Electromagnetic Compatibility
Test Report

Test Report No: STC 291006
Issued on: January 03, 2007

Product Name
Multi Function Power Meter
Model: PM172N/ PM174/PM175

Tested According to
CISPR 11:2004
Amendment 1

Tests Performed for
SATEC Ltd.
Har Hotzvim, P.O.Box 45022, Jerusalem 91450
Phone: 972-2-5411000

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

ACCREDITED
1633.01

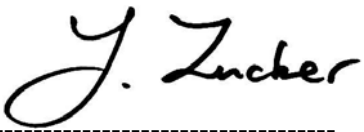
Test personnel

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

Rami Nataf Ilya Arbitman

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

Bina Talkar



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

Y. Zucker
QA and Lab. Manager
QualiTech EMC Laboratory

Test Report details:

Test commencement date:	19.12.2006
Test completion date:	24.12.2006
Customer's Representative:	Slava Dubrovsky
Issued on:	03.01.2007

Revision details:

Version	Date	Details/Reasons
Amendment 1	03.01.2007	Additional testing according to EN 55011:2003

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 set up and exercised using the configuration, modes of operation and arrangements defined in this report only.

Customer's statement:

According to Customer's declaration "SATEC PM174 and PM175 meters are manufactured on the PM172 N platform by replacing a device faceplate and downloading a different device firmware without any change in device hardware. A different device name designates a power quality option added by the device firmware. The microcontroller clock, external bus clock and communication ports' clocks frequencies have not been changed.

Partial Testing:

According to customer's request only following tests were performed: CISPR 11.
Since this test report contains tests requested by the client; a subset of tests deemed necessary by QualiTech, declaration of conformity is not given for this test report.

Modifications:

Modifications made to the EUT

None

Modifications made to the Test Standard

None

Summary of Compliance Status

The Multi Function Power Meter Model: PM174/PM175 was tested according to the following test method.
Test results are given in full in sections 3÷4.

Test type	Test Method	Class applied	Frequency Range	Test results
Radiated Emission	CISPR 11	A	30MHz÷1GHz	**Comply**
Conducted Emission on 220 VAC	CISPR 11	A	150kHz÷30MHz	**Comply**

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Table of Content

1. General

1.1. Purpose:

The purpose of this report is to show compliance to Electromagnetic Emission requirements outlined in the referenced specifications.

1.2. Referenced documents:

CISPR 11:2004	Industrial, Scientific And Medical (ISM) Radio-Frequency Equipment - Radio Disturbance Characteristics - Limits And Methods of Measurement

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:

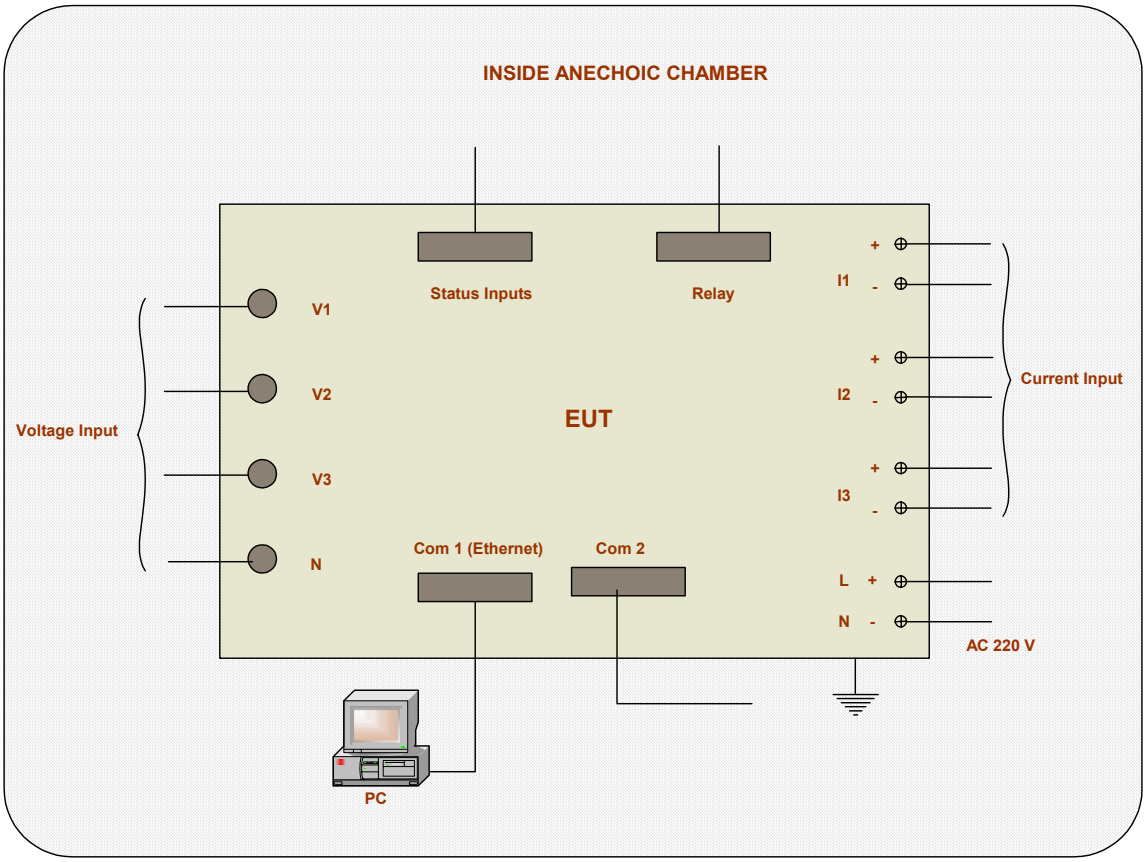
The PM174/PM175 is a compact, multi-function, three-phase AC power meter specially designed to meet the requirements of users ranging from electrical panel builders to substation operators. Bright 3-row LED display provides easy local meter readings.
Two communication ports allow local and remote automatic meter readings and setup though the supplemental communication or user data acquisition software. Different communication options are available for remote communications with the meter including public telephone lines, LAN and the Internet.

