TEST REPORT

Application No.:	GZCR2303000249AT
Applicant:	Corning Optical Communications LLC
Address of Applicant:	6 Concord Road, Shrewsbury, Massachusetts, United States
Manufacturer:	Comba Network Systems Company Limited
Address of Manufacturer:	No.10 Shenzhou Road, Guangzhou Science City, Guangzhou 510663, Guangdong, P.R.China
Equipment Under Test (EUT):	
EUT Name:	Low Band dRAU
Model No.:	dLRU-G2-678
Trade Mark:	Corning
Standard(s) :	47 CFR Part 2 47 CFR Part 22 47 CFR Part 27 47 CFR Part 90
Date of Receipt:	2020-11-24 for report GZEM201101673602 2023-03-08 for report GZCR230300024902
Date of Test:	2020-12-08 to 2021-01-13 for report GZEM201101673602 2023-08-24 to 2023-09-07 for report GZCR230300024902
Date of Issue:	2021-01-13 for report GZEM201101673602 2023-09-08 for report GZCR230300024902

Test Result:	**Pass***

* In the configuration tested, the EUT complied with the standards specified above.

Ricky Liu
Manager

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Revision Record			
Version	**Report No.**	**Date**	**Remark**
01	GZCR230300024902	2023-09-08	Original

Authorized for issue by:				
		Kevin Zhang **Kevin Zhang/Project Engineer**		
		Jerry Chan **Jerry Chan/Reviewer**		

2 Test Summary

2.1 600MHz Service (663-698MHz paired with 617-652MHz)

Item	Requirement	Method	Result
AGC threshold level	/	KDB935210 D05 v01r04 clause 3.2	PASS
Out-of-band rejection	/	KDB935210 D05 v01r04 clause 3.3	PASS
Input-versus-output signal comparison	47 CFR Part 2.1049	KDB935210 D05 v01r04 clause 3.4	PASS
Mean output power and amplifier/booster gain	47 CFR Part 27.50(c)	KDB935210 D05 v01r04 clause 3.5	PASS
Out-of-band/out-of-block (including intermodulation) emissions and spurious esmissions	47 CFR Part 27.53(g)	KDB935210 D05 v01r04 clause 3.6	PASS
Frequency stability	47 CFR Part 27.54	47 CFR Part 2.1055 KDB935210 D05 v01r04 clause 3.7 ANSI C63.26-2015 Clause 5.6	PASS
Radiated spurious emissions	47 CFR Part 2.1053 47 CFR Part 27.53(g)	KDB935210 D05 v01r04 clause 3.8 ANSI C63.26-2015 Clause 5.5	PASS

2.2 Lower 700MHz (698-716MHz paired with 728-746MHz)

Item	Requirement	Method	Result
AGC threshold level	/	KDB935210 D05 v01r04 clause 3.2	PASS
Out-of-band rejection	/	KDB935210 D05 v01r04 clause 3.3	PASS
Input-versus-output signal comparison	47 CFR Part 2.1049	KDB935210 D05 v01r04 clause 3.4	PASS
Mean output power and amplifier/booster gain	47 CFR Part 27.50(c)	KDB935210 D05 v01r04 clause 3.5	PASS
Out-of-band/out-of-block (including intermodulation) emissions and spurious esmissions	47 CFR Part 27.53(g)	KDB935210 D05 v01r04 clause 3.6	PASS
Frequency stability	47 CFR Part 27.54	47 CFR Part 2.1055 KDB935210 D05 v01r04 clause 3.7 ANSI C63.26-2015 Clause 5.6	PASS
Radiated spurious emissions	47 CFR Part 2.1053 47 CFR Part 27.53(g)	KDB935210 D05 v01r04 clause 3.8 ANSI C63.26-2015 Clause 5.5	PASS

2.3 Upper 700MHz (776-787MHz paired with 746-757MHz)

Item	Requirement	Method	Result
AGC threshold level	/	KDB935210 D05 v01r04 clause 3.2	PASS
Out-of-band rejection	/	KDB935210 D05 v01r04 clause 3.3	PASS
Input-versus-output signal comparison	47 CFR Part 2.1049	KDB935210 D05 v01r04 clause 3.4	PASS
Mean output power and amplifier/booster gain	47 CFR Part 27.50(b)	KDB935210 D05 v01r04 clause 3.5	PASS
Out-of-band/out-of-block (including intermodulation) emissions and spurious esmissions	47 CFR Part 27.53(c)	KDB935210 D05 v01r04 clause 3.6	PASS
Frequency stability	47 CFR Part 27.54	47 CFR Part 2.1055 KDB935210 D05 v01r04 clause 3.7 ANSI C63.26-2015 Clause 5.6	PASS
Radiated spurious emissions	47 CFR Part 2.1053 47 CFR Part 27.53(c) 47 CFR Part 27.53(f)	KDB935210 D05 v01r04 clause 3.8 ANSI C63.26-2015 Clause 5.5	PASS

2.4 FirstNet (788-798MHz paired with 758-768MHz)

Item	Requirement	Method	Result
AGC threshold level	/	KDB935210 D05 v01r04 clause 4.2	PASS
Out-of-band rejection	/	KDB935210 D05 v01r04 clause 4.3	PASS
Input-versus-output signal comparison	47 CFR Part 90.210 47 CFR Part 90.219(e)(4)	KDB935210 D05 v01r04 clause 4.4	PASS
Input/output power and amplifier/booster gain	47 CFR Part 90.219(e)(1)	KDB935210 D05 v01r04 clause 4.5	PASS
Noise figure	47 CFR Part 90.219(e)(2)	KDB935210 D05 v01r04 clause 4.6	PASS
Out-of-band/out-of-block (including intermodulation) emissions and spurious esmissions	47 CFR Part 90.219(e)(3) 47 CFR Part 90.543(c) 47 CFR Part 90.543(e)(1) 47 CFR Part 90.543(e)(3)	KDB935210 D05 v01r04 clause 4.7	PASS
Frequency stability	47 CFR Part 90.539	47 CFR Part 2.1055 KDB935210 D05 v01r04 clause 4.8 ANSI C63.26-2015 Clause 5.6	PASS
Radiated spurious emissions	47 CFR Part 2.1053 47 CFR Part 90.219(e)(3) 47 CFR Part 90.543(f)	KDB935210 D05 v01r04 clause 4.9 ANSI C63.26-2015 Clause 5.5	PASS
Noise/emission at antenna terminal	47 CFR Part 2.1051 47 CFR Part 90.219(d)(6)	ANSI C63.26-2015 Clause 5.7	PASS
Occupied bandwidth	47 CFR Part 2.1049 47 CFR Part 90.219(a)	ANSI C63.26-2015 Clause 5.4	PASS

2.5 ESMR (817-824MHz paired with 862-869MHz)

Item	Requirement	Method	Result
AGC threshold level	/	KDB935210 D05 v01r04 clause 3.2	PASS
Out-of-band rejection	/	KDB935210 D05 v01r04 clause 3.3	PASS
Input-versus-output signal comparison	47 CFR Part 2.1049	KDB935210 D05 v01r04 clause 3.4	PASS
Mean output power and amplifier/booster gain	47 CFR Part 90.635	KDB935210 D05 v01r04 clause 3.5	PASS
Out-of-band/out-of-block (including intermodulation) emissions and spurious esmissions	47 CFR Part 90.691	KDB935210 D05 v01r04 clause 3.6	PASS
Frequency stability	47 CFR Part 90.213	47 CFR Part 2.1055 KDB935210 D05 v01r04 clause 3.7 ANSI C63.26-2015 Clause 5.6	PASS
Radiated spurious emissions	47 CFR Part 2.1053 47 CFR Part 90.691	KDB935210 D05 v01r04 clause 3.8 ANSI C63.26-2015 Clause 5.5	PASS

2.6 Cellular (824-849MHz paired with 869-894MHz)

Item	Requirement	Method	Result
AGC threshold level	/	KDB935210 D05 v01r04 clause 3.2	PASS
Out-of-band rejection	/	KDB935210 D05 v01r04 clause 3.3	PASS
Input-versus-output signal comparison	47 CFR Part 2.1049	KDB935210 D05 v01r04 clause 3.4	PASS
Mean output power and amplifier/booster gain	47 CFR Part 22.913	KDB935210 D05 v01r04 clause 3.5	PASS
Out-of-band/out-of-block (including intermodulation) emissions and spurious esmissions	47 CFR Part 22.917	KDB935210 D05 v01r04 clause 3.6	PASS
Frequency stability	47 CFR Part 2.1055 47 CFR Part 22.355	47 CFR Part 2.1055 KDB935210 D05 v01r04 clause 3.7 ANSI C63.26-2015 Clause 5.6	PASS
Radiated spurious emissions	47 CFR Part 2.1053 47 CFR Part 22.917	KDB935210 D05 v01r04 clause 3.8 ANSI C63.26-2015 Clause 5.5	PASS

♣ **Model No.:** dLRU-678, dLRU-G2-678

According to the declaration from the applicant, the electrical circuit design, layout, components used and internal wiring were identical for all models, with only difference on the Model No.

All test data in this report was copied from report **GZEM201101673602 (FCC ID: OJFDLRU678).**

Furthermore, tests using 100 MHz AWGN signal for 5GNR were supplemented in this report.

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4 General Information

4.1 Details of E.U.T.

Power Supply:	DC 36-57V		
Test Voltage:	DC 48V		
Cable:	N/A		
Operating Temperature:	-40 to +55 °C		
Operating Humidity:	5 to 95 %		
Frequency Range:	600MHz Service	Uplink:	663MHz to 698MHz
		Downlink:	617MHz to 652MHz
	Lower 700MHz	Uplink:	698MHz to 716MHz
		Downlink:	728MHz to 746MHz
	Upper 700MHz	Uplink:	776MHz to 787MHz
		Downlink:	746MHz to 757MHz
	FirstNet	Uplink:	788MHz to 798MHz
		Downlink:	758MHz to 768MHz
	ESMR	Uplink:	817MHz to 824MHz
		Downlink:	862MHz to 869MHz
	Cellular	Uplink:	824MHz to 849MHz
		Downlink:	869MHz to 894MHz
Radio System Type:	☐ GSM		
	☒ WCDMA		
	☒ LTE		
	☒ 5G NR		
Interface:	RF Port:	2 (4.3-10-Female, ANT1~ANT2)	
	Management Port:	1 (RJ45)	
	Power Jack:	1	
	Optical Port:	1 (SFP+)	
Supported Channel Bandwidth:	GSM	☐ 200 kHz	
	WCDMA	☒ 5MHz	
	LTE	☐ 1.4 MHz	☐ 3 MHz ☒ 5 MHz
		☒ 10 MHz	☒ 15 MHz ☒ 20 MHz
	5G NR	☒ 5 MHz	☒ 10 MHz ☒ 15 MHz
		☒ 20 MHz	

Detailed Band,technology and bandwidth :

Band	Technology	Supported Bandwidth
600MHz service	4G/5G	5/10/15/20MHz
lower 700MHz	4G/5G	5/10/15/MHz
upper 700MHz	4G/5G	5/10MHz
Firstnet	4G/5G	5/10MHz
ESMR	3G	5MHz
	4G/5G	5MHz
Cellular	3G	5MHz
	4G/5G	5/10/15/20MHz

Output Power (per antenna port):	Max. 20dBm (Downlink)
EUT MIMO property:	2X2 MIMO ANT1 and ANT2 are MIMO port, and the internal circuit design is identical, the intend output power for antenna ports are identical.
System Gain:	Max. 20dB (Downlink)
Antenna Type:	External Dedicated Antenna
Permission Antenna Gain:	12.5dBi or less
Software Version:	DRAUL_AV01.01.17.00
Note:	1. The EUT is a remote unit of a fiber DAS. The fiber DAS are typically comprised of three components (host unit, fiber-optic expansion unit and remote unit), which will be interconnected via fiber-optic. The host unit connects directly to a base station via coaxial cable but cannot connect to antenna for receiving downlink and transmitting uplink, the EUT connects to antenna for transmitting downlink and receiving uplink. Therefore, only peformed the test for downlink. 2. In additional, the host unit and fiber-optic expansion unit will be used as support unit for test in the report. 3. ANT1 and ANT2 are MIMO port, and the internal circuit design is identical, the intend output power for antenna ports are identical. Therefore only perform test at antenna port 1 and record the data in this report.

4.2 Description of Support Units

Description	Manufacturer	Model No.	Serial No.
Notebook	IBM	T30	S/N78-3VMLX 06/01
IHU/HEU supplied by the manufacturer	Corning	/	/
DRU supplied by the manufacture	Corning	/	/
RIU supplied by the manufacturer	Corning	/	/
DCU supplied by the manufacturer	Corning	/	/
DEU supplied by the manufacturer	Corning	/	/

4.3 Test Environment

Environment Parameter	Selected Values During Test	
Ralative Humidity	Ambient	
Value	Temperature (℃)	Voltage (V)
TNVN	+20	DC 48V
TLVL	-40	DC 40.8V
TLVH	-40	DC 55.2V
THVL	+50	DC 40.8V
THVH	+50	DC 55.2V

VN: Normal Voltage

TN: Normal Teperature

VL: Lower Extreme Voltege

HL: Higher Extreme Voltage

TL: Lower Extreme Teperature

TH: Higher Extreme Teperature

4.4 Test Configuration

600MHz Service (663-698MHz paired with 617-652MHz)

RF Ch.	Test Conf.	Test Freq. (MHz)	Test Signal	Remark
B	DL_1S_B_AWGN	619.5	AWGN(99% OBW of 4.1MHz)	a single test signal
M	DL_1S_M_AWGN	634.5		
T	DL_1S_T_AWGN	649.5		
B	DL_2S_B_AWGN	619.5, 624.5		two adjacent test signals
T	DL_2S_T_AWGN	644.5, 649.5		
B	DL_1S_B_GSM	617.4	GSM-TDMA	a single test signal
M	DL_1S_M_GSM	634.5		
T	DL_1S_T_GSM	651.6		
B	DL_2S_B_GSM	617.4, 617.8		two adjacent test signals
T	DL_2S_T_GSM	651.2, 651.6		
B	DL_1S_B_AWGN	667	100MHz AWGN	a single test signal
M	DL_1S_M_AWGN	634.5		
T	DL_1S_T_AWGN	602		
B	DL_2S_B_AWGN	667, 767		two adjacent test signals
T	DL_2S_T_AWGN	502, 602		

Lower 700MHz (698-716MHz paired with 728-746MHz)

RF Ch.	Test Conf.	Test Freq. (MHz)	Test Signal	Remark
B	DL_1S_B_AWGN	730.5	AWGN(99% OBW of 4.1MHz)	a single test signal
M	DL_1S_M_AWGN	737		
T	DL_1S_T_AWGN	743.5		
B	DL_2S_B_AWGN	730.5, 735.5		two adjacent test signals
T	DL_2S_T_AWGN	738.5, 743.5		
B	DL_1S_B_GSM	728.4	GSM-TDMA	a single test signal
M	DL_1S_M_GSM	737		
T	DL_1S_T_GSM	745.6		
B	DL_2S_B_GSM	728.4, 728.8		two adjacent test signals
T	DL_2S_T_GSM	745.2, 745.6		
B	DL_1S_B_AWGN	778	100MHz AWGN	a single test signal
M	DL_1S_M_AWGN	737		
T	DL_1S_T_AWGN	696		
B	DL_2S_B_AWGN	778, 878		two adjacent test signals
T	DL_2S_T_AWGN	596, 696		

Upper 700MHz (776-787MHz paired with 746-757MHz)

RF Ch.	Test Conf.	Test Freq. (MHz)	Test Signal	Remark
B	DL_1S_B_AWGN	748.5	AWGN(99% OBW of 4.1MHz)	a single test signal
M	DL_1S_M_AWGN	751.5		
T	DL_1S_T_AWGN	754.5		
B	DL_2S_B_AWGN	748.5, 753.5		two adjacent test signals
T	DL_2S_T_AWGN	749.5, 754.5		
B	DL_1S_B_GSM	746.4	GSM-TDMA	a single test signal
M	DL_1S_M_GSM	751.5		
T	DL_1S_T_GSM	756.6		
B	DL_2S_B_GSM	746.4, 746.8		two adjacent test signals
T	DL_2S_T_GSM	756.2, 756.6		
B	DL_1S_B_GSM	796	100MHz AWGN	a single test signal
M	DL_1S_M_GSM	751.5		
T	DL_1S_T_GSM	707		
B	DL_2S_B_GSM	796, 896		two adjacent test signals
T	DL_2S_T_GSM	607, 707		

FirstNet (788-798MHz paired with 758-768MHz)

RF Ch.	Test Conf.	Test Freq. (MHz)	Test Signal	Remark
B	DL_1S_B_AWGN	760.5	AWGN(99% OBW of 4.1MHz)	a single test signal
M	DL_1S_M_AWGN	763		
T	DL_1S_T_AWGN	765.5		
/	DL_2S_B_AWGN	760.5, 765.5		two adjacent test signals
B	DL_1S_B_AWGN	808	100MHz AWGN	a single test signal
M	DL_1S_M_AWGN	763		
T	DL_1S_T_AWGN	718		
B	DL_2S_B_AWGN	808, 908		two adjacent test signals
T	DL_2S_T_AWGN	618, 718		

ESMR (817-824MHz paired with 862-869MHz)

RF Ch.	Test Conf.	Test Freq. (MHz)	Test Signal	Remark
B	DL_1S_B_AWGN	864.5	AWGN(99% OBW of 4.1MHz)	a single test signal
M	DL_1S_M_AWGN	865.5		
T	DL_1S_T_AWGN	866.5		
B	DL_2S_B_AWGN	864.5, 869.5		two adjacent test signals
T	DL_2S_T_AWGN	861.5, 866.5		
B	DL_1S_B_GSM	862.4	GSM-TDMA	a single test signal
M	DL_1S_M_GSM	865.5		
T	DL_1S_T_GSM	868.6		
B	DL_2S_B_GSM	862.4, 862.8		two adjacent test signals
T	DL_2S_T_GSM	868.2, 868.6		
B	DL_1S_B_AWGN	912	100MHz AWGN	a single test signal
M	DL_1S_M_AWGN	865.5		
T	DL_1S_T_AWGN	819		
B	DL_2S_B_AWGN	912, 1012		two adjacent test signals
T	DL_2S_T_AWGN	719, 819		

Cellular (824-849MHz paired with 869-894MHz)

RF Ch.	Test Conf.	Test Freq. (MHz)	Test Signal	Remark
B	DL_1S_B_AWGN	871.5	AWGN(99% OBW of 4.1MHz)	a single test signal
M	DL_1S_M_AWGN	881.5		
T	DL_1S_T_AWGN	891.5		
B	DL_2S_B_AWGN	871.5, 876.5		two adjacent test signals
T	DL_2S_T_AWGN	886.5, 891.5		
B	DL_1S_B_GSM	869.4	GSM-TDMA	a single test signal
M	DL_1S_M_GSM	881.5		
T	DL_1S_T_GSM	893.6		
B	DL_2S_B_GSM	869.4, 869.8		two adjacent test signals
T	DL_2S_T_GSM	893.2, 893.6		
B	DL_1S_B_AWGN	919	100MHz AWGN	a single test signal
M	DL_1S_M_AWGN	881.5		
T	DL_1S_T_AWGN	844		
B	DL_2S_B_AWGN	919, 1019		two adjacent test signals
T	DL_2S_T_AWGN	744, 844		

4.5 Measurement Uncertainty

No.	Item	Measurement Uncertainty
1	Radio Frequency	±5.5 x 10^{-8}
2	RF Conducted power	±0.68dB
3	Conducted Spurious Emissions	±1.04dB
4	RF Radiated Power	±4.5dB (below 1GHz)
		±4.8dB (above 1GHz)
5	Radiated Spurious Emission Test	±4.5dB (30MHz-1GHz)
		±4.8dB (1GHz-18GHz)
6	Temperature	±0.4°C
7	Humidity	±1.3%
8	Supply Voltages	±1.5%
9	Time	±3%

4.6 Test Location

All tests were performed at:

SGS-CSTC Standards Technical Services Co., Ltd., Guangzhou Branch EMC Laboratory,
198 Kezhu Road, Scientech Park, Guangzhou Economic & Technology Development District,
Guangzhou, China 510663

Tel: +86 20 82155555 Fax: +86 20 82075059

No tests were sub-contracted.

4.7 Test Facility

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

- **ACMA**

SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory can also perform testing for the Australian C-Tick mark as a result of our NVLAP accreditation.

- **SGS UK(Certificate No.: 32), SGS-TUV SAARLAND and SGS-FIMKO**

Have approved SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory as a supplier of EMC TESTING SERVICES and SAFETY TESTING SERVICES.

- **FCC Recognized 2.948 Listed Test Firm(Registration No.: 282399)**

SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 282399, May 31, 2002.

- **FCC Recognized Accredited Test Firm(Registration No.: 486818)**

SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory has been accredited and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Designation Number: CN5016, Test Firm Registration Number: 486818, Jul 13, 2017.

- **Industry Canada (Registration No.: 4620B, CAB identifier: CN0052)**

SGS-CSTC Standards Technical Services Co., Ltd., has been registered by Innovation Science and Economic Development Canada for Wireless Device Testing laboratories to test to Canadian radio equipment requirements. Registration No. 4620B, CAB identifier: CN0052.

- **VCCI (Registration No.: R-12460, C-12584, G-10449 and T-11179)**

The 10m Semi-anechoic chamber and Shielded Room of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: R-12460, C-12584，G-10449 and T-11179 respectively.

- **CBTL (Lab Code: TL129)**

SGS-CSTC Standards Technical Services Co., Ltd., E&E Laboratory has been assessed and fully comply with the requirements of ISO/IEC 17025:2005, the Basic Rules, IECEE 01 and Rules of procedure IECEE 02, and the relevant IECEE CB-Scheme Operational documents.

4.8 Deviation from Standards

None

4.9 Abnormalities from Standard Conditions

None

5 Equipment List

For report GZEM201101673602:

Conducted Test

Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
MXA Signal Analyzer	AgilentTechnologies	N9020A	SEM004-10	2020-03-02	2021-03-01
ESG Vector Signal Generator	Keysight	E4438C	SEM006-03	2020-03-31	2021-03-30
Signal Generator	Rohde & Schwarz	SMB100A	EMC2093	2020-01-10	2021-01-09
Signal Generator	R & S	SMR20	EMC0516	2020-01-10	2021-01-09
6dB Attenuator	HP	8491A	EMC2062	2020-04-15	2022-04-14
MI CABLE	SGS-EMC	0.8M	EMC2136	2019-11-02	2021-11-01
MI CABLE	SGS-EMC	0.8M	EMC2137	2019-11-02	2021-11-01
Temperature Chamber	GZ GongWen Co.Ltd.	GDJW-100	EMC0039	2020-07-01	2021-06-30
High-low temperature control box	GZ GongWen Co.Ltd	GDJW-100	EMC0039	2020-06-29	2021-06-28

Radiated Test

Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
Chamber cable	HangTianXing	N/A	EMC0542	2019-06-28	2021-06-27
Horn Antenna 1GHz-18GHz	Rohde & Schwarz	HF906	EMC0518	2018-09-02	2021-09-01
1GHz-26.5 GHz Pre-Amplifier	Agilent	8449B	EMC0521	2020-01-10	2021-01-09
Amplifier	HP	8447F	EMC2065	2020-05-26	2021-05-25
2.4GHz Filter	Micro-Tronics	BRM 50702	EMC2069	2020-01-10	2021-01-09
966 Anechoic Chamber	C.R.T	9m x 6m x 6m	EMC2142	2020-12-19	2023-12-18
MXE EMI Receiver	Keysight	N9038A	EMC2139	2020-11-13	2021-11-12
EXA Signal Analyzer	Keysight	N9010A	EMC2138	2020-11-13	2021-11-12
Trilog Broadband Antenna 30MHz-1GHz	SCHWARZBECKMESS-ELEKTRONIK	VULB 9168	SEM003-18	2019-02-22	2022-02-22
Test Software E3	Audix	Ver.6.120110a	GZE100-61	N/A	N/A

For report GZCR230300024902:

Conducted test equipment					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
Temperature Chamber	GZ GongWen Co.Ltd.	GDJW-100	EMC0039	2023-06-29	2024-06-28
MI CABLE	SGS-EMC	0.8M	EMC2137	2021-11-02	2023-11-01
MI CABLE	SGS-EMC	0.8M	EMC2136	2021-11-02	2023-11-01
EXA Signal Analyzer (10Hz-44GHz)	Keysight	N9010A	EMC2138	2022-09-08	2023-09-07
MXA Signal Analyzer (10Hz-50GHz)	KEYSIGHT	N9020B	SEM004-24	2023-03-20	2024-03-19
4X4 Power Sensor Unit	TST	TSPS2023R	EMC2257	2022-09-08	2023-09-07
Test Software	TST	V2.0	GZE100-78	N/A	N/A
ESG vector signal generator (250kHz-6GHz)	Agilent Technologies	E4438C	SEM006-03	2023-02-20	2024-02-19

For report GZCR230300024902:

Radiated test equipment (30MHz-1GHz)					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
10m Semi-Anechoic Chamber	ETS	N/A	EMC0530	2022-10-16	2025-10-15
Coaxial cable	Mirco-COAX UTIFLEX	311A	EMC0540	2023-06-14	2025-06-13
Amplifier (9kHz-1.3GHz)	HP	8447F	EMC2065	2023-06-14	2024-06-13
EMI Test Receiver (1Hz-8GHz)	Rohde & Schwarz	ESW8	EMC2220	2023-05-19	2024-05-18
Test Software E3	Audix	Ver.6.120110a	GZE100-61	N/A	N/A
Trilog Broadband Antenna (25MHz-1GHz)	SCHWARZBECK MESS-ELEKTRONIK	VULB 9168	EMC2174	2022-06-19	2025-06-18
TRILOG Broadband Antenna (25M-2GHz)	SCHWARZBECK	VULB 9168	SEM003-18	2022-03-03	2025-03-02
EMI Test Receiver (1Hz-8GHz)	Rohde & Schwarz	ESW8	EMC2220	2023-05-19	2024-05-18

For report GZCR230300024902:

Radiated test equipment (above 1GHz)					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
1GHz-26.5 GHz Pre-Amplifier	Agilent	8449B	EMC0521	2022-12-16	2023-12-15
Microwave Broadband Preamplifier (18-40GHz)	SCHWARZBECK	BBV 9721	EMC2172	2023-08-21	2024-08-20
EMI Test Receiver (10Hz-26.5GHz)	Rohde & Schwarz	ESIB26	EMC0522	2022-12-16	2023-12-15
EXA Signal Analyzer (10Hz-44GHz)	Keysight	N9010A	EMC2138	2022-09-08	2023-09-07
Chamber cable (Above 1GHz)	Scoflex	KMKM-8.0m	EMC0545	2022-08-24	2024-08-23
Chamber Cable (Below 1GHz)	Scoflex	KMKM-8.0m	EMC0546	2022-08-24	2024-08-23
Trilog Broadband Antenna (25MHz-1GHz)	SCHWARZBECK	VULB 9160	EMC2025	2022-09-07	2025-09-06
Horn Antenna (1GHz-18GHz)	SCHWARZBECK MESS-ELEKTRONIK	BBHA 9120D	EMC2026	2022-09-21	2025-09-20
Horn Antenna 1-18GHz	SCHWARZBECK MESS-ELEKTRONIK	BBHA 9120D	EMC2251	2022-02-02	2025-08-01
Horn Antenna (14-40GHz)	SCHWARZBECK	BBHA 9170	EMC2041	2023-06-18	2026-06-17
Broad-Band Horn Antenna (15-40GHz)	Schwarzbeck	BBHA 9170	SEM003-15	2021-7-11	2024-7-10
966 Anechoic Chamber	C.R.T	9m x 6m x 6m	EMC2142	2020-12-20	2023-12-19
Test Software E3	Audix	Ver.6.120110a	GZE100-61	N/A	N/A

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中国·广州·经济技术开发区科学城科珠路198号 邮编: 510663 t (86-20) 82155555 f (86-20) 82075058 sgs.china@sgs.com

6 Radio Spectrum Matter Test Result for 600MHz Service

6.1 AGC Threshold level

Test Requirement: Not specified

Test Method: KDB 935210 D05 clause 3.2

Limit: No limit

6.1.1 E.U.T. Operation

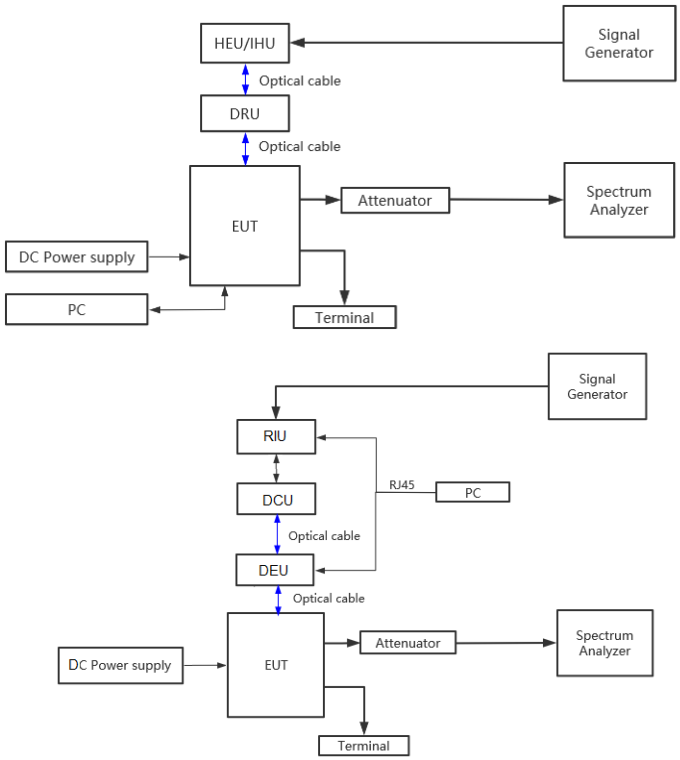
Operating Environment:

Temperature: 24.6 °C Humidity: 59 % RH Atmospheric Pressure: 1020 mbar

Test Mode: Set the EUT to maximum output power and maximum gain.

