



## EMI -- TEST REPORT

<b>Test Report No. :</b>	<b>T32272-00-01HU</b>	<b>04. July 2008</b>
		<b>Date of issue</b>

**Type / Model Name** : E71 FBD / 010111003

**Product Description** : Receiver Unit

**Applicant** : fuba Automotive GmbH & Co. KG

**Address** : TecCenter  
D-31162 Bad Salzdetfurth

**Manufacturer** : fuba Automotive GmbH & Co. KG

**Address** : TecCenter  
D-31162 Bad Salzdetfurth

**Licence holder** : fuba Automotive GmbH & Co. KG

**Address** : TecCenter  
D-31162 Bad Salzdetfurth

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



DAT-P-207/05-00

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 B - Unintentional Radiators (October 01, 2007)

Part 15, Subpart B, Section 15.107	AC Line conducted emissions
Part 15, Subpart B, Section 15.109	Radiated emissions, general requirements
Part 15, Subpart B, Section 15.111	Antenna power conduction

## 2 SUMMARY

### GENERAL REMARKS:

None

### 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 : 27. February 2008

Testing concluded on : 07. March 2008

Checked by:



Klaus Gegenfurter  
Ich bestätige die  
Richtigkeit und Integrität  
dieses Dokuments  
2008.07.04 11:12:51  
+02'00'

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Klaus Gegenfurter  
Dipl.-Ing.(FH)  
Manager: Radio Group

Tested by:



Huber Markus  
Ich bin der Verfasser  
dieses Dokuments  
2008.07.04 10:57:37  
+02'00'

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Huber Markus

### 3.2 Power supply system utilised

Power supply voltage : 12 V / DC

### 3.3 Short description of the Equipment under Test (EuT)

The EuT consist of an AM/FM amplifier with diversity and a RKE-Receiver (FBD) on a printed circuit board, accommodated in a housing.

Number of tested samples: 1

Serial number: see Photo documentation of the EuT under Point 3 / Equipment Under Test

#### **EuT operation mode:**

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

- Rx mode at 315 MHz

-  
-  
-

#### **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:**

- SMY Rhode & Schwarz

Model : 02-02/05-05-016

- Agilent

Model : 02-02/05-05-007

- PSU

Model : 02-02/50-07-033

-

Model :

-

Model :

-

Model :

- customer specific cables

- 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

#### 4.4.2.1 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."

## **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**

#### **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.

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 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**

**Remarks:** The measurement is not applicable.

The EuT has no AC mains connections.

## 5.2 Spurious emissions (Magnetic field) 9 kHz – 30 MHz

For test instruments and accessories used see section 6 Part SER 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 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  $\text{dB}\mu\text{V}/\text{m}$ , is arrived at by taking the reading from the EMI receiver (Level  $\text{dB}\mu\text{V}$ ) 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:

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

#### 5.2.4 Test result

Measurement distance: 3 m

Frequency [MHz]	L: QP [dB $\mu$ V]	L: AV [dB $\mu$ V]	Bandwidth [kHz]	Correct. [dB]	L: QP [dB $\mu$ V/m]	L: AV [dB $\mu$ V/m]	Limit [dB $\mu$ V/m]	Delta [dB]
0,009-0,150			0,2	20				>20
0,150-30,0			9,0	20				>20

Limit according to FCC Part 15 Subpart 15.209(a)

Frequency [MHz]	Field strength of spurious emissions		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: No emission from the EuT can be measured in this frequency range.

### 5.3 Radiated emissions (electric field)

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

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



### 5.3.3 Description of Measurement

Radiated 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 dB $\mu$ V/m, is arrived by taking the reading from the EMI receiver (Level dB $\mu$ V) 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 radiated emissions from the EuT are measured in the frequency range of 1 GHz to maximum frequency as specified in section 15.33, using a tuned receiver (Spectrum Analyser) and appropriate linearly polarized antennas. 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 horizontally from the EuT.

Measurement are made in both the horizontal and vertical planes of polarization in a fully anechoic room using a spectrum analyzer with the detector function set to peak and resolution as well as video bandwidth set to 1 MHz. All tests are performed at a test-distance of 3 meters. Hand-held or body-worn devices are rotated through three orthogonal axes to determine which altitude and configuration procedure the highest emission relative the limit and therefore shall be used for final testing. During the tests the EUT is rotated all around to find the maximum levels of emissions. The cables and equipment were placed and moved within the range of position likely to find their maximum emissions. When the EuT is larger than the beamwidth of the measuring antenna, the measurement antenna will be moved over the surfaces for the four sides or the test distance will be reduced to demonstrate that emissions were at maximum at the limit distance.

