

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

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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
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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)

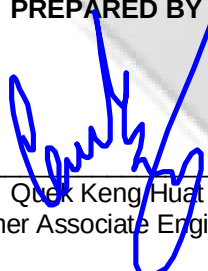
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QUOTATION NUMBER 2191005132

JOB NUMBER 7191097736

TEST PERIOD 29 Sep 2014 – 05 Aug 2015

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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.

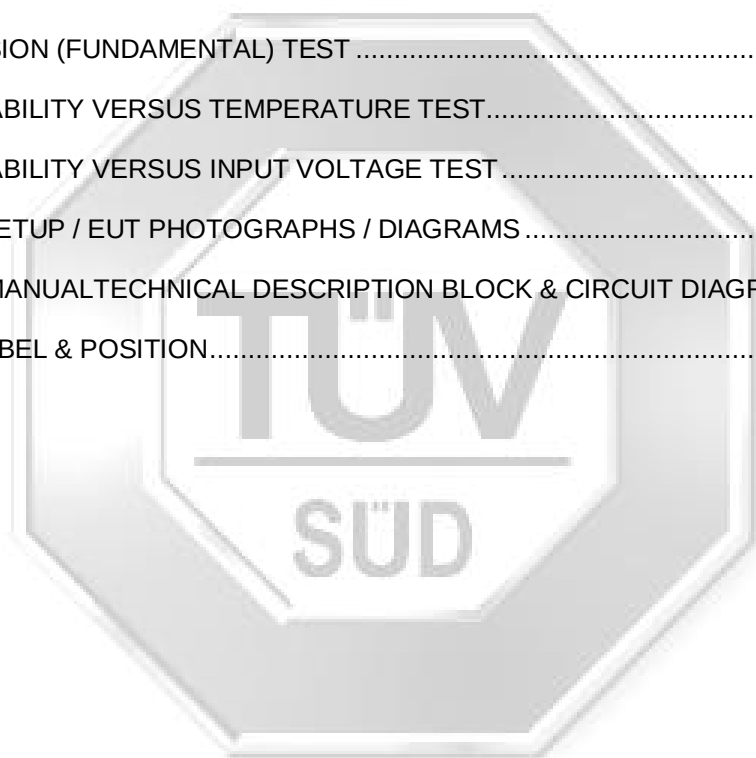
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TEST SUMMARY

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.

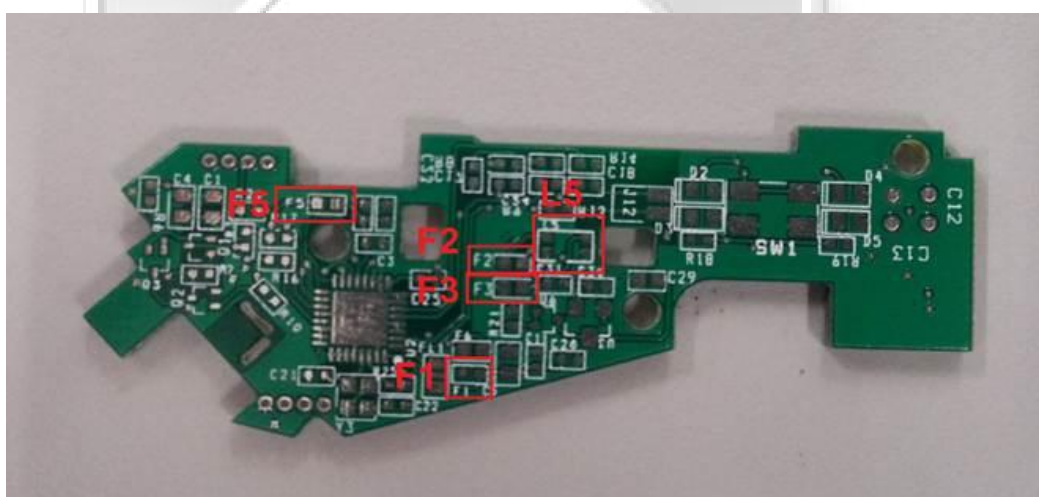
TEST SUMMARY

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
Würth Electronics	Suppression ferrite beads	742792093	Noise suppression	F2,F3,F4,F5
Würth 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 100 Pasir Panjang Road #06-02 Singapore 118518
Manufacturer	: JSB TECH Pte Ltd 100 Pasir Panjang Road #06-02 Singapore 118518
Factory (ies)	: JSB TECH Pte Ltd 100 Pasir Panjang Road #06-02 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**
- 2. Radiated Emissions (Spurious Emissions inclusive Restricted Bands Requirement)**
- 3. Radiated Emissions (Fundamental)**
- 4. Frequency Stability Versus Temperature**
- 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.



