FCC TEST REPORT

FOR

Shen Zhen ANNTLENT Communication Technology co., Ltd.

Cell phone signal booster

Test Model: AN-USF5 Plus

Additional Model No.: PTE-USF5 Plus

Prepared for	:	Shen Zhen ANNTLENT Communication Technology co., Ltd.
Address	:	Room 601, Unit 1 Building 10, Haoyue Garden, Minzhi Sub-district, Longhua District, Shenzhen, China
Prepared by	:	Shenzhen LCS Compliance Testing Laboratory Ltd.
Address	:	101, 201 Bldg A & 301 Bldg C, Juji Industrial Park Shajing Street, Baoan District, Shenzhen, China
Tel	:	(+86)755-82591330
Fax	:	(+86)755-82591332
Web	:	www.LCS-cert.com
Mail	:	webmaster@LCS-cert.com
Date of receipt of test sample	:	March 01, 2022
Number of tested samples	:	2
Serial number	:	Prototype
Date of Test	:	March 02, 2022 ~ March 21, 2022
Date of Report	:	March 21, 2022

Scan code to check authenticity

FCC TEST REPORT

FCC CFR 47 PART 20.21

Report Reference No.	**:**	**LCS220226024AEA**
Date of Issue.....	:	March 21, 2022
Testing Laboratory Name.....	**:**	**Shenzhen LCS Compliance Testing Laboratory Ltd.**
Address.....	:	101, 201 Bldg A & 301 Bldg C, Juji Industrial Park Shajing Street, Baoan District, Shenzhen, China
Testing Location/ Procedure.....	:	Full application of Harmonised standards ■ Partial application of Harmonised standards □ Other standard testing method □
Applicant's Name.....	**:**	**Shen Zhen ANNTLENT Communication Technology co., Ltd.**
Address.....	:	Room 601, Unit 1 Building 10, Haoyue Garden, Minzhi Sub-district, Longhua District, Shenzhen, China
Test Specification		
Standard.....	:	FCC CFR Title 47 Part 20.21
Test Report Form No.....	:	LCSEMC-1.0
TRF Originator.....	:	Shenzhen LCS Compliance Testing Laboratory Ltd.
Master TRF.....	:	Dated 2011-03

Test Item Description.....	**:**	**Cell phone signal booster**
Trade Mark.....	:	Phonetone ANYCALL PROUTONE ORPEY ANNTLENT
Test Model.....	:	AN-USF5 Plus
Ratings.....	:	For AC Adapter(model: SSK0500200U1070-B): Input: AC 100-240V,50/60Hz, 0.35A Output: DC 5V⎓ 2.0A, 10W
Result	**:**	**Positive**

Compiled by:	**Supervised by:**	**Approved by:**
Diamond.Lu/ Administrators	Jin Wang/ Administrators	Gavin Liang/ Manager

FCC -- TEST REPORT

Test Report No. : **LCS220226024AEA**	March 21, 2022 Date of issue

Test Model.....	: AN-USF5 Plus
EUT.....	: Cell phone signal booster
Applicant.....	**: Shen Zhen ANNTLENT Communication Technology co., Ltd.**
Address.....	: Room 601, Unit 1 Building 10, Haoyue Garden, Minzhi Sub-district, Longhua District, Shenzhen, China
Telephone.....	: /
Fax.....	: /
Manufacturer.....	**: Shen Zhen ANNTLENT Communication Technology co., Ltd.**
Address.....	: Room 601, Unit 1 Building 10, Haoyue Garden, Minzhi Sub-district, Longhua District, Shenzhen, China
Telephone.....	: /
Fax.....	: /
Factory.....	: **Shen Zhen ANNTLENT Communication Technology co., Ltd.**
Address.....	: Room 601, Unit 1 Building 10, Haoyue Garden, Minzhi Sub-district, Longhua District, Shenzhen, China
Telephone.....	: /
Fax.....	: /

Test Result	**Positive**

The test report merely corresponds to the test sample.
It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

Revision History

Revision	Issue Date	Revisions	Revised By
000	March 21, 2022	Initial Issue	Gavin Liang

TABLE OF CONTENTS

1.GENERAL INFORMATION

1.1 Description of Device (EUT)

EUT	:	Cell phone signal booster
Equipment Type	:	Consumer Signal Booster
Test Model	:	AN-USF5 Plus
Additional Model No.	:	PTE-USF5 Plus
Model Declaration	:	PCB board, structure and internal of these model(s) are the same, So no additional models were tested
Power Supply	:	For AC Adapter(model: SSK0500200U1070-B): Input: AC 100-240V,50/60Hz, 0.35A Output: DC 5V⎓ 2.0A, 10W
Hardware Version	:	AN-USF5 Plus V1.0
Software Version	:	AN-USF5 Plus V1.0
Frequency Range	:	Lower 700MHz Band(B12) Uplink: 698~716MHz, Downlink: 728~746 MHz Upper 700MHz Band(B13) Uplink: 776~787MHz, Downlink: 746~757 MHz Cellular Band(B5) Uplink: 824~849MHz, Downlink: 869~894 MHz PCS Band(B2) Uplink: 1850~1910MHz, Downlink: 1930~1990 MHz AWS Band(B4) Uplink: 1710~1755MHz, Downlink: 2110~2155 MHz
Max .Gain	:	≤64dB(B12, B13, B5)；≤72dB(B2, B4)
Max. Antenna Port Output power	:	Uplink: ≤20dBm Downlink: ≤8dBm
Emission Designator	:	F9W, G7D, G7W, GXW, W7D
FCC Classification	:	B2W/Wideband Consumer Booster(CMRS)
Operating Temperature	:	-25ºC~+55ºC

mode	Frequency(MHz)	Antenna Gain(dBi)			Cable loss(dB)
		YAgi Antenna (model: PTE-YG-800/1900)	LPDA Antenna (model: AN-201)	Omni directional glass fiber Antenna (model: PTE-GF-700-2500)	
Uplink	698-716	8	9	3	5.21
	776-787	8	9	3	5.21
	824-849	10	9	5	5.49
	1850-1910	10	10.5	5	6.25
	1710-1755	10	10.5	5	5.89
mode	Frequency(MHz)	Rubber Antenna (model: PTE-RB-800-2100)	Ceiling Antenna (model: PTE-CI-800-2500)	Indoor Panel Antenna (model: AN-101)	Cable loss(dB)
Downlink	728-746	3	3	7	2.19
	746-757	3	3	7	2.19
	869-894	3.5	4.5	7	2.29
	1930-1990	3.5	4.5	8.5	2.55
	2110-2155	3.5	4.5	8.5	2.86

1.2 Support equipment List

Manufacturer	Description	Model	Serial Number	Certificate
Shen Zhen SIMSUKIAN ELECTRONIC Technology co., Ltd	AC/DC Adapter	SSK0500200U1070-B	---	FCC SDoC

1.3 External I/O Cable

I/O Port Description	Quantity	Cable
Antenna Port	2	N/A
DC IN Port	1	N/A

1.4 Description of Test Facility

FCC Registration Number is 254912.
NVLAP Accreditation Code is 600167-0.
FCC Designation Number is CN5024.
CAB identifier is CN0071.
CNAS Registration Number is L4595.
Industry Canada Registration Number is 9642A.

The 3m-Semi anechoic test site fulfils CISPR 16-1-4 according to ANSI C63.10:2013 and CISPR 16-1-4:2010 VSWR requirement for radiated emission above 1GHz.

1.5 Statement of the Measurement Uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. To CISPR 16 – 4 "Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements" and is documented in the LCS quality system acc. To DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

1.6 Measurement Uncertainty

Test Item		Frequency Range	Uncertainty	Note
Radiation Uncertainty	:	9KHz~30MHz	3.10dB	(1)
		30MHz~200MHz	2.96dB	(1)
		200MHz~1000MHz	3.10dB	(1)
		1GHz~26.5GHz	3.80dB	(1)
		26.5GHz~40GHz	3.90dB	(1)
Conduction Uncertainty	:	150kHz~30MHz	1.63dB	(1)
Power disturbance	:	30MHz~300MHz	1.60dB	(1)

(1). This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

1.7 Operation Band

Uplink Frequency(MHz)	Downlink Frequency(MHz)
698-716(Lower 700 Band)	728-746(Lower 700 Band)
776-787(Upper 700 Band)	746-757(Upper 700 Band)
824-849(Cellular Band)	869-894(Cellular Band)
1850-1910(PCS Band)	1930-1990(PCS Band)
1710-1755(AWS Band)	2110-2155(AWS Band)

2. TEST METHODOLOGY

All tests and measurements indicated in this document were performed in accordance with:

1) The Code of federal Regulations Title 47, Part 2, Part 22, Part 24, Part 27, Part 20.21;
2) ANSI C63.26-2015, American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services;
3) KDB 935210 D03 Signal Booster Measurements v04r04.

2.1 EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

2.2 General Test Procedures

2.2.1 Radiated spurious emissions

The EUT is placed on the turntable, which is 1.5 m above ground plane.The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the maximum emissions, exploratory radiated spurious emissions measurements were made according to the requirements in Section 6.3 of ANSI C63.10-2013

3. SYSTEM TEST CONFIGURATION

3.1 Justification

The system was configured for testing in a continuous transmits condition.

3.2 EUT Exercise Software

N/A

3.3 Special Accessories

Manufacturer	Description	Model	Serial Number	Certificate
--	--	--	--	--

3.4 Block Diagram/Schematics

Please refer to the related document.

3.5 Equipment Modifications

Shenzhen LCS Compliance Testing Laboratory Ltd. has not done any modification on the EUT.

3.6 Test Setup

Please refer to the test setup photo.

4. SUMMARY OF TEST RESULTS

Requirement	CFR 47 Section	Result
Authorized Frequency Band Verification Test	§20.21(e)(3)	PASS
Maximum Power Measurement Procedure	§20.21(e)(8)(i)(D) §20.21(e)(8)(i)(B)&§20.21(e)(4)	PASS
Maximum Booster Gain Computation	§20.21(e)(8)(i)(C)(2) §20.21(e)(8)(i)(B)&§20.21(e)(4)	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	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)&§20.21(e)(4)	PASS
Uplink inactivity	§20.21(e)(8)(i)(I) &§20.21(e)(4)	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	PASS
Anti-Oscillation	§20.21(e)(8)(ii)(A)&§20.21(e)(4)	PASS
Radiated Spurious Emission	§2.1053	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.

