



FCC TEST REPORT

FOR

Shenyang Sanfeng Intelligent Technology Co., Ltd

Cell Phone Signal booster

Test Model: SF007

Prepared for : Shenyang Sanfeng Intelligent Technology Co., Ltd
Address : No.10-1(1-28-12), Hunnan West Road, Hunnan District, Shenyang City, Liaoning Province, 110000 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 : July 25, 2024
Number of tested samples : 2
Sample No. : A240723011-1, A240723011-2
Serial number : Prototype
Date of Test : July 25, 2024 ~ August 13, 2024
Date of Report : August 13, 2024



Shenzhen LCS Compliance Testing Laboratory Ltd.
Add: 101, 201 Bldg A & 301 Bldg C, Juji Industrial Park Yabianxueziwei, Shajing Street, Baoan District, Shenzhen, 518000, China
Tel: + (86) 0755-82591330 | E-mail: webmaster@lcs-cert.com | Web: www.lcs-cert.com
Scan code to check authenticity



FCC TEST REPORT	
FCC CFR 47 PART 20.21	
Report Reference No. : LCSA07234101EA	
Date of Issue..... : August 13, 2024	
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..... : Shenyang Sanfeng Intelligent Technology Co., Ltd	
Address..... : No.10-1(1-28-12), Hunnan West Road, Hunnan District,Shenyang City, Liaoning Province, 110000 China	
Test Specification	
Standard..... : FCC CFR Title 47 Part 20.21	
Test Report Form No..... : TRF-4-E-187 A/0	
TRF Originator..... : Shenzhen LCS Compliance Testing Laboratory Ltd.	
Master TRF..... : Dated 2011-03	
Shenzhen LCS Compliance Testing Laboratory Ltd. All rights reserved.	
This publication may be reproduced in whole or in part for non-commercial purposes as long as the Shenzhen LCS Compliance Testing Laboratory Ltd. is acknowledged as copyright owner and source of the material. Shenzhen LCS Compliance Testing Laboratory Ltd. takes no responsibility for and will not assume liability for damages resulting from the reader's interpretation of the reproduced material due to its placement and context.	
Test Item Description..... : Cell Phone Signal booster	
Trade Mark..... : APlusBoost, Atcall	
Test Model..... : SF007	
Ratings..... : For AC Adapter(Model: WTA24-1201500-U): Input: 100-240V~50/60Hz 1.0A Output: 12V ---1.5A	
Result : Positive	

Compiled by:

Diamond Lu/ Administrator

Supervised by:

Cary Luo/ Technique principal

Approved by:

Gavin Liang / Manager



Shenzhen LCS Compliance Testing Laboratory Ltd.

Add: 101, 201 Bldg A & 301 Bldg C, Juji Industrial Park Yabianxueziwei, Shajing Street, Baoan District, Shenzhen, 518000, China

Tel: +(86) 0755-82591330 | E-mail: webmaster@lcs-cert.com | Web: www.lcs-cert.com

Scan code to check authenticity

**FCC -- TEST REPORT**

Test Report No. : LCSA07234101EA	<u>August 13, 2024</u> Date of issue
--	---

Test Model.....	: SF007
EUT.....	: Cell Phone Signal booster
Applicant.....	: Shenyang Sanfeng Intelligent Technology Co., Ltd
Address.....	: No.10-1(1-28-12), Hunnan West Road, Hunnan District,Shenyang City, Liaoning Province, 110000 China
Telephone.....	: /
Fax.....	: /
Manufacturer.....	: Shenyang Sanfeng Intelligent Technology Co., Ltd
Address.....	: No.10-1(1-28-12), Hunnan West Road, Hunnan District,Shenyang City, Liaoning Province, 110000 China
Telephone.....	: /
Fax.....	: /
Factory.....	: Shenyang Sanfeng Intelligent Technology Co., Ltd
Address.....	: No.10-1(1-28-12), Hunnan West Road, Hunnan District,Shenyang City, Liaoning Province, 110000 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.



Shenzhen LCS Compliance Testing Laboratory Ltd.

Add: 101, 201 Bldg A & 301 Bldg C, Juji Industrial Park Yabianxueziwei, Shajing Street, Baoan District, Shenzhen, 518000, China

Tel: +(86) 0755-82591330 | E-mail: webmaster@lcs-cert.com | Web: www.lcs-cert.com

Scan code to check authenticity



Revision History

Revision	Issue Date	Revisions	Revised By
000	August 13, 2024	Initial Issue	---



Shenzhen LCS Compliance Testing Laboratory Ltd.
Add: 101, 201 Bldg A & 301 Bldg C, Juji Industrial Park Yabianxueziwei, Shajing Street, Baoan District, Shenzhen, 518000, China
Tel: +(86) 0755-82591330 | E-mail: webmaster@lcs-cert.com | Web: www.lcs-cert.com
Scan code to check authenticity



TABLE OF CONTENTS

Description	Page
1. GENERAL INFORMATION	6
1.1 Description of Device (EUT)	6
1.2 Support equipment List	9
1.3 External I/O Cable	9
1.4 Description of Test Facility	9
1.5 Statement of the Measurement Uncertainty	10
1.6 Measurement Uncertainty	10
1.7 Operation Band	10
2. TEST METHODOLOGY	11
2.1 EUT Configuration	11
2.2 General Test Procedures	11
3. SYSTEM TEST CONFIGURATION	12
3.1 Justification	12
3.2 EUT Exercise Software	12
3.3 Special Accessories	12
3.4 Block Diagram/Schematics	12
3.5 Equipment Modifications	12
3.6 Test Setup	12
4. SUMMARY OF TEST RESULTS	13
5. SUMMARY OF TEST EQUIPMENT	14
6. MEASUREMENT RESULTS	15
6.1 Noise Limits	15
6.2 Authorized Frequency Band Verification	25
6.3 Maximum power measurement	28
6.4 Gain Limits and Bidirectional Capability&Variable Gain&Variable Uplink Gain Timing	35
6.5 Anti-Oscillation	42
6.6 Intermodulation Limits	54
6.8. Conducted Spurious Emission	85
6.9 Uplink Inactivity	96
6.10 Occupied Bandwidth	99
7. RADIATION SPURIOUS EMISSION	113
8. TEST SETUP PHOTOGRAPHS OF EUT	117
9. EXTERIOR PHOTOGRAPHS OF THE EUT	117
10. INTERIOR PHOTOGRAPHS OF THE EUT	117





1. GENERAL INFORMATION

1.1 Description of Device (EUT)

EUT	: Cell Phone Signal booster
Equipment Type	: Mobile Wideband Consumer Zone Enhancers
Test Model	: SF007
Power Supply	For AC Adapter(Model: WTA24-1201500-U): : Input: 100-240V~50/60Hz 1.0A Output: 12V $\overline{\text{---}}$ 1.5A
Hardware Version	: 253-50-V1.0
Software Version	: 253-V1.1
Frequency Range	Lower 700MHz Band (B12, B17) Uplink: 698~716MHz, Downlink: 728~746MHz Upper 700MHz Band (B13) Uplink: 776~787MHz, Downlink: 746~757MHz Cellular Band (B5) Uplink: 824~849MHz, Downlink: 869~894MHz PCS Band (B2, B25) Uplink: 1850~1915MHz, Downlink: 1930~1995MHz AWS Band(B4) Uplink: 1710~1755MHz, Downlink: 2110~2155 MHz
Max Gain	: Uplink: ≤ 45 dB Downlink: ≤ 50 dB
Max Antenna Port Output Power	: Uplink: ≤ 27 dBm Downlink: ≤ 0 dBm
Emission Designator	GXW: Cellular Band (B5), PCS Band (B2) G7W: Cellular Band (B5), PCS Band (B2) F9W: Cellular Band (B5), PCS Band (B2), AWS Band(B4) G7D: Lower 700MHz Band (B12, B17), Upper 700MHz Band (B13), Cellular Band (B5), PCS Band (B2, B25), AWS Band(B4) W7D: Lower 700MHz Band (B12, B17), Upper 700MHz Band (B13), Cellular Band (B5), PCS Band (B2, B25), AWS Band(B4)
FCC Classification	: B2W/Wideband Consumer Booster(CMRS)
Operating Temperature	: -20°C~+65°C





Antenna Information:

Mode	Frequency (MHz)	Outdoor Antenna Gain (dBi) (Omni-directional Antenna)	Cable loss (dB)
Uplink	698-716	0.67	1.2
	776-787	0.76	1.2
	824-849	1.68	1.38
	1850-1915	2.15	2.15
	1710-1755	3.6	1.95
Mode	Frequency (MHz)	Indoor Antenna Gain (dBi) (Patch Antenna)	Cable loss (dB)
Downlink	728-746	-0.75	0.65
	746-757	-0.75	0.65
	869-894	3.51	0.74
	1930-1995	-0.06	1.21
	2110-2155	0.79	1.17



Shenzhen LCS Compliance Testing Laboratory Ltd.
Add: 101, 201 Bldg A & 301 Bldg C, Juji Industrial Park Yabianxueziwei, Shajing Street, Baoan District, Shenzhen, 518000, China
Tel: +(86) 0755-82591330 | E-mail: webmaster@lcs-cert.com | Web: www.lcs-cert.com
Scan code to check authenticity



MSCL Calculations SF007:

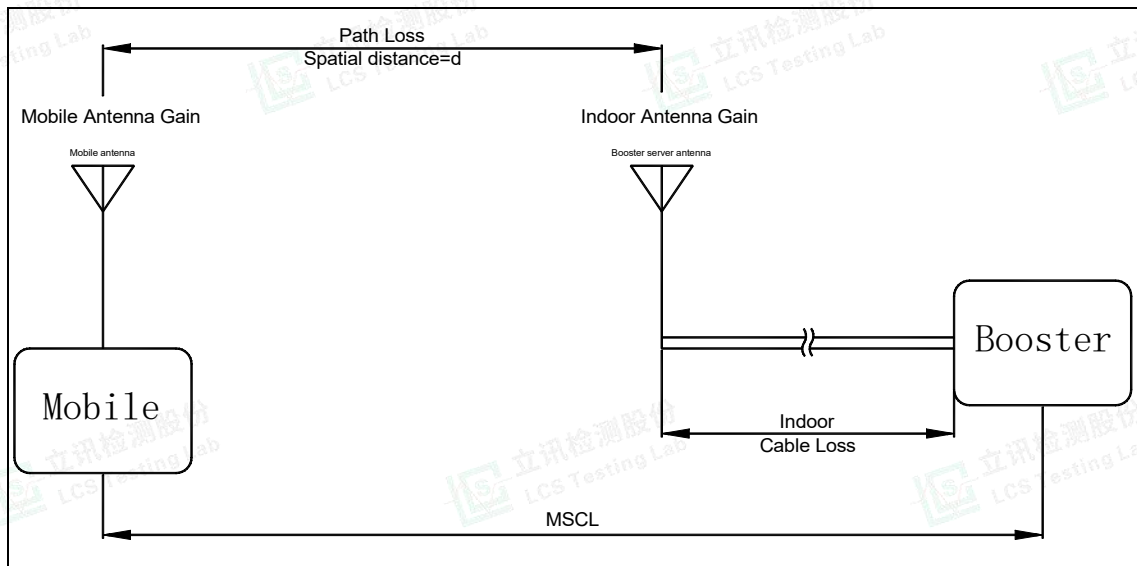


Figure 1

Remark: $MSCL = \text{Path loss} + \text{Indoor Cable Loss} - \text{Mobile Antenna Gain} - \text{Indoor Antenna Gain} + \text{Polarity Loss}$

Path loss=20Logf+20LogD-27.56				
Operation Band	Frequency (MHz)	D (m)	Constant (dB)	Path loss (dB)
Lower 700 Band (698-716)	698	2	27.56	35.34
Upper 700 Band (776-787)	776	2	27.56	36.26
Cellular Band (824-849)	824	2	27.56	36.78
PCS Band (1850-1915)	1850	2	27.56	43.80
AWS Band (1710-1755)	1710	2	27.56	43.12

Path loss=20Logf+20LogD-27.56					
MSCL Calculations of fixed booster SF007					
MSCL					
Operation Band	Path loss (dB)	Indoor Cable Loss (dB)	Indoor Antenna Gain (dBi)	Polarity Loss (dB)	MSCL (dB)
Lower 700 Band (698-716)	35.34	1.2	-0.75	3	40.29
Upper 700 Band (776-787)	36.26	1.2	-0.75	3	41.21
Cellular Band (824-849)	36.78	1.38	3.51	3	37.65
PCS Band (1850-1915)	43.80	2.15	-0.06	3	49.01
AWS Band (1710-1755)	43.12	1.95	0.79	3	47.28





1.2 Support equipment List

Manufacturer	Description	Model	Serial Number	Certificate
Shenzhen Wentong Electronic Co., Ltd	ADAPTOR	WTA24-1201500-U	---	FCC

1.3 External I/O Cable

I/O Port Description	Quantity	Cable
Antenna Port	2	N/A
DC IN Port	1	N/A
Type-C USB 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.



Shenzhen LCS Compliance Testing Laboratory Ltd.

Add: 101, 201 Bldg A & 301 Bldg C, Juji Industrial Park Yabianxueziwei, Shajing Street, Baoan District, Shenzhen, 518000, China

Tel: +(86) 0755-82591330 | E-mail: webmaster@lcs-cert.com | Web: www.lcs-cert.com

Scan code to check authenticity



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 Band Frequency (MHz)	Downlink Band Frequency (MHz)
Lower 700 Band (698-716MHz)	Lower 700 Band (728-746MHz)
Upper 700 Band (776-787MHz)	Upper 700 Band (746-757MHz)
Cellular Band (824-849MHz)	Cellular Band (869-894MHz)
PCS Band (1850-1915MHz)	PCS Band (1930-1995MHz)
AWS Band (1710-1755MHz)	AWS Band (2110-2155MHz)





2. TEST METHODOLOGY

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

- 1) FCC Part 22: Cellular Radiotelephone Service
- 2) FCC Part 24: Broadband PCS.
- 3) FCC Part 27: MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES
- 4) FCC Part 2: FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS
- 5) FCC Part 20.21: Signal boosters..
- 6) ANSI C63.26-2015, American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services;
- 7) 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.



Shenzhen LCS Compliance Testing Laboratory Ltd.
Add: 101, 201 Bldg A & 301 Bldg C, Juji Industrial Park Yabianxueziwei, Shajing Street, Baoan District, Shenzhen, 518000, China
Tel: +(86) 0755-82591330 | E-mail: webmaster@lcs-cert.com | Web: www.lcs-cert.com
Scan code to check authenticity



4. SUMMARY OF TEST RESULTS

Requirement	CFR 47 Section	Result
Noise Limits	§20.21(e)(8)(i)(A) §20.21(e)(8)(i)(H)	PASS
Authorized Frequency Band Verification Test	§20.21(e)(3)	PASS
Maximum Power Measurement	§20.21(e)(8)(i)(D) §20.21(e)(8)(i)(B)&§20.21(e)(4)	PASS
Gain Limits and Bidirectional Capability &Variable Gain &Variable Uplink Gain Timing	§20.21(e)(8)(i)(C)(2) §20.21(e)(8)(i)(B) §20.21(e)(8)(i)(C) (1) §20.21(e)(8)(i)(H)	PASS
Anti-Oscillation	§20.21(e)(8)(ii)(A)&§20.21(e)(4)	PASS
Intermodulation Limits	§20.21(e)(8)(i)(F)	PASS
Out of Band Emission	§20.21(e)(8)(i)(E)	PASS
Conducted Spurious Emission	§2.1051	PASS
Uplink inactivity	§20.21(e)(8)(i)(I)	PASS
Occupied Bandwidth	§2.1049	PASS
Radiated Spurious Emission	§2.1053	PASS
RF Exposure	RSS-102: 2.5.2	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	Power Meter	R&S	NRVS	100444	2024-06-06	2025-06-05
2	Power Sensor	R&S	NRV-Z81	100458	2024-06-06	2025-06-05
3	Power Sensor	R&S	NRV-Z32	10057	2024-06-06	2025-06-05
4	LTE Test Software	Tonscend	JS1120-1	N/A	N/A	N/A
5	RF Control Unit	Tonscend	JS0806-1	158060009	2023-10-18	2024-10-17
6	MXA Signal Analyzer	Agilent	N9020A	MY51250905	2023-10-18	2024-10-17
7	WIDEBAND RADIO COMMUNICATION TESTER	R&S	CMW 500	103818	2024-06-06	2025-06-05
8	DC Power Supply	Agilent	E3642A	N/A	2023-10-18	2024-10-17
9	EMI Test Software	AUDIX	E3	/	N/A	N/A
10	3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH03-HY	2024-06-06	2025-06-05
11	Positioning Controller	Max-Full	MF7802BS	MF780208586	N/A	N/A
12	Active Loop Antenna	SCHWARZBECK	FMZB 1519B	00005	2024-07-13	2027-07-12
13	By-log Antenna	SCHWARZBECK	VULB9163	9163-470	2021-09-12	2024-09-11
14	By-log Antenna	SCHWARZBECK	VULB9163	9163-471	2021-09-12	2024-09-11
15	Horn Antenna	SCHWARZBECK	BBHA 9120D	9120D-1925	2021-09-05	2024-09-04
16	Horn Antenna	SCHWARZBECK	BBHA 9120D	9120D-1926	2021-09-05	2024-09-04
17	Broadband Horn Antenna	SCHWARZBECK	BBHA 9170	791	2021-08-29	2024-08-28
18	Broadband Horn Antenna	SCHWARZBECK	BBHA 9170	792	2021-08-29	2024-08-28
19	Broadband Preamplifier	SCHWARZBECK	BBV9719	9719-025	2021-08-29	2024-08-28
20	EMI Test Receiver	R&S	ESR 7	101181	2024-06-06	2025-06-05
21	RS SPECTRUM ANALYZER	R&S	FSP40	100503	2024-06-06	2025-06-05
22	Low-frequency amplifier	SchwarzZBECK	BBV9745	00253	2023-10-18	2024-10-17
23	High-frequency amplifier	JS Denki Pte	PA0118-43	JSPA21009	2023-10-18	2024-10-17
24	6dB Attenuator	/	100W/6dB	1172040	2024-06-06	2025-06-05
26	3dB Attenuator	/	2N-3dB	/	2023-10-18	2024-10-17
27	Temperature & Humidity Chamber	GUANGZHOU GOGNWEN	GDS-100	70932	2023-10-05	2024-10-04
28	EMI Test Software	Farad	EZ	/	N/A	N/A
29	RADIO COMMUNICATION TESTER	R&S	CMU 200	105988	2024-06-06	2025-06-05



Shenzhen LCS Compliance Testing Laboratory Ltd.

Add: 101, 201 Bldg A & 301 Bldg C, Juji Industrial Park Yabianxueziwei, Shajing Street, Baoan District, Shenzhen, 518000, China

Tel: +(86) 0755-82591330 | E-mail: webmaster@lcs-cert.com | Web: www.lcs-cert.com

Scan code to check authenticity



6. MEASUREMENT RESULTS

6.1 Noise Limits

6.1.1 Applicable Standard

According to §20.21(e)(8)(i)(A) Noise Limits (uplink); §20.21(e)(8)(i)(H) Transmit Power Off Mode (uplink and downlink noise power):

1. The transmitted maximum noise power in dBm/MHz of consumer boosters at their uplink and downlink ports shall not exceed the following limits:

Mobile booster maximum noise power shall not exceed -59 dBm/MHz.

