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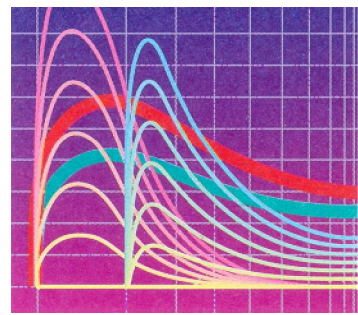
Test Report

No.: E20273 Edition 4

Designation of equipment under test:

AIS Transponder DEBEG 3400

EMC Test Laboratory
accredited by
DATEch e.V.
in compliance with DIN EN 45 001
under the
Reg. No. TTI-P-G071/94-01



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Testing body: PHOENIX TEST-LAB
Königswinkel 10
D-32825 Blomberg
Germany

Client: STN ATLAS Marine Electronics GmbH
System Navigation / Communication
Behringstrasse 120
D-22763 Hamburg

Order number: 20273

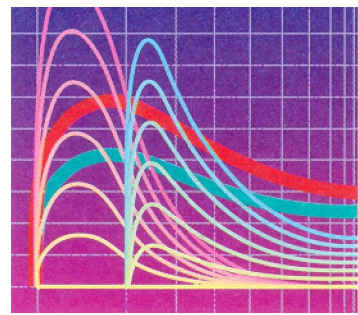
Type of test: Testing of the electromagnetic disturbances characteristics
Testing of the electromagnetic immunity characteristics

Tested on the basis of: *EN 60945 Navigations- und Funkkommunikationsgeräte und Systeme für die Seeschifffahrt, Edition September 1997*
IEC 60945 Ed. 4 date of circulation 2001-02-02 closing date for voting 2001-07-06

Disturbance emission: Chapter 9.2: Conducted emissions
Chapter 9.3: Radiated emissions from enclosure port
The limits and requirements according to *EN 60945*

Immunity interference: Chapter 10.2: Conducted low-frequency interference
Chapter 10.3: Conducted high-frequency interference
Chapter 10.4: Electromagnetic fields
Chapter 10.5: Conducted fast transients (burst)
Chapter 10.6: Conducted slow transients (surge)
Chapter 10.7: Power supply variations
Chapter 10.8: Power supply failure
Chapter 10.9: Electrostatic discharge
Chapter 5.2.3: Confusing of the DC-poles

The limits and requirements according to *EN 60945*



Equipment under test, EUT: AIS-Transponder

Type identification: DEBEG 3400

Seriesnumber:

Manufacturer: STN ATLAS Marine Electronics GmbH
Systems Navigation / Communication

Date the EUT was received: 29. April 2002

Annex: Photos of the test set-ups and the test subject

Client represented during the test by the following person(s): Dr. Wilfried Plagge
Attingimus Nachrichtentechnik

Place of test: PHOENIX TEST-LAB Blomberg

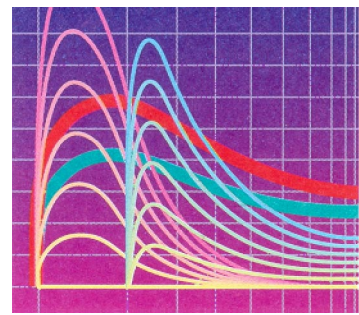
Date of test:

Test result: The requirements made in the test documents were fulfilled by the equipment under test.
The complete test results are presented in the following.

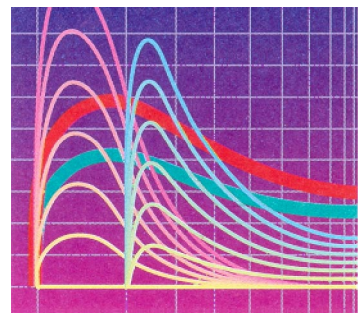
Blomberg, 19. September 2002

Test Engineer: Raimund Blask

approved by authorized Engineer



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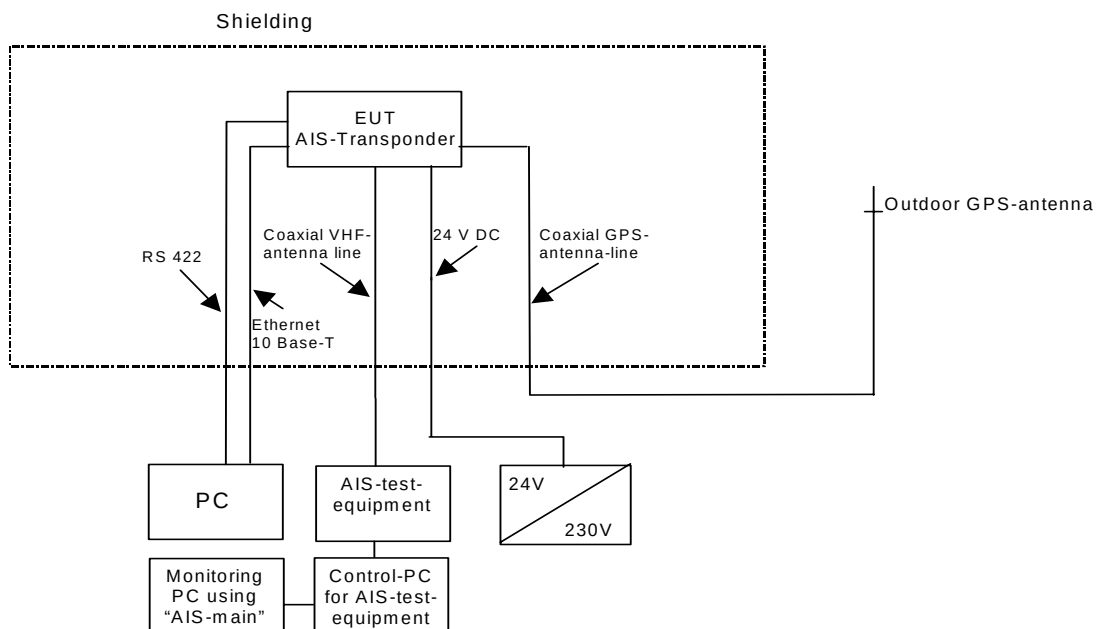


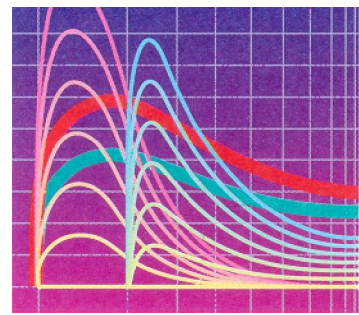
1 Operational states and test set-up

The rf-connector of the AIS transponder is connected to the respective AIS test unit connector. This way all transmissions of the AIS transponder are monitored. Furthermore transmissions addressing the AIS transponder are initiated on the test unit. The reaction of the AIS transponder is examined.

A terminal program running on a separate PC acts as a counterpart for the presentation interface of the AIS transponder. A connection is made between the presentation port and a serial port of the PC via a RS422-RS232 converter. The NMEA sentences transmitted on the presentation interface are recorded. Sending a VSD-sentence sent to the transponder triggers the emission of a message type 5 on the rf-channels. This again is monitored by the AIS test unit.

Test set-up:



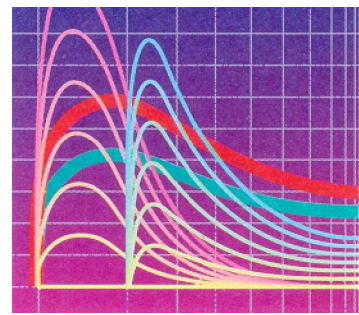


2 List of test modules and results

2.1 Disturbance emission

Radiated emission – Enclosure port				
Frequency range	Limit	Basic standard	Remark	Status
150kHz – 300kHz 300kHz – 30MHz	80 – 52 dB μ V/m in 3m 52 – 34 dB μ V/m in 3m	EN 60945 Chapter 9.3	H-field	fulfilled
30MHz –156MHz 156MHz –165MHz 165MHz – 1GHz	54 dB μ V/m in 3m 24 dB μ V/m in 3m 54 dB μ V/m in 3m	EN 60945 Chapter 9.3	E-field	fulfilled
Remark: For frequencies from 150 kHz to 30 MHz measurements shall be made of the magnetic H-field. The receiver bandwidth in the frequency ranges 150 kHz to 30 MHz and 156 MHz to 165 MHz shall be 9 kHz, and in the frequency ranges 30 MHz to 156 MHz and 165 MHz to 1 GHz shall be 120 kHz.				

Conducted emission – Power supply ports				
Frequency range	Limit	Basic standard	Remark	Status
10kHz – 150kHz 150kHz – 350kHz 350kHz – 30MHz	96 – 50 dB μ V 60 – 50 dB μ V 50 dB μ V	EN 60945 Chapter 9.2	-	fulfilled
Remark: The measuring bandwidth in the frequency range 10 kHz to 150 kHz shall be 200 Hz, and in the frequency range 150 kHz to 30 MHz shall be 9 kHz				

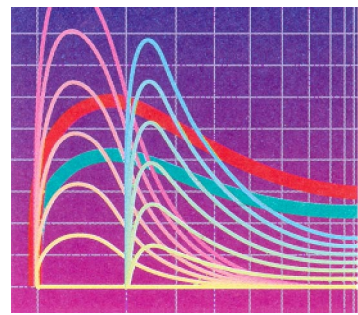


2.2 EMC Immunity

Definition of evaluation criterion according to EN 60945 chapter 10.1:

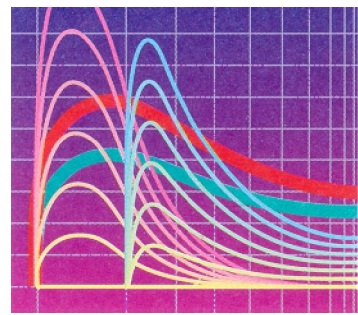
- A: No apparent impairment of function within the tolerance limits.
- B: Partial impairment of function, however self-regulating through e.g. automatic restart. Function must be restored within the tolerance limits after the test; a safe state must be guaranteed at all times.
- C: Partial impairment of function, however non self-regulating, e.g. manual start-up is necessary (Reset, Program start); a safe state must be guaranteed at all times.

Immunity – Enclosure port					
Environmental phenomena	Test specification and units	Basic standard	Remark	Performance criteria	Status
Electromagnetic fields	80 – 1000 MHz 10V/m; AM; 80%; 1kHz	EN 60945 Chapter 10.4	---	A	fulfilled
Electromagnetic fields	1000 - 2000 MHz 10V/m; AM; 80%; 1kHz	IEC 60945 Ed.4	---	A	fulfilled
Electrostatic discharge (ESD)	up to ± 6 kV charging voltage for contact discharge	EN 60945 Chapter 10.9	---	B	fulfilled
Electrostatic discharge (ESD)	up to ± 8 kV charging voltage for air discharge	EN 60945 Chapter 10.9	---	B	fulfilled



Immunity – Power supply ports, DC and AC					
Environmental phenomena	Test specification and units	Basic standard	Remark	Performance criteria	Status
Conducted high frequency interference	3V; AM; 80%; 1kHz 10kHz – 80MHz	EN 60945 Chapter 10.3	---	A	fulfilled
Conducted high frequency interference	10 V; AM; 80%; 1kHz 2 / 3 / 4 MHz, 6.2 / 8.2 / 12.6 MHz, 16.5 / 18.8 / 22 / 25 MHz	EN 60945 Chapter 10.3	---	A	fulfilled
Power supply failure	3 interruptions of 60s	EN 60945 Chapter 10.8	---	C	fulfilled
Power supply variations	$U_N + 20\%$ for 1.5s	EN 60945 Chapter 10.7	---	B	fulfilled
	$U_N - 20\%$ for 1.5s			B	fulfilled
Conducted low frequency interference (harmonics)	3V eff, max. 2W 50 kHz – 10 kHz	EN 60945 Chapter 10.2		B	fulfilled
Fast transients (Burst)	$\pm 2\text{kV}$ (peak) 5/50ns (Tr/Th) 5kHz repetition frequency	EN 60945 Chapter 10.5	---	B	fulfilled
Transients (Surge)	1,2 / 50 μs up to $\pm 0.5\text{kV}$ line/line up to $\pm 1.0\text{kV}$ line/earth	EN 60945 Chapter 10.6	---	B	fulfilled

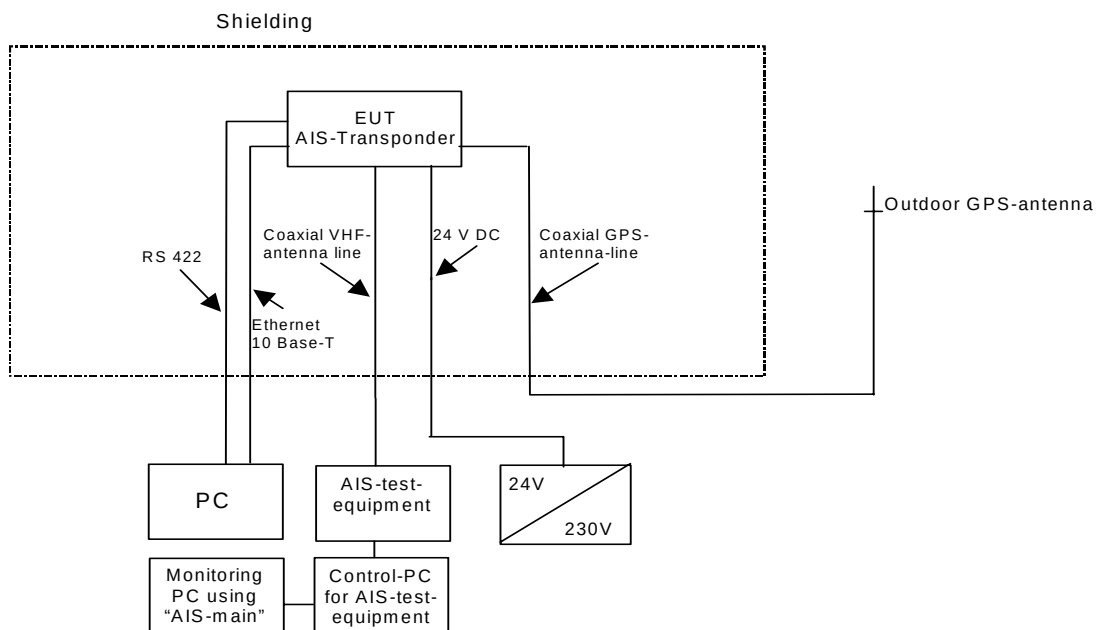
Immunity – Data, control and communications connections					
Environmental phenomena	Test specification and units	Basic standard	Remark	Performance criteria	Status
Conducted high frequency interference	3V; AM; 80%; 1kHz 10kHz – 80MHz	EN 60945 Chapter 10.3	---	A	fulfilled
Conducted high frequency interference	10 V; AM; 80%; 1kHz 2 / 3 / 4 MHz, 6.2 / 8.2 / 12.6 MHz, 16.5 / 18.8 / 22 / 25 MHz	EN 60945 Chapter 10.3	---	A	fulfilled
Fast transients (Burst)	$\pm 1\text{kV}$ (peak) 5/50ns (Tr/Th) 5kHz repetition frequency	EN 60945 Chapter 10.5	---	B	fulfilled
Transients (Surge)	1,2 / 50 μs up to $\pm 0.5\text{kV}$ line/line up to $\pm 1.0\text{kV}$ line/earth	EN 60945 Chapter 10.6	---	B	-

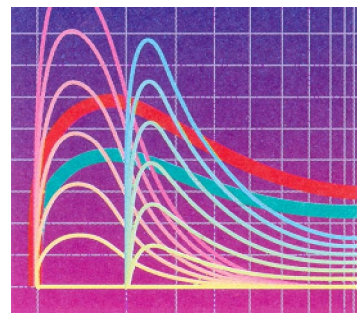


3 Test sequence and test results electromagnetic disturbances characteristics

3.1 Radiated radio disturbance according to EN 60945 chapter 9.3 (E-field)

- Test set-up:
- Table set-up
 - The drawing below schematically shows the test set-up.
 - Photos of the test set-up can also be referred to in the annex.



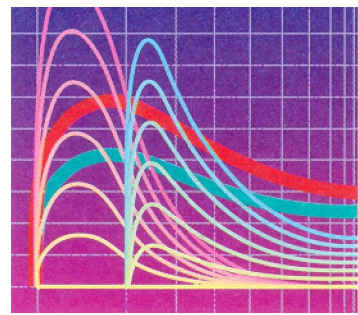


Test: The interfering field strength is measured in two stages. In the first non-standard stage, preliminary measurements are made in a fully anechoic chamber. Here the equipment under test is measured from various sides in normal fitted position. This procedure makes it possible to ascertain without the effect of external interference sources and without adjusting the antenna in height whether the test object is emitting interference at certain frequencies. In the second stage, the frequencies determined in the preliminary measurements are measured in compliance with the standard on a standard open area test site with a quasi-peak detector.

Measuring devices: AH-controller HD100 (PM-No. 480181)
 AH-antenna mast (PM-No. 480187/480188)
 AH-turntable (PM-No. 480186)
 Fully anechoic chamber (PM-No. 480190)
 Receiver ESI (PM-Nr. 480355)
 EMI softwarepackage ES-K1 (PM-No. 480111)
 Antenna Chase CBL 6112 (PM-No. 480185)
 DC filter 4*60A (PM-No. 480209)
 Filter (X11) 0-4MHz; 100R; 2*symm. Typ C110-E1 (PM-No. 480213)

Measuring records: The measuring records are presented on the following pages.

Test result: The requirements of the test documents were fulfilled.

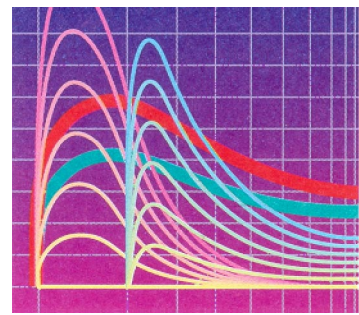


Title: Spurious emission measurement according EN60945
 EUT: AIS-Transponder DEBEG 3400
 Manufacturer: STN-Atlas
 Operating Condition: Normal operation mode
 Test site: fully anechoic chamber M20; PHOENIX TEST LAB GmbH
 Operator: R. Blask

Scantable for the preliminary measurement: EN60945 ESI

Unit: dB μ V/m
 Detector: Modus:
 Curve1: MaxPeak ClearWrite
 Curve2: Average ClearWrite

Subrange	1	2	3	4	5
Start frequency	150.0 kHz	30.0 MHz	156.0 MHz	165.0 MHz	
Stop frequency	30.0 MHz	156.0 MHz	165.0 MHz	1.0 GHz	
Increment	6.0 kHz	80.0 kHz	6.0 kHz	80.0 kHz	
Measurement time	10.0 ms	10.0 ms	10.0 ms	10.0 ms	
IF-bandwidth	9 kHz	120 kHz	9 kHz	120 kHz	
Preamplifier	20 dB	20 dB	20 dB	20 dB	
RF-attenuation	0 dB	0 dB	0 dB	0 dB	
Ref.-level	-30.0 dBm	-30.0 dBm	-30.0 dBm	-30.0 dBm	
Min. RF-attenuation	0 dB	0 dB	0 dB	0 dB	
IF. attenuation					
Autorange	On	On	On	On	
Demodulation	FM	FM	FM	FM	
Receiver	ESI7	ESI7	ESI7	ESI7	
Signal path	None	RF3 CP1	RF3 CP1	RF3 CP1	
Probe transducer	_HFH2-Z2 (dB μ V/m) 98	_CBL6112B	_CBL6112B	_CBL6112B	
System transducer	None	RF3 CP1	RF3 CP1	RF3 CP1	
Scan-mode	Lin	Lin	Lin	Lin	
Tracking-gen.					
Input	2DC	2DC	2DC	2DC	



Scantable for the subsequent measurement: EN60945 ESI_fin

Unit: dB μ V/m

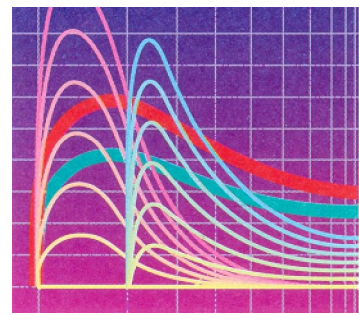
Detector: Mode:

