TEST REPORT

Application No.:	FYCR2207000277AT
Applicant:	Corning Optical Communication LLC
Address of Applicant:	6 Concord Road, Shrewsbury, MA 01545 United States
Manufacturer:	Comba Network System Company Limited.
Address of Manufacturer:	No.10 Shenzhou Road, Guangzhou Science City, Guangzhou, Guangdong
Factory:	Comba Telecom Technology (Guangzhou) Ltd.
Address of Factory:	No.6 Jinbi Road, Economics and Technology Development District, Guangdong, China
Equipment Under Test (EUT):	
EUT Name:	Digital Low-power Remote Unit High Band supporting 3.5G
Model No.:	dLRU-G2-35
FCC ID:	OJFDLRUG235
Standard(s) :	FCC Part 2, FCC Part 20, FCC Part 96
Date of Receipt:	2022-07-21
Date of Test:	2022-07-26 to 2022-08-02
Date of Issue:	2022-08-03
Test Result:	**Pass***

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

Winkey Wang
EMC Technical Manager

Revision Record				
Version	**Chapter**	**Date**	**Modifier**	**Remark**
01		2020-08-03		Original

Authorized for issue by:				
		Tree Zhan **Tree Zhan/Project Engineer**		
		Winkey Wang **Winkey Wang/Reviewer**		

2 Test Summary

Test Item	Reference	Result
RF Output Power, Amplifier Gain and Peak to Average Ratio	FCC PART 2.1046; FCC PART 96.41	PASS
Conducted Spurious Emissions	FCC PART 2.1051; FCC PART 96.41	PASS
Out-of-band/out-of-block (including intermodulation) Emissions	FCC PART 2.1051; FCC PART 96.41	PASS
Adjacent Channel Leakage Ratio (ACLR)	FCC PART 96.41	PASS
Radiated Spurious Emissions	FCC PART 2.1053; FCC PART 96.41	PASS
Occupied Bandwidth and Input-versus-output signal comparison	FCC PART 2.1049	PASS
Frequency Stability	FCC PART 2.1055	PASS
Out of Band Rejection	KDB 935210 D05 v01r04 3.3	PASS

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.

Test method standard:

ANSI C63.26-2015

KDB 935210 D05 Indus Booster Basic Meas v01r04

KDB 935210 D02 Signal Booster Certification v04r02

KDB 940660 D01 Part 96 CBRS v03

3 Contents

4 General Information

4.1 Details of E.U.T.

Power supply:	DC 38-58V
Test voltage	DC 48V
Sample Type:	Digital Low-power Remote Unit High Band supporting 3.5G
Support Network	LTE/NR Band 48
Frequency range:	3550-3700 MHz
Modulation Type:	PSK/QPSK/QAM/16QAM/64QAM/256QAM
Support Channel Bandwidth:	LTE: 10MHz/20MHz 5G NR: 10MHz/20MHz/40MHz/60MHz/80MHz/100MHz
Normal Output Power:	16dBm/10MHz
System Gain:	-8dB
Antenna Type:	External antenna
Antenna Gain:	0dBi
Antenna Port:	2*2 MIMO
Hardware version:	Version 1
Software version:	DLRUHG2_V01.00.01.23

4.2 Test Environment

Environment Parameter	Selected Values During Tests	
Relative Humidity	52%	
Atmospheric Pressure:	1015Pa	
Temperature:	TL	-30 °C
	TN	+20 °C
	TH	+50°C
Voltage:	VL	40.8 V
	VN	48.0 V
	VH	55.2 V

NOTE: VL= lower extreme test voltage
VN= nominal voltage
VH= upper extreme test voltage
TL= lower extreme test temperature
TN= normal temperature
TH= upper extreme test temperature

4.3 Description of Support Units

Description	Manufacturer	Model No.	Serial No.
RIU (Radio Interface Unit)	Supported by customer	RIU-G2-35	N/A
DCU (Digital Conversion Unit)	Supported by customer	DCU-G2	N/A
DEU (Distributed Extension Unit)	Supported by customer	DEU-G2	N/A

Fuyong lab. Xinlong TechnoPark, Fengtang Road, Fuyong Subdistrict, Bao'an, Shenzhen, China 518103 t (86–755) 88663988 f (86–755) 26710594 www.sgsgroup.com.cn
中国·深圳·宝安区福永街道凤塘大道鑫龙科技园福永实验室 邮编: 518103 t (86–755) 88663988 f (86–755) 26710594 sgs.china@sgs.com

4.4 Measurement Uncertainty

No.	Item	Measurement Uncertainty
1	Radio Frequency	± 7.25 x 10^{-8}
2	Occupied Bandwidth	± 3%
3	RF conducted power	± 0.75dB
4	Conducted Spurious emissions	± 0.75dB
5	RF Radiated power	± 4.5dB (below 1GHz)
		± 4.8dB (above 1GHz)
6	Radiated Spurious emission test	± 4.5dB (Below 1GHz)
		± 4.8dB (Above 1GHz)
7	Temperature test	± 1°C
8	Humidity test	± 3%
9	Supply voltages	± 1.5%
10	Time	± 3%

4.5 Test Location

All tests were performed at:

Compliance Certification Services (Kunshan) Inc. Shenzhen branch.

Fuyong lab. Xinlong TechnoPark,Fengtang Road, Fuyong Subdistrict, Bao'an, Shenzhen, China

Tel: +86 755 8866 3988 Fax: +86 755 2671 0594

No tests were sub-contracted.

4.6 Test Facility

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

• **A2LA (Certificate No. 6606.01)**

Compliance Certification Services (Kunshan) Inc. Shenzhen branch is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 6606.01.

• **FCC –Designation Number: CN1322**

Compliance Certification Services (Kunshan) Inc. Shenzhen branch has been recognized as an accredited testing laboratory.

Designation Number: CN1322. Test Firm Registration Number: 718073

• **Innovation, Science and Economic Development Canada**

Compliance Certification Services (Kunshan) Inc. Shenzhen branch has been recognized by ISED as an accredited testing laboratory.

CAB identifier: CN0129.

IC#: 28189.

4.7 Deviation from Standards

None

4.8 Abnormalities from Standard Conditions

None

5 Equipment List

RF conducted test system					
Test Equipment	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal. Date**	**Cal. Due date**
Shielding Room	CRT	N/A	SEM001-15	2019-10-12	2022-10-11
MXA Signal Analyzer (10Hz-50GHz)	KEYSIGHT	N9020B	SEM004-24	2022-04-24	2023-04-23
Programmable DC Source	Chroma	62012P-80-60	SEM011-09	2022-04-06	2023-04-05
Coaxial Cable	SGS	N/A	SEM033-02	2022-05-16	2023-05-15
Programmable Temperature & Humidity Chamber	Jinghaichuang	BE1000LH	GZE1015-1	2022-04-15	2023-04-14

Radiated Emissions (30MHz-1GHz)					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
3m Anechoic Chamber	CRT	N/A	SEM001-13	2021-07-13	2024-07-12
Trilog-Broadband Antenna(25MHz-2GHz)	Schwarzbeck	VULB9168	SEM003-33	2021-09-25	2024-09-24
MXE EMI receiver(20Hz-8.4GHz)	Agilent	N9038A	SEM004-05	2022-07-12	2023-07-11
Pre-amplifier (0.1-1.3GHz)	HP	8447D	SEM005-02	2022-07-12	2023-07-11
Spectrum Analyzer(20Hz-43GHz)	Rohde & Schwarz	101288	SEM004-08	2022-07-12	2023-07-11
Low Noise Amplifier(100MHz-18GHz)	CLAVIIO	BDLNA-0118-352810	SEM005-05	2022-07-12	2023-07-11
Coaxial Cable	SGS	N/A	SEM033-02	2022-05-16	2023-05-15
Measurement Software	AUDIX	e3 V8.2014-6-27	N/A	N/A	N/A
MXG Analog Signal Generator(100kHz-6GHz)	Agilent	N5181A	SEM006-16	2021-09-15	2022-09-14

Radiated Emissions (Above 1GHz)					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
3m Anechoic Chamber	CRT	N/A	SEM001-13	2021-07-13	2024-07-12
MXE EMI receiver(20Hz-8.4GHz)	Agilent	N9038A	SEM004-05	2022-07-12	2023-07-11

Broad-Band Horn Antenna (15-40GHz)	Schwarzbeck	BBHA 9170	SEM003-15	2021-7-11	2024-7-10
Broad-Band Horn Antenna (1-18GHz)	Schwarzbeck	BBHA 9120D	SEM003-32	2021-9-26	2024-9-25
Spectrum Analyzer(20Hz-43GHz)	Rohde & Schwarz	101288	SEM004-08	2022-07-12	2023-07-11
Low Noise Amplifier(100MHz-18GHz)	CLAVIIO	BDLNA-0118-352810	SEM005-05	2022-07-12	2023-07-11
Pre-amplifier(26GHz-40GHz)	Compliance Directions Systems Inc.	PAP-2640-50	SEM005-08	2022-07-12	2023-07-11
Pre-amplifier(18GHz-26GHz)	Rohde & Schwarz	CH14-H052	SEM005-17	2022-07-12	2023-07-11
Coaxial Cable	SGS	N/A	SEM033-02	2022-05-16	2023-05-15
Measurement Software	AUDIX	e3 V8.2014-6-27	N/A	N/A	N/A
MXG Analog Signal Generator(100kHz-6GHz)	Agilent	N5181A	SEM006-16	2021-09-15	2022-09-14

