Cert. No. 1152.01
Electrical (EMC)

**DATE: 21 May 2007**

# I.T.L. (PRODUCT TESTING) LTD.

# CE EMC Test Report

**for**

# Satec Ltd.

**Equipment under test:**

# Power Meter

# PM130EH PLUS*

* See customer's declaration on page 5.

Written by: _____
D. Shidlowsky, Documentation

Approved by: _____
D. Yadidi, Test Engineer

Approved by: _____
I. Raz, EMC Laboratory Manager

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# 1. General Information

## 1.1 Administrative Information

| | |
|---|---|
| Manufacturer: | Satec Ltd. |
| Manufacturer's Address: | Har Hotzvim Science Based Industrial Park<br>P.O.B. 45022<br>Jerusalem 91450<br>Israel<br>Tel: +972-2-541-1000<br>Fax: +972-2-581-2371 |
| Manufacturer's Representative: | Danny Shacked |
| Equipment Under Test (E.U.T): | Power Meter |
| Equipment Model No.: | PM130EH PLUS (See customer's declaration on following page). |
| Equipment Serial No.: | Not designated |
| Date of Receipt of E.U.T: | 16.04.07 |
| Start of Test: | 16.04.07 |
| End of Test: | 18.04.07 |

## Administrative Information cont'd

| | |
|---|---|
| Test Laboratory Location: | I.T.L (Product Testing) Ltd.<br>1 Batsheva St.,<br>Lod<br>ISRAEL 71100<br>I.T.L (Product Testing) Ltd.<br>Kfar Bin Nun,<br>ISRAEL 99780 |
| Test Specifications: | See Section 2 (The tests listed in this section were performed according to the customer's request). |

SATEC
Powerful Solutions

# DECLARATION

I HEREBY DECLARE THAT THE FOLLOWING PRODUCTS:

PM130P PLUS

ARE IDENTICAL ELCTRONICALLY, PHYSICALLY, AND MECHANICALLY TO:

PM130EH PLUS

Please relate to them (from an EMC point of view) as the same product.

Thank you,

April 18, 2007.

Dany Shacked
Projects Manager
SATEC LTD.
ISRAEL


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## 1.2 Abbreviations and Symbols

The following abbreviations and symbols are applicable to this test report:

| | |
|---|---|
| A/m | ampere per meter |
| AC | alternating current |
| AM | amplitude modulation |
| ARA | Antenna Research Associates |
| Aux | auxiliary |
| Avg | average |
| CDN | coupling-decoupling network |
| cm | centimeter |
| dB | decibel |
| dBm | decibel referred to one milliwatt |
| dbµV | decibel referred to one microvolt |
| dbµV/m | decibel referred to one microvolt per meter |
| DC | direct current |
| EFT/B | electrical fast transient/burst |
| EMC | electromagnetic compatibility |
| ESD | electrostatic discharge |
| E.U.T. | equipment under test |
| GHz | gigahertz |
| HP | Hewlett Packard |
| Hz | Hertz |
| kHz | kilohertz |
| kV | kilovolt |
| LED | light emitting diode |
| LISN | line impedance stabilization network |
| m | meter |
| mHn | millihenry |
| MHz | megahertz |
| msec | millisecond |
| N/A | not applicable |
| per | period |
| QP | quasi-peak |
| PC | personal computer |
| RF | radio frequency |
| RE | radiated emission |
| sec | second |
| V | volt |
| V/m | volt per meter |
| VRMS | volts root mean square |

## 1.3 List of Accreditations

The EMC laboratory of I.T.L. is accredited by the following bodies:

1. The American Association for Laboratory Accreditation (A2LA) (U.S.A.), Certificate No. 1152.01.
2. The Federal Communications Commission (FCC) (U.S.A.), Registration No. 90715.
3. The Israel Ministry of the Environment (Israel), Registration No. 1104/01.
4. The Voluntary Control Council for Interference by Information Technology Equipment (VCCI) (Japan), Registration Numbers: C-1350, R-1285.
5. Industry Canada (Canada), File No. IC 4025.
6. TUV Product Services, England, ASLLAS No. 97201.
7. Nemko (Norway), Authorization No. ELA 207.

I.T.L. Product Testing Ltd. is accredited by the American Association for Laboratory Accreditation (A2LA) and the results shown in this test report have been determined in accordance with I.T.L.'s terms of accreditation unless stated otherwise in the report.

# 2. Applicable Documents

| | | |
|---|---|---|
| 2.1 | **CISPR 22: 2005** | *Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement* |
| 2.2 | **EN 61000-6-2: 2005** | *Electromagnetic Compatibility (EMC)-Part 6-2: Generic Standards – Immunity for industrial environments* |
| 2.3 | **IEC 61000-4-2: 2001** | *Electromagnetic Compatibility (EMC), Part 4: Testing and Measurement Techniques; Section 2: Electrostatic discharge immunity test: Basic EMC publication.* |
| 2.4 | **IEC 61000-4-3: 2006** | *Electromagnetic Compatibility (EMC), Part 4: Testing and Measurement Techniques; Section 3: Radiated, radio frequency, electromagnetic field immunity test.* |
| 2.5 | **IEC 61000-4-4: 2004** | *Electromagnetic compatibility (EMC), Part 4. Testing and measurement techniques; Electrical fast transient /burst immunity test, Basic EMC Publication.* |
| 2.6 | **IEC 61000-4-5: 2005** | *Electromagnetic Compatibility (EMC), Part 4: Testing and Measurement Techniques; Section 5: Surge immunity test.* |
| 2.7 | **IEC 61000-4-6: 2006** | *Electromagnetic Compatibility (EMC), Part 4: Testing and Measurement Techniques; Section 6: Conducted disturbances induced by radio-frequency fields.* |
| 2.8 | **CISPR 16-1: 1999** | *Specification for Radio Disturbance and Immunity Measuring Apparatus and Methods, Part 1. Radio Disturbance and Immunity Measuring Apparatus.* |
| 2.9 | **CISPR 16-2: 1999** | *Specification for Radio Disturbance and Immunity Measuring Apparatus and Methods, Part 2. Methods of measurement of disturbances and immunity.* |

# 3. Test Site Descriptions

## 3.1. Locations:

The Electromagnetic Compatibility Test Facility of I.T.L. (Product testing) Ltd. Is located at
Telrad Industrial Park, Lod, 71100 Israel.
Telephone: +972-8-9153100
Fax: +972-8-9153101

The Electromagnetic Compatibility Test Facility of I.T.L. (PRODUCT TESTING) LTD. is located at Kfar Bin Nun, Israel 99780

Telephone: + 972-8-9797799, Fax: + 972-8-9797702

## 3.2. Open Site (Lod):

The OATS is located on a one floor-building roof. The OATS onsists of 3 meter and 10 meter ranges, using a 21.5m X 8.5m solid metal ground plane, a remote controlled turntable and an antenna mast.

## 3.3. Ground Plane (Lod):

The ground plane is made from steel plates, which are welded continously together. The Grounfd plane is lies and welded on welded steel condtruction with vias to allow for water drainage.
All the power, control, and signal lines to the turntable and the 3 m and 10m antenna mast outlets are routed in shielded conduits under the plane to the control building

## 3.4. Antenna Mast (Lod):

ETS model 2070-2. The antenna position and polarization are remote controlled via Fiber Optical Link using ETS/EMCO Dual Controller Type 2090. The antenna position is adjustable between 1-4 meters. Pressurized air is used to power changing the polarity of the antenna.

## 3.5. Turntable (Lod):

ETS model 2087 series. The position of the turntable is remote-controlled via Fiber Optic Link, using ETS/EMCO Dual Controller Type 2090. The turntable is mounted in a pit and its surface is flush with the Open Site Ground Plane. Brushes near the periphery of the turntable ensure good conductive connection to the ground plane. The Turntable maximum load is 1250 Kg.

## 3.6. EMI Receiver (Lod):

Type HP8542E, including HP85420E R.F. filter manufactured by Hewlett-Packard, being in full compliance with CISPR 16 requirements.

## 3.7. E.U.T. Support (Lod):

Table mounted E.U.T.s are supported during testing on 80 cm high all-wooden tables (no metal nails or screws).

## 3.8. Test Equipment (Lod)

See details in Section 6.

## 3.9. Shielded Room (KBN)

A Modular Shielded Room, Type S81, manufactured by Rayproof, consisting of a Main Room and a Control Room.

The dimensions of the Main Room are: length: 7.4 m, width: 4.35 m, height: 3.75 m.

The dimensions of the Control Room are: length: 3.12 m, width: 2.5 m, height: 2.5 m.

The shielding performance is:

magnetic field: 60 dB at 10 kHz rising linearly to 100 dB at 100 kHz,
electric field: better than 110 dB between 50 MHz and 1 GHz,
plane wave: 110 dB between 50 MHz and 1 GHz.