Curve1: MaxPeak ClearWrite

Curve2: Average ClearWrite

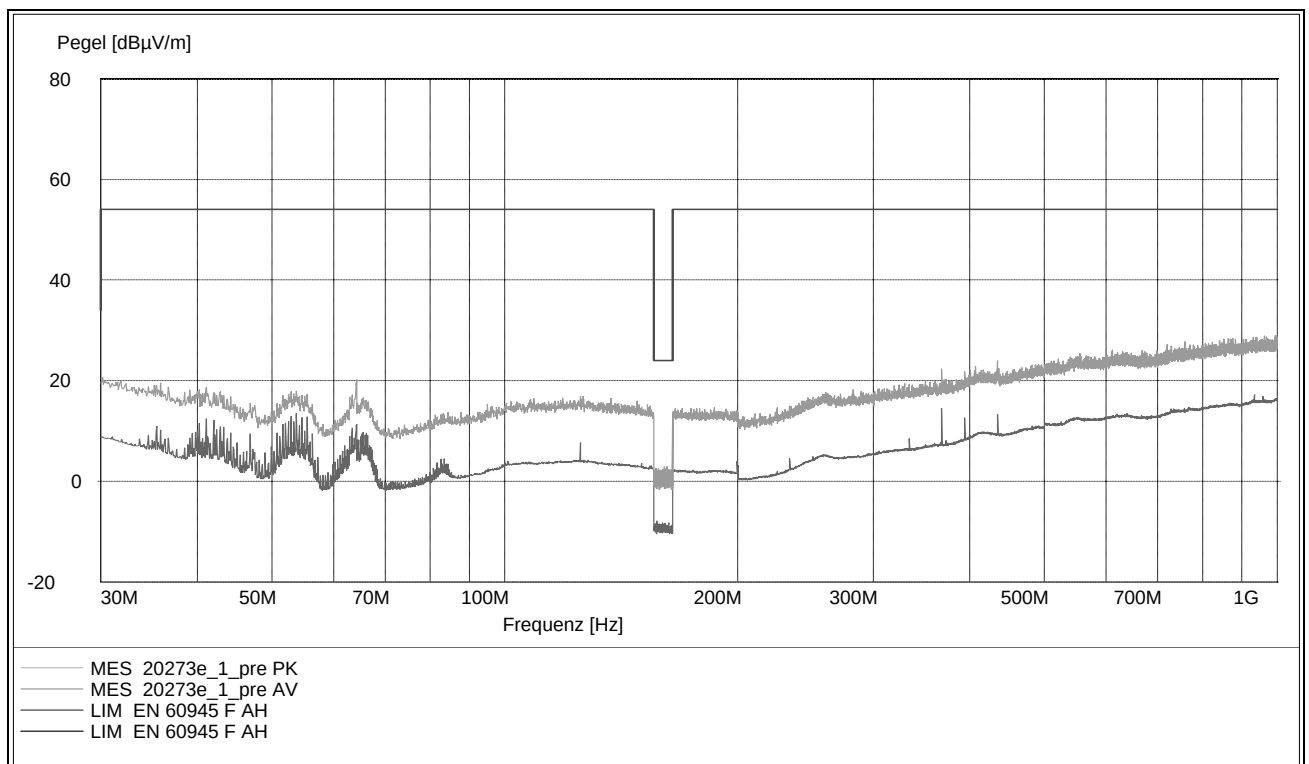
Subrange	1	2	3	4	5
Start frequency	150.0 kHz	30.0 MHz	156.0 MHz	165.0 MHz	
Stop frequency	30.0 MHz	156.0 MHz	165.0 MHz	1.0 GHz	
Increment	600.0 Hz	8.0 kHz	600.0 Hz	8.0 kHz	
Measurement time	10.0 ms	10.0 ms	10.0 ms	10.0 ms	
IF-bandwidth	9 kHz	120 kHz	9 kHz	120 kHz	
Preamplifier	20 dB	20 dB	20 dB	20 dB	
RF-attenuation	0 dB	0 dB	0 dB	0 dB	
Ref.-level	-30.0 dBm	-30.0 dBm	-30.0 dBm	-30.0 dBm	
Min. RF-attenuation	0 dB	0 dB	0 dB	0 dB	
IF. attenuation					
Autorange	On	On	On	On	
Demodulation	FM	FM	FM	FM	
Receiver	ESI7	ESI7	ESI7	ESI7	
Signal path	None	RF3 CP1	RF3 CP1	RF3 CP1	
Probe transducer	_HFH2-Z2 (dB μ V/m) 98	_CBL6112B	_CBL6112B	_CBL6112B	
System transducer	None	RF3 CP1	RF3 CP1	RF3 CP1	
Scan-mode	Lin	Lin	Lin	Lin	
Tracking-gen.					
Input	2DC	2DC	2DC	2DC	

The measurement time with the quasi-peak measuring detector is 1 second.



The curves in the diagram only represent the maximum measured value for each frequency point of all preliminary measurements, which were carried out with the EUT in various positions.

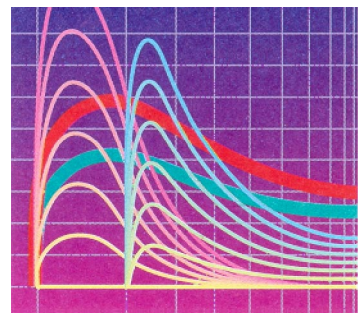
The top measured curve represents the peak measurement. The measured points marked with x are frequency points for which later measurements with a quasi-peak detector were carried out. These values are indicated in the following table. The bottom measured curve represents average values, which are only required for control purposes.



Data record name: 20273e_1

of 15. May 2002

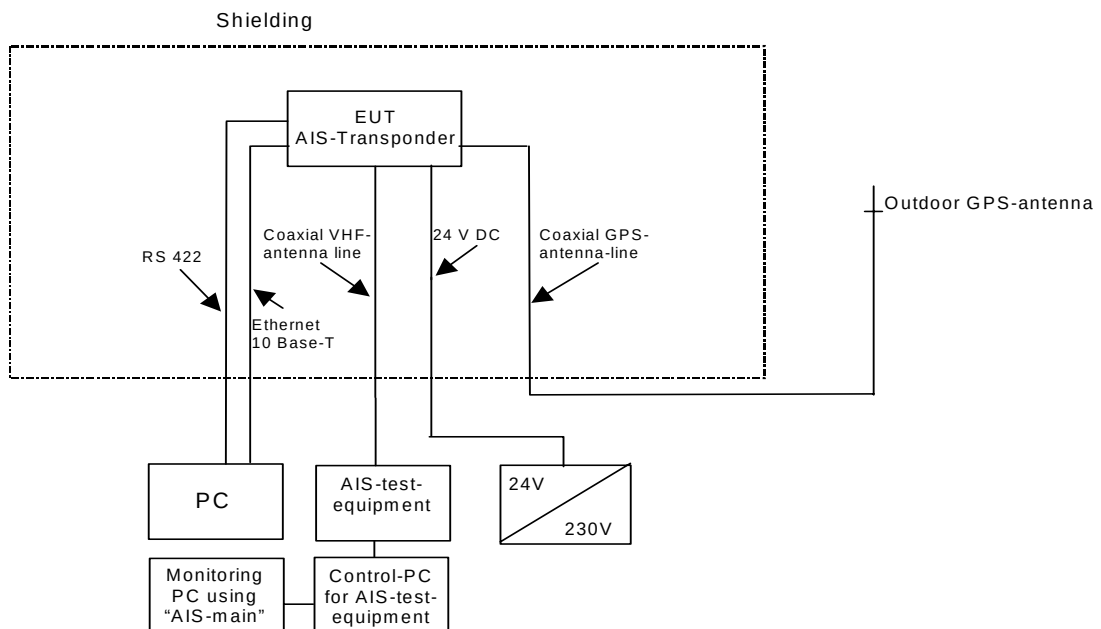
In this case it was not necessary to carry out subsequent measurements because at no frequency was a value above the Qualify limit curve during the preliminary measurements.

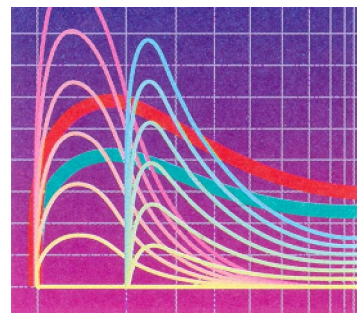


3.2 Radiated radio disturbance according to EN 60945 chapter 9.3 (magnetic. field)

Test set-up:

- Table set-up
- The drawing below schematically shows the test set-up.
- Photos of the test set-up can also be referred to in the annex.



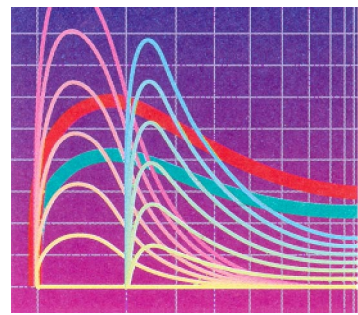


Test: The interfering field strength is measured in two stages. In the first non-standard stage, preliminary measurements are made in a fully anechoic chamber. Here the equipment under test is measured from various sides in normal fitted position. This procedure makes it possible to ascertain without the effect of external interference sources and without adjusting the antenna in height whether the test object is emitting interference at certain frequencies. In the second stage, the frequencies determined in the preliminary measurements are measured in compliance with the standard on a standard open area test site with a quasi-peak detector.

Measuring devices: AH-controller HD100 (PM-No. 480181)
 AH-antenna mast (PM-No. 480187/480188)
 AH-turntable (PM-No. 480186)
 fully anechoic chamber (PM-No. 480190)
 receiver ESI (PM-Nr. 480355)
 EMI softwarepackage ES-K1 (PM-No. 480111)
 FF-controller HD 100 (PM-No. 480139)
 FF-antenna mast (PM-No. 480086)
 FF-turntable (PM-No. 480087)
 open area test site (PM-No. 480085)
 relays switch unit RSU (PM-No. 480077)
 receiver ESAI + Display (PM-Nr. 480025, PM-Nr. 480026)
 Antenna R+S Loop antenna HFH2-Z2 (PM-Nr. 480059)
 DC filter 4*60A (PM-No. 480209)
 filter (X11) 0-4MHz; 100R; 2*symm. Type C110-E1 (PM-No. 480213)

Measuring records: The measuring records are presented on the following pages.

Test result: The requirements of the test documents were fulfilled.

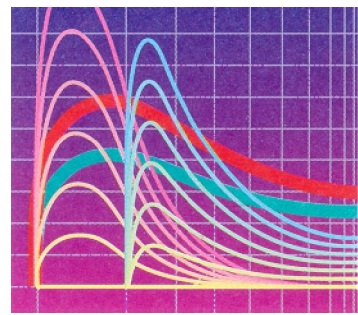


Title: Spurious emission measurement according EN60945
 EUT: AIS-Transponder DEBEG 3400
 Manufacturer: STN Atlas
 Operating Condition: Normal operation mode
 Test site: Fully anechoic chamber M20; PHOENIX TEST LAB GmbH
 Operator: R. Blask

Scantable for the preliminary measurement: EN60945 ESI

Unit: dB μ V/m
 Detector: Modus:
 Curve1: MaxPeak ClearWrite
 Curve2: Average ClearWrite

Subrange	1	2	3	4	5
Start frequency	150.0 kHz	30.0 MHz	156.0 MHz	165.0 MHz	
Stop frequency	30.0 MHz	156.0 MHz	165.0 MHz	1.0 GHz	
Increment	6.0 kHz	80.0 kHz	6.0 kHz	80.0 kHz	
Measurement time	10.0 ms	10.0 ms	10.0 ms	10.0 ms	
IF-bandwidth	9 kHz	120 kHz	9 kHz	120 kHz	
Preamplifier	20 dB	20 dB	20 dB	20 dB	
RF-attenuation	0 dB	0 dB	0 dB	0 dB	
Ref.-level	-30.0 dBm	-30.0 dBm	-30.0 dBm	-30.0 dBm	
Min. RF-attenuation	0 dB	0 dB	0 dB	0 dB	
IF. attenuation					
Autorange	On	On	On	On	
Demodulation	FM	FM	FM	FM	
Receiver	ESI7	ESI7	ESI7	ESI7	
Signal path	None	RF3 CP1	RF3 CP1	RF3 CP1	
Probe transducer	_HFH2-Z2 (dB μ V/m) 98	_CBL6112B	_CBL6112B	_CBL6112B	
System transducer	None	RF3 CP1	RF3 CP1	RF3 CP1	
Scan-mode	Lin	Lin	Lin	Lin	
Tracking-gen.					
Input	2DC	2DC	2DC	2DC	



Scantable for the subsequent measurement: EN60945 ESI_fin

Unit: dB μ V/m

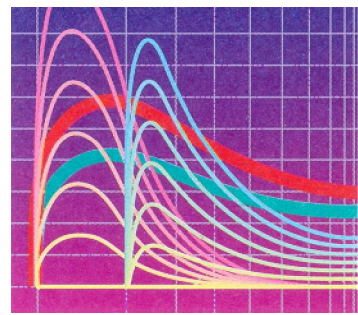
Detector: Mode:

Curve1: MaxPeak ClearWrite

Curve2: Average ClearWrite

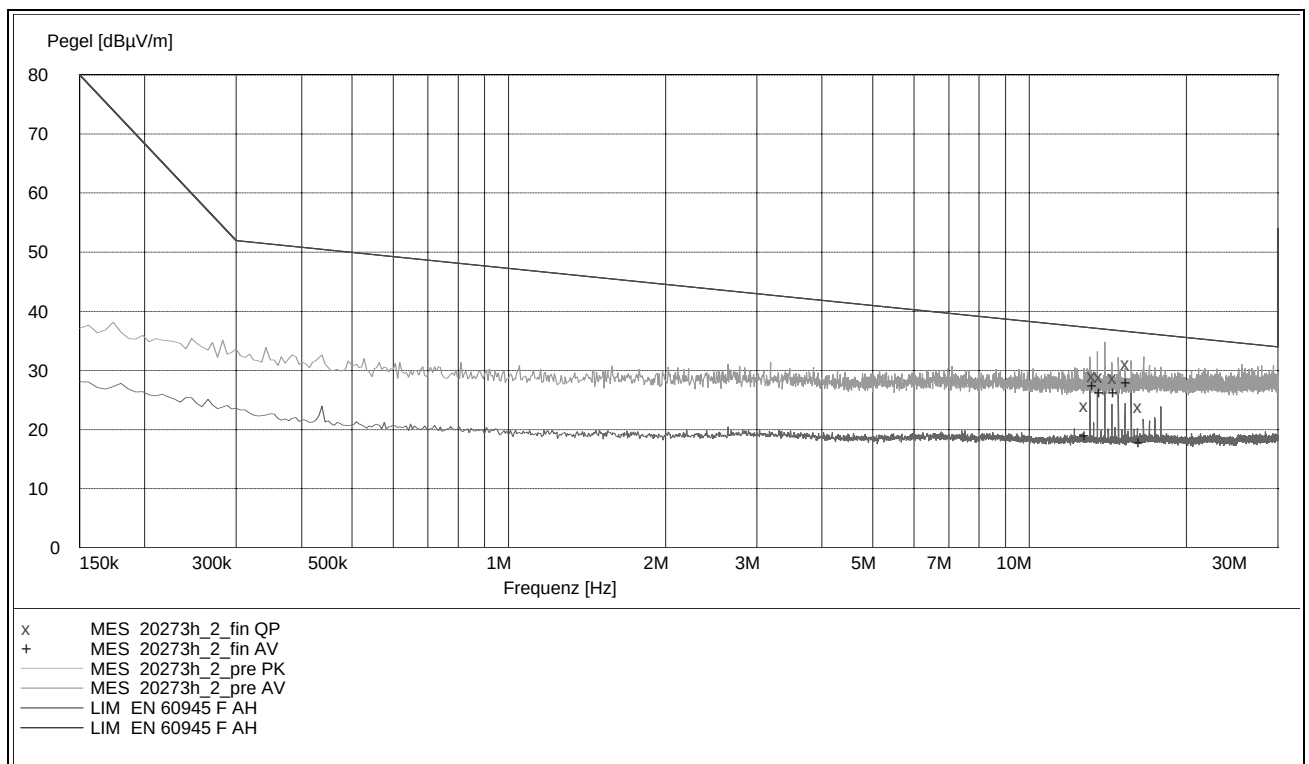
Subrange	1	2	3	4	5
Start frequency	150.0 kHz	30.0 MHz	156.0 MHz	165.0 MHz	
Stop frequency	30.0 MHz	156.0 MHz	165.0 MHz	1.0 GHz	
Increment	600.0 Hz	8.0 kHz	600.0 Hz	8.0 kHz	
Measurement time	10.0 ms	10.0 ms	10.0 ms	10.0 ms	
IF-bandwidth	9 kHz	120 kHz	9 kHz	120 kHz	
Preamplifier	20 dB	20 dB	20 dB	20 dB	
RF-attenuation	0 dB	0 dB	0 dB	0 dB	
Ref.-level	-30.0 dBm	-30.0 dBm	-30.0 dBm	-30.0 dBm	
Min. RF-attenuation	0 dB	0 dB	0 dB	0 dB	
IF. attenuation					
Autorange	On	On	On	On	
Demodulation	FM	FM	FM	FM	
Receiver	ESI7	ESI7	ESI7	ESI7	
Signal path	None	RF3 CP1	RF3 CP1	RF3 CP1	
Probe transducer	_HFH2-Z2 (dB μ V/m) 98	_CBL6112B	_CBL6112B	_CBL6112B	
System transducer	None	RF3 CP1	RF3 CP1	RF3 CP1	
Scan-mode	Lin	Lin	Lin	Lin	
Tracking-gen.					
Input	2DC	2DC	2DC	2DC	

The measurement time with the quasi-peak measuring detector is 1 second.



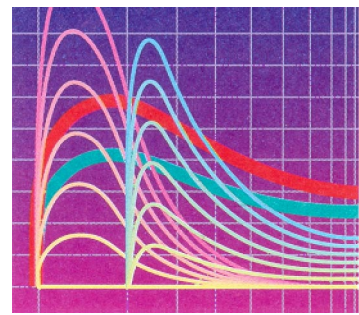
The curves in the diagram only represent the maximum measured value for each frequency point of all preliminary measurements, which were carried out with the EUT in various positions.

The top measured curve represents the peak measurement. The measured points marked with x are frequency points for which later measurements with a quasi-peak detector were carried out. These values are indicated in the following table. The bottom measured curve represents average values, which are only required for control purposes.



Data record name: 20273h_2

of 15. May 2002



Result measured with the quasi-peak detector:

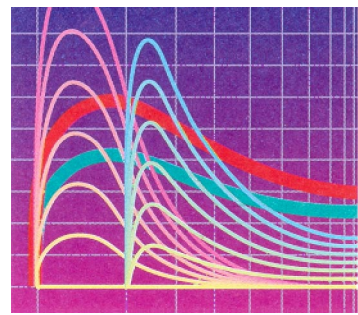
(These values are marked in the above diagram by x)

Frequency MHz	Level dB μ V/m	Transducer dB/m	Limit dB μ V/m	Margin dB	Height cm	Azimuth deg	Antenna position
13.080000	24.00	19.7	37.2	13.2	150.0	270.00	Inline
13.512000	29.20	19.7	37.1	7.9	150.0	305.00	Inline
13.950000	28.90	19.6	37.0	8.1	150.0	162.00	Inline
14.820000	28.80	19.6	36.8	7.9	150.0	359.00	Inline
15.686000	31.10	19.7	36.5	5.5	150.0	124.00	Inline
16.570000	23.80	19.8	36.3	12.5	150.0	269.00	Inline

Data record name: 20273h_2_fin QP

of 15. May 2002

The results from the standard subsequent measurements on the open area test site are presented in the following.



