
TECHNICAL REPORT

JOTRON ELECTRONICS AS

TYPE TESTING OF HANDHELD VHF RADIO TYPE
TRON TR20 GMDSS

REPORT NO. 2001-3269

REVISION NO. 02

DET NORSKE VERITAS

TECHNICAL REPORT

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Approved by: Per Ove Øyberg Head of Section	Organisational unit: Testing, Product and Personnel Certification	
Client: Jotron Electronics AS	Client ref.: Eirik Storjordet	

Summary:

A handheld VHF radio type TRON TR20 GMDSS manufactured by Jotron Electronics AS has been EMC and environmentally tested according to the specifications listed below. The purpose of the testing was to qualify for wheel marking in accordance with the EU's Marine Equipment Directive.

CENELEC:

- ETS 300 225, 1998
- ETS 300 828, 1998

The tests were carried out in the Environmental Laboratory at Det Norske Veritas, Høvik, Norway during the time period 2001-07-30 to 2001-12-07.

NOTE:

The **radio tests** specified in clause 8 (Field measurement), 9 (Transmitter) and 10 (Receiver) in ETS 300 225 were measured by COMLAB during the time period 2001-09-07 to 2001-10-03. The results are described in **Test report: 01/05883/5**, issued 2001-10-05.

Testing according to clause 7.10 of ETS 300 225 was performed by SP - Sveriges Provnings- och Forskningsinstitut during 2001-11-02 to 2001-11-05. The results are described in **Test report: P105518**.

With implementation of the modifications described in Ch. 4.4, the EUT passed all the tests.

Rev. 02: This revision contains in addition to Rev. 01 the followings:

6.3.1 Open and short circuiting of antenna output

6.3.2 Battery capacity

Report no.: 2001-3269	Subject group:	
Report title: Type testing of handheld VHF radio type TRON TR20 GMDSS		
Work carried out by: Huu Dung Dinh, Per Gulbrandsen		
Work verified by: Steinar Andersen		
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ENVIRONMENTAL TESTS
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DISPLAYS

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1 SCOPE OF WORK

A handheld VHF radio type TRON TR20 GMDSS manufactured by Jotron Electronics AS has been EMC and environmentally tested according to the specifications listed below.

The purpose of the testing was to qualify for wheel marking in accordance with the EU's Marine Equipment Directive.

Test specifications for CE marking:

CENELEC

ETS 300 225, 1998

Technical characteristics and methods of measurement for survival craft portable VHF radiotelephone apparatus

ETS 300 828, 1998

ElectroMagnetic Compatibility (EMC) for radiotelephone transmitters and receivers for the maritime mobile service operating in the VHF bands

For each test, reference is made to the relevant section or paragraph in the specifications.

NOTE: The **radio tests** specified in clause 8 (Field measurement), 9 (Transmitter) and 10 (Receiver) in ETS 300 225 were measured by COMLAB during the time period 2001-09-07 to 2001-10-03. The results are described in **Test report: 01/05883/5**, issued 2001-10-05.

Testing according to clause 7.10 of ETS 300 225 was performed by SP - Sveriges Provnings- och Forskningsinstitut during 2001-11-02 to 2001-11-05. The results are described in **Test report: P105518**.

2 TEST LABORATORY

The tests (except as stated in Ch. 1) were carried out in the Environmental Laboratory at Det Norske Veritas, Høvik, Norway.

Ambient conditions in the laboratory:

Parameter	Required (IEC 60068-1)	Actual
Temperature	15 – 35 °C	21 – 23.5 °C
Humidity	25 – 75 % RH	42 – 64 % RH
Barometric pressure	860 – 1060 mbar	935 - 1008 mbar

For details about the test facilities and instruments used, see Chapter 8.

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3 TEST PERIOD

The VHF radio was received for test on 30 July 2001. The tests were carried out between 30 July and 07 December 2001.

The following representative from the client was present during parts of the testing, and took part in the performance testing and in the evaluation of the same.

- Mr. Arne Fredriksen

4 EQUIPMENT UNDER TEST

4.1 Equipment submitted for tests

Unit	Description	Make	Type	S/N
1	Handheld VHF radio *	Jotron Electronics	TRON TR20 GMDSS	-
2	Battery	-	NiMH	-
3	Battery	-	Lithium	-

* Without battery

The VHF radio will from now on be referred to as **EUT (Equipment Under Test)**.

