TEST REPORT

Application No.:	FYCR2206000223AT(SHCR2204000733AT)
Applicant:	Sunwave Communications Co., Ltd.
Address of Applicant:	581 Huoju Avenue, Binjiang, Hangzhou, Zhejiang, China
Manufacturer:	Sunwave Communications Co., Ltd.
Address of Manufacturer:	581 Huoju Avenue, Binjiang, Hangzhou, Zhejiang, China
Equipment Under Test (EUT):	
EUT Name:	Remote Unit
Model No.:	iDAS-R318
Trade mark:	CROSSFIRE
FCC ID:	2AEJ4R31866
Standard(s) :	FCC Part 2; FCC Part 20; FCC Part 27
Date of Receipt:	2022-06-09
Date of Test:	2022-06-10 to 2022-06-26
Date of Issue:	2022-07-02
Test Result:	**Pass***

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

Winkey Wang
EMC Laboratory Manager

Revision Record				
Version	***Chapter***	***Date***	***Modifier***	***Remark***
01		*2022-07-02*		*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	2.1046; 27.50(d)	PASS
Conducted Spurious Emissions	2.1051; 27.53(h)	PASS
Out-of-band/out-of-block (including intermodulation) Emissions	2.1051; 27.53(h)	PASS
Radiated Spurious Emissions	2.1053	PASS
Occupied Bandwidth and Input-versus-output signal comparison	2.1049	PASS
Frequency Stability	2.1055; 27.54	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

Remark: This EUT supports 2*2 MIMO and 4*4 MIMO.

For MIMO mode the output signals are considered completely uncorrelated.

3 Contents

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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 General Information

4.1 Details of E.U.T.

Power supply:	DC48V
Sample Type:	Fixed production
Support Network:	LTE, NR
Operation Frequency Band:	Downlink 2110MHz to 2200MHz
Modulation Type:	DFT-s-OFDM: PI/2 BPSK, QPSK, 16QAM, 64QAM, 256QAM CP-OFDM: QPSK, 16QAM, 64QAM, 256QAM LTE: QPSK, 16QAM, 64QAM
Rated Input Power Range:	0dBm-15dBm
Output Power	37dBm(Total)
Antenna Type:	External antenna
Antenna Gain:	6dBi
Antenna Port:	UL: 2*2MIMO,4*4 MIMO DL: 2*2MIMO,4*4 MIMO

4.2 Description of Support Units

The EUT has been tested as an independent unit.

4.3 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%

4.4 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.

4.5 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.

4.6 Deviation from Standards

None

4.7 Abnormalities from Standard Conditions

None

5 Equipment List

RF test system					
Test Equipment	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal. Date**	**Cal. Due date**
Shielding Room	CRT	N/A	SEM001-14	2021-07-13	2024-07-12
MXA Signal Analyzer (10Hz-50GHz)	KEYSIGHT	N9020B	SEM004-24	2022-04-24	2023-04-23
DC Power Supply	Chroma	62024P-80-60	SEM011-09	2021-07-13	2022-07-12
Humidity/ Temperature Indicator	MINGLE	TH607	SEM002-17	2021-09-14	2022-09-13
Coaxial Cable	SGS	N/A	SEM032-01	2021-07-09	2022-07-08
ESG Vector Signal Generator(250kHz-6GHz)	Agilent	E4438C	MY4907250 5	2021-7-13	2022-7-12
Attenuator	Weinschel Associates	WA41	SEM021-09	N/A	N/A

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	2022-07-12
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	2021-07-13	2022-07-12
Pre-amplifier (0.1-1.3GHz)	HP	8447D	SEM005-02	2021-07-13	2022-07-12
Coaxial Cable	SGS	N/A	SEM032-01	2021-07-09	2022-07-08
Measurement Software	AUDIX	e3 V8.2014-6-27	N/A	N/A	N/A
ESG Vector Signal Generator(250kHz-6GHz)	Agilent	E4438C	MY49072505	2021-7-13	2022-7-12
Attenuator	Weinschel Associates	WA41	SEM021-09	N/A	N/A
Substitution Antenna	Schwarzbeck	VULB9168	SEM003-18	2019-08-08	2022-08-07
Signal Generator(9kHz-40GHz)	N5173B	MY53270267	Agilent	2021/7/13	2022/7/12

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	2022-07-12
Broad-Band Horn	Schwarzbeck	BBHA 9170	SEM003-15	2021-07-11	2024-07-10

Antenna (15-40GHz)					
Broad-Band Horn Antenna (1-18GHz)	Schwarzbeck	BBHA 9120D	SEM003-32	2021-09-26	2024-09-25
Spectrum Analyzer(20Hz-43GHz)	Rohde & Schwarz	101288	SEM004-08	2021-07-13	2022-07-12
Low Noise Amplifier(100MHz-18GHz)	CLAVIIO	BDLNA-0118-352810	SEM005-05	2021-07-13	2022-07-12
Pre-amplifier(26GHz-40GHz)	Compliance Directions Systems Inc.	PAP-2640-50	SEM005-08	2021-07-13	2022-07-12
Pre-amplifier(18GHz-26GHz)	Rohde & Schwarz	CH14-H052	SEM005-17	2021-07-13	2022-07-12
Coaxial Cable	SGS	N/A	SEM032-01	2021-07-09	2022-07-08
Measurement Software	AUDIX	e3 V8.2014-6-27	N/A	N/A	N/A
ESG Vector Signal Generator(250kHz-6GHz)	Agilent	E4438C	MY49072505	2021-7-13	2022-7-12
Attenuator	Weinschel Associates	WA41	SEM021-09	N/A	N/A
Substitution Antenna	ETS-Lindgren	3142C	SEM003-01	2020-06-26	2023-06-25
Substitution Antenna	Rohde&Schwarz	HF907	SEM003-06	2021-04-17	2024-04-16
Signal Generator(9kHz-40GHz)	N5173B	MY53270267	Agilent	2021/7/13	2022/7/12

General used equipment					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
Humidity/ Temperature Indicator	Mingle	TH607	SEM002-22	2021-09-14	2022-09-13
Humidity/ Temperature Indicator	Mingle	TH607	SEM002-23	2021-09-14	2022-09-13
Barometer	DUMAI	DYM3	SEM002-24	2021-09-14	2022-09-13

6 Test Results

6.1 Test conditions

Environment Parameter	Selected Values During Tests	
Relative Humidity	52%	
Atmospheric Pressure:	1010Pa	
Temperature:	TL	-40°C
	TN	+20°C
	TH	+55°C
Voltage:	VL	DC40.8 V
	VN	DC48 V
	VH	DC55.2 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

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 repeaters. 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

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, repeater 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 repeater, but repeater 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.

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

ERFPA (AMP) and boosters/repeaters (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.

The E62-M2 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 E62-M2 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 RF Output Power and Amplifier Gain

Test Requirement: FCC Part 2.1046; FCC Part 27.50(d)

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:

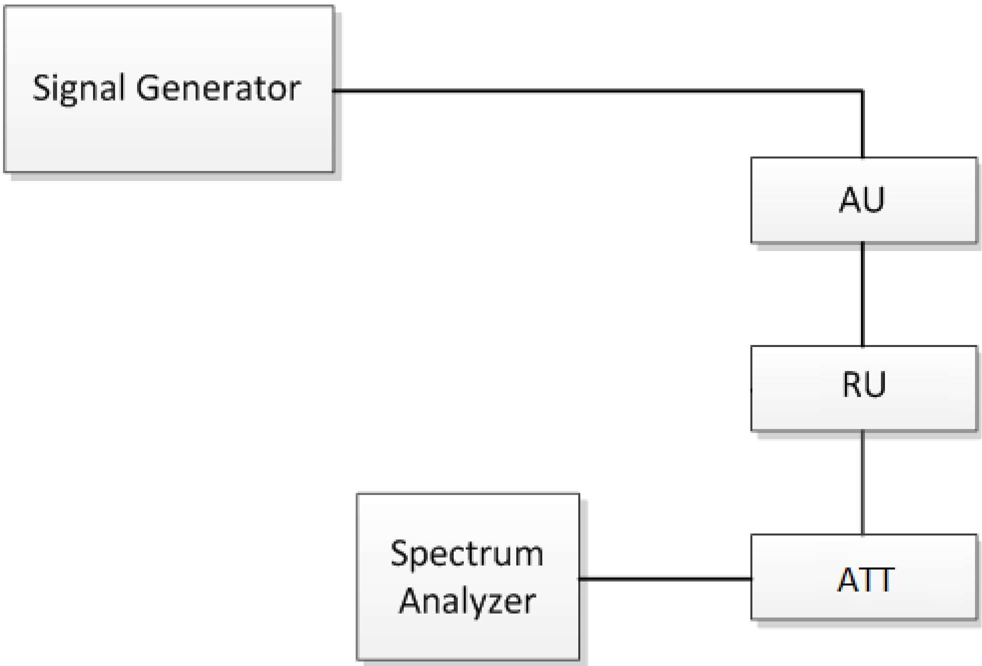

Fig.1 RF Output Power test configuration

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: 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.

