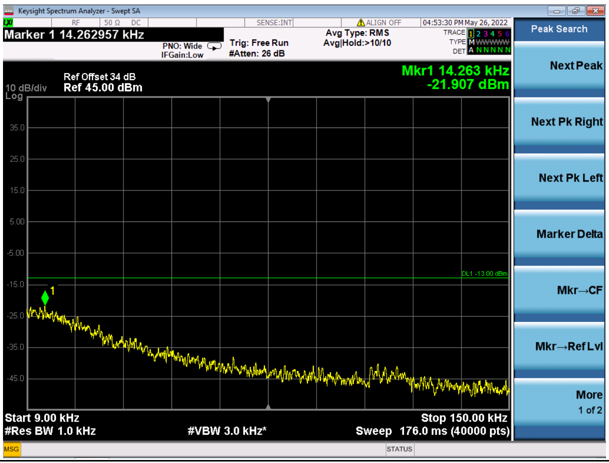
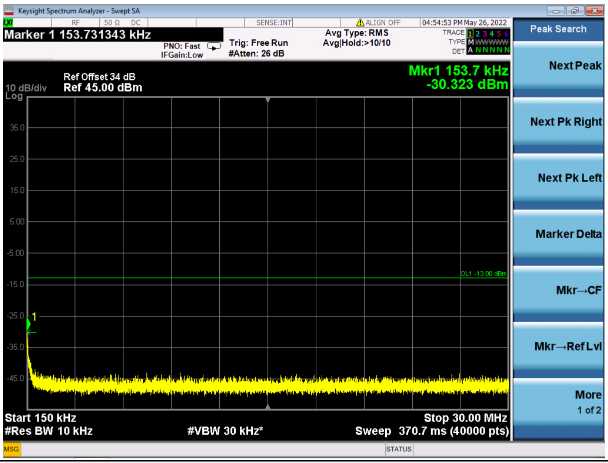
FDD LTE Band 43 _ AWGN _ High Channel

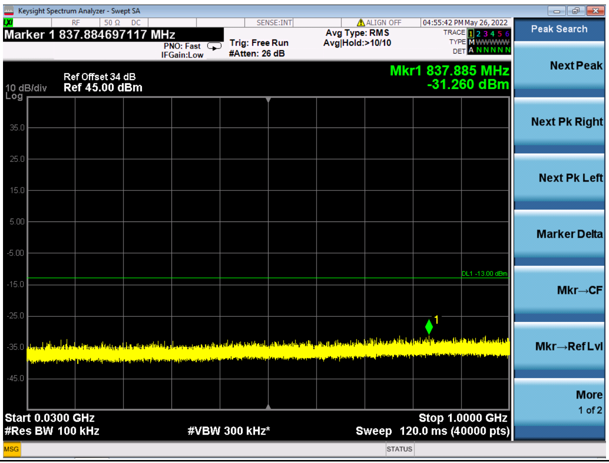
9KHz-150KHz



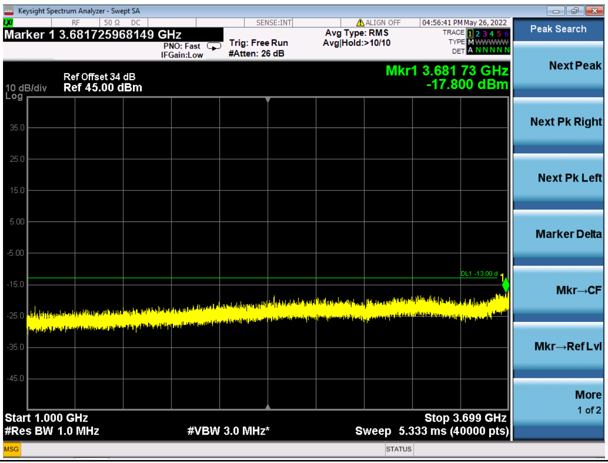
150KHz-30MHz



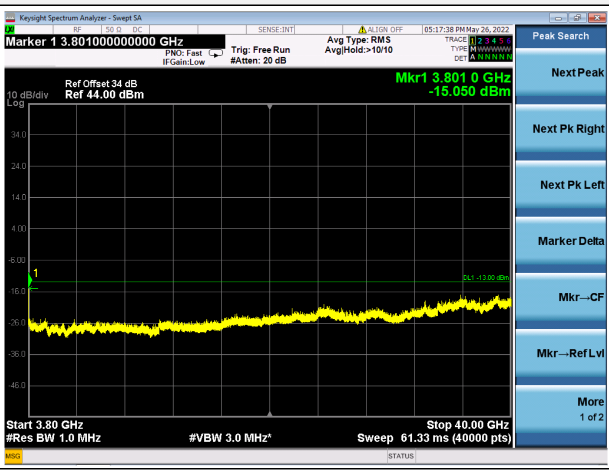
30MHz-1000MHz

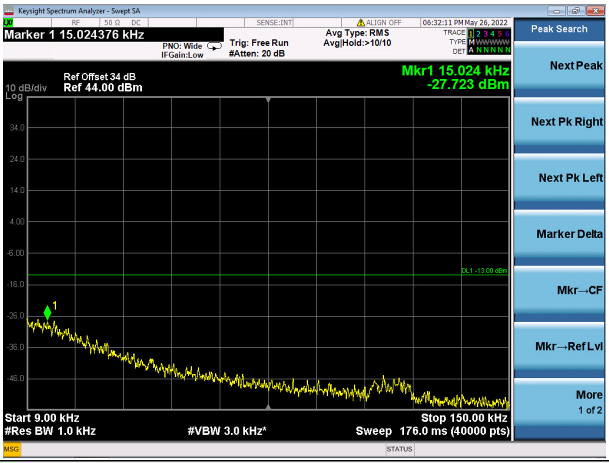
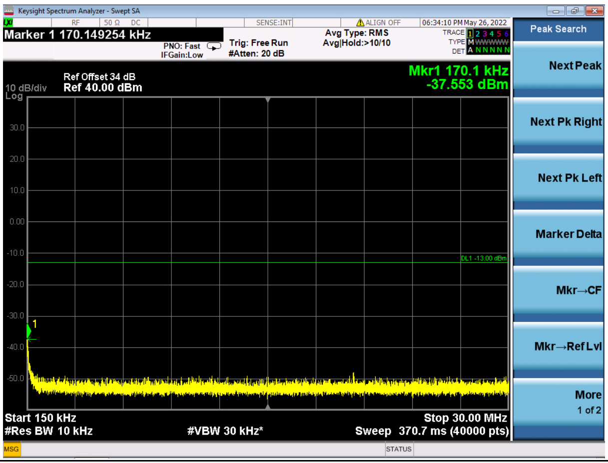
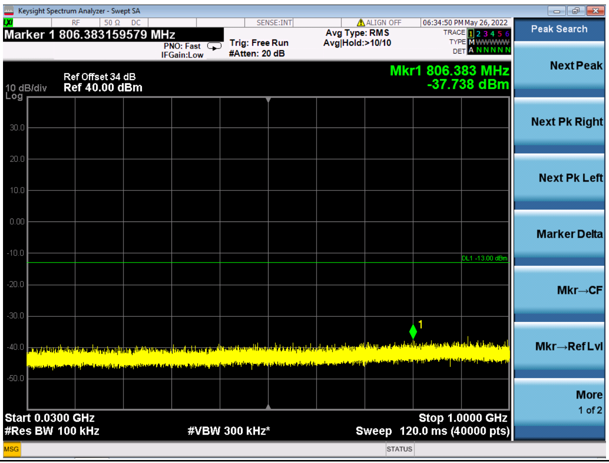
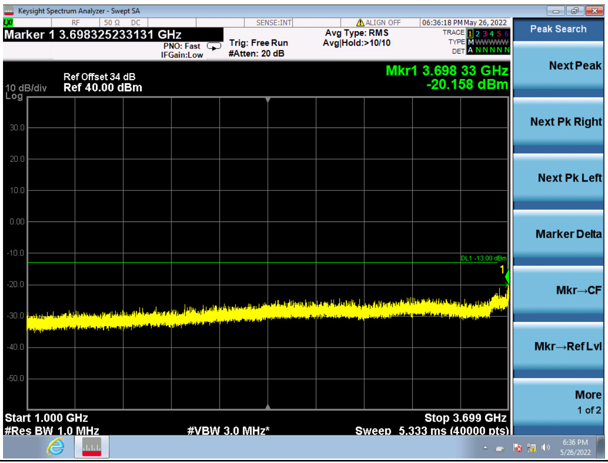
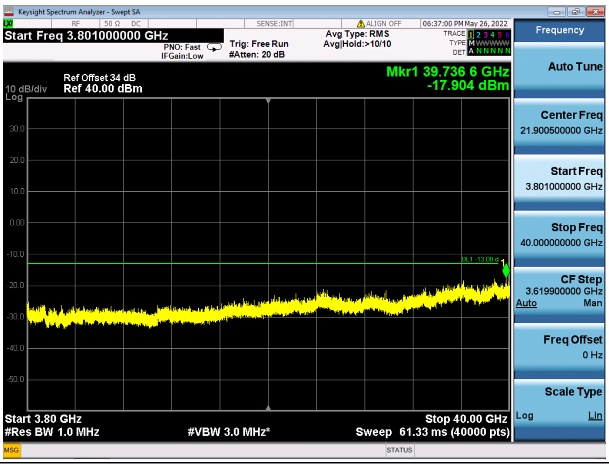