General used equipment					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
Humidity/ Temperature Indicator	Mingle	TH607	SEM002-17	2021-09-14	2022-09-13
Humidity/ Temperature Indicator	Mingle	TH607	SEM002-18	2021-09-14	2022-09-13
Barometer	DUMAI	DYM3	SEM002-24	2021-09-14	2022-09-13

6 Test Procedure & Measurement Data

6.1 Out of Band Rejection

Test Requirement: Section D.3(I) 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:

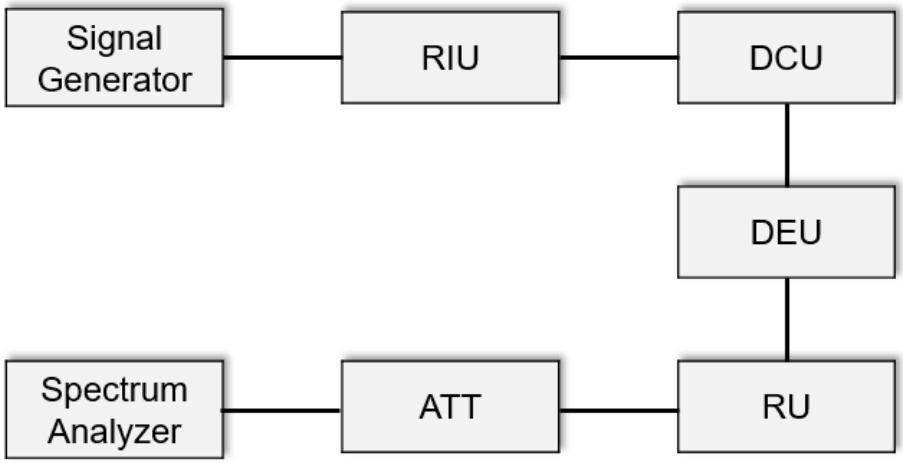


Fig.1. Out of Band rejection test configuration

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

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

3) Dwell time = approximately 10 ms.

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

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

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

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

RBW.

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

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

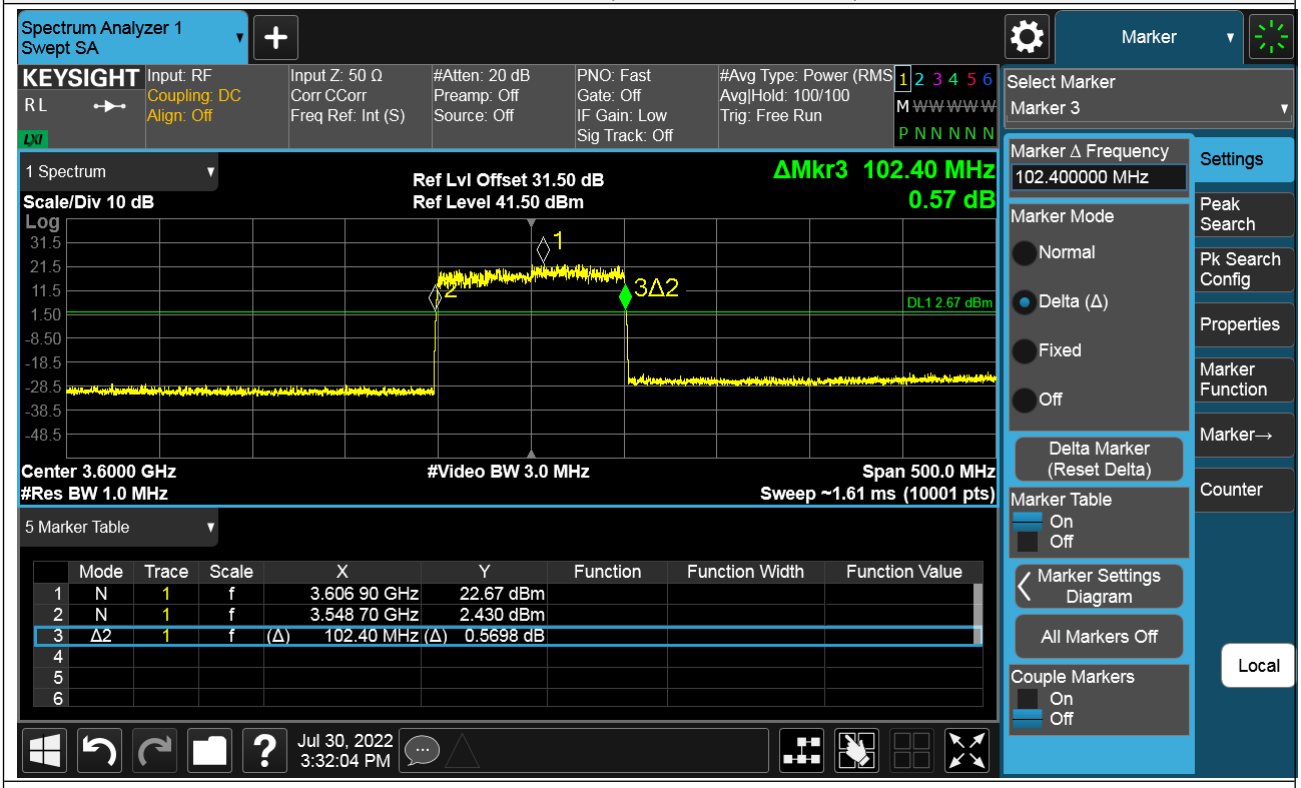
i) Capture the frequency response of the EUT.

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

6.1.1 Measurement Data

Out of Band Rejection

FDD Band 48 (3550MHz-3650MHz)



FDD Band 48 (3650MHz-3700MHz)

Remark:

For Band 48 (3550MHz-3650MHz), f_0 = 3606.9MHz

For Band 48 (3650MHz-3700MHz), f_0 = 3678.35MHz

6.2 RF Output Power and Amplifier Gain

Test Requirement: FCC Part 2.1046; FCC Part 96.41

Test Method: KDB 935210 D05 Indus Booster Basic Meas v01r04
KDB 940660 D01 Part 96 CBRS v03

EUT Operation:

Status: Drive the EUT to maximum output power.

Conditions: Normal conditions

Application: Cellular Band RF output ports

Test Configuration:

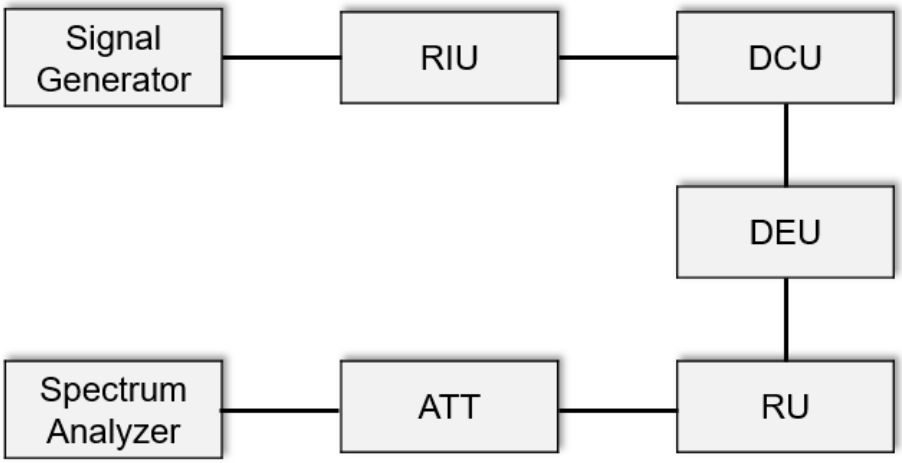


Fig.2. RF Output Power test configuration

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 f_0 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:

Gain (dB) = output power (dBm) - 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 Measurement Data

TDD Band 48 (3550MHz-3700MHz)							
Mode	Operation Band	Frequency f_0 (MHz)	Signal Type	Signal Level	Input Power (dBm)	Total Conducted Output Power (dBm)	Booster Gain (dB)
MIMO Mode							
Downlink	3550MHz - 3650MHz	3606.9MHz	AWGN	Pre-AGC	24	16.18	-7.82
				3dB Above AGC	27	16.22	/
		3606.9MHz	GSM	Pre-AGC	24	15.97	-8.03
				3dB Above AGC	27	16.30	/
Downlink	3650MHz - 3700MHz	3678.35MHz	AWGN	Pre-AGC	24	15.51	-8.49
				3dB Above AGC	27	16.16	/
		3678.35MHz	GSM	Pre-AGC	24	15.31	-8.69
				3dB Above AGC	27	15.97	/

Remark:
This EUT supports SISO, 2*2 MIMO.
For MIMO mode the output signals are considered correlated.

