



InterLab®

FCC Measurement/Technical Report on GSM Module TC63 Siemens Cellular Engine TC63

Report Reference: 4_SIEM_0504_GSM_FCCe

Test Laboratory:

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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 a GSM cellular radiotelephone device

Applicable FCC Rules

Prepared in accordance with the requirements of FCC Rules and Regulations as listed in 47 CFR Ch.1 Parts 0 to 19 and Parts 20 to 69 (10-1-01 Edition). The following subparts are applicable to the results in this test report.

Part 2

Subpart J - Equipment Authorization Procedures, Certification

- § 2.1046 Measurement required: RF power output
- § 2.1049 Measurement required: Occupied bandwidth
- § 2.1051 Measurement required: Spurious emissions at antenna terminals
- § 2.1053 Measurement required: Field strength of spurious emission
- § 2.1055 Measurement required: Frequency stability
- § 2.1057 Frequency spectrum to be investigated

Part 22

Subpart H – Cellular Radiotelephone Service

- § 22.355 Frequency tolerance
- § 22.913 Effective radiated power limits
- § 22.917 Emission limitations for cellular

Summary Test Results:

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

0.2 Measurement Summary

Spurious emissions at antenna terminals

The measurement was performed according to FCC §2.1051

10-01-2001

OP-Mode	Setup	Port	Final Result
op-mode 1	Setup_a01	antenna connector	passed
op-mode 2	Setup_a01	antenna connector	passed
op-mode 3	Setup_a01	antenna connector	passed

Field strength of spurious radiation

The measurement was performed according to FCC §2.1053

10-01-2001

OP-Mode	Setup	Port	Final Result
op-mode 1	Setup_a02	enclosure	passed
op-mode 2	Setup_a02	enclosure	passed
op-mode 3	Setup_a02	enclosure	passed

The tests were chosen on customer's demand.




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Responsible for
Accreditation Scope:



Responsible
for Test Report:





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. TTI-P-G 178/99

Responsible for Accreditation Scope:	Dipl.-Ing. Bernhard Retka Dipl.-Ing. Arndt Stöcker Dipl.-Ing. Thomas Hoell
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Report Template Version:	2005-04-20
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1.2 Project Data

Responsible for testing and report:	Dipl.-Ing. Robert Machulec
Receipt of EUT:	2005-05-02
Date of Test(s):	2005-05-02
Date of Report:	2005-05-06

1.3 Applicant Data

Company Name:	Siemens AG
Address:	Siemensdamm 50 13629 Berlin Germany
Contact Person:	Thorsten Liebig

1.4 Manufacturer Data

Company Name:	please see applicant data
Address:	
Contact Person:	

2 Testobject Data

2.1 General EUT Description

Equipment under	GSM Module TC63
Type Designation:	Siemens Cellular Engine TC63
Kind of Device:	GSM 850/900/1800/1900
(optional)	
Voltage Type:	DC
Nominal Voltage:	4,5 V
Maximum Voltage:	4,5 V
Minimum Voltage:	3,2 V

General product description:

GSM module for mobile phones which is able to operate in the bands 850, 900, 1800 and 1900.

The manufacturer declared that nominal voltage is equal to high voltage.

In GSM 850 mode the card operates in channel blocks A and B from 824,2 MHz (lowest channel = 128) to 848,8 MHz (highest channel = 251).

The EUT provides the following ports:

Ports

antenna connector
enclosure

The main components of the EUT are listed and described in Chapter 2.2

2.2 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	GSM Phone	TC63	3556330000 10085	Rev.B2.5	Rev.00.432	2005-05-02

Remark: EUT A is connected to the development board. The SMA antenna connector is provided by the development board. For radiated tests an external antenna will be used additionally.

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

2.3 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	HW Status	SW Status	Serial no.	FCC ID
AE1	Allgon-MiniMAG Dualband Antenna	Ordering number: 1140.26	-	-	EMV Referenz Antenne No.02	-
AE2	Development Board	DSB75			B1 0077	-

2.4 EUT Setups

This chapter describes the combination of EUT's and ancillary equipment used for testing.

Setup No.	Combination of EUTs	Description
setup_a01	EUT A + AE2	setup for spurious emissions conducted test
setup_a02	EUT A + AE1 + AE2	setup for spurious emissions radiated test

2.5 Operating Modes

This chapter describes the operating modes of the EUT's used for testing.

