

FCC Test Report (WLAN) (Spot Check)

Report No.: RF190603E08

FCC ID: NKR-WNCJS8T

Original FCC ID: NKR-VZJS8V

Test Model: JS8T

Received Date: June 03, 2019

Test Date: June 28 to July 05, 2019

Issued Date: Aug. 20, 2019

Applicant: Wistron NeWeb Corp.

Address: 20 Park Avenue II, Hsinchu Science Park, Hsinchu 308, Taiwan, R.O.C.

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

Lab Address: E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300,
Taiwan R.O.C.

Test Location : E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300,
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**FCC Registration /
Designation Number:** 723255 / TW2022



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Release Control Record

| Issue No. | Description | Date Issued |
|-------------|-------------------|---------------|
| RF190603E08 | Original release. | Aug. 20, 2019 |

1 Certificate of Conformity

Product: OTT BOX

Brand: WNC

Test Model: JS8T

Status of EUT ENGINEERING SAMPLE

Applicant: Wistron NeWeb Corp.

Test Date: June 28 to July 05, 2019

Standards: 47 CFR FCC Part 15, Subpart C (Section 15.247)
ANSI C63.10: 2013

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 : Wendy Wu , **Date:** Aug. 20, 2019
Wendy Wu / Specialist

Approved by : May Chen , **Date:** Aug. 20, 2019
May Chen / Manager

2 Summary of Test Results

| 47 CFR FCC Part 15, Subpart C (Section 15.247) | | | |
|--|--|--------|--|
| FCC Clause | Test Item | Result | Remarks |
| 15.207 | AC Power Conducted Emission | PASS | Meet the requirement of limit. Minimum passing margin is 12.92dB at 26.60938 MHz. |
| 15.205 / 15.209 / 15.247(d) | Radiated Emissions and Band Edge Measurement | PASS | Meet the requirement of limit. Minimum passing margin is -0.3dB at 2483.50MHz |
| 15.247(d) | Antenna Port Emission | PASS | Meet the requirement of limit. |

Note:

Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

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) |
|------------------------------------|----------------|--------------------------------------|
| Conducted Emissions at mains ports | 150kHz ~ 30MHz | 1.8 dB |
| Radiated Emissions up to 1 GHz | 30MHz ~ 1GHz | 5.1 dB |
| Radiated Emissions above 1 GHz | 1GHz ~ 6GHz | 5.1 dB |
| | 6GHz ~ 18GHz | 5.0 dB |
| | 18GHz ~ 40GHz | 5.2 dB |

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

| | |
|-----------------------|---|
| Product | OTT BOX |
| Brand | WNC |
| Test Model | JS8T |
| Status of EUT | ENGINEERING SAMPLE |
| Power Supply Rating | 12Vdc from power adapter |
| Modulation Type | CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM 256QAM for OFDM in 11ac mode and VHT (20/40) mode in 2.4GHz |
| Modulation Technology | DSSS, OFDM |
| Transfer Rate | 802.11b: up to 11Mbps 802.11a/g: up to 54Mbps 802.11n: up to 300Mbps 802.11ac: up to 866.7Mbps |
| Operating Frequency | 2.4GHz: 2.412 ~ 2.462GHz 5GHz: 5.18~ 5.24GHz, 5.26GHz ~ 5.32GHz, 5.50GHz ~ 5.72GHz, 5.745 ~ 5.825GHz |
| Number of Channel | 2.4GHz: 802.11b, 802.11g, 802.11n (HT20), VHT20: 11 802.11n (HT40), VHT40: 7 5GHz: 802.11a, 802.11n (HT20), 802.11ac (VHT20): 25 802.11n (HT40), 802.11ac (VHT40): 12 802.11ac (VHT80): 6 |
| Output Power | 2.4GHz: 641.636 mW 5.18 ~ 5.24GHz: 247.256 mW 5.26 ~ 5.32GHz: 211.137 mW 5.5 ~ 5.72GHz: 205.4 mW 5.745 ~ 5.825GHz: 402.91 mW |
| Antenna Type | Refer to Note |
| Antenna Connector | Refer to Note |
| Accessory Device | Adapter x1 Remote controller x 1 (Brand: NA, Model: RC3441530/01BR) |
| Data Cable Supplied | HDMI cable x 1 (Shielded, 1.2m) |

Note:

- Exhibit prepared for FCC Spot Check Verification report, the format, test items and amount of spot-check test data are decided by applicant's engineering judgment, for more details please refer to declaration letter exhibit.
- Simultaneously transmission condition.

| Condition | Technology | |
|-----------|-------------|-----------|
| 1 | WLAN 2.4GHz | Bluetooth |
| 2 | WLAN 5GHz | Bluetooth |

Note: The emission of the simultaneous operation has been evaluated and no non-compliance was found.

3. The EUT needs to be supplied from power adapter, the information is as below table:

| Brand | Model No. | Spec. |
|--------|-------------------|--|
| Frecom | F12L33-120100SPAU | Input: 100-240Vac, 0.3A, 50/60Hz Output: 12V, 1A DC Output cable: Unshielded, 1.5m |

4. The antennas provided to the EUT, please refer to the following table:

| WLAN | | | | |
|------------------------|------------------------|--------------------------|--------------------------|----------------|
| Chain No. | Antenna Net Gain (dBi) | Frequency range (GHz) | Antenna type | Connector type |
| Chain 0 | 3.62 | 2.4~2.4835 | On board printed antenna | none |
| | 3.57 | 5.15~5.25 | | |
| | 3.63 | 5.25~5.35 | | |
| | 2.50 | 5.47~5.725 | | |
| | 2.88 | 5.725~5.85 | | |
| Chain 1 | 5.36 | 2.4~2.4835 | On board printed antenna | none |
| | 3.26 | 5.15~5.25 | | |
| | 3.26 | 5.25~5.35 | | |
| | 3.75 | 5.47~5.725 | | |
| | 4.22 | 5.725~5.85 | | |
| Bluetooth | | | | |
| Antenna Net Gain (dBi) | Frequency range (GHz) | Antenna type | Connector type | |
| 2.39 | 2.4~2.4835 | On board printed antenna | none | |

5. The EUT incorporates a MIMO function.

| 2.4GHz Band | | |
|------------------|-----------------------|-----|
| MODULATION MODE | TX & RX CONFIGURATION | |
| 802.11b | 2TX | 2RX |
| 802.11g | 2TX | 2RX |
| 802.11n (HT20) | 2TX | 2RX |
| 802.11n (HT40) | 2TX | 2RX |
| VHT20 | 2TX | 2RX |
| VHT40 | 2TX | 2RX |
| 5GHz Band | | |
| MODULATION MODE | TX & RX CONFIGURATION | |
| 802.11a | 2TX | 2RX |
| 802.11n (HT20) | 2TX | 2RX |
| 802.11n (HT40) | 2TX | 2RX |
| 802.11ac (VHT20) | 2TX | 2RX |
| 802.11ac (VHT40) | 2TX | 2RX |
| 802.11ac (VHT80) | 2TX | 2RX |

Note: The modulation and bandwidth are similar for 802.11n mode for 20MHz (40MHz) and 802.11ac mode for 20MHz (40MHz), therefore investigated worst case to representative mode in test report.