TDD Band 48 (3550MHz-3700MHz)								
Mode	Operation Band	Frequency f_0 (MHz)	Signal Type	Signal Leve	Input Power (dBm/)	Conducted Power (dBm/)	Total Conducted Power (dBm)	Max E.I.R.P (dBm)
MIMO Mode (2*2 MIMO)								
Downlink	3550MHz - 3650MHz	3606.9MHz	AWGN	Pre-AGC	24	16.18	19.18	22.18
				3dB Above AGC	27	16.22	19.22	22.22
		3606.9MHz	GSM	Pre-AGC	24	15.97	18.97	21.97
				3dB Above AGC	27	16.30	19.30	22.30
Downlink	3650MHz - 3700MHz	3678.35MHz	AWGN	Pre-AGC	24	15.51	18.51	21.51
				3dB Above AGC	27	16.16	19.16	22.16
		3678.35MHz	GSM	Pre-AGC	24	15.31	18.31	21.31
				3dB Above AGC	27	15.97	18.97	21.97

Remark:
This EUT supports SISO, 2*2 MIMO.
For MIMO mode the output signals are considered correlated.
Max E.I.R.P = Total Conducted Power + Antenna Gain

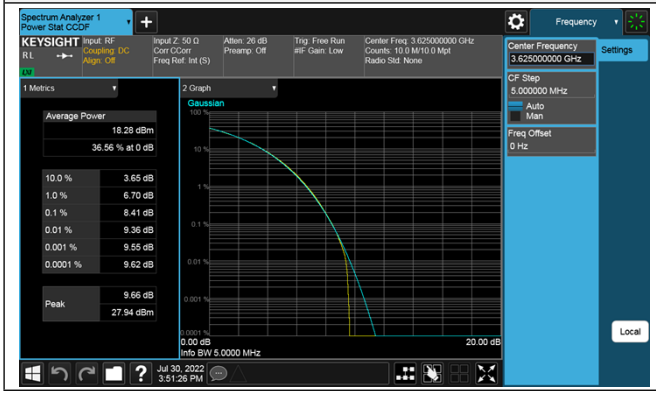
TDD Band 48 (3550MHz-3700MHz)										
Mode	Operation Band	Frequency f_0 (MHz)	Signal Type	Signal Leve	Input Power (dBm/10MHz)	Conducted Power (dBm/10MHz)	Total Conducted Power (dBm/10MHz)	Max E.I.R.P (dBm/ 10MHz)	Limit (dBm/ 10MHz)	Verdict
MIMO Mode (2*2 MIMO)										
Downlink	3550MHz - 3650MHz	3606.9MHz	AWGN	Pre-AGC	24	16.18	19.18	22.18	23	PASS
				3dB Above AGC	27	16.22	19.22	22.22	23	PASS
		3606.9MHz	GSM	Pre-AGC	24	15.97	18.97	21.97	23	PASS
				3dB Above AGC	27	16.30	19.30	22.30	23	PASS
Downlink	3650MHz - 3700MHz	3678.35MHz	AWGN	Pre-AGC	24	15.51	18.51	21.51	23	PASS
				3dB Above AGC	27	16.16	19.16	22.16	23	PASS
		3678.35MHz	GSM	Pre-AGC	24	15.31	18.31	21.31	23	PASS
				3dB Above AGC	27	15.97	18.97	21.97	23	PASS

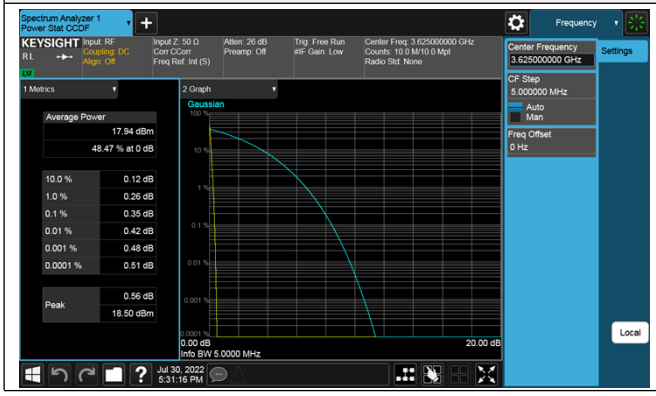
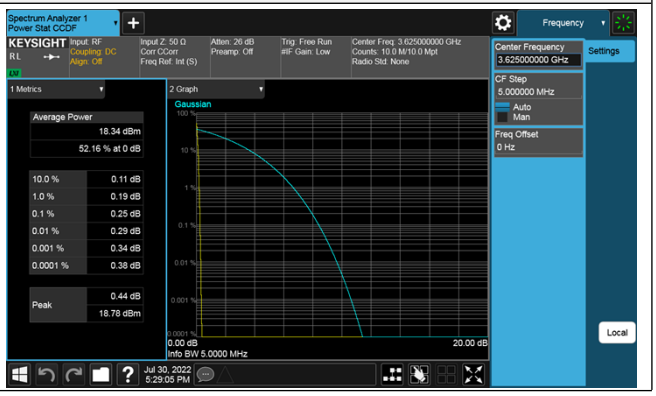
Remark:
This EUT supports SISO, 2*2 MIMO.
For MIMO mode the output signals are considered correlated.
Max E.I.R.P = Total Conducted Power + Antenna Gain

PAPR:

TDD Band 48 (3550MHz-3700MHz)								
Mode	Operation Band	Frequency (MHz)	Signal Type	Signal Level (dBm)	Input Power (dBm)	PAPR (dB)	Limit (dB)	Verdict
MIMO Mode (2*2 MIMO)								
Downlink	3550MHz -3700MHz	3625MHz	AWGN	Pre-AGC	24	8.41	13	PASS
				3dB Above AGC	27	8.39	13	PASS
		3625MHz	GSM	Pre-AGC	24	0.35	13	PASS
				3dB Above AGC	27	0.25	13	PASS

Remark:
This EUT supports SISO, 2*2 MIMO.
For MIMO mode the output signals are considered correlated.

TDD Band 48 _ AWGN	
Pre-AGC	3dB Above AGC
	

TDD Band 48 _GSM	
Pre-AGC	3dB Above AGC
	

6.3 Conducted Spurious Emissions

Test Requirement: FCC Part 2.1051; FCC Part 96.41.

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:

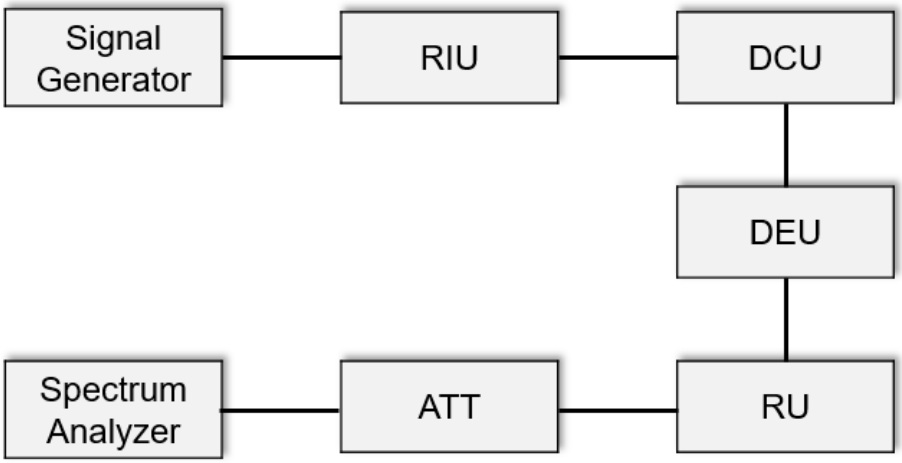


Fig.3. Conducted Spurious Emissions test configuration

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).

