1116

TEST REPORT FOR THE PATTERN AND CONSTRUCTION OF ELECTRICITY METERS

MANUFACTURER	:	*Schneider Electric*
TYPE	:	*PM55***
CLASS	:	*0.2s (kWh) & 2(kvarh)*
DESCRIPTION	:	*Polyphase, Active Import/Export (kWh), Reactive Import/Export (kvarh), Transformer Operated, Electricity Meter*

Tested in accordance with IEC 62052-11: 2003, Electricity metering equipment (AC) – General requirements, tests and test conditions.
Part 11: Metering equipment.

And IEC 62053-22: 2003, Electricity metering equipment (AC) – Particular requirements
Part 22: Static meters for active energy (classes 0.2s and 0.5s).

And IEC 62053-23: 2003, Electricity metering equipment (AC) – Particular requirements
Part 23: Static meters for reactive energy (classes 2 & 3).

The meters tested satisfied the required specification.

ISSUED BY:	CHECKED BY:	VERIFIED BY:
K. Hunter	P. Fairless	R. Jackson
Test Engineer	Test Engineer	Metering Manager

REPORT ISSUE DATE: 25th July 2013

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INTRODUCTION

The type tests described were carried out in the SGS (Durham) measurement laboratory on behalf of:

CLIENT DETAILS: Schneider Electric
44P Electronic City East Phase
Hosur Road
Bangalore
560100
India

ORDER No's: 133576, 133577, 132957

APPLICATION RECEIVED DATE: 19th April 2013

DATE OF RECEIPT OF SAMPLES: 12th April 2013

DATE OF TESTS: 23rd April 2013 to 27th June 2013

In the cases where no or only limited tests have been conducted on the submitted samples, tests carried out during previous OFGEM approval (or by other accredited bodies) on meters of similar construction and designs have been taken to confirm that the meter satisfies the requirements of the relevant standard. See supporting documentation for reference.

Conditions under which the type tests took place:

Unless otherwise stated, the meters were examined at an ambient temperature of 23°C ± 2°C, and after the voltage circuits had been connected to reference voltage for at least 1 hour.

Unless otherwise stated, Polyphase tests were tested with a standard phase sequence of L1-L2-L3 (corresponding to the Red, Yellow & Blue phases).

The tests were conducted using equipment, traceable to National and International Standards.

INFORMATION ON THE ELECTRICITY METERS TESTED

Manufacturer	:	*Schneider Electric*
Type	:	*PM5500*
Class	:	*0.2s (kWh) & 2(kvarh)*
Type of circuit	:	*3 phase 4 wire*
No. of Elements	:	*3*
Basic Current (In)	:	*5A*
Maximum Current (Im)	:	*10A*
Reference Supply Voltage	:	*3x230/400V*
Auxiliary Voltage	:	*100-480V*
Rated Frequency	:	*50Hz*
Pulse output constant	:	*10000 imp/kWh & kvarh*
Manufacturers Serial No's	:	*2271226, 2271222, 2271235, JB1310419000037*

GENERAL REQUIREMENTS

Sealing Arrangements IEC 62052-11 X-Ref. 5.2.1

The meter shall have a case which can be sealed in such a way that the internal parts of the meter are accessible only after breaking the seal(s) The cover shall not be removable without the use of a tool. Non permanent deformation may not influence the meter.	Complied

Display of Measured Values IEC 62052-11 X-Ref. 5.10

The principal unit is (kWh) The active tariff shall be indicated. The identification of each tariff applied shall be possible. The register shall be able to record and display, starting from zero, for a minimum of 1500 h, the energy corresponding to maximum current at reference voltage and unity power factor.	Complied
Non-volatile memory shall have a minimum retention time of four months. In the case of multiple values presented by a single display, it shall be possible to display the content of all relevant memories. Automatic sequencing displays shall display each value for at least 5 s. Every numerical element of an electronic display shall be able to show all numbers from "zero" to "nine":	Complied

Inspection of Markings IEC 62052-11 X-Ref. 5.12

The requirements are met for the marking of the meter samples with respect to both name-plates and connection diagrams.	Complied

SUPPORTING DOCUMENTATION

Accredited Laboratory tests reports:

Radio Interference Suppression	X-Ref. 7.5.8	
Labtest Certification Inc	Report No.: 11162-1E	Issued: 2nd January 2013

SUMMARY OF TEST RESULTS

IEC 62052-11: 2003 General Requirements:

EN 62052-11 Clause	Test	Performed	Result
5.2.2.1	Spring hammer	Yes	Complied
5.2.2.2	Shock	Yes	Complied
5.2.2.3	Vibration	Yes	Complied
5.8	Resistance to heat and fire	Yes	Complied
5.9	Penetration of dust and water	No	-
6.3.1	Dry heat	Yes	Complied
6.3.2	Cold	Yes	Complied
6.3.3	Damp heat cyclic	Yes	Complied
6.3.4	Solar radiation	No	-
7.1.2	Voltage dips and short interruptions	Yes	Complied
7.2	Influence of heating	Yes	Complied
7.3.2	Impulse voltage	Yes	Complied
7.5.2	Electrostatic discharge immunity	Yes	Complied
7.5.3	Radiated immunity	Yes	Complied
7.5.4	Fast transient bursts immunity	Yes	Complied
7.5.5	Conducted immunity	Yes	Complied
7.5.6	Surge immunity	Yes	Complied
7.5.7	Damped oscillatory waves immunity	Yes	Complied
7.5.8	Radio interference suppression	No*	-

IEC 62053-22: 2003 Particular Requirements:

EN 62053-22 Clause	Test	Performed	Result
7.1	Power consumption	Yes	Complied
7.2	Influence of short–time over-currents	Yes	Complied
7.3	Influence of self-heating	Yes	Complied
7.3.3	AC voltage	Yes	Complied
8.1	Current variation	Yes	Complied
8.2	Variation of error due to voltage variation	Yes	Complied
8.2	Variation of error due to frequency variation	Yes	Complied
8.2	Reverse Phase Sequence	Yes	Complied
8.2	Voltage Unbalance	Yes	Complied
8.2	Operation of accessories	No	-
8.2	Auxiliary voltage variation	Yes	Complied
8.2	Variation of error due to temperature variation	Yes	Complied
8.2	Variation of error due to harmonics	Yes	Complied
8.2	Sub-harmonics in the AC circuit	Yes	Complied
8.2	Continuous magnetic induction of external origin	Yes	Complied
8.2	Magnetic induction of external origin (0.5mT)	Yes	Complied
8.3	Starting and no-load condition	Yes	Complied
8.4	Meter constant	Yes	Complied

SUMMARY OF TEST RESULTS (cont.)

IEC 62053-23: 2003 Particular Requirements:

EN 62053-23 Clause	Test	Performed	Result
7.1	Power consumption	No	-
7.2	Influence of short–time overcurrents	No	-
7.3	Influence of self-heating	No	-
7.4	AC voltage	No	-
8.1	Current variation	Yes	Complied
8.2	Variation of error due to voltage variation	Yes	Complied
8.2	Variation of error due to frequency variation	Yes	Complied
8.2	Operation of accessories	No	-
8.2	Variation of error due to temperature variation	No	-
8.2	DC Component in the current circuit	No	-
8.2	Continuous magnetic induction of external origin	No	-
8.2	Magnetic induction of external origin (0.5mT)	No	-
8.3	Starting and no-load condition	Yes	Complied
8.4	Meter constant	Yes	Complied

No*: Tests performed at Labtest Certification Inc Report No: 11162-1E

1 INSULATION IEC 62052-11 X-Ref. 7

1.1 Impulse Voltage Test X-Ref. 7.3.2

Test Results ID / Sample No.	Test Procedure: EN62052-11 Impulse Voltage
Impulse / 2271226	19EMA TP12

Environmental Conditions

Temperature	23°C
Relative Humidity	44%
Barometric Pressure	998mB

Impulse specification: Test level 6kV @ 0.5J open circuit
Time between impulse's 3s

The meter samples were placed on a flat conducting earth surface with the case wrapped in a conductive foil.
The test voltage was applied 10 times in each polarity between the points listed below:-

1) With one terminal of the voltage circuit connect to earth, the impulse voltage was applied between the common voltage/current meter terminal and earth.

2) With all meter terminals connected together, impulse voltage was applied between the meter terminals and earth.

During the tests auxiliary circuits with reference rated voltage ≤ 40V were connected to earth.

On completion of the above tests, the meter was found to function correctly and within the accuracy specification when subsequently operated under reference operating conditions, with no signs of damage or degradation in the meter's insulation properties.

1.2 AC Voltage Test

IEC 62053-22 X-Ref. 7.4

Test Results ID / Sample No.	Test Procedure: EN62052-22 AC Voltage
AC / 2271226	19EMA TP13

Environmental Conditions

Temperature	23°C
Relative Humidity	44%
Barometric Pressure	998mB

Test level 2kV & 4kV Test duration 1 minute.

The a.c. voltage tests were conducted as follows:

1) Between all meter voltage and current circuits connected together, and earth.

2) Between all circuits not intended to be connected together in service, and earth.

The earth consisting of a conductive foil wrapped around the meter and connected to a flat conducting earth surface, upon which the meter was placed.
During the tests auxiliary circuits with reference rated voltage ≤ 40V were connected to earth.

On completion of the above test, the meter was found to function correctly and within the accuracy specification when subsequently operated under reference operating conditions, with no signs of damage or degradation in the meter's insulation properties.

2 ACCURACY REQUIREMENTS IEC 62053-22 X-Ref. 8

2.1 Meter Constant X-Ref. 8.4

The relation between the test output and the meter energy registers were checked to ensure the constant marking on the meter nameplate.

Measurement mode - Active Import Energy kWh

Test Results ID / Sample No. Meter Constant / 2271222	Test Procedure: Meter Constant (1h @ Im) 19EMA TP37

Test conditions: *Un: 3x230/400V* *Imax: 10A* *Cos. ϕ = 1.0, 50Hz*

Test Circuit: *3 phase 4 wire*

Measurement mode: *Active Import Energy kWh*

Number of Pulses Recorded	Pulse Constant (p/ kWh)	LED Test Output (kWh)	Energy Registered By Meter (kWh)	Percentage difference between Energy Registered and LED Test Output (%)
69067	10000	6.9067	6.9090	0.03

Limit of % Error Variation: ±0. 2% for Class 0.2

Measurement mode - Active Export Energy kWh

Test Results ID / Sample No. Meter Constant / 2271222	Test Procedure: Meter Constant (1h @ Im) 19EMA TP37

Test conditions: *Un: 3x230/400V* *Imax: 10A* *Cos. ϕ = 1.0, 50Hz*

Test Circuit: *3 phase 4 wire*

Measurement mode: *Active Export Energy kWh*

Number of Pulses Recorded	Pulse Constant (p/ kWh)	LED Test Output (kWh)	Energy Registered By Meter (kWh)	Percentage difference between Energy Registered and LED Test Output (%)
69042	10000	6.904	6.904	0.00

Limit of % Error Variation: ±0. 2% for Class 0.2

During the registration tests, rate registers not active were found not to have been corrupted.

Meter Constant (cont.) IEC 62053-23 X-Ref. 8.4

Measurement mode - Reactive Import Energy kvarh

Test Results ID / Sample No.	Test Procedure: Meter Constant (1h @ Im)
Meter Constant / 2271226	19EMA TP37

Test conditions: *Un: 3x230/400V* *Imax: 10A* *Cos. ϕ = 1.0, 50Hz*

Test Circuit: *3 phase 4 wire*

Measurement mode: *Reactive Import Energy kvarh*

Number of Pulses Recorded	Pulse Constant (p/ kWh)	LED Test Output (kWh)	Energy Registered By Meter (kWh)	Percentage difference between Energy Registered and LED Test Output (%)
69051	10000	6.905	6.905	0.00

Limit of % Error Variation: ± 2% for Class 2

Measurement mode - Reactive Export Energy kvarh

Test Results ID / Sample No.	Test Procedure: Meter Constant (1h @ Im)
Meter Constant / 2271226	19EMA TP37

Test conditions: *Un: 3x120/208V* *Imax: 10A* *Cos. ϕ = 1.0, 50Hz*

Test Circuit: *3 phase 4 wire*

Measurement mode: *Reactive Export Energy kvarh*

Number of Pulses Recorded	Pulse Constant (p/ kWh)	LED Test Output (kWh)	Energy Registered By Meter (kWh)	Percentage difference between Energy Registered and LED Test Output (%)
69023	10000	6.9023	6.906	0.05

Limit of % Error Variation: ± 2% for Class 2

During the registration tests, rate registers not active were found not to have been corrupted.

2.2 Starting and No-Load condition IEC 62053-22 X-Ref. 8.3

Initial Start-up of the meter X-Ref. 8.3.1

Test Results ID / Sample No.	Test Procedure: Start-up
Start Up / 2271222	

The meter sample was fully functional within 5s after rated voltage Un was applied to the meter terminals.

