中认信通
CHINA CERTIFICATION ICT CO., LTD (DONGGUAN)

ACCREDITED
TESTING LABORATORY
CERTIFICATE # 6356.01

TEST REPORT

Applicant: **Sunwave Communications Co.,Ltd.**
Address: 581 Huoju Avenue,Binjiang District,Hangzhou,China

FCC ID: **2AEJ4R31166E**
Product Name: **Remote Unit**
Model Number: **iDAS-R311**
Standard(s): **47 CFR Part 27**
47 CFR Part 20.21
ANSI C63.26-2015
KDB 935210 D05 Indus Booster Basic Meas v01r04

The above equipment has been tested and found compliant with the requirement of the relative standards by China Certification ICT Co., Ltd (Dongguan)

Report Number: CR22020015-00
Date Of Issue: 2022-05-25
Reviewed By: Sun Zhong Sun Zhong
Title: Manager
Test Laboratory: **China Certification ICT Co., Ltd (Dongguan)**
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Test Facility

The Test site used by China Certification ICT Co., Ltd (Dongguan) to collect test data is located on the No. 113, Pingkang Road, Dalang Town, Dongguan, Guangdong, China.

The lab has been recognized as the FCC accredited lab under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No. : 442868, the FCC Designation No. : CN1314.

The lab has been recognized by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements, the CAB identifier: CN0123.

Declarations

China Certification ICT Co., Ltd (Dongguan) is not responsible for the authenticity of any test data provided by the applicant. Data included from the applicant that may affect test results are marked with a triangle symbol "▲". Customer model name, addresses, names, trademarks etc. are not considered data.

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested.

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CONTENTS

1. GENERAL INFORMATION

1.1 Product Description for Equipment under Test (EUT)

1.1.1 General:

EUT Name:	Remote Unit
EUT Model:	iDAS-R311
Equipment Type:	Industrial signal booster-Fiber-optic booster system remote Unit
Rated Input Voltage:	AC 120V/60Hz or DC 48V
Serial Number:	CR21110016-RF-S2
EUT Received Date:	2021.11.23
EUT Received Status:	Good
MIMO Type:	2TX2RX

1.1.2 Operation Frequency Band(s):

Bands	Uplink Frequency(RX) (MHz)	Downlink Frequency(TX) (MHz)
AWS	1710-1780	2110-2200

1.1.3 Antenna Information Detail▲:

Antenna	Manufacturer	Antenna Type	input impedance (Ohm)	Antenna Gain (dBi)	Requirement
1	ShenZhen VLG Wireless TECHNOLOGY CO,.LTD	External	50	12	**Compliance**
2		External	50	12	**Compliance**

Note: The above antenna is only recommended and will not actually be sold together with EUT.

1.1.4 Accessory Information:

Accessory Description	Manufacturer	Model	Parameters
/	/	/	/

1.2 Description of Test Configuration

1.2.1 EUT Operation Condition:

EUT Operation Mode:	The system was configured for testing in a test mode which has been done in the factory.
Equipment Modifications:	No
EUT Exercise Software:	No
Note: The device built in two fully identical RF board which work in MIMO and SISO mode, and we recorded worst test results for the modes in this report.	

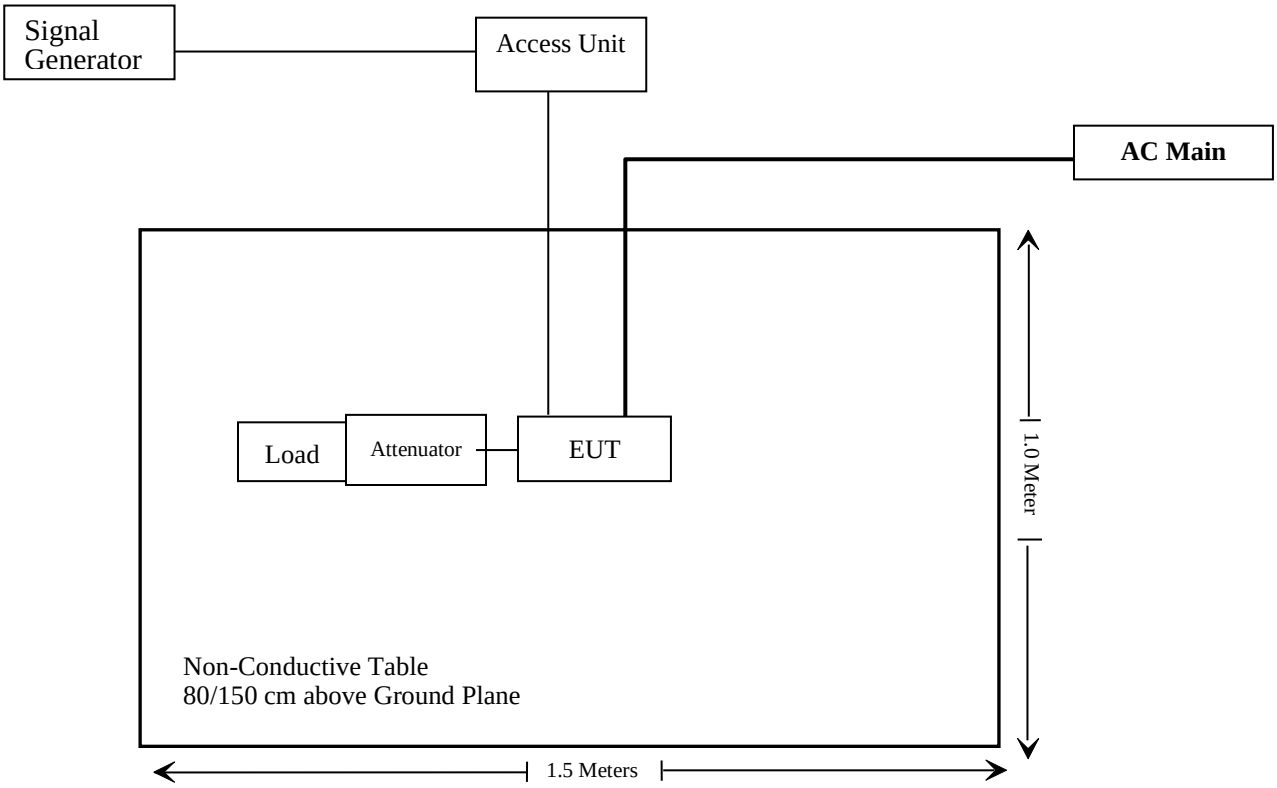
1.2.2 Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
Agilent	MXG Vector Signal Generator	N5182B	MY51350142
Sunwave Communications Co.,Ltd.	Access Unit	A2	CR21100016-RF-S8
E-Microwave	Coaxial Attenuator	EMCA40-200SN-6	OE01201046
Unknown	Load	Unknown	Unknown

1.2.3 Support Cable List and Details

Cable Description	Shielding Type	Ferrite Core	Length (m)	From Port	To
RF cable	Yes	No	2	Signal Generator	Access Unit
RF cable	Yes	No	1.5	EUT	load
AC cable	Yes	No	2	AC Main	EUT

1.2.4 Radiated Spurious Emissions Block Diagram of Test Setup



1.3 Measurement Uncertainty

Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty. The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval.

Parameter	Measurement Uncertainty
Occupied Channel Bandwidth	±5 %
RF output power, conducted	±0.61dB
Unwanted Emissions, radiated	30M~200MHz: 4.15 dB,200M~1GHz: 5.61 dB,1G~6GHz: 5.14 dB, 6G~18GHz: 5.93 dB,18G~26.5G:5.47 dB,26.5G~40G:5.63 dB
Unwanted Emissions, conducted	±1.26 dB
Temperature	±1℃
Humidity	±5%
DC and low frequency voltages	±0.4%
Duty Cycle	1%

2. SUMMARY OF TEST RESULTS

FCC Standard(s)/Rule(s)	Description of Test	Result
KDB 935210 D02 Clause II(p)(4)	AGC threshold level	Compliant
KDB 935210 D02 Clause II(p)(2)	Out-of-band rejection	Compliant
§2.1047,§27.50	Mean output power and amplifier gain	Compliant
§2.1049, KDB 935210 D02 Clause II(p)(3)	Occupied bandwidth and Input-versus-output signal comparison	Compliant
§2.1051,§27.53 KDB 935210 D02 Clause II(p)(1)	Out-of-band/block (including intermodulation) emissions	Compliant
§2.1051,§27.53	Spurious emissions at antenna terminals	Compliant
§2.1053§27.53	Radiated spurious emissions	Compliant
§2.1055, §27.54	Frequency tolerance	Not Applicable*
§1.1310 & §2.1091	Maximum Permissible Exposure (MPE)	Compliant

Not Applicable*: the device is a booster does not alter the input signal.

3. REQUIREMENTS AND TEST PROCEDURES

3.1 AGC threshold level

3.1.1 Applicable Standard

KDB 935210 D02 Signal Boosters Certification v04r02 II (p)(4):

For devices using automatic gain control (AGC) as a means for complying with service rule power limits, provide test results showing maximum output with and without AGC activated.

3.1.2 Test Procedure

KDB 935210 D05 Indus Booster Basic Meas v01r04 Clause 3.2

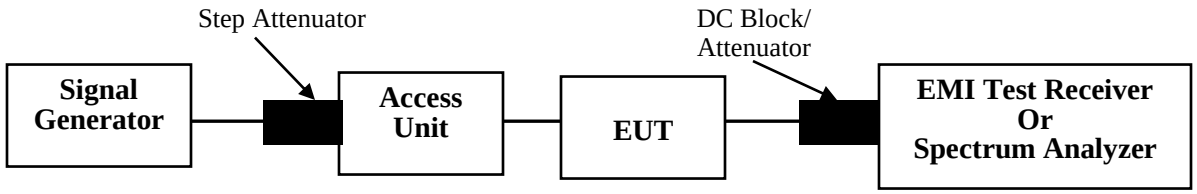
The AGC threshold is to be determined as follows.

In the case of fiber-optic distribution systems, the RF input port of the equipment under test (EUT) refers to the RF input of the supporting equipment RF to optical convertor; see also descriptions and diagrams for typical DAS booster systems in KDB Publication 935210 D02.

Devices intended to be directly connected to an RF source (donor port) only need to be evaluated for any over-the-air transmit paths.

a) Connect a signal generator to the input of the EUT.
b) Connect a spectrum analyzer or power meter to the output of the EUT using appropriate attenuation as necessary.
c) The signal generator should initially be configured to produce either of the required test signals (i.e., broadband or narrowband).
d) Set the signal generator frequency to the center frequency of the EUT operating band.
e) While monitoring the output power of the EUT, measured using the methods of 3.5.3 or 3.5.4, increase the input level until a 1 dB increase in the input signal power no longer causes a 1 dB increase in the output signal power.
f) Record this level as the AGC threshold level.
g) Repeat the procedure with the remaining test signal.

3.1.3 EUT Setup



3.2 Out-Of-Band Rejection

3.2.1 Applicable Standard

KDB 935210 D02 Signal Boosters Certification v04r02 II (p)(2):

Out-of-band rejection–testing for rejection of out-of-band signals may be appropriate. Alternatively, filter frequency response plots are acceptable.

