



InterLab®

Final Report on

Wireless Wrist Modem EmSeeQ200

HW: 1.0

SW: 1.1.0

Report Reference: ODE_MUS_EMFINDERS_0902_FCCe

Test Specification FCC24

Date: October 05, 2009

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: Mr. Boris Binger
Date Of Test Report: 2009/10/05
Date of first test: 2009/09/08
Date of last test: 2009/10/01

1.2 Applicant Data

Company Name: 7layers Inc.
Street: 15 Musick
City: Irvine, CA 92618
Country: USA

Contact Person: Mr. Patrick Lomax
Fax: +1-949-716-6521

1.3 Test Laboratory Data

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

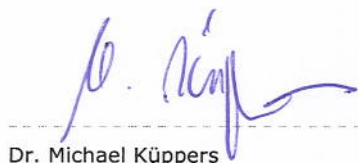
7 layers DE

Company Name : 7 layers AG
Street : Borsigstrasse 11
City : 40880 Ratingen
Country : Germany
Contact Person : Mr. Michael Albert
Phone : +49 2102 749 201
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E Mail : michael.albert@7Layers.de

Laboratory Details

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



(A. Petz)

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: EmSeeQ200

| | |
|-------------------------------|--|
| <i>Type / Model / Family:</i> | Wireless Wrist Modem EmSeeQ200 HW: 1.0 SW: 1.1.0 |
| Manufacturer: | |
| <i>Company Name:</i> | EmFinders |
| <i>Street:</i> | 6170 Research Rd |
| <i>City:</i> | Frisco, Tx 75034 |
| <i>Country:</i> | USA |
| <i>Contact Person:</i> | Mr. Chris Buehler |
| <i>E-Mail:</i> | cbuehler@emfinders.com |

Parameter List:

| Parameter name | Value |
|------------------------|--|
| AC Power Supply | periphery equipment 120 (V) |
| Antenna gain 1900 band | -3 dBi (dBi) |
| Antenna gain 850 band | -9 dBi (dBi) |
| DC Power Supply | 12 (V) |
| highest channel | 251 (848.8MHz) for GSM850, 810 (1909.8MHz) for GSM1900 |
| lowest channel | 128 (824.2MHz) for GSM850, 512 (1850.2MHz) for GSM1900 |
| mid channel | 190 (836.6MHz) for GSM850, 661 (1880.0MHz) for GSM1900 |

Ancillary Equipment: EPS060100

| | |
|-------------------------------|---|
| <i>Type / Model / Family:</i> | AC Charger |
| Manufacturer: | |
| <i>Company Name:</i> | CUI Inc. |
| <i>Street:</i> | 20050 SW 112th Ave. Tualatin, OR 97062 |
| <i>Contact Person:</i> | Mr. Nordstrom |

2.2 Detailed Description of OUT Samples

Sample : b01

| | |
|---------------------------|---------------------------|
| <i>OUT Identifier</i> | EmSeeQ200 |
| <i>Sample Description</i> | sample #01 7L DE radiated |
| <i>Serial No.</i> | AAA0501 |
| <i>HW Status</i> | 1.0 |
| <i>SW Status</i> | 1.1.0 |

Sample : AC_01

| | |
|---------------------------|----------------------|
| <i>OUT Identifier</i> | EPS060100 |
| <i>Sample Description</i> | AC Charger #01 7L DE |
| <i>Serial No.</i> | EPS060100-P7P |
| <i>HW Status</i> | not present |
| <i>SW Status</i> | not present |

2.3 OUT Features

Features for OUT: EmSeeQ200

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

Features for OUT: EPS060100

| <i>Designation</i> | <i>Description</i> | <i>Allowed Values</i> | <i>Supported Value(s)</i> |
|-----------------------------------|--|-----------------------|---------------------------|
| Features for scope: FCC_v2 | | | |
| AC | The OUT is powered by or connected to AC Mains | | |

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 AE01 | Pulsar Charger & Protection | | | | Charging Stand |

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.

| Setup No. | List of OUT samples | List of auxiliary equipment |
|---------------------|---------------------------|-----------------------------|
| Sample No. | Sample Description | AE No. AE Description |
| b01 | | |
| Sample: b01 | sample #01 7L DE radiated | |
| Setup_b01_01 | | |
| Sample: AC_01 | AC Charger #01 7L DE | AE AE01 Charging Stand |
| Sample: b01 | sample #01 7L DE radiated | |

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.

Note:

The end-user product EmSeeQ200 is using the GSM module GE864 (see FCC Grant RI7GE864). Technical differences between the module GE864 and this product EmSeeQ200 have been analyzed by the accredited test laboratory. As a consequence of this exercise it was necessary to repeat some specific testing on product EmSeeQ200 in reference to the test plan for the module GE864. This Test Report lists all tests which are related to FCC part 24 that have been carried out on this product EmSeeQ200.

3.2 List of the Applicable Body

(Body for Scope: FCC_v2)

| Designation | Description |
|---|------------------------------------|
| FCC47CFRChIPART24PERSONAL COMMUNICATIONS SERVICES | Part 24, Subpart E - Broadband PCS |

3.3 List of Test Specification

| | |
|----------------------------|--|
| <i>Test Specification:</i> | FCC part 2 and 24 |
| <i>Date / Version</i> | 2009/03/26 Version: 10-1-08 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 Ref.</i> | <i>Setup</i> |
|---|---------------|---------------------|-----------------|--------------|
| 24.1 RF Power Output §2.1046, §24.232 | | | | |
| 24.1; Frequency Band = 1900, Mode = GSM, Channel = 512, Frequency = 1850.2MHz, Method = conducted | Passed | 2009/09/24 | Lab 2 | b01 |
| 24.1; Frequency Band = 1900, Mode = GSM, Channel = 512, Frequency = 1850.2MHz, Method = radiated | Passed | 2009/09/30 | Lab 1 | Setup_b01_01 |
| 24.1; Frequency Band = 1900, Mode = GSM, Channel = 661, Frequency = 1880.0MHz, Method = conducted | Passed | 2009/09/24 | Lab 2 | b01 |
| 24.1; Frequency Band = 1900, Mode = GSM, Channel = 661, Frequency = 1880.0MHz, Method = radiated | Passed | 2009/09/30 | Lab 1 | Setup_b01_01 |
| 24.1; Frequency Band = 1900, Mode = GSM, Channel = 810, Frequency = 1909.8MHz, Method = conducted | Passed | 2009/09/24 | Lab 2 | b01 |
| 24.1; Frequency Band = 1900, Mode = GSM, Channel = 810, Frequency = 1909.8MHz, Method = radiated | Passed | 2009/10/01 | Lab 1 | Setup_b01_01 |
| 24.4 Field strength of spurious radiation §2.1053, §24.238 | | | | |
| 24.4; Frequency Band = 1900, Mode = GSM, Channel = 512, Frequency = 1850.2MHz | Passed | 2009/09/08 | Lab 1 | Setup_b01_01 |
| 24.4; Frequency Band = 1900, Mode = GSM, Channel = 661, Frequency = 1880.0MHz | Passed | 2009/09/08 | Lab 1 | Setup_b01_01 |
| 24.4; Frequency Band = 1900, Mode = GSM, Channel = 810, Frequency = 1909.8MHz | Passed | 2009/09/08 | Lab 1 | Setup_b01_01 |



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, Frequency = 1850.2MHz, Method = conducted

Result: Passed
Setup No.: b01
Date of Test: 2009/09/24 13:57
Body: NO BODY
Test Specification: FCC part 2 and 24

Detailed Results:

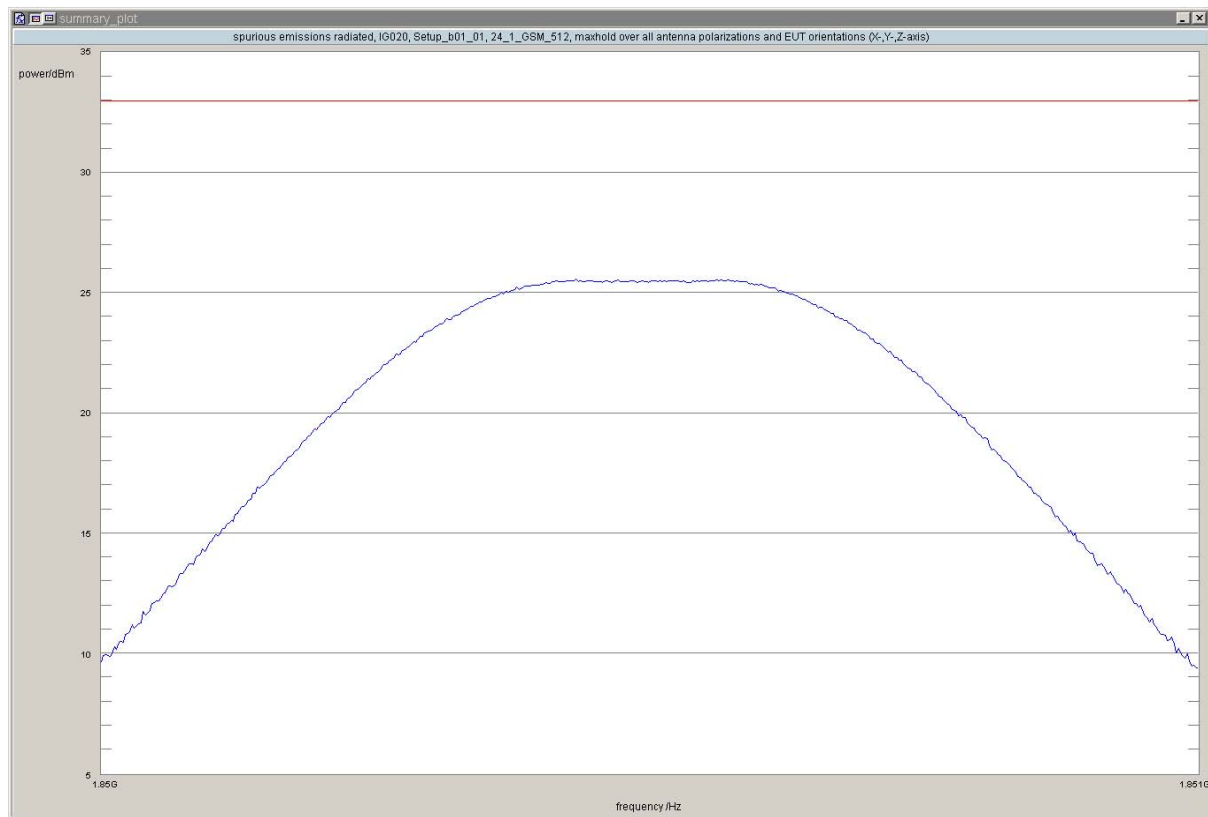
| detector | trace | resolution bandwidth /kHz | conducted peak value /dBm | verdict |
|----------|---------|---------------------------------|---------------------------------|---------|
| peak | maxhold | 300 | 29.38 | passed |
| average | maxhold | 300 | 28.97 | passed |
| rms | maxhold | 300 | 28.96 | passed |

no external antenna gain is specified, the verdict is valid
for external antenna gains less than 3.62dBi.

Test: 24.1; Frequency Band = 1900, Mode = GSM, Channel = 512, Frequency = 1850.2MHz, Method = radiated

Result: Passed
Setup No.: Setup_b01_01
Date of Test: 2009/09/30 20:56
Body: FCC47CFRChIPART24PERSONAL COMMUNICATIONS SERVICES
Test Specification: FCC part 2 and 24

Detailed Results:



| detector | trace | resolution bandwidth /kHz | frequency /MHz | peak value /dBm | limit /dBm | margin to limit /dB | azimuth /° | antenna polarization | EUT orientation | verdict |
|----------|---------|---------------------------|----------------|-----------------|------------|---------------------|------------|----------------------|-----------------|---------|
| peak | maxhold | 300 | 1850.13 | 25.57 | 33.00 | 7.43 | 105.0 | vertical | vertical | passed |

no further values have been found with a margin of less than 30 dB

Test: 24.1; Frequency Band = 1900, Mode = GSM, Channel = 661, Frequency = 1880.0MHz, Method = conducted

Result: Passed

Setup No.: b01

Date of Test: 2009/09/24 13:56

Body: NO BODY

Test Specification: FCC part 2 and 24

Detailed Results:

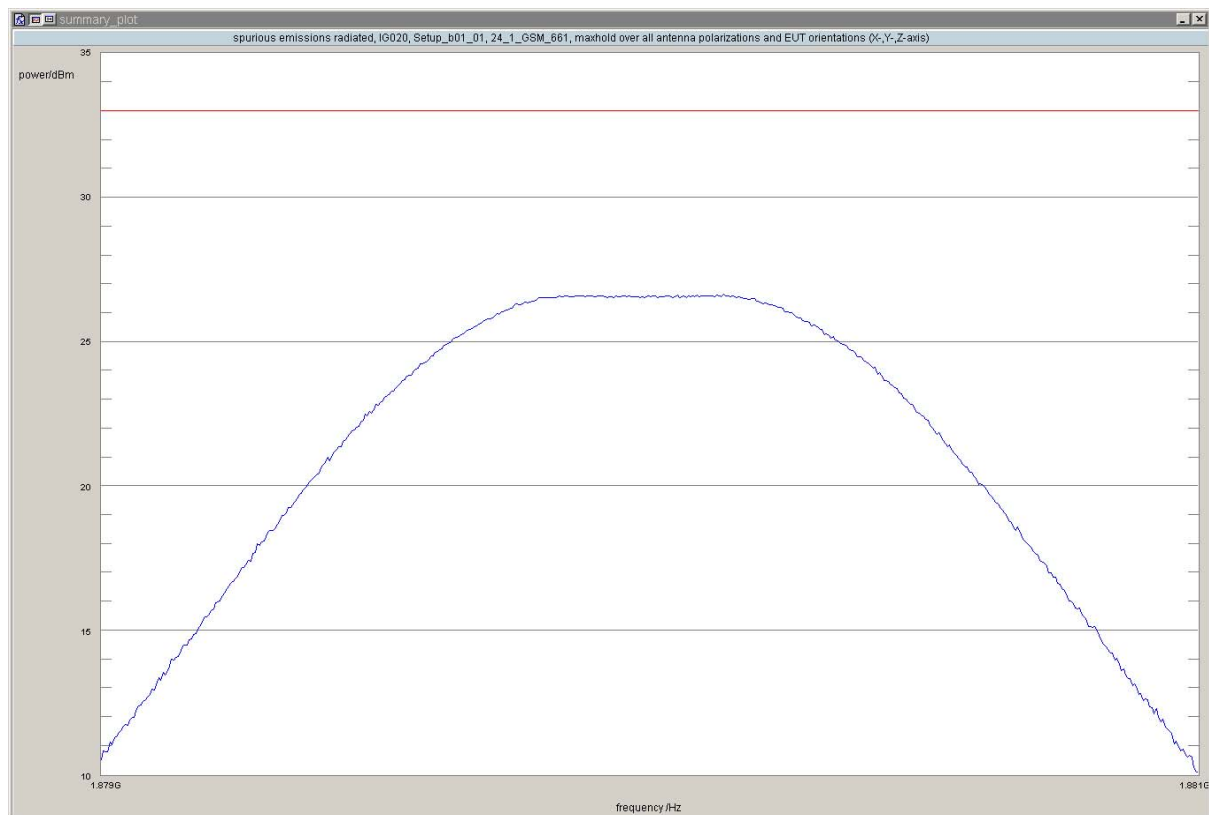
| detector | trace | resolution bandwidth /kHz | conducted peak value /dBm | verdict |
|----------|---------|---------------------------|---------------------------|---------|
| peak | maxhold | 300 | 28.83 | passed |
| average | maxhold | 300 | 28.41 | passed |
| rms | maxhold | 300 | 28.42 | passed |

no external antenna gain is specified, the verdict is valid for external antenna gains less than 4.17dBi.

