




TEST REPORT FROM RFI GLOBAL SERVICES LTD

Test of: Siemens AG.
Wolf 5

To: FCC Part 15.247: 2004 (Subpart C)

Test Report Serial No:
RFI\MPTE1\RP71222JD03A

This Test Report Is Issued Under The Authority Of Andrew Brown, Operations Manager: 	
Tested By: Steven Wong  pp	Checked By: Nigel Davison 
Report Copy No: PDF01	
Issue Date: 13 September 2005	Test Dates: 18 August 2005 to 01 September 2005

"The **Bluetooth®** word mark and logos are owned by the Bluetooth SIG, Inc. and any use of such marks by RFI Global Services Ltd. is under license. Other trademarks and trade names are those of their respective owners."

This report is issued in Adobe Acrobat portable document format (PDF). It is only a valid copy of the report if it is being viewed in PDF format with the following security options not allowed: Changing the document, Selecting text and graphics, Adding or changing notes and form fields.

This report may be copied in full. The results in this report apply only to the sample(s) tested.

RFI Global Services Ltd

Pavilion A, Ashwood Park, Ashwood Way, Basingstoke, Hampshire RG23 8BG

Telephone: +44 (0)1256 312000 Facsimile: +44 (0)1256 312001

Email: info@rfi-global.com Website: www.rfi-global.com

Registered in England and Wales. Company number: 2117901

Test of: **Siemens AG.**

Wolf 5

To: **FCC Part 15.247: 2004 (Subpart C)**

This page has been left intentionally blank.

Test of: Siemens AG.
Wolf 5
To: FCC Part 15.247: 2004 (Subpart C)

Table of Contents

1. Client Information4

2. Equipment Under Test (EUT)5

3. Test Results..... 10

4. Deviations from the Test Specification 11

5. Operation of the EUT during Testing 12

6. Summary of Test Results 13

7. Measurements, Examinations and Derived Results 14

8. Measurement Uncertainty40

9. Measurement Methods41

Appendix 1. Test Equipment Used49

Appendix 2. Test Configuration Drawings..... 51

Test of: Siemens AG.
Wolf 5

To: FCC Part 15.247: 2004 (Subpart C)

1. Client Information

Company Name:	Siemens AG.
Address:	COM MD PD HW1 KLF/Wolfgang Kusters Sudstr, 9 Kamp-Lintford D-47475
Contact Name:	Mr W. Koesters

Test of: Siemens AG.
Wolf 5
To: FCC Part 15.247: 2004 (Subpart C)

2. Equipment Under Test (EUT)

The following information (with the exception of the Date of Receipt) has been supplied by the client:

2.1. Identification of Equipment Under Test (EUT)

Brand Name:	Siemens AG
Model Name or Number:	Wolf 5
Unique Type Identification:	S30880-S8900-A90-1
Serial Number:	004400001061561
Hardware Version:	B2.2.2
Software Version:	W6250C-MMTZ-1.1.302
FCC ID Number:	PWX-SXG75
Country of Manufacture:	Germany
Date of Receipt:	18 August 2005

Test of: Siemens AG.
Wolf 5
To: FCC Part 15.247: 2004 (Subpart C)

2.2. Accessories

The following accessories were supplied with the EUT:

Description:	UK AC Travel Charger
Brand Name:	Siemens
Model Name or Number:	ETC-510
Serial Number:	None Stated
Cable Length and Type:	1.8m
Connected to Port:	Charger/Handsfree/Data Port
Date of Receipt:	18 August 2005

Description:	Eu AC Travel Charger
Brand Name:	Siemens
Model Name or Number:	ETC-500
Serial Number:	None Stated
Cable Length and Type:	1.8m
Connected to Port:	Charger/Handsfree/Data Port
Date of Receipt:	18 August 2005

Description:	CLA Car Charger
Brand Name:	Siemens
Model Name or Number:	ECC-600
Serial Number:	None Stated
Cable Length and Type:	50cm
Connected to Port:	Charger/Handsfree/Data Port
Date of Receipt:	18 August 2005

Description:	Headset PTT
Brand Name:	Siemens
Model Name or Number:	HHS-510
Serial Number:	None Stated
Cable Length and Type:	1.3m
Connected to Port:	Charger/Handsfree/Data Port (only to set EUT into Bluetooth Test Mode)
Date of Receipt:	18 August 2005

Test of: Siemens AG.
Wolf 5
To: FCC Part 15.247: 2004 (Subpart C)

Accessories (Continued)

Description:	Stereo Headset
Brand Name:	Siemens
Model Name or Number:	HHS-700
Serial Number:	None Stated
Cable Length and Type:	1.3m
Connected to Port:	Charger/Handsfree/Data Port
Date of Receipt:	18 August 2005

Description:	Data Cable (USB)
Brand Name:	Siemens
Model Name or Number:	DCA-540
Serial Number:	None Stated
Cable Length and Type:	1.5m
Connected to Port:	Charger/Handsfree/Data Port
Date of Receipt:	18 August 2005

Test of: Siemens AG.
Wolf 5
To: FCC Part 15.247: 2004 (Subpart C)

2.3. Description of EUT

The equipment under test is a Dual mode 3G/GSM/GPRS tri-band mobile station incorporated with Bluetooth technology and FM radio receiver. (Only the *Bluetooth*® frequency band is tested under FCC part 15.247).

2.4. Modifications Incorporated in EUT

During the course of testing the EUT was not modified.

Test of: Siemens AG.
 Wolf 5
 To: FCC Part 15.247: 2004 (Subpart C)

2.5. Additional Information Related to Testing

Power Supply Requirement:	Nominal 115 V 60 Hz AC Mains supply via AC/DC adapter and Internal battery supply of 4.2 V.		
Intended Operating Environment:	Residential, Commercial, Light Industry, Within GSM Coverage (Not covered by this report) Within <i>Bluetooth</i> Coverage and FM radio receiver (Only <i>Bluetooth</i> part is covered by this report).		
Equipment Category:	Short Range (Low Power) (<i>Bluetooth</i>), GSM 900/GSM 1800/GSM 1900 (Not covered by this report) and FM radio receiver (Not covered by this report).		
Type of Unit:	Portable (Standalone battery powered device)		
Temperature Range:	-30°C to +55°C		
Transmit Frequency Range:	2402 MHz to 2480 MHz		
Transmit Channels Tested:	Channel ID	Channel Number	Channel Frequency (MHz)
	Bottom	1	2402
	Middle	40	2441
	Top	79	2480
Receive Frequency Range:	2402 MHz to 2480 MHz		
Receive Channels Tested:	Channel ID	Channel Number	Channel Frequency (MHz)
	Bottom	1	2402
	Middle	40	2441
	Top	79	2480
Maximum Power Output (ERP)	-4.6 dBm		

2.6. Port Identification

Port	Description	Type/Length	Applicable
1	Charger/Handsfree/Data Port	n/a	Y
2	Multimedia Card Slot	n/a	Y

2.7. Support Equipment

No support equipment was used to exercise the EUT during testing.

Test of: Siemens AG.
Wolf 5
To: FCC Part 15.247: 2004 (Subpart C)

3. Test Results

Reference:	FCC Part 15.247: 2004 Subpart C.
Title:	Code of Federal Regulations, Part 15.247 (47CFR22) (Intentional Radiators operating within the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz).

3.1. Methods and Procedures

The methods and procedures used were as detailed in:

ANSI C63.2 (1987)

Title: American National Standard for Instrumentation - Electromagnetic noise and field strength.

ANSI C63.4 (2003)

Title: American National Standard Methods of Measurement of Electromagnetic Emissions from Low Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

ANSI C63.5 (1988)

Title: American National Standard for the Calibration of antennas used for Radiated Emission measurements in Electromagnetic Interference (EMI) control.

ANSI C63.7 (1988)

Title: American National Standard Guide for Construction of Open Area Test Sites for performing Radiated Emission Measurements.

CISPR 16-1: (1999)

Title: Specification For Radio Disturbance and Immunity Measuring Apparatus and Methods. Part 1: Radio Disturbance and Immunity Measuring Apparatus.

DA00-705 (2000)

Title: Filing and Frequency Measurement Guidelines for Frequency Hopping Spread Spectrum Systems.

3.2. Definition of Measurement Equipment

The measurement equipment used complied with the requirements of the standards referenced in the methods & procedures section above. Appendix 1 contains a list of the test equipment used.

Test of: Siemens AG.

Wolf 5

To: FCC Part 15.247: 2004 (Subpart C)

4. Deviations from the Test Specification

None.

Test of: Siemens AG.
Wolf 5
To: FCC Part 15.247: 2004 (Subpart C)

5. Operation of the EUT during Testing

5.1. Operating Modes

The EUT was tested in the following operating modes, unless otherwise stated.

For all transmit mode measurements the *Bluetooth* test mode was active and set to transmit on top, middle and bottom channels and hopping on all channels as necessary with the longest data packet size.

Receive mode measurements were performed with the EUT in *Bluetooth* mode and in its normal search mode.

5.2. Configuration and Peripherals

The EUT was tested in the following configuration:

All radiated measurement were performed with EUT connected with the multimedia` card and the UK AC\DC adapter. As this was found to be the worst case configuration. For AC mains conducted measurements, the EUT was connected with the multimedia card and EU AC/DC adapter. As this is found to be the worst case configuration for this test.

