



# InterLab<sup>®</sup>

## Final Report on Cinterion AC65i

**Report Reference:** MDE\_CINTE\_0810\_AC65i\_FCCe

**Date:** December 04, 2008

### Test Laboratory:

7 layers AG  
Borsigstr. 11  
40880 Ratingen  
Germany



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 test laboratory.

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## 1 Administrative Data

### 1.1 Project Data

*Project Responsible:* Holger Leutfeld  
*Date Of Test Report:* 2008/12/04  
*Date of first test:* 2008/11/15  
*Date of last test:* 2008/11/18

### 1.2 Applicant Data

*Company Name:* Siemens AG  
*Street:* Siemensdamm 50  
*City:* 13629 Berlin  
*Country:* Germany  
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### 1.3 Test Laboratory Data

The following list shows all places and laboratories involved for test result generation:

#### 7 layers DE

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*Company Name :* 7 layers AG  
*Street :* Borsigstrasse 11  
*City :* 40880 Ratingen  
*Country :* Germany  
*Contact Person :* Mr. Michael Albert  
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#### Laboratory Details

<i>Lab ID</i>	<i>Identification</i>	<i>Responsible</i>	<i>Accreditation Info</i>
Lab 1	Radiated Emissions	Mr. Robert Machulec Mr. Andreas Petz	DAR-Registration no. DAT-P-192/99-01
Lab 2	Radio Lab	Mr. Robert Machulec Mr. Andreas Petz	DAR-Registration no. DAT-P-192/99-01

### 1.4 Signature of the Testing Responsible



Dr. Michael Küppers  
responsible for tests performed in: Lab 1, Lab 2

## 1.5 Signature of the Accreditation Responsible



Accreditation scope responsible person  
responsible for Lab 1, Lab 2

## 2 Test Object Data

### 2.1 General OUT Description

The following section lists all OUTs (Object's Under Test) involved during testing.

#### OUT: Cinterion AC65i

*Product Category:* Module  
*Manufacturer:*  
*Company Name:* see applicant

#### Parameter List:

<i>Parameter name</i>	<i>Value</i>
<b>Parameter for Scope FCC_v2:</b>	
AC Power Supply	120 for peripheral devices (V)
Antenna gain	1.65 (dBi)
DC Power Supply	12 (V)
highest channel	251 for GSM850, 810 for GSM1900
lowest channel	128 for GSM850, 512 for GSM1900
mid channel	190 for GSM850, 661 for GSM1900

### 2.2 Detailed Description of OUT Samples

#### Sample : C01

<i>OUT Identifier</i>	Cinterion AC65i		
<i>Sample Description</i>			
<i>HW Status</i>	B 2.0.1		
<i>SW Status</i>	rev 00.240		
<i>Date of Receipt</i>	2008/10/10		
<i>Low Voltage</i>	3.8 V	<i>Low Temp.</i>	-10 °C
<i>High Voltage</i>	4.5 V	<i>High Temp.</i>	55 °C
<i>Nominal Voltage</i>	4.5 V	<i>Normal Temp.</i>	21 °C

### 2.3 OUT Features

#### Features for OUT: Cinterion AC65i

<i>Designation</i>	<i>Description</i>	<i>Allowed Values</i>	<i>Supported Value(s)</i>
<b>Features for scope: FCC_v2</b>			
AC	The OUT is powered by or connected to AC Mains		
DC	The OUT is powered by or connected to DC Mains		
GSM850	EUT supports GSM850 band 824MHz - 849MHz		
PantC	permanent fixed antenna connector, which may be built-in, designed as an indispensable part of the equipment		
PCS1900	EUT supports PCS1900 band 1850MHz - 1910MHz		

### 2.4 Auxiliary Equipment

<i>AE No.</i>	<i>Type Designation</i>	<i>Serial No.</i>	<i>HW Status</i>	<i>SW Status</i>	<i>Description</i>
AE 02					Flex cable
AE 04					Shielded Housing for DSB
AE 03					Test Antenna
AE 01	DSB75_B1.1_0152				Evaluation board

### 2.5 Setups used for Testing

For each setup a relation is given to determine if and which samples and auxiliary equipment is used. The left side list all OUT samples and the right side lists all auxiliary equipment for the given setup.

