# Test Report No. 7191097736-EEC14/01
**dated 31 Jul 2015**

PSB Singapore

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FORMAL REPORT ON TESTING IN ACCORDANCE WITH
47 CFR FCC Parts 15B & C : 2012
OF A
**SMART LUGGAGE LOCK**
**[ Model : GT3000 ]**
**[ FCC ID : 2AFP6-EGEET30 ]**

| | |
|---|---|
| **TEST FACILITY** | TÜV SÜD PSB Pte Ltd<br>Electrical & Electronics Centre (EEC), Product Services,<br>No. 1 Science Park Drive, Singapore 118221 |
| **FCC REG. NO.** | 99142 (3m and 10m Semi-Anechoic Chamber, Science Park) |
| **IND. CANADA REG. NO.** | 2932I-1 (3m and 10m Semi-Anechoic Chamber, Science Park) |
| **PREPARED FOR** | JSB TECH Pte Ltd<br>100 Pasir Panjang Road #06-02<br>Singapore 118518<br><br>Tel : (65) 6397 5028 Fax : (65) 6397 5025 |
| **QUOTATION NUMBER** | 2191005132 |
| **JOB NUMBER** | 7191097736 |
| **TEST PERIOD** | 29 Sep 2014 – 05 Aug 2015 |

| **PREPARED BY** | **APPROVED BY** |
|---|---|
| Quek Keng Huat | Lim Cher Hwee |
| Higher Associate Engineer | Assistant Vice President |

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LA-2007-0380-A
LA-2007-0381-F
LA-2007-0382-B
LA-2007-0383-G
LA-2007-0384-G
LA-2007-0385-E
LA-2007-0386-C
LA-2010-0464-D

The results reported herein have been performed in accordance with the laboratory's terms of accreditation under the Singapore Accreditation Council - Singapore Laboratory Accreditation Scheme. Tests/Calibrations marked "Not SAC-SINGLAS Accredited" in this Report are not included in the SAC-SINGLAS Accreditation Schedule for our laboratory.

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## TEST SUMMARY

The product was tested in accordance with the customer's specifications.

**Test Results Summary**

| Test Standard | Description | Pass / Fail |
|---|---|---|
| 47 CFR FCC Part 15: 2012 | | |
| 15.107(a), 15.207 | Conducted Emissions | Pass |
| 15.109(a), 15.205, 15.209, 15.225(d) | Radiated Emissions (Spurious Emissions inclusive Restricted Bands Requirement) | Pass *See Modification |
| 15.225(a) | Radiated Emissions (Fundamental) | Pass |
| 15.225(e) | Frequency Stability Versus Temperature | Pass |
| 15.225(e) | Frequency Stability Versus Input Voltage | Pass |

**Notes**

1. The Equipment Under Test (EUT) was configured to operate continuously in the test mode at 13.56MHz.

2. The EUT is a Class B device when in non-transmitting state and meets the 47 CFR FCC Part15B Class B requirements.

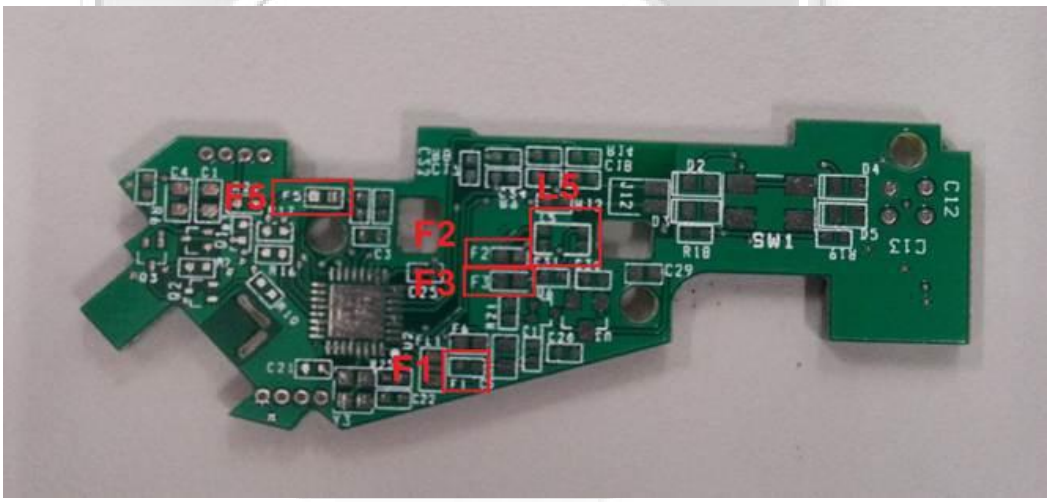
3. All test measurement procedures are according to ANSI C63.4: 2014.

