

FCC Test Report (WLAN) (Spot Check)

Report No.: RF180830E03I

FCC ID: 2APLE18300403

Original FCC ID: 2APLE18300398

Test Model: VMB5000

Received Date: June 08, 2020

Test Date: July 18 to Aug. 10, 2020

Issued Date: Aug. 14, 2020

Applicant: Arlo Technologies, Inc.

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

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Test Location: E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300,
Taiwan

**FCC Registration /
Designation Number:** 723255 / TW2022



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Release Control Record

| Issue No. | Description | Date Issued |
|--------------|-------------------|---------------|
| RF180830E03I | Original release. | Aug. 14, 2020 |

1 Certificate of Conformity

Product: Arlo Gen5 Entry Hub

Brand: Arlo

Test Model: VMB5000

Sample Status: ENGINEERING SAMPLE

Applicant: Arlo Technologies, Inc.

Test Date: July 18 to Aug. 10, 2020

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 : Phoenix Huang, **Date:** Aug. 14, 2020
Phoenix Huang / Specialist

Approved by : Clark Lin, **Date:** Aug. 14, 2020
Clark Lin / Technical 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 -12.12 dB at 0.47041 MHz. |
| 15.205 / 15.209 / 15.247(d) | Radiated Emissions and Band Edge Measurement | PASS | Meet the requirement of limit. Minimum passing margin is -0.5 dB at 2483.50 MHz. |
| 15.247(b) | Conducted power | PASS | Meet the requirement of limit. |

Note:

- For 2.4 GHz band compliance with rule 15.247(d) of the band-edge items, the test plots were recorded in Annex A.
- 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 | 1.9 dB |
| Radiated Emissions up to 1 GHz | 9kHz ~ 30MHz | 3.1 dB |
| | 30MHz ~ 1GHz | 5.5 dB |
| Radiated Emissions above 1 GHz | 1GHz ~ 18GHz | 5.1 dB |
| | 18GHz ~ 40GHz | 5.3 dB |

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT (WLAN)

| | |
|-----------------------|---|
| Product | Arlo Gen5 Entry Hub |
| Brand | Arlo |
| Test Model | VMB5000 |
| 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 only |
| Modulation Technology | DSSS, OFDM |
| Transfer Rate | 802.11b: up to 11 Mbps 802.11a/g: up to 54 Mbps 802.11n: up to 300 Mbps 802.11ac: up to 866.7 Mbps |
| Operating Frequency | 2.4GHz: 2.412 ~ 2.462 GHz 5GHz: 5.18 ~ 5.24 GHz, 5.26 ~ 5.32 GHz, 5.50 ~ 5.70 GHz, 5.745 ~ 5.825 GHz |
| Number of Channel | 2.4GHz: 802.11b, 802.11g, 802.11n (HT20): 11 802.11n (HT40): 7 5GHz: 802.11a, 802.11n (HT20), 802.11ac (VHT20): 24 802.11n (HT40), 802.11ac (VHT40): 11 802.11ac (VHT80): 2 |
| Output Power | 2.412 ~ 2.462 GHz: 907.922 mW 5.18 ~ 5.24 GHz: 531.612 mW 5.26 ~ 5.32 GHz: 229.908 mW 5.5 ~ 5.7 GHz: 231.024 mW 5.745 ~ 5.825 GHz: 465.254 mW |
| Antenna Type | Refer to Note |
| Antenna Connector | Refer to Note |
| Accessory Device | Adapter x 1 |
| Data Cable Supplied | NA |

Note:

- Exhibit prepared for 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 the declaration letter exhibit. (Original FCC ID: 2APLE18300398, Report No.: RF180830E03E)
- There are WLAN and Sub-GHz technology used for the EUT. The EUT has below radios as following table:

| Radio 1 | Radio 2 |
|-------------------------|---------|
| WLAN (2.4GHz+5GHz band) | Sub-GHz |

3. Simultaneously transmission condition.

| Condition | Technology | | |
|-----------|-------------|-----------|---------|
| 1 | WLAN 2.4GHz | WLAN 5GHz | Sub-GHz |

4. The EUT must be supplied with a power adapter and following different models could be chosen as following table:

| No. | Brand | Model No. | Spec. |
|-----|-------|------------|--|
| 1 | Arlo | AD2076F10 | Input: 100-120Vac, 0.56A, 50/60Hz Output: 12Vdc, 1.5A DC output cable (Unshielded, 1.8m) |
| 2 | Arlo | AD2067M20 | Input: 100-240Vac, 1.0A, 50/60Hz Output: 12Vdc, 2.5A DC output cable (Unshielded, 1.8m) |
| 3 | Arlo | 2ABB018F 1 | Input: 100-120Vac, 0.6A, 50/60Hz Output: 12Vdc, 1.5A DC output cable (Unshielded, 1.8m) |
| 4 | Arlo | P030WM1251 | Input: 100-240Vac, 1.0A, 50/60Hz Output: 12Vdc, 2.5A DC output cable (Unshielded, 1.8m) |

Note: In original report, from the above models, the worst radiated emission and AC power conducted emission test was found in **Adapter 2**. Therefore only the test data of the modes were recorded in this report.

