TEST REPORT

Application No.:	GZCR2311001254AT
Applicant:	Corning Optical Communications LLC
Address of Applicant:	840 N McCarthy Blvd Milpitas, CA 95035
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:	HRU Digital High Power Amplifier Module supporting 700
Model No.:	dHRU-G2-7
Trade Mark:	Corning
Standard(s) :	47 CFR Part 2 47 CFR Part 20 47 CFR Part 27 47 CFR Part 90
Date of Receipt:	2021-03-09 for original report GZCR210300001302 2023-11-29 for report GZCR231100125402
Date of Test:	2021-03-11 to 2021-04-03 for original report GZCR210300001302 2023-12-6 to 2023-12-10 for report GZCR231100125402
Date of Issue:	2021-04-08 for original report GZCR210300001302 2023-12-20 for report GZCR231100125402
Test Result:	**Pass***

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

Ricky Liu
Manager

Revision Record			
Version	**Report No.**	**Date**	**Remark**
01	GZCR231100125402	2023-12-20	Original

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

2 Test Summary

2.1 Lower 700MHz (only for downlink: 728-746MHz)

Item	Requirement	Method	Result
Out-of-band rejection	KDB935210 D05 v01r04 clause 3.3	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 27.53(g)	KDB935210 D05 v01r04 clause 3.8 ANSI C63.26-2015 Clause 5.5	PASS

2.2 Upper 700MHz (only for downlink: 746-757MHz)

Item	Requirement	Method	Result
Out-of-band rejection	KDB935210 D05 v01r04 clause 3.3	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 27.53(c) 47 CFR Part 27.53(f)	KDB935210 D05 v01r04 clause 3.8 ANSI C63.26-2015 Clause 5.5	PASS

2.3 FirstNet (only for downlink: 758-768MHz)

Item	Requirement	Method	Result
Out-of-band rejection	KDB935210 D05 v01r04 clause 4.3	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 90.541	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 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

Remark:

According to the declaration from the applicant, the model **dHRU-G2-7** in this report **GZCR231100125402** and model **dHRU-dHPAM-7** in report **GZCR210300001302 (FCC ID: OJFDHRU-DHPAM-7)** are identical in the electrical circuit design, layout, components used and internal wiring were identical, with only difference on the Model No..

All test data in this report was copied from report **GZCR210300001302**.

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

3 Contents

4 General Information

4.1 Details of E.U.T.

Power Supply:	AC 100-240V, 50/60Hz		
Test Voltage:	AC 110V, 60Hz		
Cable:	AC mains (unshielded, 1.5m)		
Operating Temperature:	-40 to +55 °C		
Operating Humidity:	5 to 95 %		
Frequency Range:	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

Radio System Type:

- ☐ GSM
- ☐ WCDMA
- ☒ LTE
- ☒ 5G NR

Interface:

- RF Port: 2 (4.3-10-Female, ANT1~ANT2)
- 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

Band	Technology	Supported Bandwidth
Lower 700MHz	4G/5G	5/10/15MHz
Upper 700MHz	4G/5G	5/10MHz
FirstNet	4G/5G	5/10MHz

Output Power (per antenna port):	Max. 43dBm (Downlink)
EUT MIMO property:	2X2 MIMO
System Gain:	Max. 43dB (Downlink)
Antenna Type:	External Dedicated Antenna
Permission Antenna Gain:	12.5dBi or less
Software Version:	V01.00.00.04
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 applicant	Corning	/	/
DRU supplied by the applicant	Corning	/	/
ODU supplied by the applicant	Corning	dHRU-dHPOM	/
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	AC 110V
TLVL	-40	AC 93.5V
TLVH	-40	AC 126.5V
THVL	+50	AC 93.5V
THVH	+50	AC 126.5V

VN: Normal Voltage

TN: Normal Teperature

VL: Lower Extreme Voltege

HL: Higher Extreme Voltage

TL: Lower Extreme Teperature

TH: Higher Extreme Teperature

No.198, Kezhu Road, Science City, Economic & Technological Development Area, Guangzhou, Guangdong, China 510663 t (86-20) 82155555 www.sgsgroup.com.cn

中国·广东·广州高新技术产业开发区科学城科珠路198号 邮编：510663 t (86-20) 82155555 sgs.china@sgs.com

4.4 Test Configuration

Lower & Upper 700MHz (only for downlink: 728-746MHz & 746-757MHz)

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	742.5		
T	DL_1S_T_AWGN	754.5		
B	DL_2S_B_AWGN	730.5, 735.5		two adjacent test signals
T	DL_2S_T_AWGN	749.5, 754.5		
B	DL_1S_B_GSM	728.4	GSM-TDMA	a single test signal
M	DL_1S_M_GSM	742.5		
T	DL_1S_T_GSM	756.6		
B	DL_2S_B_GSM	728.4, 728.8		two adjacent test signals
T	DL_2S_T_GSM	756.2, 756.6		
B	DL_1S_B_AWGN	778	100MHz AWGN	a single test signal
M	DL_1S_M_AWGN	742.5		
T	DL_1S_T_AWGN	707		
B	DL_2S_B_AWGN	678, 778		two adjacent test signals
T	DL_2S_T_AWGN	707, 807		
Note: The test was performed together for Lower 700MHz downlink and Upper 700MHz downlink.				

FirstNet (only for downlink: 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		
B	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	708, 808		two adjacent test signals

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%

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

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/New Zealand Regulatory Compliance Mark (RCM).

● **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 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.

● **ISED (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-20107 and T-11179)**

The 10m Semi-anechoic chamber, 966 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-20107 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 17025:2017, 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 original test

Conducted Test					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
MXA Signal Analyzer	AgilentTechnologies	N9020A	SEM004-10	2021-03-02	2022-03-01
ESG Vector Signal Generator	Keysight	E4438C	SEM006-03	2021-03-12	2022-03-11
Signal Generator	Rohde & Schwarz	SMB100A	EMC2093	2021-01-09	2022-01-08
MXG Vector Signal Generator (9kHz-6GHz)	Keysight	N5182B	EMC2216	2020-11-04	2021-11-03
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	2021-01-08	2022-01-07
Amplifier	HP	8447F	EMC2065	2020-05-26	2021-05-25
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 supplement test

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	2023-11-02	2025-11-01
MI CABLE	SGS-EMC	0.8M	EMC2136	2023-11-02	2025-11-01
EXA Signal Analyzer (10Hz-44GHz)	Keysight	N9010A	EMC2138	2023-08-23	2024-08-22
MXA Signal Analyzer (10Hz-50GHz)	KEYSIGHT	N9020B	SEM004-24	2023-03-20	2024-03-19
4X4 Power Sensor Unit	TST	TSPS2023R	EMC2257	2023-08-23	2024-08-22
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

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

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	2023-08-23	2024-08-22
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

6 Radio Spectrum Matter Test Result for Lower 700MHz

6.1 Out-of-band rejection

Test Requirement: Not specified

Test Method: KDB 935210 D05 clause 3.3

Limit: No limit

6.1.1 E.U.T. Operation

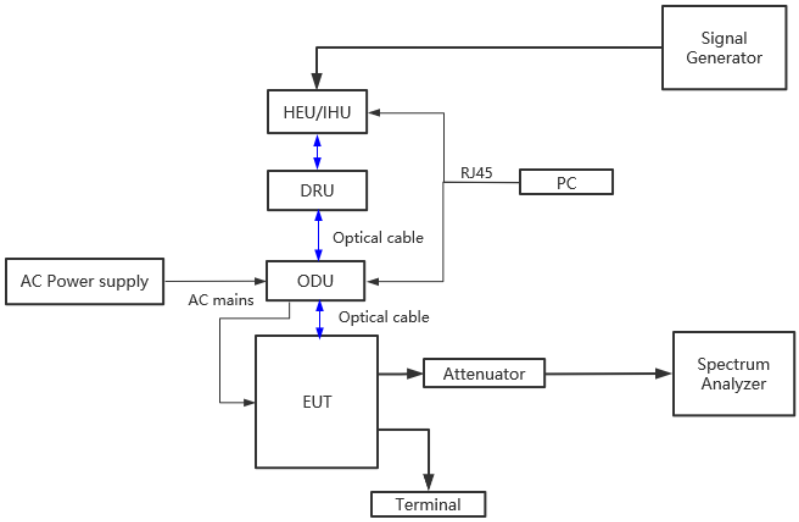
Operating Environment:

