

TEST REPORT

Application No.: GZCR2411001398AT
Applicant: Comba Telecom Network Systems Limited
Address of Applicant: Flat/Rm 10, 3/F, Bio-Informatics Ctr, 2 Science Park West Avenue, HK Science Park, Pak Shek Kok, N.T. Hong Kong
Manufacturer: Comba Network Systems Company Limited
Address of Manufacturer: No. 10 Shenzhou Road, Guangzhou Science City, Guangzhou 510663, Guangdong, P.R. China
Factory: Comba Telecom Technology (Guangzhou) Ltd.
Address of Factory: No. 6 Jinbi Road, Economics and Technology Development District, Guangzhou, Guangdong, China
Product Name: Comflex NGc
Model No.: MRU-7851719c-AC, MRU-7851719c-DC ♣
 ♣ Please refer to section 2 of this report which indicates which item was actually tested and which were electrically identical.
Trade Mark: Comba
Standard(s) : 47 CFR Part 2
 47 CFR Part 20
Date of Receipt: 2024-11-25
Date of Test: 2025-02-20 to 2025-03-14
Date of Issue: 2025-03-21

Test Result:	Pass*
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* In the configuration tested, the EUT complied with the standards specified above.



Jerry Chan
Manager



SGS-CSTC Standards Technical Services Co., Ltd.
Guangzhou Branch, EMC Laboratory

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Revision Record			
Version	Report No.	Date	Remark
01	GZCR241100139802	2025-03-21	Original

Authorized for issue by:			
		Kevin Zhang	
		Kevin Zhang/Project Engineer	
		Vico Cui	
		Vico Cui/Reviewer	



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2 Test Summary

Item (FCC Rule 47 CFR)	Item & Method (KDB 935210 D04 v02r02 Subclause)	Result
20.21(e)(3) Frequency Bands	7.1.1 Authorized frequency band verification	PASS
	7.1.2 Authorized CMRS provider test	PASS
20.21(e)(9)(i)(D) Power Limits 20.21(e)(9)(i)(B) Bidirectional Capability	7.2 Maximum power	PASS
20.21(e)(9)(i)(C)(2) Booster Gain Limits 20.21(e)(9)(i)(B) Bidirectional Capability	7.3 Maximum booster gain computation	PASS
20.21(e)(9)(i)(G) Intermodulation Limits	7.4 Intermodulation product	PASS
20.21(e)(9)(i)(F) Out of Band Emission Limits	7.5 Out-of-band emissions	PASS
2.1051 Spurious emissions at antenna terminals	7.6 Conducted spurious emissions	PASS
20.21(e)(9)(i)(A) Noise Limits 20.21(e)(9)(i)(I) Transmit Power Off Mode	7.7 Noise	PASS
20.21(e)(9)(i)(J) Uplink Inactivity	7.8 Uplink inactivity	PASS
20.21(e)(9)(i)(C)(1) Booster Gain Limits 20.21(e)(9)(i)(I) Transmit Power Off Mode	7.9 Variable booster gain	PASS
2.1049 Occupied bandwidth	7.10 Occupied bandwidth	PASS
20.21(e)(9)(ii)(A) Anti-Oscillation 20.21(e)(5) Anti-Oscillation	7.11 Oscillation detection	PASS
2.1053 Field strength of spurious radiation	7.13 Radiated spurious emissions (below 1GHz)	PASS
2.1053 Field strength of spurious radiation	7.13 Radiated spurious emissions (above 1GHz)	PASS
20.21(e)(9)(i)(B) Bidirectional Capability 20.21(e)(3) Frequency Band	7.14 Spectrum block filtering	PASS



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Item (FCC Rule 47 CFR)	Item & Method (KDB 935210 D04 v02r02 Subclause)	Result
20.21(e)(9)(i)(E) Out of Band Gain Limits	7.15 Out of band gain	PASS
2.1055 Frequency stability	7.16 Frequency stability	PASS
20.21(e)(4) Self-monitoring	1	PASS
20.21(e)(9)(i)(H) Booster Antenna Kitting	2	PASS
20.21(e)(9)(i)(I) Transmit Power Off Mode	3	PASS
20.21(e)(9)(ii)(B) Gain Control	4	PASS
20.21(e)(9)(ii)(C) Interference Avoidance for Wireless Subsystems	5	PASS

Note:

E.U.T./ EUT means Equipment Under Test

Pass means the test result passed the test standard requirement, please find the detailed decision rule in the report relative section.

The EUT is an Remote Unit (RU) of an in-building distributed antenna solution (DAS) for provider-specific consumer application and must be integrated with the Master Unit (MU) to form DAS in order to function properly. Optical fibers will be used between RU and MU for connecting.

The DAS has 8 server ports and 1 donor port. The server ports are referred to as MT1 thru MT8 and the donor port is referred to as DT in the test report.

- ¹ There is no specific test for this functionality but it is instead indirectly addressed by the noise and gain limits tests.
- ² Generic testing requirements are not established; rather technical documentation is used describing all antennas, cables, and/or coupling devices that may be used with a consumer booster and how those meet the requirements.
- ³ There is no specific test for this functionality but it is instead addressed through a combination of the variable noise, variable gain, and oscillation detection tests.
- ⁴ Conformance to the requirement to include AGC circuitry is verified in 7.1 and 7.2.
- ⁵ 20.21(e)(9)(ii)(C) Consumer boosters using unlicensed (part 15) or other frequency bands for wireless transmissions between donor and server subsystems for its internal operations must employ interference avoidance methods to prevent interference transmitted into authorized CMRS spectrum bands. Before testing please submit a proposed test plan in a KDB inquiry for FCC review and acceptance. This device without any unlicensed (part 15) or other frequency bands for wireless transmissions function, PAG is not required.



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♣ Declaration of EUT Family Grouping:

Model No.: MRU-7851719c-AC, MRU-7851719c-DC

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 power supply module.

Therefore, only model MRU-7851719c-AC was test for all above items and only mode MRU-7851719c-DC was test for Radiated spurious emissions in this report.



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4 General Information

4.1 Details of EUT

Power Supply:	AC 100-240V, 50/60Hz for MRU-7851719c-AC DC 48V for MRU-7851719c-DC	
Test Voltage:	AC 120V for MRU-7851719c-AC DC 48V for MRU-7851719c-DC	
Cable:	AC mains (4m, unshielded) for MRU-7851719c-AC	
Operating Temperature:	-20 to +55 °C	
Operating Humidity:	≤85%	
Frequency Range:	Lower 700MHz:	Uplink: 698-716MHz Downlink: 728-746MHz
	Upper 700MHz:	Uplink: 777-787MHz Downlink: 746-756MHz
	Cellular:	Uplink: 824-849MHz Downlink: 869-894MHz
	AWS-1:	Uplink: 1710-1755MHz Downlink: 2110-2155MHz
	Broadband PCS:	Uplink: 1850-1915MHz Downlink: 1930-1995MHz
Interface:	Antenna Port:	8 (NEX10-F)
	Optical Port	1 (SC-APC)
	Debug Port	1 (RJ45)
Radio System Type:	WCDMA, LTE	
Minimum Bandwidth:	5MHz	
Normal Output Power:	Uplink	19dBm (conducted)
	Downlink	10dBm/5MHz (EIRP/ERP, per antenna port)
Normal System Gain:	Uplink	65dB
	Downlink	70dB (per antenna port)
Antenna Type:	External dedicated antenna	
Antenna Gain:	9dBi declared by the manufacturer	
Cable Loss:	-9dB declared by the manufacturer	
Software Version:	MRU5667M07R00.02.05	
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4.2 Description of Support Units