All the power lines entering both shielded rooms are filtered.

## 3.10. Open Test Site (KBN)

Consists of 3 meter and 10 meter ranges, using a 7x14 meter solid metal ground plane, a remote controlled turntable and an antenna mast. The turntable and the tested equipment that is placed on it are environment protected. All the power, control and signal lines are routed under the ground plane.

## 3.11. Antenna Mast (KBN)

Type AAM-4/A, manufactured by Antenna Research Associates (ARA). The antenna position and polarization are remotely controlled via Fiber Optical Link using ARA Dual Controller Type ACU-2/5, and pressurized air.

The antenna position is adjustable between 1-4 meters.

## 3.12. Turntable (KBN)

Type ART-1001/4, manufactured by ARA. The position of the turntable is remotely controlled via a Fiber Optic Link, using ARA Dual Controller Type ACU-2/5. The turntable is mounted in a pit and its surface is flush with the Open Site Ground Plane.

## 3.13. EMI Receiver (KBN)

Type HP8542E, including HP85420E R.F. filter manufactured by Hewlett-Packard, being in full compliance with CISPR 16 requirements.

## 3.14. Test Equipment (KBN)

See details in Section 6.

# 4. Summary of Test Results

| Test | Results |
|---|---|
| **Conducted Emissions**<br>CISPR 22: 2005 Class A | The E.U.T met the performance requirements of the specification.<br>The margin between the emission levels and the specification limit was, in the worst case, 10.9 dB for the phase line at 0.51 MHz and 10.7 dB for the neutral line at 0.64 MHz. |
| **Radiated Emissions**<br>CISPR 22: 2005 Class A | The E.U.T met the performance requirements of the specification.<br>The margin between the emission level and the specification limit was 6.4 dB in the worst case at the frequency of 182.20 MHz, vertical polarization. |
| **ESD**<br>IEC 61000-4-2: 2001<br>Air Discharge, 8kV<br>Contact Discharge, 4kV | The E.U.T met the performance requirements of the specification. |
| **Radiated Immunity**<br>(80-1000 MHz)<br>IEC 61000-4-3: 2006<br>10 V/m, 80% A.M. by 1kHz | The E.U.T met the performance requirements of the specification. |
| **EFT/B**<br>IEC 61000-4-4: 2004<br>2kV Power lines, 1kV Signal lines | The E.U.T met the performance requirements of the specification. |

# Summary of Test Results (cont'd.)

| Test | Results |
|---|---|
| **Conductive Surges**<br>IEC 61000-4-5: 2005<br>Differential mode; 1kV<br>Signal lines, 2kV | The E.U.T met the performance requirements of the specification. |
| **Conducted Disturbances**<br>(0.15-80 MHz)<br>IEC 61000-4-6: 2006<br>10 VRMS,<br>80% A.M. by 1kHz | The E.U.T met the performance requirements of the specification. |
| **Immunity to Magnetic Field**<br>IEC 61000-4-8: 2001<br>30 A/m, 50Hz | The E.U.T met the performance requirements of the specification. |

# 5. Equipment Under Test (E.U.T.) Description

The E.U.T. is a compact panel mounted 3 phase AC electronic microprocessor-based power meter for measurement, monitoring, and management of electrical parameters, presenting results in visual form on 3-row 7-segment LED display. It provides RS-485 interface for remote data reading and setup. The PM130EH PLUS is intended for use in industrial environments.

The E.U.T. is powered from single phase, 85-265VAC.

# 6. List of Test Equipment

## 6.1 Emission Tests (Lod)

The equipment indicated below by an "X" was used for testing Conducted Emission (**CE**), Radiated Emission (**RE**), and **EN 61000-3-2;3**

Test equipment calibration is in accordance with ITL Q.A. Procedure PM 110 "Calibration Control Procedure", which complies with ISO 9002 and ISO/IEC Guide 17025.

| Instrument | Manufacturer | Model | Serial No. | Used in Test | | | |
|---|---|---|---|---|---|---|---|
| | | | | CE | RE | -2 | -3 |
| LISN (AC) (9KHz-30MHz) | 3810/2BR 50ohm 50/250 | EMCO | 1297 | X | | | |
| EMI Receiver | 8546A | HP | 3650A00365 | X | X | | |
| Receiver RF Filter Section | 85460A | HP | 3650A00365 | X | X | | |
| EMC Analyzer | HP 8593 | HP | 3536A00120 | | X | | |
| RF Amplifier (100KHz-3GHz) | 8347A | HP | 3307A01534 | | X | | |
| Antenna - Log Periodic | ARA | LPD-2010/A | 1038 | | X | | |
| Antenna Mast | ETS/EMCO | 2070-2 | 9608=1497 | | X | | |
| Mast & Table Controller | ETS/EMCO | 2090 | 9608-1456 | | X | | |
| Power Analysis System | EM Test | DPA 500 | 0501/09 | | | | |
| AC Power Source | EM Test | ACS 500 | 1101/01 | | | | |

## 6.2 Immunity Tests (Lod)

Equipment indicated below by an "X" used in **Tests IEC 61000:-2,-3,-4,-5,-6,-8,-11.**

Test equipment calibration is in accordance with ITL Q.A. Procedure PM 110, "Calibration Control Procedure", which complies with ISO 9002 and ISO/IEC Guide 17025.

| Instrument | Manuf. | Model | Serial No. | Used in Test IEC 61000-4: | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | -2 | -3 | -4 | -5 | -6 | -8 | -11 |
| EFT Burst Generator | CEMASTER | KeyTek | 9612436 | | | X | | | | |
| ESD Simulator | MiniZAP 15/EC | Keytek | 9512290 | X | | | | | | |
| RF Amplifier 80MHz-1GHz / 100W | 100W1000M1 | AR | 19842 | | X | | | | | |
| Isotopic Field Probe 80MHz-40GHz | EP-2080 | AR | 23190 | | X | | | | | |
| Isotopic Field Monitor | FM-2000 | AR | 19719 | | X | | | | | |
| Signal Generator 10KHz-1000MHz | 6061A | FLUKE | 4250301 | | X | | | | | |
| RF Current Probe | FCC | F-120-9 | 105 | | | | | | | |
| 1.2/50; 8/20usec Surge Unit | E501A | KeyTek | 9512398 | | | | X | | | |
| 1.2/50; 8/20usec AC Surge Unit | E551 | KeyTek | 9512398 | | | | X | | | |
| AC Power Source | EM TEST | UCS 500-M | 1198-45 | | | | | | | |
| Power Analysis System | Xitron | 2503A | 2005 | | | | | | | |
| Current Generator | FCC | F-1000-4-8-125A | 9838 | | | | | | | |
| Magnetic Loop | FCC | F-1000-4-8/9/10-L-1M | 9836 | | | | | | | |

## 6.3 Immunity Tests (KBN)

Equipment indicated below by an “X” used in **Tests IEC 61000:-2,-3,-4,-5,-6,-8,-11.**

Test equipment calibration is in accordance with ITL Q.A. Procedure PM 110, "Calibration Control Procedure", which complies with ISO 9002 and ISO/IEC Guide 17025.

| Instrument | Manuf. | Model | Serial No. | Used in Test IEC 61000-4: | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | -2 | -3 | -4 | -5 | -6 | -8 | -11 |
| Transient Generator | EM TEST | EFT 500SI | 1198-01 | | | | | | | |
| E-Field Meter | Holaday | HI-4433-HSE | 85252 | | | | | | | |
| Signal Generator | Marconi | 2022D | 119196015 | | | | | X | | |
| Spectrum Analyzer | HP | 8591E | 3414U01226 | | | | | | | |
| ESD Simulator | SCHAFFNER | NSG-435 | 174-002-001(ZI) | | | | | | | |
| Receiver | HP | 85420E/85422E | 3427A00103/34 | | | | | | | |
| Power Amplifier | IFI | SMX100 | 1194-4537 | | | | | X | | |
| CDN Network | FCC | FCC-801-M3-25 | 90 | | | | | X | | |
| RF Current Probe | FCC | F-120-9 | 105 | | | | | X | | |
| Transient Wave- form Monitor | CDI | TWM-100 | 3233 | | | | | | | |
| Phase Control Amplifier | CDI | PCA-1000 | 3217 | | | | | | | |
| Single Phase Isolated Backfilter | CDI | CDI-1kVA | 3221 | | | | | | | |
| Surge Generator | CDI | CDI-1000i | 3153 | | | | | | | |
| Surge Generator | EM TEST | UCS 500-M | 1198-45 | | | | | | | |
| AC Power Source | EM TEST | UCS 500-M | 1198-45 | | | | | | | |
| Power Analysis System | Xitron | 2503A | 2005 | | | | | | | |
| Current Generator | FCC | F-1000-4-8-125A | 9838 | | | | | | X | |
| Magnetic Loop | FCC | F-1000-4-8/9/10-L-1M | 9836 | | | | | | X | |

# 7. E.U.T. Performance Verification

## 7.1 Mode of Operation

During the tests, The E.U.T. was set as follows:

1. Displays active energy at front panel.
2. Communicates through RS485 connection to laptop monitor.
3. All parameters were displayed in real time through the laptop.