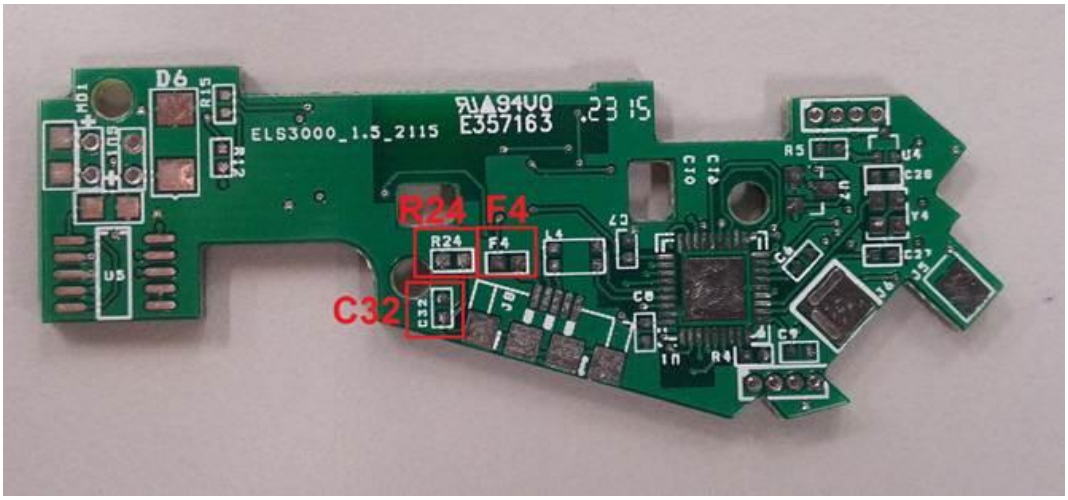
**Modifications**

The EUT was brought to compliance to Radiated Emissions test by the following modifications:

1. Suppression ferrite beads were added to the 5V USB input power and VDD of the transceiver IC.
2. Common mode choke was added to the 5V USB input power.
3. RC filter was added to the USB connector.
4. The details of modifications are shown below:

| Manufacturer | Description | Part Number | Purpose | Location |
|---|---|---|---|---|
| Wurth Electronics | Suppression ferrite beads | 742792093 | Noise suppression | F2,F3,F4,F5 |
| Wurth Electronics | Suppression ferrite beads | 742792041 | Noise suppression | F1 |
| Murata Electronics | Common mode choke | DLW31SN900SQ 2L | Noise suppression | L5 |
| | Resistor and Capacitor | | RC Filter | R24, C32 |



## PRODUCT DESCRIPTION

| | | |
|---|---|---|
| Description | : | The Equipment Under Test (EUT) is a **SMART LUGGAGE LOCK.** |
| Applicant | : | JSB TECH Pte Ltd<br>100 Pasir Panjang Road #06-02<br>Singapore 118518 |
| Manufacturer | : | JSB TECH Pte Ltd<br>100 Pasir Panjang Road #06-02<br>Singapore 118518 |
| Factory (ies) | : | JSB TECH Pte Ltd<br>100 Pasir Panjang Road #06-02<br>Singapore 118518 |
| Model Number | : | GT3000 |
| FCC ID | : | 2AFP6-EGEET30 |
| Serial Number | : | Nil |
| Microprocessor | : | ARM Cortex-A57 |
| Operating / Transmitting Frequency | : | 13.56MHz |
| Clock / Oscillator Frequency | : | 8MHz |
| Modulation | : | Phase Jitter Modulation (PJM) |
| Antenna Gain | : | Refer to manufacturer's user manual / operating manual |
| Port / Connectors | : | Refer to manufacturer's user manual / operating manual |
| Rated Input Power | : | 3Vdc |
| Accessories | : | Nil or list down all available accessories |

## SUPPORTING EQUIPMENT DESCRIPTION

The EUT was tested as a stand-alone unit without any supporting equipment.

## EUT OPERATING CONDITIONS

| **47 CFR FCC Part 15** |
|---|
| **1. Conducted Emissions**<br>**2. Radiated Emissions (Spurious Emissions inclusive Restricted Bands Requirement)**<br>**3. Radiated Emissions (Fundamental)**<br>**4. Frequency Stability Versus Temperature**<br>**5. Frequency Stability Versus Input Voltage** |
| The EUT was exercised by operating in maximum continuous transmission in test mode, i.e transmitting at 13.56MHz continuously. |

## 47 CFR FCC Parts 15.107(a) and 15.207 Conducted Emission Limits

| Frequency Range (MHz) | Limit Values (dBµV) | |
|---|---|---|
| | Quasi-peak (Q-P) | Average (AV) |
| 0.15 - 0.5 | 66 – 56 * | 56 – 46 * |
| 0.5 - 5.0 | 56 | 46 |
| 5.0 - 30.0 | 60 | 50 |
| * Decreasing linearly with the logarithm of the frequency | | |

## 47 CFR FCC Parts 15.107(a) and 15.207 Conducted Emission Test Instrumentation

| Instrument | Model | S/No | Cal Due Date |
|---|---|---|---|
| Schaffner EMI Receiver | SMR4503 | 040 | 21 Jan 2016 |
| Agilent EMC Analyzer-SA7 | E7403A | US41160167 | 28 May 2016 |
| Schaffner LISN –LISN7 (Ref) | NNB42 | 00008 | 28 Jan 2016 |

## 47 CFR FCC Parts 15.107(a) and 15.207 Conducted Emission Test Setup

1. The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m x 1m x 0.8m high, non-metallic table.
2. The power supply for the EUT was fed through a 50Ω/50μH EUT LISN, connected to filtered mains.
3. The RF OUT of the EUT LISN was connected to the EMI test receiver via a low-loss coaxial cable.
4. All other supporting equipment were powered separately from another LISN.

