

# TEST REPORT

**Application No.:** KSCR2109000065CR  
**FCC ID:** OJFPS-MP-UHF  
**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 Huoju Avenue, Binjiang District, Hangzhou, China  
**Equipment Under Test (EUT):**  
**EUT Name:** Remote Unit  
**Model No.:** PS-MP  
**Trade mark:** CORNING  
**Standard(s) :** FCC Part 2; FCC Part 90;  
**Date of Receipt:** 2021-10-08  
**Date of Test:** 2021-10-18 to 2022-01-07  
**Date of Issue:** 2022-01-20

<b>Test Result:</b>	<b>Pass*</b>
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\* In the configuration tested, the EUT complied with the standards specified above.

Eric Lin  
Laboratory Manager

The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards. Any mention of SGS International Electrical Approvals or testing done by SGS International Electrical Approvals in connection with, distribution or use of the product described in this report must be approved by SGS International Electrical Approvals in writing.



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Revision Record			
Version	Description	Date	Remark
00	Original	2022-01-20	/

Authorized for issue by:			
		<i>Damon Zhou</i>	
		<b>Damon Zhou / Project Engineer</b>	
		<i>Eric Lin</i>	
		<b>Eric Lin / Reviewer</b>	



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## 2 Test Summary

Test Item	Test Requirement	Test Method	Result
Input/output power and amplifier/booster gain	47 CFR Part 2.1046, 47 CFR Part 90.205, 47 CFR Part 90.219, 47 CFR Part 90.279	KDB 935210 D05 v01r04	PASS
Conducted Spurious Emissions	47 CFR Part 2.1051, 47 CFR Part 90.219(e)(3)	KDB 935210 D05 v01r04	PASS
Out-of-band/out-of-block (including intermodulation)	47 CFR Part 2.1051, 47 CFR Part 90.210(b), 47 CFR Part 90.210(g), 47 CFR Part 90.219(e)(3), 47 CFR Part 22.359, 47 CFR Part 80.211(f), 47 CFR Part 74.462(c), 47 CFR Part 90.210(i), 47 CFR Part 90.210(j)	KDB 935210 D05 v01r04	PASS
Radiated Spurious Emissions	47 CFR Part 2.1053	KDB 935210 D05 v01r04	PASS
Input-Versus-output signal comparison	47 CFR Part 2.1049, 47 CFR Part 90.210, 47 CFR Part 90.219(e)(4)(iii)	KDB 935210 D05 v01r04	PASS
Frequency Stability	47 CFR Part 2.1055, 47 CFR Part 90.213	KDB 935210 D05 v01r04	PASS
Out of Band Rejection	/	KDB 935210 D05 v01r04	PASS
Noise	47 CFR Part 90.219(e)(2)	KDB 935210 D05 v01r04	PASS
<p>Remark: EUT: In this whole report EUT means Equipment Under Test. Tx: In this whole report Tx (or tx) means Transmitter. Rx: In this whole report Rx (or rx) means Receiver. All modes have been tested and only record the worst test result. This is a DAS, no need to implement uplink test as it is cable connect to BTS (No air radiation), then the test about Uplink would be ignored.</p>			
<p>Test method standard: ANSI C63.26-2015 KDB 935210 D05 Indus Booster Basic Meas v01r04</p>			



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## 4 General Information

### 4.1 Details of E.U.T.

Product Name:	Remote Unit
Model No.:	PS-MP
Trade Mark:	CORNING
Antenna Type:	External Antenna
Antenna Gain:	Max Antenna Gain 0.0 dBi(Provided by manufacturer)
Power Supply:	AC 100~240V 50/60Hz or DC 48V
Test Voltage	AC 120V/60Hz
Max Power Consumption:	150W
Type of Modulation	CQPSK/12.5kHz FM/TETRA
Frequency Band:	380MHz - 512MHz
Normal Output Power:	24dBm (downlink)
System Gain:	74 ± 2dB
Power Control Method:	ALC

Rule Part	Frequency Range (MHz)	Test Frequency (MHz)
FCC Part 90	406.1 ~ 420	416.0100
FCC Part 90	421 ~ 430	426.9885
FCC Part 90	450 ~ 470	460.0000
FCC Part 90	470 ~ 491	472.9900
	491 ~ 512	506.0900

### 4.2 Description of Support Units

Description	Manufacturer	Model No.	Serial No.
Note Book	LENOVO	Y510P	SZSMT55INP141501639
Remote Unit	CORNING	PS-AU-AIR	/



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### 4.3 Measurement Uncertainty

No.	Item	Measurement Uncertainty
1	Radio Frequency	$\pm 7.25 \times 10^{-8}$
2	Duty cycle	$\pm 0.37\%$
3	Occupied Bandwidth	$\pm 3\%$
4	Conduction emission	$\pm 3.0\text{dB}$ (150kHz to 30MHz)
5	RF conducted power	$\pm 0.75\text{dB}$
6	RF power density	$\pm 2.84\text{dB}$
7	Conducted Spurious emissions	$\pm 0.75\text{dB}$
8	RF Radiated power	$\pm 4.5\text{dB}$ (Below 1GHz)
		$\pm 4.8\text{dB}$ (Above 1GHz)
9	Radiated Spurious emission test	$\pm 4.5\text{dB}$ (Below 1GHz)
		$\pm 4.8\text{dB}$ (Above 1GHz)
10	Temperature test	$\pm 1^\circ\text{C}$
11	Humidity test	$\pm 3\%$
12	Supply voltages	$\pm 1.5\%$
13	Time	$\pm 3\%$

Remark:

The  $U_{\text{lab}}$  (lab Uncertainty) is less than  $U_{\text{CISPR}}$  (CISPR Uncertainty), so the test results

- compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.



