1116

APPROVAL REPORT FOR THE PATTERN AND CONSTRUCTION OF ELECTRICITY METERS

MANUFACTURER	:	*Elster Metering Systems*
TYPE	:	*AS230*
CLASS	:	*1 or 2 (kWh)*
DESCRIPTION	:	*Single Phase, Active Import/Export, Reactive Import/ Export, Credit, Electricity Meter*

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

and

EN 62053-21: 2003, Electricity metering equipment (AC) – Particular requirements
Part 21: Static meters for active energy (classes 1 & 2).

The meters tested satisfied the required specification.

ISSUED BY: CHECKED BY:

Test Engineer Test Engineer

REPORT ISSUE DATE: 24th October 2008

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Member of SGS Group (Société Générale de Surveillance)

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INTRODUCTION

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

CLIENT DETAILS: Elster Metering Systems
Unit 1
Tollgate Business Park
Beaconside
Stafford
Staffordshire
ST16 3HS

ORDER No: 3201067

APPLICATION RECEIVED DATE: 16th September 2008

DATE OF RECEIPT OF SAMPLES: 17th September & 10th October 2008

DATE OF TESTS: 24th September to 16th October 2008

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	:	*Elster Metering Systems*
Type	:	*AS230*
Class	:	*1 or 2 (kWh)*
Type of circuit	:	*1 phase 2 wire*
No. of Elements	:	*1*
Basic Current (Ib/In)	:	*5A*
Maximum Current (Im)	:	*100A*
Reference Supply Voltage	:	*220V-240V*
Rated Frequency	:	*50Hz*
Pulse output constant	:	*2000Imp/kWh*
Manufacturers Serial No.	:	*001, 002, 003, 004, 025, 027*

GENERAL REQUIREMENTS

Sealing Arrangements EN62052-11 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. Meters with a reference voltage > 250V shall be provided with a protected earth terminal.	Conformance

Display of Measured Values EN62052-11 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.	Conformance
- *Electronic Display* 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":	Conformance

Inspection of Markings EN62052-11 X-Ref. 5.12

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

Reverse Energy Check Ofgem UK Requirement

The reversal of energy flow does not cause any decrement of energy.	Conformance

SUPPORTING DOCUMENTATION

Accredited Laboratory tests reports:

Short-Time Over-Current
X-Ref. 8.7.8: ERA Report No. 2008-0594 Issued: 1st October 2008

SUMMARY OF TEST RESULTS

EN 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	Yes	Complied
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	N/A	N/A
7.1.2	Voltage dips and short interruptions	Yes	Complied
7.2	Influence of heating	Yes	Complied
7.3.2	Impulse voltage	Yes	Complied
7.4	Earth fault	N/A	N/A
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	N/A	N/A
7.5.8	Radio interference suppression	Yes	Complied

EN 62053-21: 2003 Particular Requirements:

EN 62053-21 Clause	Test	Performed	Result
7.1	Power consumption	Yes	Complied
7.2	Influence of short–time overcurrents	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	N/A	N/A
8.2	Voltage unbalance	N/A	N/A
8.2	Operation of accessories	N/A	N/A
8.2	Variation of error due to temperature variation	No	Not Tested
8.2	Variation of error due to harmonics	Yes	Complied
8.2	DC component in AC current	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.)

OFGEM UK pattern approval requirements:

Test	Applicable?	Result
Inspection of markings	Yes	Complied
Display of the measured values	Yes	Complied
Reverse energy check	Yes	Complied
Interaction between measuring elements	N/A	N/A
Sealing Arrangements	Yes	Complied

Yes: Tests performed at SGS

Yes[1]: Test performed at ERA Report No: 2008-0594

Not tested: Tested by SGS Report No.EMA121661
Issued 24th October 2008

N/A: Not Applicable

1 INSULATION EN62052-11 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 / 025	19EMA TP12

Environmental Conditions

Temperature	19°C
Relative Humidity	43%
Barometric Pressure	1001mB

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 meters were 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

EN62053-21 X-Ref. 7.4

Test Results ID / Sample No.	Test Procedure: EN62052-21 AC Voltage
AC / 025	19EMA TP13

Environmental Conditions

Temperature	19°C
Relative Humidity	43%
Barometric Pressure	1001mB

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 tests, the meters were 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 EN62053-21 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.

Sample No:	Test Procedure: Meter Constant (1h @ Im) +P
001	19EMA TP37

Test conditions: *Un: 230V* *Imax: 100A* *Cos. ϕ = 1.0, 50Hz*

Test Circuit: *1 phase 2 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 (%)
45999	2000	22.999	22.999	0.00

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

Sample No:	Test Procedure: Meter Constant (1h @ Im) -P
001	19EMA TP37

Test conditions: *Un: 230V* *Imax: 100A* *Cos. ϕ = 1.0, 50Hz*

Test Circuit: *1 phase 2 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 (%)
46004	2000	23.002	23.002	0.00

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

2.2 Starting and No-Load Condition EN62053-21 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 / 001	

The meter samples were 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 / 001	19EMA TP36

Tests were conducted as follows;

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

The minimum test duration in minutes being given by

$$\Delta t \geq \frac{600 \times 10^6}{k \cdot m \cdot Un \cdot Imax} \quad \text{[min] for meter of class 1}$$

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

where

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

The meter samples were 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 (cont.)

Starting X-Ref. 8.3.3

Test Results ID / Sample No.	Test Procedure: Starting Current 0.4 (% Ib) +P Starting Current 0.4 (% Ib) -P
Starting Current / 001	19EMA TP36

The meters commenced and continued to measure the applied active power in the import and export direction.

Test conditions for Direct Connected meters
Class 1 Active meters : Umin, 0.4%Ib, Cos. ϕ = 1.0, 50Hz

2.4 Influence Quantities

EN62053-21 X-Ref. 8

2.4.1 Variation in Current

X-Ref. 8.1

Test Results ID / Sample No.	Test Procedure: EN62053-21 Acc 1P2W kWh +P
Current Variation / 002	19EMA TP25

Test conditions: *Un: 230V* *Fn: 50Hz*
Ib/In: 5A *Im: 100A*

Test Circuit: *1 phase 2 wire*

Measurement mode - Active Import Energy kWh

			Limit of % Error	
CURRENT	PF Cos. ϕ	*% Error*	Accuracy	
			Class 1	Class 2
0.05 Ib	1.0	*-0.21*	±1.5	±2.5
0.1 Ib	-	*-0.17*	±1.0	±2.0
Ib	-	*-0.01*	±1.0	±2.0
0.5 Im	-	*-0.03*	±1.0	±2.0
Im	-	*-0.08*	±1.0	±2.0
0.1 Ib	0.5ind	*-0.09*	±1.5	±2.5
Ib	-	*0.01*	±1.0	±2.0
0.5 Im	-	*-0.01*	±1.0	±2.0
Im	-	*-0.10*	±1.0	±2.0
0.1 Ib	0.8cap	*-0.17*	±1.5	-
Ib	-	*-0.04*	±1.0	-
0.5 Im	-	*-0.07*	±1.0	-
Im	-	*-0.13*	±1.0	-

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

Test Results ID / Sample No.	Test Procedure: EN62053-21 Acc 1P2W kWh -P
Current Variation / 002	19EMA TP25

Test conditions: *Un: 230V* *Fn: 50Hz*
Ib/In: 5A *Im: 100A*

Test Circuit: *1 phase 2 wire*

Measurement mode - Active Export Energy kWh

			Limit of % Error	
CURRENT	PF Cos. ϕ	*% Error*	Accuracy	
			Class 1	Class 2
0.05 Ib	1.0	*0.03*	±1.5	±2.5
0.1 Ib	-	*0.02*	±1.0	±2.0
Ib	-	*-0.08*	±1.0	±2.0
0.5 Im	-	*-0.17*	±1.0	±2.0
Im	-	*-0.19*	±1.0	±2.0
0.1 Ib	0.5ind	*0.13*	±1.5	±2.5
Ib	-	*-0.09*	±1.0	±2.0
0.5 Im	-	*-0.14*	±1.0	±2.0
Im	-	*-0.20*	±1.0	±2.0
0.1 Ib	0.8cap	*0.08*	±1.5	-
Ib	-	*-0.09*	±1.0	-
0.5 Im	-	*-0.14*	±1.0	-
Im	-	*-0.18*	±1.0	-