1000MHz-3699MHz



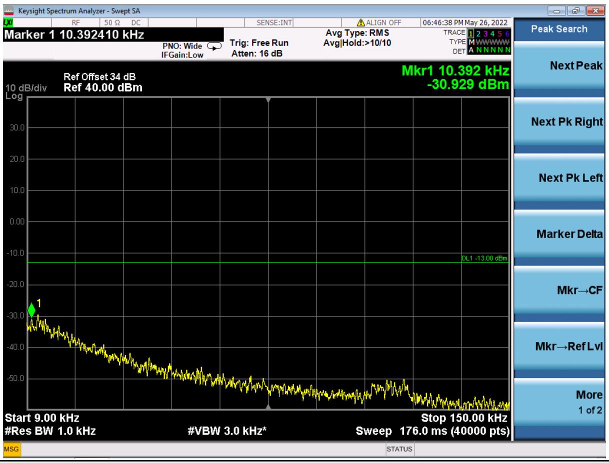
3801MHz-20000MHz



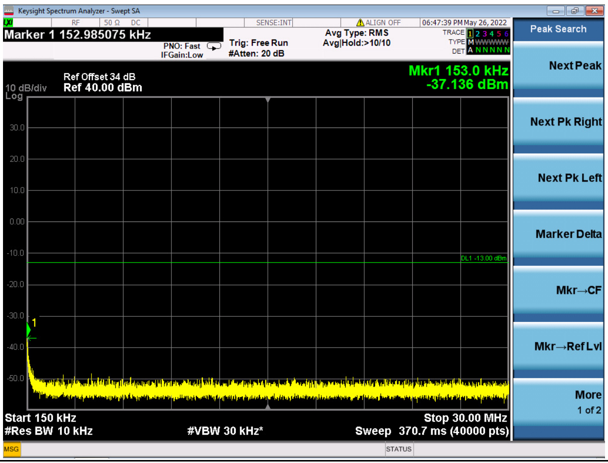
FDD LTE Band 43 _ GSM _ Low Channel	
9KHz-150KHz	150KHz-30MHz
	