Description	Manufacturer	Model No.	Serial No.
Notebook	LENOVO	Lenovo Xiaoxinchao 5000	PF0TNMG8
Comflex NGc	Comba Network System Company Limited	Comflex NGc MU	/
Mathced, attenuator, splitter, coupler and combiner supplied by the client.	/	/	/

4.3 Test Environment

Environment Parameter	Selected Values During Test	
Ralative Humidity	Ambient	
Value	Temperature (°C)	Voltage (V)
TNVN	Asmbient	AC 120 V 60 Hz
TLVL	-30	AC 102 V 60 Hz
TLVH	-30	AC 138 V 60 Hz
THVL	+50	AC 102 V 60 Hz
THVH	+50	AC 138 V 60 Hz

VN: Normal Voltage, TN: Normal Teperature

VL: Lower Extreme Voltege, VH: Higher Extreme Voltage

TL: Lower Extreme Teperature, TH: Higher Extreme Teperature



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4.4 Measurement Uncertainty

No.	Item	Measurement Uncertainty
1	RF Output Power	$\pm 0.75\text{dB}$
2	Transmitter unwanted emissions	$\pm 0.75\text{dB}$
3	Radiated Spurious Emissions Below 1GHz	$\pm 3.08\text{dB}$ (9kHz to 150kHz); $\pm 3.19\text{dB}$ (150kHz to 30MHz); $\pm 5.14\text{dB}$ (30MHz-1GHz) (3m); $\pm 4.90\text{dB}$ (30MHz-1GHz) (10m)
4	Radiated Spurious Emissions Above 1GHz	$\pm 4.82\text{dB}$
5	Occupied Channel Bandwidth	$\pm 0.274\%$

Remark:

The U_{lab} (lab Uncertainty) is less than U_{CISPR} (CISPR Uncertainty) or U_{ETSI} (ETSI Uncertainty).

Emission decision rule:

- Compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit, marked as Pass in the report.
- Non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit, marked as Fail in the report.

4.5 Test Location

All tests were performed at:

SGS-CSTC Standards Technical Services Co., Ltd., Guangzhou Branch EMC Laboratory,
No.198, Kezhu Road, Science City, Economic & Technological Development Area, Guangzhou,
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Tel: +86 20 82155555

No tests were sub-contracted.



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4.6 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.

4.7 Deviation from Standards

None

4.8 Abnormalities from Standard Conditions

None



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5 Equipment List

Conducted test equipment					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
Temperature Chamber	GZ GongWen Co.Ltd.	GDJW-100	EMC0039	2024-06-17	2025-06-16
EXA Signal Analyzer (10Hz-44GHz)	Keysight	N9010A	EMC2138	2024-08-19	2025-08-18
MXA Signal Analyzer (10Hz-50GHz)	KEYSIGHT	N9020B	SEM004-24	2024-03-16	2025-03-15
Spectrum Analyzer(9kHz-30GHz)	Rohde & Schwarz	FSP30	SEM004-06	2024-09-21	2025-09-20
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
4X4 Power Sensor Unit	TST	TSPS2023R	EMC2257	2024-08-19	2025-08-18
EXA Signal Analyzer	Agilent Technologies	N9010A	EMC2222	2024-12-03	2025-12-02
ESG vector signal generator (250kHz-6GHz)	Agilent Technologies	E4438C	SEM006-03	2024-12-03	2025-12-02
Test Software	TST	V2.0	GZE100-82	N/A	N/A

Radiated Spurious Emissions Below 1GHz					
Equipment	Manufacturer	Model No.	Inventory No.	Cal Date	Cal Due Date
966 Anechoic Chamber	Shenzhen C.R.T	CRTSGSSAC966	EMC2230	2022-04-12	2025-04-11
EMI Test Receiver(1Hz-8GHz)	Rohde & Schwarz	ESW8	EMC2229	2024-12-03	2025-12-02
Amplifier(9k-1000MHz)	SONOMA	310	EMC2237	2024-12-03	2025-12-02
Trilog Broadband Antenna (25MHz-2GHz)	Schwarzbeck Mess-Elektronik	VULB 9168	EMC2238	2022-04-20	2025-04-19
Coaxial Cable	Mirco-COAX UTIFLEX ve	LA2-C125-8000	EMC2239	2024-12-04	2026-12-03
Test Software E3	Audix	Ver.6.191211	GZE100-81	N/A	N/A
Active Loop Antenna-RED	ETS-Lindgren	6502	EMC2190	2024-04-08	2026-04-07



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Radiated Spurious Emissions Above 1GHz					
Equipment	Manufacturer	Model No.	Inventory No.	Cal Date	Cal Due Date
1GHz-26.5 GHz Pre-Amplifier	Agilent	8449B	EMC0521	2024-10-14	2025-10-13
Chamber cable (Above 1GHz)	Scoflex	KMKM-8.0m	EMC0545	2024-08-19	2026-08-18
Horn Antenna (1GHz-18GHz)	SCHWARZBECK MESS-ELEKTRONIK	BBHA 9120D	EMC2026	2022-09-23	2025-09-22
Horn Antenna (14-40GHz)	SCHWARZBECK	BBHA 9170	EMC2041	2023-06-18	2026-06-17
EXA Signal Analyzer (10Hz-44GHz)	Keysight	N9010A	EMC2138	2024-08-19	2025-08-18
966 Anechoic Chamber	C.R.T	9m x 6m x 6m	EMC2142	2023-12-20	2026-12-19
Microwave Broadband Preamplifier (18-40GHz)	SCHWARZBECK	BBV 9721	EMC2172	2024-08-19	2025-08-18
Test Software E3	Audix	Ver.6.120110a	GZE100-61	N/A	N/A

General used equipment					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
DMM	Fluke	73	EMC0006	2024-06-13	2025-06-12



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6 Radio Spectrum Matter Test Results

6.1 Authorized frequency band verification

Test Requirement: 47 CFR Part 20.21(e)(3), KDB 935210 D04 clause 7.1.1

Test Method: KDB 935210 D04 clause 7.1.1

Limit: *20.21(e)(3) Frequency Bands:*
Consumer Signal Boosters must be designed and manufactured such that they only operate on the frequencies used for the provision of subscriber-based services under parts 22 (Cellular), 24 (Broadband PCS), 27 (AWS-1, 700 MHz Lower A-E Blocks, and 700 MHz Upper C Block), and 90 (Specialized Mobile Radio).
KDB 935210 D04 clause 7.1.1:
This test is intended to confirm that the signal booster only operates on the CMRS frequency bands authorized for use by the NPS. In addition, this test will identify the frequency at which the maximum gain is realized with each CMRS operational band, which then serves as a basis for subsequent tests.