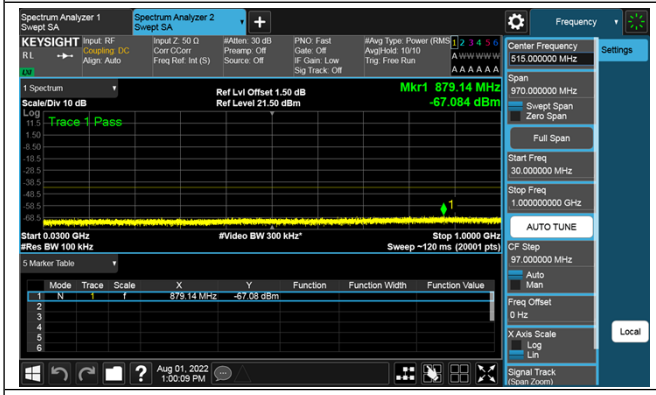
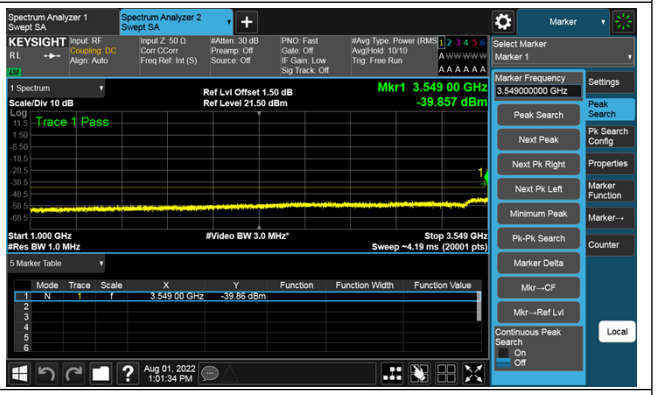
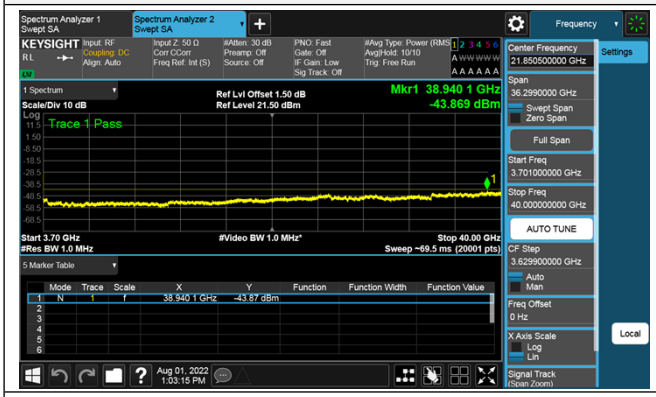
g) Set the VBW ≥ 3 × RBW.

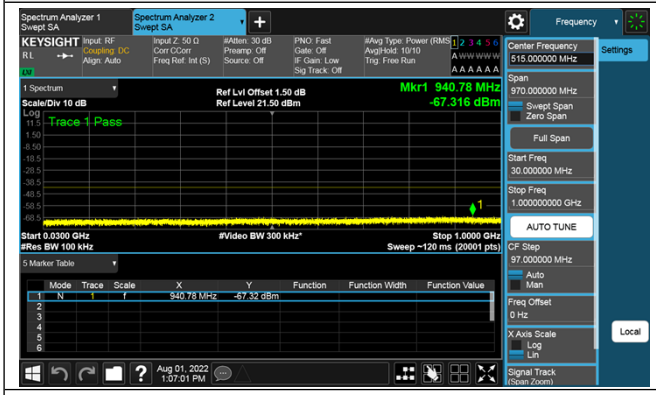
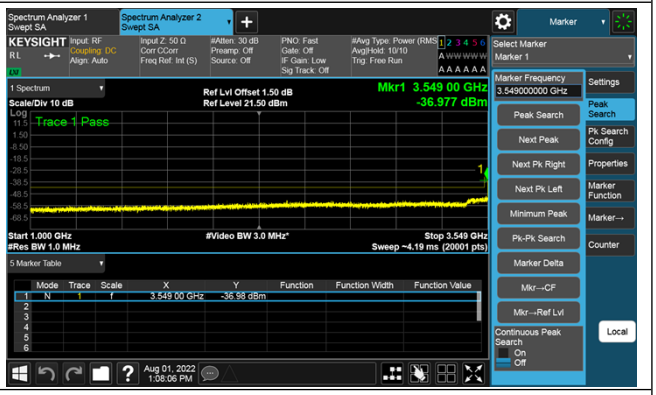
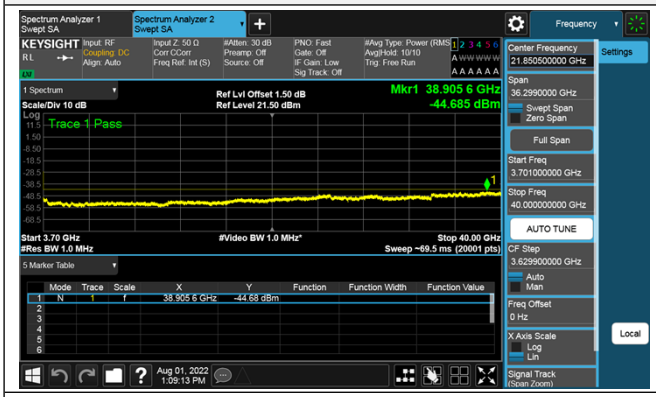
h) Set the Sweep time = auto-couple.

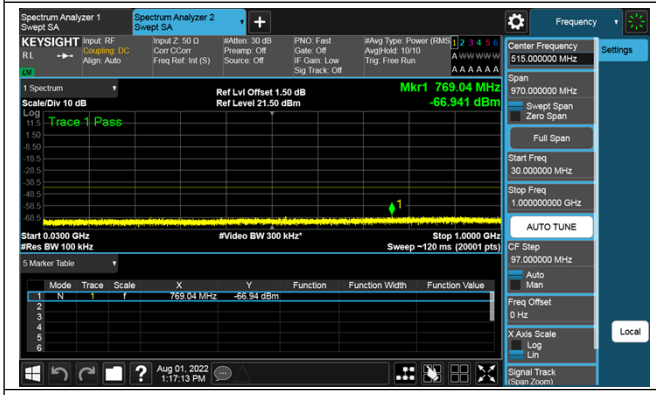
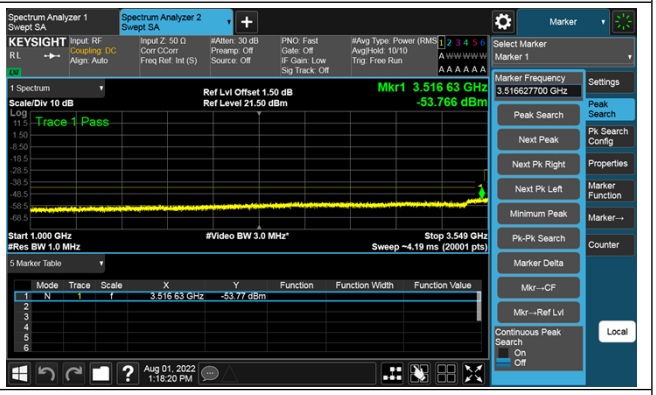
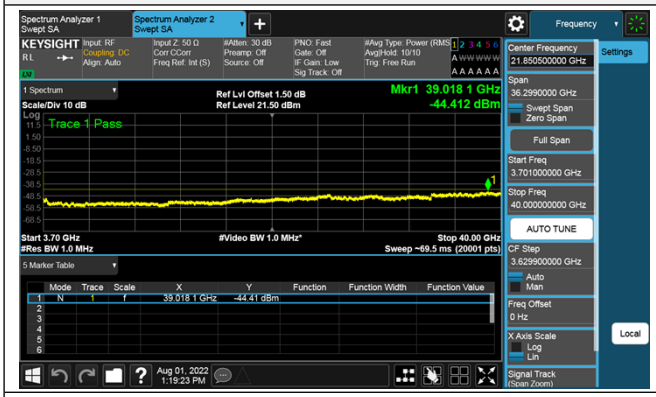
i) Set the spectrum analyzer start frequency to the lowest RF signal generated in the equipment, without going below 9 kHz, and the stop frequency to the lower band/block edge frequency minus 100 kHz or 1 MHz, as specified in the