Test Configuration: Refer to clause 4.4 in this report.

6.1.2 Test Setup



6.1.3 Test Procedure

a) Connect a signal generator to the input of the EUT.

b) Connect a spectrum analyzer or power meter to the output of the EUT using appropriate attenuation as necessary.

c) The signal generator should initially be configured to produce either of the required test signals (i.e., broadband or narrowband).

d) Set the signal generator frequency to the center frequency of the EUT operating band.

e) While monitoring the output power of the EUT, measured using the methods of 3.5.3 or 3.5.4, increase the input level until a 1 dB increase in the input signal power no longer causes a 1 dB increase in the output signal power.

f) Record this level as the AGC threshold level.

g) Repeat the procedure with the remaining test signal

6.1.4 Measurement Record

Please refer to Appendix – Test data and result for report GZCR230300024902

6.2 Out-of-band rejection

Test Requirement: Not specified

Test Method: KDB 935210 D05 clause 3.3

Limit: No limit

6.2.1 E.U.T. Operation

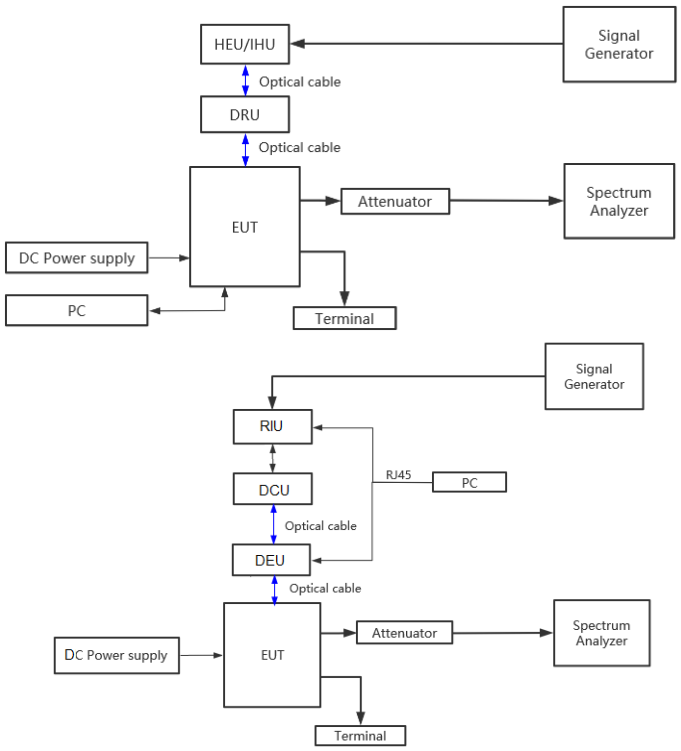
Operating Environment:

Temperature: 24.6 °C Humidity: 59 % RH Atmospheric Pressure: 1020 mbar

Test Mode: Set the EUT to maximum output power and maximum gain.

EUT Configuration: Refer to clause 4.4 in this report.

6.2.2 Test Setup



6.2.3 Test Procedure

a) Connect a signal generator to the input of the EUT.

b) Configure a swept CW signal with the following parameters:

1) Frequency range = ± 250 % of the passband, for each applicable CMRS band (see also KDB Publication 935210 D02 [R7] and KDB Publication 634817 [R5] about selection of frequencies for testing and for grant listings).

2) Level = a sufficient level to affirm that the out-of-band rejection is > 20 dB above the noise floor and will not engage the AGC during the entire sweep.

3) Dwell time = approximately 10 ms.

4) Number of points = SPAN/(RBW/2).

c) Connect a spectrum analyzer to the output of the EUT using appropriate attenuation.

d) Set the span of the spectrum analyzer to the same as the frequency range of the signal generator.

e) Set the resolution bandwidth (RBW) of the spectrum analyzer to be 1 % to 5 % of the EUT passband, and the video bandwidth (VBW) shall be set to ≥ 3 × RBW.

f) Set the detector to Peak Max-Hold and wait for the spectrum analyzer' s spectral display to fill.

g) Place a marker to the peak of the frequency response and record this frequency as f0.

h) Place two markers, one at the lowest and the other at the highest frequency of the envelope of the spectral display, such that each marker is at or slightly below the −20 dB down amplitude, to determine the 20 dB bandwidth.

i) Capture the frequency response of the EUT.

j) Repeat for all frequency bands applicable for use by the EUT.

6.2.4 Measurement Record

Please refer to Appendix – Test data and result for report GZCR230300024902

6.3 Input-versus-output signal comparison

Test Requirement: 47 CFR Part 2.1049

Test Method: KDB 935210 D05 clause 3.4

Limit: Compare the spectral plot of input signal to the output signal to affirm that they are similar

6.3.1 E.U.T. Operation

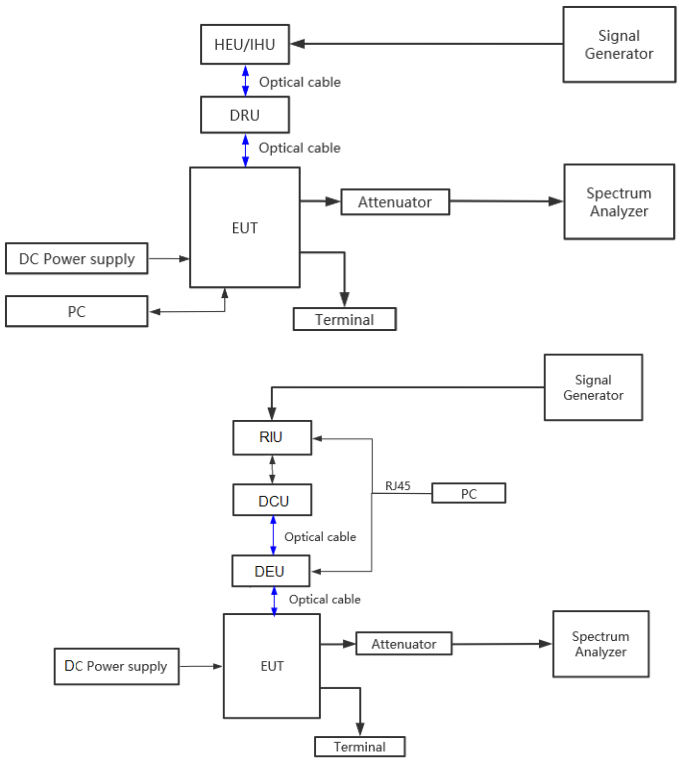
Operating Environment:

Temperature: 24.6 °C Humidity: 59 % RH Atmospheric Pressure: 1020 mbar

Test Mode: Set the EUT to maximum output power and maximum gain.

EUT Configuration: Refer to clause 4.4 in this report.

6.3.2 Test Setup



6.3.3 Test procedure

a) Connect a signal generator to the input of the EUT.

b) Configure the signal generator to transmit the AWGN signal.

c) Configure the signal amplitude to be just below the AGC threshold level (see 3.2), but not more than 0.5 dB below.

d) Connect a spectrum analyzer to the output of the EUT using appropriate attenuation.

e) Set the spectrum analyzer center frequency to the center frequency of the operational band under test. The span range of the spectrum analyzer shall be between 2 × to 5 × the emission bandwidth (EBW) or alternatively, the OBW.

f) The nominal RBW shall be in the range of 1 % to 5 % of the anticipated OBW, and the VBW shall be ⩾ 3 × RBW.

g) Set the reference level of the instrument as required to preclude the signal from exceeding the maximum spectrum analyzer input mixer level for linear operation. In general, the peak of the spectral envelope must be more than [10 log (OBW / RBW)] below the reference level.

Steps f) and g) may require iteration to enable adjustments within the specified tolerances.

h) The noise floor of the spectrum analyzer at the selected RBW shall be at least 36 dB below the reference level.

i) Set spectrum analyzer detection function to positive peak.

j) Set the trace mode to max hold.

k) Determine the reference value: Allow the trace to stabilize. Set the spectrum analyzer marker to the highest amplitude level of the displayed trace (this is the reference value) and record the associated frequency.

l) Place two markers, one at the lowest and the other at the highest frequency of the envelope of the spectral display, such that each marker is at or slightly below the −26 dB down amplitude. The 26 dB EBW (alternatively OBW) is the positive frequency difference between the two markers. If the spectral envelope crosses the −26 dB down amplitude at multiple points, the lowest or highest frequency shall be selected as the frequencies that are the furthest removed from the center frequency at which the spectral envelope crosses the −26 dB down amplitude point.

m) Repeat steps e) to l) with the input signal connected directly to the spectrum analyzer (i.e., input signal measurement).

n) Compare the spectral plot of the input signal (determined from step m) to the output signal (determined from step l) to affirm that they are similar (in passband and rolloff characteristic features and relative spectral locations), and include plot(s) and descriptions in test report.

o) Repeat the procedure [steps e) to n)] with the input signal amplitude set to 3 dB above the AGC threshold.

p) Repeat steps e) to o) with the signal generator set to the narrowband signal.

q) Repeat steps e) to p) for all frequency bands authorized for use by the EUT.

6.3.4 Measurement Record

Please refer to Appendix – Test data and result for report GZCR230300024902

6.4 Mean output power and amplifier/booster gain

Test Requirement: 47 CFR Part 27.50(c)

Test Method: KDB 935210 D05 clause 3.5

Limit: Fixed and base stations transmitting a signal with an emission bandwidth greater than 1 MHz must not exceed an ERP of 1000 watts/MHz and an antenna height of 305 m HAAT

6.4.1 E.U.T. Operation

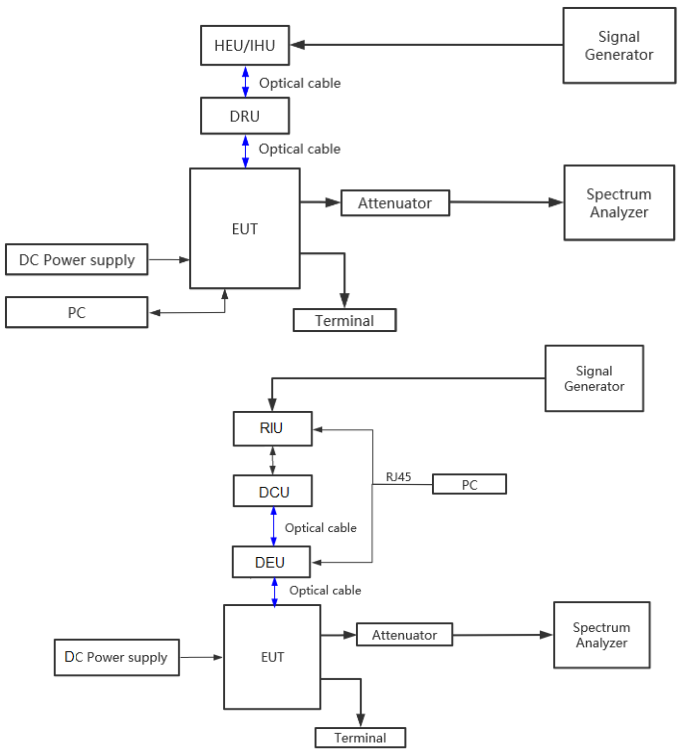
Operating Environment:

Temperature: 24.6 °C Humidity: 59 % RH Atmospheric Pressure: 1020 mbar

Test Mode: Set the EUT to maximum output power and maximum gain.

EUT Configuration: Refer to clause 4.4 in this report.

6.4.2 Test Setup



6.4.3 Test procedure

Test procedure of output power:

a) Connect a signal generator to the input of the EUT.

b) Configure to generate the AWGN (broadband) test signal.

c) The frequency of the signal generator shall be set to the frequency f0 as determined from 3.3.

d) Connect a spectrum analyzer or power meter to the output of the EUT using appropriate attenuation as necessary.

e) Set the signal generator output power to a level that produces an EUT output level that is just below the AGC threshold (see 3.2), but not more than 0.5 dB below.

f) Measure and record the output power of the EUT; use 3.5.3 or 3.5.4 for power measurement.

g) Remove the EUT from the measurement setup. Using the same signal generator settings, repeat the power measurement at the signal generator port, which was used as the input signal to the EUT, and record as the input power. EUT gain may be calculated as described in 3.5.5.

h) Repeat steps f) and g) with input signal amplitude set to 3 dB above the AGC threshold level.

i) Repeat steps e) to h) with the narrowband test signal.

j) Repeat steps e) to i) for all frequency bands authorized for use by the EUT.

1) Adjust the frequency of the input signals, either below or above the pass band, so that the lowest order intermodulation product is positioned in the centre of the pass band, according to clause 4.2.5.2.

2) Take the measurement of the rise of the output signal.

3) Repeat the measurement for the opposite path of the Repeater.

Calculating the mean gain:

After the mean input and output power levels have been measured as described in the preceding subclauses, the mean gain of the EUT can be determined from:

Gain (dB) = output power (dBm) − input power (dBm).

6.4.4 Measurement Record

Please refer to Appendix – Test data and result for report GZCR230300024902

6.5 Out-of-band/out-of-block (including intermodulation) emissions and spurious

Test Requirement: 47 CFR Part 27.53(g)

Test Method: KDB 935210 D05 clause 3.6

Limit: 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.
(reduce 3.01dB when on 2×2 MIMO mode)

6.5.1 E.U.T. Operation

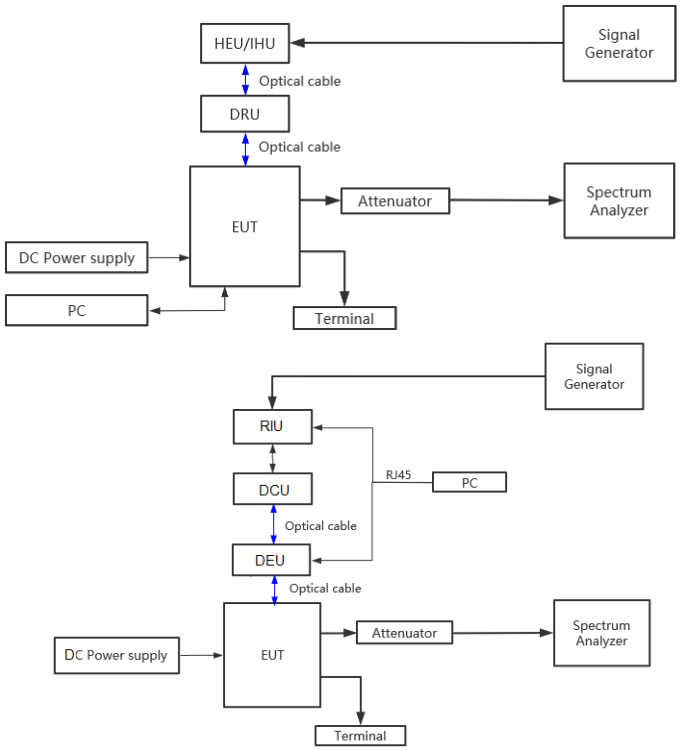
Operating Environment:

Temperature: 24.6 °C Humidity: 59 % RH Atmospheric Pressure: 1020 mbar

Test Mode: Set the EUT to maximum output power and maximum gain.

EUT Configuration: Refer to clause 4.4 in this report.

6.5.2 Test Setup



6.5.3 Test procedure

Test procedure of Out-of-band/out-of-block emissions:

a) Connect a signal generator to the input of the EUT.

If the signal generator is not capable of generating two modulated carriers simultaneously, then two discrete signal generators can be connected with an appropriate combining network to support this two-signal test.

b) Set the signal generator to produce two AWGN signals as previously described (e.g., 4.1 MHz OBW). Set the signal generator amplitudes so that the power from each into the EUT is equivalent.

c) Set the center frequencies such that the AWGN signals occupy adjacent channels, as defined by industry standards such as 3GPP or 3GPP2, at the upper edge of the frequency band or block under test.

d) Set the composite power levels such that the input signal is just below the AGC threshold (see 3.2), but not more than 0.5 dB below. The composite power can be measured using the procedures provided in KDB Publication 971168 [R8], but it will be necessary to expand the power integration bandwidth so as to include both of the transmit channels. Alternatively, the composite power can be measured using an average power meter as described in KDB Publication 971168 [R8].

e) Connect a spectrum analyzer to the output of the EUT using appropriate attenuation as necessary.

f) Set the RBW = reference bandwidth in the applicable rule section for the supported frequency band (typically 1 % of the EBW or 100 kHz or 1 MHz)

g) Set the VBW = 3 × RBW.

h) Set the detector to power averaging (rms) detector.

i) Set the Sweep time = auto-couple.

j) Set the spectrum analyzer start frequency to the upper block edge frequency, and the stop frequency to the upper block edge frequency plus 300 kHz or 3 MHz, for frequencies below and above 1 GHz, respectively.

k) Trace average at least 100 traces in power averaging (rms) mode.

l) Use the marker function to find the maximum power level

m) Capture the spectrum analyzer trace of the power level for inclusion in the test report.

n) Repeat steps k) to m) with the composite input power level set to 3 dB above the AGC threshold.

o) Reset the frequencies of the input signals to the lower edge of the frequency block or band under test.

p) Reset the spectrum analyzer start frequency to the lower block edge frequency minus 300 kHz or 3 MHz, for frequencies below and above 1 GHz, respectively, and the stop frequency to the lower band or block edge frequency.

q) Repeat steps k) to n).

r) Repeat steps a) to q) with the signal generator configured for a single test signal tuned as close as possible to the block edges.

s) Repeat steps a) to r) with the narrowband test signal.

t) Repeat steps a) to s) for all authorized frequency bands or blocks used by the EUT.

Test procedure of Spurious emissions

a) Connect a signal generator to the input of the EUT.

b) Set the signal generator to produce the broadband test signal as previously described (i.e., 4.1 MHz OBW AWGN).

c) Set the center frequency of the test signal to the lowest available channel within the frequency band or block.

d) Set the EUT input power to a level that is just below the AGC threshold (see 3.2), but not more than 0.5 dB below.

e) Connect a spectrum analyzer to the output of the EUT using appropriate attenuation as necessary.

f) Set the RBW = reference bandwidth in the applicable rule section for the supported frequency band of operation (e.g., reference bandwidth is typically 100 kHz or 1 MHz).

g) Set the VBW $\geqslant$ 3 $\times$ RBW.

h) Set the Sweep time = auto-couple.

i) Set the spectrum analyzer start frequency to the lowest RF 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.

The number of measurement points in each sweep must be $\geqslant$ (2 $\times$ span/RBW), which may require that the measurement range defined by the start and stop frequencies be subdivided, depending on the available number of measurement points provided by the spectrum analyzer.4

j) Select the power averaging (rms) detector function.

k) Trace average at least 10 traces in power averaging (rms) mode.

l) 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.

m) Reset the spectrum 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 spectrum analyzer stop frequency to 10 × the highest frequency of the fundamental emission (see Section 2.1057). 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 be subdivided, depending on the available number of measurement points provided by the spectrum analyzer.

n) Trace average at least 10 traces in power averaging (rms) mode.

o) 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; also provide tabular data, if required.

p) Repeat steps i) to o) with the input test signals firstly tuned to a middle band/block frequency/channel, and then tuned to a high band/block frequency/channel.

q) Repeat steps c) to p) with the narrowband test signal.

r) Repeat steps b) to q) for all authorized frequency bands/blocks used by the EUT.

6.5.4 Measurement Record

Please refer to Appendix – Test data and result for report GZCR230300024902

6.6 Frequency stability

Test Requirement: 47 CFR Part 27.54

Test Method: 47 CFR Part 2.1055
KDB 935210 D05 clause 3.7
ANSI C63.26-2015 clause 5.6

Limit: The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

6.6.1 E.U.T. Operation

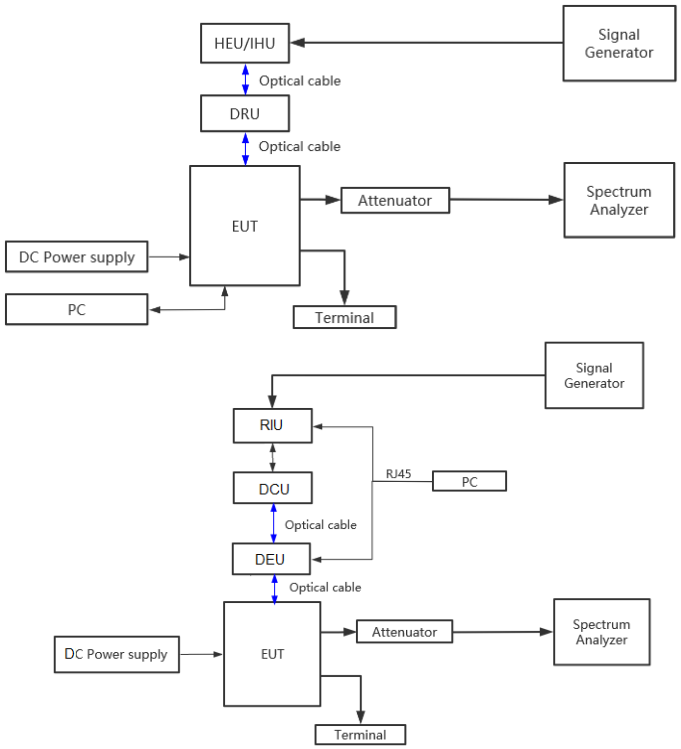
Operating Environment:

Temperature: 24.6 °C Humidity: 59 % RH Atmospheric Pressure: 1020 mbar

Test Mode: Set the EUT to maximum output power and maximum gain.

EUT Configuration: Refer to clause 4.4 in this report.

6.6.2 Test Setup



6.6.3 Test procedure

Frequency stability is a measure of the frequency drift due to temperature and supply voltage variations, with reference to the frequency measured at +20 °C and rated supply voltage.

The operating carrier frequency shall be set up in accordance with the manufacturer's published operation and instruction manual prior to the commencement of these tests. No adjustment of any frequency determining circuit element shall be made subsequent to this initial set-up. Frequency stability is tested:

a) At 10 °C intervals of temperatures between −30 °C and +50 °C at the manufacturer's rated supply voltage, and

b) At +20 °C temperature and ±15% supply voltage variations. If a product is specified to operate over a range of input voltage then the −15% variation is applied to the lowermost voltage and the +15% is applied to the uppermost voltage.

During the test all necessary settings, adjustments and control of the EUT have to be performed without disturbing the test environment, i.e., without opening the environmental chamber. The frequency stabilities can be maintained to a lesser temperature range provided that the transmitter is automatically inhibited from operating outside the lesser temperature range. For handheld equipment that is only capable of operating from internal batteries and the supply voltage cannot be varied, the frequency stability tests shall be performed at the nominal battery voltage and the battery end point voltage specified by the manufacturer. An external supply voltage can be used and set at the internal battery nominal voltage, and again at the battery operating end point voltage which shall be specified by the equipment manufacturer.

If an unmodulated carrier is not available, the mean frequency of a modulated carrier can be obtained by using a frequency counter with gating time set to an appropriately large multiple of bit periods (gating time depending on the required accuracy). Full details on the choice of values shall be included in the test report.

