



TEST REPORT
FCC Part 22 /Part 24

Report Reference No.: HK1910222686-1E

FCC ID : 2AHH4MAS-501

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Date of issue.....: Oct.29, 2019

Testing Laboratory Name: **Shenzhen HUAK Testing Technology Co., Ltd.**

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

Applicant's name: **Toplovo Industrial Co.,Ltd**

Address.....: 4F, Building B2b, Yingzhan Industrial Park, Kengzi Town, Pingshan District, Shenzhen, China. 518122

Test specification :

Standard : **FCC Part 22/FCC Part 24**

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Test item description: Personal GPS tracker

Trade Mark: Toplovo, Mobile Alert

Manufacturer: Toplovo Industrial Co.,Ltd

Model/Type reference.....: MAS-501

Listed Models: /

Ratings.....: DC 5V from USB or DC3.7V By Battery

Modulation: WCDMA

Hardware version: V12

Software version: V12

Frequency..... UMTS Band II, UMTS Band V

Result.....: **PASS**



TEST REPORT

| | | |
|--------------------------|-----------------|---------------|
| Test Report No. : | HK1910222686-1E | Oct. 28, 2019 |
| | | Date of issue |

Equipment under Test : Personal GPS tracker

Model /Type : MAS-501

Listed Models : /

Applicant : **Toplovo Industrial Co.,Ltd**

Address : 4F, Building B2b, Yingzhan Industrial Park, Kengzi Town,
Pingshan District,Shenzhen, China. 518122

Manufacturer : **Toplovo Industrial Co.,Ltd**

Address : 4F, Building B2b, Yingzhan Industrial Park, Kengzi Town,
Pingshan District,Shenzhen, China. 518122

| | |
|---------------------|-------------|
| 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.



Revision History

| Revision | Issue Date | Revisions | Revised By |
|----------|------------|---------------|------------|
| V1.0 | 2019-10-28 | Initial Issue | James Zhou |
| | | | |
| | | | |



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1 TEST STANDARDS

The tests were performed according to following standards:

[FCC Part 2:](#) FREQUENCY ALLOCA-TIONS AND RADIO TREATY MAT-TERS; GENERAL RULES AND REG-ULATIONS

[FCC Part 22 Subpart H:](#) PRIVATE LAND MOBILE RADIO SERVICES.

[FCC Part 24 Subpart E:](#) PUBLIC MOBILE SERVICES

[ANSI/TIA-603-E-2016:](#) Land Mobile FM or PM Communications Equipment Measurement and Performance Standards.

[ANSI C63.26-2015:](#) IEEE/ANSI Standard for Compliance Testing of Transmitters Used in Licensed Radio Services

[FCKDB971168D01 v03r01](#) Power Meas License Digital Systems



2 SUMMARY

2.1 General Remarks

| | | |
|--------------------------------|---|---------------|
| Date of receipt of test sample | : | Oct. 21, 2019 |
| | | |
| Testing commenced on | : | Oct. 25, 2019 |
| | | |
| Testing concluded on | : | Oct. 28, 2019 |

2.2 Product Description

The **Toplovo Industrial Co.,Ltd** 's Model: MAS-501. or the "EUT" as referred to in this report; more general information as follows, for more details, refer to the user's manual of the EUT.

| | |
|-------------------------------|---|
| Name of EUT | Personal GPS tracker |
| Model Number | MAS-501 |
| Modulation Type | QPSK for UMTS |
| Antenna Type | Internal Antenna |
| UMTS Operation Frequency Band | Device supported UMTS FDD Band II, FDD Band V |
| HSDPA Release Version | Release 10 |
| HSUPA Release Version | Release 6 |
| DC-HSUPA Release Version | Not Supported |
| WCDMA Release Version | R99 |
| Extreme temp. Tolerance | -30°C to +50°C |
| Extreme vol. Limits | DC 5V from USB or DC3.7V By Battery |
| Antenna gain: | FDD Band V: 2.0dBi, FDD Band II: 2.0dBi |

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 5V from USB or DC3.7V By Battery

Test frequency list

| Test Mode | TX/RX | RF Channel | | |
|-----------|-------|--------------|--------------|--------------|
| | | Low(L) | Middle(M) | High (H) |
| WCDMA850 | TX | Channel 4132 | Channel 4182 | Channel 4233 |
| | | 826.4 MHz | 836.4 MHz | 846.6 MHz |
| | RX | Channel 4357 | Channel 4407 | Channel 4458 |
| | | 871.4 MHz | 881.4 MHz | 891.6 MHz |
| Test Mode | TX/RX | RF Channel | | |
| | | Low(L) | Middle (M) | High (H) |
| WCDMA1900 | TX | Channel 9262 | Channel 9400 | Channel 9538 |
| | | 1852.4 MHz | 1880.0 MHz | 1907.6 MHz |
| | RX | Channel 9662 | Channel 9800 | Channel 9938 |
| | | 1932.4 MHz | 1960.0 MHz | 1987.6 MHz |



2.4 Short description of the Equipment under Test (EUT)

2.4.1 General Description

This is a Personal GPS tracker .

For more details, refer to the user's manual of the EUT

2.5 EUT configuration

The following peripheral devices and interface cables were connected during the measurement:

- - supplied by the manufacturer
- - supplied by the lab

| | | |
|-----|---------------|---|
| ○ / | M/N : | / |
| | Manufacturer: | / |

2.6 Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for **FCC ID: 2AHH4MAS-501** filing to comply with FCC Part 22 and Part 24 Rules.

2.7 General Test Conditions/Configurations

2.7.1 Test Modes

NOTE: The test mode(s) are selected according to relevant radio technology specifications.

| Test Mode | Test Modes Description |
|-----------|-------------------------------|
| UMTS/TM1 | WCDMA system, QPSK modulation |
| UMTS/TM2 | HSDPA system, QPSK modulation |
| UMTS/TM3 | HSUPA system, QPSK modulation |

Note:

1. As WCDMA, HSDPA and HSUPA with the same emission designator, test result recorded in this report at the worst case UMTS/TM1 only after exploratory scan.

2.7.2 Test Environment

| Environment Parameter | Selected Values During Tests | |
|-----------------------|------------------------------|---------|
| Relative Humidity | Ambient | |
| Temperature | TN | Ambient |
| Voltage | VL | 3.33V |
| | VN | 3.70V |
| | VH | 4.03V |

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

2.8 Modifications

No modifications were implemented to meet testing criteria.



3 TEST ENVIRONMENT

3.1 Address of the test laboratory

Shenzhen HUAK Testing Technology Co., Ltd.
Add.:1F, B2 Building, Junfeng Zhongcheng Zhizao Innovation Park, Heping Community, Fuhai Street,
Bao'an District, Shenzhen, China

3.2 Environmental conditions

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

| | |
|-----------------------|--------------|
| Temperature: | 15-35 ° C |
| | |
| Humidity: | 30-60 % |
| | |
| Atmospheric pressure: | 950-1050mbar |

(1) expressed at approximately the 95% confidence level using a coverage factor of $k=1.96$.

3.3 Test Description

3.3.1 Cellular Band (824-849MHz paired with 869-894MHz)

| Test Item | FCC Rule No. | Requirements | Verdict |
|---|-----------------------------|---|---------|
| Effective(Isotropic) Radiated Output Power | Part§2.1046, Part§22.913 | FCC: $ERP \leq 7W$. $IC \leq 11.5W$. | Pass |
| Bandwidth | Part§2.1049 | OBW: No limit. EBW: No limit. | Pass |
| Band Edges Compliance | Part§2.1051, Part§22.917 | $\leq -13dBm/1\%EBW$, in 1MHz bands immediately outside and adjacent to The frequency block. | Pass |
| Spurious Emission at Antenna Terminals | Part§2.1051, Part§22.917 | FCC/IC: $\leq -13dBm/100kHz$, from 9kHz to 10th harmonics but outside authorized operating frequency ranges. | Pass |
| Field Strength of Spurious Radiation | Part§2.1053, Part§22.917 | FCC/IC: $\leq -13dBm/100kHz$. | Pass |
| Frequency Stability | Part§2.1055, Part§22.355 | FCC/IC: $\leq \pm 2.5ppm$. | Pass |

NOTE 1: For the verdict, the "N/A" denotes "not applicable", the "N/T" de notes "not tested".



3.3.2 PCS Band (1850-1915MHz paired with 1930-1995MHz)

| Test Item | FCC/IC Rule No. | Requirements | Verdict |
|---|-----------------------------|--|---------|
| Effective(Isotropic) Radiated Output Power | Part§2.1046, Part§24.232 | EIRP \leq 2W | Pass |
| Peak-Average Ratio | Part§2.1046, Part§24.232 | FCC:Limit \leq 13dB | Pass |
| Bandwidth | Part§2.1049 | OBW: No limit. EBW: No limit. | Pass |
| Band Edges Compliance | Part§2.1051, Part§24.238 | \leq -13dBm/1%*EBW, In 1MHz bands immediately outside and adjacent to The frequency block. | Pass |
| Spurious Emission at Antenna Terminals | Part§2.1051, Part§24.238 | \leq -13dBm/1MHz, from 9kHz to 10th harmonics but outside authorized Operating frequency ranges. | Pass |
| Field Strength of Spurious Radiation | Part§2.1053, Part§24.238 | \leq -13dBm/1MHz. | Pass |
| Frequency Stability | Part§2.1055, Part§24.235 | FCC: within authorized frequency block. | Pass |
| NOTE 1: For the verdict, the "N/A" denotes "not applicable", the "N/T" de notes "not tested". | | | |



