

FCC Test Report (BT-LE)

Report No.: RF170421E06-2

FCC ID: 2ACTO-APX740

Test Model: APX 740

Received Date: Apr. 21, 2017

Test Date: May 05 to June 09, 2017

Issued Date: July 31, 2017

Applicant: Sophos 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 |
|---------------|-------------------|---------------|
| RF170421E06-2 | Original release. | July 31, 2017 |

1 Certificate of Conformity

Product: Sophos Access Point

Brand: SOPHOS

Test Model: APX 740

Sample Status: ENGINEERING SAMPLE


Applicant: Sophos Ltd

Test Date: May 05 to June 09, 2017

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 :  _____, **Date:** July 31, 2017
Wendy Wu / Specialist

Approved by :  _____, **Date:** July 31, 2017
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 -6.96dB at 0.42344MHz. |
| 15.205 & 209 & 15.247(d) | Radiated Emissions & Band Edge Measurement | PASS | Meet the requirement of limit. Minimum passing margin is -6.3dB at 95.31MHz. |
| 15.247(d) | Antenna Port Emission | PASS | Meet the requirement of limit. |
| 15.247(a)(2) | 6dB bandwidth | PASS | Meet the requirement of limit. |
| 15.247(b) | Conducted power | PASS | Meet the requirement of limit. |
| 15.247(e) | Power Spectral Density | PASS | Meet the requirement of limit. |
| 15.203 | Antenna Requirement | PASS | Antenna connector is i-pex(MHF) not a standard connector. |

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 | 1.84 dB |
| Radiated Emissions up to 1 GHz | 30MHz ~ 1GHz | 5.32 dB |
| | 1GHz ~ 6GHz | 5.14 dB |
| Radiated Emissions above 1 GHz | 6GHz ~ 18GHz | 5.04 dB |
| | 18GHz ~ 40GHz | 5.25 dB |

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

| | |
|-----------------------|---------------------|
| Product | Sophos Access Point |
| Brand | SOPHOS |
| Test Model | APX 740 |
| Status of EUT | ENGINEERING SAMPLE |
| Power Supply Rating | DC 55V from POE |
| Modulation Type | GFSK |
| Modulation Technology | DTS |
| Transfer Rate | Up to 1Mbps |
| Operating Frequency | 2402MHz ~ 2480MHz |
| Number of Channel | 40 |
| Output Power | 5.07mW (7.05 dBm) |
| Antenna Type | Refer to Note |
| Antenna Connector | Refer to Note |
| Accessory Device | NA |
| Data Cable Supplied | NA |

Note:

- The EUT has three radio transceivers, radio 1 is WLAN technologies for single band (2.4GHz), radio 2 is WLAN technology for single band (5GHz), and radio 3 is Bluetooth low energy (BT-LE) technology only.
- Simultaneously transmission condition.

| Condition | Technology | |
|-----------|-----------------------|---------------------|
| 1 | WLAN 2.4GHz (Radio 1) | WLAN 5GHz (Radio 2) |

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

- The EUT must be supplied with a POE (only for test not for sale) as following table:

| Brand | Model No. | Spec. |
|------------|--------------|--|
| PowerDsine | PD-9001GR/AC | Input: 100-240Vac, 50/60Hz, 0.67A Output: 55Vdc, 0.6A |

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

| Radio 1 | | | | | | | | |
|------------------|---------------------|-------|-----------|------------------------|-----------------------|--------------|----------------|---------------|
| 2.4GHz | | | | | | | | |
| Antenna No. | Transmitter Circuit | Brand | Model No. | Antenna Net Gain (dBi) | Frequency Range (GHz) | Antenna Type | Connector Type | *Cable Length |
| 1 | Chain (0) | NA | NA | 4.99 | 2.4~2.4835 | PIFA | i-pex(MHF) | 176 |
| 2 | Chain (1) | NA | NA | 4.47 | 2.4~2.4835 | PIFA | i-pex(MHF) | 140 |
| 3 | Chain (2) | NA | NA | 3.71 | 2.4~2.4835 | PIFA | i-pex(MHF) | 98 |
| 4 | Chain (3) | NA | NA | 4.83 | 2.4~2.4835 | PIFA | i-pex(MHF) | 70 |
| Radio 2 | | | | | | | | |
| 5GHz | | | | | | | | |
| Antenna No. | Transmitter Circuit | Brand | Model No. | Antenna Net Gain (dBi) | Frequency Range (GHz) | Antenna Type | Connector Type | *Cable Length |
| 1 | Chain (0) | NA | NA | 5.94 | 5.15~5.85 | Dipole | i-pex(MHF) | 79 |
| 2 | Chain (1) | NA | NA | 5.71 | 5.15~5.85 | Dipole | i-pex(MHF) | 117 |
| 3 | Chain (2) | NA | NA | 5.61 | 5.15~5.85 | Dipole | i-pex(MHF) | 157 |
| 4 | Chain (3) | NA | NA | 5.32 | 5.15~5.85 | Dipole | i-pex(MHF) | 189 |
| Radio 3 | | | | | | | | |
| Bluetooth | | | | | | | | |
| Antenna No. | Transmitter Circuit | Brand | Model No. | Antenna Net Gain (dBi) | Frequency Range (GHz) | Antenna Type | Connector Type | *Cable Length |
| 1 | Chain (0) | NA | NA | 2.75 | 2.4~2.4835 | PIFA | i-pex(MHF) | 121 |

Note: For 1TX configuration mode, max gain was selected for the final test.

5. 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.

3.2 Description of Test Modes

40 channels are provided to this EUT:

| CHANNEL | FREQ. (MHz) | CHANNEL | FREQ. (MHz) | CHANNEL | FREQ. (MHz) | CHANNEL | FREQ. (MHz) |
|---------|----------------|---------|----------------|---------|----------------|---------|----------------|
| 0 | 2402 | 10 | 2422 | 20 | 2442 | 30 | 2462 |
| 1 | 2404 | 11 | 2424 | 21 | 2444 | 31 | 2464 |
| 2 | 2406 | 12 | 2426 | 22 | 2446 | 32 | 2466 |
| 3 | 2408 | 13 | 2428 | 23 | 2448 | 33 | 2468 |
| 4 | 2410 | 14 | 2430 | 24 | 2450 | 34 | 2470 |
| 5 | 2412 | 15 | 2432 | 25 | 2452 | 35 | 2472 |
| 6 | 2414 | 16 | 2434 | 26 | 2454 | 36 | 2474 |
| 7 | 2416 | 17 | 2436 | 27 | 2456 | 37 | 2476 |
| 8 | 2418 | 18 | 2438 | 28 | 2458 | 38 | 2478 |
| 9 | 2420 | 19 | 2440 | 29 | 2460 | 39 | 2480 |

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 **RE<1G**: Radiated Emission below 1GHz
PLC: Power Line Conducted Emission **APCM**: Antenna Port Conducted Measurement

NOTE: 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.

| AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION TYPE | DATA RATE (Mbps) |
|-------------------|----------------|-----------------|------------------|
| 0 to 39 | 0, 19, 39 | GFSK | 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.

| AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION TYPE | DATA RATE (Mbps) |
|-------------------|----------------|-----------------|------------------|
| 0 to 39 | 39 | GFSK | 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.

| AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION TYPE | DATA RATE (Mbps) |
|-------------------|----------------|-----------------|------------------|
| 0 to 39 | 39 | GFSK | 1 |

Antenna Port Conducted Measurement:

- This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.
- 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.

| AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION TYPE | DATA RATE (Mbps) |
|-------------------|----------------|-----------------|------------------|
| 0 to 39 | 0, 19, 39 | GFSK | 1 |

