TEST REPORT
FROM
RADIO FREQUENCY
INVESTIGATION LTD.

Test Of: Sony Ericsson Mobile Communications.
GR48 GSM/GPRS Communications Module

To: FCC Part 15, 22 and 24

Test Report Serial No:
RFI/MPTB1/RP44962JD01A

This Test Report Is Issued Under The Authority Of Richard Jacklin, Operations Director:	**Checked By:**
Tested By: pp	**Release Version No: PDF)1**
Issue Date: 19 September 2003	**Test Dates: 08 July 2003 to 19 July 2003**

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1. Client Information

Company Name:	Sony Ericsson Mobile Communications.
Address:	Maplewood Chineham Business Park Basingstoke Hampshire RG24 8YB UK
Contact Name:	Mr Jose Aurelio Rodrigo

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:	Sony Ericsson
Model Name or Number:	GR48
Unique Type Identification:	6220511-BV
FCC IDNumber:	PY76220511
Country of Manufacture:	Taiwan
Date of Receipt:	08 July 2003

2.2. Description Of EUT

The equipment under test is a GSM/GPRS communications module for the GSM bands 850 and 1900 for voice, SMS, CSD, HSCSD (Class 2) and GPRS (class 8).

Accessories to be included in the testing and approval are the following:

GR47/GR48 Developer's Kit

Switch Mode Power Supply EPA-121DA-12

Portable Hands-free J-Type PHF

Quad Band Antenna DG/AG300

9 Pin to 9 Pin RS232 Cable

2.3. Modifications Incorporated In EUT

The EUT has not been modified from what is described by the Model Number and Unique Type Identification stated above.

2.4. Additional Information Related To Testing

Power Supply Requirement:	DC Supply of (Customer supplied) EPA-121DA-12
Intended Operating Environment:	Residential, Commercial
Type of Unit:	Cellular Communications Module
Weight:	18.5 g
Dimensions:	50 x 33 x 6.82 mm
Interface Ports:	Systems Bus Connector of 60 Pin
Highest Fundamental Frequency	1908.75 MHz

850 MHz

Transmit Frequency Range	824.2 MHz to 848.8 MHz		
Transmit Channels Tested	**Channel ID**	**Channel Number**	**Channel Frequency (MHz)**
	Bottom	128	824.2
	Middle	190	836.6
	Top	251	848.8
Receive Frequency Range	869.2 MHz to 893.8 MHz		
Receive Channels Tested	**Channel ID**	**Channel Number**	**Channel Frequency (MHz)**
	Bottom	128	869.2
	Middle	190	881.6
	Top	251	893.8
Maximum Power Output (ERP)	30.9 dBm		

1900 MHz

Transmit Frequency Range	1850.2 MHz to 1909.8 MHz		
Transmit Channels Tested	**Channel ID**	**Channel Number**	**Channel Frequency (MHz)**
	Bottom	512	1850.2
	Middle	660	1879.8
	Top	810	1908.8
Receive Frequency Range	1930.2 MHz to 1989.8 MHz		
Receive Channels Tested	**Channel ID**	**Channel Number**	**Channel Frequency (MHz)**
	Bottom	512	1930.2
	Middle	660	1959.8
	Top	810	1989.8
Maximum Power Output (EIRP)	27.2 dBm		

2.5. Support Equipment

The following support equipment was used to exercise the EUT during testing:

Description:	Kit to help GR48 integrators to develop hardware and software applications
Brand Name:	Sony Ericsson
Model Name or Number:	GR47/GR48 Developer's Kit (4000006)
Serial Number:	200309:007
Cable Length And Type:	Not applicable
Connected to Port:	System Bus of GR48

Description:	Switch Mode Power Supply
Brand Name:	Stontronics Ltd
Model Name or Number:	EPA-121DA-12
Serial Number:	Not applicable
Cable Length And Type:	2 m (two wires)
Connected to Port:	5-32 V DC input of GR47/GR48 Developer's Kit

Description:	Portable Hands-free
Brand Name:	DUB
Model Name or Number:	J-Type PHF
Serial Number:	Not applicable
Cable Length And Type:	1 m (2 coaxial cables)
Connected to Port:	MIC and EAR ports of GR47/GR48 Developer's Kit

Support Equipment (Continued)

Description:	Quad Band Antenna
Brand Name:	DUB
Model Name or Number:	DG/AG300
Serial Number:	Not applicable
Cable Length And Type:	1 m (coaxial cable)
Connected to Port:	RF port of GR47/GR48 Developer's Kit

Description:	Software Development Board
Brand Name:	Not applicable
Model Name or Number:	TVK 117 8190 P1B
Serial Number:	200322:106
Cable Length And Type:	9 Way D Type 3 m
Connected to Port:	Com 1 & Com 2

3. Test Specification, Methods And Procedures

3.1. Test Specifications

Reference:	FCC Part 15 Subpart B: 2002 (Section 15.107 and 15.109)
Title:	Code of Federal Regulations, Part 15 (47CFR15) Radio Frequency Devices: Unintentional Radiators.
Comments:	A description of the test facility used for this test is on file with, and has been accepted by, the Federal Communications Commission as required by Section 2.948 of Federal Rules.
Purpose of Test:	To determine whether the equipment complied with the requirements of the specification for the purposes of certification.

Reference:	FCC Part 22 Subpart H: 2002 (Cellular Radiotelephone Service)
Title:	Code of Federal Regulations, Part 22 (47CFR22) Personal Communication Services.
Comments:	A description of the test facility used for this test is on file with, and has been accepted by, the Federal Communications Commission as required by Section 2.948 of Federal Rules.
Purpose of Test:	To determine whether the equipment complied with the requirements of the specification for the purposes of certification.

Reference:	FCC Part 24 Subpart E: 2002 (Broadband PCS)
Title:	Code of Federal Regulations, Part 24 (47CFR24) Personal Communication Services.
Comments:	A description of the test facility used for this test is on file with, and has been accepted by, the Federal Communications Commission as required by Section 2.948 of Federal Rules.
Purpose of Test:	To determine whether the equipment complied with the requirements of the specification for the purposes of certification.

3.2. 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 (2001)
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.

3.3. 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.

4. Deviations From The Test Specification

None.

5. Operation Of The EUT During Testing

5.1. Operating Conditions

The EUT was tested in a normal laboratory environment.

During testing, the EUT was powered by a nominal 115 V 60 Hz AC Mains supply via the supplied switched mode power supply.

5.2. Operating Modes

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

Preliminary radiated scans were performed on the EUT with the accessories stated in Section 2.1 of this report connected and then disconnected. The combination that exhibited the worse case mode of operation was then used to perform final measurements.

Transmitter Modes:

For carrier ERP / EIRP, occupied bandwidth and final transmitter radiated measurements, testing was performed at full power on top, middle and bottom channels of the assigned frequency block.

For frequency stability testing, measurements were performed at full power on the top and bottom channels of the assigned frequency block at –30.0 ºC through to +50.0 ºC in 10-degree increments.

All transmitter Radiated Spurious pre-scan tests were performed at full power on the middle channel of the assigned frequency block. Final measurements were than performed on the top, middle and bottom channels if an emission was identified.

Receiver Modes:

Testing was performed with the call terminated from the GSM Test Simulator and the phone left in its receive mode.

5.3. Configuration And Peripherals

The EUT was tested in the following configuration:

Configured with AC power supply and laptop connected.

All tests were performed with the EUT connected via an air link or directly to a GSM test set.

6. Summary Of Test Results

850 MHz

Range Of Measurements	Specification Reference	Mode of Operation	Port Type	Compliancy Status
Receiver AC Conducted Spurious Emissions (150 kHz to 30 MHz)	C.F.R. 47 FCC Part 15: 2002 Section 15.107	Receive	AC Mains Input	Complied
Receiver Radiated Emissions	C.F.R. 47 FCC Part 15: 2002 Section 15.109	Receive	Antenna	Complied
Carrier Output Power	C.F.R. 47 FCC Part 2: 2002 Section 2.1046(a)	Transmit	Antenna Terminals	Complied
Effective Radiated Power (ERP)	C.F.R. 47 FCC Part 22: 2002 Section 22.913(a)	Transmit	Antenna	Complied
Frequency Stability (Temperature Variation)	C.F.R. 47 FCC Part 22: 2002 Section 22.355	Transmit	Antenna Terminals	Complied
Frequency Stability (Voltage Variation)	C.F.R. 47 FCC Part 22: 2002 Section 22.355	Transmit	Antenna Terminals	Complied
Occupied Bandwidth	C.F.R. 47 FCC Part 2: 2002 Section 2.1049(i)	Transmit	Antenna Terminals	Complied
Radiated Out of Band Emissions	C.F.R. 47 FCC Part 22: 2002 Section 22.917	Transmit	Antenna	Complied
Radiated Band Edges	C.F.R. 47 FCC Part 2: 2002 Section 2.1053	Transmit	Antenna	Complied
Conducted Out of Band Emissions	C.F.R. 47 FCC Part 22: 2002 Section 22.917	Transmit	Antenna Terminals	Complied
Conducted Emissions at Band & Block Edges	C.F.R. 47 FCC Part 22: 2002 Section 22.917	Transmit	Antenna Terminals	Complied

Summary Of Test Results (Continued)

1900 MHz

Range Of Measurements	Specification Reference	Mode of Operation	Port Type	Compliancy Status
Receiver AC Conducted Spurious Emissions (150 kHz to 30 MHz)	C.F.R. 47 FCC Part 15: 2002 Section 15.107	Receive	AC Mains Input	Complied
Receiver Radiated Emissions	C.F.R. 47 FCC Part 15: 2002 Section 15.109	Receive	Antenna	Complied
Carrier Output Power	C.F.R. 47 FCC Part 2: 2002 Section 2.1046(a)	Transmit	Antenna Terminals	Complied
Effective Isotropic Radiated Power (EIRP)	C.F.R. 47 FCC Part 24: 2002 Section 24.232	Transmit	Antenna	Complied
Frequency Stability (Temperature Variation)	C.F.R. 47 FCC Part 24: 2002 Section 24.235	Transmit	Antenna Terminals	Complied
Frequency Stability (Voltage Variation)	C.F.R. 47 FCC Part 24: 2002 Section 24.235	Transmit	Antenna Terminals	Complied
Occupied Bandwidth	C.F.R. 47 FCC Part 24: 2002 Section 24.238	Transmit	Antenna Terminals	Complied
Radiated Out of Band Emissions	C.F.R. 47 FCC Part 24: 2002 Section 24.238	Transmit	Antenna	Complied
Radiated Band Edges	C.F.R. 47 FCC Part 2: 2002 Section 2.1053	Transmit	Antenna	Complied
Conducted Out of Band Emissions	C.F.R. 47 FCC Part 24: 2002 Section 24.238	Transmit	Antenna Terminals	Complied
Conducted Emissions at Band & Block Edges	C.F.R. 47 FCC Part 24: 2002 Section 24.238	Transmit	Antenna Terminals	Complied

6.1. Location Of Tests

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

7. Measurements, Examinations And Derived Results

7.1. General Comments

7.1.1. This section contains test results only.

7.1.2. 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 11 for details of measurement uncertainties.

8. Test Results 850 MHz

8.1. Receiver AC Conducted Spurious Emissions: Section 15.107

8.1.1. The EUT was configured as for AC conducted emissions measurements as described in Section 10 of this report.

8.1.2. Tests were performed to identify the maximum emissions levels on the AC mains line of the EUT.

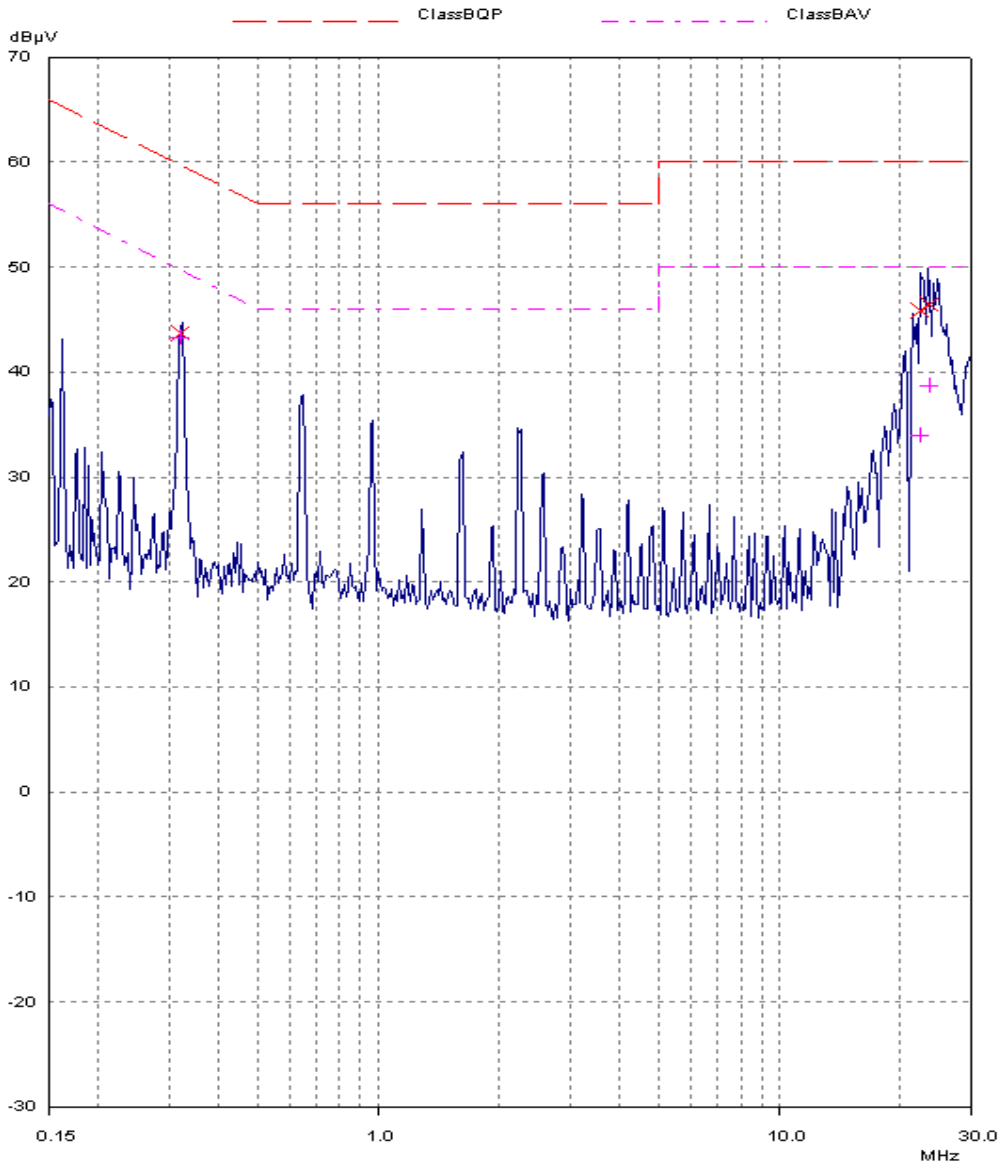
Results: Quasi-Peak Detector Measurements On Live And Neutral Lines

Frequency (MHz)	Line	Q-P Level (dBμV)	Q-P Limit (dBμV)	Margin (dB)	Result
0.31978	Neutral	43.71	59.71	16.00	Complied
22.34810	Neutral	45.92	60.00	14.08	Complied
23.62832	Neutral	46.41	60.00	13.59	Complied

Results: Average Detector Measurements On Live And Neutral Lines

Frequency (MHz)	Line	Av. Level (dBμV)	Av. Limit (dBμV)	Margin (dB)	Result
0.31978	Neutral	43.23	49.71	6.48	Complied
22.34810	Neutral	33.99	50.00	16.01	Complied
23.62832	Live	38.69	50.00	11.31	Complied

Receiver AC Conducted Spurious Emissions



8.2. Receiver Radiated Emission: Section 15.109

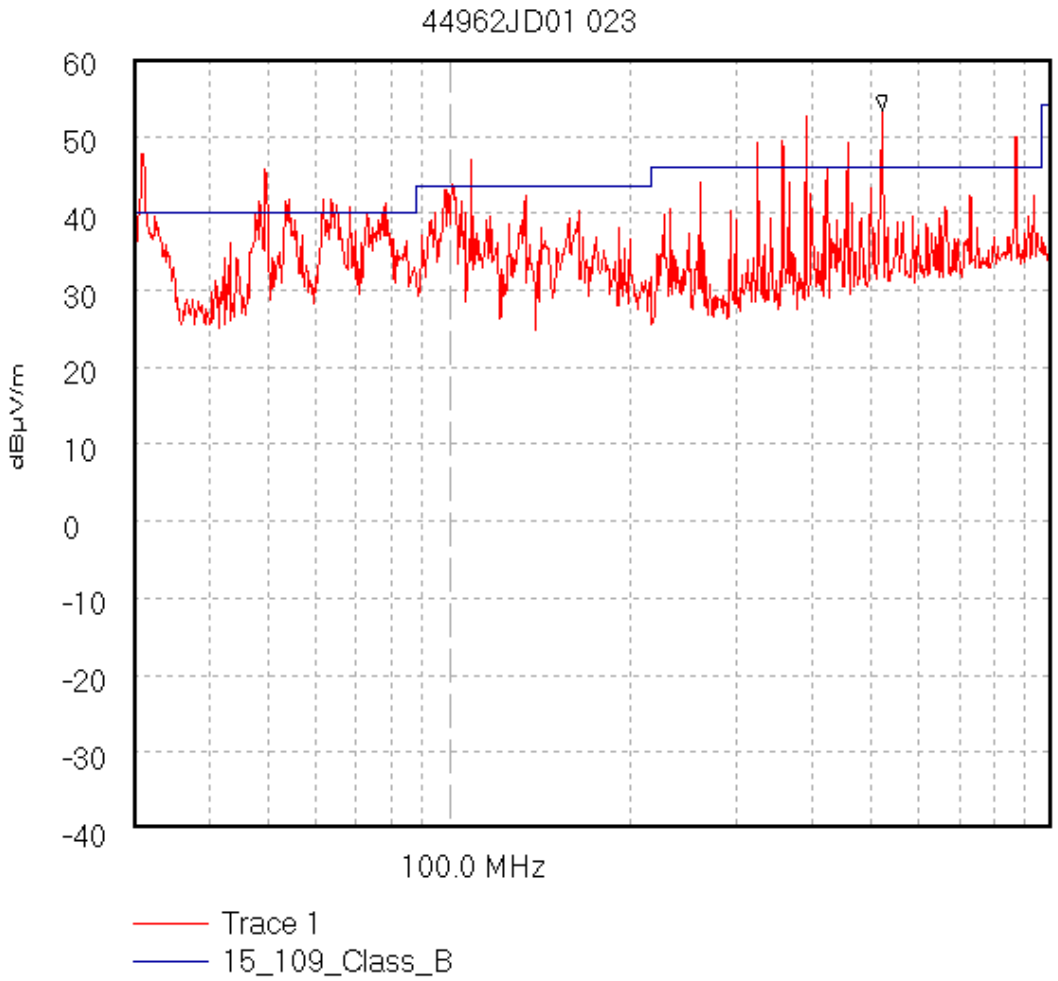
8.2.1. The EUT was configured as for receiver-radiated emissions testing as described in Section 10 of this report.

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

Result:

Frequency (MHz)	Polarity (H/V)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
30.90	Vert.	34.0	40.0	6.0	Complied
48.80	Vert.	31.0	40.0	9.0	Complied
54.40	Vert.	29.3	40.0	10.7	Complied
61.60	Vert.	22.6	40.0	17.4	Complied
64.10	Vert.	26.1	40.0	13.9	Complied
68.20	Vert.	20.1	40.0	19.9	Complied
79.10	Vert.	24.5	40.0	15.5	Complied
101.90	Vert.	32.5	43.5	11.0	Complied
109.30	Vert.	23.0	43.5	20.5	Complied
326.80	Horiz.	24.7	46.0	21.3	Complied
358.90	Horiz.	25.5	46.0	20.5	Complied
460.50	Vert.	28.7	46.0	17.3	Complied
525.70	Vert.	33.0	46.0	13.0	Complied
875.90	Vert.	39.3	46.0	6.7	Complied

Receiver Radiated Emission
(30.0 MHz to 1.0 GHz)



Start 30.0 MHz; Stop 1.0 GHz - Log Scale
Ref 60 dBµV/m; Ref Offset 0.0 dB; 10 dB/div
RBW 120.0 kHz; VBW 100.0 kHz; Att 10 dB; Swp 80.0 mS
Peak 521.701 MHz, 53.45 dBµV/m
Limit/Mask: 15_109_Class_B; ; Limit Test Failed
Transducer Factors: A1037
7/17/2003 10:46:17 AM

Receiver Radiated Emission: Section 15.109 (Continued)

8.2.1. Electric Field Strength Measurements 1.0 to 6.0 GHz

Results:

Highest Average Level:

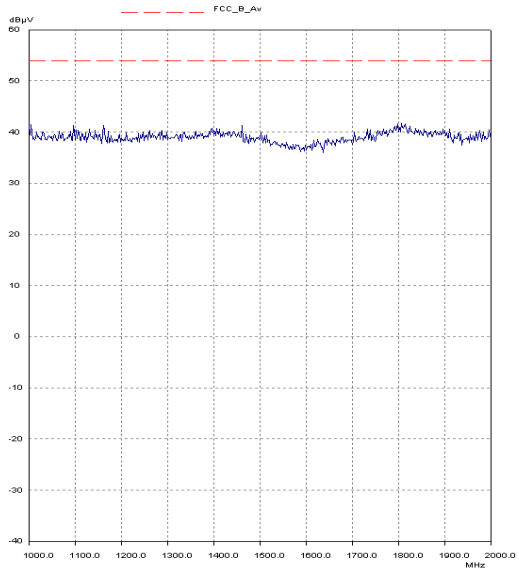
Frequency (GHz)	Antenna Polarity (H/V)	Average Detector level (dBμV)	Antenna factor (dB)	Cable loss (dB)	Actual Average Level (dBμV/m)	Average Limit (dBμV/m)	Average Margin (dB)	Result
5.5444	Horiz.	5.33	24.4	1.5	31.23	54.00	22.77	Complied

Highest Peak Level:

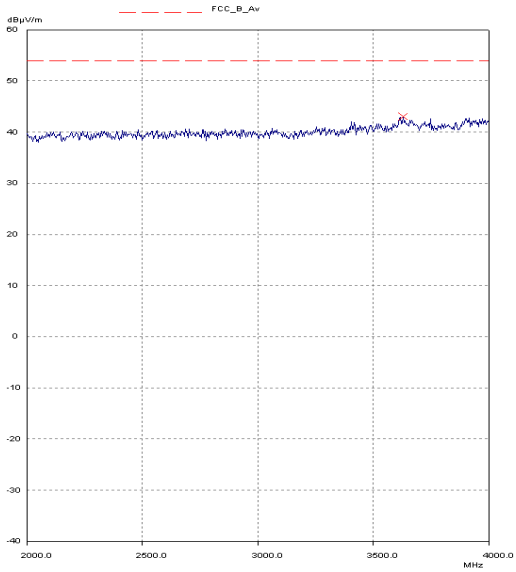
Frequency (GHz)	Antenna Polarity (H/V)	Peak Detector level (dBμV)	Antenna factor (dB)	Cable loss (dB)	Actual Peak Level (dBμV/m)	Peak Limit (dBμV/m)	Peak Margin (dB)	Result
5.5444	Horiz.	18.64	24.4	1.5	44.54	74.00	29.46	Complied

Receiver Radiated Emission: Section 15.109 (Continued)

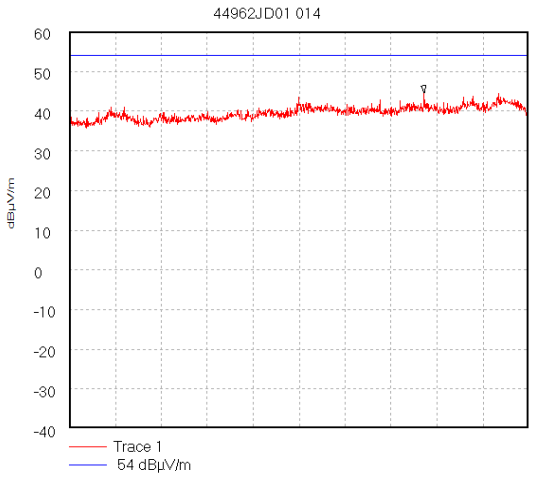
Receiver Radiated Emission (1.0 GHz to 2.0 GHz)



Receiver Radiated Emission (2.0 GHz to 4.0 GHz)



Receiver Radiated Emission (4.0 GHz to 6.0 GHz)



Start 4.0 GHz; Stop 6.0 GHz
Ref 60 dBµV/m; Ref Offset 0.0 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 5.544 GHz, 44.54 dBµV/m
Display Line: 54 dBµV/m;
Transducer Factors: 4to6g_Horn
10/07/2003 16:24:00

8.3. Transmitter Carrier Output Power: Section 2.1046(a)

8.3.1. The EUT was configured as for conducted measurements as described in Section 10 of this report.

8.3.2. Tests were performed to identify the maximum Carrier Output Power.

Results:

Channel	Measured Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	824.222	31.2	38.45	7.25	Complied
Middle	836.488	31.4	38.45	7.05	Complied
Top	848.833	30.8	38.45	7.65	Complied

8.4. Transmitter Effective Radiated Power (ERP): Section 22.913(a)

8.4.1. The EUT was configured as for Effective Radiated Power as described in Section 10 of this report.

8.4.2. Tests were performed to identify the maximum Effective Radiated Power (ERP).

Results:

Channel	Measured Frequency (MHz)	Antenna Polarity	Maximum Transmitter ERP (dBm)	Limit ERP (dBm)	Margin (dB)	Result
Bottom	824.216	Horiz.	30.9	38.45	7.55	Complied
Middle	836.617	Horiz.	29.8	38.45	8.65	Complied
Top	848.869	Horiz.	30.1	38.45	8.35	Complied

8.5. Transmitter Frequency Stability (Temperature Variation): Section 22.355

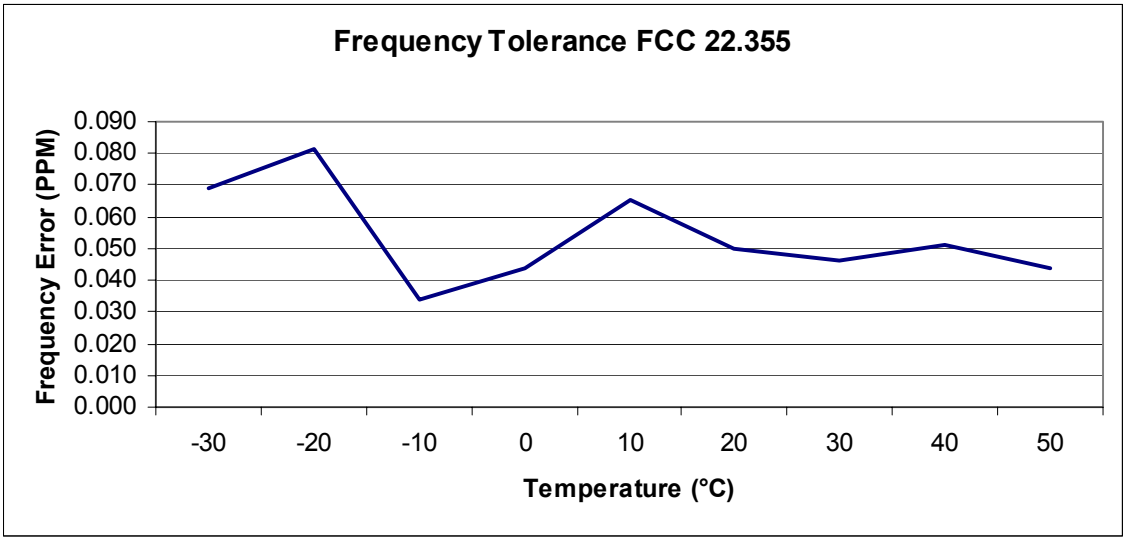
8.5.1. The EUT was configured as for frequency stability measurements as described in Section 10 of this report.