2.3 Running with No-Load X-Ref. 8.3.2

Test Results ID / Sample No.	Test Procedure: Non Registration Test 115(%U)
No Load / 2271222,	19EMA TP36

Tests were conducted as follows;

Test conditions: *115% Un, current circuits open*

The minimum test duration in minutes being given by

$$\Delta t \geq \frac{900 \times 10^6}{k \cdot m \cdot Un \cdot Imax} \quad \text{[min] for meters of class 0.2s}$$

$$\Delta t \geq \frac{600 \times 10^6}{k \cdot m \cdot Un \cdot Imax} \quad \text{[min] for meters of class 0.5s}$$

where

k is the meter output constant (pulses per kWh)
m is the number of measuring elements

The meter sample was tested for a period of at least Δt minutes, on completion of which, no changes in the energy registers were recorded, and the test output did not produce more than one pulse.

Test Results ID / Sample No.	Test Procedure: Non Registration Test 115(%U)
No Load / 2271222	19EMA TP36

Test conditions: *115% Un, current circuits open*

The minimum test duration in minutes being given by

$$\Delta t \geq \frac{480 \times 10^6}{k \cdot m \cdot Un \cdot Imax} \quad \text{[min] for meters of class 2}$$

$$\Delta t \geq \frac{300 \times 10^6}{k \cdot m \cdot Un \cdot Imax} \quad \text{[min] for meters of class 3}$$

where

k is the meter output constant (pulses per kvarh)
m is the number of measuring elements

The meter sample was tested for a period of at least Δt minutes, on completion of which, no changes in the energy registers were recorded, and the test output did not produce more than one pulse.

Starting and No-Load condition IEC 62053-23 X-Ref. 8.3

Initial Start-up of the meter X-Ref. 8.3.1

Test Results ID / Sample No.	Test Procedure: Start-up
Start Up / 2271226	

The meter sample was fully functional within 5s after rated voltage Un was applied to the meter terminals.

Starting X-Ref. 8.3.3

Test Results ID / Sample No.	Test Procedure: Starting Current 0.1(% Ib)
Starting Current / 2271222	19EMA TP36

The meter commenced and continued to measure the active power in both the import and export directions.

Test conditions for Transformer Operated meters
Class 0.2s Active meters : Umin, 0.1%In, Cos. ϕ = 1.0, 50Hz

Test Results ID / Sample No.	Test Procedure: Starting Current 0.3(% Ib)
Starting Current / 2271226	19EMA TP36

The meter commenced and continued to measure the applied reactive power in both the import and export directions.

Test conditions for Transformer Operated meters
Class 2 Reactive meters : Umin, 0.3%In, Sin ϕ = 1.0, 50Hz

2.4 Influence of Ambient Temperature

IEC 62053-22 X-Ref. 8
X-Ref. 8.2

Test Results ID / Sample No.	Test Procedure: EN62053-22 Temperature Variation
Temperature Var. / 2271226	19EMA TP31

Test conditions: *Un: 3x230/400V* *Ux: 230V* *Fn: 50Hz*
In: 5A *Im: 10A*

Test Circuit: *3 phase 4 wire*

Measurement mode - Active Import Energy kWh

Temperature /°C	Current	PF Cos. ϕ	*% Error*	*Mean Temperature coefficient %/K*
33	0.05In	1.0	*0.00*	*-0.0025*
13	0.05In	1.0	*0.05*	
33	0.1In	0.5ind	*0.04*	*0.005*
13	0.1In	0.5ind	*-0.06*	
33	In	1.0	*-0.01*	*-0.0025*
13	In	1.0	*0.04*	
33	In	0.5ind	*0.04*	*0.0045*
13	In	0.5ind	*-0.05*	
33	Im	1.0	*-0.01*	*-0.002*
13	Im	1.0	*0.05*	
33	Im	0.5ind	*0.04*	*0.003*
13	Im	0.5ind	*-0.02*	

Limit of Mean Temperature coefficient for: Class 0.2s ±0.01%/K @ Cos. ϕ = 1.0
±0.02%/K @ Cos. ϕ = 0.5ind

Influence of Ambient Temperature (cont.)

Operation of meter at the limit of the specified operating temperature range (Indoor meters) IEC 62053-22 X-Ref. 6.1

Test conditions: *Un: 3x230/400V* *Ux: 230V* *Fn: 50Hz*
In: 5A *Im: 10A*

Temperature /°C	Current	PF Cos. ϕ	*% Error*
-10°C	0.1In	1.0	*0.10*
45°C	0.1In	1.0	*-0.02*
-10°C	0.2In	0.5ind	*-0.15*
45°C	0.2In	0.5ind	*0.11*
-10°C	In	1.0	*0.09*
45°C	In	1.0	*-0.03*
-10°C	In	0.5ind	*-0.13*
45°C	In	0.5ind	*0.10*
-10°C	Im	1.0	*0.10*
45°C	Im	1.0	*-0.04*
-10°C	Im	0.5ind	*-0.11*
45°C	Im	0.5ind	*0.09*

Limits of % Error: Class accuracy.

Operation of meter at the Limit of temperature range (Indoor meters) X-Ref. 6.1

Test conditions: *Un: 3x230/400V* *Ux: 230V* *Fn: 50Hz*
In: 5A *Im: 10A*

Temperature /°C	Current	*% Error*
70°C	In	*-0.11*
-25°C	In	*0.08*

On completion of the above test, the meter was found to function correctly and within the accuracy specification when subsequently operated under reference operating conditions.

2.5 Influence Quantities

IEC 62053-22 X-Ref. 8

2.5.1 Variation in Current

X-Ref. 8.1

Test Results ID / Sample No.	Test Procedure: EN62053-22 Acc3P4W kWh +P
Current Variation / 2271222	19EMA TP25

Test conditions: *Un: 3x230/400V* *In: 5A* *Im: 10A* *Fn: 50Hz*
Ux: 230V

Test Circuit: *3 phase 4 wire*

Measurement mode - Active Import Energy kWh

			Limit of % Error	
CURRENT	PF Cos. ϕ	*% Error*	Accuracy	
			Class 0.2s	Class 0.5s
0.01 In	1.0	*0.03*	±0.4	±1.0
0.02 In	-	*0.01*	±0.4	±1.0
0.05 In	-	*0.02*	±0.2	±0.5
0.1 In	-	*0.02*	±0.2	±0.5
0.2 In	-	*0.02*	±0.2	±0.5
0.5 In	-	*0.00*	±0.2	±0.5
In	-	*0.00*	±0.2	±0.5
0.4 Im	-	*0.02*	±0.2	±0.5
0.6 Im	-	*0.01*	±0.2	±0.5
0.8 Im	-	*0.01*	±0.2	±0.5
Im	-	*0.01*	±0.2	±0.5
0.02 In	0.5ind	*0.06*	±0.5	±1.0
0.05 In	-	*0.04*	±0.5	±1.0
0.1 In	-	*0.05*	±0.3	±0.6
0.2 In	-	*0.03*	±0.3	±0.6
0.5 In	-	*0.00*	±0.3	±0.6
In	-	*0.03*	±0.3	±0.6
Im	-	*0.04*	±0.3	±0.6
0.1 In	0.25ind	*0.11*	±0.5	±1.0
0.2 In	-	*0.06*	±0.5	±1.0
0.5 In	-	*0.00*	±0.5	±1.0
In	-	*0.06*	±0.5	±1.0
0.1 In	0.8cap	*0.00*	±0.3	±0.6
0.2 In	-	*0.01*	±0.3	±0.6
0.5 In	-	*0.00*	±0.3	±0.6
In	-	*-0.01*	±0.3	±0.6
0.1 In	0.5cap	*-0.02*	±0.5	±1.0
0.2 In	-	*-0.01*	±0.5	±1.0
0.5 In	-	*-0.01*	±0.5	±1.0
In	-	*-0.02*	±0.5	±1.0

Polyphase meter carrying a single-phase load, with balanced voltage applied to the voltage's circuits. X-Ref. 8.1

Test conditions: *Un: 3x230/400V* *Ux: 230V* *Fn: 50Hz*
In: 5A *Im: 10A*

Test Circuit: *3 phase 4 wire*

Measurement mode - Active Import Energy kWh

Elements/Lines		I1 Element L1	I2 Element L2	I3 Element L3	Limit of % Error	
CURRENT	PF Cos. ϕ	*% Error*	*% Error*	*% Error*	Accuracy	
					Class 0.2s	Class 0.5s
0.05 In	1.0	*0.00*	*0.01*	*0.02*	±0.3	±0.6
0.1 In	-	*0.02*	*0.02*	*0.02*	±0.3	±0.6
0.2 In	-	*0.00*	*0.00*	*0.02*	±0.3	±0.6
0.5 In	-	*0.00*	*0.00*	*0.00*	±0.3	±0.6
In	-	*0.01*	*0.02*	*0.01*	±0.3	±0.6
Im	-	*0.02*	*0.01*	*0.01*	±0.3	±0.6
0.1 In	0.5ind	*0.05*	*0.05*	*0.06*	±0.4	±1.0
0.2 In	-	*0.01*	*0.02*	*0.05*	±0.4	±1.0
0.5 In	-	*0.01*	*0.02*	*-0.03*	±0.4	±1.0
In	-	*0.01*	*0.04*	*0.01*	±0.4	±1.0
Im	-	*0.02*	*0.04*	*0.02*	±0.4	±1.0
0.2 In	0.5cap	*-0.01*	*-0.03*	*-0.01*	-	-
In	-	*0.00*	*-0.03*	*-0.02*	-	-
Im	-	*0.00*	*-0.02*	*-0.03*	-	-

Variation in Current(cont.) X-Ref. 8.1

Test Results ID / Sample No.	Test Procedure: Acc 3P4W kWh -P
Current Variation / 22271226	19EMA TP25

Test conditions: *Un: 3x230/400V* *Ux: 230V* *Fn: 50Hz*
In: 5A *Im: 10A*

Test Circuit: *3 phase 4 wire*

Measurement mode - Active Export Energy kWh

			Limit of % Error	
CURRENT	PF Cos. ϕ	*% Error*	Accuracy	
			Class 0.2s	Class 0.5s
0.01 In	1.0	*0.04*	±0.4	±1.0
0.02 In	-	*0.04*	±0.4	±1.0
0.05 In	-	*0.04*	±0.2	±0.5
0.1 In	-	*0.02*	±0.2	±0.5
0.2 In	-	*0.02*	±0.2	±0.5
0.5 In	-	*0.03*	±0.2	±0.5
In	-	*0.03*	±0.2	±0.5
Im	-	*0.04*	±0.2	±0.5
0.02 In	0.5ind	*0.43*	±0.5	±1.0
0.05 In	-	*0.11*	±0.5	±1.0
0.1 In	-	*0.05*	±0.3	±0.6
0.2 In	-	*0.04*	±0.3	±0.6
0.5 In	-	*0.03*	±0.3	±0.6
In	-	*0.03*	±0.3	±0.6
Im	-	*0.04*	±0.3	±0.6
0.1 In	0.8cap	*0.01*	±0.3	±0.6
0.2 In	-	*0.02*	±0.3	±0.6
0.5 In	-	*0.04*	±0.3	±0.6
In	-	*0.03*	±0.3	±0.6
0.1 In	0.5cap	*0.00*	±0.5	±1.0
0.2 In	-	*0.01*	±0.5	±1.0
0.5 In	-	*0.04*	±0.5	±1.0
In	-	*0.04*	±0.5	±1.0

Polyphase meter carrying a single-phase load, with balanced voltage applied to the voltage's circuits. X-Ref. 8.1

Test conditions: *Un: 3x230/400V* *Ux: 230V* *Fn: 50Hz*
In: 5A *Im: 10A*

Test Circuit: *3 phase 4 wire*

Measurement mode - Active Export Energy kWh

Elements/Lines		I1 Element L1	I2 Element L2	I3 Element L3	Limit of % Error	
CURRENT	PF Cos. ϕ	*% Error*	*% Error*	*% Error*	Accuracy	
					Class 0.2s	Class 0.5s
0.1 In	1.0	*0.00*	*0.03*	*0.03*	±0.3	±0.6
In	-	*0.03*	*0.03*	*0.04*	±0.3	±0.6
Im	-	*0.03*	*0.03*	*0.03*	±0.3	±0.6
0.2 In	0.5ind	*0.02*	*0.04*	*0.06*	±0.4	±1.0
In	-	*0.02*	*0.03*	*0.04*	±0.4	±1.0
Im	-	*-0.01*	*0.05*	*0.04*	±0.4	±1.0
0.2 In	0.5cap	*0.03*	*0.02*	*0.02*	-	-
In	-	*0.03*	*0.04*	*0.03*	-	-
Im	-	*0.03*	*0.02*	*0.03*	-	-

Variation in Current (cont.) IEC 62053-22X-Ref. 8
X-Ref. 8.1

Test Results ID / Sample No.	Test Procedure: EN62053-23 Acc 3P4W kvarh +Q
Current Variation / 2271226	19EMA TP25

