

FCC Test Report

(PART 90 Subpart S)

Report No.: RF151229C25-9

FCC ID: M82-TREK733L

Test Model: TREK-733L

Received Date: Apr. 14, 2016

Test Date: Nov. 21 ~ Nov. 24, 2016

Issued Date: Nov. 25, 2016

Applicant: ADVANTECH CO., LTD

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Issued By: Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch

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Release Control Record

| Issue No. | Description | Date Issued |
|---------------|-------------------|---------------|
| RF151229C25-9 | Original release. | Nov. 25, 2016 |

1 Certificate of Conformity

Product: Computer

Brand: Advantech

Test Model: TREK-733L

Sample Status: Engineering sample

Applicant: ADVANTECH CO., LTD

Test Date: Nov. 21 ~ Nov. 24, 2016

Standards: FCC Part 90, Subpart S
FCC Part 2

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

Prepared by : Suntee Liu , **Date:** Nov. 25, 2016
Suntee Liu / Specialist

Approved by : Bruce Chen , **Date:** Nov. 25, 2016
Bruce Chen / Project Engineer

2 Summary of Test Results

| Applied Standard: FCC Part 90 & Part 2 | | | |
|--|---|--------|---|
| FCC Clause | Test Item | Result | Remarks |
| 2.1046 90.635 (b) | Maximum Peak Output Power Limit: max. 3 watts e.r.p peak power | PASS | Meet the requirement of limit. |
| 2.1055 90.213 | Frequency Stability | PASS | Meet the requirement of limit. |
| 2.1049 90.209 | Occupied Bandwidth | PASS | Meet the requirement of limit. |
| 2.1051 90.691 | Emission Masks | PASS | Meet the requirement of limit. |
| --- | Peak To Average Ratio | PASS | Meet the requirement of limit. |
| 2.1051 90.691 | Conducted Spurious Emissions | PASS | Meet the requirement of limit. |
| 2.1053 90.691 | Radiated Spurious Emissions | PASS | Meet the requirement of limit. Minimum passing margin is -26.00dB at 1635.80, 1641.00MHz. |

2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

| Measurement | Frequency | Expanded Uncertainty (k=2) (\pm) |
|--------------------------------|-----------------|---|
| Radiated Emissions up to 1 GHz | 30MHz ~ 200MHz | 3.86 dB |
| | 200MHz ~1000MHz | 3.87 dB |
| Radiated Emissions above 1 GHz | 1GHz ~ 18GHz | 2.29 dB |
| | 18GHz ~ 40GHz | 2.29 dB |

2.2 Test Site And Instruments

| Description & Manufacturer | Model No. | Serial No. | Cal. Date | Cal. Due |
|---|------------------------------|--------------------------------|---------------|---------------|
| Test Receiver ROHDE & SCHWARZ | ESIB7 | 100187 | Apr. 18, 2016 | Apr. 17, 2017 |
| Spectrum Analyzer ROHDE & SCHWARZ | FSP40 | 100040 | Aug. 16, 2016 | Aug. 15, 2017 |
| BILOG Antenna SCHWARZBECK | VULB9168 | 9168-171 | Jan. 07, 2016 | Jan. 06, 2017 |
| HORN Antenna SCHWARZBECK | 9120D | 209 | Jan. 20, 2016 | Jan. 19, 2017 |
| HORN Antenna SCHWARZBECK | BBHA 9170 | BBHA9170241 | Jan. 18, 2016 | Jan. 17, 2017 |
| Preamplifier Agilent | 8447D | 2944A10738 | Aug. 22, 2016 | Aug. 21, 2017 |
| Preamplifier Agilent | 8449B | 3008A01964 | Aug. 22, 2016 | Aug. 21, 2017 |
| RF signal cable HUBER+SUHNER | SUCOFLEX 104 | Cable-CH3-03 (214378) | Aug. 22, 2016 | Aug. 21, 2017 |
| RF signal cable HUBER+SUHNER | SUCOFLEX 106 | Cable-CH3-03 (309224+12738) | Aug. 22, 2016 | Aug. 21, 2017 |
| Software BV ADT | ADT_Radiated_ V7.6.15.9.4 | NA | NA | NA |
| Antenna Tower inn-co GmbH | MA 4000 | 013303 | NA | NA |
| Antenna Tower Controller BV ADT | AT100 | AT93021702 | NA | NA |
| Turn Table BV ADT | TT100 | TT93021702 | NA | NA |
| Turn Table Controller BV ADT | SC100 | SC93021702 | NA | NA |
| WIT Standard Temperature And Humidity Chamber | TH-4S-C | W981030 | Jun. 08, 2016 | Jun. 07, 2017 |
| Mini-Circuits Power Splitter | ZN2PD-9G | NA | Jun. 09, 2016 | Jun. 08, 2017 |
| JFW 20dB attenuation | 50HF-020-SMA | NA | NA | NA |

- Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in HwaYa Chamber 3.
3. The horn antenna and preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
4. The FCC Site Registration No. is 988962.
5. The IC Site Registration No. is IC 7450F-3.

3 General Information

3.1 General Description of EUT

| | |
|---------------------|--|
| Product | Computer |
| Brand | Advantech |
| Test Model | TREK-733L |
| Sample Status | Engineering sample |
| Power Supply Rating | 12 or 24Vdc (Car power system) 3.6Vdc (Battery) |
| Modulation Type | QPSK, OQPSK, HPSK |
| Operating Frequency | 817.9MHz ~ 823.1MHz |
| Max. ERP Power | CDMA: 79.433mW (19.0dBm) EVDO: 79.433mW (18.7dBm) |
| Antenna Type | Refer to Note |
| Antenna Connector | Refer to Note |
| Accessory Device | Stand, GPS + LTE antenna, LTE antenna, Core (For power cable), Battery |
| Data Cable Supplied | 2.1m Display cable with 1 core 5m Coaxial cable without core (For GPS + LTE antenna) 5.1m Coaxial cable without core (For LTE antenna) 0.27m power cable with one external ferrite core |

Note:

1. The EUT provides 1 completed transmitter (Fixed on chain 0) and 2 receivers.
2. The EUT uses following antennas.

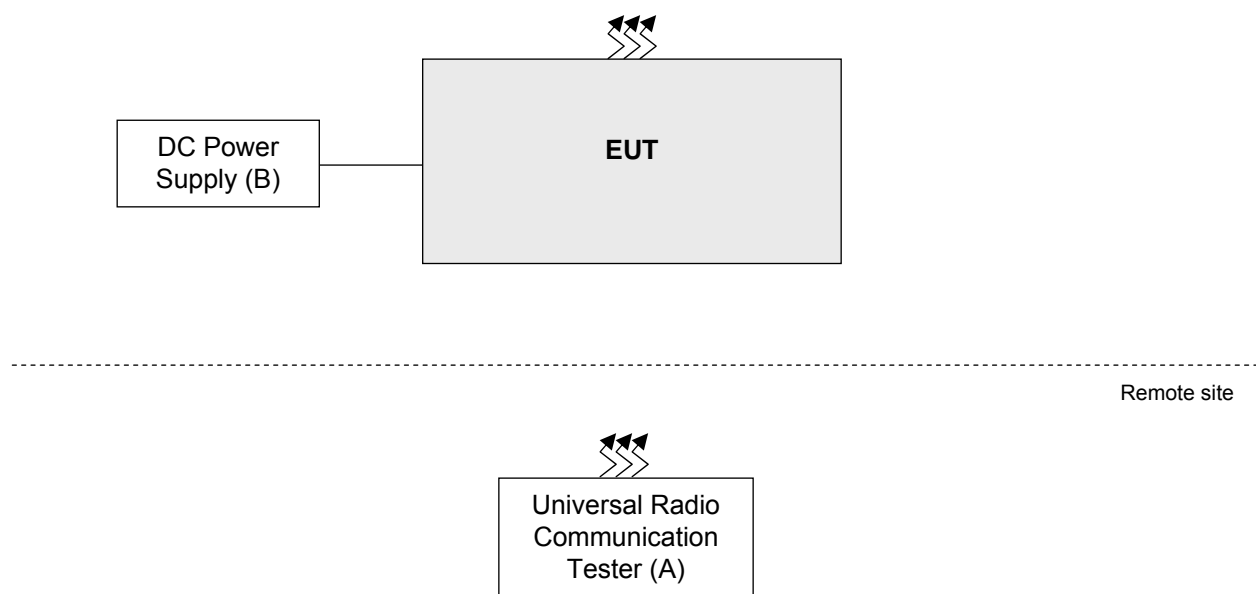
| Antenna | Brand | Frequency Range (MHz) | Antenna Gain (dBi) | Antenna Type | Antenna Connector |
|-----------------------|-------|-----------------------|--------------------|--------------|-------------------|
| WWAN (Main) – Chain 0 | JEM | 1850-1910 | 0.9 | Dipole | SMA |
| | | 1710-1755 | -0.5 | | |
| | | 824-849 | 0.5 | | |
| | | 777-787 | 0.2 | | |
| | | 704-716 | 0.2 | | |
| | | 1920-1980 | -0.4 | | |
| WWAN (Aux) – Chain 1 | JEM | 1850-1910 | 1.2 | Dipole | SMA |
| | | 1710-1755 | 1.8 | | |
| | | 824-849 | -0.1 | | |
| | | 777-787 | 1 | | |
| | | 704-716 | 1 | | |
| | | 1920-1980 | 0.7 | | |
| WiFi & BT | JEM | 2400-2483.5 | 2.87 | PCB | i-pex(MHF) |

3. The EUT was operated with following battery:

| Battery | |
|---------|----------------|
| Brand: | Formosan |
| Model: | GP01NCR18650PF |
| Rating: | 3.6Vdc, 2270mA |

4. WLAN 2.4GHz, WWAN 2/3G and LTE 4G technologies can transmit at same time.
5. Spurious emission of the simultaneous operation (WLAN 2.4GHz, WWAN 2/3G and LTE 4G) has been evaluated and no non-compliance was found.

3.2 Configuration of System Under Test



3.2.1 Description Of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

| ID | Product | Brand | Model No. | Serial No. | FCC ID | Remarks |
|----|--------------------------------------|---------|-----------|------------|--------|---------|
| A. | Universal Radio Communication Tester | R&S | CMU200 | 123112 | NA | - |
| B. | DC Power Supply | Topward | 6603D | 700637 | NA | - |

Note:

1. All power cords of the above support units are non-shielded (1.8m).
2. Item A acted as a communication partner to transfer data.

3.3 Test Mode Applicability and Tested Channel Detail

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates, XYZ axis and antenna ports. The worst case was found when positioned on Z-plane. Following channel(s) was (were) selected for the final test as listed below:

| EUT Configure Mode | Test Item | Available Channel | Tested Channel | Mode |
|--------------------|------------------------------|-------------------|----------------|------------|
| - | ERP | 476 to 684 | 476, 580, 684 | CDMA, EVDO |
| - | Frequency Stability | 476 to 670 | 580 | CDMA |
| - | Occupied Bandwidth | 476 to 684 | 476, 580, 684 | CDMA |
| - | Emission Masks | 476 to 684 | 476, 580, 684 | CDMA |
| - | Peak To Average Ratio | 476 to 684 | 476, 580, 684 | CDMA |
| - | Conducted Emission | 476 to 684 | 476, 580, 684 | CDMA |
| - | Radiated Emission Below 1GHz | 476 to 670 | 476 | CDMA |
| - | Radiated Emission Above 1GHz | 476 to 684 | 476, 580, 684 | CDMA |

Test Condition:

| Test Item | Environmental Conditions | Input Power (System) | Tested By |
|-----------------------|------------------------------------|----------------------|------------|
| ERP | 25deg. C, 69%RH | 120Vac, 60Hz | Chris Lin |
| Frequency Stability | 24deg. C, 64%RH | 120Vac, 60Hz | Match Tsui |
| Occupied Bandwidth | 24deg. C, 64%RH | 120Vac, 60Hz | Match Tsui |
| Emission Masks | 24deg. C, 64%RH | 120Vac, 60Hz | Match Tsui |
| Peak To Average Ratio | 24deg. C, 64%RH | 120Vac, 60Hz | Match Tsui |
| Conducted Emission | 24deg. C, 64%RH | 120Vac, 60Hz | Match Tsui |
| Radiated Emission | 24deg. C, 68%RH 25deg. C, 69%RH | 120Vac, 60Hz | Chris Lin |

3.4 EUT Operating Conditions

The EUT makes a call to the communication simulator. The communication simulator station system controlled a EUT to export maximum output power under transmission mode and specific channel frequency.

3.5 General Description of Applied Standards

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

FCC 47 CFR Part 2

FCC 47 CFR Part 90

KDB 971168 D01 Power Meas License Digital Systems v02r02

ANSI/TIA/EIA-603-C 2004

All test items have been performed and recorded as per the above standards.

Note: The EUT has been verified to comply with the requirements of FCC Part 15, Subpart B, Class B (DoC).
The test report has been issued separately.

4 Test Types and Results

4.1 Output Power Measurement

4.1.1 Limits of Output Power Measurement

Per FCC Part 90.542(a)(6)(7),

Control stations and mobile stations transmitting in the 758-768 MHz band and the 788-798 MHz band are limited to 30 watts ERP.

Portable stations (hand-held devices) transmitting in the 758-768 MHz band and the 788-798 MHz band are limited to 3 watts ERP.

4.1.2 Test Procedures

EIRP / ERP MEASUREMENT:

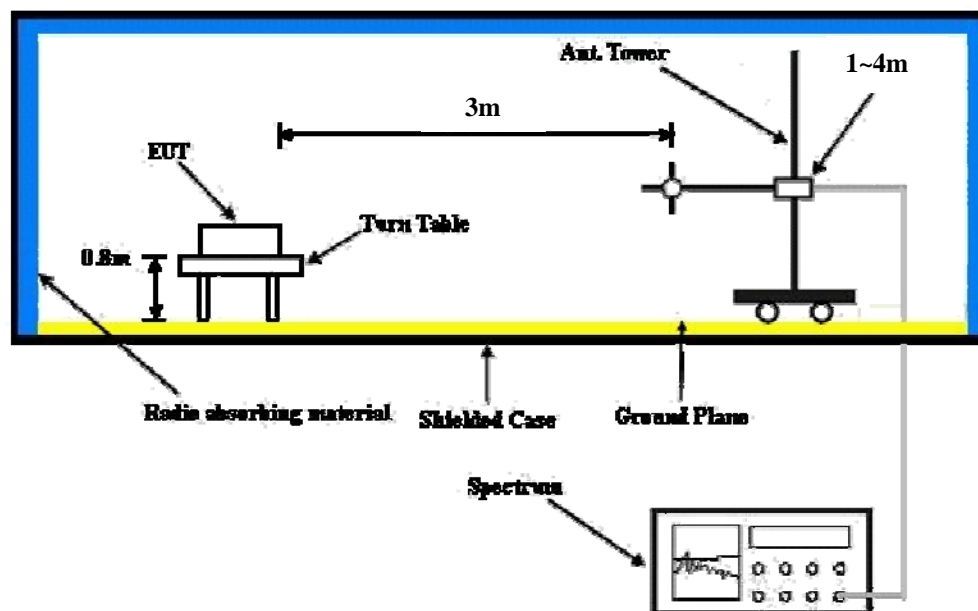
- a. The EUT was set up for the maximum power with CDMA, EVDO link data modulation. The power was measured with Agilent Spectrum Analyzer. All measurements were done at 1 channel. RWB and VBW is 5MHz for CDMA, EVDO.
- b. Substitution method is used for E.I.R.P measurement. In the semi-anechoic chamber, EUT placed on the 0.8m height of Turn Table, rotated the table around 360 degrees to search the maximum radiation power and receiver antenna shall be rotated vertical and horizontal polarization and moved height from 1m to 4m to find the maximum polar radiated power. The "Read Value" is the spectrum reading the maximum power value.
- c. The substitution horn antenna is substituted for EUT at the same position and signals generator export the CW signal to the substitution antenna via a tx cable. Rotated the Turn Table and moved receiving antenna to find the maximum radiation power. Adjust output power level of S.G to get a Value of spectrum reading equal to "Read Value" of step b. Record the power level of S.G
- d. $EIRP = \text{Output power level of S.G} - \text{TX cable loss} + \text{Antenna gain of substitution horn}$. E.R.P power can be calculated form E.I.R.P power by subtracting the gain of dipole, $E.R.P \text{ power} = E.I.P.R \text{ power} - 2.15\text{dBi}$.