8.5.2. Tests were performed to identify the maximum frequency error of the EUT with variations in ambient temperature.

Results Bottom Channel (824.2 MHz)

Temperature (°C)	Nominal Frequency	Measured Frequency	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)	Margin (ppm)	Result
-30	824.2	824.200057	57	0.069	2.5	2.431	Complied
-20	824.2	824.200067	67	0.081	2.5	2.419	Complied
-10	824.2	824.200028	28	0.034	2.5	2.466	Complied
0	824.2	824.200036	36	0.044	2.5	2.456	Complied
10	824.2	824.200054	54	0.066	2.5	2.434	Complied
20	824.2	824.200041	41	0.050	2.5	2.450	Complied
30	824.2	824.200038	38	0.046	2.5	2.454	Complied
40	824.2	824.200042	42	0.051	2.5	2.449	Complied
50	824.2	824.200036	36	0.044	2.5	2.456	Complied

Frequency Variation From 824.2 MHz

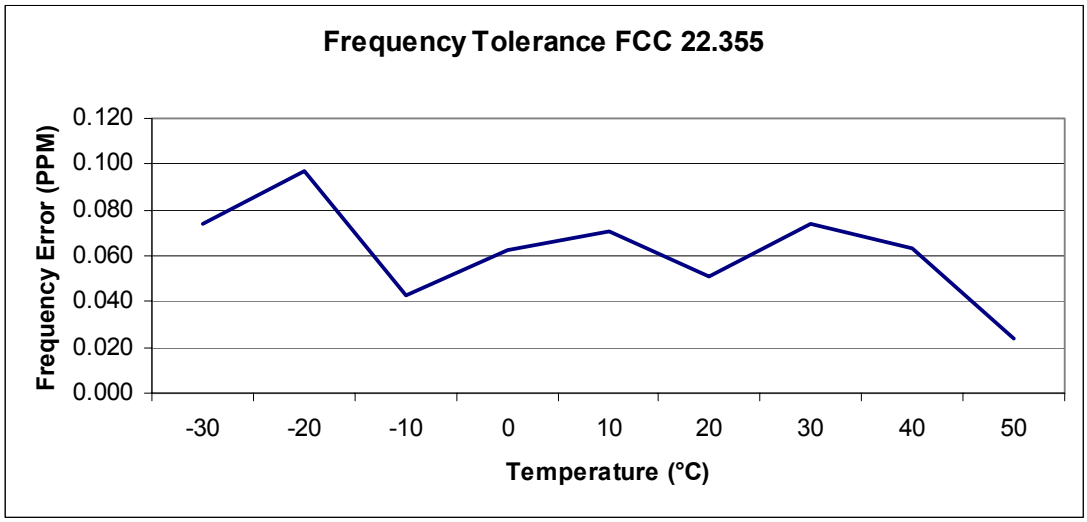


Transmitter Frequency Stability (Temperature Variation): Section 22.355 (Continued)

Results Top Channel (848.8 MHz)

Temperature (°C)	Nominal Frequency	Measured Frequency	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)	Margin (ppm)	Result
-30	848.8	848.800063	63	0.074	2.5	2.426	Complied
-20	848.8	848.800082	82	0.097	2.5	2.403	Complied
-10	848.8	848.800036	36	0.042	2.5	2.458	Complied
0	848.8	848.800053	53	0.062	2.5	2.438	Complied
10	848.8	848.800060	60	0.071	2.5	2.429	Complied
20	848.8	848.800043	43	0.051	2.5	2.449	Complied
30	848.8	848.800063	63	0.074	2.5	2.426	Complied
40	848.8	848.800054	54	0.064	2.5	2.436	Complied
50	848.8	848.800020	20	0.024	2.5	2.476	Complied

Frequency Variation From 848.8 MHz



8.6. Transmitter Frequency Stability (Voltage Variation): Section 22.355

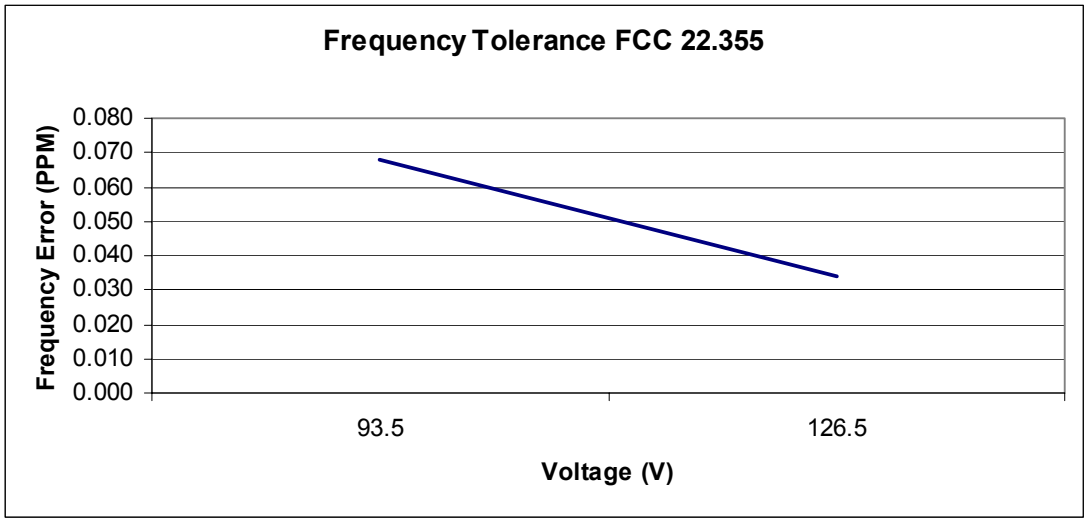
8.6.1. The EUT was configured as for frequency stability measurements as described in Section 10 of this report.

8.6.2. Tests were performed to identify the maximum frequency error of the EUT with variations in nominal operating voltage.

Results Bottom Channel (824.2 MHz)

Supply Voltage (V)	Nominal Frequency	Measured Frequency	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)	Margin (ppm)	Result
93.5	824.2	824.200056	56	0.068	2.5	2.568	Complied
126.5	824.2	824.200028	28	0.034	2.5	2.534	Complied

Frequency Variation From 824.2MHz

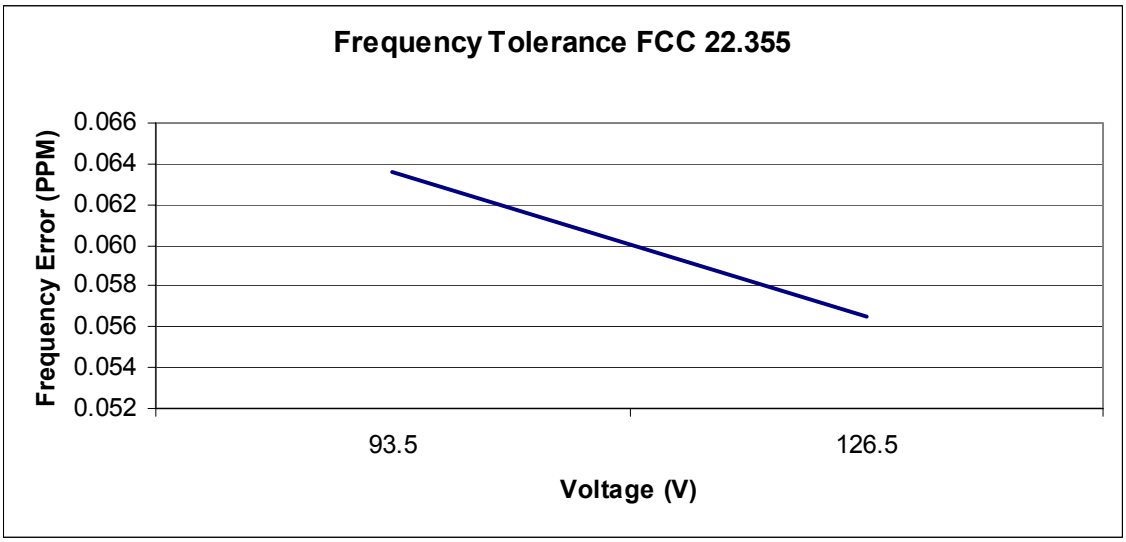


Transmitter Frequency Stability (Voltage Variation): Section 22.355 (Continued)

Results Top Channel (848.8 MHz)

Supply Voltage (V)	Nominal Frequency	Measured Frequency	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)	Margin (ppm)	Result
93.5	848.8	848.800054	54	0.064	2.5	2.564	Complied
126.5	848.8	848.800048	48	0.057	2.5	2.557	Complied

Frequency Variation From 848.8 MHz



8.7. Transmitter Occupied Bandwidth: Section 2.1049(i)

8.7.1. The EUT was configured as for Occupied Bandwidth measurements as described in Section 10 of this report.

8.7.2. Tests were performed to identify the maximum bandwidth occupied by the fundamental frequency of the EUT.

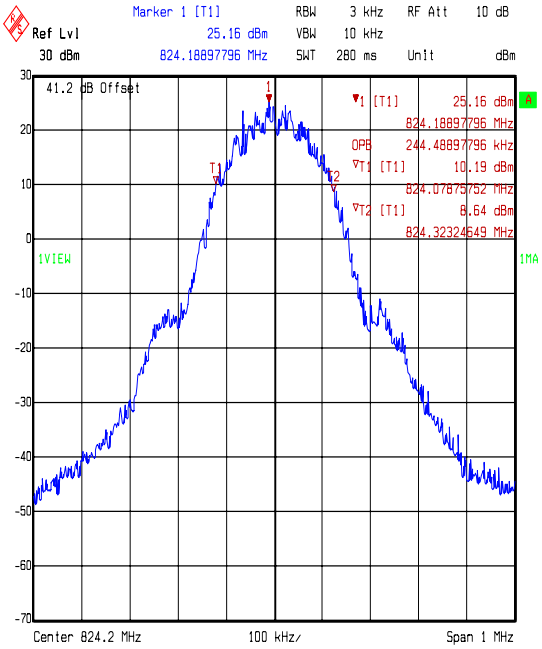
Results:

Channel	Frequency (MHz)	Resolution Bandwidth (kHz)	Video Bandwidth (kHz)	Occupied Bandwidth (kHz)
Bottom	824.2	3.0	3.0	244.489
Middle	836.6	3.0	3.0	250.501
Top	848.8	3.0	3.0	248.497

Test Of: Sony Ericsson Mobile Communications.
GR48 GSM/GPRS Communications Module
To: FCC Part 15, 22 & 24

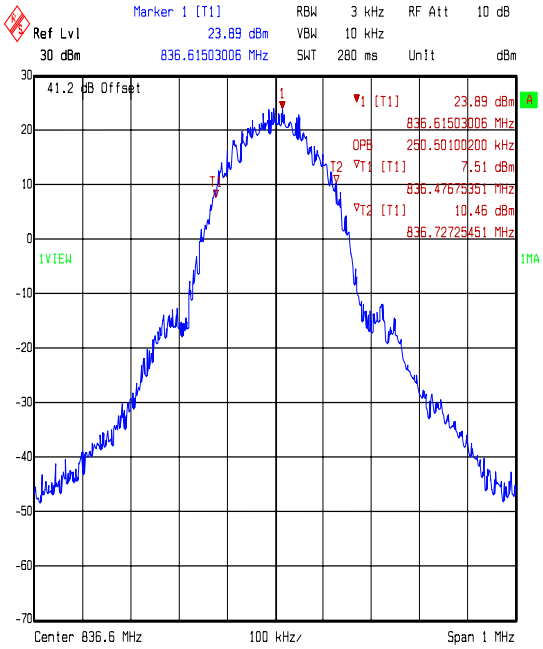
Transmitter Occupied Bandwidth

Bottom Channel



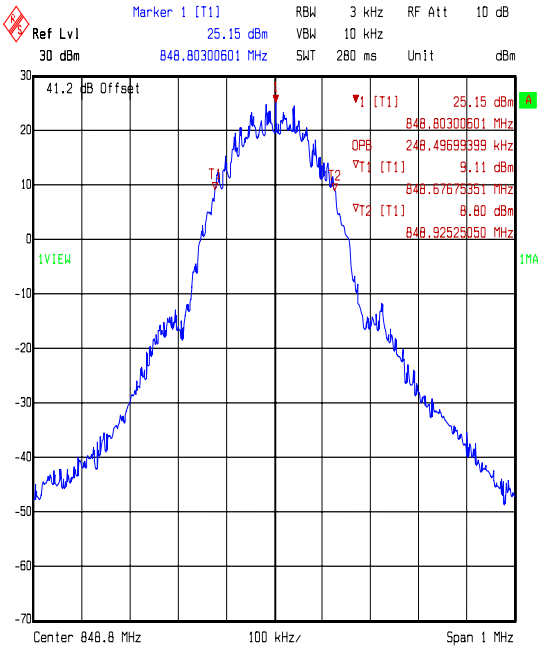
Title: Testing for Sony Ericsson Mobile Comms Intl AB. EUT:GR48.
Comment A: Occupied Power Bandwidth. FCC Part 2.1049. ARFCN 128 : 850
Mode. 44962JD01.
Date: 15.JUL.2003 9:47:50

Middle Channel



Title: Testing for Sony Ericsson Mobile Comms Intl AB. EUT:GR48.
Comment A: Occupied Power Bandwidth. FCC Part 2.1049. ARFCN 190 : 850
Mode. 44962JD01.
Date: 15.JUL.2003 9:49:08

Top Channel



Title: Testing for Sony Ericsson Mobile Comms Intl AB. EUT:GR48.
Comment A: Occupied Power Bandwidth. FCC Part 2.1049. ARFCN 251 : 850
Mode. 44962JD01.
Date: 15.JUL.2003 9:51:44

8.8. Transmitter Out of Band Emissions: Section 2.1053 & 22.917

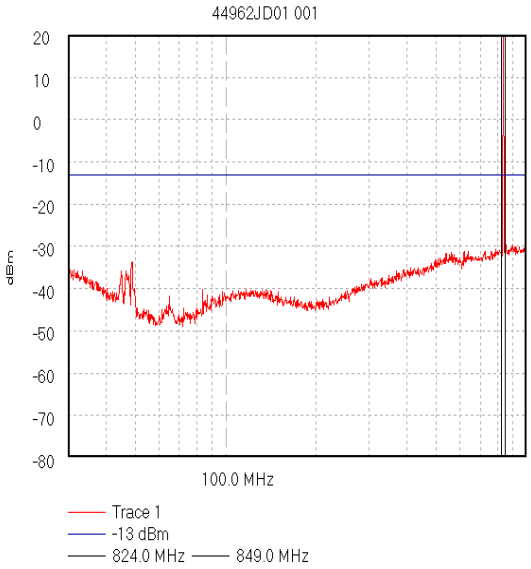
8.8.1. The EUT was configured as for transmitter radiated emissions testing as described in Section 10 of this report.

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

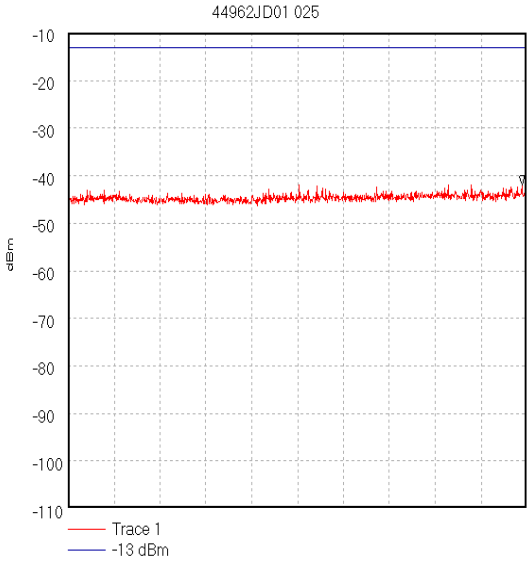
Result:

Channel	Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	4121.266	-28.43	-13.0	15.43	Complied
Middle	4183.144	-26.32	-13.0	13.32	Complied
Top	4244.294	-31.91	-13.0	18.91	Complied

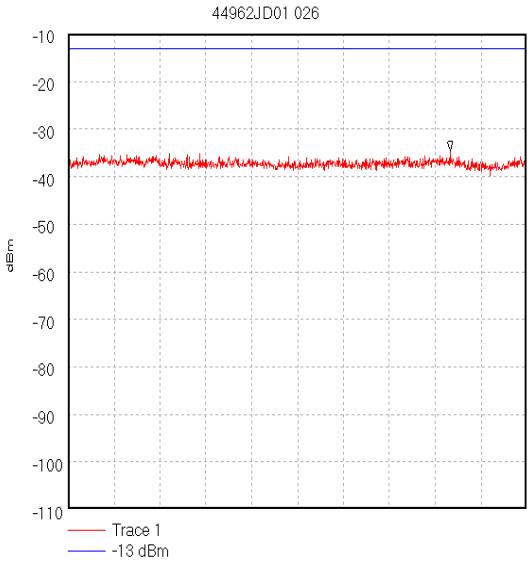
Transmitter Out of Band Emissions Middle Channel



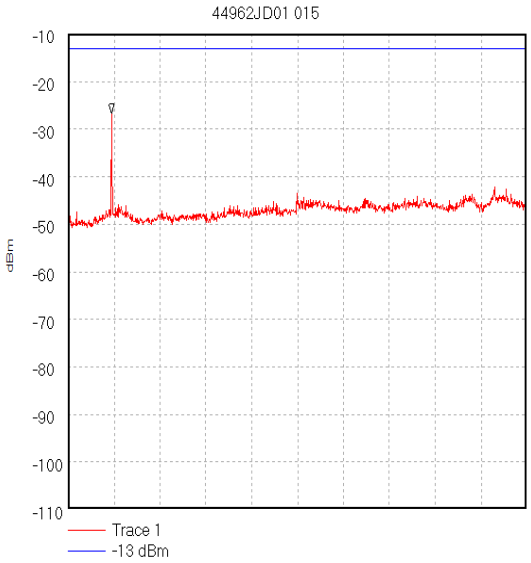
Start 30.0 MHz; Stop 1.0 GHz - Log Scale
Ref 20 dBm; Ref Offset 20.0 dB; 10 dB/div
RBW 174.0 kHz; VBW 100.0 kHz; Att 10 dB; Swp 80.0 mS
Peak 835.91872 MHz, 23.98 dBm
Display Line: -13 dBm;
Transducer Factors: A1037
7/9/2003 11:40:24 AM



Start 1.0 GHz; Stop 2.0 GHz
Ref -10 dBm; Ref Offset 30.2 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 10 dB; Swp 20.0 mS
Peak 1.99 GHz, -41.91 dBm
Display Line: -13 dBm;
7/17/2003 11:53:47 AM

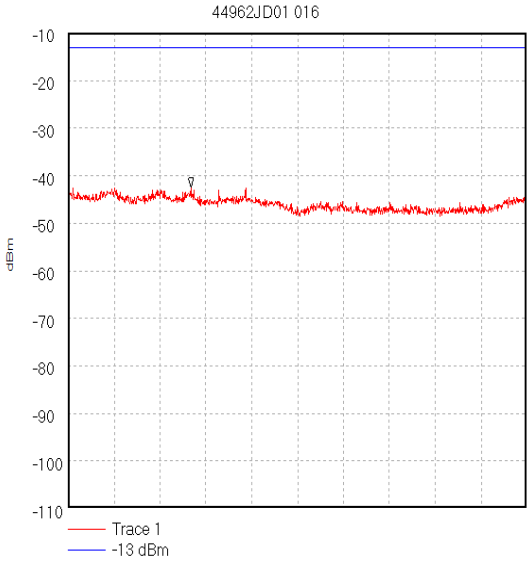


Start 2.0 GHz; Stop 4.0 GHz
Ref -10 dBm; Ref Offset 37.7 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 10 dB; Swp 20.0 mS
Peak 3.667 GHz, -34.47 dBm
Display Line: -13 dBm;
7/17/2003 11:58:51 AM

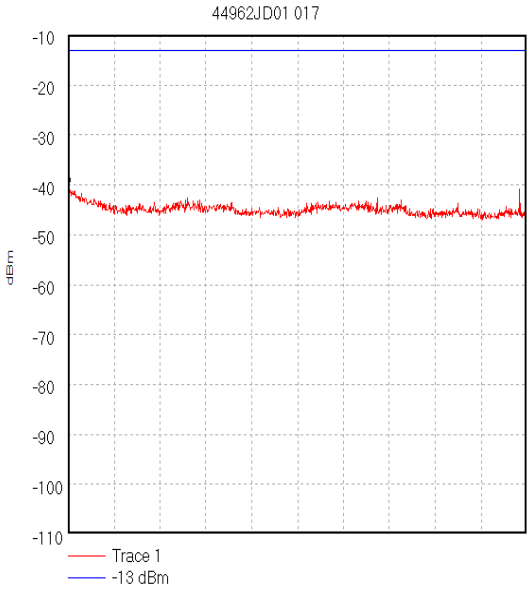


Start 4.0 GHz; Stop 6.0 GHz
Ref -10 dBm; Ref Offset 34.0 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 4.189 GHz, -26.73 dBm
Display Line: -13 dBm;
11/07/2003 09:48:07

Transmitter Out of Band Emissions Middle Channel (Continued)



Start 6.0 GHz; Stop 8.0 GHz
Ref -10 dBm; Ref Offset 36.2 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 6.536 GHz, -42.47 dBm
Display Line: -13 dBm;
11/07/2003 10:22:48



Start 8.0 GHz; Stop 10.0 GHz
Ref -10 dBm; Ref Offset 39.0 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 8.0 GHz, -40.77 dBm
Display Line: -13 dBm;
11/07/2003 10:32:04

8.9. Transmitter Radiated Emissions At Band Edges: Section 2.1053

8.9.1. The EUT was configured as for transmitter radiated emissions testing described in Section 10 of this report.

8.9.2. Tests were performed to identify the maximum emissions level at the band edges of the frequency block that the EUT will operate over.

