EM133

TOU SMART ENERGY METER

SATEC EM133 is a Smart DIN Rail TOU Energy Meter. It is based on SATEC's best seller PM130 PLUS with an off-the-shelf LCD display (similar to the BFM136 display). The EM133 provides the full functionality of the PM130EH PLUS combined with 2 Digital Inputs, 1 Digital Output, IR (Infra Red) communication and battery backup for the real time clock. It is fully compatible with all PM130 PLUS modules.

The EM133 can serve any application from residential energy metering, through industrial energy and harmonic analysis through utility comprehensive substation automation. It provides multifunctional 3-phase power metering, revenue metering and basic power quality information. The EM133 features an internal real time clock (RTC), battery backup and onboard non-volatile memory for event and data logging. The device includes 16 set points and 4 counters that operate the built in 2 DI/ 1RO or the various analog and digital I/O add-ons.

The EM133 offers a wide range of network configurations and versatile voltage and current connections: 57 to 400V AC, up to 63A direct current measurement, connection of standard CTs (1A, 5A) and a wide range of remote CTs (split or solid cores).

Main Features

Multifunctional 3-Phase Smart Meter

- True RMS, volts, amps, power, power factor, neutral current, voltage and current unbalance, frequency
- Ampere/Volt demand meter
- 25, 50, 60 and 400 Hz measurements
- 128 samples per cycle

Billing/TOU Energy Meter

- Accuracy Class 0.5S per IEC 62053-22
- MID certified EN50470-3 Class B or C (5A)
- Four-quadrant active and reactive energy poly-phase static meter
- Three-phase total and per phase energy measurements; active, reactive and apparent energy counters
- Time-of-Use, 4 totalization and tariff energy/demand registers x 8 tariffs, 4 seasons x 4 types of days, 8 tariff changes per day
- One–time easy programmable tariff calendar schedule
- Automatic daily energy and maximum demand profile log for total and tariff registers

SATEC
Powerful Solutions

EM133

Harmonic Analyzer

- Voltage and current THD, TDD and K-Factor, up to 40th order harmonic
- Voltage and current harmonic spectrum and angles

Real-time Waveform Capture (via PC)

- Real-time "scope mode" waveform monitoring capability
- Simultaneous 6-channel 8-cycle waveform capture at a rate of 64 samples per cycle

Programmable Logical Controller

- Embedded programmable controller
- 16 control set points; programmable thresholds and delays
- Relay output control
- 1-cycle response time

Event and Data Recording

- Non-volatile memory for long-term event and data recording for at least 90 days history storage capabilities
- Event recorder for logging internal diagnostic events and setup changes
- Two data recorders; programmable data logs on a periodic basis; automatic daily energy and maximum demand profile log

Display

- Easy to read 2 x 16 Characters LCD display, adjustable update time
- Auto-scroll option with adjustable page exposition time; auto-return to a default page

Real-time Clock

- Backup for 260 days

Inputs/Outputs

- Built-in 2 Digital Inputs and 1 form A solid state digital output
- Optional module 8 Digital Inputs
- Optional module 4 Digital Inputs and 2 digital outputs (Solid State or Electro Mechanical)
- Optional module 12 Digital Inputs and 4 digital outputs with optional Ethernet, RS-485 or CAN
- Optional module 4 Analog Outputs

Communications

- Standard 2-wire RS-485 communication port
- Built-in IR communication port
- Optional multipurpose RS-232/422/485 port
- Optional 10/100Base T port
- Optional PROFIBUS port
- Optional RF module (available in certain regions only)
- Optional 2G/3G modem
- Optional CANopen port

Communication protocols

- Modbus RTU
- SATEC ASCII
- DNP 3.0
- IEC 60870-5-101 (option)
- IEC 60870-5-104 (option)

Meter Security

- 3 levels Password security for protecting meter setups and accumulated data from unauthorized changes

Upgradeable Firmware

- Easy upgrading device firmware through a serial or Ethernet port.

Software Support

- Includes comprehensive Power Analysis Software (PAS) for configuration and data acquisition
- Optional ExpertPower™ client for communicating with the SATEC proprietary ExpertPower™ Internet services

Specifications

VOLTAGE INPUTS	
Voltage Connections	3 phases, 1 Neutral
Voltage Ratings	Direct voltage connection: → 220 to 400V (L-N) → 380 to 690V (L-L) → Range 0-800VAC Via PT (Power Transformer): → 57.7 to 120V (L-N) → 100 to 207V (L-L) → Range 0-250VAC
Starting Voltage	0.2% U_N
Input Impedance	≥ 1MΩ
Burden with Aux. Power supply	≤0.2VA/phase
Overload withstand	4000 VAC (L-G) for 1 min.
Impulse Voltage	6kV
Terminal Blocks	4 Sealed, pitch 7-10mm 2.5 to 4 mm²

CURRENT INPUTS	
Current Connections	3 galvanic isolated inputs
Current Ratings	Choice of 4 options: → ../5A CT connection → ../1A CT connection → Direct up to 100A → Remote CT (40mA)
Starting Current	0.2% I_N
Burden per phase	<0.2 VA (../5A) <0.05 VA (../1A)
Overload (continuous)	2×I_N (1.2×I_N for 100A model)
Over current	50×I_N (for 1 second)
Galvanic isolation	4000 VAC (L-G) for 1 min.
Terminal Blocks	6 Sealed, pitch 7-10mm 4 to 16 mm²

AUXILIARY POWER SUPPLY	
Rated Input	40-300 V AC/DC
Insulation Dielectric withstand	4000 VAC for 1 min.
Output power	4W
Terminal Blocks	2 Sealed, pitch 7-10mm 2.5 to 4 mm²

BUILT IN COMMUNICATION	
Communication Type	RS-485
Max. Baud Rate	115.2 kb/s
Isolation	4000 VAC (L-G) for 1 min.
Max. Cable Length	1000 m
Protocols	MODBUS RTU/ASCII DNP 3.0 IEC 60870 -5-101 (option) IEC 60870 -5-104 (option)
Terminal Blocks	3 Sealed, pitch 7-10mm 2.5 to 4 mm²

INFRA RED COMMUNICATION	
Baud rate	Up to 19.200 kb/s
Protocols	MODBUS RTU/ASCII

ADD-ON MODULES	
Max. # of Modules	1
Available Modules	RS-232; PROFIBUS; ETHERNET; Digital I/O; Analog Outputs

FRONT PANEL	
Display type	2×16 Characters Transflective LCD with backlight
Character size	3.2×1.85 mm
Viewing area	46×11 mm
LEDs	Total 6 LEDs: → 1 Pulse calibration output → 3 voltage indication → 2 RX/TX activity
Keypad	2 buttons
Nameplate	According to IEC 60688 and IEC 62052-11

MECHANICAL	
Enclosure	DIN Rail mount Complies with EN50022
Dimensions [W×H×D]	125 × 90 × 75mm
Enclosure Material	Reinforced Polycarbonate

TEMPERATURE	
Operational	-25°C to 60°C
Storage	-30°C to 85°C

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Standards Compliance specifications

EMC per IEC 60688 and IEC 62052-11:

Immunity:

- IEC61000-4-2: Electrostatic discharge, 15/– air/contact
- IEC61000-4-3: Electromagnetic RF Fields, 10V/m @ 80Mhz – 1000MHz
- IEC61000-4-4: Fast Transients burst, 4KV on current and voltage circuits and 2 KV for auxiliary circuits
- IEC61000-4-5: Surge 4KV on current and voltage circuits and 1 KV for auxiliary circuits
- IEC61000-4-6: Conducted Radio-frequency, 10V @ 0.15Mhz – 80MHz
- IEC61000-4-8: Power Frequency Magnetic Field

Emission (radiated/conducted):

- EN55022: 2010 Class A (CISPR 22)
- FCC p.15 Class A mandatory

Safety

- UL/IEC 61010-1
- UL 916

Insulation

- IEC 62052-11: Insulation impulse 6KV/500Ω @ 1.2/50 µs
- IEC 62053-22: AC voltage tests related to ground, 4 kV AC @ 1mn, for power and signal ports (above 40V)
- 2.5KVAC r.m.s. @ 1mn, for other ports (below 40V)

Atmospheric Environment

- Operational ambient temperature range: -25°C to +60 °C
- Long-term damp heat withstand according to IEC 68-2-3 <95% (non condensing), +40 °C
- Transport and storage temperature range: – 30°C to +85 °C
- IEC 60068-2-6: Vibration
- Frequency range: 10Hz to 150Hz
- Transition frequency: 60Hz
- Constant movement amplitude 0.075mm, f<60Hz
- Constant acceleration 9.8 m/s^2 (1g), f > 60Hz
- Additional Transport vibration and shocks:
- Longitudinal acceleration: 2.0 g
- Vertical acceleration: 1.2 g
- Transversal acceleration: 1.2 g
- Enclosure protection: IP20

Accuracy according to:

- IEC 62053-22, class 0.5S – active energy
- IEC 62053-21, class 0.5 – reactive energy
- IEC 60688, class 0.5S – active energy
- IEC 60688, class 1 – reactive energy
- EN 50470-3, class B or C (5A version)

Заличено по чл.2 от ЗЗЛД

Order String

EM133 ☐☐☐☐☐☐

OPTIONS	
Current Inputs	
5 Ampere (MID Certified)	5
1 Ampere	1
Direct current measurement up to 63A	63
High Accuracy Current Sensors (HACS). Requires ordering of 3 HACS - please refer to SATEC's **HACS Datasheet.**	HACS
5A split core remote high accuracy current sensor (HACS), 50/60Hz only	RS5
Calibration at Frequency	
25 Hz	25HZ
50 Hz	50HZ
60 Hz	60HZ
400 Hz	400HZ
Resolution	
Low Resolution 1A, 1V	-
High Resolution 0.01A, 0.1V	H
Power Supply	
40-300V AC/DC (MID Certified)	ACDC
Powered from measured voltages (120-277 V L-N), only for 50/60Hz	SE
12V/24V DC power supply	21DC
Communication Protocol	
Modbus and DNP 3.0	-
Modbus and IEC 60870-101/104	870
Testing and Certificate	
Full functional test, calibration at various workloads & detailed test report	-
Full functional test, calibration at various workloads & detailed test report plus ISO 17025 and ILAC certified calibration certificate	CC

Заличено по чл.2 от ЗЗЛД

Expansion Module (Max. 1 module per instrument, can be ordered separately)	
4 Analog Outputs: ±1mA	AO1
4 Analog Outputs: 0-20mA	AO2
4 Analog Outputs: 0-1mA	AO3
4 Analog Outputs: 4-20mA	AO4
4 Analog Outputs: 0-3mA	AO5
4 Analog Outputs: ±3mA	AO6
4 Analog Outputs: 0-5mA	AO7
4 Analog Outputs: ±5mA	AO8
Communication: Ethernet (TCP/IP)	ETH
Communication: PROFIBUS	PRO
Communication: RS232 (for DIN rail enclosure)	RS232D
Communication: RS232/422/485	RS232
Communication: 2G/3G GSM Modem (Doesn't support 870 protocol)	T3G
Communication: 2G/3G CDMA Modem (Doesn't support 870 protocol)	T3C
Communication: CAN Bus (EM133 only, doesn't support 870 protocol)	CAN
Communication: RF (available in certain regions only – contact your SATEC partner for available options)	RF-x-y
4 Digital Inputs (Dry Contact) / 2 Relay Outputs 250V / 5A AC	DIOR
4 Digital Inputs (Dry Contact) / 2 SSR Outputs 250V / 0.1A AC	DIOS
8 Digital Inputs (Dry Contact - Not Compatible with EM133-AR)	8DI
12 Digital Inputs (Dry Contact) / 4 Relay Outputs 250V/5A AC	12DIOR-DRC
12 Digital Inputs (125VDC) / 4 Relay Outputs 250V/5A AC	12DIOR-125V
12 Digital Inputs (250VDC) / 4 Relay Outputs 250V/5A AC	12DIOR-250V
12DIOR-DRC with Ethernet	12DIOR-DRC-ETH
12DIOR-125V with Ethernet	12DIOR-125V-ETH
12DIOR-250V with Ethernet	12DIOR-250V-ETH
12DIOR-DRC with RS-485	12DIOR-DRC-485
12DIOR-125V with RS-485	12DIOR-125V-485
12DIOR-250V with RS-485	12DIOR-250V-485
12DIOR-DRC with CANopen	12DIOR-DRC-CAN
12DIOR-125V with CANopen	12DIOR-125V-CAN
12DIOR-250V with CANopen	12DIOR-250V-CAN

Заличено по чл.2 от ЗЗЛД

ENVIRONMENTAL & MECHANICAL LABORATORY

TEST REPORT

ENERGY POWER METER

For

SII

21/08/2014

Report No: 20140818-1524

Report Edition: 01

Report Status: Released

ENVIRONMENTAL & MECHANICAL LABORATORY DETAILS

Name:	Environmental & Mechanical Lab.
Address:	30, Hasivim St., Petach Tikva, Israel, 4959388.
Phone No.:	972-3-9266170. 972-3-9268810.
Fax No.:	972-3-9268811.
E-Mail:	eli.avital@ecitele.com

CUSTOMER DETAILS

Company Name:	SII
Representative	Leonid Fine
Address:	42 Haim Levanon St., Tel Aviv 69977.
Phone No.:	03-6367635
Fax No.:	03-6467779
E-Mail:	leon_fine@sii.org.il

DOCUMENT CONTROL

DOCUMENT HISTORY

The following table records information regarding released editions of this document and briefly describes their file location, purpose, and changes made to them.

Edition ID	Release Date	Responsible Author	File Reference, Purpose and Description of Changes
01	21/08/2014	Dina Klebansky	**File Reference:** W:\Reports\TR\Proj2014\SII ENERGY POWER METER 2014-07-23.doc **Purpose:** **Changes:**

DOCUMENT APPROVALS

This edition has been approved by:

	Name	Title	Signature	Date
Compiled	Dina Klebansky	Technical Writer	Заличено по чл.2 от ЗЗЛД	21/08/2014
Tested	Zion Asslizada	Test Engineer	Заличено по чл.2 от ЗЗЛД	21/08/2014
Approved	Eli Avital	Environmental, HALT and HASS Labs Manager	Заличено по чл.2 от ЗЗЛД	21/08/2014

OPEN ISSUES

This part of the document control section is used to record and track open issues and/or unresolved questions. As the development of this document proceeds, these issues and questions should be resolved and then removed from the list.

No.	Subject/Section	Description
1.		
2.		

EXECUTIVE SUMMARY

The following table summarizes the tests that have been performed in QualiTech - Environmental & Mechanical Laboratory.
SII had performed the functional tests and the tests results are his sole responsibility.
The stated results apply only to the specific UUT that were currently tested.

No.	Test Name	Pass /Fail	Job Number	Notes
1.	Sine Vibration Test	Pass	14/2487	
2.	Mechanical Shock Test	Pass	14/2488	
3.	High Temperature (Dry Heat- Storage) Test	Pass	14/2489	
4.	Low Temperature (Storage) Test	Pass	14/2518	
5.	Temperature and Humidity (Damp Heat-Operation) Test	Pass	14/2519	
6.	Immunity to Voltage Surge Test	Pass	14/2628	Performed by EMC Lab.
7.	Temperature Cycling (Storage & Operation) Test	Pass	14/2631	

Statement of Compliance with test requirements:
QualiTech - Environmental & Mechanical Lab. declare that the UUT ENERGY POWER METER was tested to comply with the requirements of the applicable environmental test specification.

Customer granted the permission to reproduce and distribute this report only in the full format with no change and no addition.

A2LA symbol in the front page is applicable only to the tests under the scope of QualiTech accreditations.
QualiTech has A2LA accreditation to ISO/IEC 17025:2005 for test types as listed in the following link:
http://www.a2la.org/scopepdf/1881-01.pdf

TABLE OF CONTENTS

1. INTRODUCTION

1.1. PURPOSE

The purpose of this report is to outline the test results of the ENERGY POWER METER, which was tested according to the applicable documents (see section 1.3), at ECI Telecom Environmental & Mechanical Lab.

1.2. GLOSSARY

1.	ETR	Environmental Test Report
2.	ETS	European Telecommunication Standard
3.	IEC	International Electronic Community
4.	N/A	Not Applicable
5.	NCR	No Calibration Required
6.	RH	Relative Humidity
7.	TBD	To Be Defined
8.	UUT	Unit Under Test

1.3. APPLICABLE DOCUMENTS

This section contains a list of resources referenced by or related to this document.

- BS EN 62052-11:2003.
- IEC 60068.

2. UUT DESCRIPTION

4 units of SATEC Ltd.:

1. BFM 136 - Power meter, 100 – 240Vac, 50/60Hz, 10VA.
2. EM133 – 5 Power meter, 400Vac, 3 phases, 5A (10A), 3VA.
3. PM 130EH PLUS – Power meter, 240Vac, 50/60Hz, 5A, 9VA.
4. PM 175 – Power meter, 690Vac, 50Hz, 5A, 10W.

All units are 3-phase, multi-channel, multi-function energy meters suitable for use in single-phase and multi-phase electrical networks. The units monitor and measure voltage and current and calculate power consumption. Current monitored and measured via current transformers.

The units are intended for wall or DIN real mounting.

The units are equipped with RS-485 serial port module for communication. The Ethernet 10/100BaseT and wireless modem are also available.

3. SINE VIBRATION TEST - 14/2487

3.1. UNIT UNDER TEST OVERVIEW

Test Date	23/07/2014
Customer Representative	Leonid Fine
Customer Name	SII
Unit Name	ENERGY POWER METER
Item Manufacturer	SATEC
Item Quantity	4 units

3.2. TECHNICAL SOURCE

- BS EN 62052-11:2003, Paragraph 5.2.2.3.
- IEC 60068-2-6.

3.3. TEST INSTRUMENTATION

No.	Instrument Type	Instrument Model	Due Cal.
1.	Electrodynamic Vibration System	U&D TA117-60/CSTA	10/12/2014
2.	Vibration Control System	U&D VWIN Model 2000	10/12/2014
3.	Charge Amplifier	ENDEVCO ISOTRON P.S. Model 2793	10/12/2014
4.	Control Accelerometer Model	ENDEVCO 2224C	See Due Cal. at Accelerometers List Paragraph.

3.4. LAB'S ENVIRONMENTAL CONDITIONS

Parameter Name	Parameter Value	Tolerance Value	Measure Unit
Temperature	25	± 10	Degree Celsius (°C).
Humidity	55	± 27	% R.H.
Mains Voltage	230	± 23	Volts
Mains Frequency	50	± 2	Hertz
Site Air Pressure	760	± 5	mmHg
	1012	± 5	millibar

3.5. TEST PROCEDURE

3.5.1. EXCLUSIONS FROM THE TEST METHOD

None.

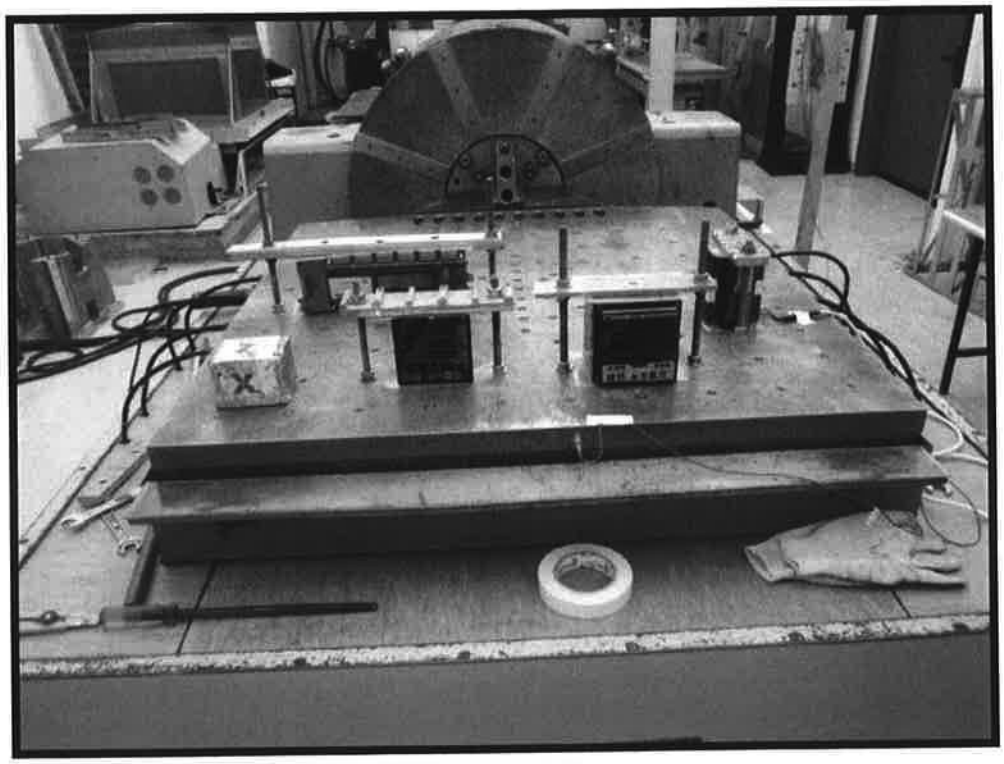
3.5.2. VIBRATION TEST PROCEDURE DESCRIPTION

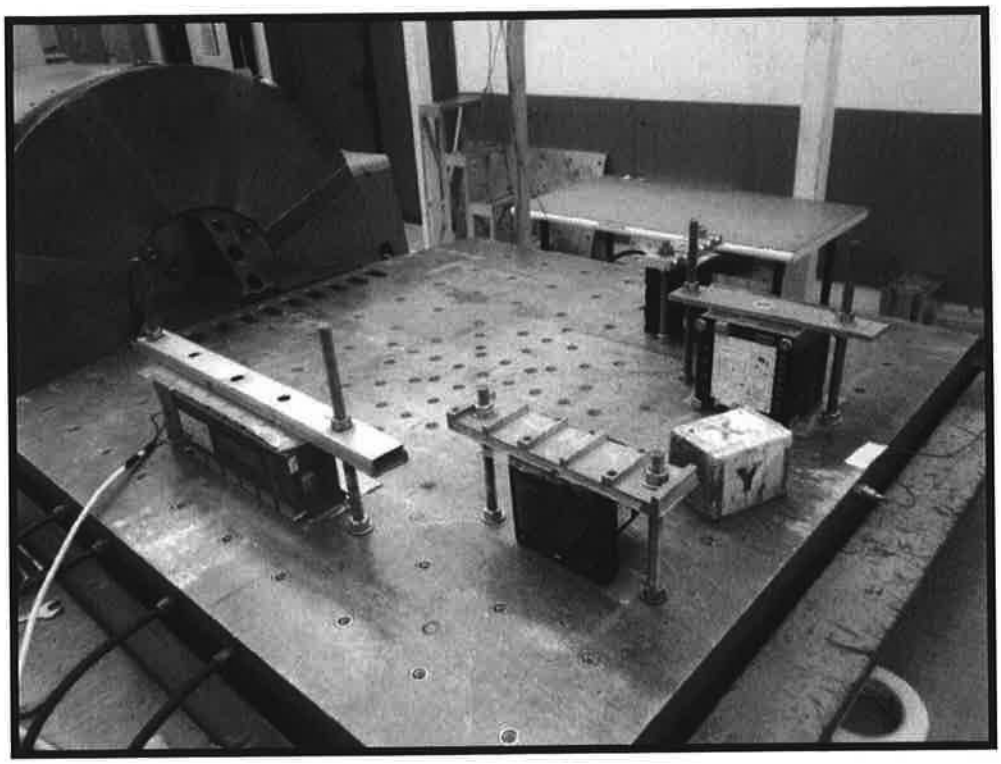
Item Position	The test item was strictly attached to vibration exciter.
Vibration Axes	3 (X, Y, Z).
Sweeping Frequency	Logarithm. From 10 Hz To 150 Hz. Within 03:54 minutes
Vibration Time in Each Axis	01:18 hours
Vibration Level	1 g max.

3.5.3. TEST PERFORMANCE

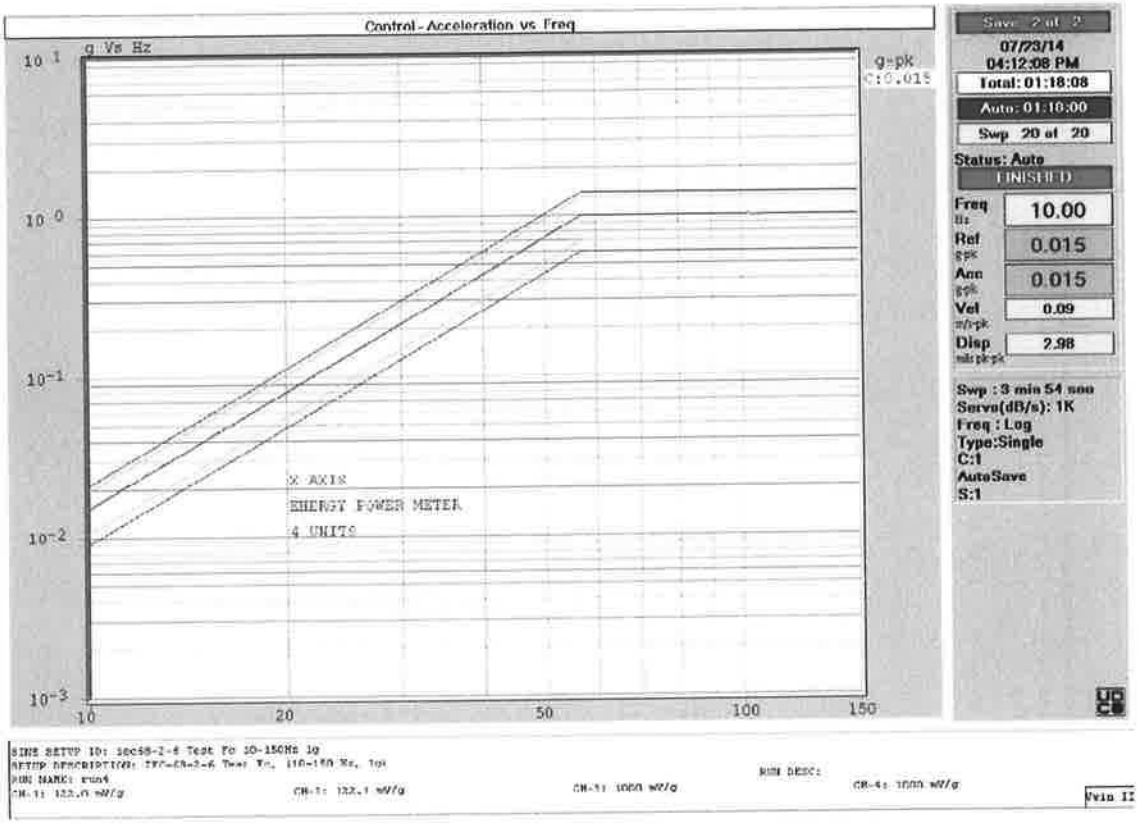
Functional Test	• At the end of test. • Performed by customer representative.
Visual Test	• At the end of test. • Performed by customer representative.

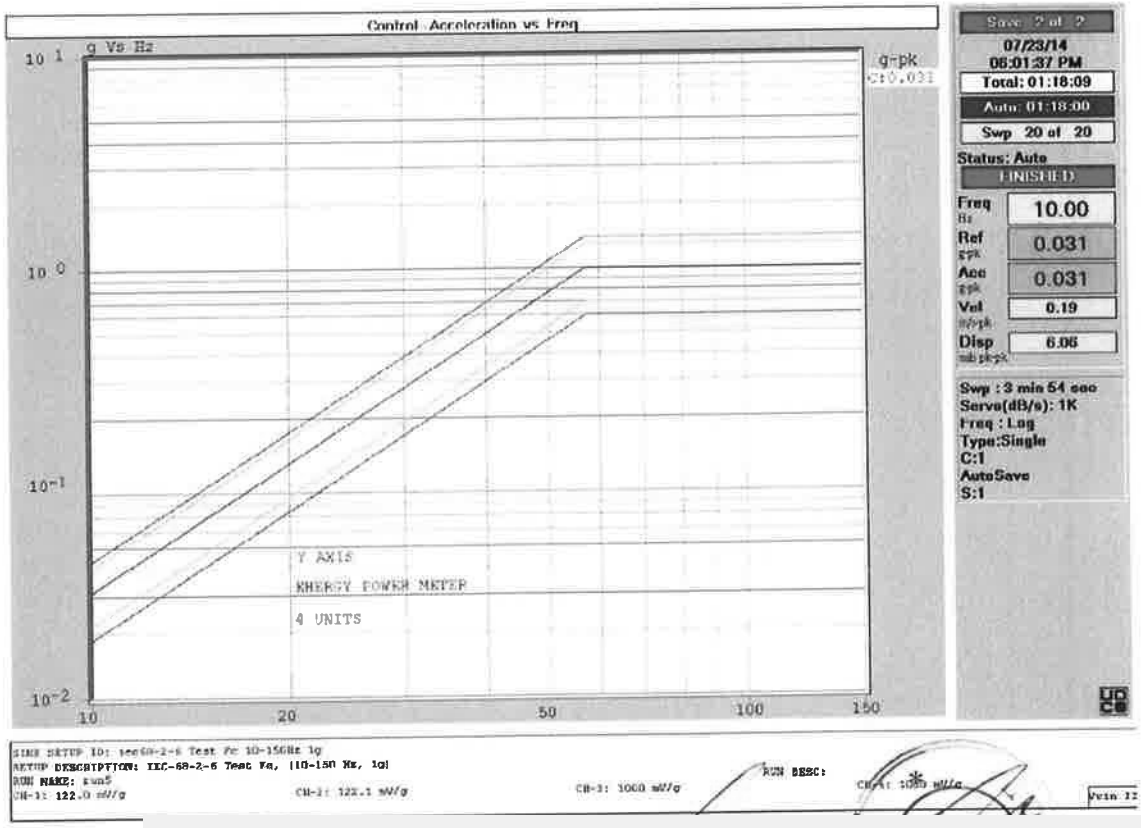
3.5.4. TEST PICTURES





3.5.5. TEST GRAPHS





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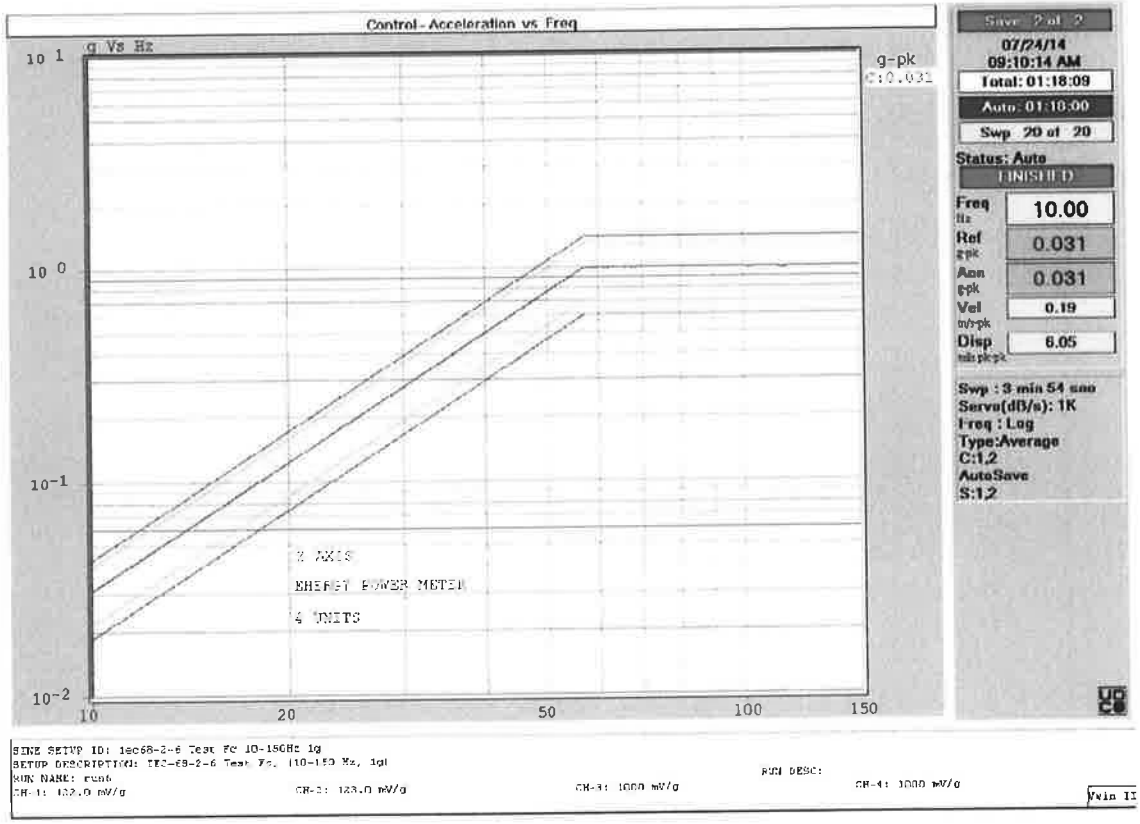


3.5.6. ACCELEROMETERS LIST

Channel (U&D)	Servo Output (mV/g)	Accelerometer Type		Due Cal.
		Model	Serial Number	
1	122	ENDEVCO 2224C	19604	10/12/2014
2	123	ENDEVCO 2224C	19606	10/12/2014

3.5.7. MEASUREMENT POINTS DESCRIPTION

No.	Setup	Run No.	Channel Meas. U&D	Control Axis	Meas. Axis	Definition of measurement points
1.	iec 68-2-6 Test Fc	4	1	X	N/A	Control on vibration fixture.
2.	iec 68-2-6 Test Fc	5	1	Y	N/A	Control on vibration fixture.
3.	iec 68-2-6 Test Fc	6	1,2	Z	N/A	Control on vibration fixture.

3.6. TEST RESULTS

Based on the customer's declaration - The unit under test has PASSED the test.

4. MECHANICAL SHOCK TEST - 14/2488

4.1. UNIT UNDER TEST OVERVIEW

Test Date	23/07/2014
Customer Representative	Leonid Fine
Customer Name	SII
Unit Name	ENERGY POWER METER
Item Manufacturer	SATEC
Item Quantity	4 units

4.2. TECHNICAL SOURCE

- BS EN 62052-11:2003, Paragraph 5.2.2.2.

4.3. TEST INSTRUMENTATION

No.	Instrument Type	Instrument Model	Due Cal.
1.	Mechanical Shock Machine	Electrodynamic vibration system: U&D TA117-60/CSTA	09/12/2014
2.	Shock Control System	U&D VWIN Model 2000	10/12/2014
3.	Charge Amplifier	ENDEVCO ISOTRON P.S. Model 2793	09/12/2014
4.	Control Accelerometer Model	ENDEVCO 2224C	See Due Cal. at Accelerometers List Paragraph.

4.4. LAB'S ENVIRONMENTAL CONDITIONS

Parameter Name	Parameter Value	Tolerance Value	Measure Unit
Temperature	25	± 10	Degree Celsius (°C).
Humidity	55	± 27	% R.H.
Mains Voltage	230	± 23	Volts
Mains Frequency	50	± 2	Hertz
Site Air Pressure	760	± 5	mmHg
	1012	± 5	millibar

4.5. TEST PROCEDURE

4.5.1. EXCLUSIONS FROM THE TEST METHOD

None.

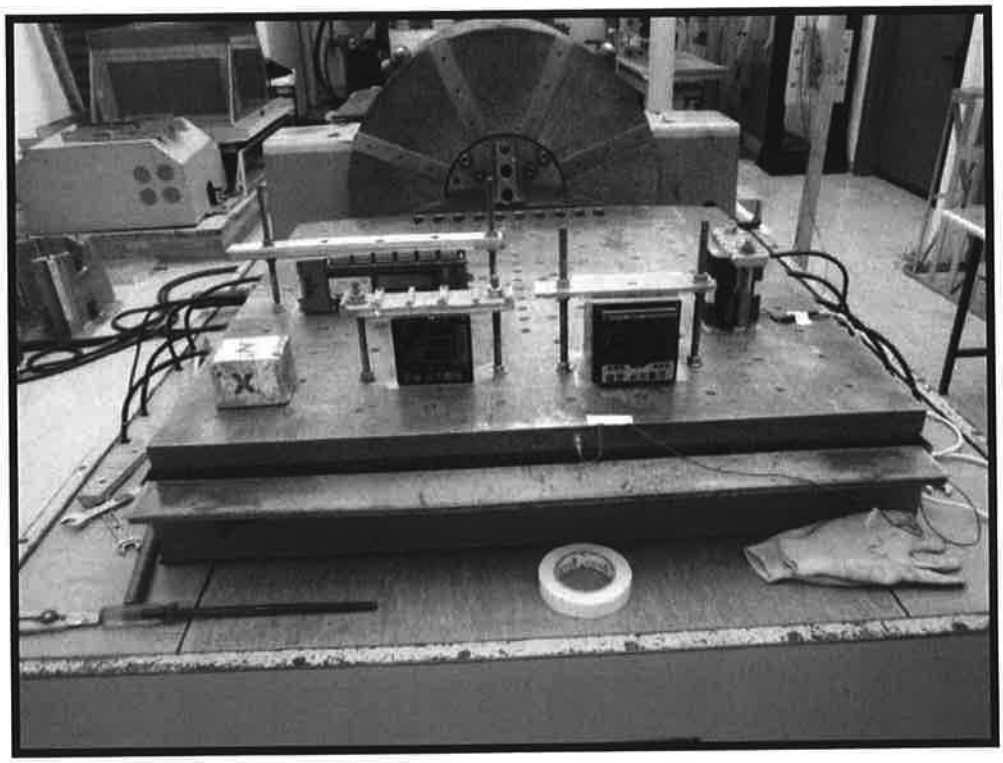
4.5.2. MECHANICAL SHOCK TEST PROCEDURE DESCRIPTION

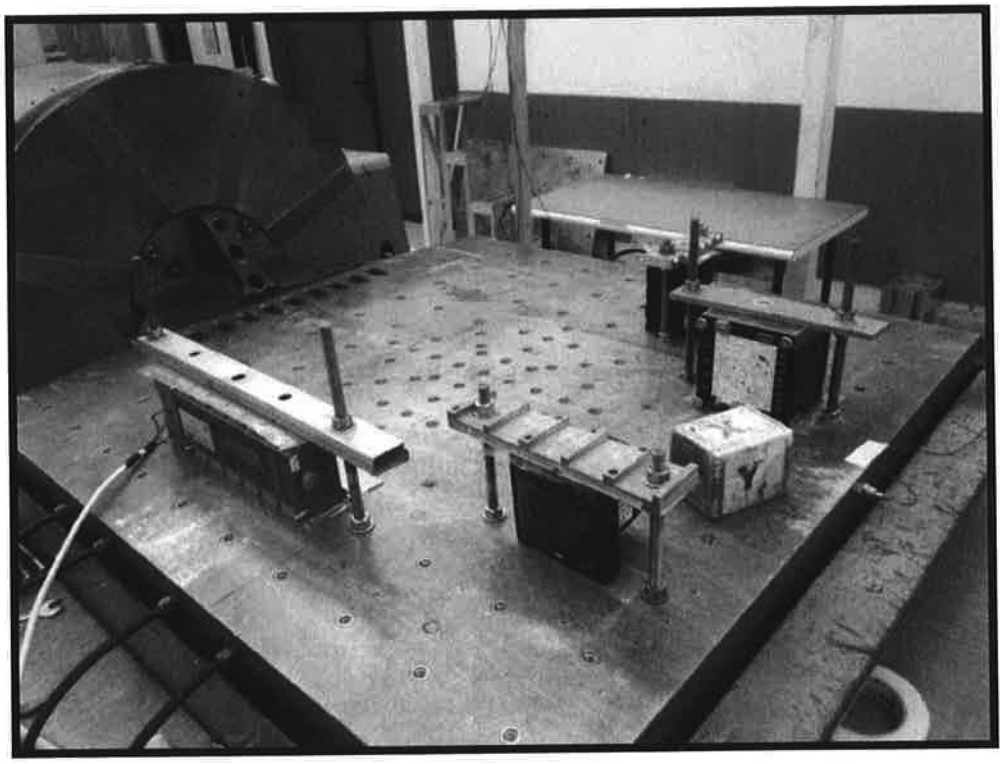
Item Position	The test item was rigidly attached to the shock machine.
Number of Shocks	3 shocks were conducted in each of the 6 directions of the test item.
Shock Level	27 g.
Time Duration	16 msec.
Shape	Half sine.
Total Number of Shocks	18 shocks.

4.5.3. TEST PERFORMANCE

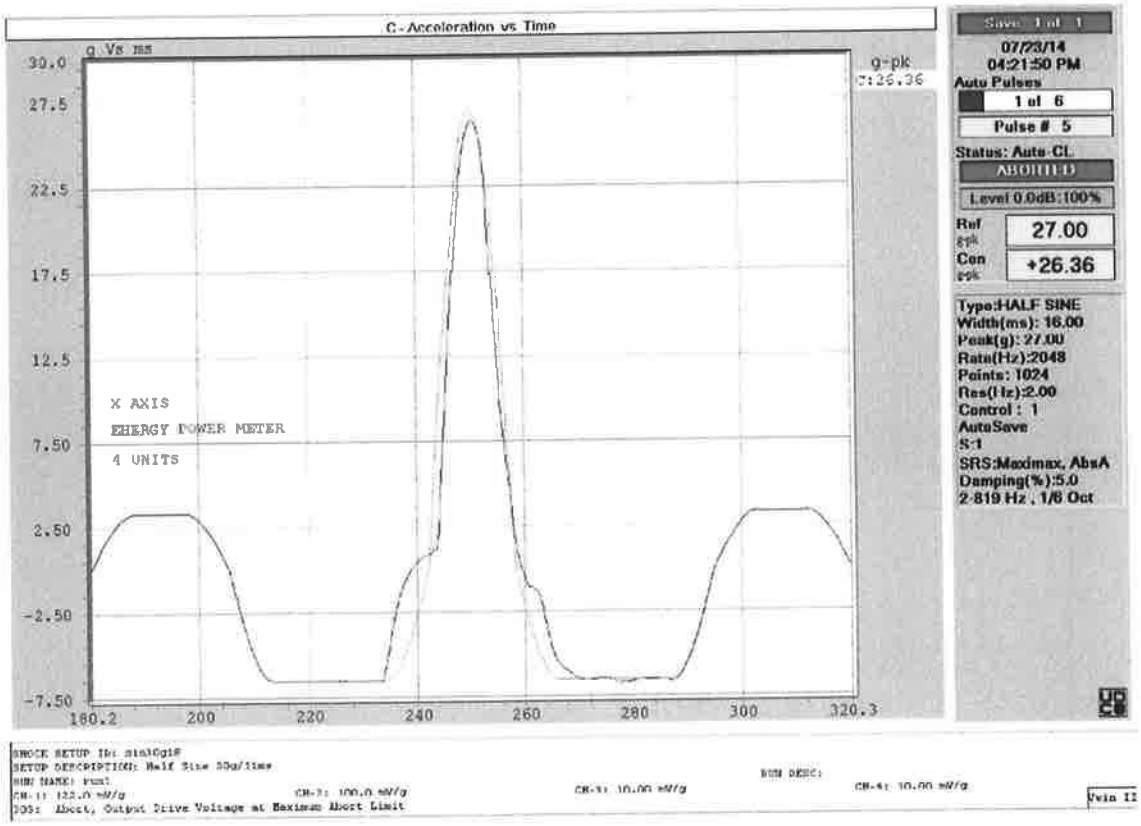
Functional Test	• At the end of test. • Performed by customer representative.
Visual Test	• At the end of test. • Performed by customer representative.

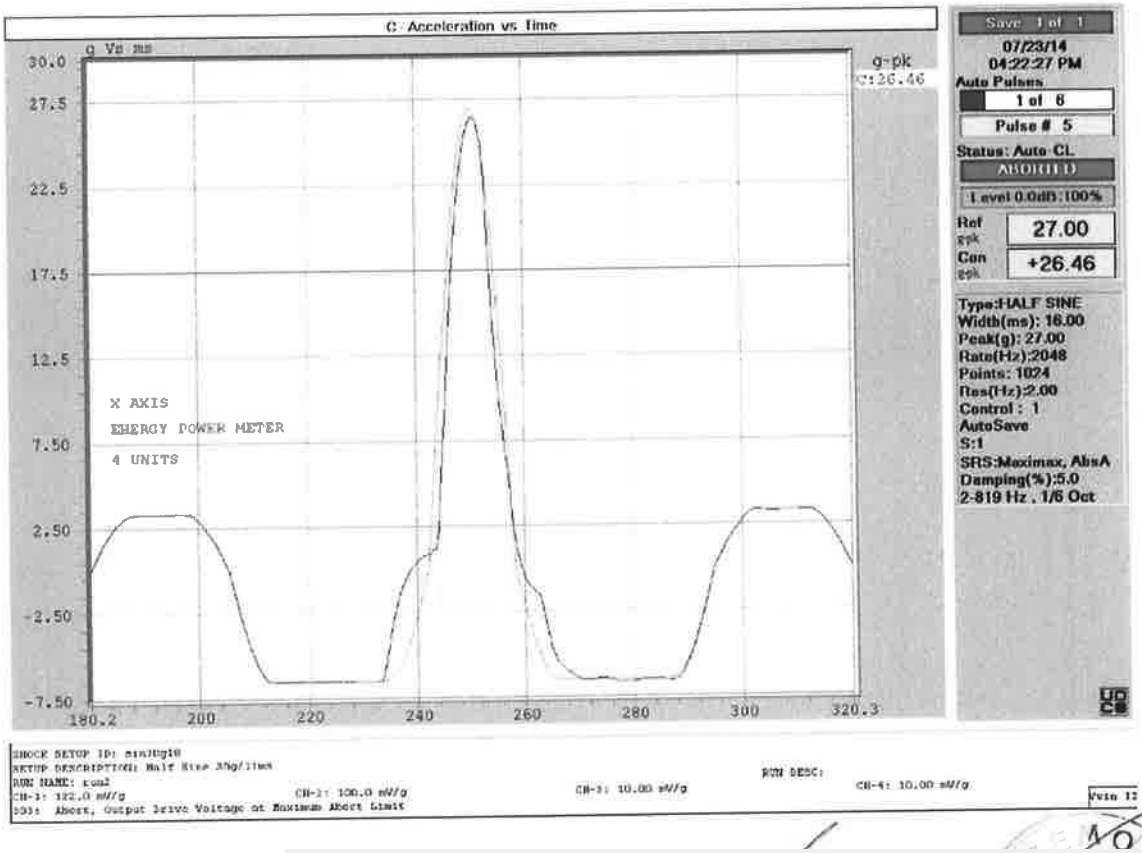
4.5.4. TEST PICTURES

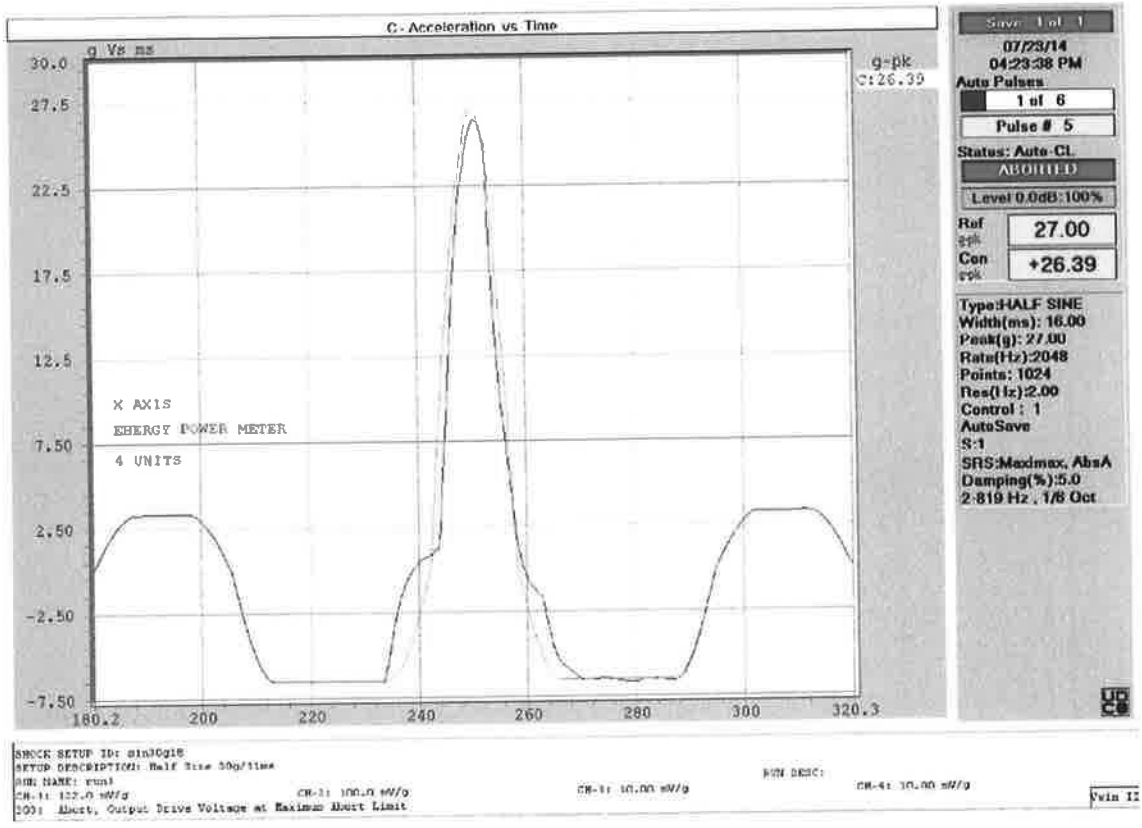


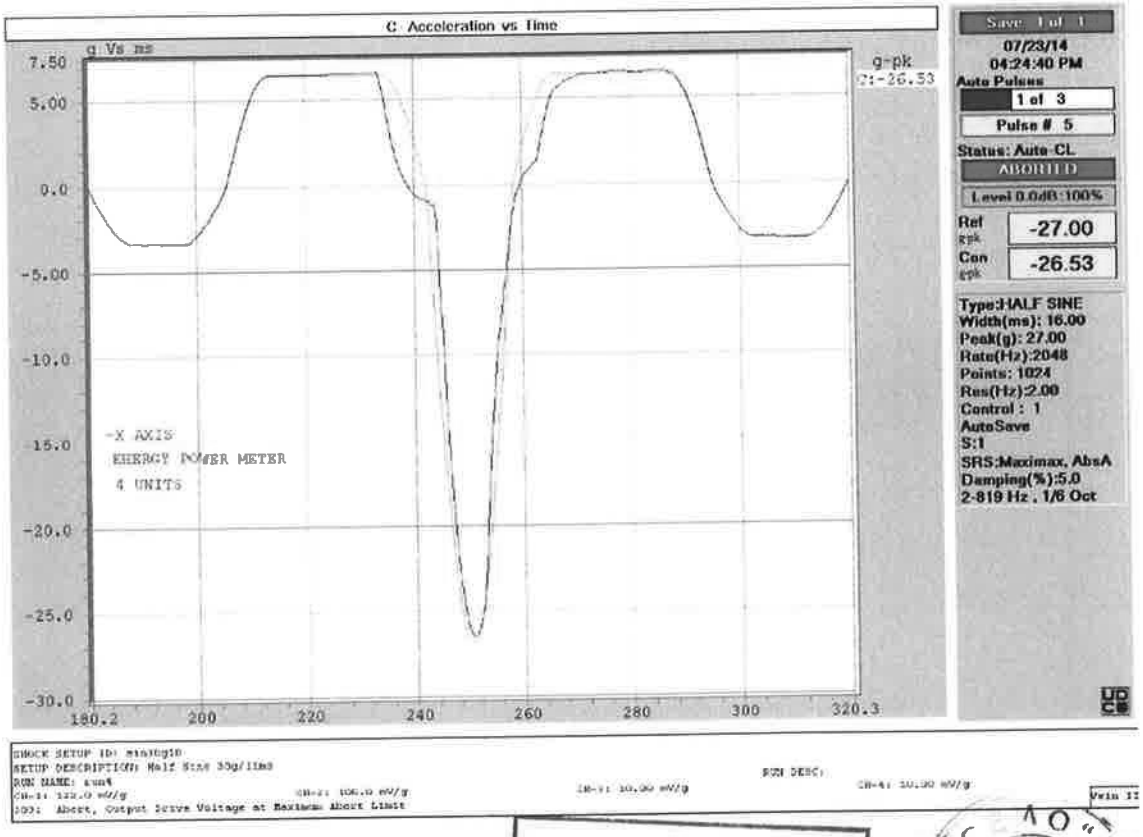


4.5.5. TEST GRAPHS









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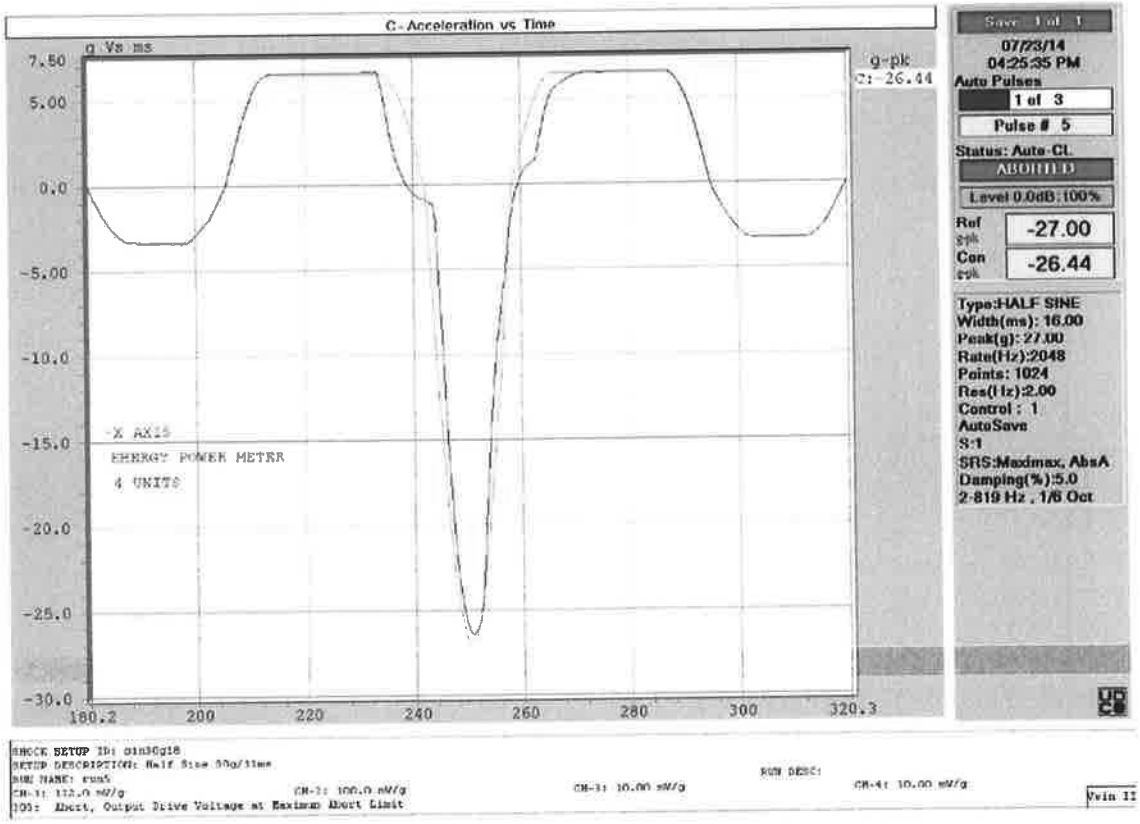

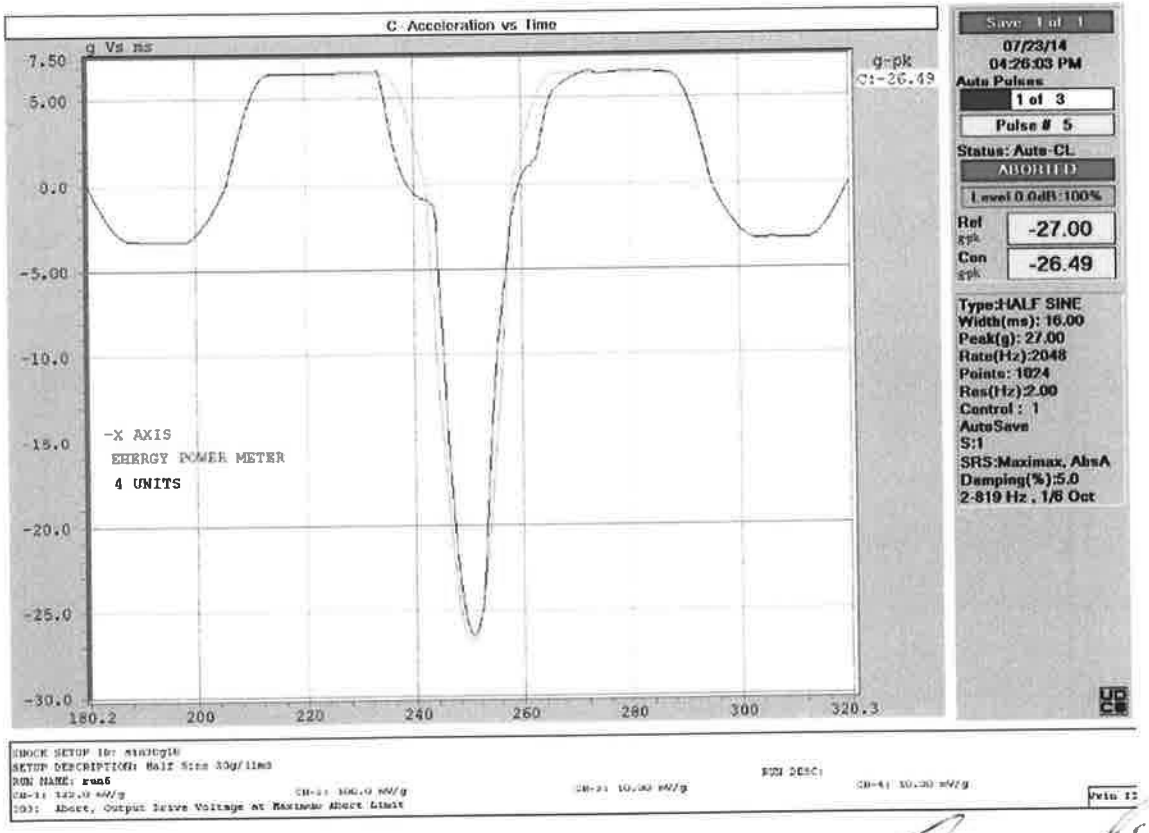

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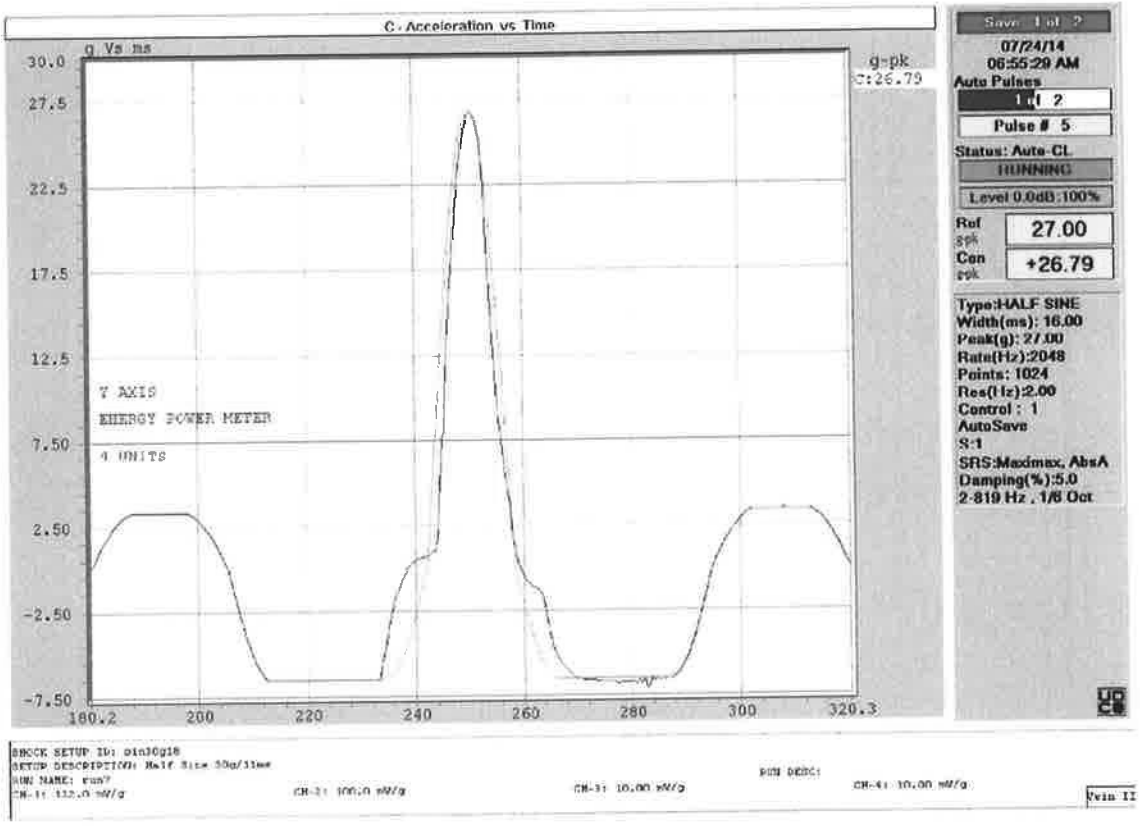

