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Test Report

No.: E40252A

Designation of equipment under test: electrical wheel chair Dragon (version 8 km/h)

EMC Test Laboratory
accredited by
DATEch e.V.
in compliance with DIN EN ISO/IEC 17025
under the
Reg. No. DAT-P-105/94-31

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Testing body: PHOENIX TESTLAB GmbH
Königswinkel 10
D-32825 Blomberg
Germany

Client: INVACARE Germany GmbH
Dehmer Str. 66
D - 32549 Bad Oeynhausen

Order number: 40252

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

Tested on the basis of:

Disturbance emission: - EN 55011:1998 + A1:1999 + A2:2002

Industrial, scientific and medical (ISM) radio-frequency equipment - Radio disturbance characteristics - Limits and methods of measurement (electromagnetic radio disturbances)

The limits and requirements according to
EN 61000-6-3:2001 Generic standards - Emission standard for residential, commercial and light industrial environments
The requirements according to EN 12184:1999 are considered.

Immunity interference: - IEC 61000-4-2:1995 + AMD 1:1998 + AMD 2:2000

Electrostatic discharge immunity test

- ENV 50204:1995

Radiated electromagnetic field from digital radio telephones immunity test

- IEC 61000-4-3:1995 + AMD 1:1998

Radiated, radio-frequency, electromagnetic field immunity test

The limits and requirements according to
EN 61000-6-1:2001 Generic standards - Immunity for residential, commercial and light-industrial environments
The requirements according to EN 12184:1999 are considered.

Equipment under
test, EUT: electrical wheel chair

Type identification: Dragon (version 8 km/h)

Serial number: none

Manufacturer: INVACARE Germany GmbH

Date the EUT
was received: 2004-03-19

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

Client represented
during the test
by the following
person(s): Mr. Mesch

Place of test: PHOENIX TESTLAB Blomberg

Date of test: 2004-03-19 - 2004-05-03

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, 2004-05-06



Test Engineer: M. Pohl



approved by authorized Engineer

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1 Operational states and test set-up

The following states were defined as the operating conditions:

- 50% forward driving direction

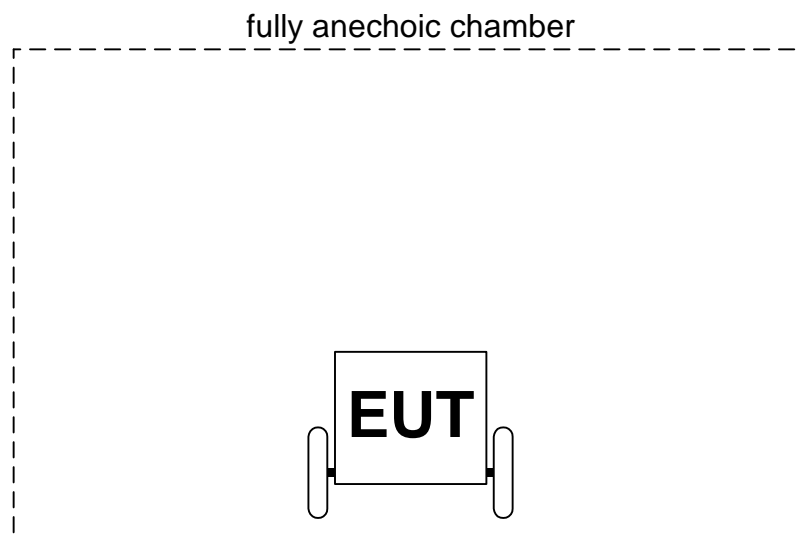
Definition of the functions to be monitored and corresponding tolerance limits:

- see EN 12184 chapter 9.8.2.1

Special EMC measures:

- none

The system was set up as follows:



2 List of test modules and results

2.1 Electromagnetic disturbance characteristics

Electromagnetic radiation disturbances characteristics – enclosure port				
Frequency range	Limits	Basic standard	Remark	Status
30 to 230 MHz 230 to 1000 MHz	30 dB(μ V/m) at 10m 37 dB(μ V/m) at 10m	EN 55022 Class B	see note 1	fulfilled
note 1: Only applies to operating media that contain microelectronics, e.g. microprocessors, with a working frequency above 9 kHz. The statistical assessment in compliance with the standard must be used.				

