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EMC TEST REPORT OF A

Rotapanel Controller

type:

RP-2000 MODBUS and RP-2000 PROFIBUS

Manufactured by:

Rotapanel International B.V.

Thales Nederland B.V., is a leading company in the area of defence electronics. Thales is a subsidiary of Thales, France. Part of Thales is the Environmental Test Laboratory with facilities for EMC, CLIMATOLOGICAL, SHOCK and VIBRATION tests.



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Qualification Test Report

Test requested by :

Company : 551
 Postal-code and city : Rotapanel International B.V.
 Address : 8938 AB Leeuwarden
 Telephone number : Plutoweg 2
 Fax number : 058 2880000
 Representative(s) : 058 2882830
 H.G. Born

Test carried out by :

Company : Thales Nederland B.V.
 Department : ECC
 Address : P.O. Box 42
 Postal-code and city : 7550 GD Hengelo (O.)
 Telephone number : 074-2482446
 Fax number : 074-2484037

Date :

Date start of test : 22-02-2000 revised 12-7-2007
 Date test completed : 01-02-2000
 Testlocation : 01-02-2000
 Additional tests : 4-7-2007

Copies to: 2 x Hengelo
 2 x **Environmental Test Laboratory**

Test Engineer : Rotapanel International B.V. Signature
 A.A.G. Sogtoen

Author : J Schuurmans (tests 2007) Signature
 A.A.G. Sogtoen
 J. Schuurmans (2007)

Report approved by : D.J. Groot Boerle, manager ECC. Signature



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1. Summary

An EMC Test has been carried out on a Rotapanel control, type RP 2000, indicated in this report as Equipment Under Test, EUT. The Rotapanel control is intended to be used as control unit for PVMS (Prismatic Variable Message Signs). The purpose of this test was to establish whether or not the EUT did meet the requirements of the Generic Standards.

EN 61000-6-4 Generic Emission standard for the industrial environment

EN 61000-6-2 Generic Immunity standard for the industrial environment

Basic standard tests regarding emission, requirement EN 61000-6-4

Test	Aspects:	Applied
EN 55011	Conducted emission, ISM-equipment, 0.15 - 30 MHz	Yes
EN 55011	Radiated emission, ISM-equipment, 30 - 1000 MHz	Yes
EN55022	Radiated emission, 30 MHz - 6000 MHz (additional test 2007)	Yes

Basic standard tests regarding immunity, requirement EN 61000-6-2

Test	Aspects:	Applied
EN 61000-4-2	Electrostatic discharges	Yes
EN 61000-4-3	Electromagnetic radiation - radiated immunity	Yes
EN 61000-4-3	Electromagnetic radiated immunity 80 MHz - 3000 MHz (additional test 2007)	Yes
EN 61000-4-4	Electrical Fast Transient/Burst	Yes
EN 61000-4-5	Surges	Yes
EN 61000-4-6	Electromagnetic radiation - conducted immunity	Yes
EN 61000-4-11	Supply voltage interruptions and decreases	No*

This test has not been applied since the EUT has an energy reserve of 100 ms and thus will meet this requirement.

Test	Aspects:	Applied
EN 12966	tables 11 and 12	YES

The additional tests as referenced above were performed in response to the modified and extended requirements in EN 12966, and the updated basic standards.

This report can be used as a reference document for the Declaration of Conformity for the EMC Directive 2004/108/EC.



2. Conclusion

The EUT meets the requirements of the Generic Immunity Standard EN 61000-6-2 and the Generic Emission Standard EN 61000-6-3 and EN 61000-6-4. The additional tests done in 2007 show the tested EUT meet the requirements of the modified standard EN 12966-1, Road vertical signs - Variable message traffic signs.

Note: This report is a revised version of the report of 22-02-2000. Although the results are valid for the valid standards in 2007 at some places in the report the 'old' numbers for the Genric Standards' are mentioned. The following reference should be applied:

EN 50081-1 has become EN 61000-6-3

EN 50081-2 has become EN 61000-6-4

EN 50082-2 has become EN 61000-6-2

The EMC Directive 89/336/EEC has become 2004/108/EC.

The conclusion regarding emission:

Test	Complies	Remarks
EN 55011 Cond. Emission	Yes	The EUT meets the requirements of Group 1, Class B For quasi peak the minimum margin found was 19 dB at .3 MHz
EN 55011 Rad. Emission	Yes	The EUT meets the requirements for Group 1, Class B For quasi peak the minimum margin found was 11 dB at 198 MHz

The conclusion regarding immunity:

Test	Complies	Remarks
EN 61000-4-2	Yes	Immunity is met up to and including severity level 2 , contact discharge and severity level 3 , air discharge
EN 61000-4-3	Yes	Immunity is met up to and including severity level 3
EN 61000-4-4	Yes	Immunity is met up to and including severity level 3
EN 61000-4-5	Yes	Immunity is met up to and including severity level 4, line to PE and severity level 3 line to line
EN 61000-4-6	Yes	Immunity is met up to and including severity level 3
EN 12966	Yes	Requirements of table 11 and 12 are met



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3. Introduction

3.1 General

Rotapanel International B.V. commissioned DSA-ETL to carry out an EMC test of a Rotapanel control.

This test has been prepared by Rotapanel International B.V. and Signaal. As a result of this an EMC Testplan has been prepared which is included in this report.

The test has been attended by:

Rotapanel International B.V.: Mr. H.G. Born
 Signaal: Mr. A.A.G. Sogtoen

3.2 Equipment Under Test (EUT)

The Equipment Under Test (EUT): Rotapanel control
 Type: RP-2000
 Kind of equipment: Industrial equipment
 Tested types in 2007: RP-2000 (Modbus), RP-2000 profibus

3.3 Manufacturer

Rotapanel International B.V.

3.4 Supplier

Rotapanel International B.V.

3.5 Performance criteria: EN 50082

A: 'no influence'

The apparatus shall continue to operate as intended. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer when the apparatus is used as intended.

B: 'temporary influence, self-recoverable'

The apparatus shall continue to operate as intended after the test. During the test degradation of performance is allowed. No change of actual operating state or stored data is allowed.

C: 'manual reset allowed'

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

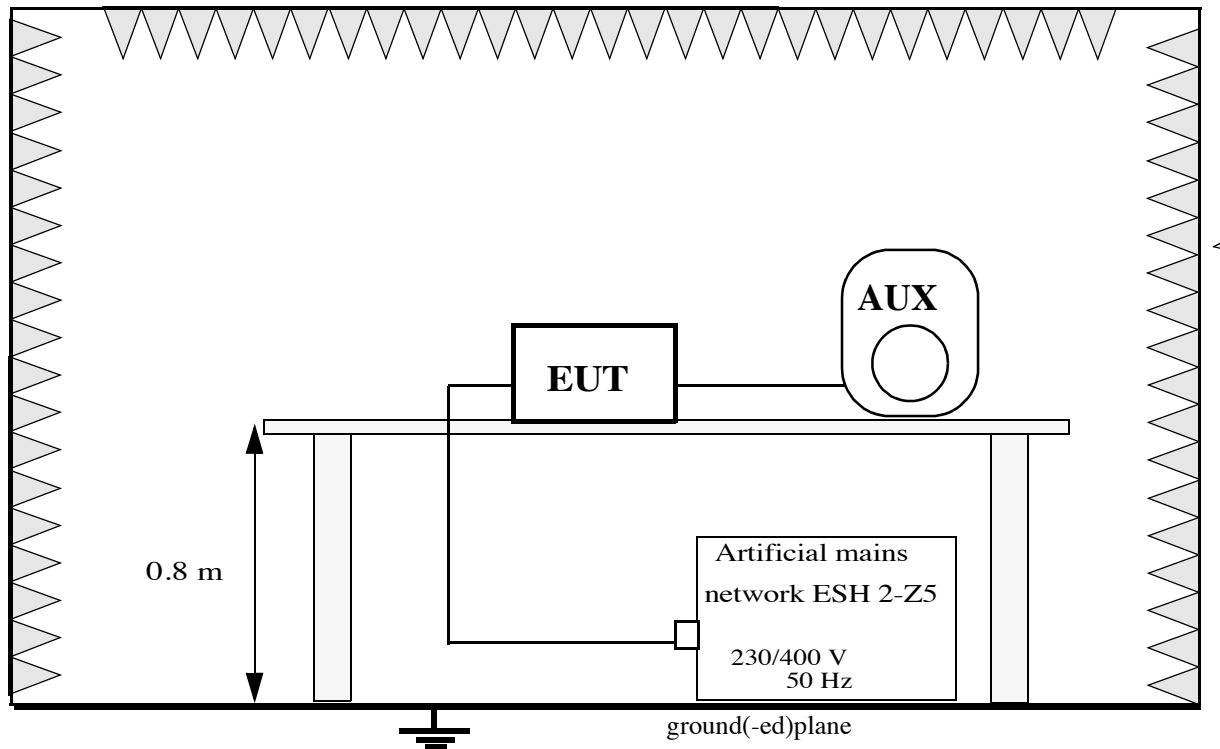


For all levels up to and including severity level 3: the apparatus shall not become dangerous or unsafe as a result of the application of the test.

* For more detail see generic immunity standard EN 61000-6-x.

3.6 EUT set-up

The EUT has been set-up in SEC 2 as indicated below:



Test set-up in SEC 2

The EUT controlled a PVMS (Prismatic Variable Message Signs) which turned with a dwell time set to 1 sec.