Test of: Siemens AG.
Wolf 5
To: FCC Part 15.247: 2004 (Subpart C)

6. Summary of Test Results

Range of Measurements	Specification Reference	Port Type	Compliance Status
Idle Mode AC Conducted Emissions (150 kHz to 30 MHz)	C.F.R. 47 FCC Part 15: 2004 Section 15.107	AC Mains	Complied
Idle Mode Radiated Spurious Emissions	C.F.R. 47 FCC Part 15: 2004 Section 15.109	Antenna	Complied
Transmitter AC Conducted Emissions (150 kHz to 30 MHz)	C.F.R. 47 FCC Part 15: 2004 Section 15.207	AC Mains	Complied
Transmitter 20 dB Bandwidth	C.F.R. 47 FCC Part 15: 2004 Section 15.247(a)(1)	Antenna	Complied
Transmitter Carrier Frequency Separation	C.F.R. 47 FCC Part 15: 2004 Section 15.247(a)(1)	Antenna	Complied
Transmitter Average Time of Occupancy	C.F.R. 47 FCC Part 15: 2004 Section 15.247(a)(1)(iii)	Antenna	Complied
Transmitter Maximum Peak Output Power	C.F.R. 47 FCC Part 15: 2004 Section 15.247(b)(1)	Antenna	Complied
Transmitter Radiated Emissions	C.F.R. 47 FCC Part 15: 2004 Sections 15.247(d) & 15.209(a)	Antenna	Complied
Transmitter Band Edge Radiated Emissions	C.F.R. 47 FCC Part 15: 2004 Sections 15.247(d) & 15.209(a)	Antenna	Complied

6.1. Location of Tests

All the measurements described in this report were performed at the premises of RFI Global Services Ltd, Ewhurst Park, Ramsdell, Basingstoke, Hampshire, RG26 5RQ, England.

Test of: Siemens AG.
Wolf 5
To: FCC Part 15.247: 2004 (Subpart C)

7. Measurements, Examinations and Derived Results

7.1. General Comments

This section contains test results only.

Measurement uncertainties are evaluated in accordance with current best practice. Our reported expanded uncertainties are based on standard uncertainties, which are multiplied by an appropriate coverage factor to provide a statistical confidence level of approximately 95%. Please refer to section 8 for details of measurement uncertainties.

Test of: Siemens AG.
Wolf 5
To: FCC Part 15.247: 2004 (Subpart C)

7.2. Test Results

7.2.1. Idle Mode AC Conducted Spurious Emissions: Section 15.107

The EUT was configured as for ac conducted emission measurements as described in section 9 of this report.

Tests were performed to identify the maximum emission levels present on the ac mains line of the EUT.

Results:

Quasi-Peak Detector Measurements on Live and Neutral Lines

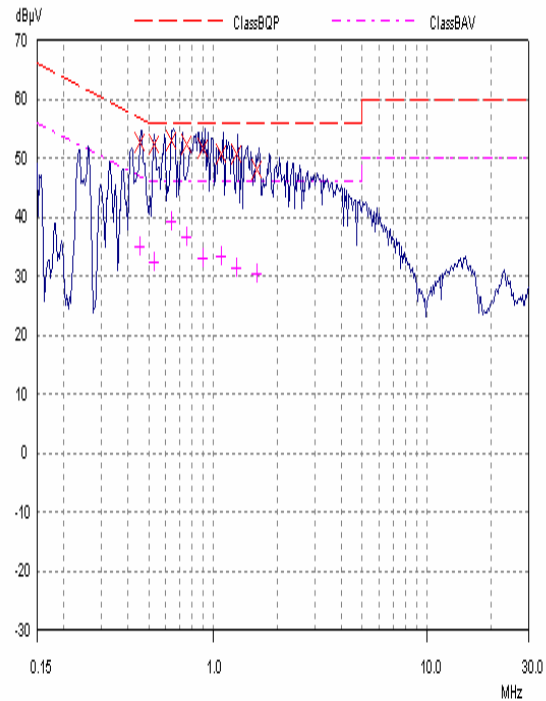
Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.45734	Neutral	52.57	56.74	4.17	Complied
0.53081	Neutral	52.47	56.00	3.53	Complied
0.64072	Neutral	52.95	56.00	3.05	Complied
0.75895	Neutral	52.42	56.00	3.58	Complied
0.90382	Neutral	51.81	56.00	4.19	Complied
1.10111	Neutral	50.71	56.00	5.29	Complied
1.29122	Neutral	50.69	56.00	5.31	Complied
1.61449	Neutral	48.10	56.00	7.90	Complied

Average Detector Measurements on Live and Neutral Lines

Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.45734	Neutral	35.00	46.74	11.74	Complied
0.53081	Neutral	32.18	46.00	13.82	Complied
0.64072	Neutral	39.06	46.00	6.94	Complied
0.75895	Neutral	36.72	46.00	9.28	Complied
0.90382	Neutral	32.84	46.00	13.16	Complied
1.10111	Neutral	33.42	46.00	12.58	Complied
1.29122	Neutral	31.47	46.00	14.53	Complied
1.61449	Neutral	30.32	46.00	15.68	Complied

Test of: Siemens AG.
Wolf 5
To: FCC Part 15.247: 2004 (Subpart C)

Idle Mode AC Conducted Spurious Emissions: Section 15.107 (Continued)



Note: This plot is a pre-scan and for indication purposes only. For final measurements, see accompanying tables.

Test of: Siemens AG.
Wolf 5
To: FCC Part 15.247: 2004 (Subpart C)

7.2.2. Idle Mode Radiated Spurious Emissions: Section 15.109 - Electric Field Strength Measurements (Frequency Range: 30 to 1000 MHz)

The EUT was configured as for radiated emission testing as described in section 9 of this report.

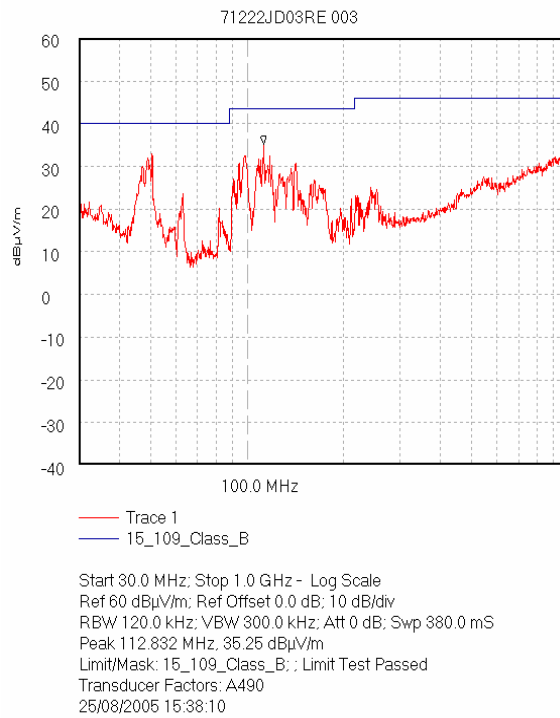
Tests were performed to identify the maximum receiver or standby radiated emission levels.

Results:

Frequency (MHz)	Antenna Polarity	Q-P Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
50.344	Vert.	18.5	40.0	21.5	Complied
98.288	Vert.	28.0	43.5	15.5	Complied
113.808	Vert.	20.3	43.5	23.2	Complied

Test of: Siemens AG.
Wolf 5
To: FCC Part 15.247: 2004 (Subpart C)

Idle Mode Radiated Spurious Emissions: Section 15.109 - Electric Field Strength Measurements
(Frequency Range: 30 to 1000 MHz) (Continued)



Note: This plot is a pre-scan and for indication purposes only. For final measurements, see accompanying tables.

Test of: Siemens AG.
Wolf 5
To: FCC Part 15.247: 2004 (Subpart C)

7.2.3. Idle Mode Radiated Spurious Emissions: Section 15.109 - Electric Field Strength Measurements (Frequency Range: 1 to 12.5 GHz)

Results:

Highest Peak Level:

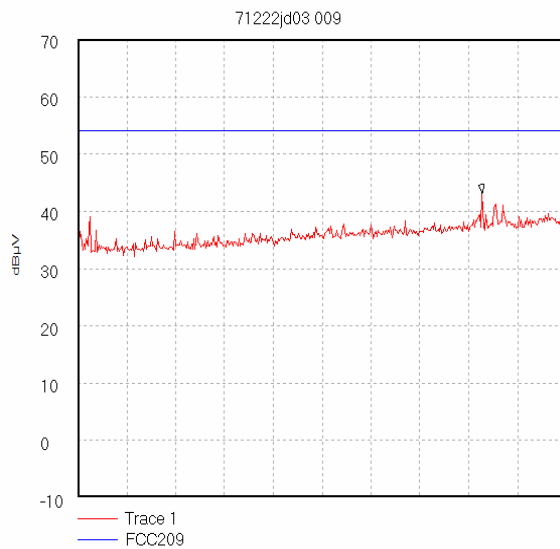
Frequency (GHz)	Antenna Polarity	Detector Level (dB μ V)	Antenna Factor (dB)	Cable Loss (dB)	Actual Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
3.895	Vert.	21.4	23.3	1.1	45.8	74.0	8.2	Complied

Note(s):

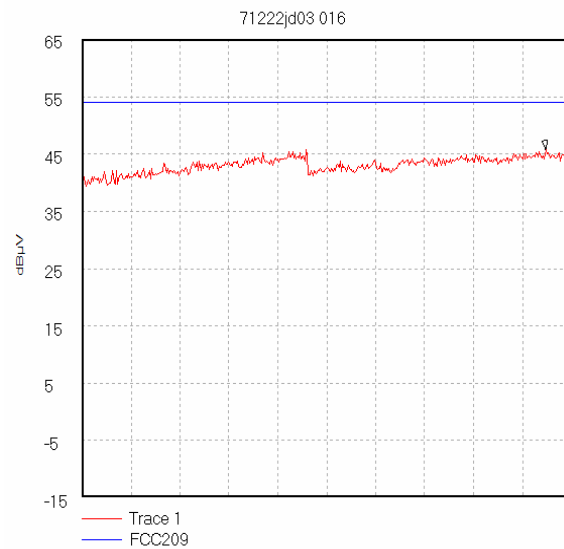
1. No spurious emissions were detected above the noise floor of the measuring receiver; therefore, the highest peak noise floor reading of the measuring receiver was recorded as shown in the table above.
-

Test of: Siemens AG.
 Wolf 5
 To: FCC Part 15.247: 2004 (Subpart C)