2.2 EMC Immunity

Definition of evaluation criterion:

- A: No apparent impairment of function within the tolerance limits.
- B: Partial impairment of function, however self-regulating through eg. automatic restart. Function must be restored within the tolerance limits after the test; a safe state must be guaranteed at all times.

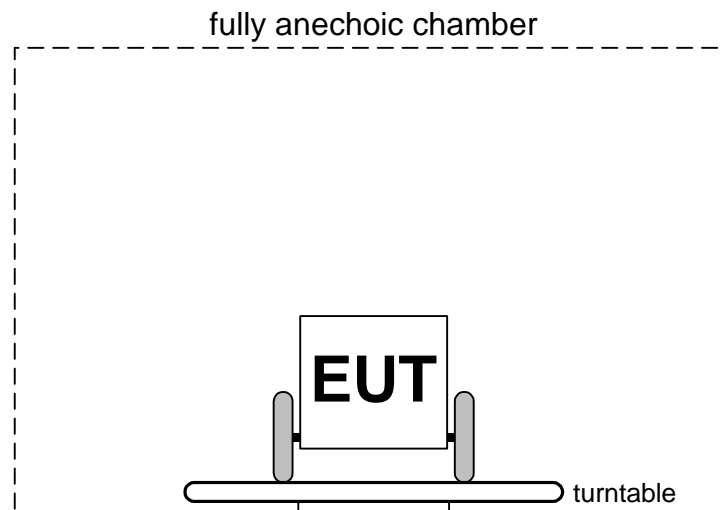
Immunity - Enclosure Port				
Environmental phenomena	Test specification and units	Basic standards	Performance criterion	Status
Radio-frequency electromagnetic field	26-1000 MHz, 20 V/m, 80% AM (1 kHz)	IEC 61000-4-3	A	fulfilled
	900 MHz \pm 10 MHz and 1,90 GHz \pm 50 MHz, 20 V/m, 50% PM (200 Hz)	ENV 50204	A	fulfilled
Electrostatic discharge (ESD)	up to \pm 6 kV charge voltage (contact discharge)	IEC 61000-4-2	B	fulfilled
	up to \pm 8 kV charge voltage (air discharge)		B	fulfilled

3 Test sequence and test results electromagnetic disturbances characteristics

3.1 Radiated radio disturbance according to EN 55022 class B

Test set-up:

- Stand 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 used for preliminary measurement:

- fully anechoic chamber M5 (PM-No. 480073)
- antenna mast (PM-No. 480069)
- turntable (PM-No. 480070)
- controller HD 100 (PM-No. 480067)
- relay switch unit RSU (PM-No. 480077)
- EMI softwarepackage ES-K1 (PM-No. 480111)
- receiver ESVS30 (PM-No. 480024)
- bi.-log. antenna CBL6112C (PM-No. 480327)

measuring devices used for final measurement:

- open area test site M6 (PM-No. 480085)
- antenna mast (PM-No. 480086)
- turntable (PM-No. 480087)
- controller HD 100 (PM-No. 480139)
- relay switch unit RSU (PM-No. 480077)
- EMI softwarepackage ES-K1 (PM-No. 480111)
- receiver ESVS30 (PM-No. 480024)
- bi.-log. antenna CBL6111A (PM-No. 480147)

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

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

Title: preliminary measurement on a 3m-distance
receiver ESVS30 by Rohde & Schwarz
EUT: Topan 8km/h
Manufacturer: Invacare Deutschland GmbH
Operating Condition: 50% forward run
Test site: PHOENIX TEST-LAB Blomberg; Absorberhalle M5
Operator: M. Pohl
Test Specification: stand set-up