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3.7 Simulation of the functional behaviour of the EUT

The functional behaviour is simulated by means of:

The Rotapanel control was connected to PVMS (Prismatic Variable Message Signs), which was simulating the rotation of bill boards.

Condition(s) of the EUT: normal operation, rotating dwell time was set to 1 sec.

3.8 Registration of the behaviour of the EUT

The following equipment has been used for the registration of the parameters assessed:

A video camera was used to monitor the bill board unit

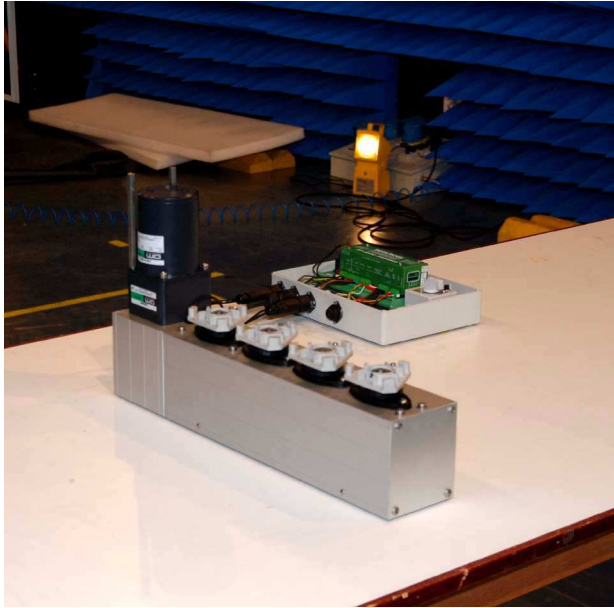
3.9 Modifications to meet the requirements

The EUT did meet the requirements without any modification



Photograph of the EUT (2000)





Photograph of the EUT (2007)



4. Emission Tests

4.1 EN 55011 Conducted emission testing, ISM-equipment, 0,15 - 30 MHz

Standards

EN 50081-2, 1993

Basic standard

EN 55011, 1991-03 Limits and methods for radio interference characteristics of industrial, scientific and medical radio-frequency equipment.

Objective

The objective of this test is to establish whether or not the EUT causes a conducted interference on the mains supply with respect to the limits as prescribed by this standard.

Requirements

Class A equipment limits dB (μ V)					Class B equipment limits dB(μ V)	
Frequency band MHz	Group 1		Group 2		Group 1 & 2	
	Quasi peak	Average	Quasi peak	Average	Quasi peak	Average
0,15 - 0,50	79	66	100	90	66 decreasing with logarithm of frequency to 56	56 decreasing with logarithm of frequency to 46
0,50 - 5	73	60	86	76	56	46
5 - 30	73	60	90 decreasing with logarithm of frequency to 70	80 decreasing with logarithm of frequency to 60	60	50

Note: The Group1 limits are identical to the EN 55022 requirements for ITE-equipment, except that the meaning of the Classes is different.



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Separation into groups

- * Group 1 ISM equipment contains all ISM equipment in which there is intentionally generated and/or used conductively coupled radio frequency energy which is necessary for the internal functioning of the equipment itself.
- * Group 2 ISM equipment contains all ISM equipment in which radio frequency energy is intentionally generated and/or used in the form of electromagnetic radiation for the treatment of material, and spark erosion equipment.

Division into classes

- * Class A equipment is equipment suitable for use in all establishments other than domestic and those directly connected to a low voltage power supply network which supplies buildings used for domestic purposes.
- * Class B equipment is equipment suitable for use in domestic establishments and in establishments directly connected to a low voltage power supply network which supplies buildings used for domestic purposes.

Test procedure

In accordance with EN 55011 and C.I.S.P.R. 16 (specification for radio interference measuring EUT and measuring methods).

The Rohde & Schwarz software ES K1 will be used to carry out this test.

Test equipment

	Bar Code	Calibration up to week
Rohde and Schwarz ESH2-Z5, LISN	25337	41-2000
Rohde and Schwarz, test-receiver type ESS	57994	50-2000

Verification

Preceding to the test an ambient measurement has to be carried out, the ambient level has to be at least 6 dB below the test result of the EUT.

Test results

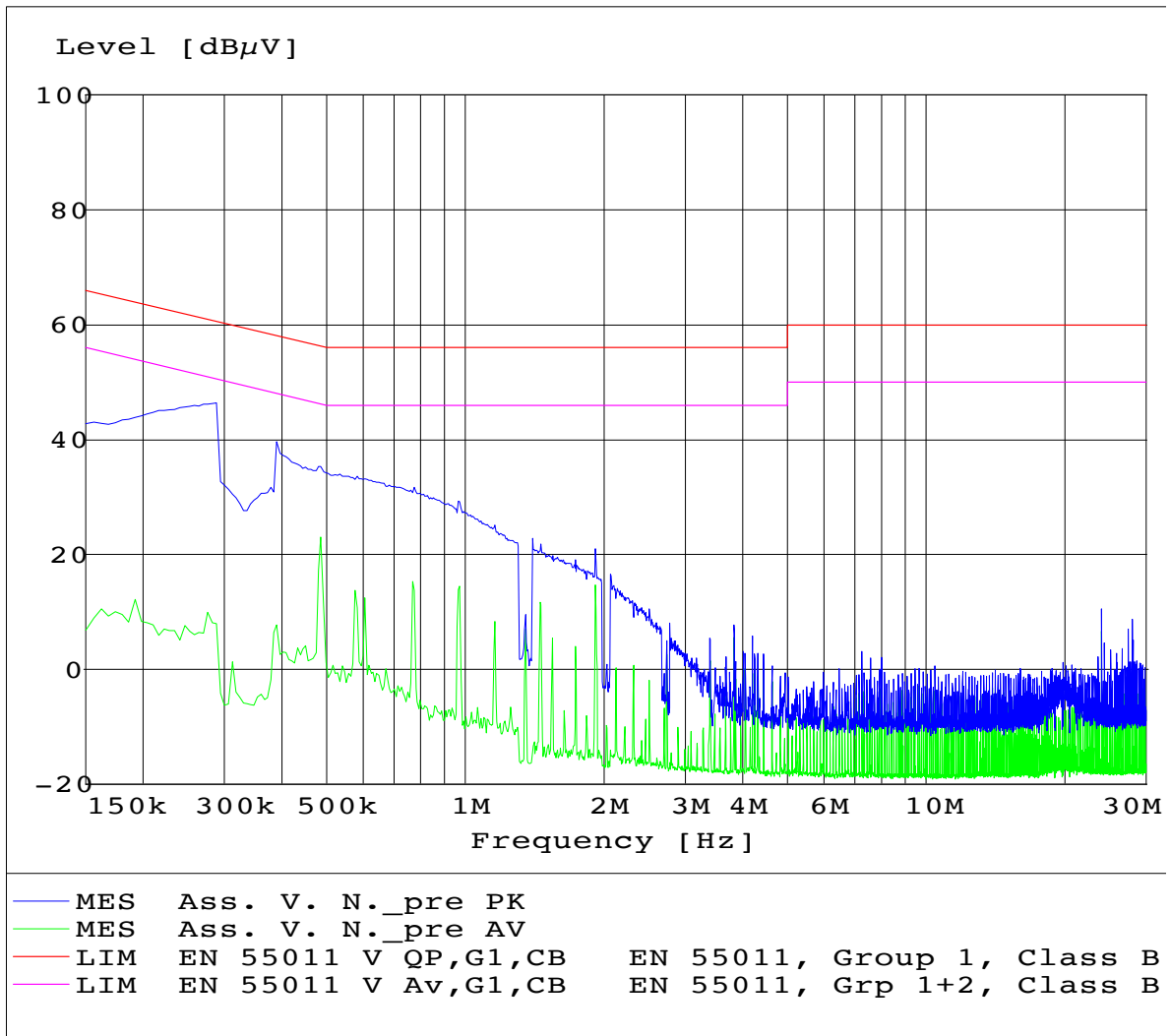
The EUT meets the requirements of Group 1, Class B.