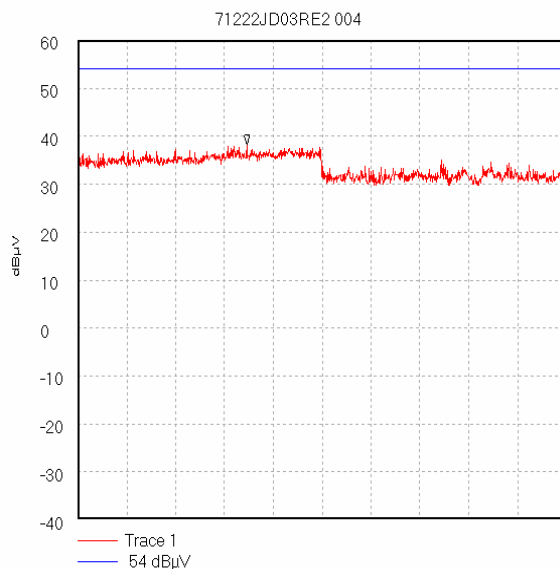
**Idle Mode Radiated Spurious Emissions: Section 15.109 - Electric Field Strength Measurements
 (Frequency Range: 1 to 12.5 GHz) (Continued)**



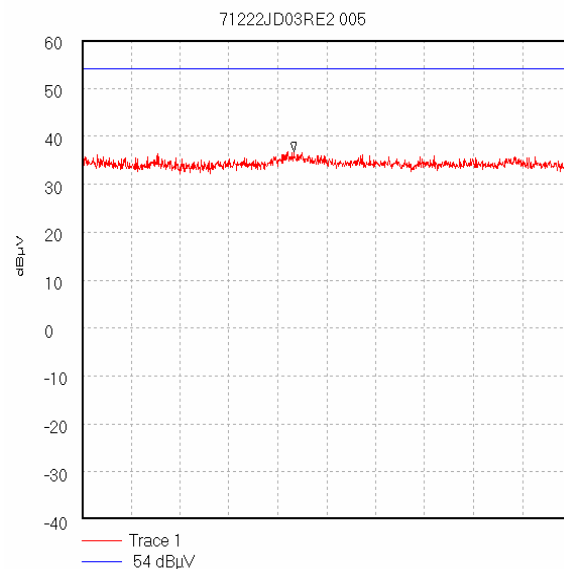
Start 1.0 GHz; Stop 2.0 GHz
 Ref 70 dBμV; Ref Offset 0.0 dB; 10 dB/div
 RBW 1.0 MHz; VBW 1.0 MHz; Att 10 dB; Swp 20.0 mS
 Peak 1.828 GHz; 43.08 dBμV
 Limit/Mask: FCC209;
 Transducer Factors: 1G-2G(G40,C1115,C387,A1534)
 23/08/2005 13:07:20



Start 2.0 GHz; Stop 4.0 GHz
 Ref 65 dBμV; Ref Offset 0.0 dB; 10 dB/div
 RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 41.572 mS
 Peak 3.895 GHz; 45.8 dBμV
 Limit/Mask: FCC209;
 Transducer Factors: 2G-4G(G40,C1115,C387,A1534)
 23/08/2005 14:07:37



Start 4.0 GHz; Stop 6.0 GHz
 Ref 60 dBμV; Ref Offset 0.0 dB; 10 dB/div
 RBW 1000.0 kHz; VBW 3.0 MHz; Att 0 dB; Swp 20.0 mS
 Peak 4.693333 GHz; 38.24 dBμV
 Display Line: 54 dBμV; : Limit Test Passed
 30/08/2005 16:23:14

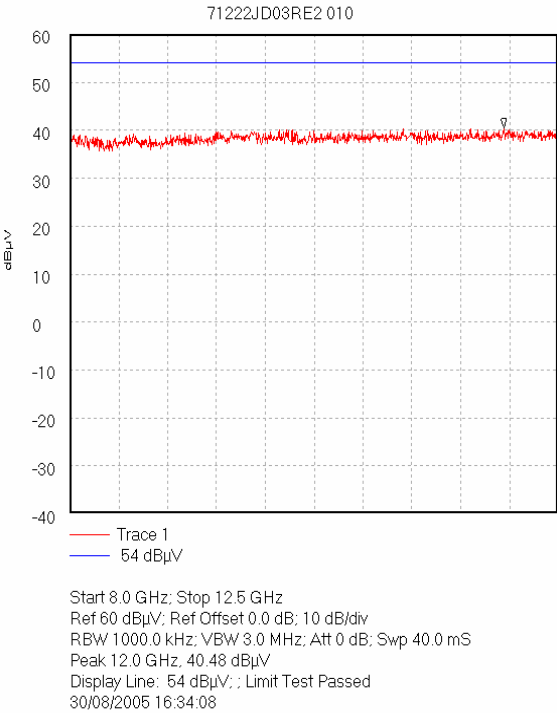


Start 6.0 GHz; Stop 8.0 GHz
 Ref 60 dBμV; Ref Offset 0.0 dB; 10 dB/div
 RBW 1000.0 kHz; VBW 3.0 MHz; Att 0 dB; Swp 20.0 mS
 Peak 6.866667 GHz; 36.85 dBμV
 Display Line: 54 dBμV; : Limit Test Passed
 30/08/2005 16:26:30

Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

Test of: Siemens AG.
Wolf 5
To: FCC Part 15.247: 2004 (Subpart C)

Idle Mode Radiated Spurious Emissions: Section 15.109 - Electric Field Strength Measurements (Frequency Range: 1 to 12.5 GHz) (Continued)



Test of: Siemens AG.
Wolf 5
To: FCC Part 15.247: 2004 (Subpart C)

7.2.4. Transmitter AC Conducted Spurious Emissions: Section 15.207

The EUT was configured for ac conducted emission measurements as described in section 9 of this report.

Tests were performed to identify the maximum emission levels present on the ac mains line of the EUT.

Results: Top Channel

Quasi-Peak Detector Measurements on Live and Neutral Lines

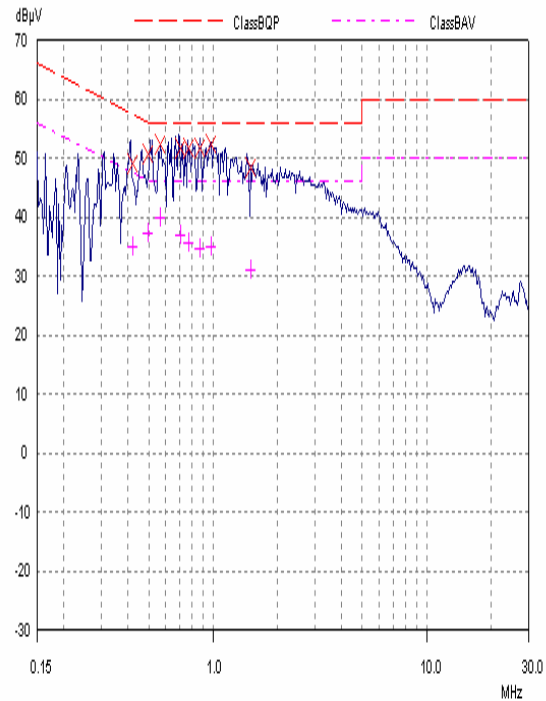
Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.42109	Neutral	49.06	57.43	8.37	Complied
0.49696	Neutral	50.56	56.05	5.49	Complied
0.56970	Neutral	52.42	56.00	3.58	Complied
0.70494	Neutral	51.53	56.00	4.47	Complied
0.77154	Neutral	51.81	56.00	4.19	Complied
0.87011	Neutral	51.81	56.00	4.19	Complied
0.98167	Neutral	52.31	56.00	3.69	Complied
1.50835	Neutral	48.45	56.00	7.55	Complied

Average Detector Measurements on Live and Neutral Lines

Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.42109	Neutral	35.02	47.43	12.41	Complied
0.49696	Neutral	37.36	46.05	8.69	Complied
0.56970	Neutral	40.00	46.00	6.00	Complied
0.70494	Neutral	36.93	46.00	9.07	Complied
0.77154	Neutral	35.71	46.00	10.29	Complied
0.87011	Neutral	34.56	46.00	11.44	Complied
0.98167	Neutral	35.02	46.00	10.98	Complied
1.50835	Neutral	31.11	46.00	14.89	Complied

Test of: Siemens AG.
Wolf 5
To: FCC Part 15.247: 2004 (Subpart C)

Transmitter AC Conducted Spurious Emissions: Section 15.207 (Continued)



Note: This plot is a pre-scan and for indication purposes only. For final measurements, see accompanying tables.

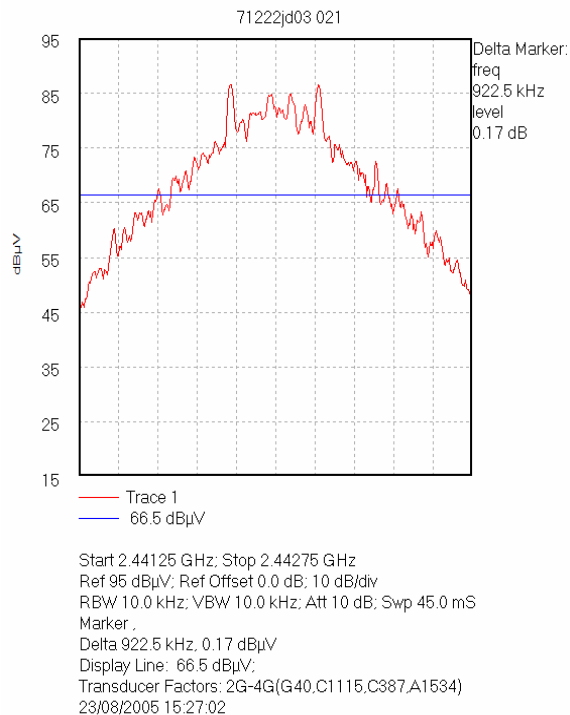
Test of: Siemens AG.
Wolf 5
To: FCC Part 15.247: 2004 (Subpart C)

7.2.5. Transmitter 20 dB Bandwidth: Section 15.247(a)(1)

The EUT was configured for 20 dB bandwidth measurements as described in section 9 of this report. Tests were performed to identify the 20 dB bandwidth.

