TEST REPORT
FROM
RADIO FREQUENCY
INVESTIGATION LTD.

Test Of: Nokia UK Ltd.
NHL-10 Mobile Handset

To: FCC Part 24

Test Report Serial No:
RFI/MPTB1/RP45084JD01A

This Test Report Is Issued Under The Authority Of Richard Jacklin, Operations Director: 	**Checked By:** 
Tested By: 	**Release Version No:** **PDF01**
Issue Date: 01 September 2003	**Test Dates: 01 August 2003 to 12 August 2003**

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

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1. Client Information

Company Name:	Nokia Mobile Phones
Address:	Nokia House Summit Avenue Southwood Farnborough Hants GU14 0NG UK
Contact Name:	Mr A White

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:	Nokia
Unique Type Identification:	NHL-10
IMEI Number:	004400261775348 *
FCC ID Number:	QVVNHL-10
Country of Manufacture:	Finland
Date of Receipt:	01 August 2003

** This sample was used for all radiated tests*

Brand Name:	Nokia
Unique Type Identification:	NHL-10
IMEI Number:	004400261780843 **
FCC ID Number:	QVVNHL-10
Country of Manufacture:	Finland
Date of Receipt:	01 August 2003

*** This sample was used for all direct connection, i.e. conducted tests*

2.2. Description Of EUT

The equipment under test is a tri-band camera mobile handset, which supports IR and Bluetooth.

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: (Internal, non-removable lithium ion battery)	4.2V		
Declared Battery End Point Voltage	3.45 V DC		
Power Supply Requirement: (AC Battery Charger)	Nominal 115 V 60 Hz AC Mains supply		
Intended Operating Environment:	Within GSM Network Coverage		
Equipment Category:	Portable		
Type of Unit:	Handset		
Weight:	122g		
Dimensions:	108.6mm x 58.2mm x 23.7mm		
Interface Ports:	Charger Connection Accessory Connection		
Transmit Frequency Range	1850 MHz to 1910 MHz		
Transmit Channels Tested	**Channel ID**	**Channel Number**	**Channel Frequency (MHz)**
	Bottom	512	1850.2
	Middle	660	1879.8
	Top	810	1909.8
Receive Frequency Range	1930 MHz to 1990 MHz		
Receive Channels Tested	**Channel ID**	**Channel Number**	**Channel Frequency (MHz)**
	Bottom	512	1930.2
	Middle	660	1960.0
	Top	810	1989.8
Highest Fundamental Frequency	1989.8 MHz		
Highest Oscillator Frequency	3980.0 MHz		
Maximum Power Output (EIRP)	30.2 dBm		

2.5. Support Equipment

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

Description:	Universal Radio Communications Tester
Brand Name:	Rohde & Schwartz
Model Name or Number:	CMU200
Serial Number:	1100.0008.02
Connected to Port:	RF Link

Description:	Li-ion Battery
Brand Name:	Nokia
Model Name or Number:	BL-5C
Serial Number:	06704007034137111
Cable Length And Type:	N/A
Connected to Port:	Battery

Description:	AC Power Supply
Brand Name:	Nokia
Model Name or Number:	ACP-12U
Serial Number:	0675303399791K104LC0070467
Cable Length And Type:	175 cm
Connected to Port:	Charger

Description:	Headset
Brand Name:	Nokia
Model Name or Number:	HDC-5
Serial Number:	02714676417182089923
Cable Length And Type:	1 metre
Connected to Port:	Accessory

3. 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.

3.1. 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

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 the disconnected. The combination that exhibited the worse case mode of operation was then used to perform final measurements.

Transmitter Modes:

For carrier output power, 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 then performed on the top, middle and bottom channels if an emission was identified.

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

Idle Modes:

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

5.3. Configuration And Peripherals

The EUT was tested in the following configuration:

Configured with hands free kit, AC battery charger and internal battery.

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

The reason for choosing this configuration was that the client defined it as being likely to be the worst case with regards EMC.

6. Summary Of Test Results

Part 24

Range Of Measurements	Specification Reference	Port Type	Compliancy Status
Idle Mode AC Conducted Spurious Emissions (150 kHz to 30 MHz)	C.F.R. 47 FCC Part 15: 2002 Section 15.107	AC Mains Input	Complied
Idle Mode Radiated Spurious Emissions	C.F.R. 47 FCC Part 15: 2002 Section 15.109	Enclosure	Complied
Transmitter Carrier Output Power	C.F.R. 47 FCC Part 2: 2002 Section 2.1046(a)	*Antenna Terminals	Complied
Transmitter Effective Isotropic Radiated Power (EIRP)	C.F.R. 47 FCC Part 24: 2002 Section 24.232	Antenna	Complied
Transmitter Frequency Stability (Temperature Variation)	C.F.R. 47 FCC Part 24: 2002 Section 24.235	*Antenna Terminals	Complied
Transmitter Frequency Stability (Voltage Variation)	C.F.R. 47 FCC Part 24: 2002 Section 24.235	*Antenna Terminals	Complied
Transmitter Occupied Bandwidth	C.F.R. 47 FCC Part 24: 2002 Section 24.238	*Antenna Terminals	Complied
Transmitter Out of Band Emissions	C.F.R. 47 FCC Part 24: 2002 Section 2.1051/24.238	*Antenna Terminals	Complied
Transmitter Conducted Emissions at Block Edges	C.F.R. 47 FCC Part 24: 2002 Section 2.1051/24.238	*Antenna Terminals	Complied
Transmitter Out of Band Emissions	C.F.R. 47 FCC Part 24: 2002 Section 2.1053/24.238	Antenna	Complied
Transmitter Radiated Band Edges	C.F.R. 47 FCC Part 2: 2002 Section 2.1053/24.238	Antenna	Complied

*Note. This is an access point on the EUT provided by the manufacturer for the purpose of this test.

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. Details of the test methods and procedures can be found in section 9 of this report.

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 10 for details of measurement uncertainties.

8. Test Results

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.

8.1. Idle Mode AC Conducted Spurious Emissions: Section 15.107

8.1.1. The EUT was configured as for AC conducted emissions measurements as described in Section 9 of this report.

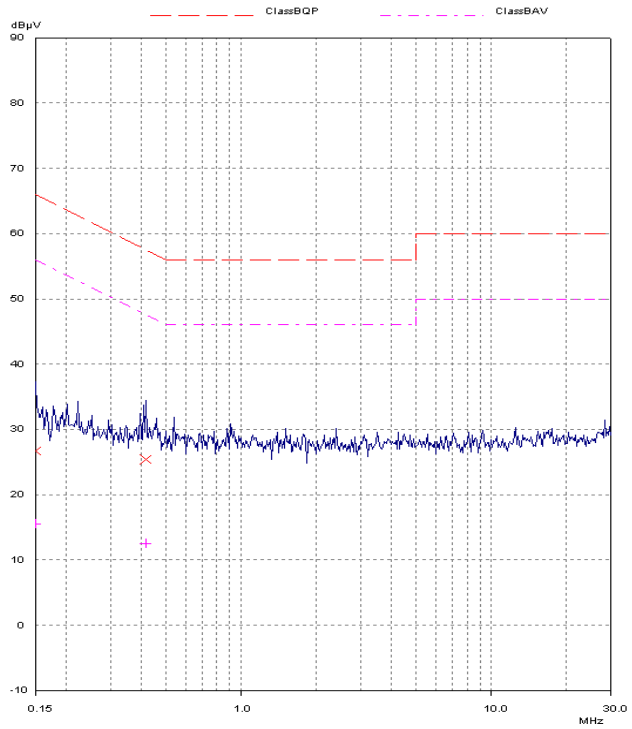
8.1.2. Tests were performed to identify the maximum emissions levels on the AC mains line of the EUT.

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

Frequency (MHz)	Line	Q-P Level (dBµV)	Q-P Limit (dBµV)	Margin (dB)	Result
0.15000	Neutral	26.70	66.00	39.30	Complied
0.41557	Live	25.35	57.54	32.19	Complied

Results: Average Detector Measurements On Live And Neutral Lines

Frequency (MHz)	Line	Av. Level (dBµV)	Av. Limit (dBµV)	Margin (dB)	Result
0.15000	Live	15.47	56.00	40.53	Complied
0.41557	Live	12.43	47.54	35.11	Complied



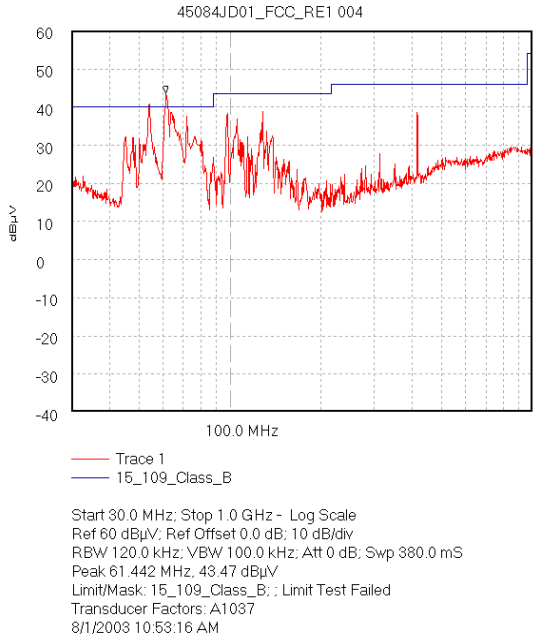
8.2. Idle Mode Radiated Emissions: Section 15.109

8.2.1. Electric Field Strength Measurements (Frequency Range: 30 to 1000 MHz)

8.2.1.1. The EUT was configured as for radiated field strength emissions testing as described in Section 9 of this report.