## 47 CFR FCC Parts 15.107(a) and 15.207 Conducted Emission Test Method

1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. A scan was made on the NEUTRAL line over the required frequency range using an EMI test receiver.
3. High peaks, relative to the limit line, were then selected.
4. The EMI test receiver was then tuned to the selected frequencies and the necessary measurements made with a receiver bandwidth setting of 9kHz. Both Quasi-peak and Average measurements were made.
5. Steps 2 to 4 were then repeated for the LIVE line.

**Sample Calculation Example**

At 20 MHz Q-P limit = 60.0 dBμV

Transducer factor of LISN, pulse limiter & cable loss at 20 MHz = 11.2 dB

Q-P reading obtained directly from EMI Receiver = 40.0 dBμV
(Calibrated for system losses)

Therefore, Q-P margin = 60.0 - 40.0 = 20.0 i.e. 20.0 dB below Q-P limit

**47 CFR FCC Parts 15.107(a) and 15.207 Conducted Emission Results**

| | | | |
|---|---|---|---|
| Test Input Power | 120V 60Hz<br>(5Vdc to EUT via USB port) | Temperature | 23°C |
| Line Under Test | AC Mains | Relative Humidity | 59% |
| | | Atmospheric Pressure | 1030mbar |
| | | Tested By | Chua Choon Meng |

| Frequency (MHz) | Q-P Value (dBµV) | Q-P Limit (dBµV) | Q-P Margin (dB) | AV Value (dBµV) | AV Limit (dBµV) | AV Margin (dB) | Line |
|---|---|---|---|---|---|---|---|
| 0.3883 | 45.1 | 58.1 | 13.0 | 41.6 | 48.1 | 6.5 | Live |
| 0.8271 | 37.4 | 56.0 | 18.6 | 9.2 | 46.0 | 36.8 | Neutral |
| 3.3380 | 37.4 | 56.0 | 18.6 | 24.0 | 46.0 | 22.0 | Live |
| 3.6025 | 26.9 | 56.0 | 29.1 | 34.0 | 46.0 | 12.0 | Live |
| 3.9353 | 39.0 | 56.0 | 17.0 | 28.8 | 46.0 | 17.2 | Live |
| 4.2245 | 36.3 | 56.0 | 19.7 | 24.4 | 46.0 | 21.6 | Live |

Notes

1. All possible modes of operation were investigated from 150kHz to 30MHz. Only the worst case emissions measured, using the correct CISPR detectors, are reported. All other emissions were relatively insignificant.
2. A "positive" margin indicates a PASS as it refers to the margin present below the limit line at the particular frequency. Conversely, a “negative” margin indicates a FAIL.
3. EMI receiver Resolution Bandwidth (RBW) and Video Bandwidth (VBW) settings:
   9kHz - 30MHz
   RBW: 9kHz VBW: 30kHz
4. Conducted Emissions Measurement Uncertainty
   All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95%, with a coverage factor of 2, in the range 9kHz – 30MHz is ±2.2dB.

## 47 CFR FCC Part 15.205 Restricted Bands

| MHz | | | MHz | | | MHz | | | GHz | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.090 | - | 0.110 | 16.42 | - | 16.423 | 399.9 | - | 410 | 4.5 | - | 5.15 |
| 0.495 | - | 0.505 | 16.69475 | - | 16.69525 | 608 | - | 614 | 5.35 | - | 5.46 |
| 2.1735 | - | 2.1905 | 16.80425 | - | 16.80475 | 960 | - | 1240 | 7.25 | - | 7.75 |
| 4.125 | - | 4.128 | 25.5 | - | 25.67 | 1300 | - | 1427 | 8.025 | - | 8.5 |
| 4.17725 | - | 4.17775 | 37.5 | - | 38.25 | 1435 | - | 1626.5 | 9.0 | - | 9.2 |
| 4.20725 | - | 4.20775 | 73 | - | 74.6 | 1645.5 | - | 1646.5 | 9.3 | - | 9.5 |
| 6.215 | - | 6.218 | 74.8 | - | 75.2 | 1660 | - | 1710 | 10.6 | - | 12.7 |
| 6.26775 | - | 6.26825 | 108 | - | 121.94 | 1718.8 | - | 1722.2 | 13.25 | - | 13.4 |
| 6.31175 | - | 6.31225 | 123 | - | 138 | 2200 | - | 2300 | 14.47 | - | 14.5 |
| 8.291 | - | 8.294 | 149.9 | - | 150.05 | 2310 | - | 2390 | 15.35 | - | 16.2 |
| 8.362 | - | 8.366 | 156.52475 | - | 156.52525 | 2483.5 | - | 2500 | 17.7 | - | 21.4 |
| 8.37625 | - | 8.38675 | 156.7 | - | 156.9 | 2690 | - | 2900 | 22.01 | - | 23.12 |
| 8.41425 | - | 8.41475 | 162.0125 | - | 167.17 | 3260 | - | 3267 | 23.6 | - | 24.0 |
| 12.29 | - | 12.293 | 167.72 | - | 173.2 | 3332 | - | 3339 | 31.2 | - | 31.8 |
| 12.51975 | - | 12.52025 | 240 | - | 285 | 3345.8 | - | 3358 | 36.43 | - | 36.5 |
| 12.57675 | - | 12.57725 | 322 | - | 335.4 | 3600 | - | 4400 | Above 38.6 | | |
| 13.36 | - | 13.41 | | | | | | | | | |

