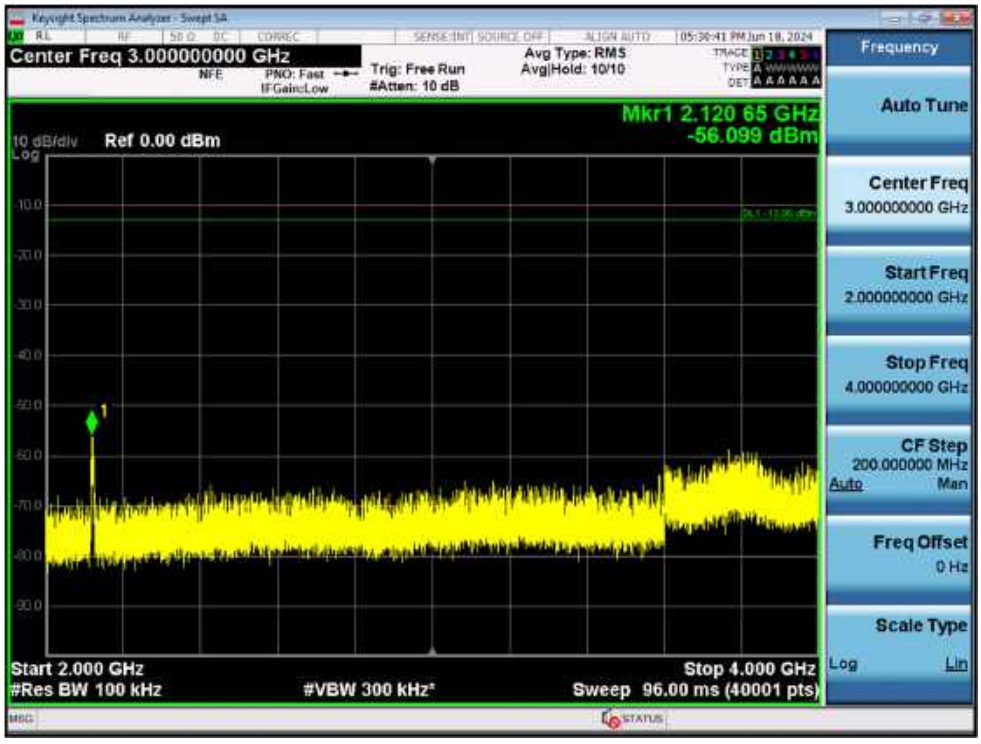
Conducted Spurious Emissions / Lower 700 MHz / Uplink / 30 MHz ~ 697.9 MHz



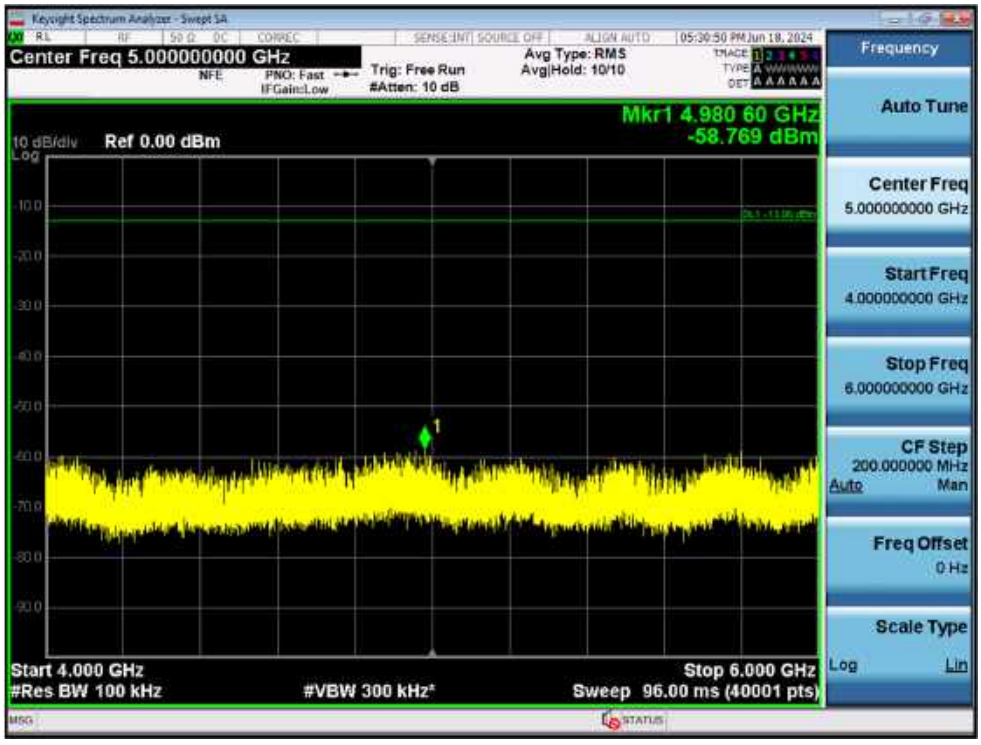
Conducted Spurious Emissions / Lower 700 MHz / Uplink / 716.1 MHz ~ 2 GHz



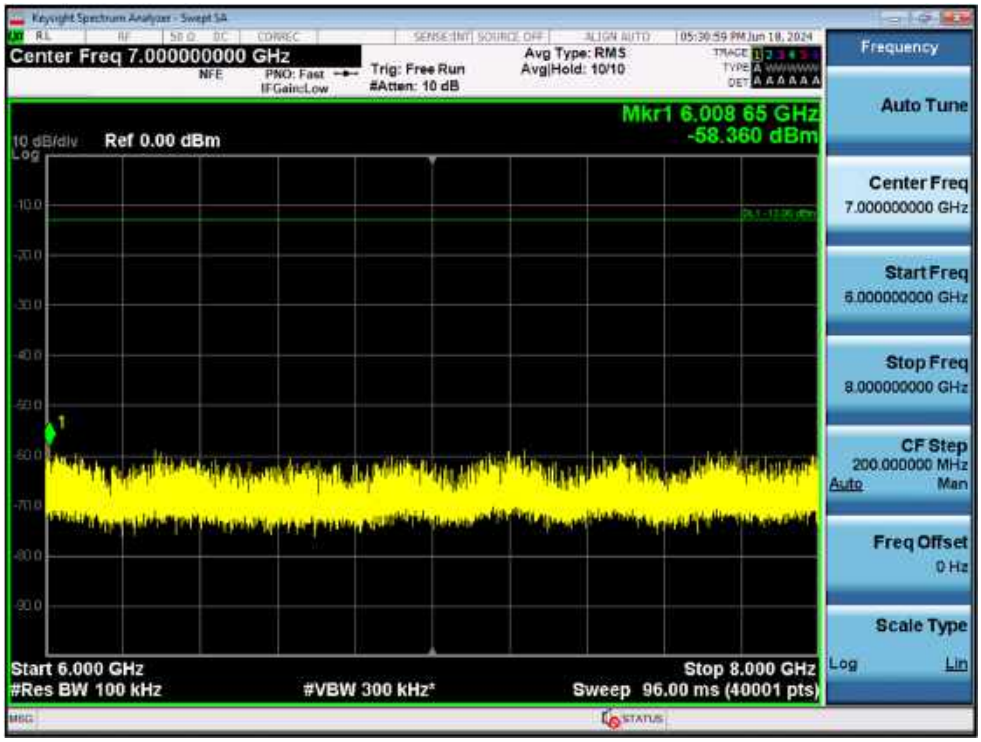
Conducted Spurious Emissions / Lower 700 MHz / Uplink / 2 GHz ~ 4 GHz