30MHz-1000MHz	1000MHz-3699MHz
	
3801MHz-20000MHz	
	

FDD LTE Band 43 _ GSM _ Middle Channel

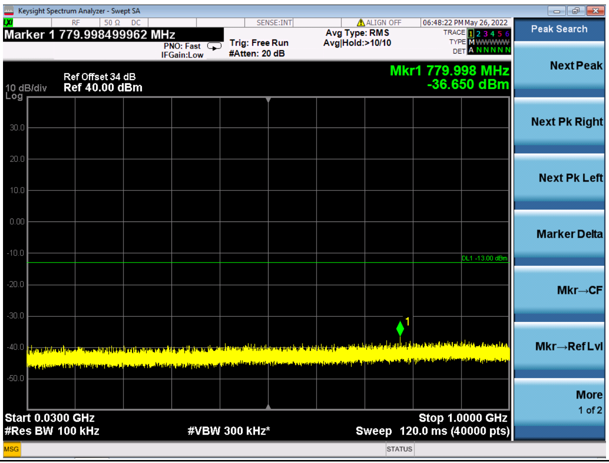
9KHz-150KHz



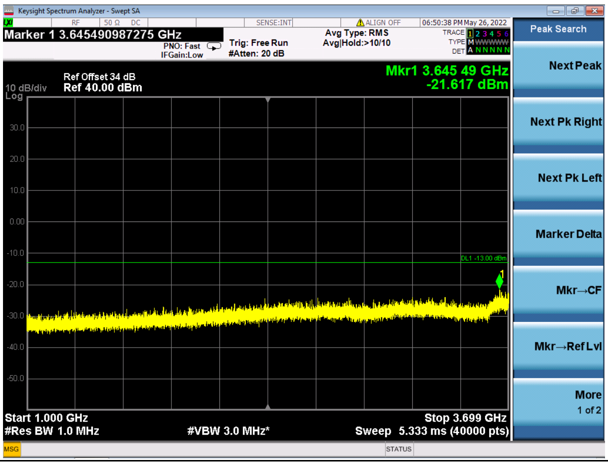
150KHz-30MHz



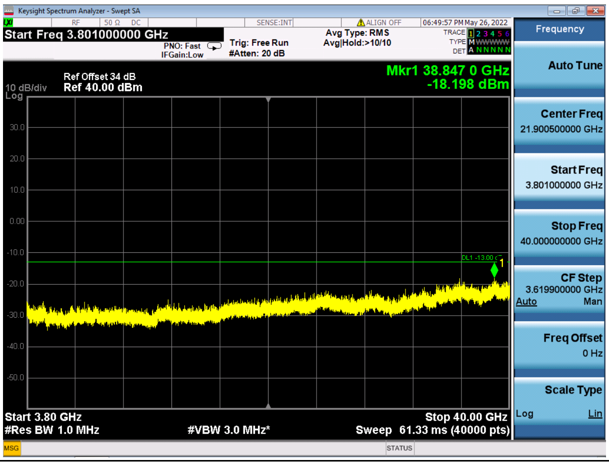
30MHz-1000MHz

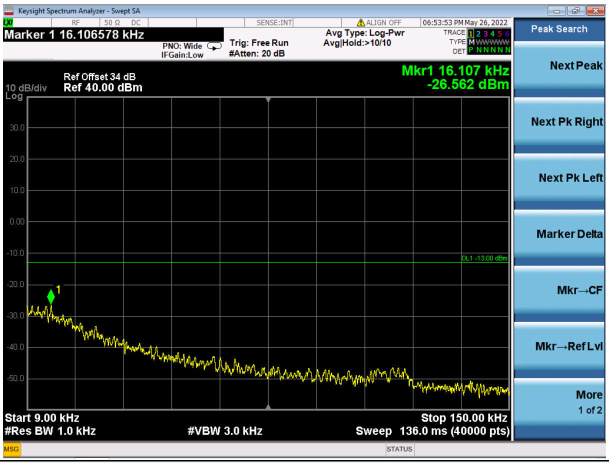
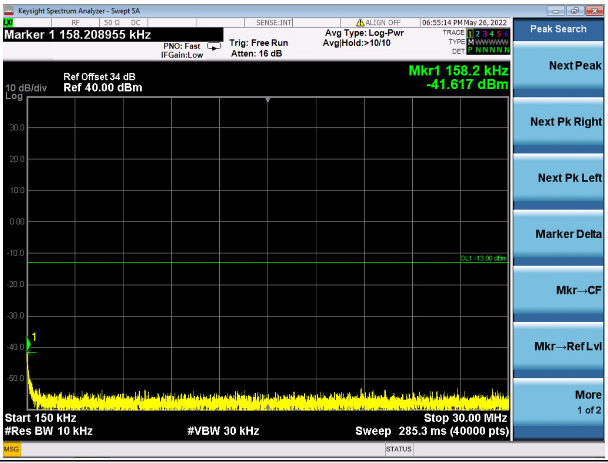
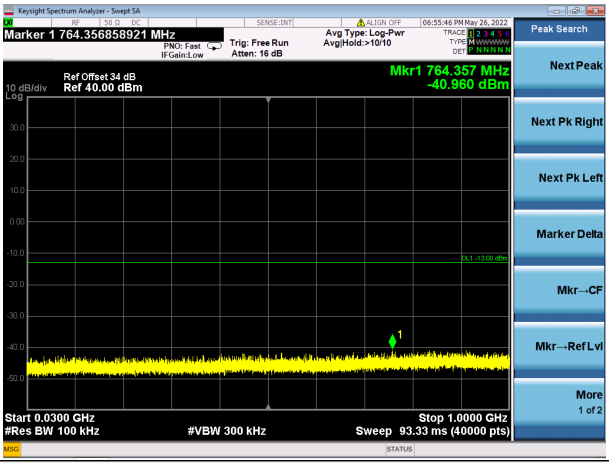
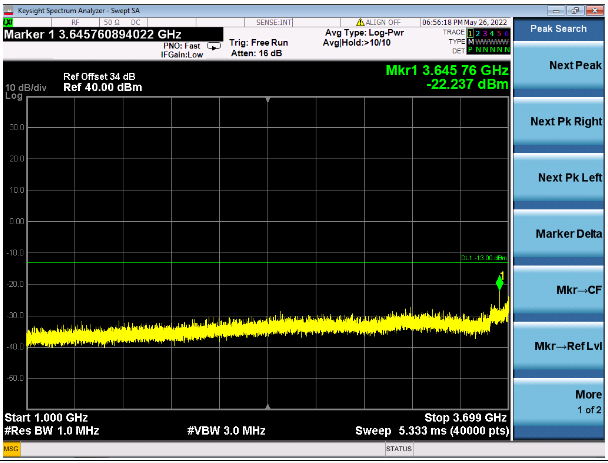
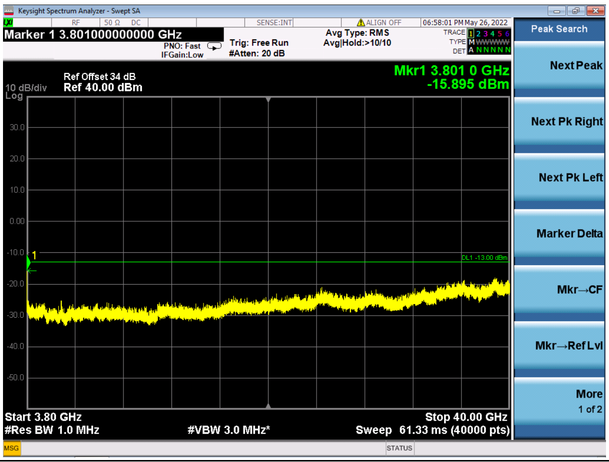


1000MHz-3699MHz



3801MHz-20000MHz



FDD LTE Band 43 _ GSM _ High Channel	
9KHz-150KHz	150KHz-30MHz
	
30MHz-1000MHz	1000MHz-3699MHz
	
3801MHz-20000MHz	
	

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

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

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:

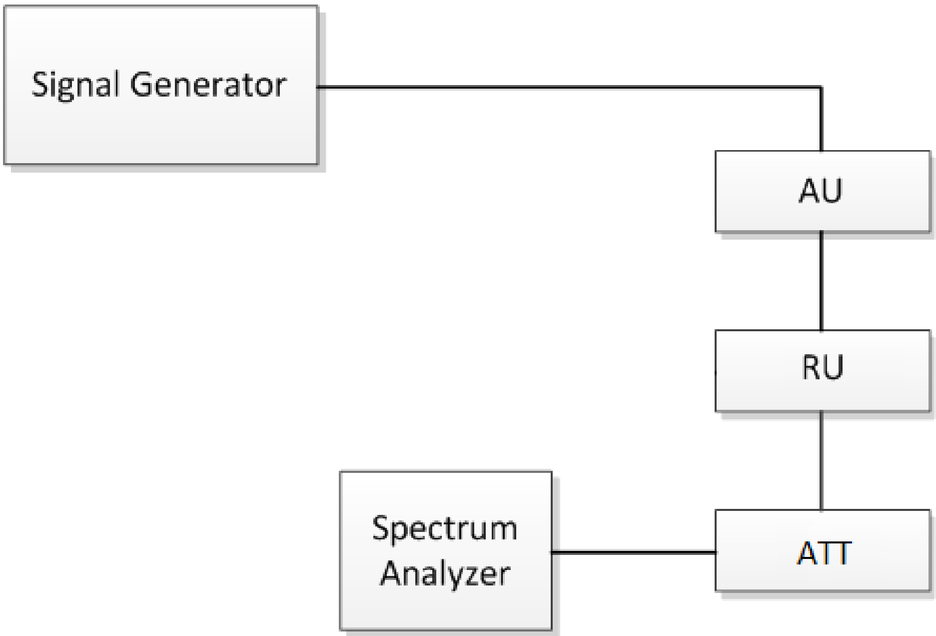


Fig.3. Band edge test configuration

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.

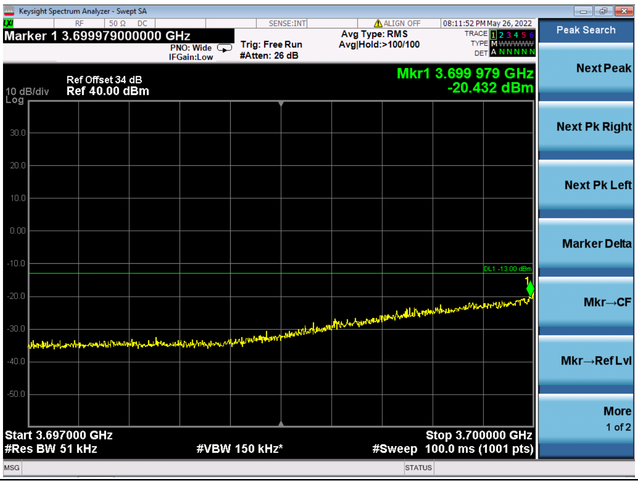
· Not needed for Single Channel systems.