When performing frequency stability measurements on booster, the instability associated with the EUT must be isolated from any frequency instability associated with the measurement instrumentation. One method for realizing this isolation is to connect the reference clock input of the signal generator to the reference output of the frequency counter to confirm that any frequency instability is associated with the EUT, but is not due to differences between the reference oscillators internal to the measurement instrumentation.

6.6.4 Measurement Record

Please refer to Appendix – Test data and result for report GZCR230300024902

6.7 Radiated spurious emission

Test Requirement: 47 CFR Part 2.1053, 27.53(g)

Test Method: KDB 935210 D05 clause 3.7

ANSI C63.26-2015 clause 5.6

Limit: 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.

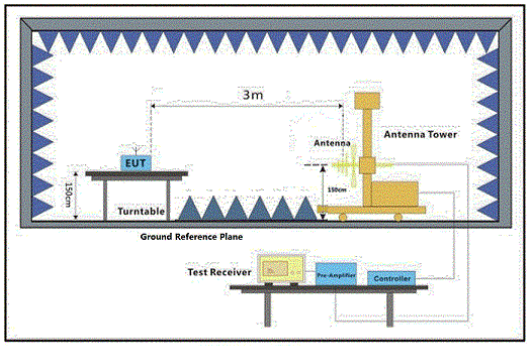
6.7.1 E.U.T. Operation

Operating Environment:

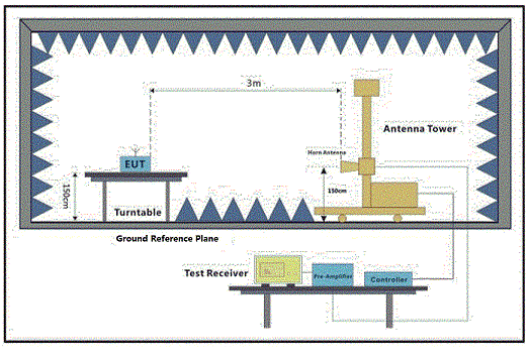
Temperature: 25.1 °C Humidity: 59 % RH Atmospheric Pressure: 1010 mbar

Test Mode: Set the EUT to maximum output power and maximum gain (activate MIMO mode simultaneously).

6.7.2 Test Setup



30MHz-1GHz



Above 1GHz

6.7.3 Test procedure

1. Scan from 30MHz to 12.75GHz, find the maximum radiation frequency to measure.
2. The technique used to find the Spurious Emissions of the transmitter was the antenna substitution method. Substitution method was performed to determine the actual ERP/EIRP emission levels of the EUT.

Below 1GHz test procedure as below:

1) The EUT was powered on and placed on a table in the chamber. The antenna of the transmitter was extended to its maximum length. modulation mode and the measuring receiver shall be tuned to the frequency of the transmitter under test.
2) Rotating through 360° the turntable. After the fundamental emission was maximized, a field strength measurement was made.
3) Steps 1) and 2) were performed with the EUT and the receive antenna in both vertical and horizontal polarization.
4) The transmitter was then removed and replaced with another antenna. The center of the antenna was approximately at the same location as the center of the transmitter.
5) A signal at the disturbance was fed to the substitution antenna by means of a non-radiating cable. With both the substitution and the receive antennas horizontally polarized, the receive antenna was raised and lowered to obtain a maximum reading at the test receiver. The level of the signal generator was adjusted until the measured field strength level in step 2) is obtained for this set of conditions.
6) The output power into the substitution antenna was then measured.
7) Steps 5) and 6)were repeated with both antennas vertically polarized.
8) Calculate power in dBm by the following formula:

Level (dBm) = Read Level (dBm) + Correction Factor (dB)

6.7.4 Measurement Record

Please refer to Appendix – Test data and result for report GZCR230300024902

7 Radio Spectrum Matter Test Result for Lower 700MHz

7.1 AGC Threshold level

Test Requirement: Not specified

Test Method: KDB 935210 D05 clause 3.2

Limit: No limit

7.1.1 E.U.T. Operation

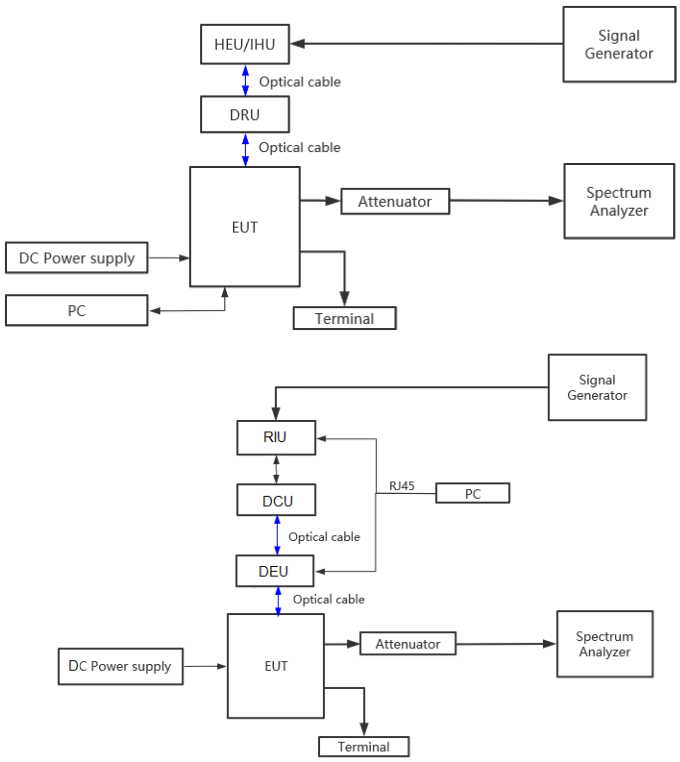
Operating Environment:

Temperature: 24.6 °C Humidity: 59 % RH Atmospheric Pressure: 1020 mbar

Test Mode: Set the EUT to maximum output power and maximum gain.

Test Configuration: Refer to clause 4.4 in this report.

7.1.2 Test Setup



7.1.3 Test Procedure

a) Connect a signal generator to the input of the EUT.

b) Connect a spectrum analyzer or power meter to the output of the EUT using appropriate attenuation as necessary.

c) The signal generator should initially be configured to produce either of the required test signals (i.e., broadband or narrowband).

d) Set the signal generator frequency to the center frequency of the EUT operating band.

e) While monitoring the output power of the EUT, measured using the methods of 3.5.3 or 3.5.4, increase the input level until a 1 dB increase in the input signal power no longer causes a 1 dB increase in the output signal power.

f) Record this level as the AGC threshold level.

g) Repeat the procedure with the remaining test signal

7.1.4 Measurement Record

Please refer to Appendix – Test data and result for report GZCR230300024902

7.2 Out-of-band rejection

Test Requirement: Not specified

Test Method: KDB 935210 D05 clause 3.3

Limit: No limit

7.2.1 E.U.T. Operation

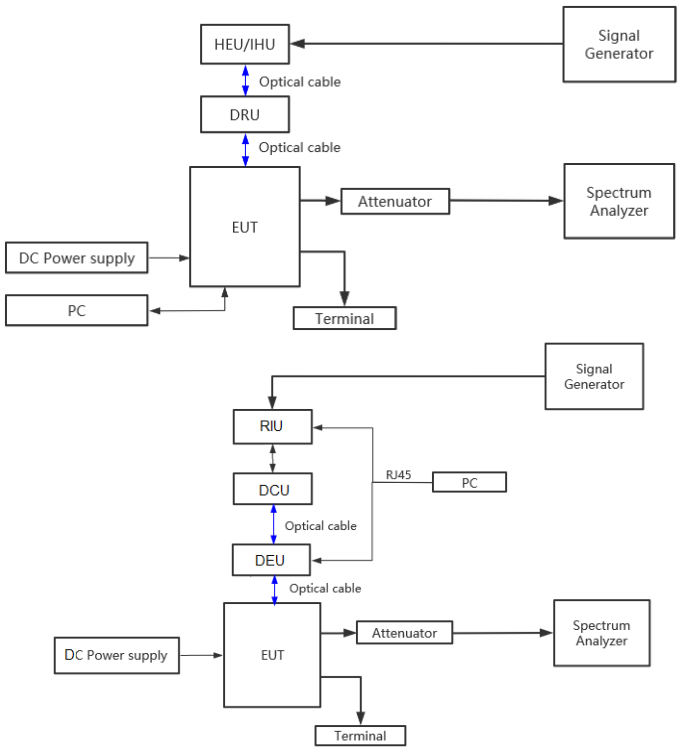
Operating Environment:

Temperature: 24.6 °C Humidity: 59 % RH Atmospheric Pressure: 1020 mbar

Test Mode: Set the EUT to maximum output power and maximum gain.

EUT Configuration: Refer to clause 4.4 in this report.

7.2.2 Test Setup



7.2.3 Test Procedure

a) Connect a signal generator to the input of the EUT.

b) Configure a swept CW signal with the following parameters:

1) Frequency range = ± 250 % of the passband, for each applicable CMRS band (see also KDB Publication 935210 D02 [R7] and KDB Publication 634817 [R5] about selection of frequencies for testing and for grant listings).

2) Level = a sufficient level to affirm that the out-of-band rejection is > 20 dB above the noise floor and will not engage the AGC during the entire sweep.

3) Dwell time = approximately 10 ms.

4) Number of points = SPAN/(RBW/2).

c) Connect a spectrum analyzer to the output of the EUT using appropriate attenuation.

d) Set the span of the spectrum analyzer to the same as the frequency range of the signal generator.

e) Set the resolution bandwidth (RBW) of the spectrum analyzer to be 1 % to 5 % of the EUT passband, and the video bandwidth (VBW) shall be set to ≥ 3 × RBW.

f) Set the detector to Peak Max-Hold and wait for the spectrum analyzer' s spectral display to fill.

g) Place a marker to the peak of the frequency response and record this frequency as f0.

h) Place two markers, one at the lowest and the other at the highest frequency of the envelope of the spectral display, such that each marker is at or slightly below the −20 dB down amplitude, to determine the 20 dB bandwidth.

i) Capture the frequency response of the EUT.

j) Repeat for all frequency bands applicable for use by the EUT.

7.2.4 Measurement Record

Please refer to Appendix – Test data and result for report GZCR230300024902

7.3 Input-versus-output signal comparison

Test Requirement: 47 CFR Part 2.1049

Test Method: KDB 935210 D05 clause 3.4

Limit: Compare the spectral plot of input signal to the output signal to affirm that they are similar

7.3.1 E.U.T. Operation

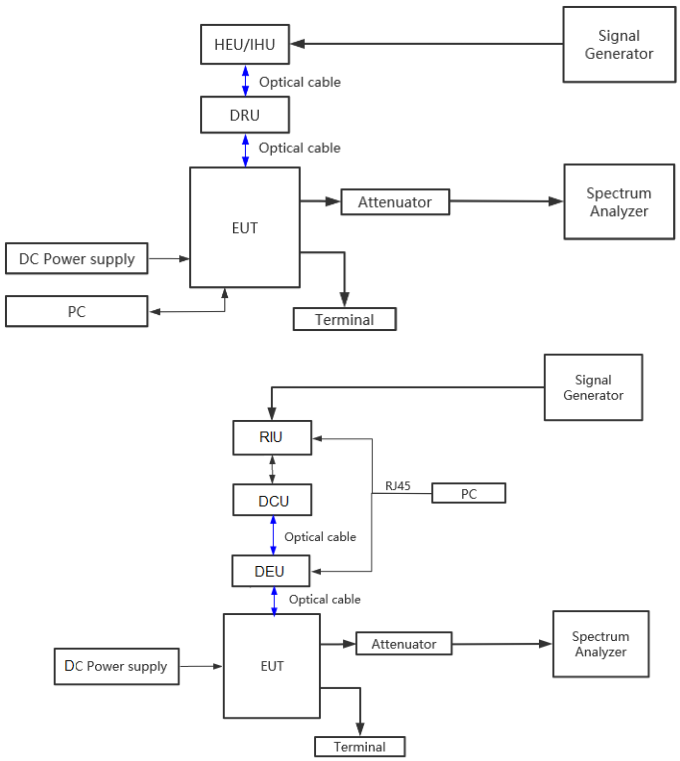
Operating Environment:

Temperature: 24.6 °C Humidity: 59 % RH Atmospheric Pressure: 1020 mbar

Test Mode: Set the EUT to maximum output power and maximum gain.

EUT Configuration: Refer to clause 4.4 in this report.

7.3.2 Test Setup



7.3.3 Test procedure

a) Connect a signal generator to the input of the EUT.

b) Configure the signal generator to transmit the AWGN signal.

c) Configure the signal amplitude to be just below the AGC threshold level (see 3.2), but not more than 0.5 dB below.

d) Connect a spectrum analyzer to the output of the EUT using appropriate attenuation.

e) Set the spectrum analyzer center frequency to the center frequency of the operational band under test. The span range of the spectrum analyzer shall be between 2 × to 5 × the emission bandwidth (EBW) or alternatively, the OBW.

f) The nominal RBW shall be in the range of 1 % to 5 % of the anticipated OBW, and the VBW shall be ⩾ 3 × RBW.

g) Set the reference level of the instrument as required to preclude the signal from exceeding the maximum spectrum analyzer input mixer level for linear operation. In general, the peak of the spectral envelope must be more than [10 log (OBW / RBW)] below the reference level.

Steps f) and g) may require iteration to enable adjustments within the specified tolerances.

h) The noise floor of the spectrum analyzer at the selected RBW shall be at least 36 dB below the reference level.

i) Set spectrum analyzer detection function to positive peak.

j) Set the trace mode to max hold.

k) Determine the reference value: Allow the trace to stabilize. Set the spectrum analyzer marker to the highest amplitude level of the displayed trace (this is the reference value) and record the associated frequency.

l) Place two markers, one at the lowest and the other at the highest frequency of the envelope of the spectral display, such that each marker is at or slightly below the −26 dB down amplitude. The 26 dB EBW (alternatively OBW) is the positive frequency difference between the two markers. If the spectral envelope crosses the −26 dB down amplitude at multiple points, the lowest or highest frequency shall be selected as the frequencies that are the furthest removed from the center frequency at which the spectral envelope crosses the −26 dB down amplitude point.

m) Repeat steps e) to l) with the input signal connected directly to the spectrum analyzer (i.e., input signal measurement).

n) Compare the spectral plot of the input signal (determined from step m) to the output signal (determined from step l) to affirm that they are similar (in passband and rolloff characteristic features and relative spectral locations), and include plot(s) and descriptions in test report.

o) Repeat the procedure [steps e) to n)] with the input signal amplitude set to 3 dB above the AGC threshold.

p) Repeat steps e) to o) with the signal generator set to the narrowband signal.

q) Repeat steps e) to p) for all frequency bands authorized for use by the EUT.

7.3.4 Measurement Record

Please refer to Appendix – Test data and result for report GZCR230300024902

7.4 Mean output power and amplifier/booster gain

Test Requirement: 47 CFR Part 27.50(c)

Test Method: KDB 935210 D05 clause 3.5

Limit: Fixed and base stations transmitting a signal with an emission bandwidth greater than 1 MHz must not exceed an ERP of 1000 watts/MHz and an antenna height of 305 m HAAT

7.4.1 E.U.T. Operation

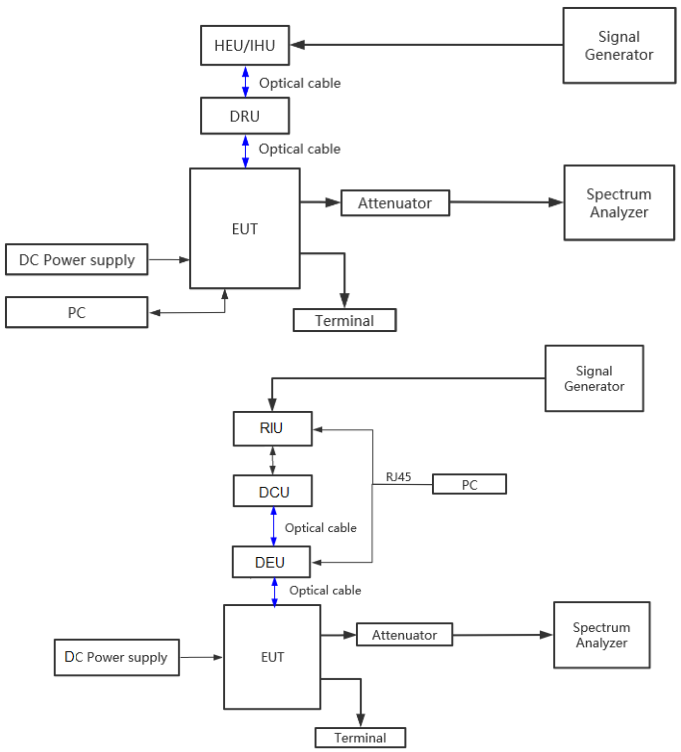
Operating Environment:

Temperature: 24.6 °C Humidity: 59 % RH Atmospheric Pressure: 1020 mbar

Test Mode: Set the EUT to maximum output power and maximum gain.

EUT Configuration: Refer to clause 4.4 in this report.

7.4.2 Test Setup



7.4.3 Test procedure

Test procedure of output power:

a) Connect a signal generator to the input of the EUT.

b) Configure to generate the AWGN (broadband) test signal.

c) The frequency of the signal generator shall be set to the frequency f0 as determined from 3.3.

d) Connect a spectrum analyzer or power meter to the output of the EUT using appropriate attenuation as necessary.

e) Set the signal generator output power to a level that produces an EUT output level that is just below the AGC threshold (see 3.2), but not more than 0.5 dB below.

f) Measure and record the output power of the EUT; use 3.5.3 or 3.5.4 for power measurement.

g) Remove the EUT from the measurement setup. Using the same signal generator settings, repeat the power measurement at the signal generator port, which was used as the input signal to the EUT, and record as the input power. EUT gain may be calculated as described in 3.5.5.

h) Repeat steps f) and g) with input signal amplitude set to 3 dB above the AGC threshold level.

i) Repeat steps e) to h) with the narrowband test signal.

j) Repeat steps e) to i) for all frequency bands authorized for use by the EUT.

1) Adjust the frequency of the input signals, either below or above the pass band, so that the lowest order intermodulation product is positioned in the centre of the pass band, according to clause 4.2.5.2.

2) Take the measurement of the rise of the output signal.

3) Repeat the measurement for the opposite path of the Repeater.

Calculating the mean gain:

After the mean input and output power levels have been measured as described in the preceding subclauses, the mean gain of the EUT can be determined from:

Gain (dB) = output power (dBm) − input power (dBm).

7.4.4 Measurement Record

Please refer to Appendix – Test data and result for report GZCR230300024902

7.5 Out-of-band/out-of-block (including intermodulation) emissions and spurious

Test Requirement: 47 CFR Part 27.53(g)

Test Method: KDB 935210 D05 clause 3.6

Limit: 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.
(reduce 3.01dB when on 2×2 MIMO mode)

7.5.1 E.U.T. Operation

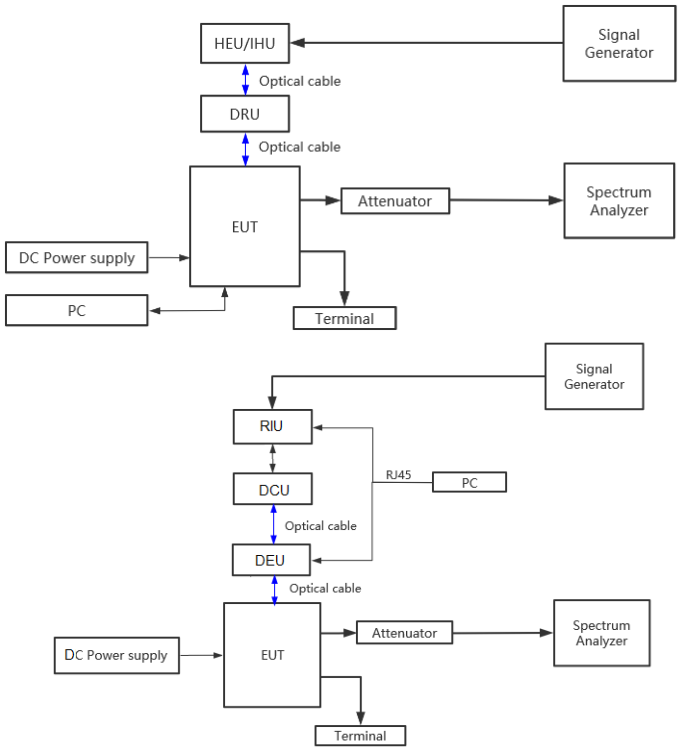
Operating Environment:

Temperature: 24.6 °C Humidity: 59 % RH Atmospheric Pressure: 1020 mbar

Test Mode: Set the EUT to maximum output power and maximum gain.

EUT Configuration: Refer to clause 4.4 in this report.

7.5.2 Test Setup



7.5.3 Test procedure

Test procedure of Out-of-band/out-of-block emissions:

a) Connect a signal generator to the input of the EUT.

If the signal generator is not capable of generating two modulated carriers simultaneously, then two discrete signal generators can be connected with an appropriate combining network to support this two-signal test.

b) Set the signal generator to produce two AWGN signals as previously described (e.g., 4.1 MHz OBW). Set the signal generator amplitudes so that the power from each into the EUT is equivalent.

c) Set the center frequencies such that the AWGN signals occupy adjacent channels, as defined by industry standards such as 3GPP or 3GPP2, at the upper edge of the frequency band or block under test.

d) Set the composite power levels such that the input signal is just below the AGC threshold (see 3.2), but not more than 0.5 dB below. The composite power can be measured using the procedures provided in KDB Publication 971168 [R8], but it will be necessary to expand the power integration bandwidth so as to include both of the transmit channels. Alternatively, the composite power can be measured using an average power meter as described in KDB Publication 971168 [R8].

e) Connect a spectrum analyzer to the output of the EUT using appropriate attenuation as necessary.

f) Set the RBW = reference bandwidth in the applicable rule section for the supported frequency band (typically 1 % of the EBW or 100 kHz or 1 MHz)

g) Set the VBW = 3 × RBW.

h) Set the detector to power averaging (rms) detector.

i) Set the Sweep time = auto-couple.

j) Set the spectrum analyzer start frequency to the upper block edge frequency, and the stop frequency to the upper block edge frequency plus 300 kHz or 3 MHz, for frequencies below and above 1 GHz, respectively.

k) Trace average at least 100 traces in power averaging (rms) mode.

l) Use the marker function to find the maximum power level

m) Capture the spectrum analyzer trace of the power level for inclusion in the test report.

n) Repeat steps k) to m) with the composite input power level set to 3 dB above the AGC threshold.

o) Reset the frequencies of the input signals to the lower edge of the frequency block or band under test.

p) Reset the spectrum analyzer start frequency to the lower block edge frequency minus 300 kHz or 3 MHz, for frequencies below and above 1 GHz, respectively, and the stop frequency to the lower band or block edge frequency.

q) Repeat steps k) to n).

r) Repeat steps a) to q) with the signal generator configured for a single test signal tuned as close as possible to the block edges.

s) Repeat steps a) to r) with the narrowband test signal.

t) Repeat steps a) to s) for all authorized frequency bands or blocks used by the EUT.

Test procedure of Spurious emissions

a) Connect a signal generator to the input of the EUT.

b) Set the signal generator to produce the broadband test signal as previously described (i.e., 4.1 MHz OBW AWGN).

c) Set the center frequency of the test signal to the lowest available channel within the frequency band or block.

d) Set the EUT input power to a level that is just below the AGC threshold (see 3.2), but not more than 0.5 dB below.

e) Connect a spectrum analyzer to the output of the EUT using appropriate attenuation as necessary.

f) Set the RBW = reference bandwidth in the applicable rule section for the supported frequency band of operation (e.g., reference bandwidth is typically 100 kHz or 1 MHz).

g) Set the VBW $\geqslant$ 3 $\times$ RBW.

h) Set the Sweep time = auto-couple.

i) Set the spectrum analyzer start frequency to the lowest RF 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.

The number of measurement points in each sweep must be $\geqslant$ (2 $\times$ span/RBW), which may require that the measurement range defined by the start and stop frequencies be subdivided, depending on the available number of measurement points provided by the spectrum analyzer.4

j) Select the power averaging (rms) detector function.

k) Trace average at least 10 traces in power averaging (rms) mode.

l) 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.

m) Reset the spectrum 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 spectrum analyzer stop frequency to 10 × the highest frequency of the fundamental emission (see Section 2.1057). 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 be subdivided, depending on the available number of measurement points provided by the spectrum analyzer.

n) Trace average at least 10 traces in power averaging (rms) mode.

o) 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; also provide tabular data, if required.

p) Repeat steps i) to o) with the input test signals firstly tuned to a middle band/block frequency/channel, and then tuned to a high band/block frequency/channel.

q) Repeat steps c) to p) with the narrowband test signal.

r) Repeat steps b) to q) for all authorized frequency bands/blocks used by the EUT.

7.5.4 Measurement Record

Please refer to Appendix – Test data and result for report GZCR230300024902

7.6 Frequency stability

Test Requirement: 47 CFR Part 27.54

Test Method: 47 CFR Part 2.1055

KDB 935210 D05 clause 3.7

ANSI C63.26-2015 clause 5.6

Limit: The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

7.6.1 E.U.T. Operation

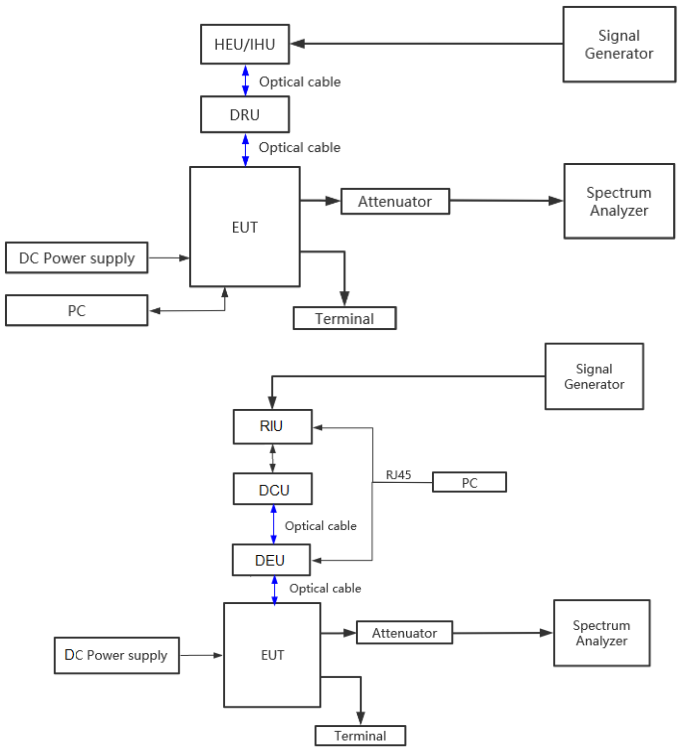
Operating Environment:

Temperature: 24.6 °C Humidity: 59 % RH Atmospheric Pressure: 1020 mbar

Test Mode: Set the EUT to maximum output power and maximum gain.