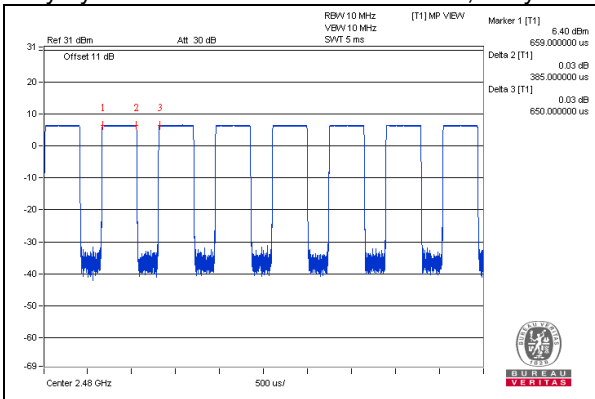
Test Condition:

| APPLICABLE TO | ENVIRONMENTAL CONDITIONS | INPUT POWER | TESTED BY |
|---------------|--------------------------|--------------|---------------|
| RE \geq 1G | 22deg. C, 68%RH | 120Vac, 60Hz | Rey Chen |
| RE<1G | 25deg. C, 71%RH | 120Vac, 60Hz | Andy Ho |
| PLC | 25deg. C, 75%RH | 120Vac, 60Hz | Andy Ho |
| APCM | 25deg. C, 60%RH | 120Vac, 60Hz | Anderson Chen |

3.3 Duty Cycle of Test Signal

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

Duty cycle = $0.385 \text{ ms} / 0.65 \text{ ms} = 0.592$, Duty factor = $10 * \log(1/0.592) = 2.27$



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. | Laptop | DELL | E5430 | HYV4VY1 | FCC DoC | Provided by Lab |
| B. | POE | PowerDsine | PD-9001GR/AC | NA | NA | Supplied by client |
| C. | Laptop | LENOVO | E440 | PF071LWC | NA | Provided by Lab |

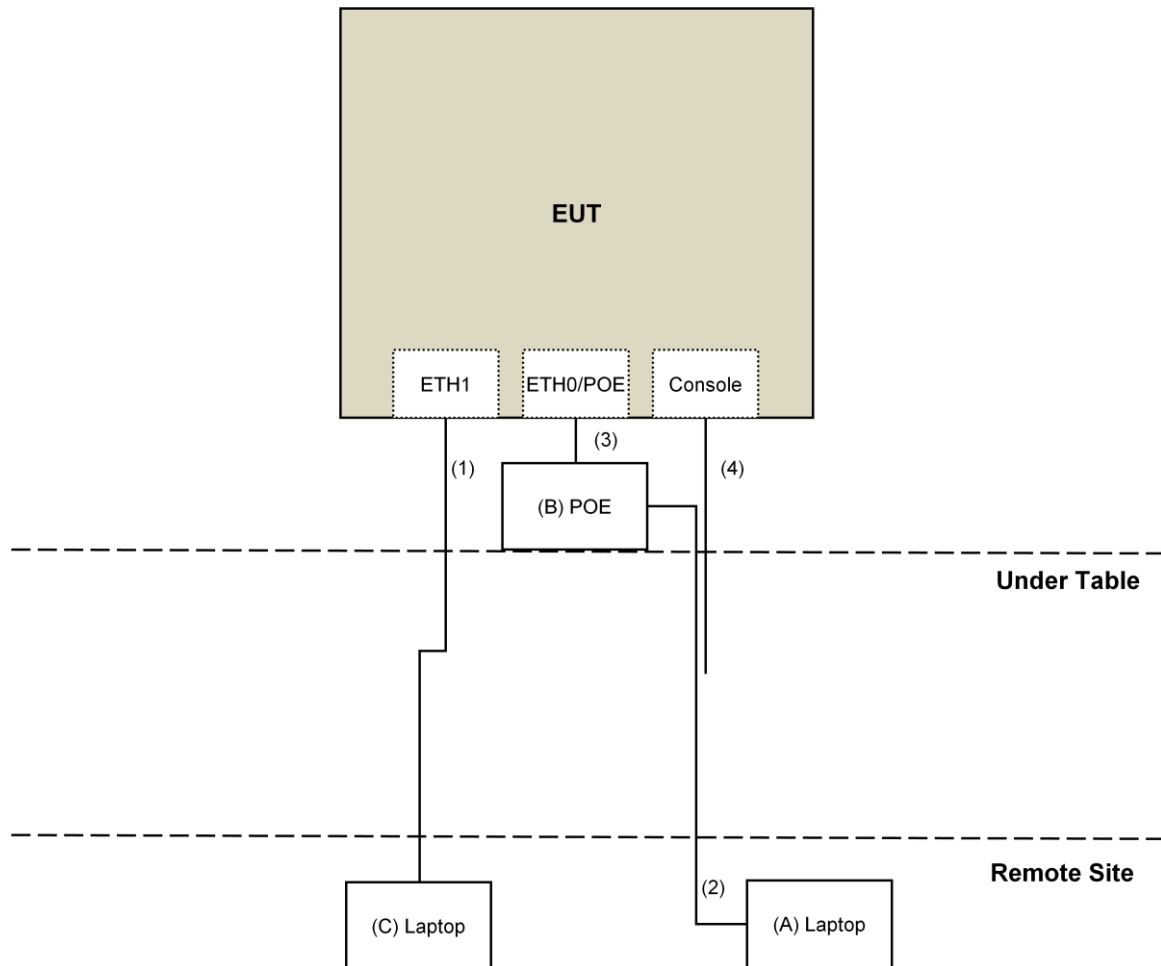
Note:

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

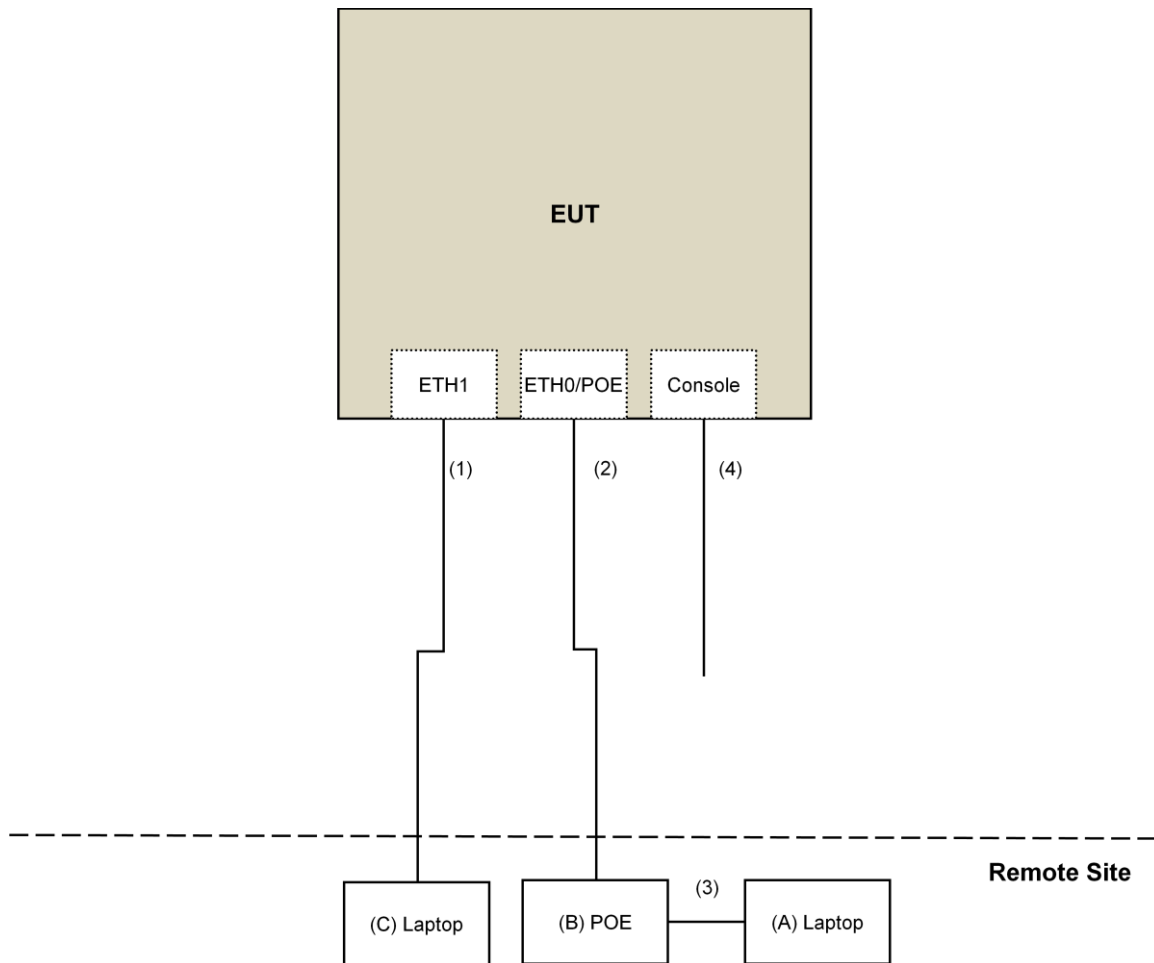
| ID | Descriptions | Qty. | Length (m) | Shielding (Yes/No) | Cores (Qty.) | Remarks |
|----|---------------|------|------------|--------------------|--------------|-----------------|
| 1. | RJ-45 Cable | 1 | 10 | No | 0 | Provided by Lab |
| 2. | RJ-45 Cable | 1 | 10 | No | 0 | Provided by Lab |
| 3. | RJ-45 Cable | 1 | 3 | No | 0 | Provided by Lab |
| 4. | Console Cable | 1 | 1.5 | No | 0 | Provided by Lab |

