

EMI -- TEST REPORT

Test Report No. : T30197-00-04HU	December 08, 2005 Date of issue
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Type / Model Name : 5WK4 9167

Product Description : Keyless vehicle module

Applicant : Siemens VDO Automotive AG

Address : Siemensstrasse 12

D-93055 Regensburg, Germany

Manufacturer : Siemens VDO Automotive AG

Address : Siemensstrasse 12

D-93055 Regensburg, Germany

Licence holder : Siemens VDO Automotive AG

Address : Siemensstrasse 12

D-93055 Regensburg, Germany

Test Result according to the standards listed in clause 1 test standards:	Positive
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The test report merely corresponds to the test sample.
It is not permitted to copy extracts of these test results without the written permission of the test laboratory.

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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, 2004)

Part 15, Subpart C, Section 15.209(a)	Radiated emissions, general requirements
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Part 15, Subpart C, Section 15.207(a)	AC Line conducted emissions
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2 SUMMARY

GENERAL REMARKS:

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

Testing commenced on : 05. September 2005

Testing concluded on : 06. September 2005

Checked by:

Tested by:

Klaus Gegenfurtner
Dipl. Ing.(FH)

Markus Huber

3 EQUIPMENT UNDER TEST

3.1 Photo documentation of the EuT

Complete System

T30197-00-00HU

External Photo

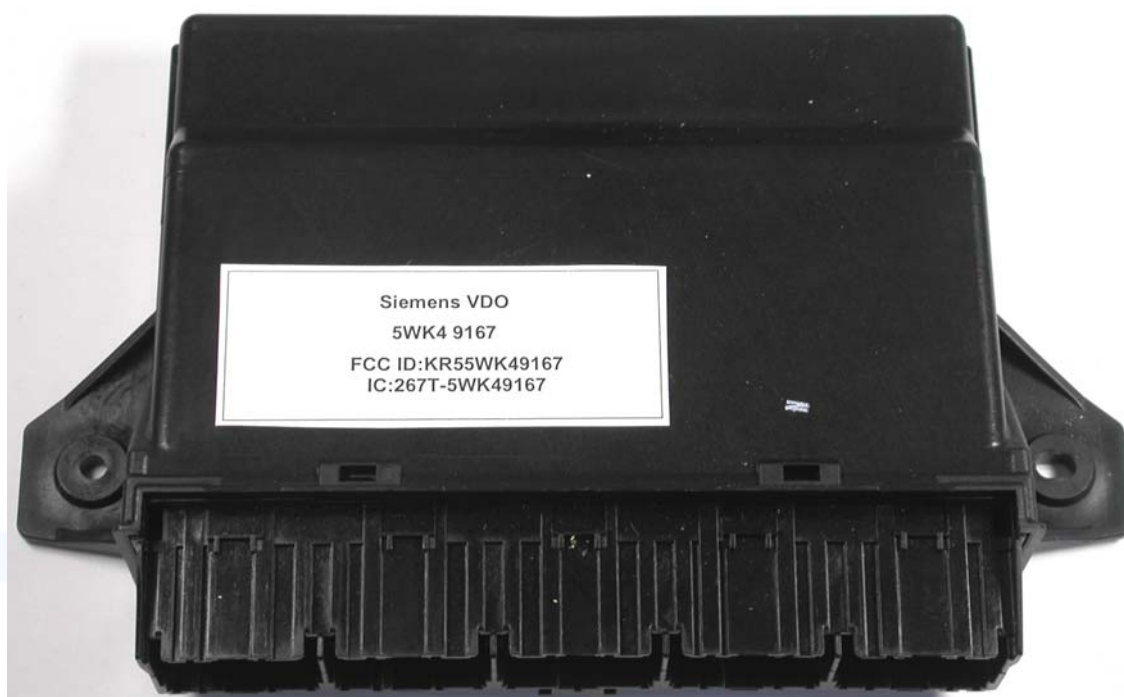
Top view



FCC ID:KR55WK49167

Electronic
T30197-00-00HU

External Photo
Top view



File No. **T30197-00-04HU**, page **6** of **29**

FCC ID:KR55WK49167

Electronic
T30197-00-00HU

External Photo
Rear view

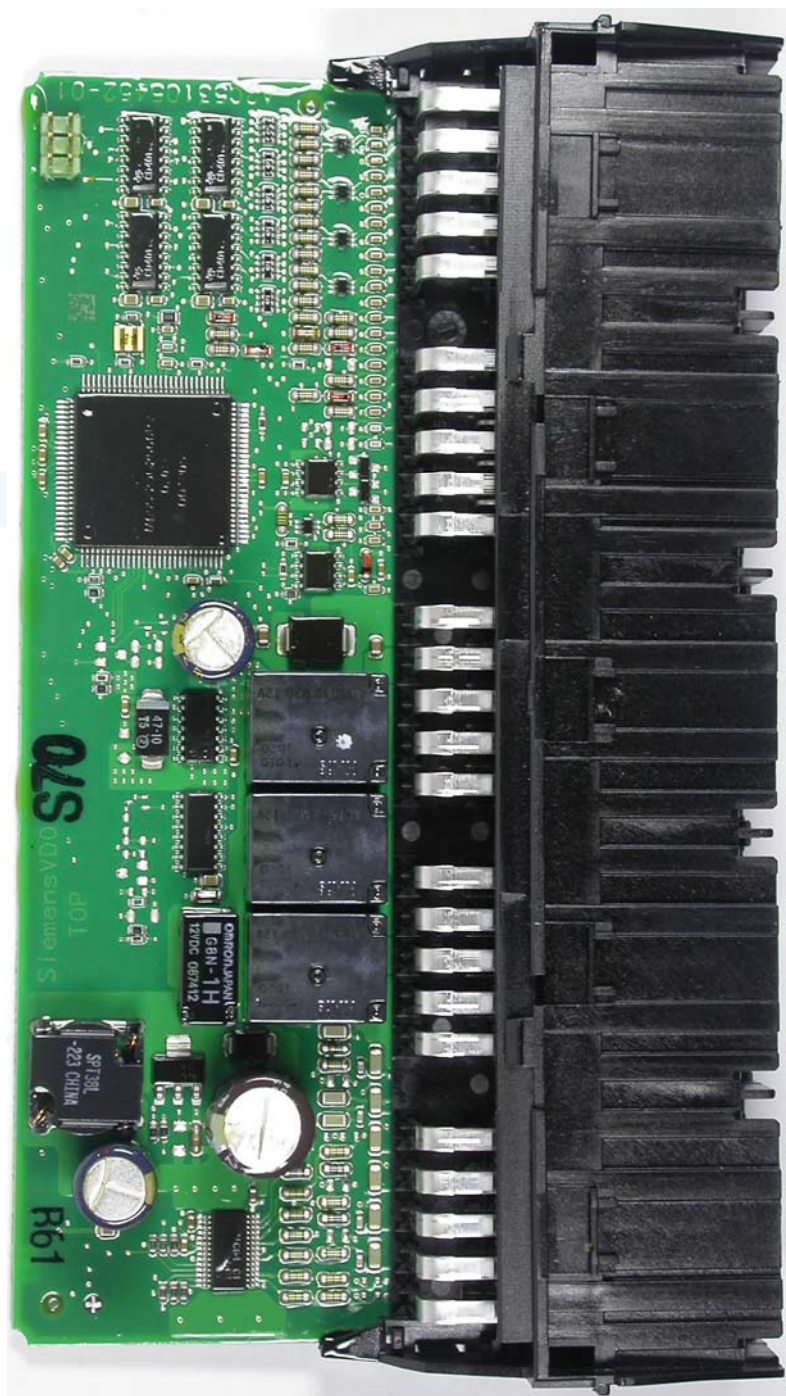


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FCC ID:KR55WK49167

Electronic
T30197-00-00HU

Internal Photo
Front view

