Report No. E10042.00

Test Report

Product	Navtex radio receiver
Name and address of the applicant	Polaris Electronics A/S Kærholt 1, P. O. Box 7957 DK-9210 Aalborg SØ, Denmark
Name and address of the manufacturer	Polaris Electronics A/S Kærholt 1, P. O. Box 7957 DK-9210 Aalborg SØ, Denmark
Model	Sirius-3 Navtex
Rating	100mA, 10-36V DC
Brand name	POLARIS
Serial number	B
Additional information	-
Tested according to	EN 60945 (2002)
Order number	134363-3
Tested in period	2010-02-04 to 2010-02-16
Issue date	2010-02-26

Name and address of the testing laboratory

Nemko

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NORWEGIAN ACCREDITATION TEST 033

ACCREDITED REPORT
REF. NA – TEST 033

An accredited technical test executed under the Norwegian accreditation scheme

Prepared by [Tore Løvlien]	Approved by [Geir Antonsen]

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REVISIONS

Revision #	Date	Order #	Description
00	2010-02-16	134363	-

GENERAL REMARKS

This report applies only to the sample(s) tested. It is the manufacturer's responsibility to assure the additional production units of this product are manufactured with identical electrical and mechanical components. The manufacturer is responsible to the Competent Authorities in Europe for any modifications made to the product, which result in non-compliance to the relevant regulations.

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Opinions expressed within this report regarding general assessments and qualifications for PASS or FAIL to the standards limits and requirements, are not part of the current accreditation. Neither is opinions expressed regarding model variants covered by the testing of this report.

CALIBRATION

All instruments used in the tests given in this test report are calibrated and traceable to national or international standards. Between calibrations all test set-ups are controlled and verified on a regular basis by periodic checks to ensure, with 95% confidence that the instruments remain within the calibrated levels.

MEASUREMENT UNCERTAINTY

Measurement uncertainties are calculated or considered for all instruments and instrument set-ups used during these tests. Uncertainty figures are found in an appendix to this report.

Further information about measurement uncertainties is provided on request.

EVALUATION OF RESULTS

If not explicitly stated otherwise in the standard, the test is passed if the measurement value is equal to or below the limit line, regardless of the uncertainty of the measurement. If the measurement value is above the limit line, the test is not passed - ref. IECEE/CTL (Sec) 056/94 (CTL = Committee of Testing Laboratories).

The instrumentation accuracy is within limits agreed by the IECEE/CTL (ref. Nemko proc. P227).

DESCRIPTION OF TESTED DEVICE (EUT)

SYSTEM DESCRIPTION

Navtex maritime radio receiver: 518kHz (main frequency), 490kHz (local) and 4.209MHz (tropical environment).
The receiver contains radio modules for the 3 frequency bands and a computer with display and touch screen.
The receiver is intended for installation in pilothouses on ships.

Hardware identity and/or version: Frontend 2.2 000-005
Software identity and/or version: Computer 1.2 000-008

PORTS AVAILABLE

This equipment is fitted with the following electrical ports.

PO no.	Port Name	Type	Count	Comment
1	PWR	D-Sub 9 pin male	1	Power supply
2	AUX	D-Sub 9 pin female	1	-
3	USB	USB	1	Printer
4	ECDIS	D-Sub 9 pin female	1	-
5	NMEA	D-Sub 9 pin female	1	GPS input connection
6	ANT	PL connector female	1	Antenna connection

AVAILABLE OPERATING MODES

The following functional operating modes are available and are considered applicable under intended use.

FU no.	Operating mode	Comment	Investigated
1	Normal receiving mode		Yes

ACCESSORIES APPLIED DURING TEST

AE no.	Description	Manufacturer	Type	Serial no.
1	Monitoring PC	Lenovo	N500	-
2	RF Generator	HP	8657B	-
3	GPS receiver (active)	-	-	-

EQUIPMENT MODIFICATIONS

The following equipment modifications were required to achieve compliance with the applied standards.

MO no.	Modification	Purpose
1	Passive components in power supply input port	Pass conducted emission test

ADDITIONAL INFORMATION RELATED TO TESTING

No further information.

GENERAL TEST CONDITIONS

TEST LABORATORY

The following Nemko test sites have been utilized for the tests documented in this report:

	Site	
☐	**GAUSTAD**	(Gaustadalleen 30, N-0314 Oslo, Norway)
☒	**KJELLER**	(Instituttveien 6, N-2027 Kjeller, Norway)
☐	**SKAR**	(Maridalsveien 621, N-0890 Oslo, Norway)

Laboratory accreditation:
NORSK AKKREDITERING – TEST 033
P06 – EMC - Electromagnetic Compatibility
P17 – Environmental Tests

POWER SUPPLIED TO EUT

Filtered electrical power was available for operation of EuT in all the test sites.

Voltage type: 12V DC
Grounding: Grounded through a chassis pin connection

AMBIENT CONDITIONS

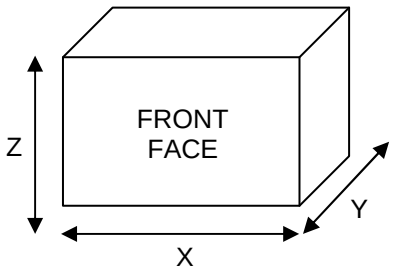
All EMC tests and measurements were performed in a shielded enclosure or in a controlled environment suitable for the tests conducted.

Normal ambient test conditions:

Ambient temperature:	21.2 – 22.4°C
Relative humidity:	19.6 – 38.8%RH
Atmospheric pressure:	99.31 – 101.3kPa

Note: The climatic conditions in the test areas are automatically controlled and recorded continuously.

DEFINITION OF AXIS CONVENTIONS



EVALUATION OF PERFORMANCE

FUNCTIONS MONITORED DURING IMMUNITY TESTS

In order to verify acceptable performance by the EuT during the applied tests, the following functions were monitored:

#	Function	Monitoring method
1	Transmission of data from Pc to equipment under test.	By use of computer software / visual
2	Observation of data integrity	By use of computer software / visual

FUNCTIONAL CHECKS

A verification of correct function was performed before, during and after each test, by the following tests:

#	Functional tests
1	The equipment was operating and functioning before, during and after the tests.
2	Communication with operator and transmission of data was performed continuously
3	Touch screen functionality

PERFORMANCE CRITERIA

In order to pass each test, the EuT shall meet the following criteria:

Criteria	General description	Criteria modified by manufacturer
A	The device shall continue to operate as intended both during and after the test. No degradation of performance or loss of function is allowed below the expected performance level of the device	
B	The device shall continue to operate as intended after the test. No degradation of performance or loss of function is allowed below the expected performance level of the device	
C	Temporary loss of function during test is allowed, provided the function is self-recoverable or can be restored by the operation of the controls	

SUMMARY OF TESTING

APPLIED STANDARDS

» **EN 60945 (2002)** *Maritime navigation and radiocommunication equipment and systems - General requirements - Methods of testing and required test results*

APPLIED TESTS

Test items	Test methods	Result
Mains Port Disturbance Voltage	EN 60945 (2002)	PASS
Radiated Disturbance (LF)	EN 60945 (2002)	PASS
Radiated Disturbance (RF)	EN 60945 (2002)	PASS
Electrostatic Discharges	EN 60945 (2002) EN 61000-4-2 (2001), Ed.1.2	PASS
Radiated RF Field	EN 60945 (2002) EN 61000-4-3 (2001), Ed.3.0	PASS
Electric Fast Transients	EN 60945 (2002) EN 61000-4-4 (2004), Ed.2.0	PASS
Surge	EN 60945 (2002) EN 61000-4-5 (2006), Ed.2.0	NA
Conducted RF Disturbance	EN 60945 (2002) EN 61000-4-6 (2007), Ed.2.2	PASS
Power supply failure	EN 60945 (2002) EN 61000-4-11 (2004), Ed.2.0	PASS
Voltage and Frequency Variations	EN 60945 (2002) EN 61000-4-11 (2004), Ed.2.0	NA
Conducted LF Disturbance	EN 60945 (2002) EN 61000-4-16 (2001), Ed.1.1	NA
Low Temperature	EN 60945 (2002) EN 60068-2-1 (2007), Ed.6.0	PASS Note 1
Dry Heat	EN 60945 (2002) EN 60068-2-2 (2007), Ed.5.0	PASS Note 1
Damp Heat	EN 60945 (2002) EN 60068-2-30 (2005), Ed.3.0	PASS Note 1
Corrosion	EN 60945 (2002) EN 60068-2-52 (1996), Ed.2.0	NA
Vibration	EN 60945 (2002) EN 60068-2-6 (2008), Ed.6.0	PASS Note 1
Drop	EN 60945 (2002)	NA
Ingress Protection (IP)	EN 60945 (2002) IEC 60529 (2001), Ed.2.1	-
Compass Safe	EN 60945 (2002) EN ISO 694 (2001)	PASS Note 1

Extreme Power Supply	EN 60945 (2002) IEC 60092-101 (1994)	PASS Note 1

Note 1 : Tested in separate test report no. 134363 ENV
PASS : Tested and complied with the requirements
FAIL : Tested and failed the requirements
NA : Test not relevant to this specimen (evaluated by the test laboratory)
– : Test not performed (instructed by the applicant)
* : An asterisk (*) placed after the verdict in the Result column indicates test items that are not within Nemko's scope of accreditation
# : A grid (#) placed after the verdict in the Result column indicates test items that are only partly covered by Nemko's scope of accreditation. Further information is detailed in the test section

DEVIATIONS AND EVALUATIONS

Product standards with dated references to basic standards may be modified by Nemko AS to test according to the newest edition of the basic standard. This may impact the compliance criteria or technical performance of the test, still this is considered to be adequate as long as the test is expected to confirm compliance to the intention of the product standard. The table above lists the edition of the basic standards used during testing.