5. SUMMARY OF TEST EQUIPMENT

Item	Equipment	Manufacturer	Model No.	Serial No.	Cal Date	Due Date
1	LTE Test Software	Tonscend	JS1120-1	N/A	N/A	N/A
2	RF Control Unit	Tonscend	JS0806	158060009	2021-06-21	2022-06-20
3	MXA Signal Analyzer	Agilent	N9020A	MY51250905	2021-06-21	2022-06-20
4	DC Power Supply	Agilent	E3642A	N/A	2021-11-25	2022-11-24
5	MXG Vector Signal Generator	Agilent	N5182A	MY47071151	2021-06-21	2022-06-20
6	PSG Analog Signal Generator	Agilent	E8257D	MY4520521	2021-06-21	2022-06-20
7	Temperature & Humidity Chamber	GUANGZHOU GOGNWEN	GDS-100	70932	2021-10-07	2022-10-06
8	EMI Test Software	EZ	EZ-EMC	/	N/A	N/A
9	3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH03-HY	2021-06-21	2022-06-20
10	Positioning Controller	MF	MF7082	MF78020803	2021-06-21	2022-06-20
11	Active Loop Antenna	SCHWARZBECK	FMZB 1519B	00005	2019-07-26	2022-07-25
12	By-log Antenna	SCHWARZBECK	VULB9163	9163-470	2021-06-21	2022-06-20
13	Horn Antenna	SCHWARZBECK	BBHA 9120D	9120D-1925	2019-07-02	2022-07-01
14	Broadband Horn Antenna	SCHWARZBECK	BBHA 9170	791	2020-09-20	2023-09-19
15	Broadband Preamplifier	SCHWARZBECK	BBV9745	9719-025	2021-06-21	2022-06-20
16	EMI Test Receiver	R&S	ESR 7	101181	2021-06-21	2022-06-20
17	RS SPECTRUM ANALYZER	R&S	FSP40	100503	2021-06-21	2022-06-20
18	Broadband Preamplifier	/	BP-01M18G	P190501	2021-06-21	2022-06-20
19	RF Cable-R03m	Jye Bao	RG142	CB021	2021-06-21	2022-06-20
20	RF Cable-HIGH	SUHNER	SUCOFLEX 106	03CH03-HY	2021-06-21	2022-06-20
21	WIDEBAND RADIO COMMUNICATION TESTER	R&S	CMW 500	103818	2021-06-21	2022-06-20
22	RF Filter	Micro-Tronics	BRC50718	S/N-017	2021-06-21	2022-06-20
23	RF Filter	Micro-Tronics	BRC50719	S/N-011	2021-06-21	2022-06-20
24	RF Filter	Micro-Tronics	BRC50720	S/N-011	2021-06-21	2022-06-20
25	RF Filter	Micro-Tronics	BRC50721	S/N-013	2021-06-21	2022-06-20
26	RF Filter	Micro-Tronics	BRM50702	S/N-195	2021-06-21	2022-06-20
27	6dB Attenuator	/	100W/6dB	1172040	2021-06-21	2022-06-20
28	3dB Attenuator	/	2N-3dB	/	2021-06-21	2022-06-20
29	RS SPECTRUM ANALYZER	R&S	FSP40	100503	2021-06-21	2022-06-20

6. MEASUREMENT RESULTS

6.1 Authorized Frequency Band Verification

Applicable Standard

According to § 20.21(e)(3) Frequency Bands.

This test is intended to confirm that the signal booster only operates on the CMRS frequency bands authorized for use by the NPS. In other words, the signal booster shall reject amplification of other signals outside of its passband. In addition, this test will identify the frequency at which the maximum gain is realized within each CMRS operational band, which then serves as a basis for subsequent tests.

Test Procedure

According to section 7.1 of KDB 935210 D03 Signal Booster Measurement v04r04:

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.

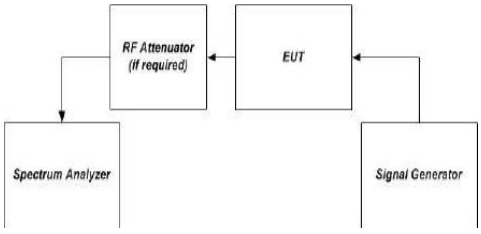


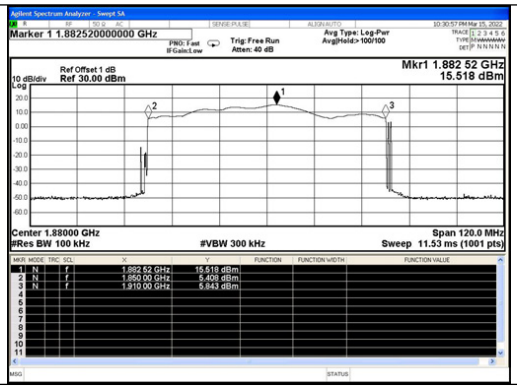
Figure 1 – Band verification test instrumentation setup

Test Data

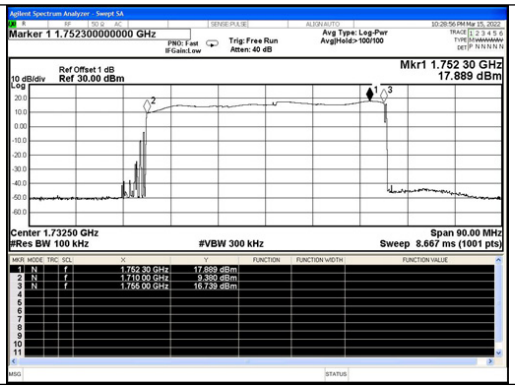
Temperature	23.1℃	Humidity	54.2%
Test Engineer	Ling Zhu	Test Mode	Transmitting

Test Graphs

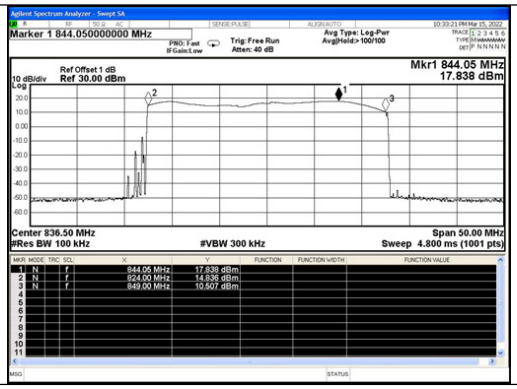
Uplink



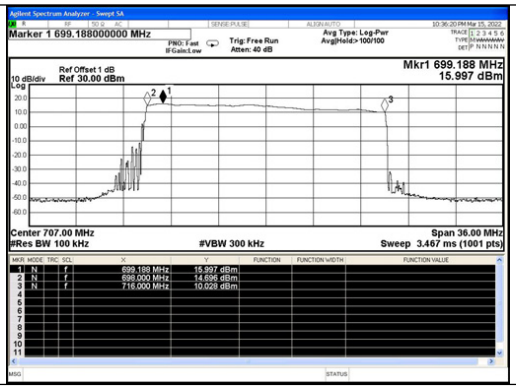
PCS Band



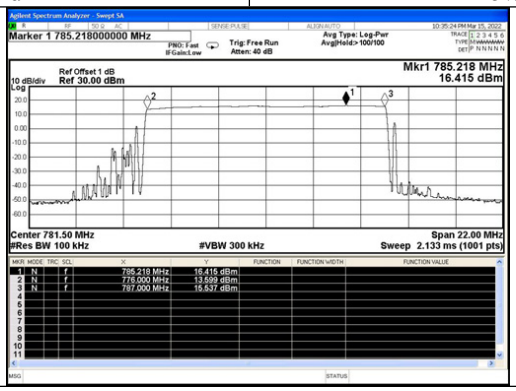
AWS Band



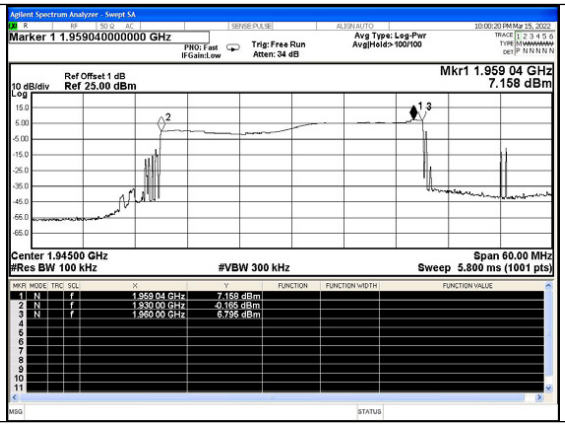
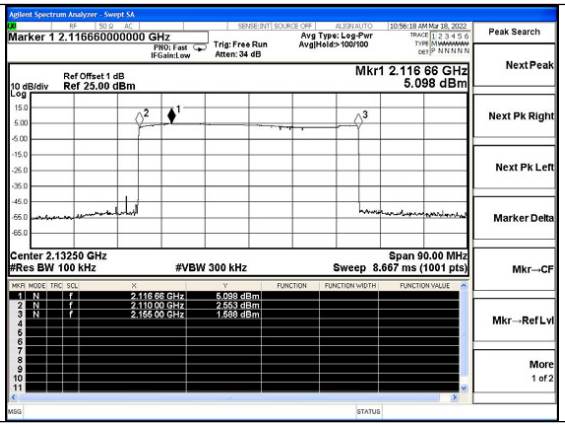
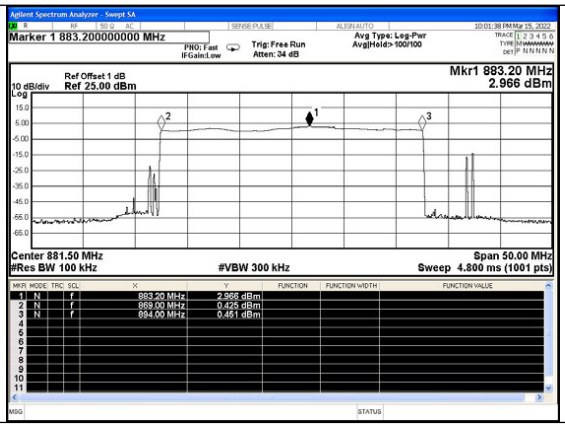
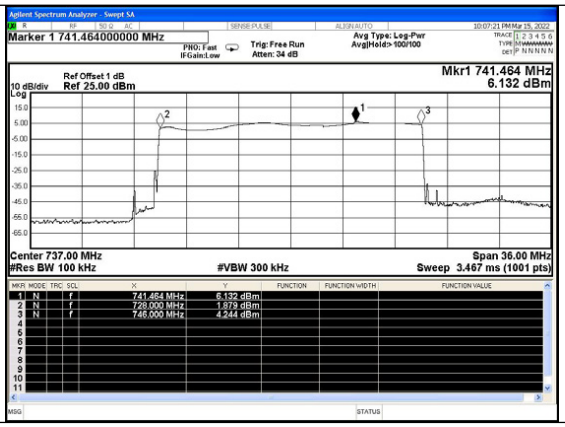
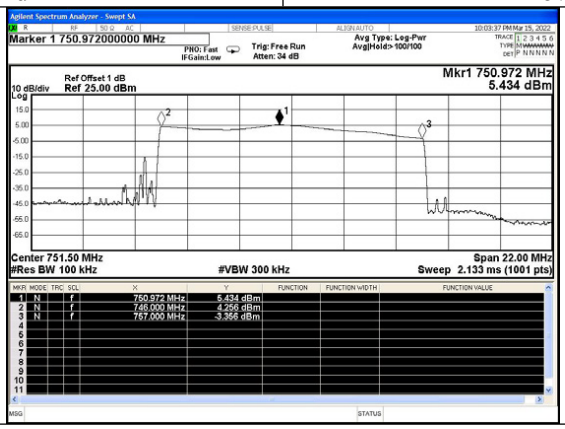
Cellular band



