PHOENIX TESTLAB
Königswinkel 10
32825 Blomberg
Germany
Phone +49 5235 9500-0
Fax +49 5235 9500-10

TEST REPORT

Test Report Reference: R72572FCC_BMW

Equipment under Test:
LCDAS / Lane Change Distance Aid System
Generation 1.5

Type identification: BMW 66 32 – 4 055 655 - 01
(Hella part no.: 009 014-50)

Applicant: Hella KGaA Hueck & Co.

Manufacturer: Hella KGaA Hueck & Co.

Test Laboratory
(CAB)
accredited by
DATech in der TGA GmbH
in compliance with DIN EN ISO/IEC 17025
under the
Reg. No. DAT-P-105/99-21,
FCC Test site registration number 90877
and
Industry Canada Test site registration IC3469

Contents: **Page**

1 IDENTIFICATION

1.1 APPLICANT

Name:	Hella KGaA Hueck & Co.
Address:	Rixbecker Str. 75 59552 Lippstadt
Country:	Germany
Name for contact purposes:	Mr. Heinz-Theo Holle
Phone:	+49-(0)-2941-38-8392
Fax:	+49-(0)-2941-38-47-8392
Mail address:	heinz-theo.holle@hella.com

1.2 MANUFACTURER

Name:	Hella KGaA Hueck & Co.
Address:	Rixbecker Str. 75 59552 Lippstadt
Country:	Germany
Name for contact purposes:	Mr. Heinz-Theo Holle
Phone:	+49-(0)-2941-38-8392
Fax:	+49-(0)-2941-38-47-8392
Mail address:	heinz-theo.holle@hella.com

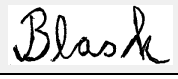
1.3 DATES

Date of receipt of test sample:	17 December 2007
Start of test:	5 February 2008
End of test:	27 February 2008

1.4 TEST LABORATORY

The tests were carried out at: **PHOENIX TESTLAB GmbH**
Königswinkel 10
D-32825 Blomberg **Phone:** **+49 (0) 52 35 / 95 00-0**
Germany **Fax:** **+49 (0) 52 35 / 95 00-10**

accredited by DATech GmbH in compliance with DIN EN ISO/IEC 17025 under Reg. No. DAT-P-105/99-21, FCC Test site registration number 90877 and Industry Canada Test site registration IC3469

Test engineer:	Raimund BLASK		16 April 2008
	Name		Date
Test report checked by:	Bernd STEINER		16 April 2008
	Name		Date

PHOENIX TESTLAB GmbH
Königswinkel 10
32825 Blomberg
Tel. 0 52 35 / 95 00-0
Fax 0 52 35 / 95 00-10

1.5 RESERVATION

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1.6 NORMATIVE REFERENCES

[1] **ANSI C63.4-2003** American National Standard for Methods of Measuring of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

[2] **FCC 47 CFR Part 15 (October 2007)** Radio Frequency Devices

[3] **RSS-210 Issue 7 (June 2007)** Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment

[4] **RSS-Gen Issue 2 (June 2007)** General Requirements and Information for the Certification of Radiocommunication Equipment

1.7 TEST RESULTS

The requirements of this test document are fulfilled by the equipment under test. The complete test results are presented in the following.

2 TECHNICAL DATA OF EQUIPMENT

Channel 1	RX:	24.075 GHz to 24.175 GHz	TX:	24.075 GHz to 24.175 GHz
Channel 2	RX:	-	TX:	-
Channel 3	RX:	-	TX:	-

Type:	24 GHz-Lane Change Decision Aid System LCDAS Generation 1.5					
Type of equipment: *	Short range device (using 24 GHz ISM-frequency range)					
FCC ID:*	-					
IC:*	-					
Duty cycle:*	100 %					
Rated RF output power: *	< +20 dBm					
Lowest / highest internal frequency*	> 100 kHz / 24.175 GHz					
Antenna type:	Integral					
Alignment range: *	24.075 GHz to 24.175 GHz					
Switching range: *	24.075 GHz to 24.175 GHz					
Modulation: *	FMCW					
Bit rate of transmitter: *	-					
Supply Voltage: *	U_{Nom} =	12.0 V DC	U_{Min}=	9.0 V DC	U_{Max}=	15.0 V DC
Power Supply: *	12 V DC by external power supply					
Temperature range: *	-40 °C to +70 °C					
Printed circuit designation: *	-					
Software: *	-					
Ancillaries to be tested with:	-					

*: Declared by the applicant.

Ports/Connectors

Identification	Connector		Length
	EUT	Ancillary	
Connection cable (including data and DC power supply lines	fixed	-	1.5 m

2.1 PERIPHERY DEVICES

The following equipment was used as control unit and ancillary equipment:

A data PC Laptop with “Drive REC II” was connected to the EUT.

3 ADDITIONAL INFORMATION

All tests were carried out with an unmodified sample.

If a variation of the supply voltage was necessary, it was done in the range 9 V DC to 15 V DC. This range was declared by the applicant as extreme supply voltage range.

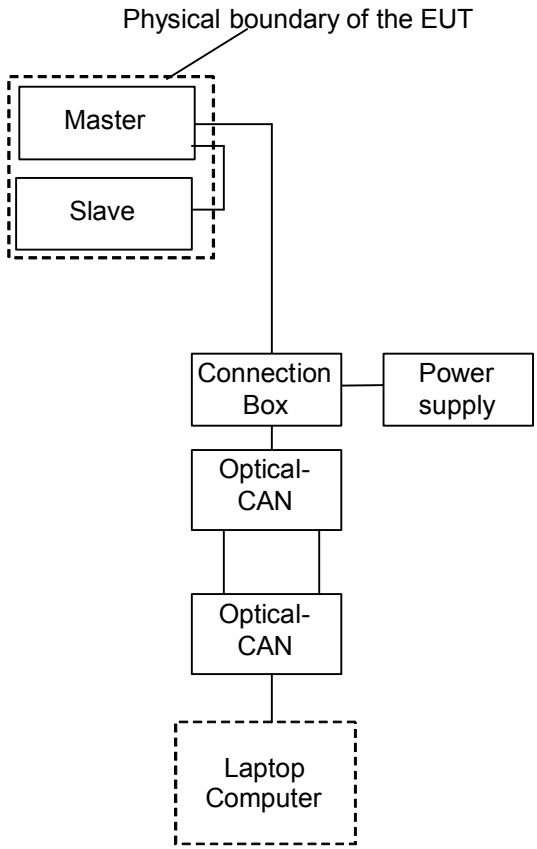
For the whole frequency range a preliminary measurement in a fully anechoic chamber was carried out to determine the frequencies, which were radiated by the EUT. The final measurements on the detected frequencies were carried out on an outdoor test site without ground plane (for the frequency range 9 kHz to 30 MHz), on an open area test site with ground plane (for the frequency range 30 MHz to 1 GHz) or the fully anechoic chamber (for the frequency range 1 GHz to 110 GHz).

4 OPERATIONAL STATES AND PHYSICAL BOUNDARIES

The EUT is a Lane Change Decision Aid System (LCDAS), which is intended for vehicular use.

No tests in stand-by mode of the transmitter / receive mode were carried out, because the transmitter is operating continuously and has no stand-by mode. No monitoring of the “Flexray-Bus” was done during the test (as declared by the applicant).

The physical boundaries of the Equipment Under Test are shown below.



5 LIST OF TEST MODULES

Application	Frequency range	FCC 47 CFR Part 15 section [2]	RSS-210, issue 7 [3]; RSS-Gen, issue 2 [4]	Status	Refer page
20 dB bandwidth within assigned band	24.075 GHz to 24.175 GHz	15.215 (c) [2]	-	Passed	28
Field strength of fundamental	24.075 GHz to 24.175 GHz	15.245 [2]	Annex 7 [3]	Passed	27
Field strength of harmonics	Restricted bands below 17.7 GHz	15.209 [2]	2.6 [3]	Passed	16 to 24
Field strength of harmonics	Restricted bands above 17.7 GHz	15.245 [2]	Annex 7 (1) [3]	Passed	16 to 24
Emissions outside the specified bands	9 kHz to 110 GHz	15.245 [2]	Annex 7 (3) [3]	Passed	16 to 24
Band edge compliance	24.075 GHz to 24.175 GHz	15.215 (c) [2]	Annex 7 [3]	Passed	25 to 27
99 % bandwidth	24.075 GHz to 24.175 GHz	-	4.6.1 [4]	Passed	Annex D
Conducted emissions	150 kHz to 30 MHz	15.207 [2]	7.2.2 [4]	Not applicable*	-

* EUT is DC powered and designed for vehicular use only.

6 RADIATED EMISSIONS

6.1 METHOD OF MEASUREMENT (RADIATED EMISSIONS)

The radiated emission measurement is subdivided into 5 stages.

- A preliminary measurement carried out in a fully anechoic chamber with a fixed antenna height in the frequency range 9 kHz to 1 GHz.
- A final measurement carried out on an outdoor test side without reflecting ground plane and a fixed antenna height in the frequency range 9 kHz to 30 MHz.
- A final measurement carried out on an open area test side with reflecting ground plane and various antenna height in the frequency range 30 MHz to 1 GHz.
- A preliminary measurement carried out in a fully anechoic chamber with a variable antenna distance and height in the frequency range 1 GHz to 110 GHz.
- A final measurement carried out in a fully anechoic chamber with a fixed antenna height in the frequency range 1 GHz to 110 GHz.

