Test Report No. 7191017859-EEC11/01
dated 28 Oct 2011

PSB Singapore

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FORMAL REPORT ON TESTING IN ACCORDANCE WITH
ETSI EN 301 489-1 V1.8.1 : 2008
ETSI EN 301 489-7 V1.3.1 : 2005
OF A
HOME AUTOMATION SYSTEM
[Model : CP9000]

TEST FACILITY	TÜV SÜD PSB Pte Ltd, Electrical & Electronics Centre (EEC), Product Services, No. 1 Science Park Drive, Singapore 118221 TÜV SÜD PSB Pte Ltd, Electrical & Electronics Centre (EEC), Product Services, 13 Internatonal Business Park #01-01, Singapore 609932
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QUOTATION NUMBER	219138177
JOB NUMBER	7191017859
TEST PERIOD	13 Oct 2011 – 18 Oct 2011

PREPARED BY	**APPROVED BY**
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TÜV SÜD PSB

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LA-2007-0381-F
LA-2007-0382-B
LA-2007-0383-G
LA-2007-0384-G
LA-2007-0385-E
LA-2007-0386-C
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TEST SUMMARY

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

Test Results Summary

Test Standard	Test Description	Pass / Fail
ETSI EN 301 489-1 and ETSI EN 301 489-7 Emissions		
EN 61000-3-2 : 2006	Harmonic Current Emissions (Class A)	Pass
EN 61000-3-3 : 1995	Voltage Fluctuation / Flicker	Pass
EN 55022 : 2006	Conducted Emissions	Pass
EN 55022 : 2006	Radiated Emissions	Pass
ETSI EN 301 489-1 and ETSI EN 301 489-7 Immunity		
IEC 61000-4-2 : 2001	Electrostatic Discharge Immunity	Pass
IEC 61000-4-3 : 2006	RF Radiated Immunity	Pass
IEC 61000-4-4 : 2004	Electrical Fast Transient / Burst Immunity	Pass
IEC 61000-4-5 : 2005	Voltage Surge Immunity	Pass
IEC 61000-4-6 : 2004	Conducted Disturbance Immunity	Pass
IEC 61000-4-11 : 2004	Voltage Dips and Interruptions Immunity	Pass
ISO 7637-2 : 2004	Transient and Surge Immunity (for 12VDC powered equipment)	Not Applicable *See Note 1
ISO 7637-2 : 2004	Transient and Surge Immunity (for 24VDC powered equipment)	Not Applicable *See Note 1

Notes

1. The Equipment Under Test (EUT) is not an equipment for vehicular use.

Modifications

No modifications were made.

PRODUCT DESCRIPTION

Description	:	The Equipment Under Test (EUT) is a **HOME AUTOMATION SYSTEM.**
Manufacturer	:	Cytech Technology Pte Ltd 55 Ubi Ave 1 #07-04 Singapore 408935
Model Number(s)	:	CP9000
Serial Number(s)	:	Nil
Microprocessor(s)	:	Toshiba TMP91FY42FG
Operating Frequency	:	9.8304 MHz
Clock / Oscillator Frequency	:	9.8304 MHz
Modulation	:	Not Applicable.
Port / Connectors	:	Refer to manufacturer's user manual / operating manual.
Rated Input Power	:	230V 50Hz
Accessories	:	Refer to manufacturer

SUPPORTING DESCRIPTION DESCRIPTION

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

EUT OPERATING CONDITIONS

ETSI EN 301 489-1 and ETSI EN 301 489-7 Emissions
1. Harmonic Current Emissions **2. Voltage Fluctuation / Flicker Emissions** **3. Conducted Emissions** **4. Radiated Emissions**
The EUT was exercised in the Security Off (Disarm) mode whereby the control unit will monitor the sensors connected to it continuously.
ETSI EN 301 489-1 and ETSI EN 301 489-7 Immunity
1. Electrostatic Discharge Immunity **2. RF Radiated Immunity** **3. Electrical Fast Transient / Burst Immunity** **4. Voltage Surge Immunity** **5. Conducted Disturbance Immunity** **6. Voltage Dips and Interruptions Immunity**
The EUT was exercised in the Security Off (Disarm) mode whereby the control unit will monitor the sensors connected to it continuously.

HARMONIC CURRENT EMISSION TEST

EN 61000-3-2 Harmonic Current Emission Limits (Class A)

Harmonic Order (n)	Maximum Permissible Harmonic Current (A)
Odd Harmonics	
3	2.30
5	1.14
7	0.77
9	0.40
11	0.33
13	0.21
$15 \leq n \leq 39$	0.51 x 15 / n
Even Harmonics	
2	1.08
4	0.43
6	0.30
$8 \leq n \leq 40$	0.23 x 8 / n

EN 61000-3-2 Harmonic Current Emission Test Instrumentation

Instrument	Model	S/No	Cal Due Date
Voltech Universal 3-Phase Power Analyzer – Voltech1	PM6000	200006700392	30 Jun 2012
Voltech LISN – Voltech1	IEC Standard 555	IB54/5118	NA
Elgar Power Supply	SW3500A	511	Output monitored

EN 61000-3-2 Harmonic Current Emission Test Setup

1. The EUT was arranged as shown in the setup photos.
2. The EUT mains cable was plugged into the test system at the reference impedance output, from where the EUT receives its 230V 50Hz supply. The mains cable was laid in the most direct path between the test system and the EUT, with its length not exceeding 1m. Cable length in excess of 1m were bundled parallel to the mains cable.
3. The distance between the test system and the EUT was maintained at 0.8m.

EN 61000-3-2 Harmonic Current Emission Test Method

1. Verification of the equipment Class was made prior to the test as spelt out in the standard. This was necessary to ensure that the correct Class limit was applied during the test.
2. The EUT was switched on at the start of the test, but actual measurements commenced only after a 10 seconds delay, as specified in the standard.
3. The harmonic current emissions were measured automatically within the test system, with the results being downloaded to the test system PC controller.
4. For Class D equipment, the Class D limit was adjusted in real time during the measurements, according to the actual power drawn. The voltage source was monitored simultaneously during the test to ensure that the harmonic content and voltage deviations were within the acceptable limits specified in the standard.
5. For Class B equipment, the Class B limit for transitory harmonics (for orders 2 to 10 not exceeding 10% of the 2.5 minute observation period) was adjusted 1.5 times the limit for steady-state harmonics (Class A limits).

Harmonic Current Emissions Test Setup

EN 61000-3-2 Harmonic Current Emission Results

Operating Mode	Disarm Mode	Temperature	20°C
Test Input Power	230V 50Hz	Relative Humidity	60%
		Atmospheric Pressure	1030mbar
		Tested By	Paul Teo

Voltage (V)	229.1881
Frequency (Hz)	49.9840
Current (A)	0.0741
Power (W)	15.9026
Power Factor	0.7997
Class	A
Result	Pass
Voltage Source Qualification Result	Pass

EN 61000-3-3 Voltage Fluctuation / Flicker Limits

Tests	Limits	Description
P_{st}	1.0	P_{st} : short-term flicker indicator
P_{lt}	0.65	P_{lt} : long-term flicker indicator
d(t) (ms)	200	d(t) : maximum time that not exceeds 200ms
d_{max} (%)	4	d_{max} : maximum relative voltage change
d_c (%)	3	d_c : maximum relative steady-state voltage change

EN 61000-3-3 Voltage Fluctuation / Flicker Test Instrumentation

Instrument	Model	S/No	Cal Due Date
Voltech Universal 3-Phase Power Analyzer – Voltech1	PM6000	200006700392	30 Jun 2012
Voltech LISN – Voltech1	IEC Standard 555	IB54/5118	NA
Elgar Power Supply	SW3500A	511	Output monitored

EN 61000-3-3 Voltage Fluctuation / Flicker Test Setup

1. The EUT was arranged as shown in the setup photos.
2. The EUT mains cable was plugged into the test system at the reference impedance output, from where the EUT receives its 230V 50Hz supply. The mains cable was laid in the most direct path between the test system and the EUT, with its length not exceeding 1m. Cable length in excess of 1m were bundled parallel to the mains cable.
3. The distance between the test system and the EUT was maintained at 0.8m.

EN 61000-3-3 Voltage Fluctuation / Flicker Test Method

1. The voltage fluctuation/flicker was measured automatically within the test system, with the results being downloaded to the test system PC controller.
2. The test voltage supply, to which the EUT was connected, was checked during the test to ensure that:
   a. The voltage was maintained at ±2% of nominal.
   b. The frequency was maintained at 50Hz ±0.5%.
   c. The total harmonic distortion of the supply was less than 3%.

