



Registration No. DAT-P-207/05

EMI -- TEST REPORT

- FCC Part 15.209 -

Test Report No. : T32837-02-00HS	12. October 2009 Date of issue
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Type / Model Name : DC08

Product Description : Keyless Controller

Applicant : Marquardt GmbH

Address : Schlossstraße 16

78604 Rietheim-Weilheim

Manufacturer : Marquardt GmbH

Address : Schlossstraße 16

78604 Rietheim-Weilheim

Licence holder : Marquardt GmbH

Address : Schlossstraße 16

78604 Rietheim-Weilheim

Test Result according to the standards listed in clause 1 test standards:	POSITIVE
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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 A - General (October 01, 2007)

Part 15, Subpart A, Section 15.31	Measurement standards
Part 15, Subpart A, Section 15.33	Frequency range of radiated measurements
Part 15, Subpart A, Section 15.35	Measurement detector functions and bandwidths

FCC Rules and Regulations Part 15, Subpart B - Unintentional Radiators (October 01, 2007)

Part 15, Subpart B, Section 15.109	Radiated emissions, general requirements
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FCC Rules and Regulations Part 15, Subpart C - Intentional Radiators (October, 2007)

Part 15, Subpart C, Section 15.203	Antenna requirement
Part 15, Subpart C, Section 15.205	Restricted bands of operation
Part 15, Subpart C, Section 15.209	Radiated emission limits, general requirements

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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ANSI C95.1:1992	IEEE Standard for Safety Levels with respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz
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CISPR 16-4-2: 2003	Uncertainty in EMC measurement
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CISPR 22: 2005 EN 55022: 2006	Information technology equipment
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2 SUMMARY

GENERAL REMARKS:

The EUT is a controller for keyless go events in a car and works at two frequencies,

LF = 21.845 kHz,

RF = 315.00 MHz.

The prototype of the EUT had the production status:

HW-Version: A2128207526 and

SW-Version: A2124420126.

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 : 13.October 2008

Testing concluded on : 07. October 2009

Checked by:

Tested by:

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

Hermann Smetana
Dipl.-Ing.(FH)
Radio Expert

3 EQUIPMENT UNDER TEST

3.1 Photo documentation of the EUT – See attachment A

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 controller for keyless go systems in a car. It checks the ID for the entry and authenticates the user for the keyless go procedure.

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 transmission at 21 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 : _____

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 may notice that tolerances within the calibration of the equipment and facilities may cause additional uncertainty. The measurement uncertainty is calculated for all measurements listed in this test report acc. to CISPR 16-4-2 „Uncertainties, statistics and limit modelling – Uncertainty in EMC measurement“ and documented in the mikes-testingpartners gmbh quality system acc. to DIN EN ISO/IEC 17025. For all measurements shown in this report, the measurement uncertainty of the test laboratory, mikes-testingpartners gmbh, is below the measurement uncertainty as defined by CISPR. Therefore, no special measures must be taken into consideration with regard to the limits according to CISPR. Furthermore, component diversity and modifications in production process of devices may result in additional deviation. If necessary, refer to the test lab for the actual measurement uncertainty for the specific test. The manufacturer has the sole responsibility of continued compliance of the EUT.

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 set out by the International Special Committee on Radio Interference (CISPR) Publication 22, European Standard EN 55022 as shown under section 1 of this report.

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 - "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz."

In compliance with 47 CFR Part 15 Subpart A, Section 15.38 testing for FCC compliance may be achieved by following the procedures set out in ANSI C63.4 and applying 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.

4.5 Determination of worst case measurement conditions

Measurements have been made in original application to take into account the influence on the radiation direction from the chassis of the car. For the further measurement the EUT is set in X position with the max power of the RF-Amplifier.

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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: None

Remarks: The measurement is not applicable. The EUT has no AC mains connector.



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



5.2.1 Applicable standard

According to FCC Part 15C, Section 15.209:

The emissions from intentional radiators shall not exceed the effective field strength limits.

