FCC RF Test Report

(Bootser)

Report No.:	JYTSZ-R12-2301682
Applicant:	Shenzhen Giesonwell Technology Co.,Ltd
Address of Applicant:	Room 201, Building 25, Zhiheng Industiral Park, No.15 Guankou 2nd Road, Nantou Street, Shenzhen, China
Equipment Under Test (EUT)	
Product Name:	Booster
Model No.:	Link50, Link10, Link30
Trade mark:	N/A
FCC ID:	2BDYJ-LK103050
Applicable standards:	FCC CFR Title 47 Part 2 FCC CFR Title 47 Part 20 Section 20.21
Date of sample receipt:	27 Nov., 2023
Date of Test:	28 Nov., to 26 Dec., 2023
Date of report issued:	27 Dec., 2023
Test Result:	PASS

Tested by:	***Project Engineer***	***Date:***	*27 Dec., 2023*
Reviewed by:	***Senior Engineer***	***Date:***	*27 Dec., 2023*
Approved by:	***Manager***	***Date:***	*27 Dec., 2023*

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in above the application standard version. Test results reported herein relate only to the item(s) tested.

1 Version

Version No.	Date	Description
00	*27 Dec., 2023*	*Original*

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3 General Information

3.1 Client Information

Applicant:	Shenzhen Giesonwell Technology Co., Ltd
Address:	Room 201, Building 25, Zhiheng Industiral Park, No.15 Guankou 2nd Road, Nantou Street, Shenzhen, China
Manufacturer/ Factory:	Shenzhen Giesonwell Technology Co., Ltd
Address:	Room 201, Building 25, Zhiheng Industiral Park, No.15 Guankou 2nd Road, Nantou Street, Shenzhen, China

3.2 General Description of E.U.T.

Product Name:	Booster	
Model No.:	Link50, Link10, Link30	
Operation Frequency Range:	LTE band 4:	Uplink: 1710 MHz - 1755 MHz Downlink: 2110 MHz - 2155 MHz
	LTE band 5:	Uplink: 824 MHz - 849 MHz Downlink: 869 MHz - 894 MHz
	LTE band 12:	Uplink: 699 MHz - 716 MHz Downlink: 729 MHz - 746 MHz
	LTE band 13:	Uplink: 777MHz - 787 MHz Downlink:746 MHz - 756 MHz
	LTE band 25:	Uplink:1850MHz - 1910 MHz Downlink:1930 MHz - 1990 MHz
Antenna Type:	Wall mounted antenna(ANT1) log periodic antenna(ANT2)	
Antenna Gain:	LTE band 4:	ANT1: 7.02dBi; ANT2: 7.63 (declare by Applicant)
	LTE band 5:	ANT1: 6.20dBi; ANT2: 7.24 (declare by Applicant)
	LTE band 12:	ANT1: 4.51dBi; ANT2: 6.30 (declare by Applicant)
	LTE band 13:	ANT1: 4.51dBi; ANT2: 6.30 (declare by Applicant)
	LTE band 25:	ANT1: 7.82dBi; ANT2: 7.38 (declare by Applicant)
Power Supply:	DC 5V	
AC Adapter:	Model: AD0310-504000UB Input: AC100-240V, 50/60Hz, 0.8A Output: DC 5.0V, 4A 20W	
Test Sample Condition:	Link50,Link10,Link30 were identical inside, the electrical circuit design, layout, components used and internal wiring, with only difference being model name.	

3.3 Test Mode and Environment

Test Mode:	
Uplink mode:	Keep the EUT in Uplink mode to communication
Downlink mode:	Keep the EUT in Downlink mode to communication
Remark: *The EUT has been tested under continuous transmitting mode. Channel Low, Mid and High for each type band with rated data rate were chosen for full testing. The field strength of spurious radiation emission was measured as EUT stand-up position (H mode) and lie down position (E1, E2 mode) for these modes. Just the worst case position (H mode) shown in report.*	
Operating Environment:	
Temperature:	Normal: 15℃ ~ 35℃, Extreme: -30℃ ~ +50℃
Humidity:	20 % ~ 75 % RH
Atmospheric Pressure:	1008 mbar
Voltage:	Nominal: 120 Vac, Extreme: Low 102 Vac, High 138 Vac
Test Engineer:	Lucas Ding (Conducted measurement) Kiran Zeng (Radiated measurement)

3.4 Description of Test Auxiliary Equipment

Test Equipment	Manufacturer	Model No.	Serial No.
N/A	N/A	N/A	N/A

3.5 Measurement Uncertainty

Parameter	Expanded Uncertainty (Confidence of 95%(U = 2Uc(y)))
Radiated Emission (1GHz ~ 6GHz) (3m FAR)	4.95 dB
Radiated Emission (6GHz ~ 18GHz) (3m FAR)	5.23 dB
Radiated Emission (18GHz ~ 40GHz) (3m FAR)	5.32 dB
Note: *All the measurement uncertainty value were shown with a coverage k=2 to indicate 95% level of confidence. The measurement data show herein meets or exceeds the CISPR measurement uncertainty values specified in CISPR 16-4-2 and can be compared directly to specified limit to determine compliance.*	

3.6 Additions to, Deviations, or Exclusions from the Method

No

3.7 Laboratory Facility

The test facility is recognized, certified, or accredited by the following organizations:

- **FCC - Designation No.: CN1211**

JianYan Testing Group Shenzhen Co., Ltd. has been accredited as a testing laboratory by FCC(Federal Communications Commission). The test firm Registration No. is 727551.

- **ISED – CAB identifier.: CN0021**

The 3m Semi-anechoic chamber and 10m Semi-anechoic chamber of JianYan Testing Group Shenzhen Co., Ltd. has been Registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 10106A-1.

- **CNAS - Registration No.: CNAS L15527**

JianYan Testing Group Shenzhen Co., Ltd. is accredited to ISO/IEC 17025:2017 General Requirements for the Competence of Testing and Calibration laboratories for the competence of testing. The Registration No. is CNAS L15527.

- **A2LA - Registration No.: 4346.01**

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 General requirements for the competence of testing and calibration laboratories. The test scope can be found as below link: https://portal.a2la.org/scopepdf/4346-01.pdf

3.8 Laboratory Location

JianYan Testing Group Shenzhen Co., Ltd.
Address: No.101, Building 8, Innovation Wisdom Port, No.155 Hongtian Road, Huangpu Community, Xinqiao Street, Bao'an District, Shenzhen, Guangdong, People's Republic of China.
Tel: +86-755-23118282, Fax: +86-755-23116366
Email: info-JYTee@lets.com, Website: http://jyt.lets.com

3.9 Test Instruments list

Radiated Emission(3m SAC):					
Test Equipment	**Manufacturer**	**Model No.**	**Manage No.**	**Cal. Date (mm-dd-yy)**	**Cal. Due date (mm-dd-yy)**
3m SAC	ETS	9m*6m*6m	WXJ001-1	04-14-2021	04-13-2024
Loop Antenna	Schwarzbeck	FMZB 1519 B	WXJ002-4	02-09-2023	02-08-2024
BiConiLog Antenna	Schwarzbeck	VULB9163	WXJ002	02-09-2023	02-08-2024
Biconical Antenna	Schwarzbeck	VUBA9117	WXJ002-1	07-02-2021	07-01-2024
Horn Antenna	Schwarzbeck	BBHA9120D	WXJ002-2	02-09-2023	02-08-2024
Horn Antenna	Schwarzbeck	BBHA9120D	WXJ002-3	01-09-2023	01-08-2024
Horn Antenna	Schwarzbeck	BBHA9170	WXJ002-5	01-09-2023	01-08-2024
Horn Antenna	Schwarzbeck	BBHA9170	WXJ002-6	01-09-2023	01-08-2024
Pre-amplifier (30MHz ~ 1GHz)	Schwarzbeck	BBV9743B	WXJ001-2	01-10-2023	01-09-2024
Pre-amplifier (1GHz ~ 18GHz)	SKET	LNPA_0118G-50	WXJ001-3	01-10-2023	01-09-2024
Pre-amplifier (18GHz ~ 40GHz)	RF System	TRLA-180400G45B	WXJ002-7	01-11-2023	01-10-2024
EMI Test Receiver	Rohde & Schwarz	ESRP7	WXJ003-1	01-11-2023	01-10-2024
Spectrum Analyzer	Rohde & Schwarz	FSP 30	WXJ004	01-10-2023	01-09-2024
Spectrum Analyzer	KEYSIGHT	N9010B	WXJ004-2	09-25-2023	09-24-2024
Coaxial Cable (30MHz ~ 1GHz)	JYTSZ	JYT3M-1G-NN-8M	WXG001-4	01-18-2023	01-17-2024
Coaxial Cable (1GHz ~ 18GHz)	JYTSZ	JYT3M-18G-NN-8M	WXG001-5	01-18-2023	01-17-2024
Coaxial Cable (18GHz ~ 40GHz)	JYTSZ	JYT3M-40G-SS-8M	WXG001-7	01-18-2023	01-17-2024
Band Reject Filter Group	Tonscend	JS0806-F	WXJ089	N/A	
Test Software	Tonscend	TS+	Version: 3.0.0.1		

Radiated Emission(3m FAR):					
Test Equipment	**Manufacturer**	**Model No.**	**Manage No.**	**Cal. Date (mm-dd-yy)**	**Cal. Due date (mm-dd-yy)**
3m FAR	YUNYI	9m*6m*6m	WXJ097	06-15-2023	06-14-2028
BiConiLog Antenna	Schwarzbeck	VULB9163	WXJ097-2	07-13-2023	07-12-2024
Biconical Antenna	Schwarzbeck	VUBA9117	WXJ002-1	07-02-2021	07-01-2024
Horn Antenna	Schwarzbeck	BBHA9120D	WXJ097-3	07-14-2023	07-13-2024
Horn Antenna	Schwarzbeck	BBHA9120D	WXJ002-3	01-09-2023	01-08-2024
Horn Antenna	Schwarzbeck	BBHA9170	WXJ002-5	01-09-2023	01-08-2024
Horn Antenna	Schwarzbeck	BBHA9170	WXJ002-6	01-09-2023	01-08-2024
Pre-amplifier (30MHz ~ 1GHz)	YUNYI	PAM-310N	WXJ097-5	05-14-2023	05-13-2024
Pre-amplifier (1GHz ~ 18GHz)	YUNYI	PAM-118N	WXJ097-6	05-14-2023	05-13-2024
Pre-amplifier (18GHz ~ 40GHz)	RF System	TRLA-180400G45B	WXJ002-7	01-11-2023	01-10-2024
EMI Test Receiver	Rohde & Schwarz	ESCI3	WXJ003	01-10-2023	01-09-2024
Spectrum Analyzer	Rohde & Schwarz	FSP 30	WXJ004	01-10-2023	01-09-2024
Spectrum Analyzer	KEYSIGHT	N9010B	WXJ081-1	06-13-2023	06-12-2024
Coaxial Cable (30MHz ~ 1GHz)	JYTSZ	JYT3M-1G-NN-13M	WXG097-1	08-01-2023	07-31-2024
Coaxial Cable (1GHz ~ 18GHz)	JYTSZ	JYT3M-18G-NN-8M	WXG097-2	08-01-2023	07-31-2024
Coaxial Cable (18GHz ~ 40GHz)	JYTSZ	JYT3M-40G-SS-8M	WXG097-3	08-01-2023	07-31-2024
High Band Reject Filter Group	Tonscend	JS0806-F	WXJ089	N/A	
Low Band Reject Filter Group	Tonscend	JS0806-F	WXJ097-4	N/A	
Test Software	Tonscend	TS+	Version: 5.0.0		

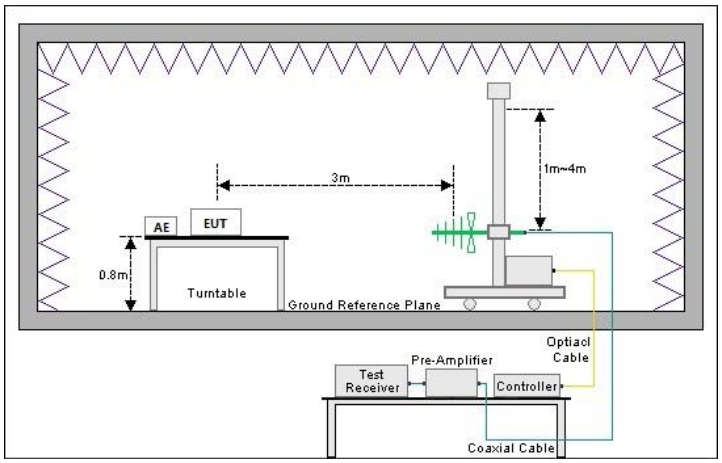
Conducted method:					
Test Equipment	**Manufacturer**	**Model No.**	**Manage No.**	**Cal. Date (mm-dd-yy)**	**Cal. Due date (mm-dd-yy)**
Spectrum Analyzer	KEYSIGHT	N9010B	WXJ081-1	06-13-2023	06-12-2024
Vector Signal Generator	Keysight	N5182B	WXJ091-1	06-13-2023	06-12-2024
Vector Signal Generator	Keysight	N5182B	WXJ091-2	06-14-2023	06-13-2024
Signal Generator	Keysight	N5173B	WXJ091-3	06-13-2023	06-12-2024
Network Analyzer	Keysight	E5071C	WXJ091	01-10-2023	01-09-2024
RF Control Unit	Tonscend	JS0806-1	WXG010-2	N/A	N/A
RF Control Unit	Tonscend	JS0806-1	WXG010-3	N/A	N/A
Band Reject Filter Group	Tonscend	JS0806-F	WXG010-4	N/A	N/A
Test Software	Tonscend	TS+	Version: 2.6.9.0526		