2.4.2 Voltage Variation

EN62053-21 X-Ref. 8.2

Specified Operating Range

Test Results ID / Sample No.	Test Procedure: EN62053-21 Voltage Variation P
Voltage Variation / 001	19EMA TP26

Test conditions: *Un: 220V* *Fn: 50Hz*
Ib/In: 5A *Im: 100A*

Test Circuit: *1 phase 2 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 1	Class 2
0.05 Ib	1.0	*-0.30*	*-0.21*	*-0.70*	±0.7	±1.0
Ib	-	*0.00*	*-0.01*	*-0.05*	±0.7	±1.0
Im	-	*-0.06*	*-0.08*	*-0.09*	±0.7	±1.0
0.1 Ib	0.5ind	*0.29*	*-0.09*	*0.83*	±1.0	±1.5
Ib	-	*-0.01*	*0.01*	*-0.07*	±1.0	±1.5
Im	-	*-0.04*	*-0.03*	*-0.03*	±1.0	±1.5

Voltage Variation (cont.) EN62053-21 X-Ref. 8.2

Specified Operating Range

Test Results ID / Sample No.	Test Procedure: EN62053-21 Voltage Variation P
Voltage Variation / 001	19EMA TP26

Test conditions: *Un: 240V* *Fn: 50Hz*
Ib/In: 5A *Im: 100A*

Test Circuit: *1 phase 2 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 1	Class 2
0.05 Ib	1.0	*-0.01*	*-0.21*	*0.43*	±0.7	±1.0
Ib	-	*0.00*	*-0.01*	*0.01*	±0.7	±1.0
Im	-	*-0.04*	*-0.08*	*-0.04*	±0.7	±1.0
0.1 Ib	0.5ind	*0.07*	*-0.09*	*0.22*	±1.0	±1.5
Ib	-	*0.07*	*0.01*	*0.03*	±1.0	±1.5
Im	-	*-0.02*	*-0.03*	*-0.01*	±1.0	±1.5

2.4.3 Frequency Variation

EN62053-21 X-Ref. 8.2

Test Results ID / Sample No.	Test Procedure: EN62053-21 Frequency 51 to 49Hz P
Frequency Variation / 001	19EMA TP27

Test conditions: *Un: 230V* *Fn: 50Hz*
Ib/In: 5A *Im: 100A*

Test Circuit: *1 phase 2 wire*

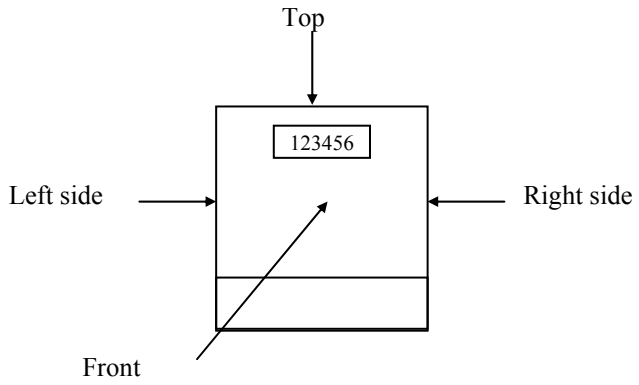
Measurement mode - Active Import Energy kWh

		102% Fn	100% Fn	98% Fn	Limit of % Error Variation	
Current	PF Cos. ϕ	*% Error*	*% Error*	*% Error*	Accuracy	
					Class 1	Class 2
0.05 Ib	1.0	*-0.59*	*-0.21*	*-0.36*	±0.5	±0.8
Ib	1.0	*-0.01*	*-0.01*	*-0.02*	±0.5	±0.8
Im	1.0	*-0.06*	*-0.08*	*-0.06*	±0.5	±0.8
0.10 Ib	0.5ind	*-0.30*	*-0.09*	*-0.17*	±0.7	±1.0
Ib	0.5ind	*0.04*	*0.01*	*0.01*	±0.7	±1.0
Im	0.5ind	*-0.01*	*-0.03*	*-0.06*	±0.7	±1.0

2.4.4 Continuous Magnetic Induction of External Origin EN62053-21 X-Ref. 8.2

The continuous magnetic induction was obtained using an electromagnetic coil of 1000 Ampere-turns. This magnetic field was applied to all accessible surfaces of the meter samples when mounted as for normal use.

Application of the continuous magnetic induction



Test Results ID / Sample No.	Test Procedure: EN62053-21 DC Magnetic Field P
DC Mag. Field / 027	19EMA TP35

Test conditions: *Un: 230V* *Fn: 50Hz*
Ib/In: 5A *Im: 100A*

Test Circuit: *1 phase 2 wire*

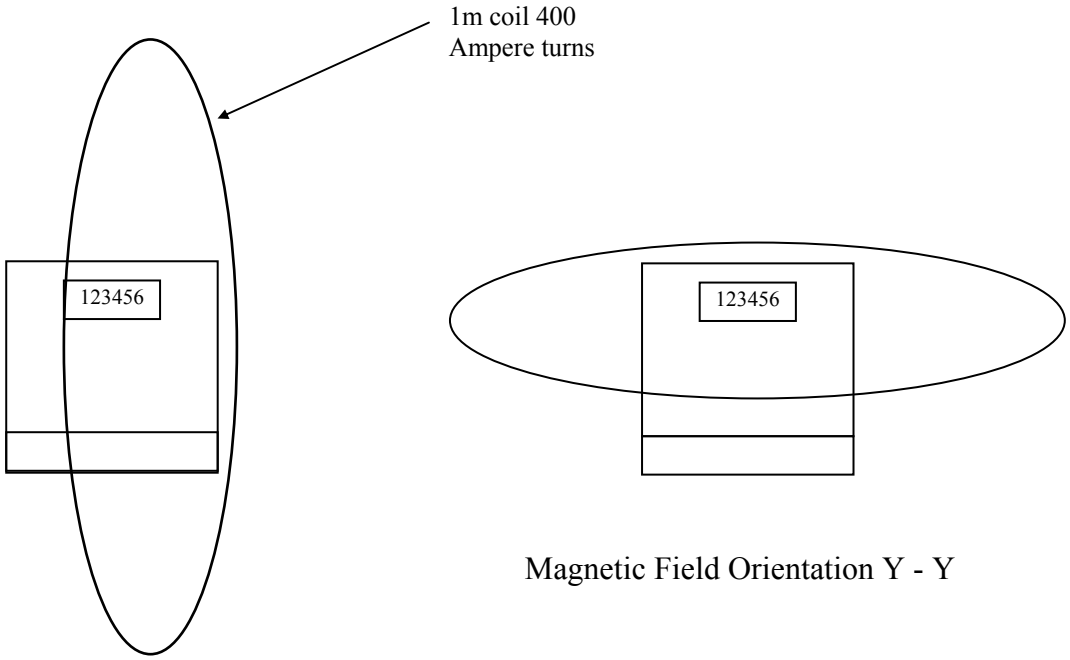
Measurement mode - Active Import Energy kWh

		Limit of % Error Variation	
Electromagnetic Position	*% Error*	Accuracy	
		Class 1	Class 2
No field applied	*0.00*	-	-
Left side of meter	*-0.01*	±2.0	±3.0
Front of meter	*0.00*	±2.0	±3.0
Right side of meter	*0.00*	±2.0	±3.0
Top of meter	*0.00*	±2.0	±3.0

2.4.5 Magnetic Induction of External origin 0.5mT EN62053-21 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)

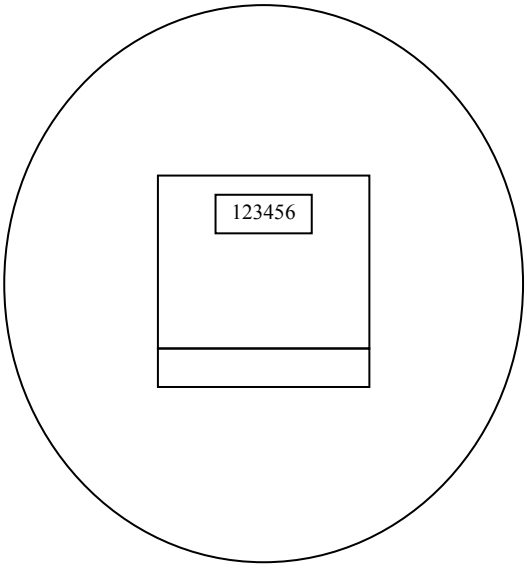
The magnetic field's orientation with respect to the meter under test



