



FCC Test Report FCC CFR Title 47 Part 2, Part 27

Report Reference No.: HK2302270554-5E

FCC ID: 2A2FCBT4101

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Date of issue: Apr. 28, 2023

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China

Applicant's name: PowUnity GmbH

Address: Feldstrasse 9d Innsbruck, 6020 Austria

Test specification:

Standard: FCC CFR Title 47 Part 2, Part 27

TRF Originator: Shenzhen HUAKE Testing Technology Co., Ltd.

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Test item description: GPS Tracker

Trade Mark: BikeTrax

Manufacturer: PowUnity GmbH

Model/Type reference: BT41-01

Series Models: T4101-03-04

Modulation Type: QPSK, 16QAM

Rating: DC 3.7V from battery

Hardware version: V2.2

Software version: V2.2

Result: PASS

**TEST REPORT****Test Report No. :****HK2302270554-5E**

Apr. 28, 2023

Date of issue

Equipment under Test : GPS Tracker

Model /Type : BT41-01

Series Models : T4101-03-04

Applicant : **PowUnity GmbH**

Address : Feldstrasse 9d Innsbruck, 6020 Austria

Manufacturer : **PowUnity GmbH**

Address : Feldstrasse 9d Innsbruck, 6020 Austria

Test result**Pass**

The test report merely corresponds to the test sample.

It is not permitted to copy extracts of these test result without the written permission of the test laboratory.



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**** Modified History ****

| Revision | Description | Issued Data | Remark |
|--------------|-----------------------------|---------------|------------|
| Revision 1.0 | Initial Test Report Release | Apr. 28, 2023 | Jason Zhou |
| | | | |
| | | | |



1 Summary

1.1 Test Standards

The tests were performed according to following standards:

[FCC Part 27](#): MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES

47 CFR FCC Part 15 Subpart B: - Unintentional Radiators.

[FCC Part 2](#): FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS.

1.2 Test Description

| Test Item | Section in CFR 47 | Result |
|--|---|--------|
| RF Output Power | Part 2.1046 27.50 (b)(10) | Pass |
| Peak-to-Average Ratio | 27.50 (d)(5) | Pass |
| 99% & -26 dB Occupied Bandwidth | Part 2.1049 Part 27.53(h) | Pass |
| Spurious Emissions at Antenna Terminal | Part 2.1051 Part 27.53(h) | Pass |
| Field Strength of Spurious Radiation | Clause 7 of KDB971168 D01 v02r02 | Pass |
| Out of band emission, Band Edge | 2.1051 27.53 (c)(2) and (5), (h)(1) and (3)(i) | Pass |
| Frequency stability | 2.1055 27.54 | Pass |



1.3 Information of The Test Laboratory

Shenzhen HUAKE Testing Technology Co., Ltd.
Add.: 1-2/F., Building B2, Junfeng Zhongcheng Zhizao Innovation Park, Heping,
Fuhai Street, Bao'an District, Shenzhen, Guangdong, China

Testing Laboratory Authorization:

A2LA Accreditation Code is 4781.01.
FCC Designation Number is CN1229.
Canada IC CAB identifier is CN0045.
CNAS Registration Number is L9589.

1.4 Statement of The Measurement Uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16 - 4 „Specification for radio disturbance and immunity measuring apparatus and methods – Part 4:Uncertainty in EMC Measurements“ and is documented in the Shenzhen HUAKE Testing Technology Co., Ltd.quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for Shenzhen HUAKE Testing Technology Co., Ltd.is reported:

| Test | Range | Measurement Uncertainty | Notes |
|-----------------------|------------|-------------------------|-------|
| Radiated Emission | 30~1000MHz | 4.10dB | (1) |
| Radiated Emission | Above 1GHz | 4.32dB | (1) |
| Conducted Disturbance | 0.15~30MHz | 3.20dB | (1) |

(1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.



2 General Information

2.1 General Remarks

| | | |
|--------------------------------|---|---------------|
| Date of receipt of test sample | : | Feb. 27, 2023 |
| | | |
| Testing commenced on | : | Feb. 27, 2023 |
| | | |
| Testing concluded on | : | Apr. 28, 2023 |

2.2 Product Description

| | |
|--------------------------|--------------------------------------|
| Name of EUT | GPS Tracker |
| Model/Type reference: | BT41-01 |
| Series Models: | T4101-03-04 |
| Power supply: | DC 3.7V from battery |
| Adapter Information | N/A |
| Modulation Type | QPSK, 16QAM |
| Antenna Type | Internal Antenna |
| Operation Frequency Band | LTE Band 13 |
| Operation frequency | LTE Band 13: 777~787 MHz |
| LTE Release | R8 |
| Extreme temp. Tolerance | -30°C to +50°C |
| Extreme vol. Limits | 3.15VDC to 4.26VDC (nominal: 3.7VDC) |

2.3 Equipment Under Test

Power supply system utilised

| | | | |
|----------------------|---|---|---------------------------------|
| Power supply voltage | : | <input type="radio"/> 120V/ 60 Hz | <input type="radio"/> 115V/60Hz |
| | | <input type="radio"/> 12 V DC | <input type="radio"/> 24 V DC |
| | | <input checked="" type="radio"/> Other (specified in blank below) | |

DC 3.7V from battery

Environmental Conditions

During the measurement the environmental conditions were within the listed ranges:

| | |
|---------------------|---------|
| Normal Temperature: | 25°C |
| Relative Humidity: | 55 % |
| Air Pressure: | 101 kPa |



2.4 Description of Test Modes

The EUT has been tested under typical operating condition. The CMW500 used to control the EUT staying in continuous transmitting and receiving mode for testing. Regards to the frequency band operation: the lowest middle and highest frequency of channel were selected to perform the test, then shown on this report.

Note:

1. For the ERP/EIRP and radiated emission test, every axis (X, Y, Z) was verified, and show the worst result on this report.
2. Test method and refer to 3GPP TS136521.



2.5 Equipments Used During The Test

| Test Equipment | Manufacturer | Model No. | Serial No. | Calibration Date | Calibration Due Date |
|---------------------------------|--------------|-------------|------------|------------------|----------------------|
| LISN | ENV216 | R&S | HKE-059 | 2023/02/17 | 2024/02/16 |
| LISN | R&S | ENV216 | HKE-002 | 2023/02/17 | 2024/02/16 |
| Broadband antenna | Schwarzbeck | VULB 9163 | HKE-012 | 2023/02/17 | 2024/02/16 |
| Receiver | R&S | ESR-7 | HKE-010 | 2023/02/17 | 2024/02/16 |
| Spectrum analyzer | Agilent | N9020A | HKE-048 | 2023/02/17 | 2024/02/16 |
| RF automatic control unit | Tonscend | JS0806-2 | HKE-060 | 2023/02/17 | 2024/02/16 |
| Horn antenna | Schwarzbeck | 9120D | HKE-013 | 2023/02/17 | 2024/02/16 |
| Loop antenna | Schwarzbeck | FMZB 1519 B | HKE-014 | 2023/02/17 | 2024/02/16 |
| Preamplifier | EMCI | EMC051845SE | HKE-015 | 2023/02/17 | 2024/02/16 |
| Preamplifier | Agilent | 83051A | HKE-016 | 2023/02/17 | 2024/02/16 |
| Temperature and humidity meter | Boyang | HTC-1 | HKE-075 | 2023/02/17 | 2024/02/16 |
| High pass filter unit | Tonscend | JS0806-F | HKE-055 | 2023/02/17 | 2024/02/16 |
| RF cable | Times | 1-40G | HKE-034 | 2023/02/17 | 2024/02/16 |
| Power meter | Agilent | E4419B | HKE-085 | 2023/02/17 | 2024/02/16 |
| Power Sensor | Agilent | E9300A | HKE-086 | 2023/02/17 | 2024/02/16 |
| Wireless Communication Test Set | R&S | CMW500 | HKE-026 | 2023/02/17 | 2024/02/16 |
| Horn Antenna | Schwarzbeck | BBHA 9170 | HKE-017 | 2023/02/17 | 2024/02/16 |
| High gain antenna | Schwarzbeck | LB-180400KF | HKE-054 | 2023/02/17 | 2024/02/16 |
| Horn antenna | Schwarzbeck | 9120D | HKE-135 | 2023/02/17 | 2024/02/16 |
| High gain antenna | Schwarzbeck | LB-180400KF | HKE-128 | 2023/02/17 | 2024/02/16 |
| Broadband antenna | Schwarzbeck | VULB 9163 | HKE-087 | 2023/02/17 | 2024/02/16 |
| Signal generator | Agilent | E4433B | HKE-120 | 2023/02/17 | 2024/02/16 |
| Signal generator | Agilent | E4421B | HKE-121 | 2023/02/17 | 2024/02/16 |

2.6 Modifications

No modifications were implemented to meet testing criteria.