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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
<b>RF Conducted Test</b>						
1	Spectrum Analyzer	Agilent	E4446A	MY44020154	04/16/2021	04/15/2022
2	Spectrum Analyzer	Keysight	N9020A	MY55370209	10/11/2021	10/10/2022
3	Spectrum Analyzer	Keysight	N9010A	MY56480443	02/01/2021	01/31/2022
4	Signal Generator	Agilent	N5182A	MY50142015	08/27/2021	08/26/2022
5	Radio Communication Test Station	Anritsu	MT8000A	6262012849	N/A	N/A
6	Radio Communication Analyzer	Anritsu	MT8821C	6201692222	N/A	N/A
7	Universal Radio Communication Tester	R&S	CMW500	159275	10/12/2021	10/11/2022
8	Universal Radio Communication Tester	R&S	CMW500	167239	04/16/2021	04/15/2022
9	Power Meter	Anritsu	ML2495A	1445010	04/15/2021	04/14/2022
10	Switcher	CCSRF	FY562	KUS2001M001-3	10/12/2021	10/11/2022
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	AI SI	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	/	04/15/2021	04/14/2022
17	Software	BST	TST-PASS	N/A	N/A	N/A
18	Temp. / Humidity Chamber	TERCHY	MHK-120AK	X30109	04/15/2021	04/14/2022
19	Thermometer	Anymetre	TH603	CCS007	10/14/2021	10/13/2022
<b>RF Radiated Test</b>						
1	Spectrum Analyzer	R&S	FSV40	101493	10/11/2021	10/10/2022
2	Signal Generator	Agilent	E8257C	MY43321570	10/18/2021	10/17/2022
3	Loop Antenna	Schwarzbeck	HXYZ9170	9170-108	02/22/2021	02/21/2022
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	10/26/2020	10/25/2022
7	Horn-antenna(1-18GHz)	ETS-LINDGREN	3117	00143290	02/22/2021	02/21/2023
8	Horn Antenna(18-40GHz)	Schwarzbeck	BBHA9170	BBHA9170171	02/22/2021	02/21/2022
9	Pre-Amplifier(30MHz~18GHz)	LNA	/	/	04/15/2021	04/14/2022
10	Amplifier(18~40GHz)	COM-POWER	PAM-840A	461332	10/18/2021	10/17/2022
11	Low Pass Filter	MICRO-TRONICS	VLFX-950	RV142900829	N.C.R	N.C.R
12	High Pass Filter	Mini-Circuits	VHF-1200	15542	N.C.R	N.C.R
13	Filter (5450MHz~5770 MHz)	MICRO-TRONICS	BRC50704-01	2	N.C.R	N.C.R
14	Filter (5690 MHz~5930 MHz)	MICRO-TRONICS	BRC50705-01	4	N.C.R	N.C.R
15	Filter (5150 MHz~5350 MHz)	MICRO-TRONICS	BRC50703-01	2	N.C.R	N.C.R
16	Filter (885 MHz~915 MHz)	MICRO-TRONICS	BRM14698	1	N.C.R	N.C.R
17	Filter (815 MHz~860 MHz)	MICRO-TRONICS	BRM14697	1	N.C.R	N.C.R
18	Filter (1745 MHz~1910 MHz)	MICRO-TRONICS	BRM14700	1	N.C.R	N.C.R
19	Filter (1922 MHz~1977 MHz)	MICRO-TRONICS	BRM50715	1	N.C.R	N.C.R
20	Filter (2550 MHz)	MICRO-TRONICS	HPM13362	5	N.C.R	N.C.R
21	Filter (1532 MHz~1845 MHz)	MICRO-TRONICS	BRM50713	1	N.C.R	N.C.R



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22	Filter (2.4GHz)	MICRO-TRONICS	BRM50701	5	N.C.R	N.C.R
23	RE test cable	/	RE01-RE04	/	04/15/2021	04/14/2022
24	Software	Faratronic	EZ_EMV-3A1	N/A	N/A	N/A



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## 6 Test Results

### 6.1 Test conditions

Input voltage:	AC 120V	
Test voltage	Normal	AC 120V
	Extreme	AC 102V ~ AC 138V

#### Operating Environment:

Test Temperature:	Normal	22°C ~ 26°C
	Extreme	-40 ~ 50°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:

The PS-MP system working principle: the RF signal coupled from BTS is transferred into optical signal, and then transmitted via a fiber to remote unit. The remote re-transfers the optical signal back to RF signal, through the frequency translation and after power amplifiers, can extend the BTS coverage to another desired area; the PS-MP system is compliant with the description about distributed antenna system in FCC rules, So **the Equipment belongs to the remote unit.**



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## 6.2 Test Procedure & Measurement Data

### 6.2.1 Input/output power and amplifier/booster gain

Test Requirement: 47 CFR Part 2.1046, 47 CFR Part 90.205, 47 CFR Part 90.219, 47 CFR Part 90.279

Test Method: KDB 935210 D05 Indus Booster Basic Meas v01r04

Limit: **47 CFR Part 90.205**

Applicants for licenses must request and use no more power than the actual power necessary for satisfactory operation. Except where otherwise specifically provided for, the maximum power that will be authorized to applicants whose license applications for new stations are filed after August 18, 1995 is as follows in FCC Part 90.205 (a) through (r).

**47 CFR Part 90.219(e)(1)**

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

**47 CFR Part 22.565(a)**

Limits of Effective Radiated Power (ERP) Corresponding to Effective Antenna Heights (EAH) of Base Stations in the 421-430 MHz Band.

