

## EMI -- TEST REPORT

<b>Test Report No. :</b> T31424-00-02HU	17. January 2007
	Date of issue

**Type / Model Name** : WFS 125VO2

**Product Description** : Vehicle Immobilizer

**Applicant** : Delphi Deutschland GmbH

**Address** : Wiehlpuhl 4

D-51766 Engelskirchen

**Manufacturer** : Delphi Deutschland GmbH

**Address** : Wiehlpuhl 4

D-51766 Engelskirchen

**Licence holder** : Delphi Deutschland GmbH

**Address** : Wiehlpuhl 4

D-51766 Engelskirchen

<b>Test Result</b> according to the standards listed in clause 1 test standards:	<b>POSITIVE</b>
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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.

# Contents

<b>1</b>	<b><u>TEST STANDARDS</u></b>	<b>3</b>
<b>2</b>	<b><u>SUMMARY</u></b>	<b>4</b>
<b>3</b>	<b><u>EQUIPMENT UNDER TEST</u></b>	<b>5</b>
3.1	PHOTO DOCUMENTATION OF THE EUT	5
3.2	POWER SUPPLY SYSTEM UTILISED	9
3.3	SHORT DESCRIPTION OF THE EQUIPMENT UNDER TEST (EUT)	9
<b>4</b>	<b><u>TEST ENVIRONMENT</u></b>	<b>10</b>
4.1	ADDRESS OF THE TEST LABORATORY	10
4.2	ENVIRONMENTAL CONDITIONS	10
4.3	STATEMENT OF THE MEASUREMENT UNCERTAINTY	10
4.4	MEASUREMENT PROTOCOL FOR FCC, VCCI AND AUSTEL	10
<b>5</b>	<b><u>TEST CONDITIONS AND RESULTS</u></b>	<b>12</b>
5.1	CONDUCTED EMISSIONS	12
5.2	FIELD STRENGTH OF THE FUNDAMENTAL WAVE	13
5.3	SPURIOUS EMISSIONS (MAGNETIC FIELD) 9 KHZ – 30 MHZ	15
5.4	EMISSION BANDWIDTH	18
<b>6</b>	<b><u>USED TEST EQUIPMENT AND ACCESSORIES</u></b>	<b>20</b>

## **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

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## 2 SUMMARY

### GENERAL REMARKS:

The carrier frequency is 125.0 kHz.

### FINAL ASSESSMENT:

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

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

Testing commenced on : 05. January 2007

Testing concluded on : 10. January 2007

Checked by:

Tested by:

\_\_\_\_\_  
Klaus Gegenfurtner  
Dipl.-Ing.(FH)  
Manager: Radio Group

\_\_\_\_\_  
Huber Markus

### 3 EQUIPMENT UNDER TEST

#### 3.1 Photo documentation of the EuT

External Photo  
Front View



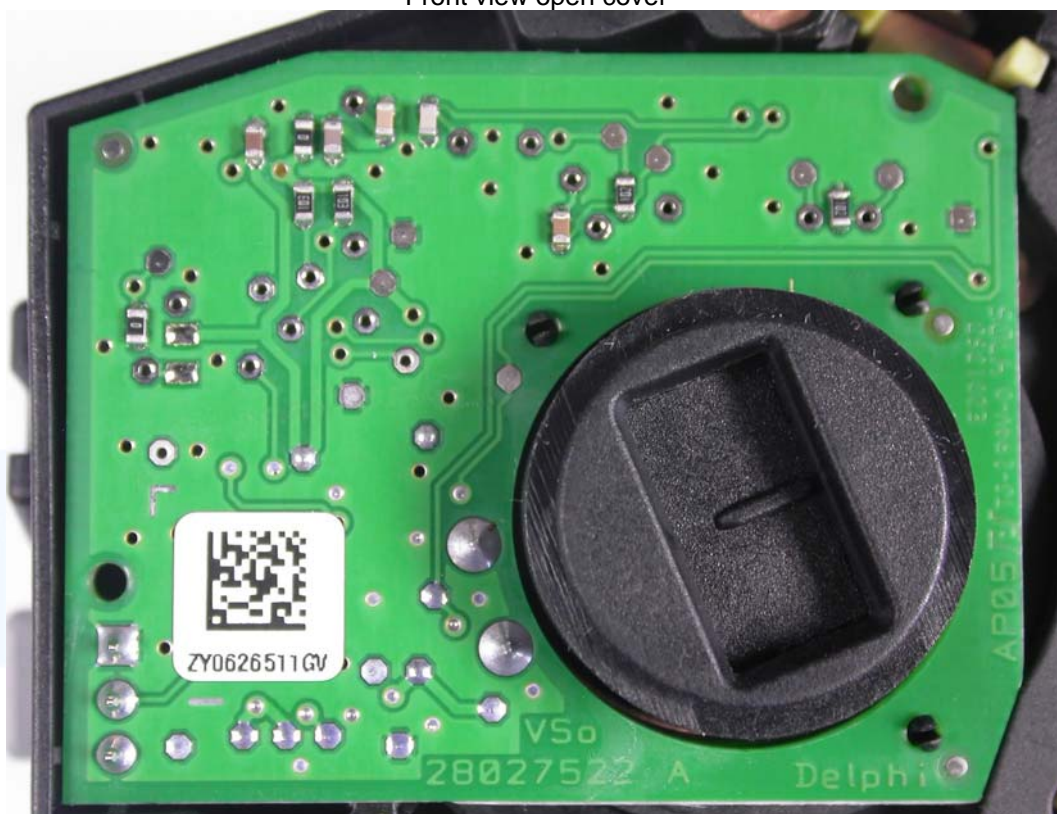
External Photo  
Rear View



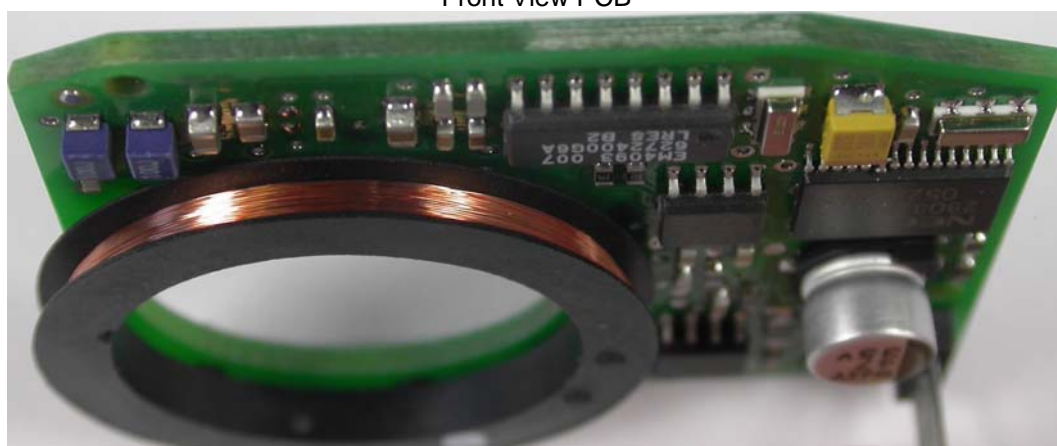
FCC ID: LTQWFS125VO2



Internal Photo  
Front view open cover

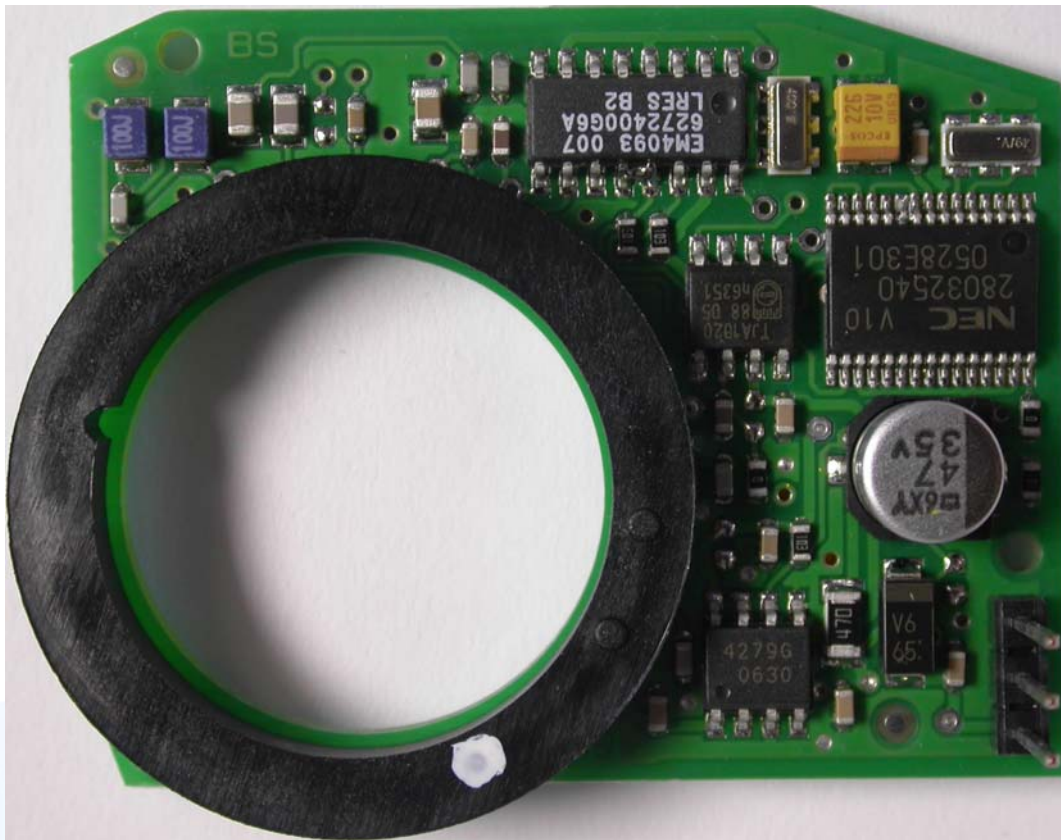


Internal Photo  
Front View PCB

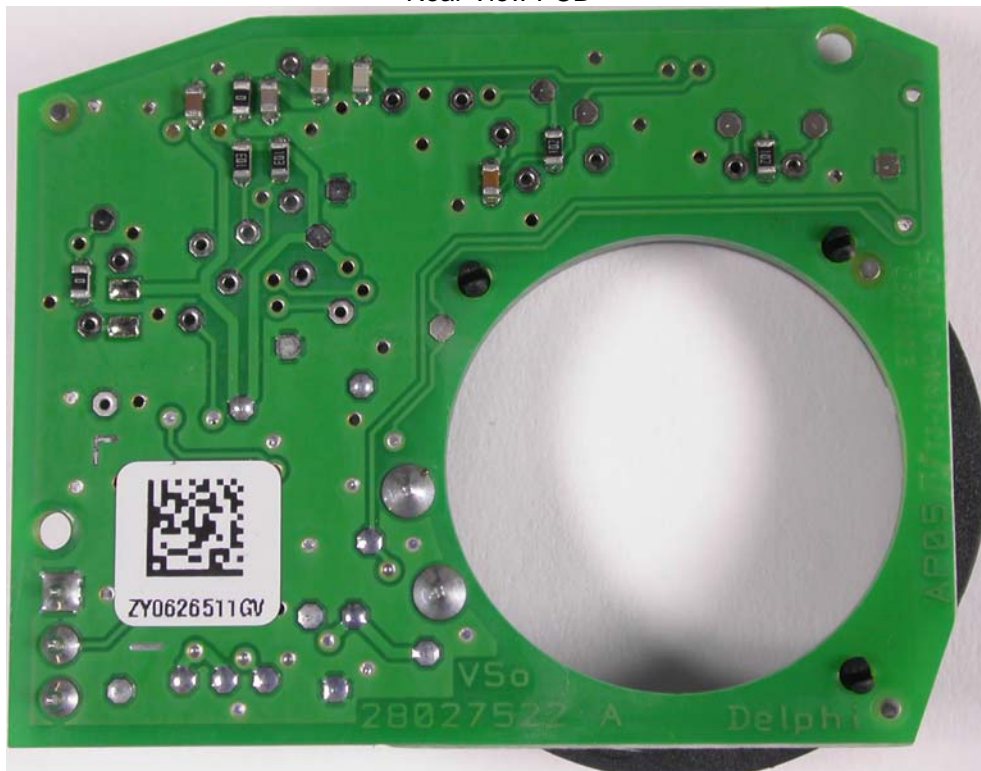


FCC ID: LTQWFS125VO2

Internal Photo  
Front View PCB

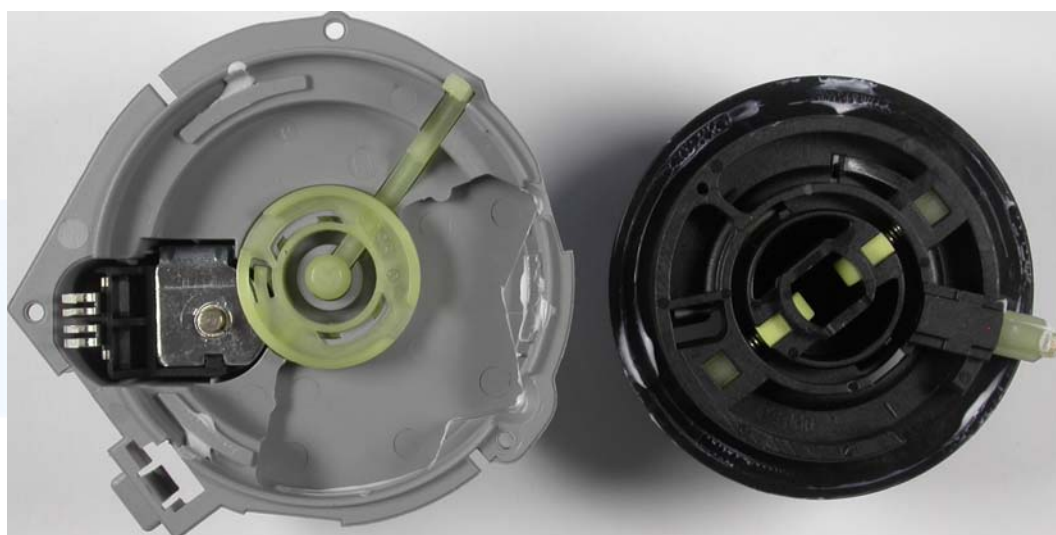


Internal Photo  
Rear View PCB



FCC ID: LTQWFS125VO2

Internal Photo  
Open Housing without 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 an immobilizer for vehicular use.

Number of tested samples: 1  
Serial number: Prototype  
Art. No.: 28032519  
Sample No.: 17  
Variant: WFS 125VO2  
Project: VO 00SC

#### EuT operation mode:

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

- Cont. Tx mode at 125 kHz

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#### 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 : \_\_\_\_\_