6.1.1 E.U.T. Operation

Operating Environment:

Temperature: 22~26 °C Humidity: 45~60 % RH Atmospheric Pressure: 1015 mbar

EUT Operation: Set the EUT to maximum gain and drive to maximum output power.

6.1.2 Test Setup

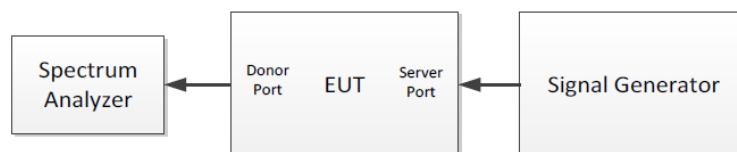


Figure 2 – Uplink test configuration in EUT test mode

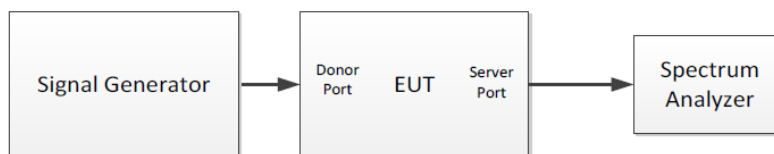


Figure 3 – Downlink test configuration in EUT test mode

6.1.3 Measurement Record

Please refer to Appendix - Test Data and Result for report GZCR241100139802.

6.2 Authorized CMRS provider test

Test Requirement: 47 CFR Part 20.21(e)(3), KDB 935210 D04 clause 7.1.2

Test Method: KDB 935210 D04 clause 7.1.2

Limit: 20.21(e)(3) Frequency Bands:

Consumer Signal Boosters must be designed and manufactured such that they only operate on the frequencies used for the provision of subscriber-based services under parts 22 (Cellular), 24 (Broadband PCS), 27 (AWS-1, 700 MHz Lower A-E Blocks, and 700 MHz Upper C Block), and 90 (Specialized Mobile Radio).

KDB 935210 D04 clause 7.1.2:

This test shall be used to ensure the booster restricts its operation only to the spectrum assigned to the CMRS provider supporting the equipment certification request.

6.2.1 E.U.T. Operation

Operating Environment:

Temperature: 22~26 °C Humidity: 45~60 % RH Atmospheric Pressure: 1015 mbar

EUT Operation: Set the EUT to maximum gain and drive to maximum output power.

6.2.2 Test Setup

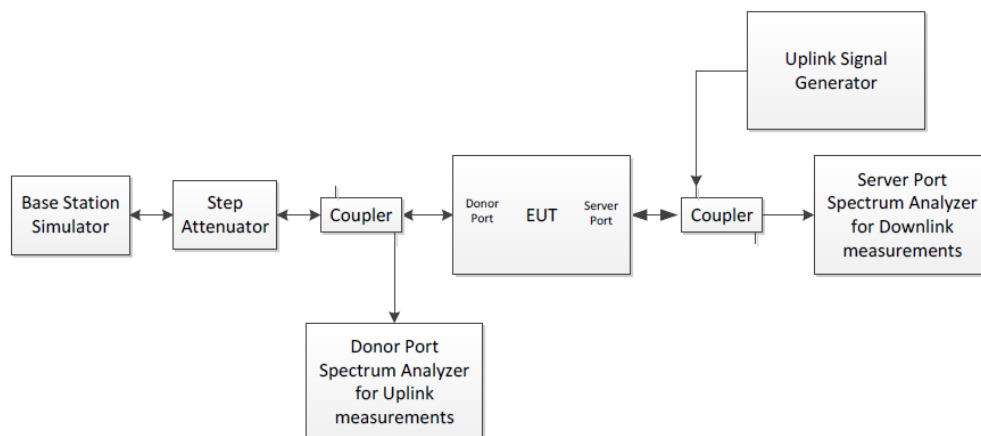


Figure 1 – Test configuration in EUT normal operational mode

6.2.3 Measurement Record

Please refer to Appendix - Test Data and Result for report GZCR241100139802.



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6.3 Maximum power

Test Requirement: 47 CFR Part 20.21(e)(9)(i)(D), 20.21(e)(9)(i)(B)

Test Method: KDB 935210 D04 clause 7.2

Limit: *20.21(e)(9)(i)(D) Power Limits:*

A booster's uplink power must not exceed 1 watt composite conducted power and equivalent isotropic radiated power (EIRP) for each band of operation. Downlink power shall not exceed 0.05 watt (17 dBm) composite and 10 dBm per channel conducted and EIRP for each band of operation. Compliance with power limits will use instrumentation calibrated in terms of RMS equivalent voltage.

20.21(e)(9)(i)(B) Bidirectional Capability:

Consumer Boosters must be able to provide equivalent uplink and downlink gain and conducted uplink power output that is at least 0.05 watts.

6.3.1 E.U.T. Operation

Operating Environment:

Temperature: 22~26 °C Humidity: 45~60 % RH Atmospheric Pressure: 1015 mbar

EUT Operation: Set the EUT to maximum gain and drive to maximum output power.

6.3.2 Test Setup

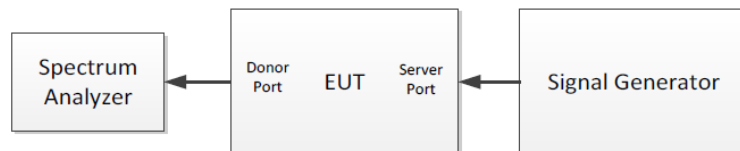


Figure 2 – Uplink test configuration in EUT test mode

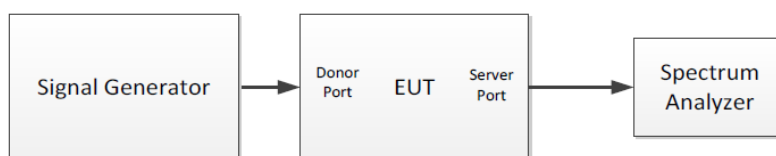


Figure 3 – Downlink test configuration in EUT test mode

6.3.3 Measurement Record

Please refer to Appendix - Test Data and Result for report GZCR241100139802.



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6.4 Maximum booster gain computation

Test Requirement: 47 CFR Part 20.21(e)(9)(i)(C)(2), 20.21(e)(9)(i)(B)

Test Method: KDB 935210 D04 clause 7.3

Limit: **20.21(e)(9)(i)(C)(2) Booster Gain Limits:**
The uplink and downlink maximum gain of a Consumer Booster referenced to its input and output ports shall not exceed the following limits:
(i) Fixed Booster maximum gain shall not exceed $19.5 \text{ dB} + 20 \text{ Log}_{10}(\text{Frequency})$, or 100 dB for systems having automatic gain adjustment based on isolation measurements between booster donor and server antennas.
(ii) Where, Frequency is the uplink mid-band frequency of the supported spectrum bands in MHz.
20.21(e)(9)(i)(B) Bidirectional Capability:
Consumer Boosters must be able to provide equivalent uplink and downlink gain and conducted uplink power output that is at least 0.05 watts.