6.2.1.1 Measurement Record:

<table>
<tr><td colspan="8">FDD LTE Band 66(2110MHz-2200MHz)</td></tr>
<tr><td>Mode</td><td>Operation Band</td><td>Frequency (MHz)</td><td>Signal Type</td><td>Signal Level (dBm)</td><td>Input Power (dBm)</td><td>Total Output Power (dBm)</td><td>Gain (dB)</td></tr>
<tr><td colspan="8">MIMO Mode</td></tr>
<tr><td rowspan="4">Downlink</td><td rowspan="4">2110MHz ~2200MHz</td><td rowspan="2">2112.5MHz</td><td rowspan="2">AWGN</td><td>Pre-AGC</td><td>0</td><td>37.01</td><td>37.01</td></tr>
<tr><td>3dB Above AGC</td><td>3</td><td>37.12</td><td>/</td></tr>
<tr><td rowspan="2">2110.2MHz</td><td rowspan="2">GSM</td><td>Pre-AGC</td><td>0</td><td>36.03</td><td>36.03</td></tr>
<tr><td>3dB Above AGC</td><td>3</td><td>36.04</td><td>/</td></tr>
<tr><td colspan="8">Remark:
This EUT supports 2*2 MIMO and 4*4 MIMO.
For MIMO mode the output signals are considered completely uncorrelated.</td></tr>
</table>

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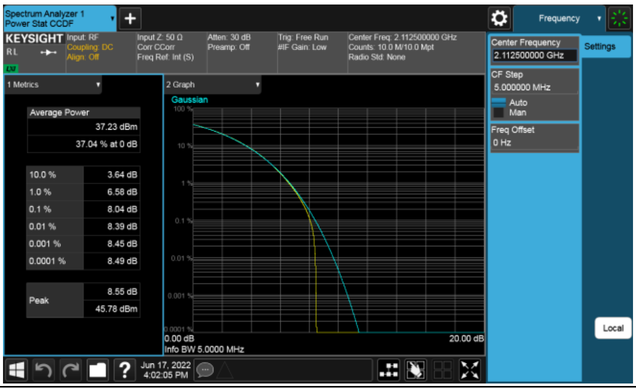
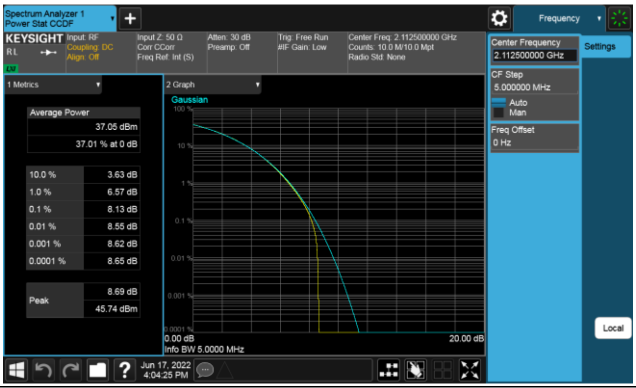
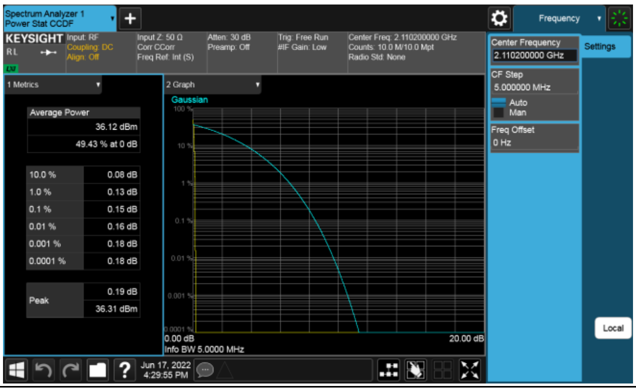
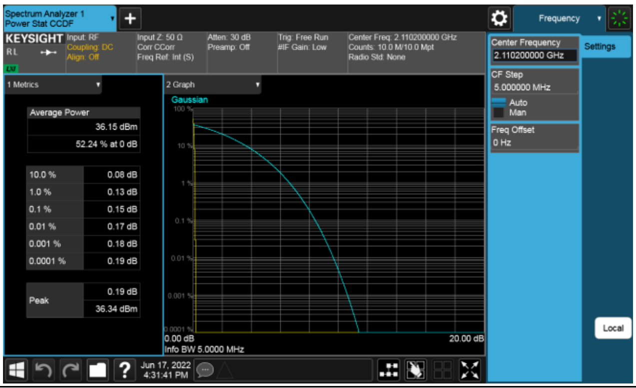
Mode	Operation Band	Frequency (MHz)	Signal Type	Signal Level (dBm)	Input Power (dBm)	PAPR (dB)	Limit (dB)
FDD LTE Band 66(2110MHz-2200MHz)							
Downlink	2110MHz ~2200MHz	2112.5MHz	AWGN	Pre-AGC	0	8.04	13.0
				3dB Above AGC	3	8.13	13.0
		2110.2MHz	GSM	Pre-AGC	0	0.15	13.0
				3dB Above AGC	3	0.15	13.0

FDD LTE Band 66 _ AWGN

Pre-AGC	3dB Above AGC
	

FDD LTE Band 66 _ GSM

Pre-AGC	3dB Above AGC
	

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6.2.2 Conducted Spurious Emissions

Test Requirement:	FCC Part 2.1051; FCC Part 27.53(h)
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:	

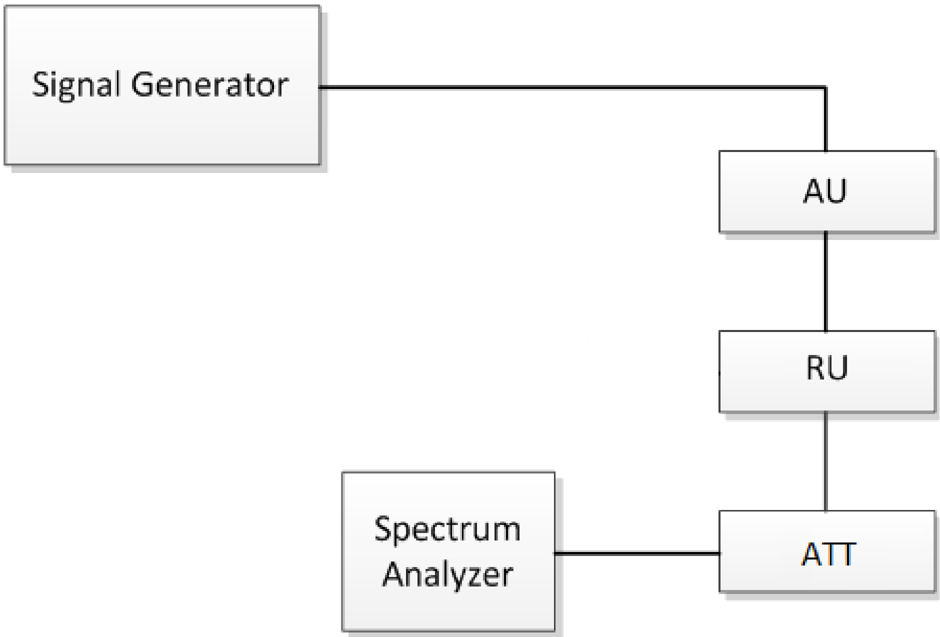


Fig.2. Conducted Spurious Emissions test configuration

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.

