TCT 通测检测 TESTING CENTRE TECHNOLOGY

TEST REPORT

FCC ID: 2ALGRPLX-85

Product: Cell phone signal booster

Model No.: PLX-85

Additional Model No.: PLX-W85, PLX-B85, PLX-W85A, PLX-B85A

Trade Mark: N/A

Report No.: TCT170309E020

Issued Date: Mar. 31, 2017

Issued for:

Shenzhen Fuzhixing Electronics Co., Ltd.

5/F, Block C, Penglongpan Hi-technology Park, Dafu Ind. Zone, Guanlan, Longhua New Dist., Shenzhen, Guangdong, China

Issued By:

Shenzhen Tongce Testing Lab.

1F, Leinuo Watch Building, Fuyong Town, Baoan Dist, Shenzhen, China

TEL: +86-755-27673339

FAX: +86-755-27673332

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Hotline: 400-6611-140 Tel: 86-755-27673339 Fax: 86-755-27673332 http://www.tct-lab.com

1. Test Certification

Product:	Cell phone signal booster
Model No.:	PLX-85
Additional Model:	PLX-W85, PLX-B85, PLX-W85A, PLX-B85A
Applicant:	Shenzhen Fuzhixing Electronics Co., Ltd.
Address:	5/F, Block C, Penglongpan Hi-technology Park, Dafu Ind. Zone, Guanlan, Longhua New Dist., Shenzhen, Guangdong, China
Manufacturer:	Shenzhen Fuzhixing Electronics Co., Ltd.
Address:	5/F, Block C, Penglongpan Hi-technology Park, Dafu Ind. Zone, Guanlan, Longhua New Dist., Shenzhen, Guangdong, China
Date of Test:	Mar. 21 – Mar. 30, 2017
Applicable Standards:	FCC CFR Title 47 Part 20.21

The above equipment has been tested by Shenzhen Tongce Testing Lab. and found compliance with the requirements set forth in the technical standards mentioned above. The results of testing in this report apply only to the product/system, which was tested. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Tested By:	Jin Wang	***Date:***	***Mar. 30, 2017***
	Jin Wang		
Reviewed By:	Joe Zhou	***Date:***	***Mar. 31, 2017***
	Joe Zhou		
Approved By:	Tomsin	***Date:***	***Mar. 31, 2017***
	Tomsin		

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2. Test Result Summary

Requirement	CFR 47 Section	Result
Authorized Frequency Band Verification Test	§20.21(e)(3)	PASS
Maximum Power Measurement Procedure	§2.1046/20.21(e)(8)(i)(D)	PASS
Maximum Booster Gain Computation	§20.21(e)(8)(i)(B)	PASS
Intermodulation Product	§20.21(e)(8)(i)(F)	PASS
Out of Band Emissions	§20.21(e)(8)(i)(E)	PASS
Conducted Spurious Emission	§2.1051/§27	PASS
Noise Limit Procedure Variable Noise Variable Noise Timing	§20.21(e)(8)(i)(A)(2)(i) §20.21(e)(8)(i)(A)(1) §20.21(e)(8)(i)(H)	PASS
Uplink inactivity	§20.21(e)(8)(i)(I)	PASS
Variable Booster Gain Variable Uplink Gain Timing	§20.21(e)(8)(i)(C) (1), (2)(i) §20.21(e)(8)(i)(H)	PASS
Occupied Band Width	§2.1049/§27	PASS
Anti-Oscillation	§20.21(e)(8)(ii)(A)	PASS
Radiated Spurious Emission	§2.1053/§27	PASS
Spectrum Block Filter	N/A	N/A

Note:

1. PASS: Test item meets the requirement.

2. Fail: Test item does not meet the requirement.

3. N/A: Test case does not apply to the test object.

4. The test result judgment is decided by the limit of test standard.

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3. EUT Description

Product Name:	Cell phone signal booster
Model :	PLX-85
Additional Model:	PLX-W85, PLX-B85, PLX-W85A, PLX-B85A
Trade Mark:	**N/A**
Operation Frequency:	824-849MHz (Uplink), 869-894MHz(Downlink)
Emission Designator:	CDMA(F9W), WCDMA(F9W)
AGC Level:	Uplink:-44.00dBm Downlink:-57.00dBm
Gain:	Uplink:60±2 dB Downlink: 62±2 dB
Conducted Output Power:	Uplink:16.54dBm Downlink:7.72dBm
Max. Antenna Gain:	Uplink:7.9dBi Downlink:6.6 dBi
EIRP:	Uplink:24.44dBm Downlink:14.32dBm
FCC Classification:	B2W/Wideband Consumer Booster(CMRS)
Power Supply:	DC 5V from adapter
Remark:	All models above are identical in interior structure, electrical circuits and components, just model names and surface are different for the marketing requirement.

4. Genera Information

4.1. Test environment

Operating Environment:	
Temperature:	25.0 °C
Humidity:	56 % RH
Atmospheric Pressure:	1010 mbar

4.2. Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Equipment	Model No.	Serial No.	FCC ID	Trade Name
AC Adapter	FZX-05-25	/	/	Phonelex

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5. Facilities and Accreditations

5.1. Facilities

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

- FCC - Registration No.: 572331

  Shenzhen Tongce Testing Lab

  The 3m Semi-anechoic chamber has been registered and fully described in a report with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files.

- IC - Registration No.: 10668A-1

  The 3m Semi-anechoic chamber of Shenzhen TCT Testing Technology Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing

- CNAS - Registration No.: CNAS L6165

  Shenzhen TCT Testing Technology Co., Ltd. is accredited to ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration laboratories for the competence of testing. The Registration No. is CNAS L6165.

5.2. Location

Shenzhen Tongce Testing Lab
Address: 1F, Leinuo Watch Building, Fuyong Town, Baoan Dist, Shenzhen, China
Tel: 86-755-36638142

5.3. Measurement Uncertainty

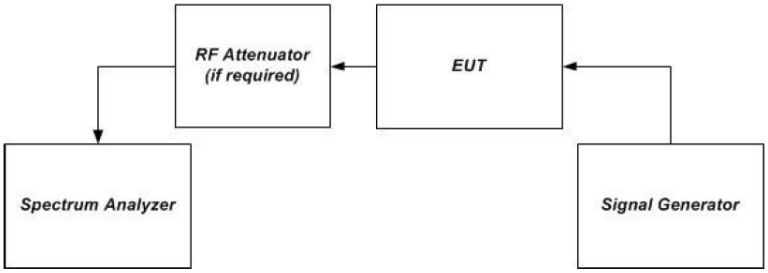
The reported uncertainty of measurement y ± U, where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95 %.

No.	Item	MU
1	Conducted Emission	±2.56dB
2	RF power, conducted	±0.12dB
3	Spurious emissions, conducted	±0.11dB
4	All emissions, radiated(<1G)	±3.92dB
5	All emissions, radiated(>1G)	±4.28dB
6	Temperature	±0.1°C
7	Humidity	±1.0%

6. Test Results and Measurement Data

6.1. Authorized Frequency Band Verification

6.1.1. Test Specification

Test Requirement:	FCC Part20 Section 20.21(e)(3)
Test Method:	935210 D03 Signal Booster Measurements v04
Limit	Uplink: 824 MHz ~ 849 MHz Downlink: 869MHz ~ 894MHz
Test Setup:	
Test Procedure:	935210 D03 Signal Booster Measurement v02r01 a) Connect the EUT to the test equipment as shown in Figure 1. 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 (e.g., cycle ac/dc power). h) Reset the spectrum analyzer span to 2 × the width of the CMRS band under test. Adjust the tuned frequency of the signal generator to sweep 2 × 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 7.1c) to 7.1j) for all operational uplink and downlink bands.
Test Result:	PASS

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6.1.2. Test Instruments

Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
Signal Generator	Agilent	N5182	MY47070282	Aug. 15, 2016	Aug. 11, 2017
Spectrum Analyzer	Agilent	N9020A	MY49100060	Aug. 15, 2016	Aug. 11, 2017
Attenuation	AF115A-09-34	JFW	907763	Aug. 15, 2016	Aug. 11, 2017

Note: *The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).*

6.1.3. Test data

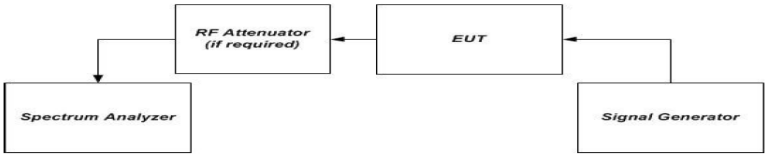
Plot

Uplink

Downlink

6.2. Maximum Power

6.2.1. Test Specification

Test Requirement:	FCC Part 20.21 (e)(8)(i)(B); FCC Part 20.21 (e)(8)(i)(D)
Test Method:	KDB935210 D03 Signal Booster Measurement v04
Limit:	Uplink: Upper / 1 W (30 dBm), Lower / 50 mW (17 dBm) Downlink: Upper / 50 mW (17 dBm)
Test Setup:	
Test Procedure:	a) Connect the EUT to the test equipment as shown in Set-Up. 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 Frequency Band 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 control. d) Slowly increase the signal generator power level until the output signal reaches the AGC operational limit (from observation of signal behavior on the spectrum analyzer; e.g., no further increase in output power as input power is increased). 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 (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. h) Set RBW = 100 kHz for AWGN signal type and 300 kHz for CW or GSM signal type i) Set VBW ≥ 3 × RBW j) Select either the BURST POWER or CHANNEL POWER measurement tool, as required for each signal type. The channel power integration bandwidth shall be 99% occupied bandwidth (4.1 MHz). k) Select the RMS (power averaging) detector. l) Ensure that the number of measurement points per sweep ≥ (2 × span)/RBW (Note: This requirement does not apply for BURST power measurement mode). m) Set sweep time = auto couple, or as necessary (but no less than auto couple value). n) Trace average at least 100 traces in power averaging (i.e., RMS) mode. o) Record the measured power level as P_{out} with one set of results for the GSM or CW input stimulus and another set of results for the AWGN input stimulus. p) Repeat the procedure for each operational uplink and downlink frequency band supported by the booster.
Test Result:	PASS

6.2.2. Test Instruments

Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
Signal Generator	Agilent	N5182	MY47070282	Aug. 15, 2016	Aug. 11, 2017
Spectrum Analyzer	Agilent	N9020A	MY49100060	Aug. 15, 2016	Aug. 11, 2017
Attenuation	AF115A-09-34	JFW	907763	Aug. 15, 2016	Aug. 11, 2017

Note: *The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).*

6.2.3. Test Data

Pre AGC						
Pulse GSM				4.1MHz AWGN		
Frequency (MHz)	Input (dBm)	Output (dBm)	*Gain (dB)	Input (dBm)	Output (dBm)	*Gain (dB)
UL 824-849	-44.00	15.61	59.61	-44.00	15.19	59.19
DL 869-894	-57.00	6.81	63.81	-57.00	6.70	63.70
*Fixed Booster maximum gain shall not exceed 6.5 dB + 20 Log10 (Frequency), where Frequency is the uplink mid-band frequency of the supported spectrum bands in MHz.						