EUT Features:

- 3 voltage and 3 current transformer-isolated AC inputs for direct connection to power line or via potential and current transformers
- Multi-function 3-phase meter (true RMS, volts, amps, power, power factor, neutral current, voltage and current unbalance, frequency)
- Class 0.5 four-quadrant energy meter
- Time-of-Use, 8 totalization and tariff energy/demand registers x 8 tariffs, 4 seasons x 4 types of days, 8 tariff changes per day, easy programmable tariff schedule
- LED bar graph showing percent load with respect to user-definable nominal load current
- 2 digital inputs for monitoring external contacts, and receiving pulses from energy, water and gas meters
- 2 relay outputs for alarms and controls, and for output energy pulses
- 25/50/60/400 Hz operation

1.3.2. EUT Configuration:

EUT Configuration for Emissions & Immunity Testing:



1.3.3. EUT Cards/Modules configuration:

No	Hardware Component	Manufacturer's Catalog Number	Serial Number	Hardware Revision	Quantity
1	PM172E	S172E-N4	0001	N4	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
220 VAC	Standard	Indoor	4 kOhm	30	3	1	1	Power Line	PM
COM 1 (Ethernet)	UTP	Indoor	50	>300	5	1	1	PM	LAN
Current Input (3 Phase)	4 wires	Indoor	20 mOhm	>30	10	1	1	Current source	PM
Voltage Input (3 Phase)	4 wires	Indoor	500 kOhm	>30	10	1	1	Power Line	PM
Status Input	Unshielded unbalanced	Indoor	3k Ohm	<30	10	1	1	Dry Contact	PM
Relay	Unshielded Multipair	Indoor	100 …1000	<30	10	1	1	PM	Load
COM2 (RS-485)	Unshielded balanced	Indoor	50	1000	30	1	1	PM	LAN

1.3.5. Clock frequencies table:

Frequency [MHz]	Location
20 [MHz]	Microconrtroller (42)
32.768 kHz	RTC (423)

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 Group

Address: 30, Hasivim St., 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

3. Electric Field Emission Measurements

Date of Test: 19.12.2006
Relative Humidity: 45%
Ambient Temperature: 22 °C
Atmospheric Pressure: 1011.4 hPa

Test Method: **EN 55011**

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
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	Phot.3	3.1-3.4

Test Results:

Table 3: Frequency range 30MHz÷1GHz

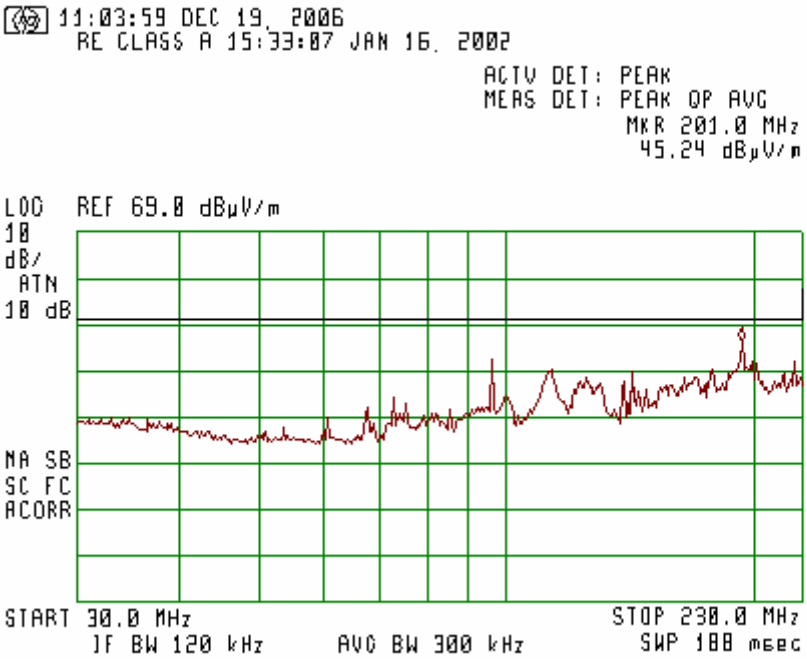
Frequency [MHz]	Ant. Type	Ant. Pol.	Ant. Pos. [cm]	Turn-table Azimuth [°]	Radiated Emission dB(µV/m)	Limit at 3m dB(µV/m)	Margin [dB]	Pass/ Fail
36.061600	Biconical	V	100	92	36.7	50	-13.3	**Pass**
100.011700	Biconical	H	230	246	40.3	50	-9.7	**Pass**
200.012239	Biconical	H	161	110	44.0	50	-6	**Pass**
300.007855	Log-periodic	H	121	107	54.5	57	-2.5	**Pass**
400.010200	Log-periodic	V	160	271	56.6	57	-0.4	**Pass**
500.007600	Log-periodic	V	136	163	47.9	57	-9.1	**Pass**

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

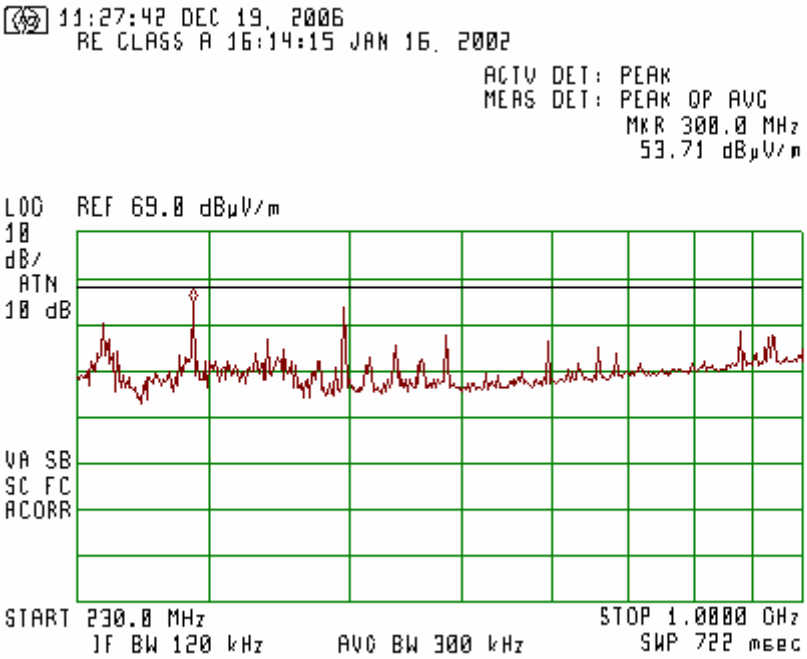
Summary:

Frequency Range	Test method reference	Class Limits applied	Test Results	Remarks
30MHz÷1GHz	EN55011, Sec. 8 & 10	A	Tab. 3	**Pass**

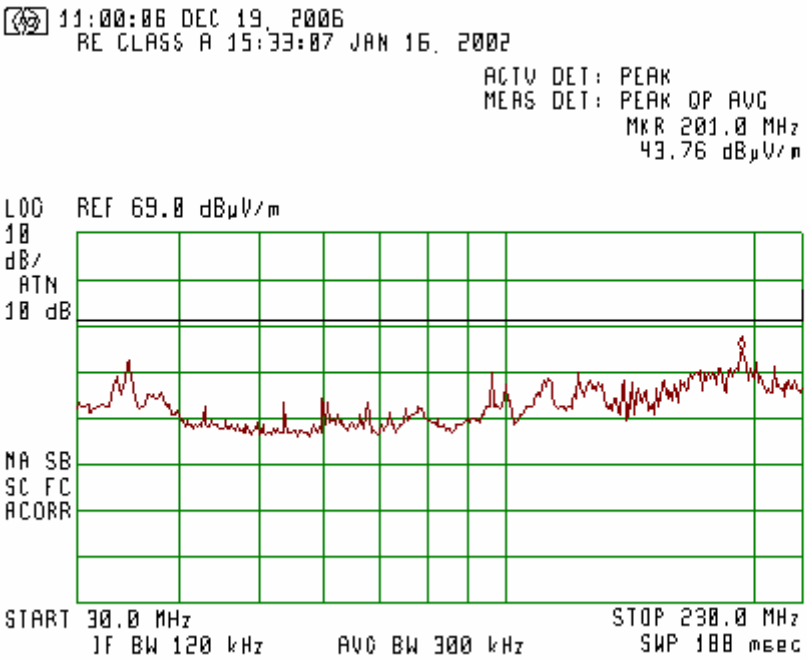
Plot 3.1
Horizontal Polarization
30MHz-230MHz