Test conditions: *Un: 3x230/400V* *Ux: 230V* *Fn: 50Hz*
In: 5A *Im: 10A*

Test Circuit: *3 phase 4 wire*

Measurement mode - Reactive Import Energy kvarh

			Limit of % Error	
CURRENT	PF Sin ϕ	*% Error*	Accuracy	
			Class 2	Class 3
0.05 In	1.0	*0.02*	±2.5	±4.0
0.1 In	-	*0.02*	±2.0	±3.0
0.2 In	-	*0.02*	±2.0	±3.0
0.5 In	-	*0.01*	±2.0	±3.0
In	-	*0.01*	±2.0	±3.0
0.4 Im	-	*0.01*	±2.0	±3.0
0.6 Im	-	*0.11*	±2.0	±3.0
0.8 Im	-	*0.01*	±2.0	±3.0
Im	-	*-0.09*	±2.0	±3.0
0.1 In	0.5ind	*-0.03*	±2.5	±4.0
0.2 In	-	*-0.02*	±2.0	±3.0
0.5 In	-	*-0.01*	±2.0	±3.0
In	-	*-0.01*	±2.0	±3.0
Im	-	*-0.02*	±2.0	±3.0
0.2 In	0.25ind	*-0.08*	±2.5	±4.0
0.5 In	-	*0.04*	±2.5	±4.0
In	-	*-0.15*	±2.5	±4.0
0.2 In	0.5cap	*0.03*	±2.0	±3.0
0.5 In	-	*0.01*	±2.0	±3.0
In	-	*0.04*	±2.0	±3.0
Im	-	*0.05*	±2.0	±3.0
0.2 In	0.25cap	*0.06*	±2.5	±4.0
0.5 In	-	*0.05*	±2.5	±4.0
In	-	*0.00*	±2.5	±4.0

Polyphase meter carrying a single-phase load, with balanced voltage applied to the voltage's circuits. X-Ref. 8.1

Test conditions: *Un: 3x230/400V* *Ux: 230V* *Fn: 50Hz*
In: 5A *Im: 10A*

Test Circuit: *3 phase 4 wire*

Measurement mode - Reactive Import Energy kvarh

Elements/Lines		I1 Element L1	I2 Element L2	I3 Element L3	Limit of % Error	
CURRENT	PF Sin ϕ	*% Error*	*% Error*	*% Error*	Accuracy	
					Class 2	Class 3
0.1 In	1.0	*0.01*	*0.02*	*0.02*	±3.0	±4.0
In	-	*0.01*	*0.02*	*0.01*	±3.0	±4.0
Im	-	*0.01*	*0.02*	*0.01*	±3.0	±4.0
0.2 In	0.5ind	*-0.02*	*-0.02*	*0.00*	±3.0	±4.0
In	-	*0.00*	*-0.01*	*-0.01*	±3.0	±4.0
Im	-	*-0.02*	*0.00*	*-0.01*	±3.0	±4.0
0.2 In	0.5cap	*0.03*	*0.03*	*0.06*	±3.0	±4.0
In	-	*0.02*	*0.04*	*0.02*	±3.0	±4.0
Im	-	*0.01*	*0.04*	*0.03*	±3.0	±4.0

Variation in Current(cont.) X-Ref. 8.1

Test Results ID / Sample No.	Test Procedure: EN62053-23 Acc 3P4W kvarh -Q
Current Variation / 2271226	19EMA TP25

Test conditions: *Un: 3x230/400V* *Ux: 230V* *Fn: 50Hz*
In: 5A *Im: 10A*

Test Circuit: *3 phase 4 wire*

Measurement mode - Reactive Export Energy kvarh

			Limit of % Error	
CURRENT	PF Sin ϕ	*% Error*	Accuracy	
			Class 2	Class 3
0.05 In	1.0	*0.01*	±2.5	±4.0
0.1 In	-	*0.02*	±2.0	±3.0
0.2 In	-	*0.01*	±2.0	±3.0
0.5 In	-	*0.00*	±2.0	±3.0
In	-	*0.01*	±2.0	±3.0
Im	-	*0.01*	±2.0	±3.0
0.1 In	0.5ind	*-0.02*	±2.5	±4.0
In	-	*0.00*	±2.0	±3.0
Im	-	*-0.02*	±2.0	±3.0
0.1 In	0.5cap	*0.06*	±2.0	±4.0
In	-	*0.04*	±2.0	±3.0
Im	-	*0.05*	±2.0	±3.0

Polyphase meter carrying a single-phase load, with balanced voltage applied to the voltage's circuits. X-Ref. 8.1

Test conditions: *Un: 3x230/400V* *Ux: 230V* *Fn: 50Hz*
In: 5A *Im: 10A*

Test Circuit: *3 phase 4 wire*

Measurement mode - Reactive Export Energy kvarh

Elements/Lines		I1 Element L1	I2 Element L2	I3 Element L3	Limit of % Error	
CURRENT	PF Sin ϕ	*% Error*	*% Error*	*% Error*	Accuracy	
					Class 2	Class 3
In	1.0	*0.01*	*0.01*	*0.00*	±3.0	±4.0
In	0.5ind	*-0.01*	*-0.01*	*-0.01*	±3.0	±4.0
In	0.5cap	*0.00*	*0.06*	*0.03*	±3.0	±4.0

2.5.2 Voltage Variation

IEC 62053-22 X-Ref. 8.2

Specified Operating Range

Test Results ID / Sample No.	Test Procedure: EN62053-22 Voltage Variation P
Voltage Variation / 2271222	19EMA TP26

Test conditions: *Un: 3x230/400V* *Ux: 230V* *Fn: 50Hz*
In: 5A *Im: 10A*

Test Circuit: *3 phase 4 wire*

Measurement mode - Active Energy kWh

		110% Un	100% Un	90% Un	Limit of % Error Variation	
Current	PF Cos. ϕ	*% Error*	*% Error*	*% Error*	Accuracy	
					Class 0.2s	Class 0.5s
0.05 In	1.0	*-0.01*	*-0.02*	*-0.01*	±0.1	±0.2
In	-	*-0.03*	*-0.02*	*-0.02*	±0.1	±0.2
Im	-	*-0.02*	*-0.02*	*-0.02*	±0.1	±0.2
0.1 In	0.5ind	*0.06*	*0.07*	*0.06*	±0.2	±0.4
In	-	*0.05*	*0.07*	*0.04*	±0.2	±0.4
Im	-	*0.04*	*0.05*	*0.06*	±0.2	±0.4

Limit Range of Operation

		115% Un	80% Un	Limit of % Error Variation	
Current	PF Cos. ϕ	*% Error*	*% Error*	Accuracy	
				Class 0.2s	Class 0.5s
In	1.0	*-0.02*	*-0.02*	±0.3	±0.6
In	0.5ind	*0.03*	*0.03*	±0.6	±1.2

Voltage Variation (cont.) IEC 62053-23 X-Ref. 8.2

Specified Operating Range

Test Results ID / Sample No.	Test Procedure: EN62053-23 Voltage Variation Q
Voltage Variation / 2271226	19EMA TP26

Test conditions: *Un: 3x230/400V* *Ux: 230V* *Fn: 50Hz*
In: 5A *Im: 10A*

Test Circuit: *3 phase 4 wire*

Measurement mode - Reactive Energy kvarh

		110% Un	100% Un	90% Un	Limit of % Error Variation	
Current	PF Sin ϕ	*% Error*	*% Error*	*% Error*	Accuracy	
					Class 2	Class 3
0.05 In	1.0	*0.02*	*0.02*	*0.02*	±1.0	±2.0
In	-	*0.01*	*0.01*	*0.01*	±1.0	±2.0
Im	-	*0.01*	*0.02*	*0.02*	±1.0	±2.0
0.1 In	0.5ind	*-0.02*	*-0.02*	*-0.02*	±1.5	±3.0
In	-	*-0.01*	*0.00*	*0.00*	±1.5	±3.0
Im	-	*0.00*	*-0.01*	*0.00*	±1.5	±3.0

Limit Range of Operation

		115% Un	80% Un	Limit of % Error Variation	
Current	PF Sin ϕ	*% Error*	*% Error*	Accuracy	
				Class 2	Class 3
In	1.0	*0.01*	*0.01*	±3.0	±6.0
In	0.5ind	*0.00*	*0.00*	±4.5	±9.0

2.5.3 Frequency Variation

IEC62053-22 X-Ref. 8.2

Test Results ID / Sample No.	Test Procedure: EN62053-22 Frequency 51Hz to 49Hz P
Frequency Variation / 2271222	19EMA TP27

Test conditions: *Un: 3x230/400V* *Ux: 230V* *Fn: 50Hz*
In: 5A *Im: 10A*

Test Circuit: *3 phase 4 wire*

Measurement mode - Active Import Energy kWh

		102% Fn	100% Fn	98% Fn	Limit of % Error Variation	
Current	PF Cos. ϕ	*% Error*	*% Error*	*% Error*	Accuracy	
					Class 0.2s	Class 0.5s
0.05 In	1.0	*-0.02*	*-0.01*	*-0.02*	±0.1	±0.2
In	1.0	*-0.02*	*-0.02*	*-0.03*	±0.1	±0.2
Im	1.0	*-0.01*	*-0.02*	*-0.02*	±0.1	±0.2
0.10 In	0.5ind	*0.00*	*0.06*	*0.12*	±0.1	±0.2
In	0.5ind	*-0.02*	*0.04*	*0.08*	±0.1	±0.2
Im	0.5ind	*0.00*	*0.05*	*0.09*	±0.1	±0.2

Frequency Variation (cont) IEC62053-22 X-Ref. 8.2

Test Results ID / Sample No.	Test Procedure: EN62053-23 Frequency 51Hz to 49Hz Q
Frequency Variation / 2271226	19EMA TP27

Test conditions: *Un: 3x230/400V* *Ux: 230V* *Fn: 50Hz*
In: 5A *Im: 10A*

Test Circuit: *3 phase 4 wire*

Measurement mode - Reactive Import Energy kvarh

		102% Fn	100% Fn	98% Fn	Limit of % Error Variation	
Current	PF Sins ϕ	*% Error*	*% Error*	*% Error*	Accuracy	
					Class 2	Class 3
0.05 In	1.0	*0.01*	*0.01*	*0.01*	±2.5	±2.5
In	1.0	*0.06*	*0.01*	*0.01*	±2.5	±2.5
Im	1.0	*0.02*	*0.01*	*0.01*	±2.5	±2.5
0.10 In	0.5ind	*-0.02*	*-0.02*	*-0.14*	±2.5	±2.5
In	0.5ind	*0.00*	*-0.01*	*-0.12*	±2.5	±2.5
Im	0.5ind	*-0.02*	*-0.01*	*-0.10*	±2.5	±2.5

2.5.4 Reversed Phase Sequence

IEC 62053-22 X-Ref. 8.2

Test Results ID / Sample No.	Test Procedure: EN62053-22 Reverse Phase Sequence
Reverse Phase / 2271222	19EMA TP28

Test conditions: *Un: 3x230/400V* *Ux: 230V* *Fn: 50Hz*
In: 5A *Im: 10A*

Test Circuit: *3 phase 4 wire*

Measurement mode - Active Import Energy kWh

		Limit of % Error Variation	
Phase Sequence Current	*% Error*	Accuracy	
		Class 0.2s	Class 0.5s
Sequence **L1-L2-L3** 0.1 In	*-0.02*	-	-
Sequence **L1-L3-L2** 0.1 In	*-0.02*	±0.05	±0.1

2.5.5 Voltage Unbalance

IEC 62053-22 X-Ref. 8.2

Test Results ID / Sample No.	Test Procedure: EN62053-22 Phase Interruption
Voltage Unbalance / 2271222	19EMA TP29

Test conditions: *Un: 3x230/400V* *Ux: 230V* *Fn: 50Hz*
In: 5A *Im: 10A*

Test Circuit: *3 phase 4 wire*

Measurement mode - Active Import Energy kWh

		Limit of % Error Variation	
Network Phase/Lines connected	*% Error*	Accuracy	
		Class 0.2s	Class 0.5s
L1 & L2 & L3	*-0.02*	-	-
L2 & L3	*-0.03*	±0.5	±1.0
L1 & L3	*-0.31*	±0.5	±1.0
L1 & L2	*-0.43*	±0.5	±1.0
L3	*-0.03*	±0.5	±1.0
L2	*-0.03*	±0.5	±1.0
L1	*0.15*	±0.5	±1.0

2.5.6 Continuous Magnetic Induction of External Origin IEC 62053-22 X-Ref. 8.2

Test Results ID / Sample No.	Test Procedure: EN62053-22 DC Magnetic Field P
DC Mag. Field / 2271226	19EMA TP33

Test conditions: *Un: 3x230/400V* *Ux: 230V* *Fn: 50Hz*
In: 5A *Im: 10A*

Test Circuit: *3 phase 4 wire*

Measurement mode - Active Import Energy kWh

		Limit of % Error Variation	
Electromagnetic Position	*% Error*	Accuracy	
		Class 0.2s	Class 0.5s
No field applied	*0.00*	-	-
Left side of meter	*0.00*	±2.0	±2.0
Front of meter	*0.00*	±2.0	±2.0
Right side of meter	*0.00*	±2.0	±2.0
Top of meter	*0.00*	±2.0	±2.0