3.2.2 Test Procedure

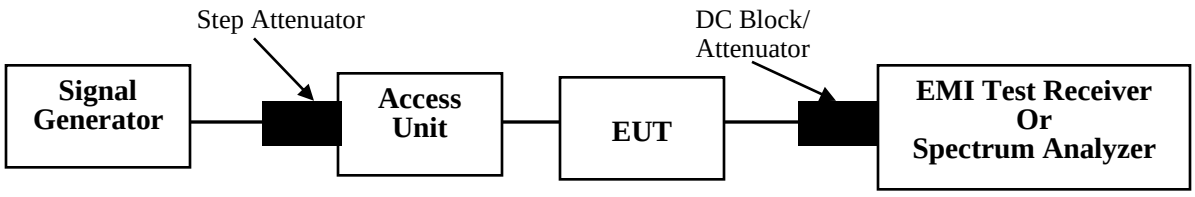
KDB 935210 D05 Indus Booster Basic Meas v01r04 Clause 3.3

A signal booster shall reject amplification of other signals outside of its passband. Adjust the internal gain control of the EUT (if so equipped) to the maximum gain for which equipment certification is sought.

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 20 dB bandwidth.
i) Capture the frequency response of the EUT.
j) Repeat for all frequency bands applicable for use by the EUT.

3.2.3 EUT Setup



3.3 Mean Output Power And Amplifier Gain

3.3.1 Applicable Standard

According to§ 27.50

(d)(2) The power of each fixed or base station transmitting in the 1995-2000 MHz, the 2110-2155 MHz 2155-2180 MHz band, or 2180-2200 MHz band and situated in any geographic location other than that described in paragraph (d)(1) of this section is limited to:
(i) An equivalent isotropically radiated power (EIRP) of 1640 watts when transmitting with an emission bandwidth of 1 MHz or less;
(ii) An EIRP of 1640 watts/MHz when transmitting with an emission bandwidth greater than 1 MHz.

3.3.2 Test Procedure

KDB 935210 D05 Indus Booster Basic Meas v01r04 Clause 3.5

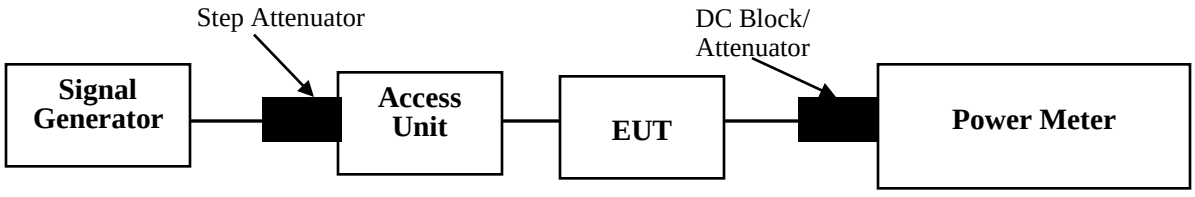
a) Connect a signal generator to the input of the EUT.
b) Configure to generate the AWGN (broadband) test signal.
c) The frequency of the signal generator shall be set to the frequency of (f0) as determined from 3.3.
d) Connect a spectrum analyzer or power meter to the output of the EUT using appropriate 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 the output power of the EUT and record (see 3.5.3 or 3.5.4 for power measurement guidance).
g) Remove the EUT from the measurement setup and using the same signal generator settings, repeat the power measurement on the input signal to the EUT and record as input power.
h) Repeat the procedure with the narrowband test signal.
i) Repeat the procedure for both test signals with input signal amplitude set to 3 dB above the AGC threshold level.
j) Repeat for all frequency bands authorized for use by the EUT.

Method 1: Power measurement with a spectrum or signal analyzer
Guidance for performing input/output power measurements using a spectrum or signal analyzer is provided in 5.2 of KDB Publication 971168.

Calculating the mean amplifier, booster, or repeater gain
NOTE–§§ 20.21 and 2.1033(c) do not require gain test data; inclusion of industrial booster gain test data in test reports submitted for FCC equipment authorization is optional.
After the mean input and output power levels have been measured as described above, the mean gain of the EUT can be determined from:

Gain (dB) = output power (dBm) − input power (dBm).
Report the mean gain for each authorized operating frequency band and each test signal stimulus.

3.3.3 EUT Setup



3.4 Occupied Bandwidth And Input-Versus-Output Signal Comparison

3.4.1 Applicable Standard

According to§ 2.1049 and KDB935210 D02 Signal Boosters Certification v04r02, II (p)(3)

Report worst case results for occupied bandwidth comparison and intermodulation tests done with and without any AGC circuitry activated, for devices so equipped.

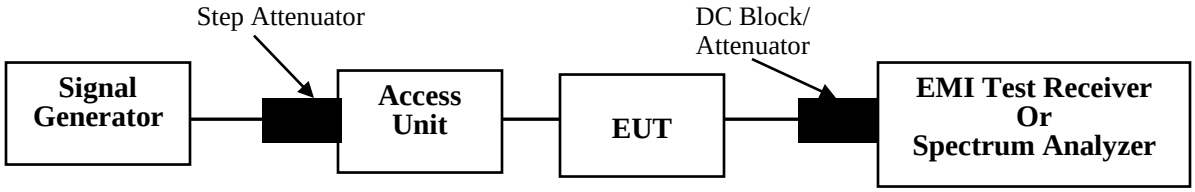
3.4.2 Test Procedure

KDB 935210 D05 Indus Booster Basic Meas v01r04 Clause 3.4

A 26 dB bandwidth measurement shall be performed on the input signal and the output signal (alternatively, the 99% OBW can be measured and used) to demonstrate compliance to the technical requirements specified in §90.219(e)(4)(i) and (ii). See KDB Publication 971168 for more information regarding measuring the OBW.

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 EBW or alternatively, the OBW.
f) The nominal resolution bandwidth (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.
NOTE—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 2 dB emission bandwidth is the positive frequency difference between the two markers.
NOTE—The spectral envelope may cross the −26 dB down amplitude at multiple points. If so, the lowest or highest frequency shall be selected as the frequencies 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 steps a) to n) with the signal generator set to the narrowband signal.
p) Repeat the procedure for both test signals with the input signal amplitude set 3 dB above the AGC threshold.
q) Repeat for all frequency bands authorized for use by the EUT.

3.4.3 EUT Setup



3.5 Out-Of-Band/Block Emissions(Including Intermodulation Products)

3.5.1 Applicable Standard

According to §27.53

(h) (1) ***General protection levels.*** Except as otherwise specified below, for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10}$ (P) dB.

(2) *Additional protection levels.* Notwithstanding the foregoing paragraph (h)(1) of this section:
(i) Operations in the 2180-2200 MHz band are subject to the out-of-band emission requirements set forth in §27.1134 for the protection of federal government operations operating in the 2200-2290 MHz band.

3.5.2 Test Procedure

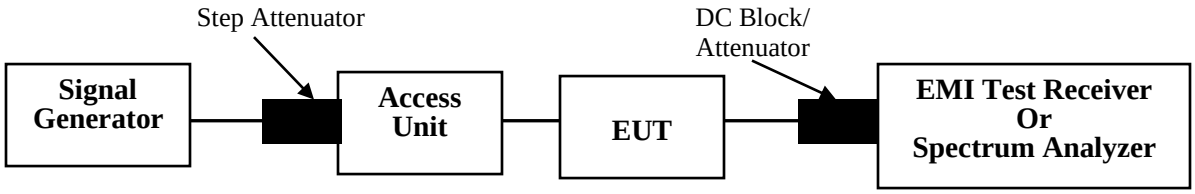
KDB 935210 D05 Indus Booster Basic Meas v01r04 Clause 3.6.2

a) Connect a signal generator to the input of the EUT.
NOTE—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 the two-tone 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 of interest.

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, 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.
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 emission bandwidth, 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 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 (i.e., 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 the procedure with the composite input power level set to 3 dB above the AGC threshold.
o) Reset the input signals frequencies to the lower edge of the frequency block or band under examination.
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.

3.5.3 EUT Setup



3.6 Spurious Emissions At Antenna Terminals

3.6.1 Applicable Standard

According to §27.53

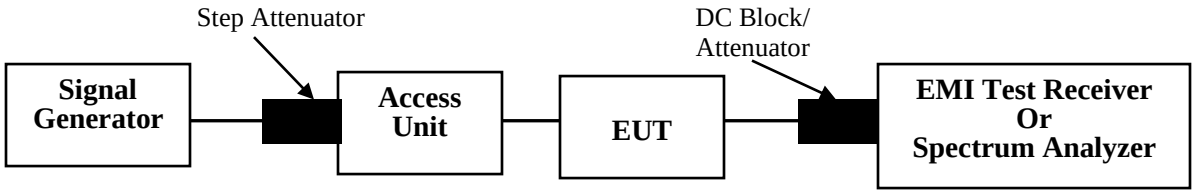
(h) (1) ***General protection levels.*** Except as otherwise specified below, for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10}$ (P) dB.

(2) *Additional protection levels.* Notwithstanding the foregoing paragraph (h)(1) of this section:
(i) Operations in the 2180-2200 MHz band are subject to the out-of-band emission requirements set forth in §27.1134 for the protection of federal government operations operating in the 2200-2290 MHz band.

3.6.2 Test Procedure

KDB 935210 D05 Indus Booster Basic Meas v01r04, Clause 3.6.3:
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 (e.g., 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 analyzer start frequency to the lowest radio frequency 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.
NOTE—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.
j) Select the power averaging (rms) detector function.
k) Trace average at least 10 traces in power averaging (i.e., 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 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 analyzer stop frequency to 10 times the highest frequency of the fundamental emission (see §2.1057). Note that 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 (i.e., 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 and provide tabular data, if required.
p) Repeat the procedure with the input test signals tuned to a middle band/block frequency/channel and then a high band/block frequency/channel.
q) Repeat entire procedure with the narrowband test signal.
r) Repeat for all authorized frequency bands/blocks used by the EUT.

3.6.3 EUT Setup



3.7 Radiated Spurious Emissions

3.7.1 Applicable Standard

According to§2.1053 Measurements required: Field strength of spurious radiation.

According to §27.53

(h) (1) ***General protection levels.*** Except as otherwise specified below, for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10}$ (P) dB.

(2) *Additional protection levels.* Notwithstanding the foregoing paragraph (h)(1) of this section:
(i) Operations in the 2180-2200 MHz band are subject to the out-of-band emission requirements set forth in §27.1134 for the protection of federal government operations operating in the 2200-2290 MHz band.

3.7.2 Test Procedure

The transmitter was placed on a turntable, and it was transmitting into a non-radiating load which was also placed on the turntable.

The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT.

The frequency range up to tenth harmonic of the fundamental frequency was investigated.

Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution.