Conducted Power Measurement:

The EUT was set up for the maximum power with LTE link data modulation and link up with simulator. Set the EUT to transmit under low, middle and high channel and record the power level shown on simulator.

4.1.3 Test Setup

EIRP / ERP Measurement:



For the actual test configuration, please refer to the attached file (Test Setup Photo).

Conducted Power Measurement:



For the actual test configuration, please refer to the attached file (Test Setup Photo).

4.1.4 Test Results

Conducted Output Power (dBm)

| Band | CDMA2000 BC10 | | |
|-------------------|---------------|--------------|-------|
| Channel | 476 | 580 | 684 |
| Frequency (MHz) | 817.9 | 820.5 | 823.1 |
| RC1+SO55 | 23.08 | 23.11 | 23.02 |
| RC3+SO55 | 23.05 | 23.09 | 22.98 |
| RC3+SO32(+ F-SCH) | 23.06 | 23.10 | 23.00 |
| RC3+SO32(+SCH) | 23.02 | 23.07 | 22.96 |
| RTAP 153.6 | 23.06 | 23.10 | 22.99 |
| RETAP 4096 | 23.02 | 23.06 | 22.95 |

CDMA Mode

| | | | | | | | |
|---|-------------|----------------|-----------------------|------------------------|-----------|-------------|-------------|
| MODE | | TX channel 476 | | | | | |
| Antenna Polarity & Test Distance: Horizontal at 3 M | | | | | | | |
| No. | Freq. (MHz) | Reading (dBm) | S.G Power Value (dBm) | Correction Factor (dB) | ERP (dBm) | Limit (dBm) | Margin (dB) |
| 1 | 817.90 | -13.1 | 18.2 | -0.2 | 18.0 | 34.8 | -16.8 |
| Antenna Polarity & Test Distance: Vertical at 3 M | | | | | | | |
| No. | Freq. (MHz) | Reading (dBm) | S.G Power Value (dBm) | Correction Factor (dB) | ERP (dBm) | Limit (dBm) | Margin (dB) |
| 1 | 817.90 | -12.9 | 19.2 | -0.2 | 19.0 | 34.8 | -15.8 |

| | | | | | | | |
|---|-------------|----------------|-----------------------|------------------------|-----------|-------------|-------------|
| MODE | | TX channel 580 | | | | | |
| Antenna Polarity & Test Distance: Horizontal at 3 M | | | | | | | |
| No. | Freq. (MHz) | Reading (dBm) | S.G Power Value (dBm) | Correction Factor (dB) | ERP (dBm) | Limit (dBm) | Margin (dB) |
| 1 | 820.50 | -12.8 | 18.4 | -0.1 | 18.3 | 34.8 | -16.5 |
| Antenna Polarity & Test Distance: Vertical at 3 M | | | | | | | |
| No. | Freq. (MHz) | Reading (dBm) | S.G Power Value (dBm) | Correction Factor (dB) | ERP (dBm) | Limit (dBm) | Margin (dB) |
| 1 | 820.50 | -13.1 | 19.0 | -0.1 | 18.9 | 34.8 | -15.9 |

| | | | | | | | |
|---|-------------|----------------|-----------------------|------------------------|-----------|-------------|-------------|
| MODE | | TX channel 684 | | | | | |
| Antenna Polarity & Test Distance: Horizontal at 3 M | | | | | | | |
| No. | Freq. (MHz) | Reading (dBm) | S.G Power Value (dBm) | Correction Factor (dB) | ERP (dBm) | Limit (dBm) | Margin (dB) |
| 1 | 823.10 | -13.1 | 18.2 | -0.1 | 18.1 | 34.8 | -16.7 |
| Antenna Polarity & Test Distance: Vertical at 3 M | | | | | | | |
| No. | Freq. (MHz) | Reading (dBm) | S.G Power Value (dBm) | Correction Factor (dB) | ERP (dBm) | Limit (dBm) | Margin (dB) |
| 1 | 823.10 | -12.9 | 19.1 | -0.1 | 19.0 | 34.8 | -15.8 |

Note: ERP (dBm) = S.G Power Value (dBm) + Correction Factor (dB).

EVDO Mode

| | | | | | | | |
|---|-------------|----------------|-----------------------|------------------------|-----------|-------------|-------------|
| MODE | | TX channel 476 | | | | | |
| Antenna Polarity & Test Distance: Horizontal at 3 M | | | | | | | |
| No. | Freq. (MHz) | Reading (dBm) | S.G Power Value (dBm) | Correction Factor (dB) | ERP (dBm) | Limit (dBm) | Margin (dB) |
| 1 | 817.90 | -13.5 | 17.8 | -0.2 | 17.6 | 34.8 | -17.2 |
| Antenna Polarity & Test Distance: Vertical at 3 M | | | | | | | |
| No. | Freq. (MHz) | Reading (dBm) | S.G Power Value (dBm) | Correction Factor (dB) | ERP (dBm) | Limit (dBm) | Margin (dB) |
| 1 | 817.90 | -13.2 | 18.8 | -0.2 | 18.6 | 34.8 | -16.2 |

| | | | | | | | |
|---|-------------|----------------|-----------------------|------------------------|-----------|-------------|-------------|
| MODE | | TX channel 580 | | | | | |
| Antenna Polarity & Test Distance: Horizontal at 3 M | | | | | | | |
| No. | Freq. (MHz) | Reading (dBm) | S.G Power Value (dBm) | Correction Factor (dB) | ERP (dBm) | Limit (dBm) | Margin (dB) |
| 1 | 820.50 | -13.4 | 17.8 | -0.1 | 17.7 | 34.8 | -17.1 |
| Antenna Polarity & Test Distance: Vertical at 3 M | | | | | | | |
| No. | Freq. (MHz) | Reading (dBm) | S.G Power Value (dBm) | Correction Factor (dB) | ERP (dBm) | Limit (dBm) | Margin (dB) |
| 1 | 820.50 | -13.4 | 18.7 | -0.1 | 18.6 | 34.8 | -16.2 |

| | | | | | | | |
|---|-------------|----------------|-----------------------|------------------------|-----------|-------------|-------------|
| MODE | | TX channel 684 | | | | | |
| Antenna Polarity & Test Distance: Horizontal at 3 M | | | | | | | |
| No. | Freq. (MHz) | Reading (dBm) | S.G Power Value (dBm) | Correction Factor (dB) | ERP (dBm) | Limit (dBm) | Margin (dB) |
| 1 | 823.10 | -13.4 | 17.9 | -0.1 | 17.8 | 34.8 | -17.0 |
| Antenna Polarity & Test Distance: Vertical at 3 M | | | | | | | |
| No. | Freq. (MHz) | Reading (dBm) | S.G Power Value (dBm) | Correction Factor (dB) | ERP (dBm) | Limit (dBm) | Margin (dB) |
| 1 | 823.10 | -13.2 | 18.8 | -0.1 | 18.7 | 34.8 | -16.1 |

Note: ERP (dBm) = S.G Power Value (dBm) + Correction Factor (dB).