8.2.1.2. Tests were performed to identify the maximum radiated spurious emissions levels.

Frequency (MHz)	Ant. Pol.	Q-P Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
53.827	V	26.6	40.0	13.4	Complied
61.253	V	29.0	40.0	11.0	Complied
97.133	V	35.9	43.5	7.6	Complied
416.001	V	22.2	46.0	23.8	Complied



Idle Mode Radiated Emissions: Section 15.109 (Continued)

Electric Field Strength Measurements (Frequency Range: 1.0 to 10.0 GHz)

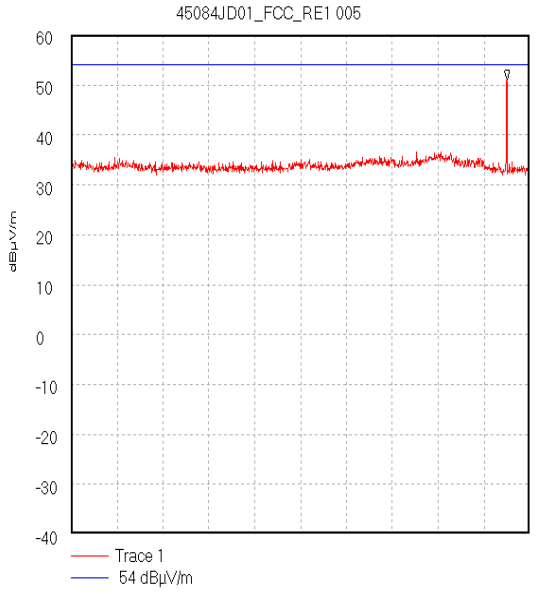
Highest Peak Level:

**Note: No spurious emissions from the EUT were detected above the noise floor of the measuring receiver; the highest peak noise floor reading of the measuring receiver recorded was 35.9 dBμV/m at 9.702 GHz. An emission was detected at 1.91 GHz at a level of 51.0 dBμV/m (refer to plot 45084JD01_FCC_RE1 005), this was, however, after further investigation, found to emanate from the CMU 200 Radio Communications Tester being used as support equipment and not from the EUT. This emission was, therefore, disregarded.*

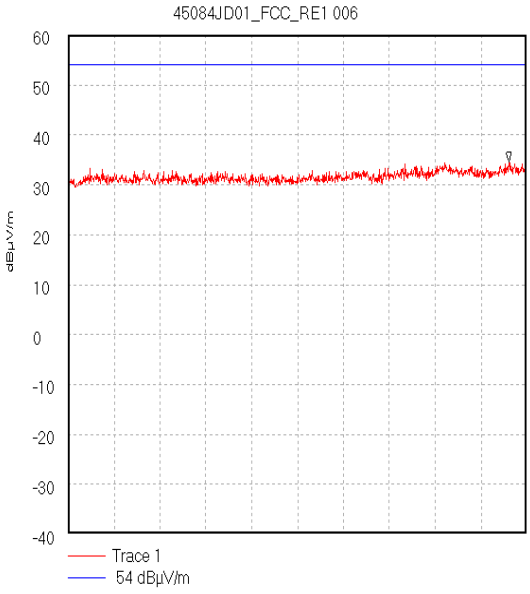
Highest Average Level:

**Note: Not recorded, no spurious emissions were detected above the noise floor of the measuring receiver.*

*Note:

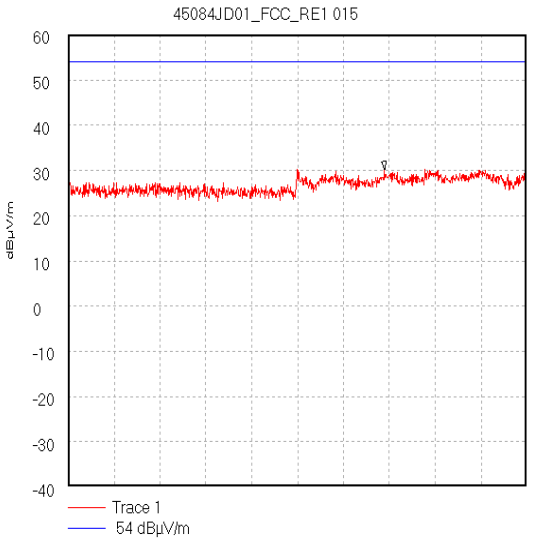


Start 1.0 GHz; Stop 2.0 GHz
Ref 60 dBµV/m; Ref Offset 5.0 dB; 10 dB/div
RBW 1000.0 kHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 1.95 GHz, 51.02 dBµV/m
Display Line: 54 dBµV/m; ; Limit Test Passed
8/1/2003 11:07:49 AM

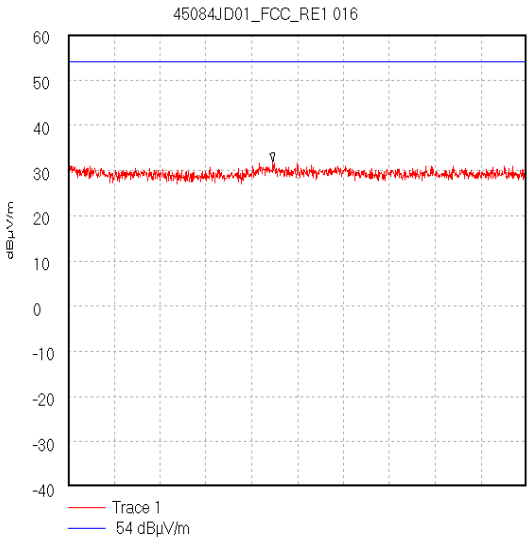


Start 2.0 GHz; Stop 4.0 GHz
Ref 60 dBµV/m; Ref Offset 5.0 dB; 10 dB/div
RBW 1000.0 kHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 3.922 GHz, 34.56 dBµV/m
Display Line: 54 dBµV/m; ; Limit Test Passed
8/1/2003 11:14:07 AM

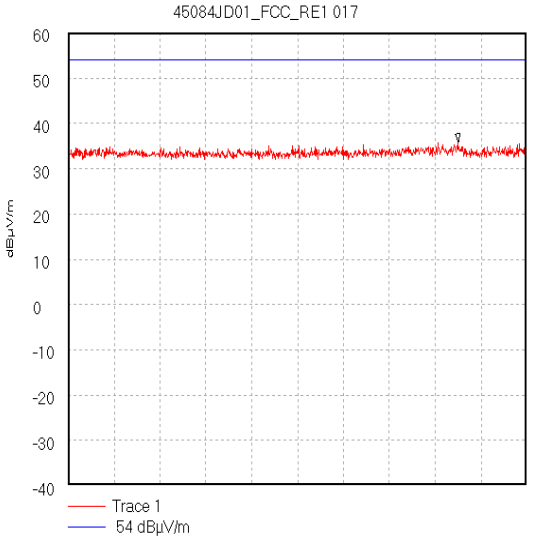
Idle Mode Radiated Emissions (Continued)



Start 4.0 GHz; Stop 6.0 GHz
Ref 60 dBµV/m; Ref Offset 0.0 dB; 10 dB/div
RBW 1000.0 kHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 5.38 GHz, 30.19 dBµV/m
Display Line: 54 dBµV/m; ; Limit Test Passed
Transducer Factors: 4to6g_Horn
05/08/2003 15:18:47



Start 6.0 GHz; Stop 8.0 GHz
Ref 60 dBµV/m; Ref Offset 0.0 dB; 10 dB/div
RBW 1000.0 kHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 6.893 GHz, 31.92 dBµV/m
Display Line: 54 dBµV/m; ; Limit Test Passed
Transducer Factors: 6to8g_Horn
05/08/2003 15:38:54



Start 8.0 GHz; Stop 10.0 GHz
Ref 60 dBµV/m; Ref Offset 0.0 dB; 10 dB/div
RBW 1000.0 kHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 9.702 GHz, 35.88 dBµV/m
Display Line: 54 dBµV/m; ; Limit Test Passed
Transducer Factors: 8to12G_Horn
05/08/2003 15:43:03

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

8.3.1. The EUT was configured as for Effective Isotropic Radiated Power as described in Section 9 of this report.

8.3.2. 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	V	29.7	33.0	3.3	Complied
Middle	1879.8	V	29.4	33.0	3.6	Complied
Top	1909.8	V	30.2	33.0	2.8	Complied

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

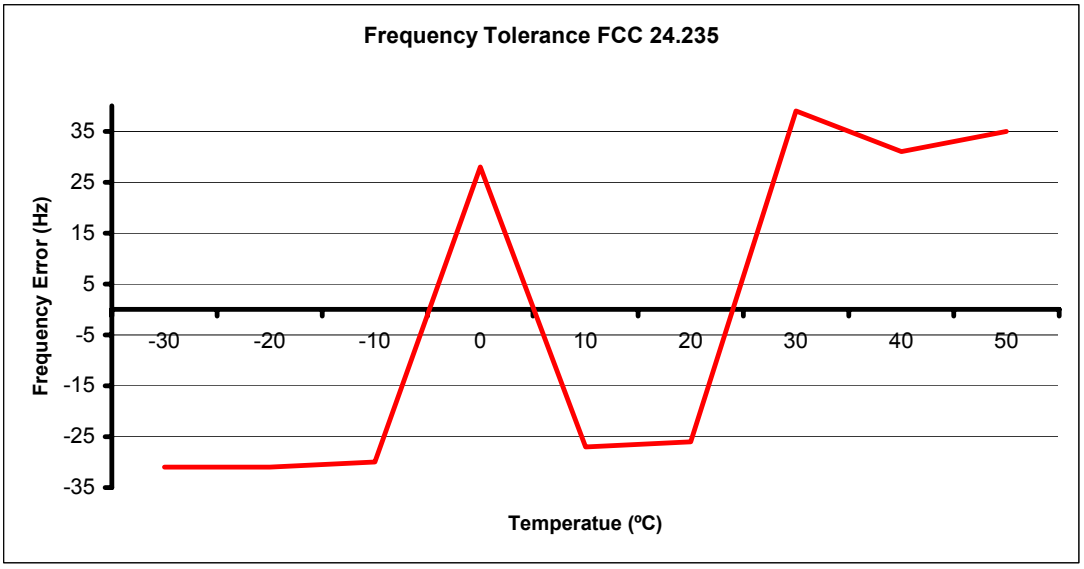
8.4.1. The EUT was configured as for frequency stability measurements as described in Section 9 of this report.