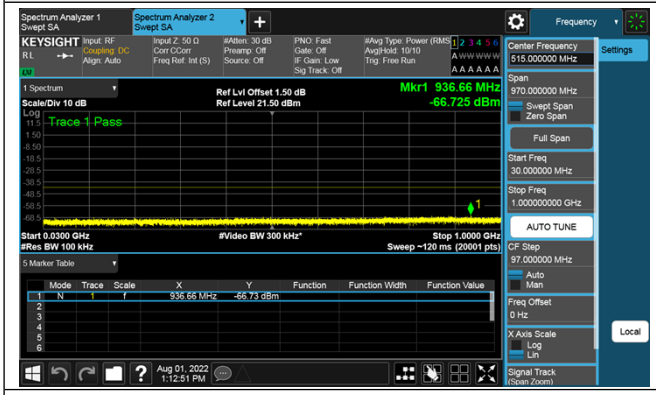
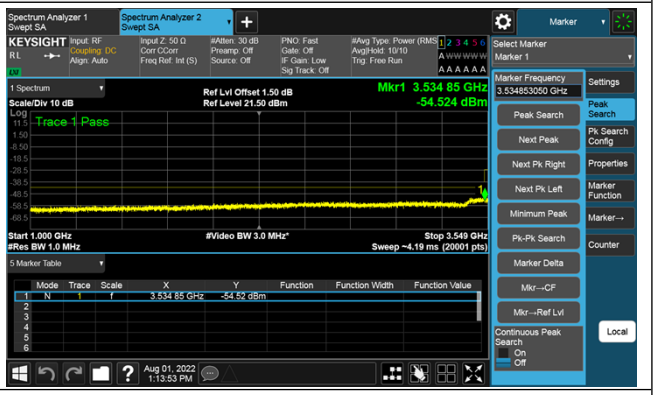
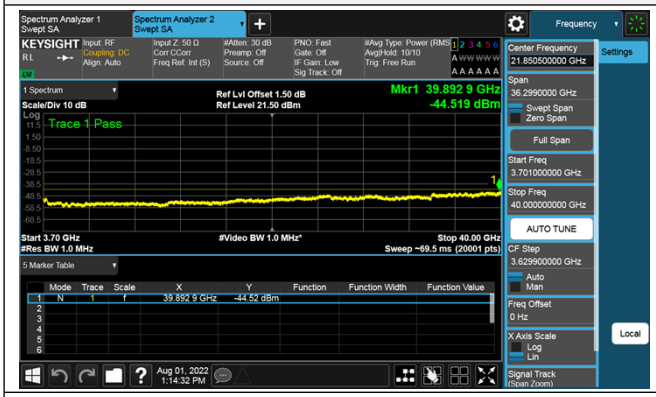
applicable rule part.
The number of measurement points in each sweep must be ≥ (2 × span/RBW), which may require that the measurement range defined by the start and stop frequencies be subdivided, depending on the available number of measurement points provided by the spectrum analyzer.2
j) Select the 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 ≥ (2 × span/RBW), which may require that the measurement range defined by the start and stop frequencies be subdivided, depending on the available number of measurement points provided by the spectrum analyzer.
n) Trace average at least 10 traces in power averaging (rms) mode.
o) Use the peak marker function to identify the highest amplitude level over each of the measured frequency ranges. Record the frequency and amplitude and capture a plot for inclusion in the test report; also provide tabular data, if required.
p) Repeat steps i) to o) with the input test signals firstly tuned to a middle band/block frequency/channel, and then tuned to a high band/block frequency/channel.
q) Repeat steps b) to p) with the narrowband test signal.
r) Repeat steps b) to q) for all authorized frequency bands/blocks used by the EUT.

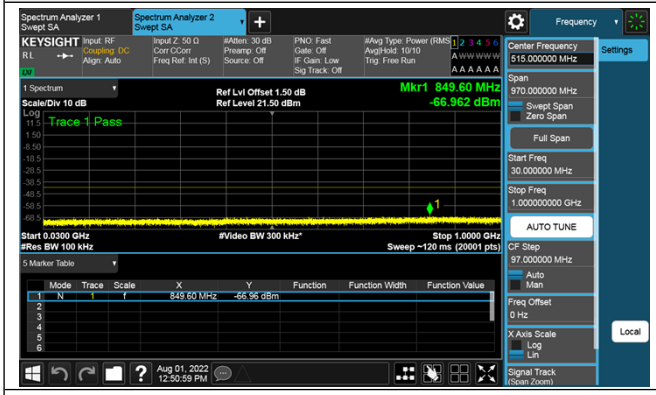
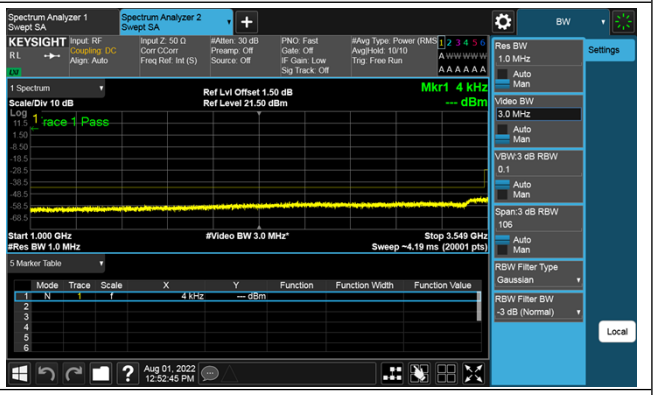
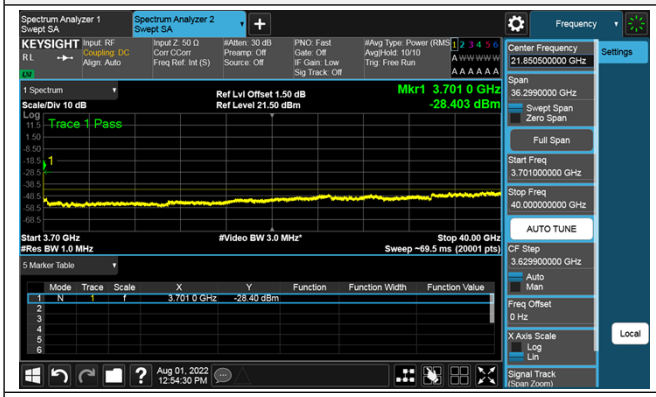
6.3.1 Measurement Data

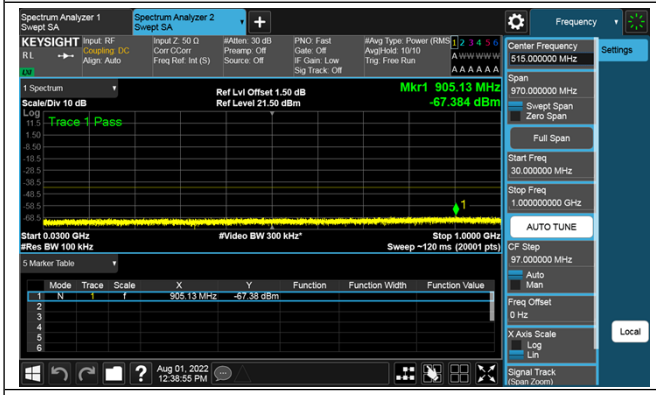
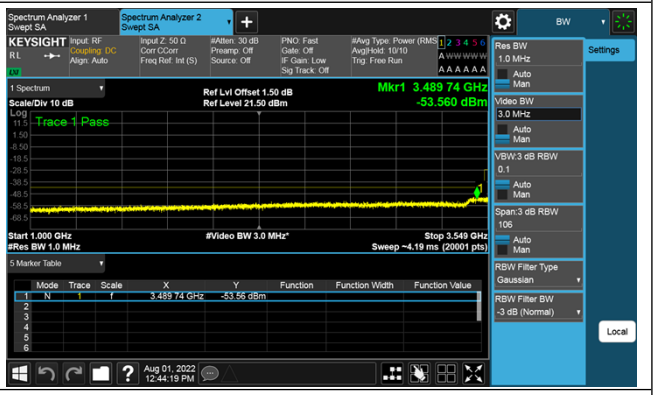
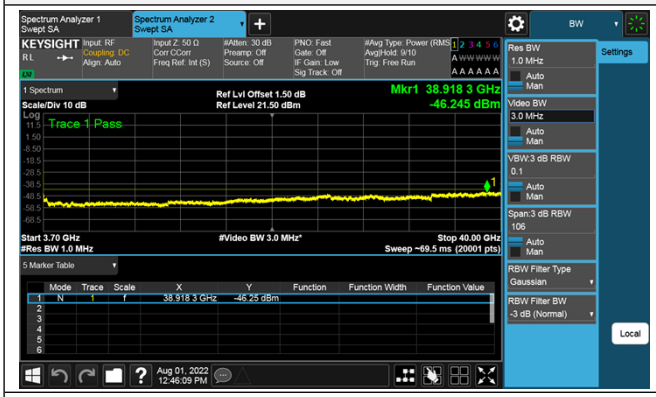
<table>
<tr><th colspan="2">TDD Band 48 _ AWGN _ Low Channel</th></tr>
<tr><td>30MHz-1000MHz</td><td>1000MHz-3549MHz</td></tr>
<tr><td> 
</td><td> 
</td></tr>
<tr><td>Remark:
1.For 2*2MIMO, one of ANT ports was measured and the limit shall be reduced by 10lg(2), so the limit was calculated to show -43dBm/MHz in order to determine the test result conveniently.
2.The level in -67.084dBm/100KHz = -57.084dBm/MHz</td><td>1.For 2*2MIMO, one of ANT ports was measured and the limit shall be reduced by 10lg(2), so the limit was calculated to show -43dBm/MHz in order to determine the test result conveniently.</td></tr>
<tr><td>3701MHz-40000MHz</td><td></td></tr>
<tr><td> 
</td><td></td></tr>
<tr><td>1.For 2*2MIMO, one of ANT ports was measured and the limit shall be reduced by 10lg(2), so the limit was calculated to show -43dBm/MHz in order to determine the test result conveniently.</td><td></td></tr>
</table>