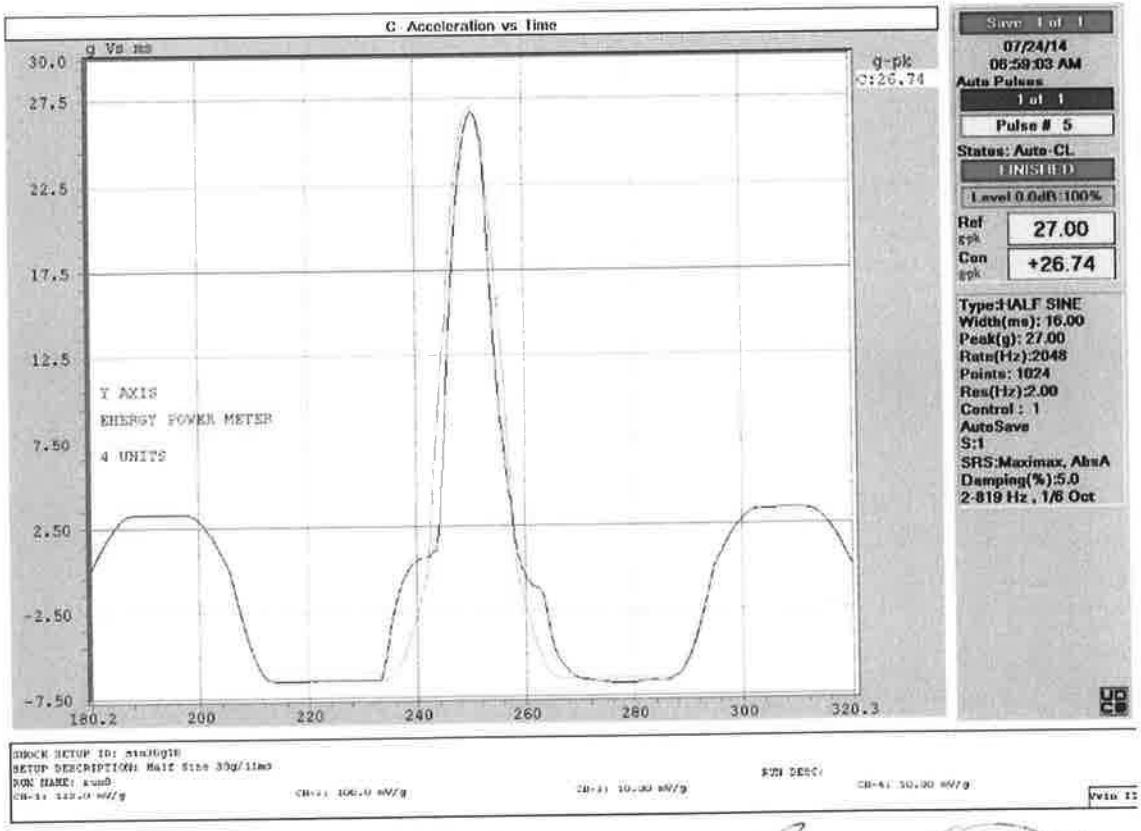

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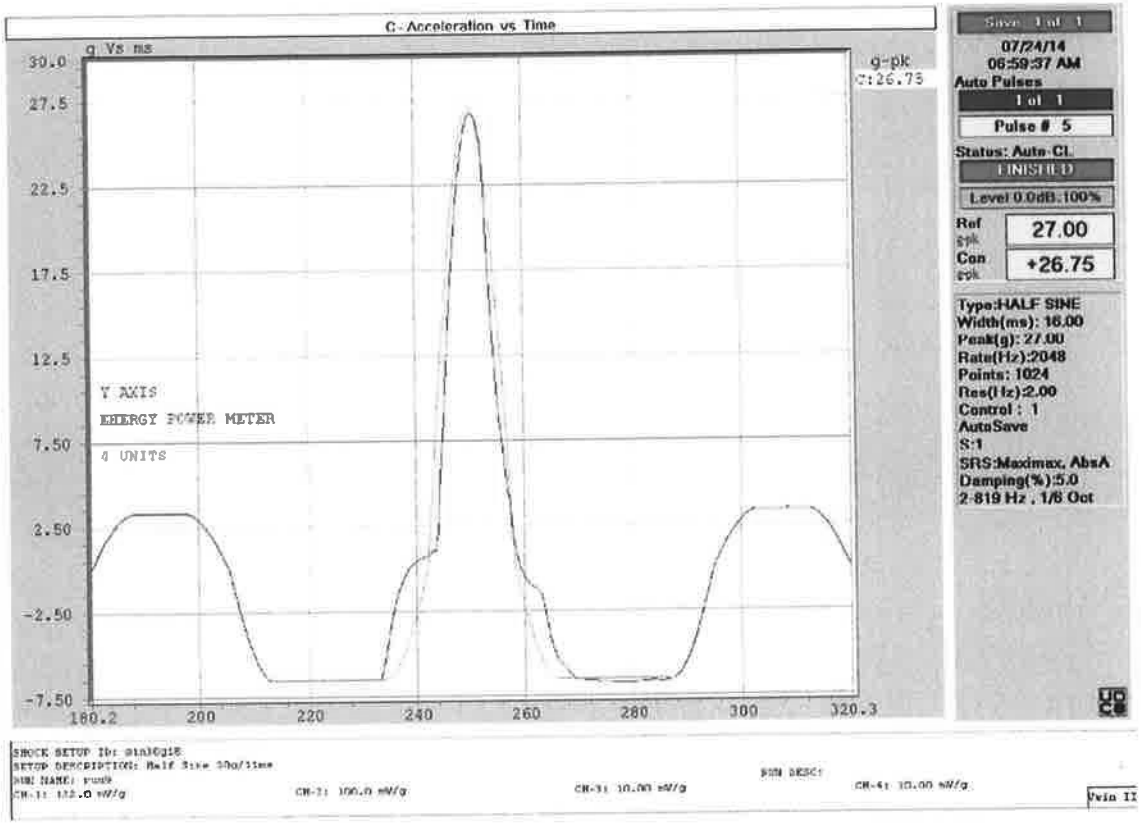

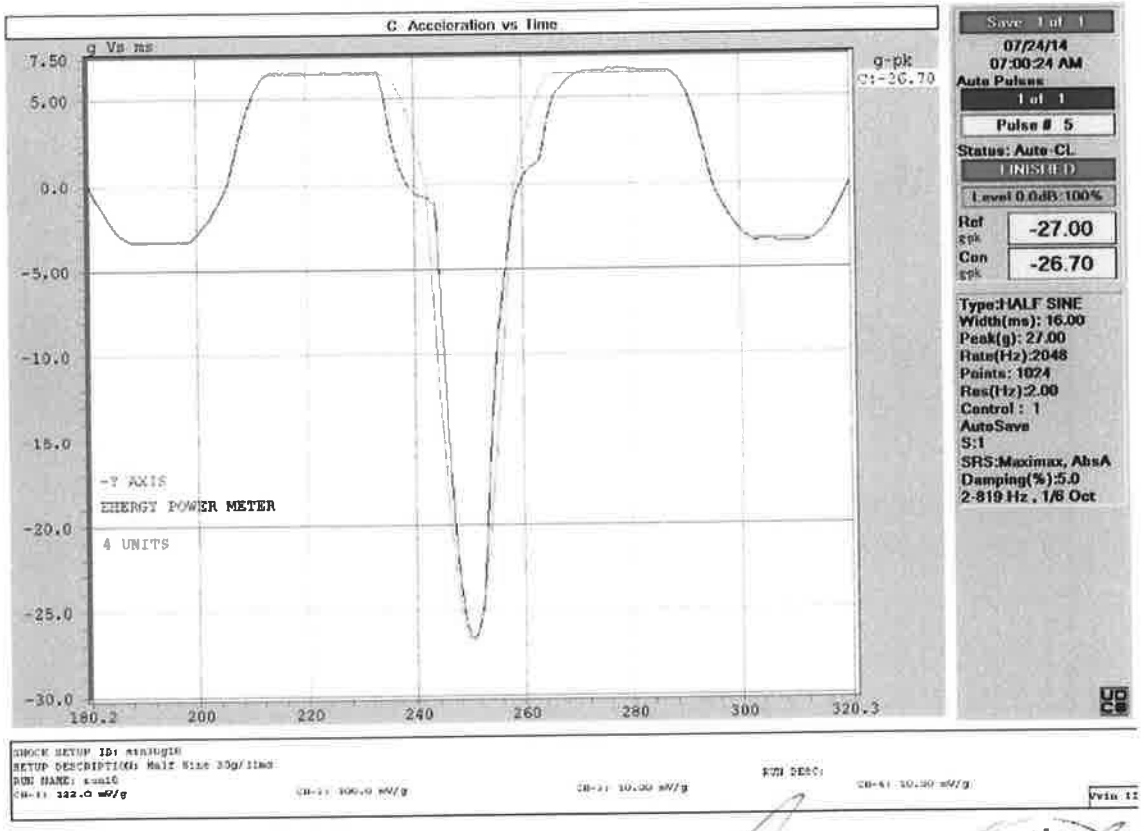

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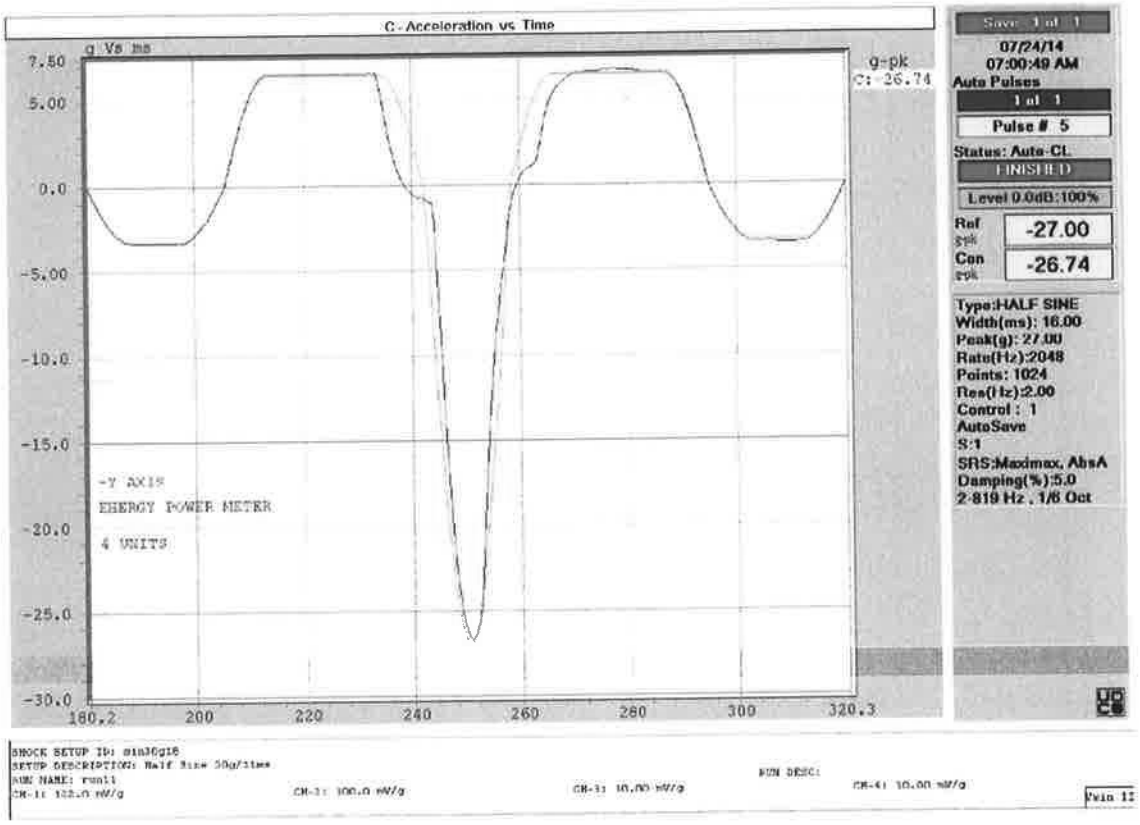

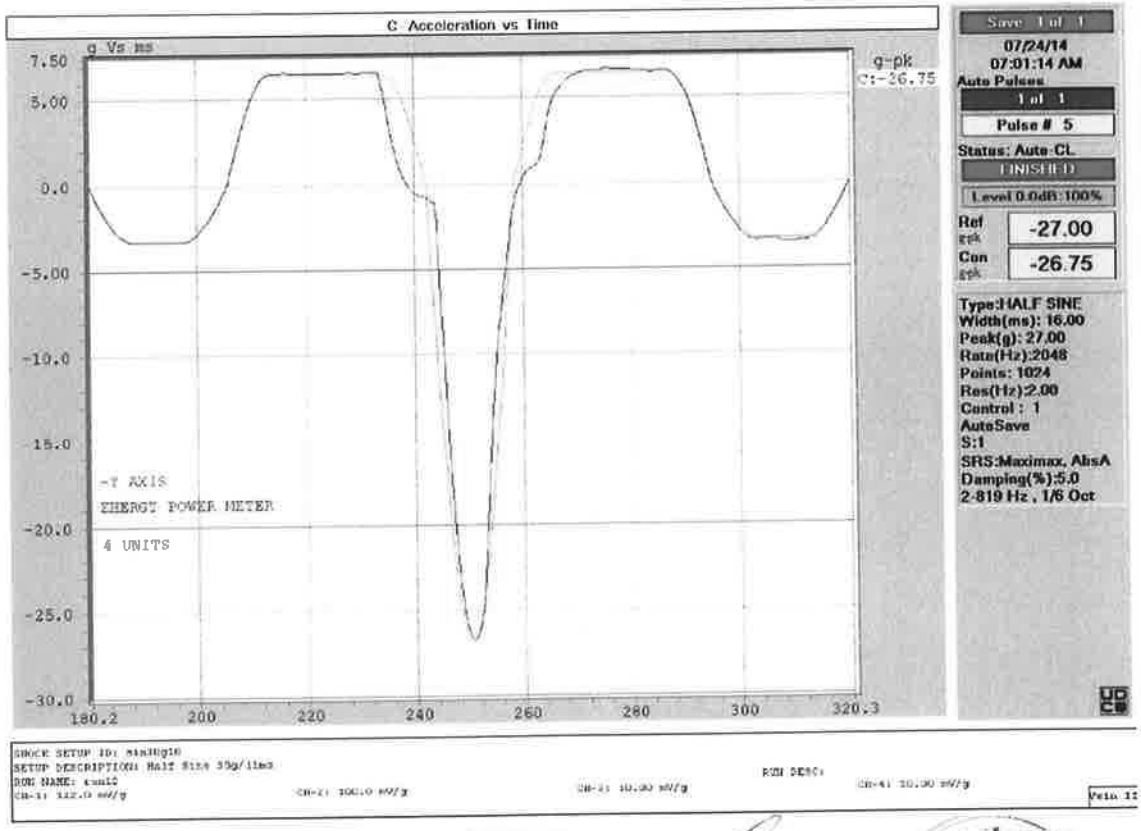

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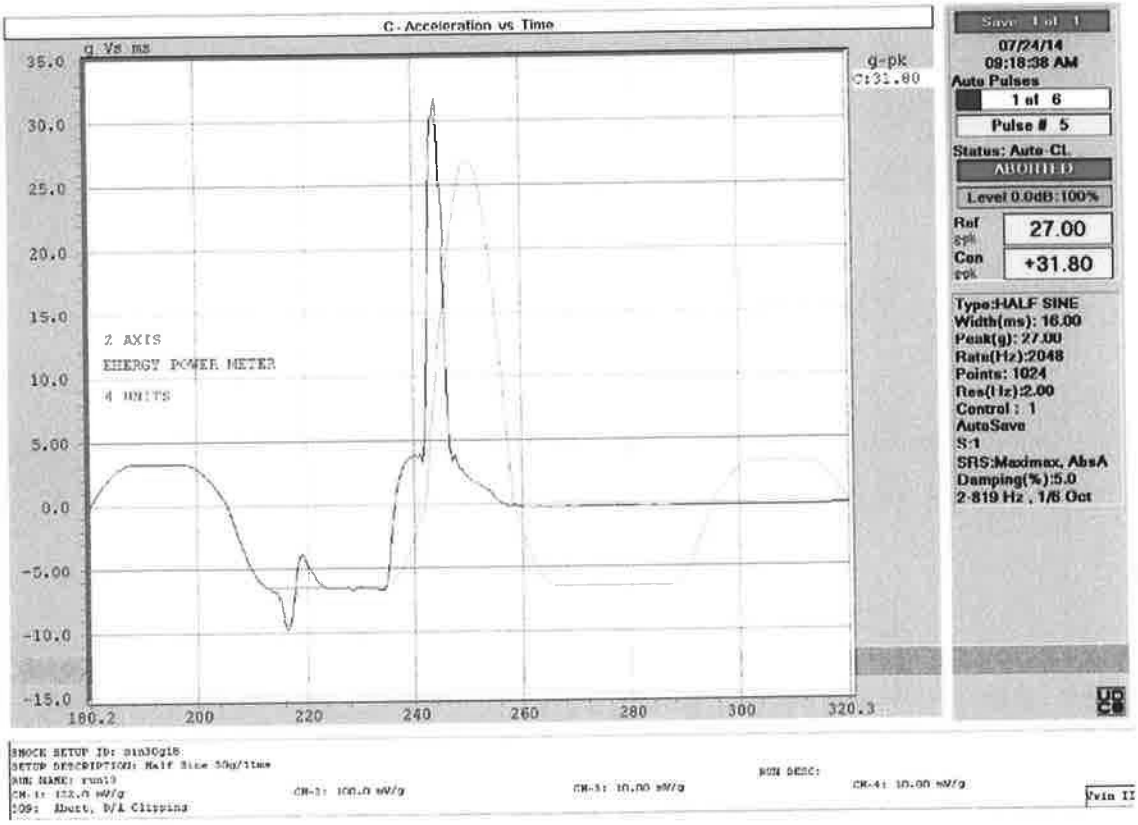

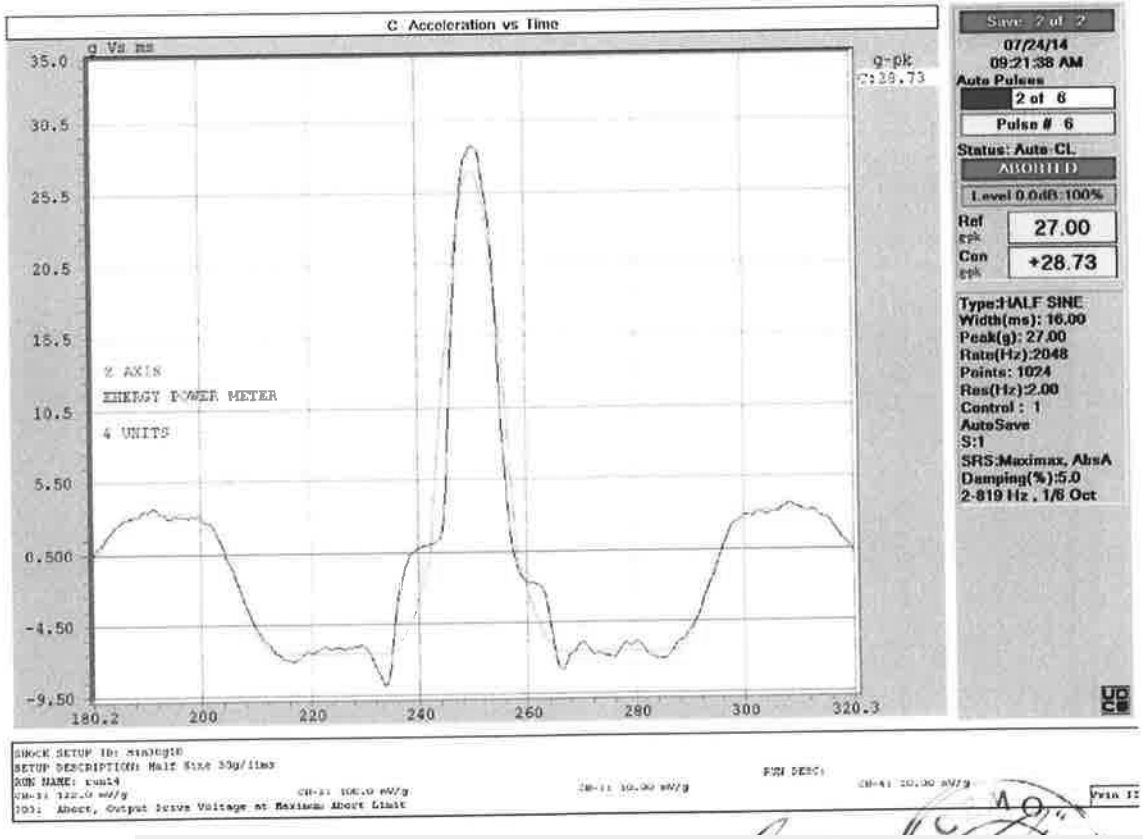

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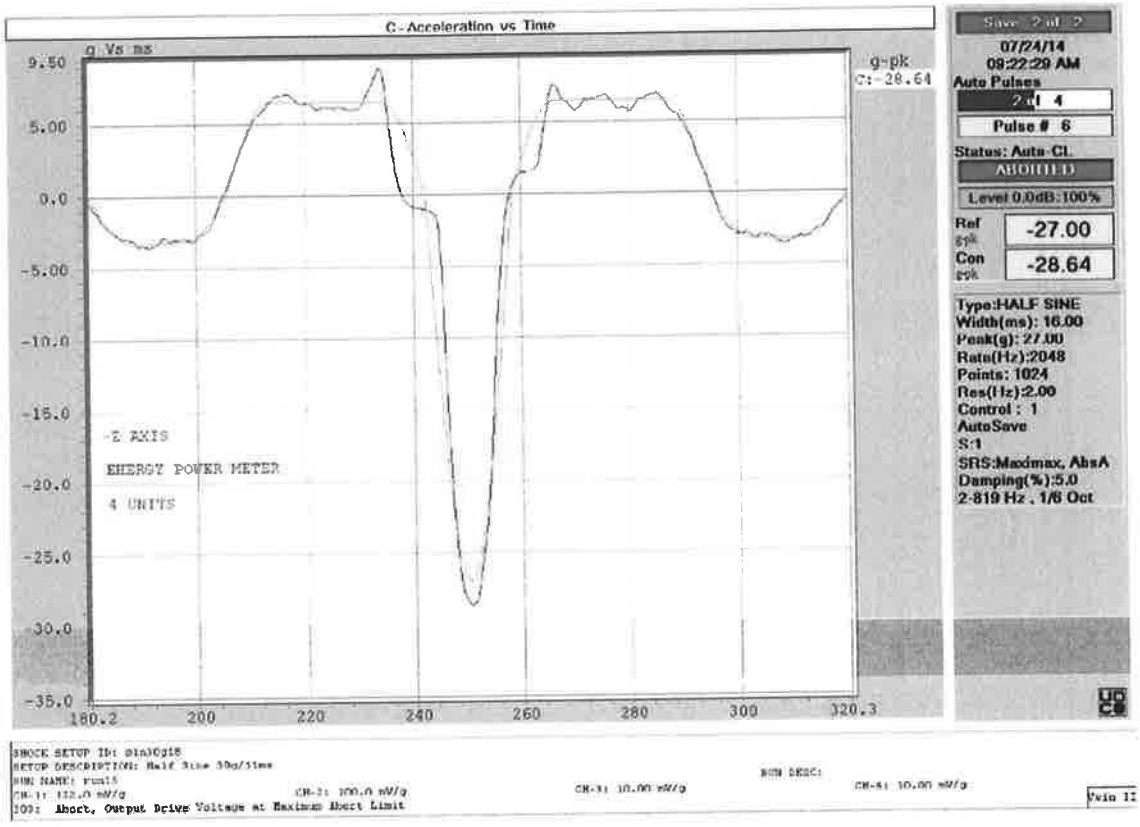
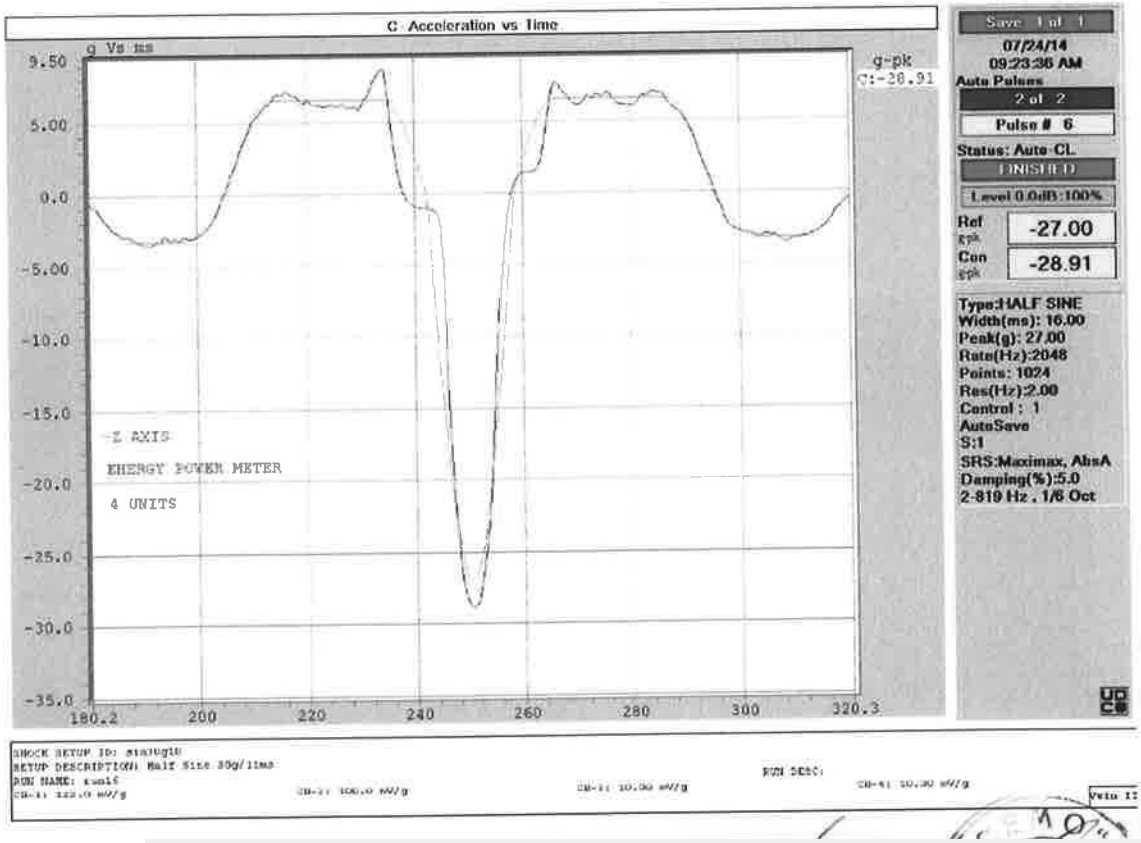




Заличено по чл.2 от ЗЗЛД

4.5.6. ACCELEROMETERS LIST

Channel (U&D)	Servo Output (mV/g)	Accelerometer Type		Due Cal.
		Model	Serial Number	
1	122	ENDEVCO 2224C	19604	10/12/2014

4.5.7. MEASUREMENT POINTS DESCRIPTION

No.	Setup	Run No.	Channel Meas. U&D	Control Axis	Meas. Axis	Definition of measurement points
1.	sin30g18	1	1	X	N/A	Control on shock fixture.
2.	sin30g18	2	1	X	N/A	Control on shock fixture.
3.	sin30g18	3	1	X	N/A	Control on shock fixture.
4.	sin30g18	4	1	-X	N/A	Control on shock fixture.
5.	sin30g18	5	1	-X	N/A	Control on shock fixture.
6.	sin30g18	6	1	-X	N/A	Control on shock fixture.
7.	sin30g18	7	1	Y	N/A	Control on shock fixture.
8.	sin30g18	8	1	Y	N/A	Control on shock fixture.
9.	sin30g18	9	1	Y	N/A	Control on shock fixture.
10.	sin30g18	10	1	-Y	N/A	Control on shock fixture.
11.	sin30g18	11	1	-Y	N/A	Control on shock fixture.
12.	sin30g18	12	1	-Y	N/A	Control on shock fixture.
13.	sin30g18	13	1	Z	N/A	Control on shock fixture.
14.	sin30g18	14	1	Z	N/A	Control on shock fixture.
15.	sin30g18	15	1	-Z	N/A	Control on shock fixture.
16.	sin30g18	16	1	-Z	N/A	Control on shock fixture.

4.6. TEST RESULTS

Based on the customer's declaration - The unit under test has PASSED the test.

5. DRY HEAT (Storage) TEST - 14/2489

5.1. UNIT UNDER TEST OVERVIEW

Test Date	24/07/2014
Customer Representative	Leonid Fine
Customer Name	SII
Unit Name	ENERGY POWER METER
Item Manufacturer	SATEC
Item Quantity	4 units

5.2. TECHNICAL SOURCE

- BS EN 62052-11:2003, Paragraph 6.3.1.

5.3. TEST INSTRUMENTATION - TEMPERATURE CHAMBER

No.	Instrumentation Name	Due Cal.
1.	THERMOTRON_SM-8C	11/12/2014

5.4. LAB'S ENVIRONMENTAL CONDITIONS

Parameter Name	Parameter Value	Tolerance Value	Measure Unit
Temperature	25	± 10	Degree Celsius (°C).
Humidity	55	± 27	% R.H.
Mains Voltage	230	± 23	Volts
Mains Frequency	50	± 2	Hertz
Site Air Pressure	760	± 5	mmHg
	1012	± 5	millibar

5.5. TEST PROCEDURE

5.5.1. EXCLUSIONS FROM THE TEST METHOD

None.

5.5.2. HIGH TEMPERATURE TEST PROCEDURE DESCRIPTION

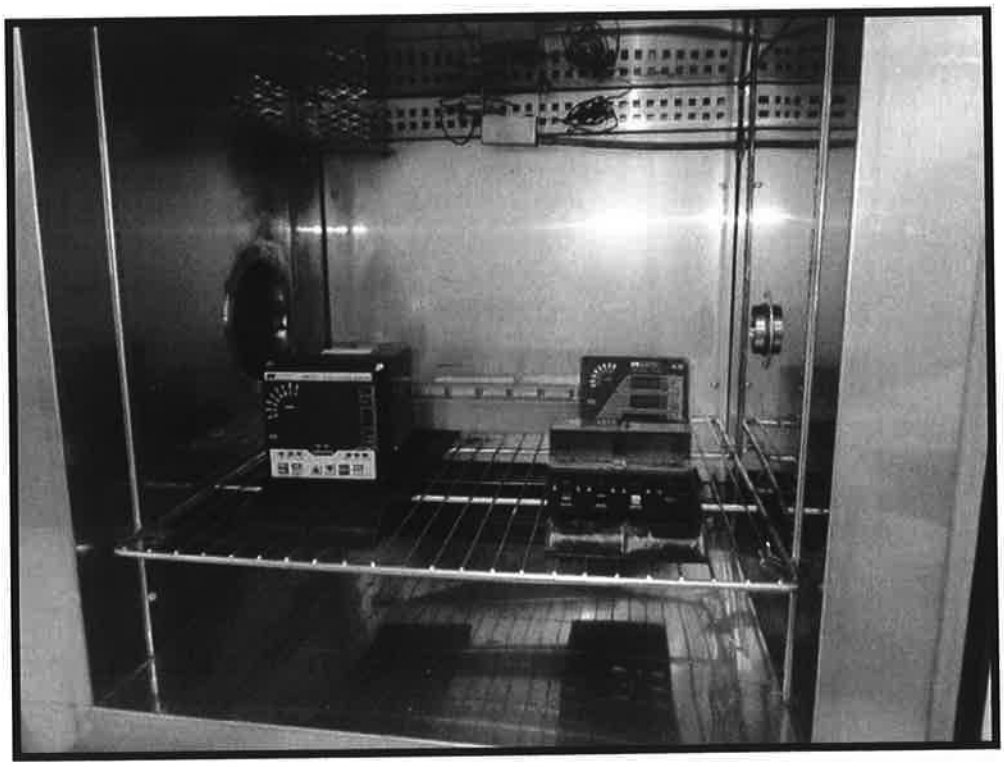
Number of Cycles	One temperature cycle was conducted.
Cycle Time	73:30 hours

Temperature Change		Period	Remarks
From	To		
25°C	70°C	45 minutes	
70°C	70°C	72 hours	
70°C	25°C	45 minutes	

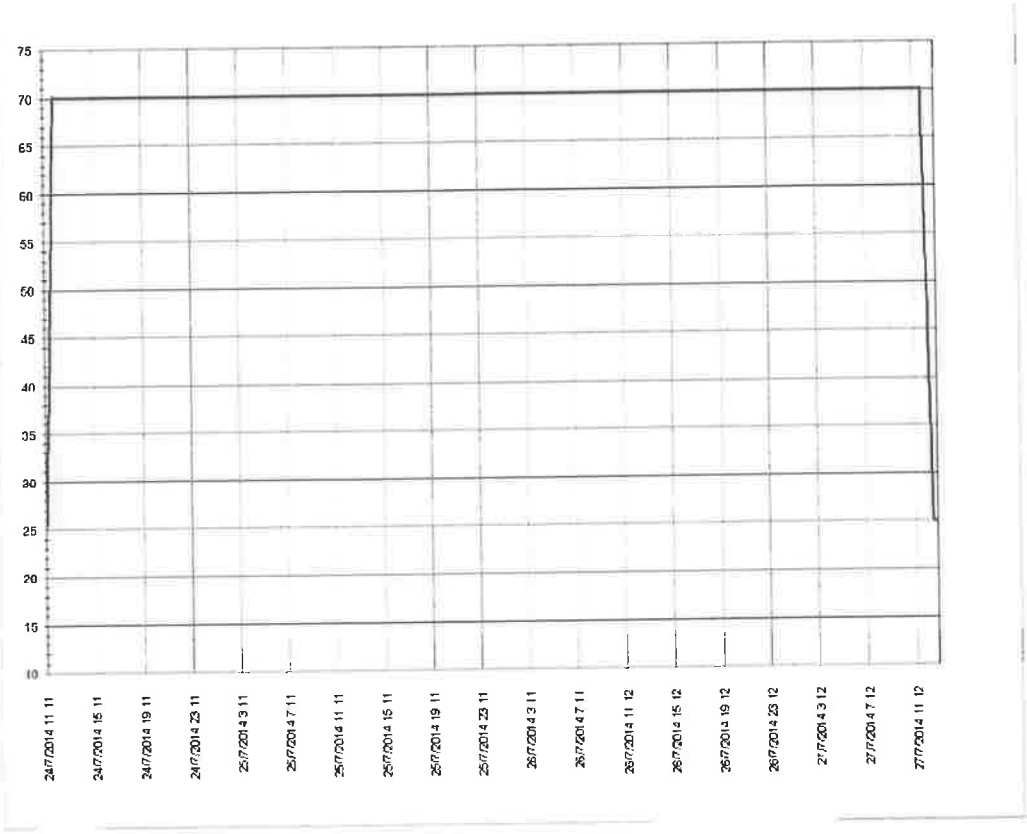
5.5.3. TEST PERFORMANCE

Functional Test	• At the end of test. • Performed by customer representative.
Visual Test	• At the end of test. • Performed by customer representative.

5.5.4. TEST PICTURES



5.5.5. TEST GRAPHS



5.6. TEST RESULTS

Based on the customer's declaration - The unit under test has PASSED the test.

6. LOW TEMPERATURE (Storage) TEST - 14/2518

6.1. UNIT UNDER TEST OVERVIEW

Test Date	27/07/2014
Customer Representative	Leonid Fine
Customer Name	SII
Unit Name	ENERGY POWER METER
Item Manufacturer	SATEC
Item Quantity	4 units

6.2. TECHNICAL SOURCE

- BS EN 62052-11:2003, Paragraph 6.3.1.

6.3. TEST INSTRUMENTATION - TEMPERATURE CHAMBER

No.	Instrumentation Name	Due Cal.
1.	THERMOTRON_SM-8C	11/12/2014

6.4. LAB'S ENVIRONMENTAL CONDITIONS

Parameter Name	Parameter Value	Tolerance Value	Measure Unit
Temperature	25	± 10	Degree Celsius (°C).
Humidity	55	± 27	% R.H.
Mains Voltage	230	± 23	Volts
Mains Frequency	50	± 2	Hertz
Site Air Pressure	760	± 5	mmHg
	1012	± 5	millibar

6.5. TEST PROCEDURE

6.5.1. EXCLUSIONS FROM THE TEST METHOD

None.

6.5.2. LOW TEMPERATURE TEST PROCEDURE DESCRIPTION

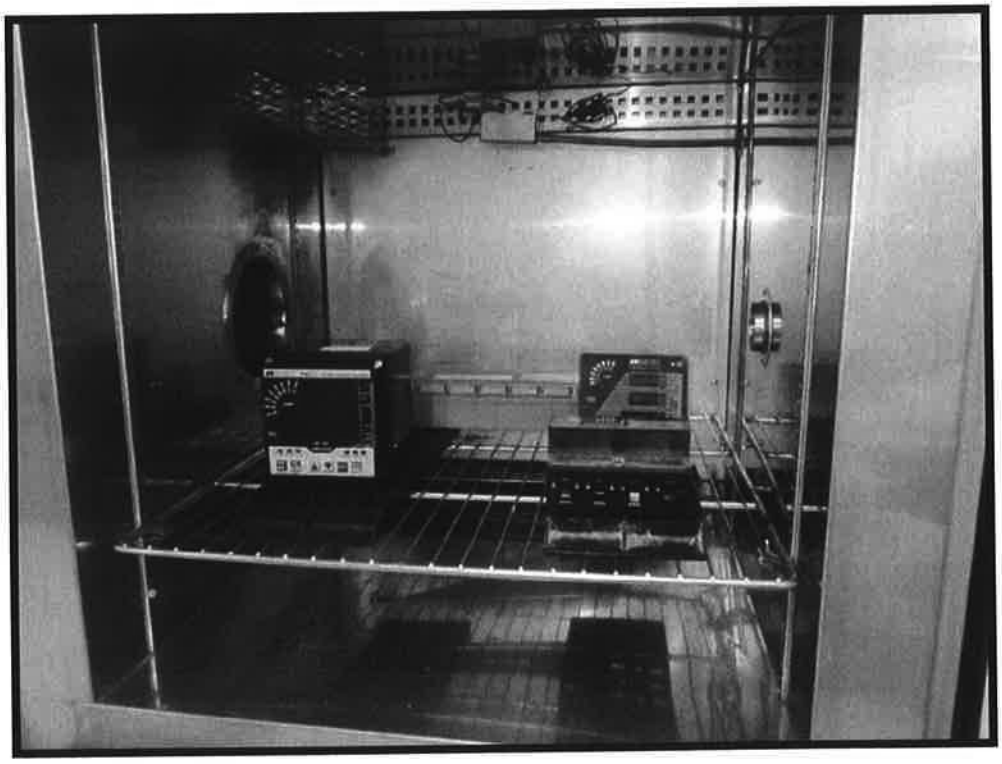
Number of Cycles	One temperature cycle was conducted.
Cycle Time	73:40 hours

Temperature Change		Period	Remarks
From	To		
25°C	-25°C	50 minutes	
-25°C	-25°C	72 hours	
-25°C	25°C	50 minutes	

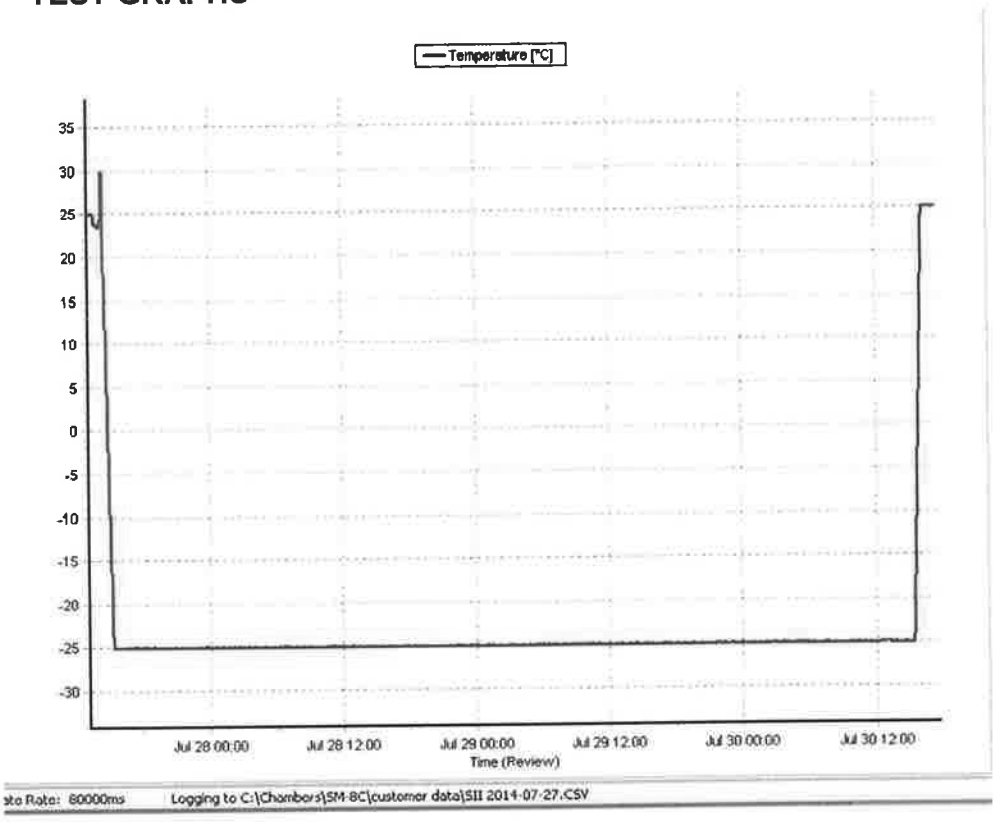
6.5.3. TEST PERFORMANCE

Functional Test	• At the end of test. • Performed by customer representative.
Visual Test	• At the end of test. • Performed by customer representative.

6.5.4. TEST PICTURES



6.5.5. TEST GRAPHS



6.6. TEST RESULTS

Based on the customer's declaration - The unit under test has PASSED the test.

7. HIGH TEMPERATURE (DUMP HEAT -Operation) TEST - 14/2519

7.1. UNIT UNDER TEST OVERVIEW

Test Date	31/07/2014
Customer Representative	Leonid Fine
Customer Name	SII
Unit Name	ENERGY POWER METER
Item Manufacturer	SATEC
Item Quantity	4 units

7.2. TECHNICAL SOURCE

- BS EN 62052-11:2003, Paragraph 6.3.3.

7.3. TEST INSTRUMENTATION - TEMPERATURE & HUMIDITY CHAMBER

No.	Instrumentation Name	Due Cal.
1.	THERMOTRON_SM-8C	11/12/2014

7.4. LAB'S ENVIRONMENTAL CONDITIONS

Parameter Name	Parameter Value	Tolerance Value	Measure Unit
Temperature	25	± 10	Degree Celsius (°C).
Humidity	55	± 27	% R.H.
Mains Voltage	230	± 23	Volts
Mains Frequency	50	± 2	Hertz
Site Air Pressure	760	± 5	mmHg
	1012	± 5	millibar

7.5. TEST PROCEDURE

7.5.1. EXCLUSIONS FROM THE TEST METHOD

None.

7.5.2. TEMPERATURE & HUMIDITY TEST PROCEDURE DESCRIPTION

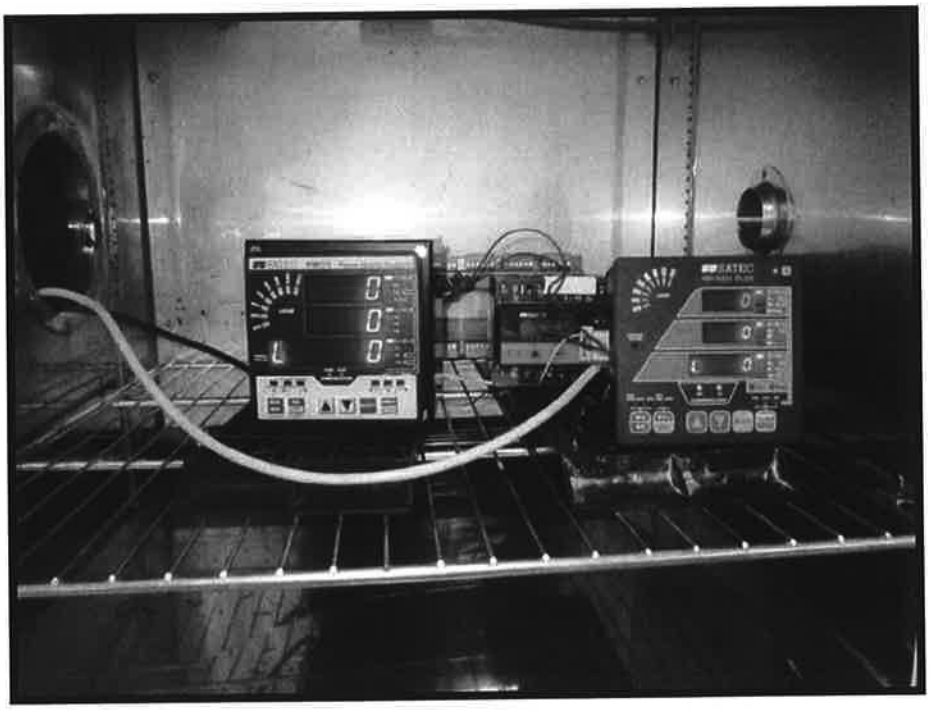
Number of Cycles	6 temperature & humidity cycles were conducted.
Cycle Time	24 hours

No.	Temperature Change		Humidity		Period	Remarks
	From	To	From	To		
1.	25°C	40°C	95%	95%	3 hours	
2.	40°C	40°C	95%	95%	9 hours	
3.	40°C	25°C	95%	95%	3 hours	
4.	25°C	25°C	95%	95%	9 hours	

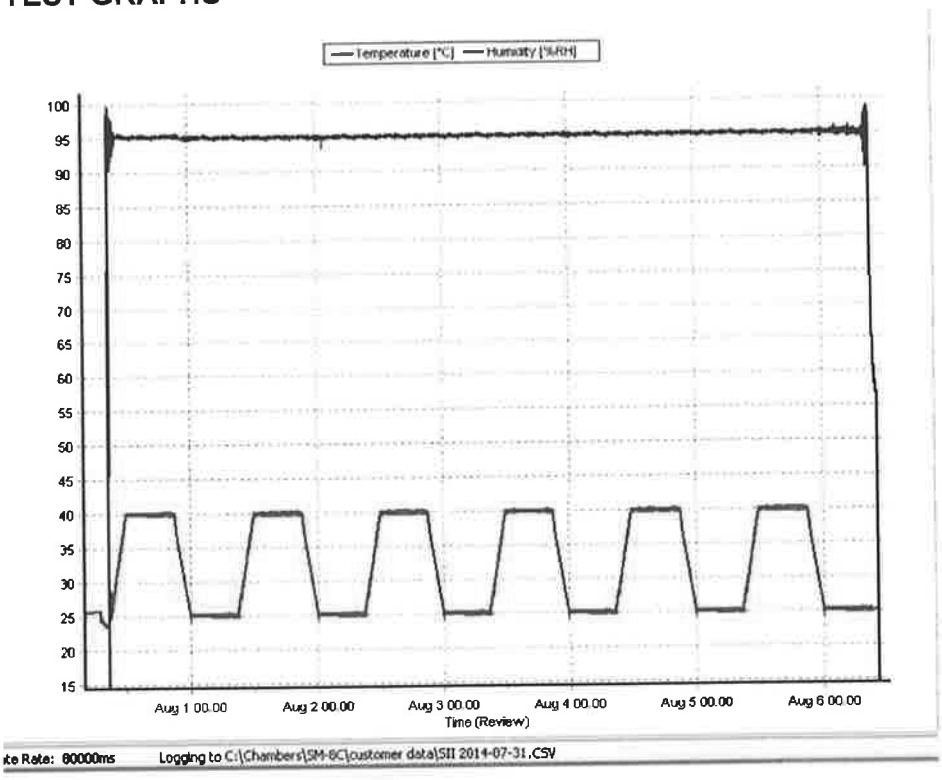
7.5.3. TEST PERFORMANCE

Functional Test	• During test. • At the end of test. • Performed by customer representative.
Visual Test	• At the end of test. • Performed by customer representative.

7.5.4. TEST PICTURES



7.5.5. TEST GRAPHS



7.6. TEST RESULTS

Based on the customer's declaration - The unit under test has PASSED the test.

- After Temperature & Humidity (Damp Heat) Test, Immunity To Voltage Surge Test was performed.

8. IMMUNITY TO VOLTAGE SURGE TEST - 14/2628

8.1. UNIT UNDER TEST OVERVIEW

Test Date	11/07/2014
Customer Representative	Leonid Fine
Customer Name	SII
Unit Name	ENERGY POWER METER
Item Manufacturer	SII
Item Quantity	4 units

- The test was performed by EMC Lab. See document below:

8.2. IMMUNITY TO VOLTAGE SURGE TEST

Date of Test: 11.07.2014
Relative Humidity: 48%
Ambient Temperature: 21°C
Atmospheric Pressure: 1011.4 hPa
Test performed by: Dmitry Isaev

8.2.1. TEST METHOD: EN61000-4-5

8.2.2. TEST PROCEDURE:

Surge Tests were performed on a ground reference plane 3m x 3m wide.
The EUT was placed on a table 0.1m above the ground reference plane, and was configured, arranged and operated in a manner consistent with typical application and load conditions.
Surge voltage was applied to the EUT power supply by means of a coupling/decoupling network, and directly to the tested ports.
The surges were applied as described in the table below.

8.2.3. LIST OF TEST EQUIPMENT:

IP6.2 2 & 4 -wire Coupling Network
EMtest, Coupling/Decoupling network for burst and surge, CNI 503 A18/ 32A
EMTest, Surge Generator combination wave, VCS 500 N10

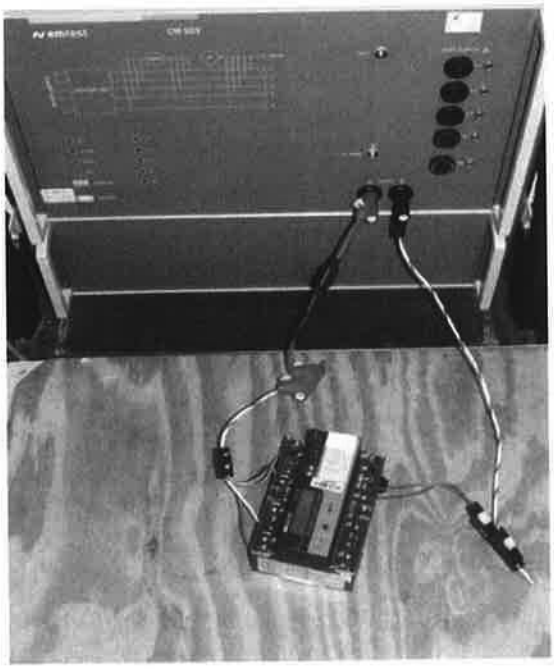
8.2.4. TEST RESULTS:

Surge Application	Test Level, kV	Repetitions at each polarity	Pass/ Fail
EM133			
V1+V2+V3+Vn to RS-485(X+ and X-)	±4	5	*
PM175			
V1+V2+V3+Vn+L+N to COM1	±4	5	*
V1+V2+V3+Vn+L+N to COM2			*
V1+V2+V3+Vn+L+N to GND			*
BFM136			
V1+V2+V3+Vn+L+N to COM1(RS-485)	±4	5	*
PM130EH Plus			
V1+V2+V3+Vn+L+N to RS-485	±4	5	*
V1+V2+V3+Vn+L+N to GND			*

* Normal performance of the EUT should be verified by the customer at customer premises after tests.

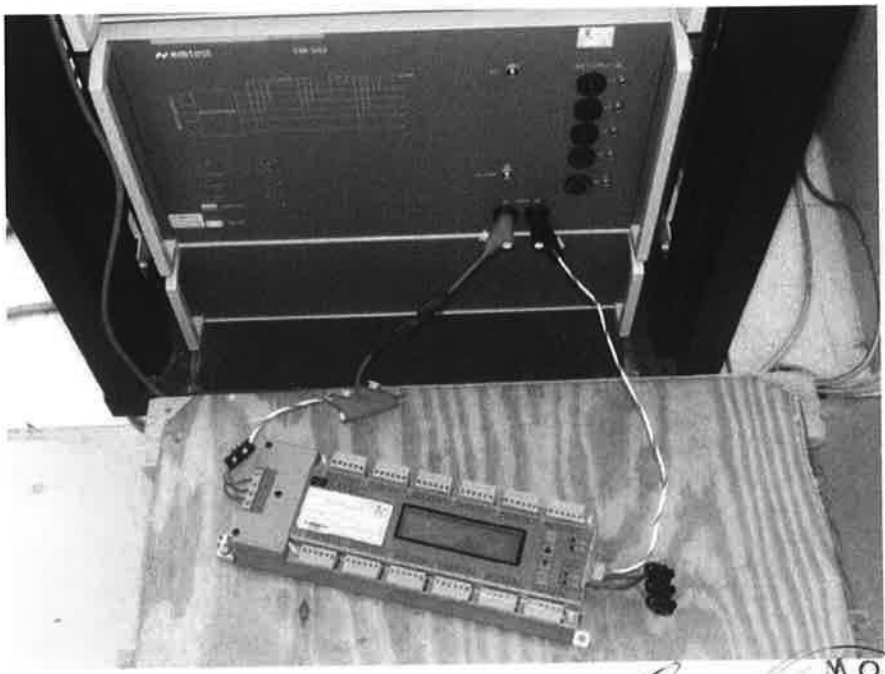
8.2.5. TEST PICTURES

Test Picture 1: Surge on EM133



Test Picture 2: Surge on PM175

Test Picture 3: Surge on BFM136



Test Picture 4: Surge on PM130EH Plus

9. TEMPERATURE CYCLING (Storage & Operation) TEST - 14/2631

9.1. UNIT UNDER TEST OVERVIEW

Test Date	14/08/2014, 17/08/2014
Customer Representative	Leonid Fine
Customer Name	SII
Unit Name	ENERGY POWER METER
Item Manufacturer	SATEC
Item Quantity	4 units

9.2. TECHNICAL SOURCE

- BS EN 62052-11:2003, Paragraph 6.1
- IEC 60721-3-3, Table 1.

9.3. TEST INSTRUMENTATION - TEMPERATURE CHAMBER

No.	Instrumentation Name	Due Cal.
1.	ASSO_SK-3102	27/12/2014
2.	ASSO_ SD-305	12/12/2014

9.4. LAB'S ENVIRONMENTAL CONDITIONS

Parameter Name	Parameter Value	Tolerance Value	Measure Unit
Temperature	25	± 10	Degree Celsius (°C).
Humidity	55	± 27	% R.H.
Mains Voltage	230	± 23	Volts
Mains Frequency	50	± 2	Hertz
Site Air Pressure	760	± 5	mmHg
	1012	± 5	millibar

9.5. TEST PROCEDURE

9.5.1. EXCLUSIONS FROM THE TEST METHOD

None.

9.5.2. TEMPERATURE CYCLING TEST PROCEDURE DESCRIPTION

Temperature Cycling (Storage) Test

Number of Cycles	One temperature cycle was conducted.
Cycle Time	15:10 hours

Temperature Change		**Period**	**Remarks**
From	**To**		
25°C	-25°C	50 minutes	
-25°C	-25°C	6 hours	
-25°C	70°C	1:35 hours	
70°C	70°C	6 hours	
70°C	25°C	45 minutes	

Temperature Cycling (Operation) Test

Number of Cycles	One temperature cycle was conducted.
Cycle Time	13:50 hours

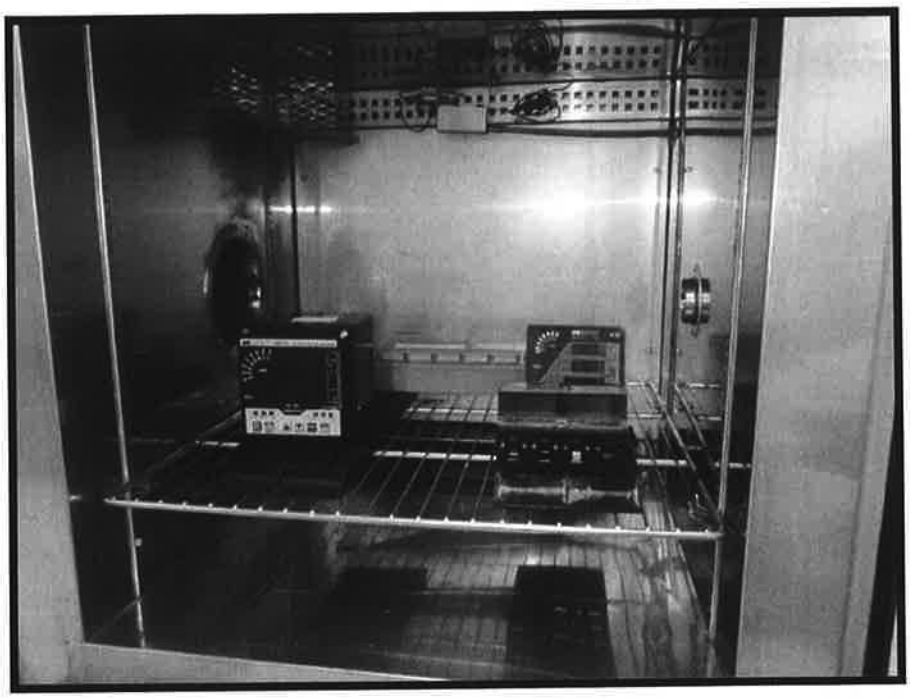
Temperature Change		**Period**	**Remarks**
From	**To**		
25°C	-10°C	35 minutes	
-10°C	-10°C	6 hours	
-10°C	45°C	55 minutes	
45°C	45°C	6 hours	
45°C	25°C	20 minutes	

9.5.3. TEST PERFORMANCE

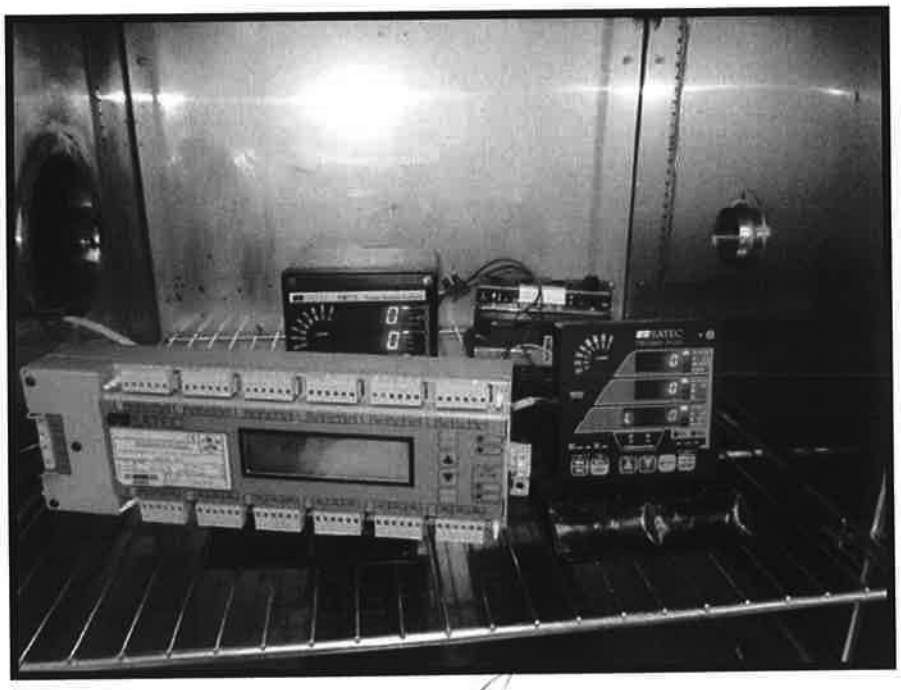
Functional Test	• During test. • At the end of test. • Performed by customer representative.
Visual Test	• At the end of test. • Performed by customer representative.

9.5.4. TEST PICTURES

Temperature Cycling (Storage) Test

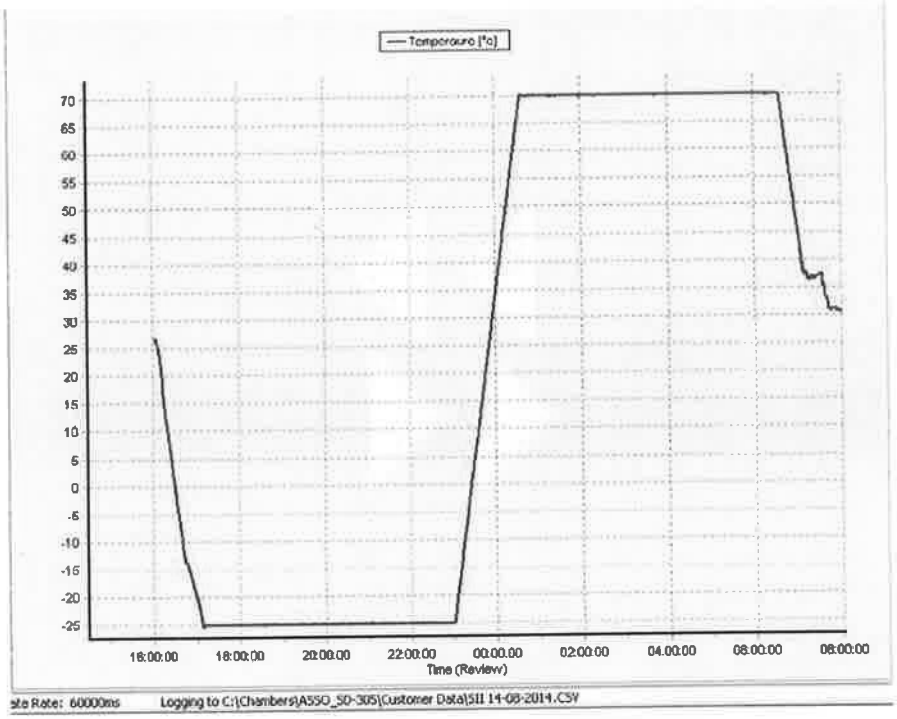


Temperature Cycling (Operation) Test

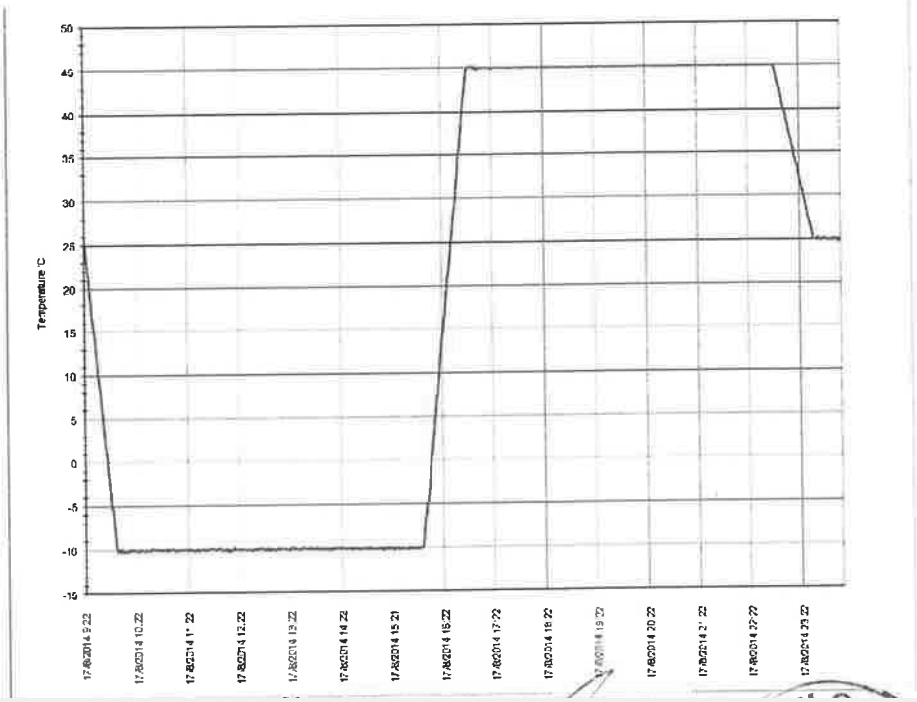


9.5.5. TEST GRAPHS

Temperature Cycling (Storage) Test Graph



Temperature Cycling (Operation) Test Graph



9.6. T

Based on the customer's declaration - The unit under test has PASSED the test.