3.4.1 Configuration of System under Test

For Conducted Emission:



For other 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 DTS Meas Guidance v04
ANSI C63.10-2013

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 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

For below 1GHz test:

| DESCRIPTION & MANUFACTURER | MODEL NO. | SERIAL NO. | CALIBRATED DATE | CALIBRATED UNTIL |
|--|--------------------------|-------------------------------|-----------------|------------------|
| Test Receiver Agilent | N9038A | MY50010156 | Aug. 18, 2016 | Aug. 17, 2017 |
| Pre-Amplifier ^(*) EMCI | EMC001340 | 980142 | Jan. 20, 2016 | Jan. 19, 2018 |
| Loop Antenna ^(*) Electro-Metrics | EM-6879 | 264 | Dec. 16, 2016 | Dec. 15, 2018 |
| RF Cable | NA | LOOPCAB-001 LOOPCAB-002 | Jan. 17, 2017 | Jan. 16, 2018 |
| Pre-Amplifier Mini-Circuits | ZFL-1000VH2 B | AMP-ZFL-05 | May 07, 2016 | May 06, 2017 |
| Trilog Broadband Antenna SCHWARZBECK | VULB 9168 | 9168-361 | Dec. 29, 2016 | Dec. 28, 2017 |
| RF Cable | 8D | 966-3-1 966-3-2 966-3-3 | Apr. 01, 2017 | Mar. 31, 2018 |
| Fixed attenuator Mini-Circuits | UNAT-5+ | PAD-3m-3-01 | Oct. 05, 2016 | Oct. 04, 2017 |
| Software | ADT_Radiated _V8.7.08 | NA | NA | NA |
| Antenna Tower & Turn Table Max-Full | MF-7802 | MF780208406 | 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 calibration interval of the above test instruments is 24 months and the calibrations are traceable to NML/ROC and NIST/USA.
3. The test was performed in 966 Chamber No. 3.
4. The FCC Site Registration No. is 147459
5. The CANADA Site Registration No. is 20331-1
6. Loop antenna was used for all emissions below 30 MHz.
7. Tested Date: May 05, 2017

For other test:

| DESCRIPTION & MANUFACTURER | MODEL NO. | SERIAL NO. | CALIBRATED DATE | CALIBRATED UNTIL |
|--|---|----------------------------|---|---|
| Test Receiver Agilent | N9038A | MY50010156 | Aug. 18, 2016 | Aug. 17, 2017 |
| Horn_Antenna SCHWARZBECK | BBHA9120-D | 9120D-406 | Dec. 28, 2016 | Dec. 27, 2017 |
| Pre-Amplifier EMCI | EMC12630SE | 980384 | Feb. 02, 2017 | Feb. 01, 2018 |
| RF Cable | EMC104-SM-SM-1200 EMC104-SM-SM-2000 EMC104-SM-SM-5000 | 160922 150317 150322 | Feb. 02, 2017 Mar. 29, 2017 Mar. 29, 2017 | Feb. 01, 2018 Mar. 28, 2018 Mar. 28, 2018 |
| Spectrum Analyzer Keysight | N9030A | MY54490520 | July 29, 2016 | July 28, 2017 |
| Pre-Amplifier EMCI | EMC184045S E | 980386 | Feb. 02, 2017 | Feb. 01, 2018 |
| Horn_Antenna SCHWARZBECK | BBHA 9170 | BBHA9170608 | Dec. 15, 2016 | Dec. 14, 2017 |
| RF Cable | SUCOFLEX 102 | 36432/2 36433/2 | Jan. 15, 2017 | Jan. 14, 2018 |
| 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 28, 2016 | June 27, 2017 |
| Power meter Anritsu | ML2495A | 1014008 | May 11, 2017 | May 10, 2018 |
| Power sensor Anritsu | MA2411B | 0917122 | May 11, 2017 | May 10, 2018 |

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. The FCC Site Registration No. is 147459
4. The CANADA Site Registration No. is 20331-1
5. Tested Date: June 06 to 09, 2017

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. Both X and Y axes 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 detect 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:

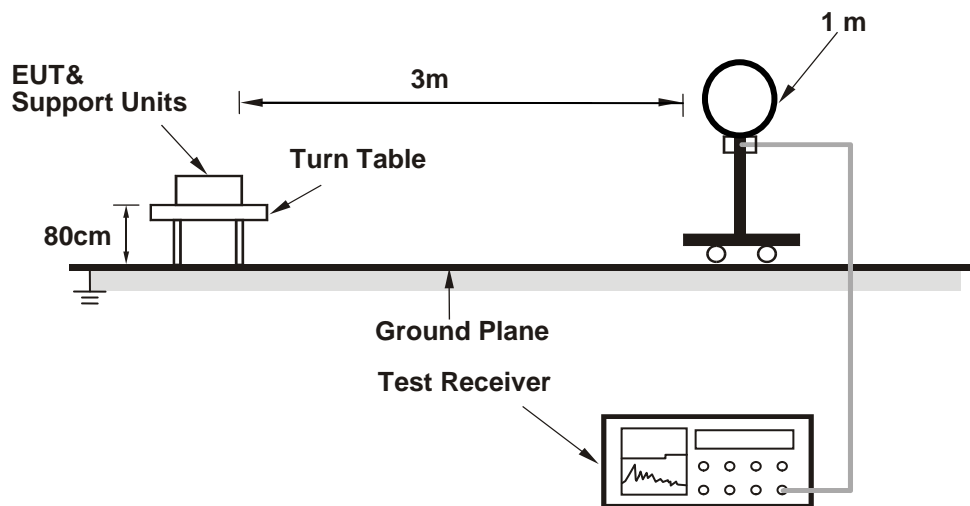
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Average detection (AV) at frequency above 1GHz. If duty cycle of test signal is < 98%, the duty factor need added to measured value.
4. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 Deviation from Test Standard