4. ANTENNA PORT TEST DATA AND RESULTS

4.1 Test Conditions:

Serial Number:	CR21110016-RF-S2		Test Date:	2022.01.25~2022.05.24	
Test Site:	RF		Test Mode:	Transmitting	
Tester:	Morpheus shi		Test Result:	Pass	
Temperature: (℃)	16.8~22.9	Relative Humidity: (%)	60~64	ATM Pressure: (kPa)	101~101.7

4.2 Test Equipment List and Details:

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSU26	200256	2021-07-22	2022-07-21
YINSAIGE	Coaxial Cable	SS402	SJ0100002	Each time	N/A
YINSAIGE	Coaxial Cable	SS402	SJ0100003	Each time	N/A
YINSAIGE	Coaxial Cable	SS402	SJ0100004	Each time	N/A
Mini-Circuits	DC Block	BLK-18-S+	1554404	Each time	N/A
Weinschel	Coaxial Attenuators	53-20-34	LN749	Each time	N/A
HP	Step Attenuator	8494B	1510A05007	Each time	N/A
Agilent	MXG Vector Signal Generator	N5182B	MY51350142	2021-04-25	2022-04-24
Agilent	MXG Vector Signal Generator	N5182B	MY51350142	2022-04-25	2023-04-24
R&S	Spectrum Analyzer	FSV40	101943	2021-10-10	2022-10-09
Agilent	USB Wideband Power Sensor	U2021XA	MY54080015	2021-07-22	2022-07-21

** Statement of Traceability: China Certification ICT Co., Ltd (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).*

4.3 Test Data:

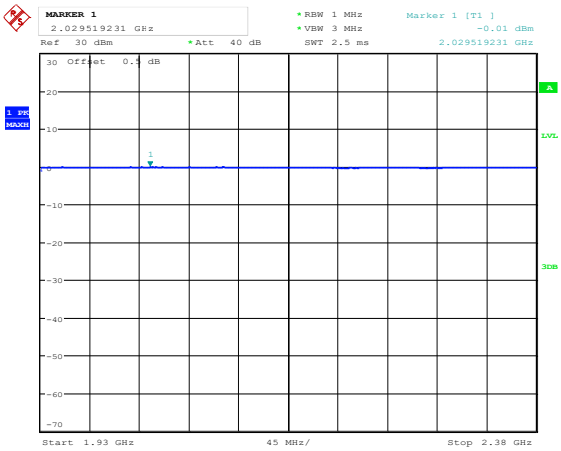
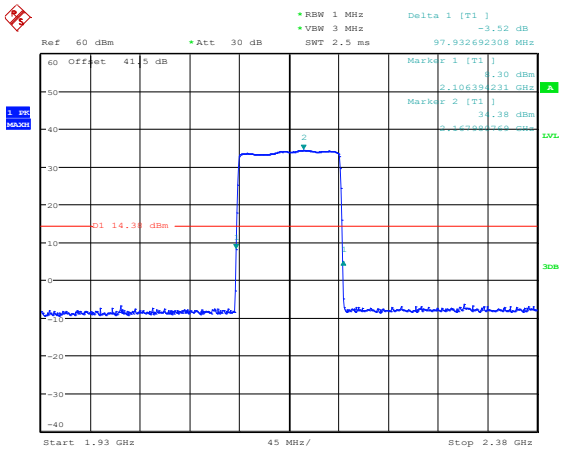
4.3.1 AGC Input Level

Operation Band	Signal Type	AGC Input Level (dBm)
AWS	AWGN	1.1
	GSM	1.1

4.3.2 Out-Of-Band Rejection

Operation Band	20 dB Bandwidth (MHz)
AWS	97.93

Note: The EUT supports SISO mode. Each antenna can be used as SISO port. We only exhibit the worst test data that works at ant 1 port.

Bands	Input	Output
AWS		

4.3.3 Mean Output Power And Amplifier Gain:

For SISO Mode:

Operational Frequencies(MHz)	Link	Frequency F_0 (MHz)	Signal Type	Signal Level	Input Power(dBm)	Output Power(dBm)		Total Output Power (dBm)	Gain(dB)
						Ant 1	Ant 2		
2110-2200	Downlink	2167.98	AWGN	AGC	0.84	42.85	/	42.85	42.01
				3dB above AGC	3.91	42.79	/	42.79	39.08
			GSM	AGC	0.67	42.94	/	42.94	42.27
				3dB above AGC	3.68	42.87	/	42.87	39.19

For MIMO Mode:

Operational Frequencies(MHz)	Link	Frequency F_0 (MHz)	Signal Type	Signal	Input Power(dBm)	Output Power(dBm)		Total Output Power (dBm)	Gain(dB)
						Ant 1	Ant 2		
2110-2200	Downlink	2167.98	AWGN	AGC	0.84	42.85	42.62	45.75	/
				3dB above AGC	3.91	42.79	42.69	45.75	/
			GSM	AGC	0.67	42.94	42.66	45.81	/
				3dB above AGC	3.68	42.87	42.66	45.78	/

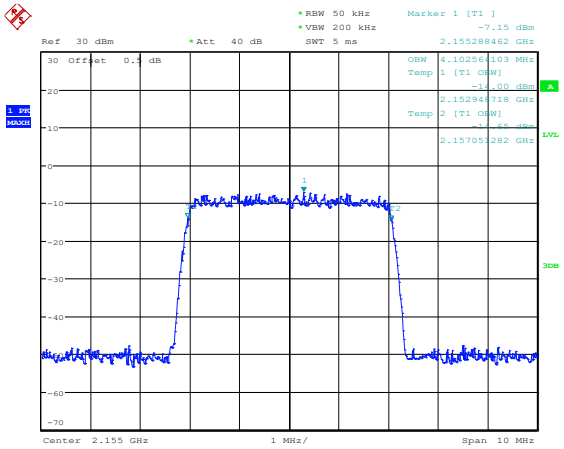
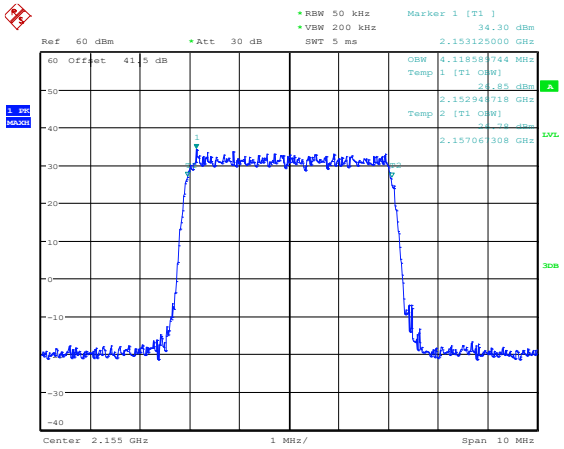
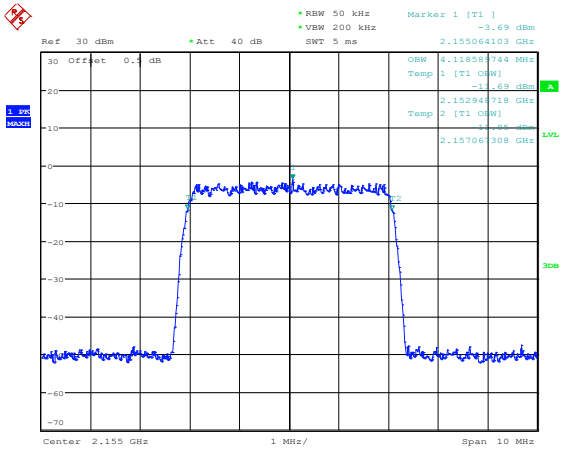
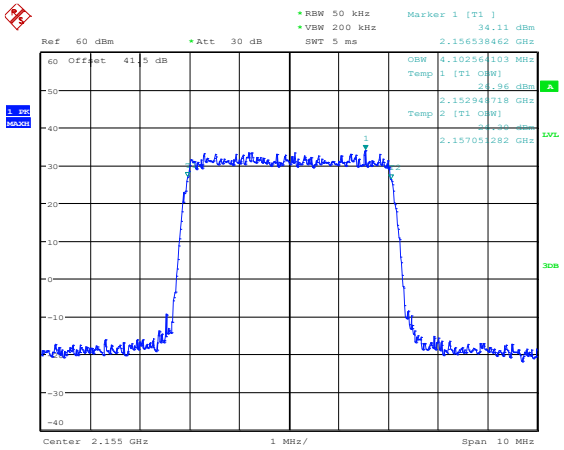
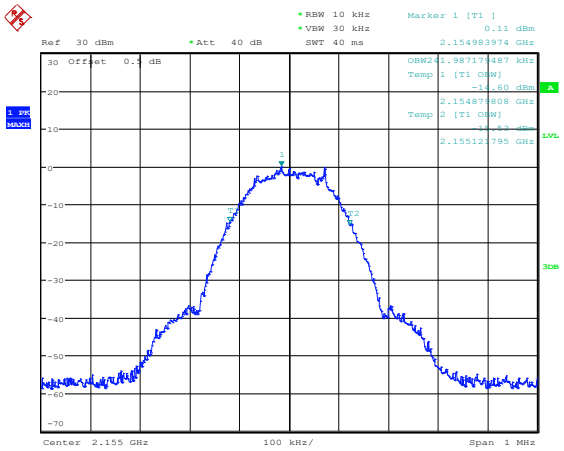
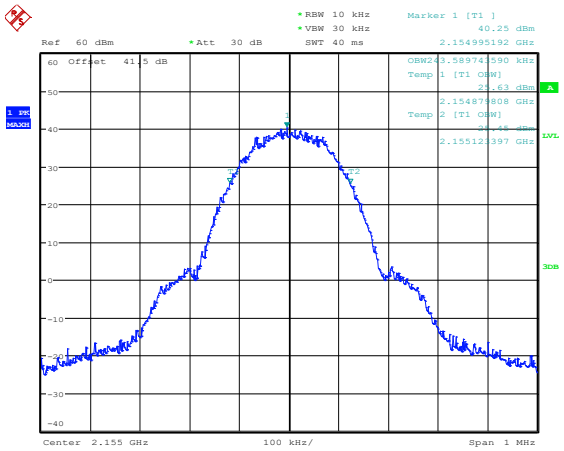
Note:
1. The EIRP of EUT is 57.81dBm which is less than the EIRP limit of which is 1640W/MHz.
2. The EUT supports SISO mode. Each antenna can be used as SISO port. We only exhibit the worst test data that works at ant 1 port.
3. This EUT supports 2*2 MIMO mode.
4. For MIMO mode the output signals are considered completely uncorrelated, so the antenna gain is 12dBi