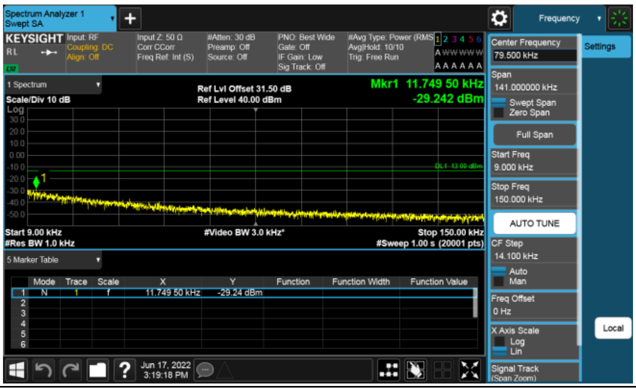
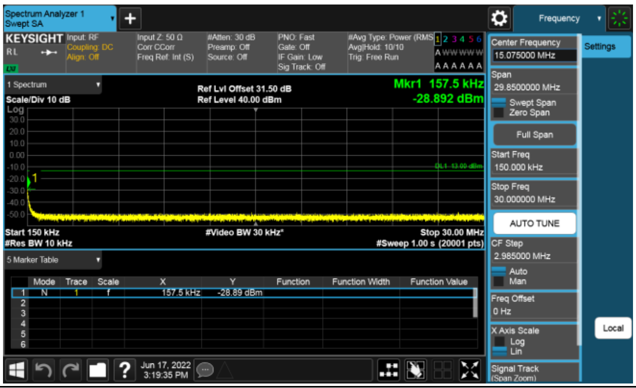
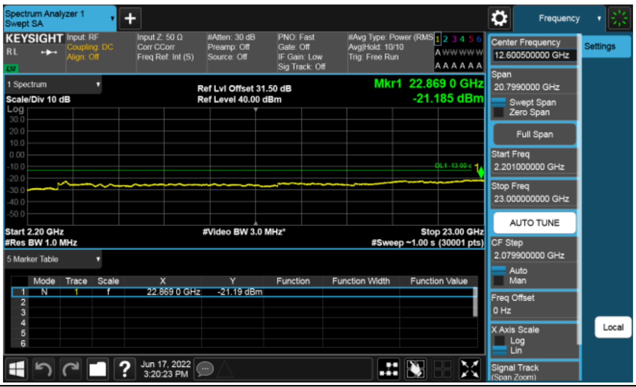
f) Set the RBW = reference bandwidth in the applicable rule section for the supported frequency band of operation (e.g., reference bandwidth is typically 100 kHz or 1 MHz).

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.

6.2.2.1 Measurement Record:

<table>
<tr><th colspan="2">FDD LTE Band 66 _ AWGN _ Low Channel</th></tr>
<tr><td>9KHz-150KHz</td><td>150KHz-30MHz</td></tr>
<tr><td>
</td><td>
</td></tr>
<tr><td>30MHz-1000MHz</td><td>1000MHz-2109MHz</td></tr>
<tr><td>
</td><td>
</td></tr>
<tr><td>2201MHz-23000MHz</td><td></td></tr>
<tr><td>
</td><td></td></tr>
</table>

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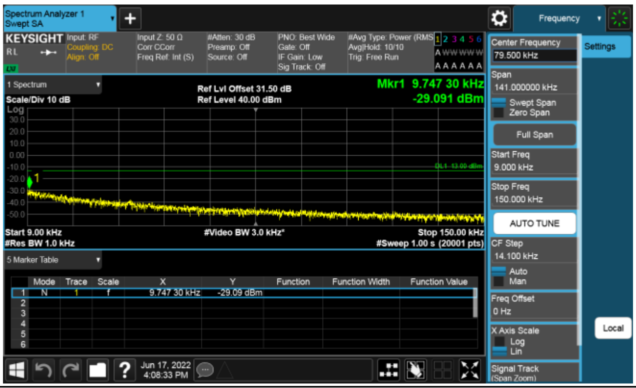
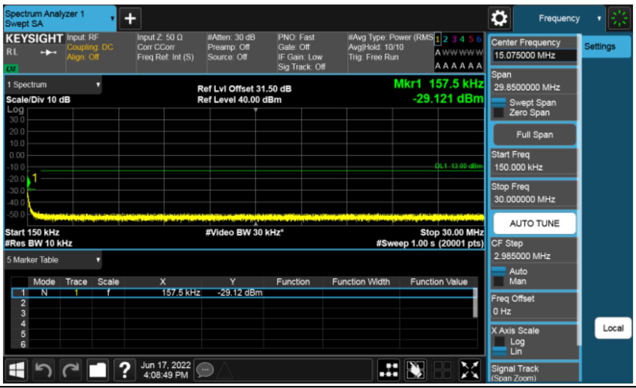
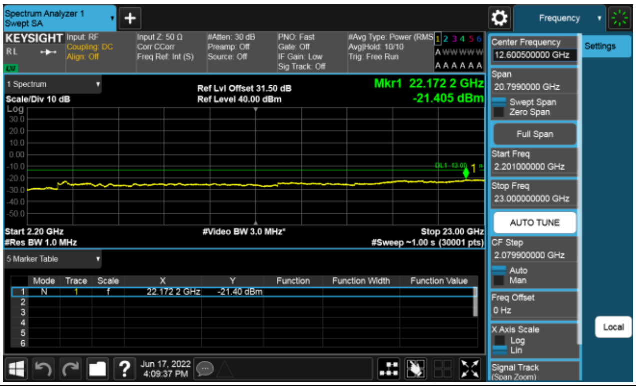
中国・深圳・宝安区福永街道凤塘大道鑫龙科技园福永实验室 邮编: 518103 t (86–755) 88663988 f (86–755) 26710594 sgs.china@sgs.com

FDD LTE Band 66 _ AWGN _ Middle Channel	
9KHz-150KHz	150KHz-30MHz
	
30MHz-1000MHz	1000MHz-2109MHz
	
2201MHz-23000MHz	
	

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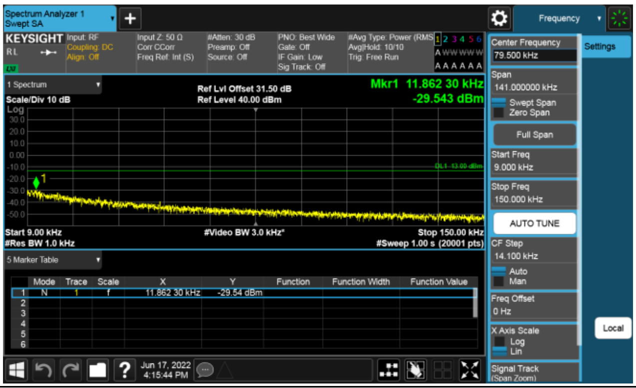
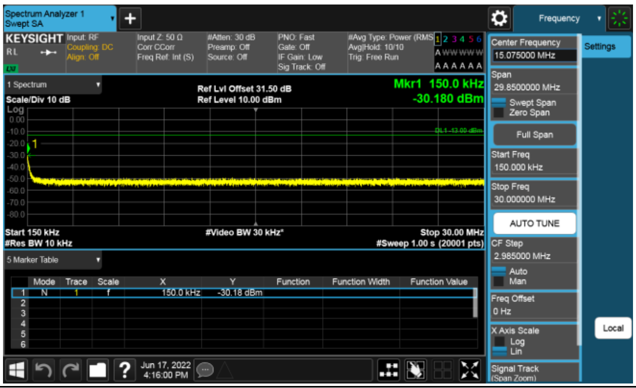
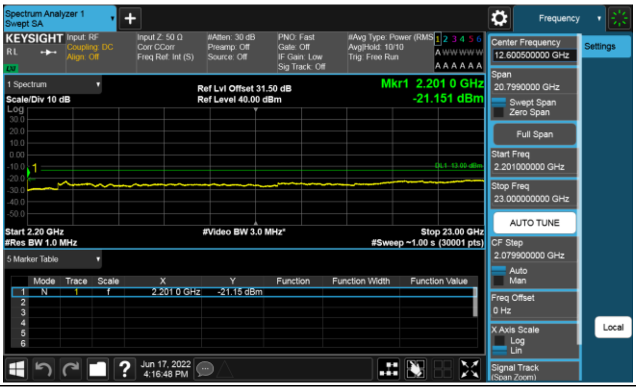
	