Pulse GSM					Conducted and EIRP	
Frequency (MHz)	Output Power (dBm)	Ant Gain (dBi)	Cable Loss (dB)	EIRP (dBm)	Limit Min (dBm)	Limit Max (dBm)
UL 824-849	15.61	10.00	2.10	23.51	17	30
DL 869-894	6.81	7.00	0.40	13.41	N/A	17

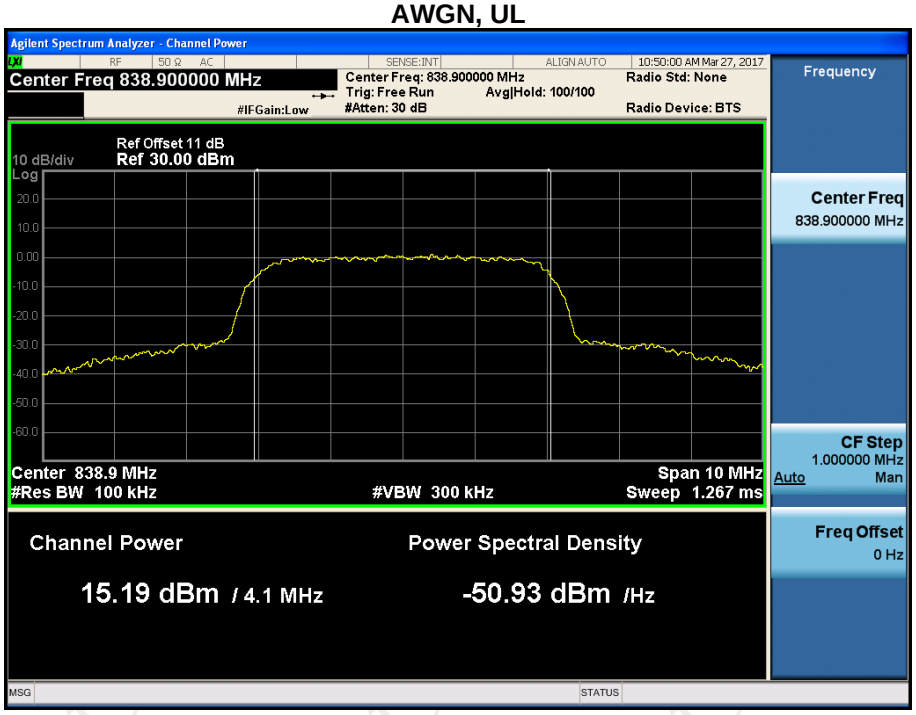
4.1MHz AWGN					Conducted and EIRP	
Frequency (MHz)	Output Power (dBm)	Ant Gain (dBi)	Cable Loss (dB)	EIRP (dBm)	Limit Min (dBm)	Limit Max (dBm)
UL 824-849	15.19	10.00	2.10	23.09	17	30
DL 869-894	6.70	7.00	0.40	13.30	N/A	17

Section 5.5 Power						
Pulse GSM				4.1MHz AWGN		
Frequency (MHz)	Input (dBm)	Output (dBm)	*Gain (dB)	Input (dBm)	Output (dBm)	*Gain (dB)
UL 824-849	-43.00	16.54	59.54	-43.00	15.97	58.97
DL 869-894	-56.00	7.35	63.35	-56.00	7.72	63.72
Note: The booster went into Transmitter off mode at Max input power of -20dBm (DL). Results presented on the above table are at 1 dB below the Transmit off RF input level. This table it is for reference only.						

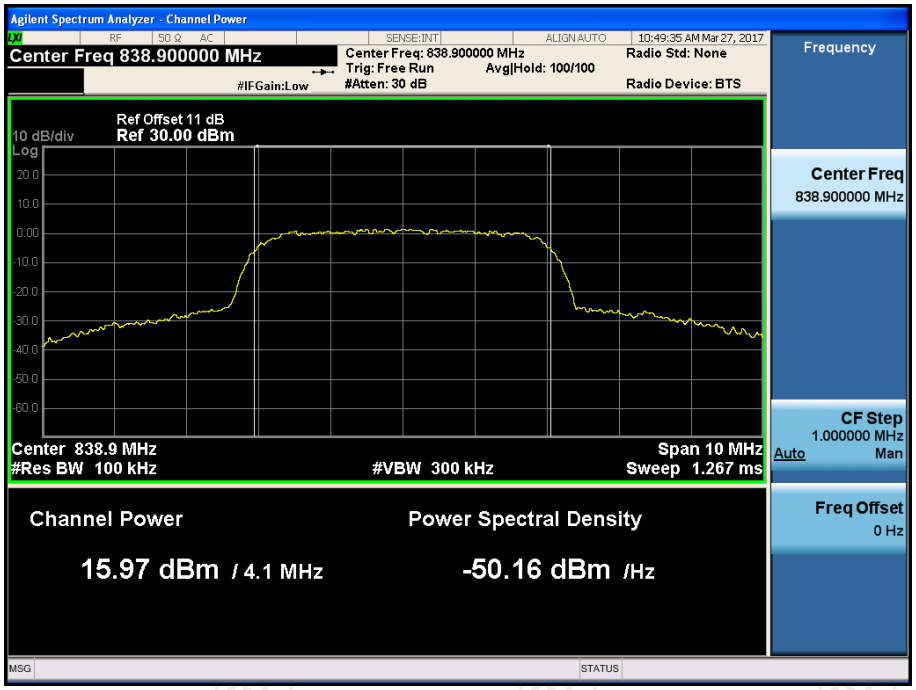
	Pulse GSM	4.1MHz GSM	Limit (dB)
UL gain vs DL gain	4.2	4.75	9.0