For quasi peak the minimum margin found was 19 dB at 300 kHz

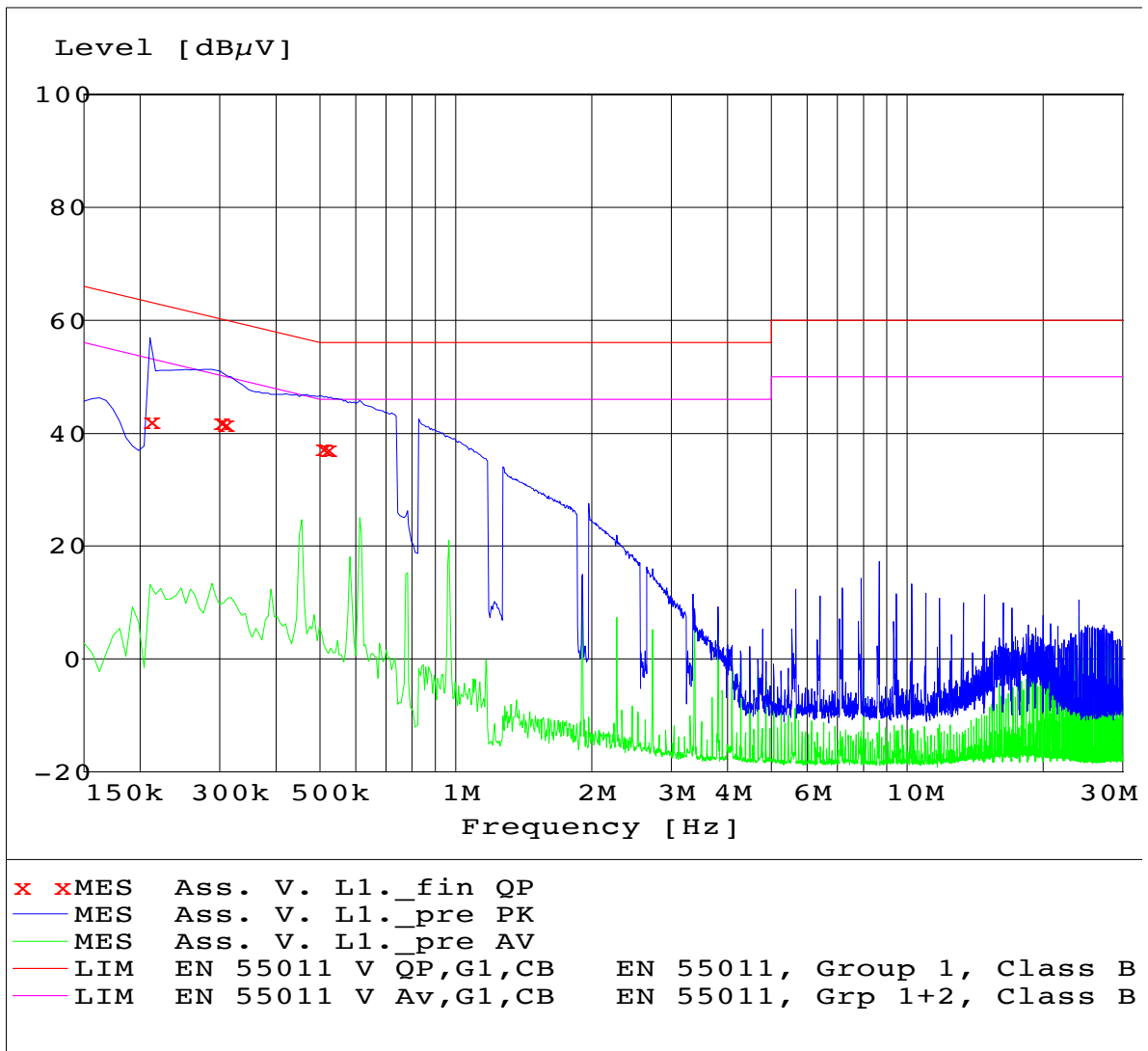
Detailed results are given in the Rohde & Schwarz files added to this report.



EN 55011 Conducted emission testing, ISM-equipment, 0,15 - 30 MHz, line neutral



EN 55011 Conducted emission testing, ISM-equipment, 0,15 - 30 MHz, line phase (L1)



4.2 EN 55011 Radiated emission testing, ISM-equipment, 30 - 1000 MHz

Standards

EMC-D: EN 50081-2, 1993

Basic standard

EN 55011, 1991-03 Limits and methods for radio interference characteristics of industrial, scientific and medical radio-frequency equipment.

Objective

The objective of this test is to establish whether or not the EUT causes a radiated interference with respect to the limits as prescribed by this standard.

Requirements

Electromagnetic radiation disturbance limits for group 1 equipment

Frequency band MHz	Measured on a test site	
	Class A 30 m measurement distance dB μ V/m	Class B 10 m measurement distance dB μ V/m
0,15 - 30	u.c.	u.c.
30 - 230	30	30
230 - 1000	37	37

u.c. = under consideration

Division into classes

* Class A equipment is equipment suitable for use in all establishments other than domestic and those directly connected to a low voltage power supply network which supplies buildings used for domestic purposes.

* Class B equipment is equipment suitable for use in domestic establishments and in establishment directly connected to a low voltage power supply network which supplies buildings used for domestic purposes.



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Test procedure

In accordance with EN 55011, and C.I.S.P.R. 16 (specification for radio interference measuring EUT and measuring methods) as well as in accordance with EN 50147 (alternative test sites since the OATS, open area test site as referred to in C.I.S.P.R. 16, will not be used).

The EUT will be placed on a metal reference ground plane on an insulating support of 10 cm height, a connection between the EUT and reference plane shall not be better than in the final application of the EUT on site.

A receiving antenna will be placed towards the front as well as towards the back side of the EUT, at those frequencies where the emission level is close to the limit, a height scan of the antenna will be carried out.

Since the antenna distance will be 3 m a 20 dB correction for Class A and a 10 dB correction for Class B will be applied.

During this test the mains supply will still be taken from the LISN in order to have a reproducible mains impedance.

The Rohde & Schwarz software ES-K1 will be used to carry out this test.

Test equipment

	Bar Code	Calibration up to week
Rohde and Schwarz test receiver, type ESS	57994	50-2000
ARA SAS 2a active antenna	51270	32-2000
EATON 533-11M impulse generator	44894	41-2000

Verification

Preceding to the test an ambient measurement has to be carried out, the ambient level has to be at least 6 dB below the result of the test result of the EUT.

Test results

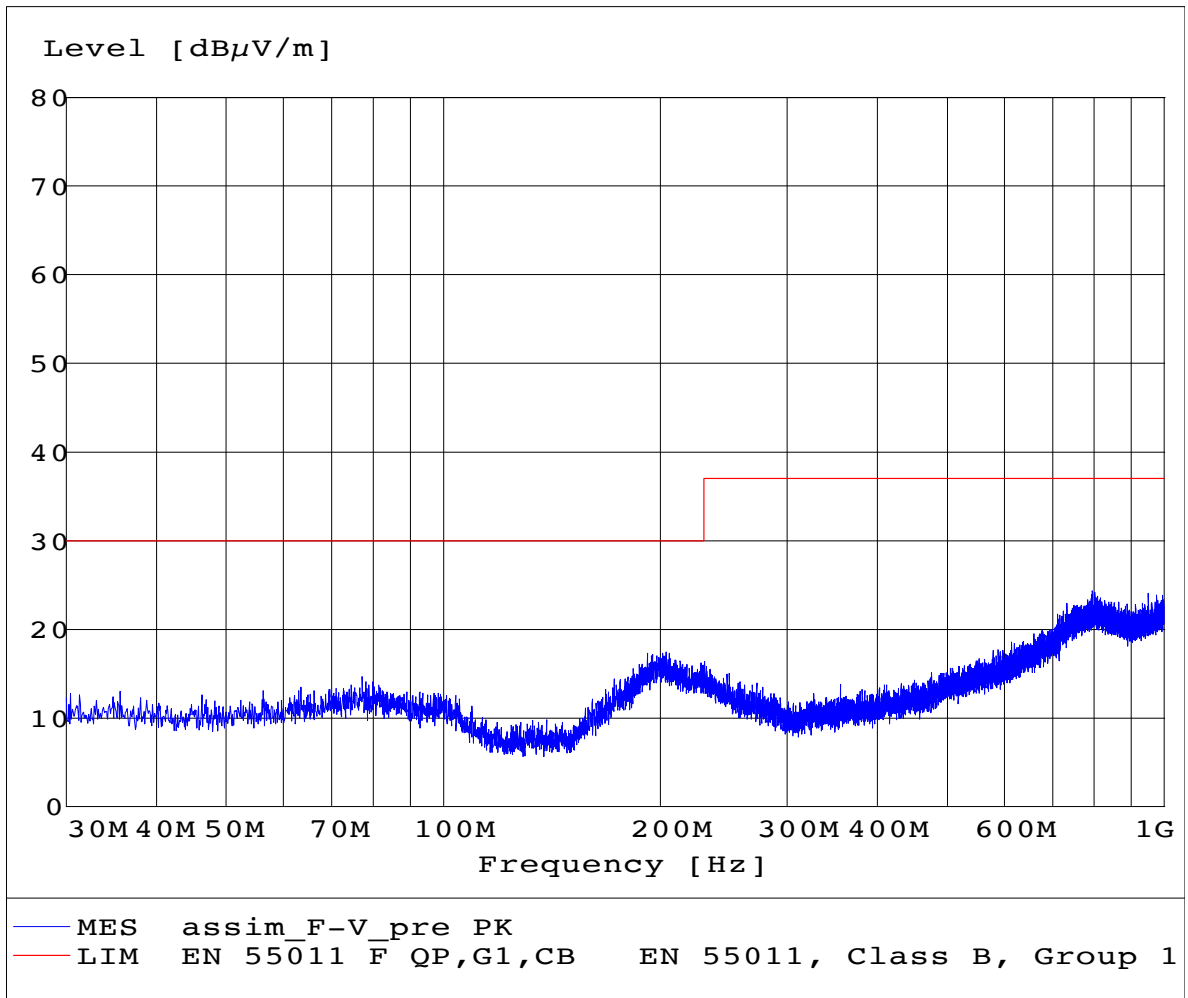
The EUT meets the requirements of Group 1, Class B.