2.5.7 Magnetic Induction of External Origin 0.5mT IEC 62053-22 X-Ref. 8.2

Ac magnetic induction of external origin, produced by a coil of one metre diameter, field strength at its centre 0.5mT (400 Ampere turns)

Test Results ID / Sample No.	Test Procedure: T/T +P X-X FAIRY RING T/T +P Y-Y FAIRY RING T/T +P Z-Z FAIRY RING
AC Mag. Fields / 2271222	19EMA TP34

Test conditions: *Un: 3x230/400V* *Fn: 50Hz*
In: 5A *PF: Cos. ϕ = 1.0*

Test Circuit: *3 phase 4 wire*

Measurement mode - Active Import Energy kWh

Phase angle of the field with respect to U3 (Vph)	Direction of field orientation		
	X - X	Y - Y	Z - Z
	% Error	*% Error*	% Error
No Field Applied	*0.02*	*-0.02*	*-0.01*
0°	*0.01*	*-0.02*	*-0.02*
30°	*0.00*	*-0.02*	*-0.03*
60°	*0.01*	*-0.01*	*-0.02*
90°	*0.01*	*-0.01*	*-0.01*
120°	*0.02*	*-0.01*	*-0.01*
150°	*0.02*	*-0.01*	*0.00*
180°	*0.01*	*-0.02*	*0.00*
210°	*0.02*	*-0.02*	*-0.01*
240°	*0.01*	*-0.02*	*-0.01*
270°	*0.01*	*-0.02*	*-0.01*
300°	*0.00*	*-0.02*	*-0.01*
330°	*0.00*	*-0.02*	*-0.01*
360°	*0.00*	*-0.02*	*-0.01*

Limit of % Error Variation for Class 0.2s ± 0.5%
Class 0.5s ± 1.0%

2.5.8 Auxiliary Power Supply Voltage Variation IEC 62053-22 X-Ref. 8.2

Test Results ID / Sample No.	Test Procedure: EN62053-22 Aux Voltage Variation (PLE)
Aux Voltage Var / 2271226	

Test conditions: *Un: 3x230/400V* *Ux: 100V* *Fn: 50Hz*
0.01In: 0.05A *PF: Cos. ϕ = 1.0*

Measurement mode - Active Energy kWh

Auxiliary Power Supply Voltage Level	*% Error*	Limit of % Error Variation Accuracy	
		Class 0.2s	Class 0.5s
100%	*-0.01*	-	-
115%	*0.02*	±0.05	±0.1
85%	*0.00*	±0.05	±0.1

Test conditions: *Un: 3x230/400V* *Ux: 230V* *Fn: 50Hz*
0.01In: 0.05A *PF: Cos. ϕ = 1.0*

Measurement mode - Active Energy kWh

Auxiliary Power Supply Voltage Level	*% Error*	Limit of % Error Variation Accuracy	
		Class 0.2s	Class 0.5s
100%	*0.02*	-	-
115%	*-0.02*	±0.05	±0.1
85%	*0.00*	±0.05	±0.1

Test conditions: *Un: 3x230/400V* *Ux: 480V* *Fn: 50Hz*
0.01In: 0.05A *PF: Cos. ϕ = 1.0*

Measurement mode - Active Energy kWh

Auxiliary Power Supply Voltage Level	*% Error*	Limit of % Error Variation Accuracy	
		Class 0.2s	Class 0.5s
100%	*0.03*	-	-
115%	*0.02*	±0.05	±0.1
85%	*0.00*	±0.05	±0.1

2.6 Accuracy test in the Presence of Harmonics IEC 62053-23 X-Ref. 8.2

2.6.1 Harmonic Components in the Current and Voltage Circuits X-Ref. 8.2

Test Results ID / Sample No.	Test Procedure: EN62053-22 Harmonics Tests
Harmonics / 2271222	19EMA TP32

Test conditions: *Un: 3x230/400V* *Ux: 230V* *Fn: 50Hz*
In: 5A *Im: 10A* *PF: Cos. ϕ = 1.0*

Fundamental frequency current: I_0 = 0.5 Imax
Fundamental frequency voltage: U_0 = Un
content of 5th harmonic current: I_5 = 40% of I_0
content of 5th harmonic voltage: U_5 = 10% of Un

Resulting harmonic power due to the 5th harmonic presence: $P_{resultant}$ = 1.04 P_0

Test Circuit: *3 phase 4 wire*

Measurement mode - Active Energy kWh

		Limit of % Error Variation	
Waveform	*% Error*	Accuracy	
		Class 0.2s	Class 0.5s
Fundamental Only (P_0) 0.5 Imax	*-0.03*	-	-
Fundamental + 5th Harmonic ($P_{resultant}$ = 1.04 P_0)	*-0.04*	±0.4	±0.5

2.6.3 Influence of Odd and Sub Harmonics in the AC Current Circuit X-Ref. 8.2

Test Results ID / Sample No.	Test Procedure: EN62053-22 Harmonics Tests
Harmonics / 2271222	19EMA TP32

Test conditions: *Un: 3x230/400V* *Ux : 230V* *Fn: 50Hz:*
In:5A *PF: Cos. ϕ = 1.0*

Reference current waveform: I_{ref} = 0.5 In
Reference voltage: U = Un
Test current Phase-fired waveform: $I_{test} = \sqrt{2} \cdot I_{ref}$
Firing points = 5ms and 15ms ± 1ms
Test current Burst fired waveform: $I_{test} = 2 \cdot I_{ref}$
Distortion factor on the voltage waveform: < 0.5 % THD

Test Circuit: *3 phase 4 wire*

Measurement mode - Active Energy kWh

		Limit of % Error Variation	
Waveform	*% Error*	Accuracy	
		Class 0.2s	Class 0.5s
Fundamental Only 0.5 In	*-0.02*	-	-
Waveform Phase-fired Test current	*0.04*	±0.6	±1.5
Waveform Burst fired Test current	*0.03*	±0.6	±1.5

3 ELECTRICAL REQUIREMENTS IEC 62053-22 X-Ref. 7

3.1 Power Consumption X-Ref. 7.1

Test Results ID / Sample No.	Test Procedure: EN62053-22 Power Consumption
Power Consumption / 2271226	19EMA TP22

	Volts/V	Amps/A	VA	Watts/W
Auxiliary Power Supply Wiring Configuration: Single Phase Two Wire Voltage Circuit: **L1**	*480V*	*0.231A*	*11.28*	*3.84*

Power consumption limits for auxiliary power supply circuits shall not exceed the following based on IEC 62053-61: 1998-02

Voltage Circuits	Single Phase	Two Element	Three Element
Basic Meter	2W 10VA	2W 10VA	2W 10VA
multi-energy meter	3W 15VA	2.5W 12.5VA	2W 10VA
Multi-function meter	5W 25VA	3.5W 17.5VA	3W 15VA

3.2 Influence of Supply Voltage — IEC 62052-11 X-Ref. 7

Voltage dips and interruptions — X-Ref. 7.1.2

Test Results ID / Sample No.	Test Procedure: EN62052-11 Voltage Dips
Voltage Dips / 2271222	19EMA TP10

Environmental Conditions

Power Supply	230V, 50Hz
Temperature	21°C
Relative Humidity	38%
Barometric Pressure	1004mB

Test Circuit: *1 phase 2 wire, in the case of Polyphase meters tests were conducted on each voltage circuit in turn.*

The tests were applied under the following conditions;

- voltage and auxiliary circuits energised with reference voltage
- current circuits open.

Test a)	Voltage interruption of:	V = 100%
	Interruption time:	1s
	Number of interruptions:	3
	Restoring time between interruption:	50ms
Test b)	Voltage interruption of:	V = 100%
	Interruption time:	20ms
	Number of interruptions:	1
Test c)	Voltage depression of:	V=50%
	Depression time:	60s
	Number of depressions:	1

The application of the above test did not produce a change in the meter registers of more than ***x*** kWh/kvarh, and the test output did not produce a signal equivalent of more than ***x*** kWh/kvarh, where ***x*** is given by

$$\boldsymbol{x} = 10^{-6} \cdot m \cdot Un \cdot Imax$$

3.3 Test of Influence of Short-Time Over-Currents IEC 62053-22 X-Ref. 7.2

Test Results ID / Sample No.	Test Procedure: EN62053-22 Short-Time Over-Current
STOC / 2271226	19EMA TP23

Environmental Conditions

Temperature	21°C
Relative Humidity	45%
Barometric Pressure	1010mB

Test Conditions: *Im: 10A* *Fn: 50Hz*

Test Circuit: *3 phase 4 wire*

The test was applied under the following conditions;

Meter for connection through current transformer:

An impulse currents were applied = 20 x Imax
At rated frequency for 0.5 second duration
Applied to each current phase

On completion of the test, the meters voltage circuits were energised at reference voltage for 1 hour.

Power Factor	Current	*% Error*
Cos. ϕ = 1.0	In	*0.04*

Limit of % Error: Class 0.2s ± 0.05% for connection through a current transformer
Class 0.5s ± 0.05% for connection through a current transformer

The meter showed no signs of damage and functioned correctly.

3.4 Test of Influence of Self Heating

IEC 227122262053-22 X-Ref. 7
X-Ref. 7.3

Test conditions:- The meter voltage circuits were energised at reference voltage for at least 2 hours, without any current in the current circuits, after which the meter's maximum rated current was applied and the meter error determined every 5 minutes. The test was conducted at power factors of both Cos. ϕ = 1.0 and Cos. ϕ = 0.5 ind.

Test Results ID / Sample No.	Test Procedure: EN62053-22 Self Heating
Self Heating / 2271222	19EMA TP24

Test conditions: *Un: 3x230/400V* *Ux: 230V*
Im: 10A *Fn: 50Hz*

Test Circuit: *3 phase 4 wire*

Measurement Mode Active Energy kWh

Elapsed Test time (minutes)	Un Im Cos.ϕ = 1.0	Un Im Cos.ϕ = 0.5
	% Error	*% Error*
1	*-0.01*	*0.02*
5	*-0.02*	*0.06*
10	*-0.03*	*0.09*
15	*-0.04*	*0.10*
20	*-0.04*	*0.11*
25	*-0.04*	*0.11*
30	*-0.05*	*0.11*
35	*-0.03*	*0.11*
40	*-0.04*	*0.10*
45	*-0.05*	*0.12*
50	*-0.05*	*0.11*
55	*-0.03*	*0.12*
60	*-0.04*	*0.10*

Limit of % Error Variation: Class 0.2s ±0.1% @ Cos. ϕ = 1.0 & Cos. ϕ = 0.5ind
Class 0.5s ±0.2% @ Cos. ϕ = 1.0 & Cos. ϕ = 0.5ind

3.5 Test of Influence of Heating IEC 62052-11 X-Ref. 7.2

Test Results ID / Sample No.	Test Procedure: EN62052-11 Heating
Heating / JB1310419000037	19EMA TP11

The tests were conducted with the meter cover and terminal cover in place

Test conditions: *115%Un: 3x448.5V* *Im: 10A* *Fn: 50Hz*

Ambient Temperature : 40°C
Test Duration : 2 hours
Surface Temperature Rise: Current Circuit: 6.1K
Voltage Circuit: 4.9K

Permissible temperature rise: 25K

Surface temperature of the meter was measured on the meter back, approximately 10mm above the meter current circuit and voltage circuit terminal block.

On completion of the above test, the meter was found to function correctly and within the accuracy specification when subsequently operated under reference operating conditions, with no signs of damage or degradation in the meter's insulation properties.

4 ELECTROMAGNETIC COMPATIBILITY (E.M.C.) IEC 62052-11 X-Ref. 7.5

4.1 Immunity to Electrostatic Discharges (ESD) X-Ref. 7.5.2

Test Results ID / Sample No.	Test Procedure: EN62052-11 Electrostatic Discharge
ESD / 2271222	19EMA TP14

The meter was tested in accordance with IEC 61000-4-2 as follows:

Environmental Conditions

Power Supply	230V, 50Hz
Temperature	20°C
Relative Humidity	39%
Barometric Pressure	989mB

E.S.D Generator specification:
Test level severities: 8kV contact, conductive surfaces / coupling planes
15kV air gap discharge - non conducting surfaces
Positive / Negative polarity
Number of discharges: 10 at each polarity
Rise time of discharge current: <1ns
Pulse duration (50%) 30ns
Time between discharges: 1s

Meter in operating condition with the voltage and auxiliary circuits energised. Current circuits open.

