

FCC ID: KR55WK48171

EMI -- TEST REPORT

Test Report No. :	T30380-00-03KJ	12. December 2005
		Date of issue

Type / Model Name : 5WK4 8171

Product Description : Keyless vehicle module

Applicant : Siemens VDO Automotive AG

Address : Siemensstrasse 12

93055 Regensburg, Germany

Manufacturer : Siemens VDO Automotive AG

Address : Siemensstrasse 12

93055 Regensburg, Germany

Licence holder : Siemens VDO Automotive AG

Address : Siemensstrasse 12

93055 Regensburg, Germany

Test Result according to the standards listed in clause 1 test standards:
POSITIVE

POSITIVE



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.

FCC ID: KR55WK48171

Contents

1 TEST STANDARDS	3
2 SUMMARY	4
3 EQUIPMENT UNDER TEST	5
3.1 PHOTO DOCUMENTATION OF THE EUT (EXTERNAL PHOTOS)	5
3.2 PHOTO DOCUMENTATION OF THE EUT (INTERNAL PHOTOS)	9
3.3 POWER SUPPLY SYSTEM UTILISED	11
3.4 SHORT DESCRIPTION OF THE EQUIPMENT UNDER TEST (EuT)	11
4 TEST ENVIRONMENT	12
4.1 ADDRESS OF THE TEST LABORATORY	12
4.2 ENVIRONMENTAL CONDITIONS	12
4.3 STATEMENT OF THE MEASUREMENT UNCERTAINTY	12
4.4 MEASUREMENT PROTOCOL FOR FCC, VCCI AND AUSTEL	12
5 TEST CONDITIONS AND RESULTS	14
5.1 CONDUCTED EMISSIONS	14
5.2 FIELD STRENGTH OF THE FUNDAMENTAL WAVE	15
5.3 SPURIOUS EMISSIONS (MAGNETIC FIELD) 9 KHz – 30 MHz	17
5.4 RADIATED EMISSIONS (ELECTRIC FIELD) 30 MHz – 1 GHz	20
5.5 RADIATED EMISSIONS (ELECTRIC FIELD) 1 GHz – 40 GHz	22
5.6 EMISSION BANDWIDTH	24
6 USED TEST EQUIPMENT AND ACCESSORIES	26

FCC ID: KR55WK48171

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

FCC ID: KR55WK48171

2 SUMMARY

GENERAL REMARKS:

None

FINAL ASSESSMENT:

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

Date of receipt of test sample	: <u>acc. to storage records</u>
Testing commenced on	: <u>28. November 2005</u>
Testing concluded on	: <u>30. November 2005</u>

Checked by:

Tested by:

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

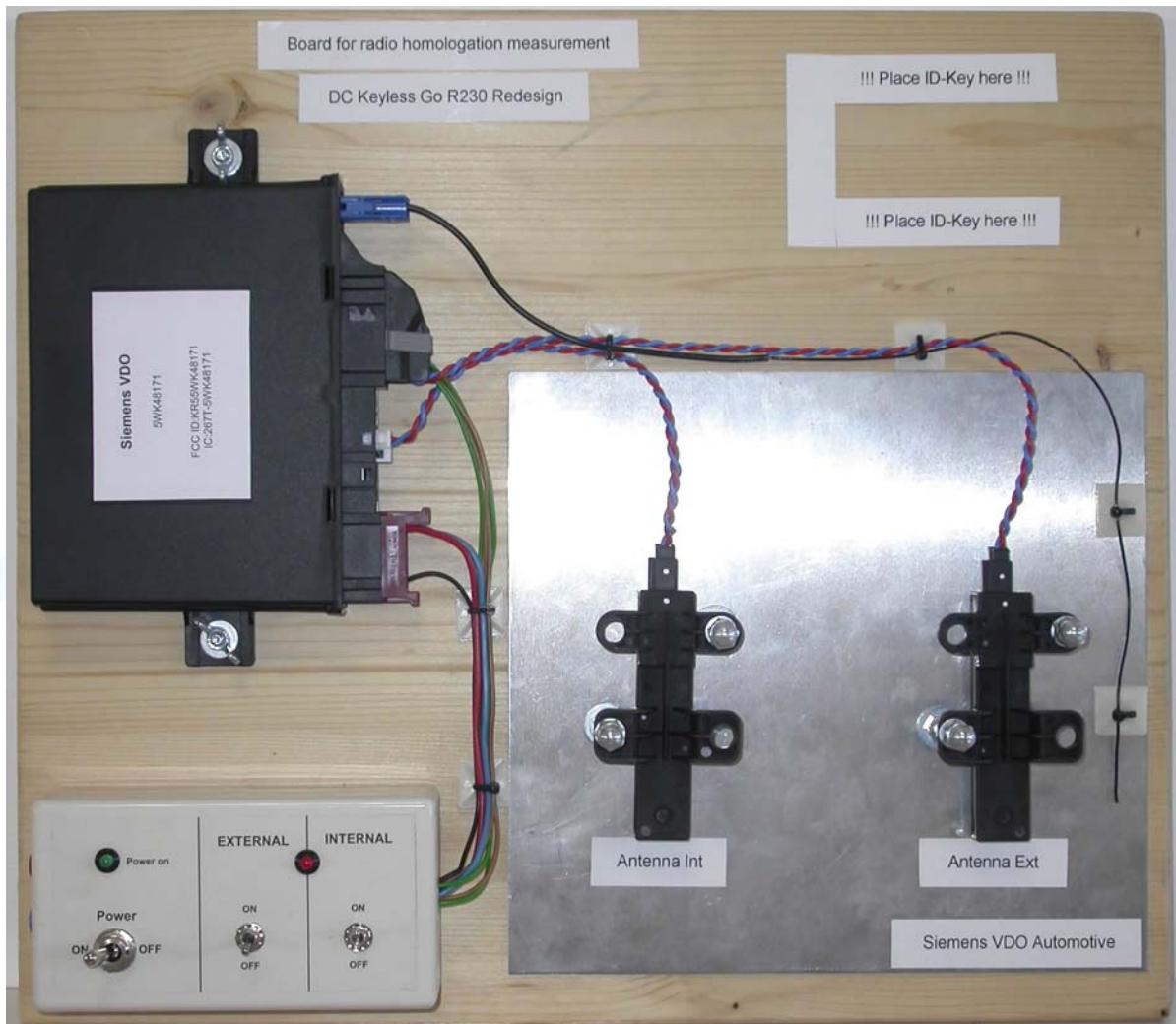
Josef Knab

FCC ID: KR55WK48171

3 EQUIPMENT UNDER TEST

3.1 Photo documentation of the EuT (external photos)

Test board – top view

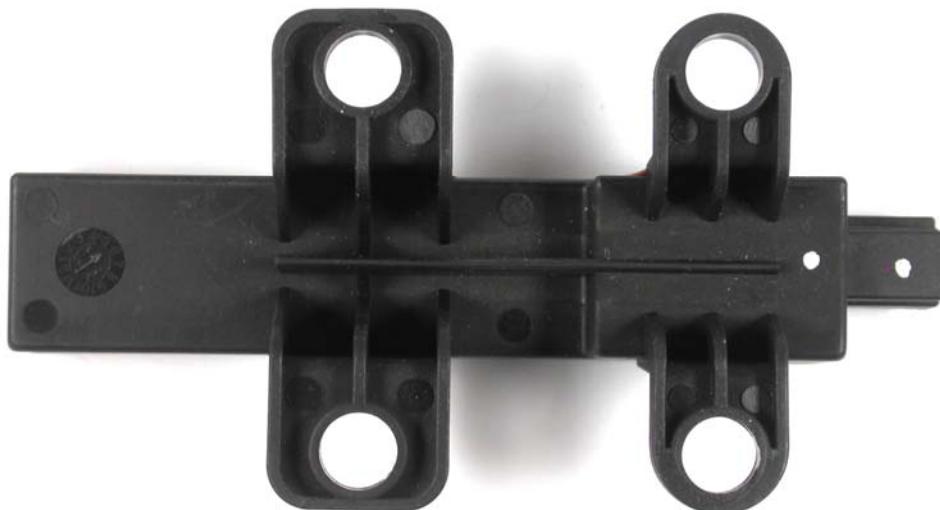
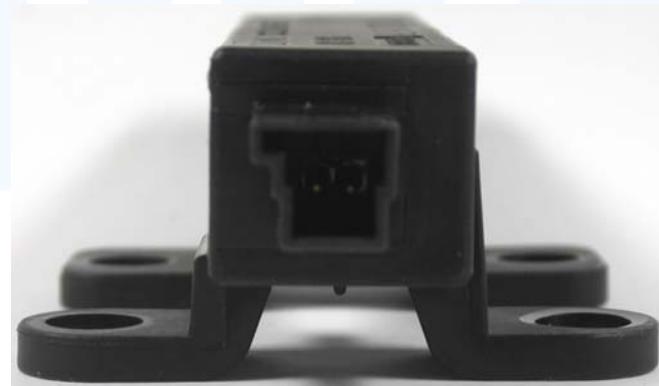


ID-Key (accessories)



FCC ID: KR55WK48171

Loop coil antenna 5WK4 8172 – build in the doors, in the trunk lid and in the bumper