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

| Sub-GHz | | | | | | | |
|---------|-------|---------------|------------------------|----------------------|--------------|----------------|-------------------|
| Ant No. | Brand | Model | Antenna Gain (dBi) | Frequency rang (MHz) | Antenna type | Connector type | |
| 1 | NA | 902P00214N0 | 1.5 | 860~930 | PIFA | NA | |
| WLAN | | | | | | | |
| Ant No. | Brand | Model | Antenna Net Gain (dBi) | Frequency rang (GHz) | Antenna type | Connector type | Cable Length (mm) |
| 1 | NA | 9 07X01052X0 | 2.5 | 2.4~2.4835 | Dipole | i-pex | 75 |
| | | | 1.8 | 5.15~5.25 | | | |
| | | | 2 | 5.25~5.35 | | | |
| | | | 2.2 | 5.47~5.725 | | | |
| | | | 1.6 | 5.725~5.85 | | | |
| 2 | NA | 9 07X00747X19 | 2.5 | 2.4~2.4835 | Dipole | i-pex | 90 |
| | | | 2.2 | 5.15~5.25 | | | |
| | | | 1.2 | 5.25~5.35 | | | |
| | | | 3.2 | 5.47~5.725 | | | |
| | | | 3.5 | 5.725~5.85 | | | |

6. 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 |
| 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 |

7. The above EUT information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or user's manual.
8. The above Antenna information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications, the laboratory shall not be held responsible.

3.2 Description of Test Modes

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

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

7 channels are provided for 802.11n (HT40):

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

3.2.1 Test Mode Applicability and Tested Channel Detail

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

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

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) |
|---------|-------------------|----------------|-----------------------|-----------------|------------------|
| 802.11b | 1 to 11 | 1, 6, 11 | DSSS | DBPSK | 1 |

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 (Mbps) |
|---------|-------------------|----------------|-----------------------|-----------------|------------------|
| 802.11b | 1 to 11 | 6 | DSSS | DBPSK | 1 |

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 (Mbps) |
|---------|-------------------|----------------|-----------------------|-----------------|------------------|
| 802.11b | 1 to 11 | 6 | DSSS | DBPSK | 1 |

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) |
|---------|-------------------|----------------|-----------------------|-----------------|------------------|
| 802.11b | 1 to 11 | 6 | DSSS | DBPSK | 1 |

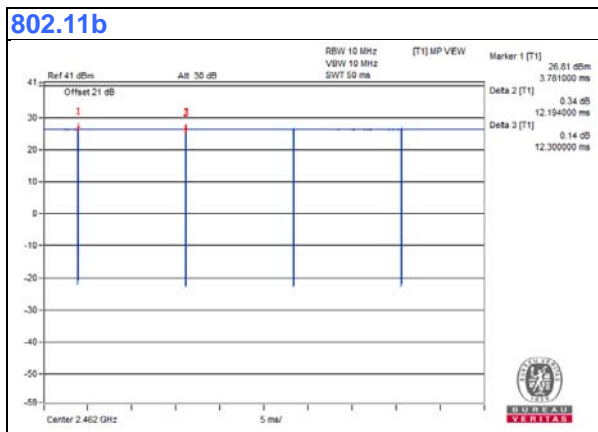
Test Condition:

| APPLICABLE TO | ENVIRONMENTAL CONDITIONS | INPUT POWER | TESTED BY |
|---------------|--------------------------|--------------|--------------|
| RE \geq 1G | 25deg. C, 75%RH | 120Vac, 60Hz | Ryan Du |
| RE<1G | 23deg. C, 68%RH | 120Vac, 60Hz | Ryan Du |
| PLC | 25deg. C, 70%RH | 120Vac, 60Hz | Sampson Chen |
| APCM | 25deg. C, 60%RH | 120Vac, 60Hz | Ryan Du |

3.3 Duty Cycle of Test Signal

Duty cycle of test signal is < 98%, duty factor shall be considered.

802.11b: Duty cycle = 12.194 ms/12.3 ms = 0.991



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.

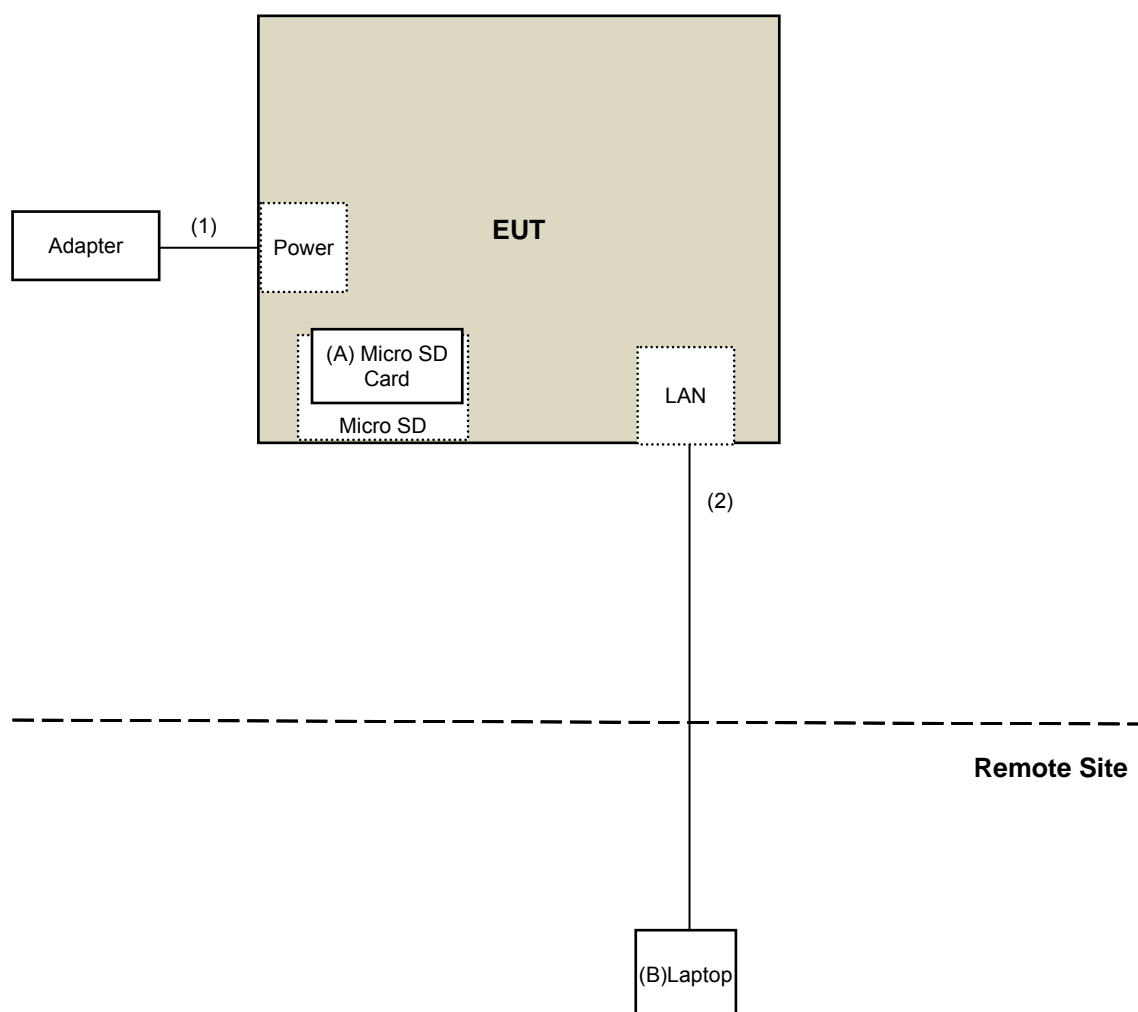
| ID | Product | Brand | Model No. | Serial No. | FCC ID | Remarks |
|----|---------------|---------|-----------|------------|---------|-----------------|
| A. | Micro SD Card | SanDisk | 8GB | NA | NA | Provided by Lab |
| B. | Laptop | DELL | E6420 | B92T3R1 | FCC DoC | Provided by Lab |