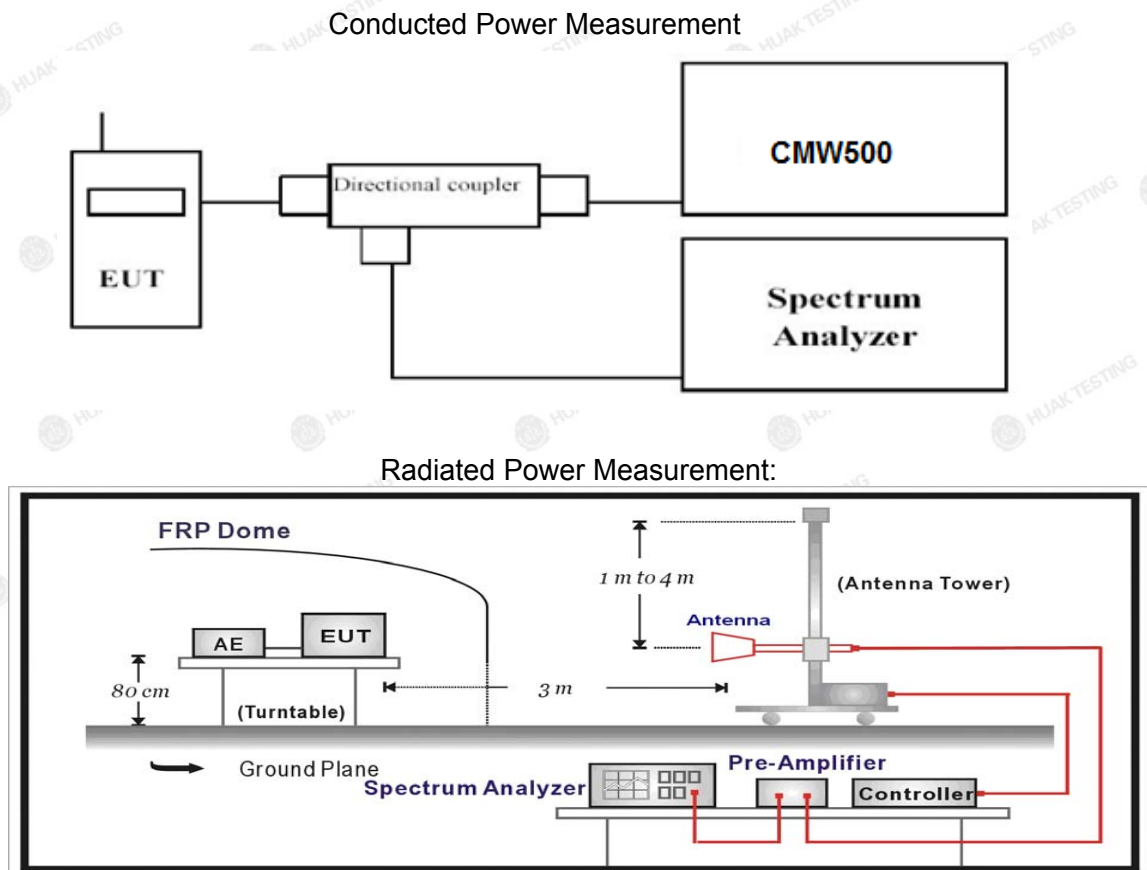
3 Test Conditions and Results

3.1 Output Power

LIMIT

According to §27.50 (b) (10): Portable stations (hand-held devices) transmitting in the 746-757 MHz, 776-788 MHz, and 805-806 MHz bands are limited to 3 watts ERP.

TEST CONFIGURATION



TEST PROCEDURE

The EUT was setup according to EIA/TIA 603D.

Conducted Power Measurement:

- Place the EUT on a bench and set it in transmitting mode.
- Connect a low loss RF cable from the antenna port to a spectrum analyzer and CMW500 by a Directional Couple.
- EUT Communicate with CMW500, then select a channel for testing.
- Add a correction factor to the display of spectrum, and then test.

Radiated Power Measurement:

- The EUT shall be placed at the specified height on a support, and in the position closest to normal use as declared by provider.
- The test antenna shall be oriented initially for vertical polarization and shall be chosen to correspond to the frequency of the transmitter.
- The output of the test antenna shall be connected to the measuring receiver.
- The transmitter shall be switched on and the measuring receiver shall be tuned to the frequency of the transmitter under test.



- e. The test antenna shall be raised and lowered through the specified range of height until a maximum signal level is detected by the measuring receiver.
- f. The transmitter shall then be rotated through 360° in the horizontal plane, until the maximum signal level is detected by the measuring receiver.
- g. The test antenna shall be raised and lowered again through the specified range of height until a maximum signal level is detected by the measuring receiver.
- h. The maximum signal level detected by the measuring receiver shall be noted.
- i. The transmitter shall be replaced by a substitution antenna.
- j. The substitution antenna shall be orientated for vertical polarization and the length of the substitution antenna shall be adjusted to correspond to the frequency of the transmitter.
- k. The substitution antenna shall be connected to a calibrated signal generator.
- l. If necessary, the input attenuator setting of the measuring receiver shall be adjusted in order to increase the sensitivity of the measuring receiver.
- m. The test antenna shall be raised and lowered through the specified range of height to ensure that the maximum signal is received.
- n. The input signal to the substitution antenna shall be adjusted to the level that produces a level detected by the measuring receiver, that is equal to the level noted while the transmitter radiated power was measured, corrected for the change of input attenuator setting of the measuring receiver.
- o. The measurement shall be repeated with the test antenna and the substitution antenna orientated for horizontal polarization.
- p. The measure of the effective radiated power is the larger of the two levels recorded at the input to the substitution antenna, corrected for gain of the substitution antenna if necessary.
- q. Test site anechoic chamber refer to ANSI C63.4.

TEST RESULTS

Conducted Measurement:

| LTE FDD Band 13 | | | | |
|----------------------|----------------|-----------------|---------------------|-------|
| TX Channel Bandwidth | RB Size/Offset | Frequency (MHz) | Average Power [dBm] | |
| | | | QPSK | 16QAM |
| 5 MHz | 1 RB low | 779.5 | 20.29 | 20.45 |
| | | 782 | 20.23 | 20.55 |
| | | 784.5 | 19.23 | 18.71 |
| | 1 RB high | 779.5 | 19.99 | 20.42 |
| | | 782 | 20.07 | 20.30 |
| | | 784.5 | 19.76 | 18.33 |
| | 50% RB mid | 779.5 | 20.08 | 20.26 |
| | | 782 | 19.49 | 19.62 |
| | | 784.5 | 20.31 | 18.31 |
| | 100% RB | 779.5 | 19.18 | 18.89 |
| | | 782 | 20.65 | 18.15 |
| | | 784.5 | 19.45 | 17.36 |
| 10 MHz | 1 RB low | 782 | 20.10 | 20.39 |
| | 1 RB high | 782 | 20.13 | 20.38 |
| | 50% RB mid | 782 | 19.94 | 18.42 |
| | 100% RB | 782 | 19.85 | 18.43 |



3.2 Radiated Measurement

Remark:

1. We were tested all RB Configuration refer 3GPP TS136 521 for each Channel Bandwidth of LTE FDD Band 13; recorded worst case for each Channel Bandwidth of LTE FDD Band 13.
2. $EIRP = P_{Mea}(dBm) - P_{cl}(dB) + P_{Ag}(dB) + G_a(dBi)$
Margin = Limit - EIRP

LTE FDD Band 13_Channel Bandwidth 5MHz_QPSK

| Frequency (MHz) | P _{Mea} (dBm) | P _{cl} (dB) | G _a Antenna Gain(dB) | P _{Ag} (dB) | EIRP (dBm) | ERP (dBm) | Limit (dBm) | Margin (dB) | Polarization |
|-----------------|------------------------|----------------------|---------------------------------|----------------------|------------|-----------|-------------|-------------|--------------|
| 779.5 | -17.48 | 3.06 | 9.68 | 34.8 | 23.94 | 21.79 | 34.77 | 12.98 | V |
| 782.0 | -17.06 | 3.17 | 9.68 | 34.8 | 24.25 | 22.1 | 34.77 | 12.67 | V |
| 784.5 | -15.48 | 3.22 | 9.75 | 34.8 | 25.85 | 23.7 | 34.77 | 11.07 | V |
| 779.5 | -18.25 | 3.06 | 9.68 | 34.8 | 23.17 | 21.02 | 34.77 | 13.75 | H |
| 782.0 | -17.39 | 3.17 | 9.68 | 34.8 | 23.92 | 21.77 | 34.77 | 13 | H |
| 784.5 | -18.1 | 3.22 | 9.75 | 34.8 | 23.23 | 21.08 | 34.77 | 13.69 | H |

LTE FDD Band 13_Channel Bandwidth 10MHz_QPSK

| Frequency (MHz) | P _{Mea} (dBm) | P _{cl} (dB) | G _a Antenna Gain(dB) | P _{Ag} (dB) | EIRP (dBm) | ERP (dBm) | Limit (dBm) | Margin (dB) | Polarization |
|-----------------|------------------------|----------------------|---------------------------------|----------------------|------------|-----------|-------------|-------------|--------------|
| 782.0 | -16.47 | 3.22 | 9.75 | 34.8 | 24.86 | 22.71 | 34.77 | 12.06 | V |
| 782.0 | -15.16 | 3.06 | 9.68 | 34.8 | 26.26 | 24.11 | 34.77 | 10.66 | H |

LTE FDD Band 13_Channel Bandwidth 5MHz_16QAM

| Frequency (MHz) | P _{Mea} (dBm) | P _{cl} (dB) | G _a Antenna Gain(dB) | P _{Ag} (dB) | EIRP (dBm) | ERP (dBm) | Limit (dBm) | Margin (dB) | Polarization |
|-----------------|------------------------|----------------------|---------------------------------|----------------------|------------|-----------|-------------|-------------|--------------|
| 779.5 | -17.63 | 3.06 | 9.68 | 34.8 | 23.79 | 21.64 | 34.77 | 13.13 | V |
| 782.0 | -17.4 | 3.17 | 9.68 | 34.8 | 23.91 | 21.76 | 34.77 | 13.01 | V |
| 784.5 | -16.53 | 3.22 | 9.75 | 34.8 | 24.8 | 22.65 | 34.77 | 12.12 | V |
| 779.5 | -18.02 | 3.06 | 9.68 | 34.8 | 23.4 | 21.25 | 34.77 | 13.52 | H |
| 782.0 | -17.49 | 3.17 | 9.68 | 34.8 | 23.82 | 21.67 | 34.77 | 13.1 | H |
| 784.5 | -16.95 | 3.22 | 9.75 | 34.8 | 24.38 | 22.23 | 34.77 | 12.54 | H |

LTE FDD Band 13_Channel Bandwidth 10MHz_16QAM

| Frequency (MHz) | P _{Mea} (dBm) | P _{cl} (dB) | G _a Antenna Gain(dB) | P _{Ag} (dB) | EIRP (dBm) | ERP (dBm) | Limit (dBm) | Margin (dB) | Polarization |
|-----------------|------------------------|----------------------|---------------------------------|----------------------|------------|-----------|-------------|-------------|--------------|
| 782.0 | -16.47 | 3.22 | 9.75 | 34.8 | 24.86 | 22.71 | 34.77 | 12.06 | V |
| 782.0 | -15.58 | 3.06 | 9.68 | 34.8 | 25.84 | 23.69 | 34.77 | 11.08 | H |

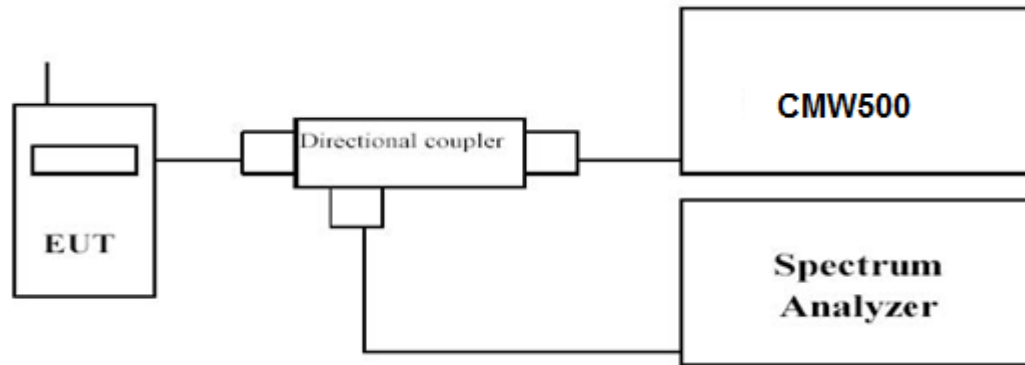


3.3 Peak-to-Average Ratio (PAR)

LIMIT

The Peak-to-Average Ratio (PAR) of the transmission may not exceed 13 dB.