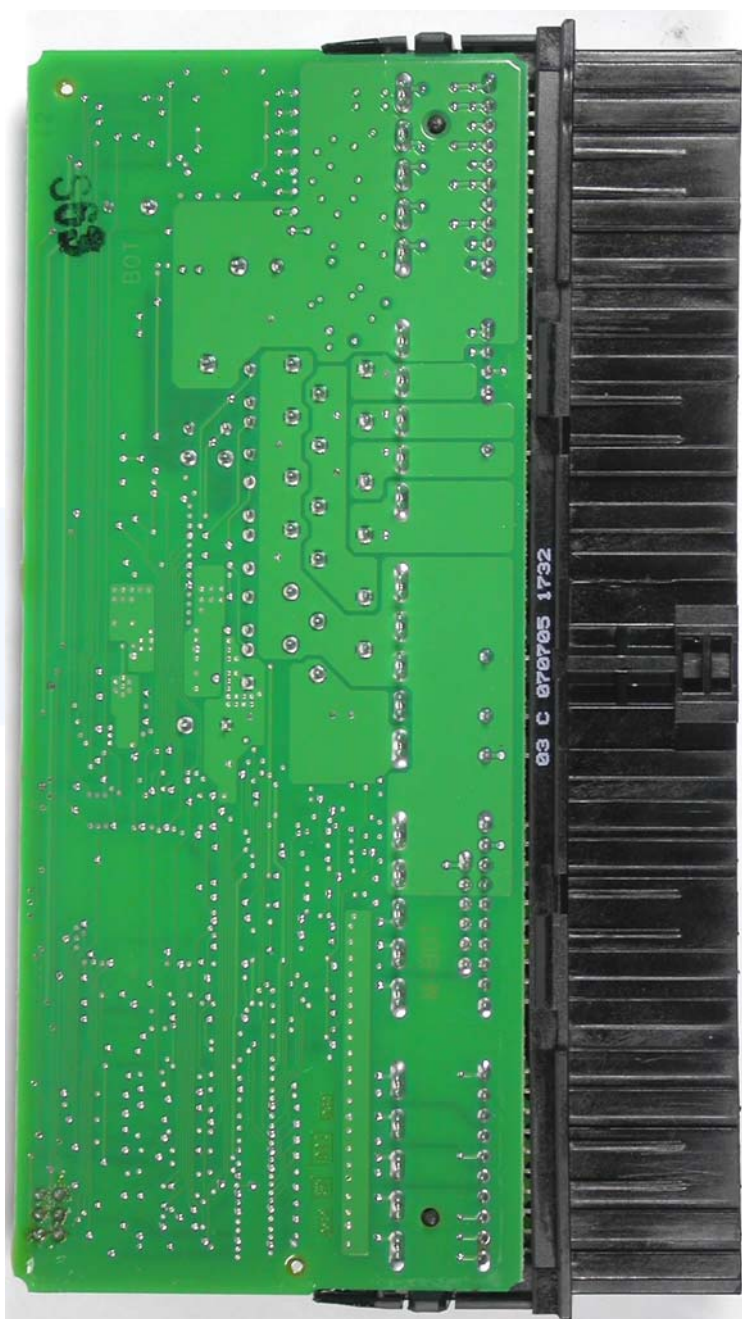


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Electronic
T30197-00-00HU

Internal Photo
Rear view



File No. **T30197-00-04HU**, page **9** of **29**

FCC ID:KR55WK49167

Antenna
T30197-00-00HU

External Photo
Front view



Antenna
T30197-00-00HU

External Photo
Rear view



FCC ID:KR55WK49167

Antenna
T30197-00-00HU

Internal Photo
Rear view



File No. **T30197-00-04HU**, page **11** of **29**

FCC ID:KR55WK49167

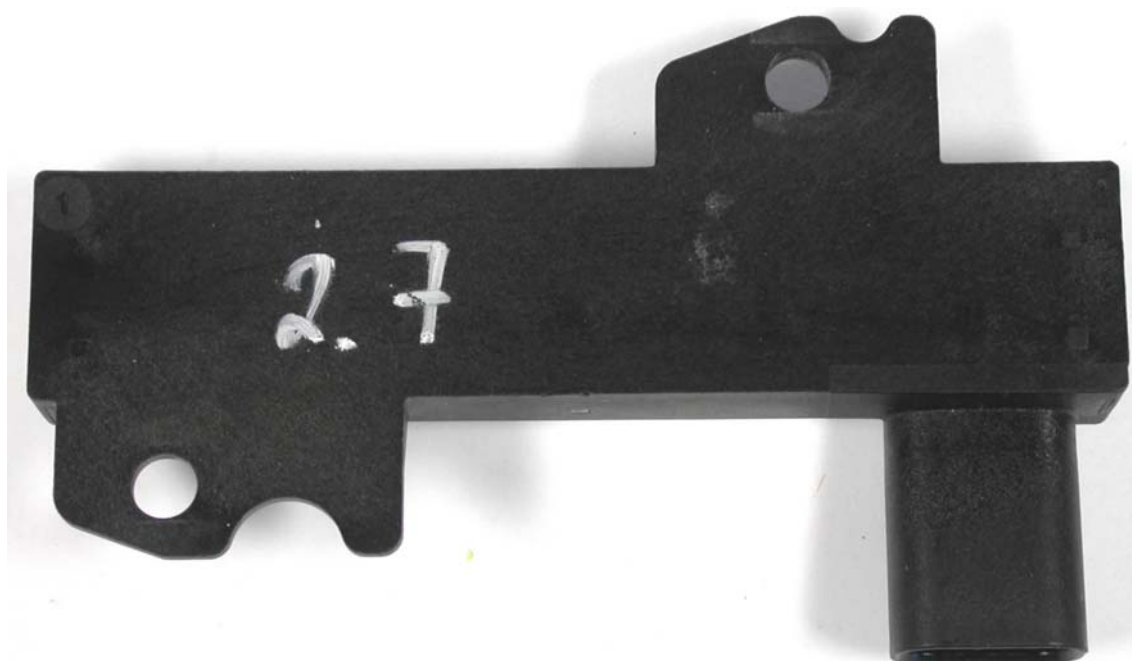
Antenna
T30197-00-00HU

External Photo
Front view



Antenna
T30197-00-00HU

External Photo
Rear view



File No. **T30197-00-04HU**, page 12 of 29

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Antenna
T30197-00-00HU

Internal Photo
Rear view



3.2 Power supply system utilised

Power supply voltage : 12.8 V / DC

3.3 Short description of the Equipment under Test (EuT)

The EuT is a part of a keyless vehicle system. The System consist of a module and lf-antennas.

