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1 TEST STANDARDS

The tests were performed according to following standards:

FCC Rules and Regulations Part 15 Subpart C - Intentional Radiators (October 01, 2003)

Part 15, Subpart C, Section 15.35(c)	Correction for Pulse Operation (Duty Cycle)
Part 15, Subpart C, Section 15.207(a)	AC Line conducted emissions
Part 15, Subpart C, Section 15.209(a)	Radiated emissions, general requirements
Part 15, Subpart C, Section 15.247(c)	Radiated emissions, outside the used frequency band
Part 15, Subpart C, Section 15.247(2)	Minimum 6dB bandwidth requirement
Part 15, Subpart C, Section 15.247(b)(3)	Maximum Peak output Power of intentional radiator
Part 15, Subpart C, Section 15.247(d)	Peak power spectral density

FCC Rules and Regulations Part 15 Subpart B - Unintentional Radiators (October 01, 2003)

Part 15, Subpart B, Section 15.107(a)	AC Line conducted emissions
Part 15, Subpart B, Section 15.109(a)	Radiated emissions, general requirements

2 SUMMARY

GENERAL REMARKS:

All spurious emissions not mentioned in this test report are
from 25-1000MHz: < 30 dB μ V
above 1000MHz: < 40 dB μ V

FINAL ASSESSMENT:

The equipment under test **fulfills** the EMI requirements cited in clause 1 test standards.


Date of receipt of test sample : acc. to storage records of MBPS

Testing commenced on : 13. September 2004

Testing concluded on : 07. October 2004

Checked by:

Tested by:

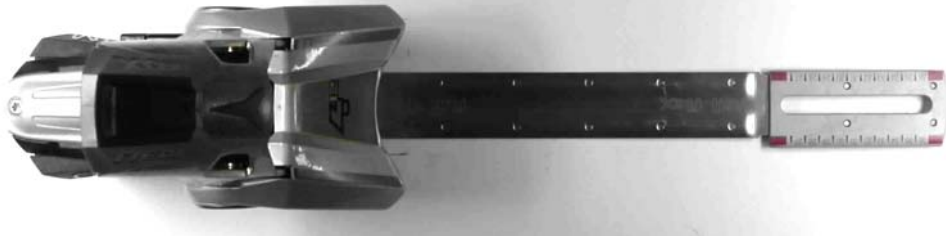

Günter Mikes
Dipl. Ing.(FH)


Xaver Fischer

3 EQUIPMENT UNDER TEST

3.1 Photo documentation of the EuT

Fersenautomatik



Fersenautomatik



Appropriate action to be in compliance with the FCC – rules:

(20db distance of carrier frequency to the first harmonic at 4.930Ghz)

Implement action:

Material:

Dimensions:

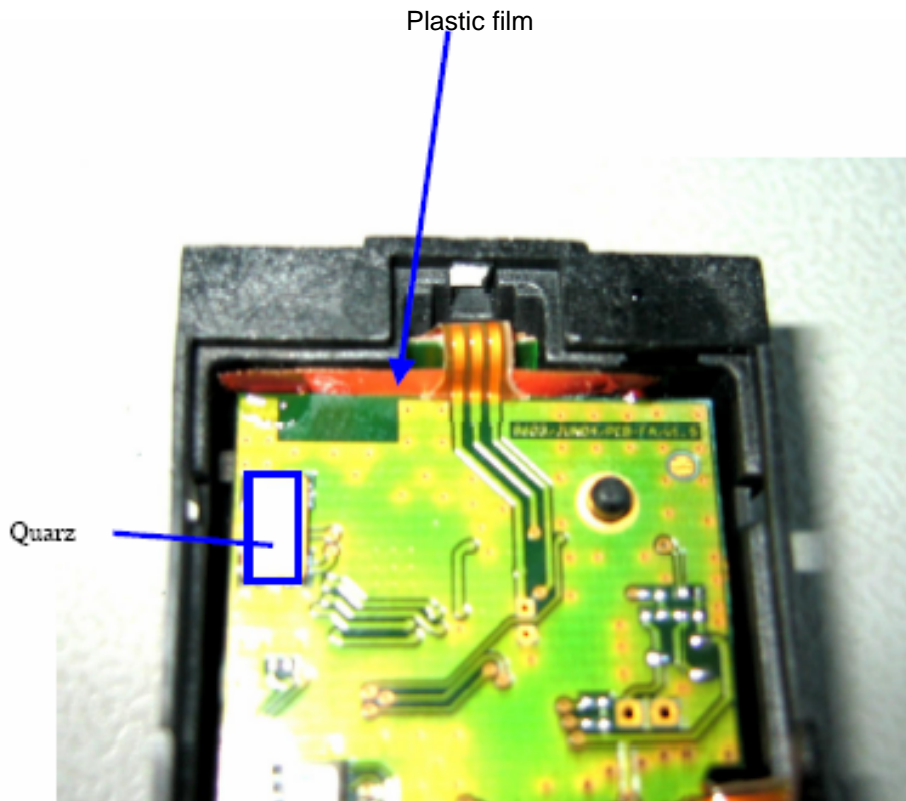
Position:

Insert a conductive strip

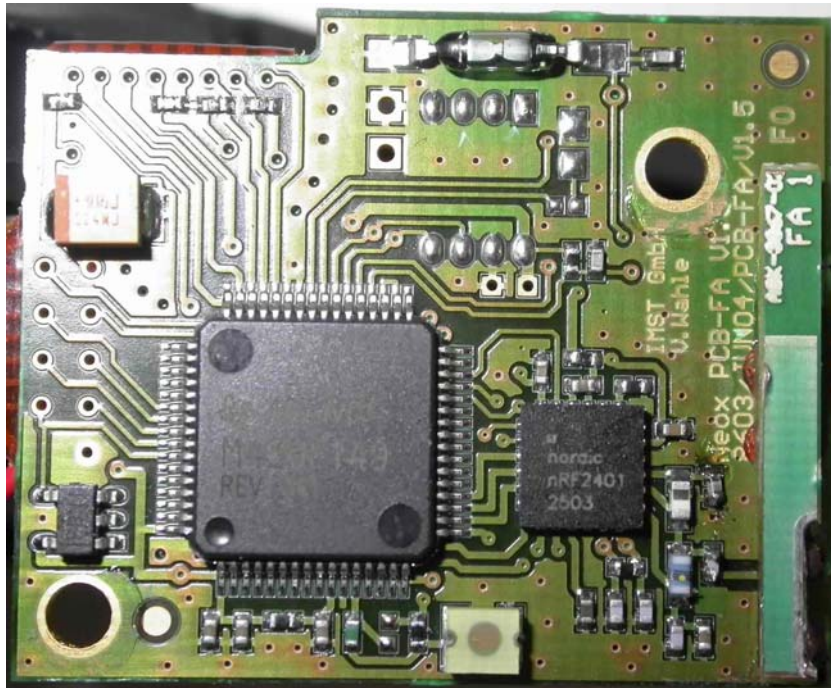
Kapton, coated with 35µ copper, or Cu-foil (alternative)

23mm x 2.5mm

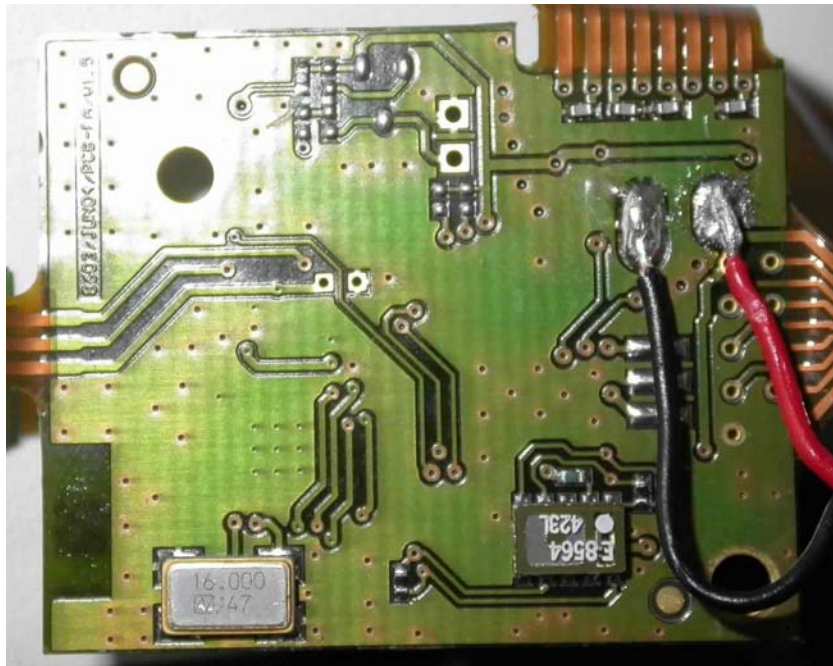
Parallel to the antenna, stuck at the front side of BB-wall, left-justified (where is populated the quartz), 2 glue dots (see picture)



