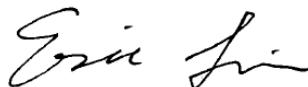


TEST REPORT

Application No.: KSCR2209001814AT
FCC ID: OJFE62-N3-7LU
Applicant: Corning Optical Communications LLC
Address of Applicant: 6 Concord Road, Shrewsbury, MA 01545 United States
Manufacturer: Corning Optical Communications LLC
Address of Manufacturer: 6 Concord Road, Shrewsbury, MA 01545 United States
Factory: Sunwave Communications Co., Ltd
Address of Factory: 581 Houju Avenue, Binjinag District, Hangzhou, China
Equipment Under Test (EUT):
EUT Name: Remote Unit
Model No.: E62-N3
Trade mark: **CORNING**
Standard(s) : FCC Part 2
 FCC Part 20
 FCC Part 27 subpart F
 FCC Part 27 subpart H
Date of Receipt: 2022-09-23
Date of Test: 2022-09-23 to 2022-10-15
Date of Issue: 2022-10-18

Test Result:	Pass*
---------------------	--------------

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



Eric Lin
Laboratory Manager



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Revision Record				
Version	Chapter	Date	Modifier	Remark
00	Original	2022-10-18		/

Authorized for issue by:			
			
		<hr/> Cloud Peng / Project Engineer	
			
		<hr/> Eric Lin / Reviewer	



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2 Test Summary

2.1 746MHz-756MHz for FCC Part 27 subpart F

Test Item	Reference	Result
RF Output Power, Amplifier Gain and Peak to Average Ratio	2.1046; 27.50(b)	PASS
Conducted Spurious Emissions	2.1051; 27.53(c)(f)	PASS
Out-of-band/out-of-block (including intermodulation) Emissions	2.1051; 27.53(c)	PASS
Radiated Spurious Emissions	2.1053; 27.53(c)(f)	PASS
Occupied Bandwidth and Input-versus-output signal comparison	2.1049(h)	PASS
Frequency Stability	2.1055; 27.54	PASS
<p>Remark:</p> <p>EUT: In this whole report EUT means Equipment Under Test.</p> <p>Tx: In this whole report Tx (or tx) means Transmitter.</p> <p>Rx: In this whole report Rx (or rx) means Receiver.</p> <p>All modes have been tested and only record the worst test result.</p> <p>The products are equipped with internal antenna and external antenna. The main difference is the appearance and antenna, but there is no difference in the circuit. Therefore, we only evaluated the internal and external antennas in the radiation test part, and the worst test result was the external antenna products with load test.</p> <p>Test method standard:</p> <p>ANSI C63.26-2015</p> <p>KDB 935210 D05 Indus Booster Basic Meas v01r04</p> <p>KDB 935210 D02 Signal Booster Certification v04r02</p>		



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2.2 729MHz-746MHz for FCC Part 27 subpart H

Test Item	Reference	Result
RF Output Power, Amplifier Gain and Peak to Average Ratio	2.1046; 27.50(c)	PASS
Conducted Spurious Emissions	2.1051; 27.53(g)	PASS
Out-of-band/out-of-block (including intermodulation) Emissions	ANSI C63.26 KDB 935210 D05 v01r04 935210 D02 v04r02	PASS
Radiated Spurious Emissions	2.1053; 27.53(g)	PASS
Occupied Bandwidth and Input-versus-output signal comparison	2.1049(h)	PASS
Frequency Stability	2.1055; 27.54	PASS
<p>Remark:</p> <p>EUT: In this whole report EUT means Equipment Under Test.</p> <p>Tx: In this whole report Tx (or tx) means Transmitter.</p> <p>Rx: In this whole report Rx (or rx) means Receiver.</p> <p>All modes have been tested and only record the worst test result.</p> <p>The products are equipped with internal antenna and external antenna. The main difference is the appearance and antenna, but there is no difference in the circuit. Therefore, we only evaluated the internal and external antennas in the radiation test part, and the worst test result was the external antenna products with load test.</p> <p>Test method standard:</p> <p>ANSI C63.26-2015 KDB 935210 D05 Indus Booster Basic Meas v01r04 KDB 935210 D02 Signal Booster Certification v04r02</p>		



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4 General Information

4.1 Details of E.U.T.

Product Name:	Remote Unit
Device type	Booster
Model No.:	E62-N3
Antenna Type:	External&Internal
Antenna Gain:	2.13 dBi for 729MHz to 746MHz (Provided by manufacturer) 2.43 dBi for 746MHz to 756MHz (Provided by manufacturer)
Power Supply:	DC 48V
Type of Modulation	5G NR: CP-OFDM: QPSK, 16QAM, 64QAM, 256QAM LTE: QPSK, 16QAM, 64QAM, 256QAM
Frequency Band:	729MHz to 746MHz 746MHz to 756MHz
Power Control Method:	ALC
Temperature Range:	-30°C to 50°C
Antenna Delivery:	4T4R MIMO,2T2R MIMO,SISO

4.2 Description of Support Units

Description	Manufacture	Model No.	S/N
Notebook	ThinkPad	K27	/



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4.3 Measurement Uncertainty

No.	Item	Measurement Uncertainty
1	Radio Frequency	8.4 x 10 ⁻⁸
2	Timeout	2s
3	Duty Cycle	0.37%
4	Occupied Bandwidth	3%
5	RF Conducted Power	0.6dB
6	RF Power Density	2.9dB
7	Conducted Spurious Emissions	0.75dB
8	RF Radiated Power	5.2dB (Below 1GHz)
		5.9dB (Above 1GHz)
9	Radiated Spurious Emission Test	4.2dB (Below 30MHz)
		4.5dB (30MHz-1GHz)
		5.1dB (1GHz-18GHz)
		5.4dB (Above 18GHz)
10	Temperature Test	1°C
11	Humidity Test	3%
12	Supply Voltages	1.5%
13	Time	3%

Note: The measurement uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.



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4.4 Test Location

All tests were performed at:

Compliance Certification Services (Kunshan) Inc.

No.10 Weiye Rd, Innovation park, Eco&Tec, Development Zone, Kunshan City, Jiangsu, China.

Tel: +86 512 5735 5888 Fax: +86 512 5737 0818

No tests were sub-contracted.

4.5 Test Facility

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

- **CNAS (No. CNAS L4354)**

CNAS has accredited Compliance Certification Services (Kunshan) Inc. to ISO/IEC 17025:2017 General Requirements for the Competence of Testing and Calibration Laboratories (CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence in the field of testing.

- **A2LA (Certificate No. 2541.01)**

Compliance Certification Services (Kunshan) Inc. is accredited by the American Association for Laboratory Accreditation (A2LA). Certificate No. 2541.01.

- **FCC (Designation Number: CN1172)**

Compliance Certification Services Inc. has been recognized as an accredited testing laboratory.

Designation Number: CN1172.

- **ISED (CAB Identifier: CN0072)**

Compliance Certification Services (Kunshan) Inc. has been recognized by Innovation, Science and Economic Development (ISED) Canada as an accredited testing laboratory.

CAB Identifier: CN0072.

- **VCCI (Member No.: 1938)**

The 3m and 10m Semi-anechoic chamber and Shielded Room of Compliance Certification Services (Kunshan) Inc. has been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: R-20134, C-11707, T-11499, G-10216 respectively.