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

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 : _____

- Power Line DC
- Antenna Cable

4 TEST ENVIRONMENT

4.1 Address of the test laboratory

mikes-testingpartners 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-testingpartners 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-testingpartners 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

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."

4.5 Discovery of worst case measurement conditions

The EuT was built up on a homologation board for testing. The homologation board is performed to activate different functions of the KV Module via software. If the plus and the minus plug is connected to a power supply the ECU starts sending the If telegrams in the following order:

In.group (Int.1+Int.2+Int.3), left group, right group, bumper antenna, int. group.

Every group has a time slot of 150ms. After this time, the software changes automatically the sending group.

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 Description of Measurement

The final level, expressed in dB μ V, is arrived at by taking the reading directly from the EMI receiver. This level is compared directly to the FCC Limit or to the CISPR limit, which is equivalent to the Australian AS 3548 limit.

To convert between dB μ V and μ V, the following conversions apply:

$$\text{dB}\mu\text{V} = 20(\log \mu\text{V})$$

$$\mu\text{V} = \text{Inverse log}(\text{dB}\mu\text{V}/20)$$

Conducted emissions 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 50 Ω /50 μ H (CISPR 16) characteristics. Table top equipment is placed on a non-conducting table 80 centimeter's above the floor and is positioned 40 centimeter's 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.

5.1.4 Test result

Frequency range:

Min. limit margin

The requirements are **FULFILLED**.

Remarks: The measurement is not applicable.

The EuT is DC powered and will be built in a vehicle.

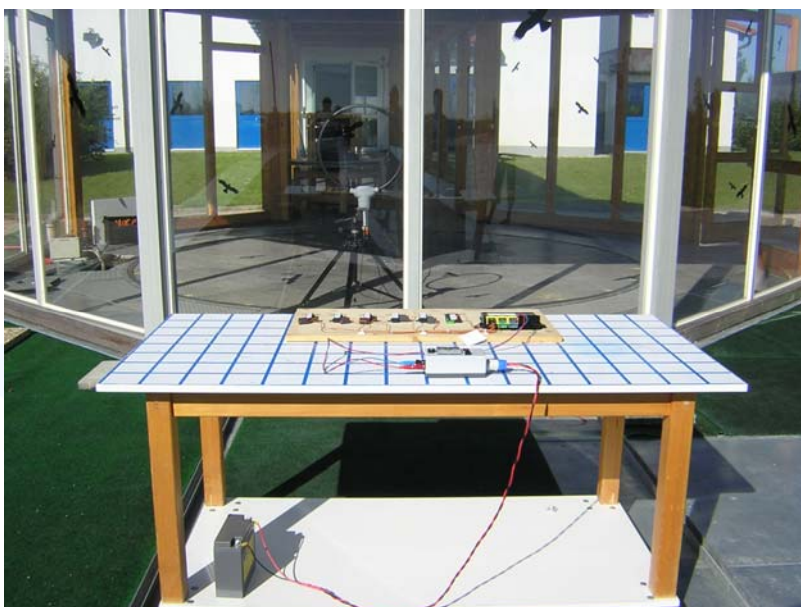
5.2 Field strength of the fundamental wave

For test instruments and accessories used see section 6 Part CPR 1.

5.2.1 Description of the test location

Test location: OATS1
Test distance: 3 metres
Test distance: 10 metres

5.2.2 Photo documentation of the test set-up



5.2.3 Description of Measurement

The magnetic field strength from the EuT will be measured on an open area test site in the frequency range of 9 kHz to 30 MHz using a tuned receiver and a shielded loop antenna. The set up of the Equipment under test will be in accordance to ANSI C63.4-2003. The antenna was positioned 3, 10 or 30 meters horizontally from the EuT. Measurements have been made in all three orthogonal axes and the shielded loop antenna was rotated to locate the maximum of the emissions. In the case where larger measuring distances are required the results will extrapolated based on the values measured on the closer distances according to Section 15.31 (f) (2) [2]. The final measurement will be performed with an EMI Receiver set to Quasi Peak detector except for the frequency bands 9 kHz to 90 kHz and 110 to 490 kHz where an average detector will be used according to Section 15.209 (d) [2].

The final level, expressed in dB μ V/m, is arrived at by taking the reading from the EMI receiver (Level dB μ V) and adding the antenna correction factor and cable loss factor (Factor dB) to it. This result then has to be compared with the relevant FCC limit.