6. The above EUT information is declared by manufacturer and for more detailed features description, please refers to the manufacturer's specifications or user's manual.

3.2 Description of Test Modes

11 channels are provided for 802.11b, 802.11g, 802.11n (HT20), VHT20:

| Channel | Frequency | Channel | Frequency |
|---------|-----------|---------|-----------|
| 1 | 2412MHz | 7 | 2442MHz |
| 2 | 2417MHz | 8 | 2447MHz |
| 3 | 2422MHz | 9 | 2452MHz |
| 4 | 2427MHz | 10 | 2457MHz |
| 5 | 2432MHz | 11 | 2462MHz |
| 6 | 2437MHz | | |

7 channels are provided for 802.11n (HT40), VHT40:

| Channel | Frequency | Channel | Frequency |
|---------|-----------|---------|-----------|
| 3 | 2422MHz | 7 | 2442MHz |
| 4 | 2427MHz | 8 | 2447MHz |
| 5 | 2432MHz | 9 | 2452MHz |
| 6 | 2437MHz | | |

3.2.1 Test Mode Applicability and Tested Channel Detail

| EUT CONFIGURE MODE | APPLICABLE TO | | | | DESCRIPTION |
|--------------------|---------------|-------|-----|------|-------------|
| | RE≥1G | RE<1G | PLC | APCM | |
| - | √ | √ | √ | √ | - |

Where **RE≥1G**: Radiated Emission above 1GHz & Bandedge Measurement
RE<1G: Radiated Emission below 1GHz
PLC: Power Line Conducted Emission
APCM: Antenna Port Conducted Measurement

NOTE:

1. The EUT had been pre-tested on the positioned of each 2 axis. The worst case was found when positioned on X-plane.

Radiated Emission Test (Above 1GHz):

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

| MODE | AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION TECHNOLOGY | MODULATION TYPE | DATA RATE (Mbps) |
|---------|-------------------|----------------|-----------------------|-----------------|------------------|
| 802.11g | 1 to 11 | 1, 6, 11 | OFDM | BPSK | 6 |

Radiated Emission Test (Below 1GHz):

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

| MODE | AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION TECHNOLOGY | MODULATION TYPE | Data Rate Parameter |
|---------|-------------------|----------------|-----------------------|-----------------|---------------------|
| 802.11g | 1 to 11 | 6 | OFDM | BPSK | 6 |

Power Line Conducted Emission Test:

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

| MODE | AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION TECHNOLOGY | MODULATION TYPE | Data Rate Parameter |
|---------|-------------------|----------------|-----------------------|-----------------|---------------------|
| 802.11g | 1 to 11 | 6 | OFDM | BPSK | 6 |

Antenna Port Conducted Measurement:

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

| MODE | AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION TECHNOLOGY | MODULATION TYPE | DATA RATE (Mbps) |
|---------|-------------------|----------------|-----------------------|-----------------|------------------|
| 802.11g | 1 to 11 | 1, 6, 11 | OFDM | BPSK | 6 |

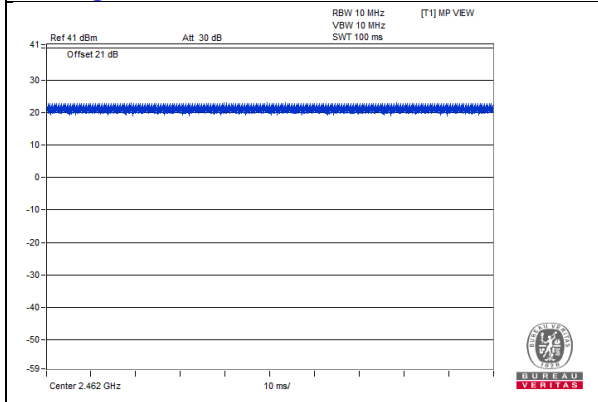
Test Condition:

| Applicable To | Environmental Conditions | Input Power | Tested By |
|---------------|--------------------------|--------------|--------------|
| RE \geq 1G | 22deg. C, 66%RH | 120Vac, 60Hz | Robert Cheng |
| RE<1G | 22deg. C, 66%RH | 120Vac, 60Hz | Robert Cheng |
| PLC | 24deg. C, 74%RH | 120Vac, 60Hz | Andy Ho |
| APCM | 25deg. C, 60%RH | 120Vac, 60Hz | Jyunchun Lin |

3.3 Duty Cycle of Test Signal

Duty cycle of test signal is 100 %, duty factor is not required.

802.11g



3.4 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.