4.3.4 Occupied Bandwidth And Input-Versus-Output Signal Comparison:

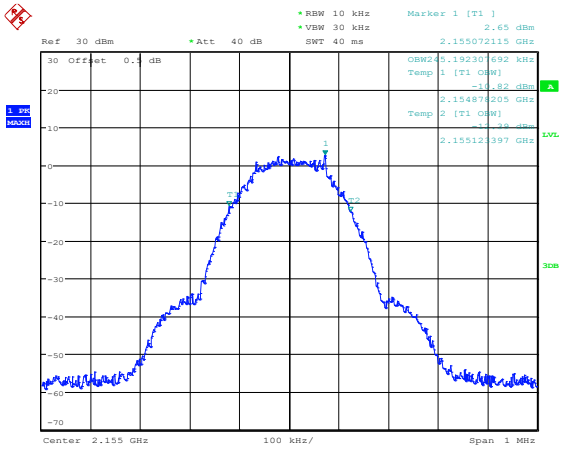
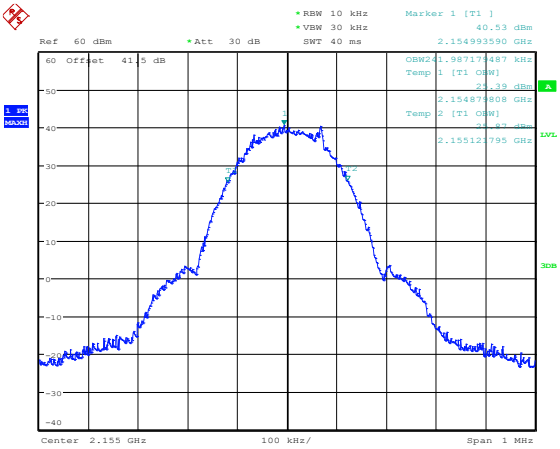
Operation Band	Signal Type	Signal Level	99% Occupied Bandwidth (MHz)		26dB Bandwidth (MHz)		Spectral growth of the 26 dB bandwidth (%)
			Input	Output	Input	Output	
AWS	AWGN	AGC	4.103	4.119	4.471	4.471	0.00
		3dB above AGC	4.119	4.103	4.471	4.471	0.00
	GSM	AGC	0.242	0.244	0.319	0.317	0.63
		3dB above AGC	0.245	0.242	0.319	0.316	0.95

Note: For this item, it has no MIMO testing requirements, since the EUT supports 1*1 SISO, we only exhibit the worst test data that works at ant 1 port.

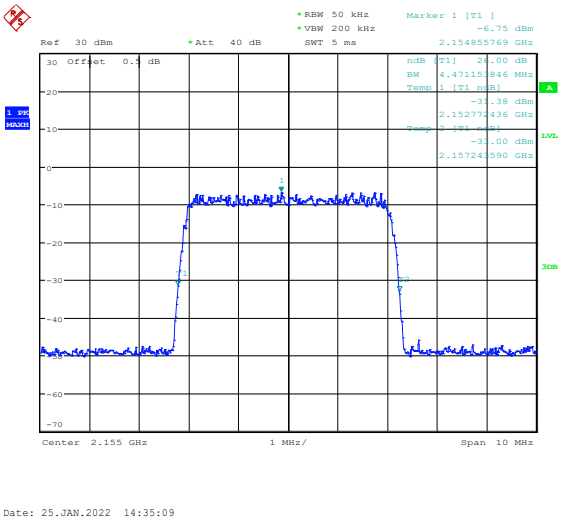
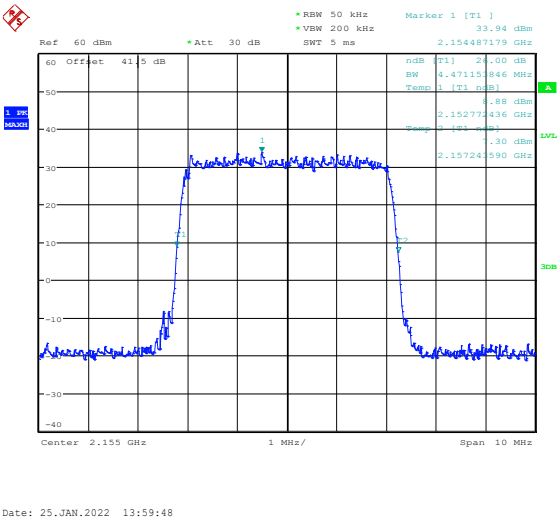
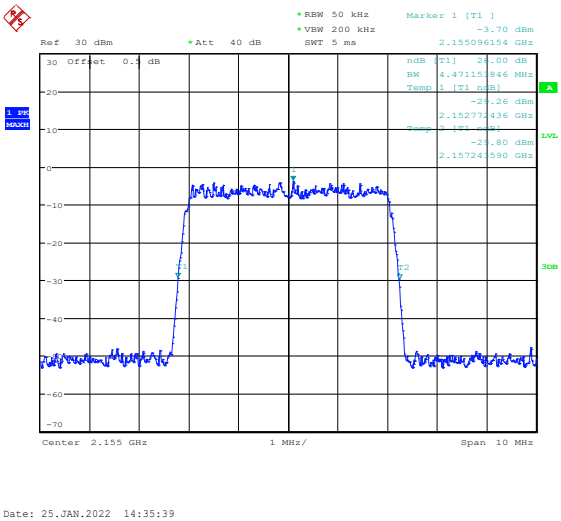
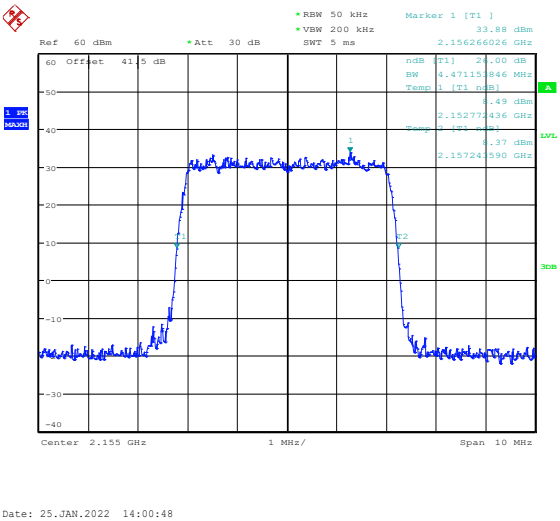
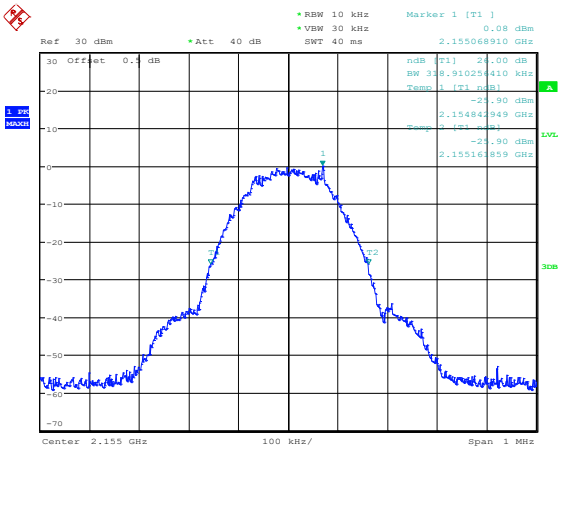
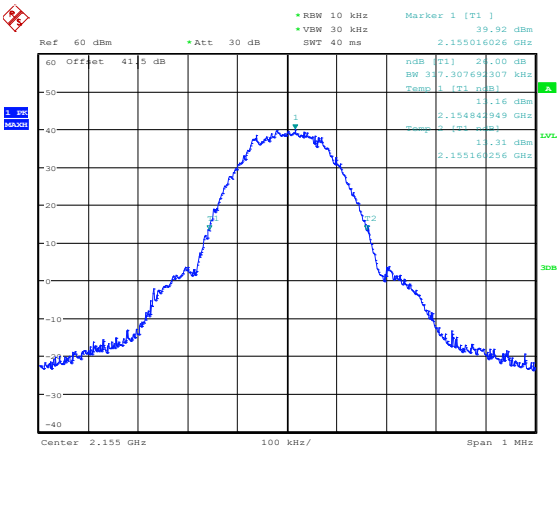
99% Occupied Bandwidth

Mode	Input	Output
AWS Band AWGN Pre-AGC		
AWS Band AWGN AGC + 3dB		
AWS Band GSM Pre-AGC		

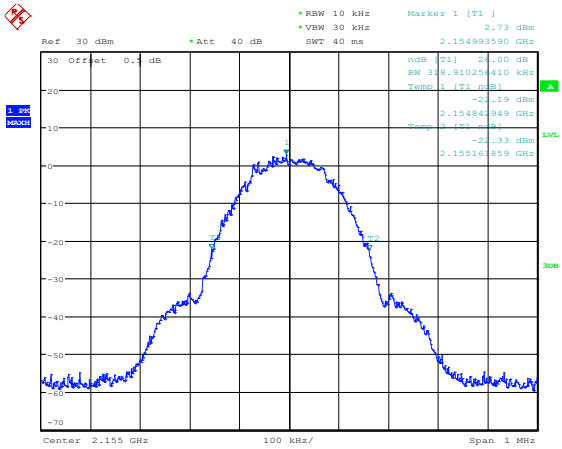
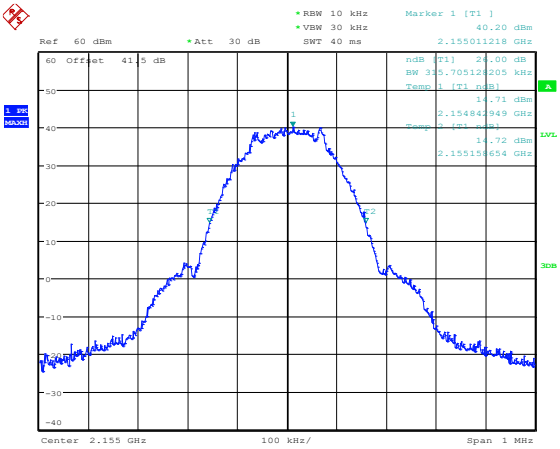
99% Occupied Bandwidth

Mode	Input	Output
AWS Band GSM AGC + 3dB		

26dB Bandwidth

Mode	Input	Output
AWS Band AWGN Pre-AGC		
AWS Band AWGN AGC + 3dB		
AWS Band GSM Pre-AGC		

26dB Bandwidth

Mode	Input	Output
AWS Band GSM AGC + 3dB	 Date: 25.JAN.2022 14:37:16	 Date: 25.JAN.2022 14:02:06

