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FCC TEST REPORT (RFID)

REPORT NO.: RF140704E05

MODEL NO.: xCE-25-C

FCC ID: MQT-E25C

RECEIVED: July 04, 2014

TESTED: July 08 to 31, 2014

ISSUED: Aug. 18, 2014

APPLICANT: XAC AUTOMATION CORP.

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

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RELEASE CONTROL RECORD

| ISSUE NO. | REASON FOR CHANGE | DATE ISSUED |
|-------------|-------------------|---------------|
| RF140704E05 | Original release | Aug. 18, 2014 |



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1 CERTIFICATION

PRODUCT : PINPAD
BRAND NAME : XAC
MODEL NO. : xCE-25-C
TEST SAMPLE : ENGINEERING SAMPLE
APPLICANT : XAC AUTOMATION CORP.
TESTED : July 08 to 31, 2014
STANDARDS: FCC Part 15, Subpart C (Section 15.225)
FCC Part 15, Subpart C (Section 15.215)
ANSI C63.10-2009

The above equipment (Model: xCE-25-C) 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 : Midoli Peng , **DATE:** Aug. 18, 2014
(Midoli Peng, Specialist)

APPROVED BY : May Chen , **DATE:** Aug. 18, 2014
(May Chen, Manager)



2 SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

| APPLIED STANDARD: FCC PART 15, SUBPART C (SECTION 15.225, 15.215) | | | |
|---|---|--------|---|
| STANDARD SECTION | TEST TYPE AND LIMIT | RESULT | REMARK |
| 15.207 | Conducted emission test | PASS | Meet the requirement of limit. Minimum passing margin is -19.44dB at 27.12109MHz. |
| 15.225 (a) | The field strength of any emissions within the band 13.553-13.567 MHz | PASS | Meet the requirement of limit. Minimum passing margin is -54.23dB at 13.56MHz |
| 15.225 (d) | The field strength of any emissions appearing outside of the 13.110-14.010 MHz band | PASS | Meet the requirement of limit. Minimum passing margin is -3.2dB at 949.22MHz |
| 15.225 (e) | The frequency tolerance | PASS | Meet the requirement of limit. |
| 15.215 (c) | 20dB Bandwidth | PASS | Meet the requirement of limit. |

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:

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$.

| Measurement | Value |
|------------------------------|---------|
| Conducted Emission | 2.86 dB |
| Radiated emissions-Chamber G | 5.37 dB |
| Radiated emissions-Chamber H | 5.43 dB |

3 GENERAL INFORMATION

3.1 GENERAL DESCRIPTION OF EUT(RFID)

| | |
|----------------------------|--|
| PRODUCT | PINPAD |
| MODEL NO. | xCE-25-C |
| POWER SUPPLY | DC 3.7V from Battery DC 5V from power adapter |
| MODULATION TYPE | ASK |
| OPERATING FREQUENCY | 13.56MHz |
| NUMBER OF CHANNEL | 1 |
| ANTENNA TYPE | Please see NOTE |
| DATA CABLE | NA |
| I/O PORTS | Refer to user's manual |
| ASSOCIATED DEVICES | Adapter x 1 |

NOTE:

1. There are Bluetooth 4.0 and RFID technology used for the EUT.
2. Bluetooth and RFID technology can not transmit at same time.
3. The antennas provided to the EUT, please refer to the following table:

| BT Antenna Spec. | | | | | |
|---------------------------|-----------------|--------------|-------------------|-----------|------------------------------|
| Brand | Model No. | Antenna Type | Antenna Connector | Gain(dBi) | Frequency range (MHz to MHz) |
| ACX | AT3216-T2R4 PAA | Chip | NA | 1.5 | 2400~2500 |
| RFID Antenna Spec. | | | | | |
| Brand | Model No. | Antenna Type | Antenna Connector | Gain(dBi) | Frequency range (MHz) |
| XAC | 39cm wire | Wire | NA | NA | 13.56 |

4. The EUT could be supplied with DC 3.7V battery or power adapter as the following table:

| Item | Brand | Model No. | Spec. |
|---------|-------|----------------------|--|
| Battery | Large | 523450 | 1050mAh, 3.7V |
| Adapter | MOSO | MSP-C1000IC5.0-5W-zz | AC input: 100-240V, 50/60Hz, 0.25A DC output: 5V, 1A DC output cable: Unshielded, 1.8m |

5. The EUT is pre-tested under following test modes :

| Pre-test Mode | Description |
|---------------|---------------------|
| Mode A | Battery mode |
| Mode B | Adapter mode |

For the above modes, the worse radiated emissions test was found in **Mode B**. Therefore only the test data of the modes were recorded in this report.

6. For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.

3.2 DESCRIPTION OF TEST MODES

The EUT only has 1 channel.

| CHANNEL | FREQUENCY (MHz) |
|---------|-----------------|
| 1 | 13.56 |

3.2.1 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL

| EUT CONFIGURE MODE | APPLICABLE TO | | | | | DESCRIPTION |
|--------------------|---------------|------------------|------------------|----|----|-------------|
| | PLC | RE (Below 30MHz) | RE (Above 30MHz) | BW | FC | |
| - | √ | √ | √ | √ | √ | - |

Where **PLC**: Power Line Conducted Emission **RE**: Radiated Emission
BW: 20dB Bandwidth **FS**: Frequency Stability

POWER LINE CONDUCTED EMISSION TEST:

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

| EUT CONFIGURE MODE | AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION TYPE |
|--------------------|-------------------|----------------|-----------------|
| - | 1 | 1 | ASK |

RADIATED EMISSION TEST(BELOW 30MHz):

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

| EUT CONFIGURE MODE | AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION TYPE |
|--------------------|-------------------|----------------|-----------------|
| - | 1 | 1 | ASK |