Plot

AWGN, UL



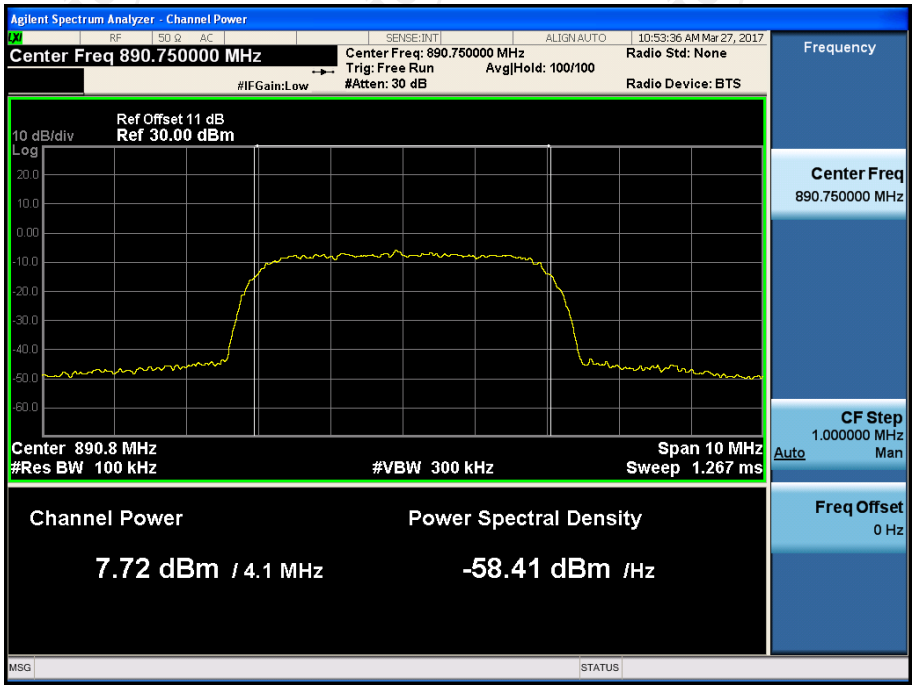
UL_824-849MHz_AWGN



UL_824-849MHz_AWGN_Max

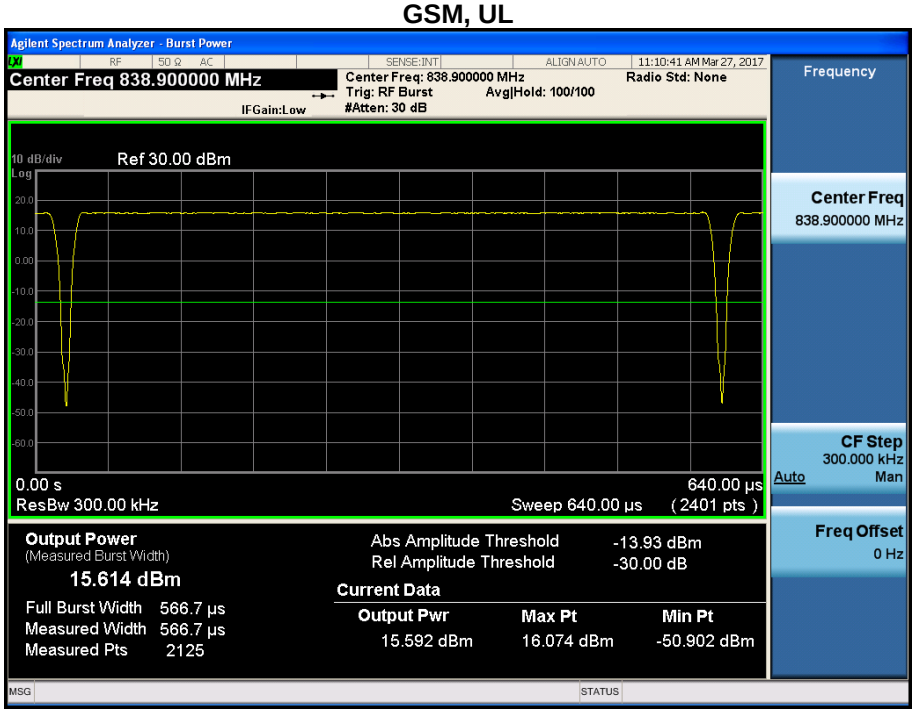
AWGN, DL

DL_869-894MHz_AWGN

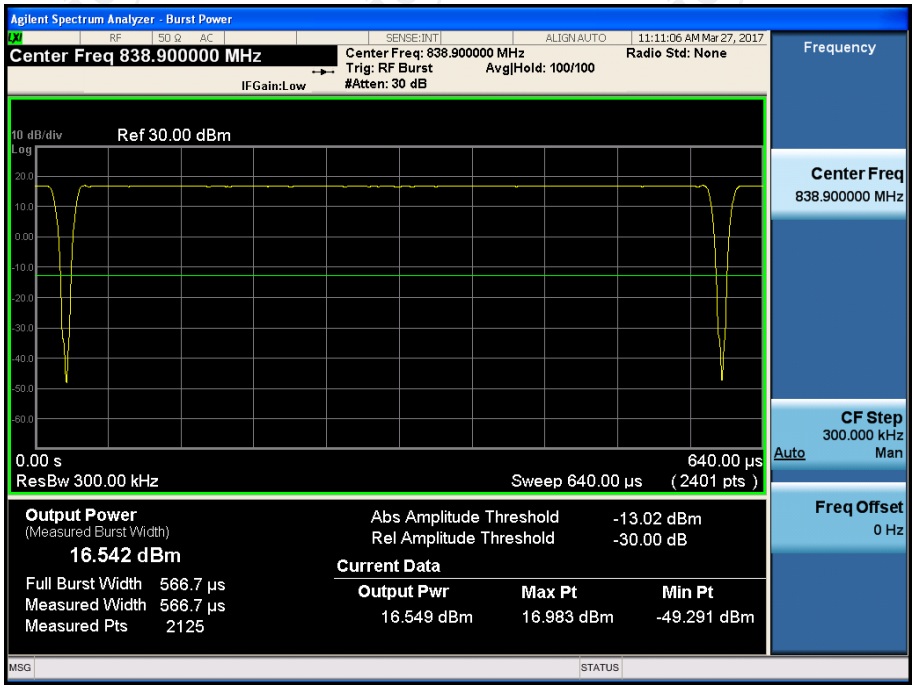


DL_869-894MHz_AWGN_Max

GSM, UL

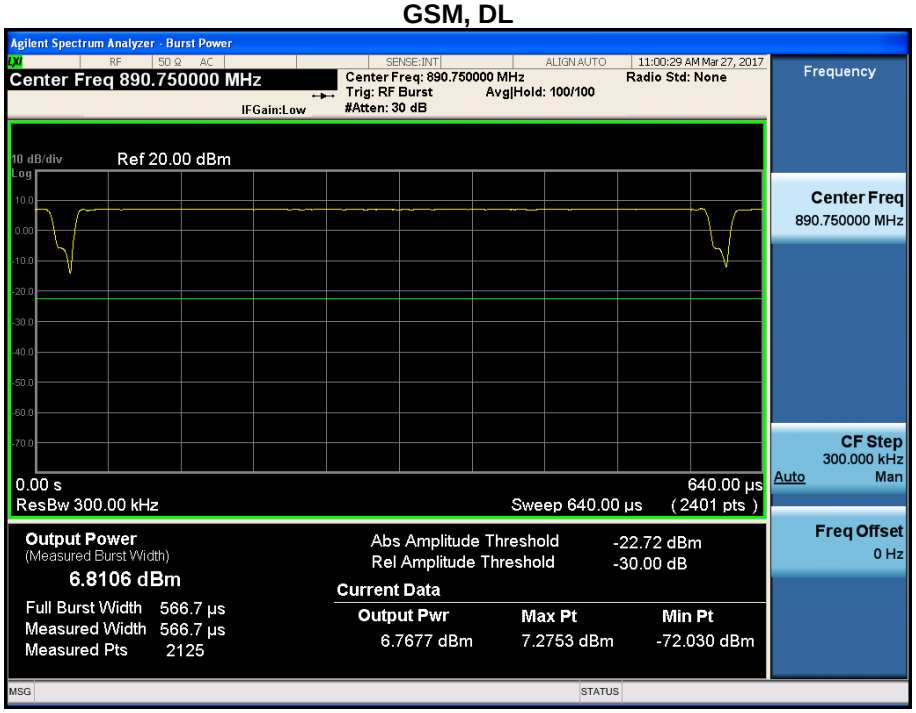


UL_869-894MHz_GSM

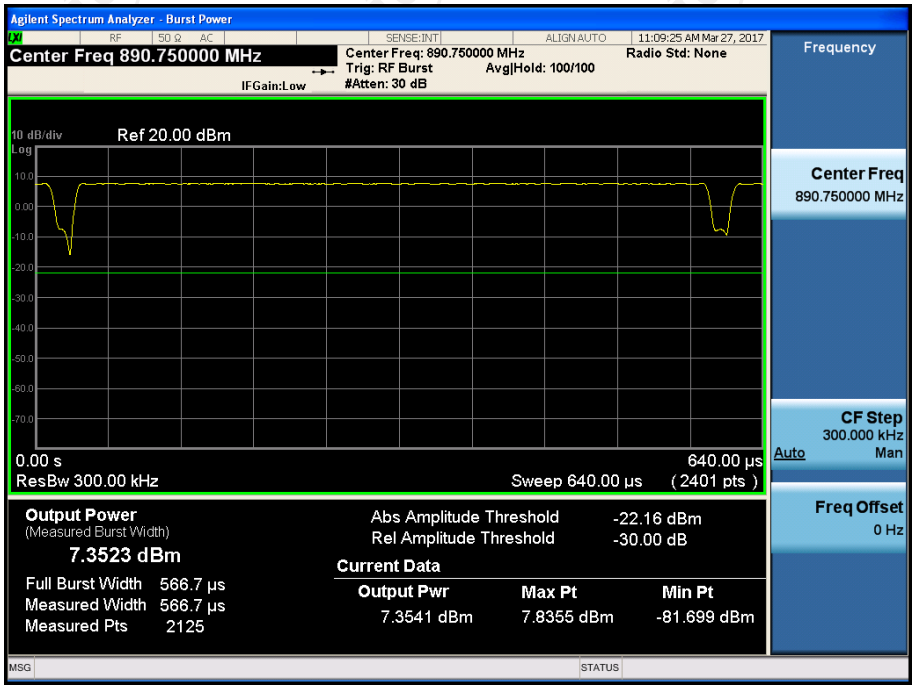


UL_869-894MHz_GSM_Max

GSM, DL



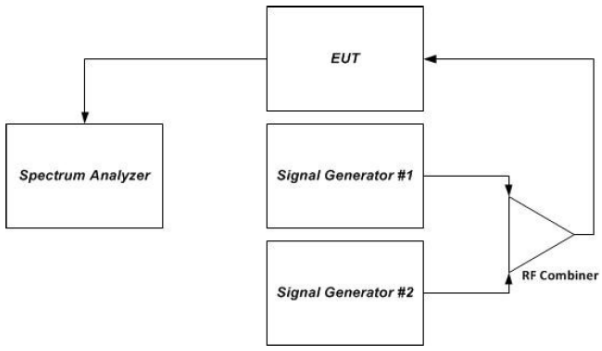
DL_869-894MHz_GSM



DL_869-894MHz_GSM_Max

6.3. Intermodulation Product

6.3.1. Test Specification

Test Requirement:	FCC Part20 Section 20.21(e)(8)(i)(F)
Test Method:	KDB935210 D03 Signal Booster Measurement v04
Limit:	-19dBm
Test Setup:	 Figure 2 – Intermodulation product instrumentation test setup
Test Procedure:	a) Connect the signal booster to the test equipment as shown in Set-Up. Begin with the uplink output connected to the spectrum analyzer. b) Set the spectrum analyzer RBW = 3 kHz. c) Set the VBW ≥ 3 × the 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. 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. h) Set the signal generator amplitudes so that the power from each into the RF combiner is equivalent and turn on the RF output. i) Increase the signal generators' amplitudes equally until just before the EUT begins AGC and ensure that all intermodulation products (if any exist), are below the specified limit of −19 dBm. j) Utilize the trace averaging function of the spectrum analyzer and wait for the trace to stabilize. Place a marker at the highest amplitude intermodulation product. 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 steps e) to l) for all uplink and downlink operational bands. **Note:** If using a single signal generator with dual outputs, ensure that intermodulation products are not the result of the generator. n) Increase the signal generator amplitude in 2 dB steps to 10 dB above the AGC threshold determined in i) to ensure that the EUT maintains compliance with the intermodulation
Test Result:	PASS

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6.3.2. Test Instruments

Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
Signal Generator	Agilent	E4421B	GB39340839	Aug. 15, 2016	Aug. 11, 2017
Signal Generator	Agilent	N5182	MY47070282	Aug. 15, 2016	Aug. 11, 2017
Spectrum Analyzer	Agilent	N9020A	MY49100060	Aug. 15, 2016	Aug. 11, 2017
RF Combiner	SUNVNDN	SUD-CS 0800	16230009	Aug. 15, 2016	Aug. 11, 2017
Attenuation	AF115A-09-34	JFW	907763	Aug. 15, 2016	Aug. 11, 2017

Note: *The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).*

6.3.3. Test data

Pre AGC						
Link	Frequency (MHz)	Frequency1 (MHz)	Frequency2 (MHz)	IMD Level [dBm]	IMD Limit [dBm]	Margin (dB)
Uplink	836.5	835.6	837.4	-47.00	-19.00	-28.00
Downlink	881.5	880.6	882.4	-64.57	-19.00	-54.57

AGC+10dB						
Link	Frequency (MHz)	Frequency1 (MHz)	Frequency2 (MHz)	IMD Level [dBm]	IMD Limit [dBm]	Margin (dB)
Uplink	836.5	835.6	837.4	-21.50	-19.00	-2.50
Downlink	881.5	880.6	882.4	-50.17	-19.00	-31.17

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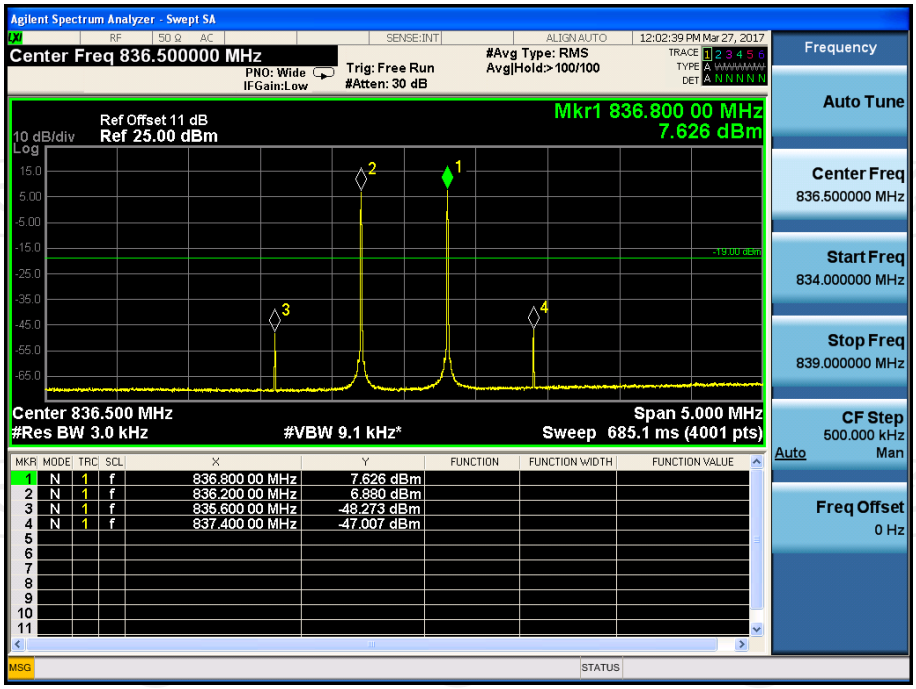
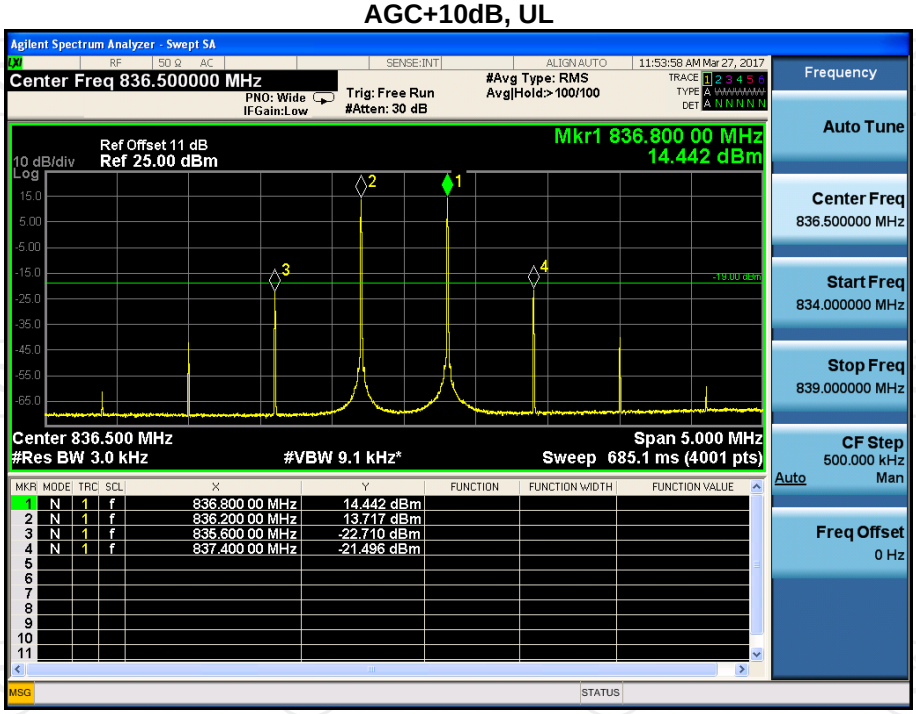
Plot

