Test Report No. S09EEC01803/04
dated 12 Aug 2009

PSB Singapore

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FORMAL REPORT ON TESTING IN ACCORDANCE WITH
FCC Parts 15B & C : 2008
OF A
CONTACT-LESS SMART CARD (CSC) READER/WRITER
[Model : SR14+ABC]
[FCC ID : VTZSR14ABC]

TEST FACILITY	TÜV SÜD PSB Pte Ltd, Electrical & Electronics Centre (EEC), Product Services, 1 Science Park Drive, Singapore 118221
FCC REG. NO.	90937 (3m & 10m OATS) 99142 (10m Semi-Anechoic Chamber) 871638 (3m Semi-Anechoic Chamber) 325572 (10m Semi-Anechoic Chamber)
IND. CANADA REG. NO.	2932I-1 (3m and 10m Semi-Anechoic Chambers)
PREPARED FOR	Kenetics Innovations Pte Ltd 2 Tannery Road #05-01, Cencon Building Singapore 347720 Tel : +65 6749 0083 Fax : +65 6749 0093
QUOTATION NUMBER	Q09EEC02295
JOB NUMBER	S09EEC01803
TEST PERIOD	22 Jul 2009 – 08 Aug 2009

PREPARED BY	**APPROVED BY**
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Associate Engineer	Assistant Vice President

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LA-2007-0380-A
LA-2007-0380-A-1
LA-2007-0381-F
LA-2007-0382-B
LA-2007-0383-G
LA-2007-0384-G
LA-2007-0385-E
LA-2007-0386-C

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
FCC Part 15: 2008		
15.107(a), 15.207	Conducted Emissions	Not Tested *See Note 1
15.109(a), 15.205, 15.209, 15.225(d)	Radiated Emissions (Spurious Emissions inclusive Restricted Bands Requirement)	Pass
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 13.56MHz, which represents the operating channel of the Equipment Under Test (EUT) was chosen and tested. The EUT was configured to operate in the test mode during the test.

2. The Equipment Under Test (EUT) is a DC operated device and contains no provision for public utility connections.

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

4. All test measurement procedures are according to ANSI C63.4: 2003.

Modifications

No modifications were made.

PRODUCT DESCRIPTION

Description	:	The Equipment Under Test (EUT) is a **CONTACT-LESS SMART CARD (CSC) READER/WRITER.** It's designed for use with PC host or embedded into equipment for card encoding, verification and credit/debit operation.
Manufacturer	:	Kenetics Innovations Pte Ltd 2 Tannery Road #05-01, Cencon Building Singapore 347720
Model Number	:	SR14+ABC
Serial Number	:	02000029
Microprocessor	:	AT91SAM7XC256, LPC2468
Operating Frequency	:	13.56MHz
Clock / Oscillator Frequency	:	18.342MHz (Microprocessor) 27.12MHz (RF transceiver) 32.768kHz (Real time clock)
Port / Connectors	:	Mini-USB Connector, RS 232, RS 485
Rated Input Power	:	12Vdc (via connected host), 5V (via USB)
Accessories	:	Nil

SUPPORTING DESCRIPTION DESCRIPTION

Equipment Description (Including Brand Name)	Model, Serial & FCC ID Number	Cable Description (List Length, Type & Purpose)
HP Laptop	M/N: Compaq nx9005 S/N: CNF40970XJ FCC ID: DoC	1.80m USB cable
HP AC Adaptor (for HP Laptop)	M/N: Series PPP014S S/N: 18057-0314 FCC ID: Verification	1.80m unshielded AC power cable 1.80m unshielded DC power cable
Manson Dual DC Power Supply	M/N: EP-613 S/N: 330674612 FCC ID: Nil	1.80m unshielded AC power cable 1.00m unshielded DC power cable

EUT OPERATING CONDITIONS

FCC Part 15
1. Radiated Emissions (Spurious Emissions inclusive Restricted Bands Requirement) **2. Radiated Emissions (Fundamental)** **3. Frequency Stability Versus Temperature** **4. Frequency Stability Versus Input Voltage**
The EUT was exercised by operating in maximum continuous transmission in test mode, i.e transmitting at maximum RF power continuously.

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									

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	2400 / F (kHz) @ 300m
0.490 - 1.705	24000 / F (kHz) @ 30m
1.705 - 30.0	30 @ 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.	

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 (20Hz-26.5GHz) – ESMI3	ESMI	829214/005 829550/004	08 Jan 2010
Agilent Preamplifier (PA7)	87405B	10020	04 Feb 2010
Schaffner Bilog Antenna – BL3	CBL6112B	2549	18 Dec 2009
EMCO Loop Antenna	6502	9108-2673	23 Jul 2010

RADIATED EMISSION TEST

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.