4.6 Deviation from Standards

None

4.7 Abnormalities from Standard Conditions

None



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5 Equipment List

Item	Equipment	Manufacturer	Model	Serial Number	Cal Date	Cal. Due Date
RF Conducted Test						
1	Spectrum Analyzer	Keysight	N9020A	MY55370209	08/22/2022	08/21/2023
2	Signal Generator	Agilent	N5182A	MY50142015	08/22/2022	08/21/2023
3	Spectrum Analyzer	Keysight	N9030B	MY61330164	01/22/2022	01/21/2023
4	Vector Signal Generator	R&S	SMW200A	110074	08/22/2022	08/21/2023
5	Radio Communication Test Station	Anritsu	MT8000A	6262012849	08/22/2022	08/21/2023
6	Radio Communication Analyzer	Anritsu	MT8821C	6201692222	04/01/2022	03/31/2023
7	Universal Radio Communication Tester	R&S	CMW500	159275	08/22/2022	08/21/2023
8	Universal Radio Communication Tester	R&S	CMW500	167239	04/01/2022	03/31/2023
9	Power Meter	Anritsu	ML2495A	1445010	04/15/2022	04/14/2023
10	Switcher	CCSRF	FY562	KUS2001M001-3	08/22/2022	08/21/2023
11	AC Power Source	EXTECH	6605	1570106	N.C.R	N.C.R
12	DC Power Supply	Aglient	E3632A	MY50340053	N.C.R	N.C.R
13	6dB Attenuator	Mini-Circuits	NAT-6-2W	15542-1	N.C.R	N.C.R
14	Power Divider	AISI	IOWOPE2068	PE2068	N.C.R	N.C.R
15	Filter	MICRO-TRONICS	BRM50701	5	N.C.R	N.C.R
16	Conducted Test Cable	/	RF01-RF04	/	04/15/2022	04/14/2023
17	Software	BST	TST-PASS	N/A	N/A	N/A
18	Temp. / Humidity Chamber	TERCHY	MHK-120AK	X30109	04/15/2022	04/14/2023
19	Thermometer	Anymetre	RS-WS-N01-6J	1032844	04/15/2022	04/14/2023
RF Radiated Test						
1	Spectrum Analyzer	R&S	FSV40	101493	08/22/2022	08/21/2023
2	Signal Generator	Agilent	E8257C	MY43321570	08/22/2022	08/21/2023
3	Loop Antenna	Com-Power	AL-130R	10160008	04/13/2021	04/12/2023
4	Bilog Antenna	TESEQ	CBL 6112D	35403	06/21/2021	06/20/2023
5	Bilog Antenna	SCHWARZBECK	VULB9160	9160-3342	04/13/2021	04/12/2023
6	Horn-antenna(1-18GHz)	Schwarzbeck	BBHA9120D	267	04/02/2022	04/01/2024
7	Horn-antenna(1-18GHz)	ETS-LINDGREN	3117	00143290	02/22/2021	02/21/2023
8	Horn Antenna(18-40GHz)	Schwarzbeck	BBHA9170	BBHA9170171	02/20/2022	02/19/2023
9	Horn Antenna(18-40GHz)	Schwarzbeck	BBHA9170	BBHA9170515	02/20/2022	02/19/2023
10	Pre-Amplifier(30MHz~18GHz)	LNA	/	/	04/15/2022	04/14/2023
11	Amplifier(18~40GHz)	COM-POWER	PAM-840A	461332	01/22/2022	01/21/2023
12	Low Pass Filter	MICRO-TRONICS	VLFX-950	RV142900829	N.C.R	N.C.R
13	High Pass Filter	Mini-Circuits	VHF-1200	15542	N.C.R	N.C.R
14	Filter (5450MHz~5770 MHz)	MICRO-TRONICS	BRC50704-01	2	N.C.R	N.C.R
15	Filter (5690 MHz~5930 MHz)	MICRO-TRONICS	BRC50705-01	4	N.C.R	N.C.R
16	Filter (5150 MHz~5350 MHz)	MICRO-TRONICS	BRC50703-01	2	N.C.R	N.C.R
17	Filter (885 MHz~915 MHz)	MICRO-TRONICS	BRM14698	1	N.C.R	N.C.R
18	Filter (815 MHz~860 MHz)	MICRO-TRONICS	BRM14697	1	N.C.R	N.C.R
19	Filter (1745 MHz~1910 MHz)	MICRO-TRONICS	BRM14700	1	N.C.R	N.C.R



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20	Filter (1922 MHz~1977 MHz)	MICRO-TRONICS	BRM50715	1	N.C.R	N.C.R
21	Filter (2550 MHz)	MICRO-TRONICS	HPM13362	5	N.C.R	N.C.R
22	Filter (1532 MHz~1845 MHz)	MICRO-TRONICS	BRM50713	1	N.C.R	N.C.R
23	Filter (2.4GHz)	MICRO-TRONICS	BRM50701	5	N.C.R	N.C.R
24	RE test cable	/	RE01-RE04	/	04/15/2022	04/14/2023
25	Software	Faratronic	EZ EMC	N/A	N/A	N/A



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6 Test Results

6.1 Test conditions

Input voltage:	DC 48V	
Test voltage	Normal	DC 48V
	Extreme	DC 40.2V-DC55.8V
Operating Environment:		
Test Temperature:	Normal	22°C~26°C
	Extreme	-10~45° C
Humidity:	46%~56% RH	
Atmospheric Pressure:	990~1005mbar	
Test Requirement:	The RF output power of the EUT was measured at the antenna port, by adjusting the input power of signal generator to drive the EUT to get to maximum output power point and keep the EUT at maximum gain setting for all tests. The device should be tested on downlink. For detail test Modulation and Frequency, please refer to 7.2.	

Remark:

FIBER-OPTIC AND OTHER SIMILAR RF DISTRIBUTION SYSTEMS

Fiber-optic distribution systems are a type of in-building radiation system that receives RF signals from an antenna, distributes the signal over fiber-optic cable, and then retransmits at another location for example within a building or tunnel. Most fiber-optic systems are signal boosters; however, some may be boosters. These systems generally have two enclosures typically called host (or local or donor unit) and remote. Some systems may also have an optional expander box for fan-out to multiple remotes. The system transmits downlink signals from the remote unit to handsets, portables, or clients, and transmits uplink signals via from the host unit. Usually but not always the uplink goes through an intermediate amplifier to a “donor” antenna. Therefore both uplink and downlink must be tested, unless filing effectively documents how connection of uplink to donor antenna with or without an intermediate amplifier will be prevented, such as for always only a cabled connection to a base station. Fiber-optic systems are not amplifiers (AMP equipment class) – they are equipment class TNB or PCB. The same approval procedures also apply for multiple-enclosure systems connected by coax cable.

Synonyms and related terms: in-building radiation system, coverage enhancer, distributed antenna system, fiber-optic distribution system, converter, donor antenna

Typical in-building or distributed antenna systems can consist of five different components (enclosures), not counting antennas:

1) host unit

- a) transmits uplink to base station via antenna thru coax, **passive interface unit**, or **active interface unit** (amplifier)
- b) sends base-station downlink via fiber-optic or coax to **remote**
- c) receives handset uplink via fiber-optic or coax from **remote**
- d) optional connection to **expansion unit** via fiber-optic



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- e) separate FCC ID from **remote**, unless electrically identical
- f) **non-transmitting host unit**
- i) connects directly to a base station via coax cable but does not connect to antenna or amplifier
- ii) Part 15 digital device subject to Verification, no FCC ID

2) remote unit

- a) receives base-station downlink via fiber-optic or coax from **host**, transmits via antenna to handsets
- b) returns handset uplink via fiber-optic or coax to **host**
- c) separate FCC ID from **remote**, unless electrically identical

3) fiber-optic expansion unit

- a) fiber-optic or coax from **host**
- b) fiber-optic or coax fan-out to **remote(s)**
- c) Part 15 digital device subject to Verification, no FCC ID

4) RF expansion unit

- a) internal or external device used to add band(s) and/or transmit mode(s) to a **remote**
- b) operates only when connected to a **remote unit** as part of a booster system
- c) contains signal-processing functions to convert baseband signal into modulated RF signal
- d) use equipment class PCB or TNB for an **RF expansion unit** (the associated **remote** uses an equipment class Bxx per **Table C.1** of this document, e.g., B2I)

5) passive interface unit

- a) contains attenuators, splitters, combiners
- b) coax cable connection between **host** and base-station
- c) passive device, no FCC ID

6) active interface unit

- a) amplifies uplink signal from **host unit** for transmit by donor antenna
- b) attenuates downlink from donor antenna
- c) coax cable connection between **host** and **active interface unit**
- d) usually has separate FCC ID; in some cases could be combined/included with **host** as one enclosure

GENERAL DEFINITIONS FOR CERTIFICATION PURPOSES:

The following three general definitions follow from those stated in the Part 22, 24, 27 and 90 rule sections as listed above. Two of the definitions replace previous EAB internal definitions given for booster, booster and extender. The general term “extender” is the same as booster, but booster should be used rather than extender. The general term “translator” is the same as booster, but booster should be used rather than translator.