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

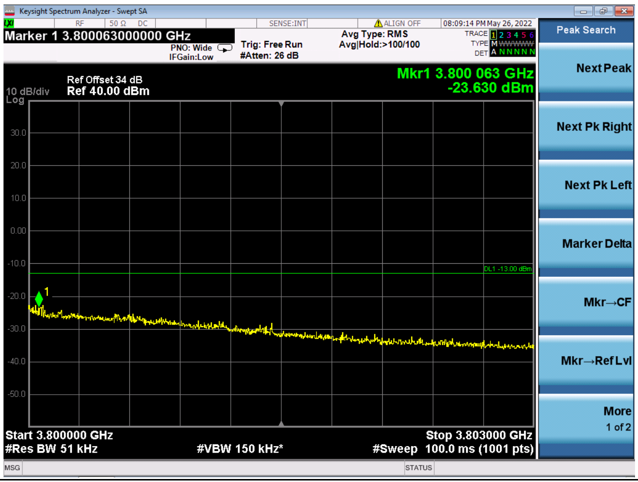
6.2.3.1 Measurement Record:

FDD LTE Band 43 _ AWGN _ One signal input

Pre-AGC _ Low Edge

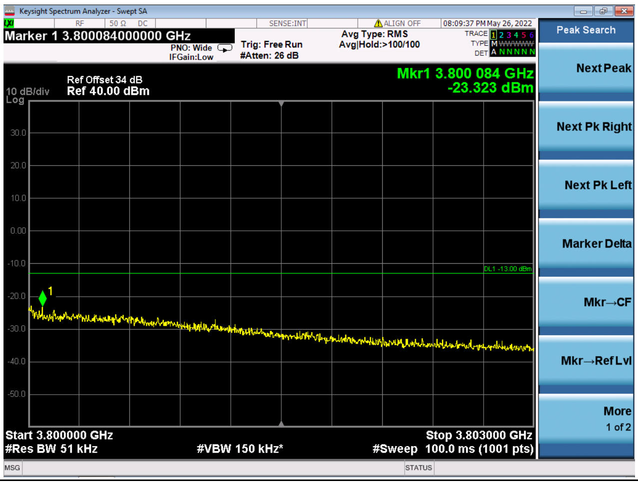


Pre-AGC _ Up Edge

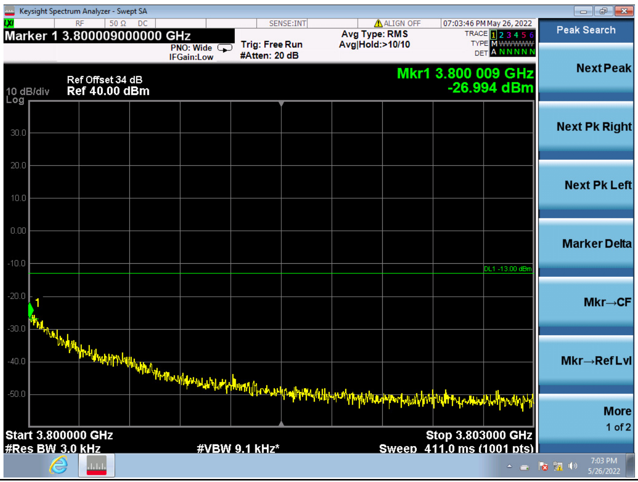
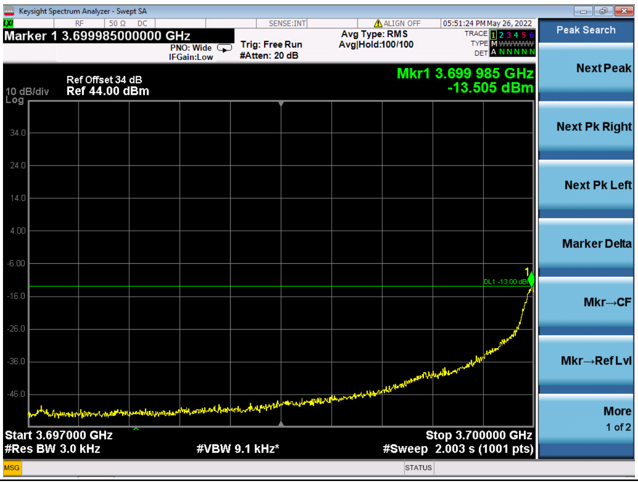
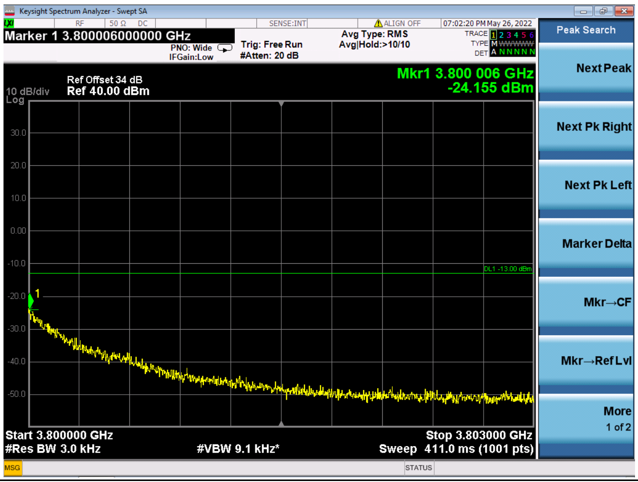


3dB Above AGC _ Low Edge

3dB Above AGC _ Up Edge

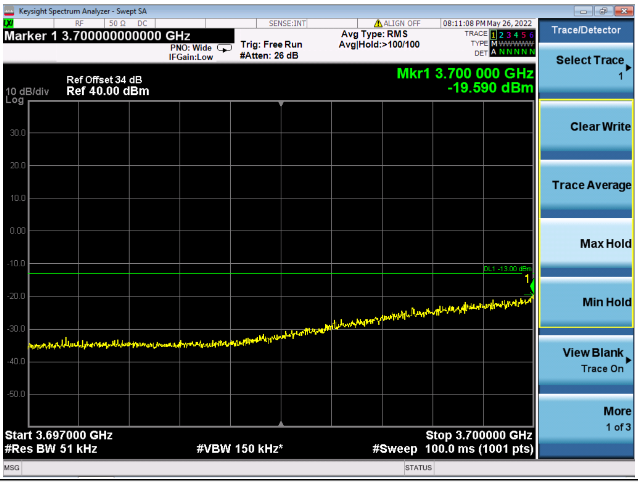


Fuyong lab. Xinlong TechnoPark, Fengtang Road, Fuyong Subdistrict, Bao'an, Shenzhen, China 518103 t (86–755) 88663988 f (86–755) 26710594 www.sgsgroup.com.cn
中国・深圳・宝安区福永街道凤塘大道鑫龙科技园福永实验室 邮编: 518103 t (86–755) 88663988 f (86–755) 26710594 sgs.china@sgs.com

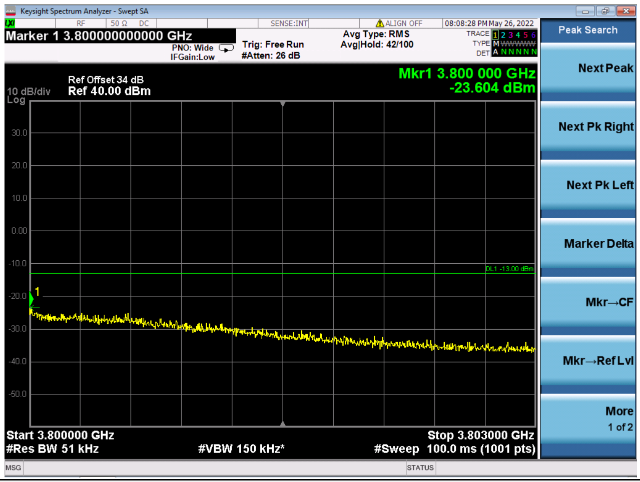
FDD LTE Band 43 _ GSM _ One signal input	
Pre-AGC _ Low Edge	Pre-AGC _ Up Edge
	