Results:

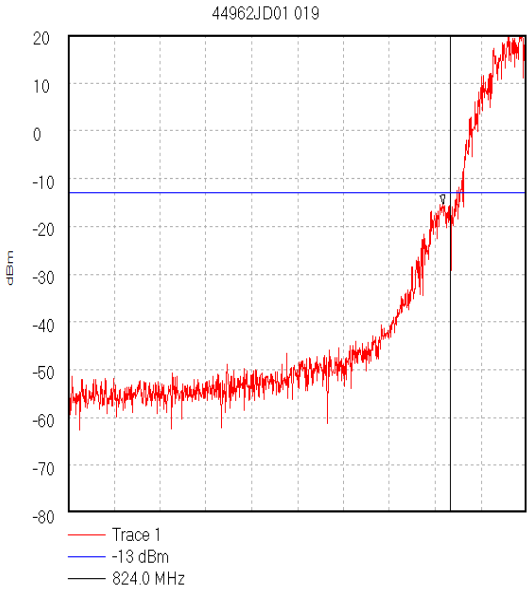
Bottom Band Edge

Frequency (MHz)	Spurious Emission (dBm)	Limit (dBm)	Margin (dB)	Result
823.981	-15.34	-13.00	2.34	Complied

Top Band Edge

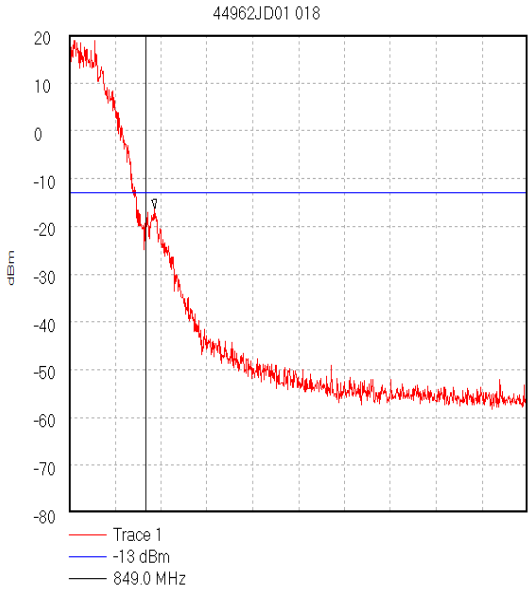
Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
849.024	-16.26	-13.00	3.26	Complied

Bottom Channel



Start 823.0 MHz; Stop 824.2 MHz
Ref 20 dBm; Ref Offset 30.8 dB; 10 dB/div
RBW 3.0 kHz; VBW 10.0 kHz; Att 20 dB; Swp 440.0 mS
Marker 823.981 MHz, -15.34 dBm
Display Line: -13 dBm;
11/07/2003 14:22:15

Top Channel



Start 848.8 MHz; Stop 850.0 MHz
Ref 20 dBm; Ref Offset 34.0 dB; 10 dB/div
RBW 3.0 kHz; VBW 10.0 kHz; Att 20 dB; Swp 400.0 mS
Marker 849.024 MHz, -16.26 dBm
Display Line: -13 dBm;
11/07/2003 11:05:03

8.10. Transmitter Conducted Out of Band Emissions: Section 22.917

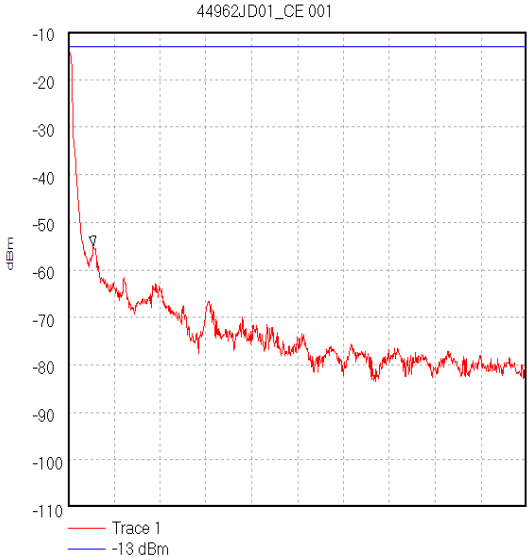
8.10.1. The EUT was configured as for transmitter conducted emissions measurements as described in Section 10 of this report.

8.10.2. Tests were performed to identify the maximum emissions levels at the antenna terminals of the EUT.

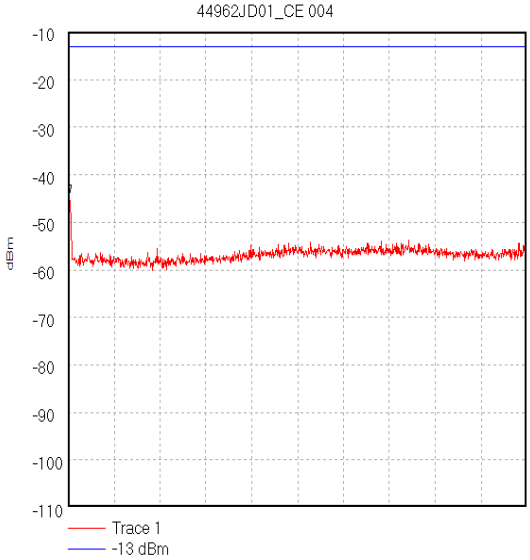
Results:

Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
1648.37	-25.96	-13.00	12.96	Complied
1673.30	-25.33	-13.00	12.33	Complied
1697.55	-25.12	-13.00	12.12	Complied

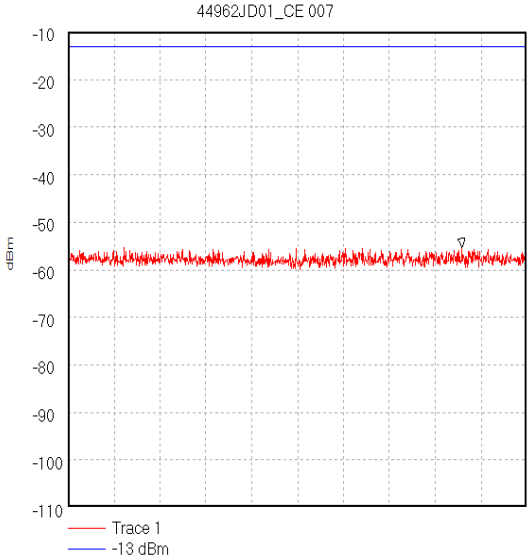
Transmitter Conducted Out of Band Emissions – Bottom Channel



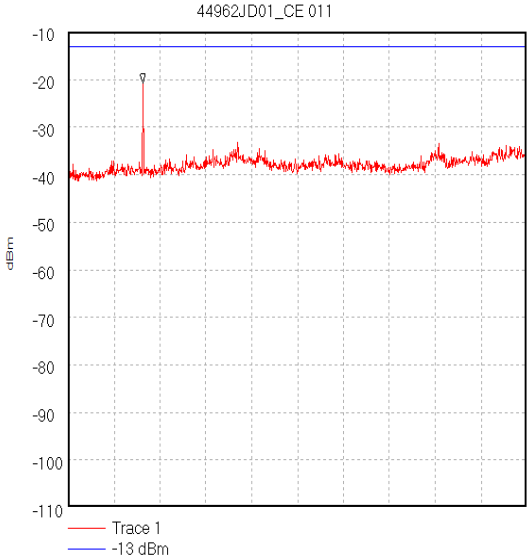
Start 9.0 kHz; Stop 1.0 MHz
Ref -10 dBm; Ref Offset 20.0 dB; 10 dB/div
RBW 10.0 kHz; VBW 10.0 kHz; Att 0 dB; Swp 40.0 mS
Peak 62.95444 kHz, -54.99 dBm
Display Line: -13 dBm;
14/07/2003 10:08:36



Start 1.0 MHz; Stop 824.0 MHz
Ref -10 dBm; Ref Offset 41.4 dB; 10 dB/div
RBW 10.0 kHz; VBW 10.0 kHz; Att 10 dB; Swp 26.0 S
Peak 2.828889 MHz, -44.12 dBm
Display Line: -13 dBm;
14/07/2003 10:29:26

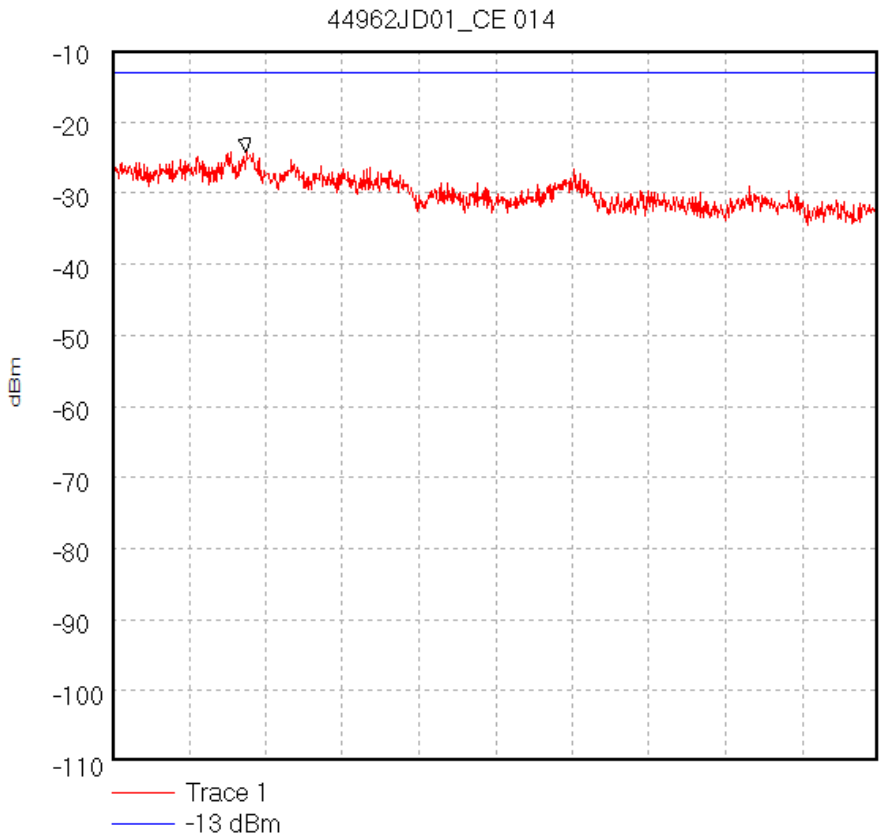


Start 849.0 MHz; Stop 1.0 GHz
Ref -10 dBm; Ref Offset 41.4 dB; 10 dB/div
RBW 10.0 kHz; VBW 10.0 kHz; Att 10 dB; Swp 4.6 S
Peak 978.692222 MHz, -55.22 dBm
Display Line: -13 dBm;
14/07/2003 10:38:32



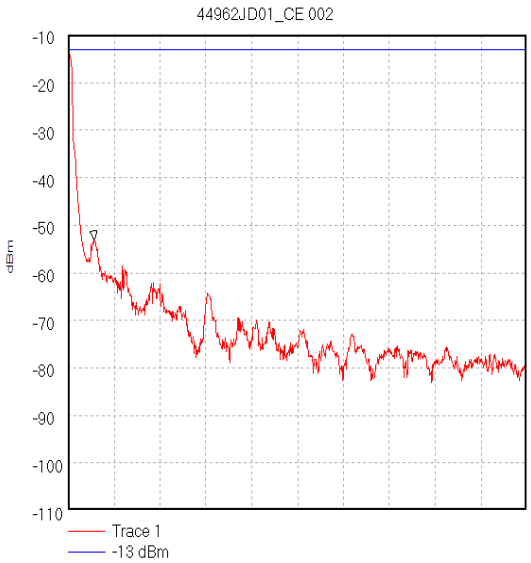
Start 1.0 GHz; Stop 5.0 GHz
Ref -10 dBm; Ref Offset 47.5 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 1.653333 GHz, -20.69 dBm
Display Line: -13 dBm;
14/07/2003 10:47:21

Transmitter Conducted Out of Band Emissions – Bottom Channel (Continued)

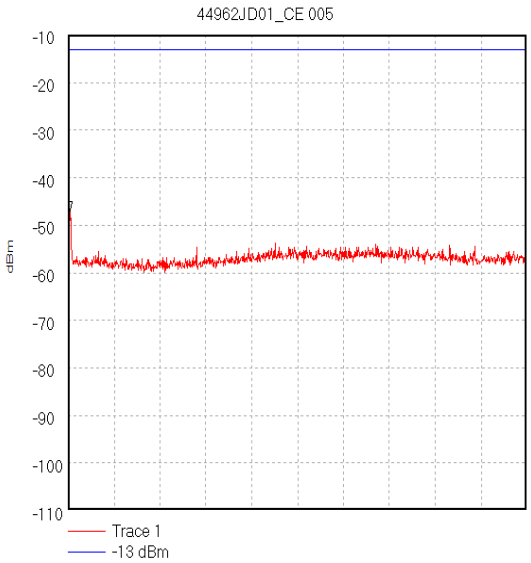


Start 5.0 GHz; Stop 10.0 GHz
Ref -10 dBm; Ref Offset 55.5 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 5.872222 GHz, -24.29 dBm
Display Line: -13 dBm;
14/07/2003 11:01:04

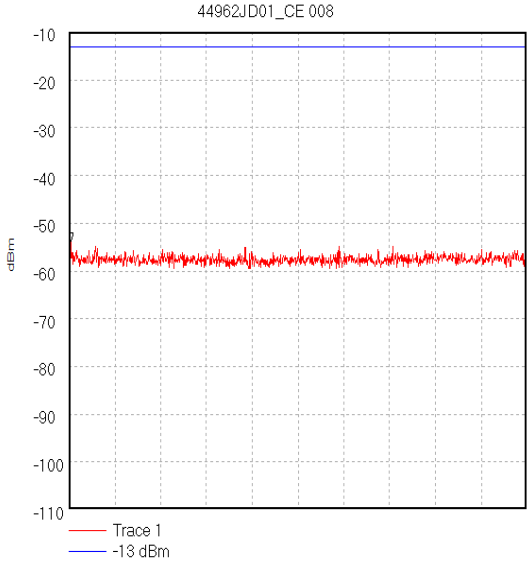
Transmitter Conducted Out of Band Emissions – Middle Channel



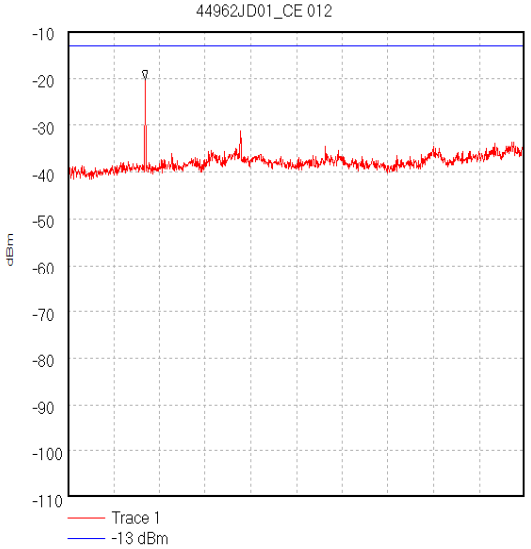
Start 9.0 kHz; Stop 1.0 MHz
Ref -10 dBm; Ref Offset 20.0 dB; 10 dB/div
RBW 10.0 kHz; VBW 10.0 kHz; Att 0 dB; Swp 40.0 mS
Peak 65.15666 kHz, -53.09 dBm
Display Line: -13 dBm;
14/07/2003 10:10:18



Start 1.0 MHz; Stop 824.0 MHz
Ref -10 dBm; Ref Offset 41.4 dB; 10 dB/div
RBW 10.0 kHz; VBW 10.0 kHz; Att 10 dB; Swp 26.0 S
Peak 3.743333 MHz, -47.07 dBm
Display Line: -13 dBm;
14/07/2003 10:30:50

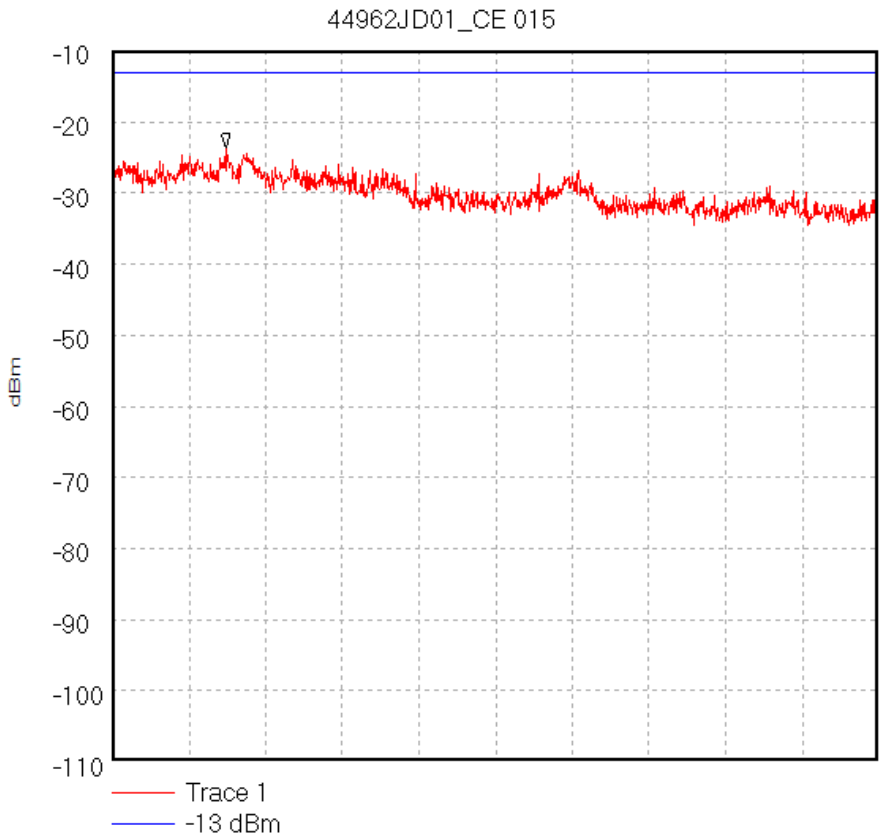


Start 849.0 MHz; Stop 1.0 GHz
Ref -10 dBm; Ref Offset 41.4 dB; 10 dB/div
RBW 10.0 kHz; VBW 10.0 kHz; Att 10 dB; Swp 4.6 S
Peak 849.503333 MHz, -53.93 dBm
Display Line: -13 dBm;
14/07/2003 10:39:20



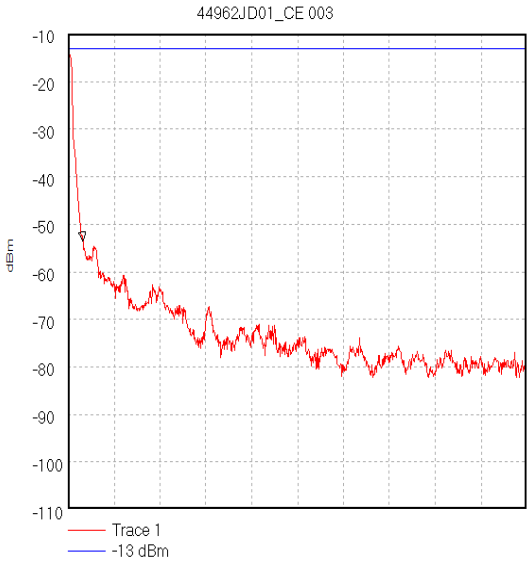
Start 1.0 GHz; Stop 5.0 GHz
Ref -10 dBm; Ref Offset 47.5 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 1.675556 GHz, -20.33 dBm
Display Line: -13 dBm;
14/07/2003 10:49:41

Transmitter Conducted Out of Band Emissions – Middle Channel (Continued)

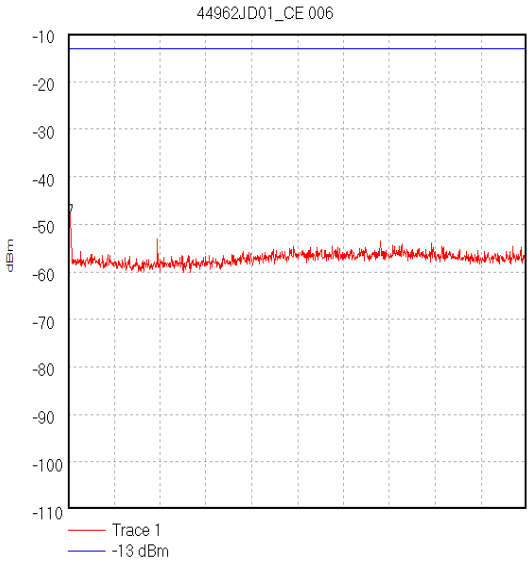


Start 5.0 GHz; Stop 10.0 GHz
Ref -10 dBm; Ref Offset 55.5 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 5.744444 GHz, -23.68 dBm
Display Line: -13 dBm;
14/07/2003 11:01:43

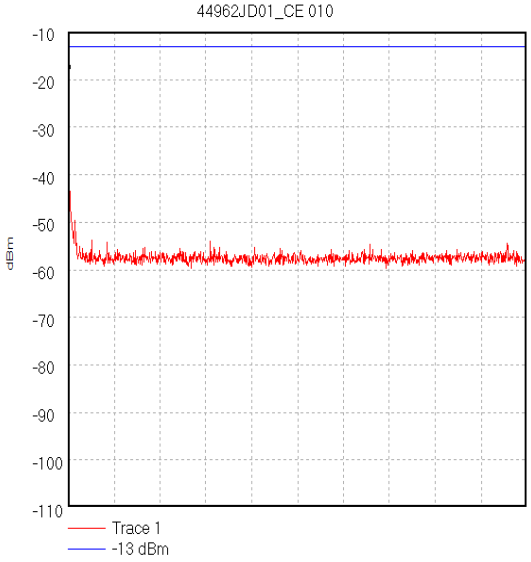
Transmitter Conducted Out of Band Emissions – Top Channel



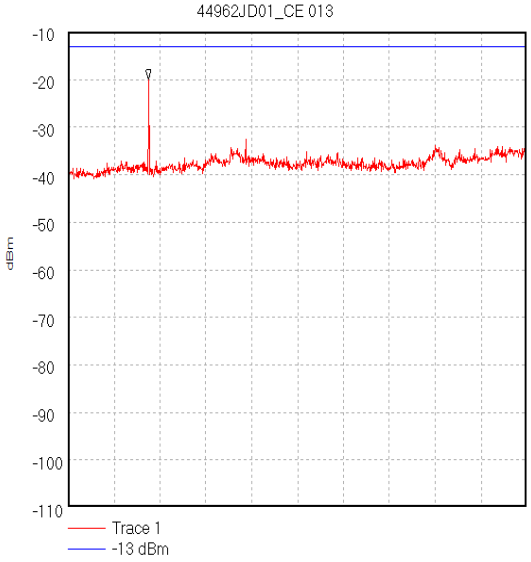
Start 9.0 kHz; Stop 1.0 MHz
Ref -10 dBm; Ref Offset 20.0 dB; 10 dB/div
RBW 10.0 kHz; VBW 10.0 kHz; Att 0 dB; Swp 40.0 mS
Peak 40.93222 kHz, -53.55 dBm
Display Line: -13 dBm;
14/07/2003 10:12:18



Start 1.0 MHz; Stop 824.0 MHz
Ref -10 dBm; Ref Offset 41.4 dB; 10 dB/div
RBW 10.0 kHz; VBW 10.0 kHz; Att 10 dB; Swp 26.0 S
Peak 3.743333 MHz, -47.78 dBm
Display Line: -13 dBm;
14/07/2003 10:32:30

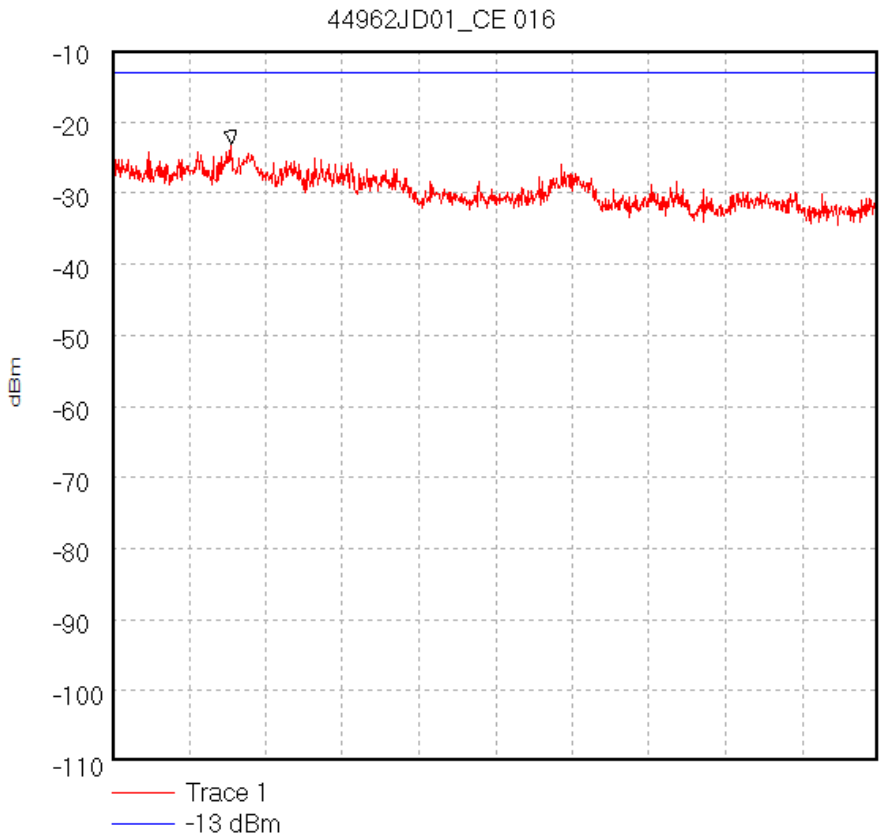


Start 849.0 MHz; Stop 1.0 GHz
Ref -10 dBm; Ref Offset 41.4 dB; 10 dB/div
RBW 10.0 kHz; VBW 10.0 kHz; Att 10 dB; Swp 4.6 S
Peak 849.0 MHz, -19.04 dBm
Display Line: -13 dBm;
14/07/2003 10:44:23



Start 1.0 GHz; Stop 5.0 GHz
Ref -10 dBm; Ref Offset 47.5 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 1.702222 GHz, -19.97 dBm
Display Line: -13 dBm;
14/07/2003 10:51:36

Transmitter Conducted Out of Band Emissions – Top Channel (Continued)



Start 5.0 GHz; Stop 10.0 GHz
Ref -10 dBm; Ref Offset 55.5 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 5.777778 GHz, -23.12 dBm
Display Line: -13 dBm;
14/07/2003 11:02:19

8.11. Transmitter Conducted Emissions (Band & Block Edges): Section 22.917

8.11.1. The EUT was configured as for transmitter conducted emissions measurements as described in Section 10 of this report.

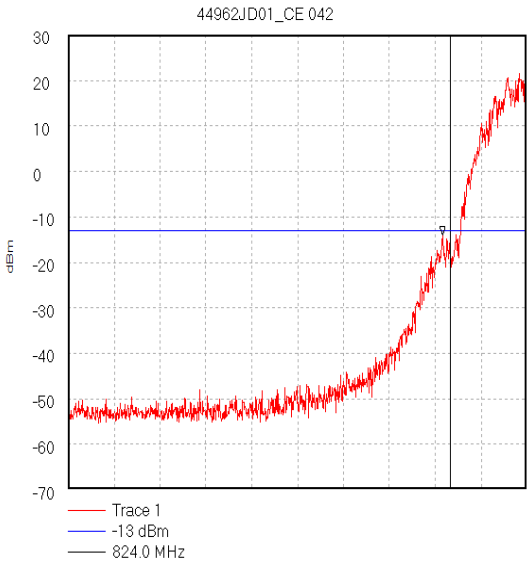
8.11.2. Tests were performed to identify the maximum emissions levels at the antenna terminals of the EUT.