TEST CONFIGURATION



TEST PROCEDURE

1. Refer to instrument's analyzer instruction manual for details on how to use the power statistics/CCDF function;
2. Set resolution/measurement bandwidth \geq signal's occupied bandwidth;
3. Set the number of counts to a value that stabilizes the measured CCDF curve;
4. Set the measurement interval as follows:
 - 1). for continuous transmissions, set to 1 ms;
 - 2). for burst transmissions, employ an external trigger that is synchronized with the EUT burst timing sequence, or use the internal burst trigger with a trigger level that allows the burst to stabilize and set the measurement interval to a time that is less than or equal to the burst duration.
5. Record the maximum PAPR level associated with a probability of 0.1%.

TEST RESULTS

Remark:

1. We were tested all RB Configuration refer 3GPP TS136 521 for each Channel Bandwidth of LTE Band 13; recorded worst case for each Channel Bandwidth of LTE Band 13.

| LTE Band 13 | | | | |
|----------------------|-----------------|----------------|-----------|-------|
| TX Channel Bandwidth | Frequency (MHz) | RB Size/Offset | PAPR (dB) | |
| | | | QPSK | 16QAM |
| 5 MHz | 779.5 | 1RB#0 | 10.54 | 11.39 |
| | 782 | | 8.62 | 8.45 |
| | 784.5 | | 10.43 | 10.65 |
| 10 MHz | 782 | 1RB#0 | 10.08 | 10.64 |



LTE Band 13-5MHz Channel Bandwidth PAPR

QPSK



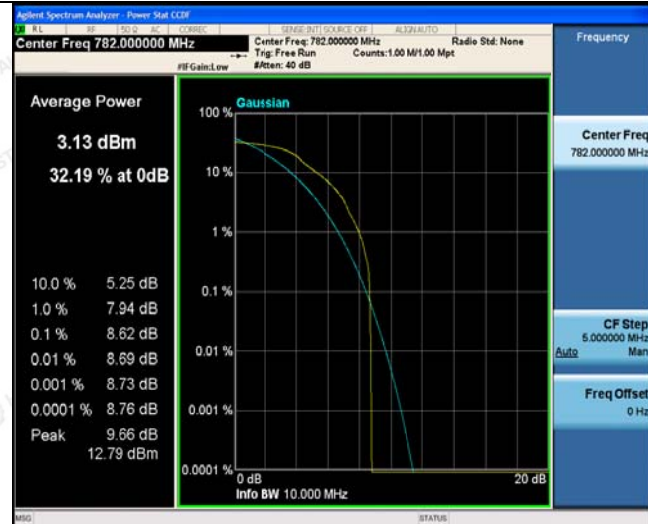
1RB#0

16QAM



1RB#0

Low Channel



1RB#0

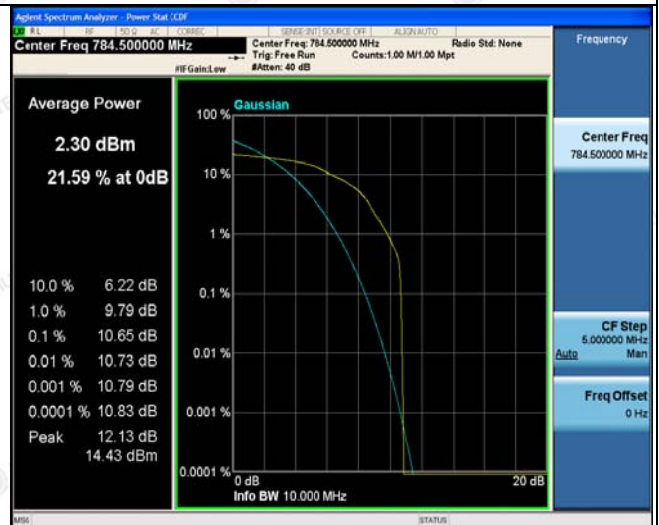


1RB#0

Middle Channel



1RB#0



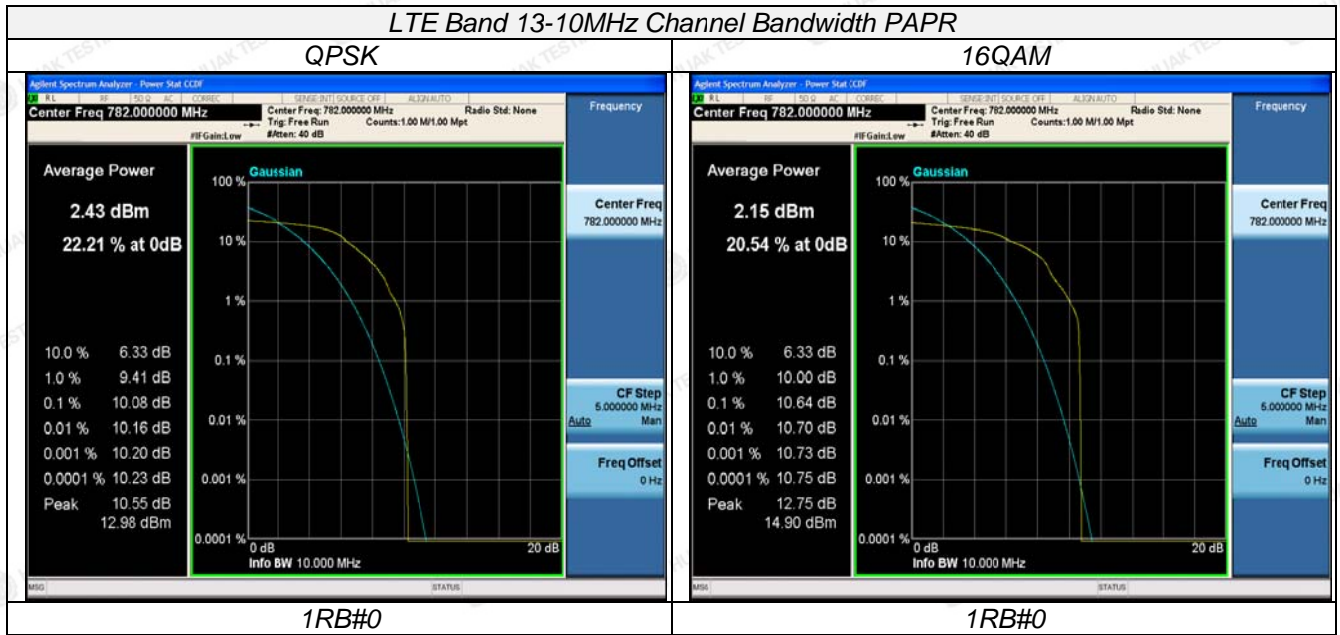
1RB#0

High Channel

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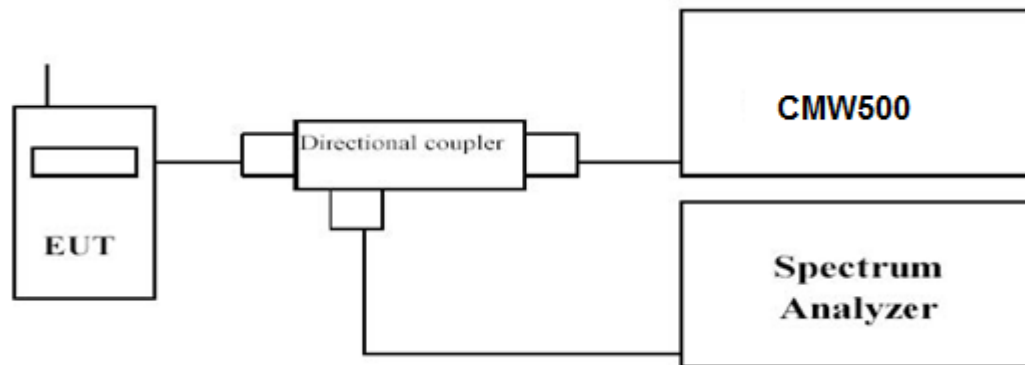