Results:

Transmitter 20 dB Bandwidth (kHz)	Limit (kHz)
922.5	None specified



Test of: Siemens AG.
Wolf 5
To: FCC Part 15.247: 2004 (Subpart C)

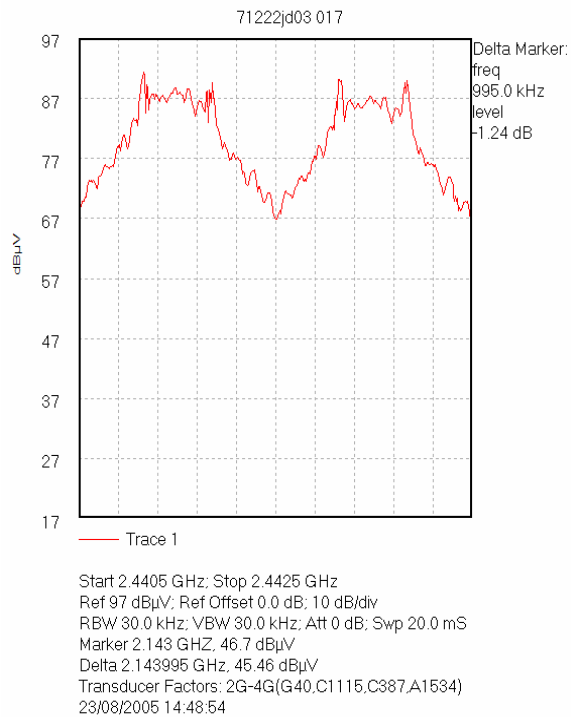
7.2.6. Transmitter Carrier Frequency Separation: Section 15.247(a)(1)

The EUT was configured for carrier frequency separation measurements as described in section 9 of this report.

Tests were performed to identify the carrier frequency separation.

Results:

Transmitter Carrier Frequency Separation (kHz)	Limit (> 20 dB or $\frac{2}{3}$ of 20 dB BW) (kHz)	Margin (kHz)	Result
995.0	922.5	72.5	Complied



Test of: Siemens AG.
Wolf 5
To: FCC Part 15.247: 2004 (Subpart C)

7.2.7. Transmitter Average Time of Occupancy: Section 15.247(a)(1)(iii)

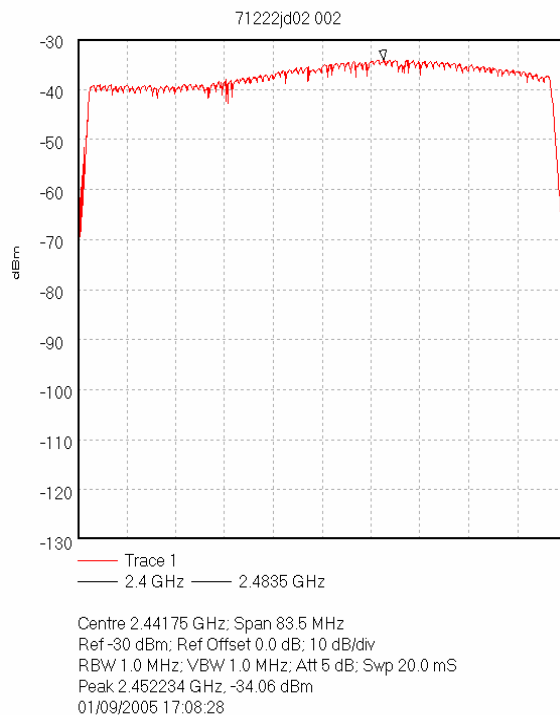
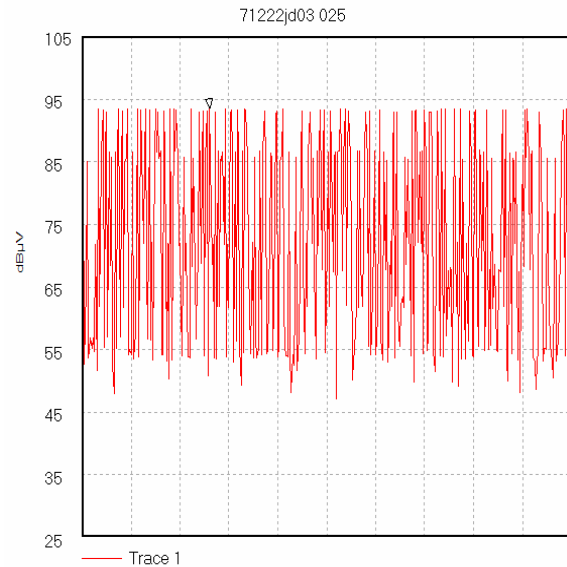
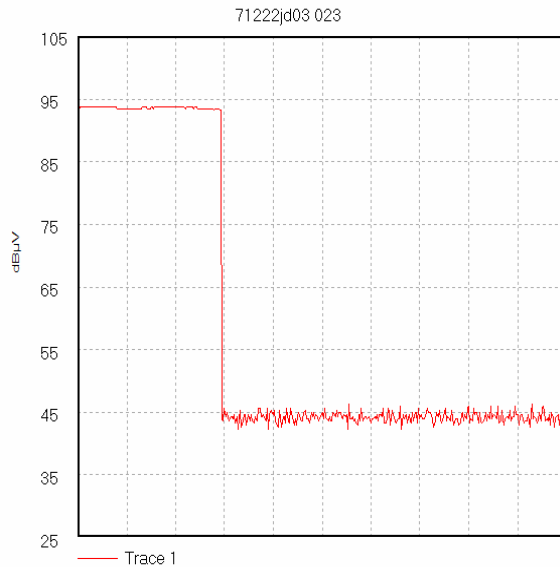
The EUT was configured for average time of occupancy measurements as described in section 9 of this report.

Tests were performed to identify the average time of occupancy in number of channels (79) x 0.4 seconds. The calculated period is 31.6 seconds.

Results:

Emission Width (µs)	Number of Hops in 31.6 Seconds	Average Time of Occupancy (s)	Limit (s)	Margin (s)	Result
2925.000	68	0.1989	0.4	0.2011	Complied

Test of: Siemens AG.
Wolf 5
To: FCC Part 15.247: 2004 (Subpart C)

Transmitter Average Time of Occupancy: Section 15.247(a)(1)(iii) (Continued)

Test of: Siemens AG.
Wolf 5
To: FCC Part 15.247: 2004 (Subpart C)

7.2.8. Transmitter Maximum Peak Output Power: (EIRP) Section 15.247(b)(1)

The EUT was configured for transmitter peak output power measurements as described in Section 9 of this report.

Tests were performed to identify the transmitter maximum peak output power (EIRP) of the EUT.

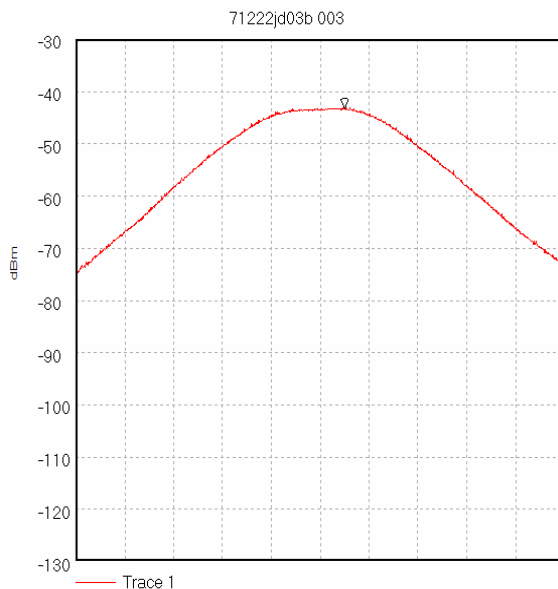
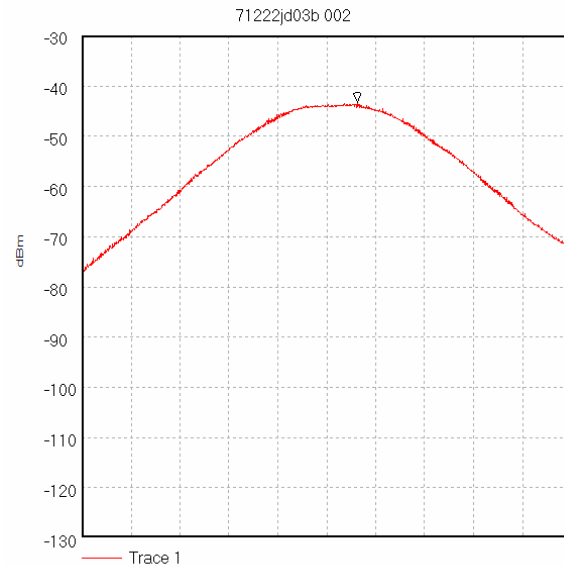
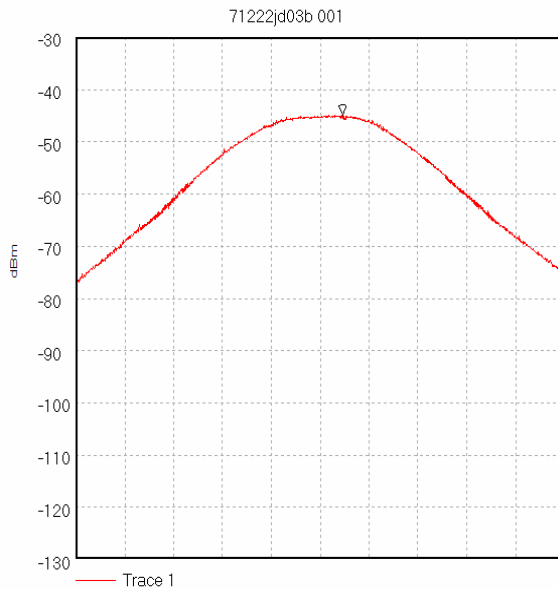
Results:**Battery Powered Devices**

Channel	EIRP (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	-6.9	30.0	36.9	Complied
Middle	-5.0	30.0	35.0	Complied
Top	-4.6	30.0	34.6	Complied

Note(s):

1. *These tests were performed radiated; therefore the EUT antenna gain is encompassed in the final result and not measurable.*
-

Test of: Siemens AG.
Wolf 5
To: FCC Part 15.247: 2004 (Subpart C)

Transmitter Maximum Peak Output Power: (EIRP) Section 15.247(b)(1) (Continued)

Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

Test of: Siemens AG.
Wolf 5
To: FCC Part 15.247: 2004 (Subpart C)

7.2.9. Transmitter Radiated Emissions: Section 15.247(d) and 15.209(a) - Electric Field Strength Measurements: 30 to 1000 MHz (emissions occurring in the restricted bands)

The EUT was configured for radiated emission testing as described in section 9 of this report.