The resolution bandwidth during the measurement is as follows:

9 kHz – 150 kHz: ResBW: 200 Hz

150 kHz – 30 MHz: ResBW: 9 kHz

Example:

Frequency (MHz)	Level (dB μ V)	+	Factor (dB)	=	Level (dB μ V/m)	Limit (dB μ V/m)	=	Delta (dB)
1.705	5	+	20	=	25	30	=	5

5.2.4 Test result

Measurement distance: 3m

Frequency [kHz]	L: PK [dB μ V]	L: AV [dB μ V]	L: QP [dB μ V]	Correct. [dB]	L: PK [dB μ V/m]	L: AV [dB μ V/m]	L: QP [dB μ V/m]	Limit [dB μ V/m]	Delta [dB]
125,00	78,6	39,6	59,1	20	98,6	59,6	79,1	105,7	46,1

Measurement distance: 10m

Frequency [kHz]	L: PK [dB μ V]	L: AV [dB μ V]	L: QP [dB μ V]	Correct. [dB]	L: PK [dB μ V/m]	L: AV [dB μ V/m]	L: QP [dB μ V/m]
125,00	47,3	10,4	27,8	20	67,3	30,4	47,8

FCC ID:KR55WK49167

Limit according to FCC Part 15 Subpart 15.209(a)

Frequency (MHz)	Field strength of fundamental wave		Measurement distance (meters)
	($\mu\text{V/m}$)	dB ($\mu\text{V/m}$)	
0.009-0.490	2400/F(kHz)	--	300
0.490-1.705	24000/F (kHz)	--	30
1.705-30.0	30	29.5	30

Limit according to FCC Part 15 Subpart 15.209(a) at transmit frequency 125 kHz

Frequency (MHz)	Field strength of fundamental wave		Measurement distance (meters)
	($\mu\text{V/m}$)	dB ($\mu\text{V/m}$)	
0.009-0.490	19,2	25,7	300

The requirements are **FULFILLED**.

Remarks:

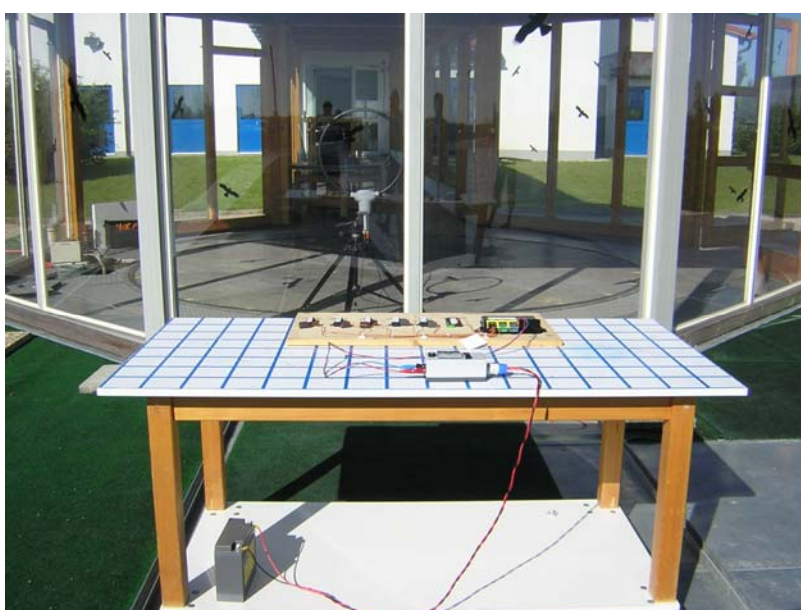
5.3 Spurious emissions (Magnetic field) 9 kHz – 30 MHz

For test instruments and accessories used see section 6 Part SER 1.

5.3.1 Description of the test location

Test location: OATS1
Test distance: 3 metres
10 metres

5.3.2 Photo documentation of the test set-up



5.3.3 Description of Measurement

The spurious emissions from the EuT will be measured on an open area test site in the frequency range of 9 kHz to 30 MHz using a tuned receiver and a shielded loop antenna. The antenna was positioned 3, 10 or 30 meters horizontally from the EuT. Measurements have been made in all three orthogonal axes and the shielded loop antenna was rotated to locate the maximum of the emissions. In the case where larger measuring distances are required the results will extrapolated based on the values measured on the closer distances according to Section 15.31 (f) (2) [2]. The final measurement will be performed with an EMI Receiver set to Quasi Peak detector except for the frequency bands 9 kHz to 90 kHz and 110 to 490 kHz where an average detector will be used according to Section 15.209 (d) [2].

The final level, expressed in dB μ V/m, is arrived at by taking the reading from the EMI receiver (Level dB μ V) and adding the antenna correction factor and cable loss factor (Factor dB) to it. This result then has to be compared with the relevant FCC limit.