**RADIATED EMISSION TEST(ABOVE 30MHz):**

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

| EUT CONFIGURE MODE | AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION TYPE |
|--------------------|-------------------|----------------|-----------------|
| - | 1 | 1 | ASK |

20dB BANDWIDTH:

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

| EUT CONFIGURE MODE | AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION TYPE |
|--------------------|-------------------|----------------|-----------------|
| - | 1 | 1 | ASK |

FREQUENCY STABILITY:

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

| EUT CONFIGURE MODE | AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION TYPE |
|--------------------|-------------------|----------------|-----------------|
| - | 1 | 1 | ASK |

TEST CONDITION:

| APPLICABLE TO | ENVIRONMENTAL CONDITIONS | INPUT POWER | TESTED BY |
|---------------|--------------------------|--------------|------------|
| PLC | 30deg. C, 70%RH | 120Vac, 60Hz | Mike Hsieh |
| RE | 25deg. C, 68%RH | 120Vac, 60Hz | Tim Ho |
| | 25deg. C, 69%RH | 120Vac, 60Hz | Tim Ho |
| BW | 25deg. C, 60%RH | 120Vac, 60Hz | Chilin Lee |
| FS | 25deg. C, 60%RH | 120Vac, 60Hz | Chilin Lee |



3.3 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 (15.225)

FCC Part 15, Subpart C (15.215)

ANSI C63.10-2009

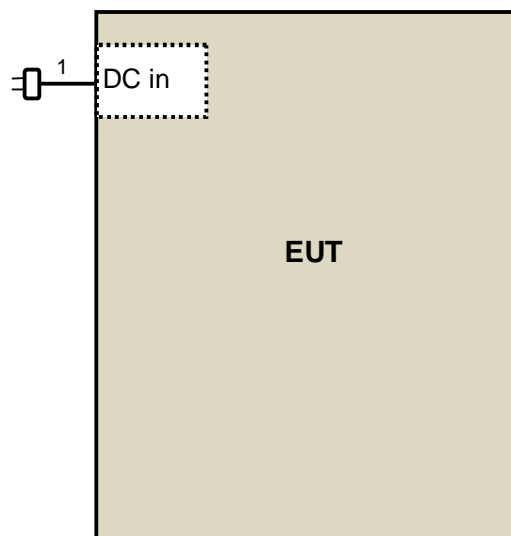
All test items have been performed and recorded as per the above standards.

3.4 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit.

| No. | Cable | Qty. | Length (m) | Shielded (Yes/ No) | Cores (Number) | Remark |
|-----|-------|------|------------|--------------------|----------------|--------------------|
| 1 | USB | 1 | 1.5 | No | 0 | Supplied by client |

3.5 CONFIGURATION OF SYSTEM UNDER TEST





4 TEST PROCEDURES AND RESULTS

4.1 CONDUCTED EMISSION MEASUREMENT

4.1.1 LIMITS OF CONDUCTED EMISSION MEASUREMENT

| FREQUENCY OF EMISSION (MHz) | CONDUCTED LIMIT (dBµV) | |
|-----------------------------|------------------------|----------|
| | Quasi-peak | Average |
| 0.15-0.5 | 66 to 56 | 56 to 46 |
| 0.5-5 | 56 | 46 |
| 5-30 | 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 0.50 MHz.

4.1.2 TEST INSTRUMENTS

| DESCRIPTION & MANUFACTURER | MODEL NO. | SERIAL NO. | CALIBRATED DATE | CALIBRATED UNTIL |
|---|-----------------------------|------------|-----------------|------------------|
| Test Receiver ROHDE & SCHWARZ | ESCS 30 | 100375 | Apr. 29, 2014 | Apr. 28, 2015 |
| Line-Impedance Stabilization Network (for EUT) SCHWARZBECK | NSLK8127 | 8127-522 | Sep. 12, 2013 | Sep. 11, 2014 |
| Line-Impedance Stabilization Network (for Peripheral) | ENV216 | 100071 | Nov. 13, 2013 | Nov. 12, 2014 |
| RF Cable (JYEBAO) | 5DFB | COCCAB-001 | Mar. 10 , 2014 | Mar. 09, 2015 |
| 50 ohms Terminator | N/A | EMC-03 | Sep. 24, 2013 | Sep. 23, 2014 |
| 50 ohms Terminator | N/A | EMC-02 | Oct. 01, 2013 | Sep. 30, 2014 |
| Software ADT | BV ADT_Cond_V7.3.7. 3 | NA | NA | NA |

Note:

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in Shielded Room No. C.
- 3 The VCCI Con C Registration No. is C-3611.
- 4 Tested Date: July 28, 2014

4.1.3 TEST PROCEDURES

- The EUT/HOST was placed 0.4 meters from the conducting wall of the shielded room with EUT/HOST 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/HOST were checked for maximum conducted interference.
- The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