8.4.2. 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	-31	1850.199969	1850.0	0.199969	Complied
-20	-31	1850.199969	1850.0	0.199969	Complied
-10	-30	1850.199970	1850.0	0.199970	Complied
0	28	1850.200028	1850.0	0.200028	Complied
10	-27	1850.199973	1850.0	0.199973	Complied
20	-26	1850.199974	1850.0	0.199974	Complied
30	39	1850.200039	1850.0	0.200039	Complied
40	31	1850.200031	1850.0	0.200031	Complied
50	35	1850.200035	1850.0	0.200035	Complied

Frequency Variation From 1850.2MHz

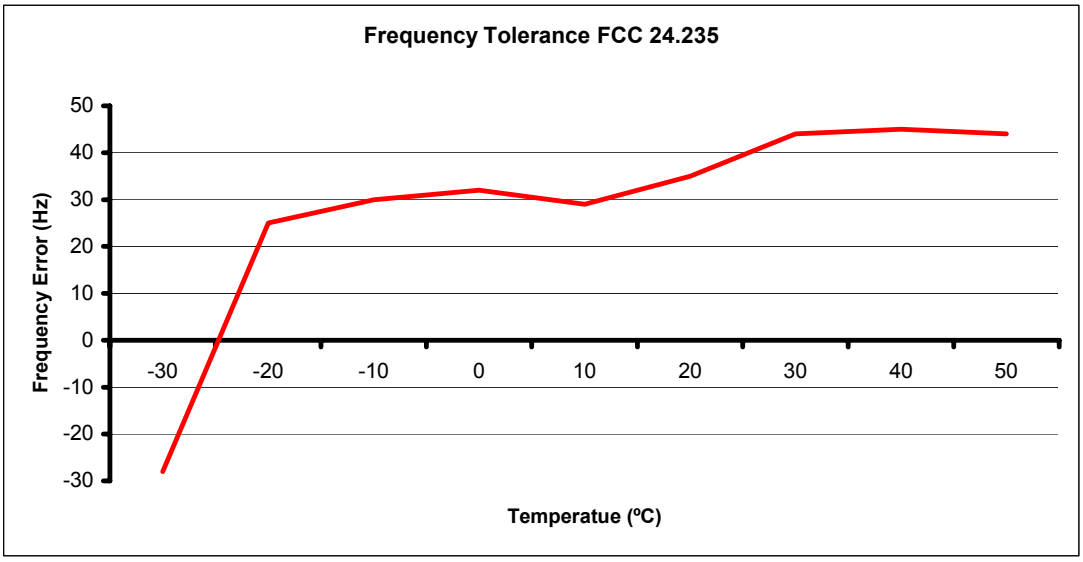


Transmitter Frequency Stability (Temperature Variation): Section 24.235 (continued)

Results Top Channel (1909.8 MHz)

Temp (ºC)	Frequency Error (Hz)	Measured Frequency (MHz)	Upper Band Edge Limit (MHz)	Margin (MHz)	Result
-30	-28	1909.799972	1910.0	0.200028	Complied
-20	25	1909.800025	1910.0	0.199975	Complied
-10	30	1909.800070	1910.0	0.199970	Complied
0	32	1909.800032	1910.0	0.199968	Complied
10	29	1909.800029	1910.0	0.199971	Complied
20	35	1909.800035	1910.0	0.199965	Complied
30	44	1909.800044	1910.0	0.199956	Complied
40	45	1909.800045	1910.0	0.199955	Complied
50	44	1909.800044	1910.0	0.199956	Complied

Frequency Variation From 1909.8MHz



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

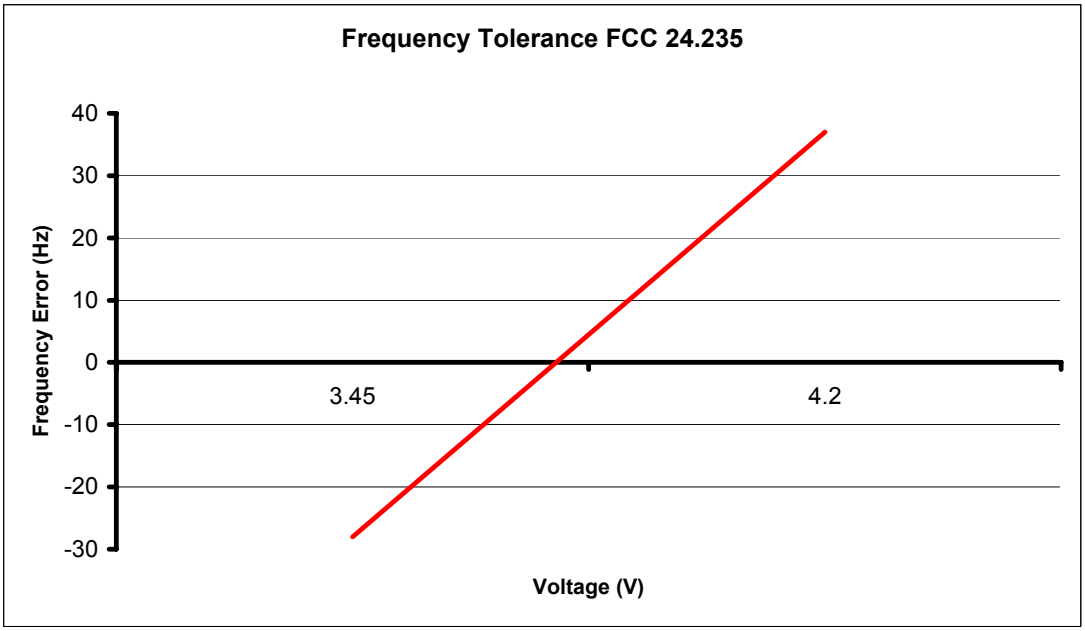
8.5.1. The EUT was configured as for frequency stability measurements as described in Section 9 of this report.

8.5.2. 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
4.2	-28	1850.199972	1850	0.199972	Complied
3.45	37	1850.200037	1850	0.200037	Complied

Frequency Variation From 1850.2MHz



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

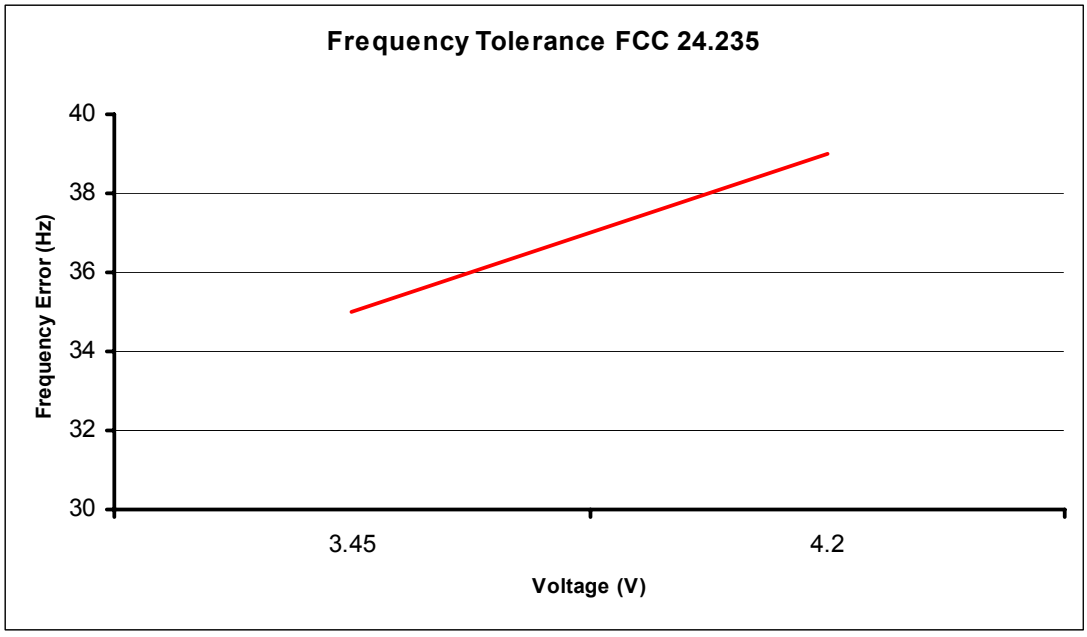
8.5.3. The EUT was configured as for frequency stability measurements as described in Section 9 of this report.