Magnetic Field Orientation Y - Y

Magnetic Field Orientation X - X

Magnetic Field Orientation Z - Z



Magnetic Induction of External Origin 0.5mT (cont.) X-Ref. 8.2

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 / 025	19EMA TP34

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

Test Circuit: *1 phase 2 wire*

Measurement mode - Active Import Energy kWh

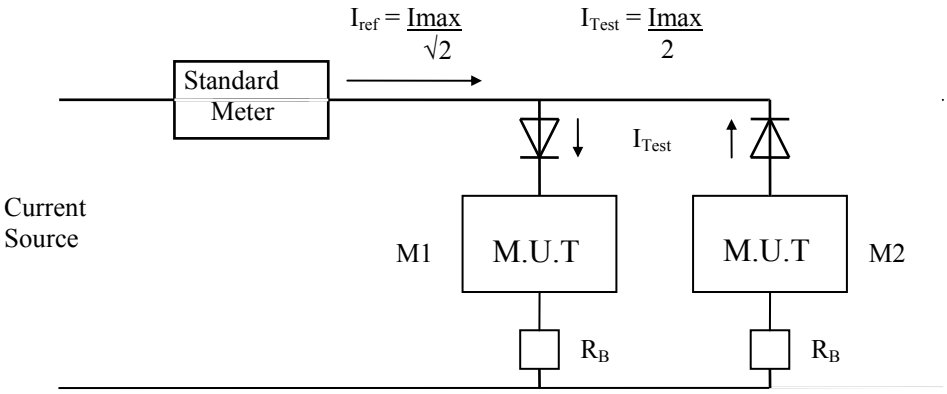
Phase angle of the field with respect to U3 (Vph)	Direction of field orientation		
	X - X	Y - Y	Z - Z
	% Error	*% Error*	% Error
No Field Applied	*-0.01*	*-0.01*	*0.01*
0°	*0.00*	*0.01*	*0.03*
30°	*0.14*	*-0.42*	*0.15*
60°	*0.24*	*-0.70*	*0.24*
90°	*0.27*	*-0.82*	*0.28*
120°	*0.24*	*-0.72*	*0.23*
150°	*0.14*	*-0.40*	*0.16*
180°	*0.00*	*0.01*	*0.03*
210°	*-0.14*	*0.42*	*-0.12*
240°	*-0.23*	*0.74*	*-0.22*
270°	*-0.25*	*0.83*	*-0.24*
300°	*-0.22*	*0.72*	*-0.21*
330°	*-0.14*	*0.41*	*-0.11*
360°	*0.01*	*0.00*	*0.01*

Limit of % Error Variation for Class 1 ± 2.0%
Class 2 ± 3.0%

2.5 Accuracy test in the Presence of Harmonics

2.5.1 DC Component in AC Current Circuit EN62053-21 X-Ref. 8.2

Tests were conducted using the circuit shown. Tests were conducted with the M.U.T connect in each of the circuit limbs M1 & M2 in turn, the overall error of the meter being the mean of the two errors obtained.



Test Results ID / Sample No.	Test Procedure: EN62053-21 DC Component in AC Current
DC Component / 004	19EMA TP35

Test conditions: *Un: 230V* *Fn: 50Hz*
Im: 100A *PF: Cos. ϕ = 1.0*

Test Circuit: *1 phase 2 wire. In the case of Polyphase meter's tests were conducted on element L1 only.*

A.C current: 0.707Im - fundamental waveform (I_{ref})
Equivalent half wave DC current: 0.5 Imax. (I_{Test})

				Limit of % Error Variation	
Test Current	*% Error*			Accuracy	
				Class 1	Class 2
0.707Im (I_{ref})	- *M1*	- *M2*	*-0.10 Mean*	-	-
0.5Im (I_{test})	*-0.25*	*0.32*	*0.28*	±3.0	±6.0

2.5.2 Harmonic Components in the Current and Voltage Circuits

EN62053-21 X-Ref. 8.2

Test Results ID / Sample No.	Test Procedure: EN62053-21 Harmonics Tests
Harmonics / 002	19EMA TP32

Test conditions: *Un: 230V* *Fn: 50Hz* *PF: Cos. ϕ = 1.0*
Ib/In: 5A *Im: 100A*

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: *1 phase 2 wire*

Measurement mode - Active Energy kWh

		Limit of % Error Variation	
Waveform	*% Error*	Accuracy	
		Class 1	Class 2
Fundamental Only (P_0) 0.5 Imax	*-0.01*	-	-
Fundamental + 5th Harmonic ($P_{resultant} = 1.04\ P_0$)	*0.04*	±0.8	±1.0

2.5.3 Influence of Odd and Sub Harmonics in the AC Current Circuit

EN62053-21 X-Ref. 8.2

Test Results ID / Sample No.	Test Procedure: EN62053-21 Harmonics Tests
Harmonics / 002	19EMA TP32

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

Reference current waveform: I_{ref} = 0.5 Ib or 0.5In
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: *1 phase 2 wire*

Measurement mode - Active Energy kWh

		Limit of % Error Variation	
Waveform	*% Error*	Accuracy	
		Class 1	Class 2
Fundamental Only 0.5 Ib / In	*0.05*	-	-
Waveform Phase-fired Test current	*0.03*	±3.0	±6.0
Waveform Burst fired Test current	*0.10*	±3.0	±6.0

3 ELECTRICAL REQUIREMENTS EN62052-11 X-Ref. 7

3.1 Power Consumption X-Ref. 7.1

Test Results ID / Sample No.	Test Procedure: EN62053-21 Power Consumption
Power Consumption / 002	19EMA TP22

Environmental Conditions

Temperature	24°C
Relative Humidity	40%
Barometric Pressure	977mB

	Volts/V	Amps/A	VA	Watts/W
Wiring Configuration: Single Phase Two Wire				
Voltage Circuit: **L1**	*230.6*	*0.391*	*9.00*	*1.36*
Current Circuit: **L1**	*0.003*	*4.996*	*0.016*	---

Power consumption limits 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

Current Circuits 4.0VA & 2.5VA for Class 1 & Class 2 respectively

3.2 Influence of Supply Voltage EN62052-11 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 / 027	19EMA TP10

Environmental Conditions

Power Supply	230V, 50Hz
Temperature	16°C
Relative Humidity	52%
Barometric Pressure	993mB

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 tests 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 EN62053-21 X-Ref. 7.2

Tests conducted on sample 003 at an external Accredited Laboratory as given in the supporting documentation

Test Conditions: *Im: 100A* *Fn: 50Hz*

Test Circuit: *1 phase 2 wire*

The test was applied under the following conditions;

Meter for direct connection:

An impulse current was applied = 30 x Imax
For one half cycle at rated frequency = 10ms 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	Ib/ In	*0.07*

Limit of % Error: Class 1 or 2 ± 1.5% for direct connection

Class 1 ± 0.5% for connection through a current transformer
Class 2 ± 1.0% for connection through a current transformer

The meter showed no signs of damage and functioned correctly.