30MHz-1000MHz	1000MHz-2109MHz
	
2201MHz-23000MHz	
	

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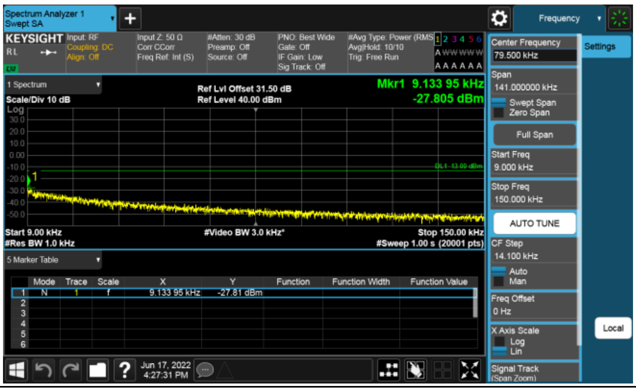
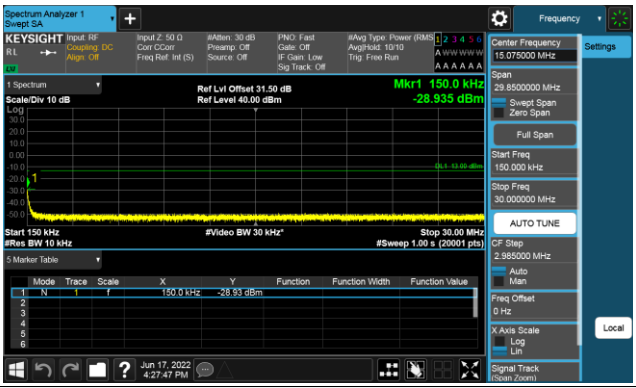
<tr><td>
</td><td>
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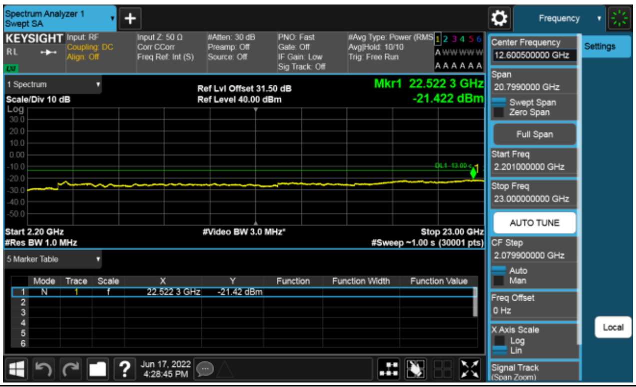
<tr><td>2201MHz-23000MHz</td><td></td></tr>
<tr><td>
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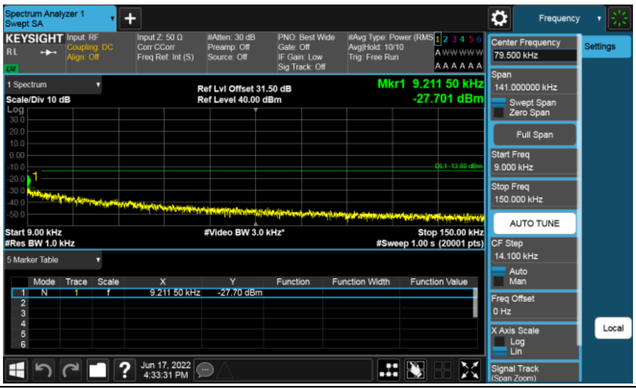
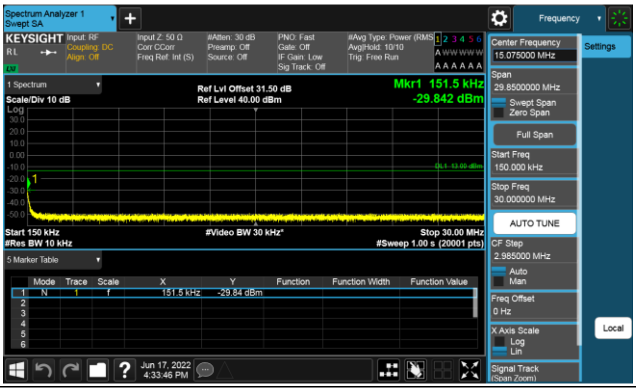
FDD LTE Band 66 _ GSM _ Middle Channel

9KHz-150KHz

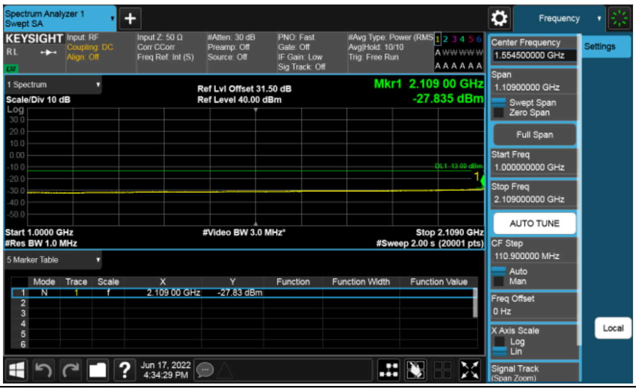


150KHz-30MHz

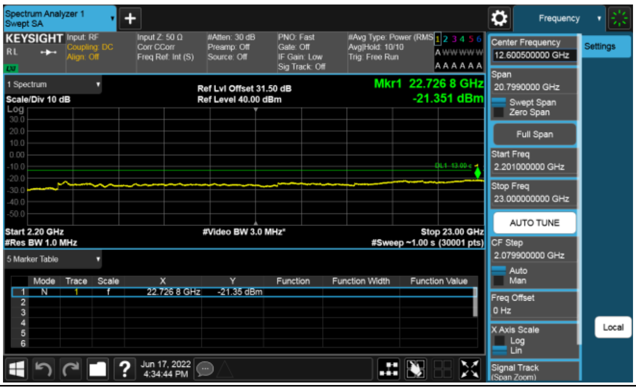


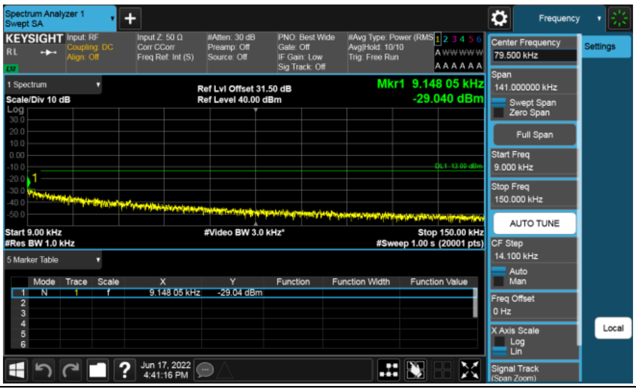
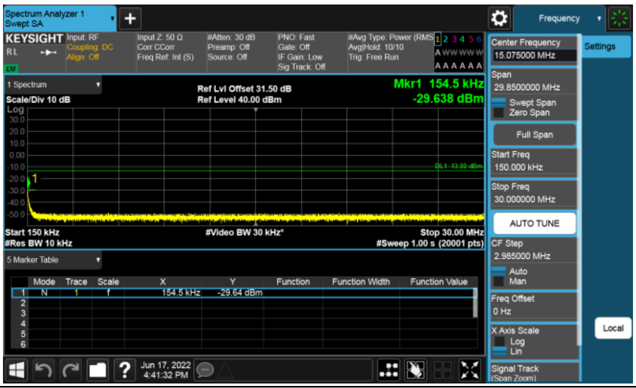
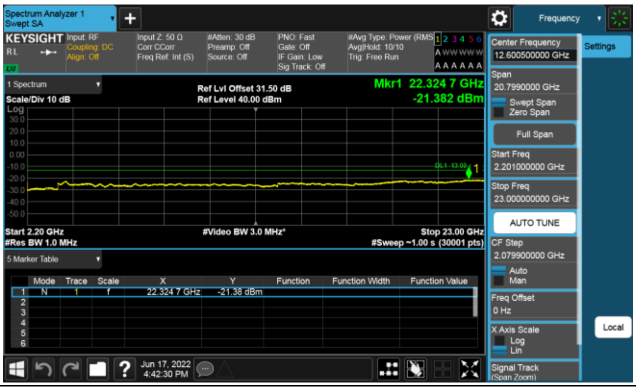
30MHz-1000MHz