3.4 Equipments Used during the Test

| Test Equipment | Manufacturer | Model No. | Serial No. | Calibration Date | Calibration Due Date |
|---------------------------------|--------------|----------------------|------------|------------------|----------------------|
| LISN | R&S | ENV216 | HKE-059 | 2018/12/27 | 2019/12/26 |
| LISN | R&S | ENV216 | HKE-002 | 2018/12/27 | 2019/12/26 |
| Receiver | R&S | ESCI 7 | HKE-010 | 2018/12/27 | 2019/12/26 |
| Spectrum analyzer | R&S | FSP40 | HKE-025 | 2018/12/27 | 2019/12/26 |
| Spectrum analyzer | Agilent | N9020A | HKE-048 | 2018/12/27 | 2019/12/26 |
| RF automatic control unit | Tonscend | JS0806-1 | HKE-060 | 2018/12/27 | 2019/12/26 |
| Loop antenna | Schwarzbeck | FMZB 1519 B | HKE-014 | 2018/12/27 | 2019/12/26 |
| Bilog Broadband Antenna | Schwarzbeck | VULB9163 | HKE-012 | 2018/12/27 | 2019/12/26 |
| Horn antenna | Schwarzbeck | 9120D | HKE-013 | 2018/12/27 | 2019/12/26 |
| High gain antenna | Schwarzbeck | LB-180400KF | HKE-054 | 2018/12/27 | 2019/12/26 |
| Preamplifier | EMCI | EMC051845SE | HKE-015 | 2018/12/27 | 2019/12/26 |
| Preamplifier | Agilent | 83051A | HKE-016 | 2018/12/27 | 2019/12/26 |
| Preamplifier | Schwarzbeck | BBV 9743 | HKE-006 | 2018/12/27 | 2019/12/26 |
| Temperature and humidity meter | Boyang | HTC-1 | HKE-075 | 2018/12/27 | 2019/12/26 |
| High-low temperature chamber | Guangke | HT-80L | HKE-118 | 2018/12/27 | 2019/12/26 |
| High pass filter unit | Tonscend | JS0806-F | HKE-055 | 2018/12/27 | 2019/12/26 |
| RF Cable(below1GHz) | Times | 9kHz-1GHz | HKE-117 | 2018/12/27 | 2019/12/26 |
| RF Cable(above 1GHz) | Times | 1-40G | HKE-034 | 2018/12/27 | 2019/12/26 |
| Power meter | Agilent | E4419B | HKE-085 | 2018/12/27 | 2019/12/26 |
| Power Sensor | Agilent | E9300A | HKE-086 | 2018/12/27 | 2019/12/26 |
| Conducted test software | Tonscend | TS+ Rev 2.5.0.0 | HKE-081 | N/A | N/A |
| Radiated test software | Tonscend | TS+ Rev 2.5.0.0 | HKE-082 | N/A | N/A |
| RF test software | Tonscend | JS1120-B Version 2.6 | HKE-083 | N/A | N/A |
| RF test software | Tonscend | JS1120-4 | HKE-113 | N/A | N/A |
| RF test software | Tonscend | JS1120-3 | HKE-114 | N/A | N/A |
| RF test software | Tonscend | JS1120-1 | HKE-115 | N/A | N/A |
| Wireless Communication Test Set | R&S | CMW500 | HKE-026 | 2018/12/27 | 2019/12/26 |
| Wireless Communication Test Set | R&S | CMU200 | HKE-029 | 2018/12/27 | 2019/12/26 |

Note: 1. The Cal.Interval was one year.



4 TEST CONDITIONS AND RESULTS

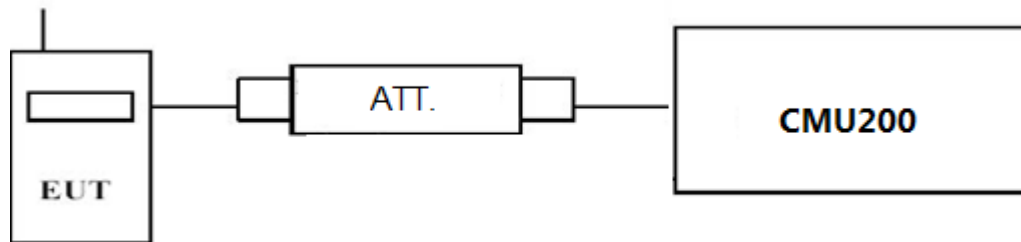
4.1 Output Power

TEST APPLICABLE

During the process of testing, the EUT was controlled via R&S Digital Radio Communication tester (CMU200) to ensure max power transmission and proper modulation. This result contains output power and EIRP measurements for the EUT. In all cases, output power is within the specified limits.

4.1.1 Conducted Output Power

TEST CONFIGURATION



TEST PROCEDURE

Conducted Power Measurement:

- a) Place the EUT on a bench and set it in transmitting mode.
- b) Connect a low loss RF cable from the antenna port to a CMU200 by an Att.
- c) EUT Communicate with CMU200 then selects a channel for testing.
- d) Add a correction factor to the display CMU200, and then test.

TEST RESULTS



| Test Mode | Test Channel | Burst Average Conducted power (dBm) | |
|-----------|---------------|-------------------------------------|--------------|
| | | UMTS Band V | UMTS Band II |
| UMTS/TM1 | LCH | 21.97 | 22.79 |
| | MCH | 22.45 | 22.46 |
| | HCH | 22.26 | 22.92 |
| UMTS/TM2 | LCH_SubTest-1 | 21.59 | 21.51 |
| | LCH_SubTest-2 | 21.99 | 21.38 |
| | LCH_SubTest-3 | 21.98 | 22.20 |
| | LCH_SubTest-4 | 21.00 | 21.04 |
| | MCH_SubTest-1 | 22.30 | 22.26 |
| | MCH_SubTest-2 | 21.17 | 21.46 |
| | MCH_SubTest-3 | 21.18 | 21.88 |
| | MCH_SubTest-4 | 21.44 | 21.43 |
| | HCH_SubTest-1 | 21.64 | 22.03 |
| | HCH_SubTest-2 | 21.73 | 21.70 |
| | HCH_SubTest-3 | 22.37 | 22.50 |
| | HCH_SubTest-4 | 20.94 | 21.44 |
| UMTS/TM3 | LCH_SubTest-1 | 20.50 | 19.91 |
| | LCH_SubTest-2 | 20.10 | 19.88 |
| | LCH_SubTest-3 | 20.56 | 20.63 |
| | LCH_SubTest-4 | 20.32 | 19.31 |
| | LCH_SubTest-5 | 19.45 | 19.80 |
| | MCH_SubTest-1 | 20.85 | 21.35 |
| | MCH_SubTest-2 | 19.88 | 20.26 |
| | MCH_SubTest-3 | 20.67 | 21.24 |
| | MCH_SubTest-4 | 19.51 | 20.15 |
| | MCH_SubTest-5 | 21.08 | 21.41 |
| | HCH_SubTest-1 | 21.99 | 20.38 |
| | HCH_SubTest-2 | 21.52 | 20.07 |
| | HCH_SubTest-3 | 21.27 | 19.68 |
| | HCH_SubTest-4 | 21.31 | 20.06 |
| | HCH_SubTest-5 | 21.40 | 20.56 |

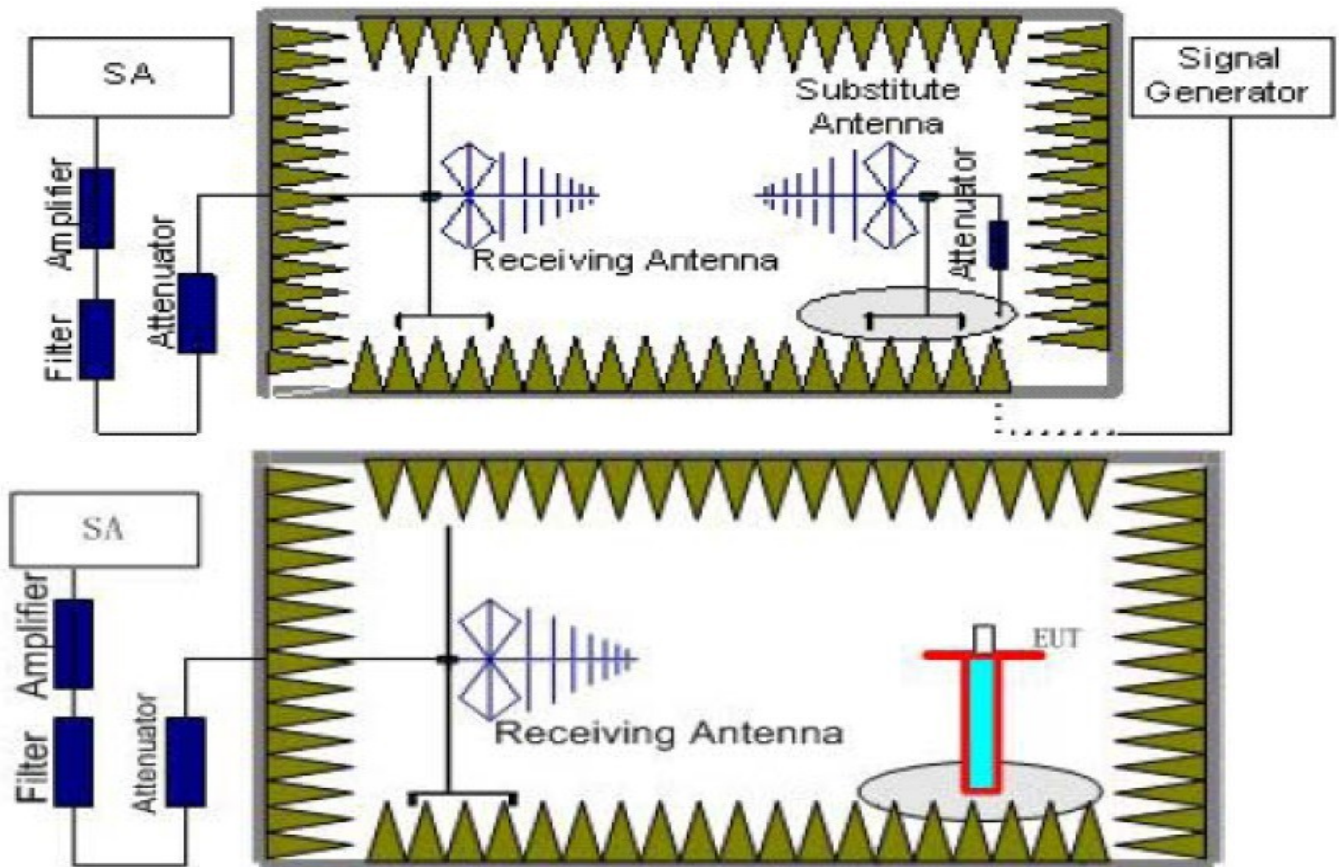
4.1.2 Radiated Output Power

TEST DESCRIPTION

This is the test for the maximum radiated power from the EUT.