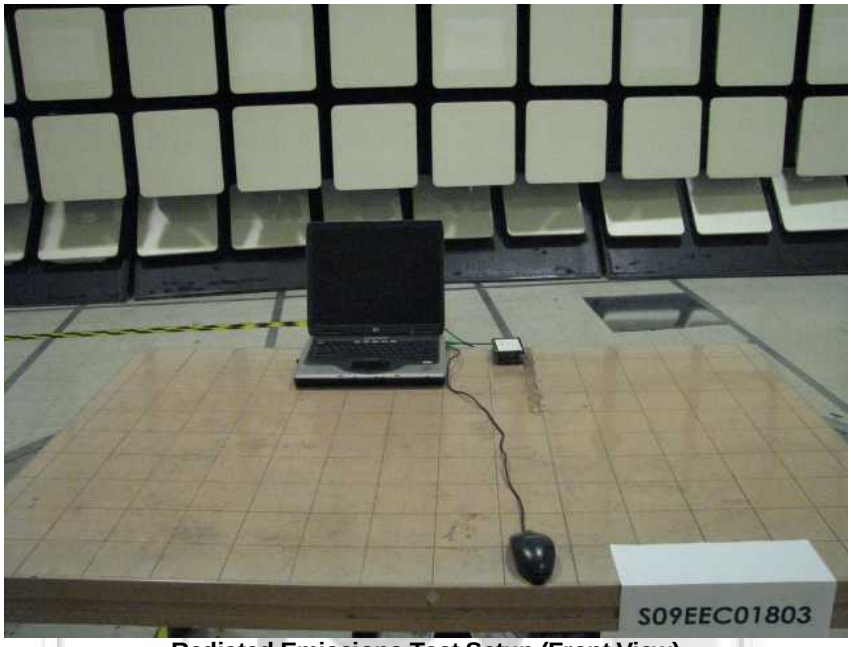
FCC Parts 15.109(a), 15.209 and 5.225(d) Radiated Emission Test Method

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 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.
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.

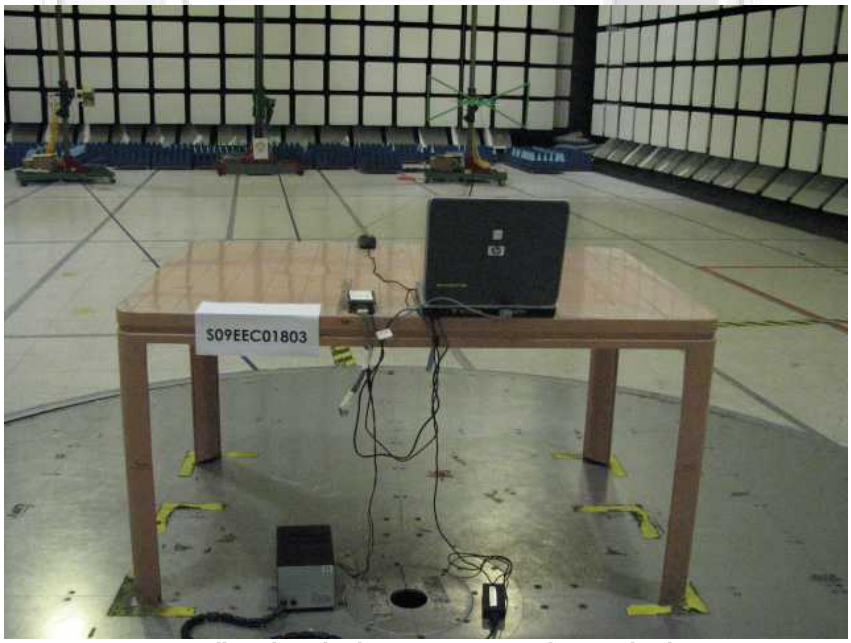
Sample Calculation Example

At 300 MHz Q-P limit (Class B) = 200 μV/m = 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 = 40.0 - 46.0 = -6.0 i.e. 6 dB below Q-P limit

9kHz – 30MHz (@10m)



Radiated Emissions Test Setup (Front View)



Radiated Emissions Test Setup (Rear View)

30MHz – 1GHz (@3m)

Radiated Emissions Test Setup (Front View)

Radiated Emissions Test Setup (Rear View)

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

Operating Mode	Transmit	Temperature	23°C
Test Input Power	12VDC	Relative Humidity	58%
Test Distance	10m	Atmospheric Pressure	1030mbar
		Tested By	Lim Kay Tak

Spurious Emissions ranging from 9kHz – 30MHz

Frequency (MHz)	Q-P Value (dBμV/m)	Q-P Margin (dB)	Azimuth (Degrees)	Height (cm)
27.3100	35.9	-3.6	34	100
--	--	--	--	--
--	--	--	--	--
--	--	--	--	--
--	--	--	--	--
--	--	--	--	--

Operating Mode	Transmit	Temperature	23°C
Test Input Power	12VDC	Relative Humidity	58%
Test Distance	3m	Atmospheric Pressure	1030mbar
		Tested By	Andy Yap

Spurious Emissions ranging from 30MHz – 1GHz

Frequency (MHz)	Q-P Value (dBμV/m)	Q-P Margin (dB)	Azimuth (Degrees)	Height (cm)	Polarisation (H/V)
40.6680	31.6	-8.4	136	100	V
195.3200	33.0	-10.5	175	100	V
215.9250	35.6	-7.9	0	144	H
529.8090	38.2	-7.8	19	100	V
664.2770	38.0	-8.0	32	100	V
930.1330	38.1	-7.9	35	100	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 10m was used for the measurement below 30MHz with the test limit was adjusted based on the following formula:
   New limit @ 10m = 30dBµV/m + 10log (30/10)
3. Quasi-peak measurement was used for frequency measurement up to 1GHz. Average and peak measurements were used for emissions above 1GHz. The average measurement was done by measuring the absolute voltage during a 0.1 second interval during which the field strength is at its maximum value.
4. "--" indicates no emissions were found and shows compliance to the limits.
5. A "-ve" margin indicates a PASS as it refers to the margin present below the limit line at the particular frequency.
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. 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 ±4.6dB.