3.4 Occupied Bandwidth and Emission Bandwidth

LIMIT

N/A

TEST CONFIGURATION



TEST PROCEDURE

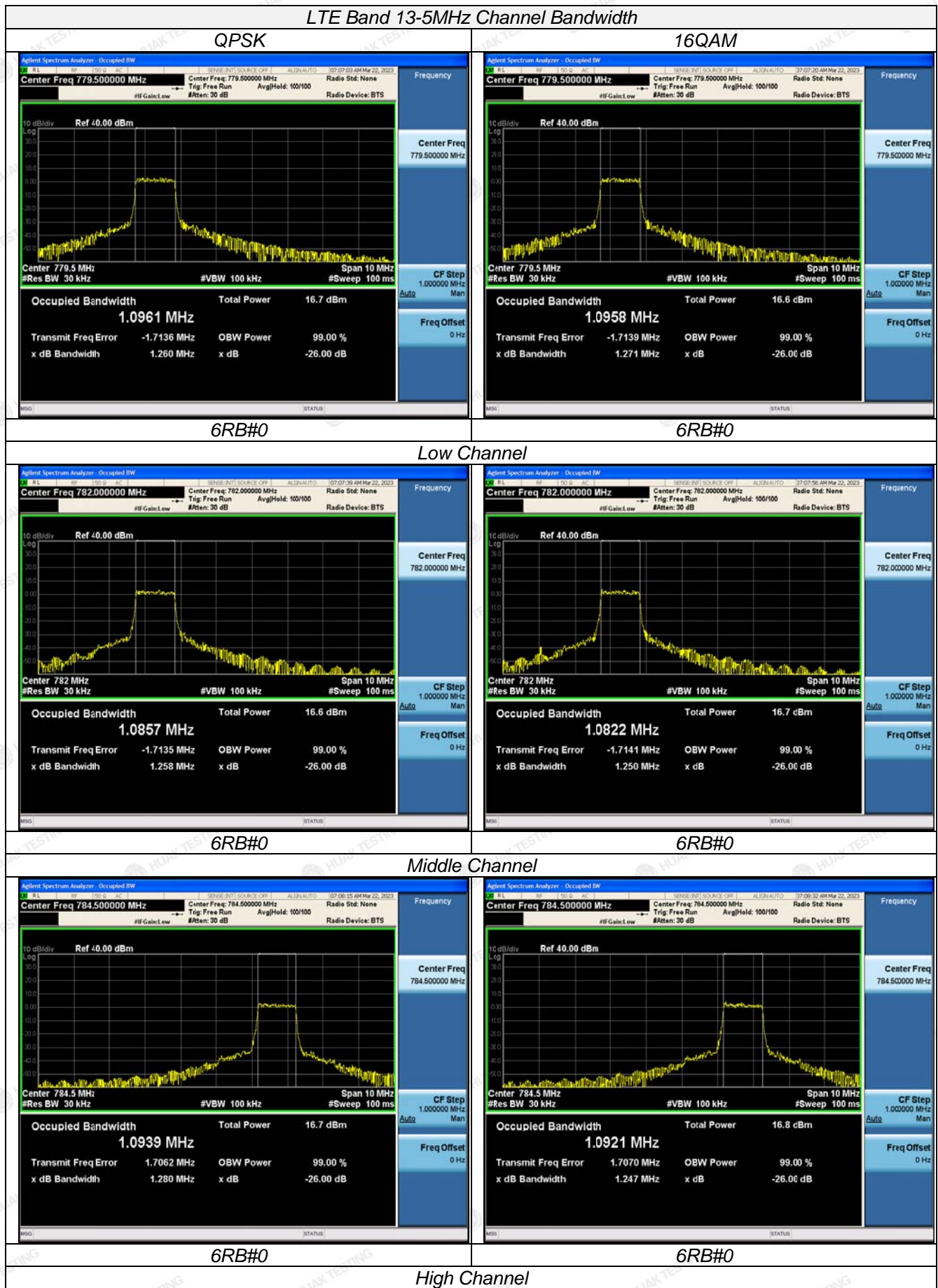
The transmitter output was connected to a calibrated coaxial cable and coupler, the other end of which was connected to a spectrum analyzer. The occupied bandwidth was measured with the spectrum analyzer at low, middle and high channel in each band. The -26dBc Emission bandwidth was also measured and recorded. Set RBW was set to about 1% of emission BW, VBW \geq 3 times RBW. -26dBc display line was placed on the screen (or 99% bandwidth), the occupied bandwidth is the delta frequency between the two points where the display line intersects the signal trace.

TEST RESULTS

Remark:

1. We were tested all RB Configuration refer 3GPP TS136 521 for each Channel Bandwidth of LTE Band 13; recorded worst case for each Channel Bandwidth of LTE Band 13.

| LTE Band 13 | | | | | | |
|----------------------|----------------|-----------------|---------------------------------|-------|------------------------------|--------|
| TX Channel Bandwidth | RB Size/Offset | Frequency (MHz) | -26dBc Emission bandwidth (MHz) | | 99% Occupied bandwidth (MHz) | |
| | | | QPSK | 16QAM | QPSK | 16QAM |
| 5 MHz | 6RB#0 | 779.5 | 1.260 | 1.271 | 1.0961 | 1.0958 |
| | | 782 | 1.258 | 1.250 | 1.0857 | 1.0822 |
| | | 784.5 | 1.280 | 1.247 | 1.0939 | 1.0921 |
| 10 MHz | 6RB#0 | 782 | 1.271 | 1.267 | 1.0936 | 1.0926 |



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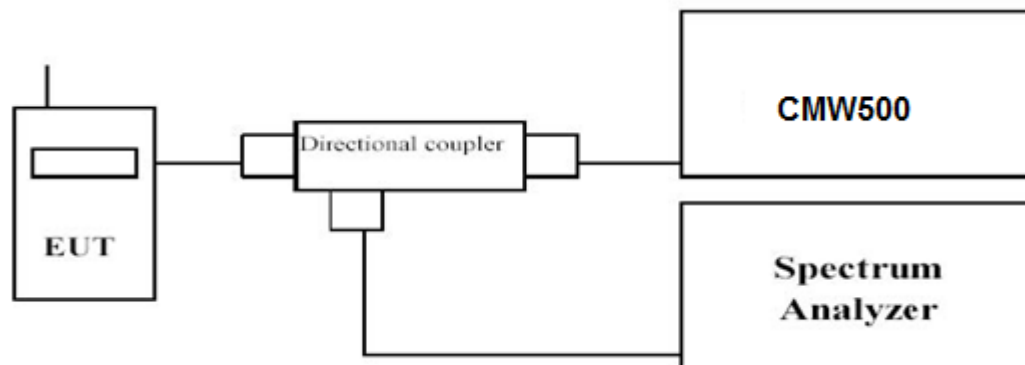
3.5 Band Edge Compliance

LIMIT

According to §27.53 (c): For operations in the 746-758 MHz band and the 776-788 MHz band, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

- (1) On any frequency outside the 746-758 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least $43 + 10 \log (P)$ dB;
- (2) On any frequency outside the 776-788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least $43 + 10 \log (P)$ dB;
- (3) On all frequencies between 763-775 MHz and 793-805 MHz, by a factor not less than $76 + 10 \log (P)$ dB in a 6.25 kHz band segment, for base and fixed stations;
- (4) On all frequencies between 763-775 MHz and 793-805 MHz, by a factor not less than $65 + 10 \log (P)$ dB in a 6.25 kHz band segment, for mobile and portable stations;

TEST CONFIGURATION



TEST PROCEDURE

1. The transmitter output port was connected to base station.
2. The RF output of EUT was connected to the power meter by RF cable and attenuator, the path loss was compensated to the results for each measurement.
3. Set EUT at maximum power through base station.
4. Select lowest and highest channels for each band and different modulation.
5. Measure Band edge using RMS (Average) detector by spectrum.

TEST RESULTS

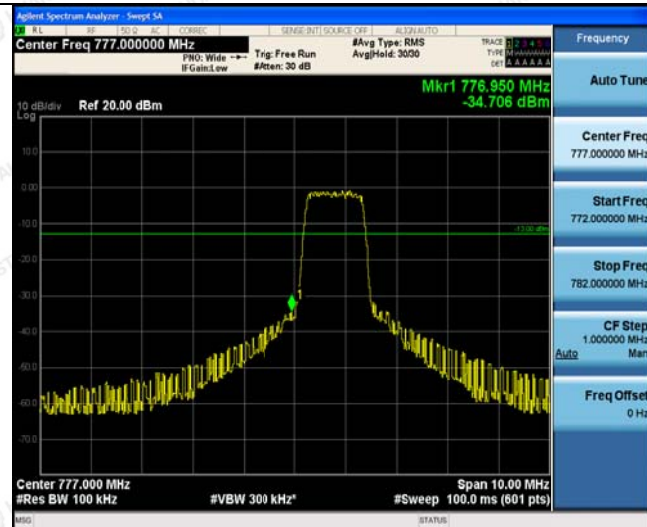
Remark:

1. We were tested all RB Configuration refer 3GPP TS136 521 for each Channel Bandwidth of LTE Band 13; recorded worst case for each Channel Bandwidth of LTE Band 13.



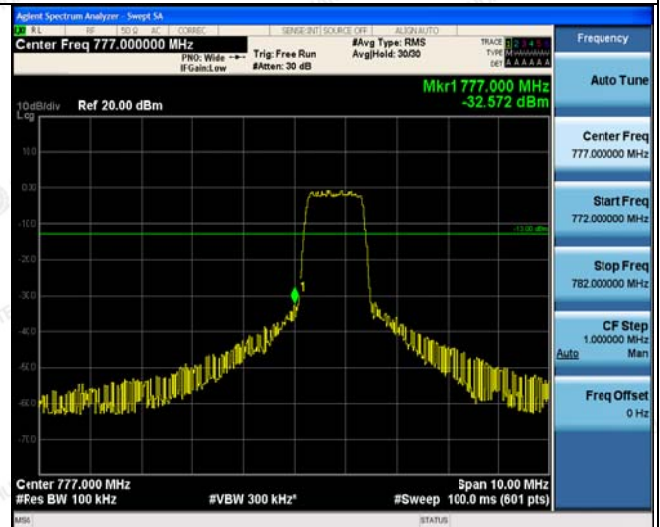
LTE Band 13-5MHz Channel Bandwidth Band Edge Compliance