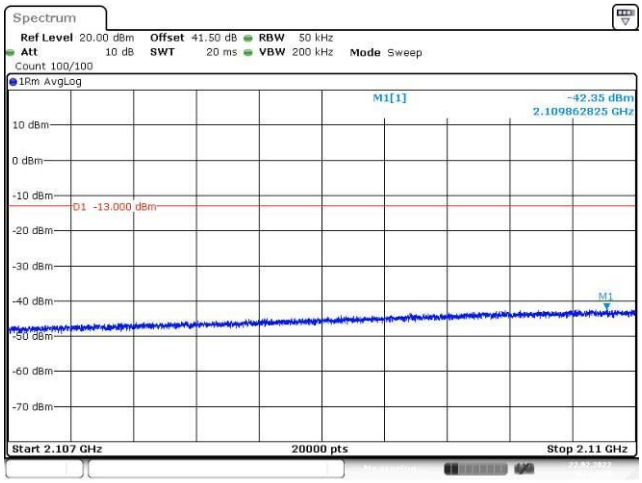
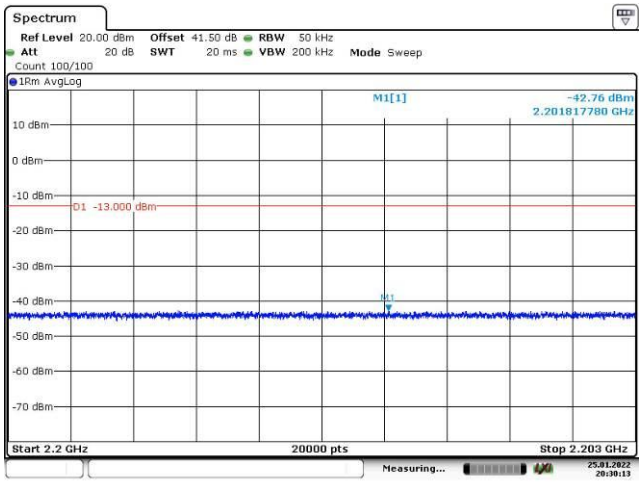
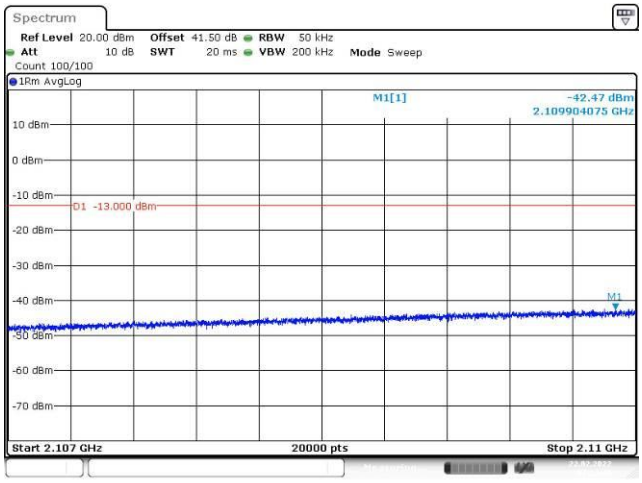
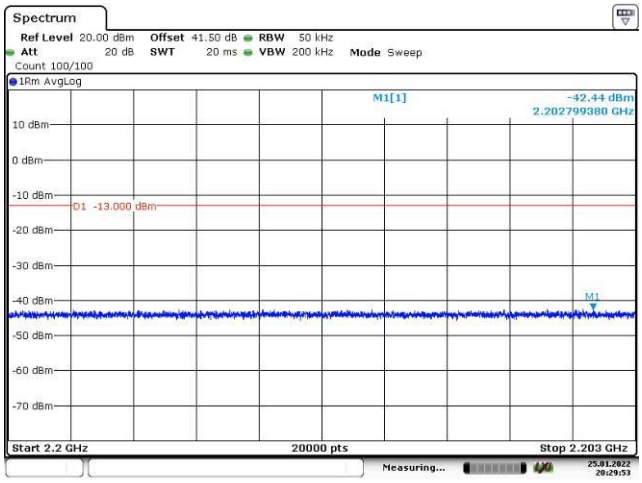
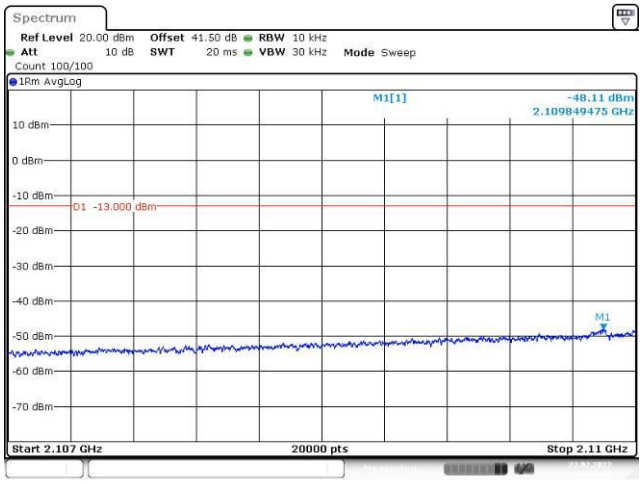
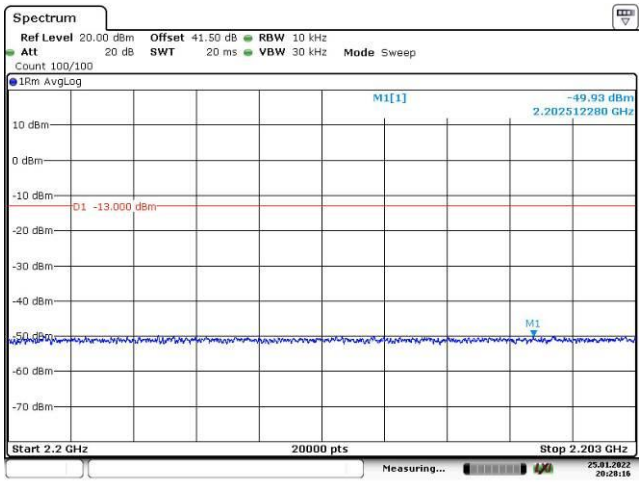
4.3.5 Out-Of-Band/Block Emissions(Including Intermodulation Products)

Signal Input	Signal Level	Test Range	Test Level (dBm)		Limit (dBm)	Result
			AWGN Signal	GSM Signal		
One	AGC	Low Range	-42.35	-48.11	-16.01	PASS
	3dB above AGC	Low Range	-42.47	-47.90	-16.01	PASS
	AGC	High Range	-42.76	-49.93	-16.01	PASS
	3dB above AGC	High Range	-42.44	-49.69	-16.01	PASS
Two	AGC	Low Range	-42.44	-48.31	-16.01	PASS
	3dB above AGC	Low Range	-42.13	-48.80	-16.01	PASS
	AGC	High Range	-53.72	-60.56	-16.01	PASS
	3dB above AGC	High Range	-53.51	-60.73	-16.01	PASS

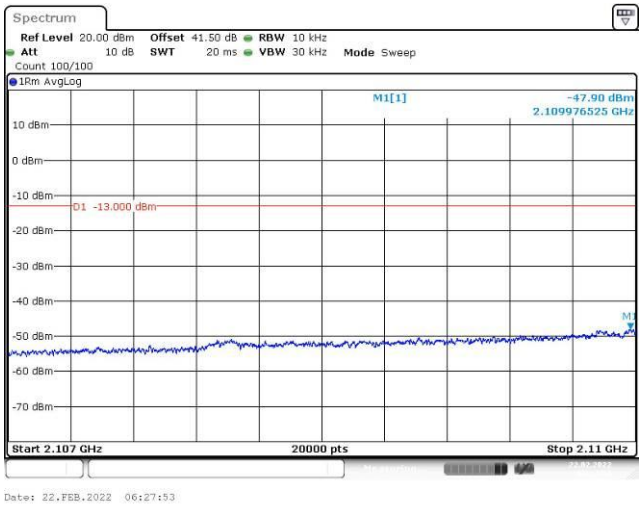
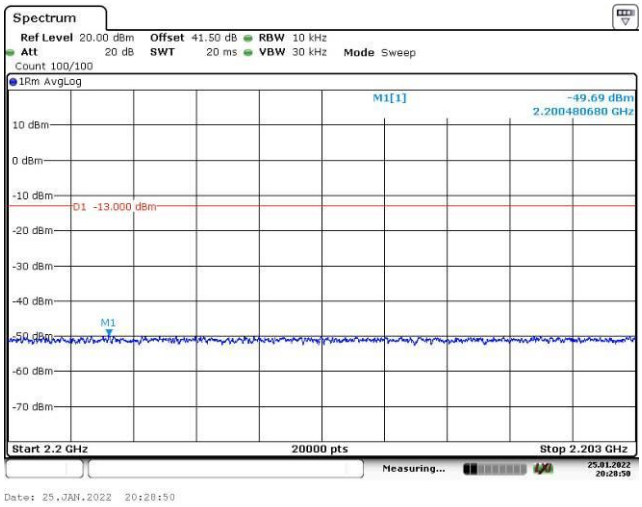
Note: The EUT supports 2*2 MIMO, since we only exhibited the results of the worst test port, so we subtract 10 * log (2) from -13dBm.

One Signal:

Out-Of-Band/Block Emissions(Including Intermodulation Products)