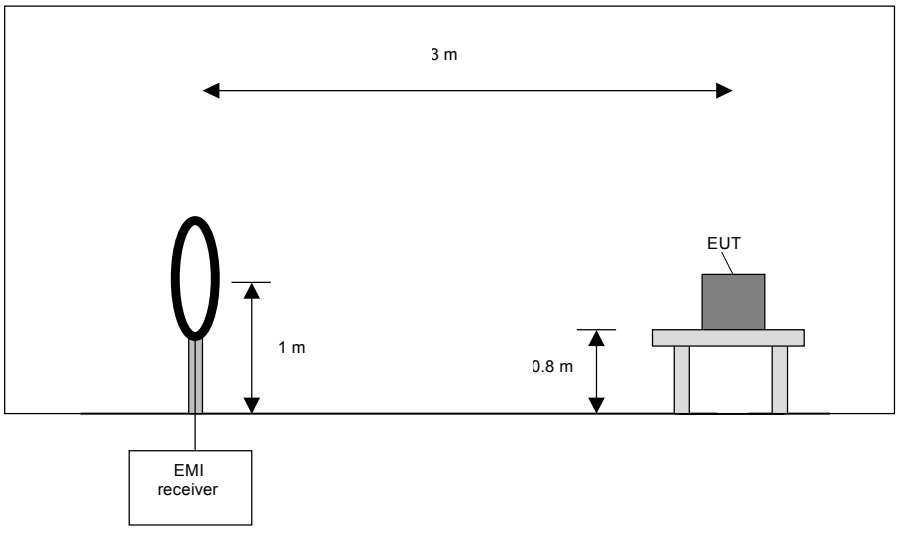
Preliminary measurement (9 kHz to 30 MHz):

In the first stage a preliminary measurement will be performed in a shielded room with a measuring distance of 3 meters. Tabletop devices will set up on a non-conducting support with a size of 1 m by 1.5 m and a height of 80 cm. Floor-standing devices will be placed directly on the turntable/ground plane. The set up of the Equipment under test will be in accordance to ANSI C63.4-2003 [1].

The frequency range 9 kHz to 30 MHz will be monitored with a spectrum analyser while the system and its cables will be manipulated to find out the configuration with the maximum emission levels if applicable. The EMI Receiver will be set to MAX Hold mode. The EUT and the measuring antenna will be rotated around their vertical axis to found the maximum emissions.

The resolution bandwidth of the spectrum analyser will be set to the following values:

Frequency range	Resolution bandwidth
9 kHz to 150 kHz	200 Hz
150 kHz to 30 MHz	10 kHz



Preliminary measurement procedure:

Prescans were performed in the frequency range 9 kHz to 150 kHz and 150 kHz to 30 MHz.

The following procedure will be used:

1) Monitor the frequency range at horizontal polarisation and a EUT azimuth of 0 °.
2) Manipulate the system cables within the range to produce the maximum level of emission.
3) Rotate the EUT by 360 ° to maximize the detected signals.
4) Make a hardcopy of the spectrum.
5) Measure the frequencies of highest detected emission with a lower span and resolution bandwidth to increase the accuracy and note the frequency value.
6) Repeat steps 1) to 5) with the other orthogonal axes of the EUT (because of EUT is a module and might be used in a handheld equipment application).
7) Rotate the measuring antenna and repeat steps 1) to 5).

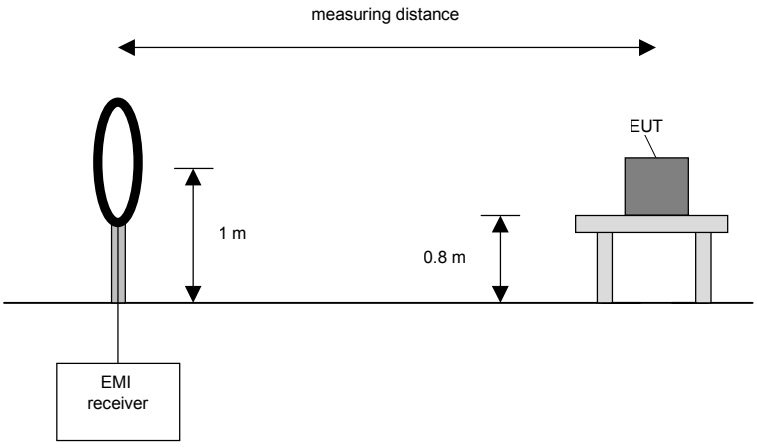
Final measurement (9 kHz to 30 MHz):

In the second stage a final measurement will be performed on an open area test site with no conducting ground plane in a measuring distances of 3 m, 10 m and 30 m if possible. 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 a EMI Receiver set to Quasi Peak detector except for the frequency bands 30 kHz to 90 kHz and 110 kHz to 490 kHz where an average detector will be used according Section 15.209 (d) [2].

On the during the preliminary measurement detected frequencies the final measurement will be performed while rotating the EUT and the measuring antenna in the range of 0 ° to 360 ° around their vertical axis until the maximum value is found.

The resolution bandwidth of the EMI Receiver will be set to the following values:

Frequency range	Resolution bandwidth
9 kHz to 150 kHz	200 Hz
150 kHz to 30 MHz	9 kHz



Final measurement procedure:

The following procedure will be used:

1) Monitor the frequency range with the measuring antenna at vertical orientation parallel to the EUT at an azimuth of 0 °.
2) Rotate the EUT by 360 ° to maximize the detected signals and note the azimuth and orientation.
3) Rotate the measuring antenna to find the maximum and note the value.
4) Rotate the measuring antenna and repeat steps 1) to 3) until the maximum value is found.
5) Repeat steps 1) to 4) with the other orthogonal axes of the EUT (because of EUT is a module and might be used in a handheld equipment application).

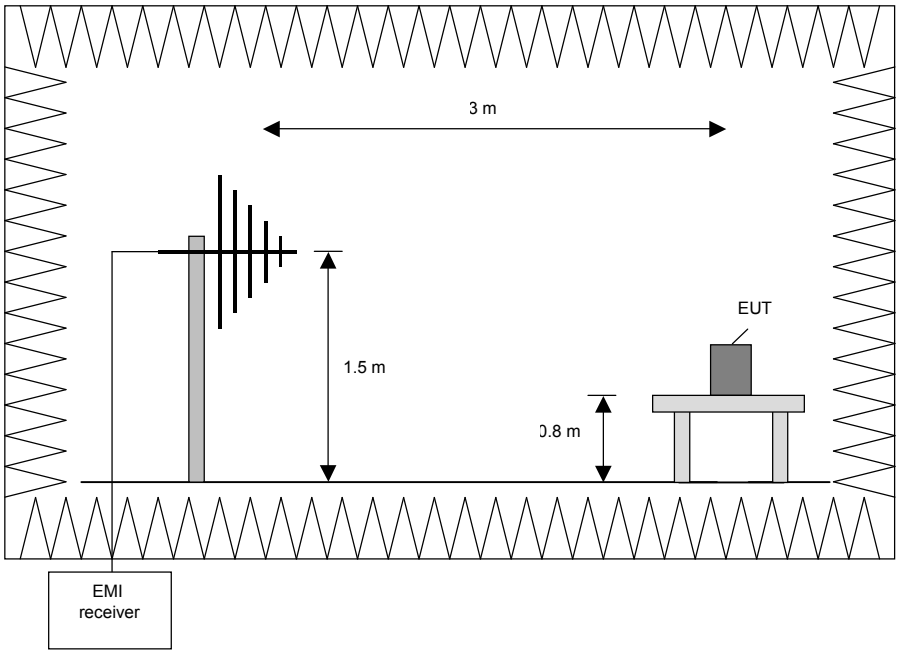
Preliminary measurement (30 MHz to 1 GHz)

In the first stage a preliminary measurement will be performed in a fully anechoic chamber with a measuring distance of 3 meter. Tabletop devices will set up on a non-conducting support with a size of 1 m by 1.5 m and a height of 80 cm. Floor-standing devices will be placed directly on the turntable/ground plane. The set up of the Equipment under test will be in accordance to ANSI C63.4-2003 [1].

The frequency range 30 MHz to 1 GHz will be measured with an EMI Receiver set to MAX Hold mode and a resolution bandwidth of 100 kHz. The measurement will be performed in horizontal and vertical polarisation of the measuring antenna and while rotating the EUT in its vertical axis in the range of 0 ° to 360 °.

The resolution bandwidth of the EMI Receiver will be set to the following values:

Frequency range	Resolution bandwidth
30 MHz to 230 MHz	100 kHz
230 MHz to 1 GHz	100 kHz



Procedure preliminary measurement:

Prescans were performed in the frequency range 30 MHz to 230 MHz and 230 MHz to 1 GHz.
The following procedure will be used:

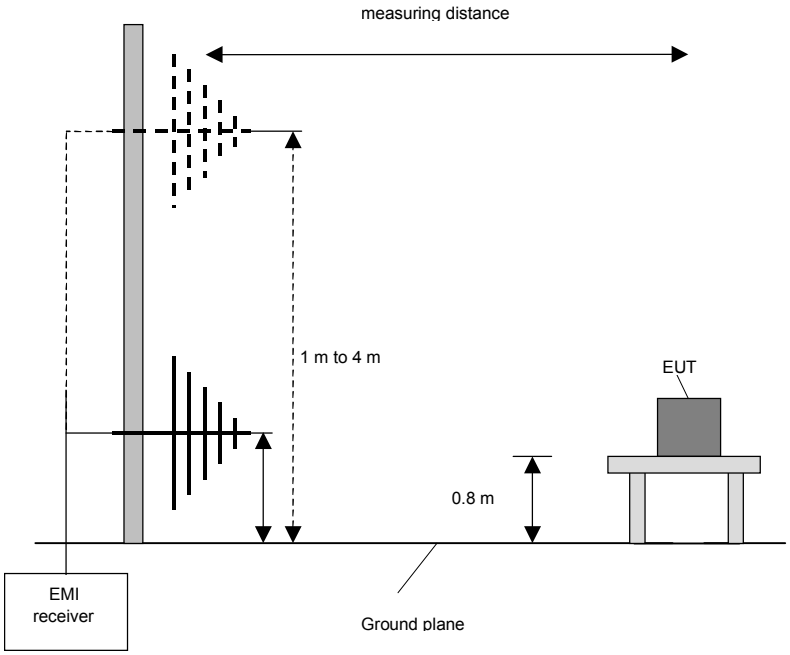
1. Monitor the frequency range at horizontal polarisation and a EUT azimuth of 0 °.
2. Manipulate the system cables within the range to produce the maximum level of emission.
3. Rotate the EUT by 360 ° to maximize the detected signals.
4. Make a hardcopy of the spectrum.
5. Measure the frequency of the detected emissions with a lower span and resolution bandwidth to increase the accuracy and note the frequency value.
6. Repeat 1) to 4) with the other orthogonal axes of the EUT if handheld equipment.
7. Repeat 1) to 5) with the vertical polarisation of the measuring antenna.