4.2 Frequency Stability Measurement

4.2.1 Limits of Frequency Stability Measurement

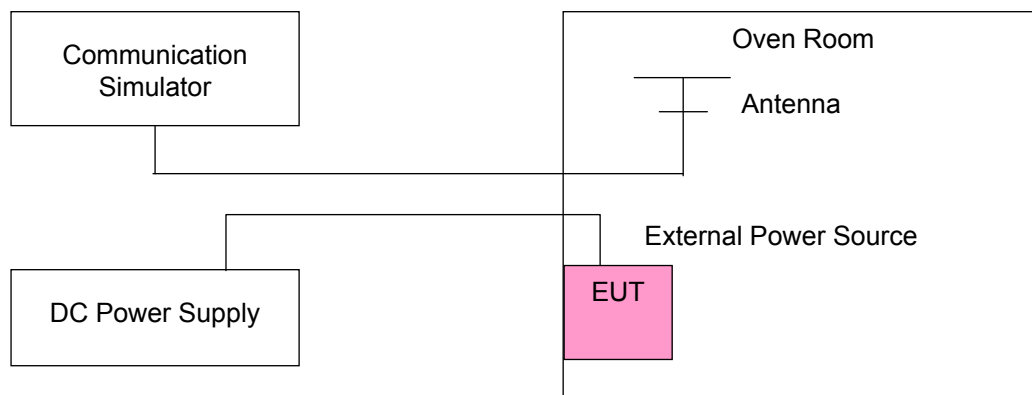
The frequency stability of mobile, portable and control transmitters operating in the wideband segment must be 1.25 parts per million or better when AFC is locked to a base station, and 5 parts per million or better when AFC is not locked.

4.2.2 Test Procedure

- Device is placed at the oven room. The oven room could control the temperatures and humidity. Power warm up is at least 15 min and power applied should perform before recording frequency error.
- EUT is connected the external power supply to control the DC input power. The test voltage range is from minimum to maximum working voltage. Each step shall be record the frequency error rate.
- The temperature range step is 10 degrees in this test items. All temperature levels shall be hold the $\pm 0.5^{\circ}\text{C}$ during the measurement testing. The each temperature step shall be at least 0.5 hours, consider the EUT could be test under the stability condition.

NOTE: The frequency error was recorded frequency error from the communication simulator.

4.2.3 Test Setup



4.2.4 Test Results

Frequency Error vs. Voltage

| Voltage (Volts) | Frequency Error (ppm) | Limit (ppm) |
|-----------------|-----------------------|-------------|
| | CDMA | |
| 26.4 | -0.005 | 2.5 |
| 24 | -0.004 | 2.5 |
| 21.6 | -0.005 | 2.5 |

NOTE: The applicant defined the normal working voltage is from 21.6Vdc to 26.4Vdc.

Frequency Error vs. Temperature.

| TEMP. (°C) | Frequency Error (ppm) | Limit (ppm) |
|------------|-----------------------|-------------|
| | CDMA | |
| 70 | -0.008 | 2.5 |
| 60 | -0.008 | 2.5 |
| 50 | -0.007 | 2.5 |
| 40 | -0.006 | 2.5 |
| 30 | -0.006 | 2.5 |
| 20 | -0.004 | 2.5 |
| 10 | -0.006 | 2.5 |
| 0 | -0.006 | 2.5 |
| -10 | -0.007 | 2.5 |
| -20 | -0.008 | 2.5 |

4.3 Occupied Bandwidth Measurement

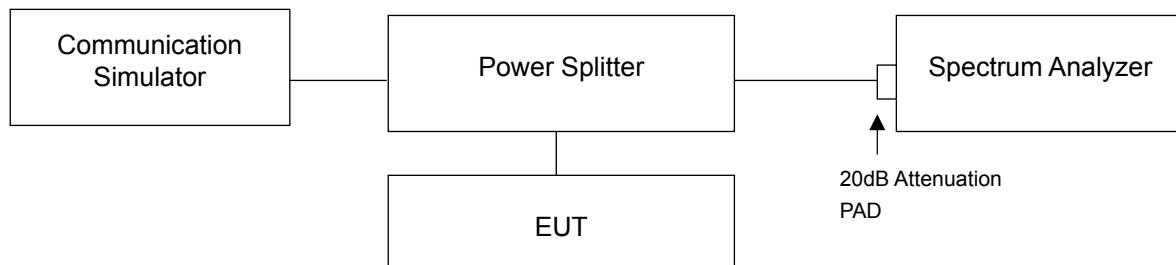
4.3.1 Limits Of Occupied Bandwidth Measurement

The width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage 0.5 %of the total mean power of a given emission.

4.3.2 Test Procedure

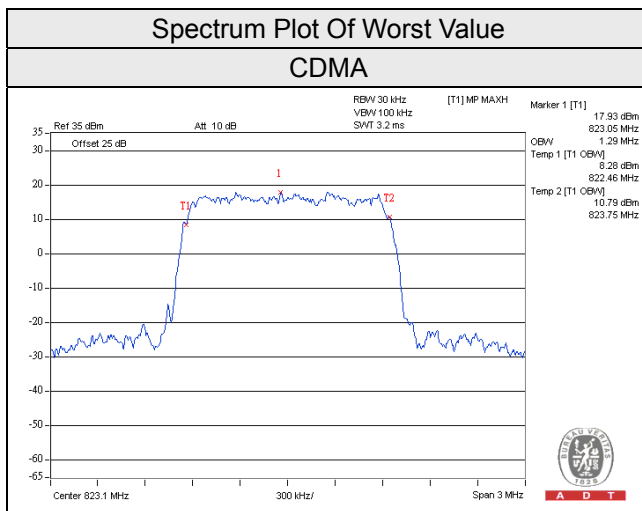
The EUT makes a call to the communication simulator. All measurements were done at low, middle and high operational frequency range. The communication simulator station system controlled a EUT to export maximum output power under transmission mode and specific channel frequency. Use OBW measurement function of Spectrum analyzer to measure 99 % occupied bandwidth.

4.3.3 Test Setup



4.3.4 Test Result

| Channel | Frequency (MHz) | 99% Occupied Bandwidth (MHz) |
|---------|-----------------|------------------------------|
| | | CDMA |
| 476 | 817.90 | 1.27 |
| 580 | 820.50 | 1.26 |
| 684 | 823.10 | 1.29 |



4.4 Emission Mask Measurement

4.4.1 Limits Of Emission Mask Measurement

Per 90.210(n), Emission mask shall comply with 90.210(b)

(1) On any frequency removed from the assigned frequency by more than 50 percent, but not more than 100 percent of the authorized bandwidth: At least 25 dB.

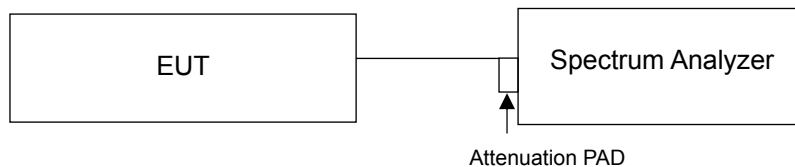
(2) On any frequency removed from the assigned frequency by more than 100 percent, but not more than 250 percent of the authorized bandwidth: At least 35 dB.