EUT Configuration: Refer to clause 4.4 in this report.

7.6.2 Test Setup



7.6.3 Test procedure

Frequency stability is a measure of the frequency drift due to temperature and supply voltage variations, with reference to the frequency measured at +20 °C and rated supply voltage.

The operating carrier frequency shall be set up in accordance with the manufacturer's published operation and instruction manual prior to the commencement of these tests. No adjustment of any frequency determining circuit element shall be made subsequent to this initial set-up. Frequency stability is tested:

a) At 10 °C intervals of temperatures between −30 °C and +50 °C at the manufacturer's rated supply voltage, and

b) At +20 °C temperature and ±15% supply voltage variations. If a product is specified to operate over a range of input voltage then the −15% variation is applied to the lowermost voltage and the +15% is applied to the uppermost voltage.

During the test all necessary settings, adjustments and control of the EUT have to be performed without disturbing the test environment, i.e., without opening the environmental chamber. The frequency stabilities can be maintained to a lesser temperature range provided that the transmitter is automatically inhibited from operating outside the lesser temperature range. For handheld equipment that is only capable of operating from internal batteries and the supply voltage cannot be varied, the frequency stability tests shall be performed at the nominal battery voltage and the battery end point voltage specified by the manufacturer. An external supply voltage can be used and set at the internal battery nominal voltage, and again at the battery operating end point voltage which shall be specified by the equipment manufacturer.

If an unmodulated carrier is not available, the mean frequency of a modulated carrier can be obtained by using a frequency counter with gating time set to an appropriately large multiple of bit periods (gating time depending on the required accuracy). Full details on the choice of values shall be included in the test report.

When performing frequency stability measurements on booster, the instability associated with the EUT must be isolated from any frequency instability associated with the measurement instrumentation. One method for realizing this isolation is to connect the reference clock input of the signal generator to the reference output of the frequency counter to confirm that any frequency instability is associated with the EUT, but is not due to differences between the reference oscillators internal to the measurement instrumentation.

7.6.4 Measurement Record

Please refer to Appendix – Test data and result for report GZCR230300024902

7.7 Radiated spurious emission

Test Requirement: 47 CFR Part 2.1053, 27.53(g)

Test Method: KDB 935210 D05 clause 3.7

ANSI C63.26-2015 clause 5.6

Limit: 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.

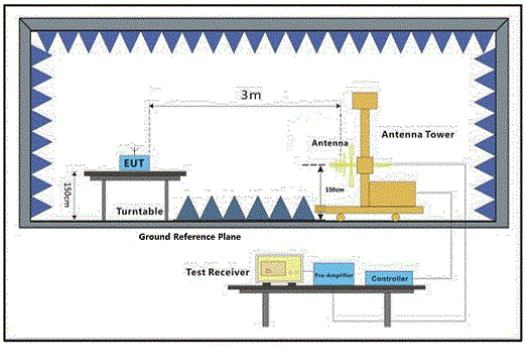
7.7.1 E.U.T. Operation

Operating Environment:

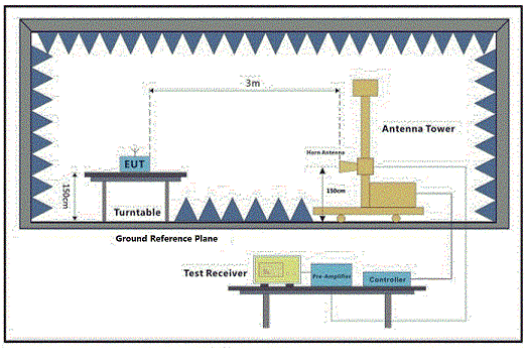
Temperature: 25.1 °C Humidity: 59 % RH Atmospheric Pressure: 1010 mbar

Test Mode: Set the EUT to maximum output power and maximum gain (activate MIMO mode simultaneously).

7.7.2 Test Setup



30MHz-1GHz



Above 1GHz

7.7.3 Test procedure

1. Scan from 30MHz to 12.75GHz, find the maximum radiation frequency to measure.
2. The technique used to find the Spurious Emissions of the transmitter was the antenna substitution method. Substitution method was performed to determine the actual ERP/EIRP emission levels of the EUT.

Below 1GHz test procedure as below:

1) The EUT was powered on and placed on a table in the chamber. The antenna of the transmitter was extended to its maximum length. modulation mode and the measuring receiver shall be tuned to the frequency of the transmitter under test.
2) Rotating through 360° the turntable. After the fundamental emission was maximized, a field strength measurement was made.
3) Steps 1) and 2) were performed with the EUT and the receive antenna in both vertical and horizontal polarization.
4) The transmitter was then removed and replaced with another antenna. The center of the antenna was approximately at the same location as the center of the transmitter.
5) A signal at the disturbance was fed to the substitution antenna by means of a non-radiating cable. With both the substitution and the receive antennas horizontally polarized, the receive antenna was raised and lowered to obtain a maximum reading at the test receiver. The level of the signal generator was adjusted until the measured field strength level in step 2) is obtained for this set of conditions.
6) The output power into the substitution antenna was then measured.
7) Steps 5) and 6)were repeated with both antennas vertically polarized.
8) Calculate power in dBm by the following formula:

Level (dBm) = Read Level (dBm) + Correction Factor (dB)

7.7.4 Measurement Record

Please refer to Appendix – Test data and result for report GZCR230300024902

8 Radio Spectrum Matter Test Result for Upper 700MHz

8.1 AGC Threshold level

Test Requirement: Not specified

Test Method: KDB 935210 D05 clause 3.2

Limit: No limit

8.1.1 E.U.T. Operation

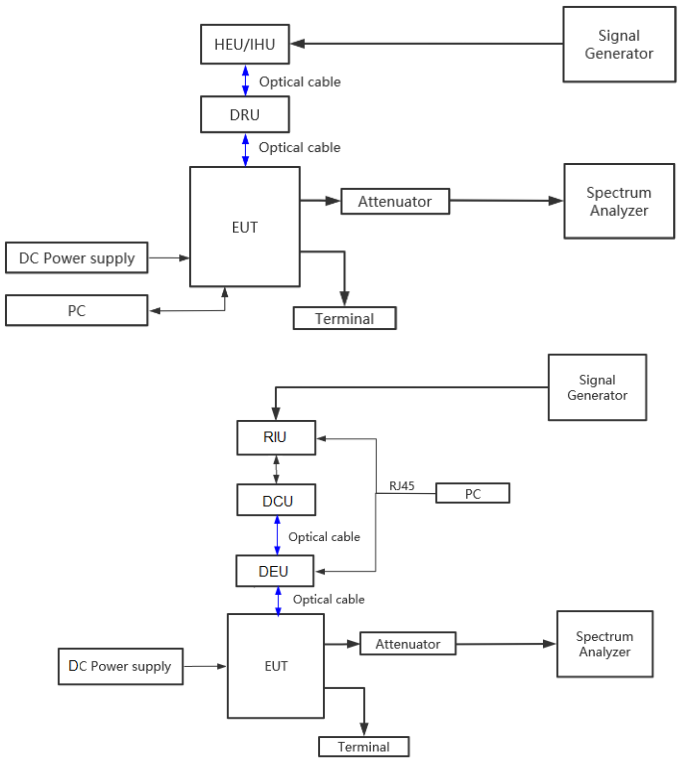
Operating Environment:

Temperature: 24.6 °C Humidity: 59 % RH Atmospheric Pressure: 1020 mbar

Test Mode: Set the EUT to maximum output power and maximum gain.

Test Configuration: Refer to clause 4.4 in this report.

8.1.2 Test Setup



8.1.3 Test Procedure

a) Connect a signal generator to the input of the EUT.

b) Connect a spectrum analyzer or power meter to the output of the EUT using appropriate attenuation as necessary.

c) The signal generator should initially be configured to produce either of the required test signals (i.e., broadband or narrowband).

d) Set the signal generator frequency to the center frequency of the EUT operating band.

e) While monitoring the output power of the EUT, measured using the methods of 3.5.3 or 3.5.4, increase the input level until a 1 dB increase in the input signal power no longer causes a 1 dB increase in the output signal power.

f) Record this level as the AGC threshold level.

g) Repeat the procedure with the remaining test signal

8.1.4 Measurement Record

Please refer to Appendix – Test data and result for report GZCR230300024902

8.2 Out-of-band rejection

Test Requirement: Not specified

Test Method: KDB 935210 D05 clause 3.3

Limit: No limit

8.2.1 E.U.T. Operation

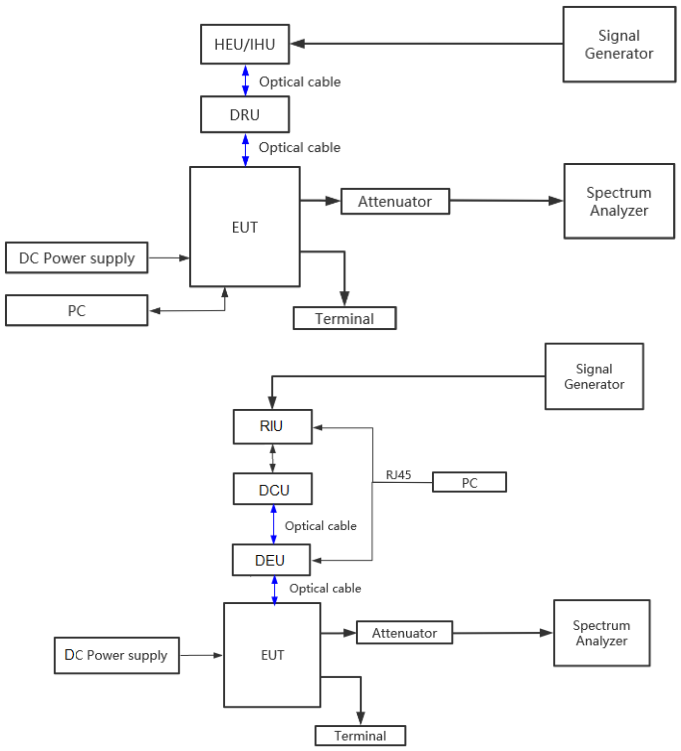
Operating Environment:

Temperature: 24.6 °C Humidity: 59 % RH Atmospheric Pressure: 1020 mbar

Test Mode: Set the EUT to maximum output power and maximum gain.

EUT Configuration: Refer to clause 4.4 in this report.

8.2.2 Test Setup



8.2.3 Test Procedure

a) Connect a signal generator to the input of the EUT.

b) Configure a swept CW signal with the following parameters:

1) Frequency range = ± 250 % of the passband, for each applicable CMRS band (see also KDB Publication 935210 D02 [R7] and KDB Publication 634817 [R5] about selection of frequencies for testing and for grant listings).

2) Level = a sufficient level to affirm that the out-of-band rejection is > 20 dB above the noise floor and will not engage the AGC during the entire sweep.

3) Dwell time = approximately 10 ms.

4) Number of points = SPAN/(RBW/2).

c) Connect a spectrum analyzer to the output of the EUT using appropriate attenuation.

d) Set the span of the spectrum analyzer to the same as the frequency range of the signal generator.

e) Set the resolution bandwidth (RBW) of the spectrum analyzer to be 1 % to 5 % of the EUT passband, and the video bandwidth (VBW) shall be set to ≥ 3 × RBW.

f) Set the detector to Peak Max-Hold and wait for the spectrum analyzer' s spectral display to fill.

g) Place a marker to the peak of the frequency response and record this frequency as f0.

h) Place two markers, one at the lowest and the other at the highest frequency of the envelope of the spectral display, such that each marker is at or slightly below the −20 dB down amplitude, to determine the 20 dB bandwidth.

i) Capture the frequency response of the EUT.

j) Repeat for all frequency bands applicable for use by the EUT.

8.2.4 Measurement Record

Please refer to Appendix – Test data and result for report GZCR230300024902

8.3 Input-versus-output signal comparison

Test Requirement: 47 CFR Part 2.1049

Test Method: KDB 935210 D05 clause 3.4

Limit: Compare the spectral plot of input signal to the output signal to affirm that they are similar

8.3.1 E.U.T. Operation

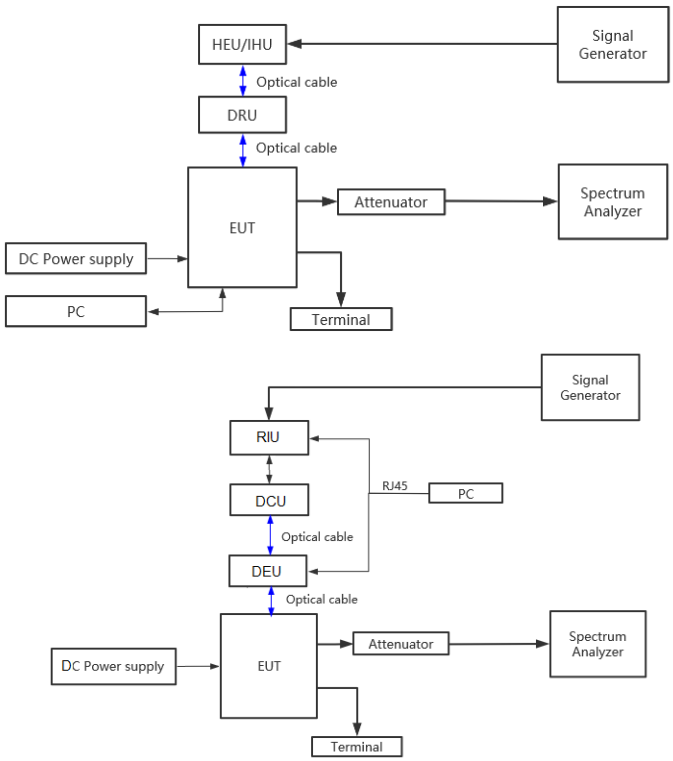
Operating Environment:

Temperature: 24.6 °C Humidity: 59 % RH Atmospheric Pressure: 1020 mbar

Test Mode: Set the EUT to maximum output power and maximum gain.

EUT Configuration: Refer to clause 4.4 in this report.

8.3.2 Test Setup



8.3.3 Test procedure

a) Connect a signal generator to the input of the EUT.

b) Configure the signal generator to transmit the AWGN signal.

c) Configure the signal amplitude to be just below the AGC threshold level (see 3.2), but not more than 0.5 dB below.

d) Connect a spectrum analyzer to the output of the EUT using appropriate attenuation.

e) Set the spectrum analyzer center frequency to the center frequency of the operational band under test. The span range of the spectrum analyzer shall be between 2 × to 5 × the emission bandwidth (EBW) or alternatively, the OBW.

f) The nominal RBW shall be in the range of 1 % to 5 % of the anticipated OBW, and the VBW shall be ⩾ 3 × RBW.

g) Set the reference level of the instrument as required to preclude the signal from exceeding the maximum spectrum analyzer input mixer level for linear operation. In general, the peak of the spectral envelope must be more than [10 log (OBW / RBW)] below the reference level.

Steps f) and g) may require iteration to enable adjustments within the specified tolerances.

h) The noise floor of the spectrum analyzer at the selected RBW shall be at least 36 dB below the reference level.

i) Set spectrum analyzer detection function to positive peak.

j) Set the trace mode to max hold.

k) Determine the reference value: Allow the trace to stabilize. Set the spectrum analyzer marker to the highest amplitude level of the displayed trace (this is the reference value) and record the associated frequency.

l) Place two markers, one at the lowest and the other at the highest frequency of the envelope of the spectral display, such that each marker is at or slightly below the −26 dB down amplitude. The 26 dB EBW (alternatively OBW) is the positive frequency difference between the two markers. If the spectral envelope crosses the −26 dB down amplitude at multiple points, the lowest or highest frequency shall be selected as the frequencies that are the furthest removed from the center frequency at which the spectral envelope crosses the −26 dB down amplitude point.

m) Repeat steps e) to l) with the input signal connected directly to the spectrum analyzer (i.e., input signal measurement).

n) Compare the spectral plot of the input signal (determined from step m) to the output signal (determined from step l) to affirm that they are similar (in passband and rolloff characteristic features and relative spectral locations), and include plot(s) and descriptions in test report.

o) Repeat the procedure [steps e) to n)] with the input signal amplitude set to 3 dB above the AGC threshold.

p) Repeat steps e) to o) with the signal generator set to the narrowband signal.

q) Repeat steps e) to p) for all frequency bands authorized for use by the EUT.

8.3.4 Measurement Record

Please refer to Appendix – Test data and result for report GZCR230300024902

8.4 Mean output power and amplifier/booster gain

Test Requirement: 47 CFR Part 27.50(b)

Test Method: KDB 935210 D05 clause 3.5

Limit: Fixed and base stations transmitting a signal in the 757-758 and 775-776 MHz bands must not exceed an effective radiated power (ERP) of 1000 watts and an antenna height of 305 m height above average terrain (HAAT)

8.4.1 E.U.T. Operation

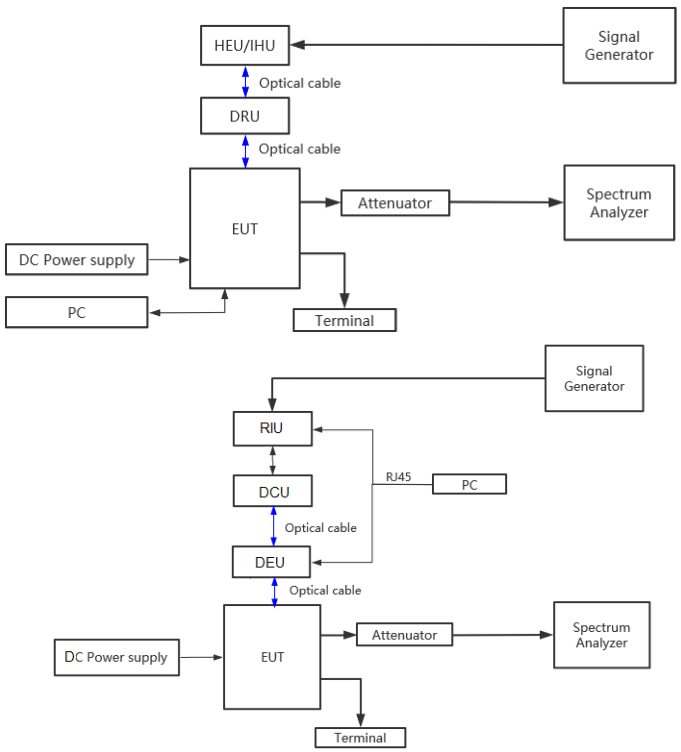
Operating Environment:

Temperature: 24.6 °C Humidity: 59 % RH Atmospheric Pressure: 1020 mbar

Test Mode: Set the EUT to maximum output power and maximum gain.

EUT Configuration: Refer to clause 4.4 in this report.

8.4.2 Test Setup



8.4.3 Test procedure

Test procedure of output power:

a) Connect a signal generator to the input of the EUT.

b) Configure to generate the AWGN (broadband) test signal.

c) The frequency of the signal generator shall be set to the frequency f0 as determined from 3.3.

d) Connect a spectrum analyzer or power meter to the output of the EUT using appropriate attenuation as necessary.

e) Set the signal generator output power to a level that produces an EUT output level that is just below the AGC threshold (see 3.2), but not more than 0.5 dB below.

f) Measure and record the output power of the EUT; use 3.5.3 or 3.5.4 for power measurement.

g) Remove the EUT from the measurement setup. Using the same signal generator settings, repeat the power measurement at the signal generator port, which was used as the input signal to the EUT, and record as the input power. EUT gain may be calculated as described in 3.5.5.

h) Repeat steps f) and g) with input signal amplitude set to 3 dB above the AGC threshold level.

i) Repeat steps e) to h) with the narrowband test signal.

j) Repeat steps e) to i) for all frequency bands authorized for use by the EUT.

1) Adjust the frequency of the input signals, either below or above the pass band, so that the lowest order intermodulation product is positioned in the centre of the pass band, according to clause 4.2.5.2.

2) Take the measurement of the rise of the output signal.

3) Repeat the measurement for the opposite path of the Repeater.

Calculating the mean gain:

After the mean input and output power levels have been measured as described in the preceding subclauses, the mean gain of the EUT can be determined from:

Gain (dB) = output power (dBm) − input power (dBm).

8.4.4 Measurement Record

Please refer to Appendix – Test data and result for report GZCR230300024902

8.5 Out-of-band/out-of-block (including intermodulation) emissions and spurious

Test Requirement: 47 CFR Part 27.53(c)

Test Method: KDB 935210 D05 clause 3.6

Limit: (1) On any frequency outside the 746-758 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least 43 + 10 log (P) dB;

(2) On any frequency outside the 776-788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least 43 + 10 log (P) dB;

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

(4) On all frequencies between 763-775 MHz and 793-805 MHz, by a factor not less than 65 + 10 log (P) dB in a 6.25 kHz band segment, for mobile and portable stations

(reduce 3.01dB when on 2×2 MIMO mode)

8.5.1 E.U.T. Operation

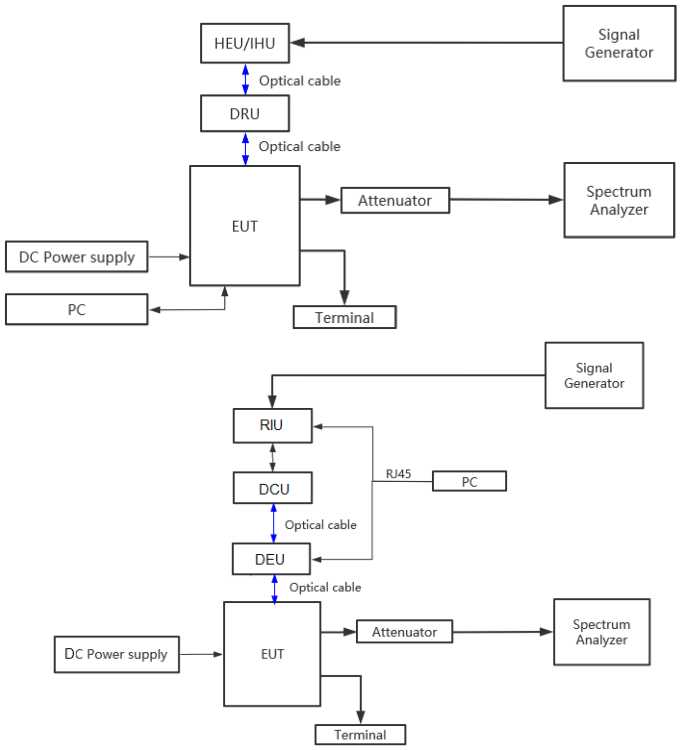
Operating Environment:

Temperature: 24.6 °C Humidity: 59 % RH Atmospheric Pressure: 1020 mbar

Test Mode: Set the EUT to maximum output power and maximum gain.

EUT Configuration: Refer to clause 4.4 in this report.

8.5.2 Test Setup



8.5.3 Test procedure

Test procedure of Out-of-band/out-of-block emissions:

a) Connect a signal generator to the input of the EUT.

If the signal generator is not capable of generating two modulated carriers simultaneously, then two discrete signal generators can be connected with an appropriate combining network to support this two-signal test.

b) Set the signal generator to produce two AWGN signals as previously described (e.g., 4.1 MHz OBW). Set the signal generator amplitudes so that the power from each into the EUT is equivalent.

c) Set the center frequencies such that the AWGN signals occupy adjacent channels, as defined by industry standards such as 3GPP or 3GPP2, at the upper edge of the frequency band or block under test.

d) Set the composite power levels such that the input signal is just below the AGC threshold (see 3.2), but not more than 0.5 dB below. The composite power can be measured using the procedures provided in KDB Publication 971168 [R8], but it will be necessary to expand the power integration bandwidth so as to include both of the transmit channels. Alternatively, the composite power can be measured using an average power meter as described in KDB Publication 971168 [R8].

e) Connect a spectrum analyzer to the output of the EUT using appropriate attenuation as necessary.

f) Set the RBW = reference bandwidth in the applicable rule section for the supported frequency band (typically 1 % of the EBW or 100 kHz or 1 MHz)

g) Set the VBW = 3 × RBW.

h) Set the detector to power averaging (rms) detector.

i) Set the Sweep time = auto-couple.

j) Set the spectrum analyzer start frequency to the upper block edge frequency, and the stop frequency to the upper block edge frequency plus 300 kHz or 3 MHz, for frequencies below and above 1 GHz, respectively.

k) Trace average at least 100 traces in power averaging (rms) mode.

l) Use the marker function to find the maximum power level

m) Capture the spectrum analyzer trace of the power level for inclusion in the test report.

n) Repeat steps k) to m) with the composite input power level set to 3 dB above the AGC threshold.

o) Reset the frequencies of the input signals to the lower edge of the frequency block or band under test.

p) Reset the spectrum analyzer start frequency to the lower block edge frequency minus 300 kHz or 3 MHz, for frequencies below and above 1 GHz, respectively, and the stop frequency to the lower band or block edge frequency.

q) Repeat steps k) to n).

r) Repeat steps a) to q) with the signal generator configured for a single test signal tuned as close as possible to the block edges.

s) Repeat steps a) to r) with the narrowband test signal.

t) Repeat steps a) to s) for all authorized frequency bands or blocks used by the EUT.

Test procedure of Spurious emissions

a) Connect a signal generator to the input of the EUT.

b) Set the signal generator to produce the broadband test signal as previously described (i.e., 4.1 MHz OBW AWGN).

c) Set the center frequency of the test signal to the lowest available channel within the frequency band or block.

d) Set the EUT input power to a level that is just below the AGC threshold (see 3.2), but not more than 0.5 dB below.

e) Connect a spectrum analyzer to the output of the EUT using appropriate attenuation as necessary.

f) Set the RBW = reference bandwidth in the applicable rule section for the supported frequency band of operation (e.g., reference bandwidth is typically 100 kHz or 1 MHz).

g) Set the VBW $\geqslant$ 3 $\times$ RBW.

h) Set the Sweep time = auto-couple.

i) Set the spectrum analyzer start frequency to the lowest RF 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.