## 47 CFR FCC Parts 15.109(a), 15.209 and 15.225(d) Radiated Emission Limits

| Frequency Range (MHz) | Quasi-Peak Limit Values (dBµV/m) |
|---|---|
| 0.009 - 0.490 | 20 log [2400 / F (kHz)] @ 300m |
| 0.490 - 1.705 | 20 log [24000 / F (kHz)] @ 30m |
| 1.705 - 30.0 | 30.0 @ 30m |
| 30 - 88 | 40.0 @ 3m |
| 88 - 216 | 43.5 @ 3m |
| 216 - 960 | 46.0 @ 3m |
| Above 960 | 54.0* @ 3m |
| * Above 1GHz, average detector was used. A peak limit of 20dB above the average limit does apply. | |

## 47 CFR FCC Parts 15.109(a), 15.209 and 15.225(d) Radiated Emission Test Instrumentation

| Instrument | Model | S/No | Cal Due Date |
|---|---|---|---|
| R&S Test Receiver – ESI1 | ESI40 | 100010 | 14 Jul 2016 |
| Schaffner Bilog Antenna –(30MHz-2GHz) BL3 (Ref) | CBL6112D | 2549 | 29 Jan 2016 |
| Com-Power Preamplifier (1MHz-1GHz) | PAM-103 | 441096 | 13 Oct 2015 |
| EMCO Loop Antenna | 6502 | 134413 | 01 Oct 2015 |

## 47 CFR FCC Parts 15.109(a), 15.209 and 15.225(d) Radiated Emission Test Setup

1. The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m X 1.0m X 0.8m high, non-metallic table.
2. The filtered power supply for the EUT and supporting equipment were tapped from the appropriate power sockets located on the turntable.
3. The relevant broadband antenna was set at the required test distance away from the EUT and supporting equipment boundary.

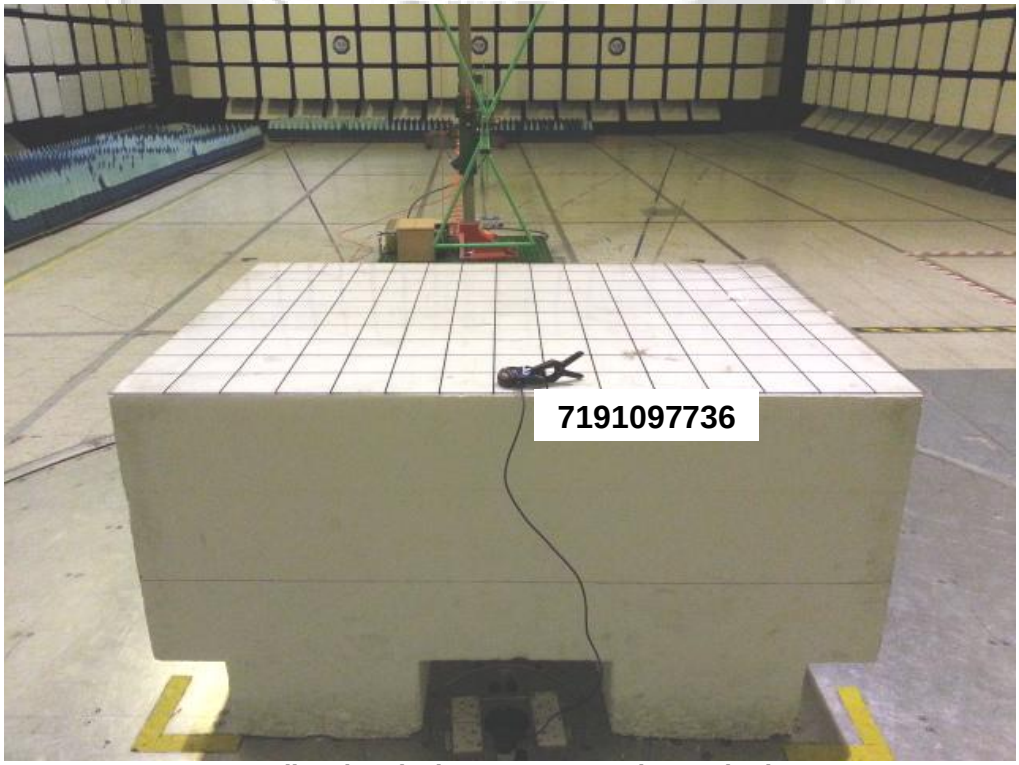
## 47 CFR FCC Parts 15.109(a), 15.209 and 5.225(d) Radiated Emission Test Method

1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. A prescan was carried out to pick the worst emission frequencies from the EUT. For EUT which is a portable device, the prescan was carried out by rotating the EUT through three orthogonal axes to determine which altitude and equipment arrangement produces such emissions.
3. The test was carried out at the selected frequency points obtained from the prescan in step 2. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner:
   a. Vertical or horizontal polarisation (whichever gave the higher emission level over a full rotation of the EUT) was chosen.
   b. The EUT was then rotated to the direction that gave the maximum emission.
   c. Finally, the antenna height was adjusted to the height that gave the maximum emission.
4. A Quasi-peak measurement was made for that frequency point if it was less than or equal to 1GHz. For frequency point in the range of 9kHz – 90kHz, 110kHz – 490kHz and above 1GHz, both Peak and Average measurements were carried out.
5. Steps 3 and 4 were repeated for the next frequency point, until all selected frequency points were measured.
6. The frequency range covered was from the lowest radio frequency signal generated from the EUT, without going below 9kHz to 10$^{th}$ harmonics of the EUT fundamental frequency, using the loop antenna for frequency below 30MHz, Bi-log antenna for frequencies from 30MHz up to 1GHz, and the Horn antenna above 1GHz.