4 Measurement Setup and Procedure

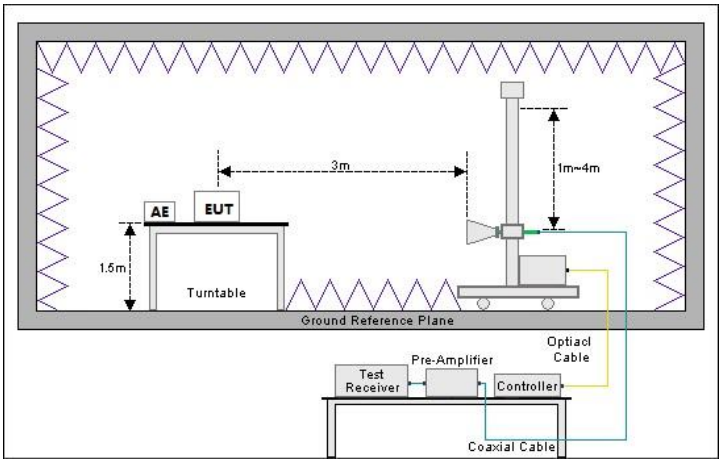
4.1 Test Setup

1) Radiated emission measurement:

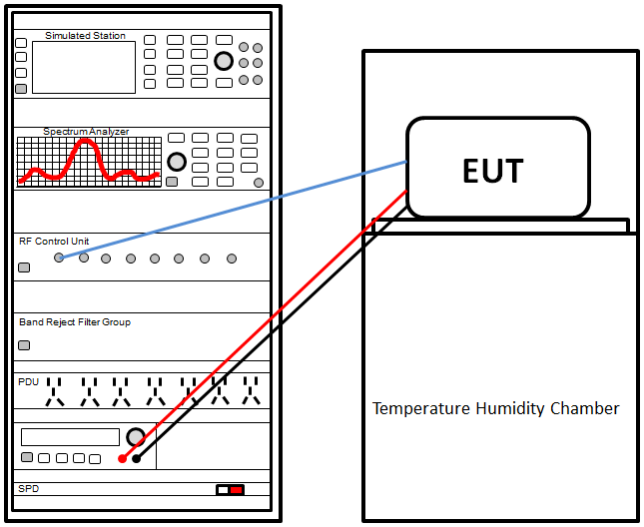
Below 1GHz (3m SAC)



Above 1GHz (3m FAR)



2) Conducted test method



4.2 Test Procedure

Test method	Test step
Radiated emission	**For below 1GHz:** 1. The EUT was placed on the tabletop of a rotating table 0.8 m the ground at a 3 m semi anechoic chamber. The measurement distance from the EUT to the receiving antenna is 3 m. 2. EUT works in each mode of operation that needs to be tested，and having the EUT continuously working, respectively on 3 axis (X, Y & Z) and considered typical configuration to obtain worst position. The highest signal levels relative to the limit shall be determined by rotating the EUT from 0° to 360° and with varying the measurement antenna height between 1 m and 4 m in vertical and horizontal polarizations. 3. Open the test software to control the test antenna and test turntable. Perform the test, save the test results, and export the test data. **For above 1GHz:** 1. The EUT was placed on the tabletop of a rotating table 1.5 m the ground at a 3 m fully anechoic room. The measurement distance from the EUT to the receiving antenna is 3 m. 2. EUT works in each mode of operation that needs to be tested，and having the EUT continuously working, respectively on 3 axis (X, Y & Z) and considered typical configuration to obtain worst position. The highest signal levels relative to the limit shall be determined by rotating the EUT from 0° to 360° and with varying the measurement antenna height between 1 m and 4 m in vertical and horizontal polarizations. 3. Open the test software to control the test antenna and test turntable. Perform the test, save the test results, and export the test data.
Conducted test method	1. The antenna port of EUT was connected to the test port of the test system through an RF cable. 2. The EUT is keeping in continuous transmission mode and tested in all modulation modes. 3. Open the test software, prepare a test plan, and control the system through the software. After the test is completed, the test report is exported through the test software.

5 Test Results

5.1 Summary

5.1.1 Clause and Data Summary

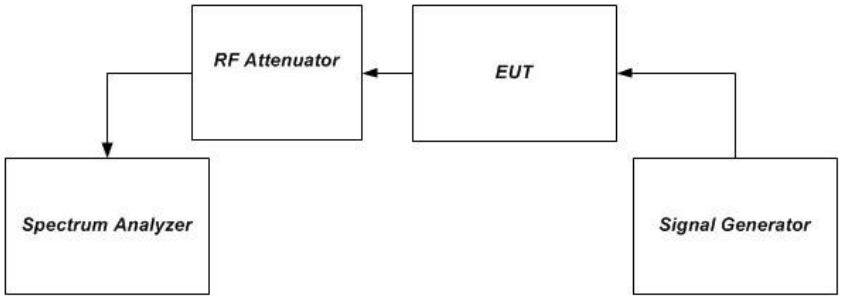
Test Item	Section in CFR 47	Result
Frequency Band	Part 20.21(e)(3)	Pass
Maximum Power and Gain	Part 20.21(e)(8)(i)(B) Part 20.21(e)(8)(i)(C) Part 20.21(e)(8)(i)(D)	Pass
Intermodulation	Part 20.21(e)(8)(i)(F)	Pass
Out-of-Band Emission	Part 20.21(e)(8)(i)(E)	Pass
Conducted Spurious Emissions	Part 2.1051 Part 27.53(g)	Pass
Noise Limits	Part 20.21(e)(8)(i)(A)	Pass
Uplink Inactivity	Part 20.21(e)(8)(i)(I)	Pass
Variable Gain	Part 20.21(e)(8)(i)(C) Part 20.21(e)(8)(i)(H)	Pass
Occupied Bandwidth	Part 2.1049	Pass
Anti – Oscillation	Part 20.21(e)(8)(ii)(A)	Pass
Radiated Spurious Emissions	Part 2.1053	Pass
Spectrum Block Filtering	Part 20.21(e)(8)(i)(B) Part 20.21(e)(3)	Pass *(see note 1)*

Remark:

1. *Pass: The EUT complies with the essential requirements in the standard.*
2. *N/A: Not Applicable.*
3. *Note 1: The test results Refer to section 6.1&6.6 and 6.8 for details.*

Test Method:	*ANSI C63.26-2015* *KDB 935210 D03 Signal Booster Measurements v04r02*

5.2 Frequency Band

Test Requirement:	FCC part 20.21(e)(3)
Limit:	Band 4:Uplink: 1710MHz-1755MHz, Downlink: 2110MHz-2155MHz Band 5:Uplink: 824MHz-849MHz, Downlink: 869MHz-894MHz Band 12:Uplink: 699MHz-716MHz, Downlink: 729MHz-746MHz Band 13:Uplink: 777MHz-787MHz, Downlink: 746MHz-756MHz Band 25:Uplink: 1850MHz-1910MHz, Downlink: 1930MHz-1990MHz
Test setup:	
Test Procedure:	a) Connect the EUT to the test equipment as shown in Test setup. 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 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. 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 Instruments:	Refer to section 5.9 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed

Test plot as follows:

Band 4

1710MHz-1755MHz(Uplink)

2110MHz-2155MHz(Downlink)

Band 5

824MHz-849MHz(Uplink)

869MHz-894MHz(Downlink)

Band 12

699MHz-716MHz(Uplink)

729MHz-746MHz(Downlink)

Band 13

746MHz-756MHz(Uplink)

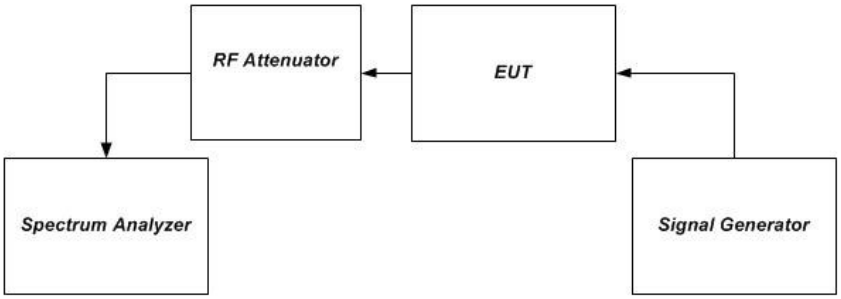
777MHz-787MHz(Downlink)

Band 25

1850MHz-1915MHz(Uplink)

1930MHz-1955MHz(Downlink)

5.3 Maximum Power and Gain

Test Requirement:	FCC part 20.21(e)(8)(i)(B), FCC part 20.21(e)(8)(i)(C) FCC part 20.21(e)(8)(i)(D)
Limit:	Maximum Power: Uplink ≤ 30dBm(EIRP), Downlink ≤ 30dBm(EIRP) Maximum Gain: Fixed Booster maximum gain shall not exceed 6.5 dB + 20 Log_{10} (Frequency)
Test setup:	
Test Procedure:	a) Connect the EUT to the test equipment as shown test setup. 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 section 6.1 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 EUT maximum input level. 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.

	k) G (dB) = P_{OUT}(dBm) ? P_{IN}(dBm)
Test Instruments:	Refer to section 5.9 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed

Measurement Data:

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Output Power of Uplink					
Frequency Band	Input Level (dBm)	Output Power (dBm)	Limit (dBm)		Result
1710MHz ~ 1755MHz Pulsed GSM	-47.68	11.69	30dBm		Pass
1710MHz ~ 1755MHz AWGN	-49.60	11.94	30dBm		Pass
EIRP of Uplink					
Frequency Band	Output Level (dBm)	Antenna Gain (dBi)	EIPR Level (dBm)	EIRP Limit (dBm)	Result
1710MHz ~ 1755MHz	11.94	7.63	19.57	30	Pass

Output Power of Downlink				
Frequency Band	Input Level (dBm)	Output Power (dBm)	Limit (dBm)	Result
2110MHz ~ 2155MHz Pulsed GSM	-47.40	20.30	30	Pass
2110MHz ~ 2155MHz AWGN	-48.80	19.90	30	Pass
EIRP of Downlink				
Frequency Band	Output Level (dBm)	Antenna Gain (dBi)	EIPR Level (dBm)	Limit (dBm)	Result
2110MHz ~ 2155MHz	20.30	7.63	27.93	30	Pass

Gain of Uplink			
Frequency Band	Gain(dB)	Limit(dB)	Result
1710MHz ~ 1755MHz Pulsed GSM	59.37	71.27	Pass
1710MHz ~ 1755MHz AWGN	61.54	71.27	Pass
Remark: G (dB) = P_{OUT}(dBm) ? P_{IN}(dBm).			

Gain of Downlink			
Frequency Band	Gain(dB)	Limit(dB)	Result
2110MHz ~ 2155MHz Pulsed GSM	67.7	73.08	Pass
1930MHz ~ 1995MHz AWGN	68.7	73.08	Pass
Remark: G (dB) = P_{OUT}(dBm) ? P_{IN}(dBm).			

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Output Power of Uplink				
Frequency Band	Input Level (dBm)	Output Power (dBm)	Limit(dBm)	Result
824MHz ~ 849MHz Pulsed GSM	-43.50	11.30	30	Pass
824MHz ~ 849MHz AWGN	-42.20	11.13	30	Pass

EIRP of Uplink					
Frequency Band	Output Level (dBm)	Antenna Gain (dBi)	EIPR Level (dBm)	EIRP Limit (dBm)	Result
824MHz ~ 849MHz	11.30	7.24	16.39	30.00	Pass

Output Power of Downlink				
Frequency Band	Input Level (dBm)	Output Power (dBm)	Limit (dBm)	Result
869MHz ~ 894MHz Pulsed GSM	-42.96	18.31	30	Pass
869MHz ~ 894MHz AWGN	-42.80	18.14	30	Pass

EIRP of Downlink					
Frequency Band	Output Level (dBm)	Antenna Gain (dBi)	EIPR Level (dBm)	Limit (dBm)	Result
869MHz ~ 894MHz	18.31	7.24	23.4	30	Pass

Gain of Uplink			
Frequency Band	Gain(dB)	Limit(dB)	Result
824MHz ~ 849MHz Pulsed GSM	54.8	65.22	Pass
824MHz ~ 849MHz AWGN	53.33	65.22	Pass
Remark: G (dB) = P_{OUT}(dBm) ? P_{IN}(dBm).			

Gain of Downlink			
Frequency Band	Gain(dB)	Limit(dB)	Result
869MHz ~ 894MHz Pulsed GSM	61.27	65.40	Pass
869MHz ~ 894MHz AWGN	60.94	65.40	Pass
Remark: G (dB) = P_{OUT}(dBm) ? P_{IN}(dBm).			

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Output Power of Uplink				
Frequency Band	Input Level (dBm)	Output Power (dBm)	Limit(dBm)	Result
698MHz ~ 716MHz Pulsed GSM	-41.94	11.18	30.00	Pass
698MHz ~ 716MHz AWGN	-42.30	12.25	30.00	Pass

EIRP of Uplink					
Frequency Band	Output Level (dBm)	Antenna Gain (dBi)	EIPR Level (dBm)	EIRP Limit (dBm)	Result
698MHz ~ 716MHz	12.25	6.30	16.4	30.00	Pass

Output Power of Downlink				
Frequency Band	Input Level (dBm)	Output Power (dBm)	Limit (dBm)	Result
698MHz ~ 716MHz Pulsed GSM	-39.4	17.42	30.00	Pass
698MHz ~716MHz AWGN	-39.2	18.57	30.00	Pass

EIRP of Downlink					
Frequency Band	Output Level (dBm)	Antenna Gain (dBi)	EIPR Level (dBm)	Limit (dBm)	Result
728MHz ~ 746MHz	18.57	6.30	22.72	30	Pass

Gain of Uplink			
Frequency Band	Gain(dB)	Limit(dB)	Result
698MHz ~ 716MHz Pulsed GSM	53.12	63.49	Pass
698MHz ~716MHz AWGN	54.55	63.49	Pass
Remark: G (dB) = P_{OUT}(dBm) ? P_{IN}(dBm).			