Effective antenna height (EAH) in meters (feet)	Maximum effective radiated power (ERP) (watts)
Above 305-457 (above 1000-1500)	75

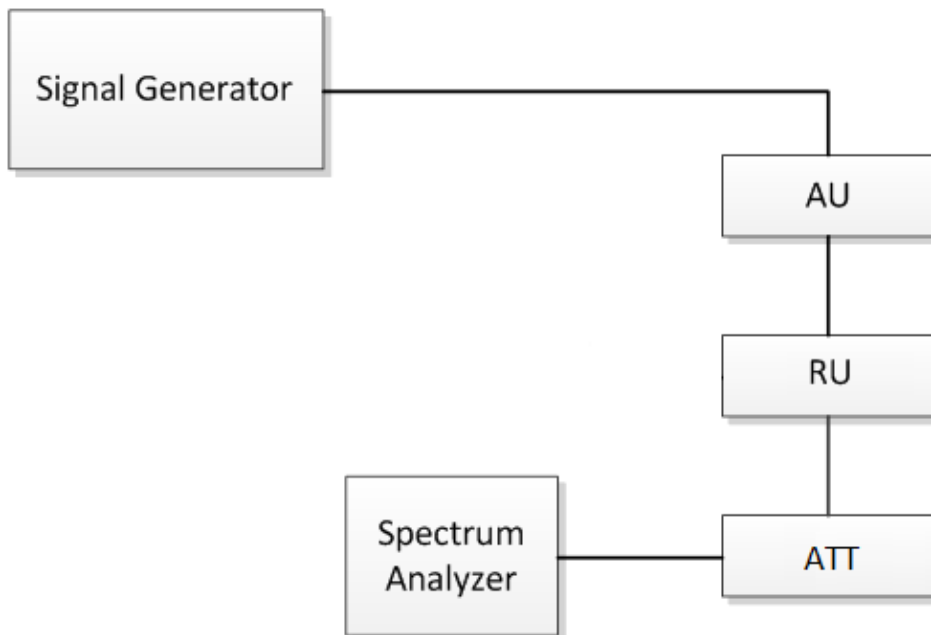
EUT Operation:

Status: Drive the EUT to maximum output power.

Conditions: Normal conditions

Application: Cellular Band RF output ports

Test Configuration:



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Test Procedure: KDB 935210 D05 4.5

Apply the same guidance as in 3.5.2 to measure the maximum input and output power levels necessary for computing the mean EUT gain, but with the following modifications:

- a) Configure the signal generator for CW operation, instead of AWGN,
- b) Select the spectrum analyzer positive peak detector, instead of the power averaging (rms) detector,
- c) Activate the max hold function, instead of the trace averaging function,
- d) Use in conjunction with the guidance in 4.5.3.

4.5.3 Power measurement Method 1: using a spectrum or signal analyzer

- a) Set the frequency span to at least 1 MHz.
- b) Set RBW = 100 kHz.
- c) Set VBW  $\geq 3 \times$  RBW.
- d) Set the detector to PEAK, and trace mode to MAX HOLD.
- e) Place a marker on the peak of the signal and record the value as the maximum power.
- f) Repeat step e) but with the EUT in place.
- g) EUT gain may be calculated as described in 4.5.5.

4.5.5 Calculating amplifier, repeater, or industrial booster gain

NOTE—Sections 90.219 and 2.1033(c) do not require gain test data; inclusion of industrial booster gain test data in test reports submitted for FCC equipment authorization is optional.

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

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

Report the gain for each authorized operating frequency band, and each test signal stimulus.

Remark: The system continuously monitors the input power.

### 6.2.1.1 Measurement Record:

Please refer to Appendix A - Input/output power and amplifier/booster gain.



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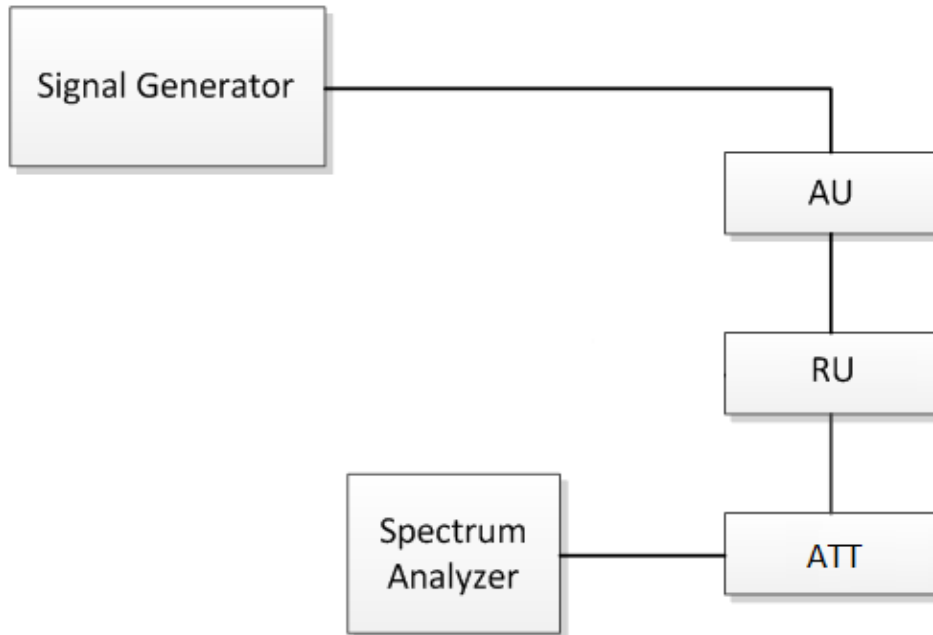
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### 6.2.2 Conducted Spurious Emissions