<i>Setup No.</i>	<i>List of OUT samples</i>		<i>List of auxiliary equipment</i>	
	<i>Sample No.</i>	<i>Sample Description</i>	<i>AE No.</i>	<i>AE Description</i>
<b>F02_FCC24</b>				
	<i>Sample: C01</i>		AE 02	Flex cable
			AE 04	Shielded Housing for DSB
			AE 03	Test Antenna
			AE 01	Evaluation board

### 3 Results

#### 3.1 General

**Documentation of tested devices:**

Available at the test laboratory.

**Interpretation of the test results:**

The results of the inspection are described on the following pages, where 'Conformity' or 'Passed' means that the certification criteria were verified and that the tested device is conform to the applied standard.

In cases where 'Declaration' is printed, the required documents are available in the manufacturers product documentation.

In cases where 'not applicable' is printed, the test case requirements are not relevant to the specific equipment implementation.

#### 3.2 List of the Applicable Body

(Body for Scope: FCC\_v2)

<i>Designation</i>	<i>Description</i>
FCC47CFRChIPART24PERSONAL COMMUNICATIONS SERVICES	Part 24, Subpart E - Broadband PCS

#### 3.3 List of Test Specification

<i>Test Specification:</i>	<b>FCC part 2 and 24</b>
<i>Date / Version</i>	2007/10/01 Version: 10-1-07 Edition
<i>Title:</i>	PART 2 - GENERAL RULES AND REGULATIONS PART 24 - PERSONAL COMMUNICATIONS SERVICES



### 3.4 Summary

<i>Test Case Identifier / Name</i> <i>Test (condition)</i>	<i>Result</i>	<i>Date of Test</i>	<i>Lab</i> <i>Ref.</i>	<i>Setup</i>
<b>24.1 RF Power Output §2.1046, §24.232</b>				
24.1; Frequency Band = 1900, Mode = GSM, Channel = 512, Method = conducted	Passed	2008/11/18	Lab 2	F02_FCC24
24.1; Frequency Band = 1900, Mode = GSM, Channel = 661, Method = conducted	Passed	2008/11/18	Lab 2	F02_FCC24
24.1; Frequency Band = 1900, Mode = GSM, Channel = 810, Method = conducted	Passed	2008/11/18	Lab 2	F02_FCC24
<b>24.4 Field strength of spurious radiation §2.1053, §24.238</b>				
24.4; Frequency Band = 1900, Mode = GSM, Channel = 512	Passed	2008/11/15	Lab 1	F02_FCC24
24.4; Frequency Band = 1900, Mode = GSM, Channel = 661	Passed	2008/11/15	Lab 1	F02_FCC24
24.4; Frequency Band = 1900, Mode = GSM, Channel = 810	Passed	2008/11/15	Lab 1	F02_FCC24



### 3.5 Detailed Results

#### 3.5.1 24.1 RF Power Output §2.1046, §24.232

Test: 24.1; Frequency Band = 1900, Mode = GSM, Channel = 512, Method = conducted

Result: Passed

Setup No.: F02\_FCC24

Date of Test: 2008/11/18 14:10

Body: FCC47CFRChIPART24PERSONAL COMMUNICATIONS SERVICES

Test Specification: FCC part 2 and 24

Test Equipment Environmental Conditions

Temperature: 23°C

Air Pressure: 1013hPa

Rel. Humidity: 36%

**Detailed Results:**  
 01423 A01, GSM 1900, channel 512 (1850.2 MHz)

detector	trace	resolution bandwidth /kHz	peak value /dBm	limit /dBm	verdict
peak	maxhold	300	30.07	EIRP 33	passed
average	maxhold	300	29.66	EIRP 33	passed
rms	maxhold	300	29.65	EIRP 33	passed

Test: 24.1; Frequency Band = 1900, Mode = GSM, Channel = 661, Method = conducted

Result: Passed

Setup No.: F02\_FCC24

Date of Test: 2008/11/18 13:50

Body: FCC47CFRChIPART24PERSONAL COMMUNICATIONS SERVICES

Test Specification: FCC part 2 and 24

Test Equipment Environmental Conditions

Temperature: 23°C

Air Pressure: 1013hPa

Rel. Humidity: 36%

**Detailed Results:**  
 01423 A01, GSM 1900, channel 661 (1880.0 MHz)

detector	trace	resolution bandwidth /kHz	peak value /dBm	limit /dBm	verdict
peak	maxhold	300	30.37	EIRP 33	passed
average	maxhold	300	29.93	EIRP 33	passed
rms	maxhold	300	29.92	EIRP 33	passed