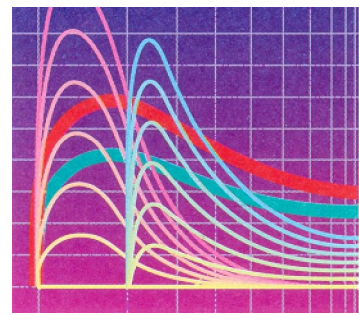
Title: Subsequent measurement with HFH2-Z2 and ESAI from R&S at 3m distance
 EUT: AIS-Transponder
 Manufacturer: STN ATLAS Electronic
 Operating Condition: Normal operation mode
 Test site: PHOENIX TEST-LAB Blomberg, Open area test-site M6
 Operator: R. Blask

Scantable for the subsequent measurement: GL 1997 M6 M CP2_fin

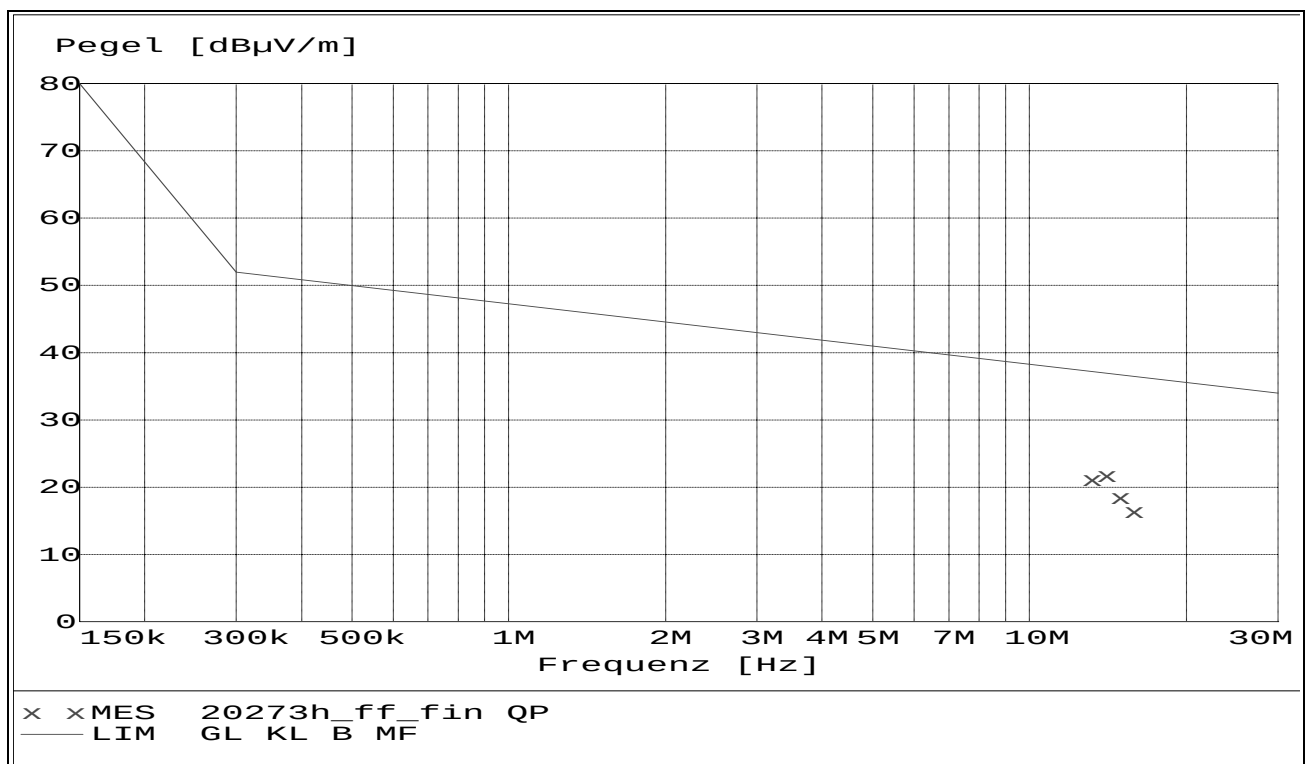
Unit: dB μ V/m
 Detector: Mode:
 Curve1: Average ClearWrite
 Curve2: None ClearWrite

Subrange	1	2	3	4	5
Start frequency	150.0 kHz				
Stop frequency	30.0 MHz				
Increment	900.0 Hz				
Measurement time	100.0 ms				
IF-bandwidth	9 kHz				
Preamplifier	Off				
RF-attenuation	0 dB				
Ref.-level	-50.0 dBm				
Min. RF-attenuation	10 dB				
IF. attenuation					
Autorange	On				
Demodulation	AM				
Receiver	ESAI				
Signal path	H-Feld FF				
Probe transducer	HFH2-Z2 (dB μ V/m)				
System transducer	Treppe 01/02				
Scan-mode	Lin				
Tracking-gen.	Off				
Input	1AC				

The measurement time with the quasi-peak measuring detector is 1 second.



The measured points and the limit line in the following diagram refer to the standard measurement of the emitted interference in compliance with the above mentioned standard. The measured points marked with x are the measured results of the standard subsequent measurement on the open area test site.



Data record name: 20273h_ff

of 17. May 2002

The results of the standard subsequent measurement on the open area test site are indicated in the table below. The limits as well as the measured results (levels) refer to the above mentioned standard while taking account of the specified requirements for a 3m measuring distance.

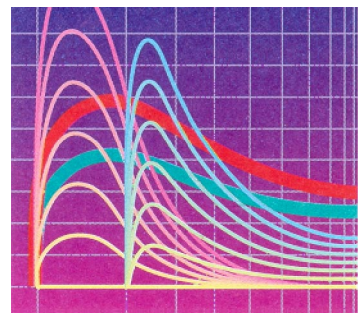
Result measured with the quasi-peak detector:

(These values are marked in the above diagram by x)

Frequency MHz	Level dBµV/m	Transducer dB/m	Limit dBµV/m	Margin dB	Height cm	Azimuth deg	Polarisation
13.056000	21.10	20.0	37.3	16.1	150.0	180.00	Inline
13.956000	21.60	19.9	37.0	15.4	150.0	270.00	Inline
14.826000	18.40	19.9	36.8	18.4	150.0	267.00	Inline
15.702000	16.30	20.0	36.5	20.3	150.0	270.00	Inline

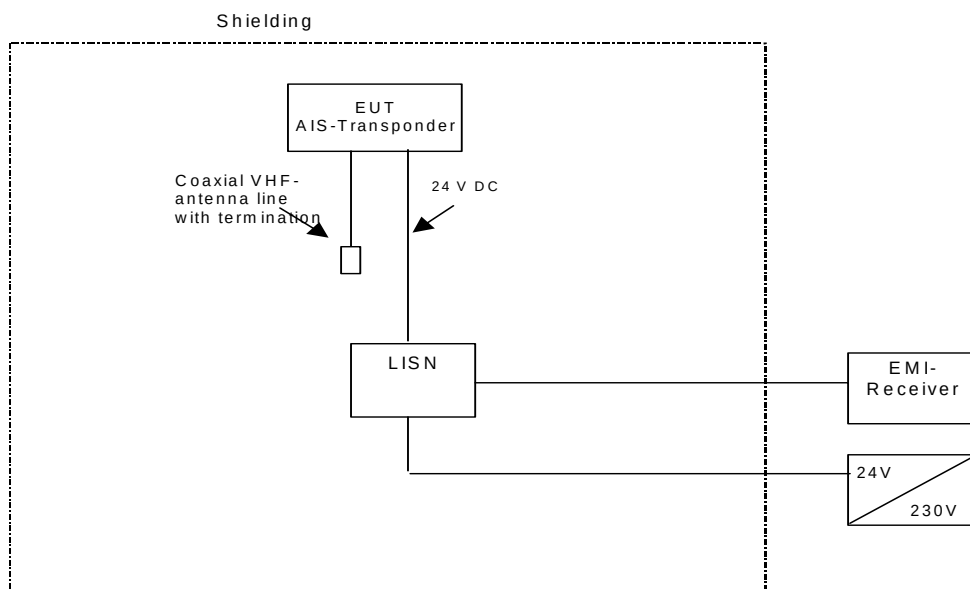
Data record name: 20273h_ff_fin QP

of 17. May 2002



3.3 Conducted radio disturbances according to EN 60945 chapter 9.2

- Test set-up:
- Table set-up
 - The drawing below schematically shows the test set-up.
 - Photos of the test set-up can also be referred to in the annex.

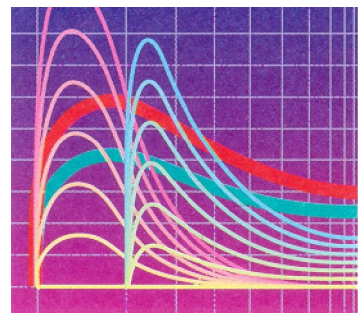


Measuring devices:

- Shielded chamber (PM-No. 480088)
- ESAI test receiver + display (PM-No. 480025, PM-No. 480026)
- EMI ES-K1 software package (PM No. 480111)
- LISN NSLK8128 (PM-No. 480058)
- DC filter (PM-No. 480099)

Measuring records: The measuring records are presented on the following pages.

Test results: The requirements of the test documents were fulfilled.

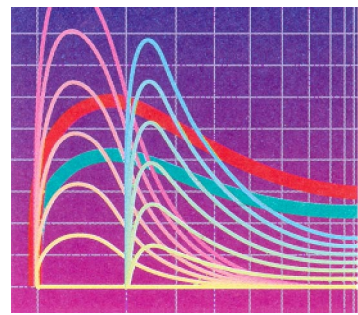


EUT: AIS-Transponder DEBEG 3400
 Manufacturer: STN Atlas
 Operating condition: Normal operation mode
 Test site: PHOENIX TEST-LAB Blomberg M4
 Operator: R. Blask
 Test Specification:

Scantable for the preliminary measurement: GL 1997 M4

Unit: dBμV
 Detector: Mode:
 Curve1: MaxPeak ClearWrite
 Curve2: Average ClearWrite

Subrange	1	2	3	4	5
Start frequency	10.0 kHz	150.0 kHz			
Stop frequency	150.0 kHz	30.0 MHz			
Increment	150.0 Hz	6.0 kHz			
Measurement time	50.0 ms	50.0 ms			
IF-bandwidth	200 Hz	9 kHz			
Preamplifier	Off	Off			
RF-attenuation	20 dB	20 dB			
Ref.-level	-50.0 dBm	-50.0 dBm			
Min. RF-attenuation	20 dB	20 dB			
IF. attenuation					
Autorange	On	On			
Demodulation	AM	AM			
Receiver	ESAI	ESAI			
Signal path	Tisch	Tisch			
Probe transducer	_NSLK	_NSLK			
System transducer	SK Tisch 01/02	SK Tisch 01/02			
Scan-mode	Lin	Lin			
Tracking-gen.	Off	Off			
Input	1DC	1DC			



Scantable for the subsequent measurement: GL 1997 M4_fin

Unit: dB μ V

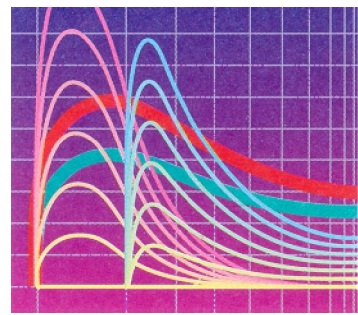
Detector: Mode:

Curve1: MaxPeak ClearWrite

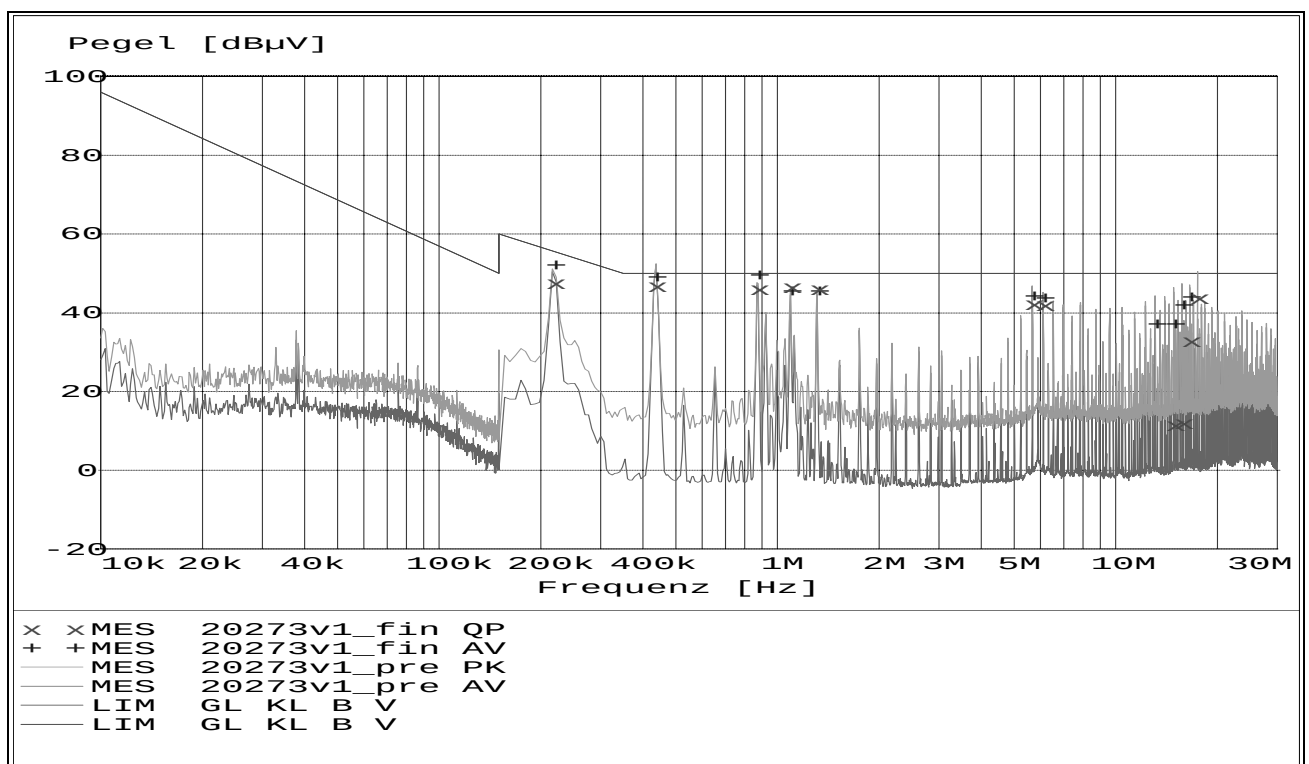
Curve2: Average ClearWrite

Subrange	1	2	3	4	5
Start frequency	10.0 kHz	150.0 kHz			
Stop frequency	150.0 kHz	30.0 MHz			
Increment	20.0 Hz	900.0 Hz			
Measurement time	100.0 ms	100.0 ms			
IF-bandwidth	200 Hz	9 kHz			
Preamplifier	Off	Off			
RF-attenuation	20 dB	20 dB			
Ref.-level	-50.0 dBm	-50.0 dBm			
Min. RF-attenuation	20 dB	20 dB			
IF. attenuation					
Autorange	On	On			
Demodulation	AM	AM			
Receiver	ESAI	ESAI			
Signal path	Tisch	Tisch			
Probe transducer	_NSLK	_NSLK			
System transducer	SK Tisch 01/02	SK Tisch 01/02			
Scan-mode	Lin	Lin			
Tracking-gen.	Off	Off			
Input	1DC	1DC			

The measurement time with the quasi-peak measuring detector is 5 seconds.

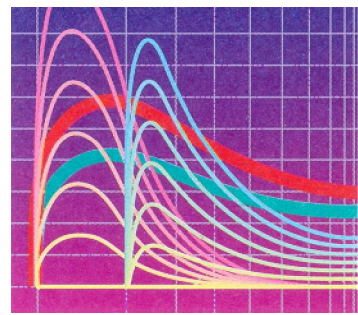


The curves in the diagram only represent for each frequency point the maximum measured value of all preliminary measurements which were made for each power supply line. The top measured curve represents the peak measurement and the bottom measured curve the average measurement. The quasi-peak measured points are marked by x and the average measured points by +.



Data record name: 20273v1

of 01.July 2002



Result measured with the quasi-peak detector:

(These values are marked in the above diagram by x)

Frequency MHz	Level dB μ V/m	Transducer dB/m	Limit dB μ V/m	Margin dB	Phase	PE
0.218400	47.30	0.6	55.6	8.3	N	GND
0.436200	46.80	0.7	50.0	3.2	N	GND
0.872700	45.80	0.7	50.0	4.2	L1	FLO
1.090500	46.50	0.7	50.0	3.5	N	FLO
1.309200	45.80	0.7	50.0	4.2	L1	FLO
5.666100	42.20	1.0	50.0	7.8	L1	FLO
6.101700	41.90	1.0	50.0	8.1	N	FLO
14.832600	11.30	1.9	50.0	38.7	L1	GND
15.715500	12.00	2.0	50.0	38.0	L1	FLO
16.559700	32.70	2.1	50.0	17.3	L1	GND
17.428200	43.60	2.1	50.0	6.4	L1	GND

Data record name: 20273v1_fin QP

of 01.July 2002

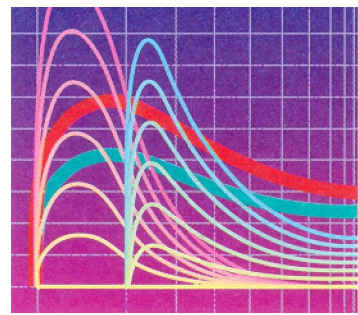
Result measured with the average detector:

(These values are marked in the above diagram by +)

Frequency MHz	Level dB μ V/m	Transducer dB/m	Limit dB μ V/m	Margin dB	Phase	PE
0.218400	52.00	0.6	55.6	3.6	N	GND
0.436200	48.90	0.7	50.0	1.1	N	FLO
0.872700	49.50	0.7	50.0	0.5	N	GND
1.090500	45.40	0.7	50.0	4.6	L1	FLO
1.309200	45.30	0.7	50.0	4.8	L1	GND
5.664300	44.10	1.0	50.0	5.9	L1	GND
6.099900	43.70	1.0	50.0	6.3	N	FLO
13.071300	36.90	1.7	50.0	13.1	L1	GND
14.813700	37.00	1.9	50.0	13.0	L1	FLO
15.683100	41.90	2.0	50.0	8.1	L1	GND
16.553400	43.90	2.1	50.0	6.1	L1	GND

Data record name: 20273v1_fin AV

of 01.July 2002

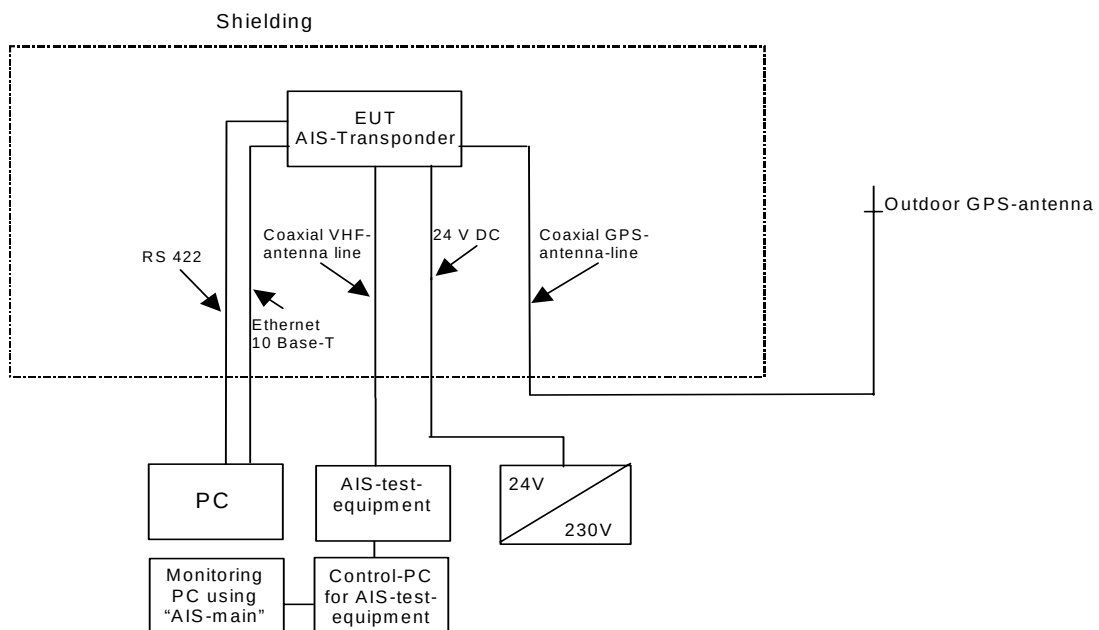


4 Test sequence and test results electromagnetic immunity characteristics

4.1 Immunity test for high frequency electromagnetic fields according to EN 60945 chapter 10.4 and IEC 60945 Ed. 4 (additional frequency range up to 2 GHz)

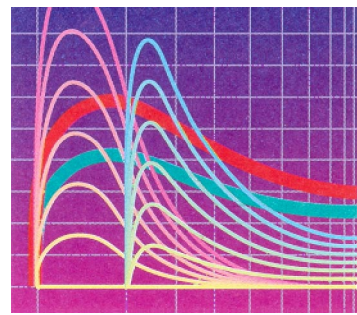
Test set-up:

- Table set-up
- The drawing below schematically shows the test set-up.
- Photos of the test set-up can also be referred to in the annex.
- The transmitting antenna is set at 1.5m above the floor.



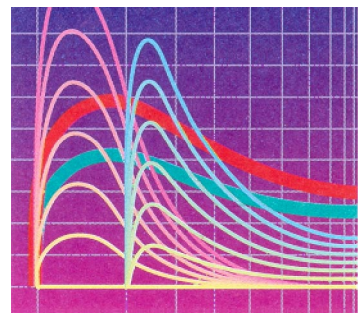
Monitoring of EUT:

The output signals were checked by the monitoring system outside the anechoic chamber.