**Sample Calculation Example**

| | |
|---|---|
| At 300 MHz | Q-P limit = 46.0 dBμV/m |
| Log-periodic antenna factor & cable loss at 300 MHz = 18.5 dB | |
| Q-P reading obtained directly from EMI Receiver = 40.0 dBμV/m (Calibrated level including antenna factors & cable losses) | |
| Therefore, Q-P margin = 46.0 - 40.0 = 6.0 | i.e. 6.0 dB below Q-P limit |


**Radiated Emissions Test Setup (Front View)**




**Radiated Emissions Test Setup (Rear View)**

## 47 CFR FCC Parts 15.109(a), 15.205, 15.209 and 15.225(d) Radiated Emission Results

| | | | |
|---|---|---|---|
| Test Input Power | 120V 60Hz<br>(5Vdc to EUT via USB port) | Temperature | 22°C |
| Test Distance | 3m *See Note 2 | Relative Humidity | 48% |
| | | Atmospheric Pressure | 1030mbar |
| | | Tested By | Lim Kay Tak |

Spurious Emissions ranging from 9kHz – 30MHz (for 9kHz – 90kHz, 110kHz – 490kHz) *See Note 3

| Freq (GHz) | Peak Value (dBµV/m) | Peak Limit (dBµV/m) | Peak Margin (dB) | AV Value (dBµV/m) | AV Limit (dBµV/m) | AV Margin (dB) | Height (cm) | Azimuth (Degrees) | Pol (H/V) | Ch |
|---|---|---|---|---|---|---|---|---|---|---|
| -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |

Spurious Emissions ranging from 9kHz - 30MHz *See Note 2

| Frequency (MHz) | Q-P Value (dBµV/m) | Q-P Limit (dBµV/m) | Q-P Margin (dB) | Height (cm) | Azimuth (Degrees) |
|---|---|---|---|---|---|
| 1.2510 | 35.3 | 65.7 | 30.4 | 100 | 34 |
| 1.3470 | 32.5 | 65.0 | 32.5 | 100 | 298 |
| 1.6730 | 29.9 | 63.1 | 33.2 | 100 | 120 |
| 1.9770 | 28.1 | 70.0 | 41.9 | 100 | 252 |
| 2.5530 | 25.9 | 70.0 | 44.1 | 100 | 316 |
| 12.6600 | 31.9 | 70.0 | 38.1 | 100 | 40 |

| | | | |
|---|---|---|---|
| Test Input Power | 110V 60Hz<br>(5Vdc to EUT via USB port) | Temperature | 22°C |
| Test Distance | 3m | Relative Humidity | 47% |
| | | Atmospheric Pressure | 1030mbar |
| | | Tested By | Lim Kay Tak |

Spurious Emissions ranging from 30MHz – 1GHz

| Frequency (MHz) | Q-P Value (dBµV/m) | Q-P Limit (dBµV/m) | Q-P Margin (dB) | Height (cm) | Azimuth (Degrees) | Pol (H/V) |
|---|---|---|---|---|---|---|
| 81.0460 | 24.2 | 40.0 | 15.8 | 100 | 259 | V |
| 850.6710 | 28.5 | 46.0 | 17.5 | 100 | 340 | H |
| 866.3770 | 28.4 | 46.0 | 17.6 | 100 | 340 | H |
| 884.0470 | 28.4 | 46.0 | 17.6 | 100 | 340 | H |
| 905.6440 | 28.5 | 46.0 | 17.5 | 100 | 340 | H |
| 925.2770 | 32.5 | 46.0 | 13.5 | 100 | 340 | H |

Notes

1. All possible modes of operation were investigated. Only the worst case emissions measured, using the correct CISPR detectors, are reported. All other emissions were relatively insignificant.
2. A closer test distance of 3m was used for the measurement instead of 30m. The limit was extrapolated from 30m to 3m distance.
3. "--" indicates no emissions were found and shows compliance to the limits.
4. Quasi-peak measurement was used for frequency measurement up to 1GHz
5. A "positive" margin indicates a PASS as it refers to the margin present below the limit line at the particular frequency. Conversely, a "negative" margin indicates a FAIL.
6. EMI receiver Resolution Bandwidth (RBW) and Video Bandwidth (VBW) settings:
   9kHz - 150kHz
   RBW: 100Hz VBW: 300Hz
   150kHz - 30MHz
   RBW: 10kHz VBW: 30kHz
   30MHz - 1GHz
   RBW: 120kHz VBW: 1MHz
   >1GHz
   RBW: 1MHz VBW: 1MHz
7. The upper frequency of radiated emission investigations was according to requirements stated in Section 15.33(a) for intentional radiators & Section 15.33(b) for unintentional radiators.
8. The channel in the table refers to the transmit channel of the EUT.
9. Radiated Emissions Measurement Uncertainty
   All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95%, with a coverage factor of 2, in the range 30MHz – 25GHz is ±4.0dB.