Op. Mode	Description of Operating Modes	Remarks
op-mode 1	Call established on Traffic Channel (TCH) 128, Carrier Frequency 824,2 MHz	128 is the lowest channel
op-mode 2	Call established on Traffic Channel (TCH) 190, Carrier Frequency 836,6 MHz	190 is a mid channel of the full GSM band
op-mode 3	Call established on Traffic Channel (TCH) 251, Carrier Frequency 848,8 MHz	251 is the highest channel

3 Test Results

3.1 Spurious emissions at antenna terminals

Standard FCC Part 22, 10-01-2001
Subpart H

The test was performed according to FCC §2.1051, 10-01-2001

3.1.1 Test Description

1) The EUT was coupled to the R&S Spectrum Analyser and the R&S CMD55 / CMU200 Digital Communication Tester through a Power Divider. Refer to chapter "Setup Drawings".

2) The total insertion losses for RF Path 1 and RF Path 2 were measured. The values were used to correct the readings from the R&S Spectrum Analyser and the R&S CMD55 / CMU200 Digital Communication Tester.

3) A speech call was established on a Traffic Channel (TCH) between the EUT and the base station simulator (R&S CMD55 / CMU200 Digital Communication Tester).

Important Settings:

- Discontinuous Transmission: OFF
- Modulation Signal: PSR16-1 (Pseudo Random Sequence)
- Output Power: Maximum
- Channel: Varied during measurements
(lowest channel: 128, mid channel: 190 and highest channel: 251)

4) Important Analyser Settings

- [Resolution Bandwidth / Video Bandwidth]:
 - a) [3 kHz / 10 kHz] in the Span of 1 MHz directly below and above the GSM-Band,
 - b) [10 kHz / 30 kHz] in case the curve of the analyser IF-Filter leads to an exceeding of the limit, in this case a worst case correction factor of 20 dB (1 MHz -> 10 kHz) was used
 - c) [1 MHz / 3 MHz] otherwise
- Sweep Time: Calculated by using a formula given in the Product Standard "GSM 11.10-1 edition 4" for spurious emissions measurements (depending on the transmitting signal, the span and the resolution bandwidth)

5) The spurious emissions (peak) were measured in the frequency range from 9 kHz to 10 GHz (up to the 10th harmonic) during the call is established on the lowest channel (128), mid channel (190) and on the highest channel (251).

3.1.2 Test Requirements / Limits

§ 2.1051 Spurious emissions at antenna terminals

The radio frequency voltage or power generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in Sec. 2.1049 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.



§ 2.1057 Frequency spectrum to be investigated.

(a) In all of the measurements set forth in Secs. 2.1051 and 2.1053, the spectrum shall be investigated from the lowest radio frequency signal generated in the equipment, without going below 9 kHz, up to at least the frequency shown below:

(1) If the equipment operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

(b) Particular attention should be paid to harmonics and subharmonics of the carrier frequency as well as to those frequencies removed from the carrier by multiples of the oscillator frequency. Radiation at the frequencies of multiplier stages should also be checked.

(c) The amplitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be reported.

(d) Unless otherwise specified, measurements above 40 GHz shall be performed using a minimum resolution bandwidth of 1 MHz.

§ 22.917 Emission limitations for cellular

(e) Out of band emissions. The mean power of emissions must be attenuated below the mean power of the unmodulated carrier (P) on any frequency twice or more than twice the fundamental frequency by: at least $43 + 10 \log P$ dB.

3.1.3 Test Protocol

Temperature: 25 °C
Air Pressure: 1003 hPa
Humidity: 37 %

Op. Mode	Setup	Port
op-mode 1	setup_a01	antenna connector

Frequency GHZ	Bandwidth kHz	Measured Level dBm	Limit dBm
0.824	3	-13.66	-13.0
1.647	1000	-33.66	-13.0
7.425	1000	-33.74	-13.0

Remark: No (further) spurious emissions were found in the range 20 dB below the limit.

Op. Mode	Setup	Port
op-mode 2	setup_a01	antenna connector

Frequency GHZ	Bandwidth kHz	Measured Level dBm	Limit dBm
1.673	1000	-34.06	-13.0
7.528	1000	-40.52	-13.0

Remark: No (further) spurious emissions were found in the range 20 dB below the limit.