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

Results Top Channel (1909.8 MHz)

Supply Voltage (V)	Frequency Error (Hz)	Measured Frequency (MHz)	Lower Band Edge Limit (MHz)	Margin (MHz)	Result
4.2	35	1909.800035	1910	0.199965	Complied
3.45	39	1909.800039	1910	0.199961	Complied

Frequency Variation From 1909.8MHz



8.6. Transmitter Occupied Bandwidth: Section 24.238

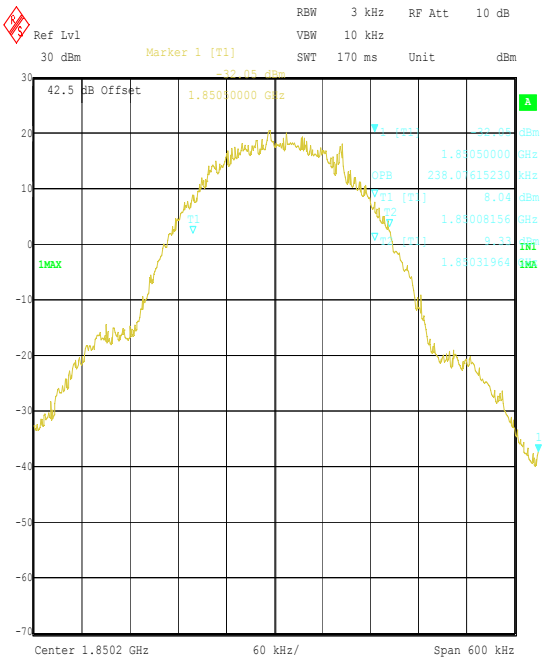
8.6.1. The EUT was configured as for Occupied Bandwidth measurements as described in Section 9 of this report.

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

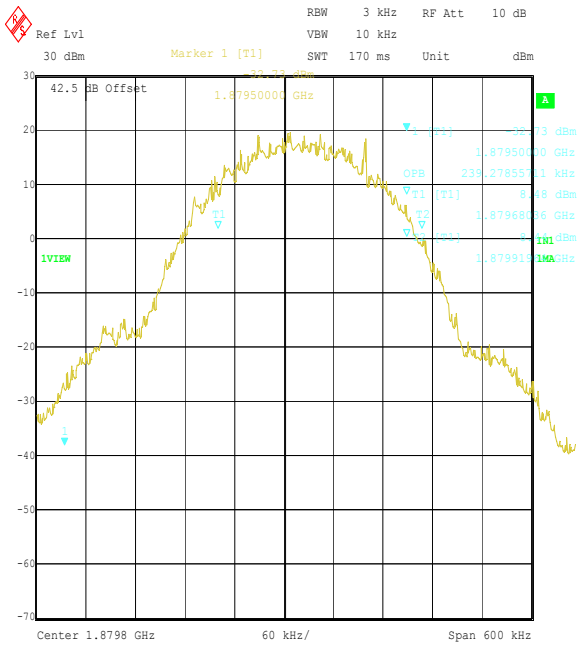
Results:

Channel	Frequency (MHz)	Resolution Bandwidth (kHz)	Video Bandwidth (kHz)	Occupied Bandwidth (kHz)
Bottom	1850.2	3.0	10.0	238.1
Middle	1879.8	3.0	10.0	239.3
Top	1909.8	3.0	10.0	240.5

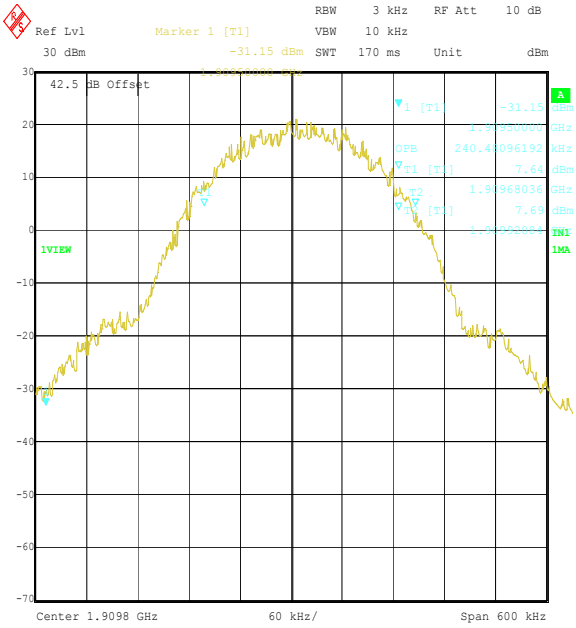
Transmitter Occupied Bandwidth (Continued)



Title: Nokia Calimero 004400261780843 FCC P24. Occupied Bandwidth.
Comment A: 45084JD01_FCC_GSM_Bot_001
Date: 11.AUG.2003 09:30:34



Title: Nokia Calimero 004400261780843 FCC P24. Occupied Bandwidth.
Comment A: 45084JD01_FCC_GSM_Mid_002
Date: 11.AUG.2003 09:32:30



Title: Nokia Calimero 004400261780843 FCC P24. Occupied Bandwidth.
Comment A: 45084JD01_FCC_GSM_Top_003
Date: 11.AUG.2003 09:34:32

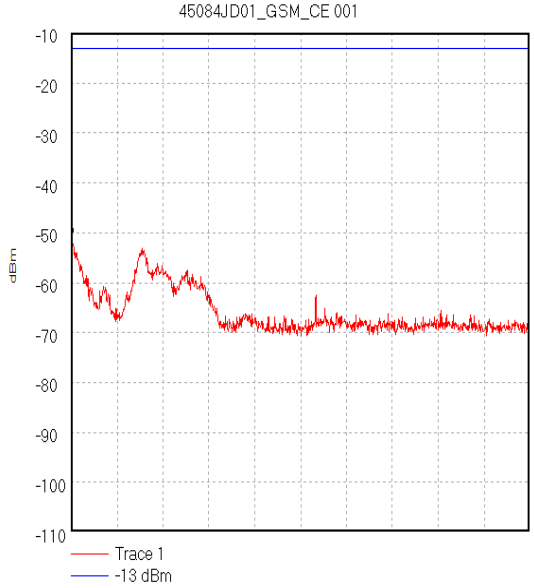
8.7. Transmitter Out of Band Emissions: Section 2.1051/24.238

8.7.1. The EUT was configured as for conducted emissions measurements as described in Section 9 of this report.

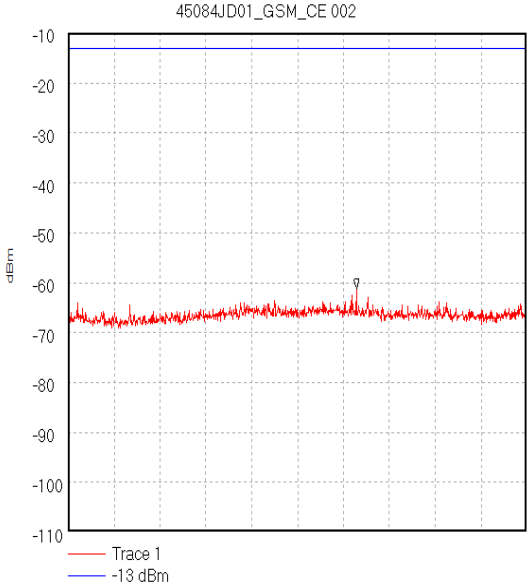
8.7.2. Tests were performed to identify the maximum transmitter conducted emission levels.

Result: Bottom Channel

Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
1849.0	-21.5	-13.0	8.5	Complied

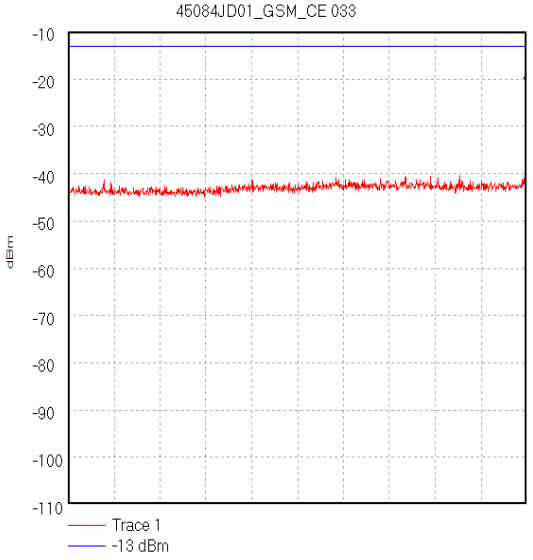


Start 1.0 MHz; Stop 30.0 MHz
Ref -10 dBm; Ref Offset 40.5 dB; 10 dB/div
RBW 10.0 kHz; VBW 10.0 kHz; Att 0 dB; Swp 880.0 mS
Peak 1.0 MHz, -51.16 dBm
Display Line: -13 dBm;
08/08/2003 14:10:26