Conducted Spurious Emissions / Lower 700 MHz / Uplink / 4 GHz ~ 6 GHz

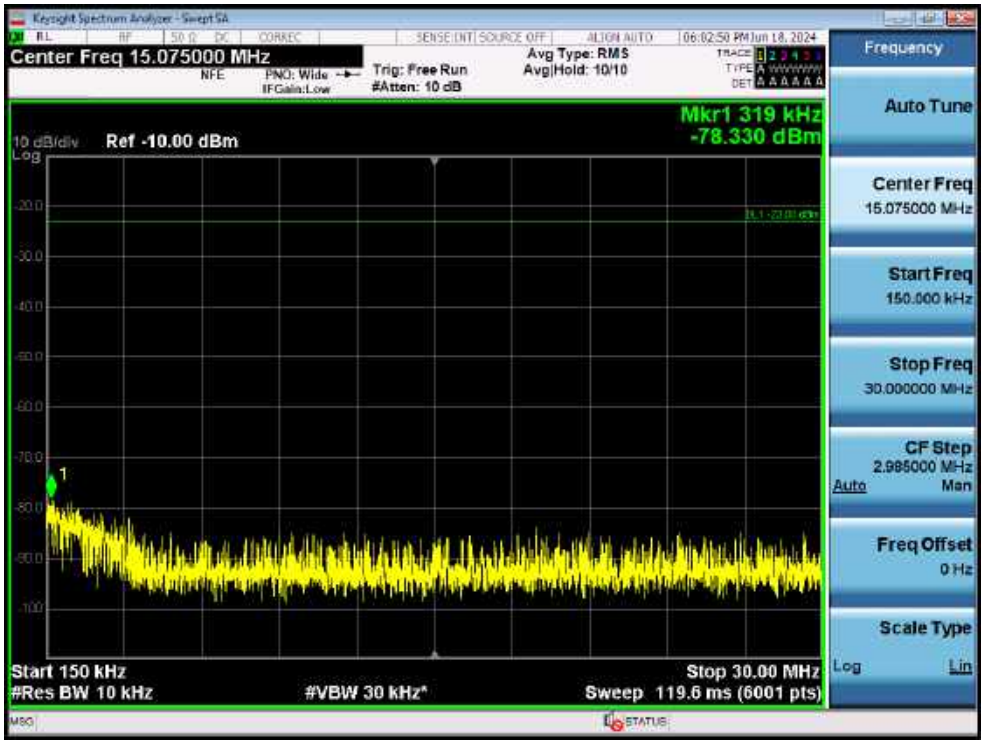


Conducted Spurious Emissions / Lower 700 MHz / Uplink / 6 GHz ~ 8 GHz

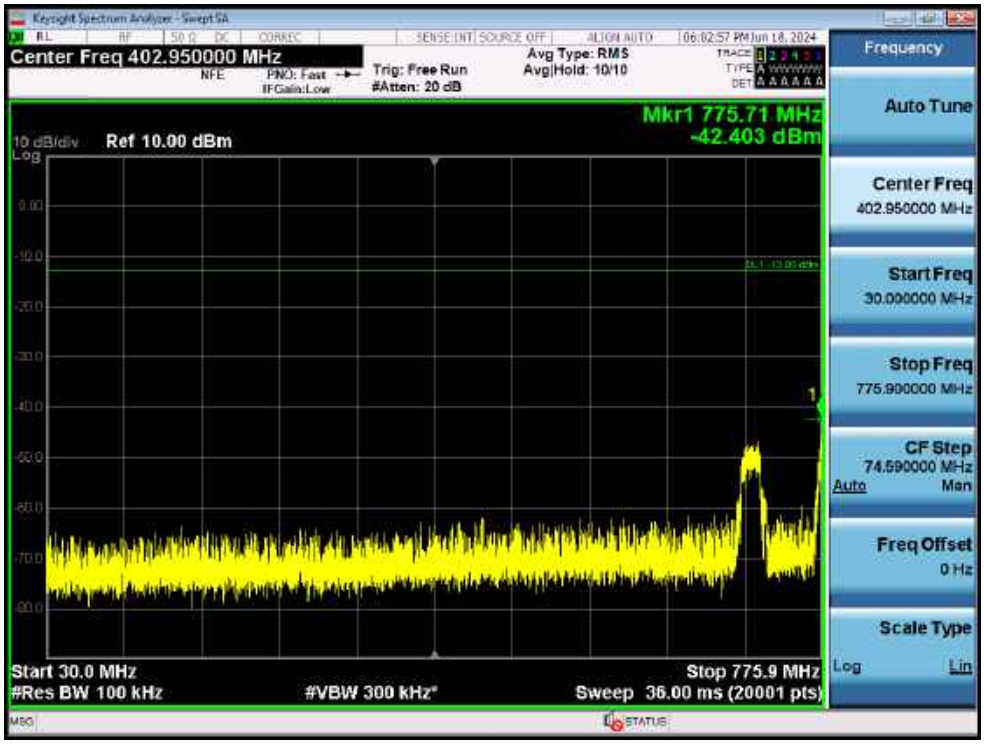


Conducted Spurious Emissions / Upper 700 MHz / Uplink / 9 kHz ~ 150 kHz

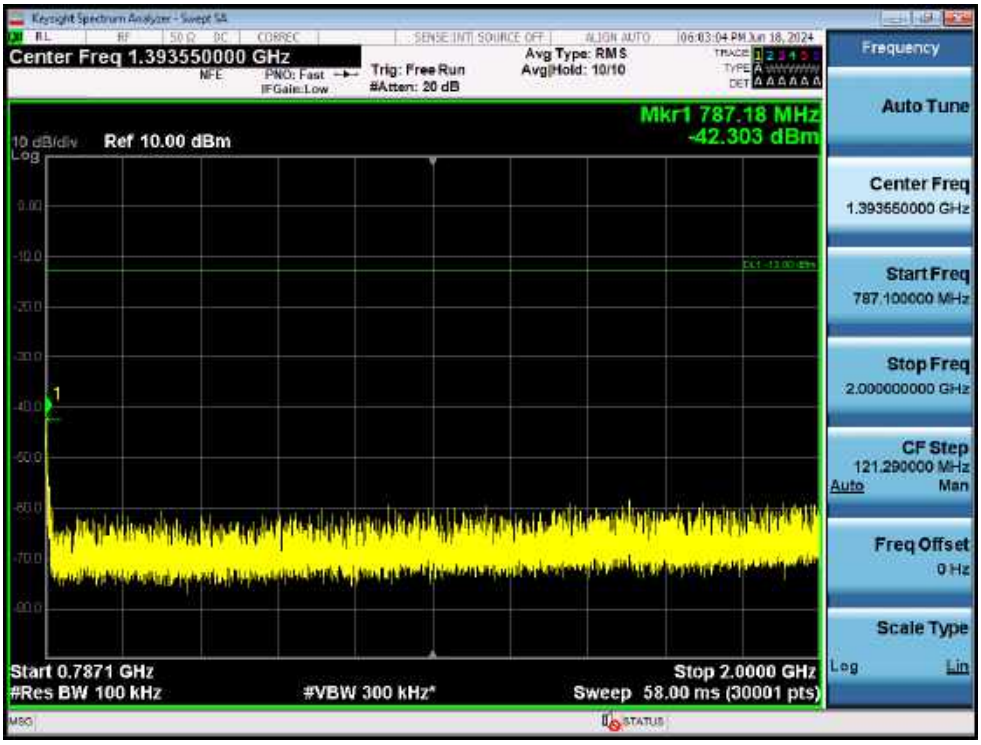
Conducted Spurious Emissions / Upper 700 MHz / Uplink / 150 kHz ~ 30 MHz



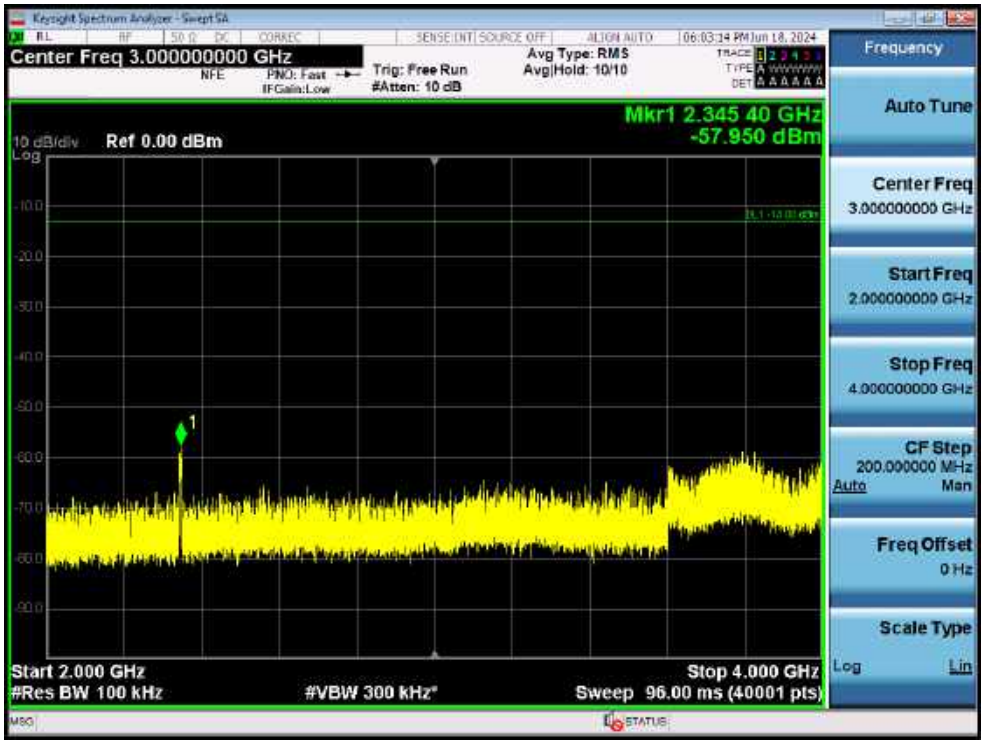
Conducted Spurious Emissions / Upper 700 MHz / Uplink / 30 MHz ~ 776.9 MHz