Gain of Downlink			
Frequency Band	Gain(dB)	Limit(dB)	Result
728MHz ~ 746MHz Pulsed GSM	56.82	63.85	Pass
728MHz ~ 746MHz AWGN	57.77	63.85	Pass
Remark: G (dB) = P_{OUT}(dBm) ? P_{IN}(dBm).			

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Output Power of Uplink				
Frequency Band	Input Level (dBm)	Output Power (dBm)	Limit(dBm)	Result
777MHz ~ 787MHz Pulsed GSM	-41.40	11.34	30.00	Pass
777MHz ~ 787MHz AWGN	-41.60	11.92	30.00	Pass

EIRP of Uplink					
Frequency Band	Output Level (dBm)	Antenna Gain (dBi)	EIPR Level (dBm)	EIRP Limit (dBm)	Result
777MHz ~ 787MHz	11.92	6.30	16.07	30.00	Pass

Output Power of Downlink				
Frequency Band	Input Level (dBm)	Output Power (dBm)	Limit (dBm)	Result
746MHz ~ 756MHz Pulsed GSM	-39.4	18.51	30	Pass
746MHz ~ 756MHz AWGN	-39.2	18.57	30	Pass

EIRP of Downlink					
Frequency Band	Output Level (dBm)	Antenna Gain (dBi)	EIPR Level (dBm)	Limit (dBm)	Result
746MHz ~ 756MHz	18.57	6.30	22.72	30	Pass

Gain of Uplink			
Frequency Band	Gain(dB)	Limit(dB)	Result
777MHz ~ 787MHz Pulsed GSM	52.74	64.36	Pass
777MHz ~ 787MHz AWGN	53.52	64.36	Pass
Remark: G (dB) = P_{OUT}(dBm) ? P_{IN}(dBm).			

Gain of Downlink			
Frequency Band	Gain(dB)	Limit(dB)	Result
746MHz ~ 756MHz Pulsed GSM	57.91	64.01	Pass
746MHz ~ 756MHz AWGN	57.77	64.01	Pass
Remark: G (dB) = P_{OUT}(dBm) ? P_{IN}(dBm).			

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Output Power of Uplink				
Frequency Band	Input Level (dBm)	Output Power (dBm)	Limit(dBm)	Result
1850MHz ~ 1915MHz Pulsed GSM	-49.50	12.18	30	Pass
1850MHz ~ 1915MHz AWGN	-49.75	12.38	30	Pass

EIRP of Uplink					
Frequency Band	Output Level (dBm)	Antenna Gain (dBi)	EIPR Level (dBm)	EIRP Limit (dBm)	Result
1850MHz ~ 1915MHz	12.38	7.82	20.2	30	Pass

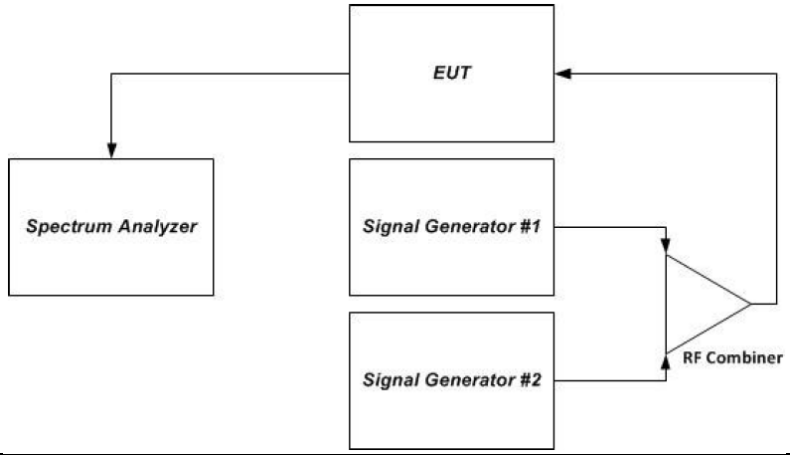
Output Power of Downlink				
Frequency Band	Input Level (dBm)	Output Power (dBm)	Limit (dBm)	Result
1930MHz ~ 1995MHz Pulsed GSM	-48.25	18.14	30	Pass
1930MHz ~ 1995MHz AWGN	-49.20	19.65	30	Pass

EIRP of Downlink					
Frequency Band	Output Level (dBm)	Antenna Gain (dBi)	EIPR Level (dBm)	Limit (dBm)	Result
1930MHz ~ 1995MHz	19.65	7.82	27.47	30	Pass

Gain of Uplink			
Frequency Band	Gain(dB)	Limit(dB)	Result
1850MHz ~ 1915MHz Pulsed GSM	61.68	71.99	Pass
1850MHz ~ 1915MHz AWGN	62.13	71.99	Pass
Remark: G (dB) = P_{OUT}(dBm) ? P_{IN}(dBm).			

Gain of Downlink			
Frequency Band	Gain(dB)	Limit(dB)	Result
1930MHz ~ 1995MHz Pulsed GSM	66.39	72.36	Pass
1930MHz ~ 1995MHz AWGN	68.85	72.36	Pass
Remark: G (dB) = P_{OUT}(dBm) ? P_{IN}(dBm).			

5.4 Intermodulation

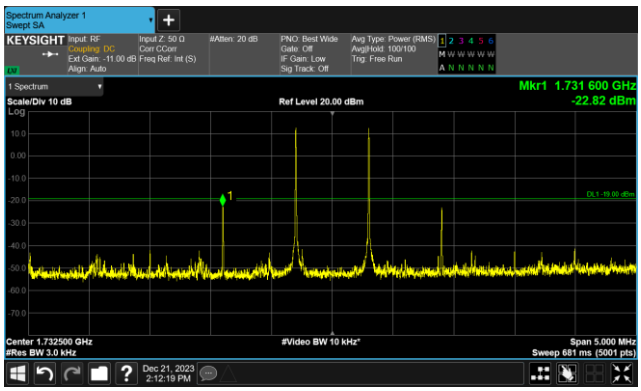
Test Requirement:	FCC part 20.21(e)(8)(F)
Limit:	-19 dbm.
Test setup:	
Test Procedure:	a) Connect the signal booster to the test equipment as shown in test setup. Begin with the uplink output (donor) port connected to the spectrum analyzer. b) Set the spectrum analyzer RBW = 3 kHz. c) Set the VBW ≥ 3 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 x 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. configure the test signal pair around the frequency with maximum output power of the EUT. h) Set the signal generator amplitudes so that the power from each into the RF combiner is equivalent, then turn on the RF output. i) Simultaneously increase each signal generators' amplitude equally until just before the EUT begins AGC, then affirm that all intermodulation-product emissions are below the specified limit of ?19 dBm. j) Use the trace averaging function of the spectrum analyzer, and wait for the trace to stabilize. Place a marker at the highest amplitude intermodulation-product emission. k) Record the maximum intermodulation product amplitude level that is observed. l) Capture the spectrum analyzer trace for inclusion in the test report. m) Repeat e) to l) for all uplink and downlink operational bands. n) Increase the signal generator amplitude in 2 dB steps to 10 dB above the AGC threshold determined in i).
Test Instruments:	Refer to section 5.9 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed

Measurement Data:

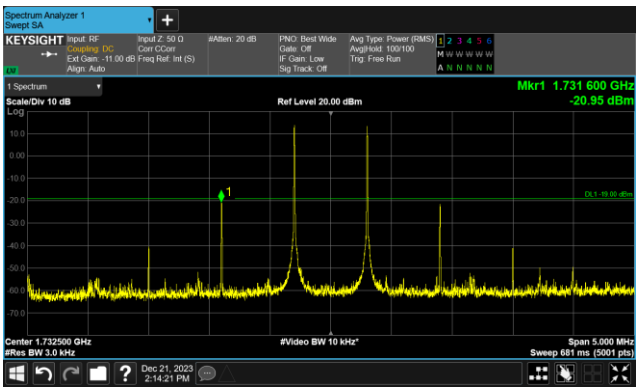
Test plots as below:

