

EMI -- TEST REPORT

Test Report No. : T31823-00-00KG	29. June 2007 <hr style="border: 0; border-top: 1px solid black; margin: 0;"/> Date of issue
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Type / Model Name : Opel CIM - Code number 204.287

Product Description : Immobilizer System

Applicant : Valeo Schalter und Sensoren GmbH

Address : Laiernstrasse 12

D-74321 Bietigheim-Bissingen

Manufacturer : Valeo Schalter und Sensoren GmbH

Address : Laiernstrasse 12

D-74321 Bietigheim-Bissingen

Licence holder : Valeo Schalter und Sensoren GmbH

Address : Laiernstrasse 12

D-74321 Bietigheim-Bissingen

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, 2006)

Part 15, Subpart C, Section 15.209(a) Radiated emissions, general requirements

Part 15, Subpart C, Section 15.207(a) AC Line conducted emissions

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2 SUMMARY

GENERAL REMARKS:

The carrier frequency of the unit is 125 kHz.

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 : 20. June 2007

Testing concluded on : 21. June 2007

Checked by:

Tested by:

Thomas Weise
Dipl.-Ing.(FH)
Laboratory Manager

Gegenfurtner Klaus
Dipl.-Ing.(FH)

3 EQUIPMENT UNDER TEST

3.1 Photo documentation of the EuT

External Photo
Front View



External Photo
Side View

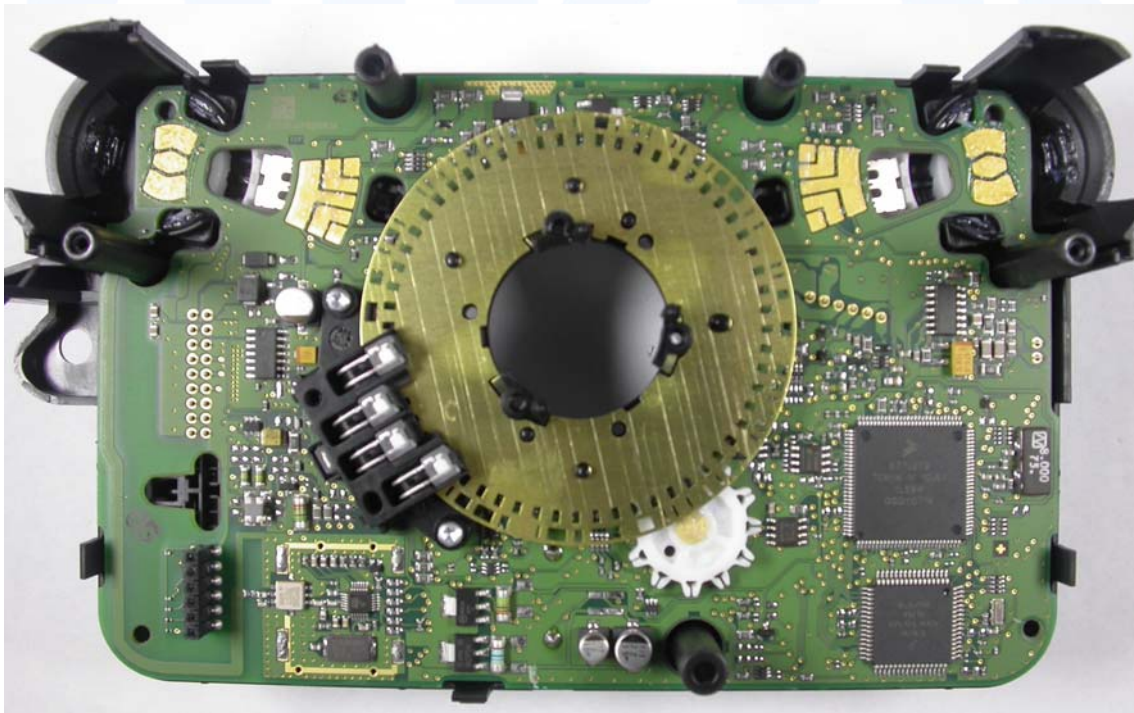


External Photo

Rear View



Internal Photo
Front View BCB with open cover



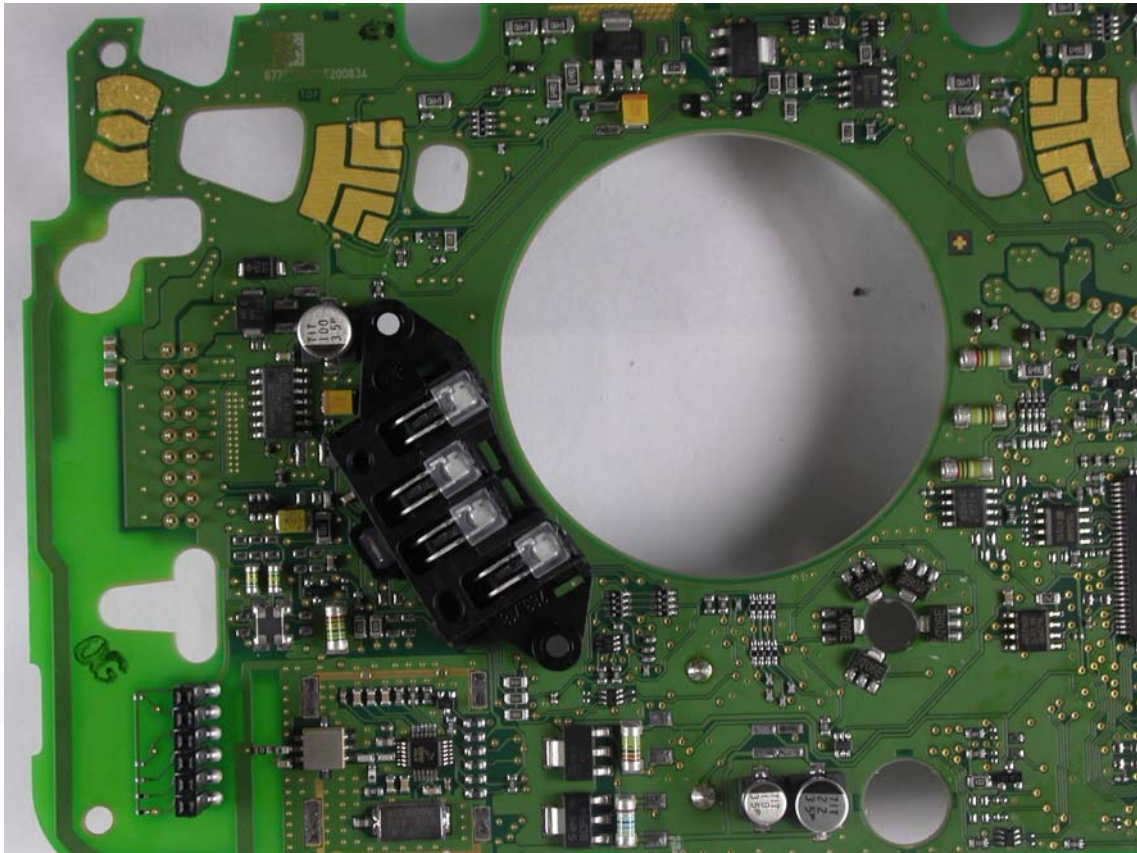
Internal Photo
Front View PCB



Internal Photo
Front View PCB, detailed photo



Internal Photo
Front View PCB, detailed photo



Internal Photo
Rear View PCB



3.2 Power supply system utilised

Power supply voltage : 12 V / DC

3.3 Short description of the Equipment under Test (EuT)

The EUT is a transceiver for an immobilizer system for vehicular use.