Test Results

EMISSION – MAINS PORT DISTURBANCE VOLTAGE

TEST DESCRIPTION

Method
The reference method for this test is listed in the table under clause APPLIED TESTS.

Set-up
The measurements were performed in a shielded enclosure. EuT was connected to an Artificial Mains Network (AMN) and placed on a wooden table 80cm (tabletop) above the grounded floor and 40cm from the reference ground plane (wall). EuT was connected to the AMN by its power cable, which was adjusted to 100cm length by folding.

Procedure
A screening test was first performed to decide the most disturbing operating mode of the EuT, maximizing the cable layout and deciding the proper dwell time for the measurements.

Then measurements were run between each of the current carrying wires of the power cord, and ground.

The frequency was swept in the range specified under Severity.

A comparison of the results obtained from the different wires was then performed to find the highest level at each frequency. This worst-case sweep with peak detector is presented below.

At the frequencies where the peak level of the emission was exceeding the applicable [limit - offset], the emission was also measured with the quasi-peak detector and, if required, with the average detector.

Instruments used during measurement

Instrument list:	EMI Receiver: Rohde&Schwarz ESAI (LR-1090) (04/10) LISN: Rohde&Schwarz ESH3-Z5 (LR-1076) (10/11) Pulse Limiter: Rohde&Schwarz ESH3-Z2 (LR-1074) (03/10)

Comments
No recorded comments.

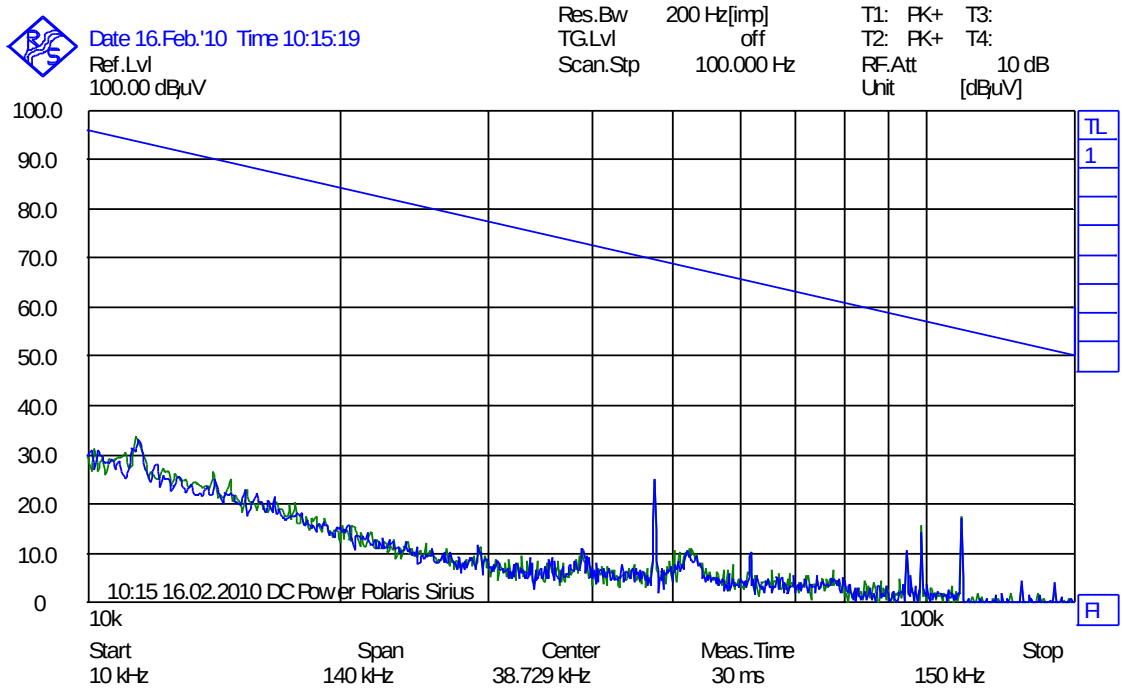
Severity

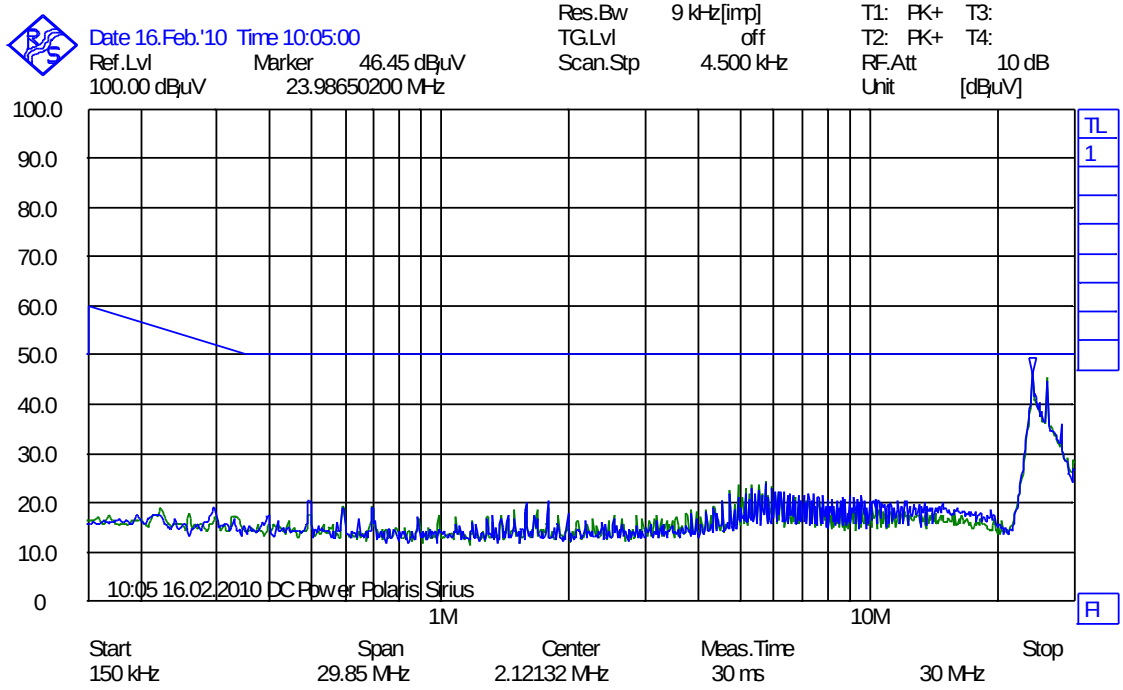
Port:	DC power port
Frequency range:	10k-30MHz
Frequency step:	100 Hz / 4.5 kHz
Dwell time:	30 mSec
Bandwidth:	200 Hz / 9 kHz

Conformity

Verdict:	PASS
Test engineer:	TLO

DISTURBANCE PREVIEW





QUASI PEAK DETECTOR DATA

Frequency [MHz]	Level [dBuV]	Af [dB]	Limit [dBuV]	Margin [dB]	Det	Position	Verdict [Pass/Fail]
23.98	44.7	-	50.0	- 5.3	QP	- to gnd	Pass
25.95	44.0	-	50.0	- 6.0	QP	- to gnd	Pass

EMISSION – RADIATED DISTURBANCE

TEST DESCRIPTION

Method
The reference method for this test is listed in the table under clause APPLIED TESTS.

Set-up
All measurements are performed in a 10m semi-anechoic chamber. EuT is connected to filtered mains supply and placed on a wooden table 80 cm (tabletop) above the ground plane, in the centre of the turntable. The measuring antenna is located 3 meters from EuT and 100cm above the ground plane.

Procedure
A screening test was first performed to decide the most disturbing operating mode of the EuT, maximizing the cable layout and deciding the proper dwell time for the measurements.

A set of preliminary measurements are then run with a peak detector across the frequency range, for 0°, 90°, 180° and 270° turntable azimuths. The frequency is swept in the range specified under Severity.

A comparison of the levels measured at each measurement positions is then performed, and the highest level at each frequency is stored. This "Worst Case" sweep with peak detector is presented in the report.

At the frequencies where the peak values of the emission are exceeding the applicable [limit - offset], the emission is also measured with the quasi-peak detector: Cables connected to EuT are fixed to cause maximum emission, and a maximum emitting point is searched by tuning the turntable azimuth 0 - 360°.

The quasi-peak detector measurement is performed at the maximum emitting point and compared to the limit. The emission level is calculated in the following matter: Elevel = Ereading + Eantenna + Ecable.

Instruments used during measurement

Instrument list:	EMI Receiver: Rohde&Schwarz ESN 10 (LR 1237) (10/09) Antenna: Rohde & Schwarz HFH2-Z2 (LR 0285) (07/10)

Comments
No recorded comments.