External radio frequency power amplifier (ERFPA) - any device which, (1) when used in conjunction with a radio transmitter signal source, is capable of amplification of that signal, and (2) is not an integral part of a radio transmitter as manufactured. The EAS equipment class AMP is used only for an ERFPA device inserted between a transmitter (TNB/PCB) and an antenna (has only one antenna port) **Booster** is a device that automatically reradiates signals from base transmitters without channel translation, for the purpose of improving the reliability of existing service by increasing the signal strength in dead spots. An “in-building radiation system” is a signal booster. These devices are not intended to extend the size of coverage from the originating base station. A booster can be either single or multiple channels.



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Booster is a device that retransmits the signals of other stations. Boosters are different from boosters in that they can include frequency translation and can extend coverage beyond the design of the original base station. A booster is typically single channel but can also be multiple channels.

ERFPA (AMP) and boosters/boosters (TNB/PCB) can generally be authorized for all rule parts except 15 and 18.

Tests should be done with each typical signal. e.g., for F3E emissions use 2500 Hz with 2.5 or 5 kHz deviation. Use of CW signal for some tests is acceptable in lieu of actual emission, in some cases when CW signal gives worst case.



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6.2 Test Procedure & Measurement Data

6.2.1 RF Output Power and Amplifier Gain

Test Requirement: FCC Part 2.1046; FCC Part 27.53
 Test Method: KDB 935210 D05 Indus Booster Basic Meas v01r04
 EUT Operation:
 Status: Drive the EUT to maximum output power.
 Conditions: Normal conditions
 Application: Cellular Band RF output ports
 Test Configuration:

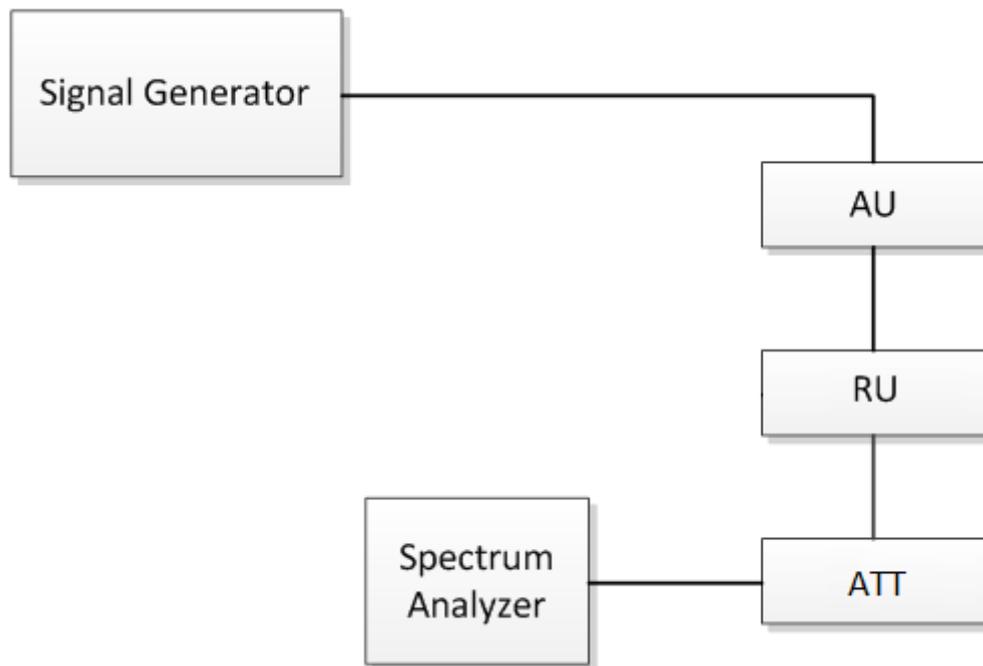


Fig.1 RF Output Power test configuration



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Test Procedure:

RF output power test procedure:

- a) Connect a signal generator to the input of the EUT.
- b) Configure to generate the AWGN (broadband) test signal.
- c) The frequency of the signal generator shall be set to the frequency f0 as determined from 3.3.
- d) Connect a spectrum analyzer or power meter to the output of the EUT using appropriate attenuation as necessary.
- e) Set the signal generator output power to a level that produces an EUT output level that is just below the AGC threshold (see 3.2), but not more than 0.5 dB below.
- f) Measure and record the output power of the EUT; use 3.5.3 or 3.5.4 for power measurement.
- g) Remove the EUT from the measurement setup. Using the same signal generator settings, repeat the power measurement at the signal generator port, which was used as the input signal to the EUT, and record as the input power. EUT gain may be calculated as described in 3.5.5.
- h) Repeat steps f) and g) with input signal amplitude set to 3 dB above the AGC threshold level.
- i) Repeat steps e) to h) with the narrowband test signal.
- j) Repeat steps e) to i) for all frequency bands authorized for use by the EUT.

Amplifier gain test procedure:

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

$$\text{Gain (dB)} = \text{output power (dBm)} - \text{input power (dBm)}.$$

Peak to Average Ratio:

Please according to KDB 971168 D01 clause 5.7.

Remark:

The system continuously monitors the input power.

6.2.1.1 Measurement Record:

Please refer to Appendix A for KSCR2209001814AT-FCC WWAN booster(746MHz to 756MHz).

Please refer to Appendix B for KSCR2209001814AT-FCC WWAN booster(729MHz to 746MHz).



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6.2.2 Conducted Spurious Emissions

Test Requirement: FCC Part 2.1051; FCC Part 27.53
 Test Method: KDB 935210 D05 Indus Booster Basic Meas v01r04
 EUT Operation:
 Status: Drive the EUT to maximum output power.
 Conditions: Normal conditions
 Application: Cellular Band RF output ports
 Test Configuration:

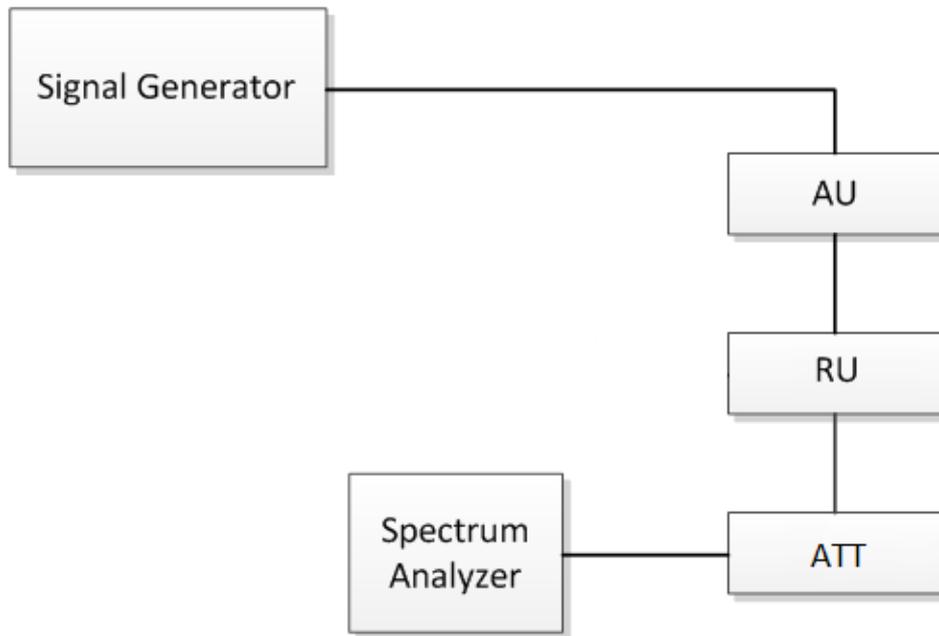


Fig.2. Conducted Spurious Emissions test configuration



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Test Procedure:

Conducted Emissions test procedure:

- a) Connect a signal generator to the input of the EUT.
- b) Set the signal generator to produce the broadband test signal as previously described (i.e., 4.1 MHz OBW AWGN).
- c) Set the center frequency of the test signal to the lowest available channel within the frequency band or block.
- d) Set the EUT input power to a level that is just below the AGC threshold (see 3.2), but not more than 0.5 dB below.
- e) Connect a spectrum analyzer to the output of the EUT using appropriate attenuation as necessary.
- f) Set the RBW = reference bandwidth in the applicable rule section for the supported frequency band of operation (e.g., reference bandwidth is typically 100 kHz or 1 MHz).
- g) Set the VBW $\geq 3 \times$ RBW.
- h) Set the Sweep time = auto-couple.
- i) Set the spectrum analyzer start frequency to the lowest RF signal generated in the equipment, without going below 9 kHz, and the stop frequency to the lower band/block edge frequency minus 100 kHz or 1 MHz, as specified in the applicable rule part.
The number of measurement points in each sweep must be $\geq (2 \times \text{span}/\text{RBW})$, which may require that the measurement range defined by the start and stop frequencies be subdivided, depending on the available number of measurement points provided by the spectrum analyzer.2
- j) Select the power averaging (rms) detector function.
- k) Trace average at least 10 traces in power averaging (rms) mode.
- l) Use the peak marker function to identify the highest amplitude level over each measured frequency range. Record the frequency and amplitude and capture a plot for inclusion in the test report.
- m) Reset the spectrum analyzer start frequency to the upper band/block edge frequency plus 100 kHz or 1 MHz, as specified in the applicable rule part, and the spectrum analyzer stop frequency to 10 times the highest frequency of the fundamental emission (see § 2.1057). The number of measurement points in each sweep must be $\geq (2 \times \text{span}/\text{RBW})$, which may require that the measurement range defined by the start and stop frequencies be subdivided, depending on the available number of measurement points provided by the spectrum analyzer.
- n) Trace average at least 10 traces in power averaging (rms) mode.
- o) Use the peak marker function to identify the highest amplitude level over each of the measured frequency ranges. Record the frequency and amplitude and capture a plot for inclusion in the test report; also provide tabular data, if required.
- p) Repeat steps i) to o) with the input test signals firstly tuned to a middle band/block frequency/channel, and then tuned to a high band/block frequency/channel.
- q) Repeat steps b) to p) with the narrowband test signal.
- r) Repeat steps b) to q) for all authorized frequency bands/blocks used by the EUT.

6.2.2.1 Measurement Record:

Please refer to Appendix A for KSCR2209001814AT-FCC WWAN booster(746MHz to 756MHz).

Please refer to Appendix B for KSCR2209001814AT-FCC WWAN booster(729MHz to 746MHz).



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6.2.3 Out-of-band/out-of-block emissions

Test Requirement:	FCC part 2.1051; FCC Part 27.53
Test Method:	KDB 935210 D05 Indus Booster Basic Meas v01r04
EUT Operation:	
Status:	Drive the EUT to maximum output power.
Conditions:	Normal conditions
Application:	Cellular Band RF output ports
Test Configuration:	

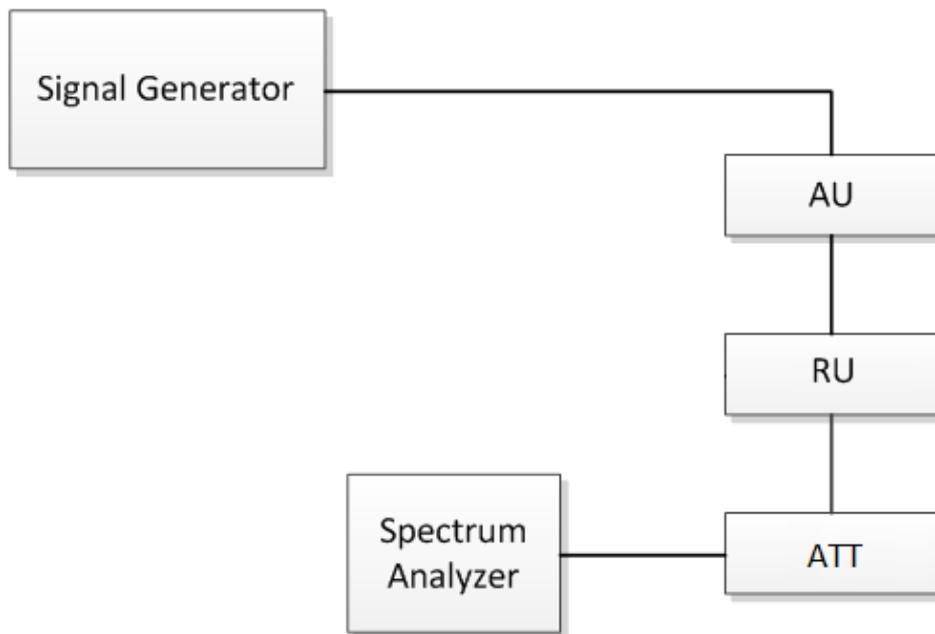


Fig.3. Band edge test configuration

- Test Procedure:
- Out-of-band/out-of-block emissions test procedure:
- Connect a signal generator to the input of the EUT. If the signal generator is not capable of generating two modulated carriers simultaneously, then two discrete signal generators can be connected with an appropriate combining network to support this two-signal test.
 - Set the signal generator to produce two AWGN signals as previously described (e.g., 4.1 MHz OBW).
 - Set the center frequencies such that the AWGN signals occupy adjacent channels, as defined by industry standards such as 3GPP or 3GPP2, at the upper edge of the frequency band or block under test.
 - Set the composite power levels such that the input signal is just below the AGC threshold (see 3.2), but not more than 0.5 dB below. The composite power can be measured using the procedures provided in KDB Publication 971168 [R8], but it will be necessary to expand the power integration bandwidth so as to



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include both of the transmit channels. Alternatively, the composite power can be measured using an average power meter as described in KDB Publication 971168 [R8].

- e) Connect a spectrum analyzer to the output of the EUT using appropriate attenuation as necessary.
- f) Set the RBW = reference bandwidth in the applicable rule section for the supported frequency band (typically 1 % of the EBW or 100 kHz or 1 MHz)
- g) Set the VBW = 3 × RBW.
- h) Set the detector to power averaging (rms) detector.
- i) Set the Sweep time = auto-couple.
- j) Set the spectrum analyzer start frequency to the upper block edge frequency, and the stop frequency to the upper block edge frequency plus 300 kHz or 3 MHz, for frequencies below and above 1 GHz, respectively.
- k) Trace average at least 100 traces in power averaging (rms) mode.
- l) Use the marker function to find the maximum power level.
- m) Capture the spectrum analyzer trace of the power level for inclusion in the test report.
- n) Repeat steps k) to m) with the composite input power level set to 3 dB above the AGC threshold.
- o) Reset the frequencies of the input signals to the lower edge of the frequency block or band under test.
- p) Reset the spectrum analyzer start frequency to the lower block edge frequency minus 300 kHz or 3 MHz, for frequencies below and above 1 GHz, respectively, and the stop frequency to the lower band or block edge frequency.
- q) Repeat steps k) to n).
- r) Repeat steps a) to q) with the signal generator configured for a single test signal tuned as close as possible to the block edges.
- s) Repeat steps a) to r) with the narrowband test signal.
- t) Repeat steps a) to s) for all authorized frequency bands or blocks used by the EUT.

Remark:

- At maximum drive level, for each modulation: two tests (high-, low-band edge) with two tones
- Limit usually is -13dBm conducted.
- Not needed for Single Channel systems.

Test have been done with two modulated carriers and single modulated carriers, all modes have been tested and we only record the worst test result with two modulated carriers

6.2.3.1 Measurement Record:

Please refer to Appendix A for KSCR2209001814AT-FCC WWAN booster(746MHz to 756MHz).