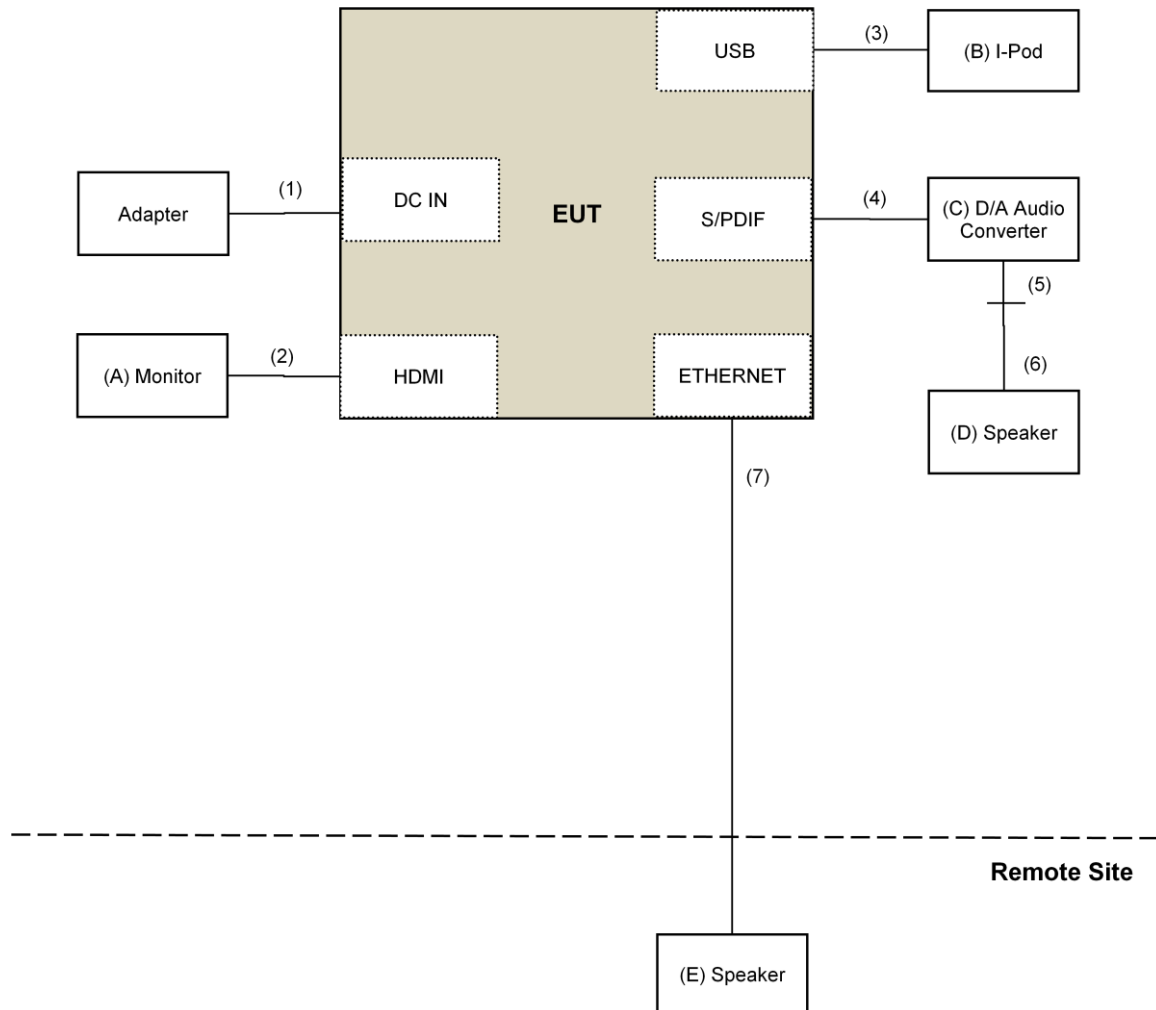
| ID | Product | Brand | Model No. | Serial No. | FCC ID | Remarks |
|----|---------------------|--------|-----------|--------------|---------|-----------------|
| A. | Monitor | ASUS | VN248 | NA | NA | Provided by Lab |
| B. | iPod | Apple | MC749TA/A | CC4DN25WDFDM | NA | Provided by Lab |
| C. | D/A Audio Converter | LINDY | NA | NA | NA | Provided by Lab |
| D. | Speaker | Lenovo | 41A5330 | NA | NA | Provided by Lab |
| E. | Laptop | DELL | E6420 | B92T3R1 | FCC DoC | Provided by Lab |

Note:

1. All power cords of the above support units are non-shielded (1.8m).

| ID | Descriptions | Qty. | Length (m) | Shielding (Yes/No) | Cores (Qty.) | Remarks |
|----|--------------|------|------------|--------------------|--------------|--------------------|
| 1. | DC Cable | 1 | 1.5 | No | 0 | Supplied by client |
| 2. | HDMI Cable | 1 | 1.2 | Yes | 0 | Supplied by client |
| 3. | USB Cable | 1 | 0.1 | Yes | 0 | Provided by Lab |
| 4. | Fiber Cable | 1 | 1.5 | No | 0 | Provided by Lab |
| 5. | Audio Cable | 1 | 0.2 | No | 0 | Provided by Lab |
| 6. | Audio Cable | 1 | 1.5 | No | 0 | Provided by Lab |
| 7. | RJ-45 Cable | 1 | 10 | No | 0 | Provided by Lab |

3.4.1 Configuration of System under Test



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 Part 15, Subpart C (15.247)

KDB 558074 D01 15.247 Meas Guidance v05r02

KDB 662911 D01 Multiple Transmitter Output v02r01

ANSI C63.10-2013

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

4 Test Types and Results

4.1 Radiated Emission and Bandedge Measurement

4.1.1 Limits of Radiated Emission and Bandedge Measurement

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 20dB below the highest level of the desired power:

| Frequencies (MHz) | Field Strength (microvolts/meter) | Measurement Distance (meters) |
|-------------------|-----------------------------------|-------------------------------|
| 0.009 ~ 0.490 | 2400/F(kHz) | 300 |
| 0.490 ~ 1.705 | 24000/F(kHz) | 30 |
| 1.705 ~ 30.0 | 30 | 30 |
| 30 ~ 88 | 100 | 3 |
| 88 ~ 216 | 150 | 3 |
| 216 ~ 960 | 200 | 3 |
| Above 960 | 500 | 3 |

NOTE:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. For frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.

4.1.2 Test Instruments

| DESCRIPTION & MANUFACTURER | MODEL NO. | SERIAL NO. | CALIBRATED DATE | CALIBRATED UNTIL |
|---|----------------------|---------------|-----------------|------------------|
| Test Receiver Agilent | N9038A | MY50010156 | July 12, 2018 | July 11, 2019 |
| Pre-Amplifier EMCI | EMC001340 | 980142 | Jan. 25, 2019 | Jan. 24, 2020 |
| Loop Antenna Electro-Metrics | EM-6879 | 269 | Sep. 07, 2018 | Sep. 06, 2019 |
| RF Cable | NA | LOOPCAB-001 | Jan. 14, 2019 | Jan. 13, 2020 |
| RF Cable | NA | LOOPCAB-002 | Jan. 14, 2019 | Jan. 13, 2020 |
| Pre-Amplifier Mini-Circuits | ZFL-1000VH2B | AMP-ZFL-05 | Apr. 30, 2019 | Apr. 29, 2020 |
| Trilog Broadband Antenna SCHWARZBECK | VULB 9168 | 9168-361 | Nov. 22, 2018 | Nov. 21, 2019 |
| RF Cable | 8D | 966-3-1 | Mar. 18, 2019 | Mar. 17, 2020 |
| RF Cable | 8D | 966-3-2 | Mar. 18, 2019 | Mar. 17, 2020 |
| RF Cable | 8D | 966-3-3 | Mar. 18, 2019 | Mar. 17, 2020 |
| Fixed attenuator Mini-Circuits | UNAT-5+ | PAD-3m-3-01 | Sep. 27, 2018 | Sep. 26, 2019 |
| Horn_Antenna SCHWARZBECK | BBHA9120-D | 9120D-406 | Nov. 25, 2018 | Nov. 24, 2019 |
| Pre-Amplifier EMCI | EMC12630SE | 980384 | Jan. 28, 2019 | Jan. 27, 2020 |
| RF Cable | EMC104-SM-SM-1200 | 160922 | Jan. 28, 2019 | Jan. 27, 2020 |
| RF Cable | EMC104-SM-SM-2000 | 180601 | June 10, 2019 | June 09, 2020 |
| RF Cable | EMC104-SM-SM-6000 | 180602 | June 10, 2019 | June 09, 2020 |
| Spectrum Analyzer Keysight | N9030A | MY54490679 | July 23, 2018 | July 22, 2019 |
| Pre-Amplifier EMCI | EMC184045SE | 980387 | Jan. 28, 2019 | Jan. 27, 2020 |
| Horn_Antenna SCHWARZBECK | BBHA 9170 | BBHA9170519 | Nov. 25, 2018 | Nov. 24, 2019 |
| RF Cable | EMC102-KM-KM-1200 | 160924 | Jan. 28, 2019 | Jan. 27, 2020 |
| RF Cable | EMC102-KM-KM-1200 | 160925 | Jan. 28, 2019 | Jan. 27, 2020 |
| Software | ADT_Radiated_V8.7.08 | NA | NA | NA |
| Antenna Tower & Turn Table Max-Full | MF-7802 | MF780208406 | NA | NA |
| Boresight Antenna Fixture | FBA-01 | FBA-SIP01 | NA | NA |
| Spectrum Analyzer R&S | FSV40 | 100964 | June 04, 2019 | June 03, 2020 |
| Power meter Anritsu | ML2495A | 1014008 | May 13, 2019 | May 12, 2020 |
| Power sensor Anritsu | MA2411B | 0917122 | May 13, 2019 | May 12, 2020 |
| Fixed Attenuator Mini-Circuits | MDCS18N-10 | MDCS18N-10-01 | Apr. 15, 2019 | Apr. 14, 2020 |