QPSK



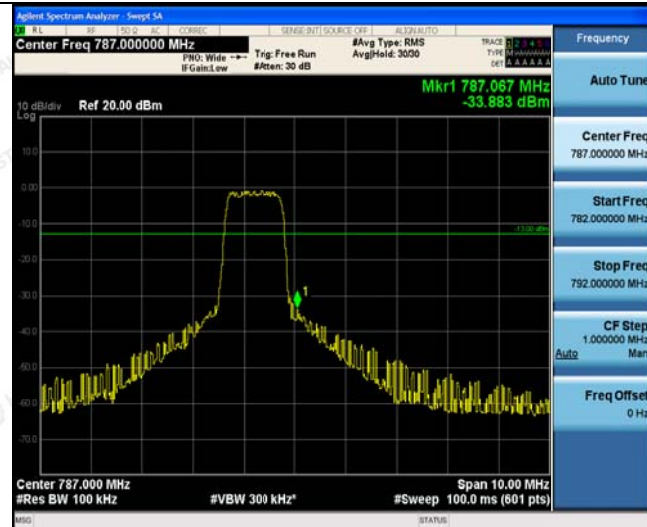
6RB#0

16QAM

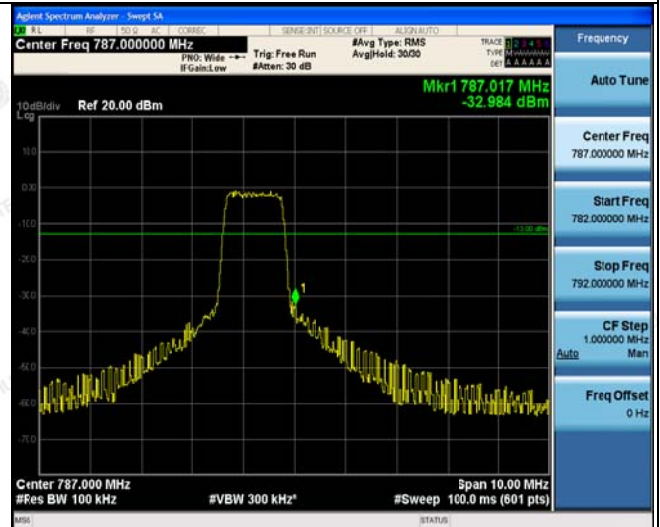


6RB#0

Low Channel

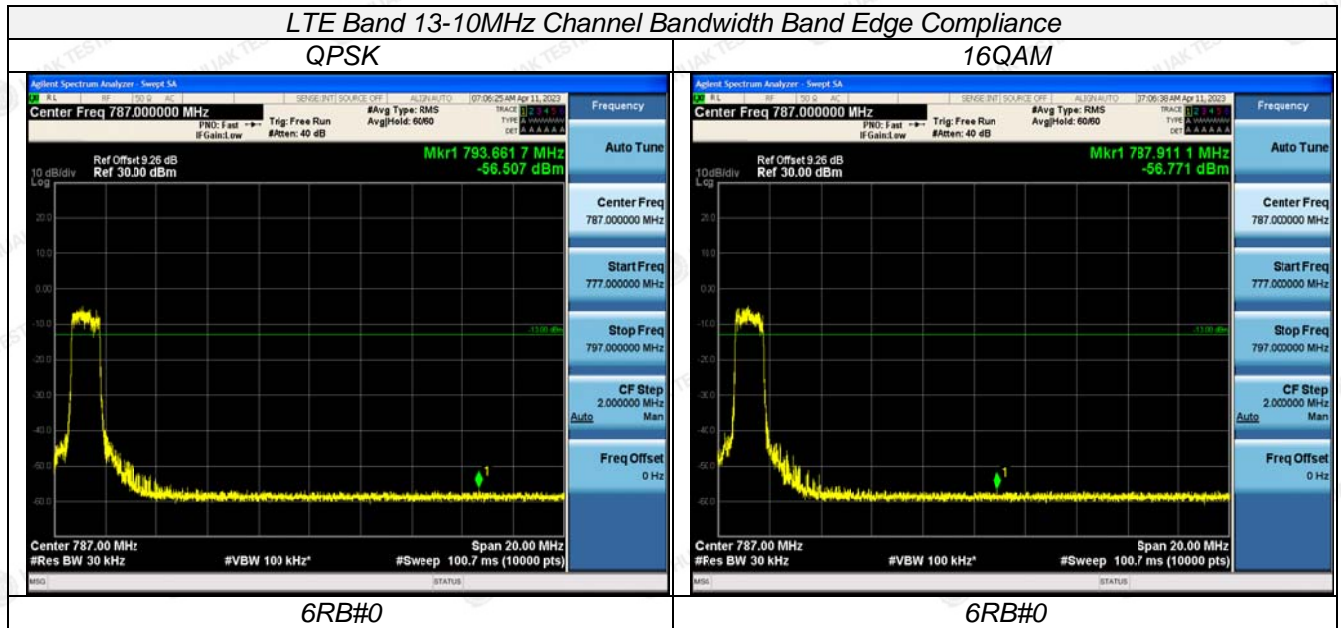


6RB#0



6RB#0

High Channel



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3.6 Spurious Emission

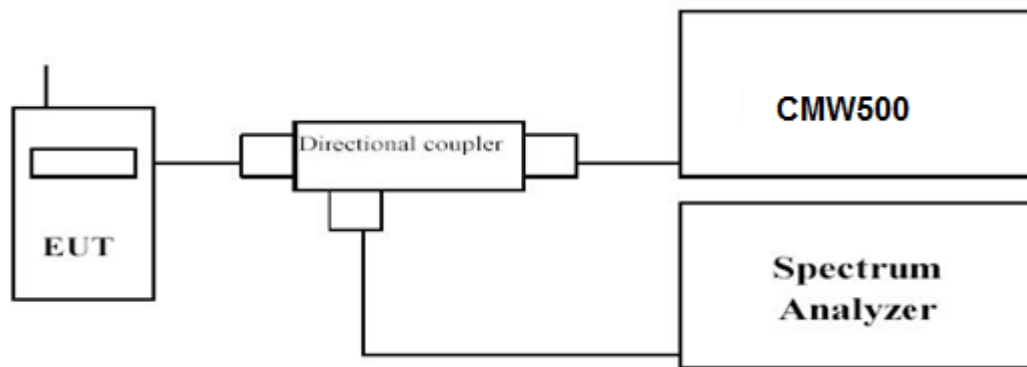
LIMIT

According to §27.53 (c): For operations in the 746-758 MHz band and the 776-788 MHz band, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

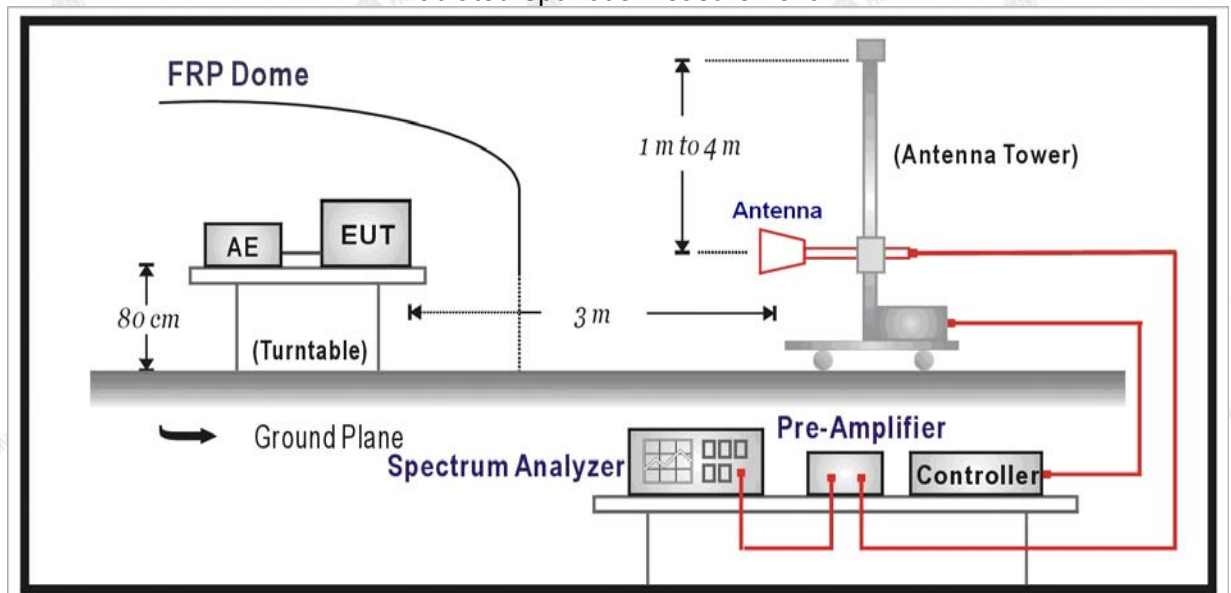
- (1) On any frequency outside the 746-758 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least $43 + 10 \log (P)$ dB;
- (2) On any frequency outside the 776-788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least $43 + 10 \log (P)$ dB;
- (3) On all frequencies between 763-775 MHz and 793-805 MHz, by a factor not less than $76 + 10 \log (P)$ dB in a 6.25 kHz band segment, for base and fixed stations;
- (4) On all frequencies between 763-775 MHz and 793-805 MHz, by a factor not less than $65 + 10 \log (P)$ dB in a 6.25 kHz band segment, for mobile and portable stations;

TEST CONFIGURATION

Conducted Spurious Measurement:



Radiated Spurious Measurement:



TEST PROCEDURE

The EUT was setup according to EIA/TIA 603D.

**Conducted Spurious Measurement:**

- Place the EUT on a bench and set it in transmitting mode.
- Connect a low loss RF cable from the antenna port to a spectrum analyzer and CMW500 by a Directional Couple.
- EUT Communicate with CMW500, then select a channel for testing.
- Add a correction factor to the display of spectrum, and then test.
- The resolution bandwidth of the spectrum analyzer was set sufficient scans were taken to show the out of band Emission if any up to 10th harmonic.
- Please refer to following tables for test antenna conducted emissions.

| Working Frequency | Sub range (GHz) | RBW | VBW | Sweep time (s) |
|-------------------|-------------------|-------|-------|----------------|
| LTE FDD Band 13 | 0.000009~0.000015 | 1KHz | 3KHz | Auto |
| | 0.000015~0.03 | 10KHz | 30KHz | Auto |
| | 0.03~26.5 | 1 MHz | 3 MHz | Auto |

Radiated Spurious Measurement:

- The EUT shall be placed at the specified height on a support, and in the position closest to normal use as declared by provider.
- The test antenna shall be oriented initially for vertical polarization and shall be chosen to correspond to the frequency of the transmitter.
- The output of the test antenna shall be connected to the measuring receiver.
- The transmitter shall be switched on and the measuring receiver shall be tuned to the frequency of the transmitter under test.
- The test antenna shall be raised and lowered through the specified range of height until a maximum signal level is detected by the measuring receiver.
- The transmitter shall then be rotated through 360° in the horizontal plane, until the maximum signal level is detected by the measuring receiver.
- The test antenna shall be raised and lowered again through the specified range of height until a maximum signal level is detected by the measuring receiver.
- The maximum signal level detected by the measuring receiver shall be noted.
- The transmitter shall be replaced by a substitution antenna.
- The substitution antenna shall be orientated for vertical polarization and the length of the substitution antenna shall be adjusted to correspond to the frequency of the transmitter.
- The substitution antenna shall be connected to a calibrated signal generator.
- If necessary, the input attenuator setting of the measuring receiver shall be adjusted in order to increase the sensitivity of the measuring receiver.
- The test antenna shall be raised and lowered through the specified range of height to ensure that the maximum signal is received.
- The input signal to the substitution antenna shall be adjusted to the level that produces a level detected by the measuring receiver, that is equal to the level noted while the transmitter radiated power was measured, corrected for the change of input attenuator setting of the measuring receiver.
- The measurement shall be repeated with the test antenna and the substitution antenna orientated for horizontal polarization.
- The measure of the effective radiated power is the larger of the two levels recorded at the input to the substitution antenna, corrected for gain of the substitution antenna if necessary.
- The resolution bandwidth of the spectrum analyzer was set at 100 kHz for Part 22 and 1MHz for Part 24. The frequency range was checked up to 10th harmonic.
- Test site anechoic chamber refer to ANSI C63.

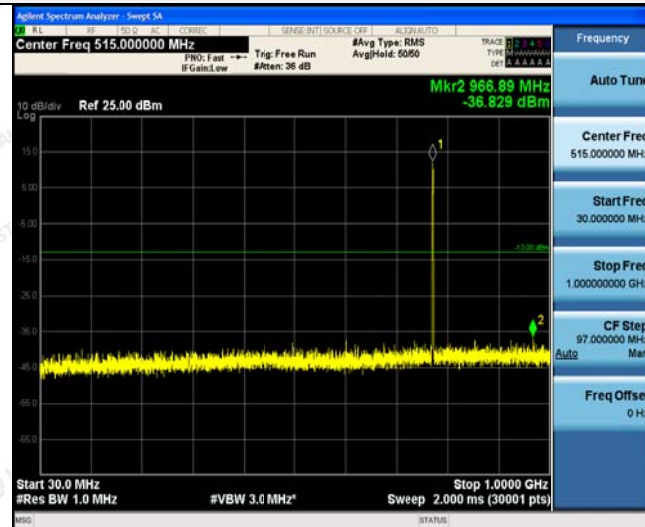
TEST RESULTS**Remark:**

- We were tested all RB Configuration refer 3GPP TS136 521 for each Channel Bandwidth of LTE Band 13; recorded worst case for each Channel Bandwidth of LTE Band 13.