6.4.1 E.U.T. Operation

Operating Environment:

Temperature: 22~26 °C Humidity: 45~60 % RH Atmospheric Pressure: 1015 mbar

EUT Operation: Set the EUT to maximum gain and drive to maximum output power.

6.4.2 Test Setup

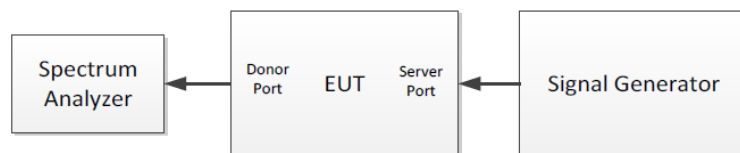


Figure 2 – Uplink test configuration in EUT test mode

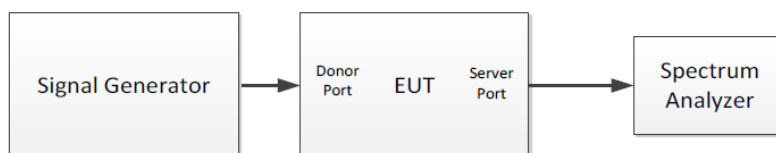


Figure 3 – Downlink test configuration in EUT test mode

6.4.3 Measurement Record

Please refer to Appendix - Test Data and Result for report GZCR241100139802.



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6.5 Intermodulation product

Test Requirement: 47 CFR Part 20.21(e)(9)(i)(G)

Test Method: KDB 935210 D04 clause 7.4

Limit: 20.21(e)(9)(i)(G) *Intermodulation Limits:*

The transmitted intermodulation products of a consumer booster at its uplink and downlink ports shall not exceed the power level of -19 dBm for the supported bands of operation. Compliance with intermodulation limits will use boosters operating at maximum gain and maximum rated output power, with two continuous wave (CW) input signals spaced 600 kHz apart and centered in the pass band of the booster, and with a 3 kHz measurement bandwidth.

6.5.1 E.U.T. Operation

Operating Environment:

Temperature: 22~26 °C Humidity: 45~60 % RH Atmospheric Pressure: 1015 mbar

EUT Operation: Set the EUT to maximum gain and drive to maximum output power.

6.5.2 Test Setup

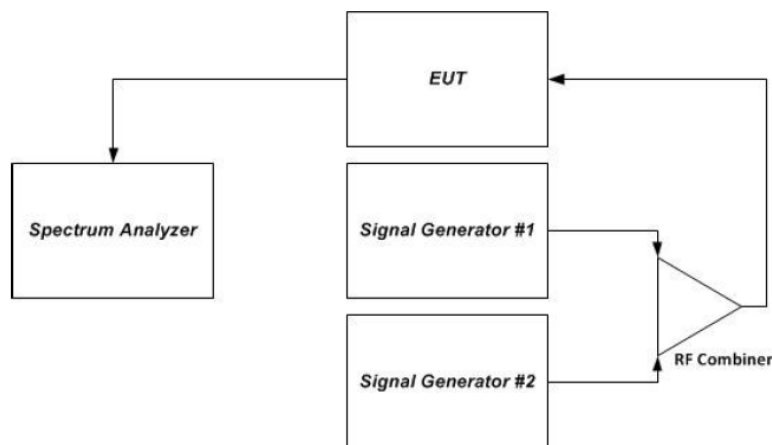


Figure 5 – Intermodulation product instrumentation test setup

6.5.3 Measurement Record

Please refer to Appendix - Test Data and Result for report GZCR241100139802.

6.6 Out-of-band emissions

Test Requirement: 47 CFR Part 20.21(e)(9)(i)(F)

Test Method: KDB 935210 D04 clause 7.5

Limit:

20.21(e)(9)(i)(F) Out of Band Emission Limits:

Booster out of band emissions (OOBE) shall meet the FCC's mobile emission limits for the supported bands of operation. Compliance to OOBE limits will utilize high peak-to-average CMRS signal types.

22.917

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

24.238

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

27.53(c)

For operations in the 746-758 MHz band and the 776-788 MHz band, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

- (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;

27.53(g)

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.

27.53(h)

the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10}(P)$ dB.



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6.6.1 E.U.T. Operation

Operating Environment:

Temperature: 22~26 °C Humidity: 45~60 % RH Atmospheric Pressure: 1015 mbar

EUT Operation: Set the EUT to maximum gain and drive to maximum output power.

6.6.2 Test Setup

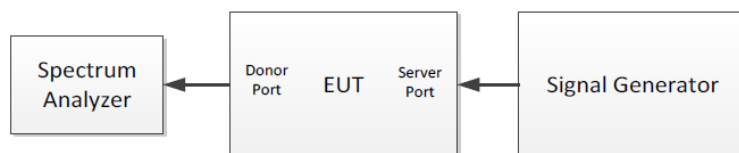


Figure 2 – Uplink test configuration in EUT test mode

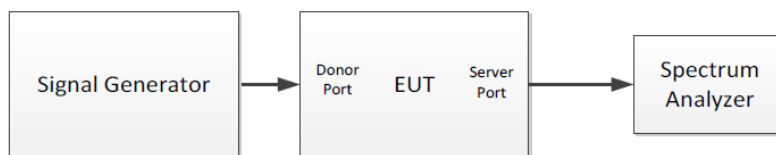


Figure 3 – Downlink test configuration in EUT test mode

6.6.3 Measurement Record

Please refer to Appendix - Test Data and Result for report GZCR241100139802.



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6.7 Conducted spurious emissions

Test Requirement: 47 CFR Part 2.1051, 20.21(e)(9)(i)(F)

Test Method: KDB 935210 D04 clause 7.6

Limit:

20.21(e)(9)(i)(F) Out of Band Emission Limits:

Booster out of band emissions (OOBE) shall meet the FCC's mobile emission limits for the supported bands of operation. Compliance to OOBE limits will utilize high peak-to-average CMRS signal types.

22.917

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

24.238

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

27.53(c)

For operations in the 746-758 MHz band and the 776-788 MHz band, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

- (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;

27.53(g)

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.

27.53(h)

the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10}(P)$ dB.



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6.7.1 E.U.T. Operation

Operating Environment:

Temperature: 22~26 °C Humidity: 45~60 % RH Atmospheric Pressure: 1015 mbar

EUT Operation: Set the EUT to maximum gain and drive to maximum output power.

6.7.2 Test Setup

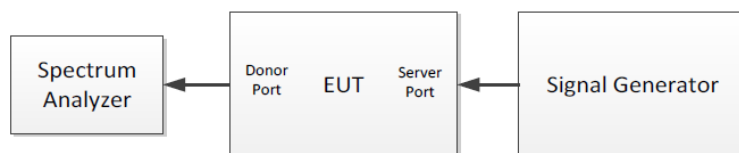


Figure 2 – Uplink test configuration in EUT test mode

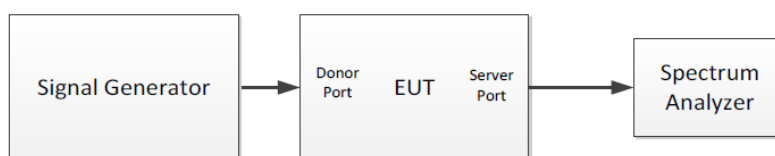


Figure 3 – Downlink test configuration in EUT test mode

6.7.3 Measurement Record

Please refer to Appendix - Test Data and Result for report GZCR241100139802.