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 966 Chamber No. 3.
3. Loop antenna was used for all emissions below 30 MHz.
4. Tested Date: June 28 to July 05, 2019

4.1.3 Test Procedures

For Radiated emission below 30MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. Parallel, perpendicular, and ground-parallel orientations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

NOTE:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9kHz at frequency below 30MHz.

For Radiated emission above 30MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
- f. The test-receiver system was set to peak and average detects function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

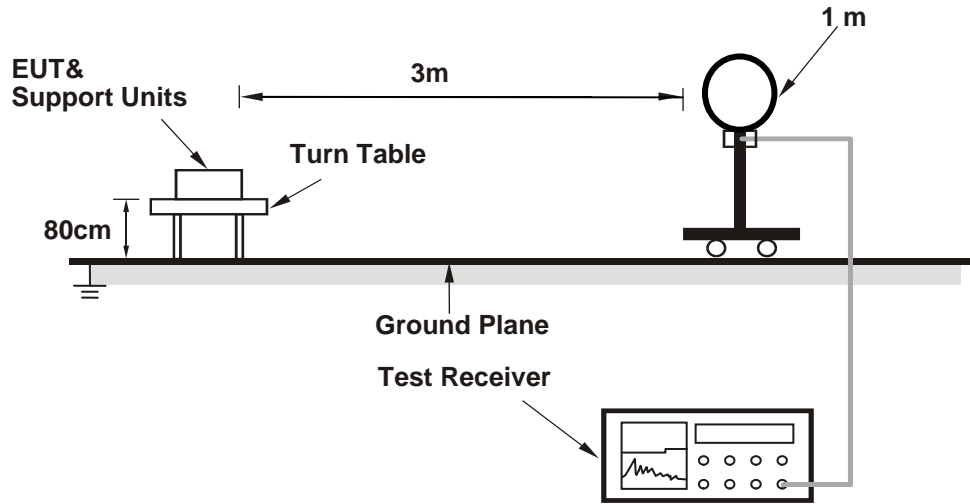
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is $\geq 1/T$ (Duty cycle < 98%) or 10Hz (Duty cycle $\geq 98\%$) for Average detection (AV) at frequency above 1GHz.
4. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 Deviation from Test Standard

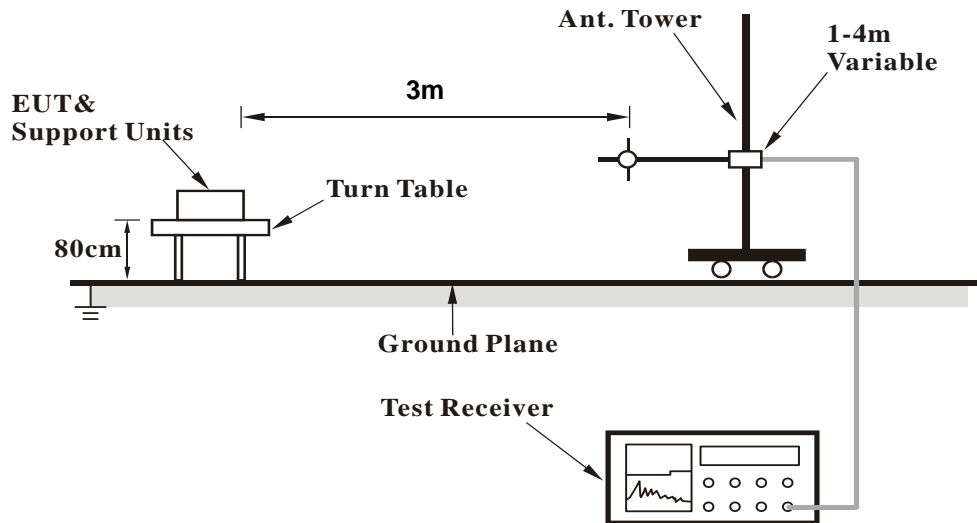
No deviation.

4.1.5 Test Setup

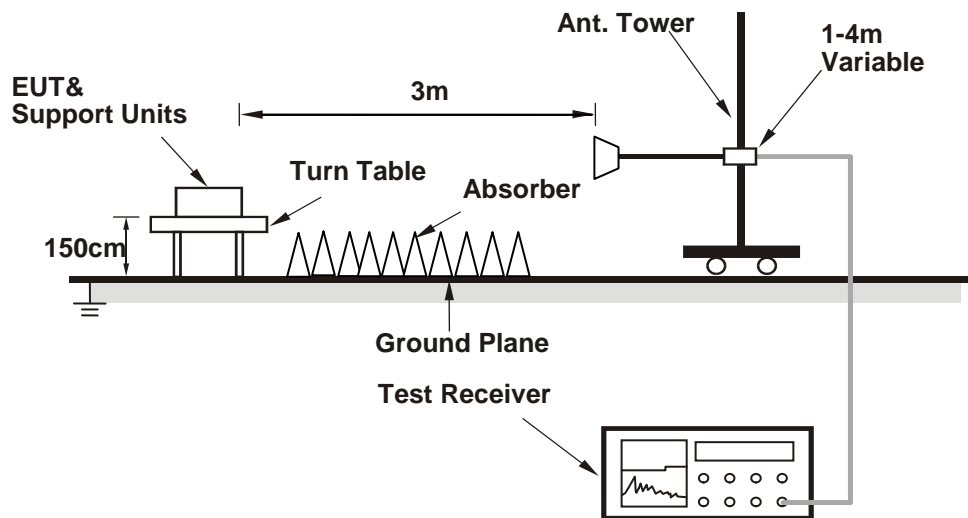
For Radiated emission below 30MHz



For Radiated emission 30MHz to 1GHz



For Radiated emission above 1GHz



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

4.1.6 EUT Operating Conditions

- a. Placed the EUT on the testing table.
- b. Controlling software (HyperTerminal paste command) has been activated to set the EUT under transmission condition continuously at specific channel frequency.