The resolution bandwidth during the measurement is as follows:

9 kHz – 150 kHz: ResBW: 200 Hz

150 kHz – 30 MHz: ResBW: 9 kHz

Example:

Frequency (MHz)	Level (dB μ V)	+	Factor (dB)	=	Level (dB μ V/m)	Limit (dB μ V/m)	=	Delta (dB)
1.705	5	+	20	=	25	30	=	5

5.3.4 Test result

Measurement distance: 3m

Frequency [kHz]	L: PK [dB μ V]	L: AV [dB μ V]	L: QP [dB μ V]	Correct. [dB]	L: PK [dB μ V/m]	L: AV [dB μ V/m]	L: QP [dB μ V/m]	Limit [dB μ V/m]	Delta [dB]
375,0	35,8	4,1	21,1	20	55,8	24,1	41,1	96,1	72,0
625,0	25,4	2,1	16,0	20	45,4	22,1	36,0	111,7	89,6

Measurement distance: 10m

Frequency [kHz]	L: PK [dB μ V]	L: AV [dB μ V]	L: QP [dB μ V]	Correct. [dB]	L: PK [dB μ V/m]	L: AV [dB μ V/m]	L: QP [dB μ V/m]
No emissions were measured at distance of 10m							

Limit according to FCC Part 15 Subpart 15.209(a)

Frequency (MHz)	Field strength of spurious emissions		Measurement distance (meters)
	(μ V/m)	dB (μ V/m)	
0.009-0.490	2400/F(kHz)	--	300
0.490-1.705	24000/F (kHz)	--	30
1.705-30.0	30	29.5	30

FCC ID:KR55WK49167

The requirements are **FULFILLED**.

Remarks: Measurement has been performed up to the 10th harmonic of the highest fundamental frequency
designed to be emitted by the intentional radiator.

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5.4 Radiated emissions (electric field) 30 MHz – 1 GHz

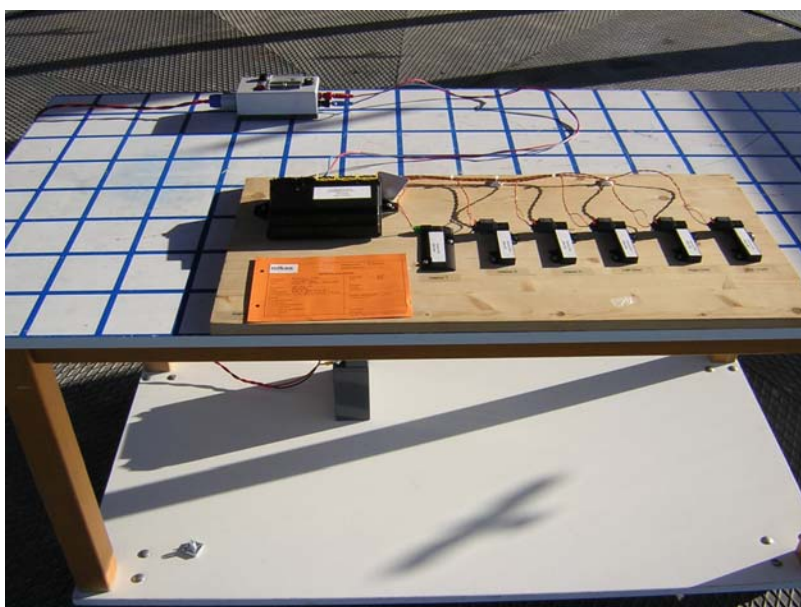
For test instruments and accessories used see section 6 Part SER 2.

5.4.1 Description of the test location

Test location: OATS1

Test distance: 3 metres

5.4.2 Photo documentation of the test set-up



5.4.3 Description of Measurement

Spurious emissions from the EuT are measured in the frequency range of 30 MHz 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. 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. The set up of the Equipment under test will be in accordance to ANSI C63.4-2003. The 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 polarization`s and the EuT are rotated 360 degrees.

The final level, expressed in dBµV/m, is arrived by taking the reading from the EMI receiver (Level dBµV) and adding the correction factors and cable loss factor (Factor dB) to it. This is done automatically in the EMI receiver, where the correction factors are stored. This result then has the FCC or CISPR limit subtracted from it to provide the Delta which gives the tabular data as shown in the data sheets at page.

