



Inter**Lab**<sup>®</sup>

FCC Measurement/Technical Report on

Bluetooth transceiver

Bluetooth Car Kit

HCB-108 / DEA-0002007

**Report Reference:** MDE\_SE\_0809\_FCCb

**Test Laboratory:**

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DAT-P-192/99-01

**Note:**

The following test results relate only to the devices specified in this document. This report shall not be reproduced in parts without the written approval of the testing laboratory.

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## **0 Summary**

### **0.1 Technical Report Summary**

#### **Type of Authorization**

Certification for an Unintentional Radiator (Class B digital device)

#### **Applicable FCC Rules**

Prepared in accordance with the requirements of FCC Rules and Regulations as listed in 47 CFR Ch.1 Parts 2 (10-1-07 Edition) and 15 (10-1-07 Edition). The following subparts are applicable to the results in this test report.

Part 2, Subpart J - Equipment Authorization Procedures, Certification

Part 15, Subpart A – General

§ 15.31 Measurement standards

§ 15.33 Frequency range of radiated measurements

Part 15, Subpart B – Unintentional Radiators

§ 15.101 Equipment authorization of unintentional radiators

§ 15.107 Conducted limits

§ 15.109 Radiated emission limits

#### **Note:**

None.

#### **Summary Test Results:**

**The EUT complied with all performed tests as listed in chapter 0.2 Measurement Summary.**

## 0.2 Measurement Summary

### FCC Part 15, Subpart B § 15.107

Conducted Emissions (AC power line)			
The measurement was performed according to ANSI C63.4			
<b>OP-Mode</b>	<b>Setup</b>	<b>Port</b>	<b>2003 Final Result</b>
op-mode 5	Setup_01	AC Port (power line)	passed

### FCC Part 15, Subpart B § 15.109

Spurious Radiated Emissions			
The measurement was performed according to ANSI C63.4			
<b>OP-Mode</b>	<b>Setup</b>	<b>Port</b>	<b>2003 Final Result</b>
op-mode 5	Setup_01	Enclosure	passed
op-mode 5	Setup_02	Enclosure	passed



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Responsible for  
Accreditation Scope:

B. Puth

Responsible  
for Test Report:

Machulec



## 1 Administrative Data

### 1.1 Testing Laboratory

Company Name: 7 Layers AG  
Address Borsigstr. 11  
40880 Ratingen  
Germany

This facility has been fully described in a report submitted to the FCC and accepted under the registration number 96716.

The test facility is also accredited by the following accreditation organisation:  
- Deutscher Akkreditierungs Rat DAR-Registration no. DAT-P-192/99-01

Responsible for Accreditation Scope: Dipl.-Ing. Bernhard Retka  
Dipl.-Ing. Robert Machulec  
Dipl.-Ing. Thomas Hoell  
Dipl.-Ing. Andreas Petz

Report Template Version: 2008-08-06

### 1.2 Project Data

Responsible for testing and report: Dipl.-Ing. Robert Machulec  
Date of Test(s): 2008-07-28 to 2008-08-13  
Date of Report: 2008-08-27

### 1.3 Applicant Data

Company Name: Sony Ericsson Mobile Communication AB  
Address: Torshamnsgatan 27  
SE-164 94 Kista  
Sweden  
Contact Person: Mr. Lennart Skoglund

### 1.4 Manufacturer Data

Company Name: Sony Ericsson Mobile Communication AB  
Address: Nya Vattentornet  
SE-221 88 Lund  
Sweden  
Contact Person: Mr. Peter Lindeborg



## **2 Product labelling**

### **2.1 FCC ID label**

At the time of the report there was no FCC label available.

### **2.2 Location of the label on the EUT**

see above

### 3 Test object Data

#### 3.1 General EUT Description

<b>Equipment under Test</b>	Bluetooth transceiver
<b>Type Designation:</b>	HCB-108 / DEA-0002007
<b>Kind of Device:</b>	Bluetooth Car Kit
<b>(optional)</b>	
<b>Voltage Type:</b>	AC / DC (car charger) / DC (internal battery)
<b>Voltage level:</b>	115 V / 12 V / 3.7 V
<b>Modulation Type:</b>	GFSK, 8DPSK, $\pi/4$ DQPSK
<b>FCC ID:</b>	PY7DEA-2007

#### General product description:

Bluetooth is a short-range radio link intended to be a cable replacement between portable and/or fixed electronic devices.

Bluetooth operates in the unlicensed ISM Band at 2.4 GHz. In the US a band of 83.5 MHz width is available. In this band, the Bluetooth technology defines 79 RF channels spaced 1 MHz (2402 - 2480 MHz). The actual RF channel is chosen from a pseudo-random hopping sequence through the 79 channels. A channel is occupied for a defined amount of time slots, with a nominal slot length of 625  $\mu$ s. The maximum dwell time on one channel is defined by the packet type and is 0.625 ms for DH1 packets, 1.875 ms for DH3 and 3.125 ms for DH5. The nominal hop rate is 1600 hops/s for DH1, 1600/3 for DH3 and 1600/5 for DH5. All frequencies are equally used. The maximum nominal average time of occupancy is 0.4 s within a period of 79\*0.4 seconds.