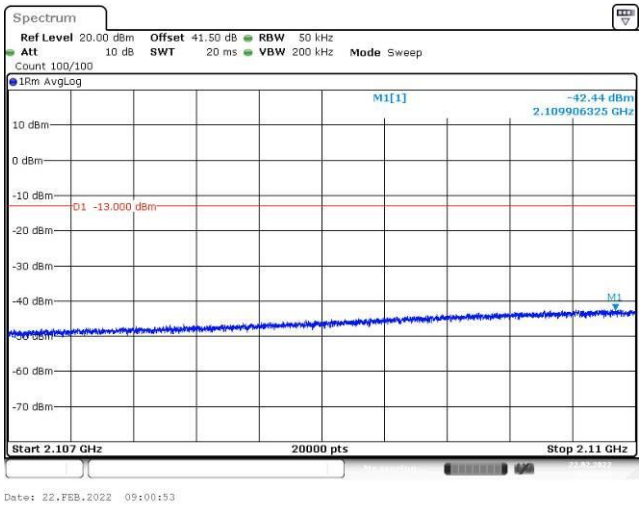
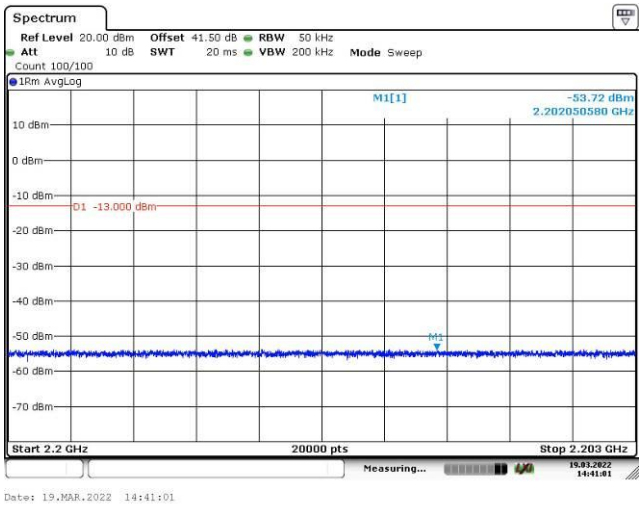
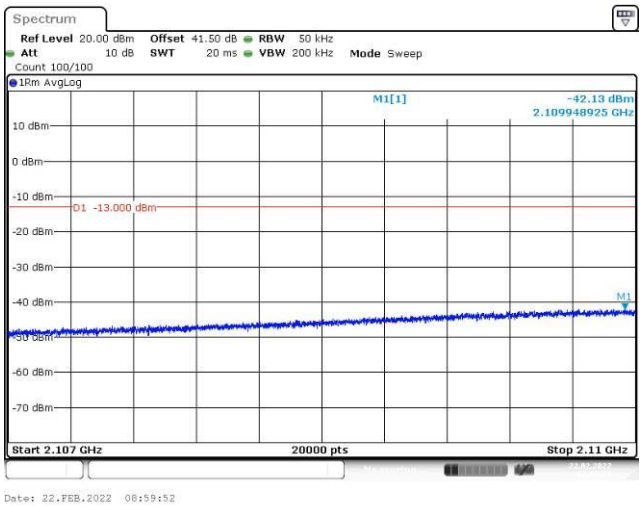
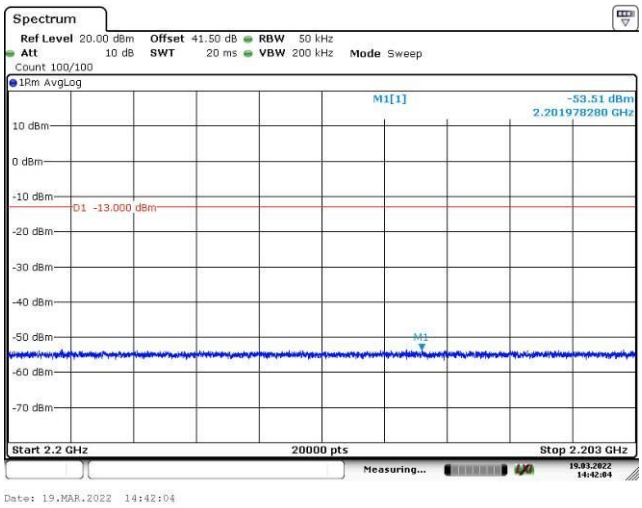
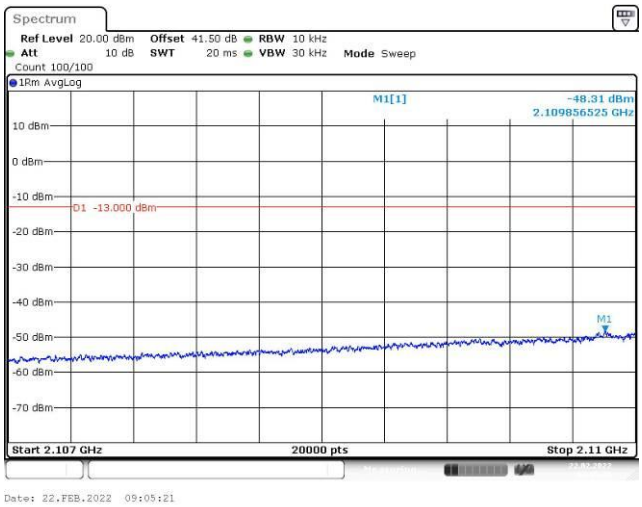
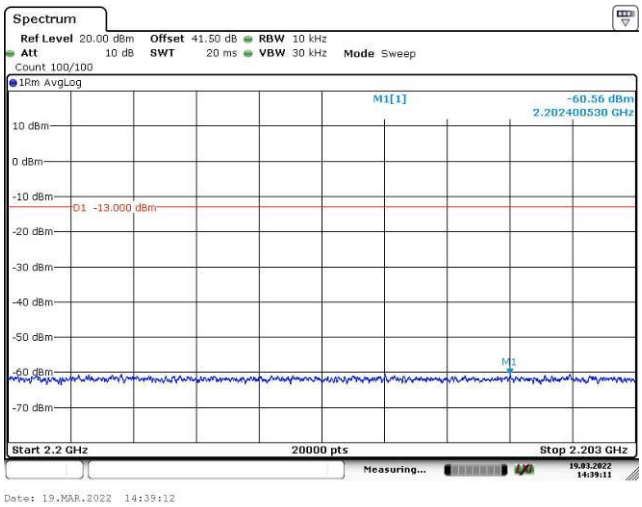
Mode	Left	Right
AWS Band AWGN Pre-AGC		
AWS Band AWGN AGC + 3dB		
AWS Band GSM Pre-AGC		

Out-Of-Band/Block Emissions(Including Intermodulation Products)

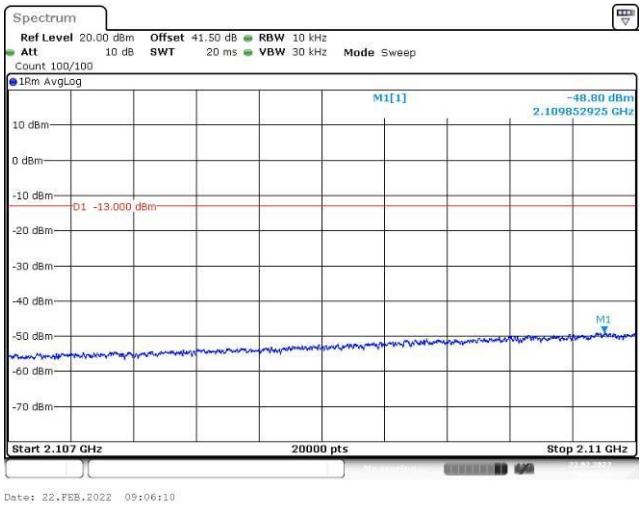
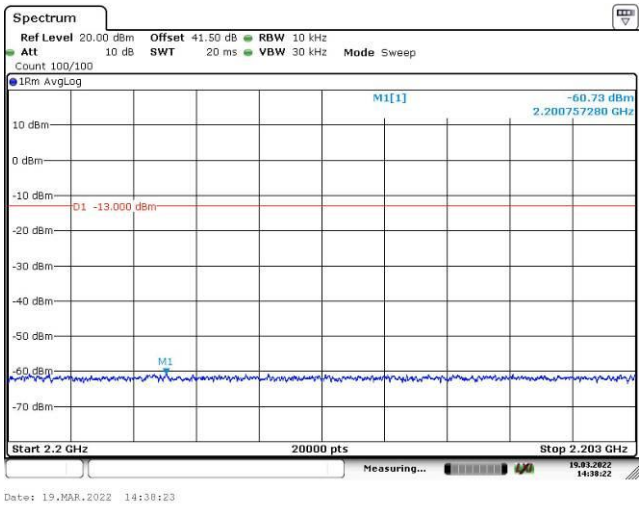
Mode	Left	Right
AWS Band GSM AGC + 3dB		

Two Signal:

Out-Of-Band/Block Emissions(Including Intermodulation Products)

Mode	Left	Right
AWS Band AWGN Pre-AGC	 Date: 22.FEB.2022 09:00:53	 Date: 19.MAR.2022 14:41:01
AWS Band AWGN AGC + 3dB	 Date: 22.FEB.2022 08:59:52	 Date: 19.MAR.2022 14:42:04
AWS Band GSM Pre-AGC	 Date: 22.FEB.2022 09:05:21	 Date: 19.MAR.2022 14:39:12

Out-Of-Band/Block Emissions(Including Intermodulation Products)

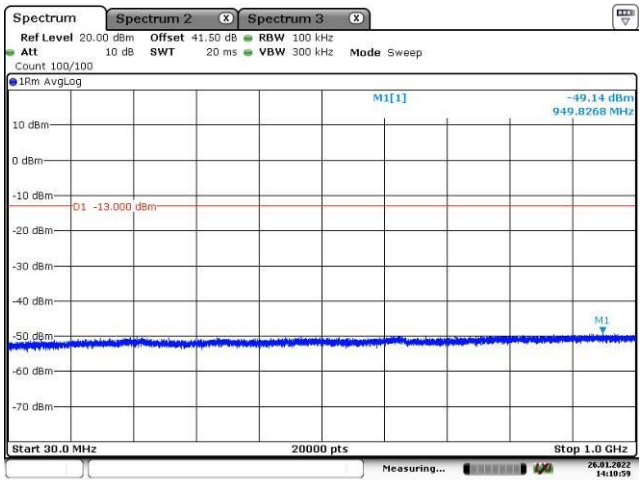
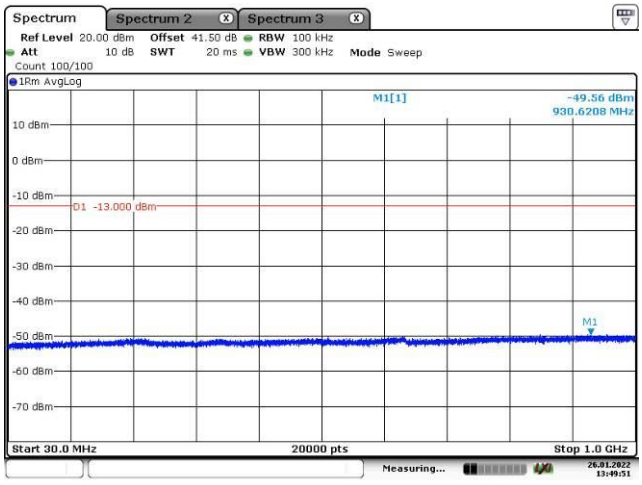
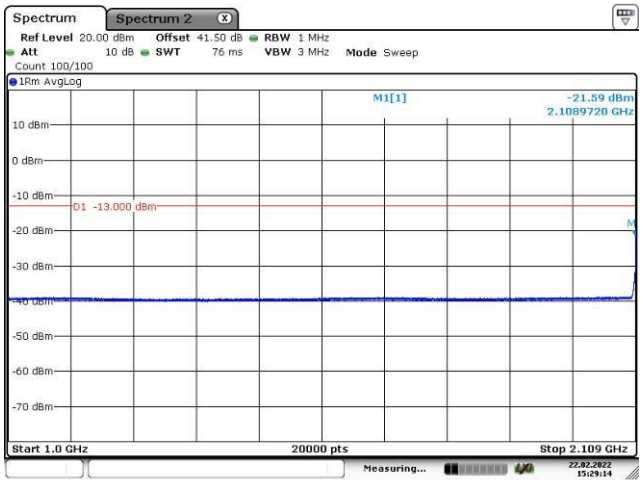
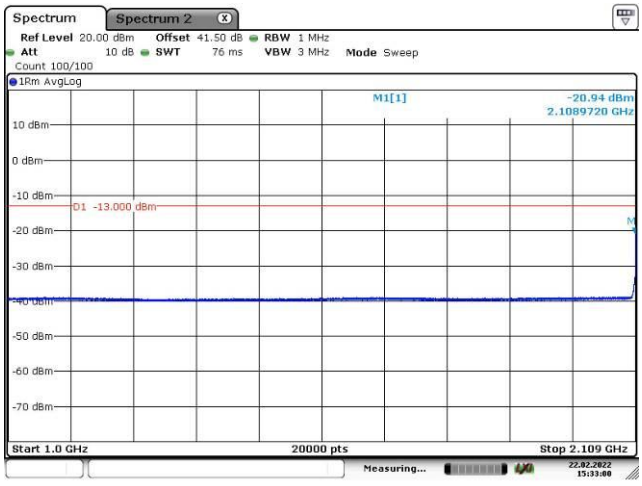
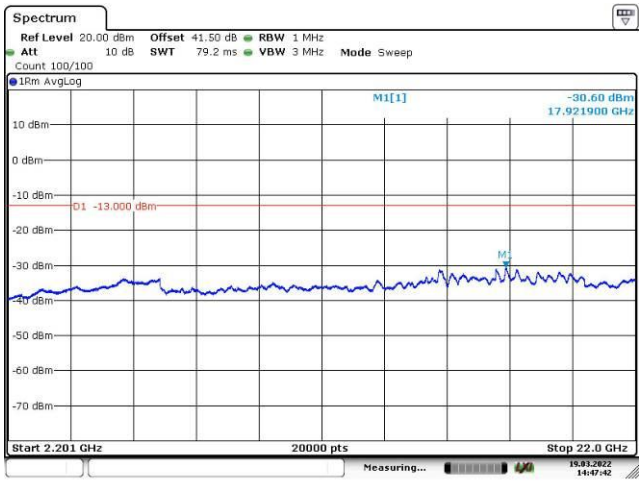
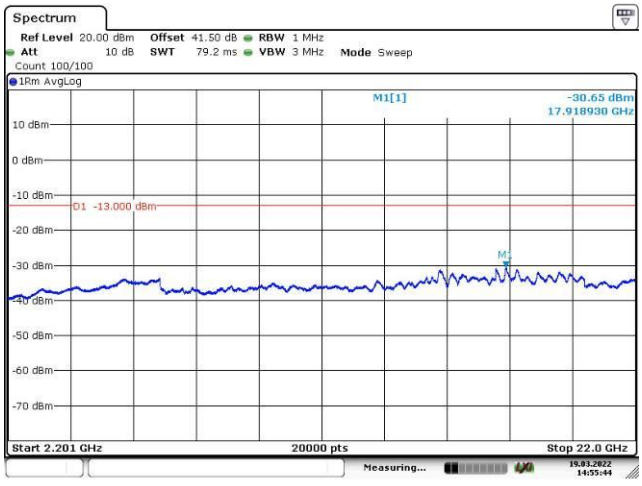
Mode	Left	Right
AWS Band GSM AGC + 3dB		