Number of tested samples: 1
Serial number: Prototype

EuT operation mode:

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

- Continuous TX mode at 125 kHz

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 : _____
- _____ Model : _____
- unscreened power cables

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 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, European Standard EN 55022 as shown under section 1 of this report.

In compliance with 47 CFR Part 15 Subpart A Section 15.38 testing for FCC compliance may be done following the ANSI C63.4-2003 procedures and using the CISPR 22 Limits.

4.4.1.2 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 using the appropriate impedance characteristic or left unterminated. Where appropriate, cables are manually manipulated with respect to each other thus obtaining maximum disturbances from the unit.

4.4.2 DETAILS OF TEST PROCEDURES

General Standard Information

The test methods used comply with CISPR Publication 22, EN 55022 - "Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement" 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."

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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.

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 centimeters above the floor and is positioned 40 centimeters from the vertical ground plane (wall) of the screen room. If the minimum limit 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: 0.15 MHz - 30 MHz

Min. limit margin

The requirements are

Remarks: The measurement is not applicable, because the EuT is battery powered.

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

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: 3 m

Frequency [MHz]	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]
0.125	60.6	56.3	59.5	20	80.6	76.3	79.5	105.0	28.7

Measurement distance: 30 m

Frequency [MHz]	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]
0.125	20.6	16.3	19.5	20	40.6	36.3	39.5	65.0	28.7

Measurement distance: 300 m

Frequency [MHz]	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]
0.125	-19.5	-23.7	-20.5	20	0.6	-3.7	-0.5	25.0	28.7

Limit according to FCC Part 15 Subpart 15.209(a)

Frequency (MHz)	Field strength of fundamental wave		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

The requirements are **FULFILLED**.

Remarks:

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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

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 dBµV/m, is arrived at by taking the reading from the EMI receiver (Level dBµV) 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:

$$\begin{array}{rclclclclcl}
 \text{Frequency} & & \text{Level} & + & \text{Factor} & = & \text{Level} & \text{Limit} & = & \text{Delta} \\
 \text{(MHz)} & & \text{(dB}\mu\text{V)} & & \text{(dB)} & & \text{(dB}\mu\text{V/m)} & \text{(dB}\mu\text{V/m)} & & \text{(dB)} \\
 1.705 & & 5 & + & 20 & = & 25 & 30 & = & 5
 \end{array}$$

5.3.4 Test result

Measurement distance: 3 m

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]
0.376	32.8	22.8	31.0	20	52.8	42.8	51.0	95.5	52.7
0.626	26.3	15.4	20.9	20	46.3	35.4	40.9	71.1	24.8

Measurement distance: 30 m

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]
0.376	-7.8	-17.2	-9.0	20	12.8	2.8	11.0	55.5	52.7
0.626	-13.7	-24.6	-19.1	20	6.3	-4.6	0.9	31.1	24.8

Measurement distance: 300 m

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]
0.376	-47.2	-57.2	-49.0	20	-27.2	-37.2	-29.0	15.5	52.7

Limit according to FCC Part 15 Subpart 15.209(a)

Frequency (MHz)	Field strength of spurious emissions		Measurement distance (meters)
	(µV/m)	dB (µV/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

The requirements are **FULFILLED**.

Remarks: All other unwanted emissions in the frequency range 9 kHz to 30 MHz were below 10 dBuV/m
at a test distance of 3 metres.