4.1.7 Test Results

Above 1GHz Data:

802.11g

| | | | |
|------------------------|--------------|------------------------------|--------------|
| CHANNEL | TX Channel 1 | DETECTOR FUNCTION | Peak (PK) |
| FREQUENCY RANGE | 1GHz ~ 25GHz | | Average (AV) |

| ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M | | | | | | | | |
|---|-------------|-------------------------|----------------|-------------|--------------------|----------------------|------------------|--------------------------|
| NO. | FREQ. (MHz) | EMISSION LEVEL (dBuV/m) | LIMIT (dBuV/m) | MARGIN (dB) | ANTENNA HEIGHT (m) | TABLE ANGLE (Degree) | RAW VALUE (dBuV) | CORRECTION FACTOR (dB/m) |
| 1 | 2390.00 | 73.3 PK | 74.0 | -0.7 | 2.10 H | 187 | 75.3 | -2.0 |
| 2 | 2390.00 | 53.1 AV | 54.0 | -0.9 | 2.10 H | 187 | 55.1 | -2.0 |
| 3 | *2412.00 | 112.3 PK | | | 2.10 H | 187 | 114.3 | -2.0 |
| 4 | *2412.00 | 103.3 AV | | | 2.10 H | 187 | 105.3 | -2.0 |
| 5 | 4824.00 | 36.8 PK | 74.0 | -37.2 | 1.30 H | 310 | 34.5 | 2.3 |
| 6 | 4824.00 | 23.7 AV | 54.0 | -30.3 | 1.30 H | 310 | 21.4 | 2.3 |

| ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M | | | | | | | | |
|---|-------------|-------------------------|----------------|-------------|--------------------|----------------------|------------------|--------------------------|
| NO. | FREQ. (MHz) | EMISSION LEVEL (dBuV/m) | LIMIT (dBuV/m) | MARGIN (dB) | ANTENNA HEIGHT (m) | TABLE ANGLE (Degree) | RAW VALUE (dBuV) | CORRECTION FACTOR (dB/m) |
| 1 | 2390.00 | 68.7 PK | 74.0 | -5.3 | 2.89 V | 196 | 70.7 | -2.0 |
| 2 | 2390.00 | 48.2 AV | 54.0 | -5.8 | 2.89 V | 196 | 50.2 | -2.0 |
| 3 | *2412.00 | 106.6 PK | | | 2.89 V | 196 | 108.6 | -2.0 |
| 4 | *2412.00 | 97.4 AV | | | 2.89 V | 196 | 99.4 | -2.0 |
| 5 | 4824.00 | 36.6 PK | 74.0 | -37.4 | 2.16 V | 159 | 34.3 | 2.3 |
| 6 | 4824.00 | 24.1 AV | 54.0 | -29.9 | 2.16 V | 159 | 21.8 | 2.3 |

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency.

| | | | |
|------------------------|--------------|------------------------------|--------------|
| CHANNEL | TX Channel 6 | DETECTOR FUNCTION | Peak (PK) |
| FREQUENCY RANGE | 1GHz ~ 25GHz | | Average (AV) |

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M

| NO. | FREQ. (MHz) | EMISSION LEVEL (dBuV/m) | LIMIT (dBuV/m) | MARGIN (dB) | ANTENNA HEIGHT (m) | TABLE ANGLE (Degree) | RAW VALUE (dBuV) | CORRECTION FACTOR (dB/m) |
|-----|----------------|-------------------------------|-------------------|----------------|--------------------------|----------------------------|------------------------|--------------------------------|
| 1 | *2437.00 | 118.5 PK | | | 1.37 H | 184 | 120.6 | -2.1 |
| 2 | *2437.00 | 108.5 AV | | | 1.37 H | 184 | 110.6 | -2.1 |
| 3 | 4874.00 | 37.9 PK | 74.0 | -36.1 | 1.61 H | 215 | 35.6 | 2.3 |
| 4 | 4874.00 | 24.5 AV | 54.0 | -29.5 | 1.61 H | 215 | 22.2 | 2.3 |
| 5 | 7311.00 | 41.8 PK | 74.0 | -32.2 | 1.54 H | 312 | 33.5 | 8.3 |
| 6 | 7311.00 | 29.1 AV | 54.0 | -24.9 | 1.54 H | 312 | 20.8 | 8.3 |

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M

| NO. | FREQ. (MHz) | EMISSION LEVEL (dBuV/m) | LIMIT (dBuV/m) | MARGIN (dB) | ANTENNA HEIGHT (m) | TABLE ANGLE (Degree) | RAW VALUE (dBuV) | CORRECTION FACTOR (dB/m) |
|-----|----------------|-------------------------------|-------------------|----------------|--------------------------|----------------------------|------------------------|--------------------------------|
| 1 | *2437.00 | 113.6 PK | | | 2.80 V | 187 | 115.7 | -2.1 |
| 2 | *2437.00 | 103.9 AV | | | 2.80 V | 187 | 106.0 | -2.1 |
| 3 | 4874.00 | 38.3 PK | 74.0 | -35.7 | 2.06 V | 167 | 36.0 | 2.3 |
| 4 | 4874.00 | 24.8 AV | 54.0 | -29.2 | 2.06 V | 167 | 22.5 | 2.3 |
| 5 | 7311.00 | 41.5 PK | 74.0 | -32.5 | 3.01 V | 191 | 33.2 | 8.3 |
| 6 | 7311.00 | 28.5 AV | 54.0 | -25.5 | 3.01 V | 191 | 20.2 | 8.3 |

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency.

| | | | |
|------------------------|---------------|------------------------------|--------------|
| CHANNEL | TX Channel 11 | DETECTOR FUNCTION | Peak (PK) |
| FREQUENCY RANGE | 1GHz ~ 25GHz | | Average (AV) |