For quasi peak the minimum margin found was 11 dB at 198 MHz

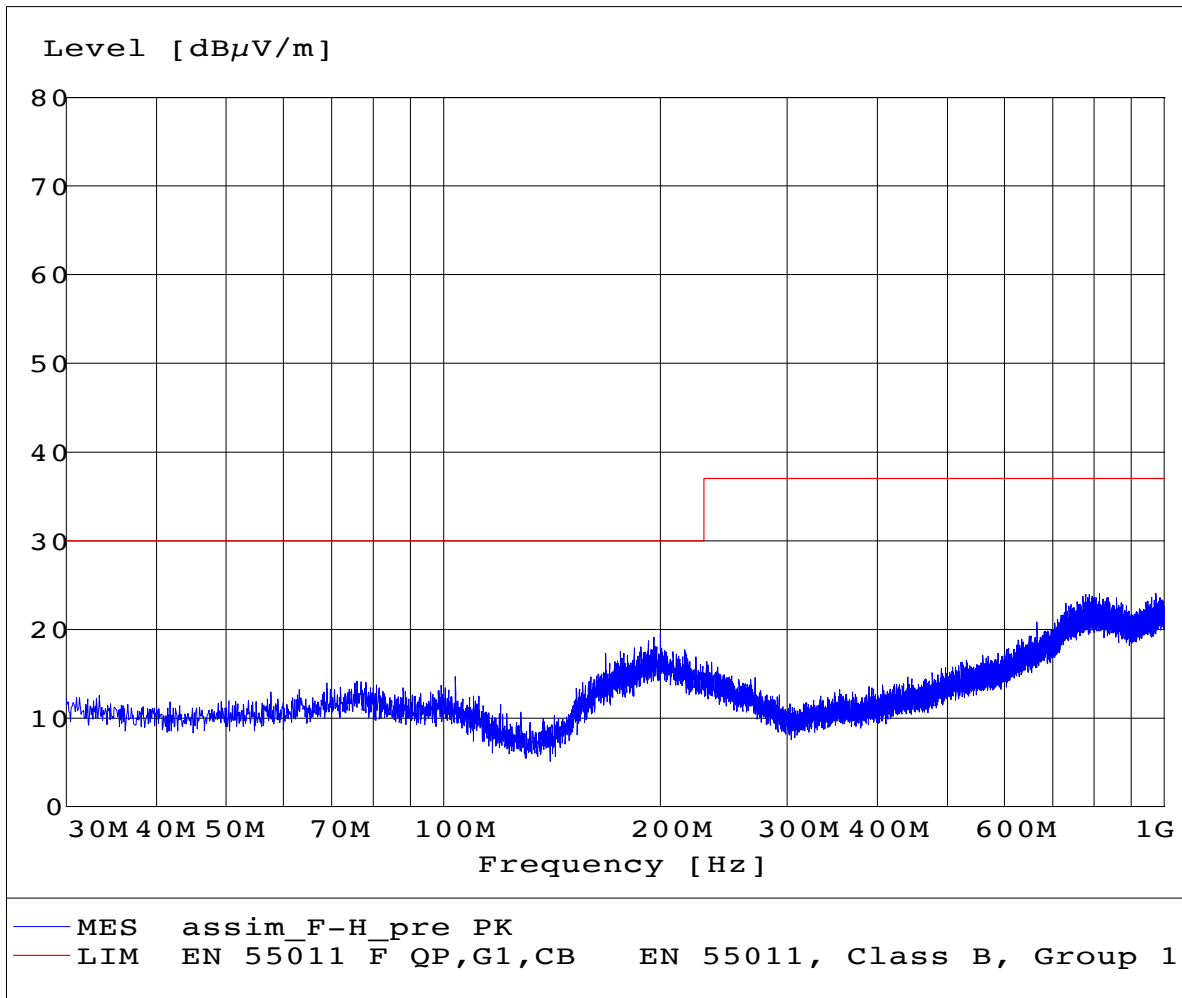
Detailed results are given in the Rohde & Schwarz files added to this report.



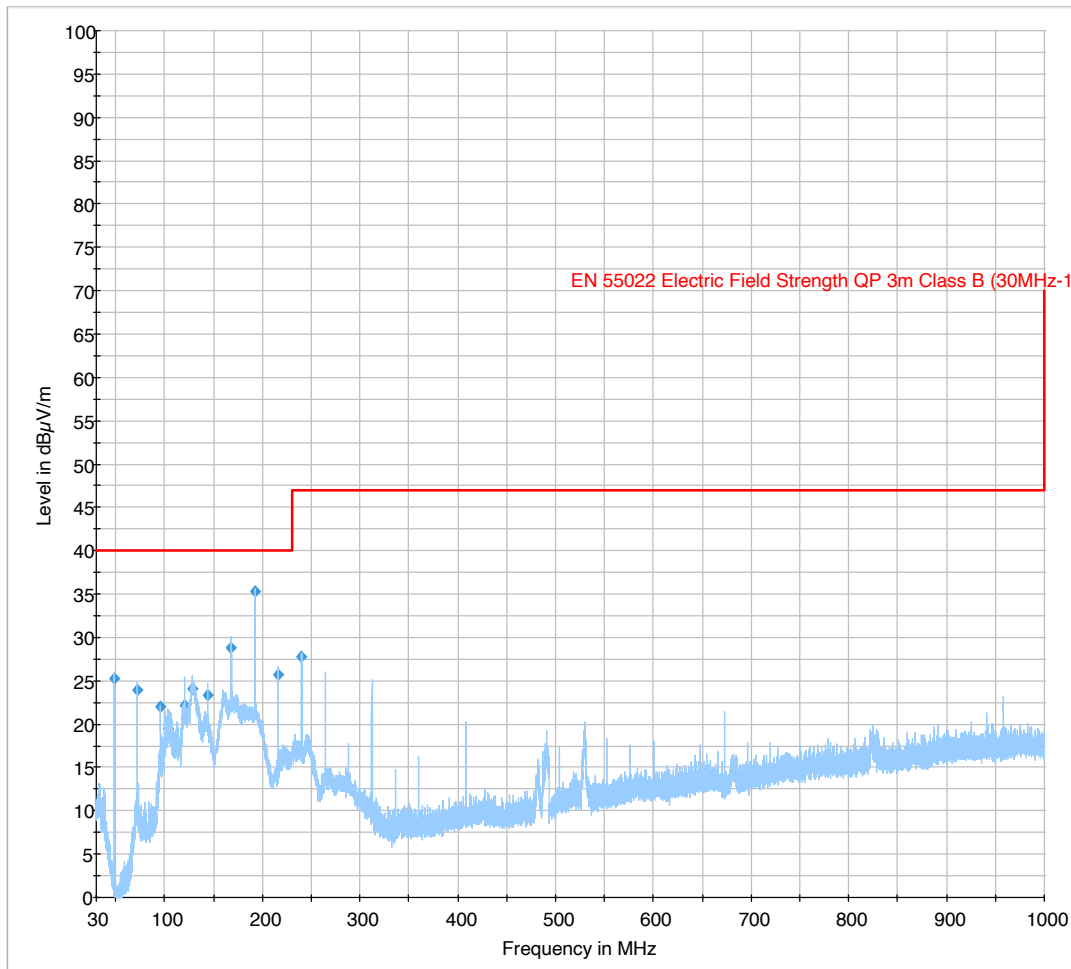
Radiated emission testing, ISM-equipment, 30 - 1000 MHz, polarisation vertical



Radiated emission testing, ISM-equipment, 30 - 1000 MHz, polarisation horizontal



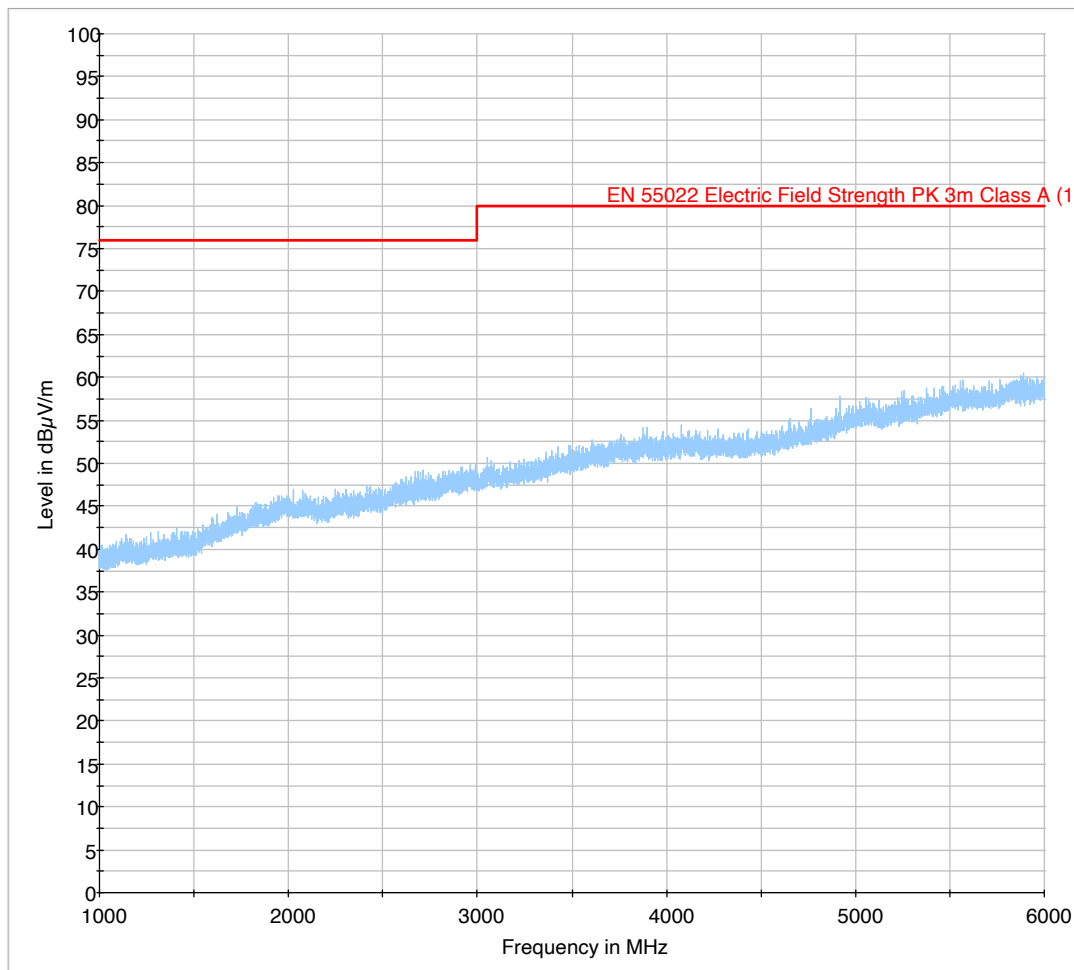
Radiated emission testing according EN 55022 30 - 1000 MHz, 1



Radiated emission



Radiated emission testing according EN 55022 1000 - 6000 MHz, 1



Radiated emission above 1 GHz, both polarisations.