3.4 Test of Influence of Self Heating EN62053-21 X-Ref. 7.3

Test conditions: - The meter voltage circuits were energised at reference voltage for at least 1 hour, 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: EN62053-21 (class 1) Self Heating
Self Heating / 002	19EMA TP24

Test conditions: *Un: 230V* *Fn: 50Hz*
Im: 100A *PF: Cos. ϕ = 1.0*

Test Circuit: *1 phase 2 wire*

Measurement mode-Active Energy kWh

Elapsed Test time (minutes)	Un Im Cos.ϕ = 1.0 *% Error*	Un Im Cos.ϕ = 0.5 *% Error*
1	*-0.08*	*-0.08*
5	*-0.18*	*-0.19*
10	*-0.25*	*-0.26*
15	*-0.26*	*-0.29*
20	*-0.27*	*-0.28*
25	*-0.29*	*-0.31*
30	*-0.28*	*-0.28*
35	*-0.28*	*-0.30*
40	*-0.29*	*-0.28*
45	*-0.29*	*-0.31*
50	*-0.29*	*-0.27*
55	*-0.30*	*-0.33*
60	*-0.29*	*-0.31*

Limit of % Error Variation: Class 1 ±0.7% @ Cos. ϕ = 1.0 & ±1.0% @ Cos. ϕ = 0.5ind
Class 2 ±1.0% @ Cos. ϕ = 1.0 & ±1.5% @ Cos. ϕ = 0.5ind

3.5 Test of Influence of Heating EN62052-11 X-Ref. 7.2

Test Results ID / Sample No.	Test Procedure: EN62052-11 Heating
Heating / 004	19EMA TP11

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

Test conditions: *115%Un: 264.5V* *Im: 100A* *Fn: 50Hz*

Ambient Temperature : 40°C
Test Duration : 2 hours
Surface Temperature Rise: 22.1K

Permissible temperature rise: 25K

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

On completion of the above tests, the meters were 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.) EN62052-11 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 / 027	19EMA TP14

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

Environmental Conditions

Power Supply	230V, 50Hz
Temperature	16°C
Relative Humidity	48%
Barometric Pressure	998mB

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

The tests were conducted with the meter under test (MUT) arrange as Table Top equipment fitted with a 0.8m by 1.6m by 1mm (thickness) horizontal coupling plane, the MUT plus coupling planes being mounted on a wooden bench plus insulating support 0.8m above the reference ground plane.

The reference ground plane having dimensions of 1.8m by 2.6m by 1mm (thickness)

The reference ground plane and horizontal coupling plane were electrically connected via 470 kΩ resistors.

The MUT and all cables were isolated from the horizontal coupling plane by a 0.5mm insulating support.

The discharge return cable of the ESD generator to the ground reference plane being made via a 2m earth cable isolated from the coupling planes by at least 0.1m.

For each type of ESD application (direct, contact & indirect) there was a minimum of 1s between successive discharges.

For direct application of discharge to the MUT, only those points and surfaces of the equipment which are accessible to personnel during normal usage were exposed to ESD, i.e. push buttons, terminal / cover screws, conductive metallic cards inserted into card / token reader interfaces.

In the application of direct contact discharge to conductive surfaces of the MUT, the ESD generator was held perpendicular to the surface to which the discharge was to be applied, i.e. the discharge electrode being first made contact with the test point, then the discharge triggered.

For application of air gap discharge to non-conducting surfaces of the MUT, the triggered ESD generator was held perpendicular to the surface to which the discharge was to be applied, the discharge electrode being moved closer to the insulated test point until discharge occurred or the discharge electrode touched the MUT.

In the case of indirect application of the discharge, the horizontal coupling and the vertical coupling planes were used. Discharges were applied in each polarity to the horizontal coupling plane centrally to each side of the MUT located 0.1m for the ESD application, as well as to the central edge of the vertical plane comprising of a 0.5m by 0.5m aluminium plate, in turn positioned 0.1m from each side of the MUT. The reference ground plane and the vertical coupling plane being electrically connected via 470 kΩ resistors, insulated from the horizontal coupling plate by 0.5mm insulating support.

Discharges were applied to the coupling planes in sufficient different positions that all four faces of the MUT were completely illuminated.

The electrostatic air discharge was applied to non conductive surfaces of the MUT.

Contact and indirect electrostatic discharge were applied to coupling planes and external conductive surfaces of the meter cover/base.

The tests were conducted under the following conditions;

Meter in operating condition with the voltage and auxiliary circuits energised, all the voltage and auxiliary circuits were connected together, with the 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

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

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.

4.2 Immunity to Electromagnetic HF Fields X-Ref. 7.5.3

Test Results ID / Sample No.	Test Procedure: EN62052-11 Radiated Immunity
RI / 025	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, 50Hz
Temperature	18°C
Relative Humidity	42%
Barometric Pressure	1001mB

Port: Enclosure
Test Level: 10 V/m (mode 1) & 30 V/m (mode 2)
Frequency Range: 80-2000 MHz
Dwell Time: Function of Meter Pulses (≥ 2 Secs)
Frequency Step Size: 1%
Modulation: 80%, 1 kHz Amplitude Modulation.

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 80-2000MHz)

EUT Face	Polarity	Observations	
		Mode 1	Mode 2
Front	Vertical	1.52	Note 1
Front	Horizontal	1.20	Note 1
RHS	Vertical	1.76	Note 1
RHS	Horizontal	0.96	Note 1
Rear	Vertical	1.12	Note 1
Rear	Horizontal	1.62	Note 1
LHS	Vertical	-0.56	Note 1
LHS	Horizontal	0.72	Note 1

Note 1: The signal outputs recorded and the change in register are within the critical change limits specified in EN62052-11.

4.3 Fast Transient Burst Test

X-Ref. 7.5.4

Test Results ID / Sample No.	Test Procedure: EN62052-11 Fast Transient Bursts
FTB / 025	19EMA TP16

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

Environmental Conditions

Temperature	18°C
Relative Humidity	40%
Barometric Pressure	998mB

Transient/Burst specification:

Pulse level severity 1kV, 2kV or 4kV
Rise time 5ns
Width 50ns
Repetition Rate 5 kHz & 2.5 kHz
Burst Duration 15ms
Burst Period 300ms
Burst Generation Asynchronous (Common mode)

The tests were conducted with the meter under test (MUT) arrange as Table Top equipment, the MUT being mounted on a wooden bench plus insulating support 0.8m above the reference ground plane.

The electrical fast transient / burst generator was bonded to the reference ground plan.

AC Mains/power cables were of 1m in length.

For power / earth lines on both single and three phase equipment for test b), direct coupling of the electrical fast transient interference signal was performed via a coupling/de-coupling network.

For I/O and communication lines with a voltage of greater than 40V, and during phantom load / accuracy influence testing of the meter as detailed in Test a), the electrical fast transient interference signal was couple to the lines via a capacitive coupling clamp, with a distance between the clamp and the MUT of 0.8m to 1m.

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

Operating mode: The meter voltage circuits were energised at reference voltage Un, with Ib/In Cos. ϕ = 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 10 minutes. The fast transient burst was applied three times for 1s for each test voltage polarity, spread equally over the test duration.

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

Test Circuit: *1 phase 2 wire*

Measurement mode - Active Import Energy kWh

		Limit of % Error Variation	
Effect on Meter Registration	*% Error*	Accuracy	
		Class 1	Class 2
No FTB applied	*0.04*	-	-
Application of FTB @ ±4kV (on Voltage & Current Circuits)	*0.05*	±4.0	±6.0
Application of FTB @ ±2kV (on auxiliary circuits of > 40V)	*0.04*	±4.0	±6.0

On completion of the above tests, the meters were 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 / 025	19EMA TP17

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

Environmental Conditions

Temperature	19°C
Relative Humidity	40%
Barometric Pressure	995mB

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)	Observations
Current and Voltage Circuits	0.15 to 80	0.40

4.5 Surge Immunity

X-Ref 7.5.6

Test Results ID / Sample No.	Test Procedure: EN62052-11 Surge
Surge / 027	19EMA TP18

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

Ports:	Current, 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

Temperature	17°C
Relative Humidity	52%
Barometric Pressure	1001mB

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 Radio Interference Measurement X-Ref. 7.5.8

Radiated Emissions

Test Results ID / Sample No.	Test Procedure: EN62052-11 Radiated Emissions
RE / 025	19EMA TP21

The meter was tested in accordance with EN55022 as follows:

Environmental Conditions

Power Supply	230V, 50Hz
Temperature	17°C
Relative Humidity	40%
Barometric Pressure	998mB

Operating Mode: The MUT was operated with voltage and auxiliary circuits energised with reference voltage and a current of between 0.1Ib and 0.2Ib and 1m leads attached to all terminals.