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6.8 Noise

Test Requirement: 47 CFR Part 20.21(e)(9)(i)(A), 20.21(e)(9)(i)(I)

Test Method: KDB 935210 D04 clause 7.7

Limit:

20.21(e)(9)(i)(A) Noise Limits:

The transmitted noise power in dBm/MHz of frequency selective consumer boosters outside the licensee's spectrum blocks at their uplink and downlink ports shall not exceed the following limits:

(1) -103 dBm/MHz-RSSI

(i) Where RSSI is the downlink composite signal power received in dBm for frequencies in the band of operation outside the licensee's spectrum block as measured after spectrum block filtering is applied and is referenced to the booster's donor port for each band of operation. RSSI is expressed in negative dB units relative to 1 mW.

(ii) Boosters with MSCL less than 40 dB, shall reduce the Noise output in (A) by 40dB-MSCL, where MSCL is the minimum coupling loss in dB between the wireless device and booster's server port. MSCL must be calculated or measured for each band of operation and provided in compliance test reports.

(2)

(i) Fixed booster maximum downlink noise power shall not exceed -102.5 dBm/MHz + 20 Log10 (Frequency), where Frequency is the uplink mid-band frequency of the supported spectrum bands in MHz.

(iii) Compliance with Noise limits will use instrumentation calibrated in terms of RMS equivalent voltage, and with booster input ports terminated or without input signals applied within the band of measurement.

20.21(e)(9)(i)(I) Transmit Power Off Mode:

When the consumer booster cannot otherwise meet the noise and gain limits defined herein it must operate in "Transmit Power OFF Mode." In this mode of operation, the uplink and downlink noise power shall not exceed -70 dBm/MHz and uplink gain shall not exceed the lesser of 23 dB or MSCL.

6.8.1 E.U.T. Operation

Operating Environment:

Temperature: 22~26 °C Humidity: 45~60 % RH Atmospheric Pressure: 1015 mbar

EUT Operation: Set the EUT to maximum gain.



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6.8.2 Test Setup

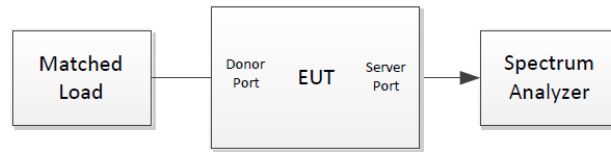


Figure 6 – Maximum downlink noise limit test configuration

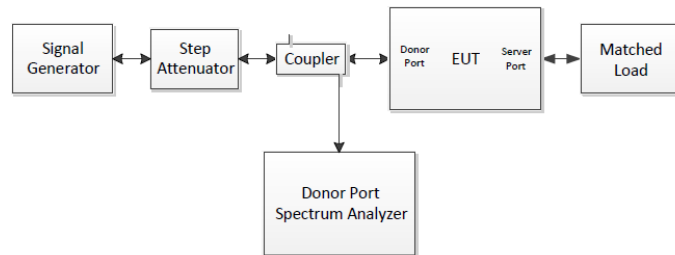


Figure 7 – Uplink RSSI-dependent noise limit test configuration

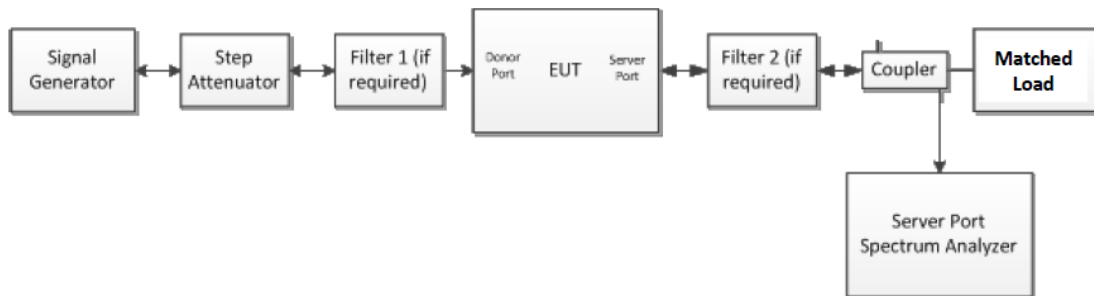


Figure 8 – Downlink RSSI-dependent noise limit test configuration

6.8.3 Measurement Record

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6.9 Uplink inactivity

Test Requirement: 47 CFR Part 20.21(e)(9)(i)(J)

Test Method: KDB 935210 D04 clause 7.8

Limit: 20.21(e)(9)(i)(C)(2) Uplink inactivity:
When a consumer booster is not serving an active device connection after 5 seconds the uplink noise power shall not exceed -70 dBm/MHz.

6.9.1 E.U.T. Operation

Operating Environment:

Temperature: 22~26 °C Humidity: 45~60 % RH Atmospheric Pressure: 1015 mbar

EUT Operation: Set the EUT to maximum gain.

6.9.2 Test Setup

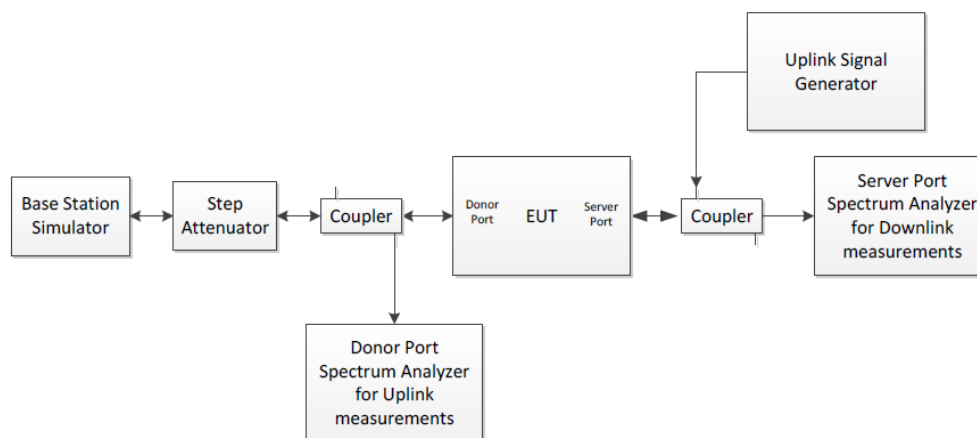


Figure 1 – Test configuration in EUT normal operational mode

6.9.3 Measurement Record

Please refer to Appendix - Test Data and Result for report GZCR241100139802.