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 | 1.8 | No | 0 | Supplied by client |
| 2. | 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 and References

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

Test Standard:

FCC Part 15, Subpart C (15.247)

ANSI C63.10-2013

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

References Test Guidance:

KDB 558074 D01 15.247 Meas Guidance v05r02

KDB 662911 D01 Multiple Transmitter Output v02r01

All test items have been performed as a reference to the above KDB test guidance.

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 30dB 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

For Radiated Emission test:

| DESCRIPTION & MANUFACTURER | MODEL NO. | SERIAL NO. | CALIBRATED DATE | CALIBRATED UNTIL |
|---|----------------------|-------------|-----------------|------------------|
| Test Receiver Agilent | N9038A | MY51210202 | Dec. 13, 2019 | Dec. 12, 2020 |
| Pre-Amplifier EMCI | EMC001340 | 980142 | May 25, 2020 | May 24, 2021 |
| Loop Antenna Electro-Metrics | EM-6879 | 264 | Feb. 18, 2020 | Feb. 17, 2021 |
| RF Cable | NA | LOOPCAB-001 | Jan. 08, 2020 | Jan. 07, 2021 |
| RF Cable | NA | LOOPCAB-002 | Jan. 08, 2020 | Jan. 07, 2021 |
| Pre-Amplifier Mini-Circuits | ZFL-1000VH2B | AMP-ZFL-01 | Oct. 23, 2019 | Oct. 22, 2020 |
| Trilog Broadband Antenna SCHWARZBECK | VULB 9168 | 9168-406 | Nov. 11, 2019 | Nov. 10, 2020 |
| RF Cable | 8D | 966-4-1 | Mar. 18, 2020 | Mar. 17, 2021 |
| RF Cable | 8D | 966-4-2 | Mar. 18, 2020 | Mar. 17, 2021 |
| RF Cable | 8D | 966-4-3 | Mar. 18, 2020 | Mar. 17, 2021 |
| Fixed attenuator Mini-Circuits | UNAT-5+ | PAD-3m-4-01 | Sep. 26, 2019 | Sep. 25, 2020 |
| Horn_Antenna SCHWARZBECK | BBHA 9120D | 9120D-783 | Nov. 24, 2019 | Nov. 23, 2020 |
| Pre-Amplifier EMCI | EMC12630SE | 980385 | Aug. 15, 2019 | Aug. 14, 2020 |
| RF Cable | EMC104-SM-SM-1200 | 160923 | Jan. 15, 2020 | Jan. 14, 2021 |
| RF Cable | EMC104-SM-SM-2000 | 180502 | Apr. 29, 2020 | Apr. 28, 2021 |
| RF Cable | EMC104-SM-SM-6000 | 180418 | Apr. 29, 2020 | Apr. 28, 2021 |
| Pre-Amplifier EMCI | EMC184045SE | 980387 | Jan. 15, 2020 | Jan. 14, 2021 |
| Horn_Antenna SCHWARZBECK | BBHA 9170 | BBHA9170519 | Nov. 24, 2019 | Nov. 23, 2020 |
| RF Cable | EMC102-KM-KM-1200 | 160924 | Jan. 15, 2020 | Jan. 14, 2021 |
| RF Cable | EMC-KM-KM-4000 | 200214 | Mar. 11, 2020 | Mar. 10, 2021 |
| Software | ADT_Radiated_V8.7.08 | NA | NA | NA |
| Boresight Antenna Tower & Turn Table Max-Full | MF-7802BS | MF780208530 | 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 966 Chamber No. 4.
3. Tested Date: July 18 to Aug. 10, 2020