Voltage Fluctuation / Flicker Test Setup

EN 61000-3-3 Voltage Fluctuation / Flicker Results

Operating Mode	Disarm Mode	Temperature	20°C
Test Input Power	230V 50Hz	Relative Humidity	60%
		Atmospheric Pressure	1030mbar
		Tested By	Paul Teo

Parameters	Reading	Limits	Results
P_{st}	0.0850	1	Pass
d_c (%)	0.0030	3	Pass
d_{max} (%)	0.0170	4	Pass
d_t (ms)	0	200	Pass

EN 55022 Conducted Emission Limits

AC / DC Port

Frequency Range (MHz)	Limit Values (dBµV)	
	Quasi-peak (QP)	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		

EN 55022 Conducted Emission Test Instrumentation

Instrument	Model	S/No	Cal Due Date
R&S Test Receiver – ESI3	ESIB7	100015	05 Jul 2012
Agilent EMC Analyzer-SA7	E7403A	US41160167	27 May 2012
Schaffner LISN –LISN7 (Ref)	NNB42	00008	16 Jun 2012
EMCO LISN (for supporting) – LISN6	3825/2	9309-2127	29 Jul 2012

AC / DC Port

EN 55022 Conducted Emission Test Setup

1. The EUT and supporting equipment were set up in accordance with the requirements of the standard as shown in the setup photos.
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.

EN 55022 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 (Class B) = 1000 μV = 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 = 40.0 - 60.0 = -20.0 i.e. 20.0 dB below Q-P limit

Conducted Emissions Test Setup (Front View)

Conducted Emissions Test Setup (Rear View)

EN 55022 Conducted Emission Results

Operating Mode	Disarm Mode	Temperature	20°C
Test Input Power	230V 50Hz	Relative Humidity	60%
Line Under Test	AC Mains	Atmospheric Pressure	1030mbar
		Tested By	Paul Teo

Frequency (MHz)	Q-P Value (dBμV)	Q-P Margin (dB)	AV Value (dBμV)	AV Margin (dB)	Line
0.1561	53.7	-12.0	24.4	-31.3	Neutral
0.1826	52.7	-11.7	22.9	-31.5	Live
0.2639	40.3	-21.0	10.8	-40.5	Neutral
0.2868	41.5	-19.1	10.8	-39.8	Live
0.2948	39.9	-20.5	10.6	-39.8	Live
0.3124	38.5	-21.5	9.5	-40.4	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 "-ve" margin indicates a PASS as it refers to the margin present below the limit line at the particular frequency.
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.

EN 55022 Radiated Emission Limits

Frequency Range (MHz)	Quasi-Peak Limit Values (dBµV/m) @ 10m
30 - 230	30.0
230 - 1000	37.0
Note : At transition frequency, lower limit applies.	

Frequency Range (GHz)	Average Limit Values (dBµV/m) @ 3m	Peak Limit Values (dBµV/m) @ 3m
1 - 3	50.0	70.0
3 - 6	54.0	74.0
Note : At transition frequency, lower limit applies.		

EN 55022 Radiated Emission Test Instrumentation

Instrument	Model	S/No	Cal Due Date
R&S Test Receiver – ESI1	ESI40	100010	06 Jun 2012
Schaffner Bilog Antenna –(30MHz-2GHz) BL3 (Ref)	CBL6112B	2549	06 Jan 2012
EMCO Horn Antenna(1GHz-18GHz) – H15 (Ref)	3115	0003-6008	20 May 2012
Teseq Preamplifier (9kHz-1GHz)	LNA6901	72266	23 Jun 2012
Agilent Preamplifier(1GHz-26.5GHz) (PA18)	8449D	3008A02305	08 Oct 2012

EN 55022 Radiated Emission Test Setup

1. The EUT and supporting equipment were set up in accordance with the requirements of the standard as shown in the setup photos.
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.

EN 55022 Radiated Emission Test Method

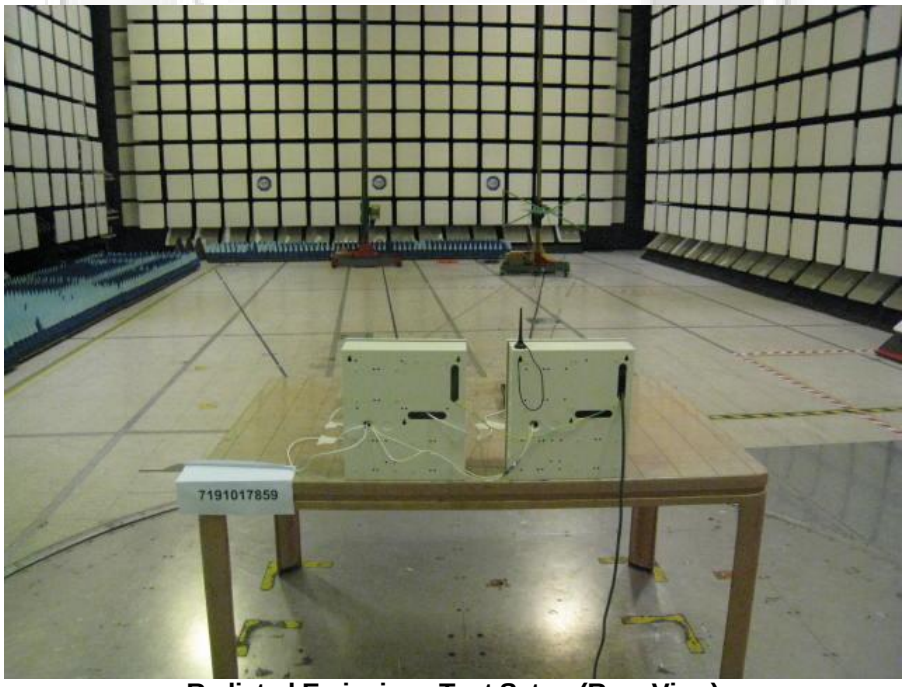
1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. A prescan was carried out to pick the worst emission frequencies from the EUT. For EUT which is a portable device, the prescan was carried out by rotating the EUT through three orthogonal axes to determine which altitude 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 30MHz to 6GHz, using the 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) = 70.8 μV/m = 37.0 dBμV/m
Log-periodic antenna factor & cable loss at 300 MHz = 18.5 dB
Q-P reading obtained directly from EMI Receiver = 31.0 dBμV/m (Calibrated level including antenna factors & cable losses)
Therefore, Q-P margin = 31.0 - 37.0 = -6.0 i.e. 6 dB below Q-P limit

30MHz – 1GHz Test Setup

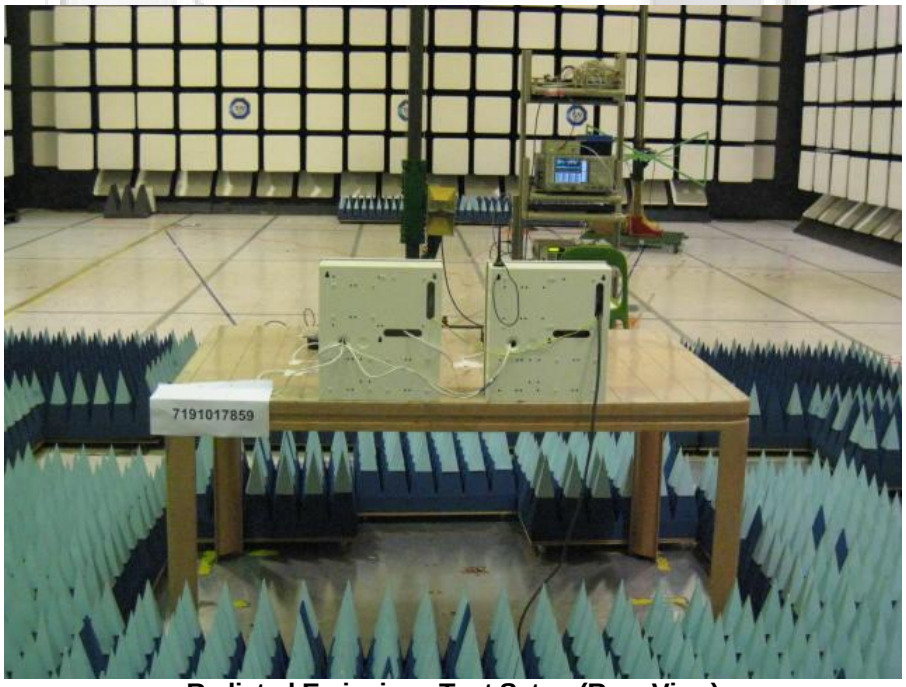
Radiated Emissions Test Setup (Front View)



Radiated Emissions Test Setup (Rear View)

1GHz – 6GHz Test Setup

Radiated Emissions Test Setup (Front View)



Radiated Emissions Test Setup (Rear View)