- 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 (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 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 it's 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."

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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 $\mu$ 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 $\mu$ V and  $\mu$ 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 $\Omega$ /50  $\mu$ 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

**Remarks:** The measurement is not applicable. The EuT is battery powered.

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## 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 $\mu$ V/m, is arrived at by taking the reading from the EMI receiver (Level dB $\mu$ 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 $\mu$ V)	+	Factor (dB)	=	Level (dB $\mu$ V/m)	Limit (dB $\mu$ 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 $\mu$ V]	L: AV [dB $\mu$ V]	L: QP [dB $\mu$ V]	Correct. [dB]	L: PK [dB $\mu$ V/m]	L: AV [dB $\mu$ V/m]	L: QP [dB $\mu$ V/m]	Limit [dB $\mu$ V/m]	Delta [dB]
0.125	55.7	55.0	55.2	20.0	75.7	75.0	75.2	105.0	30.0

Calculated value at distance: 30 m

Frequency [MHz]	L: PK [dB $\mu$ V]	L: AV [dB $\mu$ V]	L: QP [dB $\mu$ V]	Correct. [dB]	L: PK [dB $\mu$ V/m]	L: AV [dB $\mu$ V/m]	L: QP [dB $\mu$ V/m]	Limit [dB $\mu$ V/m]	Delta [dB]
0.125	15.7	15.0	15.2	20.0	35.7	35.0	35.2	65.0	30.0

Calculated value at distance: 300 m

Frequency [MHz]	L: PK [dB $\mu$ V]	L: AV [dB $\mu$ V]	L: QP [dB $\mu$ V]	Correct. [dB]	L: PK [dB $\mu$ V/m]	L: AV [dB $\mu$ V/m]	L: QP [dB $\mu$ V/m]	Limit [dB $\mu$ V/m]	Delta [dB]
0.125	-24.3	-25.0	-24.8	20.0	-4.3	-5.0	-4.8	25.0	30.0

Limit according to FCC Part 15 Subpart 15.209(a)

Frequency (MHz)	Field strength of fundamental wave		Measurement distance (meters)
	( $\mu$ V/m)	dB ( $\mu$ 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 be 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 $\mu$ V/m, is arrived at by taking the reading from the EMI receiver (Level dB $\mu$ 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 $\mu$ V)	+	Factor (dB)	=	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	=	Delta (dB)
1.705	5	+	20	=	25	30	=	5