For other test items:

| DESCRIPTION & MANUFACTURER | MODEL NO. | SERIAL NO. | CALIBRATED DATE | CALIBRATED UNTIL |
|--------------------------------|-------------------------------|---------------|-----------------|------------------|
| Spectrum Analyzer R&S | FSV40 | 100964 | May 29, 2020 | May 28, 2021 |
| Power meter Anritsu | ML2495A | 1529002 | July 22, 2020 | July 21, 2021 |
| Power sensor Anritsu | MA2411B | 1339443 | July 22, 2020 | July 21, 2021 |
| Fixed Attenuator Mini-Circuits | MDCS18N-10 | MDCS18N-10-01 | Apr. 14, 2020 | Apr. 13, 2021 |
| Software | ADT_RF Test Software V6.6.5.4 | NA | NA | NA |

- NOTE:**
1. The test was performed in Oven room 2.
 2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
 3. Tested Date: July 24, 2020

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:

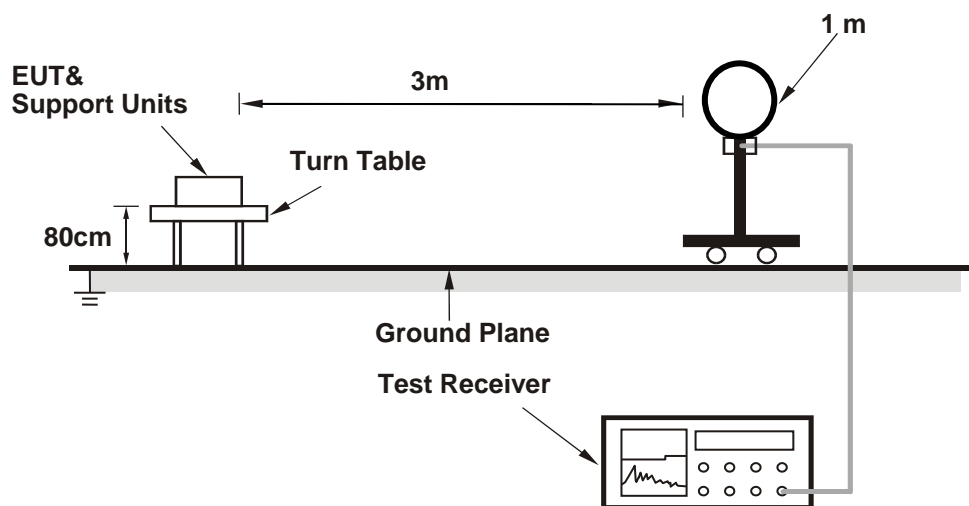
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
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

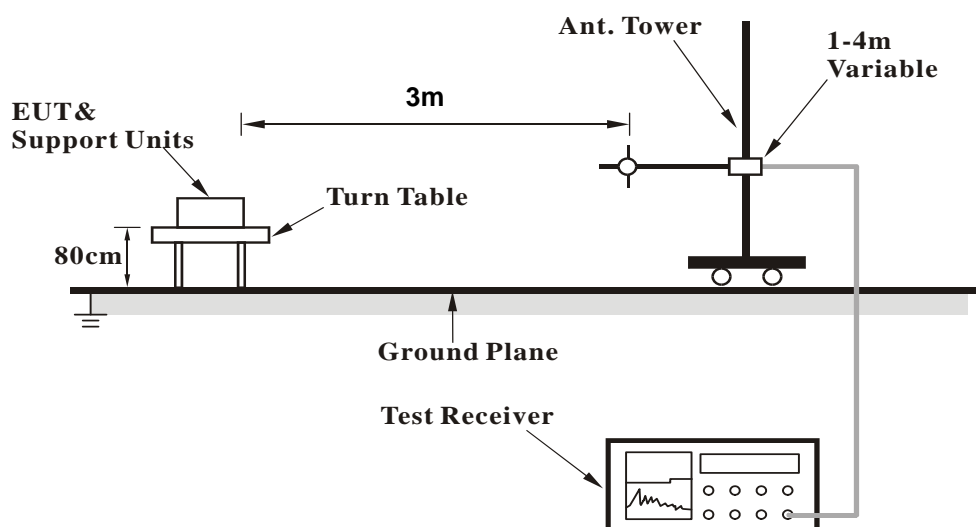
No deviation.

4.1.5 Test Setup

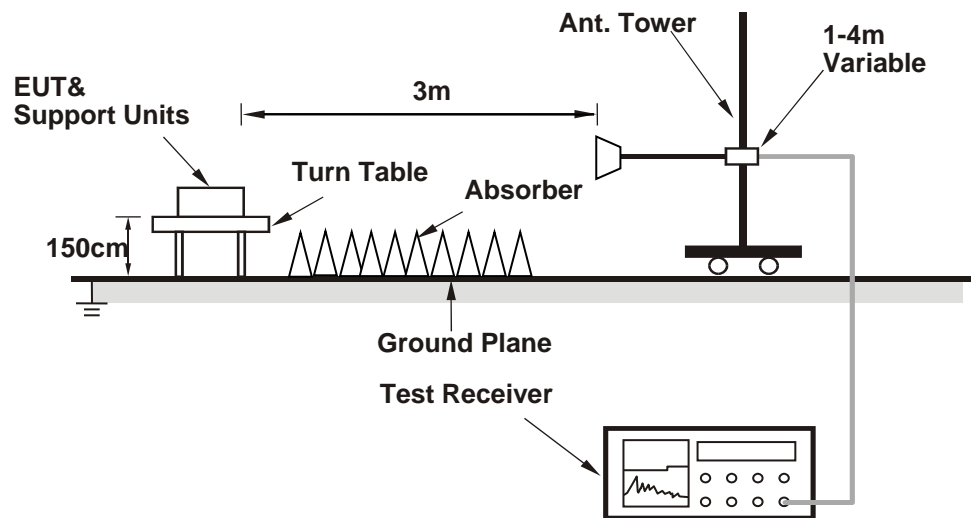
For Radiated emission below 30MHz



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

- Placed the EUT on the testing table.
- Controlling software (QDART-connectivity (1.0.40)) has been activated to set the EUT under transmission condition continuously at specific channel frequency.