Measuring devices:

- AH-controller HD100 (PM-No. 480181)
- AH-turntable (PM-No. 480186)
- AH-antenna mast (PM-No. 480187, 480188)
- Fully anechoic chamber (PM-No. 480190)
- Power amplifier AR 1000L M20 (PM-No. 480198)
- Power amplifier AR 500W1000M5 (PM-No. 480199)
- Power amplifier AR 200T1G2 (PM-No. 480200)
- Power amplifier AR 200T2G4 (PM-No. 480201)
- Signal generator SME06 (PM-No. 480174)
- Power meter NRVD (PM-No. 480176, 480177)
- Insertion unit URV5-Z2 (PM-No. 480191, 480192)
- Terminating impedance RNB (PM-No. 480062, 480063)
- Power probe NRV-Z2 (PM-No. 480193/480194)
- Relays switch unit RSU (PM-No. 480175)
- Amplifier interface SCIU (PM-No. 480178)
- Control unit FM2000 (PM-No. 480173)
- Field sensor FP2000 (PM-No. 480195)
- Field sensor FP2080 (PM-No. 480196)
- EMS softwarepackage EMS-K1 (PM-No. 480222)
- Horn antenna EMCO 3109 (PM-No. 480082)
- Log.per.antenna AT1080 (PM-No. 480189)
- DC filter 4*60A (PM-No. 480209)
- Filter (X11) 0-4MHz; 100R; 2*symm. Type C110-E1 (PM-No. 480213)



Measuring records:

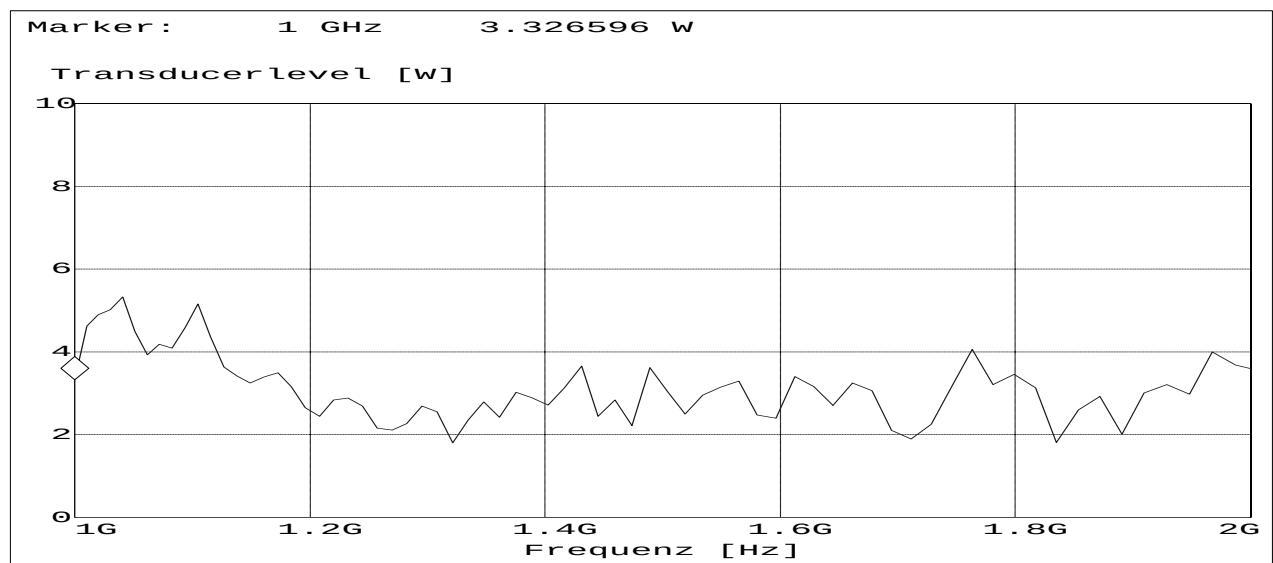
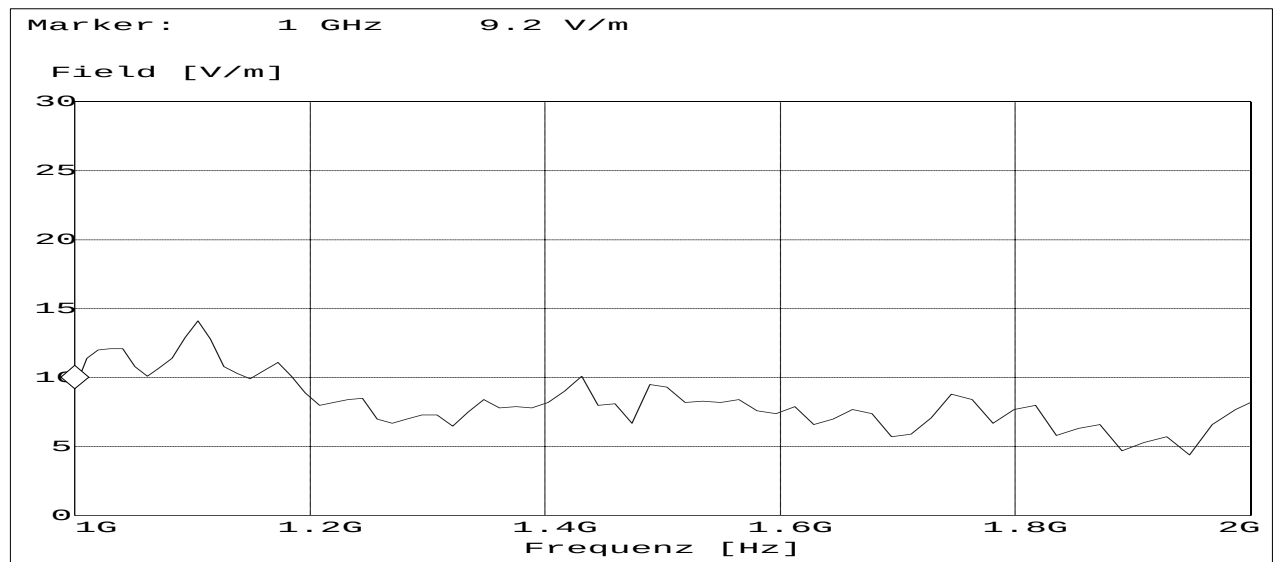
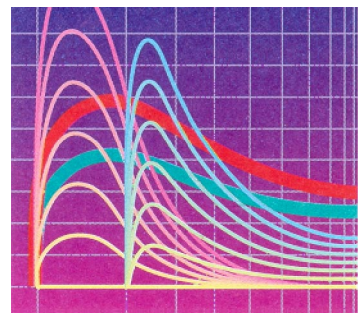
The tests in the table below were carried out.

Date of test:		14. May 2002		
Ambient conditions:		60% Frel, 19°C		
Test level:		80-2000MHz, 10V/m, AM, 400 Hz, 80%		
Increment:		log 1%		
Dwell time:		≥3s		
Distance antenna/ test object	Polarisation	Radiation direction	EUT reaction	Result
3m	vertical	0 °	No reaction detected	A
3m	vertical	90 °	No reaction detected	A
3m	vertical	180 °	No reaction detected	A
3m	vertical	270 °	No reaction detected	A
3m	horizontal	0 °	No reaction detected	A
3m	horizontal	90 °	No reaction detected	A
3m	horizontal	180 °	No reaction detected	A
3m	horizontal	270 °	No reaction detected	A

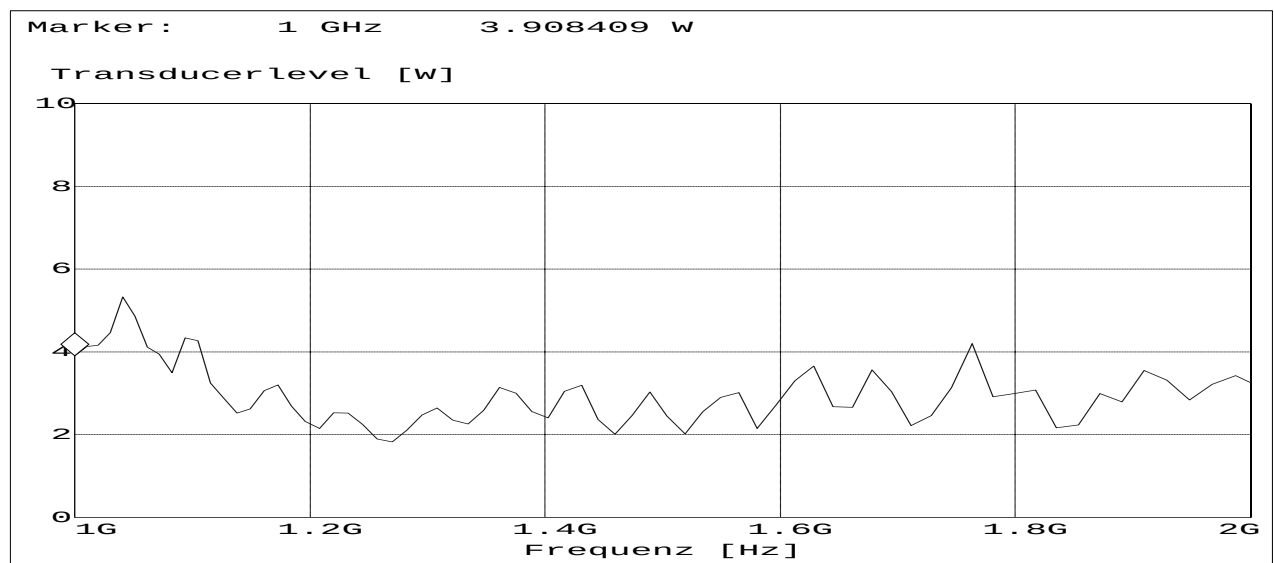
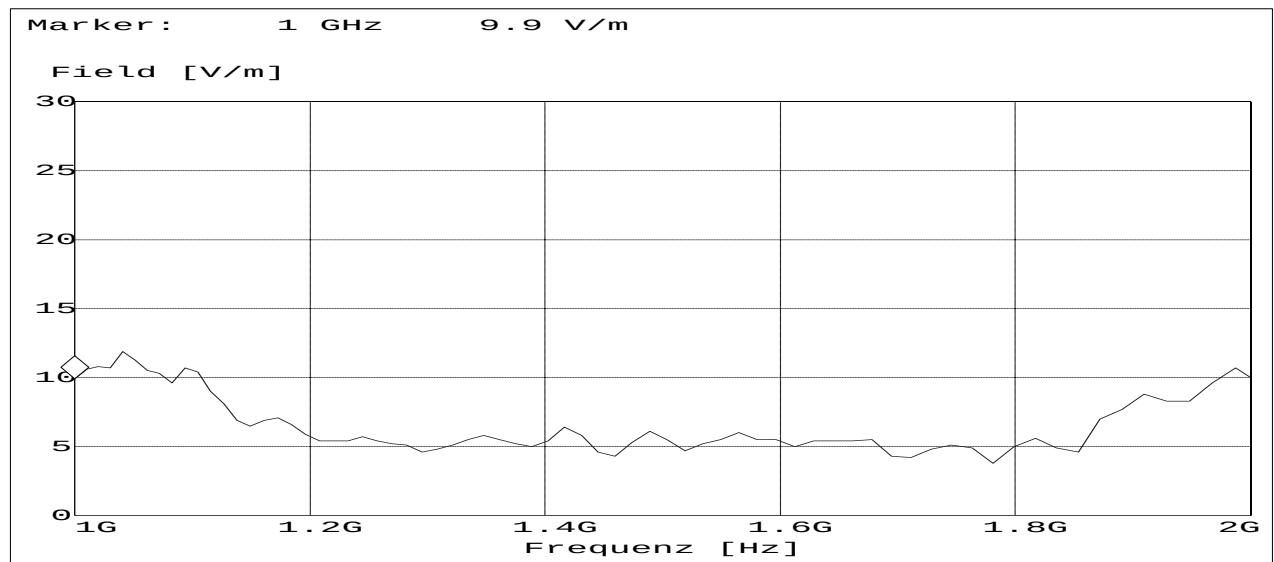
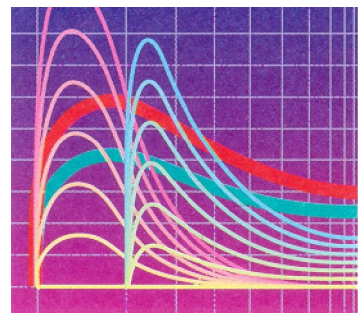
Test results: The requirements of the test documents were fulfilled.

The curves in the following graphs are representative of the entire frequency range:

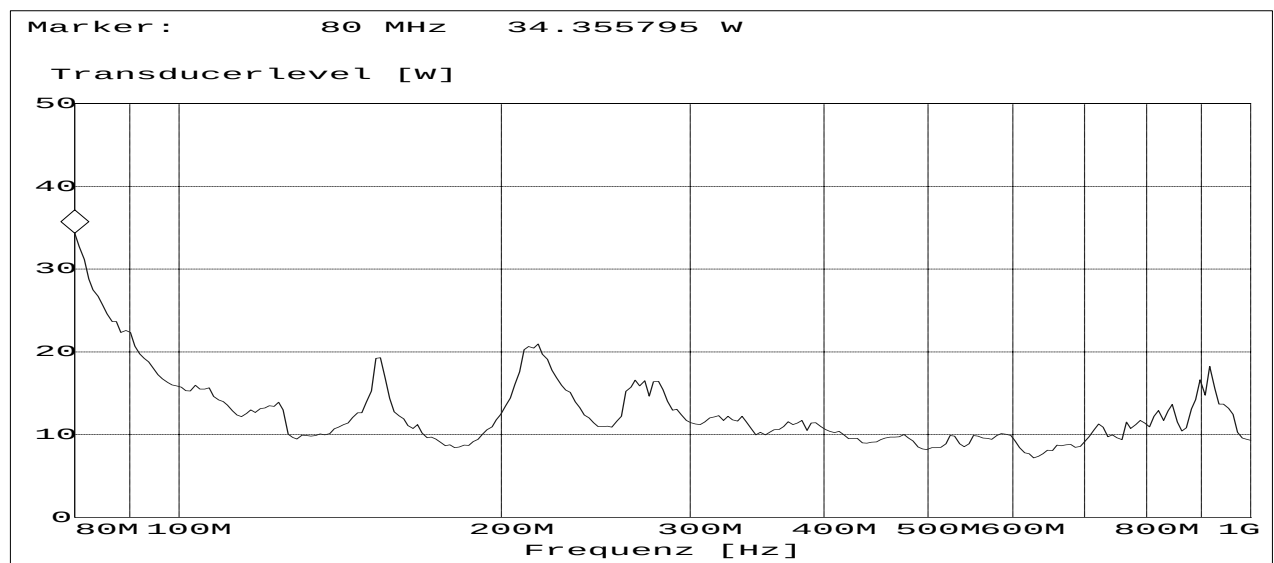
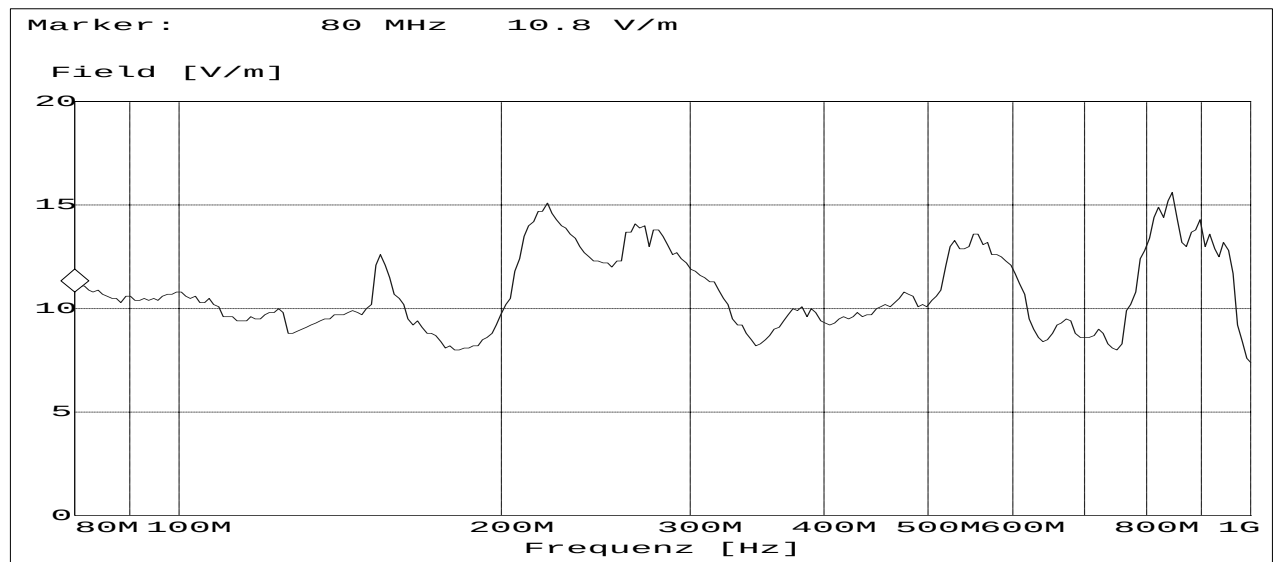
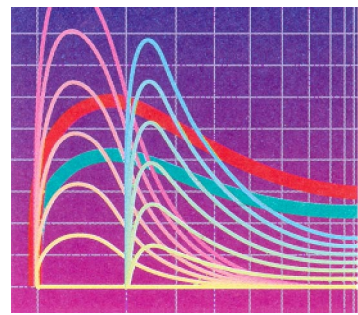
- The 'Transducerlevel' curve represents the power transmitted by the antenna. This power profile must be taken as the basis of any subsequent test.
- The 'Field' curve shows the measured field strength corresponding with polarisation of the transmitting antenna. This curve only serves to prove that a field was produced. Refer to the Annex for a photo of the position of the field probe in relation to the equipment under test.



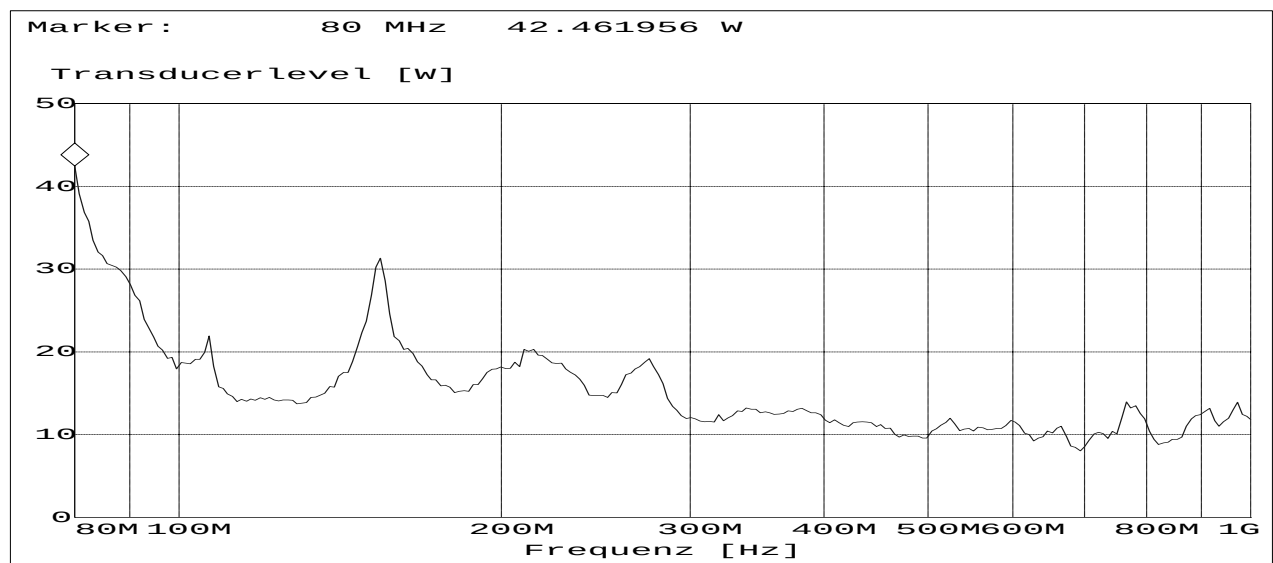
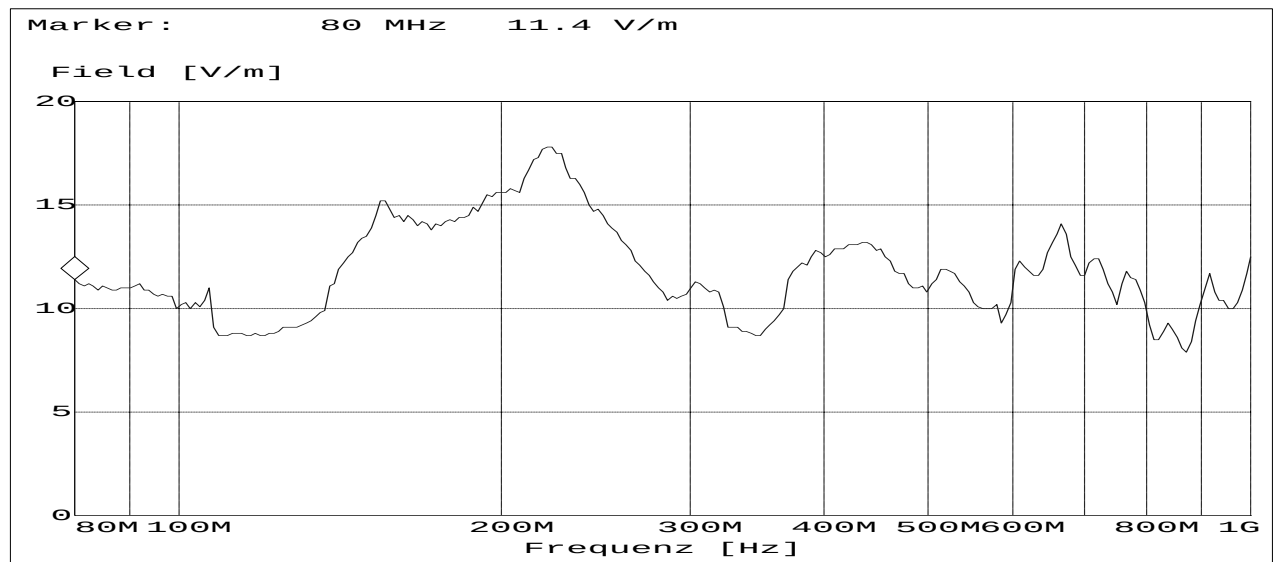
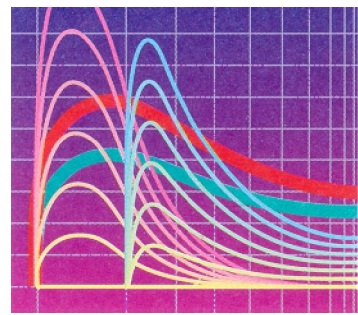
20273hh0: 1...2 GHz, horizontal polarisation