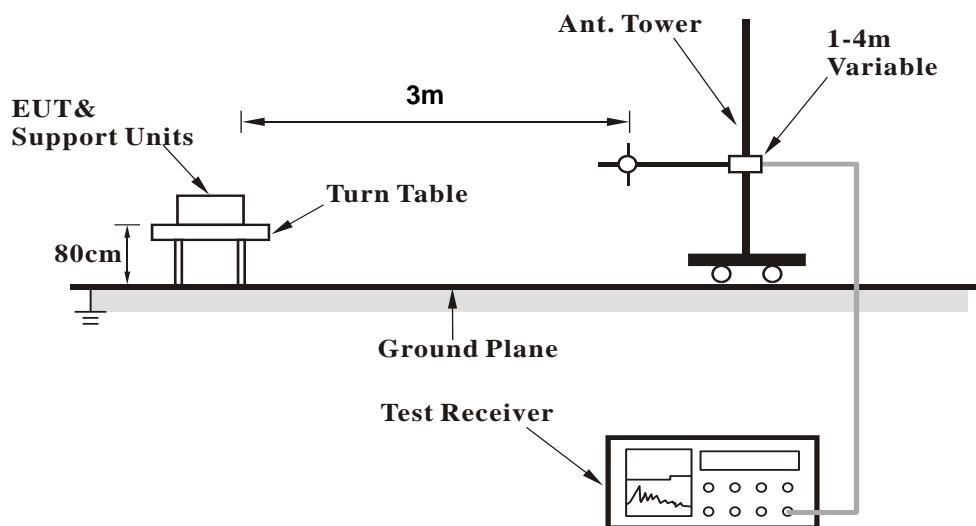
No deviation.

4.1.5 Test Setup

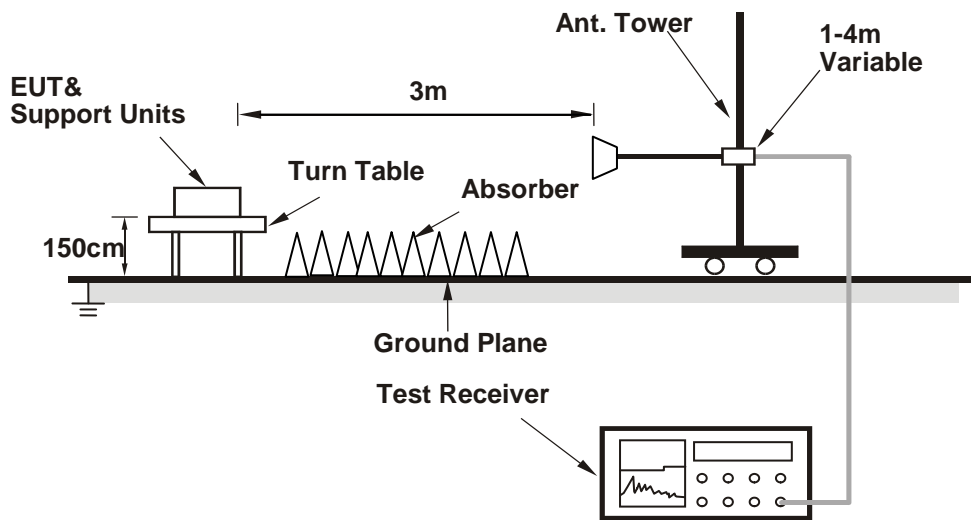
For Radiated emission below 30MHz



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. Connected the EUT with the Laptop which is placed on remote site.
- b. Controlling software (QDART-QCARCT [Ver3.0.197.0]) has been activated to set the EUT on specific status.

4.1.7 Test Results

Above 1GHz Data:

| | | | |
|------------------------|--------------|------------------------------|--------------|
| CHANNEL | TX Channel 0 | 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 | 45.2 PK | 74.0 | -28.8 | 3.86 H | 89 | 46.8 | -1.6 |
| 2 | 2390.00 | 42.9 AV | 54.0 | -11.1 | 3.86 H | 89 | 44.5 | -1.6 |
| 3 | *2402.00 | 100.1 PK | | | 3.86 H | 89 | 101.6 | -1.5 |
| 4 | *2402.00 | 98.1 AV | | | 3.86 H | 89 | 99.6 | -1.5 |
| 5 | 4804.00 | 38.5 PK | 74.0 | -35.5 | 1.70 H | 226 | 35.5 | 3.0 |
| 6 | 4804.00 | 26.4 AV | 54.0 | -27.6 | 1.70 H | 226 | 23.4 | 3.0 |

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 | 47.3 PK | 74.0 | -26.7 | 3.61 V | 141 | 48.9 | -1.6 |
| 2 | 2390.00 | 39.9 AV | 54.0 | -14.1 | 3.61 V | 141 | 41.5 | -1.6 |
| 3 | *2402.00 | 103.8 PK | | | 3.61 V | 141 | 105.3 | -1.5 |
| 4 | *2402.00 | 102.7 AV | | | 3.61 V | 141 | 104.2 | -1.5 |
| 5 | 4804.00 | 39.3 PK | 74.0 | -34.7 | 2.35 V | 257 | 36.3 | 3.0 |
| 6 | 4804.00 | 28.5 AV | 54.0 | -25.5 | 2.35 V | 257 | 25.5 | 3.0 |

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. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

| | | | |
|------------------------|---------------|------------------------------|--------------|
| CHANNEL | TX Channel 19 | 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 | *2440.00 | 100.0 PK | | | 3.89 H | 100 | 101.5 | -1.5 |
| 2 | *2440.00 | 98.0 AV | | | 3.89 H | 100 | 99.5 | -1.5 |
| 3 | 4880.00 | 28.3 PK | 74.0 | -45.7 | 1.71 H | 231 | 25.1 | 3.2 |
| 4 | 4880.00 | 26.4 AV | 54.0 | -27.6 | 1.71 H | 231 | 23.2 | 3.2 |
| 5 | 7320.00 | 42.9 PK | 74.0 | -31.1 | 2.16 H | 233 | 34.0 | 8.9 |
| 6 | 7320.00 | 31.7 AV | 54.0 | -22.3 | 2.16 H | 233 | 22.8 | 8.9 |

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 | *2440.00 | 104.2 PK | | | 2.09 V | 345 | 105.7 | -1.5 |
| 2 | *2440.00 | 103.0 AV | | | 2.09 V | 345 | 104.5 | -1.5 |
| 3 | 4880.00 | 39.5 PK | 74.0 | -34.5 | 2.37 V | 260 | 36.3 | 3.2 |
| 4 | 4880.00 | 28.6 AV | 54.0 | -25.4 | 2.37 V | 260 | 25.4 | 3.2 |
| 5 | 7320.00 | 50.6 PK | 74.0 | -23.4 | 2.10 V | 123 | 41.7 | 8.9 |
| 6 | 7320.00 | 40.1 AV | 54.0 | -13.9 | 2.10 V | 123 | 31.2 | 8.9 |

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. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

| | | | |
|------------------------|---------------|------------------------------|--------------|
| CHANNEL | TX Channel 39 | 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 | *2480.00 | 100.1 PK | | | 3.85 H | 110 | 101.5 | -1.4 |
| 2 | *2480.00 | 98.9 AV | | | 3.85 H | 110 | 100.3 | -1.4 |
| 3 | 2483.50 | 52.0 PK | 74.0 | -22.0 | 3.85 H | 110 | 53.4 | -1.4 |
| 4 | 2483.50 | 40.8 AV | 54.0 | -13.2 | 3.85 H | 110 | 42.2 | -1.4 |
| 5 | 4960.00 | 39.1 PK | 74.0 | -34.9 | 1.73 H | 235 | 35.9 | 3.2 |
| 6 | 4960.00 | 26.7 AV | 54.0 | -27.3 | 1.73 H | 235 | 23.5 | 3.2 |
| 7 | 7440.00 | 43.0 PK | 74.0 | -31.0 | 2.14 H | 224 | 33.8 | 9.2 |
| 8 | 7440.00 | 31.6 AV | 54.0 | -22.4 | 2.14 H | 224 | 22.4 | 9.2 |