Final measurement (30 MHz to 1 GHz)

A final measurement on an open area test site will be performed on selected frequencies found in the preliminary measurement. During this test the EUT will be rotated in the range of 0 ° to 360 °, the measuring antenna will be set to horizontal and vertical polarisation and raised and lowered in the range from 1 m to 4 m to find the maximum level of emissions.

The resolution bandwidth of the EMI Receiver will be set to the following values:

Frequency range	Resolution bandwidth
30 MHz to 1 GHz	120 kHz



Procedure final measurement:

The following procedure will be used:

1) Measure on the selected frequencies at an antenna height of 1 m and a EUT azimuth of 23 °.
2) Move the antenna from 1 m to 4 m and note the maximum value at each frequency.
3) Rotate the EUT by 45 ° and repeat 2) until an azimuth of 337 ° is reached.
4) Repeat 1) to 3) for the other orthogonal antenna polarization.
5) Move the antenna and the turntable to the position where the maximum value is detected.
6) Measure while moving the antenna slowly +/- 1 m.
7) Set the antenna to the position where the maximum value is found.
8) Measure while moving the turntable +/- 45 °.
9) Set the turntable to the azimuth where the maximum value is found.
10) Measure with Final detector (QP and AV) and note the value.
11) Repeat 5) to 10) for each frequency.
12) Repeat 1) to 11) for each orthogonal axes of the EUT if handheld equipment.

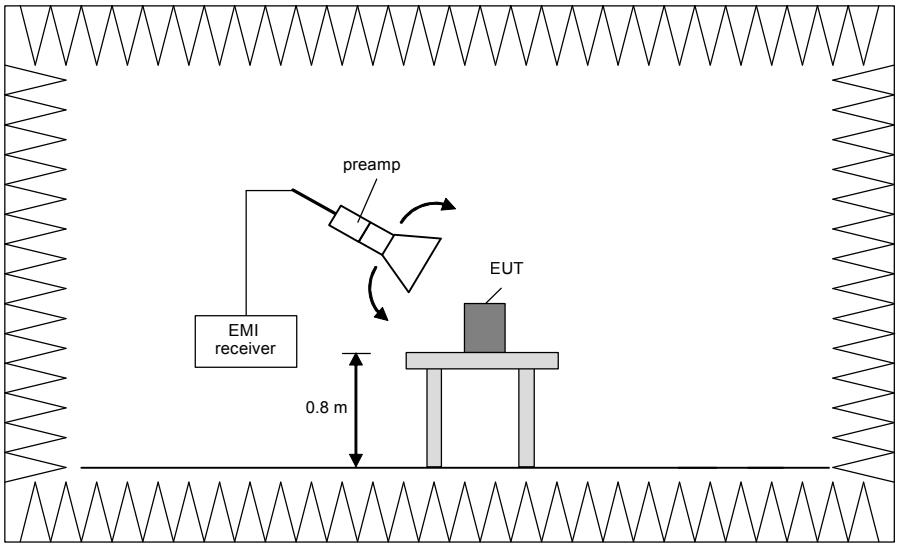
Preliminary and final measurement (1 GHz to 110 GHz)

This measurement will be performed in a fully anechoic chamber. Tabletop devices will set up on a non-conducting support with a size of 1 m by 1.5 m and a height of 80 cm. Floor-standing devices will be placed directly on the turntable/ground plane. The set up of the Equipment under test will be in accordance to ANSI C63.4-2003 [1].
The resolution bandwidth of the EMI Receiver will be set to the following values:

Frequency range	Resolution bandwidth (preliminary)	Resolution bandwidth (final)
1 GHz to 110 GHz	1 MHz	1 MHz

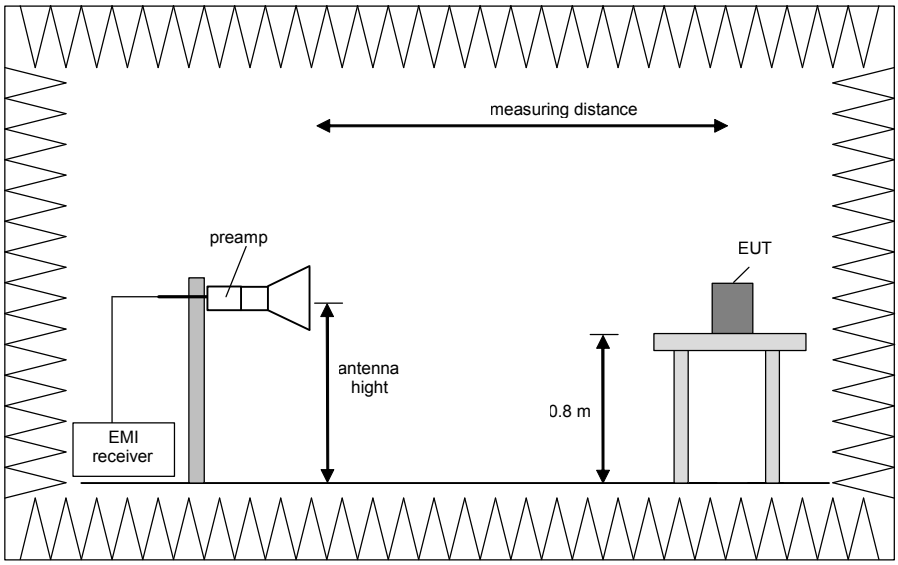
Preliminary measurement (1 GHz to 110 GHz)

The spectrum analyser set to MAX Hold mode and a resolution bandwidth of 100 kHz. The measurement will be performed in horizontal and vertical polarisation of the measuring antenna, the antenna close to the EUT and while moving the antenna over all sides of the EUT. With the spectrum analyser in CLEAR / WRITE mode the cone of the emission should be found and than the measuring distance will be set to 3 m with the receiving antenna moving in this cone of emission. At this position the final measurement will be carried out.



Final measurement (1 GHz to 110 GHz)

The EMI Receiver set to peak and average mode and a resolution bandwidth of 1 MHz. The measurement will be performed in horizontal and vertical polarisation of the measuring antenna and while rotating the EUT in its vertical axis in the range of 0 ° to 360 ° in order to have the antenna inside the cone of radiation.



Procedure of measurement:

The measurements were performed in the frequency range 1 GHz to 110 GHz.
The following procedure will be used:

1) Monitor the frequency range at horizontal polarisation and move the antenna over all sides of the EUT (if necessary move the EUT to another orthogonal axis).
2) Change the antenna polarisation and repeat 1) with vertical polarisation.
3) Make a hardcopy of the spectrum.
4) Measure the frequency of the detected emissions with a lower span and resolution bandwidth to increase the accuracy and note the frequency value.
5) Change the analyser mode to Clear / Write and found the cone of emission.
6) Rotate and move the EUT, so that the measuring distance can be enlarged to 3 m and the antenna will be still inside the cone of emission.
7) Measure the level of the detected frequency with the correct resolution bandwidth, with the antenna polarisation and azimuth and the peak and average detector, which causes the maximum emission.
8) Repeat steps 1) to 7) for the next antenna spot if the EUT is lager than the antenna beam width.

Step 1) to 6) are defined as preliminary measurement.

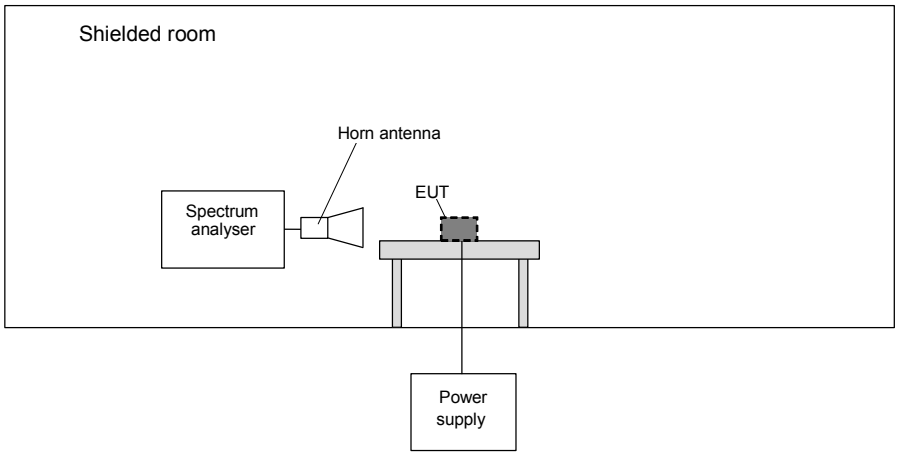
6.2 METHOD OF MEASUREMENT (20 dB BANDWIDTH)

The calibration of the spectrum analyser has to be checked with the help of a known signal from a signal generator. The EUT has to be connected to the spectrum analyser via a low loss cable. If the EUT is not equipped with an antenna connector, a temporary antenna connector has to be installed or a test fixture shall be used. The EUT has to be switched on, the transmitter shall work with its maximum data rate.

The following spectrum analyser settings shall be used:

- Span: App. 2 to 3 times the 20 dB bandwidth, centred on the actual channel.
- Resolution bandwidth: 100 kHz.
- Video bandwidth: 100 kHz.
- Sweep: Auto.
- Detector function: peak.
- Trace mode: Max hold.

After trace stabilisation the marker shall be set on the signal peak. The first display line has to be set on this value. The second display line has to be set 20 dB below the first line (or the peak marker). The frequency lines shall be set on the intersection points between the second display line and the measured curve.



6.3 METHOD OF MEASUREMENT (BAND-EDGE COMPLIANCE)

The same test set-up as used for the final radiated emission measurement shall be used.
The measurements shall be carried out with using a resolution bandwidth of 100 kHz.

The following spectrum analyser settings shall be used:

- Span: Wide enough to capture the peak level of the emission on the channel closest to the band-edge, as well as any modulation products, which fall outside the assigned frequency band.
- Resolution bandwidth: 100 kHz.
- Video bandwidth: ≥ the resolution bandwidth.
- Sweep: Auto.
- Detector function: Peak.
- Trace mode: Max hold.