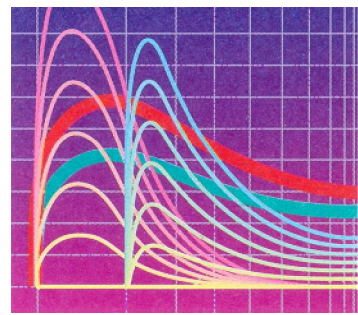
20273hv0: 1...2 GHz, vertical polarisation



20273lh0: 80...1000 MHz, horizontal polarisation



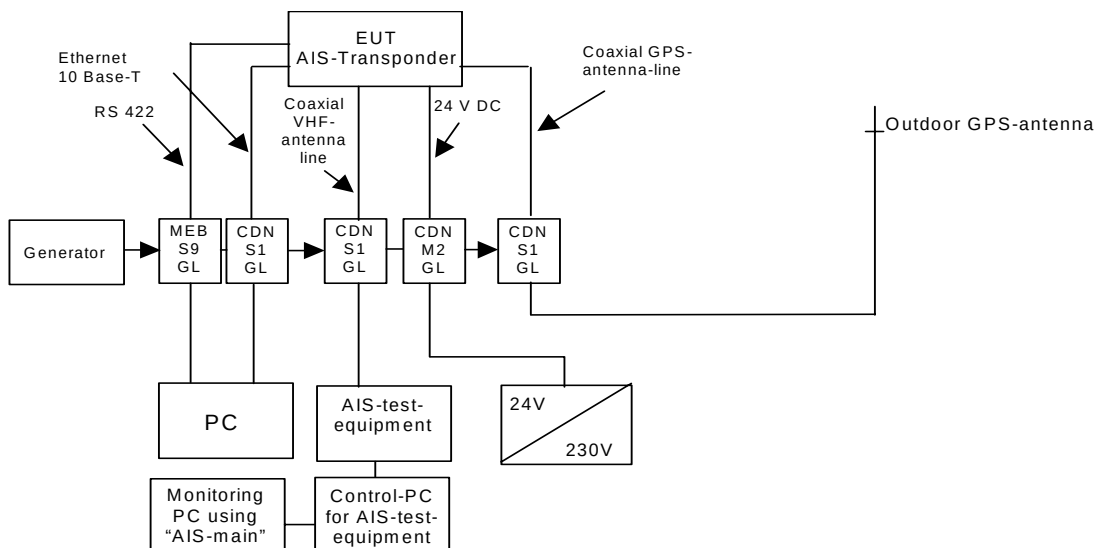
20273lv0: 80...1000 MHz, vertical polarisation



4.2 Immunity test for conducted voltages, induced by RF-fields according to EN 60945 chapter 10.3

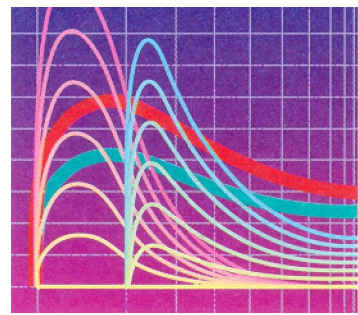
Test set-up:

- Table set-up
- The drawing below schematically shows the test set-up.
- Photos of the test set-up can also be referred to in the annex.
- The EUT is placed 10 cm above the ground plane.



Monitoring of EUT:

The output signals were checked by the monitoring system.



Measurement devices: Power amplifier AR 25A250A (PM No. 480154)
 Signal generator SMG (PM No. 480016)
 Millivoltmeter URV5 (PM No. 480015)
 Power probe URV5-Z2 (PM No. 480019, PM No. 480020)
 Terminating impedance RNB (PM No. 480007, PM No. 480008)
 Relay interface ICS 4874 (PM No. 480066)
 Attenuator 6dB (PM-No. 410061)
 EMS software package EMS-K1 (PM No. 480112)
 Shielded room (PM No. 480088)
 DC filter (PM-No. 480099)
 MEB CDN S1/50-801/6 (PM-No. 410033)
 Lüthi CDN 801-S9 (PM-No. 410040)
 EMV CDN M2 GL (PM-No. 410073)

Measuring records:

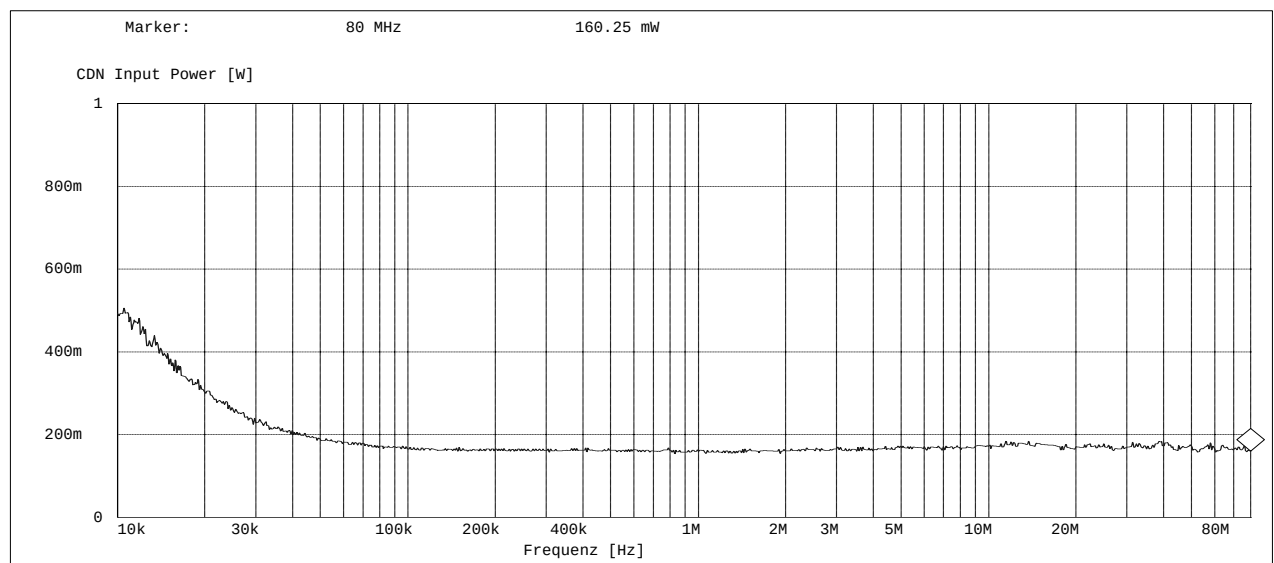
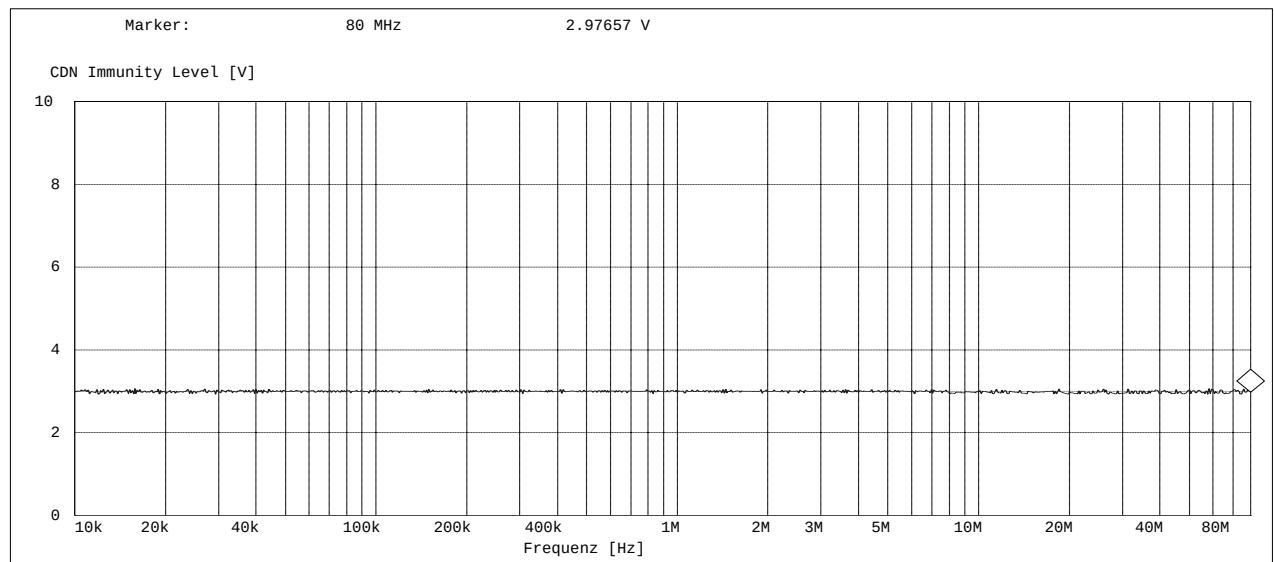
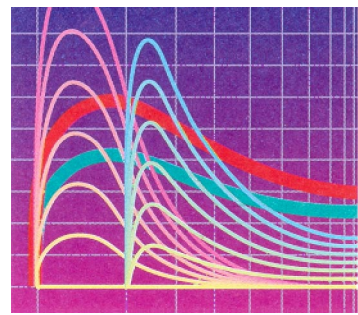
The tests in the table below were carried out.

Date of test:	17. May 2002		
Ambient conditions:	60% F _{rel} , 19°C		
Test level 1:	10 kHz – 80 MHz, 3V, AM, 80%, 400 Hz		
Increment:	log 1%		
Test level 2:	2 MHz, 3 MHz, 4 MHz, 6,2 MHz, 8,2 MHz, 12,6 MHz, 16,5 MHz, 18,8 MHz, 22 MHz, 25 MHz, 10V, AM, 80%, 400 Hz		
Dwell time:	≥3s		
Coupling network	Coupling to	EUT reaction	Result
EMV CDN M2 GL	24 V DC	No reaction detected	A
Lüthi CDN 801-S9	RS 422	No reaction detected	A
MEB CDN S1/50-801/6	VHF-antenna	No reaction detected	A
MEB CDN S1/50-801/6	GPS-antenna	No reaction detected	A
MEB CDN S1/50-801/6	Ethernet 10-Base-T	No reaction detected	A

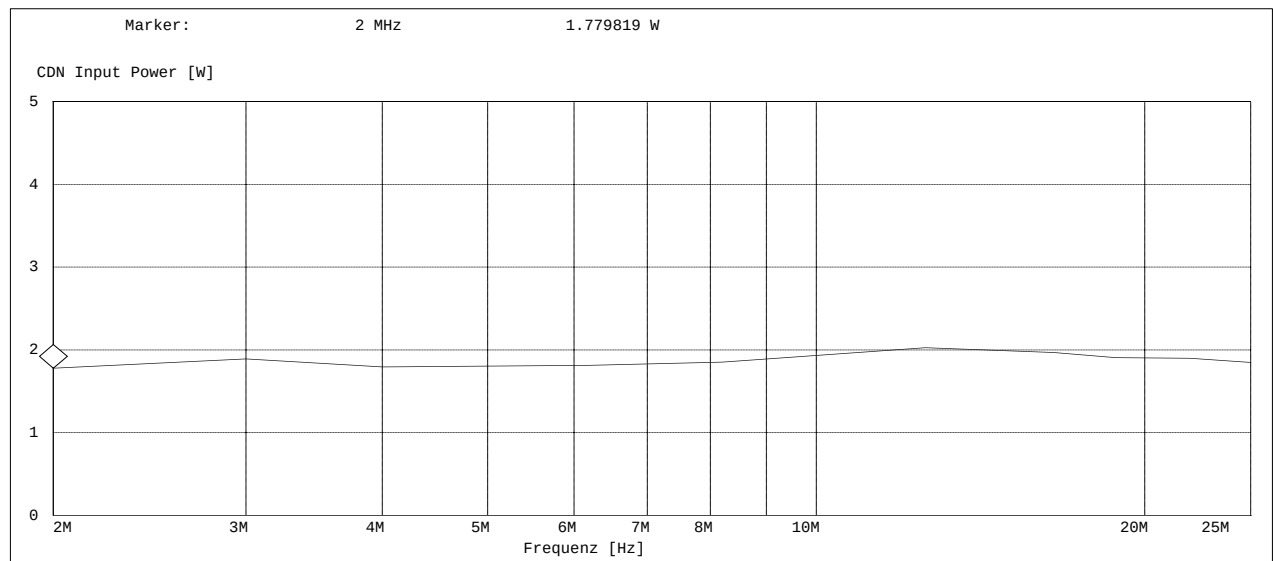
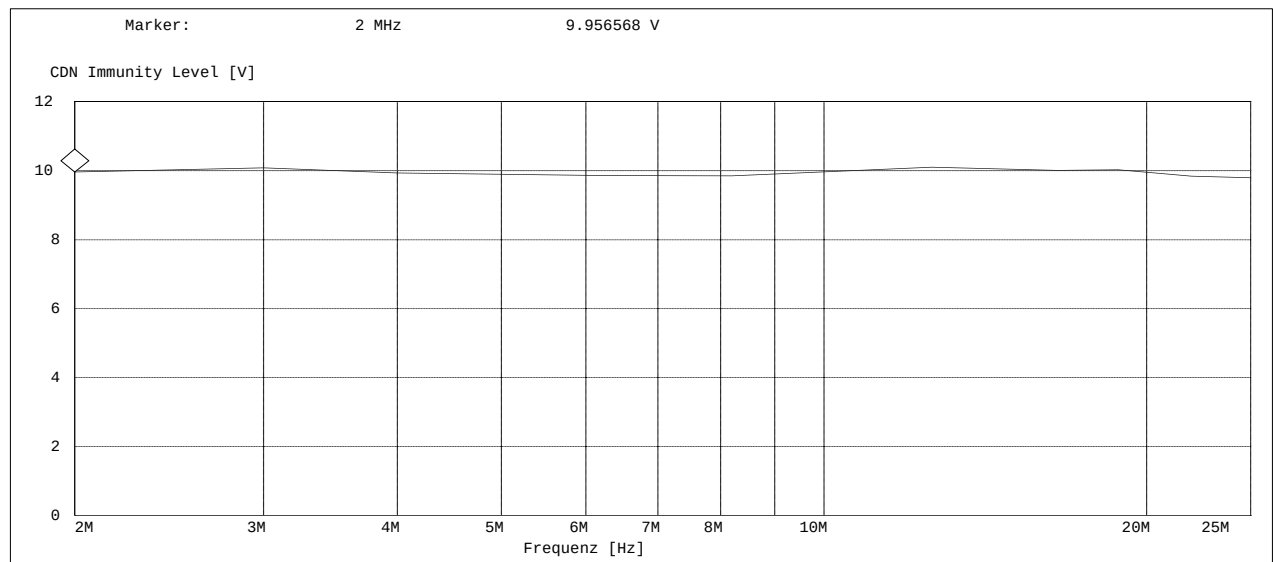
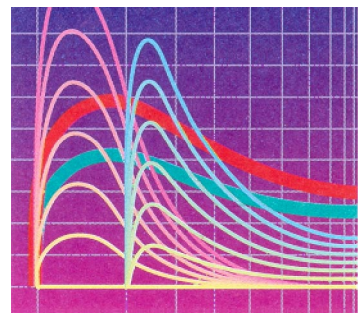
Test result: The requirements for the test documents were fulfilled.

The curves in the following graphs are representative of the entire frequency range:

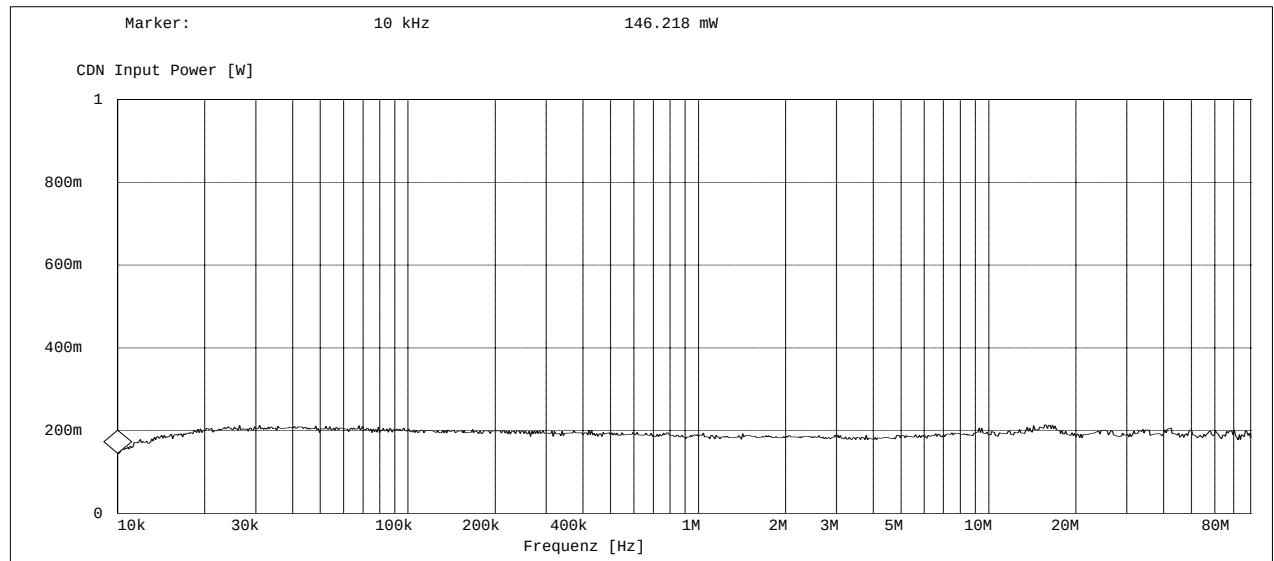
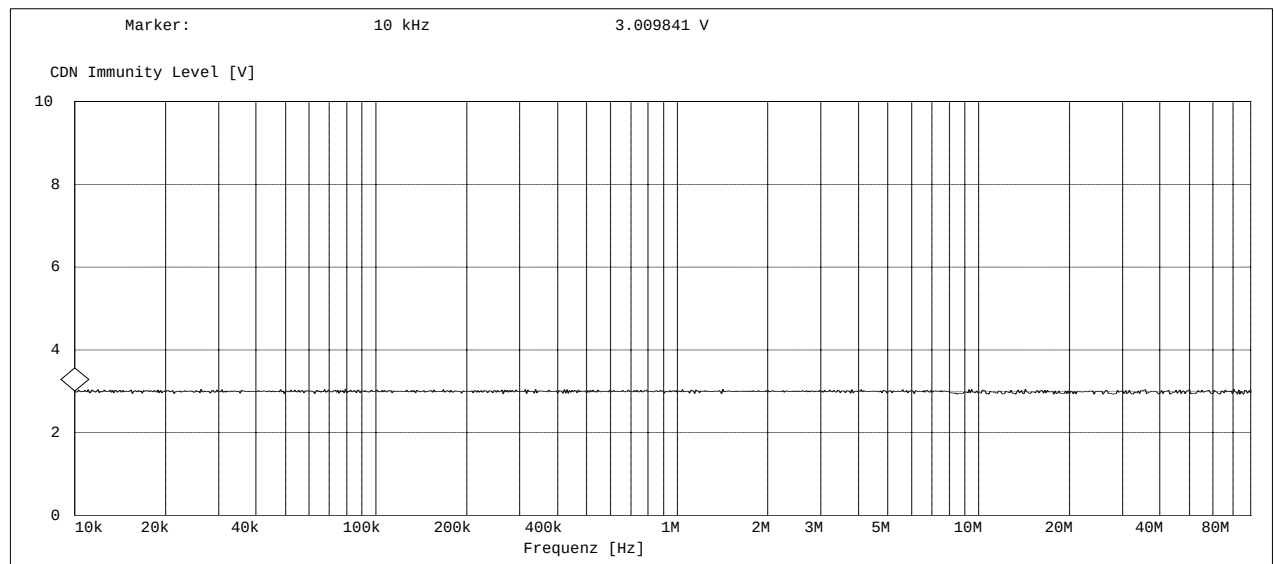
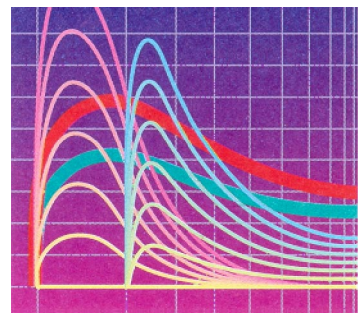
- The 'CDN INPUT POWER' curve represents the power transmitted to the CDN.
- This power profile must be taken as the basis of any subsequent test.