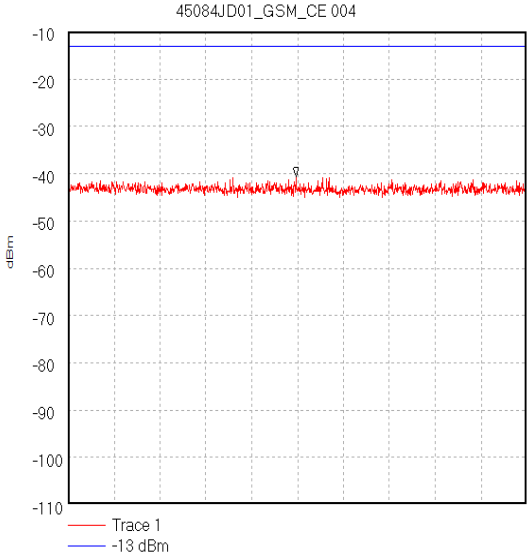


Start 30.0 MHz; Stop 1.0 GHz
Ref -10 dBm; Ref Offset 41.9 dB; 10 dB/div
RBW 10.0 kHz; VBW 10.0 kHz; Att 0 dB; Swp 30.0 S
Peak 640.022222 MHz, -61.16 dBm
Display Line: -13 dBm;
08/08/2003 14:12:21

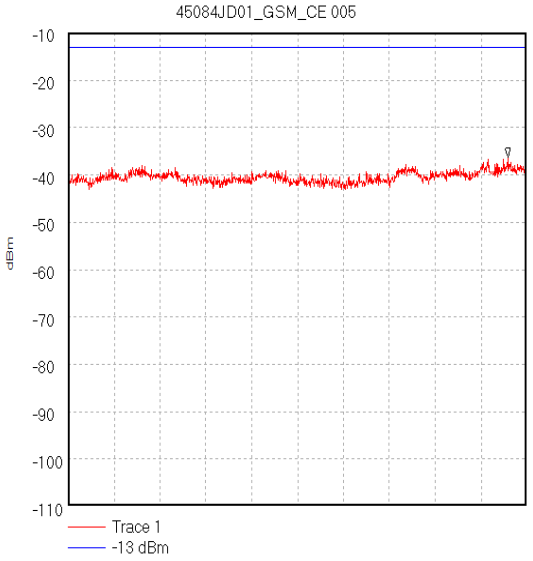
Transmitter Out of Band Emissions Bottom Channel (Continued)



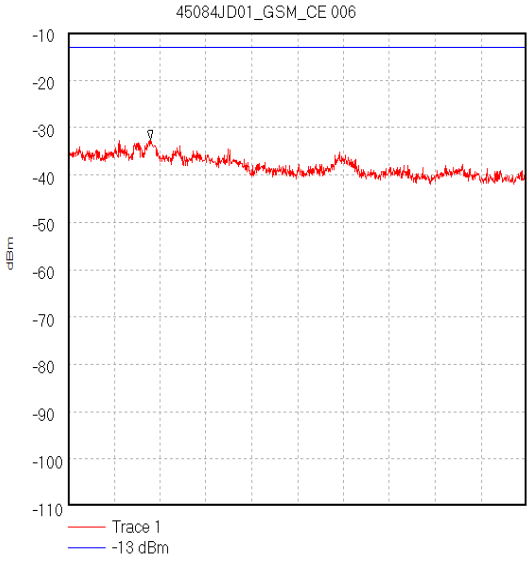
Start 1.0 GHz; Stop 1.849 GHz
Ref -10 dBm; Ref Offset 42.5 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 1.849 GHz, -21.5 dBm
Display Line: -13 dBm;
08/08/2003 15:08:19



Start 1.911 GHz; Stop 2.0 GHz
Ref -10 dBm; Ref Offset 42.6 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 1.955203 GHz, -40.7 dBm
Display Line: -13 dBm;
08/08/2003 14:14:51

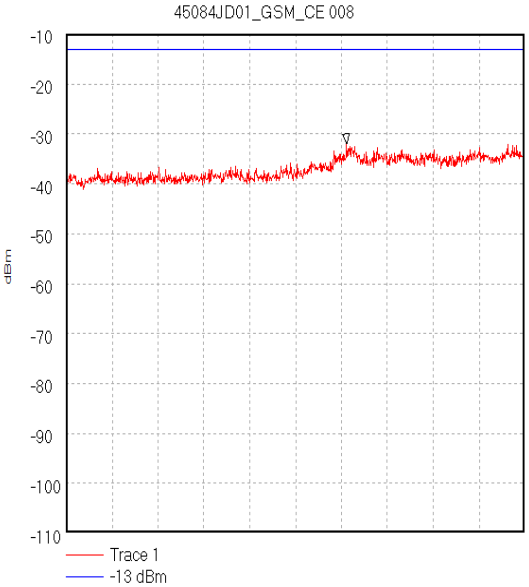


Start 2.0 GHz; Stop 5.0 GHz
Ref -10 dBm; Ref Offset 44.0 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 4.876667 GHz, -36.28 dBm
Display Line: -13 dBm;
08/08/2003 14:15:25

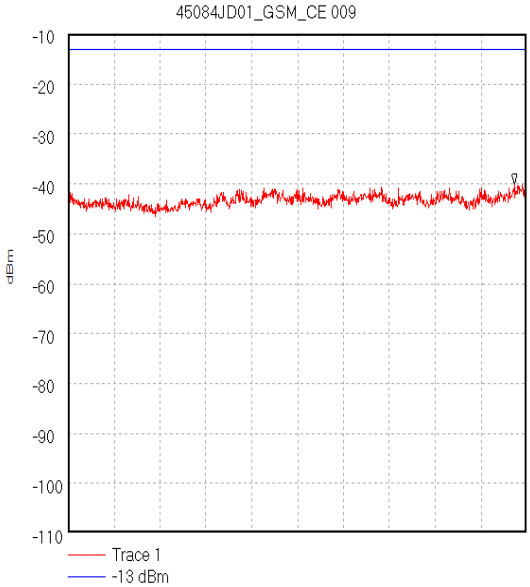


Start 5.0 GHz; Stop 10.0 GHz
Ref -10 dBm; Ref Offset 45.8 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 5.9 GHz, -32.57 dBm
Display Line: -13 dBm;
08/08/2003 14:16:37

Transmitter Out of Band Emissions Bottom Channel (Continued)



Start 10.0 GHz; Stop 15.0 GHz
Ref -10 dBm; Ref Offset 47.0 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 13.055556 GHz, -31.99 dBm
Display Line: -13 dBm;
08/08/2003 14:18:51



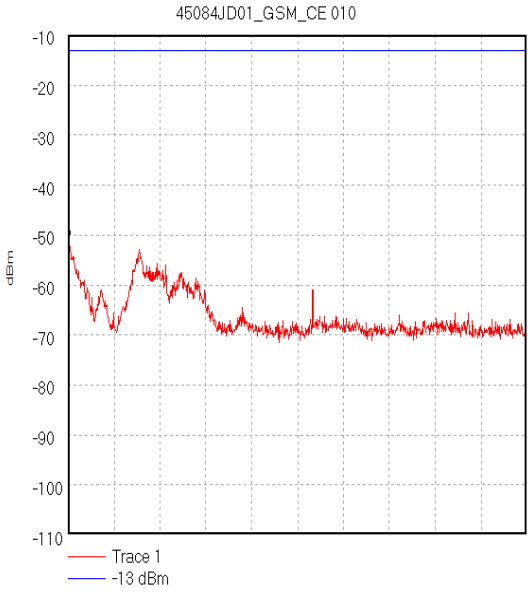
Start 15.0 GHz; Stop 20.0 GHz
Ref -10 dBm; Ref Offset 38.1 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 19.866667 GHz, -40.09 dBm
Display Line: -13 dBm;
08/08/2003 14:19:32

Test Of: **Nokia UK Ltd.**
NHL-10
To: **FCC Part 24**

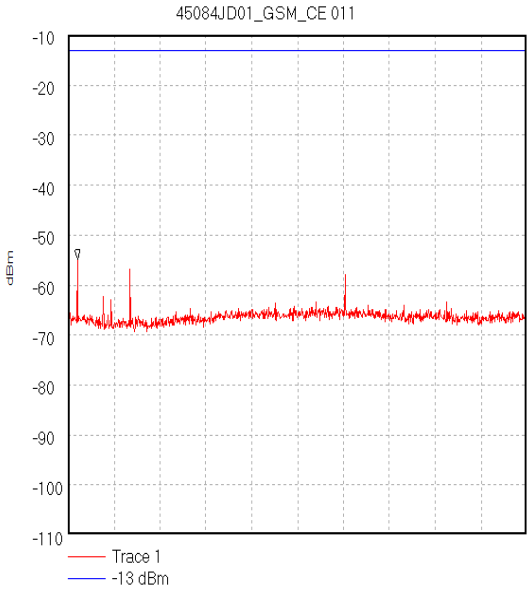
Transmitter Out of Band Emissions: Section 2.1051/24.238 (Continued)

Result: Middle Channel

Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
13094.4	-31.0	-13.0	18.1	Complied