Tests were performed to identify the maximum transmitter radiated emission levels.

Results:

Top Channel

Frequency (MHz)	Antenna Polarity	Q-P Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
113.852	Vert.	25.3	43.5	18.2	Complied

Note(s):

1. The preliminary scans showed similar emission levels for each mode below 1 GHz, therefore final radiated emissions measurements were performed with the EUT set to the top channel only.
-

Test of: Siemens AG.
Wolf 5
To: FCC Part 15.247: 2004 (Subpart C)

7.2.10. Transmitter Radiated Emissions: Section 15.247(d) and 15.209(a) - Electric Field Strength Measurements: 30 to 1000 MHz (emissions outside the restricted bands)

The EUT was configured for radiated emission testing as described in section 9 of this report.

Tests were performed to identify the maximum transmitter radiated emission levels.

Results:

Top Channel

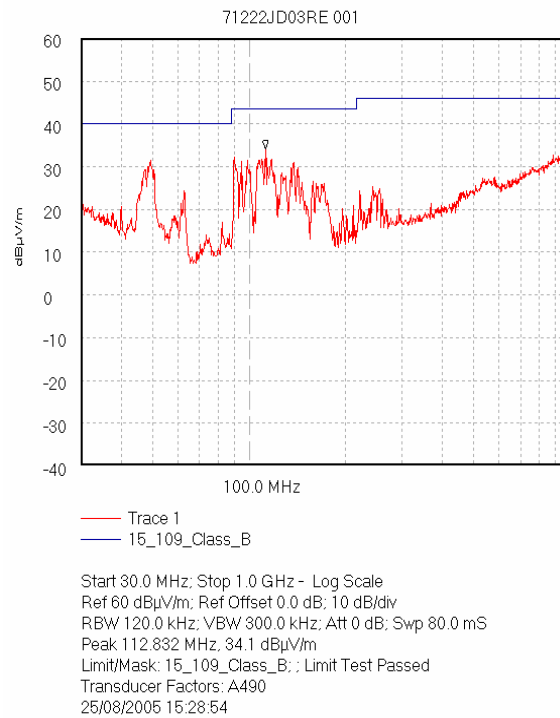
Frequency (MHz)	Antenna Polarity	Peak Level (dB μ V/m)	-20 dBc Limit (dB μ V/m)	Margin (dB)	Result
50.328	Vert.	19.9	40.0	20.1	Complied
89.022	Vert.	28.1	43.5	15.4	Complied

Note(s):

1. *The preliminary scans showed similar emission levels for each mode below 1 GHz, therefore final radiated emissions measurements were performed with the EUT set to the top channel only.*
-

Test of: Siemens AG.
Wolf 5
To: FCC Part 15.247: 2004 (Subpart C)

Transmitter Radiated Emissions: Section 15.247(d) and 15.209(a) - Electric Field Strength Measurements: 30 to 1000 MHz (emissions outside the restricted bands) (Continued)



Note: This plot is a pre-scan and for indication purposes only. For final measurements, see accompanying tables.

Test of: Siemens AG.
Wolf 5
To: FCC Part 15.247: 2004 (Subpart C)

7.2.11. Transmitter Radiated Emissions: Section 15.247(d) and 15.209(a) - Electric Field Strength Measurements (Frequency Range: 1 to 25 GHz) (emissions outside the restricted bands)

The EUT was configured for radiated emission testing as described in section 9 of this report.

Tests were performed to identify the maximum transmitter radiated emission levels.

Results:

Highest Peak Level:

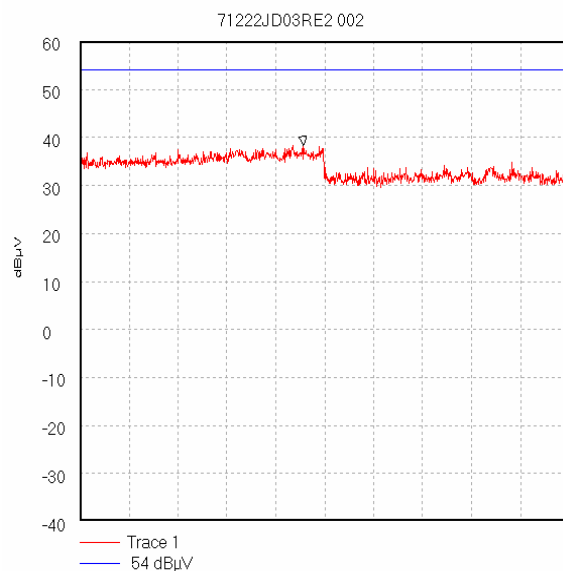
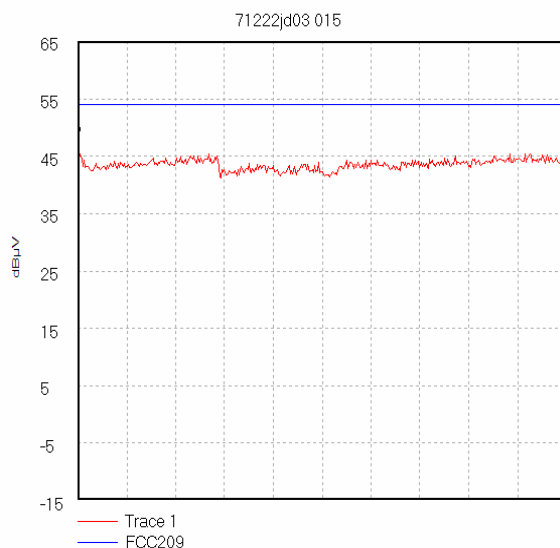
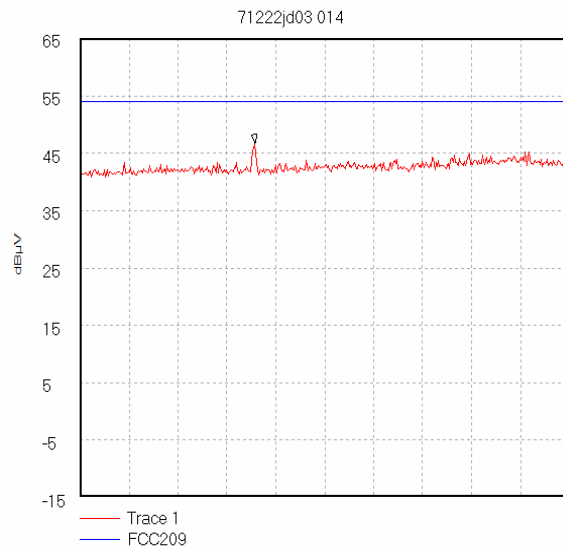
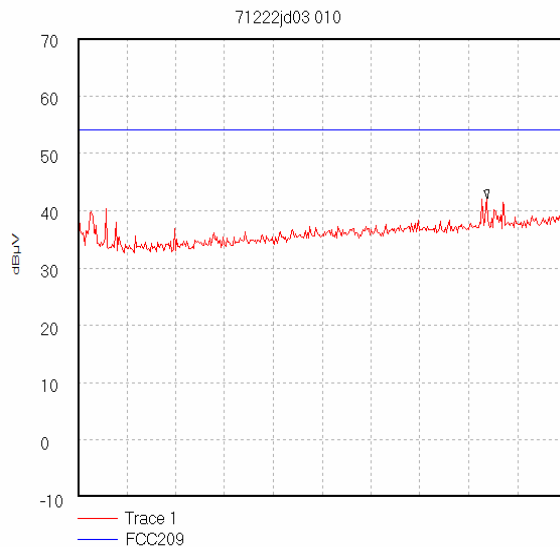
Frequency (GHz)	Antenna Polarity	Detector Level (dB μ V)	Antenna Factor (dB)	Cable Loss (dB)	Actual Level (dB μ V/m)	-20 dBc Limit (dB μ V/m)	Margin (dB)	Result
24.1833	Horiz.	4.2	37.1	2.7	44.0	70.6	26.6	Complied

Note(s):

1. No spurious emissions from the EUT were detected above the noise floor of the measuring receiver; therefore, the highest peak noise floor reading of the measuring receiver was recorded as shown in the table above.
 2. Plots 71222JD03 010 and 71222JD03 014 shows emissions occurring between 1 to 4 GHz. It has been confirmed that these are background emissions and not from the EUT.
-

Test of: Siemens AG.
Wolf 5
To: FCC Part 15.247: 2004 (Subpart C)

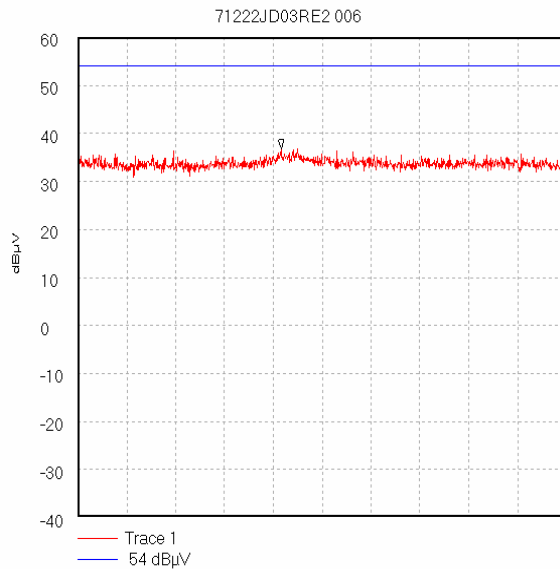
Transmitter Radiated Emissions: Section 15.247(d) and 15.209(a) - Electric Field Strength Measurements (Frequency Range: 1 to 25 GHz) (emissions outside the restricted bands) (Continued)