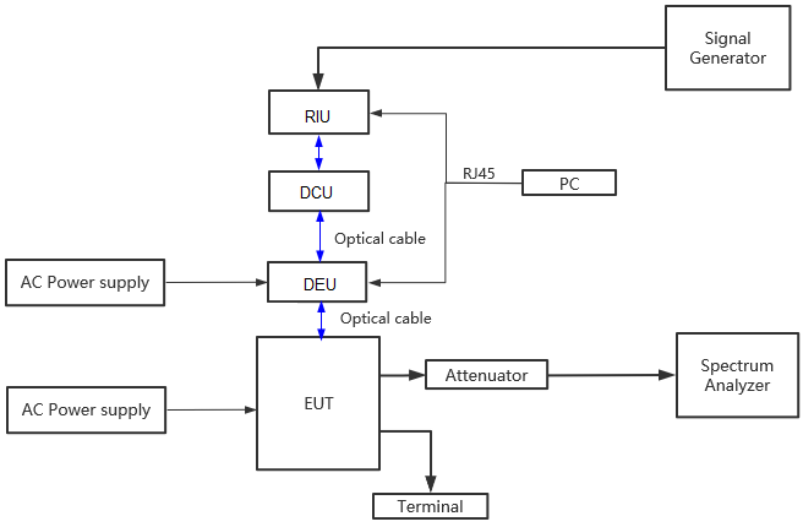
Temperature: 24.6 °C Humidity: 59 % RH Atmospheric Pressure: 1020 mbar

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

EUT Configuration: Refer to clause 4.4 in this report.

6.1.2 Test Setup





6.1.3 Measure Data

Please refer to Appendix-Test Data and Result for report GZCR231100125402

6.2 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

6.2.1 E.U.T. Operation

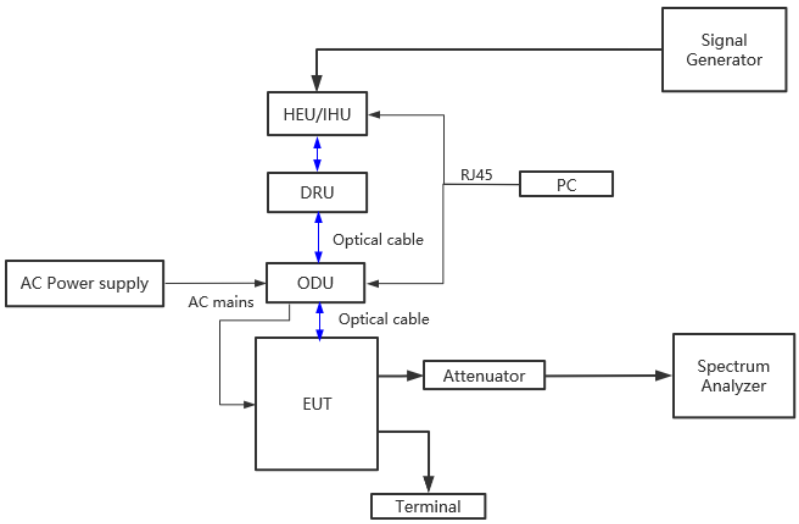
Operating Environment:

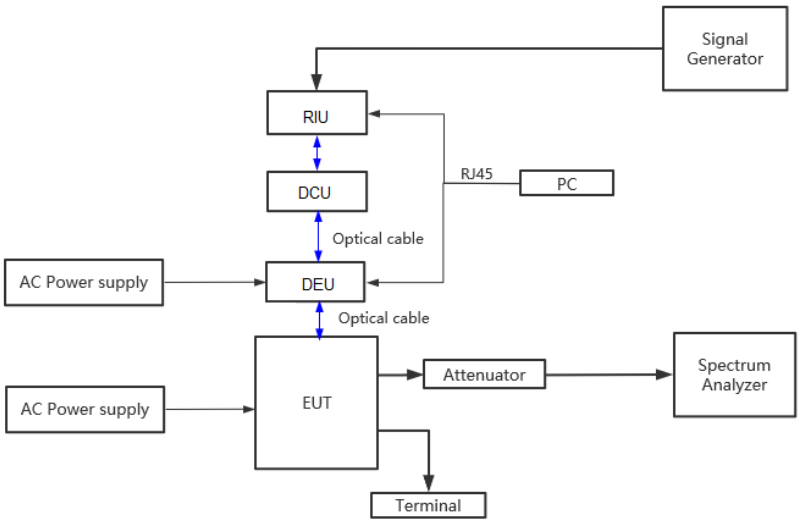
Temperature: 24.6 °C Humidity: 59 % RH Atmospheric Pressure: 1020 mbar

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 Measure Data

Please refer to Appendix-Test Data and Result for report GZCR231100125402

6.3 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 in the 600 MHz band and the 698-746 MHz band 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.

6.3.1 E.U.T. Operation

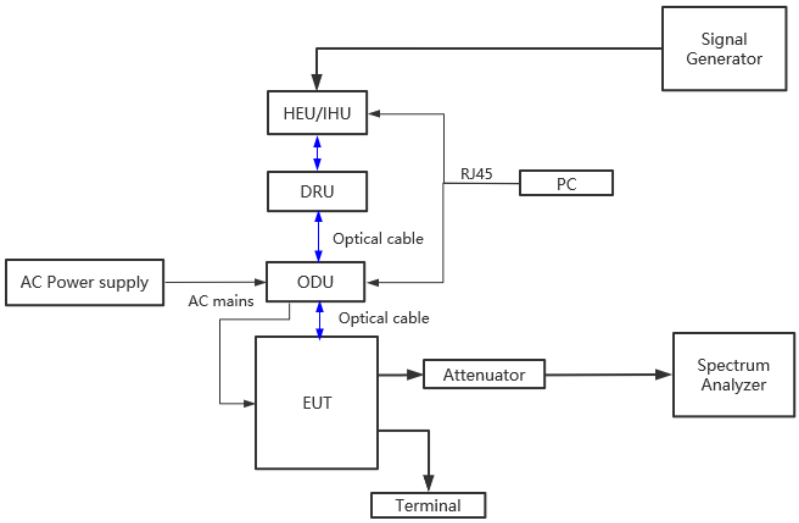
Operating Environment:

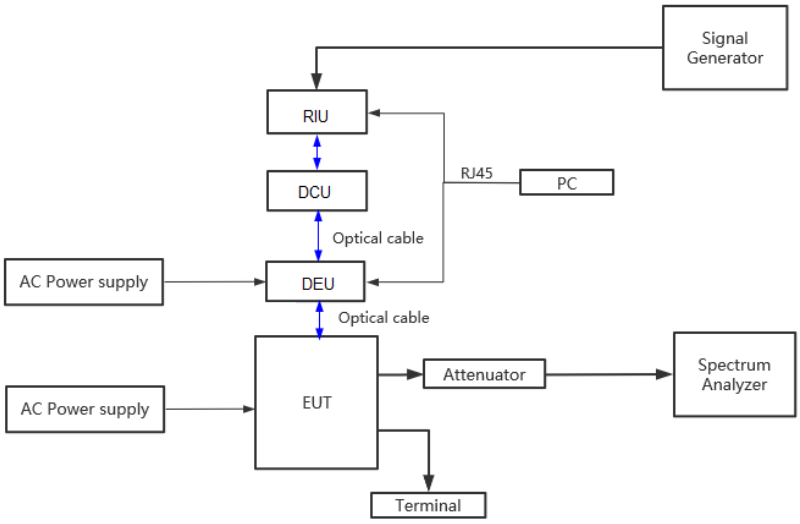
Temperature: 24.6 °C Humidity: 59 % RH Atmospheric Pressure: 1020 mbar

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 Measure Data

Please refer to Appendix-Test Data and Result for report GZCR231100125402

6.4 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: For operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least 43 + 10 log (P) dB
(reduce 3.01dB when on 2×2 MIMO mode)

6.4.1 E.U.T. Operation

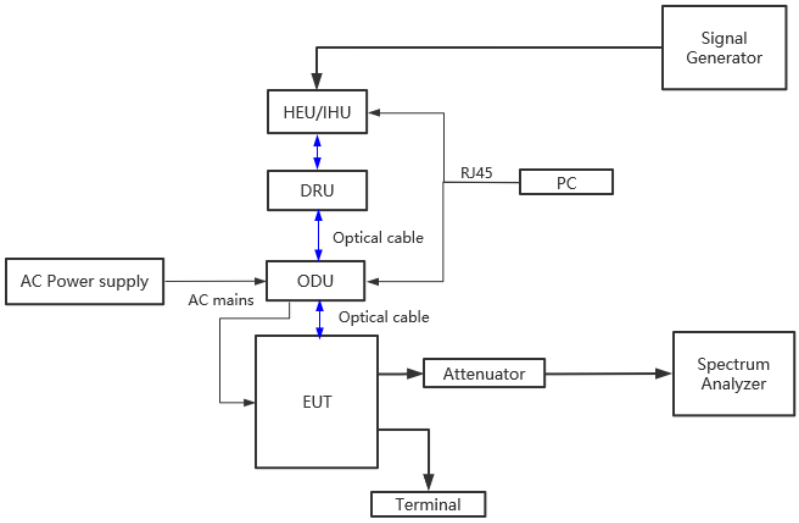
Operating Environment:

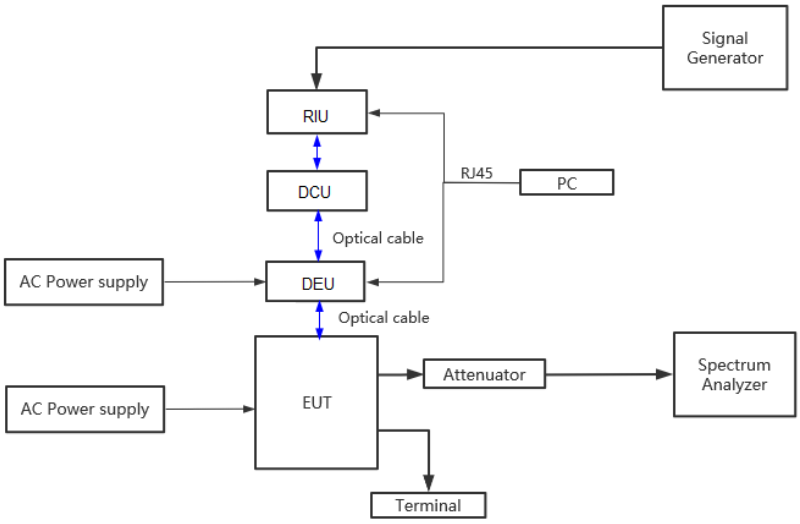
Temperature: 24.6 °C Humidity: 59 % RH Atmospheric Pressure: 1020 mbar

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 Measure Data

Please refer to Appendix-Test Data and Result for report GZCR231100125402

6.5 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.

6.5.1 E.U.T. Operation

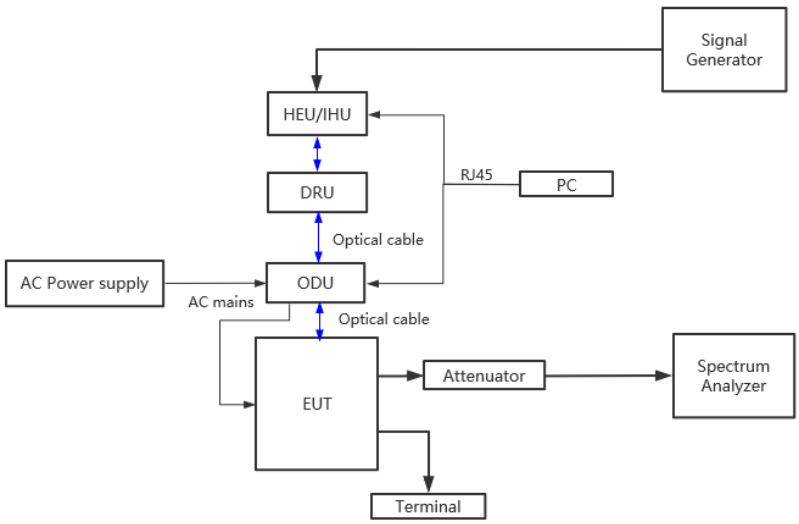
Operating Environment:

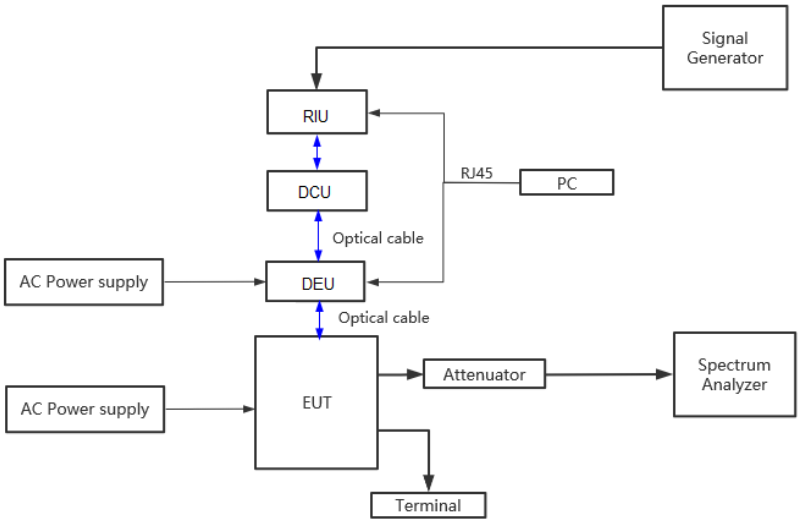
Temperature: 24.6 °C Humidity: 59 % RH Atmospheric Pressure: 1020 mbar

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 Measure Data

Please refer to Appendix-Test Data and Result for report GZCR231100125402

6.6 Radiated spurious emission

Test Requirement:	47 CFR Part 2.1053, 27.53(g)
Test Method:	KDB 935210 D05 clause 3.8
	ANSI C63.26-2015 clause 5.6
Limit:	For operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least 43 + 10 log (P) dB

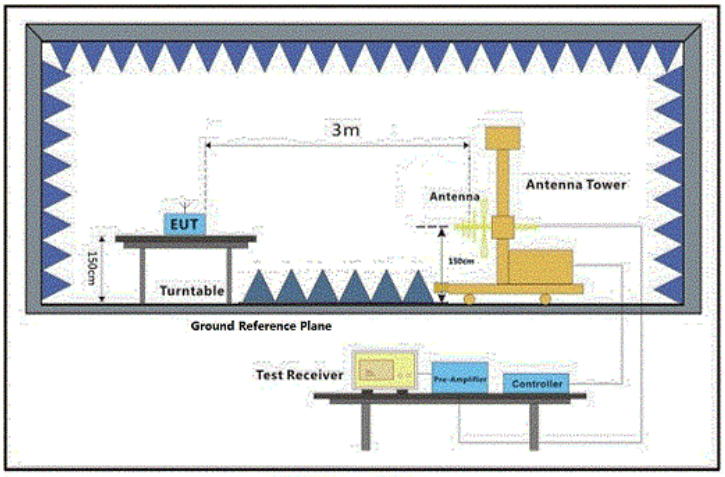
6.6.1 E.U.T. Operation

Operating Environment:

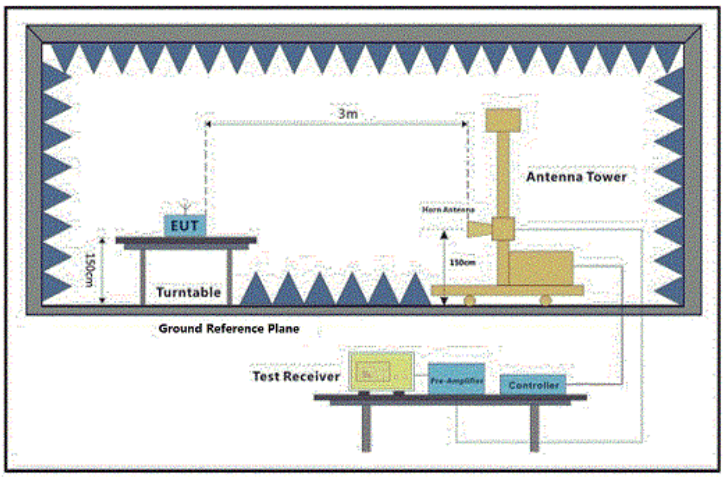
Temperature: 25.1 °C Humidity: 59 % RH Atmospheric Pressure: 1010 mbar

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

6.6.2 Test Setup



30MHz-1GHz



Above 1GHz

6.6.3 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)