The basic data rate of 1 Mbps uses GFSK modulation and the enhanced data rate uses PSK modulation. For the enhanced data rate of 3 Mbps 8DPSK modulation and of 2 Mbps  $\pi/4$  DQPSK modulation is used.

#### Specific product description for the EUT:

The EUT is a handsfree which uses Bluetooth technology to be connected to e.g. a mobile phone. The EUT is automatically switched off during charging.

#### The EUT provides the following ports:

##### Ports

Enclosure  
DC Port (DC power input)

**The main components of the EUT are listed and described in Chapter 3.2**



### 3.2 EUT Main components

#### Type, S/N, Short Descriptions etc. used in this Test Report

Short Description	Equipment under Test	Type Designation	Serial No.	HW Status	SW Status	Date of Receipt
EUT A (Code: 13210b01)	Bluetooth transceiver	HCB-108 / DEA- 0002007	0029	AP1.2	BHC892_RC _20080718- 01-7657	2008-07-28
Remark: The EUT is equipped with an integral antenna (gain = -2 dBi)						

**NOTE:** The short description is used to simplify the identification of the EUT in this test report.

### 3.3 Ancillary Equipment

For the purposes of this test report, ancillary equipment is defined as equipment which is used in conjunction with the EUT to provide operational and control features to the EUT. It is necessary to configure the system in a typical fashion, as a customer would normally use it. But nevertheless Ancillary Equipment can influence the test results.

Short Description	Equipment under Test	Type Designation	Serial no.	HW Status	SW Status	FCC ID
AE1	Battery	BST-38 / CBA- 0002008	566860SWM ANM 08W17	-	-	-
AE2	AC Travel Charger	CST-60 / CAA- 0002002-BV	458B 06W03	R3A	-	-
AE3	DC Vehicular Charger	CLA-61 / CAA- 0002006	458B 07W01	FP1	-	-

### 3.4 EUT Setups

This chapter describes the combination of EUTs and ancillary equipment used for testing.

Setup No.	Combination of EUTs	Description
Setup_01	EUT A + AE1 + AE2	setup for measurements with AC supply
Setup_02	EUT A + AE1 + AE3	setup for measurements with DC supply

### 3.5 Operating Modes

This chapter describes the operating modes of the EUTs used for testing.

Op. Mode	Description of Operating Modes	Remarks
op-mode 5	Tx standby, RX on	EUT is powered and charging the internal battery





## 4 Test Results

### 4.1 Conducted emissions (AC power line)

**Standard** FCC Part 15, 10-1-07  
Subpart B

**The test was performed according to:** ANSI C 63.4, 2003

#### 4.1.1 Test Description

The test set-up was made in accordance to the general provisions of ANSI C 63.4-2003. The Equipment Under Test (EUT) was setup in a shielded room to perform the conducted emissions measurements in a typical installation configuration. The EUT was powered from 50 $\mu$ H || 50 Ohm Line Impedance Stabilization Network (LISN). The LISN's unused connections were terminated with 50 Ohm loads.

The measurement procedure consists of two steps. It is implemented into the EMI test software ES-K1 from R&S.

##### Step 1: Preliminary scan

Intention of this step is, to determine the conducted EMI-profile of the EUT.

EMI receiver settings:

- Detector: Peak - Maxhold
- Frequency range: 150 kHz – 30 MHz
- Frequency steps: 5 kHz
- IF-Bandwidth: 9 kHz
- Measuring time / Frequency step: 20 ms
- Measurement on phase + neutral lines of the power cords

On basis of this preliminary scan the highest amplitudes and the corresponding frequencies relative to the limit are identified. Emissions above the limit and emissions which are in the 10 dB range below the limit are considered.

##### Step 2: Final measurement

Intention of this step is, to determine the highest emissions with the settings defined in the test specification for the frequencies identified in step 1.

EMI receiver settings:

- Detector: Quasi-Peak
- IF - Bandwidth: 9 kHz
- Measuring time: 1 s / frequency

At each frequency determined in step 1, four measurements are performed in the following combinations:

- 1) Neutral lead - reference ground (PE grounded)
- 2) Phase lead - reference ground (PE grounded)
- 3) Neutral lead - reference ground (PE floating)
- 4) Phase lead - reference ground (PE floating)

The highest value is reported.



#### 4.1.2 Test Requirements / Limits

FCC Part 15, Subpart B, §15.107

Frequency Range (MHz)	QP Limit (dBµV)	AV Limit (dBµV)
0.15 – 0.5	66 to 56	56 to 46
0.5 – 5	56	46
5 – 30	60	50

Used conversion factor: Limit (dBµV) = 20 log (Limit (µV)/1µV).

#### 4.1.3 Test Protocol

Temperature: 25 °C  
 Air Pressure: 1019 hPa  
 Humidity: 56 %

Op. Mode	Setup	Port
op-mode 5	Setup_01	AC Port (power line)

Power line	Frequency MHz	Measured value dBµV	Delta to limit dBµV	Remarks
N	0.24	47.50	14.6	-

Remark: Please see annex for the measurement plot.