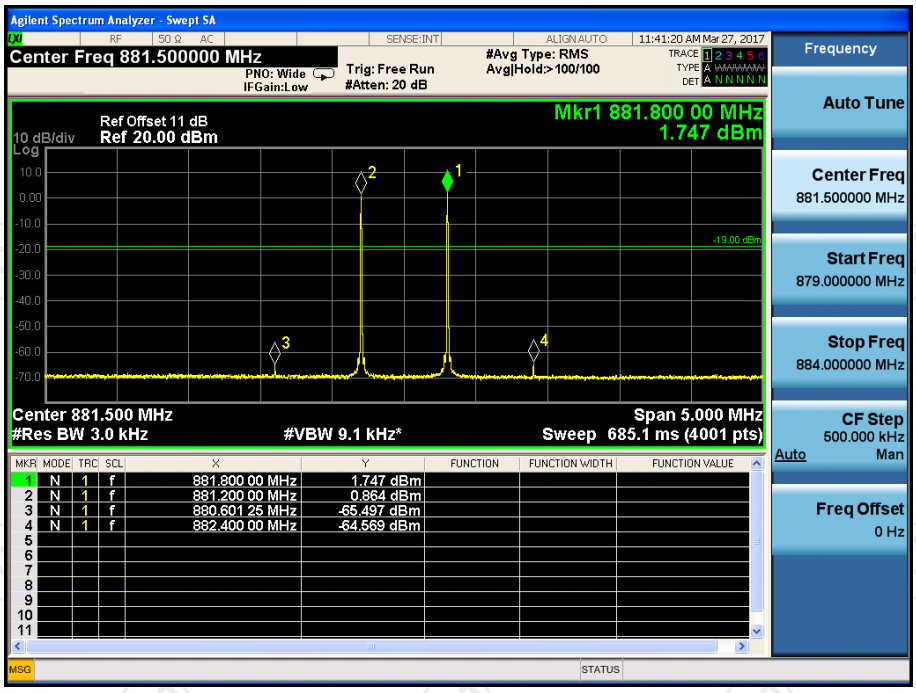
Pre AGC, UL



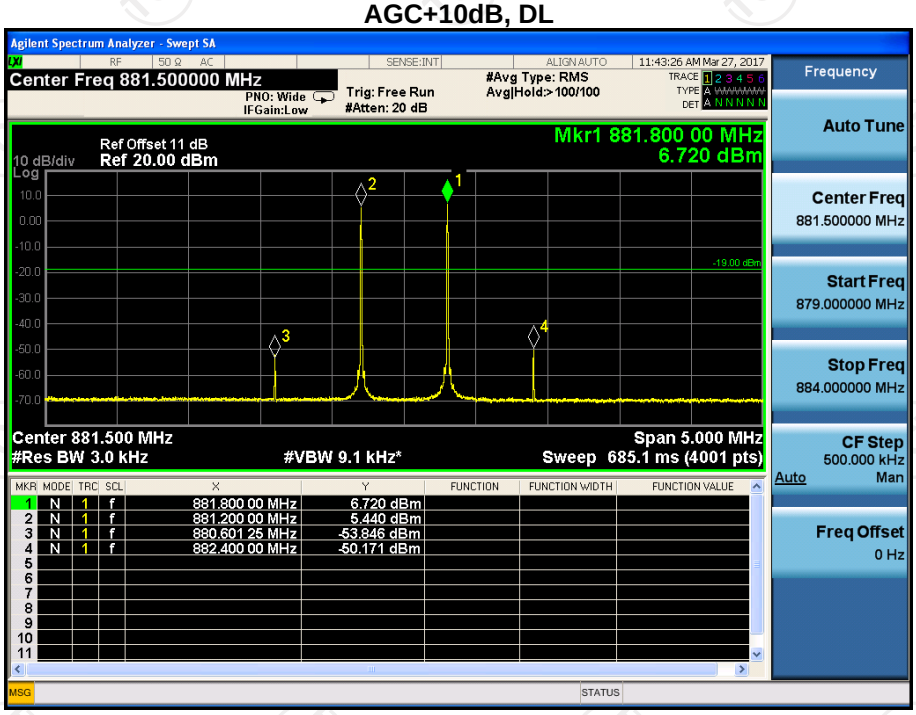
AGC+10dB, UL



Pre AGC, DL

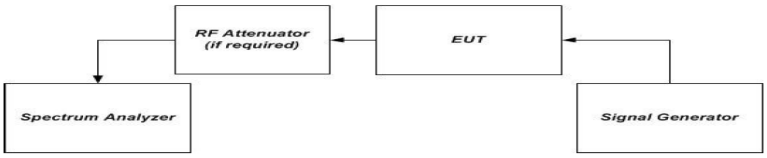


AGC+10dB, DL



6.4. Out of Band Emission

6.4.1. Test Specification

Test Requirement:	FCC Part20 Section 20.21(e)(8)(i)(E)
Test Method:	KDB935210 D03 Signal Booster Measurement v04
Limit:	-19dBm
Test Setup:	
Test Procedure:	a) Connect the EUT to the test equipment as shown in Set-Up. Begin with the uplink output connected to the spectrum analyzer. b) Configure the signal generator for the appropriate operation for all uplink and downlink bands: i) GSM: 0.2 MHz from upper and lower band edge ii) LTE (5 MHz): 2.5 MHz from upper and lower band edge iii) CDMA: 1.25 MHz from upper and lower band edge, except for cellular 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. Note 1: Alternative test modulation types: • CDMA (alternative 1.25 MHz AWGN) • LTE 5 MHz (alternative W-CDMA or 4.1 MHz AWGN) Note 2: For LTE, the signal generator should utilize the uplink and downlink signal types for these modulations in uplink and downlink tests, respectively. LTE shall us e 5 MHz signal 25 resource blocks transmitting. Note 3: AWGN is the measured 99% occupied bandwidth. c) Set the signal generator amplitude to the maximum power level prior to AGC similar to the procedures in method of Maximum power d) to f) of power measurement procedure for appropriate modulations. d) Set RBW = measurement bandwidth specified in the applicable rule section for the supported frequency band. e) Set VBW = 3 × RBW. f) Select the RMS (power averaging) 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 indicated in 5.4 is reached. Ensure that the EUT maintains compliance with the OOBE limits. m) Reset the analyzer start frequency to the lower band/block edge frequency minus 100 kHz or 1 MHz, as per applicable rule part, and the stop frequency to the lower band/block edge frequency and repeat steps j) to l).

	n) Repeat steps b) through m) for each uplink and downlink operational band.
Test Result:	PASS

6.4.2. Test Instruments

Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
Signal Generator	Agilent	N5182	MY47070282	Aug. 15, 2016	Aug. 11, 2017
Spectrum Analyzer	Agilent	N9020A	MY49100060	Aug. 15, 2016	Aug. 11, 2017
Attenuation	AF115A-09-34	JFW	907763	Aug. 15, 2016	Aug. 11, 2017

Note: *The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).*

6.4.3. Test data

Pre AGC						
Link	**Signal Type**	**Bandedge**	**Frequency (MHz)**	**Emission Level [dBm]**	**Emission Limit [dBm]**	**Result**
Uplink	GSM	Low	823.980	-48.48	-19	PASS
		Uper	849.003	-48.68		
	CDMA	Low	823.969	-49.32		
		Uper	849.145	-44.76		
	AWGN	Low	824.000	-30.16		
		Uper	849.000	-28.94		
Downlink	GSM	Low	869.000	-57.87		
		Uper	894.020	-53.46		
	CDMA	Low	868.971	-51.14		
		Uper	894.094	-45.19		
	AWGN	Low	868.998	-48.65		
		Uper	894.002	-40.82		

Note: The EUT also maintains compliance with the out-of-band emissions limit at input power indicated in section 5.5.

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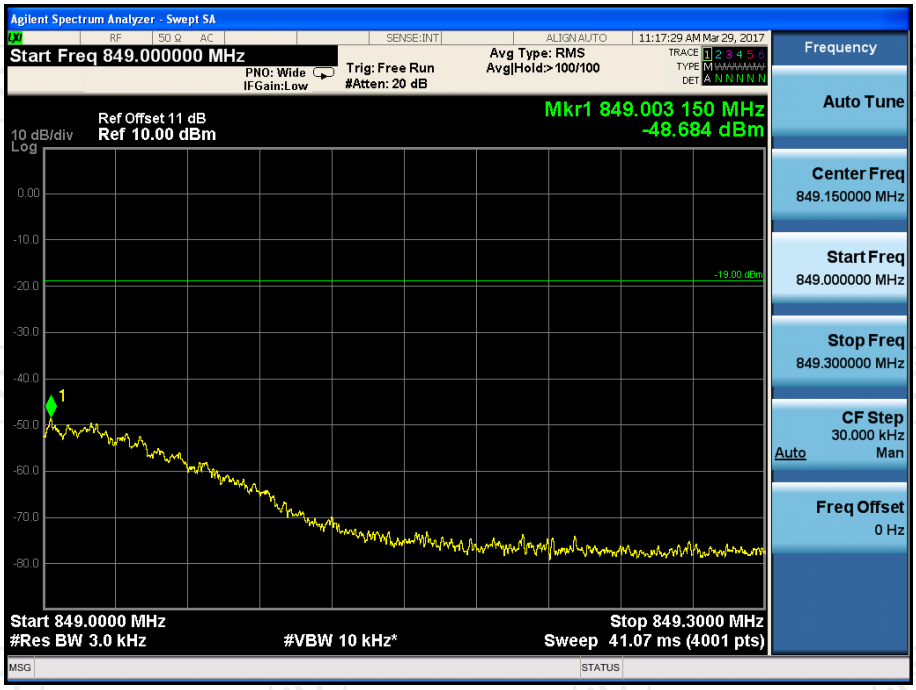
Plot