Band 4
Uplink

Normal

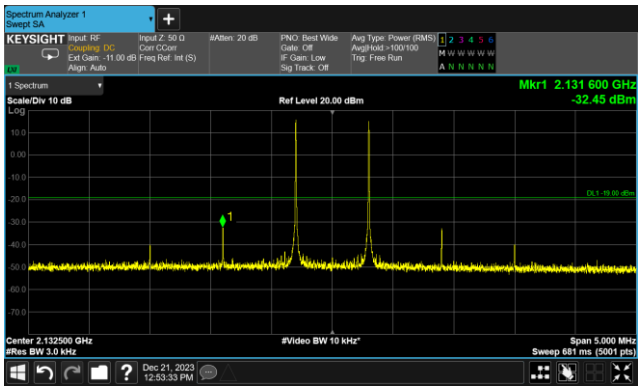


Increase 10 dB

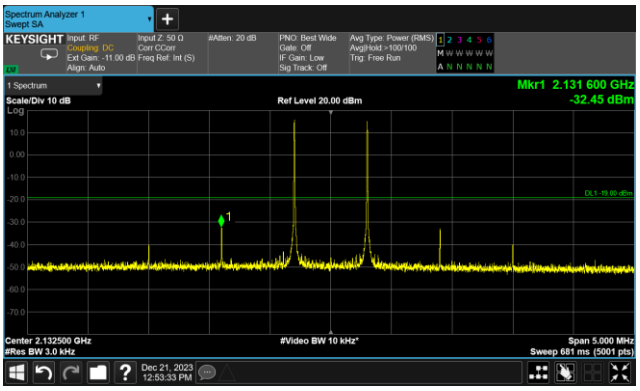


Downlink

Normal



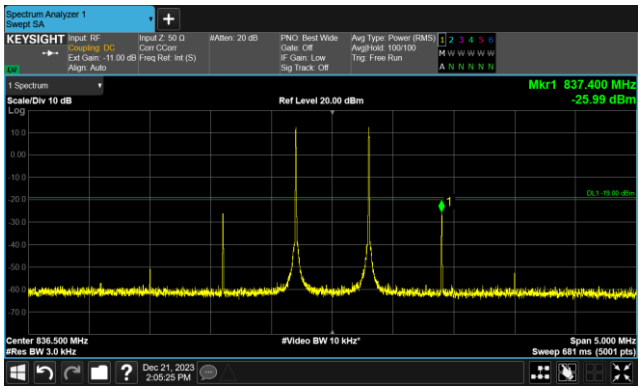
Increase 10 dB



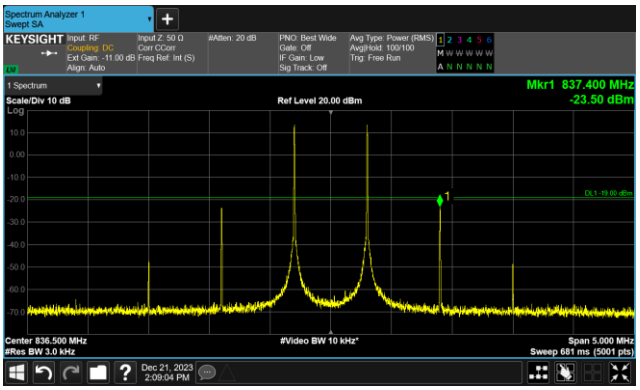
Band 5

Uplink

Normal

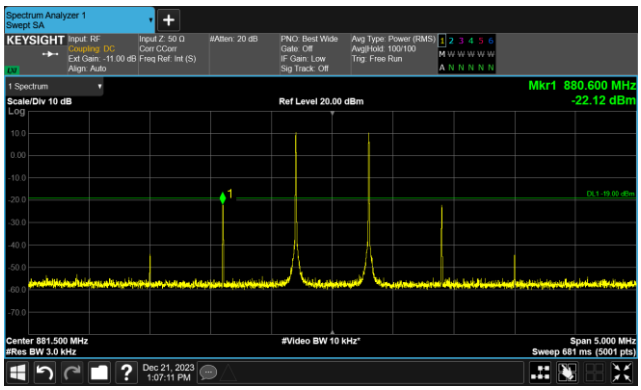


Increase 10 dB

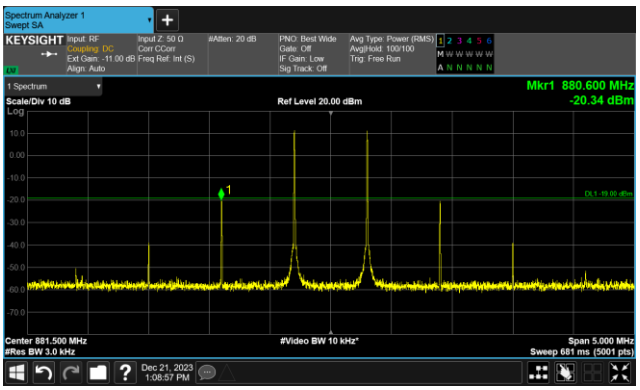


Downlink

Normal

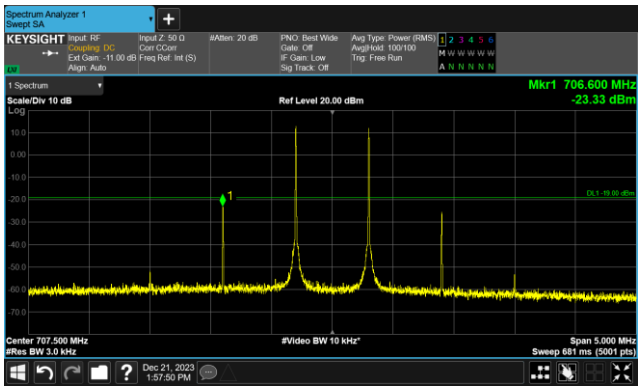


Increase 10 dB

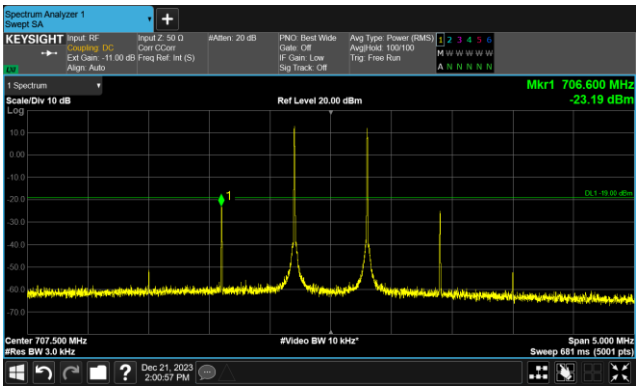


Band 12
Uplink

Normal

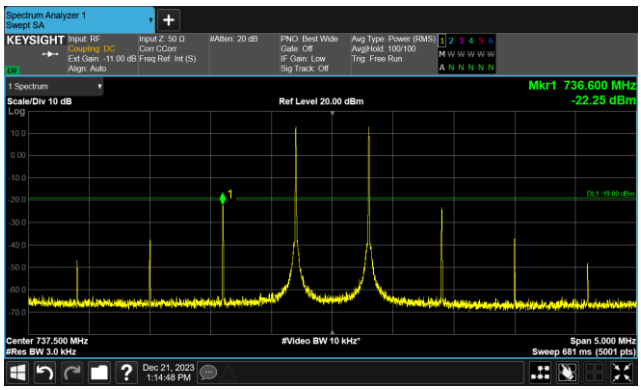


Increase 10 dB

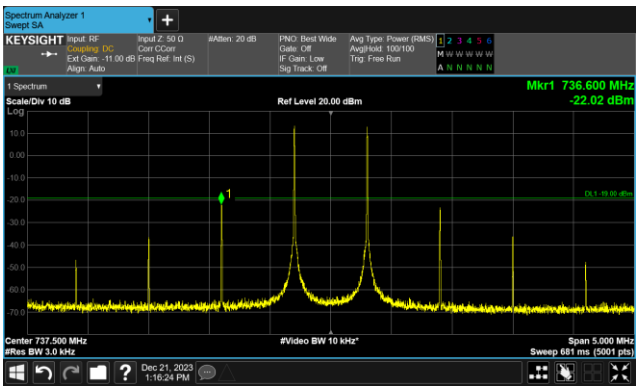


Downlink

Normal

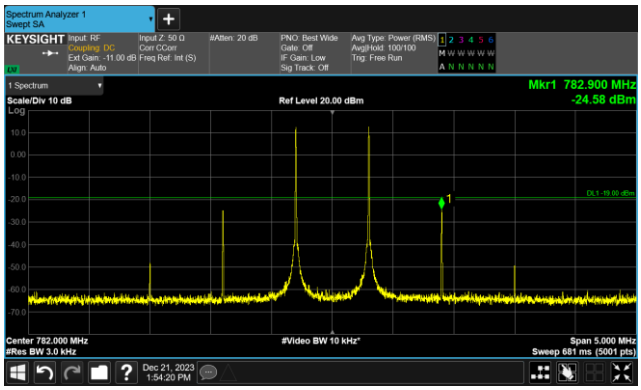


Increase 10 dB

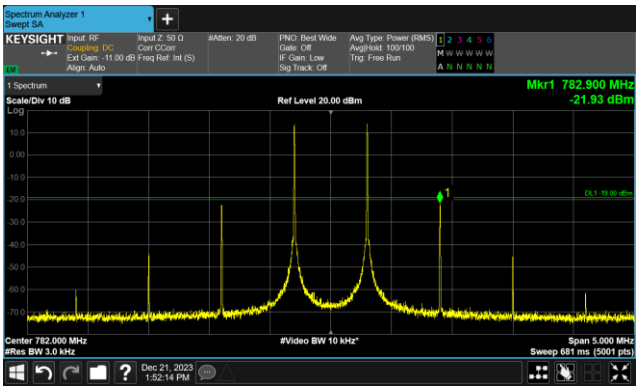


Band 13
Uplink

Normal

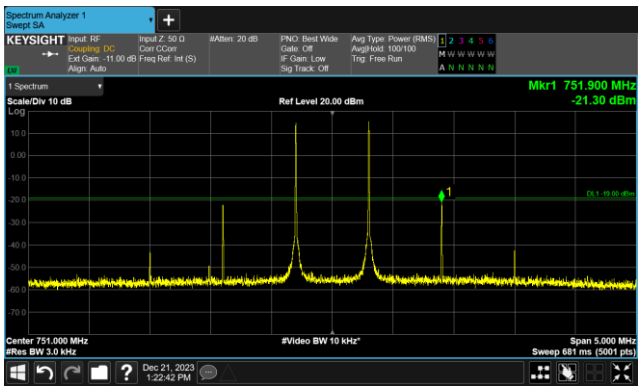


Increase 10 dB

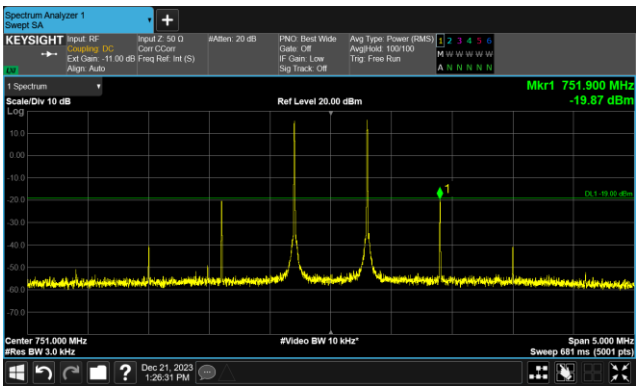


Downlink

Normal



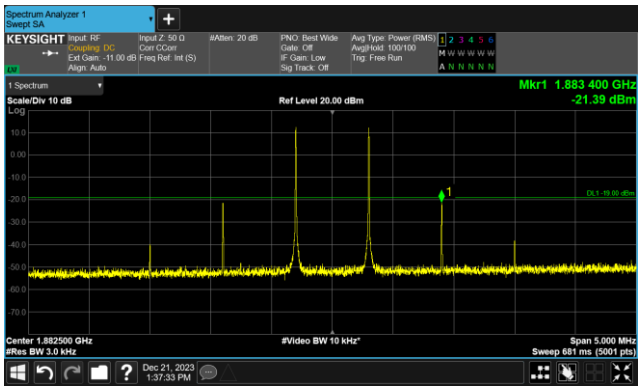
Increase 10 dB



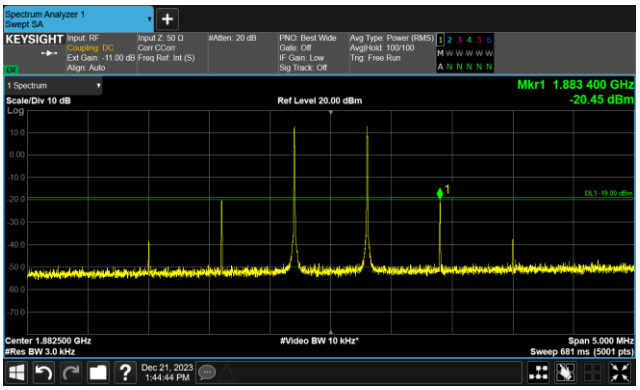
Band 25

Uplink

Normal

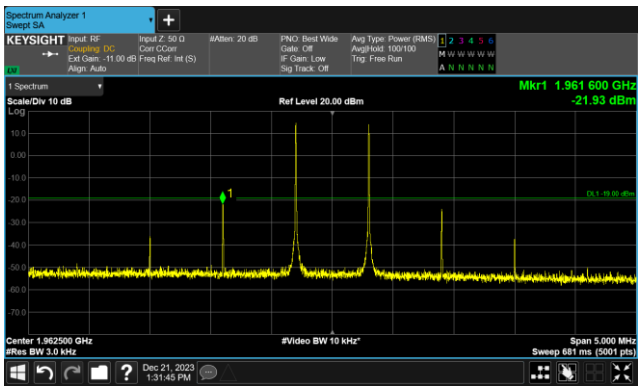


Increase 10 dB

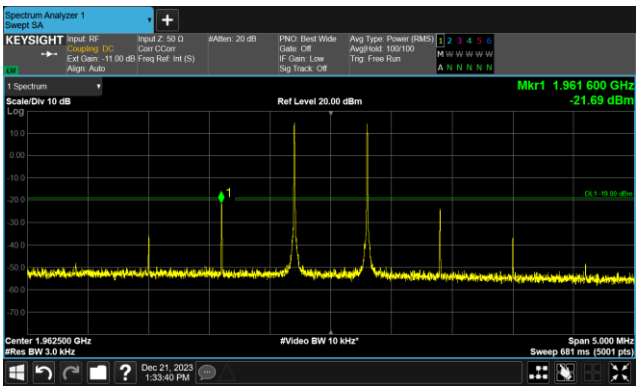


Downlink

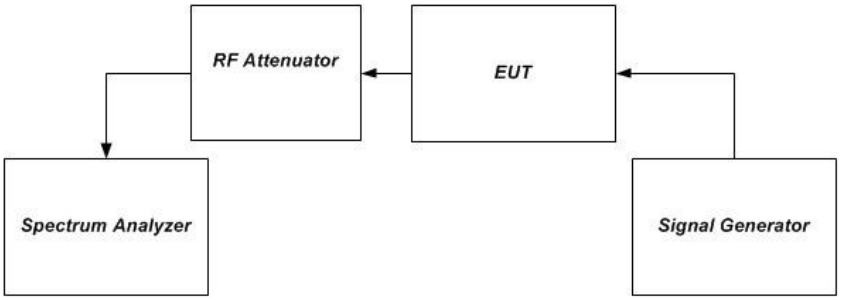
Normal



Increase 10 dB



5.5 Out-of-Band Emission

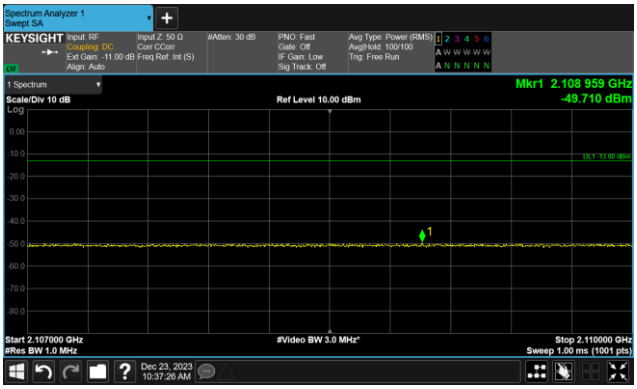
Test Requirement:	FCC part 20.21(e)(i)(E)
Limit:	-13dBm
Test setup:	
Test Procedure:	a) Connect the EUT to the test equipment as shown in test setup. Begin with the uplink output (donor) port connected to the spectrum analyzer. b) Configure the signal generator for the appropriate operation for all uplink 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. c) Set the signal generator amplitude to the maximum power level prior to AGC. d) Set RBW ? 100kHz(below 1GHz) or 1MHz(above 1GHz) NOTE: Within 300 kHz and 3 MHz away from band edge, if smaller RBW is used, per Parts 24 and 27 the smaller RBW is applicable only for frequencies within 100 kHz or 1 MHz away from the band edge. e) Set VBW = 3 x RBW. f) Select the power averaging (rms) detector. g) Sweep time = auto-couple. h) Set the analyzer start frequency to the upper band/block edge frequency and the stop frequency to the upper band/block edge frequency plus: 300 kHz (when operational frequency is < 1 GHz), or 3 MHz (when operational frequency is ⩾ 1 GHz). i) Trace average at least 100 traces in power averaging (i.e., rms) mode. j) Use peak marker function to find the maximum power level. k) Capture the spectrum analyzer trace of the power level for inclusion in the test report. l) Increase the signal generator amplitude in 2 dB steps until the EUT maximum input level is reached. Affirm that the EUT maintains compliance with the OOBE limits. m) Reset the analyzer start frequency to the lower band/block edge frequency minus: 300 kHz (when operational frequency is < 1 GHz), or 3 MHz (when operational frequency is ⩾ 1 GHz), and the stop frequency to the lower band/block edge frequency, then repeat i) to l). n) Repeat b) through m) for each uplink and downlink operational band.
Test Instruments:	Refer to section 5.9 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed

Measurement Data:

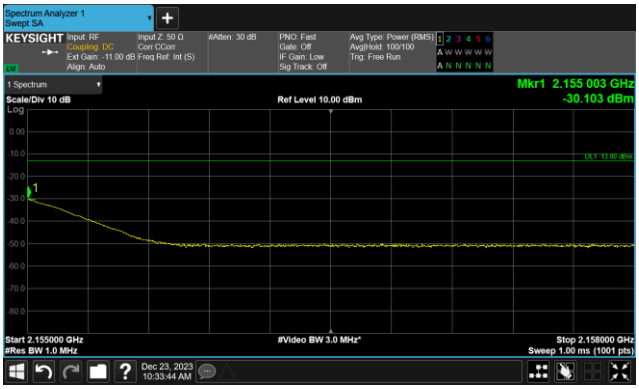
Test plots as below:

Band 4
Downlink of GSM Signal
Normal

Lower

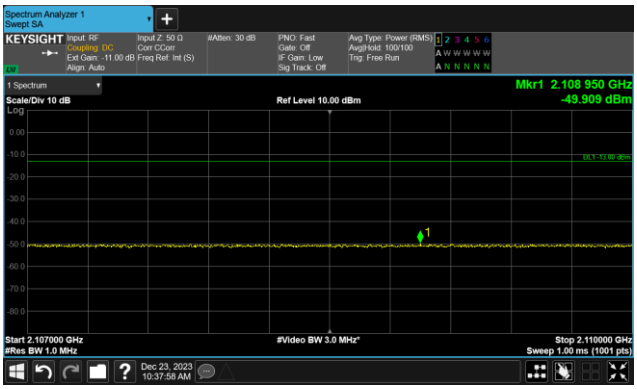


Upper

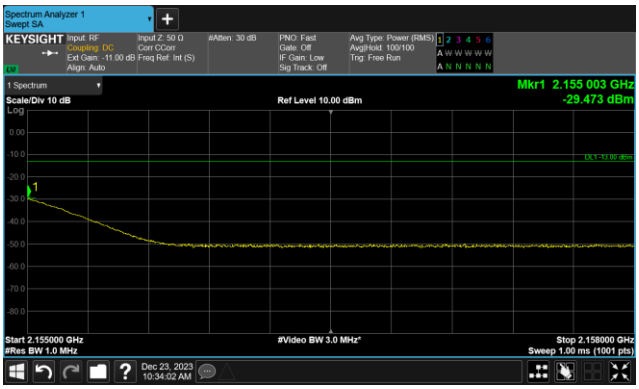


Increase 10 dB

Lower

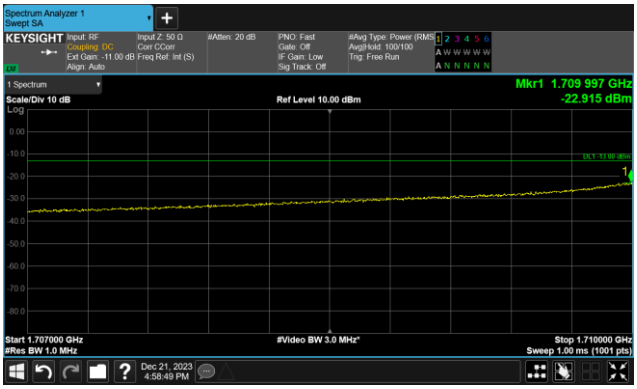


Upper

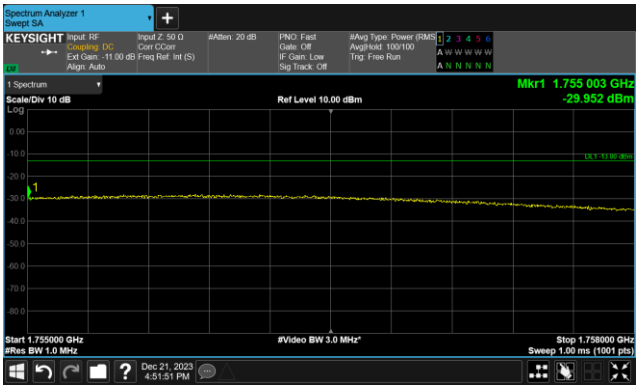


Band 4
Uplink of CDMA Signal
Normal

Lower

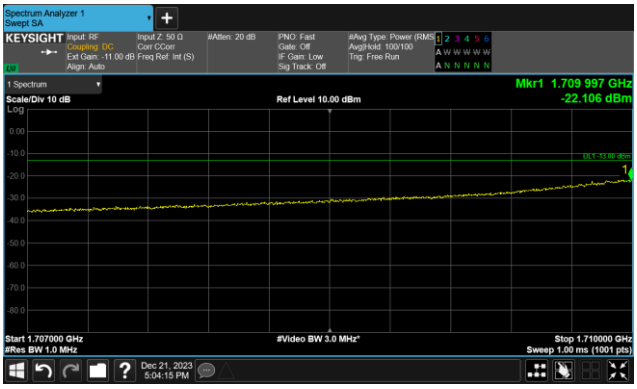


Upper

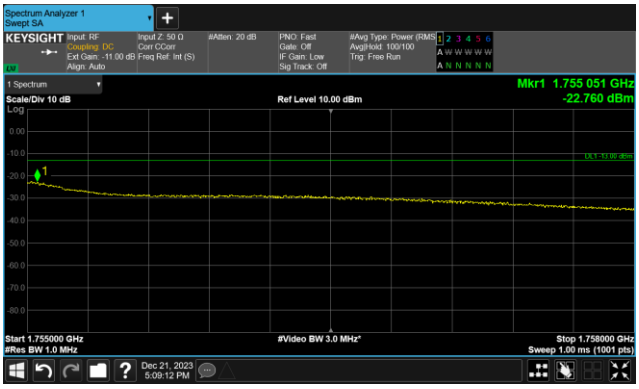


Increase 10 dB

Lower

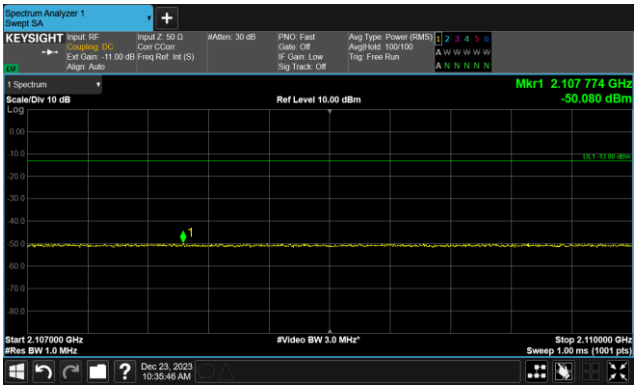


Upper

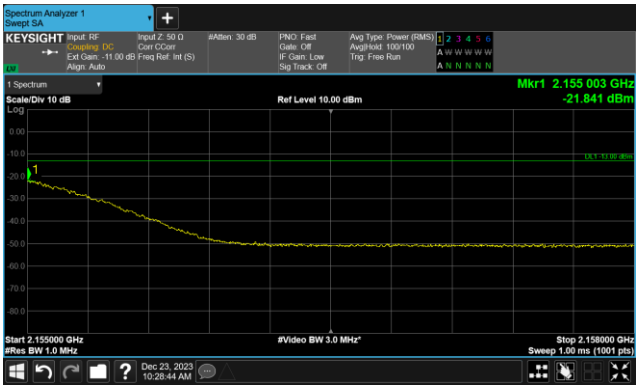


Band 4
Downlink of CDMA Signal
Normal

Lower

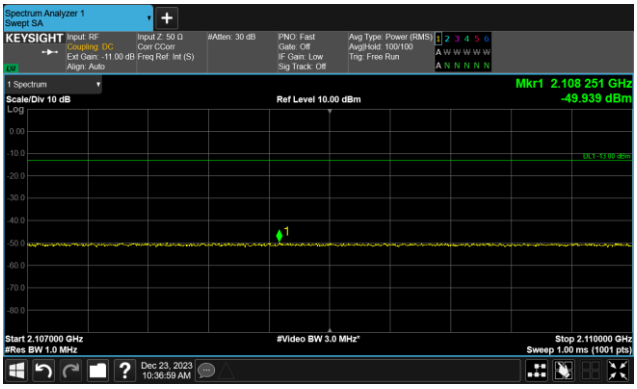


Upper

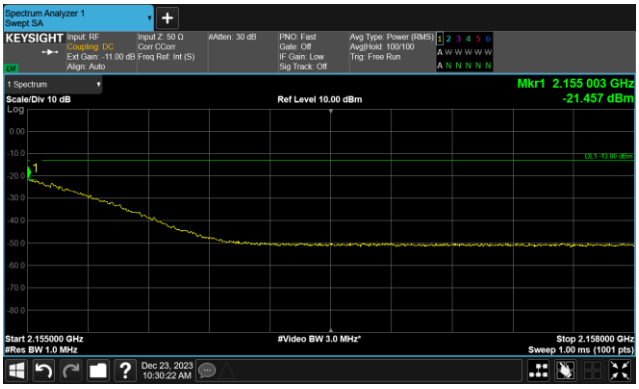


Increase 10 dB

Lower

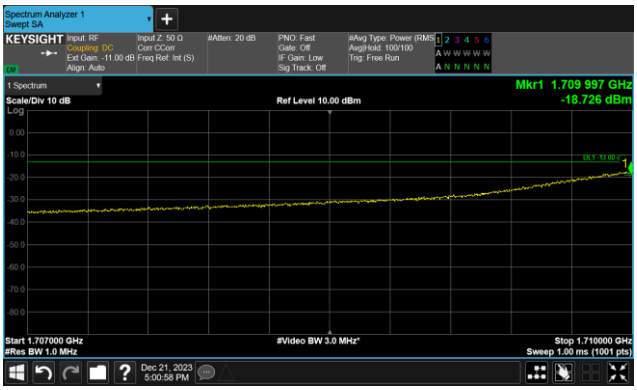


Upper

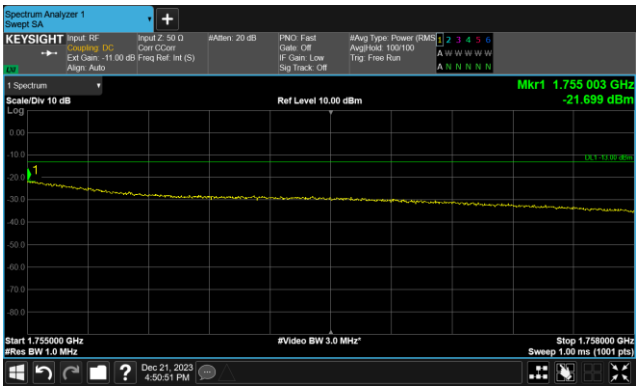


Band 4
Uplink of LTE Signal
Normal

Lower

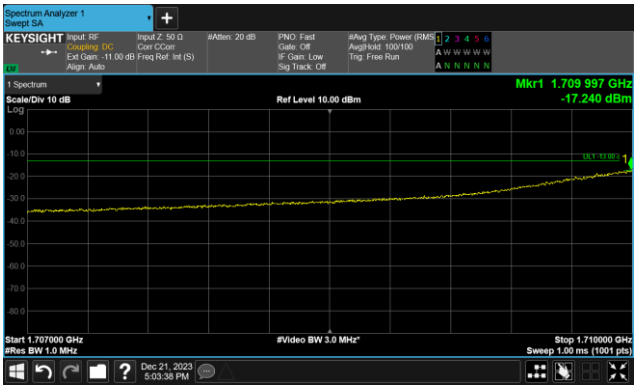


Upper

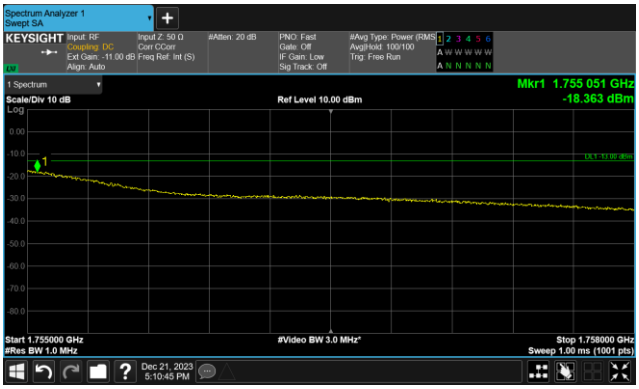


Increase 10 dB

Lower

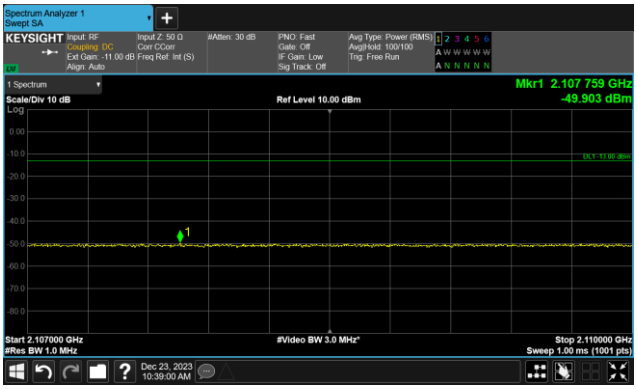


Upper

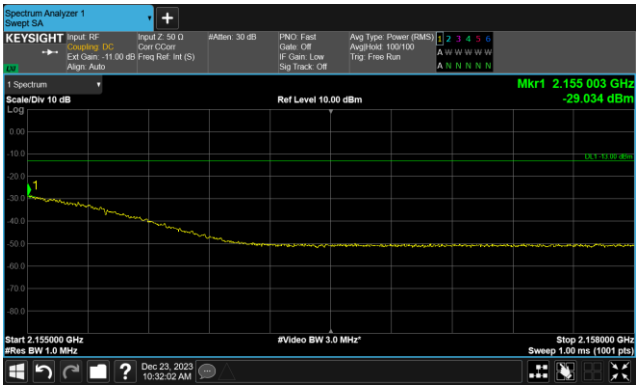