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M

| NO. | FREQ. (MHz) | EMISSION LEVEL (dBuV/m) | LIMIT (dBuV/m) | MARGIN (dB) | ANTENNA HEIGHT (m) | TABLE ANGLE (Degree) | RAW VALUE (dBuV) | CORRECTION FACTOR (dB/m) |
|-----|----------------|-------------------------------|-------------------|----------------|--------------------------|----------------------------|------------------------|--------------------------------|
| 1 | *2462.00 | 113.2 PK | | | 1.00 H | 196 | 115.4 | -2.2 |
| 2 | *2462.00 | 103.0 AV | | | 1.00 H | 196 | 105.2 | -2.2 |
| 3 | 2483.50 | 72.6 PK | 74.0 | -1.4 | 1.00 H | 196 | 74.8 | -2.2 |
| 4 | 2483.50 | 53.7 AV | 54.0 | -0.3 | 1.00 H | 196 | 55.9 | -2.2 |
| 5 | 4924.00 | 36.7 PK | 74.0 | -37.3 | 1.36 H | 144 | 34.2 | 2.5 |
| 6 | 4924.00 | 23.7 AV | 54.0 | -30.3 | 1.36 H | 144 | 21.2 | 2.5 |
| 7 | 7386.00 | 41.7 PK | 74.0 | -32.3 | 1.39 H | 308 | 33.4 | 8.3 |
| 8 | 7386.00 | 28.7 AV | 54.0 | -25.3 | 1.39 H | 308 | 20.4 | 8.3 |

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M

| NO. | FREQ. (MHz) | EMISSION LEVEL (dBuV/m) | LIMIT (dBuV/m) | MARGIN (dB) | ANTENNA HEIGHT (m) | TABLE ANGLE (Degree) | RAW VALUE (dBuV) | CORRECTION FACTOR (dB/m) |
|-----|----------------|-------------------------------|-------------------|----------------|--------------------------|----------------------------|------------------------|--------------------------------|
| 1 | *2462.00 | 108.0 PK | | | 2.82 V | 187 | 110.2 | -2.2 |
| 2 | *2462.00 | 97.8 AV | | | 2.82 V | 187 | 100.0 | -2.2 |
| 3 | 2483.50 | 68.5 PK | 74.0 | -5.5 | 2.82 V | 187 | 70.7 | -2.2 |
| 4 | 2483.50 | 48.9 AV | 54.0 | -5.1 | 2.82 V | 187 | 51.1 | -2.2 |
| 5 | 4924.00 | 37.2 PK | 74.0 | -36.8 | 2.11 V | 150 | 34.7 | 2.5 |
| 6 | 4924.00 | 24.2 AV | 54.0 | -29.8 | 2.11 V | 150 | 21.7 | 2.5 |
| 7 | 7386.00 | 41.1 PK | 74.0 | -32.9 | 2.98 V | 196 | 32.8 | 8.3 |
| 8 | 7386.00 | 28.2 AV | 54.0 | -25.8 | 2.98 V | 196 | 19.9 | 8.3 |

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency.

Below 1GHz Data:

802.11g

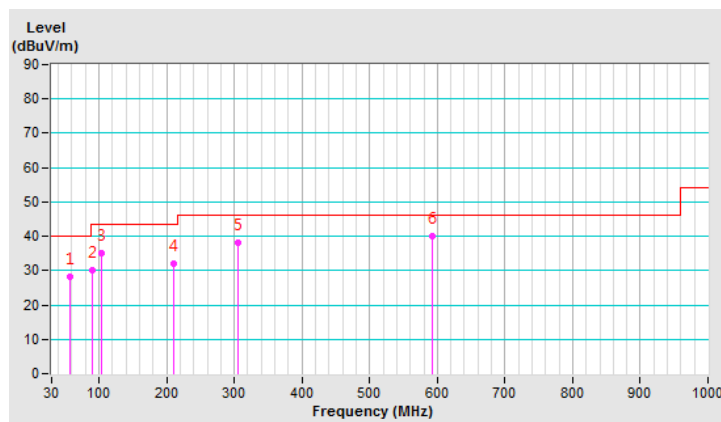
| | | | |
|------------------------|--------------|--------------------------|-----------------|
| CHANNEL | TX Channel 6 | DETECTOR FUNCTION | Quasi-Peak (QP) |
| FREQUENCY RANGE | 9kHz ~ 1GHz | | |

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M

| NO. | FREQ. (MHz) | EMISSION LEVEL (dBuV/m) | LIMIT (dBuV/m) | MARGIN (dB) | ANTENNA HEIGHT (m) | TABLE ANGLE (Degree) | RAW VALUE (dBuV) | CORRECTION FACTOR (dB/m) |
|-----|-------------|-------------------------|----------------|-------------|--------------------|----------------------|------------------|--------------------------|
| 1 | 56.80 | 28.2 QP | 40.0 | -11.8 | 1.47 H | 88 | 41.9 | -13.7 |
| 2 | 90.38 | 30.1 QP | 43.5 | -13.4 | 1.36 H | 67 | 48.4 | -18.3 |
| 3 | 104.67 | 35.2 QP | 43.5 | -8.3 | 1.89 H | 25 | 51.6 | -16.4 |
| 4 | 210.08 | 32.1 QP | 43.5 | -11.4 | 1.50 H | 58 | 47.1 | -15.0 |
| 5 | 304.83 | 38.1 QP | 46.0 | -7.9 | 1.00 H | 360 | 49.6 | -11.5 |
| 6 | 592.99 | 39.9 QP | 46.0 | -6.1 | 1.50 H | 308 | 44.5 | -4.6 |

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit of frequency range 30MHz~1000MHz.
5. The emission levels were very low against the limit of frequency range 9kHz~30MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.



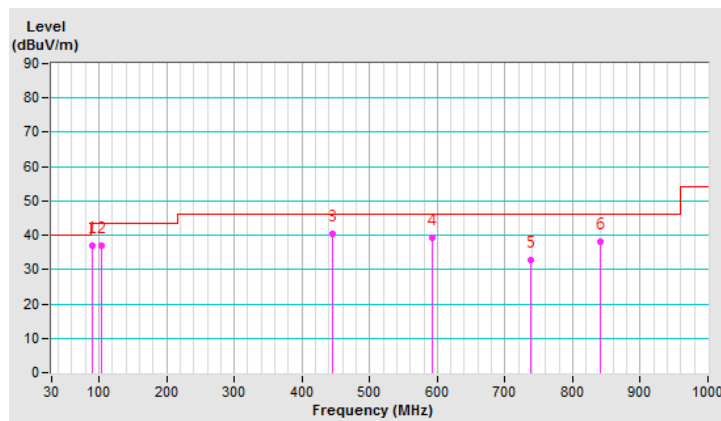
| | | | |
|------------------------|--------------|--------------------------|-----------------|
| CHANNEL | TX Channel 6 | DETECTOR FUNCTION | Quasi-Peak (QP) |
| FREQUENCY RANGE | 9kHz ~ 1GHz | | |