4.3.6 Spurious Emissions At Antenna Terminals

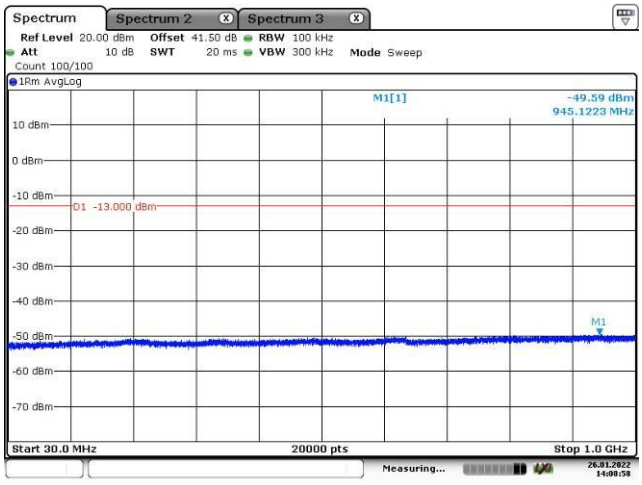
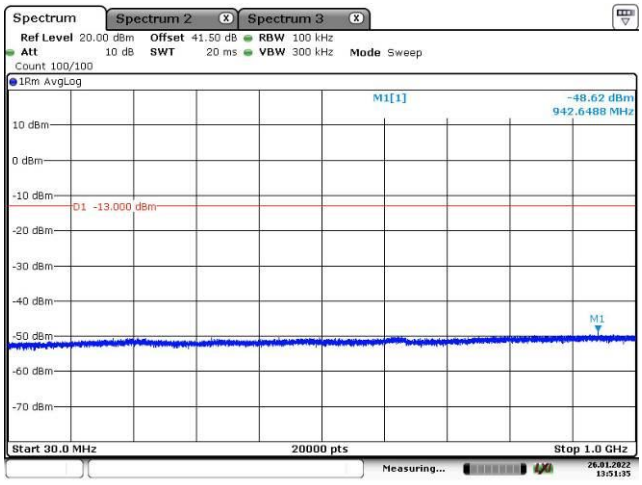
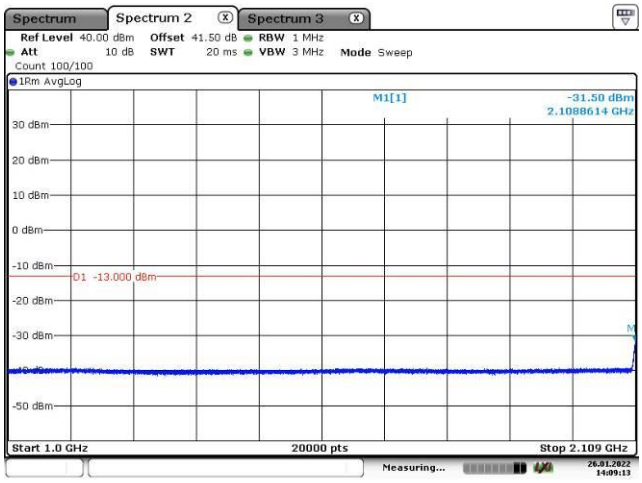
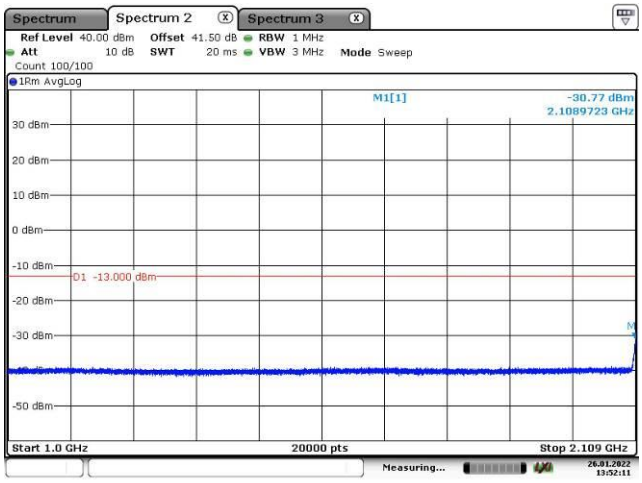
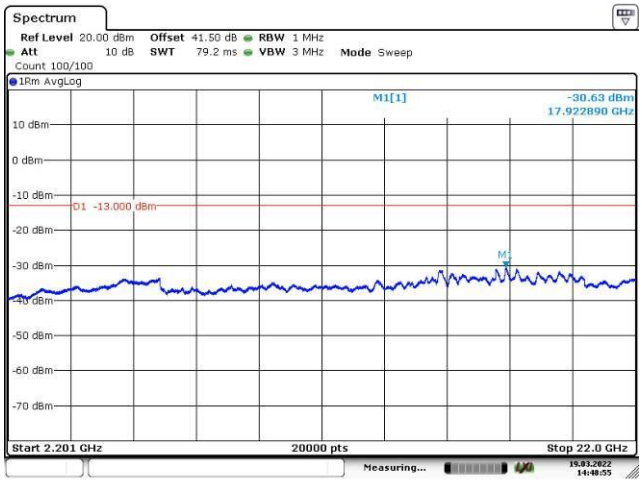
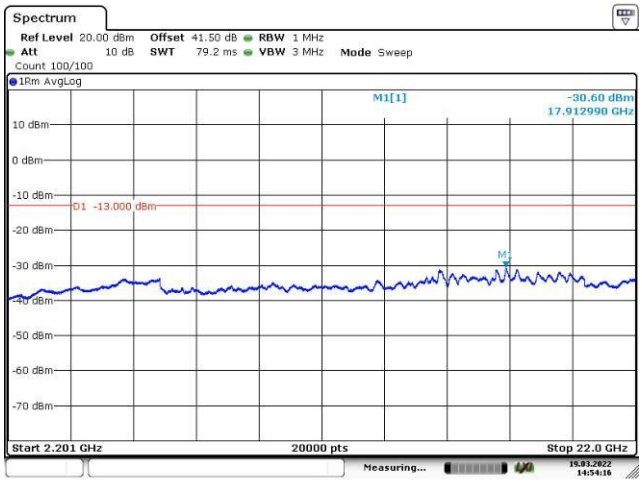
Channel	Frequency Range (MHz)	Test Level (dBm)		Limit (dBm)	Result
		AWGN Signal	GSM Signal		
Lowest	30-1000	-49.14	-49.56	-16.01	PASS
	1000-2109	-21.59	-20.94	-16.01	PASS
	2201-22000	-30.60	-30.65	-16.01	PASS
Middle	30-1000	-49.59	-48.62	-16.01	PASS
	1000-2109	-31.50	-30.77	-16.01	PASS
	2201-22000	-30.63	-30.60	-16.01	PASS
Highest	30-1000	-49.45	-49.67	-16.01	PASS
	1000-2109	-31.24	-33.25	-16.01	PASS
	2201-22000	-30.48	-30.70	-16.01	PASS

Note: The EUT supports 2*2 MIMO, since we only exhibited the results of the worst test port, so we subtract 10 * log (2) from -13dBm.

Spurious Emissions At Antenna Terminals

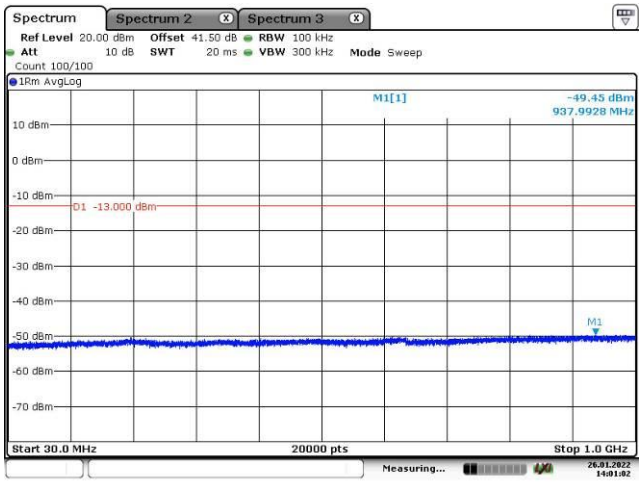
Mode	AWGN	GSM
AWS Band Low Channel		
		
		

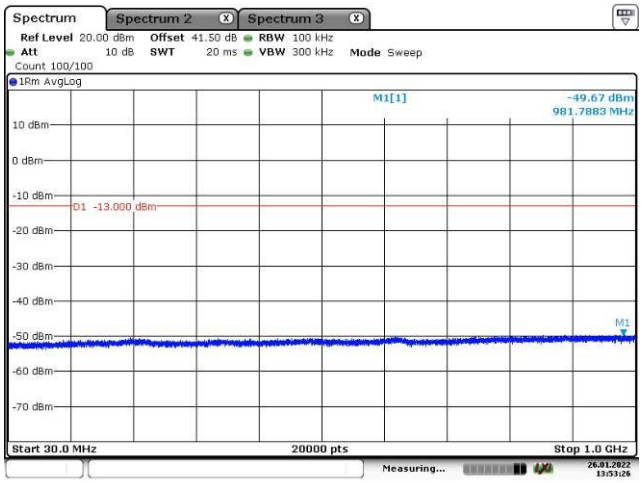
Spurious Emissions At Antenna Terminals

Mode	AWGN	GSM
AWS Band Middle Channel		
		
		