Results:

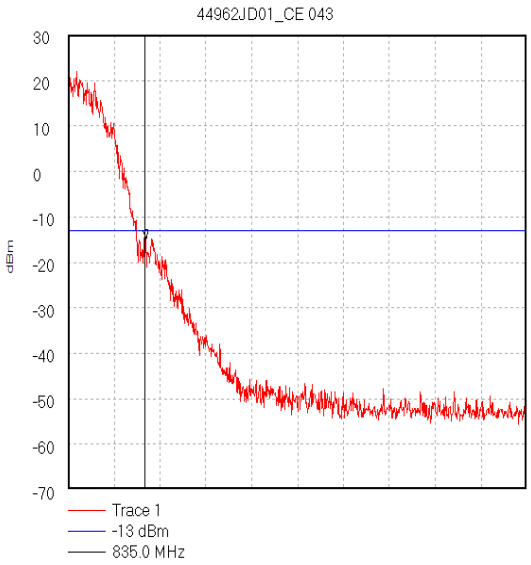
Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
823.980	-14.10	-13.0	1.10	Note 1
835.004	-14.89	-13.0	1.89	Complied
834.980	-14.59	-13.0	1.59	Complied
845.002	-15.02	-13.0	2.02	Complied
844.997	-15.20	-13.0	2.50	Complied
846.502	-30.81	-13.0	17.81	Complied
846.492	-34.39	-13.0	21.39	Complied
849.021	-14.56	-13.0	1.56	Complied

Note 1: The measured result is within the test standard limit by a margin less than the measurement uncertainty; it is therefore not possible to state compliance based on the 95% level of confidence. However, the result indicates that compliance is more probable than non-compliance.

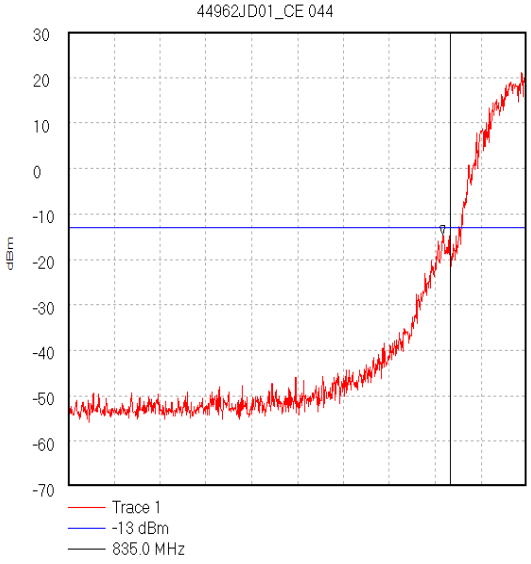
Transmitter Conducted Emissions (Block Edges)



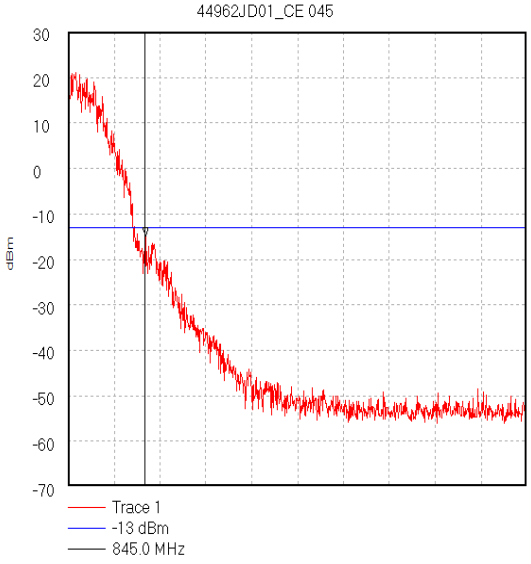
Start 823.0 MHz; Stop 824.2 MHz
Ref 30 dBm; Ref Offset 41.2 dB; 10 dB/div
RBW 3.0 kHz; VBW 3.0 kHz; Att 20 dB; Swp 400.0 mS
Marker 823.98 MHz, -14.1 dBm
Display Line: -13 dBm;
14/07/2003 14:53:10



Start 834.8 MHz; Stop 836.0 MHz
Ref 30 dBm; Ref Offset 41.2 dB; 10 dB/div
RBW 3.0 kHz; VBW 3.0 kHz; Att 20 dB; Swp 400.0 mS
Marker 835.004 MHz, -14.89 dBm
Display Line: -13 dBm;
14/07/2003 15:18:33



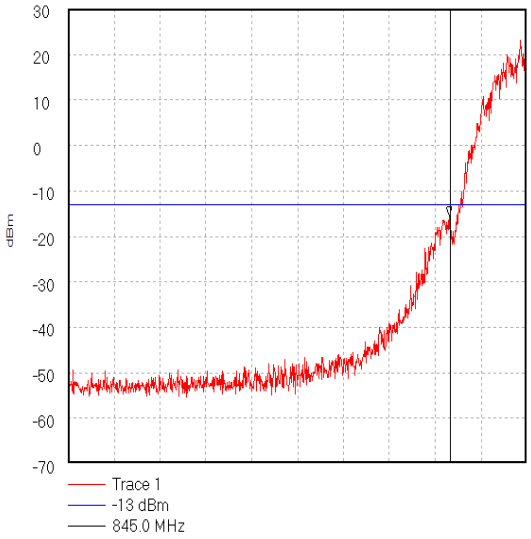
Start 834.0 MHz; Stop 835.2 MHz
Ref 30 dBm; Ref Offset 41.2 dB; 10 dB/div
RBW 3.0 kHz; VBW 3.0 kHz; Att 20 dB; Swp 400.0 mS
Marker 834.98 MHz, -14.59 dBm
Display Line: -13 dBm;
14/07/2003 15:21:51



Start 844.8 MHz; Stop 846.0 MHz
Ref 30 dBm; Ref Offset 41.2 dB; 10 dB/div
RBW 3.0 kHz; VBW 3.0 kHz; Att 20 dB; Swp 400.0 mS
Marker 845.002667 MHz, -15.02 dBm
Display Line: -13 dBm;
14/07/2003 15:25:22

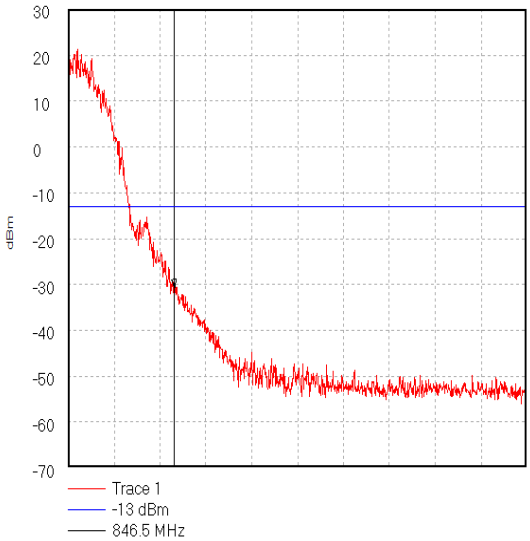
Transmitter Conducted Emissions (Block Edges) (Continued)

44962JD01_CE 046



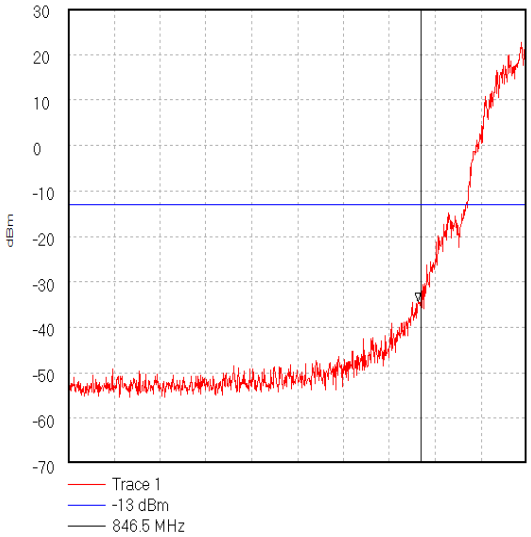
Start 844.0 MHz; Stop 845.2 MHz
Ref 30 dBm; Ref Offset 41.2 dB; 10 dB/div
RBW 3.0 kHz; VBW 3.0 kHz; Att 20 dB; Swp 400.0 mS
Marker 844.997333 MHz, -15.5 dBm
Display Line: -13 dBm;
14/07/2003 15:31:35

44962JD01_CE 047



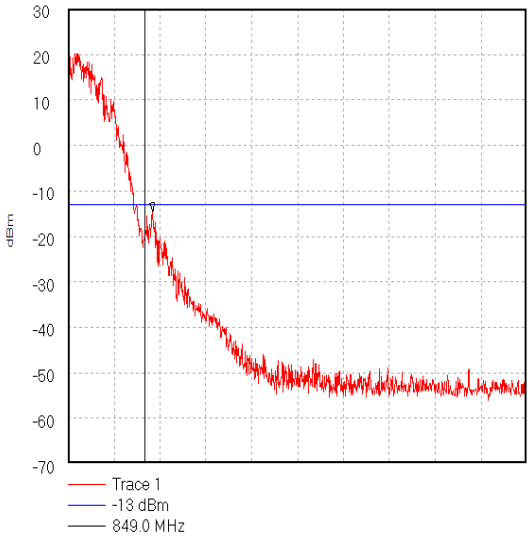
Start 846.2 MHz; Stop 847.5 MHz
Ref 30 dBm; Ref Offset 41.2 dB; 10 dB/div
RBW 3.0 kHz; VBW 3.0 kHz; Att 20 dB; Swp 440.0 mS
Marker 846.501889 MHz, -30.81 dBm
Display Line: -13 dBm;
14/07/2003 15:37:13

44962JD01_CE 048



Start 845.5 MHz; Stop 846.8 MHz
Ref 30 dBm; Ref Offset 41.2 dB; 10 dB/div
RBW 3.0 kHz; VBW 3.0 kHz; Att 20 dB; Swp 440.0 mS
Marker 846.492333 MHz, -34.39 dBm
Display Line: -13 dBm;
14/07/2003 15:39:56

44962JD01_CE 049



Start 848.8 MHz; Stop 850.0 MHz
Ref 30 dBm; Ref Offset 41.2 dB; 10 dB/div
RBW 3.0 kHz; VBW 3.0 kHz; Att 20 dB; Swp 400.0 mS
Marker 849.021333 MHz, -14.56 dBm
Display Line: -13 dBm;
14/07/2003 15:42:50

9. Test Results 1900 MHz

9.1. Receiver AC Conducted Spurious Emissions: Section 15.107

9.1.1. The EUT was configured as for AC conducted emissions measurements as described in Section 10 of this report.

9.1.2. Tests were performed to identify the maximum emissions levels on the AC mains line of the EUT.

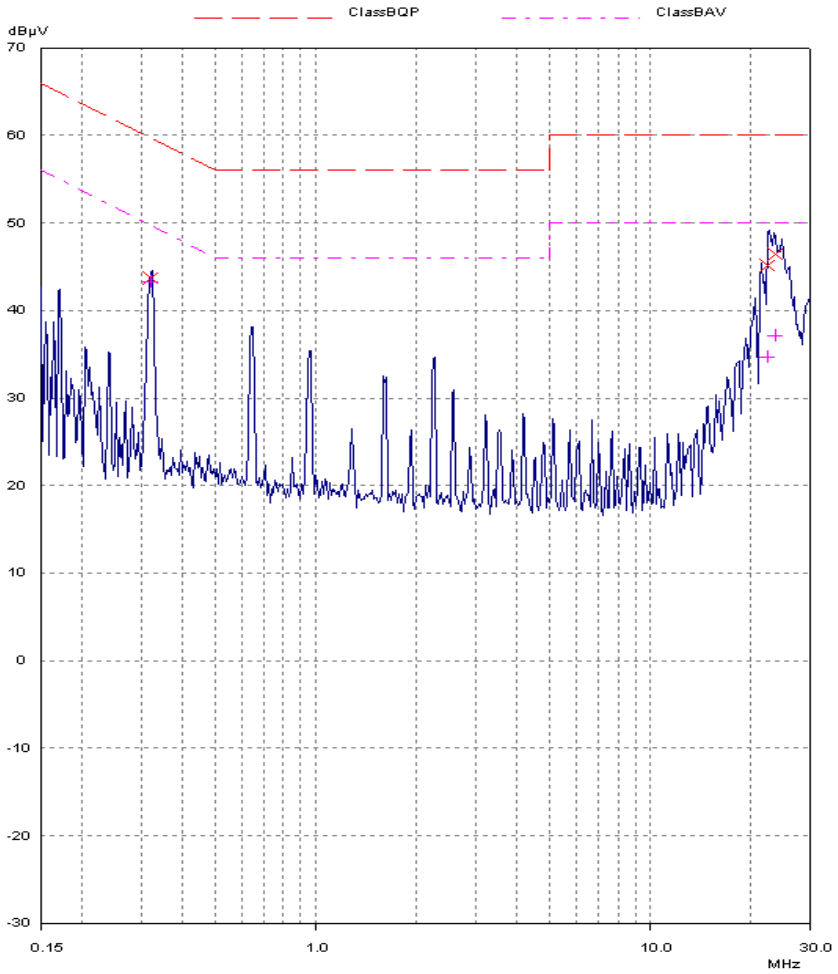
Results: Quasi-Peak Detector Measurements On Live And Neutral Lines

Frequency (MHz)	Line	Q-P Level (dBμV)	Q-P Limit (dBμV)	Margin (dB)	Result
0.32098	Neutral	43.66	59.68	16.02	Complied
22.32230	Live	45.19	60.0	14.81	Complied
23.62292	Neutral	46.38	60.0	13.62	Complied

Results: Average Detector Measurements On Live And Neutral Lines

Frequency (MHz)	Line	Av. Level (dBμV)	Av. Limit (dBμV)	Margin (dB)	Result
0.32098	Neutral	43.23	49.68	6.54	Complied
22.32230	Live	34.67	50.00	15.33	Complied
23.62292	Neutral	37.11	50.00	12.89	Complied

Receiver AC Conducted Spurious Emissions



9.2. Receiver Radiated Emission: Section 15.109

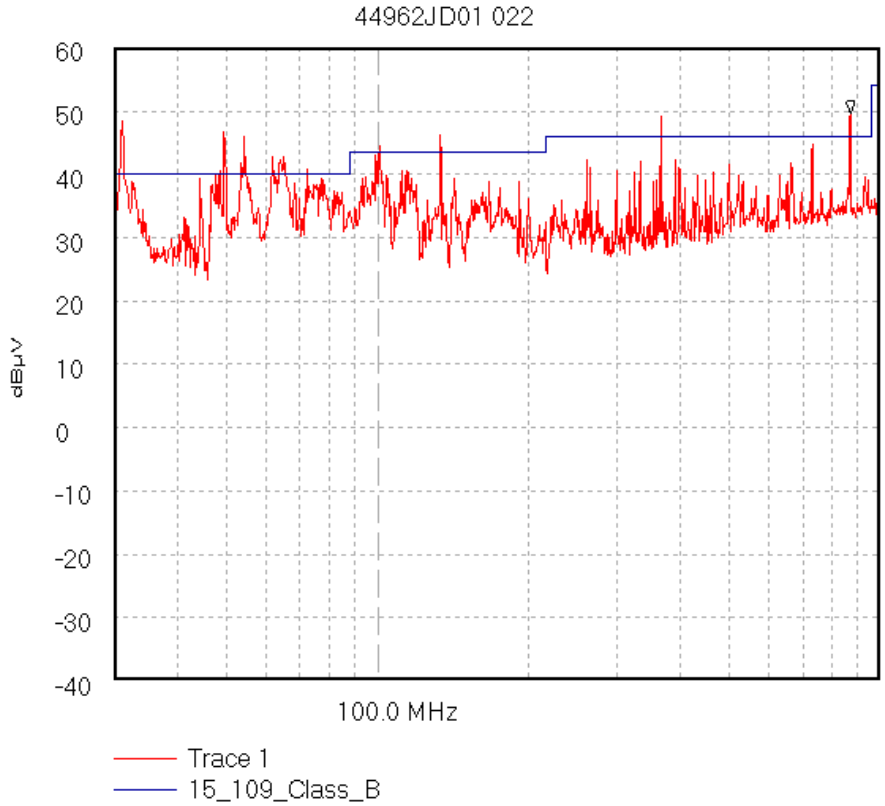
9.2.1. The EUT was configured as for receiver radiated emissions testing as described in Section 10 of this report.

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

Results:

Frequency (MHz)	Polarity (H/V)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
31.10	Vert.	33.7	40.0	6.3	Complied
48.80	Vert.	28.5	40.0	11.5	Complied
54.60	Vert.	29.3	40.0	10.7	Complied
62.10	Vert.	24.6	40.0	15.4	Complied
65.30	Vert.	17.1	40.0	22.9	Complied
72.60	Vert.	18.5	40.0	21.5	Complied
101.50	Vert.	28.4	43.5	15.1	Complied
133.90	Vert.	23.4	43.5	20.1	Complied
367.30	Vert.	26.3	46.0	19.7	Complied
875.90	Vert.	39.2	46.0	6.8	Complied

Receiver Radiated Emission
(30.0 MHz to 1.0 GHz)



Start 30.0 MHz; Stop 1.0 GHz - Log Scale
Ref 60 dBµV; Ref Offset 0.0 dB; 10 dB/div
RBW 120.0 kHz; VBW 100.0 kHz; Att 10 dB; Swp 80.0 mS
Peak 872.523 MHz, 49.57 dBµV
Limit/Mask: 15_109_Class_B; ; Limit Test Failed
Transducer Factors: A1037
7/17/2003 10:37:46 AM

Receiver Radiated Emission: Section 15.109 (Continued)

9.2.1. Electric Field Strength Measurements 1.0 to 10.0 GHz

Results:

Highest Average Level:

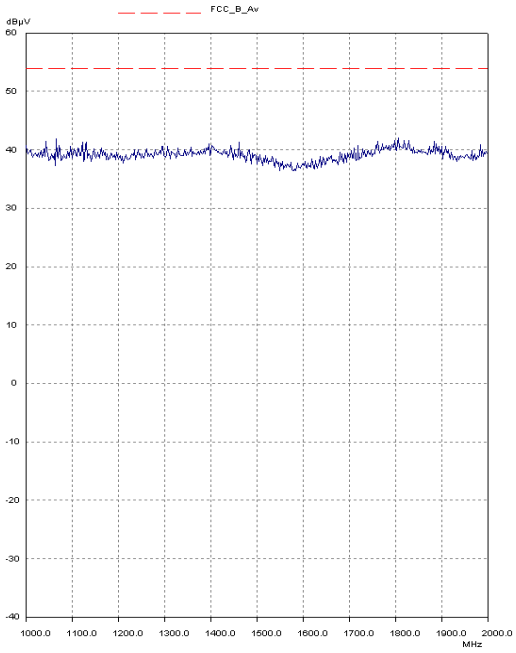
Frequency (GHz)	Antenna Polarity (H/V)	Average Detector level (dBμV)	Antenna factor (dB)	Cable loss (dB)	Actual Average Level (dBμV/m)	Average Limit (dBμV/m)	Average Margin (dB)	Result
5.9244	Horiz.	5.28	24.4	1.5	31.18	54.00	22.82	Complied

Highest Peak Level:

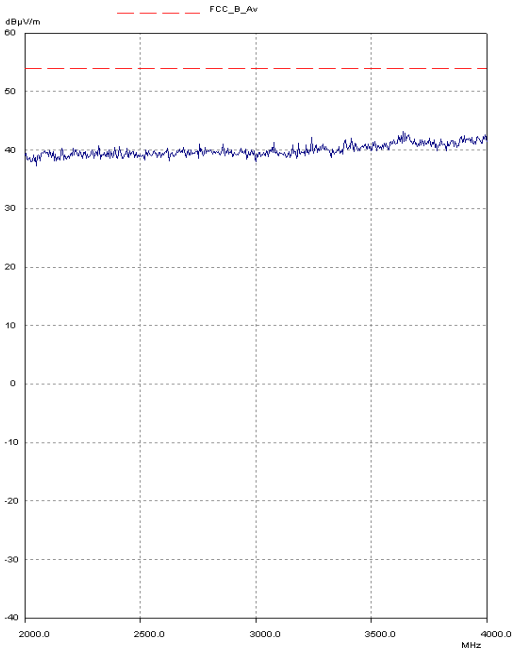
Frequency (GHz)	Antenna Polarity (H/V)	Peak Detector level (dBμV)	Antenna factor (dB)	Cable loss (dB)	Actual Peak Level (dBμV/m)	Peak Limit (dBμV/m)	Peak Margin (dB)	Result
5.9244	Horiz.	18.61	24.4	1.5	44.51	74.00	29.49	Complied

Receiver Radiated Emission: Section 15.109 (Continued)

Receiver Radiated Emission (1.0 GHz to 2.0 GHz)

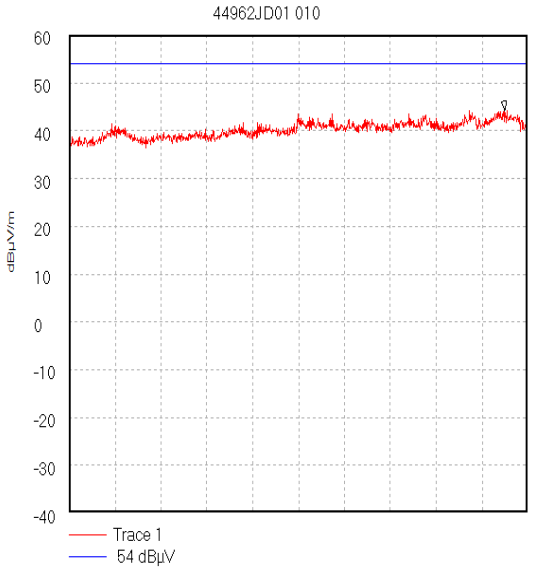


Receiver Radiated Emission (2.0 GHz to 4.0 GHz)



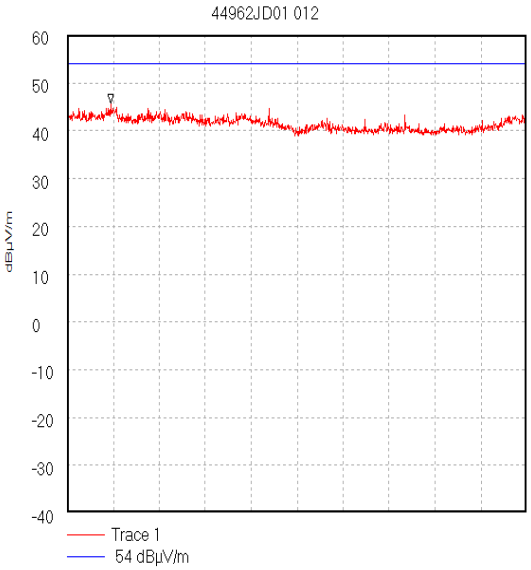
Receiver Radiated Emission: Section 15.109 (Continued)

Receiver Radiated Emission (4.0 GHz to 6.0 GHz)



Start 4.0 GHz; Stop 6.0 GHz
Ref 60 dBµV/m; Ref Offset 0.0 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 5.9 GHz, 44.21 dBµV/m
Display Line: 54 dBµV;
Transducer Factors: 4to6g_Horn
10/07/2003 15:20:27

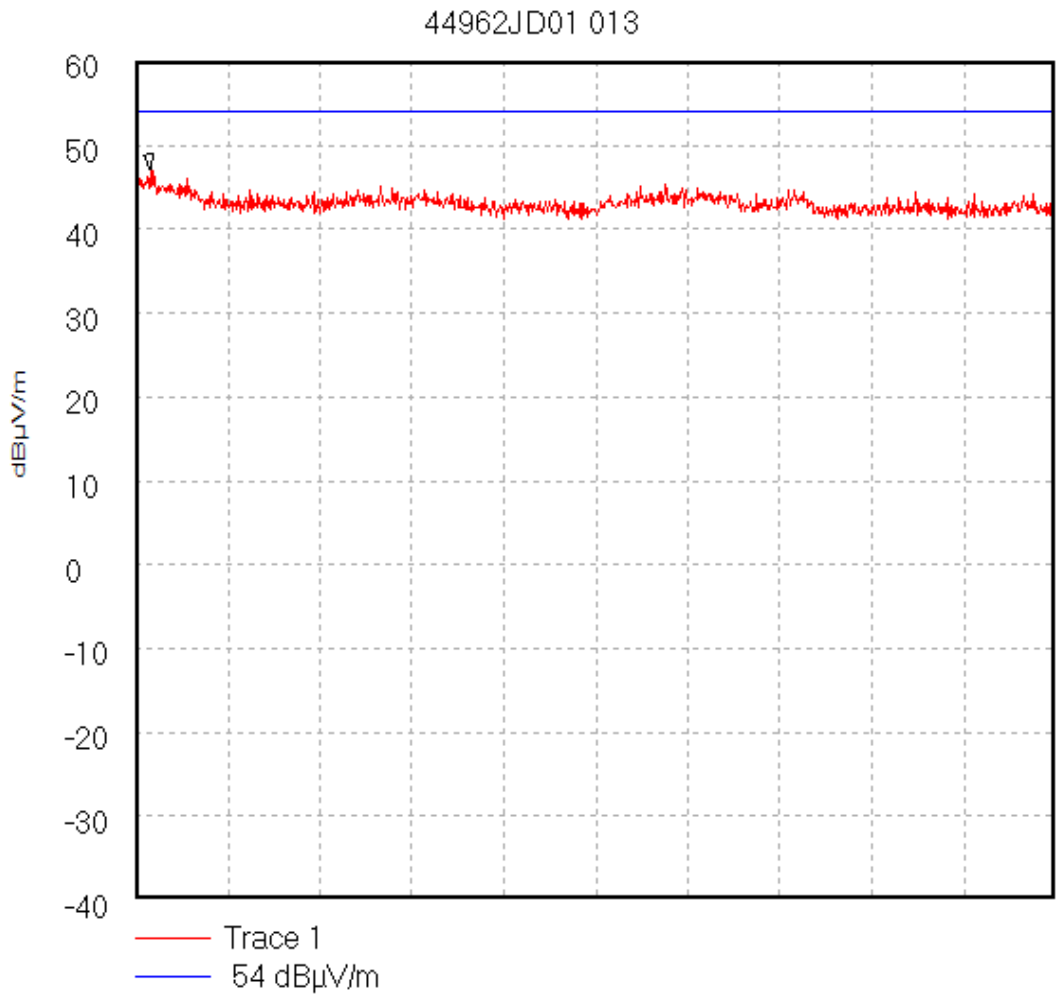
Receiver Radiated Emission (6.0 GHz to 8.0 GHz)