GSM UL

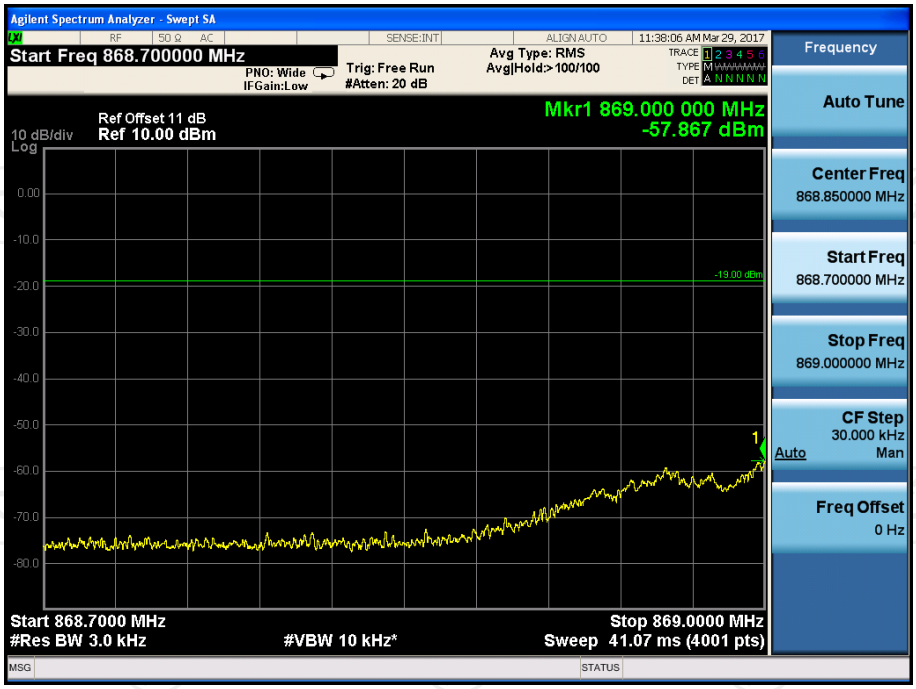
L-edge



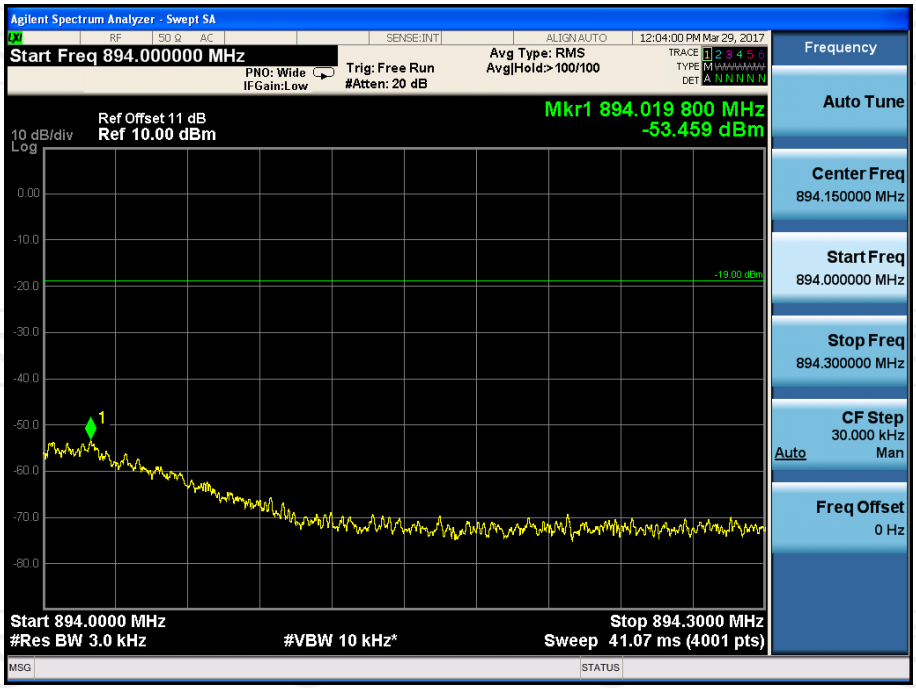
H-edge

Plot

GSM DL



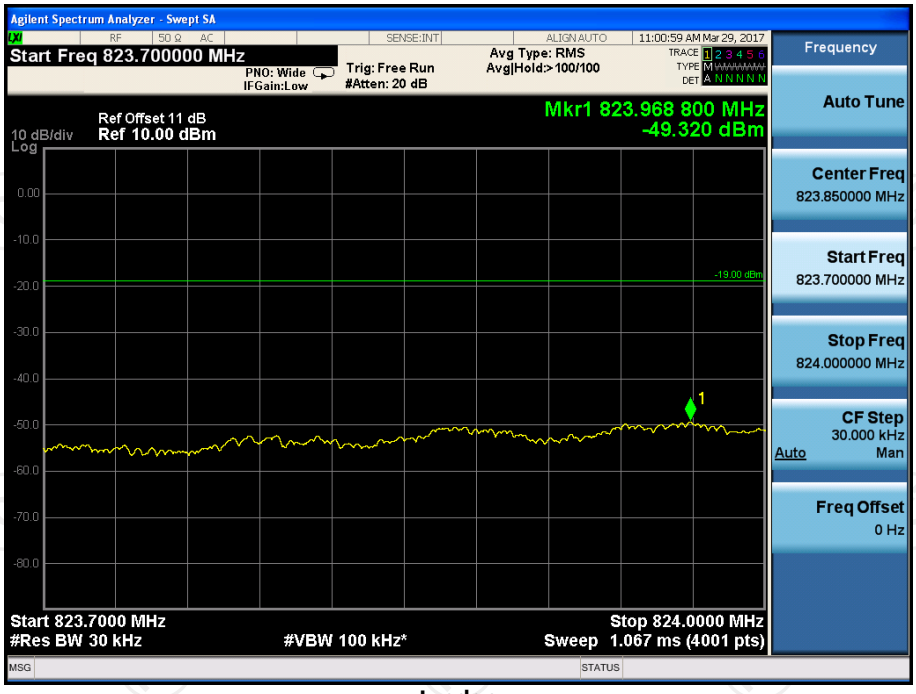
L-edge



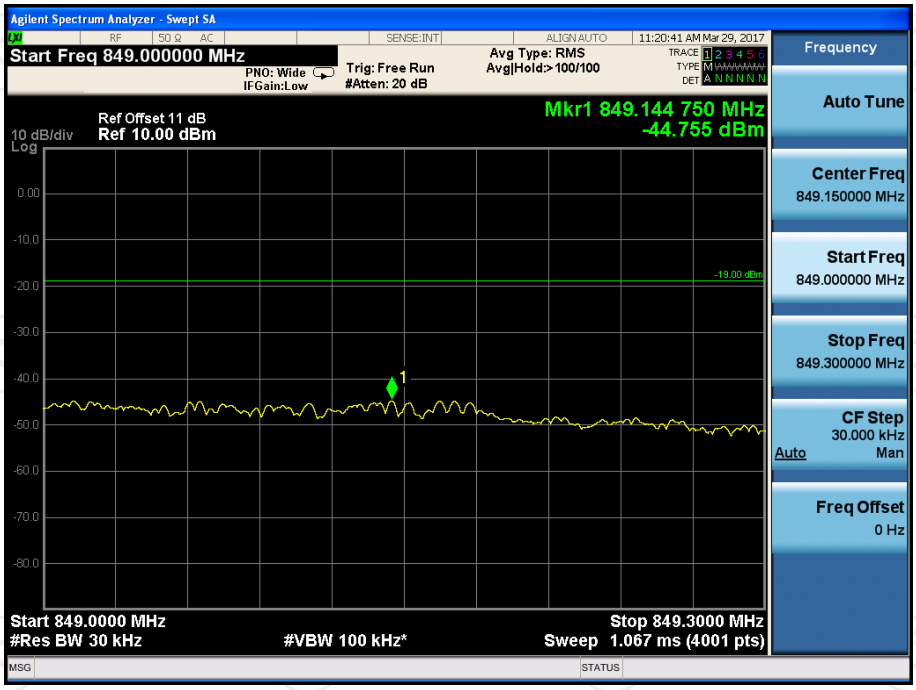
H-edge

Plot

CDMA UL



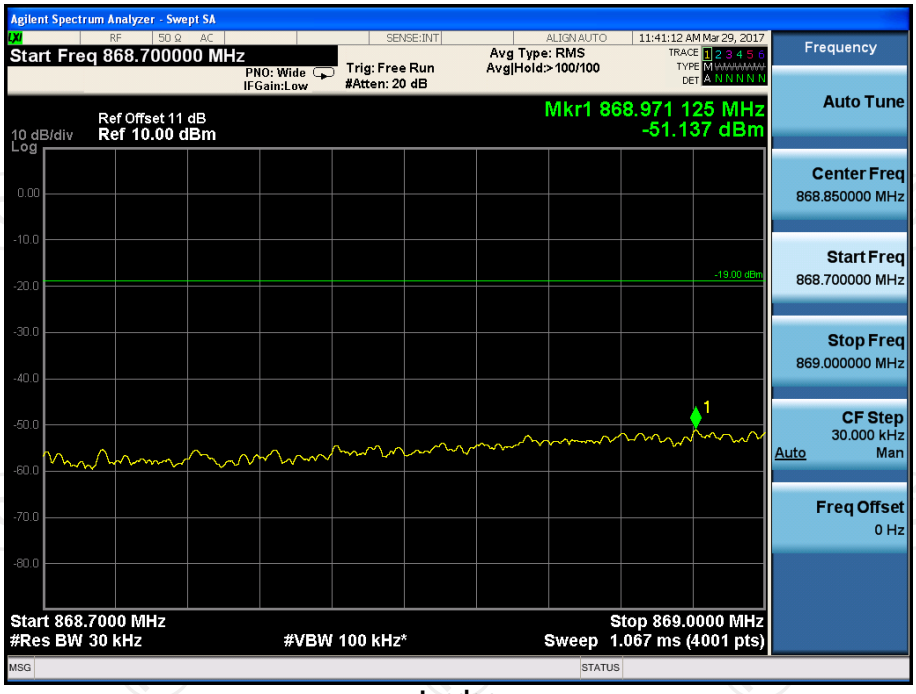
L-edge



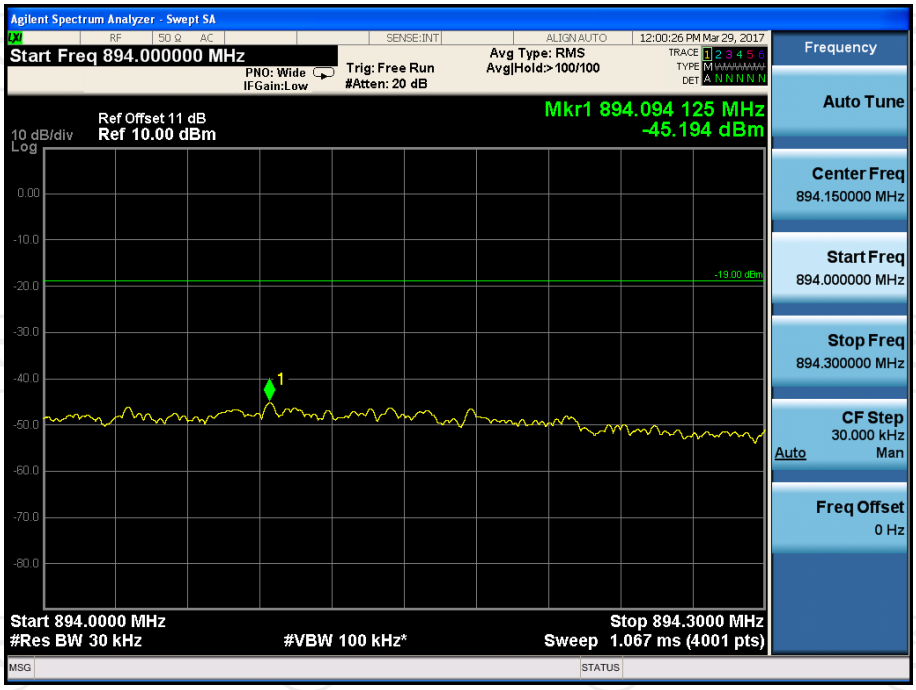
H-edge

Plot

CDMA DL



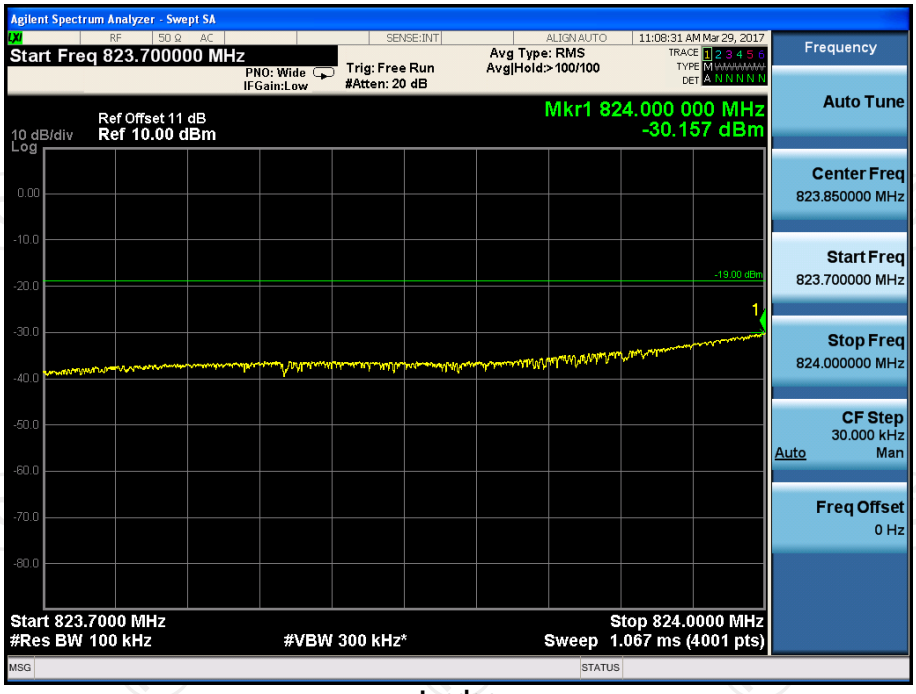
L-edge



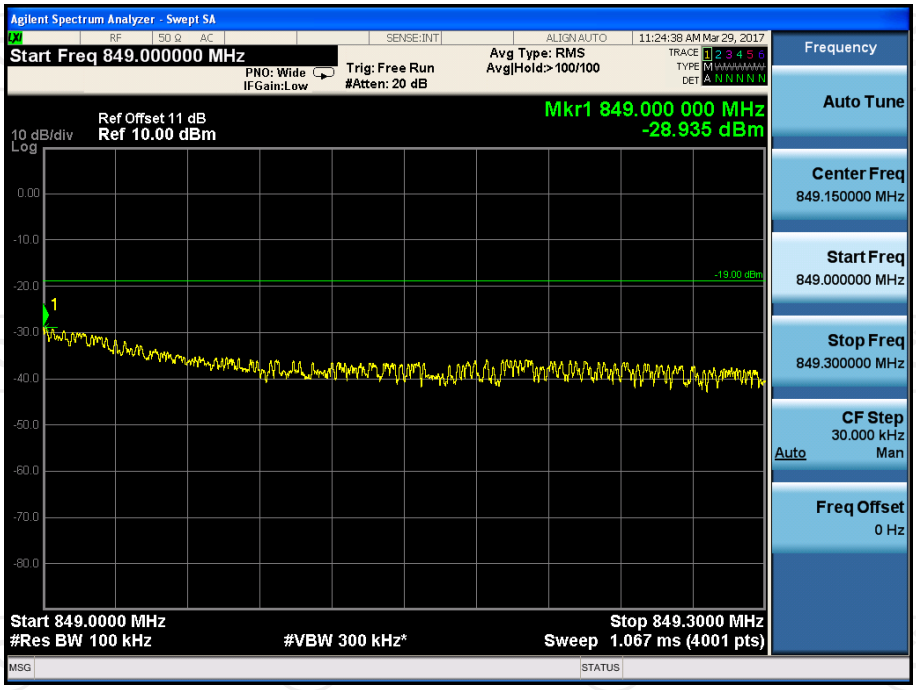
H-edge

Plot

LTE UL



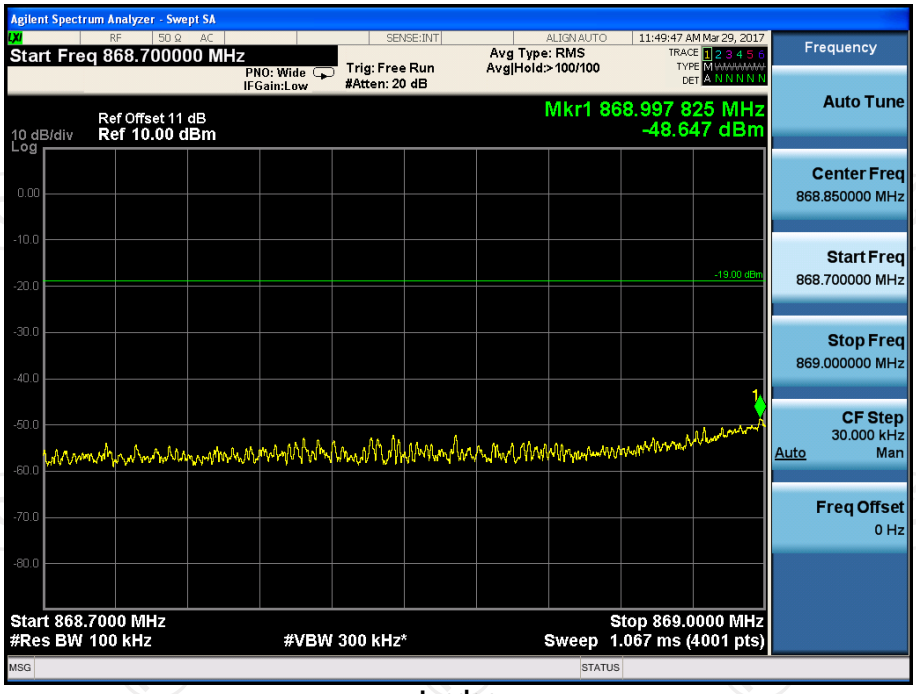
L-edge



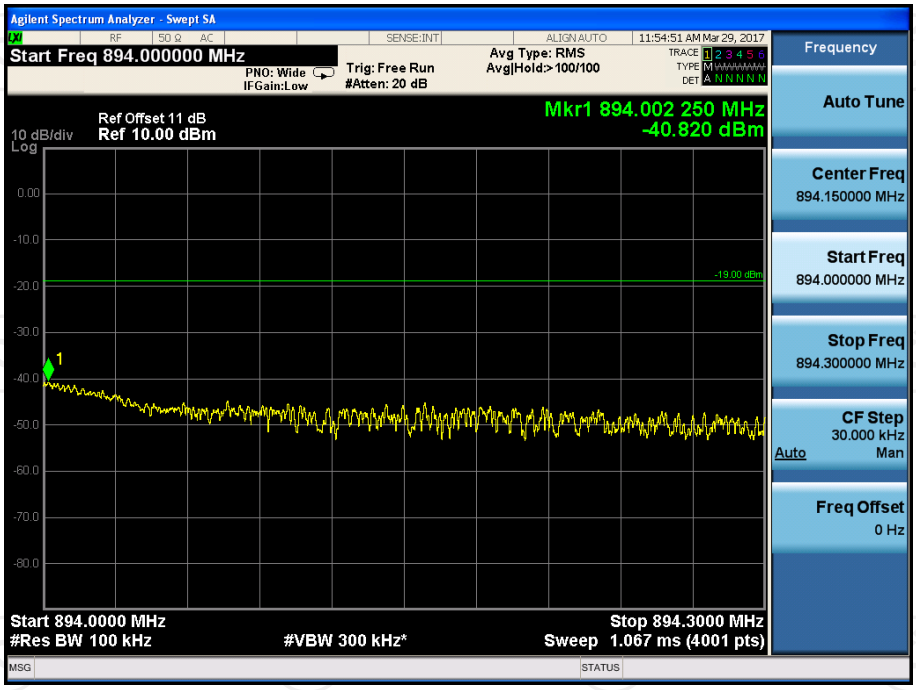
H-edge

Plot

LTE DL



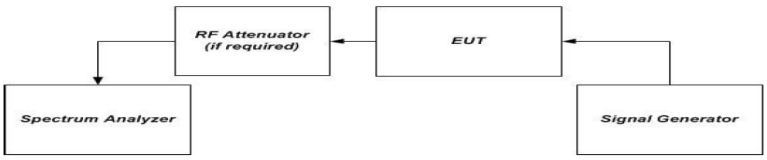
L-edge



H-edge

6.5. Conducted Spurious Emission

6.5.1. Test Specification

Test Requirement:	FCC Part2 Section 1051; FCC Rules Part 27 Subpart C, Section 27.53
Test Method:	KDB 935210 D03 Signal Booster Measurement V04
Limit:	•§2.1053, Conducted emissions limit = 43 + 10 log (P) = -13 dBm •§27.53(c), For operations in the 746-758 MHz band and the 776-788 MHz band On all frequencies between 763-775 MHz and 793-805 MHz, by a factor not less than 76 + 10 log (P) dB=-46dBm in a 6.25 kHz band segment, for base and fixed stations • §27.53(e), 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(-40dBm)/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and −80 dBW(-50dBm) EIRP for discrete emissions of less than 700 Hz bandwidth.
Test Setup:	
Test Procedure:	a) Connect the EUT to the test equipment as shown in Set-Up. Begin with the uplink output connected to the spectrum analyzer. b) Configure the signal generator for AWGN with a 99% occupied bandwidth of 4.1 MHz operation 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 Maximum power. d) Turn on the signal generator RF output and measure the spurious emission power levels with an