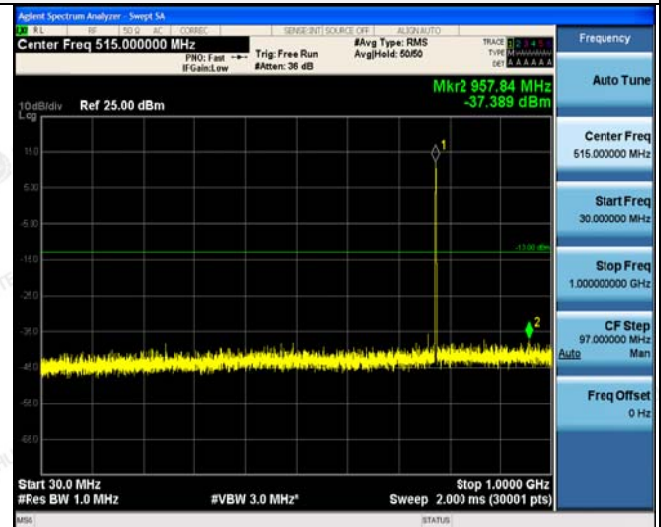
Conducted Measurement:

LTE Band 13-5MHz Channel Bandwidth
Low Channel

QPSK



16QAM



30~1000MHz



30~1000MHz



1000~5000MHz

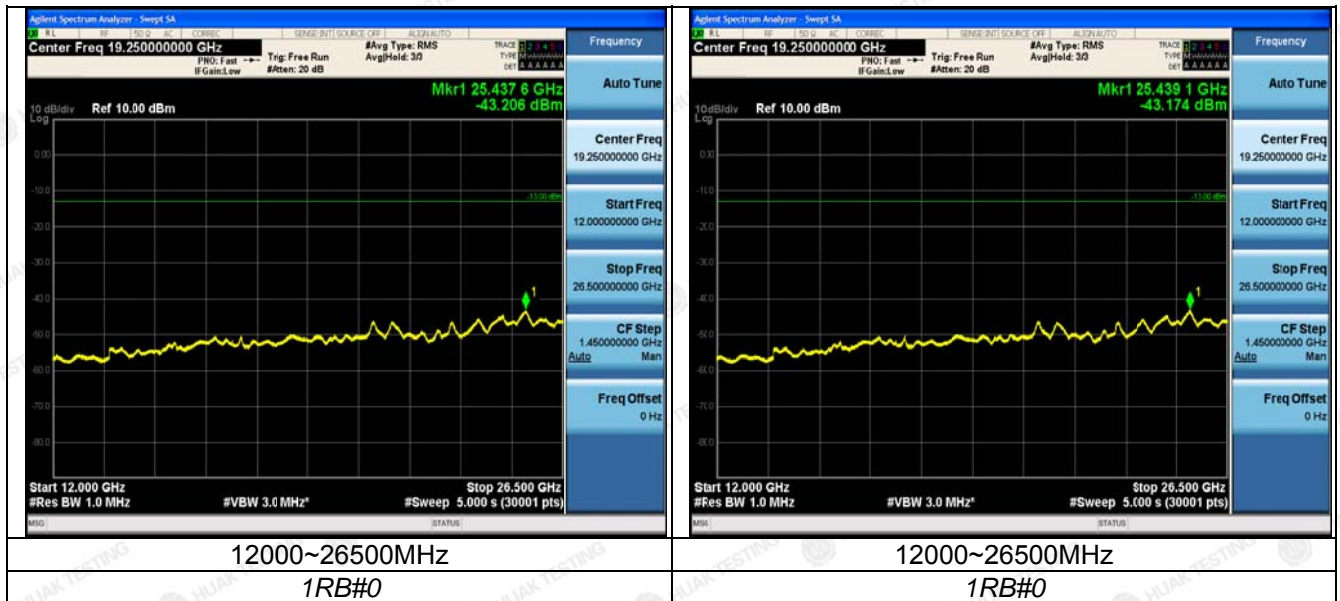


1000~5000MHz



5000~12000MHz

5000~12000MHz



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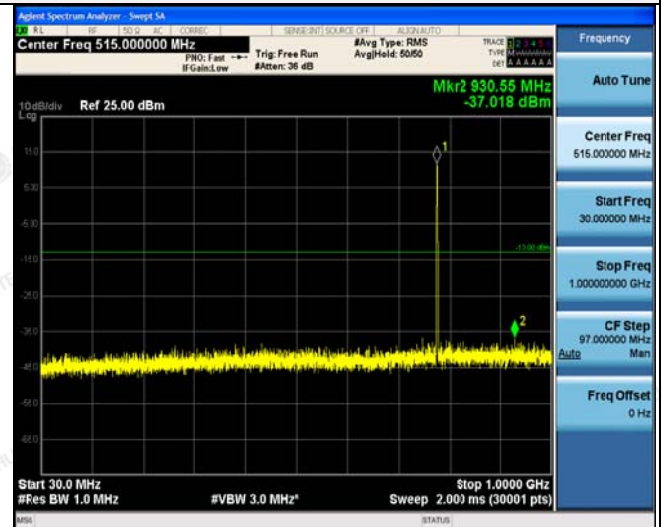
Add: 1-2F., Building B2, Junfeng Zhongcheng Zhizao Innovation Park, Heping Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China