**Test: 24.1; Frequency Band = 1900, Mode = GSM, Channel = 810, Method = conducted**

*Result:* Passed  
*Setup No.:* F02\_FCC24  
*Date of Test:* 2008/11/18 14:12  
*Body:* FCC47CFRChIPART24PERSONAL COMMUNICATIONS SERVICES  
*Test Specification:* FCC part 2 and 24

*Test Equipment Environmental Conditions*

*Temperature:* 23°C  
*Air Pressure:* 1013hPa  
*Rel. Humidity:* 36%

**Detailed Results:**

01423 A01, GSM 1900, channel 810 (1909.8 MHz)

detector	trace	resolution bandwidth /kHz	peak value /dBm	limit /dBm	verdict
peak	maxhold	300	29.90	EIRP 33	passed
average	maxhold	300	29.47	EIRP 33	passed
rms	maxhold	300	29.47	EIRP 33	passed





**3.5.2 24.4 Field strength of spurious radiation §2.1053, §24.238**

**Test: 24.4; Frequency Band = 1900, Mode = GSM, Channel = 512**

Result: Passed

Setup No.: F02\_FCC24

Date of Test: 2008/11/15 23:59

Body: FCC47CFRChIPART24PERSONAL COMMUNICATIONS SERVICES

Test Specification: FCC part 2 and 24

*Test Equipment Environmental Conditions*

Temperature: 24°C

Air Pressure: 1027hPa

Rel. Humidity: 36%

**Detailed Results:**

frequency /MHz	peak value /dBm	margin to limit /dB	limit /dBm	verdict
1850	-15.90	2.90	-13.00	Passed

no further values have been found with a margin of less than 20 dB

**Test: 24.4; Frequency Band = 1900, Mode = GSM, Channel = 661**

Result: Passed

Setup No.: F02\_FCC24

Date of Test: 2008/11/15 22:18

Body: FCC47CFRChIPART24PERSONAL COMMUNICATIONS SERVICES

Test Specification: FCC part 2 and 24

*Test Equipment Environmental Conditions*

Temperature: 24°C

Air Pressure: 1027hPa

Rel. Humidity: 36%

**Detailed Results:**

frequency /MHz	peak value /dBm	margin to limit /dB	limit /dBm	verdict
-	-	-	-13.00	Passed

no further values have been found with a margin of less than 20 dB

**Test: 24.4; Frequency Band = 1900, Mode = GSM, Channel = 810**

*Result:* Passed  
*Setup No.:* F02\_FCC24  
*Date of Test:* 2008/11/15 21:52  
*Body:* FCC47CFRChIPART24PERSONAL COMMUNICATIONS SERVICES  
*Test Specification:* FCC part 2 and 24

*Test Equipment Environmental Conditions*

*Temperature:* 24°C  
*Air Pressure:* 1027hPa  
*Rel. Humidity:* 36%

**Detailed Results:**

frequency /MHz	peak value /dBm	margin to limit /dB	limit /dBm	verdict
1910	-14.93	1.93	-13.00	Passed