Test: 24.1; Frequency Band = 1900, Mode = GSM, Channel = 661, Frequency = 1880.0MHz, Method = radiated

Result: Passed
Setup No.: Setup_b01_01
Date of Test: 2009/09/30 20:18
Body: FCC47CFRChIPART24PERSONAL COMMUNICATIONS SERVICES
Test Specification: FCC part 2 and 24

Detailed Results:



| detector | trace | resolution bandwidth /kHz | frequency /MHz | peak value /dBm | limit /dBm | margin to limit /dB | azimuth /° | antenna polarization | EUT orientation | verdict |
|----------|---------|---------------------------|----------------|-----------------|------------|---------------------|------------|----------------------|-----------------|---------|
| peak | maxhold | 300 | 1880.07 | 26.67 | 33.00 | 6.33 | 105.0 | vertical | vertical | passed |

no further values have been found with a margin of less than 30 dB

Test: 24.1; Frequency Band = 1900, Mode = GSM, Channel = 810, Frequency = 1909.8MHz, Method = conducted

Result: Passed
Setup No.: b01
Date of Test: 2009/09/24 13:58
Body: NO BODY
Test Specification: FCC part 2 and 24

**Detailed Results:**

| detector | trace | resolution bandwidth /kHz | conducted peak value /dBm | verdict |
|----------|---------|---------------------------------|---------------------------------|---------|
| peak | maxhold | 300 | 29.29 | passed |
| average | maxhold | 300 | 28.87 | passed |
| rms | maxhold | 300 | 28.89 | passed |

no external antenna gain is specified, the verdict is valid
for external antenna gains less than 3.71dBi.

Test: 24.1; Frequency Band = 1900, Mode = GSM, Channel = 810, Frequency = 1909.8MHz, Method = radiated

Result: Passed

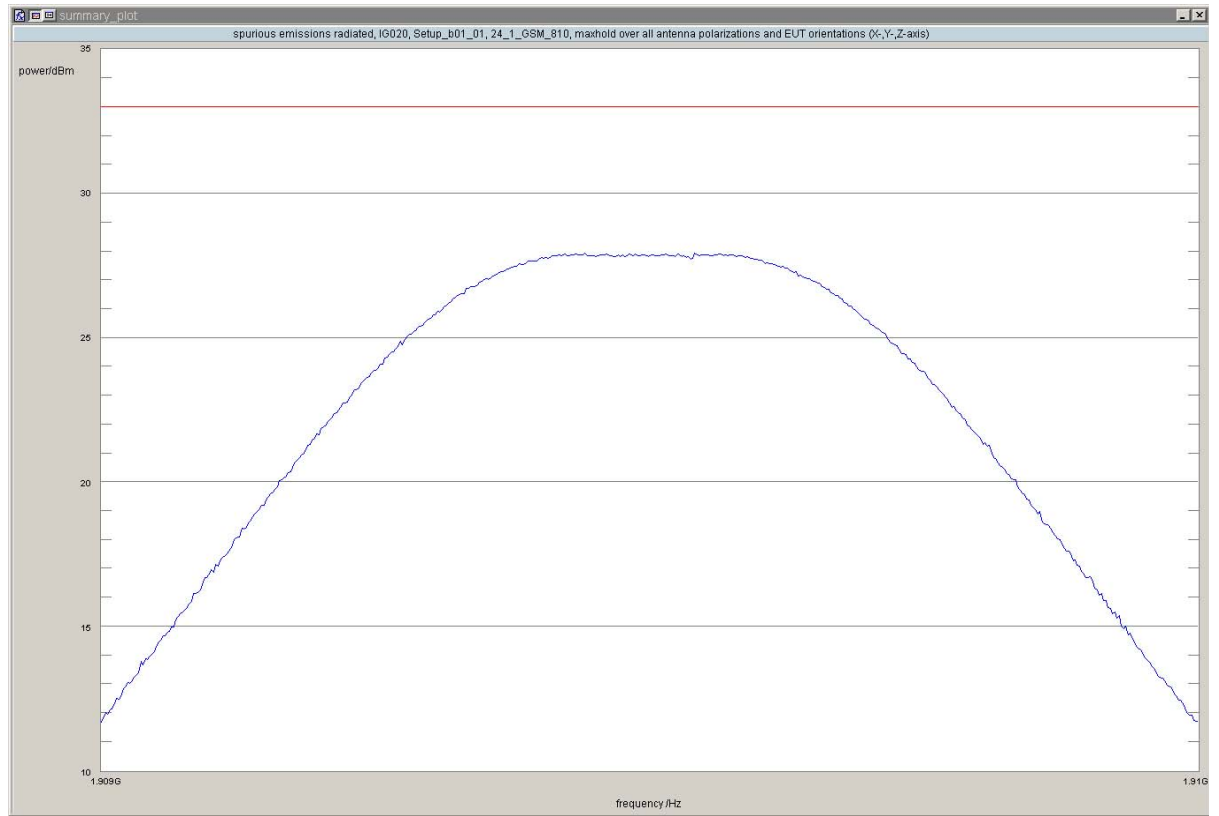
Setup No.: Setup_b01_01

Date of Test: 2009/10/01 9:13

Body: FCC47CFRChIPART24PERSONAL COMMUNICATIONS SERVICES

Test Specification: FCC part 2 and 24

Detailed Results:



| detector | trace | resolution bandwidth /kHz | frequency /MHz | peak value /dBm | limit /dBm | margin to limit /dB | azimuth /° | antenna polarization | EUT orientation | verdict |
|----------|---------|---------------------------|----------------|-----------------|------------|---------------------|------------|----------------------|-----------------|---------|
| peak | maxhold | 300 | 1909.74 | 27.93 | 33.00 | 5.07 | 105.0 | vertical | vertical | passed |

no further values have been found with a margin of less than 30 dB

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

Test: 24.4; Frequency Band = 1900, Mode = GSM, Channel = 512, Frequency = 1850.2MHz