Severity

Port:	Enclosure Port
Frequency range:	150 kHz – 30 MHz
Frequency step:	4.5 kHz
Dwell time:	50 mSec
Bandwidth:	9 kHz
Meas. distance:	3 m

Conformity

Verdict:	PASS
Test engineer:	TLO

DISTURBANCE PREVIEW

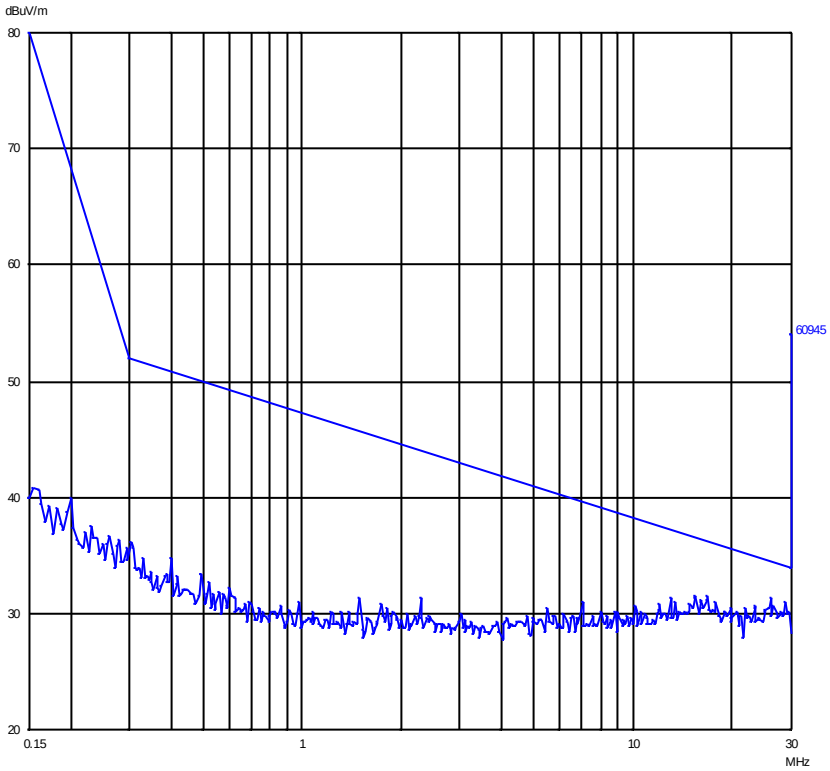
150k-30MHz

Nemko AS 04. Feb 10 09:53
peak

Operator: Tlo
Comment: Polaris Sirius B
60945 3 m
loop longitidunal

Scan Settings (1 Range)
|-------- Frequencies ----------||---------- Receiver Settings ----------|
Start Stop Step IF BW Detector M-Time Atten Preamp OpRge
150k 30M 4.5k 9k PK 50ms AUTO LN ON 60dB

Transducer No. Start Stop Name
3 9k 30M HFH2Z2uV



QUASI PEAK DETECTOR DATA

Frequency [MHz]	Level [dBuV]	Af [dB]	Limit [dBuV]	Margin [dB]	Height [cm]	Azimuth [deg]	Verdict [Pass/Fail]
0.01-30	-	-	-	All below limit	-	-	Pass

EMISSION – RADIATED DISTURBANCE

TEST DESCRIPTION

Method
The reference method for this test is listed in the table under clause APPLIED TESTS.

Set-up
All measurements are performed in a 10m semi-anechoic chamber. EuT is connected to filtered mains supply and placed on a wooden table 80 cm (tabletop) above the ground plane, in the centre of the turntable. The measuring antenna is located 3 meters from EuT.

Procedure
A screening test was first performed to decide the most disturbing operating mode of the EuT, maximizing the cable layout and deciding the proper dwell time for the measurements.

A set of preliminary measurements are then run with a peak detector across the frequency range, for horizontal and vertical polarizations of the antenna, and for 0°, 90°, 180° and 270° turntable azimuths. The frequency is swept in the range specified under Severity.

A comparison of the levels measured at each measurement positions is then performed, and the highest level at each frequency is stored. This "Worst Case" sweep with peak detector is presented in the report.

At the frequencies where the peak values of the emission are exceeding the applicable [limit - offset], the emission is also measured with the quasi-peak detector: Cables connected to EuT are fixed to cause maximum emission, and a maximum emitting point is searched by tuning the turntable azimuth 0 - 360° and then tuning the antenna height 100 - 400cm above the ground plane.

The quasi-peak detector measurement is performed at the maximum emitting point and compared to the limit. The emission level is calculated in the following matter: Elevel = Ereading + Eantenna + Ecable.

Instruments used during measurement

Instrument list:
EMI Receiver: Rohde&Schwarz ESN 10 (LR 1237) (10/11)
Antenna: Rohde & Schwarz 116 (LR 1260) (04/10)
Antenna: Rohde & Schwarz HL223 (LR 1261) (08/10)
Preamplifier: Hewlett Packard HP10855A (LR 1445) (02/10)

Comments
No recorded comments.

Severity

Port:	Enclosure Port
Frequency range:	30 MHz – 2000 MHz
Frequency step:	50 / 4.5 kHz
Dwell time:	50 mSec
Bandwidth:	120 / 9 kHz
Meas. distance:	3 meter

Conformity

Verdict:	PASS
Test engineer:	TLO

DISTURBANCE PREVIEW

30-200MHz HP

Nemko AS

04. Feb 10 10:48

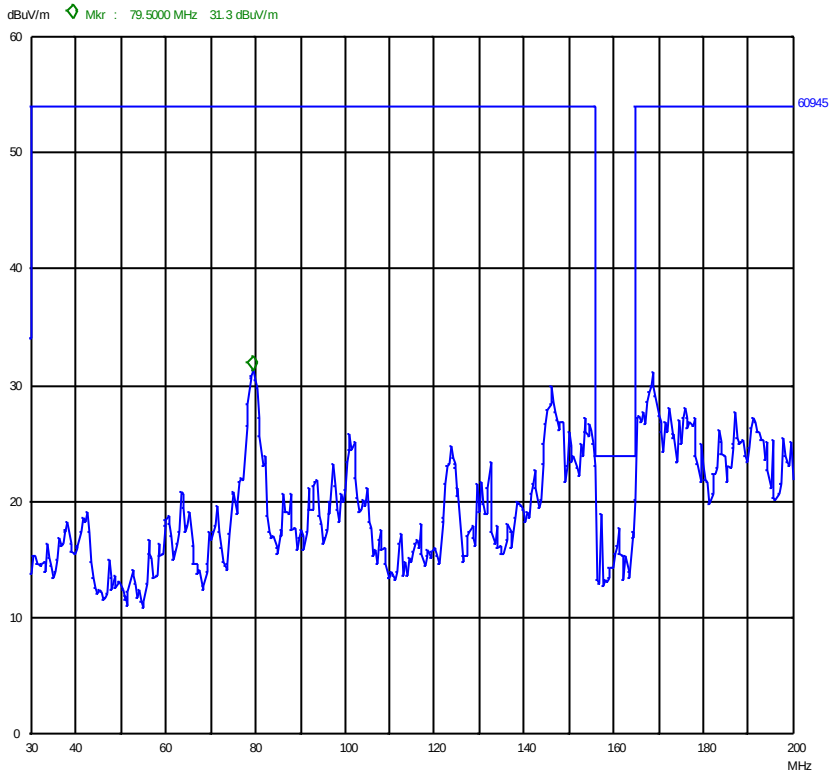
peak

Operator: Tlo
Comment: Polaris Sirius B
60945 3 m
2,5m HP

Scan Settings (3 Ranges)

Frequencies			Receiver Settings				
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
30M	156M	50k	120k	PK	50ms	AUTO	LN ON	60dB
156M	165M	4.5k	9k	PK	50ms	AUTO	LN OFF	60dB
165M	200M	50k	120k	PK	50ms	AUTO	LN ON	60dB

Transducer No.	Start	Stop	Name
11	30M	200M	HK116



30-200M VP

Nemko AS

peak

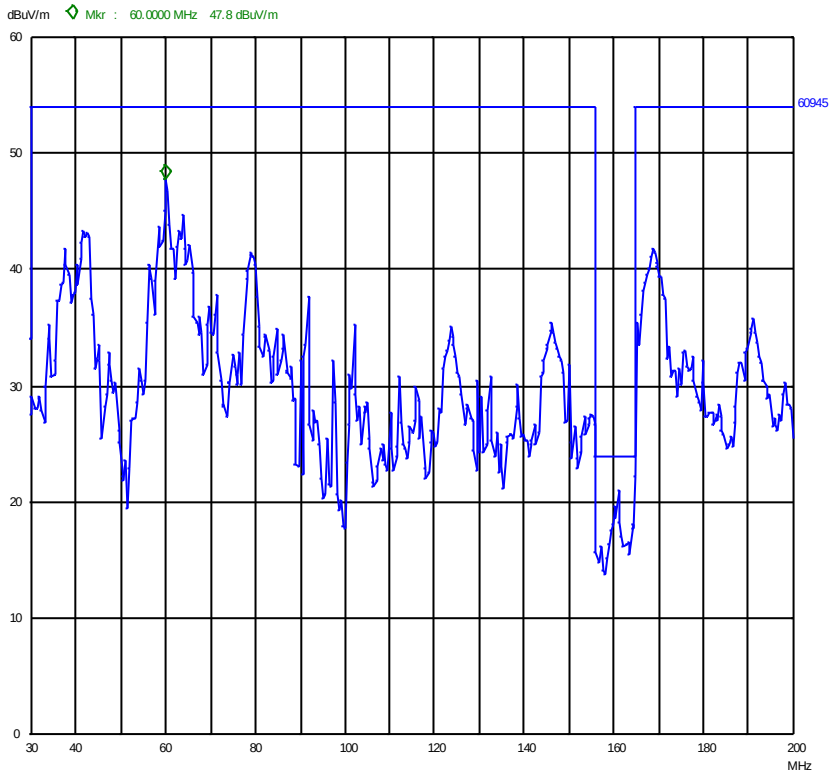
04. Feb 10 10:39

Operator: Tlo
Comment: Polaris Sirius B
60945 3 m
1m VP

Scan Settings (3 Ranges)