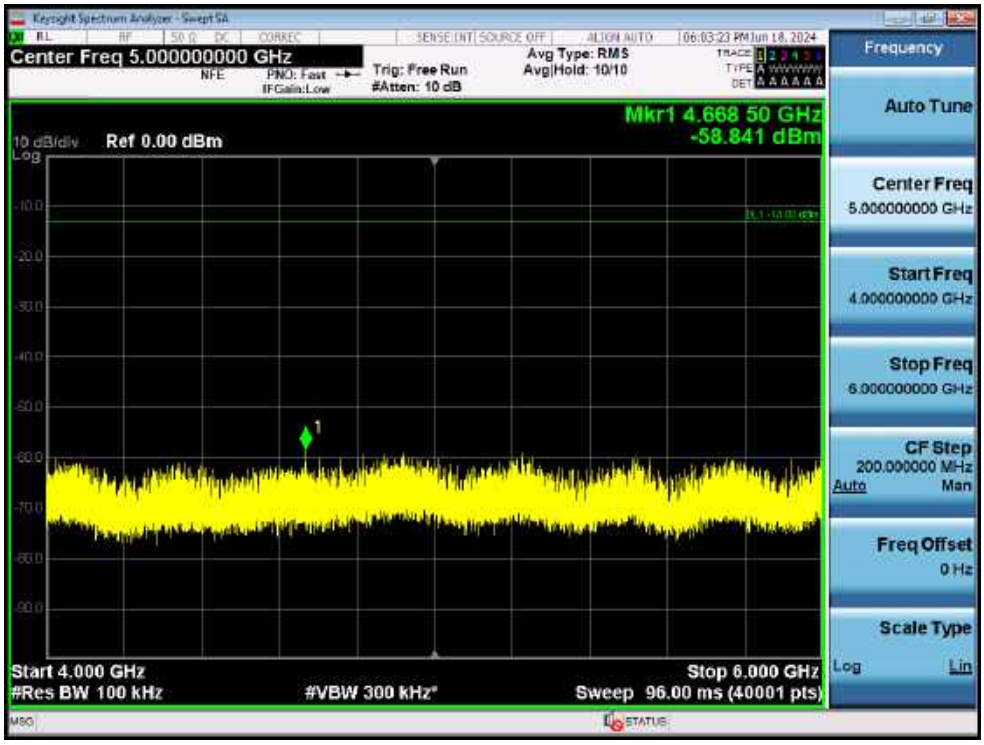
Conducted Spurious Emissions / Upper 700 MHz / Uplink / 787.1 MHz ~ 2 GHz



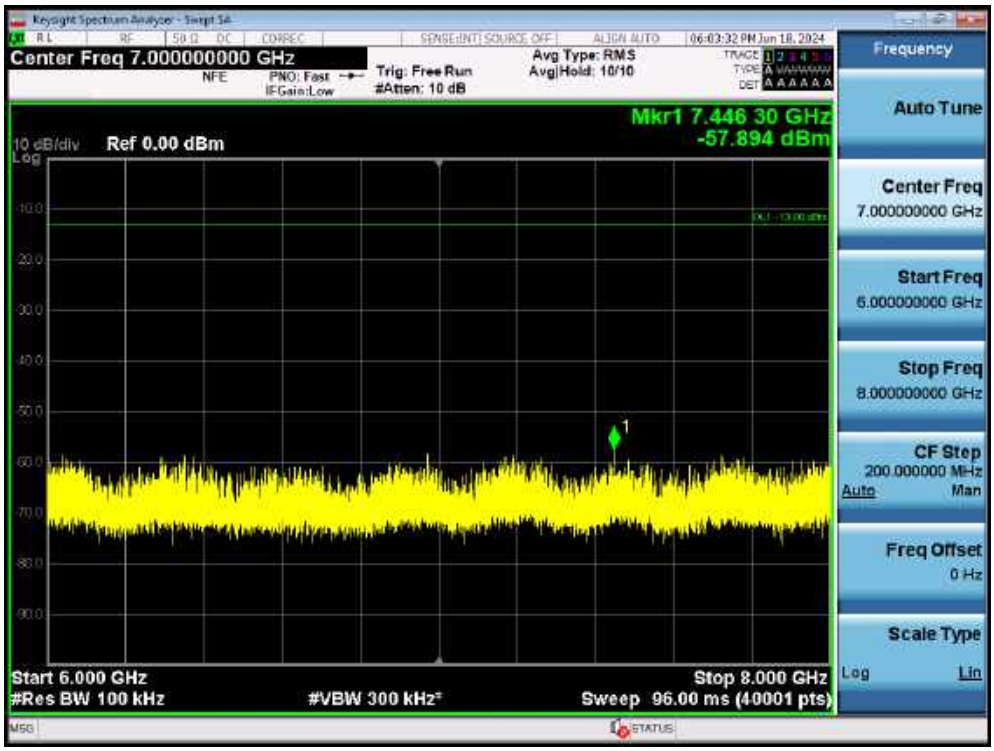
Conducted Spurious Emissions / Upper 700 MHz / Uplink / 2 GHz ~ 4 GHz



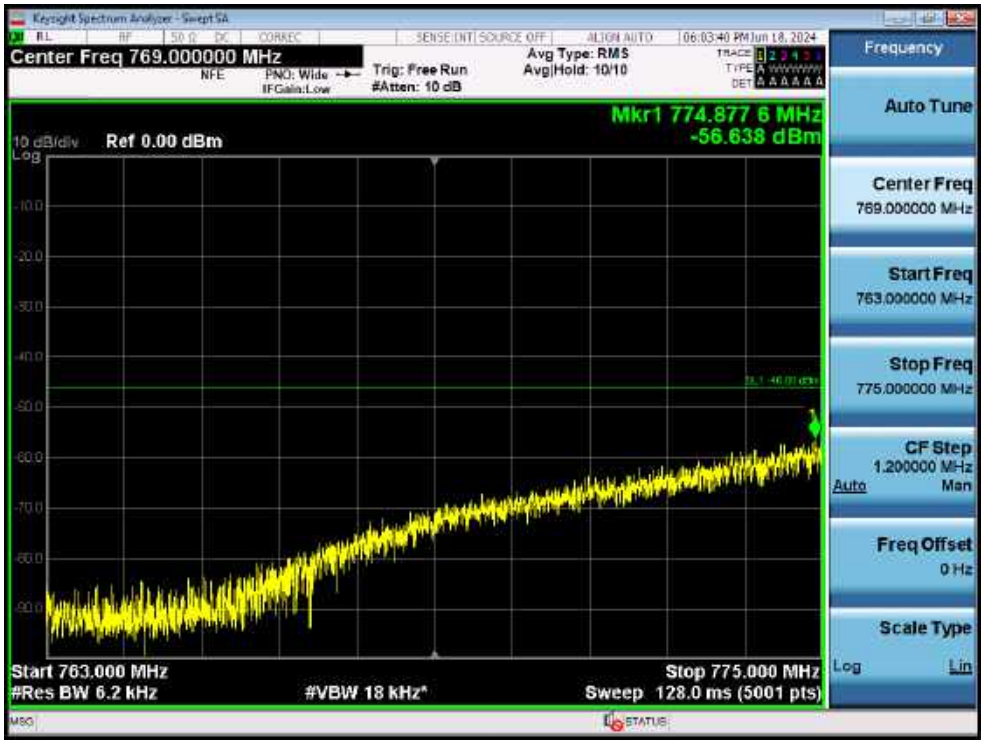
Conducted Spurious Emissions / Upper 700 MHz / Uplink / 4 GHz ~ 6 GHz



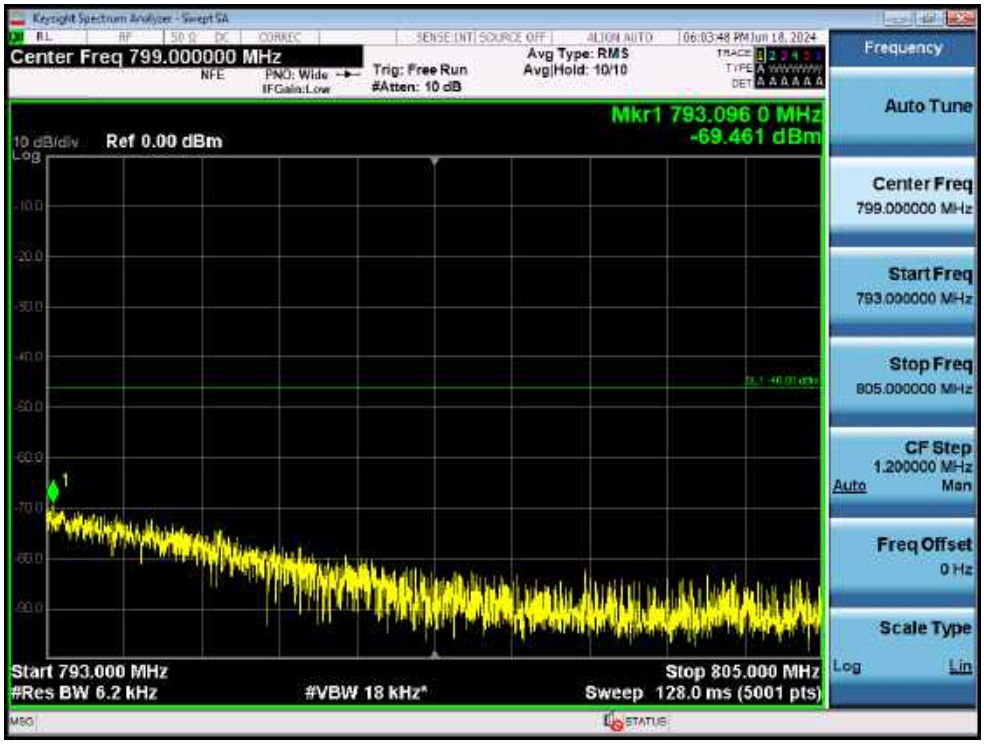
Conducted Spurious Emissions / Upper 700 MHz / Uplink / 6 GHz ~ 8 GHz