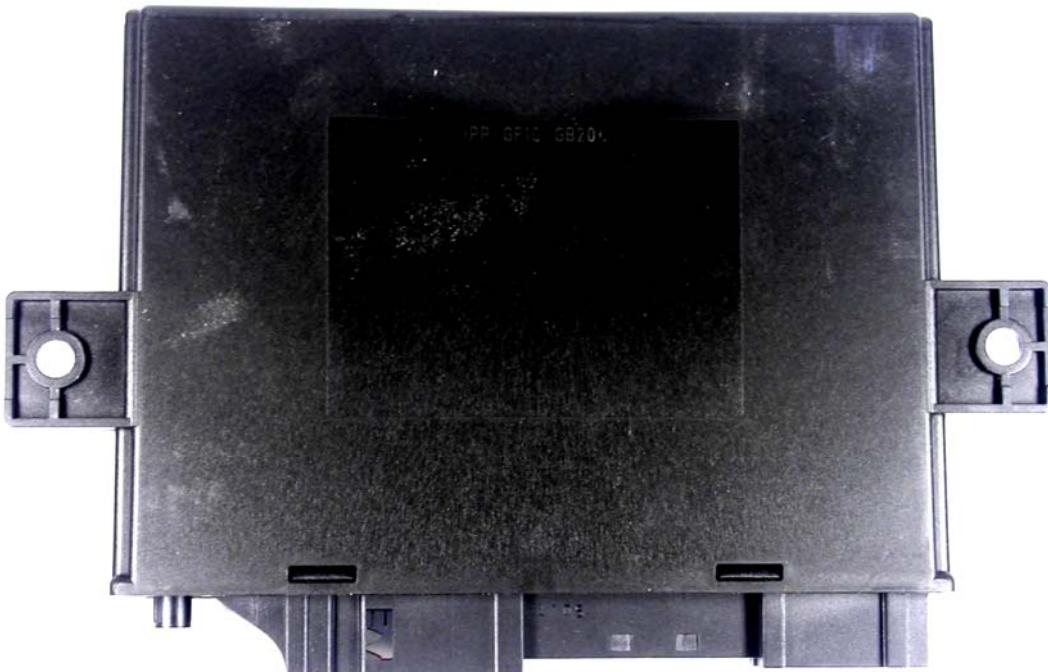


FCC ID: KR55WK48171

Control unit 5WK4 8171 – top view



Control unit 5WK4 8171 – rear view



FCC ID: KR55WK48171

Control unit 5WK4 8171 – front view

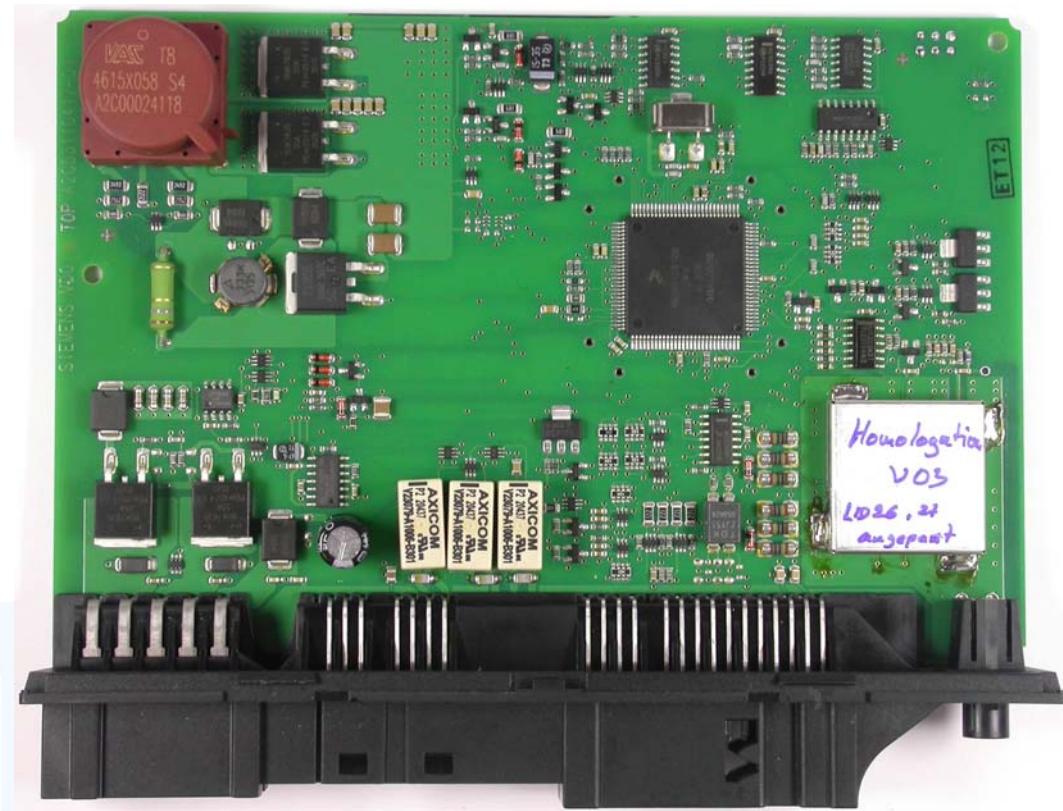


mikes

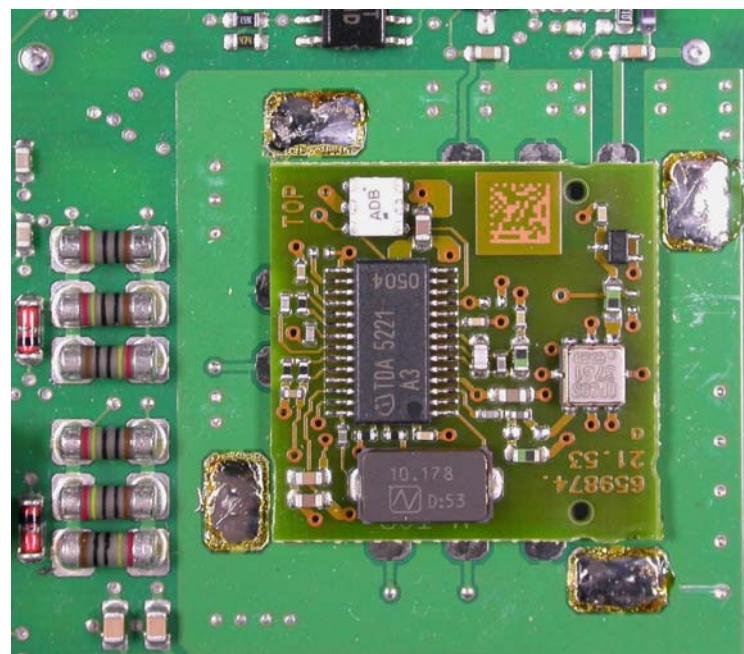
FCC ID: KR55WK48171

3.2 Photo documentation of the EuT (internal photos)

Control unit 5WK4 8171 – PCP top view

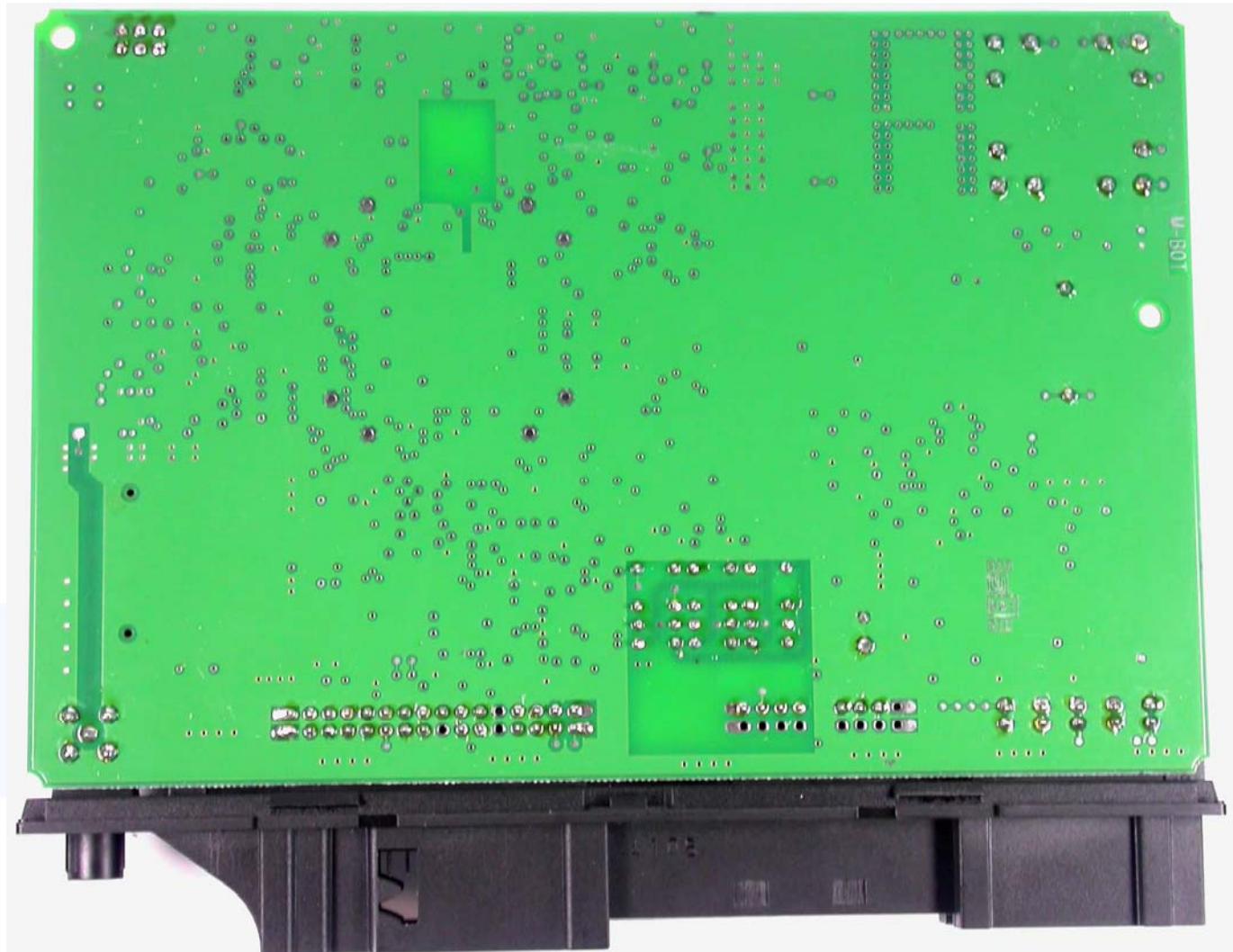


Control unit 5WK4 8171 – PCP top view – without shielding



FCC ID: KR55WK48171

Control unit 5WK4 8171 – PCB rear view



FCC ID: KR55WK48171

3.3 Power supply system utilised

Power supply voltage : 13.5 V

3.4 Short description of the Equipment under Test (EuT)

The immobilizer system is an equipment which enables comfortable operation of the vehicle. To be able to operate the vehicle the driver only has to take the key with him. The vehicle communicates with the key inductively via ferrite- antennas which are located in the front doors and in