Result: A pre-scan was performed in the anechoic chamber with an antenna to M.U.T. test distance of 3m. During this pre-scan no M.U.T. peak emissions were observed within 15dB of the test limit.

Radio Interference Measurement (cont)

Conducted Emissions

Test Results ID / Sample No.	Test Procedure: EN62052-11 Conducted Emissions
CE / 027	19EMA TP21

The meter was tested in accordance with EN55022 as follows:

Environmental Conditions

Power Supply	230V, 50Hz
Temperature	16°C
Relative Humidity	52%
Barometric Pressure	993mB

The emissions on the AC mains were measured in the frequency range 0.15 – 30 MHz

Operating Mode: The MUT was operated with voltage and auxiliary circuits energised with reference voltage and a current of between 0.1Iref and 0.2Iref and 1m leads attached to all terminals.

Results:

Line 1 Worst Case Emissions

Frequency (MHz)	Quasi Peak Measurement (dBuV)	Quasi Peak Limit (dBuV)	Average Measurement (dBuV)	Average Limit (dBuV)
0.181	31.6	64.44	5.7	54.44
0.222	30.6	62.74	5.7	52.74
0.285	29.2	60.67	5.7	50.67
0.366	27.4	58.59	5.7	48.59

Line 2 Worst Case Emissions

Frequency (MHz)	Quasi Peak Measurement (dBuV)	Quasi Peak Limit (dBuV)	Average Measurement (dBuV)	Average Limit (dBuV)
0.199	31.6	63.65	5.7	53.65
0.226	30.5	62.59	5.7	52.59
0.294	28.1	60.41	5.7	50.41
361.5	27.1	60.00	5.7	50.00

5 CLIMATIC INFLUENCES EN62052-11 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 / 002	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 tests, the meters were 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 / 002	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 tests, the meters were 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 / 003	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 tests, the meters were 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 EN62052-11 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 / 004	19EMA TP01

Environmental Conditions

Temperature	20°C
Relative Humidity	44%
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.

6.2 Shock Test X-Ref. 5.2.2.2

Test Results ID / Sample No.	Test Procedure: EN62052-11 Shock
Shock / 027	19EMA TP02

Environmental Conditions

Temperature	18°C
Relative Humidity	48%
Barometric Pressure	1001mB

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 meters were 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 / 027	19EMA TP03

Environmental Conditions

Temperature	20°C
Relative Humidity	48%
Barometric Pressure	998mB

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 tests, the meters were 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 / 001	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.

6.5 Penetration of Dust & Water

X-Ref. 5.9

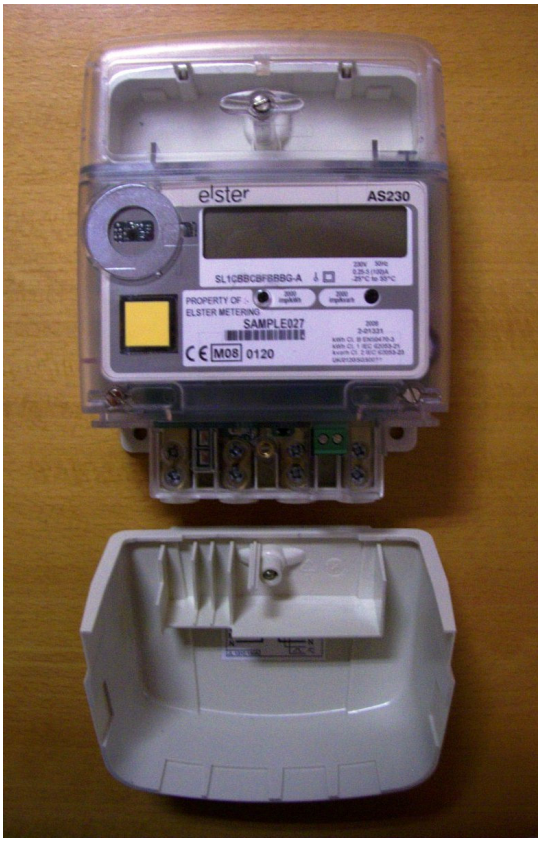
Test Results ID / Sample No.	Test Procedure: EN62052-11 Dust & Water
Dust & Water / 002	19EMA TP05

The meter was tested in accordance with IEC 60529 as follows:

Dust Test: IP5X, non-operating condition, Neither under, nor over pressure
Water Test: IPX1, non-operating condition

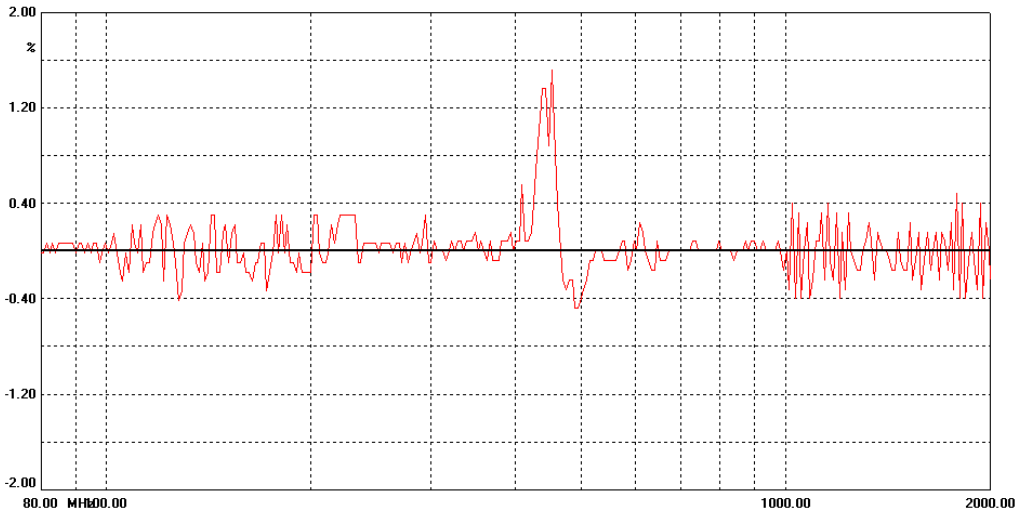
On completion of the above tests, the meters were found to function correctly and within the accuracy specification when subsequently operated under reference operating conditions with no signs of damage or degradation in the meter's insulation properties.