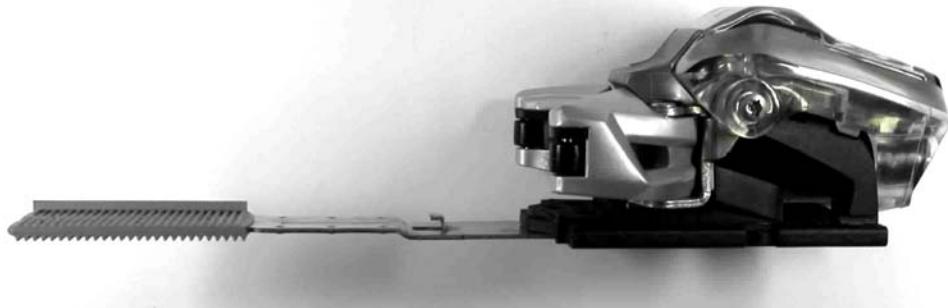
Fersenautomatik



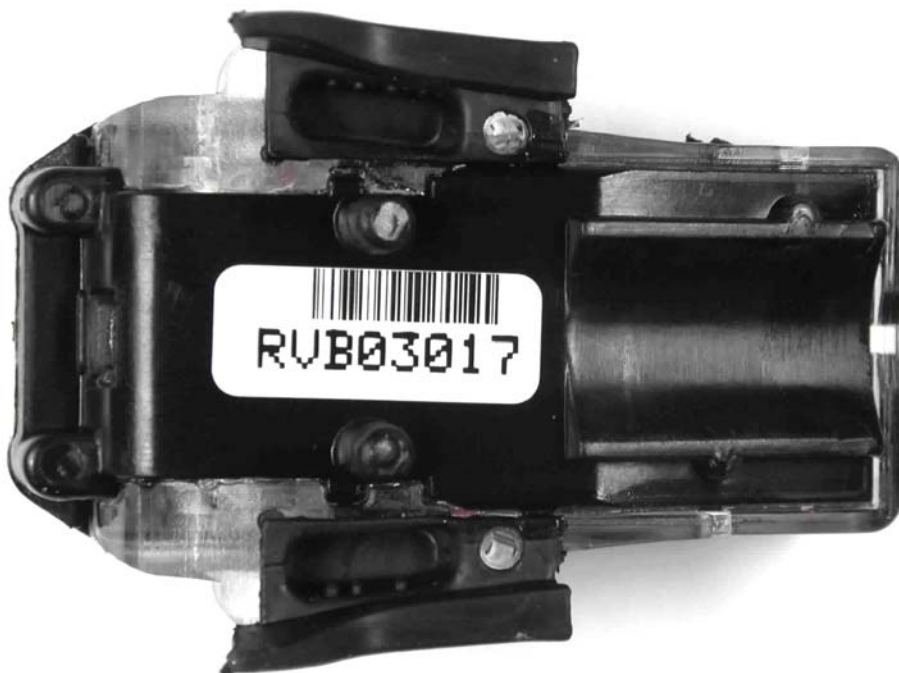
Fersenautomatik



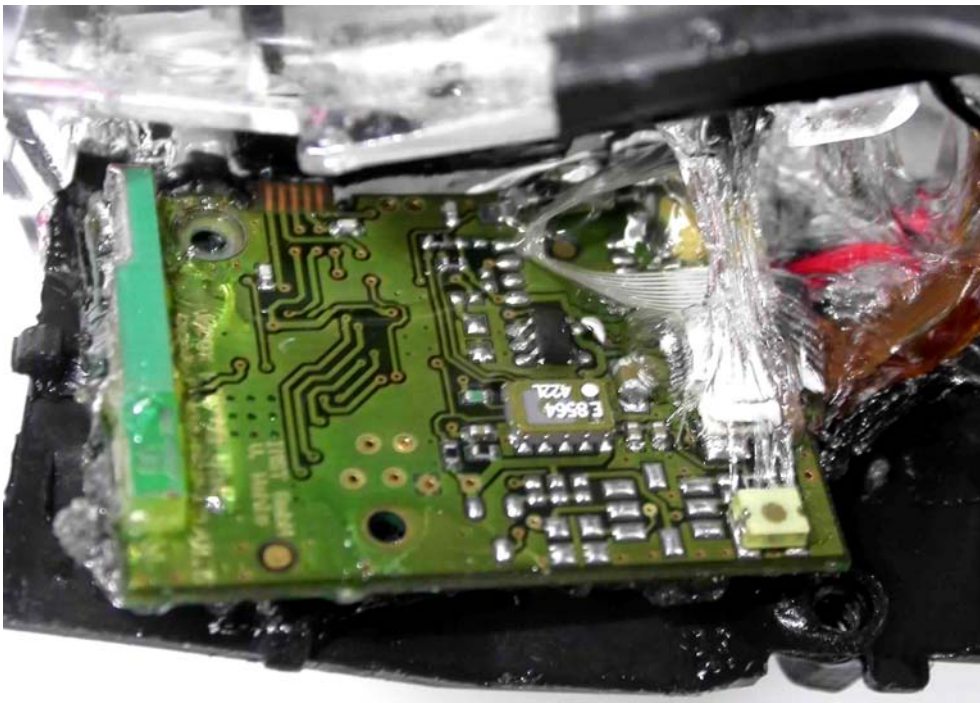
Vorderbacke



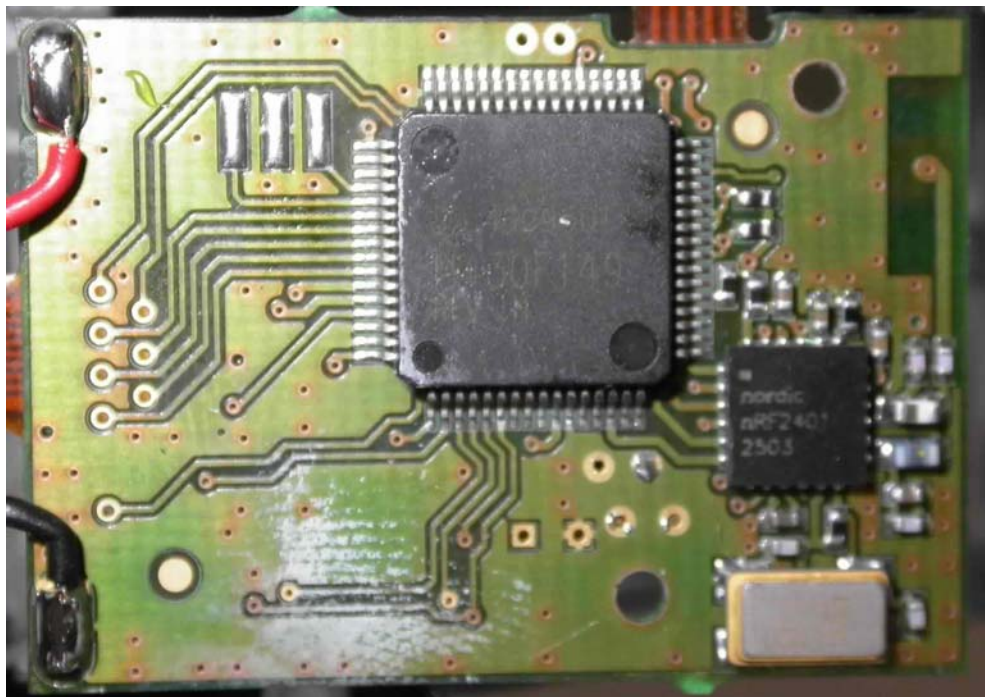
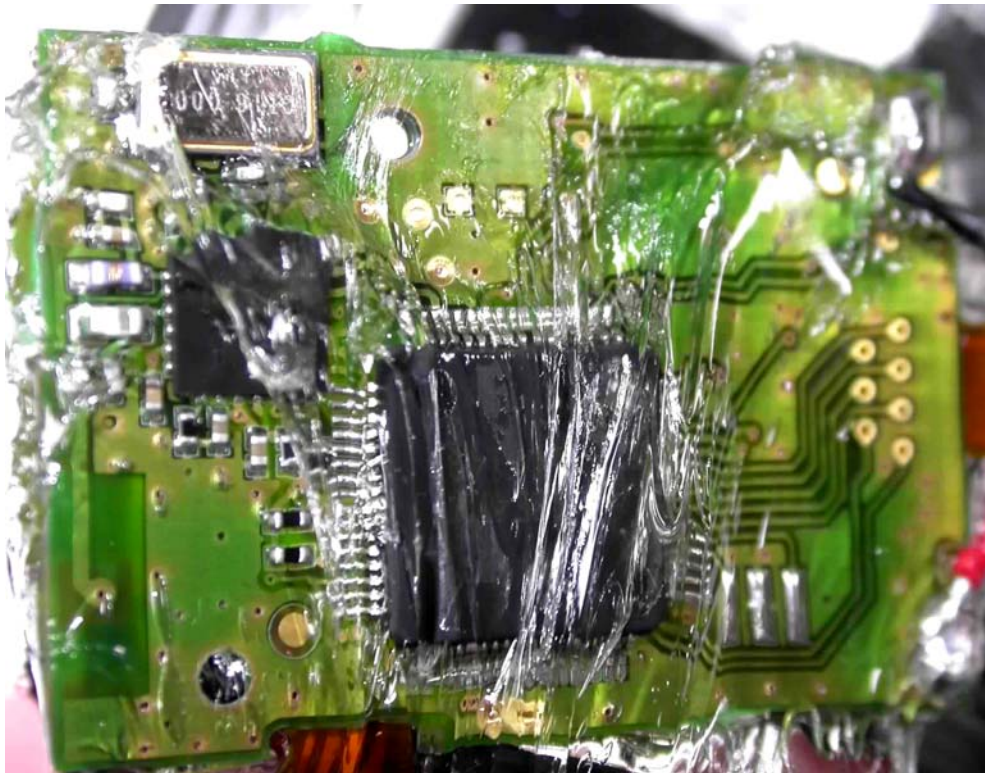
Vorderbacke



Vorderbacke



Vorderbacke



Vorderbacke



3.2 Power supply system utilised

Power supply voltage : 3.6 V / DC

3.3 Short description of the Equipment under Test (EuT)

The EuT NEOX EBM contains contactless battery powered moduls for measurement and wireless communication functions.