2. The transmitted noise power in dBm/MHz of consumer boosters at their uplink port shall not exceed -103 dBm/MHz - RSSI.

6.1.2 Test Procedure

Maximum transmitter noise power level

According to section 7.7.1 of KDB 935210 D03 Signal Booster Measurement v04r04:

- a) Connect the EUT to the test equipment as shown in Figure 2. 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 $\geq$ 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 $\geq$ 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 3 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% OBW of 4.1 MHz.
- j) Set the spectrum analyzer RBW for 1 MHz, VBW $\geq$ 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 $\geq$ 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 3), 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.



Shenzhen LCS Compliance Testing Laboratory Ltd.

Add: 101, 201 Bldg A & 301 Bldg C, Juji Industrial Park Yabianxueziwei, Shajing Street, Baoan District, Shenzhen, 518000, China

Tel: +(86) 0755-82591330 | E-mail: webmaster@lcs-cert.com | Web: www.lcs-cert.com

Scan code to check authenticity



See Appendix D for noise limits graphs.

n) Repeat 7.7.1h) through 7.7.1m) for all operational uplink bands.

NOTE—Some signal boosters will require a signal generator input because they will not operate unless a signal is received at the input terminals. If this is the case, for the setups shown in Figure 2 and Figure 3 connect a second signal generator at the server port, then cycle the RF output of the second signal generator to simulate this function.

NOTE—Some signal boosters have a maximum transmitter noise power level that is less than the Transmit Power Off Mode of -70 dBm. For these boosters it is still necessary to confirm that the uplink noise power limits are met in the presence of a downlink signal. Test reports should show measurement data demonstrating compliance. Alternatively the applicant may provide attestation with detailed design information and explanation justifying the omission of the variable uplink testing.

Variable uplink noise timing

According to section 7.7.2 of KDB 935210 D03 Signal Booster Measurement v04r04:

Variable uplink noise timing is to be measured as follows, using the test setup shown in Figure 3.

- Set the spectrum analyzer to the uplink frequency to be measured.
- Set the span to 0 Hz, with a sweep time of 10 seconds.
- Set the power level of signal generator to the lowest level of the RSSI-dependent noise [see 7.7.1m)].
- Select MAX HOLD and increase the power level of signal generator by 10 dB for mobile boosters, and 20 dB for fixed boosters.
- Confirm that the uplink noise decreases to the specified level within 1 second for mobile devices, and within 3 seconds for fixed devices.¹⁸
- Repeat 7.7.2a) to 7.7.2e) for all operational uplink bands.
- Include plots and summary table in test report.

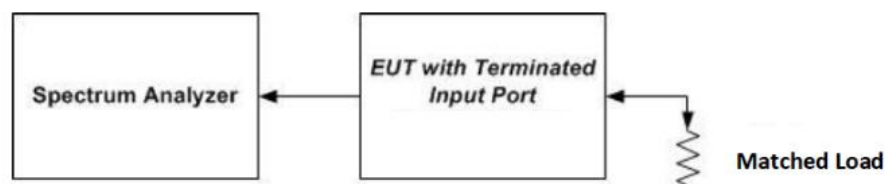
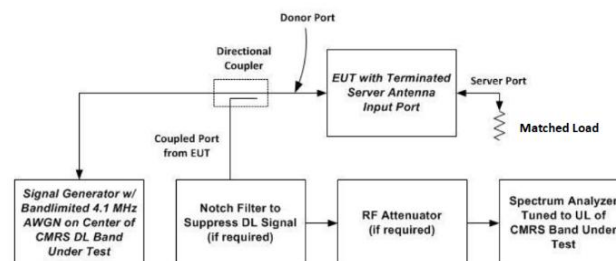


Figure 2 – Noise limit test setup



Shenzhen LCS Compliance Testing Laboratory Ltd.

Add: 101, 201 Bldg A & 301 Bldg C, Juji Industrial Park Yabianxueziwei, Shajing Street, Baoan District, Shenzhen, 518000, China

Tel: +(86) 0755-82591330 | E-mail: webmaster@lcs-cert.com | Web: www.lcs-cert.com

Scan code to check authenticity



**Figure 3 – Test setup for uplink noise power measurement
in the presence of a downlink signal**

6.1.3 Test Data

Temperature	23.6℃	Humidity	52.3%
Test Engineer	Nick Peng	Test Mode	Transmitting

Max Noise Power				
Operation Band		Measured (dBm/MHz)	Limit (dBm/MHz)	Result (dB)
Uplink	Lower 700 Band	-62.425	-59.0 dBm	PASS
	Upper 700 Band	-62.595	-59.0 dBm	PASS
	Cellular Band	-63.146	-59.0 dBm	PASS
	PCS Band	-59.533	-59.0 dBm	PASS
	AWS Band	-60.827	-59.0 dBm	PASS
Downlink	Lower 700 Band	-63.011	-59.0 dBm	PASS
	Upper 700 Band	-62.920	-59.0 dBm	PASS
	Cellular Band	-63.572	-59.0 dBm	PASS
	PCS Band	-62.608	-59.0 dBm	PASS
	AWS Band	-64.455	-59.0 dBm	PASS





Variable Uplink Noise				
Operation Band	RSSI dBm	Measured dBm/MHz	Limit dBm/MHz	Results
Lower 700Band	-80	-61.317	-59.0	PASS
	-70	-60.916	-59.0	PASS
	-60	-61.003	-59.0	PASS
	-50	-60.647	-59.0	PASS
	-44	-61.639	-59.5	PASS
	-43	-62.804	-60.2	PASS
Upper 700 Band	-80	-61.882	-59.0	PASS
	-70	-61.841	-59.0	PASS
	-60	-61.988	-59.0	PASS
	-50	-60.240	-59.0	PASS
	-44	-62.667	-59.5	PASS
	-43	-62.070	-60.2	PASS
Cellular Band	-80	-62.274	-59.0	PASS
	-70	-62.656	-59.0	PASS
	-60	-62.637	-59.0	PASS
	-50	-62.232	-59.0	PASS
	-44	-63.787	-59.5	PASS
	-43	-63.526	-60.2	PASS
PCS Band	-80	-60.291	-59.0	PASS
	-70	-60.265	-59.0	PASS
	-60	-60.434	-59.0	PASS
	-44	-64.888	-59.5	PASS
	-43	-63.836	-60.2	PASS
	-42	-63.463	-61.0	PASS
AWS Band	-80	-61.054	-59.0	PASS
	-70	-61.193	-59.0	PASS
	-60	-61.239	-59.0	PASS
	-44	-64.132	-59.5	PASS
	-43	-64.413	-60.2	PASS
	-42	-65.152	-61.0	PASS





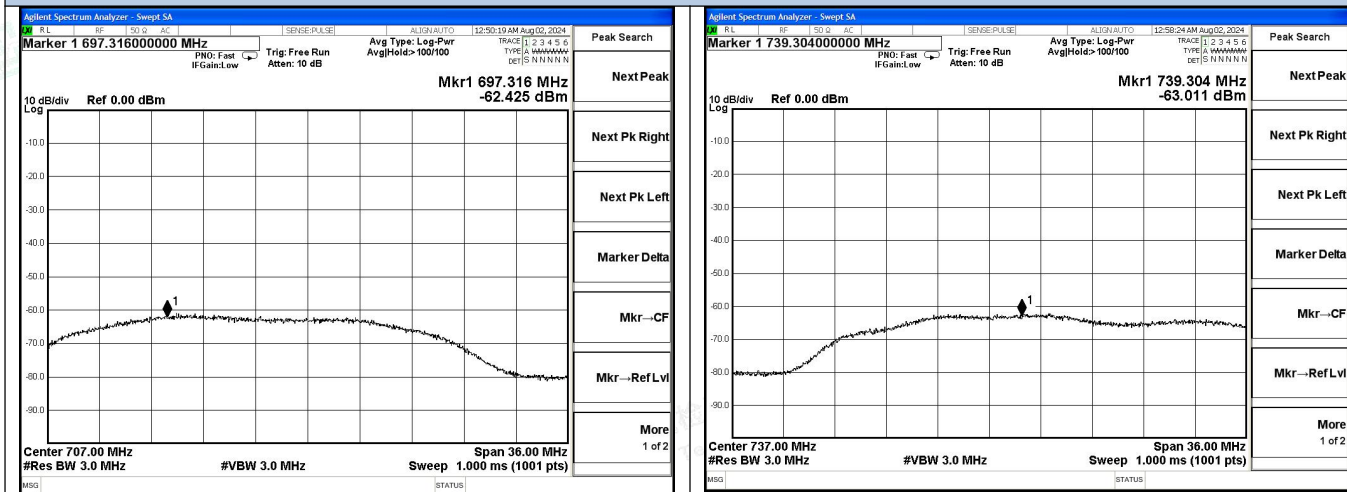
Variable Uplink Noise Timing			
Operation Band	Measured (s)	Limit (s)	Results
Lower 700 Band	0.070	3	PASS
Upper 700 Band	0.080	3	PASS
Cellular Band	0.080	3	PASS
PCS Band	0.080	3	PASS
AWS Band	0.080	3	PASS



Shenzhen LCS Compliance Testing Laboratory Ltd.
Add: 101, 201 Bldg A & 301 Bldg C, Juji Industrial Park Yabianxueziwei, Shajing Street, Baoan District, Shenzhen, 518000, China
Tel: +(86) 0755-82591330 | E-mail: webmaster@lcs-cert.com | Web: www.lcs-cert.com
Scan code to check authenticity