Please refer to Appendix B for KSCR2209001814AT-FCC WWAN booster(729MHz to 746MHz).



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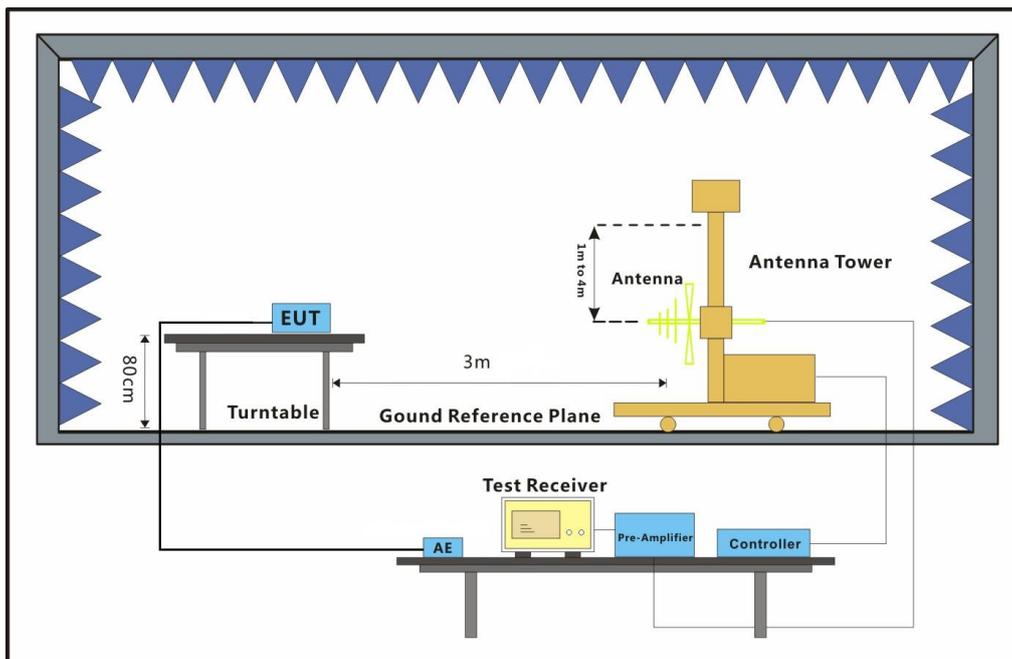
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6.2.4 Radiated Spurious Emissions

- Test Requirement: FCC Part 2.1053; FCC Part 27.53
- Test Method: KDB 935210 D05 Indus Booster Basic Meas v01r04
- EUT Operation:
 - Status: Drive the EUT to maximum output power.
 - Conditions: Normal conditions
 - Application: Enclosure
- Test Configuration:
 - 30MHz to 1GHz emissions:



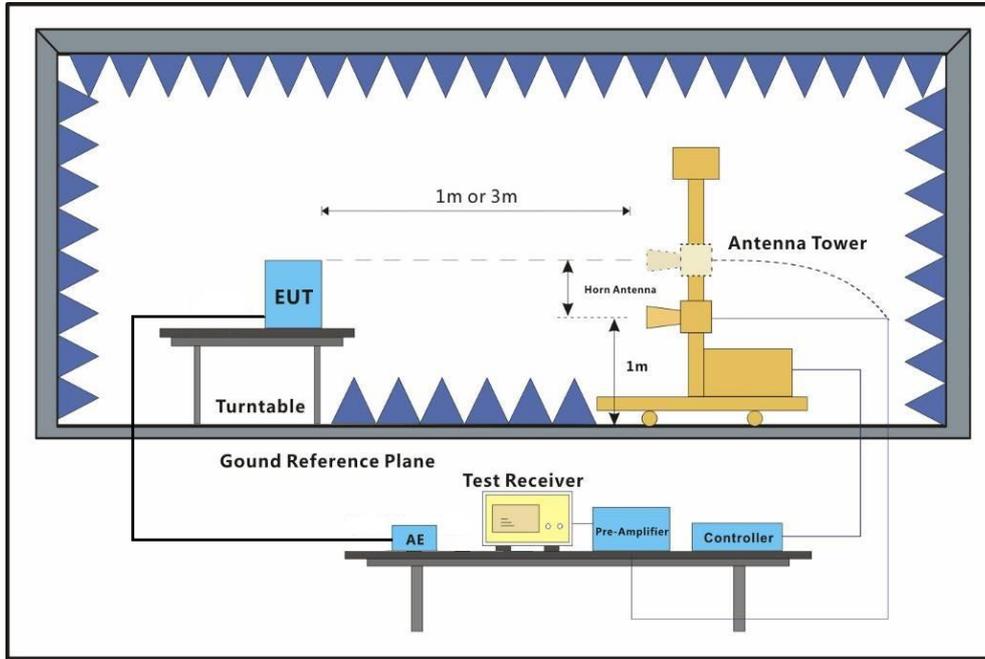
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1GHz to 40GHz emissions:



Test Procedure:

1. Test the background noise level with all the test facilities;
2. Keep one transmitting path, all other connectors shall be connected by normal power or RF leads;
3. Select the suitable RF notch filter to avoid the test receiver or spectrum analyzer produce unwanted spurious emissions;
4. Keep the EUT continuously transmitting in max power;
5. Read the radiated emissions of the EUT enclosure.

Radiated Emissions Test Procedure:



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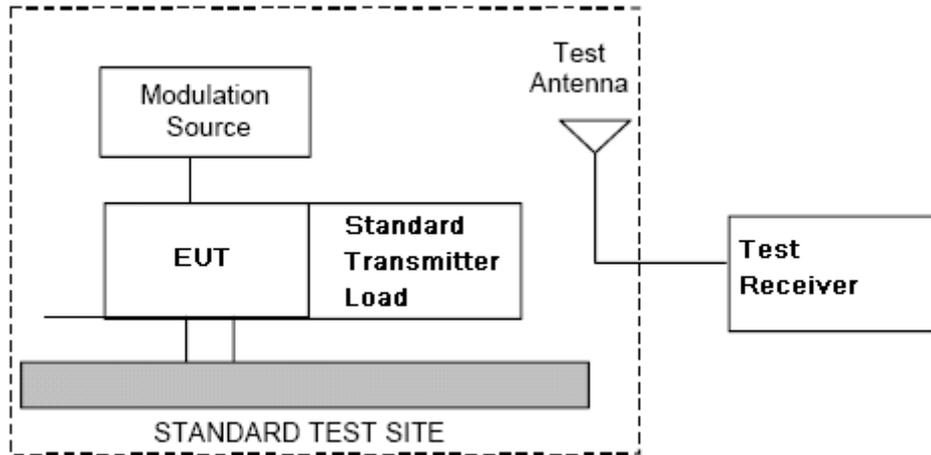
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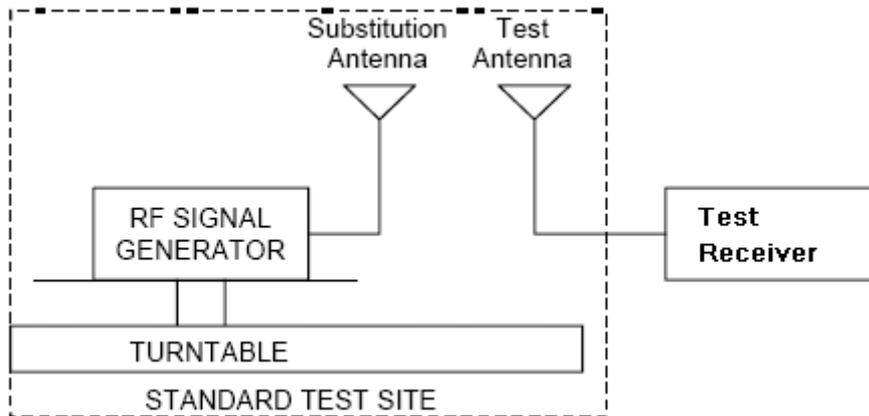


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- a) Connect the equipment as illustrated.
- b) Adjust the spectrum analyzer for the following settings:
 - 1) Resolution Bandwidth = 100 kHz for spurious emissions below 1 GHz, and 1 MHz for spurious emissions above 1GHz.
 - 2) Video Bandwidth = 300 kHz for spurious emissions below 1 GHz, and 3 MHz for spurious emissions above 1 GHz.
 - 3) Sweep Speed slow enough to maintain measurement calibration.
 - 4) Detector Mode = Positive Peak.
- c) Place the transmitter to be tested on the turntable in the standard test site, The transmitter is transmitting into a no radiating load that is placed on the turntable. The RF cable to this load should be of minimum length.
- d) Measurements shall be made from 30MHz to 10 times of fundamental carrier, except for the region close to the carrier equal to \pm the carrier bandwidth.
- e) Key the transmitter without modulation or normal modulation base the standard.
- f) For each spurious frequency, raise and lower the test antenna from 1 m to 4 m to obtain a maximum reading on the spectrum analyzer with the test antenna at horizontal polarity. Then the turntable should be rotated 360° to determine the maximum reading. Repeat this procedure to obtain the highest possible reading. Record this maximum reading.
- g) Repeat step f) for each spurious frequency with the test antenna polarized vertically.