Abreviations: FA: Fersenautomatik
VB: Vorderbacke

Number of tested samples: 1
Serial number: Prototype

EuT operation mode:

The equipment under test was operated during the measurement under the following conditions:

- Tx-mode with normal modulation

EuT configuration:

(The CDF filled by the applicant can be viewed at the test laboratory.)

The following peripheral devices and interface cables were connected during the measurements:

- _____ Model : _____
- _____ Model : _____
- _____ Model : _____
- _____ Model : _____
- _____ Model : _____
- _____ Model : _____

4 TEST ENVIRONMENT

4.1 Address of the test laboratory

MIKES BAPT Product Service GmbH
Ohmstrasse 2-4
94342 Strasskirchen
Germany

4.2 Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature: 15-35 ° C

Humidity: 30-60 %

Atmospheric pressure: 86-106 kPa

4.3 Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16-4-2 /11.2003 „Uncertainties, statistics and limit modelling – Uncertainty in EMC measurements“ and is documented in the MIKES BAPT Product Service GmbH quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

4.4 Measurement Protocol for FCC, VCCI and AUSTEL

4.4.1 GENERAL INFORMATION

4.4.1.1 Test Methodology

Conducted and radiated disturbance testing is performed according to the procedures in International Special Committee on Radio Interference (CISPR) Publication 22 (1997), European Standard EN 55022 and Australian Standard AS 3548 (which are based on CISPR 22).

The Japanese standard, "Voluntary Control Council for Interference (VCCI) by Data Processing Equipment and Electronic Office Machines, Technical Requirements" is technically equivalent to CISPR 22 (1997). For official compliance, a conformance report must be sent to and accepted by the VCCI.

In compliance with FCC Docket 92-152, "Harmonization of Rules for Digital Devices Incorporate International Standards", testing for FCC compliance may be done following the ANSI C63.4-2003 procedures and using the CISPR 22 Limits.

4.4.1.2 Measurement Error

The data and results referenced in this document are true and accurate. The reader is cautioned that there is some measurement variability due to the tolerances of the test equipment that can contribute to a nominal product measurement uncertainty. The measurement uncertainty was calculated for all measurements listed in this test report according to NIS 81/5.1994 "The treatment of uncertainty in EMC measurements" and is documented in the MIKES BABT Product Service GmbH quality system according to DIN EN ISO/IEC 17025. Furthermore, component differences and manufacturing process variability of production units similar to that tested may result in additional product uncertainty. If necessary, refer to the test lab for the actual measurement uncertainty for specific tests. The manufacturer has the sole responsibility of continued compliance of the device.

4.4.1.3 Justification

The Equipment Under Test (EUT) is configured in a typical user arrangement in accordance with the manufacturer's instructions. A cable is connected to each available port and either terminated with a peripheral into its characteristic impedance or left unterminated. When appropriate, the cables are manually manipulated with respect to each other to obtain maximum disturbances from the unit.

4.4.2 DETAILS OF TEST PROCEDURES

4.4.2.1 General Standard Information

The test methods used comply with CISPR Publication 22 (1997), EN 55022 (2001) and AS 3548 (1992) - "Limits and Methods of Measurement of Radio Interference Characteristics of Information Technology Equipment" and with ANSI C63.4-2003 - "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz."

4.4.2.2 Conducted disturbance

Conducted disturbance on the 50 Hz and/or 60 Hz power interface of the EUT are measured in the frequency range of 150 kHz to 30 MHz. The measurements are performed using a receiver, which has CISPR characteristic bandwidth and quasi peak detection, and a Line Impedance Stabilization Network (LISN), with 50Ω/50 μH (CISPR 16) characteristics. Table top equipment is placed on a non-conducting table 80 centimetres above the floor and is positioned 40 centimetres from the vertical ground plane (wall) of the screen room. If the minimum passing margin appears to be less than 20 dB with a peak mode measurement, the emissions are remeasured using a tuned receiver with quasi peak and average detection and recorded on the data sheets.

4.4.2.3 Radiated disturbance

Radiated disturbance from the EUT are measured in the frequency range of 30 to 1000 MHz using a tuned receiver and appropriate broadband linearly polarized antennas. Measurements between 30 MHz and 1000 MHz are made with 120 kHz/6 dB bandwidth and quasi peak detection and measurements above 1000 MHz are made with a 1 MHz/6 dB bandwidth and average detection. Table top equipment is placed on a 1.0 X 1.5 meter non-conducting table 80 centimetres above the ground plane. Floor standing equipment is placed directly on the turntable/ground plane. Interface cables that are closer than 40 centimetres to the ground plane are bundled in the center in a serpentine fashion so they are at least 40 centimetres from the ground plane. Cables to simulators/testers (if used in this test) are routed through the center of the table and to a screen room located outside the test area. The antenna was positioned 3, 10 or 30 meters horizontally from the EUT. To locate maximum emissions from the test sample the antenna is varied in height from 1 to 4 meters, measurement scans are made with both horizontal and vertical antenna polarizations and the EUT are rotated 360 degrees.

5 TEST CONDITIONS AND RESULTS

5.1 Conducted emissions

For test instruments and accessories used see section 6 Part A 4.

5.1.1 Description of the test location

Test location:

5.1.2 Photo documentation of the test set-up

5.1.3 Test result

Frequency range:

Min. limit margin

The requirements are

Remarks: The test is not applicable.

5.2 Radiated power of the fundamental wave

For test instruments and accessories used see section 6 Part CPR 3.

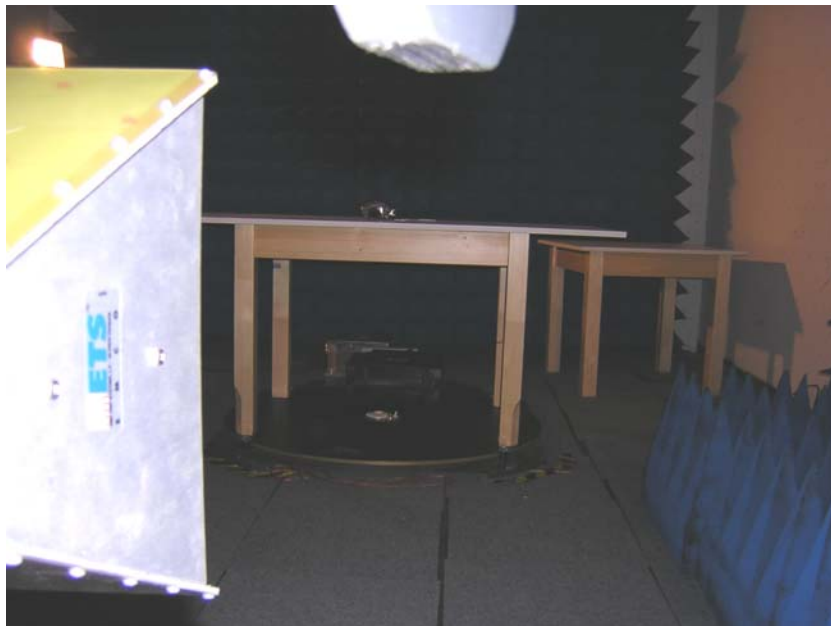
5.2.1 Description of the test location

Test location: Anechoic Chamber A2

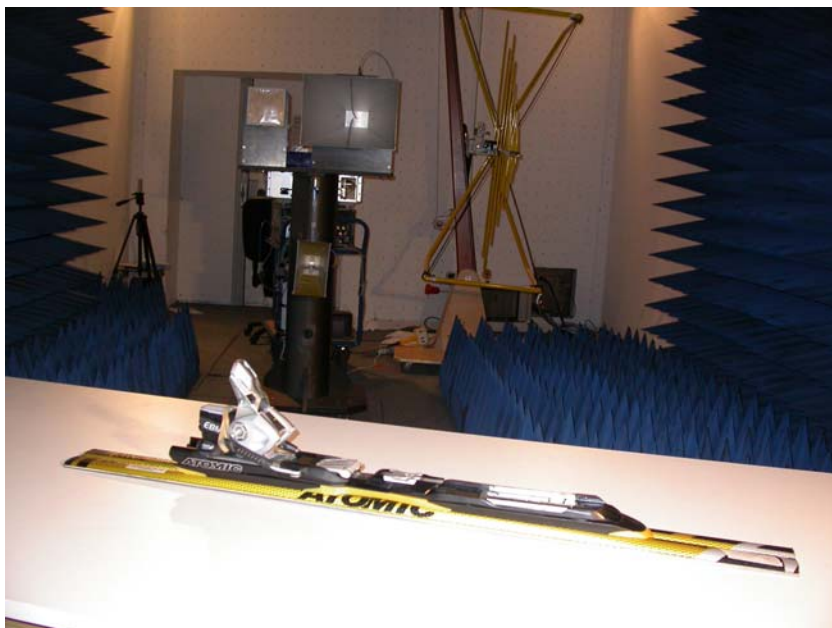
Test distance: 3m

5.2.2 Photo documentation of the test set-up

Vorderbacke (VB)