Start 6.0 GHz; Stop 8.0 GHz
Ref 60 dBµV/m; Ref Offset 0.0 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 6.189 GHz, 45.71 dBµV/m
Display Line: 54 dBµV/m;
Transducer Factors: 6to8g_Horn
10/07/2003 16:16:56

Receiver Radiated Emission: Section 15.109 (Continued)

Receiver Radiated Emission
(8.0 GHz to 10.0 GHz)



Start 8.0 GHz; Stop 10.0 GHz
Ref 60 dBµV/m; Ref Offset 0.0 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 8.031 GHz, 47.08 dBµV/m
Display Line: 54 dBµV/m;
Transducer Factors: 8to12G_Horn
10/07/2003 16:20:11

9.3. Transmitter Carrier Output Power: Section 2.1046(a)

9.3.1. The EUT was configured as for conducted measurements as described in Section 10 of this report.

9.3.2. Tests were performed to identify the maximum Carrier Output Power.

Results:

Channel	Measured Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	1850.2	27.8	33.0	4.5	Complied
Middle	1879.8	27.4	33.0	5.6	Complied
Top	1909.8	27.6	33.0	5.4	Complied

9.4. Transmitter Effective Isotropic Radiated Power (EIRP): Section 24.232

9.4.1. The EUT was configured as for Effective Isotropic Radiated Power as described in Section 10 of this report.

9.4.2. Tests were performed to identify the maximum Effective Isotropic Radiated Power (EIRP).

Results:

Channel	Measured Frequency (MHz)	Antenna Polarity	Maximum Transmitter EIRP (dBm)	Limit EIRP (dBm)	Margin (dB)	Result
Bottom	1850.2	Horiz.	26.1	33.0	6.9	Complied
Middle	1879.8	Horiz.	26.8	33.0	6.2	Complied
Top	1909.8	Horiz.	27.2	33.0	5.8	Complied

9.5. Transmitter Frequency Stability (Temperature Variation): Section 24.235

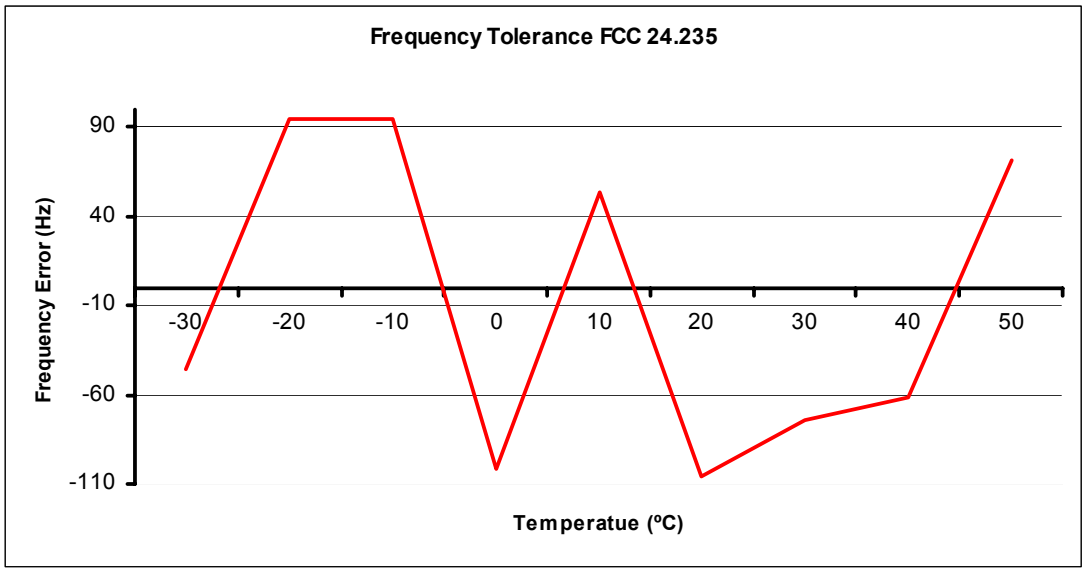
9.5.1. The EUT was configured as for frequency stability measurements as described in Section 10 of this report.

9.5.2. Tests were performed to identify the maximum frequency error of the EUT with variations in ambient temperature.

Results Bottom Channel (1850.2 MHz)

Temp (ºC)	Frequency Error (Hz)	Measured Frequency (MHz)	Lower Band Edge Limit (MHz)	Margin (MHz)	Result
-30	-46	1850.199954	1850.0	0.199954	Complied
-20	95	1850.200095	1850.0	0.200095	Complied
-10	95	1850.200095	1850.0	0.200095	Complied
0	-102	1850.199898	1850.0	0.199898	Complied
10	54	1850.200054	1850.0	0.200054	Complied
20	-106	1850.199894	1850.0	0.199894	Complied
30	-74	1850.199926	1850.0	0.199926	Complied
40	-61	1850.199939	1850.0	0.199939	Complied
50	72	1850.200072	1850.0	0.200072	Complied

Frequency Variation From 1850.2 MHz

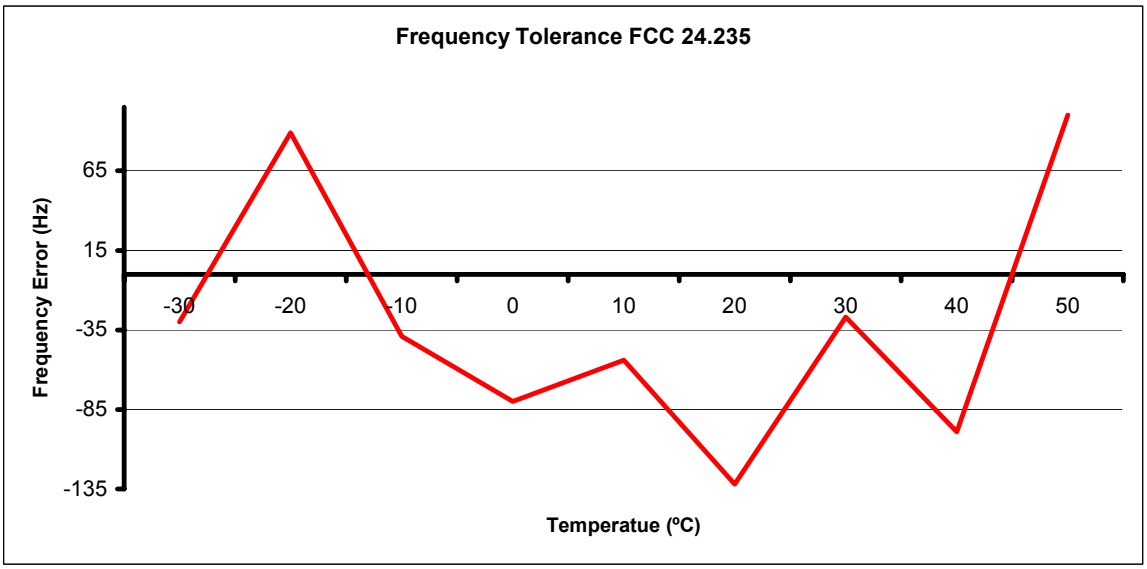


Transmitter Frequency Stability (Temperature Variation): Section 24.235 (continued)

Results Top Channel (1909.8 MHz)

Temp (ºC)	Frequency Error (Hz)	Measured Frequency (MHz)	Upper Band Edge Limit (MHz)	Margin (MHz)	Result
-30	-30	1909.799970	1910.0	0.200030	Complied
-20	89	1909.800089	1910.0	0.199911	Complied
-10	-39	1909.799961	1910.0	0.200039	Complied
0	-80	1909.799920	1910.0	0.200080	Complied
10	-54	1909.799946	1910.0	0.200054	Complied
20	-132	1909.799868	1910.0	0.200132	Complied
30	-57	1909.799943	1910.0	0.200057	Complied
40	-99	1909.799901	1910.0	0.200099	Complied
50	100	1909.800100	1910.0	0.199900	Complied

Frequency Variation From 1909.8 MHz



9.6. Transmitter Frequency Stability (Voltage Variation): Section 24.235

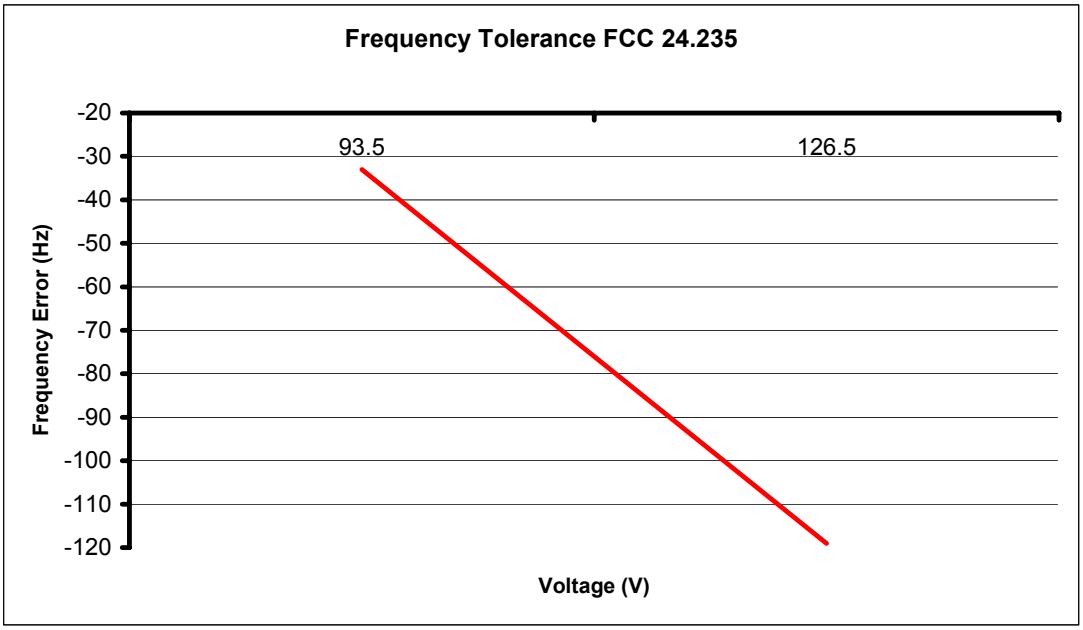
9.6.1. The EUT was configured as for frequency stability measurements as described in Section 10 of this report.

9.6.2. Tests were performed to identify the maximum frequency error of the EUT with variations in nominal operating voltage.

Results Bottom Channel (1850.2 MHz)

Supply Voltage (V)	Frequency Error (Hz)	Measured Frequency (MHz)	Lower Band Edge Limit (MHz)	Margin (MHz)	Result
93.5	-33	1850.199967	1850.0	0.199967	Complied
126.5	-119	1850.199881	1850.0	0.199881	Complied

Frequency Variation From 1850.2 MHz

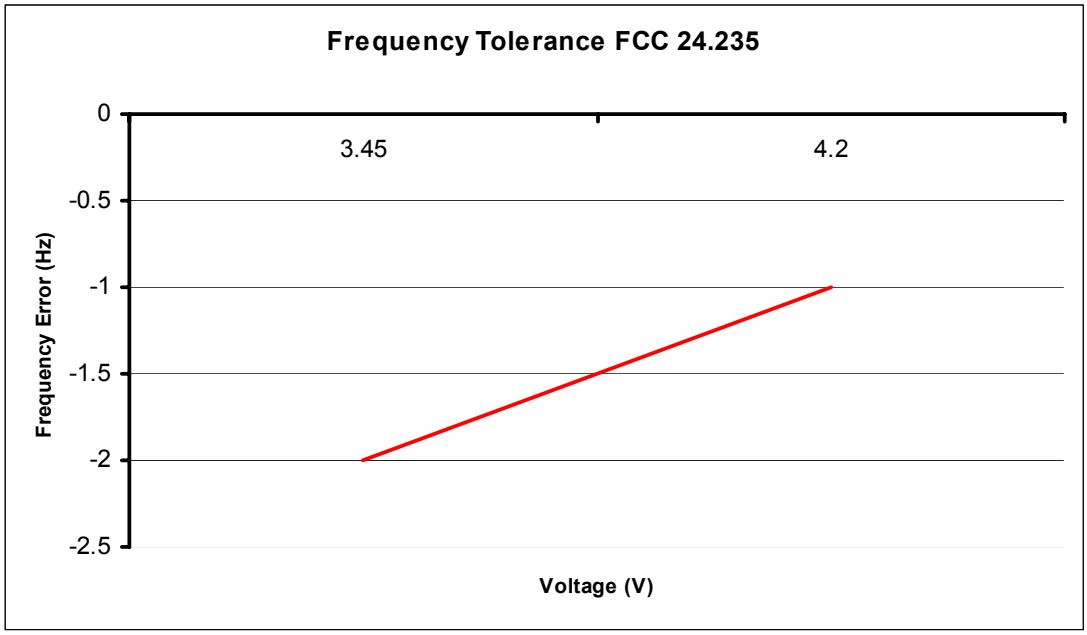


Transmitter Frequency Stability (Voltage Variation): Section 24.235 (Continued)

Results Top Channel (1909.8 MHz)

Supply Voltage (V)	Frequency Error (Hz)	Measured Frequency (MHz)	Lower Band Edge Limit (MHz)	Margin (MHz)	Result
93.5	-98	1909.799902	1910.0	0.200098	Complied
126.5	-129	1909.799871	1910.0	0.200129	Complied

Frequency Variation From 1909.8 MHz



9.7. Transmitter Occupied Bandwidth: Section 2.1049(i), 24.238

9.7.1. The EUT was configured as for Occupied Bandwidth measurements as described in Section 10 of this report.

9.7.2. Tests were performed to identify the maximum bandwidth occupied by the fundamental frequency of the EUT.

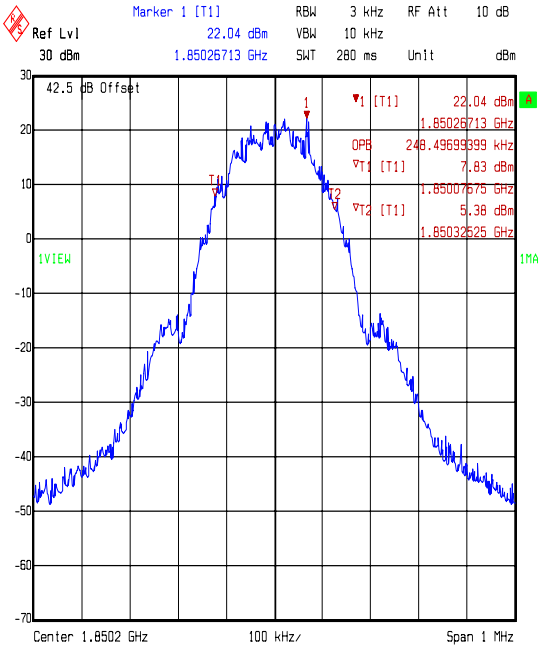
Results:

Channel	Frequency (MHz)	Resolution Bandwidth (kHz)	Video Bandwidth (kHz)	Occupied Bandwidth (kHz)
Bottom	1850.2	3.0	10.0	248.497
Middle	1879.8	3.0	10.0	248.497
Top	1909.8	3.0	10.0	246.493

Test Of: **Sony Ericsson Mobile Communications.**
GR48 GSM/GPRS Communications Module
To: **FCC Part 15, 22 & 24**

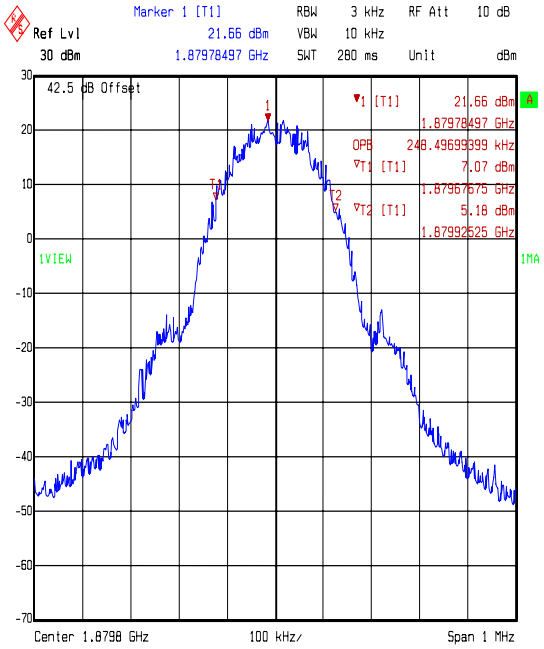
Transmitter Occupied Bandwidth

Bottom Channel



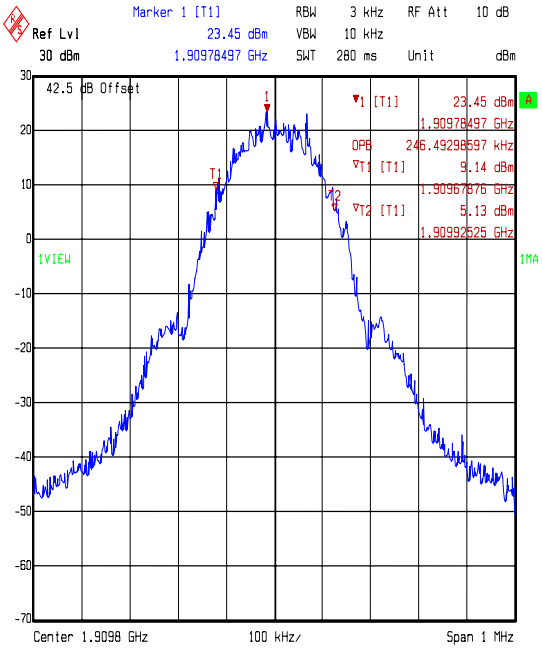
Title: Testing for Sony Ericsson Mobile Comms Intl AB. EUT:GR48.
Comment A: Occupied Power Bandwidth. FCC Part 2.1049. ARFCN 512 : 190
0 Mode. 44962JD01.
Date: 15.JUL.2003 9:56:01

Middle Channel



Title: Testing for Sony Ericsson Mobile Comms Intl AB. EUT:GR48.
Comment A: Occupied Power Bandwidth. FCC Part 2.1049. ARFCN 660 : 190
0 Mode. 44962JD01.
Date: 15.JUL.2003 9:57:09

Top Channel



Title: Testing for Sony Ericsson Mobile Comms Intl AB. EUT:GR48.
Comment A: Occupied Power Bandwidth. FCC Part 2.1049. ARFCN 810 : 190
0 Mode. 44962JD01.
Date: 15.JUL.2003 9:58:19

9.8. Transmitter Out of Band Emissions: Section 2.1053 & 24.238

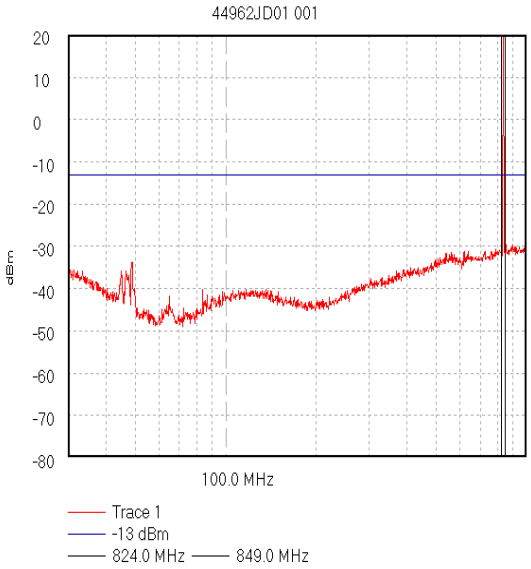
9.8.1. The EUT was configured as for transmitter radiated emissions testing as described in Section 10 of this report.

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

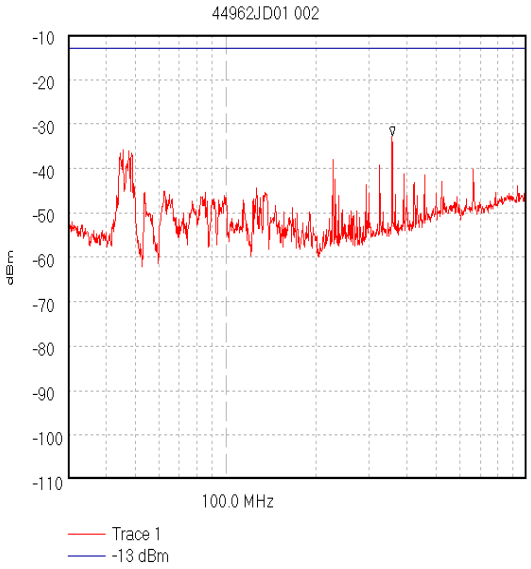
Results:

Channel	Frequency (GHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	10.68569	-18.83	-13.00	5.83	Complied
Middle	10.68580	-25.94	-13.00	12.94	Complied
Top	10.68569	-19.24	-13.00	6.24	Complied

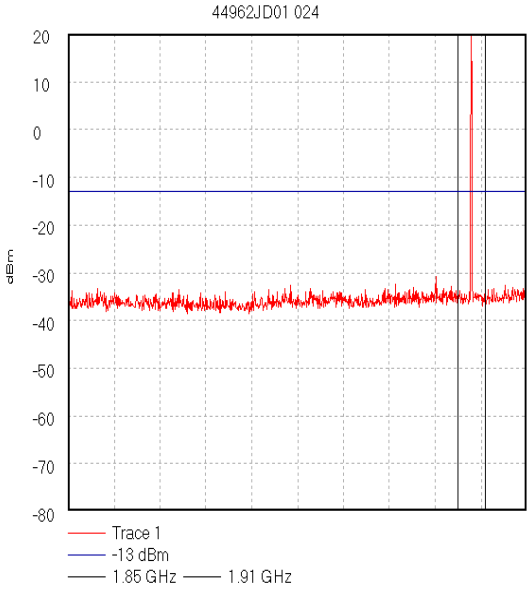
Transmitter Out of Band Emissions Middle Channel



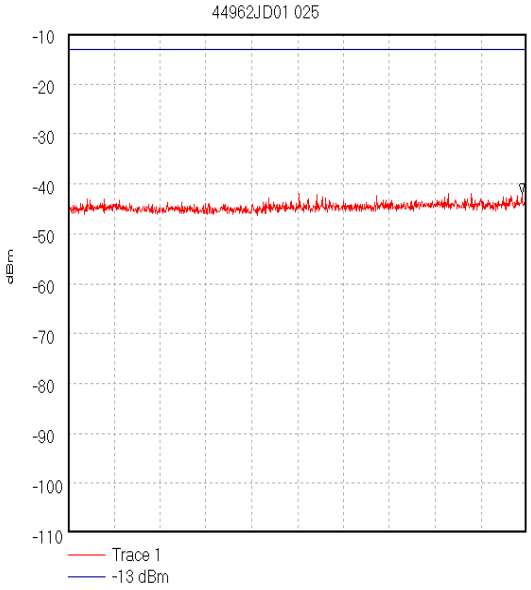
Start 30.0 MHz; Stop 1.0 GHz - Log Scale
Ref 20 dBm; Ref Offset 20.0 dB; 10 dB/div
RBW 174.0 kHz; VBW 100.0 kHz; Att 10 dB; Swp 80.0 mS
Peak 835.91872 MHz, 23.98 dBm
Display Line: -13 dBm;
Transducer Factors: A1037
7/9/2003 11:40:24 AM



Start 30.0 MHz; Stop 1.0 GHz - Log Scale
Ref -10 dBm; Ref Offset 20.0 dB; 10 dB/div
RBW 174.0 kHz; VBW 100.0 kHz; Att 10 dB; Swp 80.0 mS
Peak 357.510528 MHz, -32.75 dBm
Display Line: -13 dBm;
Transducer Factors: A1037
7/9/2003 11:46:57 AM

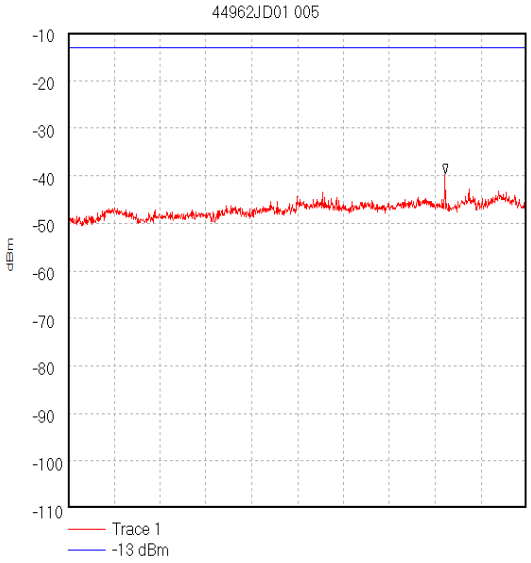


Start 1.0 GHz; Stop 2.0 GHz
Ref 20 dBm; Ref Offset 30.2 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 20 dB; Swp 20.0 mS
Peak 1.88 GHz, 20.81 dBm
Display Line: -13 dBm;
7/17/2003 11:50:49 AM