3dB Above AGC _ Low Edge	3dB Above AGC _ Up Edge
	

FDD LTE Band 43 _ AWGN _ Two signal input

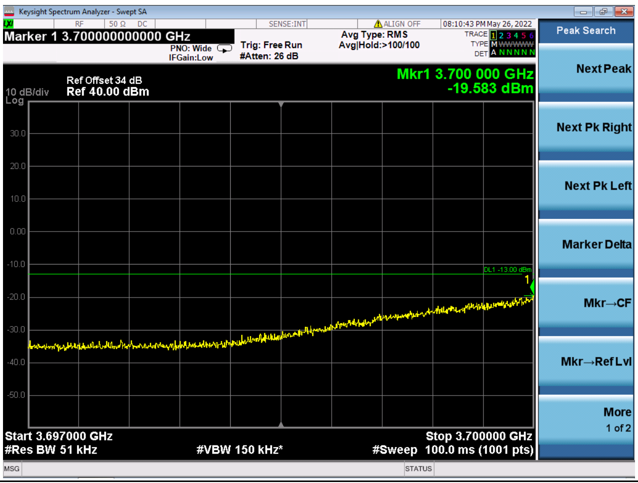
Pre-AGC _ Low Edge



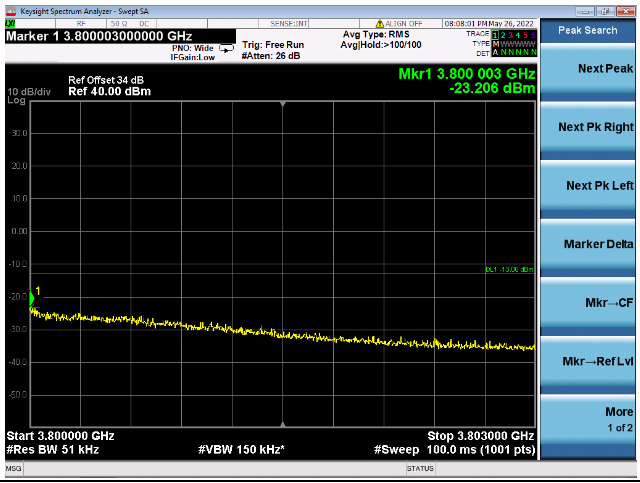
Pre-AGC _ Up Edge



3dB Above AGC _ Low Edge

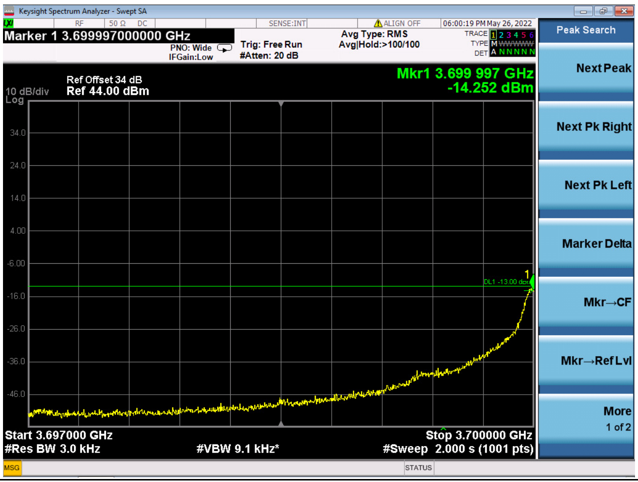


3dB Above AGC _ Up Edge

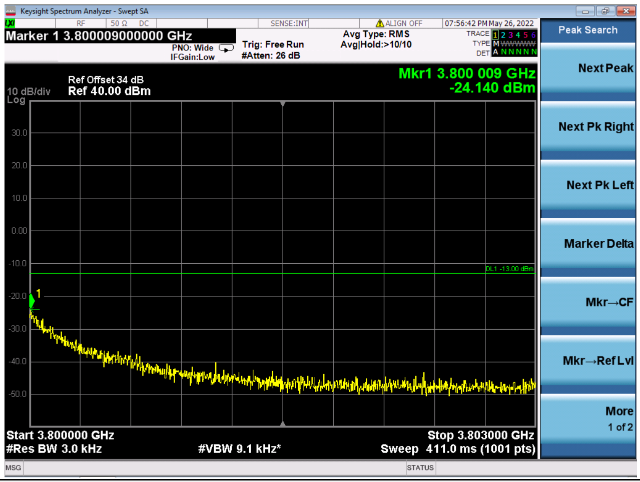


FDD LTE Band 43 _ GSM _ Two signal input

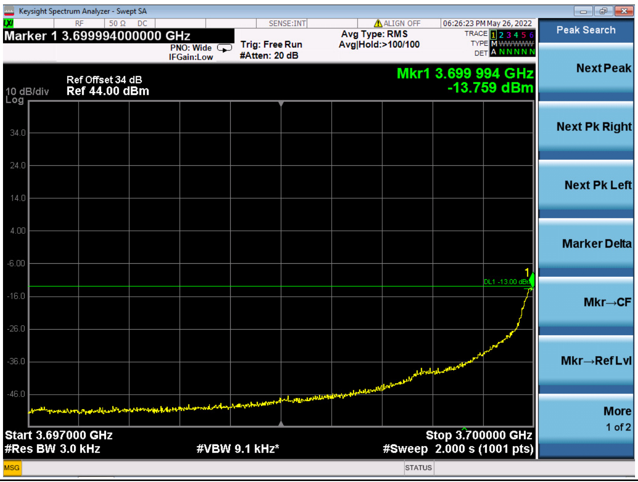
Pre-AGC _ Low Edge



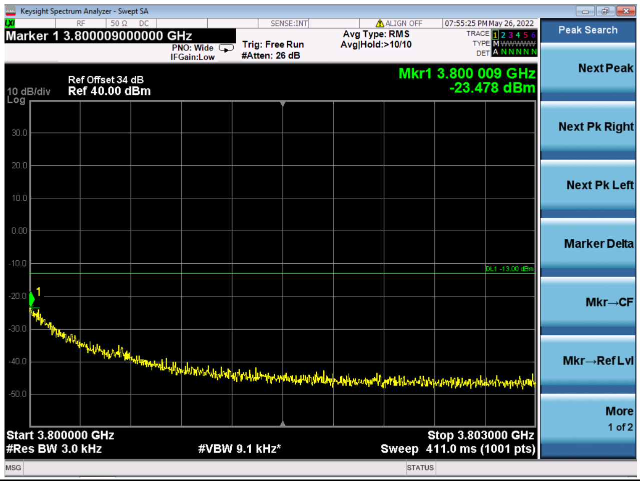
Pre-AGC _ Up Edge



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:

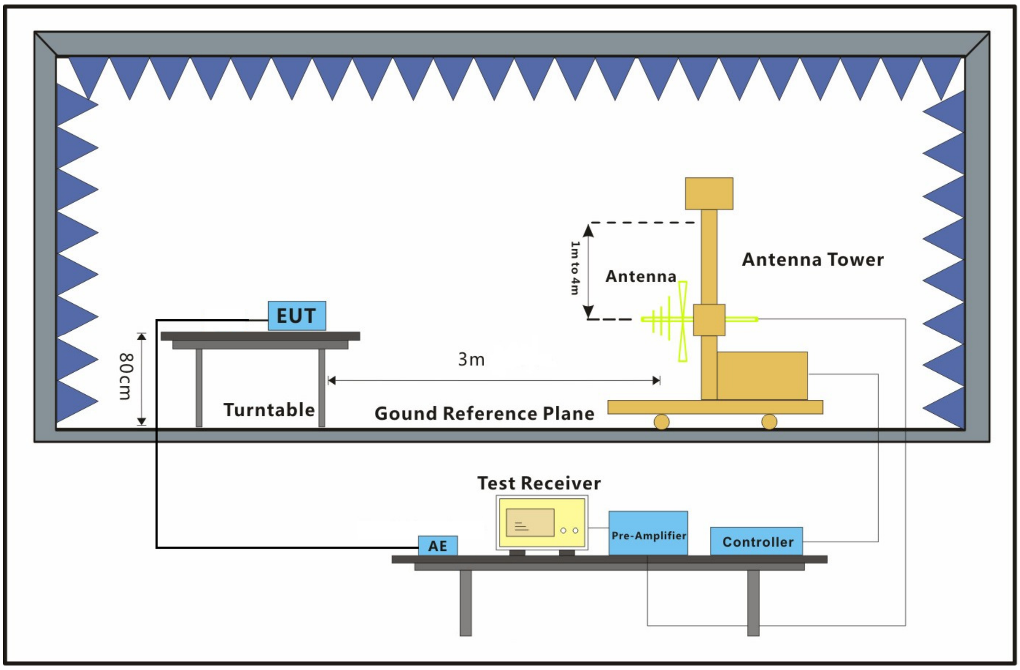
Status: Drive the EUT to maximum output power.