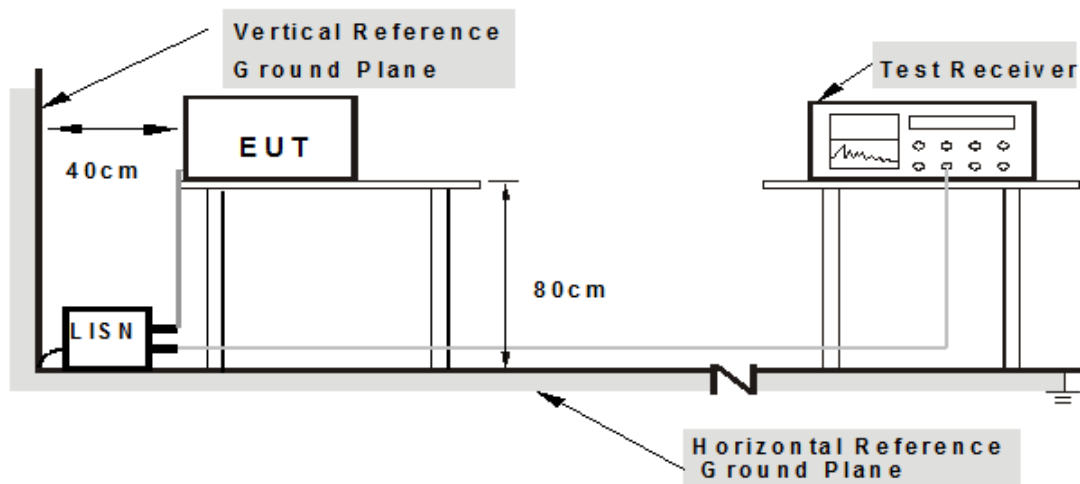
NOTE:

- The resolution bandwidth of test receiver is 9kHz for Quasi-peak detection (QP) & Average detection (AV).

4.1.4 DEVIATION FROM TEST STANDARD

No deviation

4.1.5 TEST SETUP



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

For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.



4.1.6 EUT OPERATING CONDITIONS

1. Turn on the power of all equipment.
2. The EUT runs a test program "PTest.exe" to under transmission condition (RFID) continuously.

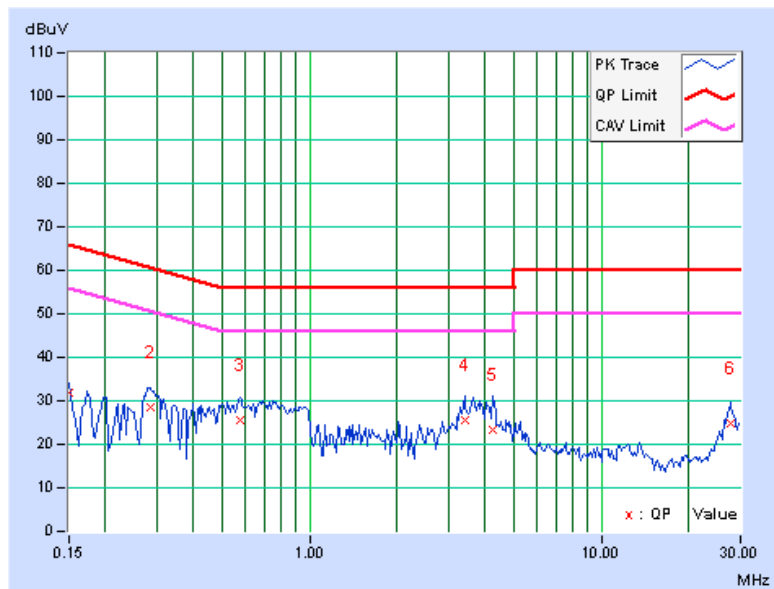
4.1.7 TEST RESULTS

| | | | |
|--------------|----------|----------------------|--------------------------------|
| PHASE | Line (L) | 6dB BANDWIDTH | Quasi-Peak (QP) / Average (AV) |
|--------------|----------|----------------------|--------------------------------|

| No | Freq. | Corr. | Reading Value | | Emission Level | | Limit | | Margin | |
|----|----------|--------|---------------|-------|----------------|-------|-----------|-------|--------|--------|
| | [MHz] | Factor | [dB (uV)] | | [dB (uV)] | | [dB (uV)] | | (dB) | |
| | | (dB) | Q.P. | AV. | Q.P. | AV. | Q.P. | AV. | Q.P. | AV. |
| 1 | 0.15000 | 0.07 | 31.75 | 24.99 | 31.82 | 25.06 | 66.00 | 56.00 | -34.18 | -30.94 |
| 2 | 0.28672 | 0.08 | 28.61 | 20.57 | 28.69 | 20.65 | 60.62 | 50.62 | -31.93 | -29.97 |
| 3 | 0.57578 | 0.10 | 25.38 | 14.33 | 25.48 | 14.43 | 56.00 | 46.00 | -30.52 | -31.57 |
| 4 | 3.41406 | 0.23 | 25.29 | 19.13 | 25.52 | 19.36 | 56.00 | 46.00 | -30.48 | -26.64 |
| 5 | 4.24609 | 0.27 | 23.16 | 15.71 | 23.43 | 15.98 | 56.00 | 46.00 | -32.57 | -30.02 |
| 6 | 27.60156 | 0.93 | 24.02 | 15.68 | 24.95 | 16.61 | 60.00 | 50.00 | -35.05 | -33.39 |

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

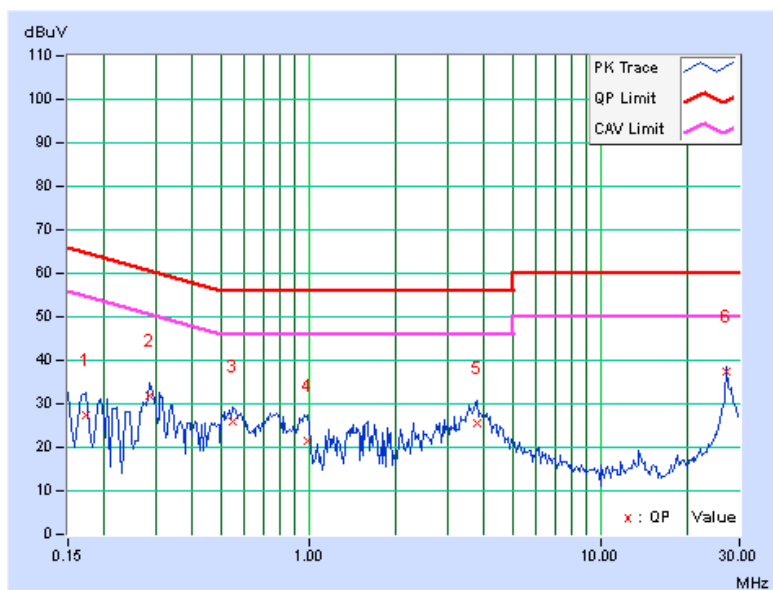


| | | | |
|--------------|-------------|----------------------|--------------------------------|
| PHASE | Neutral (N) | 6dB BANDWIDTH | Quasi-Peak (QP) / Average (AV) |
|--------------|-------------|----------------------|--------------------------------|