no further values have been found with a margin of less than 20 dB

## 4 Annex

### 4.1 Additional Information for OUT Description

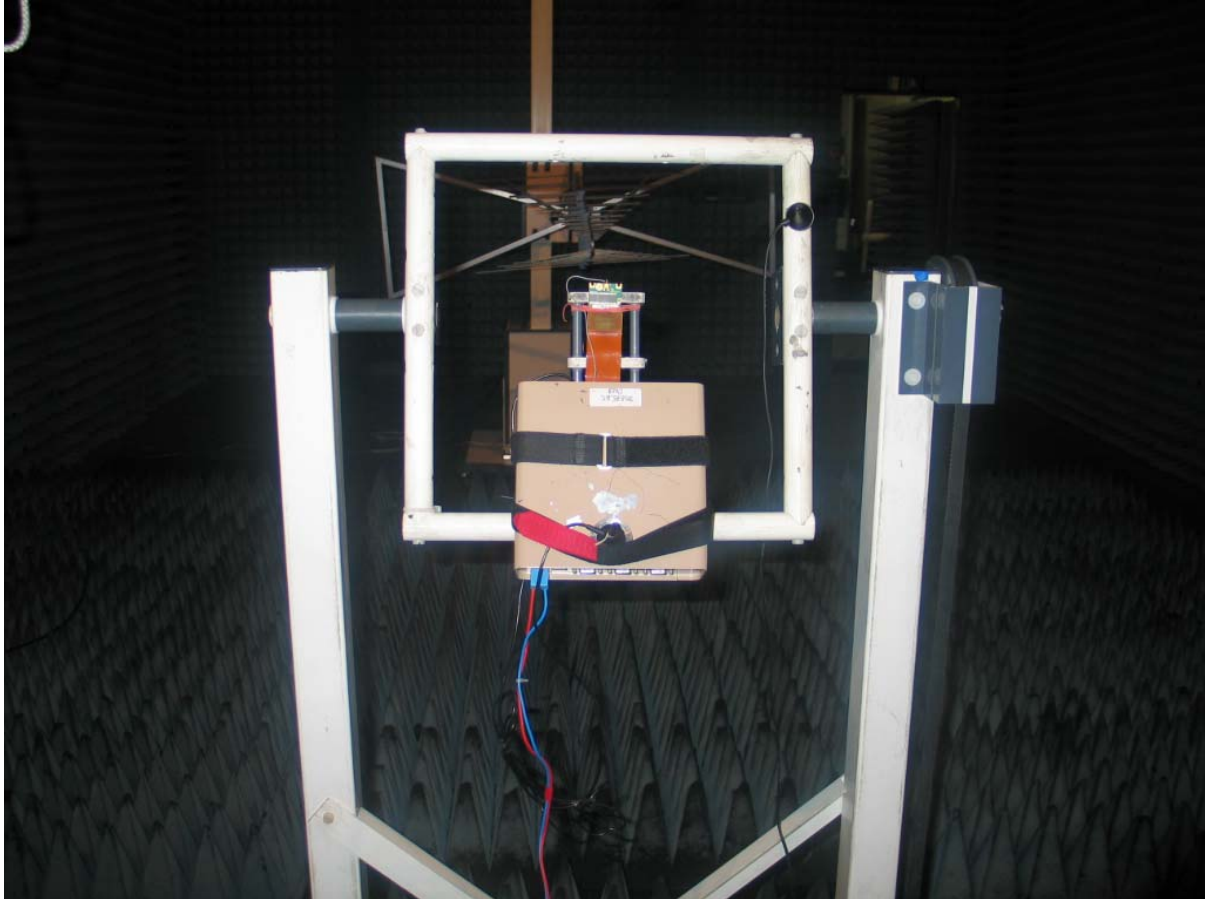


front view

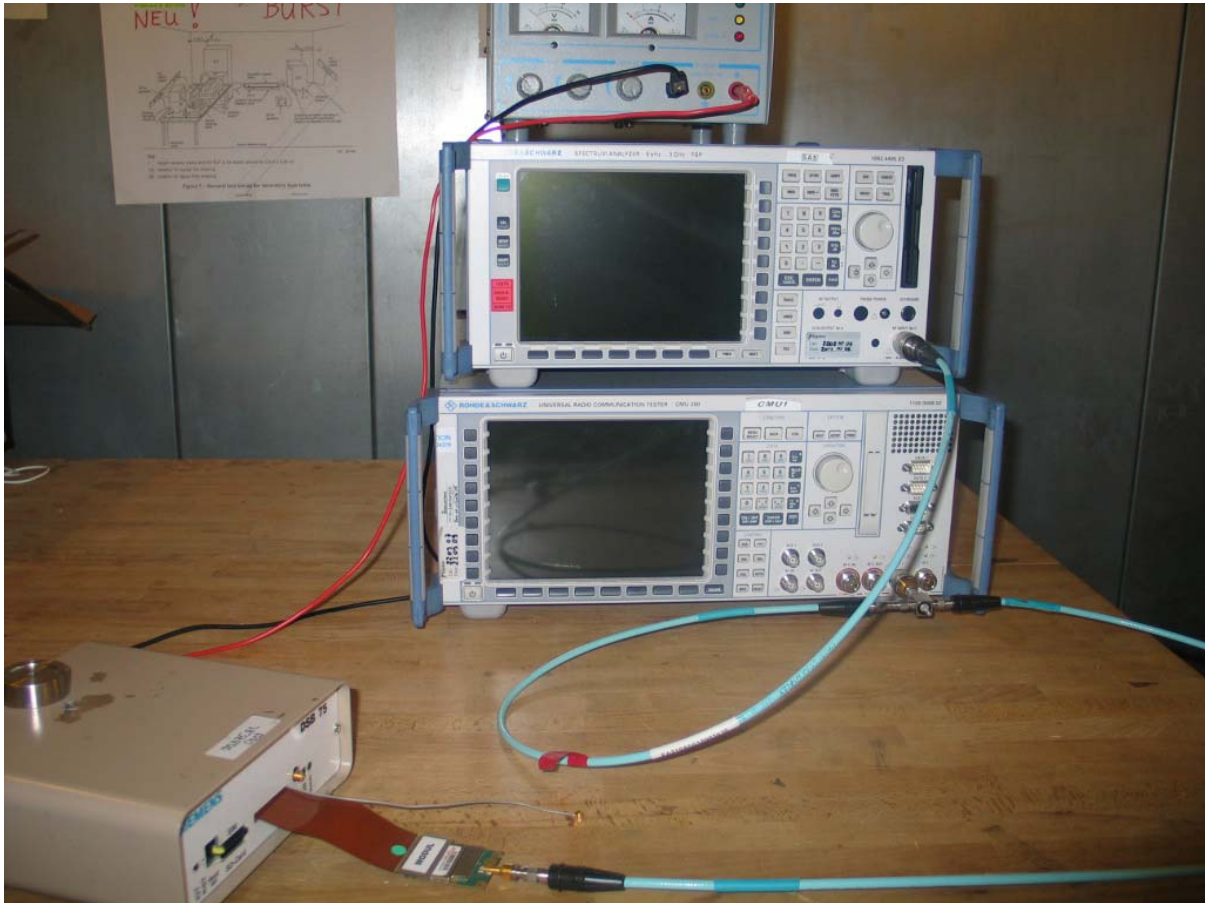


back view

## 4.2 Additional Information for Report



setup for radiated tests



setup for conducted tests



Summary of Test Results

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The EUT complied with all performed tests as listed in the summary section of this report.

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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 (10-1-07 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 radiation
- § 2.1055 Measurement required: Frequency stability
- § 2.1057 Frequency spectrum to be investigated

Part 24, Subpart E - Broadband PCS

- § 24.232 Power and antenna height limits
- § 24.235 Frequency stability
- § 24.236 Field strength limits
- § 24.238 Emission limitations for Broadband PCS equipment

Test Results

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RF Power Output

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Standard: FCC Part 24, 10-1-0, Subpart E

The test was performed according to: FCC §2.1046, 10-1-07

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 call was established on a Traffic Channel between the EUT and the base station simulator (R&S CMD55 /

CMU200 Digital Communication Tester).

Important Settings:

- Channel (Frequency): Varied during measurements

4) The transmitted power of the EUT was recorded by using a spectrum analyser and/or the internal measurement function of the CMD55 / CMU200.

#### Test Requirements / Limits

§2.1046 Measurements Required: RF Power Output

(a) For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in § 2.1033(c)(8). The electrical characteristics of the output terminals when this test is made shall be stated.