"Mobile/portable stations are limited to 2 watts e.i.r.p. Peak power" and specifies that "Peak transmit power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage. The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts."

TEST CONFIGURATION



TEST PROCEDURE

1. EUT was placed on a 0.8 meter high non-conductive stand at a 3 meter test distance from the receive antenna. A receiving antenna was placed on the antenna mast 3 meters from the EUT for emission measurements. The height of receiving antenna is 1.50m. Detected emissions were maximized at each frequency by rotating the EUT through 360° and adjusting the receiving antenna polarization. The radiated emission measurements of all transmit frequencies in three channels (High, Middle, Low) were measured with peak detector.
2. A log-periodic antenna or double-ridged waveguide horn antenna shall be substituted in place of the EUT. The log-periodic antenna will be driven by a signal generator and the level will be adjusted till the same power value on the spectrum analyzer or receiver. The level of the spurious emissions can be calculated through the level of the signal generator, cable loss, the gain of the substitution antenna and the reading of the spectrum analyzer or receiver.
3. The EUT is then put into continuously transmitting mode at its maximum power level during the test. Set Test Receiver or Spectrum RBW=10MHz, VBW=10MHz, And the maximum value of the receiver should be recorded as (P_r).
4. The EUT shall be replaced by a substitution antenna. In the chamber, an substitution antenna for the frequency band of interest is placed at the reference point of the chamber. An RF Signal source for the frequency band of interest is connected to the substitution antenna with a cable that has been constructed to not interfere with the radiation pattern of the antenna. A power (P_{Mea}) is applied to the input of the substitution antenna, and adjust the level of the signal generator output until the value of the receiver



reach the previously recorded (P_r). The power of signal source (P_{Mea}) is recorded. The test should be performed by rotating the test item and adjusting the receiving antenna polarization.

5. A amplifier should be connected to the Signal Source output port. And the cable should be connect between the Amplifier and the Substitution Antenna. The cable loss (P_{cl}), the Substitution Antenna Gain (G_a) and the Amplifier Gain (P_{Ag}) should be recorded after test.

The measurement results are obtained as described below:

$$\text{Power(EIRP)} = P_{Mea} - P_{Ag} - P_{cl} + G_a$$

We used SMF100A microwave signal generator which signal level can up to 33dBm, so we not used power Amplifier for substitution test; The measurement results are amend as described below:

$$\text{Power(EIRP)} = P_{Mea} - P_{cl} + G_a$$

6. This value is EIRP since the measurement is calibrated using an antenna of known gain (2.15 dBi) and known input power.
7. ERP can be calculated from EIRP by subtracting the gain of the dipole, $ERP = EIRP - 2.15\text{dBi}$.

TEST LIMIT

According to 22.913(a), 24.232(c) the ERP(EIRP) should be not exceeding following table limits:

| | Burst Average ERP |
|--------------|--------------------------|
| UMTS Band V | 38.45dBm (7W) |
| | Burst Average ERP |
| UMTS Band IV | 30dBm (1W) |
| | Burst Average ERP |
| UMTS Band II | 33dBm (2W) |

TEST RESULTS

Remark:

1. We were tested all Configuration refer 3GPP TS134 121.
2. $EIRP = P_{Mea}(\text{dBm}) - P_{cl}(\text{dB}) + P_{Ag}(\text{dB}) + G_a(\text{dBi})$
3. $ERP = EIRP - 2.15\text{dBi}$ as EIRP by subtracting the gain of the dipole.
4. Note: We test the H direction and V direction, V direction is worse.

UMTS/TM1/UMTS Band II

| Frequency (MHz) | P_{Mea} (dBm) | P_{cl} (dB) | G_a Antenna Gain (dB) | P_{Ag} (dB) | Burst Average EIRP (dBm) | Burst Average ERP (dBm) | Limit (dBm) | Polarization |
|-----------------|-----------------|---------------|-------------------------|---------------|--------------------------|-------------------------|-------------|--------------|
| 1852.4 | -20.2 | 3.41 | 10.24 | 33.60 | 20.23 | 18.08 | 33.01 | V |
| 1880.0 | -19.31 | 3.49 | 10.24 | 33.60 | 21.04 | 18.89 | 33.01 | V |
| 1907.6 | -21.75 | 3.55 | 10.23 | 33.60 | 18.53 | 16.38 | 33.01 | V |

UMTS/TM1/UMTS Band V

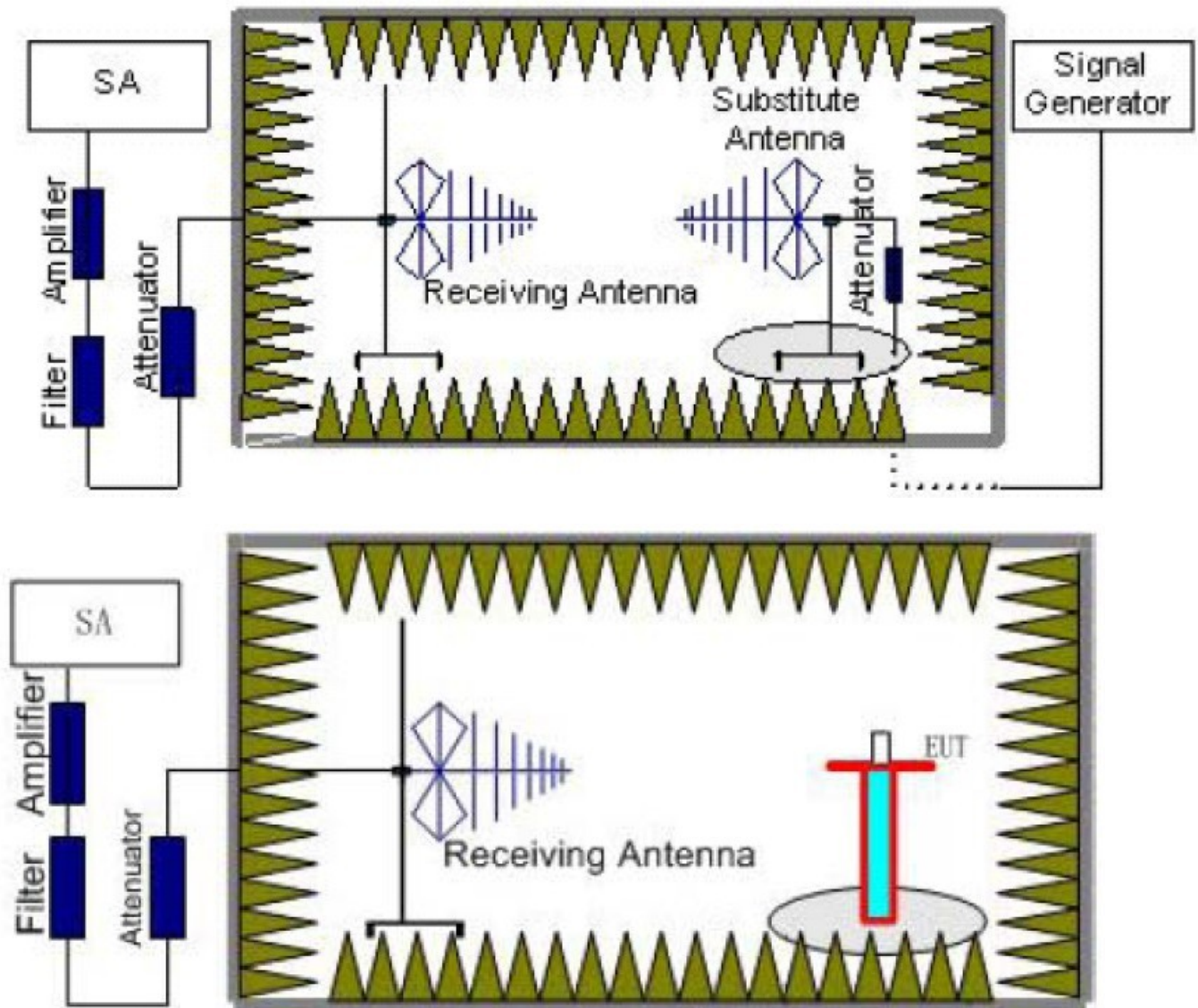
| Frequency (MHz) | P_{Mea} (dBm) | P_{cl} (dB) | G_a Antenna Gain (dB) | Correction (dB) | P_{Ag} (dB) | Burst Average ERP (dBm) | Limit (dBm) | Polarization |
|-----------------|-----------------|---------------|-------------------------|-----------------|---------------|-------------------------|-------------|--------------|
| 826.40 | -13.91 | 2.42 | 8.45 | 2.15 | 36.82 | 26.79 | 38.45 | V |
| 836.60 | -15.58 | 2.46 | 8.45 | 2.15 | 36.82 | 25.08 | 38.45 | V |
| 846.60 | -11.03 | 2.53 | 8.36 | 2.15 | 36.82 | 29.47 | 38.45 | V |

4.2 Radiated Spurious Emission

TEST APPLICABLE

According to the TIA/EIA 603D:2010 test method, The Receiver or Spectrum was scanned from 9 KHz to the 10th harmonic of the highest frequency generated within the equipment, which is the transmitted carrier that can be as high as 1910 MHz The resolution bandwidth is set as outlined in TIA/EIA 603D:2010. The spectrum is scanned with the mobile station transmitting at carrier frequencies that pertain to low, mid and high channels of WCDMA Band II , WCDMA Band V., WCDMA Band IV

TEST CONFIGURATION



TEST PROCEDURE

1. EUT was placed on a 1.50 meter high non-conductive stand at a 3 meter test distance from the receive antenna. A receiving antenna was placed on the antenna mast 3 meters from the EUT for emission measurements. The height of receiving antenna is 1.50m. Detected emissions were maximized at each frequency by rotating the EUT through 360° and adjusting the receiving antenna polarization. The radiated emission measurements of all transmit frequencies in three channels (High, Middle, Low) were measured with peak detector.
2. A log-periodic antenna or double-ridged waveguide horn antenna shall be substituted in place of the EUT. The log-periodic antenna will be driven by a signal generator and the level will be adjusted till the same power value on the spectrum analyzer or receiver. The level of the spurious emissions can be calculated through the level of the signal generator, cable loss, the gain of the substitution antenna and the reading of the spectrum analyzer or receiver.