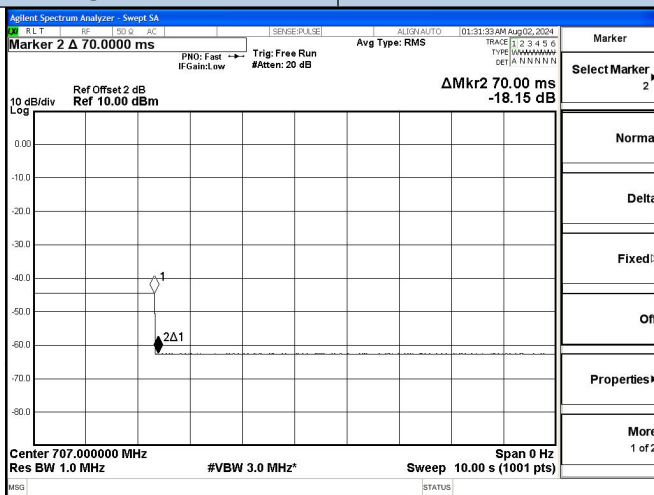


Test Graphs



Lower 700 Band UL

Lower 700 Band DL



Lower 700 Band Variable Uplink Noise Timing

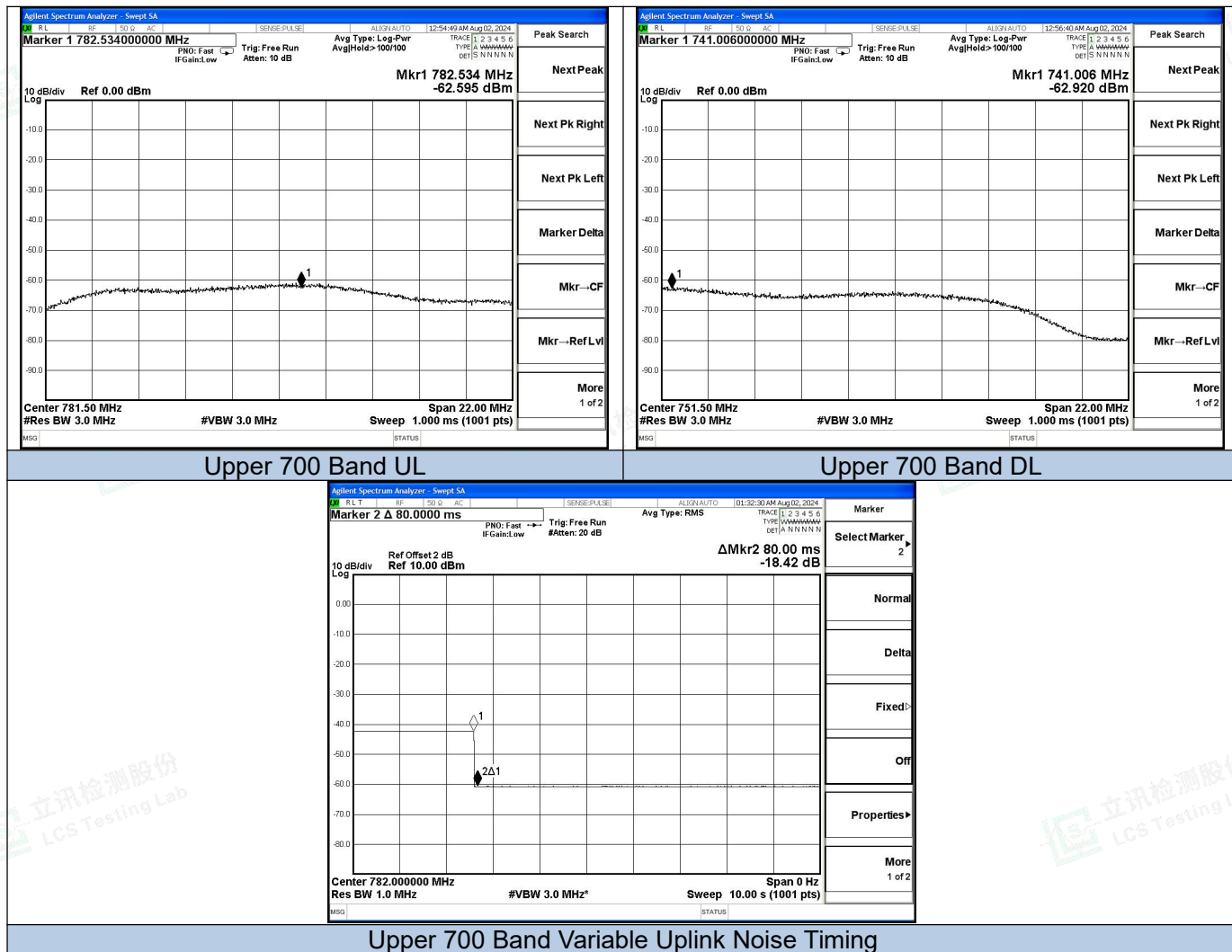


Shenzhen LCS Compliance Testing Laboratory Ltd.

Add: 101, 201 Bldg A & 301 Bldg C, Juji Industrial Park Yabianxueziwei, Shajing Street, Baoan District, Shenzhen, 518000, China

Tel: +(86) 0755-82591330 | E-mail: webmaster@lcs-cert.com | Web: www.lcs-cert.com

Scan code to check authenticity

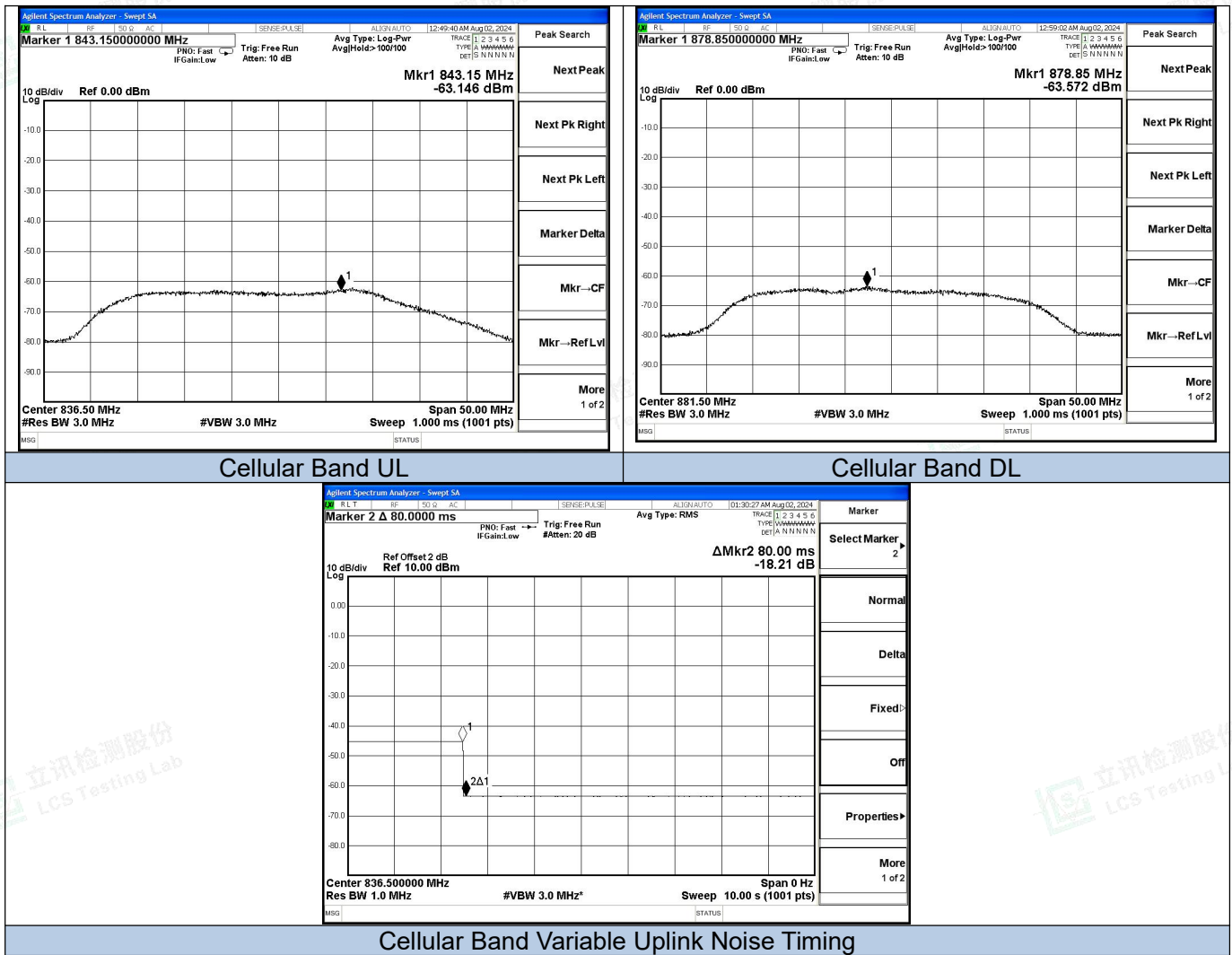


Shenzhen LCS Compliance Testing Laboratory Ltd.