Result: Passed

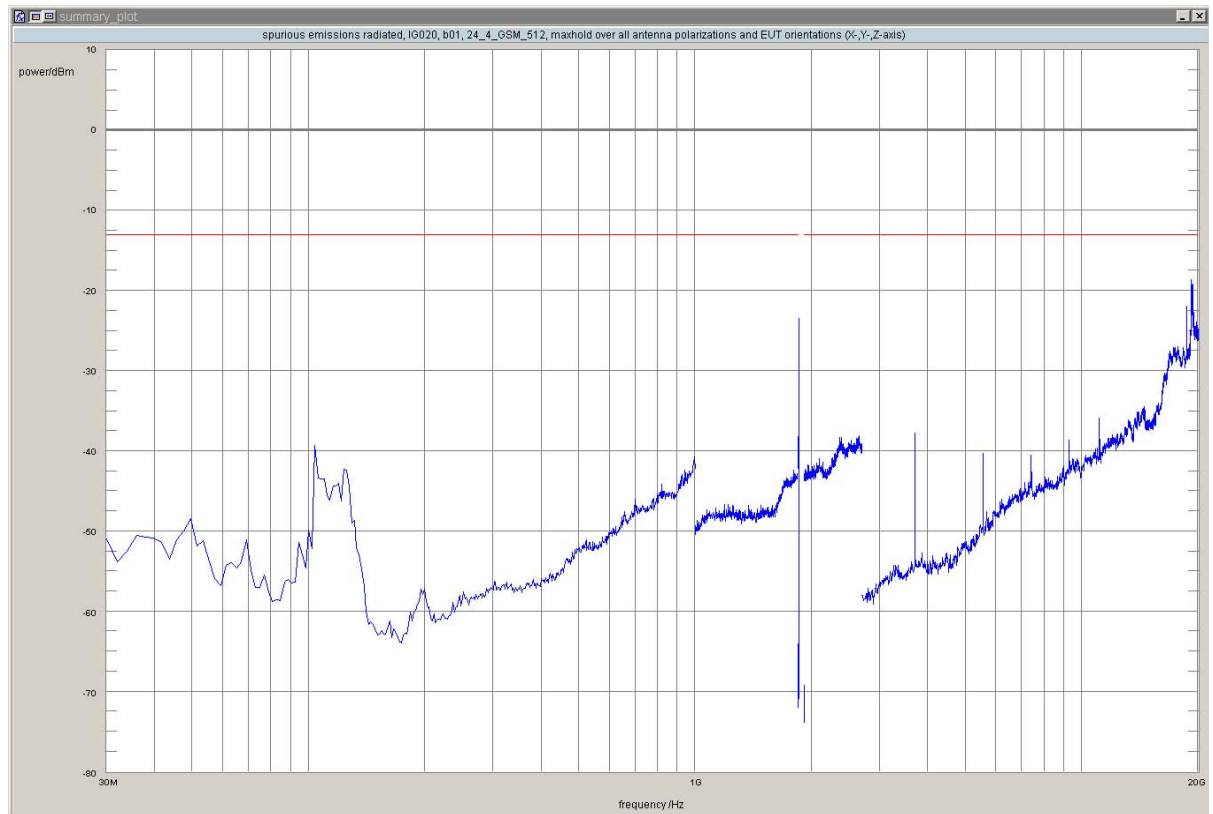
Setup No.: Setup_b01_01

Date of Test: 2009/09/08 12:08

Body: FCC47CFRChIPART24PERSONAL COMMUNICATIONS SERVICES

Test Specification: FCC part 2 and 24

Detailed Results:



| detector | trace | resolution bandwidth /kHz | frequency /MHz | peak value /dBm | limit /dBm | margin to limit /dB | azimuth /° | antenna polarization | EUT orientation | verdict |
|----------|---------|---------------------------|----------------|-----------------|------------|---------------------|------------|----------------------|-----------------|---------|
| peak | maxhold | 3 | 1849.9459 | -31.01 | -13.00 | 18.01 | 60.0 | horizontal | horizontal | passed |
| peak | maxhold | 3 | 1849.9559 | -28.66 | -13.00 | 15.66 | 60.0 | horizontal | horizontal | passed |
| peak | maxhold | 3 | 1849.9639 | -28.39 | -13.00 | 15.39 | 0.0 | vertical | horizontal | passed |
| peak | maxhold | 3 | 1849.9820 | -23.47 | -13.00 | 10.47 | 60.0 | horizontal | horizontal | passed |
| peak | maxhold | 3 | 1849.9980 | -24.67 | -13.00 | 11.67 | 60.0 | horizontal | horizontal | passed |
| peak | maxhold | 1000 | 18653.3 | -21.87 | -13.00 | 8.87 | 0.0 | vertical | vertical | passed |
| peak | maxhold | 1000 | 19214.4 | -18.63 | -13.00 | 5.63 | 90.0 | horizontal | vertical | passed |
| peak | maxhold | 1000 | 19228.5 | -19.82 | -13.00 | 6.82 | 60.0 | horizontal | horizontal | passed |
| peak | maxhold | 1000 | 19326.7 | -19.13 | -13.00 | 6.13 | -120.0 | vertical | horizontal | 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, Frequency = 1880.0MHz

Result: Passed

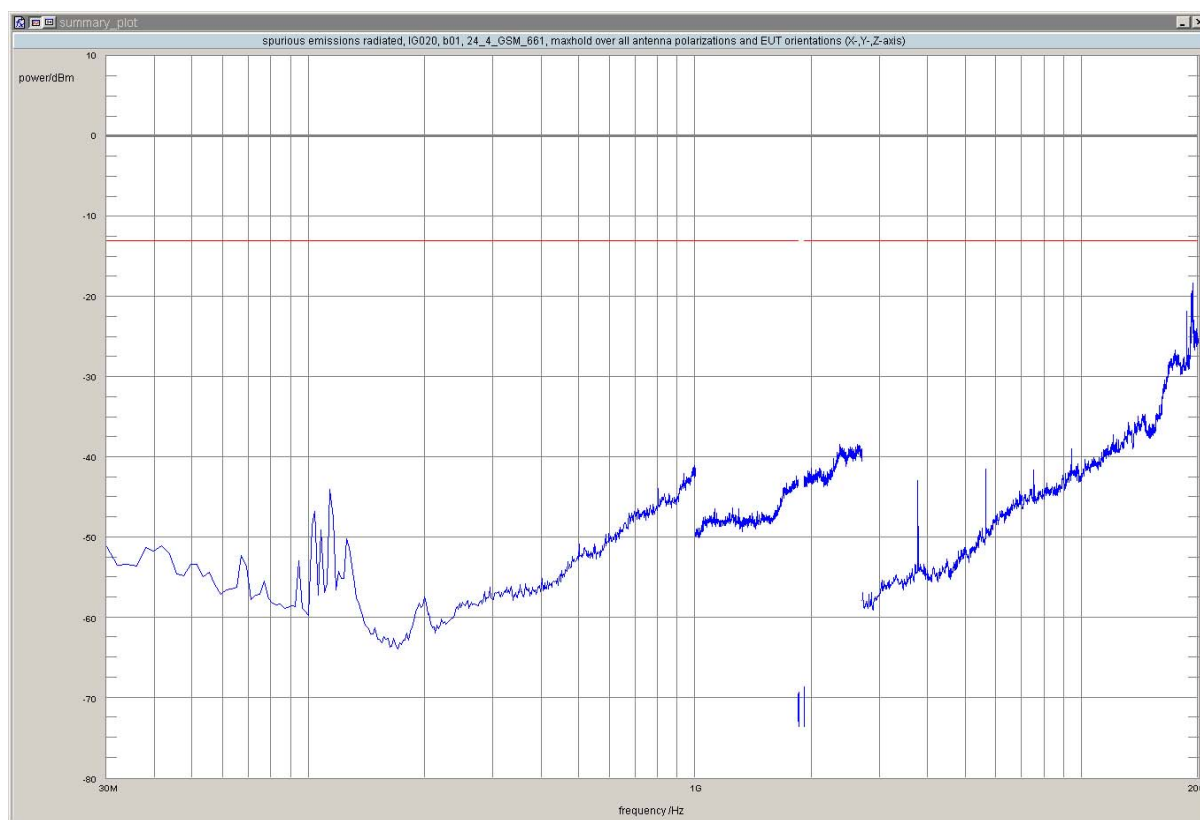
Setup No.: Setup_b01_01

Date of Test: 2009/09/08 13:09

Body: FCC47CFRChIPART24PERSONAL COMMUNICATIONS SERVICES

Test Specification: FCC part 2 and 24

Detailed Results:



| detector | trace | resolution bandwidth /kHz | frequency /MHz | peak value /dBm | limit /dBm | margin to limit /dB | azimuth /° | antenna polarization | EUT orientation | verdict |
|----------|---------|---------------------------|----------------|-----------------|------------|---------------------|------------|----------------------|-----------------|---------|
| peak | maxhold | 1000 | 18653.3 | -21.83 | -13.00 | 8.83 | -60.0 | vertical | horizontal | passed |
| peak | maxhold | 1000 | 19214.4 | -19.69 | -13.00 | 6.69 | 0.0 | horizontal | vertical | passed |
| peak | maxhold | 1000 | 19312.6 | -20.41 | -13.00 | 7.41 | 135.0 | vertical | vertical | passed |
| peak | maxhold | 1000 | 19326.7 | -18.32 | -13.00 | 5.32 | -90.0 | horizontal | vertical | passed |
| peak | maxhold | 1000 | 19340.7 | -19.42 | -13.00 | 6.42 | 135.0 | horizontal | vertical | 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, Frequency = 1909.8MHz