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 | *2480.00 | 104.3 PK | | | 2.06 V | 360 | 105.7 | -1.4 |
| 2 | *2480.00 | 103.3 AV | | | 2.06 V | 360 | 104.7 | -1.4 |
| 3 | 2483.50 | 57.3 PK | 74.0 | -16.7 | 2.06 V | 360 | 58.7 | -1.4 |
| 4 | 2483.50 | 46.9 AV | 54.0 | -7.1 | 2.06 V | 360 | 48.3 | -1.4 |
| 5 | 4960.00 | 39.7 PK | 74.0 | -34.3 | 2.41 V | 253 | 36.5 | 3.2 |
| 6 | 4960.00 | 28.7 AV | 54.0 | -25.3 | 2.41 V | 253 | 25.5 | 3.2 |
| 7 | 7440.00 | 50.1 PK | 74.0 | -23.9 | 2.14 V | 118 | 40.9 | 9.2 |
| 8 | 7440.00 | 39.8 AV | 54.0 | -14.2 | 2.14 V | 118 | 30.6 | 9.2 |

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. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

Below 1GHz Data:

| | | | |
|------------------------|---------------|------------------------------|-----------------|
| CHANNEL | TX Channel 39 | 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 | 95.31 | 37.2 QP | 43.5 | -6.3 | 1.50 H | 289 | 50.6 | -13.4 |
| 2 | 250.70 | 39.3 QP | 46.0 | -6.7 | 1.49 H | 178 | 48.8 | -9.5 |
| 3 | 281.18 | 38.2 QP | 46.0 | -7.8 | 1.00 H | 269 | 46.2 | -8.0 |
| 4 | 415.70 | 35.4 QP | 46.0 | -10.6 | 1.50 H | 266 | 40.1 | -4.7 |
| 5 | 499.96 | 36.1 QP | 46.0 | -9.9 | 1.59 H | 281 | 38.8 | -2.7 |
| 6 | 665.45 | 30.4 QP | 46.0 | -15.6 | 1.00 H | 49 | 29.9 | 0.5 |

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 | 37.50 | 33.4 QP | 40.0 | -6.6 | 1.43 V | 229 | 42.5 | -9.1 |
| 2 | 65.24 | 33.4 QP | 40.0 | -6.6 | 1.41 V | 257 | 43.3 | -9.9 |
| 3 | 110.15 | 34.7 QP | 43.5 | -8.8 | 1.00 V | 296 | 45.9 | -11.2 |
| 4 | 255.46 | 35.6 QP | 46.0 | -10.4 | 1.00 V | 296 | 44.9 | -9.3 |
| 5 | 500.01 | 34.6 QP | 46.0 | -11.4 | 1.00 V | 214 | 37.2 | -2.6 |
| 6 | 941.22 | 35.6 QP | 46.0 | -10.4 | 1.49 V | 226 | 30.9 | 4.7 |

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. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value

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, 2016 | Oct. 23, 2017 |
| Line-Impedance Stabilization Network (for EUT) R&S | ESH3-Z5 | 848773/004 | Oct. 26, 2016 | Oct. 25, 2017 |
| Line-Impedance Stabilization Network (for Peripheral) R&S | ENV216 | 100072 | June 13, 2016 | June 12, 2017 |
| 50 ohms Terminator | N/A | EMC-02 | Sep. 29, 2016 | Sep. 28, 2017 |
| RF Cable | 5D-FB | COCCAB-001 | Sep. 30, 2016 | Sep. 29, 2017 |
| 10 dB PAD Mini-Circuits | HAT-10+ | CONATT-004 | June 20, 2016 | June 19, 2017 |
| 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 Shielded Room No. 1.
3. Tested Date: May 18, 2017

4.2.3 Test Procedures

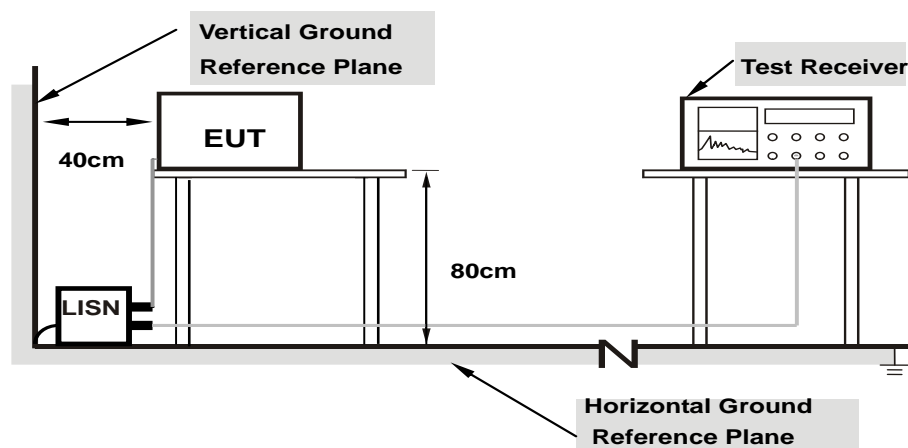
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance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

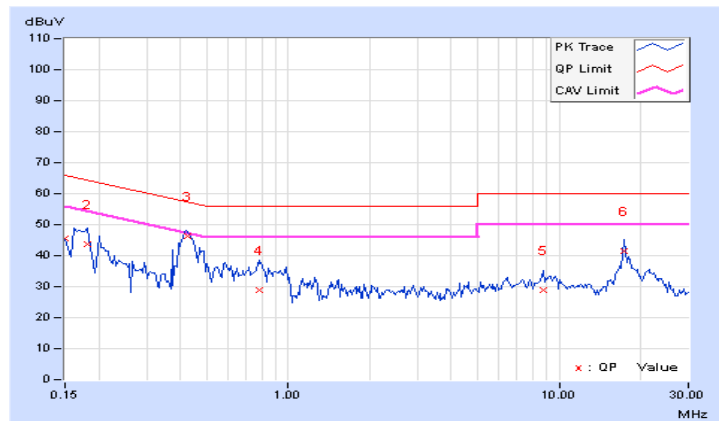
4.2.7 Test Results

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

| No | Freq. [MHz] | Corr. | Reading Value | | Emission Level | | Limit | | Margin | |
|----|----------------|----------------|---------------|-------|----------------|-------|-----------|-------|--------|--------|
| | | Factor (dB) | [dB (uV)] | | [dB (uV)] | | [dB (uV)] | | (dB) | |
| | | | Q.P. | AV. | Q.P. | AV. | Q.P. | AV. | Q.P. | AV. |
| 1 | 0.15000 | 10.19 | 35.25 | 15.77 | 45.44 | 25.96 | 66.00 | 56.00 | -20.56 | -30.04 |
| 2 | 0.18125 | 10.19 | 33.44 | 19.46 | 43.63 | 29.65 | 64.43 | 54.43 | -20.80 | -24.78 |
| 3 | 0.42600 | 10.22 | 36.15 | 29.22 | 46.37 | 39.44 | 57.33 | 47.33 | -10.96 | -7.89 |
| 4 | 0.78672 | 10.25 | 18.80 | 7.67 | 29.05 | 17.92 | 56.00 | 46.00 | -26.95 | -28.08 |
| 5 | 8.72656 | 10.48 | 18.47 | 12.52 | 28.95 | 23.00 | 60.00 | 50.00 | -31.05 | -27.00 |
| 6 | 17.44425 | 11.21 | 30.12 | 27.99 | 41.33 | 39.20 | 60.00 | 50.00 | -18.67 | -10.80 |

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.