4.1.7 Test Results

Above 1GHz Data:

802.11b

| | | | |
|------------------------|--------------|--------------------------|--------------|
| Channel | TX Channel 1 | Detector Function | Peak (PK) |
| Frequency Range | 1GHz ~ 25GHz | | Average (AV) |

| Antenna Polarity & Test Distance : Horizontal at 3 m | | | | | | | | |
|--|-----------------|-------------------------|----------------|-------------|--------------------|----------------------|------------------|--------------------------|
| No | Frequency (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 | 63.4 PK | 74.0 | -10.6 | 1.26 H | 190 | 65.2 | -1.8 |
| 2 | 2390.00 | 48.7 AV | 54.0 | -5.3 | 1.26 H | 190 | 50.5 | -1.8 |
| 3 | *2412.00 | 113.3 PK | | | 1.26 H | 190 | 115.1 | -1.8 |
| 4 | *2412.00 | 110.7 AV | | | 1.26 H | 190 | 112.5 | -1.8 |
| 5 | 4824.00 | 47.8 PK | 74.0 | -26.2 | 1.22 H | 172 | 45.6 | 2.2 |
| 6 | 4824.00 | 45.8 AV | 54.0 | -8.2 | 1.22 H | 172 | 43.6 | 2.2 |
| Antenna Polarity & Test Distance : Vertical at 3 m | | | | | | | | |
| No | Frequency (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 | 60.4 PK | 74.0 | -13.6 | 1.99 V | 258 | 62.2 | -1.8 |
| 2 | 2390.00 | 53.5 AV | 54.0 | -0.5 | 1.99 V | 258 | 55.3 | -1.8 |
| 3 | *2412.00 | 120.8 PK | | | 1.99 V | 258 | 122.6 | -1.8 |
| 4 | *2412.00 | 118.5 AV | | | 1.99 V | 258 | 120.3 | -1.8 |
| 5 | 4824.00 | 47.2 PK | 74.0 | -26.8 | 2.03 V | 257 | 45.0 | 2.2 |
| 6 | 4824.00 | 44.5 AV | 54.0 | -9.5 | 2.03 V | 257 | 42.3 | 2.2 |

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 | Frequency (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 | 112.0 PK | | | 1.22 H | 187 | 113.8 | -1.8 |
| 2 | *2437.00 | 108.4 AV | | | 1.22 H | 187 | 110.2 | -1.8 |
| 3 | 4874.00 | 50.6 PK | 74.0 | -23.4 | 2.16 H | 66 | 48.5 | 2.1 |
| 4 | 4874.00 | 49.1 AV | 54.0 | -4.9 | 2.16 H | 66 | 47.0 | 2.1 |
| 5 | 7311.00 | 43.9 PK | 74.0 | -30.1 | 1.00 H | 299 | 34.8 | 9.1 |
| 6 | 7311.00 | 34.1 AV | 54.0 | -19.9 | 1.00 H | 299 | 25.0 | 9.1 |
| Antenna Polarity & Test Distance : Vertical at 3 m | | | | | | | | |
| No | Frequency (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 | 118.2 PK | | | 1.18 V | 155 | 120.0 | -1.8 |
| 2 | *2437.00 | 116.3 AV | | | 1.18 V | 155 | 118.1 | -1.8 |
| 3 | 4874.00 | 49.6 PK | 74.0 | -24.4 | 1.88 V | 349 | 47.5 | 2.1 |
| 4 | 4874.00 | 47.4 AV | 54.0 | -6.6 | 1.88 V | 349 | 45.3 | 2.1 |
| 5 | 7311.00 | 43.5 PK | 74.0 | -30.5 | 1.96 V | 186 | 34.4 | 9.1 |
| 6 | 7311.00 | 32.7 AV | 54.0 | -21.3 | 1.96 V | 186 | 23.6 | 9.1 |

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 | Frequency (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 | 111.6 PK | | | 1.26 H | 175 | 113.4 | -1.8 |
| 2 | *2462.00 | 108.0 AV | | | 1.26 H | 175 | 109.8 | -1.8 |
| 3 | 2483.50 | 62.4 PK | 74.0 | -11.6 | 1.26 H | 175 | 64.3 | -1.9 |
| 4 | 2483.50 | 48.3 AV | 54.0 | -5.7 | 1.26 H | 175 | 50.2 | -1.9 |
| 5 | 4924.00 | 50.6 PK | 74.0 | -23.4 | 2.16 H | 66 | 48.3 | 2.3 |
| 6 | 4924.00 | 49.1 AV | 54.0 | -4.9 | 2.16 H | 66 | 46.8 | 2.3 |
| 7 | 7386.00 | 43.9 PK | 74.0 | -30.1 | 1.00 H | 299 | 34.5 | 9.4 |
| 8 | 7386.00 | 34.1 AV | 54.0 | -19.9 | 1.00 H | 299 | 24.7 | 9.4 |
| Antenna Polarity & Test Distance : Vertical at 3 m | | | | | | | | |
| No | Frequency (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 | 118.8 PK | | | 1.17 V | 166 | 120.6 | -1.8 |
| 2 | *2462.00 | 116.6 AV | | | 1.17 V | 166 | 118.4 | -1.8 |
| 3 | 2483.50 | 60.4 PK | 74.0 | -13.6 | 1.17 V | 166 | 62.3 | -1.9 |
| 4 | 2483.50 | 53.5 AV | 54.0 | -0.5 | 1.17 V | 166 | 55.4 | -1.9 |
| 5 | 4924.00 | 49.6 PK | 74.0 | -24.4 | 1.88 V | 349 | 47.3 | 2.3 |
| 6 | 4924.00 | 47.4 AV | 54.0 | -6.6 | 1.88 V | 349 | 45.1 | 2.3 |
| 7 | 7386.00 | 43.5 PK | 74.0 | -30.5 | 1.96 V | 186 | 34.1 | 9.4 |
| 8 | 7386.00 | 32.7 AV | 54.0 | -21.3 | 1.96 V | 186 | 23.3 | 9.4 |