The application of the electrostatic discharge did not produce a change in the meter registers of more than ***x*** kWh, and the test output did not produce a signal equivalent of more than ***x*** kWh, where ***x*** is given by

$$\boldsymbol{x} = 10^{-6} \cdot m \cdot Un \cdot Imax$$

where

x is the critical change value in kWh
m is the number of measuring elements
Un is the reference voltage
Imax is the maximum current

4.2 Immunity to Electromagnetic HF Fields X-Ref. 7.5.3

Test Results ID / Sample No.	Test Procedure: EN62052-11 Radiated Immunity
RI / 2271222	19EMA TP15

The meter was tested in accordance with IEC 61000-4-3 in the SGS Anechoic chamber as follows:

Environmental Conditions

Power Supply	230V, 5A, 50Hz
Temperature	19°C
Relative Humidity	41%
Barometric Pressure	998mB

Port: Enclosure
Test Level: 10 V/m (80-2000MHz) & 1V/m (2000-2700MHz) (test 1) & 30 V/m (test 2)
Frequency Range: 80-2000 MHz & 2000-2700MHz*
Dwell Time: 6 Seconds for Test 1, 2 Seconds for Test 2
Frequency Step Size: 1%
Modulation: 80%, 1 kHz Amplitude Modulation.

*2000-2700MHz:At the request of the client, the radiated immunity test was performed across an additional frequency range of 2000-2700MHz

Operating Mode:

Mode 1) Voltage and auxiliary circuits energised with reference voltage, without any current in the current circuits
Mode 2) Voltage and auxiliary circuits energised with reference voltage and with basic current Ib applied

Test Results (Radiated Immunity 80-2700MHz)

EUT Face	Polarity	*Test 1 Maximum % Error Observed*	*Test 2*	Critical Change % Error Limit	
				Accuracy	
				Class 0.5	Class 0.2
Front	Horizontal	*0.18*	*Note 1*	±2.0	±1.0
Front	Vertical	*0.18*	*Note 1*	±2.0	±1.0
Rear	Horizontal	*0.18*	*Note 1*	±2.0	±1.0
Rear	Vertical	*0.18*	*Note 1*	±2.0	±1.0
LHS	Horizontal	*0.18*	*Note 1*	±2.0	±1.0
LHS	Vertical	*0.18*	*Note 1*	±2.0	±1.0
RHS	Horizontal	*0.18*	*Note 1*	±2.0	±1.0
RHS	Vertical	*0.18*	*Note 1*	±2.0	±1.0

Note 1: The application of the RF electromagnetic field did not produce a change in the meter registers of more than ***x*** kWh, and the test output did not produce a signal equivalent of more than ***x*** kWh, where ***x*** is given by

$$\boldsymbol{x} = 10^{-6} \cdot m \cdot Un \cdot Imax$$

where

x is the critical change value in kWh
m is the number of measuring elements
Un is the reference voltage
Imax is the maximum current

4.3 Fast Transient Burst Test X-Ref. 7.5.4

Test Results ID / Sample No.	Test Procedure: EN62052-11 Fast Transient Bursts
FTB / 2271235	19EMA TP16

The meter was tested in accordance with IEC 61000-4-4 as follows:

Environmental Conditions

Power Supply	230V, 5A, 50Hz
Temperature	19°C
Relative Humidity	40%
Barometric Pressure	996 mB

Transient/Burst specification: Pulse level severity 2kV & 4kV
Rise time 5ns
Width 50ns
Repetition Rate 5 kHz & 2.5 kHz
Burst Duration 15ms
Burst Period 300ms
Burst Generation Asynchronous (Common mode)

Operating mode: The meter voltage circuits were energised at reference voltage Un, with Ib/In Cos. $\phi = 1.0$ in the current circuits.

Test voltage severity level ±4kV, Repetition Rate 5kHz voltage and current circuits
Test voltage severity level ±2kV, Repetition Rate 5kHz auxiliary circuits > 40V

The test voltage was applied on the current and voltage circuits in common mode, for a test duration of 60 seconds at each polarity.

Fast Transient Burst Test (cont) X-Ref. 7.5.4

Test conditions: *Un: 3x230/400V* *Fn: 50Hz*
In: 5A *PF: Cos. ϕ = 1.0*

Test Circuit: *3 phase 4 wire*

Measurement mode - Active Import Energy kWh

		Critical Change % Error Limit	
Test Voltage (kV)	*% Error*	Accuracy	
		Class 0.5	Class 0.2
No FTB applied	*-0.026*	-	-
+4 Voltage Circuit	*-0.065*	±2.0	±1.0
-4 Voltage Circuit	*-0.057*	±2.0	±1.0
-4 Current Circuit	*-0.034*	±2.0	±1.0
-4 Current Circuit	*-0.08*	±2.0	±1.0
+2 Auxiliary Circuit	*-0.018*	±2.0	±1.0
-2 Auxiliary Circuits	*-0.049*	±2.0	±1.0

On completion of the above test, the meter was found to function correctly and within the accuracy specification when subsequently operated under reference operating conditions, with no signs of damage or corruption to meter register data.

4.4 Immunity to Conducted Disturbances X-Ref. 7.5.5

Test Results ID / Sample No.	Test Procedure: EN62052-11 Conducted Immunity
CI / 2271222	19EMA TP17

The meter was tested in accordance with IEC 61000-4-6 as follows:

Environmental Conditions

Power Supply	230V, 5A, 50Hz
Temperature	23°C
Relative Humidity	43%
Barometric Pressure	1016mB

Ports: Current, Voltage and Auxiliary Circuits
Test Level: 10 V
Frequency Range: 0.15 to 80 MHz
Dwell Time: Function of Meter Pulses (≥ 2 Secs)
Frequency Step Size: 1%
Modulation: 80%, 1kHz Amplitude Modulation.

The compliance test was performed as follows:

Operating Mode

Voltage and auxiliary circuits energised with reference voltage and with basic current Ib applied

Test Results

MUT Port	Frequency Range (MHz)	*% Error*	Critical Change % Error Limit	
			Accuracy	
			Class 0.5	Class 0.2
Voltage & Current Circuits	0.15 to 80	*0.12*	±2.0	±1.0
Auxiliary Circuits	0.15 to 80	*0.24*	±2.0	±1.0

4.5 Surge Immunity

X-Ref 7.5.6

Test Results ID / Sample No.	Test Procedure: EN62052-11 Surge
Surge / 2271222	19EMA TP18

The meter was tested in accordance with IEC 61000-4-5 as follows:

Ports:	Voltage and Auxiliary Circuits
Test Voltage:	4kV mains, 1kV auxiliary
Test Mode:	Differential
Phase Angle:	60° and 240° relative to zero crossing
Number of Tests:	5 positive and 5 negative
Repetition Rate:	1/min

Environmental Conditions

Power Supply	230V, 50Hz
Temperature	21°C
Relative Humidity	34 %
Barometric Pressure	988mB

The application of the surge immunity test voltage did not produce a change in the meter registers of more than ***x*** kWh and the test output did not produce a signal equivalent of more than ***x*** kWh, where ***x*** is given by

$$x = 10^{-6} \cdot m \cdot Un \cdot Imax$$

4.6 Immunity to Damped Oscillatory Waves X-Ref. 7.5.7

Test Results ID / Sample No.	Test Procedure: EN62052-11 Damped Oscillatory Waves
DOW / 2271235	19EMA TP19

The meter was tested in accordance with IEC 61000-4-12 as follows:

Environmental Conditions

Power Supply	230V, 5A, 50Hz
Temperature	20°C
Relative Humidity	42%
Barometric Pressure	1011mB

Ports:	Voltage and Auxiliary Circuits
Test Level:	Common Mode: 2.5kV Differential Mode: 1kV
Test Frequencies:	100 kHz, repetition rate: 40Hz 1 MHz, repetition rate: 400Hz
Test Duration:	60s (15 cycles with 2s on, 2s off, for each frequency
Operating Mode:	The meter voltage and auxiliary circuits were energised at reference voltage Un, with Ib/In Cos. ϕ = 1.0 in the current circuits.

The test voltage was applied on the voltage circuits in common & differential coupling, for a test duration of 60 seconds at each polarity.

Test a)100kHz Test Frequency Results:

3 Phase Voltage Supply			Limit of % Error Variation	
Test Voltage(kV)	Coupling	*% Error*	Accuracy	
			Class 0.2	Class 0.5
No DOW's applied	-	*-0.055*	-	-
±1	*L1-N*	*0.143*	±1.0	±2.0
±1	*L2-N*	*0.152*	±1.0	±2.0
±1	*L3-N*	*0.143*	±1.0	±2.0
±1	*L1-L2*	*-0.063*	±1.0	±2.0
±1	*L1-L3*	*-0.063*	±1.0	±2.0
±1	*L2-L3*	*-0.063*	±1.0	±2.0
±2.5	*L1,L2,L3,N*	*0.094*	±1.0	±2.0

Auxiliary Power Supply			Limit of % Error Variation	
Test Voltage(kV)	Coupling	*% Error*	Accuracy	
			Class 0.2	Class 0.5
±1	*L1-L2*	*-0.047*	±1.0	±2.0
±2.5	*L1 & L2*	*-0.063*	±1.0	±2.0

Test b) 1MHz Test Frequency Results:

3 Phase Voltage Supply			Limit of % Error Variation	
Test Voltage(kV)	Coupling	*% Error*	Accuracy	
			Class 0.2	Class 0.5
No DOW's applied	-	*-0.055*	-	-
±1	*L1-N*	*0.135*	±1.0	±2.0
±1	*L2-N*	*0.143*	±1.0	±2.0
±1	*L3-N*	*0.135*	±1.0	±2.0
±1	*L1-L2*	*-0.072*	±1.0	±2.0
±1	*L1-L3*	*-0.055*	±1.0	±2.0
±1	*L2-L3*	*-0.063*	±1.0	±2.0
±2.5	*L1,L2,L3,N*	*-0.775*	±1.0	±2.0

Auxiliary Power Supply			Limit of % Error Variation	
Test Voltage(kV)	*Coupling*	*% Error*	Accuracy	
			Class 0.2	Class 0.5
±1	*L1-L2*	*-0.055*	±1.0	±2.0
±2.5	*L1 & L2*	*-0.072*	±1.0	±2.0

5 CLIMATIC INFLUENCES IEC 62052-11 X-Ref. 6

5.1 Dry Heat Test X-Ref. 6.3.1

Test Results ID / Sample No.	Test Procedure: EN62052-11 Dry Heat
Dry Heat / 2271235	19EMA TP07

The meter was tested in accordance with IEC 60068-2-2 as follows:

Meter in the non-operating condition
Temperature +70°C ± 2°C
Duration of the test 72h

On completion of the above test the meter was found to function correctly and within the accuracy specification when subsequently operated under reference operating conditions with no signs of damage or degradation in the meter's insulation properties.

5.2 Cold Test X-Ref. 6.3.2

Test Results ID / Sample No.	Test Procedure: EN62052-11 Cold
Cold / 2271226	19EMA TP08

The meter was tested in accordance with IEC 60068-2-1 as follows:

Meter in the non-operating condition
Temperature -25°C ± 3°C
Duration of the test 72h

On completion of the above test the meter was found to function correctly and within the accuracy specification when subsequently operated under reference operating conditions, with no signs of damage or corruption to meter register data.

5.3 Damp Heat, Cyclic Test X-Ref. 6.3.3

Test Results ID / Sample No.	Test Procedure: EN62052-11 Damp Heat
Damp Heat / 2271226	19EMA TP09

The meter was tested in accordance with IEC 60068-2-30 as follows:

Meter with reference voltage applied
Upper Temperature of +40°C
Duration of the test: 6 cycles

On completion of the above test the meter was found to function correctly and within the accuracy specification when subsequently operated under reference operating conditions with no signs of damage or degradation in the meter's insulation properties.

6 MECHANICAL REQUIREMENTS IEC 62052-11 X-Ref. 5.2.2

6.1 Spring Hammer Test X-Ref. 5.2.2.1

Test Results ID / Sample No.	Test Procedure: EN62052-11 Spring Hammer
Spring Hammer / 2271222	19EMA TP01

Environmental Conditions

Temperature	20°C
Relative Humidity	38%
Barometric Pressure	998mB

The meter was tested in accordance with IEC 60068-2-75 as follows:

Kinetic Energy of Spring Hammer 0.2 Nm ± 0.05 Nm

The meter case and terminal cover where acted upon all external surfaces, including the display window. After the test no damage was evident and the meter continued to function correctly.

MECHANICAL REQUIREMENTS (cont) IEC 62052-11 X-Ref. 5.2.2

6.2 Shock Test X-Ref. 5.2.2.2

Test Results ID / Sample No.	Test Procedure: EN62052-11 Shock
Shock / 2271235	19EMA TP02

Environmental Conditions

Temperature	19°C
Relative Humidity	44%
Barometric Pressure	991mB

The meter was tested in accordance with IEC 60068-2-27 as follows:

Meter in the non-operating condition
Half Sine Pulse
Peak Acceleration of 30 gn (300 m/s^2)
Pulse Duration of 18 ms

On completion of the above tests the meter was found to function correctly and within the accuracy specification when subsequently operated under reference operating conditions.

6.3 Vibration Test X-Ref. 5.2.2.3

Test Results ID / Sample No.	Test Procedure: EN62052-11 Vibration
Vibration / 22712235	19EMA TP03

Environmental Conditions

Temperature	20°C
Relative Humidity	46%
Barometric Pressure	999mB

The meter was tested in accordance with IEC 60068-2-6 as follows:

Meter in the non-operating condition
Test Procedure A
Frequency Range of 10 Hz to 150 Hz (Transition frequency of 60 Hz)
For F < 60 Hz, constant amplitude of movement 0.075 mm
For F > 60 Hz, constant acceleration of 9.8 m/s^2 (1g)
10 sweep cycles per axis

On completion of the above test the meter was found to function correctly and within the accuracy specification when subsequently operated under reference operating conditions.