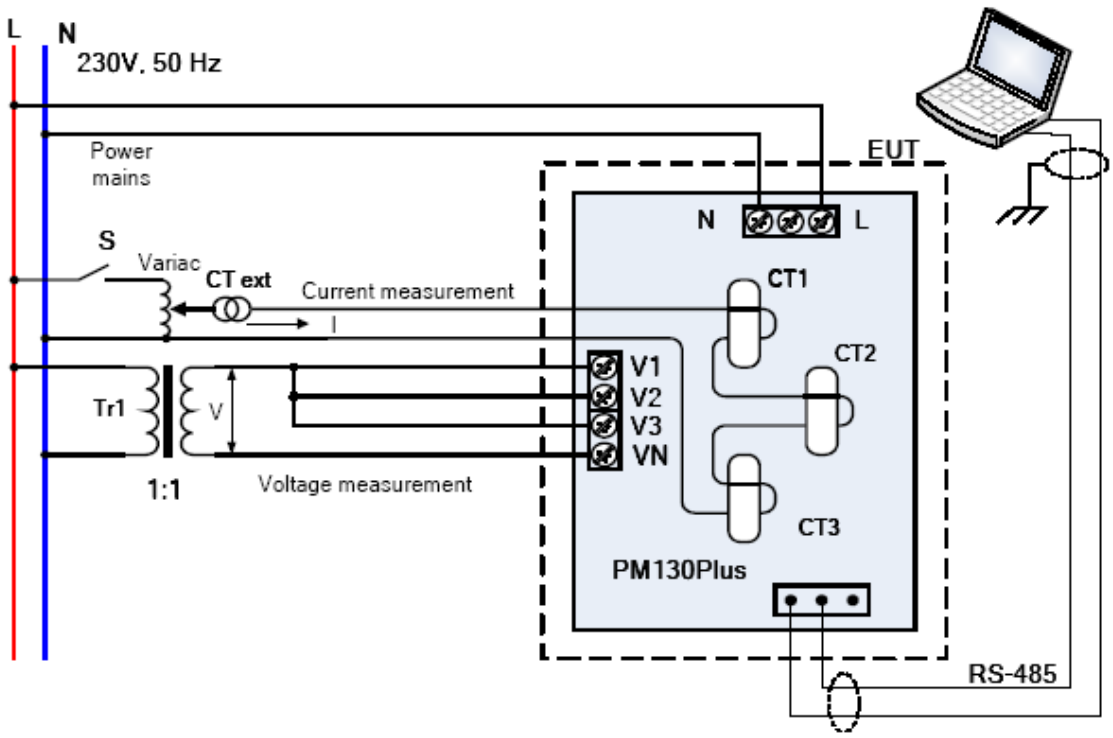



**Figure 1. Conducted and Radiated Emission Test Set-up**

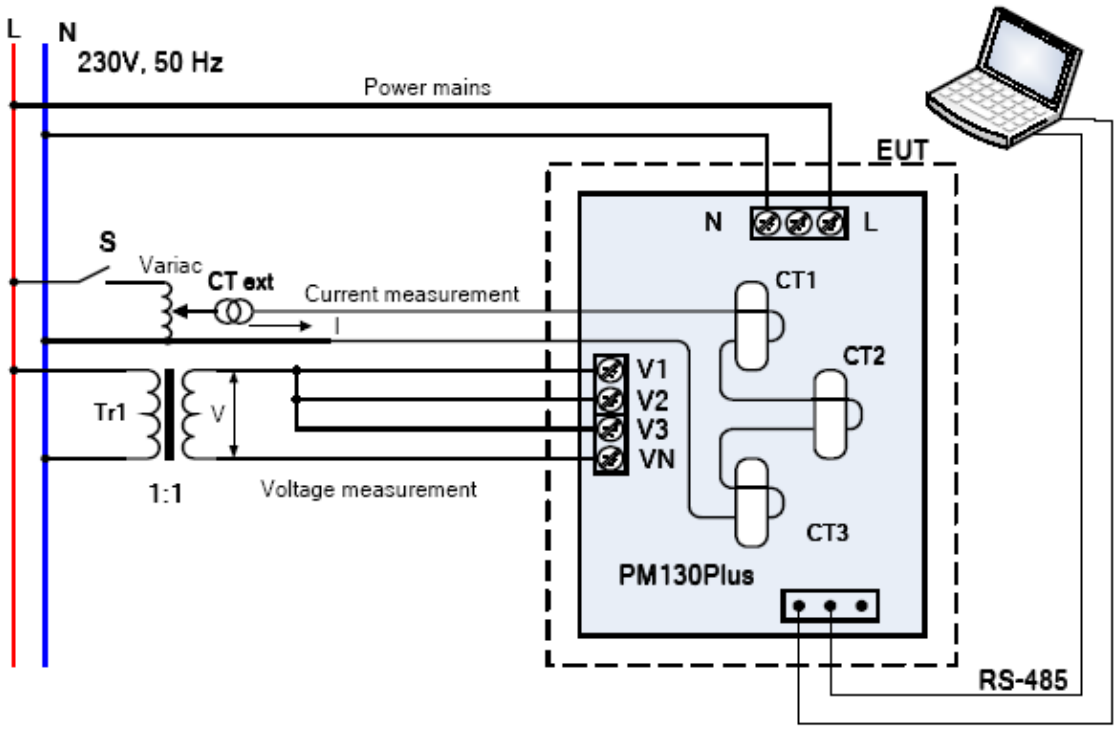



**Figure 2. Immunity Tests Set-up**

## 7.2 Monitoring of E.U.T.

The E.U.T. and laptop display were monitored while reading the energy measured level.

## 7.3 Definition of Failure

Reading of energy level is out of 118±1kW/h.

# 8. Conducted Emission on AC Mains Lines

## 8.1 Test Specification

0.15-30 MHz, CISPR 22: 2005 CLASS A

## 8.2 Test Procedure

The E.U.T operation mode and test set-up are as described in Section 7.1. In order to minimize background noise interference, the conducted emission testing was performed inside a shielded room (see Section 3), with the E.U.T placed on an 0.8 meter high wooden table, 0.4 meter from the room's vertical wall. In the case of a floor-standing E.U.T., it was placed on the horizontal ground plane.

The E.U.T was powered from 230 V AC / 50 Hz via 50 Ohm / 50 µHn Line Impedance Stabilization Network (LISN) on the phase and neutral lines. The LISN's were grounded to the shielded room ground plane (floor), and were kept at least 0.8 meters from the nearest boundary of the E.U.T

The center of the E.U.T.'s AC cable was folded back and forth, in order to form a bundle less than 0.40 meters and a total cable length of 1 meter.

The effect of varying the position of the cables was investigated to find the configuration that produces maximum emission. The configuration tested is shown in the photograph, *Figure 15. Conducted Emission Test*.

The emission voltages at the LISN's outputs were measured using a computerized receiver, complying to CISPR 16 requirements. The specification limits are loaded to the receiver via a 3.5" floppy disk and are displayed on the receiver's spectrum display.

A frequency scan between 0.15 and 30 MHz was performed at 9 kHz I.F. band width, using peak detection.

The spectral components having the highest level on each line were measured using a quasi-peak and average detector.

## 8.3 Test Results

The E.U.T. met the requirements of the CISPR 22: 2005 CLASS A specification.

The margin between the emission levels and the specification limit is, in the worst case, 10.9 dB for the phase line at 0.51 MHz and 10.7 dB at 0.64 MHz for the neutral line.

The details of the highest emissions are given in *Figure 3* to *Figure 5*.