3. The EUT is then put into continuously transmitting mode at its maximum power level during the test. Set Test Receiver or Spectrum RBW=1MHz, VBW=3MHz, And the maximum value of the receiver should be recorded as (P_r).
4. The EUT shall be replaced by a substitution antenna. In the chamber, an substitution antenna for the frequency band of interest is placed at the reference point of the chamber. An RF Signal source for the frequency band of interest is connected to the substitution antenna with a cable that has been constructed to not interfere with the radiation pattern of the antenna. A power (P_{Mea}) is applied to the input of the substitution antenna, and adjust the level of the signal generator output until the value of the receiver reach the previously recorded (P_r). The power of signal source (P_{Mea}) is recorded. The test should be performed by rotating the test item and adjusting the receiving antenna polarization.
5. A amplifier should be connected to the Signal Source output port. And the cable should be connect between the Amplifier and the Substitution Antenna. The cable loss (P_{cl}), the Substitution Antenna Gain (G_a) and the Amplifier Gain (P_{Ag}) should be recorded after test.
The measurement results are obtained as described below:
 $Power(EIRP) = P_{Mea} - P_{Ag} - P_{cl} + G_a$
6. This value is EIRP since the measurement is calibrated using an antenna of known gain (2.15 dBi) and known input power.
7. ERP can be calculated from EIRP by subtracting the gain of the dipole, $ERP = EIRP - 2.15dBi$.
8. In order to make sure test results more clearly, we set frequency range and sweep time for difference frequency range as follows table:

| Working Frequency | Subrange (GHz) | RBW | VBW | Sweep time (s) |
|-------------------------|----------------|--------|--------|----------------|
| UMTS/TM1/ WCDMA Band V | 0.00009~0.15 | 1KHz | 3KHz | 30 |
| | 0.00015~0.03 | 10KHz | 30KHz | 10 |
| | 0.03~1 | 100KHz | 300KHz | 10 |
| | 1~2 | 1 MHz | 3 MHz | 2 |
| | 2~5 | 1 MHz | 3 MHz | 3 |
| | 5~8 | 1 MHz | 3 MHz | 3 |
| | 8~10 | 1 MHz | 3 MHz | 3 |
| UMTS/TM1/ WCDMA Band II | 0.00009~0.15 | 1KHz | 3KHz | 30 |
| | 0.00015~0.03 | 10KHz | 30KHz | 10 |
| | 0.03~1 | 100KHz | 300KHz | 10 |
| | 1~2 | 1 MHz | 3 MHz | 2 |
| | 2~5 | 1 MHz | 3 MHz | 3 |
| | 5~8 | 1 MHz | 3 MHz | 3 |
| | 8~11 | 1 MHz | 3 MHz | 3 |
| | 11~14 | 1 MHz | 3 MHz | 3 |
| | 14~18 | 1 MHz | 3 MHz | 3 |
| | 18~20 | 1 MHz | 3 MHz | 2 |

TEST LIMITS

that the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

The specification that emissions shall be attenuated below the transmitter power (P) by at least $43 + 10 \log(P)$ dB, translates in the relevant power range (1 to 0.001 W) to -13 dBm. At 1 W the specified minimum attenuation becomes 43 dB and relative to a 30 dBm (1 W) carrier becomes a limit of -13 dBm. At 0.001 W (0 dBm) the minimum attenuation is 13 dB, which again yields a limit of -13 dBm. In this way a translation of the specification from relative to absolute terms is carried out.

| Frequency | Channel | Frequency Range | Verdict |
|-------------------------|---------|-----------------|---------|
| UMTS/TM1/ WCDMA Band V | Low | 9KHz-10GHz | PASS |
| | Middle | 9KHz -10GHz | PASS |
| | High | 9KHz -10GHz | PASS |
| UMTS/TM1/ WCDMA Band II | Low | 9KHz -20GHz | PASS |
| | Middle | 9KHz -20GHz | PASS |
| | High | 9KHz -20GHz | PASS |

**TEST RESULTS**

Remark:

1. We were tested all Configuration refer 3GPP TS134 121.
2. $EIRP = P_{Mea}(dBm) - P_{cl}(dB) + P_{Ag}(dB) + G_a(dBi)$
3. $ERP = EIRP - 2.15dBi$ as EIRP by subtracting the gain of the dipole.
5. Margin = Limit – Emission Level
6. We test both H direction and V direction, recorded worst case direction.

UMTS/TM1/ WCDMA Band II _ Low Channel

| Frequency (MHz) | P _{Mea} (dBm) | P _{cl} (dB) | Diatance | G _a Antenna Gain(dB) | Peak EIRP (dBm) | Limit (dBm) | Margin (dB) | Polarization |
|-----------------|------------------------|----------------------|----------|---------------------------------|-----------------|-------------|-------------|--------------|
| 3704.8 | -36.21 | 4.39 | 3.00 | 12.34 | -28.26 | -13.00 | 15.26 | H |
| 5557.2 | -41.51 | 5.31 | 3.00 | 13.52 | -33.3 | -13.00 | 20.3 | H |
| 3704.8 | -35.67 | 4.39 | 3.00 | 12.34 | -27.72 | -13.00 | 14.72 | V |
| 5557.2 | -43.09 | 5.31 | 3.00 | 13.52 | -34.88 | -13.00 | 21.88 | V |

UMTS/TM1/ WCDMA Band II _ Middle Channel

| Frequency (MHz) | P _{Mea} (dBm) | P _{cl} (dB) | Diatance | G _a Antenna Gain(dB) | Peak EIRP (dBm) | Limit (dBm) | Margin (dB) | Polarization |
|-----------------|------------------------|----------------------|----------|---------------------------------|-----------------|-------------|-------------|--------------|
| 3760.0 | -37.37 | 4.41 | 3.00 | 12.34 | -29.44 | -13.00 | 16.44 | H |
| 5640.0 | -42.74 | 5.38 | 3.00 | 13.58 | -34.54 | -13.00 | 21.54 | H |
| 3760.0 | -35.08 | 4.41 | 3.00 | 12.34 | -27.15 | -13.00 | 14.15 | V |
| 5640.0 | -42.95 | 5.38 | 3.00 | 13.58 | -34.75 | -13.00 | 21.75 | V |

UMTS/TM1/ WCDMA Band II _ High Channel

| Frequency (MHz) | P _{Mea} (dBm) | P _{cl} (dB) | Diatance | G _a Antenna Gain(dB) | Peak EIRP (dBm) | Limit (dBm) | Margin (dB) | Polarization |
|-----------------|------------------------|----------------------|----------|---------------------------------|-----------------|-------------|-------------|--------------|
| 3815.2 | -36.37 | 4.45 | 3.00 | 12.45 | -28.37 | -13.00 | 15.37 | H |
| 5722.8 | -42.01 | 5.47 | 3.00 | 13.66 | -33.82 | -13.00 | 20.82 | H |
| 3815.2 | -35.2 | 4.45 | 3.00 | 12.45 | -27.2 | -13.00 | 14.2 | V |
| 5722.8 | -43.97 | 5.48 | 3.00 | 13.66 | -35.79 | -13.00 | 22.79 | V |

UMTS/TM1/ WCDMA Band V _ Low Channel

| Frequency (MHz) | P _{Mea} (dBm) | P _{cl} (dB) | Diatance | G _a Antenna Gain(dB) | Peak EIRP (dBm) | Limit (dBm) | Margin (dB) | Polarization |
|-----------------|------------------------|----------------------|----------|---------------------------------|-----------------|-------------|-------------|--------------|
| 1652.8 | -29.94 | 3.00 | 3.00 | 9.58 | -23.36 | -13.00 | 10.36 | H |
| 2479.2 | -36.38 | 3.03 | 3.00 | 10.72 | -28.69 | -13.00 | 15.69 | H |
| 1652.8 | -30.58 | 3.00 | 3.00 | 9.68 | -23.9 | -13.00 | 10.9 | V |
| 2479.2 | -39.67 | 3.03 | 3.00 | 10.72 | -31.98 | -13.00 | 18.98 | V |

UMTS/TM1/ WCDMA Band V _ Middle Channel

| Frequency (MHz) | P _{Mea} (dBm) | P _{cl} (dB) | Diatance | G _a Antenna Gain(dB) | Peak EIRP (dBm) | Limit (dBm) | Margin (dB) | Polarization |
|-----------------|------------------------|----------------------|----------|---------------------------------|-----------------|-------------|-------------|--------------|
| 1672.8 | -29.42 | 3.00 | 3.00 | 9.58 | -22.84 | -13.00 | 9.84 | H |
| 2509.2 | -36.14 | 3.03 | 3.00 | 10.72 | -28.45 | -13.00 | 15.45 | H |
| 1672.8 | -31.22 | 3.00 | 3.00 | 9.68 | -24.54 | -13.00 | 11.54 | V |
| 2509.2 | -39.67 | 3.03 | 3.00 | 10.72 | -31.98 | -13.00 | 18.98 | V |

UMTS/TM1/ WCDMA Band V _ High Channel

| Frequency (MHz) | P _{Mea} (dBm) | P _{cl} (dB) | Diatance | G _a Antenna Gain(dB) | Peak EIRP (dBm) | Limit (dBm) | Margin (dB) | Polarization |
|-----------------|------------------------|----------------------|----------|---------------------------------|-----------------|-------------|-------------|--------------|
| 1693.2 | -32.24 | 3.00 | 3.00 | 9.58 | -25.66 | -13.00 | 12.66 | H |
| 2539.8 | -38.46 | 3.03 | 3.00 | 10.72 | -30.77 | -13.00 | 17.77 | H |
| 1693.2 | -30.84 | 3.00 | 3.00 | 9.68 | -24.16 | -13.00 | 11.16 | V |
| 2539.8 | -35.29 | 3.03 | 3.00 | 10.72 | -27.6 | -13.00 | 14.6 | V |