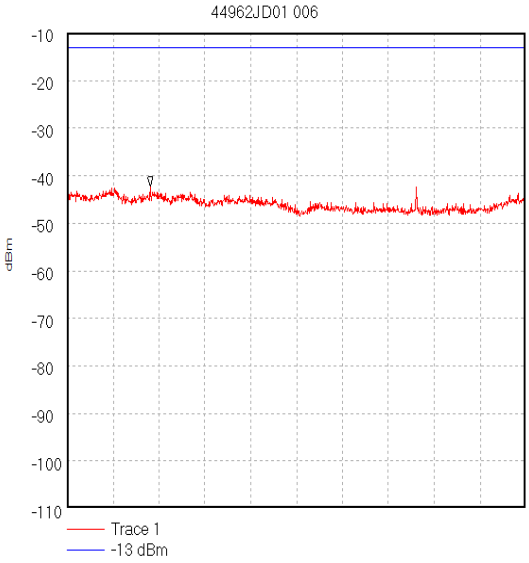


Start 1.0 GHz; Stop 2.0 GHz
Ref -10 dBm; Ref Offset 30.2 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 10 dB; Swp 20.0 mS
Peak 1.99 GHz, -41.91 dBm
Display Line: -13 dBm;
7/17/2003 11:53:47 AM

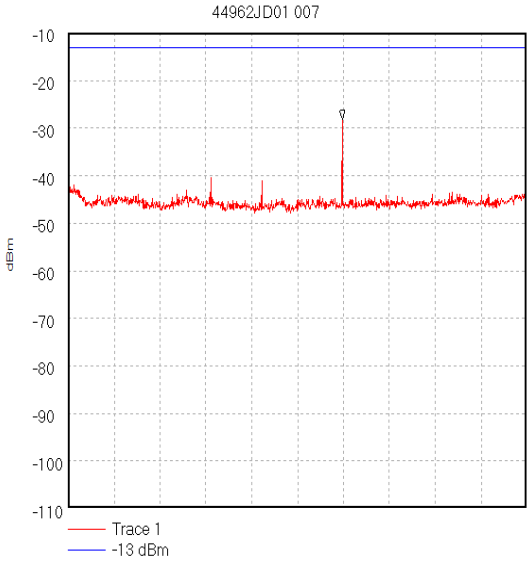
Transmitter Out of Band Emissions Middle Channel (Continued)



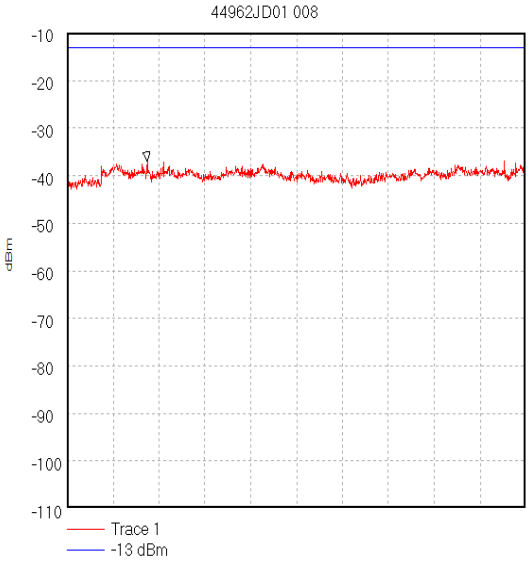
Start 4.0 GHz; Stop 6.0 GHz
Ref -10 dBm; Ref Offset 34.0 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 5.644 GHz, -39.65 dBm
Display Line: -13 dBm;
10/07/2003 14:16:03



Start 6.0 GHz; Stop 8.0 GHz
Ref -10 dBm; Ref Offset 36.2 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 6.362 GHz, -42.3 dBm
Display Line: -13 dBm;
10/07/2003 14:21:56

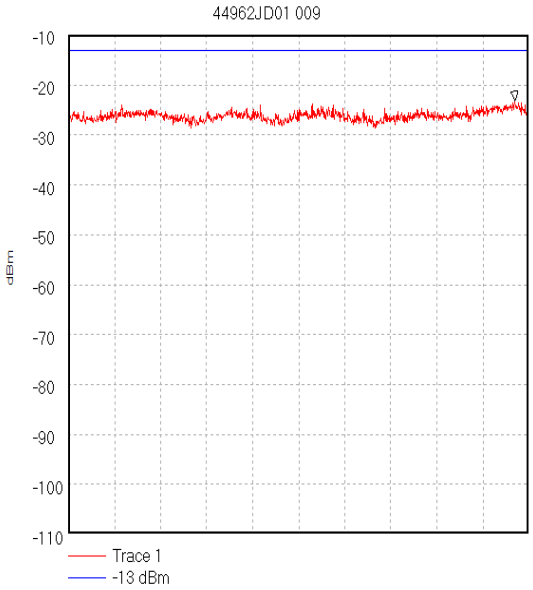


Start 8.0 GHz; Stop 12.5 GHz
Ref -10 dBm; Ref Offset 39.0 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 10.69 GHz, -28.2 dBm
Display Line: -13 dBm;
10/07/2003 14:27:53



Start 12.5 GHz; Stop 18.0 GHz
Ref -10 dBm; Ref Offset 41.3 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 40.0 mS
Peak 13.459 GHz, -36.96 dBm
Display Line: -13 dBm;
10/07/2003 14:55:55

Transmitter Out of Band Emissions Middle Channel (Continued)



Start 18.0 GHz; Stop 20.0 GHz
Ref -10 dBm; Ref Offset 54.8 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 19.94 GHz, -23.1 dBm
Display Line: -13 dBm;
10/07/2003 15:05:07

9.9. Transmitter Radiated Emissions At Band Edges: Section 2.1053, 24.238

9.9.1. The EUT was configured as for transmitter radiated emissions testing described in Section 10 of this report.

9.9.2. Tests were performed to identify the maximum emissions level at the band edges of the frequency block that the EUT will operate over.

Results:

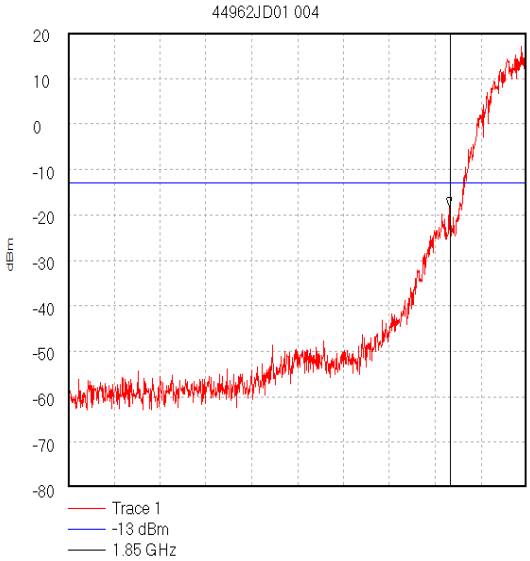
Bottom Band Edge

Frequency (MHz)	Spurious Emission (dBm)	Limit (dBm)	Margin (dB)	Result
1849.997	-18.19	-13.0	5.19	Complied

Top Band Edge

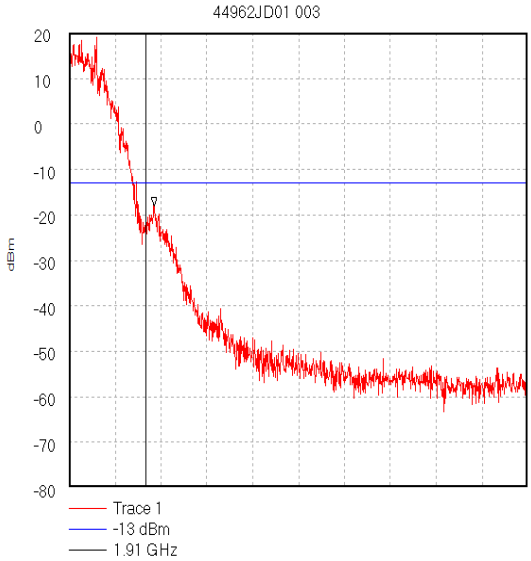
Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
1910.023	-18.06	-13.0	5.06	Complied

Bottom Channel



Start 1.849 GHz; Stop 1.8502 GHz
Ref 20 dBm; Ref Offset 26.0 dB; 10 dB/div
RBW 3.0 kHz; VBW 10.0 kHz; Att 10 dB; Swp 400.0 mS
Marker 1.849997 GHz, -18.19 dBm
Display Line: -13 dBm;
10/07/2003 14:07:28

Top Channel



Start 1.9098 GHz; Stop 1.911 GHz
Ref 20 dBm; Ref Offset 26.0 dB; 10 dB/div
RBW 3.0 kHz; VBW 10.0 kHz; Att 10 dB; Swp 400.0 mS
Marker 1.910023 GHz, -18.06 dBm
Display Line: -13 dBm;
10/07/2003 14:02:58

9.10. Transmitter Conducted Out of Band Emissions: Section 24.238

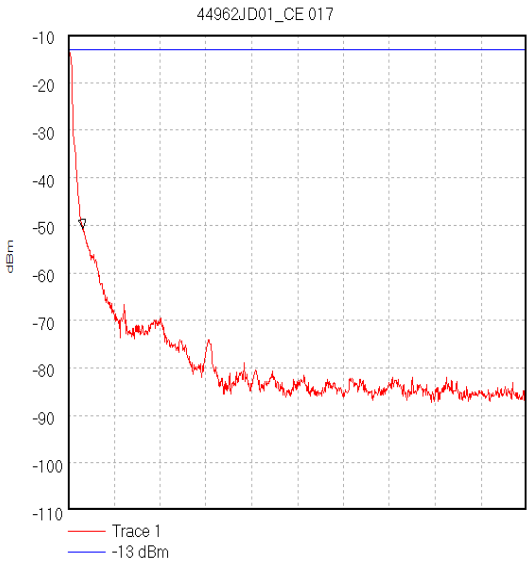
9.10.1. The EUT was configured as for transmitter conducted emissions measurements as described in Section 10 of this report.

9.10.2. Tests were performed to identify the maximum emissions levels at the antenna terminals of the EUT.

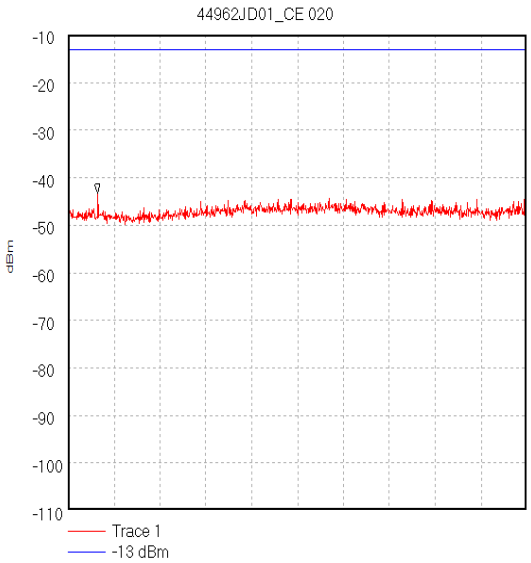
Results:

Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
16651.14	-21.17	-13.0	8.17	Complied
16917.68	-24.70	-13.0	11.70	Complied
15278.64	-20.43	-13.0	7.43	Complied

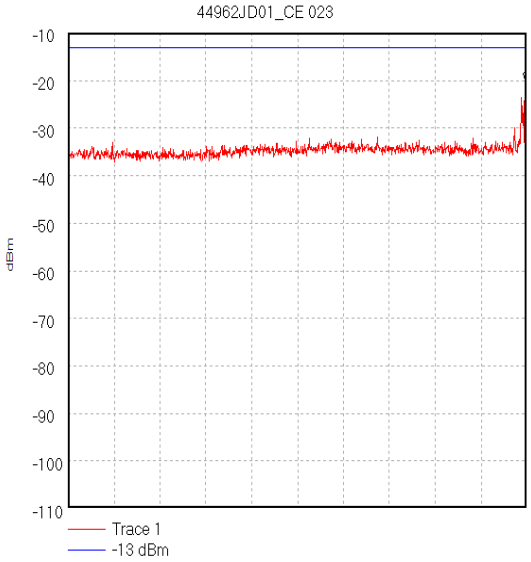
Transmitter Conducted Out of Band Emissions – Bottom Channel



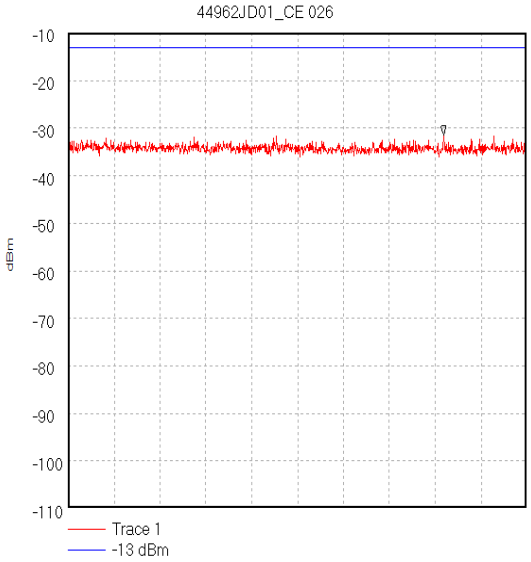
Start 9.0 kHz; Stop 1.0 MHz
Ref -10 dBm; Ref Offset 20.0 dB; 10 dB/div
RBW 10.0 kHz; VBW 10.0 kHz; Att 0 dB; Swp 40.0 mS
Peak 40.93222 kHz, -50.75 dBm
Display Line: -13 dBm;
14/07/2003 11:07:33



Start 1.0 MHz; Stop 1.0 GHz
Ref -10 dBm; Ref Offset 41.4 dB; 10 dB/div
RBW 10.0 kHz; VBW 10.0 kHz; Att 20 dB; Swp 30.0 S
Peak 65.38 MHz, -43.31 dBm
Display Line: -13 dBm;
14/07/2003 11:32:43

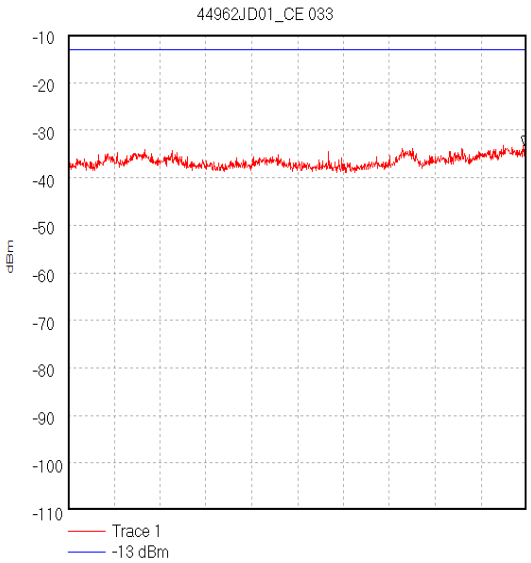


Start 1.0 GHz; Stop 1.85 GHz
Ref -10 dBm; Ref Offset 42.3 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 10 dB; Swp 20.0 mS
Peak 1.848111 GHz, -20.28 dBm
Display Line: -13 dBm;
14/07/2003 11:38:48

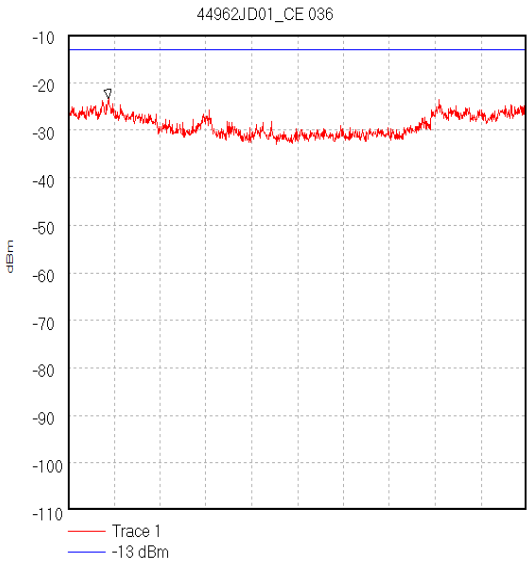


Start 1.91 GHz; Stop 2.0 GHz
Ref -10 dBm; Ref Offset 42.5 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 10 dB; Swp 20.0 mS
Peak 1.9837 GHz, -31.5 dBm
Display Line: -13 dBm;
14/07/2003 12:24:53

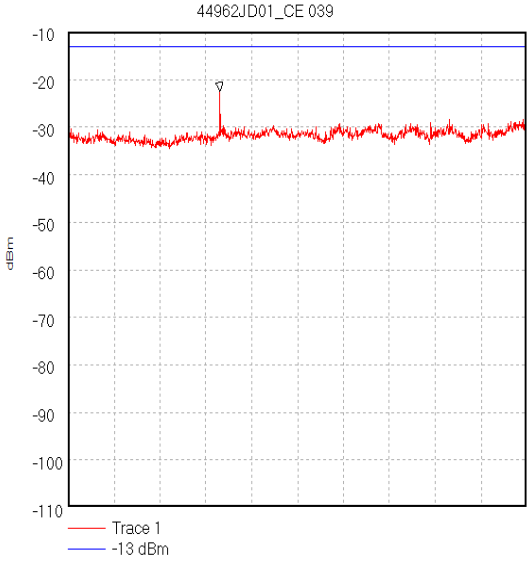
Transmitter Conducted Out of Band Emissions – Bottom Channel (Continued)



Start 2.0 GHz; Stop 5.0 GHz
Ref -10 dBm; Ref Offset 47.5 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 4.98 GHz, -33.18 dBm
Display Line: -13 dBm;
14/07/2003 14:28:57

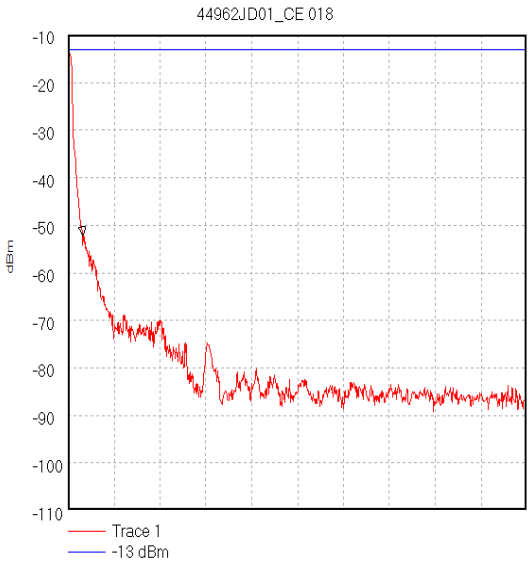


Start 5.0 GHz; Stop 15.0 GHz
Ref -10 dBm; Ref Offset 55.5 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 40.0 mS
Peak 5.877778 GHz, -23.3 dBm
Display Line: -13 dBm;
14/07/2003 14:35:18

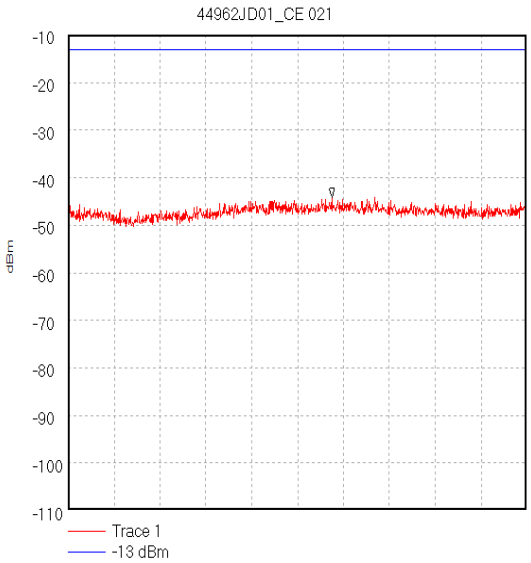


Start 15.0 GHz; Stop 20.0 GHz
Ref -10 dBm; Ref Offset 50.1 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 16.655556 GHz, -22.54 dBm
Display Line: -13 dBm;
14/07/2003 14:39:36

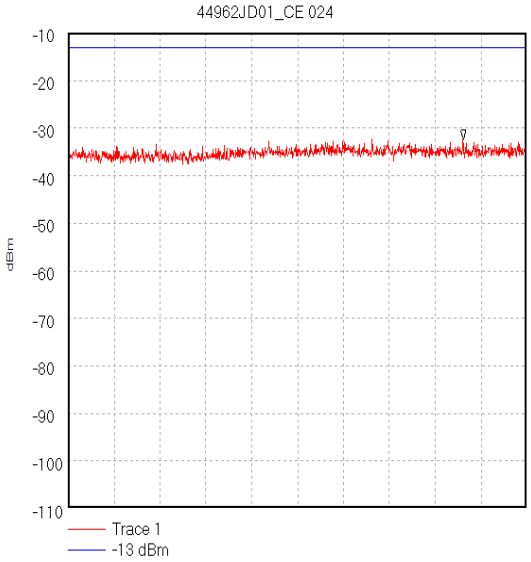
Transmitter Conducted Out of Band Emissions – Middle Channel



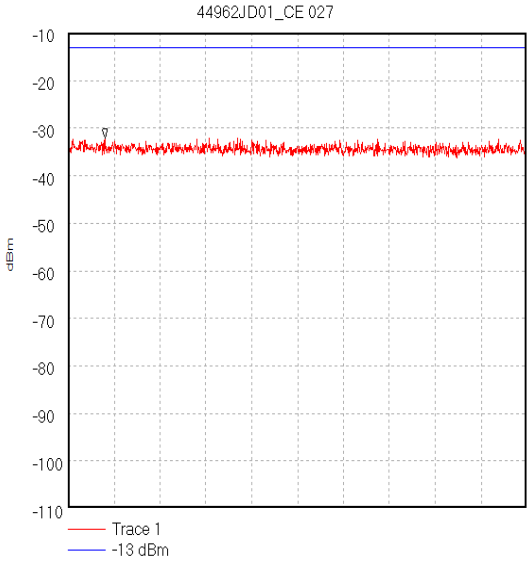
Start 9.0 kHz; Stop 1.0 MHz
Ref -10 dBm; Ref Offset 20.0 dB; 10 dB/div
RBW 10.0 kHz; VBW 10.0 kHz; Att 0 dB; Swp 40.0 mS
Peak 40.93222 kHz, -52.25 dBm
Display Line: -13 dBm;
14/07/2003 11:09:18



Start 1.0 MHz; Stop 1.0 GHz
Ref -10 dBm; Ref Offset 41.4 dB; 10 dB/div
RBW 10.0 kHz; VBW 10.0 kHz; Att 20 dB; Swp 30.0 S
Peak 575.98 MHz, -44.15 dBm
Display Line: -13 dBm;
14/07/2003 11:33:58

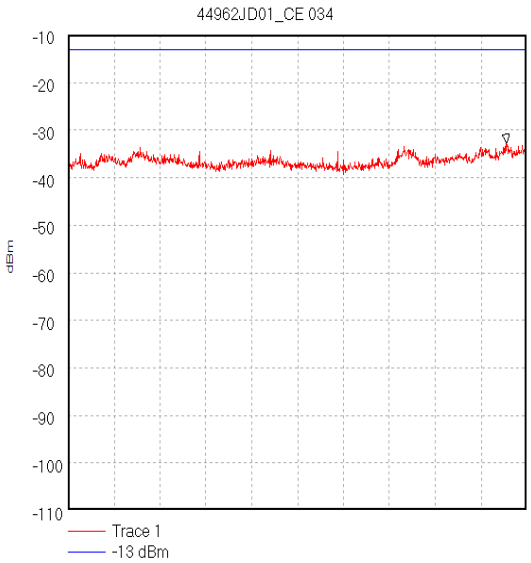


Start 1.0 GHz; Stop 1.85 GHz
Ref -10 dBm; Ref Offset 42.3 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 10 dB; Swp 20.0 mS
Peak 1.731944 GHz, -32.24 dBm
Display Line: -13 dBm;
14/07/2003 11:40:13

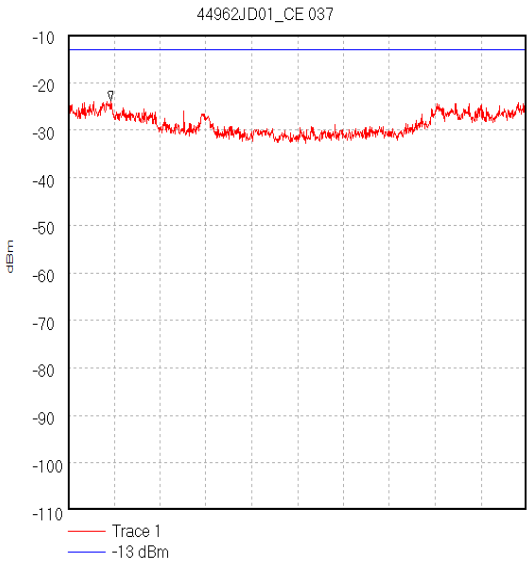


Start 1.91 GHz; Stop 2.0 GHz
Ref -10 dBm; Ref Offset 42.5 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 10 dB; Swp 20.0 mS
Peak 1.9172 GHz, -32.04 dBm
Display Line: -13 dBm;
14/07/2003 12:25:23

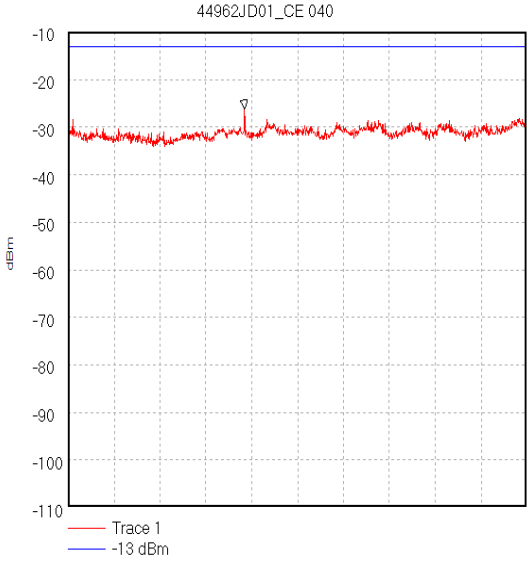
Transmitter Conducted Out of Band Emissions – Middle Channel (Continued)



Start 2.0 GHz; Stop 5.0 GHz
Ref -10 dBm; Ref Offset 47.5 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 4.866667 GHz, -32.77 dBm
Display Line: -13 dBm;
14/07/2003 14:31:05