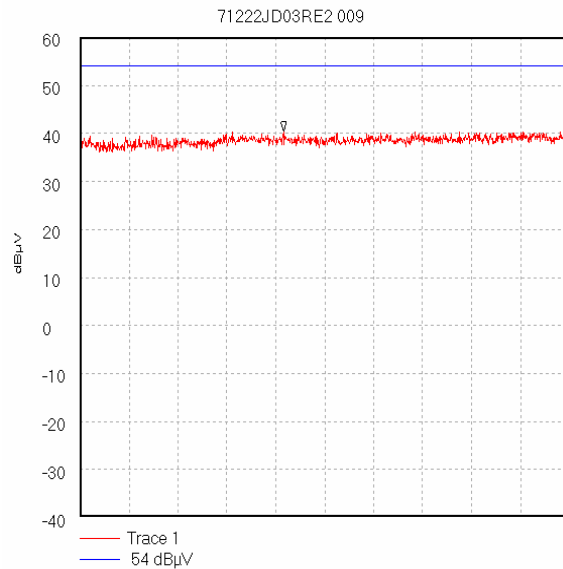
Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

Test of: Siemens AG.
Wolf 5
To: FCC Part 15.247: 2004 (Subpart C)

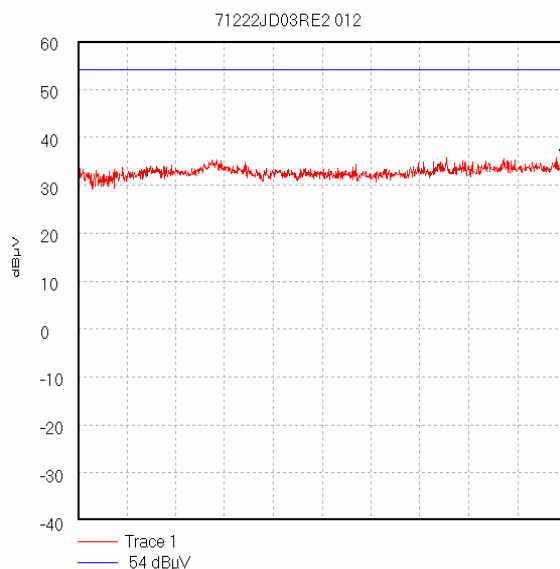
Transmitter Radiated Emissions: Section 15.247(d) and 15.209(a) - Electric Field Strength Measurements (Frequency Range: 1 to 25 GHz) (emissions outside the restricted bands) (Continued)



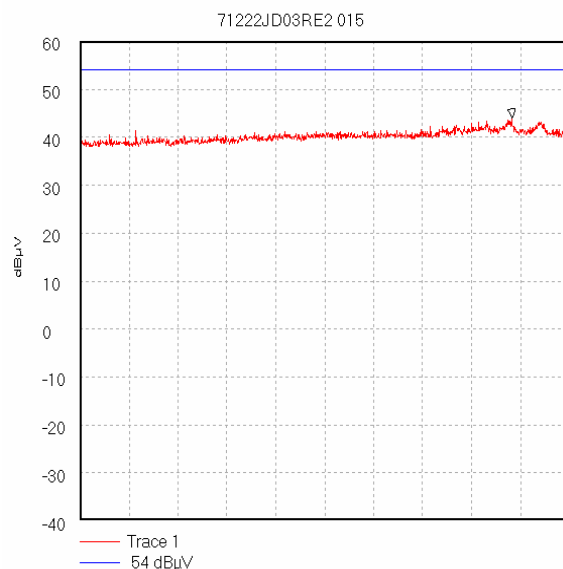
Start 6.0 GHz; Stop 8.0 GHz
Ref 60 dBμV; Ref Offset 0.0 dB; 10 dB/div
RBW 1000.0 kHz; VBW 3.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 6.833333 GHz, 36.85 dBμV
Display Line: 54 dBμV; ; Limit Test Passed
30/08/2005 16:28:10



Start 8.0 GHz; Stop 12.5 GHz
Ref 60 dBμV; Ref Offset 0.0 dB; 10 dB/div
RBW 1000.0 kHz; VBW 3.0 MHz; Att 0 dB; Swp 40.0 mS
Peak 9.875 GHz, 40.4 dBμV
Display Line: 54 dBμV; ; Limit Test Passed
30/08/2005 16:32:21



Start 12.5 GHz; Stop 18.0 GHz
Ref 60 dBμV; Ref Offset 0.0 dB; 10 dB/div
RBW 1000.0 kHz; VBW 3.0 MHz; Att 0 dB; Swp 40.0 mS
Peak 17.957222 GHz, 35.75 dBμV
Display Line: 54 dBμV; ; Limit Test Passed
30/08/2005 16:42:50



Start 18.0 GHz; Stop 25.0 GHz
Ref 60 dBμV; Ref Offset 0.0 dB; 10 dB/div
RBW 1000.0 kHz; VBW 3.0 MHz; Att 0 dB; Swp 60.0 mS
Peak 24.183333 GHz, 43.96 dBμV
Display Line: 54 dBμV; ; Limit Test Passed
30/08/2005 16:48:09

Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

Test of: Siemens AG.
Wolf 5
To: FCC Part 15.247: 2004 (Subpart C)

7.2.11.1. Transmitter Band Edge Radiated Emissions: Section 15.247(d) & 15.209(a) - Electric Field Strength Measurements

The EUT was configured for band edge compliance of radiated emission measurements as described in section 9 of this report.

Tests were performed to identify the maximum radiated band edge emissions.

Results:

Peak Power Level Hopping Mode:

Frequency (GHz)	Antenna Polarity	Detector Level (dB μ V)	Antenna Factor (dB)	Cable Loss (dB)	Actual Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2.4000	Horiz.	19.1	21.2	1.4	41.7	70.6*	28.9	Complied
2.4835	Horiz.	25.3	21.2	1.4	47.9	74.0	26.1	Complied

Average Power Level Hopping Mode:

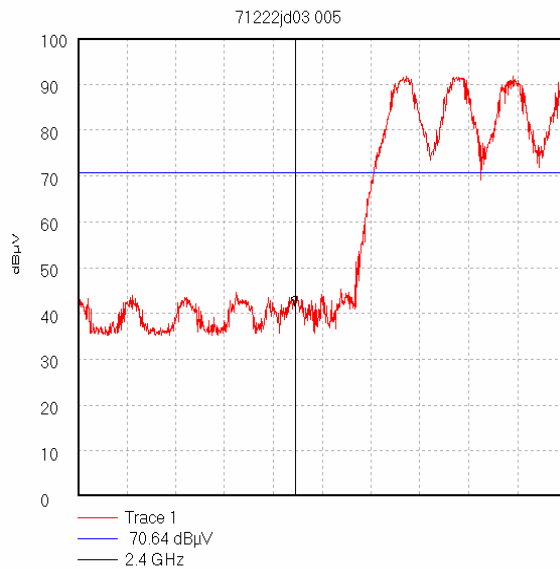
Frequency (GHz)	Antenna Polarity	Detector Level (dB μ V)	Antenna Factor (dB)	Cable Loss (dB)	Actual Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2.4835	Horiz.	17.1	21.2	1.4	39.7	54.0	14.3	Complied

Note(s):

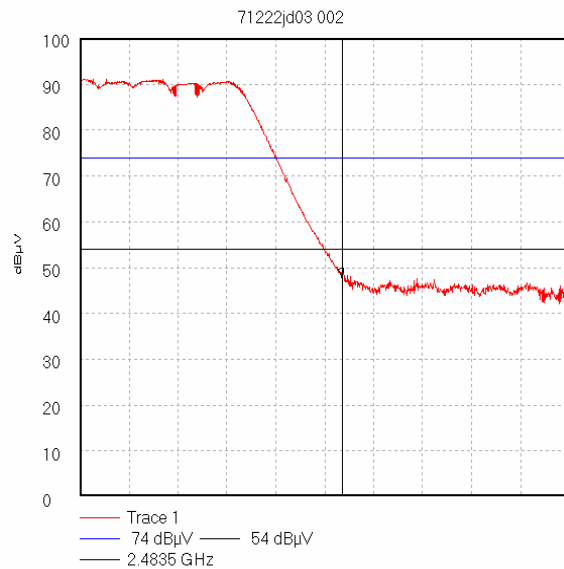
1. *-20 dBc limit
-

Test of: Siemens AG.
Wolf 5
To: FCC Part 15.247: 2004 (Subpart C)

Transmitter Band Edge Radiated Emissions: Section 15.247(d) & 15.209(a) - Electric Field Strength Measurements (Continued)



Centre 2.4005 GHz; Span 9.0 MHz
Ref 100 dBμV; Ref Offset 17.7 dB; 10 dB/div
RBW 100.0 kHz; VBW 100.0 kHz; Att 0 dB; Swp 20.0 mS
Marker 2.4 GHz, 41.7 dBμV
Display Line: 70.64 dBμV; : Limit Test Passed
02/09/2005 14:37:38



Centre 2.483 GHz; Span 14.0 MHz
Ref 100 dBμV; Ref Offset 17.7 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Marker 2.483498 GHz, 47.85 dBμV
Display Line: 74 dBμV; 54 dBμV; : Limit Test Passed
02/09/2005 14:17:59

Test of: Siemens AG.
Wolf 5
To: FCC Part 15.247: 2004 (Subpart C)

7.2.12. Transmitter Band Edge Radiated Emissions: Section 15.247(d) & 15.209(a)

The EUT was configured for band edge compliance of radiated emission measurements as described in section 9 of this report.