Result: Passed

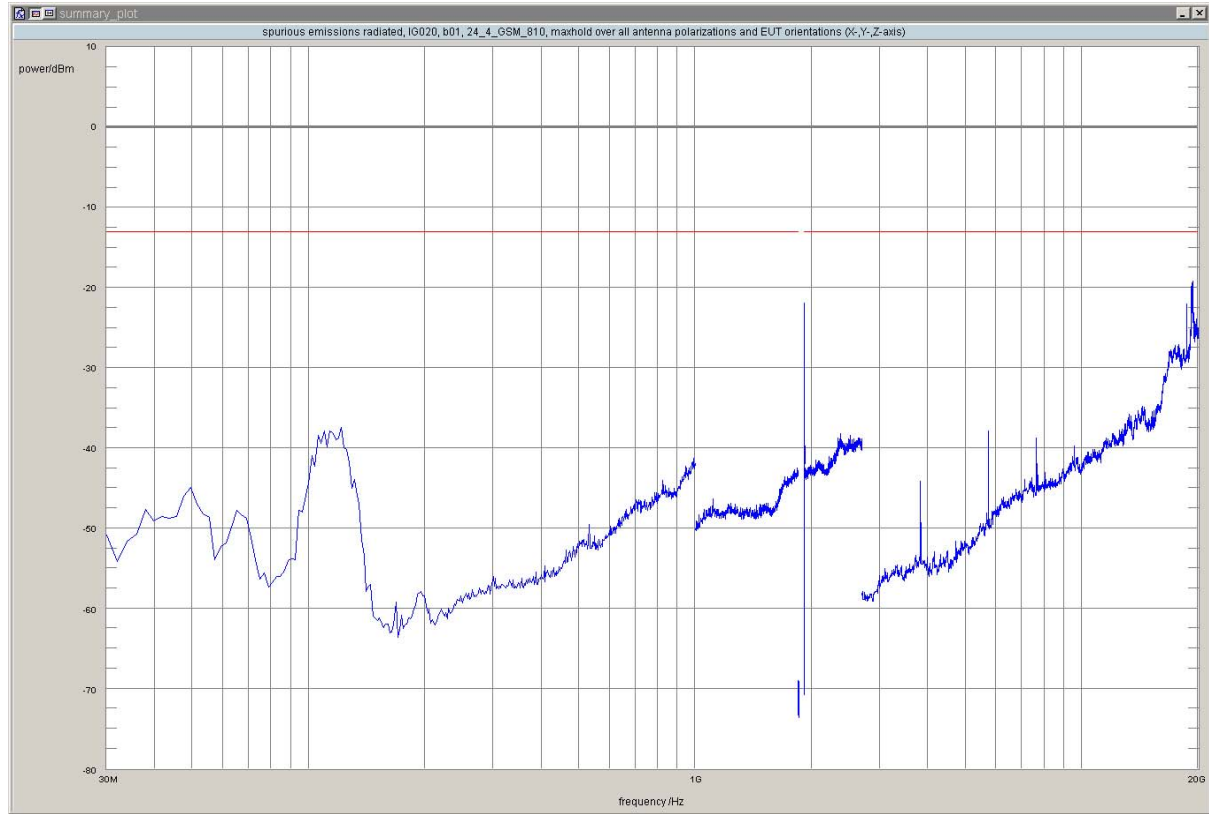
Setup No.: Setup_b01_01

Date of Test: 2009/09/08 10:09

Body: FCC47CFRChIPART24PERSONAL COMMUNICATIONS SERVICES

Test Specification: FCC part 2 and 24

Detailed Results:



| detector | trace | resolution bandwidth /kHz | frequency /MHz | peak value /dBm | limit /dBm | margin to limit /dB | azimuth /° | antenna polarization | EUT orientation | verdict |
|----------|---------|---------------------------|----------------|-----------------|------------|---------------------|------------|----------------------|-----------------|---------|
| peak | maxhold | 3 | 1910.0000 | -28.64 | -13.00 | 15.64 | 45.0 | horizontal | vertical | passed |
| peak | maxhold | 3 | 1910.0040 | -23.67 | -13.00 | 10.67 | 60.0 | horizontal | horizontal | passed |
| peak | maxhold | 3 | 1910.0140 | -29.34 | -13.00 | 16.34 | 60.0 | vertical | horizontal | passed |
| peak | maxhold | 3 | 1910.0180 | -21.91 | -13.00 | 8.91 | -90.0 | horizontal | vertical | passed |
| peak | maxhold | 3 | 1910.0321 | -28.66 | -13.00 | 15.66 | 90.0 | horizontal | vertical | passed |
| peak | maxhold | 3 | 1910.0381 | -30.92 | -13.00 | 17.92 | 0.0 | vertical | horizontal | passed |
| peak | maxhold | 3 | 1910.0441 | -28.25 | -13.00 | 15.25 | 60.0 | horizontal | horizontal | passed |
| peak | maxhold | 3 | 1910.0481 | -26.11 | -13.00 | 13.11 | -90.0 | horizontal | vertical | passed |
| peak | maxhold | 3 | 1910.0521 | -31.72 | -13.00 | 18.72 | -45.0 | horizontal | vertical | passed |
| peak | maxhold | 3 | 1910.0641 | -32.51 | -13.00 | 19.51 | 60.0 | horizontal | horizontal | passed |
| peak | maxhold | 1000 | 18653.3 | -22.05 | -13.00 | 9.05 | -90.0 | horizontal | vertical | passed |
| peak | maxhold | 1000 | 19214.4 | -19.83 | -13.00 | 6.83 | -135.0 | horizontal | vertical | passed |
| peak | maxhold | 1000 | 19312.6 | -19.63 | -13.00 | 6.63 | 45.0 | horizontal | vertical | passed |
| peak | maxhold | 1000 | 19326.7 | -19.14 | -13.00 | 6.14 | 0.0 | horizontal | horizontal | passed |
| peak | maxhold | 1000 | 19340.7 | -20.53 | -13.00 | 7.53 | 60.0 | horizontal | horizontal | passed |

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

4 Test Equipment Details

4.1 List of Used Test Equipment

The calibration, hardware and software states are shown for the testing period.

Test Equipment Anechoic Chamber

| | | | |
|----------------------|---------------------------------------|-----------------------|-------------------|
| Lab ID: | Lab 1 | | |
| Manufacturer: | Frankonia | | |
| Description: | Anechoic Chamber for radiated testing | | |
| Type: | 10.58x6.38x6 | | |
| | <i>Calibration Details</i> | <i>Last Execution</i> | <i>Next Exec.</i> |
| | FCC renewal | 2006/12/19 | 2009/12/19 |
| | IC renewal | 2009/01/21 | 2011/01/20 |
| | FCC renewal | 2009/01/07 | 2011/01/06 |

Single Devices for Anechoic Chamber

| <i>Single Device Name</i> | <i>Type</i> | <i>Serial Number</i> | <i>Manufacturer</i> |
|---------------------------|--------------------------------|---------------------------|---|
| Air compressor | none | - | Atlas Copco |
| Anechoic Chamber | 10.58 x 6.38 x 6 | none | Frankonia |
| | <i>Calibration Details</i> | | <i>Last Execution</i> <i>Next Exec.</i> |
| | FCC listing 96716 3m Part15/18 | | 2009/01/07 2011/01/06 |
| | ANSI C64.3 NSA | | 2009/01/21 2011/01/20 |
| Controller Innco 2000 | CO 2000 | CO2000/328/1247 0406/L | Innco innovative constructions GmbH |
| EMC camera | CE-CAM/1 | - | CE-SYS |
| EMC camera Nr.2 | CCD-400E | 0005033 | Mitsubishi |
| Filter ISDN | B84312-C110-E1 | | Siemens&Matsushita |
| Filter Universal 1A | BB4312-C30-H3 | - | Siemens&Matsushita |

Test Equipment Auxiliary Equipment for Radiated emissions

Lab ID: Lab 1
Description: Equipment for emission measurements
Serial Number: see single devices