RADIATED EMISSION (FUNDAMENTAL) TEST

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

FCC Parts 15.225(a), 15.225(b) and 15.225(c) Radiated Emission (Fundamental and Harmonics) Test Instrumentation

Instrument	Model	S/No	Cal Due Date
R&S Test Receiver (20Hz –26.5GHz) – ESMI1 (Ref)	ESMI	849182/003 848926/007	21 Aug 2009
EMCO Loop Antenna	6502	9108-2673	23 Jul 2010

RADIATED EMISSION (FUNDAMENTAL) TEST

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

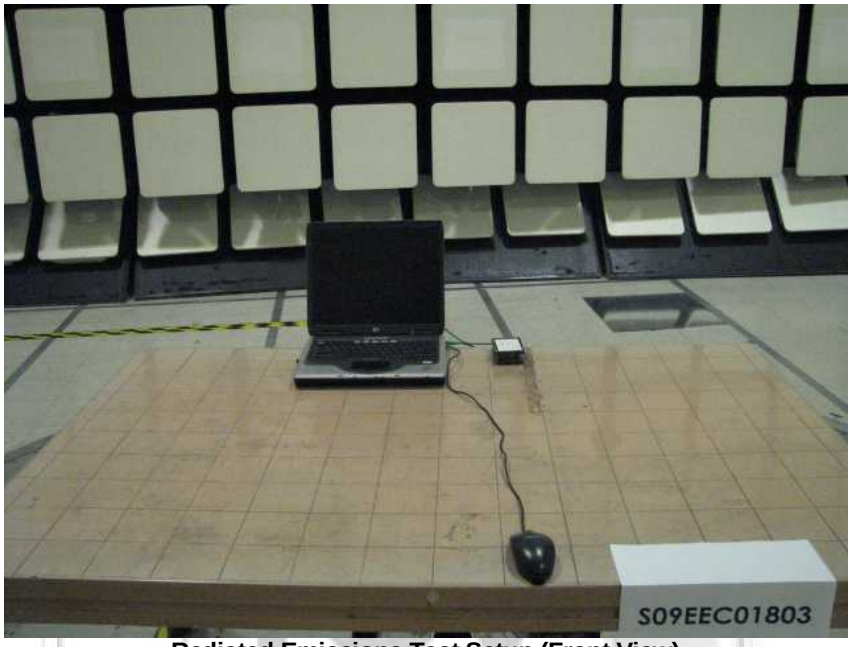
1. The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m X 1.0m X 0.8m high, non-metallic table.
2. The filtered power supply for the EUT and supporting equipment were tapped from the appropriate power sockets located on the turntable.
3. The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

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

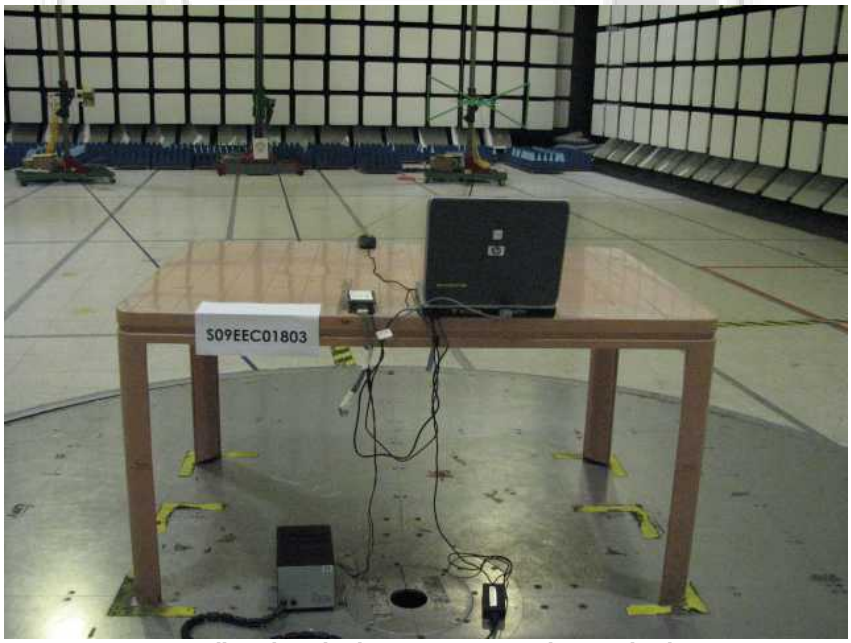
1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. A prescan was carried out to pick the fundamental frequency from the EUT. For EUT which is a portable device, the prescan was carried out by rotating the EUT through three orthogonal axes to determine which altitude and equipment arrangement produces such emissions.
3. The test was carried out at the selected fundamental frequency 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.

Sample Calculation Example

At 300 MHz Q-P limit (Class B) = 200 μV/m = 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 = 40.0 - 46.0 = -6.0 i.e. 6 dB below Q-P limit



Radiated Emissions Test Setup (Front View)



Radiated Emissions Test Setup (Rear View)

FCC Part 15.225(a) Radiated Emission (Fundamental) Results

Operating Mode	Transmit	Temperature	24°C
Test Input Power	12VDC	Relative Humidity	56%
Test Distance	10m *See Note 2	Atmospheric Pressure	1030mbar
		Tested By	Lim Kay Tak

Frequency (MHz)	Q-P Value (dBµV/m)	Q-P Margin (dB) *See Note 2 and 3	Azimuth (Degrees)	Height (cm)
13.5600	60.0	-24.0	37	100

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 10m was used for the measurement instead of 30m as the fundamental (carrier) electric field strength of the EUT at the 10m distance shows compliance to the limit of 30m test distance.
3. The margin shows the margin of the measured value aginast the limit at 30m test distance.
4. A "-ve" margin indicates a PASS as it refers to the margin present below the limit line at the particular frequency.
5. EMI receiver Resolution Bandwidth (RBW) and Video Bandwidth (VBW) settings:
   150kHz - 30MHz
   RBW: 10kHz VBW: 30kHz
6. 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 ±4.6dB.