Add: 101, 201 Bldg A & 301 Bldg C, Juji Industrial Park Yabianxueziwei, Shajing Street, Baoan District, Shenzhen, 518000, China

Tel: +(86) 0755-82591330 | E-mail: webmaster@lcs-cert.com | Web: www.lcs-cert.com

Scan code to check authenticity

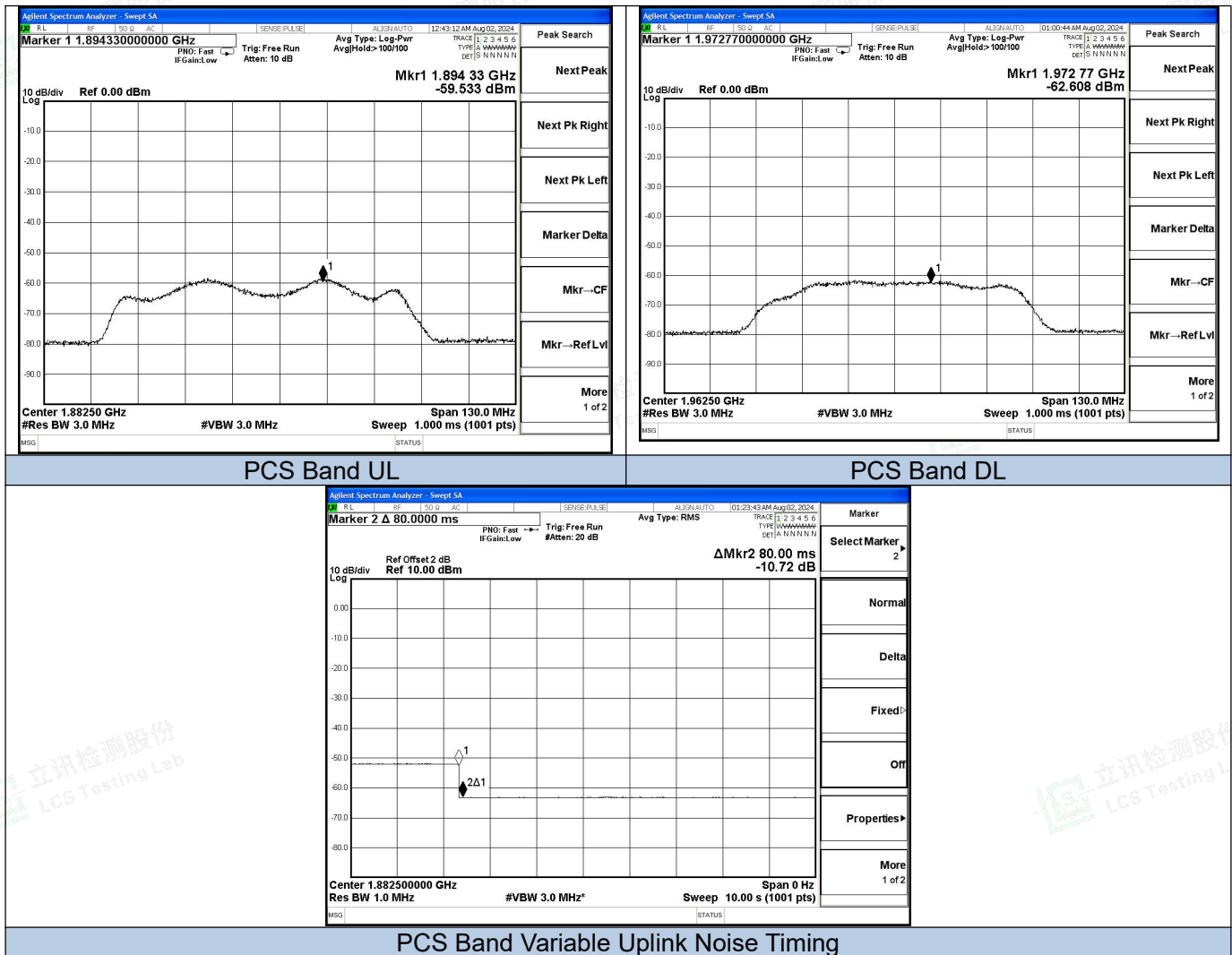


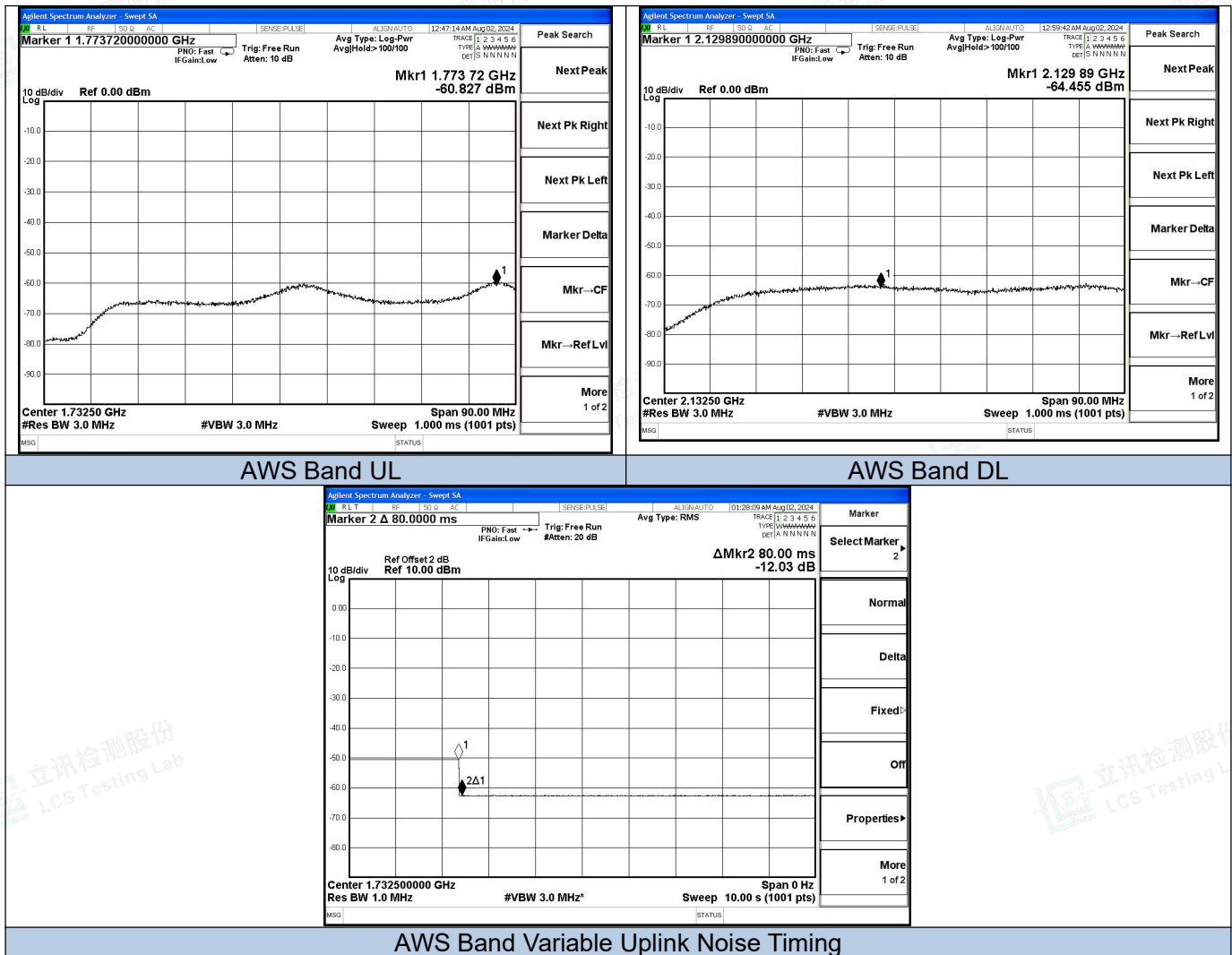
Shenzhen LCS Compliance Testing Laboratory Ltd.

Add: 101, 201 Bldg A & 301 Bldg C, Juji Industrial Park Yabianxueziwei, Shajing Street, Baoan District, Shenzhen, 518000, China

Tel: +(86) 0755-82591330 | E-mail: webmaster@lcs-cert.com | Web: www.lcs-cert.com

Scan code to check authenticity





Shenzhen LCS Compliance Testing Laboratory Ltd.

Add: 101, 201 Bldg A & 301 Bldg C, Juji Industrial Park Yabianxueziwei, Shajing Street, Baoan District, Shenzhen, 518000, China

Tel: +(86) 0755-82591330 | E-mail: webmaster@lcs-cert.com | Web: www.lcs-cert.com

Scan code to check authenticity



6.2 Authorized Frequency Band Verification

6.2.1 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.

6.2.2 Test Procedure

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

- Connect the EUT to the test equipment as shown in Figure 4. Begin with the uplink output (donor) port connected to the spectrum analyzer.
- 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.
- Set the center frequency of the spectrum analyzer to the center of the operational band under test with a span of 1 MHz.
- Set the signal generator for CW mode and tune to the center frequency of the operational band under test.
- Set the initial signal generator power to a level that is at least 6 dB below the AGC level specified by the manufacturer.
- Slowly increase the signal generator power level until the output signal reaches the AGC operational level.
- 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).
- 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.
- 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).
- Capture the spectrum analyzer trace for inclusion in the test report.
- Repeat 7.1c) to 7.1j) for all operational uplink and downlink bands.