Single Devices for Auxiliary Equipment for Radiated emissions

| Single Device Name | Type | Serial Number | Manufacturer |
|------------------------------------|----------------------------|-----------------------|----------------------------------|
| Antenna mast | AS 620 P | | HD GmbH |
| Biconical dipole | VUBA 9117 | 9117108 | Schwarzbeck |
| | <i>Calibration Details</i> | | <i>Last Execution Next Exec.</i> |
| | Standard Calibration | | 2008/10/27 2013/10/26 |
| Broadband Amplifier 18MHz-26GHz | JS4-18002600-32-5P | 849785 | Miteq |
| | <i>Calibration Details</i> | | <i>Last Execution Next Exec.</i> |
| | Path Calibration | | 2009/05/18 2009/11/17 |
| Broadband Amplifier 1GHz-4GHz | AFS4-01000400-1Q-10P-4 | - | Miteq |
| | <i>Calibration Details</i> | | <i>Last Execution Next Exec.</i> |
| | Path Calibration | | 2009/05/18 2009/11/17 |
| Broadband Amplifier 30MHz-18GHz | JS4-00101800-35-5P | 896037 | Miteq |
| | <i>Calibration Details</i> | | <i>Last Execution Next Exec.</i> |
| | Path Calibration | | 2009/05/18 2009/11/17 |
| Cable "ESI to EMI Antenna" | EcoFlex10 | W18.01- 2+W38.01-2 | Kabel Kusch |
| | <i>Calibration Details</i> | | <i>Last Execution Next Exec.</i> |
| | Path Calibration | | 2009/05/18 2009/11/17 |
| Cable "ESI to Horn Antenna" | UFB311A+UFB293C | W18.02- 2+W38.02-2 | Rosenberger Micro-Coax |
| | <i>Calibration Details</i> | | <i>Last Execution Next Exec.</i> |
| | Path Calibration | | 2009/05/18 2009/11/17 |
| Double-ridged horn | HF 906 | 357357/001 | Rohde & Schwarz GmbH & Co. KG |
| | <i>Calibration Details</i> | | <i>Last Execution Next Exec.</i> |
| | Standard Calibration | | 2009/04/16 2012/04/15 |
| Double-ridged horn | HF 906 | 357357/002 | Rohde & Schwarz GmbH & Co. KG |
| | <i>Calibration Details</i> | | <i>Last Execution Next Exec.</i> |
| | Standard Calibration | | 2009/04/28 2012/04/27 |
| Dreheinheit | DE 325 | | HD GmbH |
| High Pass Filter | 4HC1600/12750-1.5-KK | 9942011 | Trilithic |
| | <i>Calibration Details</i> | | <i>Last Execution Next Exec.</i> |
| | Path Calibration | | 2009/05/18 2009/11/17 |
| High Pass Filter | 5HC2700/12750-1.5-KK | 9942012 | Trilithic |
| | <i>Calibration Details</i> | | <i>Last Execution Next Exec.</i> |
| | Path Calibration | | 2009/05/18 2009/11/17 |
| High Pass Filter | 5HC3500/12750-1.2-KK | 200035008 | Trilithic |
| | <i>Calibration Details</i> | | <i>Last Execution Next Exec.</i> |
| | Path Calibration | | 2009/05/18 2009/11/17 |
| Log.-per. Antenna | HL 562 Ultralog | 830547/003 | Rohde & Schwarz GmbH & Co. KG |

Single Devices for Auxiliary Equipment for Radiated emissions (continued)

| Single Device Name | Type | Serial Number | Manufacturer |
|---------------------------------|----------------------------|---------------|----------------------------------|
| <i>Calibration Details</i> | | | <i>Last Execution Next Exec.</i> |
| Standard Calibration | | | 2009/05/27 2012/05/26 |
| Loop Antenna | HFH2-Z2 | 829324/006 | Rohde & Schwarz GmbH & Co. KG |
| | <i>Calibration Details</i> | | <i>Last Execution Next Exec.</i> |
| DKD calibration | | | 2008/10/07 2011/10/06 |
| Pyramidal Horn Antenna 26,5 GHz | 3160-09 | 00083069 | EMCO Elektronik GmbH |
| Pyramidal Horn Antenna 40 GHz | 3160-10 | 00086675 | EMCO Elektronik GmbH |

Test Equipment Auxiliary Test Equipment

| | |
|-----------------------|---|
| Lab ID: | Lab 1, Lab 2 |
| Manufacturer: | see single devices |
| Description: | Single Devices for various Test Equipment |
| Type: | various |
| Serial Number: | none |

Single Devices for Auxiliary Test Equipment

| Single Device Name | Type | Serial Number | Manufacturer |
|------------------------------------|----------------------------|---------------|--------------------------------------|
| AC Power Source | Chroma 6404 | 64040001304 | Chroma ATE INC. |
| Broadband Power Divider N (Aux) | 1506A / 93459 | LM390 | Weinschel Associates |
| Broadband Power Divider SMA | WA1515 | A855 | Weinschel Associates |
| Digital Multimeter 01 (Multimeter) | Voltcraft M-3860M | IJ096055 | Conrad Electronics |
| Digital Multimeter 03 (Multimeter) | Fluke 177 | 86670383 | Fluke Europe B.V. |
| Digital Oscilloscope [SA2] (Aux) | TDS 784C | B021311 | Tektronix GmbH |
| Fibre optic link Satellite (Aux) | FO RS232 Link | 181-018 | Pontis |
| Fibre optic link Transceiver (Aux) | FO RS232 Link | 182-018 | Pontis |
| Isolating Transformer | LTS 604 | 1888 | Thalheimer Transformatorenwerke GmbH |
| Notch Filter Ultra Stable (Aux) | WRCA800/960-6EEK | 24 | Wainwright |
| Spectrum Analyser | FSP3 | 836722/011 | Rohde & Schwarz GmbH & Co. KG |
| | <i>Calibration Details</i> | | <i>Last Execution Next Exec.</i> |
| DKD calibration | | | 2008/10/06 2011/10/05 |

Test Equipment Digital Signalling Devices

Lab ID: Lab 1, Lab 2

Description: Signalling equipment for various wireless technologies.

Single Devices for Digital Signalling Devices

| Single Device Name | Type | Serial Number | Manufacturer |
|--------------------------------------|--|---------------|---|
| Bluetooth Signalling Unit CBT | CBT | 100589 | Rohde & Schwarz GmbH & Co. KG |
| | <i>Calibration Details</i> | | <i>Last Execution</i> <i>Next Exec.</i> |
| | Standard Calibration | | 2008/08/14 2011/08/13 |
| Digital Radio Communication Tester | CMD 55 | 831050/020 | Rohde & Schwarz GmbH & Co. KG |
| | <i>Calibration Details</i> | | <i>Last Execution</i> <i>Next Exec.</i> |
| | Standard calibration | | 2008/10/07 2010/10/06 |
| Digital Radio Test Set | 6103E | 2359 | Racal Instruments, Ltd. |
| Universal Radio Communication Tester | CMU 200 | 102366 | Rohde & Schwarz GmbH & Co. KG |
| | <i>Calibration Details</i> | | <i>Last Execution</i> <i>Next Exec.</i> |
| | Standard calibration | | 2009/02/16 2011/02/15 |
| | <i>HW/SW Status</i> | | <i>Date of Start</i> <i>Date of End</i> |
| | Hardware: | | 2007/07/16 |
| | B11, B21V14, B21-2, B41, B52V14, B52-2, B53-2, B56V14, B68 3v04, PCMCIA, U65V04 | | |
| | Software: | | |
| Universal Radio Communication Tester | K21 4v21, K22 4v21, K23 4v21, K24 4v21, K42 4v21, K43 4v21, K53 4v21, K56 4v22, K57 4v22, K58 4v22, K59 4v22, K61 4v22, K62 4v22, K63 4v22, K64 4v22, K65 4v22, K66 4v22, K67 4v22, K68 4v22, K69 4v22 | | |
| | Firmware: | | |
| | µP1 8v50 02.05.06 | | |
| | --- | | |
| | CMU 200 | 837983/052 | Rohde & Schwarz GmbH & Co. KG |
| | <i>Calibration Details</i> | | <i>Last Execution</i> <i>Next Exec.</i> |
| | Standard calibration | | 2008/12/01 2011/11/30 |
| | <i>HW/SW Status</i> | | <i>Date of Start</i> <i>Date of End</i> |
| | HW options: | | 2007/01/02 |
| | B11, B21V14, B21-2, B41, B52V14, B52-2, B53-2, B54V14, B56V14, B68 3v04, B95, PCMCIA, U65V02 | | |
| Universal Radio Communication Tester | SW options: | | |
| | K21 4v11, K22 4v11, K23 4v11, K24 4v11, K27 4v10, K28 4v10, K42 4v11, K43 4v11, K53 4v10, K65 4v10, K66 4v10, K68 4v10, | | |
| | Firmware: | | |
| | µP1 8v40 01.12.05 | | |
| | --- | | |
| | SW: | | 2008/11/03 |
| | K62, K69 | | |
| | SMU200A | 100912 | Rohde & Schwarz GmbH & Co. KG |
| | <i>Calibration Details</i> | | <i>Last Execution</i> <i>Next Exec.</i> |
| | standard calibration | | 2008/10/28 2011/10/27 |