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M

| NO. | FREQ. (MHz) | EMISSION LEVEL (dBuV/m) | LIMIT (dBuV/m) | MARGIN (dB) | ANTENNA HEIGHT (m) | TABLE ANGLE (Degree) | RAW VALUE (dBuV) | CORRECTION FACTOR (dB/m) |
|-----|-------------|-------------------------|----------------|-------------|--------------------|----------------------|------------------|--------------------------|
| 1 | 90.11 | 37.1 QP | 43.5 | -6.4 | 1.42 V | 65 | 55.4 | -18.3 |
| 2 | 104.35 | 36.9 QP | 43.5 | -6.6 | 1.35 V | 311 | 53.3 | -16.4 |
| 3 | 444.75 | 40.4 QP | 46.0 | -5.6 | 1.41 V | 100 | 48.4 | -8.0 |
| 4 | 593.21 | 39.4 QP | 46.0 | -6.6 | 1.41 V | 189 | 44.0 | -4.6 |
| 5 | 738.20 | 32.6 QP | 46.0 | -13.4 | 1.52 V | 302 | 34.5 | -1.9 |
| 6 | 840.20 | 38.2 QP | 46.0 | -7.8 | 1.65 V | 302 | 38.2 | 0.0 |

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit of frequency range 30MHz~1000MHz.
5. The emission levels were very low against the limit of frequency range 9kHz~30MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.



4.2 Conducted Emission Measurement

4.2.1 Limits of Conducted Emission Measurement

| Frequency (MHz) | Conducted Limit (dBuV) | |
|-----------------|------------------------|---------|
| | Quasi-peak | Average |
| 0.15 - 0.5 | 66 - 56 | 56 - 46 |
| 0.50 - 5.0 | 56 | 46 |
| 5.0 - 30.0 | 60 | 50 |

Note: 1. The lower limit shall apply at the transition frequencies.

2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

4.2.2 Test Instruments

| DESCRIPTION & MANUFACTURER | MODEL NO. | SERIAL NO. | CALIBRATED DATE | CALIBRATED UNTIL |
|---|---------------------|------------|-----------------|------------------|
| Test Receiver R&S | ESCS 30 | 847124/029 | Oct. 24, 2018 | Oct. 23, 2019 |
| Line-Impedance Stabilization Network (for EUT) R&S | ESH3-Z5 | 848773/004 | Oct. 22, 2018 | Oct. 21, 2019 |
| Line-Impedance Stabilization Network (for Peripheral) R&S | ESH3-Z5 | 835239/001 | Mar. 17, 2019 | Mar. 16, 2020 |
| 50 ohms Terminator | N/A | 3 | Oct. 22, 2018 | Oct. 21, 2019 |
| RF Cable | 5D-FB | COCCAB-001 | Sep. 28, 2018 | Sep. 27, 2019 |
| Fixed attenuator EMCI | STI02-2200-10 | 003 | Mar. 14, 2019 | Mar. 13, 2020 |
| Software BVADT | BVADT_Cond_V7.3.7.4 | NA | NA | NA |

Note:

1. The calibration interval of the above test instruments are 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in Conduction 1.
- 3 Tested Date: July 04, 2019

4.2.3 Test Procedures

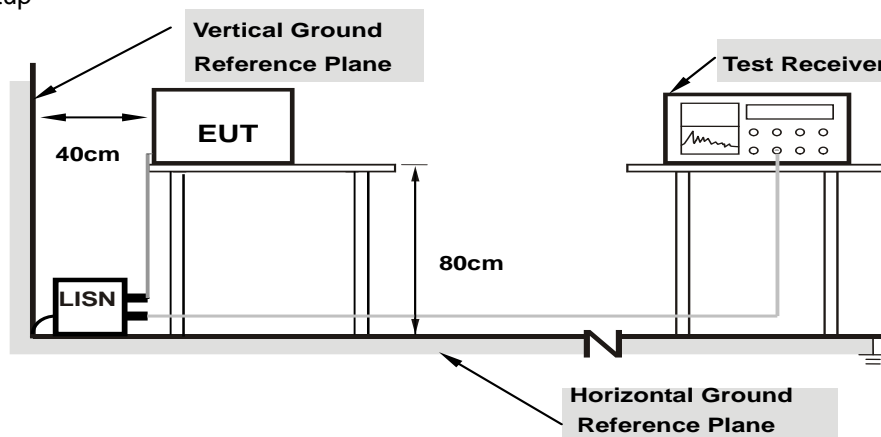
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.
- Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

NOTE: The resolution bandwidth and video bandwidth of test receiver is 9kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15MHz-30MHz.

4.2.4 Deviation from Test Standard

No deviation.

4.2.5 Test Setup



Note: 1.Support units were connected to second LISN.

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

4.2.6 EUT Operating Conditions

Same as 4.1.6.

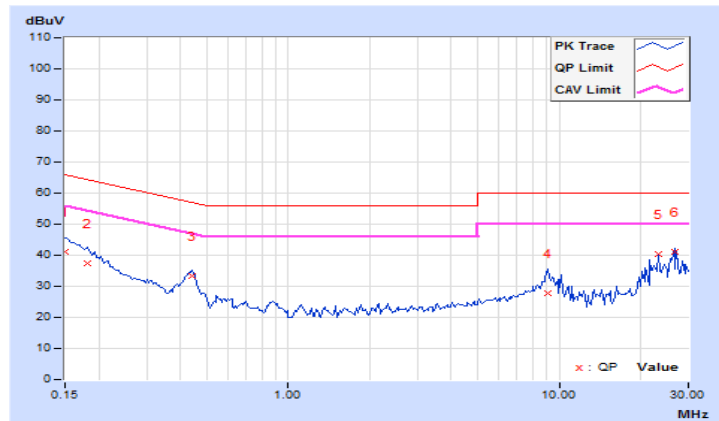
4.2.7 Test Results

| | | | |
|-------|----------|-------------------|--------------------------------|
| Phase | Line (L) | Detector Function | Quasi-Peak (QP) / Average (AV) |
|-------|----------|-------------------|--------------------------------|

| Phase Of Power : Line (L) | | | | | | | | | | |
|---------------------------|-----------------|------------------------|----------------------|--------------|-----------------------|--------------|--------------|--------------|---------------|---------------|
| No | Frequency (MHz) | Correction Factor (dB) | Reading Value (dBuV) | | Emission Level (dBuV) | | Limit (dBuV) | | Margin (dB) | |
| | | | Q.P. | AV. | Q.P. | AV. | Q.P. | AV. | Q.P. | AV. |
| 1 | 0.15000 | 10.03 | 31.21 | 17.22 | 41.24 | 27.25 | 66.00 | 56.00 | -24.76 | -28.75 |
| 2 | 0.18125 | 10.04 | 27.43 | 14.03 | 37.47 | 24.07 | 64.43 | 54.43 | -26.96 | -30.36 |
| 3 | 0.43906 | 10.08 | 23.20 | 18.75 | 33.28 | 28.83 | 57.08 | 47.08 | -23.80 | -18.25 |
| 4 | 9.05859 | 10.64 | 17.06 | 9.55 | 27.70 | 20.19 | 60.00 | 50.00 | -32.30 | -29.81 |
| 5 | 23.12891 | 11.43 | 28.85 | 24.84 | 40.28 | 36.27 | 60.00 | 50.00 | -19.72 | -13.73 |
| 6 | 26.60938 | 11.52 | 29.55 | 25.56 | 41.07 | 37.08 | 60.00 | 50.00 | -18.93 | -12.92 |