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6.10 Variable booster gain

Test Requirement: 47 CFR Part 20.21(e)(9)(i)(C)(1), 20.21(e)(9)(i)(I)

Test Method: KDB 935210 D04 clause 7.9

Limit: **20.21(e)(9)(i)(C)(1) Booster Gain Limits:**
The uplink and downlink gain in dB of a frequency selective consumer booster referenced to its input and output ports shall not exceed BSCL-28 dB-(40 dB-MSCL).
20.21(e)(9)(i)(I) Transmit Power Off Mode:
When the consumer booster cannot otherwise meet the noise and gain limits defined herein it must operate in "Transmit Power OFF Mode." In this mode of operation, the uplink and downlink noise power shall not exceed -70 dBm/MHz and uplink gain shall not exceed the lesser of 23 dB or MSCL.

6.10.1 E.U.T. Operation

Operating Environment:

Temperature: 22~26 °C Humidity: 45~60 % RH Atmospheric Pressure: 1015 mbar

EUT Operation: Set the EUT to maximum gain and drive to maximum output power.

6.10.2 Test Setup

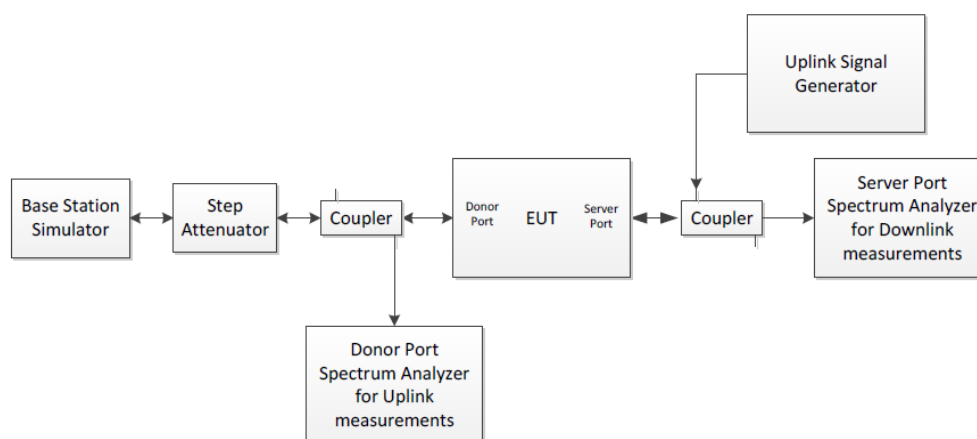


Figure 1 – Test configuration in EUT normal operational mode

6.10.3 Measurement Record

Please refer to Appendix - Test Data and Result for report GZCR241100139802.



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6.11 Occupied bandwidth

Test Requirement: 47 CFR Part 2.1049
 Test Method: KDB 935210 D04 clause 7.10
 Limit: Compare the consistency of the output signal relative to the input signal, and to satisfy the requirements of Section 2.1049.

6.11.1 E.U.T. Operation

Operating Environment:

Temperature: 22~26 °C Humidity: 45~60 % RH Atmospheric Pressure: 1015 mbar

EUT Operation: Set the EUT to maximum gain and drive to maximum output power.

6.11.2 Test Setup

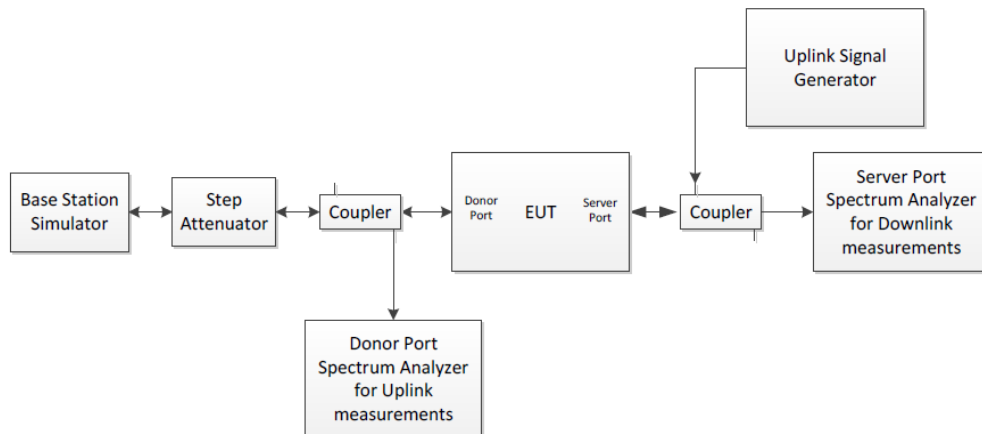


Figure 1 – Test configuration in EUT normal operational mode

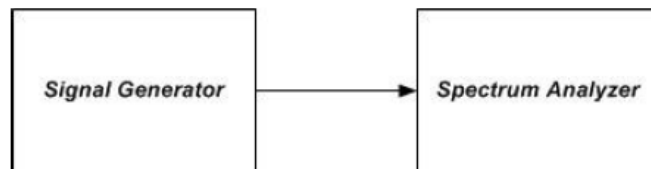


Figure 9 – Test setup for measuring characteristics of test signals used for subsequent EUT occupied bandwidth testing

6.11.3 Measurement Record

Please refer to Appendix - Test Data and Result for report GZCR241100139802.



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6.12 Oscillation detection

Test Requirement: 47 CFR Part 20.21(e)(9)(ii)(A), 20.21(e)(5)

Test Method: KDB 935210 D04 clause 7.11

Limit: **20.21(e)(9)(ii)(A) Anti-Oscillation:**
Consumer boosters must be able to detect and mitigate (i.e., by automatic gain reduction or shut down), any oscillations in uplink and downlink bands. Oscillation detection and mitigation must occur automatically within 0.3 seconds in the uplink band and within 1 second in the downlink band. In cases where oscillation is detected, the booster must continue mitigation for at least one minute before restarting. After five such restarts, the booster must not resume operation until manually reset.

20.21(e)(5) Anti-Oscillation:
Consumer Signal Boosters must be able to detect and mitigate any unintended oscillations in uplink and downlink bands (such as may result from insufficient isolation between the antennas).

6.12.1 E.U.T. Operation

Operating Environment:

Temperature: 22~26 °C Humidity: 45~60 % RH Atmospheric Pressure: 1015 mbar

EUT Operation: Set the EUT to maximum gain and drive to maximum output power.