After trace stabilisation the marker shall be set on the signal peak. The first display line has to be set on this value. The second display line has to be set 51 dB below the first line (or the peak marker). The frequency line shall be set on the edge of the assigned frequency band. Set the second marker on the emission at the band-edge, or on the highest modulation product outside of the band, if this level is higher than that at the band-edge. This frequency shall be measured with the EMI receiver as described in subclause 5.8.1 of this test report, but 100 kHz resolution bandwidth shall be used.

The measurement will be performed at the lower and upper end of the assigned frequency band.

7 TEST RESULTS

7.1 PRELIMINARY RADIATED EMISSION TEST (9 kHz to 110 GHz)

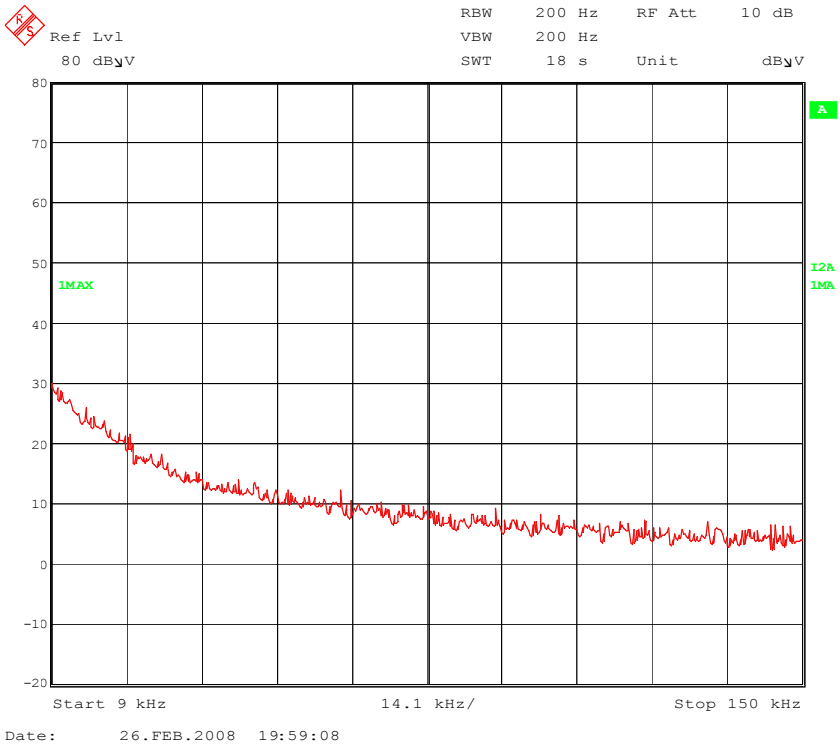
Ambient temperature	20 °C	Relative humidity	50 %

Position of EUT: The EUT was set-up on a non-conducting table of a height of 0.8 m. The distance between EUT and the antenna was 3 m (9 kHz to 12.75 GHz), 1 m (12.75 GHz to 40 GHz) and 10 cm (40 GHz to 110 GHz).

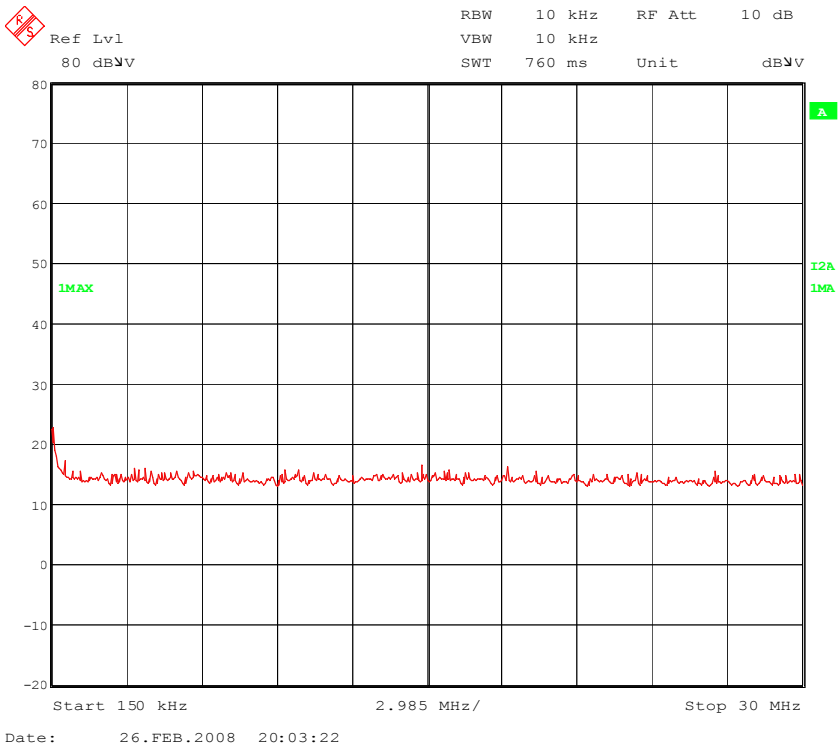
Cable guide: For further information refer to the pictures in annex A of this test report.

Test record: The test was carried out in normal operation mode of the EUT.

Supply voltage: The EUT was supplied by an external 12 V DC-Power Supply.