1000MHz-2109MHz



2201MHz-23000MHz



FDD LTE Band 66 _ GSM _ High Channel	
9KHz-150KHz	150KHz-30MHz
	
30MHz-1000MHz	1000MHz-2109MHz
	
2201MHz-23000MHz	
	

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

Test Requirement:	FCC Part 2.1051; FCC part 27.53(h)
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:	

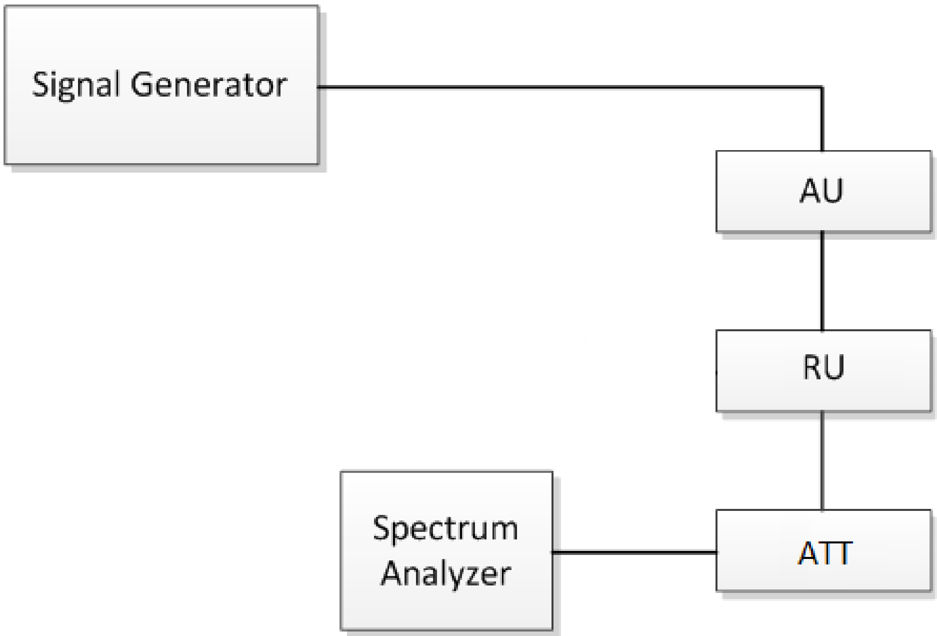


Fig.3. Band edge test configuration

Test Procedure:

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

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.

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:

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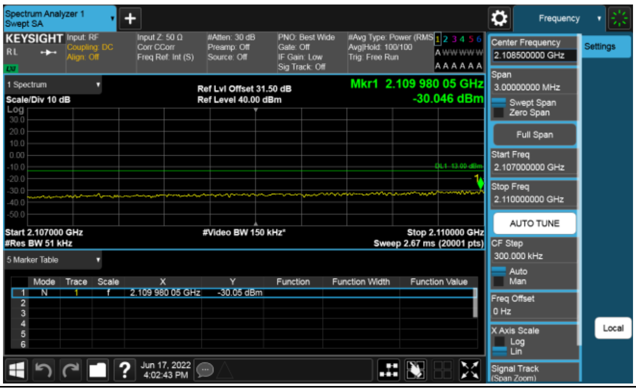
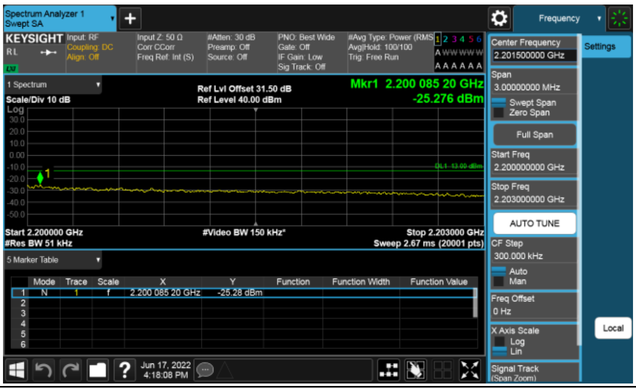
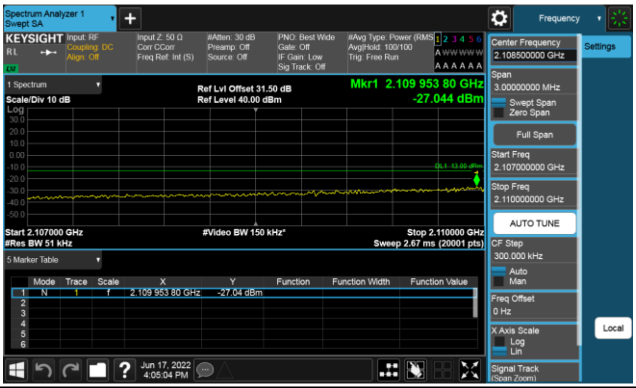
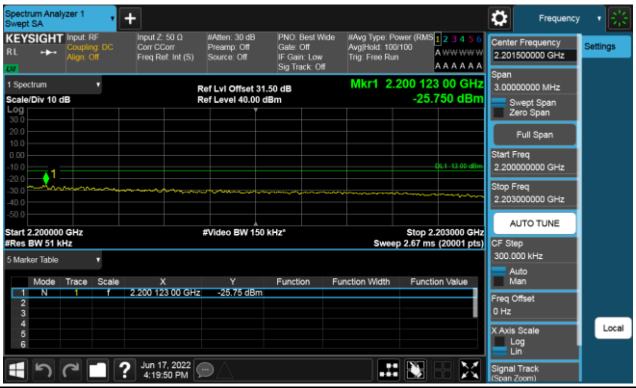
<table>
<tr><th colspan="2">FDD LTE Band 66 _ AWGN _ One signal input</th></tr>
<tr><td>Pre-AGC _ Low Edge</td><td>Pre-AGC _ Up Edge</td></tr>
<tr><td>
</td><td>
</td></tr>
<tr><td>3dB Above AGC _ Low Edge</td><td>3dB Above AGC _ Up Edge</td></tr>
<tr><td>
</td><td>
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<table>
<tr><th colspan="2">FDD LTE Band 66 _ GSM _ One signal input</th></tr>
<tr><td>Pre-AGC _ Low Edge</td><td>Pre-AGC _ Up Edge</td></tr>
<tr><td>
</td><td>
</td></tr>
<tr><td>3dB Above AGC _ Low Edge</td><td>3dB Above AGC _ Up Edge</td></tr>
<tr><td>
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<table>
<tr><th colspan="2">FDD LTE Band 66 _ AWGN _ Two signal input</th></tr>
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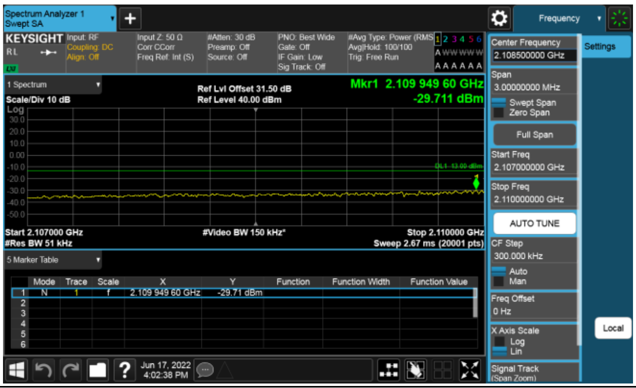
<tr><td>
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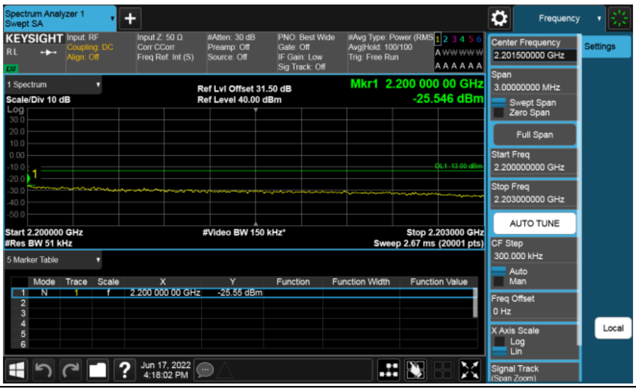
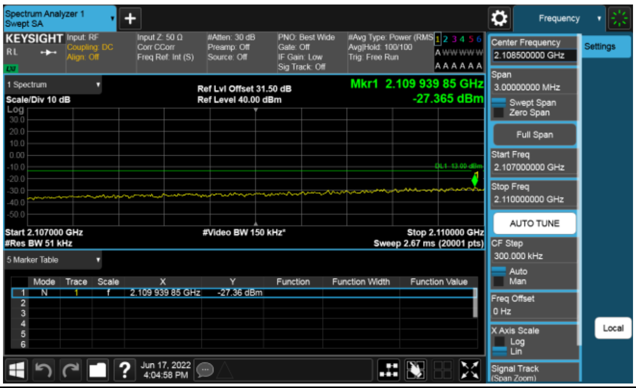
<td>
</td></tr>
<tr><td>3dB Above AGC _ Low Edge</td><td>3dB Above AGC _ Up Edge</td></tr>
<tr><td>
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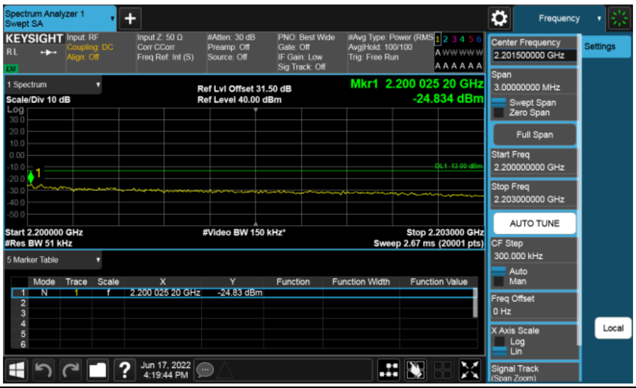
<td>
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FDD LTE Band 66 _ GSM _ Two signal input