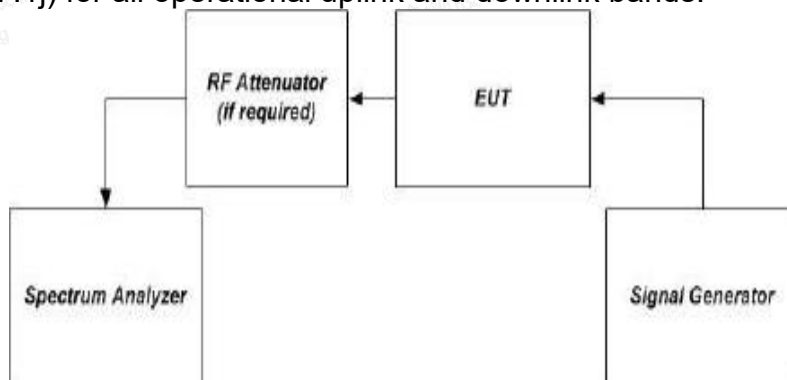


Figure 4 – Band verification test instrumentation setup

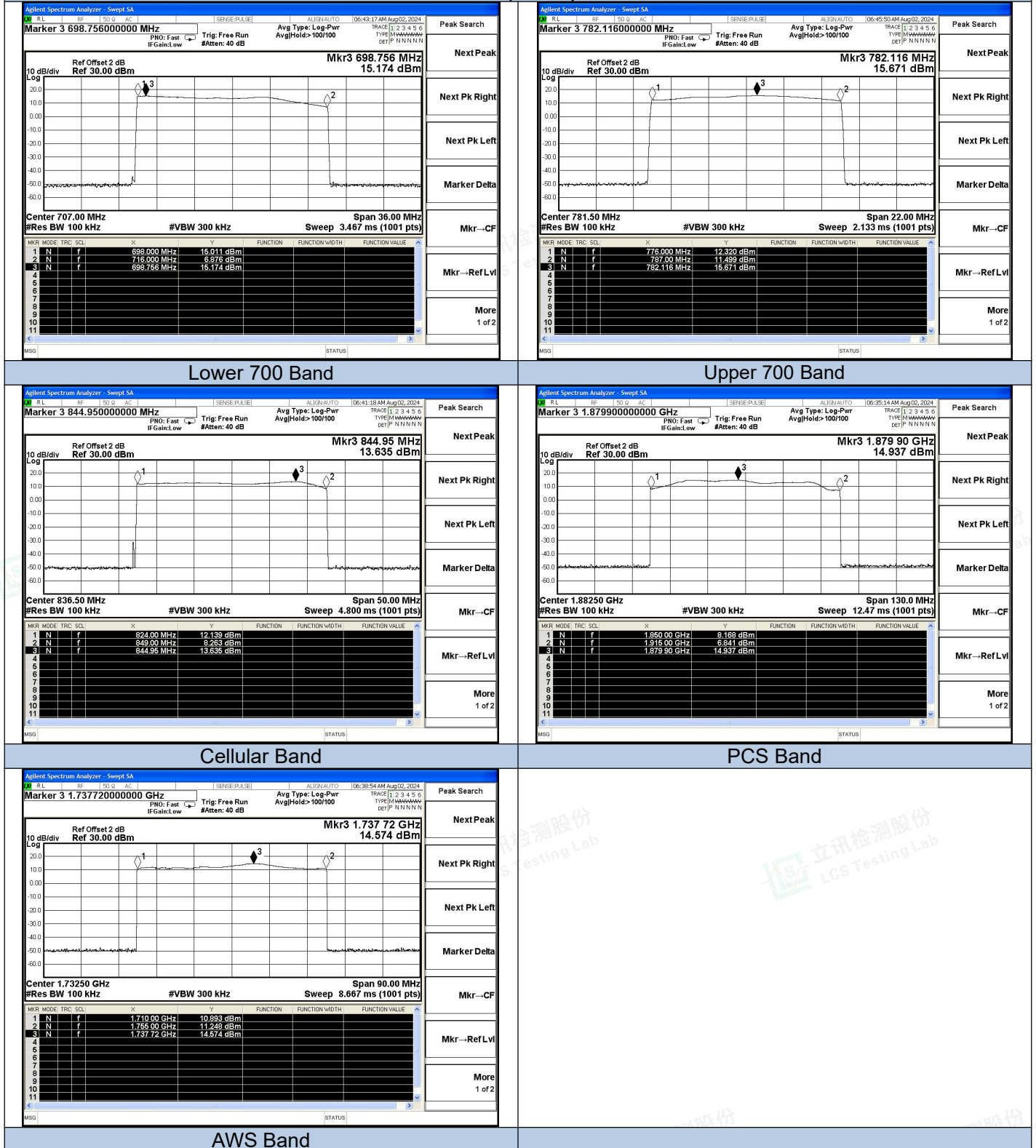




6.2.3 Test Data

Temperature	23.6°C	Humidity	52.3%
Test Engineer	Nick Peng	Test Mode	Transmitting

Test Graphs-Uplink



Shenzhen LCS Compliance Testing Laboratory Ltd.

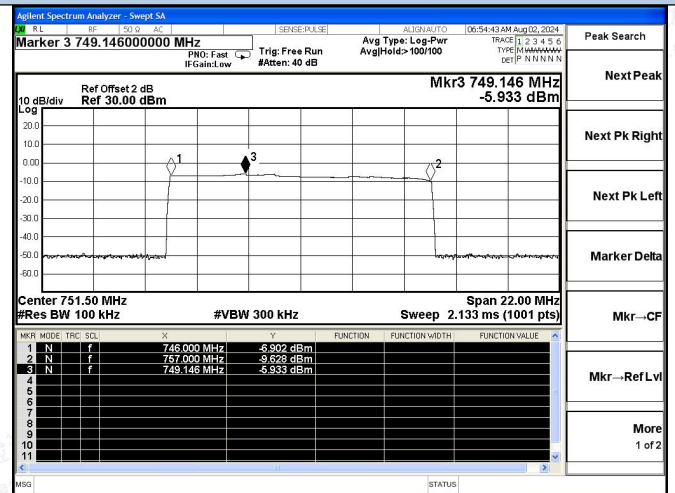
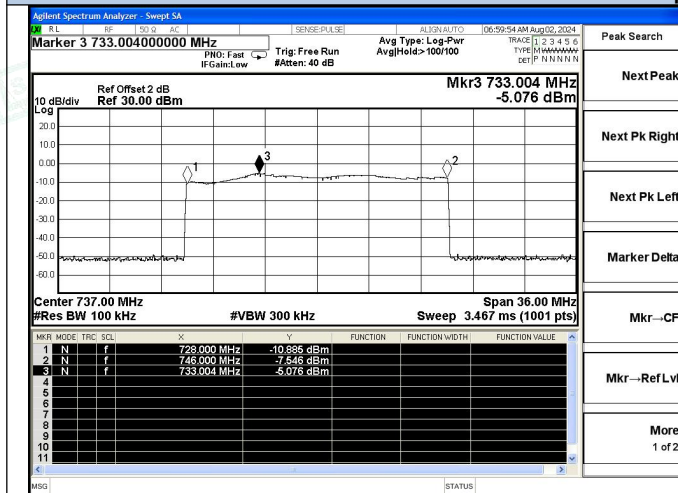
Add: 101, 201 Bldg A & 301 Bldg C, Juji Industrial Park Yabianxueziwei, Shajing Street, Baoan District, Shenzhen, 518000, China

Tel: +(86) 0755-82591330 | E-mail: webmaster@lcs-cert.com | Web: www.lcs-cert.com

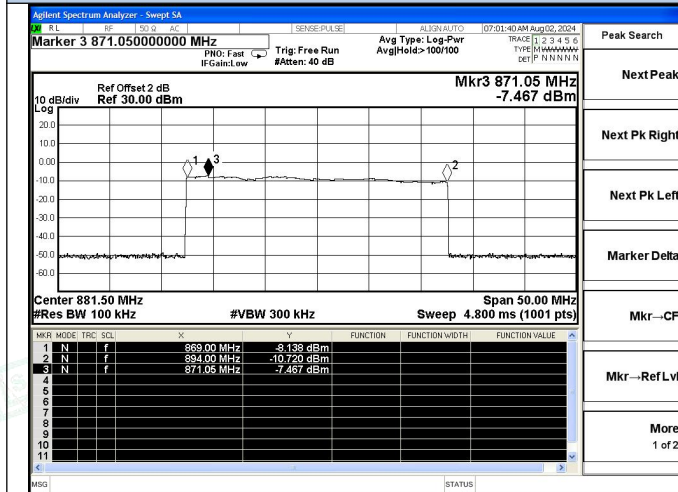
Scan code to check authenticity



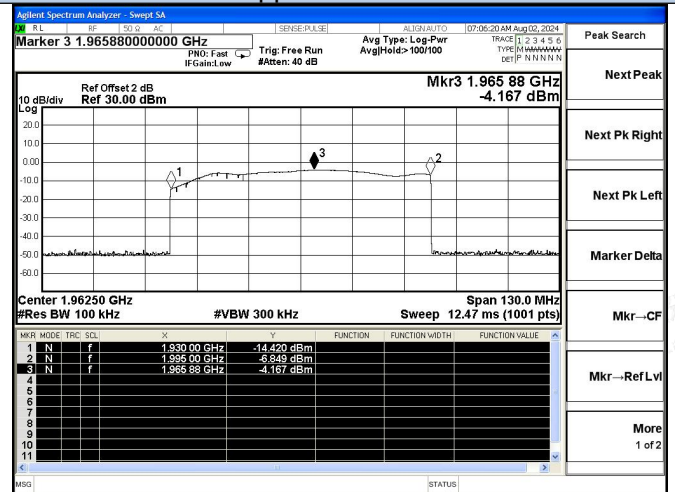
Test Graphs-Downlink



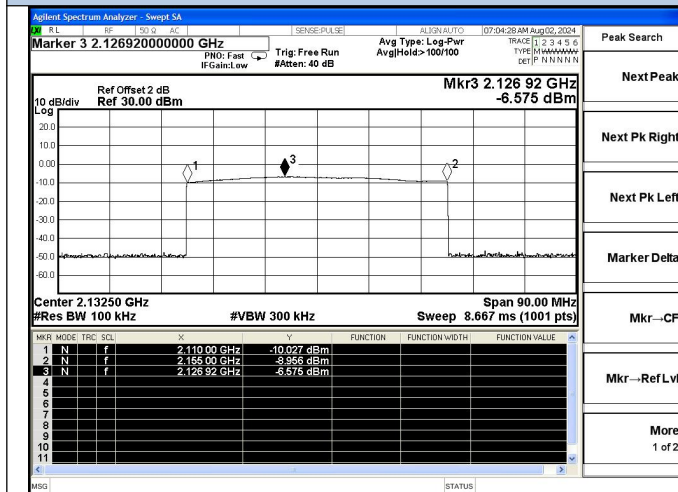
Lower 700 Band



Upper 700 Band



Cellular Band



PCS Band



AWS Band



Shenzhen LCS Compliance Testing Laboratory Ltd.