### 5.3.4 Test result

Measurement distance: 3 m

Frequency [MHz]	L: PK [dB $\mu$ V]	L: AV [dB $\mu$ V]	L: QP [dB $\mu$ V]	Correct. [dB]	L: PK [dB $\mu$ V/m]	L: AV [dB $\mu$ V/m]	L: QP [dB $\mu$ V/m]	Limit [dB $\mu$ V/m]	Delta [dB]
0.3752	23.8	20.0	21.4	20.0	43.8	40.0	41.4	95.5	55.5
0.6257	17.6	10.9	13.4	20.0	37.6	30.9	33.4	71.1	37.7
0.876	15.0	5.7	9.7	20.0	35.0	25.7	29.7	68.2	38.5
1.125	13.7	2.8	7.7	20.0	33.7	22.8	27.7	66.0	38.3

Calculated value at distance: 300 m

Frequency [MHz]	L: PK [dB $\mu$ V]	L: AV [dB $\mu$ V]	L: QP [dB $\mu$ V]	Correct. [dB]	L: PK [dB $\mu$ V/m]	L: AV [dB $\mu$ V/m]	L: QP [dB $\mu$ V/m]	Limit [dB $\mu$ V/m]	Delta [dB]
0.3752	-56.2	-60.0	-58.6	20.0	-36.2	-40.0	-38.6	15.5	55.5

Calculated value at distance: 30 m

Frequency [MHz]	L: PK [dB $\mu$ V]	L: AV [dB $\mu$ V]	L: QP [dB $\mu$ V]	Correct. [dB]	L: PK [dB $\mu$ V/m]	L: AV [dB $\mu$ V/m]	L: QP [dB $\mu$ V/m]	Limit [dB $\mu$ V/m]	Delta [dB]
0.6257	-22.4	-29.1	-26.6	20.0	-2.4	-9.1	-6.6	31.1	37.7
0.876	-25.0	-34.3	-30.3	20.0	-5.0	-14.3	-10.3	28.2	38.5
1.125	-26.3	-37.2	-32.3	20.0	-6.3	-17.2	-12.3	26.0	38.3
2.0 - 30.0				20				29.5	> 40



Limit according to FCC Part 15 Subpart 15.209(a)

Frequency (MHz)	Field strength of spurious emissions		Measurement distance (meters)
	( $\mu\text{V}/\text{m}$ )	dB ( $\mu\text{V}/\text{m}$ )	
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 from 1.125MHz to 30 MHz  
are below < -10.5 dB $\mu\text{V}/\text{m}$ .  
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 \_\_\_\_\_



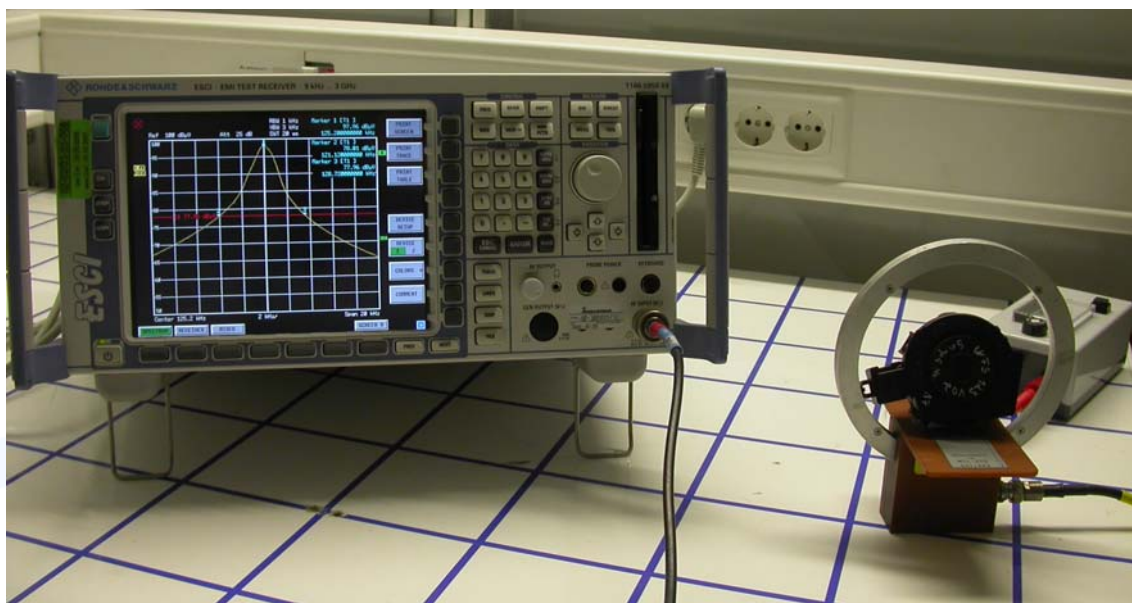
## 5.4 Emission Bandwidth

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

### 5.4.1 Description of the test location

Test location: AREA4

### 5.4.2 Photo documentation of the test set-up



### 5.4.3 Test result

Fundamental [kHz] See Plot 1	20dB Bandwidth F1	20dB Bandwidth F2	Measured Bandwidth [kHz]
125.20	121.12	128.72	7.6