## RADIATED EMISSION (FUNDAMENTAL) TEST

**47 CFR FCC Parts 15.225(a), 15.225(b) and 15.225(c) Radiated Emission (Fundamental) Limits**

| Fundamental Frequency (MHz) | Field Strength of Fundamental Limit Values @ 30m (dBµV/m) |
|---|---|
| 13.553 - 13.567 | 84.0 |
| 13.410 -13.553 | 50.5 |
| 13.567 -13.710 | 50.5 |
| 13.110 -13.410 | 40.5 |
| 13.710 -14.010 | 40.5 |

**47 CFR FCC Parts 15.225(a), 15.225(b) and 15.225(c) Radiated Emission (Fundamental) Test Instrumentation**

| Instrument | Model | S/No | Cal Due Date |
|---|---|---|---|
| R&S Test Receiver – ESI1 | ESI40 | 100010 | 14 Jul 2016 |
| Schaffner Bilog Antenna –(30MHz-2GHz) BL3 (Ref) | CBL6112D | 2549 | 29 Jan 2016 |
| Com-Power Preamplifier (1MHz-1GHz) | PAM-103 | 441096 | 13 Oct 2015 |
| EMCO Loop Antenna | 6502 | 134413 | 01 Oct 2015 |

## RADIATED EMISSION (FUNDAMENTAL) TEST

### 47 CFR FCC Parts 15.225(a), 15.225(b) and 15.225(c) Radiated Emission (Fundamental) Test Setup

1. The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m X 1.0m X 0.8m high, non-metallic table.
2. The filtered power supply for the EUT and supporting equipment were tapped from the appropriate power sockets located on the turntable.
3. The relevant broadband antenna was set at the required test distance away from the EUT and supporting equipment boundary.

### 47 CFR FCC Parts 15.225(a), 15.225(b) and 15.225(c) Radiated Emission (Fundamental) Test Method

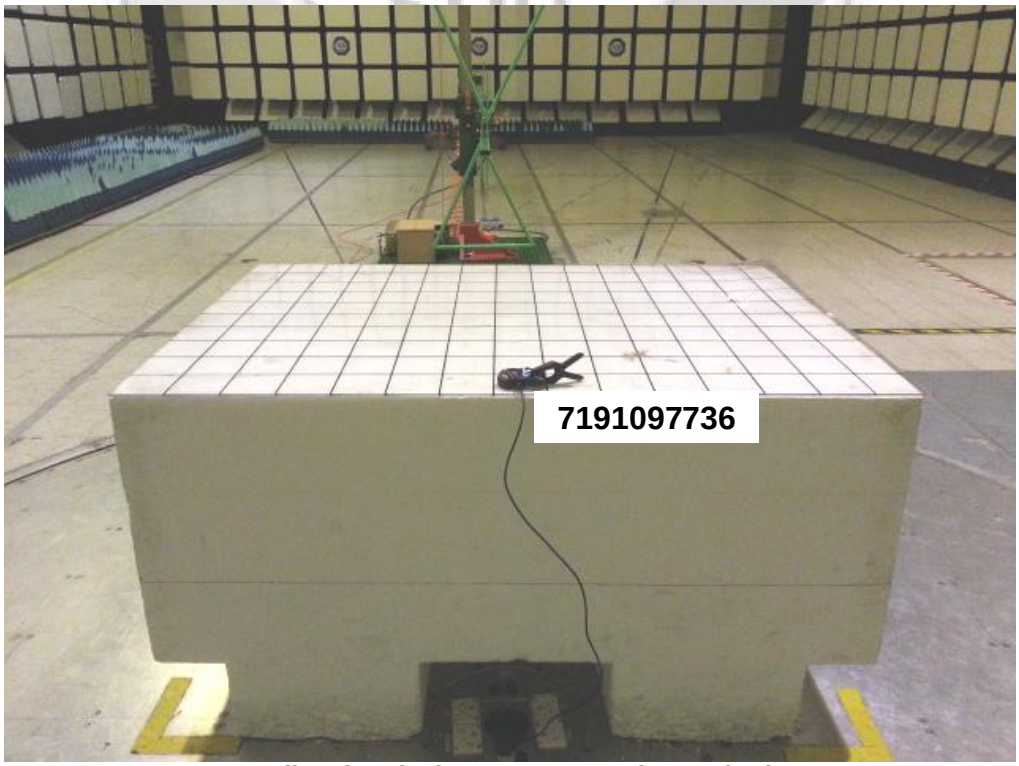
1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. A prescan was carried out to pick the fundamental frequency from the EUT. For EUT which is a portable device, the prescan was carried out by rotating the EUT through three orthogonal axes to determine which altitude and equipment arrangement produces such emissions.
3. The test was carried out at the selected frequency points obtained from the prescan in step 2. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner:
   a. Vertical or horizontal polarisation (whichever gave the higher emission level over a full rotation of the EUT) was chosen.
   b. The EUT was then rotated to the direction that gave the maximum emission.
   c. Finally, the antenna height was adjusted to the height that gave the maximum emission.
4. A Quasi-peak measurement was made for that frequency point if it was less than or equal to 1GHz. For frequency point that above 1GHz, both Peak and Average measurements were carried out.
5. Steps 3 and 4 were repeated for the next frequency point, until all selected frequency points were measured.