- Test Requirement: 47 CFR Part 2.1051, 47 CFR Part 90.219(e)(3)
- Test Method: KDB 935210 D05 Indus Booster Basic Meas v01r04
- Limit: **47 CFR Part 90.219(e)(3)**  
(e) Device Specifications. In addition to the general rules for equipment certification in §90.203(a)(2) and part 2, subpart J of this chapter, a signal booster must also meet the rules in this paragraph.  
(3) Spurious emissions from a signal booster must not exceed -13dBm within any 100 kHz measurement bandwidth.
- EUT Operation:
  - Status: Drive the EUT to maximum output power.
  - Conditions: Normal conditions
  - Application: RF output ports
- Test Configuration:



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## Test Procedure:

Conducted Emissions test procedure:

Spurious emissions shall be measured using a single test signal sequentially tuned to the low, middle and high channels or frequencies within each authorized frequency band of operation.

- a) Connect a signal generator to the input of the EUT.
- b) Configure the signal generator to produce a CW signal.
- c) Set the frequency of the CW signal to the center channel of the EUT Passband.
- d) Set the output power level so that the resultant signal is just below the AGC threshold (see 4.2)
- e) Connect a spectrum analyzer to the output of the EUT using appropriate attenuation as necessary.
- f) Set the RBW = 100kHz (i.e., for 30MHz to 1GHz PLMRS and/or PSRS booster devices).
- g) Set the VBW  $\geq 3 \times$  RBW.
- h) Set the Sweep time = auto-couple.
- i) Set the detector to PEAK
- j) Set the spectrum analyzer start frequency to 30MHz ( or the lowest radio frequency signal generated in the EUT, without going below 9kHz is the EUT has additional internal clock frequencies), and the stop frequency to 10 x the highest allowable frequency of the EUT passband.
- k) Select MAX HOLD and use the marker peak function to find the highest emission(s) outside the passband. (This could be either at a frequency lesser or greater than the passband frequencies).
- l) Capture a plot for inclusion in the test report.
- m) Repeat steps c) to l) for all authorized frequency bands/blocks of operation.

## 6.2.2.1 Measurement Record:

Please refer to Appendix B - Conducted Spurious Emissions.



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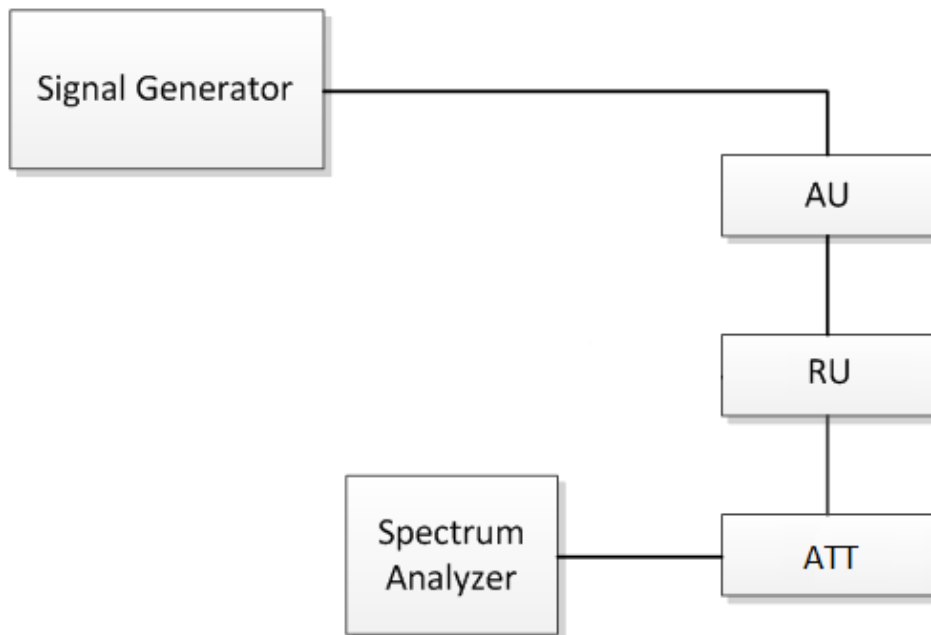
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**6.2.3 Out-of-band/out-of-block emissions (including intermodulation)**

Test Requirement: 47 CFR Part 2.1051, 47 CFR Part 90.219(e)(3)  
 Test Method: KDB 935210 D05 Indus Booster Basic Meas v01r04  
 Limit: **47 CFR Part 90.219(e)(3)**  
 (e) Device Specifications. In addition to the general rules for equipment certification in §90.203(a)(2) and part 2, subpart J of this chapter, a signal booster must also meet the rules in this paragraph.  
 (3) Spurious emissions from a signal booster must not exceed -13dBm within any 100 kHz measurement bandwidth.

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

Test Configuration:



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Test Procedure:

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

Intermodulation products shall be measured using two CW signals with all available channel spacings (e.g., 12.5 kHz and 6.25 kHz) with the center between these channels being equal to the center frequency  $f_0$  as determined from 4.3.