# Conducted Emission

| | |
|---|---|
| E.U.T Description | Power Meter |
| Type | PM130EH PLUS |
| Serial Number: | Not designated |

| | |
|---|---|
| Specification: | CISPR 22: 2005, Class **A** |
| Lead: | Phase |
| Detectors: | Peak, Average, Quasi-peak |

| Frequency (MHz) | Peak Amplitude (dBµV) | Quasi-peak Amplitude (dBµV) | QP Limit (dB µV) | QP Margin (dB) | Average Amplitude (dBµV) | Avg Limit (dB µV) | Average Margin (dB) |
|---|---|---|---|---|---|---|---|
| 0.213295 | 66.28 | 62.48 | 79.0 | -16.52 | 48.59 | 66.0 | -17.41 |
| 0.246680 | 70.38 | 65.59 | 79.0 | -13.41 | 49.82 | 66.0 | -16.18 |
| 0.382375 | 73.7 | 68.05 | 79.0 | -10.95 | 49.89 | 66.0 | -16.11 |
| 0.420654 | 66.82 | 63.91 | 79.0 | -15.09 | 46.67 | 66.0 | -19.33 |
| 0.494920 | 67.85 | 64.55 | 79.0 | -14.45 | 50.60 | 66.0 | -15.40 |
| 0.507837 | 67.30 | 61.84 | 73.0 | -11.16 | 49.10 | 60.0 | -10.90 |
| 0.636396 | 65.14 | 61.36 | 73.0 | -11.64 | 47.94 | 60.0 | -12.06 |
| 0.746804 | 60.46 | 56.89 | 73.0 | -16.11 | 45.15 | 60.0 | -14.85 |

**Figure 3. Detectors: Peak, Quasi-peak, AVERAGE .**

# Conducted Emission

| | |
|---|---|
| E.U.T Description | Power Meter |
| Type | PM130EH PLUS |
| Serial Number: | Not designated |

| | |
|---|---|
| Specification: | CISPR 22: 2005, Class **A** |
| Lead: | Neutral |
| Detectors: | Peak, Average, Quasi-peak |

| Frequency (MHz) | Peak Amplitude (dBµV) | Quasi-peak Amplitude (dBµV) | QP Limit (dB µV) | QP Margin (dB) | Average Amplitude (dBµV) | Avg Limit (dB µV) | Average Margin (dB) |
|---|---|---|---|---|---|---|---|
| 0.251613 | 70.07 | 64.60 | 79.0 | -14.40 | 50.83 | 66.0 | -15.17 |
| 0.317572 | 69.50 | 65.51 | 79.0 | -13.49 | 50.30 | 66.0 | -15.70 |
| 0.426720 | 67.85 | 65.01 | 79.0 | -13.99 | 49.03 | 66.0 | -16.97 |
| 0.513574 | 67.90 | 62.55 | 73.0 | -10.45 | 47.57 | 60.0 | -12.43 |
| 0.636381 | 65.26 | 61.61 | 73.0 | -11.39 | 49.27 | 60.0 | -10.73 |
| 0.772652 | 61.18 | 57.48 | 73.0 | -15.5 | 41.34 | 60.0 | -18.66 |
| 12.821712 | 57.87 | 51.60 | 73.0 | -21.40 | 41.78 | 60.0 | -18.22 |

**Figure 4. Detectors: Peak, Quasi-peak, AVERAGE**

# Conducted Emission

| | |
|---|---|
| E.U.T Description | Power Meter |
| Type | PM130EH PLUS |
| Serial Number: | Not designated |

| | |
|---|---|
| Specification: | CISPR 22: 2005, Class **A** |
| Lead: | Phase/Neutral |
| Detectors: | Peak, Average, Quasi-peak |

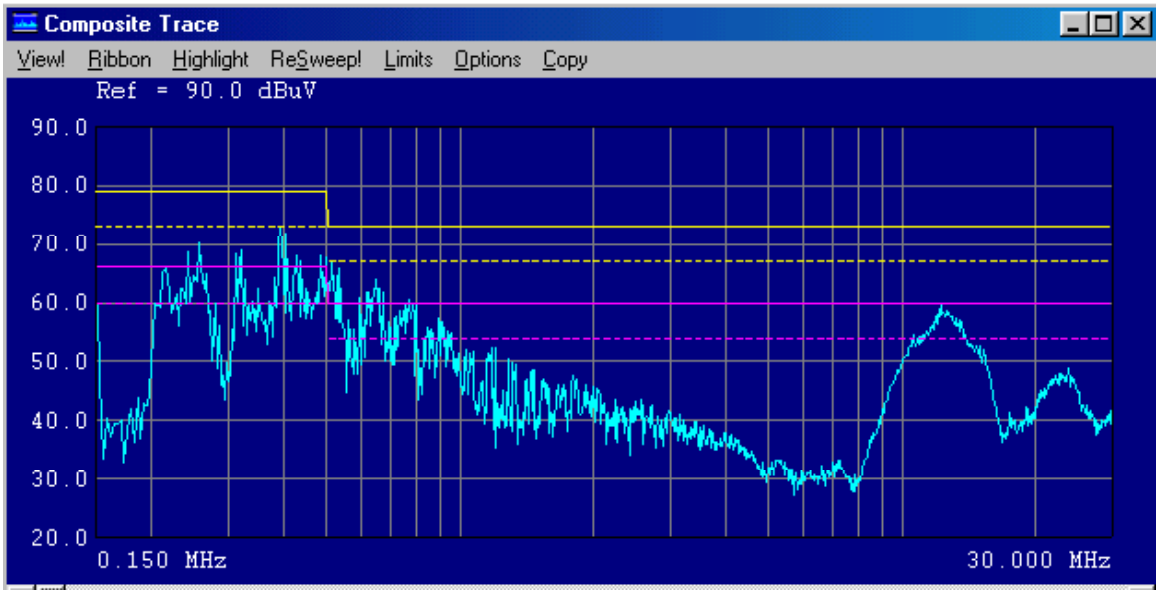



**Figure 5 Conducted Emission: PHASE/NEUTRAL**
**Detectors: Peak, Average, Quasi-peak**

# 9. Radiated Emission

## 9.1 Test Specificatio1n

30-1000 MHz, CISPR 22: 2005 CLASS A

## 9.2 Test Procedure

The E.U.T operation mode and test set-up are as described in section 7.1.

A preliminary measurement to characterize the E.U.T was performed inside the shielded room. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground. The effect of varying the position of the cables was investigated to find the configuration that produces maximum emission. The configuration tested is shown in the photograph, *Figure 16. Radiated Emission Test*.

The frequency range 30-1000 MHz was scanned, and the list of the highest emissions was verified and updated accordingly.

The emissions were measured using a computerized EMI receiver complying to CISPR 16 requirements. The specification limits and applicable correction factors are loaded to the receiver via a 3.5" floppy disk.

The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.

Verification of the E.U.T emissions was based on the following methods:

Turning the E.U.T on and off.
Using a frequency span less than 10 MHz.
Observation of the signal level during turntable rotation. Background noise is not affected by the rotation of the E.U.T.

The emissions were measured at a distance of 3 meters.

## 9.3 Test Results

The E.U.T met the requirements of the CISPR 22: 2005 CLASS A specification.

The margin between the emission level and the specification limit is 6.4 dB in the worst case at the frequency of 182.20 MHz, vertical polarization.

The details of the highest emissions are given in *Figure 6*.

# Radiated Emission

| | |
|---|---|
| E.U.T Description | Power Meter |
| Type | PM130EH PLUS |
| Serial Number: | Not designated |

Specification: CISPR 22: 2005, Class A

Antenna Polarization: Horizontal/Vertical
Frequency range: 30 MHz to 1000 MHz
Test distance: 3 meters
Detectors: Peak, Quasi-peak

| Frequency | Peak Amp | QP Amp | Antenna Polarization: | | Limit QP | Delta-limit QP |
|---|---|---|---|---|---|---|
| (MHz) | dBµV/m | dBµV/m | Hor. | Ver. | dBµV/m | (dB) |
| 177.30 | 45.2 | 41.5 | H | | 50.5 | -9.0 |
| 213.30 | 38.8 | 36.0 | H | | 50.5 | -14.5 |
| 215.80 | 45.0 | 43.9 | H | | 50.5 | -6.6 |
| 223.00 | 36.9 | 34.0 | H | | 50.5 | -16.5 |
| 288.00 | 40.1 | 38.5 | H | | 57.5 | -19.0 |
| 404.10 | 42.4 | 38.8 | H | | 57.5 | -18.7 |
| 432.00 | 39.8 | 38.2 | H | | 57.5 | -19.3 |
| 74.7.00 | 48.1 | 37.8 | | V | 50.5 | -12.7 |
| 116.00 | 47.4 | 38.8 | | V | 50.5 | -11.7 |
| 119.20 | 46.3 | 36.5 | | V | 50.5 | -14.0 |
| 182.20 | 45.6 | 44.1 | | V | 50.5 | -6.4 |
| 203.00 | 43.5 | 41.9 | | V | 50.5 | -8.6 |
| 218.40 | 39.2 | 34.0 | | V | 50.5 | -13.9 |
| 426.00 | 42.7 | 40.7 | | V | 57.5 | -16.8 |

**Figure 6. Radiated Emission. Antenna Polarization: HORIZONTAL/VERTICAL. Detectors: Peak, Quasi-peak**

*Notes:*

1. *Delta-limit QP refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.*
2. *Peak Amp and QP Amp include correction factors (Antenna Gain + Cable Loss)*

# 10. Immunity to Electrostatic Discharge

## 10.1 Test Specification

IEC 61000-4-2: 2001

## 10.2 Test Procedure

In the case of tabletop equipment, the E.U.T. was set up on a wooden table 0.8m high on an insulating support 0.5 mm thick above the reference ground plane. In the case of floor-standing equipment, the EUT and cables were set up on an insulating support 0.1m above the reference plane. The test setup is illustrated in the photograph, *Figure 17. Immunity to Electrostatic Discharge Test.*

Photographs in *Figure 7* to *Figure 8* show the locations of test points.