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- h) Reconnect the equipment as illustrated.
- i) Keep the spectrum analyzer adjusted as in step b).
- j) Remove the transmitter and replace it with a substitution antenna (the antenna should be half-wavelength for each frequency involved). The center of the substitution antenna should be approximately at the same location as the center of the transmitter. At the lower frequencies, where the substitution antenna is very long, this will be impossible to achieve when the antenna is polarized vertically. In such case the lower end of the antenna should be 0.3 m above the ground.
- k) Feed the substitution antenna at the transmitter end with a signal generator connected to the antenna by means of a non-radiating cable. With the antennas at both ends horizontally polarized, and with the signal generator tuned to a particular spurious frequency, raise and lower the test antenna to obtain a maximum reading at the spectrum analyzer. Adjust the level of the signal generator output until the previously recorded maximum reading for this set of conditions is obtained. This should be done carefully repeating the adjustment of the test antenna and generator output.
- l) Repeat step k) with both antennas vertically polarized for each spurious frequency.
- m) Calculate power in dBm into a reference ideal half-wave dipole antenna by reducing the readings obtained in steps k) and l) by the power loss in the cable between the generator and the antenna, and further corrected for the gain of the substitution antenna used relative to an ideal half-wave dipole antenna by the following formula:

$$Pd(\text{dBm}) = Pg(\text{dBm}) - \text{cable loss (dB)} + \text{antenna gain (dB)}$$

where:

Pd is the dipole equivalent power and

Pg is the generator output power into the substitution antenna.

NOTE:

- 1) It is permissible to use other antennas provided they can be referenced to a dipole.
- 2) For below 1GHz signal, the *antenna gain* (dB) is dBd, and for above 1GHz signal, the *antenna gain* (dB) is dBi
- 3) Effective radiated power (e.r.p) refers to the radiation of a half wave tuned dipole instead of an isotropic antenna. There is a constant difference of 2.15 dB between e.i.r.p. and e.r.p.
 $e.r.p \text{ (dBm)} = e.i.r.p. \text{ (dBm)} - 2.15$
- 4) For this test, the AU and EU are put outside of the chamber; connect to the RU through the optical fiber



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6.2.4.1 Measurement Record:

For booster(746MHz to 756MHz).

AWGN Low channel					
Frequency	Spurious Emission		Limit	Over limit	Result
	Polarization and Level				
MHz	polarization	dBm	dBm	dB	
380.3	Horizontal	-65.25	-13	-52.25	pass
569.1	Horizontal	-58.36	-13	-45.36	pass
803.4	Horizontal	-64.08	-13	-51.08	pass
1487.2	Horizontal	-43.84	-13	-30.84	pass
2887.7	Horizontal	-54.41	-13	-41.41	pass
4576.0	Horizontal	-50.58	-13	-37.58	pass
368.3	Vertical	-65.96	-13	-52.96	pass
564.4	Vertical	-59.14	-13	-46.14	pass
821.6	Vertical	-64.61	-13	-51.61	pass
1487.9	Vertical	-43.32	-13	-30.32	pass
2887.1	Vertical	-49.65	-13	-36.65	pass
4570.0	Vertical	-53.63	-13	-40.63	pass



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AWGN_Middle channel					
Frequency	Spurious Emission		Limit	Over limit	Result
	Polarization and Level				
MHz	polarization	dBm	dBm	dB	
384.0	Horizontal	-66.16	-13	-53.16	pass
574.4	Horizontal	-59.83	-13	-46.83	pass
811.2	Horizontal	-65.13	-13	-52.13	pass
1502.0	Horizontal	-45.15	-13	-32.15	pass
2916.8	Horizontal	-55.81	-13	-42.81	pass
4621.6	Horizontal	-51.85	-13	-38.85	pass
371.1	Vertical	-66.91	-13	-53.91	pass
569.6	Vertical	-60.43	-13	-47.43	pass
829.1	Vertical	-66.04	-13	-53.04	pass
1502.0	Vertical	-44.20	-13	-31.20	pass
2915.7	Vertical	-50.76	-13	-37.76	pass
4615.6	Vertical	-54.87	-13	-41.87	pass



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AWGN_High channel					
Frequency	Spurious Emission		Limit	Over limit	Result
	Polarization and Level				
MHz	polarization	dBm	dBm	dB	
346.4	Horizontal	-65.40	-13	-52.40	pass
517.8	Horizontal	-58.49	-13	-45.49	pass
730.6	Horizontal	-64.34	-13	-51.34	pass
1352.7	Horizontal	-43.76	-13	-30.76	pass
2625.2	Horizontal	-55.06	-13	-42.06	pass
4159.8	Horizontal	-50.46	-13	-37.46	pass
334.3	Vertical	-65.99	-13	-52.99	pass
513.2	Vertical	-59.52	-13	-46.52	pass
746.3	Vertical	-64.56	-13	-51.56	pass
1351.8	Vertical	-43.32	-13	-30.32	pass
2624.5	Vertical	-49.74	-13	-36.74	pass
4154.6	Vertical	-53.96	-13	-40.96	pass



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GMSK_Low channel					
Frequency	Spurious Emission		Limit	Over limit	Result
	Polarization and Level				
MHz	polarization	dBm	dBm	dB	
343.1	Horizontal	-64.58	-13	-51.58	pass
513.0	Horizontal	-57.53	-13	-44.53	pass
723.7	Horizontal	-62.89	-13	-49.89	pass
1338.8	Horizontal	-43.03	-13	-30.03	pass
2599.2	Horizontal	-53.01	-13	-40.01	pass
4119.0	Horizontal	-49.15	-13	-36.15	pass
331.7	Vertical	-64.62	-13	-51.62	pass
508.5	Vertical	-58.14	-13	-45.14	pass
740.1	Vertical	-63.88	-13	-50.88	pass
1339.3	Vertical	-42.46	-13	-29.46	pass
2598.5	Vertical	-48.97	-13	-35.97	pass
4113.8	Vertical	-52.68	-13	-39.68	pass



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GMSK_Middle channel					
Frequency	Spurious Emission		Limit	Over limit	Result
	Polarization and Level				
MHz	polarization	dBm	dBm	dB	
345.8	Horizontal	-64.50	-13	-51.50	pass
517.4	Horizontal	-58.80	-13	-45.80	pass
730.6	Horizontal	-63.71	-13	-50.71	pass
1352.1	Horizontal	-43.94	-13	-30.94	pass
2625.6	Horizontal	-54.38	-13	-41.38	pass
4159.5	Horizontal	-51.25	-13	-38.25	pass
334.1	Vertical	-65.65	-13	-52.65	pass
512.8	Vertical	-59.12	-13	-46.12	pass
746.7	Vertical	-64.80	-13	-51.80	pass
1351.8	Vertical	-43.06	-13	-30.06	pass
2624.2	Vertical	-49.86	-13	-36.86	pass
4154.2	Vertical	-54.30	-13	-41.30	pass



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GMSK_High channel					
Frequency	Spurious Emission		Limit	Over limit	Result
	Polarization and Level				
MHz	polarization	dBm	dBm	dB	
305.5	Horizontal	-63.87	-13	-50.87	pass
456.4	Horizontal	-57.20	-13	-44.20	pass
643.2	Horizontal	-63.13	-13	-50.13	pass
1190.4	Horizontal	-42.74	-13	-29.74	pass
2310.5	Horizontal	-54.01	-13	-41.01	pass
3660.8	Horizontal	-49.55	-13	-36.55	pass
294.5	Vertical	-64.66	-13	-51.66	pass
452.1	Vertical	-58.24	-13	-45.24	pass
657.1	Vertical	-63.12	-13	-50.12	pass
1190.2	Vertical	-42.59	-13	-29.59	pass
2310.1	Vertical	-48.51	-13	-35.51	pass
3656.5	Vertical	-53.05	-13	-40.05	pass



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For booster(729MHz to 746MHz).