6.12.2 Test Setup

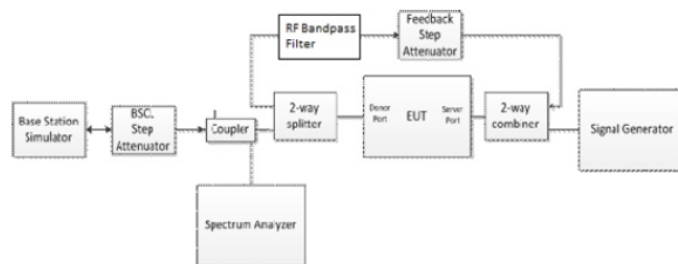


Figure 10 – Uplink oscillation detection test setup

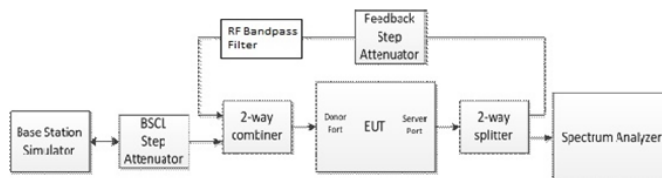


Figure 11 – Downlink oscillation detection test setup



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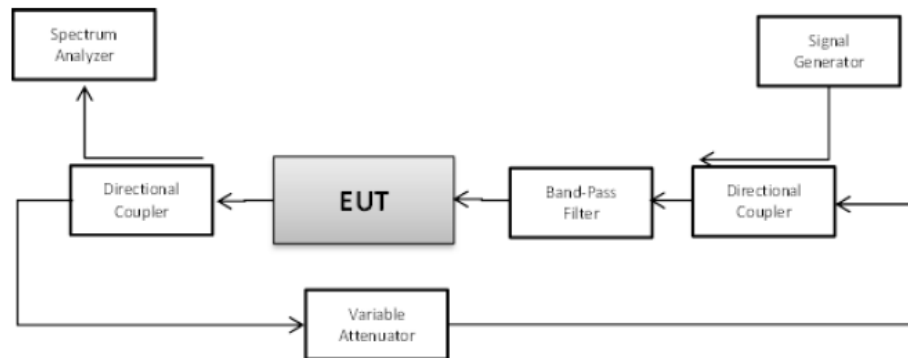


Figure 12 – Downlink oscillation mitigation test setup

6.12.3 Measurement Record

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6.13 Radiated Spurious emission (below 1GHz)

Test Requirement: 47 CFR Part 2.1053, 20.21(e)(9)(i)(F)

Test Method: KDB 935210 D04 clause 7.13

Limit:

20.21(e)(9)(i)(F) Out of Band Emission Limits:

Booster out of band emissions (OOBE) shall meet the FCC's mobile emission limits for the supported bands of operation. Compliance to OOBE limits will utilize high peak-to-average CMRS signal types.

22.917

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

24.238

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

27.53(c)

For operations in the 746-758 MHz band and the 776-788 MHz band, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

(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;

27.53(f)

For operations in the 746–758 MHz, 775–788 MHz, and 805–806 MHz bands, emissions in the band 1559–1610 MHz shall be limited to –70 dBW/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.

27.53(g)

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.

27.53(h)

the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10}(P)$ dB.



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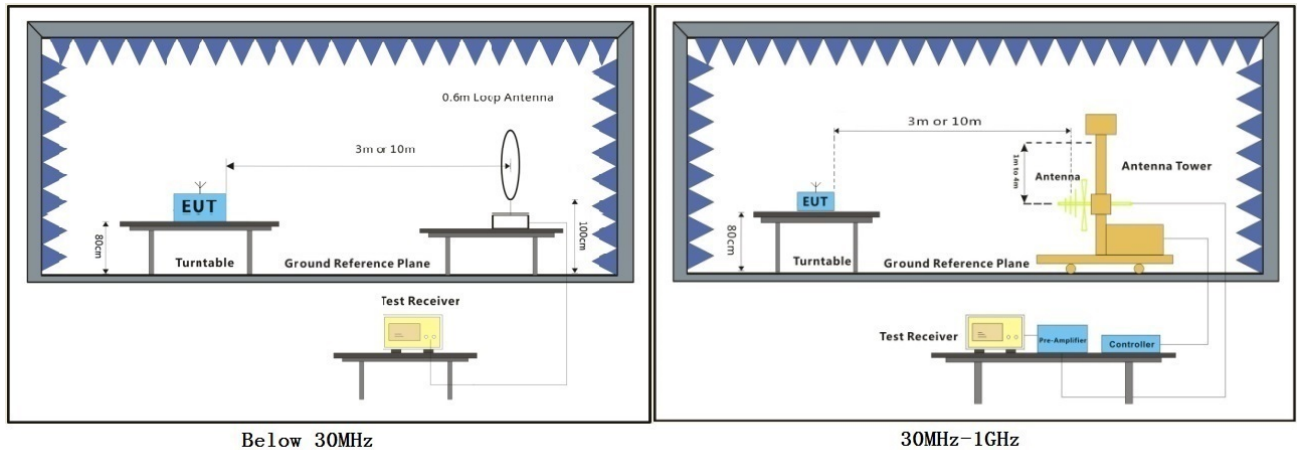
6.13.1 E.U.T. Operation

Operating Environment:

Temperature: 24.6 °C Humidity: 54 % RH Atmospheric Pressure: 1010 mbar

EUT Operation: Set the EUT to maximum gain and drive to maximum output power.

6.13.2 Test Setup



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6.13.3 Test procedure

1. Scan from 9kHz to 1GHz, 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)

6.13.4 Measurement Record

Please refer to Appendix - Test Data and Result for report GZCR241100139802.



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6.14 Radiated Spurious emission (above 1GHz)

Test Requirement: 47 CFR Part 2.1053, 20.21(e)(9)(i)(F)

Test Method: KDB 935210 D04 clause 7.13

Limit:

20.21(e)(9)(i)(F) Out of Band Emission Limits:

Booster out of band emissions (OOBE) shall meet the FCC's mobile emission limits for the supported bands of operation. Compliance to OOBE limits will utilize high peak-to-average CMRS signal types.

22.917

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

24.238

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

27.53(c)

For operations in the 746-758 MHz band and the 776-788 MHz band, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

(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;

27.53(f)

For operations in the 746–758 MHz, 775–788 MHz, and 805–806 MHz bands, emissions in the band 1559–1610 MHz shall be limited to –70 dBW/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.

27.53(g)

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.

27.53(h)

the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10}(P)$ dB.



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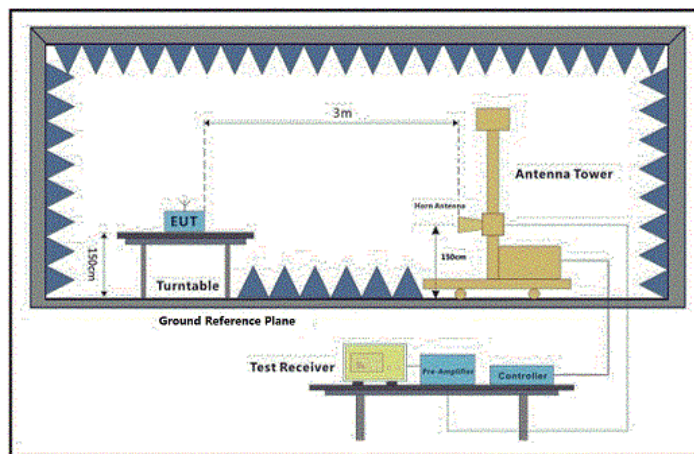
6.14.1 E.U.T. Operation

Operating Environment:

Temperature: 24.6 °C Humidity: 54 % RH Atmospheric Pressure: 1010 mbar

EUT Operation: Set the EUT to maximum gain and drive to maximum output power.

6.14.2 Test Setup



Above 1GHz



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6.14.3 Test procedure

1. Scan from 1GHz to 40GHz, 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.
 - 1) The EUT was powered on and placed on a table in the fully Anechoic 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:

$$\text{Level (dBm)} = \text{Read Level (dBm)} + \text{Correction Factor (dB)}$$

6.14.4 Measurement Record

Please refer to Appendix - Test Data and Result for report GZCR241100139802.