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:

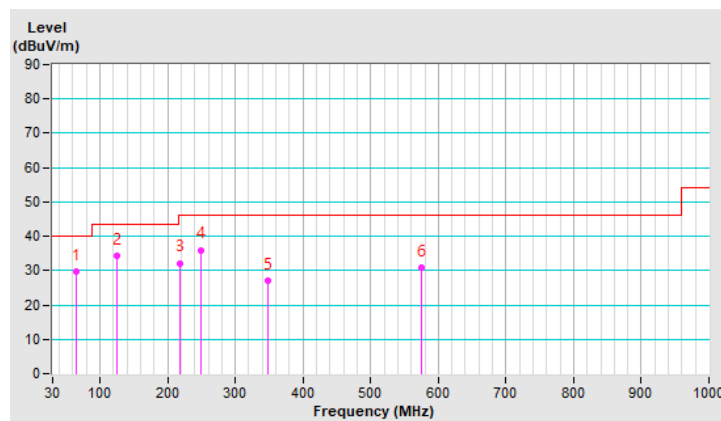
802.11b

| | | | |
|-----------------|--------------|-------------------|-----------------|
| Channel | TX Channel 6 | Detector Function | Quasi-Peak (QP) |
| Frequency Range | 9kHz ~ 1GHz | | |

| Antenna Polarity & Test Distance : Horizontal at 3 m | | | | | | | | |
|--|-----------------|-------------------------|----------------|-------------|--------------------|----------------------|------------------|--------------------------|
| No | Frequency (MHz) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (m) | Table Angle (Degree) | Raw Value (dBuV) | Correction Factor (dB/m) |
| 1 | 64.48 | 29.7 QP | 40.0 | -10.3 | 2.00 H | 147 | 38.7 | -9.0 |
| 2 | 124.99 | 34.3 QP | 43.5 | -9.2 | 3.00 H | 115 | 43.5 | -9.2 |
| 3 | 217.86 | 32.2 QP | 46.0 | -13.8 | 1.50 H | 165 | 42.9 | -10.7 |
| 4 | 249.98 | 36.0 QP | 46.0 | -10.0 | 1.00 H | 134 | 44.5 | -8.5 |
| 5 | 347.82 | 27.1 QP | 46.0 | -18.9 | 1.50 H | 241 | 32.5 | -5.4 |
| 6 | 574.63 | 30.7 QP | 46.0 | -15.3 | 1.50 H | 232 | 30.2 | 0.5 |

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.

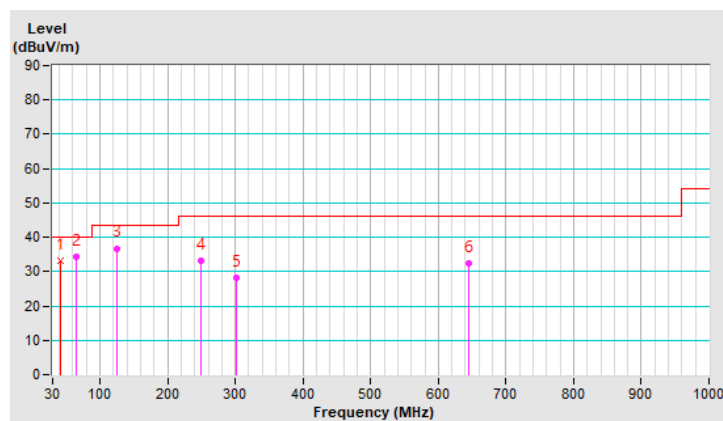


| | | | |
|-----------------|--------------|-------------------|-----------------|
| Channel | TX Channel 6 | Detector Function | Quasi-Peak (QP) |
| Frequency Range | 9kHz ~ 1GHz | | |

| Antenna Polarity & Test Distance : Vertical at 3 m | | | | | | | | |
|--|-----------------|-------------------------|----------------|-------------|--------------------|----------------------|------------------|--------------------------|
| No | Frequency (MHz) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (m) | Table Angle (Degree) | Raw Value (dBuV) | Correction Factor (dB/m) |
| 1 | 41.52 | 33.0 QP | 40.0 | -7.0 | 1.00 V | 122 | 41.3 | -8.3 |
| 2 | 65.26 | 34.3 QP | 40.0 | -5.7 | 1.00 V | 136 | 43.5 | -9.2 |
| 3 | 124.99 | 36.8 QP | 43.5 | -6.7 | 1.00 V | 198 | 46.0 | -9.2 |
| 4 | 250.01 | 33.1 QP | 46.0 | -12.9 | 1.50 V | 142 | 41.6 | -8.5 |
| 5 | 302.10 | 28.3 QP | 46.0 | -17.7 | 1.00 V | 296 | 34.7 | -6.4 |
| 6 | 644.03 | 32.5 QP | 46.0 | -13.5 | 1.50 V | 241 | 30.2 | 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 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. 23, 2019 | Oct. 22, 2020 |
| Line-Impedance Stabilization Network (for EUT) R&S | ESH3-Z5 | 848773/004 | Oct. 23, 2019 | Oct. 22, 2020 |
| Line-Impedance Stabilization Network (for Peripheral) R&S | ESH3-Z5 | 835239/001 | Mar. 19, 2020 | Mar. 18, 2021 |
| 50 ohms Terminator | 50 | 3 | Oct. 23, 2019 | Oct. 22, 2020 |
| RF Cable | 5D-FB | COCCAB-001 | Sep. 27, 2019 | Sep. 26, 2020 |
| Fixed attenuator EMCI | STI02-2200-10 | 005 | Aug. 30, 2019 | Aug. 29, 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 20, 2020