EN 55022 Radiated Emission Results

Operating Mode	Disarm Mode	Temperature	23°C
Test Input Power	230V 50Hz	Relative Humidity	55%
Test Distance	10m (30MHz – 1GHz) 3m (>1GHz – 6GHz)	Atmospheric Pressure	1030mbar
		Tested By	Zechs Ng Chee Siong

Emissions ranging from 30MHz – 1GHz

Frequency (MHz)	Q-P Value (dBµV/m)	Q-P Margin (dB)	Azimuth (Degrees)	Height (cm)	Polarisation (H/V)
31.3190	9.3	-20.7	351	143	V
49.3320	23.6	-6.4	233	100	H
61.4480	15.3	-14.7	164	272	H
97.2230	15.8	-14.2	116	114	V
148.0730	12.4	-17.6	355	100	H
399.9960	23.6	-13.4	40	240	V

Emissions above 1GHz-6GHz

Frequency (GHz)	Peak Value (dBµV/m)	Peak Margin (dBµV/m)	Average Value (dBµV/m)	Average Margin (dB)	Azimuth (Degrees)	Height (cm)	Pol (H/V)
4.8771	30.6	-43.4	23.9	-30.1	290	100	V
5.0987	32.8	-41.2	26.2	-27.8	323	170	H
5.1643	32.7	-41.3	25.9	-28.1	164	100	V
5.1930	33.1	-40.9	26.4	-27.6	156	142	H
5.4105	33.1	-40.9	26.4	-27.6	121	146	V
5.5052	33.8	-40.2	27.2	-26.8	160	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 "-ve" margin indicates a PASS as it refers to the margin present below the limit line at the particular frequency.
3. EMI receiver Resolution Bandwidth (RBW) and Video Bandwidth (VBW) settings:
   30MHz - 1GHz
   RBW: 120kHz VBW: 1MHz
   1GHz – 6GHz
   RBW: 1MHz VBW: 1MHz
4. 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 – 6.0GHz is ± 4.0dB.

IEC 61000-4-2 Electrostatic Discharge Immunity Test Pass / Fail Criteria

Test: Electrostatic Discharge Immunity
Performance Criteria: B - Transient phenomena for transmitter (TT) and receiver (TR)
PASS Criteria: The EUT shall meet the minimum criteria as specified: a. The EUT shall operate without user noticeable loss of communication link during and after the test. b. The EUT shall operate as intended with no loss of user control functions or stored data during and after the test. The communication shall be maintained after the test. c. The EUT shall show no unintentional responses when it is in idle condition. **FAIL Criteria**: For the parameters observed, anything contrary to the pass criteria is considered as FAIL.
Monitoring Method(s): a. The performance of the EUT was monitored by observing the LCD display condition of the EUT and for any alarm from the EUT.

IEC 61000-4-2 Electrostatic Discharge Immunity Test Instrumentation

Instrument	Model	S/No	Cal Due Date
NoiseKen ESD Simulator – ESD4	ESS-2002	ESS02Y1214	23 Jun 2012
NoiseKen ESD Gun – ESD4	TC-815R	ESS0746840	23 Jun 2012

ELECTROSTATIC DISCHARGE IMMUNITY TEST

IEC 61000-4-2 Electrostatic Discharge Immunity Test Setup

1. The test setup was in accordance with the standard.
2. The electrostatic discharge (ESD) gun was loaded with the correct charging / discharge network specified by the standard.
3. A 0.8m high, non-metallic table, with a Horizontal Coupling Plane (HCP) placed on the tabletop, was used as a test bench. The EUT and supporting equipment were placed on the test bench, isolated from the HCP by a thin insulating sheet.
4. The HCP was grounded to the ground plane via two 470 kΩ "bleed" resistors at each end of the ground cable.
5. A Vertical Coupling Plane (VCP) was also used during the test. The VCP was also grounded to the ground plane in a similar manner as the HCP.

IEC 61000-4-2 Electrostatic Discharge Immunity Test Method

1. Direct Air & Contact Discharges

   Application of direct air and contact discharges to the discharge points specified by the customer were carried out in the following manner:

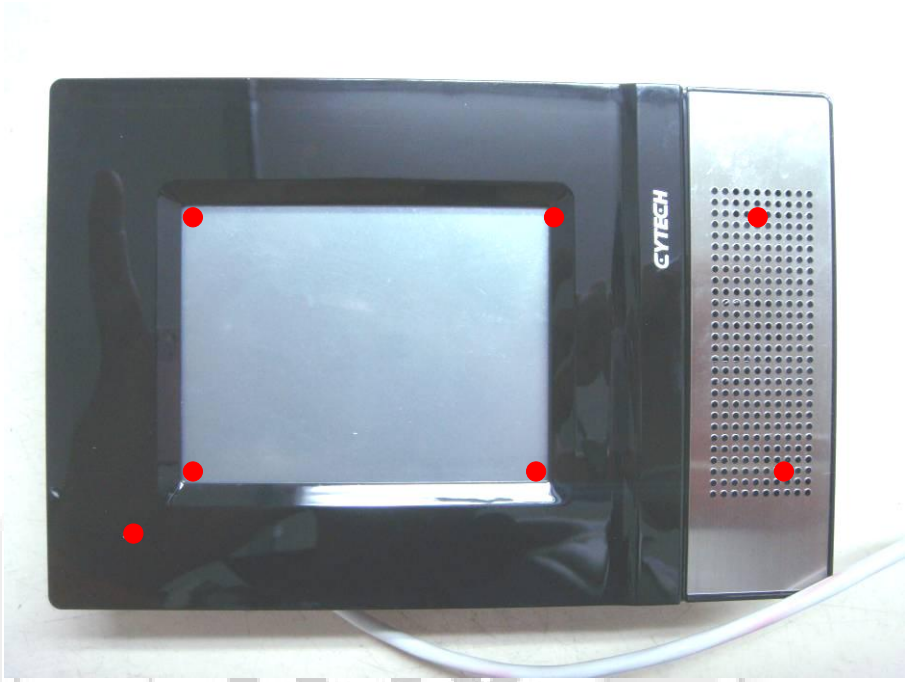
   a. The EUT was switched on and allowed to warm up to its normal operating condition.
   b. The test discharge points are shown in the report.
   c. For air discharges, the charged rounded electrode was positioned at a distance away from the test point and moved towards the EUT at a steady rate until a discharge was made or until the electrode touched the EUT, whichever occurs first.
   d. For contact discharges, the pointed electrode was applied directly to the test point, in contact with the conductive surface of the EUT. The discharges were then made with the electrode in contact with the EUT.
   e. The required number of positive and negative discharges were applied at each test point; with a one second interval between discharges.
   f. The EUT was monitored during the test in accordance with the Pass / Fail criteria declared by the customer.

2. Indirect Coupling Plane Discharges

   Indirect application of discharges using the HCP & VCP were performed on the sides of the EUT in the following manner:

   a. The EUT was switched on and allowed to warm up to its normal operating condition.
   b. The discharges to the HCP / VCP were made 0.1m away from one side of the EUT.
   c. The required number of positive and negative discharges was applied at each test point; with one second interval between discharges.
   d. The EUT was monitored during the test in accordance with the Pass / Fail criteria declared by the customer.
   e. The test was then repeated on the remaining necessary sides of the EUT.

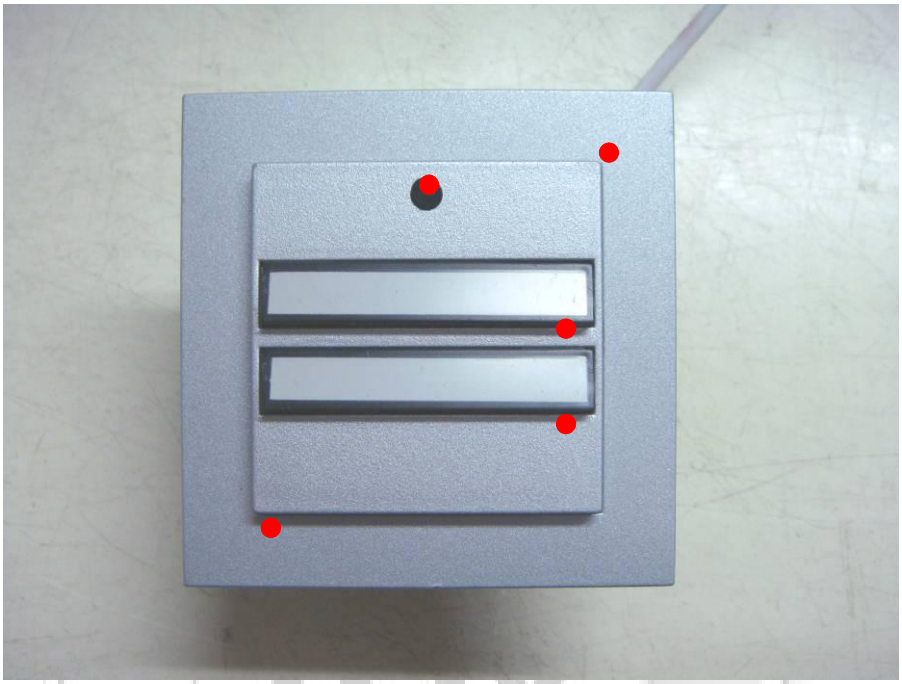
Electrostatic Discharge Immunity Test Setup