Lower 700MHz



Upper 700MHz

Downlink	
	
PCS Band	AWS Band
	
Cellular band	Lower 700MHz
	
Upper 700MHz	

6.2 Maximum power measurement

Applicable Standard

According to §20.21(e)(8)(i)(D) Power Limits;§20.21(e)(8)(i)(B) Bidirectional Capability (uplink minimum conducted power output);§20.21(e)(4) Self-monitoring:
1. A booster's uplink power must not exceed 1 watt composite conducted power and equivalent isotropic radiated power (EIRP) for each band of operation. Composite downlink power shall not exceed 0.05 watt (17 dBm) conducted and EIRP for each band of operation.
2. Consumer Boosters must be able to provide equivalent uplink and downlink gain and conducted uplink power output that is at least 0.05 watts
This procedure shall be used to demonstrate compliance to the signal booster power limits and requirements as specified in Sections 20.21(e)(8)(i)(D) and 20.21(e)(8)(i)(B) for wideband consumer signal boosters.

Test Procedure

According to section 7.2.1 of KDB 935210 D03 Signal Booster Measurement v04r04:

a) Compliance to applicable EIRP limits must be shown using the highest gains from the list of antennas, cabling, and coupling devices declared by the manufacturer for use with the consumer booster.

b) In addition, the maximum power levels measured in this procedure will be used in calculating the maximum gain as described in the next subclause.

c) The frequency with the highest power level in each operational band as determined in 7.1 is to be measured discretely by applying the following procedure using the stated emission and power detector types independently.

d) Use a signal generator to create a pulsed CW or GSM signal with a pulse width of 570 μs and a duty cycle of 12.5% (i.e., one GSM timeslot), then measure using the burst power function of the measuring instrument.

e) Use a signal generator to create an AWGN signal with a 99% occupied bandwidth (OBW) of

4.1 MHz, then measure using the channel power or band power function of the measuring instrumentation.

f) All modes of operation must be verified to maintain operation within applicable limits at the maximum uplink and downlink test levels per device type as defined in 5.5, by increasing the power level in 2 dB steps from the AGC level to the maximum input level specified in 5.5.

According to section 7.2.2 of KDB 935210 D03 Signal Booster Measurement v04r04:
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) Configure the signal generator and spectrum analyzer for operation on the frequency determined in 7.1 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 (from observation of signal behavior on the spectrum analyzer; i.e., 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 (and within 0.5 dB of) the AGC limit without triggering the AGC. Note the signal generator power level as Pin.

g) Measure the output power, Pout, 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 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 span)/RBW.

NOTE–This requirement does not apply for BURST power measurement mode.

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 Pout, with one set of results for the GSM or CW input stimulus, and another set of results for the AWGN input stimulus.

Test Data

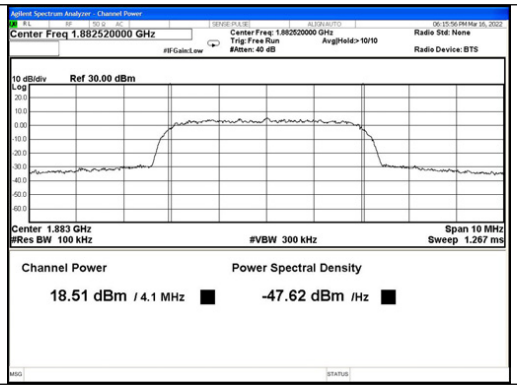
Temperature	23.1℃	Humidity	54.2%
Test Engineer	Ling Zhu	Test Mode	Transmitting

Max. Output Power								
Mode	Operation Band	Signal Type	Conducted Output Level (dBm)	Max. Antenna Gain (dB)	Min. Cable Loss (dB)	EIRP (dBm)	Limit (dBm)	Verdict
Uplink	PCS	CW	18.31	10.5	6.25	22.56	17-30	PASS
		AWGN	18.51	10.5	6.25	22.76		PASS
	AWS	CW	17.27	10.5	5.89	21.88		PASS
		AWGN	17.85	10.5	5.89	22.46		PASS
	Cellular	CW	17.70	9.0	5.49	21.21		PASS
		AWGN	17.79	9.0	5.49	21.30		PASS
	Lower 700	CW	17.03	9.0	5.21	20.82		PASS
		AWGN	17.30	9.0	5.21	21.09		PASS
	Upper 700	CW	17.53	9.0	5.21	21.32		PASS
		AWGN	17.88	9.0	5.21	21.67		PASS
Downlink	PCS	CW	7.29	8.5	2.55	13.24	≤17	PASS
		AWGN	7.45	8.5	2.55	13.40		PASS
	AWS	CW	7.18	8.5	2.42	13.26		PASS
		AWGN	7.57	8.5	2.42	13.65		PASS
	Cellular	CW	7.03	7.0	2.29	11.74		PASS
		AWGN	7.01	7.0	2.29	11.72		PASS
	Lower 700	CW	7.66	7.0	2.19	12.47		PASS
		AWGN	7.05	7.0	2.19	11.86		PASS
	Upper 700	CW	7.40	7.0	2.19	12.21		PASS
		AWGN	7.05	7.0	2.19	11.86		PASS

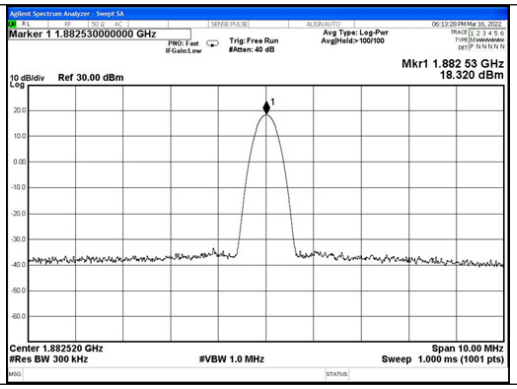
Note: EIRP(dBm) = Conducted Output Level + Max. Antenna Gain - Min.Cable Loss

Max. Input test level						
Mode	Operation Band	Signal Type	Max. Input Level (dBm)	Max. Input Level limit(dBm)	Conducted Output Level(dBm)	Verdict
Uplink	PCS	CW	-26.26	≤27	18.56	PASS
		AWGN	-26.67		18.34	PASS
	AWS	CW	-25.25		17.27	PASS
		AWGN	-25.82		17.85	PASS
	Cellular	CW	-23.69		17.39	PASS
		AWGN	-23.67		17.57	PASS
	Lower 700	CW	-25.66		17.36	PASS
		AWGN	-25.86		17.32	PASS
	Upper 700	CW	-24.66		17.57	PASS
		AWGN	-24.59		17.83	PASS
Downlink	PCS	CW	-33.06	≤-20	7.29	PASS
		AWGN	-32.99		7.45	PASS
	AWS	CW	-33.69		7.18	PASS
		AWGN	-33.27		7.57	PASS
	Cellular	CW	-31.67		7.03	PASS
		AWGN	-31.69		7.01	PASS
	Lower 700	CW	-30.67		7.66	PASS
		AWGN	-30.28		7.05	PASS
	Upper 700	CW	-33.64		7.40	PASS
		AWGN	-33.58		7.05	PASS