appropriate measurement instrument as follows. e) Set RBW = measurement bandwidth specified in the applicable rule section for the operational frequency band under consideration (see Annex 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) to enhance measurement accuracy, but the result must then be integrated over the specified measurement bandwidth. f) Set VBW = 3 × RBW. g) Select the power averaging (RMS) detector. (See above note regarding the use of a peak detector for preliminary measurements.) h) Sweep time = auto-couple. i) 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 × 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. Trace average at least 10 traces in power averaging (i.e., RMS) mode. j) 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. k) 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 × 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. l) 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. m) Repeat steps b) through l) for each supported frequency band of operation.
Test Result:	PASS

6.5.2. Test Instruments

Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
Signal Generator	Agilent	N5182	MY47070282	Aug. 15, 2016	Aug. 11, 2017
Spectrum Analyzer	Agilent	N9020A	MY49100060	Aug. 15, 2016	Aug. 11, 2017
Attenuation	AF115A-09-34	JFW	907763	Aug. 15, 2016	Aug. 11, 2017

Note: *The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).*

6.5.3. Test data

Spurious					
Link	Operation Frequency (MHz)	Frequency range of spurious emission (MHz)	Measured Frequency (MHz)	Emission Level (dBm)	Limit (dBm)
Uplink	836.5	10-823.9	823.025	-22.57	-13
		849.1-10 000	850.47	-15.17	
Downlink	881.5	10-868.9	868.771	-31.86	
		849.1-10 000	895.92	-22.784	

Note: The spurious level bellow 10MHz is too low, so not show in this report.