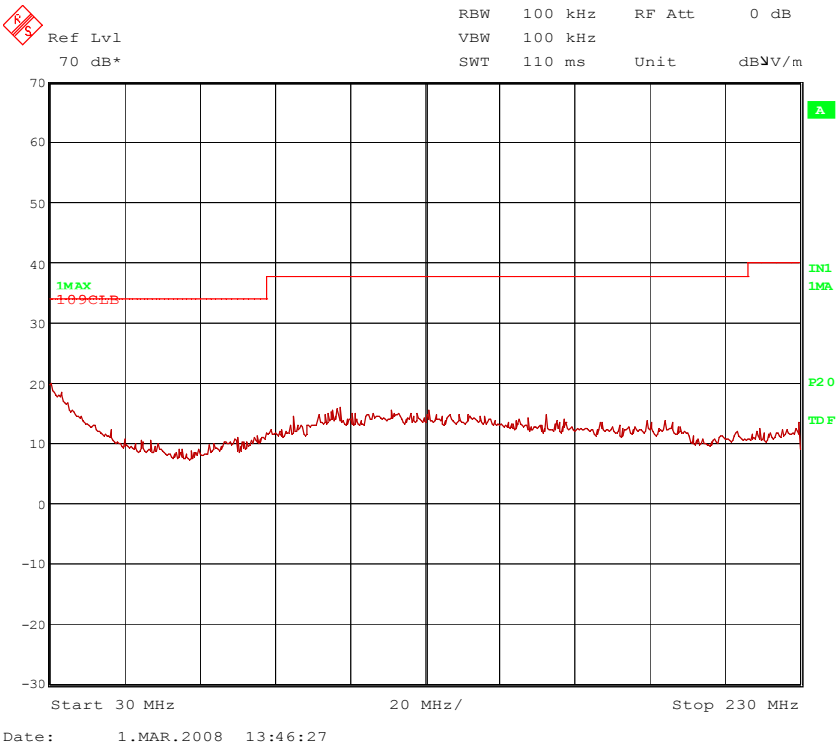


72572bmw_H1.wmf: Radiated emissions from 9 kHz to 150 kHz

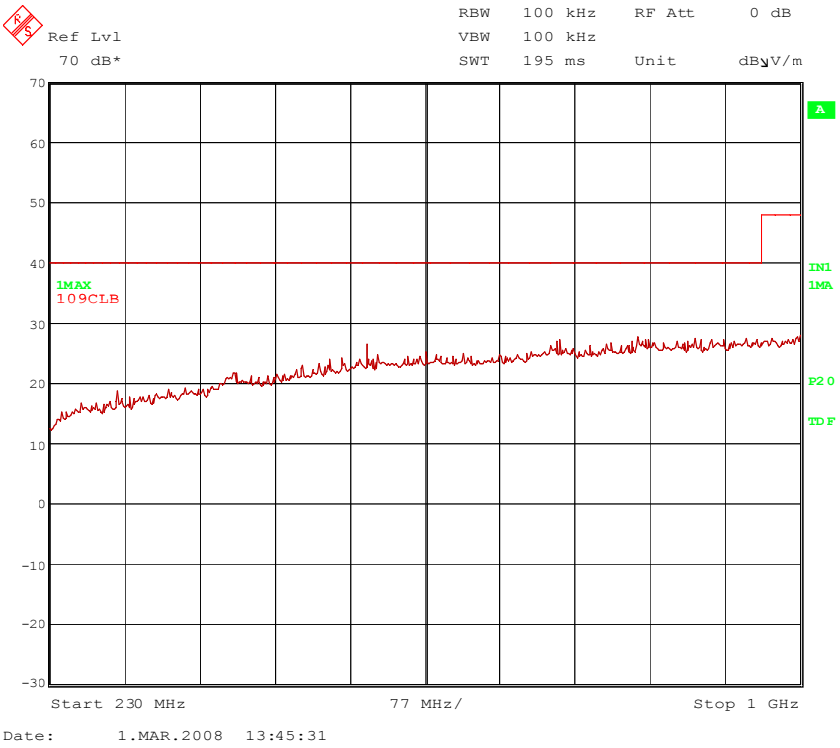


72572bmw_H2.wmf: Radiated emissions from 150 kHz to 30 MHz

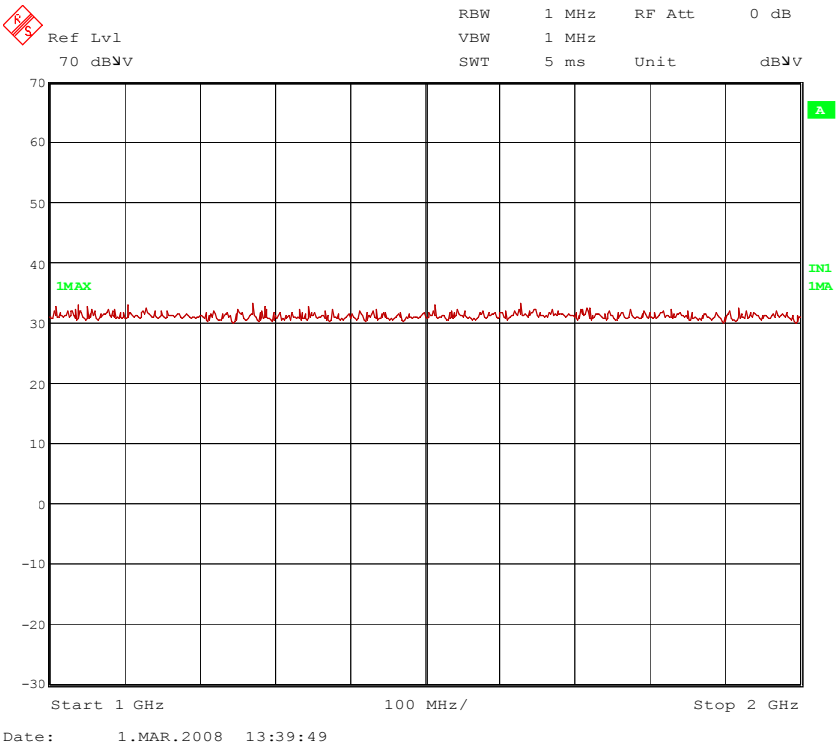
No significant emissions above the noise floor of the measuring system found, so no measurements on the outdoor test site were carried out.



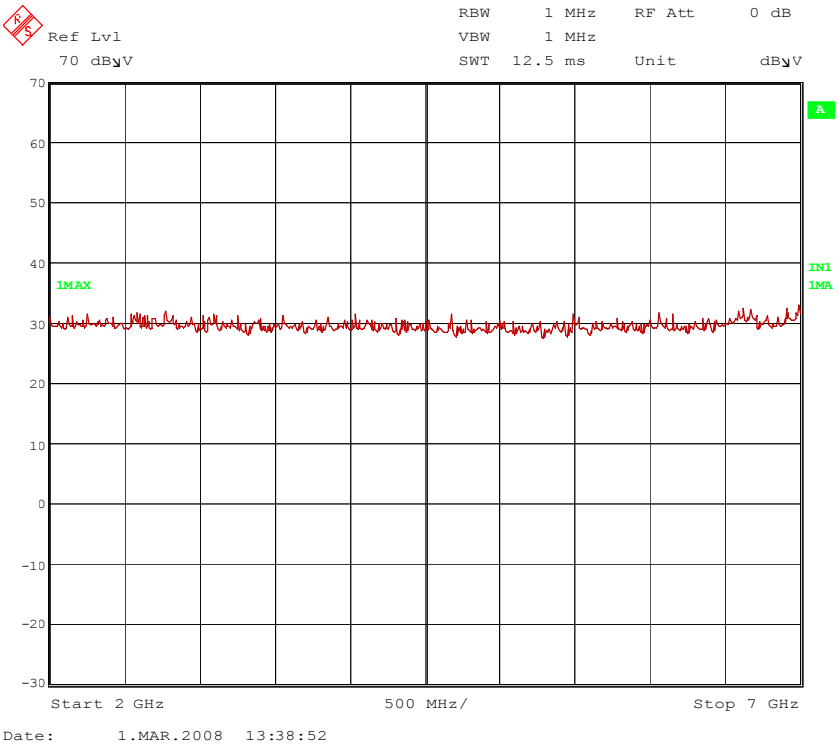
72572fcc_E1.wmf: Radiated emissions from 30 MHz to 230 MHz



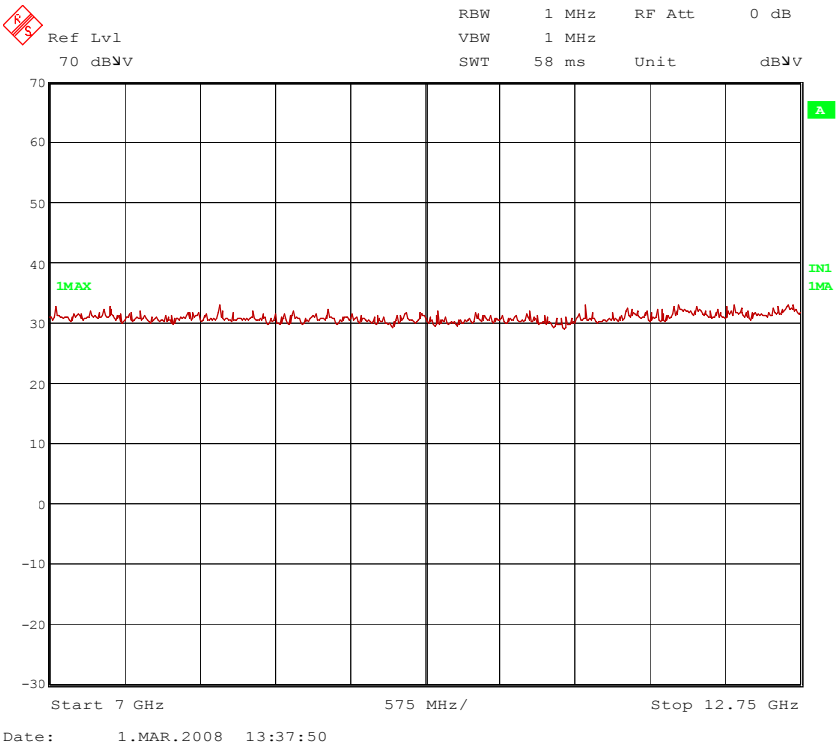
72572fcc_E2.wmf: Radiated emissions from 230 MHz to 1000 MHz



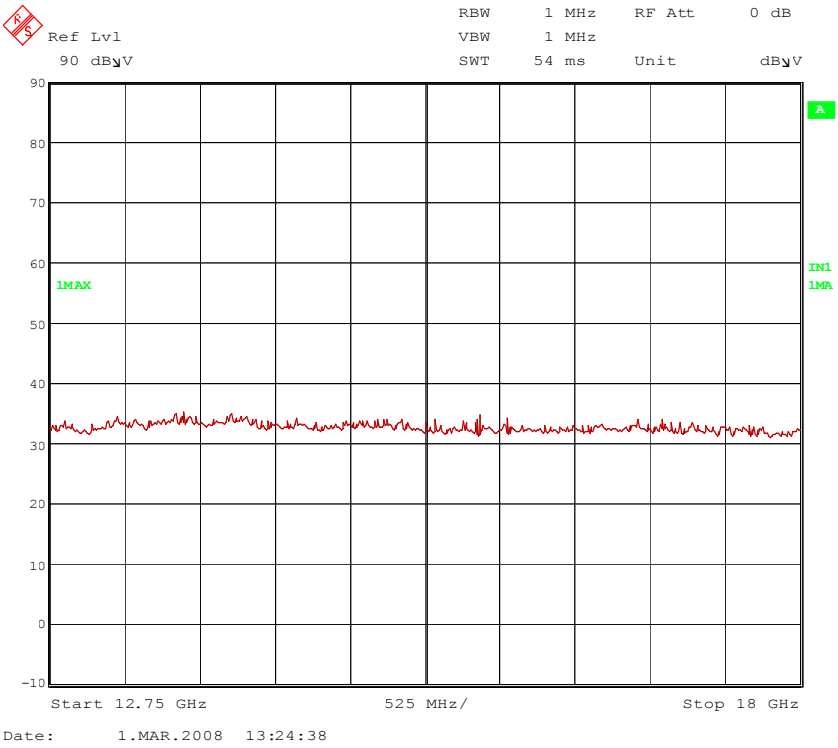
72572fcc_E3.wmf: Radiated emissions from 1 GHz to 2 GHz



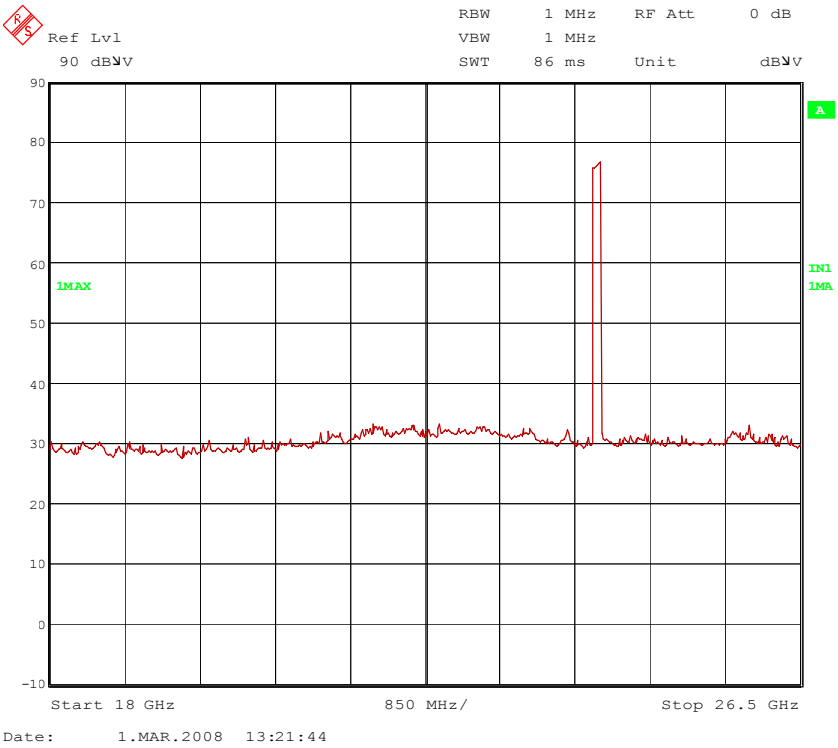
72572fcc_E4.wmf: Radiated emissions from 2 GHz to 7 GHz