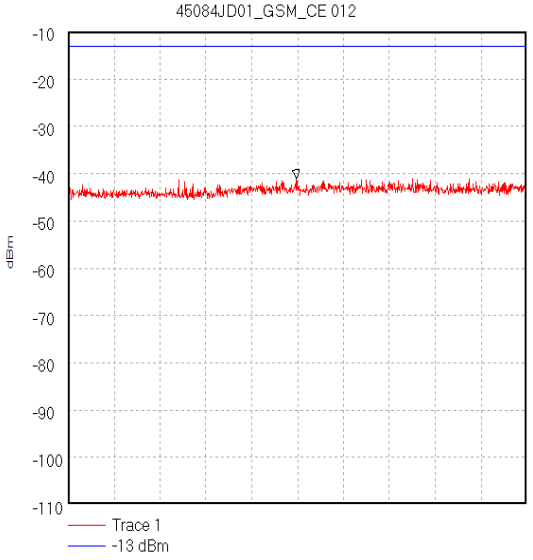


Start 1.0 MHz; Stop 30.0 MHz
Ref -10 dBm; Ref Offset 40.5 dB; 10 dB/div
RBW 10.0 kHz; VBW 10.0 kHz; Att 0 dB; Swp 880.0 mS
Peak 1.0 MHz, -51.11 dBm
Display Line: -13 dBm;
08/08/2003 14:20:49

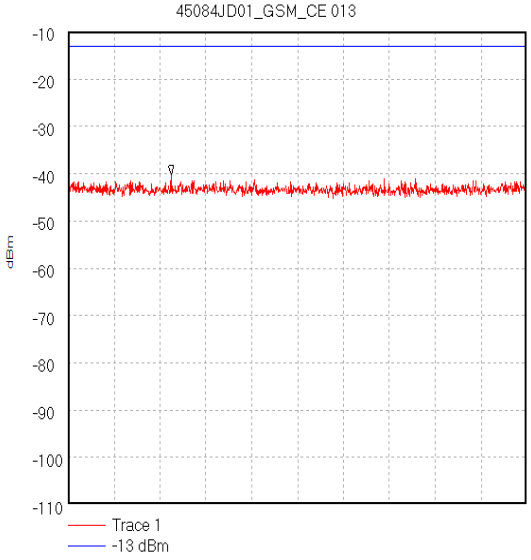


Start 30.0 MHz; Stop 1.0 GHz
Ref -10 dBm; Ref Offset 41.9 dB; 10 dB/div
RBW 10.0 kHz; VBW 10.0 kHz; Att 0 dB; Swp 30.0 S
Peak 49.4 MHz, -54.79 dBm
Display Line: -13 dBm;
08/08/2003 14:22:22

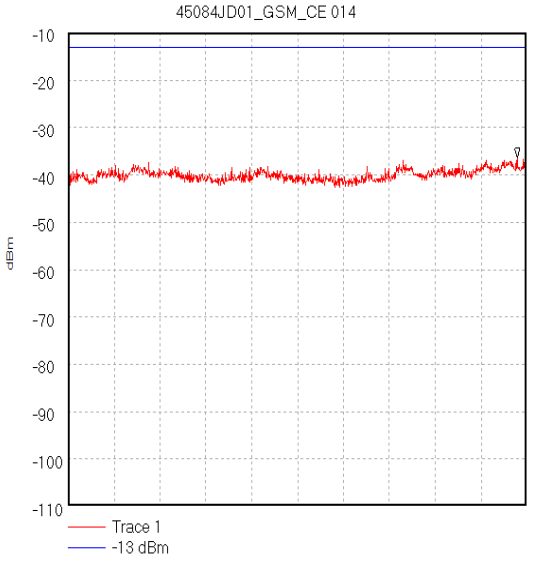
Transmitter Out of Band Emissions Middle Channel (Continued)



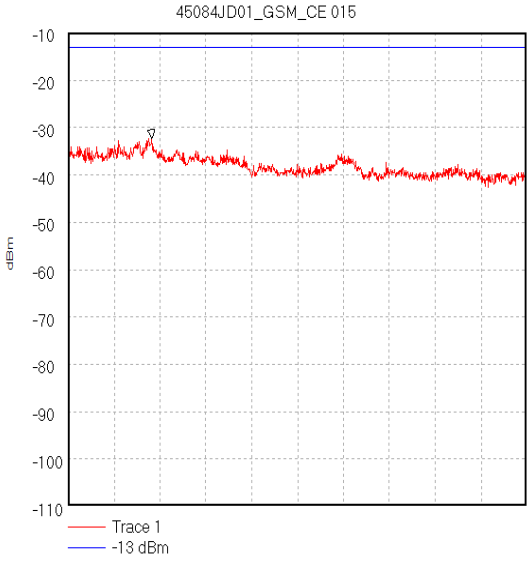
Start 1.0 GHz; Stop 1.849 GHz
Ref -10 dBm; Ref Offset 42.5 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 1.422613 GHz, -41.1 dBm
Display Line: -13 dBm;
08/08/2003 14:23:24



Start 1.911 GHz; Stop 2.0 GHz
Ref -10 dBm; Ref Offset 42.6 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 1.930976 GHz, -40.19 dBm
Display Line: -13 dBm;
08/08/2003 14:24:00

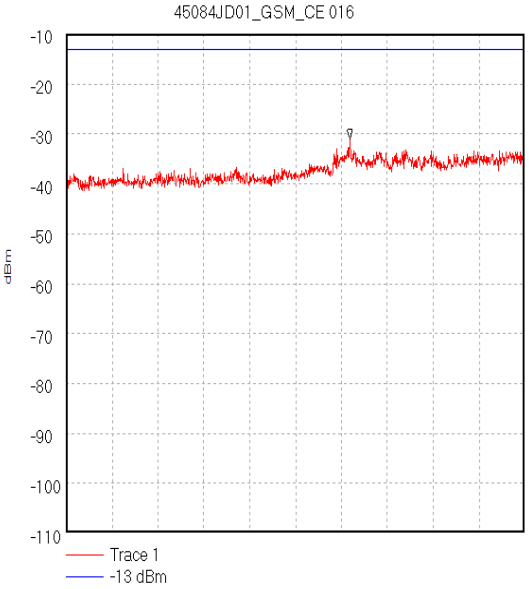


Start 2.0 GHz; Stop 5.0 GHz
Ref -10 dBm; Ref Offset 44.0 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 4.94 GHz, -36.38 dBm
Display Line: -13 dBm;
08/08/2003 14:24:38

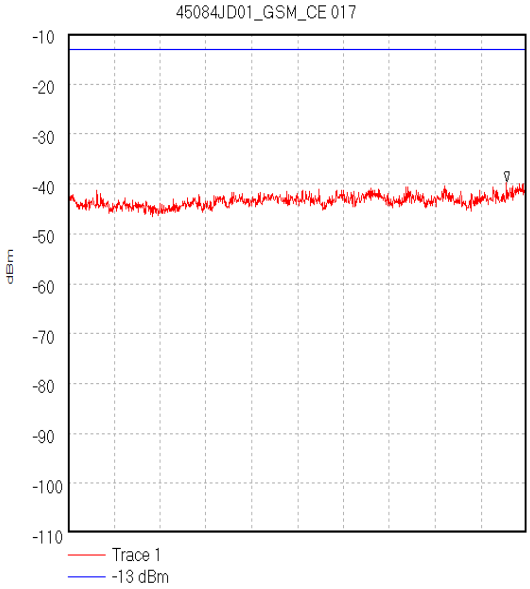


Start 5.0 GHz; Stop 10.0 GHz
Ref -10 dBm; Ref Offset 45.8 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 5.911111 GHz, -32.32 dBm
Display Line: -13 dBm;
08/08/2003 14:25:17

Transmitter Out of Band Emissions Middle Channel (Continued)



Start 10.0 GHz; Stop 15.0 GHz
Ref -10 dBm; Ref Offset 47.0 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 13.094444 GHz, -31.05 dBm
Display Line: -13 dBm;
08/08/2003 14:25:48



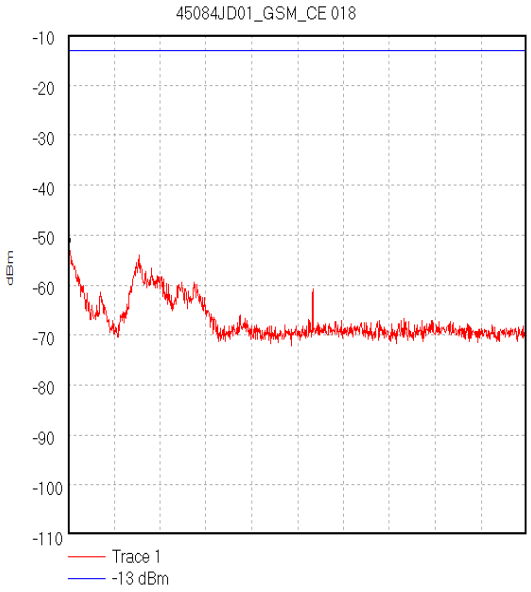
Start 15.0 GHz; Stop 20.0 GHz
Ref -10 dBm; Ref Offset 38.1 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 19.783333 GHz, -39.65 dBm
Display Line: -13 dBm;
08/08/2003 14:26:26