Add: 101, 201 Bldg A & 301 Bldg C, Juji Industrial Park Yabianxueziwei, Shajing Street, Baoan District, Shenzhen, 518000, China

Tel: +(86) 0755-82591330 | E-mail: webmaster@lcs-cert.com | Web: www.lcs-cert.com

Scan code to check authenticity



6.3 Maximum power measurement

6.3.1 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.

6.3.2 Test Procedure

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

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.

- a) In addition, the maximum power levels measured in this procedure will be used in calculating the maximum gain as described in the next subclause.
- b) 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.
- c) Use a signal generator to create a pulsed CW or GSM signal with a pulse width of 570 μ s and a duty cycle of 12.5% (i.e., one GSM timeslot), then measure using the burst power function of the measuring instrument.
- d) 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 5. 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.



Shenzhen LCS Compliance Testing Laboratory Ltd.

Add: 101, 201 Bldg A & 301 Bldg C, Juji Industrial Park Yabianxueziwei, Shajing Street, Baoan District, Shenzhen, 518000, China

Tel: +(86) 0755-82591330 | E-mail: webmaster@lcs-cert.com | Web: www.lcs-cert.com

Scan code to check authenticity



- 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 RBW.
 - 3) Select either the BURST POWER or CHANNEL POWER measurement mode, as required for each signal type. For AWGN, the channel power integration bandwidth shall be the 99% OBW of the 4.1 MHz signal.
 - 4) Select the power averaging (rms) detector.
 - 5) Affirm that the number of measurement points per sweep $\geq (2 \text{ span})/\text{RBW}$.
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 P_{out} , with one set of results for the GSM or CW input stimulus, and another set of results for the AWGN input stimulus.

6.3.3 Test Data

Temperature	23.6°C	Humidity	52.3%
Test Engineer	Nick Peng	Test Mode	Transmitting

Max Output Power									
Mode	Operation Band	Signal Type	Conducted Output Power (dBm)	Conducted Output Power limit(dBm)	Antenna Gain (dBi)	Cable Loss (dB)	EIRP (dBm)	EIRP Limit (dBm)	Verdict
Uplink	Lower 700	CW	18.569	17-30	0.67	1.2	18.039	≤ 30	PASS
		AWGN	18.270		0.67	1.2	17.740		PASS
	Upper 700	CW	18.239		0.76	1.2	17.799		PASS
		AWGN	18.530		0.76	1.2	18.090		PASS
	Cellular	CW	19.388		1.68	1.38	19.688		PASS
		AWGN	19.250		1.68	1.38	19.550		PASS
	PCS	CW	20.738		2.15	2.15	20.738		PASS
		AWGN	20.080		2.15	2.15	20.080		PASS
	AWS	CW	19.594		3.6	1.95	21.244		PASS
		AWGN	19.240		3.6	1.95	20.890		PASS
Downlink	Lower 700	CW	-5.748	/	-0.75	0.65	-7.148	≤ 17	PASS
		AWGN	-4.810		-0.75	0.65	-6.210		PASS
	Upper 700	CW	-5.533		-0.75	0.65	-6.933		PASS
		AWGN	-5.290		-0.75	0.65	-6.690		PASS
	Cellular	CW	-7.478		3.51	0.74	-4.708		PASS
		AWGN	-7.900		3.51	0.74	-5.130		PASS
	PCS	CW	-3.946		-0.06	1.21	-5.216		PASS
		AWGN	-3.270		-0.06	1.21	-4.540		PASS
	AWS	CW	-5.547		0.79	1.17	-5.927		PASS
		AWGN	-5.800		0.79	1.17	-6.180		PASS

Note: EIRP = Conducted Output Power + Antenna Gain - Cable Loss



Shenzhen LCS Compliance Testing Laboratory Ltd.
 Add: 101, 201 Bldg A & 301 Bldg C, Juji Industrial Park Yabianxueziwei, Shajing Street, Baoan District, Shenzhen, 518000, China
 Tel: +(86) 0755-82591330 | E-mail: webmaster@lcs-cert.com | Web: www.lcs-cert.com
 Scan code to check authenticity

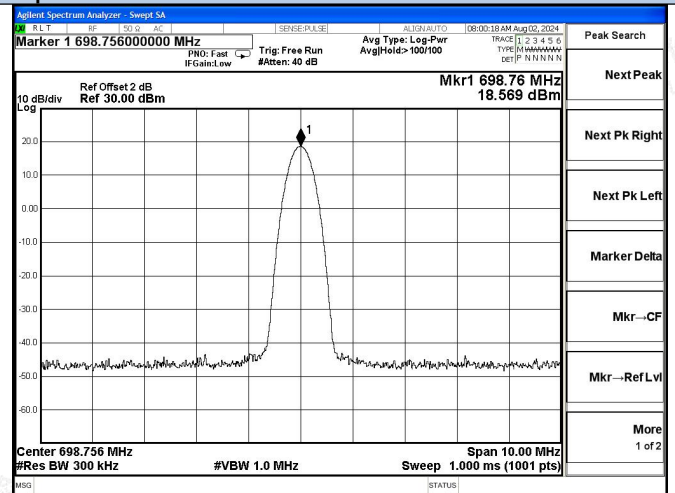
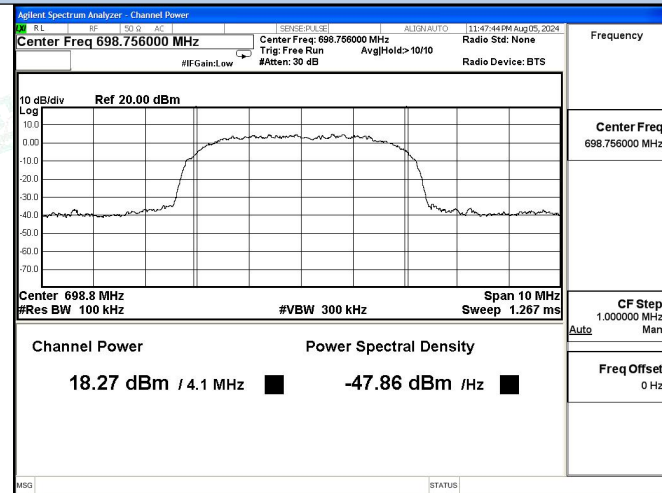


Max Input test level						
Mode	Operation Band	Signal Type	AGC Level (dBm)	Max Input Level (dBm)	Max Input Level limit (dBm)	Verdict
Uplink	Lower 700 Band	CW	-37	-26	≤27	PASS
		AWGN	-35	-26		PASS
	Upper 700 Band	CW	-48	-26		PASS
		AWGN	-48	-26		PASS
	Cellular Band	CW	-37	-24		PASS
		AWGN	-42	-24		PASS
	PCS Band	CW	-43	-16		PASS
		AWGN	-37	-16		PASS
	AWS Band	CW	-49	-19		PASS
		AWGN	-53	-20		PASS
Downlink	Lower 700 Band	CW	-60	-50	≤-20	PASS
		AWGN	-61	-48		PASS
	Upper 700 Band	CW	-67	-49		PASS
		AWGN	-64	-49		PASS
	Cellular Band	CW	-52	-50		PASS
		AWGN	-59	-50		PASS
	PCS Band	CW	-57	-48		PASS
		AWGN	-59	-46		PASS
	AWS Band	CW	-51	-47		PASS
		AWGN	-61	-48		PASS

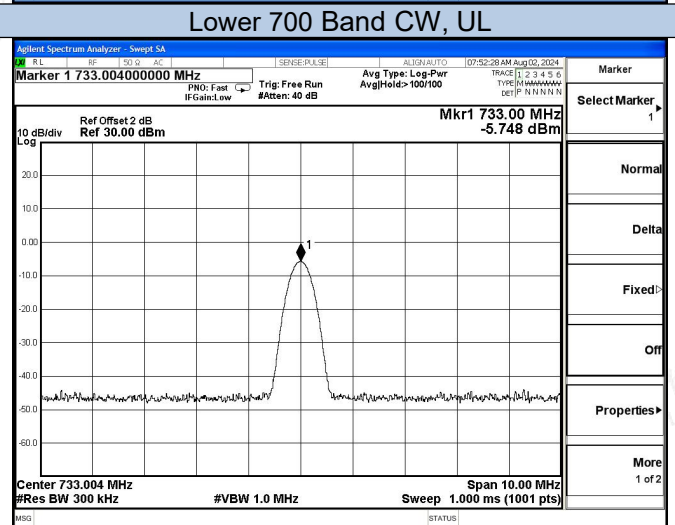
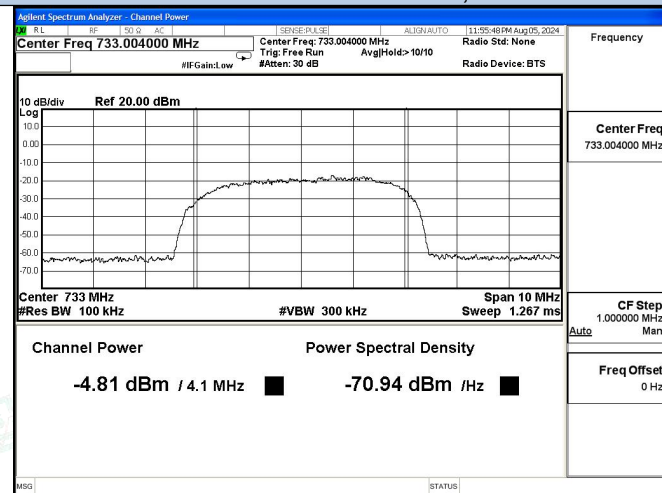