10. PARAMETERS ACCURACY & UNCERTAINTY BALANCE

ENVIRONMENTAL & MECHANICAL LABORATORIES
PARAMETERS ACCURACY & UNCERTAINTY **

Manufacturer	Model	Description	Parameter	Accuracy *	Uncertainty
AALBORG	DFC36	Gas Flow Controller	LPM	0.5	0.3
ASSOCIATED	SK-3102	Temperature Chamber	Deg C	1.5	1.5
ASSOCIATED	ZHH-2108	Temperature Chamber	Deg C	2.7	1.4
ASSOCIATED	ZHH-2127	Temp/Humidity Chamber	Deg C	1.5	1.37
			RH%	6.1	3.31
BRABENDER	KKW10.000/60	Temperature & Humidity Chamber	Deg C	1	1.45
			RH%	4.6	3.6
LANSMONT	PDT-56ED	Drop Tester	cm	0.1	0.1
MONARCH	PLT200	RPM Meter	rpm	2	0.5
TENNEY	36S	Altitude/Heat Chamber	Deg C	0.5	0.8
			Feet	100	100
TENNEY	JUNIOR	Temperature Chamber	Deg C	0.7	1.5
TENNEY	T30 RC	Temp/Humidity Chamber	Deg C	1.5	1.51
			RH%	5	3.6
TENNEY	T40 RC	Temp/Humidity Chamber	Deg C	2.1	1.6
			RH%	2.8	3.6
TENNEY	T-5S	Temperature Chamber	Deg C	2.1	1.28
THERMOTRON	F-40-CHMV-25-25 -2	Temperature & Humidity Agree Chamber	Deg C	0.5	2
			RH%	3.4	2.94
THERMOTRON	F-64-CHAMV-10-10 S	Temp. & Humidity & Altitude Chamber	Deg C	3.5	1.6
			RH%	2.5	3.6
THERMOTRON	TS-8-3Z-5-5-Ln2	Thermal Shock Chamber	Deg C	0.9	1.6
U&D	VWIN 2000	Controlled Vibration Machine	g (%)	3	3
WEISS	SNT-400	Salt Fog Chamber	Salt (%)	3	3
			Deg C	0.5	0.3
			pH	0.01	0.01
LAB	SC-1000	Bounce Machine	RPM	1	0.5

*** Accuracy in (%) onl**
**** Unless otherwise s**

END OF REPORT

carmel
Environmental Tests Ltd.

ACCREDITED
TESTING LABORATORY
CERT # 28B101

ENVIRONMENTAL TEST REPORT

CUSTOMER

SATEC
Powerful Solutions

Satec

UNIT NAME

PM135EH, PM172E

* Same enclosure & construction for the following Instruments:
PM130P, PM130E, PM130EH, PM135P, PM135E, PM135EH, PM172P, PM172E, PM172EH, PM174 & PM175.

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LABORATORY DETAILS

Lab Name	Carmel Environmental Test Laboratories
Address	33 Alexander Yannai St. PetachTikva, Israel
Tel.	+972-3-5702773
Fax	+972-3-5702774
E-Mail	info@carmel-lab.co.il
Website	http://www.carmel-lab.com

carmel
Environmental Tests Ltd.

CUSTOMER DETAILS

Customer Name	Satec
Address	POB 45022 Jerusalem 9145001, Israel
Tel.	972-52-2382511+
Customer Rep.	Avi Beim
E-Mail	avib@satec-global.com

SATEC
Powerful Solutions

Заличено по чл.2 от ЗЗЛД

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1 // DOCUMENT HISTORY

The following table records information regarding released editions of this document and briefly describes their purpose and changes made to them.

Edition ID	Release Date	Author	Purpose and Description of Changes
–	August 24, 2015	Chen Zakaim	**Purpose:** Release

2 // DOCUMENT APPROVALS

Author	***August 24, 2015***	**Approved By**	***August 24, 2015***
Chen Zakaim, Technical Writer		***Dov Carmeli, COO***	

3 // OPEN ISSUES

No.	Subject/Section	Description
1.		
2.		

Заличено по чл.2 от ЗЗЛД

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1. INTRODUCTION

1.1 // PURPOSE

The purpose of this document is to verify that the PM135EH, PM172E meets all requirements as per the applicable documents.

1.2 // SCOPE

The scope of this Environmental Test Report includes the environmental test results as specified by the customer and by the related resources.

1.3 // GLOSSARY

Term	Description
N.A	Not Applicable
N.C	Not Controlled
PSD	Power Spectral Density
TBD	To Be Defined
RH	Relative Humidity
UUT	Unit Under Test

1.4 // APPLICABLE DOCUMENTS

This section contains a list of resources (e.g., documents, files) referenced by or related to this document. All documents' revisions are the latest known on the date of the contract signing.

Main Document Customer Requirements

// Test-specific sources

Test	Document
Dust IP5X	IEC 60529
Water Splash IPX4	IEC 60529

1.5 // TEST INSTRUMENTATION

Test	Name	S/N	Calibration Due Date
Dust IP5X	Yishai Instruments & Equipments	SSC-010	31 January 2016
Water Splash IPX4	Oscillating Tube Facility	TOP2903	31 October 2015

1.6 // SYSTEM OVERVIEW

Figure 1.1 - System Overview

1.7 // EXECUTIVE SUMMARY

The following table summarizes the tests that have been performed in Carmel Environmental Test Laboratories.

Test Name	Verdict
Dust IP5X	✔Pass
Water Splash IPX4	✔Pass

Statement of Compliance with Test Requirements

We, Carmel Environmental Test Laboratories, declare under our sole responsibility that the PM135EH, PM172E was tested to comply with the requirements of the applicable environmental test specification.

1.8 // LABORATORY ACCREDITATION

Carmel Environmental Test Laboratories Ltd. Is an accredited Laboratory by the American Association for Laboratory Accreditation – A2LA (see accreditation herein).

A2LA logo in the front page is applicable only to the tests under the scope of Carmel Environmental Test Laboratories accreditations.
Carmel Environmental Test Laboratories has A2LA accreditation to ISO/IEC 17025:2005 for test types as listed in the following link:

http://www.a2la.org/scopepdf/2881-01.pdf

American Association for Laboratory Accreditation

Accredited Laboratory

A2LA has accredited

CARMEL-ENVIRONMENTAL TESTS LTD.

Petach Tikva,

for technical competence in the field of

Mechanical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 *General requirements for the competence of testing and calibration laboratories*. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009*).

Presented this 25th day of March 2014.

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President & CEO
For the Accreditation Council
Certificate Number 2881.01
Valid to March 31, 2016

For the types of tests to which this accreditation applies, please refer to the laboratory's Mechanical Scope of Accreditation.

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2. DUST IP5X TEST

2.1 // UNIT UNDER TEST OVERVIEW

Test Dates	23/08/2015
Customer	Satec
Customer Rep.	Avi Beim
Unit Name	PM135EH, PM172E Same enclosure & construction for the following Instruments: PM130P, PM130E, PM130EH, PM135P, PM135E, PM135EH, PM172P, PM172E, PM172EH, PM174 & PM175.
P/N	PM172E , PM135EH
S/N	1133212 , 1132673
Item Manufacturer	Satec
Number of Units	1+1

2.2 // TEST DESCRIPTION

2.2.1 // TEST PROCEDURE

Dust Size	<75µm	**Amount of Dust**	2Kg per cubic meter
Temperature	25°C - 35°C	**Duration**	8 hrs.

2.2.2 // EXCLUSIONS FROM THE TEST METHOD

Not Applicable.

2.2.3 // TEST INSPECTION

	Visual Test	*Functional Test*
Before Test	✔	✔
During Test	✘	✘
After Test	✔	✔

2.3 // TEST RESULTS

In visual inspection at completion of the test, no external damage observed.
operationa
Test Result

2.4 // TEST PICTURES

Figure 2.1– UUT before the Dust Test

Figure 2.2– UUT inside the Dust Chamber

Figure 2.3– UUT a

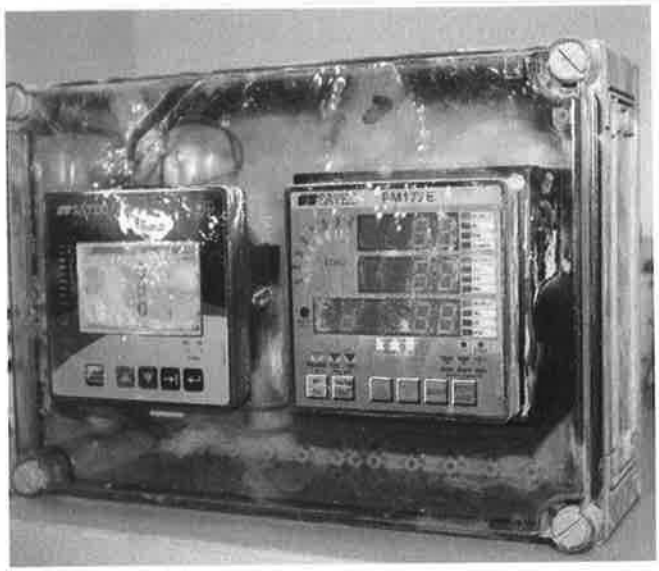

Figure 2.4– UUT after the Dust Test

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3. WATER SPLASH IPX4 TEST

3.1 // UNIT UNDER TEST OVERVIEW

Test Dates	24/08/2015
Customer	Satec
Customer Rep.	Avi Beim
Unit Name	PM135EH, PM172E Same enclosure & construction for the following Instruments: PM130P, PM130E, PM130EH, PM135P, PM135E, PM135EH, PM172P, PM172E, PM172EH, PM174 & PM175.
P/N	PM172E , PM135EH
S/N	1133212 . 1132673
Item Manufacturer	Satec
Number of Units	1+1

3.2 // TEST DESCRIPTION

3.2.1 // TEST PROCEDURE

The oscillating tube consist of spray holes over the whole 180" of the semicircle.
The tube is caused to oscillate through an angle of almost 360", 180" on either side of the vertical, the time for one complete oscillation (2 x 360") being about **12 s.**
The duration of the test: **10 min.**

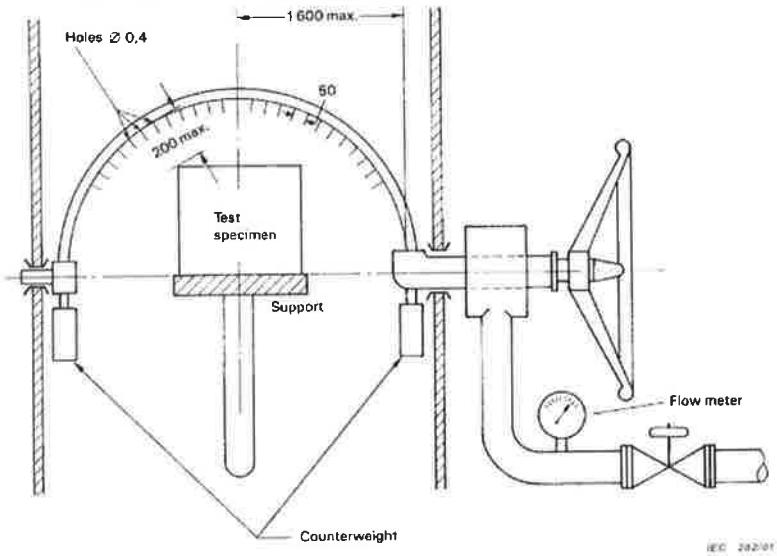

Figure 3.1–Test Devic

3.2.2 // EXCLUSIONS FROM THE TEST METHOD

Not Applicable.

3.2.3 // TEST INSPECTION

	Visual Test	*Functional Test*
Before Test	✔	✔
During Test	✘	✘
After Test	✔	✔

3.3 // TEST RESULTS

In visual inspection at completion of the test, no external damage observed.
operational and visual tests have been conducted at the end of the test.
Test Result: ✔Pass

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3.4 // TEST PICTURES

Figure 3.2–UUT during the WaterTest

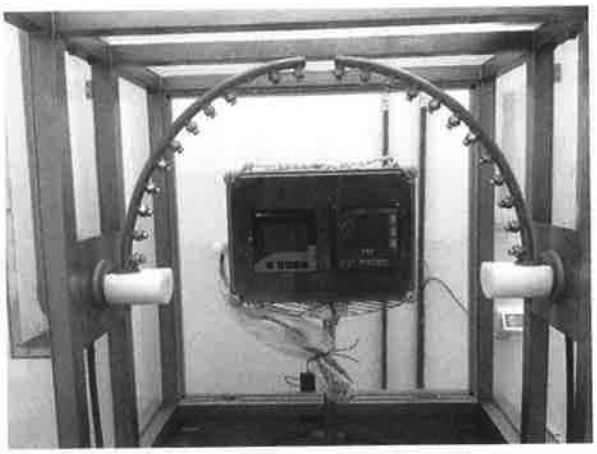

Figure 3.3– UUT during the Water Test

Figure 3.4– UUT during the Water Test

Figure 3.5–UUT after the Water test

Figure 3.6–UUT after the Water test

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Figure 3.7–UUT at the End of the Tests

Figure 3.8– UUT at the End of the Tests

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TEST REPORT

IEC 62053-22

Electricity metering equipment (a.c.) – Particular requirements – Part 22: Static meters for active energy (classes 0,2 S and 0,5 S)

IEC 62052-11

Electricity metering equipment (a.c.) – General requirements, tests and test conditions Part 11: Metering equipment

Report Number. ..... :	9412301409
Date of issue ..... :	16/09/2014
Total number of pages	23 + appendices
Applicant's name ..... :	SATEC Ltd.
Address ..... :	7 Ha-Marpe St., Har Hotzvim Industrial Park, P.O.B. 45022, Jerusalem 9145001, Israel
Testing Laboratory:	The Standards Institution of Israel
Testing location/ address ..... :	42 Chaim Levanon St., Tel Aviv 69977, Israel
Tested by (name + signature) ..... :	SERGEY VOYTENKO
Approved by (name + signature) .... :	MICHAEL TERMAN
Test specification:	
Standard ..... :	IEC 62053-22: 2003 used in conjunction with IEC 62052-11: 2003
Test procedure ..... :	N/A
Non-standard test method ..... :	N/A
Test Report Form No. ..... :	IEC62053_22A
Test Report Form(s) Originator ..... :	The Standards Institution of Israel
Master TRF ..... :	Dated 2014-07

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General disclaimer:

The test results presented in this report relate only to the object tested.
This report shall not be reproduced, except in full, without the written approval of the issuing laboratory.

Test item description ..... :	Power/Energy Management Meters
Trade Mark ..... :	SATEC
Manufacturer ..... :	SATEC Ltd.
Model/Type reference ..... :	PM130EH PLUS, PM130PLUS, PM130P, PM130E, PM130EH, PM135; BFM136; EM133, EM132, EM131; PM175, PM172P, PM172E, PM172EH
Ratings ..... :	PM130 models: PS: 85-265Vac, 88-290Vdc, 50/60Hz, 9VA; Measurement inputs: 690Vac, 1A, 5A BFM136: PS and measurement inputs: (115) 88-138 Vac or (230/277) 176-320Vac, 50/60Hz, 10VA EM133/132/131: PS: 40-300Vac/dc, 3VA max. Measurement inputs: 3x58/100-400/690Vac, 50/60Hz, 3x5A; PM17[illegible] PS: 8[illegible] Measurement inputs: 690Vac, 50Hz, 5A

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List of Attachments (including a total number of pages in each attachment):

Appendix 1 – Photographs (13 pages attached)
Appendix 2 – EMC test report (57 pages attached)
Appendix 3 – Environmental test report (45 pages attached)
Appendix 4 – Accuracy reports (60 pages attached)

Summary of testing:

1. All testing was performed on Models PM130EH PLUS, EM133 and PM175 (the worst case configurations with all functions active) and was considered representative of all other models of the same group.
2. The maximum operating ambient temperature declared by the manufacturer for the product: 45°C.

Possible test case verdicts:

- test case does not apply to the test object.....: N/A
- test object does meet the requirement.....: P (Pass)
- test object does not meet the requirement.....: F (Fail)

Testing.....:

Date of receipt of test item .....: 9/01/2014
Date (s) of performance of tests.....: 20/01/2014-17/08/2014

General remarks:

Throughout this report a ☐ comma / ☒ point is used as the decimal separator.

General product information:

1. The equipment under test are electronic power or energy meters, mainly consisting of electronic boards housed inside an enclosure

2. Models PM130EH PLUS, PM130PLUS, PM130P, PM130E, PM130EH, and PM135 are electrically and mechanically identical except a number of active functions.
   Models EM133, EM132 and EM131 are electrically and mechanically identical except a number of active functions.
   Models PM175, PM172P, PM172E, and PM172EH are electrically and mechanically identical except a number of active functions.

General conclusion:

Electronic power/energy meters models PM130EH PLUS, PM130PLUS, PM130P, PM130E, PM130EH, PM135, BFM136, EM133, EM132, EM131, PM175, PM172P, PM172E, PM172EH comply with the requirements of IEC 62053-22: 2003 and IEC 62052-11: 2003 standards.

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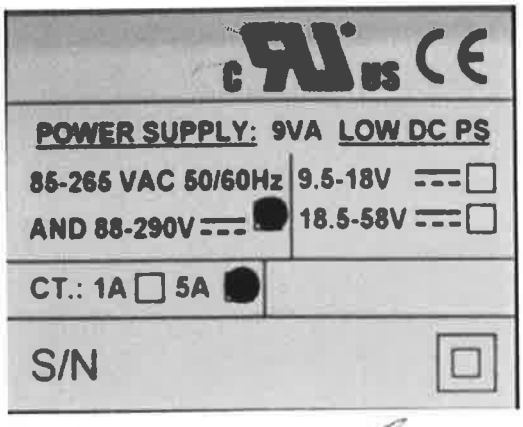
Electronics: Tel: 972-3-6465050 Fax: 972-3-7454026 - Alarms Systems Section: Tel: 972-3-6465370 Fax: 972-3-6467262

Copy of marking plate:



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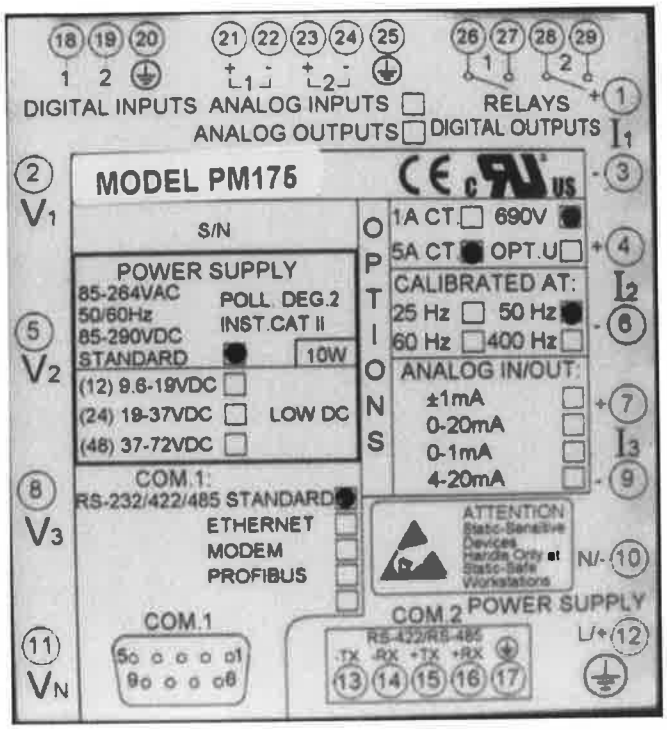
SATEC PM175 Power Quality Analyzer



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IEC 62053-22 / IEC 62052-11			
Clause	Requirement + Test	Result - Remark	Verdict
4	**STANDARD ELECTRICAL VALUES (IEC62052-11)**		P
4.1	Standard reference voltages		P
4.2	Standard currents		P
4.3	Standard reference frequencies		P
5	**MECHANICAL REQUIREMENTS AND TESTS (IEC62052-11)**		P
5.1	General mechanical requirements	Meters are designed and constructed in such a way as to avoid introducing any danger in normal use and under normal conditions with respect to electric shock, excessinve temperatures, penetration of solid objects, dust and water, and other foreseeble hazards.	P
5.2	Case		P
5.2.1	General requirements		P
5.2.2	Mechanical tests		P
5.2.2.1	Spring hammer test (IEC 60068-2-75)	Mechanical strength of the meter case was tested with a spring hammer (0,2 J ± 0,02 J)	P
5.2.2.2	Shock test (IEC60068-2-27)	See Appendix 3	P
5.2.2.3	Vibration test (IEC60068-2-6)	See Appendix 3	P
5.3	Window	The meters employ displays with clearly see readings	P
5.4	Terminals – Terminal block(s) – Protective earth terminal		
	Terminals may be grouped in (a) terminal block(s) having adequate insulating properties and mechanical strength. In order to satisfy such requirements when choosing insulating materials for the terminal block(s), adequate testing of materials shall be taken into account. The material of which the terminal block is made shall be capable of passing the tests given in ISO 75-2 for a temperature of 135 °C and a pressure of 1,8 MPa (method A). The holes in the insulating material which form an extension of the terminal holes shall be of sufficient size to also accommodate the insulation of the conductors. The manner of fixing the conductors to the terminals shall ensure adequate and durable contact such that there is no risk of loosening or undue heating. Screw connections transmitting contact force and screw fixings which may be loosened and tightened several times during the life of the meter shall screw	**EM133 and PM175**: The terminals consist of special screw contact mounted in plastic enclosure of the meter. Insulation material of the enclosure is approved and rated heat deflection temperature according ISO 75-2 138°C **PM130EH PLUS and BFM136:** UL approved terminal blocks. Material of the housing: polyamide PA 6.6. rated heat deformation temperature 240°C. The adequate and durable contact of the conductors is provided. No risk of corrosion: All contact surface are provided	P

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IEC 62053-22 / IEC 62052-11			
Clause	Requirement + Test	Result - Remark	Verdict
	into a metal nut. All parts of each terminal shall be such that the risk of corrosion resulting from contact with any other metal part is minimized. Electrical connections shall be so designed that contact pressure is not transmitted through insulating material. For current circuits, the voltage is considered to be the same as for the related voltage circuit. Terminals with different potentials which are grouped close together shall be protected against accidental short-circuiting. Protection may be obtained by insulating barriers. Terminals of one current circuit are considered to be at the same potential. The terminals, the conductor fixing screws, or the external or internal conductors shall not be liable to come into contact with metal terminal covers. The protective earth terminal, if any: a) shall be electrically bonded to the accessible metal parts; b) should, if possible, form part of the meter base; c) should preferably be located adjacent to its terminal block; d) shall accommodate a conductor having a cross-section at least equivalent to the main current conductors but with a lower limit of 6 mm2 and an upper limit of 16 mm2 (these dimensions apply only when copper conductors are used); e) shall be clearly identified by the graphical symbol IEC 60417-5019: Protective earth (ground). After installation, it shall not be possible to loosen the protective earth terminal without the use of a tool.	with galvanic coating. Contact pressure is not transmitted through insulating material. The terminals with different potentials are separated by insulation barriers. Protective earth terminal is part of the approved terminal block.	
5.5	Terminal cover(s) The terminals of a meter, if grouped in a terminal block and if not protected by any other means, shall have a separate cover which can be sealed independently of the meter cover. The terminal cover shall enclose the actual terminals, the conductor fixing screws and, unless otherwise specified, a suitable length of the external conductors and their insulation. When the meter is panel-mounted, no access to the terminals shall be possible without breaking the seal(s) of the terminal cover(s)	All terminals are provided with insulation covers	P

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IEC 62053-22 / IEC 62052-11			
Clause	Requirement + Test	Result - Remark	Verdict
5.6	Clearance and creepage distances The clearance and creepage distances between a) any terminal of a circuit with a reference voltage over 40 V and b) earth, together with terminals of auxiliary circuits with reference voltages below or equal to 40 V shall not be less than stated in – Table 3a for meters of protective class I; – Table 3b for meters of protective class II. The clearance and creepage distances between terminals of circuits with reference voltages over 40 V shall not be less than stated in Table 3a. The clearance between the terminal cover, if made of metal, and the upper surface of the screws when screwed down to the maximum applicable conductor fitted shall be not less than the relevant values indicated in Tables 3a and 3b. The requirement of the impulse voltage test shall also be met (see 7.3.2).	See appended Table 5.6	P
5.7	Insulating encased meter of protective class II		P
	A meter of protective class II shall have a durable and substantially continuous enclosure made wholly of insulating material, including the terminal cover, which envelopes all metal parts, with the exception of small parts, for example, name-plate, screws, uspensions and rivets. If such small parts are accessible by the standard test finger (as specified in IEC 60529) from outside the case, then they shall be additionally isolated from live parts by supplementary insulation against failure of basic insulation or loosening of live parts. The insulating properties of laquer, enamel, ordinary paper, cotton, oxide film on metal parts, adhesive film and sealing compound, or similar unsure materials, shall not be regarded as sufficient for supplementary insulation. For the terminal block and terminal cover of such a meter, reinforced insulation is sufficient.	**EM133, EM130EH PLUS:** The meter is fully enclosed by plastic enclosure with thickness 2mm. Laquer, enamel, ordinary paper, cotton, oxid film on metal. Adhesive film and sealing compound are not used as insulation.	P
5.8	Resistance to heat and fire		
	The terminal block, the terminal cover and the meter case shall ensure reasonable safety against spread of fire. They should not be ignited by thermal overload of live parts in contact with them. To comply therewith they shall fulfil the following test. The test shall be carried out according to IEC 60695-2-11, with the following temperatures: – terminal block: 960 °C ± 15 °C; – terminal cover and meter case: 650 °C ± 10 °C; – duration of application: 30 s ± 1 s. The contact with the glow wire may occur at	**Terminals.** Insulation material of the EM133 enclosure is used as terminal housing. The material is rated GWIT 960°C. For other models approved terminals are used. Rated GWIT of the terminal housing is 960°C. **Covers and enclosures.** EM133 - 960 °C	P

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IEC 62053-22 / IEC 62052-11			
Clause	Requirement + Test	Result - Remark	Verdict
	random location. If the terminal block is integral with the meter base, it is sufficient to carry out the test only on the terminal block.	PM175 - 875°C All materials of the covers and enclosures are approved.	
5.9	Protection against penetration of dust and water The meter shall conform to the degree of protection given in IEC 60529. Indoor meter: IP51, but without suction in the meter. Outdoor meter: IP54. The tests shall be carried out according to IEC 60529, under the following conditions: a) Protection against penetration of dust – meter in non-operating condition and mounted on an artificial wall; – the test should be conducted with sample lengths of cable (exposed ends sealed) of the types specified by the manufacturer and terminal cover in place; – for indoor meters only, the same atmospheric pressure is maintained inside the meter as outside (neither under- nor over-pressure); – first characteristic digit: 5 (IP5X) Any ingress of dust shall be only in a quantity not impairing the operation of the meter. An insulation test according to 7.3 shall be passed. b) Protection against penetration of water – meter in non-operating condition; – second characteristic digit: 1 (IPX1) for indoor meters; 4 (IPX4) for outdoor meters. Any ingress of water shall be only in a quantity not impairing the operation of the meter. An insulation test according to 7.3 shall be passed.	All meters are intended for indoor installation. Panel-mount models PM130EH PLUS and PM175 were tested for IP51; DIN-mount models BFM136 and EM133 were tested for IP30. For these models protection shall be provided by an external cabinet.	P
5.10	Display of measured values		P
	The information can be shown either by an electromechanical register or an electronic display. In the case of an electronic display the corresponding non-volatile memory shall have a minimum retention time of four months. NOTE: 1 Longer retention time of the non-volatile memory should be the subject of a purchase contract. In the case of multiple values presented by a single display it shall be possible to display the content of all relevant memories. When displaying the memory, the identification of each tariff applied shall be possible and, for automatic sequencing displays, each display of register for billing purposes shall be retained for a minimum of 5 s.	All the meters have an electronic display, the energy registers and tariffs value and status have corresponding non-volatile memory with the retention time of 10 years. All these values accessible through the communication to PC or other Master device.	P

IEC 62053-22 / IEC 62052-11			
Clause	Requirement + Test	Result - Remark	Verdict
	The active tariff rate shall be indicated.	One of the registers assigned for the active tariff rate	P
	When the meter is not energized, the electronic display need not be visible.		P
	The principal unit for the measured values shall be the kilowatt-hour (kWh), kilovar-hour (kvarh), kilovolt-ampere-hour (kVAh) or the megawatt-hour (MWh), megavar-hour (Mvarh), megavolt-ampere-hour (MVAh).	Active, reactive & total energy values are measured in the recommended principal units: kilowatt-hour (kWh), kilovar-hour (kvarh), kilovolt-ampere-hour (kVAh) or the megawatt-hour (MWh), megavar-hour (Mvarh), megavolt-ampere-hour (MVAh).	P
	For electromechanical registers, register markings shall be indelible and easily readable. When continuously rotating, the lowest values of the drums shall be graduated and numbered in ten divisions, each division being subdivided into ten parts, or any other arrangement ensuring the same reading accuracy. The drums which indicate a decimal fraction of the unit shall be marked differently when they are visible.		N/A
	Every numerical element of an electronic display shall be able to show all the numbers from "zero" to "nine".	Meet the requirements	P
	The register shall be able to record and display, starting from zero, for a minimum of 1 500 h, the energy corresponding to maximum current at reference voltage and unity power factor. NOTE: 2 Values higher than 1 500 h should be the subject of purchase contract. It shall be impossible to reset the indication of the cumulative total of electrical energy during use. NOTE 3 The regular roll over of the display is not considered as a reset.	The energy registers contain 9 digits number of kWh, kVAh, kvarh. It is more than enough for 1500 h. The maximum secondary parameters: 100A x 3 maximum currents; 230V x 3 reference voltages. 230x100x3x1500=103.5x10^6= 103500kWAh (6 digits).	P
5.11	Output device		P
	The meter shall have a test output device capable of being monitored with suitable testing equipment. Output devices generally may not produce homogeneous pulse sequences. Therefore, the manufacturer shall state the necessary number of pulses to ensure a measuring accuracy of at least 1/10 of the class of the meter at the different test points. For electrical test output see, IEC 62053-31. If the test output is an optical test output, then it shall fulfil the requirements according 5.11.1 and 5.11.2. The operation indicator, if fitted visible from the front.	The meters have an optical output device - RED LED.	P

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IEC 62053-22 / IEC 62052-11			
Clause	Requirement + Test	Result - Remark	Verdict
5.11.1	Mechanical and electrical characteristics An optical test output shall be accessible from the front. The maximum pulse frequency shall not exceed 2,5 kHz. Modulated and unmodulated output pulses are permitted. The unmodulated output pulses shall have the shape shown in Figure D.2. The pulse transition time (rise time or fall time) is the time of transition from one state to the other state, including transient effects. The transition time shall not exceed 20 µs (see Figure D.2). The distance of the optical pulse output from further adjacent ones or from an optical status display shall be sufficiently long that the transmission is not affected. An optimum pulse transmission2 is achieved when, under test conditions, the receiving head is aligned with its optical axis on the optical pulse output. The rise time given in Annex D, Figure D.2 shall be verified by a reference receiver diode with tr ≤ 0,2 µs.	The LED is accessible from the front and meet all requirements. The output device was tested with following testing equipment: The optical heads: 1. Model SH2003 (MTE manufacturer) 2. Model TK325 (Zera manufacturer) The calibrator: Model CMC256PLUS (OMICRON electronics GmbH manufacturer)	P
5.11.2	Optical characteristics The wavelength of the radiated signals for emitting systems shall be between 550 nm and 1 000 nm. The output device in the meter shall generate a signal with a radiation strength ET over a defined reference surface (optically active area) at a distance of a1 = 10 mm ± 1 mm from the surface of the meter, with the following limiting values: ON-condition: 50 µW/cm^2 ≤ E_T ≤ 1 000 µW/cm^2 OFF-condition: E_T ≤ 2 µW/cm^2 See also Figure D.1.	The wavelength of the radiated signals for emitting is 650 nm. The distance of the correct signal acceptance is in the range of: 1mm ... 50mm. The output device meets the requirements of ON/OFF condition.	P
5.12	Marking of meter		P
5.12.1	Name-plates: Every meter shall bear the following information as applicable: a) manufacturer's name or trade mark and, if required, the place of manufacture; b) designation of type (see 3.1.8) and, if required, space for approval mark; c) the number of phases and the number of wires for which the meter is suitable; d) the serial number and year of manufacture; e) the reference voltage; f) for direct connected meters, the basic current and the maximum current expressed	All required information is included on the nameplates, additional markings and instructions.	P

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IEC 62053-22 / IEC 62052-11			
Clause	Requirement + Test	Result - Remark	Verdict
	g) the reference frequency in Hz; h) the meter constant; i) the class index of the meter; j) the reference temperature if different from 23 °C; k) the sign of the double square ⊐ for insulating encased meters of protective class II.		
5.12.2	Every meter shall preferably be indelibly marked with a diagram of connections. If this is not possible reference shall be made to a connection diagram.	All connections are clearly identified. Eletrical wiring diagrams are provided wither on the unts or in the product documentation (installation/operation instructions)	P
6	**CLIMATIC CONDITIONS (IEC62052-11)**		P
6.1	Temperature range	The temperature range of the meter is as shown in Table 5.	P
6.2	Relative humidity	See 6.3.3	P
6.3	Tests of the effect of the climatic environments		P
6.3.1	Dry heat test (IEC60068-2-2)	See Appendix 3	P
6.3.2	Cold test (IEC60068-2-1)	See Appendix 3	P
6.3.3	Damp heat cyclic test (IEC60068-2-30)	See Appendix 3	P
6.3.4	Protection against solar radiation (IEC60068-2-5)	The meters are intended for indoor installation	N/A
7	**ELECTRICAL REQUIREMENTS**		P
7.1	**Influence of supply voltage (IEC62052-11)**		P
7.1.1	Voltage range	Meet requirements of Table 7 of the standard	P
7.1.2	Voltage dips and short interruptions	The tests according to a), b) and c) were carried out	P
7.2	Heating (IEC62052-11)	See appended table 7.2	P
7.3	Insulation (IEC62052-11)		P
7.3.1	General test conditions		P
7.3.2	Impulse voltage test	Impulse waveform: 1,2/50 impulse specified in IEC 60060-1	P
7.3.2.1	Impulse voltage tests for circuits and between the circuits	Impulse voltage was applied ten times with one polarity and then repeated with the other polarity.	P
7.3.2.2	Impulse voltage test of electric ci... earth		

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IEC 62053-22 / IEC 62052-11			
Clause	Requirement + Test	Result - Remark	Verdict
7.3.3	AC voltage test	See 7.4 of IEC62053-22 below	P
7.4	Immunity to earth fault (IEC62052-11)	The meters under test are not intended for use in networks equipped with earth fault neutralizers	N/A
7.5	Electromagnetic compatibility (EMC) (IEC62052-11)		P
7.5.1	General test conditions	See Appendix 2	P
7.5.2	Test of immunity to electrostatic discharges	See Appendix 2	P
7.5.3	Test of immunity to electromagnetic RF fields	See Appendix 2	P
7.5.4	Fast transient burst test	See Appendix 2	P
7.5.5	Test of immunity to conducted disturbances, induced by radio-frequency fields	See Appendix 2	P
7.5.6	Surge immunity test	See Appendix 2	P
7.5.7	Damped oscillatory waves immunity test	See Appendix 2	P
7.5.8	Radio interference suppression	See Appendix 2	P

7	**ELECTRICAL REQUIREMENTS (IEC62053-22)**		**P**
	In addition to the electrical requirements in IEC62052-11, meters shall fulfil the following requirements:		P
7.1	Power consumption		P
	The power consumption in the voltage and current circuits shall be determined at reference conditions given in 8.5 by any suitable method. The overall maximum error of the measurement of the power consumption shall not exceed 5 %. The active and apparent power consumption taken at reference temperature and reference frequency, by each voltage circuit at reference voltage and by each current circuit at rated current, shall not exceed the values shown in Table 1.	Power consumption for all models comply with the requirements of Table 1 of IEC62053-22 standard	P
7.2	Influence of short-time overcurrents		P
	Short-time overcurrents shall not damage the meter. The meter shall perform correctly when back to its initial working condition and the variation of error at rated current and unity power factor shall not exceed 0,05 %. The test circuit shall be practically non-inductive and the test shall be performed for polyphase meters phase-by-phase. After the application of the short-time overcurrent with the voltage maintained at the terminals, the meter shall be allowed to return to the initial temperature with the voltage circuit(s) energized (about 1 h).	Tested and comply with the requirements of this clause	P

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IEC 62053-22 / IEC 62052-11			
Clause	Requirement + Test	Result - Remark	Verdict
	The meter shall be able to carry for 0,5 s a current equal to 20 Imax with a relative tolerance of +0 % to –10 %.		
7.3	Influence of self-heating		P
	The variation of error due to self-heating shall not exceed the values given in Table 2. The test shall be carried out as follows: after the voltage circuits have been energized at reference voltage for at least 2 h without any current in the current circuits, the maximum current shall be applied to the current circuits. The meter error shall be measured at unity power factor immediately after the current is applied and then at intervals short enough to allow a correct drawing to be made of the curve of error variation as a function of time. The test shall be carried out for at least 1 h, and in any event until the variation of error during 20 min does not exceed 0,05 %. The same test shall then be carried out at 0,5 (inductive) power factor. The cable to be used for energizing the meter shall have a length of 1 m and a cross-section of between 1,5 mm^2 and 2,5 mm^2.	Tested, see Appendix 4	P
7.4	AC voltage test	See appended table 7.4	P

8	**ACCURACY REQUIREMENTS (IEC 62053-22)**		P
8.1	Limits of error due to variation of the current	See Appendix 4	P
8.2	Limits of error due to influence quantities	See Appendix 4	P
8.2.1	Accuracy test in the presence of harmonics		P
8.2.2	Tests of the influence of sub-harmonics		P
8.2.3	Continuous magnetic induction of external origin		P
8.3	Test of starting and no-load condition	See Appendix 4	P
8.3.1	Initial start-up of the meter		P
8.3.2	Test of no-load condition		P
8.3.3	Starting		P
8.4	Meter constant	Considered	P
8.5	Accuracy test conditions	Considered	P
8.6	Interpretation of test results	Considered	P

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IEC 62053-22 / IEC 62052-11			
Clause	Requirement + Test	Result - Remark	Verdict

Table 7.2	**TABLE : Temperature Measurements**					**P**
7.2	**HEATING**. Temperature limits - NORMAL CONDITION					P
Operating conditions:	Normal continuous operation with max load specified by manufacturer: 5A per phase					
Frequency ..... :	50 Hz	Test room ambient temperature (t_a) .... :			22 °C	
Voltage ..... :	264* V	Test duration..... :			2 h 30 Min	
Part / Location		t_m °C	t_c °C	t_{max} °C	Verdict	Comments
EM133:						
Insulation near L2 contact		26.0	59.0	90	P	Insulation thermal class A (105°C)
Capacitor C7		30.7	63.7	100	P	
Common mode choke T2		31.0	64.0	90	P	Insulation thermal class A (105°C)
Transformer T1 winding		33.7	66.7	90	P	Insulation thermal class A (105°C)
Optocoupler ISO 5		32.4	65.4	100	P	
PCB near transformer T1		30.6	63.6	105	P	
PCB PCO285 near U14		35.8	68.8	105	P	
Battery 3_3V		32.1	65.1	70	P	
Contact panel		29.7	62.7	80	P	
Display panel		31.3	64.3	80	P	
NOTE 4 - See Form A.20B for details of winding temperature measurements						
Supplementary information: 1. tc - calculated to the maximum ambient temperature declared by the product manufacturer (55°C).						

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IEC 62053-22 / IEC 62052-11			
Clause	Requirement + Test	Result - Remark	Verdict

Table 7.2	**TABLE : Temperature Measurements**					**P**
7.2	**HEATING**. Temperature limits - NORMAL CONDITION					P
Operating conditions:	Normal continuous operation with max load specified by manufacturer: 5A per phase					
Frequency..... :	50 Hz	Test room ambient temperature (t_a) .... :			22 °C	
Voltage..... :	264* V	Test duration..... :			2 h 30 Min	
Part / Location		t_m °C	t_c °C	t_{max} °C	Verdict	Comments
PM130EH PLUS:						
PCB PCO235 near J4		29.7	61.7	105	P	
Transformer T1 winding		36.5	68.5	90	P	Insulation thermal class A (105°C)
Capacitor C5		35.8	67.8	85	P	
Inductance L3		35.8	67.8	90	P	Insulation thermal class A (105°C)
PCB PCO233 near TR		36.5	68.5	105	P	
PCB PCO 210 near U5		38.6	70.6	105	P	
Voltage connector		27.7	59.7	70	P	
AC connector		28.2	60.2	70	P	
Current sensor		26.8	58.8	70	P	
Enclosure rear		26.9	58.9	80	P	
Enclosure up		26.6	58.6	80	P	
Enclosure right side		27.9	59.9	80	P	
Display		29.7	61.7	80	P	
NOTE 4 - See Form A.20B for details of winding temperature measurements						
Supplementary information: 1. tc - calculated to the maximum ambient temperature declared by the product manufacturer (55°C).						

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IEC 62053-22 / IEC 62052-11			
Clause	Requirement + Test	Result - Remark	Verdict

Table 7.2	**TABLE : Temperature Measurements**					**P**
7.2	**HEATING**. Temperature limits - NORMAL CONDITION					P
Operating conditions:	Normal continuous operation with max load specified by manufacturer: 5A per phase					
Frequency ..... :	50 Hz	Test room ambient temperature (t_a) .... :			21 °C	
Voltage ..... :	264* V	Test duration ..... :			2 h	
Part / Location		t_m °C	t_c °C	t_{max} °C	Verdict	Comments
PM175:						
Current sensor		35.3	69.3	90	P	Insulation thermal class A (105°C)
Transformer T2 winding		37.3	71.3	90	P	Insulation thermal class A (105°C)
PCB PCO196 near R3		33.1	67.1	105	P	
Logic PCB near U3		38.6	72.6	105	P	
Battery		33.6	67.6	80	P	
PCO186 RS232 ISO3		41.6	75.6	85	P	
PCO093 connector J4		37.2	71.2	80	P	
PCO093 Common mode		41.5	75.5	90	P	Insulation thermal class A (105°C)
PCO093 Capacitor C6		46.3	80.3	105	P	
PCO093 Transformer winding		53.8	87.8	90	P	Insulation thermal class A (105°C)
PCO093 PCB near Transformer		51.4	85.4	105	P	
Internal wiring		37.0	71.0	80	P	
Enclosure rear panel		31.5	65.5	80	P	
Enclosure left side		35.1	69.1	80	P	
Display panel		36.5	70.5	80	P	
NOTE 4 - See Form A.20B for details of winding temperature measurements						
Supplementary information: 1. tc - calculated to the maximum ambient temperature declared by the product manufacturer (55°C).						

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IEC 62053-22 / IEC 62052-11			
Clause	Requirement + Test	Result - Remark	Verdict

Table 7.2	**TABLE : Temperature Measurements**					**P**
7.2	**HEATING**. Temperature limits - NORMAL CONDITION					P
Operating conditions:	Normal continuous operation with max load specified by manufacturer: 5A per phase					
Frequency .....:	50 Hz	Test room ambient temperature (t_a).....:			20 °C	
Voltage.....:	264* V	Test duration .....:			2 h	
Part / Location		t_m °C	t_c °C	t_{max} °C	Verdict	Comments
BFM136:						
PCO190 Trans T1 winding		29.0	64.0	90	P	Insulation thermal class A (105°C)
PCO190 Common mode choke T2		31.7	66.7	90	P	Insulation thermal class A (105°C)
PCO190 Capacitor C2		31.3	66.3	85	P	
PCO190 PCB near heat sink		33.3	68.3	105	P	
PCO169 Capacitor C167		31.0	66	85	P	
PCO169 PCB near U6		32.7	67.7	105	P	
PCO169 T2 winding		30.4	65.4	90	P	Insulation thermal class A (105°C)
Enclosure display		27.6	62.6	80	P	
Enclosure up		27.1	62.1	70	P	
Enclosure left side		27.6	62.6	70	P	
NOTE 4 - See Form A.20B for details of winding temperature measurements						
Supplementary information: 1. tc - calculated to the maximum ambient temperature declared by the product manufacturer (55°C).						

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IEC 62053-22 / IEC 62052-11			
Clause	Requirement + Test	Result - Remark	Verdict

Table 5.6	**TABLE: Clearance and creepage distance measurements**								P
Clearance (cl) and creepage distance (cr) at/of/between:	Rated system voltage (V)	Rated impulse voltage (V)	Required Cl, mm		Cl (mm)	Required Cr, mm		Cr (mm)
			Indoor	Outdoor		Indoor	Outdoor	
EM133:								
Functional:								
I1 (phase L1) terminal and "10" (neutral) terminal	<300	4 000	3.0	N/A	7.7	3.2	N/A	7.7
"7" terminal (phase dry contact) and "VN" (neutral) terminal	<300	4 000	3.0	N/A	15.0	3.2	N/A	15.0
Basic/supplementary:								
PCB PCO284. "Com -01" and "N" pads (leads)	<300	4 000	3.0	N/A	6.5	3.2	N/A	6.5
PCB PCO284. "Com -01" and C14 pad (SMPS primary)	<300	4 000	3.0	N/A	6.5	3.2	N/A	6.5
Reinforced:								
I3 terminal (phase L3) and "+x" terminal (interface RS-485)	<300	6 000	5.5	N/A	7.8	6.3	N/A	7.8
ISO5 and ISO6 leads	<300	6 000	5.5	N/A	7.1	6.3	N/A	7.1
Supplementary information: functional insulation meets the requiremetns of Cl. 5.6., Table 3a								

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IEC 62053-22 / IEC 62052-11			
Clause	Requirement + Test	Result - Remark	Verdict

Table 5.6	**TABLE: Clearance and creepage distance measurements**								P
Clearance (cl) and creepage distance (cr) at/of/between:	Rated system voltage (V)	Rated impulse voltage (V)	Required Cl, mm		Cl (mm)	Required Cr, mm		Cr (mm)
			Indoor	Outdoor		Indoor	Outdoor	
PM130EH PLUS:								
Functional:								
PCB PCO235. V3 (phase L3) terminal and "Vn" (neutral) terminal connector J1 – J3	<300	4 000	3.0	N/A	7.0	3.2	N/A	7.0
PCB PCO235. "L" terminal (phase) and "N" (neutral) terminal connector J5	<300	4 000	3.0	N/A	3.5	3.2	N/A	3.5
Basic/supplementary:								
PCB PCO235. "L" pad and "N" track connector J5	<300	4 000	3.0	N/A	3.7	3.2	N/A	3.7
Reinforced:								
PCB PCO235. "N" (netral) lead-pad and "-" lead-pad (interface RS-485) connector J4	<300	6 000	5.5	N/A	5*2=10	6.3	N/A	5*2= 10
PCB PCO235 and PCO233. Components leads in the Primary and the Secondary circuits via spacer.	<300	6 000	5.5	N/A	7.0	6.3	N/A	N/A
Supplementary information: functional insulation meets the requiremetns of Cl. 5.6., Table 3a								

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IEC 62053-22 / IEC 62052-11			
Clause	Requirement + Test	Result - Remark	Verdict

Table 5.6	**TABLE: Clearance and creepage distance measurements**								P
Clearance (cl) and creepage distance (cr) at/of/between:	Rated system voltage (V)	Rated impulse voltage (V)	Required Cl, mm		Cl (mm)	Required Cr, mm		Cr (mm)
			Indoor	Outdoor		Indoor	Outdoor	
EM175:								
Functional:								
PCB PCO093 Power supply Casel VAF102. SS11 (Line) and L1 (neutral) leads/pads	<300	4 000	3.0	N/A	3.2	3.2	N/A	3.2
PCB PCO093. J4 via not used contact	<300	4 000	3.0	N/A	2*1.6 = 3.2	3.2	N/A	2*1.6 = 3.2
Basic/supplementary:								
RV19 (Line) and C24 (Ground) leads.	<300	4 000	3.0	N/A	7.0	3.2	N/A	7.0
Reinforced:								
PCB PCO093 Power supply Casel VAF102. Between PC11 leads	<300	6 000	5.5	N/A	7.3	6.3	N/A	7.3
RV19 lead (Line) and contact 5 J9 (Rs485 interface)	<300	6 000	5.5	N/A	15.7	6.3	N/A	15.7
R11 pad (Line, V1 circuit) and J22 contact 5 track (COM 1)	<300	6 000	5.5	N/A	18.4	6.3	N/A	18.4
Supplementary information: functional insulation meets the requiremetns of Cl. 5.6., Table 3a								

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IEC 62053-22 / IEC 62052-11			
Clause	Requirement + Test	Result - Remark	Verdict

Table 5.6	**TABLE: Clearance and creepage distance measurements**								P
Clearance (cl) and creepage distance (cr) at/of/between:	Rated system voltage (V)	Rated impulse voltage (V)	Required Cl, mm		Cl (mm)	Required Cr, mm		Cr (mm)
			Indoor	Outdoor		Indoor	Outdoor	
BFM136								
Functional:								
PCB PCO169. Terminal block J54, J55 leads (V1 or V2 or V3 and Vn)	<300	4 000	3.0	N/A	7.0	3.2	N/A	7.0
PCB PCO190 PH3 (V3) and N leads	<300	4 000	3.0	N/A	6.0	3.2	N/A	6.0
Basic/supplementary:								
PCB PCO169. C27 leads	<300	4 000	3.0	N/A	6.8	3.2	N/A	6.8
J54, J55 leads and left side panel of the enclosure	<300	4 000	3.0	N/A	5.8	3.2	N/A	5.8
The common mode choke T2 winding and grounded rear panel of the enclosure	<300	4 000	3.0	N/A	8.9	3.2	N/A	N/A
Reinforced:								
C2 lead (Primary) and J3 leads (Secondary)	<300	6 000	5.5	N/A	5.8	6.3	N/A	N/A
C11 leads	<300	6 000	5.5	N/A	7.5	6.3	N/A	7.5
ISO1 or ISO2 or ISO3 leads	<300	6 000	5.5	N/A	6.6	6.3	N/A	6.6
Supplementary information: functional insulation meets the requiremetns of Cl. 5.6., Table 3a								

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APPENDIX 3
ENVIRONMENTAL TEST REPORT

(45 pages including this cover page)

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IEC 62053-22 / IEC 62052-11			
Clause	Requirement + Test	Result - Remark	Verdict

Table 7.3.3	TABLE: Electric strength tests			P
Test voltage applied between:		Voltage shape (AC, DC, impulse, surge)	Test voltage (V)	Breakdown Yes / No
EM133:				
Terminal 9 (Phase), terminal 10 (Neutral) and terminal 11 (common)		AC	2000	No
Terminals V1 – V3, I1 – I3 and terminal 11 (common)		AC	2000	No
Terminals V1 – V3, I1 – I3, 9 (phase), 10 (Neutral) and terminals "X+", "X-" (interface RS-485)		AC	2000	No
Terminals V1 – V3, I1 – I3, 9 (phase), 10 (Neutral) and metal foil on the display and terminals covers		AC	2000	No
PM130EH PLUS:				
Terminal J1, J3 (Phase V1, V2, V3, Vn), terminal J5 (L, N,) (Neutral) and terminal J5 (G)		AC	2000	No
Terminal J1, J3 (Phase V1, V2, V3, Vn), terminal J5 (L, N,) (Neutral) and terminal J6 (SH)		AC	2000	No
Terminal J1, J3 (Phase V1, V2, V3, Vn), terminal J5 (L, N,) (Neutral) and terminal J6 ("+", "-" interface RS-485)		AC	2000	No
Terminal J1, J3 (Phase V1, V2, V3, Vn), terminal J5 (L, N,) (Neutral) and metal foil on the display and terminals covers		AC	2000	No
PM175:				
Terminals V1, V2, V3, VN, I1, I2, I3, L, N and terminals marked as protective ground.		AC	2000	No
Terminals V1, V2, V3, VN, I1, I2, I3, L, N and RS485 terminal		AC	2000	No
Terminals V1, V2, V3, VN, I1, I2, I3, L, N and RS232 terminal		AC	2000	No
Terminals V1, V2, V3, VN, I1, I2, I3, L, N and metal foil on display cover		AC	2000	No
BFM136:				
Terminals V1, V2, V3, VN and terminals marked as protective ground		AC	2000	No
Terminals V1, V2, V3, VN and RS485 terminal		AC	2000	No
Terminals V1, V2, V3, VN and RS232 terminal		AC	2000	No
Terminals V1, V2, V3, VN and metal foil on display cover		AC	2000	No
Supplementary information:				

Заличено по чл.2 от ЗЗЛД

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Electronics: Tel: 972-3-6465050 Fax: 972-3-7454026 - Alarms Systems Section: Tel: 972-3-6465370 Fax: 972-3-6467262

List of test equipment used:

Testing / measuring equipment / material used				Range used	Calibration date	
SII Ref. No.	Instrument Type	Manufacturer	Model		Last	Due
4875	Power Analyzer	Avpower	PA2200	auto	11/13	11/14
53930	Industrial scopemeter	Fluke	123 S/N DM7540064	auto	11/13	11/14
5047	True RMS Multimeter	Fluke	87III	auto	02/14	02/15
52654	Jointed test finger	PTL	P 10.04	--	02/14	02/17
5972	Ground Bond Tester	Associated Research	3140	auto	12/13	12/14
6501330	Digital Caliper	SIGNET	75430	--	10/13	10/14
52746	Test gauge	PTL	L25.84	--	02/14	02/17
2374	Impact Hammer	PTL	F22.50 No. 9106151.2	--	12/12	12/15
5004 53935	Data Acquisition/Switch Unit with Thermocouples Type J 20-Channel Armature Multiplexer	Agilent	34970A S/N US37030301 34901A S/N US37242806	auto	10/13	10/14
5971	AC/DC Withstand Voltage Tester	Associated Research	3670	auto	12/13	12/14
6501243	Humidity/Baro/Temperature Data Recorder	Lutron	MHB-382SD S/N Q655831	auto	11/13	11/14

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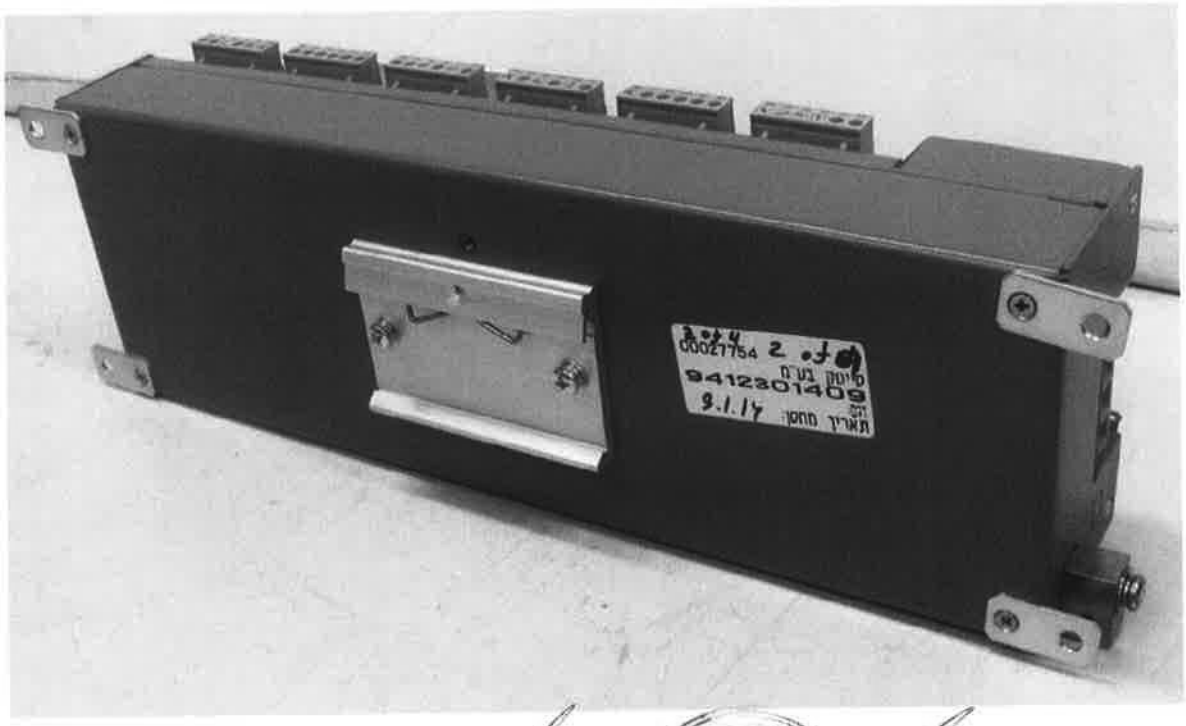
APPENDIX 1
PHOTOGRAPHS

Fig. 1
BMF136 - overall external views



Заличено по чл.2 от ЗЗЛД

Fig. 2
BMF136 – internal board (two sides)

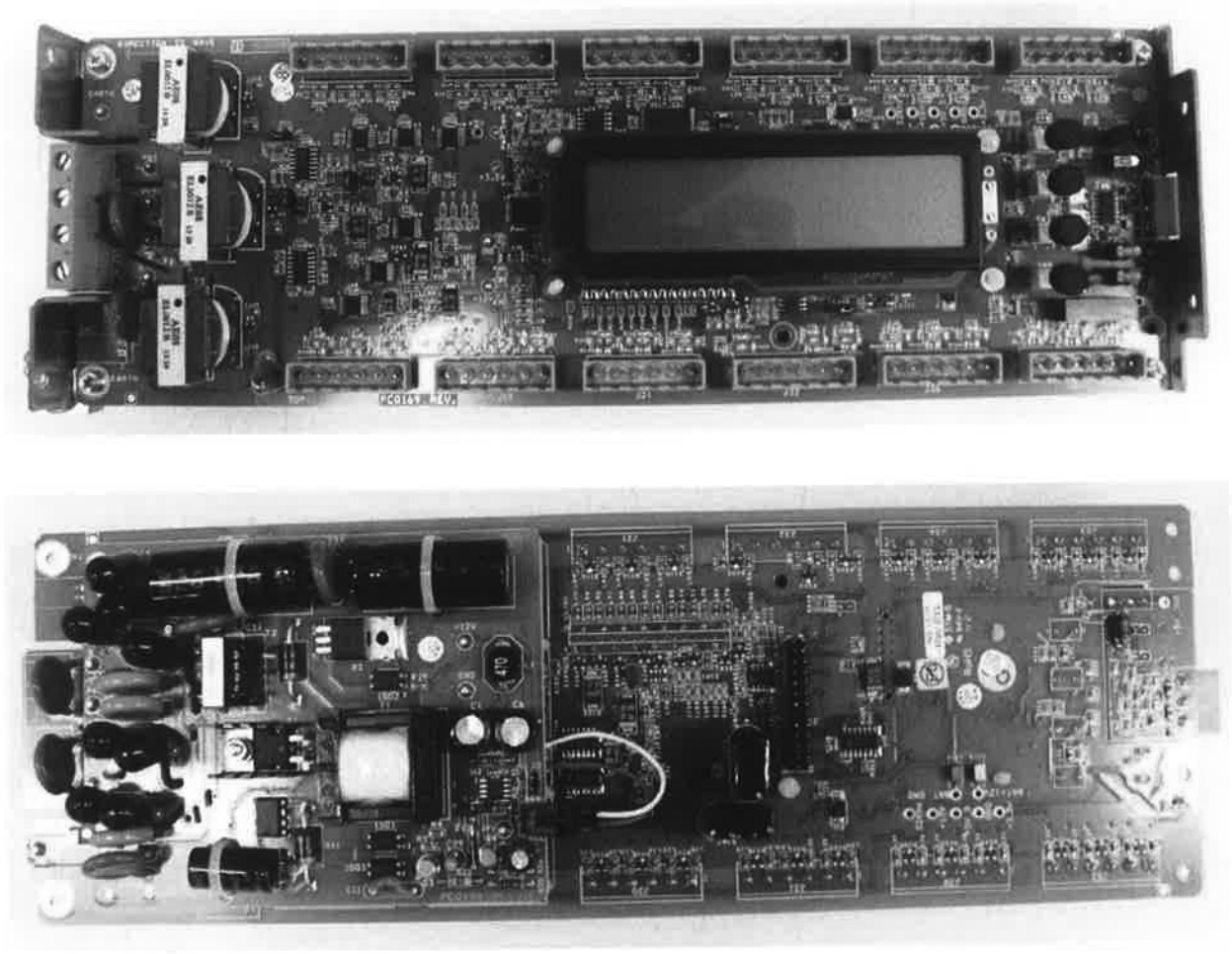


Fig. 3
EM133 - overall external views

Fig. 4
EM133 – side view with wiring diagram

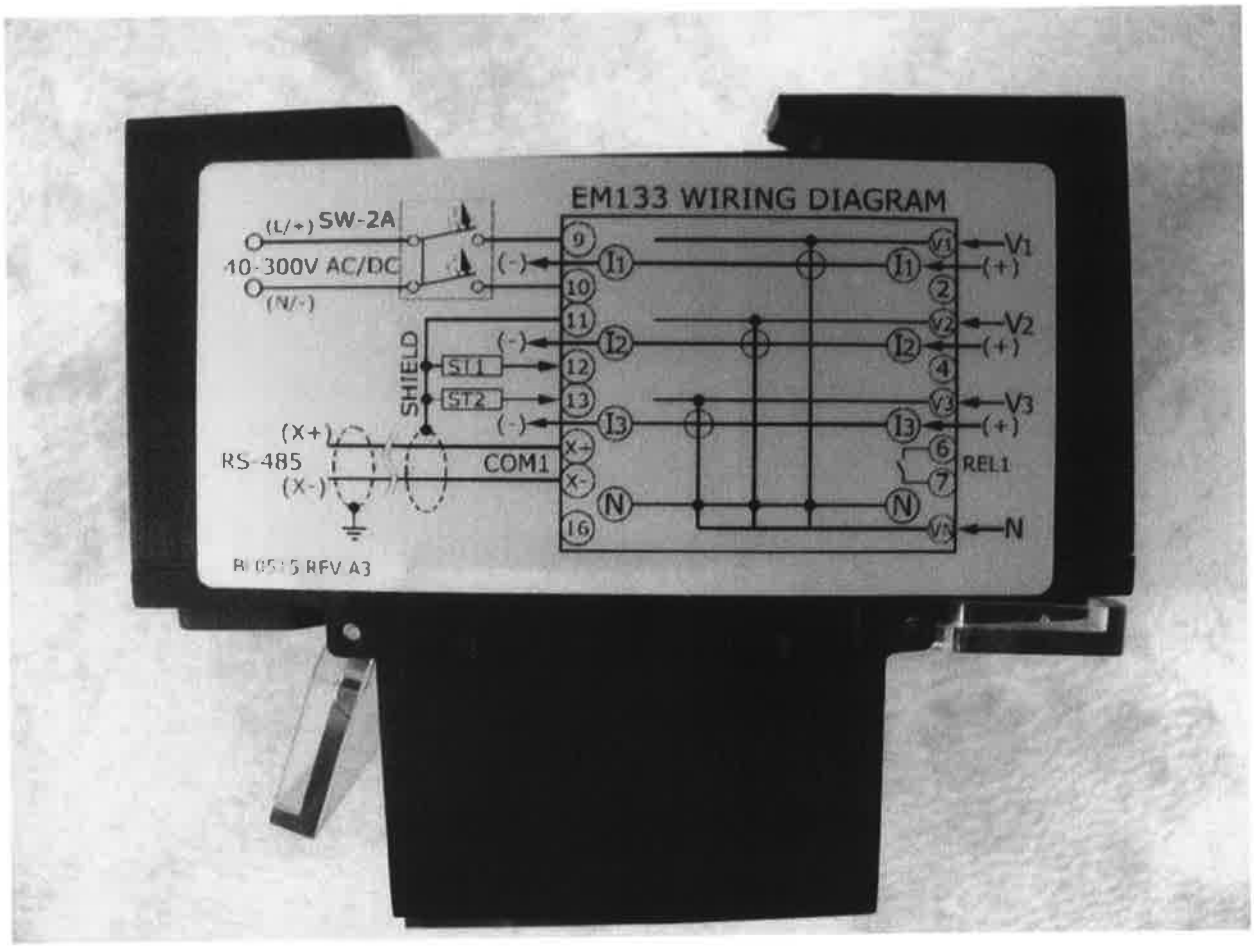
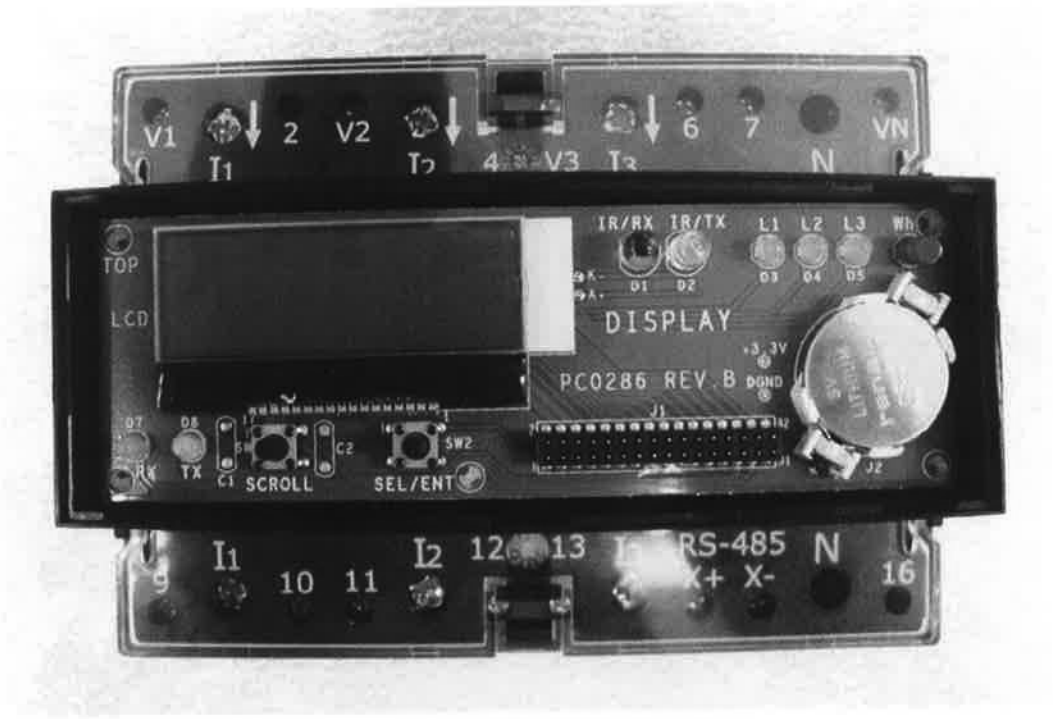