### *12.2.1 Air Discharge*

Potentials of 2, 4 and 8 kV were applied near each applicable test point. At places where discharge occurred, the potential was applied twenty times; ten times negative and ten times positive. The E.U.T.'s performance during the test was verified as detailed in Section 7.

### *12.2.2 Contact Discharge*

Potentials of 2 and 4 kV were applied to each applicable test point. In places where discharge occurred, the potential was then applied twenty times; ten negative and ten positive discharges. The E.U.T.'s performance during the test was verified as detailed in Section 7.

### *12.2.3 Indirect Discharge (vertical and horizontal coupling plane)*

Potentials of 2 and 4 kV were applied to the center of the vertical edge of the coupling plane at a distance of 0.1 meters from the outer casing of the E.U.T. to each applicable test point.

The potential was applied 10 times for each polarity, to each location of the coupling plane. All four faces of the E.U.T. were completely illuminated.

An ESD of the same characteristics as for the vertical coupling plane was applied to the horizontal coupling plane, at each side of the E.U.T., at a distance of 0.1 meter from it's outer casing.

Additional details are shown in Figure 5 of IEC 61000-4-2: 2001.

The E.U.T.'s performance during the test was verified as detailed in Section 7.

## 10.3 Test Results

The E.U.T met the requirements of specification IEC 61000-4-2: 2001.

# Immunity to Electrostatic Discharge

| | |
|---|---|
| E.U.T Description | Power Meter |
| Type | PM130EH PLUS |
| Serial Number: | Not designated |

Specification: IEC 61000-4-2: 2001

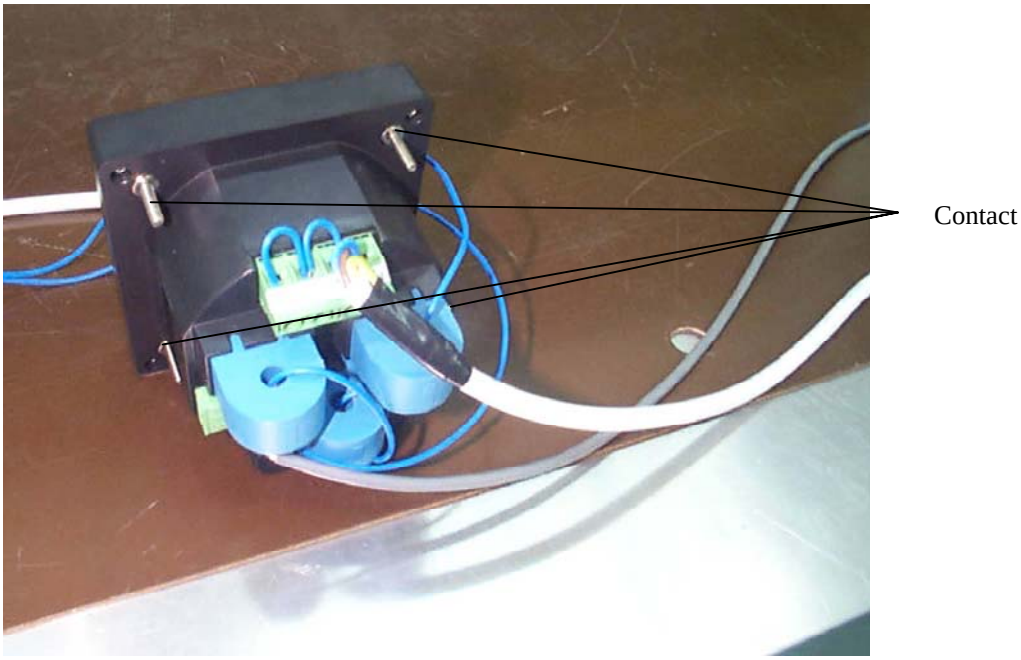



**Figure 7. ESD Test Points**

# Immunity to Electrostatic Discharge

| | |
|---|---|
| E.U.T Description | Power Meter |
| Type | PM130EH PLUS |
| Serial Number: | Not designated |

Specification: IEC 61000-4-2: 2001

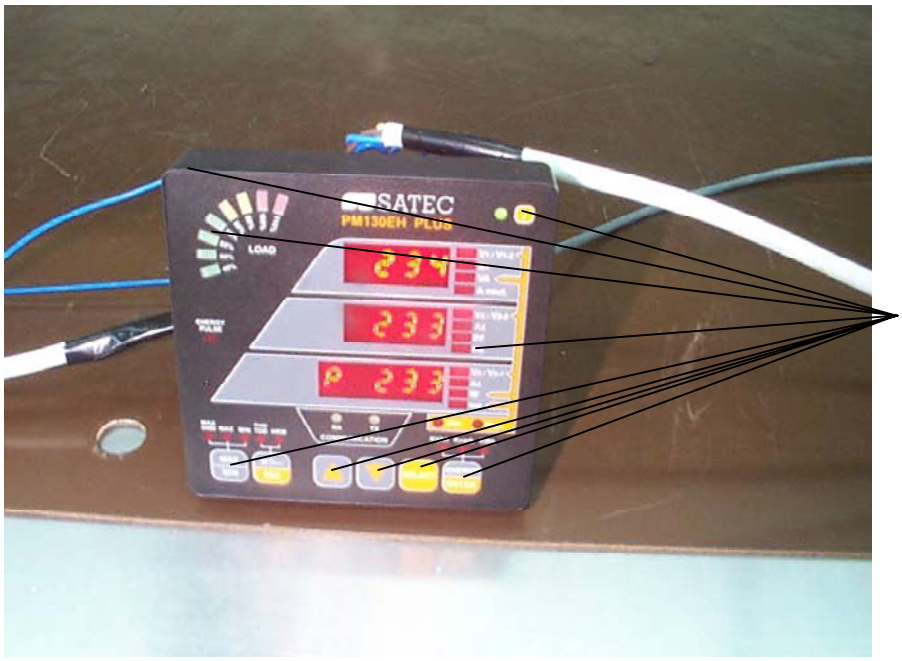



**Figure 8. ESD Test Points**

# 11. Immunity to Radiated Field

## 11.1 Test Specification

IEC 61000-4-3: 2006

## 11.2 Test Procedure

The E.U.T. was subjected to a field of 10V/m, amplitude modulated 80% by a 1kHz sinusoidal signal.

The Radiated Field was applied in vertical and horizontal polarization using Biconical and Log Periodical antennas in the frequency range of 80-1000 MHz.

The Radiated Field was calibrated and tested for uniformity in accordance with Section 6.2 of IEC 61000-4-3.

The calibration values for the driver signal generator were based on the data given in I.T.L. "Radiated Immunity Calibration Test Report" No. PM-111R-IMM.

The frequency was swept using discrete increments having a value less than 1% of the fundamental frequency.

The performance of the E.U.T. was verified during the test as described in Section 7.

The test setup is illustrated in the photograph, *Figure 18. Immunity to Radiated Field Test.*

**Note: Opinion and Interpretation:**
The most sensitive surface of the E.U.T. was fully tested.
The most sensitive E.U.T. surface was determined as follows:
A preliminary radiated emission test in the frequency range
80 – 1000 MHz was performed inside the semi-anechoic chamber using an E-field probe and spectrum analyzer. The surface having the maximum radiation level was selected as the most sensitive surface.

## 11.3 Test Results

The E.U.T. met the requirements of the IEC 61000-4-3: 2006 specification.

For additional information see *Figure 9.*

# Radiated Immunity

| | |
|---|---|
| E.U.T Description | Power Meter |
| Type | PM130EH PLUS |
| Serial Number: | Not designated |

Specification: IEC 61000-4-3: 2006, 80-1000 MHz

Amplitude Modulation: 80% AM by 1 kHz

| Frequency (MHz) | | Antenna Polarity | Specification (V/m) | PASS / FAIL | Immunity Threshold (V/m) |
|---|---|---|---|---|---|
| From | To | | | | |
| 80 | 250 | Horizontal | 10.0 | Pass | |
| 80 | 250 | Vertical | 10.0 | Pass | |
| 250 | 1000 | Horizontal | 10.0 | Pass | |
| 250 | 1000 | Vertical | 10.0 | Pass | |

**Figure 9. Immunity to Radiated Field**

# 12. Immunity to Electrical Fast Transient / Burst

## 12.1 Test Specification

IEC 61000-4-4: 2004

## 12.2 Test Procedure

In case of table top equipment, the E.U.T. was placed on non-metallic table 0.8m above the ground plane.