§24.232 Power and antenna height limits

(c) Mobile/portable stations are limited to 2 watts EIRP peak power and the equipment must employ means to limit the power to the minimum necessary for successful communications.

(d) Peak transmit power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage. The measurement results shall be properly adjusted for any instrument limitations, such as detector response times, limited resolution bandwidth capability when compared to the emission bandwidth, sensitivity, etc., so as to obtain a true peak measurement for the emission in question over the full bandwidth of the channel.

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#### Frequency stability

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Standard: FCC Part 24, 10-1-07, Subpart E

The test was performed according to FCC §2.1055, 10-1-07

#### Test Description

1) The EUT was placed inside the climatic chamber.

2) The EUT was coupled to the R&S CMD55 / CMU200 Digital Communication Tester. Refer to chapter "Setup Drawings".

3) The climatic chamber was cycled down/up to a certain temperature, starting with the EUT minimum temperature.

4) After the temperature was stabilized (at least one hour) the EUT was switched on and a call was established on a Traffic Channel between the EUT and the base station simulator (R&S CMD55 / CMU200 Digital Communication Tester).

Important Settings:

- Output Power: Maximum

- Mid Channel

5) The frequency error of the EUT was recorded by using an internal measurement function of the CMD55 / CMU200 immediately after the call was established, five minutes after the call was established and ten minutes after the call was established.

6) This measurement procedure was performed for all combinations of voltage (low, nominal, high) and temperature (from  $-30^{\circ}\text{C}$  to  $+50^{\circ}\text{C}$  in increments of  $10^{\circ}\text{C}$ ).