6.6.4 Measure Data

Please refer to Appendix-Test Data and Result for report GZCR231100125402

7 Radio Spectrum Matter Test Ressult for Upper 700MHz

7.1 Out-of-band rejection

Test Requirement: Not specified

Test Method: KDB 935210 D05 clause 3.3

Limit: No limit

7.1.1 E.U.T. Operation

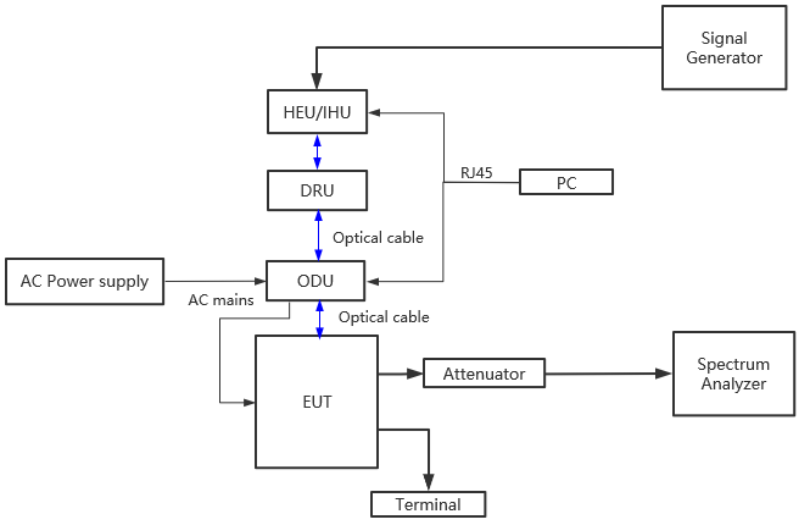
Operating Environment:

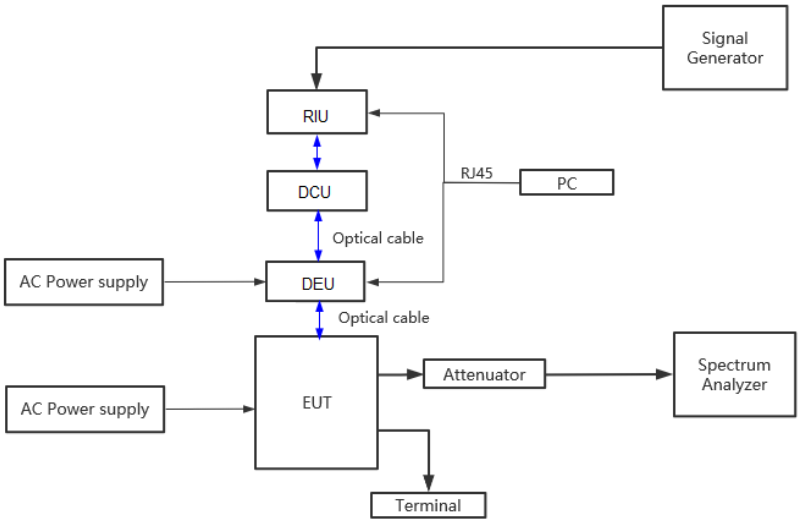
Temperature: 24.6 °C Humidity: 59 % RH Atmospheric Pressure: 1020 mbar

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

EUT Configuration: Refer to clause 4.4 in this report.

7.1.2 Test Setup





7.1.3 Measure Data

Please refer to Appendix-Test Data and Result for report GZCR231100125402

7.2 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

7.2.1 E.U.T. Operation

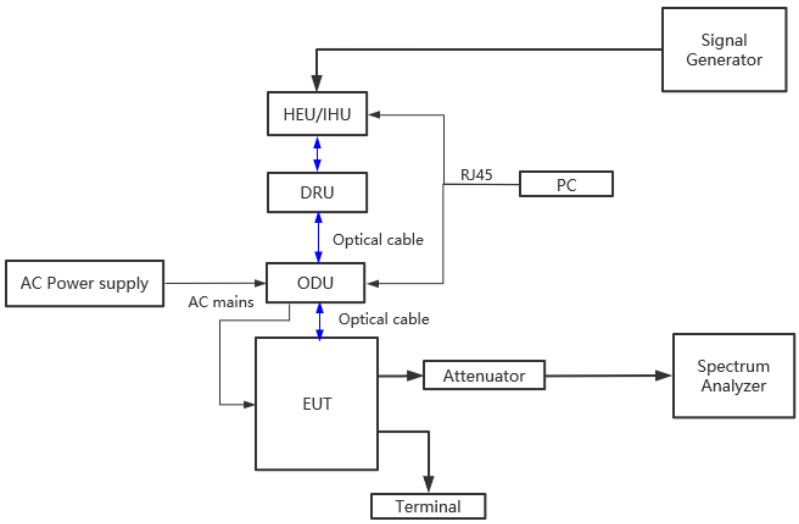
Operating Environment:

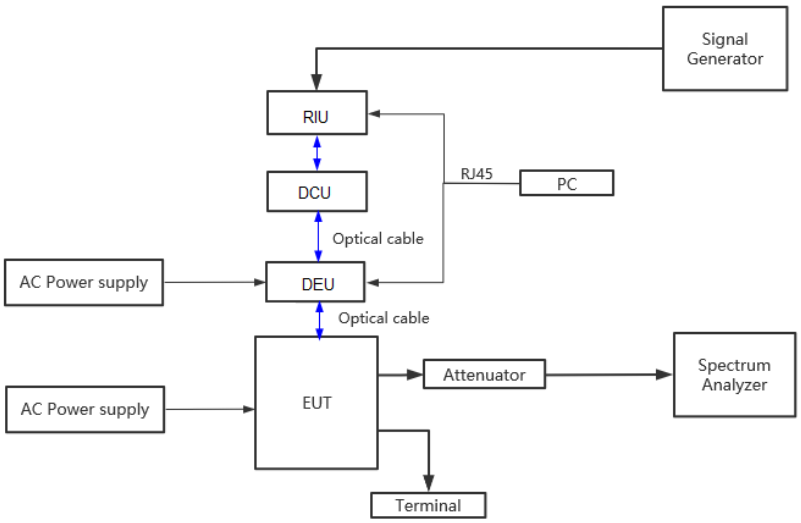
Temperature: 24.6 °C Humidity: 59 % RH Atmospheric Pressure: 1020 mbar

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 Measure Data

Please refer to Appendix-Test Data and Result for report GZCR231100125402

7.3 Mean output power and amplifier/booster gain

Test Requirement: 47 CFR 27.50(b)

Test Method: KDB 935210 D05 clause 3.5

Limit: Fixed and base stations transmitting a signal in the 746-757 MHz and 776-787 MHz bands 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.

7.3.1 E.U.T. Operation

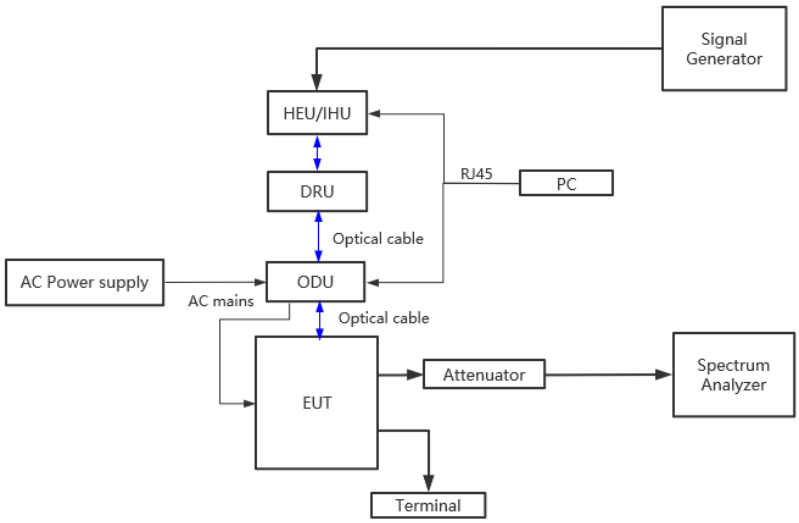
Operating Environment:

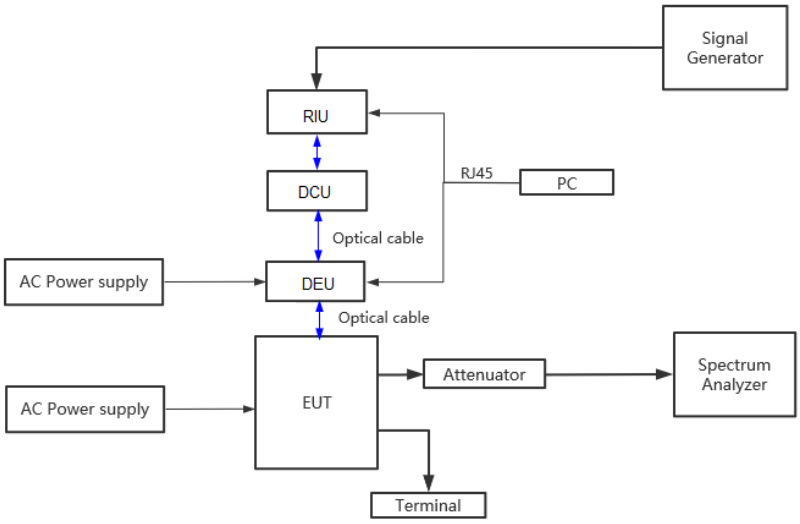
Temperature: 24.6 °C Humidity: 59 % RH Atmospheric Pressure: 1020 mbar