Fersenautomatik (FA)



5.2.3 Test result

Vorderbacke (VB)

Frequency [MHz]	Peak Power Output (dBm)	Correct. [dB]	Corr. Peak Power Output (dBm)	Peak Power Limit (dBm)	Delta [dB]
2465	-10,8	-3,8	-14,6	30	-44,6

Fersenautomatik (FA)

Frequency [MHz]	Peak Power Output (dBm)	Correct. [dB]	Corr. Peak Power Output (dBm)	Peak Power Limit (dBm)	Delta [dB]
2465	-8,5	-3,7	-12,1	30	-42,1

Peak Power Limit according to FCC Subpart 15.247(b)(3)

Frequency (MHz)	Peak Power Limit	
	(dBm)	(Watt)
902-928	30	1,0
2400-2483.5	30	1,0
5725-5850	30	1,0

The requirements are **FULFILLED**.

Remarks:

5.3 Radiated emissions (electric field) 30 MHz – 40 GHz

For test instruments and accessories used see section 6 Part SER 2, SER 3.

5.3.1 Description of the test location

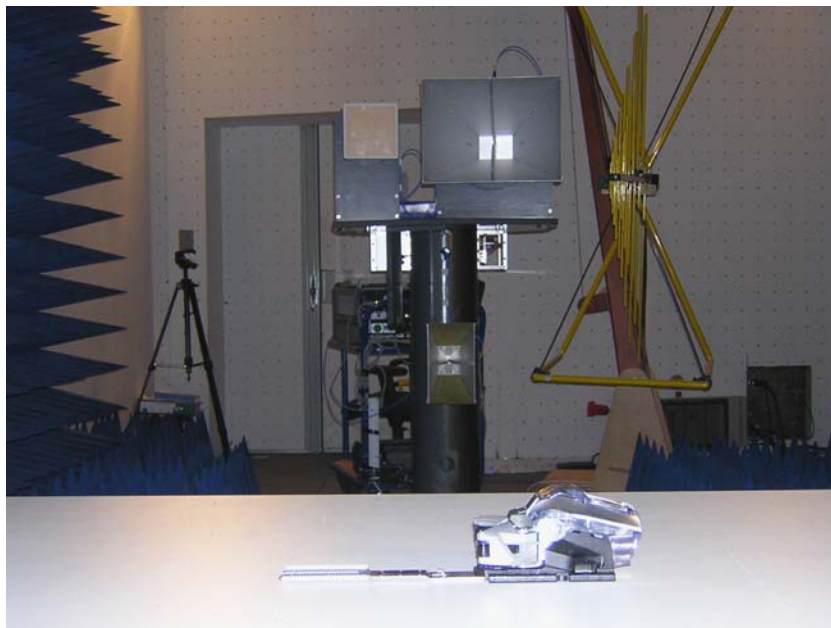
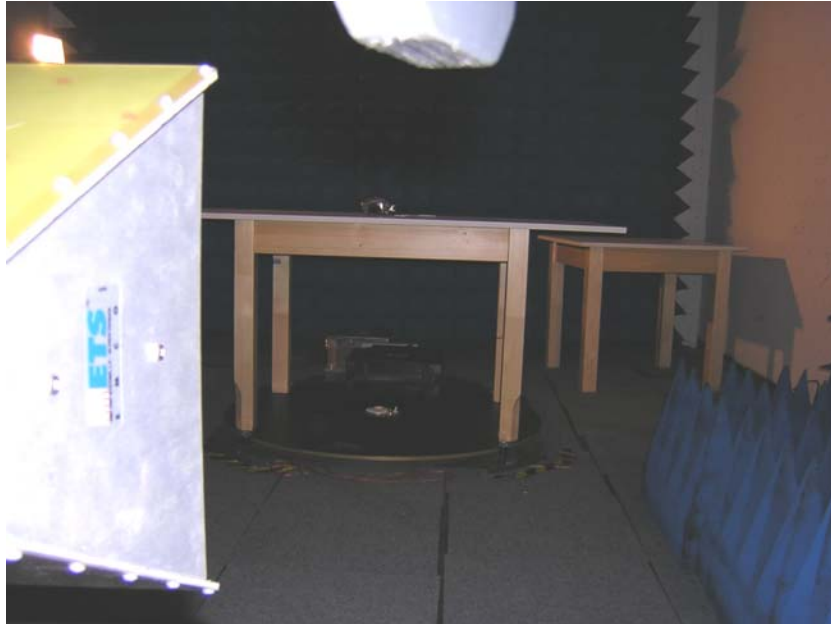
Test location: OATS1
Test location: Anechoic Chamber A2
Test distance: 3m

5.3.2 Photo documentation of the test set-up

Vorderbacke (VB)
Test location: OATS 1



Vorderbacke (VB)
Test location: Anechoic chamber A2



Fersenautomatik (FA)
Test location: OATS 1



Fersenautomatik (FA)
Test location: Anechoic chamber A2



5.3.3 Test result

Testresult in detail:(<1GHz)

Vorderbacke (VB)

Frequency [MHz]	L: QP [dBµV]	L: AV [dBµV]	Bandwidth [kHz]	Correct. [dB]	L: QP [dBµV/m]	L: AV [dBµV/m]	Limit [dBµV/m]	Delta [dB]
30 - 1000			120		< 50			

Fersenautomatik (FA)

Frequency [MHz]	L: QP [dBµV]	L: AV [dBµV]	Bandwidth [kHz]	Correct. [dB]	L: QP [dBµV/m]	L: AV [dBµV/m]	Limit [dBµV/m]	Delta [dB]
30 - 1000			120		< 50			

Testresult in detail:(>1GHz)

Vorderbacke (VB)

	Frequency [MHz]	L: PK [dBµV]	Bandwidth [kHz]	Correct. [dB]	L: PK [dBµV/m]	Limit PK [dBµV/m]	Delta [dB]
Field strength of fundamental wave as reference for radiated emissions	2465	94,5	100	-10,6	83,9		
Radiated emissions	2821	52,7	100	-8,6	44,2	63,9	-20,3
	4930	45,7	100	-2,9	42,8	63,9	-21,1
	7396	44,3	100	-1,0	43,3	63,9	-20,6

Fersenautomatik (FA)

	Frequency [MHz]	L: PK [dBµV]	Bandwidth [kHz]	Correct. [dB]	L: PK [dBµV/m]	Limit PK [dBµV/m]	Delta [dB]
Field strength of fundamental wave as reference for radiated emissions	2465	92,8	100	-10,6	82,2		
Radiated emissions	4930	63,2	100	-2,9	60,3	62,2	-1,9
	7395	59,2	100	-1,0	58,2	62,2	-4,0

Peak-Limit according to FCC Subpart 15.247(c)

In any 100 kHz bandwidth outside the frequency band 2400 – 2483.50 MHz, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in §15.209(a) is not required.

Limit according to FCC Subpart 15.209

Frequency [MHz]	Limits acc. 15.209 [dBµV/m]	Limits acc. 15.247(c) [dBµV/m]		Final Radiated Limits [dBµV/m]	
		VB	FA	VB	FA
30-88	40	63,9	62,2	63,9	62,2
88-216	43,5	63,9	62,2	63,9	62,2
216-960	46	63,9	62,2	63,9	62,2
Above 960	54	63,9	62,2	63,9	62,2

Restricted bands of operation:

The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in §15.209

MHz	MHz	GHz
25.5 – 25.67	960 – 1240	4.5 – 5.15
37.5 – 38.25	1300 – 1427	5.35 – 5.46
73 – 74.6	1435 – 1626.5	7.25 – 7.75
74.8 – 75.2	1645.5 – 1646.5	8.025 – 8.5
108 – 121.94	1660 – 1710	9.0 – 9.2
123 – 138	1718.8 – 1722.2	9.3 – 9.5
149.9 – 150.05	2200 – 2300	10.6 – 12.7
156.52475 – 156.52525	2310 – 2390	13.25 – 13.4
156.7 – 156.9	2483.5 – 2500	14.47 – 14.5
162.0125 – 167.17	2655 – 2900	15.35 – 16.2
167.72 – 173.2	3260 – 3267	17.7 – 21.4
240 – 285	3332 – 3339	22.01 – 23.12
322 – 335.4	3345.8 – 3358	23.6 – 24.0
399.9 – 410	3600 – 4400	31.2 – 31.8
608 – 614		36.43 – 36.5

The requirements are **FULFILLED**.