- a) Connect a signal generator to the input of the EUT. If the signal generator is not capable of producing two independent modulated carriers simultaneously, then two discrete signal generators can be connected, with an appropriate combining network to support the two-signal test.
- b) Configure the two signal generators to produce CW on frequencies spaced consistent with 4.7.1, with amplitude levels set to just below the AGC threshold (see 4.2). Set the signal generator amplitudes so that the power from each into the EUT is equivalent.
- c) Connect a spectrum analyzer to the EUT output.
- d) Set the span to 100 kHz.
- e) Set  $RBW = 300 \text{ Hz}$  with  $VBW \geq 3 \times RBW$ .
- f) Set the detector to power averaging (rms).
- g) Place a marker on highest intermodulation product amplitude.
- h) Capture the plot for inclusion in the test report.
- i) Repeat steps c) to h) with the composite input power level set to 3 dB above the AGC threshold.
- j) Repeat steps b) to i) for all operational bands.

NOTE - Intermodulation-product spurious emission measurements are not required for single-channel boosters that cannot accommodate two simultaneous signals within the passband.

6.2.3.1 Measurement Record:

Please refer to Appendix C - Out-of-band/out-of-block emissions (including intermodulation).



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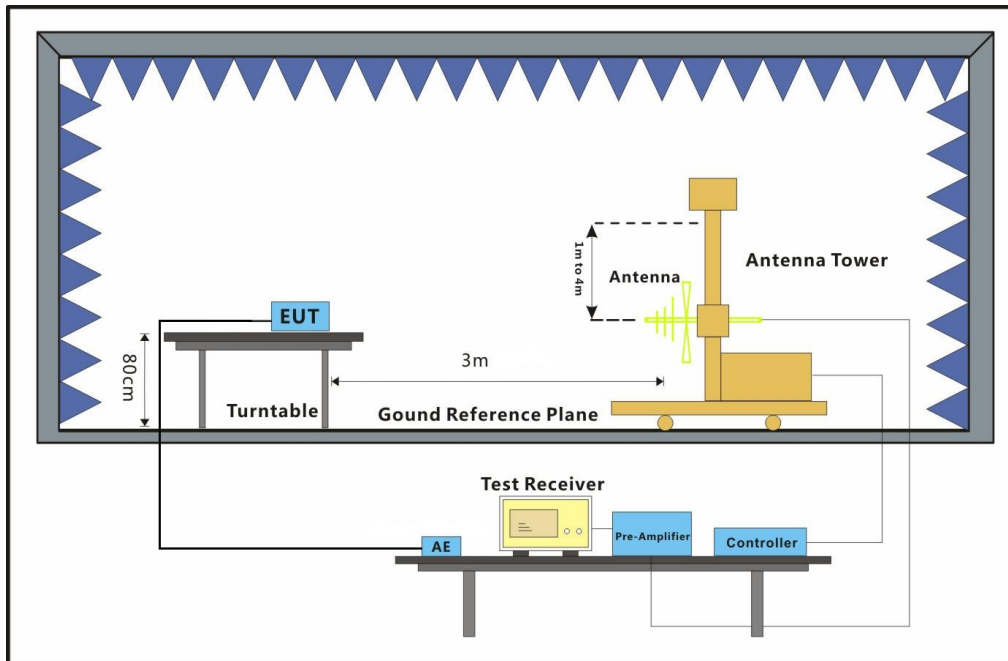
### 6.2.4 Radiated Spurious Emissions

Test Requirement: 47 CFR Part 2.1053, 47 CFR Part 90.219(e)(3)  
 Test Method: KDB 935210 D05 Indus Booster Basic Meas v01r04  
 Limit: **47 CFR Part 90.219(e)(3)**

(e) Device Specifications. In addition to the general rules for equipment certification in §90.203(a)(2) and part 2, subpart J of this chapter, a signal booster must also meet the rules in this paragraph.  
 (3) Spurious emissions from a signal booster must not exceed -13dBm within any 100 kHz measurement bandwidth.

EUT Operation:  
 Status: Drive the EUT to maximum output power.  
 Conditions: Normal conditions  
 Application: Enclosure

Test Configuration:  
 30MHz to 1GHz emissions:

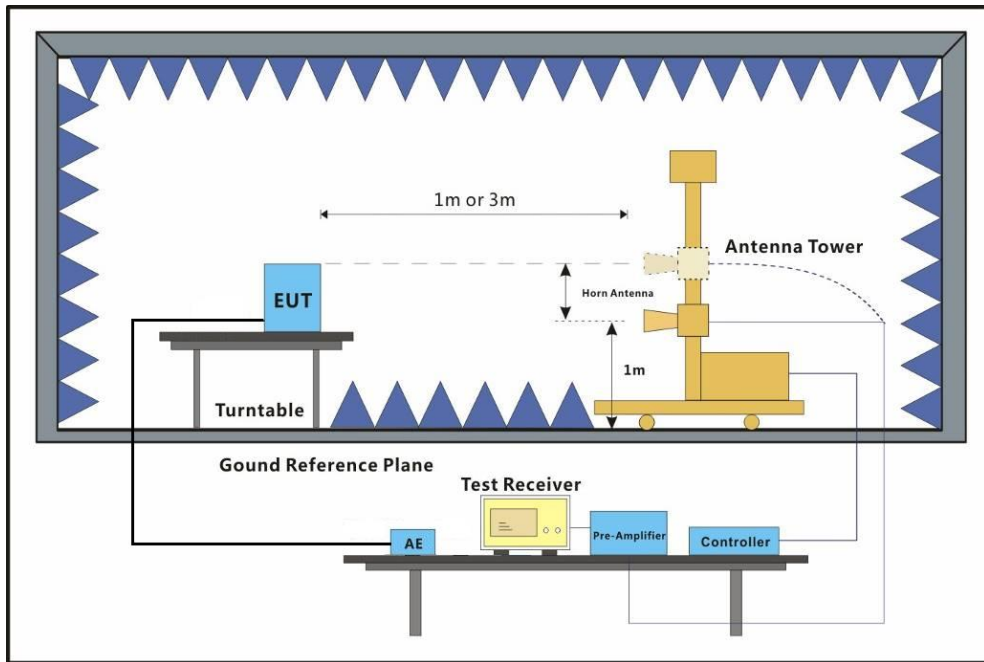


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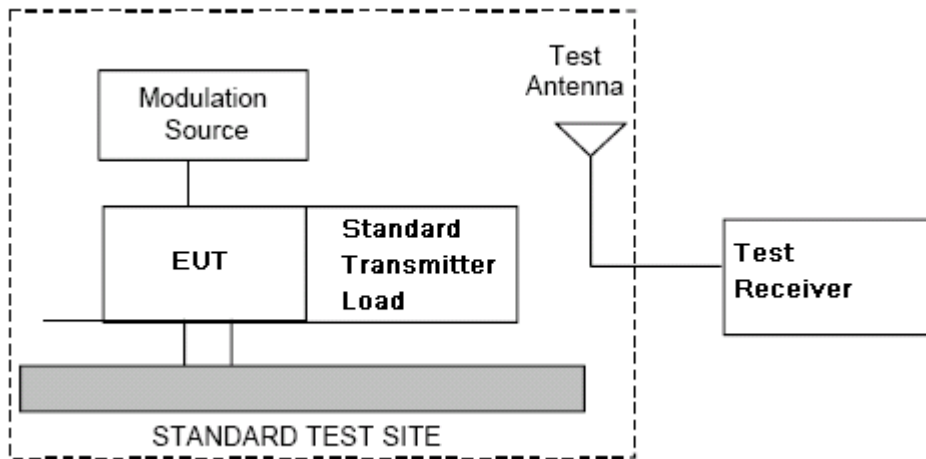
1GHz to 40GHz emissions:



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:

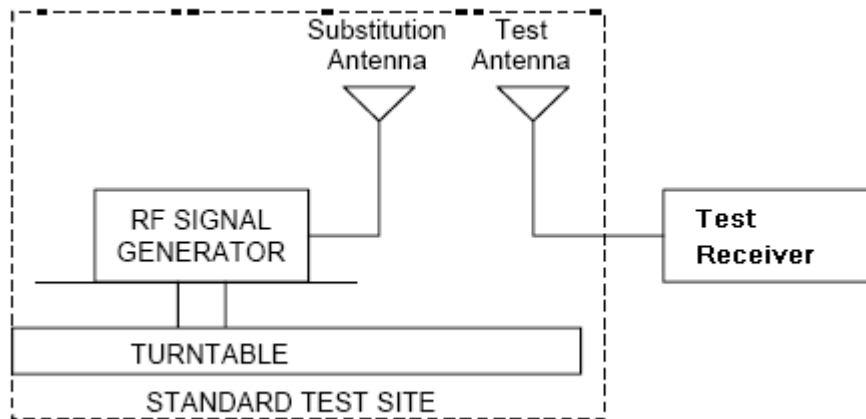


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- a) Connect the equipment as illustrated.
- b) Adjust the spectrum analyzer for the following settings:
  - 1) Resolution Bandwidth = 100 kHz for spurious emissions below 1 GHz, and 1 MHz for spurious emissions above 1GHz.
  - 2) Video Bandwidth = 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.



- 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 no 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) Reconnect the equipment as illustrated.
- m) Keep the spectrum analyzer adjusted as in step b).



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- n) 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.
- o) 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.
- p) Repeat step k) with both antennas vertically polarized for each spurious frequency.
- q) 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.  

$$\text{e.r.p. (dBm)} = \text{e.i.r.p. (dBm)} - 2.15$$
- 4) For this test, the AU and EU are put outside of the chamber; connect to the RU through the optical *fiber*.

#### 6.2.4.1 Measurement Record:

Please refer to Appendix D - Radiated Spurious Emissions.



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### 6.2.5 Input-versus-output signal comparison

Test Requirement: 47 CFR Part 2.1049, 47 CFR Part 90.210, 47 CFR Part 90.219(e)(4)(iii)  
 Test Method: KDB 935210 D05 Indus Booster Basic Meas v01r04  
 Limit: **47 CFR Part 90.210**

**Emission masks**

Except as indicated elsewhere in this part, transmitters used in the radio services governed by this part must comply with the emission masks outlined in this section. Unless otherwise stated, per paragraphs (d)(4), (e)(4), and (o) of this section, measurements of emission power can be expressed in either peak or average values provided that emission powers are expressed with the same parameters used to specify the unmodulated transmitter carrier power. For transmitters that do not produce a full power unmodulated carrier, reference to the unmodulated transmitter carrier power refers to the total power contained in the channel bandwidth. Unless indicated elsewhere in this part, the table in this section specifies the emission masks for equipment operating under this part.

Applicable Emission Masks

Frequency band (MHz)	Mask for equipment with audio low pass filter	Mask for equipment without audio low pass filter
421-512	B, D, or E	C, D, or E
450 paging only	B	G

(c) Emission Mask C. For transmitters that are not equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier output power (P) as follows:

- (1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 5 kHz, but not more than 10 kHz: At least 83 log (fd/5) dB;
- (2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 10 kHz, but not more than 250 percent of the authorized bandwidth: At least 29 log (fd/11)dB or 50 dB, whichever is the lesser attenuation;
- (3) On any frequency removed from the center of the authorized bandwidth by more than 250 percent of the authorized bandwidth: At least 43 + 10 log (P) dB.
- (4) In the 1427-1432 MHz band, licensees are encouraged to take all reasonable steps to ensure that unwanted emissions power does not exceed the following levels in the 1400-1427 MHz band:
  - (i) For stations of point-to-point systems in the fixed service: -45 dBW/27 MHz.
  - (ii) For stations in the mobile service: -60 dBW/27 MHz.