#### 4.1.4 Test result: Conducted emissions (AC power line)

FCC Part 15, Subpart B	Op. Mode	Result
	op-mode 5	passed

## 4.2 Spurious radiated emissions

**Standard** FCC Part 15, 10-1-07  
Subpart B

**The test was performed according to:** ANSI C 63.4, 2003

### 4.2.1 Test Description

#### Measurement below 1 GHz:

The test set-up was made in accordance to the general provisions of ANSI C 63.4-2003. The Equipment Under Test (EUT) was set up on a non-conductive table 1.0 x 2.0 m in the semi-anechoic chamber. The test was performed at the distance of 3 m between the EUT and the receiving antenna.

The radiated emissions measurements were made in a typical installation configuration. The measurement procedure is implemented into the EMI test software ES-K1 from R&S.

**Step 1:** Preliminary scan (test to identify the highest amplitudes relative to the limit)

Intention of this step is, to determine the radiated EMI-profile of the EUT.

Settings for step 1:

- Detector: Peak-Maxhold
- Frequency range: 30 – 1000 MHz
- Frequency steps: 60 kHz
- IF-Bandwidth: 120 kHz
- Measuring time / Frequency step: 100  $\mu$ s
- Turntable angle range:  $-180^{\circ}$  to  $180^{\circ}$
- Turntable step size:  $90^{\circ}$
- Height variation range: 1 – 3 m
- Height variation step size: 2 m
- Polarisation: Horizontal + Vertical

On basis of this preliminary scan the highest amplitudes and the corresponding frequencies relative to the limit are identified. Emissions above the limit and emissions which are in the 10 dB range below the limit are considered.

#### Step 2:

A further measurement will be performed on the frequencies determined in step 1.

Intention of this step is, to find out the approximate turntable angle and antenna height for each frequency.

Settings for step 2:

- Detector: Peak – Maxhold
- Measured frequencies: in step 1 determined frequencies
- IF – Bandwidth: 120 kHz
- Measuring time: 100 ms
- Turntable angle range:  $-180^{\circ}$  to  $180^{\circ}$
- Turntable step size:  $45^{\circ}$
- Height variation range: 1 – 4 m
- Height variation step size: 0.5 m
- Polarisation: horizontal + vertical

After this step the EMI test system has determined the following values for each frequency (of step 1):

- Frequency
- Azimuth value (of turntable)
- Antenna height

The last two values have now the following accuracy:

- Azimuth value (of turntable):  $45^{\circ}$
- Antenna height: 0.5 m



**Step 3: final measurement**

In this step the accuracy of the turntable azimuth and antenna height will be improved. This is necessary to find out the maximum value of every frequency.

For each frequency, which was determined the turntable azimuth and antenna height will be adjusted. The turntable azimuth will be slowly varied by +/- 22.5° around this value. During this action the value of emission is continuously measured. The turntable azimuth at the highest emission will be recorded and adjusted. In this position the antenna height is also slowly varied by +/- 25 cm around the antenna height determined. During this action the value of emission is also continuously measured. The antenna height of the highest emission will also be recorded and adjusted.

- Detector: Peak – Maxhold
- Measured frequencies: in step 1 determined frequencies
- IF – Bandwidth: 120 kHz
- Measuring time: 100ms
- Turntable angle range: -22.5° to + 22.5 ° around the determined value
- Height variation range: -0.25m to + 0.25m around the determined value

**Step 4: Final measurement (with QP detector)**

With the settings determined in step 3, the final measurement will be performed:

EMI receiver settings for step 4:

- Detector: Quasi-Peak(< 1GHz)
- Measured frequencies: in step 3 determined frequencies
- IF – Bandwidth: 120 kHz
- Measuring time: 1 s

**Measurement above 1 GHz:**

The following modifications apply to the measurement procedure for the frequency range above 1 GHz:

The measurement distance was reduced to 1 m. The results were extrapolated by the extrapolation factor of 20 dB/decade (inverse linear-distance for field strength measurements, inverse-linear-distance-squared for the power density measurements).

Due to the fact that in this frequency range a double ridged wave guided horn antenna (up to 18 GHz) and a horn antenna (18–25 GHz) are used, the steps 2-4 as described before, are omitted. Step 1 was performed at one height of the receiving antenna only.

Detector: Peak, Average (simultaneously)  
RBW = VBW = 1 MHz; above 7 GHz 100 kHz

**4.2.2 Test Requirements / Limits**

FCC Part 15, Subpart B, §15.109, Radiated Emission Limits  
Frequency Range (MHz): Class B Limit (dBµV/m)

Frequency Range (MHz)	Class B Limit (dBµV/m)
30 – 88	40.0
88 – 216	43.5
216 – 960	46.0
above 960	54.0

§15.35(b)

..., there is also a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit....

Used conversion factor: Limit (dBµV/m) = 20 log (Limit (µV/m)/1µV/m)



### 4.2.3 Test Protocol

Temperature: 29 °C  
 Air Pressure: 1017 hPa  
 Humidity: 51 %

Op. Mode	Setup	Port
op-mode 5	Setup_01	Enclosure

Polarisation	Frequency MHz	Corrected value dBµV/m			Limit dBµV/m	Limit dBµV/m	Limit dBµV/m	Delta to limit dB	Delta to limit dB
		QP	Peak	AV	QP	Peak	AV	QP/Peak	AV
Vertical + horizontal	36.90	30.8	-	-	40.0	-	-	9.2	-
	37.62	25.8	-	-	40.0	-	-	14.2	-
	39.00	28.3	-	-	40.0	-	-	11.7	-
	39.96	27.9	-	-	40.0	-	-	12.1	-
	103.98	33.5	-	-	43.5	-	-	10.0	-

Remark: Please see annex for the measurement plot.  
 The measurement was performed up to 12.75 GHz.  
 For tests above 1 GHz spurious emissions in the range 20 dB below the limit are reported.