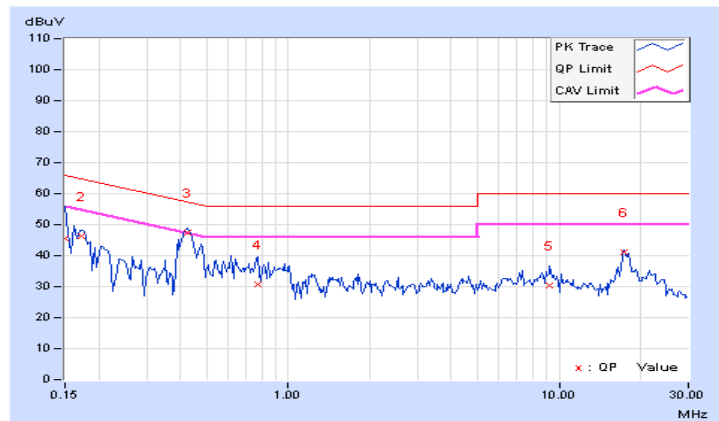


| | | | |
|-------|-------------|-------------------|--------------------------------|
| Phase | Neutral (N) | Detector Function | Quasi-Peak (QP) / Average (AV) |
|-------|-------------|-------------------|--------------------------------|

| No | Freq. [MHz] | Corr. | Reading Value | | Emission Level | | Limit | | Margin | |
|----------|----------------|----------------|---------------|--------------|----------------|--------------|--------------|--------------|---------------|--------------|
| | | Factor (dB) | [dB (uV)] | | [dB (uV)] | | [dB (uV)] | | (dB) | |
| | | | Q.P. | AV. | Q.P. | AV. | Q.P. | AV. | Q.P. | AV. |
| 1 | 0.15000 | 10.18 | 35.48 | 16.88 | 45.66 | 27.06 | 66.00 | 56.00 | -20.34 | -28.94 |
| 2 | 0.17172 | 10.17 | 35.95 | 26.01 | 46.12 | 36.18 | 64.88 | 54.88 | -18.76 | -18.70 |
| 3 | 0.42344 | 10.21 | 37.02 | 30.21 | 47.23 | 40.42 | 57.38 | 47.38 | -10.15 | -6.96 |
| 4 | 0.77500 | 10.22 | 20.37 | 9.07 | 30.59 | 19.29 | 56.00 | 46.00 | -25.41 | -26.71 |
| 5 | 9.25391 | 10.45 | 19.95 | 13.62 | 30.40 | 24.07 | 60.00 | 50.00 | -29.60 | -25.93 |
| 6 | 17.44531 | 10.99 | 30.02 | 27.79 | 41.01 | 38.78 | 60.00 | 50.00 | -18.99 | -11.22 |

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.

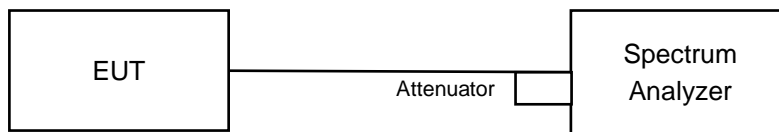


4.3 6dB Bandwidth Measurement

4.3.1 Limits of 6dB Bandwidth Measurement

The minimum of 6dB Bandwidth Measurement is 0.5 MHz.

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 Procedure

- a. Set resolution bandwidth (RBW) = 100kHz
- b. Set the video bandwidth (VBW) $\geq 3 \times$ RBW, Detector = Peak.
- c. Trace mode = max hold.
- d. Sweep = auto couple.
- e. Measure the maximum width of the emission that is constrained by the frequencies associated with the two amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission

4.3.5 Deviation from Test Standard

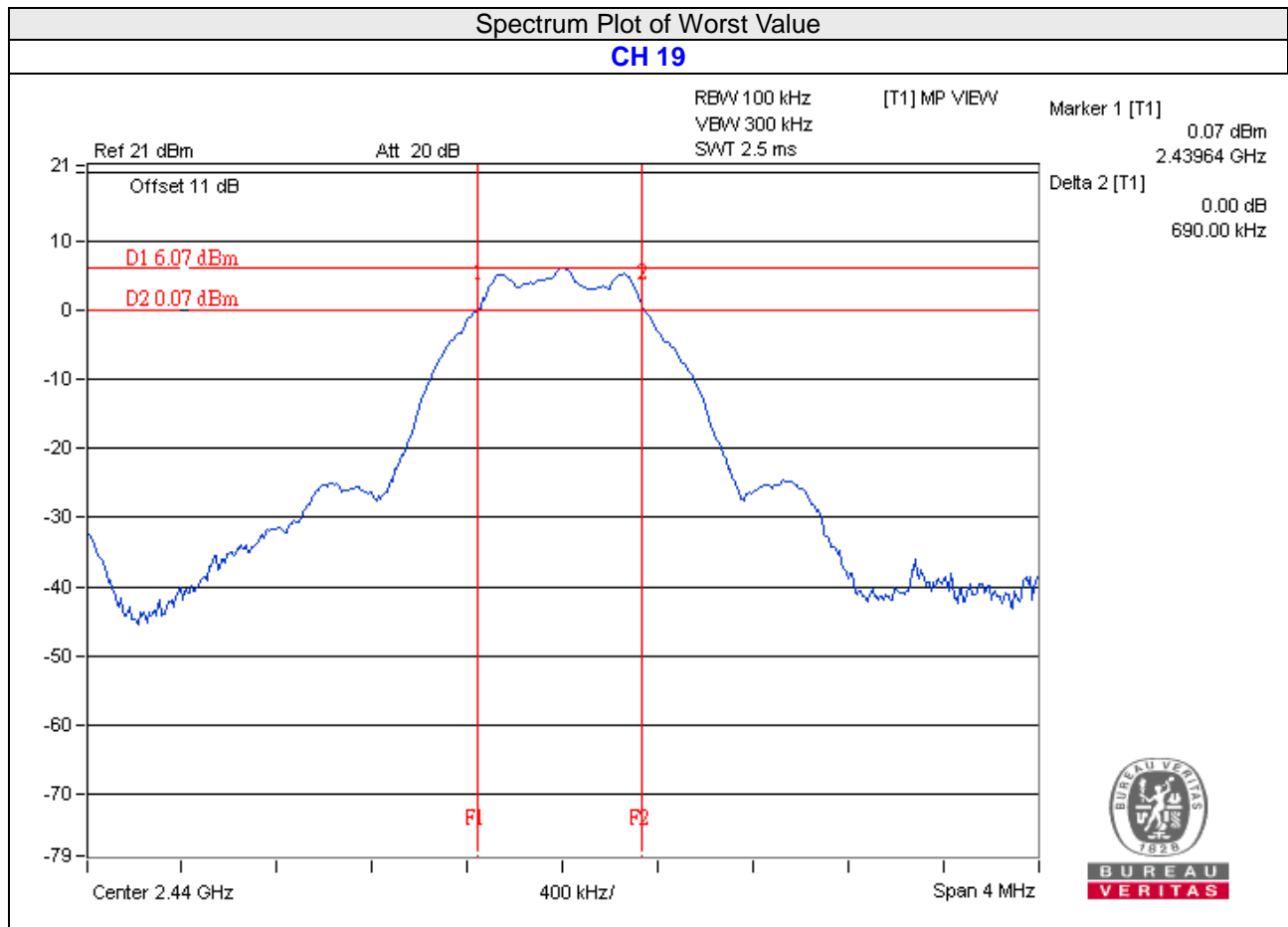
No deviation.