the trunk. These ferrite antennas are driven by inductance with a frequency of 125 kHz. By damping the body sheet-metal of the car, the system's range is kept in defined limits. This enables the locating of the key.

Number of tested samples: 1
Serial number: Prototype

EuT operation mode:

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

- cont. transmission (the control unit sends every 700 ms an inductive telegram via the antenna)

- stand by

-

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:

- Homologation board (see photos) Model : Siemens VDO Automotive AG

- Model : _____

- unscreened power cables

FCC ID: KR55WK48171

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.

FCC ID: KR55WK48171

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."

FCC ID: KR55WK48171

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 $50\Omega/50 \mu\text{H}$ (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

Remarks: The measurement is not applicable.

The EuT has no AC mains connections.

FCC ID: KR55WK48171

5.2 Field strength of the fundamental wave

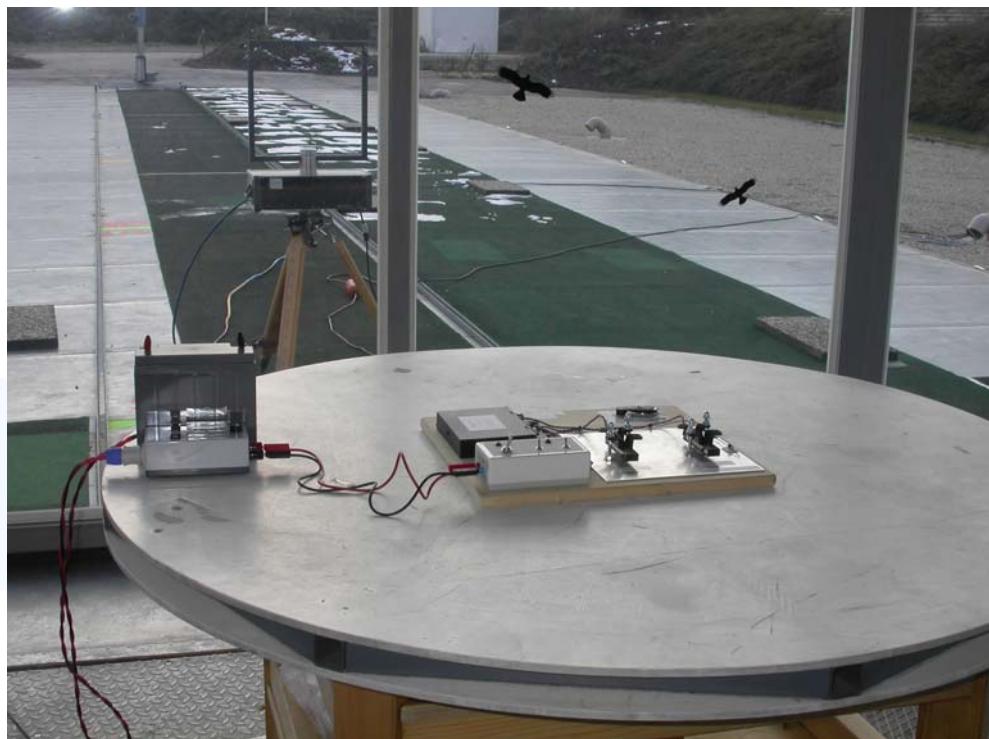
For test instruments and accessories used see section 6 Part **CPR 1**.

5.2.1 Description of the test location

Test location: OATS1

Test distance: 3 metres / 10 meters

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 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].

FCC ID: KR55WK48171

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

Test distance: 3 metres

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	77.9	37.1	62.9	20	97.9	57.1	82.9	105.7	-22.8

Test distance: 10 metres

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]
0.125	51.3	12.7	36.3	20	71.3	32.7	56.3

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	2400/125(kHz)	25.7	300
0.490-1.705	24000/F (kHz)	--	30
1.705-30.0	30	29.5	30

The requirements are **FULFILLED**.

Remarks: According to FCC Part 15.31 (f) (1) the limit was calculated for 3 meters test distance.