Fig. 5
EM133 - internal views



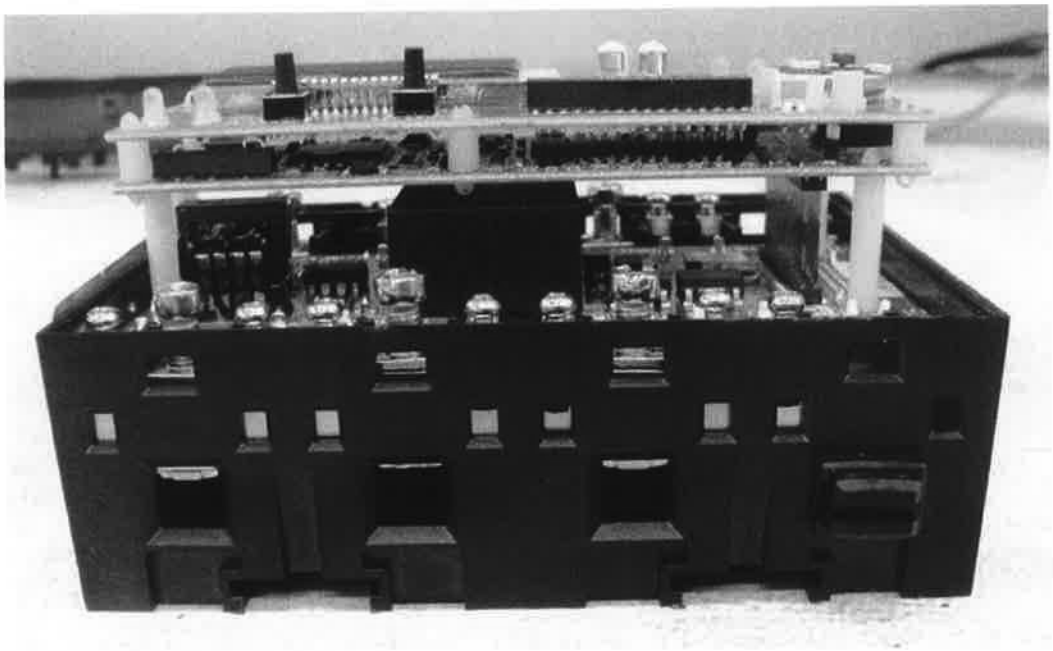
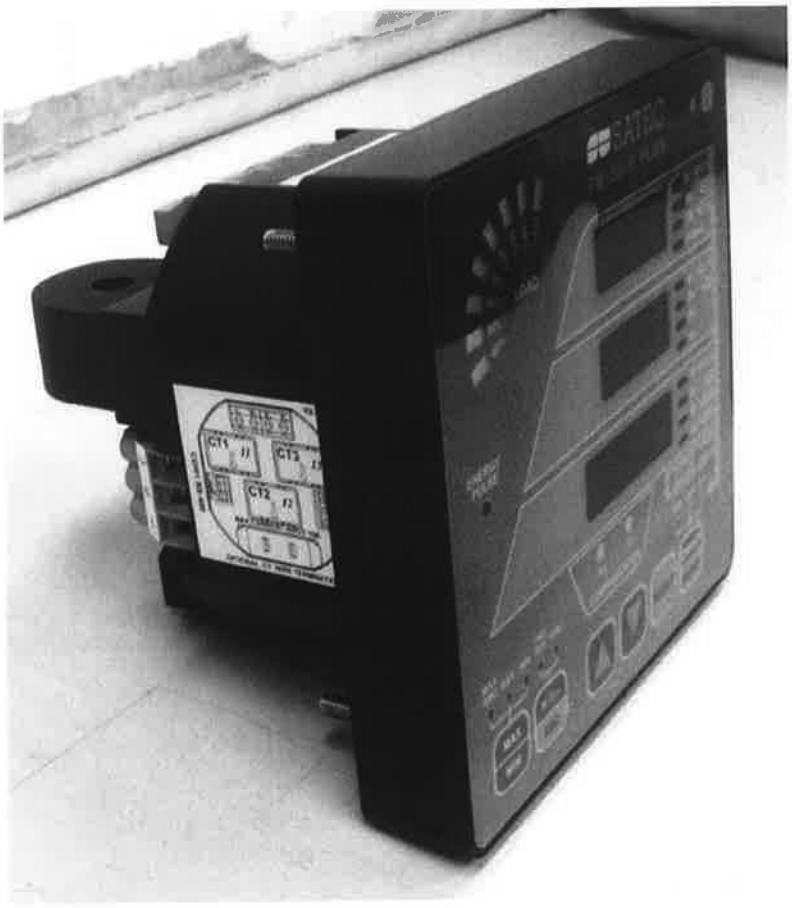


Fig. 6
PM130EH PLUS - overall external views



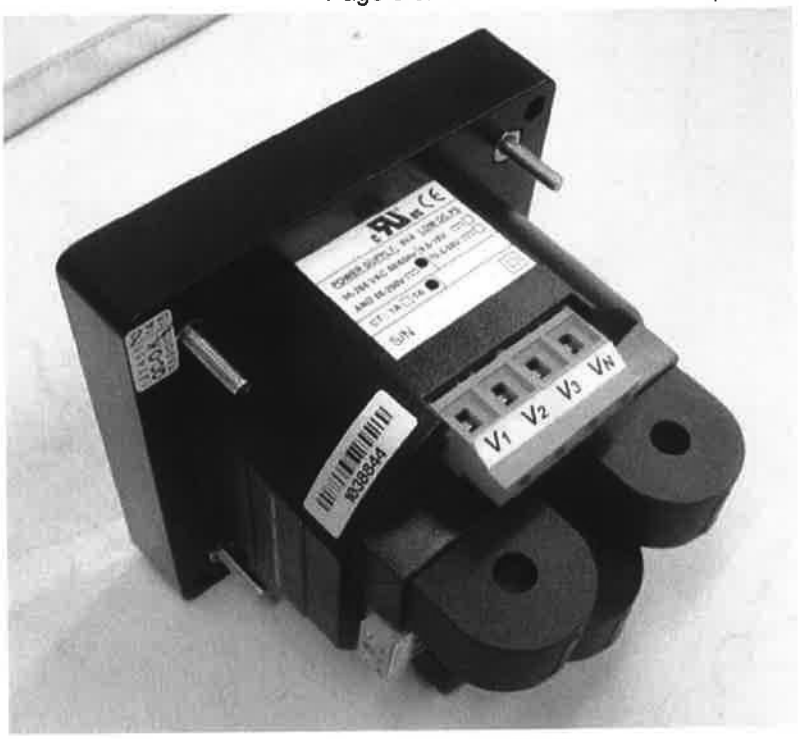


Fig. 7
PM130EH PLUS – front view

Заличено по чл.2 от ЗЗЛД

Fig. 8
PM130EH PLUS - internal views

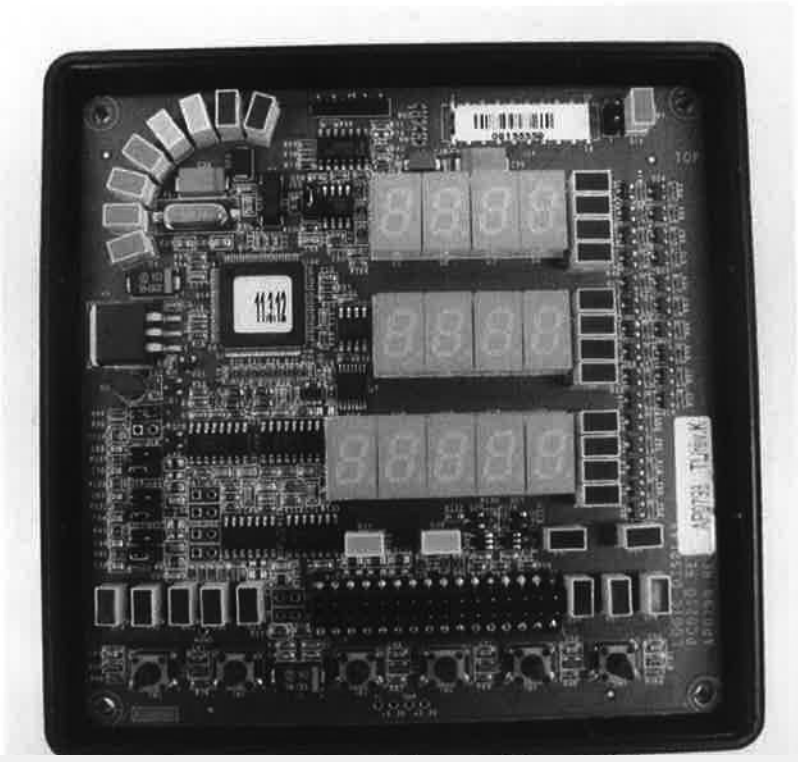
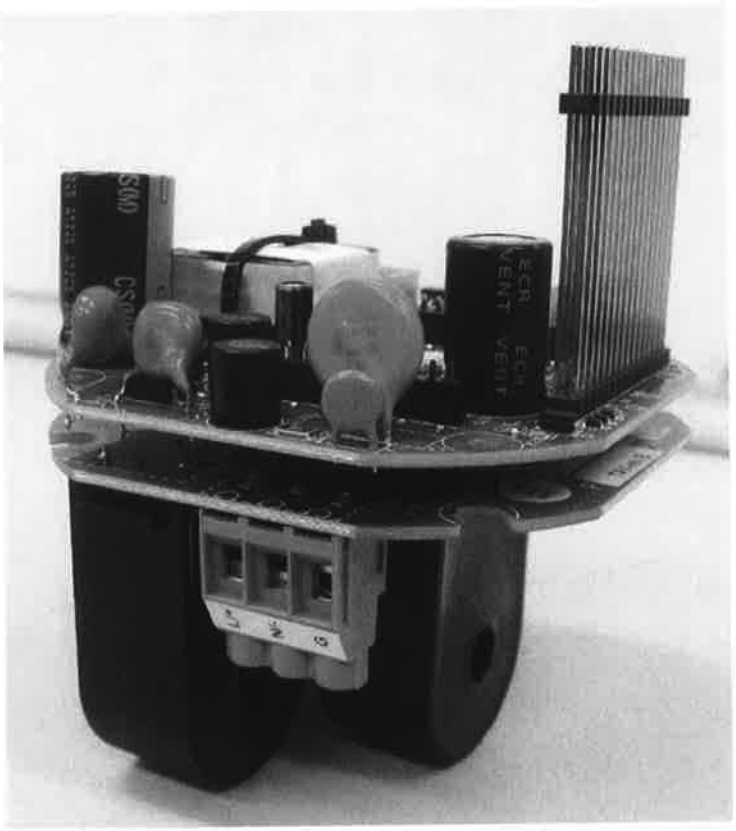


Fig. 9
PM130EH PLUS - internal views



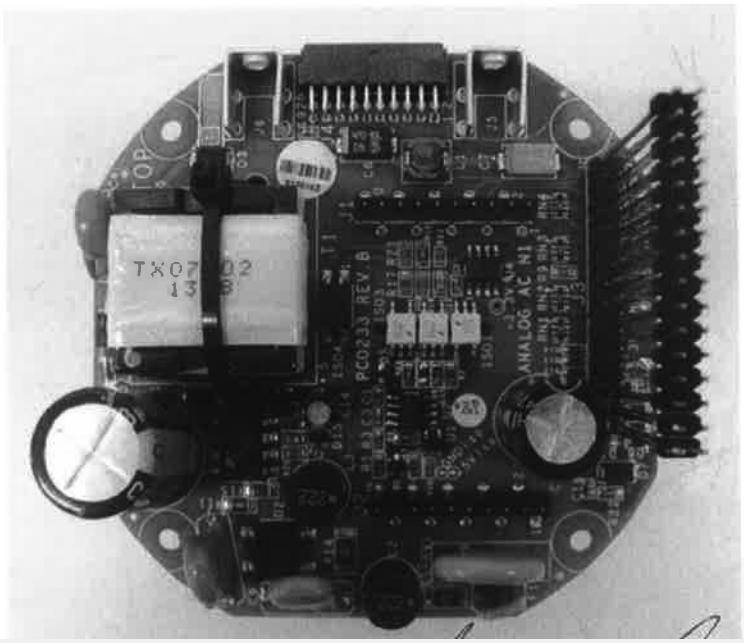


Fig. 10
PM175 - overall external views

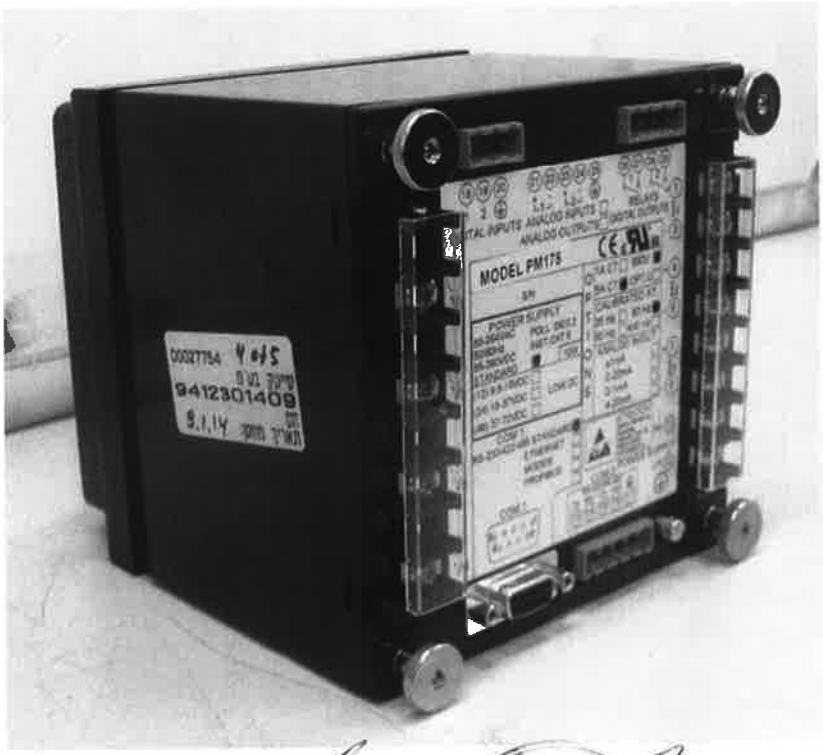


Fig. 11
PM175 - internal view

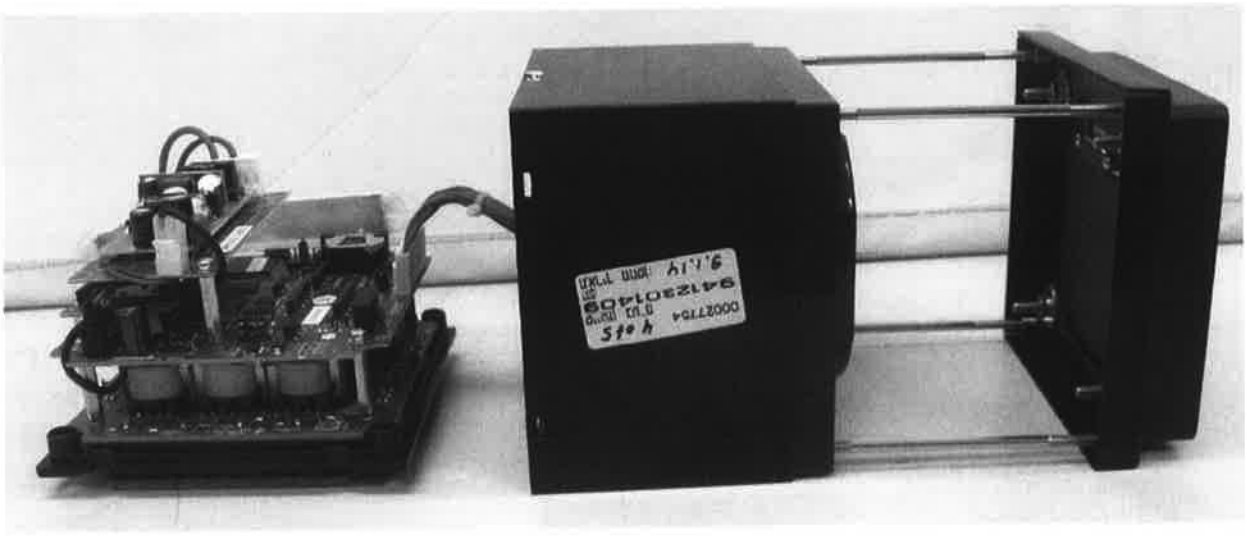
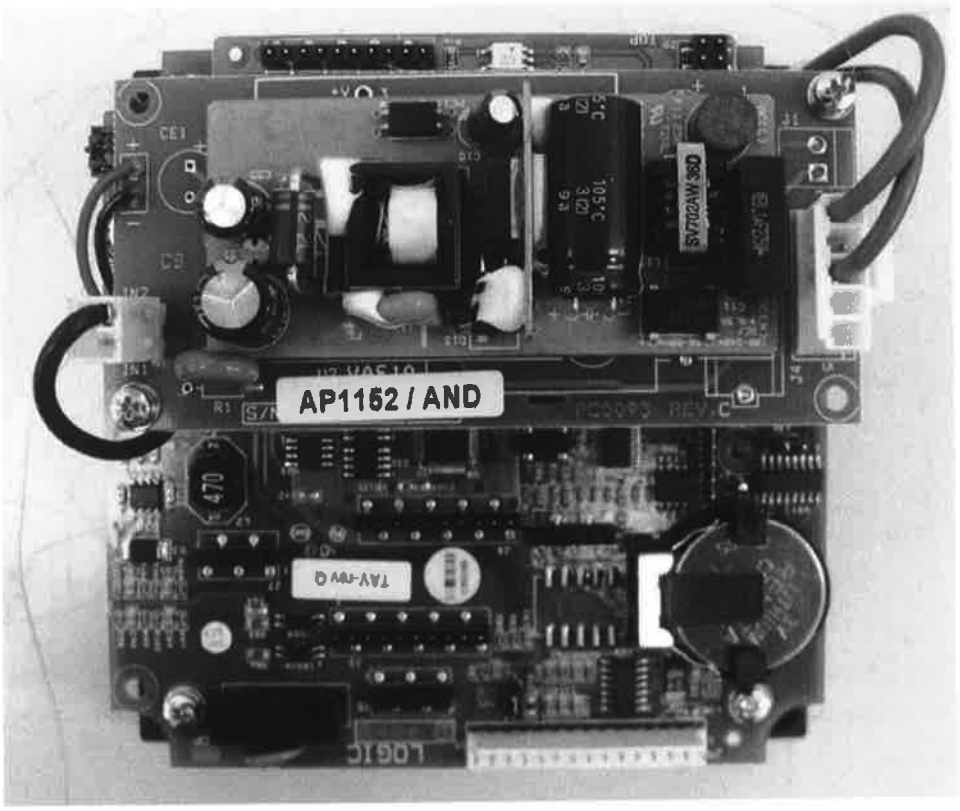


Fig. 12
PM175 - internal views



Report Ref. No.: 9412301409

APPENDIX 2
EMC TEST REPORT

(57 pages including this cover page)

Заличено по чл.2 от ЗЗЛД

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The Standards Institution of Israel

CERTIFICATE OF CONFORMITY

This is to certify that:

Equipment Under Test #1: ***True Power Meter***
Name: ***Multifunctional Power Meter***
Model: ***PM130 PLUS***

Equipment Under Test #2: ***True Power Meter***
Name: ***DIN RAIL Smart Multi Meter***
Model: ***EM133***

Equipment Under Test #3: ***True Power Meter***
Name: ***Multifunctional Power Meter***
Model: ***PM175***

Equipment Under Test #4: ***Energy Management Meter***
Name: ***Branch Feeder Monitor***
Model: ***BFM136***

Manufactured by: ***SATEC Ltd.***

Address: Har Hotzvim Industrial Park, POB 45022
Jerusalem, 91450 Israel

Tested: *23-24/03, 30/04, 4/05, 13/07, 15-16/07/2014*

Has been tested by SII and was found to comply with the requirements of the following standards:

- **IEC 62052-11**
  Electricity metering equipment (a.c.) -
  General requirements, tests and test conditions
  Part 11: Metering equipment Ed. 1.0 (2003-02) Section: 7.5.

- **IEC 61000-3-3**
  Electromagnetic compatibility (EMC). Part 3. Limits.
  Section 3. "Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current < 16 A per phase and not subjected to conditional connection" Ed.2.0 (2008).

Test results are detailed in SII Test Report No. **9412304382**

Certificate no.

Date of issue:

Заличено по чл.2 от ЗЗЛД

ВЯРНО С ОРИГИНАЛА

42 Chaim Levanon St. Tel-Aviv 69977 Israel. Telematics Laboratory Tel: 972-3-6467800 Fax: 972-3-6467779

Test Report No.9412304382

Applicant: ***SATEC Ltd.***

Equipment Under Test #1: ***True Power Meter***
Name: ***Multifunctional Power Meter***
Model: ***PM130 PLUS***

Equipment Under Test #2: ***True Power Meter***
Name: ***DIN RAIL Smart Multi Meter***
Model: ***EM133***

Equipment Under Test #3: ***True Power Meter***
Name: ***Multifunctional Power Meter***
Model: ***PM175***

Equipment Under Test #4: ***Energy Management Meter***
Name: ***Branch Feeder Monitor***
Model: ***BFM136***

Issued by:
The Standards Institution of Israel
Industry Division
Electronics & Telematics Laboratory
EMC Branch

Заличено по чл.2 от ЗЗЛД

42 Chaim Levanon St. Tel-Aviv 69977 Israel. Management: Tel: 972-3-6467800 Fax: 972-3-6467779 www.sii.org.il
Electronics: Tel: 972-3-6465050 Fax: 972-3-7454026 - Alarms Systems Section: Tel: 972-3-6465370 Fax: 972-3-6467262

Test Report No.: 9412304382 **Page 1 of 54 Pages**

Title: Test on four power meters PM130 PLUSMultifunctional Power MeterModels: PM130 PLUS, EM133, PM175, BFM136PM130 PLUS

Applicant:	SATEC Ltd.
Address:	Har Hotzvim Industrial Park, POB 45022 Jerusalem, 91450 Israel
Sample for test selected by:	The customer
The date of test:	23-24/03, 30/04, 4/05, 13/07, 15-16/07/2014

Description of EUT #1:	True Power Meter
Name:	Multifunctional Power Meter
Model:	PM130 PLUS
Serial No.:	1038842, 1038844
Description of EUT #2:	True Power Meter
Name:	DIN RAIL Smart Multi Meter
Model:	EM133
Serial No.:	1049065, 1049067
Description of EUT #3:	True Power Meter
Name:	Multifunctional Power Meter
Model:	PM175
Serial No.:	1047402, 1047404
Description of EUT #4:	Energy Management Meter
Name:	Branch Feeder Meter
Model:	BFM136
Serial No.:	1048603, 1048607
Manufactured by:	SATEC Ltd.

Reference Documents:

- ❖ IEC 62052-11 — Electricity metering equipment (a.c.) - General requirements, tests and test conditions Part 11: Metering equipment Ed. 1.0 (2003-02)
- ❖ IEC 61000-3-3 — Electromagnetic compatibility (EMC). Part 3. Limits. Section 3. "Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current < 16 A per phase and not subjected to conditional connection" Ed.2 (2008).

Compliance:

Four EUT units were found to be in compliance with the requirements of the following standards:

- ✓ **IEC 62052-11 sec. 7.5.**
- ✓ **IEC 61000-3-3**

Details see in clause 1.

Заличено по чл.2 от ЗЗЛД

ВЯРНО С ОРИГИНАЛА

This Test Report contains 54 pages and may be used only in its entirety.	This Test Report applies only to the specimen tested and may not be applied to other specimens of the same product.

Table of Contents

Заличено по чл.2 от ЗЗЛД

1. Summary of Test Results

Multifunctional Power Meter Model: PM130 PLUS

Test	Standard	Class/ Severity level/lines	Test result
Emission (per IEC 62052-11 sec. 7.5.8)			
Radiated emission Freq. range: 30 - 1000 MHz	CISPR 22	Class A	Complies
Conducted emission Freq. range: 0.15 - 30 MHz		Class A 230VAC mains	Complies
Flicker tests	IEC 61000-3-3	*230VAC mains*	Complies
Immunity (per IEC 62052-11 sec. 7.5.2 - 7.5.7)			
Immunity from Electrostatic discharge (ESD)	IEC 61000-4-2	8 kV contact discharge 15 kV air discharge	Complies
Immunity from Radiated electromagnetic fields	IEC 61000-4-3	*With current*: 10 V/m 80 MHz ÷ 2 GHz 80 % AM 1 kHz *Without current*: 30 V/m 80 MHz ÷ 2 GHz 80 % AM 1 kHz	Complies
Immunity from Electrical Fast transient (EFT)	IEC 61000-4-4	*ac mains, Voltage/ Current circuit:* ± 4.0kV Tr/Th – 5/50 ns, 5 kHz	Complies
Immunity from Surge	IEC 61000-4-5	*ac mains, Voltage circuit:* ± 1.0 kV DM Tr/Th – 1.2/50 (8/20) μs	Complies
Immunity from conducted disturbances induced by radio-frequency fields	IEC 61000-4-6	*ac mains, Auxiliary circuit:* 10 VRMS 0.15-80MHz 80 % AM 1 kHz	Complies
Immunity from Ring wave	IEC 61000-4-12	*ac mains, Voltage circuit:* ± 1.0 kV DM 20 pulses, ± 2.5kV CM 40 pulses	Complies

Заличено по чл.2 от ЗЗЛД

DIN RAIL Smart Multi Meter Model: EM133

Test	Standard	Class/ Severity level/lines	Test result
Emission (per IEC 62052-11 sec. 7.5.8)			
Radiated emission Freq. range: 30 - 1000 MHz	CISPR 22	Class B	Complies
Conducted emission Freq. range: 0.15 - 30 MHz		Class A 230VAC mains	Complies
Flicker tests	IEC 61000-3-3	*230VAC mains*	Complies
Immunity (per IEC 62052-11 sec. 7.5.2 - 7.5.7)			
Immunity from Electrostatic discharge (ESD)	IEC 61000-4-2	8 kV contact discharge 15 kV air discharge	Complies
Immunity from Radiated electromagnetic fields	IEC 61000-4-3	*With current*: 10 V/m 80 MHz ÷ 2 GHz 80 % AM 1 kHz *Without current*: 30 V/m 80 MHz ÷ 2 GHz 80 % AM 1 kHz	Complies
Immunity from Electrical Fast transient (EFT)	IEC 61000-4-4	*ac mains, Voltage/ Current circuit:* ± 4.0kV Tr/Th – 5/50 ns, 5 kHz	Complies
Immunity from Surge	IEC 61000-4-5	*ac mains, Voltage circuit:* ± 1.0 kV DM Tr/Th – 1.2/50 (8/20) µs	Complies
Immunity from conducted disturbances induced by radio-frequency fields	IEC 61000-4-6	*ac mains, Auxiliary circuit:* 10 VRMS 0.15-80MHz 80 % AM 1 kHz	Complies
Immunity from Ring Surge	IEC 61000-4-12	*ac mains, Voltage circuit:* ± 1.0 kV DM 20 pulses, ± 2.5kV CM 40 pulses	Complies

Multifunctional Power Meter Model: PM175

Test	Standard	Class/ Severity level/lines	Test result
Emission (per IEC 62052-11 sec. 7.5.8)			
Radiated emission Freq. range: 30 - 1000 MHz	CISPR 22	Class B	Complies
Conducted emission Freq. range: 0.15 - 30 MHz		Class A 230VAC mains	Complies
Flicker tests	IEC 61000-3-3	*230VAC mains*	Complies
Immunity (per IEC 62052-11 sec. 7.5.2 - 7.5.7)			
Immunity from Electrostatic discharge (ESD)	IEC 61000-4-2	8 kV contact discharge 15 kV air discharge	Complies
Immunity from Radiated electromagnetic fields	IEC 61000-4-3	*With current*: 10 V/m 80 MHz ÷ 2 GHz 80 % AM 1 kHz *Without current*: 30 V/m 80 MHz ÷ 2 GHz 80 % AM 1 kHz	Complies
Immunity from Electrical Fast transient (EFT)	IEC 61000-4-4	*ac mains, Voltage/ Current circuit:* ± 4.0kV Tr/Th – 5/50 ns, 5 kHz	Complies
Immunity from Surge	IEC 61000-4-5	*ac mains, Voltage circuit:* ± 1.0 kV DM Tr/Th – 1.2/50 (8/20) μs	Complies
Immunity from conducted disturbances induced by radio-frequency fields	IEC 61000-4-6	*ac mains, Auxiliary circuit:* 10 VRMS 0.15-80MHz 80 % AM 1 kHz	Complies
Immunity from Ring wave	IEC 61000-4-12	*ac mains, Voltage circuit:* ± 1.0 kV DM 20 pulses, ± 2.5kV CM 40 pulses	Complies

Branch Feeder Meter Model: BFM136

Test	Standard	Class/ Severity level/lines	Test result
Emission (per IEC 62052-11 sec. 7.5.8)			
Radiated emission Freq. range: 30 - 1000 MHz	CISPR 22	Class A	Complies
Conducted emission Freq. range: 0.15 - 30 MHz		Class A 230VAC mains	Complies
Flicker tests	IEC 61000-3-3	*230VAC mains*	Complies
Immunity (per IEC 62052-11 sec. 7.5.2 - 7.5.7)			
Immunity from Electrostatic discharge (ESD)	IEC 61000-4-2	8 kV contact discharge 15 kV air discharge	Complies
Immunity from Radiated electromagnetic fields	IEC 61000-4-3	*With current*: 10 V/m 80 MHz ÷ 2 GHz 80 % AM 1 kHz *Without current*: 30 V/m 80 MHz ÷ 2 GHz 80 % AM 1 kHz	Complies
Immunity from Electrical Fast transient (EFT)	IEC 61000-4-4	*ac mains, Voltage/ Current circuit:* ± 4.0kV Tr/Th – 5/50 ns, 5 kHz	Complies
Immunity from Surge	IEC 61000-4-5	*ac mains, Voltage circuit:* ± 1.0 kV DM Tr/Th – 1.2/50 (8/20) µs	Complies
Immunity from conducted disturbances induced by radio-frequency fields	IEC 61000-4-6	*ac mains, Auxiliary circuit:* 10 VRMS 0.15-80MHz 80 % AM 1 kHz	Complies
Immunity from Ring wave	IEC 61000-4-12	*ac mains, Voltage circuit:* ± 1.0 kV DM 20 pulses, ± 2.5kV CM 40 pulses	Complies

August 24, 2014

Name: Eng. Yuri Rozenberg
Position: Head of EMC Branch

Tested by: Alexander Karlinas
Position: Testing Engineer

Written by: Galit Gorodetsky
Positio

Tested by: Maxim Reizin

2. EUT Description

Note: All information in this section was provided by the customer.

2.1. General description:

EUT #1.
Multifunctional Power Meter Model PM130 PLUS:

The Equipment Under Test (hereinafter: EUT) is a low cost multifunctional 3-phase power meter.
The **PM130 PLUS** is True Power-meter, assigned for Energy metering and power quality analysis.
This series provides a cost-effective substitute for numerous analog meters used by industrial, commercial and utility customers for basic power metering

The EUT dimensions: 11.4 x 11.4 x 10.9 cm approx
The EUT power supply: 85-265VAC 50/60/400 Hz, 88-290VDC, 4 W.

Figure 1 PM130 PLUS general view

Заличено по чл.2 от ЗЗЛД

EUT #2.
DIN RAIL Smart Multi Meter Model EM133:

The Equipment Under Test (hereinafter: EUT) is a True Power-meter, assigned for Energy metering and power quality analysis.

The **EM133** is a compact, Din Rail Smart Mater, three-phase AC Power meter (XE-"power") specially designed to meet the requirements of users ranging from electrical panel builders to substation operators.

The EUT dimensions: 9.0 x 12.5 x 7 cm approx
The EUT power supply: 40-300VAC 50/60Hz, 40-300VDC, Burden 5VA.

Figure 2 EM133 general view

EUT #3.
Multifunctional Power Meter Model PM175:

The Equipment Under Test (hereinafter: EUT) is a True Power-meter, assigned for Energy metering and power quality analysis.

The **PM175** is a multifunctional 3-phase power meter. This series provides a possibility for the complex power quality analysis combined with energy metering.

The EUT dimensions: 13.3 x 12.7 x 12.7 cm approx

The EUT power supply: 85-265VAC 50/60/400 Hz, 88-290VDC, 4 W.

Figure 3 PM175 general view

EUT #4.
Branch Feeder Meter Model BFM136:

The Equipment Under Test (hereinafter: EUT) is a 3-phase, multi-channel, multi-function energy meter suitable for use in single-phase and multi-phase electrical networks.

The EUT dimensions: 12.8 x 33.1 x 6.1 cm approx

The EUT power supply: Up to 3 x 277 VAC, 5 W.

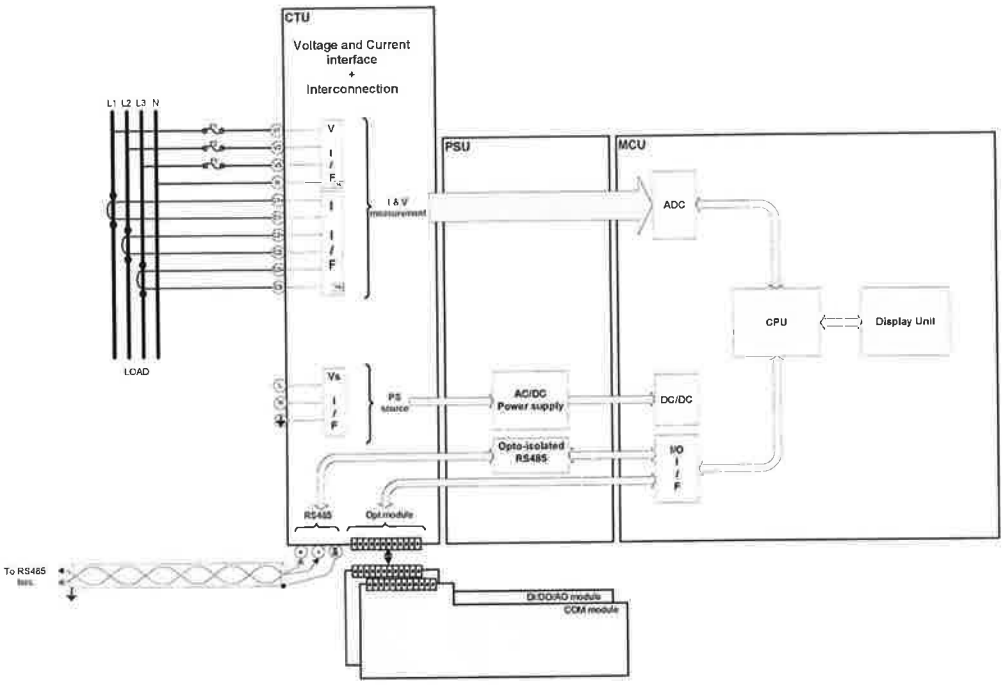


Figure 5 PM130 PLUS block diagram

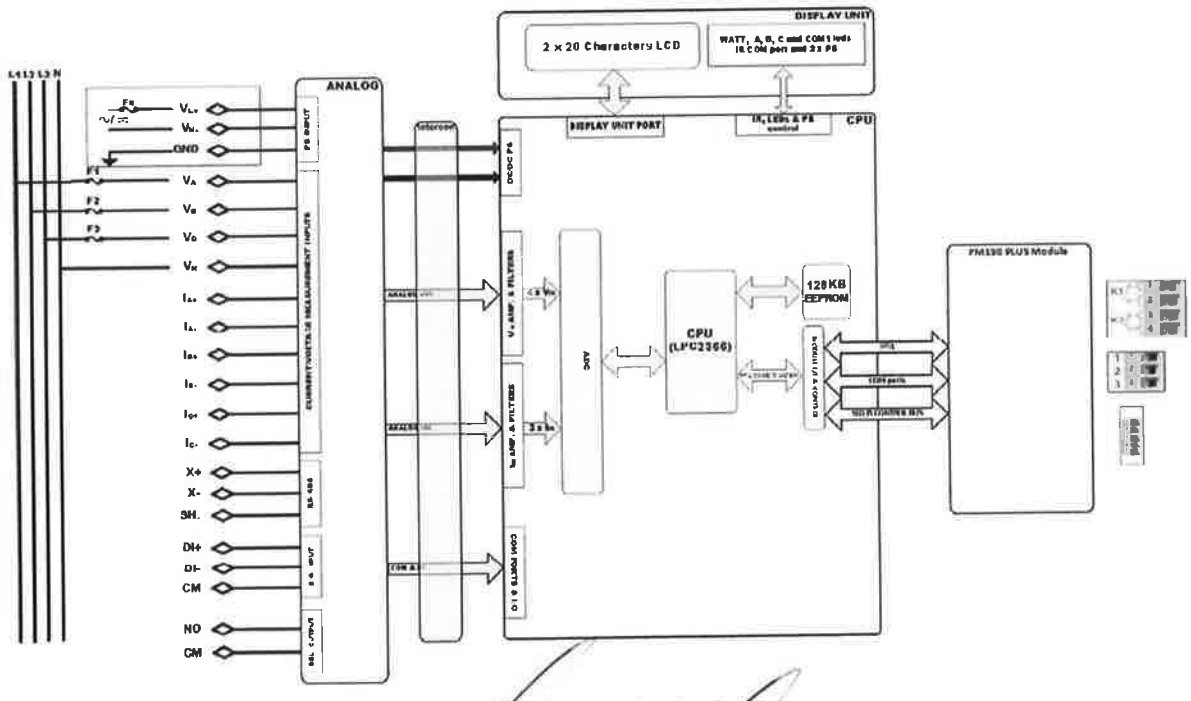


Figure 6 EM133 block diagram

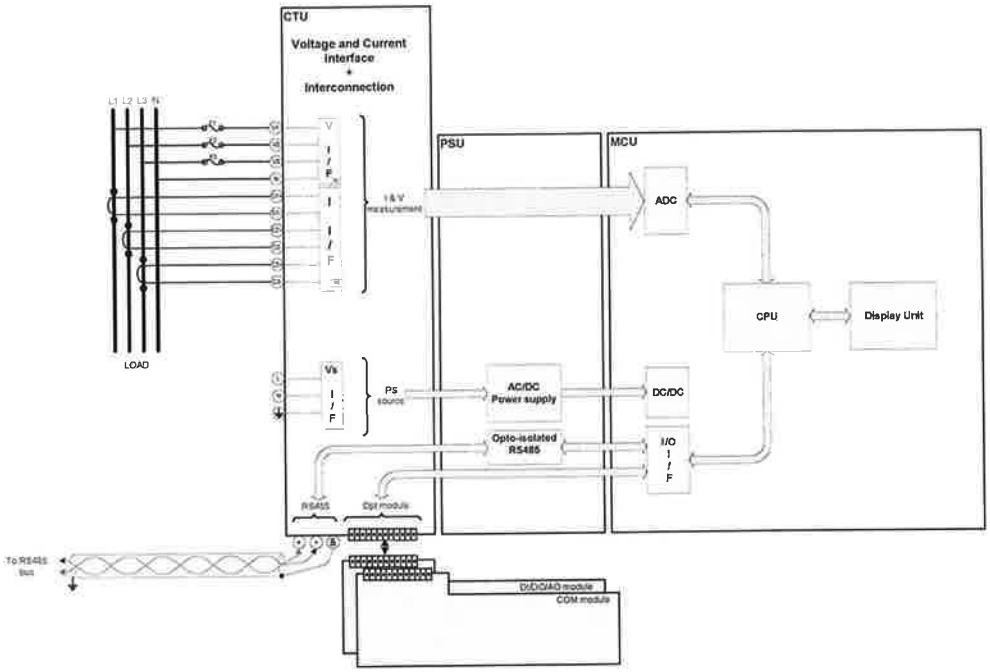
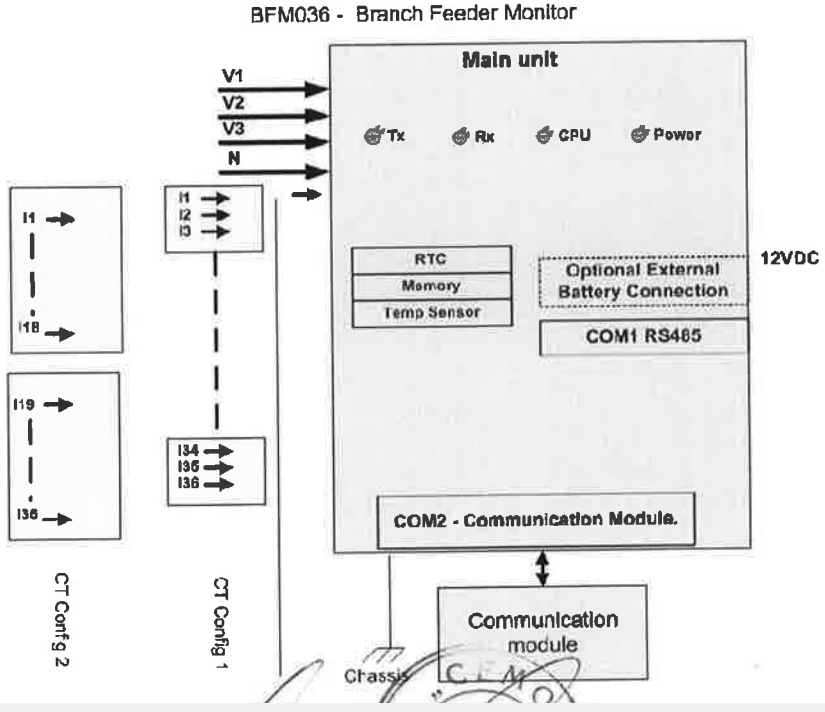


Figure 7 PM175 block diagram



2.2. *EUT sub-assemblies list:*

Table 1. PM130 PLUS Sub-assemblies list

Description	Mfr	Model
Logic board	SATEC LTD.	PC0210
Analog board	SATEC LTD.	PC0233
CT board	SATEC LTD.	PC0235

Table 2. EM133 Sub-assemblies list

Description	Mfr	Model
Logic board	SATEC LTD.	PC0285
Analog board	SATEC LTD.	PC0284
Display board	SATEC LTD.	PC0286

Table 3. PM175 Sub-assemblies list

Description	Mfr	Model
Logic board	SATEC LTD.	PC0197
Analog board	SATEC LTD.	PC0196
Power Supply board	SATEC LTD.	PC0093

Table 4. BFM136 Sub-assemblies list

Description	Mfr	Model
Motherboard	SATEC LTD.	PC0169
Power Supply	SATEC LTD.	PC0190
Ethernet Module	SATEC LTD.	PC0181

2.3. EUT connector / cable list:

Table 5. PM130 PLUS Connector / Cable list

No.	Connectors description	Connector's type	Type of Cable	Length (m)	Location	No. of identical connectors
1	Voltages	Terminal 4x7.5mm	unshielded	1	Rear Panel	1
2	Power Supply	Terminal 3x7.5mm	unshielded	1		1
3	RS485	Terminal 3x5mm	unshielded	1		1

Table 6. EM133 Connector / Cable list

No.	Connectors description	Connector's type	Type of Cable	Length (m)	Location	No. of identical connectors
1	Voltages	Terminals	unshielded	1	Top Side	4
2	Currents (+)	Terminals	unshielded	1	Top Side	3
3	Currents (-)	Terminals	unshielded	1	Bottom Side	3
4	Power Supply	Terminals	unshielded	1	Bottom Side	2
5	RS485	Terminals	unshielded	1	Bottom Side	2
6	DIG IN	Terminals	unshielded	1	Bottom Side	3
7	DIG OUT	Terminals	unshielded	1	Top Side	2

Table 7. PM175 Connector / Cable list

No.	Connectors description	Connector's type	Type of Cable	Length (m)	Location	No. of identical connectors
1	Voltages	Terminal 4x20 mm	unshielded	1	Rear Panel	1
2	Currents	Terminal 6x10 mm	unshielded	1		1
3	Power Supply	Terminal 2x10 mm	unshielded	1		1
4	RS232/ RS422	DSUB-9	unshielded	1		1
5	DIG IN	Terminal 3x5 mm	unshielded	1		1
6	DIG OUT	Terminal 4x5 mm	unshielded	1		1
7	RS422	Terminal 5x5 mm	unshielded	1		1

Table 8. BFM136 Connector / Cable list

No.	Connectors description	Connector's type	Type of Cable	Length (m)	Location	No. of identical connectors
1	Currents	Terminal 6x5mm	unshielded	1	Front panel	12
2	Voltages	Terminal 4x10mm	unshielded	1	Front panel	1
3	Ground	Screw	unshielded	1	Case	1
4	RS485	Terminal 3x5mm	unshielded	1	Right side	1
5	Ethernet	RJ45	shielded	1	Right side	1

2.4. Potential emission sources:

Table 9. Potential emission sources

Frequency, (MHz)	Location	EUT Model
8	Logic board	PM130 PLUS / EM133
20	Logic board	PM175
20	Motherboard	BFM136

2.5. EUT setup and operation:

The test setup for each EUT is shown in Fig. 9-12.
Each EUT was operated to the normal operation mode.
The list of tests ant their applicability is detailed in table 4.

Table 10. List of applicable tests

Mains voltage	Emission tests				Immunity tests					
	IEC 62052-11// CISPR 22		IEC 61000-3-x		IEC 62052-11// IEC 61000-4-x					
	Conduct.	Rad.	-2	-3	-2	-3	-4	-5	-6	-12
230 VAC	✓	✓	NA	✓	✓	✓	✓	✓	✓	✓

"N/A" denotes the test is not applicable, no standard's requirement exists

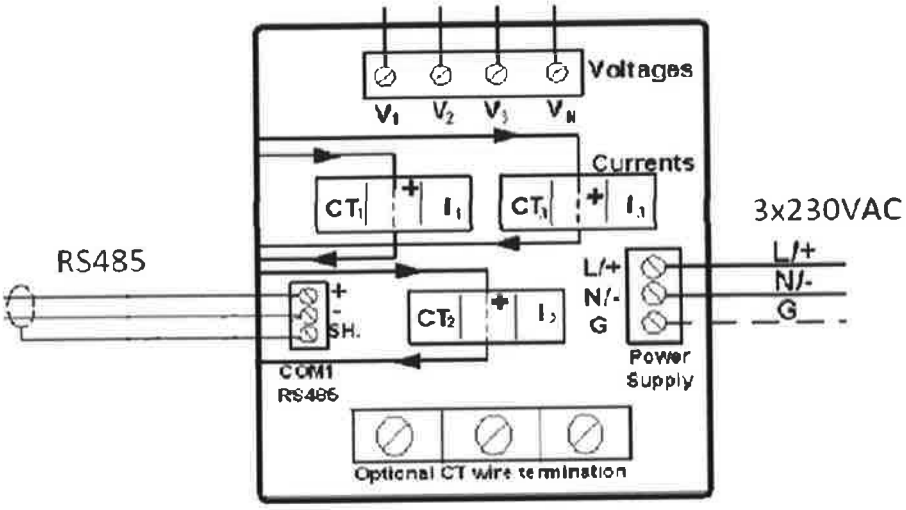


Figure 9. PM130 PLUS Test setup

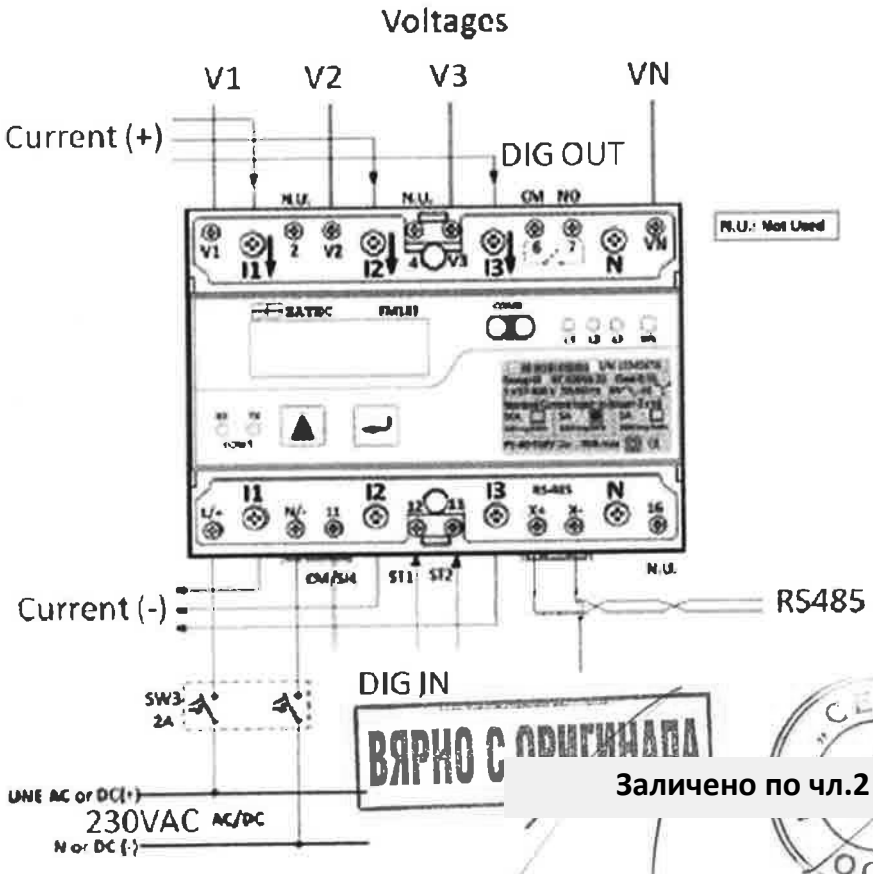


Figure 10. EM133 Test setup

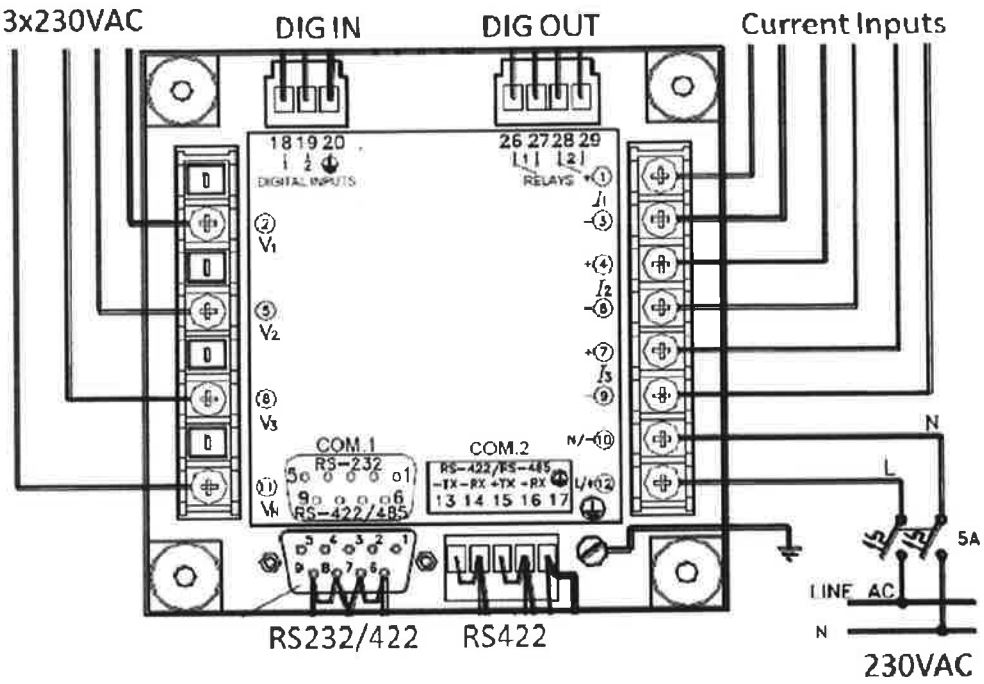


Figure 11. PM175 Test setup

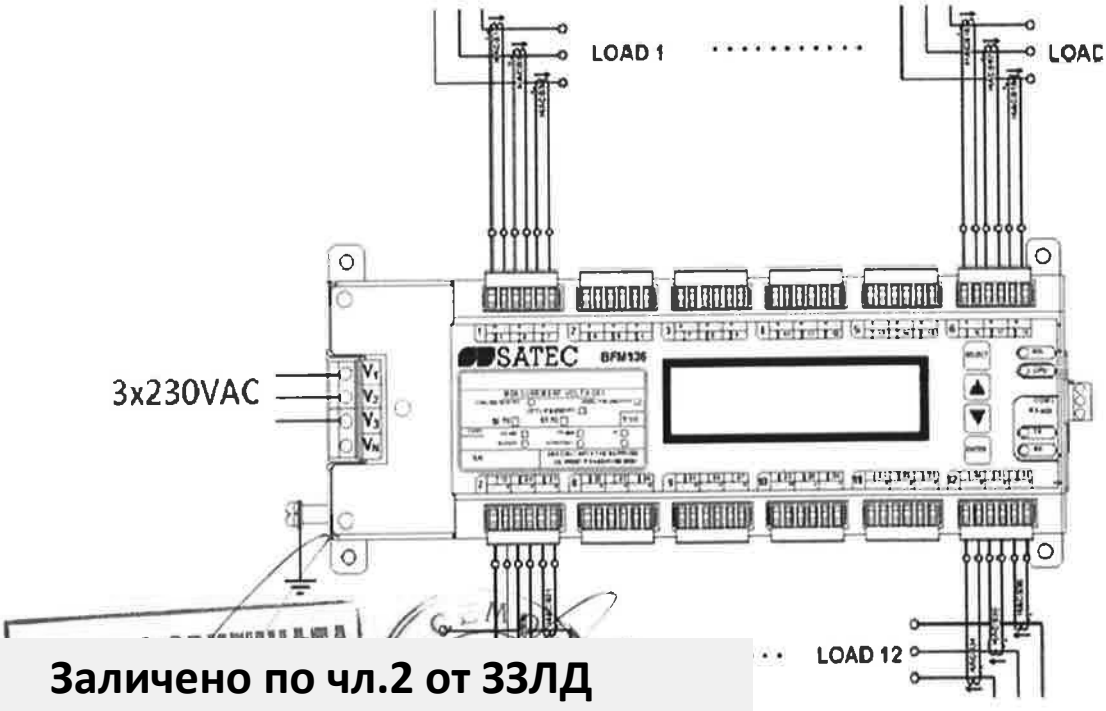


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Figure 12. BFM136 Test setup

3. Test specification, Methods and Procedures

Test Specification:

❖ IEC 62052-11	Electricity metering equipment (a.c.) - General requirements, tests and test conditions Part 11: Metering equipment Ed. 1.0 (2003)
❖ IEC 61000-3-3	Electromagnetic compatibility (EMC) Part 3. Limits. Section 3. "Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current < 16 A per phase and not subjected to conditional connection" Ed.2 (2008).

Methods and Procedures:

❖ CISPR 22	Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement (2010).	
❖ IEC 61000-3-3	Electromagnetic compatibility (EMC) Part 3. Limits. Section 3. "Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current < 16 A per phase and not subjected to conditional connection" Ed.2 (2008).	
❖ IEC 61000-4	Electromagnetic compatibility (EMC)	
	Part 4.	"Testing and measurement techniques;"
	Section 2:	"Electrostatic discharge immunity tests" (1995).
	Section 3:	"Radiated, radio-frequency, electromagnetic field immunity test" (2002).
	Section 4:	"Electrical Fast Transient/burst immunity test" (1995)."
	Section 5:	"Surge immunity tests" (1995).
	Section 6:	"Immunity to conducted disturbances induced by radio-frequency fields" (1996).
	Section 12:	Ring wave immunity test. Ed.2.0 (2006)

4. Additional deviations or exclusions from the test specifications

Not applicable

5. General conditions

5.1. Location of the Test Site:

The tests were carried out in the EMC laboratory of the Standards Institution of Israel in Tel-Aviv.

5.2. Emission tests:

- For both radiated and conducted measurements, initial scans were made using a peak detector but still using the appropriate CISPR 16 (Quasi-Peak) detector IF bandwidth.
- For conducted emissions, a tolerance limit was set 6 dB below the specification limit. Levels above the tolerance limit were retested using the Quasi-Peak detector or an average detector.
- For radiated emissions, a tolerance limit was set 10 dB below the specification limit. Levels above the tolerance limit were retested using the Quasi-Peak detector.

5.3. Initial visual check and functional test:

Initial visual check and brief built- in- test of the EUT was performed before testing. No external damages were found. The test on the EUT passed successfully.

6. Emissions

6.1. Radiated Emission Summary

Reference Documents:

IEC 62052-11 sec.7.5.8// CISPR 22

Test Procedure:

The measurements were conducted in the semi- anechoic chamber.

For each mode of operation the frequency spectrum was monitored. EUT configuration, cable configuration and mode of operation, which produced the emission that had the highest amplitude, were documented.

The frequency range from 30 MHz to 1 GHz was investigated.

Antenna used: Biconilog Antenna (20 MHz - 6000 MHz).

The levels were maximized by initially rotating the turntable through 360°, varying the antenna height between 1 m and 4 m, rerouting EUT cable and changing antenna- to- EUT polarization from vertical to horizontal.

Unless stated otherwise, the measuring equipment settings were:

Initial scan:	
Detector type	Peak
Mode	Max hold
Bandwidth	120 kHz
Step size	Continuous sweep
Sweep time	>1 seconds/MHz

Measurements	
Detector type	Quasi-peak (CISPR)
Bandwidth	120 kHz/ 1MHz
Measurement time	20 seconds/MHz
Observation	>15 seconds

Test Result:

EUT Model	Ref. Standard	Frequency range	Polar.	Table#	Result	Remarks
PM130 PLUS	CISPR 22 Class A	30-1000 MHz	V/H	11	**PASS**	The worst result is 9.5dB below limit at 240 MHz
EM133	CISPR 22 Class B			12	**PASS**	The worst result is 6.4dB below limit at 360 MHz
PM175	CISPR 22 Class B			13	**PASS**	The worst result is 1.8dB below limit at 215 MHz
BFM136	CISPR 22			14	**PASS**	The worst result is 9.4dB below limit at 167.7 MHz

ВЯРНО

Заличено по чл.2 от ЗЗЛД

Results: **Pass**
Ref. Standard / Limit: CISPR 22 Class A
Measured distance: 3m
Frequency range: 30-1000MHz

Table 11 PM130 PLUS Radiated emission test results

No	Frequency (MHz)	Antenna Polariz	Turn-table Angle (°)	Antenna Height (m)	Emission Level (dBµV/m)	Limit @ 3 m (dBµV/m)	Margin (dB)	Results
1	100.0	V	0	1.1	36.7	50	-13.3	Complies
2	114.9	V	360	1.0	38.2	50	-11.8	Complies
3	177.4	H	242	1.2	36.4	50	-13.6	Complies
4	182.6	H	240	1.2	39.6	50	-10.4	Complies
5	192.6	H	212	1.0	38.9	50	-11.1	Complies
6	240.1	H	276	1.4	47.5	57	-9.5	Complies

Results: **Pass**
Ref. Standard / Limit: CISPR 22 Class B
Measured distance: 3m
Frequency range: 30-1000MHz

Table 12 EM133 Radiated emission test results

No	Frequency (MHz)	Antenna Polariz	Turn-table Angle (°)	Antenna Height (m)	Emission Level (dBµV/m)	Limit @ 3 m (dBµV/m)	Margin (dB)	Results
1	37.1	V	269	1.1	32.0	40	-8.0	Complies
2	80.3	V	360	1.1	24.7	40	-15.3	Complies
3	240.0	H	98	1.1	39.2	47	-7.8	Complies
4	360.0	H	57	1.2	40.6	47	-6.4	Complies

Note: Emission level = E Reading (dBµV) + Cable loss (dB) + Antenna Factor (dB/m)
For Cable Loss and Antenna Factor refer to Appendix 2.

Заличено по чл.2 от ЗЗЛД

Results: **Pass**
Ref. Standard / Limit: CISPR 22 Class B
Measured distance: 3m
Frequency range: 30-1000MHz

Table 13 PM175 Radiated emission test results

No	Frequency (MHz)	Antenna Polariz	Turn-table Angle (°)	Antenna Height (m)	Emission Level (dBµV/m)	Limit @ 3 m (dBµV/m)	Margin (dB)	Results
1	136.5	H	250	2.6	36.6	40	-3.4	Complies
2	137.9	H	252	2.6	35.8	40	-4.2	Complies
3	148.2	H	262	1.6	31.3	40	-8.7	Complies
4	209.7	H	260	1.9	33.7	40	-6.3	Complies
5	215.1	H	82	1.1	38.2	40	-1.8	Complies
6	223.3	V	335	1.6	33.3	40	-6.7	Complies
7	240.0	H	82	1.1	44.1	47	-2.9	Complies
8	270.3	H	82	1.1	38.3	47	-8.7	Complies

Results: **Pass**
Ref. Standard / Limit: CISPR 22 Class A
Measured distance: 3m
Frequency range: 30-1000MHz

Table 14 BFM136 Radiated emission test results

No	Frequency (MHz)	Antenna Polariz	Turn-table Angle (°)	Antenna Height (m)	Emission Level (dBµV/m)	Limit @ 3 m (dBµV/m)	Margin (dB)	Results
1	30.6	V	100	1.2	36.6	50	-13.4	Complies
2	167.7	H	258	2.2	40.7	50	-9.4	Complies
3	169.4	H	258	2.0	34.8	50	-15.2	Complies
4	258.7	H	138	1.1	42.3	57	-14.7	Complies
5	312.2	H	41	1.1	40.3	57	-16.7	Complies
6	326.4	H	135	1.2	35.6	57	-21.4	Complies

Заличено по чл.2 от ЗЗЛД

6.2. Conducted Emission Summary

Reference Documents:

IEC 62052-11 sec.7.5.8// CISPR 22.