In case of floor mounted equipment, the E.U.T. was placed 0.1 m above a reference ground plane.

The EFT/B generator was placed on, and grounded to, this ground plane. A test signal having the waveform described in *Figure 19. Transient Waveforms* was applied to the phase neutral and ground lines of the E.U.T mains input, at a distance of 1 meter from the E.U.T. The test signal voltage was 2 kV and it was applied for 1 minute to each line, in negative and positive polarities.

The same test signal was applied to the signal lines, control and DC lines (as applicable), that are connected to the E.U.T. The voltage level was 1.0 kV in this case

Applicable signal and control lines should have a length greater than 3m.

## 12.3 Test Results

The E.U.T. met the requirements of the IEC 61000-4-4: 2004 specification.

Additional details are given in *Figure 10.*

# Electrical Fast Transient / Burst

| | |
|---|---|
| E.U.T Description | Power Meter |
| Type | PM130EH PLUS |
| Serial Number: | Not designated |

Specification: IEC 61000-4-4: 2004

**[ x ] Positive Polarity** **[ x ] Negative Polarity**

| TEST POINT | PASS / FAIL | ANOMALY | SPECIFICATION (kV) | THRESHOLD (kV) |
|---|---|---|---|---|
| Phase | Pass | No anomaly | 2.0 | |
| Neutral | Pass | No anomaly | 2.0 | |
| **CAPACITIVE CLAMP** | | | | |
| **TEST POINT** | **PASS / FAIL** | **ANOMALY** | **SPECIFICATION (kV)** | **THRESHOLD (kV)** |
| RS485 Port | Pass | | 1.0 | |
| Measurement Input Port | Pass | | 1.0 | |

**Figure 10. Immunity to Electrical Fast Transient / Burst**

# 13. Immunity to Conductive Surges

## 13.1 Test Specification

IEC 61000-4-5: 2005

## 13.2 Test Procedure

The E.U.T. was subjected to transient signals of the form of double exponential waves with a rise time of 1.2 µs and a pulse width of 50 µs (open circuit). The short circuit waveform is an 8 x 20µs double exponential. See *Figure 20. Open Circuit Waveform (1.2 x 50µs double exponential).* The surges were applied to the E.U.T. AC power lines in common and differential modes. The differential (between phase and neutral) voltages were 0.5 and 1 kV.

The surges were injected in both positive and negative polarities in to the AC line, at phase angles of 0°, 90°, 180°, 270° and 360°; both peak and zero crossings.

At least five surges were applied at each polarity. The surge repetition rate was kept to not more than one per minute.

Signal lines were tested at 2.0 kV (when applicable).

The performance of the E.U.T. was verified during the test as described in section 7.

The test setup is shown in the photograph, *Figure 21. Immunity to Conductive Surges.*

## 15.3 Test Results

The E.U.T. met the requirements of the IEC 61000-4-5: 2005 specification.

Additional details are given in *Figure 11*.

# Immunity to Conductive Surges

| | |
|---|---|
| E.U.T Description | Power Meter |
| Type | PM130EH PLUS |
| Serial Number: | Not designated |

Specification: IEC 61000-4-5: 2005

| TEST POINT | Polarity | 0°/360° | 90° | 180° | 270° | Specified Level | Remarks |
|---|---|---|---|---|---|---|---|
| Phase to Neutral | + | P | P | P | P | 0.5, 1 kV | |
| | - | P | P | P | P | 0.5, 1 kV | |

**Figure 11. Immunity to Conductive Surges Power Lines**

NOTE: Each test was executed at least five times.

# Immunity to Conductive Surges

| | |
|---|---|
| E.U.T Description | Power Meter |
| Type | PM130EH PLUS |
| Serial Number: | Not designated |

Specification: IEC 61000-4-5: 2005

| TEST POINT | Polarity | Specified Level | Remarks |
|---|---|---|---|
| RS485 Port | + | 2 kV | |
| | - | 2 kV | |
| Measurement Input Port | + | 2 kV | |
| | - | 2 kV | |

**Figure 12. Immunity to Conductive Surges Signal Lines**

NOTE: Each test was executed at least five times.

# 14. Immunity to Conducted Disturbances

## 14.1 Test Specification

IEC 61000-4-6: 2006

## 14.2 Test Procedure

The E.U.T. was subjected to conducted disturbances in the frequency range 0.15 - 80 MHz, 10 VRMS, 1kHz, 80% AM modulation.

The disturbance signal was applied to the AC power lines using a Coupling Decoupling Network (CDN) or RF Current Injection Probe for Signal Lines.

The driver signal generator levels used are based on calibration that was performed in accordance with Section 6.4 and Annex A of IEC 61000-4-6, I.T.L. Procedures PM-111-CDN/M and PM-111-C.P. 105.

The frequency was swept using discrete increments having a value less than 1% of the fundamental frequency.

The performance of the E.U.T. was verified during the test as described in Section 7.

The test setup is illustrated in the photograph *Figure 22. Conducted Disturbances.*

## 14.3 Test Results

The E.U.T. met the requirements of the IEC 61000-4-6: 2006 specification.

Additional details are given in *Figure 13*.

# Immunity to Conducted Disturbances

| | |
|---|---|
| E.U.T Description | Power Meter |
| Type | PM130EH PLUS |
| Serial Number: | Not designated |

Specification: IEC 61000-4-6: 2006
Tested at 1 kHz 80% AM Modulation

## Using CDN Network

| TEST POINT | PASS / FAIL | ANOMALY | SPECIFICATION (VRMS) | THRESHOLD (kV) |
|---|---|---|---|---|
| AC Power Port (Phase, Neutral) | Pass | No anomaly | 10 | |

## Signal Lines Using Injection Probe

| TEST POINT | PASS / FAIL | ANOMALY | SPECIFICATION (VRMS) | THRESHOLD (kV) |
|---|---|---|---|---|
| RS485 Port | Pass | No anomaly | 10 | |
| Measurements Input Ports | Pass | No anomaly | 10 | |

**Figure 13. Immunity to Conducted Disturbances**

# 15. Immunity to Magnetic Field

## 15.1 Test Specification

IEC 61000-4-8: 2001

## 15.2 Test Procedure

The E.U.T. operation mode and test setup are described in section 7.1.

For table top equipment, the E.U.T. and cables were placed on an insulating support, 0.1m thickness, which was placed on a reference non-magnetic (aluminum) ground plane. The ground plane was placed on a wood table.

For floor standing equipment, the E.U.T. and cables were placed on an insulating support, 0.1m thickness, which was placed on a reference non-magnetic (aluminum) ground plane. The ground plane was placed on the floor.

The E.U.T. was subjected to the magnetic field by using an induction coil. The induction coil was rotated $90^{\circ}$ to expose the E.U.T. to all the different field orientations.

For E.U.T.'s larger than the induction coil, the coil was shifted by steps of 50% (of the coil size), so that the volume of the E.U.T. was tested.

The test setup is illustrated in the photograph *Figure 23. Immunity to Magnetic Field.*

## 15.3 Test Results

The E.U.T. met the requirements of the IEC 61000-4-8: 2001 specification.

Additional details are given in *Figure 14*.

# Immunity to Magnetic Field

| | |
|---|---|
| E.U.T Description | Power Meter |
| Type | PM130EH PLUS |
| Serial Number: | Not designated |

Specification: IEC 61000-4-8: 2001

| | PASS / FAIL | Strength of Magnetic Field (A/m) |
|---|---|---|
| Vertical | Pass | 30.0 |
| Vertical at 90° | Pass | 30.0 |
| Horizontal | Pass | 30.0 |