Tests were performed to identify the average radiated band edge emissions.

Results:**Peak Power Level Static Mode:**

Frequency (GHz)	Antenna Polarity	Detector Level (dBμV)	Antenna Factor (dB)	Cable Loss (dB)	Actual Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
2.4000	Horiz.	19.7	21.2	1.4	42.3	70.6*	28.3	Complied
2.4835	Horiz.	25.8	21.2	1.4	48.4	74.0	25.6	Complied

Average Power Level Static Mode:

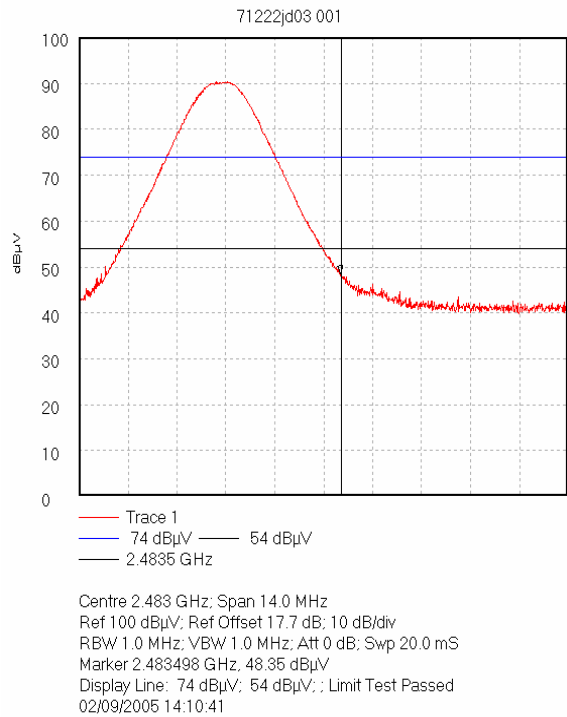
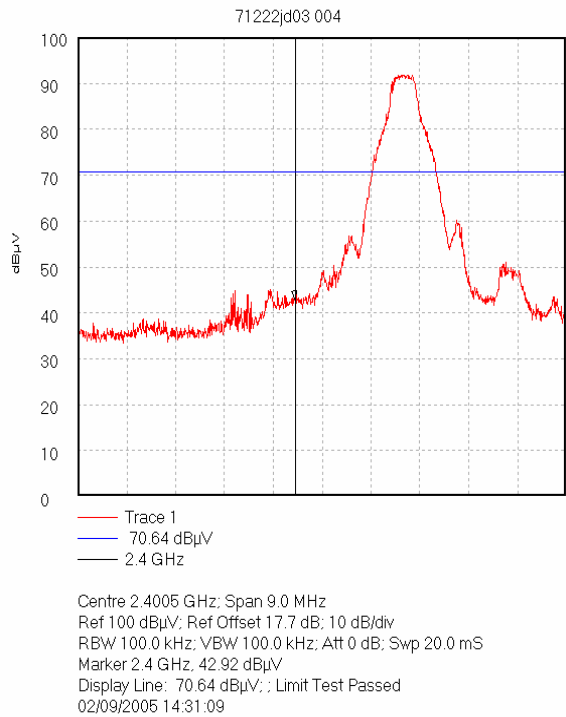
Frequency (GHz)	Antenna Polarity	Detector Level (dBμV)	Antenna Factor (dB)	Cable Loss (dB)	Actual Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
2.4835	Horiz.	17.2	21.2	1.4	39.8	54.0	14.2	Complied

Note(s):

1. *-20 dBc limit

Test of: Siemens AG.
Wolf 5
To: FCC Part 15.247: 2004 (Subpart C)

Transmitter Band Edge Radiated Emissions: Section 15.247(d) & 15.209(a) (Continued)



Test of: Siemens AG.
Wolf 5
To: FCC Part 15.247: 2004 (Subpart C)

8. Measurement Uncertainty

No measurement or test can ever be perfect and the imperfections give rise to error of measurement in the results. Consequently, the result of a measurement is only an approximation to the value of the measurand (the specific quantity subject to measurement) and is only complete when accompanied by a statement of the uncertainty of the approximation.

The expression of uncertainty of a measurement result allows realistic comparison of results with reference values and limits given in specifications and standards.

The uncertainty of the result may need to be taken into account when interpreting the measurement results.

The reported expanded uncertainties below are based on a standard uncertainty multiplied by an appropriate coverage factor, such that a confidence level of approximately 95% is maintained. For the purposes of this document "approximately" is interpreted as meaning "effectively" or "for most practical purposes".

Measurement Type	Range	Confidence Level (%)	Calculated Uncertainty
AC Conducted Spurious Emissions	0.15 MHz to 30 MHz	95%	±3.25 dB
Transmitter Maximum Peak Output Power	Not applicable	95%	±1.78 dB
Transmitter Carrier Frequency Separation	Not applicable	95%	±0.01 ppm
Transmitter Average Time of Occupancy	Not applicable	95%	±10 %
20 dB Bandwidth	Not applicable	95%	± 0.12 %
Radiated Spurious Emissions	30 MHz to 1000 MHz	95%	± 5.26 dB
Radiated Spurious Emissions	1 GHz to 40 GHz	95%	±1.78 dB

The methods used to calculate the above uncertainties are in line with those recommended within the various measurement specifications. Where measurement specifications do not include guidelines for the evaluation of measurement uncertainty, the published guidance of the appropriate accreditation body is followed.

Test of: Siemens AG.
Wolf 5
To: FCC Part 15.247: 2004 (Subpart C)

9. Measurement Methods

9.1. AC Mains Conducted Emissions

AC mains conducted emissions measurements were performed in accordance with the standard, against appropriate limits for each detector function.

The test was performed in a shielded enclosure with the equipment arranged as detailed in the standard on a wooden bench using the floor of the screened enclosure as the ground reference plane. The EUT was powered with 110V 60 Hz ac mains supplied via a line impedance stabilisation network (LISN).

Initial measurements in the form of swept scans covering the entire measurement band were performed in order to identify frequencies on which the EUT was generating interference. In order to minimise the time taken for these swept measurements, a peak detector was used in conjunction with the appropriate detector IF measuring bandwidths (see table below). Repetitive scans were performed to allow for emissions with low repetition rates, and the duty cycle of the EUT. The test configuration was the same for the initial scans as for the final measurements.

Following the initial scans, a graph was produced giving an overview of the emissions from the EUT plotted against the appropriate specification limit. A tolerance line was set 6 dB below the specification limit and levels above the tolerance line were re-tested (at individual frequencies) using the appropriate detector function.

The test equipment settings for conducted emissions measurements were as follows:

Receiver Function	Initial Scan	Final Measurements
Detector Type:	Peak	Quasi-Peak (CISPR)/Average
Mode:	Max Hold	Not applicable
Bandwidth:	10 kHz	9 kHz
Amplitude Range:	60 dB	20 dB
Measurement Time:	Not applicable	>1 s
Observation Time:	Not applicable	>15 s
Step Size:	Continuous sweep	Not applicable
Sweep Time:	Coupled	Not applicable

Test of: Siemens AG.
Wolf 5
To: FCC Part 15.247: 2004 (Subpart C)

9.2. Radiated Emissions

Radiated emissions measurements were performed in accordance with the standard, against appropriate limits for each detector function.

Initial measurements covering the entire measurement band in the form of swept scans in a shielded enclosure were performed in order to identify frequencies on which the EUT was generating interference. This determined the frequencies on which the EUT should be re-measured in full on the open area test site. In order to minimise the time taken for the swept measurements, a peak detector was used in conjunction with the appropriate detector IF measuring bandwidth (see table below). Repetitive scans were performed to allow for emissions with low repetition rates.

The initial scans were performed using an antenna height of 1.5 m and a measurement distance of 3 m. Following the initial scans, graphs were produced giving an overview of the emissions from the EUT plotted against the appropriate specification limit. Any emission within 20 dB of the limit were then measured on the open area test site, except in cases where the noise floor was within 20 dB of the limit, in these cases the highest point of the noise floor was measured.

Where an emission fell inside a restricted band, measurements were made at the appropriate test distance using a measuring receiver with a quasi peak detector for measurements below 1000 MHz and an average and peak detector for measurements above 1000 MHz. A peak detector was used for all other measurements.

For the final measurements the EUT was arranged on a non-conducting turn table on a standard test site compliant with ANSI C63.4 – 2003 Clause 5.4.

All measurements on the open area test site were performed using broadband antennas in both vertical and horizontal polarisations.

On the open area test site, at each frequency where a signal was to be measured, the trace was maximised by rotating a turntable through 360°. The angle at which the maximum signal was observed was locked out. For frequencies below 1000 MHz the test antenna was varied in height between 1 m and 4 m in order to further maximise the target emission.

For frequencies above 1000 MHz where a horn antenna was used, height searching was performed to locate the optimal height of the horn with respect to the EUT. At this point the horn was locked off and the turntable was again rotated through 360° to maximise the target signal. It should be noted that the received signal from the EUT would diminish very quickly after it exits the beam width of the horn antenna, for this reason it may not be necessary to fully height search with the horns.

Test of: Siemens AG.
Wolf 5
To: FCC Part 15.247: 2004 (Subpart C)

Radiated Emissions (Continued)

At this point, any signals found to be between the limit and a level 6 dB below it were further maximised by changing the configuration of the EUT, e.g. re-routing cables to peripherals and moving peripherals with respect to the EUT.

Scans were performed to the upper frequency limits as stated in section 15.33

The final field strength was determined as the indicated level in dB μ V plus cable loss and antenna factor.