<table>
<tr><th colspan="2">TDD Band 48 _ GSM _ Low Channel</th></tr>
<tr><td>30MHz-1000MHz</td><td>1000MHz-3549MHz</td></tr>
<tr><td> 
</td><td> 
</td></tr>
<tr><td>1.For 2*2MIMO, one of ANT ports was measured and the limit shall be reduced by 10lg(2), so the limit was calculated to show -43dBm/MHz in order to determine the test result conveniently.
2.The level in -67.316dBm/100KHz = -57.316dBm/MHz</td><td>1.For 2*2MIMO, one of ANT ports was measured and the limit shall be reduced by 10lg(2), so the limit was calculated to show -43dBm/MHz in order to determine the test result conveniently.</td></tr>
<tr><td>3701MHz-40000MHz</td><td></td></tr>
<tr><td> 
</td><td></td></tr>
<tr><td>1.For 2*2MIMO, one of ANT ports was measured and the limit shall be reduced by 10lg(2), so the limit was calculated to show -43dBm/MHz in order to determine the test result conveniently.</td><td></td></tr>
</table>

<table>
<tr><th colspan="2">TDD Band 48 _ AWGN _ Middle Channel</th></tr>
<tr><td>30MHz-1000MHz</td><td>1000MHz-3549MHz</td></tr>
<tr><td> 
</td><td> 
</td></tr>
<tr><td>1.For 2*2MIMO, one of ANT ports was measured and the limit shall be reduced by 10lg(2), so the limit was calculated to show -43dBm/MHz in order to determine the test result conveniently.
2.The level in -66.941dBm/100KHz = -56.941dBm/MHz</td><td>1.For 2*2MIMO, one of ANT ports was measured and the limit shall be reduced by 10lg(2), so the limit was calculated to show -43dBm/MHz in order to determine the test result conveniently.</td></tr>
<tr><td>3701MHz-40000MHz</td><td></td></tr>
<tr><td> 
</td><td></td></tr>
<tr><td>1.For 2*2MIMO, one of ANT ports was measured and the limit shall be reduced by 10lg(2), so the limit was calculated to show -43dBm/MHz in order to determine the test result conveniently.</td><td></td></tr>
</table>

<table>
<tr><th colspan="2">TDD Band 48 _ GSM _ Middle Channel</th></tr>
<tr><td>30MHz-1000MHz</td><td>1000MHz-3549MHz</td></tr>
<tr><td> 
</td><td> 
</td></tr>
<tr><td>1.For 2*2MIMO, one of ANT ports was measured and the limit shall be reduced by 10lg(2), so the limit was calculated to show -43dBm/MHz in order to determine the test result conveniently.
2.The level in -66.725dBm/100KHz =
-56. 725dBm/MHz</td><td>1.For 2*2MIMO, one of ANT ports was measured and the limit shall be reduced by 10lg(2), so the limit was calculated to show -43dBm/MHz in order to determine the test result conveniently.</td></tr>
<tr><td>3701MHz-40000MHz</td><td></td></tr>
<tr><td> 
</td><td></td></tr>
<tr><td>1.For 2*2MIMO, one of ANT ports was measured and the limit shall be reduced by 10lg(2), so the limit was calculated to show -43dBm/MHz in order to determine the test result conveniently.</td><td></td></tr>
</table>

<table>
<tr><th colspan="2">TDD Band 48 _ AWGN _ High Channel</th></tr>
<tr><td>30MHz-1000MHz</td><td>1000MHz-3549MHz</td></tr>
<tr><td> 
</td><td> 
</td></tr>
<tr><td>1.For 2*2MIMO, one of ANT ports was measured and the limit shall be reduced by 10lg(2), so the limit was calculated to show -43dBm/MHz in order to determine the test result conveniently.
2.The level in -66.962dBm/100KHz =
-56. 962dBm/MHz</td><td>1.For 2*2MIMO, one of ANT ports was measured and the limit shall be reduced by 10lg(2), so the limit was calculated to show -43dBm/MHz in order to determine the test result conveniently.</td></tr>
<tr><td>3701MHz-40000MHz</td><td></td></tr>
<tr><td> 
</td><td></td></tr>
<tr><td>1.For 2*2MIMO, one of ANT ports was measured and the limit shall be reduced by 10lg(2), so the limit was calculated to show -43dBm/MHz in order to determine the test result conveniently.</td><td></td></tr>
</table>

<table>
<tr><th colspan="2">TDD Band 48 _ GSM _ High Channel</th></tr>
<tr><td>30MHz-1000MHz</td><td>1000MHz-3549MHz</td></tr>
<tr><td> 
</td><td> 
</td></tr>
<tr><td>1.For 2*2MIMO, one of ANT ports was measured and the limit shall be reduced by 10lg(2), so the limit was calculated to show -43dBm/MHz in order to determine the test result conveniently.
2.The level in -67.384dBm/100KHz = -57.384dBm/MHz</td><td>1.For 2*2MIMO, one of ANT ports was measured and the limit shall be reduced by 10lg(2), so the limit was calculated to show -43dBm/MHz in order to determine the test result conveniently.</td></tr>
<tr><td>3701MHz-40000MHz</td><td></td></tr>
<tr><td> 
</td><td></td></tr>
<tr><td>1.For 2*2MIMO, one of ANT ports was measured and the limit shall be reduced by 10lg(2), so the limit was calculated to show -43dBm/MHz in order to determine the test result conveniently.</td><td></td></tr>
</table>

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

Test Requirement: FCC Part 2.1051; FCC Part 96.41

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:

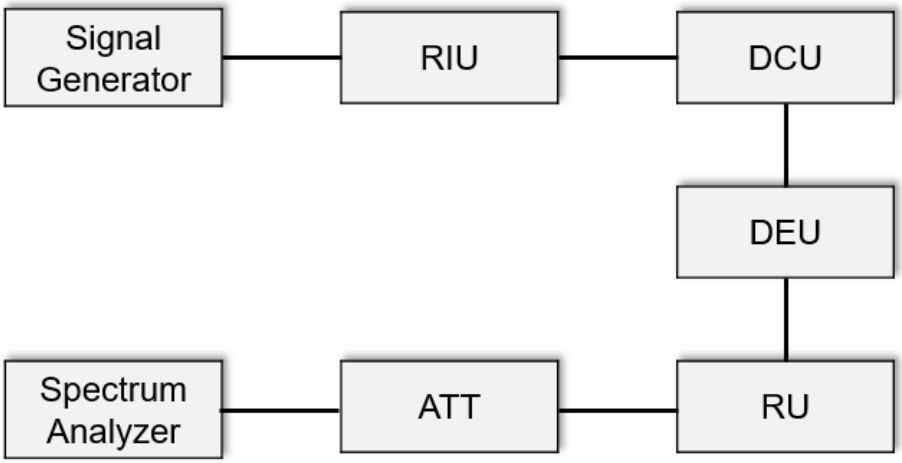


Fig.4. Band edge test configuration

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

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

b) Set the signal generator to produce two AWGN signals as previously described (e.g., 4.1 MHz OBW).

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

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

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

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

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

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.

6.4.1 Measurement Data

Out-of-band/out-of-block emissions							
Test Path	Test Channel	Signal Type	Stimulus Condition	Signal Level	Worst conducted test level	Limit (dBm/MHz)	Verdict
Downlink	LCH	AWGN	One signal input	Pre-AGC	-43.12	<=-16	PASS
				3dB Above AGC	-42.66		PASS
			Two adjacent signal input	Pre-AGC	-42.11		PASS
				3dB Above AGC	-42.65		PASS
	HCH		One signal input	Pre-AGC	-41,89		PASS
				3dB Above AGC	-42.65		PASS
			Two adjacent signal input	Pre-AGC	-43.56		PASS
				3dB Above AGC	-44.76		PASS
Remark: 1. For 2*2MIMO, one of ANT ports was measured and the limit shall be reduced by 10lg(2), so the limit was calculated to show -16dBm/MHz in order to determine the test result conveniently.							

Out-of-band/out-of-block emissions							
Test Path	Test Channel	Signal Type	Stimulus Condition	Signal Level	Worst conducted test level	Limit (dBm/MHz)	Verdict
Downlink	LCH	GSM	One signal input	Pre-AGC	-45.67	<=-16	PASS
				3dB Above AGC	-44.66		PASS
			Two adjacent signal input	Pre-AGC	-43.23		PASS
				3dB Above AGC	-43.78		PASS
	HCH		One signal input	Pre-AGC	-42.76		PASS
				3dB Above AGC	-43.83		PASS
			Two adjacent signal input	Pre-AGC	-43.23		PASS

				3dB Above AGC	-42.98		PASS

Remark:
1. For 2*2MIMO, one of ANT ports was measured and the limit shall be reduced by 10lg(2), so the limit was calculated to show -16dBm/MHz in order to determine the test result conveniently.