Scantable for the preliminary measurement: EN 55022 F AH

Unit: dB μ V/m Curve 1 Curve 2
Detector / Mode MaxPeak / ClearWrite Average / ClearWrite

Subrange	1	2	3	4	5
Start frequency	30.0 MHz	250.0 MHz			
Stop frequency	250.0 MHz	1.0 GHz			
Increment	80.0 kHz	80.0 kHz			
IF-bandwidth	120 kHz	120 kHz			
Measurement time	20.0 ms	20.0 ms			
Demodulation	A3	A3			
Autorange	Off	Off			
Preamplifier	10 dB	10 dB			
RF-attenuation	0 dB	0 dB			
min. RF-attenuation	0 dB	0 dB			
IF-attenuation	LowNoise	LowNoise			
Ref.-Level					
Receiver	ESVS	ESVS			
Signal path	ANT_AH ESVS	ANT_AH ESVS			
Scan-mode	Lin	Lin			
Input					
Tracking-gen.	Off	Off			
Probe transducer	_CBL6112C	_CBL6112C			
System transducer	Transducer AH	Transducer AH			
add. transducer 1	None	None			
add. transducer 2	None	None			
add. transducer 3	None	None			

Scantable for the subsequent measurement: EN 55022 F AH_fin

Unit: dB μ V/m

Curve 1

Curve 2

Detector / Mode

MaxPeak / ClearWrite

Average / ClearWrite

Subrange	1	2	3	4	5
Start frequency	30.0 MHz	250.0 MHz			
Stop frequency	250.0 MHz	1.0 GHz			
Increment	12.0 kHz	12.0 kHz			
IF-bandwidth	120 kHz	120 kHz			
Measurement time	100.0 ms	100.0 ms			
Demodulation	A3	A3			
Autorange	On	On			
Preamplifier	10 dB	10 dB			
RF-attenuation	0 dB	0 dB			
min. RF-attenuation	0 dB	0 dB			
IF- attenuation	LowNoise	LowNoise			
Ref.-Level					
Receiver	ESVS	ESVS			
Signal path	ANT_AH ESVS	ANT_AH ESVS			
Scan-mode	Lin	Lin			
Input					
Tracking-gen.	Off	Off			
Probe transducer	_CBL6112C	_CBL6112C			
System transducer	Transducer AH	Transducer AH			
add. transducer 1	None	None			
add. transducer 2	None	None			
add. transducer 3	None	None			