Op. Mode	Setup	Port
op-mode 3	setup_a01	antenna connector

Frequency GHZ	Bandwidth kHz	Measured Level dBm	Limit dBm
0.849	3	-15.76	-13.0
1.697	1000	-34.28	-13.0
6.796	1000	-37.28	-13.0

Remark: No (further) spurious emissions were found in the range 20 dB below the limit.

3.1.4 Test result: Spurious emissions at antenna terminals

FCC Part 22, Subpart H	Op. Mode	Result
	op-mode 1	passed
	op-mode 2	passed
	op-mode 3	passed

3.2 Field strength of spurious radiation

Standard FCC Part 22, 10-01-2001
Subpart H

The test was performed according to: FCC §2.1053, 10-01-2001

3.2.1 Test Description

1) The EUT was placed inside an anechoic chamber. Refer to chapter "Setup Drawings". The EUT was coupled to the R&S CMD55 / CMU200 Digital Communication Tester which was located outside the chamber via coaxial cable.

2) A speech call was established on a Traffic Channel (TCH) between the EUT and the base station simulator (R&S CMD55 / CMU200 Digital Communication Tester).

Important Settings:

- Discontinuous Transmission: OFF
- Modulation Signal: PSR16-1 (Pseudo Random Sequence)
- Output Power: Maximum
- Channel : Varied during measurements
(lowest channel: 128, mid channel: 190 and highest channel: 251)

3) A pre-calibration procedure is used so that the readings from the spectrum analyser are corrected and represent directly the equivalent radiated power (related to a $\lambda/2$ dipole).

4) All spurious radiation measurements were made with spectrum analyser and the appropriate calibrated antennas for the frequency range of 30 MHz to 10 GHz (up to the 10th harmonic of the transmit frequency).

5) Important Analyser Settings

- [Resolution Bandwidth / Video Bandwidth]:
 - a) [3 kHz / 10 kHz] in the Span of 1 MHz directly below and above the GSM-Band,
 - b) [10 kHz / 30 kHz] in case the curve of the analyser IF-Filter leads to an exceeding of the limit, in this case a worst case correction factor of 20 dB (1 MHz \rightarrow 10 kHz) was used
 - c) [1 MHz / 3 MHz] otherwise
- Sweep Time: Calculated by using a formula given in the Product Standard "GSM 11.10-1 edition 4" for spurious emissions measurements (depending on the transmitting signal, the span and the resolution bandwidth)

6) The spurious emissions (peak) were measured in both vertical and horizontal antenna polarisation during the call is established on the lowest channel (128), mid channel (190) and on the highest channel (251).

3.2.2 Test Requirements / Limits

§ 2.1053 Measurements required: Field strength of spurious radiation.

Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph (c) of Sec. 2.1049, as appropriate.

For equipment operating on frequencies below 890 MHz, an open field test is normally required, with the measuring instrument antenna located in the far-field at all test frequencies. In the event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurements will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from halfwave dipole antennas.

(b) The measurements specified in paragraph (a) of this section shall be made for the following equipment:

(2) All equipment operating on frequencies higher than 25 MHz.

§ 2.1057 Frequency spectrum to be investigated.

(a) In all of the measurements set forth in Secs. 2.1051 and 2.1053, the spectrum shall be investigated from the lowest radio frequency signal generated in the equipment, without going below 9 kHz, up to at least the frequency shown below:

(1) If the equipment operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

(b) Particular attention should be paid to harmonics and subharmonics of the carrier frequency as well as to those frequencies removed from the carrier by multiples of the oscillator frequency. Radiation at the frequencies of multiplier stages should also be checked.

(c) The amplitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be reported.

(d) Unless otherwise specified, measurements above 40 GHz shall be performed using a minimum resolution bandwidth of 1 MHz.

§ 22.917 Emission limitations for cellular

(e) Out of band emissions. The mean power of emissions must be attenuated below the mean power of the unmodulated carrier (P) on any frequency twice or more than twice the fundamental frequency by: at least $43 + 10 \log P$ dB.

This is calculated to be -13 dBm (effective radiated power) which corresponds to 84.6 dBµV/m (field strength) in a distance of 3 m.