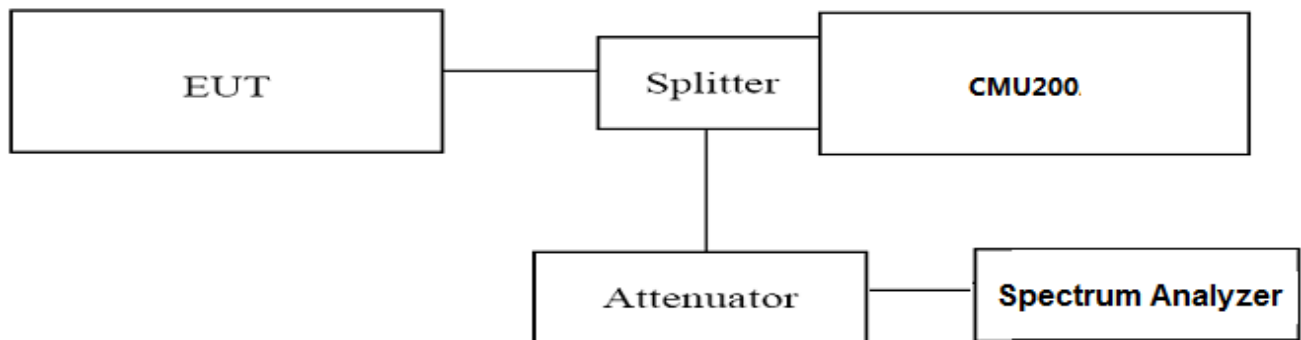


4.3 Occupied Bandwidth and Emission Bandwidth

TEST APPLICABLE

Similar to conducted emissions; occupied bandwidth measurements are only provided for selected frequencies in order to reduce the amount of submitted data. Data were taken at the extreme and mid frequencies of WCDMA Band II, WCDMA band V, WCDMA band IV. The table below lists the measured 99% Bandwidth and -26dBc Bandwidth.

TEST CONFIGURATION



TEST PROCEDURE

1. The EUT was set up for the max output power with pseudo random data modulation;
2. Set RBW=100KHz, VBW=300KHz, Span=10MHz, SWT=Auto;
3. Set SPA Max hold and View, Set 99% Occupied Bandwidth/ Set -26dBc Occupied Bandwidth
4. These measurements were done at 3 frequencies for WCDMA band II /V. (low, middle and high of operational frequency range).

TEST RESULTS

| Test Mode | Channel | Frequency (MHz) | Occupied Bandwidth (99% BW) (MHz) | Emission Bandwidth (-26 dBc BW) (MHz) | Verdict |
|-------------------------|---------|-----------------|------------------------------------|--|---------|
| UMTS/TM1/ WCDMA Band V | 4132 | 826.40 | 4.1359 | 4.711 | PASS |
| | 4182 | 836.40 | 4.1148 | 4.704 | PASS |
| | 4233 | 846.60 | 4.1344 | 4.715 | PASS |
| UMTS/TM1/ WCDMA Band II | 9262 | 1852.4 | 4.1231 | 4.736 | PASS |
| | 9400 | 1880.0 | 4.1359 | 4.705 | PASS |
| | 9538 | 1907.6 | 4.1313 | 4.728 | PASS |

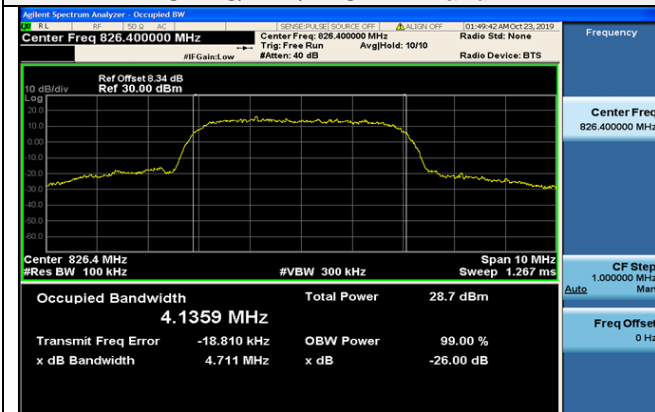
Remark:

1. Test results including cable loss;
2. please refer to following plots;

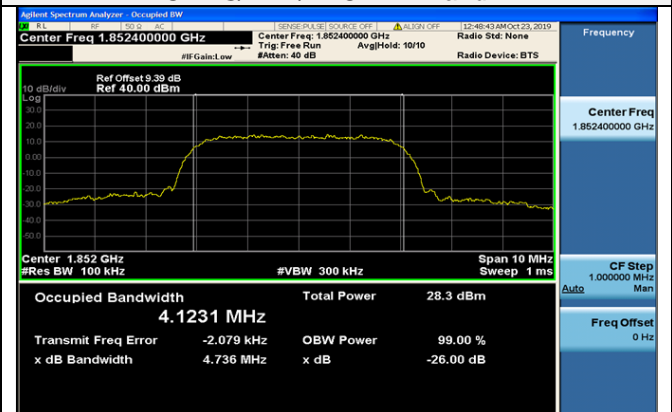


Occupied Bandwidth and Emission Bandwidth

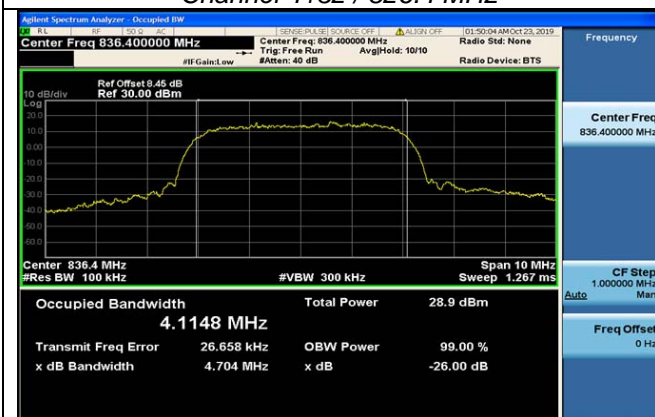
UMTS/TM1/ WCDMA Band V



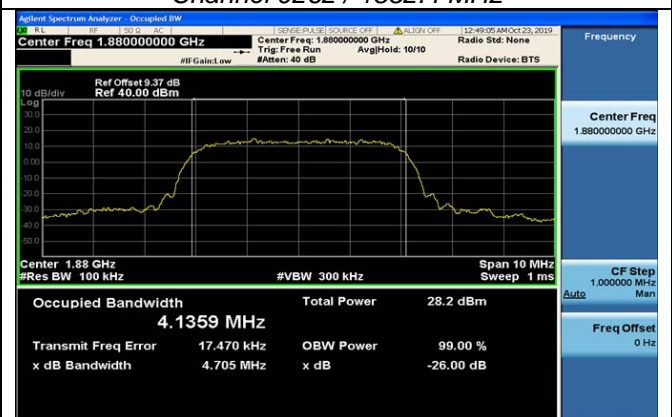
UMTS/TM1/ WCDMA Band II



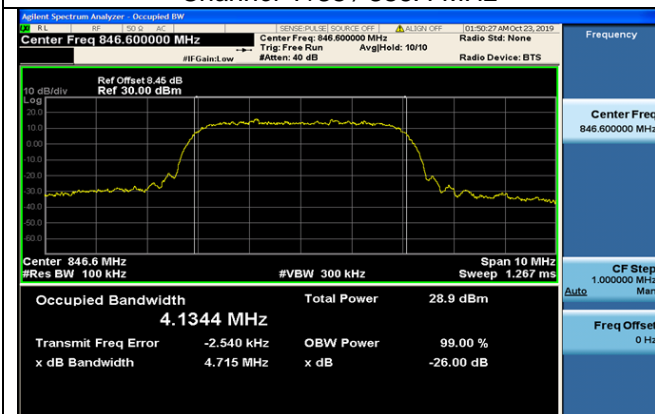
Channel 4132 / 826.4 MHz



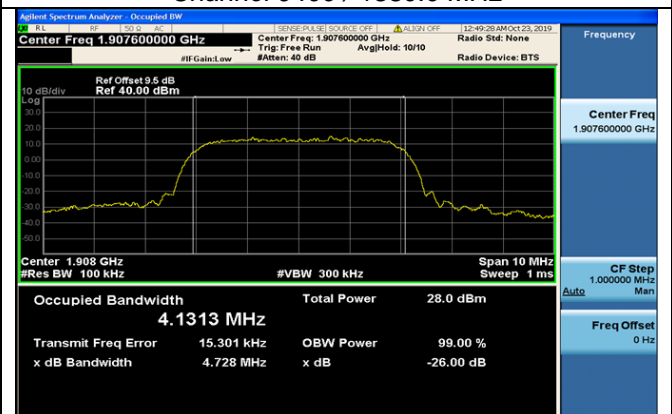
Channel 9262 / 1852.4 MHz



Channel 4183 / 836.4 MHz



Channel 9400 / 1880.0 MHz



Channel 4233 / 846.6 MHz

Channel 9538 / 1907.6 MHz

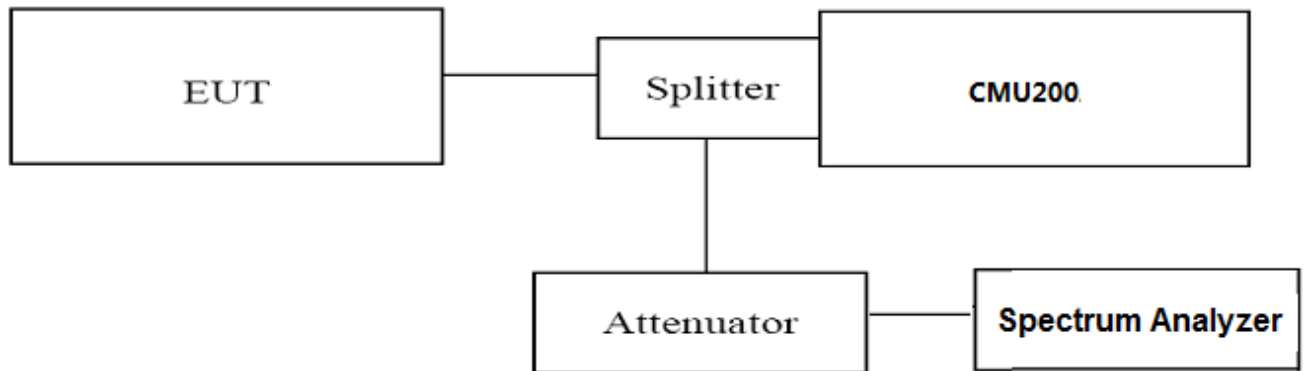


4.4 Band Edge Compliance

TEST APPLICABLE

During the process of testing, the EUT was controlled via Aglient Digital Radio Communication tester (CMU200) to ensure max power transmission and proper modulation.