ANNEX A - Photographs of Meter Under Test

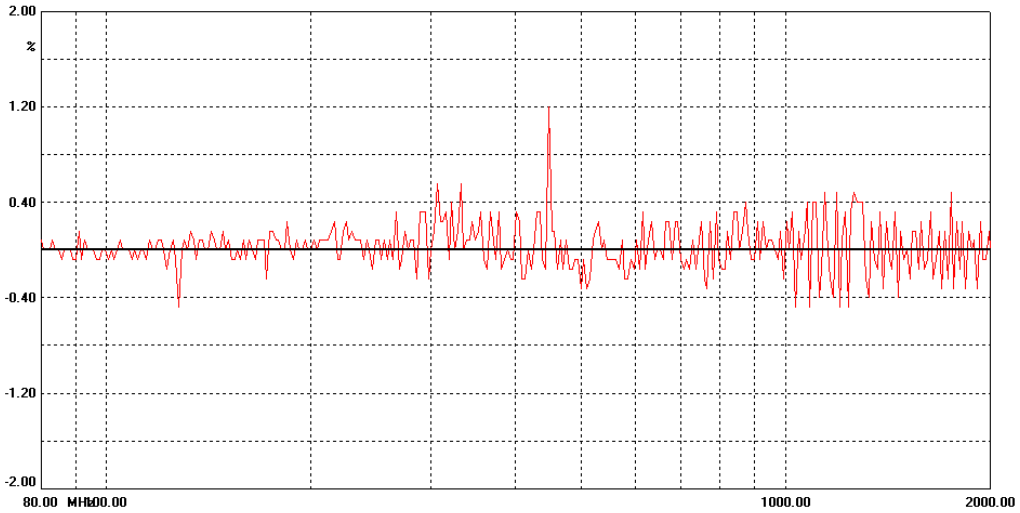


ANNEX B – Radiated Immunity Test - Graphical plots of results

AS230 Front Face, Vertical Polarisation, 80-2000MHz

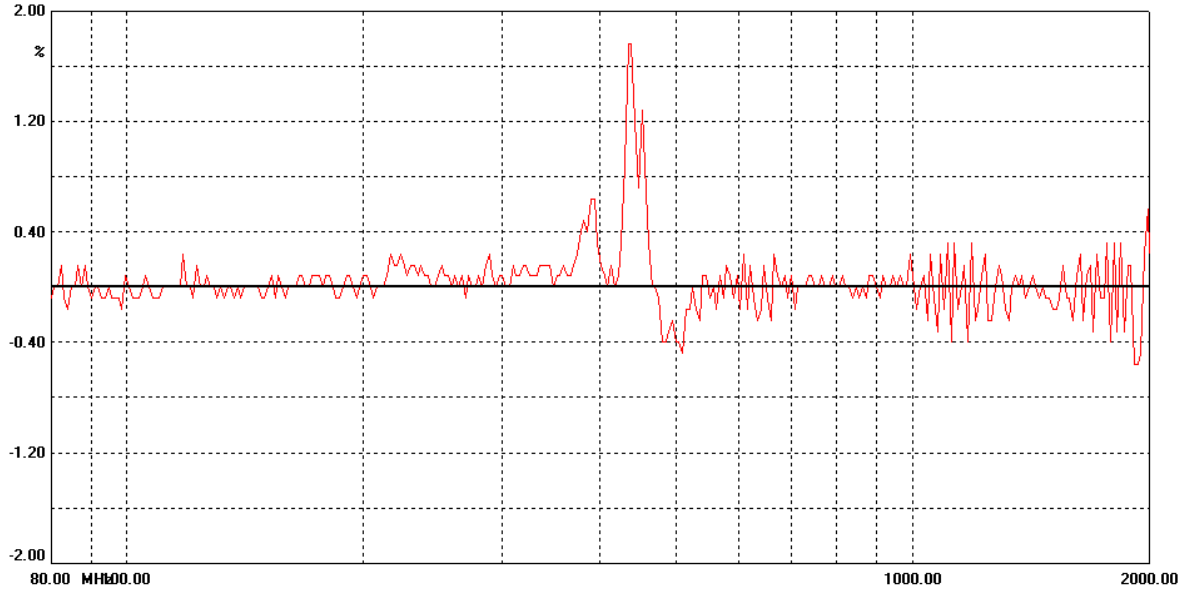


AS230 Front Face, Horizontal Polarisation, 80-2000MHz

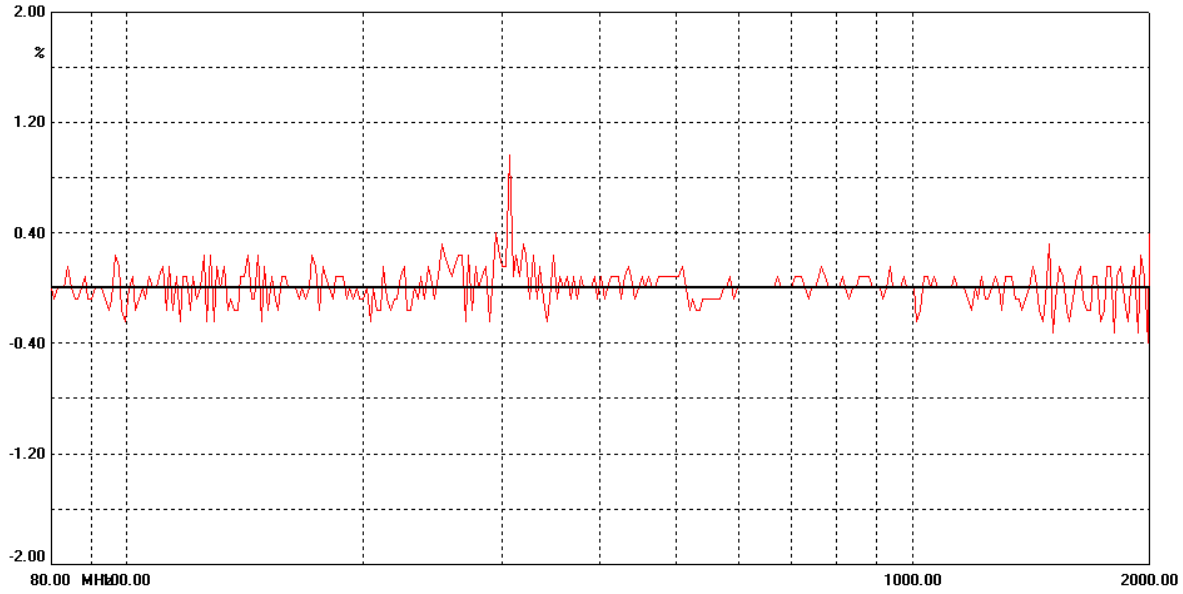


Radiated Immunity Test - Graphical plots of results (cont)