3.2.3 Test Protocol

Temperature: 25 °C
Air Pressure: 1003 hPa
Humidity: 37 %

Op. Mode	Setup	Port
op-mode 1	setup_a02	enclosure

Frequency GHz	Antenna Polarisation	Bandwidth kHz	Measured Level dBm	Limit dBm
0.824	Horizontal / Vertical	3	-16.81	-13.0
7.425	Horizontal / Vertical	1000	-30.15	-13.0

Remark: No (further) spurious emissions were found in the range 20 dB below the limit.

Op. Mode	Setup	Port
op-mode 2	setup_a02	enclosure

Frequency GHz	Antenna Polarisation	Bandwidth kHz	Measured Level dBm	Limit dBm
1.667	Horizontal / Vertical	1000	-30.8	-13.0

Remark: No (further) spurious emissions were found in the range 20 dB below the limit.

Op. Mode	Setup	Port
op-mode 3	setup_a02	enclosure

Frequency GHz	Antenna Polarisation	Bandwidth kHz	Measured Level dBm	Limit dBm
0.849	Horizontal / Vertical	3	-17.59	-13.0
1.684	Horizontal / Vertical	1000	-31.49	-13.0

Remark: No (further) spurious emissions were found in the range 20 dB below the limit.

3.2.4 Test result: Field strength of spurious radiation

FCC Part 22, Subpart H	Op. Mode	Result
	op-mode 1	passed
	op-mode 2	passed
	op-mode 3	passed

4 Test Equipment

EUT Digital Signalling System

Equipment	Type	Serial No.	Manufacturer
Digital Radio Communication Tester	CMD 55	831050/020	Rohde & Schwarz
Signalling Unit for Bluetooth Spurious Emissions	PTW60	100004	Rohde & Schwarz
Universal Radio Communication Tester	CMU 200	102366	Rohde & Schwarz

EMI Test System

Equipment	Type	Serial No.	Manufacturer
Comparison Noise Emitter	CNE III	99/016	York
EMI Analyzer	ESI 26	830482/004	Rohde & Schwarz
Signal Generator	SMR 20	846834/008	Rohde & Schwarz

EMI Radiated Auxiliary Equipment

Equipment	Type	Serial No.	Manufacturer
Antenna mast 4m	MA 240	240/492	HD GmbH H. Deisel
Biconical dipole	VUBA 9117	9117108	Schwarzbeck
Broadband Amplifier 18MHz-26GHz	JS4-18002600-32	849785	Miteq
Broadband Amplifier 30MHz-18GHz	JS4-00101800-35	896037	Miteq
Broadband Amplifier 45MHz-27GHz	JS4-00102600-42	619368	Miteq
Cable "ESI to EMI Antenna"	EcoFlex10	W18.01-2 + W38.01-2	Kabel Kusch
Cable "ESI to Horn Antenna"	UFB311A + UFB293C	W18.02-2 + W38.02-2	Rosenberger-Microcoax
Double-ridged horn	HF 906	357357/002	Rohde & Schwarz
Double-ridged horn	HF 906	357357/001	Rohde & Schwarz
High Pass Filter	5HC3500/12750-1.2-KK	200035008	Trilithic
High Pass Filter	5HC2700/12750-1.5-KK	9942012	Trilithic
High Pass Filter	4HC1600/12750-1.5-KK	9942011	Trilithic
KUEP pre amplifier	Kuep 00304000	001	7layers
Log.-per. Antenna	HL 562 Ultralog	830547/003	Rohde & Schwarz
Loop Antenna	HFH2-Z2	829324/006	Rohde & Schwarz
Pyramidal Horn Antenna 26,5 GHz	Model 3160-09	9910-1184	EMCO

EMI Conducted Auxiliary Equipment

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

Auxiliary Test Equipment

Equipment	Type	Serial No.	Manufacturer
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

Equipment	Type	Serial No.	Manufacturer
Air Compressor (pneumatic)			Atlas Copco
Controller	HD 100	100/603	HD GmbH H. Deisel
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	10.58x6.38x6		Frankonia
Turntable	DS 420S	420/573/99	HD GmbH, H. Deisel
Valve Control Unit (pneum.)	VE 615P	615/348/99	HD GmbH, H. Deisel