5.2.2 Description of Measurement

The magnetic field strength from the EUT is measured in 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 is in accordance to ANSI C63.4. The shielded loop antenna was turned to locate the maximum of the emissions. In the case where larger measuring distances are required the results are extrapolated based on the values measured on the closer distances according to Section 15.31(f)(2)(2). The final measurement is 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 resolution bandwidth during the measurement is as follows:

9 kHz – 150 kHz: RBW: 200 Hz
 150 kHz – 30 MHz: RBW: 9 kHz

Example:

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

5.2.3 Test result of the door antenna

Measured at 3 m, limit transferred to 3 m

Frequency (kHz)	Level AV (dBμV)	Bandwidth (kHz)	Correction factor (dB/m)	Corrected level AV dB(μV/m)	Limit AV dB(μV/m)	Delta (dB)
21.845	91.5	0.2	20.0	111.5	120.8	-9.3

5.2.4 Test result of the trunk antenna

Measured at 3 m, limit transferred to 3 m

Frequency (kHz)	Level AV (dBμV)	Bandwidth (kHz)	Correction factor (dB)	Corrected level AV dB(μV/m)	Limit AV dB(μV/m)	Delta (dB)
21.845	91.1	0.2	20.0	111.1	120.8	-9.7

Limit according to FCC Part 15C, Section 15.209(a):

Frequency (MHz)	Field strength of fundamental wave		Measurement distance (metres)
	(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
0.021845	109.9	40.8	300
0.021845		120.8	3

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

5.3.2 Photo documentation of the test set-up



5.3.3 Applicable standard

According to FCC Part 15C, Section 15.209:

The emissions from intentional radiators shall not exceed the effective field strength limits.

5.3.4 Description of Measurement

The spurious emission from the EUT is 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 is in accordance to ANSI C63.4. The shielded loop antenna was turned to locate the maximum of the emissions. In the case where larger measuring distances are required the results are extrapolated based on the values measured on the closer distances according to Section 15.31(f)(2)(2). The final measurement is 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 resolution bandwidth during the measurement is as follows:

9 kHz – 150 kHz: RBW: 200 Hz
 150 kHz – 30 MHz: RBW: 9 kHz

Example:

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

5.3.5 Test result of the door antenna

Measured at 3 m, limit transferred to 3 m

Frequency (MHz)	Level (dB μ V)	Bandwidth (kHz)	Correction factor (dB/m)	Corrected level dB(μ V/m)	Limit dB(μ V/m)	Delta (dB)
-	-					

5.3.6 Test result of the trunk antenna

Measured at 3 m, limit transferred to 3 m

Frequency (MHz)	Level (dB μ V)	Bandwidth (kHz)	Correction factor (dB/m)	Corrected level dB(μ V/m)	Limit dB(μ V/m)	Delta (dB)
-	-					

Limit according to FCC Part 15 Subpart 15.209(a):

Frequency (MHz)	Field strength of spurious emissions		Measurement distance (metres)
	(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: Measurement has been performed up to the 10th harmonic of the highest fundamental frequency designed to be emitted by the intentional radiator. All unwanted emissions in the frequency range from 9 kHz to 30 MHz are more than 20 dB below the limit.

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: Anechoic Chamber A1

Test distance: 3 metres

5.4.2 Photo documentation of the test set-up



5.4.3 Test result of the door antenna

Center frequency (kHz)	20dB Bandwidth f1 (kHz)	20dB Bandwidth f2 (kHz)	Measured Bandwidth (kHz)	LIMIT Fundamental
21.845	16.3	26.4	10.1	-

5.4.4 Test result of the trunk antenna

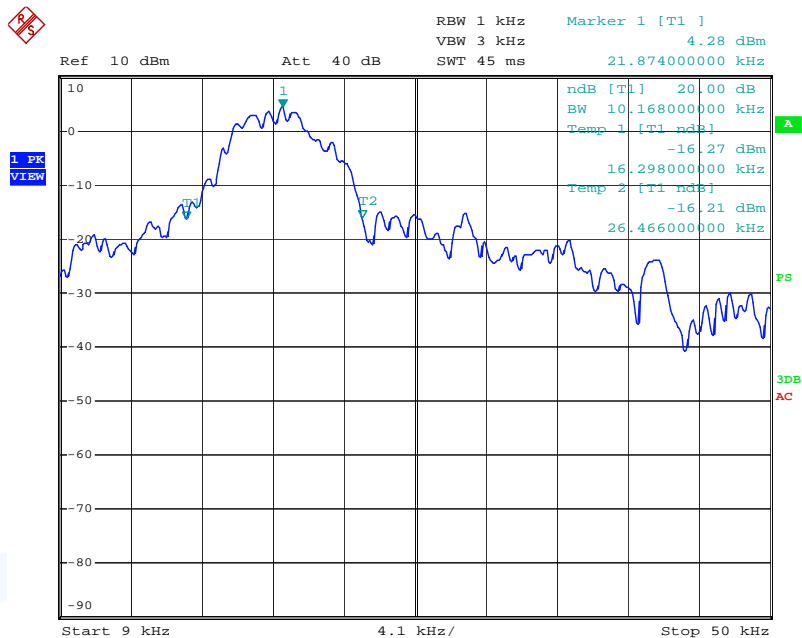
Center frequency (kHz)	20dB Bandwidth f1 (kHz)	20dB Bandwidth f2 (kHz)	Measured Bandwidth (kHz)	LIMIT Fundamental
21.845	16.8	26.5	9.7	-