Adjacent Channel Leakage Power Ratio (ACLR)						
Offset frequency	AWGN			Unit	Limit (dB)	Verdict
	Low	Middle	High			
F_c-BW	-46.81	-45.66	-47.82	dBc	<=-30	PASS
F_c+BW	-46.36	-46.63	-48.32	dBc		PASS
F_c-2BW	-47.36	-46.48	-48.39	dBc		PASS
F_c+2BW	-46.53	-48.35	-47.65	dBc		PASS

Adjacent Channel Leakage Power Ratio (ACLR)						
Offset frequency	GSM			Unit	Limit (dB)	Verdict
	Low	Middle	High			
F_c-BW	-46.33	-45.34	-46.11	dBc	<=-30	PASS
F_c+BW	-45.34	-47.11	-46.78	dBc		PASS
F_c-2BW	-46.39	-47.32	-45.89	dBc		PASS
F_c+2BW	-46.38	-47.68	-46.17	dBc		PASS

6.5 Radiated Spurious Emissions

Test Requirement: FCC Part 2.1053

Test Method: KDB 935210 D05 Indus Booster Basic Meas v01r04

EUT Operation:

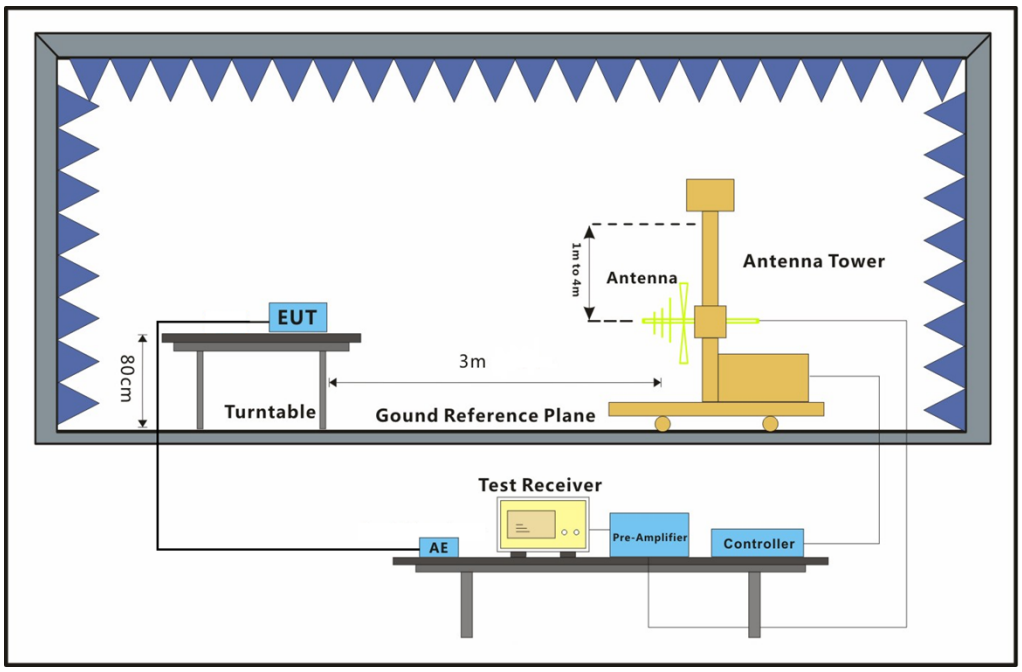
Status: Drive the EUT to maximum output power.

Conditions: Normal conditions

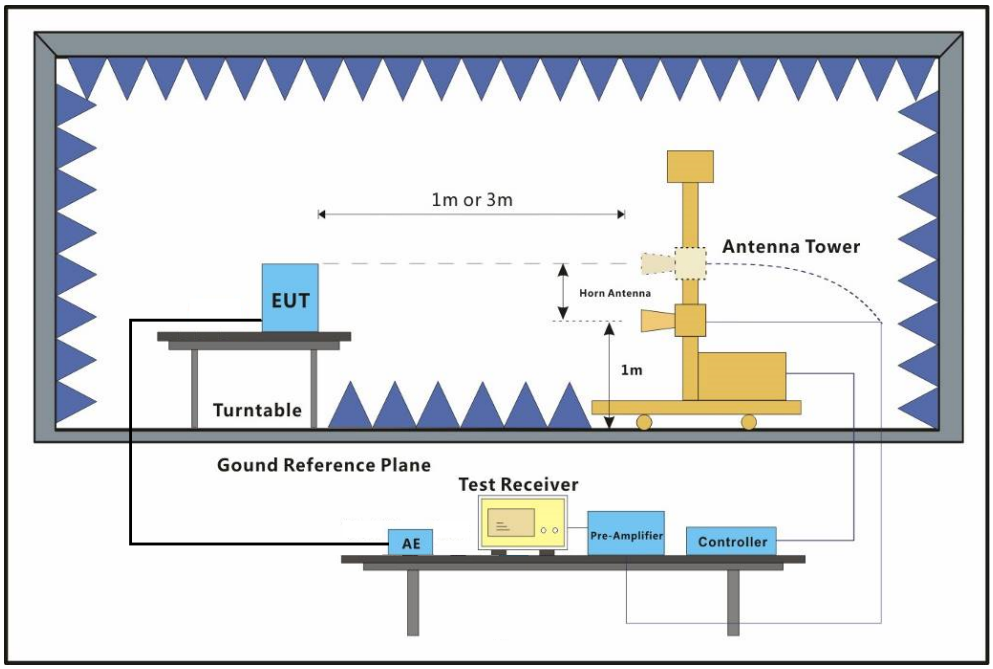
Application: Enclosure

Test Configuration:

30MHz to 1GHz emissions:



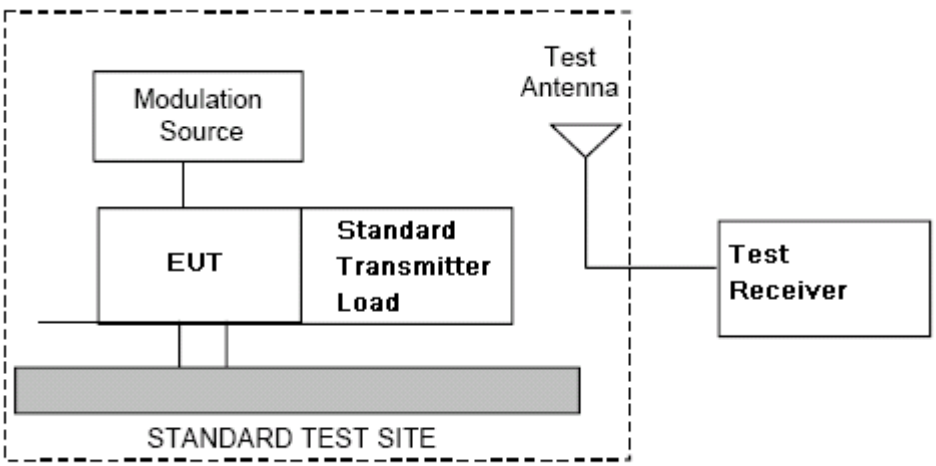
1GHz to 40GHz emissions:



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:



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.

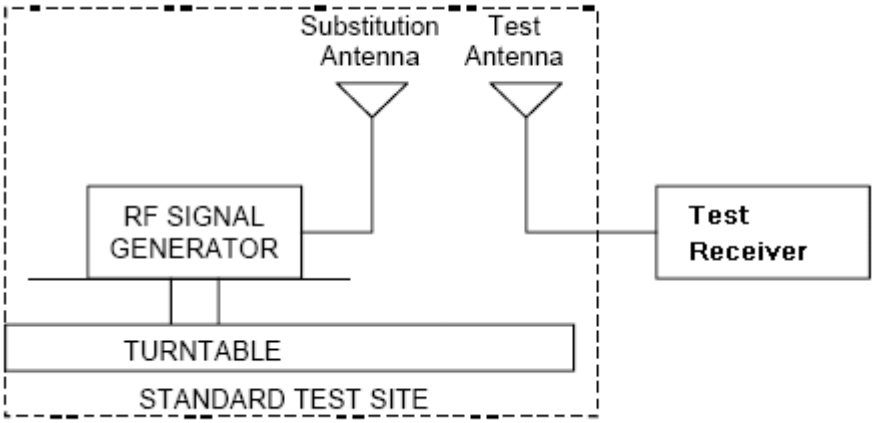
c) Place the transmitter to be tested on the turntable in the standard test site, The transmitter is transmitting into a no radiating load that is placed on the turntable. The RF cable to this load should be of minimum length.

d) Measurements shall be made from30MHz to 10 times of fundamental carrier, except for the region close to the carrier equal to ± 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) 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(dBm) = *Pg*(dBm) – *cable loss* (dB) + *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 (dBm) = 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

5) For the emissions data below 1GHz, all of them are more than 10dB lower than the limit, so the data below 1GHz is not show here.

6.5.1 Measurement Data

BAND 48-3550MHz-3700MHz-GSM Low channel								
Frequency (MHz)	EIRP(dBm)	Limit(dBm)	Over Limit (dB)	S.G. Power (dBm)	Cable loss (dB)	Antenna Gain (dBi)	Polarization (H/V)	Result
2001.084	-47.96	-40	-7.96	-53.23	0.53	5.8	Horizontal	Pass
8036.214	-52.58	-40	-12.58	-64.47	1.01	12.9	Horizontal	Pass
15003.42	-54.09	-40	-14.09	-65.95	1.44	13.3	Horizontal	Pass
1978.082	-46.43	-40	-6.43	-49.76	0.52	6	Vertical	Pass
5330.928	-47.3	-40	-7.3	-56.08	0.82	9.6	Vertical	Pass
6659.763	-47.08	-40	-7.08	-57.93	0.95	11.8	Vertical	Pass

All modes have been tested and only the worst test result has been recorded.