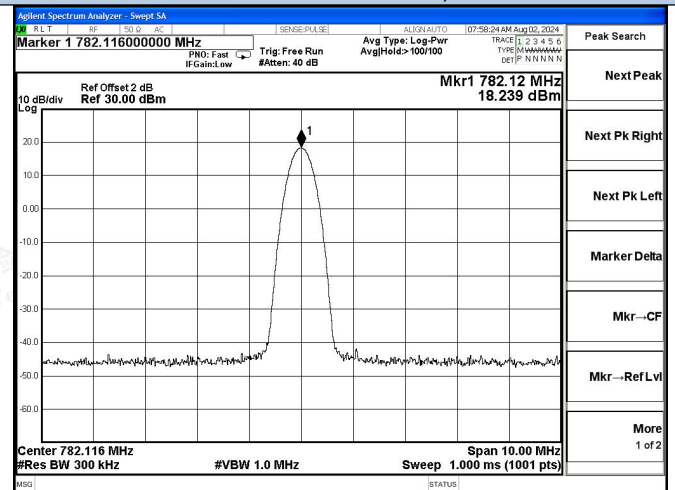
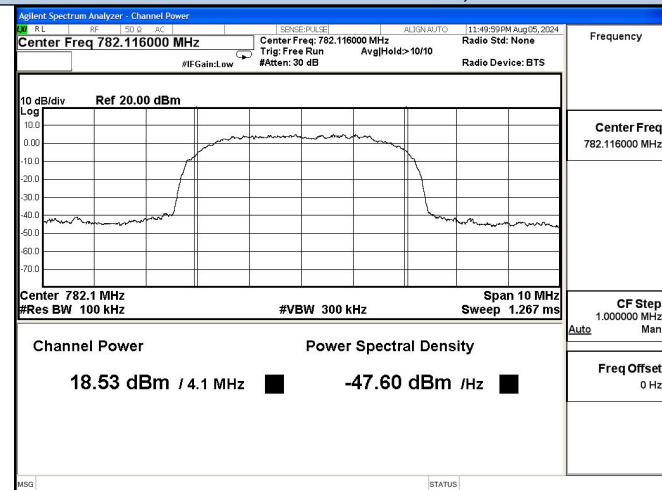
Test Graphs



Lower 700 Band AWGN, UL



Lower 700 Band AWGN, DL



Upper 700 Band AWGN, UL

Upper 700 Band CW, UL

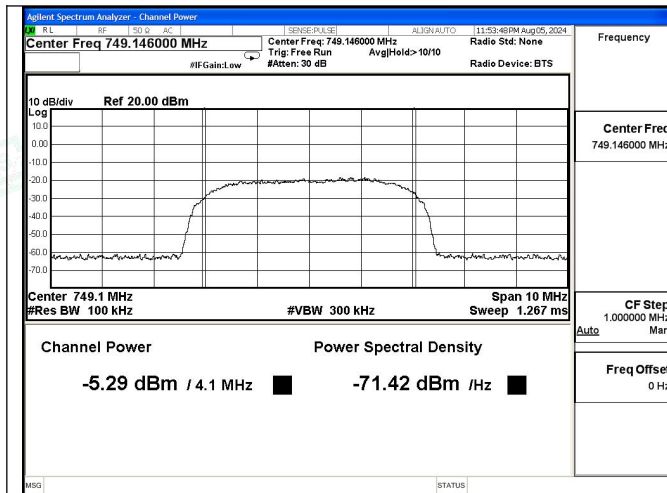


Shenzhen LCS Compliance Testing Laboratory Ltd.

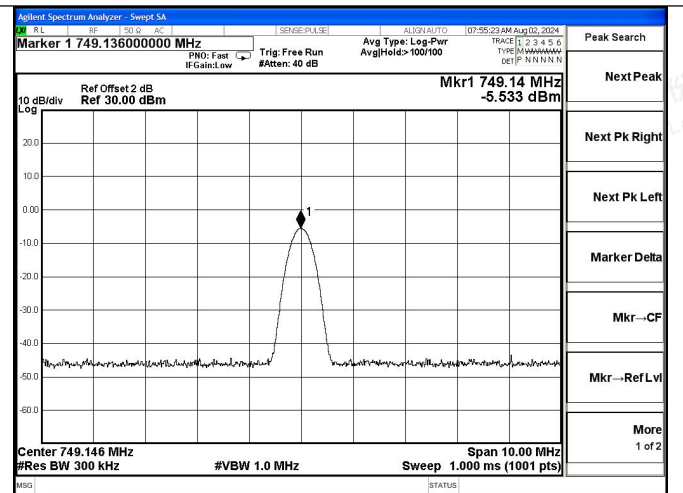
Add: 101, 201 Bldg A & 301 Bldg C, Juji Industrial Park Yabianxueziwei, Shajing Street, Baoan District, Shenzhen, 518000, China

Tel: +(86) 0755-82591330 | E-mail: webmaster@lcs-cert.com | Web: www.lcs-cert.com

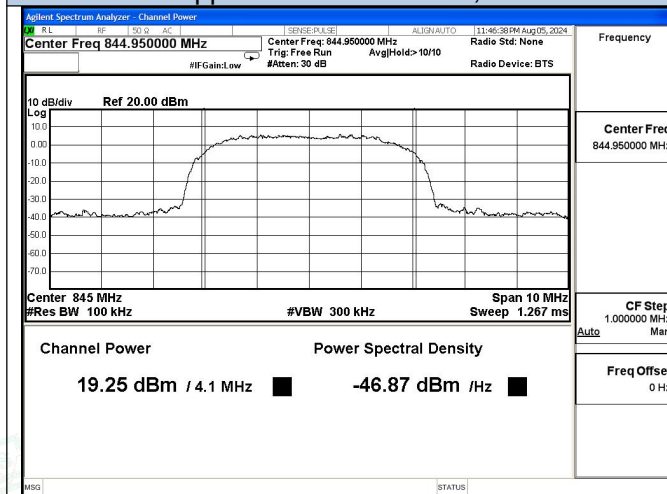
Scan code to check authenticity



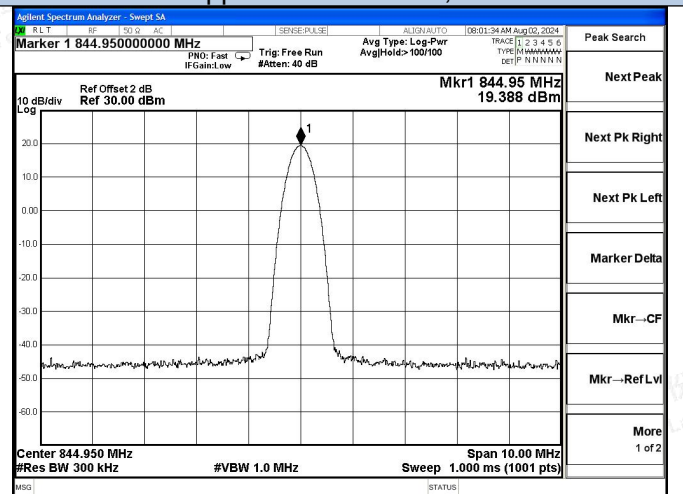
Upper 700 Band AWGN, DL



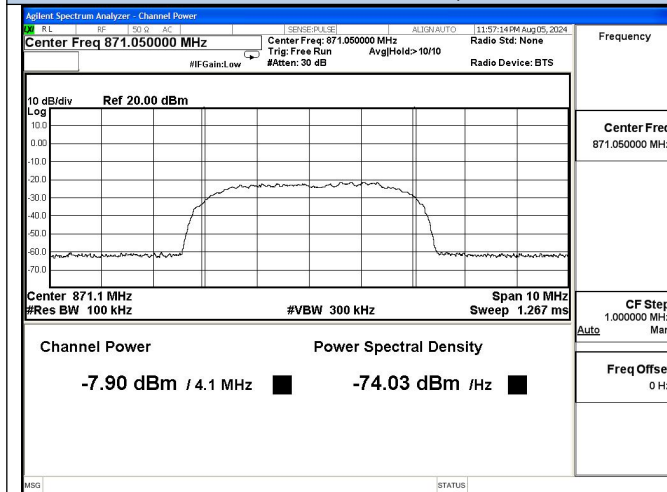
Upper 700 Band CW, DL



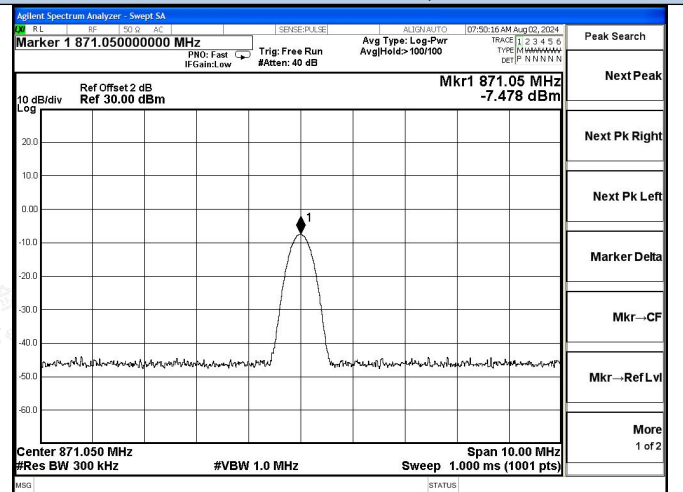
Cellular Band AWGN, UL



Cellular Band CW, UL



Cellular Band AWGN, DL



Cellular Band CW, DL



Shenzhen LCS Compliance Testing Laboratory Ltd.

Add: 101, 201 Bldg A & 301 Bldg C, Juji Industrial Park Yabianxueziwei, Shajing Street, Baoan District, Shenzhen, 518000, China

Tel: +(86) 0755-82591330 | E-mail: webmaster@lcs-cert.com | Web: www.lcs-cert.com

Scan code to check authenticity