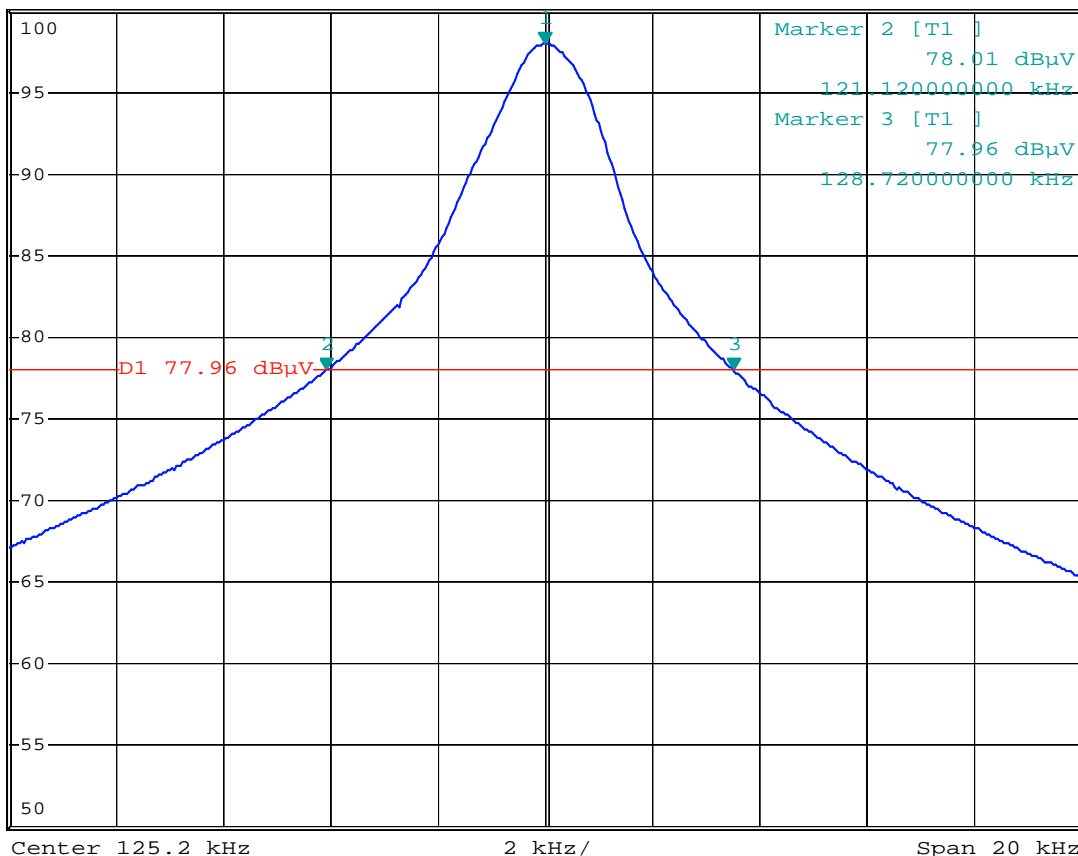
5.4.4 Test protocol

Emission Bandwidth plots



Ref 100 dB $\mu$ V Att 25 dB RBW 1 kHz Marker 1 [T1 ] 97.96 dB $\mu$ V  
 VBW 3 kHz SWT 20 ms 125.20000000 kHz

1 PK  
VIEW



## 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: T31424-00-02HU  
 Beginning of Testing: 05 Januar 2007  
 End of Testing: 10 Januar 2007

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	02-02/03-05-005
	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	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	FMZB 1516	Magnetic Field Antenna	Schwarzbeck Mess-Elektronik	01-02/24-01-018
	ESCI	EMI Test Receiver	Rohde & Schwarz München	02-02/03-05-005
	S10162-B/+11N-50		RF Cable 33m	Huber + Suhner
	KK-EF393-21N-16		RF Cable 20m	Huber + Suhner
	NW-2000-NB		RF Cable	Huber + Suhner