Spurious Emissions At Antenna Terminals

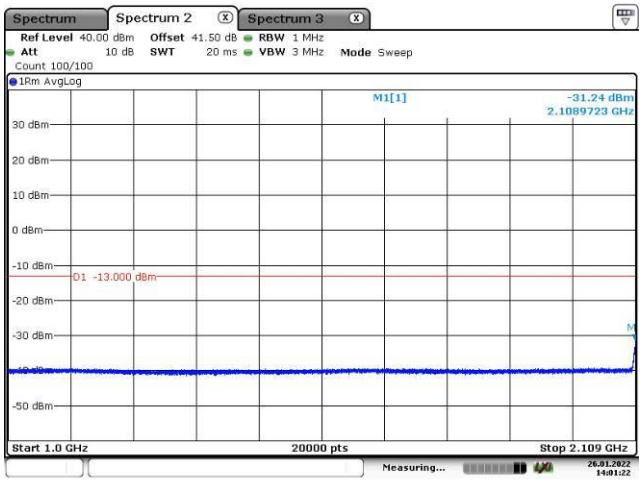
Mode **AWGN** **GSM**

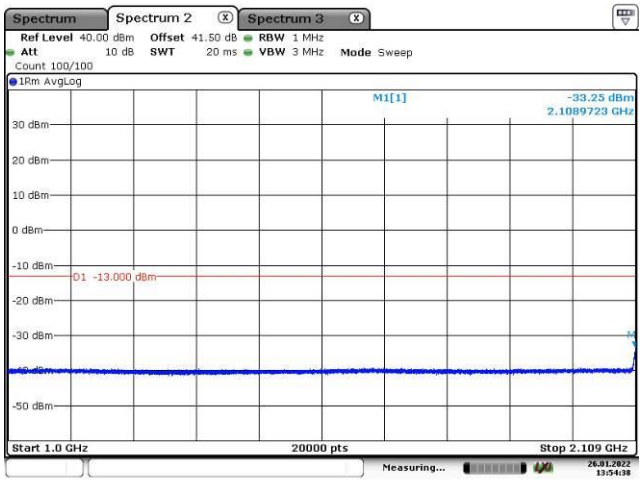


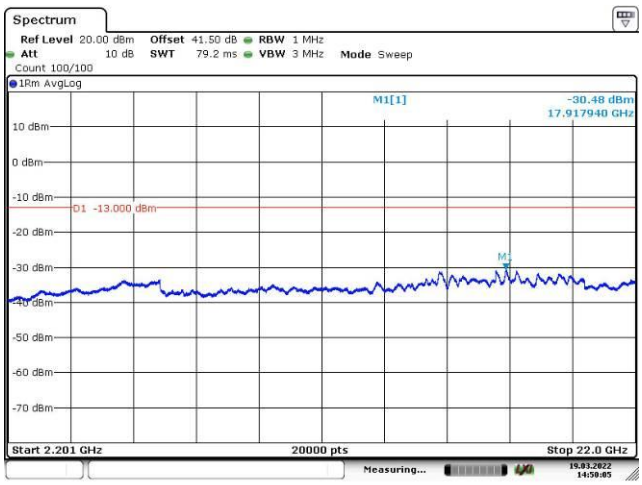


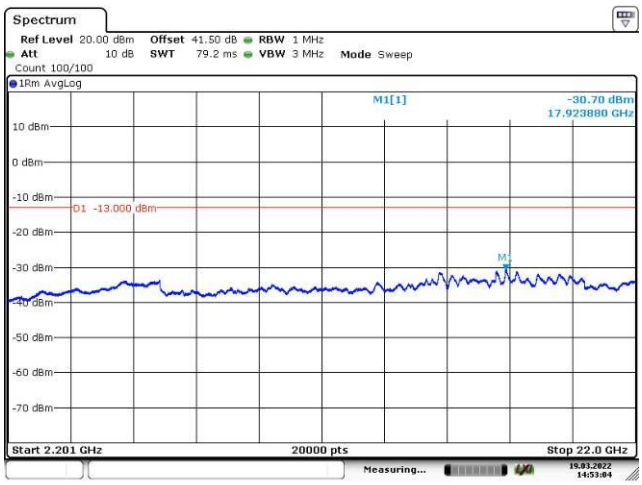
AWS Band

High Channel









5 Radiated Spurious Emissions

Serial Number:	CR21110016-RF-S2	Test Date:	2022-05-24
Test Site:	966-1,966-2	Test Mode:	2*2 MIMO transmit mode
Tester:	Great Qiao, Tommy Luo	Test Result:	Pass

Environmental Conditions:					
Temperature: (℃)	16.5~17.4	Relative Humidity: (%)	52~54	ATM Pressure: (kPa)	101.6

Test Equipment List and Details:

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Sunol Sciences	Antenna	JB6	A082520-5	2020-10-19	2023-10-18
R&S	EMI Test Receiver	ESR3	102724	2021-07-22	2022-07-21
TIMES MICROWAVE	Coaxial Cable	LMR-600-UltraFlex	C-0470-02	2021-07-18	2022-07-17
TIMES MICROWAVE	Coaxial Cable	LMR-600-UltraFlex	C-0780-01	2021-07-18	2022-07-17
Sonoma	Amplifier	310N	186165	2021-07-18	2022-07-17
EMCO	Adjustable Dipole Antenna	3121C	9109-756	N/A	N/A
MICRO-COAX	Coaxial Cable	UFA210B-0-0720-300300	99G1448	2021-07-25	2022-07-24
Agilent	Signal Generator	E8247C	MY43321352	2023-04-25	2022-04-24
ETS-Lindgren	Horn Antenna	3115	9912-5985	2020-10-13	2023-10-12
R&S	Spectrum Analyzer	FSV40	101591	2021-07-22	2022-07-21
MICRO-COAX	Coaxial Cable	UFA210A-1-1200-70U300	217423-008	2021-08-08	2022-08-07
MICRO-COAX	Coaxial Cable	UFA210A-1-2362-300300	235780-001	2021-08-08	2022-08-07
Mini	Pre-amplifier	ZVA-183-S+	5969001149	2021-11-10	2022-11-09
AH	Double Ridge Guide Horn Antenna	SAS-571	1396	2021-10-18	2024-10-17
MICRO-COAX	Coaxial Cable	UFA210B-0-0720-300300	99G1448	2021-07-25	2022-07-24
PASTERNACK	Horn Antenna	PE9852/2F-20	112002	2021-02-05	2024-02-04
PASTERNACK	Horn Antenna	PE9852/2F-20	112001	2021-02-05	2024-02-04

** Statement of Traceability: China Certification ICT Co., Ltd (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).*

Test Data:

Frequency (MHz)	Polar (H/V)	Receiver Reading (dBμV)	Substituted Method			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Substituted Level (dBm)	Antenna Gain (dBd/dBi)	Cable Loss (dB)			
AWS Band, Low channel: 2110.2 MHz								
4220.40	H	36.31	-59.70	10.77	1.32	-50.25	-13.00	37.25
4220.40	V	36.32	-59.64	10.77	1.32	-50.19	-13.00	37.19
6330.60	H	35.31	-56.83	11.16	1.81	-47.48	-13.00	34.48
6330.60	V	35.00	-57.03	11.16	1.81	-47.68	-13.00	34.68
8440.80	H	34.59	-53.49	10.89	2.21	-44.81	-13.00	31.81
8440.80	V	35.38	-52.91	10.89	2.21	-44.23	-13.00	31.23
10551.00	H	34.23	-51.71	11.40	2.50	-42.81	-13.00	29.81
10551.00	V	34.94	-51.12	11.40	2.50	-42.22	-13.00	29.22
210.72	H	45.72	-66.96	0.00	0.26	-67.22	-13.00	54.22
61.49	V	44.38	-61.12	-9.51	0.14	-70.77	-13.00	57.77
AWS Band, Middle channel: 2155 MHz								
4310.00	H	35.76	-60.46	10.71	1.34	-51.09	-13.00	38.09
4310.00	V	36.42	-59.69	10.71	1.34	-50.32	-13.00	37.32
6465.00	H	34.57	-57.28	11.27	1.83	-47.84	-13.00	34.84
6465.00	V	35.21	-56.69	11.27	1.83	-47.25	-13.00	34.25
8620.00	H	37.21	-50.87	11.00	2.22	-42.09	-13.00	29.09
8620.00	V	36.01	-52.52	11.00	2.22	-43.74	-13.00	30.74
10775.00	H	32.45	-53.60	11.40	2.51	-44.71	-13.00	31.71
10775.00	V	34.80	-51.36	11.40	2.51	-42.47	-13.00	29.47
250.45	H	47.07	-64.82	0.00	0.30	-65.12	-13.00	52.12
39.02	V	50.14	-38.72	-25.93	0.11	-64.76	-13.00	51.76
AWS Band, High channel: 2199.8 MHz								
4399.60	H	35.05	-60.53	10.66	1.37	-51.24	-13.00	38.24
4399.60	V	35.59	-60.04	10.66	1.37	-50.75	-13.00	37.75
6599.40	H	34.86	-56.93	11.28	1.91	-47.56	-13.00	34.56
6599.40	V	35.49	-56.31	11.28	1.91	-46.94	-13.00	33.94
8799.20	H	36.28	-50.82	11.14	2.28	-41.96	-13.00	28.96
8799.20	V	37.48	-50.67	11.14	2.28	-41.81	-13.00	28.81
10999.00	H	34.38	-51.43	11.40	2.58	-42.61	-13.00	29.61
10999.00	V	33.81	-51.97	11.40	2.58	-43.15	-13.00	30.15
250.45	H	47.92	-63.97	0.00	0.30	-64.27	-13.00	51.27
39.02	V	50.59	-38.27	-25.93	0.11	-64.31	-13.00	51.31

Note:
1) Absolute Level = SG Level - Cable loss + Antenna Gain
2) Margin = Limit- Absolute Level

6. RF EXPOSURE EVALUATION

6.1 Maximum Permissible Exposure (MPE)

6.1.1 Applicable Standard

According to subpart §1.1310, systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

6.1.2 Limits

Maximum Permissible Exposure (MPE) (§1.1310, §2.1091)

(B) Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	**Electric Field Strength (V/m)**	**Magnetic Field Strength (A/m)**	**Power Density (mW/cm^2)**	**Averaging Time (minutes)**
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*($180/f^2$)	30
30–300	27.5	0.073	0.2	30
300–1500	/	/	f/1500	30
1500–100,000	/	/	1.0	30

f = frequency in MHz; * = Plane-wave equivalent power density;

According to §1.1310 and §2.1091 RF exposure is calculated.

6.1.3 Calculated Formulary:

Predication of MPE limit at a given distance
$S = PG/4\pi R^2$ = power density (in appropriate units, e.g. mW/cm^2);
P = power input to the antenna (in appropriate units, e.g., mW);
G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain;
R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

6.1.4 Calculated Data

Frequency Band (MHz)	**Maximum Tune-up Conducted Output Power (dBm)**	**Antenna Gain (dBi)**	**Evaluation Distance (cm)**	**Power Density (mW/cm^2)**	**MPE Limit (mW/cm^2)**
2110-2200	47	12	400	0.40	1

Result: The device meet FCC MPE requirement at 400 cm distance.

=====END OF REPORT=====