**Sample Calculation Example**

| | |
|---|---|
| At 300 MHz | Q-P limit = 46.0 dBμV/m |
| Log-periodic antenna factor & cable loss at 300 MHz = 18.5 dB | |
| Q-P reading obtained directly from EMI Receiver = 40.0 dBμV/m (Calibrated level including antenna factors & cable losses) | |
| Therefore, Q-P margin = 46.0 - 40.0 = 6.0 | i.e. 6.0 dB below Q-P limit |

**30MHz – 1GHz Test Setup**


**Radiated Emissions Test Setup (Front View)**




**Radiated Emissions Test Setup (Rear View)**

## 47 CFR FCC Part 15.225(a / b / c) Radiated Emission (Fundamental) Results

| | | | |
|---|---|---|---|
| Test Input Power | 110V 60Hz (5Vdc to EUT via USB port) | Temperature | 22°C |
| Test Distance | 3m *See Note 2 | Relative Humidity | 48% |
| | | Atmospheric Pressure | 1030mbar |
| | | Tested By | Lim Kay Tak |

| Frequency (MHz) | Q-P Value (dBµV/m) | Q-P Limit (dBµV/m) | Q-P Margin (dB) | Height (cm) | Azimuth (Degrees) |
|---|---|---|---|---|---|
| 13.5630 | 32.3 | 84.0 | 51.7 | 100 | 21 |

Notes

1. All possible modes of operation were investigated. Only the worst case emissions measured, using the average and peak detectors, are reported. All other emissions were relatively insignificant.
2. A closer test distance of 3m was used for the measurement instead of 30m as the fundamental (carrier) electric field strength of the EUT at the 3m distance shows compliance to the limit of 30m test distance.
3. A "positive" margin indicates a PASS as it refers to the margin present below the limit line at the particular frequency. Conversely, a “negative” margin indicates a FAIL.
4. EMI receiver Resolution Bandwidth (RBW) and Video Bandwidth (VBW) settings:
   150kHz - 30MHz
   RBW: 10kHz VBW: 30kHz
   30MHz - 1GHz
   RBW: 120kHz VBW: 1MHz
   >1GHz
   RBW: 1MHz VBW: 1MHz
5. Radiated Emissions (Fundamental) Measurement Uncertainty
   All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95%, with a coverage factor of 2, in the range 30MHz – 25GHz is ±4.0dB.

## FREQUENCY STABILITY VERSUS TEMPERATURE TEST

### 47 CFR FCC Part 15.225(e) Frequency Stability Versus Temperature Limits

The EUT shows compliance to the requirements of this section, which states that the frequency tolerance of the carrier frequency shall be ± 0.01% for a temperature variation of -20°C to +50°C at normal supply voltage.

### 47 CFR FCC Part 15.225(e) Frequency Stability Versus Temperature Test Instrumentation

| Instrument | Model | S/No | Cal Due Date |
|---|---|---|---|
| HP Universal Counter | 53132A | 3736A06236 | 05 April 2016 |
| Agilent Dual Output DC Power Supply | E3620A | MY40000448 | Output Monitor |
| Cincinnati Sub-Zero Climatic Chamber | ZH-8-1-1-H/AC | ZF9722653 | 27 Dec 2015 |

### 47 CFR FCC Part 15.225(e) Frequency Stability Versus Temperature Test Setup

1. The EUT and supporting equipment were set up as shown in the setup photo. The EUT was placed in an environmental temperature chamber with a nominal supply voltage. For the battery operated EUT, a new battery was used.
2. The RF antenna connector of the EUT was connected to the frequency counter via a low-loss coaxial cable.

### 47 CFR FCC Part 15.225(e) Frequency Stability Versus Temperature Test Method

1. The EUT was switched off and the environmental temperature was set to the highest temperature, i.e, +50°C.
2. Upon reaching the highest set temperature with 30 minutes of stabilisation period, the EUT was switched on and configured to operate in the test mode with transmitting frequency at 13.56MHz.
3. The EUT's transmitting frequency was then measured at start up, and two, five and ten minutes after start up with the frequency counter was set to measure the transmitting frequency. For each measurement, the signal capturing was continuous until no further changes were observed. Four measurements were made in total.
4. Repeat steps 1 to 3 with the temperature set to the lowest temperature, i.e, -20°C.