Remarks: There is no limit according to FCC Part 15C Subpart 15.209.

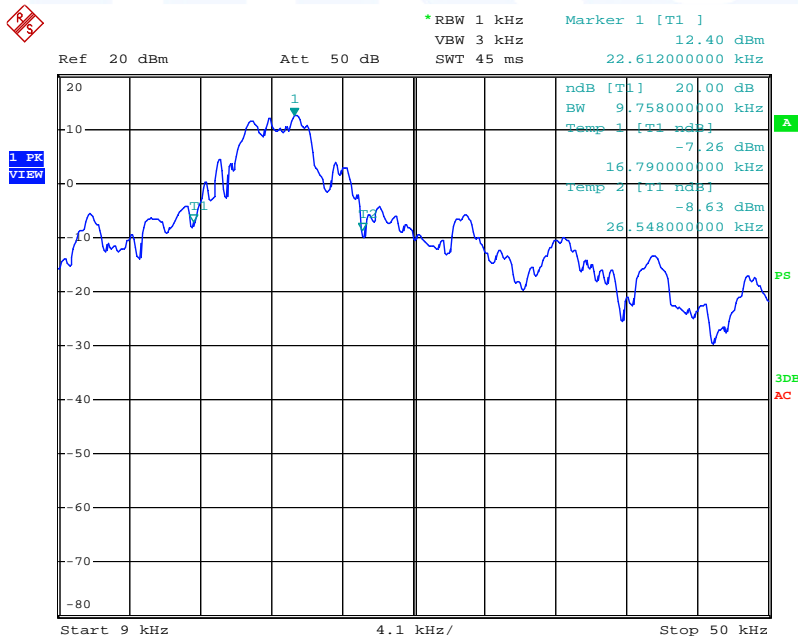
For detailed results, please see the test protocol below.

5.4.5 Test protocol

Emission Bandwidth plots
Door antenna



Trunk antenna



5.5 Antenna requirements

5.5.1 Applicable standard

According to FCC Part 15C, Section 15.203:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit that broken antennas can be replaced by the user, but the use of a standard antenna jack is prohibited.

The EUT has a special connector. A broken antenna can be replaced by a user. All supplied antennas meet the requirements of part 15.203.

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6 USED TEST EQUIPMENT AND ACCESSORIES

All test instruments used are calibrated and verified regularly. The calibration history is available on request.

Test ID	Model Type	Equipment No.	Next Calib.	Last Calib.	Next Verif.	Next Verif.
CPR 1	FMZB 1516	01-02/24-01-018			02/23/2010	02/23/2009
	ESCI	02-02/03-05-005	01/26/2010	01/26/2009		
	S10162-B	02-02/50-05-031				
	KK-EF393-21N-16	02-02/50-05-033				
CPR 2	NW-2000-NB	02-02/50-05-113				
	S10162-B	02-02/50-05-031				
	KK-EF393-21N-16	02-02/50-05-033				
MB	NW-2000-NB	02-02/50-05-113				
	FMZB 1516	01-02/24-01-018			02/23/2010	02/23/2009
	ESCI	02-02/03-05-005	01/26/2010	01/26/2009		
	FMZB 1516	01-02/24-01-018			02/23/2010	02/23/2009
SER 1	ESCI	02-02/03-05-005	01/26/2010	01/26/2009		
	S10162-B	02-02/50-05-031				
	KK-EF393-21N-16	02-02/50-05-033				
	NW-2000-NB	02-02/50-05-113				