**47 CFR Part 90.219(e)(1)**

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

**47 CFR Part 90.219(e)(4)**

(e) Device Specifications. In addition to the general rules for equipment certification in §90.203(a)(2) and part 2, subpart J of this chapter, a signal booster must also meet the rules in this paragraph.

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

- (iii) The retransmitted signals continue to meet the unwanted emissions limits of 47 CFR Part 90.210 applicable to the corresponding received signals (assuming that these received signals meet the applicable unwanted



emissions limits by a reasonable margin).

EUT Operation:

Status: Drive the EUT to maximum output power.

Conditions: Normal conditions

Application: RF output ports

Test Configuration:

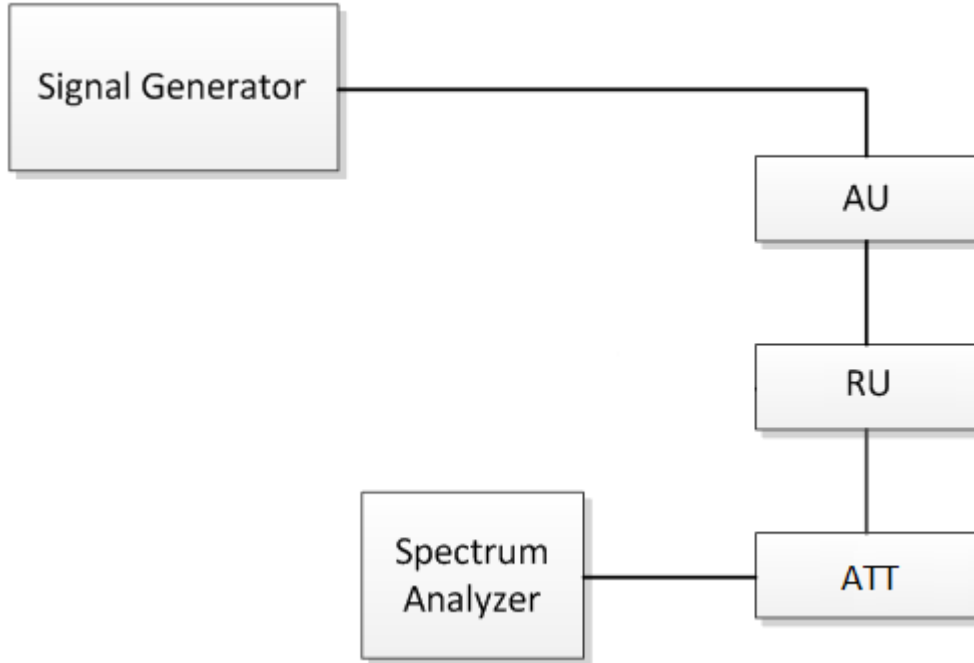


Fig.4. Input-versus-output signal comparison test configuration

Test Procedure:

- a) Connect a signal generator to the input of the EUT.
- b) Configure the signal generator to transmit the appropriate test signal associated with the public safety emission designation (see Table 1).
- c) Configure the signal level to be just below the AGC threshold (see results from 4.2).
- d) Connect a spectrum analyzer to the output of the EUT using appropriate attenuation as necessary.
- e) Set the spectrum analyzer center frequency to the nominal EUT channel center frequency. The span range for the spectrum analyzer shall be between  $2 \times$  to  $5 \times$  the EBW (or OBW).
- f) The nominal RBW shall be 300 Hz for 16K0F3E, and 100 Hz for all other emissions types.
- g) Set the reference level of the spectrum analyzer to accommodate the maximum input amplitude level, i.e., the level at  $f_0$  per 4.3.
- h) Set spectrum analyzer detection mode to peak, and trace mode to max hold.
- i) Allow the trace to fully stabilize.
- j) Confirm that the signal is contained within the appropriate emissions mask.
- k) Use the marker function to determine the maximum emission level and record the associated frequency.
- l) Capture the emissions mask plot for inclusion in the test report (output signal spectra).



- m) Measure the EUT input signal power (signal generator output signal) directly from the signal generator using power measurement guidance provided in KDB Publication 971168 [R8] (input signal spectra).
- n) Compare the spectral plot of the output signal (determined in step k), to the input signal (determined in step l) to affirm they are similar (in passband and rolloff characteristic features and relative spectral locations).
- o) Repeat steps d) to n) with the input signal amplitude set 3 dB above the AGC threshold.
- p) Repeat steps b) to o) for all authorized operational bands and emissions types (see applicable regulatory specifications, e.g., Section 90.210).
- q) Include all accumulated spectral plots depicting EUT input signal and EUT output signal in the test report and note any observed dissimilarities.

### 6.2.5.1 Measurement Record:

Please refer to Appendix E - Input-versus-output signal comparison.