Frequencies			Receiver Settings				
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
30M	156M	50k	120k	PK	50ms	AUTO	LN ON	60dB
156M	165M	4.5k	9k	PK	50ms	AUTO	LN OFF	60dB
165M	200M	50k	120k	PK	50ms	AUTO	LN ON	60dB

Transducer No.	Start	Stop	Name
11	30M	200M	HK116



200-1000MHz HP

Nemko AS

04. Feb 10 10:57

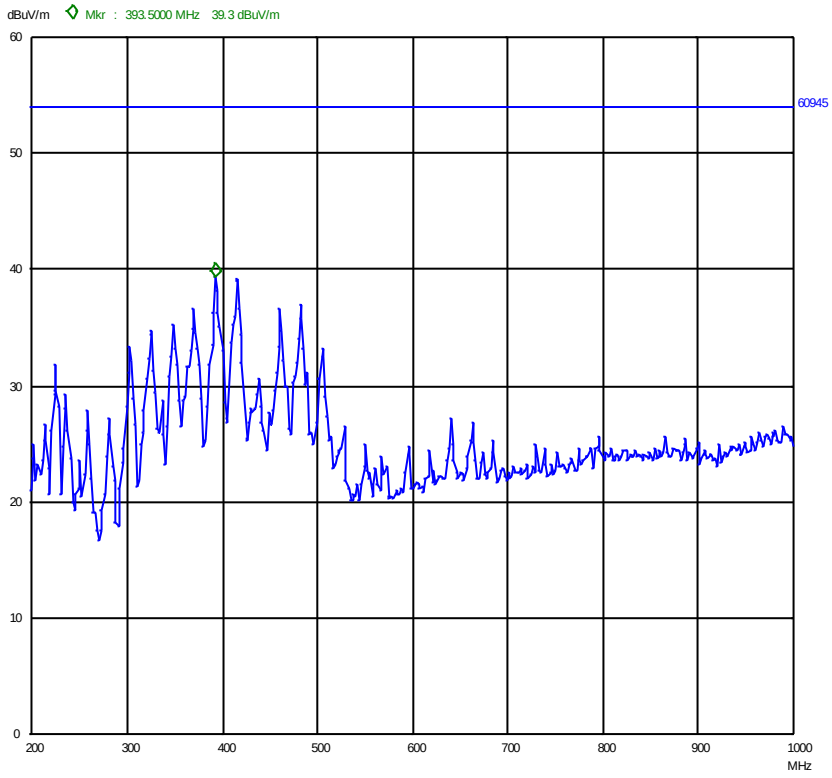
peak

Operator: Tlo
Comment: Polaris Sirius B
60945 3 m
2,5m HP

Scan Settings (1 Range)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
200M	1000M	50k	120k	PK	50ms	AUTO	LN ON	60dB

Transducer No.	Start	Stop	Name
21	200M	1000M	HL223HP



200-1000MHz VP

Nemko AS

peak

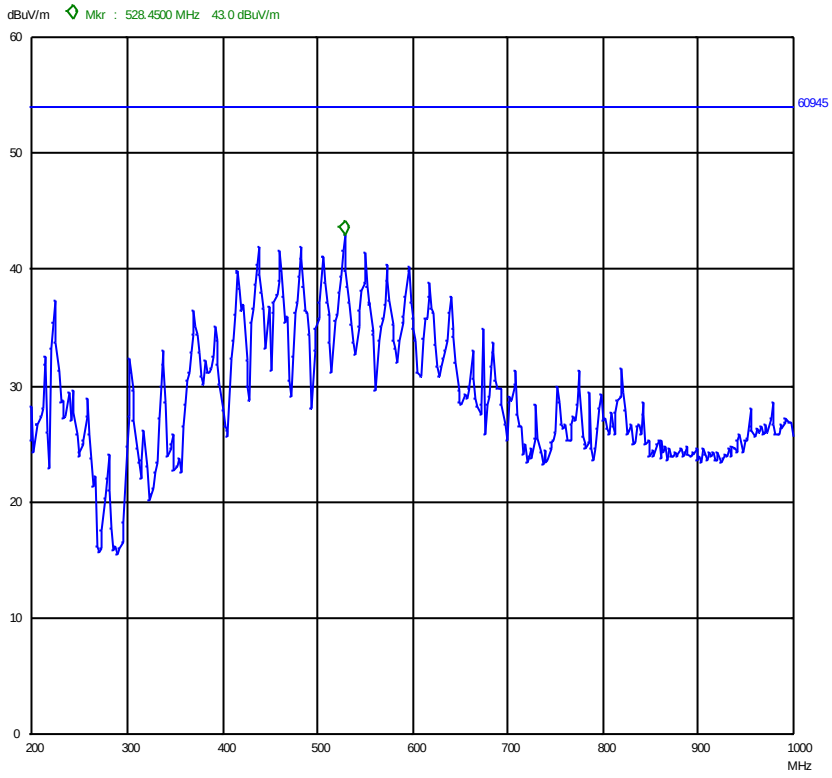
04. Feb 10 11:23

Operator: Tlo
Comment: Polaris Sirius B
60945 3 m
1m VP

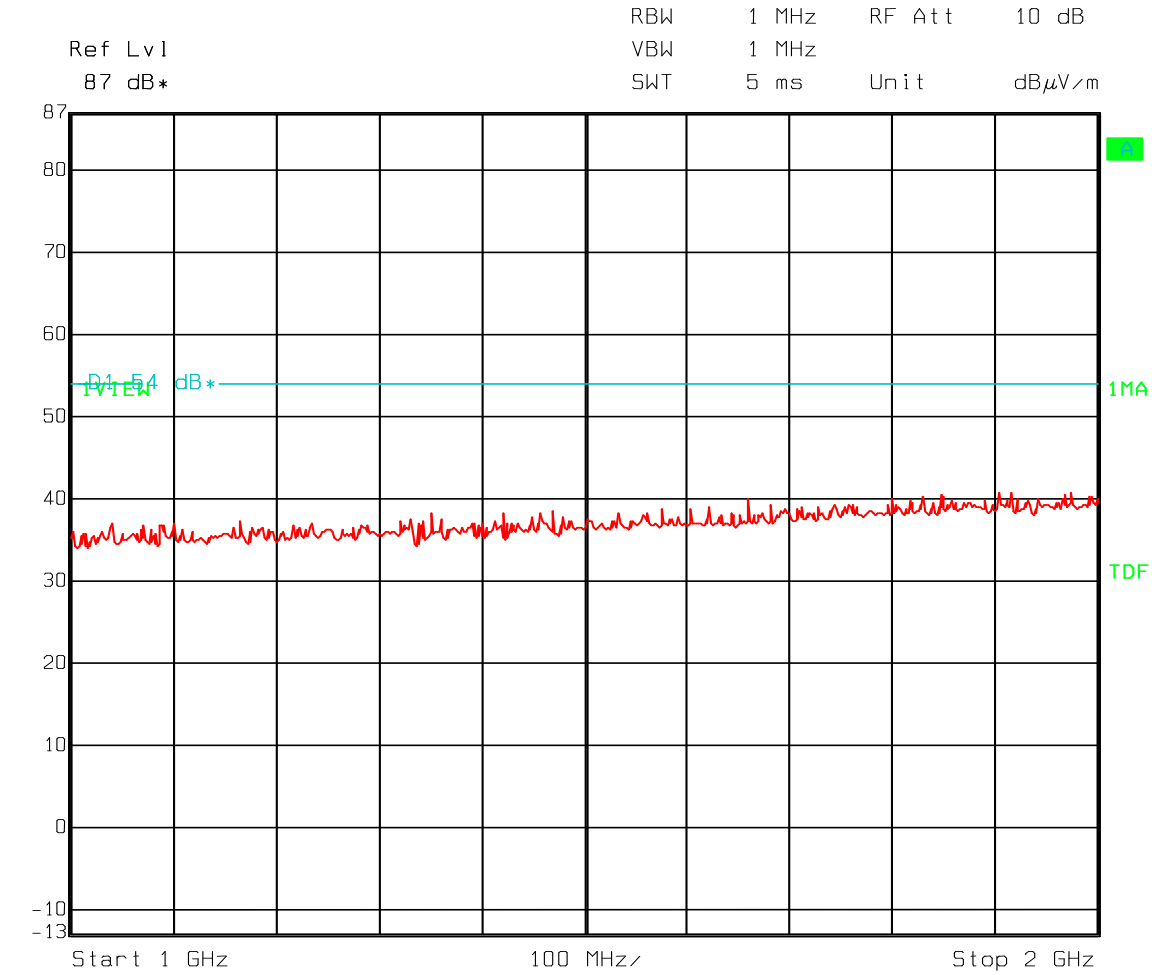
Scan Settings (1 Range)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
200M	1000M	50k	120k	PK	50ms	AUTO	LN ON	60dB