Accessory equipment not submitted for test:

- Battery charger model RCH-20.

4.2 Test configuration

- The EUT was tested as a stand alone unit with two optionally internal batteries (unit 2 and 3).
- For EMC tests the EUT was equipped with a 50 Ω dummy antenna and was set to channel 16.

4.3 Modes of operation

- All testing was carried out with the EUT in normal transmit and receive modes at different channels.

4.4 Modifications during testing

In order to pass the various tests, the EUT was modified as follows during the test period:

Test	Modification
Immersion test	New enclosure

A new enclosure was used after the EUT had successfully passed the 1m drop and 70°C / 55°C dry heat tests. The new enclosure was improved with respect to the mechanical and water sealing properties. It was thus considered not necessary to repeat the drop and the dry heat tests.

5 EVALUATION OF PERFORMANCE DURING THE TESTS

5.1 Function testing and performance monitoring

During the testing, the EUT was operated in both continuously transmitting and receiving mode. Additionally, the EUT was checked before and after each test.

5.2 Criteria of acceptance

In order to pass each test, the EUT had to meet the following criteria:

Following acceptance criteria relates to the specific test:

Performance criterion	Applies to
<i>A: No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer</i>	<ul style="list-style-type: none"> • Radiated electromagnetic field immunity • Mechanical tests • Climatic tests
<i>B: During the test, degradation of performance is allowed. No change of actual operating state or stored data is allowed</i>	<ul style="list-style-type: none"> • Electrostatic discharge • Mechanical tests • Climatic tests
<i>C: The measured value shall be below the limit value given in the relevant standard</i>	<ul style="list-style-type: none"> • Radiated emission

- The EUT shall not show any signs of malfunction.

For tests that have additional criteria of acceptance, this is described in the relevant Chapters.

6 TESTS

6.1 Mechanical tests

6.1.1 Drop test

Test specification:

- ETS 300 225, paragraph 7.4

Test particulars:

Parameters	Severity levels
High of drop	1 m
Series	6 drops / one on each surface of the EUT
Surface	Hard wooden surface

Performance check was done after the drop test.

Result: The EUT passed the test.

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6.1.2 Sinusoidal vibration test

Test specification:

- ETS 300 225, paragraph 7.5

Test particulars:

Parameters	Severity levels
Frequency range	5-12.5 Hz / 12.5-25 Hz / 25-50 Hz
Displacement/acceleration	±1.6 mm, ± 0.38mm, ±0.10mm / ±10%
Sweep rate	1 oct. per 15 minutes

The EUT was clamped to the vibrator by means of yokes.

A single sweep resonance search was run along each of the three perpendicular axes.

No resonance was detected and the EUT was thus endurance tested for 120 minutes at 30 Hz along all 3 axes.

Performance check was done, there were no harmful deterioration of the EUT after the test.

Result: The EUT passed the test.

6.2 Climatic tests**6.2.1 Dry heat test**

Test specification:

- ETS 300 225, paragraph 7.6.2

Test particulars:

Test parameters	Severity levels
Temperature cycle	70°C / 55°C
Duration	10 / 2 hours

The EUT was switched on only during the 55°C / 2 hours cycle, and keyed with a duty cycle of 5 min transmission and 5 min reception.

Performance check was done after the test.

Result: The EUT passed the test.

6.2.2 Damp heat test, cyclic

Test specification:

- ETS 300 225, paragraph 7.6.3

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Test particulars:

Test parameters	Severity levels
Temperature cycle	20°C / 40°C
Humidity	93 % RH
Total duration	16.5 hours

The EUT was switched on the last 2 hours, and keyed with a duty cycle of 5 min transmission and 5 min reception.

Performance check was done during the last 2 hours, and 1 hour after completion of the test.

Result: The EUT passed the test.

6.2.3 Low temperature test

Test specification:

- ETS 300 225, paragraph 7.6.4

Test particulars:

Test parameters	Severity levels
Temperature cycle	-30°C / -20°C
Total duration	10 / 2 hours

The EUT was switched on in receiving mode during the test period, performance was checked during the last 30 min of the test.

Result: The EUT passed the test.