6.4 Resistance to Heat & Fire

X-Ref. 5.8

Test Results ID / Sample No.	Test Procedure: EN62052-11 Heat & Fire
Heat & Fire / 2271235	19EMA TP04

The meter was tested in accordance with IEC 60695-2-11 as follows:

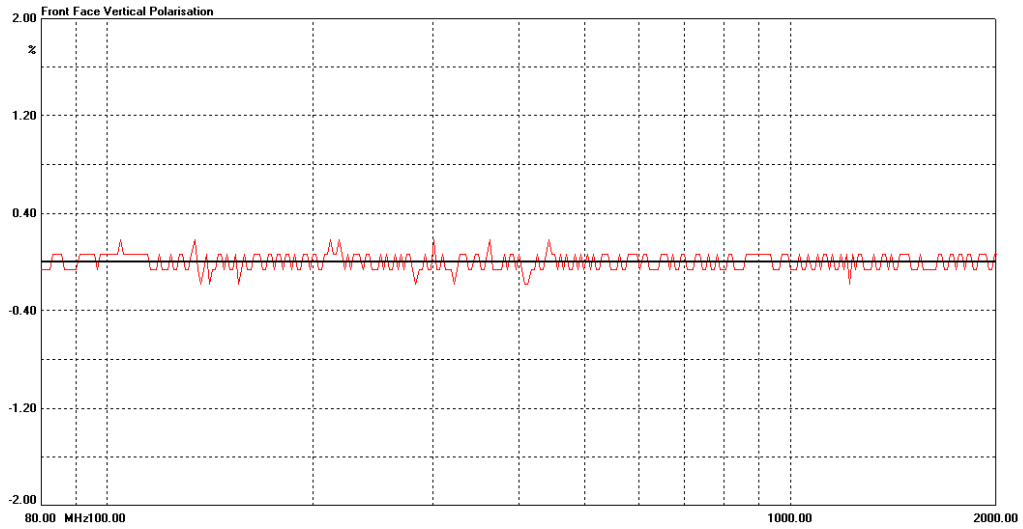
Terminal block tested at 960°C for 30 seconds.

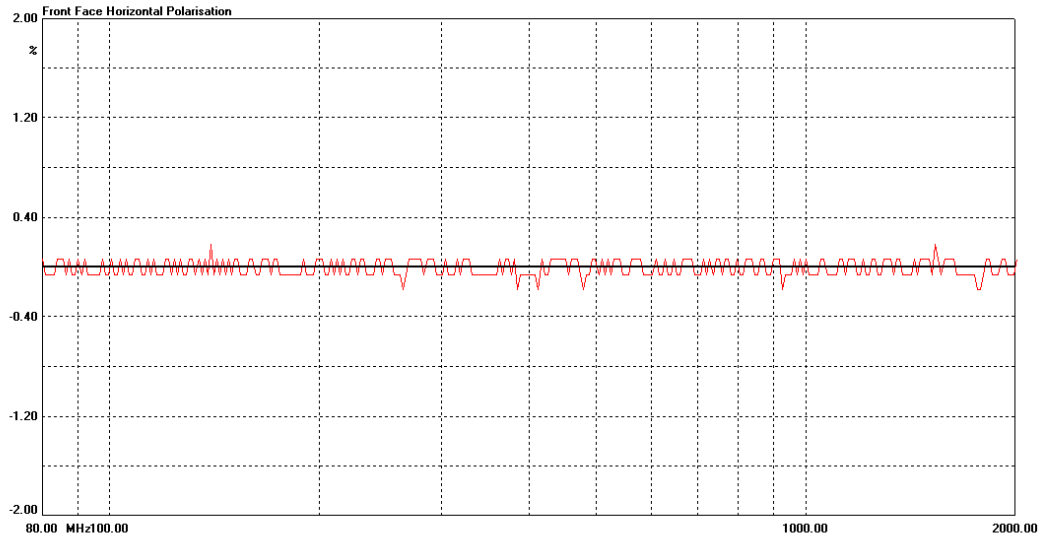
Result: Flames extinguish with 30 seconds when glow wire removed.

Terminal cover and meter case tested at 650°C for 30 seconds.

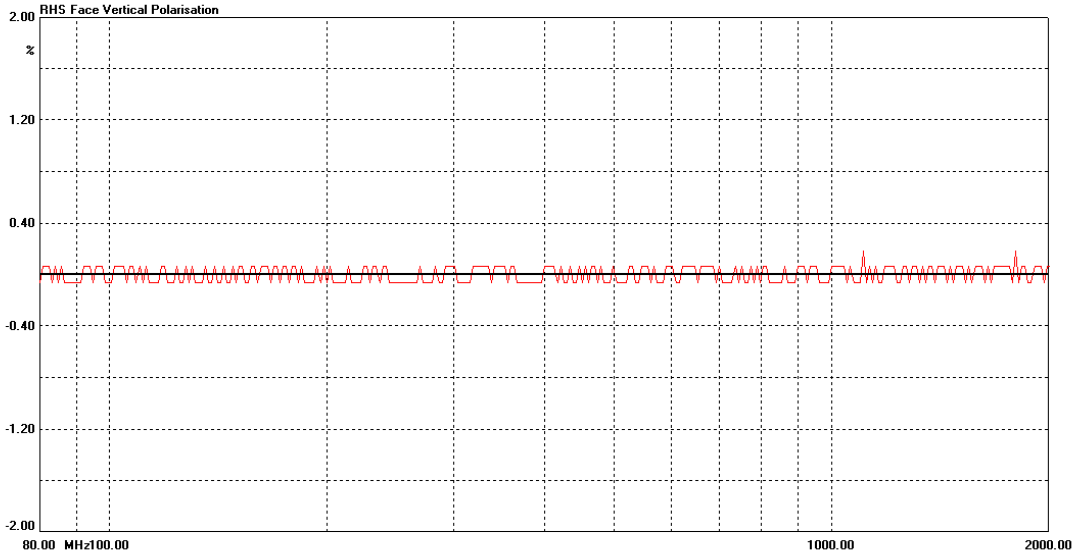
Result: No flames or drips occur.

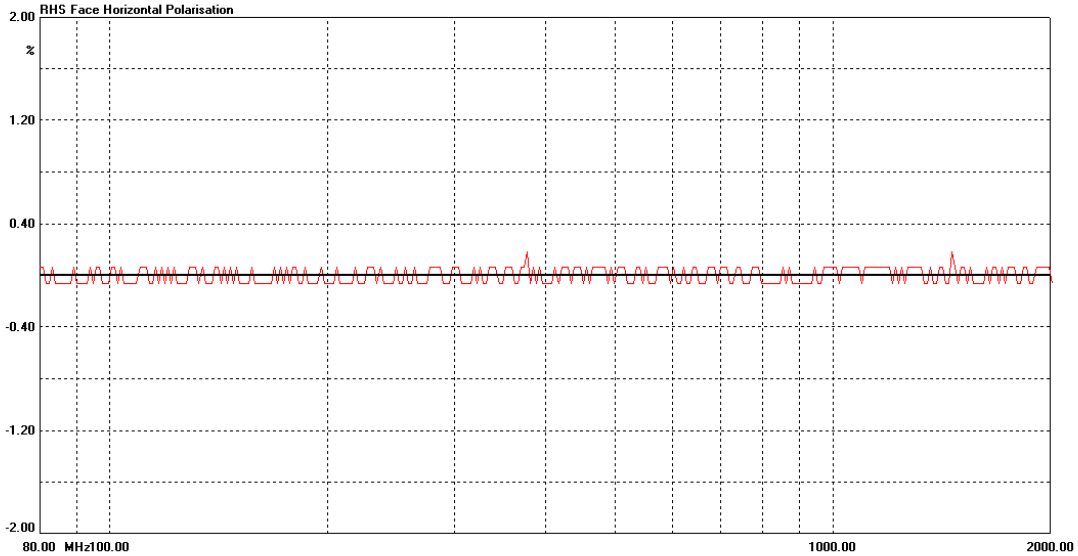
ANNEX A Radiated Immunity Test 80-2000MHz– Graphical plots of results



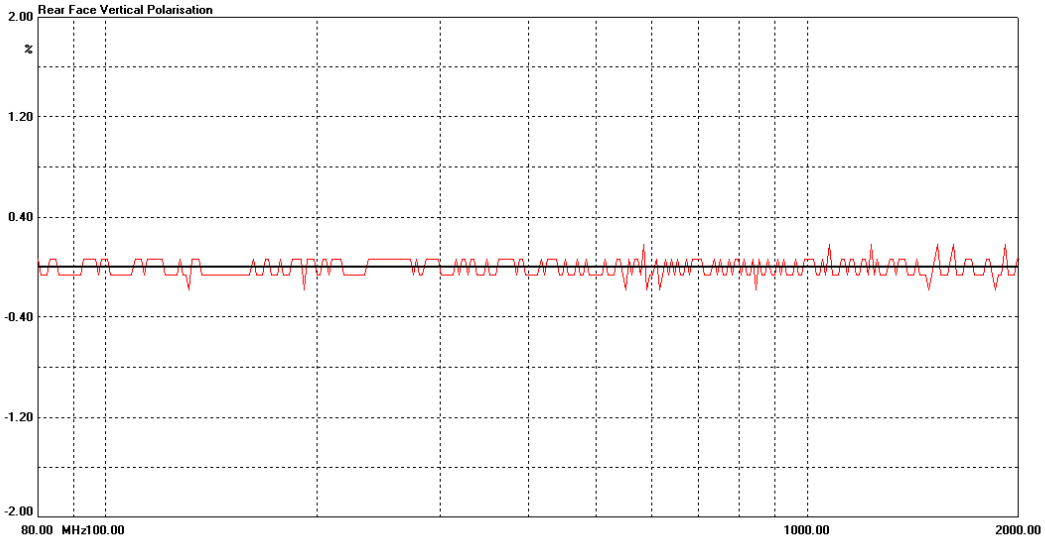


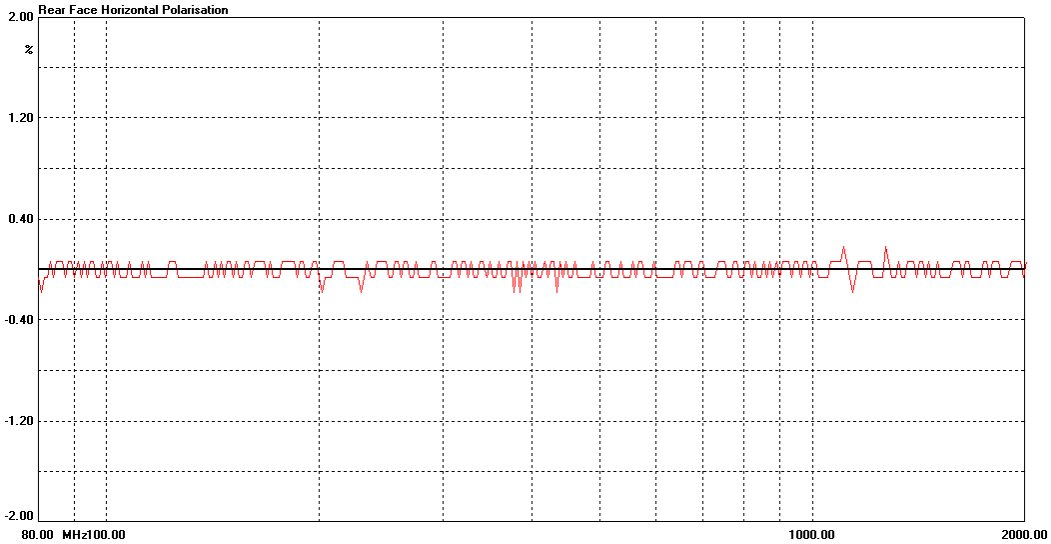
Radiated Immunity Test 80-2000MHz – Graphical plots of results (cont)