5. IMMUNITY TESTS

5.1 EN 61000-4-2 Electrostatic discharges

Standards

EMC-D: EN 50082-1, 1992

EMC-D: EN 50082-2, 1995

Basic standards

EN 61000-4-2, 1995-03

IEC 1000-4-2, 1995-01

which is derived from:

Electrostatic discharge immunity test

Objective

The objective of this test is to establish whether or not the EUT is susceptible to electrostatic discharges which might occur by charged human beings or objects (indirect discharges).

Therefore discharges are applied to points of the EUT that can be touched during normal operation including those points which are accessible for maintenance by the user.

Requirements

discharge	severity level	test voltage	requirements	
			50082-1	50082-2
air	1	+/- 2 kV	not specified	not specified
	2	+/- 4 kV	not specified	not specified
	3	+/- 8 kV	B	B
	4	+/- 15 kV	not specified	not specified
contact	1	+/- 2 kV	not specified	not specified
	2	+/- 4 kV	B	B
	3	+/- 6 kV	not specified	not specified
	4	+/- 8 kV	not specified	not specified
indirect	1	+/- 2 kV	not specified	not specified
	2	+/- 4 kV	B	B
	3	+/- 6 kV	not specified	not specified
	4	+/- 8 kV	not specified	not specified

Assessment criteria



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B, explanation in par. 3.5.

Test procedure

IEC 1000-4-2 Par 7 and 8, summary:

The EUT has to be placed on a metal reference ground plane on an insulating support of 10 cm height.

The static electricity will be applied only to those points and surfaces which are accessible to personnel during normal usage (which includes customer's maintenance).

Therefore tests will be carried out with cabinet doors closed as well as cabinet doors open if applicable.

Indirect discharges have to be applied to the horizontal and vertical coupling plane by means of contact discharges.

The application of discharges to any point of the equipment, which is accessible only for maintenance purposes, will not be carried out if there is written an agreement upon by manufacturer and user.

Attention has to be paid to the routing of the ground strap of the test generator:

for table-top equipment it is not critical

for floor-standing equipment is shall be kept away from the EUT as far as possible by pulling at it with one hand, while the other hand holds and operates the MiniZap.

1 - Switch on the ESD-generator and in case the MiniZap is used: check the battery level.

In case of an empty battery, this shall be loaded before the test can be continued

2 - The ESD-generator shall always be held in a perpendicular position with respect to the EUT.

3 - Start with a search for susceptible points by using a repetition rate of 10 or 20 pulses/s.

4 - Record and mark such points, if any.

5 - Carry out the final test by switching the ESD-generator to 1 pulse/s. Then apply at least 10 discharges at each point marked.

6 - If the EUT does not react, it meets the requirements.

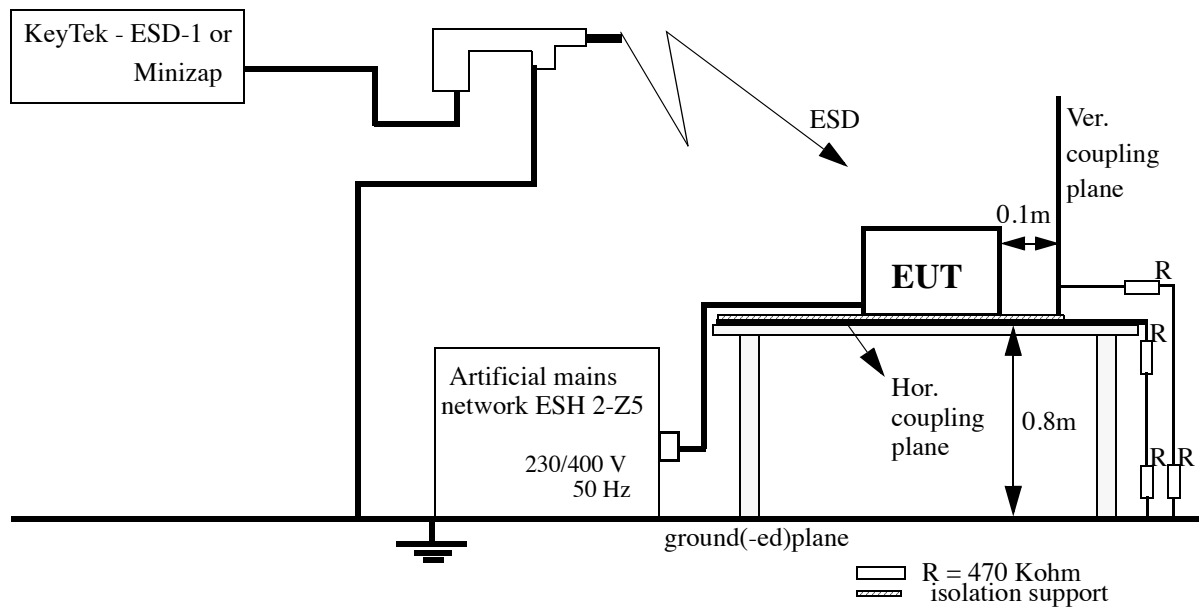
If the EUT does react temporarily, class B, it meets the requirements.

If the EUT does not recover automatically from the changed state, it does not meet the requirements.

Test equipment

	Bar Code	Calibration up to week
Keytek ESD-system or Keytek MiniZap	57286	49-2000
VCP, vertical coupling plane	57286	not applicable





Test set-up for table-top equipment

Verification

Preceding to the test the generator shall be inspected by generating visible sparks, in air as well as in contact mode.

Test results

The EUT meets the requirements.

Condition of the EUT: See para. 1.6

The following points have been chosen to discharge on: All points accessible for human touch. Any influences of the EUT were not established, this implies that the EUT meets the Class A performance criterion.



5.2 EN 61000-4-3 Electromagnetic radiation - radiated immunity

Standards

EMC-D: EN 50082-1, 1992
EMC-D: EN 50082-2, 1995

Basic standards

EN 61000-4-3, 1996-09 and ENV 50140, 1295-03 which are derived from:
IEC 1000-4-3, 1995-02 + Amd. 1 1998-06

Radiated radio frequency electromagnetic field immunity test

Frequency range: 80 MHz to 1000 MHz
Modulation: 80 % AM (amplitude modulation) with 1 kHz sinewave
Additionally tested (2007): Same conditioning as above, with extended range to 3 GHz.

Objective

The objective of this test is to establish whether or not the EUT is susceptible to electromagnetic fields as produced by radiocommunication, walkie-talkies, local fields generated by high frequency currents etc.

Requirements

severity level	Field strength	requirements	
		50082-1	50082-2
1	1 V/m	not specified	not specified
2	3 V/m	A	not specified
3	10 V/m	not specified	A
4	open	not specified	not specified

Notes:

1. ENV 50140 as well as ENV 50204 specify a test at 900 MHz (G.S.M. phones): "in addition a single test is made at 900 MHz +/- 5 MHz, 100 % modulated by 200 Hz pulses of equal mark/space ratio".
2. EN 50082-2 allows a 10 dB relaxation at the ITU broadcast frequency bands: 87 - 108 MHz, 174 - 230 MHz and 470 - 790 MHz (all +/- 1,5 MHz).
3. In general Note 2 is NOT applicable to product standards and company standards.
4. Product- and company standards may require for the ISM-frequencies 143 and 400 MHz a 6 dB higher test level.

Assessment criteria

A, explanation in par. 3.5. of the introduction.



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Test procedure

EN 61000-4-3 Par 7 and 8, summary:

The tests will be executed in our semi-anechoic or full-anechoic rooms (size resp. 12m x 7,3m x 5,3m, and 9,15m x 5,50m x 3,70m). In the semi-anechoic room the field uniformity meets the requirements with additional absorbers on the floor.

Preceding to the test the field uniformity (0 dB to max + 6 dB over at least 75 % of the surface) can be demonstrated in a surface identical to that of the EUT. If necessary, for large EUT's the test can be carried out in parts.

The test will be carried out with cabinet doors closed, as well as with doors opened if applicable. A test with the doors opened is for information purposes only.

The antenna distance is 3 m.

In principle all 6 sides of a cubicle have to be illuminated, however in practice normally only the front side and back side will be illuminated.