The number of measurement points in each sweep must be $\geqslant$ (2 $\times$ span/RBW), which may require that the measurement range defined by the start and stop frequencies be subdivided, depending on the available number of measurement points provided by the spectrum analyzer.4

j) Select the power averaging (rms) detector function.

k) Trace average at least 10 traces in power averaging (rms) mode.

l) 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.

m) Reset the spectrum 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 spectrum analyzer stop frequency to 10 × the highest frequency of the fundamental emission (see Section 2.1057). 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 be subdivided, depending on the available number of measurement points provided by the spectrum analyzer.

n) Trace average at least 10 traces in power averaging (rms) mode.

o) 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; also provide tabular data, if required.

p) Repeat steps i) to o) with the input test signals firstly tuned to a middle band/block frequency/channel, and then tuned to a high band/block frequency/channel.

q) Repeat steps c) to p) with the narrowband test signal.

r) Repeat steps b) to q) for all authorized frequency bands/blocks used by the EUT.

8.5.4 Measurement Record

Please refer to Appendix – Test data and result for report GZCR230300024902

8.6 Frequency stability

Test Requirement: 47 CFR Part 27.54

Test Method: 47 CFR Part 2.1055

KDB 935210 D05 clause 3.7

ANSI C63.26-2015 clause 5.6

Limit: The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

8.6.1 E.U.T. Operation

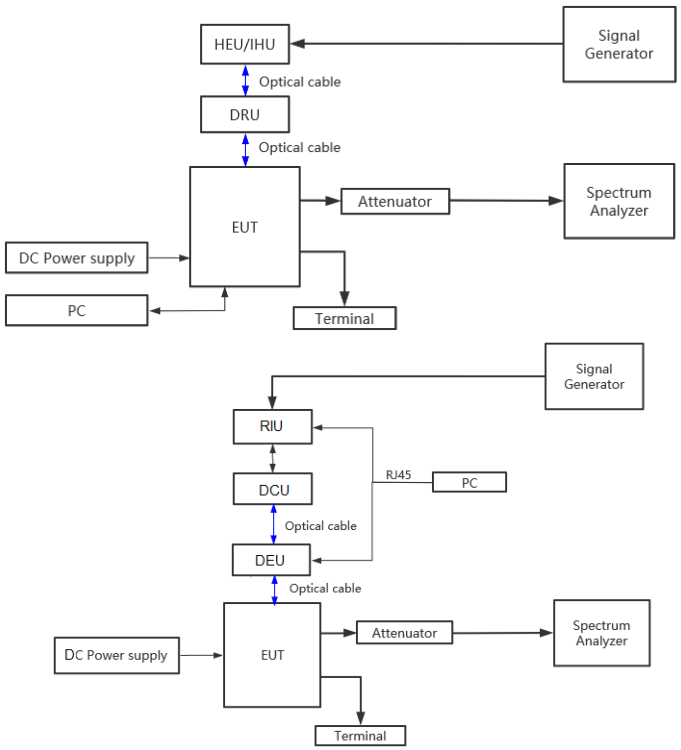
Operating Environment:

Temperature: 24.6 °C Humidity: 59 % RH Atmospheric Pressure: 1020 mbar

Test Mode: Set the EUT to maximum output power and maximum gain.

EUT Configuration: Refer to clause 4.4 in this report.

8.6.2 Test Setup



8.6.3 Test procedure

Frequency stability is a measure of the frequency drift due to temperature and supply voltage variations, with reference to the frequency measured at +20 °C and rated supply voltage.

The operating carrier frequency shall be set up in accordance with the manufacturer's published operation and instruction manual prior to the commencement of these tests. No adjustment of any frequency determining circuit element shall be made subsequent to this initial set-up. Frequency stability is tested:

a) At 10 °C intervals of temperatures between −30 °C and +50 °C at the manufacturer's rated supply voltage, and

b) At +20 °C temperature and ±15% supply voltage variations. If a product is specified to operate over a range of input voltage then the −15% variation is applied to the lowermost voltage and the +15% is applied to the uppermost voltage.

During the test all necessary settings, adjustments and control of the EUT have to be performed without disturbing the test environment, i.e., without opening the environmental chamber. The frequency stabilities can be maintained to a lesser temperature range provided that the transmitter is automatically inhibited from operating outside the lesser temperature range. For handheld equipment that is only capable of operating from internal batteries and the supply voltage cannot be varied, the frequency stability tests shall be performed at the nominal battery voltage and the battery end point voltage specified by the manufacturer. An external supply voltage can be used and set at the internal battery nominal voltage, and again at the battery operating end point voltage which shall be specified by the equipment manufacturer.

If an unmodulated carrier is not available, the mean frequency of a modulated carrier can be obtained by using a frequency counter with gating time set to an appropriately large multiple of bit periods (gating time depending on the required accuracy). Full details on the choice of values shall be included in the test report.

When performing frequency stability measurements on booster, the instability associated with the EUT must be isolated from any frequency instability associated with the measurement instrumentation. One method for realizing this isolation is to connect the reference clock input of the signal generator to the reference output of the frequency counter to confirm that any frequency instability is associated with the EUT, but is not due to differences between the reference oscillators internal to the measurement instrumentation.

8.6.4 Measurement Record

Please refer to Appendix – Test data and result for report GZCR230300024902

8.7 Radiated spurious emission

Test Requirement: 47 CFR Part 2.1053, 27.53(c), 53(f)

Test Method: KDB 935210 D05 clause 3.7

ANSI C63.26-2015 clause 5.6

Limit: (1) On any frequency outside the 746-758 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least 43 + 10 log (P) dB;

(2) On any frequency outside the 776-788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least 43 + 10 log (P) dB;

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

(4) On all frequencies between 763-775 MHz and 793-805 MHz, by a factor not less than 65 + 10 log (P) dB in a 6.25 kHz band segment, for mobile and portable stations

(5) emissions in the band 1559-1610 MHz shall be limited to −70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and −80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth.

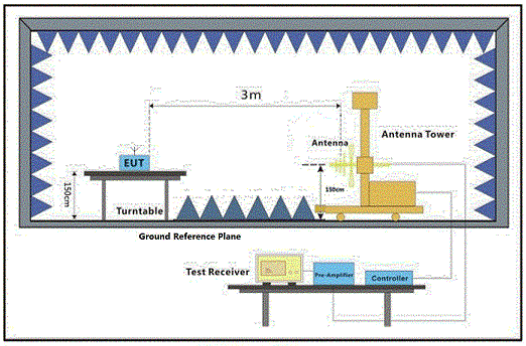
8.7.1 E.U.T. Operation

Operating Environment:

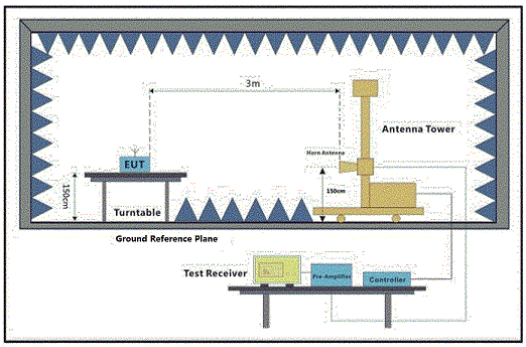
Temperature: 25.1 °C Humidity: 59 % RH Atmospheric Pressure: 1010 mbar

Test Mode: Set the EUT to maximum output power and maximum gain (activate MIMO mode simultaneously).

8.7.2 Test Setup



30MHz-1GHz



Above 1GHz

8.7.3 Test procedure

1. Scan from 30MHz to 12.75GHz, find the maximum radiation frequency to measure.
2. The technique used to find the Spurious Emissions of the transmitter was the antenna substitution method. Substitution method was performed to determine the actual ERP/EIRP emission levels of the EUT.

Below 1GHz test procedure as below:

1) The EUT was powered on and placed on a table in the chamber. The antenna of the transmitter was extended to its maximum length. modulation mode and the measuring receiver shall be tuned to the frequency of the transmitter under test.
2) Rotating through 360° the turntable. After the fundamental emission was maximized, a field strength measurement was made.
3) Steps 1) and 2) were performed with the EUT and the receive antenna in both vertical and horizontal polarization.
4) The transmitter was then removed and replaced with another antenna. The center of the antenna was approximately at the same location as the center of the transmitter.
5) A signal at the disturbance was fed to the substitution antenna by means of a non-radiating cable. With both the substitution and the receive antennas horizontally polarized, the receive antenna was raised and lowered to obtain a maximum reading at the test receiver. The level of the signal generator was adjusted until the measured field strength level in step 2) is obtained for this set of conditions.
6) The output power into the substitution antenna was then measured.
7) Steps 5) and 6)were repeated with both antennas vertically polarized.
8) Calculate power in dBm by the following formula:

Level (dBm) = Read Level (dBm) + Correction Factor (dB)

8.7.4 Measurement Record

Please refer to Appendix – Test data and result for report GZCR230300024902

9 Radio Spectrum Matter Test Result for FirstNet

9.1 AGC Threshold level

Test Requirement: Not specified

Test Method: KDB 935210 D05 clause 4.2

Limit: No limit

9.1.1 E.U.T. Operation

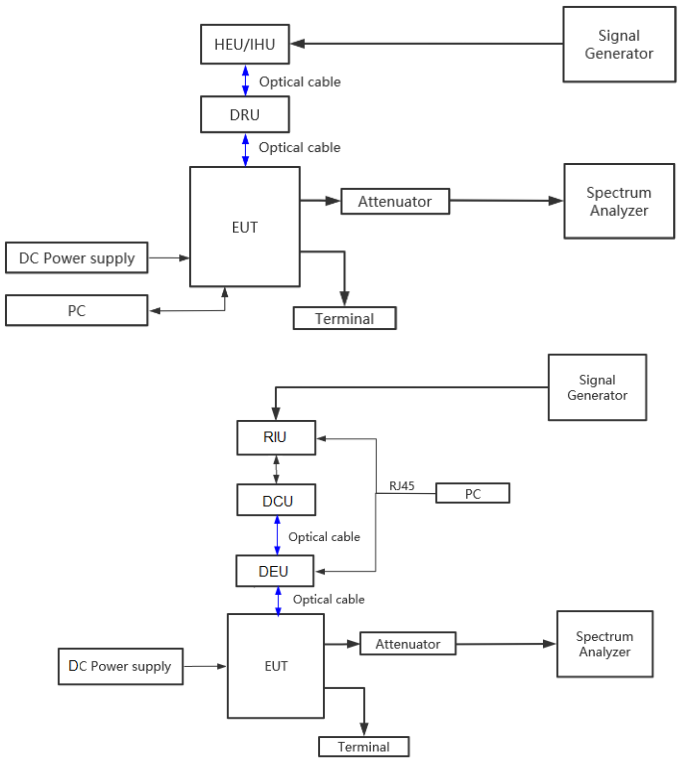
Operating Environment:

Temperature: 24.6 °C Humidity: 59 % RH Atmospheric Pressure: 1020 mbar

Test Mode: Set the EUT to maximum output power and maximum gain.

Test Configuration: Refer to clause 4.4 in this report.

9.1.2 Test Setup



9.1.3 Test Procedure

a) Connect a signal generator to the input of the EUT.

b) Connect a spectrum analyzer or power meter to the output of the EUT using appropriate attenuation as necessary.

c) The signal generator should initially be configured to produce either of the required test signals (i.e., broadband or narrowband).

d) Set the signal generator frequency to the center frequency of the EUT operating band.

e) While monitoring the output power of the EUT, measured using the methods of 3.5.3 or 3.5.4, increase the input level until a 1 dB increase in the input signal power no longer causes a 1 dB increase in the output signal power.

f) Record this level as the AGC threshold level.

g) Repeat the procedure with the remaining test signal

9.1.4 Measurement Record

Please refer to Appendix – Test data and result for report GZCR230300024902

9.2 Out-of-band rejection

Test Requirement: Not specified

Test Method: KDB 935210 D05 clause 4.3

Limit: No limit

9.2.1 E.U.T. Operation

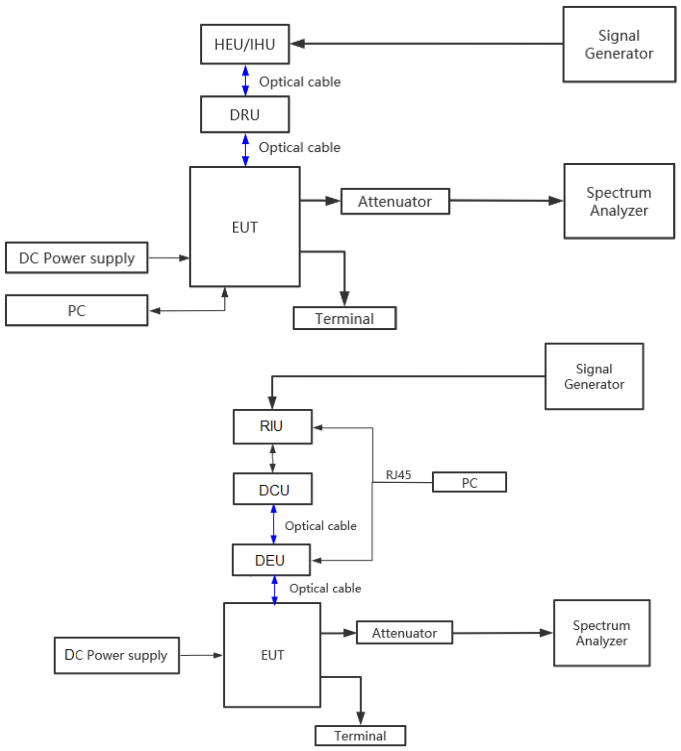
Operating Environment:

Temperature: 24.6 °C Humidity: 59 % RH Atmospheric Pressure: 1020 mbar

Test Mode: Set the EUT to maximum output power and maximum gain.

EUT Configuration: Refer to clause 4.4 in this report.

9.2.2 Test Setup



9.2.3 Test Procedure

a) Connect a signal generator to the input of the EUT.

b) Configure a swept CW signal with the following parameters:

1) Frequency range = ± 250 % of the manufacturer’ s specified pass band.

2) The CW amplitude shall be 3 dB below the AGC threshold (see 4.2), and shall not activate the AGC threshold throughout the test.

3) Dwell time = approximately 10 ms.

4) Frequency step = 50 kHz.

c) Connect a spectrum analyzer to the output of the EUT using appropriate attenuation.

d) Set the RBW of the spectrum analyzer to between 1 % and 5 % of the manufacturer’ s rated passband, and VBW = 3 × RBW.

e) Set the detector to Peak and the trace to Max-Hold.

f) After the trace is completely filled, place a marker at the peak amplitude, which is designated as f0, and with two additional markers (use the marker-delta method) at the 20 dB bandwidth (i.e., at the points where the level has fallen by 20 dB).

g) Capture the frequency response plot for inclusion in the test report.

9.2.4 Measurement Record

Please refer to Appendix – Test data and result for report GZCR230300024902

9.3 Input-versus-output signal comparison

Test Requirement: 47 CFR Part 90.210, 90.219(e)(4)

Test Method: KDB 935210 D05 clause 4.4

Limit: Compare the spectral plot of input signal to the output signal to affirm that they are similar.

90.210

Compliance with the emission mask stated in 90.210

Frequency band (MHz)	Mask for equipment with audio low pass filter	Mask for equipment without audio low pass filter
Below 25[1]	A or B	A or C
25-50	B	C
72-76	B	C
150-174[2]	B, D, or E	C, D or E
150 paging only	B	C
220-222	F	F
421-512[2 5]	B, D, or E	C, D, or E
450 paging only	B	G
806-809/851-854[6]	B	H
809-824/854-869[35]	B, D	D, G.
896-901/935-940	I	J
902-928	K	K
929-930	B	G
4940-4990 MHz	L or M	L or M
5850-5925[4]		
All other bands	B	C

The EUT is with audio low pass filter, which must comply with the emission mask B.

Emission Mask B. For transmitters that are equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power (P) as follows:

(1) On any frequency removed from the assigned frequency by more than 50 percent, but not more than 100 percent of the authorized bandwidth: At least 25 dB.

(2) On any frequency removed from the assigned frequency by more than 100 percent, but not more than 250 percent of the authorized bandwidth: At least 35 dB.

(3) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least 43 + 10 log (P) dB.

90.219(e)(4)

A signal booster must be designed such that all signals that it retransmits meet the following requirements:

(i) The signals are retransmitted on the same channels as received. Minor departures from the exact provider or reference frequencies of the input signals are allowed, provided that the retransmitted signals meet the requirements of §90.213.

(ii) There is no change in the occupied bandwidth of the retransmitted signals.

(iii) The retransmitted signals continue to meet the unwanted emissions limits of §90.210 applicable to the corresponding received signals (assuming that these received signals meet the applicable unwanted emissions limits by a reasonable margin)

9.3.1 E.U.T. Operation

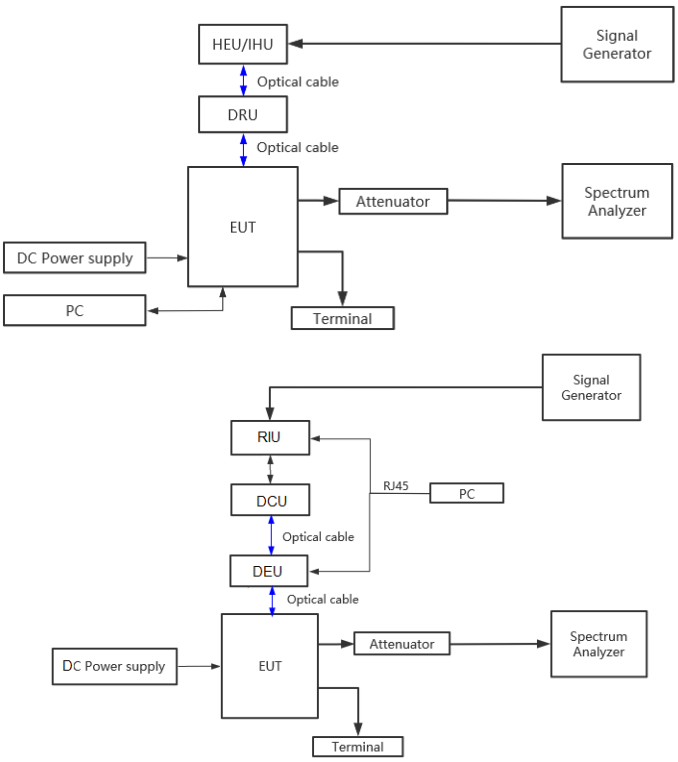
Operating Environment:

Temperature: 24.6 °C Humidity: 59 % RH Atmospheric Pressure: 1020 mbar

Test Mode: Set the EUT to maximum output power and maximum gain.

EUT Configuration: Refer to clause 4.4 in this report.

9.3.2 Test Setup



9.3.3 Test procedure

Test procedure of emission mask:

a) Connect a signal generator to the input of the EUT.

b) Configure the signal generator to transmit the appropriate test signal associated with the public safety emission designation (see Table 1).

c) Configure the signal level to be just below the AGC threshold (see results from 4.2).

d) Connect a spectrum analyzer to the output of the EUT using appropriate attenuation as necessary.

e) Set the spectrum analyzer center frequency to the nominal EUT channel center frequency. The span range for the spectrum analyzer shall be between 2 × to 5 × the EBW (or OBW).

f) The nominal RBW shall be 300 Hz for 16K0F3E, and 100 Hz for all other emissions types.

g) Set the reference level of the spectrum analyzer to accommodate the maximum input amplitude level, i.e., the level at f0 per 4.3.

h) Set spectrum analyzer detection mode to peak, and trace mode to max hold.

i) Allow the trace to fully stabilize.

j) Confirm that the signal is contained within the appropriate emissions mask.

k) Use the marker function to determine the maximum emission level and record the associated frequency.

l) Capture the emissions mask plot for inclusion in the test report (output signal spectra).

m) Measure the EUT input signal power (signal generator output signal) directly from the signal generator using power measurement guidance provided in KDB Publication 971168 [R8] (input signal spectra).

n) Compare the spectral plot of the output signal (determined in step k), to the input signal (determined in step l) to affirm they are similar (in passband and rolloff characteristic features and relative spectral locations).

o) Repeat steps d) to n) with the input signal amplitude set 3 dB above the AGC threshold.

p) Repeat steps b) to o) for all authorized operational bands and emissions types (see applicable regulatory specifications, e.g., Section 90.210).

q) Include all accumulated spectral plots depicting EUT input signal and EUT output signal in the test report, and note any observed dissimilarities.

Test procedure of occupied bandwidth:

a) Connect a signal generator to the input of the EUT.

b) Configure the signal generator to transmit the AWGN signal.

c) Configure the signal amplitude to be just below the AGC threshold level (see 3.2), but not more than 0.5 dB below.

d) Connect a spectrum analyzer to the output of the EUT using appropriate attenuation.

e) Set the spectrum analyzer center frequency to the center frequency of the operational band under test. The span range of the spectrum analyzer shall be between 2 × to 5 × the emission bandwidth (EBW) or alternatively, the OBW.

f) The nominal RBW shall be in the range of 1 % to 5 % of the anticipated OBW, and the VBW shall be ⩾ 3 × RBW.

g) Set the reference level of the instrument as required to preclude the signal from exceeding the maximum spectrum analyzer input mixer level for linear operation. In general, the peak of the spectral envelope must be more than [10 log (OBW / RBW)] below the reference level.

Steps f) and g) may require iteration to enable adjustments within the specified tolerances.

h) The noise floor of the spectrum analyzer at the selected RBW shall be at least 36 dB below the reference level.

i) Set spectrum analyzer detection function to positive peak.

j) Set the trace mode to max hold.

k) Determine the reference value: Allow the trace to stabilize. Set the spectrum analyzer marker to the highest amplitude level of the displayed trace (this is the reference value) and record the associated frequency.

l) Place two markers, one at the lowest and the other at the highest frequency of the envelope of the spectral display, such that each marker is at or slightly below the −26 dB down amplitude. The 26 dB EBW (alternatively OBW) is the positive frequency difference between the two markers. If the spectral envelope crosses the −26 dB down amplitude at multiple points, the lowest or highest frequency shall be selected as the frequencies that are the furthest removed from the center frequency at which the spectral envelope crosses the −26 dB down amplitude point.

m) Repeat steps e) to l) with the input signal connected directly to the spectrum analyzer (i.e., input signal measurement).

n) Compare the spectral plot of the input signal (determined from step m) to the output signal (determined from step l) to affirm that they are similar (in passband and rolloff characteristic features and relative spectral locations), and include plot(s) and descriptions in test report.

o) Repeat the procedure [steps e) to n)] with the input signal amplitude set to 3 dB above the AGC threshold.

p) Repeat steps e) to o) with the signal generator set to the narrowband signal.

q) Repeat steps e) to p) for all frequency bands authorized for use by the EUT.

9.3.4 Measurement Record

Please refer to Appendix – Test data and result for report GZCR230300024902

9.4 Input/output power and amplifier/booster gain

Test Requirement: 47 CFR Part 90.219(e)(1)

Test Method: KDB 935210 D05 clause 4.5

Limit: The output power capability of a signal booster must be designed for deployments providing a radiated power not exceeding 5 Watts ERP for each retransmitted channel.

9.4.1 E.U.T. Operation

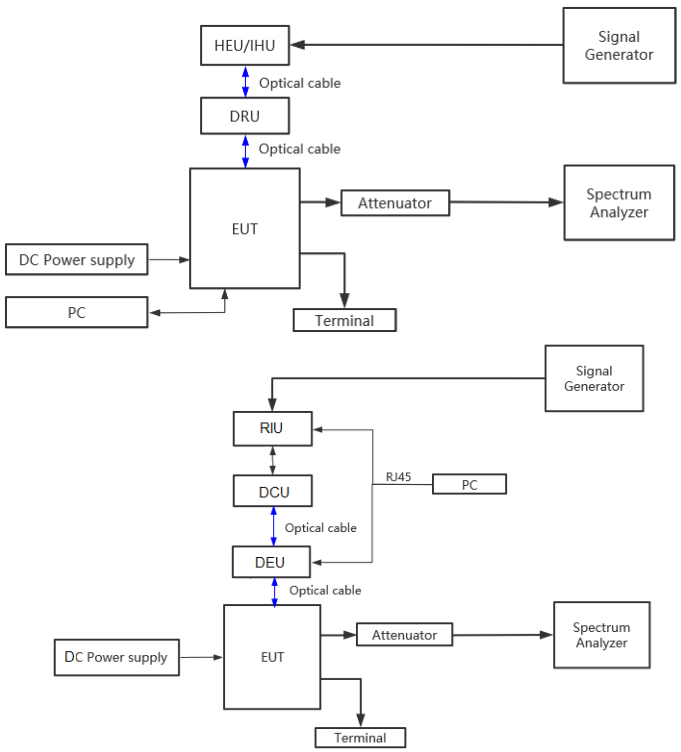
Operating Environment:

Temperature: 24.6 °C Humidity: 59 % RH Atmospheric Pressure: 1020 mbar

Test Mode: Set the EUT to maximum output power and maximum gain.

EUT Configuration: Refer to clause 4.4 in this report.

9.4.2 Test Setup



9.4.3 Test procedure

Test procedure of output power:

a) Connect a signal generator to the input of the EUT.

b) Configure to generate the AWGN (broadband) test signal.

c) The frequency of the signal generator shall be set to the frequency f0 as determined from 3.3.

d) Connect a spectrum analyzer or power meter to the output of the EUT using appropriate attenuation as necessary.

e) Set the signal generator output power to a level that produces an EUT output level that is just below the AGC threshold (see 3.2), but not more than 0.5 dB below.

f) Measure and record the output power of the EUT; use 3.5.3 or 3.5.4 for power measurement.

g) Remove the EUT from the measurement setup. Using the same signal generator settings, repeat the power measurement at the signal generator port, which was used as the input signal to the EUT, and record as the input power. EUT gain may be calculated as described in 3.5.5.

h) Repeat steps f) and g) with input signal amplitude set to 3 dB above the AGC threshold level.

i) Repeat steps e) to h) with the narrowband test signal.

j) Repeat steps e) to i) for all frequency bands authorized for use by the EUT.

1) Adjust the frequency of the input signals, either below or above the pass band, so that the lowest order intermodulation product is positioned in the centre of the pass band, according to clause 4.2.5.2.

2) Take the measurement of the rise of the output signal.

3) Repeat the measurement for the opposite path of the Repeater.

Calculating the mean gain:

After the mean input and output power levels have been measured as described in the preceding subclauses, the mean gain of the EUT can be determined from:

Gain (dB) = output power (dBm) − input power (dBm).