## 47 CFR FCC Part 15.225(e) Frequency Stability Versus Temperature Results

| | | | |
|---|---|---|---|
| Test Input Power | 3Vdc | Temperature | 50°C |
| | | Relative Humidity | 60% |
| | | Atmospheric Pressure | 1030mbar |
| | | Tested By | Chang Wai Kit |

| Channel Frequency (MHz) | ± 0.01% Carrier Tolerance (Hz) | Measured Tolerance (Hz) | Measurement with respects to Start Up Time (Mins) |
|---|---|---|---|
| 13.5600 | ±1356.0000 | -156.2100 | 0 |
| 13.5600 | ±1356.0000 | -157.9300 | 2 |
| 13.5600 | ±1356.0000 | -158.4800 | 5 |
| 13.5600 | ±1356.0000 | -159.3468 | 10 |

| | | | |
|---|---|---|---|
| Test Input Power | 3Vdc | Temperature | -20°C |
| | | Relative Humidity | 60% |
| | | Atmospheric Pressure | 1030mbar |
| | | Tested By | Chang Wai Kit |

| Channel Frequency (MHz) | ± 0.01% Carrier Tolerance (Hz) | Measured Tolerance (Hz) | Measurement with respects to Start Up Time (Mins) |
|---|---|---|---|
| 13.5600 | ±1356.0000 | -322.5300 | 0 |
| 13.5600 | ±1356.0000 | -324.8900 | 2 |
| 13.5600 | ±1356.0000 | -326.0400 | 5 |
| 13.5600 | ±1356.0000 | -327.1200 | 10 |

## FREQUENCY STABILITY VERSUS INPUT VOLTAGE TEST

### 47 CFR FCC Part 15.225(e) Frequency Stability Versus Input Voltage Limits

The EUT shows compliance to the requirements of this section, which states that the frequency tolerance of the carrier frequency shall be ± 0.01% for variation of a primary voltage from 85% to 115% of the rated supply voltage at a temperature of 20°C. For a battery operated equipment, the equipment tests shall be performed using a new battery.

### 47 CFR FCC Part 15.225(e) Frequency Stability Versus Input Voltage Test Instrumentation

| Instrument | Model | S/No | Cal Due Date |
|---|---|---|---|
| HP Universal Counter | 53132A | 3736A06236 | 05 April 2016 |
| Agilent Dual Output DC Power Supply | E3620A | MY40000448 | Output Monitor |
| Cincinnati Sub-Zero Climatic Chamber | ZH-8-1-1-H/AC | ZF9722653 | 27 Dec 2015 |

### 47 CFR FCC Part 15.225(e) Frequency Stability Versus Input Voltage Test Setup

1. The EUT and supporting equipment were set up as shown in the setup photo. The EUT was placed in an environmental temperature chamber with a nominal supply voltage. For the battery operated EUT, a new battery was used.
2. The RF antenna connector of the EUT was connected to the frequency counter via a low-loss coaxial cable.

### 47 CFR FCC Part 15.225(e) Frequency Stability Versus Input Voltage Test Method

1. The EUT was switched off and the environmental temperature was set to 20°C.
2. Upon reaching the set temperature with 30 minutes of stabilisation period, the EUT was switched on and configured to operate in the test mode with transmitting frequency at 13.56MHz.
3. The EUT's transmitting frequency was then measured at start up, and two, five and ten minutes after start up with the frequency counter set to measure the transmitting frequency. For each measurement, the signal capturing was continuous until no further changes were observed. Four measurements were made in total.
4. Repeat steps 1 to 3 with the supply voltage set to 85% and 115% of the nominal voltage supply respectively.

**47 CFR FCC Part 15.225(e) Frequency Stability Versus Input Voltage Results**

| | | | |
|---|---|---|---|
| Test Input Power | 3Vdc (Nominal Voltage) | Temperature | 20°C |
| | | Relative Humidity | 60% |
| | | Atmospheric Pressure | 1030mbar |
| | | Tested By | Chang Wai Kit |

| Channel Frequency (MHz) | ± 1% Carrier Tolerance (MHz) | Measured Tolerance (MHz) | Measurement with respects to Start Up Time (Mins) |
|---|---|---|---|
| 13.5600 | ±1356.0000 | -156.8900 | 0 |
| 13.5600 | ±1356.0000 | -157.3900 | 2 |
| 13.5600 | ±1356.0000 | -158.7800 | 5 |
| 13.5600 | ±1356.0000 | -162.5300 | 10 |

| | | | |
|---|---|---|---|
| Test Input Power | 2.55Vdc (85% of the Nominal voltage) | Temperature | 20°C |
| | | Relative Humidity | 60% |
| | | Atmospheric Pressure | 1030mbar |
| | | Tested By | Chang Wai Kit |

| Channel Frequency (MHz) | ± 1% Carrier Tolerance (MHz) | Measured Tolerance (MHz) | Measurement with respects to Start Up Time (Mins) |
|---|---|---|---|
| 13.5600 | ±1356.0000 | -138.0400 | 0 |
| 13.5600 | ±1356.0000 | -146.5500 | 2 |
| 13.5600 | ±1356.0000 | -148.9600 | 5 |
| 13.5600 | ±1356.0000 | -149.6681 | 10 |

| | | | |
|---|---|---|---|
| Test Input Power | 3.45Vdc (115% of the Nominal voltage) | Temperature | 20°C |
| | | Relative Humidity | 60% |
| | | Atmospheric Pressure | 1030mbar |
| | | Tested By | Chang Wai Kit |

| Channel Frequency (MHz) | ± 1% Carrier Tolerance (MHz) | Measured Tolerance (MHz) | Measurement with respects to Start Up Time (Mins) |
|---|---|---|---|
| 13.5600 | ±1356.0000 | -161.3800 | 0 |
| 13.5600 | ±1356.0000 | -169.0700 | 2 |
| 13.5600 | ±1356.0000 | -172.5600 | 5 |
| 13.5600 | ±1356.0000 | -173.2564 | 10 |

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July 2011