TEST CONFIGURATION



TEST PROCEDURE

1. The EUT was set up for the max output power with pseudo random data modulation;
2. Set RBW=51KHz,VBW=200KHz,Span=2MHz ,Dector: RMS;
3. These measurements were done at 2 frequencies (low and high of operational frequency range).

TEST RESULTS

| UMTS/TM1/WCDMA Band V | | | | | |
|------------------------|---------|-----------------|---------------------------|--------------|---------|
| Test Mode | Channel | Frequency (MHz) | Band Edg Compliance (dBm) | Limits (dBm) | Verdict |
| UMTS/TM1/WCDMA Band V | 4132 | 826.4 | <-13dBm | -13dBm | PASS |
| | 4233 | 846.6 | <-13dBm | -13dBm | |
| UMTS/TM1/WCDMA Band II | | | | | |
| Test Mode | Channel | Frequency (MHz) | Band Edg Compliance (dBm) | Limits (dBm) | Verdict |
| UMTS/TM1/WCDMA Band II | 9262 | 1852.4 | <-13dBm | -13dBm | PASS |
| | 9538 | 1907.6 | <-13dBm | -13dBm | |

Remark:

1. Test results including cable loss;
2. please refer to following plots;

**Band-edge Compliance****UMTS/TM1/WCDMA Band V****Channel 4132 / 826.4 MHz****Channel 4233 / 846.6 MHz****UMTS/TM1/WCDMA Band II****Channel 9262 / 1852.4 MHz****Channel 9538 / 1907.6 MHz**



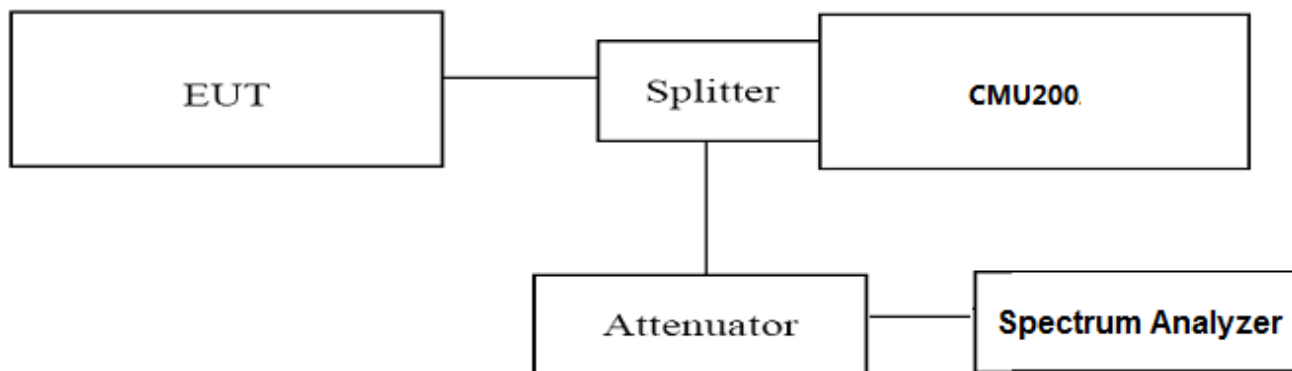
4.5 Spurious Emssion on Antenna Port

TEST APPLICABLE

The following steps outline the procedure used to measure the conducted emissions from the EUT.

1. Determine frequency range for measurements: the spectrum should be investigated from the lowest radio frequency generated in the equipment up to at least the 10th harmonic of the carrier frequency. For the equipment of WCDMA band II data taken from 9 KHz to 20 GHz. For WCDMA Band V, data taken from 9 KHz to 9 GHz. WCDMA band I V data taken from 9 KHz to 20 GHz.
2. The sweep time is set automatically by instrument itself. That should be the optimal sweep time for the span and the RBW. If the sweep time is too short, that is sweep is too fast, the sweep result is not accurate; if the sweep time is too long, that is sweep is too low, some frequency components may be lost. The instrument will give an optimal sweep time according the selected span and RBW.
3. The procedure to get the conducted spurious emission is as follows:
The trace mode is set to MaxHold to get the highest signal at each frequency;
Wait 25 seconds; Get the result.
4. Determine EUT transmit frequencies: below outlines the band edge frequencies pertinent to conducted emissions testing.

TEST CONFIGURATION



TEST PROCEDURE

1. The EUT was set up for the max output power with pseudo random data modulation;
2. These measurements were done at 3 frequencies (low, middle and high of operational frequency range) of each band.

TEST LIMIT

the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

The specification that emissions shall be attenuated below the transmitter power (P) by at least $43 + 10 \log(P)$ dB, translates in the relevant power range (1 to 0.001 W) to -13 dBm. At 1 W the specified minimum attenuation becomes 43 dB and relative to a 30 dBm (1 W) carrier becomes a limit of -13 dBm. At 0.001 W (0 dBm) the minimum attenuation is 13 dB, which again yields a limit of -13 dBm. In this way a translation of the specification from relative to absolute terms is carried out.

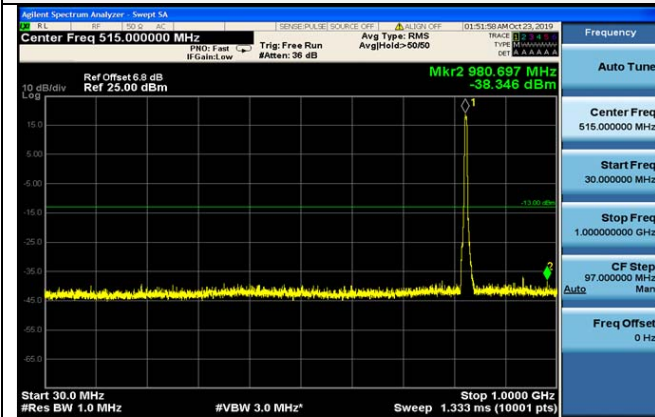
TEST RESULTS

| Test Mode | Channel | Frequency (MHz) | Spurious RF Conducted Emission (dBm) | Limits (dBm) | Verdict |
|------------------------|---------|-----------------|--------------------------------------|--------------|---------|
| UMTS/TM1/WCDMA Band V | 4132 | 826.40 | <-13dBm | -13dBm | PASS |
| | 4182 | 836.40 | <-13dBm | -13dBm | |
| | 4233 | 846.60 | <-13dBm | -13dBm | |
| UMTS/TM1/WCDMA Band II | 9262 | 1852.40 | <-13dBm | -13dBm | PASS |
| | 9400 | 1880.00 | <-13dBm | -13dBm | |
| | 9538 | 1907.60 | <-13dBm | -13dBm | |