FREQUENCY STABILITY VERSUS TEMPERATURE TEST

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.

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

Instrument	Model	S/No	Cal Due Date
HP Universal Counter	53132A	3846A09953	07 Mar 2010

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 frequnecy counterr via a low-loss coaxial cable.

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 startup, and two, five and ten minutes after startup with the spectrum analyser was set to max hold to capture the transmitting frequency. For each measurement, the signal capturing was continuous until no further changes were observed. Four measurements were made in total.
5. Repeat steps 1 to 4 with the temperature set to the lowest temperature, i.e, -20°C.

FREQUENCY STABILITY VERSUS TEMPERATURE TEST

Frequency Stability Versus Temperature Test Setup

FREQUENCY STABILITY VERSUS TEMPERATURE TEST

FCC Part 15.225(e) Frequency Stability Versus Temperature Results

Operating Mode	Transmit	Temperature	50°C
Test Input Power	12VDC	Relative Humidity	25%
		Atmospheric Pressure	1030mbar
		Tested By	Chang Wai Kit

Channel Frequency (MHz)	±0.0 1% Carrier Tolerance (Hz)	Measured Tolerance (Hz)	Measurement with respects to Startup Time (Mins)
13.56000000	±1356.0000	+29.2587	0
13.56000000	±1356.0000	+29.0881	2
13.56000000	±1356.0000	+28.6388	5
13.56000000	±1356.0000	+27.6685	10

Operating Mode	Transmit	Temperature	-20°C
Test Input Power	12VDC	Relative Humidity	25%
		Atmospheric Pressure	1030mbar
		Tested By	Chang Wai Kit

Channel Frequency (MHz)	± 0.01% Carrier Tolerance (MHz)	Measured Tolerance (MHz)	Measurement with respects to Startup Time (Mins)
13.56000000	±1356.0000	-314.0261	0
13.56000000	±1356.0000	-314.6321	2
13.56000000	±1356.0000	-315.0787	5
13.56000000	±1356.0000	-315.5512	10

FREQUENCY STABILITY VERSUS INPUT VOLTAGE TEST

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.

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

Instrument	Model	S/No	Cal Due Date
HP Universal Counter	53132A	3846A09953	07 Mar 2010

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.

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 startup, and two, five and ten minutes after startup with the spectrum analyser was set to max hold to capture the transmitting frequency. For each measurement, the signal capturing was continuous until no further changes were observed. Four measurements were made in total.
5. Repeat steps 1 to 4 with the supply voltage set to 85% and 115% of the nominal voltage supply respectively. For the battery operated EUT, this step is not applicable.

FREQUENCY STABILITY VERSUS INPUT VOLTAGE TEST

Frequency Stability Versus Input Voltage Test Setup

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

Operating Mode	Transmit	Temperature	20°C
Test Input Power	12VDC	Relative Humidity	25%
		Atmospheric Pressure	1030mbar
		Tested By	Chang Wai Kit

Channel Frequency (MHz)	± 0.01% Carrier Tolerance (Hz)	Measured Tolerance (Hz)	Measurement with respects to Startup Time (Mins)
13.56000000	±1356.0000	-154.1078	0
13.56000000	±1356.0000	-154.3291	2
13.56000000	±1356.0000	-154.3021	5
13.56000000	±1356.0000	-153.3922	10

This Report is issued under the following conditions:

1. Results of the testing/calibration in the form of a report will be issued immediately after the service has been completed or terminated.