The test equipment settings for radiated emissions measurements were as follows:

Receiver Function	Initial Scan	Final Measurements <1 GHz	Final Measurements ≥1 GHz
Detector Type:	Peak	Quasi-Peak (CISPR)	Peak / Average
Mode:	Max Hold	Not applicable	Max Hold
Bandwidth:	(120 kHz <1 GHz) (1 MHz ≥1 GHz)	120 kHz	1 MHz
Amplitude Range:	100 dB	100 dB	100 dB
Step Size:	Continuous sweep	Not applicable	Not applicable
Sweep Time:	Coupled	Not applicable	Not applicable

Test of: Siemens AG.
Wolf 5
To: FCC Part 15.247: 2004 (Subpart C)

9.3. Carrier Frequency Separation / 20 dB Bandwidth

The EUT and spectrum analyser was configured as for radiated measurements, and as per FCC Public Notice DA 00-705, Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems.

To determine the bandwidth and separation of each transmission channel the measurement analyser was configured to measure two adjacent channels whilst the EUT was in hopping mode. The spectrum analyser was configured with a resolution bandwidth and video bandwidth greater than 1% of the frequency span.

The analyser was set for a maximum hold scan to capture the profile of the signal. The peak points on the two adjacent channels were noted and the separation between them recorded.

To determine the occupied bandwidth, a resolution bandwidth of 10 kHz was used, which is greater than 1% of the 20 dB bandwidth. A video bandwidth of, at least, the same value was used.

The analyser was set for a maximum hold scan to capture the profile of the signal. The peak level was then determined, and a reference line was drawn 20 dB below the peak level.

The bandwidth was determined at the points where the 20 dB reference line intercepted the power envelope of the emission.

Test of: Siemens AG.

Wolf 5

To: FCC Part 15.247: 2004 (Subpart C)

9.4. Peak Output Power

The EUT and spectrum analyser were configured as for conducted antenna port measurements and as per FCC Public Notice DA 00-705, Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems.

Prior to testing being performed a suitable RF attenuator and cable, were calibrated for the required frequencies. For each frequency to be measured, the calibrated level of the attenuator and cable were entered as an offset into a spectrum analyser to compensate for the measurement set up.

To determine the transmitter output power, the EUT was operated at maximum power and a result was obtained from the spectrum analyser using peak detector and trace max hold.

Test of: Siemens AG.
Wolf 5
To: FCC Part 15.247: 2004 (Subpart C)

9.5. Effective Isotropic Radiated Power (EIRP)

EIRP measurements were performed in accordance with the standard, against appropriate limits.

The EIRP was measured with the EUT arranged on a non-conducting turn table on a standard test site compliant with ANSI C63.4 – 2003 Clause 5.4. The transmitter was fitted with an integral antenna; therefore all radiated tests were performed with the unit operating into the integral antenna.

The level of the EIRP was measured using a spectrum analyser.

The test antenna was positioned in the horizontal plane. The EUT was oriented in the X plane. The test antenna was then raised and lowered until a maximum peak was observed. The turntable was then rotated through 360 degrees and the maximum peak reading obtained. The height search was then repeated to take into consideration the new angular position of the turntable. The maximum reading observed was then recorded. This procedure was then repeated with the EUT oriented in the Y and Z planes. The highest reading taken in all 3 planes was recorded. The entire procedure was then repeated with the test antenna set in the vertical polarity.

Once the final amplitude (maximised) had been obtained, the EUT was substituted with a horn antenna. The centre of the substitution antenna was set to approximately the same centre location as the EUT. The substitution antenna was set to the horizontal polarity. The substitution antenna was matched into a signal generator using a 6 dB or greater attenuator. The signal generator was tuned to the EUT's frequency under test.

The test antenna was then raised and lowered to obtain a maximum reading on the spectrum analyser. The level of the signal generator output was then adjusted until the maximum recorded EUT level was observed. The signal generator level was noted. This procedure was repeated with both test antenna and substitution antenna vertically polarised. The EIRP was calculated as:-

$$\text{EIRP} = \text{Signal Generator Level} - \text{Cable Loss} + \text{Antenna Gain}$$

Test of: Siemens AG.
Wolf 5
To: FCC Part 15.247: 2004 (Subpart C)

Effective Isotropic Radiated Power (EIRP) (Continued)

Circumstances where the signal generator could not produce the desired a power substitution was performed with the signal generator set to 0 dBm. The radiated signal was maximised as previously described. The level indicated on the measuring receiver was noted. The delta between this level and the maximum level for the EUT was calculated and also noted. The EIRP of the signal generator was calculated using the above formulae. The recorded delta was added to the calculated EIRP to obtain the substituted EUT EIRP.

$$\text{Delta (dB)} = \text{EUT} - \text{SG}$$

where :

EUT = spectrum analyser indicated EUT raw level

SG = spectrum analyser indicated signal generator raw level

The signal generator actual EIRP is calculated as:

$$\text{EIRP SG} = \text{Signal Generator Level} - \text{Cable Loss} + \text{Antenna Gain}$$

The EUT EIRP is calculated as:

$$\text{EIRP EUT} = \text{EIRP SG} + \text{Delta.}$$

The test equipment settings for EIRP measurements were as follows:

Receiver Function	Setting
Detector Type:	Peak
Mode:	Not applicable
Bandwidth:	1 MHz
Amplitude Range:	100 dB
Sweep Time:	Coupled

Test of: Siemens AG.
Wolf 5
To: FCC Part 15.247: 2004 (Subpart C)

9.6. Band Edge Compliance of RF Radiated Emissions

The EUT and spectrum analyser were configured as for radiated measurements and as per FCC Public Notice DA 00-705, Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems.

To determine band edge compliance, the analyser resolution bandwidth was set to $\geq 1\%$ of the analyser span. The video bandwidth was set to be \geq to the resolution bandwidth. The sweep was set to auto and the detector to peak. The trace was set to max hold and a trace was produced.

A plot of the lower band edge of the allocated frequency band was produced. A marker was set to the level of the highest in band emission with a limit line set to 20 dB below this. The marker was then placed on the highest out of band emission (the specification states that either the band edge level must be measured or the highest out of band emission, whichever is the greater). The plots show that the highest out of band emission complies with the -20 dBc limit.

The above procedure was then repeated for the upper band edge except that, as the upper band edge fell on a restricted band edge (as defined in section 15.205(a)), the limit for the restricted band was applied instead of the -20 dBc limit i.e. the general limits defined in section 15.209(a).

Final measurements were performed on the worst-case configuration as described in Part 15.31(i).

Test of: Siemens AG.

Wolf 5

To: FCC Part 15.247: 2004 (Subpart C)

Appendix 1. Test Equipment Used

RFI No.	Instrument	Manufacturer	Type No.	Serial No.
A003	ESH3-Z2 Pulse Limiter	Rohde & Schwarz	ESH3-Z2	357 881/052
A023	Conical Log-Spiral Antenna	EMCO	3101	3118
A027	Horn Antenna	Eaton	9188-2	301
A031	2 to 4 GHz Eaton Horn Antenna	Eaton	91889-2	557
A059	3146 Log Periodic Antenna	EMCO	3146	8902-2378
A067	LISN	Rohde & Schwarz	ESH3-Z5	890603/002
A073	Biconical Antenna	EMCO	3104C	9004-4249
A1516	CMU200	Rohde & Schwarz	CMU200	1100.0008.02
A1534	Preamplifier 1-26.5 GHz	Hewlett Packard	8449B OPT H02	3008A00405
A253	WG 12 Microwave Horn	Flann Microwave	12240-20	128
A254	WG 14 Microwave Horn	Flann Microwave	14240-20	139
A255	WG 16 Microwave Horn	Flann Microwave	16240-20	519
A256	WG 18 Microwave Horn	Flann Microwave	18240-20	400
A259	Bilog Antenna	Chase	CBL6111	1513
A392	3 dB attenuator (9)	Suhner	6803.17.B	None
A436	WG 20 horn	Flann	20240-20	330
C1082	Rosenberger Cable 2m	Rosenberger	FA210A1020M5050	28463-1
C1115	Andrews	Andrews	1354	E107863
C1155	8m cable	Huber & Suhner	Sucoflex 104PA	1522/4PA
C178	Cable	Rosenberger	UFA210A-1-1181-70x70	None
C387	Cable	Rosenberger	UFB 293B-1-0720-50x51 FSCM 64639	97B1011
C453	Cable	Rosenberger	RG142XX-001-RFIB	C453-10081998
C457	Cable	Rosenberger	RG142XX-002-RFIB	C457-10081998
C461	Cable	Rosenberger	UFA210A-1-1182-704704	98H0305
C468	N-Type Coaxial Cable	Rosenberger	UFA210A-1-3937-504504	98L0440

Test of: Siemens AG.
Wolf 5
To: FCC Part 15.247: 2004 (Subpart C)

Test Equipment Used (Continued)

RFI No.	Instrument	Manufacturer	Type No.	Serial No.
C837	Details not known,	???????	???????	???????
G032	IFI Wideband RF Power Amplifier	IFI	404	0992-4198
M003	Spectrum Monitor	Rohde & Schwarz	EZM	883 580/008
M044	ESVP Receiver	Rohde & Schwarz	ESVP	891 845/026
M069	ESMI Spectrum Analyser / Receiver	Rohde & Schwarz	ESMI	829 808/007 (DU) / 827 063/008 (RU)
M088	Receiver / Spectrum Analyser System	Rohde & Schwarz	ESBI	DU:835862/018 RU:835387/006
M1008	HP 8563E	Hewlett Packard	8563E	3551A04412
M1071	Spectrum Analyser 9KHz to 12.8GHz	Agilent	HP8590E	3647U00514
M1078	Test Set	Anritsu Limited	MT8850A	6k00000244
S201	Site 1	RFI	1	
S202	Site 2	RFI	2	S202-15011990
S212	Site 12	RFI	12	

NB In accordance with UKAS requirements, all the measurement equipment is on a calibration schedule.

Test of: Siemens AG.
Wolf 5
To: FCC Part 15.247: 2004 (Subpart C)

Appendix 2. Test Configuration Drawings

This appendix contains the following drawings:

Drawing Reference Number	Title
DRG\71222\EMIRAD	Test configuration for measurement of radiated emissions.

Test of: Siemens AG.
Wolf 5
To: FCC Part 15.247: 2004 (Subpart C)

DRG\71222\EMIRAD