When the EUT did not operate at certain temperature levels, these measurements were left out.

#### Test Requirements / Limits

§2.1055 Measurements required: Frequency stability

(a) The frequency stability shall be measured with variation of ambient temperature as follows:

(1) From  $-30^{\circ}$  to  $+50^{\circ}$  centigrade for all equipment except that specified in paragraphs

(a) (2) and (3) of this section.

(b) Frequency measurements shall be made at the extremes of the specified temperature range and at intervals of not more than  $10^{\circ}$  centigrade through the range. A period of time sufficient to stabilize all of the components of the oscillator circuit at each temperature level shall be allowed prior to frequency measurement. The short term transient effects on the frequency of the transmitter due to keying (except for broadcast transmitters) and any heating element cycling normally occurring at each ambient temperature level also shall be shown. Only the portion or portions of the transmitter containing the frequency determining and stabilizing circuitry need be subjected to the temperature variation test.

(d) The frequency stability shall be measured with variation of primary supply voltage as follows:



- (1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.
- (2) For hand carried, battery powered equipment, reduce primary supply voltage to the battery operating end point which shall be specified by the manufacturer.
- (3) The supply voltage shall be measured at the input to the cable normally provided with the equipment, or at the power supply terminals if cables are not normally provided. Effects on frequency of transmitter keying (except for broadcast transmitters) and any heating element cycling at the nominal supply voltage and at each extreme also shall be shown.

#### §24.235 Frequency stability

The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

7Layers interpretation of limit:

To ensure that the frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block following limit was used:

+/- 2.5 ppm = 4700 Hz for a frequency of 1880.0 MHz

in accordance with FCC Part 22, 10-1-07, Subpart H, §22.355, table C-1: Frequency tolerance for the carrier frequency of mobile transmitters in the Public Mobile Service in the frequency range 821 to 896 MHz.

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#### Spurious emissions at antenna terminals

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Standard: FCC Part 24, 10-1-07, Subpart E

The test was performed according to FCC §2.1051, 10-1-07

#### 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 call was established on a Traffic Channel between the EUT and the base station simulator (R&S CMD55 / CMU200 Digital Communication Tester).  
Important Settings:
  - Output Power: Maximum
  - Channel: Varied during measurements
- 4) Important Analyser Settings
  - [Resolution Bandwidth]:
    - a) [ $\geq 1\%$  of wanted signal bandwidth] in the Span of 1 MHz directly below and above the PCS-Band,
    - b) otherwise [1 MHz]
    - c) [reduced resolution bandwidth] in case the curve of the analyser IF-Filter or the wanted EUT signal leads to an exceeding of the limit, in this case a correction factor was used
  - Sweep Time: Calculated by using a formula given in the Product Standard "PCS 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 20 GHz (up to the 10th harmonic) during the call was established

#### 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.

§ 24.238 Emission limitations for Broadband PCS equipment

(a) The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \log(P)$  dB.

Remark of the test laboratory: This is calculated to be -13 dBm.

(b) Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 1 MHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

(c) Licensees in this service may establish an alternative out of band emission limit to be used at specified band edge(s) in specified geographical areas [...].

(d) If any emission from a transmitter operating in this service results in interference to users of another radio service, the FCC may require a greater attenuation of that emission than specified in this section.

For reporting only spurious emission levels reaching to the 20dB margin to limit were noted.

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Field strength of spurious radiation

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Standard: FCC Part 24, 10-1-07, Subpart E

The test was performed according to: FCC §2.1053, 10-1-07

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

Important Settings:

- Output Power: Maximum  
- Channel : Varied during measurements

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 20 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 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)

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

#### 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.

##### § 24.238 Emission limitations for Broadband PCS equipment

(a) The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \log(P)$  dB.

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

(b) Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 1 MHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

(c) Licensees in this service may establish an alternative out of band emission limit to be used at specified band edge(s) in specified geographical areas [...].

(d) If any emission from a transmitter operating in this service results in interference to users of another radio service, the FCC may require a greater attenuation of that emission than specified in this section.

For reporting only spurious emission levels reaching to the 20dB margin to limit were noted.