CONDUCTED EMISSION TEST

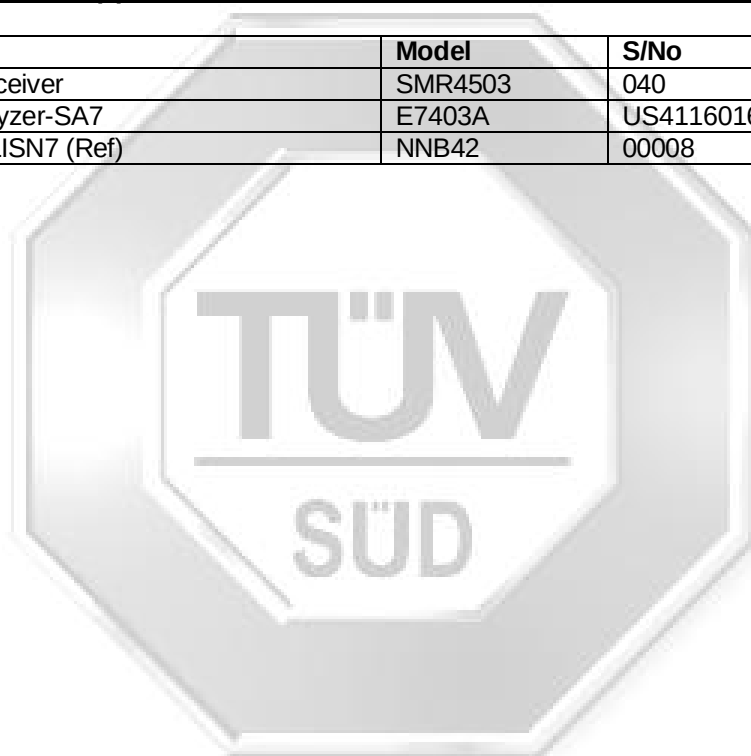
47 CFR FCC Parts 15.107(a) and 15.207 Conducted Emission Limits

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



CONDUCTED EMISSION TEST

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 50 Ω /50 μ H 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 dB μ V

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

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

Therefore, Q-P margin = 60.0 - 40.0 = 20.0

i.e. 20.0 dB below Q-P limit

CONDUCTED EMISSION TEST

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

Test Input Power	120V 60Hz (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.

RADIATED EMISSION TEST

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

RADIATED EMISSION TEST

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 10th 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

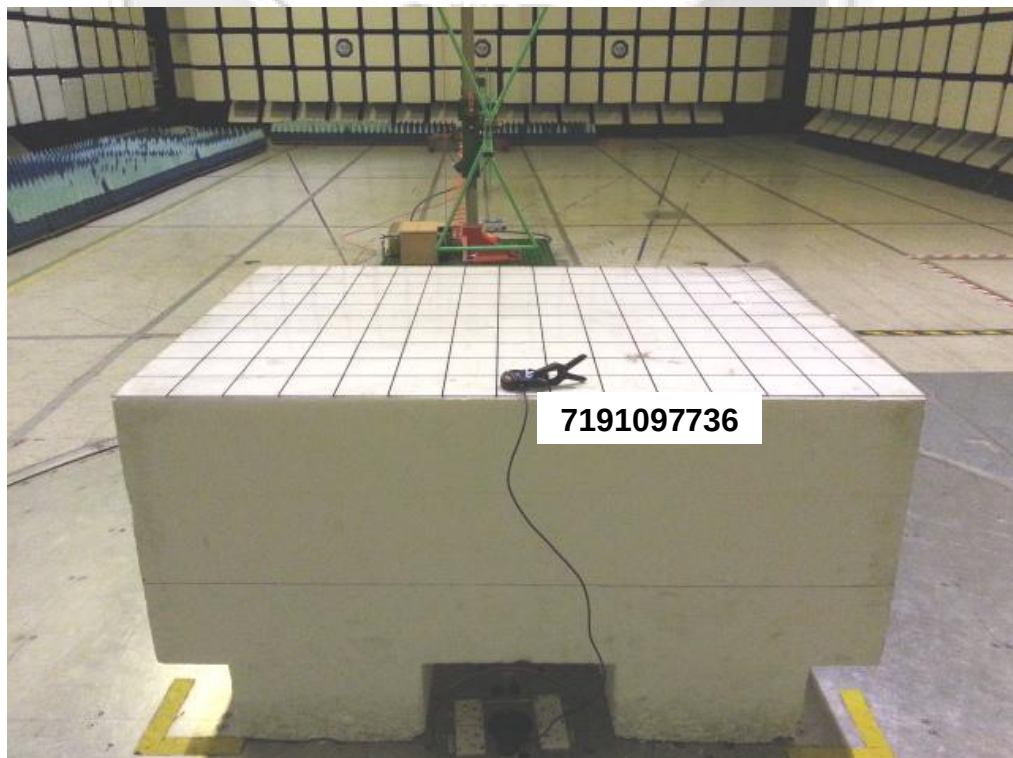
At 300 MHz	Q-P limit = 46.0 dB μ V/m
Log-periodic antenna factor & cable loss at 300 MHz = 18.5 dB	
Q-P reading obtained directly from EMI Receiver = 40.0 dB μ V/m (Calibrated level including antenna factors & cable losses)	
Therefore, Q-P margin = 46.0 - 40.0 = 6.0	i.e. 6.0 dB below Q-P limit