Remarks: During the test, the Eut was set into normal modulation mode as intended for use.
The measurement was performed up to the 10th harmonic (25000MHz).

5.4 Correction for Pulse Operation (Duty Cycle)

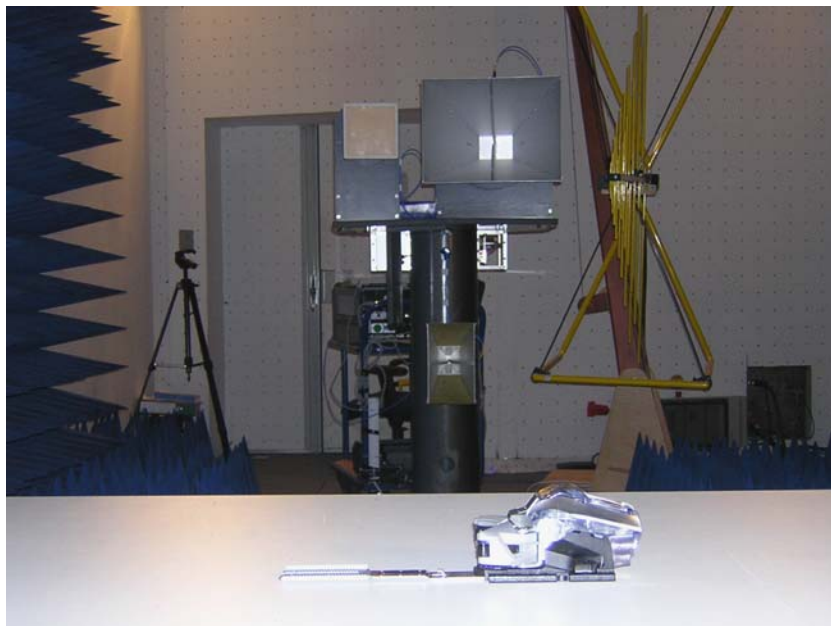
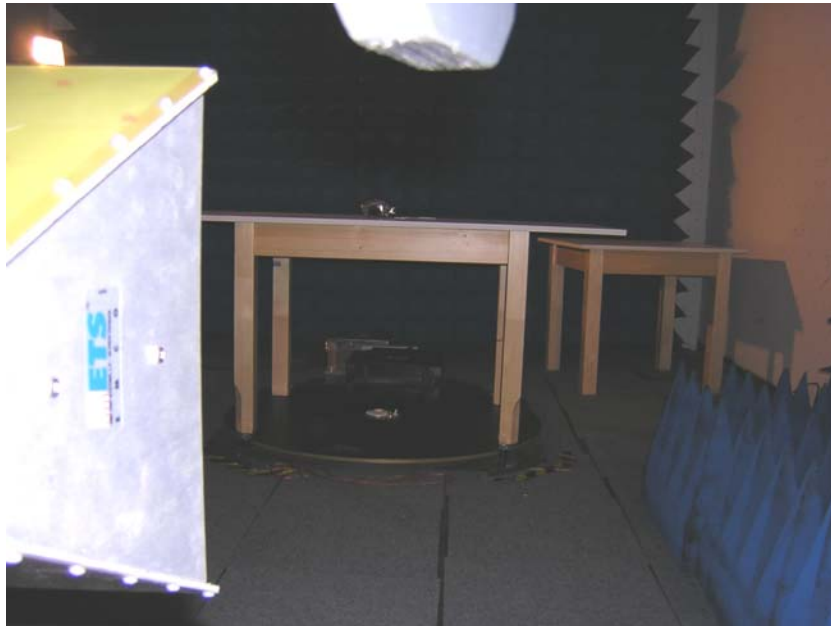
For test instruments and accessories used see section 6 Part DC.

5.4.1 Description of the test location

Test location: Anechoic Chamber A2

5.4.2 Photo documentation of the test set-up

Vorderbacke (VB)



Fersenautomatik (FA)



5.4.3 Description of Measurement

The Duty cycle factor, expressed in dB, is arrived by taking the following formula:

$$KE = 20 \log [(t_{iB} \cdot p) / T_w]$$

KE: pulse operation correction factor [dB]
 t_{iw} : pulse duration for one complete pulse track [msec]
 t_{iB} : pulse duration for one pulse [μ sec]
 T_w : a period of the pulse track [msec]
 p : number of pulses in one train

5.4.4 Test result

Vorderbacke (VB)

t_{iw} [μ sec]	T_w [msec]	t_{iB} [μ sec]	p	KE [dB / %]
201,56	199,68	201,56	1	-53,91 / 0,2

Fersenautomatik (FA)

t_{iw} [μ sec]	T_w [msec]	t_{iB} [μ sec]	p	KE [dB / %]
200,32	199,92	200,32	1	-53,96 / 0,2

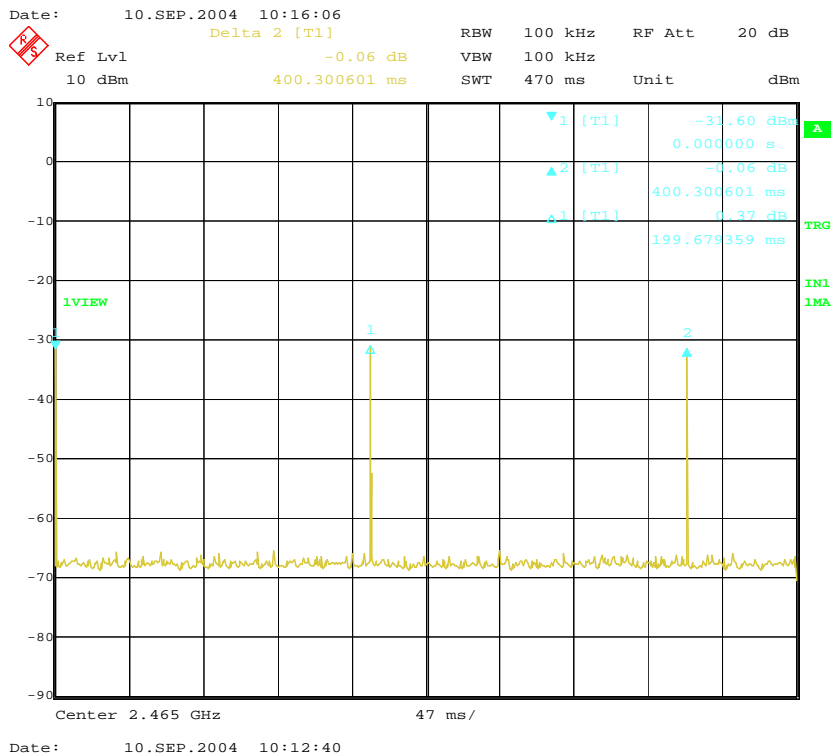
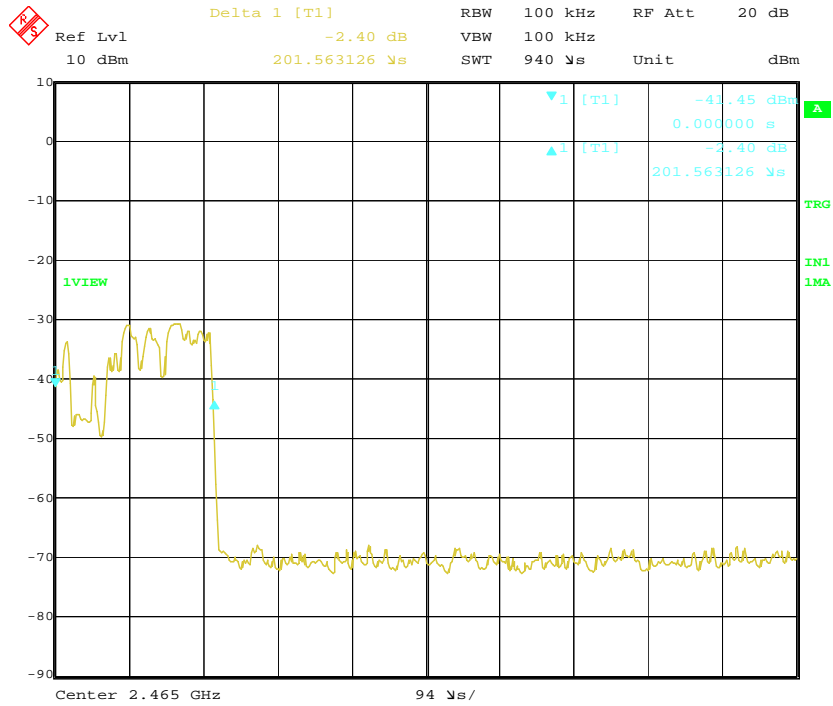
Remarks: The pulse train [T_w] exceeds 100 ms, therefore the duty cycle have been calculated by averaging the sum of the pulsewidths over the 100 ms width with the highest average value.