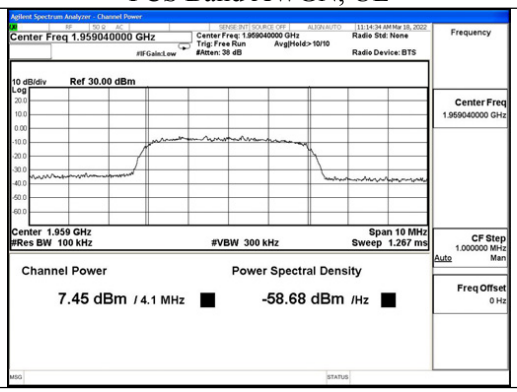
Test Graphs



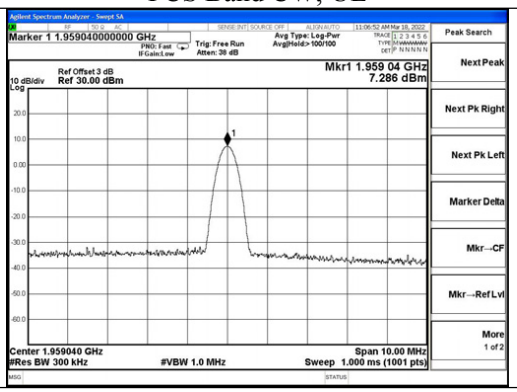
PCS Band AWGN, UL



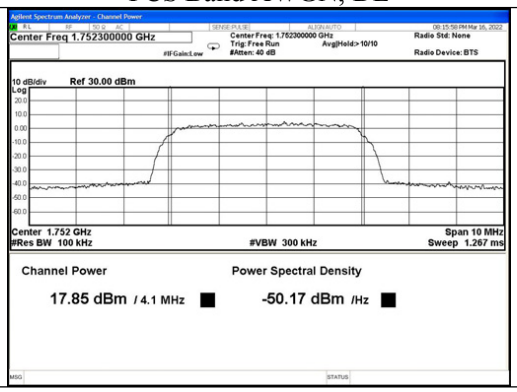
PCS Band CW, UL



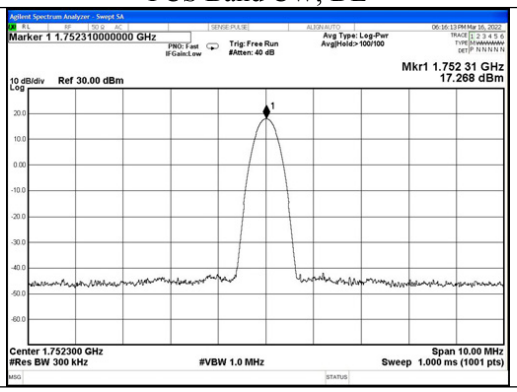
PCS Band AWGN, DL



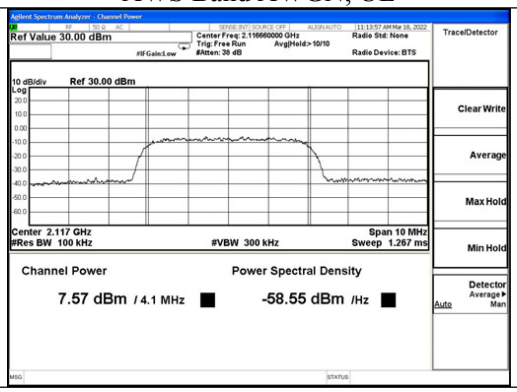
PCS Band CW, DL



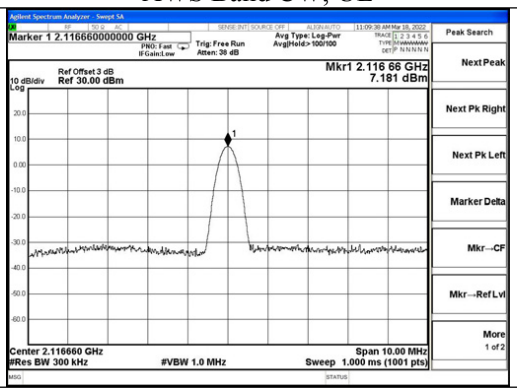
AWS Band AWGN, UL



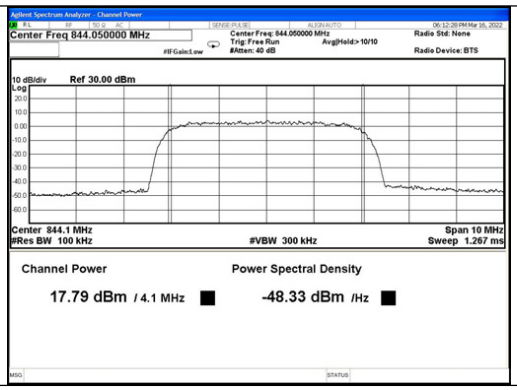
AWS Band CW, UL



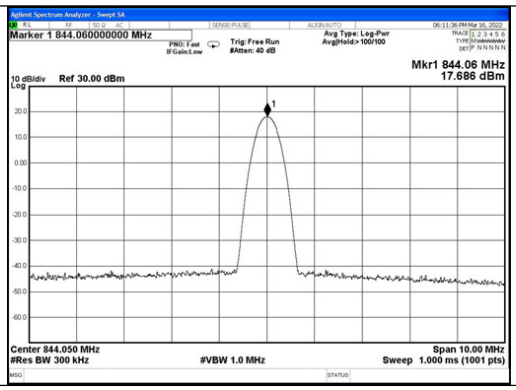
AWS Band AWGN, DL



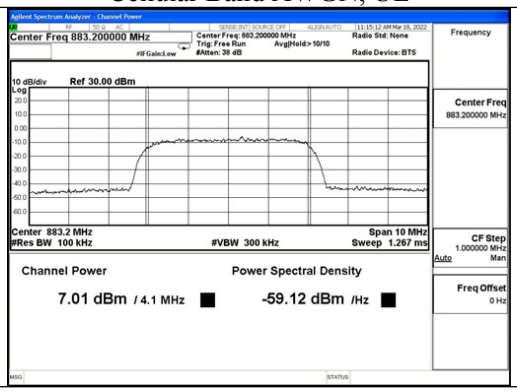
AWS Band CW, DL



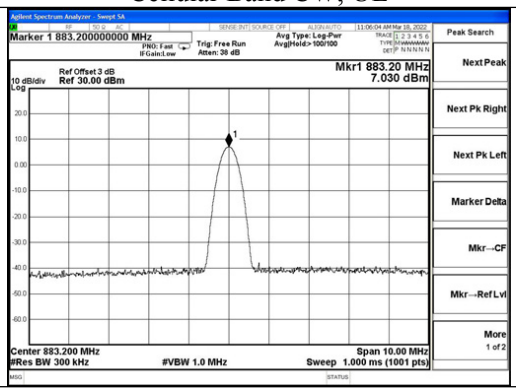
Cellular Band AWGN, UL



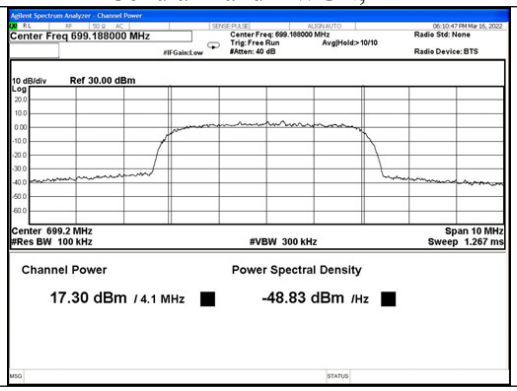
Cellular Band CW, UL



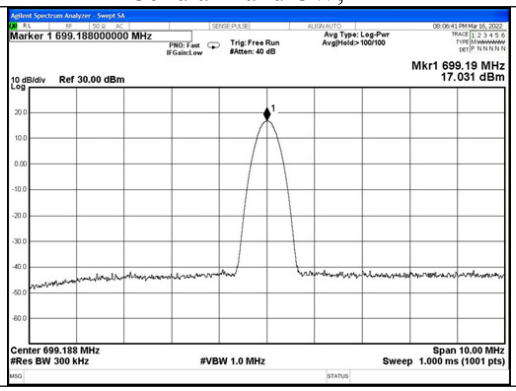
Cellular Band AWGN, DL



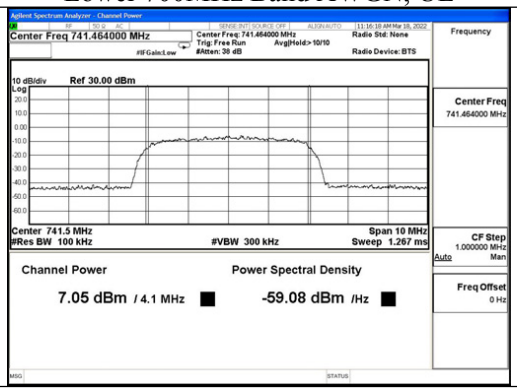
Cellular Band CW, DL



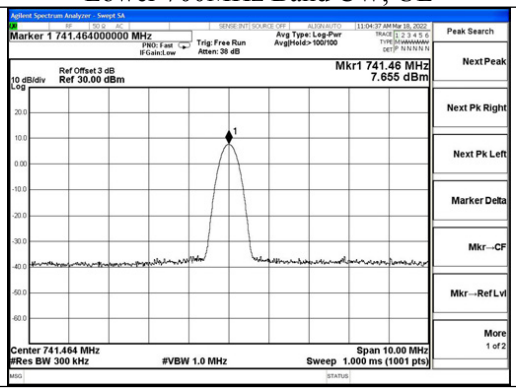
Lower 700MHz Band AWGN, UL



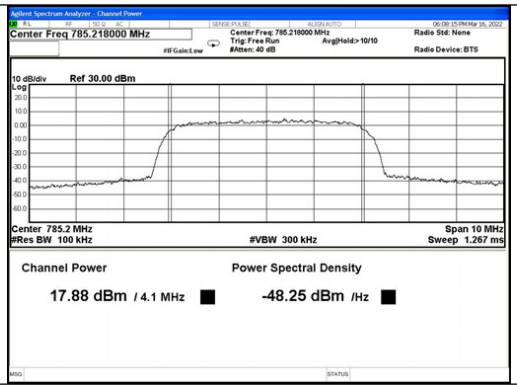
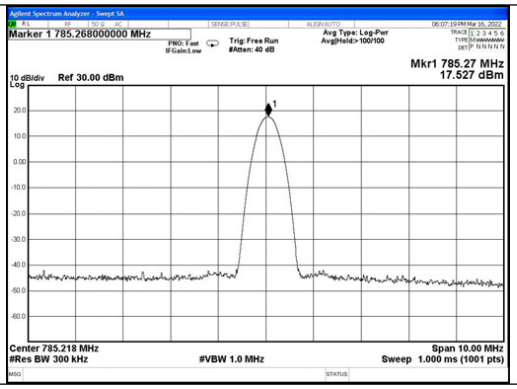
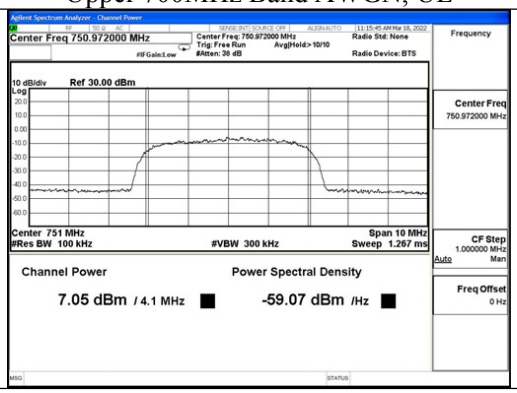
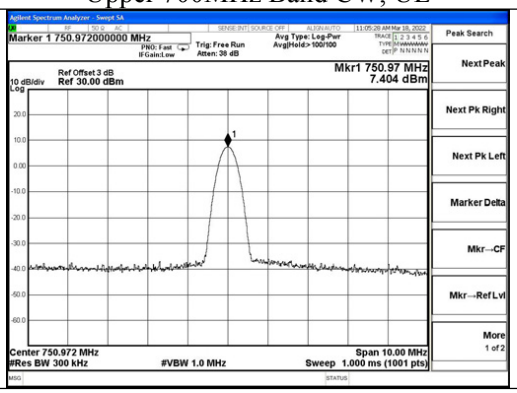
Lower 700MHz Band CW, UL