The resolution bandwidth during the measurement is as follows:

30 MHz – 1000 MHz:	ResBW: 120 kHz
Above 1000 MHz	ResBW: 1 MHz

### 5.3.4 Test result

#### Testresult in detail:(<1GHz)

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]	
30-88								<20	40	>20
88-216								<20	43,5	>23,5
216-960								<20	46	>26
960-1000								<20	54	>34

**Testresult in detail:(>1GHz)**

Frequency [MHz]	L: PK [dB $\mu$ V]	L: AV [dB $\mu$ V]	Bandwidth [kHz]	Correct. [dB]	L: PK [dB $\mu$ V/m]	L: AV [dB $\mu$ V/m]	Limit AV [dB $\mu$ V/m]	Delta [dB]
1000-4000			1000				54.0	>20

Limit according to FCC Subpart 15.109(a)

Frequency [MHz]	15.109 Limits [ $\mu$ V/m]	15.109 Limits [dB $\mu$ V/m]
30-88	100	40
88-216	150	43,5
<b>216-960</b>	<b>200</b>	<b>46</b>
<b>Above 960</b>	<b>500</b>	<b>54</b>

The requirements are **FULFILLED**.

**Remarks:** No emission from the EuT can be measured in this frequency range.

## 5.4 Spurious emissions (Antenna Conducted)

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

#### 5.4.1 Description of the test location

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

### 5.4.3 Test result

### Testresult in detail:

Bandwidth [kHz]: refers to the bandwidth of the measuring receiver

Limit according to FCC Subpart 15.111(a)

## **Frequencies 30 - 2000 MHz**

2.0nW (-57dBm)

**Remarks:** The measurement is not applicable, because the EuT has no antenna connector.

## 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: T32272-01-01HU  
 Beginning of Testing: 27 Februar 2008  
 End of Testing: 07 März 2008

Test ID	Model Type	Kind of Equipment	Manufacturer	Equipment No.
SER 1	FMZB 1516	Magnetic Field Antenna	Schwarzbeck Mess-Elektron	01-02/24-01-018
	ESCI	EMI Test Receiver	Rohde & Schwarz München	02-02/03-05-005
	S10162-B	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
SER 2	ESVS 30	EMI Test Receiver	Rohde & Schwarz München	02-02/03-05-006
	VULB 9168	Trilog-Broadband Anten	Schwarzbeck Mess-Elektron	02-02/24-05-005
	S10162-B	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
SER 3	FSP 30	Spectrum Analyzer	Rohde & Schwarz München	02-02/11-05-001
	AFS4-01000400-10-10P-4	RF Amplifier 1-4 GHz	PARZICH GMBH	02-02/17-05-003
	AMF-4F-04001200-15-10P	RF Amplifier 4-12 GHz	PARZICH GMBH	02-02/17-05-004
	AFS5-12001800-18-10P-6	RF Amplifier 12-18 GHz	PARZICH GMBH	02-02/17-06-002
	3117	Horn Antenna 1-18 GHz	EMCO Elektronik GmbH	02-02/24-05-009
	Sucoflex N-1600-SMA	RF Cable	novotronik Signalverarbeit	02-02/50-05-073
	Sucoflex N-2000-SMA	RF Cable	novotronik Signalverarbeit	02-02/50-05-075

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 Beginning of Testing: 27 Februar 2008  
 End of Testing: 07 März 2008

Equipment No.	Next Calib.	Last Calib.	Next Verif.	Last Verif.
<b>SER 1</b>				
01-02/24-01-018	02/20/2009	02/20/2008		
02-02/03-05-005	01/24/2009	01/24/2008		
02-02/50-05-031				
02-02/50-05-033				
02-02/50-05-113				
<b>SER 2</b>				
02-02/03-05-006	07/24/2008	07/24/2007		
02-02/24-05-005	04/15/2008	04/15/2005	08/21/2008	02/21/2008
02-02/50-05-031				
02-02/50-05-033				
02-02/50-05-113				
<b>SER 3</b>				
02-02/11-05-001	12/06/2008	12/06/2006		
02-02/17-05-003				
02-02/17-05-004				
02-02/17-06-002				
02-02/24-05-009	01/16/2009	01/16/2008		
02-02/50-05-073				
02-02/50-05-075				