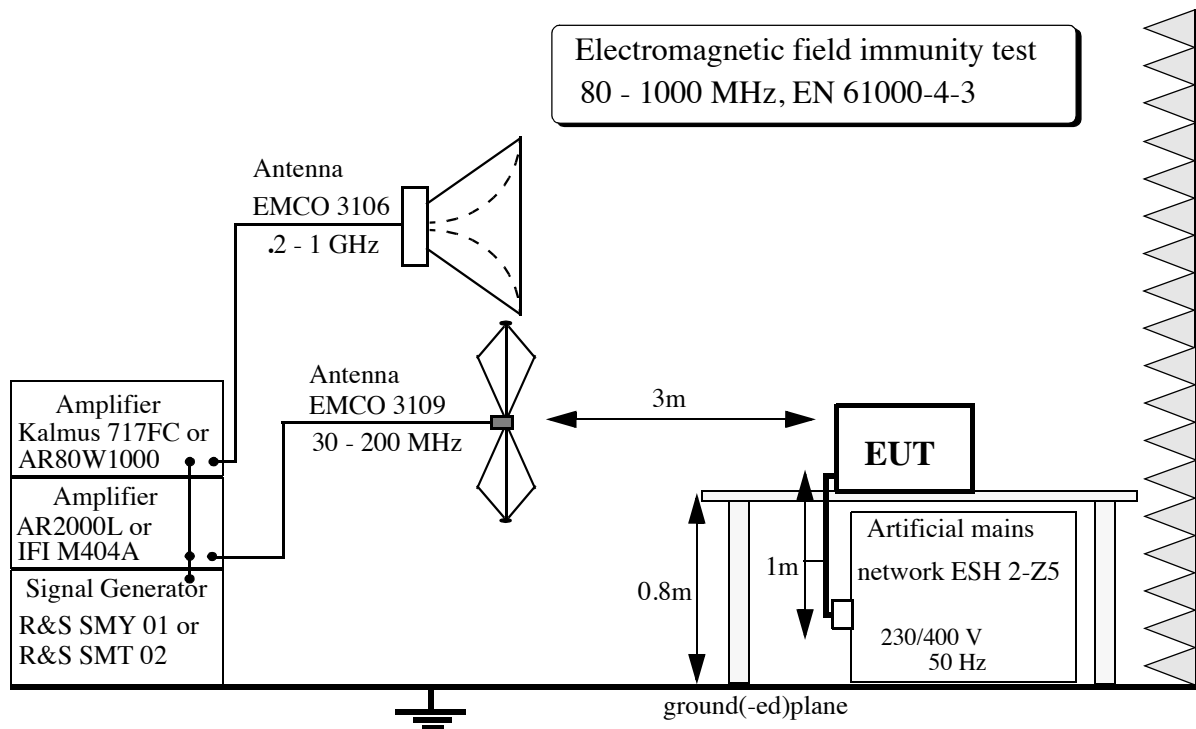
A frequency synthesizer will be used and therefore the frequency band will be swept at a step size of 1 % of the start and thereafter 1 % of the preceding value.

The Rohde & Schwarz software EMS-K1, will be used to control this test.

The dwell time at each frequency shall not be less than the time which is needed by the EUT to respond.

Sensitive frequencies like clock frequencies and harmonics of frequencies of dominant interest will be analyzed separately.





Test set-up for table-top equipment

Note: In the semi-anechoic chambers additional floor absorbers have to be used.

Test equipment

	Bar Code	Calibration up to week
Signaal full-anechoic room	61429	48-2007
Generators	52280	49-2000
Power amplifier, 100 W - 2000 W	51506 - 13602 61376 - 61475	31-2000 48-2007
antennas	25479 13641 61333	49-2000 49-2000 48-2007
Holiday field sensor	58197	49-2000

Verification

During the test the field strength should be monitored with the Holiday field sensor, it should be noted however that the absolute value will depend on the properties of the EUT. In case of doubt the absolute values can be verified in an empty room.

The Rohde & Schwarz program EMS-K1 is most suitable to carry out this verification.

An oscilloscope has to be used to verify the modulation depth and frequency.



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Test results

The EUT meets the requirements

Condition of the EUT: see para. 1.6

Only the front side of the EUT has been illuminated because the size of the EUT was small in comparison to the illuminated volume of the radiated field.

The dwell time has been set to 1 s.

Any influences on the EUT were not established, this implies that the EUT meets the Class A performance criterion.

Photograph of the set-up

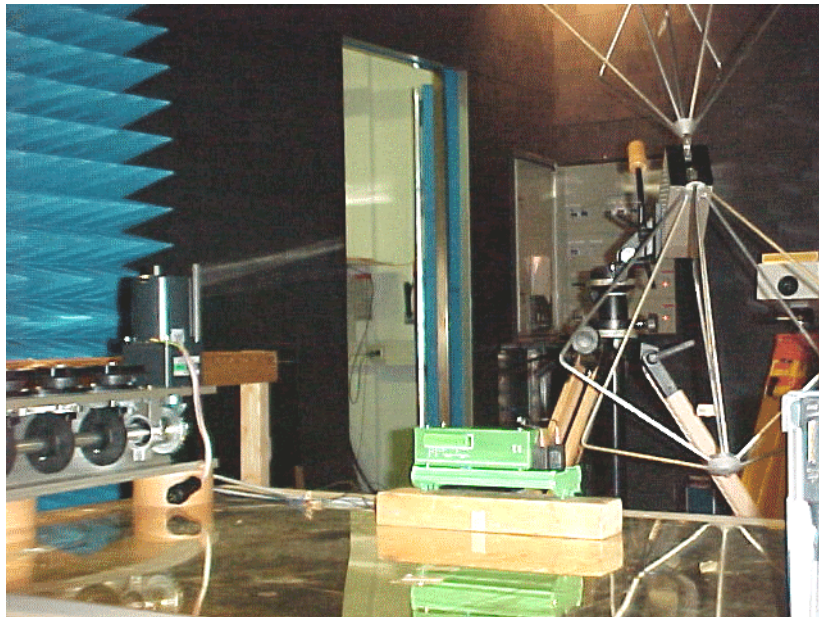


Photo : Illumination of the front-side of the EUT



5.3 EN 61000-4-4 Electrical Fast Transient/Burst

Standards

EMC-D: EN 50082-1, 1992

EMC-D: EN 50082-2, 1995

Basic Standard

EN 61000-4-4, 1995-03 which is derived from:

IEC 1000-4-4, 1995-04 Electrical fast transient/burst requirements, 1995-01

Objective

The objective of this test is to establish whether or not the EUT is susceptible to the voltage transients caused by switching (inductive) loads which are connected to the mains. This includes switching activities on all lines (non-symmetrical) with respect to reference ground as well as a common mode test on interface cables. The latter is to test the effects of cross talk from mains cables to interface cables.

Requirements

coupling	severity level	test voltage	requirements	
			50082-1	50082-2
on power supply lines AC and DC as well as ports for process control	1	+/- 500 V	DC-supply: B	not specified
	2	+/- 1 kV	AC-mains: B	not specified
	3	+/- 2 kV	not specified	B
	4	+/- 4 kV	not specified	not specified
on I/O, signal, data and control lines not involved in process control	1	+/- 250 V	not specified	not specified
	2	+/- 500 V	B	not specified
	3	+/- 1 kV	not specified	B
	4	+/- 2 kV	not specified	not specified

Signal lines of which the manufacturer declares that these shall not be longer than 3 m are not tested.

Note: For all levels: the EUT shall not become dangerous or unsafe as a result of the application of the test.



Assessment criteria

B, explanation in par. 3.5.

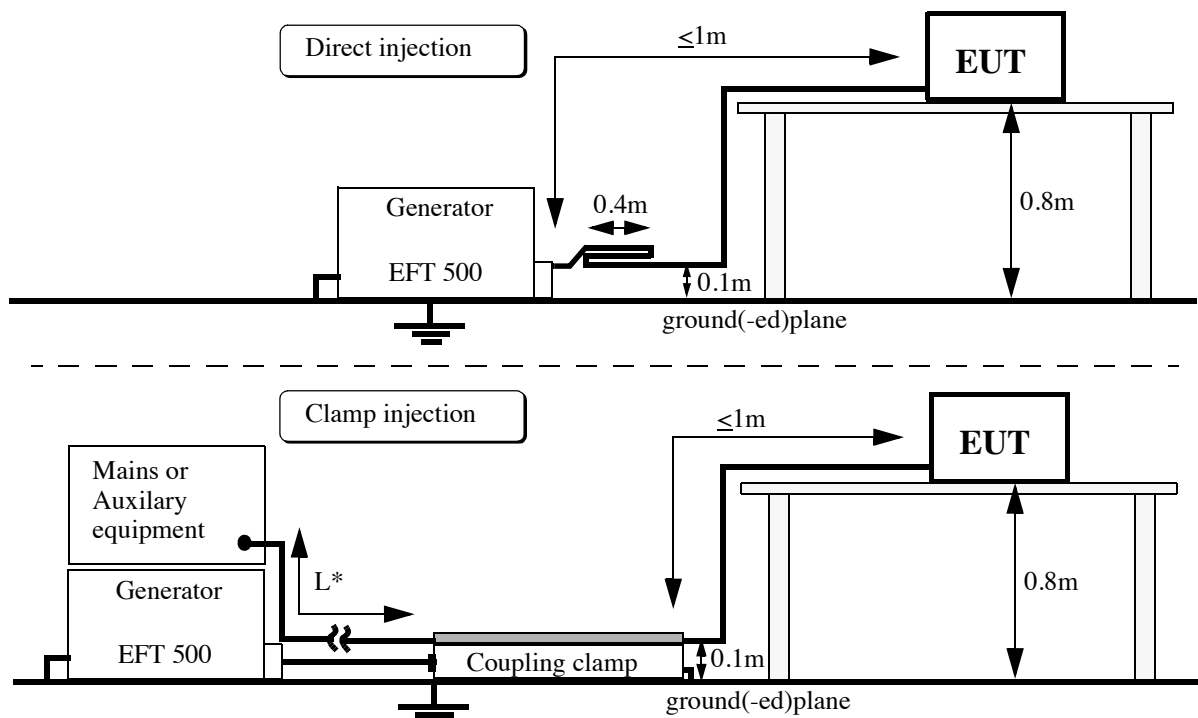
Test procedure

EN 61000-4-4 Par. 7 and 8, summary:

The EUT has to be placed on a metal reference ground plane on an insulating support of 10 cm height.