ESD TEST POINTS

ESD TEST POINTS

- **Air Discharge**
- **Contact Discharge**



ESD TEST POINTS

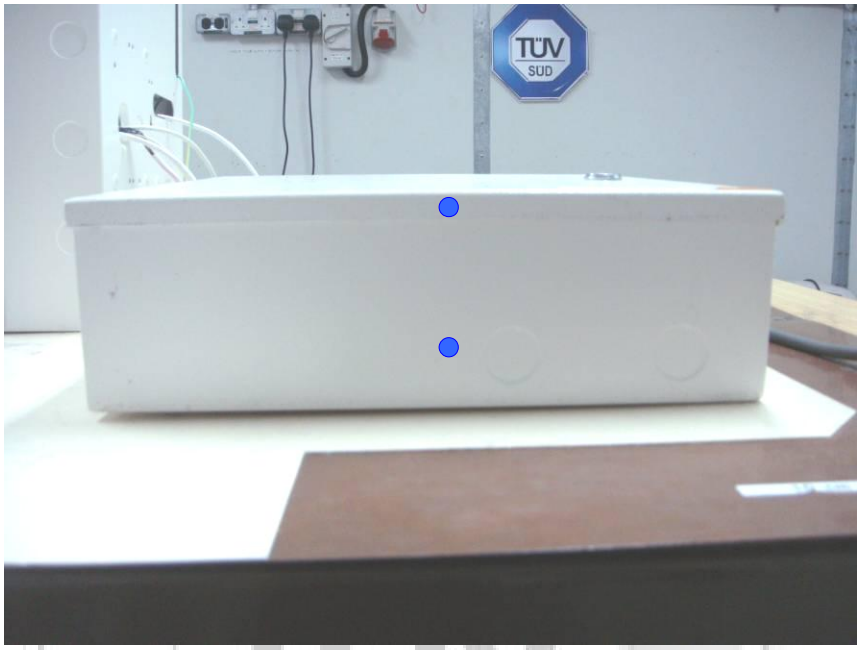
ESD TEST POINTS

- **Air Discharge**
- **Contact Discharge**

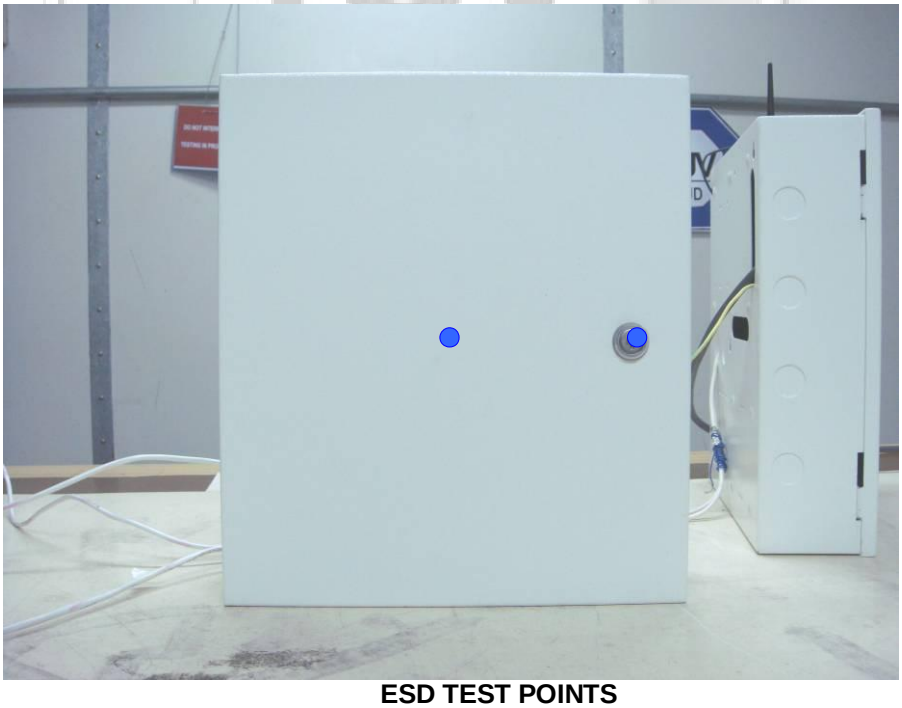
ESD TEST POINTS

ESD TEST POINTS

- **Air Discharge**
- **Contact Discharge**

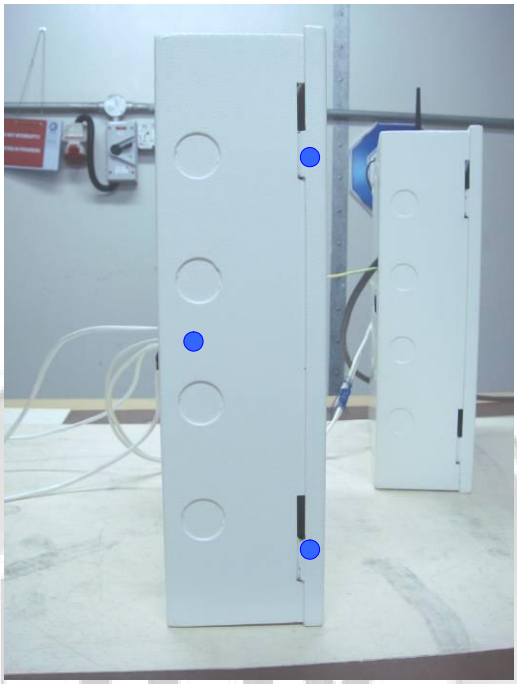


ESD TEST POINTS



ESD TEST POINTS

- **Air Discharge**
- **Contact Discharge**



ESD TEST POINTS

ESD TEST POINTS

- **Air Discharge**
- **Contact Discharge**

ELECTROSTATIC DISCHARGE IMMUNITY TEST

ESD TEST POINTS

- **Air Discharge**
- **Contact Discharge**

ELECTROSTATIS DISCHARGE IMMUNITY TEST

IEC 61000-4-2 Electrostatic Discharge Immunity Results

Operating Mode	Disarm Mode	Temperature	22°C
Test Input Power	230V 50Hz	Relative Humidity	55%
		Atmospheric Pressure	1030mbar
		Tested By	Kyaw Soe Hein

Discharge Type	Test Severity Level	Results
Air Discharges	± 2kV, ± 4kV, ± 8kV	Pass
Direct Contact Discharges	± 2kV, ± 4kV	Pass
Indirect Contact Discharges	± 2kV, ± 4kV	Pass

Notes

1. Please refer to the Pass /Fail criteria to interpret the results.
2. Human Body Model — Storage Capacitor: 150pF; Discharge Resistor: 330Ω
3. Discharge Details — No. of Discharges / Point, Level & Polarity: 10 air discharges, 10 contact discharges; Discharge Interval: 1 second

IEC 61000-4-3 RF Radiated Immunity Test Pass / Fail Criteria

Test: RF Radiated Immunity
Performance Criteria: A - Continuous phenomena for transmitter (CT) and receiver (CR)
PASS Criteria: The EUT shall meet the minimum criteria as specified: d. The EUT shall operate without user noticeable loss of communication link during and after the test. e. The EUT shall operate as intended with no loss of user control functions or stored data during and after the test. The communication shall be maintained after the test. a. The EUT shall show no unintentional responses when it is in idle condition. **FAIL Criteria**: For the parameters observed, anything contrary to the pass criteria is considered as FAIL.
Monitoring Method(s): a. The performance of the EUT was monitored by observing the LCD display condition of the EUT and for any alarm from the EUT.