BAND 48-3550MHz-3700MHz-GSM Middle channel								
Frequency (MHz)	EIRP(dBm)	Limit(dBm)	Over Limit (dB)	S.G. Power (dBm)	Cable loss (dB)	Antenna Gain (dBi)	Polarization (H/V)	Result
2001.084	-47.84	-40	-7.84	-53.11	0.53	5.8	Horizontal	Pass
6659.763	-52.52	-40	-12.52	-63.37	0.95	11.8	Horizontal	Pass
11600.35	-52.74	-40	-12.74	-64.03	1.81	13.1	Horizontal	Pass
1995.309	-47.55	-40	-7.55	-50.88	0.52	6	Vertical	Pass
6659.763	-51.31	-40	-11.31	-62.16	0.95	11.8	Vertical	Pass
11871.71	-53.19	-40	-13.19	-64.48	1.81	13.1	Vertical	Pass

All modes have been tested and only the worst test result has been recorded.

BAND 48-3550MHz-3700MHz-GSM High channel								
Frequency (MHz)	EIRP(dBm)	Limit(dBm)	Over Limit (dB)	S.G. Power (dBm)	Cable loss (dB)	Antenna Gain (dBi)	Polarization (H/V)	Result
2001.084	-48.63	-40	-8.63	-53.9	0.53	5.8	Horizontal	Pass
6640.542	-49.61	-40	-9.61	-60.46	0.95	11.8	Horizontal	Pass
15177.89	-52.97	-40	-12.97	-64.83	1.44	13.3	Horizontal	Pass
1829.582	-42.31	-40	-2.31	-45.64	0.52	6	Vertical	Pass
6640.542	-48.77	-40	-8.77	-59.62	0.95	11.8	Vertical	Pass
14284.03	-52.02	-40	-12.02	-63.95	1.67	13.6	Vertical	Pass

All modes have been tested and only the worst test result has been recorded.

6.6 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:

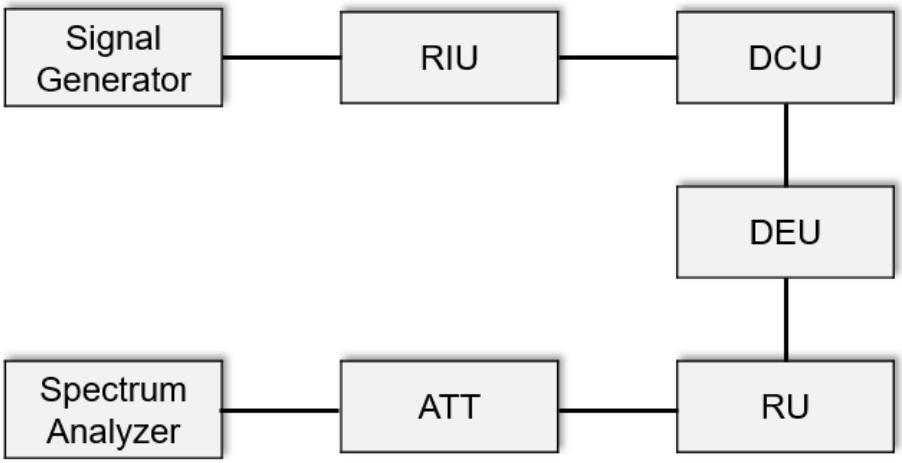


Fig.5. Occupied bandwidth test configuration

Test Procedure:

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

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

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

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

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

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

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

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

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

i) Set spectrum analyzer detection function to positive peak.

j) Set the trace mode to max hold.

k) Determine the reference value: Allow the trace to stabilize. Set the spectrum analyzer marker to the highest amplitude level of the displayed trace (this is the reference value) and record the associated frequency as f0.

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.

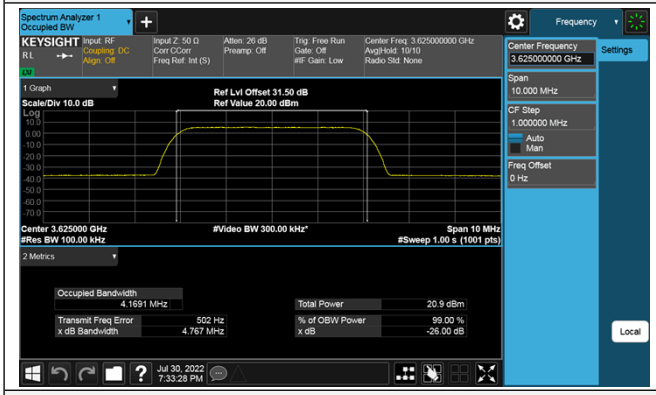
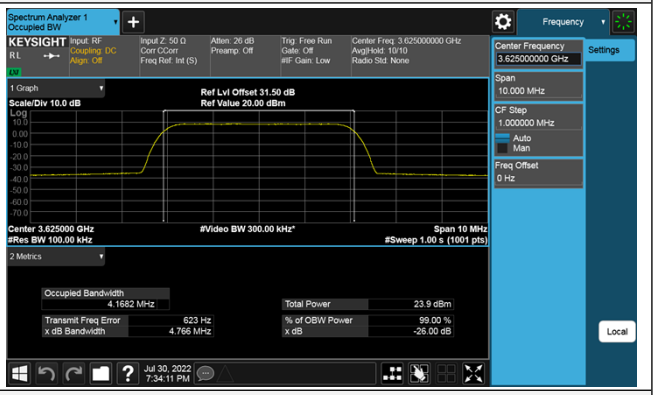
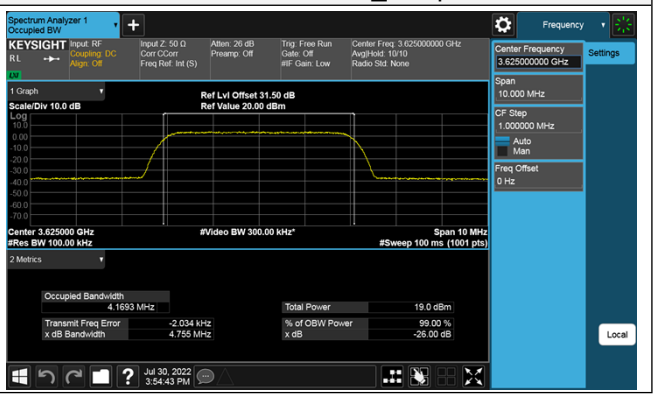
o) Repeat the procedure [steps e) to n)] with the input signal amplitude set to 3 dB above the AGC threshold.

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.

6.6.1 Measurement Data

TDD Band 48				
Signal Level	Test Channel	Signal Type	99% Occupied Channel Bandwidth (MHz)	
			AWGN	GSM
Pre-AGC	Middle Channel	Input	4.1691	0.24511
		Output	4.1722	0.2452
3dB Above AGC	Middle Channel	Input	4.1682	0.24668
		Output	4.1693	0.24946

TDD Band 48 _ AWGN	
Pre-AGC _ Input	3dB Above AGC _ Input
	
Pre-AGC _ Output	3dB Above AGC _ Output
	

TDD Band 48 _ GSM	
Pre-AGC _ Input	3dB Above AGC _ Input
	
Pre-AGC _ Output	3dB Above AGC _ Output
	

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6.7 Frequency stability

Test Requirement: FCC Part 2.1055; FCC Part 24.135

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 norminal voltage frequency value as reference point;
   d) vary the temperature from -30°C to 50°C with step 10°C
   e) when reach a temperature point, keep the temperature banlance 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 norminal voltage frequency value as reference point;
   b) vary the voltage from -15% norminal voltage to +15% voltage;
   c) read the frequency at the relative voltage.

6.7.1 Measurement Data

Test Data:

Frequency Stability vs temperature:

1.Test for TDD Band 48 Downlink (Middle Channel: 3625MHz)

Temperature(°C)	Voltage (V ac)	Frequency Error (Hz)	Tolerance(ppm)
50	48	46	0.0127
40	48	36	0.0099
30	48	38	0.0105
20	48	65	0.0179
10	48	58	0.0160
0	48	56	0.0154
-10	48	43	0.0119
-20	48	58	0.0160
-30	48	66	0.0182

Frequency Stability vs voltage:

1. Test for TDD Band 48 Downlink (Middle Channel: 3625MHz)

Voltage (V ac)	Temperature(°C)	Frequency Error (Hz)	Tolerance(ppm)
40.8	20	34	0.0094
48	20	55	0.0152
55.2	20	43	0.0119

7 Photographs

7.1 Setup photo

Please refer to setup photos for FYCR2207000277AT.

7.2 EUT Constructional Details (EUT Photos)

Please Refer to external and internal photos for FYCR2207000277AT for details.

- End of the Report -

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