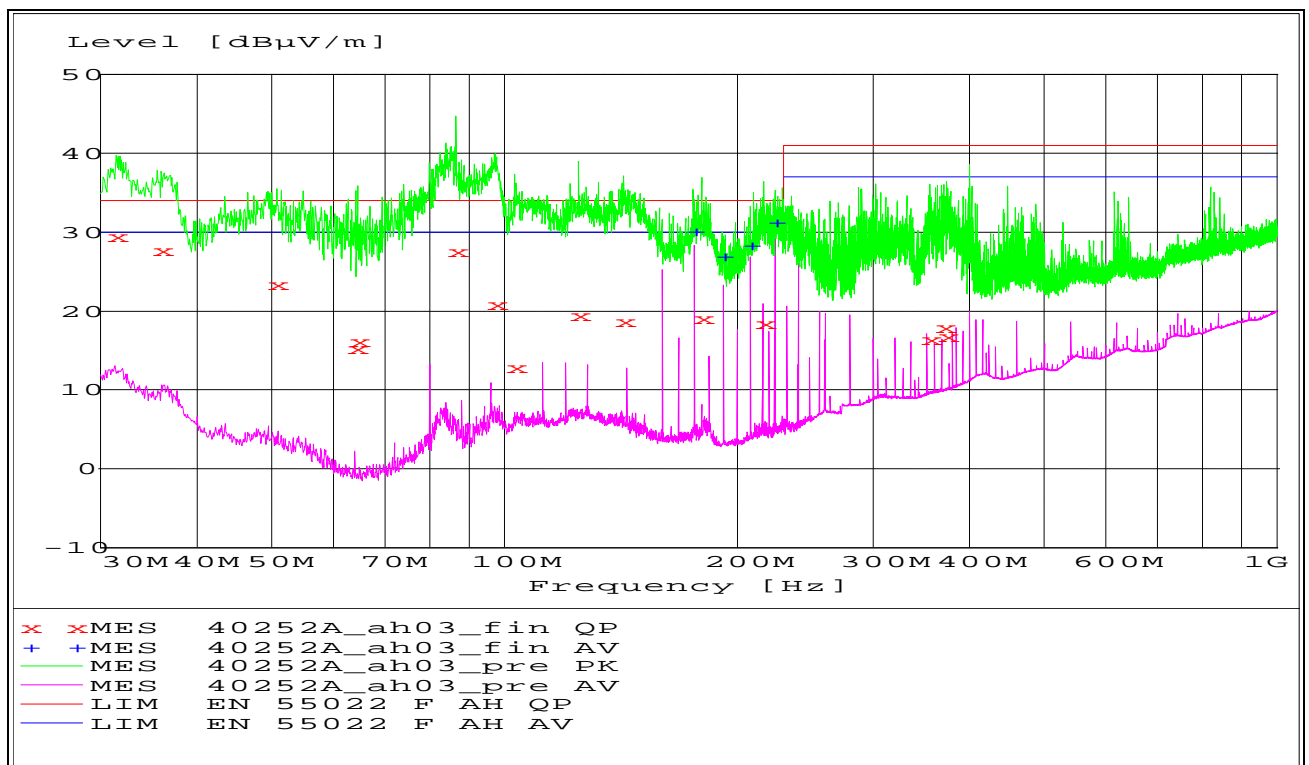
The measurement time with the quasi-peak measuring detector is 1 second.

The limit line and measurement curve shown in the diagram below refer to the preliminary measurements. Here, it must be noted that because of the reduced measuring distance and because of the floor absorbers, the measured values do not comply with the values of the above mentioned standard; they only serve as orientation in determining which frequencies must be measured on the open area test site.

The limit line is achieved with the applied standard by converting to a 3m measurement distance (+10 dB) and the correction for the free space in which in the "worst case" the reflected floor wave is missing entirely (-6dB). Therefore 4dB is added to the limit line of the standard concerned.

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: 40252A_ah03

of 03.05.04

Result measured with the quasi-peak detector:

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

Frequency MHz	Level dBµV/m	Transducer dB	Limit dBµV/m	Margin dB	Height cm	Azimuth deg	Polarisation
31.428000	29.50	17.9	34.0	4.5	150.0	91.00	VERTICAL
35.940000	27.70	15.5	34.0	6.3	150.0	134.00	VERTICAL
50.676000	23.30	8.2	34.0	10.7	150.0	151.00	VERTICAL
64.212000	15.30	5.6	34.0	18.7	150.0	241.00	VERTICAL
64.548000	16.10	5.6	34.0	17.9	150.0	196.00	VERTICAL
86.568000	27.60	9.1	34.0	6.4	150.0	91.00	VERTICAL
97.272000	20.90	10.9	34.0	13.1	150.0	83.00	VERTICAL
103.128000	12.80	11.7	34.0	21.2	150.0	359.00	HORIZONTAL
124.740000	19.40	12.6	34.0	14.6	150.0	181.00	VERTICAL
142.524000	18.70	11.7	34.0	15.3	150.0	193.00	VERTICAL
180.180000	19.00	10.0	34.0	15.0	150.0	90.00	HORIZONTAL
216.708000	18.40	10.1	34.0	15.6	150.0	88.00	HORIZONTAL
355.036000	16.40	16.3	41.0	24.6	150.0	106.00	VERTICAL
370.132000	17.90	16.6	41.0	23.1	150.0	109.00	VERTICAL
373.132000	16.80	16.6	41.0	24.2	150.0	135.00	VERTICAL