| No | Freq. | Corr. | Reading Value | | Emission Level | | Limit | | Margin | |
|----------|-----------------|-------------|---------------|--------------|----------------|--------------|--------------|--------------|---------------|---------------|
| | [MHz] | Factor (dB) | [dB (uV)] | | [dB (uV)] | | [dB (uV)] | | (dB) | |
| | | | Q.P. | AV. | Q.P. | AV. | Q.P. | AV. | Q.P. | AV. |
| 1 | 0.17344 | 0.07 | 27.43 | 16.27 | 27.50 | 16.34 | 64.79 | 54.79 | -37.29 | -38.45 |
| 2 | 0.28672 | 0.08 | 31.73 | 25.87 | 31.81 | 25.95 | 60.62 | 50.62 | -28.81 | -24.67 |
| 3 | 0.55234 | 0.10 | 26.01 | 18.44 | 26.11 | 18.54 | 56.00 | 46.00 | -29.89 | -27.46 |
| 4 | 0.99766 | 0.13 | 21.52 | 12.76 | 21.65 | 12.89 | 56.00 | 46.00 | -34.35 | -33.11 |
| 5 | 3.80469 | 0.25 | 25.37 | 17.76 | 25.62 | 18.01 | 56.00 | 46.00 | -30.38 | -27.99 |
| 6 | 27.12109 | 0.90 | 36.68 | 29.66 | 37.58 | 30.56 | 60.00 | 50.00 | -22.42 | -19.44 |

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





4.2 RADIATED EMISSION MEASUREMENT

4.2.1 LIMITS OF RADIATED EMISSION MEASUREMENT

The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.

The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in § 15.209.

| 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. As shown in 15.35(b), 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.



4.2.2 TEST INSTRUMENTS

For below 30MHz:

| DESCRIPTION & MANUFACTURER | MODEL NO. | SERIAL NO. | CALIBRATED DATE | CALIBRATED UNTIL |
|--|--------------------------|----------------------------|-----------------|------------------|
| MXE EMI Receiver Agilent | N9038A | MY51210105 | July 21,2014 | July 20,2015 |
| Pre-Amplifier EMCI | EMC001340 | 980142 | Jan. 13, 2014 | Jan. 12, 2015 |
| Loop Antenna ⁽⁷⁾ Electro-Metrics | EM-6879 | 264 | Dec. 10, 2012 | Dec. 09, 2014 |
| RF Cable | NA | LOOPCAB-001 LOOPCAB-002 | Jan. 19, 2014 | Jan. 18, 2015 |
| Software | ADT_Radiated _V8.7.07 | NA | NA | NA |
| Antenna Tower & Turn Table CT | NA | NA | NA | NA |

Note:

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The horn antenna, preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
- 3 *The calibration interval of the above test instruments is 24 months and the calibrations are traceable to NML/ROC and NIST/USA.
4. The test was performed in 966 Chamber No. G.
- 5 The FCC Site Registration No. is 966073.
- 6 The VCCI Site Registration No. is G-137.
- 7 The CANADA Site Registration No. is IC 7450H-2.
- 8 Tested Date: July 21 to 31, 2014



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For 30~1000MHz:

| DESCRIPTION & MANUFACTURER | MODEL NO. | SERIAL NO. | CALIBRATED DATE | CALIBRATED UNTIL |
|---|--------------------------|------------|-----------------|------------------|
| MXE EMI Receiver Agilent | N9038A | MY50010156 | Jan. 15, 2014 | Jan. 14, 2015 |
| Pre-Amplifier Mini-Circuits | ZFL-1000VH2 B | AMP-ZFL-04 | Nov. 13, 2013 | Nov. 12, 2014 |
| Trilog Broadband Antenna SCHWARZBECK | VULB 9168 | 9168-361 | Feb. 27, 2014 | Feb. 26, 2015 |
| RF Cable | NA | CHHCAB_001 | Oct. 06, 2013 | Oct. 05, 2014 |
| Software | ADT_Radiated _V8.7.07 | NA | NA | NA |
| Antenna Tower & Turn Table CT | NA | NA | NA | NA |

Note:

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The horn antenna, preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
3. The test was performed in 966 Chamber No. H.
- 4 The FCC Site Registration No. is 797305.
- 5 The CANADA Site Registration No. is IC 7450H-3.
- 6 Tested Date: July 08, 2014

4.2.3 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 30~1000MHz

- 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. 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.