7 layers Bluetooth™ Full RF Test Solution

Bluetooth RF Conformance Test System TS8960

Equipment	Type	Serial No.	Manufacturer
10 MHz Reference	MFS	5489/001	Efratom
Power Meter 832025/059	NRVD	832025/059	Rohde & Schwarz
Power Sensor A 832279/013	NRV-Z1	832279/013	Rohde & Schwarz
Power Sensor B 832279/015	NRV-Z1	832279/015	Rohde & Schwarz
Power Supply	E3632A	MY40003776	Agilent
Power Supply	PS-2403D	-	Conrad
RF Step Attenuator 833695/001	RSP	833695/001	Rohde & Schwarz
Rubidium Frequency Normal	MFS	002	Efratom
Signal Analyzer FSIQ26 832695/007	FSIQ26	832695/007	Rohde & Schwarz
Signal Generator 833680/003	SMP 03	833680/003	Rohde & Schwarz
Signal Generator A 834344/002	SMIQ03B	834344/002	Rohde & Schwarz
Signal Generator B 832870/017	SMIQ03B	832870/017	Rohde & Schwarz
Signal Switching and Conditioning Unit	SSCU	338826/005	Rohde & Schwarz
Signalling Unit PTW60 838312/014	PTW60 for TS8960	838312/014	Rohde & Schwarz
System Controller 829323/008	PSM12	829323/008	Rohde & Schwarz

5 Photo Report

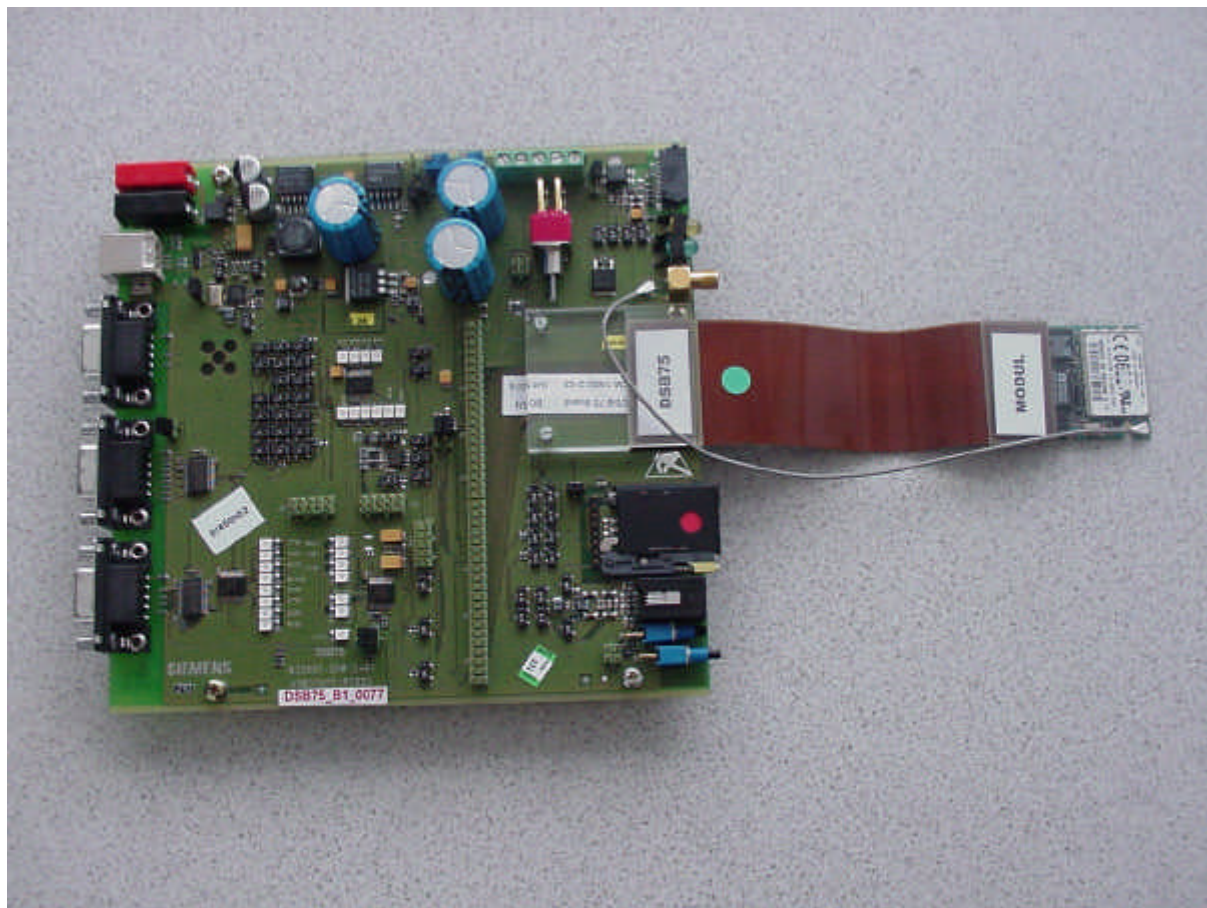


Photo 1: EUT connected to the development board



Photo 2: EUT (top side)