Conditions: Normal conditions

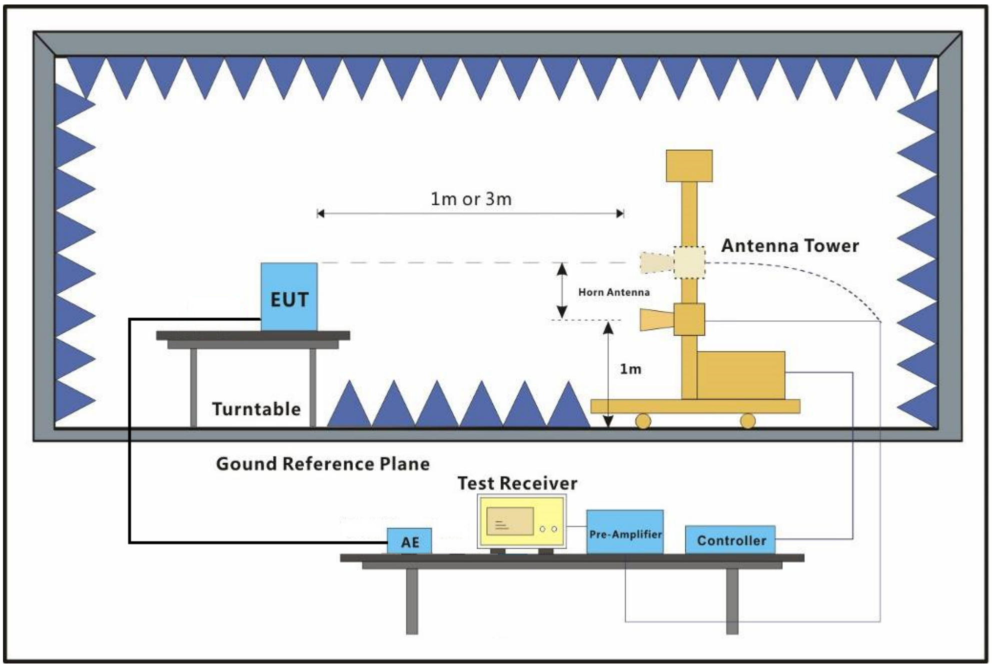
Application: Enclosure

Test Configuration:

30MHz to 1GHz emissions:



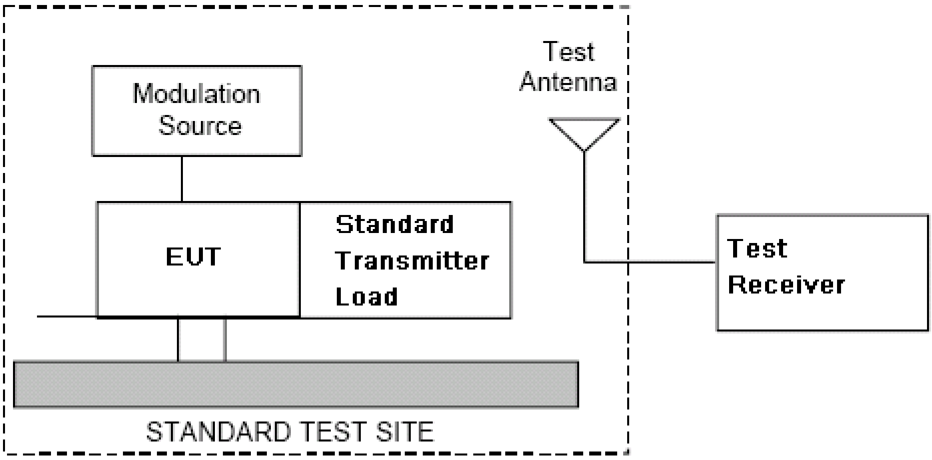
1GHz to 40GHz emissions:



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.

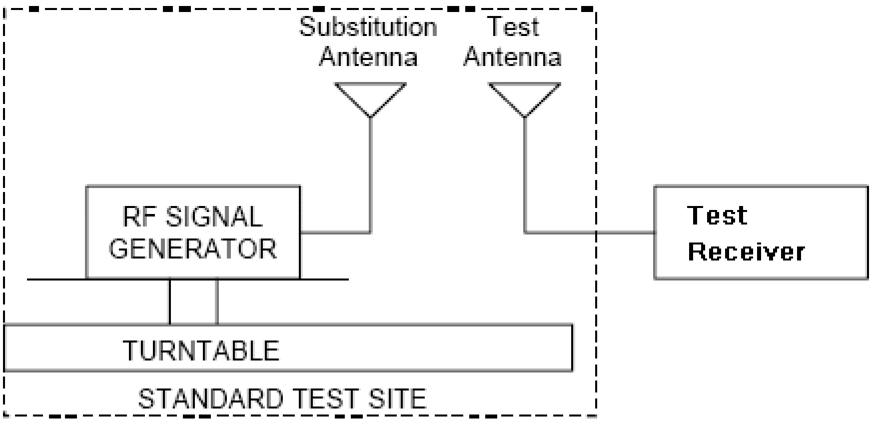
c) Place the transmitter to be tested on the turntable in the standard test site, The transmitter is transmitting into a no radiating load that is placed on the turntable. The RF cable to this load should be of minimum length.

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 43-3700MHz-3800MHz-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
2246.34	-50.56	-13	-37.56	-55.83	0.53	5.8	Horizontal	Pass
7966.83	-47	-13	-34	-59.21	0.99	13.2	Horizontal	Pass
18000	-35.07	-13	-22.07	-45.52	1.65	12.1	Horizontal	Pass
2625.79	-49.66	-13	-36.66	-52.22	0.59	5.3	Vertical	Pass
10822.92	-42.33	-13	-29.33	-54.34	1.49	13.5	Vertical	Pass
17896.25	-35.6	-13	-22.6	-46.48	1.52	12.4	Vertical	Pass

BAND 43-3700MHz-3800MHz-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
1983.8	-51.9	-13	-38.9	-57.38	0.52	6	Horizontal	Pass
5254.44	-46.37	-13	-33.37	-55.15	0.82	9.6	Horizontal	Pass
18000	-34.5	-13	-21.5	-44.95	1.65	12.1	Horizontal	Pass
2001.08	-50.62	-13	-37.62	-53.74	0.53	5.8	Vertical	Pass
7989.89	-45.76	-13	-32.76	-57.97	0.99	13.2	Vertical	Pass
12909.7	-42.28	-13	-29.28	-53.93	1.75	13.4	Vertical	Pass

BAND 43-3700MHz-3800MHz-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
1995.3	-51.73	-13	-38.73	-57.21	0.52	6	Horizontal	Pass
5898.44	-47.49	-13	-34.49	-56.94	0.85	10.3	Horizontal	Pass
11803.28	-40.08	-13	-27.08	-51.37	1.81	13.1	Horizontal	Pass
2001.08	-50.98	-13	-37.98	-54.1	0.53	5.8	Vertical	Pass
7875.25	-46.36	-13	-33.36	-58.57	0.99	13.2	Vertical	Pass
11803.28	-40.56	-13	-27.56	-51.85	1.81	13.1	Vertical	Pass

Remark:
Only recorded worst case of GSM 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:

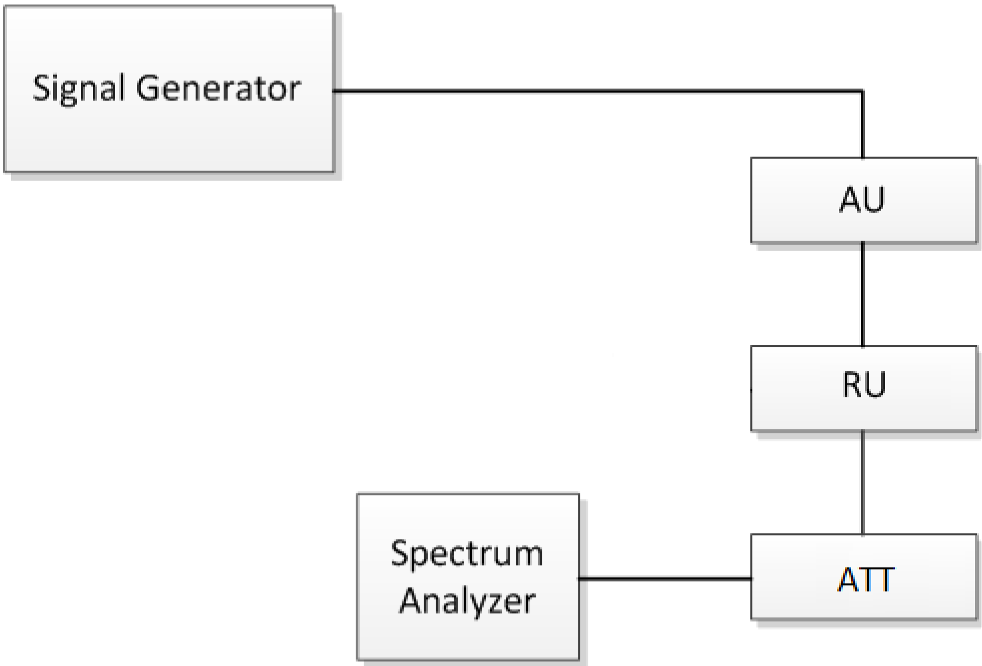


Fig.4. Occupied bandwidth test configuration

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.

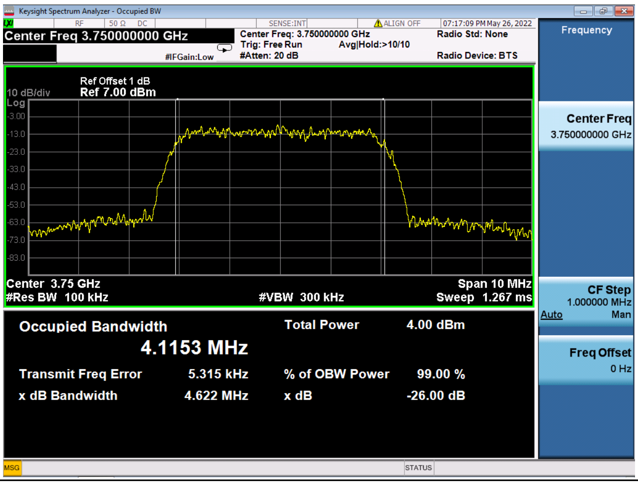
q) Repeat steps e) to p) for all frequency bands authorized for use by the EUT.

6.2.5.1 Measurement Record:

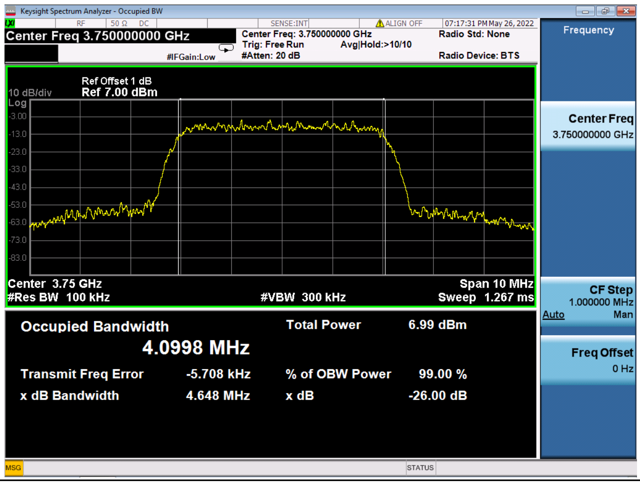
FDD LTE Band 43				
Signal Level	Test Channel	Signal Type	99% Occupied Channel Bandwidth (MHz)	
			AWGN	GSM
Pre-AGC	Middle Channel	Input	4.1153	0.24552
		Output	4.1080	0.24723
3dB Above AGC	Middle Channel	Input	4.0998	0.24525
		Output	4.1155	0.24686