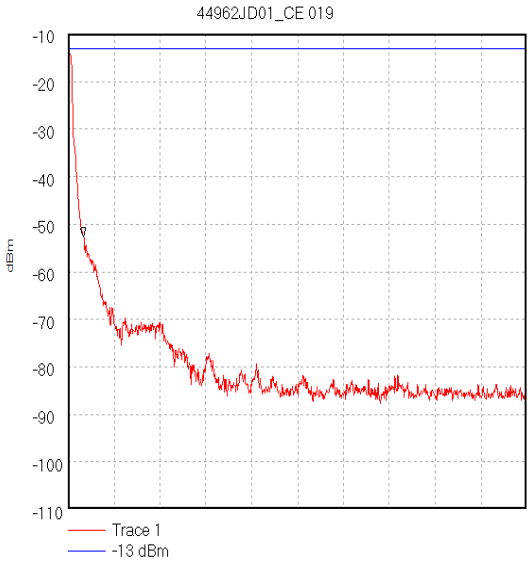


Start 5.0 GHz; Stop 15.0 GHz
Ref -10 dBm; Ref Offset 55.5 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 40.0 mS
Peak 5.922222 GHz, -23.81 dBm
Display Line: -13 dBm;
14/07/2003 14:36:19

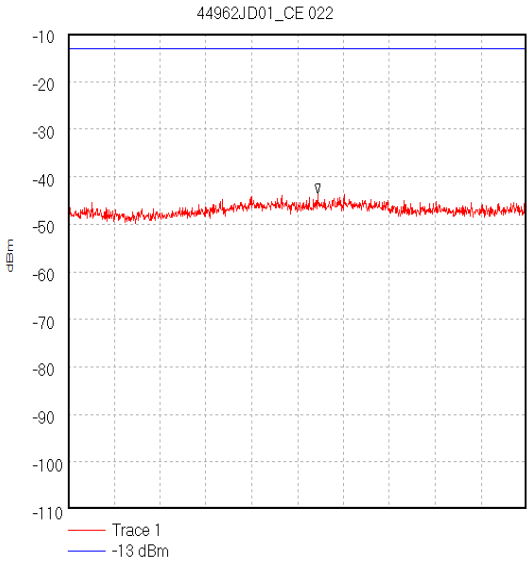


Start 15.0 GHz; Stop 20.0 GHz
Ref -10 dBm; Ref Offset 50.1 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 16.922222 GHz, -26.27 dBm
Display Line: -13 dBm;
14/07/2003 14:42:57

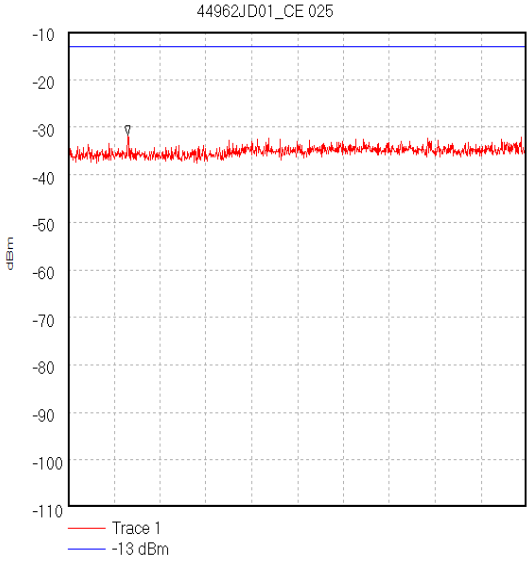
Transmitter Conducted Out of Band Emissions – Top Channel



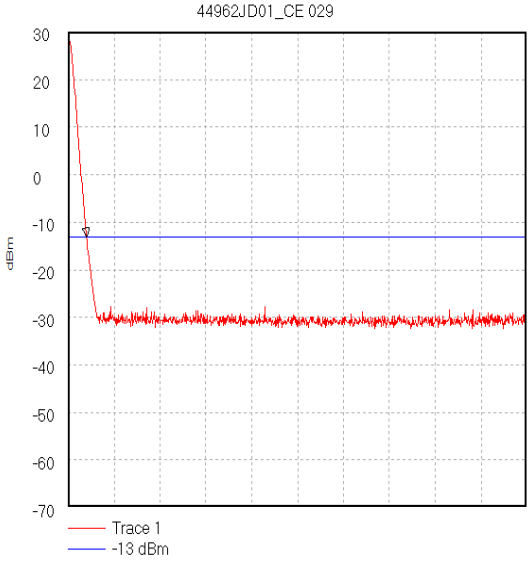
Start 9.0 kHz; Stop 1.0 MHz
Ref -10 dBm; Ref Offset 20.0 dB; 10 dB/div
RBW 10.0 kHz; VBW 10.0 kHz; Att 0 dB; Swp 40.0 mS
Peak 42.03333 kHz, -52.68 dBm
Display Line: -13 dBm;
14/07/2003 11:10:56



Start 1.0 MHz; Stop 1.0 GHz
Ref -10 dBm; Ref Offset 41.4 dB; 10 dB/div
RBW 10.0 kHz; VBW 10.0 kHz; Att 20 dB; Swp 30.0 S
Peak 544.9 MHz, -43.59 dBm
Display Line: -13 dBm;
14/07/2003 11:35:21

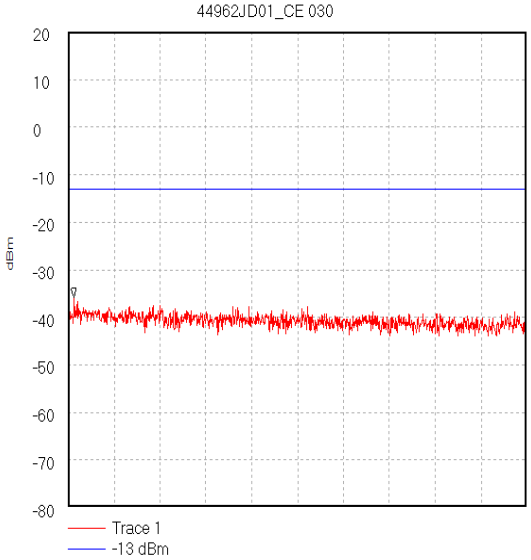


Start 1.0 GHz; Stop 1.85 GHz
Ref -10 dBm; Ref Offset 42.3 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 10 dB; Swp 20.0 mS
Peak 1.1105 GHz, -31.73 dBm
Display Line: -13 dBm;
14/07/2003 11:41:51

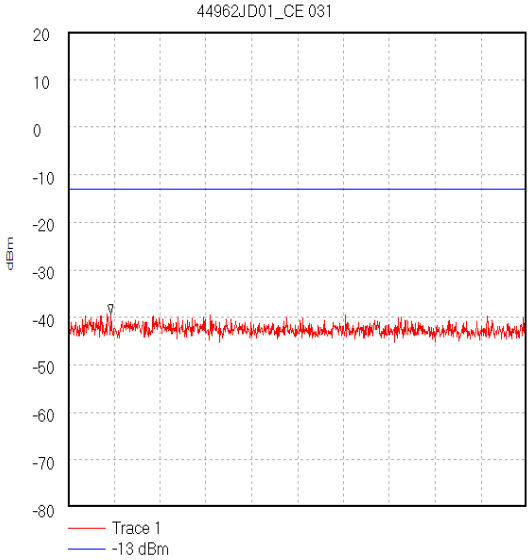


Start 1.91 GHz; Stop 2.0 GHz
Ref 30 dBm; Ref Offset 42.5 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 10 dB; Swp 20.0 mS
Marker 1.9136 GHz, -13.09 dBm
Display Line: -13 dBm;
14/07/2003 12:29:01

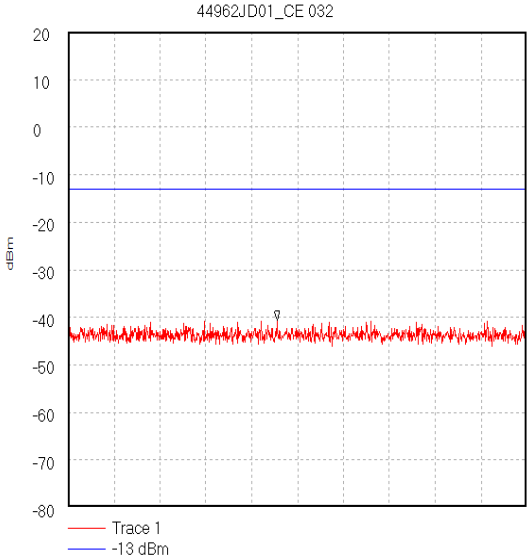
Transmitter Conducted Out of Band Emissions – Top Channel (Continued)



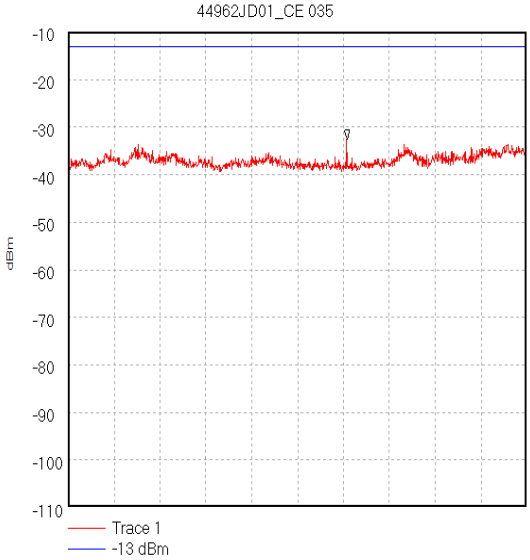
Start 1.911 GHz; Stop 1.912 GHz
Ref 20 dBm; Ref Offset 42.5 dB; 10 dB/div
RBW 100.0 kHz; VBW 100.0 kHz; Att 10 dB; Swp 20.0 mS
Peak 1.911013 GHz, -35.76 dBm
Display Line: -13 dBm;
14/07/2003 14:09:30



Start 1.912 GHz; Stop 1.913 GHz
Ref 20 dBm; Ref Offset 42.5 dB; 10 dB/div
RBW 100.0 kHz; VBW 100.0 kHz; Att 10 dB; Swp 20.0 mS
Peak 1.912093 GHz, -39.29 dBm
Display Line: -13 dBm;
14/07/2003 14:20:55

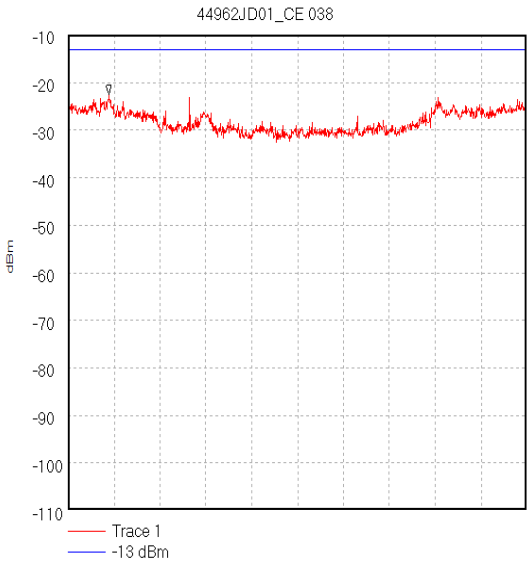


Start 1.913 GHz; Stop 1.914 GHz
Ref 20 dBm; Ref Offset 42.5 dB; 10 dB/div
RBW 100.0 kHz; VBW 100.0 kHz; Att 10 dB; Swp 20.0 mS
Peak 1.913456 GHz, -40.61 dBm
Display Line: -13 dBm;
14/07/2003 14:24:12

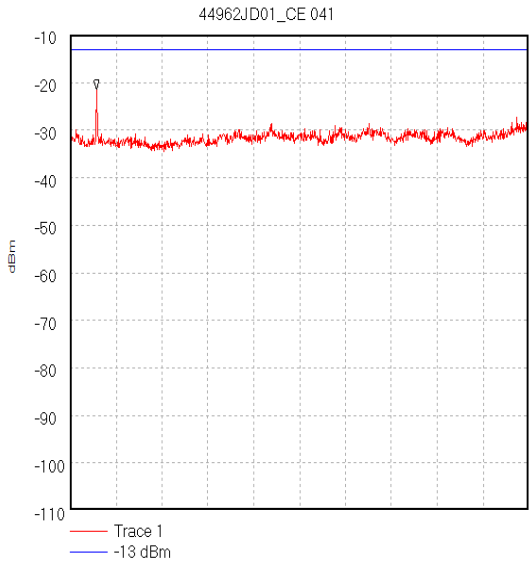


Start 2.0 GHz; Stop 5.0 GHz
Ref -10 dBm; Ref Offset 47.5 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 3.823333 GHz, -32.52 dBm
Display Line: -13 dBm;
14/07/2003 14:33:23

Transmitter Conducted Out of Band Emissions – Top Channel (Continued)



Start 5.0 GHz; Stop 15.0 GHz
Ref -10 dBm; Ref Offset 55.5 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 40.0 mS
Peak 5.888889 GHz, -22.46 dBm
Display Line: -13 dBm;
14/07/2003 14:37:22



Start 15.0 GHz; Stop 20.0 GHz
Ref -10 dBm; Ref Offset 50.1 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 15.288889 GHz, -21.47 dBm
Display Line: -13 dBm;
14/07/2003 14:45:06

9.11. Transmitter Conducted Emissions (Band & Block Edges): Section 24.238

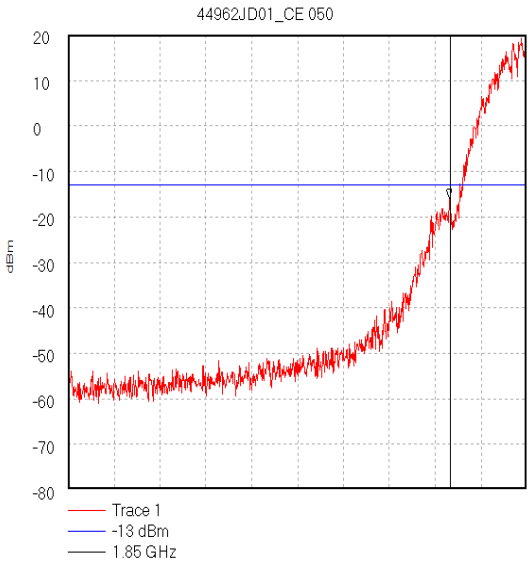
9.11.1. The EUT was configured as for transmitter conducted emissions measurements as described in Section 10 of this report.

9.11.2. Tests were performed to identify the maximum emissions levels at the antenna terminals of the EUT.

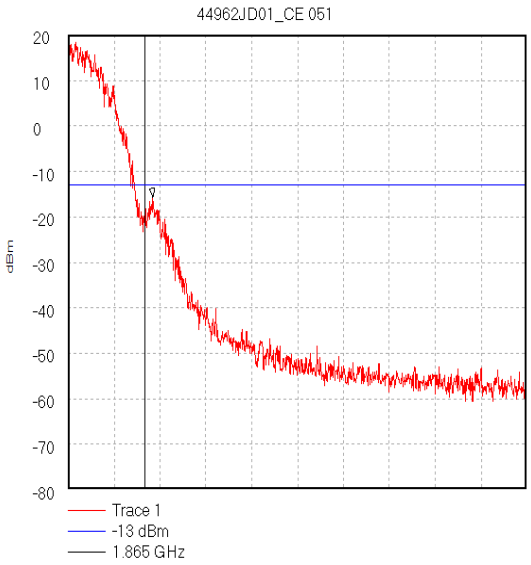
Results:

Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
1849.997	-15.93	-13.0	2.93	Complied
1865.021	-15.65	-13.0	2.65	Complied
1865.000	-17.21	-13.0	4.21	Complied
1870.023	-14.81	-13.0	1.81	Complied
1869.999	-16.87	-13.0	3.87	Complied
1885.025	-18.14	-13.0	5.14	Complied
1884.981	-17.76	-13.0	4.76	Complied
1890.021	-17.20	-13.0	4.20	Complied
1889.981	-18.31	-13.0	5.31	Complied
1895.021	-17.98	-13.0	4.98	Complied
1894.984	-18.62	-13.0	5.62	Complied
1910.020	-15.83	-13.0	2.83	Complied

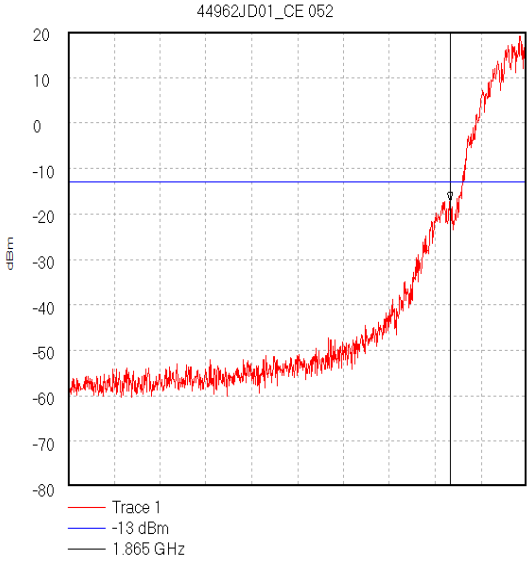
Transmitter Conducted Emissions (Block Edges)



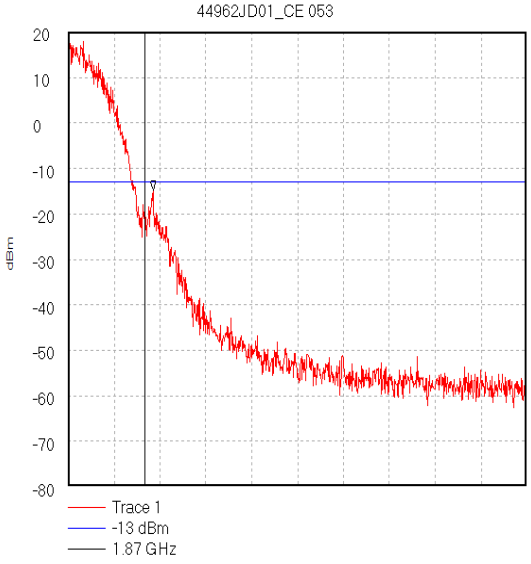
Start 1.849 GHz; Stop 1.8502 GHz
Ref 20 dBm; Ref Offset 42.5 dB; 10 dB/div
RBW 3.0 kHz; VBW 3.0 kHz; Att 10 dB; Swp 400.0 mS
Marker 1.849997 GHz, -15.93 dBm
Display Line: -13 dBm;
14/07/2003 15:53:01



Start 1.8648 GHz; Stop 1.866 GHz
Ref 20 dBm; Ref Offset 42.5 dB; 10 dB/div
RBW 3.0 kHz; VBW 3.0 kHz; Att 10 dB; Swp 400.0 mS
Marker 1.865021 GHz, -15.65 dBm
Display Line: -13 dBm;
14/07/2003 16:04:16

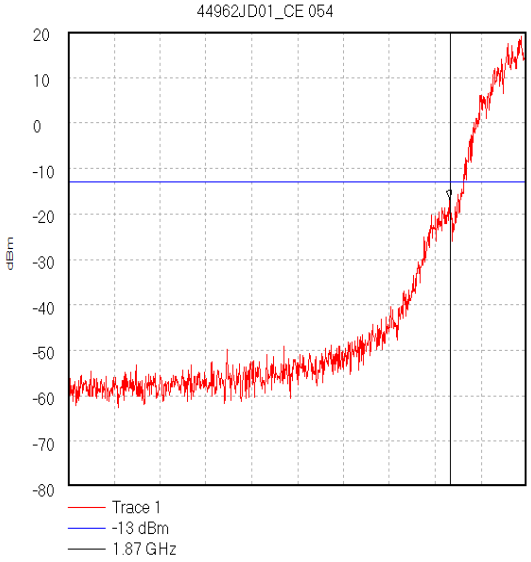


Start 1.864 GHz; Stop 1.8652 GHz
Ref 20 dBm; Ref Offset 42.5 dB; 10 dB/div
RBW 3.0 kHz; VBW 3.0 kHz; Att 10 dB; Swp 400.0 mS
Marker 1.865 GHz, -17.27 dBm
Display Line: -13 dBm;
14/07/2003 16:07:23

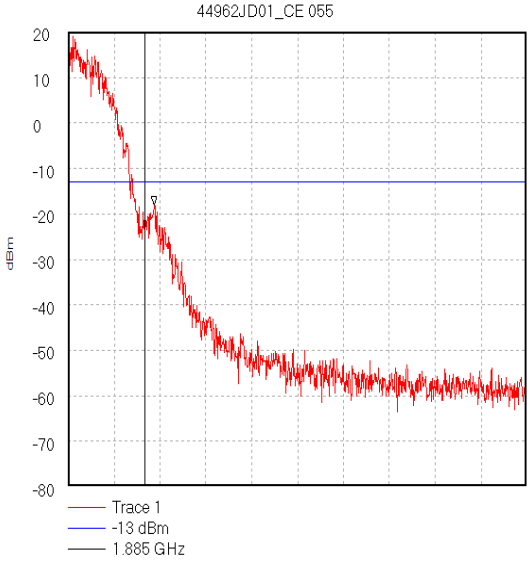


Start 1.8698 GHz; Stop 1.871 GHz
Ref 20 dBm; Ref Offset 42.5 dB; 10 dB/div
RBW 3.0 kHz; VBW 3.0 kHz; Att 10 dB; Swp 400.0 mS
Marker 1.870023 GHz, -14.81 dBm
Display Line: -13 dBm;
14/07/2003 16:09:54

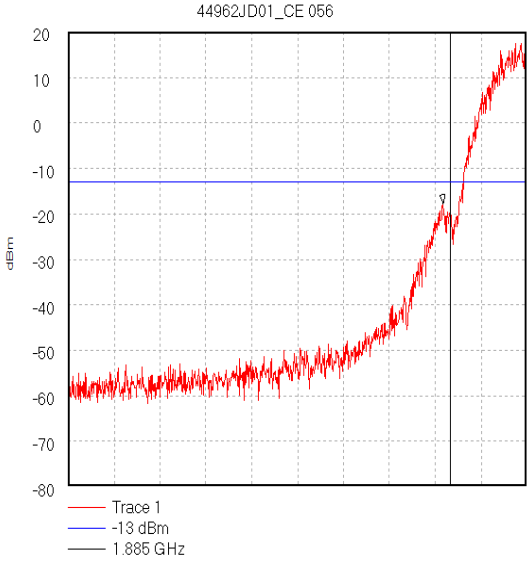
Transmitter Conducted Emissions (Block Edges) (Continued)



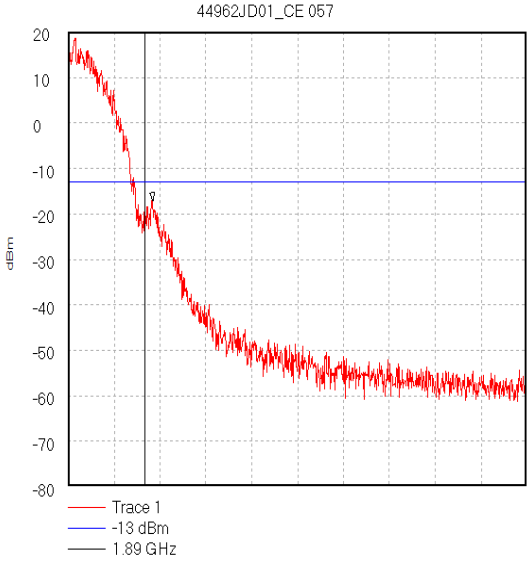
Start 1.869 GHz; Stop 1.8702 GHz
Ref 20 dBm; Ref Offset 42.5 dB; 10 dB/div
RBW 3.0 kHz; VBW 3.0 kHz; Att 10 dB; Swp 400.0 mS
Marker 1.869999 GHz, -16.87 dBm
Display Line: -13 dBm;
14/07/2003 16:11:51



Start 1.8848 GHz; Stop 1.886 GHz
Ref 20 dBm; Ref Offset 42.5 dB; 10 dB/div
RBW 3.0 kHz; VBW 3.0 kHz; Att 10 dB; Swp 400.0 mS
Marker 1.885025 GHz, -18.14 dBm
Display Line: -13 dBm;
14/07/2003 16:15:31

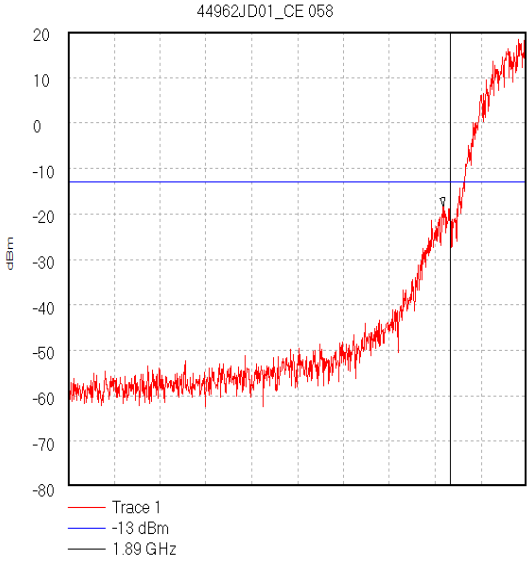


Start 1.884 GHz; Stop 1.8852 GHz
Ref 20 dBm; Ref Offset 42.5 dB; 10 dB/div
RBW 3.0 kHz; VBW 3.0 kHz; Att 10 dB; Swp 400.0 mS
Marker 1.884981 GHz, -17.76 dBm
Display Line: -13 dBm;
14/07/2003 16:17:11