Op. Mode	Setup	Port
op-mode 5	Setup_02	Enclosure

Polarisation	Frequency MHz	Corrected value dBµV/m			Limit dBµV/m	Limit dBµV/m	Limit dBµV/m	Delta to limit dB	Delta to limit dB
		QP	Peak	AV	QP	Peak	AV	QP/Peak	AV
Vertical + horizontal	37.32	32.1	-	-	40.0	-	-	7.9	-

Remark: Please see annex for the measurement plot.  
 The measurement was performed up to 12.75 GHz.  
 For tests above 1 GHz spurious emissions in the range 20 dB below the limit are reported.

### 4.2.4 Test result: Spurious radiated emissions

FCC Part 15, Subpart B	Op. Mode	Result
	op-mode 5	passed

## 5 Test Equipment

### *EUT Digital Signalling System*

<b>Equipment</b>	<b>Type</b>	<b>Serial No.</b>	<b>Manufacturer</b>	<b>Cal data</b>	<b>Next cal</b>
Digital Radio Communication Tester	CMD 55	831050/020	Rohde & Schwarz	01.12.05	01.12.08
Signalling Unit for Bluetooth	PTW60	100004	Rohde & Schwarz	-	-
Universal Radio Communication Tester	CMU200	102366	Rohde & Schwarz	22.09.07	22.09.09

### *EMI Test System*

<b>Equipment</b>	<b>Type</b>	<b>Serial No.</b>	<b>Manufacturer</b>	<b>Cal data</b>	<b>Next cal</b>
Comparison Noise Emitter	CNE III	99/016	York	-	-
EMI Analyzer	ESI 26	830482/004	Rohde & Schwarz	06.12.07	06.12.09
Signal Generator	SMR 20	846834/008	Rohde & Schwarz	05.12.07	05.12.09
AC Power Source	6404	64040000B04	Croma ATE INC.	01.06.08	N/A the parameters will be checked before testing

### *EMI Radiated Auxiliary Equipment*

<b>Equipment</b>	<b>Type</b>	<b>Serial No.</b>	<b>Manufacturer</b>	<b>Cal data</b>	<b>Next cal</b>
Antenna mast 4m	MA 240	240/492	HD GmbH H. Deisel	-	-
Biconical dipole	VUBA 9117	9117108	Schwarzbeck	02.07.03	06.10.08
Broadband Amplifier 18MHz-26GHz	JS4-18002600-32	849785	Miteq	06.02.08	06.10.08
Broadband Amplifier 30MHz-18GHz	JS4-00101800-35	896037	Miteq	06.02.08	06.10.08
Broadband Amplifier 45MHz-27GHz	JS4-00102600-42	619368	Miteq	06.02.08	06.10.08
Cable "ESI to EMI Antenna"	EcoFlex10	W18.01-2 W38.01-2	Kabel Kusch	06.02.08	06.10.08
Cable "ESI to Horn Antenna"	UFB311A UFB293C	W18.02-2 W38.02-2	Rosenberger-Microcoax	06.02.08	06.10.08
Double-ridged horn	HF 906	357357/002	Rohde & Schwarz	12.05.06	06.10.08
Double-ridged horn	HF 906	357357/001	Rohde & Schwarz	20.01.04	N/A – spare antenna
High Pass Filter	5HC3500/12750-1.2-KK	200035008	Trilithic	06.02.08	06.10.08
High Pass Filter	5HC2700/12750-1.5-KK	9942012	Trilithic	06.02.08	06.10.08
High Pass Filter	4HC1600/12750-1.5-KK	9942011	Trilithic	06.02.08	06.10.08
Log.-per. Antenna	HL 562 UltraLog	830547/003	Rohde & Schwarz	17.05.06	17.05.09
Loop Antenna	HFH2-Z2	829324/006	Rohde & Schwarz	19.08.02	N/A – only used for pre-testing
Pyramidal Horn Antenna 26.5 GHz	Model 3160-09	9910-1184	EMCO	06.02.08	06.10.08

### EMI Conducted Auxiliary Equipment

Equipment	Type	Serial No.	Manufacturer	Cal data	Next cal
Cable "LISN to ESI"	RG214	W18.03+W48.03	Huber+Suhner	06.02.08	06.10.08
Two-Line V-Network	ESH 3-Z5	828304/029	Rohde & Schwarz	01.11.05	01.11.08
Two-Line V-Network	ESH 3-Z5	829996/002	Rohde & Schwarz	-	-