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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]
30 - 1000	<25		<25						

Limit according to FCC Part 15 Subpart 15.209(a)

Frequency (MHz)	Field strength of spurious emissions		Measurement distance (meters)
	(µV/m)	dB (µV/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:

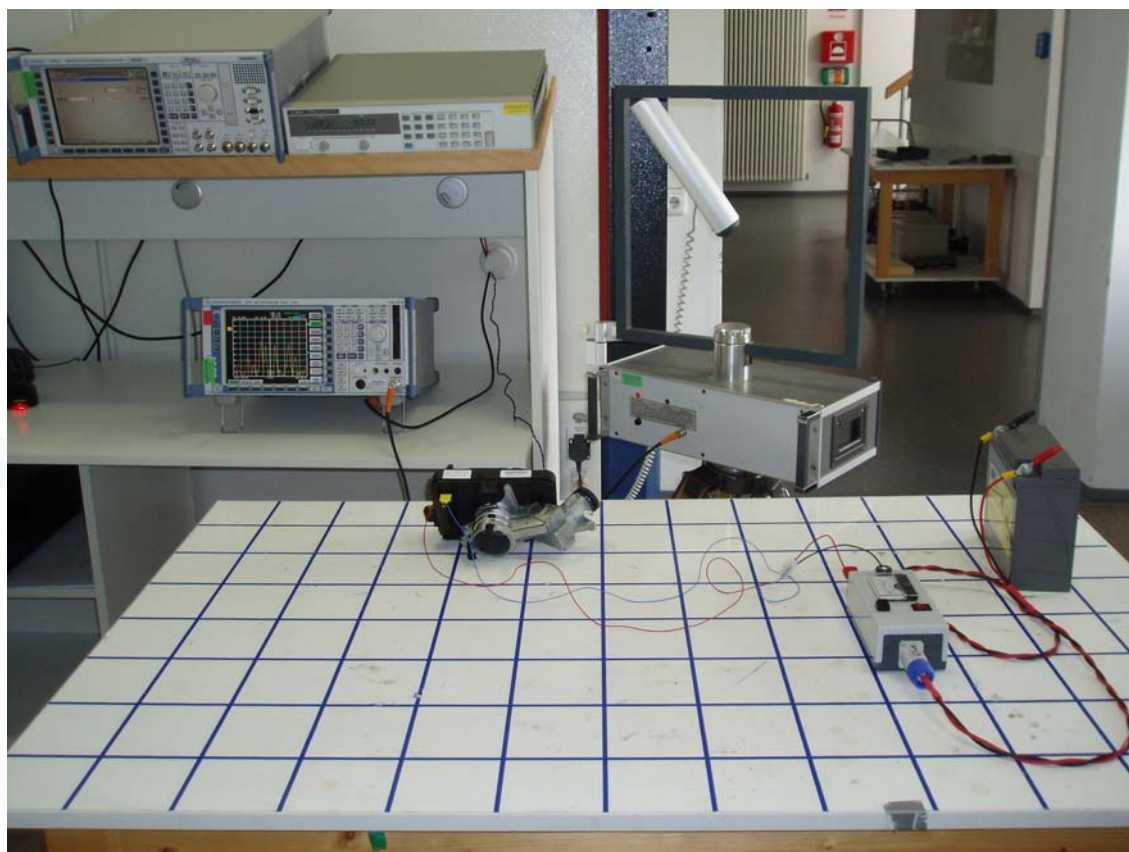
5.5 Emission Bandwidth

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

5.5.1 Description of the test location

Test location: AREA4

5.5.2 Photo documentation of the test set-up



5.5.3 Test result

Fundamental [kHz]	20dB Bandwidth F1 [kHz]	20dB Bandwidth F2 [kHz]	Measured Bandwidth [kHz]
125.26	116.5	132.6	16.1