For detailed results, please see the test protocol below.

5.4.5 Test protocol

Correction for Pulse Operation (Duty Cycle)
FCC Part 15 Subpart 15.35(c)

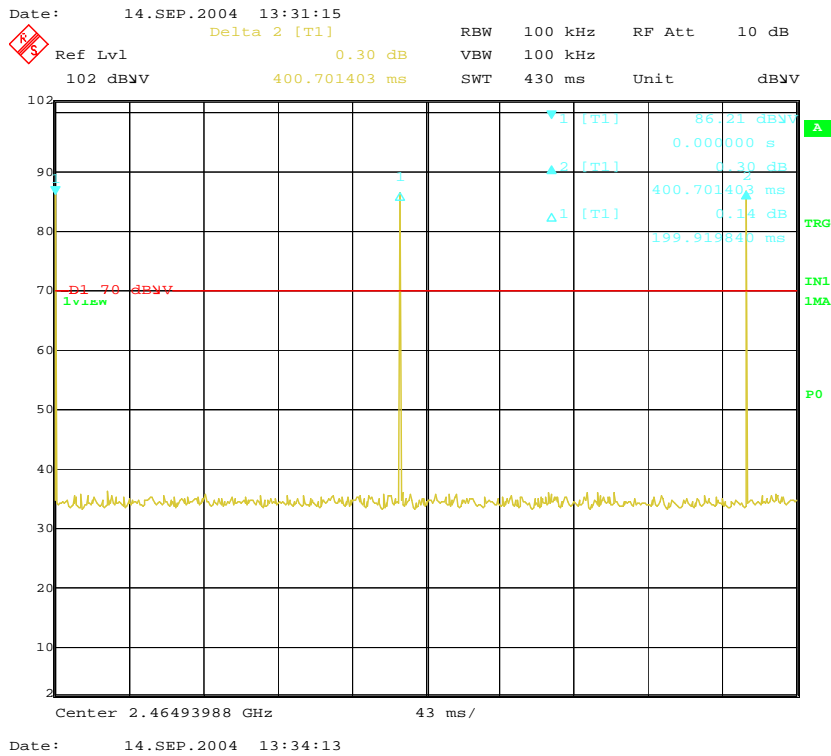
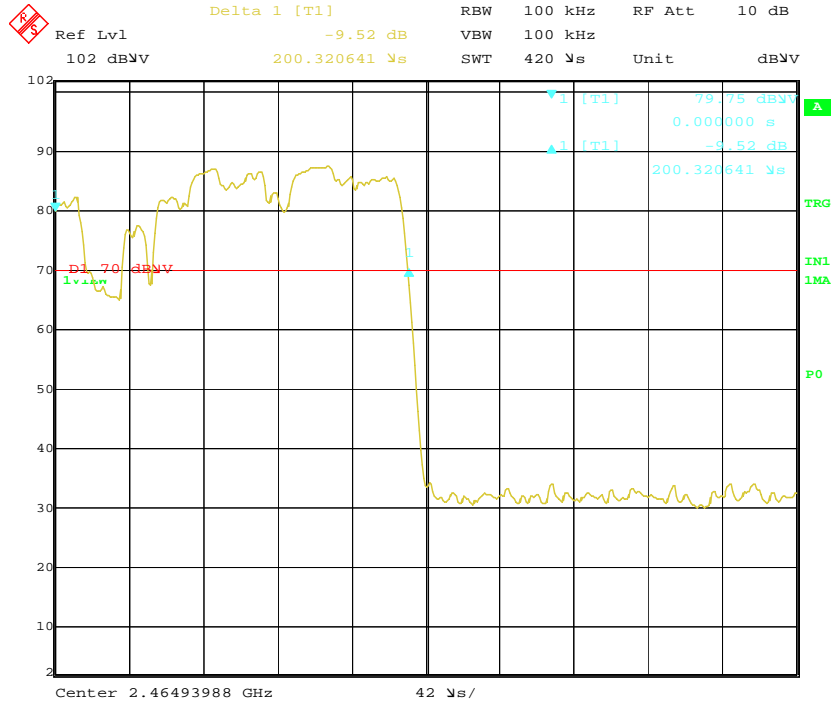
Vorderbacke (VB)



5.4.6 Test protocol

Correction for Pulse Operation (Duty Cycle)
FCC Part 15 Subpart 15.35(c)

Fersenautomatik (FA)



5.5 6dB Bandwidth Measurement

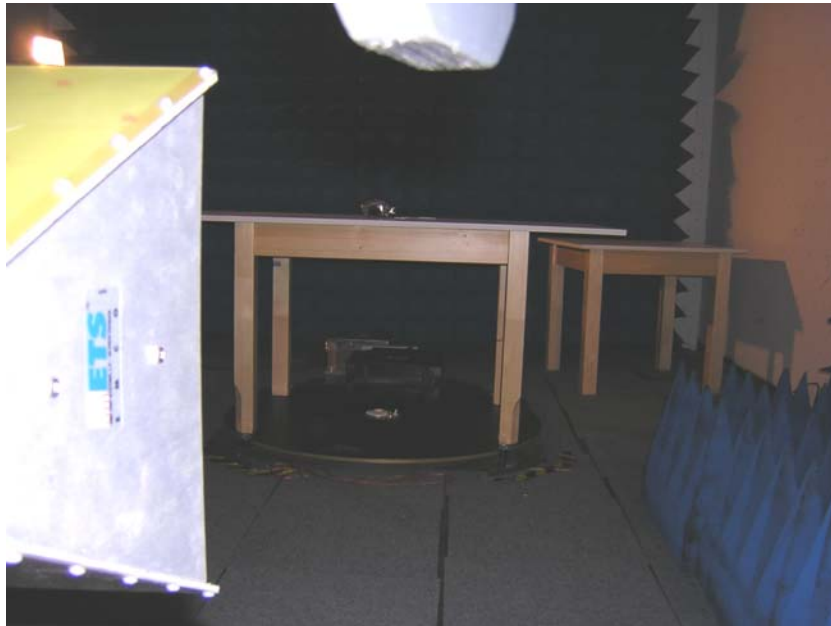
For test instruments and accessories used see section 6 Part **BW**.

5.5.1 Description of the test location

Test location: Anechoic Chamber A2

5.5.2 Photo documentation of the test set-up

Vorderbacke (VB)



Fersenautomatik (FA)



5.5.3 Test result

Vorderbacke (VB)

Fundamental Frequency [MHz]	6 dB BANDWIDTH (MHz)	MINIMUM LIMIT (MHz)
2465	0,511	0,500

Fersenautomatik (FA)

Fundamental Frequency [MHz]	6 dB BANDWIDTH (MHz)	MINIMUM LIMIT (MHz)
2465	0,501	0,500

Limit according to FCC Subpart 15.247 (a)(2)

The minimum 6 dB bandwidth shall be at least 500 kHz

The requirements are **FULFILLED**.

Remarks: For detailed results, please see the following page(s).