Test procedure:

The measurements were performed on 230VAC mains.

Coupling network used - LISN.

The test was started with an initial scan. The final measurements were performed at each frequency where the signal was 10 dB below the limit or less.

Test equipment (EMI receiver) setup was as follow:

Initial scan:		**Measurements**	
Detector type	Peak	Detector type	Quasi-peak (CISPR)
Mode	Max hold	Bandwidth	9 kHz
Bandwidth	9 kHz	Observation	>15 seconds
Step size	Continuous sweep		
Sweep time	>100 msec		

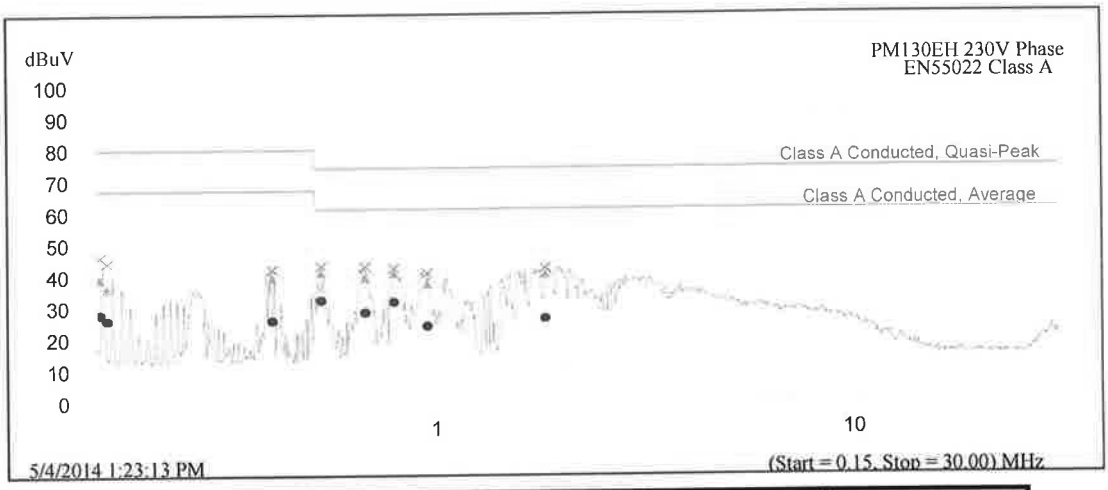
Test Result:

EUT Model	Line Description	Ref. standard	Coupling Network	Plot#	Result	Remarks
PM130 Plus	230 VAC mains	CISPR 22 Class A	LISN	#1-2	PASS	All detected peaks are 25dB at least below limit
EM133				#3-4	PASS	All detected peaks are 17dB at least below limit
PM175				#5-6	PASS	All detected peaks are 11dB at least below limit
BFM136				#7-8	PASS	All detected peaks are 7.3dB at least below limit

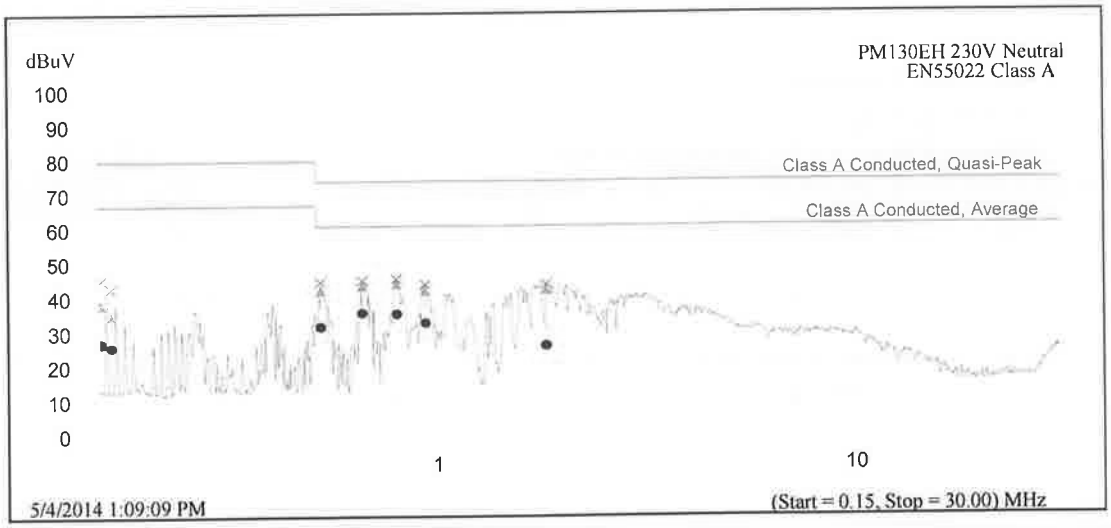
Заличено по чл.2 от ЗЗЛД

Results: **Pass**
Ref. Standard / Limit: CISPR 22 Class A
Measured line/port: 230VAC mains

Plot 1- Plot 2: **PM130 Plus Conducted emission. Phase/ Neutral**



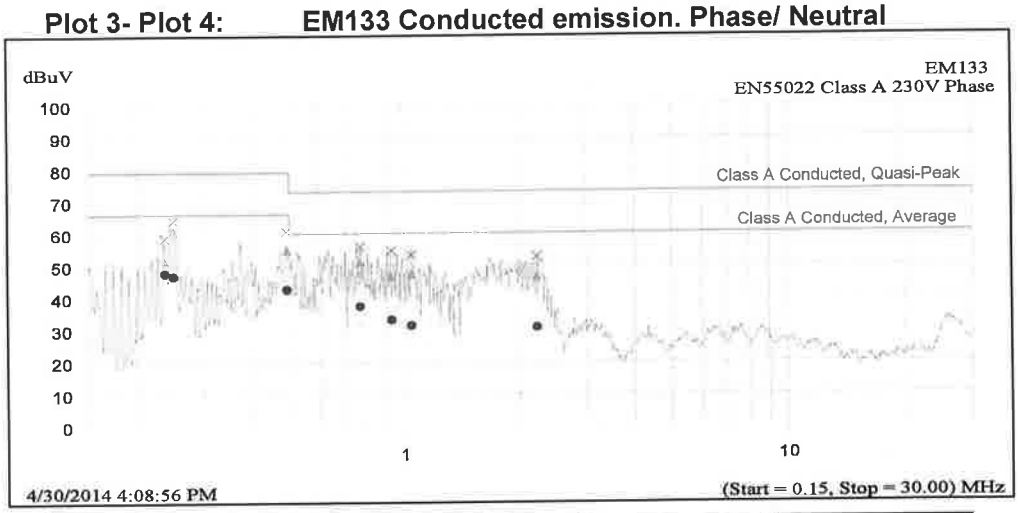
Frequency MHz	Peak dBµA	QP dBµA	Avg dBµA	QP-QP Limit dB	Avg-Avg Limit dB
0.15	45.1	38.1	27.1	-40.9	-38.9
0.52	42.0	40.0	31.2	-33.0	-28.8
0.66	41.8	38.2	27.3	-34.8	-32.7
0.77	41.2	39.7	30.6	-33.3	-29.4
0.93	39.6	36.2	22.9	-36.8	-37.1
1.80	41.1	39.3	25.2	-33.7	-34.8



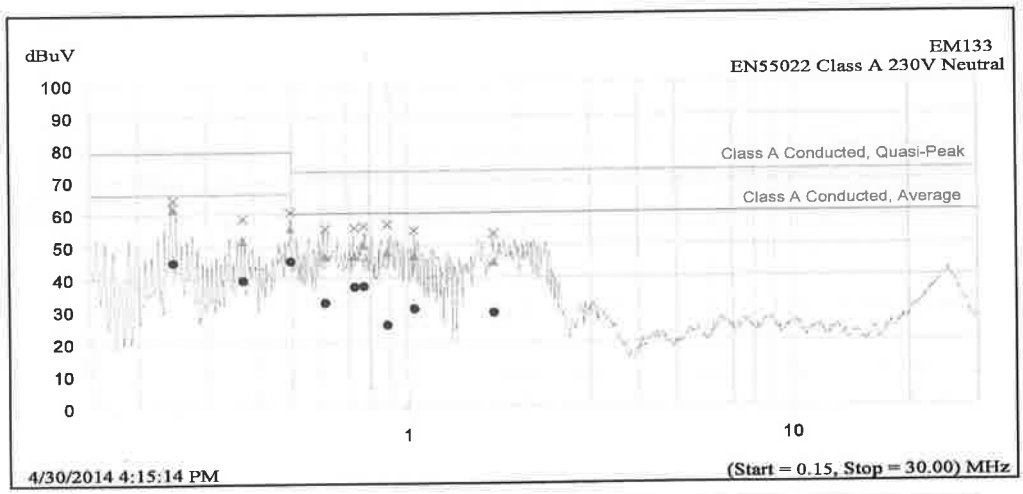
Frequency MHz	Peak dBµA	QP dBµA	Avg dBµA	QP-QP Limit dB	Avg-Avg Limit dB
0.15	44.5	37.5	26.4	-41.5	-39.6
0.51	43.7	41.1	30.8	-31.9	-29.2
0.64	44.1	42.5	34.8	-30.5	-25.2
0.78	44.6	43.0	34.5	-30.0	-25.5

Results: **Pass**
Ref. Standard / Limit: CISPR 22 Class A
Measured line/port: 230VAC mains

Plot 3- Plot 4: EM133 Conducted emission. Phase/ Neutral



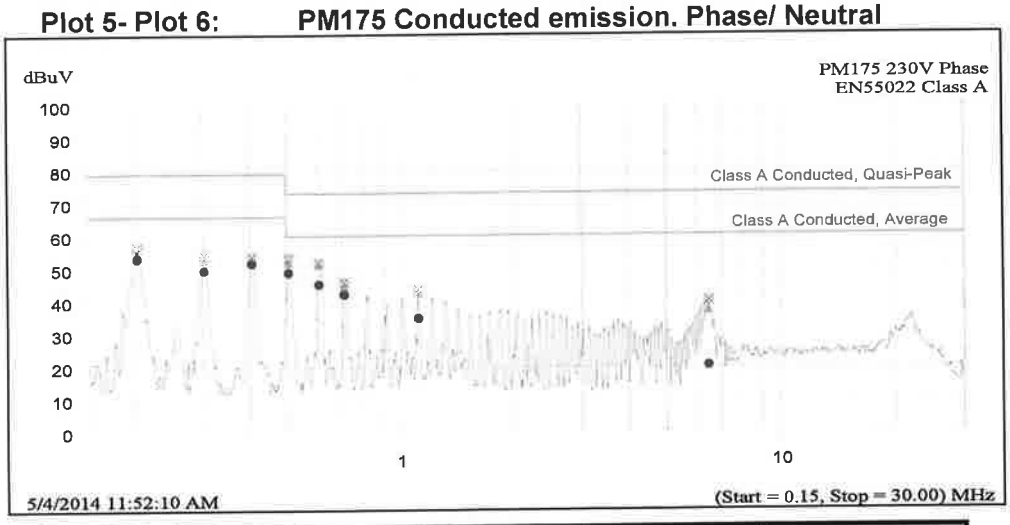
Frequency MHz	Peak dBµA	QP dBµA	Avg dBµA	QP-QP Limit dB	Avg-Avg Limit dB
0.24	58.7	51.9	48.0	-27.1	-18.0
0.25	64.2	61.3	47.0	-17.7	-19.0
0.49	60.6	54.9	42.6	-24.1	-23.4
0.77	55.8	51.1	37.3	-21.9	-22.7
0.93	54.6	46.5	33.0	-26.5	-27.0
1.04	53.1	47.3	31.2	-25.7	-28.8



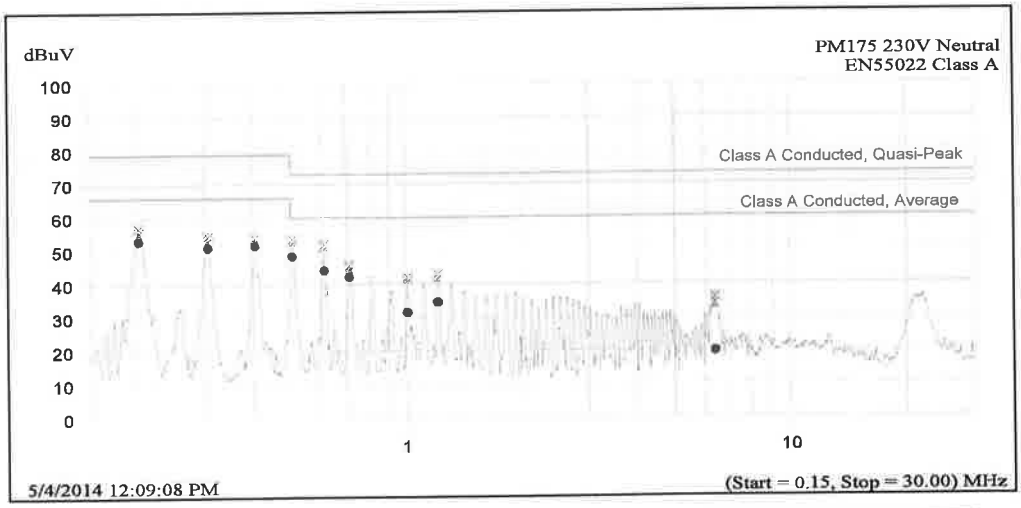
Frequency MHz	Peak dBµA	QP dBµA	Avg dBµA	QP-QP Limit dB	Avg-Avg Limit dB
0.25	64.1	61.6	45.0	-17.4	-21.0
0.37	58.3	51.5	39.3	-27.5	-26.7
0.50	60.4	55.3	45.2	-23.7	-20.8
0.61	55.1	46.7	32.2	-26.3	-27.8

Results: **Pass**
Ref. Standard / Limit: CISPR 22 Class A
Measured line/port: 230VAC mains

Plot 5- Plot 6: PM175 Conducted emission. Phase/ Neutral



Frequency MHz	Peak dBµA	QP dBµA	Avg dBµA	QP-QP Limit dB	Avg-Avg Limit dB
0.20	56.8	55.4	53.3	-23.6	-12.7
0.30	54.3	52.9	49.7	-26.1	-16.3
0.41	53.7	52.8	51.7	-26.2	-14.3
0.51	53.2	52.1	48.9	-20.9	-11.1
0.61	52.0	51.4	45.2	-21.6	-14.8
0.71	45.9	44.9	42.1	-28.1	-17.9

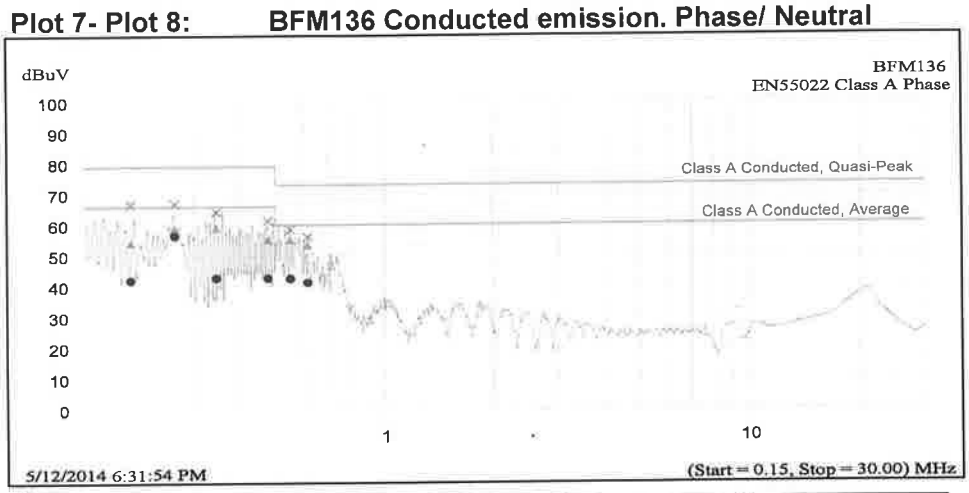


Frequency MHz	Peak dBµA	QP dBµA	Avg dBµA	QP-QP Limit dB	Avg-Avg Limit dB
0.20	56.9	55.2	53.0	-23.8	-13.0
0.31	54.3	52.5	50.9	-26.5	-15.1
0.40	53.9	52.9	51.5	-26.1	-14.5
0.51	53.6	52.6	48.4	-20.4	-11.6
0.61	52.0	51.1	44.2	-21.9	-15.8
0.71	45.7	44.8	42.3	-28.2	-17.7

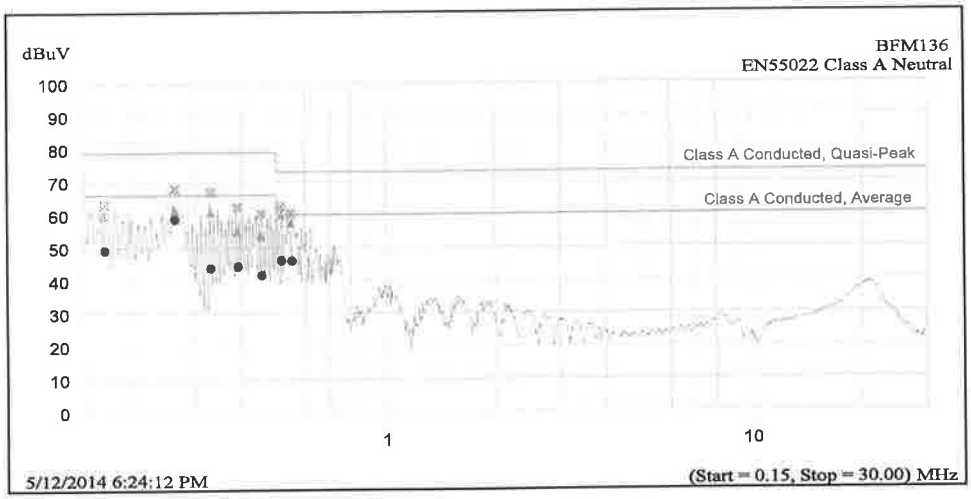
Заличено по чл.2 от ЗЗЛД

Results: **Pass**
Ref. Standard / Limit: CISPR 22 Class A
Measured line/port: 230VAC mains

Plot 7- Plot 8: BFM136 Conducted emission. Phase/ Neutral



Frequency MHz	Peak dBµA	QP dBµA	Avg dBµA	QP-QP Limit dB	Avg-Avg Limit dB
0.20	66.8	54.4	42.0	-24.6	-24.0
0.27	67.0	59.1	56.6	-19.9	-9.4
0.35	64.3	59.1	42.7	-19.9	-23.3
0.48	61.4	55.2	42.6	-23.8	-23.4
0.55	58.4	55.2	42.5	-17.8	-17.5
0.62	56.0	53.5	41.2	-19.5	-18.8



Frequency MHz	Peak dBµA	QP dBµA	Avg dBµA	QP-QP Limit dB	Avg-Avg Limit dB
0.17	63.1	59.7	49.5	-19.3	-16.5
0.27	68.0	61.1	58.7	-17.9	-7.3
0.33	67.0	60.8	43.8	-18.2	-22.2
0.39	62.3	54.9	44.2		
0.52	62.4	59.8	46.1		
0.55	60.3	57.4	46.0	-15.6	-14.0

Заличено по чл.2 от ЗЗЛД

6.3. *Flicker summary*

Results: **Pass**
Ref. Standard: IEC 61000-3-3
Mains: 230VAC

Table 15. PM130 PLUS Flicker data

Product:	**SATEC PM130EH**					
Serial No:						
Description:						
Voltech IEC61000-3 Windows Software 1.24.12		Test Date:	2014 Jul 13 17:43			
Result:	**SATEC PM130EH**					
Type of Test:	Flickermeter Test - Table					
Power Analyzer:	Voltech PM6000 SN: 200006700333 Firmware version: v1.22.07RC6					
AC Source:	Mains / Manual Source					
Overall Result	**PASS**					
Notes:	Plt test duration only 20 minutes Measurement method - Voltage					
	Plt					
Limit	0.65					
Reading	0.046					
	Pst	dc(%)	dmax(%)	3.3		
Limit	1	3.3	4	500		
Reading 1	0.083	0	0	0		
Reading 2	0.083	0	0	0		

Заличено по чл.2 от ЗЗЛД

Table 16. EM133 Flicker data

Product:	SATEC EM133				
Serial No:					
Description:					
Voltech IEC61000-3 Windows Software 1.24.12		Test Date:	2014 Jul 13 14:51		
Result:	SATEC EM133				
Type of Test:	Flickermeter Test - Table				
Power Analyzer:	Voltech PM6000 SN: 200006700333 Firmware version: v1.22.07RC6				
AC Source:	Mains / Manual Source				
Overall Result	PASS				
Notes:	Plt test duration only 20 minutes Measurement method - Voltage				
	Plt				
Limit	0.65				
Reading	0.047				
	Pst	dc(%)	dmax(%)	3.3	
Limit	1	3.3	4	500	
Reading 1	0.085	0	0.706	0	
Reading 2	0.085	0	0.705	0	

Заличено по чл.2 от ЗЗЛД

Table 17. PM175 Flicker data

Product:	SATEC PM175					
Description:						
Voltech IEC61000-3 Windows Software 1.24.12		Test Date:	2014 Jul 15 08:37			
Result:	SATEC PM175					
Type of Test:	Flickermeter Test - Table					
Power Analyzer:	Voltech PM6000 SN: 200006700333 Firmware version: v1.22.07RC6					
AC Source:	Mains / Manual Source					
Overall Result	PASS					
Notes:	Plt test duration only 20 minutes Measurement method - Voltage					
	Plt					
Limit	0.65					
Reading	0.046					
	Pst	dc(%)	dmax(%)	3.3		
Limit	1	3.3	4	500		
Reading 1	0.084	0	0	0		
Reading 2	0.084	0	0	0		

Заличено по чл.2 от ЗЗЛД

Table 18. BFM136 Flicker data

Product:	SATEC BFM136					
Serial No:						
Description:						
Voltech IEC61000-3 Windows Software 1.24.12		Test Date:	2014 Jul 15 11:43			
Result:	SAREC BFM136					
Type of Test:	Flickermeter Test - Table					
Power Analyzer:	Voltech PM6000 SN: 200006700333 Firmware version: v1.22.07RC6					
AC Source:	Mains / Manual Source					
Overall Result	PASS					
Notes:	Plt test duration only 20 minutes Measurement method - Voltage					
	Plt					
Limit	0.65					
Reading	0.046					
	Pst	dc(%)	dmax(%)	3.3		
Limit	1	3.3	4	500		
Reading 1	0.084	0	0.803	0		
Reading 2	0.084	0	0.797	0		

Заличено по чл.2 от ЗЗЛД

7. Immunity Tests

7.1. Performance criteria per IEC 62052-11 sec.7.5

(a):

During the test the behavior of the equipment shall not be perturbed and the variation of the error shall be within the limits as specified in the relevant standards.

(b):

During the test a temporary degradation or loss of function or performance is acceptable

(c):

The application of the EMC disturbance shall not produce a change in the register of more than x units and the test output shall not produce a signal equivalent to more than x units. (formula for x is in IEC 62052-11 sec.7.1.2).

7.2. Electrostatic Discharge (ESD) immunity test

Results:	**Pass**
Ref. Standard:	IEC 62052-11 sec. 7.5.2
Test procedure:	IEC 61000-4-2
Temperature:	23°C
Relative humidity:	45%
Athmosph. pressure:	1010 mbar
Performance criteria:	See sec.7.1 (b), (c).

Table 19 PM130 Plus / EM133/ PM175 ESD Data

ESD type	Test points	Test Voltage (kV)	Number of pulses	EUT performance during test	Result
Contact	HCP	2,4,6,8	+/-(4*20)	NP	PASS
	VCP	2,4,6,8	+/-(4*20)	NP	PASS
Air	Front panel	2,4,6,8, 15	+/-(4*20)	NP	PASS

Table 20 BFM136 ESD Data

ESD type	Test points	Test Voltage (kV)	Number of pulses	EUT performance during test	Result
Contact	HCP	2,4,6,8	+/-(4*20)	NP	PASS
	VCP	2,4,6,8	+/-(4*20)	NP	PASS
	Enclosure - metal parts	2,4,6,8	+/-(4*20)	NP	PASS
Air	Front panel	2,4,6,8, 15	+/-(4*20)	NP	PASS

NP -

Test Result: All tested units continued to operate as intended. No change in the readings was observed during and after the test.

7.3. Radiated Immunity test

Results:	**Pass**
Ref. Standard:	IEC 62052-11 sec. 7.5.3
Test procedure:	IEC 61000-4-3
Temperature:	23°C
Relative humidity:	45%
Athmosph. pressure:	1010 mbar
Performance criteria:	test with current: See sec.7.1 (a) test without current: See sec.7.1 (b), (c)

Table 21 Radiated Immunity Data

Test parameters	EUT performance	Result
Test with current: EUT is loaded with 1A Load 10 V/m 80 ÷ 2000 MHz 80 % AM 1 kHz	NP	PASS
Test without current: No Load 30 V/m 80 ÷ 2000 MHz 80 % AM 1 kHz	NP	PASS

Test Result: All tested units continued to operate as intended. No change in the readings was observed during and after the test.

Заличено по чл.2 от ЗЗЛД

7.4. Electrical Fast Transients (EFT) immunity test

Results:	**Pass**
Ref. Standard:	IEC 62052-11 sec. 7.5.4
Test procedure:	IEC 61000-4-4
Temperature:	23°C
Relative humidity:	45%
Athmosph. pressure:	1010 mbar
Performance criteria:	See sec.7.1 (b), nevertheless the variation of the error shall be within the limits as specified in the relevant standards.

Table 22 EFT Data

No.	Port / Cable Description	Type of coupling	Test Voltage kV	Impulse	EUT performance during test	Result
1	230VAC mains	CDN	± 4.0 CM	Tr/Th – 5/50 ns, 5 kHz	NP	PASS
2	Voltage/ Current circuit	CDN	± 4.0 CM	Tr/Th – 5/50 ns, 5 kHz	NP	PASS

Test Result: All tested units continued to operate as intended. No change in the readings was observed during and after the test.

Заличено по чл.2 от ЗЗЛД

ВЯРНО С ОРИГИНАЛА

7.5. Surge immunity test

Results:	**Pass**
Ref. Standard:	IEC 62052-11 sec. 7.5.6
Test procedure:	IEC 61000-4-5
Temperature:	23°C
Relative humidity:	45%
Athmosph. pressure:	1010 mbar
Performance criteria:	See sec.7.1 (b), (c)

Table 23: Surge Data

No.	Port / Cable Descript.	Test Voltage kV	Type of coupling	Type of Surge, µs	Number of Pulses	EUT perform. during test	Result
1	AC mains	± 1.0 DM	CDN	1.2/50 (8/20)	± 20	NP	PASS
2	Voltage circuit	± 1.0 DM	CDN	1.2/50 (8/20)	± 20	NP	PASS

Test Result: All tested units continued to operate as intended. No change in the readings was observed during and after the test.

7.6. RF conducted immunity test

Results:	**Pass**
Ref. Standard:	IEC 62052-11 sec. 7.5.5
Test procedure:	IEC 61000-4-6
Temperature:	23°C
Relative humidity:	45%
Athmosph. pressure:	1010 mbar
Performance criteria:	See sec.7.1 (a)

Table 24 RF Conducted Immunity Data

No	Port/Cable Description	Type of coupling	Frequency range, MHz	Voltage level, Vrms	Modulation	EUT perform. during test	Result
1	AC mains	CDN	0.15 ÷ 80	10.0	AM 80% 1 kHz	NP	PASS
2	Auxiliary circuit	Coupling clamp				NP	PASS

Test Result: All tested units continued to operate as intended. No change in the readings was observed during and after the test.

Заличено по чл.2 от ЗЗЛД

7.7. Ring wave immunity test

Results:	**Pass**
Ref. Standard:	IEC 62052-11 sec. 7.5.7
Test procedure:	IEC 61000-4-12
Temperature:	23°C
Relative humidity:	45%
Athmosph. pressure:	1010 mbar
Performance criteria:	See sec.7.1 (b)

Table 25: Ring wave Data

No.	Port / Cable Descript.	Test Voltage kV	Type of coupling	Number of Pulses	EUT perform. during test	Result
1	AC mains Voltage circuit	± 1.0 DM	CDN	± 20	NP	PASS
2	AC mains Voltage circuit	± 2.5 CM	CDN	± 40	NP	PASS

Test Result: All tested units continued to operate as intended. No change in the readings was observed during and after the test.

8. Appendix 1: Test equipment used

All measurements equipment is on SII calibration schedule with a recalibration interval not exceeding once a year.

Instrument	Manufac-turer	Model	SII No.	Last calibration date	Next calibration date
CISPR 22					
EMI Receiver 9 kHz - 6.5 GHz	HP	8546A+85460A	4068	06/14	06/15
EMI Analyzer 10 kHz - 26.5 GHz	HP	E7405A	4944	05/14	05/15
EMI Test Receiver 20 Hz - 40 GHz	ROHDE & SCHWARZ	R&S®ESU40	5911	11/13	11/14
LISN 9 kHz – 30 MHz	FCC	LISN-50/250-32-4-16	5023	12/13	12/14
Transient limiter 0.009-200 MHz	Agilent Techn	11947A	3107A03104	08/13	08/14
Antenna Mast	Frankonia	FAM6	5952	N/A	N/A
Metallic turntable	Frankonia	FTM2-2	5952	N/A	N/A
Positioning controller	Frankonia	FCO2	5952	N/A	N/A
Biconilog Antenna 20 MHz - 6000 MHz	ETS Lindgren	3142D-SN:00146488	-	12/13	12/14
IEC 61000-3-3					
AC Power Supply	Elgar	SW 5250A	4684	N/A	N/A
Universal Power Analyzer 230 VAC, 3ph, 30A	Voltech	PM 6000	6501179	08/13	08/14

Заличено по чл.2 от ЗЗЛД

Instrument	Manufac-turer	Model	SII No.	Last calibration date	Next calibration date
IEC 61000-4-2					
ESD Simulator, Contact Disch.: ±0.5 to ±8kV, Air Discharge: ±0.5 to ±15kV	Teseq AG	NSG.435	606332	11/13	11/14
IEC 61000-4-3					
Spectrum Analyzer 9 kHz - 6 GHz	ROHDE & SCHWARZ	R&S®FSL6	5912	06/14	06/15
MXG Analog Microwave Signal generator 100 KHz - 20 GHz	Agilent	N5183A	6501148	05/14	05/16
RF power amplifier 80-1000 MHz, 100W	Amplifier Research	100W1000M1	4883	N/A	N/A
Biconilog Antenna 30 – 2000 MHz	Schaffner	CBL 6112B	5119	01/14	01/15
Horn Antenna High-Gain 0.8 – 4.2 GHz; 20 W	Amplifier Research	AT4002A	4966	N/A	N/A
RF Power Amplifier 0.8 - 4.2 GHz; 25 W	Amplifier Research	25S1G4A	4991	N/A	N/A
Electric Field Probe 100 kHz - 3000 MHz	PMM	EP 330	5448	01/14	01/15
Field Monitor 0.15 - 3000 V/m	Amplifier Research	FM5004	4956	N/A	N/A
Anechoic chamber	Chase	Euroshield	4806	N/A	N/A
IEC 61000-4-4					
Advanced EMC Immunity Sys.	Key-Tek	EMC PRO	4695	10/13	10/14
Capacitive coupling clamp	Key-Tek	CCL-4/S	9412243	N/A	N/A

Заличено по чл.2 от ЗЗЛД

Instrument	Manufac-turer	Model	SII No.	Last calibration date	Next calibration date
IEC 61000-4-5/ IEC 61000-4-12					
ECAT Control Center: Surge generator EFT/Surge Coupler/Decoupler	Key-Tek	ECAT E501A E4553	3751	 06/14 06/14	 06/15 06/15
Advanced EMC Immunity Sys.	Key-Tek	EMC PRO	4695	10/13	10/14
Capacitive coupling clamp	Key-Tek	CCL-4/S	S/N 9412243	N/A	N/A
IEC 61000-4-6					
RF Generator 10 kHz - 1040 MHz	HP	8657A	4923	03/14	03/15
RF Generator 100 KHz - 20 GHz	Agilent	N5183A	6501148	05/13	05/14
RF Generator 10 kHz - 1050 MHz	Fluke	6060B	2384	04/14	04/15
RF power amplifier 10 kHz - 250 MHz; 75 W	Ampl Research	75A250	4847	N/A	N/A
RF power amplifier 150 kHz - 300 MHz; 10 W	ENI	411LA	SII 3757 SN: 797F	N/A	N/A
Oscilloscope 300 MHz	Lecroy	9361	4009	12/13	12/14
CDN 150 kHz – 230 MHz	FCC	801-M3-16	51906	11/13	11/14
CDN 150 kHz – 230 MHz	Schaffner	CDN M325	5122	11/13	11/14
Attenuator 6 dB, 50W	Huber-Suhner AG	5906.17.006	S/N 302789	08/13	08/14
Bulk Current Injection Probe 10 kHz – 230 MHz	FCC	F-120-9A	53923	11/13	11/14

Заличено по чл.2 от ЗЗЛД

9. Appendix 2: Antenna factor and cable loss

Cable Loss (10m cable + Mast)

Point	Frequency (MHz)	Cable Loss (dB)	Point	Frequency (MHz)	Cable Loss (dB)	Point	Frequency (MHz)	Cable Loss (dB)
1	30	0.53	15	700	3.06	28	1700	4.85
2	50	0.75	16	750	3.201	29	1800	4.98
3	100	1.08	17	800	3.27	30	1900	5.19
4	150	1.39	18	850	3.38	31	2000	5.34
5	200	1.61	19	900	3.46	32	2100	5.51
6	250	1.752	20	950	3.55	33	2200	5.69
7	300	2.00	21	1000	3.68	34	2300	5.89
8	350	2.15	22	1100	3.82	35	2400	6.07
9	400	2.26	23	1200	4.07	36	2500	6.22
10	450	2.383	30	1900	5.19	37	2600	6.28
11	500	2.52	24	1300	4.24	38	2700	6.41
12	550	2.606	25	1400	4.43	39	2800	6.53
13	600	2.75	26	1500	4.6	40	2900	6.84
14	650	2.856	27	1600	4.7			

Antenna Factor
Biconilog Antenna, MFR ETS Lindgren, Type/Model 3142D, S/N: 00146490, 3 m distance

No.	f / MHz	AF / dB/m	f / MHz	AF / dB/m	f / MHz	AF / dB/m
1	30	18.7	250	12.0	2750	31.0
2	35	15.7	300	13.8	3000	31.2
3	40	12.9	400	16.2	3250	32.7
4	45	10.6	500	18.6	3500	34.5
5	50	9.0	600	20.2	3750	34.3
6	60	7.3	700	21.8	4000	34.5
7	70	7.7	800	22.9	4250	35.3
8	80	8.2	900	24.1	4500	35.5
9	90	9.2	1000	24.8	4750	36.1
10	100	9.4	1250	26.9	5000	37.4
11	120	8.5	1500	30.2	5250	38.4
12	140	8.5	1750	28.5	5000	39.9
13	160	9.1	2000	28.9	5750	38.2
14	180	10.5	2250	29.8	6000	39.1
15	200	10.9	2500	32.5		

Заличено по чл.2 от ЗЗЛД

10. Appendix 3: Measurement uncertainty

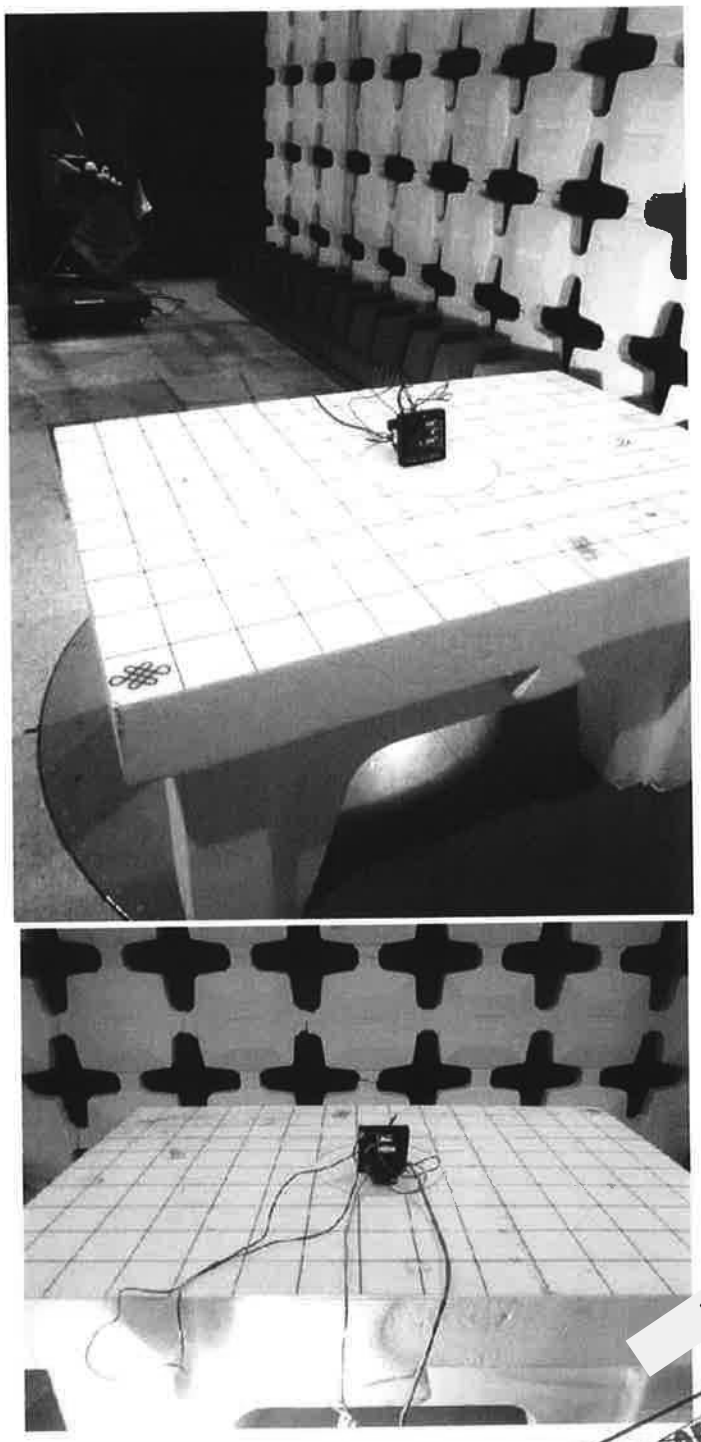
The test equipment has been calibrated according to its recommended procedures and is within the manufacturer's published limit of error.
The laboratory calibrates its standards by a third party (traceable to NIST, USA) on a regular basis according to equipment manufacturer requirements.
In the following table the uncertainty calculation is given.
Calculated uncertainty U_{LAB} are less than U_{CISPR}, therefore compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit.

Type of disturbance Test description	**Calculated uncertainty U_{LAB}**	**U_{CISPR}**
Conducted disturbance at mains port (9 kHz to 150 kHz)	3.3 dB	3.8 dB
Conducted disturbance at mains port (150 kHz to 30 MHz)	2.8 dB	3.4 dB
Disturbance power (30 MHz to 300 MHz)	3.3 dB	4.5 dB
Radiated disturbance (electric field strength at an OATS at 10 m distance) (30 MHz to 1 000 MHz)	4.18 dB	6.3 dB
Radiated disturbance (electric field strength in a SAR at 3 m distance) (30 MHz to 1 000 MHz)	4.32 dB	6.3 dB
Radiated disturbance (electric field strength in a FAR) (1 GHz to 6 GHz)	4.47 dB	5.2 dB
Radiated disturbance (electric field strength in a FAR) (6 GHz to 18 GHz)	4.47 dB	5.5 dB

The expanded uncertainty at a level of 95% confidence is obtained by multiplying the combined standard uncertainty by coverage factor of 2.

Заличено по чл.2 от ЗЗЛД

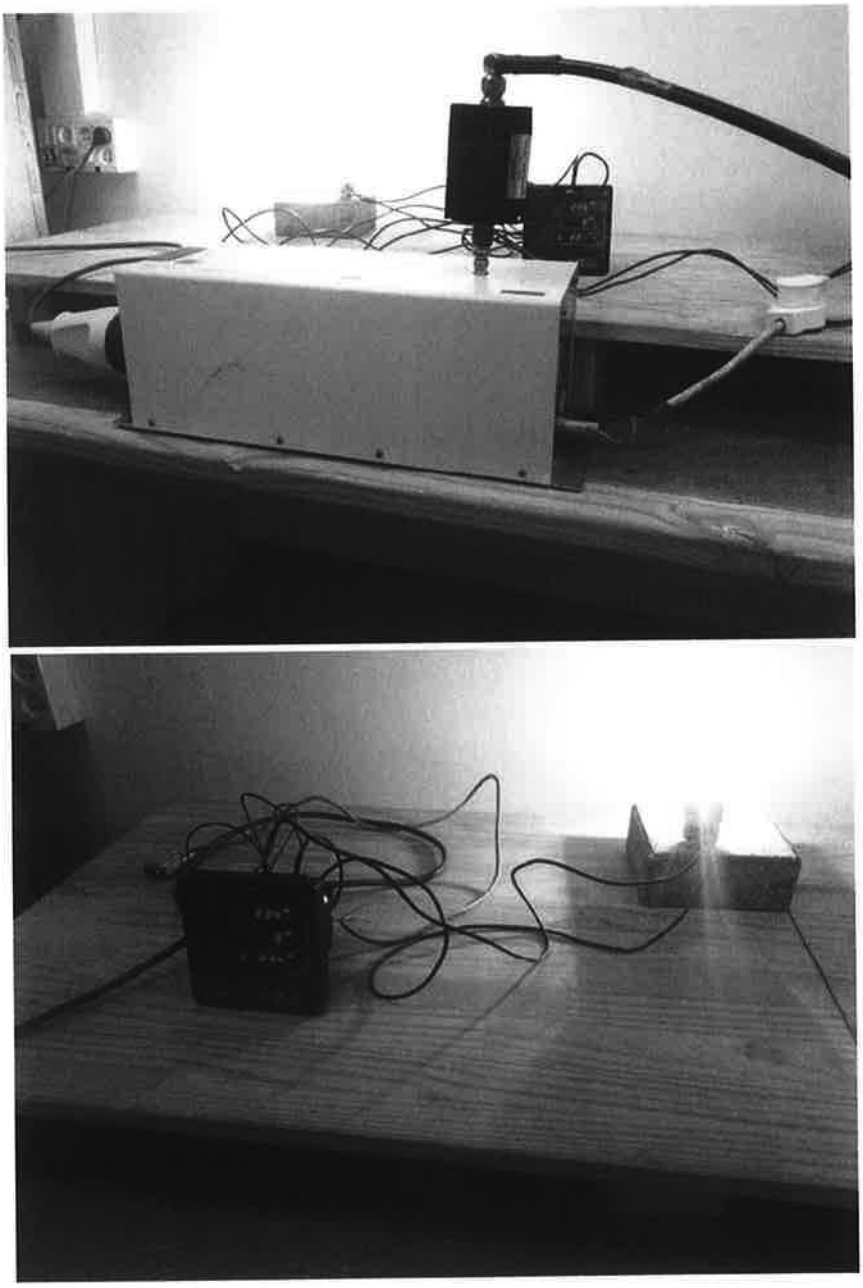
11. Appendix 4: Test illustrations



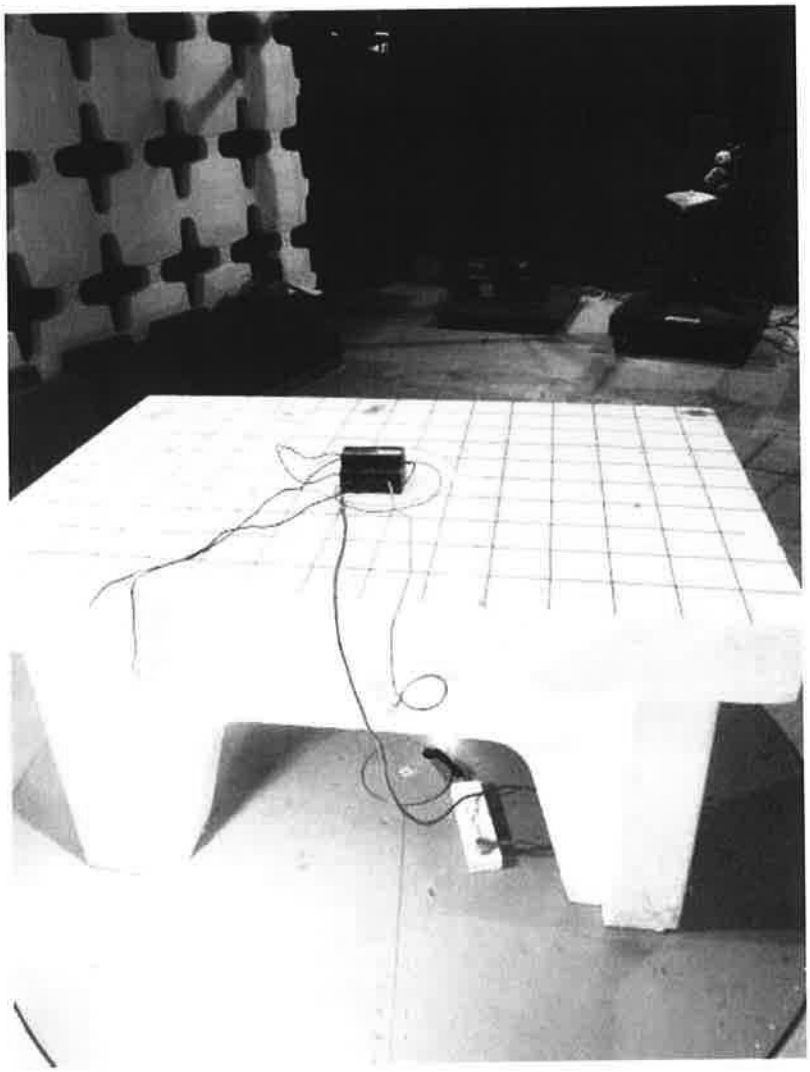
Picture #1 PM 130 Plus Radiated emission test

Picture #2
PM 130 Plus Radiated emission test setup

Заличено по чл.2 от ЗЗЛД



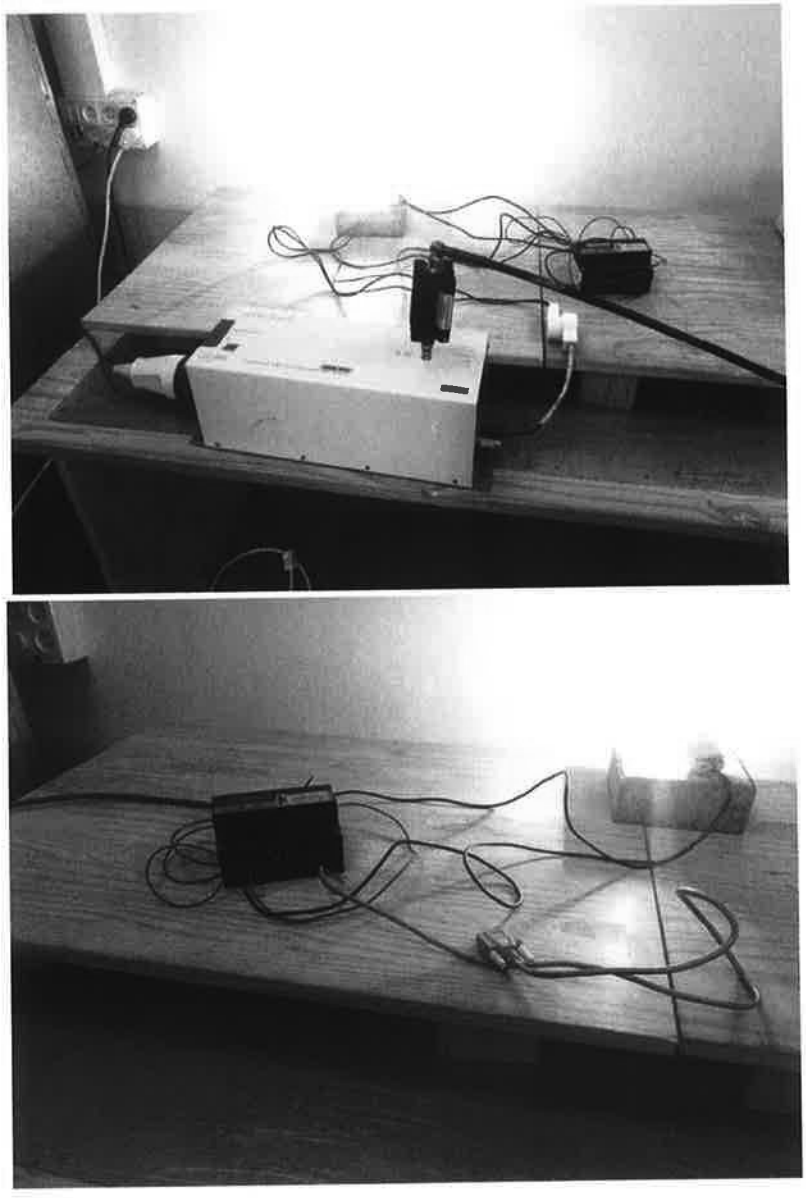
Picture #3 PM 130 Plus Immunity test setup



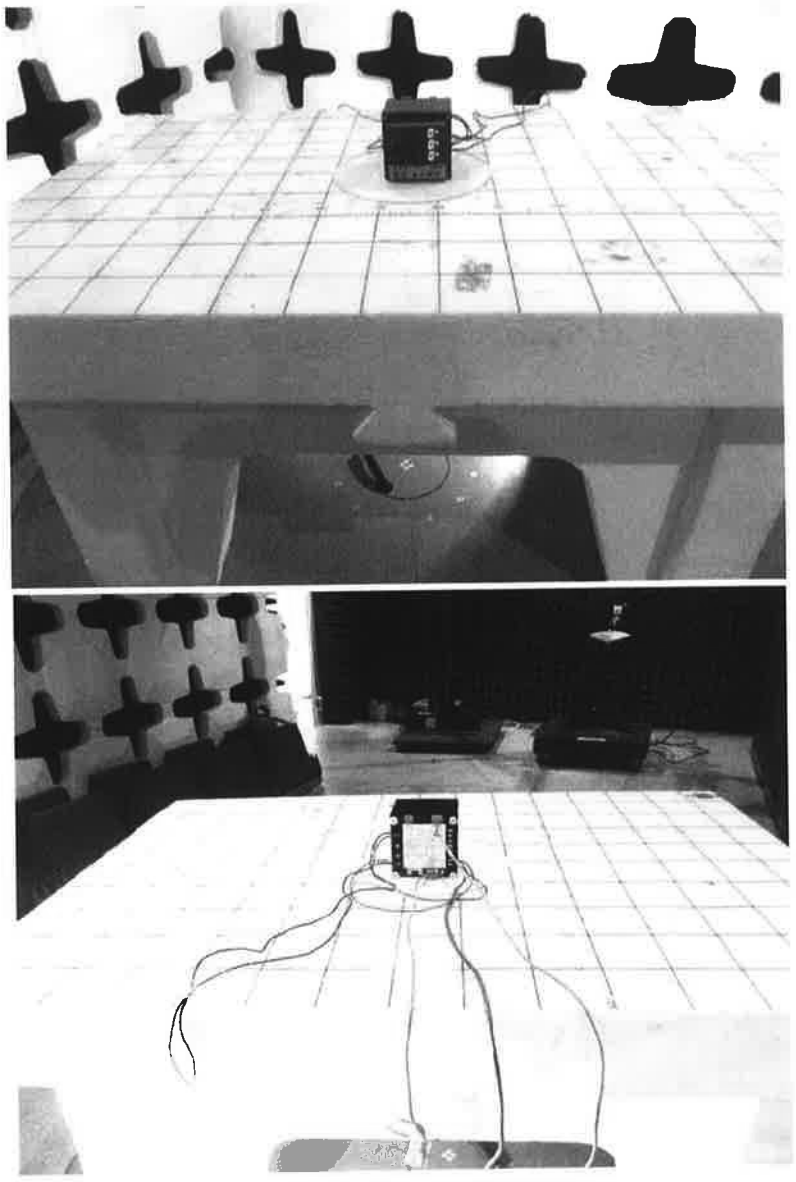
Picture #4
EM133 Radiated emission test setup

Заличено по чл.2 от ЗЗЛД

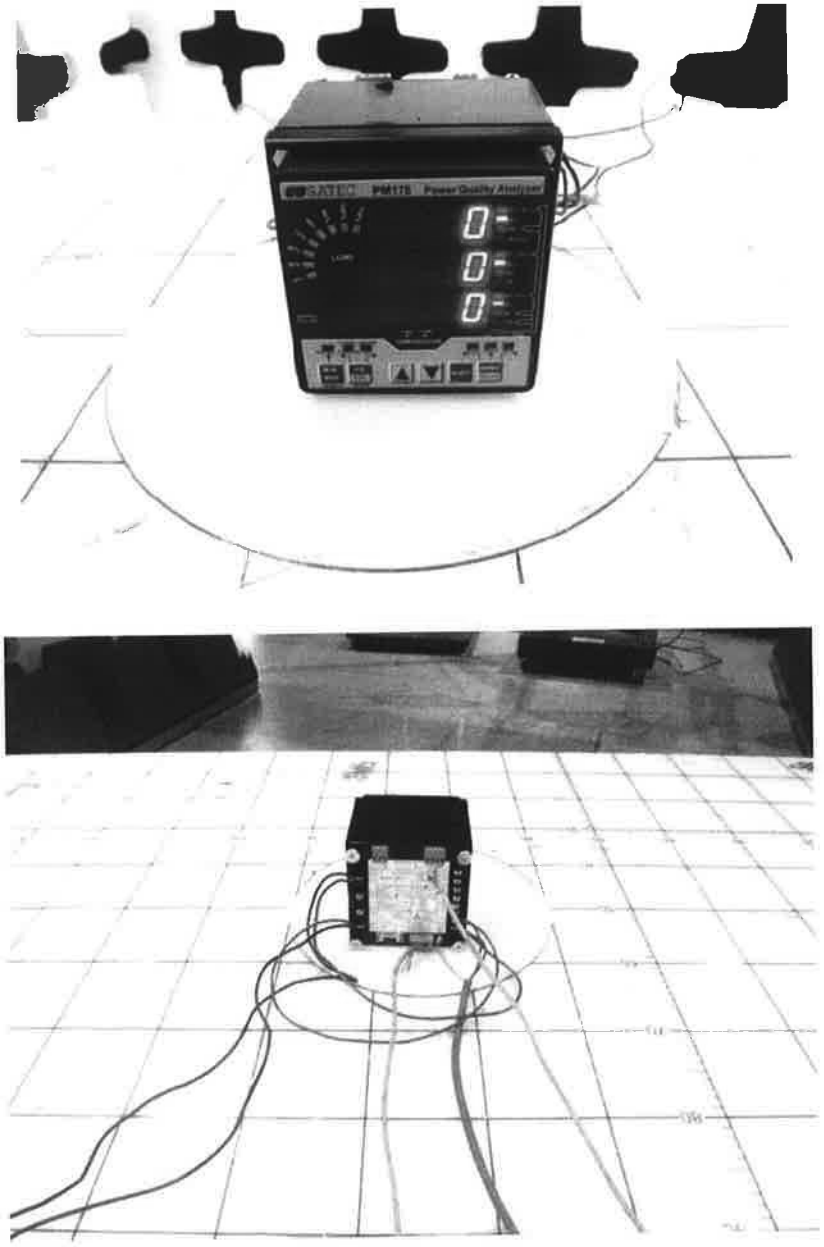
Picture #5
EM133 Radiated emission test setup



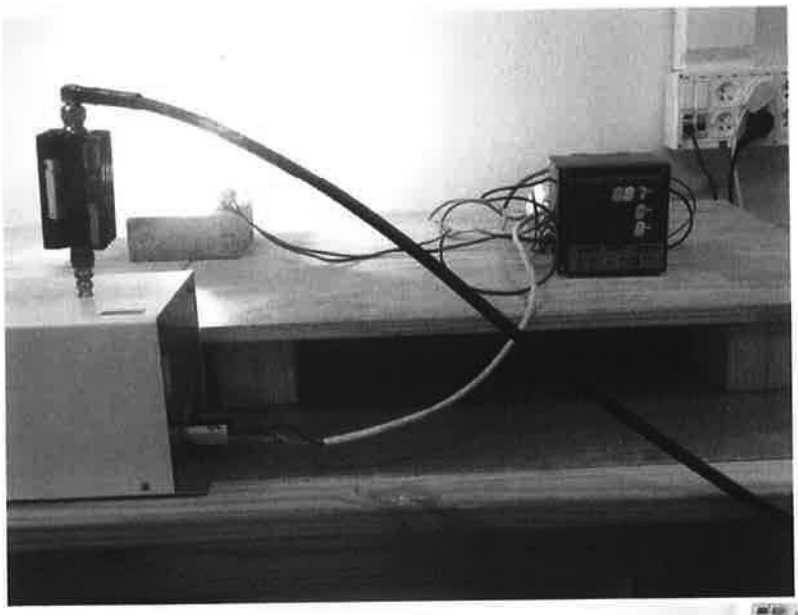
Picture #6 EM133 Immunity test setup

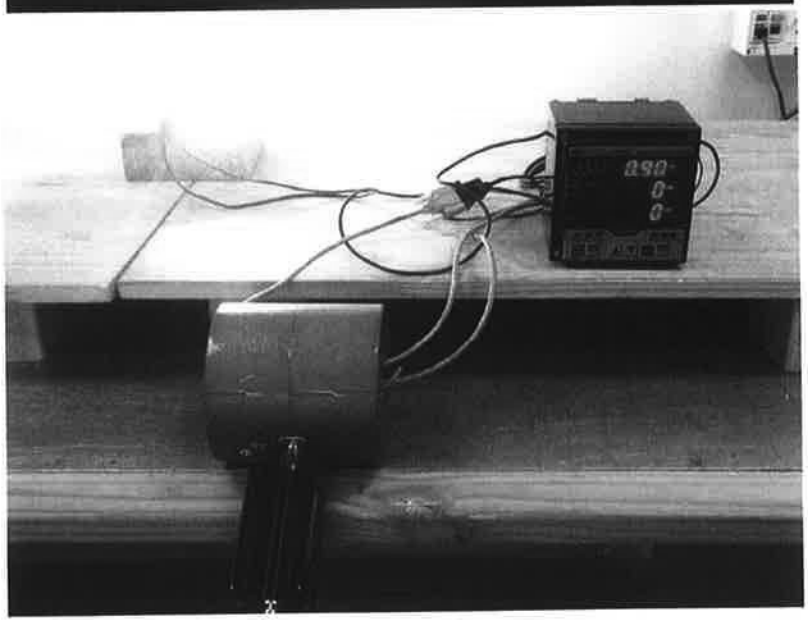


Picture #7
PM175 Radiated emission test setup

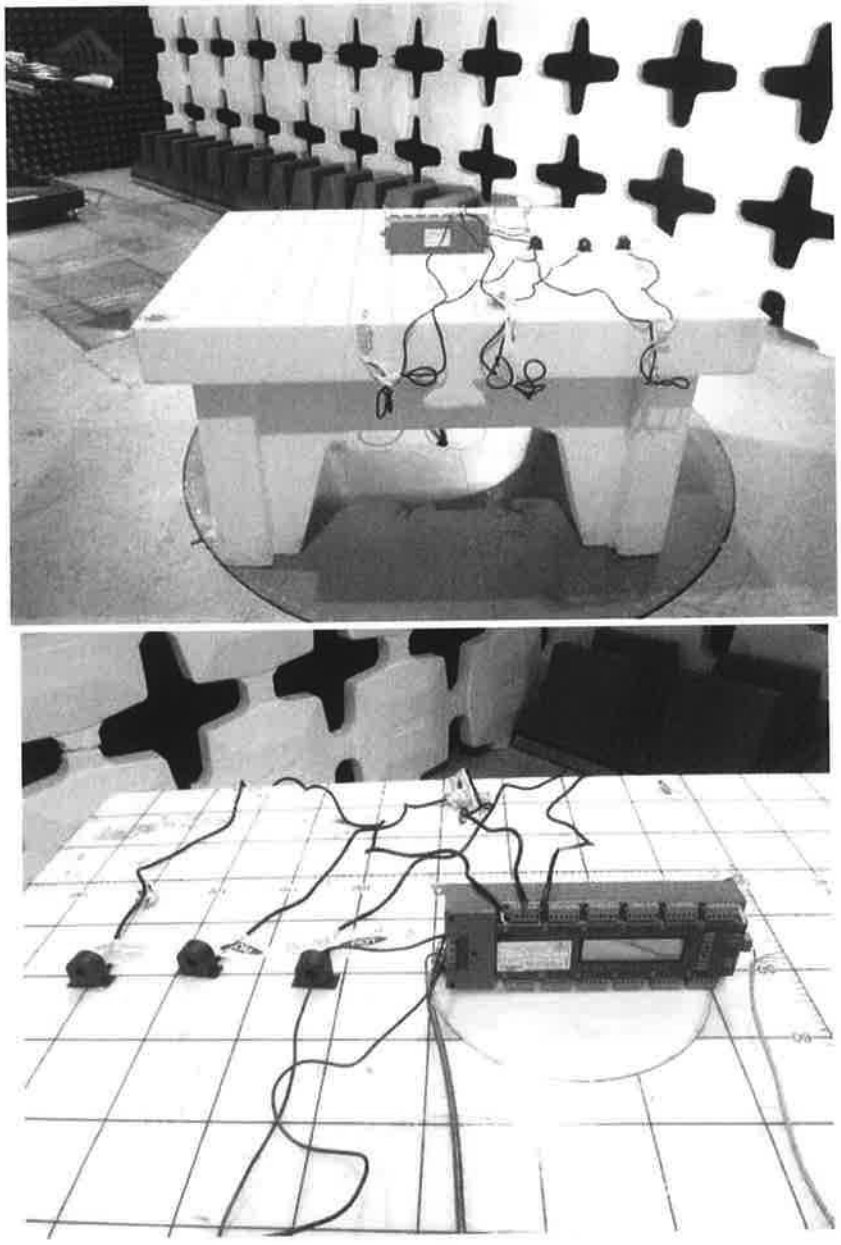


Picture #8
PM175 Radiated emission test setup





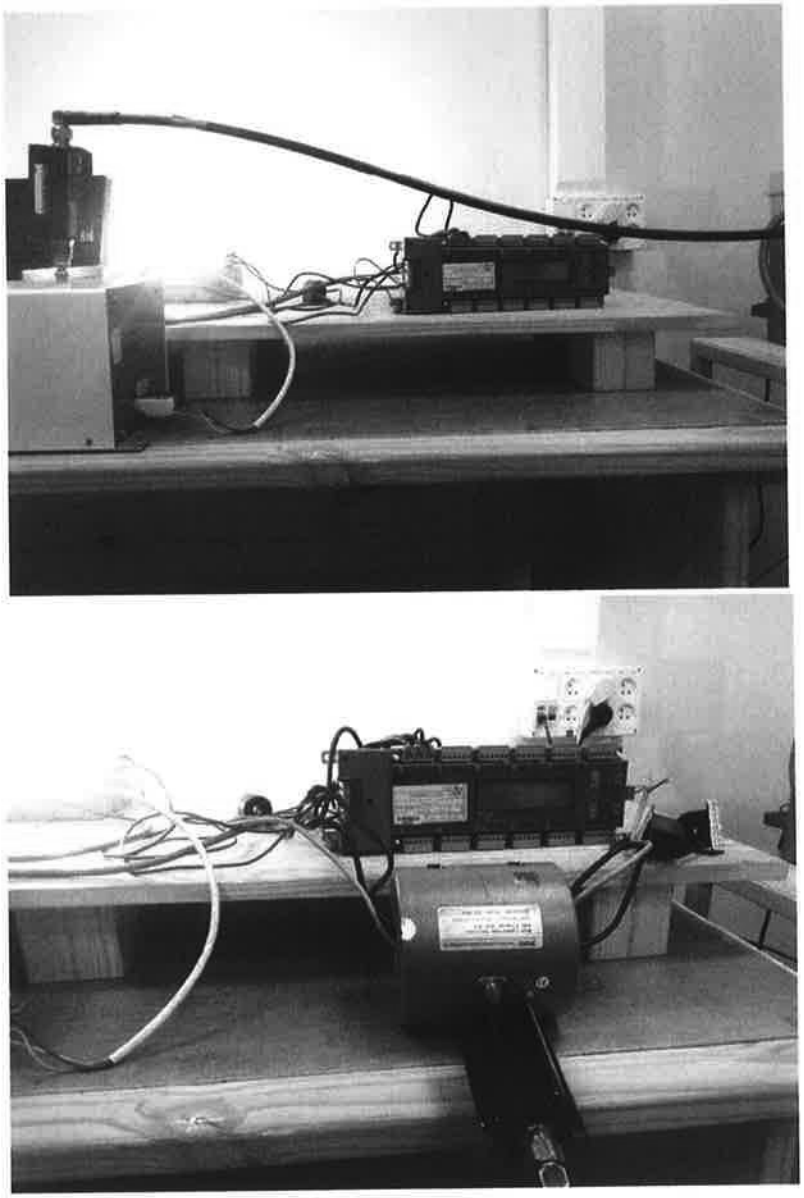
Picture #9 PM175 Immunity tests



Picture #10 BFM136 Radiated emission test setup

Заличено по чл.2 от ЗЗЛД

Picture #11
BFM136 Radiated emission test setup



Picture #12 BFM136 Immunity tests

Electromagnetic Compatibility
Test Report

Test Report No: STC 070711
Issued on: July 07, 2011

Product Name
The Expertmeter™ EM133 Series
S/N 12345685

Tested According to
IEC 62052-11 Edition 1: 2003
IEC 60688 Edition 2.2: 2002

Tests Performed for
SATEC Ltd.
Har Hotzvim, P.O.Box 45022, Jerusalem 91450
Phone: +972-2-541100

QualiTech EMC Laboratory, ECI Telecom
30 Hasivim Street,
Petah-Tikva, 49517, Israel
Tel: +972-3-926 8443
Fax: +972-3-928 7490

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Certificate 1633.01
Electrical Testing

Test Personnel

Tests Performed By: ---------- ----------

Michael Sergey Kapustin

Report Prepared By: ---------- ----------

Bina Ta

Report Reviewed By: ---------- ----------

Rami
EMC **nager**
Quali **C Laboratory**

Test Report Details:

Test commencement date:	21.06.2011
Test completion date:	28.06.2011
Customer's representative:	Ilya Jacobi
Issued on:	07.07.2011

Assessment Information:

This report contains an assessment of the EUT against Electromagnetic Compatibility based upon tests carried out on the samples submitted. The results contained in this report relate only to the items tested. Manufactured products will not necessarily give identical results due to production and measurement tolerances. QualiTech, EMC Lab does not assume responsibility for any conclusion and generalization drawn from the test results with regards to other specimens or samples of type of the equipment represented by test item.