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value

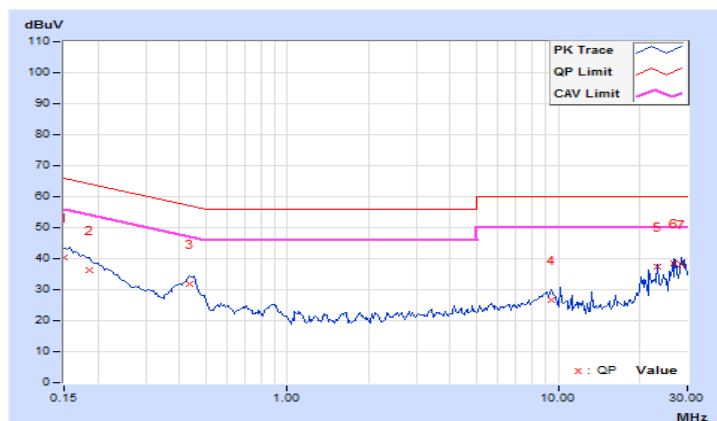


| | | | |
|-------|-------------|-------------------|--------------------------------|
| Phase | Neutral (N) | Detector Function | Quasi-Peak (QP) / Average (AV) |
|-------|-------------|-------------------|--------------------------------|

| Phase Of Power : Neutral (N) | | | | | | | | | | |
|------------------------------|-----------------|------------------------|----------------------|-------|-----------------------|-------|--------------|-------|-------------|--------|
| No | Frequency (MHz) | Correction Factor (dB) | Reading Value (dBuV) | | Emission Level (dBuV) | | Limit (dBuV) | | Margin (dB) | |
| | | | Q.P. | AV. | Q.P. | AV. | Q.P. | AV. | Q.P. | AV. |
| 1 | 0.15000 | 9.94 | 30.32 | 16.67 | 40.26 | 26.61 | 66.00 | 56.00 | -25.74 | -29.39 |
| 2 | 0.18516 | 9.95 | 26.21 | 12.51 | 36.16 | 22.46 | 64.25 | 54.25 | -28.09 | -31.79 |
| 3 | 0.43516 | 9.98 | 21.79 | 17.98 | 31.77 | 27.96 | 57.15 | 47.15 | -25.38 | -19.19 |
| 4 | 9.39063 | 10.49 | 16.19 | 8.74 | 26.68 | 19.23 | 60.00 | 50.00 | -33.32 | -30.77 |
| 5 | 23.12891 | 11.19 | 26.24 | 22.23 | 37.43 | 33.42 | 60.00 | 50.00 | -22.57 | -16.58 |
| 6 | 26.60938 | 11.25 | 27.36 | 22.70 | 38.61 | 33.95 | 60.00 | 50.00 | -21.39 | -16.05 |

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value



4.3 Conducted Output Power Measurement

4.3.1 Limits of Conducted Output Power Measurement

For systems using digital modulation in the 2400–2483.5 MHz bands: 1 Watt (30dBm)

Per KDB 662911 D01 Multiple Transmitter Output Method of conducted output power measurement on IEEE 802.11 devices,

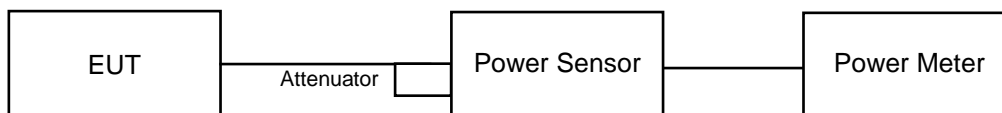
Array Gain = 0 dB (i.e., no array gain) for $N_{ANT} \leq 4$;

Array Gain = 0 dB (i.e., no array gain) for channel widths ≥ 40 MHz for any N_{ANT} ;

Array Gain = $5 \log(N_{ANT}/N_{SS})$ dB or 3 dB, whichever is less for 20-MHz channel widths with $N_{ANT} \geq 5$.

For power measurements on all other devices: Array Gain = $10 \log(N_{ANT}/N_{SS})$ dB.

4.3.2 Test Setup



4.3.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.3.4 Test Procedures

A peak power sensor was used on the output port of the EUT. A power meter was used to read the response of the peak power sensor. Record the power level.

Average power sensor was used to perform output power measurement, trigger and gating function of wide band power meter is enabled to measure max output power of TX on burst. Duty factor is not added to measured value.

.

4.3.5 Deviation from Test Standard

No deviation.

4.3.6 EUT Operating Conditions

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

4.3.7 Test Results

FOR PEAK POWER

802.11g

| Chan. | Freq. (MHz) | Peak Power (dBm) | | Total Power (mW) | Total Power (dBm) | Limit (dBm) | Pass / Fail |
|-------|-------------|------------------|---------|------------------|-------------------|-------------|-------------|
| | | Chain 0 | Chain 1 | | | | |
| 1 | 2412 | 25.21 | 24.31 | 601.668 | 27.79 | 30.00 | Pass |
| 6 | 2437 | 25.21 | 24.91 | 641.636 | 28.07 | 30.00 | Pass |
| 11 | 2462 | 25.24 | 24.62 | 623.929 | 27.95 | 30.00 | Pass |

FOR AVERAGE POWER

802.11g

| Chan. | Frequency (MHz) | Avg. Power (dBm) | | Total Power (mW) | Total Power (dBm) |
|-------|-----------------|------------------|---------|------------------|-------------------|
| | | Chain 0 | Chain 1 | | |
| 1 | 2412 | 18.22 | 17.35 | 120.699 | 20.82 |
| 6 | 2437 | 19.96 | 19.58 | 189.865 | 22.78 |
| 11 | 2462 | 18.26 | 17.51 | 123.352 | 20.91 |

5 Pictures of Test Arrangements

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

Appendix – Information of 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 FCC recognized accredited test firms and accredited according to ISO/IEC 17025.

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

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Web Site: www.bureauveritas-adt.com

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

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