Data record name: 40252A_ah03_fin QP

of 03.05.04

Result measured with the average detector:

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

Frequency MHz	Level dBµV/m	Transducer dB	Limit dBµV/m	Margin dB	Height cm	Azimuth deg	Polarisation
176.016000	30.10	10.2	30.0	-0.1	150.0	64.00	HORIZONTAL
192.012000	26.90	10.0	30.0	3.1	150.0	45.00	HORIZONTAL
208.020000	28.30	9.8	30.0	1.7	150.0	64.00	HORIZONTAL
224.016000	31.20	10.5	30.0	-1.2	150.0	74.00	HORIZONTAL

Data record name: 40252A_ah03_fin AV

of 03.05.04

In this case it was necessary to carry out subsequent measurements because at some frequency points a value was above the Qualify limit curve during the preliminary measurements. The results from the standard subsequent measurements on the open area test site are presented in the following.

Title: Subsequent measurement on 10m open area test site
 Test-Receiver ESVS30 from Rohde & Schwarz
 EUT: Topan 8km/h
 Manufacturer: Invacare Deutschland GmbH
 Operating Condition: 50% forward run
 Test site: PHOENIX TEST-LAB Blomberg; open area test site M6
 Operator: M. Pohl
 Test Specification: stand set-up

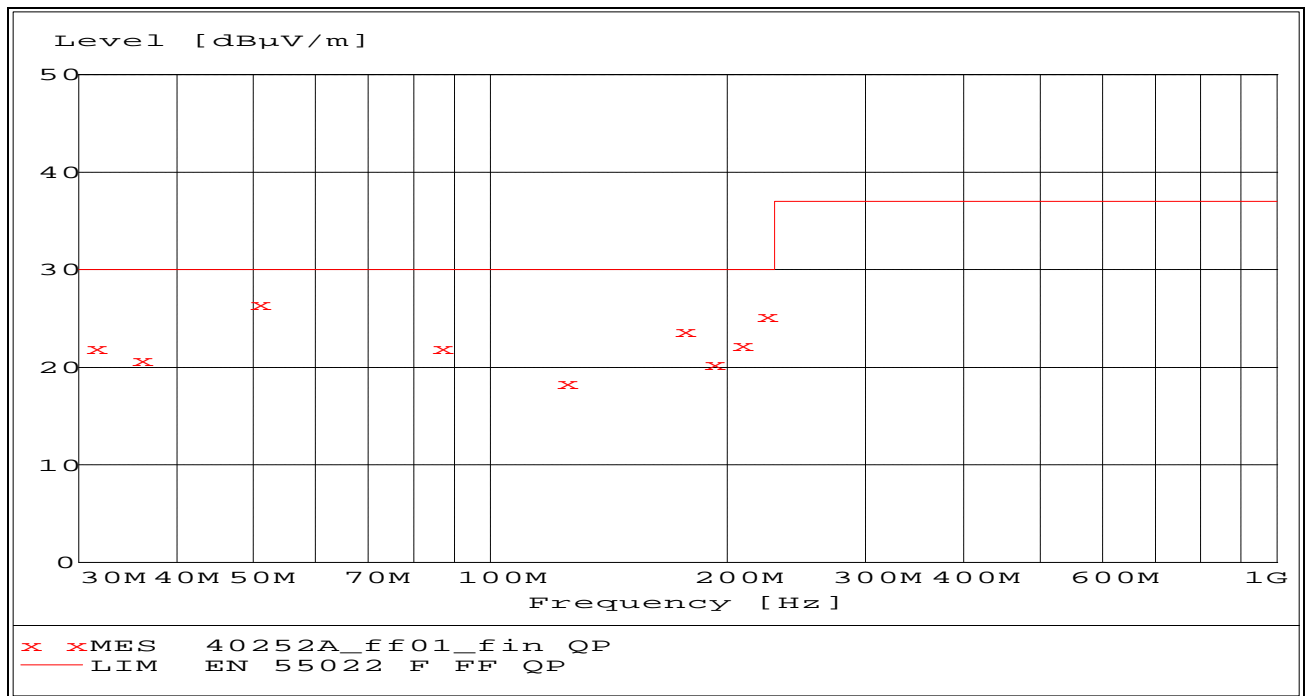
Scantable for the subsequent measurement: EN 55022 F FF_fin