The EUT was setup and exercised using the configuration, modes of operation and arrangements defined in this report only.

Customer's declaration:

All the information and test results presented in Appendix A were provided by SATEC Ltd. and the relevant testing was performed by the SATEC staff in QualiTech Lab.

Modifications:

Modifications made to the EUT

None

Modifications made to the Test Standard

None

Summary of Compliance Status

The EUT was tested according to the following test methods.
Test results are given in full in sections 3÷14.

Emission Tests

Test type	Applied on	Test Method	Class applied	Frequency Range	Test results
Radiated Emission	System	CISPR 22	B	30MHz÷1GHz	Comply
Conducted Emission	230 VAC	CISPR 22	A	150kHz÷30MHz	Comply
	3 Phase AC	CISPR 22	B	150kHz÷30MHz	Comply
	RS485	Not applicable			
	Input	Not applicable			
	Output	Not applicable			

Immunity Tests

Test type	Applied on	Test Method	Frequency Range/ application type	Test Voltage/ Stress	Performance Criteria applied	Test results
ESD	Enclosure	IEC 61000-4-2 IEC 62052-11/7.5.2	Contact	±8kV	B	Comply
			Air	±15kV	B	Comply
Radiated Immunity	System	IEC 61000-4-3 IEC 62052-11/7.5.3	80MHz ÷ 1GHz	10V/m	A	Comply
			1GHz ÷ 2GHz	10V/m	A	Comply
			80MHz ÷ 1GHz	30V/m	A	Comply
			1GHz ÷ 2GHz	30V/m	A	Comply
EFT	230 VAC	IEC 61000-4-4 IEC 62052-11/7.5.4	-	±4kV	A	Comply
	3 Phase AC		-	±4kV	A	Comply
	RS485		-	±2kV	A	Comply
	Input		-	±2kV	A	Comply
	Output		-	±2kV	A	Comply
Surge	230 VAC	IEC 61000-4-5 IEC 62052-11/7.5.6	Line to Line	±4kV	A	Comply
	3 Phase AC		Line to Line	±4kV	A	Comply
	RS485		Not applicable			
	Input		Not applicable			
	Output		Line to Line	±4kV	A	Comply
Conducted Immunity	230 VAC	IEC 61000-4-6 IEC 62052-11/7.5.5	150kHz÷80MHz	10Vrms	A	Comply
	3 Phase AC		150kHz÷80MHz	10Vrms	A	Comply
	RS485		150kHz÷80MHz	10Vrms	A	Comply
	Input		150kHz÷80MHz	10Vrms	A	Comply
	Output		150kHz÷80MHz	10Vrms	A	Comply
Magnetic Field	System	IEC 61000-4-8	50Hz	400A/m	A	Comply
Oscillatory Waves	230 VAC	IEC 61000-4-12 IEC 62052-11/7.5.7	Line to Line	± 1	A	Comply
			Line to Earth	± 2.5	A	Comply
	3 Phase AC		Line to Line	± 1	A	Comply
			Line to Earth	± 2.5	A	Comply
	DO		Line to Line	± 1	A	Comply
			Line to Earth	± 2.5	A	Comply

Test type	Applied on	Test Method	Frequency Range/ application type	Test Voltage/ Stress	Performance Criteria applied	Test results
Ambient temperature	-	IEC 60688 section 6.4	-	4kVrms/1min	A	**Comply**
AC Voltage insulation	-	IEC 61010-1 IEC 62052-11/7.3.3	-	4kVrms/1min	A	**Comply**
			-	4kVrms/1min	A	**Comply**
			-	4kVrms/1min	A	**Comply**
Impulse Voltage tests	All Terminals connected together	IEC 60688 /6.20 IEC 62052-11/7.3.2	-	6 kV	A	**Comply**
	3 Phase AC		-	6 kV	A	**Comply**
	1 Phase AC		-	6 kV	A	**Comply**

ACCREDITED
Certificate 1633.01
Electrical Testing

Заличено по чл.2 от ЗЗЛД

Table of Contents

1. General

1.1. Purpose:

The purpose of this report is to show compliance to Electromagnetic Emission and Immunity requirements outlined in the referenced specifications. ***This report serves as the basis for the "Declaration of Conformity".***

1.2. Referenced documents:

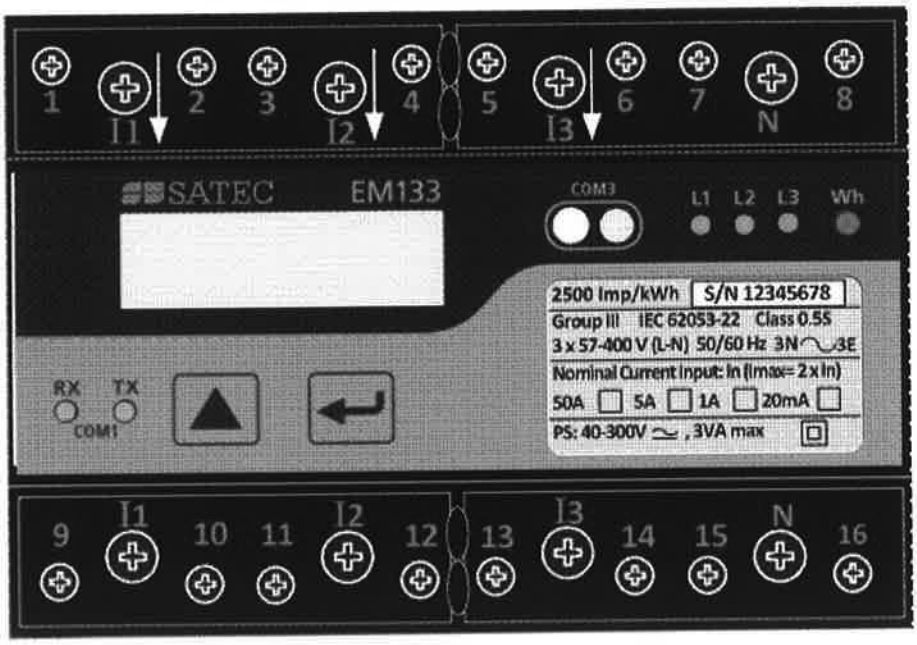
IEC 62052-11:2003	Electricity metering equipment (AC) – General requirements, tests and test conditions – Part 11: Metering equipment
IEC 60688:2002	Electrical measuring transducers for converting a.c. electrical quantities to analogue or digital signals
IEC 62053-22:2003	Electricity metering equipment (a.c.) – Particular requirements – Part 22: Static meters for active energy (classes 0,2 S and 0,5 S)
IEC 62053-23:2003	Electricity metering equipment (a.c.) - Particular requirements -- Part 23: Static meters for reactive energy (classes 2 and 3) IEC 62053-23:2003
CISPR 22: 2006 AS/NZS CISPR 22:2006	Information Technology Equipment – Radio disturbance characteristics - Limits and Methods of Measurement.
IEC 61000-4-2:2001-04	Electrostatic Discharge (ESD) Immunity test
IEC 61000-4-3:2008	Electro magnetic compatibility (EMC), Section 3: Radiated, radio frequency, electromagnetic field immunity IEC test
IEC 61000-4-4:2007	Electro magnetic compatibility (EMC), Section 4: Electrical fast transient/burst immunity test
IEC 61000-4-5:2005	Electromagnetic compatibility (EMC), Section 5: Surge immunity test
IEC 61000-4-6:2008	Electromagnetic compatibility (EMC), Section 6: Immunity to conducted disturbances, induced by radio- frequency fields
IEC 61000-4-8:2001	Power Frequency Magnetic Field Immunity

1.3. Description of the EUT system:

General description of the EUT, configuration used for Emission and Immunity testing, and the method of performance verification were defined by the manufacturer. The acceptance performance criterion was declared by the manufacturer.

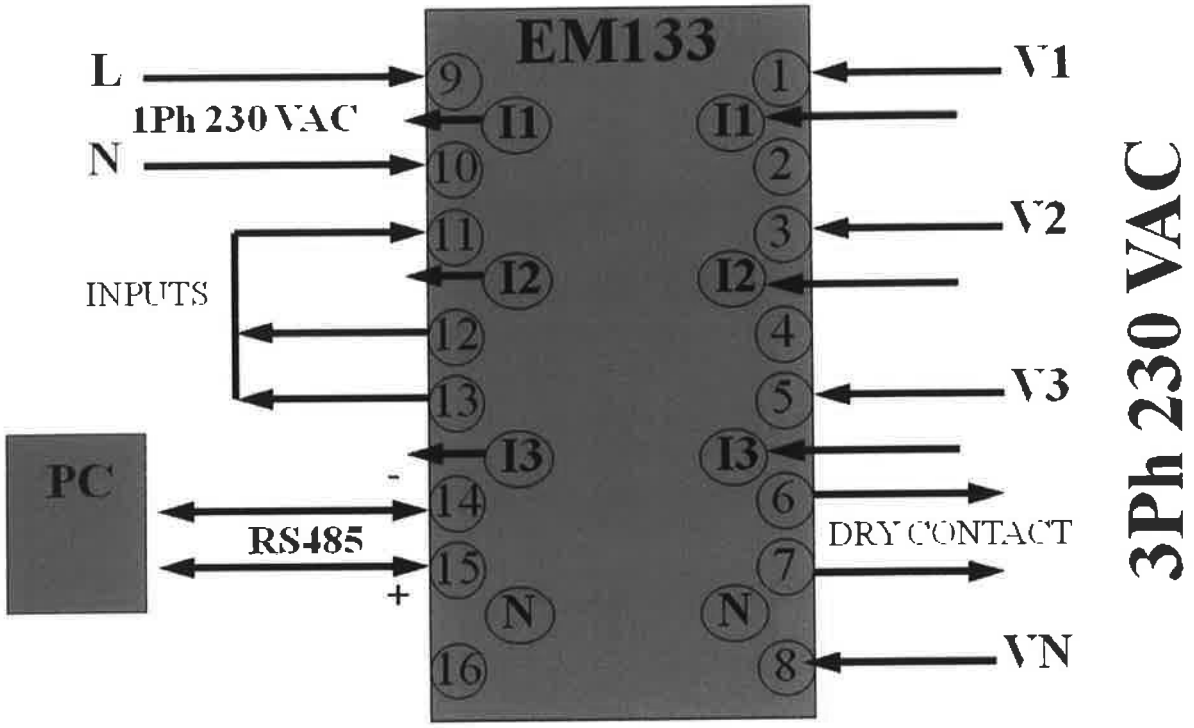
1.3.1. General Description:

The EM133 is a compact, Din Rail Smart Mater, three-phase AC Powermeter specially designed to meet the requirements of users ranging from electrical panel builders to substation operators.
The Din Rail Smart Meter, EM133 designed for acquiring real time analog inputs through 3 phase 3 wire CT/PTs circuits/ 3 phase 4 wire CT/PTs circuits.
The EM133 – SATEC Smart DIN Rail Meter is built of standard LCD display (16 characters x 2), all necessary Hardware to handle all Power Measurements that includes I/O and communication ports: 2 x Digital Inputs, 1 x Relay Output, RS-485 and IR (optional) communication ports.



1.3.2. EUT Configuration:

EUT Configuration for Emissions & Immunity Testing:



1.3.3. EUT Cards/Modules List:

No	Hardware Component	Manufacturer's Catalog Number	Serial Number	Hardware Revision	Quantity
1	Analog Board	AP1065/1071/1075	PC0284	A3	1
2	Logic Board	AP1067	PC0285	A1	1
3	Display	AP1069	PC0286	A1	1

1.3.4. Cables Identification:

Port/Line Name @ EUT	Type	Indoor/ outdoor	Impedance [Ohm]	Typical Length [m]	Tested Length [m]	# of ports/ boards available	# of ports/ boards connected	From	To
Voltage circuits	3 x Phases unshielded	Indoor	>1M	1	1	1	1	Common 3 phase Energy source	Voltage input
Current circuits	3 pairs unshielded	Indoor	<0.10	1	1	1	-	-	Current input
Auxiliary Voltage Input	Single Phase unshielded	Indoor	>160	1	1	1	1	Phase Energy source	Voltage Inlet
RS485	Unshielded	Indoor	>100	-	6	1	Terminal	-	PC
Dig. Input	Unshielded	Indoor	>350	-	1.5	2	Terminal	-	-
Dig. Output	Unshielded	Indoor	<0.10	-	1.5	1	Terminal	-	-

1.3.5. Clock Frequencies Table:

Frequency [MHz]	Location
0.032	Logic
8	Logic

1.3.6. Method of Performance verification:

During all Immunity Tests EUT was under constant observation for normal performance.
Voltage from the energy source was applied to voltage circuits V1-V3, VN; 3 pairs current circuits were connected according standards requirements; all peripheral connection – Communication port, dig. Inputs/Outputs were connected and controlled by external PC. EUT provided the measurement of the energy supplied by the common energy source. Display readings, Errors and alarms were verified.

1.3.7. EUT Pass/Fail criteria for immunity tests:

General performance criteria:

Performance Criterion A:

The EUT shall continue to operate as intended. No degradation of performance or loss of functionality is allowed below a performance level specified by the manufacturer.
Normal Performance for criteria A is specified as:

- *The EUT shall continue to operate as intended. No degradation of performance or loss of functionality is allowed below a performance level specified by the manufacturer.*
- *For the standard PASS criterion details and verification tests results see Appendix A.*

Performance Criterion B:

The EUT shall continue to operate as intended after the test. No degradation of performance or loss of functionality is allowed below a performance level specified by the manufacturer. During the exposure to electromagnetic phenomenon, degradation of performance is, however allowed. No change of actual operation state or stored data is allowed.
Minimum performance level for criteria B is specified *as:*

- *The EUT shall continue to operate as intended after the test. No degradation of performance or loss of functionality is allowed below a performance level specified by the manufacturer. During the exposure to electromagnetic phenomenon, degradation of performance is, however allowed.*
- *No change of actual operation state or stored data is allowed.*
- *For the standard PASS criterion details and verification tests results see Appendix A.*

Performance Criterion C:

Temporary loss of functionality is allowed provided the function is self- recoverable or can be restored by the operation of the controls.

Performance Criterion R:

The equipment shall withstand the test without damage or other disturbance (such as corruption of software or disoperation of fault protection facilities) and shall operate properly within specified limits after the transient electromagnetic stress has ceased. *It is not necessary to operate properly while the test condition is present.* The exposure may cause the operation of fuses or other specified devices, which have to be replaced or reset before normal operation is restored.

2. Test Facility & Uncertainty of Measurement

2.1. Accreditation/ Registration reference:

- *A2LA Certificate Number: 1633.01*

2.2. Test Facility description

The tests were performed at the EMC Laboratory, QualiTech Division, ECI Telecom

Address: 30, Hasivim Street, Petah Tikva, Israel.
Tel: 972-3-926-8443

3m Anechoic Chamber:

The 3m-screened chamber is used in two configurations: the semi-anechoic configuration for Radiated Emission measurements and the full-anechoic configuration for Radiated Immunity tests.

Semi Anechoic Configuration:

Measurement distance	3m
Chamber dimensions	9.5m x 6.5m x 5.2m
Antenna height	1 - 4m
Shielding Effectiveness	Magnetic field ≥80dB at 15 kHz ≥90dB at 100 kHz Electric field >120dB from 1MHz to 1GHz >110dB from 1GHz to 10GHz
Absorbing material	Ferrite tiles on the walls and ceiling Frankonia hybrid absorbing material in selected positions on the walls
Normalized Site Attenuation measured at 5 positions	±3.49dB, 30MHz to 1GHz
Transmission Loss measured at 5 positions, at 1.5m height	±3dB, 1GHz to 18GHz

Full-Anechoic Configuration:

Measurement distance	3m
Chamber dimensions	7m x 4m x 3m
Antenna height	1.55m at Horizontal & Vertical polarizations
Shielding Effectiveness	Magnetic field ≥80dB at 15 kHz ≥90dB at 100 kHz Electric field >120dB from 1MHz to 1GHz >110dB from 1GHz to 10GHz
Absorbing material	Ferrite tiles on the walls and ceiling Frankonia hybrid absorbing material in selected positions on the walls and floor
Field Uniformity to EN61000-4-3	±3dB 80MHz to 18GHz

2.3. Uncertainty of Measurement:

Test Name	Test Method & Range	Uncertainty	
		Combined std. Uc(y)	Expanded U
Radiated Emission	30MHz÷230MHz, Horiz. polar. 30MHz÷230MHz, Ver. polar. 230MHz÷1000MHz, Horiz. polar. 230MHz÷1000MHz, Vert. polar.	[dB] 1.8 1.967 1.487 1.499	[dB] 3.6 3.934 2.973 2.998
Conducted Emission	9 kHz÷150 kHz 150 kHz÷30MHz	[dB] 1.378 1.095	[dB] 2.756 2.190

Note: Note: QualiTech, ECI Telecom expanded measurement instrumentation uncertainty Ulab is 3.934dB for radiated emissions and Ulab is 2.756dB for conducted emissions which are both less than the Ucispr values of 5.2dB for radiated emissions and the Ucispr values of 4.0dB for conducted emissions. Therefore, we have less uncertainty than the industry norm and compliance is deemed to occur as no measured disturbance exceeds the disturbance limit.
Note: The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%.

3. Electric Field Emission Measurements

Date of Test: 26.06.2011
Relative Humidity: 54%
Ambient Temperature: 21°C
Atmospheric Pressure: 1011.4 hPa

Test Method: CISPR22 limits according to IEC 62052-11 section 7.5.8

Limits:

30MHz to 1GHz frequency range

Frequency [MHz]	QP Limit [dBµV /m] [Class A]	QP Limit [dBµV /m] [Class B]
30÷230	50	40
230÷1000	57	47

Test Procedure:

Measurements were performed at a 3-meter measurement distance in the semi-anechoic chamber in order to evaluate the radiated electromagnetic interference characteristics of the EUT. The EUT was placed on a non-metallic table, 0.8m above the turntable, was configured, arranged and operated in a manner consistent with typical application and load conditions. The test program of exercising the equipment ensured that various parts of the EUT were exercised to permit detection of all EUT disturbances.
An appropriate antenna depending upon the frequency range was used. While the turntable was being rotated, the height of the antenna was varied from 1 to 4m for the frequency range of 30MHz to 1GHz. The highest radiated emission was detected by manipulating the system cables to the worst-case position. This process was repeated for both antenna polarizations.
The amplitudes of worst-case emission were measured with the QP detector using resolution-bandwidth per CISPR16-1.

List of Test Equipment:

Semi Anechoic Chamber, 9.5m[L] x 6.5m[W] x 5.2m[H]
HP8546A, CISPR16 EMI Receiver
HP8593EM EMC Analyzer
Schwarzbeck VHBB9124, Biconical Antenna
Schwarzbeck VUSLP9111, LogPeriodic Antenna

Test Details:

Interference	Frequency Range	Measurement Means	Test Setup No.	Photograph No.	Plot Nos.
Electric Field	30MHz÷1GHz	Biconical, Log-periodic &	Fig.3	Photo.3	3.1-3.4

Test Results:

Table 3: Frequency range 30MHz÷1GHz

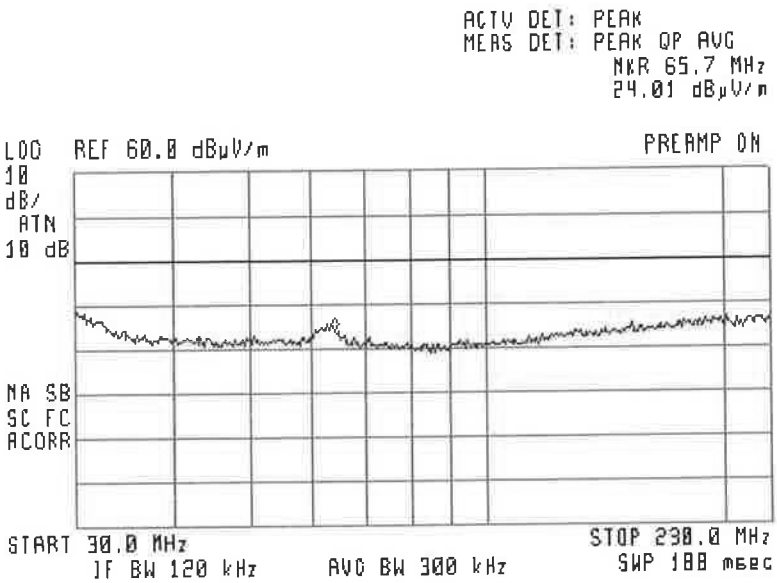
Frequency [MHz]	Ant. Type	Ant. Pol.	Ant. Pos. [cm]	Turn-table Azimuth [°]	Radiated Emission dB(μV/m)	Limit at 3m dB(μV/m)	Margin [dB]	Pass/ Fail
32.398050	Biconical	V	231	87	21.2	40	-18.8	Pass
63.928775	Biconical	V	348	269	22.1	40	-17.9	Pass
239.990825	Log-periodic	H	107	240	30.2	47	-16.8	Pass
272.355425	Log-periodic	H	106	34	27.2	47	-19.8	Pass
360.018950	Log-periodic	V	100	264	27.0	47	-20	Pass
942.327475	Log-periodic	V	100	241	29.1	47	-17.9	Pass

Note: Radiated Emission [dBμV/m] = measured [dBμV] + Correction-factor [dB(1/m)]
Correction Factor = Antenna factor + Cable Loss

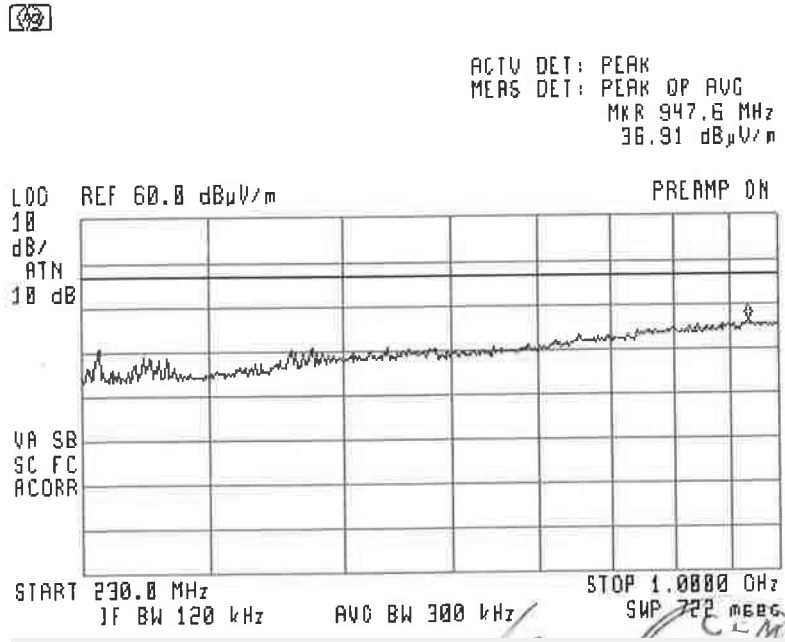
Summary:

Frequency Range	Test method reference	Class Limits applied	Test Results	Remarks
30MHz÷1GHz	EN55022, Sec. 8 & 10	B	Tab. 3	Pass

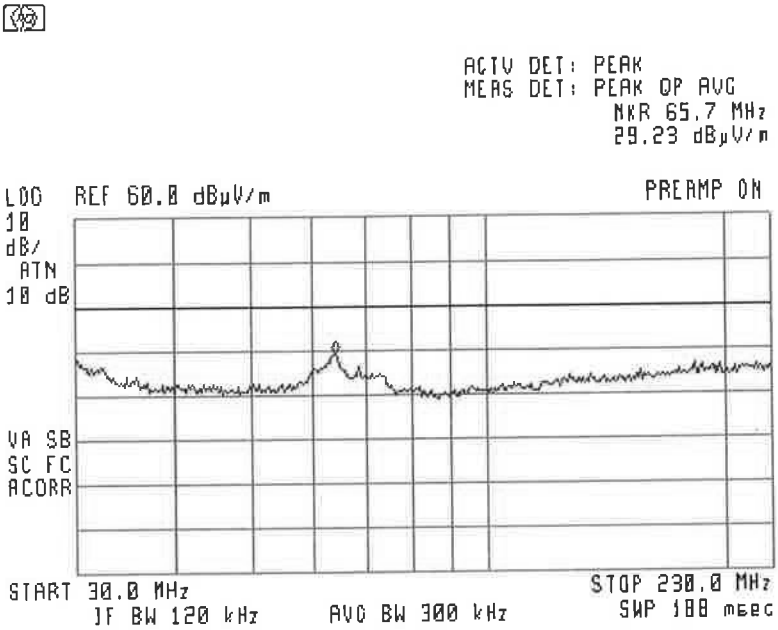
Horizontal Polarization
30MHz-230MHz
Plot 3.1



Horizontal Polarization
230MHz-1GHz
Plot 3.2



Vertical Polarization
30MHz-230MHz
Plot 3.3



Vertical Polarization
230MHz-1GHz
Plot 3.4

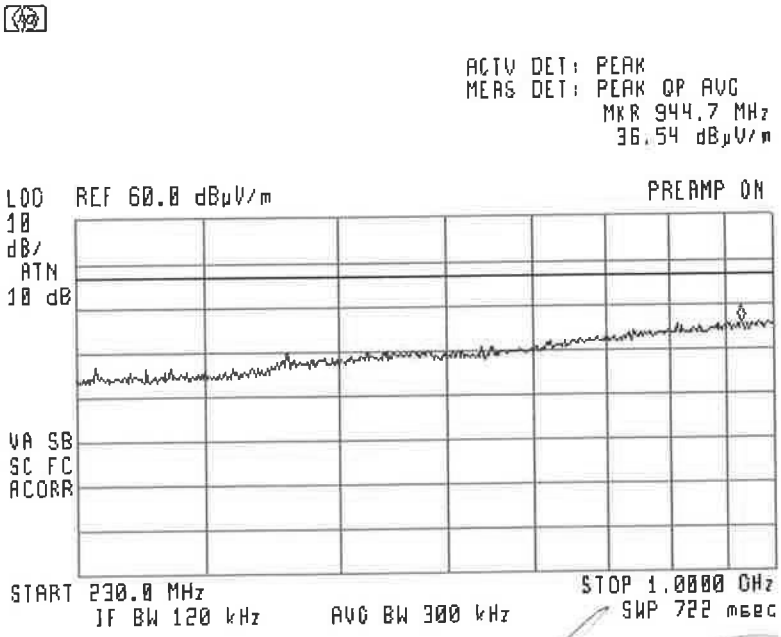
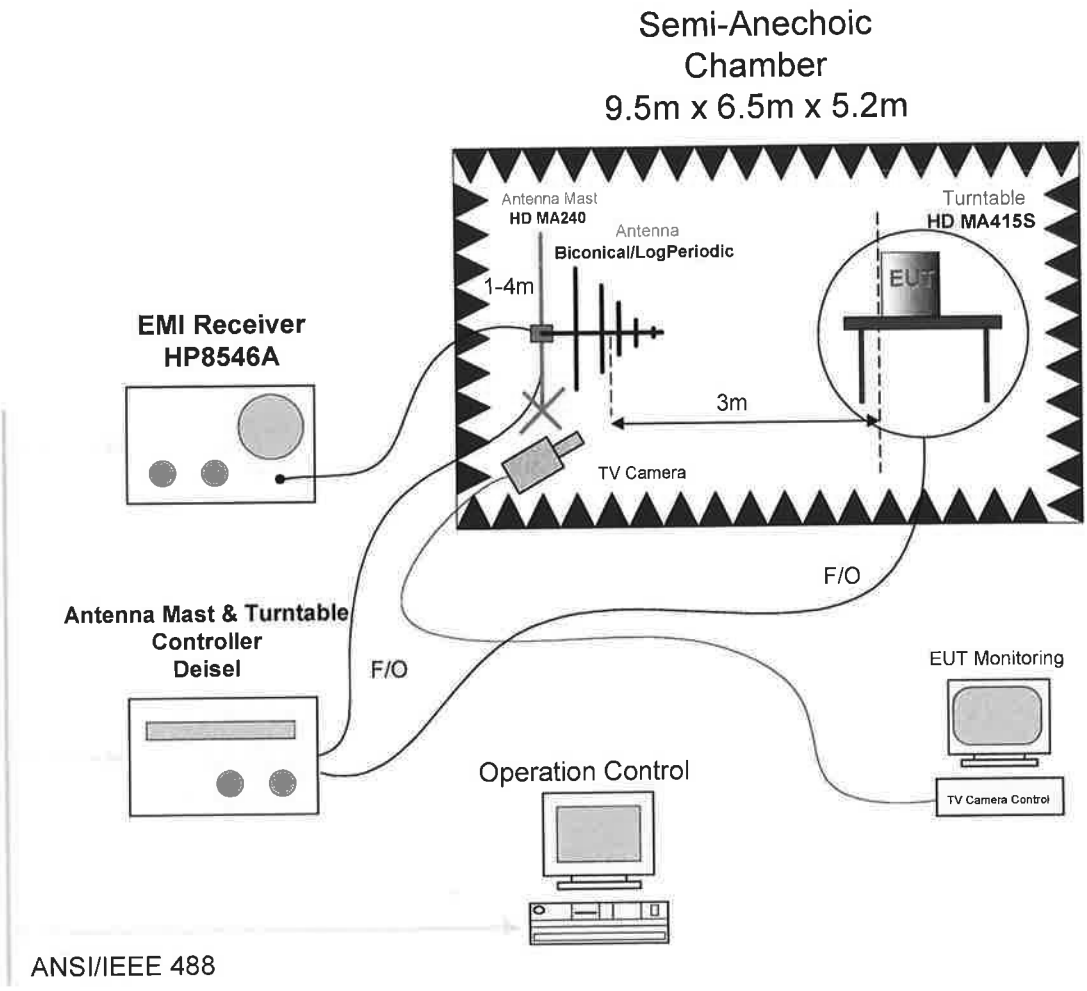
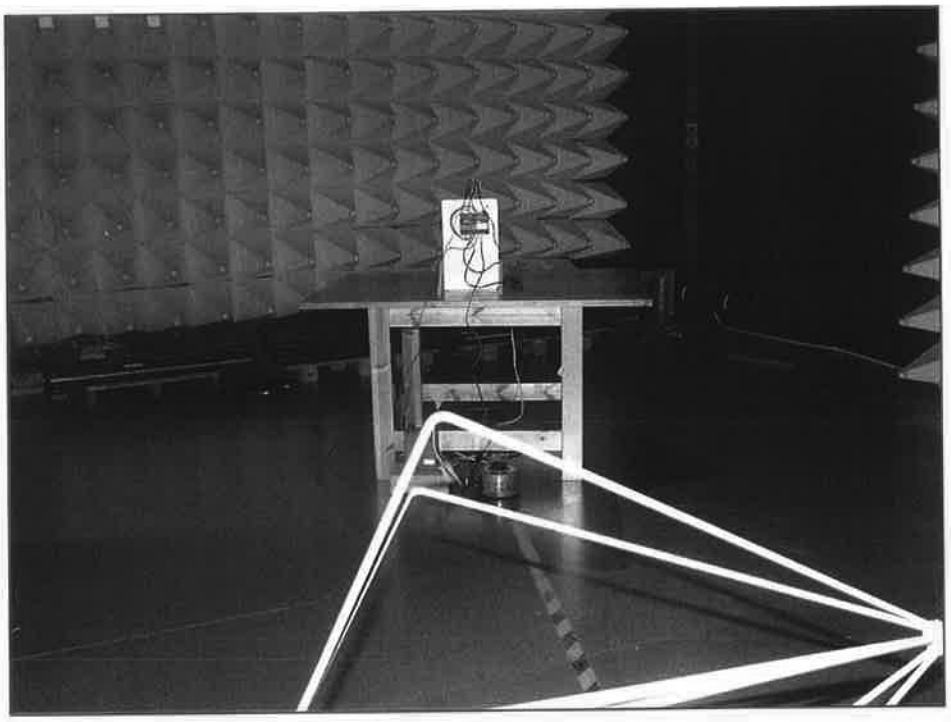


Figure 3: Setup for Radiated Emission Testing - 30MHz ÷1GHz Frequency Range



Photograph 3: Radiated Emission Testing



4. Conducted Emission Measurements

Date of Test: 26.06.2011
Relative Humidity: 48%
Ambient Temperature: 21°C
Atmospheric Pressure: 1011.4 hPa

Test Method: CISPR 22 limits according to IEC 62052-11 section 7.5.8

Limits:

Power Supply Port: Class A

Frequency [MHz]	Limits [dBµV]	
	QP	Average
0.15÷0.5	79	66
0.5÷30	73	60

Power Supply Port: Class B

Frequency [MHz]	Limits [dBµV]	
	QP	Average
0.15÷0.5	66 to 56	56 to 46
0.5÷5	56	46
5÷30	60	50

Test Procedure:

The measurements were performed on the line under test in a 4m x 3m x 3m screened enclosure by means of an Impedance Stabilization Network (ISN) bonded to the ground plane and connected to the spectrum analyzer. The EUT was placed on a non-metallic table, 0.8m above the ground reference plane and was configured, arranged and operated in a manner consistent with typical application and load conditions.
Normal performance of the EUT was verified.
Conducted common mode (asymmetric mode) disturbance at the tested port was investigated in the appropriate frequency range using the resolution-bandwidth per CISPR16-1, Table 7, and QP and Average readings were taken.
Worst-case results were recorded.

List of Test Equipment:

Screened Enclosure 4m x 3m x 3m
HP8546A, CISPR16 EMI Analyzer
Schwarzbeck NNBL 8226-2 V-LISN
HP11947A, Transient Limiter

Test Details:

Port under Test	Measured at	Test method reference	Test Setup No.	Photograph No.	Plot Nos.
230 VAC	AC line	Sec. 9. 2 & 9.5.2	Fig. 4	Photo. 4.1	4.1-4.2
3 Phase AC	3 phase AC	Sec. 9. 2 & 9.5.2	Fig. 4	Photo. 4.2	4.3-4.6
RS485	Not applicable				
Input	Not applicable				
Output	Not applicable				

Test Results:

Table 4.1: Power Supply Port:

"Phase" Lead

Frequency [MHz]	Measured Result [dBµV]		Limit [dBµV]		Margin [dB]		Pass/Fail
	QP	AVR	QP	AVR	QP	AVR	
0.517669	63.9	53.9	73.00	60.00	-9.10	-6.10	Pass
0.644816	61.7	49.9	73.00	60.00	-11.30	-10.10	Pass
0.790684	59.7	46.3	73.00	60.00	-13.30	-13.70	Pass
1.7801	57	36.6	73.00	60.00	-16.00	-23.40	Pass
1.5725	55.5	37.1	73.00	60.00	-17.50	-22.90	Pass
3.189	53.2	37	73.00	60.00	-19.80	-23.00	Pass

"Neutral" Lead

Frequency [MHz]	Measured Result [dBµV]		Limit [dBµV]		Margin [dB]		Pass/Fail
	QP	AVR	QP	AVR	QP	AVR	
0.660713	59.1	45.6	73.00	60.00	-13.90	-14.40	Pass
0.533970	58.1	43.7	73.00	60.00	-14.90	-16.30	Pass
1.948245	59.1	37.5	73.00	60.00	-13.90	-22.50	Pass
2.050928	57.2	35.7	73.00	60.00	-15.80	-24.30	Pass
3.03799	52.7	32.2	73.00	60.00	-20.30	-27.80	Pass
3.182	52.8	36.6	73.00	60.00	-20.20	-23.40	Pass

Table 4.2: Power Supply port:

"Phase 1" Lead

Frequency [MHz]	Measured Result [dBµV]		Limit [dBµV]		Margin [dB]		Pass/Fail
	QP	AVR	QP	AVR	QP	AVR	
1.548	25.6	9.1	56.00	46.00	-30.40	-36.90	Pass
7.3867	21.1	7	60.00	50.00	-38.90	-43.00	Pass
9.30267	25.4	12.1	60.00	50.00	-34.60	-37.90	Pass
11.711851	28.8	15.1	60.00	50.00	-31.20	-34.90	Pass
13.318202	38.2	24.4	60.00	50.00	-21.80	-25.60	Pass
25.275529	43	34.5	60.00	50.00	-17.00	-15.50	Pass

"Phase 2" Lead

Frequency [MHz]	Measured Result [dBµV]		Limit [dBµV]		Margin [dB]		Pass/Fail
	QP	AVR	QP	AVR	QP	AVR	
0.509024	33.1	21	56.00	46.00	-22.90	-25.00	Pass
0.530195	32.5	22.7	56.00	46.00	-23.50	-23.30	Pass
1.65844	30.7	14.8	56.00	46.00	-25.30	-31.20	Pass
1.984085	29.9	13.1	56.00	46.00	-26.10	-32.90	Pass
2.87	24.6	7.1	56.00	46.00	-31.40	-38.90	Pass
13.322011	33.3	19	60.00	50.00	-26.70	-31.00	Pass

"Phase 3" Lead

Frequency [MHz]	Measured Result [dBµV]		Limit [dBµV]		Margin [dB]		Pass/Fail
	QP	AVR	QP	AVR	QP	AVR	
1.574635	28.3	12.6	56.00	46.00	-27.70	-33.40	Pass
1.907155	26.6	9.7	56.00	46.00	-29.40	-36.30	Pass
2.121175	26.4	9.7	56.00	46.00	-29.60	-36.30	Pass
2.891	21.3	5.6	56.00	46.00	-34.70	-40.40	Pass
13.449476	32.3	18.8	60.00	50.00	-27.70	-31.20	Pass
25.524585	42	32.9	60.00	50.00	-18.00	-17.10	Pass

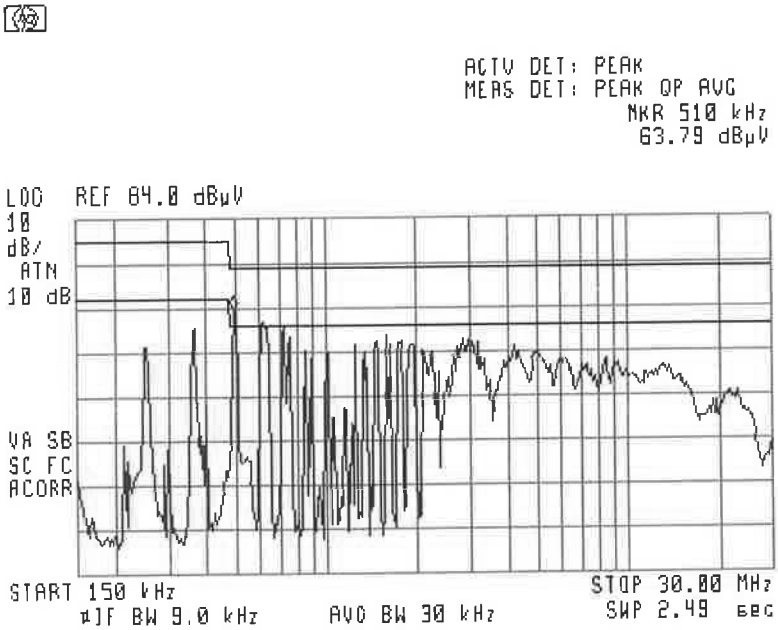
"Neutral" Lead

Frequency [MHz]	Measured Result [dBµV]		Limit [dBµV]		Margin [dB]		Pass/Fail
	QP	AVR	QP	AVR	QP	AVR	
0.514089	42.3	30.3	56.00	46.00	-13.70	-15.70	Pass
0.668029	41.8	23.9	56.00	46.00	-14.20	-22.10	Pass
1.868409	43.1	20.1	56.00	46.00	-12.90	-25.90	Pass
2.098569	41.5	21.6	56.00	46.00	-14.50	-24.40	Pass
3.059	38.6	20.8	56.00	46.00	-17.40	-25.20	Pass
25.614615	45.5	36.6	60.00	50.00	-14.50	-13.40	Pass

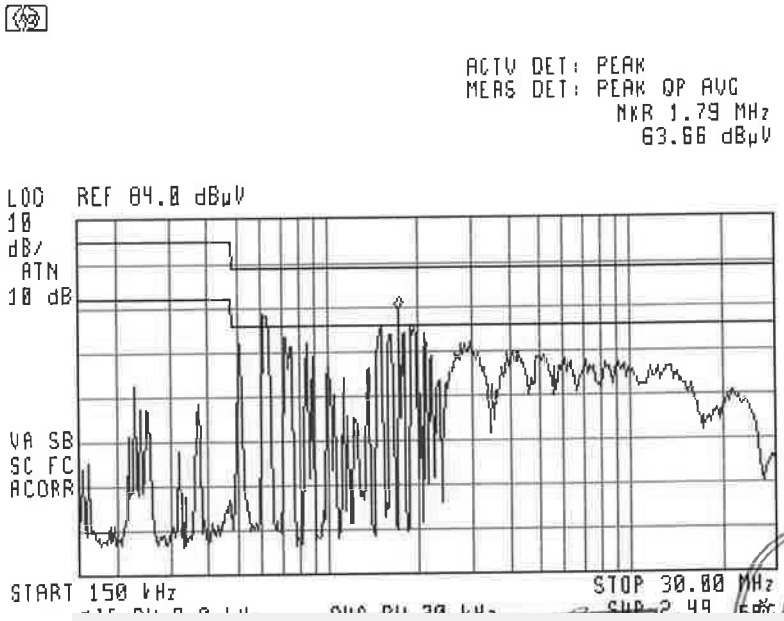
Summary:

Port under Test	Measurement Means	Class Limits applied	Frequency Range	Test Results	Remarks
230 VAC	LISN	A	150kHz – 30MHz	Tab. 4.1	Pass
3 Phase AC	LISN	B	150kHz – 30MHz	Tab. 4.2	Pass
RS485	Not applicable				
Input	Not applicable				
Output	Not applicable				

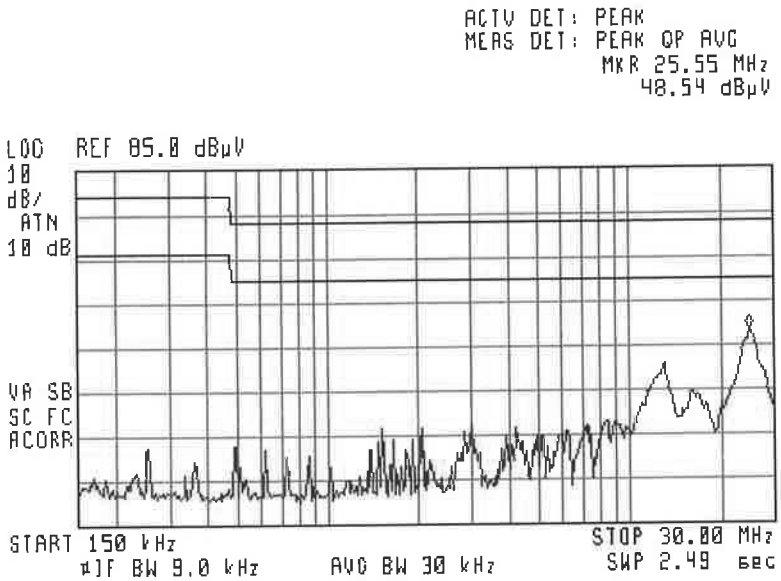
Power Supply Ports
150kHz – 30MHz
"Phase" Lead
Plot 4.1



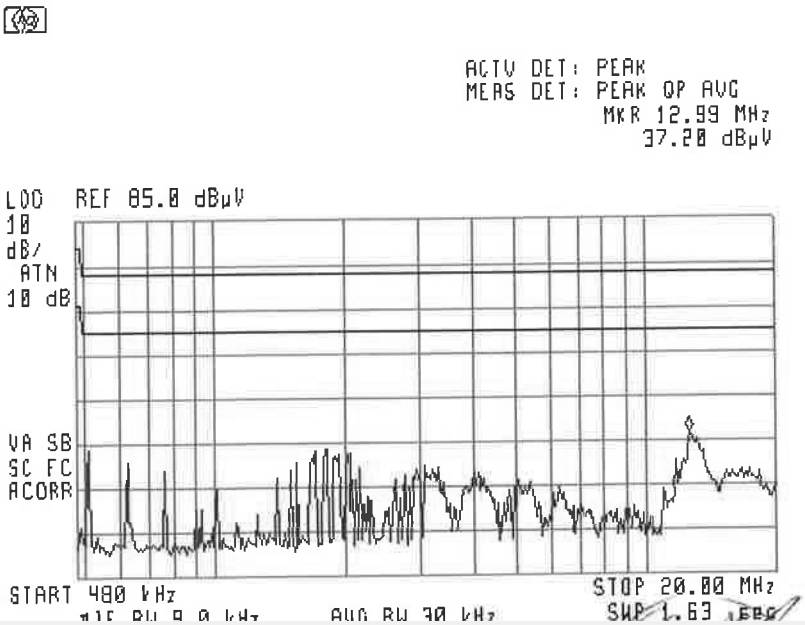
Power Supply Ports
150kHz – 30MHz
"Neutral" Lead
Plot 4.2



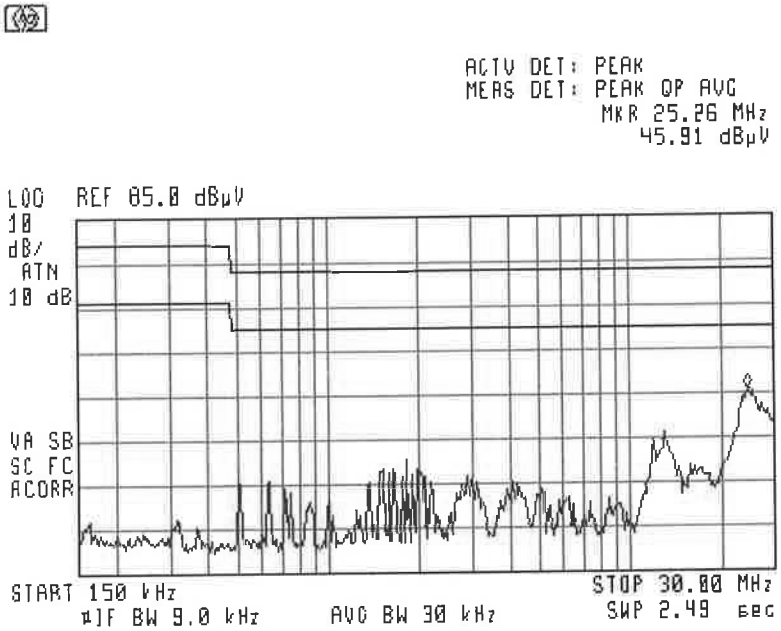
Power Supply Ports
150kHz – 30MHz
"Phase 1" Lead
Plot 4.1



Power Supply Ports
150kHz – 30MHz
"Phase 2" Lead
Plot 4.2



Power Supply Ports
150kHz – 30MHz
"Phase 3" Lead
Plot 4.3



Power Supply Ports
150kHz – 30MHz
"Neutral" Lead
Plot 4.4

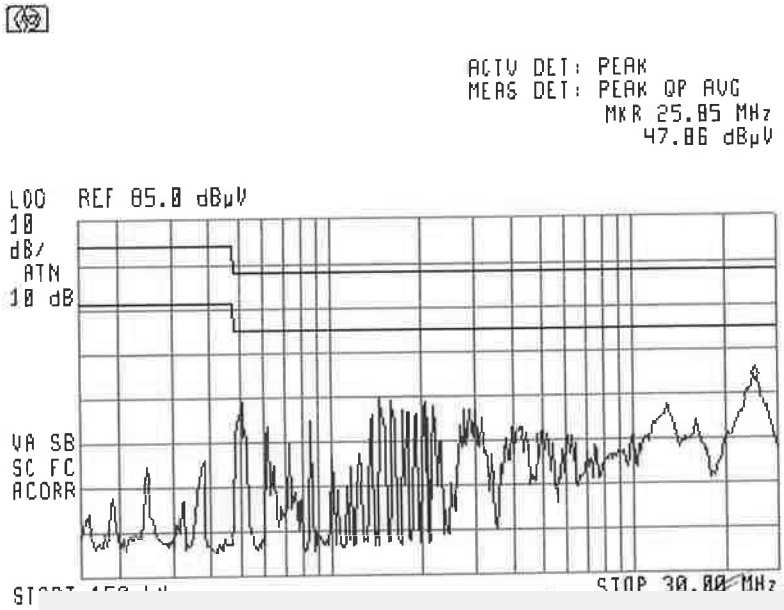
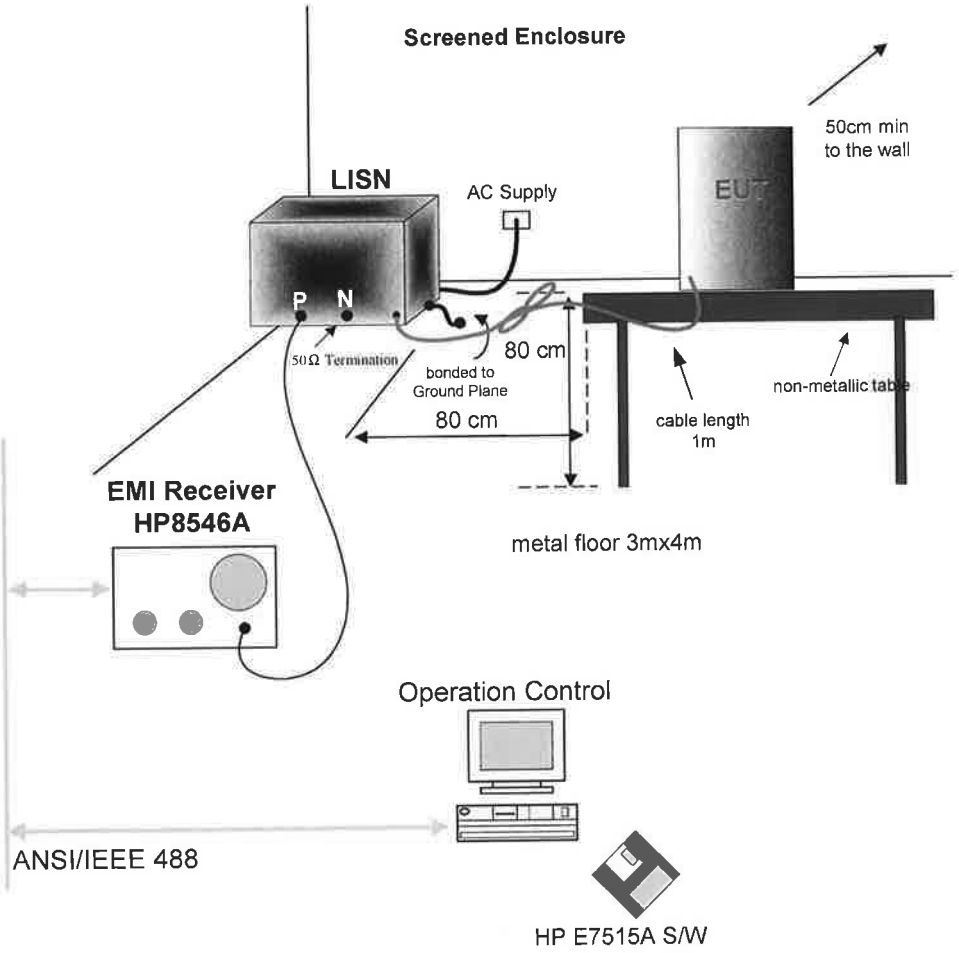
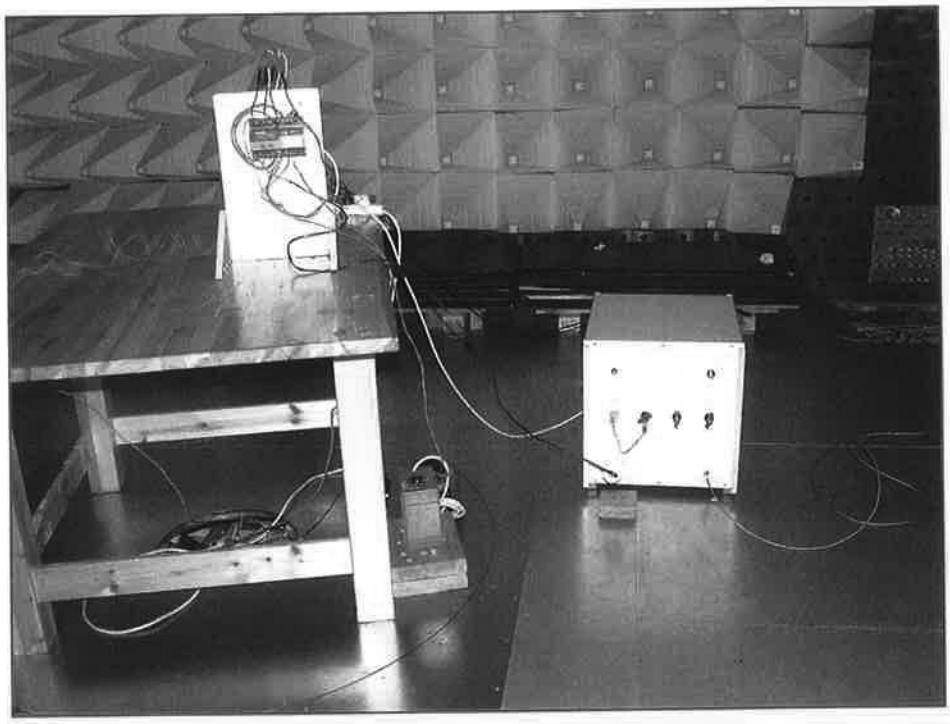


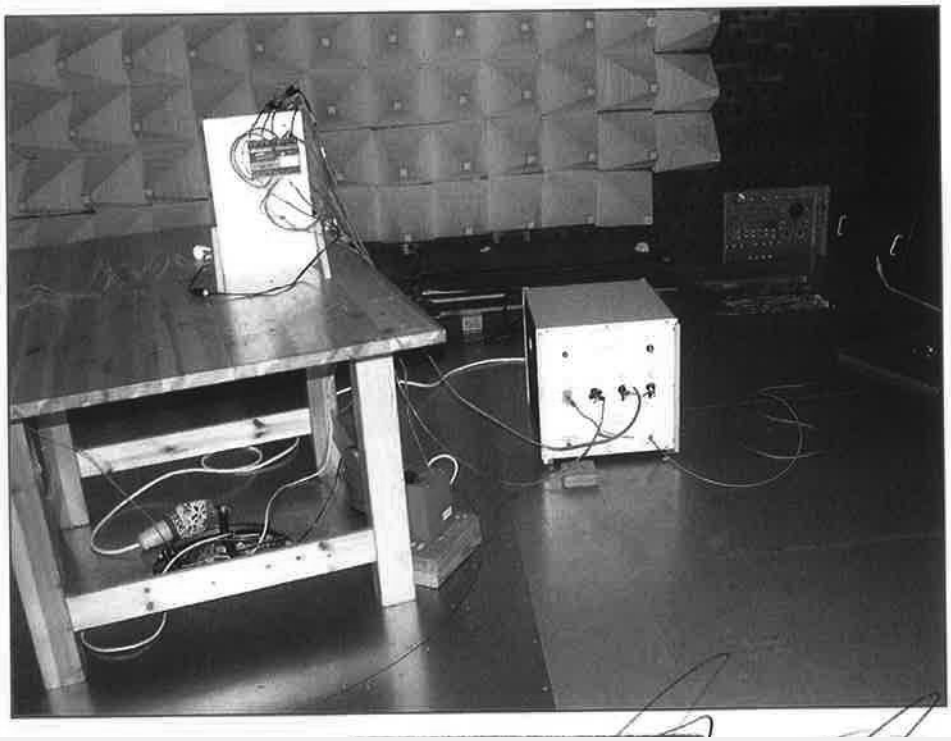
Figure 4: Setup for Conducted Emission Testing on AC Power Supply Port



Photograph 4.1: Conducted Emission Testing on AC Power Supply Port



Photograph 4.2: Conducted Emission Testing on 3 Phase AC



5. Immunity to Electrostatic Discharge

Date of Test: 26.06.2011
Relative Humidity: 50%
Ambient Temperature: 23°C
Atmospheric Pressure: 1011.4 hPa

Test Method: IEC 61000-4-2 according to IEC 62052-11 section 7.5.2

Test Voltage:

Type of Application	Test Voltage	# of Discharges each polarity	Performance Criteria
Contact Discharge	±8 kV	10	B
Air Discharge	±15 kV	10	B

Test Procedure:

Electrostatic Discharge tests were performed on a ground reference plane 3m x 3m wide.
The EUT was placed on a wooden table 0.8m high, standing on the ground reference plane. A horizontal coupling plane (HCP), 1.6m x 0.8m, was placed on the table underneath the EUT, and the EUT was isolated from the coupling plane by an insulating support 0.5mm thick. The HCP was connected to the ground reference plane by a bleed resistor lead. The EUT was placed on the HCP with its front face 10cm from the edge of the plane, and configured, arranged and operated in a manner consistent with typical application and load conditions. The cables were taken away from the test area separated from the HCP by 5cm and draped off the HCP as necessary. Normal performance of the EUT was verified.

Direct and air application:

For pre-selected points, 10 single Contact discharges in both positive and negative polarities, were applied with at least 1sec time interval between successive discharges.
Discharges were applied to surfaces and metal points which are accessible during normal usage. Inside the EUT, only the points and surfaces, which have to be accessed during maintenance, were included. The same procedure was repeated for air discharges on non- metallic parts or insulating surfaces.

Indirect application:

Ten single discharges, in both positive and negative polarities, were applied to the HCP on each side of the EUT.
The same procedure was repeated with the vertical coupling plane VCP (connected to the ground reference plane by a bleed resistor lead) on each side of the EUT such that the face of the EUT was completely illuminated.
For air discharges, voltage levels were increased gradually from 2kV until the maximum severity level was reached, for each polarity.
During the test, the EUT operation was monitored to verify the required Performance Criteria.

List of Test Equipment:

Noiseken, ESS-2000 Discharge Simulator

Test Details:

Test Setup No.	Photograph No.
Fig. 5.1	Fig. 5.2

Test Results:

Type of discharge	Points of Discharge	Discharge Voltage	Number of Discharges at each polarity	Performance Criteria applied	BER/ # of errors	Remarks
Contact Discharge	EUT	±8 kV	10	B	None	**Pass**
	HCP	±8 kV	10	B	None	**Pass**
	VCP	±8 kV	10	B	None	**Pass**
Air Discharge	EUT	±15 kV	10	B	None	**Pass**

*Verified after the test.