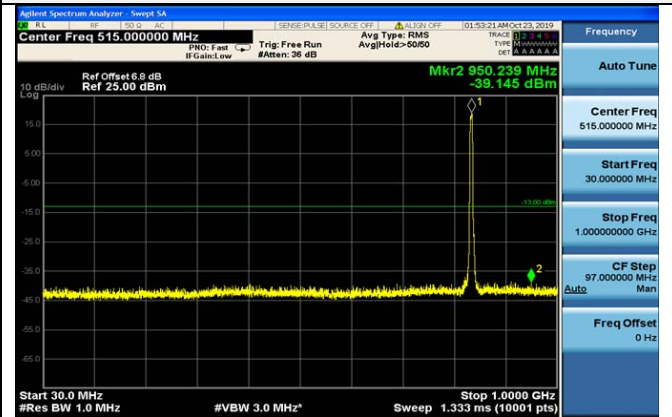
**Spurious Emission on Antenna Port**

UMTS/TM1/WCDMA Band V

Channel 4132 / 826.4 MHz



Channel 4183 / 836.6 MHz



30 MHz-1GHz



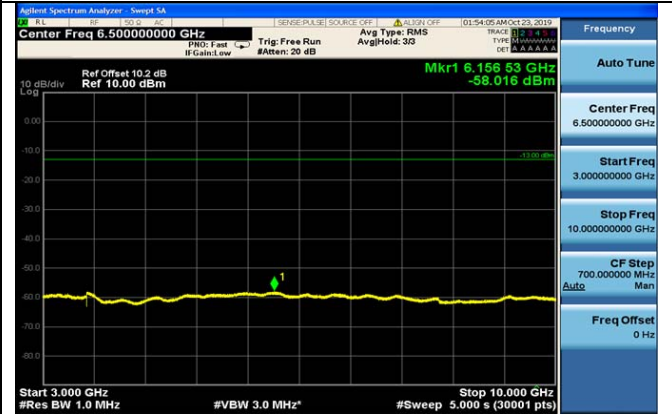
30 MHz-1GHz



1GHz-3GHz



1GHz-3GHz



3GHz-10GHz



3GHz-10GHz



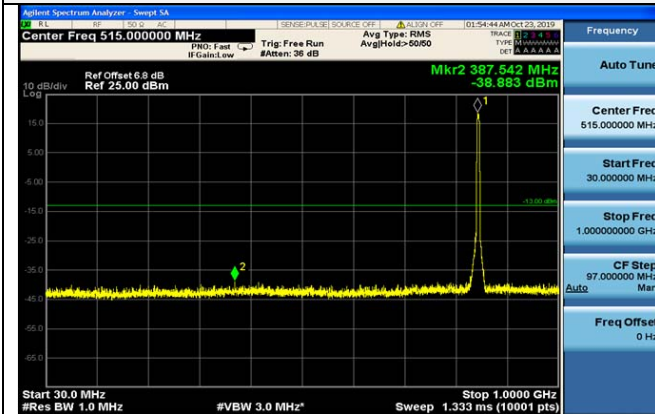
10GHz-18GHz

10GHz-18GHz



UMTS/TM1/WCDMA Band V

Channel 4233 / 846.6 MHz



30 MHz-1GHz



1GHz-3GHz



3GHz-10GHz



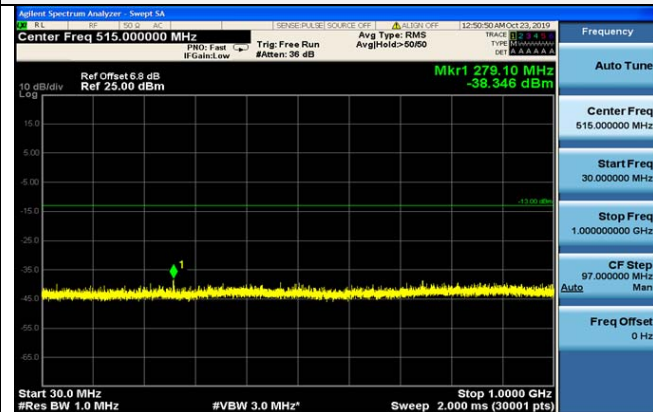
10GHz-18GHz



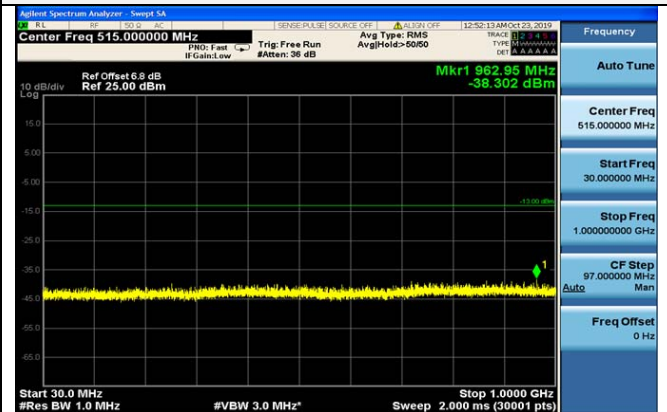
Spurious Emission on Antenna Port

UMTS/TM1/WCDMA Band II

Channel 9262 /1852.4 MHz



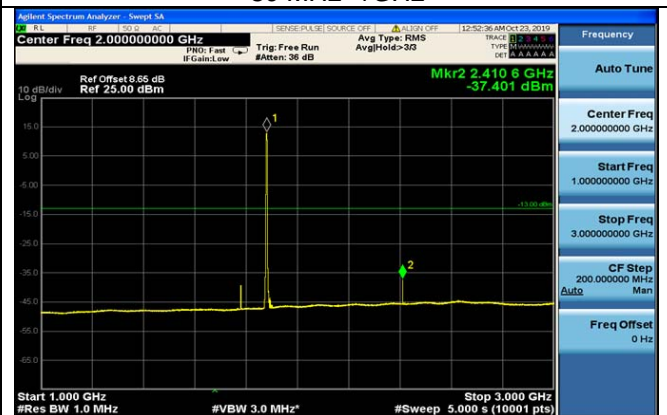
Channel 9400 / 1880.0 MHz



30 MHz-1GHz



30 MHz-1GHz



1GHz-3GHz



1GHz-3GHz



3GHz-10GHz



3GHz-10GHz

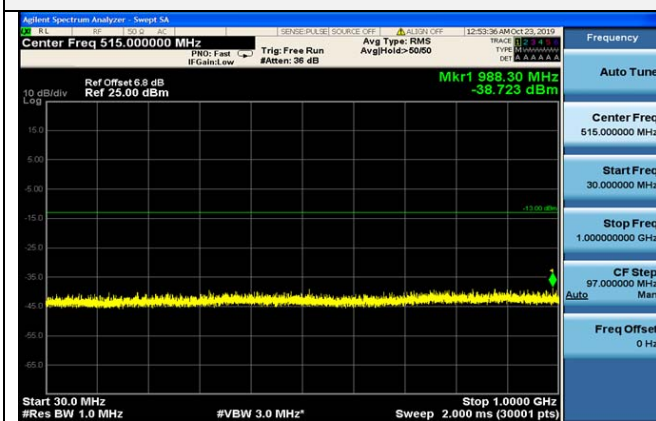


10GHz-20GHz

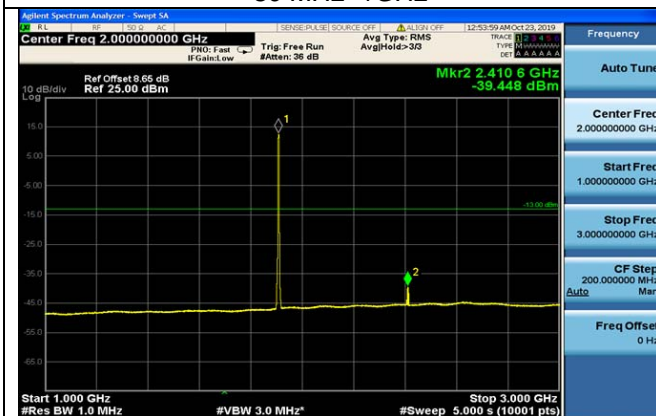
10GHz-20GHz



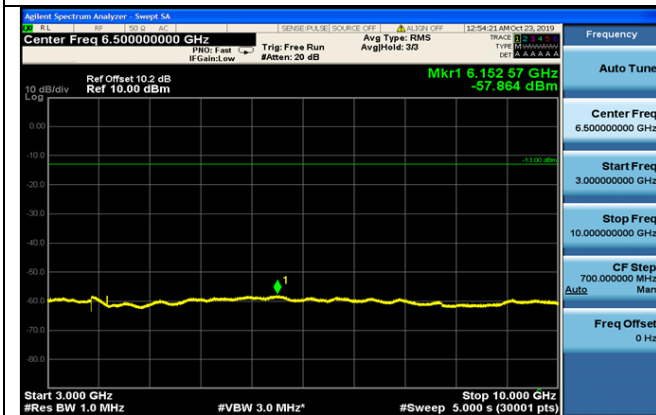
UMTS/TM1/WCDMA Band II



30 MHz-1GHz



1GHz-3GHz



3GHz-10GHz



10GHz-20GHz



4.6 Frequency Stability Test

TEST APPLICABLE

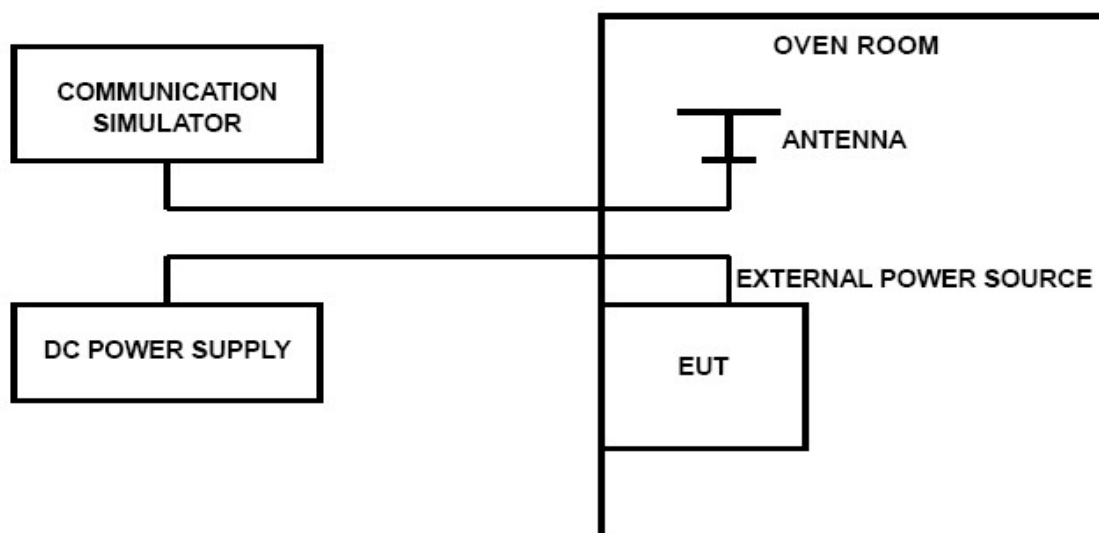
1. According to FCC Part 2 Section 2.1055 (a)(1), the frequency stability shall be measured with variation of ambient temperature from -30°C to $+50^{\circ}\text{C}$ centigrade.
2. According to FCC Part 2 Section 2.1055 (E) (2), for battery powered equipment, the frequency stability shall be measured with reducing primary supply voltage to the battery operating end point, which is specified by the manufacture.
3. Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried voltage equipment and the end voltage point was 3.40V.

TEST PROCEDURE

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 CMU200 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 CMU200 and in a simulated call on middle channel of WCDMA Band V, 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 $+50^{\circ}\text{C}$. Allow at least 0.5 hours at each temperature, unpowered, before making measurements;
5. Remeasure carrier frequency at room temperature with nominal voltage. Vary supply voltage from minimum voltage to maximum voltage, in 0.1Volt increments remeasuring carrier frequency at each voltage. Pause at nominal voltage for 0.5 hours unpowered, to allow any self-heating to stabilize, before continuing;
6. Subject the EUT to overnight soak at $+50^{\circ}\text{C}$;
7. With the EUT, powered via nominal voltage, connected to the CMU200 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 $+50^{\circ}\text{C}$ to -30°C . Allow at least 0.5 hours at each temperature, unpowered, before making measurements;
9. At all temperature levels hold the temperature to $\pm 0.5^{\circ}\text{C}$ during the measurement procedure;

TEST CONFIGURATION



**TEST LIMITS*****For Hand carried battery powered equipment***

According to the JTC standard the frequency stability of the carrier shall be accurate to within 0.1 ppm of the received frequency from the base station. This accuracy is sufficient to meet Sec. 24.235, Frequency Stability. The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. As this transceiver is considered "Hand carried, battery powered equipment" Section 2.1055(d)(2) applies. This requires that the lower voltage for frequency stability testing be specified by the manufacturer. This transceiver is specified to operate with an input voltage of between 3.40VDC and 4.20VDC, with a nominal voltage of 3.80VDC. Operation above or below these voltage limits is prohibited by transceiver software in order to prevent improper operation as well as to protect components from overstress. These voltages represent a tolerance of -10 % and +12.5 %. For the purposes of measuring frequency stability these voltage limits are to be used.