Band 4
Downlink of LTE Signal
Normal

Lower

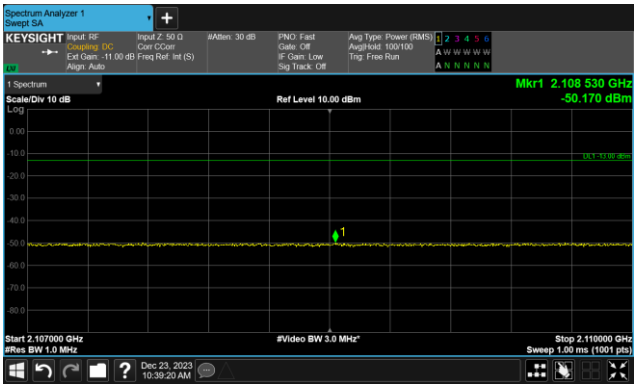


Upper

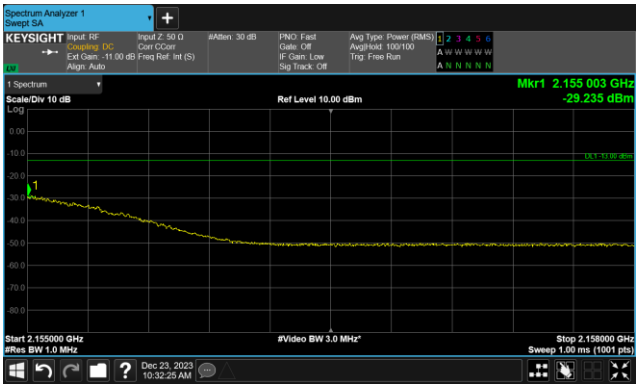


Increase 10 dB

Lower

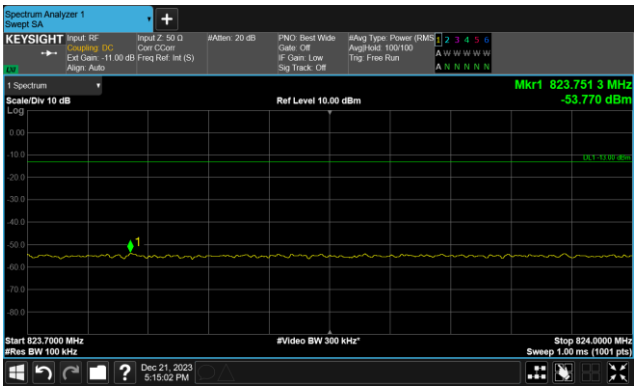


Upper

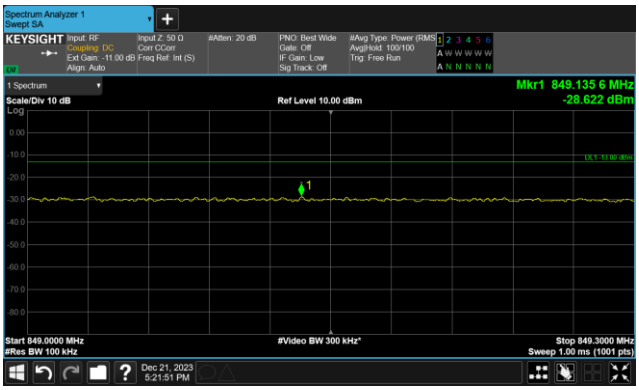


Band 5
Uplink of GSM Signal
Normal

Lower

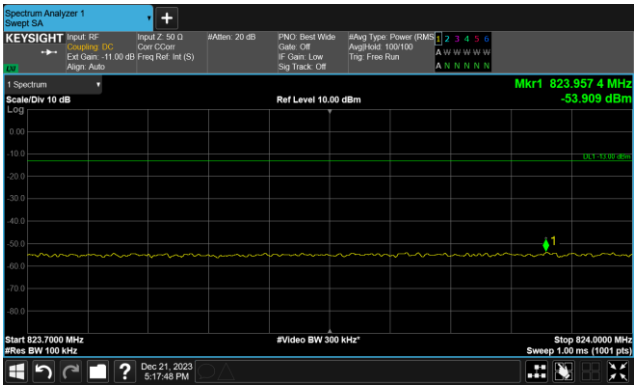


Upper

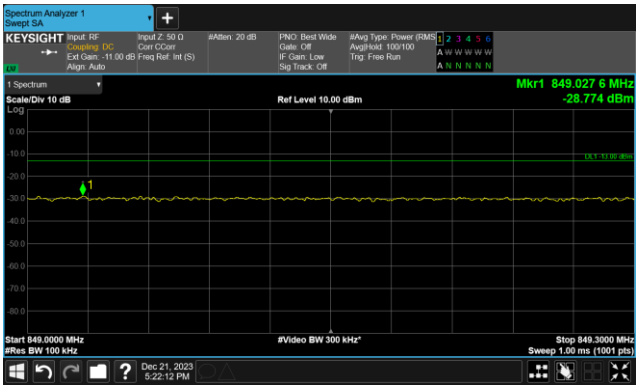


Increase 10 dB

Lower

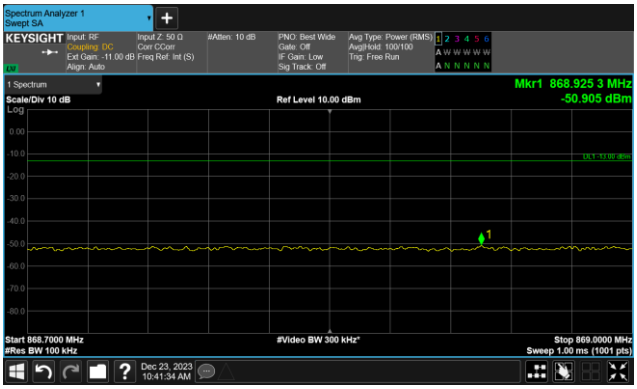


Upper

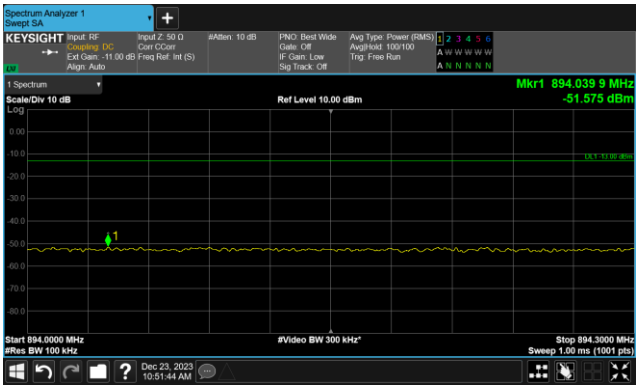


Band 5
Downlink of GSM Signal
Normal

Lower

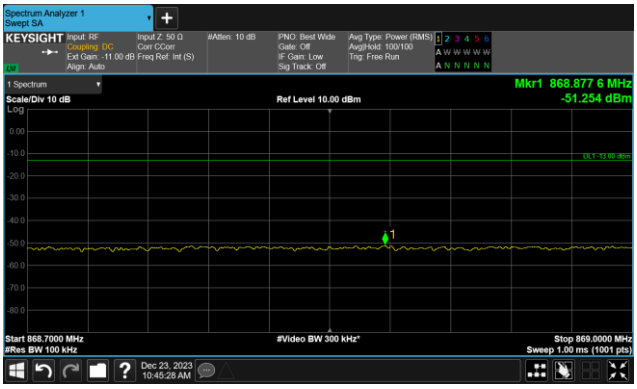


Upper

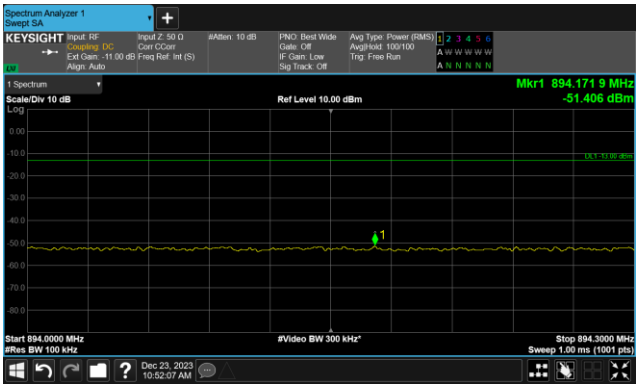


Increase 10 dB

Lower

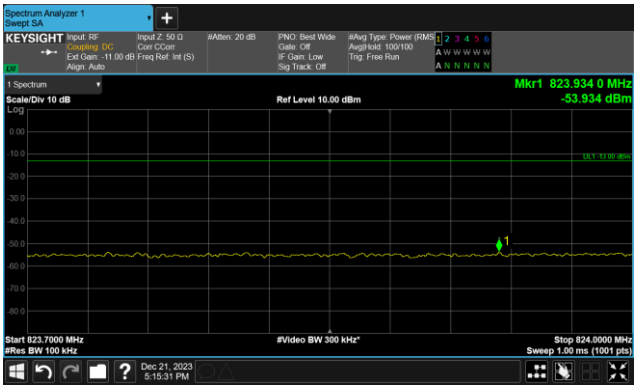


Upper

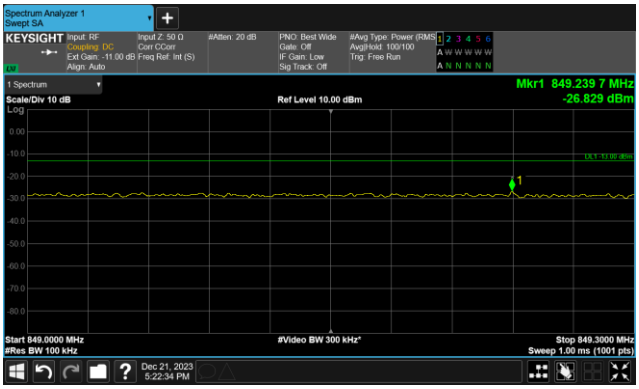


Band 5
Uplink of CDMA Signal
Normal

Lower

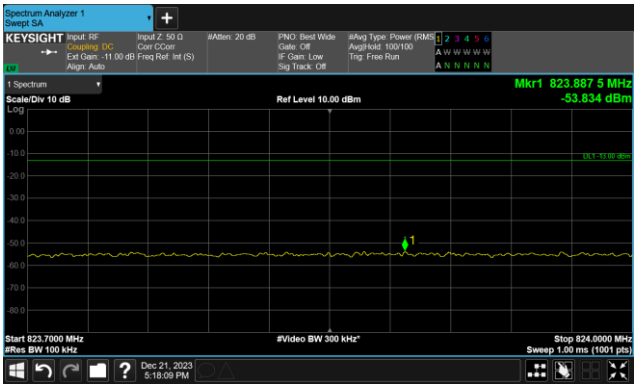


Upper

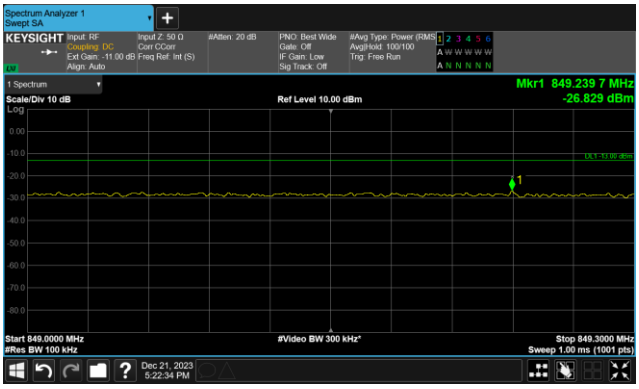


Increase 10 dB

Lower

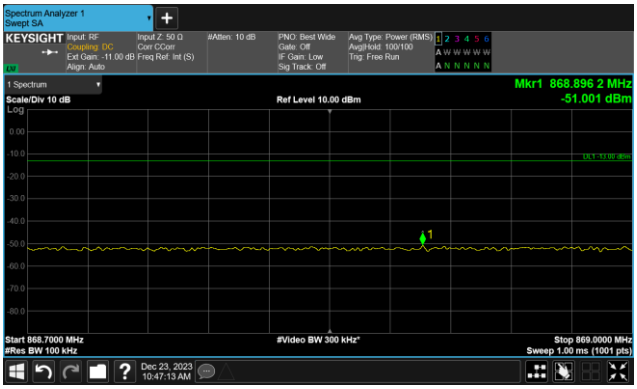


Upper

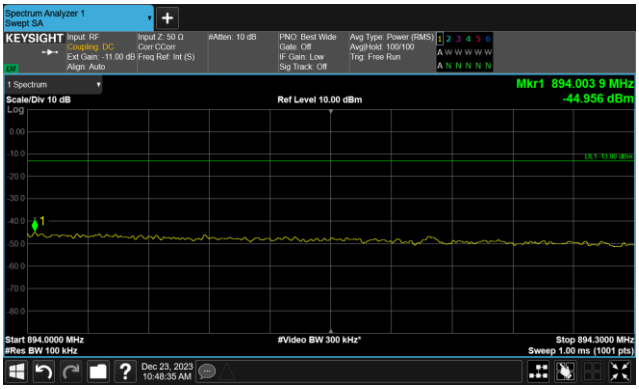


Band 5
Downlink of CDMA Signal