9.4.4 Measurement Record

Please refer to Appendix – Test data and result for report GZCR230300024902

9.5 Noise Figure

Test Requirement: 47 CFR Part 90.219(e)(2)

Test Method: KDB 935210 D05 clause 4.6

Limit: The noise figure of a signal booster must not exceed 9 dB in either direction

9.5.1 E.U.T. Operation

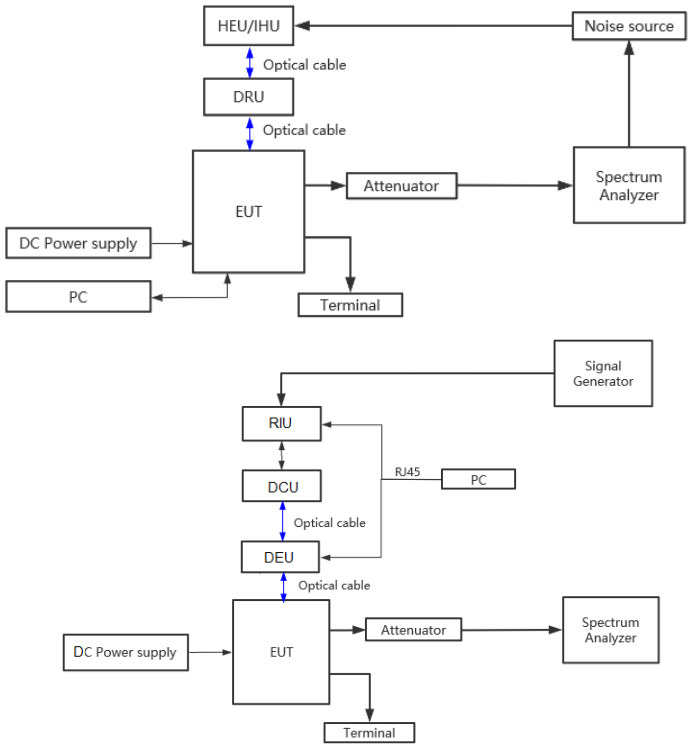
Operating Environment:

Temperature: 24.6 °C Humidity: 59 % RH Atmospheric Pressure: 1020 mbar

Test Mode: Set the EUT to maximum output power and maximum gain.

EUT Configuration: Refer to clause 4.4 in this report.

9.5.2 Test Setup



9.5.3 Test procedure

Several widely recognized methods for performing noise figure measurements are available. Some require the use of specialized equipment, such as a noise figure analyzer and/or an excess noise ratio (ENR) calibrated noise source, while others involve the use of conventional measurement instrumentation such as a spectrum analyzer. Methods that require use of a noise figure analyzer are generally accepted as producing the most accurate results, and are considered to be the reference method within this document, while others are considered to be acceptable alternative methods. Consult the relevant instrumentation application notes for detailed guidance regarding the selection and application of an appropriate methodology for performing noise figure measurements. Note also that noise figure measurements require that any AGC circuitry be disabled over the duration of the measurement.

9.5.4 Measurement Record

Please refer to Appendix – Test data and result for report GZCR230300024902

9.6 Out-of-band/out-of-block (including intermodulation) emissions and spurious

Test Requirement: 47 CFR Part 90.219(e)(3), 90.543(c), 90.543(e)

Test Method: KDB 935210 D05 clause 4.7

Limit: *90.543(c)*

Out-of-band emission limit. On any frequency outside of the frequency ranges covered by the ACP tables in this section, the power of any emission must be reduced below the mean output power (P) by at least 43 + 10log (P) dB measured in a 100 kHz bandwidth for frequencies less than 1 GHz, and in a 1 MHz bandwidth for frequencies greater than 1 GHz.

90.543(e)

For operations in the 758-768 MHz and the 788-798 MHz bands, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

(1) On all frequencies between 769-775 MHz and 799-805 MHz, by a factor not less than 76 + 10 log (P) dB in a 6.25 kHz band segment, for base and fixed stations.

(2) On all frequencies between 769-775 MHz and 799-805 MHz, by a factor not less than 65 + 10 log (P) dB in a 6.25 kHz band segment, for mobile and portable stations.

(3) On any frequency between 775-788 MHz, above 805 MHz, and below 758 MHz, by at least 43 + 10 log (P) dB.

90.219 (e)(3)

Spurious emissions from a signal booster must not exceed −13 dBm within any 100 kHz measurement bandwidth.

9.6.1 E.U.T. Operation

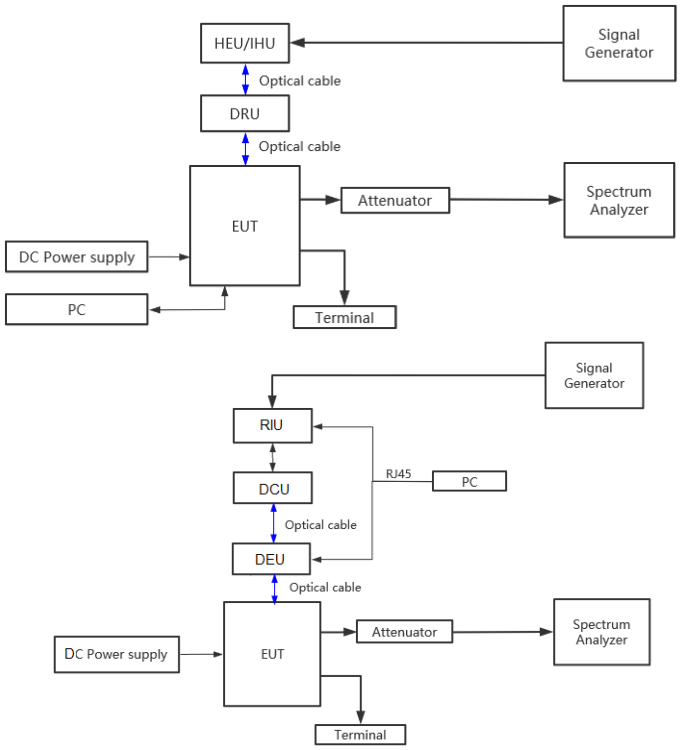
Operating Environment:

Temperature: 24.6 °C Humidity: 59 % RH Atmospheric Pressure: 1020 mbar

Test Mode: Set the EUT to maximum output power and maximum gain.

EUT Configuration: Refer to clause 4.4 in this report.

9.6.2 Test Setup



9.6.3 Test procedure

Test procedure of Out-of-band/out-of-block emissions:

a) Connect a signal generator to the input of the EUT.

If the signal generator is not capable of producing two independent modulated carriers simultaneously, then two discrete signal generators can be connected, with an appropriate combining network to support the two-signal test.

b) Configure the two signal generators to produce CW on frequencies spaced consistent with 4.7.1, with amplitude levels set to just below the AGC threshold (see 4.2). Set the signal generator amplitudes so that the power from each into the EUT is equivalent.

c) Connect a spectrum analyzer to the EUT output.

d) Set the span to 100 kHz.

e) Set RBW = 300 Hz with VBW ⩾ 3 × RBW.

f) Set the detector to power averaging (rms).

g) Place a marker on highest intermodulation product amplitude.

h) Capture the plot for inclusion in the test report.

i) Repeat steps c) to h) with the composite input power level set to 3 dB above the AGC threshold.

j) Repeat steps b) to i) for all operational bands.

Test procedure of Spurious emissions

a) Connect a signal generator to the input of the EUT.

b) Configure the signal generator to produce a CW signal.

c) Set the frequency of the CW signal to the center channel of the EUT passband.

d) Set the output power level so that the resultant signal is just below the AGC threshold (see 4.2).

e) Connect a spectrum analyzer to the output of the EUT, using appropriate attenuation as necessary.

f) Set the RBW = 100 kHz. (i.e., for 30 MHz to 1 GHz PLMRS and/or PSRS booster devices)

g) Set the VBW = 3 × RBW.

h) Set the Sweep time = auto-couple.

i) Set the detector to PEAK.

j) Set the spectrum analyzer start frequency to 30 MHz (or the lowest radio frequency signal generated in the EUT, without going below 9 kHz if the EUT has additional internal clock frequencies), and the stop frequency to 10 × the highest allowable frequency of the EUT passband.

k) Select MAX HOLD, and use the marker peak function to find the highest emission(s) outside the passband. (This could be either at a frequency lesser or greater than the passband frequencies.)

l) Capture a plot for inclusion in the test report.

m) Repeat steps c) to l) for each authorized frequency band/block of operation.

9.6.4 Measurement Record

Please refer to Appendix – Test data and result for report GZCR230300024902

9.7 Frequency stability

Test Requirement: 47 CFR Part 90.539

Test Method: 47 CFR Part 2.1055

KDB 935210 D05 clause 4.8

ANSI C63.26-2015 clause 5.6

Limit: The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

9.7.1 E.U.T. Operation

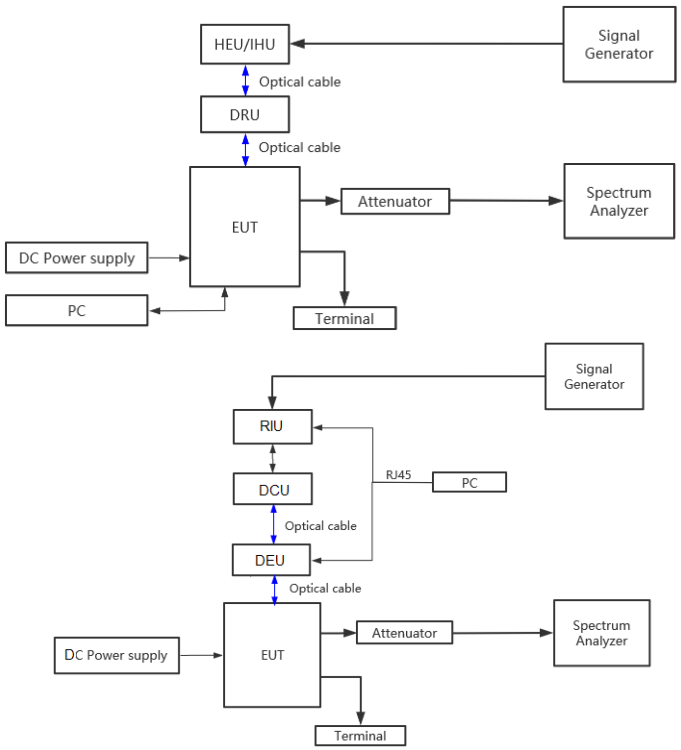
Operating Environment:

Temperature: 24.6 °C Humidity: 59 % RH Atmospheric Pressure: 1020 mbar

Test Mode: Set the EUT to maximum output power and maximum gain.

EUT Configuration: Refer to clause 4.4 in this report.

9.7.2 Test Setup



9.7.3 Test procedure

Frequency stability is a measure of the frequency drift due to temperature and supply voltage variations, with reference to the frequency measured at +20 °C and rated supply voltage.

The operating carrier frequency shall be set up in accordance with the manufacturer's published operation and instruction manual prior to the commencement of these tests. No adjustment of any frequency determining circuit element shall be made subsequent to this initial set-up. Frequency stability is tested:

a) At 10 °C intervals of temperatures between −30 °C and +50 °C at the manufacturer's rated supply voltage, and

b) At +20 °C temperature and ±15% supply voltage variations. If a product is specified to operate over a range of input voltage then the −15% variation is applied to the lowermost voltage and the +15% is applied to the uppermost voltage.

During the test all necessary settings, adjustments and control of the EUT have to be performed without disturbing the test environment, i.e., without opening the environmental chamber. The frequency stabilities can be maintained to a lesser temperature range provided that the transmitter is automatically inhibited from operating outside the lesser temperature range. For handheld equipment that is only capable of operating from internal batteries and the supply voltage cannot be varied, the frequency stability tests shall be performed at the nominal battery voltage and the battery end point voltage specified by the manufacturer. An external supply voltage can be used and set at the internal battery nominal voltage, and again at the battery operating end point voltage which shall be specified by the equipment manufacturer.

If an unmodulated carrier is not available, the mean frequency of a modulated carrier can be obtained by using a frequency counter with gating time set to an appropriately large multiple of bit periods (gating time depending on the required accuracy). Full details on the choice of values shall be included in the test report.

When performing frequency stability measurements on booster, the instability associated with the EUT must be isolated from any frequency instability associated with the measurement instrumentation. One method for realizing this isolation is to connect the reference clock input of the signal generator to the reference output of the frequency counter to confirm that any frequency instability is associated with the EUT, but is not due to differences between the reference oscillators internal to the measurement instrumentation.

9.7.4 Measurement Record

Please refer to Appendix – Test data and result for report GZCR230300024902

9.8 Noise/emission at antenna terminal

Test Requirement: 47 CFR Part 2.1051, 90.219(d)(6)

Test Method: KDB 935210 D05 clause 4.7

Limit: Good engineering practice must be used in regard to the radiation of intermodulation products and noise, such that interference to licensed communications systems is avoided. In the event of harmful interference caused by any given deployment, the FCC may require additional attenuation or filtering of the emissions and/or noise from signal boosters or signal booster systems, as necessary to eliminate the interference.

(i) In general, the ERP of intermodulation products should not exceed −30 dBm in 10 kHz measurement bandwidth.

(ii) In general, the ERP of noise within the passband should not exceed −43 dBm in 10 kHz measurement bandwidth.

(iii) In general, the ERP of noise on spectrum more than 1 MHz outside of the passband should not exceed −70 dBm in a 10 kHz measurement bandwidth.

9.8.1 E.U.T. Operation

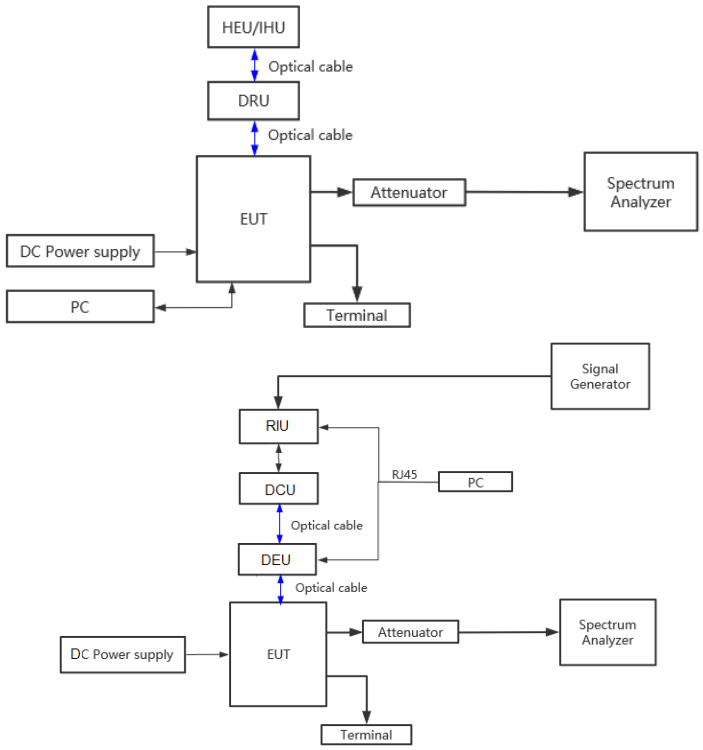
Operating Environment:

Temperature: 24.6 °C Humidity: 59 % RH Atmospheric Pressure: 1020 mbar

Test Mode: Set the EUT to maximum output power and maximum gain.

EUT Configuration: Refer to clause 4.4 in this report.

9.8.2 Test Setup



9.8.3 Test procedure

a) Connect a spectrum analyzer to the output of the EUT.

f) Set the RBW = 10 kHz

g) Set the VBW = 10 kHz.

h) Set the Sweep time = auto-couple.

i) Set the detector to PEAK.

j) Set the spectrum analyzer start frequency to 30 MHz and the stop frequency to 10 × the highest allowable frequency of the EUT passband.

k) Select MAX HOLD, and use the marker peak function to find the highest emission(s) outside the passband. (This could be either at a frequency lesser or greater than the passband frequencies.)

l) Capture a plot for inclusion in the test report.

9.8.4 Measurement Record

Please refer to Appendix – Test data and result for report GZCR230300024902

9.9 Radiated spurious emission

Test Requirement: 47 CFR Part 90.219(e)(3), 90.543(f)

Test Method: KDB 935210 D05 clause 3.7

ANSI C63.26-2015 clause 5.6

Limit: 47 CFR Part 90.219(e)(3)

Spurious emissions from a signal booster must not exceed −13 dBm within any 100 kHz measurement bandwidth.

47 CFR Part 90.543(f)

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

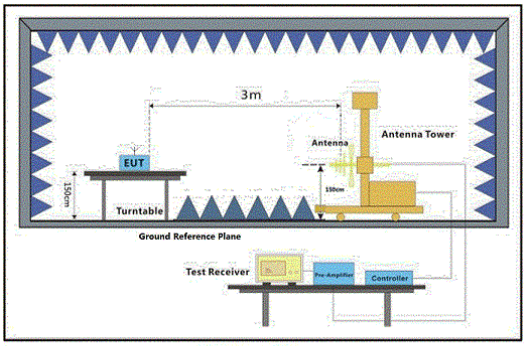
9.9.1 E.U.T. Operation

Operating Environment:

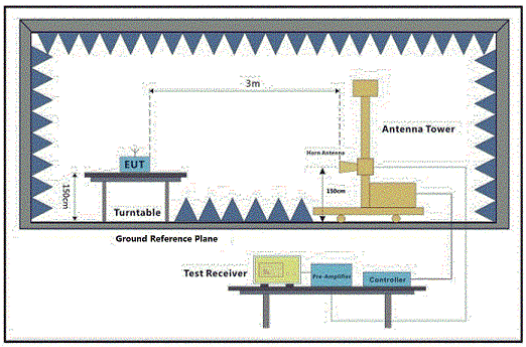
Temperature: 25.1 °C Humidity: 59 % RH Atmospheric Pressure: 1010 mbar

Test Mode: Set the EUT to maximum output power and maximum gain (activate MIMO mode simultaneously).

9.9.2 Test Setup



30MHz-1GHz



Above 1GHz

9.9.3 Test procedure

1. Scan from 30MHz to 12.75GHz, find the maximum radiation frequency to measure.
2. The technique used to find the Spurious Emissions of the transmitter was the antenna substitution method. Substitution method was performed to determine the actual ERP/EIRP emission levels of the EUT.

Below 1GHz test procedure as below:

1) The EUT was powered on and placed on a table in the chamber. The antenna of the transmitter was extended to its maximum length. modulation mode and the measuring receiver shall be tuned to the frequency of the transmitter under test.
2) Rotating through 360° the turntable. After the fundamental emission was maximized, a field strength measurement was made.
3) Steps 1) and 2) were performed with the EUT and the receive antenna in both vertical and horizontal polarization.
4) The transmitter was then removed and replaced with another antenna. The center of the antenna was approximately at the same location as the center of the transmitter.
5) A signal at the disturbance was fed to the substitution antenna by means of a non-radiating cable. With both the substitution and the receive antennas horizontally polarized, the receive antenna was raised and lowered to obtain a maximum reading at the test receiver. The level of the signal generator was adjusted until the measured field strength level in step 2) is obtained for this set of conditions.
6) The output power into the substitution antenna was then measured.
7) Steps 5) and 6)were repeated with both antennas vertically polarized.
8) Calculate power in dBm by the following formula:

Level (dBm) = Read Level (dBm) + Correction Factor (dB)

9.9.4 Measurement Record

Please refer to Appendix – Test data and result for report GZCR230300024902

10 Radio Spectrum Matter Test Result for ESMR

10.1 AGC Threshold level

Test Requirement: Not specified

Test Method: KDB 935210 D05 clause 3.2

Limit: No limit

10.1.1 E.U.T. Operation

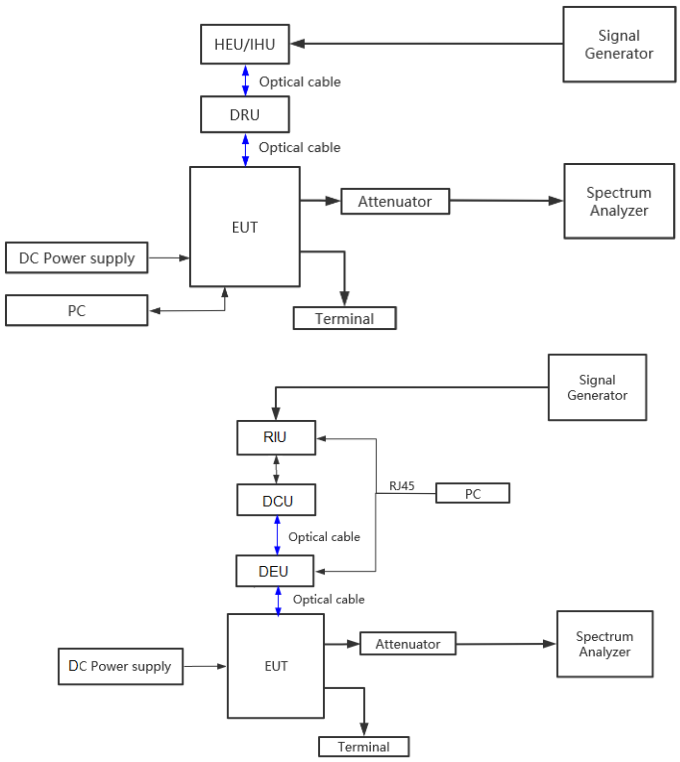
Operating Environment:

Temperature: 24.6 °C Humidity: 59 % RH Atmospheric Pressure: 1020 mbar

Test Mode: Set the EUT to maximum output power and maximum gain.

Test Configuration: Refer to clause 4.4 in this report.

10.1.2 Test Setup



10.1.3 Test Procedure

a) Connect a signal generator to the input of the EUT.

b) Connect a spectrum analyzer or power meter to the output of the EUT using appropriate attenuation as necessary.

c) The signal generator should initially be configured to produce either of the required test signals (i.e., broadband or narrowband).

d) Set the signal generator frequency to the center frequency of the EUT operating band.

e) While monitoring the output power of the EUT, measured using the methods of 3.5.3 or 3.5.4, increase the input level until a 1 dB increase in the input signal power no longer causes a 1 dB increase in the output signal power.

f) Record this level as the AGC threshold level.

g) Repeat the procedure with the remaining test signal

10.1.4 Measurement Record

Please refer to Appendix – Test data and result for report GZCR230300024902

10.2 Out-of-band rejection

Test Requirement: Not specified

Test Method: KDB 935210 D05 clause 3.2

Limit: No limit

10.2.1 E.U.T. Operation

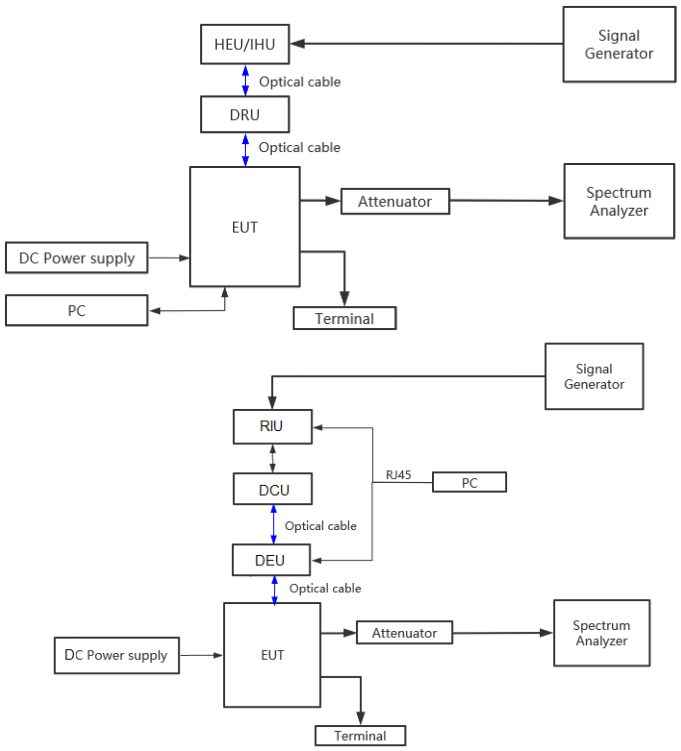
Operating Environment:

Temperature: 24.6 °C Humidity: 59 % RH Atmospheric Pressure: 1020 mbar

Test Mode: Set the EUT to maximum output power and maximum gain.

EUT Configuration: Refer to clause 4.4 in this report.

10.2.2 Test Setup



10.2.3 Test Procedure

Test procedure from clause 3.2

a) Connect a signal generator to the input of the EUT.

b) Configure a swept CW signal with the following parameters:

1) Frequency range = ± 250 % of the passband, for each applicable CMRS band (see also KDB Publication 935210 D02 [R7] and KDB Publication 634817 [R5] about selection of frequencies for testing and for grant listings).

2) Level = a sufficient level to affirm that the out-of-band rejection is > 20 dB above the noise floor and will not engage the AGC during the entire sweep.

3) Dwell time = approximately 10 ms.

4) Number of points = SPAN/(RBW/2).

c) Connect a spectrum analyzer to the output of the EUT using appropriate attenuation.

d) Set the span of the spectrum analyzer to the same as the frequency range of the signal generator.

e) Set the resolution bandwidth (RBW) of the spectrum analyzer to be 1 % to 5 % of the EUT passband, and the video bandwidth (VBW) shall be set to ≥ 3 × RBW.

f) Set the detector to Peak Max-Hold and wait for the spectrum analyzer’ s spectral display to fill.

g) Place a marker to the peak of the frequency response and record this frequency as f0.

h) Place two markers, one at the lowest and the other at the highest frequency of the envelope of the spectral display, such that each marker is at or slightly below the −20 dB down amplitude, to determine the 20 dB bandwidth.

i) Capture the frequency response of the EUT.

j) Repeat for all frequency bands applicable for use by the EUT.

Test procedure from clause 4.2

a) Connect a signal generator to the input of the EUT.

b) Configure a swept CW signal with the following parameters:

1) Frequency range = ± 250 % of the manufacturer’ s specified pass band.

2) The CW amplitude shall be 3 dB below the AGC threshold (see 4.2), and shall not activate the AGC threshold throughout the test.

3) Dwell time = approximately 10 ms.

4) Frequency step = 50 kHz.

c) Connect a spectrum analyzer to the output of the EUT using appropriate attenuation.

d) Set the RBW of the spectrum analyzer to between 1 % and 5 % of the manufacturer’ s rated passband, and VBW = 3 × RBW.

e) Set the detector to Peak and the trace to Max-Hold.

f) After the trace is completely filled, place a marker at the peak amplitude, which is designated as f0, and with two additional markers (use the marker-delta method) at the 20 dB bandwidth (i.e., at the points where the level has fallen by 20 dB).

g) Capture the frequency response plot for inclusion in the test report.