Plot 3.2
Horizontal Polarization
230MHz-1GHz



Plot 3.3
Vertical Polarization
30MHz-230MHz



Plot 3.4
Vertical Polarization
230MHz-1GHz

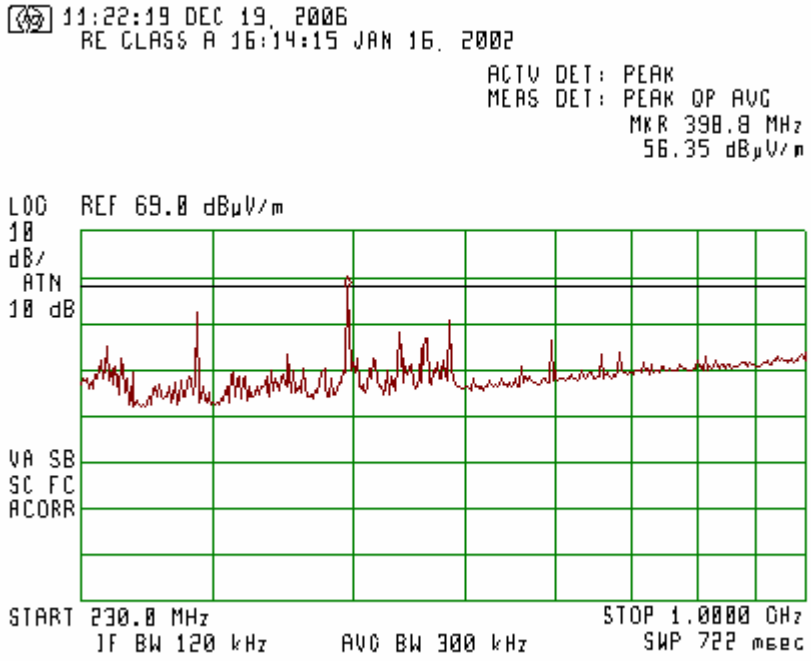
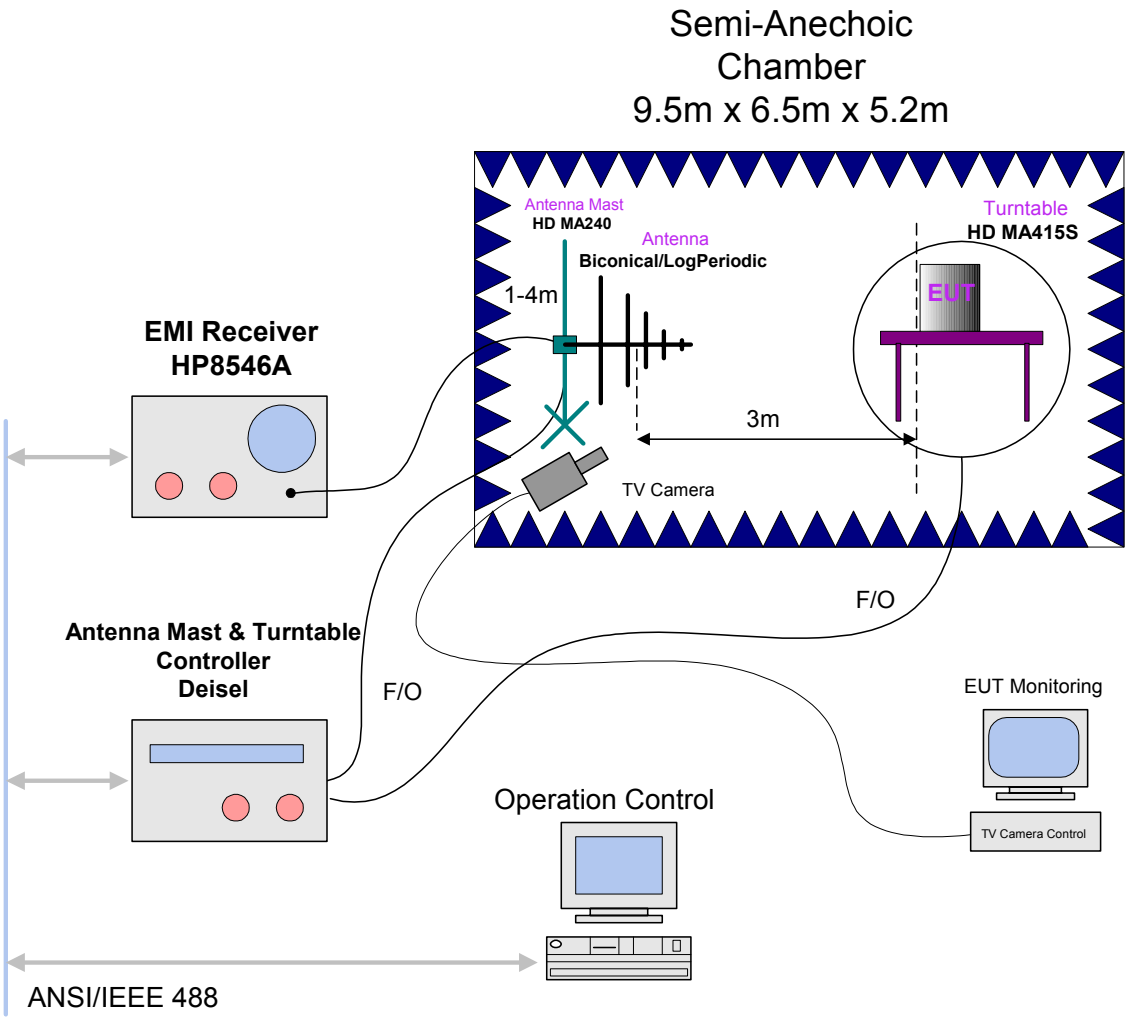
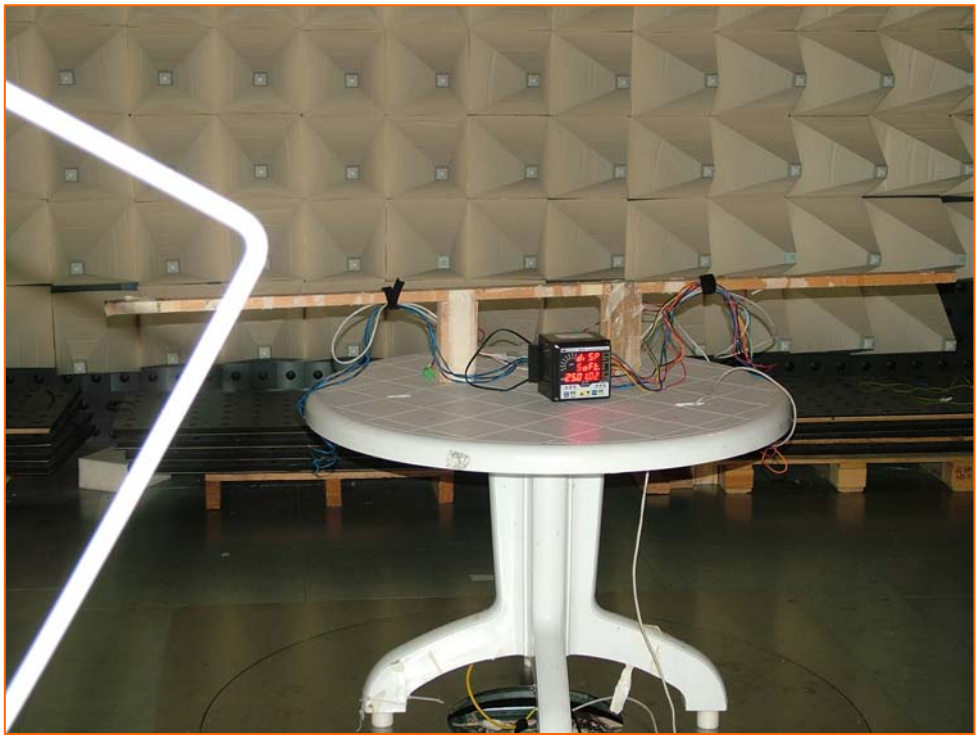
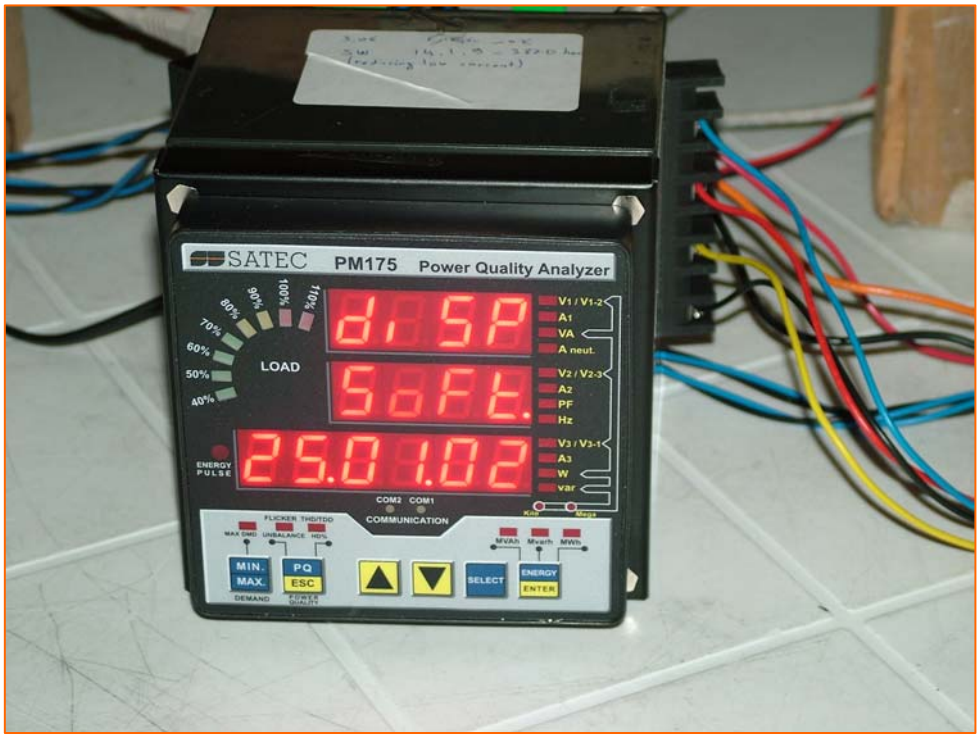