6.2.4 Corrosion test

Test specification:

- ETS 300 225, paragraph 7.7

Test particulars:

Test cycle	Severity levels
Salt spray	2 hours at 35°C
Temp / Humidity	7 days at 40°C and 95%RH
Number of cycles	4
Total duration	28 days

The salt solution was prepared by dissolving (5±1) parts by weight of sodium chloride (NaCl) in 95 parts by weight of distilled water.

Performance was checked at the end of the test. There was no deterioration or corrosion on the EUT, no evidence of moisture penetration.

Result: The EUT passed the test.

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6.2.5 Immersion test

Test specification:

- ETS 300 225, paragraph 7.8

Test particulars:

Test parameters	Severity levels
Pressure	10 kPa
Depth	1 m
Total duration	5 min

Performance was checked within 2 min after the test. There was no damage and no visible ingress of water in the EUT.

Result: The EUT passed the test.

6.2.6 Thermal shock test

Test specification:

- ETS 300 225, paragraph 7.9

Test particulars:

Test parameters	Severity levels
Temperature - air	65°C
Temperature - water	20°C
Depth	10 cm
Total duration	1 hour

Performance was checked within 2 min after the test.. There was no damage and no visible ingress of water in the EUT.

Result: The EUT passed the test.

6.2.7 Solar radiation test

Test specification:

- ETS 300 225, paragraph 7.10

Test particulars:

Test parameters	Severity levels
Intensity	1120 W/m ²
Total duration	80 hours

Performance was checked after the test. There was no visible harmful deterioration of the EUT.

Result: The EUT passed the test.

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6.2.8 Oil resistance test

Test specification:

- ETS 300 225, paragraph 7.11

Test particulars:

Test parameters	Severity levels
Oil temperature	19°C
Total duration	3 hours

Performance was checked after the test. There was no visible harmful deterioration of the EUT.

Result: The EUT passed the test.

6.3 EMC and electrical tests

All the EMC tests were carried out with the EUT in transmit mode and in receive mode.

6.3.1 Open and short circuiting of antenna output

Test specification:

- ETS 300 225, paragraph 4.5

Test particulars:

Test parameters	Severity levels
Antenna output	- open - short circuited

Performance was checked after the test. There was no harmful damages to the EUT.

Result: The EUT passed the test.

6.3.2 Battery capacity

Test specification:

- ETS 300 225, paragraph 4.7

Test particulars:

Test parameters	Severity levels
Operation	1:9 transmit to receive duty cycle
Temperature	- 20°C
Duration	8 hours

Result: The battery passed the test.

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6.3.3 Radiated emission

Test specification:

- EN 300 828, paragraph 8.1

Referenced standards:

- EN 60945; 150 kHz – 30 MHz
- EN 55022; 30 MHz – 1 GHz

Test particulars:

Frequency range	Limits, quasi-peak at 3 m
150 – 300 kHz	80 – 52 dB μ V/m
300 kHz – 30 MHz	52 – 34 dB μ V/m
30 – 230 MHz	40 dB μ V/m
230 MHz – 1 GHz	47 dB μ V/m
156 – 165 MHz	24 dB μ V/m

Below 30 MHz the emission of magnetic fields was measured by means of an active loop antenna oriented perpendicular to the EUT front. The distance from EUT to the antenna was 3 meters.

Above 30 MHz the emission was measured by a bilog antenna in horizontal and in vertical polarisation at a distance of 3 meters. The EUT was equipped with a 50 Ω dummy antenna during these measurements.

In order to find the highest emission levels, the tests were carried out with the EUT in varying orientations relative to the antenna and with antenna elevation adjusted between 1 and 4 m.