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 Result

| Channel | Frequency (MHz) | 6dB Bandwidth (MHz) | Minimum Limit (MHz) | Pass / Fail |
|---------|-----------------|---------------------|---------------------|-------------|
| 0 | 2402 | 0.70 | 0.5 | Pass |
| 19 | 2440 | 0.69 | 0.5 | Pass |
| 39 | 2480 | 0.70 | 0.5 | Pass |

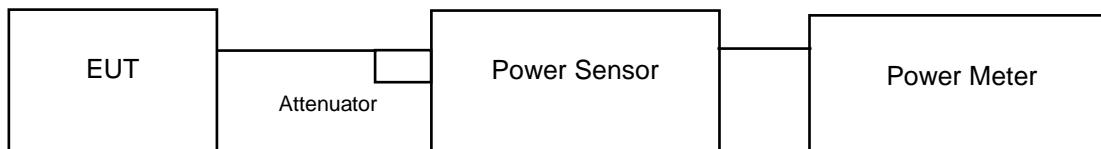


4.4 Conducted Output Power Measurement

4.4.1 Limits OF Conducted Output Power Measurement

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

4.4.2 Test Setup



4.4.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.4.4 Test Procedures

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

4.4.5 Deviation from Test Standard

No deviation.

4.4.6 EUT Operating Conditions

Same as Item 4.3.6.

4.4.7 Test Results

FOR PEAK POWER

| Channel | Frequency (MHz) | Peak Power (mW) | Peak Power (dBm) | Limit (dBm) | Pass/Fail |
|---------|-----------------|-----------------|------------------|-------------|-----------|
| 0 | 2402 | 3.882 | 5.89 | 30 | Pass |
| 19 | 2440 | 4.732 | 6.75 | 30 | Pass |
| 39 | 2480 | 5.07 | 7.05 | 30 | Pass |

FOR AVERAGE POWER

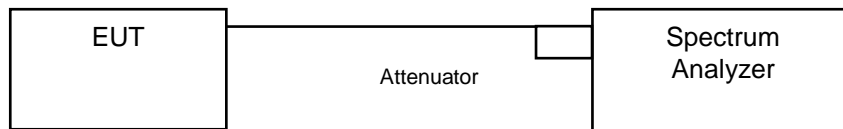
| Channel | Frequency (MHz) | Average Power (mW) | Average Power (dBm) |
|---------|-----------------|--------------------|---------------------|
| 0 | 2402 | 3.443 | 5.37 |
| 19 | 2440 | 4.385 | 6.42 |
| 39 | 2480 | 4.71 | 6.73 |

4.5 Power Spectral Density Measurement

4.5.1 Limits of Power Spectral Density Measurement

The Maximum of Power Spectral Density Measurement is 8dBm.

4.5.2 Test Setup



4.5.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.5.4 Test Procedure

- a. Set analyzer center frequency to DTS channel center frequency.
- b. Set the span to 1.5 times the DTS bandwidth.
- c. Set the RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
- d. Set the VBW $\geq 3 \times \text{RBW}$.
- e. Detector = peak.
- f. Sweep time = auto couple.
- g. Trace mode = max hold.
- h. Allow trace to fully stabilize.
- i. Use the peak marker function to determine the maximum amplitude level within the RBW.

4.5.5 Deviation from Test Standard

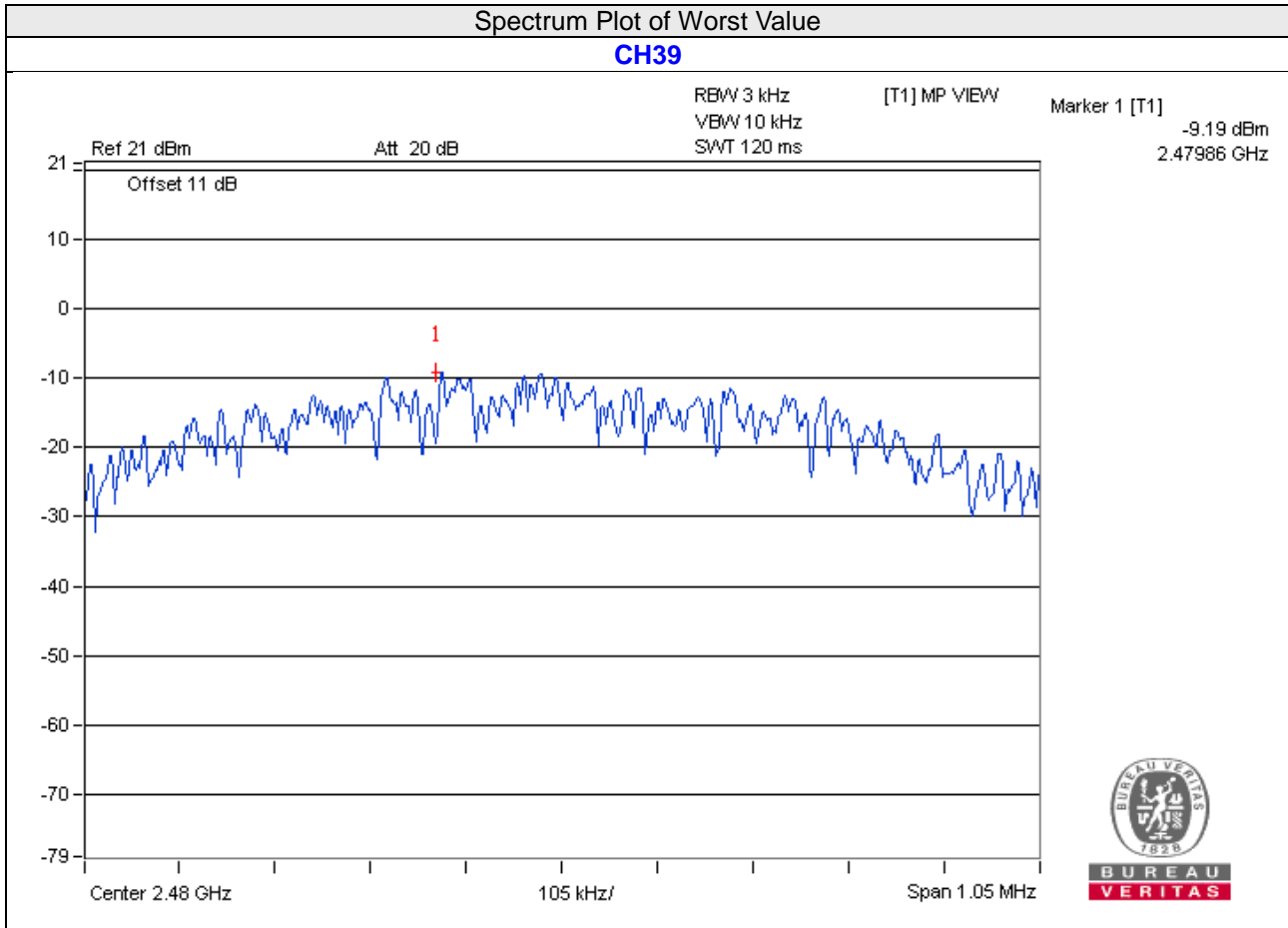
No deviation.

4.5.6 EUT Operating Condition

Same as Item 4.3.6

4.5.7 Test Results

| Channel | Freq. (MHz) | PSD (dBm/3kHz) | Limit (dBm/3kHz) | Pass /Fail |
|---------|-------------|----------------|------------------|------------|
| 0 | 2402 | -10.67 | 8 | Pass |
| 19 | 2440 | -9.48 | 8 | Pass |
| 39 | 2480 | -9.19 | 8 | Pass |

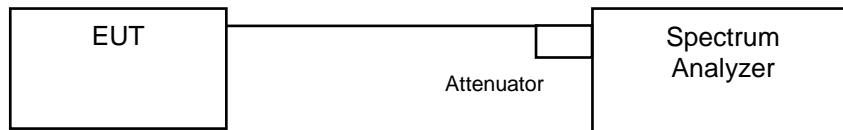


4.6 Conducted Out of Band Emission Measurement

4.6.1 Limits of Conducted Out of Band Emission Measurement

Below -20dB of the highest emission level of operating band (in 100kHz Resolution Bandwidth).

4.6.2 Test Setup



4.6.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.6.4 Test Procedure

MEASUREMENT PROCEDURE REF

1. Set the RBW = 100 kHz.
2. Set the VBW \geq 300 kHz.
3. Detector = peak.
4. Sweep time = auto couple.
5. Trace mode = max hold.
6. Allow trace to fully stabilize.
7. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.