4.2.3 Test Procedures

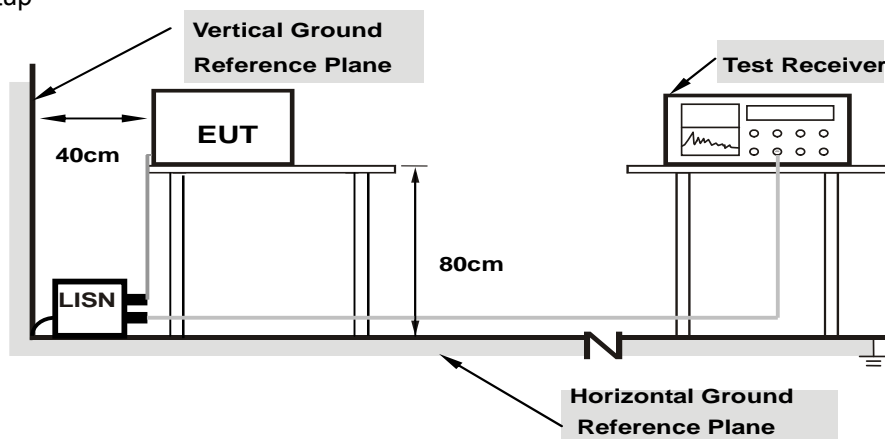
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance 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.

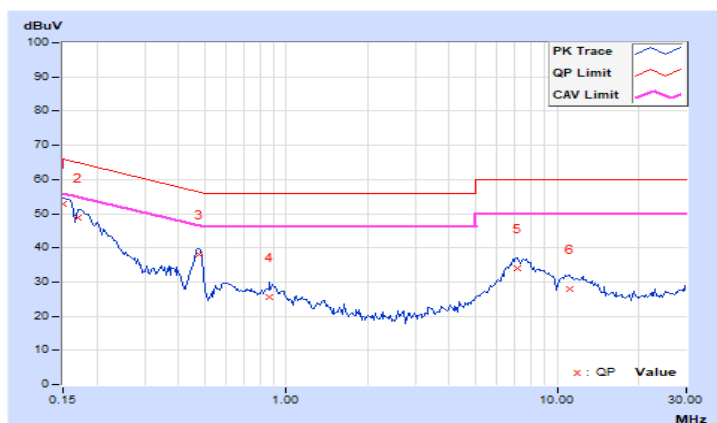
4.2.7 Test Results

| 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 | 0.15016 | 9.98 | 42.92 | 26.33 | 52.90 | 36.31 | 65.99 | 55.99 | -13.09 | -19.68 |
| 2 | 0.16960 | 9.98 | 38.89 | 21.45 | 48.87 | 31.43 | 64.98 | 54.98 | -16.11 | -23.55 |
| 3 | 0.47432 | 10.01 | 28.14 | 20.90 | 38.15 | 30.91 | 56.44 | 46.44 | -18.29 | -15.53 |
| 4 | 0.86885 | 10.04 | 15.60 | 11.66 | 25.64 | 21.70 | 56.00 | 46.00 | -30.36 | -24.30 |
| 5 | 7.09776 | 10.48 | 23.42 | 17.65 | 33.90 | 28.13 | 60.00 | 50.00 | -26.10 | -21.87 |
| 6 | 11.20333 | 10.76 | 17.20 | 10.23 | 27.96 | 20.99 | 60.00 | 50.00 | -32.04 | -29.01 |

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

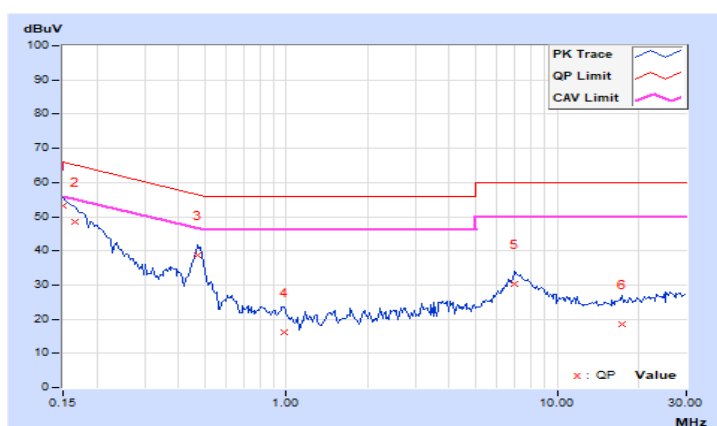


| | | | |
|-------|-------------|-------------------|--------------------------------|
| Phase | Neutral (N) | Detector Function | Quasi-Peak (QP) / Average (AV) |
|-------|-------------|-------------------|--------------------------------|

| 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 | 0.15026 | 9.99 | 43.12 | 25.94 | 53.11 | 35.93 | 65.99 | 55.99 | -12.88 | -20.06 |
| 2 | 0.16569 | 9.99 | 38.65 | 20.25 | 48.64 | 30.24 | 65.17 | 55.17 | -16.53 | -24.93 |
| 3 | 0.47041 | 10.04 | 28.59 | 24.35 | 38.63 | 34.39 | 56.51 | 46.51 | -17.88 | -12.12 |
| 4 | 0.97826 | 10.09 | 5.99 | 1.74 | 16.08 | 11.83 | 56.00 | 46.00 | -39.92 | -34.17 |
| 5 | 6.95713 | 10.43 | 19.75 | 14.56 | 30.18 | 24.99 | 60.00 | 50.00 | -29.82 | -25.01 |
| 6 | 17.32435 | 10.99 | 7.42 | 2.01 | 18.41 | 13.00 | 60.00 | 50.00 | -41.59 | -37.00 |