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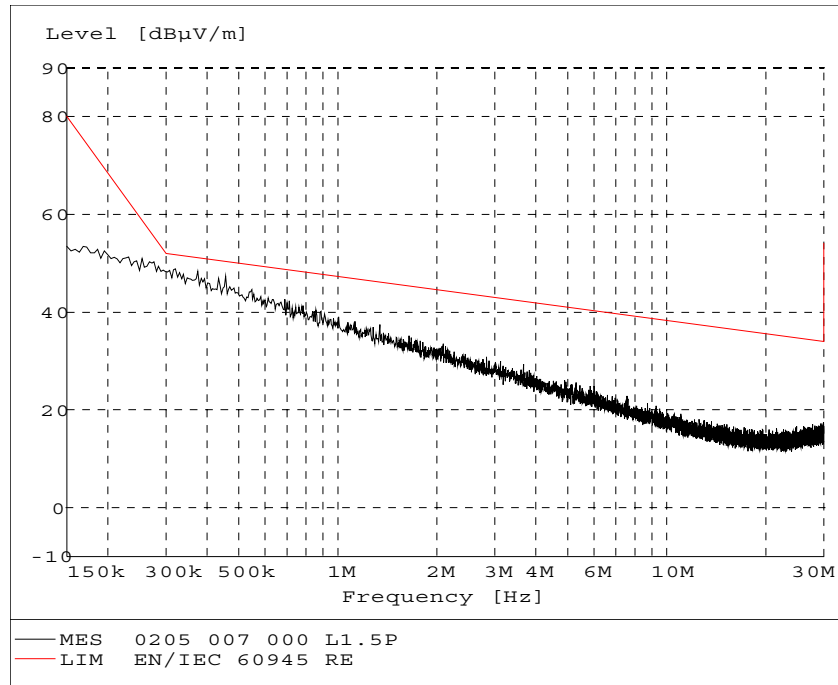