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#### Emission and Occupied Bandwidth

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The test was performed according to: FCC §2.1049, 10-1-07

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

#### Important Settings:

- Output Power: Maximum
- Channel : Varied during measurements

#### 4) Important Analyser Settings:

- Resolution Bandwidth: >1% of the manufacturer's stated occupied bandwidth
- 5) The maximum spectral level of the modulated signal was recorded as the reference.

#### 6) The emission bandwidth is measured as follows:

the two furthest frequencies above and below the frequency of the maximum reference level where the spectrum is -26 dB down have to be found.

#### 7) The occupied bandwidth (99% Bandwidth) is measured as follows:

the occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power.

#### Test Requirements / Limits

§ 2.1049 Measurements required: Occupied bandwidth

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured under the following conditions (as applicable):

(h) Transmitters employing digital modulation techniques - when modulated by an input signal such that its amplitude and symbol rate represent the maximum rated conditions under which the equipment will be operated. The signal shall be applied through any filter networks, pseudo-random generators or other devices required in normal service. Additionally, the occupied bandwidth shall be shown for operation with any devices used for modifying the spectrum when such devices are optional at the discretion of the user.

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#### Band edge compliance

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Standard: FCC Part 24, 10-1-07, Subpart E

The test was performed according to: FCC §24.238, 10-1-07

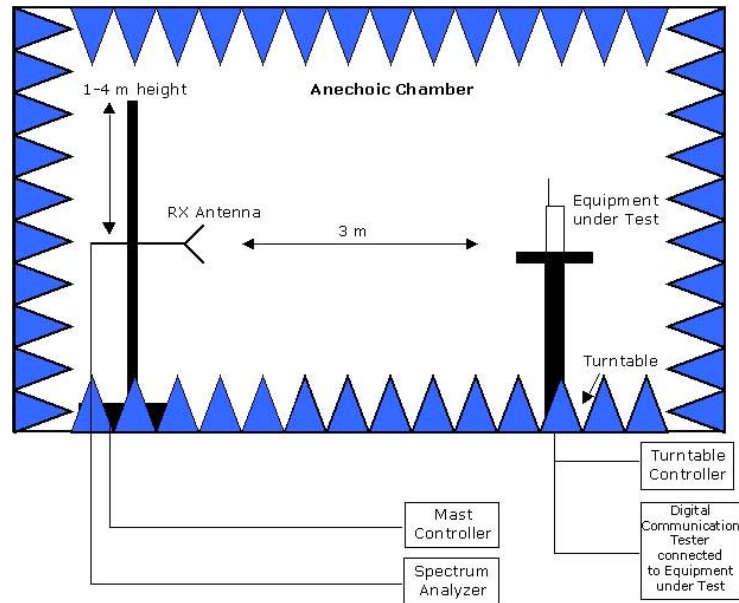
#### Test Description

- 1) The EUT was coupled to the R&S CMU200 Digital Communications Tester via a 10 dB attenuator and a 6 dB coupler.
- 2) For the measurement the EUT is connected to the Spectrum Analyser via 20 dB attenuator and 6 dB coupler.
- 3) The spectrum analyser is set to a RBW=VBW of >1% of the manufacturer's stated occupied bandwidth

#### Test Requirements / Limits

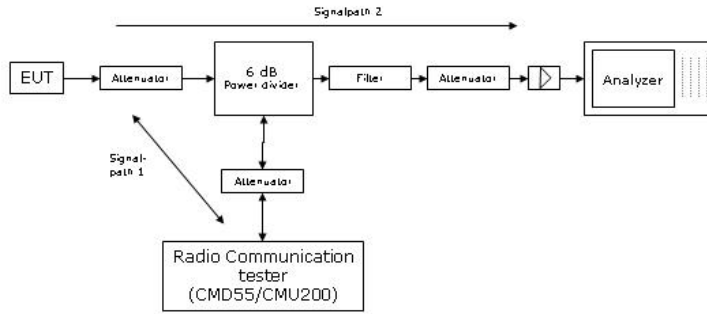
§ 24.238 Effective radiated power limits

## Setup Drawings



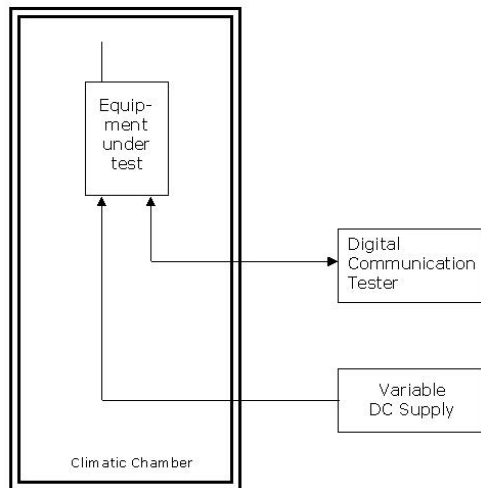
Remark: Depending on the frequency range suitable antenna types, attenuators or preamplifiers are used.