For equipment powered by primary supply voltage

According to the JTC standard the frequency stability of the carrier shall be accurate to within 0.1 ppm of the received frequency from the base station. This accuracy is sufficient to meet Sec. 24.235, Frequency Stability. The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. For this EUT section 2.1055(d)(1) applies. This requires varying primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

TEST RESULTS

| UMTS/TM1/WCDMA Band II | | | | | |
|------------------------|------------------|---------------------|----------------------|-------------|---------|
| DC Power | Temperature (°C) | Frequency error(Hz) | Frequency error(ppm) | Limit (ppm) | Verdict |
| 3.33 | 20 | 3.74 | 0.002018 | 2.50 | PASS |
| 3.70 | 20 | -1.86 | -0.001005 | 2.50 | PASS |
| 4.07 | 20 | 0.35 | 0.000189 | 2.50 | PASS |
| 3.70 | -30 | -4.70 | -0.002500 | 2.50 | PASS |
| 3.70 | -20 | 1.05 | 0.000560 | 2.50 | PASS |
| 3.70 | -10 | -4.21 | -0.002240 | 2.50 | PASS |
| 3.70 | 0 | -5.20 | -0.002768 | 2.50 | PASS |
| 3.70 | 10 | -4.44 | -0.002362 | 2.50 | PASS |
| 3.70 | 20 | 1.92 | 0.001023 | 2.50 | PASS |
| 3.70 | 30 | -1.13 | -0.000601 | 2.50 | PASS |
| 3.70 | 40 | -2.56 | -0.001364 | 2.50 | PASS |
| 3.70 | 50 | 0.11 | 0.000057 | 2.50 | PASS |

| UMTS/TM1/WCDMA Band V | | | | | |
|-----------------------|------------------|---------------------|----------------------|-------------|---------|
| DC Power | Temperature (°C) | Frequency error(Hz) | Frequency error(ppm) | Limit (ppm) | Verdict |
| 3.33 | 20 | -2.09 | -0.002499 | 2.50 | PASS |
| 3.70 | 20 | -4.71 | -0.005637 | 2.50 | PASS |
| 4.07 | 20 | 1.28 | 0.001532 | 2.50 | PASS |
| 3.70 | -30 | -4.73 | -0.005587 | 2.50 | PASS |
| 3.70 | -20 | -5.26 | -0.006218 | 2.50 | PASS |
| 3.70 | -10 | -0.60 | -0.000703 | 2.50 | PASS |
| 3.70 | 0 | -4.52 | -0.005335 | 2.50 | PASS |
| 3.70 | 10 | -6.91 | -0.008165 | 2.50 | PASS |
| 3.70 | 20 | -3.62 | -0.004272 | 2.50 | PASS |
| 3.70 | 30 | -4.12 | -0.004866 | 2.50 | PASS |
| 3.70 | 40 | -3.14 | -0.003713 | 2.50 | PASS |
| 3.70 | 50 | -2.61 | -0.003082 | 2.50 | PASS |

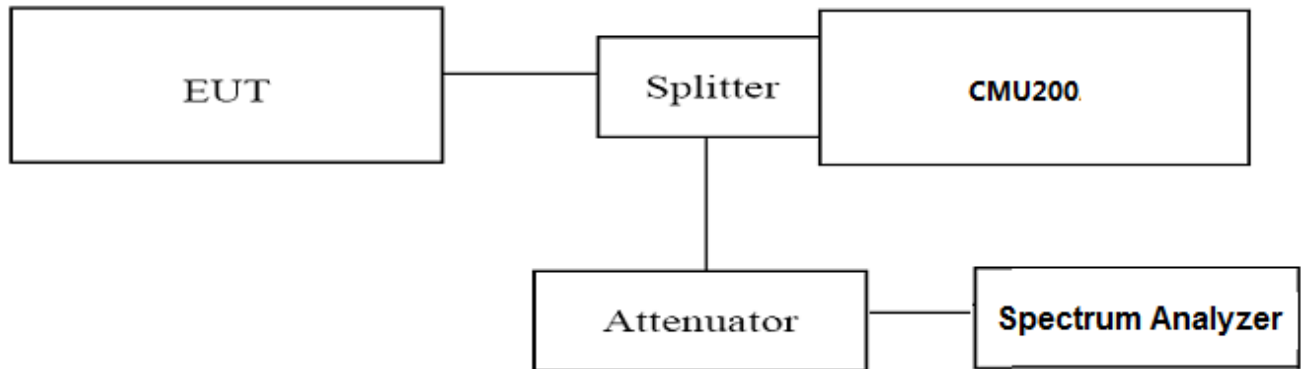


4.7 Peak-to-Average Ratio (PAR)

LIMIT

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

TEST CONFIGURATION



TEST PROCEDURE

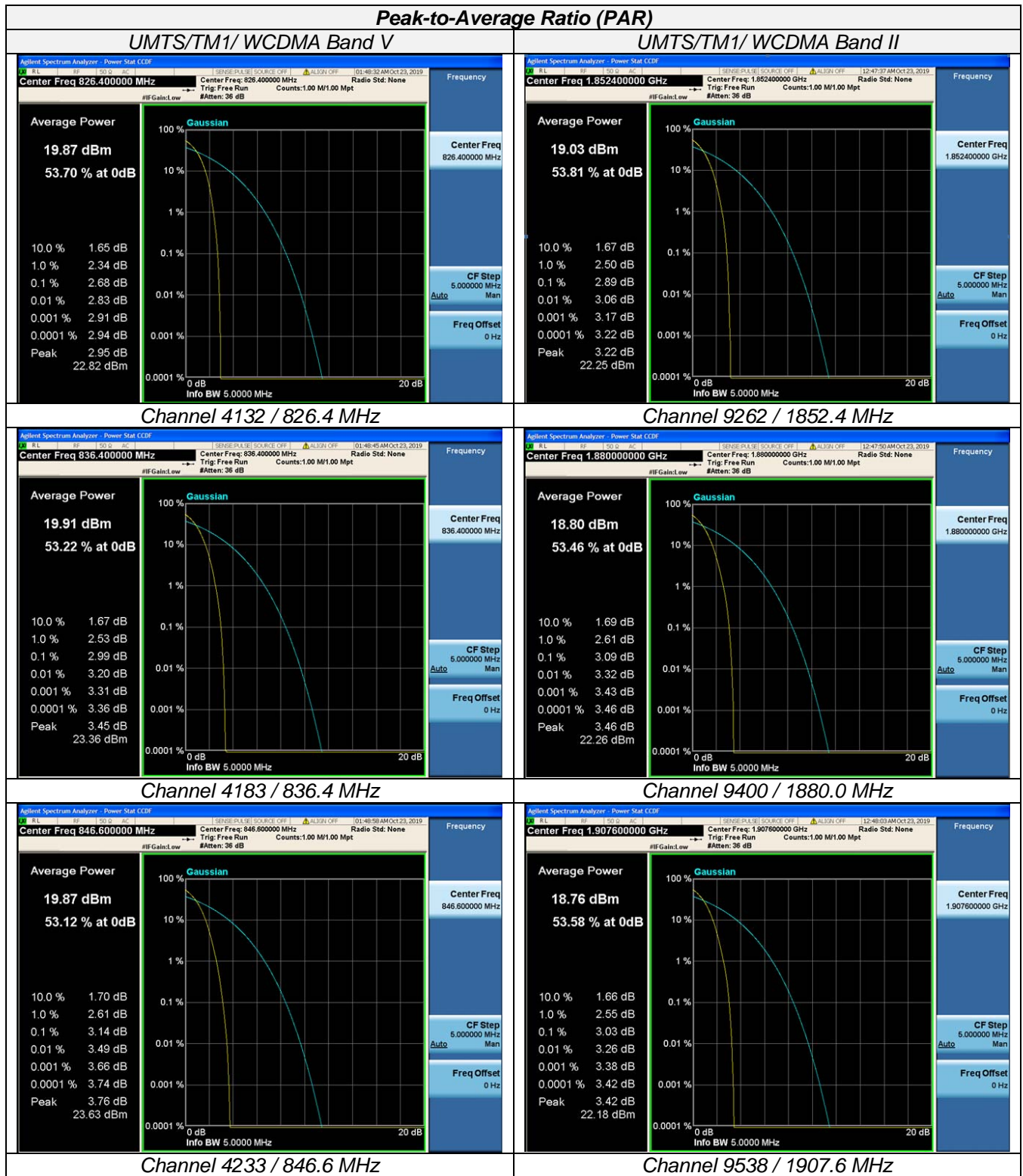
1. Refer to instrument's analyzer instruction manual for details on how to use the power statistics/CCDF function;
2. Set resolution/measurement bandwidth \geq signal's occupied bandwidth;
3. Set the number of counts to a value that stabilizes the measured CCDF curve;
4. Set the measurement interval 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

| Test Mode | Channel | Frequency (MHz) | PAPR Value (dB) | Limits (dB) | Verdict |
|------------------------|---------|-----------------|-----------------|-------------|---------|
| UMTS/TM1/WCDMA Band II | 9262 | 1852.40 | 2.89 | 13.0 | PASS |
| | 9400 | 1880.00 | 3.09 | 13.0 | PASS |
| | 9538 | 1907.60 | 3.03 | 13.0 | PASS |
| UMTS/TM1/WCDMA Band V | 4132 | 826.40 | 2.68 | 13.0 | PASS |
| | 4183 | 836.60 | 2.99 | 13.0 | PASS |
| | 4233 | 846.60 | 3.14 | 13.0 | PASS |

Remark:

1. Test results including cable loss;
2. please refer to following plots;



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