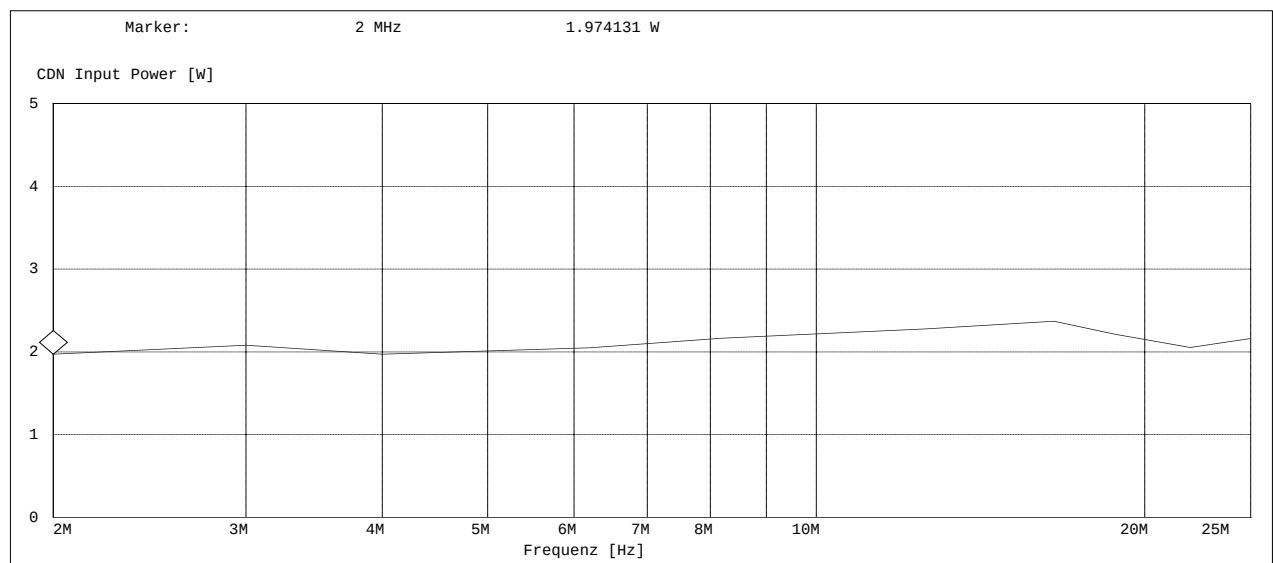
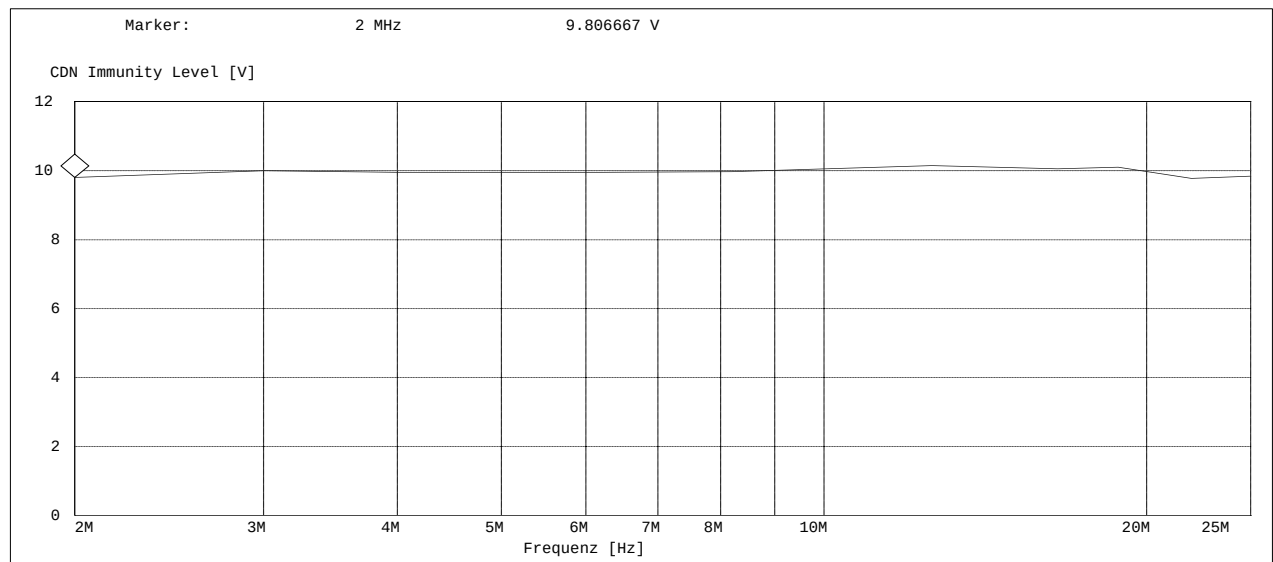
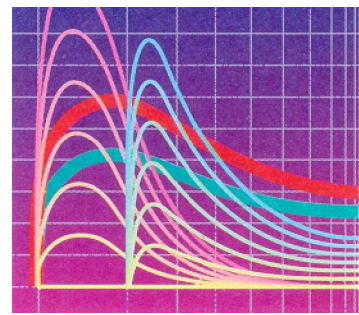
20273rs422: 10 kHz...80 MHz, coupling to RS 422 line



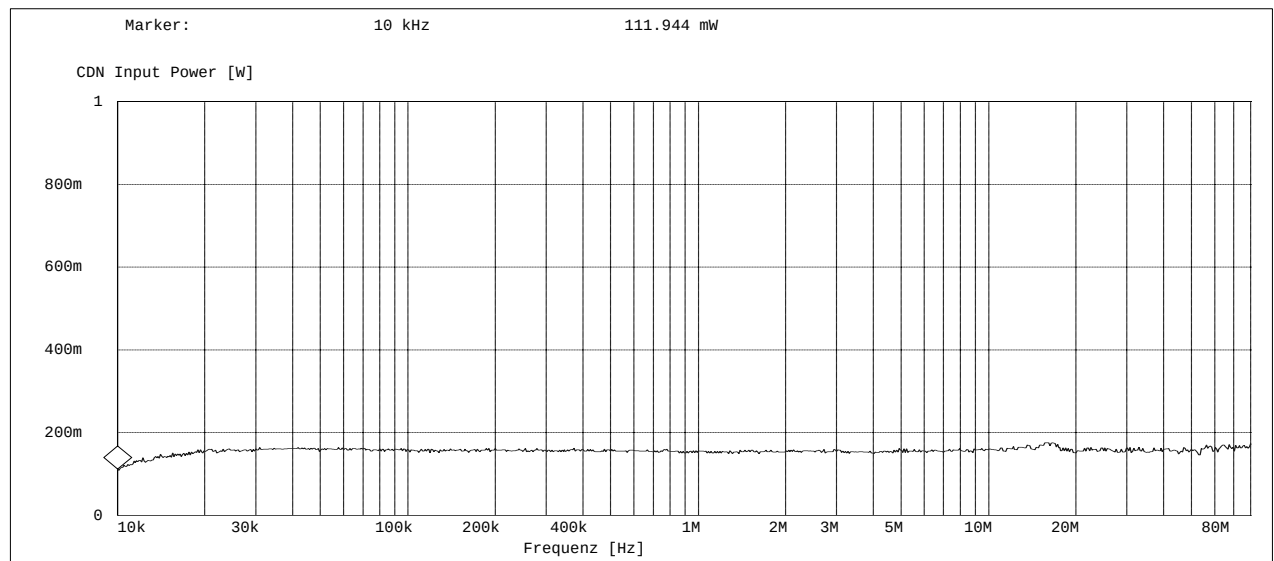
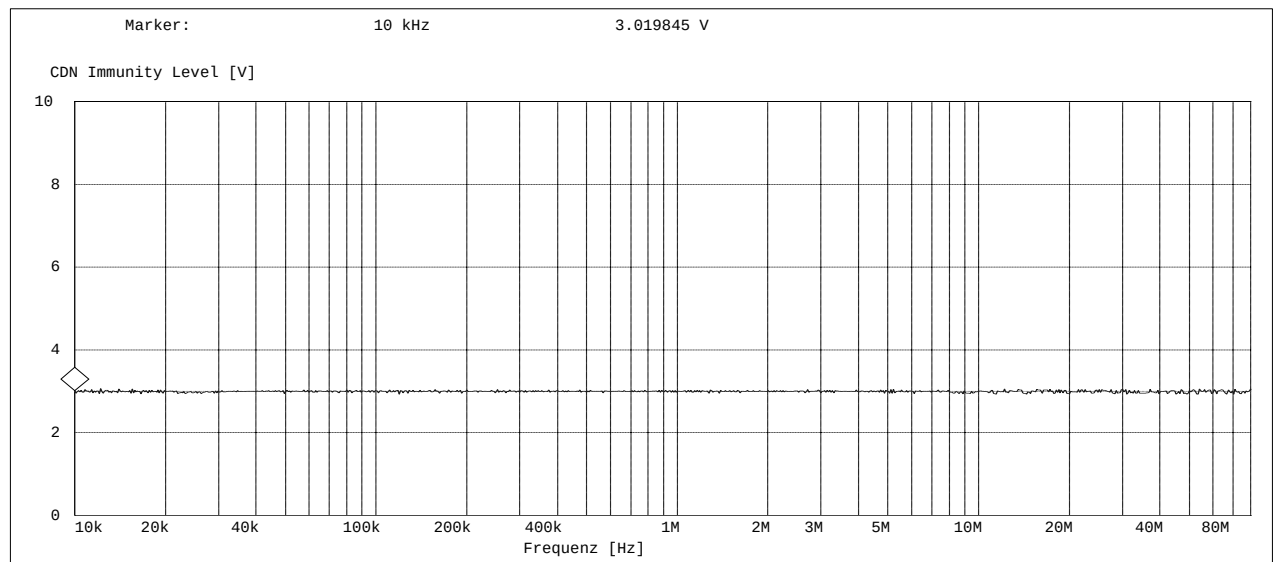
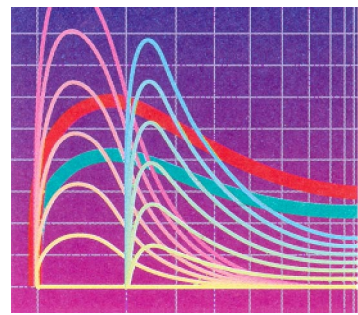
20273rs4221: discrete frequencies, coupling to RS 422 line



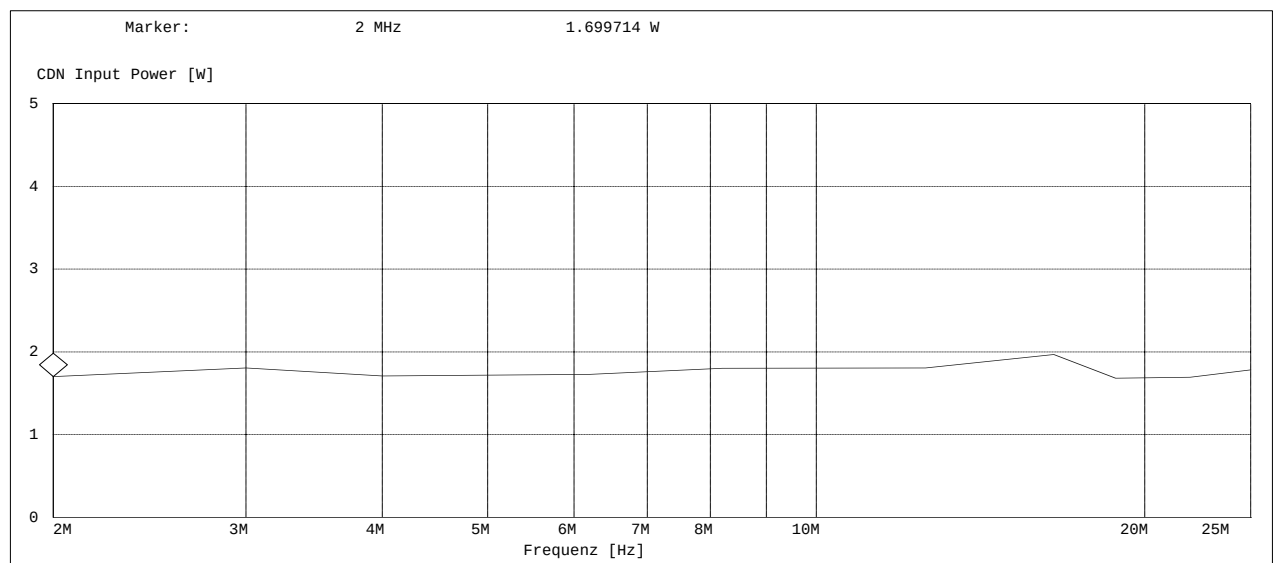
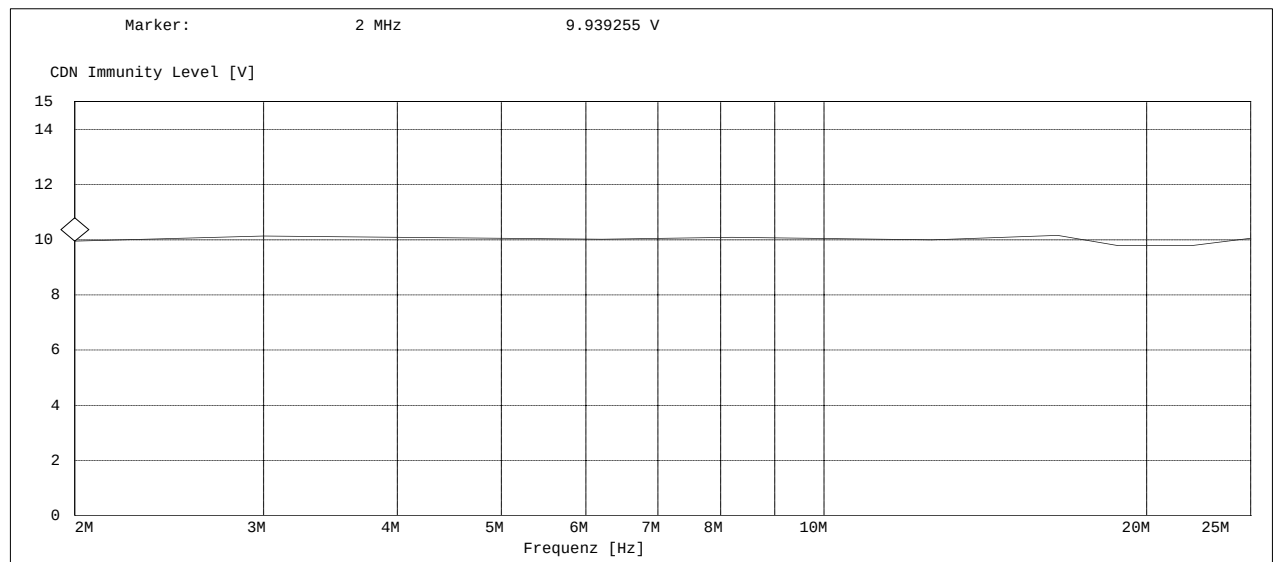
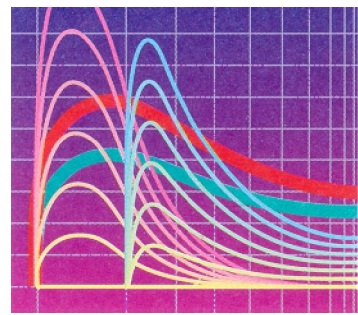
20273gps: 10 kHz...80 MHz, coupling to gps-antenna-line



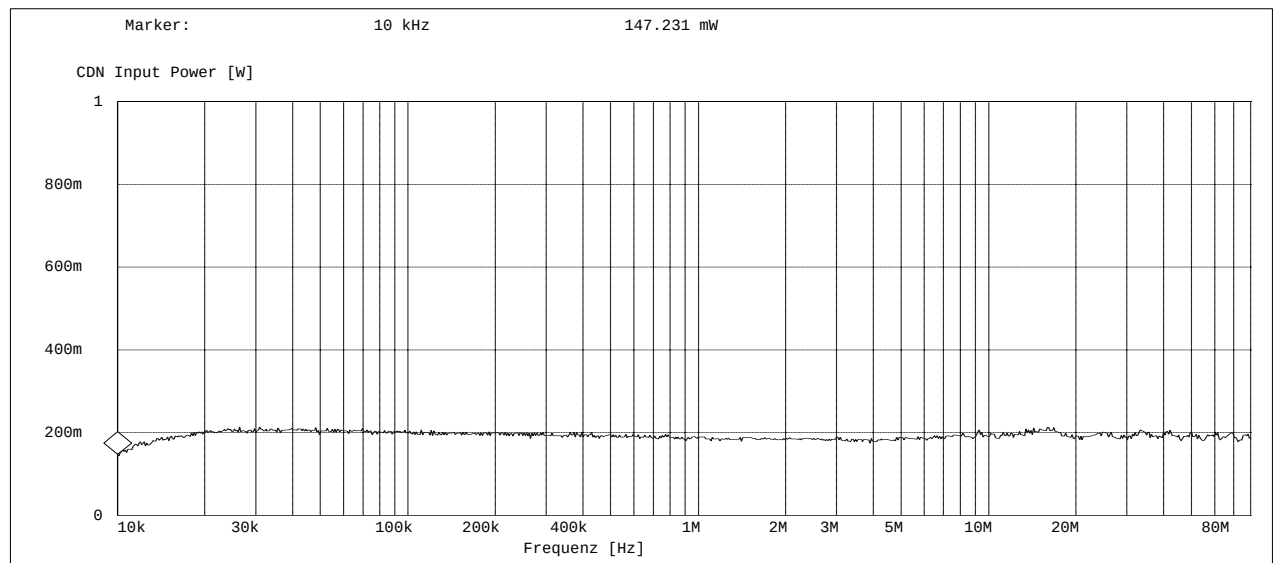
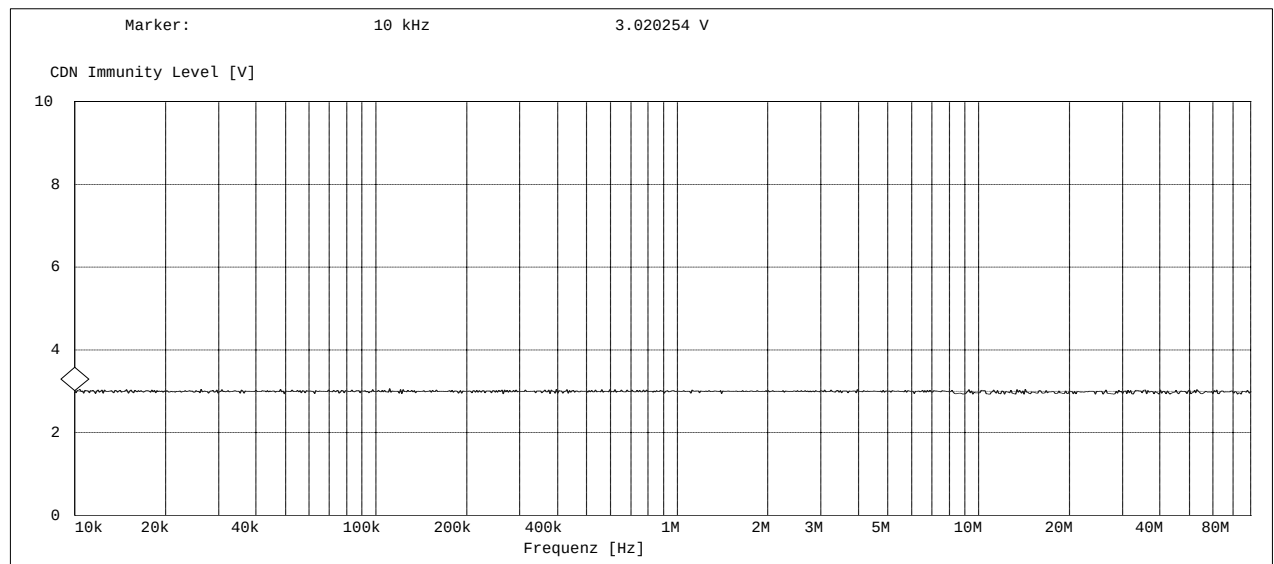
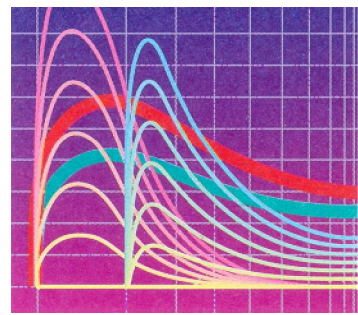
20273gps1: discrete frequencies, coupling to gps-antenna-line