LTE Band 13-5MHz Channel Bandwidth
Middle Channel

QPSK



16QAM



30~1000MHz



30~1000MHz



1000~5000MHz



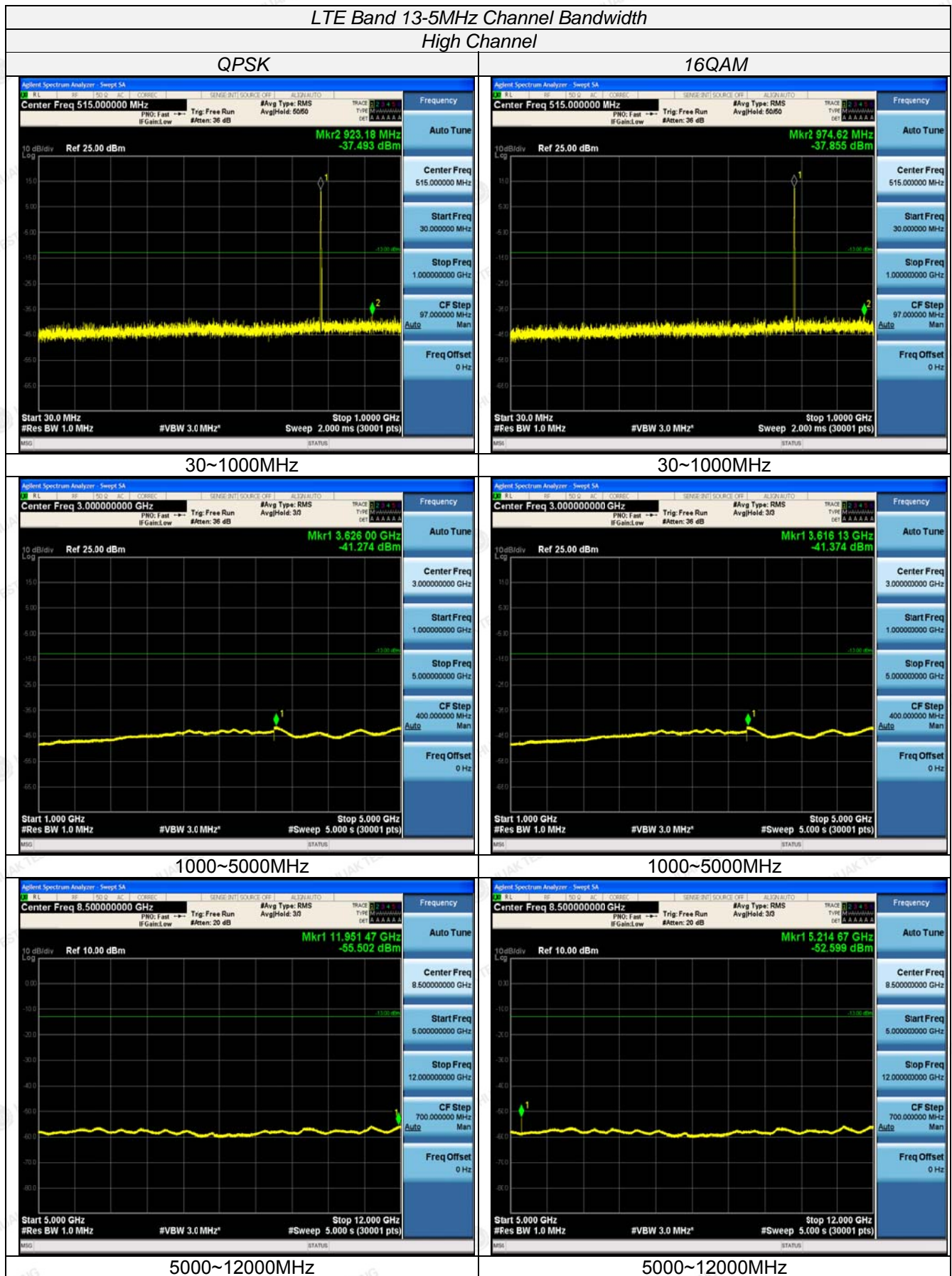
1000~5000MHz



5000~12000MHz

5000~12000MHz

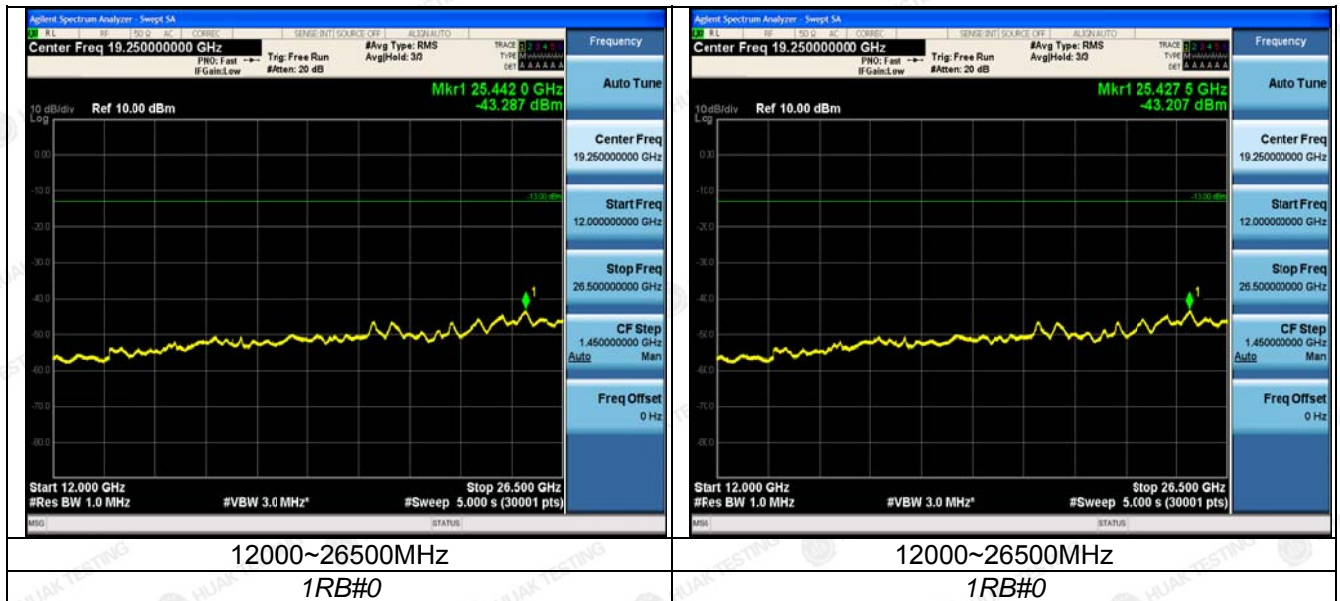




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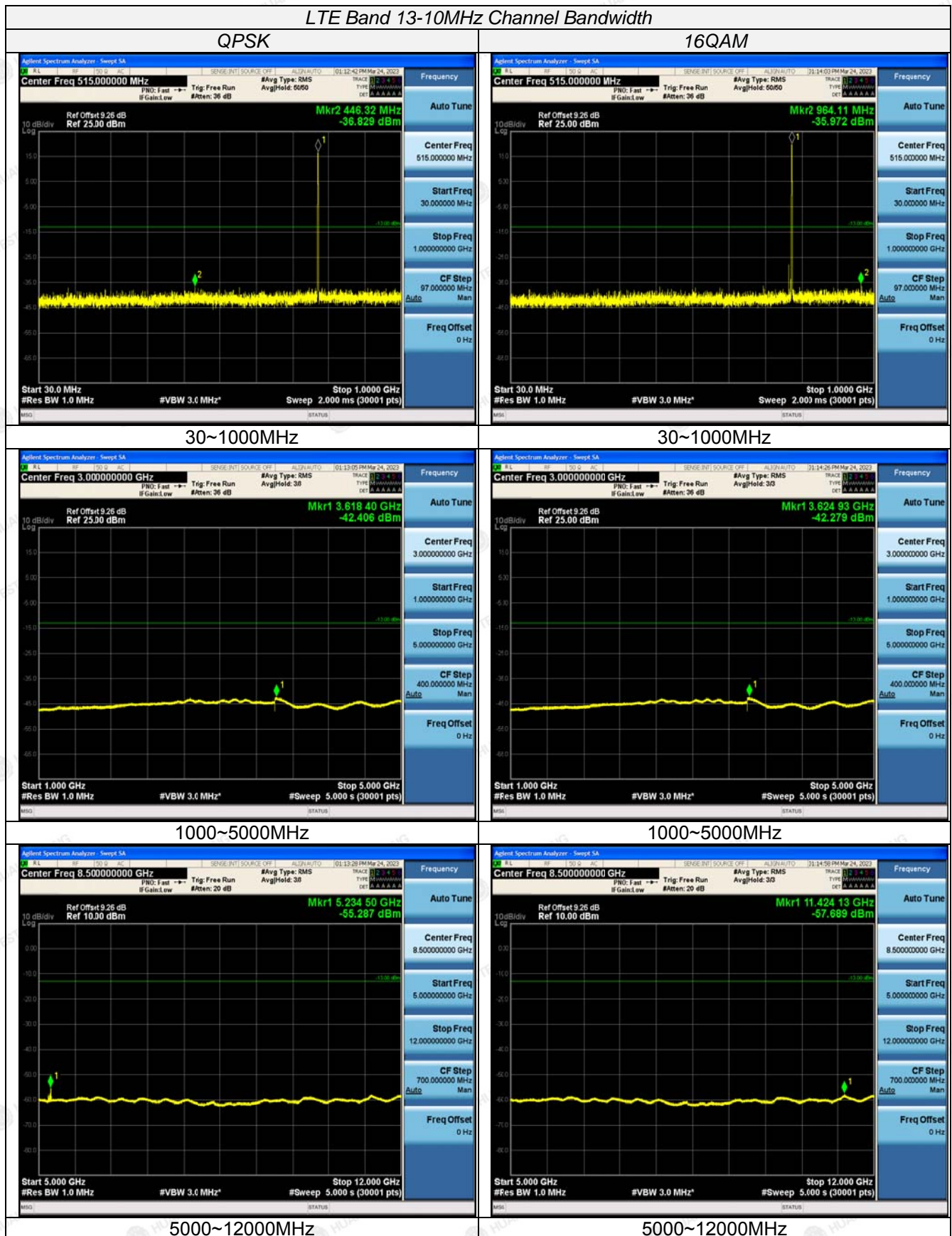
Add: 1-2F., Building B2, Junfeng Zhongcheng Zhizao Innovation Park, Heping Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China



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**Radiated Measurement:****Remark:**

1. We were tested all RB Configuration refer 3GPP TS136 521 for each Channel Bandwidth of LTE FDD Band 13; recorded worst case for each Channel Bandwidth of LTE FDD Band 13.
2. $EIRP = P_{Mea}(dBm) - P_{cl}(dB) + G_a(dBi)$
3. We were not recorded other points as values lower than limits.
4. $Margin = Limit - EIRP$

Radiated Measurement:**Remark:**

1. We were tested all RB Configuration refer 3GPP TS136 521 for each Channel Bandwidth of LTE FDD Band 13; recorded worst case for each Channel Bandwidth of LTE FDD Band 13.
2. $EIRP = P_{Mea}(dBm) - P_{cl}(dB) + G_a(dBi)$
3. We were not recorded other points as values lower than limits.
4. $Margin = Limit - EIRP$

LTE FDD Band 13_Channel Bandwidth 5MHz_QPSK_Low Channel

| Frequency (MHz) | PMea (dBm) | Pcl (dB) | Diatance | Ga Antenna Gain(dB) | Peak EIRP (dBm) | Limit (dBm) | Margin (dB) | Polarization |
|-----------------|------------|----------|----------|---------------------|-----------------|-------------|-------------|--------------|
| 1559.0 | -55.05 | 4.02 | 3 | 12.21 | -46.86 | -40.00 | 6.86 | H |
| 2338.5 | -47.96 | 5.11 | 3 | 13.26 | -39.81 | -13.00 | 26.81 | H |
| 1559.0 | -58.1 | 4.02 | 3 | 12.21 | -49.91 | -40.00 | 9.91 | V |
| 2338.5 | -54.61 | 5.11 | 3 | 13.26 | -46.46 | -13.00 | 33.46 | V |

LTE FDD Band 13_Channel Bandwidth 5MHz_QPSK_Middle Channel

| Frequency (MHz) | PMea (dBm) | Pcl (dB) | Diatance | Ga Antenna Gain(dB) | EIRP (dBm) | Limit (dBm) | Margin (dB) | Polarization |
|-----------------|------------|----------|----------|---------------------|------------|-------------|-------------|--------------|
| 1564.0 | -53.57 | 4.02 | 3 | 12.21 | -45.38 | -40.00 | 5.38 | H |
| 2346.0 | -46.77 | 5.11 | 3 | 13.26 | -38.62 | -13.00 | 25.62 | H |
| 1564.0 | -58.67 | 4.02 | 3 | 12.21 | -50.48 | -40.00 | 10.48 | V |
| 2346.0 | -54.39 | 5.11 | 3 | 13.26 | -46.24 | -13.00 | 33.24 | V |

LTE FDD Band 13_Channel Bandwidth 5MHz_QPSK_High Channel

| Frequency (MHz) | PMea (dBm) | Pcl (dB) | Diatance | Ga Antenna Gain(dB) | EIRP (dBm) | Limit (dBm) | Margin (dB) | Polarization |
|-----------------|------------|----------|----------|---------------------|------------|-------------|-------------|--------------|
| 1569.0 | -54.14 | 4.02 | 3 | 12.21 | -45.95 | -40.00 | 5.95 | H |
| 2353.5 | -47.39 | 5.11 | 3 | 13.26 | -39.24 | -13.00 | 26.24 | H |
| 1569.0 | -58.84 | 4.02 | 3 | 12.21 | -50.65 | -40.00 | 10.65 | V |
| 2353.5 | -53.92 | 5.11 | 3 | 13.26 | -45.77 | -13.00 | 32.77 | V |

LTE FDD Band 13_Channel Bandwidth 10MHz_QPSK

| Frequency (MHz) | PMea (dBm) | Pcl (dB) | Diatance | Ga Antenna Gain(dB) | EIRP (dBm) | Limit (dBm) | Margin (dB) | Polarization |
|-----------------|------------|----------|----------|---------------------|------------|-------------|-------------|--------------|
| 1564.0 | -55.09 | 4.02 | 3 | 12.21 | -46.9 | -40.00 | 6.9 | H |
| 2346.0 | -47.58 | 5.11 | 3 | 13.26 | -39.43 | -13.00 | 26.43 | H |
| 1564.0 | -59.05 | 4.02 | 3 | 12.21 | -50.86 | -40.00 | 10.86 | V |
| 2346.0 | -54.32 | 5.11 | 3 | 13.26 | -46.17 | -13.00 | 33.17 | V |