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,

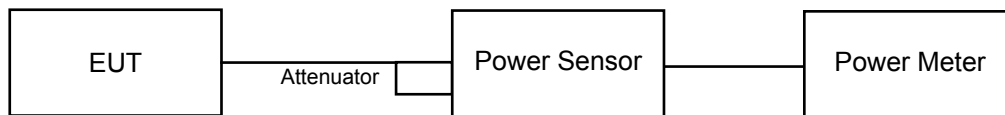
Array Gain = 0 dB (i.e., no array gain) for $N_{ANT} \leq 4$;

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

802.11b

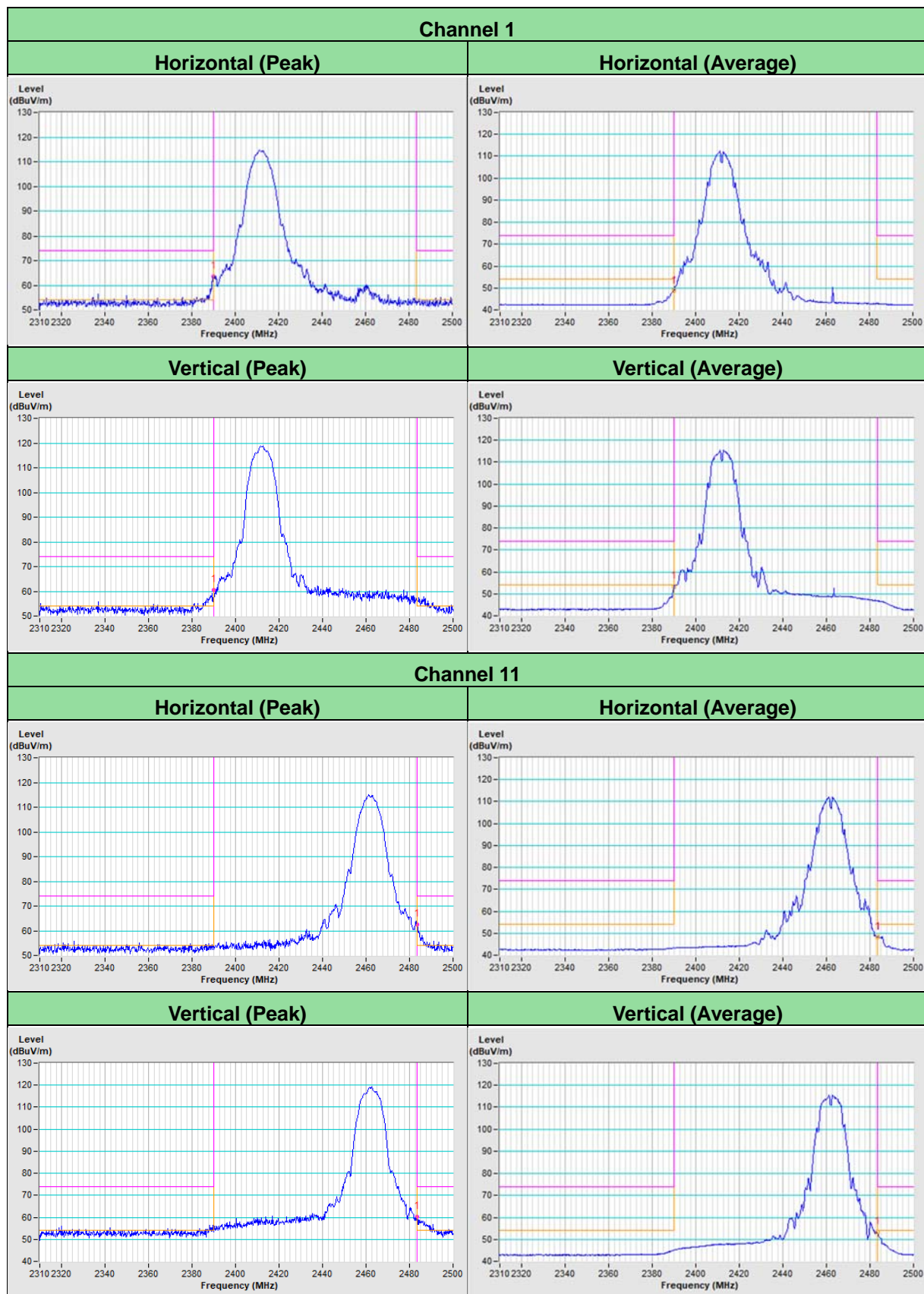
| Chan. | Chan. Freq. (MHz) | Average Power (dBm) | | Total Power (mW) | Total Power (dBm) | Limit (dBm) | Pass / Fail |
|-------|----------------------|---------------------|---------|---------------------|----------------------|-------------|-------------|
| | | Chain 0 | Chain 1 | | | | |
| 1 | 2412 | 24.69 | 25.02 | 612.13 | 27.87 | 30.00 | Pass |
| 6 | 2437 | 26.53 | 26.61 | 907.922 | 29.58 | 30.00 | Pass |
| 11 | 2462 | 23.64 | 23.79 | 470.538 | 26.73 | 30.00 | Pass |

5 Pictures of Test Arrangements

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

Annex A - Band-Edge Measurement

802.11b



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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