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 Measure Data

Please refer to Appendix-Test Data and Result for report GZCR231100125402

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

Test Requirement: 47 CFR 27.53(c)

Test Method: KDB 935210 D05 clause 3.6

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

7.4.1 E.U.T. Operation

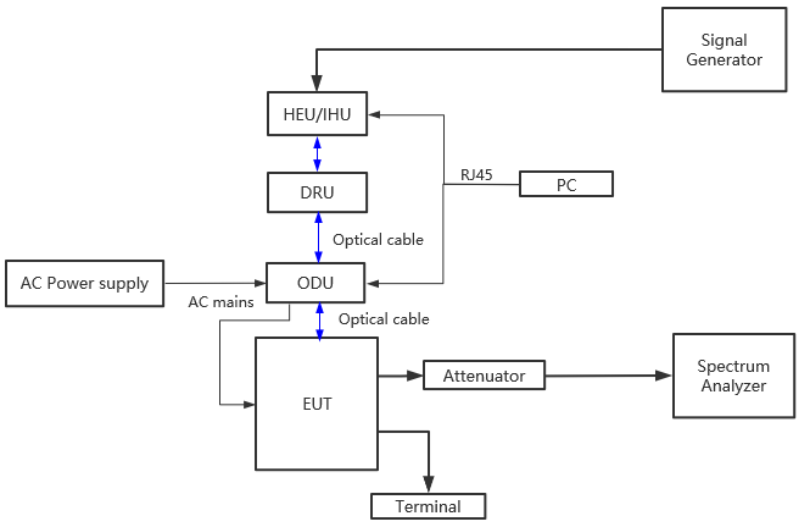
Operating Environment:

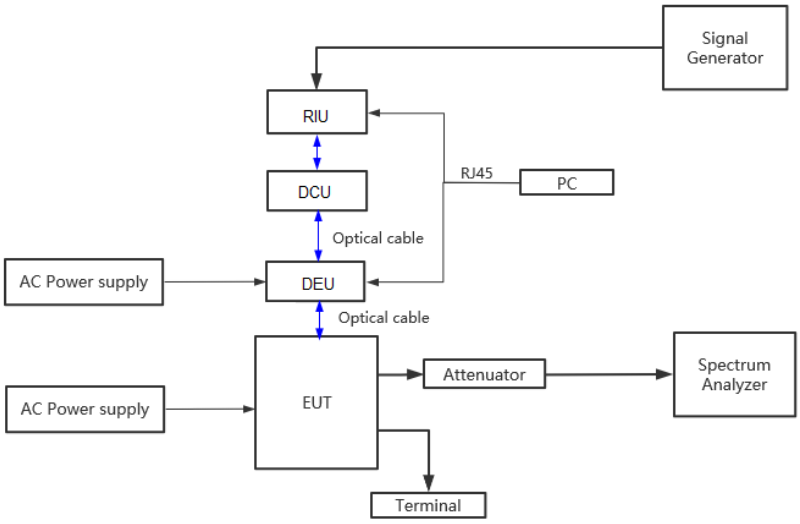
Temperature: 24.6 °C Humidity: 59 % RH Atmospheric Pressure: 1020 mbar

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 Measure Data

Please refer to Appendix-Test Data and Result for report GZCR231100125402

7.5 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.

7.5.1 E.U.T. Operation

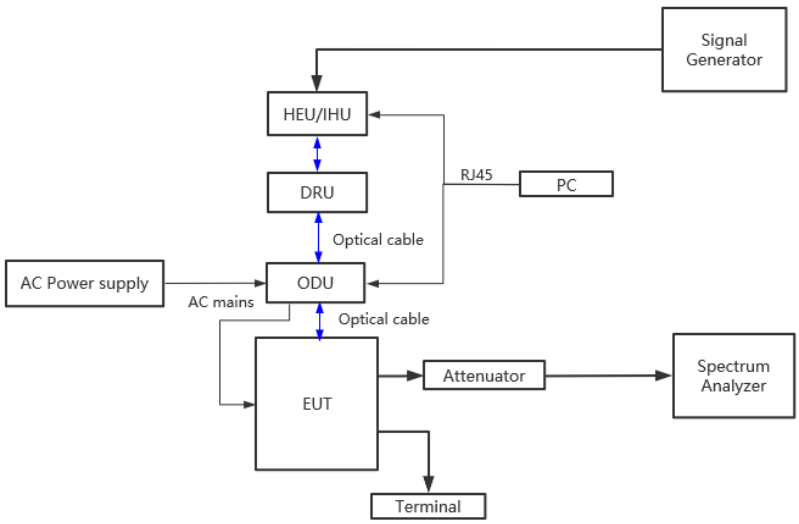
Operating Environment:

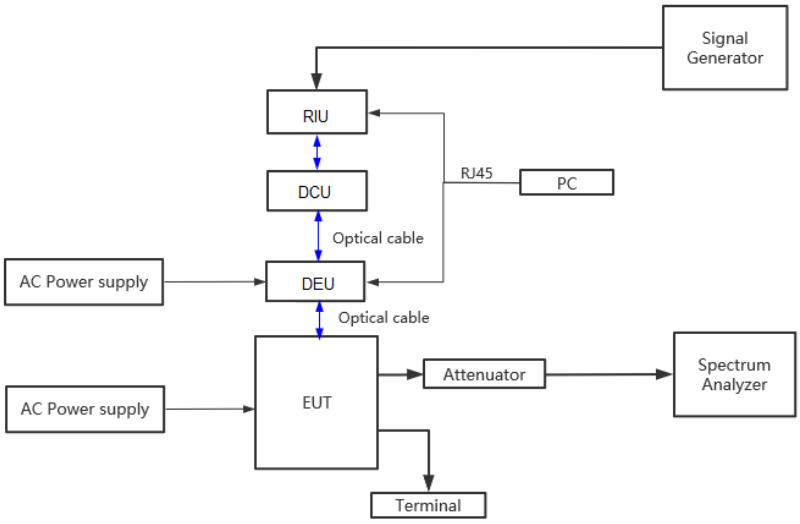
Temperature: 24.6 °C Humidity: 59 % RH Atmospheric Pressure: 1020 mbar

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 Measure Data

Please refer to Appendix-Test Data and Result for report GZCR231100125402

7.6 Radiated spurious emission

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

Test Method: KDB 935210 D05 clause 3.8

ANSI C63.26-2015 clause 5.6

Limit: 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;

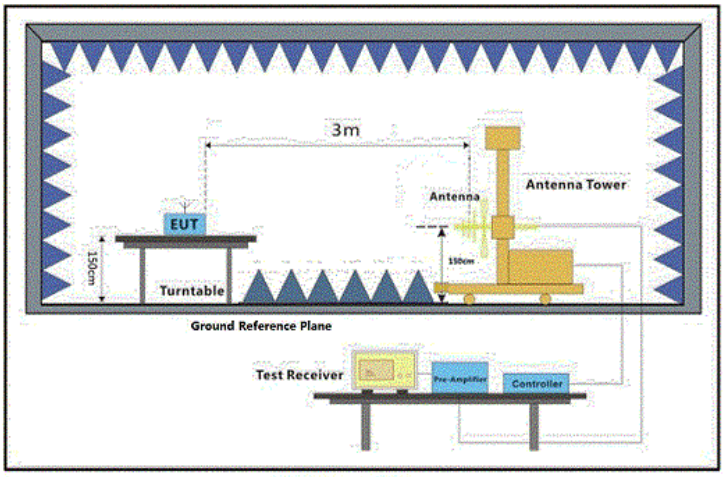
7.6.1 E.U.T. Operation

Operating Environment:

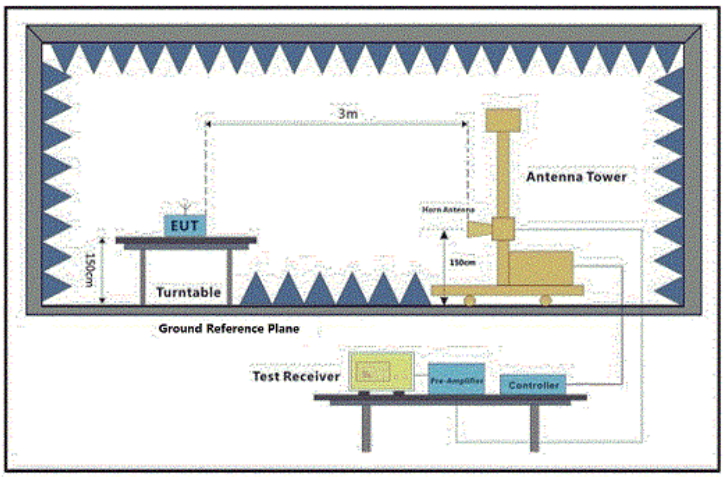
Temperature: 25.1 °C Humidity: 59 % RH Atmospheric Pressure: 1010 mbar