IEC 61000-4-3 RF Radiated Immunity Test Instrumentation

Instrument	Model	S/No	Cal Due Date
AR Laser Powered Field Probe (100k – 6GHz)	FL7006	0326064	05 Aug 2012
Teseq Bilog Antenna (26-3000MHz)	CBL 6144	30366	02 Nov 2011
Schwazrzbeck Broad-Band Horn Antenna (450MHz - 4GHz)	BBHA 9120 E	0899	Output Monitored
Agilent Signal Generator (9k – 3200MHz)	8648C	3847M01344	13 May 2012
Agilent EPM Series Power Meter	E4419B	MY45100531	28 May 2013
Agilent E-Series Avg Power Sensor (9kHz - 6GHz)	E9304A	MY41496818	28 May 2013
AR Directional Coupler (0.8 - 4.2GHz)	DC7144A	313053	01 Jul 2012
Schaffner High Power Directional Coupler (80MHz-1GHz)	CHA 9652 B	Nil	01 Jul 2012
Schaffner Power Amplifier (80MHz-1GHz)	CBA 9433	T43588	23 Sep 2012
Schaffner Power Amplifier (0.8-3.0GHz)	CBA 9429	T43589	23 Sep 2012

IEC 61000-4-3 RF Radiated Immunity Test Setup

1. The EUT was set up inside a fully anechoic chamber in accordance with the standard.
2. An isotropic field probe was placed adjacent to the EUT.

IEC 61000-4-3 RF Radiated Immunity Test Method

1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. The EUT was exercised and monitored in the manner specified by the customer.
3. All test instruments were PC controlled, via their IEEE 488.2 bus interfaces, and the test conducted in the following manner:
   a. The testing frequencies were swept over the required frequency range, with a step frequency equal to 1% of fundamental. The sweep rate was $\leq 1.5 \times 10^{-3}$ decades/s.
   b. For each frequency tested, the incident power to the antenna was adjusted to the required unmodulated test level, as established during the chamber calibration. With the incident power at the correct level, the 80% AM 1kHz AF was switched on for the specified dwell time.
4. The EUT was continuously monitored during the test in accordance with the Pass / Fail criteria declared by the customer.
5. The test was done in both horizontal and vertical antenna polarizations, and for all necessary sides of the EUT.

RF Radiated Immunity Test Setup

IEC 61000-4-3 RF Radiated Immunity Results

Operating Mode	Disarm Mode	Temperature	24°C
Test Input Power	230V 50Hz	Relative Humidity	58%
		Atmospheric Pressure	1030mbar
		Tested By	Lim Chia Fa

Sides Tested	Frequency	Test Severity Level	Results
Front, Back, Left, Right	80MHz - 1000MHz	3V/m, 80% AM 1kHz	Pass
Front, Back, Left, Right	1400MHz - 2700MHz	3V/m, 80% AM 1kHz	Pass

Notes

1. Please refer to the Pass/Fail criteria to interpret the results.
2. RF Radiated Immunity Details Frequency Step 1% of fundamental
   Sweep Rate $\leq 1.5 \times 10^{-3}$ decades/s

IEC 61000-4-4 Electrical Fast Transient / Burst Immunity Test Pass / Fail Criteria

Test: Electrical Fast Transient / Burst Immunity
Performance Criteria: B - Transient phenomena for transmitter (TT) and receiver (TR)
PASS Criteria: The EUT shall meet the minimum criteria as specified: a. The EUT shall operate without user noticeable loss of communication link after the test. b. The EUT shall operate as intended with no loss of user control functions or stored data during and after the test. The communication shall be maintained after the test. c. The EUT shall show no unintentional responses when it is in idle condition. **FAIL Criteria**: For the parameters observed, anything contrary to the pass criteria is considered as FAIL.
Monitoring Method(s): a. The performance of the EUT was monitored by observing the LCD display condition of the EUT and for any alarm from the EUT.

IEC 61000-4-4 Electrical Fast Transient / Burst Immunity Test Instrumentation

Instrument	Model	S/No	Cal Due Date
Schaffner Modula	Modula6100	34406	27 Jun 2012

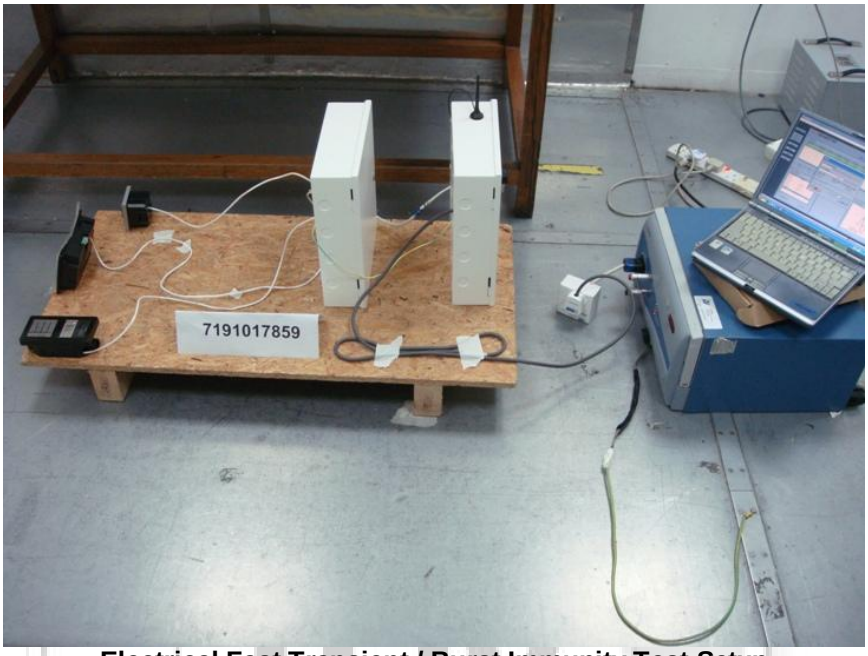
ELECTRICAL FAST TRANSIENT / BURST IMMUNITY TEST

IEC 61000-4-4 Electrical Fast Transient/Burst Immunity Test Setup

1. The test setup was in accordance with the standard.
2. The test was performed using an EFT/B generator and capacitive coupling clamp that were compliant with the standard.
3. The EFT/B generator was placed on top of the ground plane and connected to the protective earth.
4. D.C./A.C. Power Line Test
   a. The EUT was placed on top of a 0.1m high, non-metallic table, and placed at least 0.5m away from the walls of the room and other conductive surfaces.
   b. The required power was supplied to the EUT via direct connection to the EFT/B generator.
5. I/O Signal & Control Line Test
   a. Insulating supports were used to ensure that the EUT and its cables were 0.1m above the metallic ground plane.
   b. The capacitive coupling clamp was placed on top (and in contact with) the metallic ground plane.
   c. The Cable Under Test (CUT) was sandwiched between the plates of the capacitive coupling clamp. All other cables were kept as far away from the capacitive coupling clamp as possible, where possible, perpendicularly orientated with respect to the CUT.
   d. The EFT/B generator output was connected to the capacitive coupling clamp.

IEC 61000-4-4 Electrical Fast Transient/Burst Immunity Test Method

1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. D.C./A.C. Power Line Test
   a. The EFT/B test system has a built-in coupling/decoupling network, which couples the generated EFT bursts into the EUT power supply lines connected to it.
   b. The EFT bursts were coupled to the selected lines of the EUT individually and simultaneously for the necessary test duration.
3. I/O Signal & Control Line Test
   a. The interference impulses were capacitively coupled to the EUT's signal cables for the necessary test duration.
   b. The EUT was monitored during the test in accordance with the Pass / Fail criteria declared by the customer.
   c. The test was performed with EFT bursts in the positive and negative polarities and repeated on all necessary lines.



Electrical Fast Transient / Burst Immunity Test Setup

IEC 61000-4-4 Electrical Fast Transient / Burst Immunity Results

Operating Mode	Disarm Mode	Temperature	23°C
Test Input Power	230V 50Hz	Relative Humidity	55%
		Atmospheric Pressure	1030mbar
		Tested By	Kyaw Soe Hein

Cable	Test Severity Level	Results
MAINS LINE		
Live Line	± 1.0kV, ± 2.0kV	Pass
Neutral Line	± 1.0kV, ± 2.0kV	Pass
Earth Line	± 1.0kV, ± 2.0kV	Pass *See Note 3
Live + Neutral Lines	± 1.0kV, ± 2.0kV	Pass
Live + Neutral + Earth Lines	± 1.0kV, ± 2.0kV	Pass
DC, CONTROL & SIGNAL LINES		
Data Cable	± 0.5kV	Not Applicable *See Note 4

Notes

1. Please refer to the Pass/Fail criteria to interpret the results.
2. EFT/B Test Details
   - Waveshape: 5/50 Tr/Th ns
   - Repetition Frequency: 5kHz
   - Test Duration / Level & Polarity: 1 minute
3. Communication error was encountered at +2kV. The communication was recovered after the test had completed.
4. The data cable is not more than 3m.