Figure 5.1: Setup for Electrostatic Discharge Test

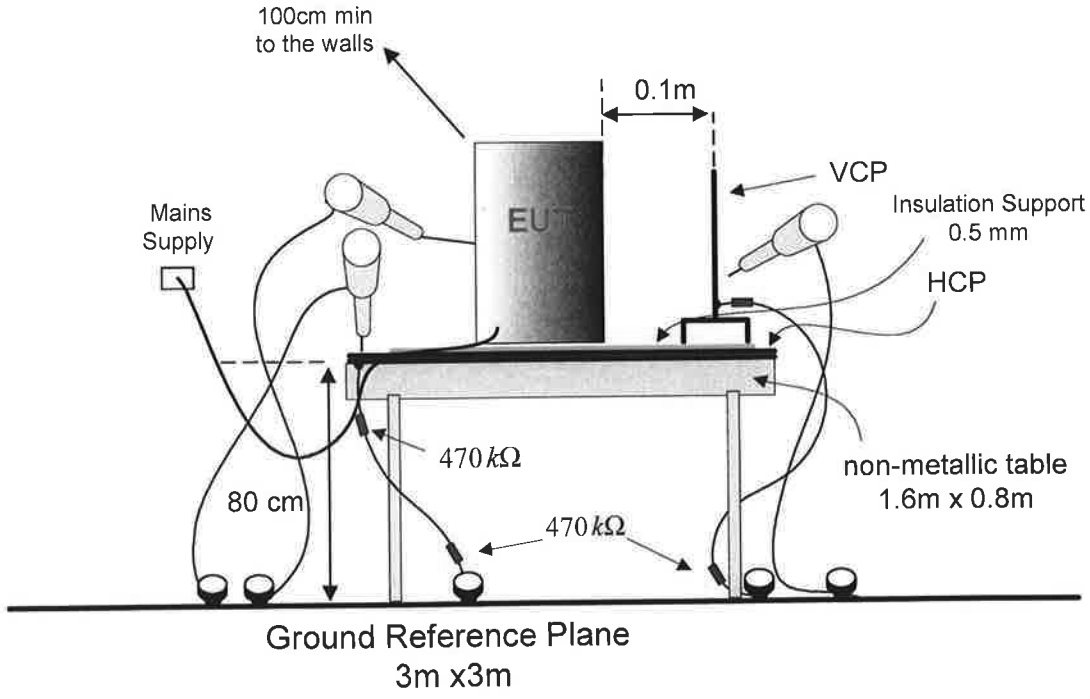
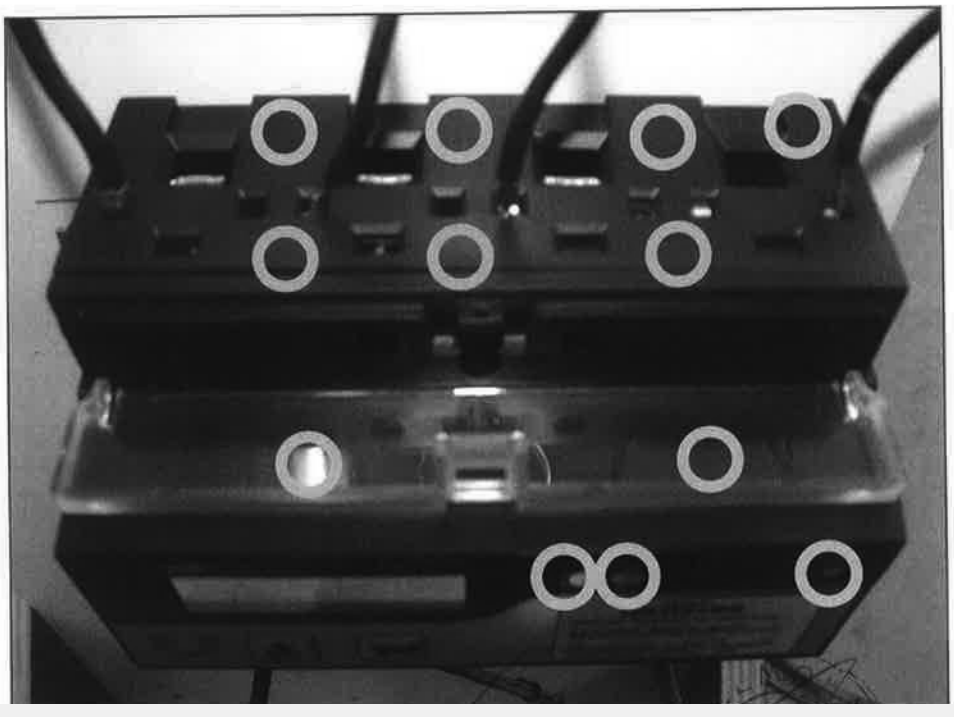


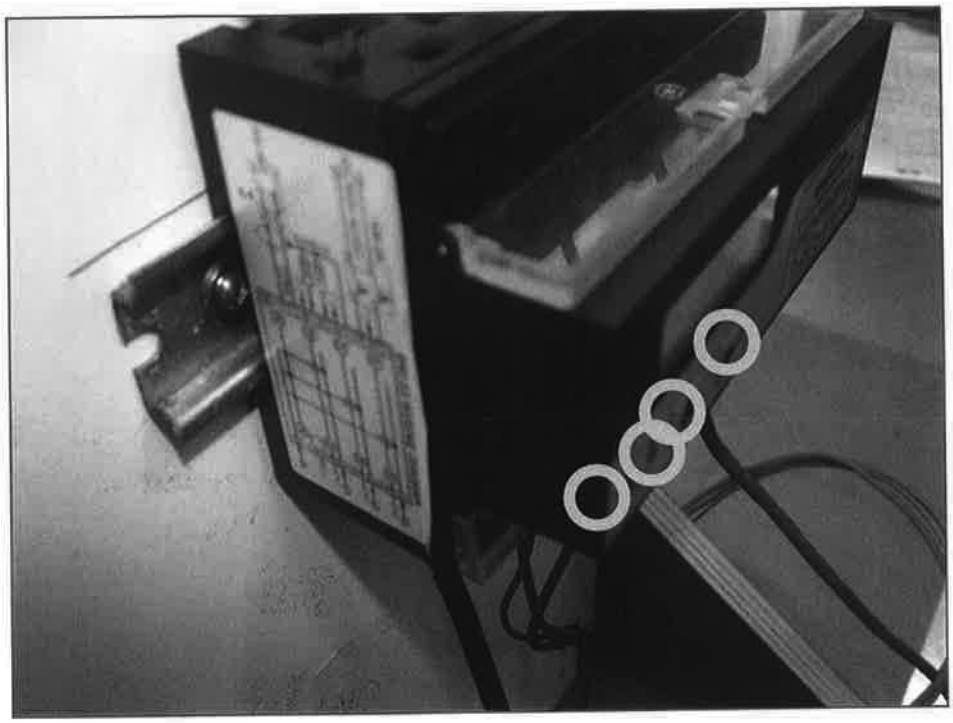
Figure 5.2: Electrostatic Discharge Map

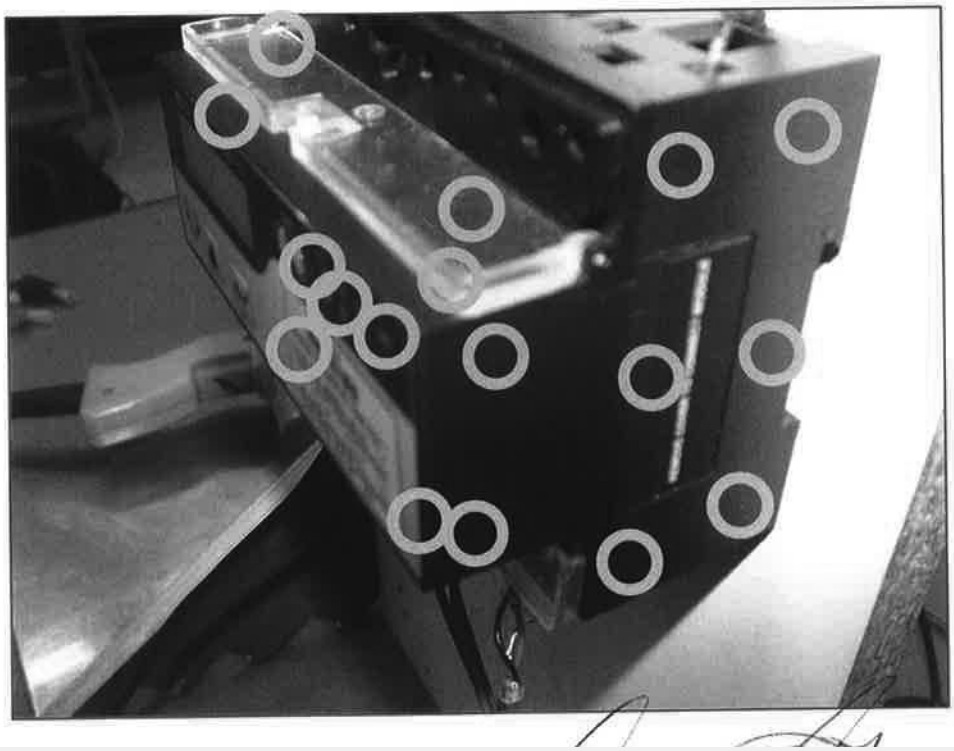
Contact Electrostatic Discharge applied at ✕ spots

Air Electrostatic Discharge applied at ○ spots



Electrostatic Discharge Map





6. Immunity to Radiated Electromagnetic Field

Date of Test: 26.06.2011
Relative Humidity: 50%
Ambient Temperature: 23°C
Atmospheric Pressure: 1011.4 hPa

Test Method: IEC 61000-4-3 according to IEC 62052-11 section 7.5.3

Test Levels:

Frequency range	Mode Of Operation	Test Level	Performance Criteria
80 MHz – 1GHz 80% AM, 1 kHz sine	Test with current	10 V/m	A
1GHz -2GHz 80% AM, 1 kHz sine		10 V/m	A
80 MHz – 1GHz 80% AM, 1 kHz sine	Test without current	30 V/m	A
1GHz -2GHz 80% AM, 1 kHz sine		30 V/m	A

Test Procedure:

The EUT was placed in a full-anechoic chamber on a non-conductive table 0.8m above the absorbing ground plane, and was configured, arranged and operated in a manner consistent with typical application and load conditions. Normal performance of the EUT was verified.
The EUT was positioned parallel to the pre-calibrated "uniform area" at a distance of 3m from the transmitting antenna.
The frequency range was swept in steps of 1% with 1kHz sine-wave 80% Amplitude modulated or 200Hz square wave 50% pulse modulated, according to the frequency range, with a dwell time of 1 sec. A list of clock and sensitive frequencies were analyzed separately if made available.
Special exercising S/W was used in order to precisely generate the required electromagnetic field based on the calibrated field uniformity data.
All tests were performed four times, with the antenna facing each of the four sides of the EUT. Each test was performed for both, horizontal and vertical antenna polarization
During the tests, the EUT and external equipment were monitored to verify normal functional performance.

List of Test Equipment:

IFI 2025 RF Signal Generator
Boonton 4230 Power Meter
Boonton 51015 Power Sensor
Anechoic Chamber 7m x 4m x 3m
AR100W100, 30MHz-1GHz Wideband Linear RF Amplifier
Werlaton C3910, 30MHz-1GHz Directional Coupler
EMCO 3142, BiLog Antenna
Ophir GRF5061, 0.8 GHz-4.2 GHz RF Amplifier
AR DC7144, 0.8 GHz

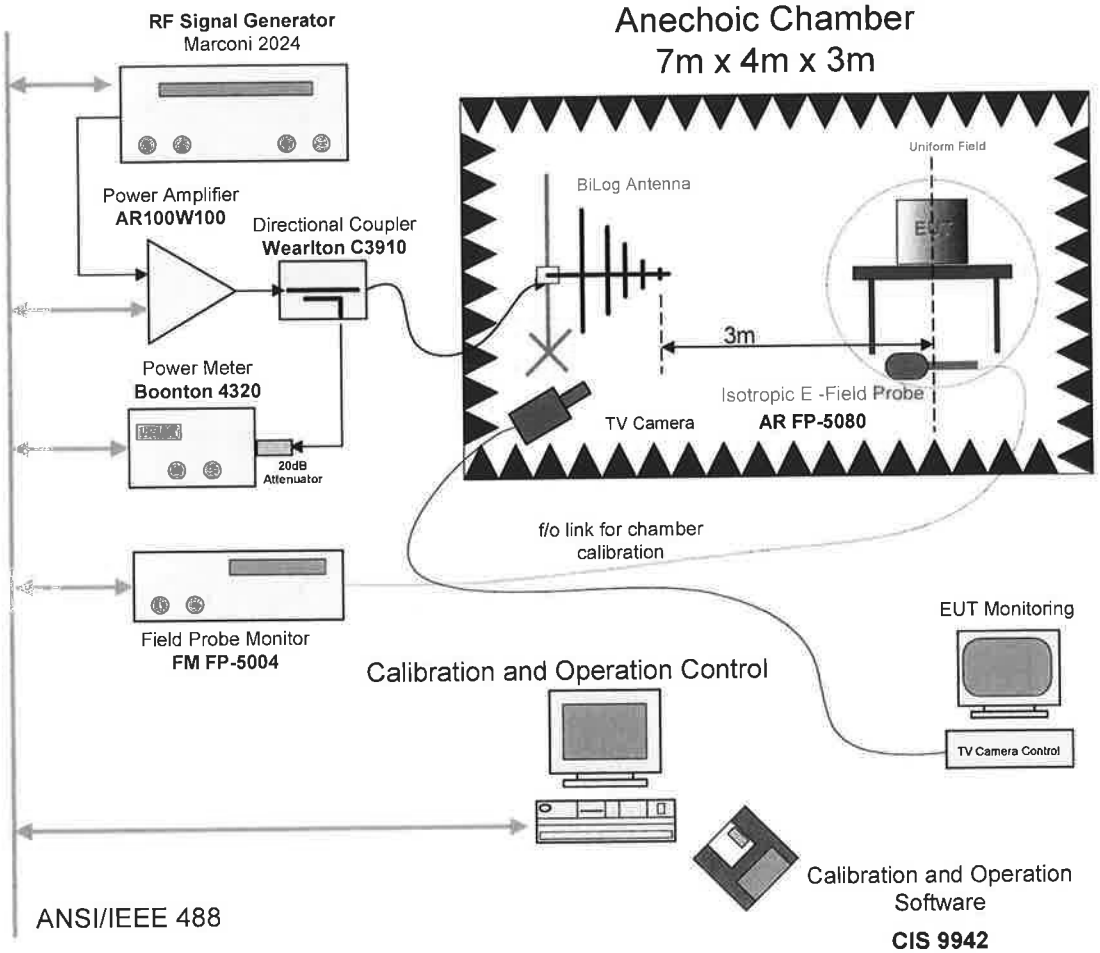
Test Details:

Frequency range	Radiating Antenna	Test Setup No.	Photograph No.
80 MHz – 1GHz 80% AM, 1 kHz sine	Bilog	Fig 6	Photo.6
1GHz -2GHz 80% AM, 1 kHz sine			
80 MHz – 1GHz 80% AM, 1 kHz sine			
1GHz -2GHz 80% AM, 1 kHz sine			

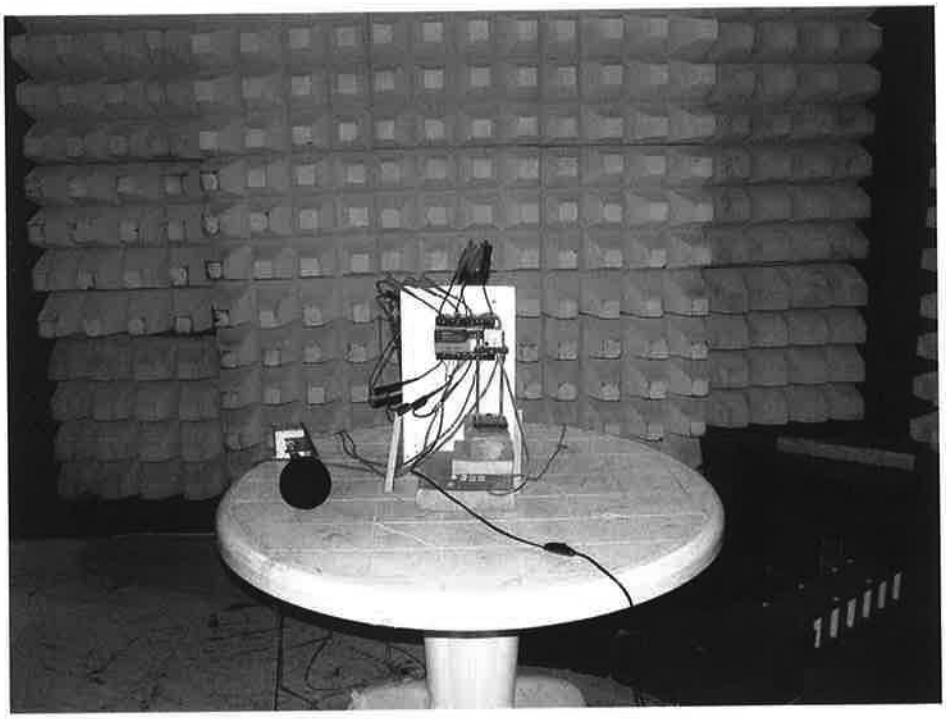
Test Results:

Frequency range	Test Level	Mode Of Operation	BER/ # of errors	Performance Criteria applied	Remarks
80 MHz – 1GHz 80% AM, 1 kHz sine	10 V/m	Test with current	None	A	**Pass**
1GHz -2GHz 80% AM, 1 kHz sine	10 V/m		None	A	**Pass**
80 MHz – 1GHz 80% AM, 1 kHz sine	30 V/m	Test without current	None	A	**Pass**
1GHz -2GHz 80% AM, 1 kHz sine	30 V/m		None	A	**Pass**

Figure 6: Setup for Radiated Immunity Test



Photograph 6: Radiated Immunity Test



7. Immunity to Electrical Fast Transients (EFT)

Date of Test: 26.06.2011
Relative Humidity: 49%
Ambient Temperature: 25°C
Atmospheric Pressure: 1011.4 hPa

Test Method: IEC 61000-4-4 according to IEC 62052-11 section 7.5.4

Test Levels:

Power Supply Port:

Power Supply leads	Peak Voltage [kV]	Test Duration	Performance Criteria
230 VAC, 3 Phase AC	± 4	60sec	B

Telecommunication ports and Signal Lines:

Signal Line	Peak Voltage [kV]	Test Duration	Performance Criteria
RS485, Input, Output	± 2	60sec	B

Test Procedure:

Electrical Fast Transient/Burst Tests were performed on a ground reference plane 3m x 3m wide. The EUT was placed on a table 0.8m above the ground reference plane, and was configured, arranged and operated in a manner consistent with typical application and load conditions. Normal functional performance of the EUT was verified.
Fast transients/Burst voltage at a repetition rate of 5 kHz was applied between the reference plane and the signal lines by means of a Capacitive Coupling Clamp, and between the ground reference plane and each of the power supply terminals, AC or DC, and protective earth (PE) terminal by means of a Coupling/Decoupling Network (CDN). Every coupling mode was applied for 1minute in each polarity. The Fast transients/Burst generator and CDN were bonded to the reference plane. The distance between the EUT and the coupling network or clamp was 1m or less. Clear distance of 0.5m was kept from the EUT to all other conducting structures. All cables, including the one being tested, were separated by 10cm from the ground reference plane. During the tests, the EUT and external equipment were monitored to verify the required performance criteria.

List of Test Equipment:

Haefely Test System, including PEFT 4010 EFT/Burst Generator
PSPN1610 coupling network
IP4A Capacitive Coupling Clamp
WinPATS Control S/W

Test Details:

Supply/Signal line/Port under Test	Test applied at	Coupling Means	Test Setup No.	Photograph No.
230 VAC	AC line	CDN	Fig.7.1	Photo.7.1
3 Phase AC	3 Phase AC	CDN	Fig.7.2	Photo.7.2
RS485	RS485	Capacitive Coupling Clamp	Fig.7.3	Photo.7.3
Input	Input	Capacitive Coupling Clamp	Fig.7.3	Photo.7.4
Output	Output	Capacitive Coupling Clamp	Fig.7.3	Photo.7.5

Test Results:

Supply/Signal line/Port under Test	Peak Voltage [kV]	Test Duration [Minutes]	BER/ # of errors	Performance Criteria Applied	Pass/ fail
230 VAC	± 4	7	None	A	**Pass**
3 Phase AC	± 4	20	None	A	**Pass**
RS485	± 2	7	None	A	**Pass**
Input	± 2	7	None	A	**Pass**
Output	± 2	7	None	A	**Pass**

Note: During the EFT test the EUT screen was blinking

Figure 7.1: Setup for EFT Test on AC Power Supply Port

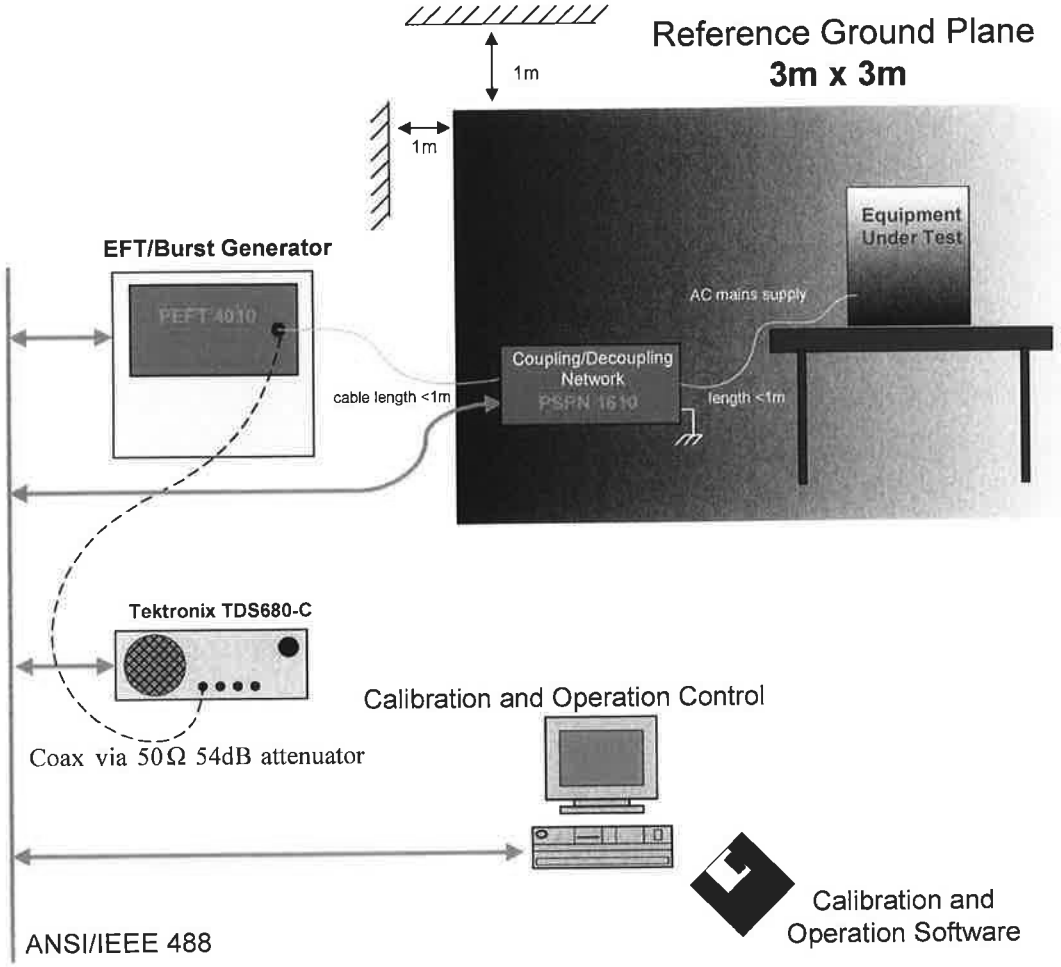


Figure 7.2: Setup for EFT Test on AC Power Supply Port

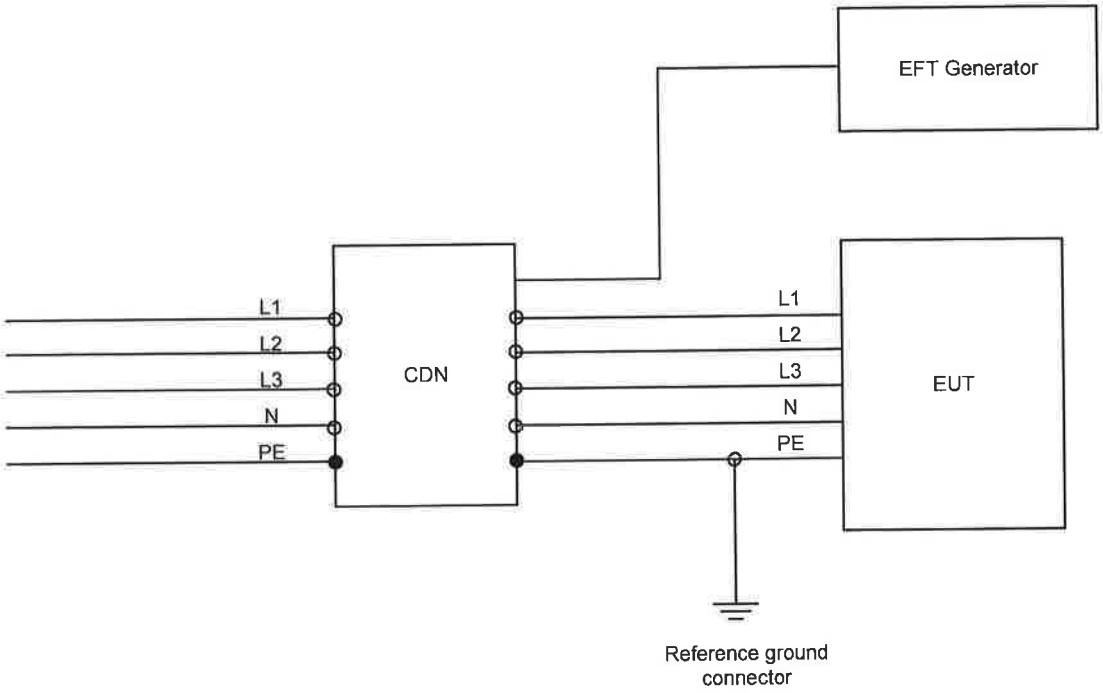
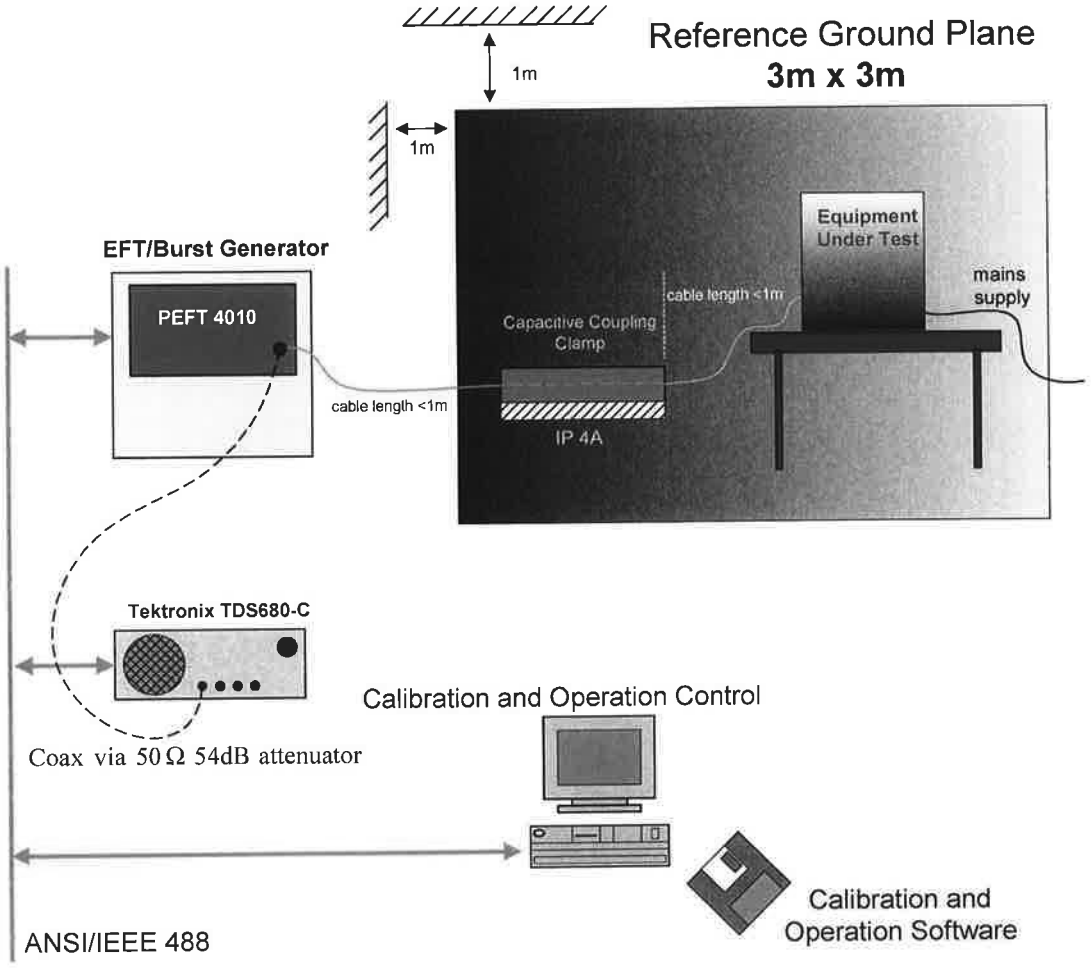
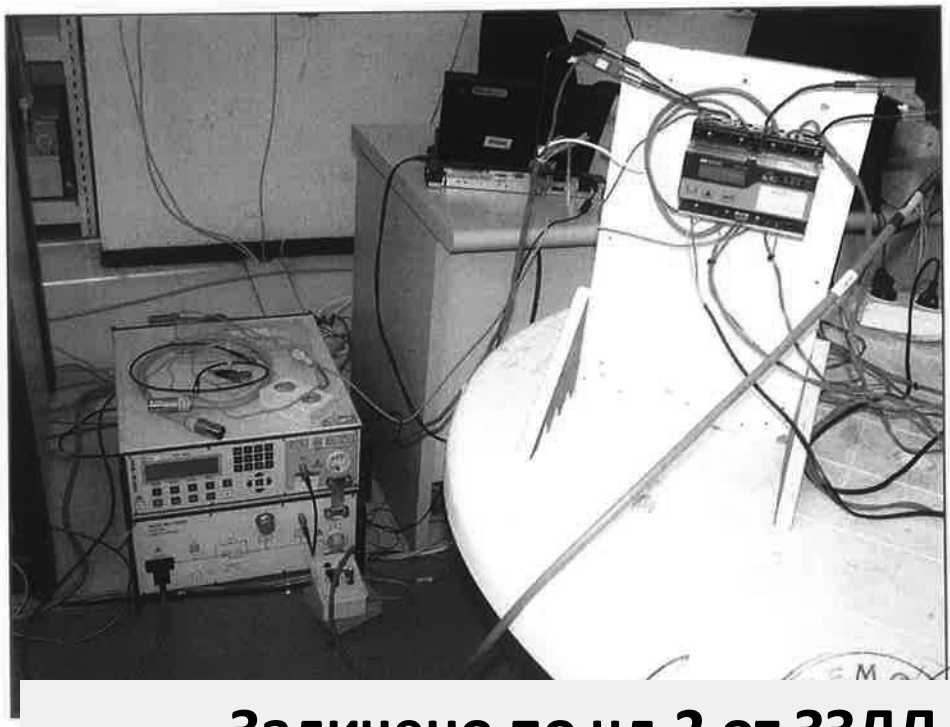


Figure 7.3: Setup for EFT Test on RS485, Input, Output



Photograph: 7.1: EFT test on AC Power Supply Port

Photograph: 7.2: EFT test on 3 phase AC



Photograph 7.3: EFT test on RS 485

Photograph 7.4: EFT test on Input

Photograph 7.5: EFT test on Output

8. Immunity to Voltage Surge

Date of Test: 22.06.2011
Relative Humidity: 48%
Ambient Temperature: 21°C
Atmospheric Pressure: 1011.4 hPa

Test Method: IEC 61000-4-5 according to IEC 60251-11 section 7.5.6

Test Levels:

Power Supply Port:

Port under Test	Pulse Shape Combination Wave	Peak Voltage	# of pulses	Performance Criteria
230 VAC & 3 phase AC	Line to Line	±4kV	5, each polarity	B

Telecommunication ports and Signal Lines:

Port under Test	Pulse Shape Combination Wave	Indoors/ Outdoor signal	Peak Voltage	# of pulses	Performance Criteria
Output	Line to Line	Indoor	±4kV	5, each polarity	B

Test Procedure:

Surge Tests were performed on a ground reference plane 3m x 3m wide.
The EUT was placed on a table 0.8m above the ground reference plane, and was configured, arranged and operated in a manner consistent with typical application and load conditions. Normal performance of the EUT was verified.
Surge voltage was applied to the EUT power supply by means of a coupling/decoupling network, and directly to the tested ports or coaxial and shielded cables via gas arrestors.
The cable between the EUT and coupling network was 2m or less in length. The surge voltages were applied synchronized to the zero crossing and the positive and negative peaks of the AC voltage wave.
The surges were applied line-to-line and line-to-earth. The test was repeated at a voltage level just below the threshold of the surge protector.

During the tests, the EUT and external equipment were monitored to verify the required functional performance criteria on all ports other than the tested port.

List of Test Equipment:

Haefely Test System, comprising of PSURGE 6.1 Mainframe
WinPATS Control S/W and WinPATS Control S/W
IP6.2 2 & 4 -wire Coupling Network
PSPN 1610 Single Port Network
PHV30.2 1.2x50/8x20µs Combination Wave Plug-In unit
EMtest ,VCS500N Surge Generator 3 PH.
EMtest,CNI503, 3 PH Network

Test Details:

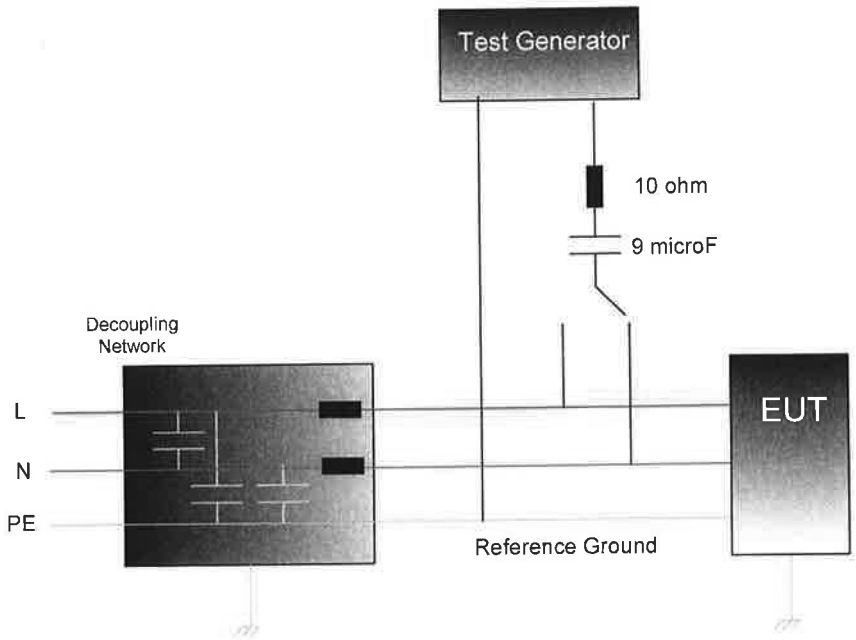
Port under Test	Test applied at	Test method reference	Generator Waveform	Indoor/ Outdoor	Test Setup No.	Photograph No.
230 VAC	AC line	Sec. 6.3.2.2	Combination Wave	Indoor	Fig. 8.1	Photo.8.2
3 Phase AC	3 Phase AC	Sec. 6.3.1.1	Combination Wave	Indoor	Fig. 8.1	Photo.8.2
RS485	Not applicable (reference voltage less than 40V)					
Input	Not applicable (reference voltage less than 40V)					
Output	Output	Sec. 6.3.2.2	Combination Wave	Indoor	Fig. 8.2	Photo.8.2

Test Results:

Port under Test	Terminal Connections	Test Level	Repetitions, each polarity	BER/ # of errors	Performance Criteria applied	Remarks
230 VAC	Line to Line	±4kV	5, each polarity	None	A	**Pass**
3 Phase AC	Line to Line	±4kV	5, each polarity	None	A	**Pass**
RS485	Not applicable (reference voltage less than 40V)					
Input	Not applicable (reference voltage less than 40V)					
Output	Line to Line	±4kV	5, each polarity	None	A	**Pass**

Figure 8.1: Setup for surge on AC Power Supply Port

Line to Earth



Line to Line

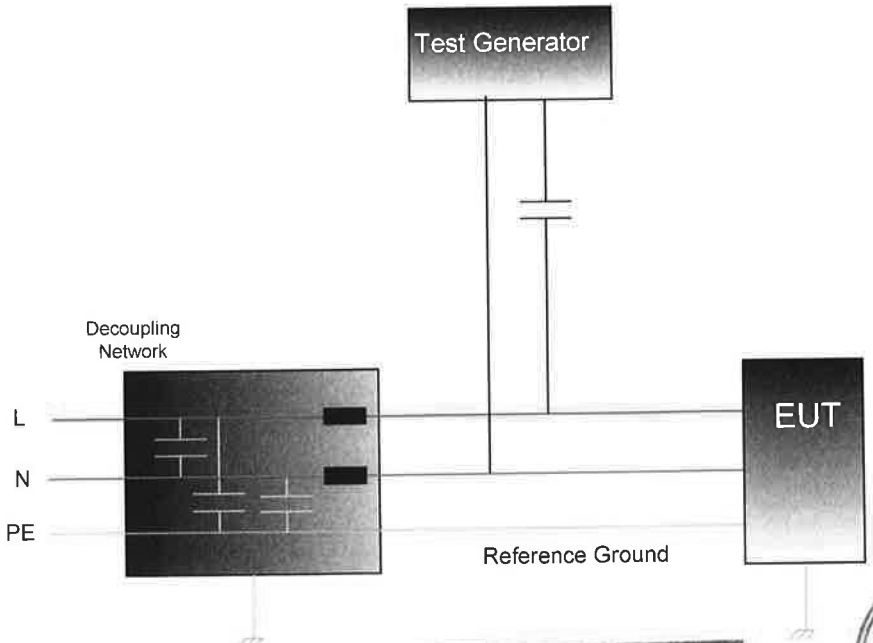
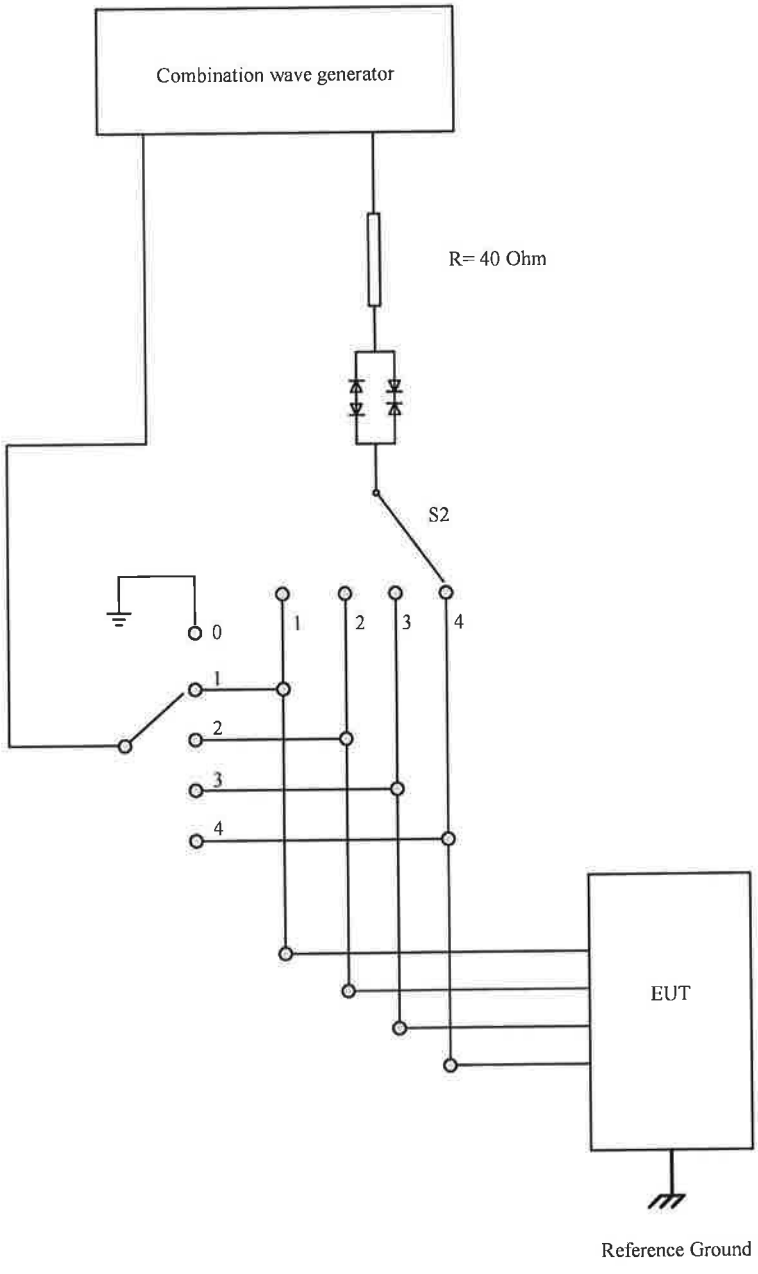
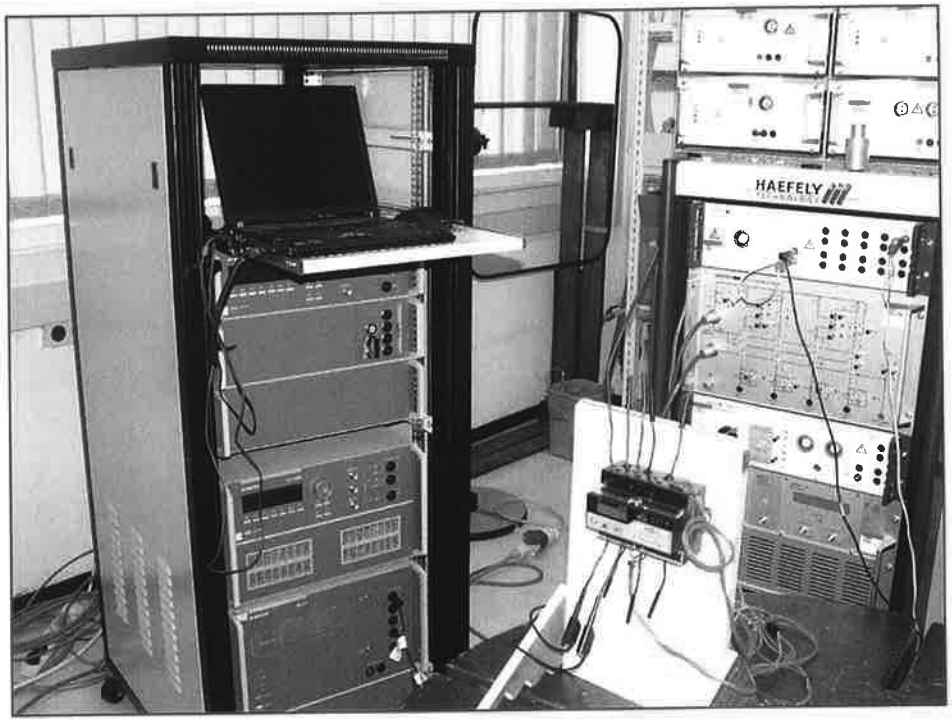


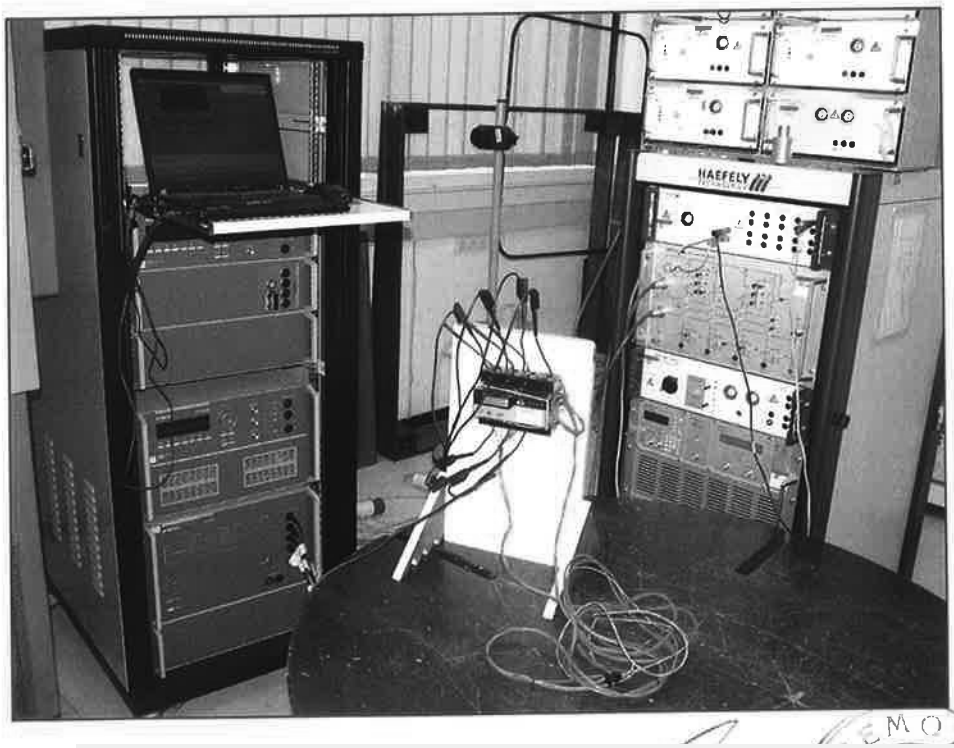
Figure 8.2: Setup for Output



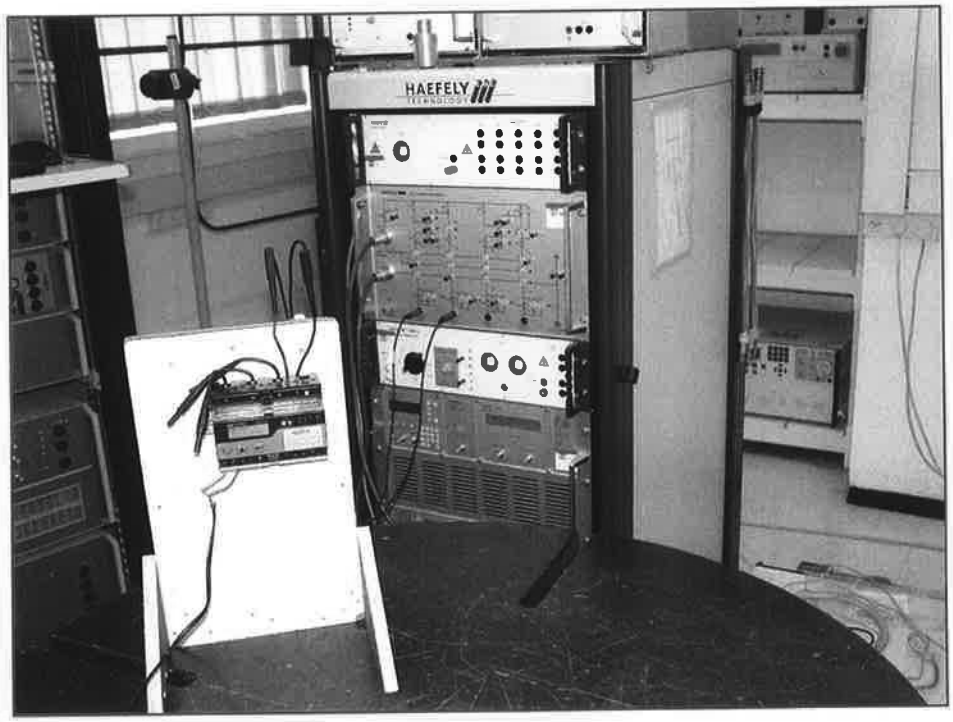
Photograph 8.1: Surge on AC Power Supply Port



Photograph 8.2: Surge on 3 phase AC



Photograph 8.3: Surge on Output



9. Immunity to Conducted RF Stress

Date of Test: 27.06.2011
Relative Humidity: 48%
Ambient Temperature: 21°C
Atmospheric Pressure: 1011.4 hPa

Test Method: IEC 61000-4-6 according to IEC 62052-11 Section 7.5.5

Test Levels:

Power Supply port:

Frequency Range	Interference Value	Performance Criteria
150kHz÷80MHz	10Vrms	A

Telecommunication ports and Signal Lines:

Frequency Range	Interference Value	Performance Criteria
150kHz÷80MHz	10Vrms	A

Test Procedure:

Conducted Immunity tests were performed on a ground reference plane 3m x 3m wide.
The EUT was placed on an insulation support of 0.1m above the ground reference plane, and was configured, arranged and operated in a manner consistent with typical application and load conditions.
Normal performance of the EUT was verified.
All cables other than those under test, were provided with terminated (50Ω) decoupling networks (CDN).
Normal performance of the EUT was verified.
Different coupling networks were used for the various cables under test. They were pre-calibrated using the same testing system, and the calibration data was used to re-set the instruments to exactly the same settings and recreate the desired RF stress (disturbing signal) during the test.
The frequency range was swept in steps of 1% with 1KHz sine-wave 80% Amplitude modulated, with a dwell time of 1 sec.
Special exercising S/W was used in order to precisely generate the required disturbing signal, based on the calibrated data.

During the tests, the EUT and external equipment were monitored to verify normal performance.

List of Test Equipment:

AR100A250, 10KHz-250MHz Power Amplifier
Werlaton C5085 10KHz-250MHz Directional Coupler
Marconi 2024 RF Signal Generator
Boonton 4235 Power Meter
Boonton 51015 Power Sensor
Fischer M3 CDN
Fischer M5 CDN
Fischer T2 CDN

Test Details:

Port under Test	Test applied at	Test method reference	Coupling Means	Test Setup No	Photograph No
230 VAC	230 VAC	Sec. 6.2.1.1	M3 CDN	Fig.9.1	Photo.9.1
3 Phase AC	3 Phase AC	Sec. 6.2.3	M5 CDN	Fig.9.2	Photo.9.1
RS485	RS485	Sec. 6.2.1.2	T2 CDN	Fig.9.3	Photo.9.2
Input	Input	Sec. 6.2.1.2	T2 CDN	Fig.9.3	Photo.9.2
Output	Output	Sec. 6.2.1.2	T2 CDN	Fig.9.3	Photo.9.2

Test Results:

Port under Test	Frequency Range	Test Level	BER/# of errors	Performance Criteria	Remarks
230 VAC	150kHz÷80MHz	10Vrms	None	A	**Pass**
3 Phase AC	150kHz÷80MHz	10Vrms	None	A	**Pass**
RS485	150kHz÷80MHz	10Vrms	None	A	**Pass**
Input	150kHz÷80MHz	10Vrms	None	A	**Pass**
Output	150kHz÷80MHz	10Vrms	None	A	**Pass**

Fig 9.1: Setup for Conducted RF Stress on AC Power Supply Port

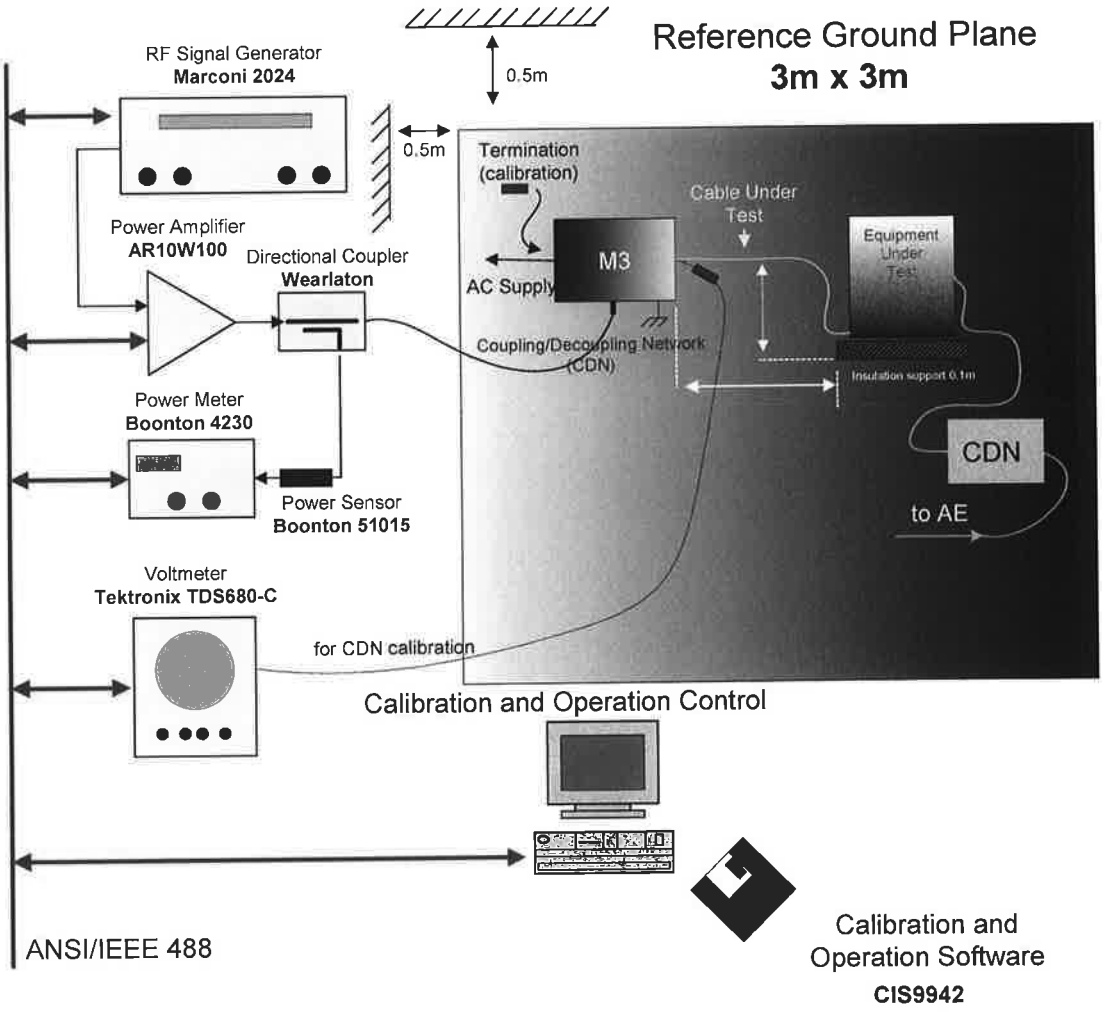
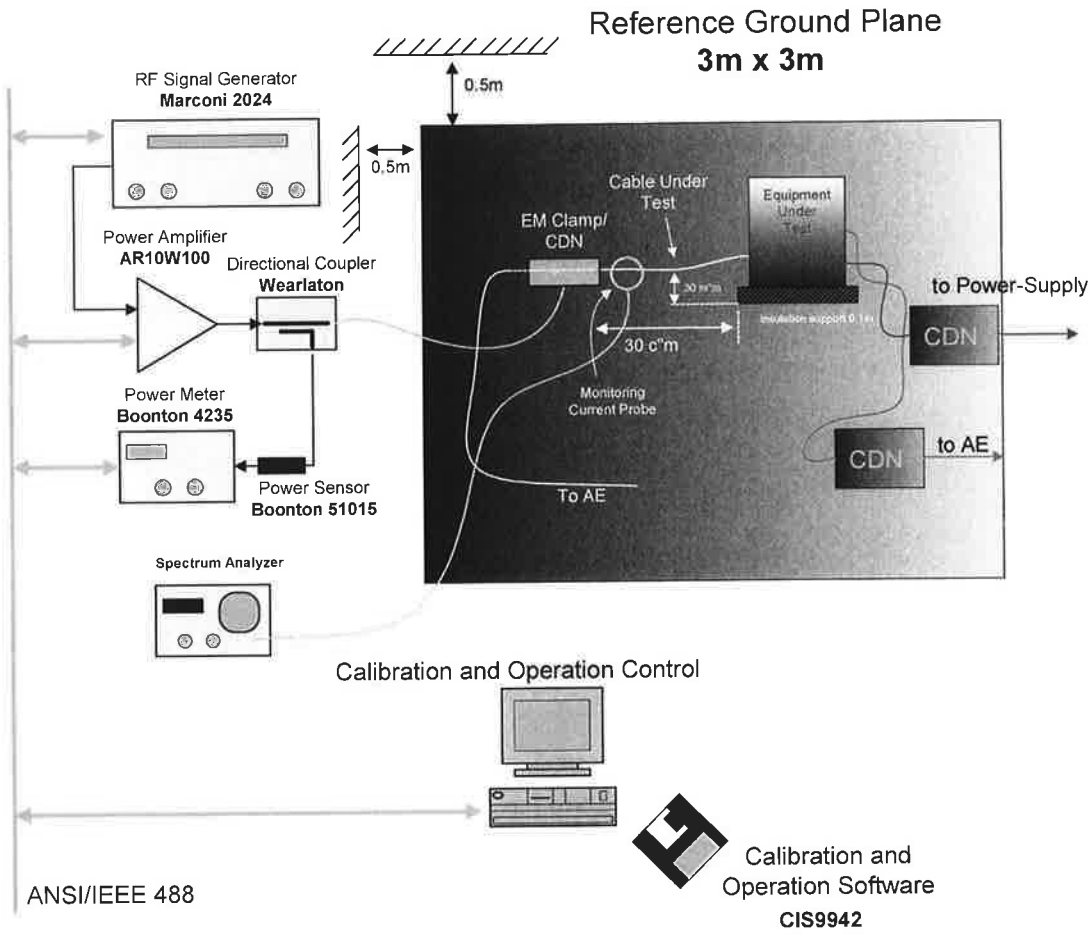
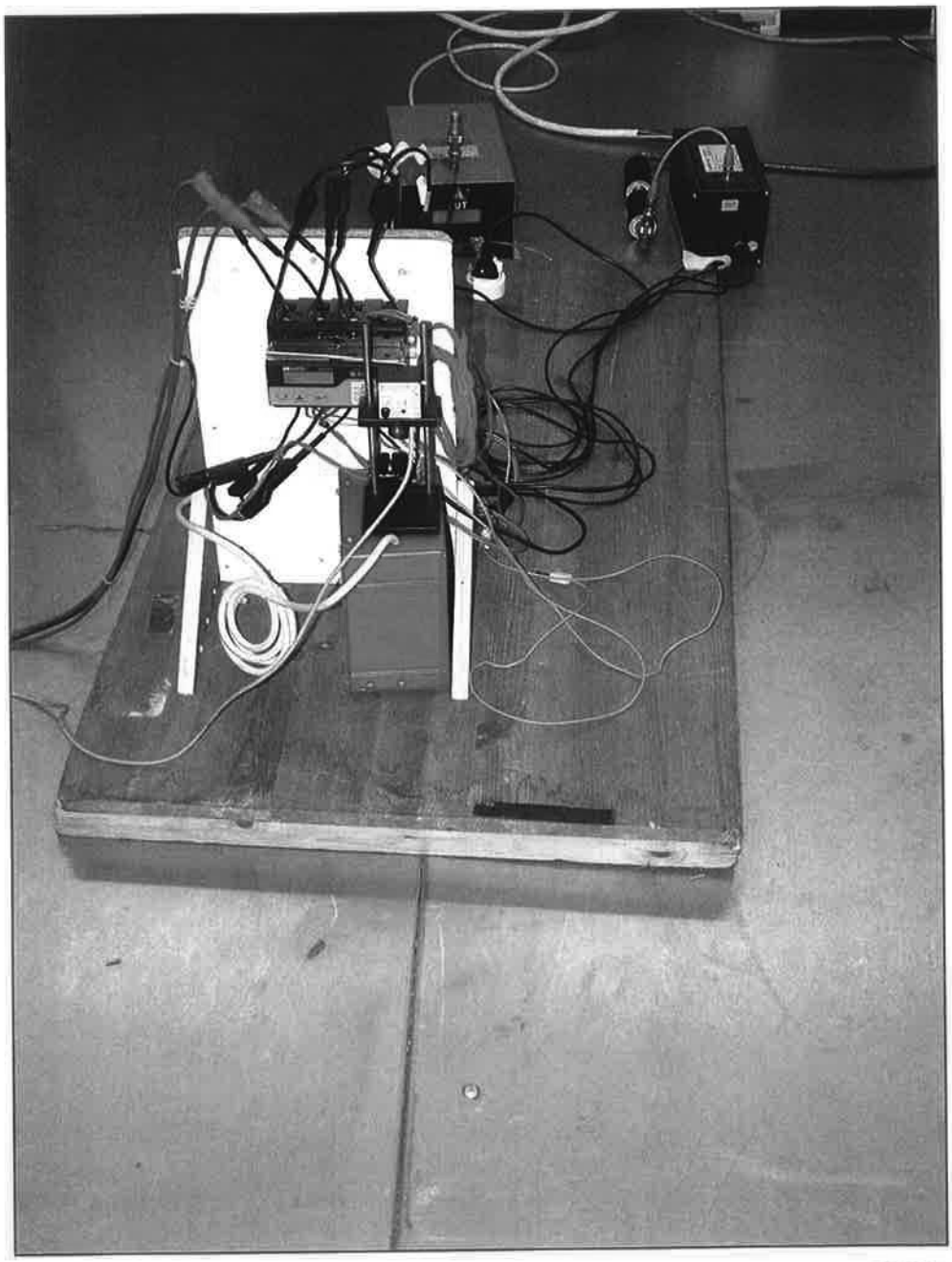


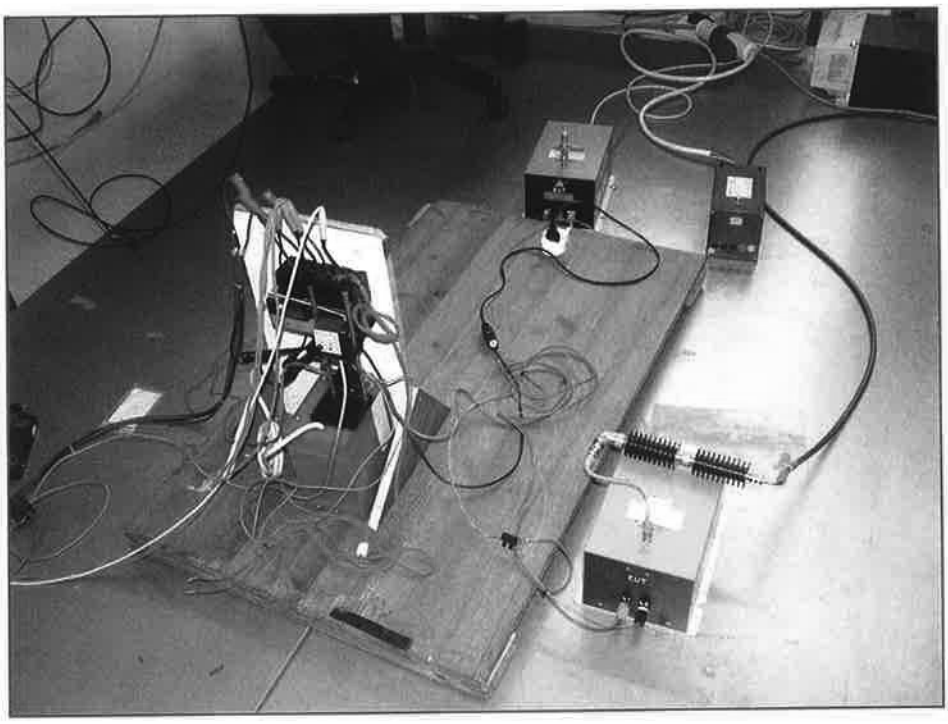
Fig 9.2: Setup for Conducted RF Stress on RS485, Input, Output



Photograph 9.1: Conducted RF Stress on AC Power Supply Port



Photograph 9.2: Conducted RF Stress on RS485, Input, Output



10. Variation due to magnetic field of external origin

Date of Test: 28.06.11
Relative Humidity: 53%
Ambient Temperature: 22°C
Atmospheric Pressure: 1011.4 hPa

Test Method: IEC 60688 Section 6.11

Limits:

H-Field [A/m]	Power frequency	Performance Criteria
400	50Hz	A

Test Procedure:

Magnetic Field test was performed on a ground reference plane 3m x 3m wide. The EUT was placed on a table 0.8m above the ground reference plane, and was configured, arranged and operated in a manner consistent with typical application and load conditions. Normal functional performance of the EUT was verified.
The induction coil was placed horizontally surrounding the EUT. The Induction coil was connected to the Test Generator. Test Generator was activated to generate Magnetic field with strength value shown in the table above. The induction coil was then rotated by 90° and test repeated in order to expose the EUT with different orientations. The dwell time was at least 2 minutes.
During the tests, the EUT and external equipment were monitored to verify the required performance criteria.