10.2.4 Measurement Record

Please refer to Appendix – Test data and result for report GZCR230300024902

10.3 Input-versus-output signal comparison

Test Requirement: 47 CFR Part 2.1049

Test Method: KDB 935210 D05 clause 3.4

Limit: Compare the input signal to the output signal to affirm that they are similar

10.3.1 E.U.T. Operation

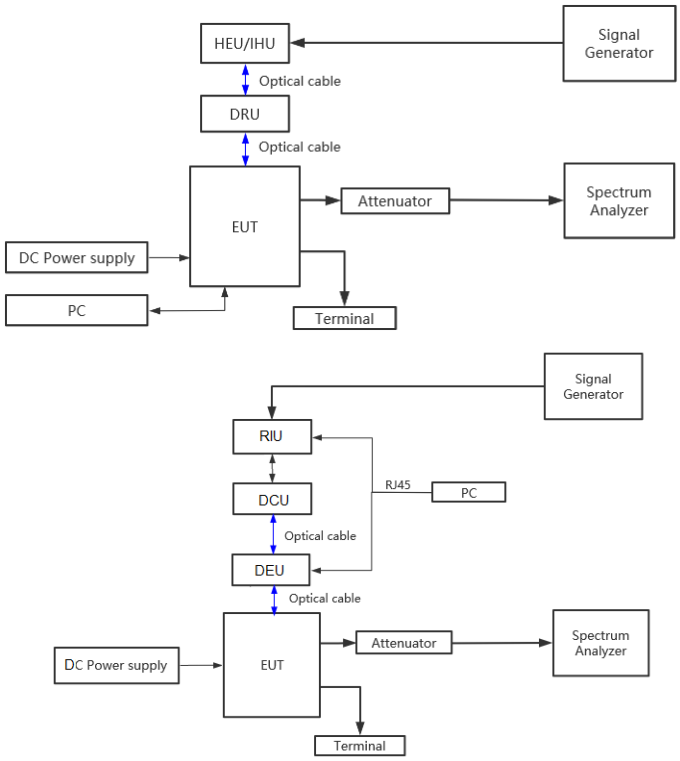
Operating Environment:

Temperature: 24.6 °C Humidity: 59 % RH Atmospheric Pressure: 1020 mbar

Test Mode: Set the EUT to maximum output power and maximum gain.

EUT Configuration: Refer to clause 4.4 in this report.

10.3.2 Test Setup



10.3.3 Test procedure

a) Connect a signal generator to the input of the EUT.

b) Configure the signal generator to transmit the AWGN signal.

c) Configure the signal amplitude to be just below the AGC threshold level (see 3.2), but not more than 0.5 dB below.

d) Connect a spectrum analyzer to the output of the EUT using appropriate attenuation.

e) Set the spectrum analyzer center frequency to the center frequency of the operational band under test. The span range of the spectrum analyzer shall be between 2 × to 5 × the emission bandwidth (EBW) or alternatively, the OBW.

f) The nominal RBW shall be in the range of 1 % to 5 % of the anticipated OBW, and the VBW shall be ⩾ 3 × RBW.

g) Set the reference level of the instrument as required to preclude the signal from exceeding the maximum spectrum analyzer input mixer level for linear operation. In general, the peak of the spectral envelope must be more than [10 log (OBW / RBW)] below the reference level.

Steps f) and g) may require iteration to enable adjustments within the specified tolerances.

h) The noise floor of the spectrum analyzer at the selected RBW shall be at least 36 dB below the reference level.

i) Set spectrum analyzer detection function to positive peak.

j) Set the trace mode to max hold.

k) Determine the reference value: Allow the trace to stabilize. Set the spectrum analyzer marker to the highest amplitude level of the displayed trace (this is the reference value) and record the associated frequency.

l) Place two markers, one at the lowest and the other at the highest frequency of the envelope of the spectral display, such that each marker is at or slightly below the −26 dB down amplitude. The 26 dB EBW (alternatively OBW) is the positive frequency difference between the two markers. If the spectral envelope crosses the −26 dB down amplitude at multiple points, the lowest or highest frequency shall be selected as the frequencies that are the furthest removed from the center frequency at which the spectral envelope crosses the −26 dB down amplitude point.

m) Repeat steps e) to l) with the input signal connected directly to the spectrum analyzer (i.e., input signal measurement).

n) Compare the spectral plot of the input signal (determined from step m) to the output signal (determined from step l) to affirm that they are similar (in passband and rolloff characteristic features and relative spectral locations), and include plot(s) and descriptions in test report.

o) Repeat the procedure [steps e) to n)] with the input signal amplitude set to 3 dB above the AGC threshold.

p) Repeat steps e) to o) with the signal generator set to the narrowband signal.

q) Repeat steps e) to p) for all frequency bands authorized for use by the EUT.

10.3.4 Measurement Record

Please refer to Appendix – Test data and result for report GZCR230300024902

10.4 Mean output power and amplifier/booster gain

Test Requirement: 47 CFR Part 90.635

Test Method: KDB 935210 D05 clause 3.5

Limit: The effective radiated power and antenna height for base stations may not exceed 1 kilowatt (30 dBw) and 304 m. (1,000 ft.) above average terrain (AAT), respectively, or the equivalent thereof as determined from the Table. These are maximum values, and applicants will be required to justify power levels and antenna heights requested.

10.4.1 E.U.T. Operation

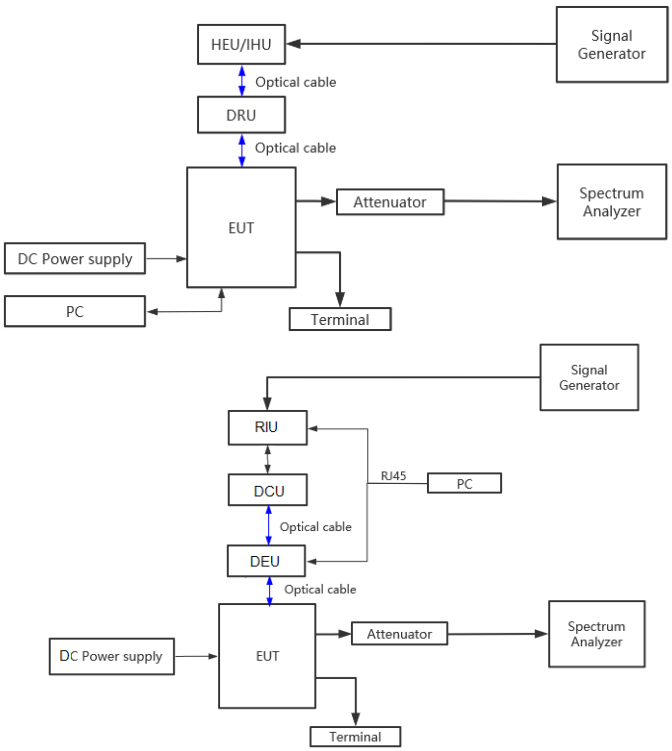
Operating Environment:

Temperature: 24.6 °C Humidity: 59 % RH Atmospheric Pressure: 1020 mbar

Test Mode: Set the EUT to maximum output power and maximum gain.

EUT Configuration: Refer to clause 4.4 in this report.

10.4.2 Test Setup



10.4.3 Test procedure

Test procedure of output power:

a) Connect a signal generator to the input of the EUT.

b) Configure to generate the AWGN (broadband) test signal.

c) The frequency of the signal generator shall be set to the frequency f0 as determined from 3.3.

d) Connect a spectrum analyzer or power meter to the output of the EUT using appropriate attenuation as necessary.

e) Set the signal generator output power to a level that produces an EUT output level that is just below the AGC threshold (see 3.2), but not more than 0.5 dB below.

f) Measure and record the output power of the EUT; use 3.5.3 or 3.5.4 for power measurement.

g) Remove the EUT from the measurement setup. Using the same signal generator settings, repeat the power measurement at the signal generator port, which was used as the input signal to the EUT, and record as the input power. EUT gain may be calculated as described in 3.5.5.

h) Repeat steps f) and g) with input signal amplitude set to 3 dB above the AGC threshold level.

i) Repeat steps e) to h) with the narrowband test signal.

j) Repeat steps e) to i) for all frequency bands authorized for use by the EUT.

1) Adjust the frequency of the input signals, either below or above the pass band, so that the lowest order intermodulation product is positioned in the centre of the pass band, according to clause 4.2.5.2.

2) Take the measurement of the rise of the output signal.

3) Repeat the measurement for the opposite path of the Repeater.

Calculating the mean gain:

After the mean input and output power levels have been measured as described in the preceding subclauses, the mean gain of the EUT can be determined from:

Gain (dB) = output power (dBm) − input power (dBm).

10.4.4 Measurement Record

Please refer to Appendix – Test data and result for report GZCR230300024902

10.5 Out-of-band/out-of-block (including intermodulation) emissions and spurious

Test Requirement: 47 CFR Part 90.691

Test Method: KDB 935210 D05 clause 3.6

Limit: Out-of-band emission requirement shall apply only to the "outer" channels included in an EA license and to spectrum adjacent to interior channels used by incumbent licensees. The emission limits are as follows:

(1) For any frequency removed from the EA licensee's frequency block by up to and including 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least 116 Log10(f/6.1) decibels or 50 + 10 Log10(P) decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 12.5 kHz

(2) For any frequency removed from the EA licensee's frequency block greater than 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least 43 + 10Log10(P) decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 37.5 kHz.

(reduce 3.01dB when on 2×2 MIMO mode)

10.5.1 E.U.T. Operation

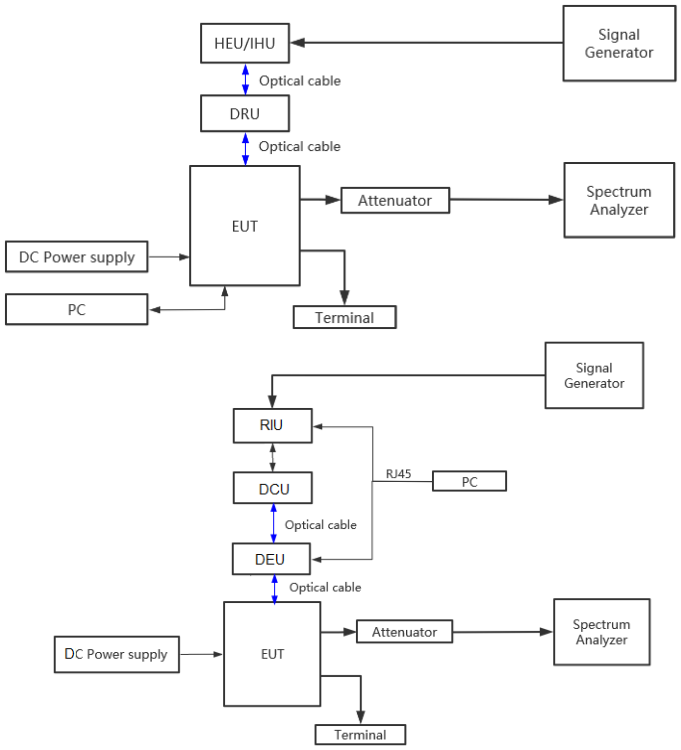
Operating Environment:

Temperature: 24.6 °C Humidity: 59 % RH Atmospheric Pressure: 1020 mbar

Test Mode: Set the EUT to maximum output power and maximum gain.

EUT Configuration: Refer to clause 4.4 in this report.

10.5.2 Test Setup



10.5.3 Test procedure

Test procedure of Out-of-band/out-of-block emissions:

a) Connect a signal generator to the input of the EUT.

If the signal generator is not capable of generating two modulated carriers simultaneously, then two discrete signal generators can be connected with an appropriate combining network to support this two-signal test.

b) Set the signal generator to produce two AWGN signals as previously described (e.g., 4.1 MHz OBW). Set the signal generator amplitudes so that the power from each into the EUT is equivalent.

c) Set the center frequencies such that the AWGN signals occupy adjacent channels, as defined by industry standards such as 3GPP or 3GPP2, at the upper edge of the frequency band or block under test.

d) Set the composite power levels such that the input signal is just below the AGC threshold (see 3.2), but not more than 0.5 dB below. The composite power can be measured using the procedures provided in KDB Publication 971168 [R8], but it will be necessary to expand the power integration bandwidth so as to include both of the transmit channels. Alternatively, the composite power can be measured using an average power meter as described in KDB Publication 971168 [R8].

e) Connect a spectrum analyzer to the output of the EUT using appropriate attenuation as necessary.

f) Set the RBW = reference bandwidth in the applicable rule section for the supported frequency band (typically 1 % of the EBW or 100 kHz or 1 MHz)

g) Set the VBW = 3 × RBW.

h) Set the detector to power averaging (rms) detector.

i) Set the Sweep time = auto-couple.

j) Set the spectrum analyzer start frequency to the upper block edge frequency, and the stop frequency to the upper block edge frequency plus 300 kHz or 3 MHz, for frequencies below and above 1 GHz, respectively.

k) Trace average at least 100 traces in power averaging (rms) mode.

l) Use the marker function to find the maximum power level

m) Capture the spectrum analyzer trace of the power level for inclusion in the test report.

n) Repeat steps k) to m) with the composite input power level set to 3 dB above the AGC threshold.

o) Reset the frequencies of the input signals to the lower edge of the frequency block or band under test.

p) Reset the spectrum analyzer start frequency to the lower block edge frequency minus 300 kHz or 3 MHz, for frequencies below and above 1 GHz, respectively, and the stop frequency to the lower band or block edge frequency.

q) Repeat steps k) to n).

r) Repeat steps a) to q) with the signal generator configured for a single test signal tuned as close as possible to the block edges.

s) Repeat steps a) to r) with the narrowband test signal.

t) Repeat steps a) to s) for all authorized frequency bands or blocks used by the EUT.

Test procedure of Spurious emissions

a) Connect a signal generator to the input of the EUT.

b) Set the signal generator to produce the broadband test signal as previously described (i.e., 4.1 MHz OBW AWGN).

c) Set the center frequency of the test signal to the lowest available channel within the frequency band or block.

d) Set the EUT input power to a level that is just below the AGC threshold (see 3.2), but not more than 0.5 dB below.

e) Connect a spectrum analyzer to the output of the EUT using appropriate attenuation as necessary.

f) Set the RBW = reference bandwidth in the applicable rule section for the supported frequency band of operation (e.g., reference bandwidth is typically 100 kHz or 1 MHz).

g) Set the VBW $\geqslant$ 3 $\times$ RBW.

h) Set the Sweep time = auto-couple.

i) Set the spectrum analyzer start frequency to the lowest RF 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.

The number of measurement points in each sweep must be $\geqslant$ (2 $\times$ span/RBW), which may require that the measurement range defined by the start and stop frequencies be subdivided, depending on the available number of measurement points provided by the spectrum analyzer.4

j) Select the power averaging (rms) detector function.

k) Trace average at least 10 traces in power averaging (rms) mode.

l) 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.

m) Reset the spectrum 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 spectrum analyzer stop frequency to 10 × the highest frequency of the fundamental emission (see Section 2.1057). 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 be subdivided, depending on the available number of measurement points provided by the spectrum analyzer.

n) Trace average at least 10 traces in power averaging (rms) mode.

o) 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; also provide tabular data, if required.

p) Repeat steps i) to o) with the input test signals firstly tuned to a middle band/block frequency/channel, and then tuned to a high band/block frequency/channel.

q) Repeat steps c) to p) with the narrowband test signal.

r) Repeat steps b) to q) for all authorized frequency bands/blocks used by the EUT.

10.5.4 Measurement Record

Please refer to Appendix – Test data and result for report GZCR230300024902

10.6 Frequency stability

Test Requirement: 47 CFR Part 90.213

Test Method: 47 CFR Part 2.1055

KDB 935210 D05 clause 3.7

ANSI C63.26-2015 clause 5.6

Limit: 1.5 ppm

10.6.1 E.U.T. Operation

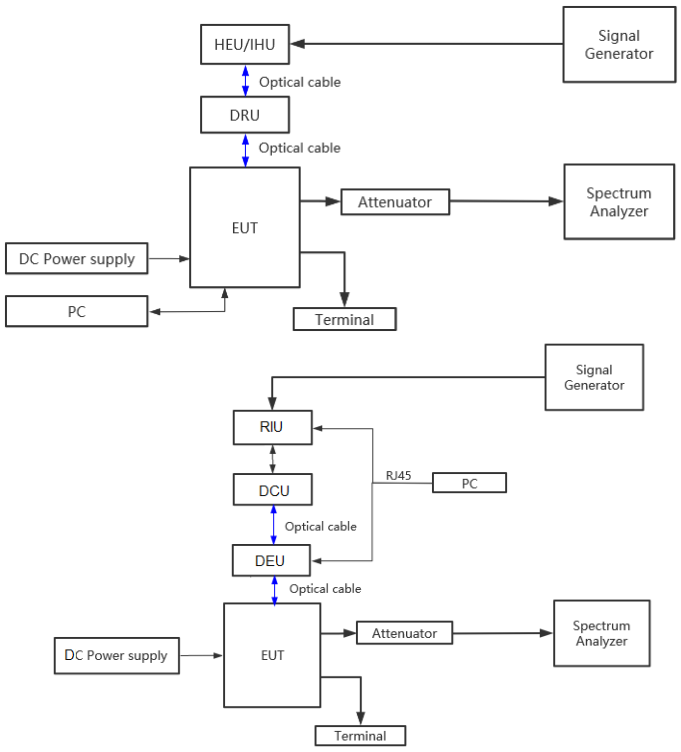
Operating Environment:

Temperature: 24.6 °C Humidity: 59 % RH Atmospheric Pressure: 1020 mbar

Test Mode: Set the EUT to maximum output power and maximum gain.

EUT Configuration: Refer to clause 4.4 in this report.

10.6.2 Test Setup



10.6.3 Test procedure

Frequency stability is a measure of the frequency drift due to temperature and supply voltage variations, with reference to the frequency measured at +20 °C and rated supply voltage.

The operating carrier frequency shall be set up in accordance with the manufacturer's published operation and instruction manual prior to the commencement of these tests. No adjustment of any frequency determining circuit element shall be made subsequent to this initial set-up. Frequency stability is tested:

a) At 10 °C intervals of temperatures between −30 °C and +50 °C at the manufacturer's rated supply voltage, and

b) At +20 °C temperature and ±15% supply voltage variations. If a product is specified to operate over a range of input voltage then the −15% variation is applied to the lowermost voltage and the +15% is applied to the uppermost voltage.

During the test all necessary settings, adjustments and control of the EUT have to be performed without disturbing the test environment, i.e., without opening the environmental chamber. The frequency stabilities can be maintained to a lesser temperature range provided that the transmitter is automatically inhibited from operating outside the lesser temperature range. For handheld equipment that is only capable of operating from internal batteries and the supply voltage cannot be varied, the frequency stability tests shall be performed at the nominal battery voltage and the battery end point voltage specified by the manufacturer. An external supply voltage can be used and set at the internal battery nominal voltage, and again at the battery operating end point voltage which shall be specified by the equipment manufacturer.

If an unmodulated carrier is not available, the mean frequency of a modulated carrier can be obtained by using a frequency counter with gating time set to an appropriately large multiple of bit periods (gating time depending on the required accuracy). Full details on the choice of values shall be included in the test report.

When performing frequency stability measurements on booster, the instability associated with the EUT must be isolated from any frequency instability associated with the measurement instrumentation. One method for realizing this isolation is to connect the reference clock input of the signal generator to the reference output of the frequency counter to confirm that any frequency instability is associated with the EUT, but is not due to differences between the reference oscillators internal to the measurement instrumentation.

10.6.4 Measurement Record

Please refer to Appendix – Test data and result for report GZCR230300024902

10.7 Radiated spurious emission

Test Requirement: 47 CFR Part 2.1053, 90.691(a)

Test Method: KDB 935210 D05 clause 3.7

ANSI C63.26-2015 clause 5.6

Limit: Out-of-band emission requirement shall apply only to the "outer" channels included in an EA license and to spectrum adjacent to interior channels used by incumbent licensees. The emission limits are as follows:

(1) For any frequency removed from the EA licensee's frequency block by up to and including 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least 116 Log10(f/6.1) decibels or 50 + 10 Log10(P) decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 12.5 kHz

(2) For any frequency removed from the EA licensee's frequency block greater than 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least 43 + 10Log10(P) decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 37.5 kHz.

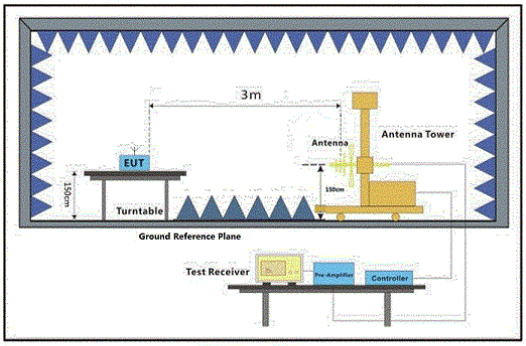
10.7.1 E.U.T. Operation

Operating Environment:

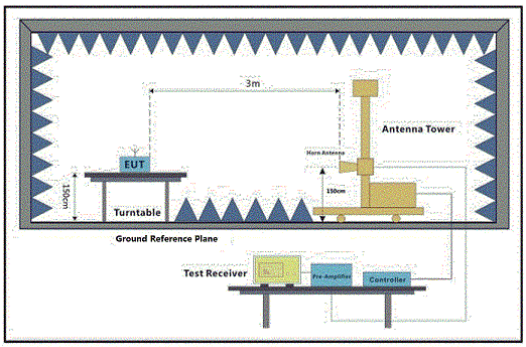
Temperature: 25.1 °C Humidity: 59 % RH Atmospheric Pressure: 1010 mbar

Test Mode: Set the EUT to maximum output power and maximum gain (activate MIMO mode simultaneously).

10.7.2 Test Setup



30MHz-1GHz



Above 1GHz

10.7.3 Test procedure

1. Scan from 30MHz to 12.75GHz, find the maximum radiation frequency to measure.
2. The technique used to find the Spurious Emissions of the transmitter was the antenna substitution method. Substitution method was performed to determine the actual ERP/EIRP emission levels of the EUT.

Below 1GHz test procedure as below:

1) The EUT was powered on and placed on a table in the chamber. The antenna of the transmitter was extended to its maximum length. modulation mode and the measuring receiver shall be tuned to the frequency of the transmitter under test.

2) Rotating through 360° the turntable. After the fundamental emission was maximized, a field strength measurement was made.

3) Steps 1) and 2) were performed with the EUT and the receive antenna in both vertical and horizontal polarization.

4) The transmitter was then removed and replaced with another antenna. The center of the antenna was approximately at the same location as the center of the transmitter.

5) A signal at the disturbance was fed to the substitution antenna by means of a non-radiating cable. With both the substitution and the receive antennas horizontally polarized, the receive antenna was raised and lowered to obtain a maximum reading at the test receiver. The level of the signal generator was adjusted until the measured field strength level in step 2) is obtained for this set of conditions.

6) The output power into the substitution antenna was then measured.

7) Steps 5) and 6)were repeated with both antennas vertically polarized.

8) Calculate power in dBm by the following formula:

Level (dBm) = Read Level (dBm) + Correction Factor (dB)

Above 1GHz test procedure as below:

1) Different between above is the test site, change from Semi- Anechoic Chamber to fully Anechoic Chamber.

2) Calculate power in dBm by the following formula:

Level (dBm) = Read Level (dBm) + Correction Factor (dB)

10.7.4 Measurement Record

Please refer to Appendix – Test data and result for report GZCR230300024902

11 Radio Spectrum Matter Test Result for Cellular

11.1 AGC Threshold level

Test Requirement: Not specified

Test Method: KDB 935210 D05 clause 3.2

Limit: No limit

11.1.1 E.U.T. Operation

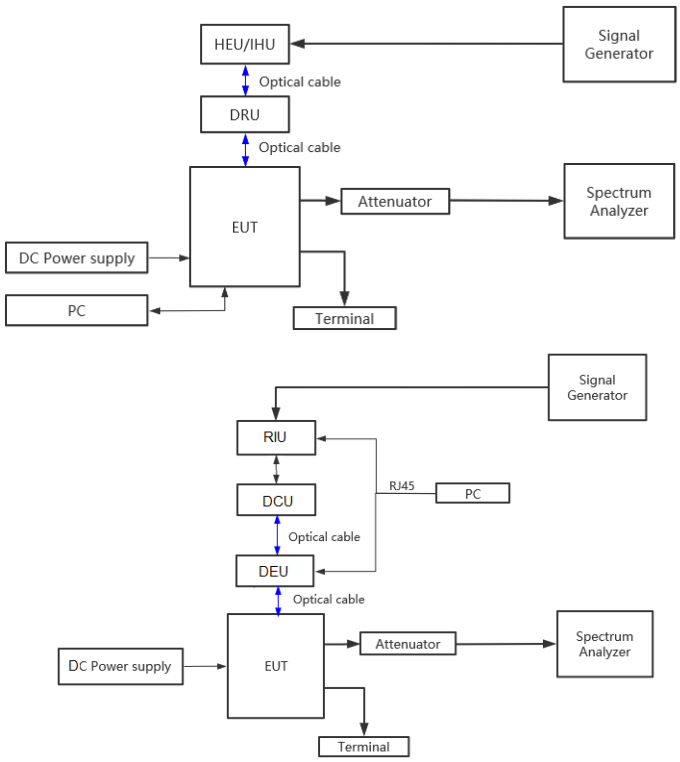
Operating Environment:

Temperature: 24.6 °C Humidity: 59 % RH Atmospheric Pressure: 1020 mbar

Test Mode: Set the EUT to maximum output power and maximum gain.

Test Configuration: Refer to clause 4.4 in this report.