IEC 61000-4-5 Voltage Surge Immunity Test Pass / Fail Criteria

Test: Voltage Surge Immunity
Performance Criteria: B - Transient phenomena for transmitter (TT) and receiver (TR)
PASS Criteria: The EUT shall meet the minimum criteria as specified: a. The EUT shall operate without user noticeable loss of communication link during and after the test. b. The EUT shall operate as intended with no loss of user control functions or stored data during and after the test. The communication shall be maintained after the test. c. The EUT shall show no unintentional responses when it is in idle condition. **FAIL Criteria**: For the parameters observed, anything contrary to the pass criteria is considered as FAIL.
Monitoring Method(s): a. The performance of the EUT was monitored by observing the LCD display condition of the EUT and for any alarm from the EUT.

IEC 61000-4-5 Voltage Surge Immunity Test Instrumentation

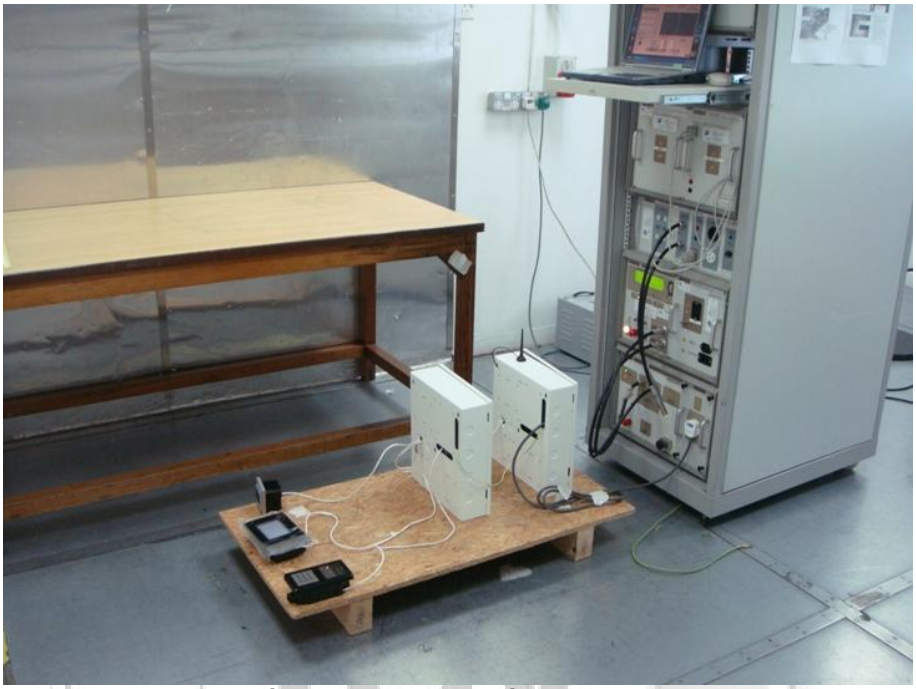
Instrument	Model	S/No	Cal Due Date
Schaffner Surge Generator System			
High Energy Pulse Generator	NSG2050	158	14 Apr 2012
Impulse Network (1, 2/50, -8/20 Comb. Wave)	PNW2050	200427-540LU	18 Apr 2012

IEC 61000-4-5 Voltage Surge Immunity Test Setup

1. The test setup was in accordance with the standard.
2. The test was performed using a voltage surge generator, mains, and signal line coupling/decoupling networks that were compliant with the standard.
3. The voltage surge generator and coupling/decoupling networks were connected to the same protective earth.
4. The test level was set with the surge generator's HV output open-circuited.
5. For testing of the mains line, the mains coupling/decoupling network was inserted into the line. The voltage surge generator HV output cables were connected to the mains coupling/decoupling network, which has the necessary resistor/capacitor configurations (as required by the standard) built-in. The settings on the mains coupling/decoupling network were selected to give the required resistor/capacitor configuration as follows:
   a. An 18µF capacitor in series with the output of the generator for differential (line-to-line) mode testing.
   b. A 10Ω resistor and 9µF capacitor in series with the output of the generator for common (line-to-ground) mode testing.
6. For testing of the signal lines, the signal line coupling/decoupling network was inserted into the line. The voltage surge generator HV output cables were connected to the signal line coupling/decoupling network, which has the necessary resistor/capacitor/gas arrestor configurations (as required by the standard) built-in. The settings on this network were selected to give the required resistor/capacitor/gas arrestor configuration as reflected in the standard.

IEC 61000-4-5 Voltage Surge Immunity Test Method

1. The power supply to EUT was switched on and allowed to warm up to its normal operating condition.
2. For a.c. mains lines, the surge was applied at the 0°, 90°, 180° and 270° angles of the a.c. mains frequency for both positive and negative surges.
3. For d.c. and signal lines , the surge was applied independent from the a.c. mains frequency angle.
4. The correct open-circuit test level was set with the surge generator disconnected from the coupling network.
5. The output of the generator was then reconnected back to the coupling network.
6. Five discharges, generated by the voltage surge generator, and were made on each relevant line, for each polarity, at each test level, with the relevant discharge interval.
7. The EUT was observed during, and checked after the test to determine the result.



Voltage Surge Immunity Test Setup

IEC 61000-4-5 Voltage Surge Immunity Results

Operating Mode	Disarm Mode	Temperature	22°C
Test Input Power	230V 50Hz	Relative Humidity	55%
		Atmospheric Pressure	1030mbar
		Tested By	Kyaw Soe Hein

Cable	Test Severity Level	Results
MAINS LINE		
Neutral - Earth	± 0.5kV, ± 1.0kV, ± 2.0kV	Pass
Live – Earth	± 0.5kV, ± 1.0kV, ± 2.0kV	Pass
Live - Neutral	± 0.5kV, ± 1.0kV	Pass
CONTROL & SIGNAL LINES		
Nil	± 0.5kV / ± 1.0kV	Not Applicable *See Note 3

Notes

1. Please refer to the Pass/Fail criteria to interpret the results.
2. Surge Details
   - Waveshape: 1.2/50 (8/20) Tr/Th µs
   - No. of Surges / Line, Level & Polarity: 5 surges, Positive and negative
   - Phase angle: 0°, 90°, 180° and 270°
3. The EUT contains no telecommunication signal.

IEC 61000-4-6 Conducted Disturbance Immunity Test Pass / Fail Criteria

Test: Conducted Disturbance Immunity
Performance Criteria: A - Continuous phenomena for transmitter (CT) and receiver (CR)
PASS Criteria: The EUT shall meet the minimum criteria as specified: a. The EUT shall operate without user noticeable loss of communication link during and after the test. b. The EUT shall operate as intended with no loss of user control functions or stored data during and after the test. The communication shall be maintained after the test. c. The EUT shall show no unintentional responses when it is in idle condition. **FAIL Criteria**: For the parameters observed, anything contrary to the pass criteria is considered as FAIL.
Monitoring Method(s): a. The performance of the EUT was monitored by observing the LCD display condition of the EUT and for any alarm from the EUT.

IEC 61000-4-6 Conducted Disturbance Immunity Test Instrumentation

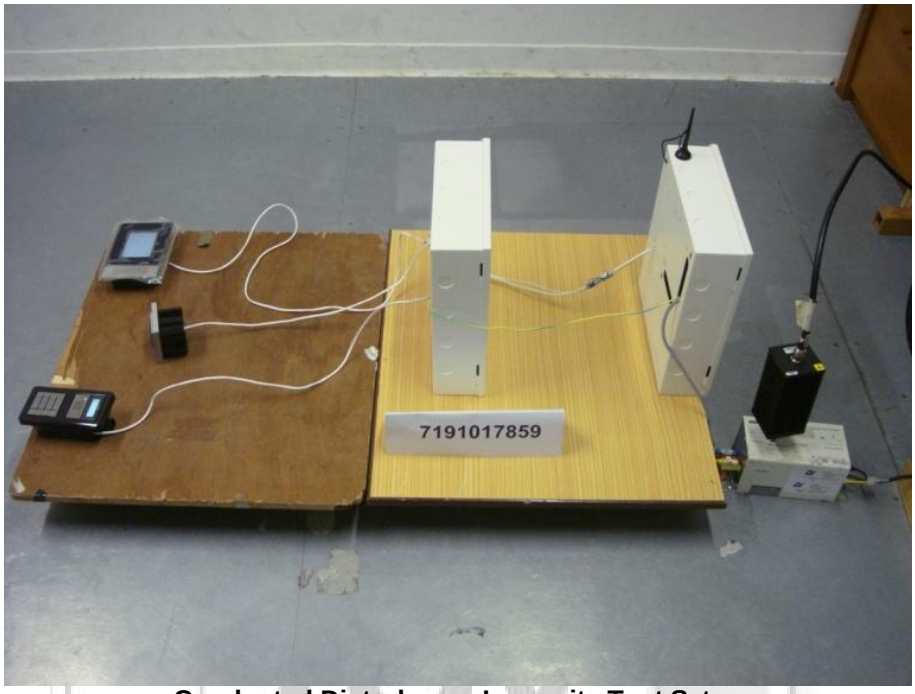
Instrument	Model	S/No	Cal Due Date
Schaffner HF Generator (One-box system)	NSG2070-1	1079	07 Jul 2012
Schaffner Power Line Coupling Decoupling Network	CDN M316	16942	23 Feb 2012