**Figure 14. Immunity to Magnetic Field**

# 16. Set Up Photographs

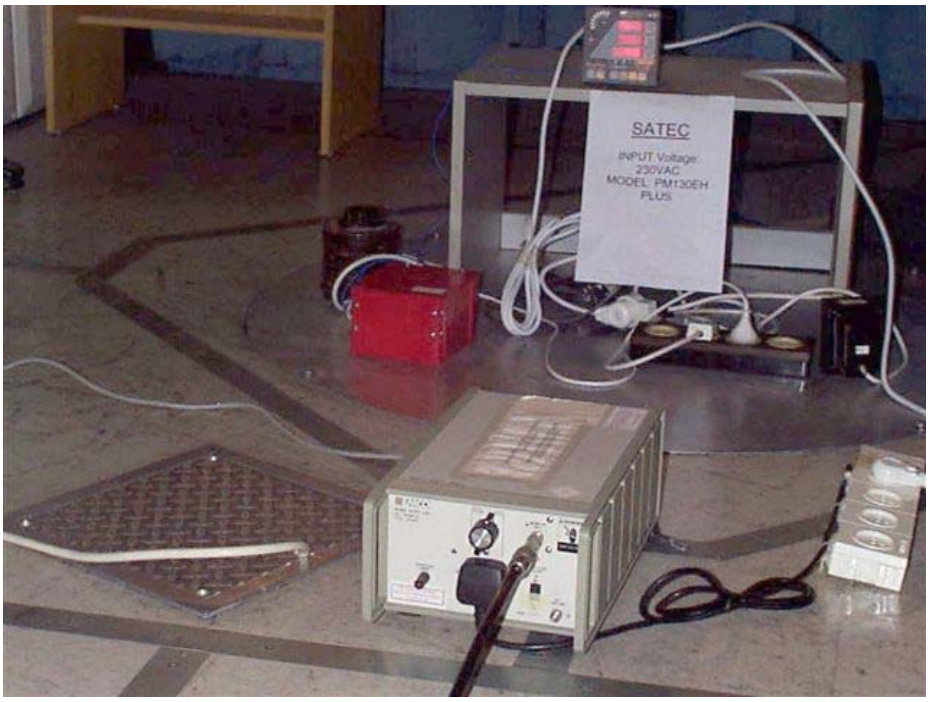



**Figure 15. Conducted Emission Test**

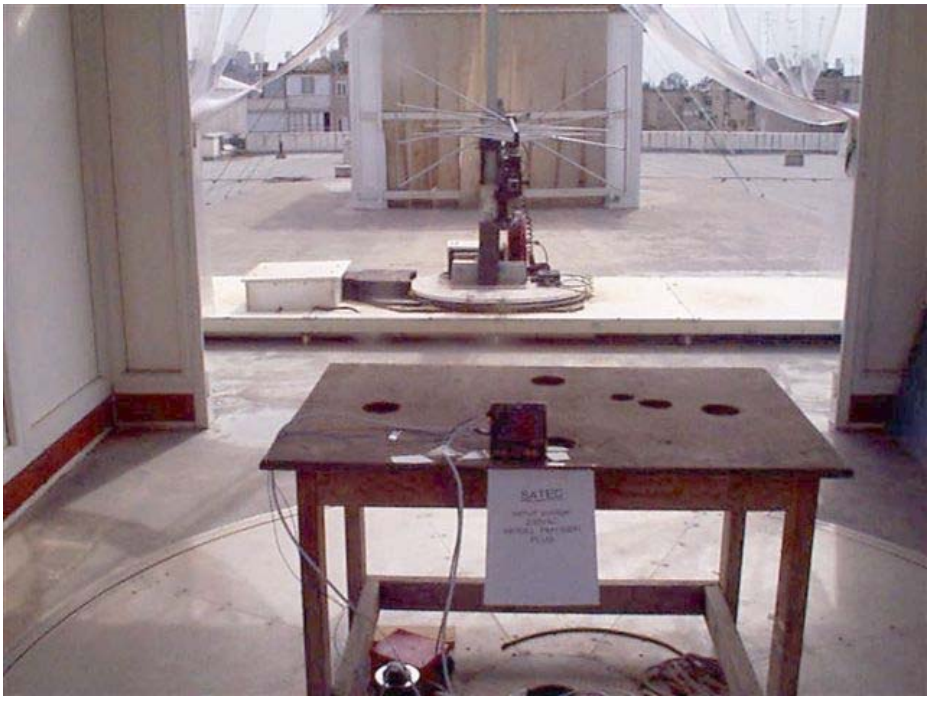


**Figure 16. Radiated Emission Test**

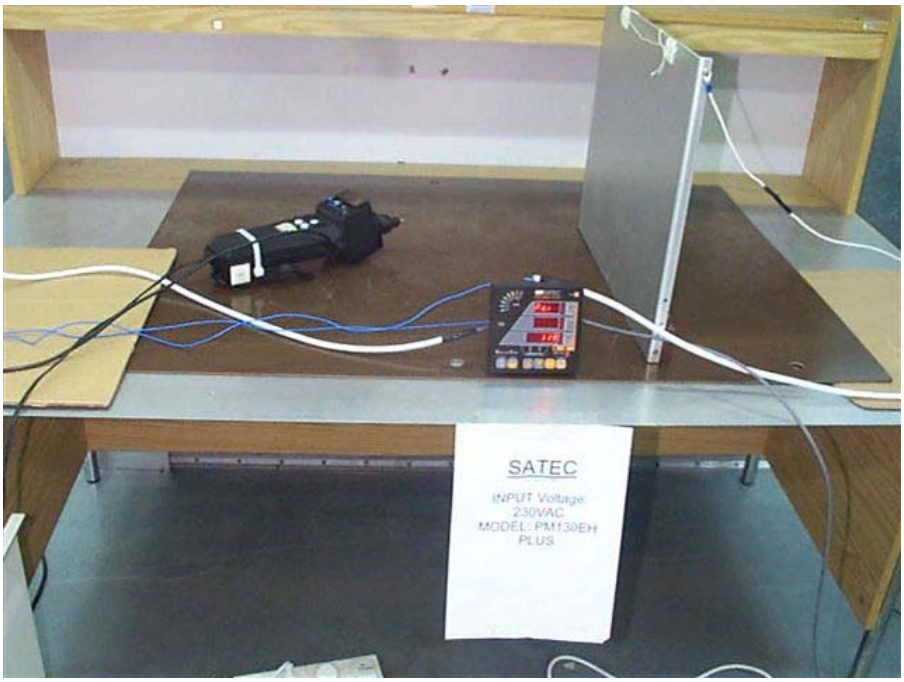



**Figure 17. Immunity to Electrostatic Discharge Test**

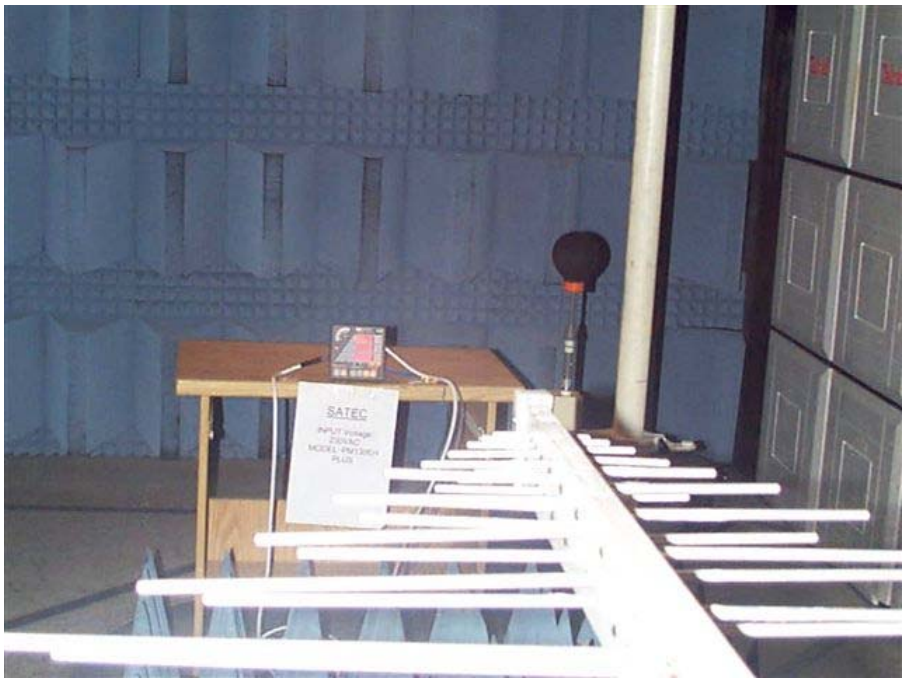



Figure 18. Immunity to Radiated Field Test

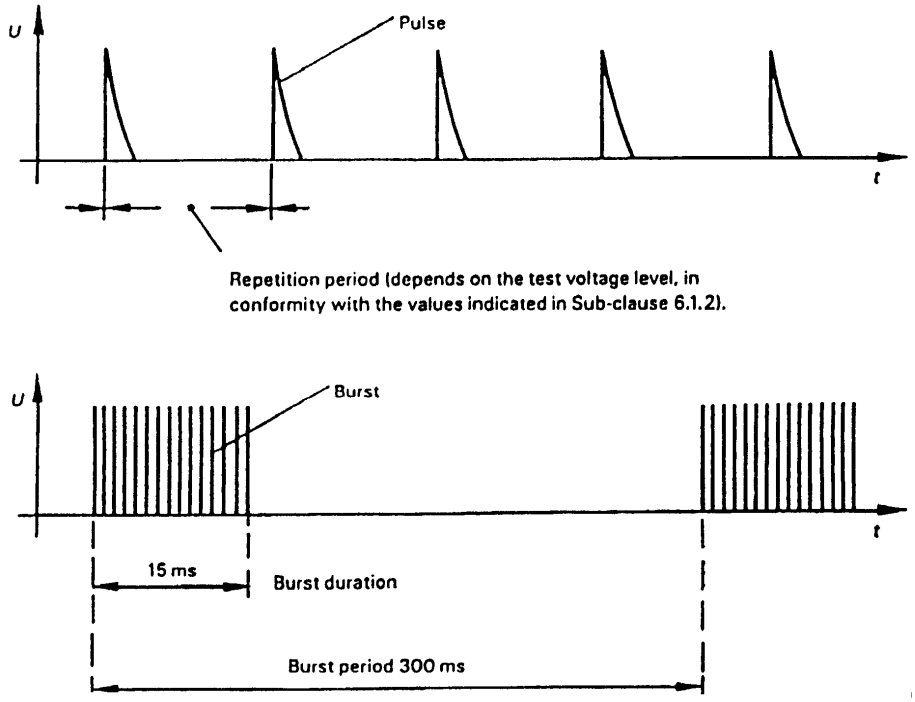
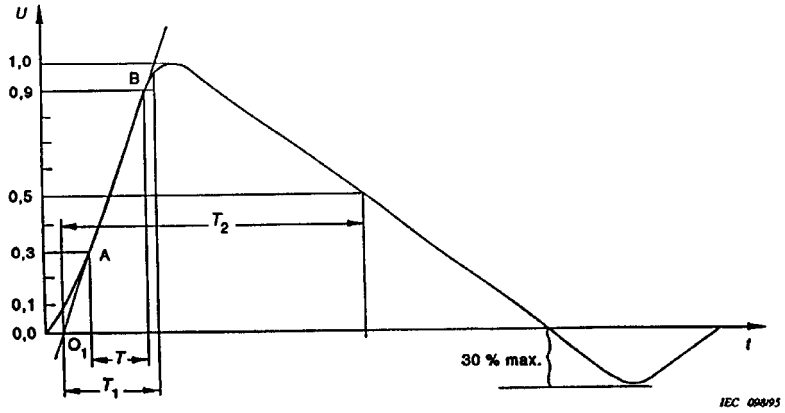



**Figure 19. Transient Waveforms**




Front time: $T_1 = 1{,}67 \times T = 1{,}2\ \mu s \pm 30\ \%$

Time to half-value: $T_2 = 50\ \mu s \pm 20\ \%$.

**Figure 2 – Waveform of open-circuit voltage (1,2/50 µs) (waveform definition according to IEC 60-1)**

**Figure 20. Open Circuit Waveform (1.2 x 50µs double exponential)**


**Figure 21. Immunity to Conductive Surges**

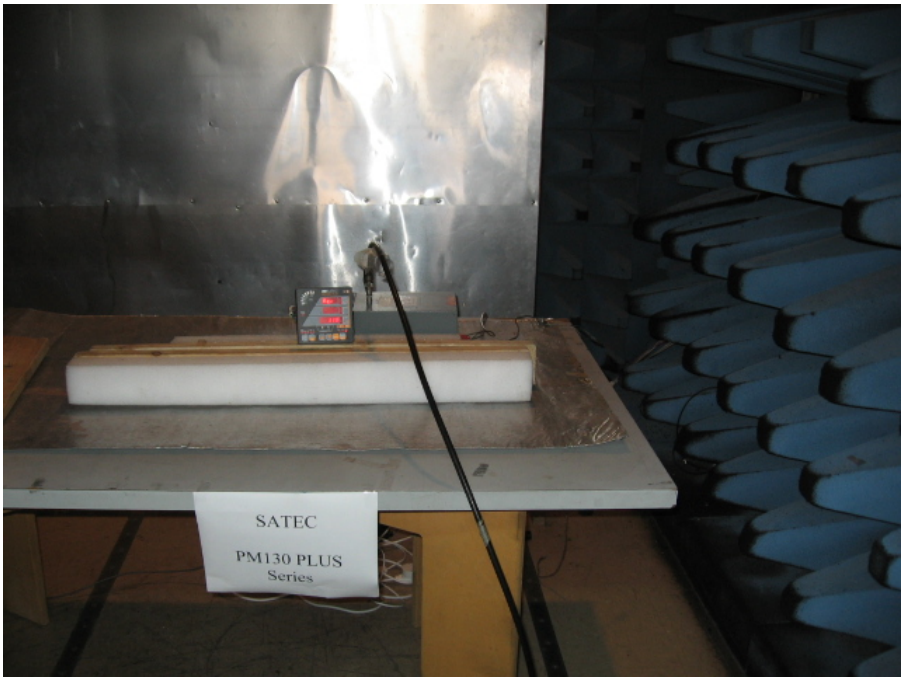
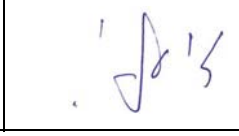



**Figure 22. Conducted Disturbances**


**Figure 23. Immunity to Magnetic Field**

# 17. Signatures of the E.U.T's Test Engineers

| Test | Test Engineer Name | Signature | Date |
|---|---|---|---|
| Conducted Emissions | D. Yadidi |  | 31.05.07 |
| Radiated Emissions | D. Yadidi |  | 31.05.07 |
| ESD | D. Yadidi |  | 31.05.07 |
| Radiated Immunity | D. Yadidi |  | 31.05.07 |
| EFT/B | D. Yadidi |  | 31.05.07 |
| Conductive Surges | D. Yadidi |  | 31.05.07 |
| Conducted Disturbances | I. Raz |  | 03.05.07 |
| Magnetic Immunity | I. Raz |  | 03.05.07 |

# 18. APPENDIX A - CORRECTION FACTORS

## 18.1 Correction factors for CABLE

**from EMI receiver**
**to test antenna**
**at 3 and 10meter range.**

| FREQUENCY | CORRECTION FACTOR | | FREQUENCY | CORRECTION FACTOR |