11.1.2 Test Setup



11.1.3 Test Procedure

a) Connect a signal generator to the input of the EUT.

b) Connect a spectrum analyzer or power meter to the output of the EUT using appropriate attenuation as necessary.

c) The signal generator should initially be configured to produce either of the required test signals (i.e., broadband or narrowband).

d) Set the signal generator frequency to the center frequency of the EUT operating band.

e) While monitoring the output power of the EUT, measured using the methods of 3.5.3 or 3.5.4, increase the input level until a 1 dB increase in the input signal power no longer causes a 1 dB increase in the output signal power.

f) Record this level as the AGC threshold level.

g) Repeat the procedure with the remaining test signal

11.1.4 Measurement Record

Please refer to Appendix – Test data and result for report GZCR230300024902

11.2 Out-of-band rejection

Test Requirement: Not specified

Test Method: KDB 935210 D05 clause 3.2

Limit: No limit

11.2.1 E.U.T. Operation

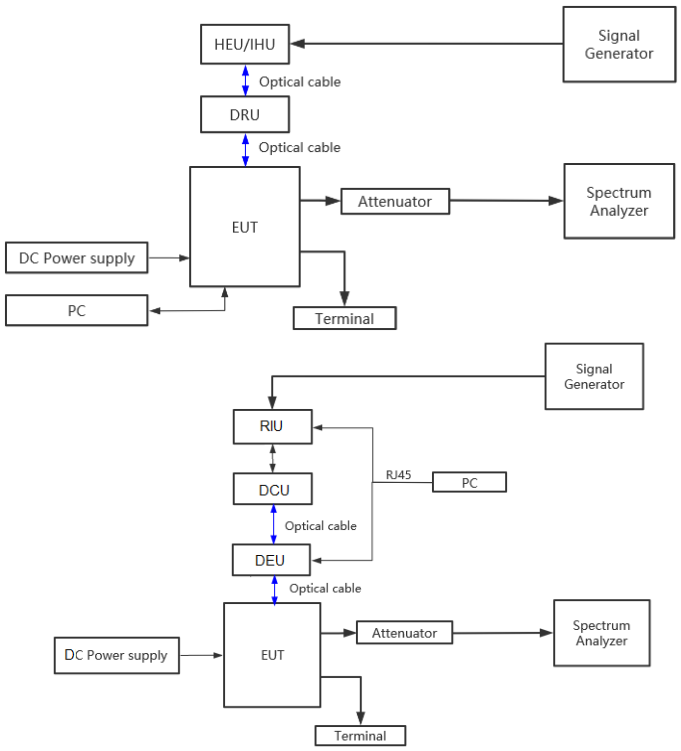
Operating Environment:

Temperature: 24.6 °C Humidity: 59 % RH Atmospheric Pressure: 1020 mbar

Test Mode: Set the EUT to maximum output power and maximum gain.

EUT Configuration: Refer to clause 4.4 in this report.

11.2.2 Test Setup



11.2.3 Test Procedure

Test procedure from clause 3.2

a) Connect a signal generator to the input of the EUT.

b) Configure a swept CW signal with the following parameters:

1) Frequency range = ± 250 % of the passband, for each applicable CMRS band (see also KDB Publication 935210 D02 [R7] and KDB Publication 634817 [R5] about selection of frequencies for testing and for grant listings).

2) Level = a sufficient level to affirm that the out-of-band rejection is > 20 dB above the noise floor and will not engage the AGC during the entire sweep.

3) Dwell time = approximately 10 ms.

4) Number of points = SPAN/(RBW/2).

c) Connect a spectrum analyzer to the output of the EUT using appropriate attenuation.

d) Set the span of the spectrum analyzer to the same as the frequency range of the signal generator.

e) Set the resolution bandwidth (RBW) of the spectrum analyzer to be 1 % to 5 % of the EUT passband, and the video bandwidth (VBW) shall be set to ≥ 3 × RBW.

f) Set the detector to Peak Max-Hold and wait for the spectrum analyzer’ s spectral display to fill.

g) Place a marker to the peak of the frequency response and record this frequency as f0.

h) Place two markers, one at the lowest and the other at the highest frequency of the envelope of the spectral display, such that each marker is at or slightly below the −20 dB down amplitude, to determine the 20 dB bandwidth.

i) Capture the frequency response of the EUT.

j) Repeat for all frequency bands applicable for use by the EUT.

Test procedure from clause 4.2

a) Connect a signal generator to the input of the EUT.

b) Configure a swept CW signal with the following parameters:

1) Frequency range = ± 250 % of the manufacturer’ s specified pass band.

2) The CW amplitude shall be 3 dB below the AGC threshold (see 4.2), and shall not activate the AGC threshold throughout the test.

3) Dwell time = approximately 10 ms.

4) Frequency step = 50 kHz.

c) Connect a spectrum analyzer to the output of the EUT using appropriate attenuation.

d) Set the RBW of the spectrum analyzer to between 1 % and 5 % of the manufacturer’ s rated passband, and VBW = 3 × RBW.

e) Set the detector to Peak and the trace to Max-Hold.

f) After the trace is completely filled, place a marker at the peak amplitude, which is designated as f0, and with two additional markers (use the marker-delta method) at the 20 dB bandwidth (i.e., at the points where the level has fallen by 20 dB).

g) Capture the frequency response plot for inclusion in the test report.

11.2.4 Measurement Record

Please refer to Appendix – Test data and result for report GZCR230300024902

11.3 Input-versus-output signal comparison

Test Requirement: 47 CFR Part 2.1049

Test Method: KDB 935210 D05 clause 3.4

Limit: Compare the input signal to the output signal to affirm that they are similar

11.3.1 E.U.T. Operation

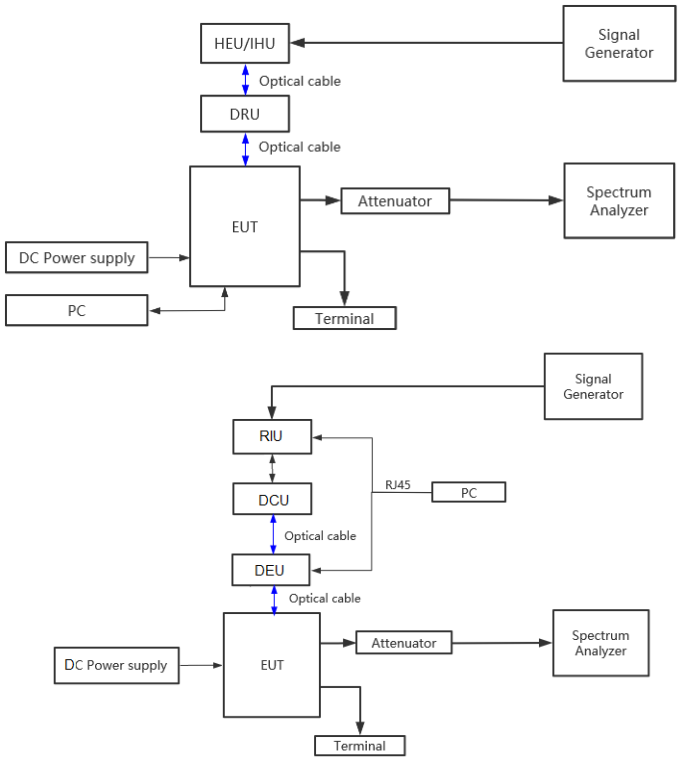
Operating Environment:

Temperature: 24.6 °C Humidity: 59 % RH Atmospheric Pressure: 1020 mbar

Test Mode: Set the EUT to maximum output power and maximum gain.

EUT Configuration: Refer to clause 4.4 in this report.

11.3.2 Test Setup



11.3.3 Test procedure

a) Connect a signal generator to the input of the EUT.

b) Configure the signal generator to transmit the AWGN signal.

c) Configure the signal amplitude to be just below the AGC threshold level (see 3.2), but not more than 0.5 dB below.

d) Connect a spectrum analyzer to the output of the EUT using appropriate attenuation.

e) Set the spectrum analyzer center frequency to the center frequency of the operational band under test. The span range of the spectrum analyzer shall be between 2 × to 5 × the emission bandwidth (EBW) or alternatively, the OBW.

f) The nominal RBW shall be in the range of 1 % to 5 % of the anticipated OBW, and the VBW shall be ⩾ 3 × RBW.

g) Set the reference level of the instrument as required to preclude the signal from exceeding the maximum spectrum analyzer input mixer level for linear operation. In general, the peak of the spectral envelope must be more than [10 log (OBW / RBW)] below the reference level.

Steps f) and g) may require iteration to enable adjustments within the specified tolerances.

h) The noise floor of the spectrum analyzer at the selected RBW shall be at least 36 dB below the reference level.

i) Set spectrum analyzer detection function to positive peak.

j) Set the trace mode to max hold.

k) Determine the reference value: Allow the trace to stabilize. Set the spectrum analyzer marker to the highest amplitude level of the displayed trace (this is the reference value) and record the associated frequency.

l) Place two markers, one at the lowest and the other at the highest frequency of the envelope of the spectral display, such that each marker is at or slightly below the −26 dB down amplitude. The 26 dB EBW (alternatively OBW) is the positive frequency difference between the two markers. If the spectral envelope crosses the −26 dB down amplitude at multiple points, the lowest or highest frequency shall be selected as the frequencies that are the furthest removed from the center frequency at which the spectral envelope crosses the −26 dB down amplitude point.

m) Repeat steps e) to l) with the input signal connected directly to the spectrum analyzer (i.e., input signal measurement).

n) Compare the spectral plot of the input signal (determined from step m) to the output signal (determined from step l) to affirm that they are similar (in passband and rolloff characteristic features and relative spectral locations), and include plot(s) and descriptions in test report.

o) Repeat the procedure [steps e) to n)] with the input signal amplitude set to 3 dB above the AGC threshold.

p) Repeat steps e) to o) with the signal generator set to the narrowband signal.

q) Repeat steps e) to p) for all frequency bands authorized for use by the EUT.

11.3.4 Measurement Record

Please refer to Appendix – Test data and result for report GZCR230300024902

11.4 Mean output power and amplifier/booster gain

Test Requirement: 47 CFR Part 22.913

Test Method: KDB 935210 D05 clause 3.5

Limit: The ERP of transmitters in the Cellular Radiotelephone Service must not exceed 500 watts per emission

11.4.1 E.U.T. Operation

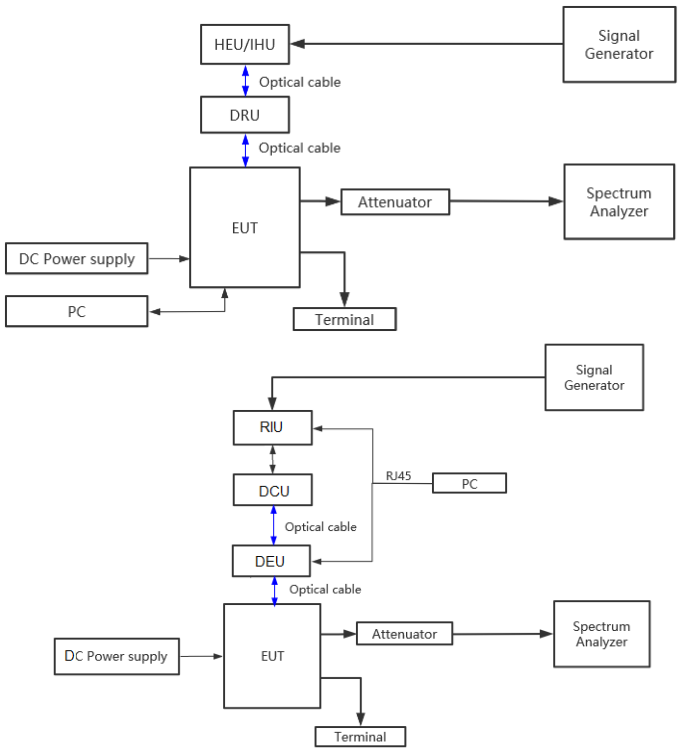
Operating Environment:

Temperature: 24.6 °C Humidity: 59 % RH Atmospheric Pressure: 1020 mbar

Test Mode: Set the EUT to maximum output power and maximum gain.

EUT Configuration: Refer to clause 4.4 in this report.

11.4.2 Test Setup



11.4.3 Test procedure

Test procedure of output power:

a) Connect a signal generator to the input of the EUT.

b) Configure to generate the AWGN (broadband) test signal.

c) The frequency of the signal generator shall be set to the frequency f0 as determined from 3.3.

d) Connect a spectrum analyzer or power meter to the output of the EUT using appropriate attenuation as necessary.

e) Set the signal generator output power to a level that produces an EUT output level that is just below the AGC threshold (see 3.2), but not more than 0.5 dB below.

f) Measure and record the output power of the EUT; use 3.5.3 or 3.5.4 for power measurement.

g) Remove the EUT from the measurement setup. Using the same signal generator settings, repeat the power measurement at the signal generator port, which was used as the input signal to the EUT, and record as the input power. EUT gain may be calculated as described in 3.5.5.

h) Repeat steps f) and g) with input signal amplitude set to 3 dB above the AGC threshold level.

i) Repeat steps e) to h) with the narrowband test signal.

j) Repeat steps e) to i) for all frequency bands authorized for use by the EUT.

1) Adjust the frequency of the input signals, either below or above the pass band, so that the lowest order intermodulation product is positioned in the centre of the pass band, according to clause 4.2.5.2.

2) Take the measurement of the rise of the output signal.

3) Repeat the measurement for the opposite path of the Repeater.

Calculating the mean gain:

After the mean input and output power levels have been measured as described in the preceding subclauses, the mean gain of the EUT can be determined from:

Gain (dB) = output power (dBm) − input power (dBm).

11.4.4 Measurement Record

Please refer to Appendix – Test data and result for report GZCR230300024902

11.5 Out-of-band/out-of-block (including intermodulation) emissions and spurious

Test Requirement: 47 CFR Part 27.53(g)

Test Method: KDB 935210 D05 clause 3.6

Limit: The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.
(reduce 3.01dB when on 2×2 MIMO mode)

11.5.1 E.U.T. Operation

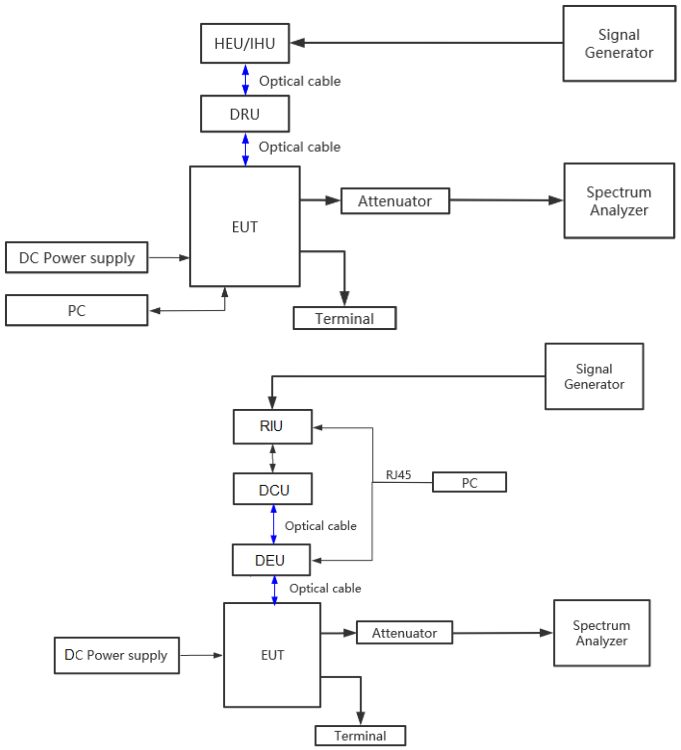
Operating Environment:

Temperature: 24.6 °C Humidity: 59 % RH Atmospheric Pressure: 1020 mbar

Test Mode: Set the EUT to maximum output power and maximum gain.

EUT Configuration: Refer to clause 4.4 in this report.

11.5.2 Test Setup



11.5.3 Test procedure

Test procedure of Out-of-band/out-of-block emissions:

a) Connect a signal generator to the input of the EUT.

If the signal generator is not capable of generating two modulated carriers simultaneously, then two discrete signal generators can be connected with an appropriate combining network to support this two-signal test.

b) Set the signal generator to produce two AWGN signals as previously described (e.g., 4.1 MHz OBW). Set the signal generator amplitudes so that the power from each into the EUT is equivalent.

c) Set the center frequencies such that the AWGN signals occupy adjacent channels, as defined by industry standards such as 3GPP or 3GPP2, at the upper edge of the frequency band or block under test.

d) Set the composite power levels such that the input signal is just below the AGC threshold (see 3.2), but not more than 0.5 dB below. The composite power can be measured using the procedures provided in KDB Publication 971168 [R8], but it will be necessary to expand the power integration bandwidth so as to include both of the transmit channels. Alternatively, the composite power can be measured using an average power meter as described in KDB Publication 971168 [R8].

e) Connect a spectrum analyzer to the output of the EUT using appropriate attenuation as necessary.

f) Set the RBW = reference bandwidth in the applicable rule section for the supported frequency band (typically 1 % of the EBW or 100 kHz or 1 MHz)

g) Set the VBW = 3 × RBW.

h) Set the detector to power averaging (rms) detector.

i) Set the Sweep time = auto-couple.

j) Set the spectrum analyzer start frequency to the upper block edge frequency, and the stop frequency to the upper block edge frequency plus 300 kHz or 3 MHz, for frequencies below and above 1 GHz, respectively.

k) Trace average at least 100 traces in power averaging (rms) mode.

l) Use the marker function to find the maximum power level

m) Capture the spectrum analyzer trace of the power level for inclusion in the test report.

n) Repeat steps k) to m) with the composite input power level set to 3 dB above the AGC threshold.

o) Reset the frequencies of the input signals to the lower edge of the frequency block or band under test.

p) Reset the spectrum analyzer start frequency to the lower block edge frequency minus 300 kHz or 3 MHz, for frequencies below and above 1 GHz, respectively, and the stop frequency to the lower band or block edge frequency.

q) Repeat steps k) to n).

r) Repeat steps a) to q) with the signal generator configured for a single test signal tuned as close as possible to the block edges.

s) Repeat steps a) to r) with the narrowband test signal.

t) Repeat steps a) to s) for all authorized frequency bands or blocks used by the EUT.

Test procedure of Spurious emissions

a) Connect a signal generator to the input of the EUT.

b) Set the signal generator to produce the broadband test signal as previously described (i.e., 4.1 MHz OBW AWGN).

c) Set the center frequency of the test signal to the lowest available channel within the frequency band or block.

d) Set the EUT input power to a level that is just below the AGC threshold (see 3.2), but not more than 0.5 dB below.

e) Connect a spectrum analyzer to the output of the EUT using appropriate attenuation as necessary.

f) Set the RBW = reference bandwidth in the applicable rule section for the supported frequency band of operation (e.g., reference bandwidth is typically 100 kHz or 1 MHz).

g) Set the VBW $\geqslant$ 3 $\times$ RBW.

h) Set the Sweep time = auto-couple.

i) Set the spectrum analyzer start frequency to the lowest RF 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.

The number of measurement points in each sweep must be $\geqslant$ (2 $\times$ span/RBW), which may require that the measurement range defined by the start and stop frequencies be subdivided, depending on the available number of measurement points provided by the spectrum analyzer.4

j) Select the power averaging (rms) detector function.

k) Trace average at least 10 traces in power averaging (rms) mode.

l) 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.

m) Reset the spectrum 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 spectrum analyzer stop frequency to 10 × the highest frequency of the fundamental emission (see Section 2.1057). 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 be subdivided, depending on the available number of measurement points provided by the spectrum analyzer.

n) Trace average at least 10 traces in power averaging (rms) mode.

o) 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; also provide tabular data, if required.

p) Repeat steps i) to o) with the input test signals firstly tuned to a middle band/block frequency/channel, and then tuned to a high band/block frequency/channel.

q) Repeat steps c) to p) with the narrowband test signal.

r) Repeat steps b) to q) for all authorized frequency bands/blocks used by the EUT.

11.5.4 Measurement Record

Please refer to Appendix – Test data and result for report GZCR230300024902

11.6 Frequency stability

Test Requirement: 47 CFR Part 22.355

Test Method: 47 CFR Part 2.1055

KDB 935210 D05 clause 3.7

ANSI C63.26-2015 clause 5.6

Limit: 1.5 ppm

11.6.1 E.U.T. Operation

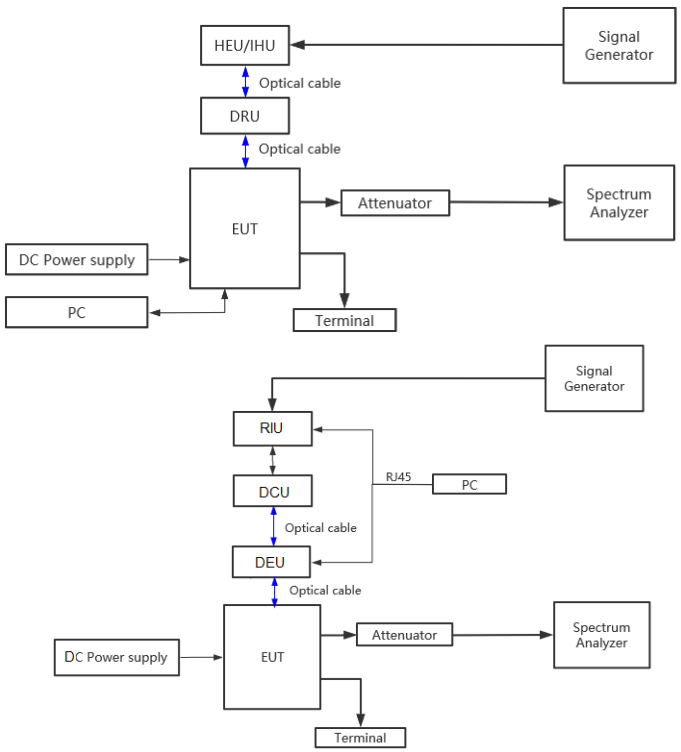
Operating Environment:

Temperature: 24.6 °C Humidity: 59 % RH Atmospheric Pressure: 1020 mbar

Test Mode: Set the EUT to maximum output power and maximum gain.

EUT Configuration: Refer to clause 4.4 in this report.

11.6.2 Test Setup



11.6.3 Test procedure

Frequency stability is a measure of the frequency drift due to temperature and supply voltage variations, with reference to the frequency measured at +20 °C and rated supply voltage.

The operating carrier frequency shall be set up in accordance with the manufacturer's published operation and instruction manual prior to the commencement of these tests. No adjustment of any frequency determining circuit element shall be made subsequent to this initial set-up. Frequency stability is tested:

a) At 10 °C intervals of temperatures between −30 °C and +50 °C at the manufacturer's rated supply voltage, and

b) At +20 °C temperature and ±15% supply voltage variations. If a product is specified to operate over a range of input voltage then the −15% variation is applied to the lowermost voltage and the +15% is applied to the uppermost voltage.

During the test all necessary settings, adjustments and control of the EUT have to be performed without disturbing the test environment, i.e., without opening the environmental chamber. The frequency stabilities can be maintained to a lesser temperature range provided that the transmitter is automatically inhibited from operating outside the lesser temperature range. For handheld equipment that is only capable of operating from internal batteries and the supply voltage cannot be varied, the frequency stability tests shall be performed at the nominal battery voltage and the battery end point voltage specified by the manufacturer. An external supply voltage can be used and set at the internal battery nominal voltage, and again at the battery operating end point voltage which shall be specified by the equipment manufacturer.

If an unmodulated carrier is not available, the mean frequency of a modulated carrier can be obtained by using a frequency counter with gating time set to an appropriately large multiple of bit periods (gating time depending on the required accuracy). Full details on the choice of values shall be included in the test report.

When performing frequency stability measurements on booster, the instability associated with the EUT must be isolated from any frequency instability associated with the measurement instrumentation. One method for realizing this isolation is to connect the reference clock input of the signal generator to the reference output of the frequency counter to confirm that any frequency instability is associated with the EUT, but is not due to differences between the reference oscillators internal to the measurement instrumentation.

11.6.4 Measurement Record

Please refer to Appendix – Test data and result for report GZCR230300024902

11.7 Radiated spurious emission

Test Requirement: 47 CFR Part 2.1053, 22.917

Test Method: KDB 935210 D05 clause 3.7

ANSI C63.26-2015 clause 5.6

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

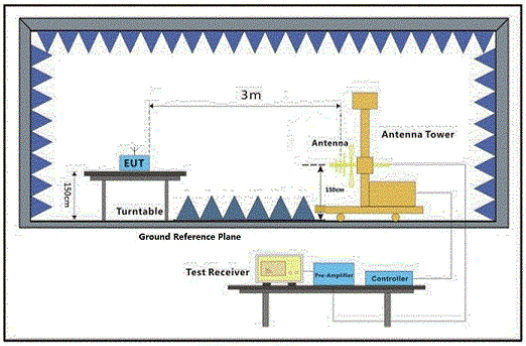
11.7.1 E.U.T. Operation

Operating Environment:

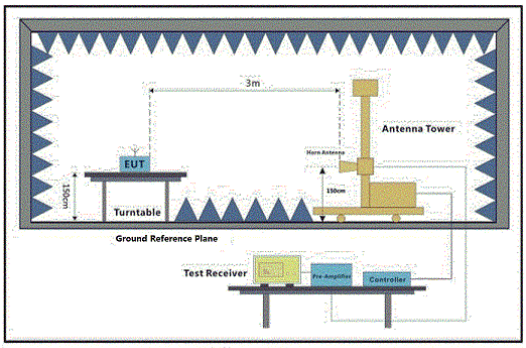
Temperature: 25.1 °C Humidity: 59 % RH Atmospheric Pressure: 1010 mbar

Test Mode: Set the EUT to maximum output power and maximum gain (activate MIMO mode simultaneously).

11.7.2 Test Setup



30MHz-1GHz



Above 1GHz

11.7.3 Test procedure

1. Scan from 30MHz to 12.75GHz, find the maximum radiation frequency to measure.
2. The technique used to find the Spurious Emissions of the transmitter was the antenna substitution method. Substitution method was performed to determine the actual ERP/EIRP emission levels of the EUT.

Below 1GHz test procedure as below:

1) The EUT was powered on and placed on a table in the chamber. The antenna of the transmitter was extended to its maximum length. modulation mode and the measuring receiver shall be tuned to the frequency of the transmitter under test.

2) Rotating through 360° the turntable. After the fundamental emission was maximized, a field strength measurement was made.

3) Steps 1) and 2) were performed with the EUT and the receive antenna in both vertical and horizontal polarization.

4) The transmitter was then removed and replaced with another antenna. The center of the antenna was approximately at the same location as the center of the transmitter.

5) A signal at the disturbance was fed to the substitution antenna by means of a non-radiating cable. With both the substitution and the receive antennas horizontally polarized, the receive antenna was raised and lowered to obtain a maximum reading at the test receiver. The level of the signal generator was adjusted until the measured field strength level in step 2) is obtained for this set of conditions.

6) The output power into the substitution antenna was then measured.

7) Steps 5) and 6)were repeated with both antennas vertically polarized.

8) Calculate power in dBm by the following formula:

Level (dBm) = Read Level (dBm) + Correction Factor (dB)

11.7.4 Measurement Record

Please refer to Appendix – Test data and result for report GZCR230300024902

12 Test Setup Photo

Please refer to Appendix –Test Setup Photo for GZCR2303000249AT

13 EUT Constructional Details

Please refer to Appendix – External and Internal Photos for GZCR2303000249AT

--Report End--

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