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March 2009

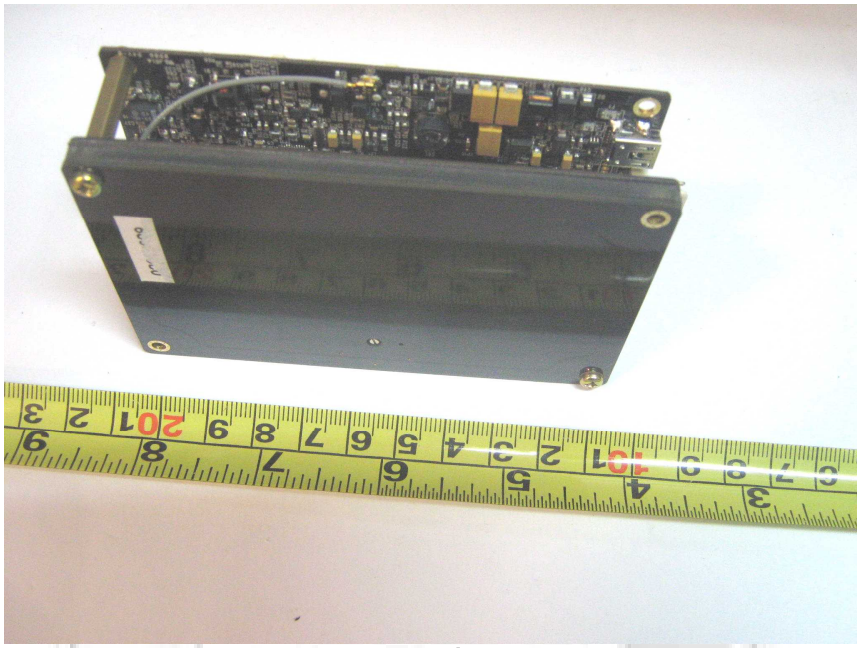
FCC LABEL & POSITION **ANNEX B**

ANNEX A

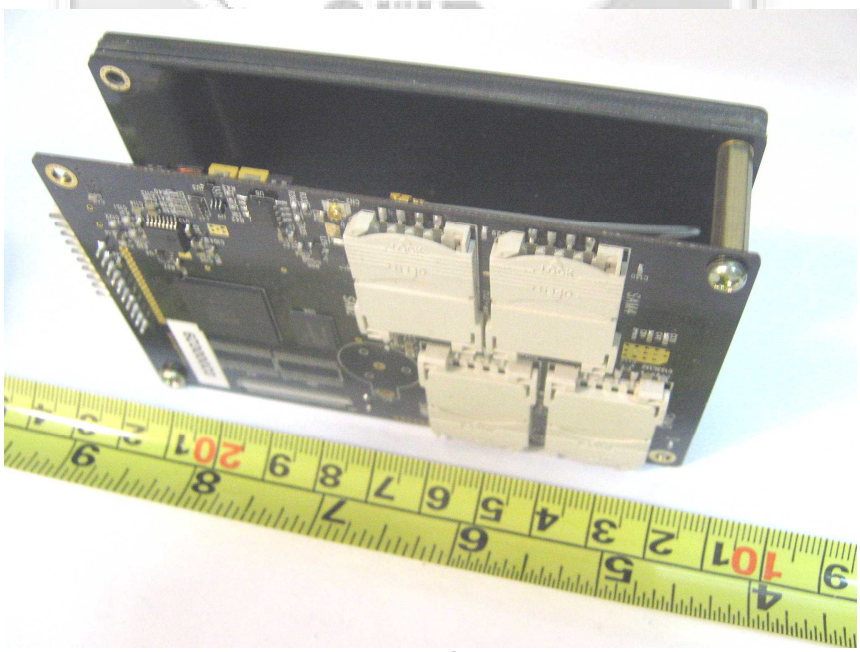
EUT PHOTOGRAPHS / DIAGRAMS

EUT PHOTOGRAPHS / DIAGRAMS — ANNEX A

EUT PHOTOGRAPHS



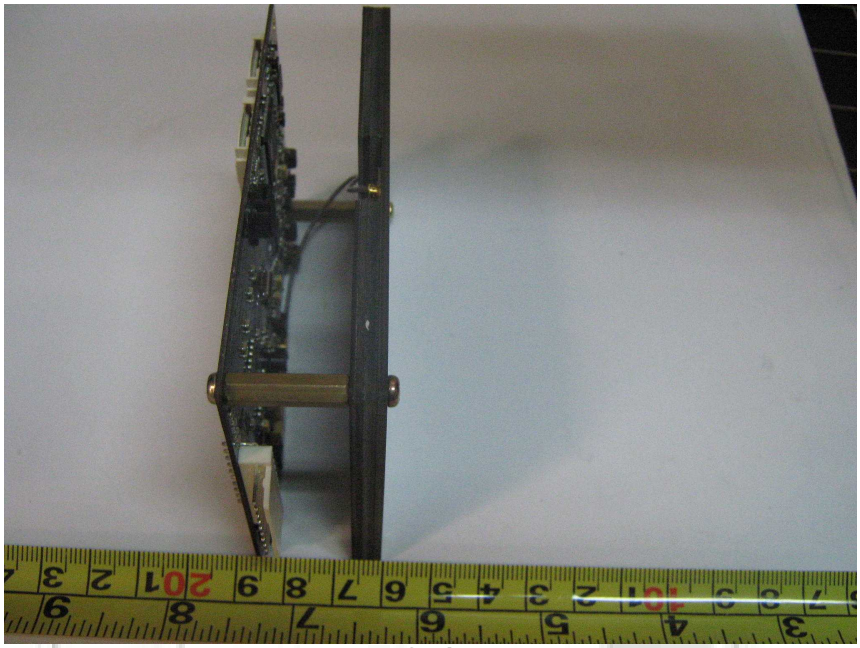
Front View



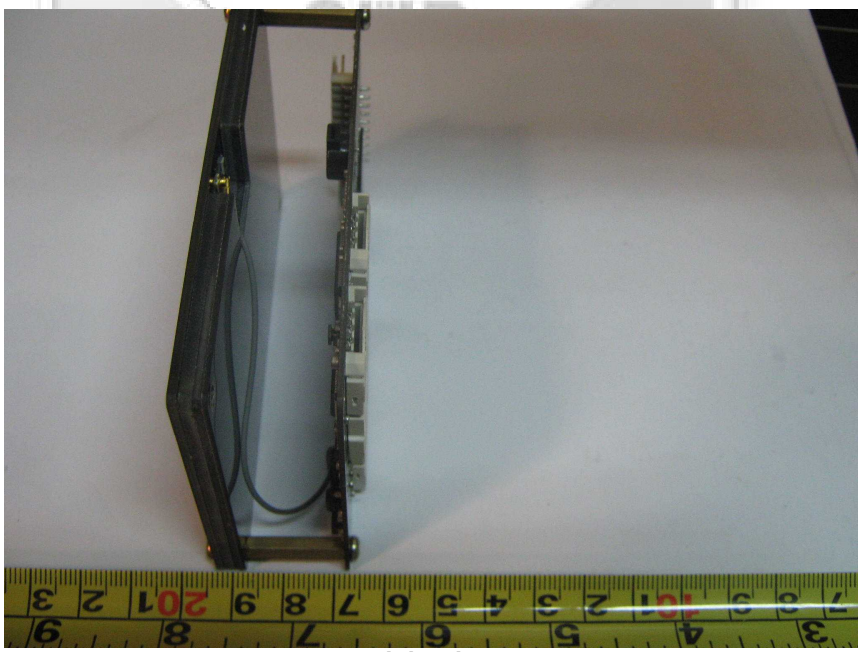