Figure 1. Radiated emission, receive mode

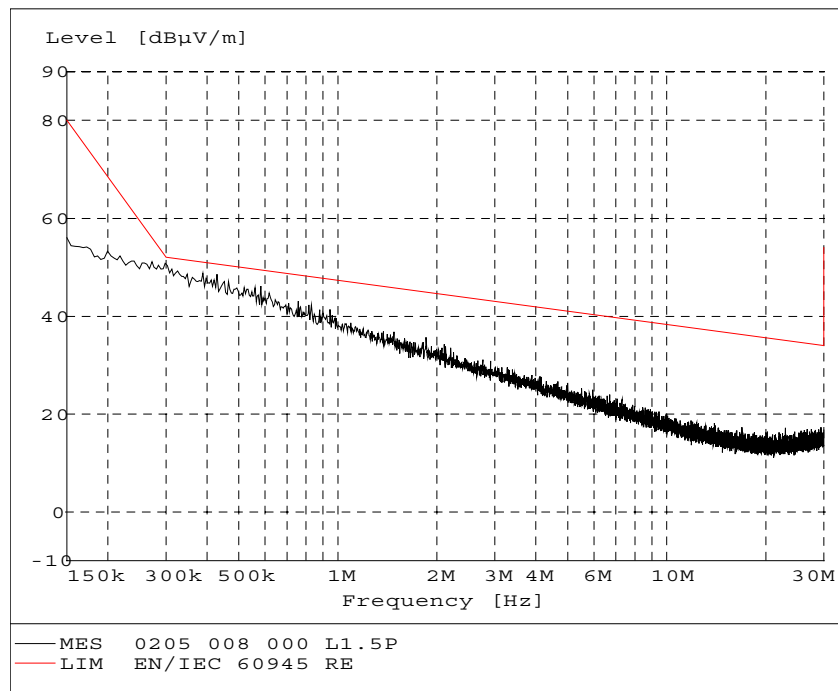


Figure 2. Radiated emission, transmit mode

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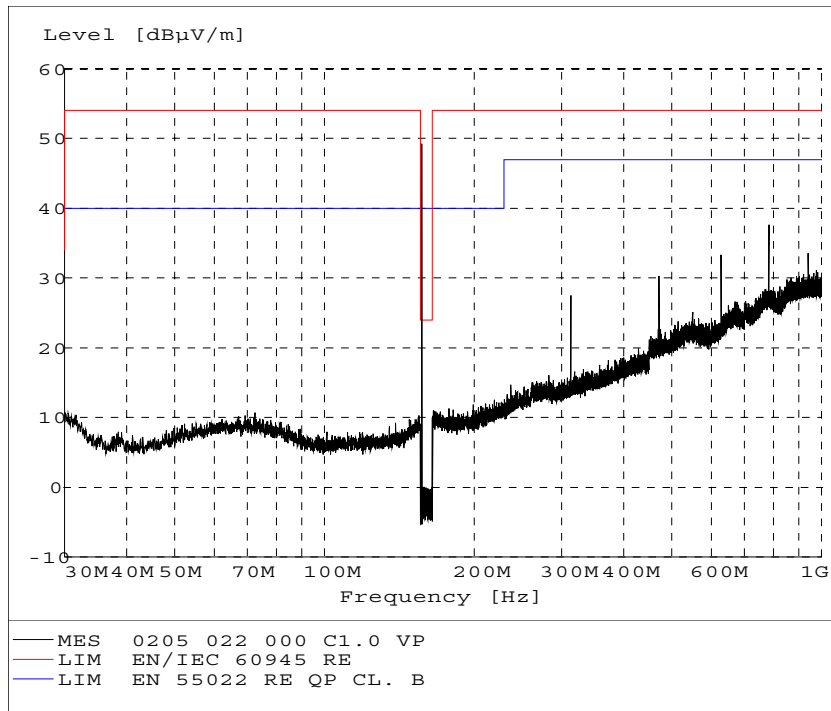


Figure 3. Radiated emission, vertical antenna, transmit mode

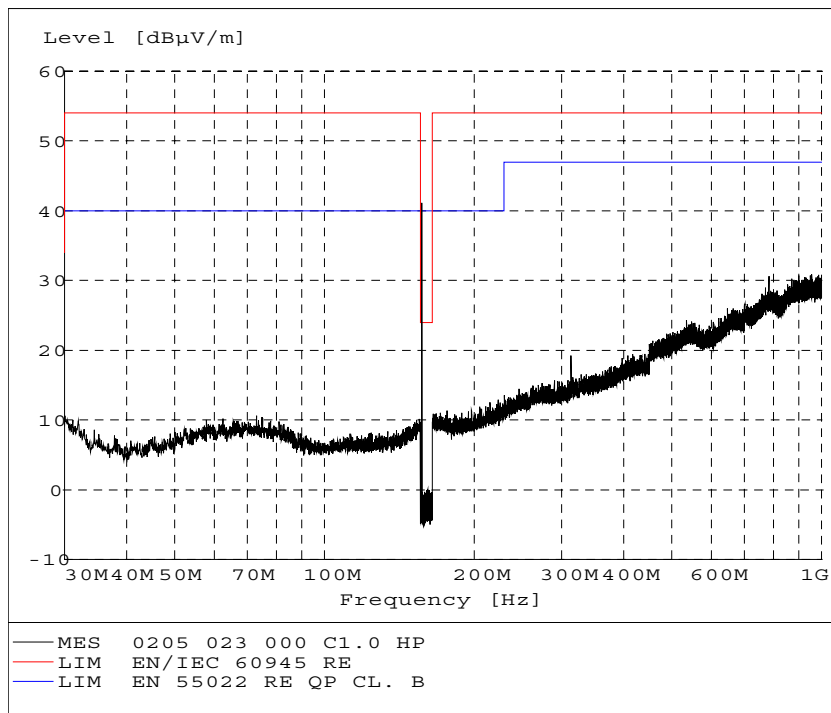


Figure 4. Radiated emission, horizontal antenna, transmit mode

Result: The EUT passed the test.

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6.3.4 Radiated electromagnetic field immunity

Test specification:

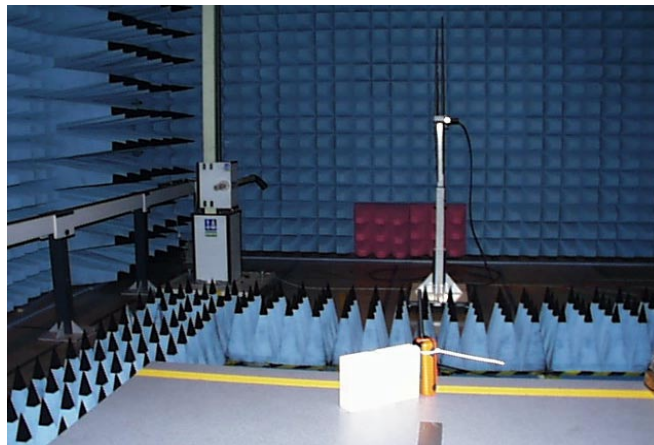
- EN 300 828, paragraph 9.1

Referenced standard:

- EN 61000-4-3, “Electromagnetic compatibility (EMC); Part 4: Testing and measurement techniques - Section 3: Radiated, radio-frequency, electromagnetic field immunity test”

Test particulars:

Parameters	Severity levels
Frequency	80-1000 MHz
Field strength	10 V/m
Modulation	80% AM, 0.4 kHz
Sweep rate	1.5×10^{-3} decade/s
No. of sweeps	1

**Set-up for radiated electromagnetic field immunity test**

The EUT was placed on a wooden table, 0.8 m above the ground plane. The EUT to antenna distance was 3 m.