FDD LTE Band 43 _ AWGN

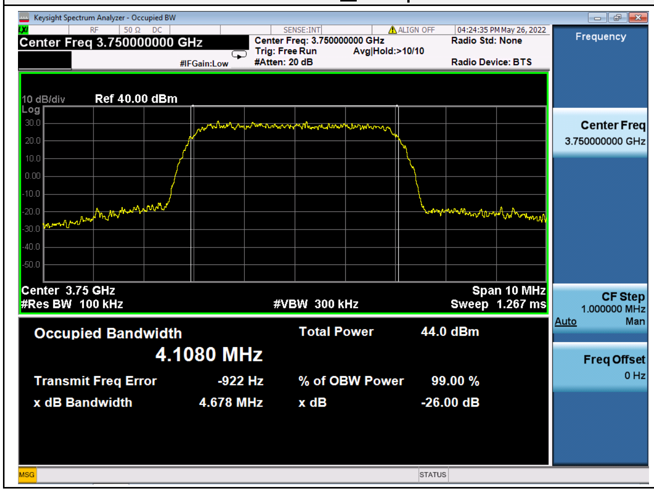
Pre-AGC _ Input



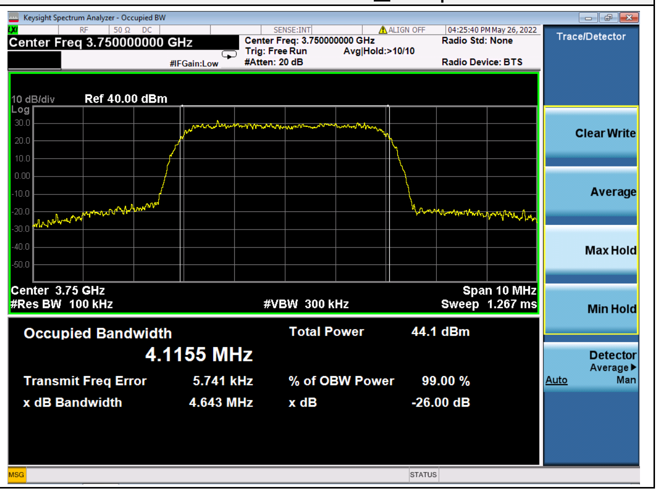
3dB Above AGC _ Input



Pre-AGC _ Output

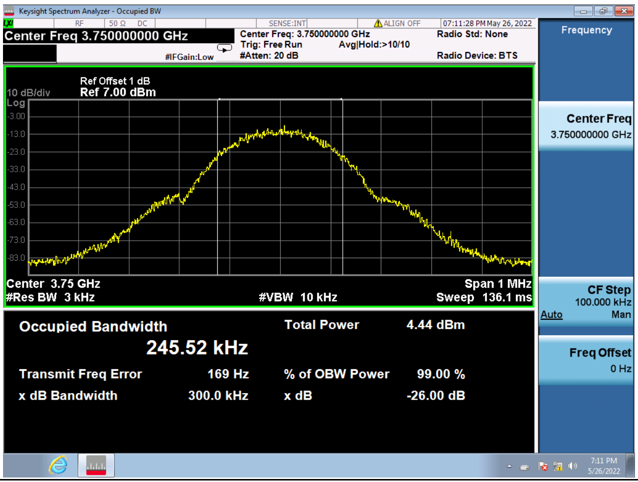


3dB Above AGC _ Output

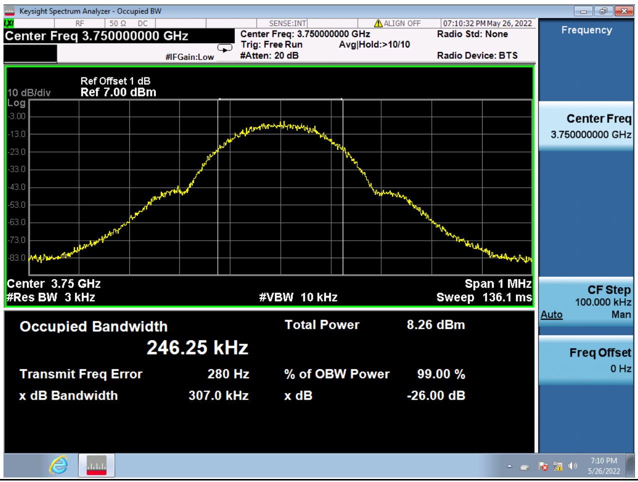


FDD LTE Band 43 _ GSM

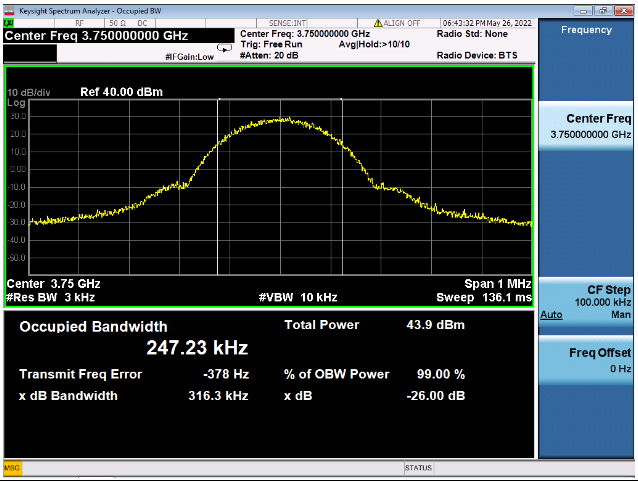
Pre-AGC _ Input



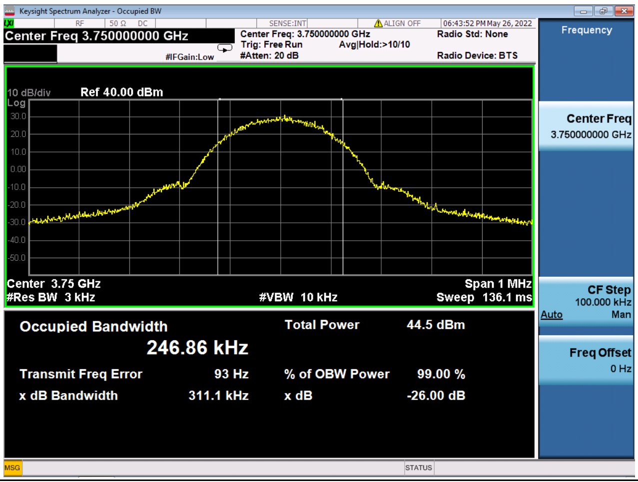
3dB Above AGC _ Input



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:

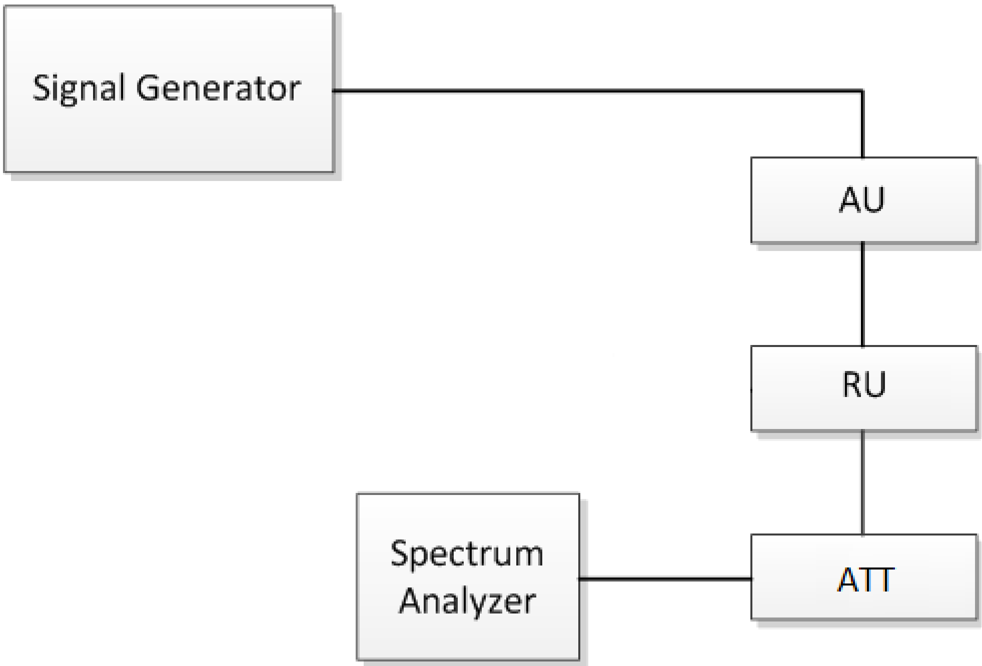


Fig.5. Out of Band rejection test configuration

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.

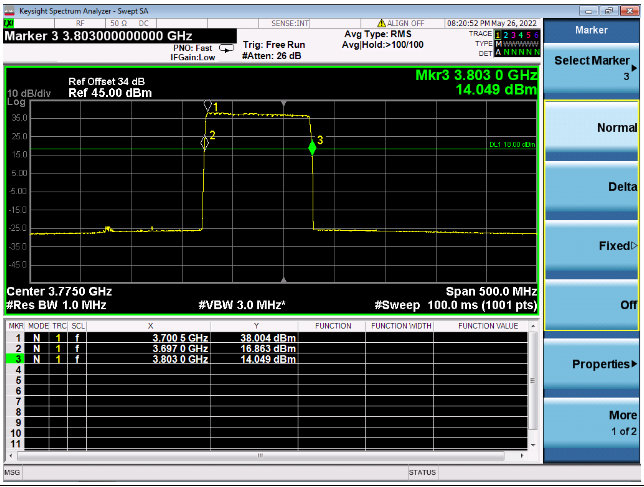
i) Capture the frequency response of the EUT.

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

Compliance Certification Services (Kunshan) Inc.
Shenzhen Branch

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

6.2.6.1 Measurement Record:

Out of Band Rejection	
FDD LTE Band 43	
	

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℃ and norminal voltage frequency value as reference point;
   d) vary the temperature from -40℃ to 55℃ with step 10℃
   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℃ 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 43 Downlink (Middle Channel: 3750MHz)

Temperature(℃)	Voltage (V dc)	Frequency Error (Hz)	Tolerance(ppm)
55	48	1.15	0.0003
50	48	1.14	0.0003
40	48	7.71	0.0021
30	48	2.88	0.0008
20	48	5.05	0.0013
10	48	-5.21	-0.0014
0	48	-8.41	-0.0022
-10	48	-7.13	-0.0019
-20	48	2.24	0.0006
-30	48	-11.61	-0.0031
-40	48	13.45	0.0036

Frequency Stability vs voltage:

1. Test for FDD LTE Band 43 Downlink (Middle Channel: 3750MHz)

Voltage (V dc)	Temperature(℃)	Frequency Error (Hz)	Tolerance(ppm)
40.8	20	14.63	0.0039
48	20	6.62	0.0018
55.2	20	14.93	0.004

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--