Lower 700MHz Band AWGN, DL



Lower 700MHz Band CW, DL

	
Upper 700MHz Band AWGN, UL	Upper 700MHz Band CW, UL
	
Upper 700MHz Band AWGN, DL	Upper 700MHz Band CW, DL

6.3 Maximum booster gain computation

Applicable Standard

According to§20.21(e)(8)(i)(C)(2) Booster Gain Limits (maximum gain);§20.21(e)(8)(i)(B) Bidirectional Capability (equivalent uplink and downlink gain):
The uplink and downlink maximum gain of a Consumer Booster referenced to its input and output ports shall not exceed the following limits:
(i) Fixed Booster maximum gain shall not exceed 6.5 dB + 20 Log10 (Frequency);
(ii) Where, Frequency is the uplink mid-band frequency of the supported spectrum bands in MHz.

According to section 7.3 of KDB 935210 D03 Signal Booster Measurement v04r04:
This subclause provides guidance for the calculation of the maximum gain, based on the results obtained from the 7.1 and 7.2 measurements. The NPS limits on maximum gain for fixed and mobile wideband consumer signal boosters are provided in §20.21(e)(8)(i)(C)(2). Additionally, §20.21(e)(8)(i)(B) requires that wideband consumer signal boosters be able to provide equivalent uplink and downlink gain, i.e., within 9 dB.
a) Calculate the maximum gain of the booster as follows to demonstrate compliance to the applicable gain limits as specified.
b) For both the uplink and downlink in each supported frequency band, use each of the POUT and PIN result pairs for all signal types used in 7.2 in the following equation to obtain the maximum gain, G:

$$G\ (dB) = POUT(dBm) - PIN(dBm).$$

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

Test Data

Temperature	23.1℃	Humidity	54.2%
Test Engineer	Ling Zhu	Test Mode	Transmitting

Max. Gain							
Mode	Operation Band	Signal Type	Pre AGC Input Level (dBm)	Conducted Output Level (dBm)	Gain (dB)	Gain Limit (dB)	Verdict
Uplink	PCS	CW	-49.5	18.31	67.81	≤71.98	PASS
		AWGN	-49.42	18.51	67.93		PASS
	AWS	CW	-51.98	17.27	69.25	≤71.27	PASS
		AWGN	-51.61	17.85	69.46		PASS
	Cellular	CW	-42.42	17.70	60.12	≤64.95	PASS
		AWGN	-44.67	17.79	62.46		PASS
	Lower 700	CW	-44.46	17.03	61.49	≤63.49	PASS
		AWGN	-42.52	17.30	59.82		PASS
	Upper 700	CW	-42.39	17.53	59.92	≤64.36	PASS
		AWGN	-41.26	17.88	59.14		PASS
Downlink	PCS	CW	-59.33	7.29	66.62	≤71.98	PASS
		AWGN	-59.2	7.45	66.65		PASS
	AWS	CW	-59.2	7.18	66.38	≤71.27	PASS
		AWGN	-58.24	7.57	65.81		PASS
	Cellular	CW	-54.18	7.03	61.21	≤64.95	PASS
		AWGN	-55.05	7.01	62.06		PASS
	Lower 700	CW	-54.81	7.66	62.47	≤63.49	PASS
		AWGN	-55.85	7.05	62.90		PASS
	Upper 700	CW	-55.12	7.40	62.52	≤64.36	PASS
		AWGN	-56.27	7.05	63.32		PASS

Note: 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.

Uplink Gain VS Downlink Gain						
Band	Signal Type	Uplink Gain (dB)	Downlink Gain (dB)	Caculated value(dBc)	Limit (dBc)	Verdict
PCS	CW	67.81	66.62	1.19	<9	PASS
	AWGN	67.93	66.65	1.28		PASS
AWS	CW	69.83	66.38	3.45		PASS
	AWGN	68.88	65.81	3.07		PASS
Cellular	CW	60.12	61.21	-1.09		PASS
	AWGN	62.46	62.06	0.4		PASS
Lower 700	CW	61.49	62.47	-0.98		PASS
	AWGN	59.82	62.90	-3.08		PASS
Upper 700	CW	59.92	62.52	-2.6		PASS
	AWGN	59.14	63.32	-4.18		PASS

6.4 Intermodulation Product

Applicable Standard

According to §20.21(e)(8)(i)(F) Intermodulation Limits:
The transmitted intermodulation products of a consumer booster at its uplink and downlink ports shall not exceed the power level of −19 dBm for the supported bands of operation.

Test Procedure

According to section 7.4 of KDB 935210 D03 Signal Booster Measurement v04r04:
a) Connect the signal booster to the test equipment as shown in Figure 2. Begin with the uplink output (donor) port connected to the spectrum analyzer.
b) Set the spectrum analyzer RBW = 3 kHz.
c) Set the VBW ≥ 3 RBW.
d) Select the rms detector.
e) Set the spectrum analyzer center frequency to the center of the supported operational band under test.
f) Set the span to 5 MHz. Affirm that the number of measurement points per sweep ≥ (2 × span)/RBW.
g) Configure the two signal generators for CW operation with generator #1 tuned 300 kHz below the operational band center frequency and generator #2 tuned 300 kHz above the operational band center frequency. If the maximum output power is not at the operational-band (booster pass band) center frequency, configure the test signal pair around the frequency with maximum output power as determined per 7.2.
h) Set the signal generator amplitudes so that the power from each into the EUT is equivalent, then turn on the RF output.
i) Simultaneously increase each signal generators' amplitude equally until just before the EUT begins AGC, then affirm that all intermodulation-product emissions (if any occur) are below the specified limit of −19 dBm.
j) Use the trace averaging function of the spectrum analyzer, and wait for the trace to stabilize. Place a marker at the highest amplitude intermodulation-product emission.
k) Record the maximum intermodulation product amplitude level that is observed.
l) Capture the spectrum analyzer trace for inclusion in the test report.
m) Repeat 7.4e) to 7.4l) for all uplink and downlink operational bands.
NOTE–If using a single signal generator with dual outputs, affirm 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 7.4i), but not exceeding the maximum input level of 5.5, to affirm that the EUT maintains compliance with the intermodulation limit. The test report shall include either a statement describing that the device complies at 10 dB above AGC or at the 5.5 power levels, or a table showing compliance at the additional input power(s) required.

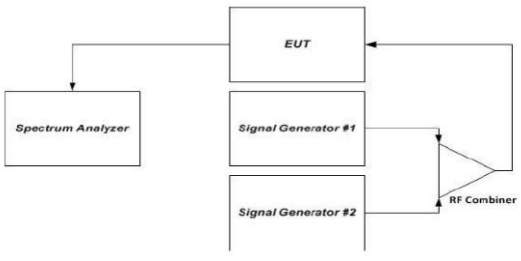
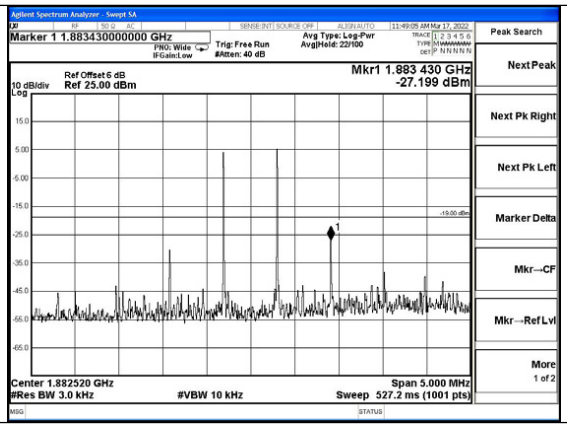