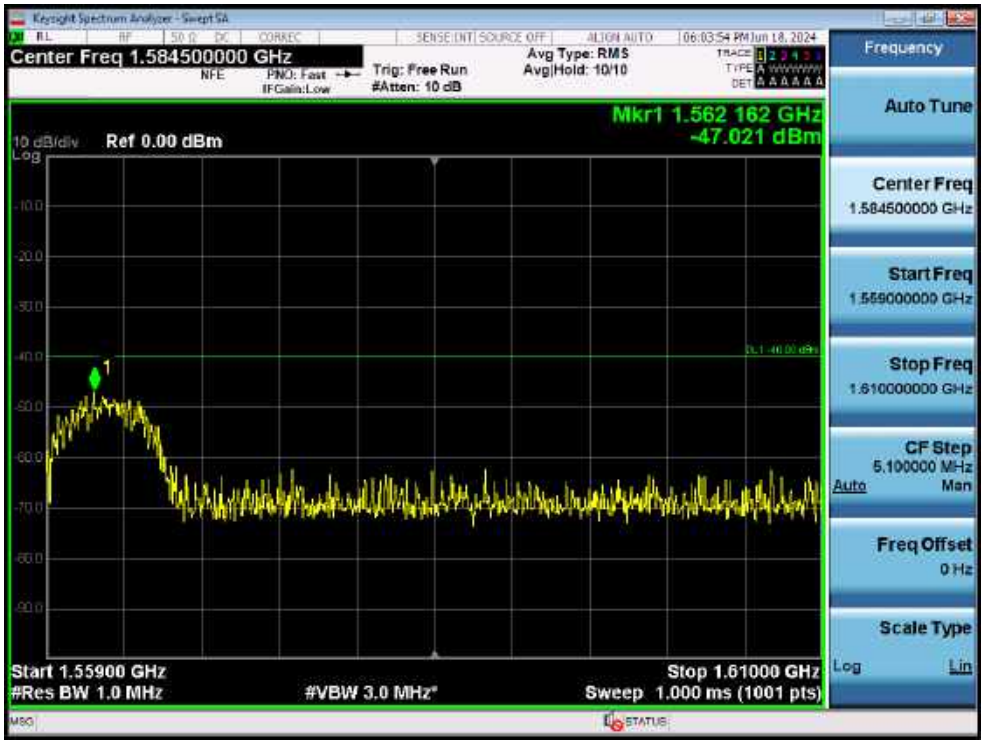
Conducted Spurious Emissions / Upper 700 MHz / Uplink / 763 MHz ~ 775 MHz



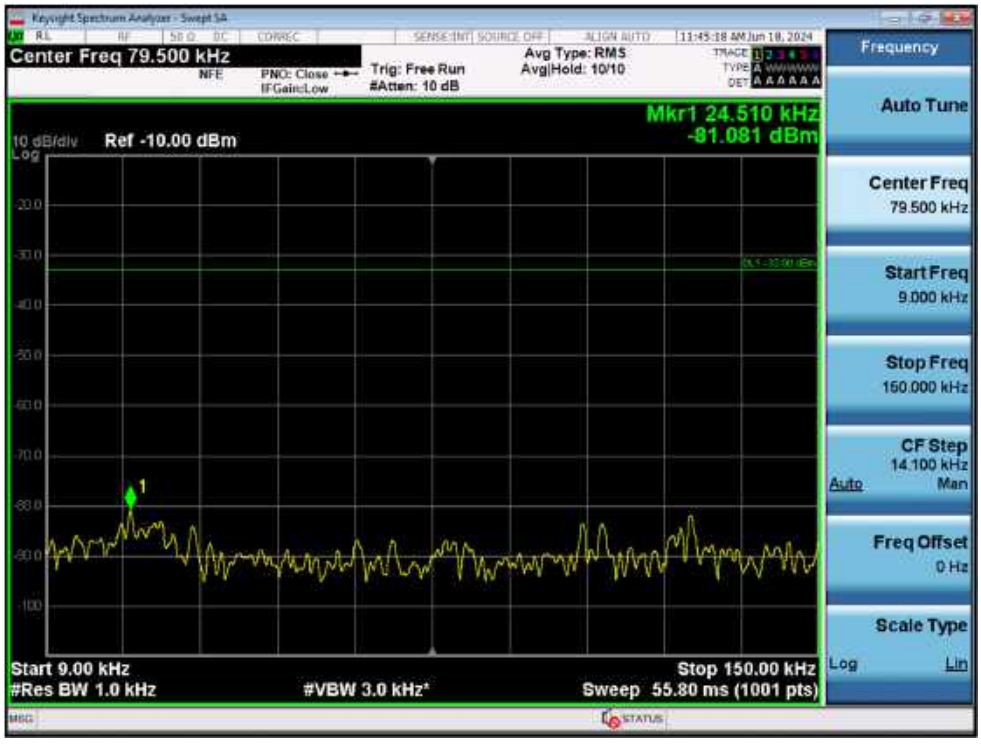
Conducted Spurious Emissions / Upper 700 MHz / Uplink / 793 MHz ~ 805 MHz



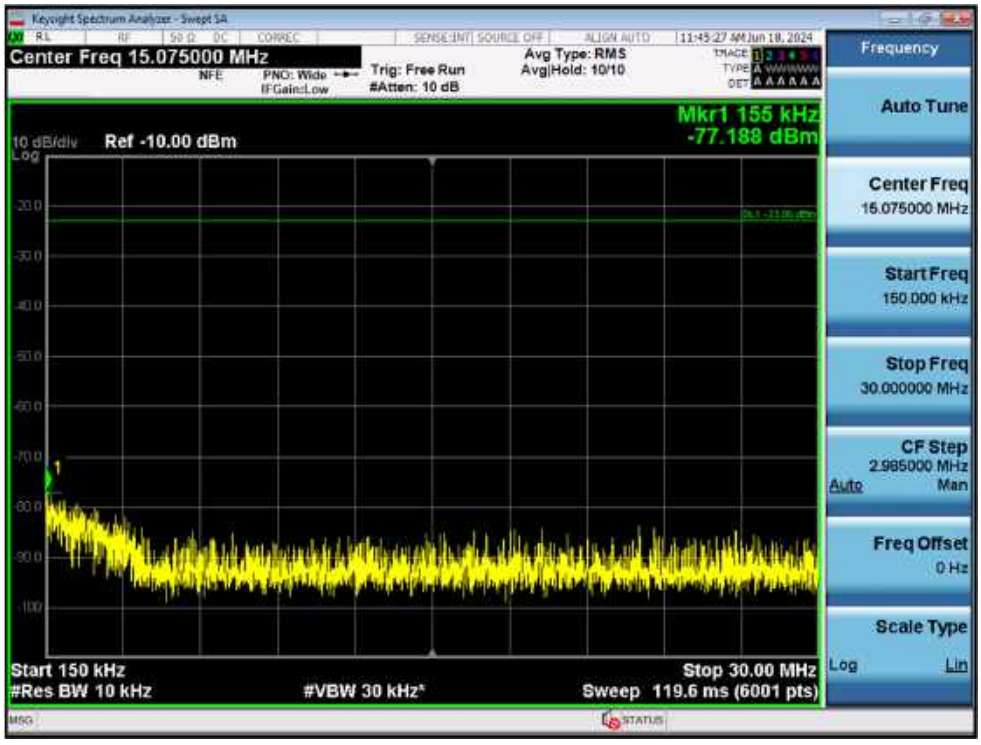
Conducted Spurious Emissions / Upper 700 MHz / Uplink / 1.559 GHz ~ 1.610 GHz