Transducer No.	Start	Stop	Name
21	200M	1000M	HL223HP

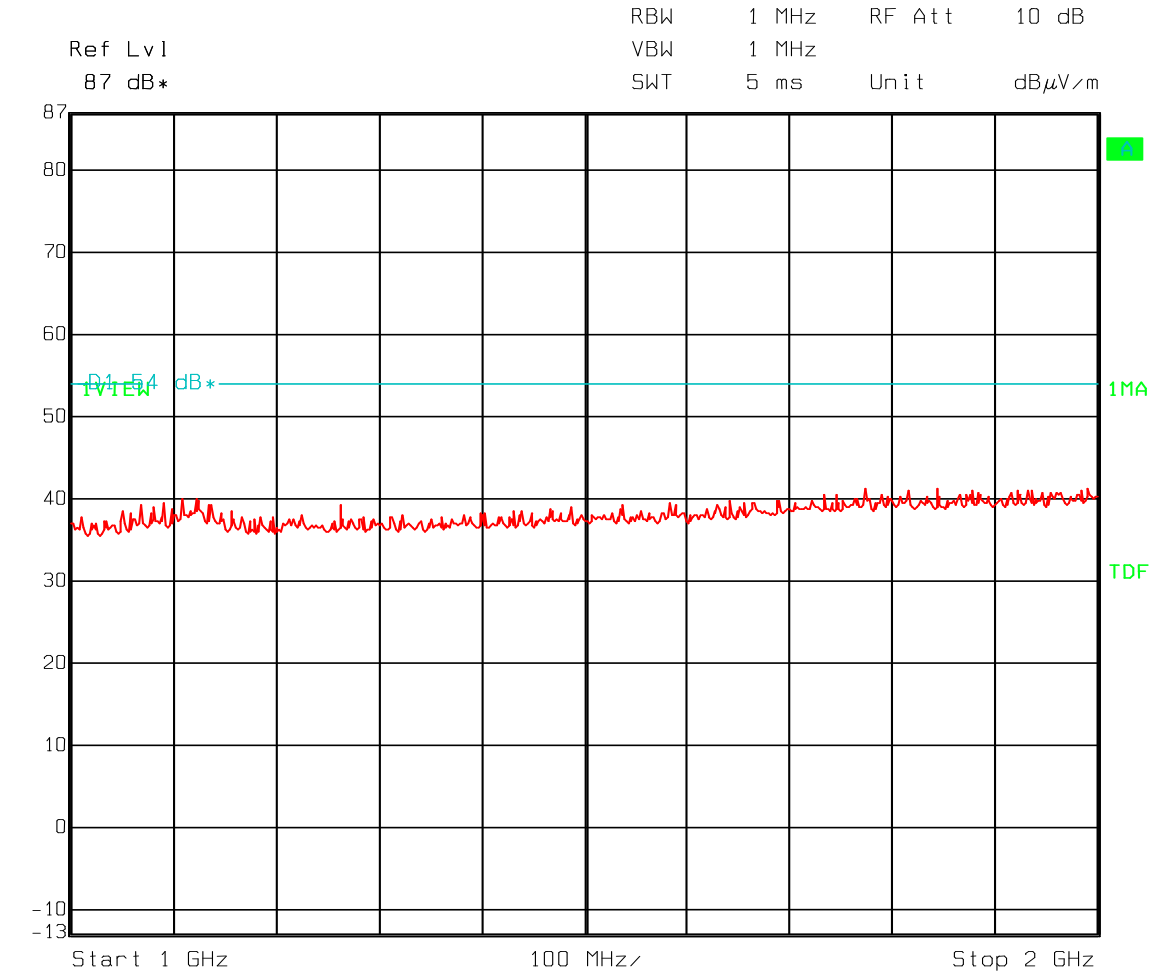


1-2GHz HP



Date: 04.FEB.2010 11:45:11

1-2GHz VP



Date: 04.FEB.2010 11:43:12

QUASI PEAK DETECTOR DATA (HORIZONTAL)

Frequency [MHz]	Level [dBuV]	Af [dB]	Limit [dBuV]	Margin [dB]	Height [cm]	Azimuth [deg]	Verdict [Pass/Fail]
30 - 2000	-	-	-	-	-	-	Pass

QUASI PEAK DETECTOR DATA (VERTICAL)

Frequency [MHz]	Level [dBuV]	Af [dB]	Limit [dBuV]	Margin [dB]	Height [cm]	Azimuth [deg]	Verdict [Pass/Fail]
42.5	37.3	-	54.0	- 16.7	100	0	Pass
60.0	41.0	-	54.0	- 13.0	100	0	Pass
168.7	41.5	-	54.0	- 12.5	100	0	Pass
528.5	42.4	-	54.0	- 11.6	100	0	Pass

IMMUNITY – ELECTROSTATIC DISCHARGES

TEST DESCRIPTION

Method
The reference method for this test is listed in the table under clause APPLIED TESTS.

Set-up
A ground reference plane is located on the floor, and connected to earth via a low impedance connection. The return cable of the ESD generator is connected to the reference plane.

EuT is placed on a wooden table 80 cm (tabletop) above the reference plane, and all cables attached to the EuT is isolated the same way.

A vertical coupling plane (VCP) of 50x50 cm is placed 10 cm from the EuT's exterior. This VCP is connected to the reference plane via a cable with two 470kΩ resistors located one in each end of the cable.

In case of tabletop equipment, a horizontal coupling plane (HCP) of 160x80 cm is located on the table, and connected to the reference plane the same way as the VCP. EuT is separated from the HCP by a 0.5mm insulating support.

Procedure
Direct contact and air discharges are applied to the EuT enclosure. Indirect contact discharges are applied to the mid edge of the HCP and VCP.

Contact discharges are applied to various selected test points of the EuT at conductive surfaces, and to the HCP and VCP. Air discharges are applied to various selected test points of the EuT at non-conductive surfaces.

Discharges are applied at increasing levels to each test point.

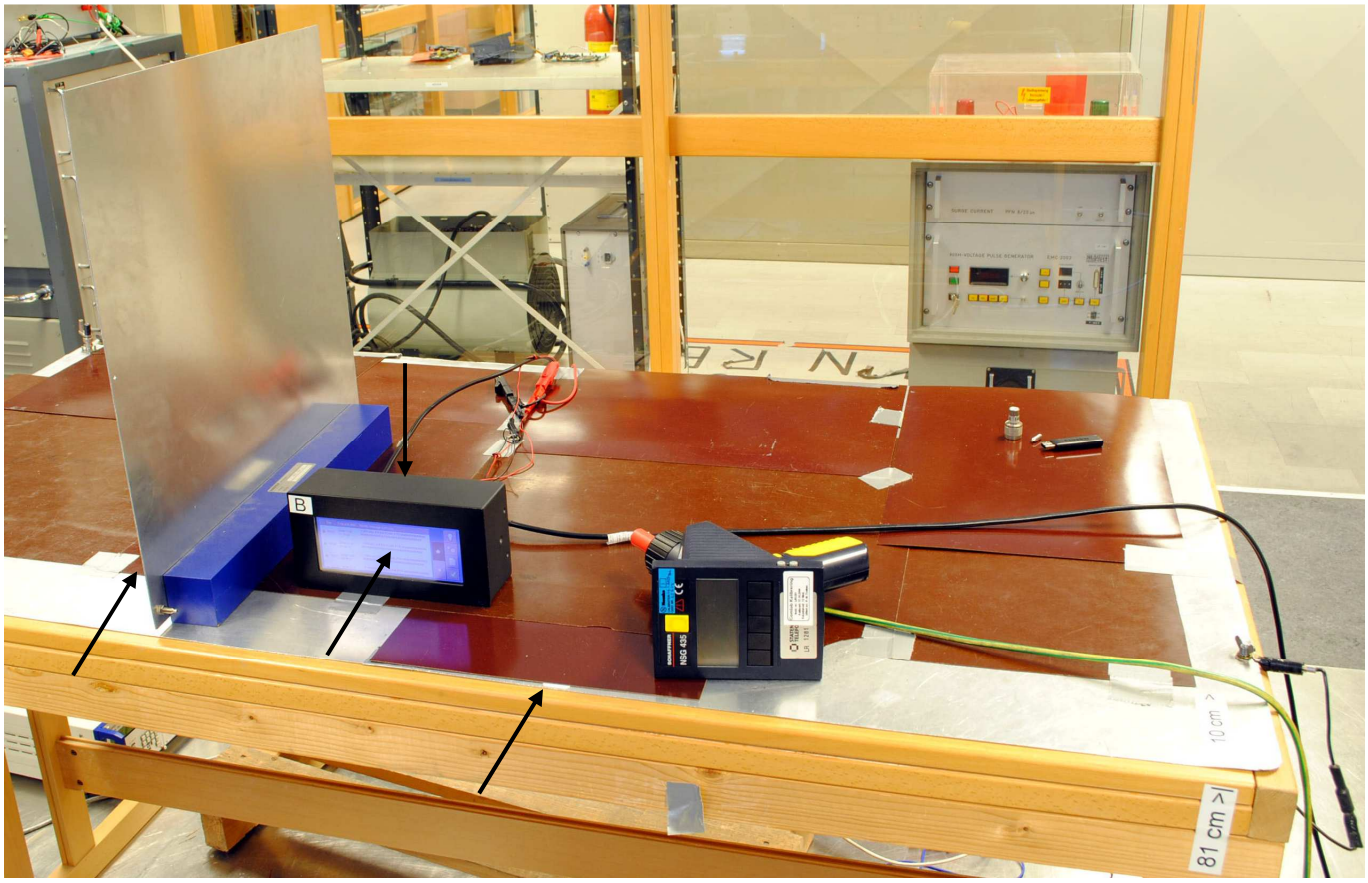
Instruments used during measurement
Instrument list: ESD Generator: Schaffner / NSG 435 (LR-1281) (01/2010)

Comments
No recorded comments.