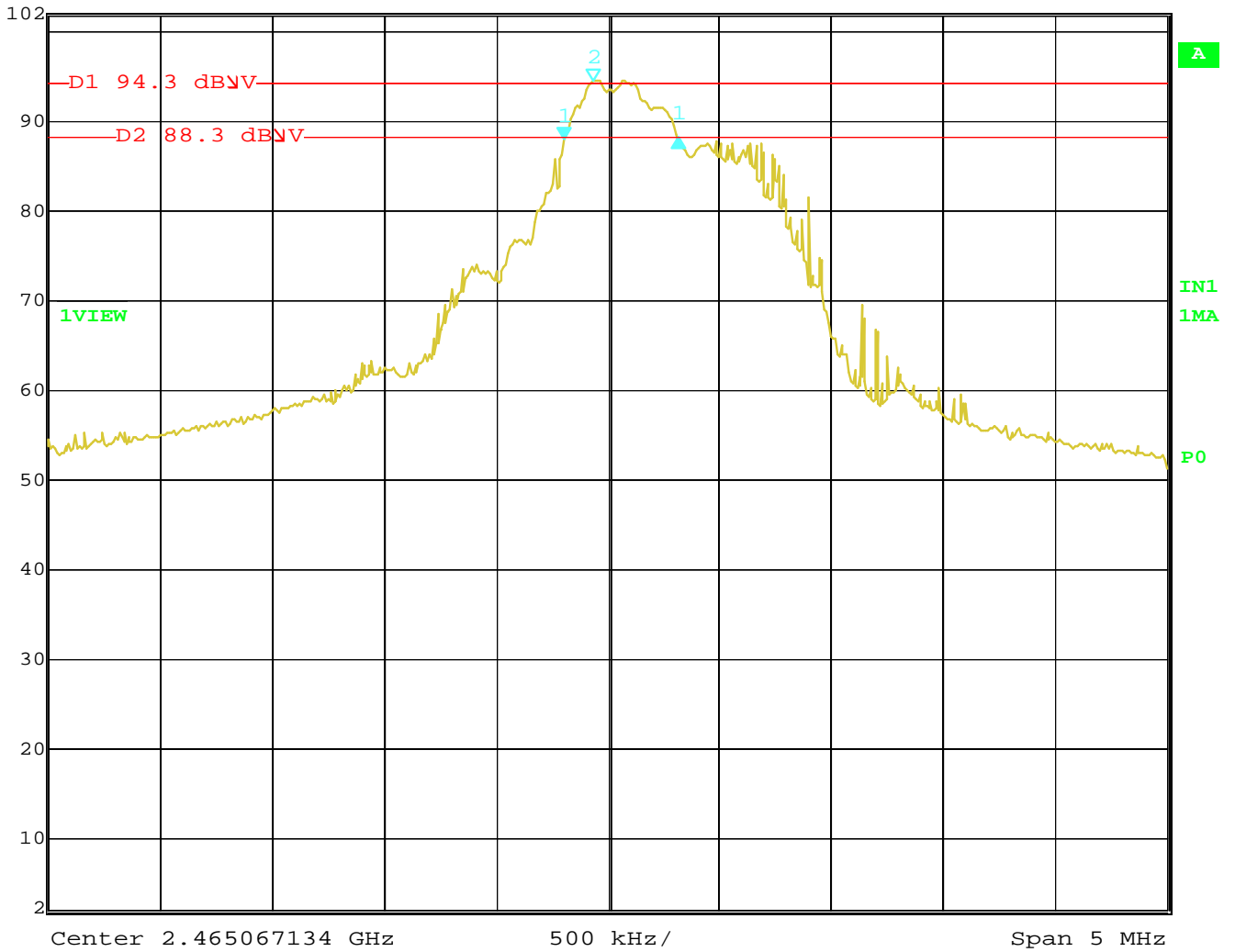
5.5.4 Test protocol

6dB Bandwidth Measurement
FCC Part 15 Subpart 15.247(a)(2)

Vorderbacke (VB)



	Delta 1 [T1]	RBW	100 kHz	RF Att	10 dB
Ref Lvl	0.28 dB	VBW	100 kHz		
102 dBμV	511.02204409 kHz	SWT	500 s	Unit	dBμV



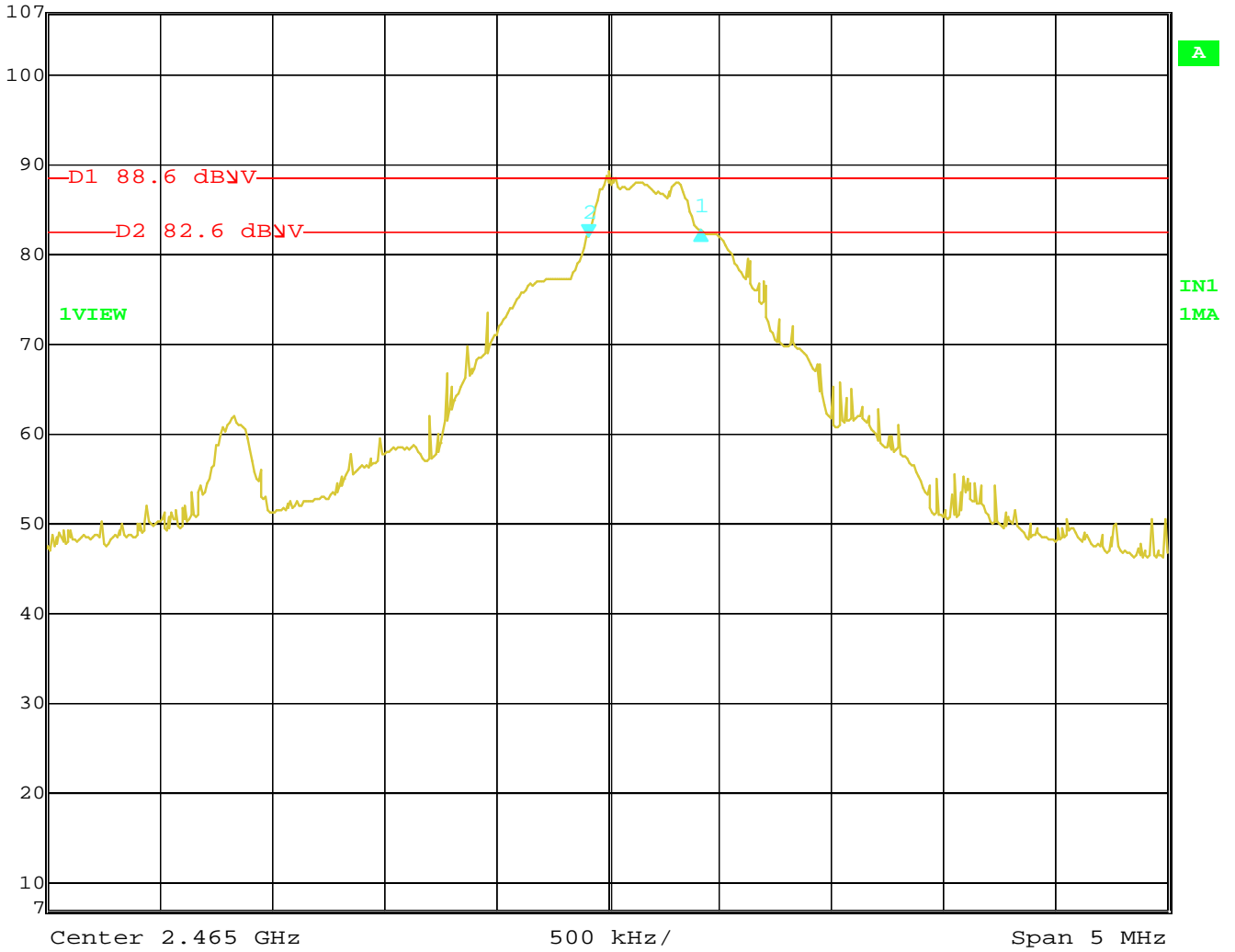
Date: 14.SEP.2004 11:55:55

6dB Bandwidth Measurement
 FCC Part 15 Subpart 15.247(a)(2)

Fersenautomatik (FA)



Ref Lvl	Delta 1 [T1]	RBW	100 kHz	RF Att	10 dB
107 dBμV	0.67 dB	VBW	100 kHz		
	501.00200401 kHz	SWT	500 s	Unit	dBμV



Date: 14.SEP.2004 15:38:17

5.6 Peak Power Density

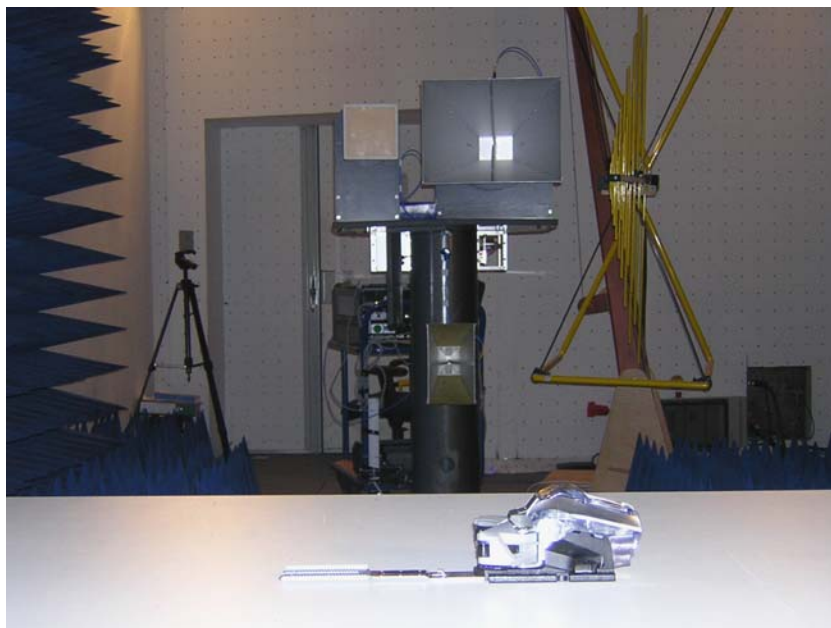
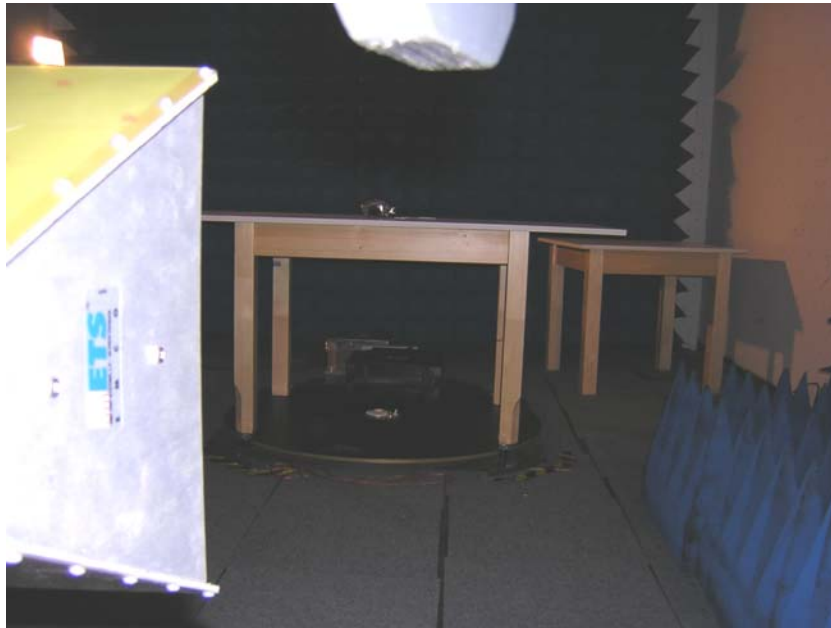
For test instruments and accessories used see section 6 Part PPD.