Rear View

EUT PHOTOGRAPHS / DIAGRAMS — ANNEX A

EUT PHOTOGRAPHS



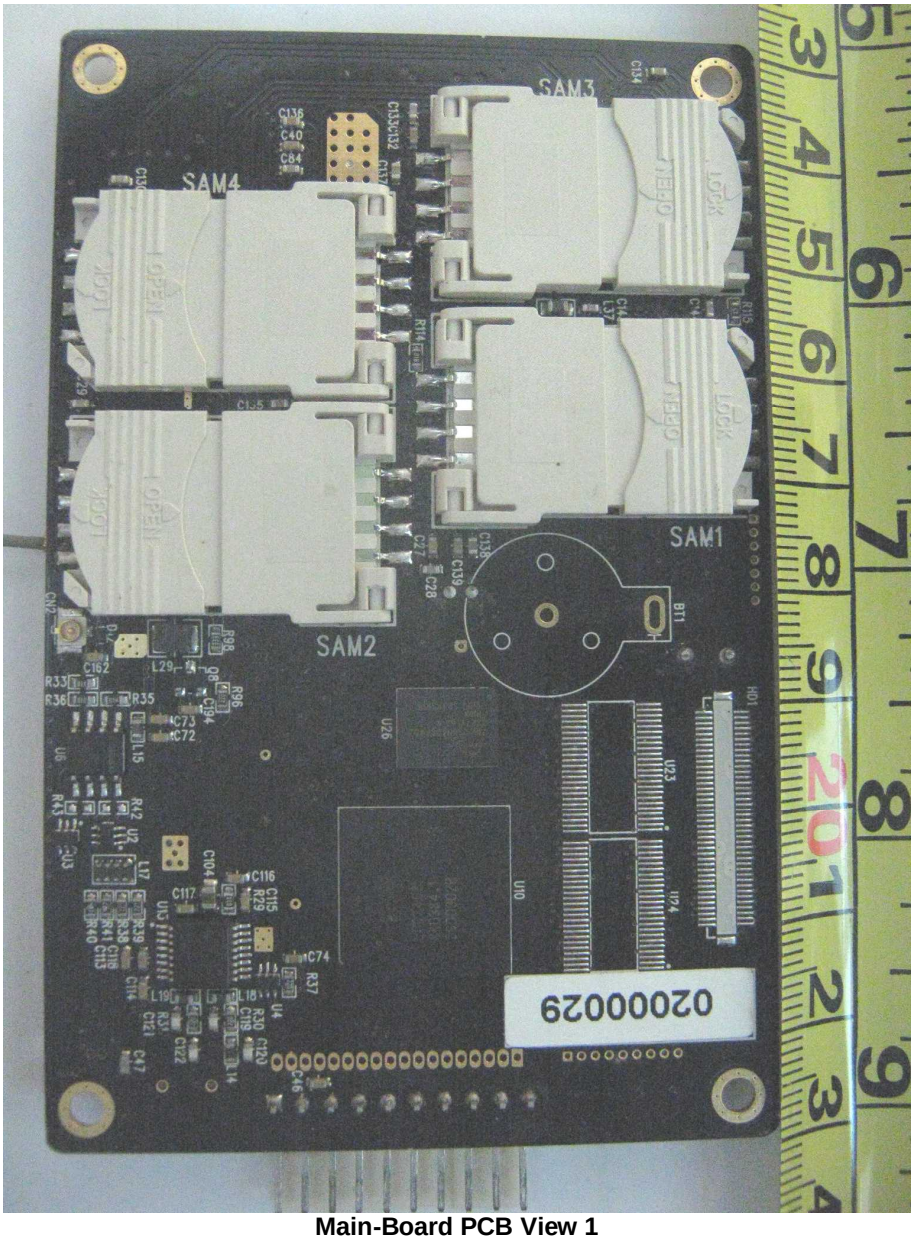
Left View



Right View

EUT PHOTOGRAPHS / DIAGRAMS — ANNEX A

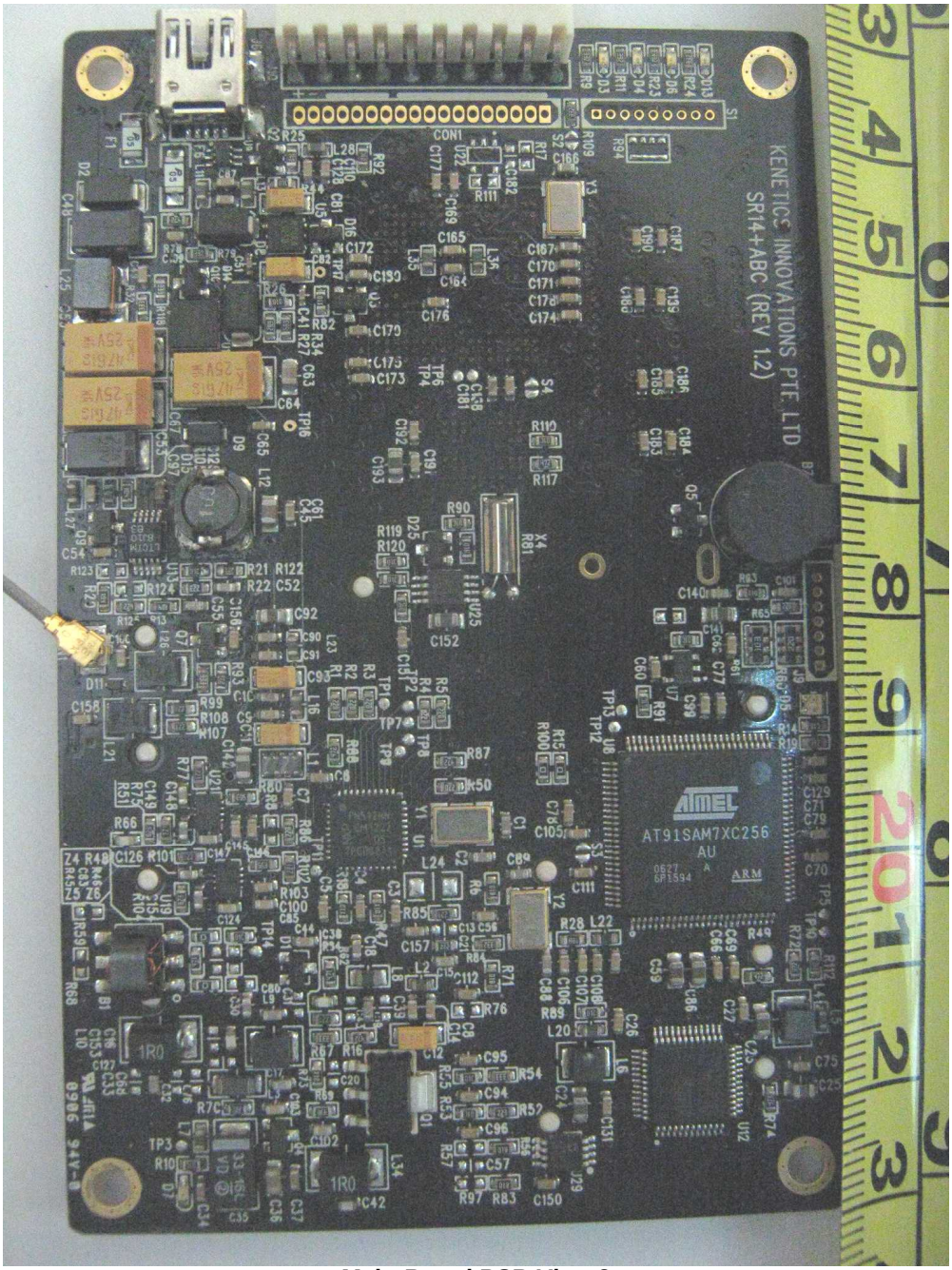
EUT PHOTOGRAPHS



Main-Board PCB View 1

EUT PHOTOGRAPHS / DIAGRAMS — ANNEX A

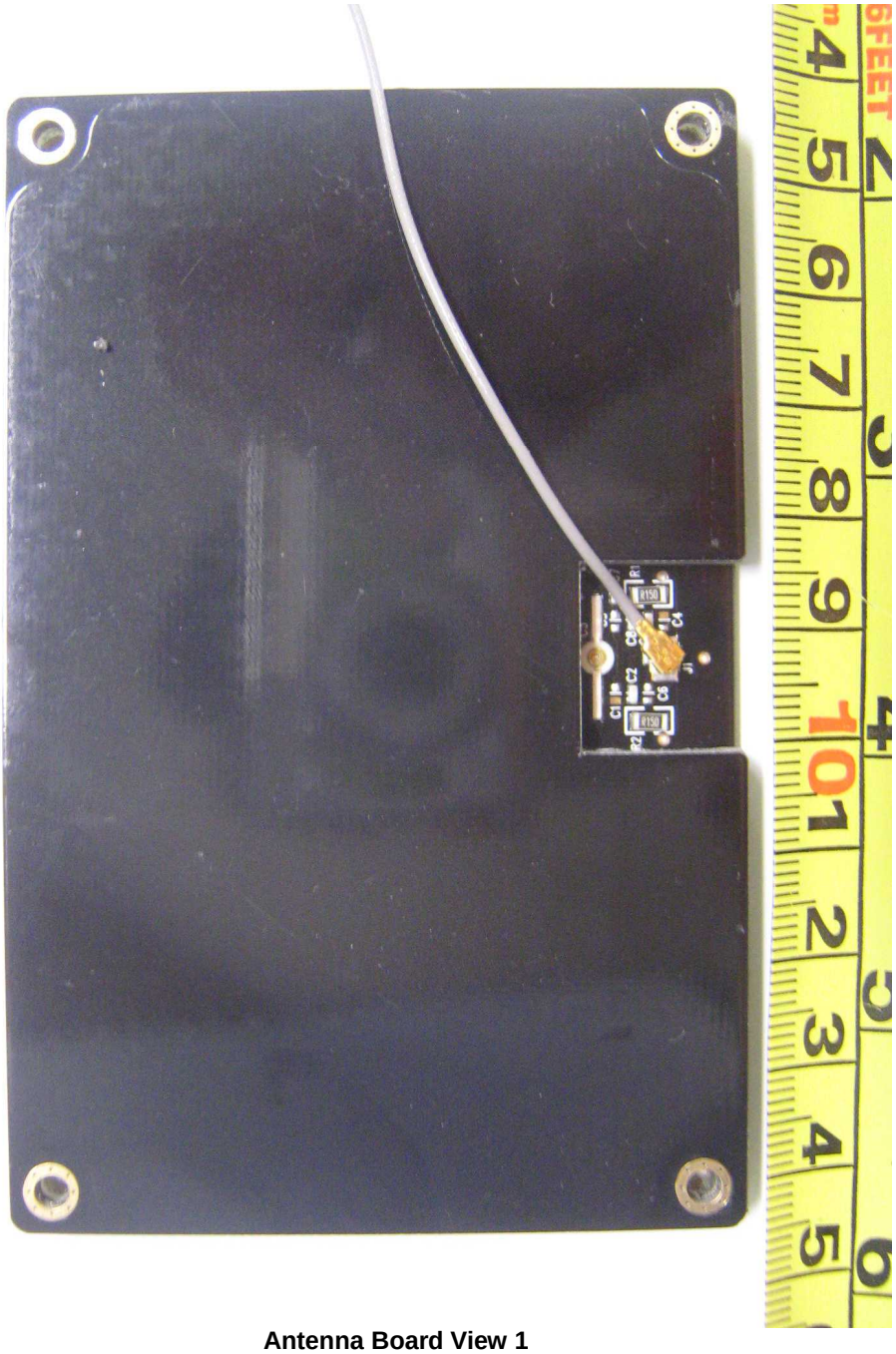
EUT PHOTOGRAPHS



Main-Board PCB View 2