Pre-AGC _ Low Edge

Pre-AGC _ Up Edge

3dB Above AGC _ Low Edge

3dB Above AGC _ Up Edge

6.2.4 Radiated Spurious Emissions

Test Requirement: FCC Part 2.1053

Test Method: KDB 935210 D05 Indus Booster Basic Meas v01r04

EUT Operation:

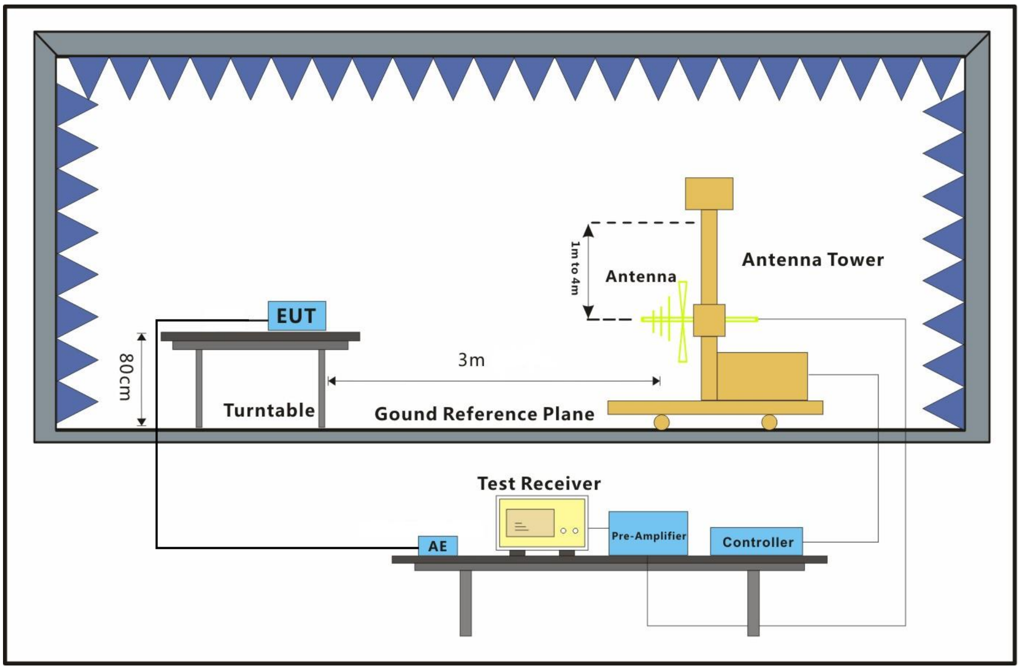
Status: Drive the EUT to maximum output power.

Conditions: Normal conditions

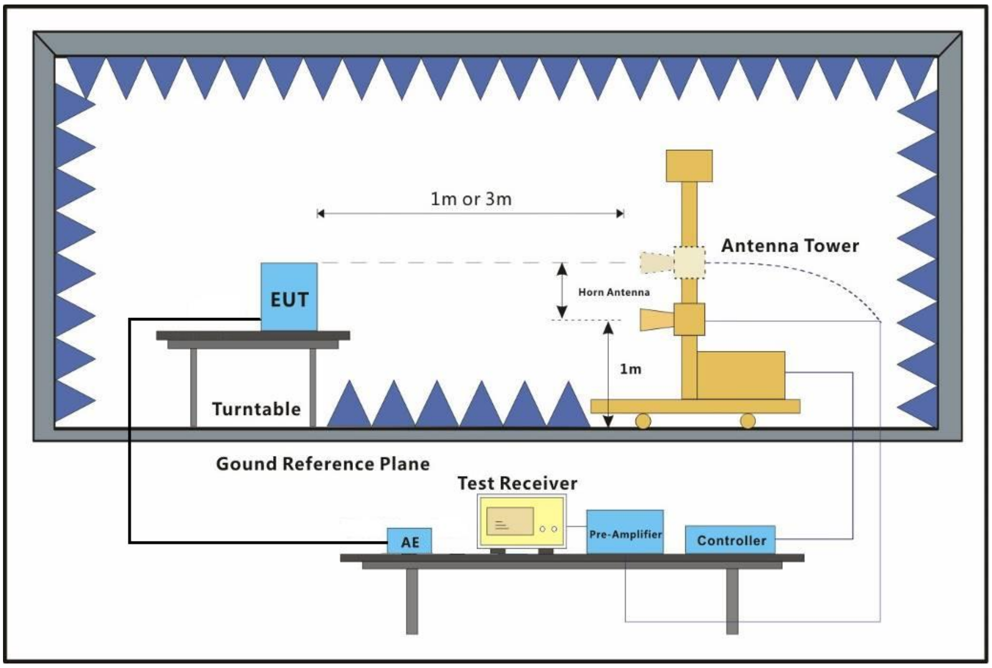
Application: Enclosure

Test Configuration:

30MHz to 1GHz emissions:



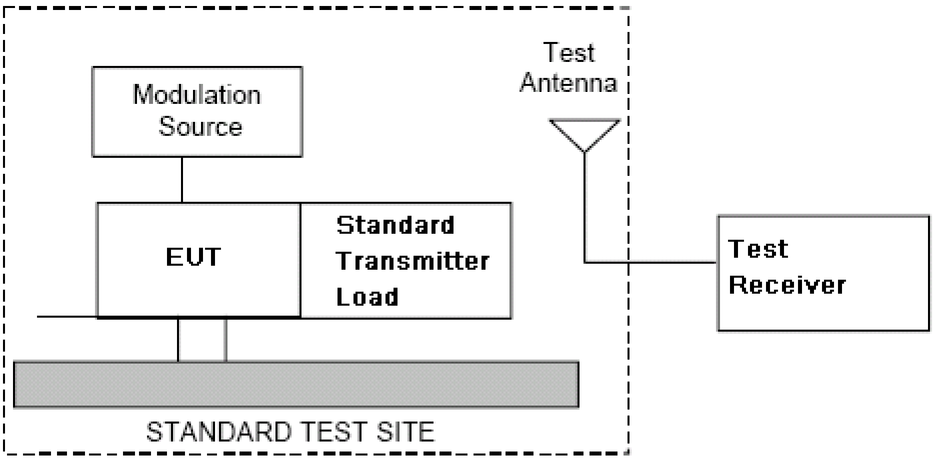
1GHz to 40GHz emissions:



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.

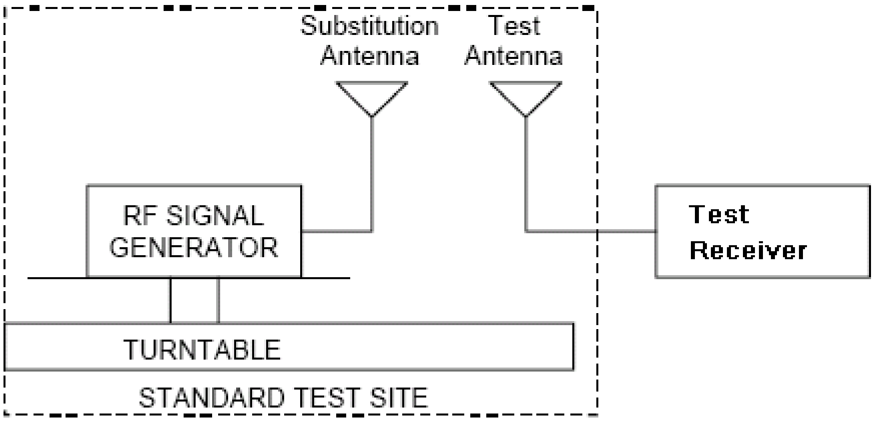
c) Place the transmitter to be tested on the turntable in the standard test site, The transmitter is transmitting into a no radiating load that is placed on the turntable. The RF cable to this load should be of minimum length.

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

6.2.4.1 Measurement Record:

BAND 66-2110MHz-2200MHz-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
7875.25	-41.1	-13	-28.1	-53.31	0.99	13.2	Horizontal	Pass
11803.28	-43.64	-13	-30.64	-54.93	1.81	13.1	Horizontal	Pass
17844.59	-40.87	-13	-27.87	-51.75	1.52	12.4	Horizontal	Pass
5830.64	-32.39	-13	-19.39	-41.84	0.85	10.3	Vertical	Pass
11803.28	-41.99	-13	-28.99	-53.28	1.81	13.1	Vertical	Pass
17690.53	-39.44	-13	-26.44	-50.32	1.52	12.4	Vertical	Pass

BAND 66-2110MHz-2200MHz-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
5797.03	-34.6	-13	-21.6	-44.05	0.85	10.3	Horizontal	Pass
7875.25	-41.29	-13	-28.29	-53.5	0.99	13.2	Horizontal	Pass
17948.05	-40.38	-13	-27.38	-51.26	1.52	12.4	Horizontal	Pass
5780.3	-33.76	-13	-20.76	-43.21	0.85	10.3	Vertical	Pass
11803.28	-41.63	-13	-28.63	-52.92	1.81	13.1	Vertical	Pass
17948.05	-40.64	-13	-27.64	-51.52	1.52	12.4	Vertical	Pass

BAND 66-2110MHz-2200MHz-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
7875.25	-40.98	-13	-27.98	-53.19	0.99	13.2	Horizontal	Pass
11803.28	-43.66	-13	-30.66	-54.95	1.81	13.1	Horizontal	Pass
17948.05	-40.31	-13	-27.31	-51.19	1.52	12.4	Horizontal	Pass
7875.25	-46.28	-13	-33.28	-58.49	0.99	13.2	Vertical	Pass
11803.28	-42.23	-13	-29.23	-53.52	1.81	13.1	Vertical	Pass
17690.53	-39.87	-13	-26.87	-50.75	1.52	12.4	Vertical	Pass

Remark:
Only recorded worst case of AWGN input signal test data in the report.

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:	

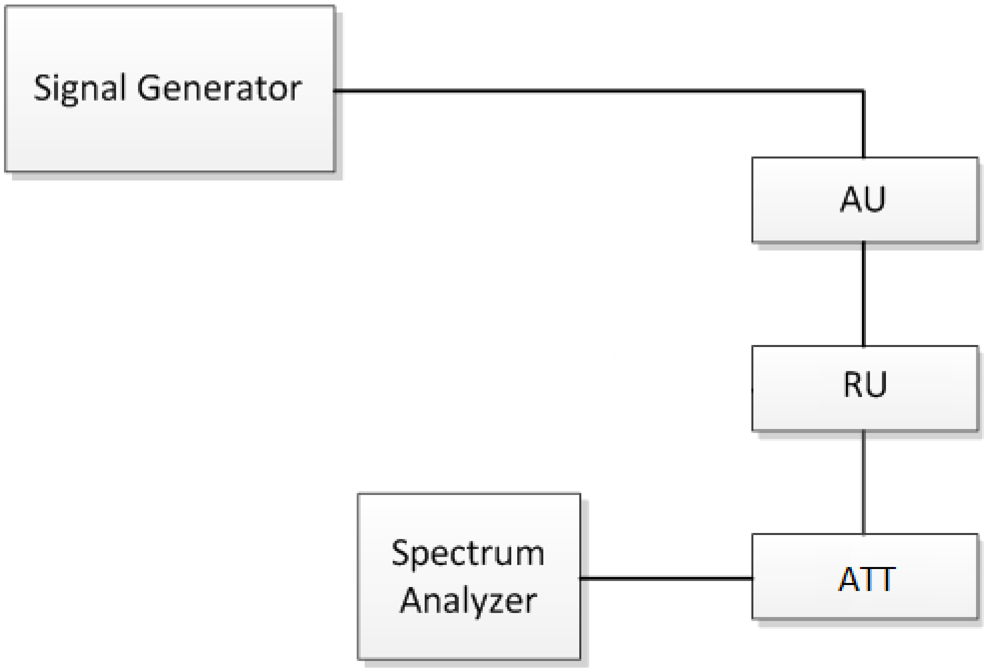


Fig.4. Occupied bandwidth test configuration

Test Procedure:

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.