### Auxiliary Test Equipment – calibration not applicable; spare equipment

Equipment	Type	Serial No.	Manufacturer	Cal data	Next cal
Broadband Resist. Power Divider N	1506A / 93459	LM390	Weinschel	-	-
Broadband Resist. Power Divider SMA	1515 / 93459	LN673	Weinschel	-	-
Digital Multimeter 01	Voltcraft M-3860M	IJ096055	Conrad	-	-
Digital Multimeter 02	Voltcraft M-3860M	IJ095955	Conrad	-	-
Digital Oscilloscope	TDS 784C	B021311	Tektronix	-	-
Fibre optic link Satellite	FO RS232 Link	181-018	Pontis	-	-
Fibre optic link Transceiver	FO RS232 Link	182-018	Pontis	-	-
I/Q Modulation Generator	AMIQ-B1	832085/018	Rohde & Schwarz	-	-
Notch Filter ultra stable	WRCA800 /960-6E	24	Wainwright	-	-
Spectrum Analyzer 9 kHz to 3 GHz	FSP3	838164/004	Rohde & Schwarz	-	-
Temperature Chamber	VT 4002	58566002150010	Vötsch	-	-
Temperature Chamber	KWP 120/70	59226012190010	Weiss	-	-
ThermoHygro Datalogger 03	Opus10 THI (8152.00)	7482	Lufft Mess- und Regeltechnik GmbH	-	-

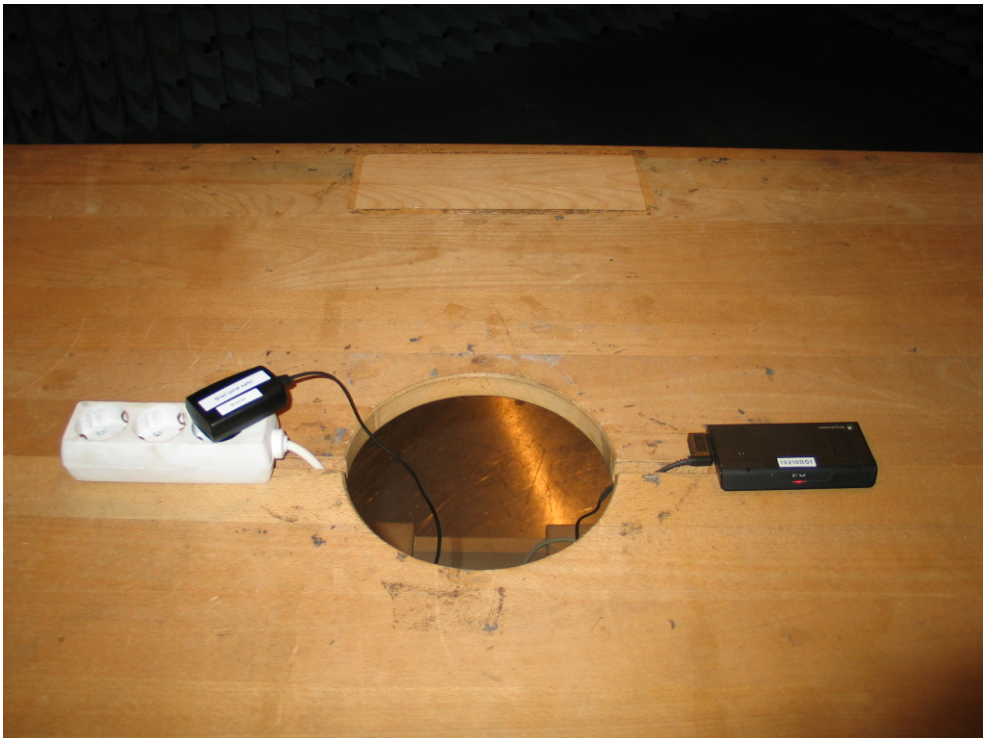
### Anechoic Chamber – calibration not applicable

Equipment	Type	Serial No.	Manufacturer	Cal data	Next cal
Air Compressor (pneumatic)			Atlas Copco	-	-
Controller	CO 2000	CO2000/328/12470406/L	Innco innovative constructions GmbH	-	-
EMC Camera	CE-CAM/1		CE-SYS	-	-
EMC Camera for observation of EUT	CCD-400E	0005033	Mitsubishi	-	-
Filter ISDN	B84312-C110-E1		Siemens & Matsushita	-	-
Filter telephone systems / modem	B84312-C40-B1		Siemens & Matsushita	-	-
Filter Universal 1A	B84312-C30-H3		Siemens & Matsushita	-	-
Fully/Semi AE Chamber	10.58x6.3 8x6		Frankonia	-	-
Turntable	DS 420S	420/573/99	HD GmbH, H.Deisel	-	-
Valve Control Unit (pneum.)	VE 615P	615/348/99	HD GmbH, H.Deisel	-	-