Figure 3: Setup for Radiated Emission Testing - 30MHz ÷1GHz Frequency range



Photograph 3: Radiated Emission Testing - 30MHz ÷1GHz Frequency range





4. Conducted Emission measurements

Date of Test: 19.12.2006
Relative Humidity: 45%
Ambient Temperature: 22°C
Atmospheric Pressure: 1011.4 hPa

Test Method: CISPR 11

Limits:

Power Supply Port: Class A

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

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.
220 VAC	AC Line	Sec. 9. 2 & 9.5.2	Fig. 4	Photo. 4	4.1-4.2

Test Results:

Table 4: Power Supply port:

"Phase" Lead

Frequency [MHz]	Measured Result [dBµV]		Limit [dBµV]		Margin [dB]		Pass/Fail
	QP	AVR	QP	AVR	QP	AVR	
0.204579	49.1	44.1	79.00	66.00	-29.90	-21.90	**Pass**
0.307043	45.4	42.9	79.00	66.00	-33.60	-23.10	**Pass**
0.508822	43.8	43.1	73.00	60.00	-29.20	-16.90	**Pass**
6.302377	50.6	42.9	73.00	60.00	-22.40	-17.10	**Pass**
21.663098	50.9	46.8	73.00	60.00	-22.10	-13.20	**Pass**
26.487653	48	44.3	73.00	60.00	-25.00	-15.70	**Pass**

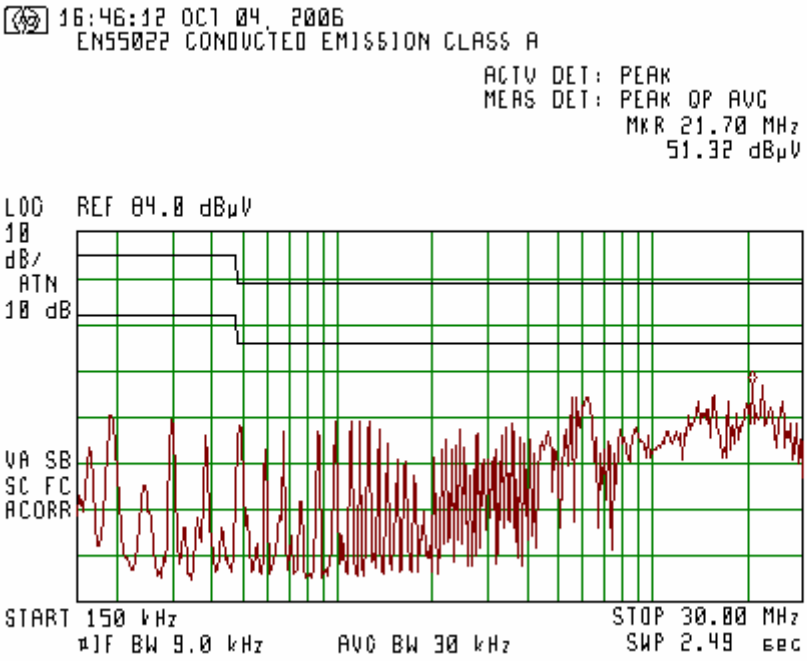
"Neutral" Lead

Frequency [MHz]	Measured Result [dBµV]		Limit [dBµV]		Margin [dB]		Pass/Fail
	QP	AVR	QP	AVR	QP	AVR	
0.204579	47.7	42.7	79.00	66.00	-31.30	-23.30	**Pass**
0.307043	46.4	44.8	79.00	66.00	-32.60	-21.20	**Pass**
0.508822	45.4	44.7	73.00	60.00	-27.60	-15.30	**Pass**
6.302377	50	41.6	73.00	60.00	-23.00	-18.40	**Pass**
21.663098	51.4	47.6	73.00	60.00	-21.60	-12.40	**Pass**
26.487653	48.2	44.4	73.00	60.00	-24.80	-15.60	**Pass**