(3) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least $43 + 10 \log (P)$ dB

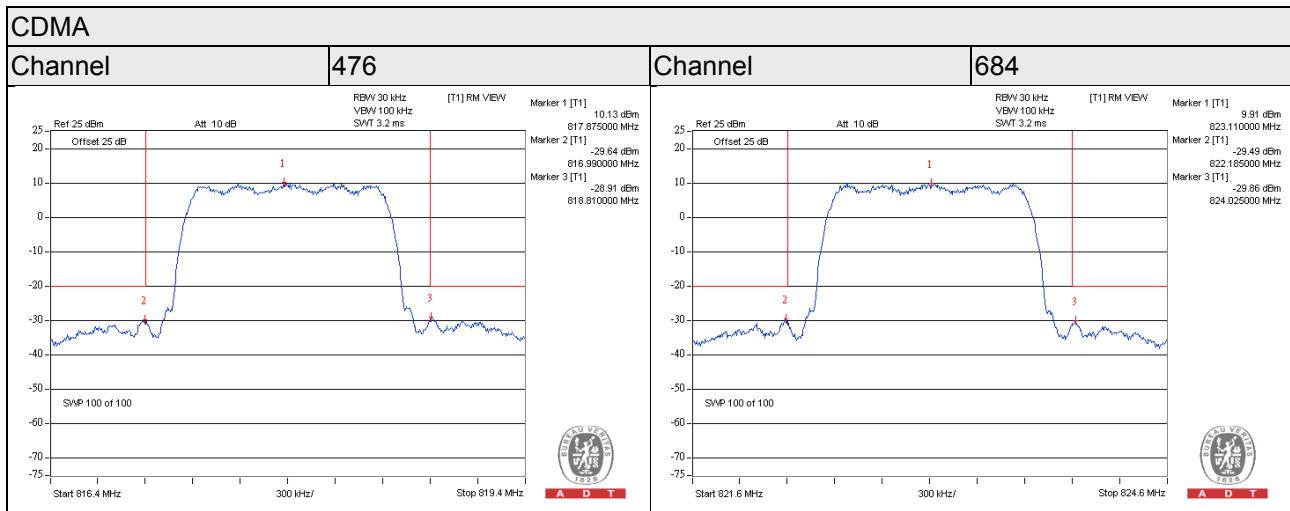
4.4.2 Test Procedures

1. The power was measured with Agilent Spectrum Analyzer. All measurements were done at 1 channel.
2. The measurement used the power splitter via EUT RF power connector between signal generator and spectrum analyzer.
3. Record the test plot.

4.4.3 Test Setup



4.4.4 Test Results

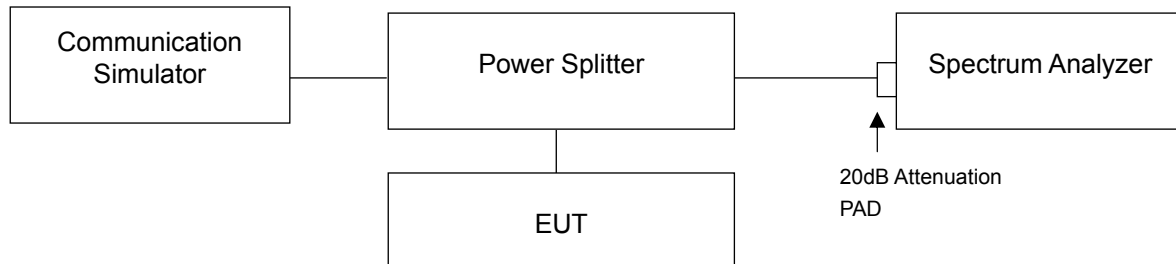


4.5 Peak To Average Ratio

4.5.1 Limits of Peak To Average Ratio Measurement

In measuring transmissions in this band using an average power technique, the peak to-average ratio (PAR) of the transmission may not exceed 13 dB.

4.5.2 Test Setup

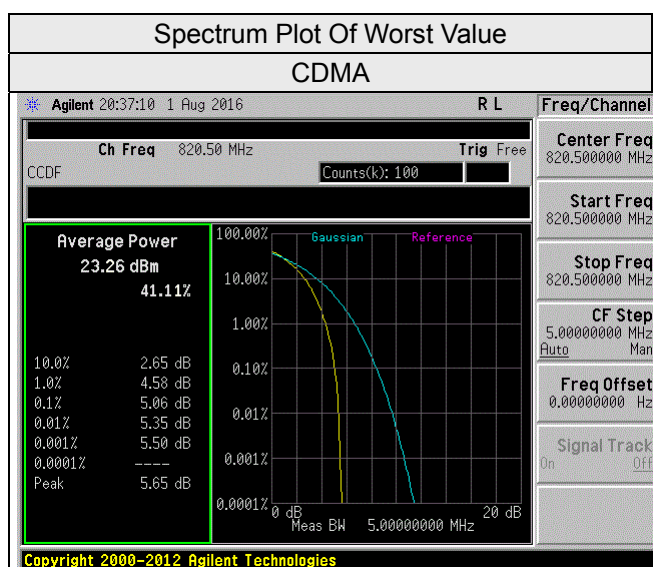


4.5.3 Test Procedures

1. Set resolution/measurement bandwidth \geq signal's occupied bandwidth;
2. Set the number of counts to a value that stabilizes the measured CCDF curve;
3. Record the maximum PAPR level associated with a probability of 0.1%.

4.5.4 Test Results

| Channel | Frequency (MHz) | Peak To Average Ratio (dB) |
|---------|-----------------|----------------------------|
| | | CDMA |
| 476 | 817.90 | 4.90 |
| 580 | 820.50 | 5.06 |
| 684 | 823.10 | 4.58 |



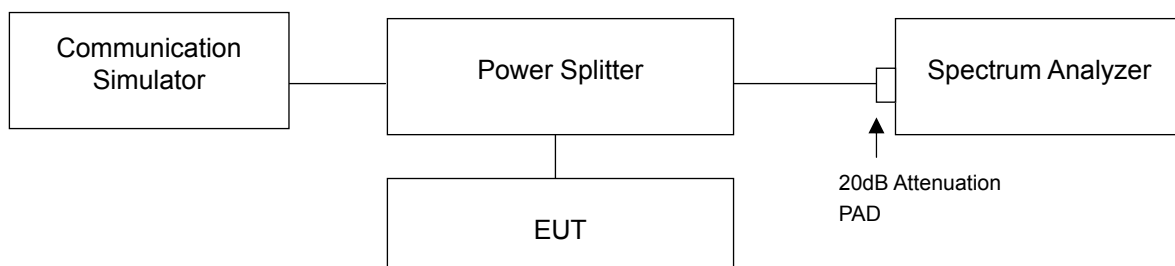
4.6 Conducted Spurious Emissions

4.6.1 Limits of Conducted Spurious Emissions Measurement

The power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) by at least $43 + 10 \log_{10}(P)$ dB. The limit of emission equal to -13dBm .

On all frequencies between 769 – 775 MHz and 799 – 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.