FCC ID: KR55WK48171

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

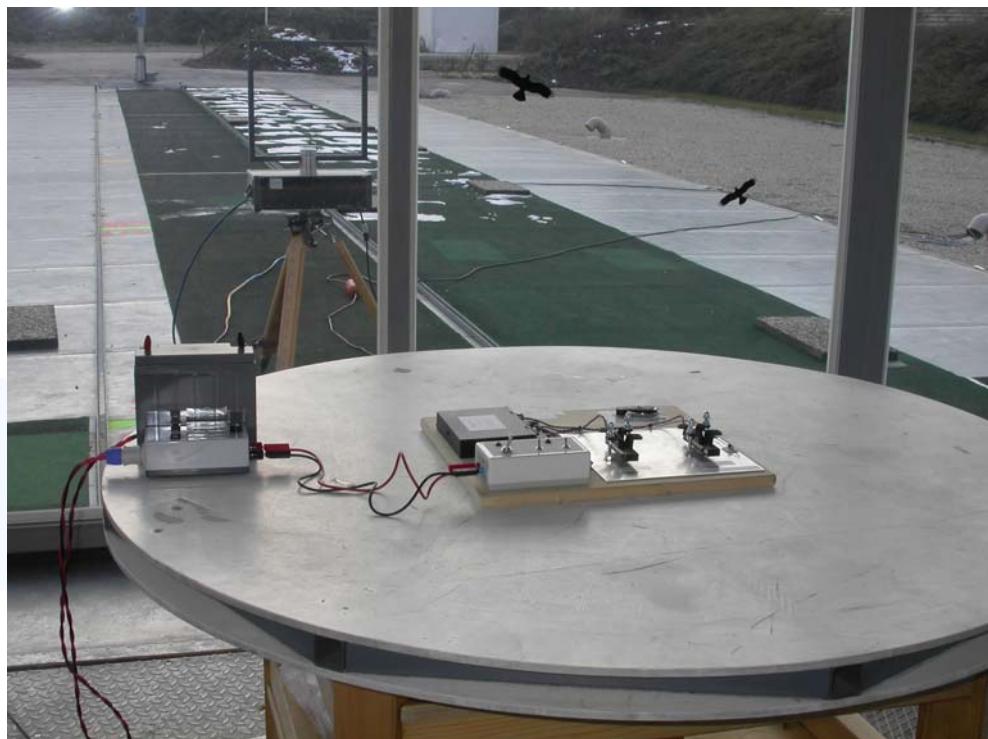
For test instruments and accessories used see section 6 Part **SER 1**.

5.3.1 Description of the test location

Test location: OATS1

Test distance: 3 metres / 10 meters

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].

FCC ID: KR55WK48171

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

Test distance: 3 metres

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]
0.250	36.1	8.0	25.3	20	56.1	28.0	45.3	99.6	-54.3
0.375	37.1	7.3	29.2	20	57.6	27.3	49.2	96.1	-46.9
0.500	27.1	3.8	18.9	20	47.2	23.8	38.9	73.6	-34.7
0.625	31.3	4.1	23.2	20	51.3	24.1	43.2	71.7	-28.5
0.750	26.0	2.7	18.0	20	46.0	22.7	38.0	70.1	-32.1
0.875	29.4	3.6	21.4	20	49.4	23.6	41.4	68.8	-27.4
1.000	24.4	2.2	16.5	20	44.4	22.2	36.5	67.6	-31.1
1.125	29.3	2.3	21.4	20	49.3	22.3	41.4	66.6	-25.2
1.375	29.9	2.1	21.7	20	49.9	22.1	41.7	64.8	-23.1
1.625	22.8	0.9	14.6	20	42.8	20.9	34.6	63.4	-28.8
1.875	18.1	0.4	10.8	20	38.1	20.4	30.8	69.5	-38.7
2.000	20.0	0.4	11.9	20	40.0	20.4	31.9	69.5	-37.6
2.250	18.7	0.2	10.7	20	38.7	20.2	30.7	69.5	-38.8

Test distance: 10 metres

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]
0.250 *	-	-	-	20	-	-	-

* below ambient noise

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: KR55WK48171

The requirements are **FULFILLED**.

Remarks: According to FCC Part 15.31 (f) (1) the limit was calculated for 3 meters test distance.