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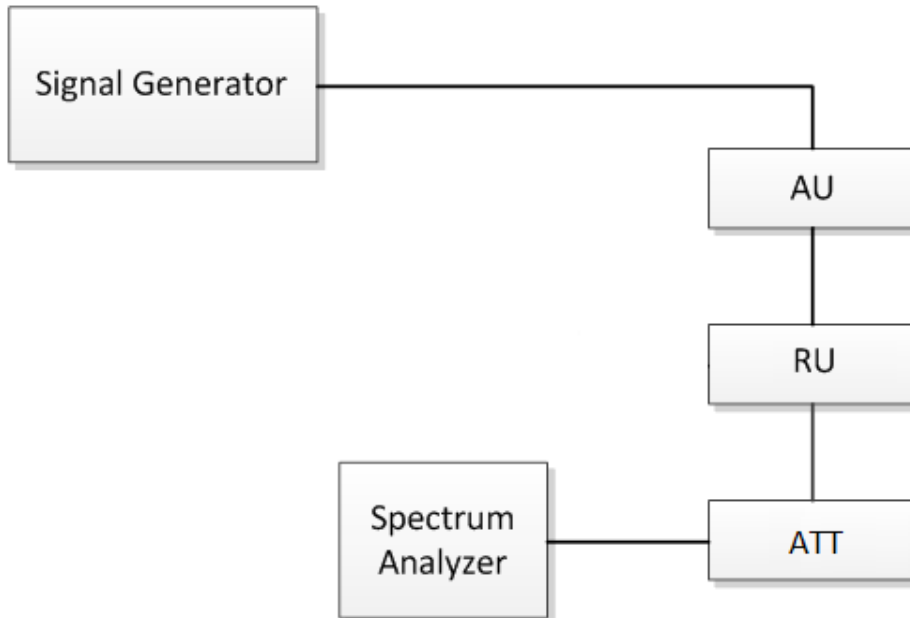
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### 6.2.6 Out of Band Rejection

Test Requirement: /  
 Test Method: KDB 935210 D05 Indus Booster Basic Meas v01r04  
 Limit: Shall within the passband  
 EUT Operation:  
     Status: Drive the EUT to maximum output power. .  
     Conditions: Normal conditions  
     Application: RF output ports  
 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 manufacturer's specified pass band.
    - 2) The CW amplitude shall be 3 dB below the AGC threshold (see 4.2) and shall not activate the AGC threshold throughout the test.
    - 3) Dwell time = approximately 10 ms.
    - 4) Frequency step = 50 kHz.
  - c) Connect a spectrum analyzer to the output of the EUT using appropriate attenuation.
  - d) Set the RBW of the spectrum analyzer to between 1 % and 5 % of the manufacturer's rated passband, and VBW = 3 × RBW.
  - e) Set the detector to Peak and the trace to Max-Hold.
  - f) After the trace is completely filled, place a marker at the peak amplitude, which is designated as  $f_0$ , and with two additional markers (use the marker-delta method) at the 20 dB bandwidth (i.e., at the points where the level has fallen by 20 dB).
  - g) Capture the frequency response plot for inclusion in the test report.



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6.2.6.1 Measurement Record:

Please refer to Appendix F - Out of Band Rejection.



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## 6.2.7 Frequency Stability

Test Requirement: 47 CFR Part 2.1055, 47 CFR Part 90.213,  
 Test Method: KDB 935210 D05 Indus Booster Basic Meas v01r04  
 Limit: **47 CFR Part 90.213**  
 +/- 2.5ppm

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 -40°C to 50°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 G - Frequency Stability.



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### 6.2.8 Noise

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

**Test Method:** KDB 935210 D05 Indus Booster Basic Meas v01r04

**Limit:** The ERP of noise within the passband should not exceed -43 dBm in a 10 kHz measurement bandwidth.  
The ERP of noise in spectrum more than 1 MHz outside of the passband should not exceed -70 dBm in a 10 kHz measurement bandwidth.  
The noise figure of a zone enhancer shall not exceed 9 dB in either direction.

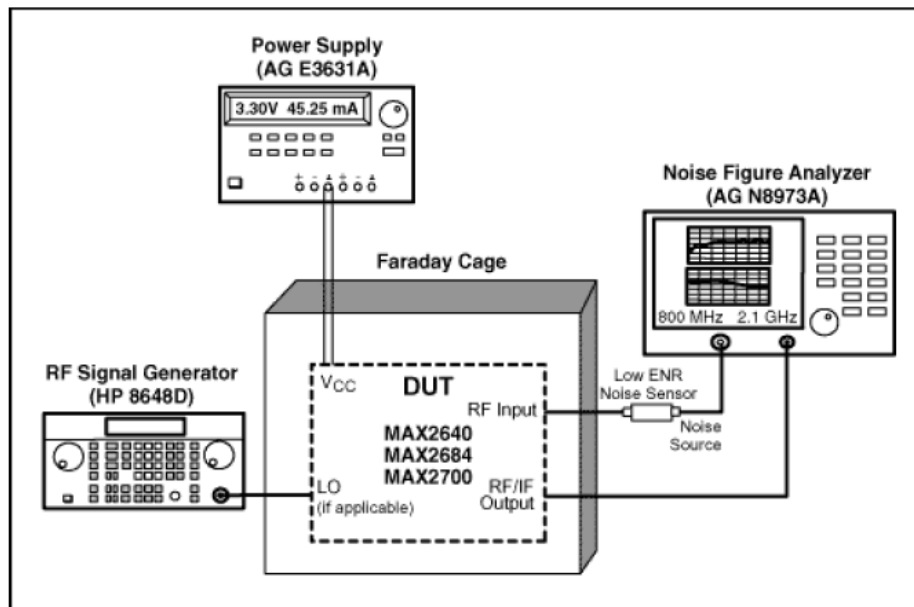
**EUT Operation:**

**Status:** Drive the EUT to maximum output power.

**Conditions:** Temperature conditions, voltage conditions

**Application:** RF output ports

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



#### 6.2.8.1 Measurement Record:

Please refer to Appendix H - Noise.



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## Photographs - Test Setup

Please refer to test setup photo

## 7 Photographs - EUT Constructional Details

Please refer to external and internal photo

--The End of Report--



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