Unit: dB μ V/m Curve 1 Curve 2
 Detector / Mode Average / ClearWrite None / ClearWrite

Subrange	1	2	3	4	5
Start frequency	30.0 MHz	250.0 MHz			
Stop frequency	250.0 MHz	1.0 GHz			
Increment	12.0 kHz	12.0 kHz			
IF-bandwidth	120 kHz	120 kHz			
Measurement time	100.0 ms	100.0 ms			
Demodulation	A3	A3			
Autorange	On	On			
Preamplifier	10 dB	10 dB			
RF-attenuation	0 dB	0 dB			
min. RF-attenuation	0 dB	0 dB			
IF- attenuation	LowNoise	LowNoise			
Ref.-Level					
Receiver	ESVS	ESVS			
Signal path	ANT_FF ESVS	ANT_FF ESVS			
Scan-mode	Lin	Lin			
Input					
Tracking-gen.	Off	Off			
Probe transducer	_CBL 6111A	_CBL 6111A			
System transducer	Transducer FF	Transducer FF			
add. transducer 1	None	None			
add. transducer 2	None	None			
add. transducer 3	None	None			

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: 40252A_ff01

of 03.05.04

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 10 m 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	Limit dBµV/m	Margin dB	Height cm	Azimuth deg	Polarisation
31.428000	21.90	17.9	30.0	8.1	110.0	206.00	VERTICAL
35.940000	20.80	15.3	30.0	9.2	103.0	286.00	VERTICAL
50.676000	26.50	8.7	30.0	3.5	247.0	229.00	VERTICAL
86.568000	21.90	9.7	30.0	8.1	200.0	0.00	VERTICAL
124.740000	18.40	12.9	30.0	11.6	250.0	0.00	HORIZONTAL
176.016000	23.70	10.5	30.0	6.3	397.0	55.00	HORIZONTAL
192.012000	20.30	10.4	30.0	9.7	397.0	46.00	HORIZONTAL
208.020000	22.30	10.8	30.0	7.7	396.0	66.00	HORIZONTAL
224.016000	25.20	11.4	30.0	4.8	396.0	76.00	HORIZONTAL

Data record name: 40252A_ff01_fin QP

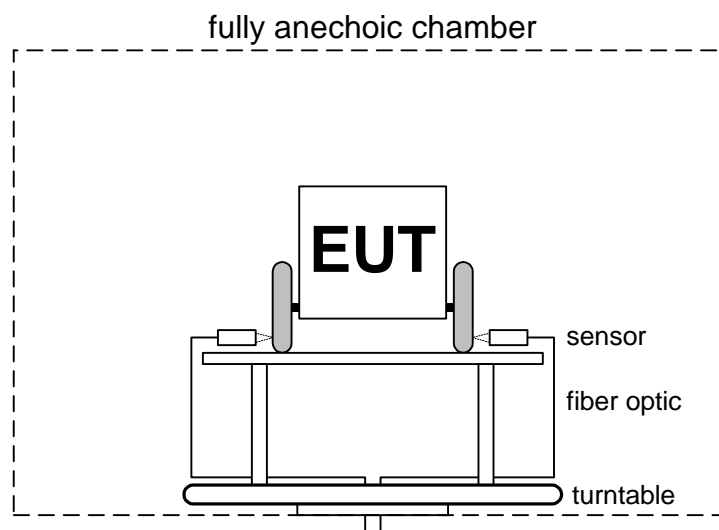
of 03.05.04

4 Test sequence and test results electromagnetic immunity characteristics

4.1 Immunity test for high frequency electromagnetic fields according to EN 61000-4-3 and ENV 50204

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:

visually:

With the camera system of the anechoic chamber

electrically:

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

Measuring devices:

- fully anechoic chamber M8 (PM-No. 480190)
- antenna mast for antenna AT1080 (PM-No. 480187)
- antenna mast (PM-No. 480188)
- turntable (PM-No. 480186)
- controller HD100 (PM-No. 480181)
- power amplifier AR1000LM20 (PM-No. 480198)
- power amplifier AR1000W1000M1 (PM-No. 480420)
- power amplifier AR80S1G3 (PM-No. 480418)
- signal generator SME06 (PM-No. 480174)
- powermeter NRVD (PM-No. 480176, 480177)
- insertion unit URV5-Z2 (PM-No. 480191, 480192)
- terminating impedance RNB (PM-No. 410062, 410063)
- power probe NRV-Z2 (PM-No. 480193, 480194)
- relay switch unit RSU (PM-No. 480175)
- amplifier interface SCIU (PM-No. 480178)
- control unit FM2000 (PM-No. 480173)
- field sensor FP2000 (PM-No. 480075)
- EMS softwarepackage EMS-K1 (PM-No. 480222)
- biconical antenna VHBC 9133 (PM-No. 480163)
- log.-per. antenna AT1080 (PM-No. 480189)
- horn antenna EMCO 3115A (PM-No. 480183)
- oszilloscope HP 54540A (PM-No. 480001)

Measuring records:

The tests in the table below were carried out.

Date of test:		2004-03-19		
Ambient conditions:		35% F _{rel} , 22°C; Air pressure conforms to the requirements of the standard		
Test level:		26-1000 MHz, 20 V/m, 80% AM (1 kHz)		
Increment:		log 1%		
Dwell time:		≥3s		
Distance antenna/ test object	Polarisation	Radiation direction	EUT reaction	Result
3m	vertical	0°	none detected	A
3m	vertical	90°	none detected	A
3m	vertical	180°	none detected	A
3m	vertical	270°	none detected	A
3m	horizontal	0°	none detected	A
3m	horizontal	90°	none detected	A
3m	horizontal	180°	none detected	A
3m	horizontal	270°	none detected	A

Date of test:		2004-03-19		
Ambient conditions:		35% F _{rel} , 22° C; Air pressure conforms to the requirements of the standard		
Test level:		900 MHz ± 10 MHz and 1,90 GHz ± 50 MHz, 20 V/m, 200 Hz PM (50%)		
Increment:		log 1%		
Dwell time:		≥3s		
Distance antenna/ test object	Polarisation	Radiation direction	EUT reaction	Result
3m	vertical	0°	none detected	A
3m	vertical	90°	none detected	A
3m	vertical	180°	none detected	A
3m	vertical	270°	none detected	A
3m	horizontal	0°	none detected	A
3m	horizontal	90°	none detected	A
3m	horizontal	180°	none detected	A
3m	horizontal	270°	none detected	A

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

4.2 Immunity test for discharge of static electricity according to EN 61000-4-2

Test set-up:

- Stand 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.



Measuring devices: Schaffner ESD simulator NSG 438 (PM-No. 480406)
testing table Numerik PTi (PM-No. 480049)

Measuring records:

The tests in the table below were carried out.

Date of test:		2004-05-03	
Ambient conditions:		35% 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
contact discharge ±2kV	CD	none detected	A
contact discharge ±4kV	CD	none detected	A
contact discharge ±6kV	CD	none detected	A
air discharge ±2kV	AD	none detected	A
air discharge ±4kV	AD	none detected	A
air discharge ±8kV	AD	none detected	A

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

5 Annex



40252A_m1e1.jpg



40252A_m1e2.jpg



40252A_m1e3.jpg



40252A_m5a.jpg



40252A_m6a.jpg