Severity
Port: Enclosure Port

Conformity
Verdict:
Test engineer:

Description of test points



DETAILED TEST LOG

Note: The choice of test levels could differ from the procedure, based on the nature of EuT.
Note: An asterisk (*) indicates tests not within the scope of accreditation.
Note: Possible test case performances: <space> = Not tested, or letters indicating level of performance.
Note: ND = No Discharge, indicates discharge attempts, which have given no actual observable discharge.

Test Point	Applied Level [kV]	Discharge Type	Discharges per test level	Required Criteria	Complied Criteria	Result
All sides	±4, ±8	Air	10	B	A	PASS
Display	±4, ±8	Air	10	B	A	PASS
Cables	±4, ±8	Air	10	B	A	PASS
Metal chassie	±4, ±6	Contact	10	B	A	PASS
Cable connectors	±4, ±6	Contact	10	B	A	PASS
HCP	±4, ±6	Contact	10	B	A	PASS
VCP	±4, ±6	Contact	10	B	A	PASS

CONCLUSION

No operation errors were detected during or after the applied test(s)

IMMUNITY – RADIATED RF DISTURBANCE

TEST DESCRIPTION

Method
The reference method for this test is listed in the table under clause APPLIED TESTS.

Set-up
The tests are performed at 3 meter antenna distance in an anechoic chamber. EuT is placed on a wooden table 80 cm (tabletop) above the floor.
The EuT is placed with its front parallel with the uniform area, and the cables connected to EuT is arranged so that 100 cm of each cable is exposed to the electromagnetic field. The excess of the cable is then routed out of the uniform area.
The uniform area below 1 GHz is 1,5x1,5 m (0,8 to 2,3 m above ground plane).
The uniform area above 1 GHz is 1x1 m (0,8 to 1,8 m above ground plane).
When EUT cover more the 1x1 m area, then a second 1x1 m area is used to expose the rest of the EUT (1,3 to 2,3 m above ground plane).

Procedure
The EuT is exposed to a RF electromagnetic field generated by one or more antennas. The field is applied with the antennas. Due to the construction of the EUT only one face of the EUT may be exposed to the field. The polarization of the field requires testing each side of the EuT twice, once with the antenna horizontally and again with the antenna vertically. The antenna height during test is 155 cm < 1GHz, and 136 cm above 1GHz.

A field level and type as specified below is applied in the defined frequency range. The frequency is swept through the range with a step width and a dwell time per frequency as specified below.

Instruments used during measurement

Instrument list:
Amplifier: Amplifier Research / 500W100A (LR-1354) (N/A)
Amplifier: Amplifier Research / 25S1G4A (LR-1432) (N/A)
Antenna: Rohde&Schwarz / HL 023A1 (LR-282) (N/A)
Antenna: EMCO / 3161-01 (LR-1178) (N/A)
Antenna: EMCO / 3161-02 (LR-1179) (N/A)
Field Probe: Amplifier Research / FP4080 (LR-1424) (06/2011)
Power Meter: Rohde&Schwarz / NRVD (LR-1347) (03/2010)
Power probe: Rohde&Schwarz / NRV-Z5 (LR-1372) (06/2010)
RF Generator: Rohde&Schwarz / SMT03 (LR-1230) (01/2011)

Comments
No recorded comments.

Severity		**Conformity**	
Port:	Enclosure Port	Verdict:	PASS
Frequency range:	80 – 2000 MHz	Test engineer:	TLO
Step size:	1 %		
Dwell time:	3 sec.		
Modulation:	80% AM @ 400Hz		
Field generation:	Testing has been performed in an anechoic chamber using antennas to apply the field		

DETAILED TEST LOG

Note: The choice of test levels could differ from the procedure, based on the nature of EuT.
Note: An asterisk (*) indicates tests not within the scope of accreditation.
Note: Possible test case performances: <space> = Not tested, or letters indicating level of performance.

Frequency range [MHz]	Field strength [V/m]	Azimuth [deg]	Polarization	Required Criteria	Complied Criteria	Result
80 - 2000	10	0°	HOR	A	A	PASS
80 - 2000	10	0°	VER	A	A	PASS

CONCLUSION

No operation errors were detected during or after the applied test(s)

IMMUNITY – ELECTRIC FAST TRANSIENTS

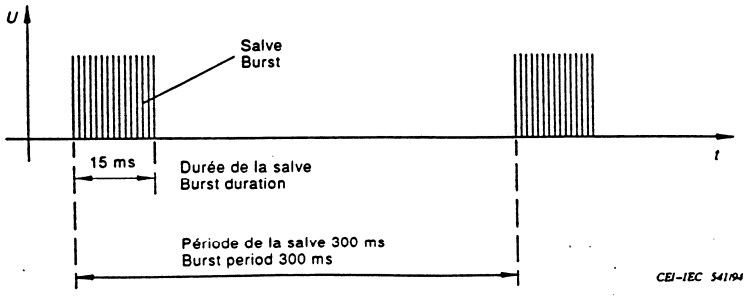
TEST DESCRIPTION

Method
The reference method for this test is listed in the table under clause APPLIED TESTS.

Set-up
A ground reference plane is located on the floor, and connected to earth via a low impedance connection. The EFT/B generator's reference ground is connected to the reference plane.

EuT is placed on a wooden pallet 10 cm above the reference plane, and all cables attached to the EuT are isolated the same way.

Procedure
Transients are applied at increasing levels to each single line of the AC or DC mains port using a coupling network (both one and one line separately, and then all lines at once), and other remaining ports using a capacitive coupling clamp.



Instruments used during measurement

Instrument list: Fast Transient Couplig Clamp: Haefely / IP4A-93 (LR-1301) (01/2010)
Fast Transient Generator: Haefely / PEFT Junior (LR-1297) (01/2010)

Comments
No recorded comments.

Severity		**Conformity**	
Port:	DC power, Antenna, RS-422 and USB	Verdict:	PASS
Duration:	1 min.	Test engineer:	TLO

DETAILED TEST LOG

Note: The choice of test levels could differ from the procedure, based on the nature of EuT.
Note: An asterisk (*) indicates tests not within the scope of accreditation.
Note: Possible test case performances: <space> = Not tested, or letters indicating level of performance.

Port	Applied Level [kV]	Injection Method	Required Criteria	Complied Criteria	Result
DC Input Port (N)	±1, ±2	CDN	B	A	PASS
DC Input Port (L1)	±1, ±2	CDN	B	A	PASS
DC Input Port (PE)	±1, ±2	CDN	B	A	PASS
DC Input Port (All at once)	±1, ±2	CDN	B	A	PASS
Signal Ports (Antenna, RS-422, USB)	±0.5, ±1	CLAMP	B	A	PASS

CONCLUSION
No operation errors were detected during or after the applied test(s)

IMMUNITY – POWER SUPPLY FAILURE

TEST DESCRIPTION

Method
The reference method for this test is listed in the table under clause APPLIED TESTS.

Set-up
Only the general laboratory conditions apply. No special requirements are defined for the configuration of the EuT. The DC power input of the EuT is connected to the power simulator system that generates the interruptions.

Procedure
The duration of the interruption is specified below. EuT was given at least 10 seconds periods to recover between each test. The number of tests applied at each phase angle is specified below.

Instruments used during measurement
Instrument list:

Comments
No recorded comments.

Severity		**Conformity**	
Port:	DC Input Port	Verdict:	PASS
Intervals	60 sec.	Test engineer:	TLO
Repetitions:	3 times		

DETAILED TEST LOG

Note: The choice of test levels could differ from the procedure, based on the nature of EuT.
Note: An asterisk (*) indicates tests not within the scope of accreditation.
Note: Possible test case performances: <space> = Not tested, or letters indicating level of performance.