MEASUREMENT PROCEDURE OOB

1. Set RBW = 100 kHz.
2. Set VBW \geq 300 kHz.
3. Detector = peak.
4. Sweep = auto couple.
5. Trace Mode = max hold.
6. Allow trace to fully stabilize.
7. Use the peak marker function to determine the maximum amplitude level.

4.6.5 Deviation from Test Standard

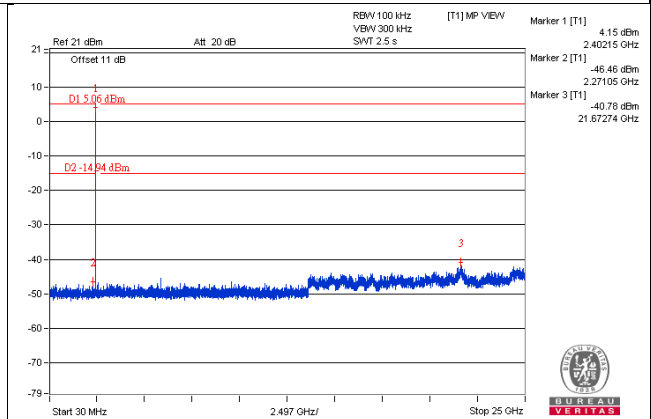
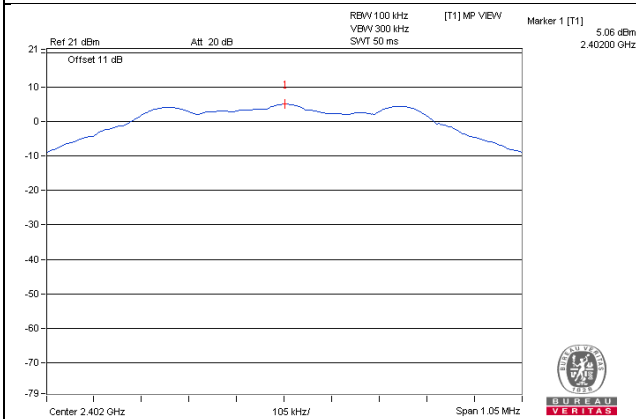
No deviation.

4.6.6 EUT Operating Condition

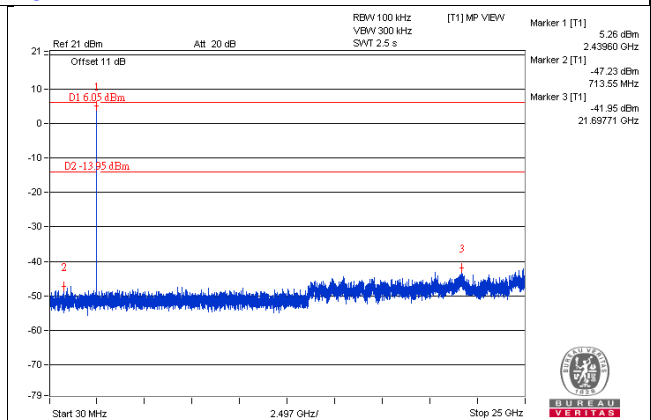
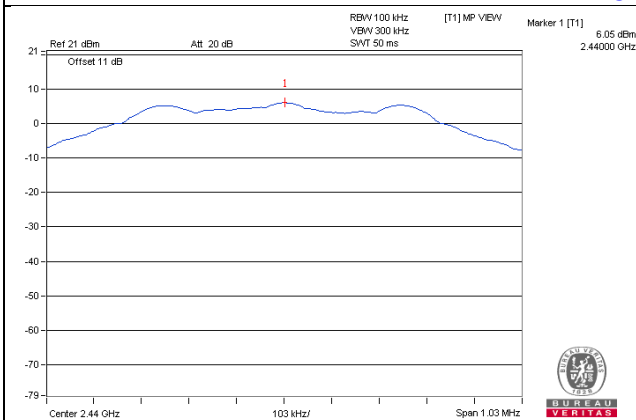
Same as Item 4.3.6

4.6.7 Test Results

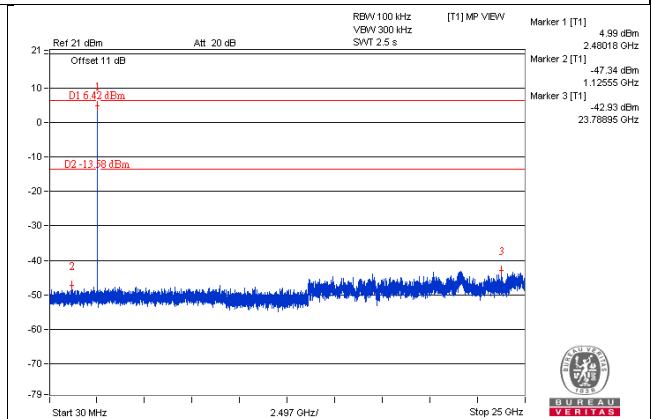
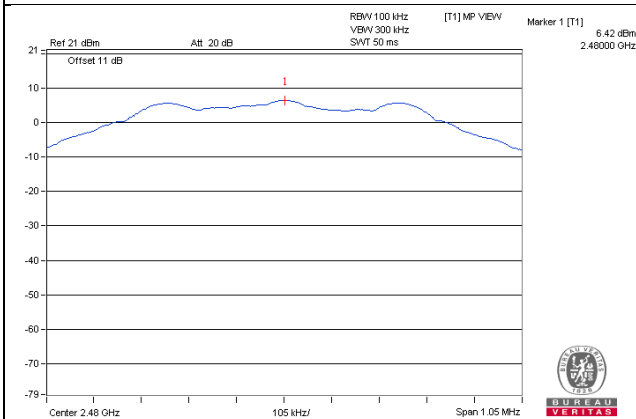
CH 0



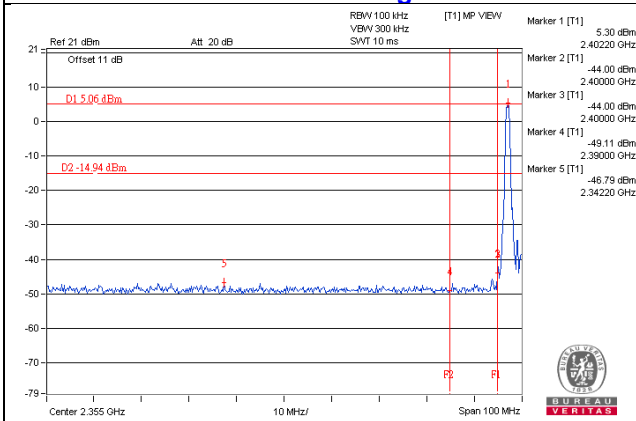
CH 19



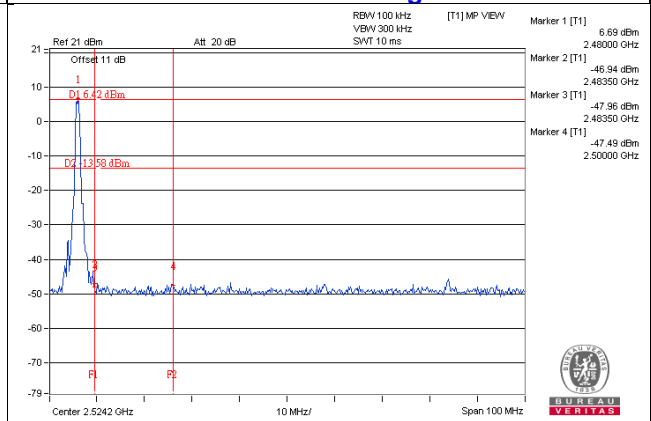
CH 39



CH 0 Band edge



CH 39 Band edge



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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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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