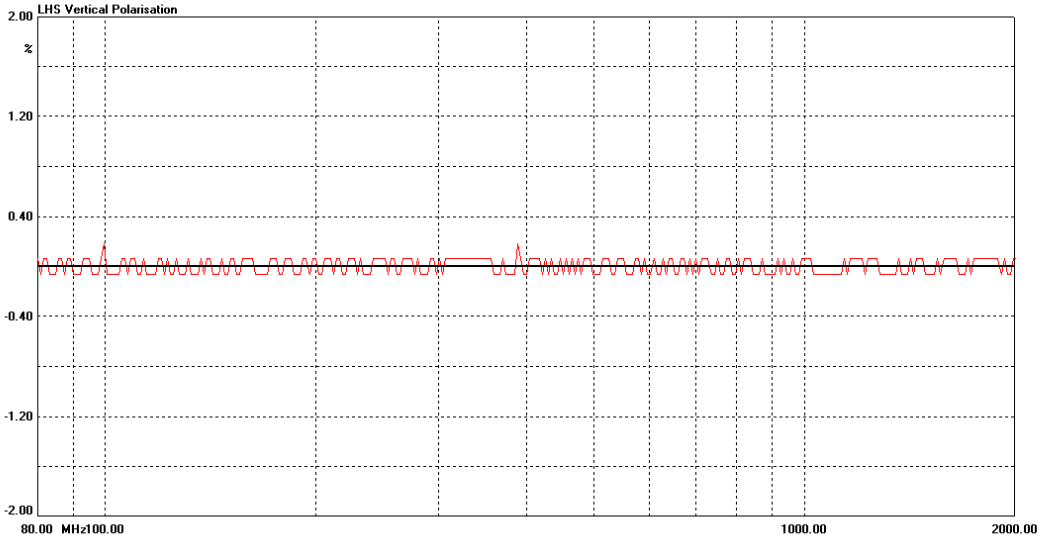


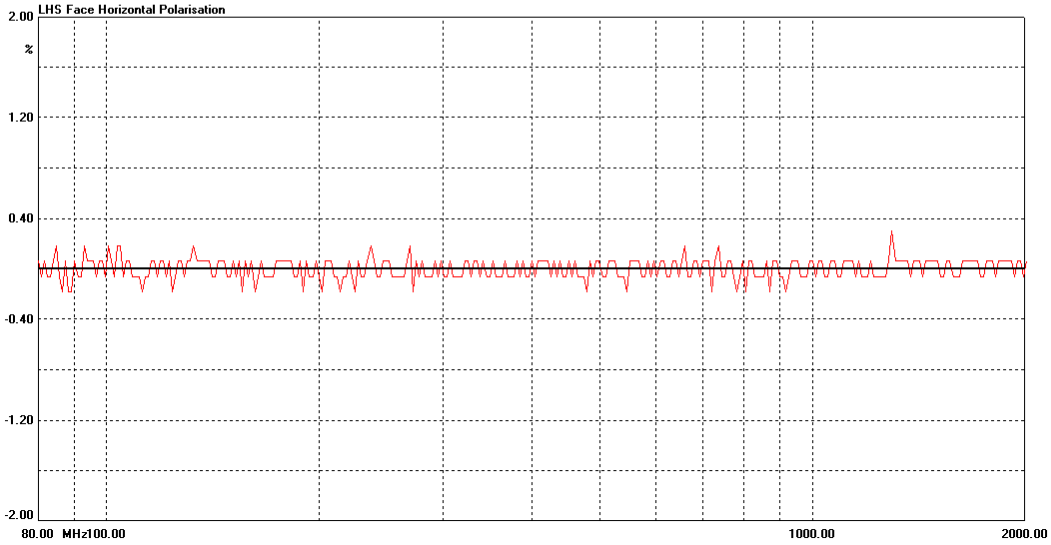
Radiated Immunity Test 80-2000MHz – Graphical plots of results (cont)



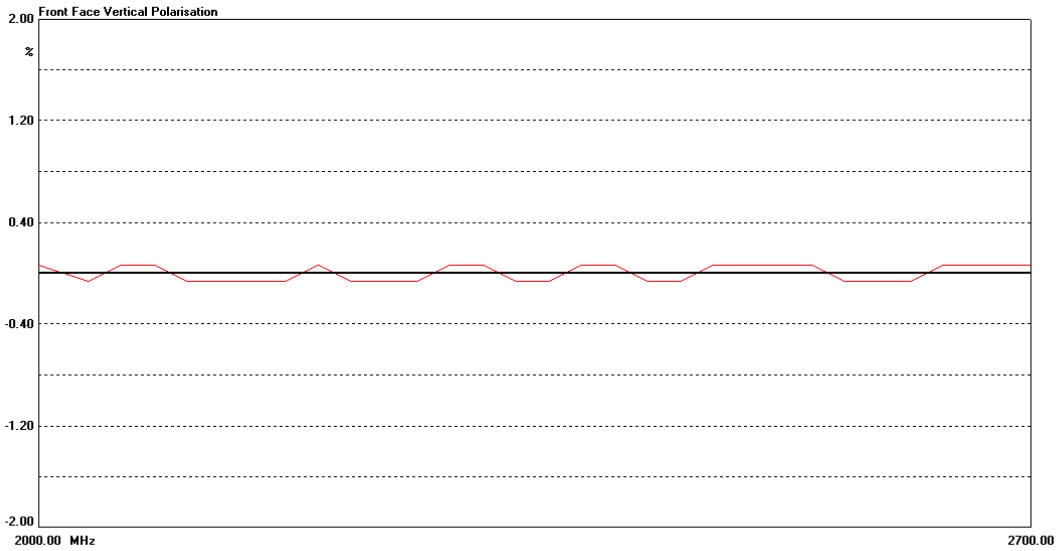


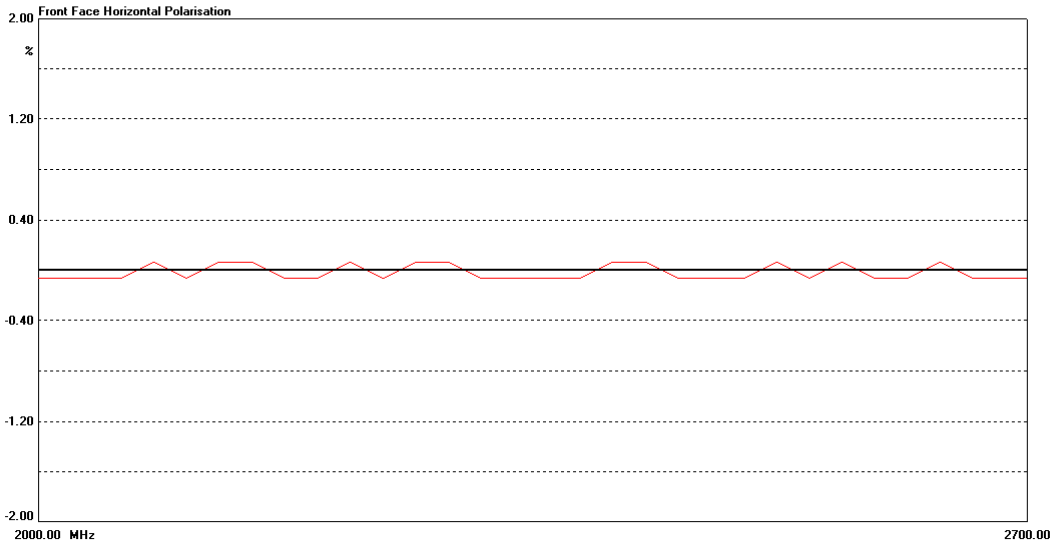
Radiated Immunity Test 80-2000MHz – Graphical plots of results (cont)



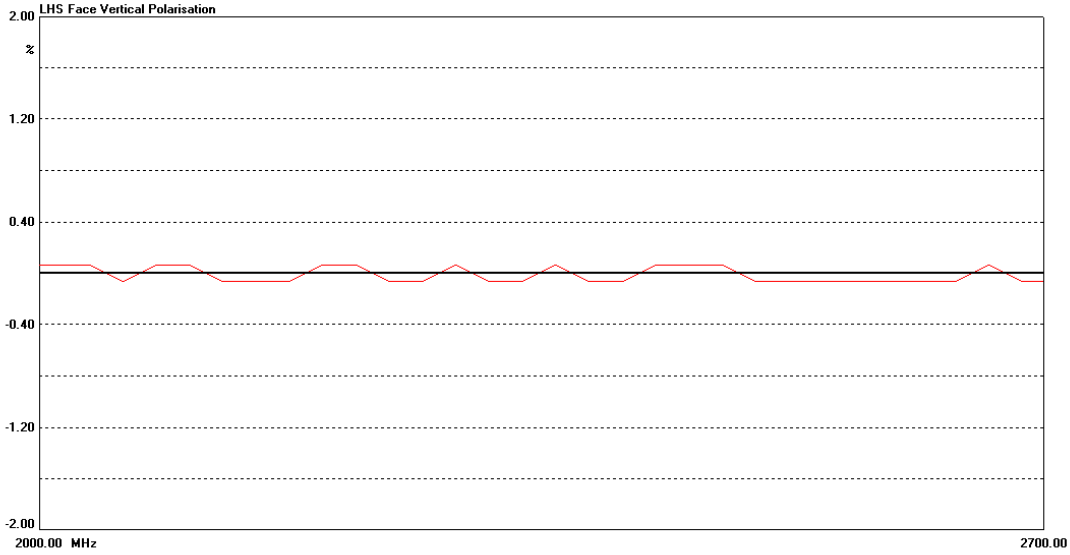


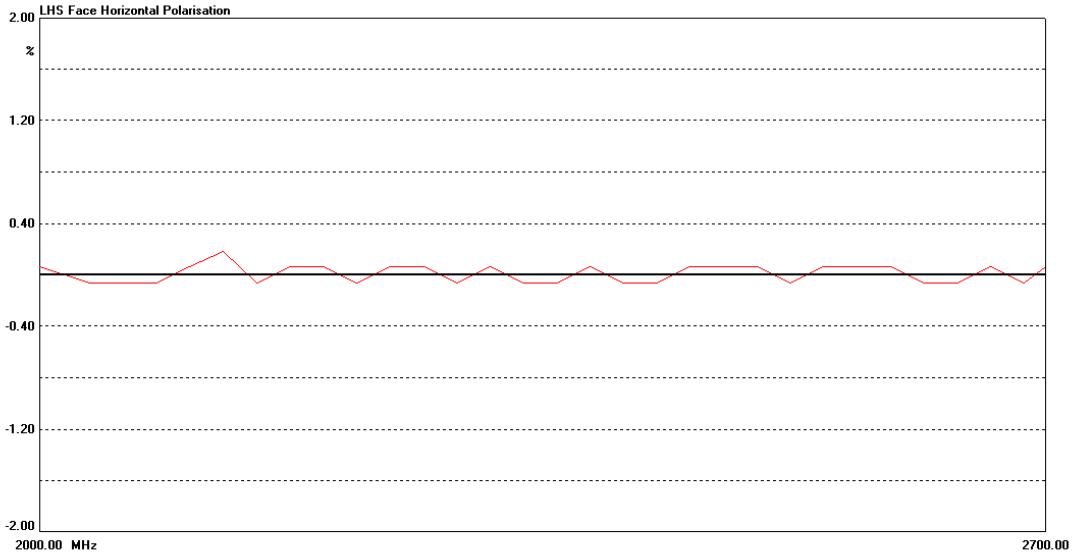
Radiated Immunity Test 2 – 2.7GHz – Graphical plots of results



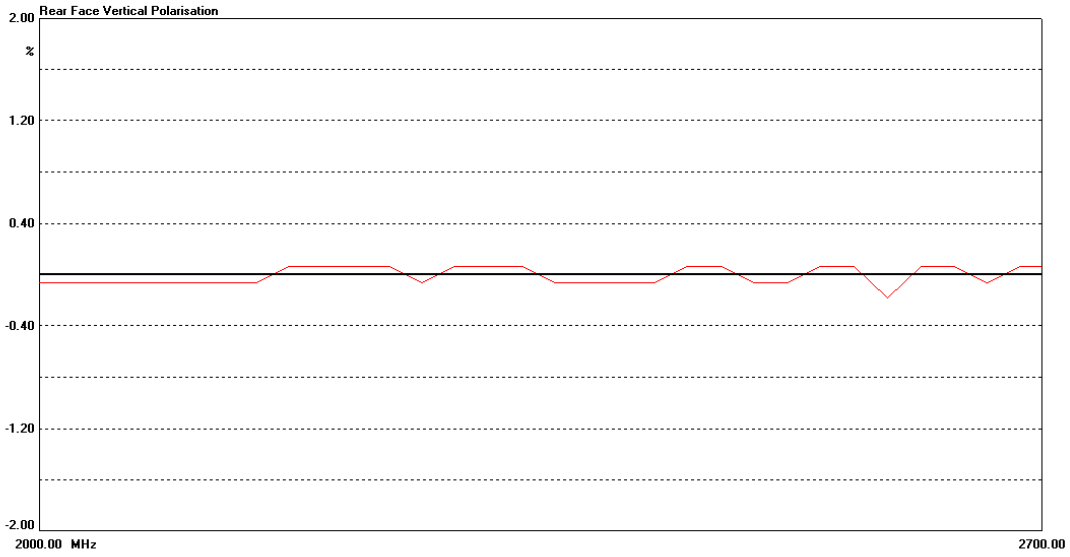


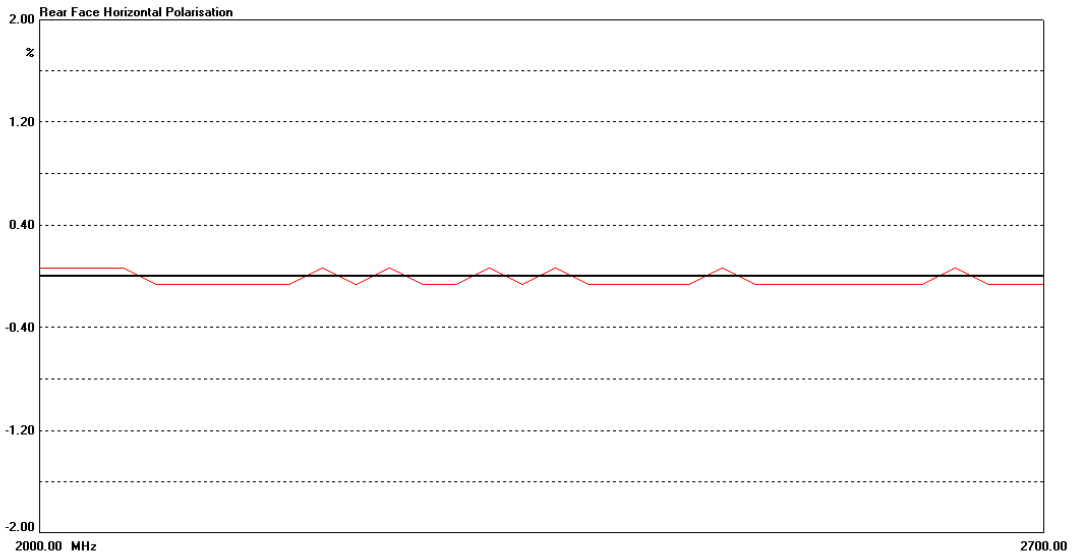
Radiated Immunity Test 2 – 2.7GHz – Graphical plots of results (cont)