4.6.2 Test Setup



4.6.3 Test Procedure

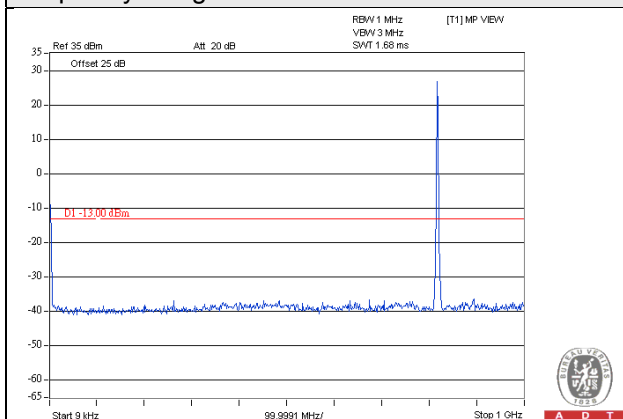
- The EUT was set up for the maximum peak power with LTE link data modulation. The power was measured with Agilent Spectrum Analyzer.
- The conducted spurious emission used the power splitter via EUT RF power connector between signal generator and spectrum analyzer.
- When the spectrum scanned from 30MHz to 8GHz, it shall be connected to the band reject filter attenuated the carried frequency. The spectrum set RB=1MHz, VB=3MHz.