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

7.6.2 Test Setup



30MHz-1GHz



Above 1GHz

7.6.3 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)

7.6.4 Measure Data

Please refer to Appendix-Test Data and Result for report GZCR231100125402

8 Radio Spectrum Matter Test Result for FirstNet

8.1 Out-of-band rejection

Test Requirement: Not specified

Test Method: KDB 935210 D05 clause 4.3

Limit: No limit

8.1.1 E.U.T. Operation

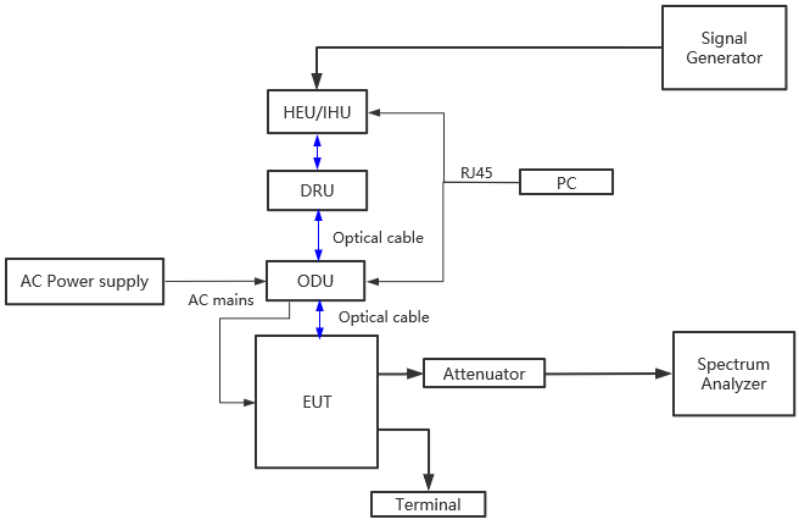
Operating Environment:

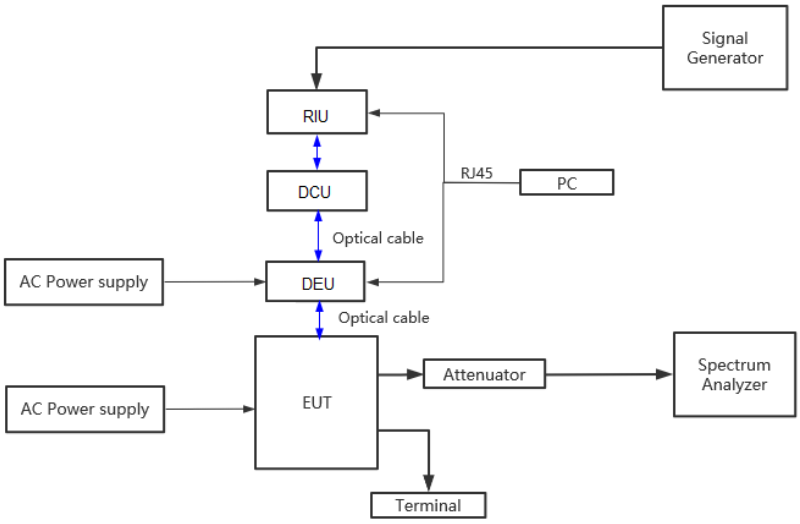
Temperature: 24.6 °C Humidity: 59 % RH Atmospheric Pressure: 1020 mbar

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

EUT Configuration: Refer to clause 4.4 in this report.

8.1.2 Test Setup





8.1.3 Measure Data

Please refer to Appendix-Test Data and Result for report GZCR231100125402

8.2 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	A or B	A or C
25-50	B	C
72-76	B	C
150-174	B, D, or E	C, D or E
150 paging only	B	C
220-222	F	F
421-512	B, D, or E	C, D, or E
450 paging only	B	G
806-809/851-854	B	H
809-824/854-869	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		
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)

8.2.1 E.U.T. Operation

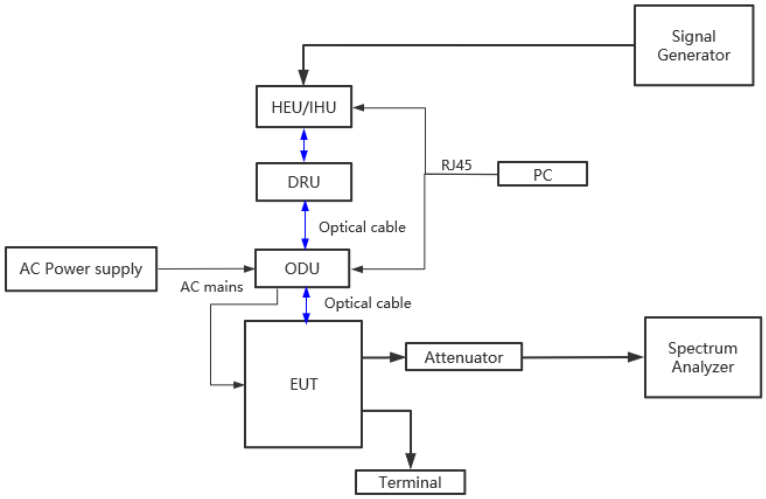
Operating Environment:

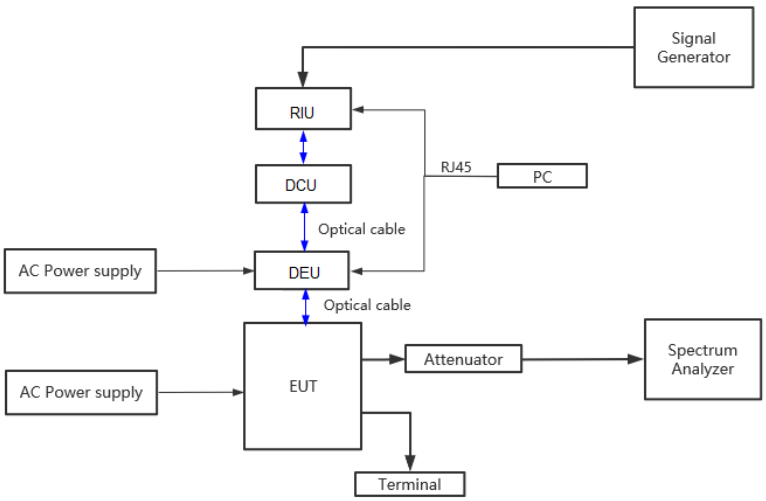
Temperature: 24.6 °C Humidity: 59 % RH Atmospheric Pressure: 1020 mbar

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 Measure Data

Please refer to Appendix-Test Data and Result for report GZCR231100125402

8.3 Input/output power and amplifier/booster gain

Test Requirement: 47 CFR Part 90.541

Test Method: KDB 935210 D05 clause 4.5

Limit: The effective radiated power and antenna height for base stations may not exceed 1 kilowatt (30 dBw) and 304 m

8.3.1 E.U.T. Operation

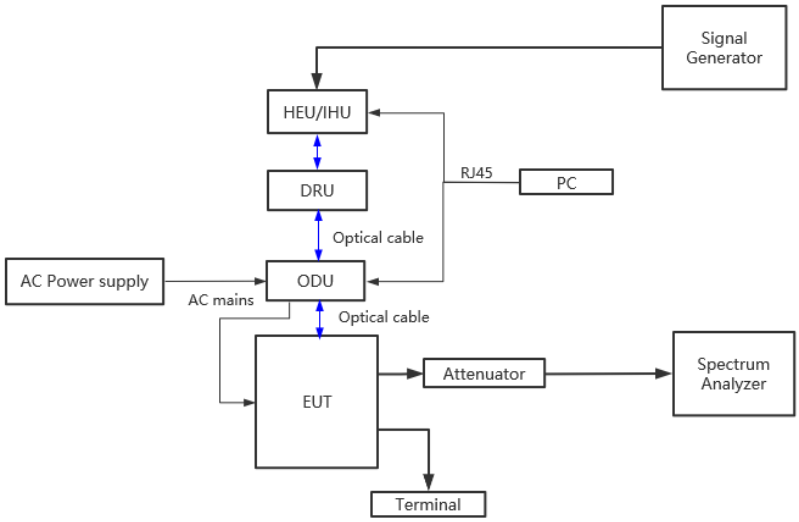
Operating Environment:

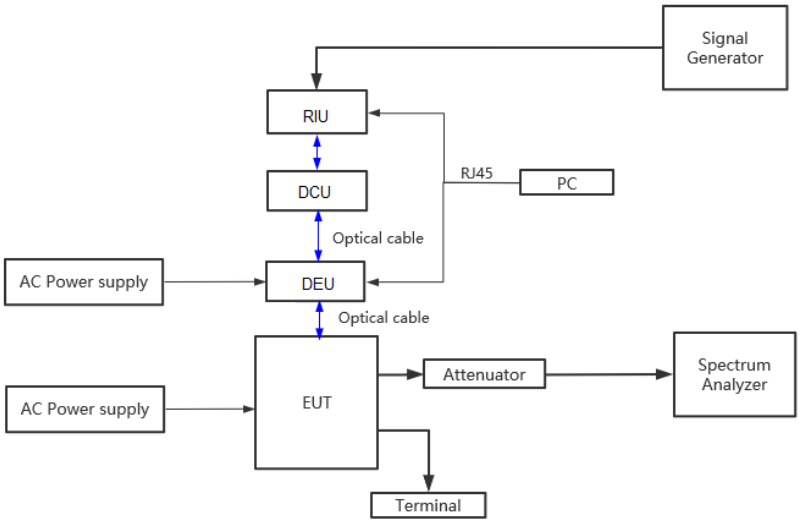
Temperature: 24.6 °C Humidity: 59 % RH Atmospheric Pressure: 1020 mbar

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 Measure Data

Please refer to Appendix-Test Data and Result for report GZCR231100125402

8.4 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

8.4.1 E.U.T. Operation

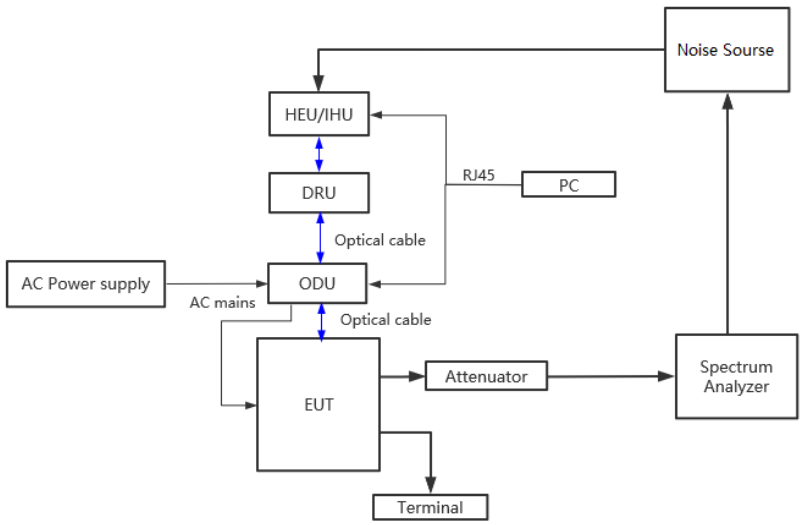
Operating Environment:

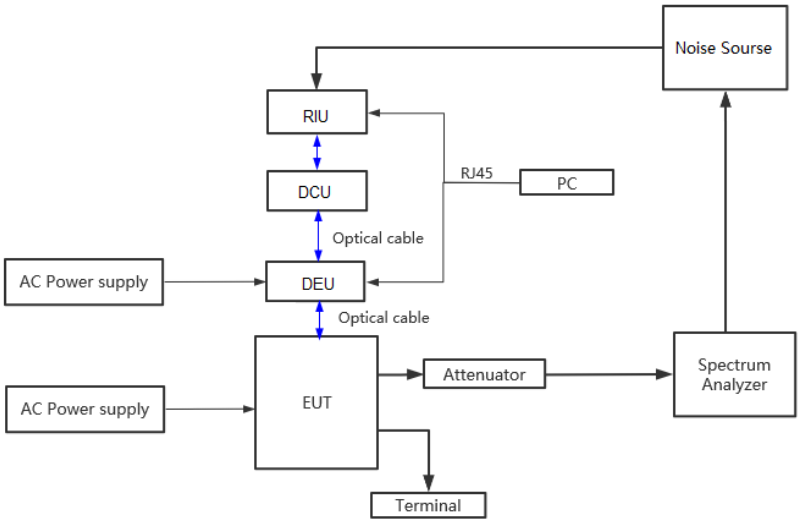
Temperature: 24.6 °C Humidity: 59 % RH Atmospheric Pressure: 1020 mbar

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 Measure Data

Please refer to Appendix-Test Data and Result for report GZCR231100125402

8.5 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.

8.5.1 E.U.T. Operation

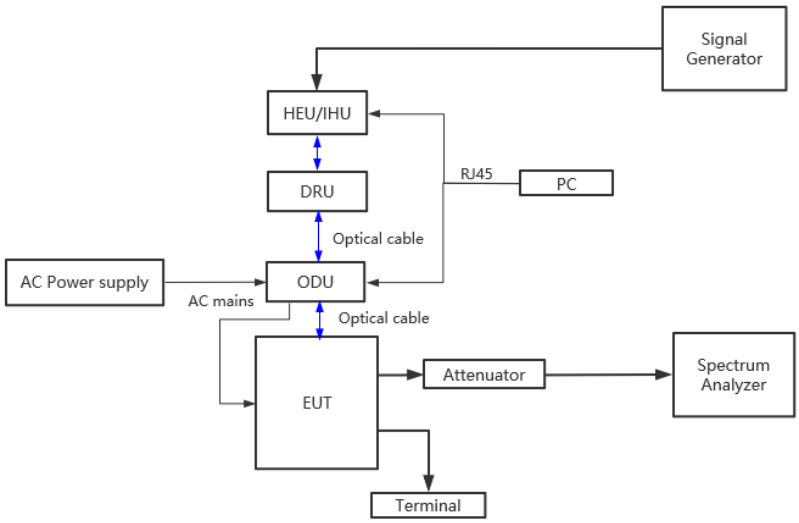
Operating Environment:

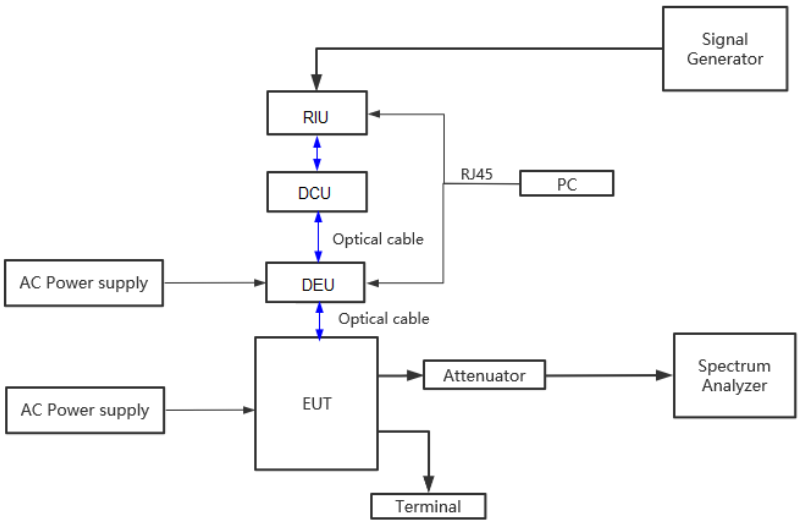
Temperature: 24.6 °C Humidity: 59 % RH Atmospheric Pressure: 1020 mbar

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 Measure Data

Please refer to Appendix-Test Data and Result for report GZCR231100125402

8.6 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.