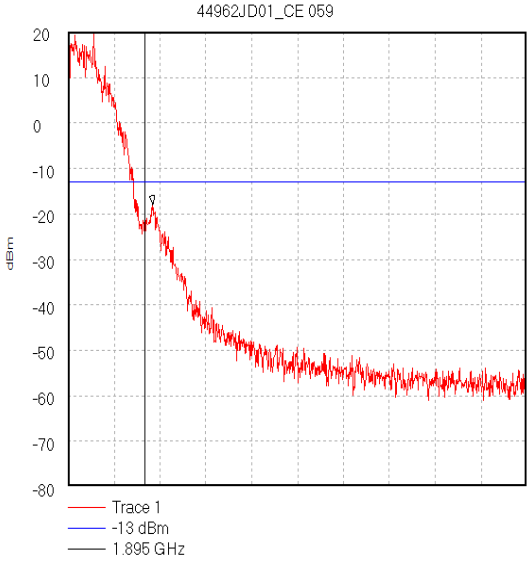


Start 1.8898 GHz; Stop 1.891 GHz
Ref 20 dBm; Ref Offset 42.5 dB; 10 dB/div
RBW 3.0 kHz; VBW 3.0 kHz; Att 10 dB; Swp 400.0 mS
Marker 1.890021 GHz, -17.2 dBm
Display Line: -13 dBm;
14/07/2003 16:19:34

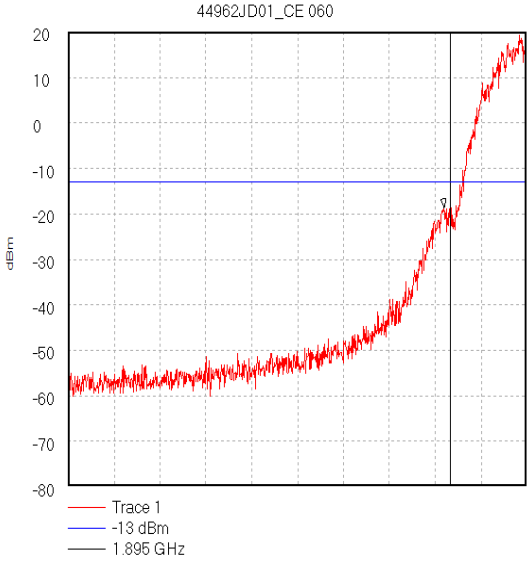
Transmitter Conducted Emissions (Block Edges) (Continued)



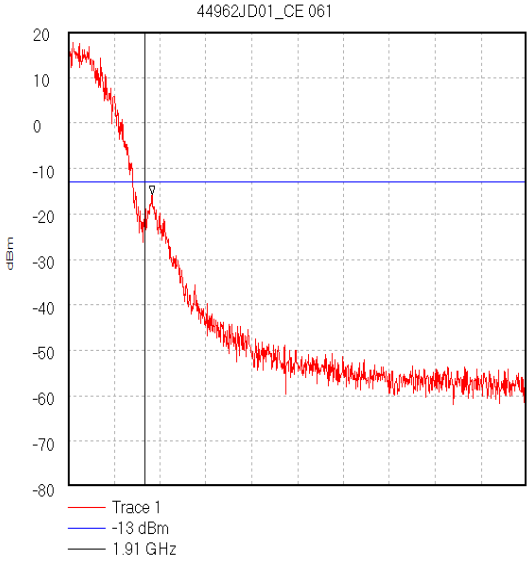
Start 1.889 GHz; Stop 1.8902 GHz
Ref 20 dBm; Ref Offset 42.5 dB; 10 dB/div
RBW 3.0 kHz; VBW 3.0 kHz; Att 10 dB; Swp 400.0 mS
Marker 1.889981 GHz, -18.31 dBm
Display Line: -13 dBm;
14/07/2003 16:21:59



Start 1.8948 GHz; Stop 1.896 GHz
Ref 20 dBm; Ref Offset 42.5 dB; 10 dB/div
RBW 3.0 kHz; VBW 3.0 kHz; Att 10 dB; Swp 400.0 mS
Marker 1.895021 GHz, -17.98 dBm
Display Line: -13 dBm;
14/07/2003 16:23:56



Start 1.894 GHz; Stop 1.8952 GHz
Ref 20 dBm; Ref Offset 42.5 dB; 10 dB/div
RBW 3.0 kHz; VBW 3.0 kHz; Att 10 dB; Swp 400.0 mS
Marker 1.894984 GHz, -18.62 dBm
Display Line: -13 dBm;
14/07/2003 16:26:04



Start 1.9098 GHz; Stop 1.911 GHz
Ref 20 dBm; Ref Offset 42.5 dB; 10 dB/div
RBW 3.0 kHz; VBW 3.0 kHz; Att 10 dB; Swp 400.0 mS
Marker 1.91002 GHz, -15.83 dBm
Display Line: -13 dBm;
14/07/2003 16:28:07

10. Measurement Methods

10.1. Effective Radiated Power (ERP)

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

The ERP was measured with the EUT arranged on a non-conducting turn table on a standard test site compliant with ANSI C63.4 – 2001 Clause 5.4. The transmitter was fitted with an integral antenna; as such all radiated tests were performed with the unit operating into the integral antenna.

The level of the ERP 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 substitution antenna. For ERP measurements a dipole antenna was used. 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 pad. 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 ERP was calculated as:-

ERP = Signal Generator Level - Cable Loss + Antenna Gain

Note that an ideal dipole has 0 dBd of gain, however, realistically this isn't the case and any gain/or loss present is taken into consideration.

Effective Radiated Power (ERP) (Continued)

Circumstances where the signal generator could not produce the desired 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 ERP of the signal generator was calculated using the above formulae. The recorded delta was added to the calculated ERP to obtain the substituted EUT ERP.

The test equipment settings for ERP measurements were as follows:

Receiver Function	Setting
Detector Type:	Peak
Mode:	Not applicable
Bandwidth:	>= Emission Bandwidth
Amplitude Range:	100 dB
Sweep Time:	Coupled

10.2. FCC Part 2.1055: Frequency Stability

The EUT was situated within an environmental test chamber and connected to test equipment via and access port.

Measurements were performed with the EUT operating under extremes of temperature in 10 degree increments within the range –30 to 50 Deg C.

Measurements were also performed at voltage extremes between the declared nominal supply voltage and at the declared endpoint voltage.

The requirement was to determine the frequency stability of the device under specified environmental operating conditions.

Measurements were made on the top, middle and bottom channels.

The EUT was switched off for a minimum of 30 minutes between each stage of testing while the environmental chamber stabilised at the next temperature within the stated temperature range.

The frequency error measured was converted to an error in ppm using the following formula as defined by TIA_EIA_603A :-

$$\text{ppm error} = \left(\frac{MCF_{MHz}}{ACF_{MHz}} - 1\right) * 10^6$$

where MCF_{MHz} is the measured carrier frequency in MHz
ACF_{MHz} is the assigned carrier frequency in MHz

The measured ppm had to be less then the relevant limits in order to comply.

10.3. Occupied Bandwidth

The EUT was connected to a spectrum analyser enabled with an occupied bandwidth function and a GSM test set via a bi-directional coupler to its antenna port. If the EUT was not fitted with an antenna port as standard, the client made a temporary antenna port available.

Measurements were performed to determine the Occupied Bandwidth in accordance with FCC Part 2.1049. The Occupied Bandwidth was measured from the fundamental emission at the bottom middle and top channels.

As the EUT is a PCS phone, no modulation input port was available. A call was thus setup using the PCS/GSM simulator and using normal modulation. The Occupied Bandwidth was measured in this configuration.

The Occupied Bandwidth was measured using the built in occupied bandwidth function of the Rohde and Schwarz FSEB spectrum analyser. It was set to measure the bandwidth where 99% of the signal power was contained. The analyser settings were set as per those outlined in the FSEB user manual for this measurement, i.e., RBW <= 1/20 of occupied bandwidth. A value of 3kHz was used.

10.4. Conducted Measurements:

The test was performed in a laboratory environment.

Conducted measurements at the Antenna port were performed from the lowest declared frequency to 10 times the highest EUT fundamental frequency as shown in section 2.5 of this report.

A measuring receiver was connected to the antenna port of the EUT via a suitable cable and RF Attenuator. The total loss of both the cable and the attenuator were measured and entered as a reference level offset into the measuring receiver to correct for the losses.

The limit in the standard states that emissions shall be attenuated by at least 43+10 Log(P) dB below the transmitter power (P), where (P) is the maximum measured fundamental power for the channel under test. This limit always reduces to –13 dBm as such, the limit line presented on the accompanying plots is set to –13 dBm.

The frequency band described above was investigated with the transmitter operating at full power on the top, bottom and middle channels. Any spurious observed were then recorded and compared to the –13 dBm limit. The requirement is for the emission to be less than –13 dBm. The margin between emission and limit is recorded and should always be positive to indicate compliance.

It should be noted that FCC Part 24.238 states that the 1st MHz band immediately adjacent to the applicants declared frequency block may be measured using a resolution bandwidth of at least 1% of the emission bandwidth. This bandwidth was found to be 3 kHz

The measurements in the 2nd and 3rd 1MHz blocks away from the adjacent 1 MHz block from 1911 MHz to 1912 MHz and 1912 MHz to 1913 MHz were carried out using an analyser Span of 1 MHz and a 100 kHz receiver resolution bandwidth (RBW). 10 linear readings were taken for each 100 kHz strip across the 1 MHz band. These readings were integrated to give the emission level in an equivalent 1 MHz bandwidth.

The test equipment settings for conducted antenna port measurements were as follows:

Receiver Function	Settings
Detector Type:	Peak
Mode:	Max Hold
Bandwidth:	1 MHz >1GHz
Bandwidth:	10 kHz <1GHz
Amplitude Range:	100 dB
Step Size:	Continuous sweep
Sweep Time:	Coupled

The resolution bandwidth used for measurements in the 1 MHz blocks either side of the declared operating frequency block were set as described in the procedure above.

10.5. FCC Part 15: 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.

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.

During the swept measurements (and also during subsequent final measurements on single frequencies) 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.

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

10.6. Transmitter Radiated Emissions

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

Initial pre-scans covering the entire measurement band from the lowest generated frequency declared up to 10 times the highest fundamental frequency stated in section 2.5 of this report. The scans were performed within a screened chamber in order to identify frequencies on which the EUT was generating spurious. This procedure identified the frequencies from the EUT which required further examination. Repetitive scans were performed to allow for emissions with low repetition rates, and for the duty cycle of the EUT.

The initial scans were performed using an antenna height of 1.5 m and a measurement distance of 3 m. A limit line was set to the specification limit by characterising the screen room using a known signal source set at exactly the same location as the EUT. The signal source was derived from either a horn antenna or a dipole dependant on the frequency band under investigation. Any levels within 20 dB of this limit were measured where possible, on occasion; the receiver noise floor came within the 20 dB boundary. On these occasions, the system noise floor may have been recorded.

An open area test site using the appropriate test distance and measuring receiver with a Peak detector was used for final measurements at each frequency recorded in the screen room.

The levels were maximised by initially rotating the turntable through 360° and then varying the antenna height between 1 m and 4 m in the vertical polarisation. 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. The procedure was repeated for the horizontal polarisation.

Once the final amplitude (maximised) had been obtained, the EUT was substituted with a substitution antenna. For EIRP measurements a Horn antenna whose gain was based on an isotropic antenna was used, ERP measurements were done using a dipole. 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 pad. 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 radiated power was calculated as:-

EIRP/ERP = Signal Generator Level - Cable Loss + Antenna Gain

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Transmitter Radiated Emissions (Continued)

The limit in the standard states that emissions shall be attenuated by at least 43+10 Log(P) dB below the transmitter power (P), where (P) is the maximum measured fundamental power for the channel under test. This limit always reduces to –13 dBm as such, the limit line presented on the accompanying plots is set to –13 dBm.

Any spurious measured were then compared to the –13 dBm limit. The requirement is for the emission to be less than –13 dBm. The margin between emission and limit is recorded and should always be positive to indicate compliance.

All measurements were performed using broadband horn antennas.

It should be noted that FCC Part 22.917 states that the 1st MHz band immediately adjacent to the applicant's declared frequency block may be measured using a resolution bandwidth of at least 1% of the emission bandwidth. This bandwidth was found to be 3 kHz

10.7. Receiver Radiated Emissions

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

Initial pre-scans covering the entire measurement band from the lowest generated frequency declared up to 5 times the highest clock frequency stated in section 2.5 of this report were performed within a screened chamber in order to identify frequencies on which the EUT was generating interference. This determined the frequencies from the EUT which required further examination. In order to minimise the time taken for the swept measurements, a peak detector was used in conjunction with the appropriate detector measuring bandwidth (see table below). Repetitive scans were performed to allow for emissions with low repetition rates, and for the duty cycle of the EUT.

The initial scans were performed using an antenna height of 1.5 m and a measurement distance of 3 m. A limit line was set to the specification limit. Levels within 20 dB of this limit were measured where possible, on occasion; the receiver noise floor came within the 20 dB boundary. On these occasions, the system noise floor may have been recorded.

An open area test site using the appropriate test distance and measuring receiver with a Quasi-Peak detector was used for measurements below 1000 MHz, for measurements above 1000 MHz average and peak detectors were used.

For the final measurements the EUT was arranged on a non-conducting turn table on a standard test site compliant with ANSI C63.4 – 2001 Clause 5.4.

On the open area test site, at each frequency where a signal was found, the levels were maximised by initially rotating the turntable through 360° and then varying the antenna height between 1 m and 4 m in the horizontal polarisation. 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. The procedure was repeated for the vertical polarisation.

Receiver Radiated Emissions (Continued)

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

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

Receiver Function	Initial Scan	Final Measurements Below 1 GHz	Final Measurements Above 1 GHz
Detector Type:	Peak	Quasi-Peak (CISPR)	Peak/Average
Mode:	Max Hold	Not applicable	Not applicable
Bandwidth:	(120 kHz < 1GHz) (1MHz > 1GHz)	120 kHz	1 MHz (If Applicable)
Amplitude Range:	60 dB	20 dB	20 dB (typical)
Step Size:	Continuous sweep	Not applicable	Not applicable
Sweep Time:	Coupled	Not applicable	Not applicable

11. Measurement Uncertainty

11.1. 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.

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

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

11.4. 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 30.0 MHz	95%	+/- 3.25 dB
Effective Radiated Power (ERP / Effective Isotropic Radiated Power (EIRP)	400 MHz to 26.5 GHz	95%	+/- 1.78 dB
Frequency Stability	Not applicable	95%	+/- 20 Hz
Minimum Bandwidth	Not applicable	95%	+/- 0.12 %
Occupied Bandwidth	Not applicable	95%	+/- 0.12 %
Conducted Emissions Antenna Port	9 kHz to 26.5 GHz	95%	+/- 1.2 dB
Radiated Spurious Emissions	30.0 MHz to 1000.0 MHz	95%	+/- 5.26 dB
Radiated Spurious Emissions	1.0 GHz to 26.0 GHz	95%	+/- 1.78 dB
Spectral Power Density	Not applicable	95%	+/- 1.2 dB

11.5. 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.

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
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
A1059	WG22 to K-Type Coaxial Adapter	Flann Microwave	22094-KF20	2017
A1077	3020A	Narda	3020A	40140
A1318	Narda Termination 20W AVG	Narda	374BNM	0006
A197	Site 2 Controller SC144	Unknown	SC144	150720
A200	Weinschel 100 W 20 dB Attenuator	Weinschel	WA48-20	385
A238	3 dB Attenuator	Schaffner	6803-17-B	NONE
A244	20 dB Attenuator	Schaffner	6820-17-B	None
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
A276	OATS Positioning Controller	Rohde & Schwarz	HCC	
A392	3 dB attenuator (9)	Suhner	6803.17.B	None
A430	WG 18 horn	Flann	18240-20	425
A490	Bilog Antenna	Chase	CBL6111A	1590
C1065	Rosenberger	Rosenberger	UFA210-1-7872	0985
C1079	Rosenberger 1m Cable	Rosenberger	FA210A1010M5050	28462-1
C1080	Rosenberger Cable 3m	Rosenberger	FA210A1030M5050	28464-1
C1081	Rosenberger Cable 2m	Rosenberger	FA210A1020M5050	28463-2
C1082	Rosenberger Cable 2m	Rosenberger	FA210A1020M5050	28463-1
C1086	5m Screening Effectiveness Test Cable	Radio Frequency Investigation Ltd	C1086	C1086-14072003
C341	Cable	Andrews	None	None
C344	Cable	Rosenberger	UFA210A-1-1181-70x70	1934
C453	Cable	Rosenberger	RG142XX-001-RFIB	C453-10081998

Test Equipment Used (Continued)

RFI No.	Instrument	Manufacturer	Type No.	Serial No.
C457	Cable	Rosenberger	RG142XX-002-RFIB	C457-10081998
C461	Cable	Rosenberger	UFA210A-1-1182-704704	98H0305
E009	Environmental Chamber	Thermotron Corporation	S-8-E Mini Max	25-2407-0
G013	SMHU Signal Generator	Rohde & Schwarz	SMHU	894 055/003
G088	PSU	Thurlby Thandar	CPX200	100700
M003	Spectrum Monitor	Rohde & Schwarz	EZM	883 580/008
M023	ESVP Receiver	Rohde & Schwarz	ESVP	872 991/027
M028	FSB Spectrum Analyser	Rohde & Schwarz	FSB	860 001/009 (RF), 860 161/007 (Display)
M072	FSM Spectrum Analyser	Rohde & Schwarz	FSM	862 967/010 (RF) & 863 912/048 (Display)
M084	NRVS Power Meter	Rohde & Schwarz	NRVS	864268/006
M088	Receiver / Spectrum Analyser System	Rohde & Schwarz	ESBI	DU:835862/018 RU:835387/006
M1093	Will tek	Will tek	4202S	0513018
M133	Temperature/Humidity/Pressure Meter	RS Components	None	None
M139	Fluke 11 DVM	Fluke	11	65830028
M173	Turntable Controller	R.H.Electrical Services	RH351	3510020
M281	Power Meter	Hewlett Packard	E4418A (EPM441A)	GB37170210-01
S003	Power Control	Zen	E08	736699
S202	Site 2	RFI	2	S202-15011990
S212	Site 12	RFI	12	
S503	Antenna Mast	EMCO	1051-25	9205 1670

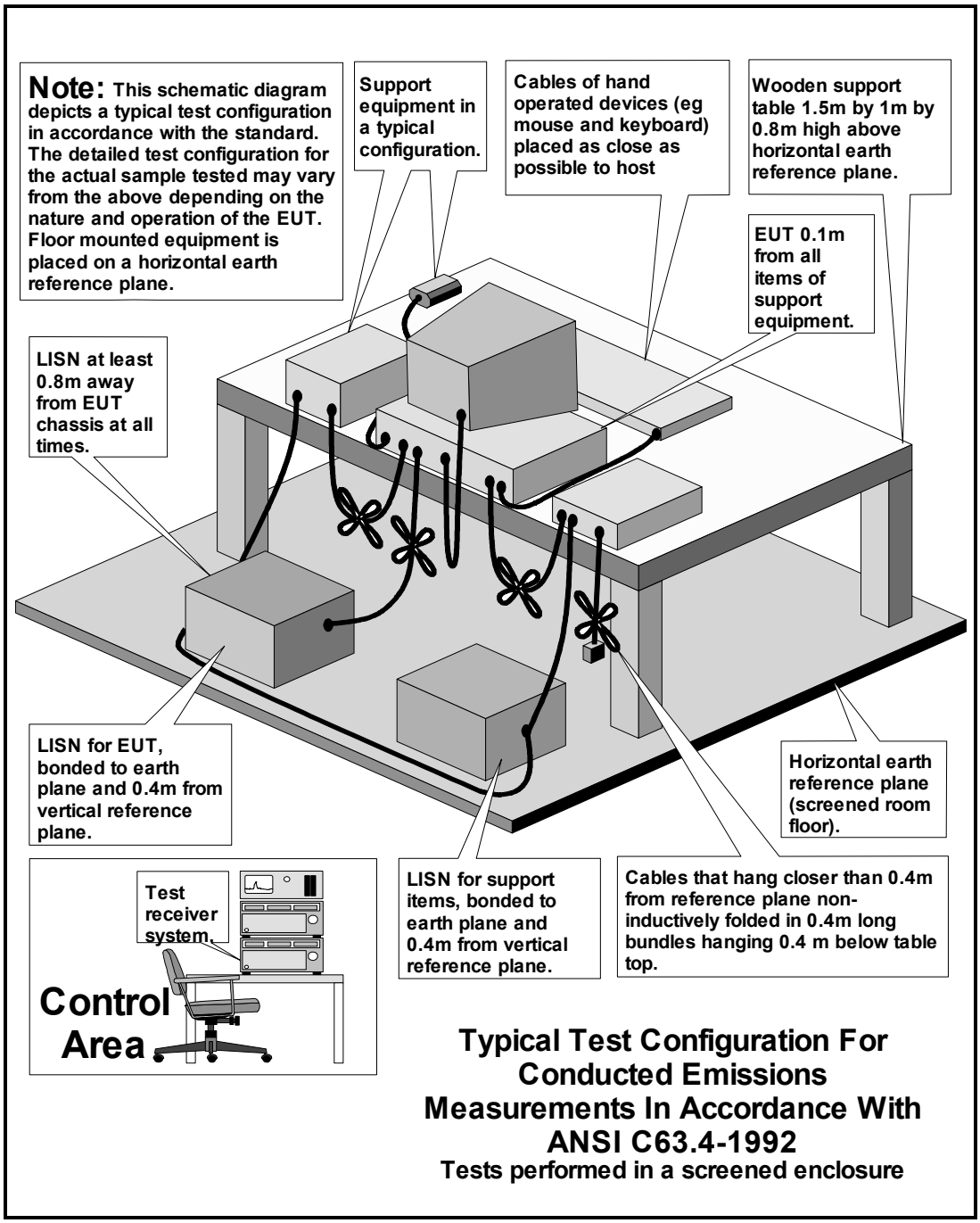
NB In accordance with UKAS requirements, all the measurement equipment is on a calibration schedule.

Appendix 2. Test Configuration Drawings

This appendix contains the following drawings:

Drawing Reference Number	Title
DRG\44962JD01\EMICON	Test configuration for measurement of conducted emissions
DRG\44962JD01\EMIRAD	Test configuration for measurement of radiated emissions

DRG\44962JD01\EMICON



Typical Test Configuration For Conducted Emissions Measurements In Accordance With ANSI C63.4-1992

Tests performed in a screened enclosure

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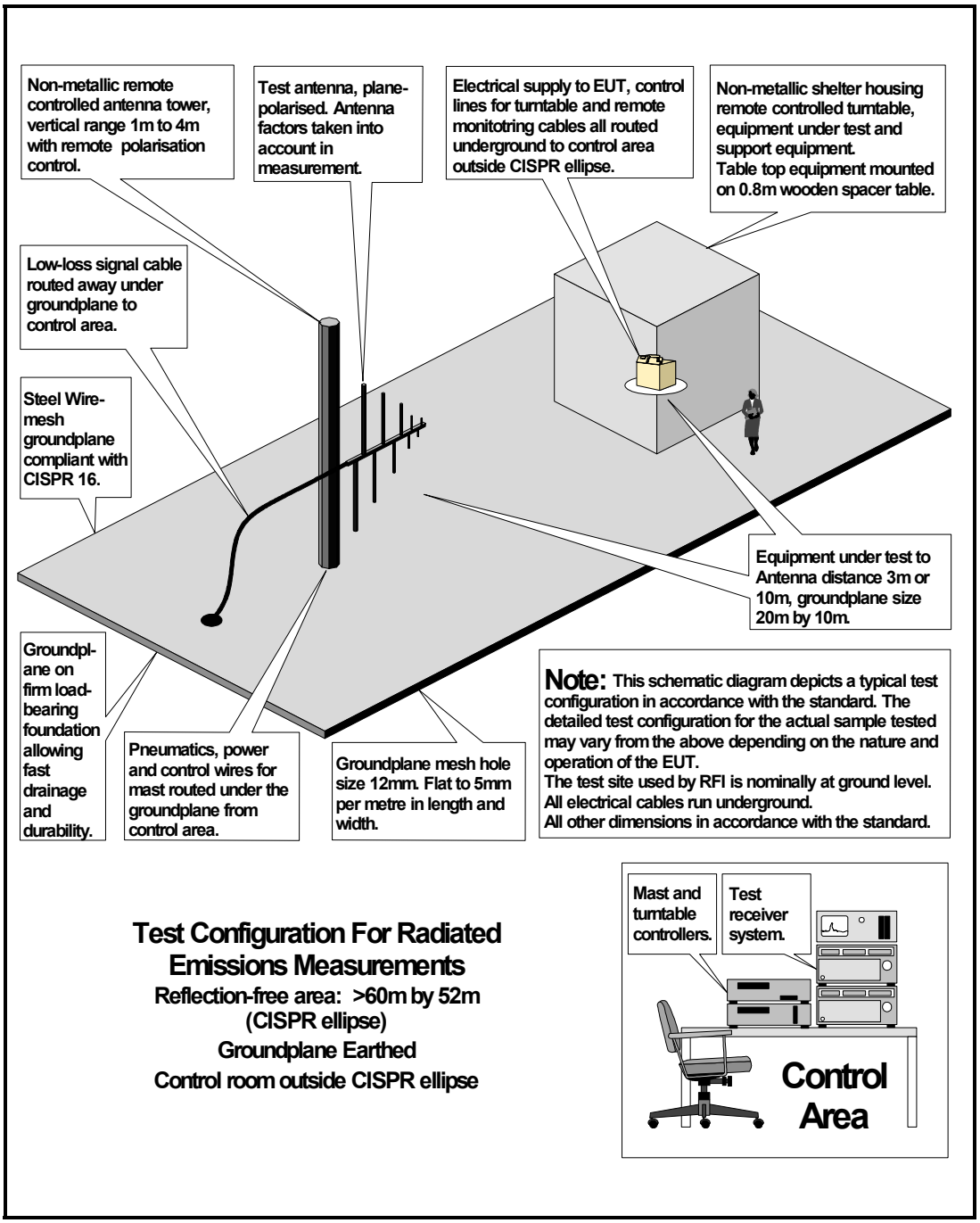

Test Configuration For Radiated Emissions Measurements

Reflection-free area: >60m by 52m (CISPR ellipse)

Groundplane Earthed

Control room outside CISPR ellipse

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