EUT PHOTOGRAPHS / DIAGRAMS — ANNEX A

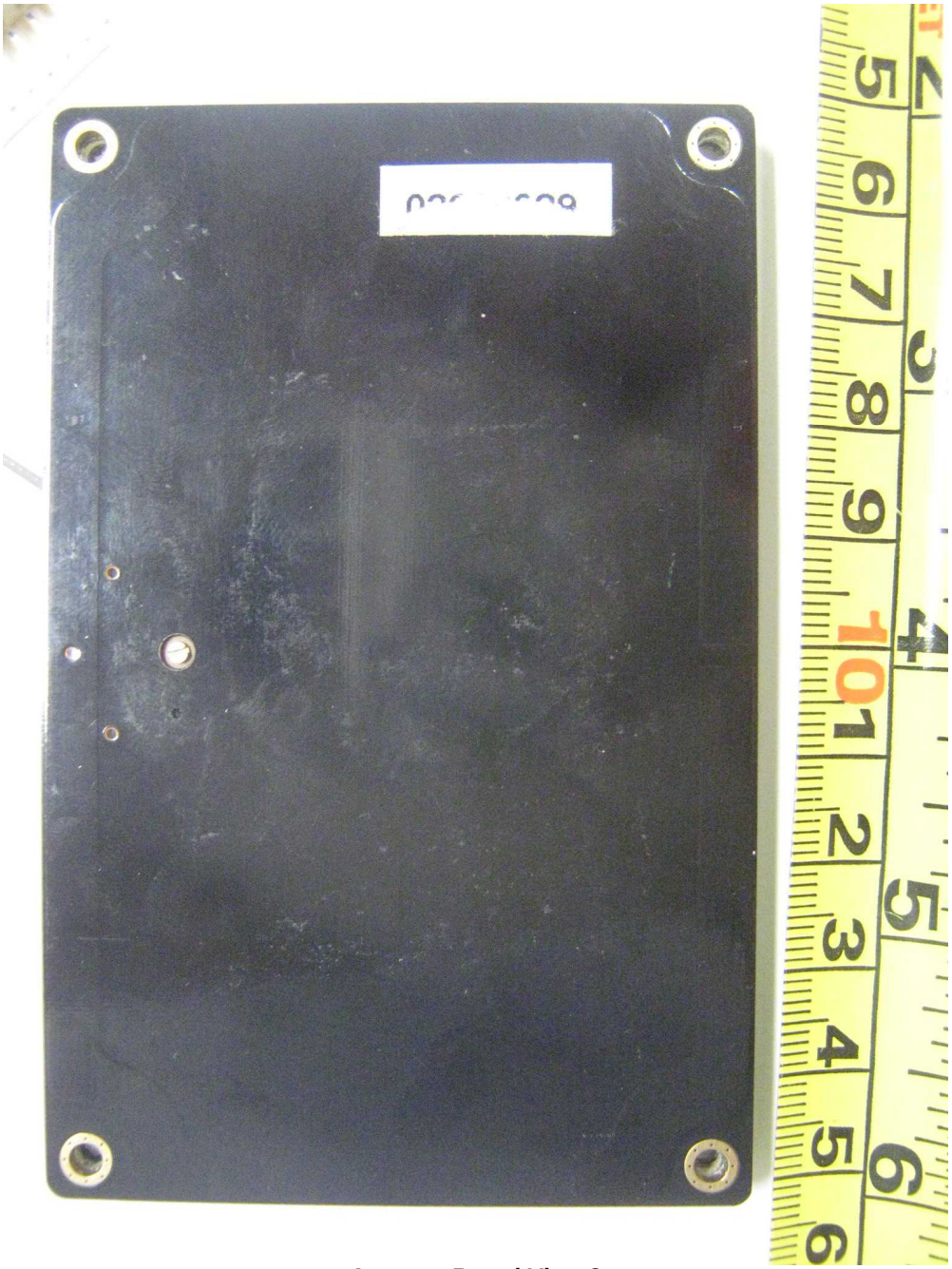
EUT PHOTOGRAPHS



Antenna Board View 1

EUT PHOTOGRAPHS / DIAGRAMS — ANNEX A

EUT PHOTOGRAPHS



Antenna Board View 2

FCC LABEL & POSITION **ANNEX B**

ANNEX B

FCC LABEL & POSITION

FCC LABEL & POSITION — ANNEX B

Labelling requirements per Section 2.925 & 15.19

The label shown will be permanently affixed at a conspicuous location on the device and be readily visible to the user at the time of purchase.

Sample Label

Physical Location of FCC Label on EUT

USER MANUAL TECHINCAL DESCRIPTION BLOCK & CIRCUIT DIAGRAM **ANNEX C**

ANNEX C

USER MANUAL TECHNICAL DESCRIPTION BLOCK & CIRCUIT DIAGRAMS

(Please refer to manufacturer for details)