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6.15 Spectrum block filtering

Test Requirement: 47 CFR Part 20.21(e)(9)(i)(C)(2), 20.21(e)(9)(i)(B)

Test Method: KDB 935210 D04 clause 7.14

Limit: *20.21(e)(9)(i)(B) Bidirectional Capability:*
Consumer Boosters must be able to provide equivalent uplink and downlink gain and conducted uplink power output that is at least 0.05 watts.
20.21(e)(3) Frequency Bands:
Consumer Signal Boosters must be designed and manufactured such that they only operate on the frequencies used for the provision of subscriber-based services under parts 22 (Cellular), 24 (Broadband PCS), 27 (AWS-1, 700 MHz Lower A-E Blocks, and 700 MHz Upper C Block), and 90 (Specialized Mobile Radio).

6.15.1 E.U.T. Operation

Operating Environment:

Temperature: 22~26 °C Humidity: 45~60 % RH Atmospheric Pressure: 1015 mbar

EUT Operation: Set the EUT to maximum output power and maximum gain.

6.15.2 Test Setup

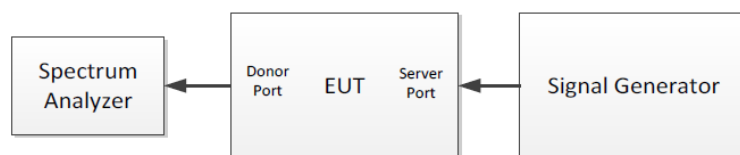


Figure 2 – Uplink test configuration in EUT test mode

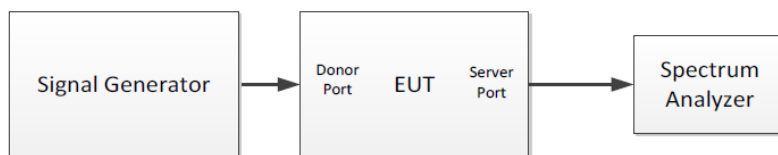


Figure 3 – Downlink test configuration in EUT test mode

6.15.3 Measurement Record

Please refer to Appendix - Test Data and Result for report GZCR241100139802.



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6.16 Out of band gain

Test Requirement: 47 CFR Part 20.21(e)(9)(i)(E)

Test Method: KDB 935210 D04 clause 7.15

Limit: **20.21(e)(9)(i)(E) Out of Band Gain Limits:**
 (1) A frequency selective booster shall have the following minimum attenuation referenced to the gain in the center of the pass band of the booster:
 (i) -20 dB at the band edge, where band edge is the end of the licensee's allocated spectrum,
 (ii) -30 dB at 1 MHz offset from band edge,
 (iii) -40 dB at 5 MHz offset from band edge.
 (2) A frequency selective booster having maximum gain greater than 80 dB (referenced to the center of the pass band) shall limit the out of band gain to 60 dB at 0.2 MHz offset from the band edge, and 45 dB at 1 MHz offset from the band edge, where band edge is the end of the licensee's allocated spectrum.

6.16.1 E.U.T. Operation

Operating Environment:

Temperature: 22~26 °C Humidity: 45~60 % RH Atmospheric Pressure: 1015 mbar

EUT Operation: Set the EUT to maximum output power and maximum gain.

6.16.2 Test Setup

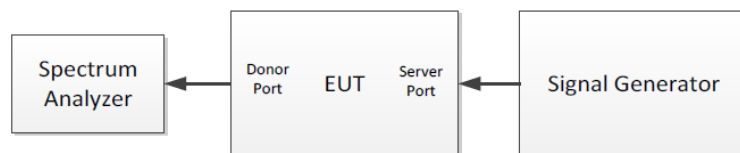


Figure 2 – Uplink test configuration in EUT test mode

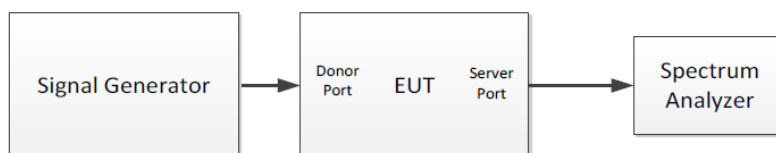


Figure 3 – Downlink test configuration in EUT test mode

6.16.3 Measurement Record

Please refer to Appendix - Test Data and Result for report GZCR241100139802.



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6.17 Frequency Stability

Test Requirement: 47 CFR Part 2.1055
 Test Method: 47 CFR Part 2.1055
 KDB 935210 D04 clause 7.16

Limit: 22.235 Frequency tolerance:

The carrier frequency of each transmitter in the Public Mobile Services must be maintained within the tolerances given in below table:

Frequency range (MHz)	Base, fixed (ppm)
25 to 50	20.0
50 to 450	5.0
450 to 512	2.5
821 to 896	1.5
928 to 929	5.0
929 to 960	1.5
2110 to 2220	10.0

24.235 & 27.54 Frequency stability:

The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

6.17.1 E.U.T. Operation

Operating Environment:

Temperature: 22~26 °C Humidity: 45~60 % RH Atmospheric Pressure: 1015 mbar

EUT Operation: Set the EUT to maximum output power and maximum gain.

6.17.2 Test Setup

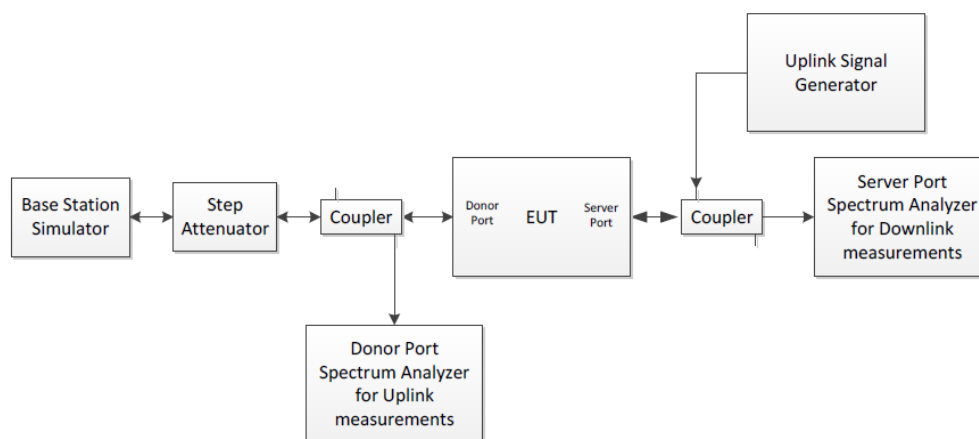


Figure 1 – Test configuration in EUT normal operational mode

6.17.3 Measurement Record

Please refer to Appendix - Test Data and Result for report GZCR230300022302.



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7 Test Setup Photographs

Refer to Appendix - Test Setup Photos for GZCR241100139802.



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8 EUT Constructional Details (EUT Photos)

Refer to Appendix - External and Internal Photos for GZCR2411001398AT.

- End of the Report -



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