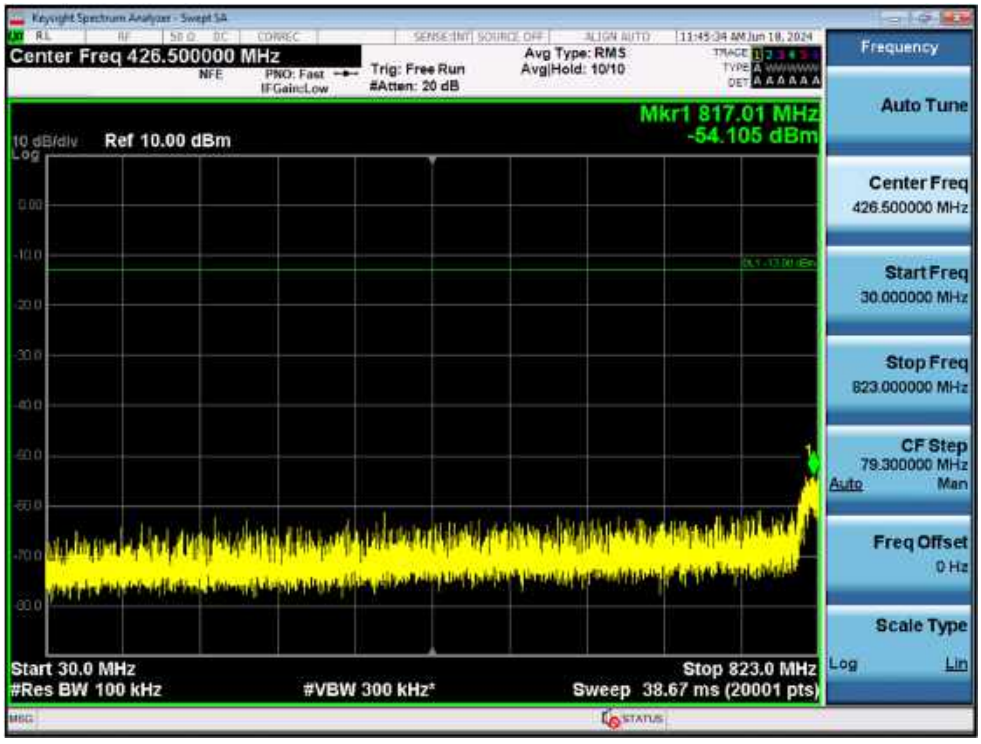
Conducted Spurious Emissions / Cellular / Uplink / 9 kHz ~ 150 kHz



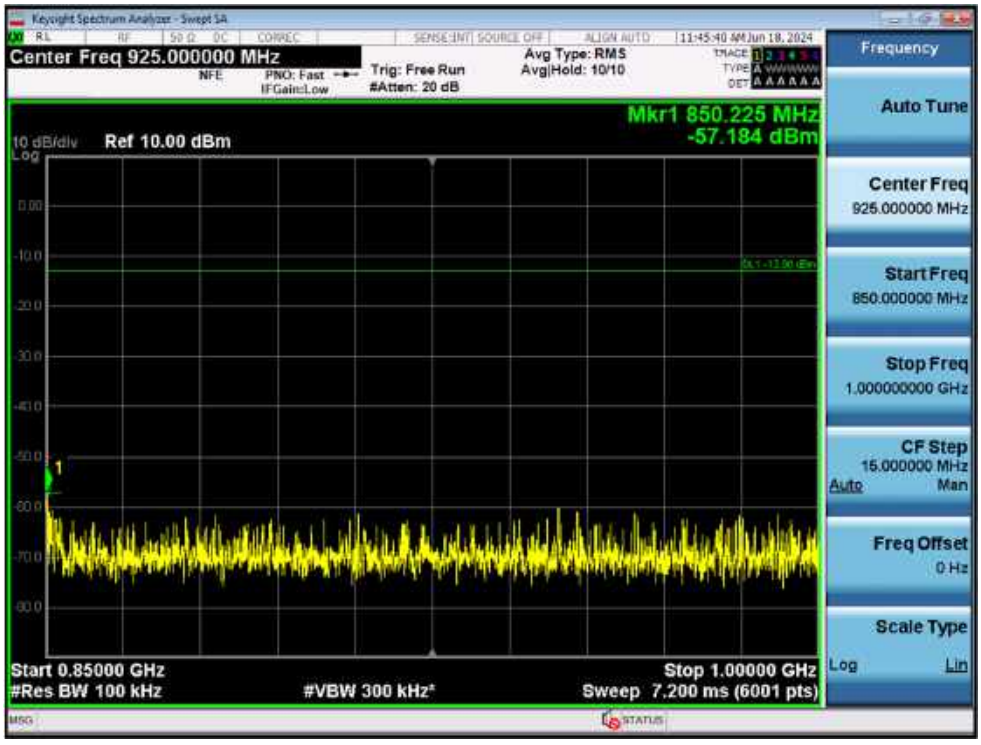
Conducted Spurious Emissions / Cellular / Uplink / 150 kHz ~ 30 MHz



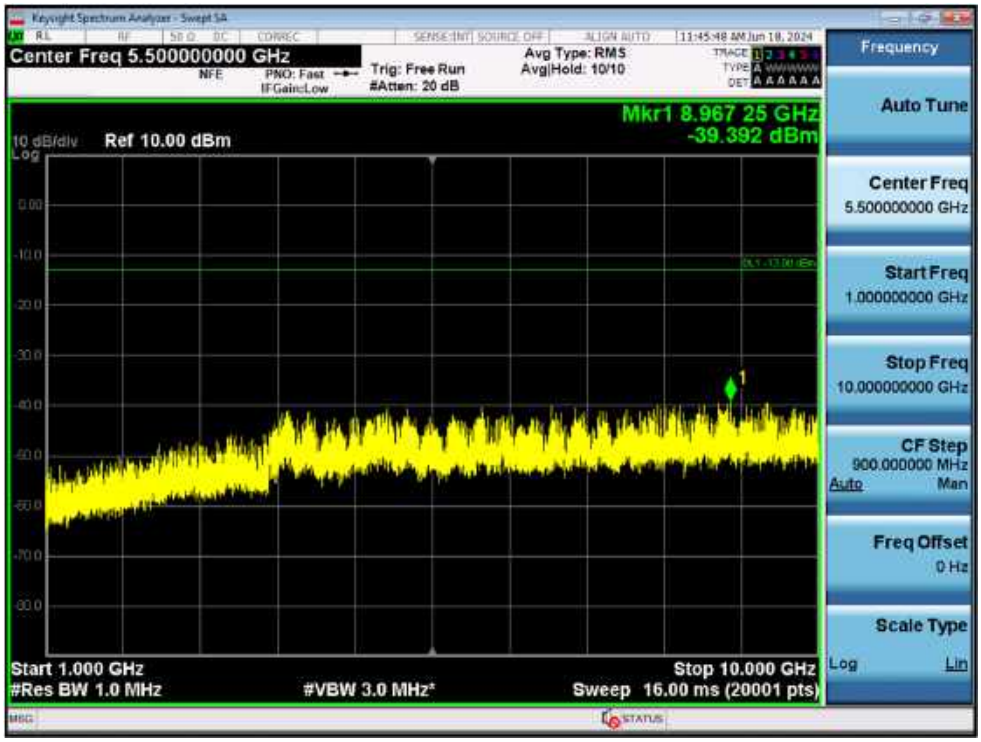
Conducted Spurious Emissions / Cellular / Uplink / 30 MHz ~ 823 MHz