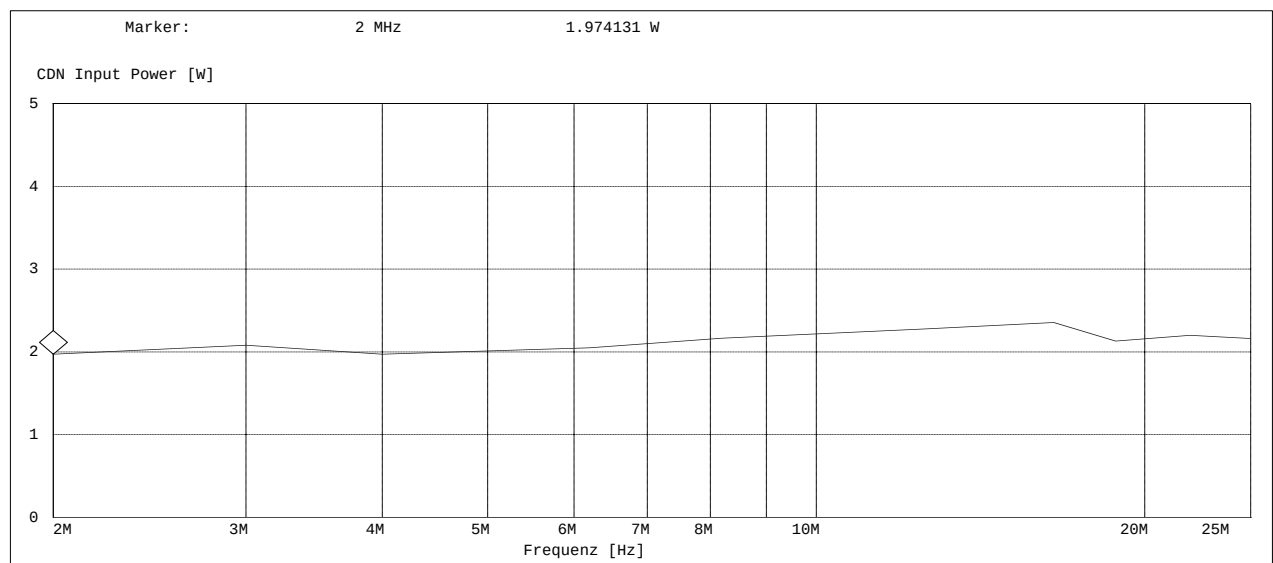
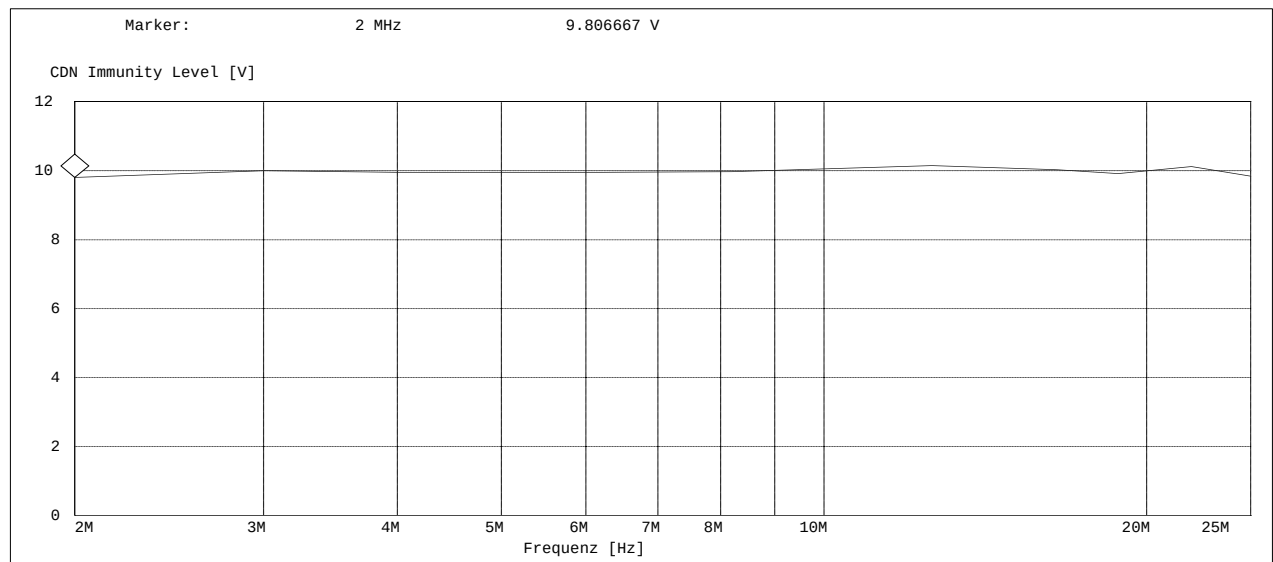
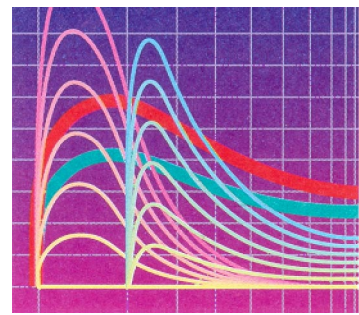
20273dc: 10 kHz...80 MHz, coupling to 24 V DC-power-supply



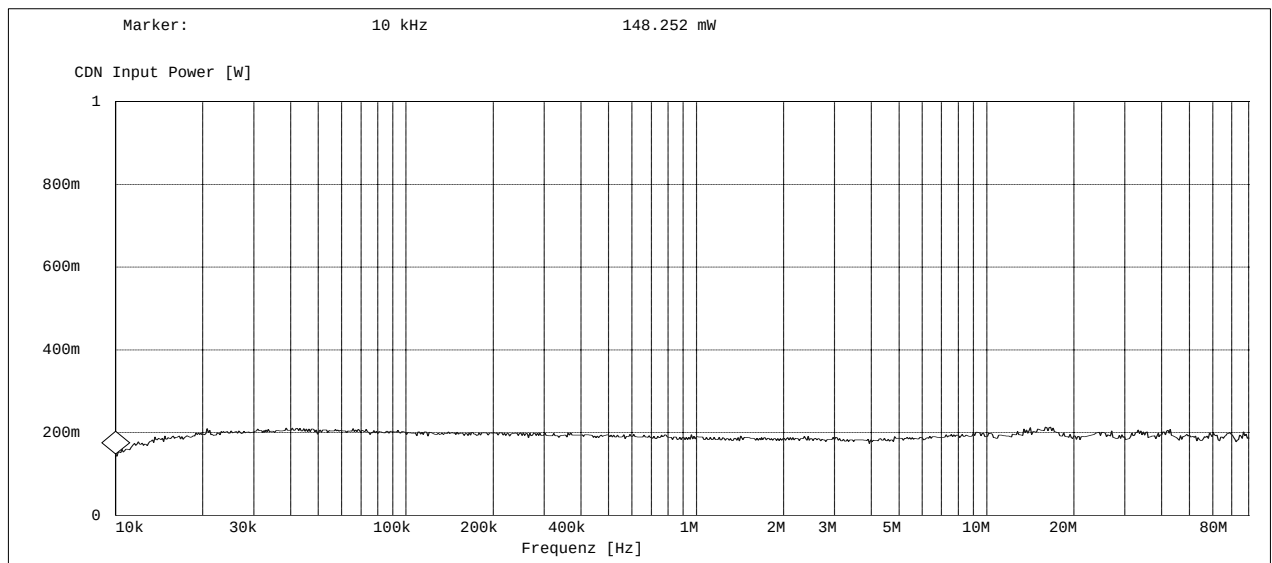
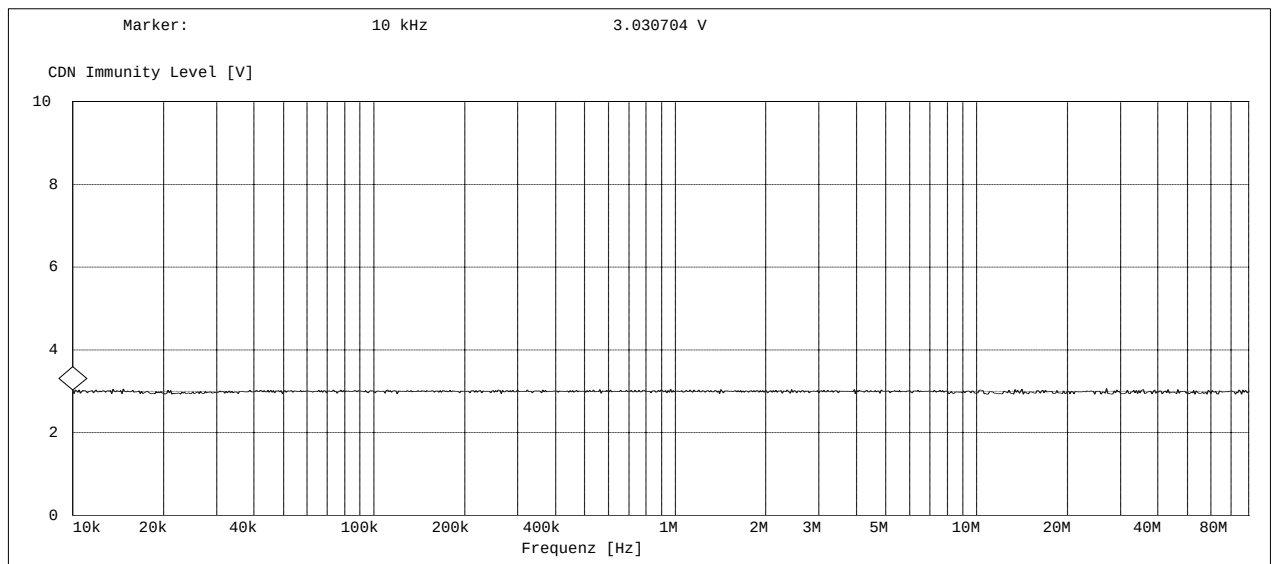
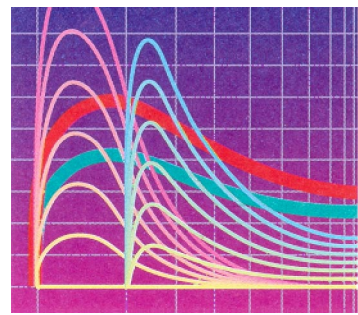
20273dc1: discrete frequencies, coupling to 24 V DC-power-supply



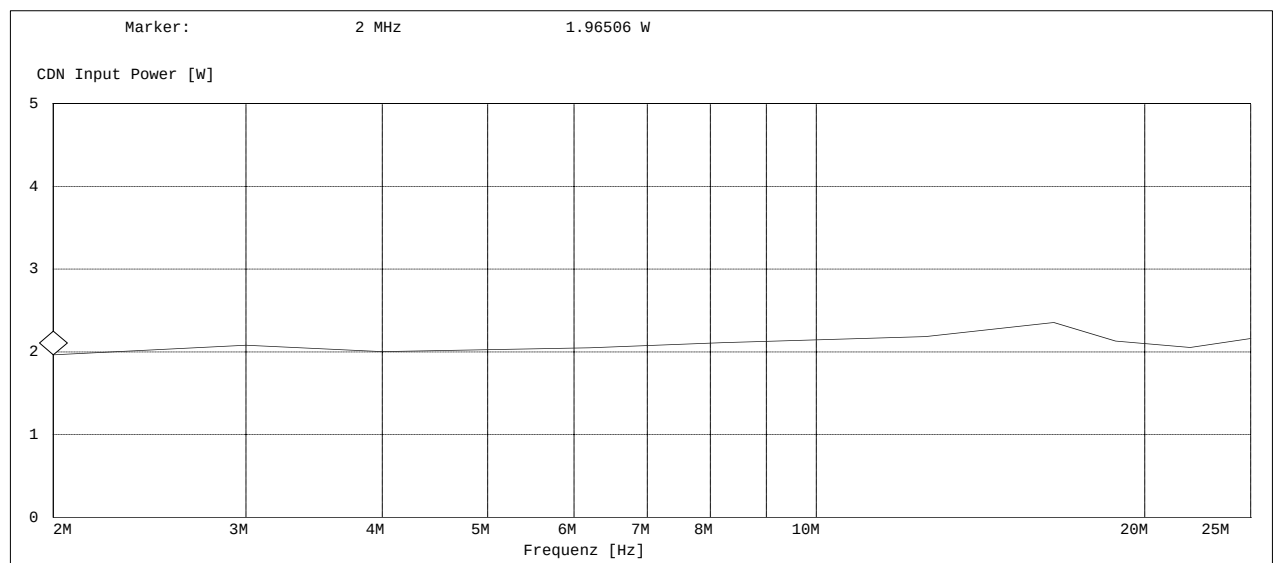
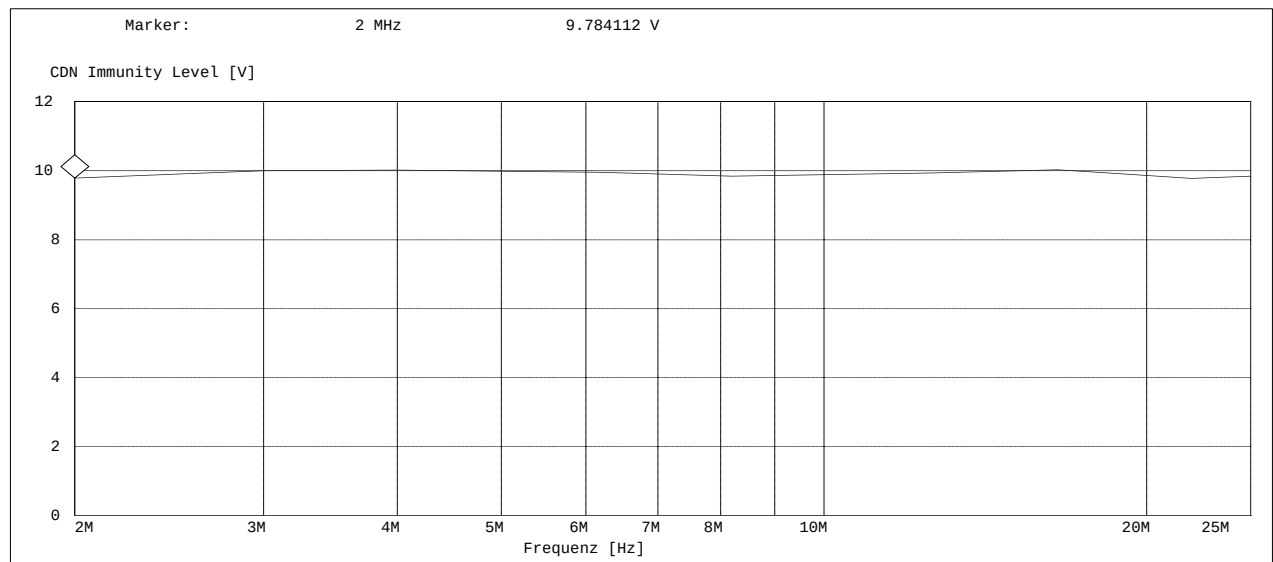
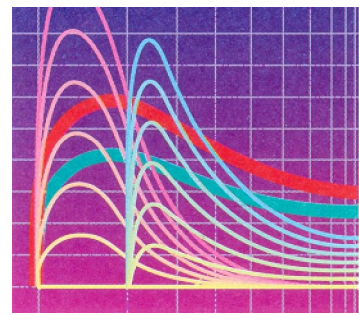
20273eth: 10 kHz...80 MHz, coupling to Ethernet 10-Base-T



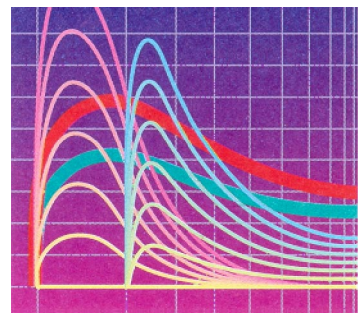
20273eth1: Discrete frequencies, coupling to Ethernet 10-Base-T



20273vhf: 10 kHz...80 MHz, coupling to vhf-antenna-line



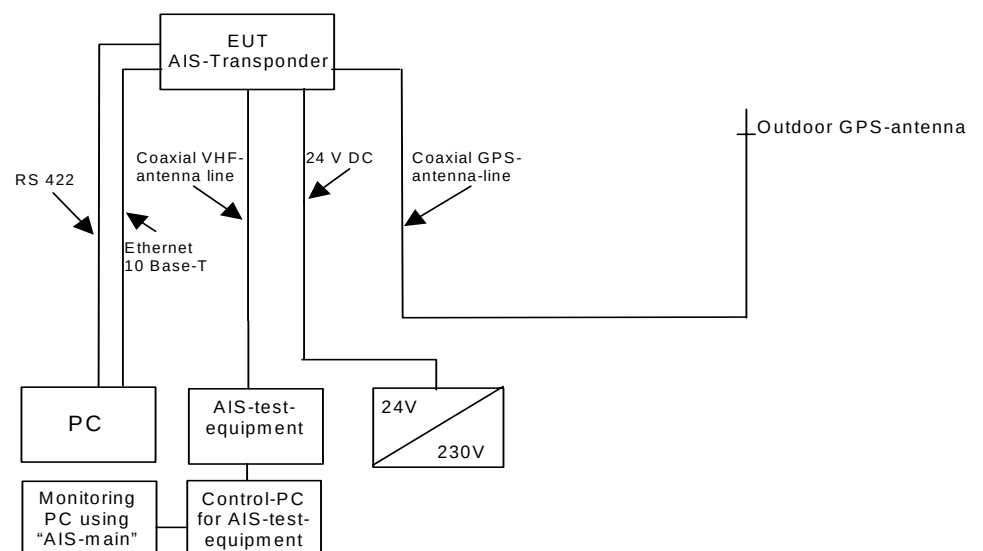
20273vhf1: Discrete frequencies, coupling to vhf-antenna-line

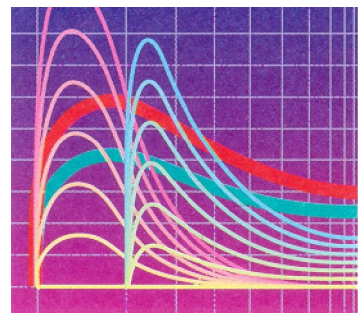


4.3 Immunity test for discharge of static electricity according to EN 60945 chapter 10.9

Test set-up:

- Table set-up
- The drawing below schematically shows the test set-up.
- Photos of the test set-up can also be referred to in the annex.





Test plan:

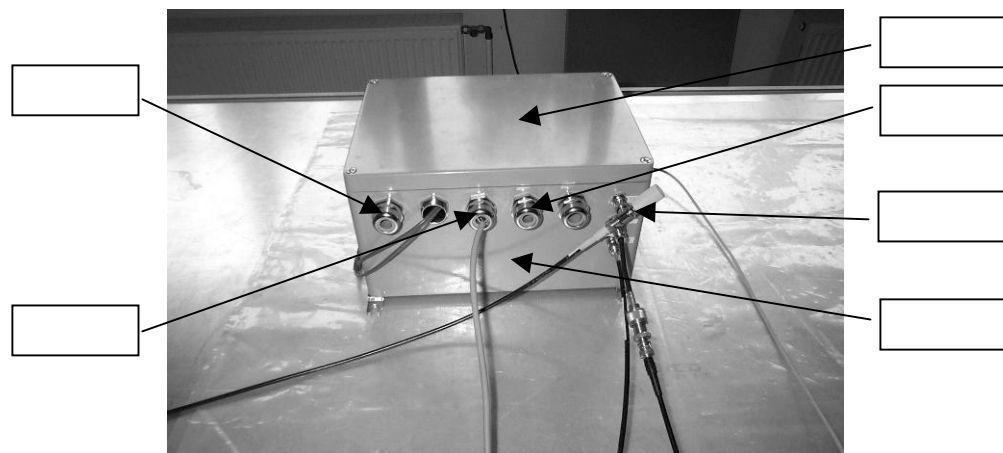
The equipment under test is triggered with 10 positive and negative impulses each per discharge location and test voltage.

Contact discharge (CD) is carried out on the conductive parts of the equipment under test and on the coupling plates for the indirect discharge.

Air discharge (AD) is carried out on isolating parts of the equipment under test.

The discharge locations can be seen on the following figure.

Indirect discharge (ID) is carried out on the vertical (VCP) and horizontal (HCP) coupling plate.



CD 1: Cable passage

CD 2: Cable passage

AD 1: Enclosure

CD 3: Cable passage

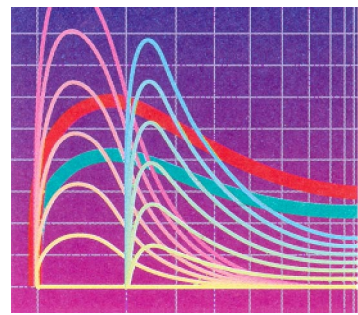
CD 4: Ethernet

AD 2: Enclosure

Measuring devices:

Schaffner ESD simulator NSG 435 (PM No. 480027)

Testing table Numerik PTi (PM No. 480049)

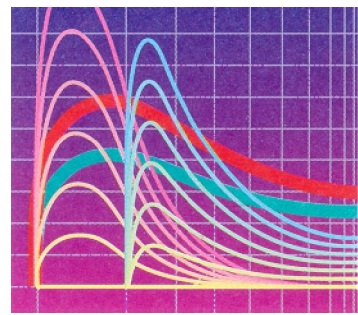


Measuring records:

The tests in the table below were carried out.