The test time will be approximately 10 minutes for each condition of the EUT and each coupling mode. In addition to the supply line all lines that may be longer than 3 m are tested. (Only those lines of which the manufacturer expressly declares that these should not be longer than 3 m are excluded from testing.)

Kies de figuur die van toepassing is



* distance between Coupling clamp and mains or auxiliary equipment = 5 x distance Coupling clamp and EUT for decoupling purposes.

Typical test set-up for table-top equipment

Note: The EUT shall only be connected to the ground plane if such a separate ground connection is prescribed by the manufacturer for normal use.



Test equipment

	Bar Code	Calibration up to week
EM-test EFT 500 Generator	57276	49-2000
Luthi coupling clamp	55434	32-2000
Tektronix oscilloscope 220	71188	02-2001

Verification

A 400 MHz oscilloscope has to be used to verify the prescribed waveform and amplitude.

Test results

The EUT meets the requirements

The detailed results are given in the table below:

Condition of the EUT: see para. 1.6

IEC 1000-4 test level	Open Voltage	Pulse Freq	Mains, cable length: 1 m (max. length 1m)			
			Indicate if L1	is phase or	neutral:	L1= phase
			L1	L2	L1+L2	L1+L2+PE
2	+ 1000 V	5 kHz	OK	OK	OK	OK
	- 1000 V	5 kHz	OK	OK	OK	OK
3	+ 2000 V	5 kHz	OK	OK	OK	OK
	- 2000 V	5 kHz	OK	OK	OK	OK

OK: Any influences of the EUT were not established, this implies that the EUT meets the Class A performance criterion.



IEC 1000-4 test level	Open Voltage	Pulse Freq	I/O lines longer than 3 meter, proces control			
			Cable 1			
2	+ 1000 V	5 kHz	OK			
	- 1000 V	5 kHz	OK			
3	+ 2000 V	5 kHz	OK			
	- 2000 V	5 kHz	OK			

OK: Any influences of the EUT were not established, this implies that the EUT meets the Class A performance criterion.

Cable number

1

Signal name or function

I/O cable for auxiliary equipment



5.4 EN 61000-4-5 Surges

Standards

EMC-D: EN 50082-1, 1992
EMC-D: EN 50082-2, 1995

Basic standards

EN 61000-4-5, 1995-02 which is derived from:
IEC 1000-4-5, 1995-02 Surge immunity test.

Objective

The objective of this test is to establish whether or not the EUT is susceptible to the voltage transients caused by switching activities in the mains (heavy loads), failures in the power distribution network or indirect lightning strokes.

Requirements

The severity levels are:	Level	Open-circuit test voltage
	1	0,5 kV
	2	1,0 kV
	3	2,0 kV
	4	4,0 kV

The application of the test levels is given below:

1,2/50 μ s open circuit and 8/20 μ s short circuit pulses on mains and signal lines.

coupling mode		requirements	
		50082-1	50082-2
line to line	AC power inputs and outputs	+/- 1 kV (B)	+/- 2 kV (B)
	DC power inputs and outputs	+/- 500 V (B)* ¹	+/- 500 V (B) * ²
	Process, measurement and control lines	not specified	+/- 1 kV (B)
line to ground	AC power inputs and outputs	+/- 2 kV (B)	+/- 4 kV (B)
	DC power inputs and outputs	+/- 500 V (B)* ¹	+/- 500 V (B) * ²
	Process, measurement and control lines	not specified	+/- 2 kV (B)

*¹: Not applicable to input ports intended for connection to dedicated non-rechargeable power supplies.

*²: Not applicable to input ports intended for connection to a battery which must be removed or disconnected from the EUT for recharging.



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Assessment criteria

B, explanation in par. 3.5.

Test procedure

EN 61000-4-5 Par. 8, summary:

Coupling, AC power line:

Line to line- between phase and neutral through 2Ω and $18\ \mu\text{F}$

Line to ground- between phase and safety earth or between neutral and safety-earth, through 12Ω and $9\ \mu\text{F}$.

Coupling shielded I/O lines:

Direct coupling between the shield and the earth bar of the cabinet, the injection point at the shield should have a distance to the cabinet of at least 20 m.

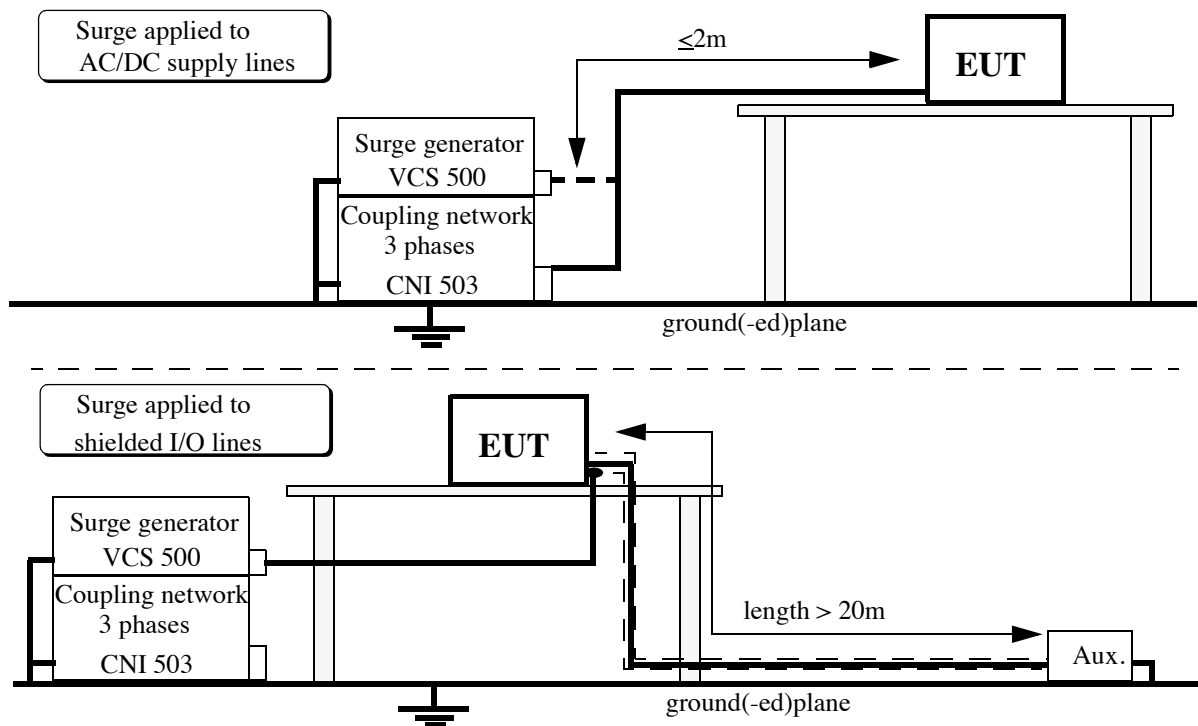
This implies that the total length of the test cables has to be app. 30 m.

Coupling unshielded I/O lines:

See the basic standard

Test duration of each condition: a minimum of five pulses of each polarity at each condition of the EUT, to be repeated at the following phase angles: 0° , 90° and 270° , pulse repetition time min. 60 s.





Typical test set-up for table-top equipment

Note: The EUT shall only be connected to the ground plane if such a separate ground connection is prescribed by the manufacturer for normal use.

Note: The EUT shall only be connected to the ground plane if such a separate ground connection is prescribed by the manufacturer for normal use.

Test equipment

	Bar Code	Calibration up to week
EM-test VC-5 500 Generator	56873	49-2000
3-phase coupling network EM test 503	56874	49-2000
Tektronix oscilloscope 220	71188	02-2001

Verification

A 400 MHz oscilloscope has to be used to verify the prescribed waveform and amplitude.



Test results

The EUT meets the requirements

Condition of the EUT: see para. 1.6

IEC 1000-4 test level	Open Voltage	Line to Earth coupling: 2 Ohm +10 Ohm and 9 μ F			
		Neutral - Safety Earth		Phase - Safety Earth	
		0	90	270	
2	+ 1000 V	10A	10A	10A	10A
	- 1000 V	-10A	-10A	-10A	-10A
3	+ 2000 V	20A	20A	30A	20A
	- 2000 V	-20A	-20A	-20A	-30A
4	+ 4000 V	100A	90A	90A	80A
	- 4000 V	-100A	-90A	-80A	-100A

IEC 1000-4 test level	Open Voltage	Line to Line coupling: 2 Ohm and 18 μ F		
		Phase - Neutral		
		0	90	270
2	+ 1000 V	160A	290A	50A
	- 1000 V	-160A	-50A	-280A
3	+ 2000 V	580A	710A	470A
	- 2000 V	-560A	-430A	-700A

Any influences of the EUT were not established, this implies that the EUT meets the Class A performance criterion.