mikes

FCC ID: KR55WK48171

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

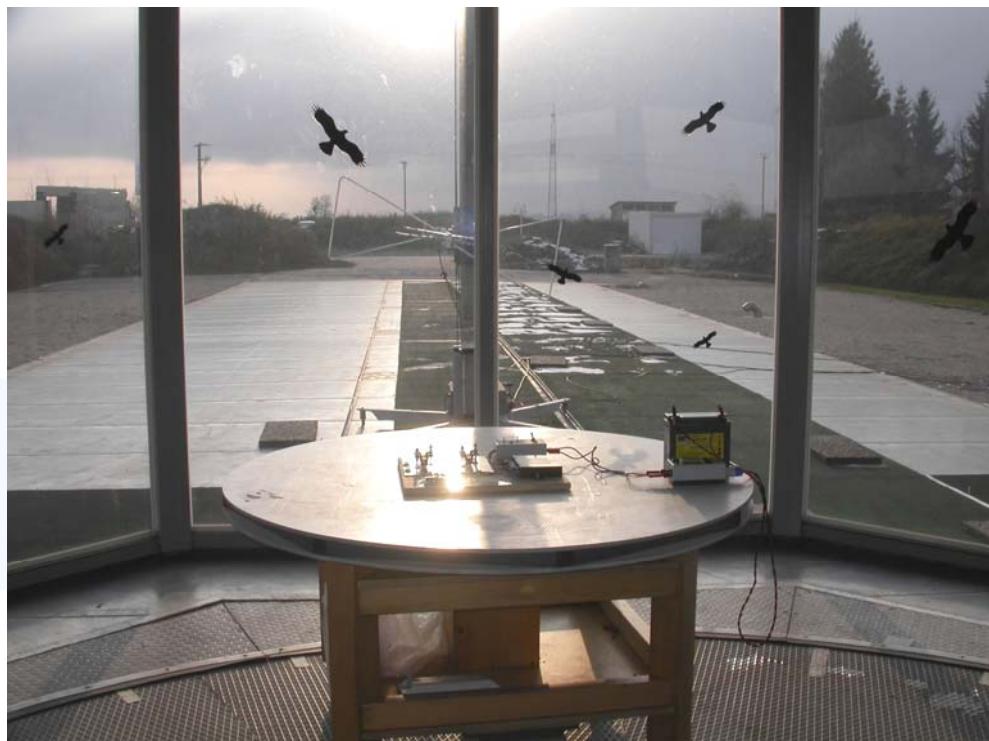
For test instruments and accessories used see section 6 Part **SER 2**.

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.

FCC ID: KR55WK48171

The final level, expressed in dB μ V/m, is arrived by taking the reading from the EMI receiver (Level dB μ 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 resolution bandwidth during the measurement is as follows:

30 MHz – 1000 MHz: ResBW: 120 kHz

Example:

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

5.4.4 Test result

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]
30 to 1000	-	-	-						

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)	
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:

FCC ID: KR55WK48171

5.5 Radiated emissions (electric field) 1 GHz – 40 GHz

For test instruments and accessories used see section 6 Part **SER 3**.

5.5.1 Description of the test location

Test location:

Test distance:

5.5.2 Photo documentation of the test set-up

5.5.3 Description of Measurement

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 bandwith 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 attitude 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.

5.5.4 Test result

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]

FCC ID: KR55WK48171

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

Remarks: The measurement is not applicable.