Figure 2 – Intermodulation product instrumentation test setup

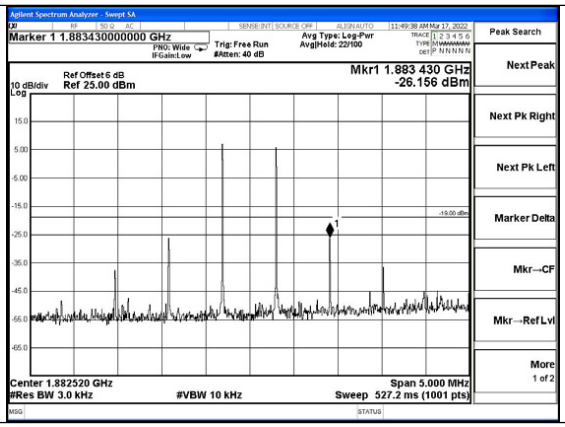
Test Data

Temperature	23.1℃	Humidity	54.2%
Test Engineer	Ling Zhu	Test Mode	Transmitting

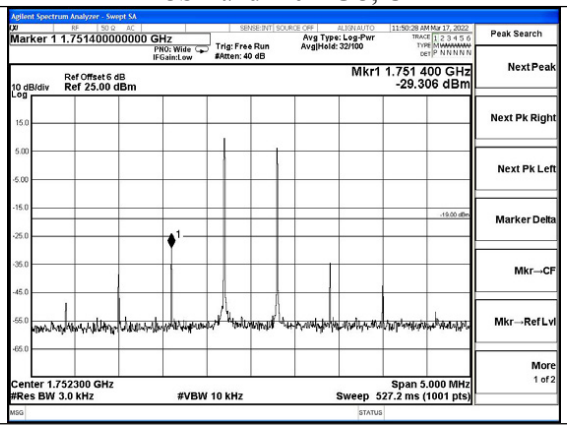
Test Graphs



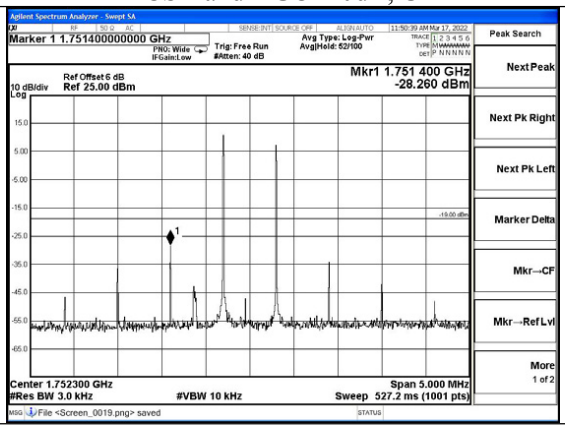
PCS Band Pre AGC, UL



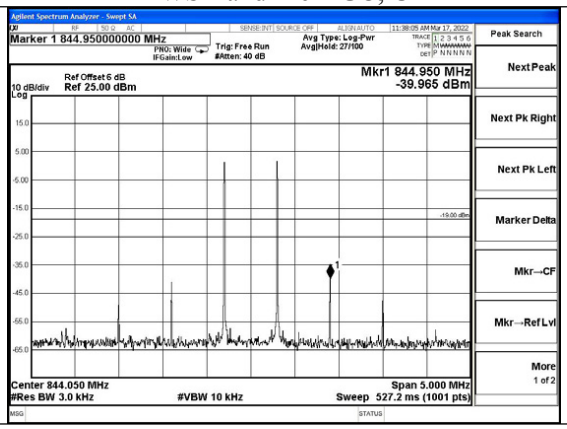
PCS Band AGC+10dB, UL



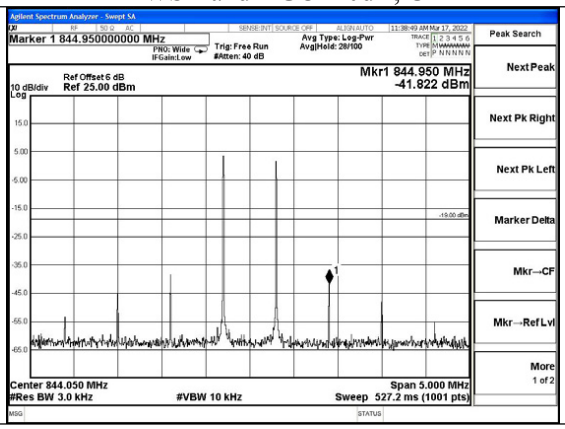
AWS Band Pre AGC, UL



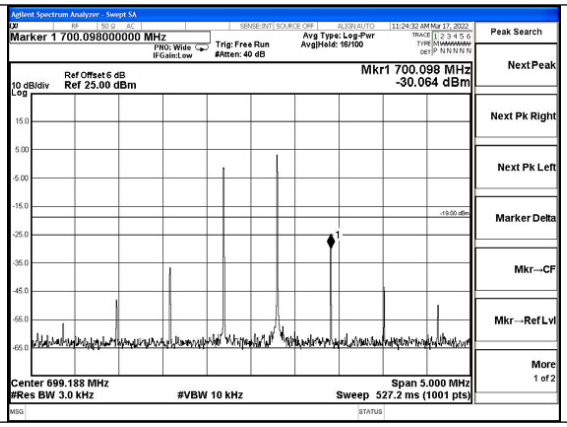
AWS Band AGC+10dB, UL



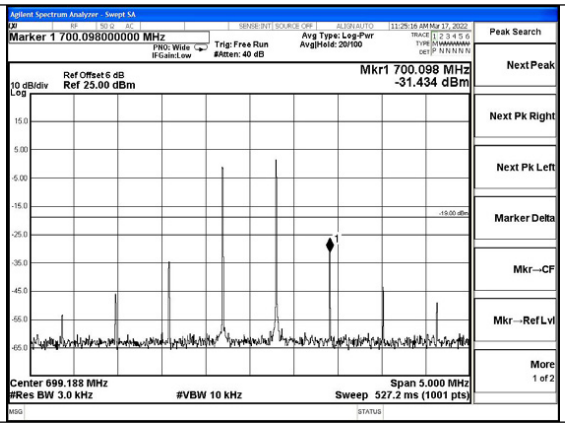
Cellular Band Pre AGC, UL



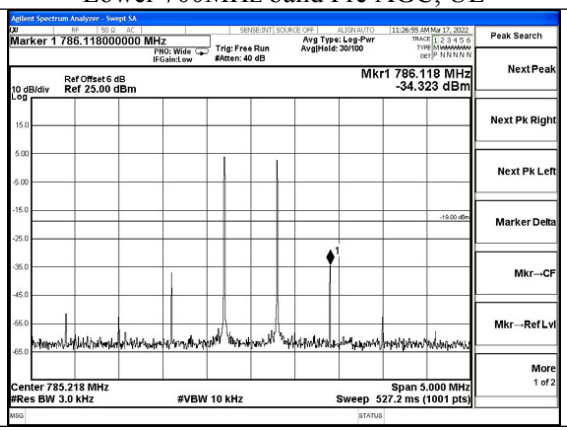
Cellular Band AGC+10dB, UL



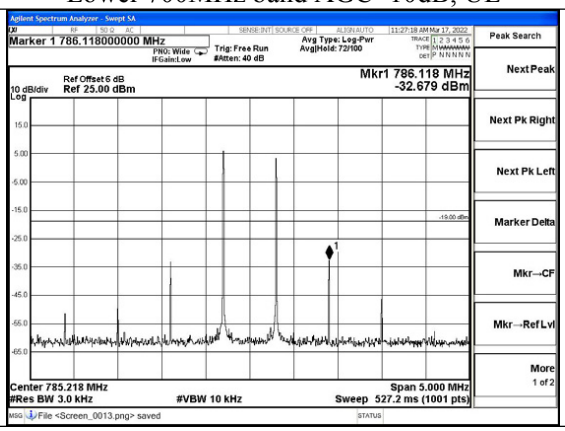
Lower 700MHz band Pre AGC, UL



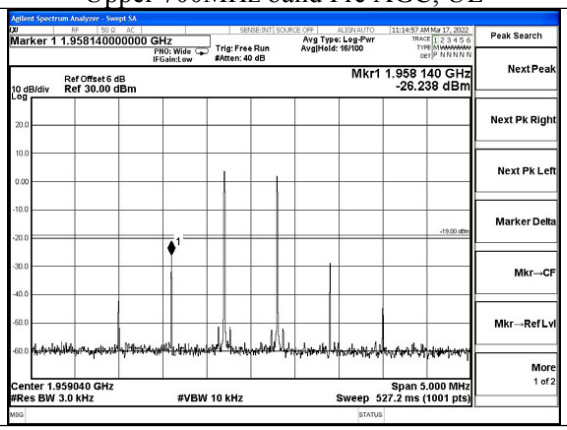
Lower 700MHz band AGC+10dB, UL



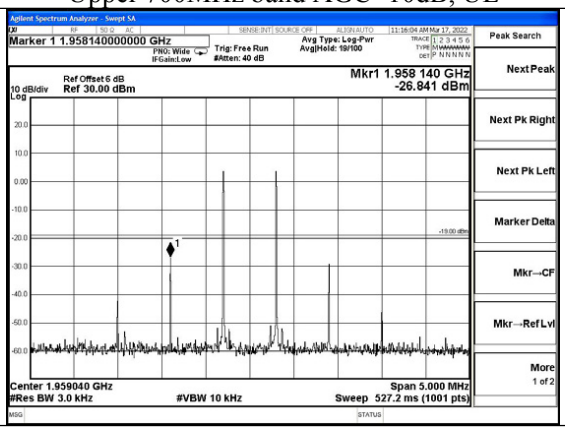
Upper 700MHz band Pre AGC, UL



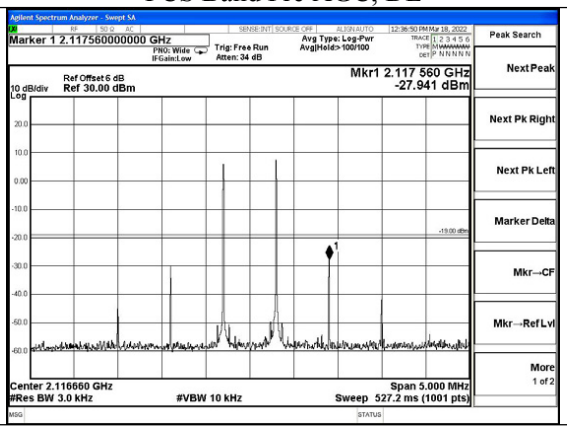
Upper 700MHz band AGC+10dB, UL



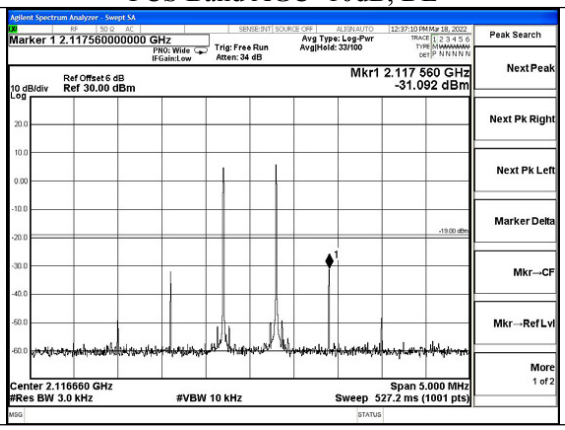
PCS Band Pre AGC, DL



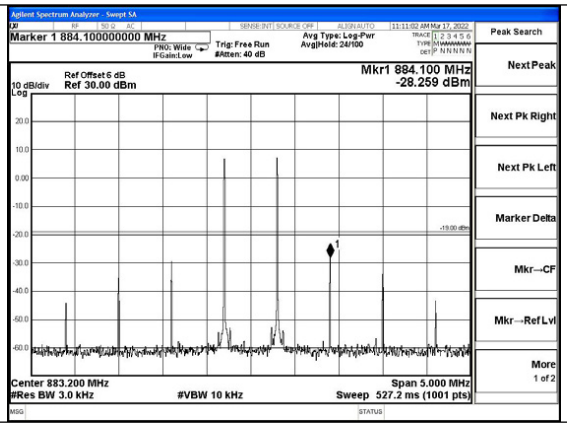
PCS Band AGC+10dB, DL



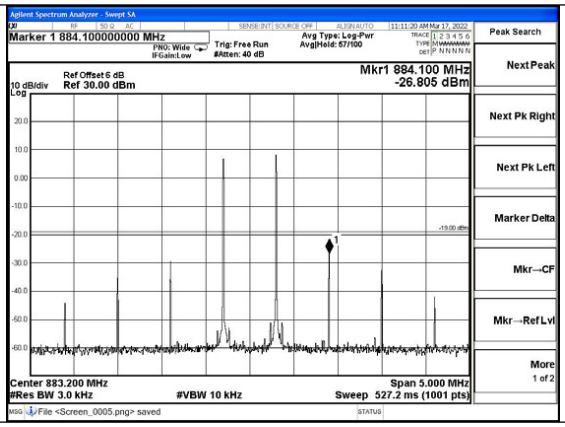
AWS Band Pre AGC, DL



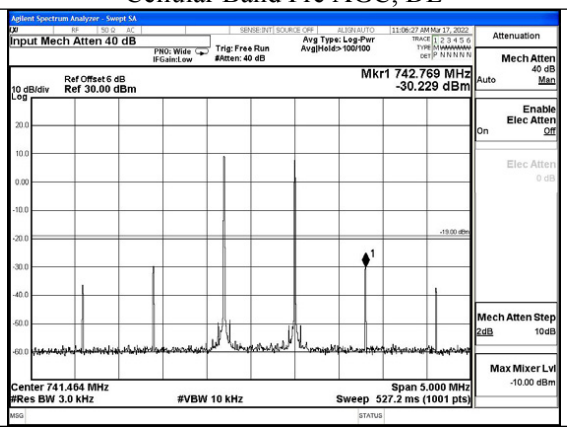
AWS Band AGC+10dB, DL



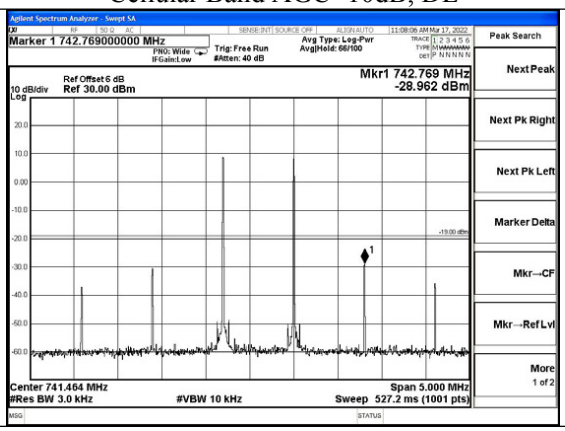
Cellular Band Pre AGC, DL



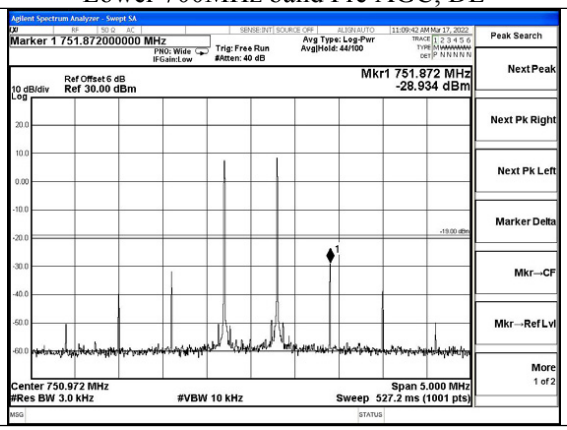
Cellular Band AGC+10dB, DL



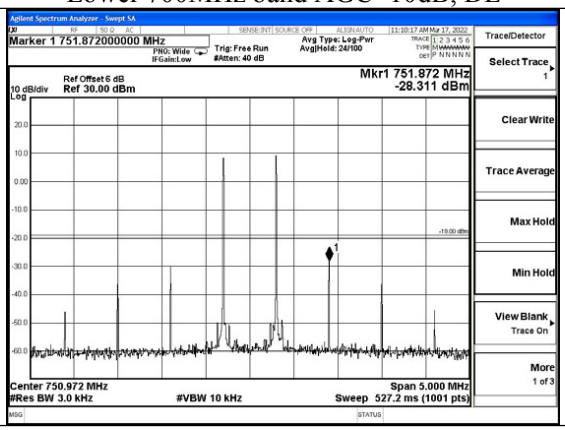
Lower 700MHz band Pre AGC, DL



Lower 700MHz band AGC+10dB, DL



Upper 700MHz band Pre AGC, DL



Upper 700MHz band AGC+10dB, DL

6.5 Out of Band Emission

Applicable Standard

According to § 20.21(e)(8)(i)(E) Out of Band Emission Limits:
Booster out of band emissions (OOBE) shall be at least 6 dB below the FCC's mobile emission limits for the supported bands of operation. Compliance to OOBE limits will utilize high peak-to-average CMRS signal types.
For B2:Per FCC §24.238 the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10log(P) dB.

For B4: Per §27.53(h): For operations in the 1710–1755 MHz and 2110–2155 MHz bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) by at least 43 + 10 log10(P) dB.

For B5:Per FCC §22.917 the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10log(P) dB.

For B12: Per §27.53 (g): For operations in the 698–746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least 43 + 10 log (P) dB.

For B13: Per §27.53 (c): For operations in the 776-788 MHz band, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following: On any frequency outside the 776-788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least 43 + 10 log (P) dB.

Calculation: Limit (dBm) =[P-43 + 10 log (P)] - 6= -19 dBm