Normal

Lower

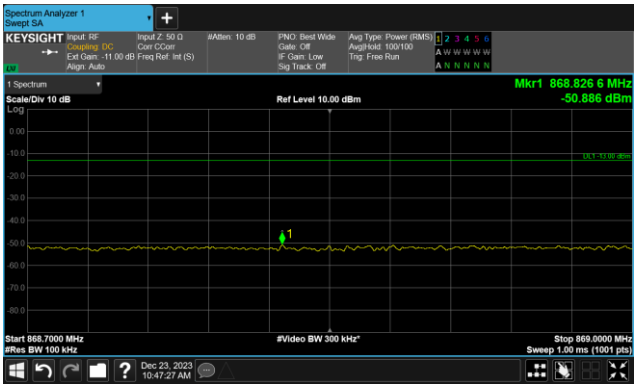


Upper

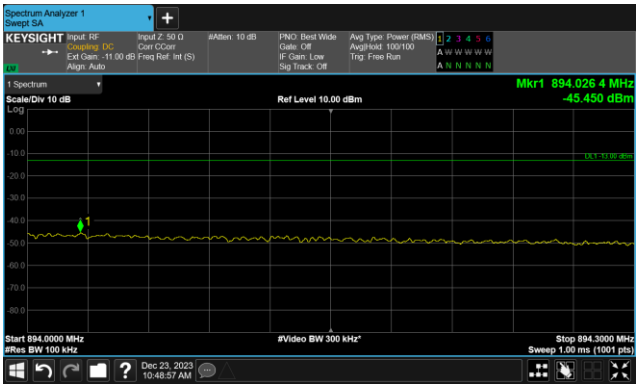


Increase 10 dB

Lower

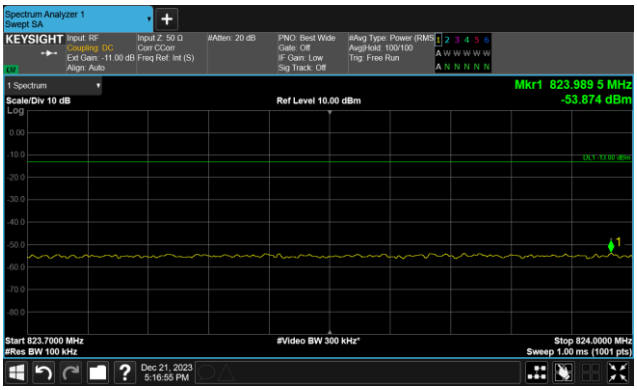


Upper

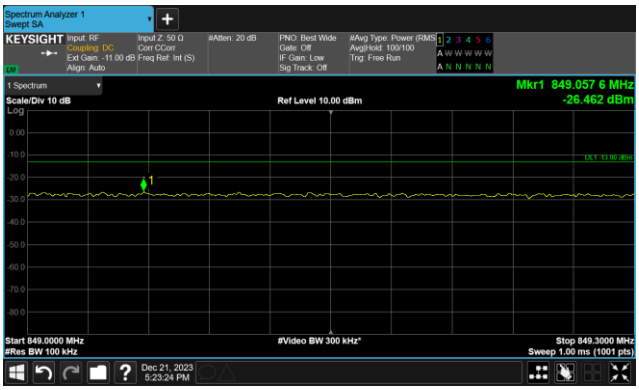


Band 5
Uplink of LTE Signal
Normal

Lower

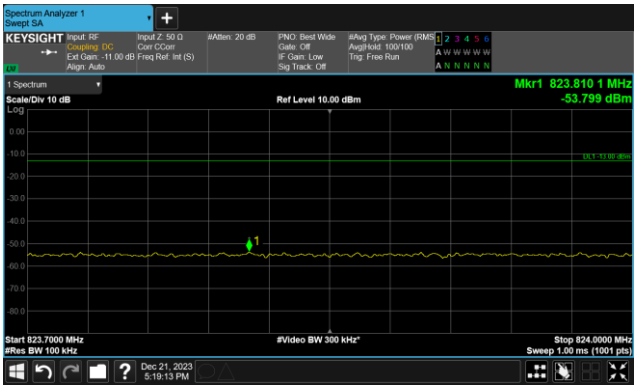


Upper

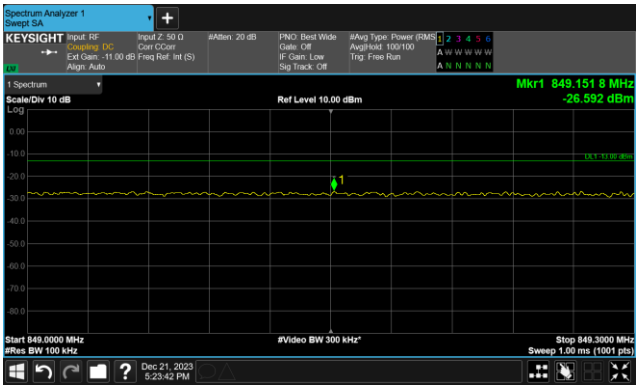


Increase 10 dB

Lower

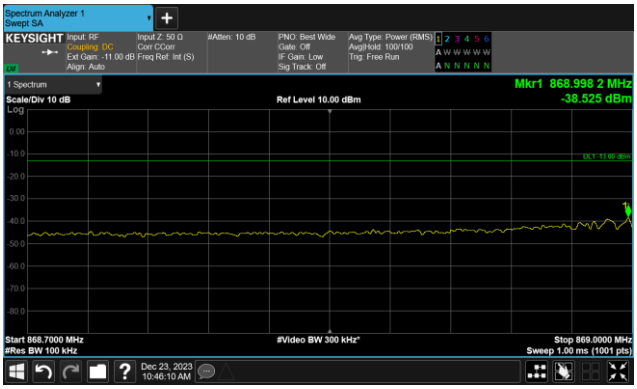


Upper

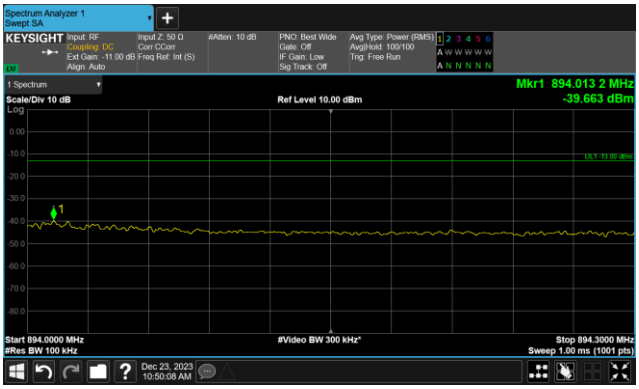


Band 5
Downlink of LTE Signal
Normal

Lower

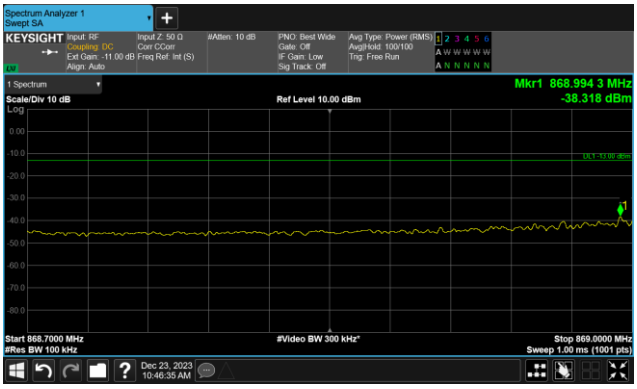


Upper

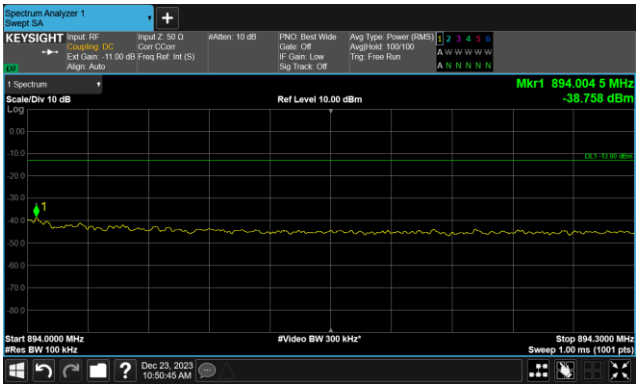


Increase 10 dB

Lower

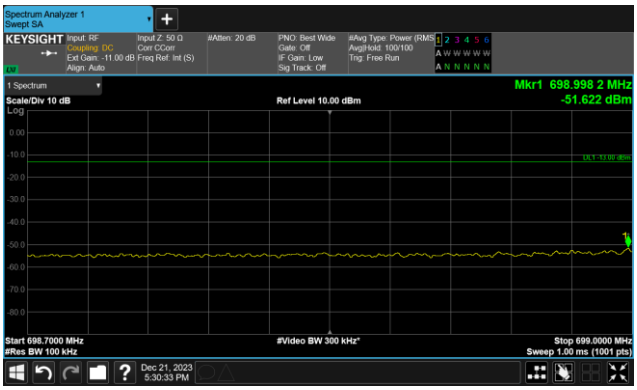


Upper

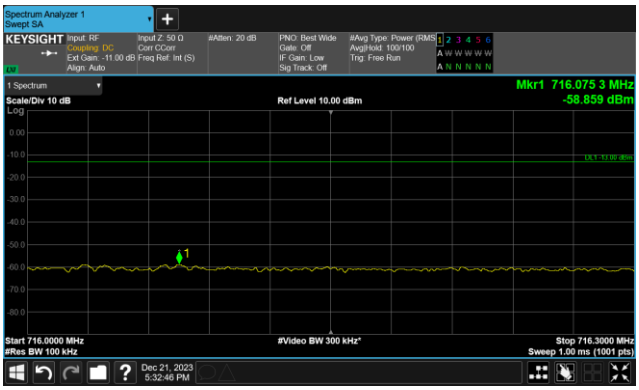


Band 12
Uplink of GSM Signal
Normal

Lower

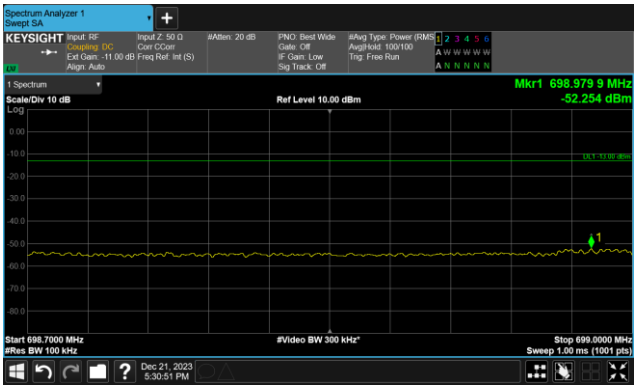


Upper

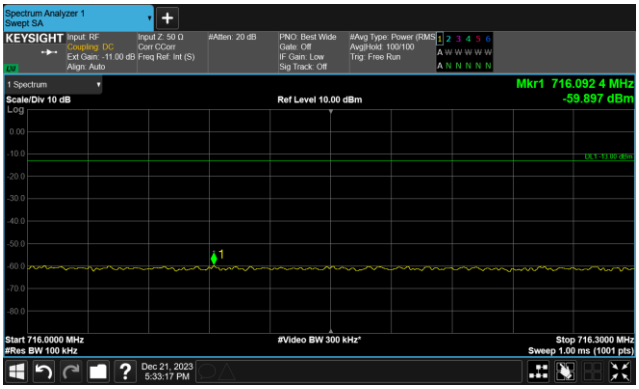


Increase 10 dB

Lower

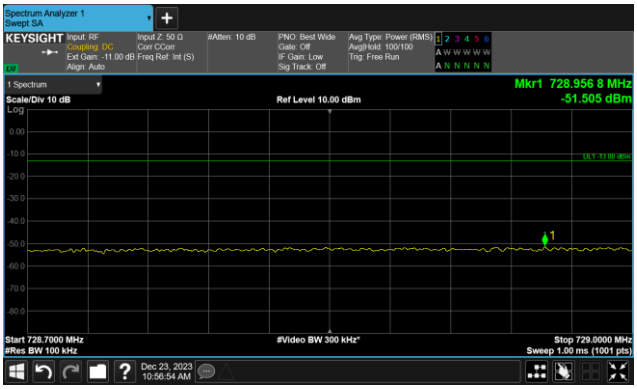


Upper

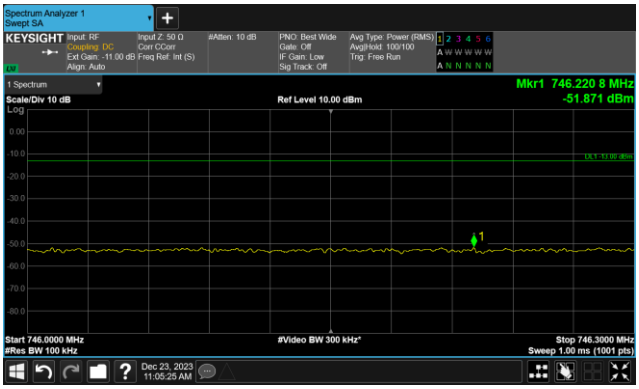


Band 12
Downlink of GSM Signal
Normal

Lower

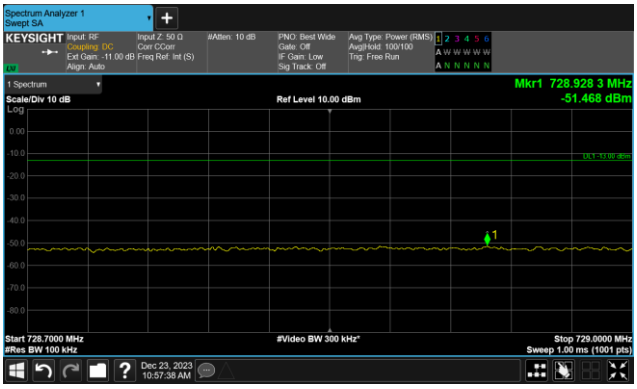