AS230 RHS Face, Vertical Polarisation, 80-2000MHz

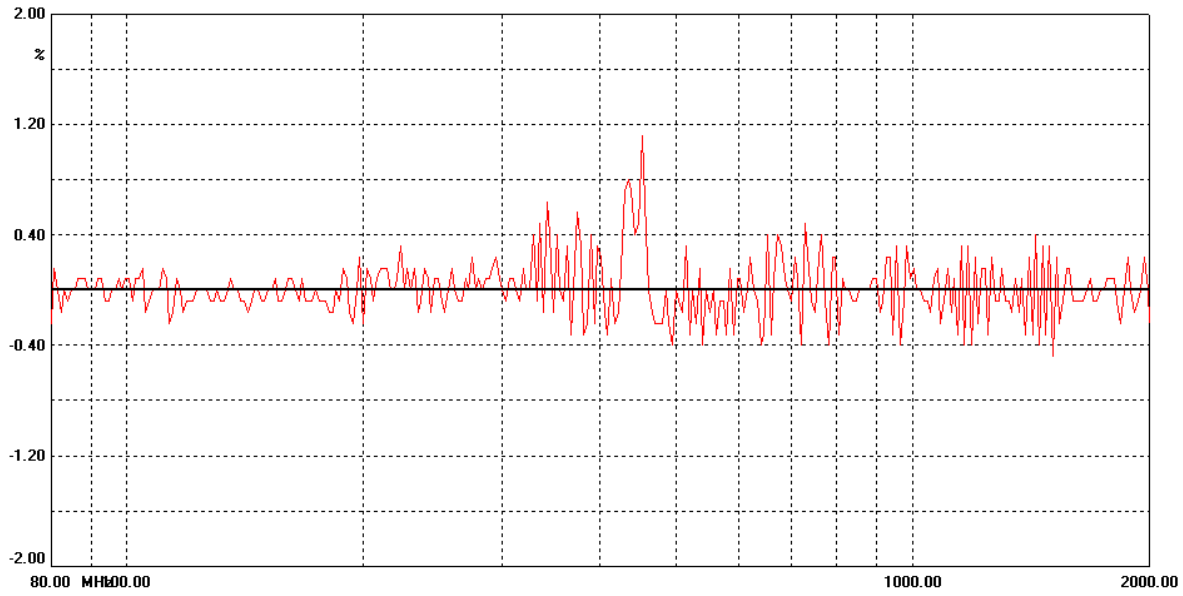


AS230 RHS Face, Horizontal Polarisation, 80-2000MHz

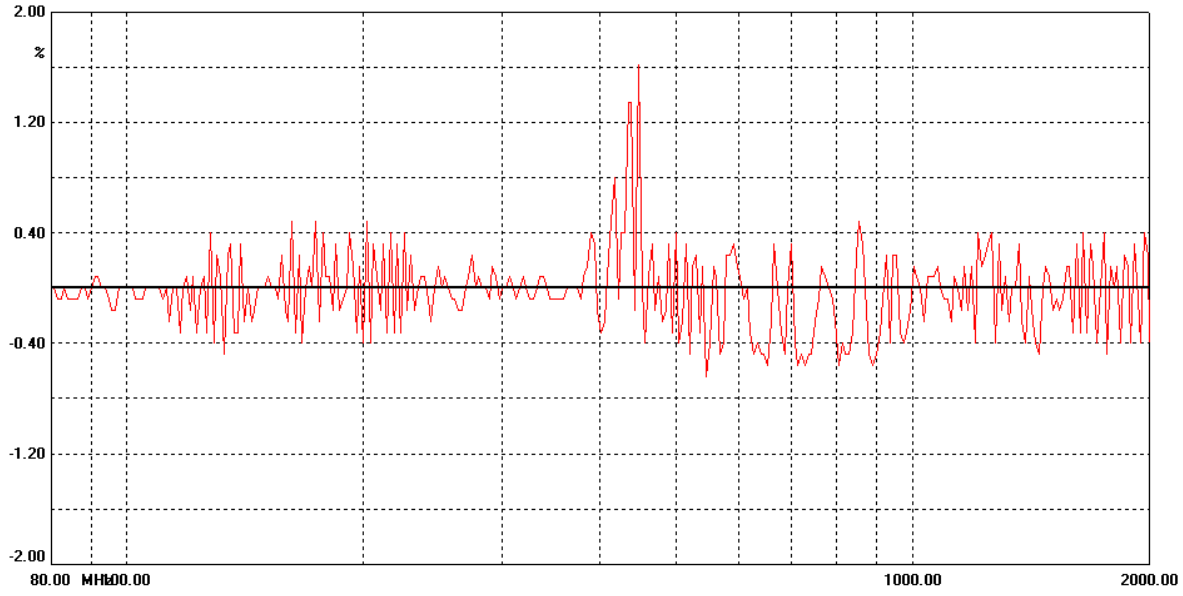


Radiated Immunity Test - Graphical plots of results (cont)

AS230 Rear Face, Vertical Polarisation, 80-2000MHz

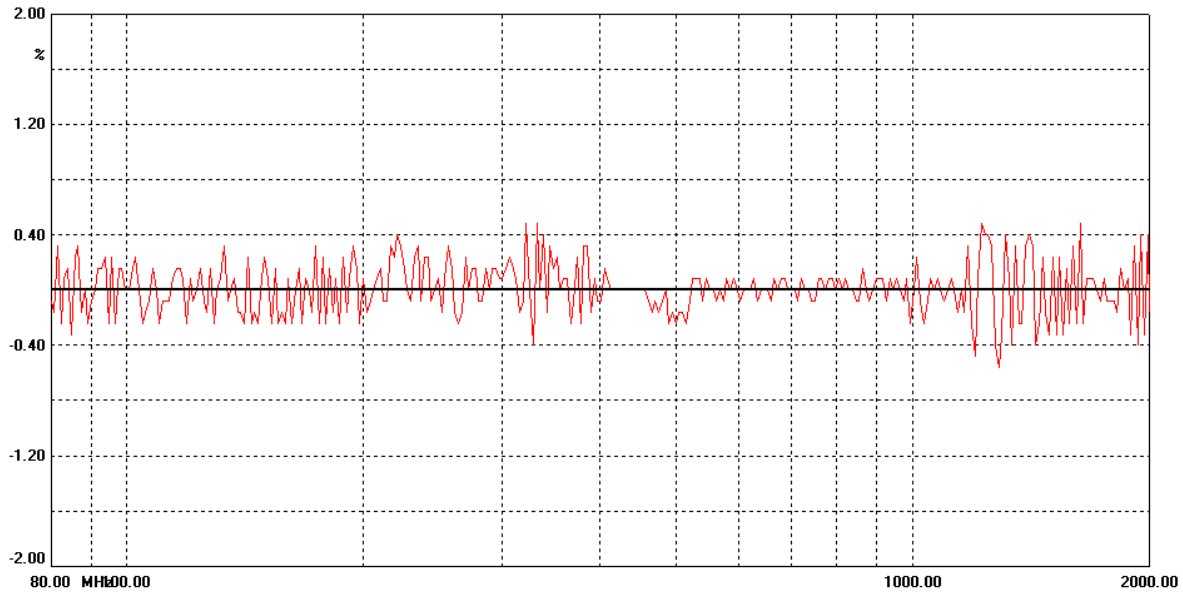


AS230 Rear Face, Horizontal Polarisation, 80-2000MHz

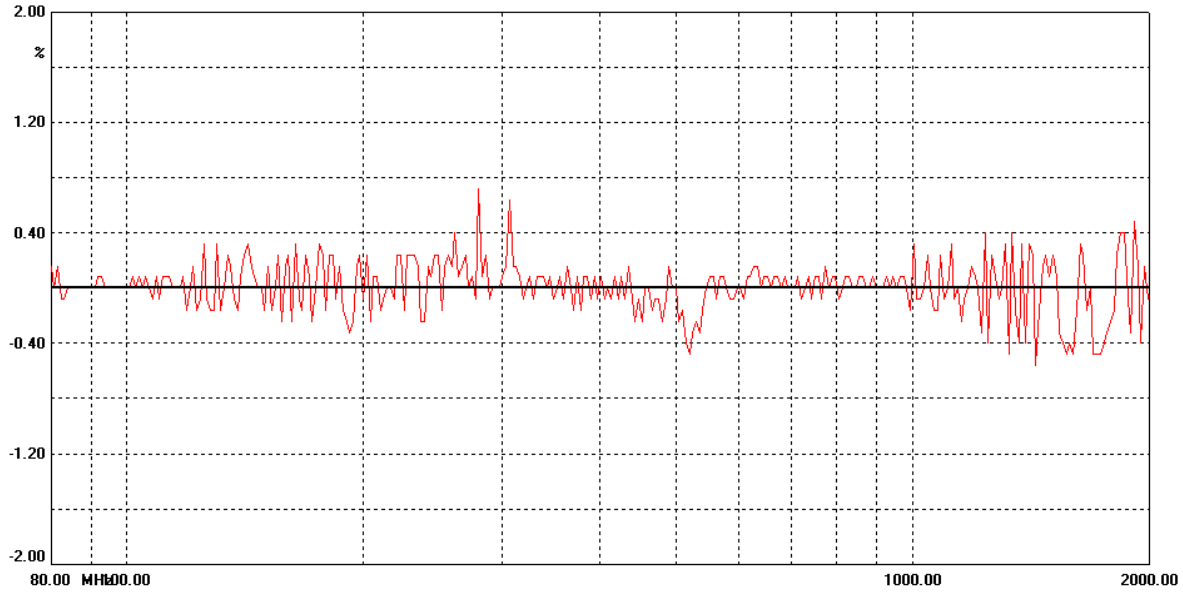


Radiated Immunity Test - Graphical plots of results (cont)