List of Test Equipment:

Pacific Power TMX-140, AC Power Source
Current Transformer 1000Amp
Immunity Loop
ELF Field Monitor Holady, HI-3624A

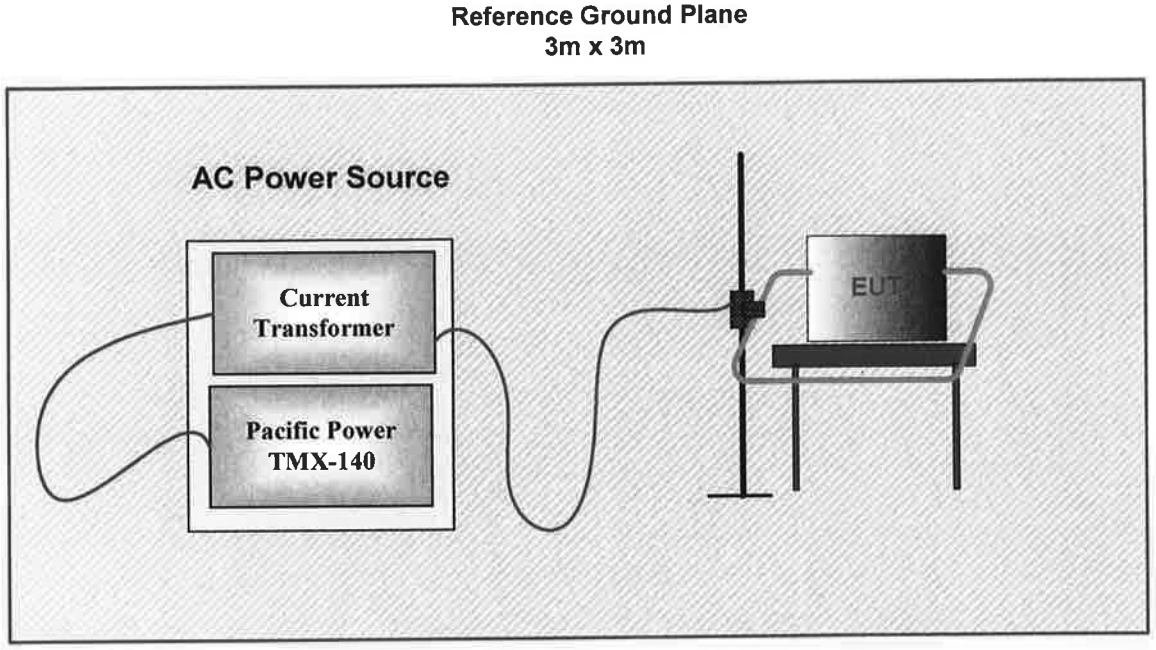
Test Details:

Magnetic Field Strength [A/m]	Test method reference	Coupling Means	Test Setup	Photograph No
400	IEC 60688 Section 6.11	Loop	Fig.10	Photo.10

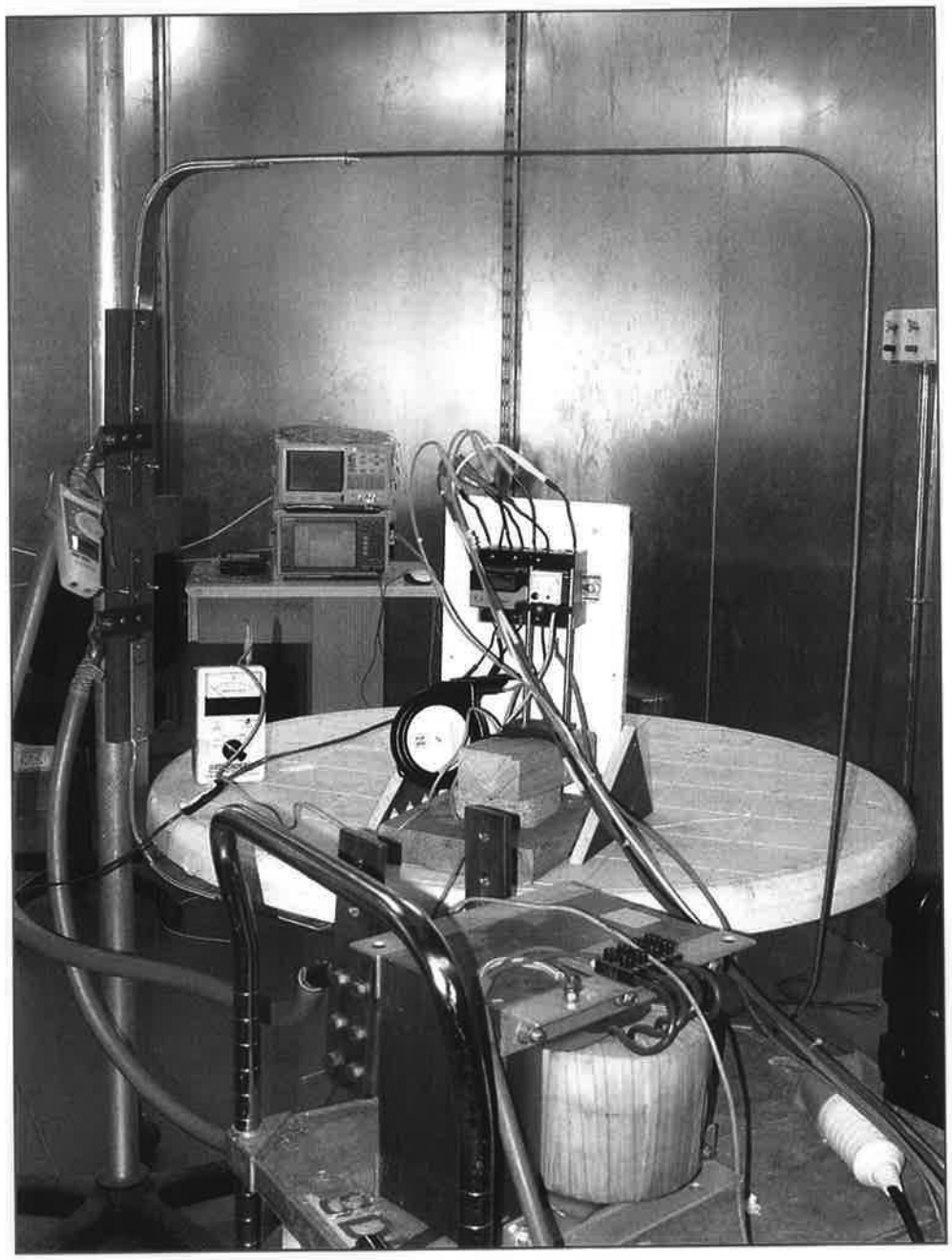
Test Results:

Magnetic Field Strength [A/m]	Power frequency	BER/# of errors	Performance Criteria	Remarks
400	50Hz	None	A	Pass

Figure 10: Immunity to Power frequency Magnetic Field Measurements



Photograph 10: Immunity to Power Frequency Magnetic Field Measurements



11. Immunity to Oscillatory Waves Measurements

Date of Test: 22.06.2011
Relative Humidity: 48%
Ambient Temperature: 21°C
Atmospheric Pressure: 1011.4 hPa

Test Method: IEC 61000-4-12 According to IEC 62052-11, Section 7.5.7

Test Levels:

Damped Oscillatory Wave	Generator waveform	Terminal connection	Level [kV]	Frequency [MHz]	Test Duration [Sec.]	Performance Criteria
230 VAC	Damp Oscillatory Wave	Line to Line	±1kV	100 KHz/1 MHz	2 sec on 2 sec off 15 cycles Total of 60 sec.	B
		Line to Earth	±2.5kV	100 KHz/1 MHz		B
3 phase		Line to Line	±1kV	100 KHz/1 MHz	2 sec on 2 sec off 15 cycles Total of 60 sec.	B
		Line to Earth	±2.5kV	100 KHz/1 MHz		B
DO		Line to Line	±1kV	100 KHz/1 MHz	2 sec on 2 sec off 15 cycles Total of 60 sec.	B
		Line to Earth	±2.5kV	100 KHz/1 MHz		B

Test Procedure:

Test shall be performed on a reference ground, 3m x 3m. For floor standing equipment, the EUT shall be placed on the reference plane on a 0.1m thickness insulating support and connected directly to the reference ground. One terminal of the generator shall be connected to the reference plane. For tabletop equipment, the generator shall be floating.
The EUT Damped Oscillatory Wave Generator shall be set as shown in Fig 8.1 8.2 and 8.3. Normal performance as described shall be verified.
The test voltage shall be applied through a coupling/decoupling network. when a CDN is not suitable for the operating signal of the EUT port to be exercised.
Tests shall be allied in common mode and differential mode.
Line to Ground (common mode): The test voltage shall be applied through the coupling network between each circuit (phase and neutral) and ground.
Line to Line (differential mode): The test voltage shall be applied through the coupling network between phase and neutral.
During the test, the EUT operation shall be monitored to verify Performance Criteria.

List of Test Equipment:

EMTest,OCS 500M, Ring and Damped Oscillatory Wave Generator

Test Details:

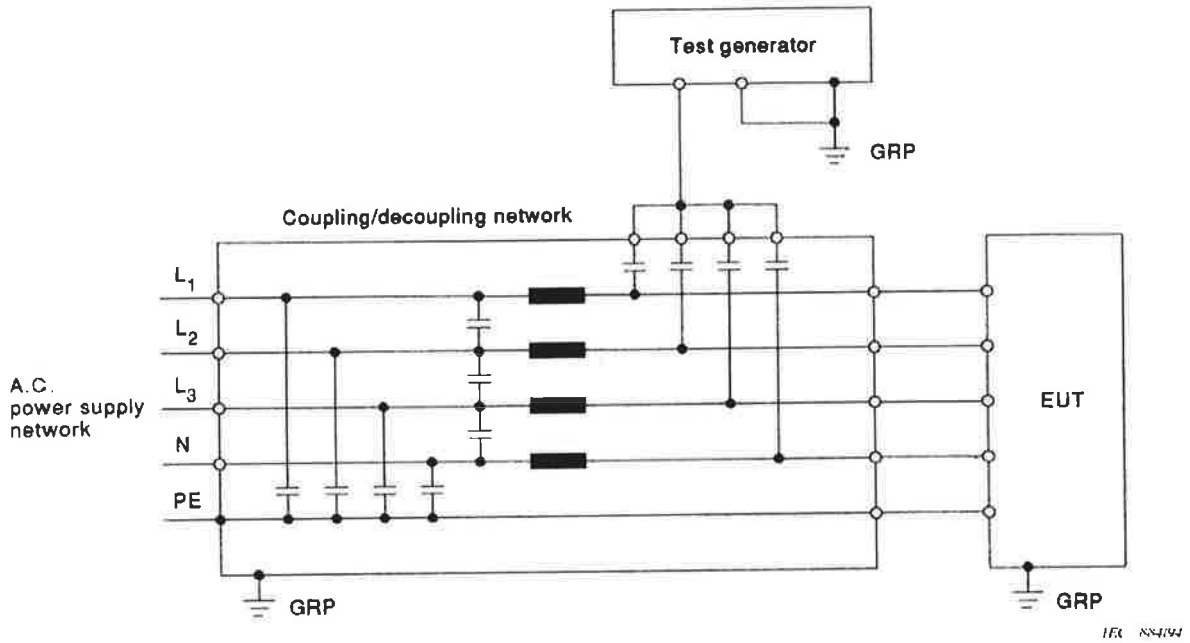
Port/Cable Name	Terminal connection	Frequency [MHz]	Coupling Means	Test duration	Test Setup No.	Photograph No.
230 VAC	Line to Line	100 KHz/1 MHz	CDN	2 sec on 2 sec off 15 cycles Total of 60 sec.	Fig.11.1	Photo.11.1
	Line to Earth	100 KHz/1 MHz				
3 phase	Line to Earth	100 KHz/1 MHz	CDN	2 sec on 2 sec off 15 cycles Total of 60 sec.	Fig.11.1	Photo.11.2
	Line to Earth	100 KHz/1 MHz				
DO	Line to Earth	100 KHz/1 MHz	CDN	2 sec on 2 sec off 15 cycles Total of 60 sec.	Fig.11.2	Photo.11.3
	Line to Earth	100 KHz/1 MHz				

Test Results:

Port/Cable Name	Damped Oscillatory Wave	Level [kV]	Frequency [MHz]	BER/ # of errors	Performance Criteria	Remarks
230 VAC	Line to Line	± 1	100 KHz/ 1 MHz	None	A	**Pass**
	Line to Earth	± 2.5	100 KHz/ 1 MHz	None	A	**Pass**
3 phase	Line to Earth	± 1	100 KHz/ 1 MHz	None	A	**Pass**
	Line to Earth	± 2.5	100 KHz/ 1 MHz	None	A	**Pass**
DO	Line to Earth	± 1	100 KHz/ 1 MHz	None	A	**Pass**
	Line to Earth	± 2.5	100 KHz/ 1 MHz	None	A	**Pass**

Fig 11.1: Setup for Immunity to Oscillatory Waves Measurements
AC Line

Line to Earth



Line to Line

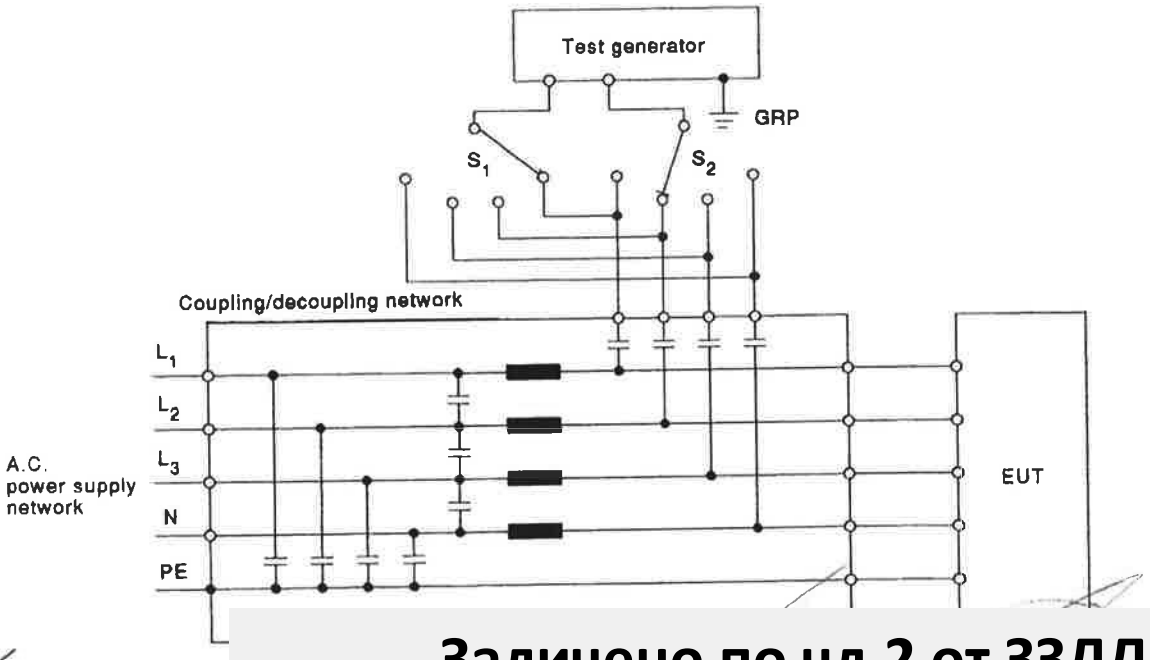
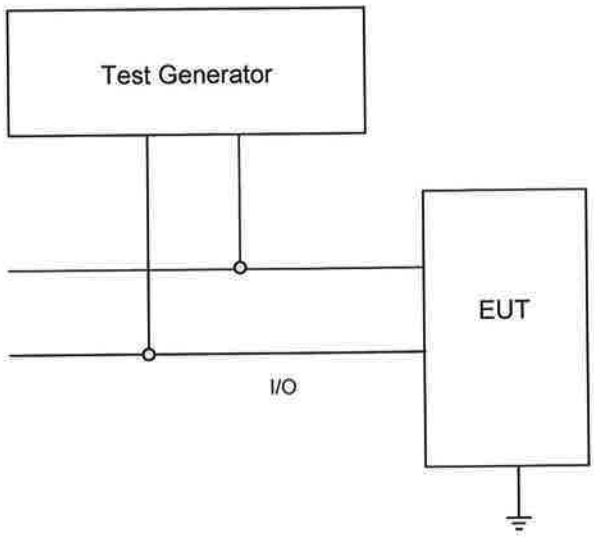
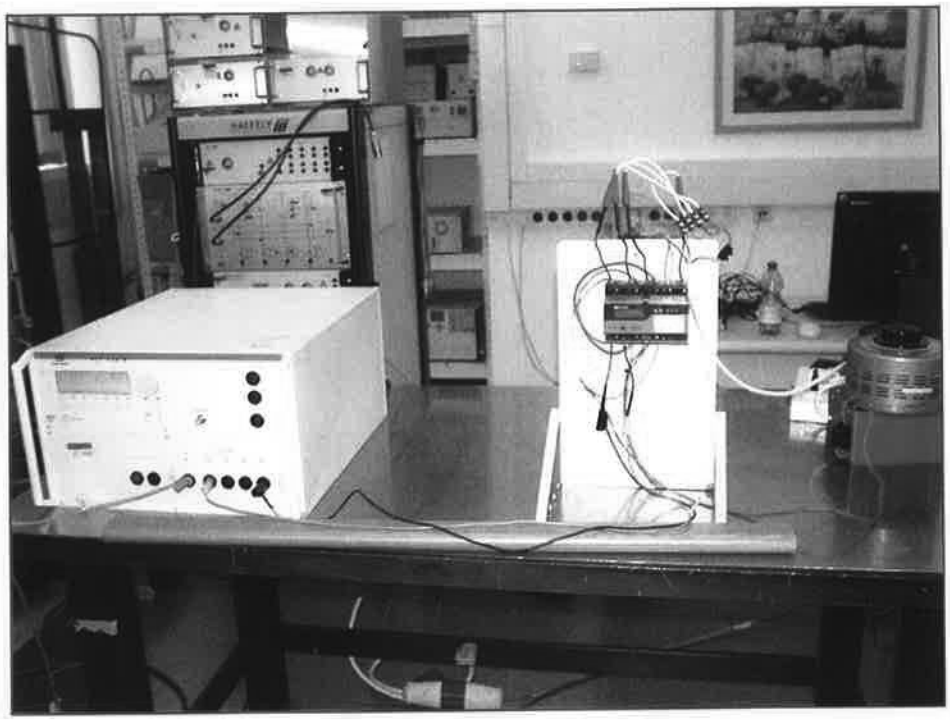


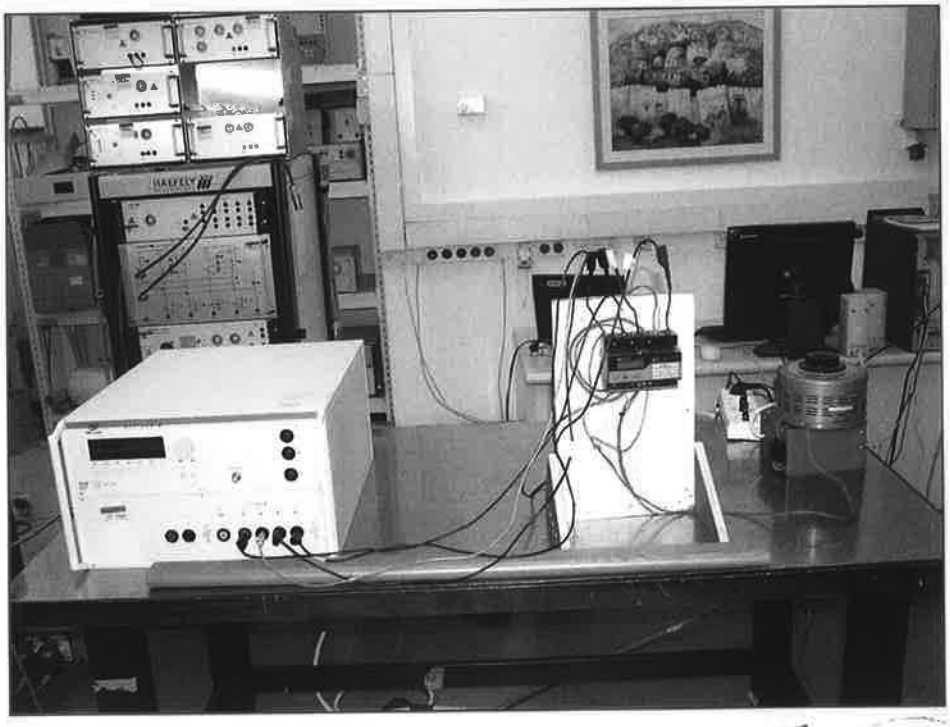
Figure 11.2: Setup for Immunity to Oscillatory Waves Measurements DO



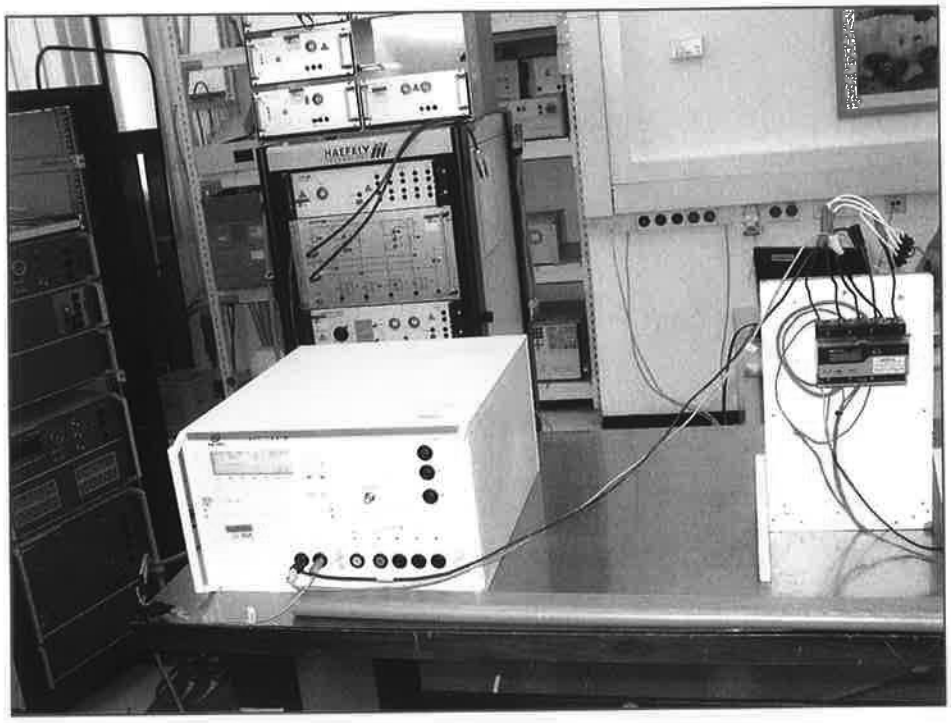
Photograph 11.1: Immunity to Oscillatory waves measurements 230 VAC



Photograph 11.2: Immunity to Oscillatory waves measurements 3 phase



Photograph 11.3: Immunity to Oscillatory waves measurements DO



12. Variations due to ambient temperature

Date of Test: 22.06.2011
Relative Humidity: 48%
Ambient Temperature: 21°C
Atmospheric Pressure: 1011.4 hPa

Test Method: IEC 60688 section 6.4

Test Levels:

Maximum allowable errors:

Parameters	25 °C	-10 °C	+55 °C
0.05In/PF 1	Reference	1.05%	0.9%
In/PF 1	Reference	1.05%	0.9%
Imax/PF 1	Reference	1.05%	0.9%
0.1In/PF 0.5ind	Reference	1.75%	1.5%
In/PF 0.5ind	Reference	1.75%	1.5%
Imax/PF 0.5ind	Reference	1.75%	1.5%

Test Procedure:

Increase the ambient temperature to the upper limit +55 °C and allow sufficient time for conditions to stabilize (30 min is usually adequate). Record the value of the **output signal.** Reduce the ambient temperature to the lower limit -10 °C and allow the same stabilization to take place. Record the value of the output signal

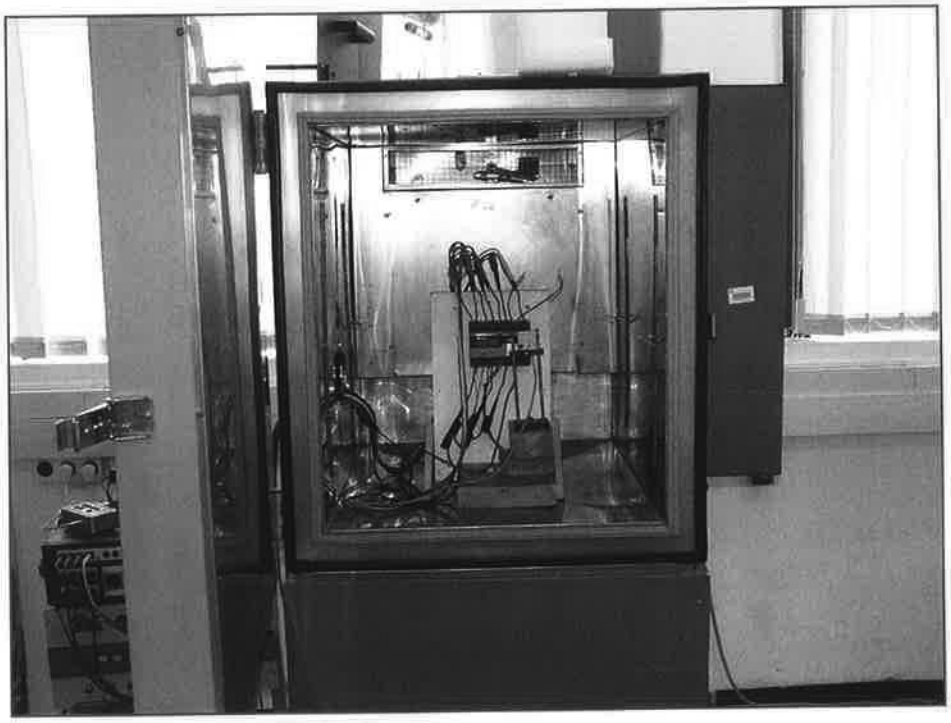
List of Test Equipment:

Oven,Tenny,Tenny 10

Test Details & results:

Parameters	25 °C	-10 °C	+55 °C	Test Result
0.05In/PF 1	Reference	1.05%	0.9%	**Pass**
In/PF 1	Reference	1.05%	0.9%	**Pass**
Imax/PF 1	Reference	1.05%	0.9%	**Pass**
0.1In/PF 0.5ind	Reference	1.75%	1.5%	**Pass**
In/PF 0.5ind	Reference	1.75%	1.5%	**Pass**
Imax/PF 0.5ind	Reference	1.75%	1.5%	**Pass**

Photograph 12: Variations due to ambient temperature Test



13. AC Voltage insulation test

Date of Test: 22.06.2011
Relative Humidity: 48%
Ambient Temperature: 21°C
Atmospheric Pressure: 1011.4 hPa

Test Method: IEC 61010-1 According to IEC 60688 section 6.19

Test Levels:

Port/Cable Name	Test Level [kV]	Test Duration [Sec.]
PH & NE to DI & RS 485	4	60
3 phase to Di & RS 485	4	60
DO to DI & RS 485	4	60

Test Procedure:

The requirements for the voltage test and other safety requirements are included in IEC 61010-1 to which reference shall be made.
The testing voltage – 4kVrms, 50Hz.
Duration of the test – 60 min.
Pass criteria: The leakage current shall not exceed 5mA.

After the test of the Meter will complete, the meter should pass the accuracy test according Table 3.

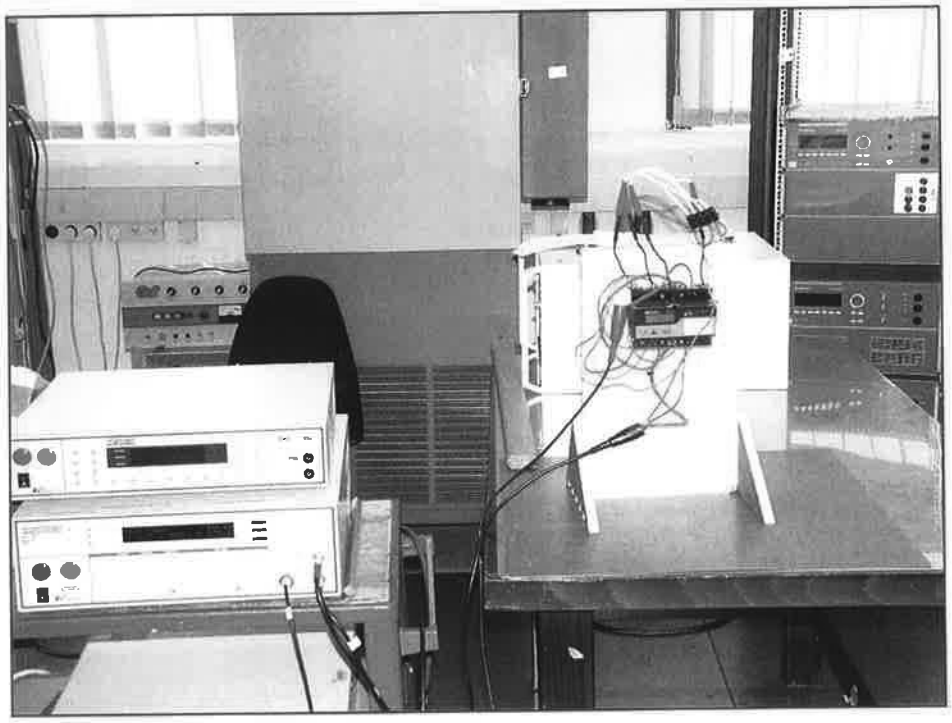
List of Test Equipment:

Quadchck II, Model: 7564SA

Test Details & results:

Port/Cable Name	Test Level [kV]	Test Duration [Sec.]	Photograph No.	Pass/Fail
PH & NE to DI & RS 485	4	60	Photo.13	Pass
3 phase to Di & RS 485	4	60		Pass
DO to DI & RS 485	4	60		Pass

Photograph 13: AC Voltage insulation test



14. Impulse Voltage tests

Date of Test: 22.06.2011
Relative Humidity: 48%
Ambient Temperature: 21°C
Atmospheric Pressure: 1011.4 hPa

Test Method: IEC 62052-11 Sec.7.3.2 & IEC 60688 Sec 6.20

Test Levels:

Port under Test	Pulse Shape Combination Wave	Peak Voltage	# of pulses	Performance Criteria
All terminals	1.2x50µs,500 Ohm	±6kV	10, each polarity	B

Test Procedure:

A peak test voltage of 6 kV in both positive and negative senses, having the standardized impulse waveform of 1,2/50 µs, shall be applied to **transducers** as follows:

– between the earth terminal and all the other terminals connected together;
– between the terminals of each circuit in turn, all other circuits being earthed.

Three positive and three negative impulses shall be applied at intervals of not less than 5 s. Any flashover (capacitance discharge) shall be considered a criterion of failure unless occurring in a component designed for such.

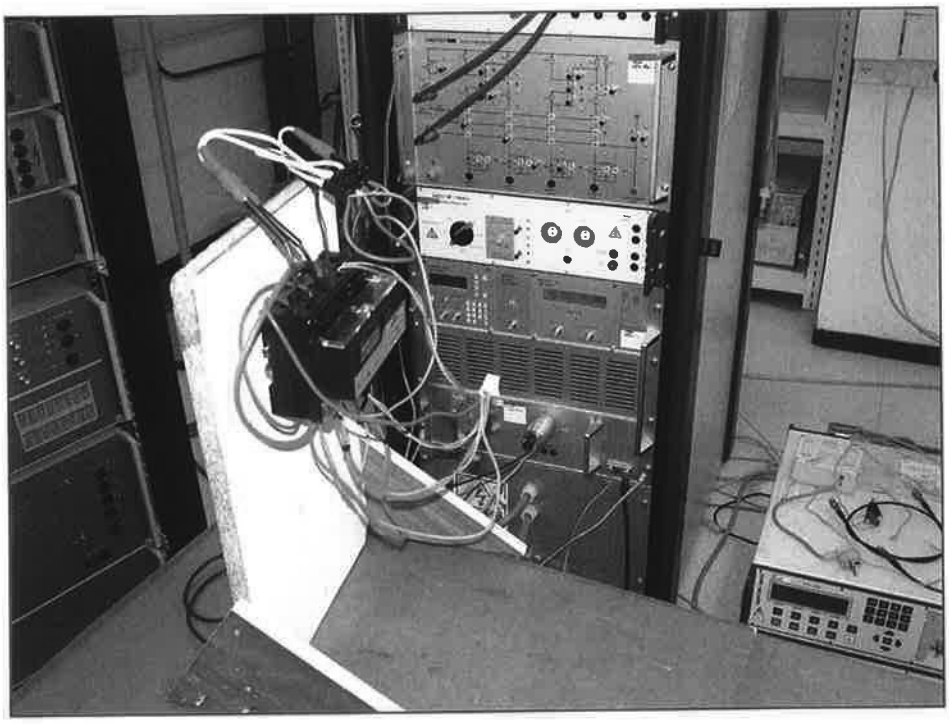
List of Test Equipment:

Haefely Test System, comprising of PSURGE 6.1 Mainframe
WinPATS Control S/W and WinPATS Control S/W
IP6.2 2 & 4 -wire Coupling Network
PHV30.2 1.2x50/8x20µs Combination Wave Plug-In unit

Test Details & results:

From	To	Test method reference	Generator Waveform	Photograph No.	Test Result
All Terminals connected together	RS485 & DI	Sec. 6.3.2.2	1.2x50µs,500 Ohm	Photo.14	**Pass**
3 Phase AC	AC 1 PH & RS485&DI&DO &Current terminals	Sec. 6.3.1.1	1.2x50µs,500 Ohm	Photo.14	**Pass**
1 Phase AC	AC 3 PH & RS485&DI&DO & Current terminals 3 Phase AC	Sec. 6.3.1.1	1.2x50µs,500 Ohm	Photo.14	**Pass**

Photograph 14: Impulse voltage test



15. Appendix

Appendix A: Auxiliary Equipment and tests results Accuracy verification.

1. Accuracy testing equipment

Three Phase Power source: CMC256-Plus – OMICRON electronics GmbH production.

Laptop: Lenovo T43.

2. The test results Pass/Fail criteria verification. (Performed by SATEC Staff)

2.1 Electrostatic Discharge test, IEC 62052-11, 7.5.2

In accordance with the Standard requirements the EUT was tested as table-top equipment, with reference voltage 230V and without any current in the current circuits (open circuit), at the beginning with Contact discharge 8 kV, and then 15 kV Air discharge 1-2 mm from EUT plastic enclosure to every point defined by QualiTech representatives, 10 negative and 10 positive pulses each type.

The standard pass criterion- *the application of the electrostatic discharge shall not produce a change in register more than x units. During the test a temporary degradation or loss of function or performance is acceptable.*

$$x = 10^n \, m \, Un \, Imax$$

where
$n = -6$;
m is the number of measuring elements - 6;
Un is the reference voltage in volts - 230;
$Imax$ is the maximum current in amperes - 10.
i.e. x = 0.015.

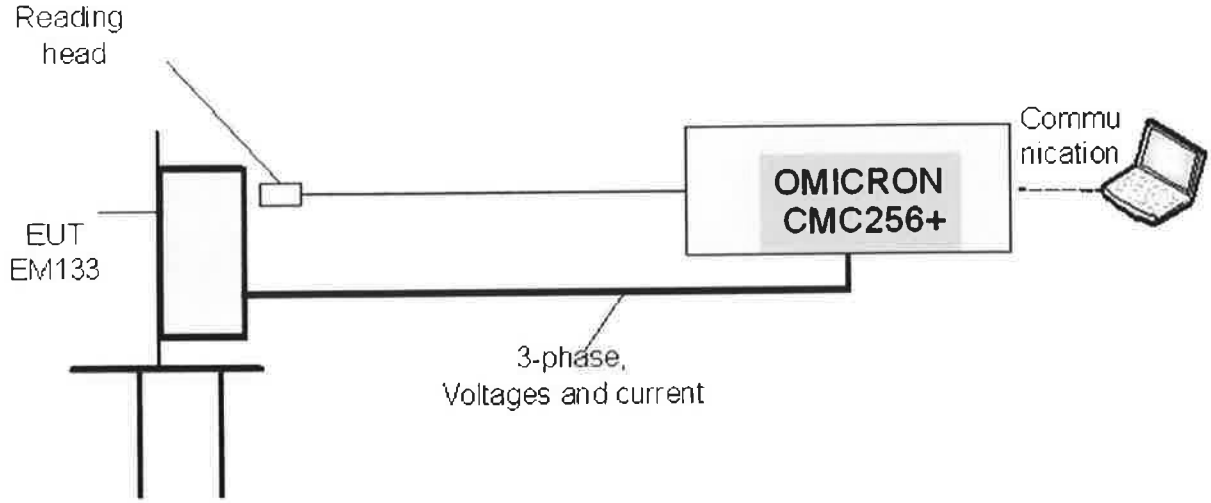
Table 1: Energy registers reading before and after test.

Active Energy Before Test (kWh)	Active Energy After Test (kWh)	Reactive Energy Before Test (kVARh)	Reactive Energy After Test (kVARh)
20430.68	20430.68	33911.89	33911.89

The final conclusion- **PASS**

2.2 Immunity to Conducted disturbances induced by radio frequency fields IEC 62052-11, 7.5.5.

Figure 1. Energy measurement verification setup



In accordance with the Standard requirements, the meter under test should be monitored through the energy acceptance. The Voltages, Currents and Power Factor, which must be provided by the precision power source (Omicron CMC256+), defined by the standards and shown below in the Table 2 – Table 6. Disturbances voltage level is 10 V, and frequency range is 150 kHz to 80MHz.

The pass criterion: *during the test, the behavior of the equipment shall not be perturbed and the variation of the error shall be within the limits as specified in the relevant standards (2% as specified in IEC62053-22).*

The test was implemented on the following ports:

- 1 phase power port (230VAC).
- 3 phase power (3 phase AC).
- RS485 Port ((RS485).
- Digital Inputs (Inputs).
- Digital Outputs (Outputs).
-

Table2. Accuracy test for CONDUCTED DISTURBANCES on 1phase Port

L1,V	L2,V	L3,V	I1,A	I2,A	I3,A	PF	Error,%	Error limit,%	NOTE
230	230	230	5	5	5	0.5ind	0.0972	2	PASS
230	230	230	1	1	1	1	0.0492	2	PASS
230	230	230	5	5	5	1	-0.0072	2	PASS
230	230	230	10	10	10	1	0.0379	2	PASS

Table3. Accuracy test for CONDUCTED DISTURBANCES on 3phase Port

L1,V	L2,V	L3,V	I1,A	I2,A	I3,A	PF	Error,%	Error limit,%	NOTE
230	230	230	5	5	5	0.5ind	0.0492	2	PASS
230	230	230	1	1	1	1	0.0492	2	PASS
230	230	230	5	5	5	1	-0.0097	2	PASS
230	230	230	10	10	10	1	0.0381	2	PASS

Table4. Accuracy test for CONDUCTED DISTURBANCES on RS485 Port

L1,V	L2,V	L3,V	I1,A	I2,A	I3,A	PF	Error,%	Error limit,%	NOTE
230	230	230	5	5	5	0.5ind	0.0010	2	PASS
230	230	230	1	1	1	1	0.0514	2	PASS
230	230	230	5	5	5	1	0.0417	2	PASS
230	230	230	10	10	10	1	-0.0119	2	PASS

Table5. Accuracy test for CONDUCTED DISTURBANCES on Digital Inputs (DI) Port

L1,V	L2,V	L3,V	I1,A	I2,A	I3,A	PF	Error,%	Error limit,%	NOTE
230	230	230	5	5	5	0.5ind	0.0010	2	PASS
230	230	230	1	1	1	1	0.0490	2	PASS
230	230	230	5	5	5	1	-0.0075	2	PASS
230	230	230	10	10	10	1	-0.0119	2	PASS

Table6. Accuracy test for CONDUCTED DISTURBANCES on Digital Outputs (DO) Port

L1,V	L2,V	L3,V	I1,A	I2,A	I3,A	PF	Error,%	Error limit,%	NOTE
230	230	230	5	5	5	0.5ind	0.0010	2	PASS
230	230	230	1	1	1	1	0.0490	2	PASS
230	230	230	5	5	5	1	-0.0075	2	PASS
230	230	230	10	10	10	1	-0.0094	2	PASS

The final conclusion- **PASS**

2.3 Immunity to Electromagnetic RF fields IEC 62052-11, 7.5.3.

In accordance with the Standard requirements the EUT was tested as table-top equipment, with cables length, exposed to the field 1m, frequency band 80 MHZ to 2000MHz, carrier modulated with 80%AM at 1kHz sine wave and was fulfilled twice-

a) with current and at the test field 10V/m and **b) without current and at the test field 30V/m.**

a) In accordance with the Standard requirements, the meter under test should be monitored through the energy acceptance. The Voltages, Currents and Power Factor, which must be provided by the precision power source (Omicron CMC256+), defined by the standards and shown below in the Table 7 – Table 8. (see figure 1).

The standard pass criterion- *during the test, the behaviour of the equipment shall not be perturbed and the variation of the error shall be within the limits as specified in the relevant standards (2% as specified in IEC62053-22).*
During the test (frequency step change in the above described range) all accuracy results were fixed and recorded. The results are show in tables bellow.

Table7. Accuracy test for ELECTROMAGNETIC RF FIELDS immunity. Antenna in Vertical polarization.

Frequency range, MHz	L1,V	L2,V	L3,V	I1,A	I2,A	I3,A	PF	Error,%	Error limit,%	NOTE
80-100	230	230	230	5	5	5	0.5ind	0.0010	2	PASS
	230	230	230	1	1	1	1	0.0463	2	PASS
	230	230	230	5	5	5	1	0.0441	2	PASS
	230	230	230	10	10	10	1	-0.0119	2	PASS
100-120	230	230	230	5	5	5	0.5ind	0.0010	2	PASS
	230	230	230	1	1	1	1	0.0487	2	PASS
	230	230	230	5	5	5	1	-0.0050	2	PASS
	230	230	230	10	10	10	1	-0.0119	2	PASS
120-150	230	230	230	5	5	5	0.5ind	0.0008	2	PASS
	230	230	230	1	1	1	1	0.0490	2	PASS
	230	230	230	5	5	5	1	0.0417	2	PASS
	230	230	230	10	10	10	1	-0.0122	2	PASS
150-230	230	230	230	5	5	5	0.5ind	0.0010	2	PASS
	230	230	230	1	1	1	1	0.0490	2	PASS
	230	230	230	5	5	5	1	0.0417	2	PASS
	230	230	230	10	10	10	1	-0.0122	2	PASS
230-320	230	230	230	5	5	5	0.5ind	0.0487	2	PASS
	230	230	230	1	1	1	1	0.0463	2	PASS
	230	230	230	5	5	5	1	0.0414	2	PASS
	230	230	230	10	10	10	1	-0.0119	2	PASS
320-480	230	230	230	5	5	5	0.5ind	0.0008	2	PASS
	230	230	230	1	1	1	1	0.0466	2	PASS
	230	230	230	5	5	5	1	-0.0075	2	PASS
	230	230	230	10	10	10	1	-0.0119	2	PASS
480-640	230	230	230	5	5	5	0.5ind	-0.0016	2	PASS
	230	230	230	1	1	1	1	0.0466	2	PASS
	230	230	230	5	5	5	1	-0.0102	2	PASS
	230	230	230	10	10	10	1	-0.0119	2	PASS
640-1000	230	230	230	5	5	5	0.5ind	-0.0014	2	PASS
	230	230	230	1	1	1	1	0.0490	2	PASS
	230	230	230	5	5	5	1	-0.0075	2	PASS
	230	230	230	10	10	10	1	-0.0119	2	PASS
1000-2000	230	230	230	5	5	5	0.5ind	0.0010	2	PASS
	230	230	230	1	1	1	1	0.0466	2	PASS
	230	230	230	5	5	5	1	-0.0075	2	PASS
	230	230	230	10	10	10	1	-0.0122	2	PASS

Table8. Accuracy test for ELECTROMAGNETIC RF FIELDS immunity. Antenna in Horizontal polarization.

Frequency range, MHz	L1,V	L2,V	L3,V	I1,A	I2,A	I3,A	PF	Error,%	Error limit,%	NOTE
80-100	230	230	230	5	5	5	0.5ind	0.0034	2	PASS
	230	230	230	1	1	1	1	-0.0014	2	PASS
	230	230	230	5	5	5	1	-0.0075	2	PASS
	230	230	230	10	10	10	1	-0.0117	2	PASS
100-120	230	230	230	5	5	5	0.5ind	0.0010	2	PASS
	230	230	230	1	1	1	1	0.0490	2	PASS
	230	230	230	5	5	5	1	-0.0050	2	PASS
	230	230	230	10	10	10	1	-0.0119	2	PASS
120-150	230	230	230	5	5	5	0.5ind	0.0010	2	PASS
	230	230	230	1	1	1	1	0.0490	2	PASS
	230	230	230	5	5	5	1	0.0417	2	PASS
	230	230	230	10	10	10	1	-0.0119	2	PASS
150-230	230	230	230	5	5	5	0.5ind	0.0490	2	PASS
	230	230	230	1	1	1	1	0.0490	2	PASS
	230	230	230	5	5	5	1	-0.0075	2	PASS
	230	230	230	10	10	10	1	-0.0117	2	PASS
230-320	230	230	230	5	5	5	0.5ind	0.0490	2	PASS
	230	230	230	1	1	1	1	0.0466	2	PASS
	230	230	230	5	5	5	1	0.0417	2	PASS
	230	230	230	10	10	10	1	0.0379	2	PASS
320-480	230	230	230	5	5	5	0.5ind	-0.0014	2	PASS
	230	230	230	1	1	1	1	0.0490	2	PASS
	230	230	230	5	5	5	1	-0.0075	2	PASS
	230	230	230	10	10	10	1	-0.0119	2	PASS
480-640	230	230	230	5	5	5	0.5ind	0.0008	2	PASS
	230	230	230	1	1	1	1	0.0490	2	PASS
	230	230	230	5	5	5	1	-0.0099	2	PASS
	230	230	230	10	10	10	1	-0.0144	2	PASS
640-1000	230	230	230	5	5	5	0.5ind	-0.0016	2	PASS
	230	230	230	1	1	1	1	0.0514	2	PASS
	230	230	230	5	5	5	1	-0.0050	2	PASS
	230	230	230	10	10	10	1	-0.0119	2	PASS
1000-2000	230	230	230	5	5	5	0.5ind	0.0010	2	PASS
	230	230	230	1	1	1	1	0.0466	2	PASS
	230	230	230	5	5	5	1	-0.0075	2	PASS
	230	230	230	10	10	10	1	-0.0122	2	PASS

The final conclusion- **PASS.**

b) During the test b) the setup was not changed but current source was disconnected from EUT current circuits and the EUT current terminals were open circuit.
The field strength was adjusted to 30V/m and frequency was changed with step variation from 80 MHz to 2Gz in the standards defined polarizations and angles.

The standard pass criterion- *the application of the RF field shall not produce a change in register more than x units. During the test a temporary degradation or loss of function or performance is acceptable.*

$$x = 10^n \, m \, Un \, Imax$$

where
$n = -6$;
m is the number of measuring elements - 6;
Un is the reference voltage in volts - 230;
$Imax$ is the maximum current in amperes - 10.
i.e. x = 0.015.

The recorded EUT Energy registers readings before and after the test were 16461.74 kWh and 1428.65 kVARh and did not change during test.

Table 9: Energy registers reading before and after test.

Active Energy Before Test (kWh)	Active Energy After Test (kWh)	Reactive Energy Before Test (kVARh)	Reactive Energy After Test (kVARh)
16461.74	16461.74	1428.65	1428.65

The final conclusion- **PASS**

2.4 Surge Immunity Test IEC 62052-11, 7.5.6.

The standard pass criterion- *the application of the surge immunity test voltage shall not produce a change in register more than x units. During the test a temporary degradation or loss of function or performance is acceptable.*

$$x = 10^n \, m \, Un \, Imax$$

where
$n = -6$;
m is the number of measuring elements - 6;
Un is the reference voltage in volts - 230;
$Imax$ is the maximum current in amperes - 10.
i.e. x = 0.015.

Table 10: Energy registers reading before and after test.

Active Energy Before Test (kWh)	Active Energy After Test (kWh)	Reactive Energy Before Test (kVARh)	Reactive Energy After Test (kVARh)
16461.74	16461.74	1428.65	1428.65

The final conclusion- **PASS**

2.5 Fast Transient burst Test IEC 62052-11, 7.5.4

The standard pass criterion- *during the test a temporary degradation or loss of function or performance is acceptable, nevertheless the variation of error shall be within the limits as specified in the relevant standards (2% as specified in IEC62053-22).*

The results before and after test are show in tables bellow

Table 11. Accuracy test before FAST TRANSIENT BURST TEST

L1,V	L2,V	L3,V	I1,A	I2,A	I3,A	PF	Error,%	Error limit,%	NOTE
230	230	230	5	5	5	0.5ind	0.0008	2	PASS
230	230	230	1	1	1	1	0.0490	2	PASS
230	230	230	5	5	5	1	0.0075	2	PASS
230	230	230	10	10	10	1	-0.0117	2	PASS

Table 12. Accuracy test after FAST TRANSIENT BURST TEST

L1,V	L2,V	L3,V	I1,A	I2,A	I3,A	PF	Error,%	Error limit,%	NOTE
230	230	230	5	5	5	0.5ind	0.0010	2	PASS
230	230	230	1	1	1	1	0.0512	2	PASS
230	230	230	5	5	5	1	0.0014	2	PASS
230	230	230	10	10	10	1	-0.0122	2	PASS

The final conclusion- **PASS**

2.6 Damped Oscillatory Waves Immunity Test IEC 62052-11, 7.5.7.

The standard pass criterion- *during the test, the behavior of the equipment shall not be perturbed and the variation of the error shall be within the limits as specified in the relevant standards (2% as specified in IEC62053-22).*

The results before and after test are show in tables bellow

Table 13. Accuracy test before DAMPED OCSILLATORY WAVES IMMUNITY TEST

L1,V	L2,V	L3,V	I1,A	I2,A	I3,A	PF	Error,%	Error limit,%	NOTE
230	230	230	5	5	5	0.5ind	0.0010	2	PASS
230	230	230	1	1	1	1	0.0466	2	PASS
230	230	230	5	5	5	1	0.0050	2	PASS
230	230	230	10	10	10	1	-0.0122	2	PASS

Table 14. Accuracy test after DAMPED OCSILLATORY WAVES IMMUNITY TEST

L1,V	L2,V	L3,V	I1,A	I2,A	I3,A	PF	Error,%	Error limit,%	NOTE
230	230	230	5	5	5	0.5ind	0.0010	2	PASS
230	230	230	1	1	1	1	0.0490	2	PASS
230	230	230	5	5	5	1	-0.0075	2	PASS
230	230	230	10	10	10	1	-0.0119	2	PASS

The final conclusion- **PASS**

2.7 Variation due to magnetic field of external origin IEC IEC60688, 6.11.

The standard pass criterion - *the variation of the error shall be within the limits as specified in the relevant standards (1% as specified in* IEC 62053-22 8.2*).*

The results before and during test are show in tables bellow

Table 15. Accuracy test before Variation due to magnetic field of external origin test

L1,V	L2,V	L3,V	I1,A	I2,A	I3,A	PF	Error,%	Error limit,%	NOTE
230	230	230	5	5	5	0.5ind	0.2898	1	PASS
230	230	230	1	1	1	1	0.0974	1	PASS
230	230	230	5	5	5	1	-0.0561	1	PASS
230	230	230	10	10	10	1	-0.0612	1	PASS

Table 16. Accuracy test during Variation due to magnetic field of external origin, EM133 horizontal to a coil

L1,V	L2,V	L3,V	I1,A	I2,A	I3,A	PF	Error,%	Error limit,%	NOTE
230	230	230	5	5	5	0.5ind	0.2898	1	PASS
230	230	230	1	1	1	1	0.0495	1	PASS
230	230	230	5	5	5	1	-0.1052	1	PASS
230	230	230	10	10	10	1	-0.0612	1	PASS

Table 17. Accuracy test before Variation due to magnetic field of external origin test, EM133 vertical to a coil

L1,V	L2,V	L3,V	I1,A	I2,A	I3,A	PF	Error,%	Error limit,%	NOTE
230	230	230	5	5	5	0.5ind	0.2898	1	PASS
230	230	230	1	1	1	1	0.0492	1	PASS
230	230	230	5	5	5	1	-0.0561	1	PASS
230	230	230	10	10	10	1	-0.0614	1	PASS

Table 18. Accuracy test during Variation due to magnetic field of external origin, EM133 tilt to a coil

L1,V	L2,V	L3,V	I1,A	I2,A	I3,A	PF	Error,%	Error limit,%	NOTE
230	230	230	5	5	5	0.5ind	0.2896	1	PASS
230	230	230	1	1	1	1	0.0495	1	PASS
230	230	230	5	5	5	1	-0.0564	1	PASS
230	230	230	10	10	10	1	-0.0614	1	PASS

The final conclusion- **PASS**

2.8 Variation due to ambient temperature, IEC60688, 6.4.

The standard pass criterion - According to IEC 62053-22 8.2 there are the following max allowable errors:

	25 °C	-10 °C	+55 °C
0.05In/PF 1	Reference	1.05%	0.9%
In/PF 1	Reference	1.05%	0.9%
Imax/PF 1	Reference	1.05%	0.9%
0.1In/PF 0.5ind	Reference	1.75%	1.5%
In/PF 0.5ind	Reference	1.75%	1.5%
Imax/PF 0.5ind	Reference	1.75%	1.5%

The results during test are show in tables bellow

Table 19. Accuracy test Variation due to ambient temperature test at 25 °C

L1,V	L2,V	L3,V	I1,A	I2,A	I3,A	PF	Error,%	Error limit,%	NOTE
230	230	230	0.25	0.25	0.25	1	0.0459	1	PASS
230	230	230	5	5	5	1	-0.0075	1	PASS
230	230	230	10	10	10	1	0.0379	1	PASS
230	230	230	0.5	0.5	0.5	0.5ind	0.1770	1	PASS
230	230	230	5	5	5	0.5ind	-0.0313	1	PASS
230	230	230	10	10	10	0.5ind	-0.0991	1	PASS

Table 20. Accuracy test Variation due to ambient temperature test at -10 °C

L1,V	L2,V	L3,V	I1,A	I2,A	I3,A	PF	Error,%	Error limit,%	NOTE
230	230	230	0.25	0.25	0.25	1	-0.2037	1.05	PASS
230	230	230	5	5	5	1	0.0916	1.05	PASS
230	230	230	10	10	10	1	-0.0882	1.05	PASS
230	230	230	0.5	0.5	0.5	0.5ind	0.2742	1.75	PASS
230	230	230	5	5	5	0.5ind	0.0733	1.75	PASS
230	230	230	10	10	10	0.5ind	0.0323	1.75	PASS

Table 21. Accuracy test Variation due to ambient temperature test at +55 °C

L1,V	L2,V	L3,V	I1,A	I2,A	I3,A	PF	Error,%	Error limit,%	NOTE
230	230	230	0.25	0.25	0.25	1	0.2069	0.9	PASS
230	230	230	5	5	5	1	0.1394	0.9	PASS
230	230	230	10	10	10	1	0.0870	0.9	PASS
230	230	230	0.5	0.5	0.5	0.5ind	0.4338	1.5	PASS
230	230	230	5	5	5	0.5ind	-0.0125	1.5	PASS
230	230	230	10	10	10	0.5ind	-0.1432	1.5	PASS

The final conclusion- **PASS**

2.9 Insulation tests, IEC 62052-11, 7.3, IEC60688, 6.20.

Impulse voltage test (6kV) IEC 62052-11, 7.3.2, IEC 60688, 6.20 and AC voltage Insulation test (4kVAC) IEC 62052-11, 7.3.3

The standard pass criterion: The device inspection after the tests: there shall be no change at reference conditions in the percentage error of the meter greater than defined in the relevant standard and no functional and mechanical damage to the equipment.
In Table18 given percentage error limits as specified in IEC 62053-22 8.2

Table 18 – Percentage error limits
(single-phase meters and polyphase meters with balanced loads)

Value of current	Power factor	Percentage error limits for meters of class	
		0,2 S	0,5 S
0,01 *In* ≤ *I* < 0,05 *In*	1	±0,4	±1,0
0,05 *In* ≤ *I* ≤ *Imax*	1	±0,2	±0,5
0,02 *In* ≤ *I* < 0,1 *In*	0,5 inductive 0,8 capacitive	±0,5 ±0,5	±1,0 ±1,0

The results after Insulation tests are show in table 19

Table19. Accuracy test after Insulation tests

L1,V	L2,V	L3,V	I1,A	I2,A	I3,A	PF	Error,%	Error limit,%	NOTE
230	230	230	0.05	0.05	0.05	1	-0.2453	1	PASS
230	230	230	0.25	0.25	0.25	1	-0.0489	1	PASS
230	230	230	5	5	5	1	-0.0225	0.5	PASS
230	230	230	10	10	10	1	-0.0401	0.5	PASS
230	230	230	0.1	0.1	0.1	0.5ind	0.0741	1	PASS
230	230	230	0.5	0.5	0.5	0.5ind	0.1716	1	PASS
230	230	230	5	5	5	0.5ind	-0.0161	1	PASS
230	230	230	10	10	10	0.5ind	-0.0951	1	PASS
230	230	230	0.1	0.1	0.1	0.8cap	-0.1447	1	PASS
230	230	230	0.5	0.5	0.5	0.8cap	0.0016	1	PASS
230	230	230	5	5	5	0.8cap	0.0018	1	PASS
230	230	230	10	10	10	0.8cap	-0.0334	1	PASS

The final conclusion- **PASS**

Appendix B: Abbreviations/ Glossary used in the test report

AC	Alternating Current
AVR	Average (Detector)
A/m	Ampere per meter
AE	Auxiliary equipment
AM	Amplitude modulation
cm	Centimeter
CE	Conducted Emission
CI	Conducted Immunity
dB	Decibel
dBm	Decibel referred to one Mill watt
dB(μV)	Decibel referred to one micro volt
dB(μV/*m*)	Decibel referred to one micro volt per meter
DC	Direct Current
ESD	Electrostatic Discharge
EFT	Electrical Fast Transients
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Immunity
EN	European Standard
EUT	Equipment under test
F/O	Fiber optic
GHz	Gigahertz
Hz	Hertz
HCP	Horizontal Coupling Plane
kHz	Kilohertz
kV	Kilovolt

ISN	Impedance stabilization network
LISN	Line Impedance Stabilization Network
m	Meter
MHz	Megahertz
NA	Not Applicable
QP	Quasi-Peak (Detector)
Ω	Ohm
PM	Pulse modulation
PC	Personal Computer
RF	Radio Frequency
RE	Radiated Emission
RI	Radiated Immunity
rms	Root-mean-square
sec	Second
SA	Spectrum analyzer
Transceiver	Transmitter -receiver
V	Volt
VCP	Vertical coupling plane
W	Watt

Appendix C: Accreditation Certificate

The American Association for Laboratory Accreditation

World Class Accreditation

Accredited Laboratory

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QUALITECH (ECI TELECOM)

Petach-Tikva, ISRAEL

for technical competence in the field of

Electrical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 *General Requirements for the Competence of Testing and Calibration Laboratories*. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communique dated 8 January 2009*).

Presented this 22nd day of March 2011.

Заличено по чл.2 от ЗЗЛД

President & CEO
For the Accreditation Council
Certificate Number 1633.01
Valid to September 30, 2012

For the tests or types of tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.

Заличено по чл.2 от ЗЗЛД

End of the Test Report

SATEC
Powerful Solutions

Declaration of Conformity

The Manufacturer SATEC LTD.
HAR HOTZVIM PARK
POB 45022 Jerusalem 91450 ISRAEL

According to EN.ISO/IEC 17050-1:2010 and EN.ISO/IEC 17050-2:2006, do hereby declare under our sole responsibility that the following products:

EM 133 series

Confirm to the provisions of the following Standards and Directives applying to them:

EN 50022 -Specification for low voltage switchgear and controlgear for industrial use. Mounting rails. Top hat rails 35 mm wide for snap-on mounting of equipment.
EN 61000-4-2 Level 4 - Electromagnetic compatibility (EMC). Testing and measurement techniques. Electrostatic discharge immunity test.
EN 61000-4-3 Level 3 - Electromagnetic compatibility (EMC) - Part 4-3: Testing and measurement techniques - Radiated, radio-frequency,electromagnetic field immunity test
EN 61000-4-4 Level 4 - Electromagnetic compatibility (EMC) - Part 4-4: Testing and measurement techniques - Electrical fast transient/burst immunity test
EN 61000-4-5 - Electromagnetic compatibility (EMC) - Part 4-5: Testing and measurement techniques - Surge immunity test
EN 61000-4-8 Level 4 - Electromagnetic compatibility (EMC) - Part 4-8: Testing and measurement techniques - Power frequency magnetic field immunity test
EN 61000-4-12 Level 3-4 - Electromagnetic compatibility (EMC). Testing and measurement techniques. Oscillatory waves immunity test. Basic EMC publication
EN 60688 - Electrical measuring transducers for converting A.C. and D.C. electrical quantities to analogue or digital signals
EN 61010 - Safety requirements for electrical equipment for measurement, control, and laboratory use
EN 60529 - Degrees of protection provided by enclosures (IP Code)
EN 60068-2-1/-2/-3 - Environmental testing

Michael Katz
Regional Sales Engineer| SATEC LTD

Date.....18.07.2019.....

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אזור תעשייה הר חוצבים, רח' המרפא 7
ת"ד 45022 ירושלים 91450
טל' 02-5411000 פקס 02-5812371
www.satec-global.com

Har Hotzvim Industrial Park, 7 Hamarpe St.
POB 45022 Jerusalem 91450 Israel
Tel. +972-2-5411000 Fax +972-2-5812371 satec@satec-global.com

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CERTIFICATE

This is to certify that the Quality Management System of

SATEC LTD.

7, Hamarphe St. , Jerusalem , Israel

Has been audited and registered by SII-QCD as conforming to the requirements of

ISO 9001:2015

This Certificate is Applicable to

Design, development & manufacture of electronic instruments & systems for electrical energy measurement management & control.

Certificate No.:	81696	**Certificate Issue Date:**	25/07/2016
Initial Certification Date:	13/12/2009	**Certification Expiry Date:**	12/01/2019

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Deputy Director General

Director, Quality & Certification Division

The Standards Institution of Israel

Our Vision: To Enhance Both Global Competitiveness of our Services, with our Uncompromised Quality and Integrity

הרשות הלאומית להסמכת מעבדות
Israel Laboratory Accreditation Authority

ISO/IEC 17025: 2005 **Calibration Laboratory**

Accreditation Certificate No. 357

SATEC Calibration Lab.

Main site (Main Laboratory): Zeev Lev 25, Jerusalem, 9145001, Israel

Valid from: 20.11.2016 **Until: 19.11.2018**

The organization was assessed by the Israel Laboratory Accreditation Authority (ISRAC) and found to be worthy of accreditation to the detailed schedule attached. The schedule is an integral part of this certificate and is numbered with the above certificate number .

Accreditation demonstrates technical competence and operation of an internationally recognized quality management system. The organization accredited by ISRAC complies with the standards/requirements mentioned above, meets the technical competence requirements and management system requirements that are necessary for it to consistently deliver technically competent results.

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The accreditation is valid provided that the organization continues to meet the criteria as laid down by ISRAC.

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Date of first accreditation: 20.11.2016

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General Manager **Version 1**
Israel Laboratory Accreditation Authority