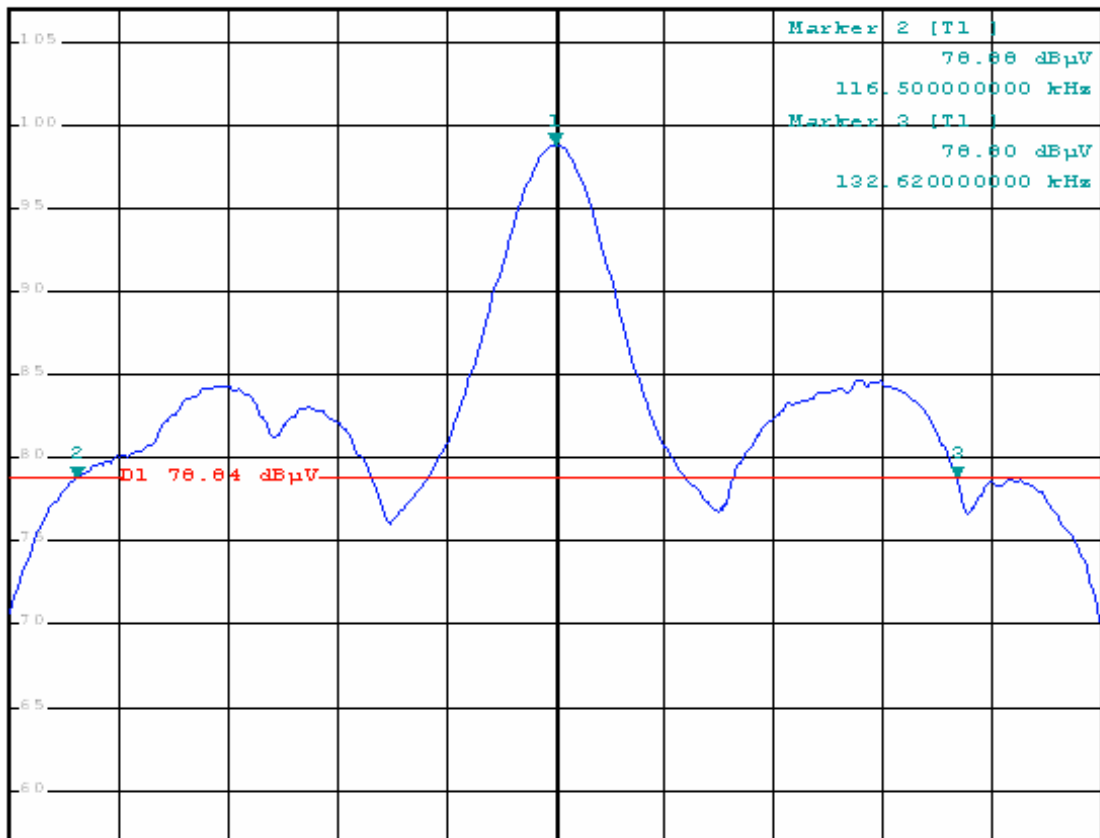
5.5.4 Test protocol

Emission Bandwidth plots



• RBW 1 kHz Marker 1 [T1]
 • VBW 3 kHz 98.84 dBμV
 Ref 107 dBμV Att 30 dB SWT 20 ms 125.260000000 kHz

1 PK
VIEW



Center 125.26 kHz 2 kHz / Span 20 kHz

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 ID	Model / Type	Kind of Equipment	Manufacturer	Equipment No.
CPR 1	FMZB 1516	Magnetic Field Antenna	Schwarzbeck Mess-Elektronik	01-02/24-01-018
	ESCI	EMI Test Receiver	Rohde & Schwarz München	02-02/03-05-004
CPR 2	ESVS 30	EMI 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/+11N-50-10-5/11N	RF Cable 33m	Huber + Suhner	02-02/50-05-031
	KK-EF393-21N-16	RF Cable 20m	Huber + Suhner	02-02/50-05-033
	NW-2000-NB	RF Cable	Huber + Suhner	02-02/50-05-113
MB	FMZB 1516	Magnetic Field Antenna	Schwarzbeck Mess-Elektronik	01-02/24-01-018
	FSP 30	Spectrum Analyzer	Rohde & Schwarz München	02-02/11-05-001
SER 1	FMZB 1516	Magnetic Field Antenna	Schwarzbeck Mess-Elektronik	01-02/24-01-018
	ESCI	EMI Test Receiver	Rohde & Schwarz München	02-02/03-05-004