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

FCC ID: KR55WK48171

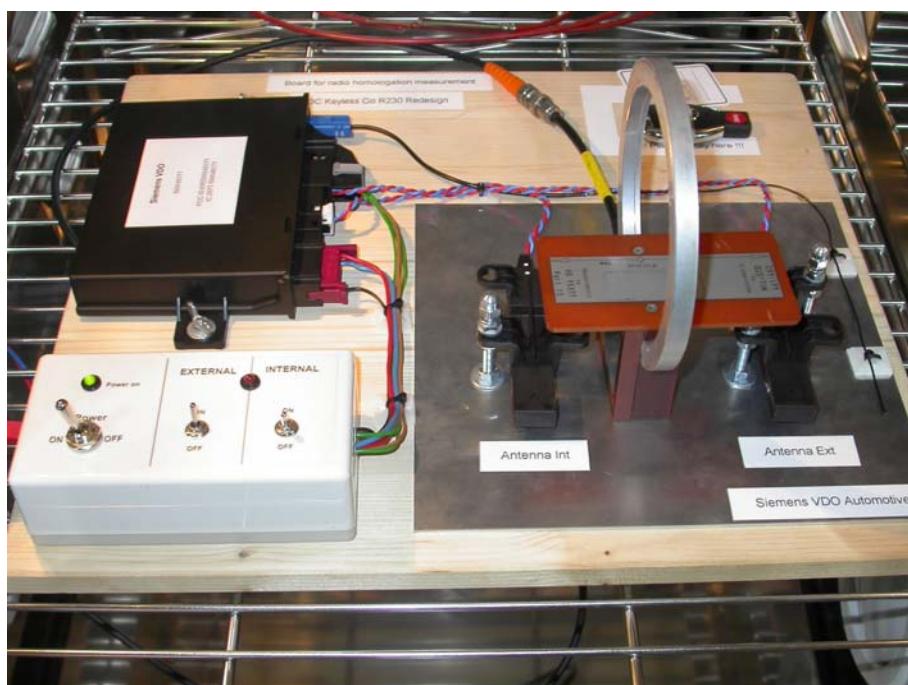
5.6 Emission Bandwidth

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

5.6.1 Description of the test location

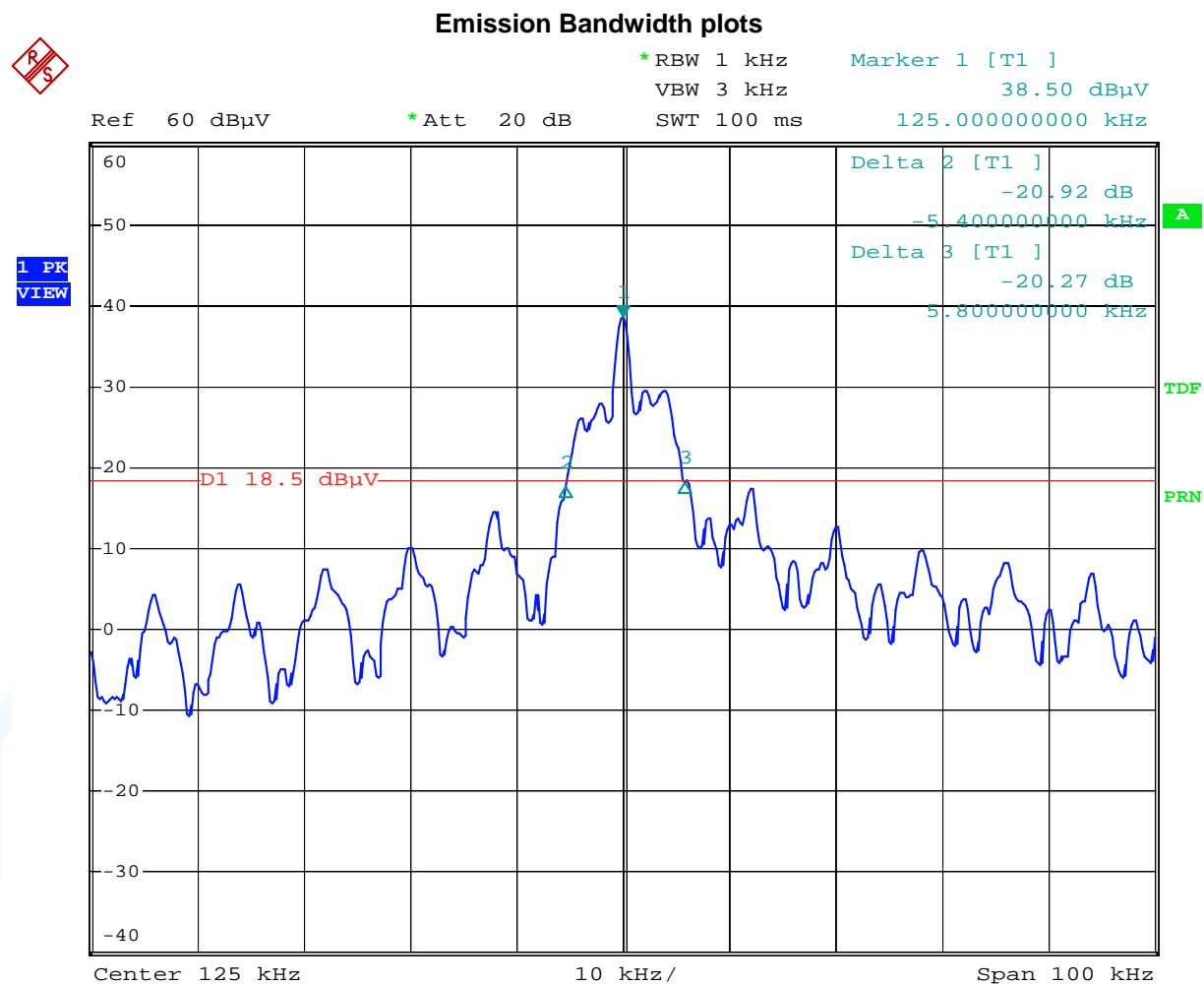
Test location: AREA4

5.6.2 Photo documentation of the test set-up



FCC ID: KR55WK48171

5.6.3 Test protocol



FCC ID: KR55WK48171

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	Antenna 9kHz - 30 MHz	Schwarzbeck Mess-Elektronik	01-02/24-01-018
	ESHS 30	Test Receiver	Rohde & Schwarz München	02-02/03-05-002
	S10162-B / +11N-50-10-5 / +	RF Cable 33 m	Huber + Suhner	02-02/50-05-031
	KK-EF393-21N-16	RF Cable 20 m	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
	THS730A	Handheld Scope	Tektronix GmbH	02-02/13-05-001
	HZ-10	Magnetic Field Antenna	Rohde & Schwarz München	02-02/24-05-012
	WK-340/40	Climatic Chamber	Weiss Umwelttechnik GmbH	02-02/45-05-001
	HM-8142	Power Supply	A.H.-Systems Inc.	02-02/50-05-047
SER 1	FMZB 1516	Antenna 9kHz - 30 MHz	Schwarzbeck Mess-Elektronik	01-02/24-01-018
	ESHS 30	Test Receiver	Rohde & Schwarz München	02-02/03-05-002
	S10162-B / +11N-50-10-5 / +	RF Cable 33 m	Huber + Suhner	02-02/50-05-031
	KK-EF393-21N-16	RF Cable 20 m	Huber + Suhner	02-02/50-05-033
	NW-2000-NB	RF Cable	Huber + Suhner	02-02/50-05-113
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 / +11N-50-10-5 / +	RF Cable 33 m	Huber + Suhner	02-02/50-05-031
	KK-EF393-21N-16	RF Cable 20 m	Huber + Suhner	02-02/50-05-033
	NW-2000-NB	RF Cable	Huber + Suhner	02-02/50-05-113