The resolution bandwidth during the measurement is as follows:
30 MHz – 1000 MHz: ResBW: 120 kHz

Example:

Frequency (MHz)	Level (dBµV)	+	Factor (dB)	=	Level (dBµV/m)	Limit (dBµV/m)	=	Delta (dB)
719	75	+	32.6	=	107.6	110	=	-2.4

5.4.4 Test result

Frequency [MHz]	L: PK [dBµV]	L: AV [dBµV]	L: QP [dBµV]	Correct. [dB]	L: PK [dBµV/m]	L: AV [dBµV/m]	L: QP [dBµV/m]	Limit [dBµV/m]	Delta [dB]
182,11			17,4	13,7			31,1	43,5	-12,4
158,10			12,5	16,1			28,6	43,5	-14,9
166,11			14,2	15,5			29,7	43,5	-13,8
170,11			16,6	15,0			31,6	43,5	-11,9
174,11			16,2	14,6			30,8	43,5	-12,7
176,11			11,4	14,3			25,7	43,5	-17,8
178,11			14,9	14,1			29,0	43,5	-14,5
186,11			15,3	13,4			28,7	43,5	-14,8
198,12			15,2	12,4			27,6	43,5	-15,9

Limit according to FCC Part 15 Subpart 15.209(a)

FCC ID:KR55WK49167

Frequency (MHz)	Field strength of spurious emissions		Measurement distance (meters)
	($\mu\text{V/m}$)	dB ($\mu\text{V/m}$)	
30-88	100	40	3
88-216	150	43.5	3
216-960	200	46	3
Above 960	500	54	3

The requirements are **FULFILLED**.

Remarks:

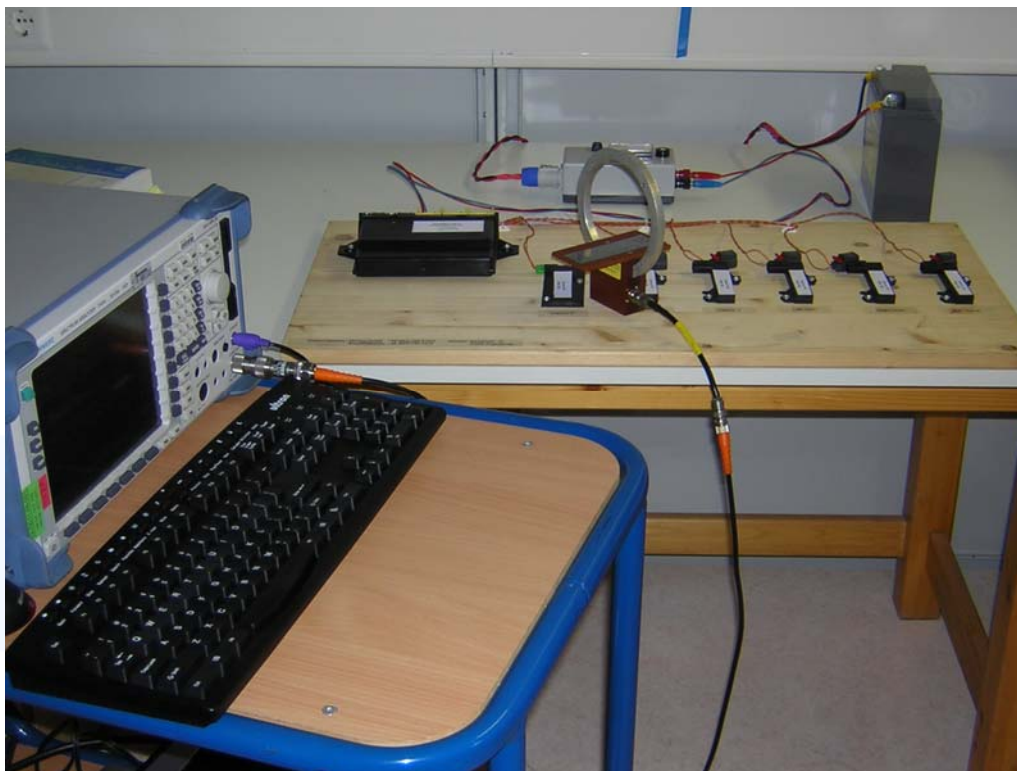
5.5 Emission Bandwidth

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

5.5.1 Description of the test location

Test location: Shielded Room S4

5.5.2 Photo documentation of the test set-up



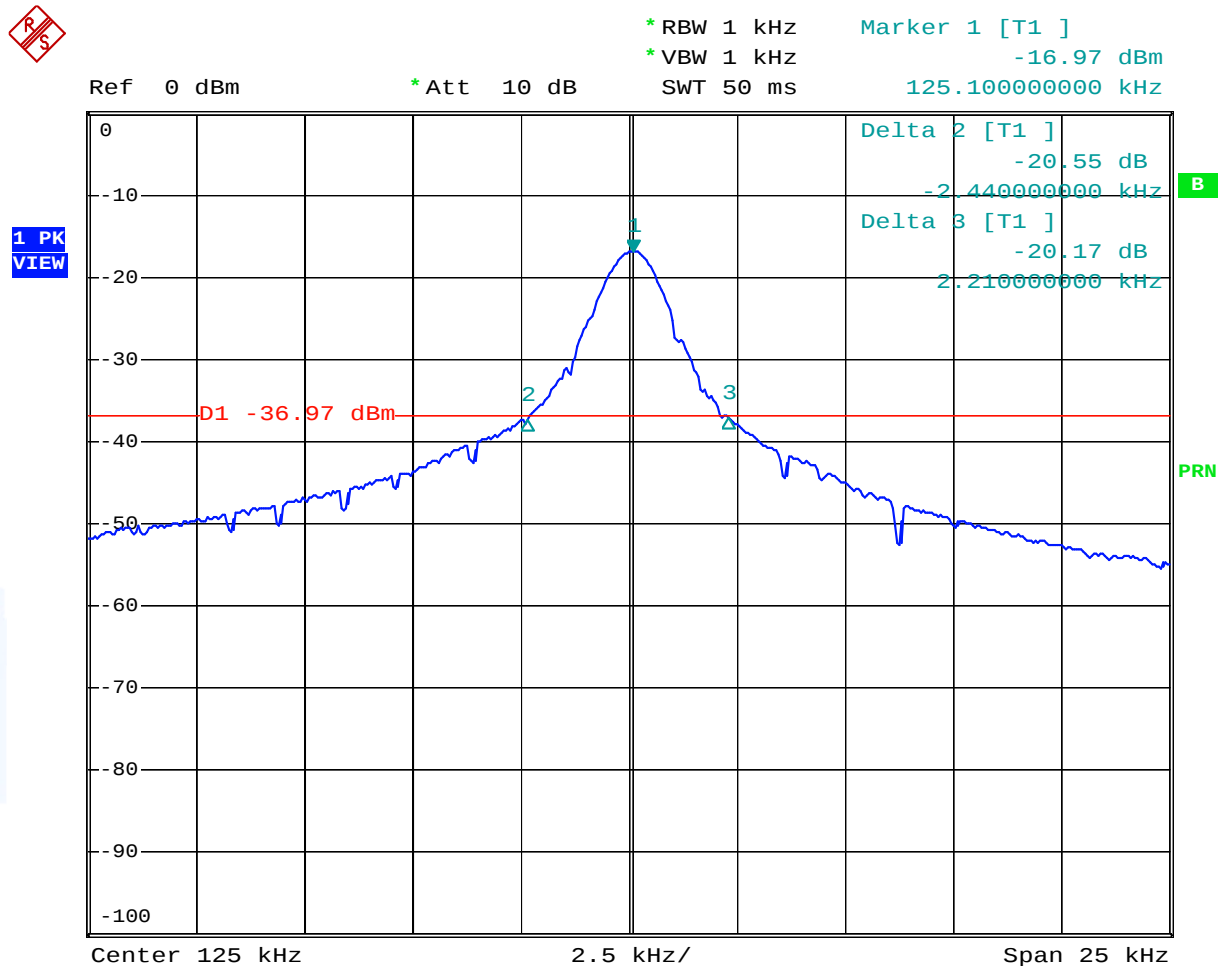
5.5.3 Test result

Channel Frequency [kHz]	20 dB Bandwidth [kHz]
125,1	4,65

Remarks: It is not required to measure the 20dB Bandwidth, therefore exists no limits in the table above.

5.5.4 Test protocol

Emission Bandwidth plots



Date: 5.SEP.2005 15:06:25

6 USED TEST EQUIPMENT AND ACCESSORIES

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

The calibration intervals and the calibration history will be given out on request.

Test Report No: T30197-00-02HU
Beginning of Testing: 05 September 2005
End of Testing: 06 September 2005

Test ID	Model Type	Kind of Equipment	Manufacturer	Equipment No.
CPR 1	ESHS 30	Test Receiver	Rohde & Schwarz München	02-02/03-05-007
	HFH 2 - Z 2	Antenna	Rohde & Schwarz München	02-02/24-05-020
MB	FSP 30	Spectrum Analyzer	Rohde & Schwarz München	02-02/11-05-001
	HZ-10	Magnetic Field Antenna	Rohde & Schwarz München	02-02/24-05-012
SER 1	ESHS 30	Test Receiver	Rohde & Schwarz München	02-02/03-05-007
	HFH 2 - Z 2	Antenna	Rohde & Schwarz München	02-02/24-05-020
SER 2	ESVS 30	Test Receiver	Rohde & Schwarz München	02-02/03-05-006
	VULB 9168	Trilog-Broadband Antenna	Schwarzbeck Mess-Elektronik	02-02/24-05-005
	S10162-B	RF Cable 33 m	Huber + Suhner	02-02/50-05-031
	KK-EF393	RF Cable 20 m	Huber + Suhner	02-02/50-05-033
	NW-2000-NB	RF Cable	Huber + Suhner	02-02/50-05-113