IEC 61000-4-6 Conducted Disturbance Immunity Test Setup

1. CDN Injection Method
   a. The EUT and auxiliary equipment were placed on top of the Ground Reference Plane (GRP) and isolated from it by a 0.1m thick insulating support as shown in the setup photos.
   b. The test system includes a RF signal generator, a power amplifier, attenuators, a spectrum analyzer and various types of Coupling/Decoupling Networks (CDNs).
   c. The EUT's Cables Under Test (CUT) were cut in order to insert the CDNs into the line. The cable lengths were kept as short as possible to maintain a distance of 0.1m to 0.3m between the EUT and the CDNs.
   d. The interconnecting cables between the EUT, CDNs and auxiliary equipment were kept at a height of 3cm to 5cm above the GRP.
   e. The CDNs were placed on the GRP, in direct electrical contact with it.
2. EM Clamp Injection Method
   a. The EUT and auxiliary equipment were placed on top of the Ground Reference Plane (GRP) and isolated from it by a 0.1m thick insulating support as shown in the setup photos.
   b. The test system includes a RF signal generator, a power amplifier, attenuators, a spectrum analyzer and an EMC clamp.
   c. The EUT's Cable Under Test (CUT) was clamped using the EM clamp. The cable length was kept as short as possible to maintain a distance of 0.1m to 0.3m between the EUT and the EM clamp.
   d. The interconnecting cables between the EUT, EM clamp and auxiliary equipment were kept at a height of 3cm to 5cm above the GRP.
   e. The EM clamp was placed on the GRP, in direct electrical contact with it.

IEC 61000-4-6 Conducted Disturbance Immunity Test Method

1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. The interfering signal was swept from 150kHz to 80MHz, with a step increment of 50kHz in the range of 150kHz to 5MHz and a step frequency equal to 1% of the fundamental for the range 5MHz to 80MHz. The sweep rate for all classes was set to $\leq 1.5 \times 10^{-3}$ decades/s.
3. CDN Injection Method
   The output power level from the power amplifier to the CDN was adjusted through the signal generator so that the incident power reached the same level as that established during calibration. Once the incident power to the CDN reached the calibrated level, the 80% AM 1kHz AF was switched on for the specified dwell time.
4. EM Clamp Injection Method
   The output power level from the power amplifier to the EM clamp was adjusted through the signal generator so that the incident power reached the same level as that established during calibration. Once the incident power to the EM clamp reached the calibrated level, the 80% AM 1kHz AF was switched on for the specified dwell time.
5. The EUT was continuously monitored during the test in accordance with the Pass / Fail criteria declared by the customer.



Conducted Disturbance Immunity Test Setup

IEC 61000-4-6 Conducted Disturbance Immunity Results

Operating Mode	Disarm Mode	Temperature	22^{o}C
Test Input Power	230V 50Hz	Relative Humidity	55%
		Atmospheric Pressure	1030mbar
		Tested By	Kyaw Soe Hein

Cable	Frequency	Test Severity Level	Results
MAINS LINE			
AC Mains	0.15MHz - 80MHz	3V, 80% AM 1kHz	Pass
DC, CONTROL & SIGNAL LINES			
Data Cable	0.15MHz - 80MHz	3V, 80% AM 1kHz	Not Applicable *See Note 3

Notes

1. Please refer to the Pass/Fail criteria to interpret the results.
2. Conducted Immunity Details — Frequency Step: 50kHz increment step (150kHz-5MHz), 1% of fundamental (5MHz-80MHz); Sweep Rate: $\leq 1.5 \times 10^{-3}$ decades/s
3. The data cable is not more than 3m.

VOLTAGE DIPS AND INTERRUPTIONS IMMUNITY TEST

IEC 61000-4-11 Voltage Dips and Interruptions Immunity Test Pass / Fail Criteria

Test: Voltage Dips and Interruptions Immunity (30% dip, 0.5 cycle)
Performance Criteria: A - Continuous phenomena for transmitter (CT) and receiver (CR)
PASS Criteria: The EUT shall meet the minimum criteria as specified: a. The EUT shall operate without user noticeable loss of communication link during and after the test. b. The EUT shall operate as intended with no loss of user control functions or stored data during and after the test. The communication shall be been maintained after the test. a. The EUT shall show no unintentional responses when it is in idle condition. **FAIL Criteria**: For the parameters observed, anything contrary to the pass criteria is considered as FAIL.
Monitoring Method(s): a. The performance of the EUT was monitored by observing the LCD display condition of the EUT and for any alarm from the EUT.

Test: Voltage Dips and Interruptions Immunity (100% dip, 0.5 cycle; 100% dip, 1 cycle)
Performance Criteria: B - Transient phenomena for transmitter (TT) and receiver (TR)
PASS Criteria: The EUT shall meet the minimum criteria as specified: c. The EUT shall operate without user noticeable loss of communication link during and after the test. d. The EUT shall operate as intended with no loss of user control functions or stored data during and after the test. The communication shall be been maintained after the test. e. The EUT shall show no unintentional responses when it is in idle condition. **FAIL Criteria**: For the parameters observed, anything contrary to the pass criteria is considered as FAIL.
Monitoring Method(s): a. The performance of the EUT was monitored by observing the LCD display condition of the EUT and for any alarm from the EUT.

VOLTAGE DIPS AND INTERRUPTIONS IMMUNITY TEST

IEC 61000-4-11 Voltage Dips and Interruptions Immunity Test Pass / Fail Criteria

Test: Voltage Dips and Interruptions Immunity (30% dip, 25 cycles and 100% interruption, 250 cycles)
Performance Criteria: C - Transient phenomena for transmitter (TT) and receiver (TR)
PASS Criteria: The EUT shall meet the minimum criteria as specified: a. The EUT may show loss of functions during the test, which shall be recoverable by operators. b. The EUT shall show its intended operations after recovering from operations. c. The EUT shall show no change of operating mode during and after the test. **FAIL Criteria**: For the parameters observed, anything contrary to the pass criteria is considered as FAIL.
Monitoring Method(s): a. The performance of the EUT was monitored by observing the LCD display condition of the EUT and for any alarm from the EUT.

IEC 61000-4-11 Voltage Dips and Interruptions Immunity Test Instrumentation

Instrument	Model	S/No	Cal Due Date
Elgar Power Supply	SW3500A	511	Output monitored

VOLTAGE DIPS AND INTERRUPTIONS IMMUNITY TEST

IEC 61000-4-11 Voltage Dips and Interruptions Immunity Test Setup

1. The test setup was in accordance with the standard.
2. The EUT mains cable was plugged into voltage dips and short interruptions immunity test system generator where it receives its required test supply voltage level. The mains cable was laid in the most direct path between the test system and the EUT, with its length not exceeding 1m. Cable length in excess of 1m were bundled parallel to the mains cable.
3. The distance between the test system and the EUT was maintained at 0.8m.

IEC 61000-4-11 Voltage Dips and Interruptions Immunity Test Method

1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. The test system was controlled by the test software to apply the required voltage dips and interrupts to EUT mains cable.
3. The EUT was monitored during the test in accordance with the Pass / Fail criteria declared by the customer.

Voltage Dips and Interruptions Immunity Test Setup

VOLTAGE DIPS AND INTERRUPTIONS IMMUNITY TEST

IEC 61000-4-11 Voltage Dips and Interruptions Immunity Results

Operating Mode	Disarm Mode	Temperature	20°C
Test Input Power	230V 50Hz	Relative Humidity	60%
		Atmospheric Pressure	1030mbar
		Tested By	Paul Teo

Cable	Test Severity Level	Results
MAINS LINE		
AC Mains	100% dip, 0.5 cycle	Pass
AC Mains	100% dip, 1 cycle	Pass
AC Mains	30% dip, 0.5 cycle	Pass
AC Mains	30% dip, 25 cycles	Pass
AC Mains	100% interruption, 250 cycles	Pass

Notes

1. Please refer to the Pass/Fail criteria to interpret the results.
2. VDI Immunity Details Changes occur at zero-crossing

Please note that this Report is issued under the following terms :