Result: The EUT passed the test.

6.3.5 Electrostatic discharge

Test specification:

- EN 300 828, paragraph 9.2

Referenced standard:

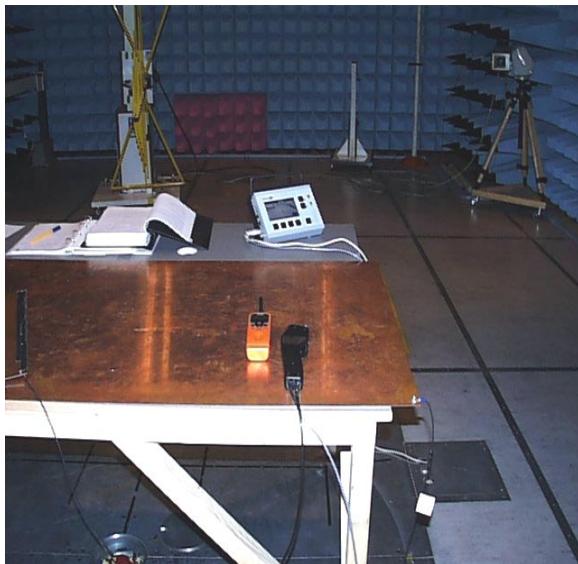
- EN 61000-4-2, March 1995: Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques - Section 2: Electrostatic discharge immunity test

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Test particulars:

Parameters	Severity level
Amplitude	Contact: ± 6 kV Air: ± 8 kV
Number of discharges	10 per point/polarity
Repetition rate	1 per s

As non-conductive plastic housing covers the entire unit, only contact discharge against a vertical coupling pane (VCP) was found relevant.

**Set-up for ESD test**

Result: The EUT passed the test.

7 SUMMARY OF TEST RESULTS

With implementation of the modifications described in Ch. 4.4, the EUT passed all the tests.

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8 TEST FACILITIES AND INSTRUMENTS

The following test facilities and instruments were used during the testing:

Instrument description	Make	Model	Serial number
Power Amplifier	AR	200W1000M7	12949
Dual Directional Coupler	AR	DC6280M1	14768
Log periodic antenna	AR	AT1080	17257
Receiver Module for Field Probe	AR	FM2000	12784
Field Strength Probe	AR	FP2000	12789
Bilog Antenna	Chase	CBL6121A	1019
Personal Computer	Compac	Prolinea 5150	None
SW for radiated immunity testing	DNV	EMC_RUN	NA
SW for Large EMC room	DNV	EMC_ROOM	NA
SW for radiated immunity testing	DNV	EMC_RUN	NA
Loop Antenna	Eaton	96020	NA
Turntable	H. Deisel	DS 420	None
Controller	H. Deisel	HD 100	100/371 Bj:95
Antenna Mast	H. Deisel	MA 240	240/354 Bj:95
Semi-anechoic Chamber	Siemens Matsushita Components	NA	NA
ESD Simulator	Compliance Instruments	ESDC30	7410106
ESP Pistol	Compliance Instruments	ESDP33	7420106
SW for emission testing	Rohde & Schwarz	ES-K1	1026.6790.02
EMI Test Receiver	Rohde & Schwarz	ESAI	825316/009
Signal generator	Rohde & Schwarz	SMT 03	839441/006
Climatic Chamber (2)	Heraeus Vötsch	VSKZ 04/90/S	44055
SW for Climatic Chamber	Vötsch	SIMPATI	V 1.24
Vibrator	Instron	1508	NA
Vibration control system	Schlumberger	SI 1215	300228
Accelerometer (reference)	KISTLER	8702B500M3	C63013

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