Upper

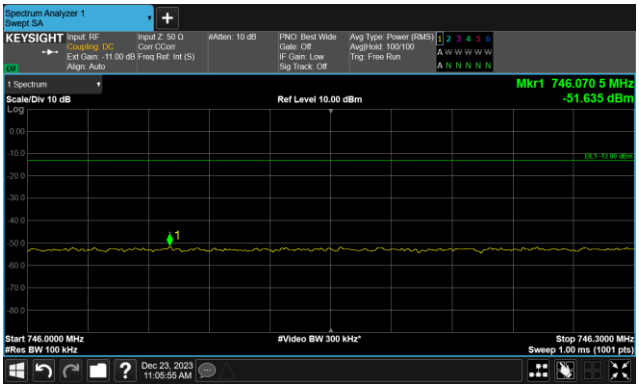


Increase 10 dB

Lower

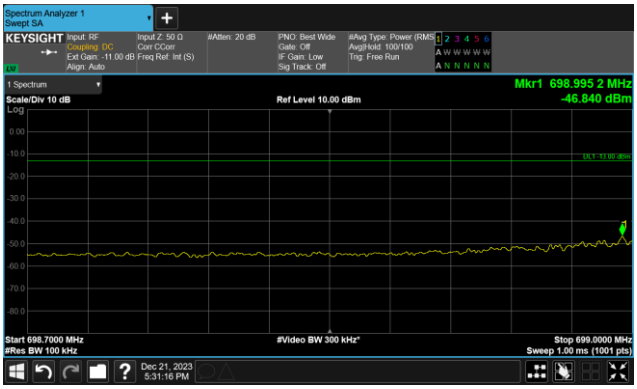


Upper

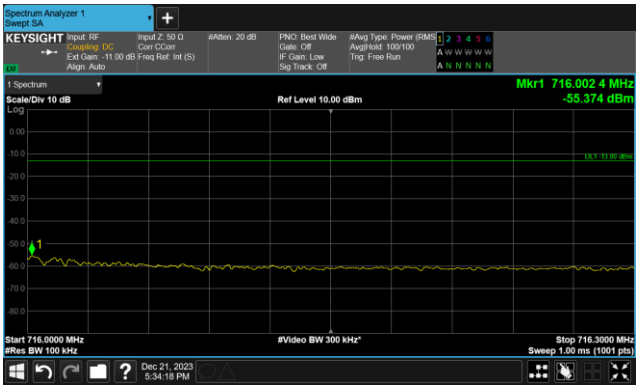


Band 12
Uplink of CDMA Signal
Normal

Lower

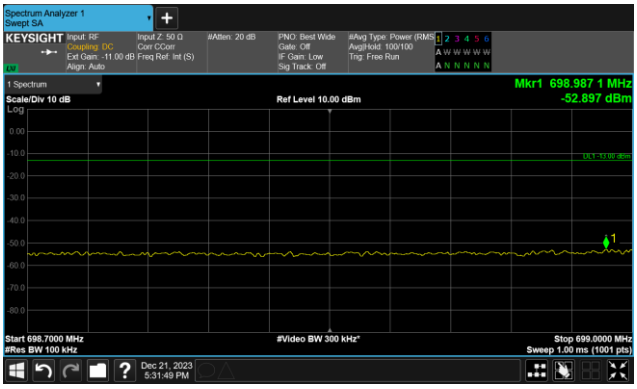


Upper

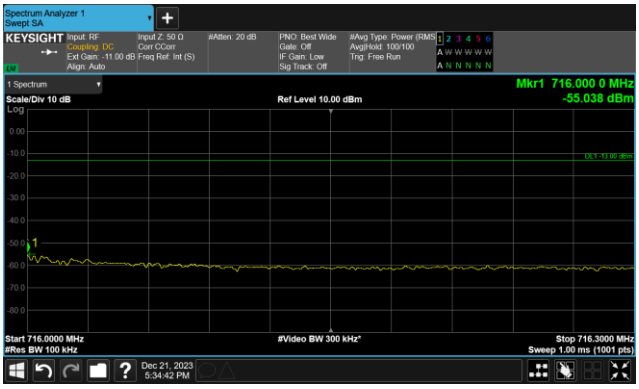


Increase 10 dB

Lower

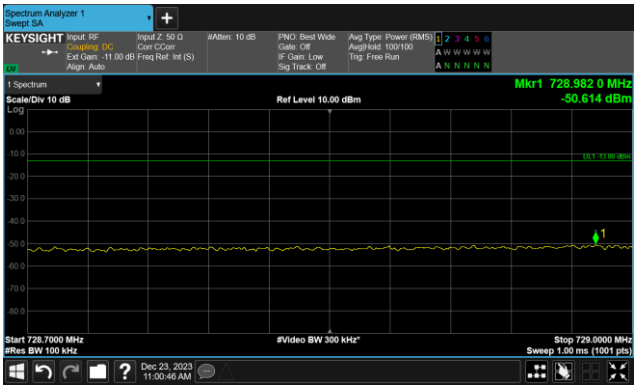


Upper

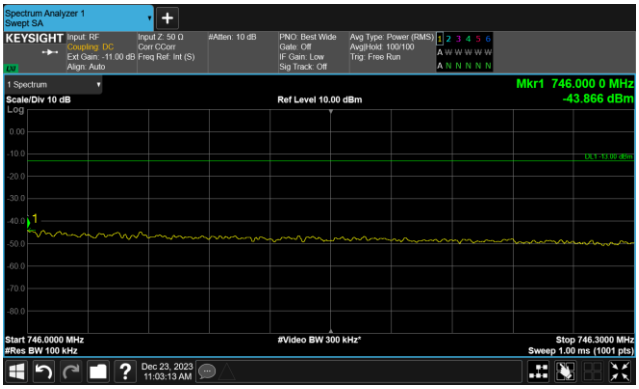


Band 12
Downlink of CDMA Signal
Normal

Lower

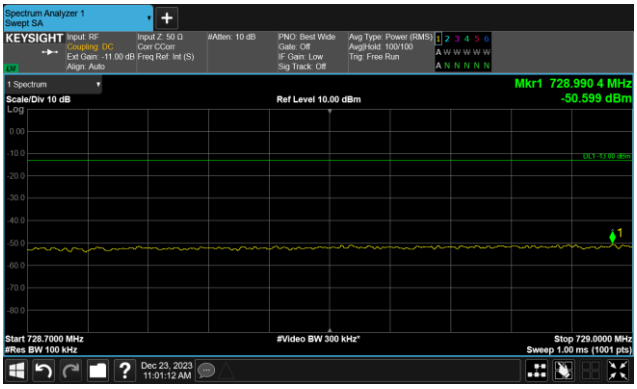


Upper

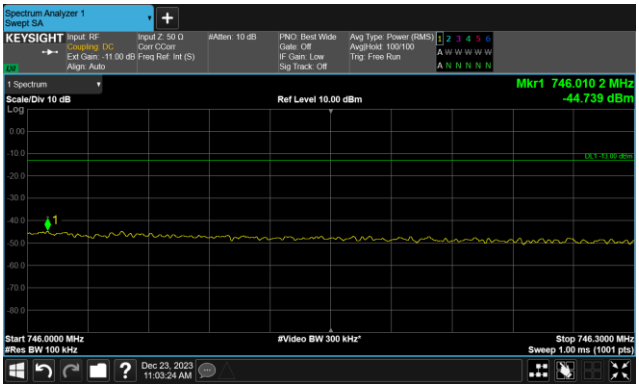


Increase 10 dB

Lower

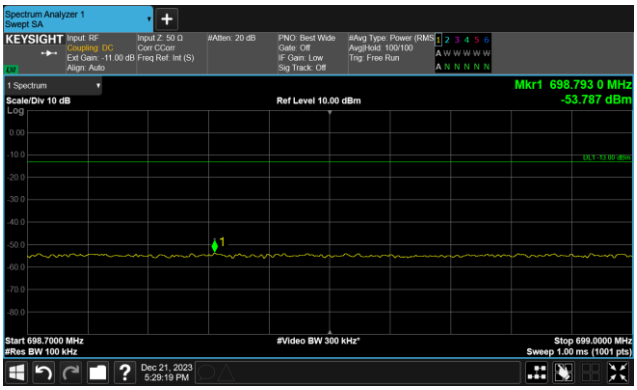


Upper

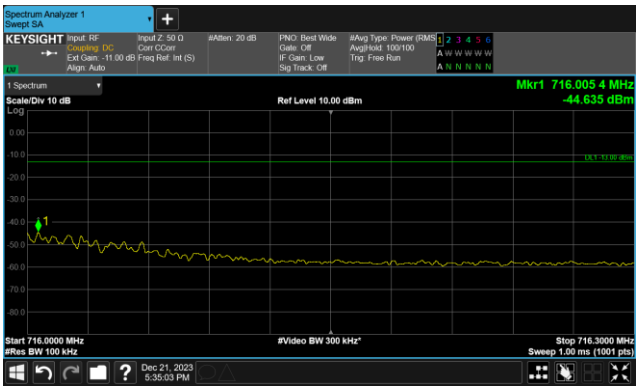


Band 12
Uplink of LTE Signal
Normal

Lower

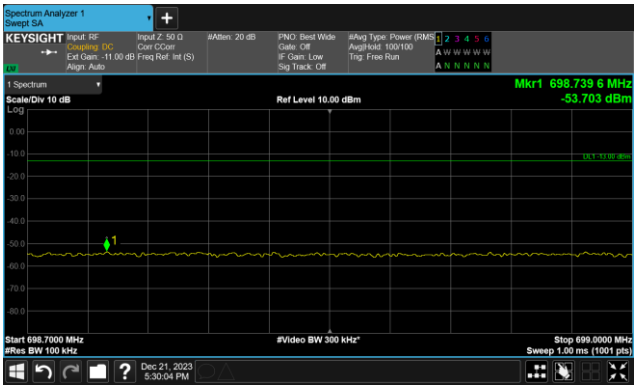


Upper

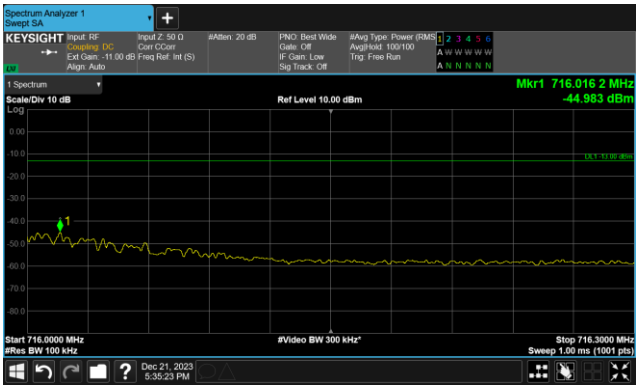


Increase 10 dB

Lower

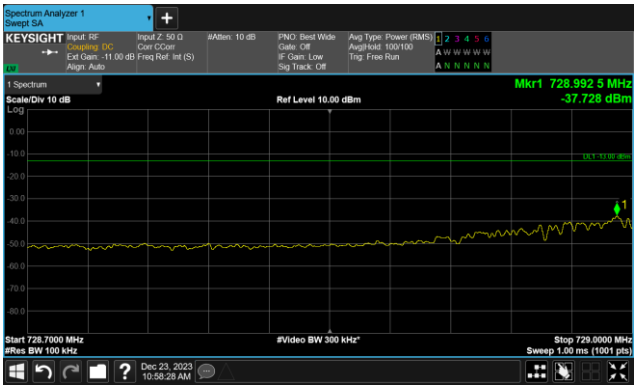


Upper

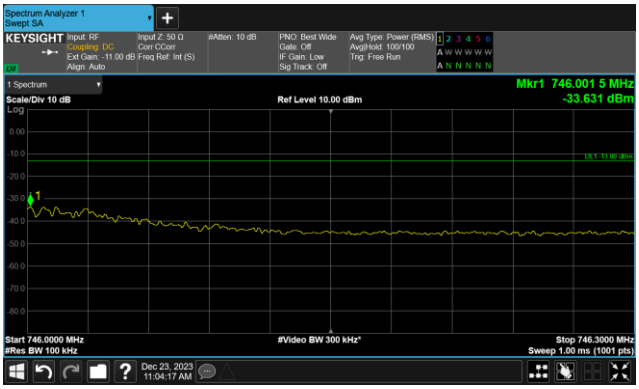


Band 12
Downlink of LTE Signal
Normal

Lower

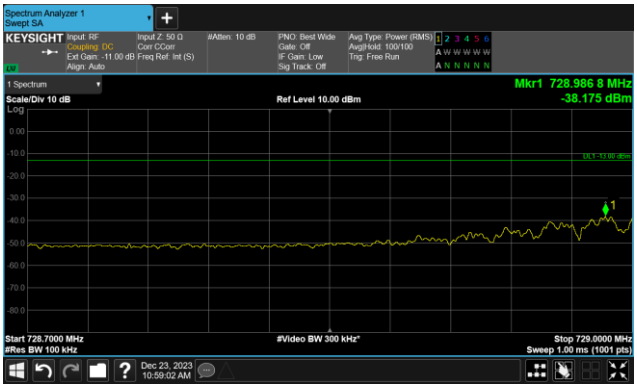


Upper



Increase 10 dB

Lower



Upper