Date of test:	22. May 2002		
Ambient conditions:	60% F _{rel} , 19°C; Air pressure conforms to the requirements of the standard		
Number of impulses:	10 per polarity, test voltage and discharge location		
Method of discharge	Discharge location	EUT reaction	Result
Indirect coupling ±2kV	HCP	No reaction detected	B
	VCP	No reaction detected	B
Indirect coupling ±4kV	HCP	No reaction detected	B
	VCP	No reaction detected	B
Indirect coupling ±6kV	HCP	No reaction detected	B
	VCP	No reaction detected	B
Direct coupling ±2kV	CD	No reaction detected	B
Direct coupling ±4kV	CD	No reaction detected	B
Direct coupling ±6kV	CD	No reaction detected	B
Air discharge ±2kV	AD	No reaction detected	B
Air discharge ±4kV	AD	No reaction detected	B
Air discharge ±8kV	AD	No reaction detected	B

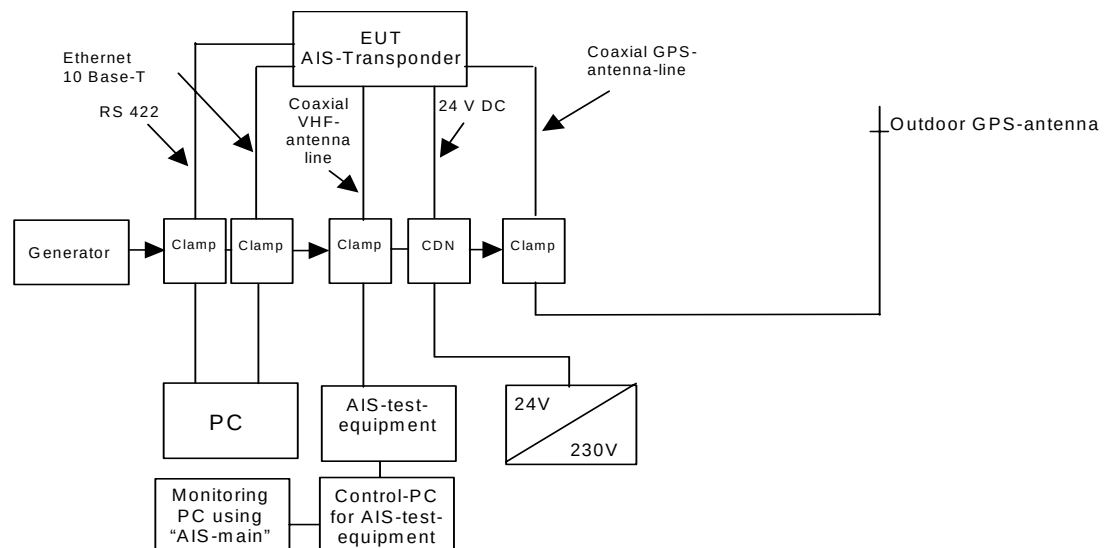
Test results: The requirements of the test documents were fulfilled.



4.4 Immunity test for electrical fast transients (burst) according to EN 60945 chapter 10.5

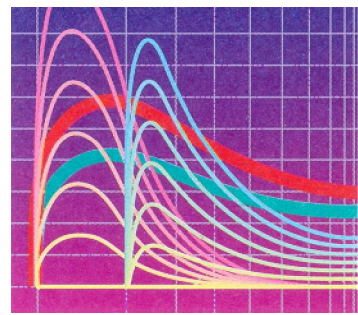
Test set-up:

- Table set-up
- The drawing below schematically shows the test set-up.
- Photos of the test set-up can also be referred to in the annex.
- The EUT is placed 10 cm above the ground plane.



Measuring devices:

Test table Numerik PTi (PM No. 480050)
 Test system PEFT (Burst) (PM No. 480028)
 Coupling filter FP-EFT 32.1 (PM No. 480029)
 Coupling clamp IP4A (PM No. 480030)
 Software: WinPATS (PM No. 480113)



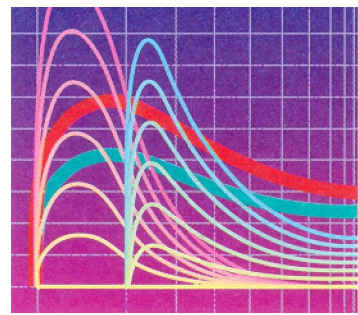
Measuring records:

The tests in the table below were carried out.

Date of test:	01. July 2002			
Ambient conditions:	55% Frel, 20°C; the air pressure conforms to the requirements of the standard			
Test duration:	5 min per polarity, test voltage and line			
Burst frequency:	5 kHz			
Method of coupling	Coupling to	Test voltage	EUT reaction	Result
CDN	24 V DC	± 2 kV DM ± 1 kV CM	No reaction detected	B
Coupling clamp	VHF-Antenna	± 1 kV CM	No reaction detected	B
Coupling clamp	GPS-Antenna	± 1 kV CM	No reaction detected	B
Coupling clamp	RS 422	± 1 kV CM	No reaction detected	B
Coupling clamp	Ethernet 10 Base-T	± 1 kV CM	No reaction detected	B

Remark: DM: Differential mode
 CM: Common mode

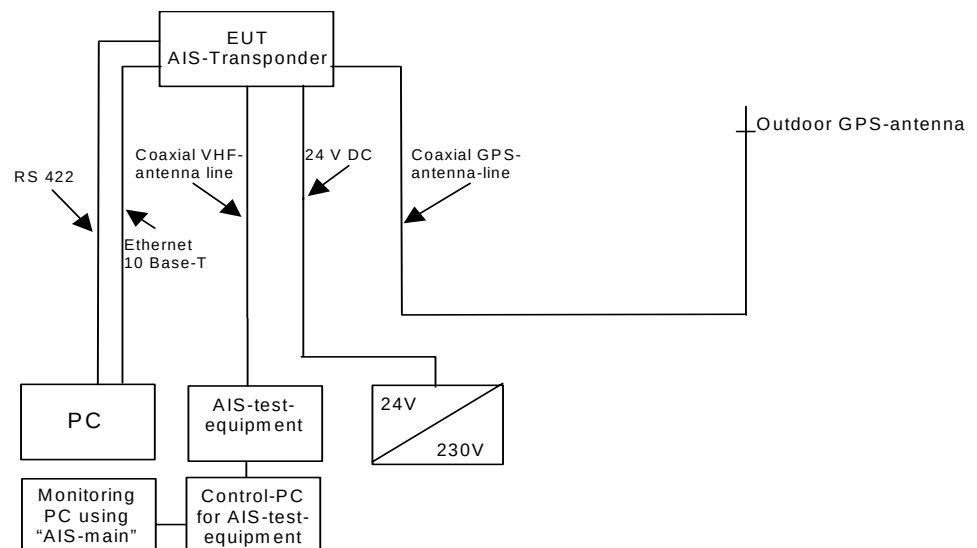
Test results: The requirements of the test documents were fulfilled.



4.5 Immunity test for electrical transients (surge) according to EN 60945 chapter 10.6

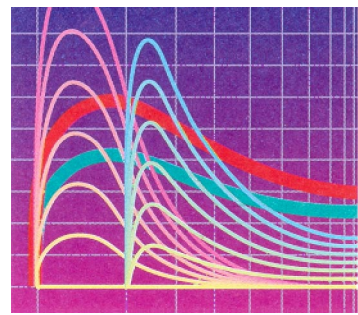
Test set-up:

- Table set-up
- The drawing below schematically shows the test set-up.
- Photos of the test set-up can also be referred to in the annex.
- The EUT is placed 10 cm above the ground plane.



Measuring devices:

Test table Numerik PTi (PM-No. 480050)
 Test system PSURGE (PM-No. 480031)
 Coupling filter FP-SURGE 32.1 (PM-No. 480032)
 Coupling network IP 6.2 (PM-No. 480034)
 Coupling device AP 300
 Decoupling network DEC1A (PM-No. 480153)
 Software: Win PATS (PM-No. 480113)

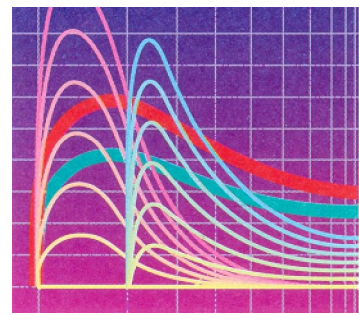


Measuring records:

The tests in the table below were carried out.

Date of test: 01. July 2002 Ambient conditions: 55 % Frel, 20°C; the air pressure is in accordance to the standard Test duration: 5 impulses per polarity, test voltage and line Pulse interruptions: 60s				
Method of coupling	Coupling to	Test voltage	EUT reaction	Result
CDN	24 V DC	± 0.5 kV line / line ± 1 kV line / earth	No reaction detected	B

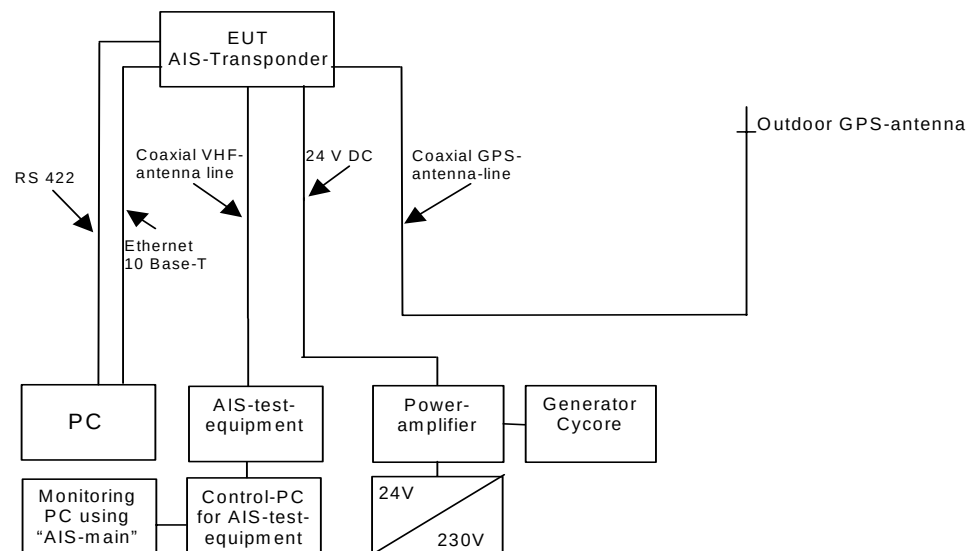
Test results: The requirements of the test documents were fulfilled.



4.6 Conducted low frequency interference (harmonics and interharmonics) according to EN 60945 chapter 10.2

Test set-up:

- Table set-up
- The drawing below schematically shows the test set-up.
- Photos of the test set-up can also be referred to in the annex.

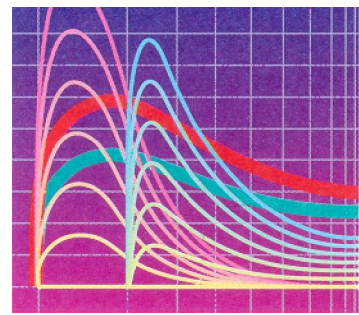


Measuring devices: Power amplifier PAS 5000 (PM-Nr. 480357)
 Generator SyCore (PM-Nr. 480356)
 Software: Script Manager (PM-Nr. 480114)

Measuring records:

Date of test:	16. May 2002	
Test level:	50Hz – 10kHz, 3V _{eff} , max 2W	
Sweep range:	1,5 x 10 ⁻³ dec/s (1% / 3s)	
Test duration:	1s	
Coupling to	EUT reaction	Result
24 V DC	No reaction detected	B

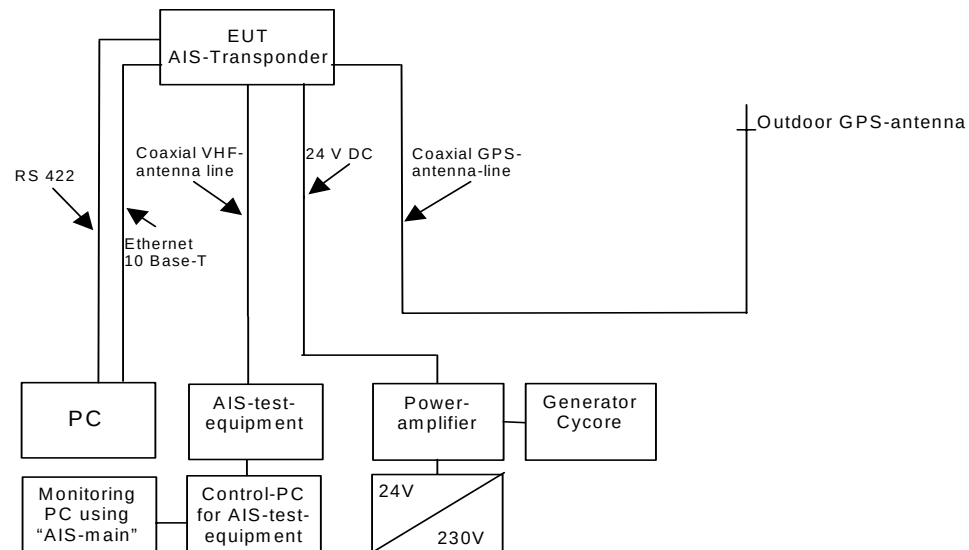
Test result: The requirements made in the test documents were fulfilled.



4.7 Power supply failure according to EN 60945 chapter 10.8

Test set-up:

- Table set-up
- The drawing below schematically shows the test set-up.
- Photos of the test set-up can also be referred to in the annex.

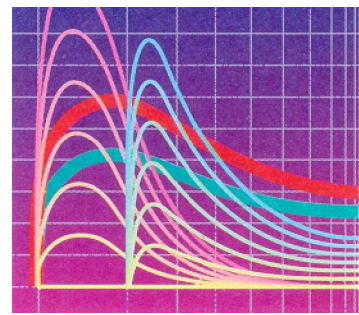


Measuring devices: Power amplifier PAS 5000 (PM-No. 480357)
 Generator SyCore (PM-No. 480356)
 Software: Script Manager (PM-No. 480114)

Measuring records:

Date of test:	22. May 2002	
Test level:	3 interruptions of 60s within a 5-minute period	
Coupling to	EUT action	Result
24V DC	Automatic restart of the system, no user reaction necessary	B

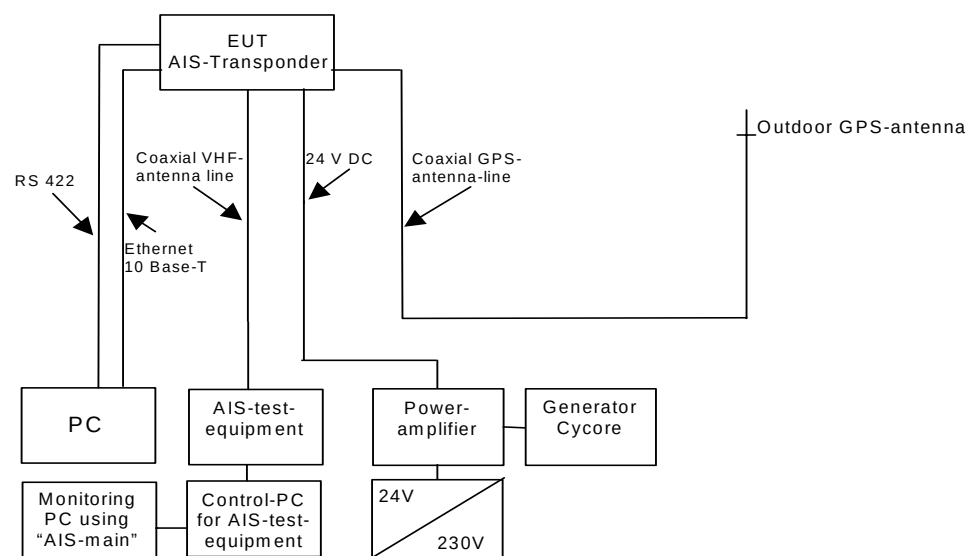
Test result: The requirements made in the test documents were fulfilled.



4.8 Power supply variations according to EN 60945 chapter 10.7

Test set-up:

- Table set-up
- The drawing below schematically shows the test set-up.



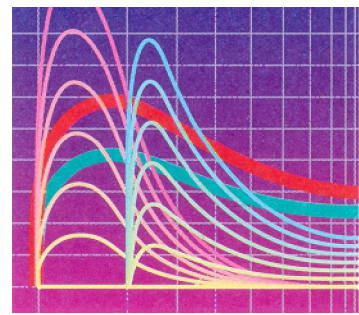
Measuring devices:

- power amplifier PAS 5000 (PM-No. 480357)
- generator SyCore (PM-No. 480356)
- software: Script Manager (PM-No. 480114)

Measuring records:

Date of test:	22. May 2002		
Test basics:	Electrical supply – rectified alternating current		
Coupling to	Test level	EUT reaction	Result
24 V DC	$U_B + 20\%$ permanent	No reaction detectable	B
	$U_B - 20\%$ permanent	No reaction detectable	B

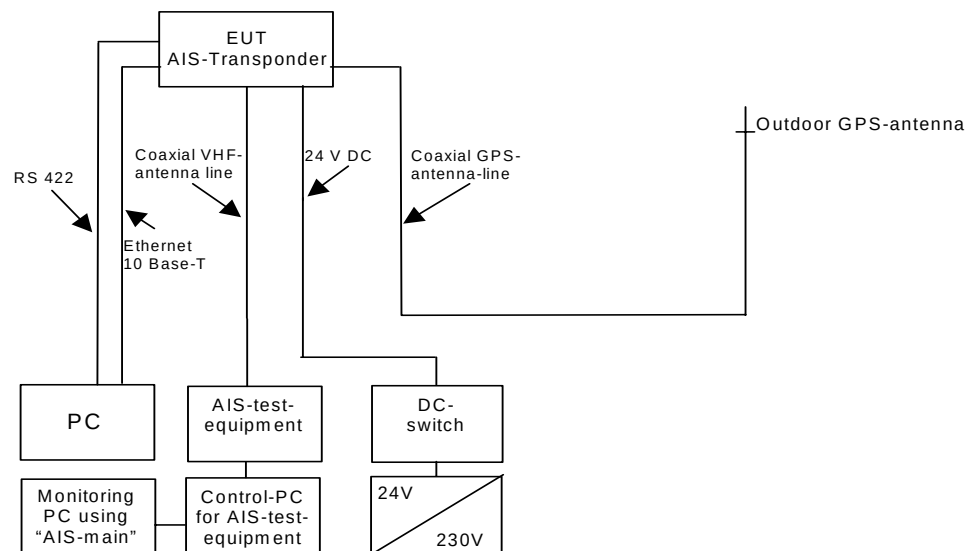
Test result: The requirements made in the test documents were fulfilled.



4.9 Excessive conditions according to EN 60945 chapter 5.2.3 (confusing of the DC-poles)

Test set-up:

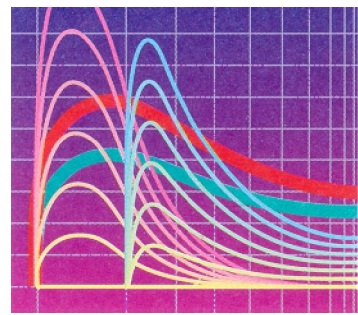
- Table set-up
- The drawing below schematically shows the test set-up.



Measuring records:

Date of test:	22. May 2002	
Test level:	Confusing the DC-poles for 5 minutes	
Coupling to	EUT action after test	Result
24V DC	Automatic restart of the system, no user reaction necessary	B

Test result: The requirements made in the test documents were fulfilled.



5 Annex

The annex consists of 20 pages and contains pictures of the test set-ups:

Pictures of the test set-up for
electromagnetic radiation disturbances (e-field):

20273emi1.jpg, 20273emi2.jpg
20273emi3.jpg

Pictures of the test set-up for
electromagnetic radiation disturbances (h-field):

20273emi4.jpg,
20273emihff1.jpg,
20273emihff2.jpg

Pictures of the test set-up for
mains terminal disturbance voltage on the V-LISN:
Pictures of the test set-up for
harmonics and voltage fluctuation:

20273emiv1.jpg, 20273emiv2.jpg

20273M3_3.jpg

Pictures of the test set-up for immunity to
radio-frequency electromagnetic field:

20273ems1.jpg, 20273ems2.jpg
20273ems4.jpg, 20273ems5.jpg

Pictures of the test set-up for conducted voltages:

20273emsc1.jpg,
20273emsc2.jpg

Pictures of the test set-up for ESD:

20273esd1.jpg, 20273esd2.jpg
20273esd3.jpg

Pictures of the test set-up for Burst:

20273burst1.jpg

Pictures of the test set-up for Surge:

20273surge1.jpg