NOTE:

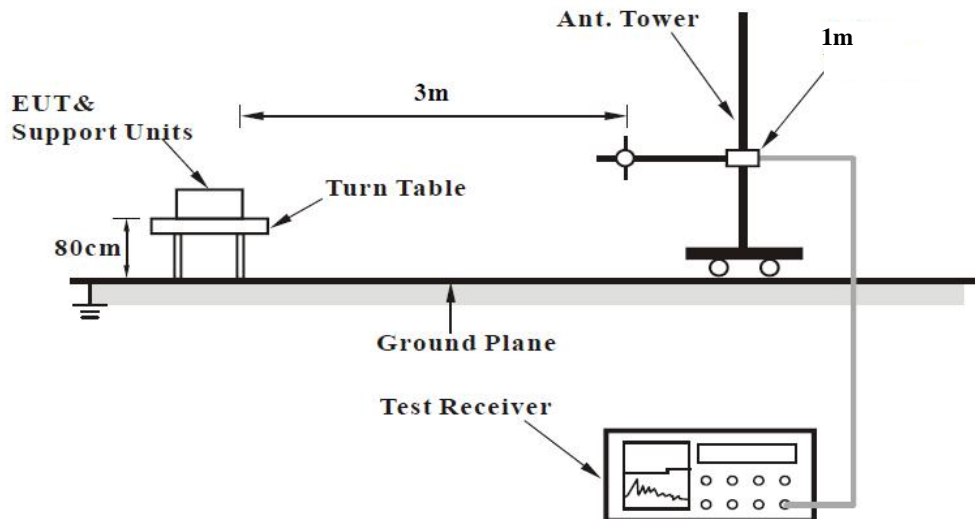
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency 30MHz ~ 1GHz.

4.2.4 DEVIATION FROM TEST STANDARD

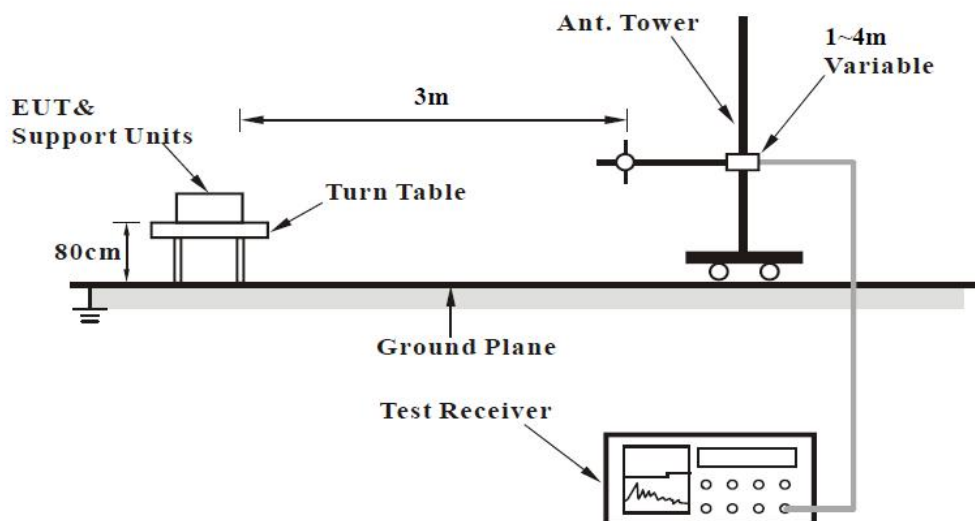
No deviation

4.2.5 TEST SETUP

For Radiated emission below 30MHz



For Radiated emission 30~1000MHz



For the actual test configuration, please refer to the related item in this test report - Photographs of the Test Configuration.

4.2.6 EUT OPERATING CONDITIONS

Set the transmitter part of EUT under transmission condition continuously at specific channel frequency.

4.2.7 TEST RESULTS

| | | | |
|------------------------|--------------------|--------------------------|-----------------|
| FREQUENCY RANGE | 13.553 ~ 13.567MHz | DETECTOR FUNCTION | Quasi-Peak (QP) |
|------------------------|--------------------|--------------------------|-----------------|

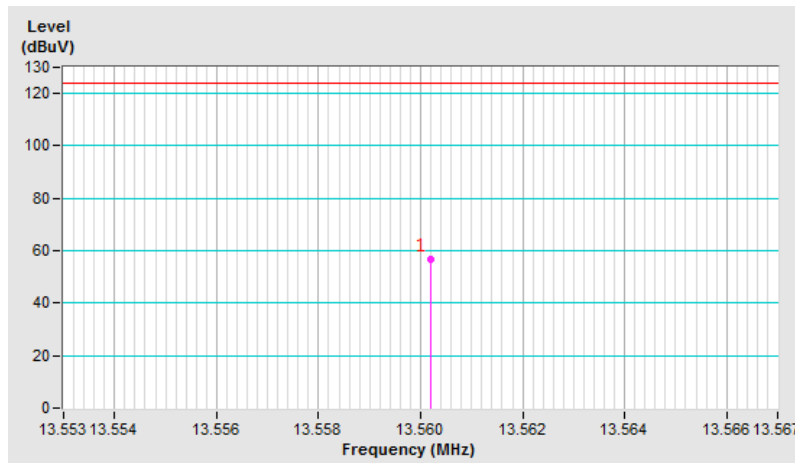
| LOOP ANTENNA TEST DISTANCE: AT 3 M (X AXIS) | | | | | | | | |
|---|-------------|-------------------------|----------------|-------------|--------------------|----------------------|------------------|--------------------------|
| No. | Freq. (MHz) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (m) | Table Angle (Degree) | Raw Value (dBuV) | Correction Factor (dB/m) |
| 1 | *13.56 | 56.94 QP | 124.00 | -67.06 | 1.00 | 268 | 60.58 | -3.64 |

- 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.