4.6.4 Test Results

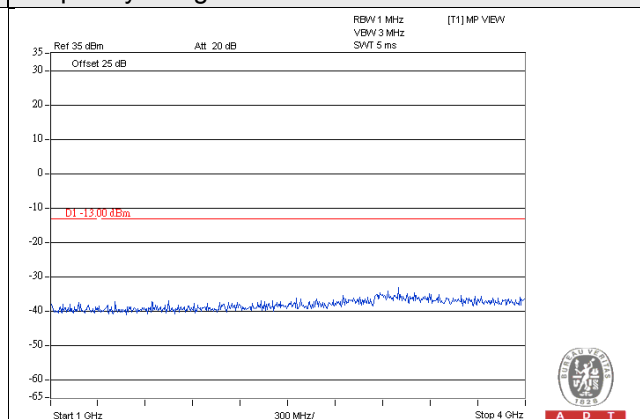
CDMA

Channel 476

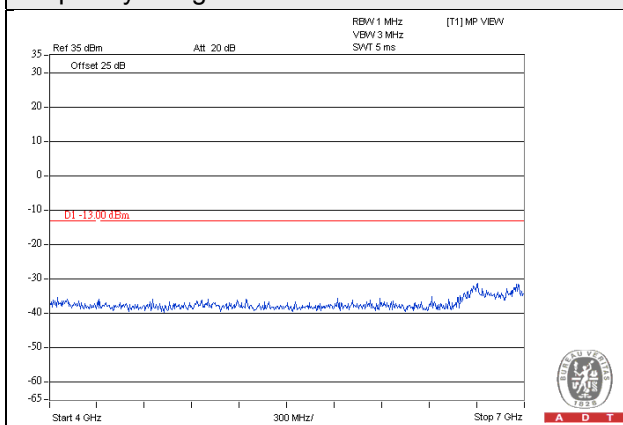
Frequency Range : 9kHz~1GHz



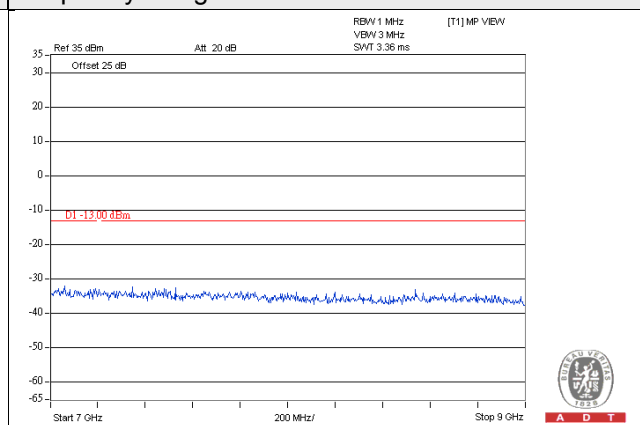
Frequency Range : 1GHz~4GHz



Frequency Range : 4GHz~7GHz



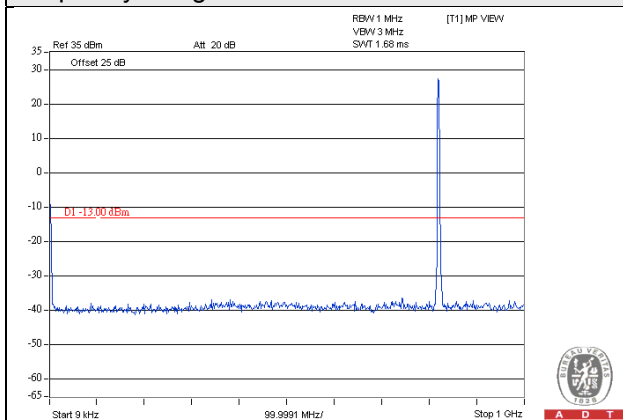
Frequency Range : 7GHz~9GHz



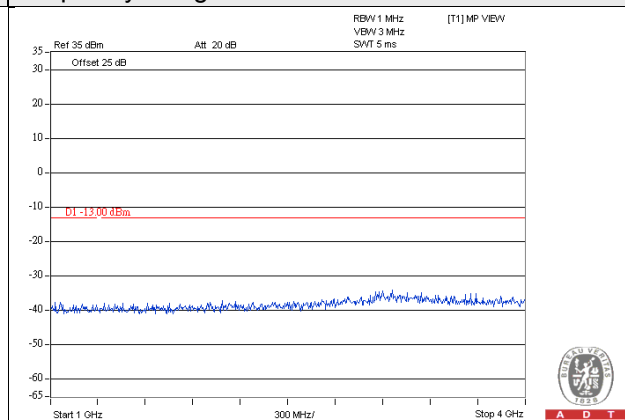
CDMA

Channel 580

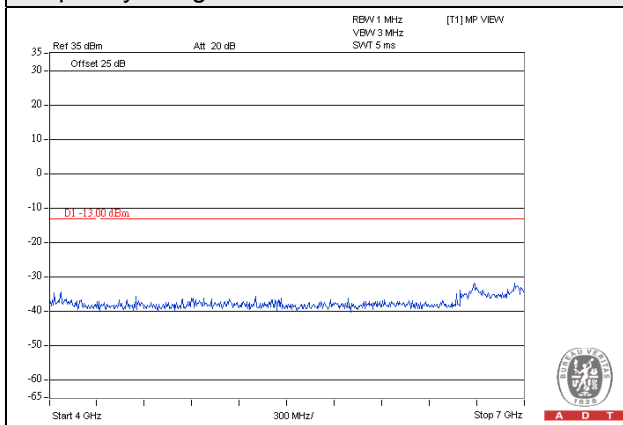
Frequency Range : 9kHz~1GHz



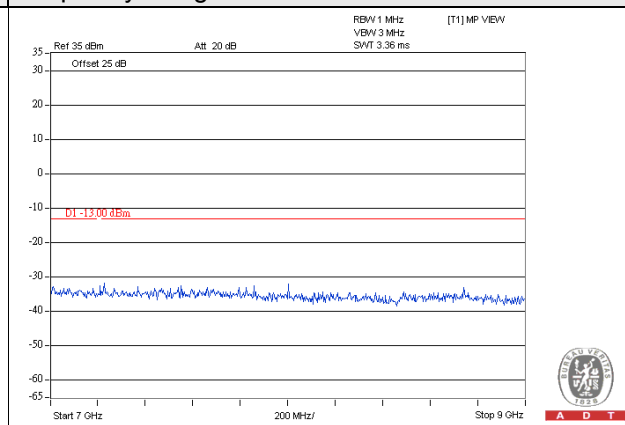
Frequency Range : 1GHz~4GHz



Frequency Range : 4GHz~7GHz



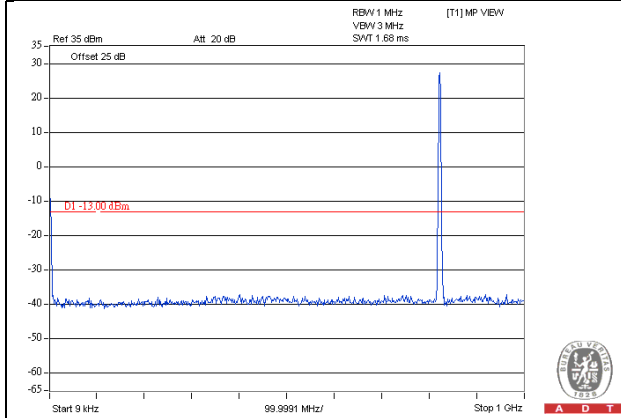
Frequency Range : 7GHz~9GHz



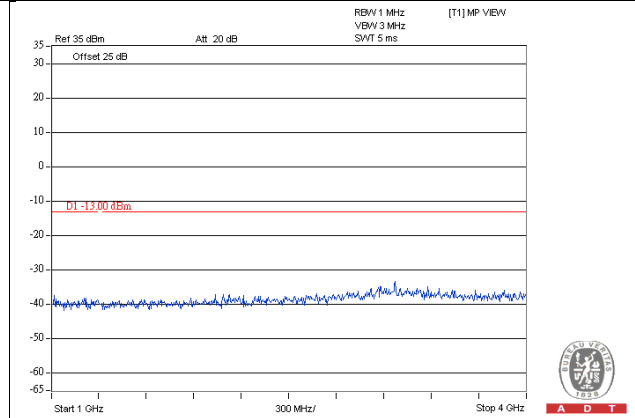
CDMA

Channel 684

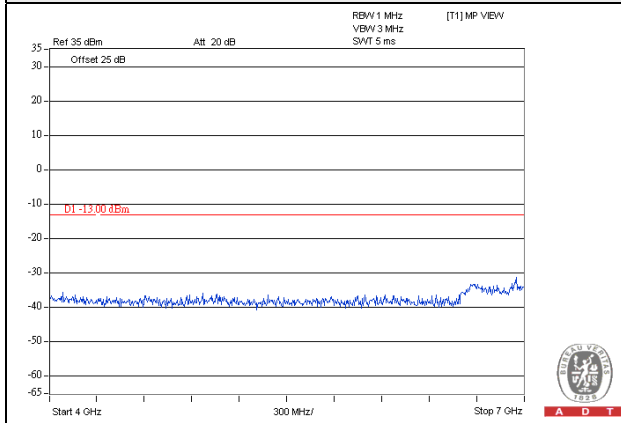
Frequency Range : 9kHz~1GHz



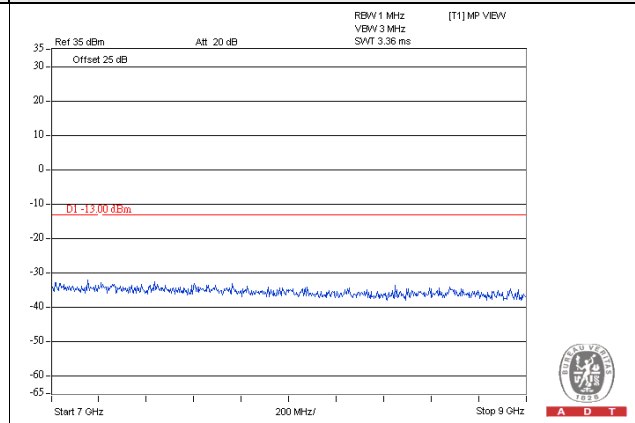
Frequency Range : 1GHz~4GHz



Frequency Range : 4GHz~7GHz



Frequency Range : 7GHz~9GHz



4.7 Radiated Emission Measurement

4.7.1 Limits of Radiated Emission Measurement

(1) The power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) by at least $43 + 10 \log_{10}(P)$ dB. The limit of emission equal to -13dBm

(2) For operations in the 758-775 MHz and 788-805 MHz bands, all emissions including harmonics in the band 1559-1610 MHz shall be limited to -70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and -80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth.

4.7.2 Test Procedure

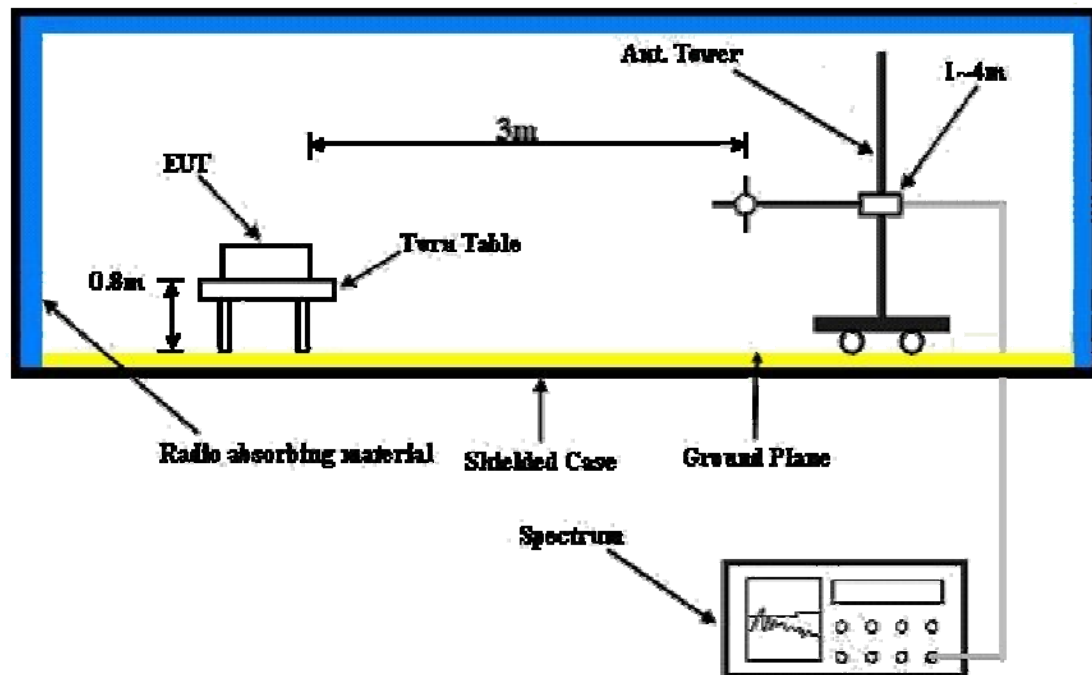
- a. Substitution method is used for E.I.R.P measurement. In the semi-anechoic chamber, EUT placed on the 0.8m height of Turn Table, rotated the table around 360 degrees to search the maximum radiation power and receiver antenna shall be rotated vertical and horizontal polarization and moved height from 1m to 4m to find the maximum polar radiated power. The "Read Value" is the spectrum reading the maximum power value.
- b. The substitution horn antenna is substituted for EUT at the same position and signals generator export the CW signal to the substitution antenna via a TX cable. Rotated the Turn Table and moved receiving antenna to find the maximum radiation power. Adjust output power level of S.G to get a Value of spectrum reading equal to "Read Value " of step a. Record the power level of S.G
- c. $\text{EIRP} = \text{Output power level of S.G} - \text{TX cable loss} + \text{Antenna gain of substitution horn}.$
- d. E.R.P power can be calculated form E.I.R.P power by subtracting the gain of dipole, $\text{E.R.P power} = \text{E.I.P.R power} - 2.15\text{dBi}.$

NOTE: The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1MHz/3MHz.

4.7.3 Deviation from Test Standard

No deviation.

4.7.4 Test Setup



For the actual test configuration, please refer to the attached file (Test Setup Photo).