Principle set-up for radiated measurements



**Remark:** Depending on the frequency range suitable attenuators and/or filters and/or amplifiers are used.

Principle set-up for conducted measurements under nominal conditions



Principle set-up for tests under extreme test conditions

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Test Equipment

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*EUT Digital Signalling System*

Equipment	Type	Serial No.	Manufacturer	Last Cal	Next cal
Digital Radio Communication Tester	CMD 55	831050/020	Rohde & Schwarz	07.10.08	07.10.11
Signalling Unit for Bluetooth	PTW60	100004	Rohde & Schwarz	-	-
Universal Radio Communication Tester	CMU200	102366	Rohde & Schwarz	22.09.07	22.09.09
Universal Radio Communication Tester	CMU200	837983/052	Rohde & Schwarz	22.09.07	22.09.09
Signalling Unit for Bluetooth	CBT	100302	Rohde & Schwarz	22.09.06	N/A – only used for signalling

*EMI Test System*

Equipment	Type	Serial No.	Manufacturer	Last Cal	Next cal
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	01.06.11

*EMI Radiated Auxiliary Equipment*

Equipment	Type	Serial No.	Manufacturer	Last Cal	Next cal
Antenna mast 4m	MA 240	240/492	HD GmbH H. Deisel	-	-
Biconical dipole	VUBA 9117	9117108	Schwarzbeck	27.10.08	27.10.13
Broadband Amplifier 18MHz-26GHz	JS4-18002600-32	849785	Miteq	26.06.08	26.12.08
Broadband Amplifier 30MHz-18GHz	JS4-00101800-35	896037	Miteq	26.06.08	26.12.08
Broadband Amplifier 45MHz-27GHz	JS4-00102600-42	619368	Miteq	26.06.08	26.12.08
Cable "ESI to EMI Antenna"	EcoFlex10	W18.01-2 W38.01-2	Kabel Kusch	26.06.08	26.12.08
Cable "ESI to Horn Antenna"	UFB311A UFB293C	W18.02-2 W38.02-2	Rosenberger-Microcoax	26.06.08	26.12.08
Double-ridged horn	HF 906	357357/002	Rohde & Schwarz	12.05.06	12.05.09
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	26.06.08	26.12.08
High Pass Filter	5HC2700/12750-1.5-KK	9942012	Trilithic	26.06.08	26.12.08
High Pass Filter	4HC1600/12750-1.5-KK	9942011	Trilithic	26.06.08	26.12.08
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	00083069	EMCO	28.02.08	N/A (Stand. Gain Horn)
Pyramidal Horn Antenna 40GHz	Model 3160-10	00086675	EMCO	18.12.07	N/A (Stand. Gain Horn)

*EMI Conducted Auxiliary Equipment*

<b>Equipment</b>	<b>Type</b>	<b>Serial No.</b>	<b>Manufacturer</b>	<b>Last Cal</b>	<b>Next cal</b>
Cable "LISN to ESI"	RG214	W18.03+W48.03	Huber+Suhner	26.06.08	26.12.08
Two-Line V-Network	ESH 3-Z5	828304/029	Rohde & Schwarz	13.10.08	13.10.11
Two-Line V-Network	ESH 3-Z5	829996/002	Rohde & Schwarz	-	-

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

<b>Equipment</b>	<b>Type</b>	<b>Serial No.</b>	<b>Manufacturer</b>	<b>Last Cal</b>	<b>Next cal</b>
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	-	-
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	-	-
Spectrum Analyzer 9 kHz to 3 GHz	FSP3	838164/004	Rohde & Schwarz	06.10.08	06.10.11
Signal Analyzer 20 Hz to 26.5 GHz	FSIQ26	840061/005	Rohde & Schwarz	02.10.08	02.10.11

*Anechoic Chamber – calibration not applicable*

<b>Equipment</b>	<b>Type</b>	<b>Serial No.</b>	<b>Manufacturer</b>	<b>Last Cal</b>	<b>Next cal</b>
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	-	-



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