Test Procedure

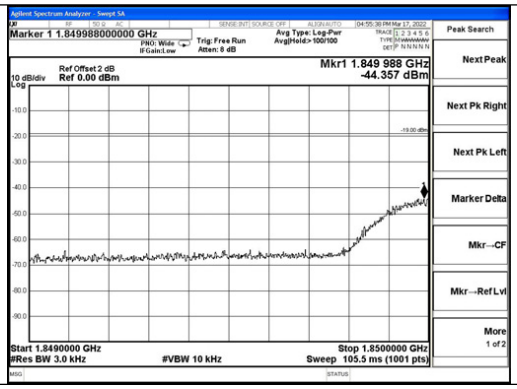
According to section 7.5 of KDB 935210 D03 Signal Booster Measurement v04r04:
a) Connect the EUT to the test equipment as shown in Figure 1. Begin with the uplink output (donor) port connected to the spectrum analyzer.
b) Configure the signal generator for the appropriate operation for all uplink and downlink bands:
1) GSM: 0.2 MHz from upper and lower band edges.
2) LTE (5 MHz): 2.5 MHz from upper and lower band edges.
3) CDMA: 1.25 MHz from upper and lower band edges, except for cellular band as follows (only the upper and lower frequencies need to be tested):
824.88 MHz, 845.73 MHz, 836.52 MHz, 848.10 MHz,
869.88 MHz, 890.73 MHz, 881.52 MHz, 893.10 MHz.
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 use the uplink and downlink signal types for these modulations in uplink and downlink tests, respectively. LTE shall use 5 MHz signal, 25 resource blocks transmitting.
NOTE 3–When using an AWGN test signal, the bandwidth shall be the measured 99% OBW.

c) Set the signal generator amplitude to the maximum power level prior to AGC similar to 7.2.2e) to7.2.2f) of the power measurement procedures for the appropriate modulations.
d) Set RBW = measurement bandwidth specified in the applicable rule section for the supported frequency band (see Appendix A for cross-reference to applicable rule section).
e) NOTE 3–Within 300 kHz and 3 MHz away from band edge, if smaller RBW is used (i.e., RBW < 100 kHz or 1 MHz, for above and below 1 GHz, respectively), per Parts 24 and 27 the smaller RBW is applicable only for frequencies within 100 kHz or 1 MHz (for above and below 1 GHz, respectively) away from the band edge.
f) Set VBW = 3 RBW.
g) Select the power averaging (rms) detector.
h) Sweep time = auto-couple.
i) 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).
j) Trace average at least 100 traces in power averaging (i.e., rms) mode.
k) Use peak marker function to find the maximum power level.
l) Capture the spectrum analyzer trace of the power level for inclusion in the test report.
m) Increase the signal generator amplitude in 2 dB steps until the maximum input level per 5.5 is reached. Affirm that the EUT maintains compliance with the OOBE limits. The test report shall include either a statement describing that the device complies at 10 dB above AGC or at the 5.5 power levels, or a table showing compliance at the additional input power(s) required.
n) 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 7.5i) to 7.5l).
Repeat 7.5b) through 7.5m) for each uplink and downlink operational band.