|---|---|---|---|---|
| (MHz) | (dB) | | (MHz) | (dB) |
| 30 | 1.96 | | 150 | 5.06 |
| 35 | 2.08 | | 160 | 5.35 |
| 40 | 2.26 | | 170 | 5.57 |
| 45 | 2.43 | | 180 | 5.7 |
| 50 | 2.59 | | 190 | 5.84 |
| 55 | 2.65 | | 200 | 6.02 |
| 60 | 2.86 | | 250 | 6.86 |
| 65 | 2.96 | | 300 | 7.59 |
| 70 | 3.04 | | 350 | 8.09 |
| 75 | 3.27 | | 400 | 8.7 |
| 80 | 3.41 | | 450 | 9.15 |
| 85 | 3.54 | | 500 | 9.53 |
| 90 | 3.68 | | 550 | 9.82 |
| 95 | 3.77 | | 600 | 10.24 |
| 100 | 3.93 | | 650 | 10.74 |
| 110 | 4.19 | | 700 | 11.25 |
| 120 | 4.41 | | 800 | 12.53 |
| 130 | 4.6 | | 900 | 13.86 |
| 140 | 4.83 | | 1000 | 14.86 |

*NOTE: The cable type is* **RG-214/U**

## 18.2 Correction factors for Bilog ANTENNA

**Model: 3142**

***Antenna serial number: 1250***

**3 meter range**

| FREQUENCY (MHz) | AFE (dB/m) |
|---|---|
| 30 | 18.4 |
| 40 | 13.7 |
| 50 | 9.9 |
| 60 | 8.1 |
| 70 | 7.4 |
| 80 | 7.2 |
| 90 | 7.5 |
| 100 | 8.5 |
| 120 | 7.8 |
| 140 | 8.5 |
| 160 | 10.8 |
| 180 | 10.4 |
| 200 | 10.5 |
| 250 | 12.7 |
| 300 | 14.3 |
| 400 | 17 |
| 500 | 18.6 |
| 600 | 19.6 |
| 700 | 21.1 |
| 800 | 21.4 |
| 900 | 23.5 |
| 1000 | 24.3 |

## 18.3 Amplifier 8347A GAIN

| FREQUENCY (MHz) | GAIN (dB) |
|---|---|
| 20 | 32.59 |
| 50 | 32.48 |
| 100 | 32.55 |
| 200 | 32.61 |
| 500 | 31.53 |
| 1000 | 31.05 |

# 19. APPENDIX B - MEASUREMENT UNCERTAINTY

## 19.1 Radiated Emission

The Open Site complies with the ±4 dB Normalized Site Attenuation requirements of ANSI C63.4-2003. In accordance with Paragraph 5.4.6.1 of this standard this tolerance includes instrumentation calibration errors, measurement technique errors, and errors due to site anomalies.

## 19.2 Conducted Emission

The uncertainty for this test is ±2 dB.