Voltage Reduction	Voltage Level		Periode	Phase Angle [deg]	Required Criteria	Complied Criteria	Result
	Nominal	Test					
100% Interruption	230	0	60 sec.	NA	C	B	PASS

CONCLUSION
No operation errors were detected during or after the applied test(s)

IMMUNITY – CONDUCTED RF DISTURBANCE

TEST DESCRIPTION

Method
The reference method for this test is listed in the table under clause APPLIED TESTS.

Set-up
The test is performed on a large ground reference plane. EuT is placed on a wooden table 10 cm above the reference plane. Cables for DC and cables going to and from support equipment plus interconnecting cables are isolated from the ground plane by a 5 cm isolating support.

Procedure
Disturbance is applied via a coupling/decoupling network (CDN) or a capacitive coupling clamp (EM Clamp) to each port separately.

All ports on EuT not subject to testing are furnished with decoupling networks to achieve RF isolation of the EuT during test. As decoupling networks Nemko use the CDNs normally used to apply the disturbance.
One of the CDNs have a 50Ω termination attached to its RF input port, this CDN behaves as true 150Ω loop. Which CDN to select is decided according to the priority given in §7.2 of the reference standard.

For AC ports, DC ports, coax lines and 2- or 4-lines balanced communication lines a CDN is used to apply the disturbance. On other multiple signal cables an EM Clamp is used to apply the disturbance.
A signal level/type as specified below is applied in the defined frequency range. The frequency is swept through the range with a step width and a dwell time per frequency as specified below.

Instruments used during measurement

Instrument list:
Amplifier: Amplifier Research / 25A100M1 (LR-1155) (N/A)
Attenuator: Narda / 765-6 (LR-1318) (10/11)
Power Meter: Rohde&Schwarz / URV5 (LR-192) (10/2011))
RF probe: Rohde&Schwarz / URV5-Z2 (LR-342) (10/2011)
RF Generator: HP / 8656B (LR-1026) (10/2011)
Network Coupling/decoupling: Fischer / FCC-801-M2-16 (LR-1312) (06/2012)
Network Coupling/decoupling: Fischer / FCC-801-C1/50N (LR-1313) (06/2012)
Current injection clamp: Fischer / F-120-9 (LR-1316) (06/2012)

Comments
No recorded comments.

Severity

Port:	DC power, Antenna, RS-422 and USB
Frequency range:	0.15 – 80MHz
Step size:	1 %
Dwell time:	3 sec.
Modulation:	80%AM@ 400Hz

Conformity

Verdict:	PASS
Test engineer:	TLO

DETAILED TEST LOG

Note: The choice of test levels could differ from the procedure, based on the nature of EuT.
Note: An asterisk (*) indicates tests not within the scope of accreditation.
Note: Possible test case performances: <space> = Not tested, or letters indicating level of performance.

Port	Frequency range [MHz]	Applied Level [Vrms]	Injection Method	Required Criteria	Complied Criteria	Result
DC Power	0.15 – 80	10	CDN-M3	A	A	PASS
RS-422 and USB	0.15 – 80	10	Injection Clamp	A	A	PASS
Antenna	0.15 – 80	10	CDN-C1	A	A	PASS

CONCLUSION

No operation errors were detected during or after the applied test(s)

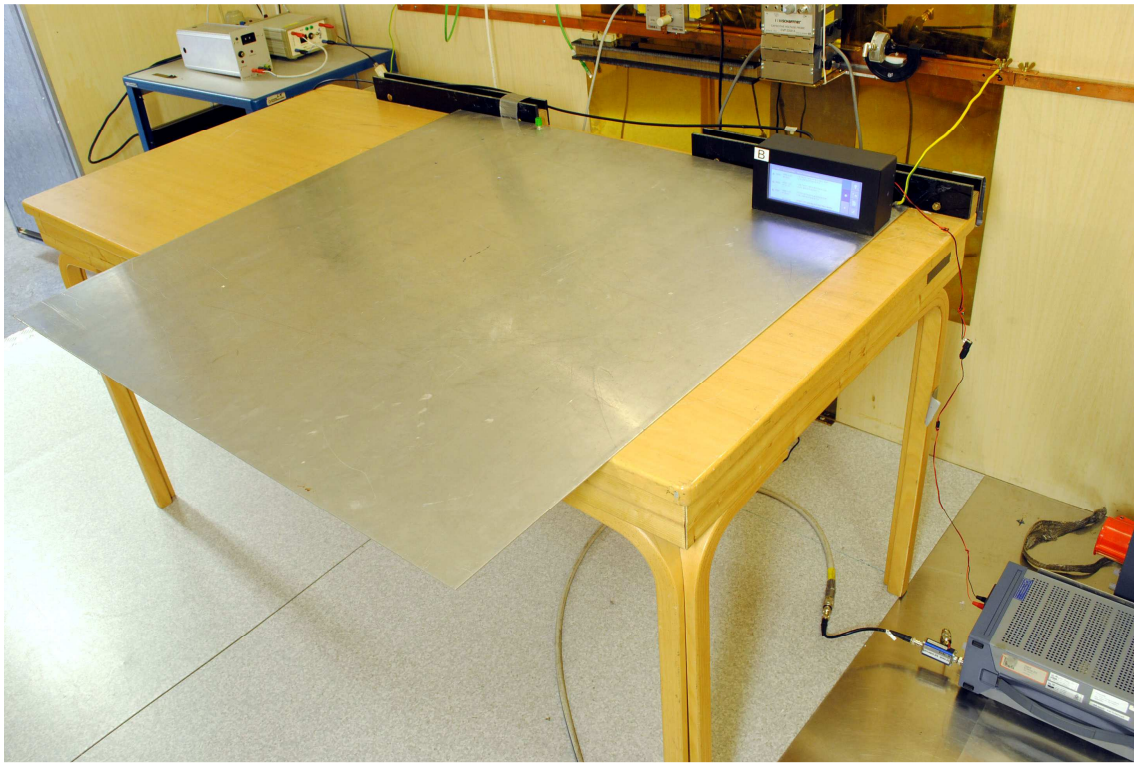
Annexes

UNCERTAINTY FIGURES

	Gaustad	Kjeller
Mains Port Disturbance Voltage	± 3.8 dB (9 kHz – 150 kHz) ± 3.5 dB (150 kHz – 30 MHz)	± 4,0 dB (0,01 – 0,15 MHz) ± 3,8 dB (0,15 – 30 MHz)
Load Port Disturbance Voltage	± 2.7 dB (150 kHz – 30 MHz)	± 2.7 dB (150 kHz – 30 MHz)
Signal Port Disturbance Voltage	± 2.7 dB (150 kHz – 30 MHz)	+2,9/-4,1 dB (150 kHz – 30 MHz)
Discontinuous Disturbance Voltage	± 4.3 dB (150 kHz – 30 MHz)	
Insertion Loss	± 2.5 dB (150 kHz – 1.605 MHz)	
Disturbance Power	± 3.4 dB (30 MHz – 300 MHz)	
Radiated Electromagnetic Field	± 2.7 dB (9 kHz – 30 MHz)	
Radiated Disturbance (3 meter)		± 4.1 dB (150 kHz – 30 MHz) ± 3,6 dB (30 – 200 MHz) ± 4.0 dB (200 – 2000 MHz)
Radiated Disturbance (10 meter)		± 4.7 dB (30 MHz – 200 MHz) ± 4.8 dB (200 MHz – 1000 MHz)
Radiated Disturbance Fully anechoic EMC chamber Test distance 3 m		± 4,8 dB (30 – 1000 MHz) ± 2,9 dB (1 – 18 GHz)
Harmonic Current Emissions	± 2.1mA	
Flicker	± 0.64 V (Dc and Dmax) ± 5 % (Pst and Plt)	
Electrostatic Discharges	± 10 % (peak voltage) ± 30 % (pulse shape)	
Radiated RF Field		± 2.4 dB
Electric Fast Transients	± 10 % (peak voltage) ± 30 % (pulse shape)	
Surge	± 10 % (peak voltage) ± 30 % (rise time) ± 20 % (duration)	
Conducted RF Disturbance	± 2 dB	± 2.8 dB (150 kHz – 26 MHz) ± 3.7 dB (26 MHz – 80 MHz)
Power Frequency Magnetic Field	± 2 %	
Dips/Interruptions	± 5 % (voltage) ± 10% (zero crossing control) ± 10º (phase relationship)	
Compass Safe Distance	± 9 % (on measured level) ± 5 cm (on distance)	
Acoustic Noise	± 1 dB	
Vibration	± 5.6 % (acceleration) ± 0.01% (frequency)	
Temperature	± 2ºC	
Humidity	± 5 %Rh	
Voltage	± 1.5 %	
Frequency	± 0.2 %	