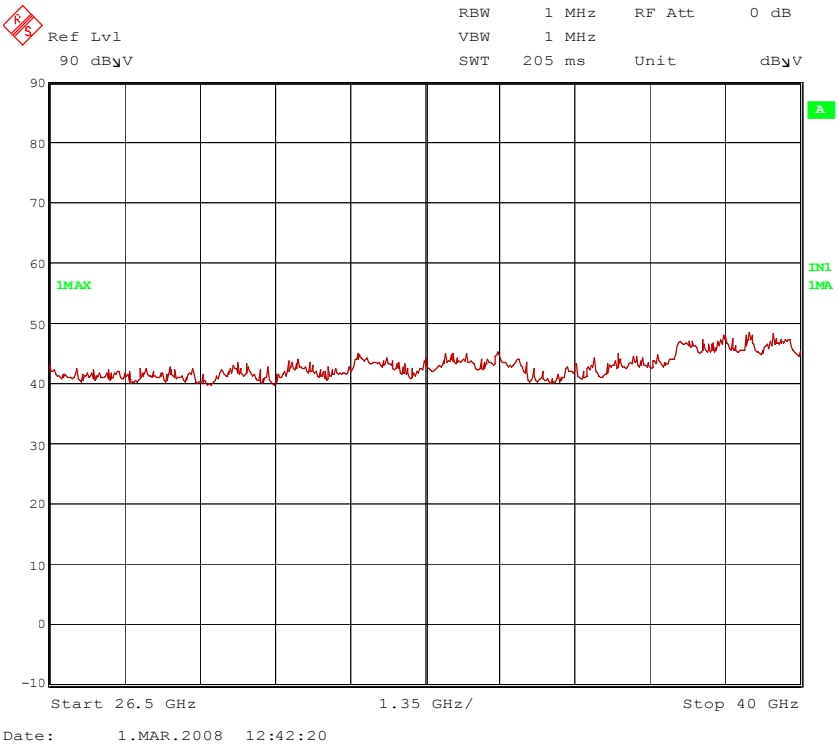
72572fcc_E5.wmf: Radiated emissions from 7 GHz to 12.75 GHz



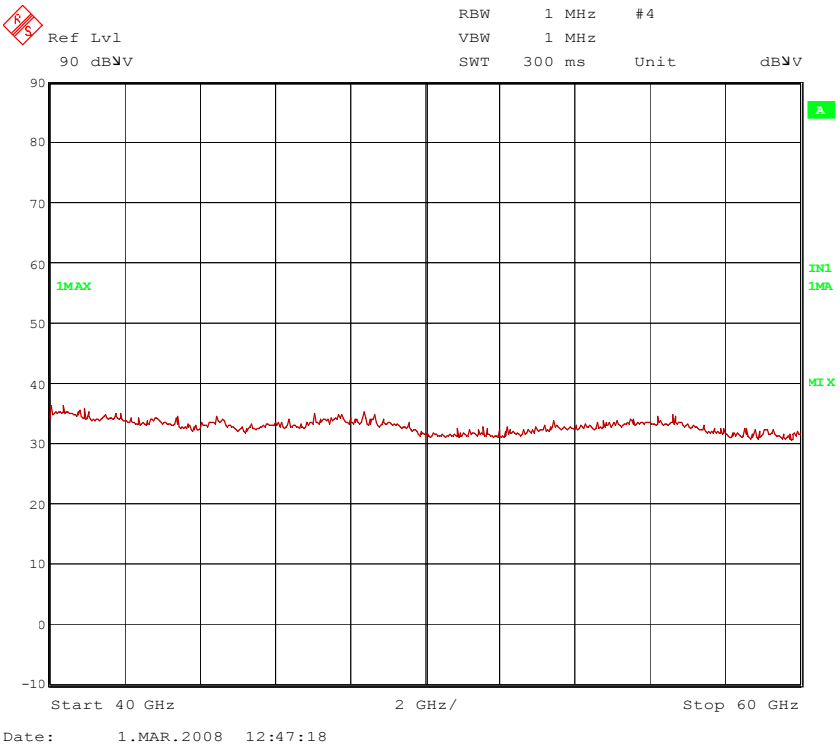
72572fcc_E6.wmf: Radiated emissions from 12.75 GHz to 18 GHz



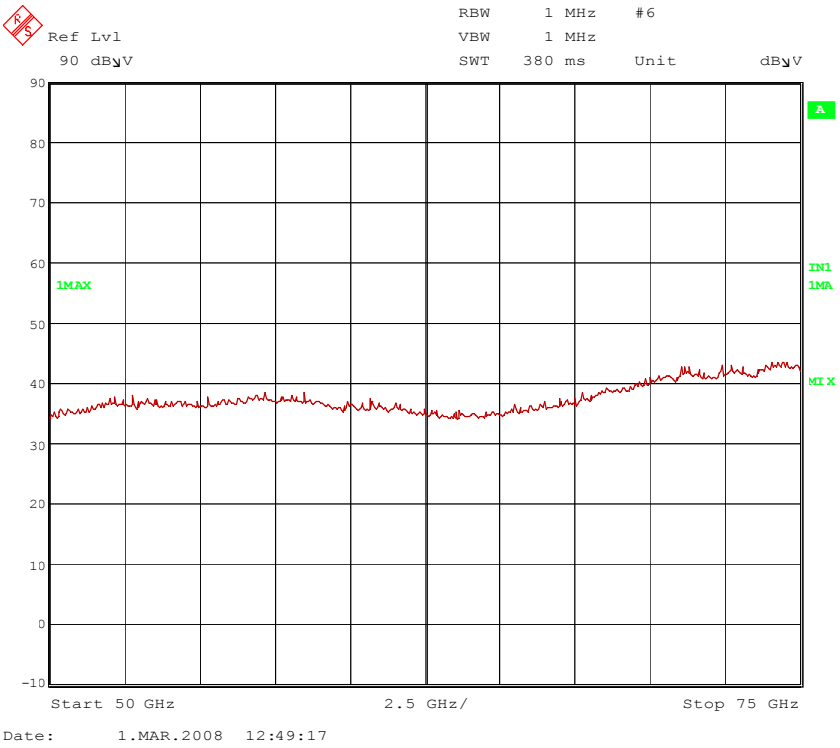
72572fcc_E7.wmf: Radiated emissions from 18 GHz to 26.5 GHz



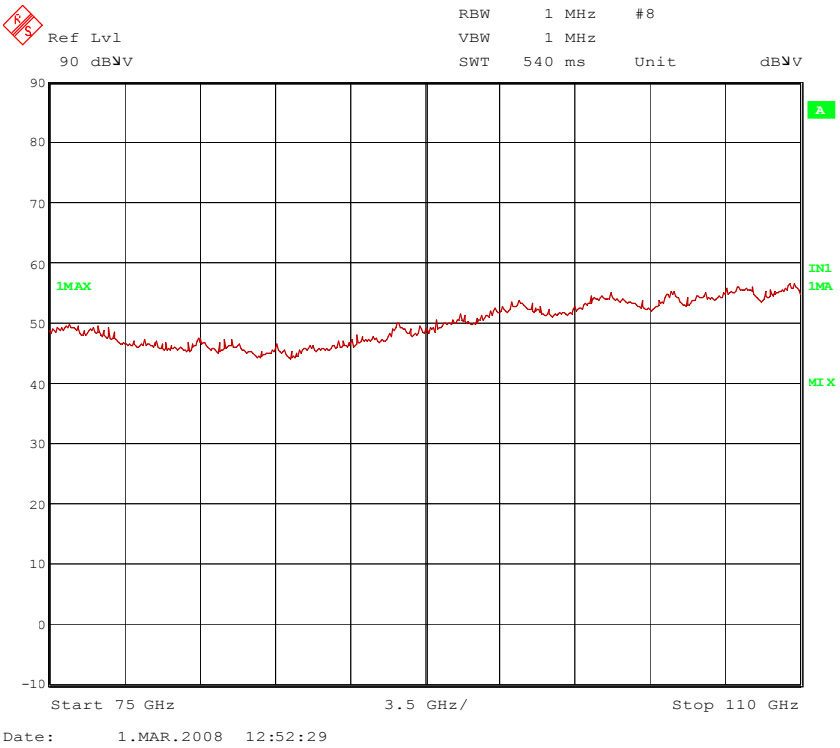
72572fcc_E8.wmf: Radiated emissions from 26.5 GHz to 40 GHz



72572fcc_E9.wmf: Radiated emissions from 40 GHz to 60 GHz



72572fcc_E10.wmf: Radiated emissions from 50 GHz to 75 GHz



72572fcc_E11.wmf: Radiated emissions from 75 GHz to 110 GHz

The following frequencies were found inside the restricted bands during the preliminary radiated emission test:

-

The following frequencies were found outside the restricted bands during the preliminary radiated emission test:

24.1754 GHz

TEST EQUIPMENT USED FOR THE TEST:

29, 31 – 36, 38, 40, 42 - 45, 49 – 52, 56 - 62

7.2 FINAL RADIATED EMISSION TEST (1 GHz to 110 GHz)

Ambient temperature	20 °C	Relative humidity	50 %

Position of EUT: The EUT was set-up on a non-conducting table of a height of 0.8 m.

Cable guide: The cable of the EUT was fixed on the non-conducting table. For further information of the cable guide refer to the pictures in annex A of this test report.

Test record: The test was carried out in normal operation mode of the EUT.

Supply voltage: The EUT was supplied by the external 12 V DC-Power-Supply.