Photo 3: EUT (bottom side)

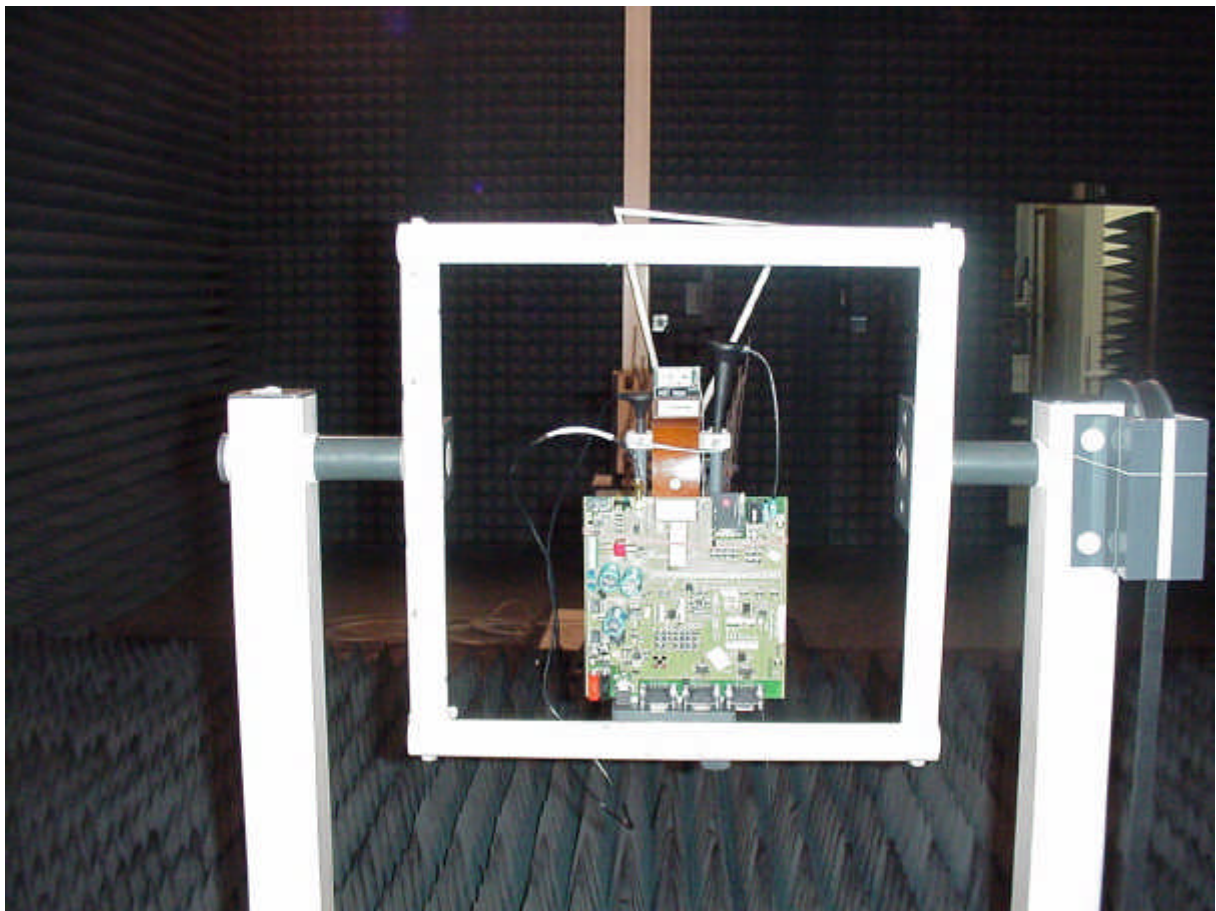
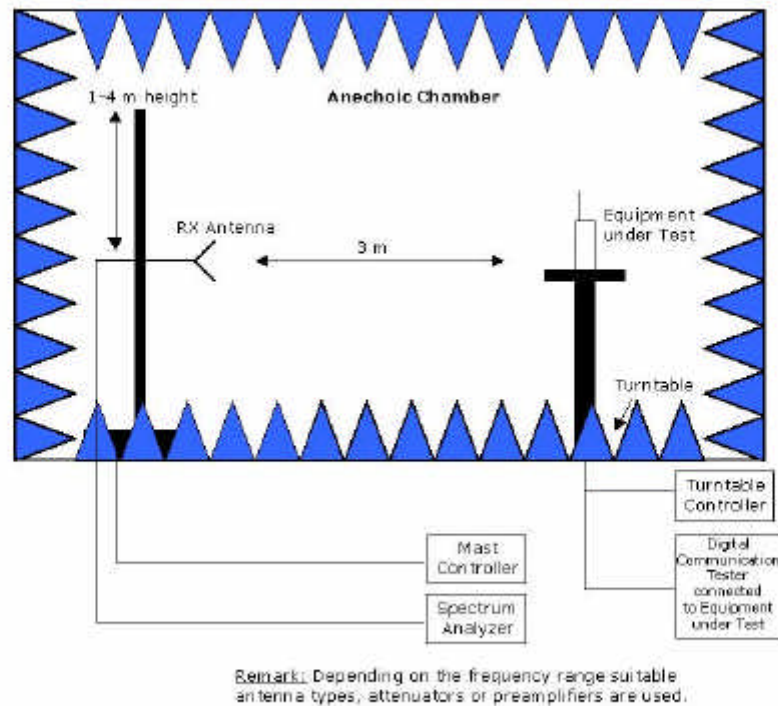
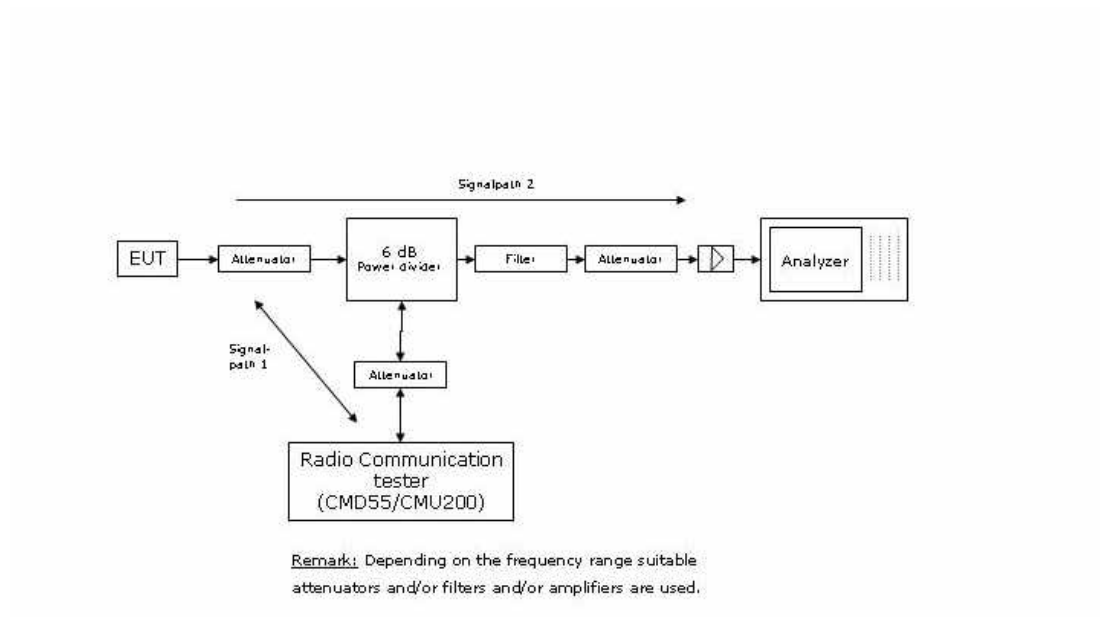


Photo 4: Setup for radiated tests

6 Setup Drawings



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



Drawing 2: Principle setup for conducted measurements under nominal conditions



7 Annex