Test Of: **Nokia UK Ltd.**
NHL-10
To: **FCC Part 24**

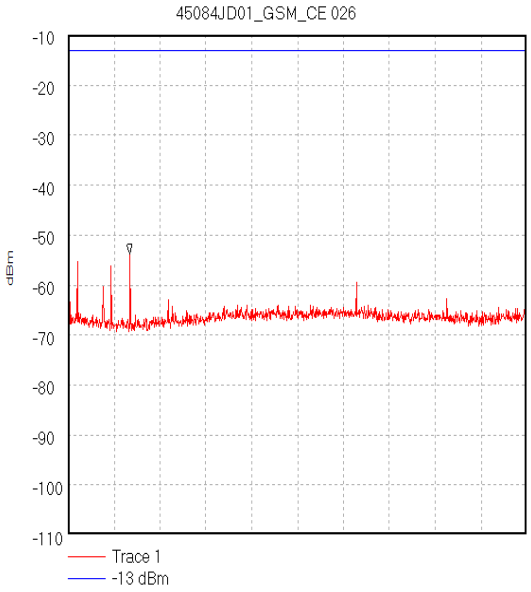
Transmitter Out of Band Emissions: Section 2.1051/24.238 (Continued)

Result: Top Channel

Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
3819.6	-33.3	-13.0	20.3	Complied

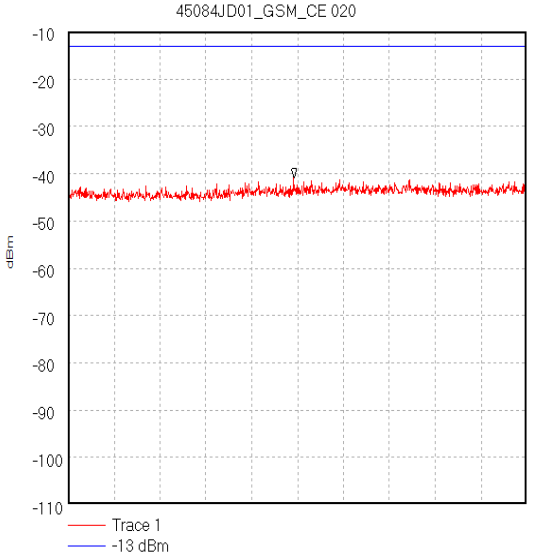


Start 1.0 MHz; Stop 30.0 MHz
Ref -10 dBm; Ref Offset 40.5 dB; 10 dB/div
RBW 10.0 kHz; VBW 10.0 kHz; Att 0 dB; Swp 880.0 mS
Peak 1.0 MHz, -52.68 dBm
Display Line: -13 dBm;
08/08/2003 14:27:15

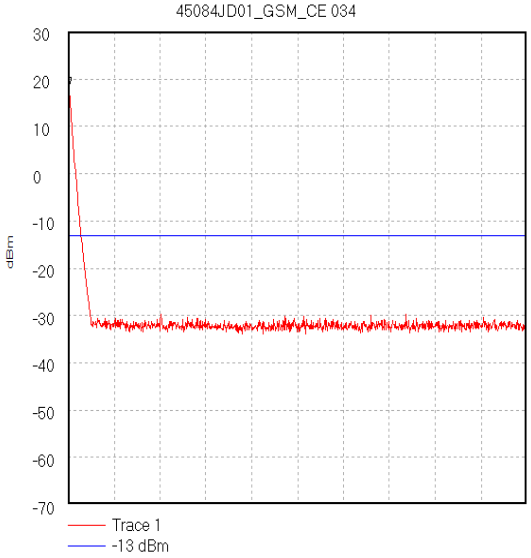


Start 30.0 MHz; Stop 1.0 GHz
Ref -10 dBm; Ref Offset 41.9 dB; 10 dB/div
RBW 10.0 kHz; VBW 10.0 kHz; Att 0 dB; Swp 30.0 S
Peak 160.411111 MHz, -53.75 dBm
Display Line: -13 dBm;
08/08/2003 14:37:00

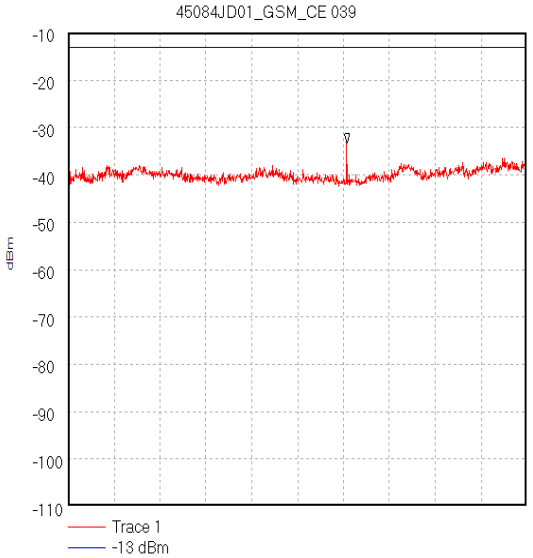
Transmitter Out of Band Emissions Top Channel (Continued)



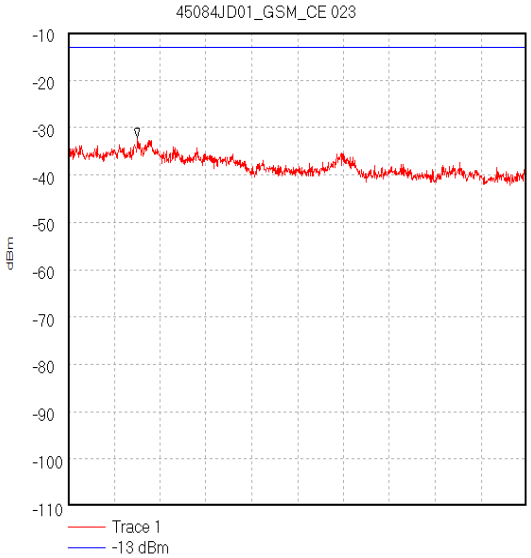
Start 1.0 GHz; Stop 1.849 GHz
Ref -10 dBm; Ref Offset 42.5 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 1.417897 GHz, -40.95 dBm
Display Line: -13 dBm;
08/08/2003 14:31:13



Start 1.911 GHz; Stop 2.0 GHz
Ref 30 dBm; Ref Offset 42.6 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 1.911099 GHz, 18.43 dBm
Display Line: -13 dBm;
08/08/2003 15:10:23

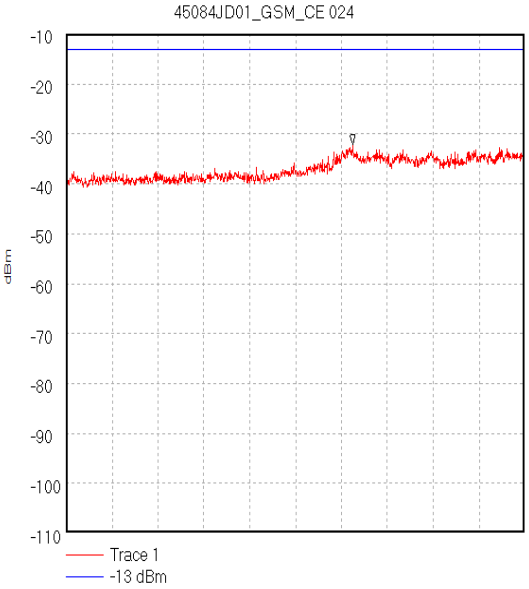


Start 2.0 GHz; Stop 5.0 GHz
Ref -10 dBm; Ref Offset 44.0 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 3.823333 GHz, -33.28 dBm
Display Line: -13 dBm;
08/08/2003 15:19:00

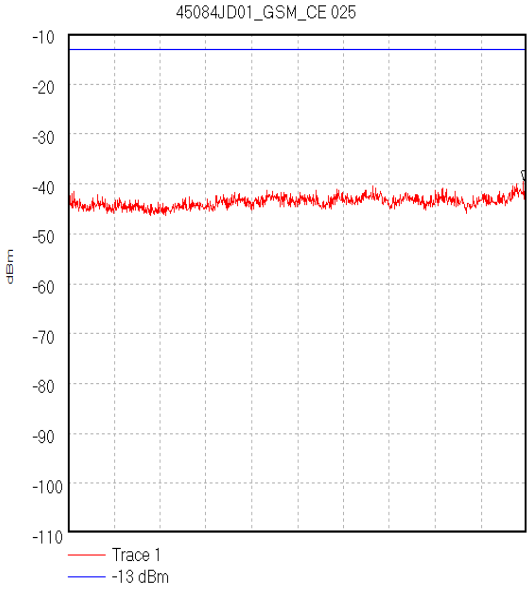


Start 5.0 GHz; Stop 10.0 GHz
Ref -10 dBm; Ref Offset 45.8 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 5.755556 GHz, -32.14 dBm
Display Line: -13 dBm;
08/08/2003 14:33:38

Transmitter Out of Band Emissions Top Channel (Continued)



Start 10.0 GHz; Stop 15.0 GHz
Ref -10 dBm; Ref Offset 47.0 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 13.122222 GHz, -32.09 dBm
Display Line: -13 dBm;
08/08/2003 14:34:20



Start 15.0 GHz; Stop 20.0 GHz
Ref -10 dBm; Ref Offset 38.1 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 19.966667 GHz, -39.43 dBm
Display Line: -13 dBm;
08/08/2003 14:35:13

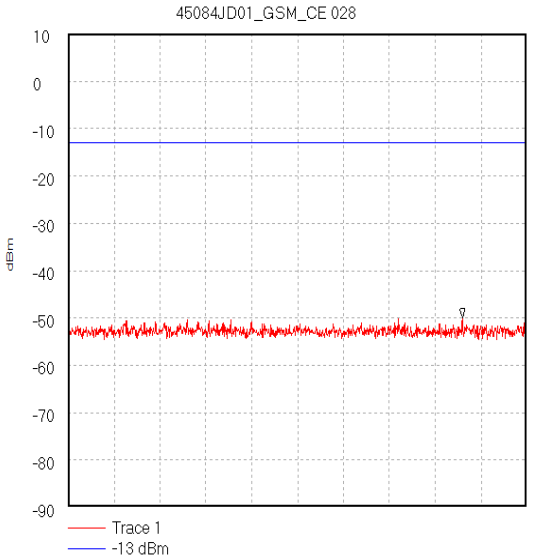
Transmitter Out of Band Emissions: Section 2.1051/24.238 (Continued)

1st 1MHz block immediately outside adjacent frequency block.