Conducted Spurious Emissions / Cellular / Uplink / 850 MHz ~ 1 GHz

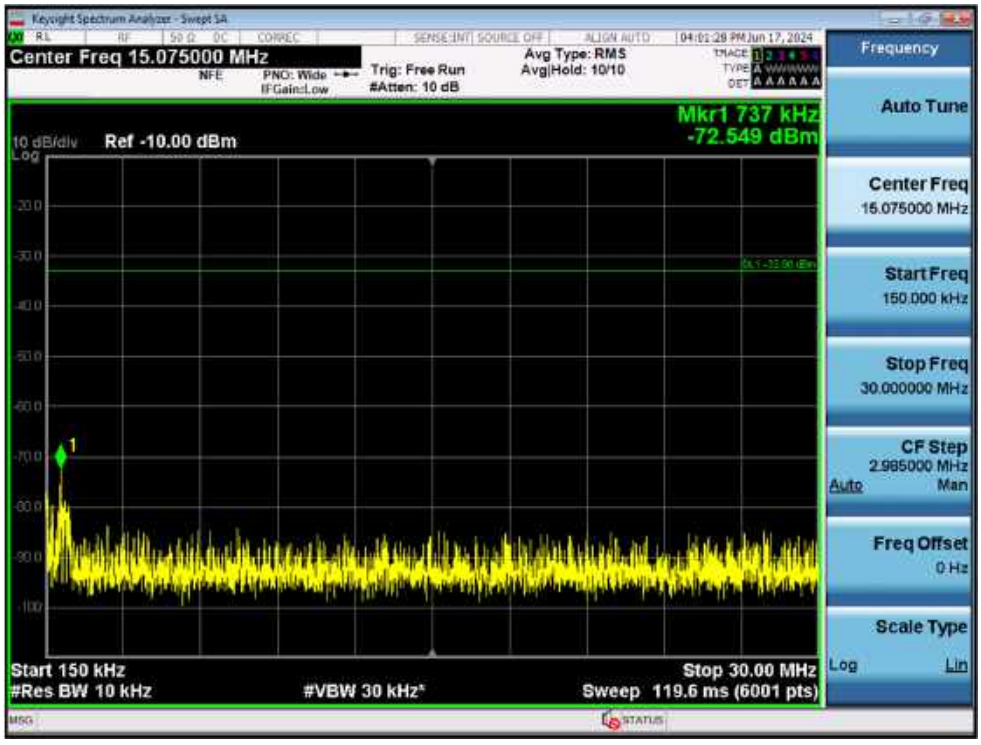


Conducted Spurious Emissions / Cellular / Uplink / 1 GHz ~ 10 GHz

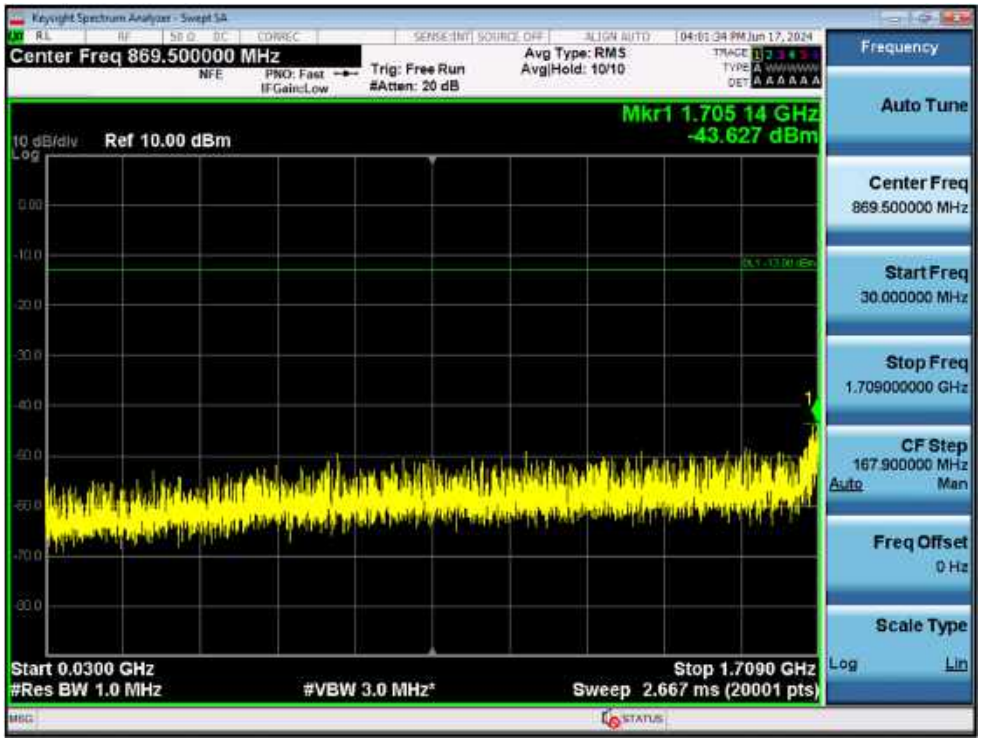


Conducted Spurious Emissions / AWS-1 / Uplink / 9 kHz ~ 150 kHz

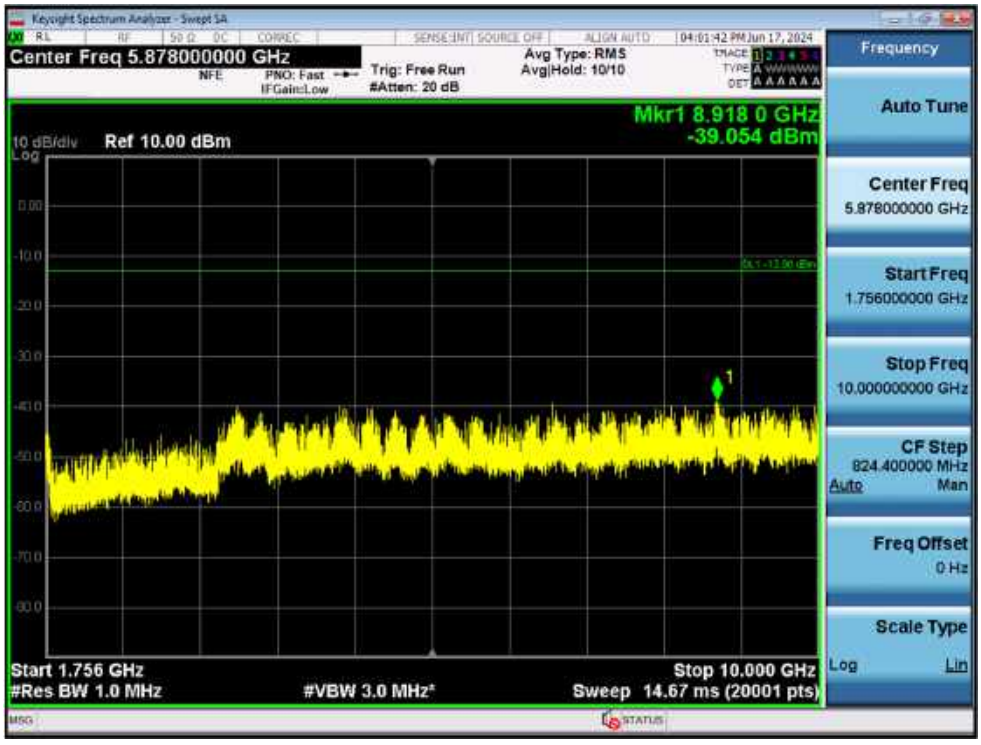
Conducted Spurious Emissions / AWS-1 / Uplink / 150 kHz ~ 30 MHz



Conducted Spurious Emissions / AWS-1 / Uplink / 30 MHz ~ 1.709 GHz



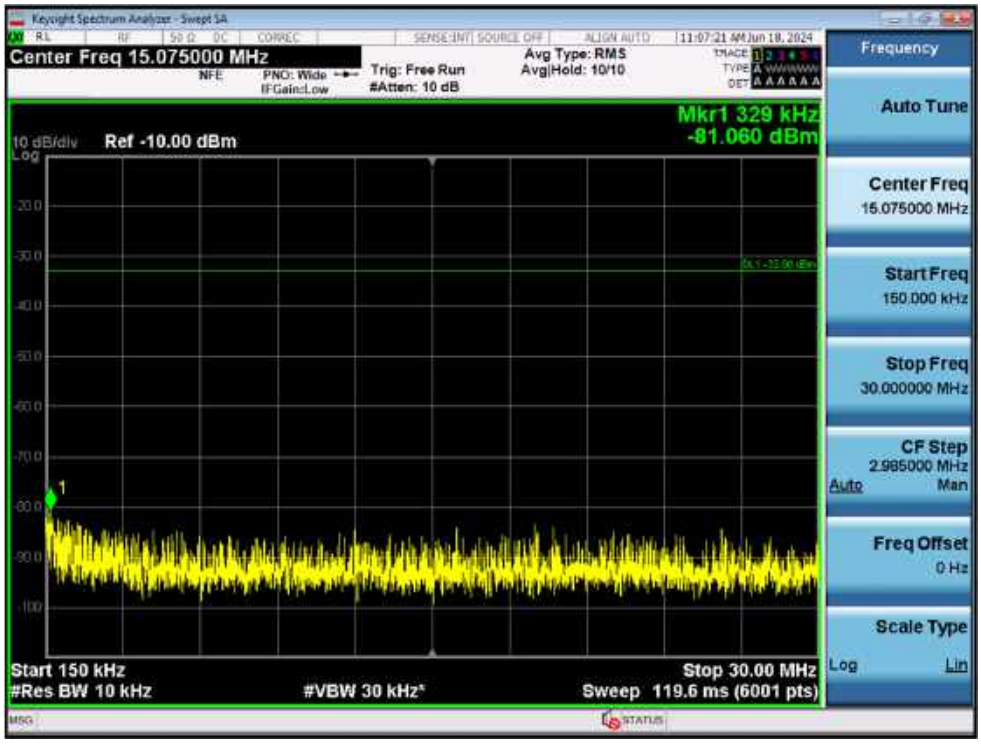
Conducted Spurious Emissions / AWS-1 / Uplink / 1.756 GHz ~ 10 GHz