## Photo Report

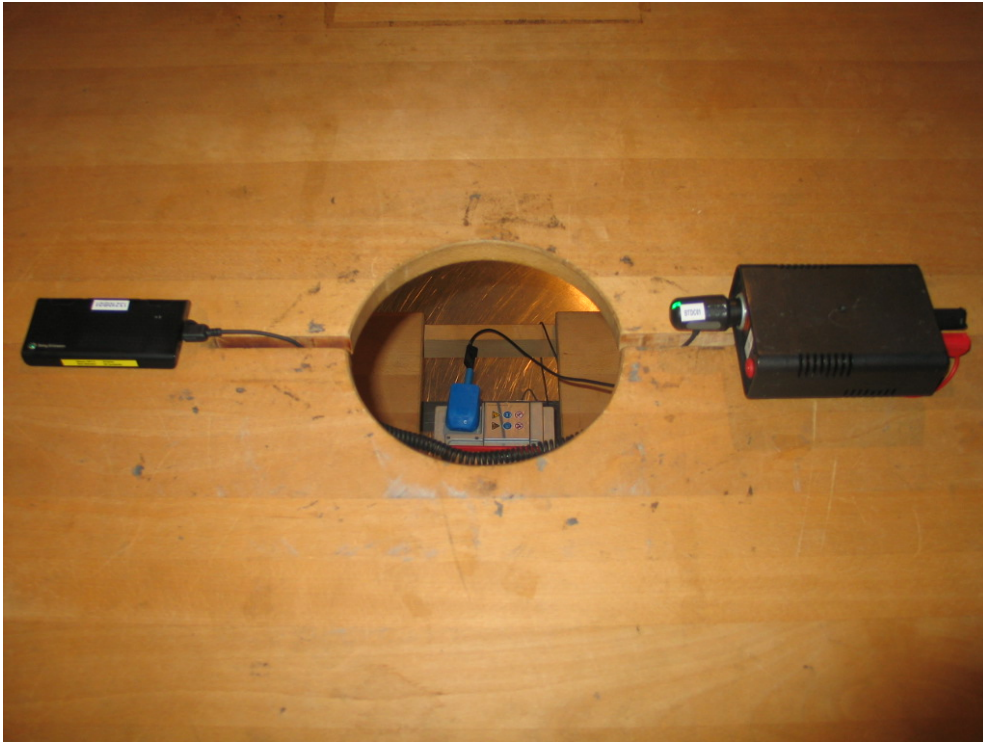


**Photo 1:** Test setup for conducted measurements at AC port (setup\_01 AC)

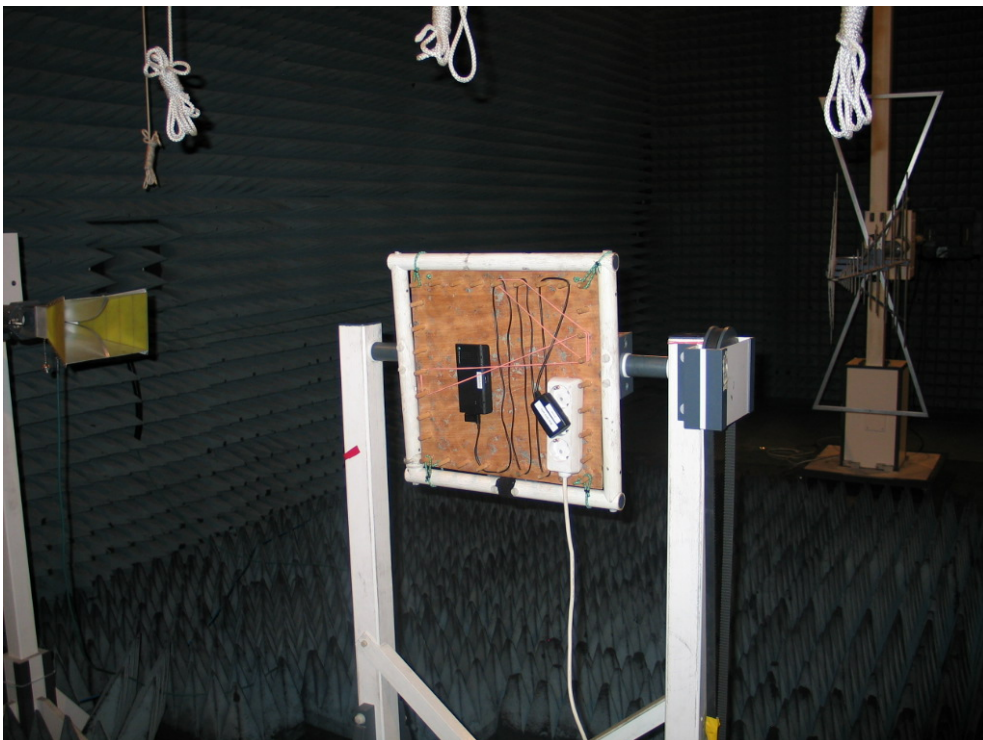


**Photo 2:** Test setup for radiated measurements below 1GHz (setup\_01 AC)

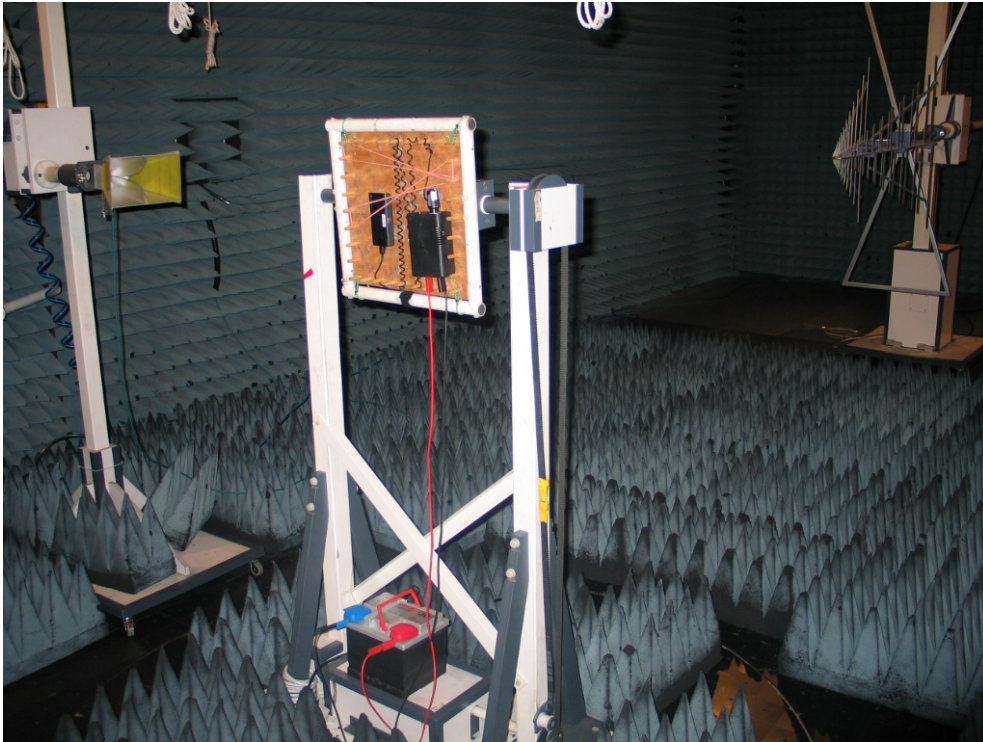




**Photo 3:** Test setup for radiated measurements below 1GHz (setup\_02 DC)

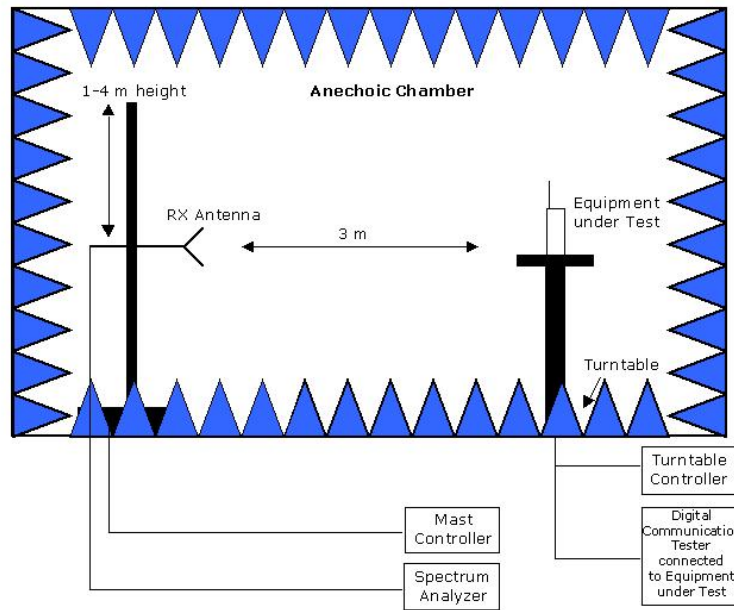


**Photo 4:** Test setup for radiated measurements above 1GHz (setup\_01 AC)



**Photo 5:** Test setup for radiated measurements above 1GHz (setup\_02 DC)

## 6 Setup Drawings



Remark: Depending on the frequency range suitable antenna types, attenuators or preamplifiers are used.

**Drawing 1:** Setup in the Anechoic chamber. For measurements below 1 GHz the ground was replaced by a conducting ground plane.