RADIATED EMISSION TEST



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Radiated Emissions Test Setup (Front View)



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Radiated Emissions Test Setup (Rear View)

RADIATED EMISSION TEST

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

Test Input Power	120V 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

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
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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 (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



RADIATED EMISSION TEST

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 $\pm 4.0\text{dB}$.

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 dB μ V/m
Log-periodic antenna factor & cable loss at 300 MHz = 18.5 dB	
Q-P reading obtained directly from EMI Receiver = 40.0 dB μ V/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

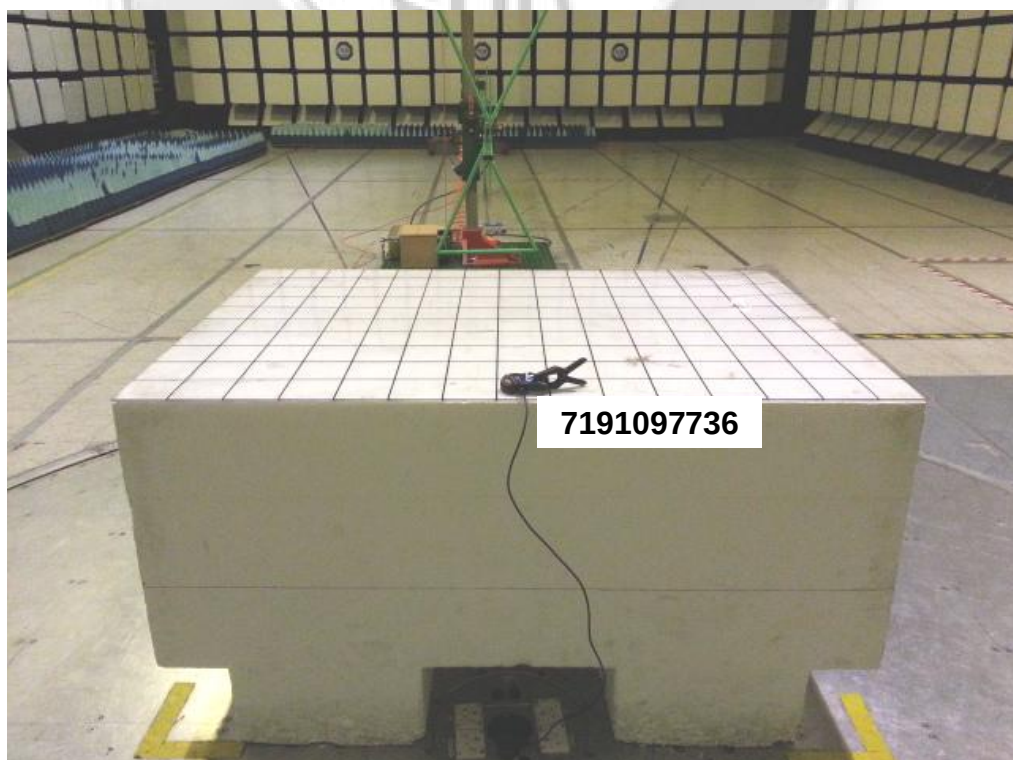
RADIATED EMISSION TEST

30MHz – 1GHz Test Setup



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Radiated Emissions Test Setup (Front View)



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Radiated Emissions Test Setup (Rear View)



RADIATED EMISSION (FUNDAMENTAL) TEST

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

- 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.
- 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.
- 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.
- 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
- 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 $\pm 0.01\%$ for a temperature variation of -20°C to $+50^{\circ}\text{C}$ 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., $+50^{\circ}\text{C}$.
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 .



FREQUENCY STABILITY VERSUS TEMPERATURE TEST

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 $\pm 0.01\%$ 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.



FREQUENCY STABILITY VERSUS INPUT VOLTAGE TEST

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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