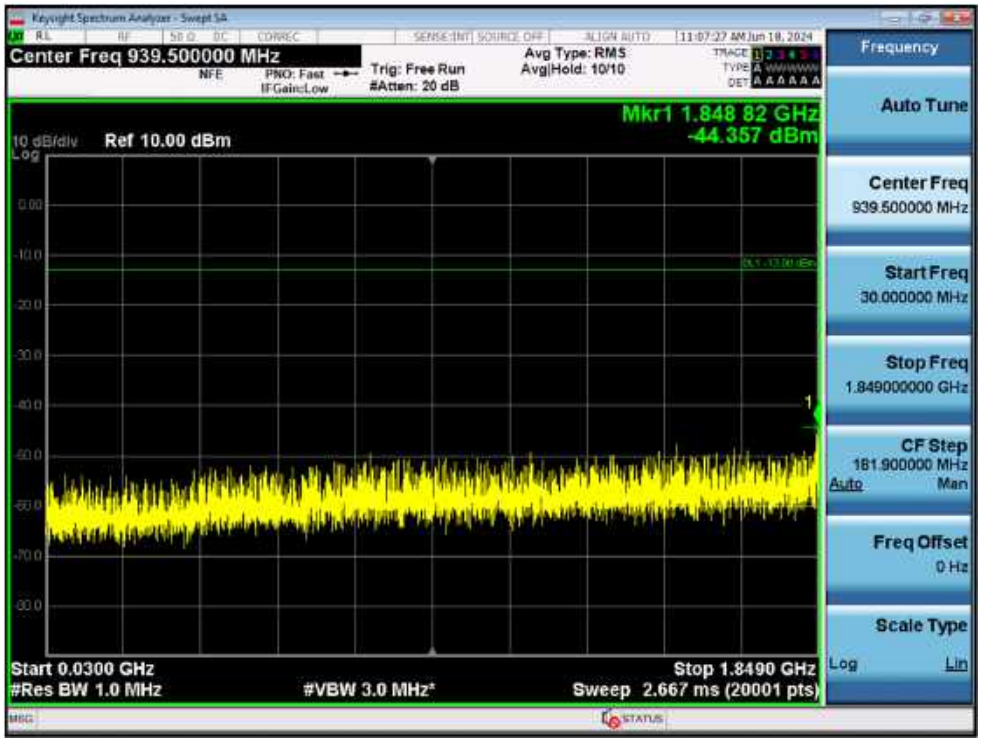
Conducted Spurious Emissions / AWS-1 / Uplink / 10 GHz ~ 26.5 GHz

Conducted Spurious Emissions / Broadband PCS / Uplink / 9 kHz ~ 150 kHz

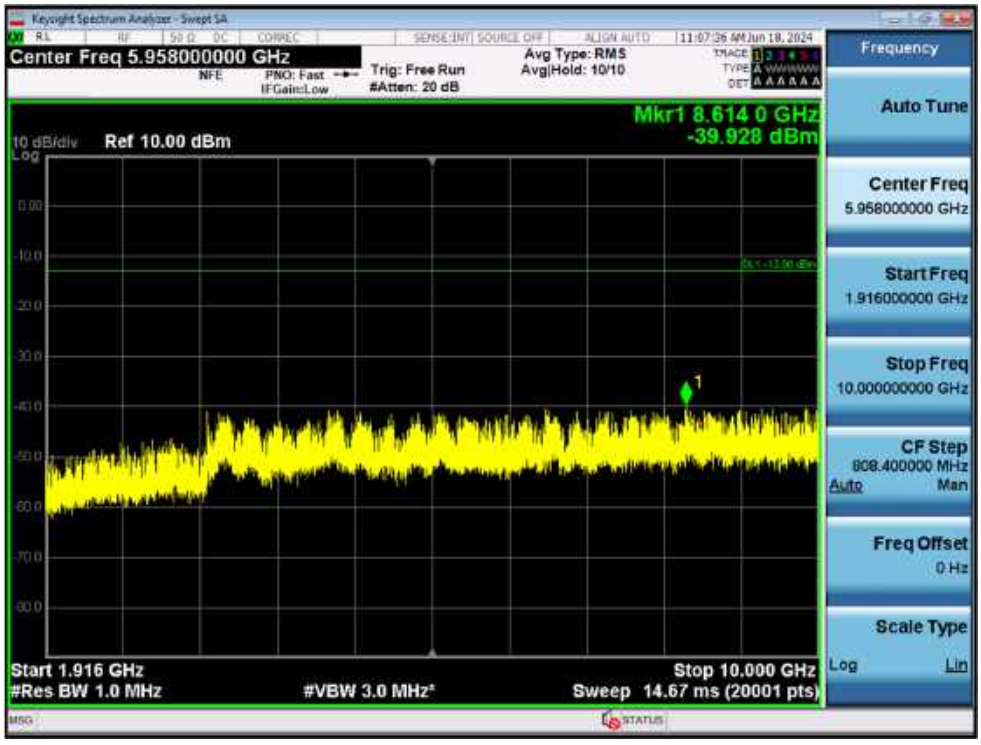
Conducted Spurious Emissions / Broadband PCS / Uplink / 150 kHz ~ 30 MHz



Conducted Spurious Emissions / Broadband PCS / Uplink / 30 MHz ~ 1.849 GHz



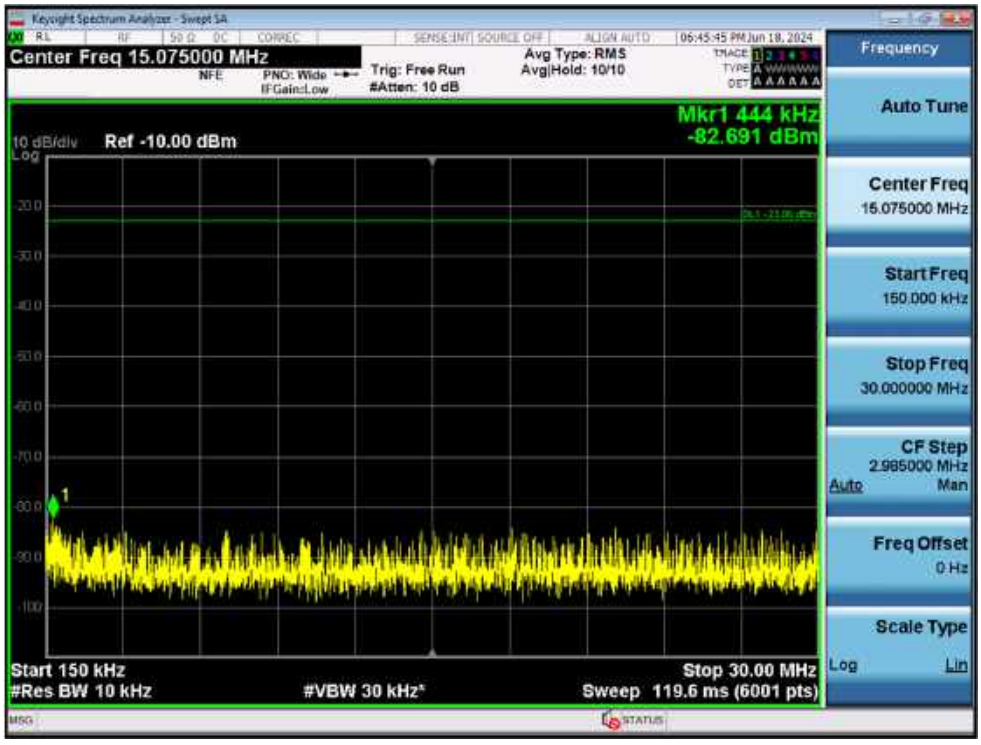
Conducted Spurious Emissions / Broadband PCS / Uplink / 1.916 GHz ~ 10 GHz



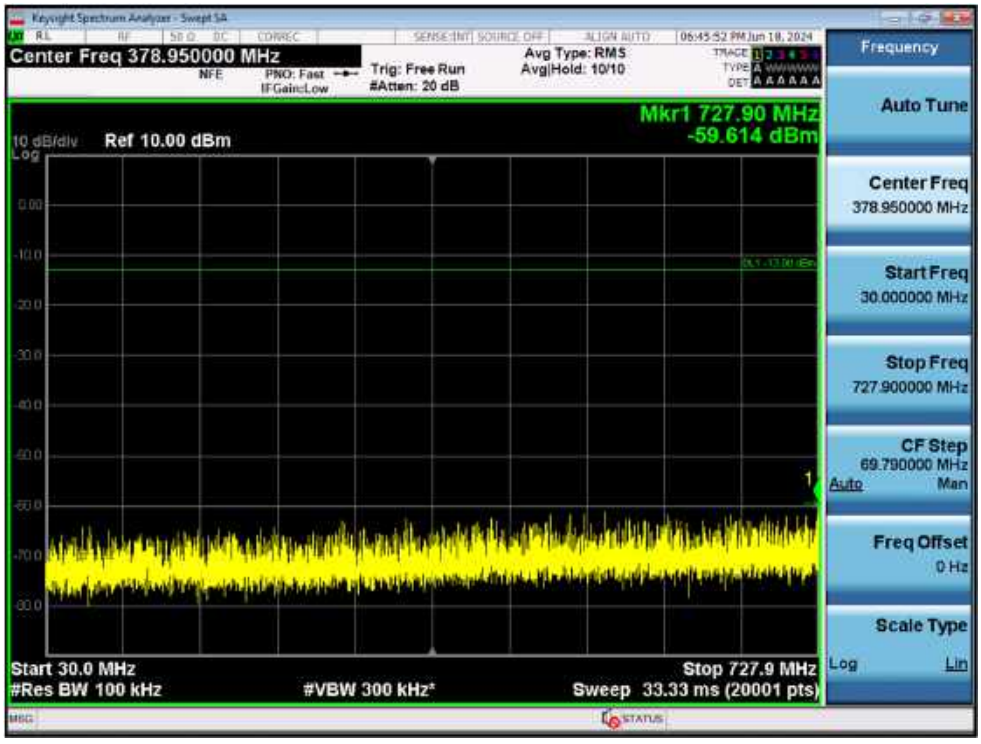
Conducted Spurious Emissions / Broadband PCS / Uplink / 10 GHz ~ 26.5 GHz