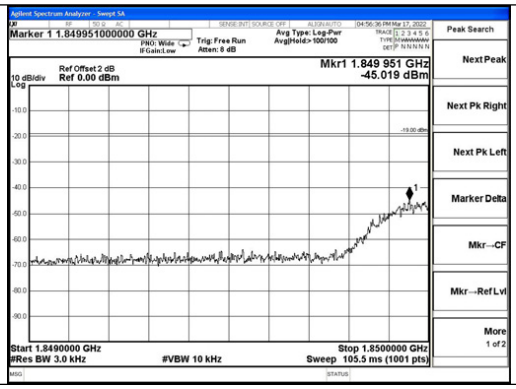
Test data

Temperature	23.1℃	Humidity	54.2%
Test Engineer	Ling Zhu	Test Mode	Transmitting

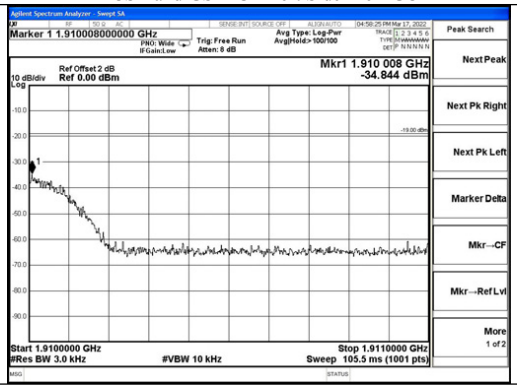
Test Graphs



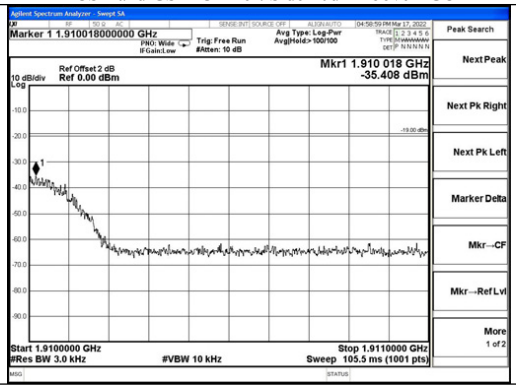
PCS Band GSM UL Left Side Pre AGC



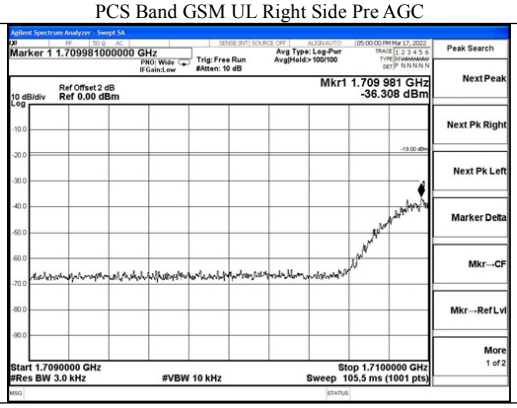
PCS Band GSM UL Left Side 10dB Above AGC



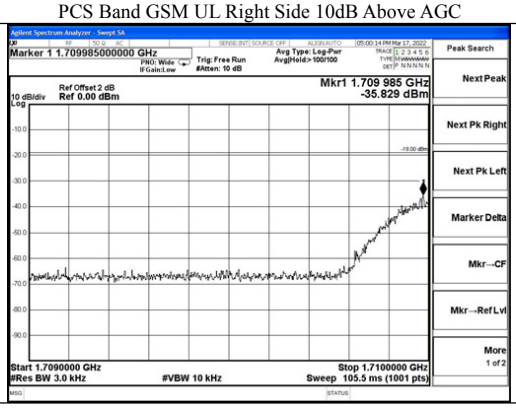
PCS Band GSM UL Right Side Pre AGC



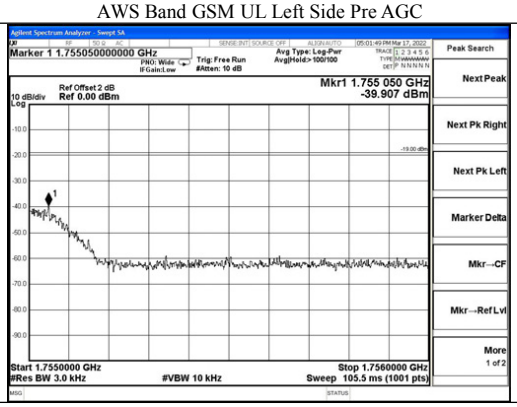
PCS Band GSM UL Right Side 10dB Above AGC

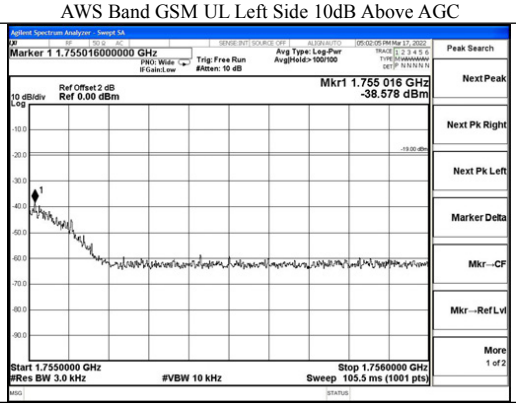


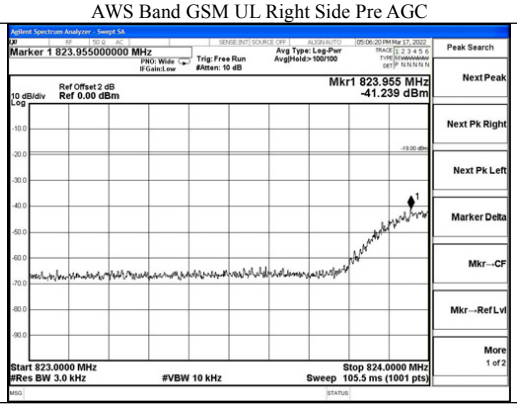
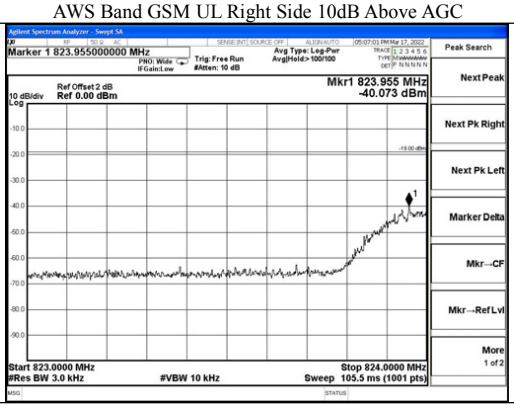
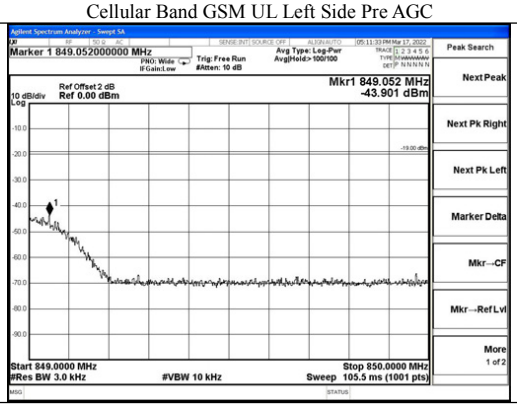
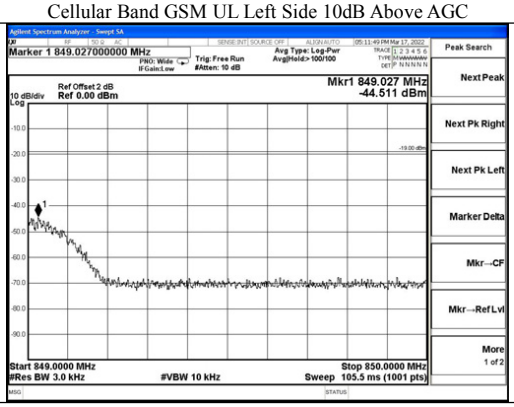
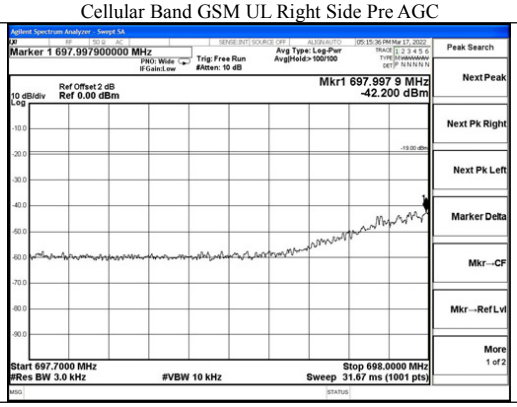
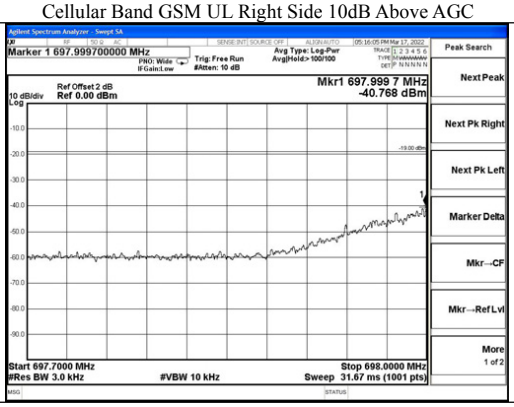
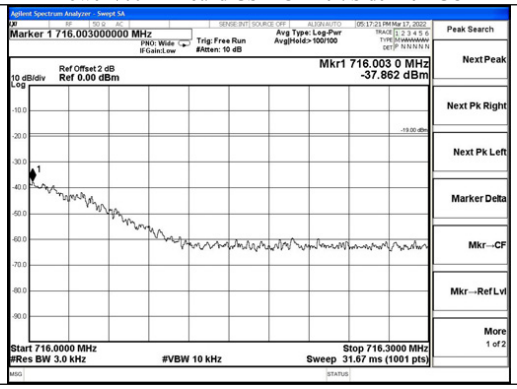
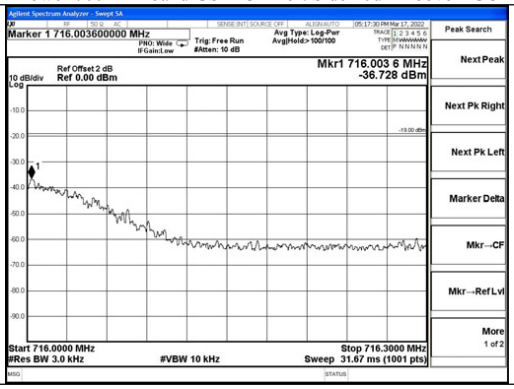
AWS Band GSM UL Left Side Pre AGC



AWS Band GSM UL Left Side 10dB Above AGC





AWS Band GSM UL Right Side Pre AGC	AWS Band GSM UL Right Side 10dB Above AGC
	
Cellular Band GSM UL Left Side Pre AGC	Cellular Band GSM UL Left Side 10dB Above AGC
	
Cellular Band GSM UL Right Side Pre AGC	Cellular Band GSM UL Right Side 10dB Above AGC
	
Lower 700MHz band GSM UL Left Side Pre AGC	Lower 700MHz band GSM UL Left Side 10dB Above AGC
	
Lower 700MHz band GSM UL Right Side Pre AGC	Lower 700MHz band GSM UL Right Side 10dB Above AGC