AS230 LHS Face, Vertical Polarisation, 80-2000MHz

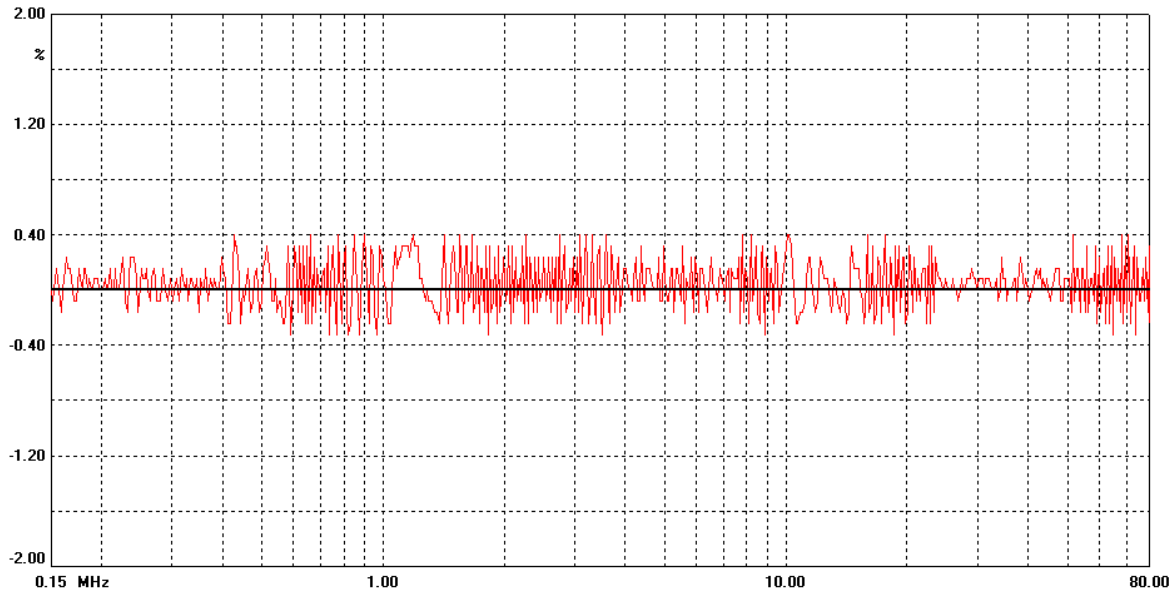


AS230 LHS Face, Horizontal Polarisation, 80-2000MHz



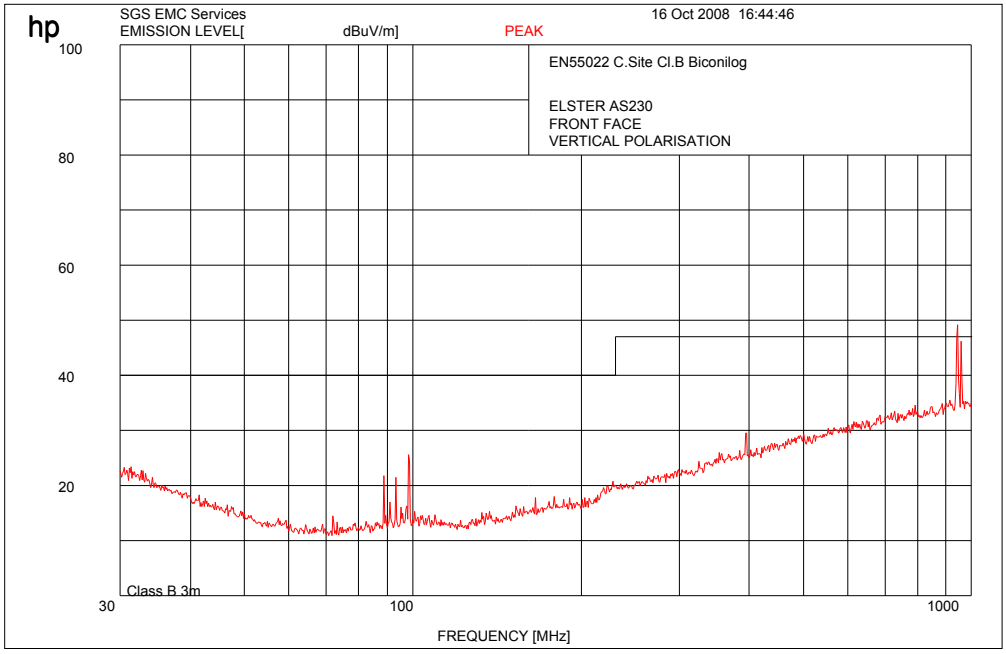
ANNEX C – Conducted Immunity Test - Graphical plots of results

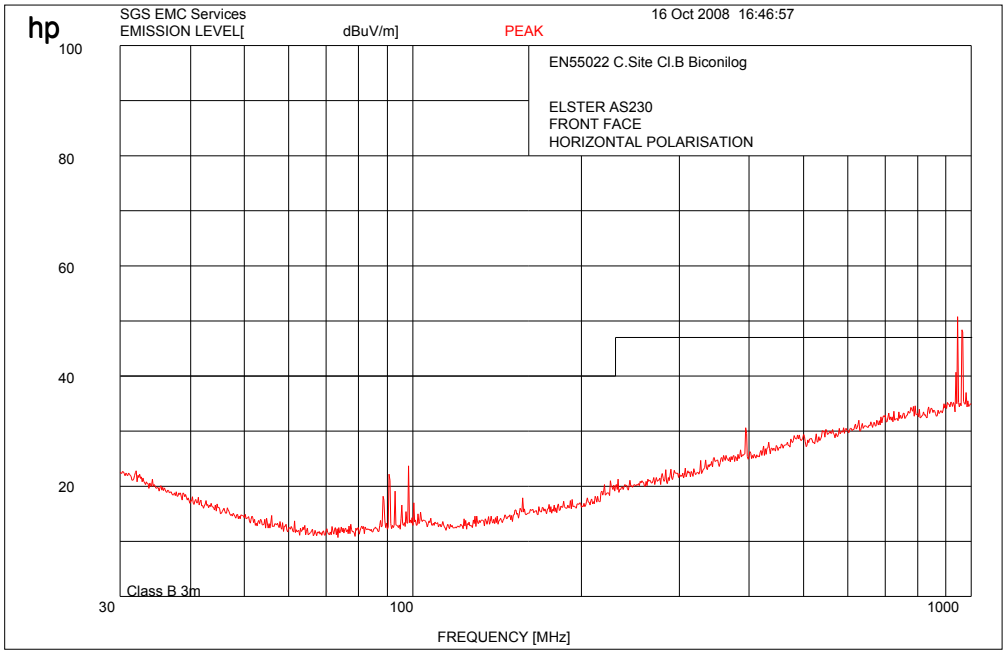
AS230 Conducted Immunity 0.15-80MHz



ANNEX D – Radiated Emissions - Graphical plots of results (Worst Case Face)

Note: Emissions between 95-100MHz and 900-1000MHz are ambient emissions and are not produced by the meter.





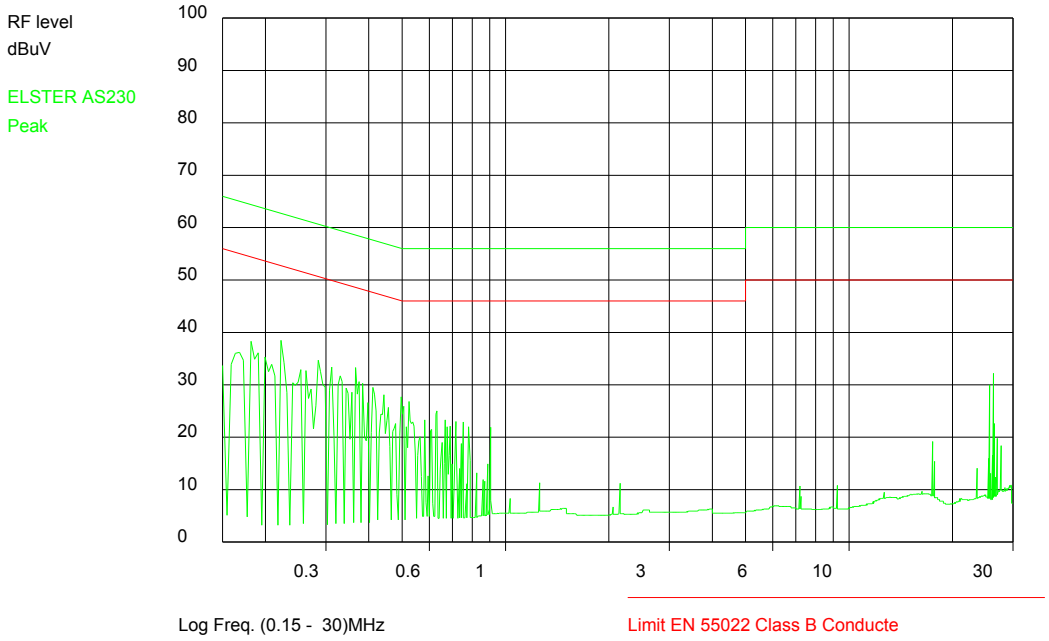
ANNEX E – Conducted Emissions Test - Graphical plots of results

Chase EMS 6.00

Notes

Analyse ELSTER AS230 LIVE PEAKS

Test: EN 55022 CLASS B MAINS TERMINALS PKS



Chase EMS 6.00

Notes

Analyse ELSTER AS230 NEUTRAL PEAKS

Test: EN 55022 CLASS B MAINS TERMINALS PKS