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July 2011

ANNEX A

EUT PHOTOGRAPHS / DIAGRAMS

PSB Singapore

EUT PHOTOGRAPHS / DIAGRAMS — ANNEX A

EUT PHOTOGRAPHS

Front View

Rear View

PSB Singapore

EUT PHOTOGRAPHS / DIAGRAMS — ANNEX A

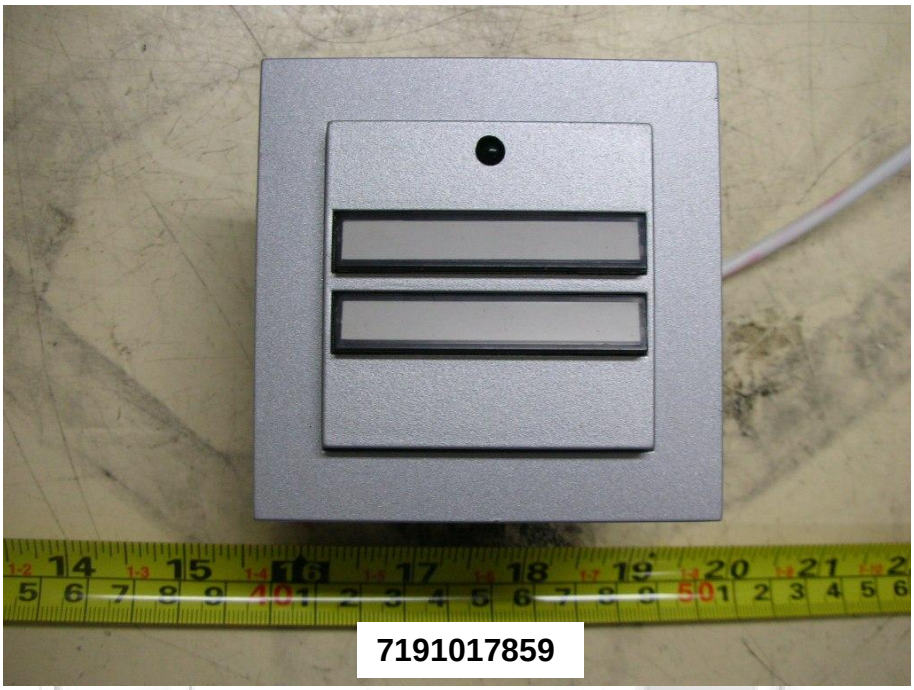
EUT PHOTOGRAPHS

Front View

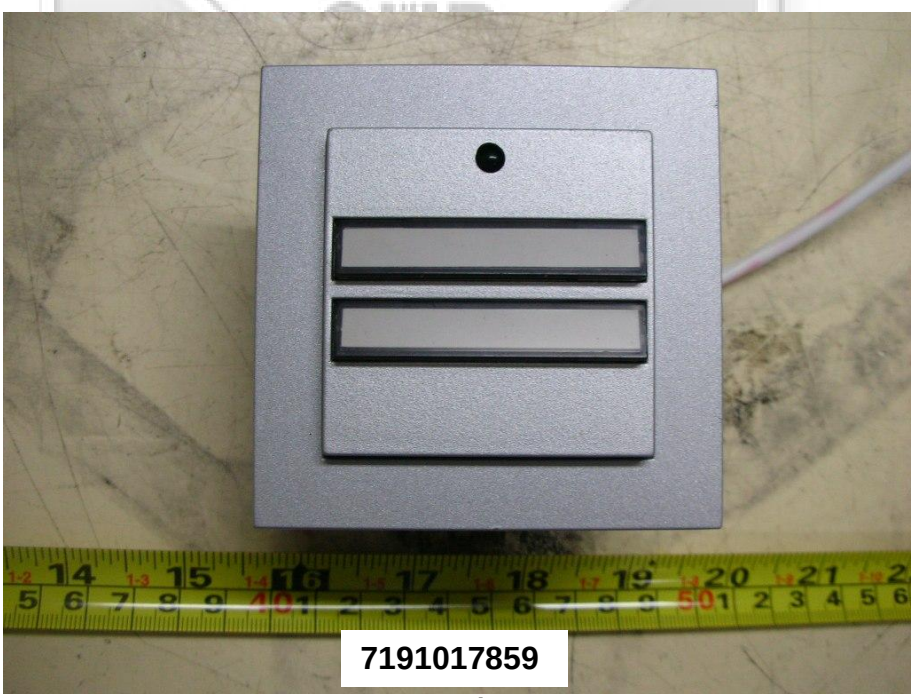
Rear View

EUT PHOTOGRAPHS / DIAGRAMS — ANNEX A

EUT PHOTOGRAPHS



Front View

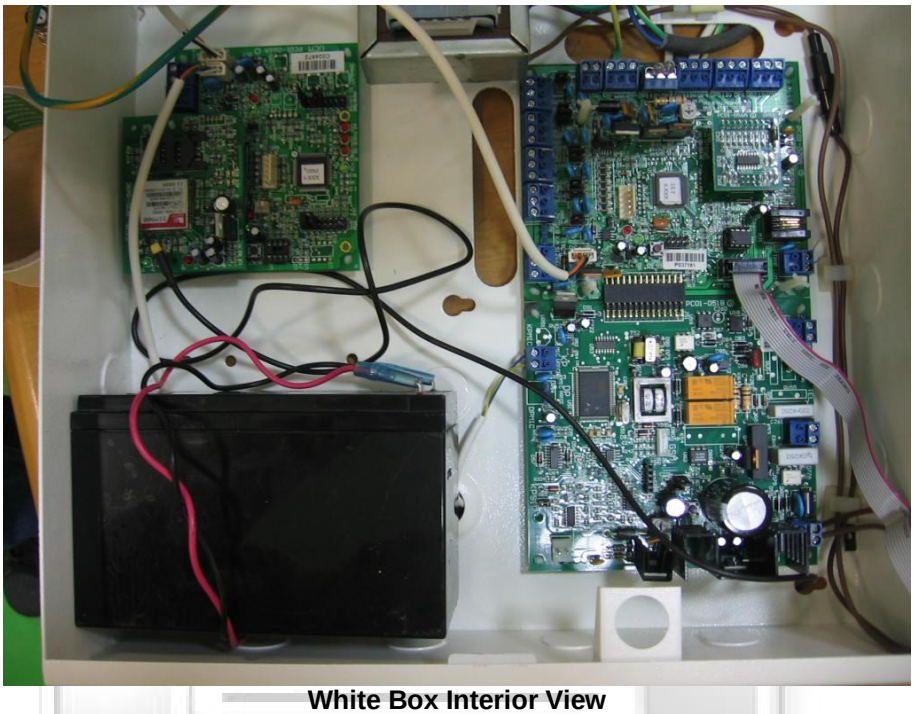


Rear View

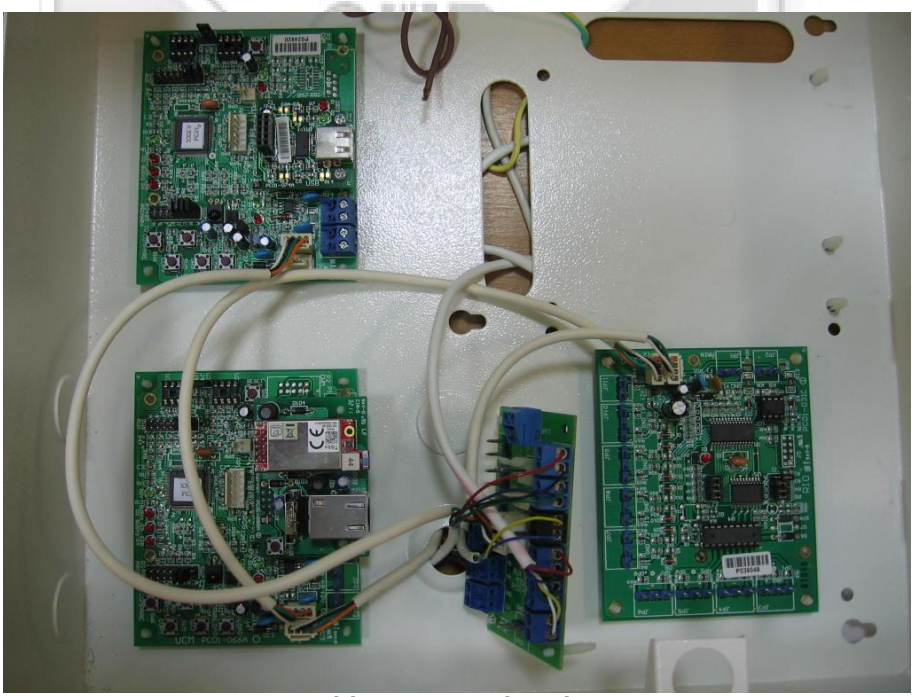
PSB Singapore

EUT PHOTOGRAPHS / DIAGRAMS — ANNEX A

EUT PHOTOGRAPHS



White Box Interior View



White Box Interior View

ANNEX B

USER MANUAL
TECHNICAL DESCRIPTION
BLOCK & CIRCUIT DIAGRAMS

(Please refer to manufacturer for details)