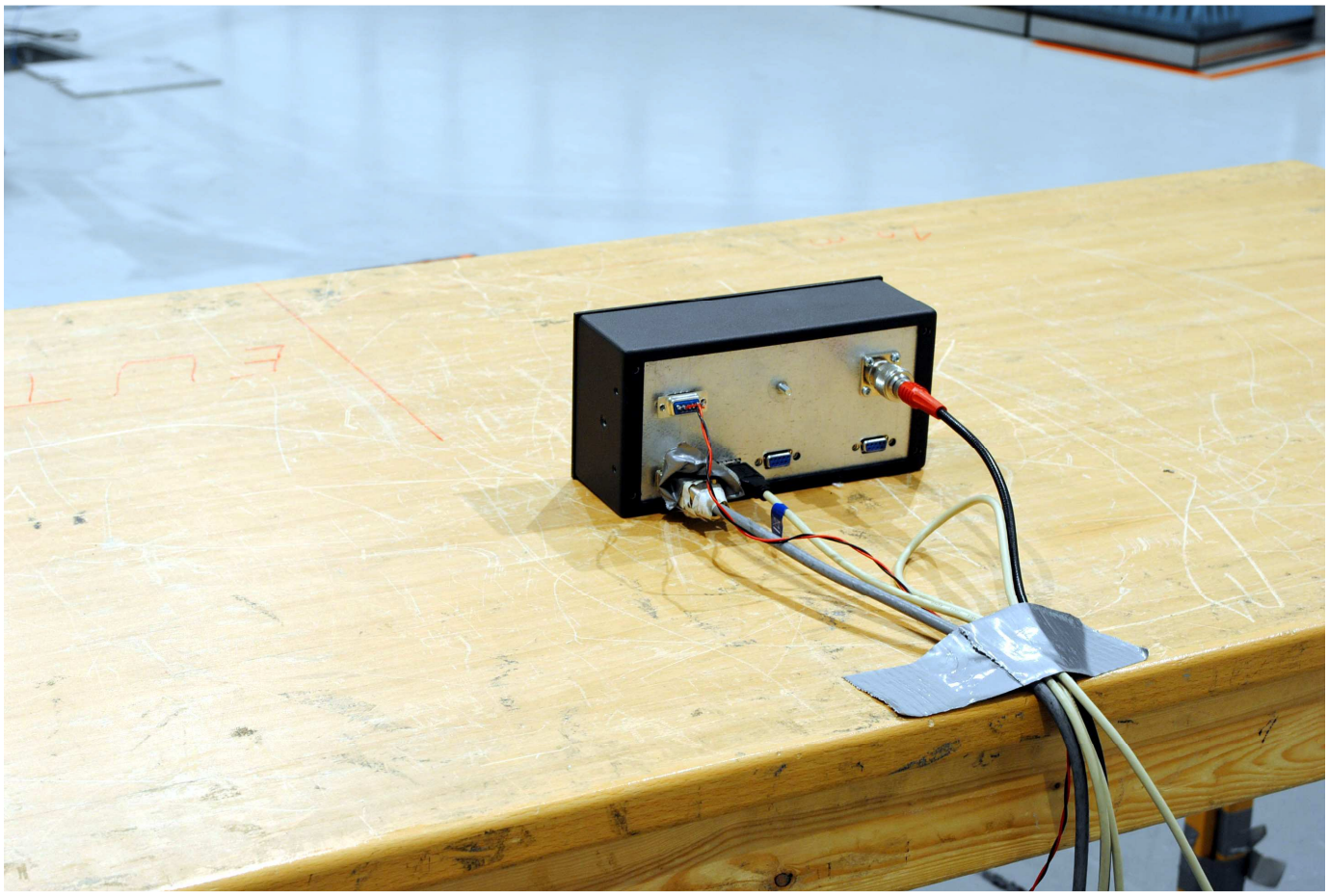
The instruments specified are subject to periodic calibration. Monthly controls ensure, with 95% confidence level, that the instruments remain within the calibrated levels

PHOTOS



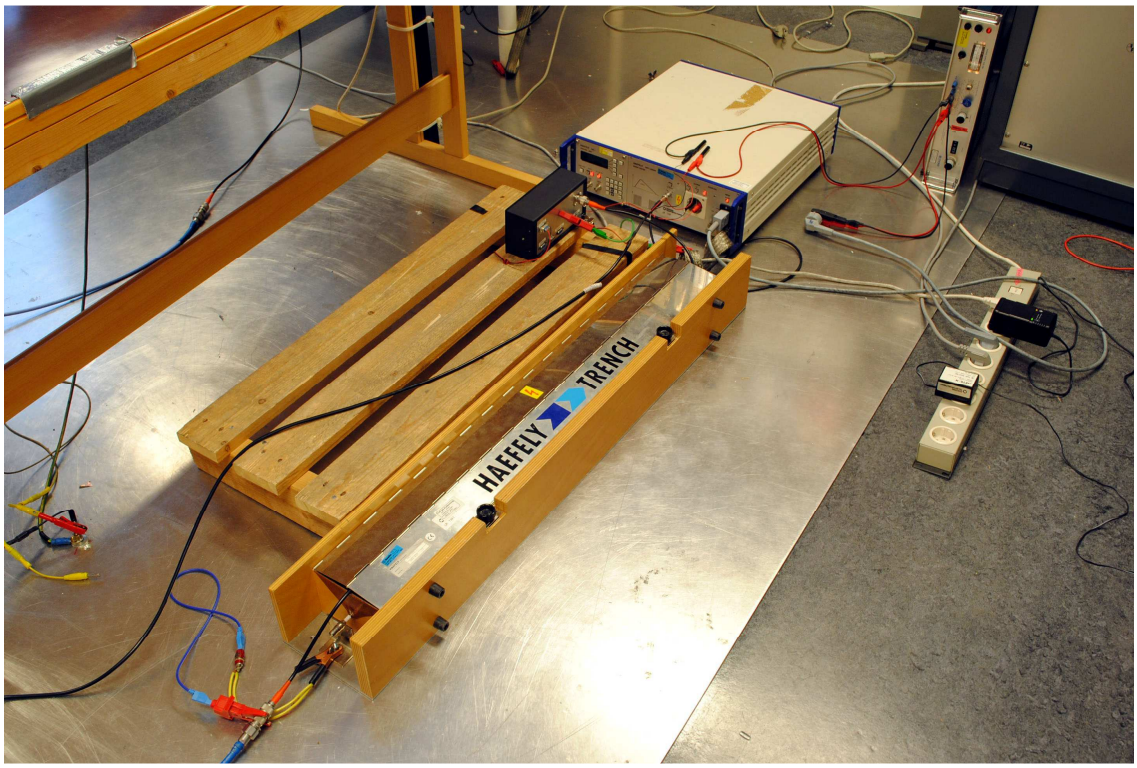
Notes: Test set-up for DC Power Port Disturbance Voltage

Notes: Test set-up for Radiated Disturbance

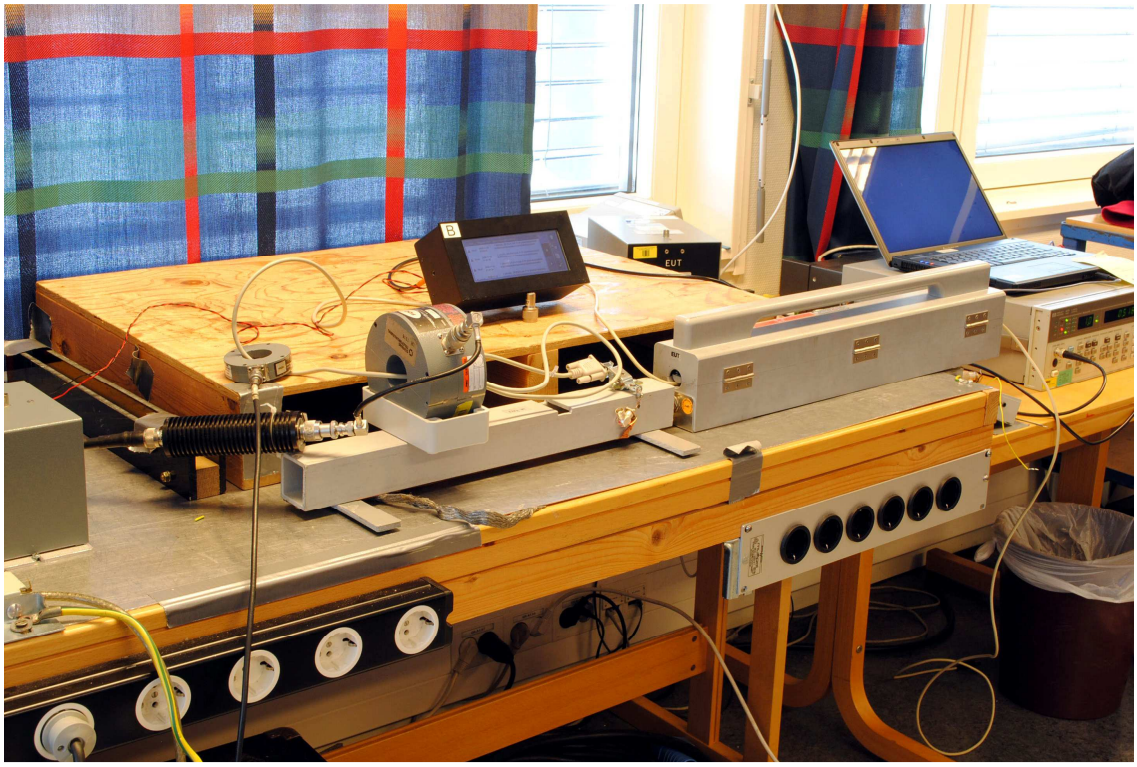


Notes: Test set-up for Radiated Disturbance

Notes: Test set-up for Radiated RF Field immunity



Notes: Test set-up for Electric Fast Transients



Notes: Test set-up for Conducted RF Disturbance