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Cable number	Signal name or function	Result of the test
1	I/O cable for auxiliary equipment	
I/O line SW.1	up to +/- 2 KV	0A / -0A
I/O line SW.2	up to +/- 2 KV	0A / -0A
motor CW	up to +/- 2 KV	10A / -10A
CCW	up to +/- 2 KV	10A / -10A

Any influences of the EUT were not established, this implies that the EUT meets the Class A performance criterion.



5.5 EN 61000-4-6 Electromagnetic radiation - conducted immunity

Standards

EMC-D: EN 50082-1
EMC-D: EN 50082-2

Basic standards

EN 61000-4-6, 1996-07 and ENV 50141, 1993-08 which are derived from:
IEC 1000-4-6, 1996-03 Immunity to conducted disturbances induced by radio frequency fields.

Frequency range: 150 kHz to 80 MHz (230 MHz)
Modulation: 80 % AM (amplitude modulation) with 1 kHz sinewave

Objective

The objective of this test is to establish whether or not the EUT is susceptible to the currents through cables or cable shields induced by electromagnetic fields. EN 61000-4-6 gives the 'translation' of such fields into open voltages (emf) to be applied to the injection networks.

Requirements

severity level	voltage level (emf)		requirements	
	U _o [dBmV]	U _o [V]	50082-1	50082-2
1	120	1	not specified	not specified
2	130	3	A	not specified
3	140	10	not specified	A
4	open	open	not specified	not specified

Signal lines of which the manufacturer declares that these shall not be longer than 1 m are not tested.

Notes

- 1 EN 50082-2 allows a 10 dB relaxation at the ITU broadcast frequency band: 47 - 68 MHz.
- 2 In general Note 1 is NOT applicable to product standards and company standards.
- 3 Product- and company standards may require for the ISM-frequencies 13 MHz, 27,125 MHz, 40 MHz and 143 MHz (all +/- 1,5 MHz) a 6 dB higher test level.
- 4 Product- and company standards may require a frequency overlap with respect to radiated Immunity, therefore the upper limit of 80 MHz might be increased to 230 MHz.

Assessment criteria

A, explanation in par. 3.5 of the introduction.



Test procedure

EN 61000-4-6 Par. 8, summary:

The EUT has to be placed on a metal reference ground plane on an insulating support of 10 cm height.

The test levels are based on the assumption that the impedance of a wire or cable above a reference plane is 150Ω , therefore the EUT has to 'see' 150Ω towards the reference plane.

The em-clamp will be placed successively around each cable (mains and I/O) of the EUT in order to inject a hf-current in that cable.

A frequency synthesizer will be used and therefore the frequency band will be swept at a step size of 1 % of the start and thereafter 1 % of the preceding value.

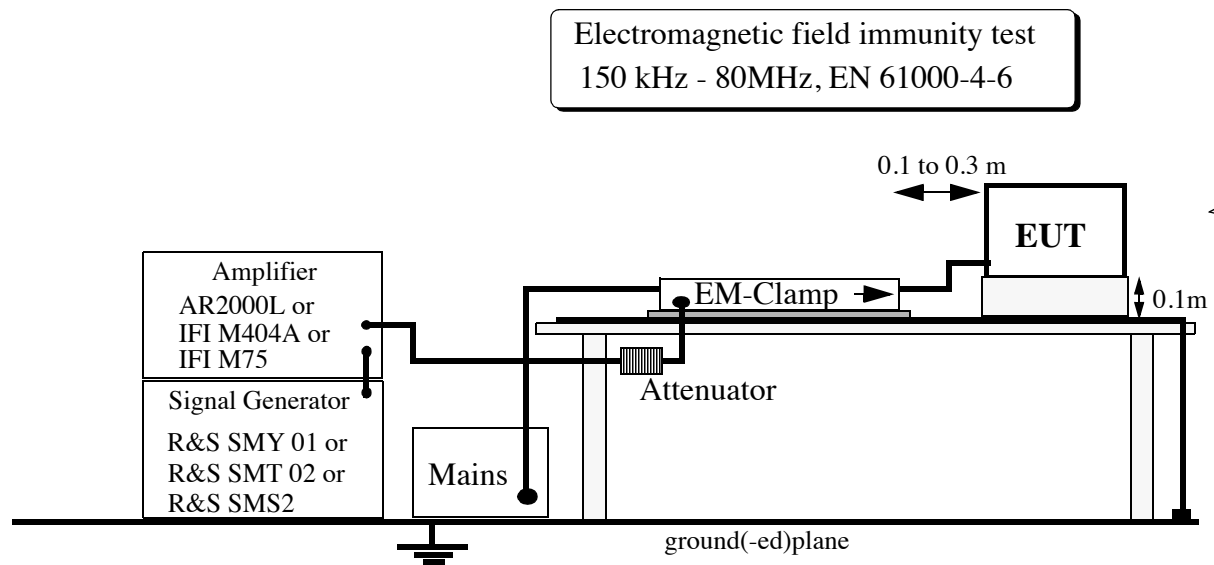
The dwell time at each frequency shall not be less than the time which is needed by the EUT to respond.

The Rohde & Schwarz EMS-K1 software will be used to carry out this test.

Sensitive frequencies like clock frequencies and harmonics of frequencies of dominant interest will be analyzed separately.

These frequencies have been supplied by the manufacturer of the EUT:

8 MHz, clock frequency



Test set-up for table-top equipment



DOCUMENT	TYP	DS	REPORT	SHEET	38 / 40
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Test equipment

	Bar Code	Calibration up to week
Signaal full-anechoic room		
Generators	13743	49-2000
Power amplifier, 10 W - 100 W	57452	not applicable
Luthi coupling clamp EM 101	55434	32-2000
Holaday field sensor	58197	49-2000

Verification

A special set-up has been prepared to verify the test levels , a copper rod terminated with 150 Ohm resistors has to put in the clamp. One of the resistor is split into a 100 Ohm and a 50 Ohm resistor, the voltage across the 50 Ohm resistor has to be measured with a high frequency voltmeter. The Rohde & Schwarz program EMS-K1 is most suitable to carry out this verification.

An oscilloscope has to be used to verify the modulation depth and frequency.

Test results

The EUT meets the requirements

Condition of the EUT: see para. 1.6

The dwell time has been set to 1 s.

Separately analysed frequencies are: 8 MHz

I/O cables tested:

Cable number	Signal name or function	Result of the test
1	I/O cable for auxiliary equipment	OK

Any influences on the EUT were not established, this implies that the EUT meets the Class A performance criterion.



5.6 EN 12966 Electromagnetic radiation - conducted immunity

Standards

n.a.

Basic standards

n.a.

Objective

The objective of this test is to establish whether or not the EUT complies with the requirements on operating voltage range, Power up activation, temporarily overvoltage tests and frequency variations.

Requirements

Table 1. Operating voltage range, Power up activation and temporarily overvoltage tests.

Test sequence	Voltage value	Measurement
1	No Power	No power supply
2	Nominal	Switch on the test module and check that there is no partial, incomplete or false display
3	Nominal	function test
4	Drop to minimum voltage	check that there is no partial, incomplete or false display
5	Drop to 50% of nominal	check that there is no partial, incomplete or false display
6	Nominal	check that there is no partial, incomplete or false display
7	Nominal	function test
8	Raise to maximum	check that there is no partial, incomplete or false display
9	Nominal	check that there is no partial, incomplete or false display
10	Nominal	function test
11	Maximum voltage stated by the protection device	check that there is no partial, incomplete or false display and and there is no visual damage to the test module



Table 1. Operating voltage range, Power up activation and temporarily overvoltage tests.

Test sequence	Voltage value	Measurement
12	Nominal	check that there is no partial, incomplete or false display
13	Nominal	Function test

Table 2. Frequency and Voltage test table.

Test sequence	Frequency value	voltage value
1	49 Hz	lower
2	50 Hz	nominal
3	51 Hz	upper

Signal lines of which the manufacturer declares that these shall not be longer than 1 m are not tested.

Notes

n.a.

Assessment criteria

See table “measurement” in table

Test procedure

The EUT is powered as indicated in table 1 and 2. The checks in the table are executed

Test results

The EUT meets the requirements



DOCUMENT	TYP	DS	REPORT	SHEET	2 / 40
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Qualification Test Report

Test requested by :

Company : 551
 Postal-code and city : Rotapanel International B.V.
 Address : 8938 AB Leeuwarden
 Telephone number : Plutoweg 2
 Fax number : 058 2880000
 Representative(s) : 058 2882830
 H.G. Born

Test carried out by :

Company : Thales Nederland B.V.
 Department : ECC
 Address : P.O. Box 42
 Postal-code and city : 7550 GD Hengelo (O.)
 Telephone number : 074-2482446
 Fax number : 074-2484037

Date :

Date start of test : 22-02-2000 revised 12-7-2007
 Date test completed : 01-02-2000
 Testlocation : 01-02-2000
 Additional tests : 4-7-2007

Copies to: 2 x Hengelo
 2 x **Environmental Test Laboratory**

Test Engineer : Rotapanel International B.V.
 A.A.G. Sogtoen

Signature

b.a. 

Author : J Schuurmans (tests 2007)
 A.A.G. Sogtoen
 J. Schuurmans (2007)

Signature

b.a. 

Report approved by : D.J. Groot Boerle, manager ECC.

Signature

b.a. 