Summary:

Port under Test	Measurement Means	Class Limits applied	Frequency Range	Test Results	Remarks
220 VAC	LISN	A	150kHz – 30MHz	Tab. 4	**Pass**

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



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

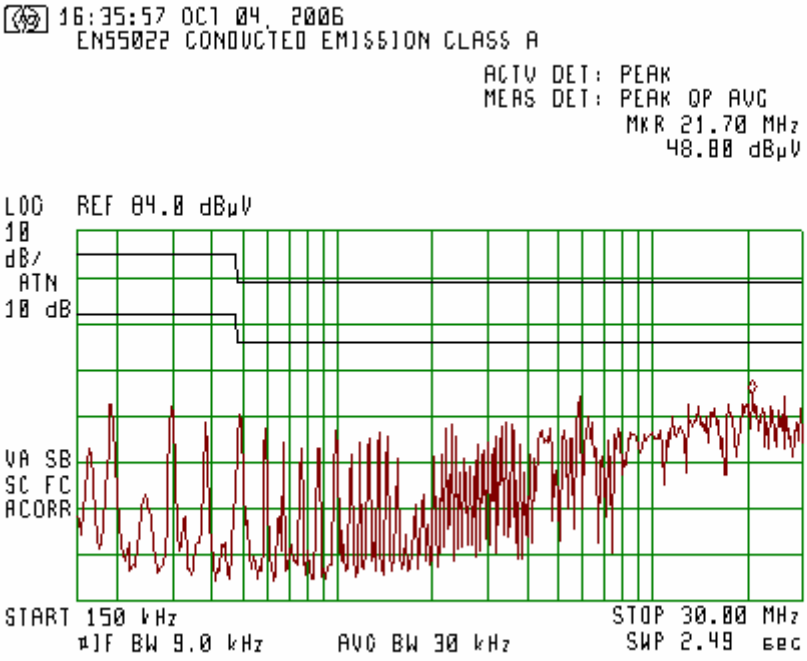
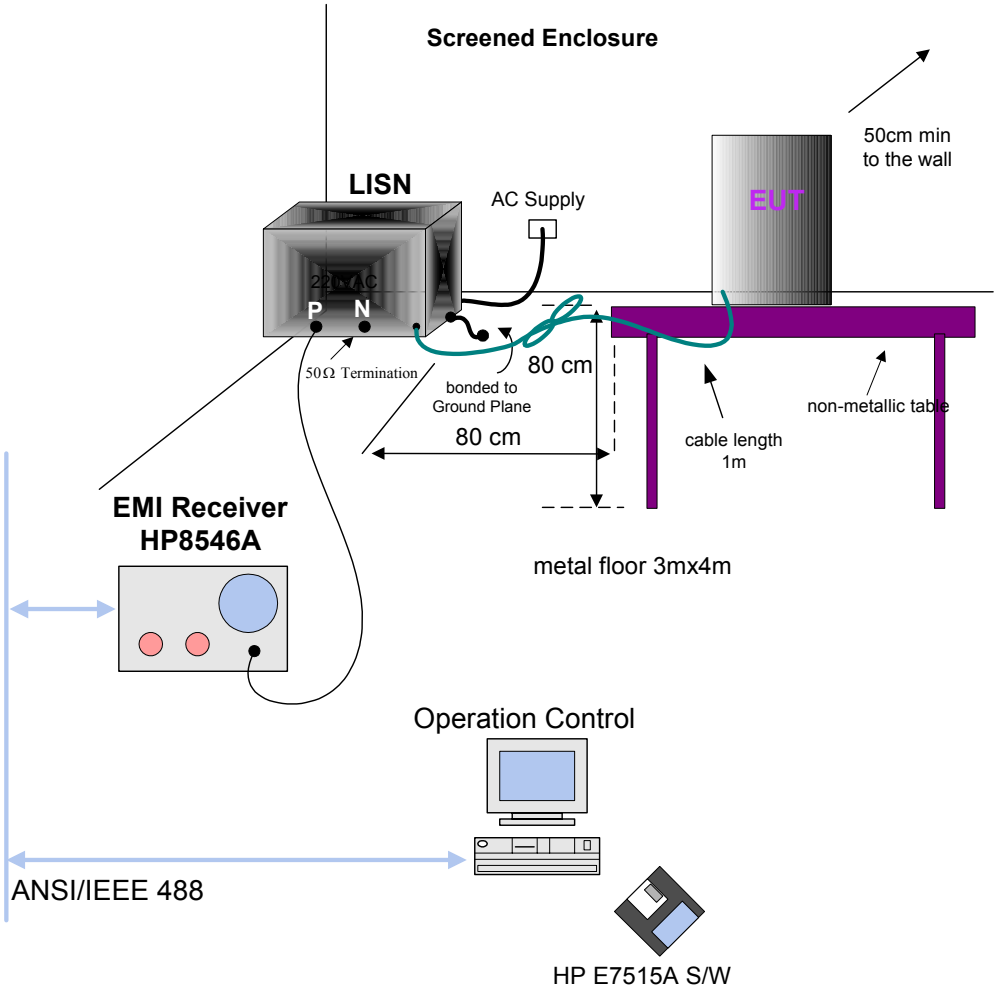
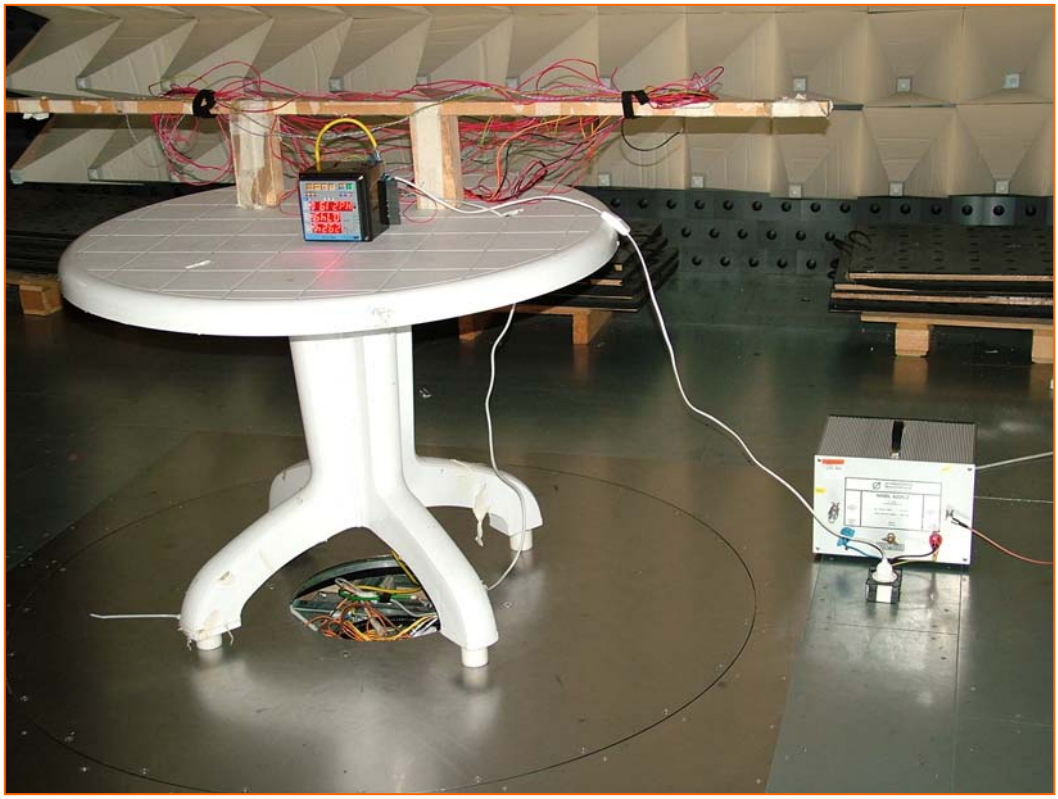


Figure 4: Set up for conducted emission testing on AC Line



Photograph 4: Conducted emission testing on AC Line



5. Appendix

Appendix A: 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 B: Accreditation Certificate

THE AMERICAN
ASSOCIATION
FOR LABORATORY
ACCREDITATION

ACCREDITED LABORATORY

A2LA has accredited

QUALITECH EXPERTS
Petach-Tikva ISRAEL

for technical competence in the field of

Electrical Testing

The accreditation covers the specific tests and types of tests listed on the agreed scope of accreditation. This laboratory meets the requirements of ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration Laboratories" and any additional program requirements in the identified field of testing.

Presented this 5th day of November 2004.

American Association for Laboratory Accreditation
Corporate SEAL 1978 District of Columbia
A2LA

President
For the Accreditation Council
Certificate Number 1633.01
Valid to January 31, 2007
Revised 11/30/2006

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

End of the Test Report