Conducted Spurious Emissions / Lower 700 MHz / Downlink / 9 kHz ~ 150 kHz

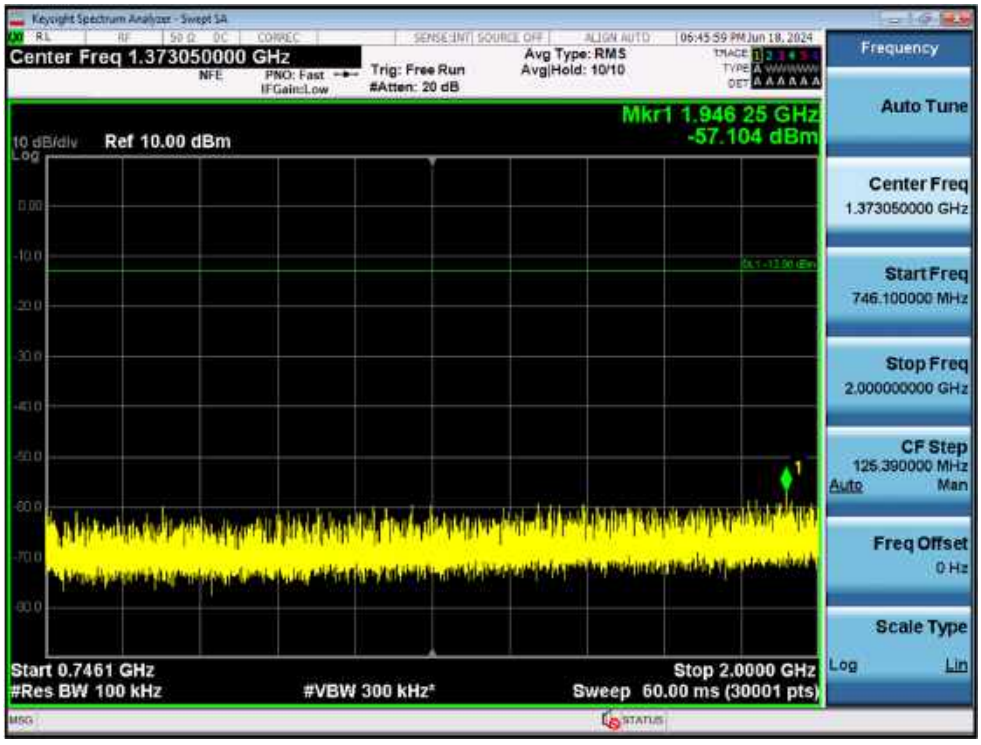
Conducted Spurious Emissions / Lower 700 MHz / Downlink / 150 kHz ~ 30 MHz



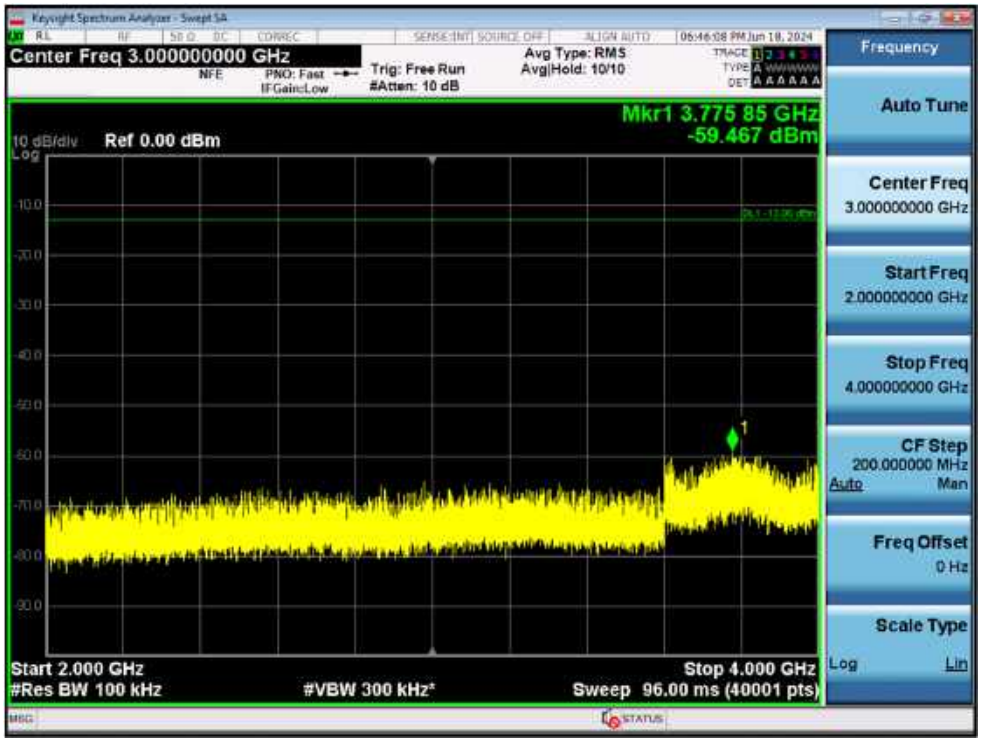
Conducted Spurious Emissions / Lower 700 MHz / Downlink / 30 MHz ~ 727.9 MHz



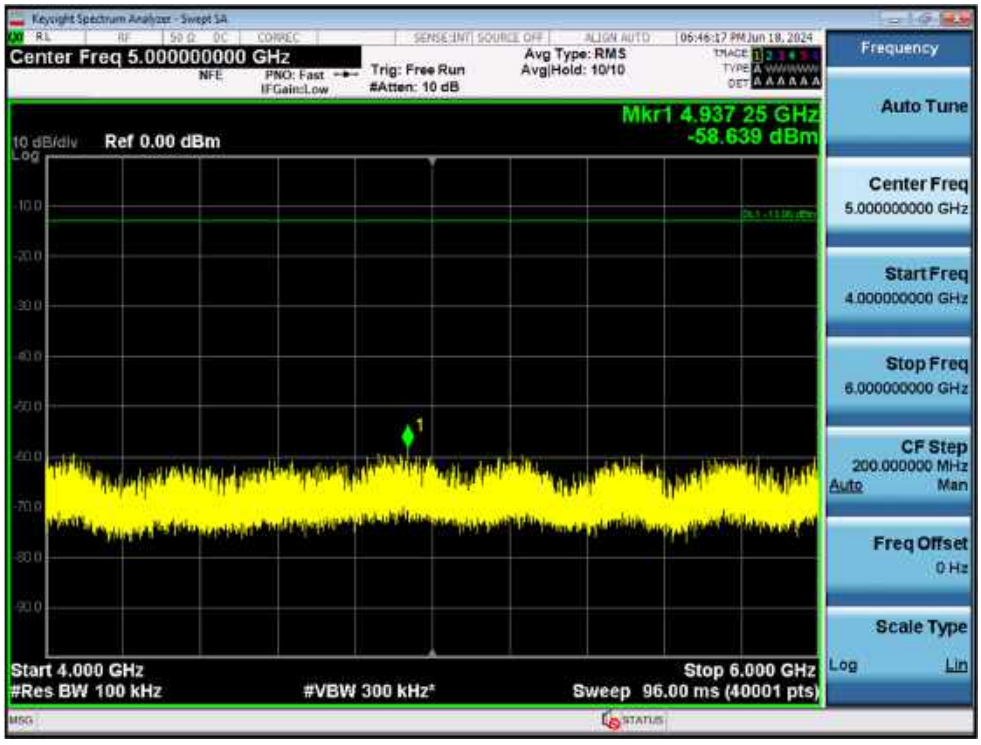
Conducted Spurious Emissions / Lower 700 MHz / Downlink / 746.1 MHz ~ 2 GHz



Conducted Spurious Emissions / Lower 700 MHz / Downlink / 2 GHz ~ 4 GHz



Conducted Spurious Emissions / Lower 700 MHz / Downlink / 4 GHz ~ 6 GHz



Conducted Spurious Emissions / Lower 700 MHz / Downlink / 6 GHz ~ 8 GHz