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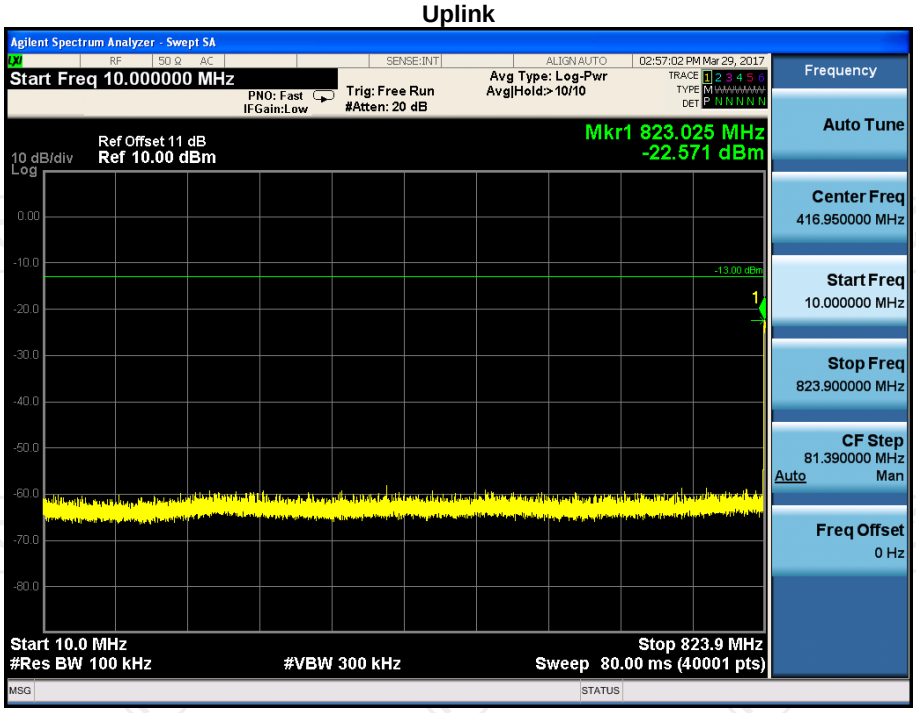
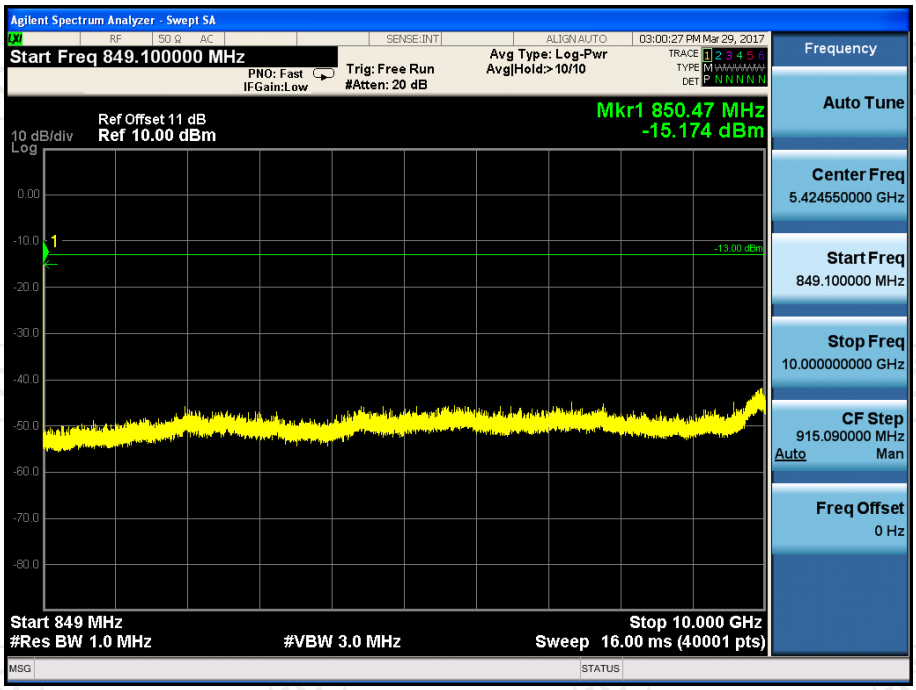
Plot

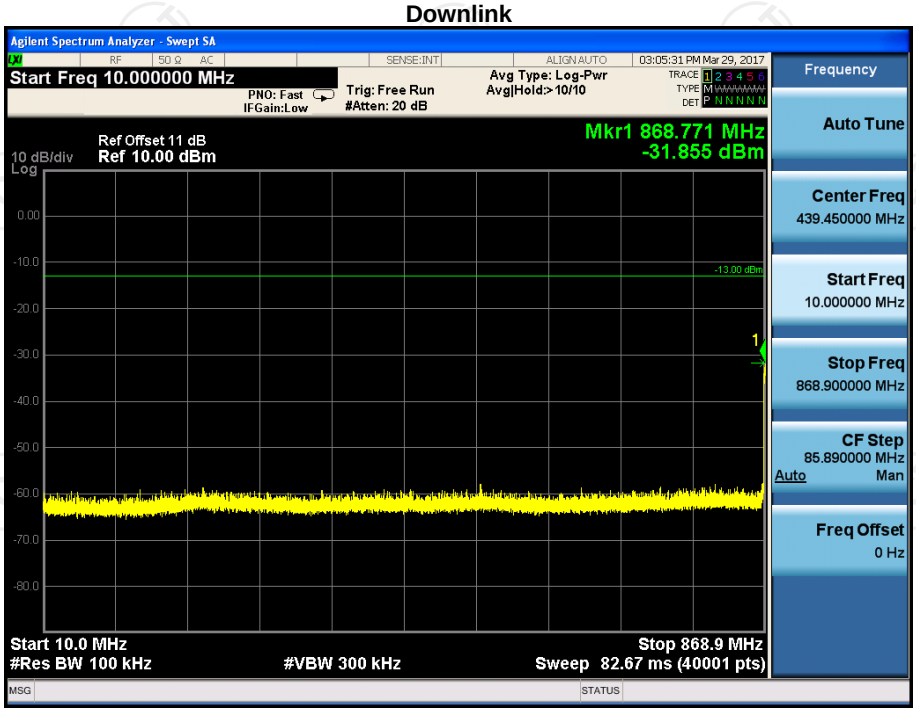
Uplink

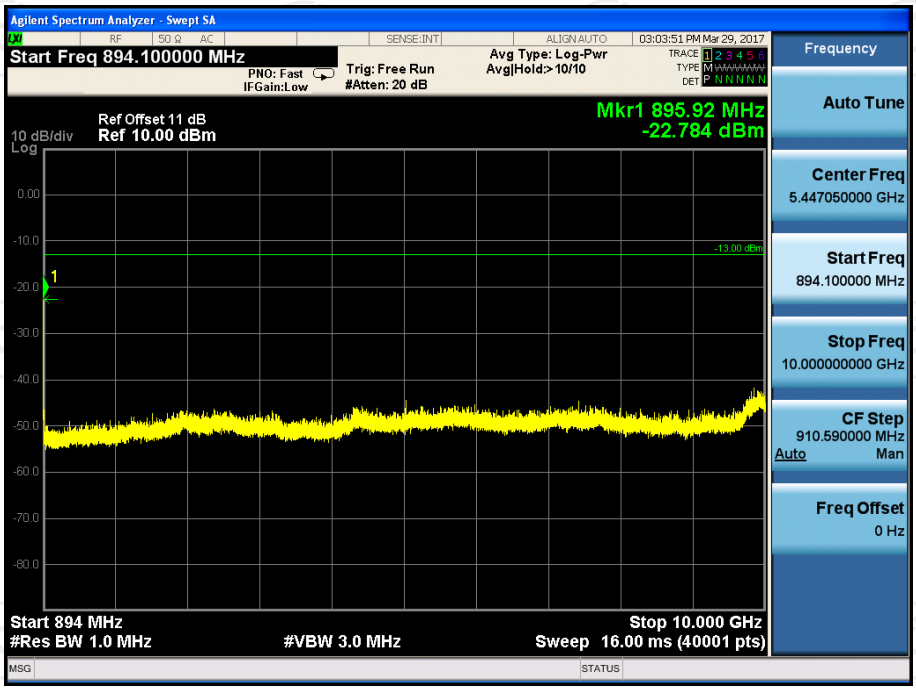

Agilent Spectrum Analyzer - Swept SA
Start Freq 10.000000 MHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>10/10
02:57:02 PM Mar 29, 2017
Ref Offset 11 dB
10 dB/div
Ref 10.00 dBm
Log
Mkr1 823.025 MHz
-22.571 dBm
-13.00 dBm
Start 10.0 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 823.9 MHz
Sweep 80.00 ms (40001 pts)
Frequency
Auto Tune
Center Freq
416.950000 MHz
Start Freq
10.000000 MHz
Stop Freq
823.900000 MHz
CF Step
81.390000 MHz
Auto
Man
Freq Offset
0 Hz


Agilent Spectrum Analyzer - Swept SA
Start Freq 849.100000 MHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>10/10
03:00:27 PM Mar 29, 2017
Ref Offset 11 dB
10 dB/div
Ref 10.00 dBm
Log
Mkr1 850.47 MHz
-15.174 dBm
-13.00 dBm
Start 849 MHz
#Res BW 1.0 MHz
#VBW 3.0 MHz
Stop 10.000 GHz
Sweep 16.00 ms (40001 pts)
Frequency
Auto Tune
Center Freq
5.424550000 GHz
Start Freq
849.100000 MHz
Stop Freq
10.000000000 GHz
CF Step
915.090000 MHz
Auto
Man
Freq Offset
0 Hz

Plot

Downlink





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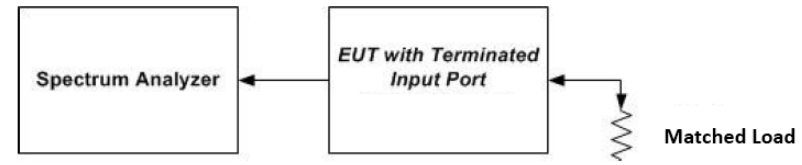
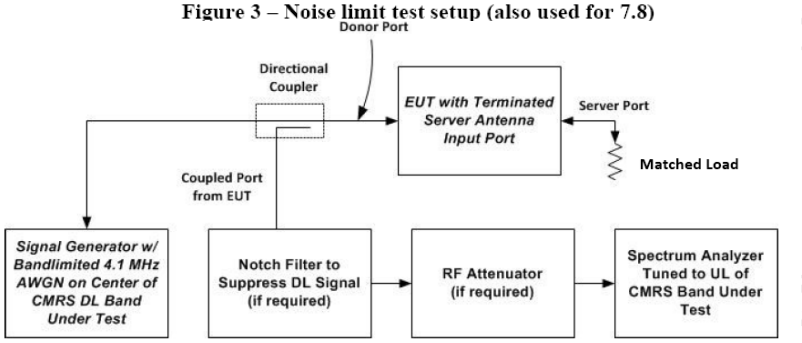
6.6. Noise Limits