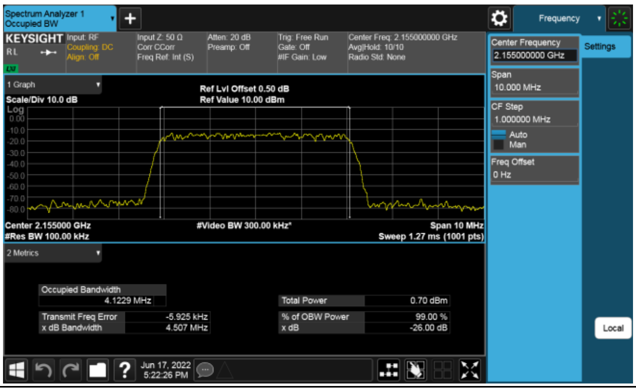
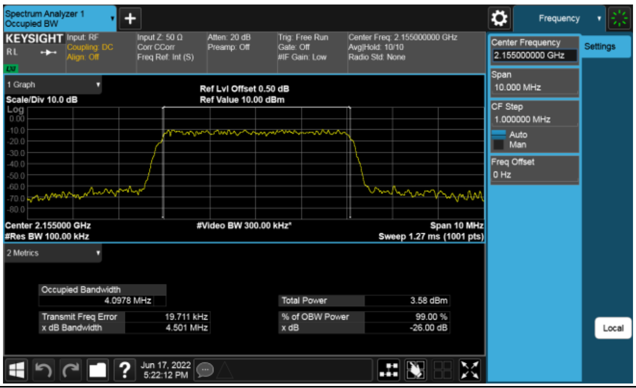
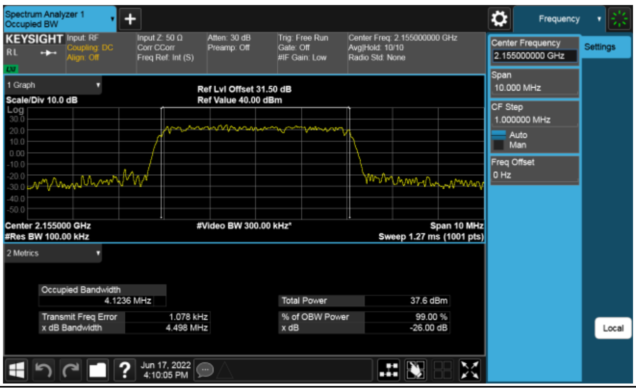
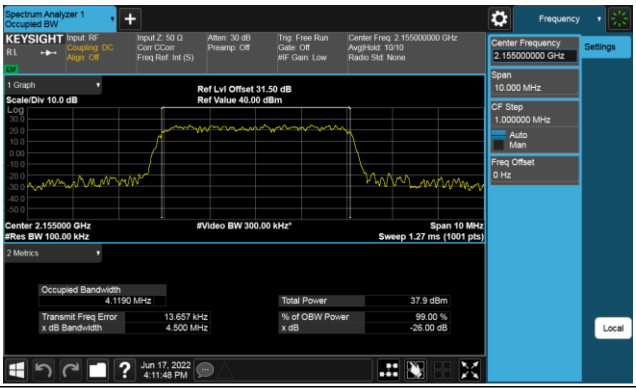
o) Repeat the procedure [steps e) to n)] with the input signal amplitude set to 3 dB above the AGC threshold.

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.

6.2.5.1 Measurement Record:

FDD LTE Band 66				
Signal Level	Test Channel	Signal Type	99% Occupied Channel Bandwidth (MHz)	
			AWGN	GSM
Pre-AGC	Middle Channel	Input	4.1229	0.24447
		Output	4.1236	0.24373
3dB Above AGC	Middle Channel	Input	4.0978	0.24548
		Output	4.1190	0.24481

FDD LTE Band 66 _ AWGN	
Pre-AGC _ Input	3dB Above AGC _ Input
	
Pre-AGC _ Output	3dB Above AGC _ Output
	

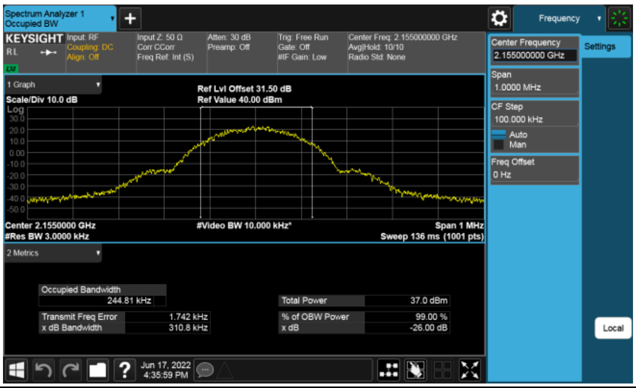
FDD LTE Band 66 _ GSM

Pre-AGC _ Input

3dB Above AGC _ Input

Pre-AGC _ Output

3dB Above AGC _ Output



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:

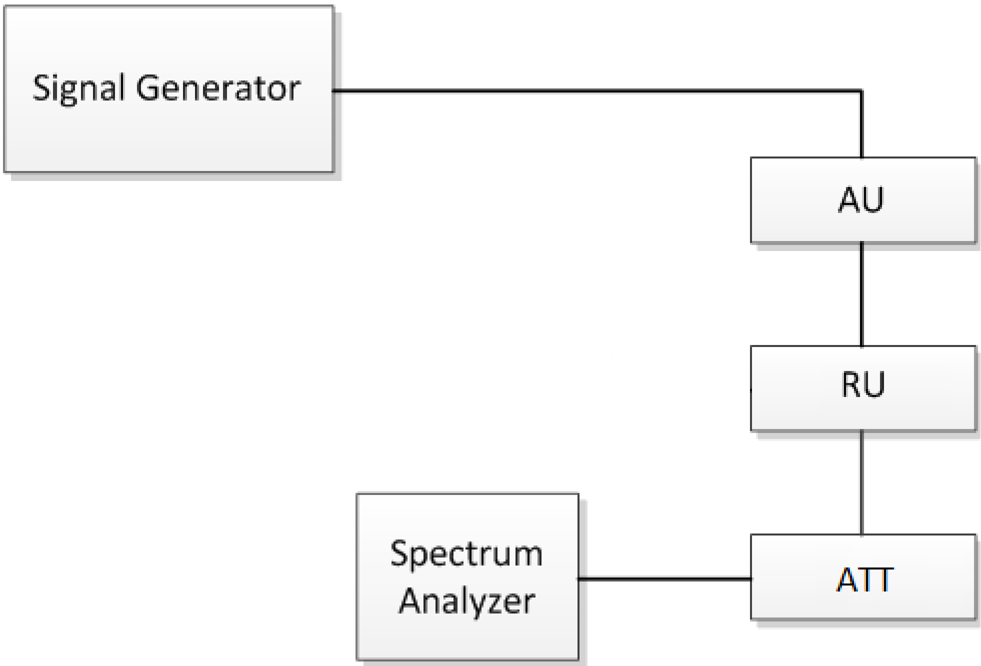


Fig.5. Out of Band rejection test configuration

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 = ± 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.

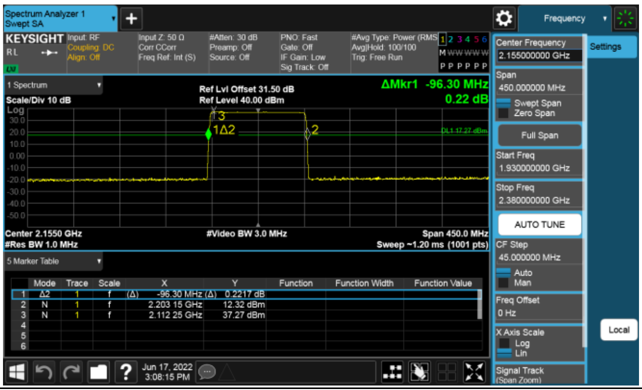
g) Place a marker to the peak of the frequency response and record this frequency as f0.

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:

Out of Band Rejection	
FDD LTE Band 66	
	

6.2.7 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 -40°C to 55°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.

6.2.7.1 Measurement Record:

Frequency Stability vs temperature:

1.Test for FDD LTE Band 66 Downlink (Middle Channel: 2155MHz)

Temperature(°C)	Voltage (V dc)	Frequency Error (Hz)	Tolerance(ppm)
55	48	-3.61	-0.0017
50	48	-2.51	-0.0012
40	48	5.21	0.0024
30	48	2.05	0.001
20	48	-7.43	-0.0034
10	48	-6.32	-0.0029
0	48	-7.33	-0.0034
-10	48	2.26	0.001
-20	48	3.62	0.0017
-30	48	-0.44	-0.0002
-40	48	-7.87	-0.0037

Frequency Stability vs voltage:

1. Test for FDD LTE Band 66 Downlink (Middle Channel: 2155MHz)

Voltage (V dc)	Temperature(°C)	Frequency Error (Hz)	Tolerance(ppm)
40.8	20	3.71	0.0017
48	20	-8.3	-0.0039
55.2	20	-9.03	-0.0042

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--