AWGN_Low channel					
Frequency	Spurious Emission		Limit	Over limit	Result
	Polarization and Level				
MHz	polarization	dBm	dBm	dB	
382.1	Horizontal	-60.78	-13	-47.78	pass
567.6	Horizontal	-61.10	-13	-48.10	pass
843.3	Horizontal	-69.11	-13	-56.11	pass
1468.0	Horizontal	-43.43	-13	-30.43	pass
2897.2	Horizontal	-52.80	-13	-39.80	pass
4601.1	Horizontal	-53.09	-13	-40.09	pass
364.0	Vertical	-64.37	-13	-51.37	pass
604.9	Vertical	-64.39	-13	-51.39	pass
827.5	Vertical	-64.04	-13	-51.04	pass
1468.0	Vertical	-40.72	-13	-27.72	pass
2939.9	Vertical	-52.46	-13	-39.46	pass
4586.4	Vertical	-54.79	-13	-41.79	pass



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AWGN_Middle channel					
Frequency	Spurious Emission		Limit	Over limit	Result
	Polarization and Level				
MHz	polarization	dBm	dBm	dB	
363.6	Horizontal	-60.24	-13	-47.24	pass
567.6	Horizontal	-61.19	-13	-48.19	pass
815.6	Horizontal	-68.83	-13	-55.83	pass
1475.0	Horizontal	-41.72	-13	-28.72	pass
2911.3	Horizontal	-50.30	-13	-37.30	pass
4584.5	Horizontal	-54.61	-13	-41.61	pass
407.8	Vertical	-69.18	-13	-56.18	pass
575.4	Vertical	-63.43	-13	-50.43	pass
825.2	Vertical	-64.98	-13	-51.98	pass
1475.0	Vertical	-44.74	-13	-31.74	pass
2910.9	Vertical	-52.59	-13	-39.59	pass
4593.7	Vertical	-50.40	-13	-37.40	pass



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AWGN_High channel					
Frequency	Spurious Emission		Limit	Over limit	Result
	Polarization and Level				
MHz	polarization	dBm	dBm	dB	
374.5	Horizontal	-63.27	-13	-50.27	pass
559.6	Horizontal	-64.30	-13	-51.30	pass
811.6	Horizontal	-67.93	-13	-54.93	pass
1482.0	Horizontal	-42.12	-13	-29.12	pass
2919.8	Horizontal	-49.81	-13	-36.81	pass
4620.3	Horizontal	-53.73	-13	-40.73	pass
381.3	Vertical	-68.51	-13	-55.51	pass
568.3	Vertical	-65.42	-13	-52.42	pass
842.8	Vertical	-62.84	-13	-49.84	pass
1482.0	Vertical	-39.49	-13	-26.49	pass
2919.1	Vertical	-45.41	-13	-32.41	pass
4586.3	Vertical	-50.46	-13	-37.46	pass



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GMSK_Low channel					
Frequency	Spurious Emission		Limit	Over limit	Result
	Polarization and Level				
MHz	polarization	dBm	dBm	dB	
382.1	Horizontal	-63.25	-13	-50.25	pass
570.6	Horizontal	-64.06	-13	-51.06	pass
811.6	Horizontal	-61.88	-13	-48.88	pass
1473.0	Horizontal	-45.04	-13	-32.04	pass
2905.4	Horizontal	-51.28	-13	-38.28	pass
4612.6	Horizontal	-53.70	-13	-40.70	pass
408.6	Vertical	-69.44	-13	-56.44	pass
561.9	Vertical	-63.15	-13	-50.15	pass
836.2	Vertical	-61.02	-13	-48.02	pass
1473.0	Vertical	-39.40	-13	-26.40	pass
2921.3	Vertical	-52.30	-13	-39.30	pass
4631.4	Vertical	-54.29	-13	-41.29	pass



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GMSK_Middle channel					
Frequency	Spurious Emission		Limit	Over limit	Result
	Polarization and Level				
MHz	polarization	dBm	dBm	dB	
406.5	Horizontal	-66.79	-13	-53.79	pass
595.4	Horizontal	-62.72	-13	-49.72	pass
812.0	Horizontal	-64.66	-13	-51.66	pass
1475.0	Horizontal	-43.07	-13	-30.07	pass
2915.4	Horizontal	-50.67	-13	-37.67	pass
4608.6	Horizontal	-50.17	-13	-37.17	pass
388.0	Vertical	-67.53	-13	-54.53	pass
574.4	Vertical	-63.46	-13	-50.46	pass
818.7	Vertical	-58.58	-13	-45.58	pass
1475.0	Vertical	-42.28	-13	-29.28	pass
2928.7	Vertical	-50.51	-13	-37.51	pass
4587.6	Vertical	-56.40	-13	-43.40	pass



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GMSK_High channel					
Frequency	Spurious Emission		Limit	Over limit	Result
	Polarization and Level				
MHz	polarization	dBm	dBm	dB	
389.1	Horizontal	-63.56	-13	-50.56	pass
577.9	Horizontal	-65.75	-13	-52.75	pass
814.3	Horizontal	-65.22	-13	-52.22	pass
1477.0	Horizontal	-43.91	-13	-30.91	pass
2909.2	Horizontal	-50.36	-13	-37.36	pass
4615.1	Horizontal	-48.71	-13	-35.71	pass
379.6	Vertical	-70.38	-13	-57.38	pass
596.5	Vertical	-62.77	-13	-49.77	pass
820.3	Vertical	-65.01	-13	-52.01	pass
1477.0	Vertical	-45.99	-13	-32.99	pass
2930.1	Vertical	-50.95	-13	-37.95	pass
4619.9	Vertical	-51.07	-13	-38.07	pass



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6.2.5 Occupied bandwidth and Input-versus-output signal comparison

Test Requirement:	FCC part 2.1049 The spectral shape of the output should look similar to input for all modulations.
EUT Operation:	
Status:	Drive the EUT to maximum output power. .
Conditions:	Normal conditions
Application:	Cellular Band RF output ports
Test Configuration:	