8.6.1 E.U.T. Operation

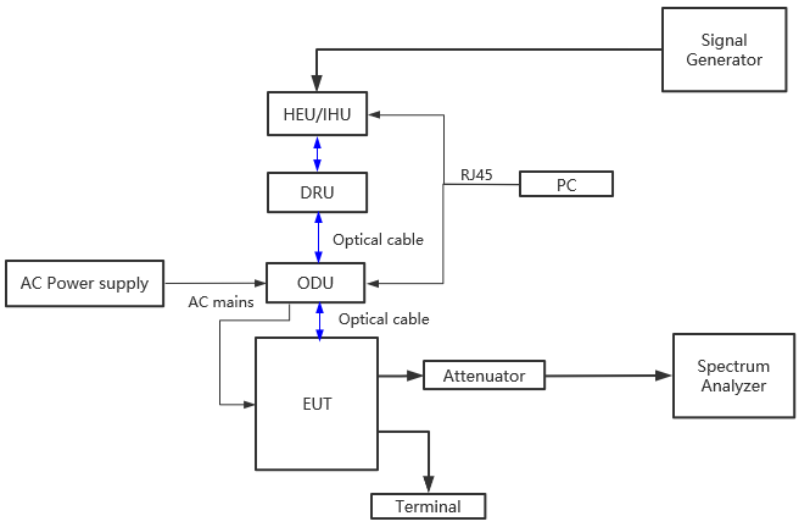
Operating Environment:

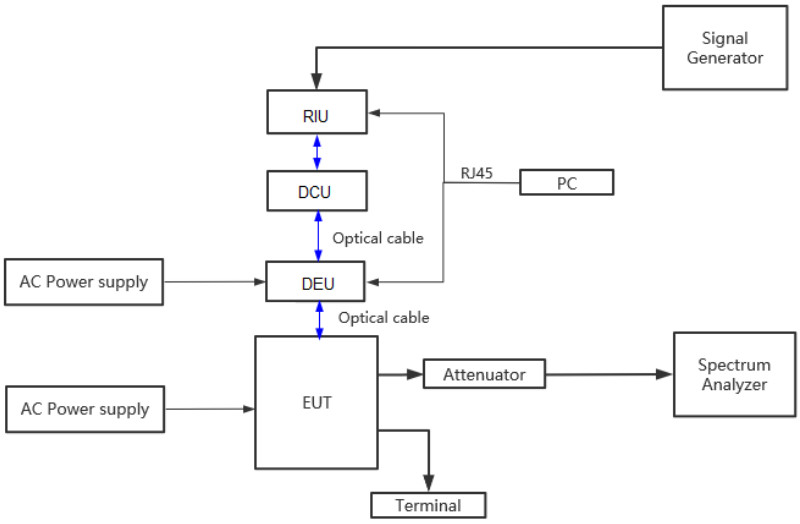
Temperature: 24.6 °C Humidity: 59 % RH Atmospheric Pressure: 1020 mbar

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 Measure Data

Please refer to Appendix-Test Data and Result for report GZCR231100125402

8.7 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.

8.7.1 E.U.T. Operation

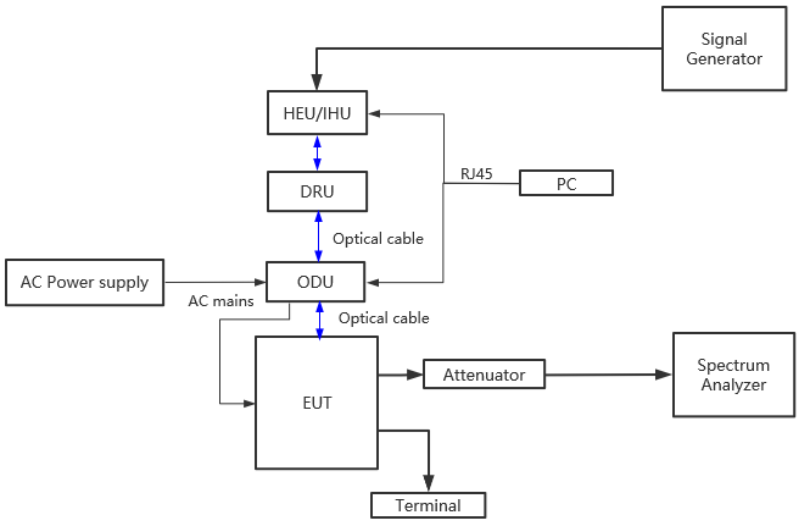
Operating Environment:

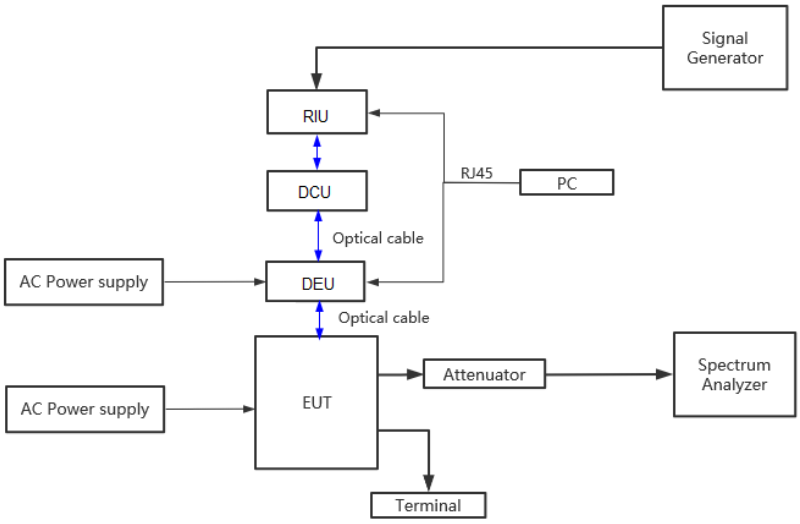
Temperature: 24.6 °C Humidity: 59 % RH Atmospheric Pressure: 1020 mbar

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

EUT Configuration: Refer to clause 4.4 in this report.

8.7.2 Test Setup





8.7.3 Measure Data

Please refer to Appendix-Test Data and Result for report GZCR231100125402

8.8 Radiated spurious emission

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

Test Method: KDB 935210 D05 clause 4.9

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.

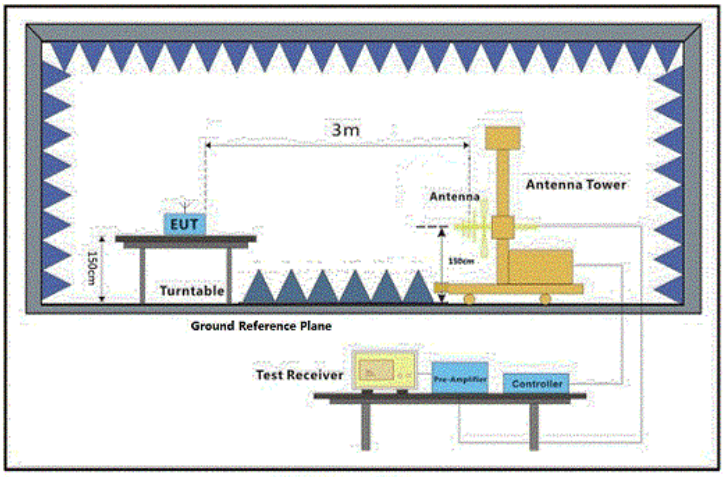
8.8.1 E.U.T. Operation

Operating Environment:

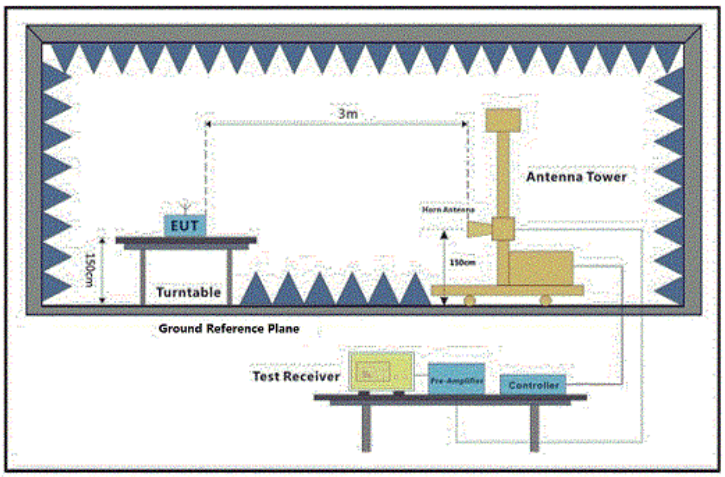
Temperature: 25.1 °C Humidity: 59 % RH Atmospheric Pressure: 1010 mbar

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

8.8.2 Test Setup



30MHz-1GHz



Above 1GHz

8.8.3 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)

8.8.4 Measure Data

Please refer to Appendix-Test Data and Result for report GZCR231100125402

9 Test Setup Photographs

Refer to Appendix - Test Setup Photos for GZCR2311001254AT.

10 EUT Constructional Details (EUT Photos)

Refer to Appendix - External and Internal Photos for GZCR2311001254AT.

--Report End--

SGS-CSTC Standards Technical Services Co., Ltd. Guangzhou Branch Testing Room EEC Laboratory.

No.198, Kezhu Road, Science City, Economic & Technological Development Area, Guangzhou, Guangdong, China 510663 t (86-20) 82155555 www.sgsgroup.com.cn

中国·广东·广州高新技术产业开发区科学城科珠路198号 邮编：510663 t (86-20) 82155555 sgs.china@sgs.com