The measured field strength was extrapolated to distance 30 meters, using the formula that the limit of field strength varies as the inverse distance square (40dB per decade of distance)

Example:

$$\begin{aligned}
 13.56\text{MHz} &= 15848\mu\text{V/m} && 30\text{m} \\
 &= 84\text{dBuV/m} && 30\text{m} \\
 &= 84+20\log(30/3)^2 && 3\text{m} \\
 &= 124\text{dBuV/m}
 \end{aligned}$$





| | | | |
|------------------------|--------------------|--------------------------|-----------------|
| FREQUENCY RANGE | 13.553 ~ 13.567MHz | DETECTOR FUNCTION | Quasi-Peak (QP) |
|------------------------|--------------------|--------------------------|-----------------|

LOOP ANTENNA TEST DISTANCE: AT 3 M (Y AXIS)

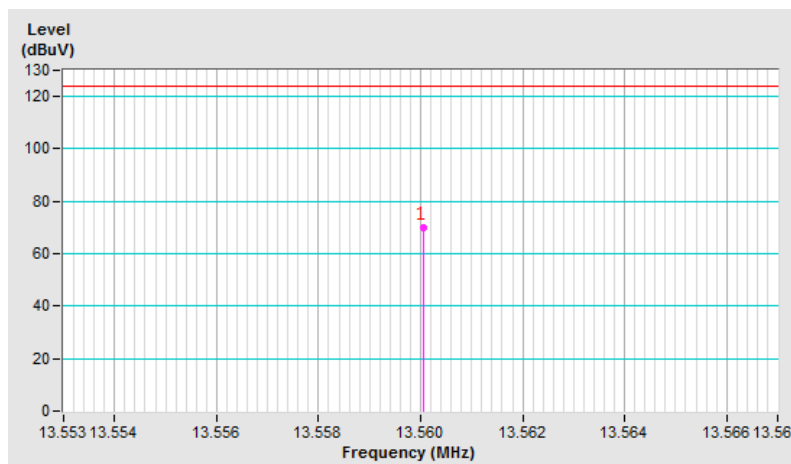
| NO. | FREQ. (MHz) | EMISSION LEVEL (dBuV/m) | LIMIT (dBuV/m) | MARGIN (dB) | ANTENNA HEIGHT (m) | TABLE ANGLE (Degree) | RAW VALUE (dBuV) | CORRECTION FACTOR (dB/m) |
|-----|-------------|-------------------------|----------------|-------------|--------------------|----------------------|------------------|--------------------------|
| 1 | *13.56 | 69.77 QP | 124.00 | -54.23 | 1.00 | 345 | 73.41 | -3.64 |

- 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.

The measured field strength was extrapolated to distance 30 meters, using the formula that the limit of field strength varies as the inverse distance square (40dB per decade of distance)

Example:

$$\begin{aligned}
 13.56\text{MHz} &= 15848\mu\text{V/m} && 30\text{m} \\
 &= 84\text{dBuV/m} && 30\text{m} \\
 &= 84+20\log(30/3)^2 && 3\text{m} \\
 &= 124\text{dBuV/m}
 \end{aligned}$$





| | | | |
|------------------------|-------------|--------------------------|-----------------|
| FREQUENCY RANGE | Below 30MHz | DETECTOR FUNCTION | Quasi-Peak (QP) |
|------------------------|-------------|--------------------------|-----------------|

| LOOP ANTENNA TEST DISTANCE: AT 3 M (X AXIS) | | | | | | | | |
|---|-------------|-------------------------|----------------|-------------|--------------------|----------------------|------------------|--------------------------|
| 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 | 0.02 | 58.10 QP | 120.00 | -61.90 | 1.00 | 121 | -13.40 | 71.50 |
| 2 | 0.04 | 52.10 QP | 114.90 | -62.80 | 1.00 | 87 | -14.10 | 66.20 |
| 3 | 4.15 | 36.60 QP | 69.50 | -32.90 | 1.00 | 254 | -1.60 | 38.20 |
| 4 | 5.97 | 32.00 QP | 69.50 | -37.50 | 1.00 | 346 | -6.10 | 38.10 |
| 5 | 16.23 | 36.80 QP | 69.50 | -32.70 | 1.00 | 82 | -0.60 | 37.40 |
| 6 | 24.38 | 37.40 QP | 69.50 | -32.10 | 1.00 | 120 | 3.40 | 34.00 |
| LOOP ANTENNA TEST DISTANCE: AT 3 M (Y AXIS) | | | | | | | | |
| 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 | 0.04 | 55.40 QP | 114.90 | -59.50 | 1.00 | 331 | -10.80 | 66.20 |
| 2 | 0.10 | 43.70 QP | 107.90 | -64.20 | 1.00 | 243 | -14.80 | 58.50 |
| 3 | 2.19 | 35.00 QP | 69.50 | -34.50 | 1.00 | 249 | -4.00 | 39.00 |
| 4 | 4.18 | 34.70 QP | 69.50 | -34.80 | 1.00 | 360 | -3.50 | 38.20 |
| 5 | 15.56 | 34.00 QP | 69.50 | -35.50 | 1.00 | 120 | -3.60 | 37.60 |
| 6 | 25.01 | 34.30 QP | 69.50 | -35.20 | 1.00 | 175 | 0.70 | 33.60 |