Test Equipment Emission measurement devices

Lab ID: Lab 1
Description: Equipment for emission measurements
Serial Number: see single devices

Single Devices for Emission measurement devices

| <i>Single Device Name</i> | <i>Type</i> | <i>Serial Number</i> | <i>Manufacturer</i> |
|---------------------------|-------------|----------------------------|---|
| Personal Computer | Dell | | Dell |
| Signal Generator | SMR 20 | 846834/008 | Rohde & Schwarz GmbH & Co. KG |
| | | <i>Calibration Details</i> | <i>Last Execution</i> <i>Next Exec.</i> |
| | | Standard Calibration | 2007/12/05 2010/12/04 |
| Spectrum Analyzer | ESIB 26 | 830482/004 | Rohde & Schwarz GmbH & Co. KG |
| | | <i>Calibration Details</i> | <i>Last Execution</i> <i>Next Exec.</i> |
| | | Standard Calibration | 2007/12/06 2009/12/05 |

Test Equipment Radio Lab Test Equipment

Lab ID: Lab 2
Description: Radio Lab Test Equipment

Single Devices for Radio Lab Test Equipment

| Single Device Name | Type | Serial Number | Manufacturer |
|---|----------------------|---------------|-------------------------------|
| Broadband Power Divider SMA | WA1515 | A856 | Weinschel Associates |
| | Calibration Details | | Last Execution Next Exec. |
| | Path Calibration | | 2009/07/07 2010/01/06 |
| Coax Attenuator 10dB SMA 2W | 4T-10 | F9401 | Weinschel Associates |
| | Calibration Details | | Last Execution Next Exec. |
| | Path Calibration | | 2009/07/07 2010/01/06 |
| Coax Attenuator 10dB SMA 2W | 56-10 | W3702 | Weinschel Associates |
| | Calibration Details | | Last Execution Next Exec. |
| | Path Calibration | | 2009/07/07 2010/01/06 |
| Coax Attenuator 10dB SMA 2W | 56-10 | W3711 | Weinschel Associates |
| | Calibration Details | | Last Execution Next Exec. |
| | Path Calibration | | 2009/07/07 2010/01/06 |
| Coax Cable Huber&Suhner | Sucotest 2,0m | | Rosenberger Micro-Coax |
| | Calibration Details | | Last Execution Next Exec. |
| | Path Calibration | | 2009/07/07 2010/01/06 |
| Coax Cable Rosenberger Micro Coax FA210A0010003030 SMA/SMA 1,0m | FA210A0010003030 | 54491-2 | Rosenberger Micro-Coax |
| | Calibration Details | | Last Execution Next Exec. |
| | Path Calibration | | 2009/07/07 2010/01/06 |
| Power Sensor | NRV-Z1 | 836219/005 | Rohde & Schwarz GmbH & Co. KG |
| | Calibration Details | | Last Execution Next Exec. |
| | DKD Calibration | | 2008/10/06 2009/10/05 |
| Powermeter | NRVS | 836333/064 | Rohde & Schwarz GmbH & Co. KG |
| | Calibration Details | | Last Execution Next Exec. |
| | DKD Calibration | | 2008/10/01 2009/09/30 |
| RF Step Attenuator RSP | RSP | 833695/001 | Rohde & Schwarz GmbH & Co.KG |
| | Calibration Details | | Last Execution Next Exec. |
| | Standard Calibration | | 2008/06/18 2011/06/17 |
| Rubidium Frequency Standard | Datum, Model: MFL | 2689/001 | Datum-Beverly |
| | Calibration Details | | Last Execution Next Exec. |
| | Standard calibration | | 2009/06/23 2010/06/22 |
| Signal Generator | SMY02 | 829309/018 | Rohde & Schwarz GmbH & Co. KG |
| | Calibration Details | | Last Execution Next Exec. |
| | standard calibration | | 2008/10/07 2011/10/06 |

Single Devices for Radio Lab Test Equipment (continued)

| <i>Single Device Name</i> | <i>Type</i> | <i>Serial Number</i> | <i>Manufacturer</i> | |
|-------------------------------|----------------------------|----------------------|---|------------|
| Signal Generator SMP | SMP02 | 836402/008 | Rohde & Schwarz GmbH & Co. KG | |
| | <i>Calibration Details</i> | | <i>Last Execution</i> <i>Next Exec.</i> | |
| | Standard Calibration | | 2007/02/27 | 2010/02/26 |
| Spectrum Analyser | FSIQ26 | 840061/005 | Rohde & Schwarz GmbH & Co. KG | |
| | <i>Calibration Details</i> | | <i>Last Execution</i> <i>Next Exec.</i> | |
| | calibration | | 2008/10/02 | 2010/10/01 |
| Temperature Chamber Vötsch 05 | VT 4002 | 58566080550010 | Vötsch | |
| | <i>Calibration Details</i> | | <i>Last Execution</i> <i>Next Exec.</i> | |
| | Specific calibration | | 2009/03/12 | 2010/03/11 |
| Vector Signal Generator | SMIQ 03B | 837747/020 | Rohde & Schwarz GmbH & Co. KG | |
| | <i>Calibration Details</i> | | <i>Last Execution</i> <i>Next Exec.</i> | |
| | Standard/DKD Calibration | | 2008/10/09 | 2011/10/08 |

4.2 Laboratory Environmental Conditions

| <i>Laboratory</i> | <i>Date</i> | <i>Temperature</i> | <i>Humidity</i> | <i>Air Pressure</i> |
|-------------------|-------------|--------------------|-----------------|---------------------|
| Lab 1 | 2009/09/08 | 25 °C | 38 % | 1017 hPa |
| | 2009/09/30 | 25 °C | 40 % | 1012 hPa |
| | 2009/10/01 | 25 °C | 38 % | 1007 hPa |
| Lab 2 | 2009/09/24 | 24 °C | 40 % | 1019 hPa |

5 Annex

5.1 Additional Information for OUT Description



back view



front view

5.2 Additional Information for Test Plan



test setup for radiated measurement

5.3 Additional Information for Report



Summary of Test Results

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

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 69. 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

additional documents

ANSI TIA-603-C-2004

Description of Methods of Measurements

RF Power Output

Standard: FCC Part 24, Subpart E

The test was performed according to: FCC §2.1046

Test Description (conducted measurement procedure)

- 1) The EUT was coupled to a Spectrum Analyser and a Digital Communication Tester through a Power Divider. Refer to chapter "Setup Drawings".
 - 2) The total insertion losses for signal path 1 and signal path 2 were measured. The values were used to correct the readings from the Spectrum Analyser and the Digital Communication Tester.
 - 3) A call was established on a Traffic Channel between the EUT and the Digital Communication Tester.
- Important Settings:
- Channel (Frequency): please refer to the detailed results
- 4) The transmitted power of the EUT was recorded by using a spectrum analyser.