LTE FDD Band 13_Channel Bandwidth 5MHz_16QAM_Low Channel

| Frequency (MHz) | PMea (dBm) | Pcl (dB) | Diatance | Ga Antenna Gain(dB) | Peak EIRP (dBm) | Limit (dBm) | Margin (dB) | Polarization |
|-----------------|------------|----------|----------|---------------------|-----------------|-------------|-------------|--------------|
| 1559.0 | -54.71 | 4.02 | 3 | 12.21 | -46.52 | -40.00 | 6.52 | H |
| 2338.5 | -47.64 | 5.11 | 3 | 13.26 | -39.49 | -13.00 | 26.49 | H |
| 1559.0 | -58.54 | 4.02 | 3 | 12.21 | -50.35 | -40.00 | 10.35 | V |
| 2338.5 | -55.04 | 5.11 | 3 | 13.26 | -46.89 | -13.00 | 33.89 | V |

LTE FDD Band 13_Channel Bandwidth 5MHz_16QAM_Middle Channel

| Frequency (MHz) | PMea (dBm) | Pcl (dB) | Diatance | Ga Antenna Gain(dB) | EIRP (dBm) | Limit (dBm) | Margin (dB) | Polarization |
|-----------------|------------|----------|----------|---------------------|------------|-------------|-------------|--------------|
| 1564.0 | -54.43 | 4.02 | 3 | 12.21 | -46.24 | -40.00 | 6.24 | H |
| 2346.0 | -47.67 | 5.11 | 3 | 13.26 | -39.52 | -13.00 | 26.52 | H |
| 1564.0 | -57.84 | 4.02 | 3 | 12.21 | -49.65 | -40.00 | 9.65 | V |
| 2346.0 | -54.38 | 5.11 | 3 | 13.26 | -46.23 | -13.00 | 33.23 | V |

LTE FDD Band 13_Channel Bandwidth 5MHz_16QAM_High Channel

| Frequency (MHz) | PMea (dBm) | Pcl (dB) | Diatance | Ga Antenna Gain(dB) | EIRP (dBm) | Limit (dBm) | Margin (dB) | Polarization |
|-----------------|------------|----------|----------|---------------------|------------|-------------|-------------|--------------|
| 1569.0 | -53.99 | 4.02 | 3 | 12.21 | -45.8 | -40.00 | 5.8 | H |
| 2353.5 | -46.66 | 5.11 | 3 | 13.26 | -38.51 | -13.00 | 25.51 | H |
| 1569.0 | -58.99 | 4.02 | 3 | 12.21 | -50.8 | -40.00 | 10.8 | V |
| 2353.5 | -53.88 | 5.11 | 3 | 13.26 | -45.73 | -13.00 | 32.73 | V |

LTE FDD Band 13_Channel Bandwidth 10MHz_16QAM

| Frequency (MHz) | PMea (dBm) | Pcl (dB) | Diatance | Ga Antenna Gain(dB) | EIRP (dBm) | Limit (dBm) | Margin (dB) | Polarization |
|-----------------|------------|----------|----------|---------------------|------------|-------------|-------------|--------------|
| 1564.0 | -54.08 | 4.02 | 3 | 12.21 | -45.89 | -40.00 | 5.89 | H |
| 2346.0 | -47.99 | 5.11 | 3 | 13.26 | -39.84 | -13.00 | 26.84 | H |
| 1564.0 | -58.53 | 4.02 | 3 | 12.21 | -50.34 | -40.00 | 10.34 | V |
| 2346.0 | -54.45 | 5.11 | 3 | 13.26 | -46.3 | -13.00 | 33.3 | V |

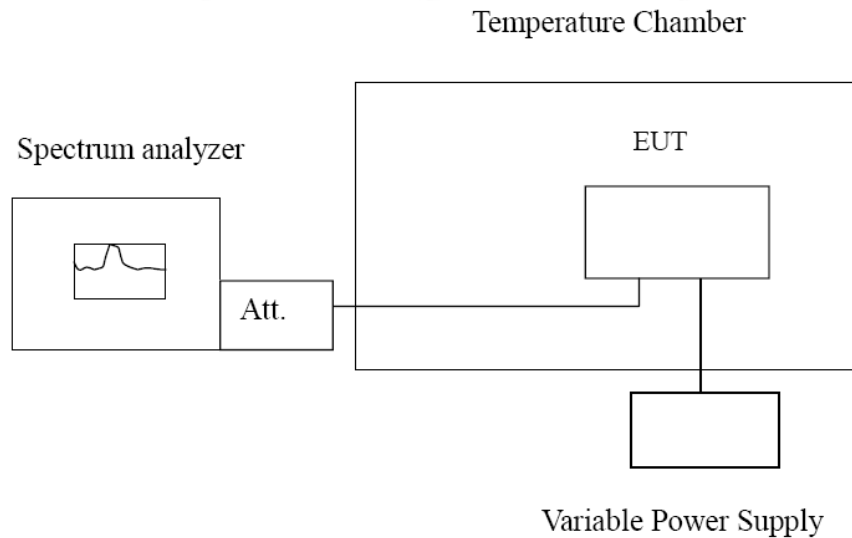


3.7 Frequency Stability Under Temperature & Voltage Variations

LIMIT

According to §27.54, §2.1055 requirement, the frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation and should not exceed 2.5ppm.

TEST CONFIGURATION



TEST PROCEDURE

The EUT was setup according to EIA/TIA 603D.

Frequency Stability Under Temperature Variations:

In order to measure the carrier frequency under the condition of AFC lock, it is necessary to make measurements with the EUT in a "call mode". This is accomplished with the use of R&S CMW500 DIGITAL RADIO COMMUNICATION TESTER.

1. Measure the carrier frequency at room temperature.
2. Subject the EUT to overnight soak at -30°C.
3. With the EUT, powered via nominal voltage, connected to the CMW500 and in a simulated call on middle channel for LTE Band 13, measure the carrier frequency. These measurements should be made within 2 minutes of Powering up the EUT, to prevent significant self-warming.
4. Repeat the above measurements at 10°C increments from -30°C to +50°C. Allow at least 1.5 hours at each temperature, unpowered, before making measurements.
5. Re-measure carrier frequency at room temperature with nominal voltage. Vary supply voltage from minimum voltage to maximum voltage, in 0.1Volt increments re-measuring carrier frequency at each voltage. Pause at nominal voltage for 1.5 hours unpowered, to allow any self-heating to stabilize, before continuing.
6. Subject the EUT to overnight soak at +50°C.
7. With the EUT, powered via nominal voltage, connected to the CMW500 and in a simulated call on the centre channel, measure the carrier frequency. These measurements should be made within 2 minutes of Powering up the EUT, to prevent significant self-warming.
8. Repeat the above measurements at 10 °C increments from +50°C to -30°C. Allow at least 1.5 hours at each temperature, unpowered, before making measurements.
9. At all temperature levels hold the temperature to +/- 0.5°C during the measurement procedure.

Frequency Stability Under Voltage Variations:

Set chamber temperature to 20°C. Use a variable AC power supply / DC power source to power the EUT and set the voltage to rated voltage. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and recorded the frequency.

Reduce the input voltage to specify extreme voltage variation ($\pm 15\%$) and endpoint, record the maximum frequency change.

**TEST RESULTS**

Remark:

1. We tested all RB Configuration refer 3GPP TS136 521 for each Channel Bandwidth of LTE Band 13; recorded worst case.

LTE Band 13, 10MHz bandwidth (worst case of all bandwidths)

Frequency Error vs Voltage

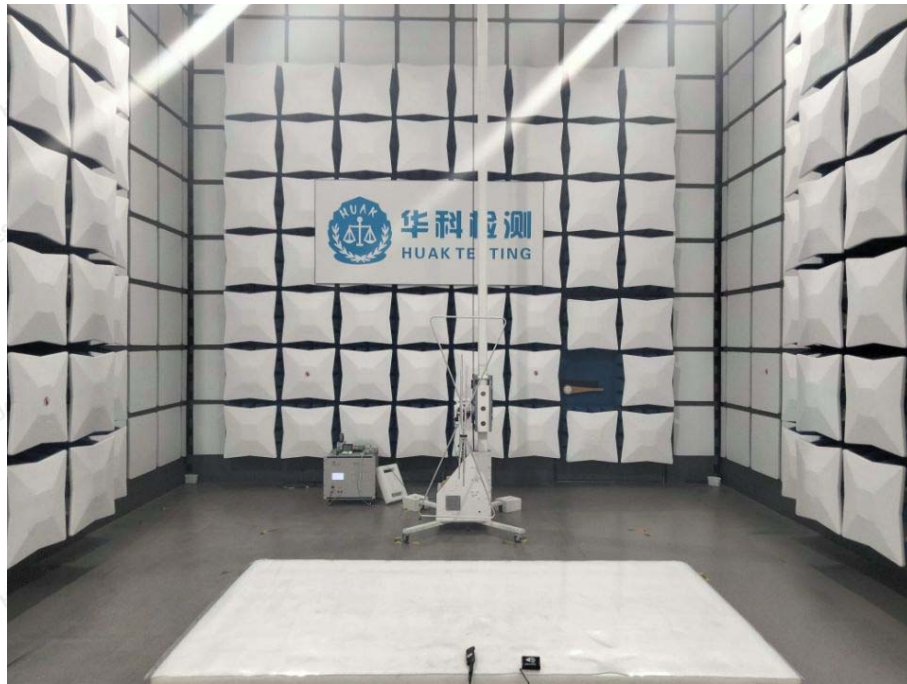
| Voltage (V) | Frequency error (Hz) | | Frequency error (ppm) | |
|----------------|----------------------|-------|-----------------------|----------|
| | QPSK | 16QAM | QPSK | 16QAM |
| 3.15V | 4.37 | 4.31 | 0.005606 | 0.005529 |
| 3.70V | -4.44 | 4.73 | -0.005696 | 0.006068 |
| 4.26V | -3.51 | 4.34 | -0.004503 | 0.005568 |

Frequency Error vs Temperature

| Temperature (°C) | Frequency error (Hz) | | Frequency error (ppm) | |
|---------------------|----------------------|-------|-----------------------|-----------|
| | QPSK | 16QAM | QPSK | 16QAM |
| -30° | -5.02 | 4.41 | -0.006440 | 0.005657 |
| -20° | 4.47 | 4.24 | 0.005734 | 0.005439 |
| -10° | -6.96 | -4.59 | -0.008900 | -0.005870 |
| 0° | -6.01 | -8.17 | -0.007685 | -0.010448 |
| 10° | -6.14 | -5.85 | -0.007852 | -0.007481 |
| 20° | -5.05 | -5.76 | -0.006458 | -0.007366 |
| 30° | -6.55 | -6.30 | -0.008376 | -0.008056 |
| 40° | 5.45 | 5.63 | 0.006947 | 0.007177 |
| 50° | 5.17 | 4.68 | 0.006590 | 0.005966 |



4 Test Setup Photos of the EUT





5 Photos of the EUT

Reference to the report: ANNEX A of external photos and ANNEX B of internal photos.

.....End of Report.....