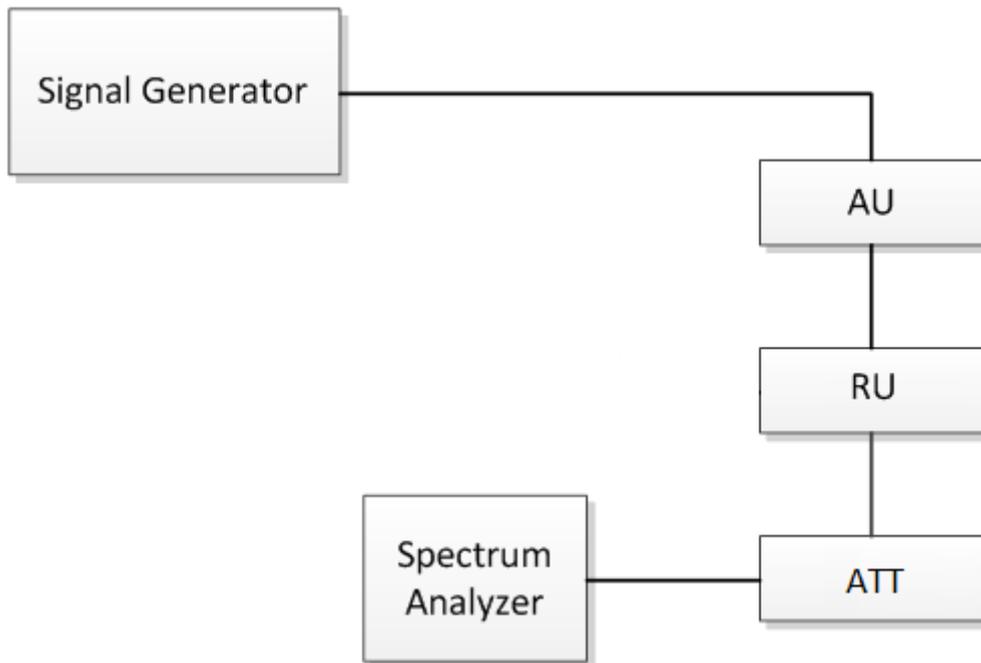


Fig.4. Occupied bandwidth test configuration

- Test Procedure:
- Connect a signal generator to the input of the EUT.
 - Configure the signal generator to transmit the AWGN signal.
 - Configure the signal amplitude to be just below the AGC threshold level (see 3.2), but not more than 0.5 dB below.
 - Connect a spectrum analyzer to the output of the EUT using appropriate attenuation.
 - Set the spectrum analyzer center frequency to the center frequency of the operational band under test. The span range of the spectrum analyzer shall be between 2 times to 5 times the emission bandwidth (EBW) or alternatively, the OBW.
 - The nominal RBW shall be in the range of 1 % to 5 % of the anticipated OBW, and the VBW shall be $\geq 3 \times$ RBW.



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

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

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

i) Set spectrum analyzer detection function to positive peak.

j) Set the trace mode to max hold.

k) Determine the reference value: Allow the trace to stabilize. Set the spectrum analyzer marker to the highest amplitude level of the displayed trace (this is the reference value) and record the associated frequency as f_0 .

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

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

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

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

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

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

6.2.5.1 Measurement Record:

Please refer to Appendix A for KSCR2209001814AT-FCC WWAN booster(746MHz to 756MHz).

Please refer to Appendix B for KSCR2209001814AT-FCC WWAN booster(729MHz to 746MHz).



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6.2.6 Out of Band Rejection

Test Requirement: Section D.3(l) of KDB 935210 D02 Signal Booster Certification v04r2
 Test for rejection of out of band signals. Filter freq. response plots are acceptable.

Test Method: KDB 935210 D05 Indus Booster Basic Meas v01r04

EUT Operation:
 Status: Drive the EUT to maximum output power. .
 Conditions: Normal conditions
 Application: Cellular Band RF output ports

Test Configuration:

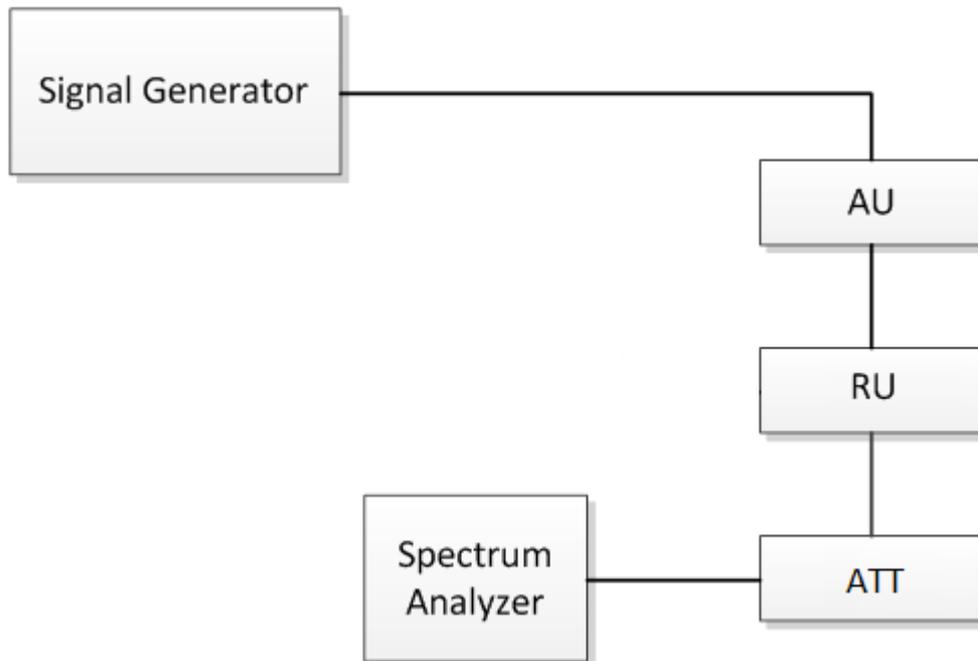


Fig.5. Out of Band rejection test configuration

Test Procedure:

- a) Connect a signal generator to the input of the EUT.
- b) Configure a swept CW signal with the following parameters:
 - 1) Frequency range = $\pm 250\%$ of the passband, for each applicable CMRS band (see also KDB Publication 935210 D02 [R7] and KDB Publication 634817 [R5] about selection of frequencies for testing and for grant listings).
 - 2) Level = a sufficient level to affirm that the out-of-band rejection is > 20 dB above the noise floor and will not engage the AGC during the entire sweep.
 - 3) Dwell time = approximately 10 ms.
 - 4) Number of points = $\text{SPAN}/(\text{RBW}/2)$.
- c) Connect a spectrum analyzer to the output of the EUT using appropriate



attenuation.

- d) Set the span of the spectrum analyzer to the same as the frequency range of the signal generator.
- e) Set the resolution bandwidth (RBW) of the spectrum analyzer to be 1 % to 5 % of the EUT passband, and the video bandwidth (VBW) shall be set to $\geq 3 \times$ RBW.
- f) Set the detector to Peak Max-Hold and wait for the spectrum analyzer's spectral display to fill.
- g) Place a marker to the peak of the frequency response and record this frequency as f_0 .
- h) Place two markers, one at the lowest and the other at the highest frequency of the envelope of the spectral display, such that each marker is at or slightly below the -20 dB down amplitude, to determine the 20dB bandwidth.
- i) Capture the frequency response of the EUT.
- j) Repeat for all frequency bands applicable for use by the EUT.

6.2.6.1 Measurement Record:

Please refer to Appendix A for KSCR2209001814AT-FCC WWAN booster(746MHz to 756MHz).

Please refer to Appendix B for KSCR2209001814AT-FCC WWAN booster(729MHz to 746MHz).



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6.2.7 Frequency Stability

Test Requirement: FCC Part 2.1055; FCC Part 27.534

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

EUT Operation:

Status: Drive the EUT to maximum output power.

Conditions: Temperature conditions, voltage conditions

Application: Cellular Band RF output ports

Test Procedure:

1. Temperature conditions:
 - a) The RF output port of the EUT was connected to Frequency Meter;
 - b) Set the working Frequency in the middle channel;
 - c) record the 20°C and nominal voltage frequency value as reference point;
 - d) vary the temperature from -10°C to 45°C with step 10°C
 - e) when reach a temperature point, keep the temperature balance at least 1 hour to make the product working in this status;
 - f) read the frequency at the relative temperature.
2. Voltage conditions:
 - a) record the 20°C and nominal voltage frequency value as reference point;
 - b) vary the voltage from -15% nominal voltage to +15% voltage;
 - c) read the frequency at the relative voltage.

6.2.7.1 Measurement Record:

Please refer to Appendix A for KSCR2209001814AT-FCC WWAN booster(746MHz to 756MHz).

Please refer to Appendix B for KSCR2209001814AT-FCC WWAN booster(729MHz to 746MHz).



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7 Photographs - Test Setup

Please refer to test setup photo

8 Photographs - EUT Constructional Details

Please refer to external and internal photo

--The End of Report--



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