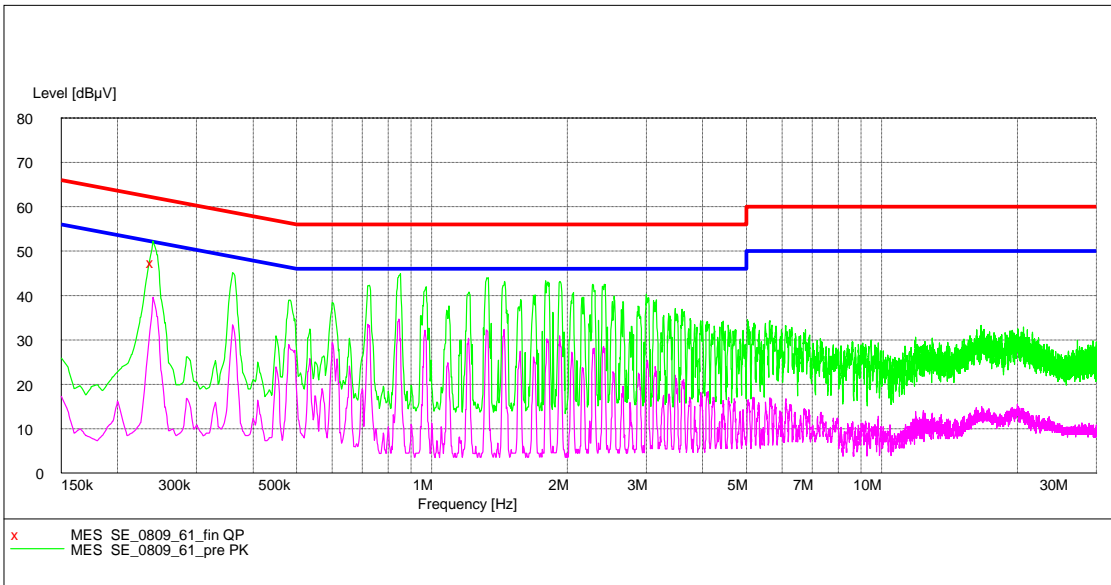
## 7 Annex measurement plots

### 7.1 AC Mains conducted

#### Op. Mode

op-mode 5      Setup 1

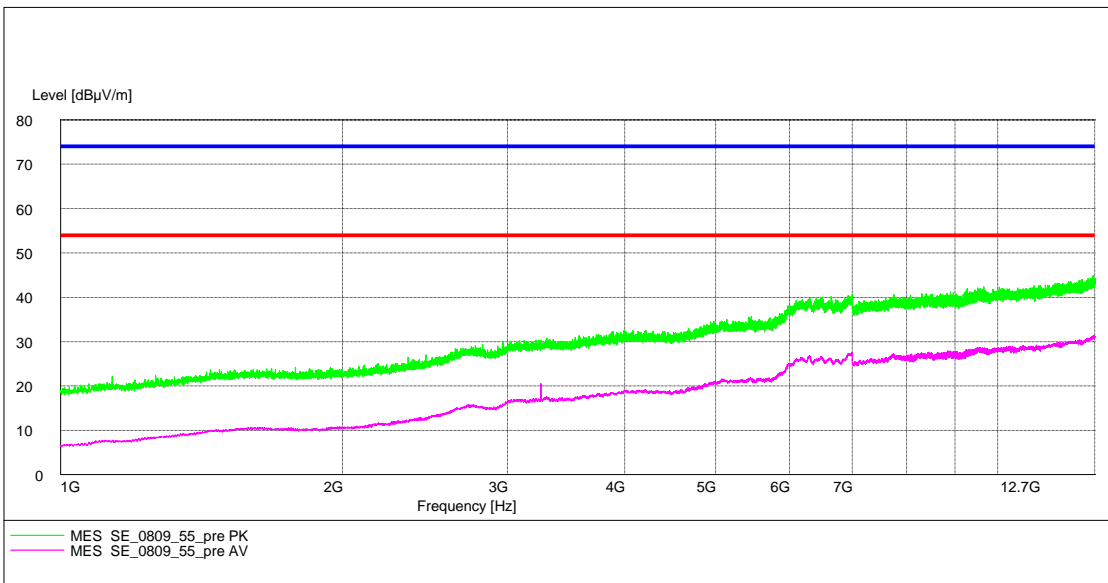
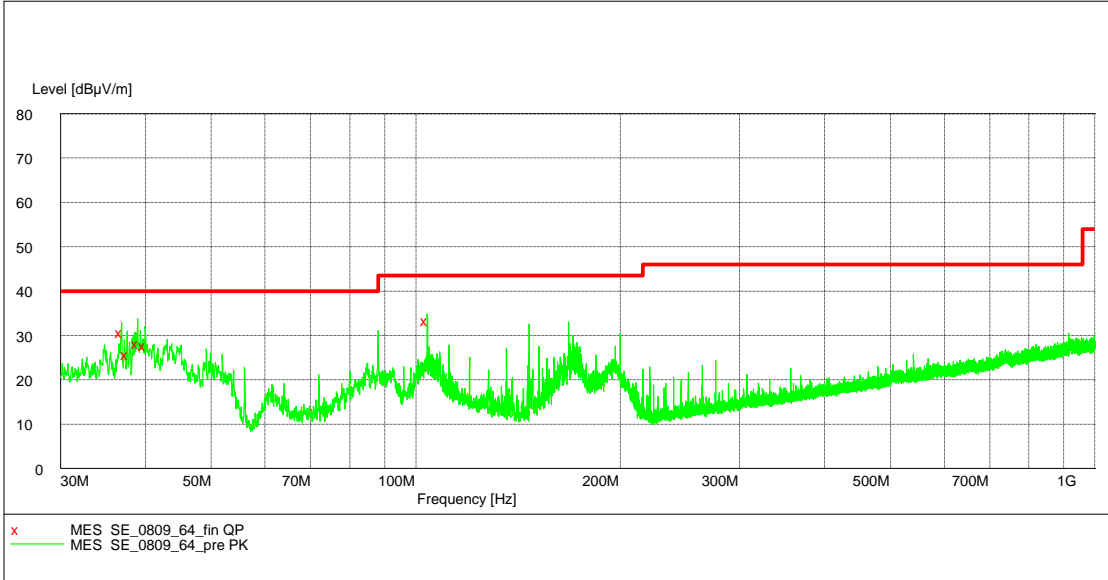
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## 7.2 Radiated Emissions

### Op. Mode

op-mode 5      Setup 1



## Op. Mode

op-mode 5

Setup 2