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



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| | | | |
|------------------------|------------|--------------------------|-----------------|
| FREQUENCY RANGE | 30~1000MHz | DETECTOR FUNCTION | Quasi-Peak (QP) |
|------------------------|------------|--------------------------|-----------------|

| 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 | 64.14 | 34.5 QP | 40.0 | -5.5 | 1.50 H | 360 | 48.55 | -14.05 |
| 2 | 271.19 | 39.9 QP | 46.0 | -6.1 | 1.00 H | 86 | 52.69 | -12.77 |
| 3 | 433.91 | 40.3 QP | 46.0 | -5.7 | 2.00 H | 117 | 48.30 | -8.03 |
| 4 | 922.11 | 40.9 QP | 46.0 | -5.1 | 1.50 H | 161 | 39.79 | 1.13 |
| 5 | 949.22 | 42.9 QP | 46.0 | -3.2 | 1.50 H | 156 | 41.37 | 1.48 |
| 6 | 976.33 | 43.5 QP | 54.0 | -10.5 | 1.50 H | 163 | 41.65 | 1.82 |
| 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 | 40.67 | 34.1 QP | 40.0 | -5.9 | 1.00 V | 236 | 47.53 | -13.39 |
| 2 | 81.36 | 34.1 QP | 40.0 | -5.9 | 1.00 V | 56 | 51.93 | -17.83 |
| 3 | 271.19 | 32.2 QP | 46.0 | -13.9 | 1.50 V | 228 | 44.92 | -12.77 |
| 4 | 433.91 | 36.7 QP | 46.0 | -9.3 | 1.50 V | 360 | 44.77 | -8.03 |
| 5 | 833.94 | 37.4 QP | 46.0 | -8.7 | 1.50 V | 360 | 37.77 | -0.42 |
| 6 | 976.33 | 40.2 QP | 54.0 | -13.8 | 1.00 V | 69 | 38.35 | 1.82 |

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



4.3 20dB BANDWIDTH

4.3.1 LIMITS OF 20dB BANDWIDTH MEASUREMENT

The 20dB bandwidth shall be specified in operating frequency band.

4.3.2 TEST INSTRUMENTS

| DESCRIPTION & MANUFACTURER | MODEL NO. | SERIAL NO. | CALIBRATED DATE | CALIBRATED UNTIL |
|----------------------------|-----------|------------|-----------------|------------------|
| SPECTRUM ANALYZER R&S | FSV 40 | 100964 | July 05, 2014 | July 04, 2015 |

Note:

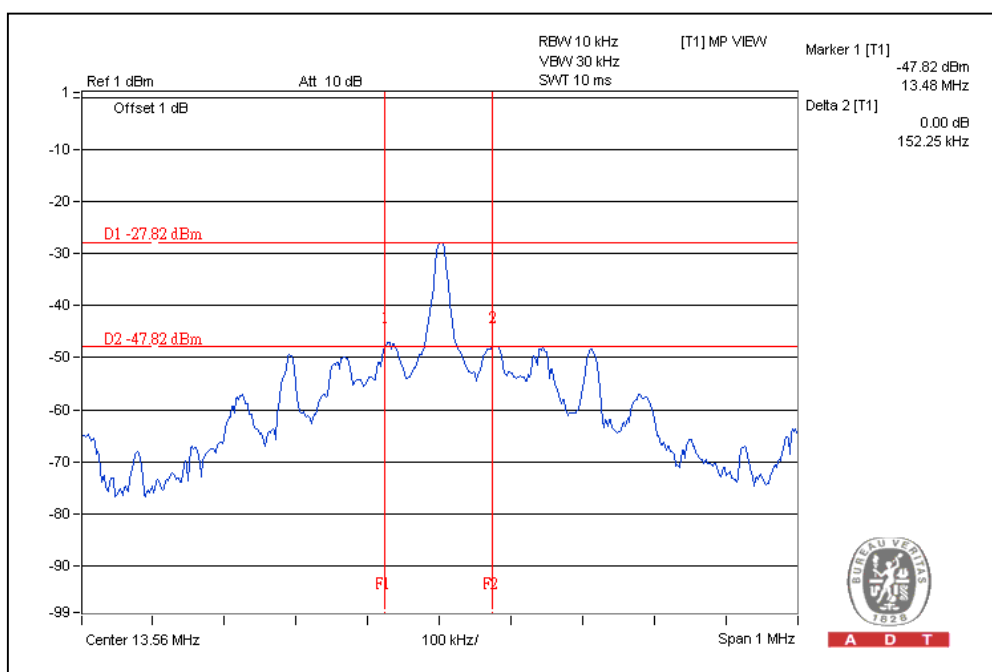
1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. Tested date : July 31, 2014

4.3.3 EUT OPERATING CONDITION

The bandwidth of the fundamental frequency was measured by spectrum analyzer with 10kHz RBW and 30kHz VBW. The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

4.3.4 TEST RESULTS

| 20dBc point (Low) | 20dBc point (High) | Operating frequency band (MHz) | PASS/FAIL |
|-------------------|--------------------|--------------------------------|-----------|
| 13.48 MHz | 0.15225 MHz | 13.11 – 14.01 | PASS |





4.4 FREQUENCY STABILITY

4.4.1 LIMITS OF FREQUENCY STABILITY MEASUREMENT

The frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ ($\pm 100\text{ppm}$) of the operating frequency over a temperature variation of -30 degrees to 50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C.

4.4.2 TEST INSTRUMENTS

| DESCRIPTION & MANUFACTURER | MODEL NO. | SERIAL NO. | CALIBRATED DATE | CALIBRATED UNTIL |
|---|------------------|-------------|-----------------|------------------|
| SPECTRUM ANALYZER R&S | FSV 40 | 100964 | July 05, 2014 | July 04, 2015 |
| Temperature & Humidity Chamber GIANTFORCE | GTH-150-40-SP-AR | MAA0812-008 | Jan. 13, 2014 | Jan. 12, 2015 |

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. Tested date : July 31, 2014