Measured frequencies outside the restricted band:										
Frequency MHz	Result dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Cable loss dB	Preamp dB	Height cm	Pol.	Measuring distance
Results measured with the peak detector										
24.1754	108.6	148.0	39.4	89.5	36.8	2.3	-	100	Vert.	30 cm
Results measured with the average detector										
24.1754	95.6	128.0	32.4	76.5	36.8	2.3	-	100	Vert.	30 cm
Measurement uncertainty						-3.6 dB / +2.2 dB				

The test results were calculated with the following formula:

Result [dBµV/m] = reading [dBµV] + cable loss [dB] + antenna factor [dB/m] – gain of preamplifier [dB]

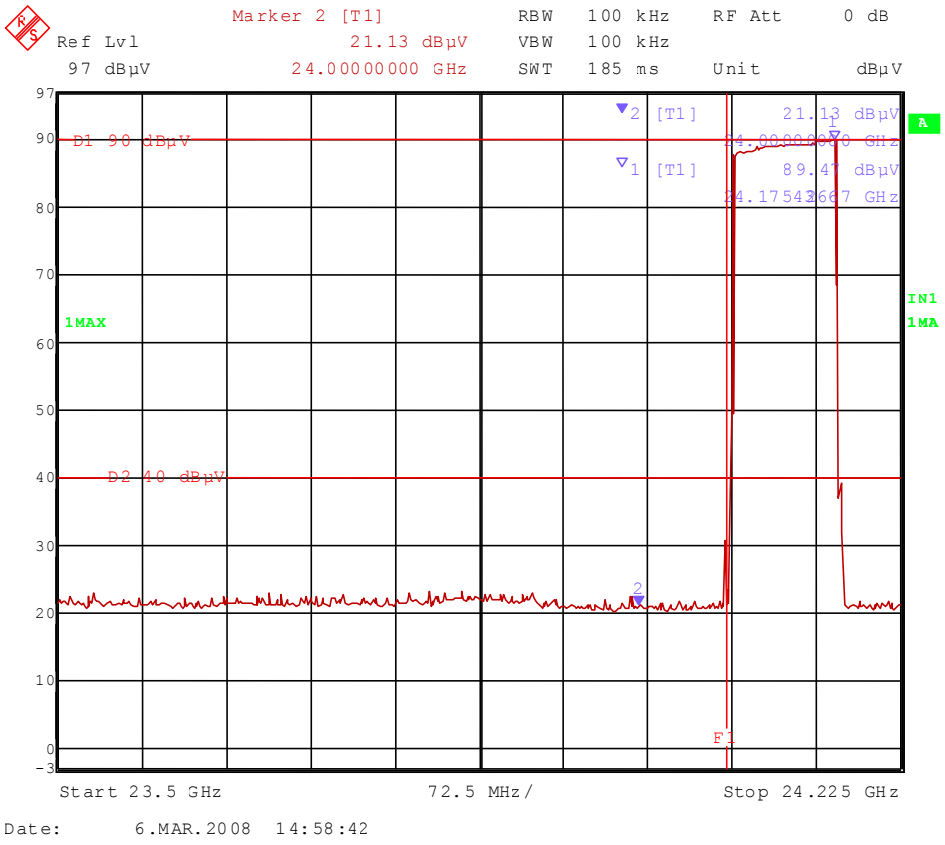
Test result: Passed

TEST EQUIPMENT USED FOR THE TEST:

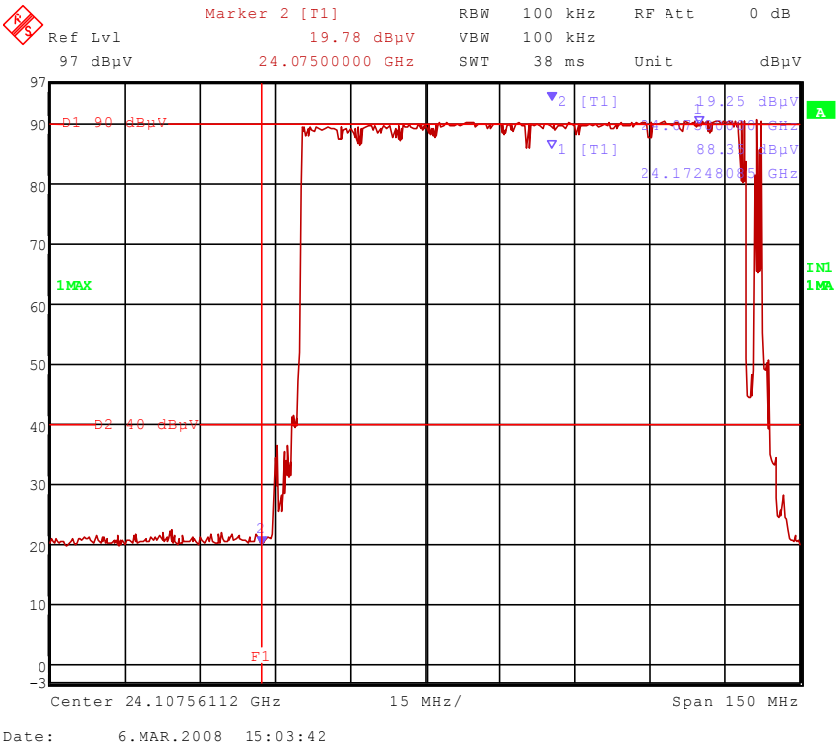
29, 31, 36, 40, 45

7.3 BAND-EDGE COMPLIANCE

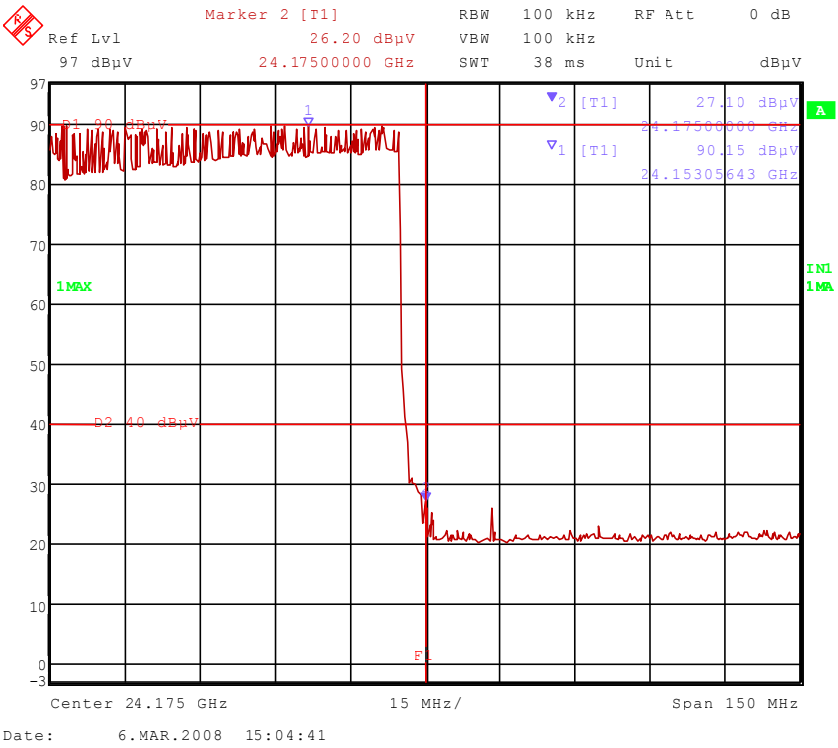
Ambient temperature	20 °C	Relative humidity	50 %



72572bec1.wmf: Band-edge compliance, lower band edge



72572bec2.wmf: Band-edge compliance, lower band edge



72572bec3.wmf: Band-edge compliance, upper band edge

The plots on the page before are showing the band-edge compliance for the lower and upper band-edge. The display line 1 (D1) in these plots represents the highest level within the assigned frequency band. The display line 2 (D2) represents the -50 dB offset to this highest level and shows the compliance with FCC 47 CFR Part 15.245 (d). The frequency line 1 (F1) shows the edge of the assigned frequency.

Band-edge compliance (lower band edge)									
Result measured with the peak detector:									
Frequency GHz	Corr. value dBµV/m	Limit (3 m) dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Corr. factor from 3 m to 30 cm	Restr. Band
24.1754	108.6	-	-	89.5	36.8	-	2.3	20 dB	no
24.0000	40.3	74.0	33.7	21.2	36.8	-	2.3	20 dB	yes
24.0750	70.1 dB down	50 dB down	20.1	19.8	36.8	-	2.3	20 dB	no
Result measured with the average detector:									
Frequency GHz	Corr. value dBµV/m	Limit (3 m) dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Corr. factor from 3 m to 30 cm	Restr. Band
24.1754	95.6	-	-	76.5	36.8	-	2.3	20 dB	no
24.0000	36.6	54.0	17.4	18.5	36.8	-	2.3	20 dB	yes
24.0750	62.0 dB down	50 dB down	12.0	15.5	36.8	-	2.3	20 dB	no
Measurement uncertainty							-3.6 dB / +2.2 dB		

Band-edge compliance (upper band edge)									
Result measured with the peak detector:									
Frequency GHz	Corr. value dBµV/m	Limit (3 m) dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Corr. factor from 3 m to 30 cm	Restr. Band
24.1742	107.4	-	-	88.3	36.8	-	2.3	20 dB	no
24.1750	61.2 dB down	50 dB down	11.2	27.1	36.8	-	2.3	20 dB	no
Result measured with the average detector:									
Frequency GHz	Corr. value dBµV/m	Limit (3 m) dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Corr. factor from 3 m to 30 cm	Restr. Band
24.1742	95.2	-	-	76.1	36.8	-	2.3	20 dB	no
24.1750	57.6 dB down	50 dB down	7.6	18.5	36.8	-	2.3	20 dB	no
Measurement uncertainty							-3.6 dB / +2.2 dB		

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

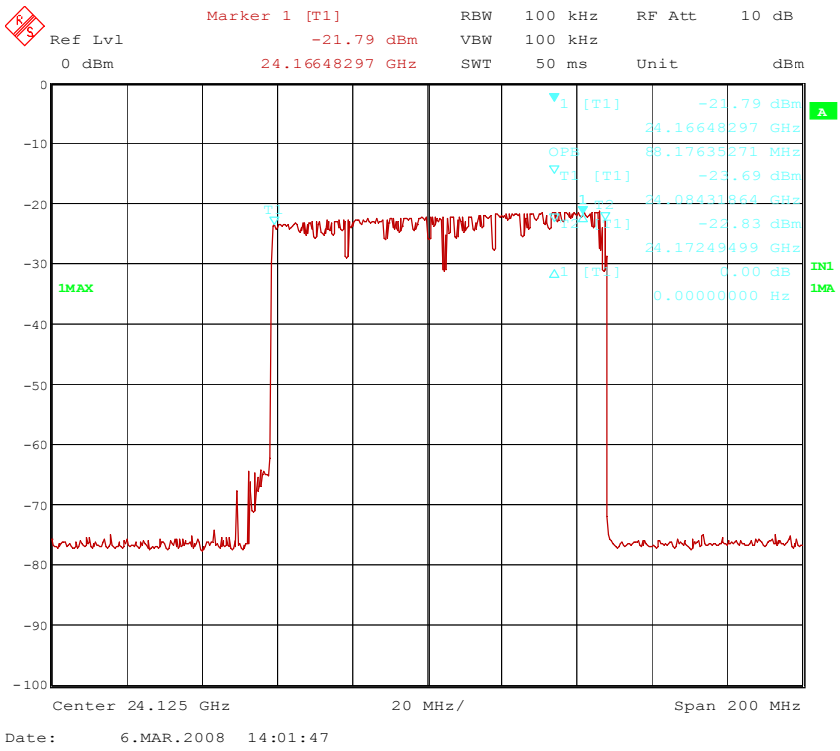
29, 31, 39, 46

7.4 20 dB BANDWIDTH WITHIN THE ASSIGNED FREQUENCY BAND

Ambient temperature:	20 °C	Relative humidity:	55 %

Position of EUT: The EUT was set-up 5 cm in front of the measuring antenna

Supply voltage: During all measurements the EUT was supplied by an external 12 V DC-Power-Supply.