4.7.5 Test Results

Below 1GHz

CDMA Mode

| | | | |
|--------------------------|-----------------|-----------------|----------------|
| Mode | TX channel 476 | Frequency Range | Below 1000 MHz |
| Environmental Conditions | 24deg. C, 68%RH | Input Power | 120Vac, 60Hz |
| Tested By | Chris Lin | | |

| Antenna Polarity & Test Distance: Horizontal at 3 M | | | | | | | |
|---|-------------|---------------|-----------------------|------------------------|-----------|-------------|-------------|
| No. | Freq. (MHz) | Reading (dBm) | S.G Power Value (dBm) | Correction Factor (dB) | ERP (dBm) | Limit (dBm) | Margin (dB) |
| 1 | 80.44 | -48.3 | -55.2 | -1.2 | -56.4 | -13.0 | -43.4 |
| 2 | 222.06 | -57.1 | -65.8 | -1.6 | -67.4 | -13.0 | -54.4 |
| 3 | 454.86 | -64.8 | -66.0 | -2.1 | -68.1 | -13.0 | -55.1 |
| 4 | 625.58 | -59.8 | -58.6 | -2.3 | -60.9 | -13.0 | -47.9 |
| 5 | 774.96 | -61.0 | -55.4 | -2.6 | -58.0 | -13.0 | -45.0 |
| 6 | 932.10 | -67.2 | -61.1 | -1.2 | -62.3 | -13.0 | -49.3 |
| Antenna Polarity & Test Distance: Vertical at 3 M | | | | | | | |
| No. | Freq. (MHz) | Reading (dBm) | S.G Power Value (dBm) | Correction Factor (dB) | ERP (dBm) | Limit (dBm) | Margin (dB) |
| 1 | 80.44 | -50.1 | -54.7 | -1.2 | -55.9 | -13.0 | -42.9 |
| 2 | 179.38 | -52.0 | -53.9 | -1.5 | -55.4 | -13.0 | -42.4 |
| 3 | 276.38 | -61.4 | -59.6 | -1.7 | -61.3 | -13.0 | -48.3 |
| 4 | 629.46 | -61.9 | -56.7 | -2.4 | -59.1 | -13.0 | -46.1 |
| 5 | 778.84 | -61.6 | -54.8 | -2.6 | -57.4 | -13.0 | -44.4 |
| 6 | 935.98 | -61.1 | -53.4 | -1.2 | -54.6 | -13.0 | -41.6 |

Remarks:

1. Output Power (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).

Above 1GHz

CDMA Mode

| | | | |
|--------------------------|-----------------|-----------------|---------------|
| Mode | TX channel 476 | Frequency Range | Above 1000MHz |
| Environmental Conditions | 25deg. C, 69%RH | Input Power | 120Vac, 60Hz |
| Tested By | Chris Lin | | |

| Antenna Polarity & Test Distance: Horizontal at 3 M | | | | | | | |
|---|----------------|---------------|-----------------------|------------------------|--------------|--------------|--------------|
| No. | Freq. (MHz) | Reading (dBm) | S.G Power Value (dBm) | Correction Factor (dB) | ERP (dBm) | Limit (dBm) | Margin (dB) |
| 1 | 1635.80 | -43.5 | -47.0 | 5.5 | -41.5 | -13.0 | -28.5 |
| 2 | 2453.70 | -52.5 | -52.7 | 6.5 | -46.2 | -13.0 | -33.2 |
| 3 | 3271.60 | -55.1 | -53.0 | 6.9 | -46.1 | -13.0 | -33.1 |
| Antenna Polarity & Test Distance: Vertical at 3 M | | | | | | | |
| No. | Freq. (MHz) | Reading (dBm) | S.G Power Value (dBm) | Correction Factor (dB) | ERP (dBm) | Limit (dBm) | Margin (dB) |
| 1 | 1635.80 | -43.1 | -44.5 | 5.5 | -39.0 | -13.0 | -26.0 |
| 2 | 2453.70 | -55.0 | -52.9 | 6.5 | -46.4 | -13.0 | -33.4 |
| 3 | 3271.60 | -57.4 | -53.8 | 6.9 | -46.9 | -13.0 | -33.9 |

Remarks:

1. Output Power (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).

| | | | |
|--------------------------|-----------------|-----------------|---------------|
| Mode | TX channel 580 | Frequency Range | Above 1000MHz |
| Environmental Conditions | 25deg. C, 69%RH | Input Power | 120Vac, 60Hz |
| Tested By | Chris Lin | | |

| Antenna Polarity & Test Distance: Horizontal at 3 M | | | | | | | |
|---|----------------|---------------|-----------------------|------------------------|--------------|--------------|--------------|
| No. | Freq. (MHz) | Reading (dBm) | S.G Power Value (dBm) | Correction Factor (dB) | ERP (dBm) | Limit (dBm) | Margin (dB) |
| 1 | 1641.00 | -44.0 | -47.4 | 5.5 | -41.9 | -13.0 | -28.9 |
| 2 | 2461.50 | -52.1 | -52.3 | 6.5 | -45.8 | -13.0 | -32.8 |
| 3 | 3282.00 | -54.3 | -52.3 | 6.9 | -45.4 | -13.0 | -32.4 |
| Antenna Polarity & Test Distance: Vertical at 3 M | | | | | | | |
| No. | Freq. (MHz) | Reading (dBm) | S.G Power Value (dBm) | Correction Factor (dB) | ERP (dBm) | Limit (dBm) | Margin (dB) |
| 1 | 1641.00 | -43.2 | -44.5 | 5.5 | -39.0 | -13.0 | -26.0 |
| 2 | 2461.50 | -57.5 | -55.2 | 6.5 | -48.7 | -13.0 | -35.7 |
| 3 | 3282.00 | -57.6 | -54.0 | 6.9 | -47.1 | -13.0 | -34.1 |

Remarks:

1. Output Power (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).

| | | | |
|--------------------------|-----------------|-----------------|---------------|
| Mode | TX channel 684 | Frequency Range | Above 1000MHz |
| Environmental Conditions | 25deg. C, 69%RH | Input Power | 120Vac, 60Hz |
| Tested By | Chris Lin | | |

| Antenna Polarity & Test Distance: Horizontal at 3 M | | | | | | | |
|---|-------------|---------------|-----------------------|------------------------|-----------|-------------|-------------|
| No. | Freq. (MHz) | Reading (dBm) | S.G Power Value (dBm) | Correction Factor (dB) | ERP (dBm) | Limit (dBm) | Margin (dB) |
| 1 | 1646.20 | -45.0 | -48.2 | 5.5 | -42.7 | -13.0 | -29.7 |
| 2 | 2469.30 | -50.5 | -50.6 | 6.5 | -44.1 | -13.0 | -31.1 |
| 3 | 3292.40 | -58.8 | -56.8 | 6.9 | -49.9 | -13.0 | -36.9 |
| Antenna Polarity & Test Distance: Vertical at 3 M | | | | | | | |
| No. | Freq. (MHz) | Reading (dBm) | S.G Power Value (dBm) | Correction Factor (dB) | ERP (dBm) | Limit (dBm) | Margin (dB) |
| 1 | 1646.20 | -46.1 | -47.2 | 5.5 | -41.7 | -13.0 | -28.7 |
| 2 | 2469.30 | -55.5 | -53.1 | 6.5 | -46.6 | -13.0 | -33.6 |
| 3 | 3292.40 | -57.8 | -54.3 | 6.9 | -47.4 | -13.0 | -34.4 |

Remarks:

1. Output Power (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).

5 Pictures of Test Arrangements

Please refer to the attached file (Test Setup Photo).

Appendix – Information on the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are accredited and approved according to ISO/IEC 17025.

If you have any comments, please feel free to contact us at the following:

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The address and road map of all our labs can be found in our web site also.

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