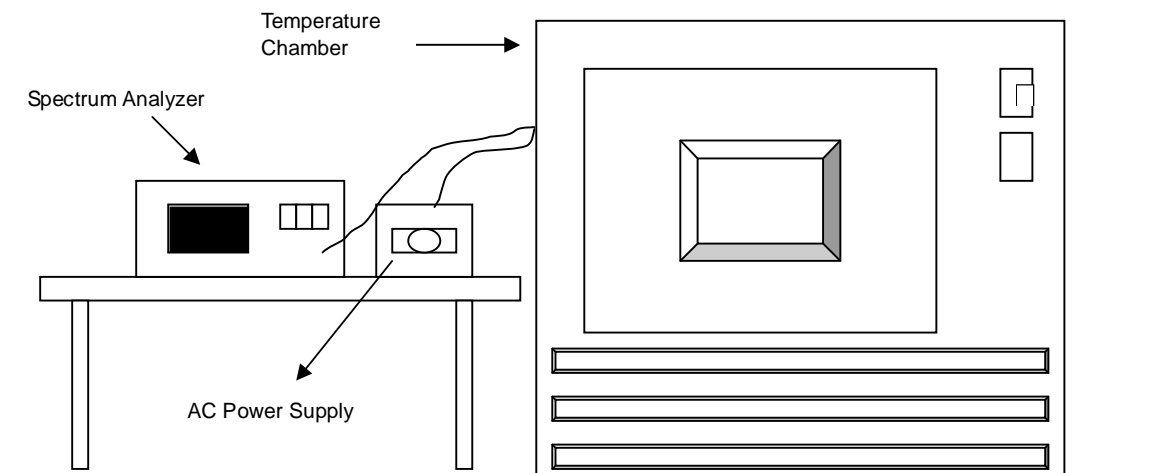
4.4.3 TEST PROCEDURE

1. The EUT was placed inside the environmental test chamber and powered by nominal AC voltage.
2. Turn the EUT on and couple its output to a spectrum analyzer.
3. Turn the EUT off and set the chamber to the highest temperature specified.
4. Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize, turn the EUT on and measure the operating frequency after 2, 5, and 10 minutes.
5. Repeat step 2 and 3 with the temperature chamber set to the lowest temperature.
6. The test chamber was allowed to stabilize at $+20$ degree C for a minimum of 30 minutes. The supply voltage was then adjusted on the EUT from 85% to 115% and the frequency record.

4.4.4 DEVIATION FROM TEST STANDARD

No deviation

4.4.5 TEST SETUP



4.4.6 EUT OPERATING CONDITION

The software provided by client to enable the EUT under transmission condition continuously at specific channel frequencies individually.



4.4.7 TEST RESULTS

| FREQUENCY STABILITY VERSUS TEMP. | | | | | | | | | |
|----------------------------------|--------------------------|-----------------------|--------------------|-----------------------|--------------------|-----------------------|--------------------|-----------------------|--------------------|
| TEMP. (°C) | POWER SUPPLY (Vac) | 0 MINUTE | | 2 MINUTE | | 5 MINUTE | | 10 MINUTE | |
| | | Measured Frequency | Frequency Drift | Measured Frequency | Frequency Drift | Measured Frequency | Frequency Drift | Measured Frequency | Frequency Drift |
| | | (MHz) | % | (MHz) | % | (MHz) | % | (MHz) | % |
| 50 | 120 | 13.56002 | 0.00015 | 13.56002 | 0.00015 | 13.56001 | 0.00007 | 13.56 | 0.00000 |
| 40 | 120 | 13.55997 | -0.00022 | 13.55997 | -0.00022 | 13.55997 | -0.00022 | 13.55996 | -0.00029 |
| 30 | 120 | 13.56002 | 0.00015 | 13.56002 | 0.00015 | 13.56001 | 0.00007 | 13.56001 | 0.00007 |
| 20 | 120 | 13.56007 | 0.00052 | 13.56007 | 0.00052 | 13.56007 | 0.00052 | 13.56006 | 0.00044 |
| 10 | 120 | 13.56001 | 0.00007 | 13.56003 | 0.00022 | 13.56002 | 0.00015 | 13.56002 | 0.00015 |
| 0 | 120 | 13.55998 | -0.00015 | 13.55997 | -0.00022 | 13.55999 | -0.00007 | 13.55999 | -0.00007 |
| -10 | 120 | 13.56008 | 0.00059 | 13.56008 | 0.00059 | 13.56008 | 0.00059 | 13.56008 | 0.00059 |
| -20 | 120 | 13.55993 | -0.00052 | 13.55994 | -0.00044 | 13.55993 | -0.00052 | 13.55995 | -0.00037 |
| -30 | 120 | 13.56003 | 0.00022 | 13.56002 | 0.00015 | 13.56001 | 0.00007 | 13.56001 | 0.00007 |

| FREQUENCY STABILITY VERSUS VOLTAGE | | | | | | | | | |
|------------------------------------|--------------------------|-----------------------|--------------------|-----------------------|--------------------|-----------------------|--------------------|-----------------------|--------------------|
| TEMP. (°C) | POWER SUPPLY (Vac) | 0 MINUTE | | 2 MINUTE | | 5 MINUTE | | 10 MINUTE | |
| | | Measured Frequency | Frequency Drift | Measured Frequency | Frequency Drift | Measured Frequency | Frequency Drift | Measured Frequency | Frequency Drift |
| | | (MHz) | % | (MHz) | % | (MHz) | % | (MHz) | % |
| 20 | 138 | 13.56007 | 0.00052 | 13.56007 | 0.00052 | 13.56007 | 0.00052 | 13.56006 | 0.00044 |
| | 120 | 13.56007 | 0.00052 | 13.56007 | 0.00052 | 13.56007 | 0.00052 | 13.56006 | 0.00044 |
| | 102 | 13.56007 | 0.00052 | 13.56007 | 0.00052 | 13.56007 | 0.00052 | 13.56006 | 0.00044 |



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5 INFORMATION ON THE TESTING LABORATORIES

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

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

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



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6 APPENDIX-A- MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB

No any modifications are made to the EUT by the lab during the test.

--- END ---