F_L	F_U	BW (F_U - F_L)
24.084318 GHz	24.172495 GHz	88.176 MHz
Measurement uncertainty		$< \pm 1*10^{-7}$

Test: Passed

TEST EQUIPMENT USED THE TEST:

1, 31, 42, 45, 51

8 TEST EQUIPMENT AND ANCILLARIES USED FOR TESTS

Emission measurement at AC mains and DC in / out ports at M4					
No.	Test equipment	Type	Manufacturer	Serial No.	PM-No
1	Shielded chamber M4	-	Siemens	B83117S1-X158	480088
2	Measuring receiver	ESAI	Rohde & Schwarz	831953/001 833181/018	480025 480026
3	LISN	NSLK8128	Schwarzbeck	8128155	480058
4	DC-filter	B84266-A21-E13	Siemens	940164525	480099
5	AC-filter	B84299-D87-E3	Siemens	930262292	480097
6	EMI-Software	ES-K1	Rohde & Schwarz	-	480111

Radiated emission measurement at M5					
No.	Test equipment	Type	Manufacturer	Serial No.	PM-No
7	Fully anechoic chamber M5	-	Siemens	B83177-S1-X156	480073
8	Measuring receiver	ESVS30	Rohde & Schwarz	829673/012	480024
9	Controller	HD100	Deisel	100/324	480067
10	Antenna support	MA240	Deisel	228/314	480069
11	Turntable	DS412	Deisel	412/317	480070
12	Antenna	CBL6112C	Chase	2689	480327
13	EMI Software	ES-K1	Rohde & Schwarz	-	480111

Radiated emission measurement at M6					
No.	Test equipment	Type	Manufacturer	Serial No.	PM-No
14	Open area test site	-	Phoenix Test-Lab	-	480085
15	Measuring receiver	ESVS30	Rohde & Schwarz	829673/012	480024
16	Controller	HD100	Deisel	100/670	480139
17	Turntable	DS420HE	Deisel	420/620/80	480087
18	Antenna support	AS615P	Deisel	615/310	480086
19	Antenna	CBL6111 A	Chase	1643	480147
20	EMI Software	ES-K1	Rohde & Schwarz	-	480111

Radiated emission measurement at M8					
No.	Test equipment	Type	Manufacturer	Serial No.	PM-No
21	Fully anechoic chamber M8	-	Siemens	B83117-E7019-T231	480190
22	Measuring receiver	ESMI	Rohde & Schwarz	843977/001 843530/018	480179 480180
23	Measuring receiver	ESCS 30	Rohde & Schwarz	828985/014	480270
24	Controller	HD100	Deisel	100/427	480181
25	Turntable	DS420	Deisel	420/435/97	480186
26	Antenna support	AS615P	Deisel	615/310	480187
27	Antenna	CBL6112 A	Chase	2034	480185
28	EMI Software	ES-K1	Rohde & Schwarz	-	480111
Radiated emission measurement at M20					
No.	Test equipment	Type	Manufacturer	Serial No.	PM-No
29	Fully anechoic chamber M20	-	Albatross Projects	B83107-E2439-T232	480303
30	Measuring receiver	ESMI	Rohde & Schwarz	843977/001 843530/018	480179 480180
31	Measuring receiver	ESI 40	Rohde & Schwarz	100064	480355
32	Controller	HD100	Deisel	100/670	480326
33	Turntable	DS420HE	Deisel	420/620/80	480315
34	Antenna support	AS615P	Deisel	615/310	480187
35	Antenna	CBL6112 B	Chase	2688	480328
36	Antenna	3115 A	EMCO	9609-4918	480183
37	Standard Gain Horn 11.9 GHz – 18 GHz	18240-20	Flann Microwave	483	480294
38	Standard Gain Horn 11.9 GHz – 18 GHz	18240-20	Flann Microwave	482	480295
39	Standard Gain Horn 17.9 GHz – 26.7 GHz	20240-20	Flann Microwave	411	480297
40	Standard Gain Horn 17.9 GHz – 26.7 GHz	20240-20	Flann Microwave	410	480296
41	Standard Gain Horn 26.4 GHz – 40.1 GHz	22240-20	Flann Microwave	469	480299

No.	Test equipment	Type	Manufacturer	Serial No.	PM-No
42	Standard Gain Horn 26.4 GHz – 40.1 GHz	22240-20	Flann Microwave	468	480298
43	RF-cable No. 30	RTK 081	Rosenberger	-	410141
44	RF-cable No. 31	RTK 081	Rosenberger	-	410142
45	RF-cable 1m	KPS-1533-400-KPS	Insulated Wire	-	480300
46	RF-cable 1m	KPS-1533-400-KPS	Insulated Wire	-	480301
47	RF-cable 2m	KPS-1533-400-KPS	Insulated Wire	-	480302
48	RF-cable No. 5	RTK 081	Rosenberger		410097
49	Preamplifier	JS3-00101200-23-5A	Miteq	681851	480337
50	Preamplifier	JS3-12001800-16-5A	Miteq	571667	480343
51	Preamplifier	JS3-18002600-20-5A	Miteq	658697	480342
52	Preamplifier	JS3-26004000-25-5A	Miteq	563593	480344
53	EMI Software	ES-K1	Rohde & Schwarz	-	480111
54	Standard Gain Horn 8.2 - 12.5 GHz	16240-20	Flann Microwave	135671	480513
55	Standard Gain Horn 33 GHz - 55 GHz	23240-20	Flann Microwave	122391	480483
56	Standard Gain Horn 40 GHz – 60 GHz	24240-20	Flann Microwave	133313	
57	Harmonic Mixer 40…60 GHz	FS-Z60	Rohde&Schwarz	100071	480481
58	Standard Gain Horn 50 GHz – 75 GHz	25240-20	Flann Microwave	135181	
59	Harmonic Mixer 50…75 GHz	FS-Z75	Rohde&Schwarz	100045	480480
60	Standard Gain Horn 75 GHz – 110 GHz	27240-20	Flann Microwave	132148	
61	Harmonic Mixer 75…110 GHz	FS-Z110	Rohde&Schwarz	100049	480482

No.	Test equipment	Type	Manufacturer	Serial No.	PM-No
62	RF-cable 1m	2JS-1401-400-2PS	Insulated Wire	-	480486
63	Microwave System Amplifier 0.5 to 26.5 GHz	83017A	Agilent	MY39500630	480488
64	Power Supply	87421A	Agilent	MY44350236	-
65	50 to 75 GHz mm Wave Source Module	83557A	Agilent	MY39420013	480485
66	Standard Gain Horn 50 GHz – 75 GHz	25240-20	Flann Microwave	135180	-
67	75 to 110 GHz mm Wave Source Module	83558A	Agilent	MY39420016	480484
68	Standard Gain Horn 75 GHz – 110 GHz	27240-20	Flann Microwave	138294	-
69	Microwave-Cable	-	Rohde&Schwarz	-	480487

Ancillary equipment used for testing					
No.	Test equipment	Type	Manufacturer	Serial No.	PM-No
70	RF-cable No. 10	RG223	Phoenix-Test-Lab	-	410102
71	Test fixture	-	Phoenix Test-Lab	-	410160
72	Loop antenna	HFH2-Z2	Rohde & Schwarz	832609/014	480059
73	Sampling Oscilloscope	TDS784D	Tektronix	B022158	480393
-	-	-	-	-	-

All used measurement equipment was calibrated (if necessary). The calibration intervals and the calibration history will be given out on request.

9 LIST OF ANNEXES

ANNEX A	**PHOTOGRAPHS OF THE TEST SET-UPS**:	**4 pages**
	Test set-up preliminary radiated H-Field	72572emi2.jpg
	Test set-up preliminary radiated E-Field	72572emi4.jpg
	Test set-up preliminary radiated E-Field	72572emi10.jpg
	Test set-up climatic chamber	72572clima2.jpg
ANNEX B	**EXTERNAL PHOTOGRAPHS OF THE TEST SAMPLE**:	**3 pages**
	EUT, 3 D-view	72572eut2_1.jpg
	EUT, 3 D-view	72572eut2_2.jpg
	EUT, connector	72572eut2_3.jpg
ANNEX C	**INTERNAL PHOTOGRAPHS OF THE TEST SAMPLE**:	**6 pages**
	EUT, controller board (master)	72572bmw_master.jpg
	EUT, controller board (slave)	72572bmw_slave.jpg
	EUT, controller board (master or slave)	72572control2.jpg
	EUT, inside view	72572ant1.jpg
	EUT, RF-PCB, front-view	72572eut5.jpg
	EUT, RF-PCB, rear-view	72572eut7.jpg
ANNEX D	**ADDITIONAL MEASUREMENT RESULTS FOR IC**:	**2 pages**