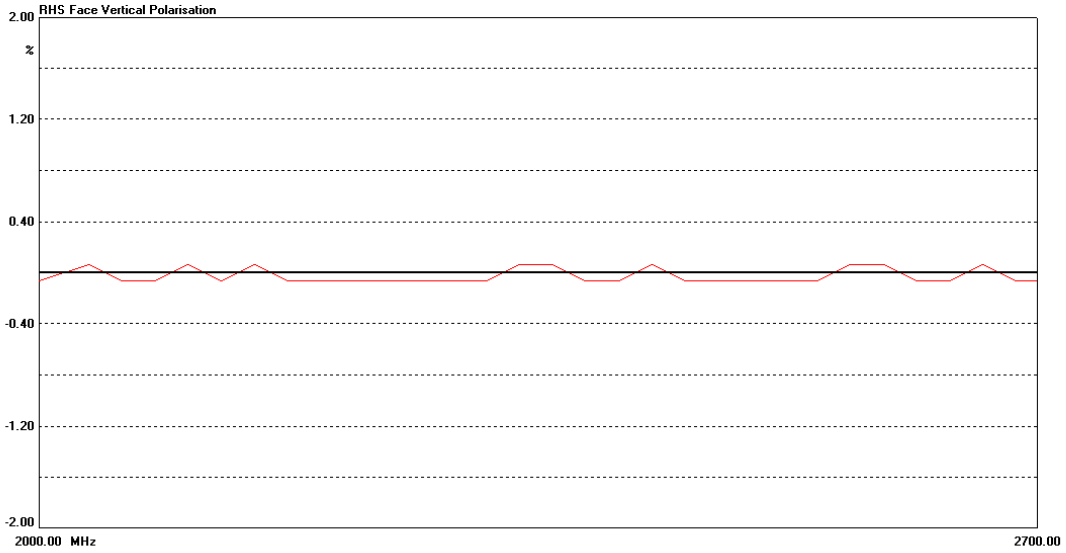


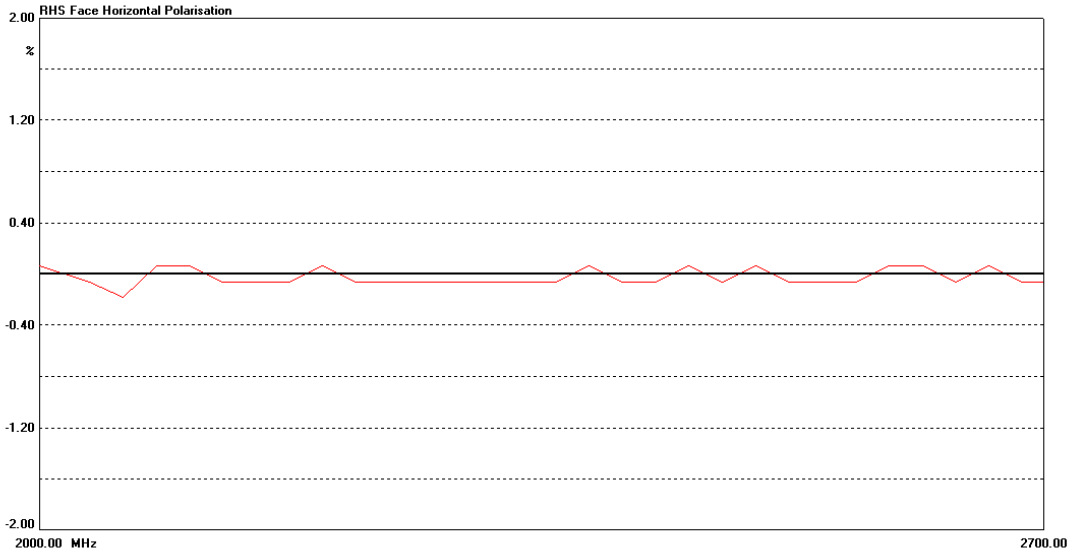
Radiated Immunity Test 2 – 2.7GHz – Graphical plots of results (cont)



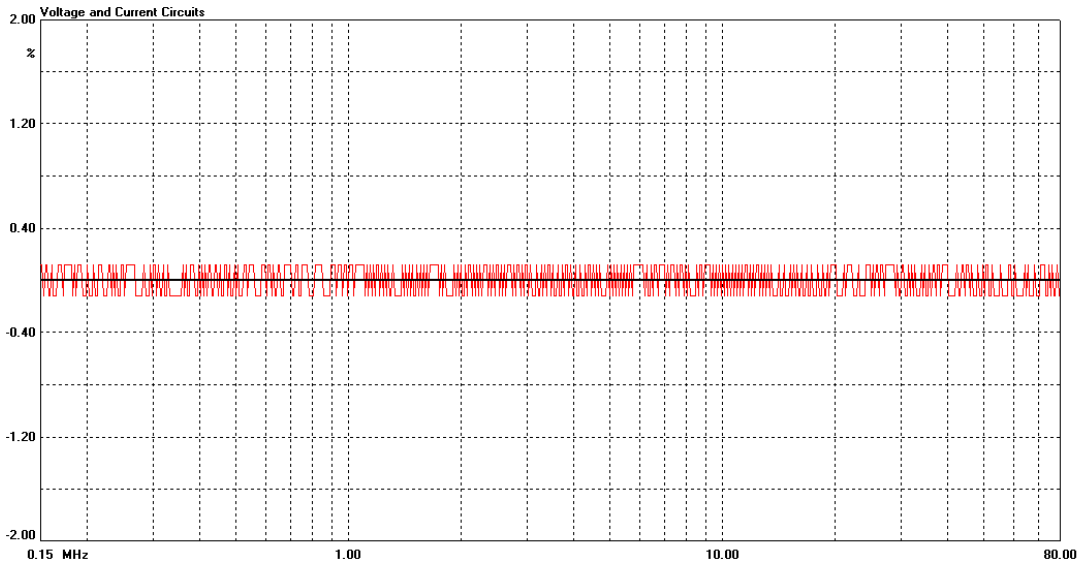


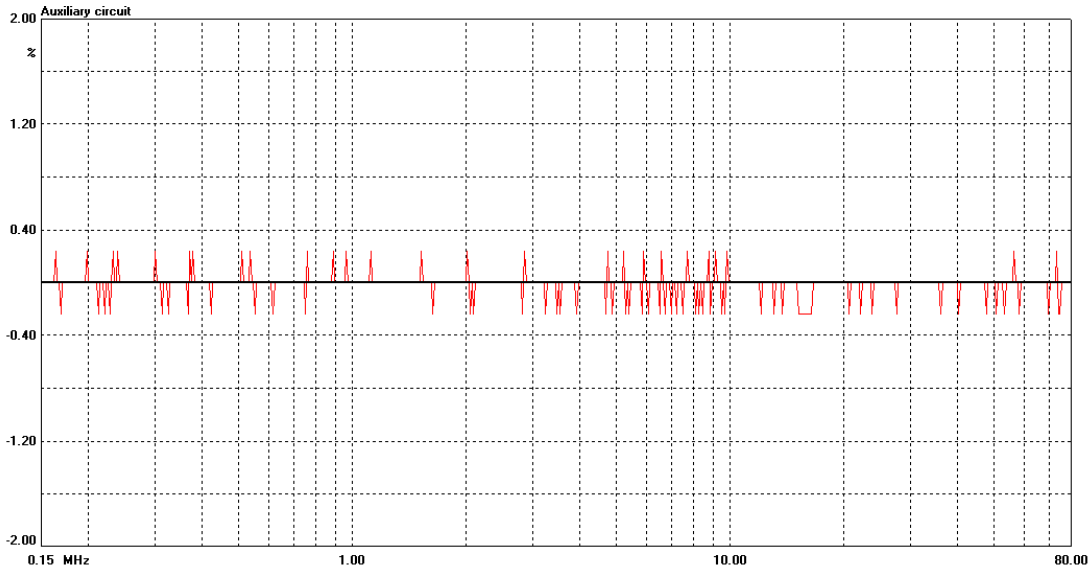
Radiated Immunity Test 2 – 2.7GHz – Graphical plots of results (cont)





ANNEX B Conducted Immunity Test – Graphical plots of results





ANNEX E Photographs of Meter Under Test

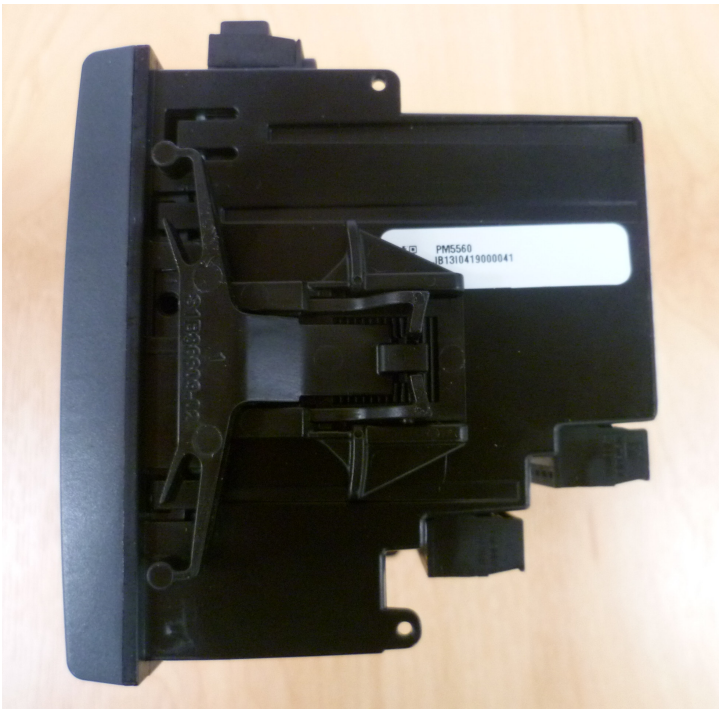
Front View

Rear View

Photographs of Meter Under Test (cont)

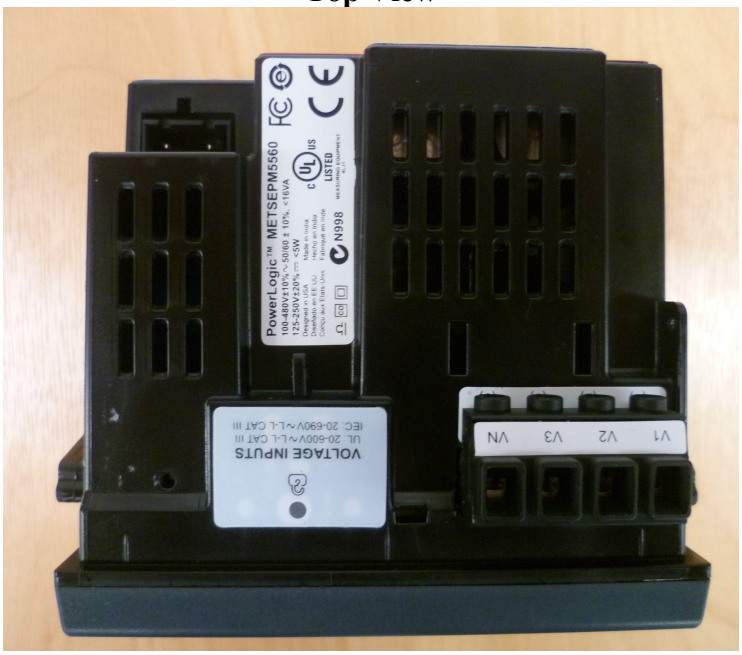
LHS View

RHS View



Photographs of Meter Under Test (cont)

Top View



Bottom View