Test Description (radiated measurement procedure)

- 1) The EUT was placed inside an anechoic chamber. Refer to chapter "Setup Drawings". The EUT was coupled to a Digital Communication Tester which was located outside the chamber via a small signalling antenna.
 - 2) A call was established on a Traffic Channel between the EUT and the Digital Communication Tester.
- Important Settings:
- Output Power: Maximum
 - Channel: please refer to the detailed results
- 3) A substitution 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) The output power was measured in both vertical and horizontal antenna polarisation during the call is established on the lowest channel, mid channel and on the highest channel. To find the worst case power all orientations (X, Y, Z) of the EUT have been measured.
 - 5) The test procedure according to TIA-603-C-2004 has been considered.

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.

(e) 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.

Emission and Occupied Bandwidth

Standard: FCC Part 24, Subpart E

The test was performed according to: FCC §2.1049

Test Description

- 1) The EUT was coupled to a Spectrum Analyser and a Digital Communication Tester through a Power Divider. Refer to chapter "Setup Drawings".
 - 2) The total insertion losses for signal path 1 and signal path 2 were measured. The values were used to correct the readings from the Spectrum Analyser and the Digital Communication Tester.
 - 3) A call was established on a Traffic Channel between the EUT and the Digital Communication Tester.
- Important Settings:
- Output Power: Maximum
 - Channel: please refer to the detailed results
- 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 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.

Spurious emissions at antenna terminals

Standard: FCC Part 24, Subpart E

The test was performed according to FCC §2.1051

Test Description

1) The EUT was coupled to a Spectrum Analyser and a Digital Communication Tester through a Power Divider. Refer to chapter "Setup Drawings".

2) The total insertion losses for signal path 1 and signal path 2 were measured. The values were used to correct the readings from the Spectrum Analyser and the Digital Communication Tester.

3) A call was established on a Traffic Channel between the EUT and the Digital Communication Tester.

Important Settings:

- Output Power: Maximum
- Channel: please refer to the detailed results

4) Important Analyser Settings

- [Resolution Bandwidth]:

a) [$\geq 1\%$ of wanted signal bandwidth] in the Span of 1 MHz directly below and above the 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: depending on the transmitting signal, the span and the resolution bandwidth

5) The spurious emissions peaks 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.

Field strength of spurious radiation

Standard: FCC Part 24, Subpart E

The test was performed according to: FCC §2.1053

Test Description

- 1) The EUT was placed inside an anechoic chamber. Refer to chapter "Setup Drawings". The EUT was coupled to a Digital Communication Tester which was located outside the chamber via a small signalling antenna.

- 2) A call was established on a Traffic Channel between the EUT and the Digital Communication Tester.

Important Settings:

- Output Power: Maximum

- Channel: please refer to the detailed results

- 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). The frequency range from 9 kHz to 30 MHz has been examined during the conducted spurious emission measurements.

- 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: depending on the transmitting signal, the span and the resolution bandwidth

- 6) The spurious emissions peaks 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. To find the worst case peaks all orientations (X, Y, Z) of the EUT have been measured.

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 dBµV/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.

Frequency stability

Standard: FCC Part 24, Subpart E

The test was performed according to FCC §2.1055

Test Description

- 1) The EUT was placed inside a temperature chamber.
 - 2) The EUT was coupled to a 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 the EUT was switched on and a call was established on a Traffic Channel between the EUT and the 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 Digital Communication Tester 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 temperature variation from -30°C to $+50^{\circ}\text{C}$ in increments of 10°C , if not otherwise stated in the detailed results.
- 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° 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° 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:

$$\pm 2.5 \text{ ppm} = 4700 \text{ Hz for a frequency of } 1880.0 \text{ MHz}$$

in accordance with FCC Part 22, 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.

Band edge compliance

Standard: FCC Part 24, Subpart E

The test was performed according to: FCC §24.238

Test Description

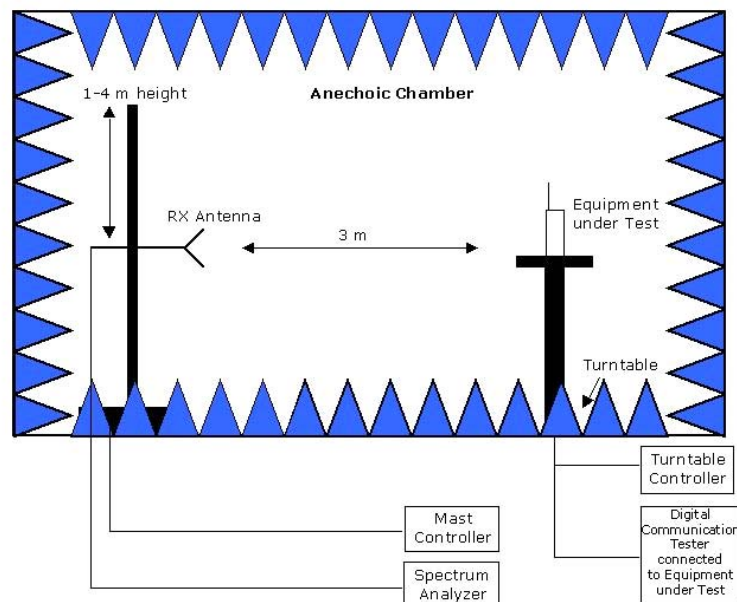
- 1) The EUT was coupled to a Spectrum Analyser and a Digital Communication Tester through a Power Divider.
 - Refer to chapter "Setup Drawings".
 - 2) The total insertion losses for signal path 1 and signal path 2 were measured. The values were used to correct the readings from the Spectrum Analyser and the Digital Communication Tester.
 - 3) A call was established on a Traffic Channel between the EUT and the Digital Communication Tester.
- Important Settings:
- Output Power: Maximum
 - Channel: please refer to the detailed results
- 4) Important Analyser Settings:
- Resolution Bandwidth = Video Bandwidth: >1% of the manufacturer's stated occupied bandwidth

Test Requirements / Limits

§ 24.238 Effective radiated power limits

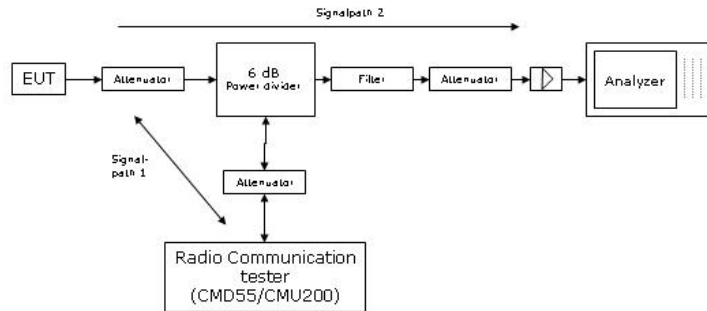
Refer to chapter "Field strength of spurious radiation".

Setup Drawings



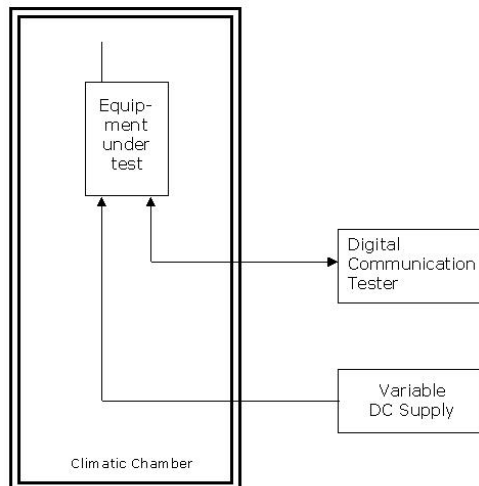
Remark: Depending on the frequency range suitable antenna types, attenuators or preamplifiers are used.

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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