6.6.1. Test Specification

Test Requirement:	FCC Part20 Section 20.21(e)(8)(i)(A); 20.21(e)(8)(i)(H)
Test Method:	KDB D03 signal Booster Measurements V04
Limit:	§20.21(e)(8)(i)(A)(1), The transmitted noise power in dBm/MHz of consumer boosters at their uplink and downlink ports shall not exceed −103 dBm/MHz—RSSI. §20.21(e)(8)(i)(A)(2)(i), Fixed booster maximum noise power shall not exceed −102.5 dBm/MHz + 20 log (F), where Frequency is the uplink mid-band frequency of the supported spectrum bands in MHz.
Test Setup:	 Figure 3 – Noise limit test setup (also used for 7.8)  Figure 4 – Test setup for uplink noise power measurement in the presence of a downlink signal
Test Procedure:	a) Connect the EUT to the test equipment as shown in Figure 3. Begin with the uplink output (donor) port connected to the spectrum analyzer. When measuring downlink noise, connect the downlink output (server) port to the spectrum analyzer. b) Set the spectrum analyzer RBW to 1 MHz with the VBW ≥ 3 × RBW. c) Select the power averaging (rms) detector and trace average over at least 100 traces. d) Set the center frequency of the spectrum analyzer to the center of the CMRS band under test with the span ≥ 2 × the CMRS band. e) Measure the maximum transmitter noise power level. f) Save the spectrum analyzer plot as necessary for inclusion in the final test report. g) Repeat 7.7b) to 7.7f) for all operational uplink and downlink bands. h) Connect the EUT to the test equipment as shown in Figure 4 for uplink noise power measurement in the presence a downlink signal. Affirm the coupled path of the RF coupler is connected to the spectrum analyzer. i) Configure the signal generator for AWGN operation with a 99%

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	OBW of 4.1 MHz. j) Set the spectrum analyzer RBW for 1 MHz, VBW ≥ 3 × RBW, with a power averaging (rms) detector with at least 100 trace averages. k) Set the center frequency of the spectrum analyzer to the center of the CMRS band under test, with the span ≥ 2 × the CMRS band. This shall include all spectrum blocks in the particular CMRS band under test (see Appendix A). l) For uplink noise measurements, set the spectrum analyzer center frequency for the uplink band under test, and tune the signal generator to the center of the paired downlink band. m) Measure the maximum transmitter noise power level while varying the downlink signal generator output level from −90 dBm to −20 dBm, as measured at the input port (i.e., downlink signal level at the booster donor port node of Figure 4), in 1 dB steps inside the RSSI-dependent region, and in 10 dB steps outside the RSSI-dependent region. Report the six values closest to the limit, with at least two points within the RSSI-dependent region of the limit. See Appendix D for noise limits graphs. n) Repeat 7.7.1h) through 7.7.1m) for all operational uplink bands. **Variable uplink noise timing** Variable uplink noise timing is to be measured as follows, using the test setup shown in Figure 4. a) Set the spectrum analyzer to the uplink frequency to be measured. b) Set the span to 0 Hz, with a sweep time of 10 seconds. c) Set the power level of signal generator to the lowest level of the RSSI-dependent noise [see 7.7.1m)]. d) Select MAX HOLD and increase the power level of signal generator by 10 dB for mobile boosters, and 20 dB for fixed boosters. e) Confirm that the uplink noise decreases to the specified level within 1 second for mobile devices, and within 3 seconds for fixed devices.12 f) Repeat 7.7.2a) to 7.7.2e) for all operational uplink bands. g) Include plots and summary table in test report.
Test Result:	PASS

6.6.2. Test Instruments

Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
Signal Generator	Agilent	N5182	MY47070282	Aug. 15, 2016	Aug. 11, 2017
Spectrum Analyzer	Agilent	N9020A	MY49100060	Aug. 15, 2016	Aug. 11, 2017
Attenuation	AF115A-09-34	JFW	907763	Aug. 15, 2016	Aug. 11, 2017
RF Combiner	SUNVNDN	SUD-CS 0800	16230009	Aug. 15, 2016	Aug. 11, 2017

Note: *The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).*

6.6.3. Test Data

Max Noise Power			
Frequency (MHz)	Measured dBm/MHz	Limit dBm/MHz	Margin (dB)
Uplink 824-849	-47.098	-44.05	PASS
Downlink 869-894	-49.026	-44.05	PASS

824-849MHz					
		Limit			
RSSI (dBm)	Measured dBm/MHz	RSSI dependent	Fix Booster Limit (dBm)	TX off	Margin (dB)
-73.0	-44.9	--	-44.05	--	-0.85
-61.0	-44.6	--	-44.05	--	-0.55
-48.0	-55.8	-55.0	--	--	-0.8
-47.0	-56.4	-56.0	--	--	-0.4
-45.0	-58.7	-58.0	--	--	-0.7
-43.0	-60.5	-60.0	--	-70	-0.5

Variable Uplink Noise Timing

Frequency MHz	Measured Sec	Limit Sec
UL 824-849	0.12	3

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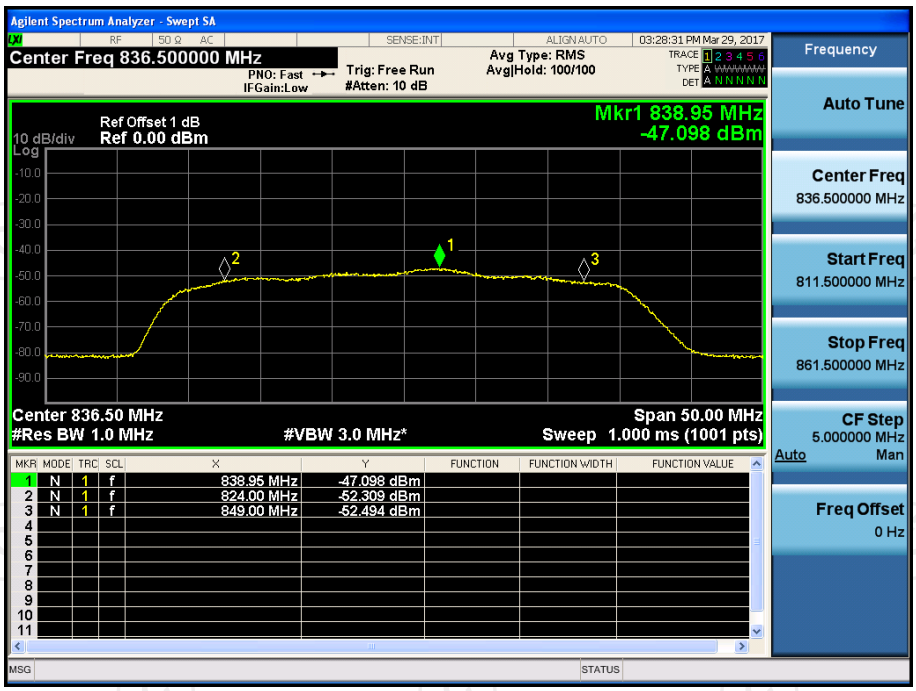
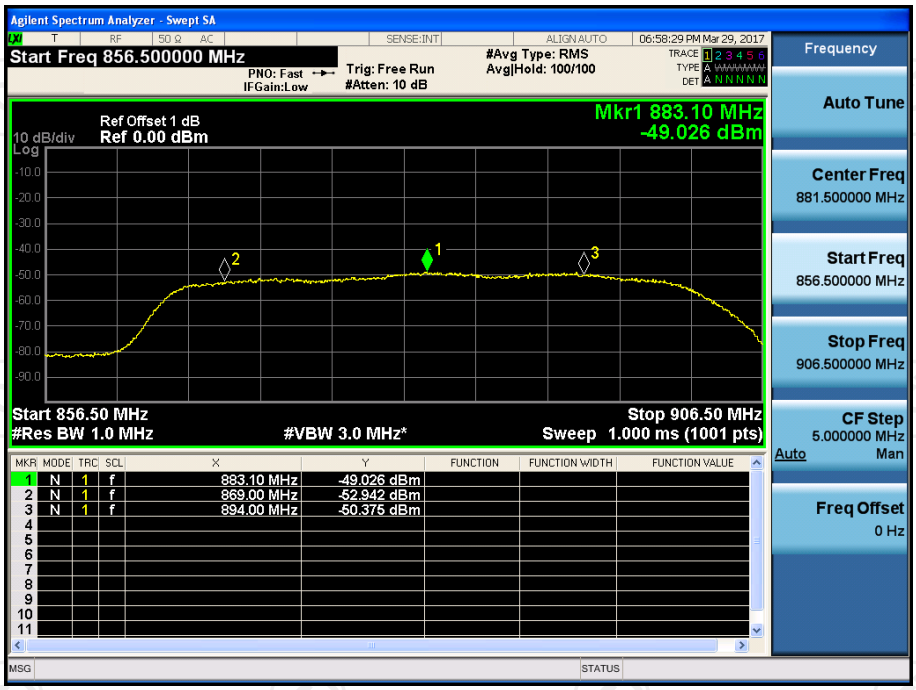
Plot



Uplink Noise

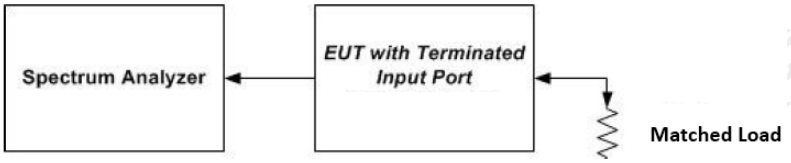


Downlink Noise

Variable Noise Timing Plot

6.7. Uplink Inactivity

6.7.1. Test Specification

Test Requirement:	FCC Part20 Section 20.21(e)(8)(i)(I)
Test Method:	KDB835210 D03 Signal Booster Measurement V04
Limit:	20.21(e), When a consumer booster is not serving an active device connection after 5 minutes the uplink noise power shall not exceed -70 dBm/MHz.
Test Setup:	 Figure 3 – Noise limit test setup (also used for 7.8)
Test Procedure:	a) Connect the EUT to the test equipment as shown in Set-Up with the uplink output connected to the spectrum analyzer. b) Select the RMS power averaging detector. c) Set the spectrum analyzer RBW for 1 MHz with the VBW ≥ 3 × RBW. d) Set the center frequency of the spectrum analyzer to the center of the uplink operational band. e) Set the span for 0 Hz with a single sweep time for a minimum of 330 seconds. f) Start to capture a new trace using MAX HOLD. g) After approximately 15 seconds turn on the EUT power. h) Once the full spectrum analyzer trace is complete place a MARKER on the leading edge of the pulse and use the DELTA MARKER METHOD to measure the time until the uplink was squelched. i) Ensure the noise level for the squelched signal is below the uplink inactivity noise power limit, as specified by the rules. j) Capture the plot for inclusion in the test report. k) Measure noise using procedures in a) to e). l) Repeat steps c) to k) for all operational uplink bands.
Test Result:	PASS

6.7.2. Test Instruments

RF Test Room				
Equipment	**Manufacturer**	**Model**	**Calibration Date**	**Calibration Due**
Spectrum Analyzer	Agilent	N9020A	Aug. 15, 2016	Aug. 11, 2017

Note: *The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).*

6.7.3. Test Data

Uplink Inactivity		
Frequency (MHz)	Measured (s)	Limit (s)
824-849	294.7	300.0

Plot