5.6.1 Description of the test location

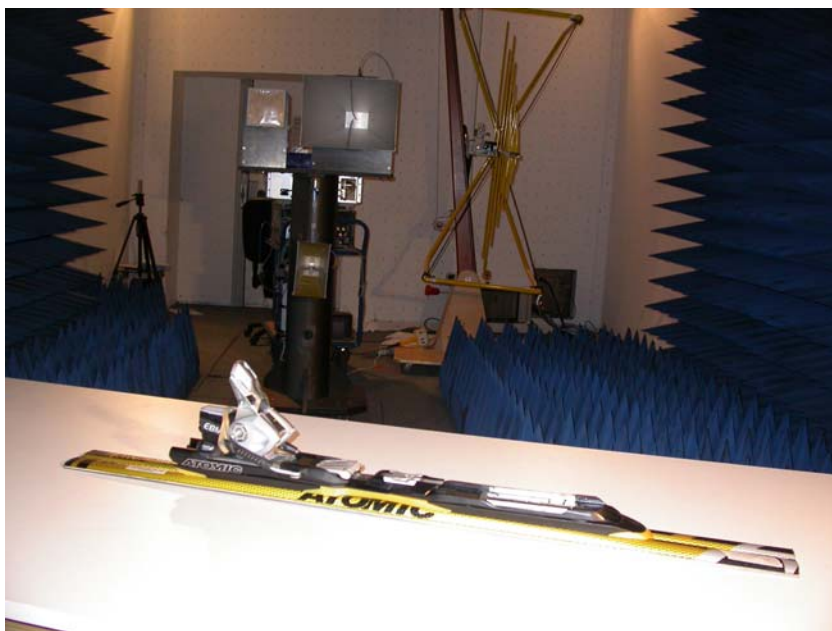
Test location: Anechoic Chamber A2

5.6.2 Photo documentation of the test set-up

Vorderbacke (VB)



Fersenautomatik (FA)



5.6.3 Test result

Vorderbacke (VB)

Fundamental Frequency [MHz]	BANDWIDTH (kHz)	Peak Power density (dBm)
2465	3	-36,45

Fersenautomatik (FA)

Fundamental Frequency [MHz]	BANDWIDTH (kHz)	Peak Power density (dBm)
2465	3	-38,88

Limit according to FCC Subpart 15.247 (d)

The peak power spectral density shall not be greater than 8 dBm in any 3 kHz band.

The requirements are **FULFILLED**.

Remarks:

5.7 Receiver conducted disturbances 0.15 - 30 MHz

For test instruments and accessories used see section 6 Part A 4.

5.7.1 Description of the test location

Test location:

5.7.2 Photo documentation of the test set-up

5.7.3 Test result

Frequency range:

Min. limit margin

The requirements are

Remarks: The measurement is not applicable.

5.8 Receiver radiated emissions (electric field) 30 MHz - 40 GHz

For test instruments and accessories used see section 6 Part SER2 and SER3.

5.8.1 Description of the test location

Test location:

Test location:

Test distance:

5.8.2 Photo documentation of the test set-up

5.8.3 Test result

Test result <1GHz

Frequency [MHz]	L: PK [dBµV]	L: QP [dBµV]	Bandwidth [kHz]	Correct. [dB]	L: PK [dBµV/m]	L: QP [dBµV/m]	Limit [dBµV/m]	Delta [dB]

5.8.4 Test result >1GHz

Frequency [MHz]	L: PK [dBµV]	L: AV [dBµV]	Bandwidth [kHz]	Correct. [dB]	L: PK [dBµV/m]	L: AV [dBµV/m]	Limit [dBµV/m]	Delta [dB]

Limit according to FCC Subpart 15.109(a)

Frequency of emission [MHz]	Field strength Limits [µV/m]	Field strength Limits [dBµV/m]
30-88	100	40
88-216	150	44
216-960	200	46
Above 960	500	54

The requirements are **FULFILLED**.

Remarks: The test can not be carried out, because it was not possible to set the EuT into receive mode.

6 USED TEST EQUIPMENT AND ACCESSORIES

All test instruments used, in addition to the test accessories, are calibrated and verified regularly.

Test ID	Model / Type	Kind of Equipment	Manufacturer	Equipment No.
CPR3	WHJS1000-10EE	High Pass Filter	Fiedler Meßtechnik	04-07/60-03-027
	N-1600-SMA	Microwave Cable	Huber+Suhner	04-07/60-04-203
	SM 01	Switchmatrix 1-18 GHz	MBPS GmbH	04-07/60-04-215
	N2000SMA	RF Cable 18 GHz	Huber+Suhner	04-07/60-04-222
	BBHA-9120 E	Horn Antenna 0,5-6 GHz	Schwarzbeck Mess-Elektronik	04-07/62-03-007
	ESIB 40	Test Receiver	Rohde & Schwarz München	04-07/63-03-002
DC	N-1600-SMA	Microwave Cable	Huber+Suhner	04-07/60-04-203
	SM 01	Switchmatrix 1-18 GHz	MBPS GmbH	04-07/60-04-215
	N2000SMA	RF Cable 18 GHz	Huber+Suhner	04-07/60-04-222
	BBHA-9120 E	Horn Antenna 0,5-6 GHz	Schwarzbeck Mess-Elektronik	04-07/62-03-007
	ESIB 40	Test Receiver	Rohde & Schwarz München	04-07/63-03-002
MB	SM 01	Switchmatrix 1-18 GHz	MBPS GmbH	04-07/60-04-215
	N2000SMA	RF Cable 18 GHz	Huber+Suhner	04-07/60-04-222
	N1000SMA	RF Cable 18 GHz	Huber+Suhner	04-07/60-04-225
	Model 3115	Horn Antenna	EMCO Elektronik GmbH	04-07/62-03-003
	ESIB 40	Test Receiver	Rohde & Schwarz München	04-07/63-03-002
PPD	WHJS1000-10EE	High Pass Filter	Fiedler Meßtechnik	04-07/60-03-027
	N-1600-SMA	Microwave Cable	Huber+Suhner	04-07/60-04-203
	SM 01	Switchmatrix 1-18 GHz	MBPS GmbH	04-07/60-04-215
	N2000SMA	RF Cable 18 GHz	Huber+Suhner	04-07/60-04-222
	BBHA-9120 E	Horn Antenna 0,5-6 GHz	Schwarzbeck Mess-Elektronik	04-07/62-03-007
	ESIB 40	Test Receiver	Rohde & Schwarz München	04-07/63-03-002
	SMR 40	Signal Generator 1-40 GH	Rohde & Schwarz München	04-07/64-03-011
SER2	Sucofeed 7/8	RF Cable	Huber+Suhner	04-07/60-04-089
	NW-2000-NB	RF Cable	MBPS GmbH	04-07/60-04-205
	NB-15000-NB	RF Cable	MBPS GmbH	04-07/60-04-207
	VULB 9165	Super Broadband Antenn	Schwarzbeck Mess-Elektronik	04-07/62-00-001
	ESVS 30	Test Receiver	Rohde & Schwarz München	04-07/63-04-001
SER3	SM 01	Switchmatrix 1-18 GHz	MBPS GmbH	04-07/60-04-215
	N2000SMA	RF Cable 18 GHz	Huber+Suhner	04-07/60-04-222
	N1000SMA	RF Cable 18 GHz	Huber+Suhner	04-07/60-04-225
	Model 3115	Horn Antenna	EMCO Elektronik GmbH	04-07/62-03-003
	ESIB 40	Test Receiver	Rohde & Schwarz München	04-07/63-03-002