First Band: 1911 to 1912 MHz

100 kHz Strip Number	Peak Power (nW/100 kHz)	100 kHz Strip Number	Peak Power (nW/100 kHz)
1	114.2882	6	66.3745
2	92.6882	7	65.6147
3	79.6162	8	67.1431
4	77.2682	9	63.6797
5	68.7070	10	49.3175
Total Peak Power:		744.6923 nW/MHz	

Band (MHz)	Peak Power (dBm/MHz)	Limit (dBm/MHz)	Margin (dB)	Status
1911 to 1912	-31.3	-13.0	18.3	Complied



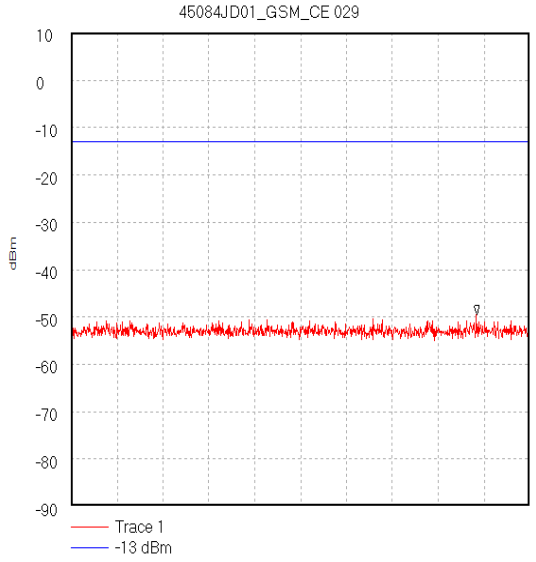
Transmitter Out of Band Emissions: Section 2.1051/24.238 (Continued)

2nd 1MHz block immediately outside adjacent frequency block.

First Band: 1912 to 1913 MHz

100 kHz Strip Number	Peak Power (nW/100 kHz)	100 kHz Strip Number	Peak Power (nW/100 kHz)
1	55.7187	6	42.3644
2	59.0203	7	42.8549
3	53.2110	8	36.3916
4	60.8135	9	33.8844
5	48.9780	10	31.2609
Total Peak Power:		464.4977 nW/MHz	

Band (MHz)	Peak Power (dBm/MHz)	Limit (dBm/MHz)	Margin (dB)	Status
1912 to 1913	-33.3	-13.0	20.3	Complied



Start 1.912 GHz; Stop 1.913 GHz
Ref 10 dBm; Ref Offset 42.6 dB; 10 dB/div
RBW 100.0 kHz; VBW 100.0 kHz; Att 0 dB; Swp 20.0 mS
Peak 1.912884 GHz, -49.49 dBm
Display Line: -13 dBm;
08/08/2003 14:47:10

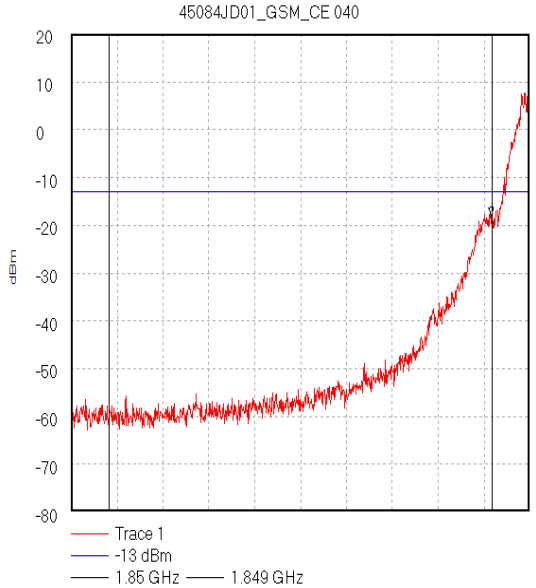
8.8.Transmitter Conducted Emissions at Block Edges: Section 2.1051/24.238

8.8.1. The EUT was configured as for conducted emissions measurements as described in Section 9 of this report.

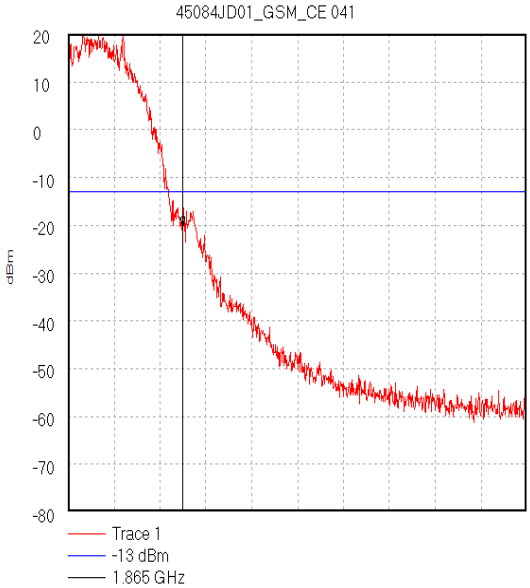
8.8.2. Tests were performed to identify the maximum emissions level at the band edges of the frequency block that the EUT will operate over.

Results: Block A

Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
1850	-18.2	-13.0	5.2	Complied
1865	-20.2	-13.0	7.2	Complied



Start 1.8489 GHz; Stop 1.8501 GHz
Ref 20 dBm; Ref Offset 42.5 dB; 10 dB/div
RBW 3.0 kHz; VBW 3.0 kHz; Att 0 dB; Swp 400.0 mS
Marker 1.85 GHz, -18.16 dBm
Display Line: -13 dBm;
08/08/2003 15:24:58

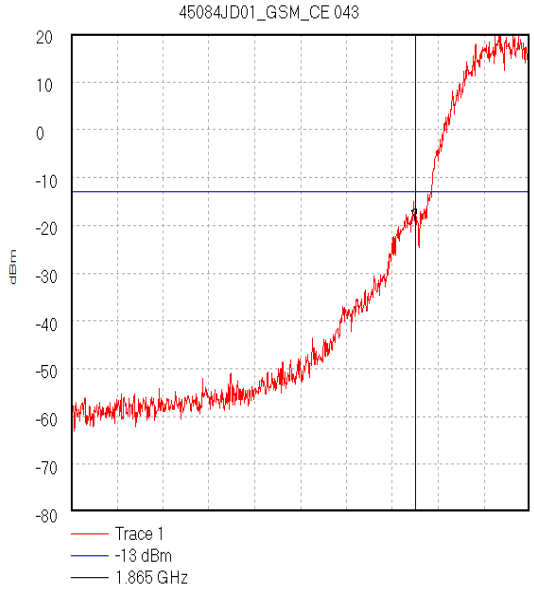


Start 1.86475 GHz; Stop 1.86575 GHz
Ref 20 dBm; Ref Offset 42.5 dB; 10 dB/div
RBW 3.0 kHz; VBW 3.0 kHz; Att 0 dB; Swp 340.0 mS
Marker 1.865 GHz, -20.19 dBm
Display Line: -13 dBm;
08/08/2003 15:27:18

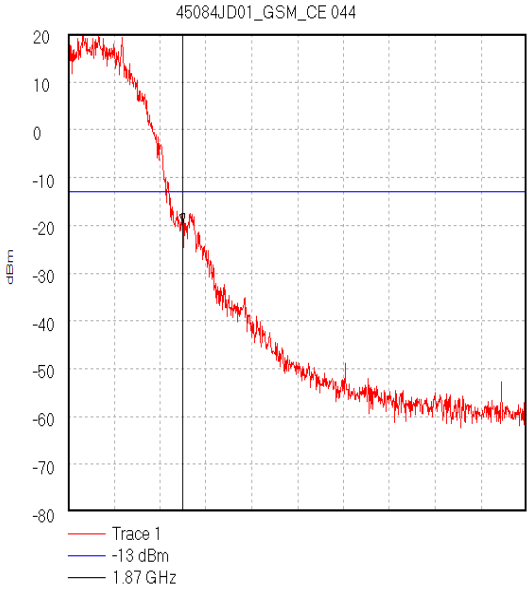
Transmitter Conducted Emissions at Block Edges: Section 2.1051/24.238 (Continued)

Results: Block D

Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
1865	-18.7	-13.0	5.7	Complied
1870	-19.6	-13.0	6.6	Complied



Start 1.86425 GHz; Stop 1.86525 GHz
Ref 20 dBm; Ref Offset 42.5 dB; 10 dB/div
RBW 3.0 kHz; VBW 3.0 kHz; Att 0 dB; Swp 340.0 mS
Marker 1.865 GHz, -18.69 dBm
Display Line: -13 dBm;
08/08/2003 15:29:16

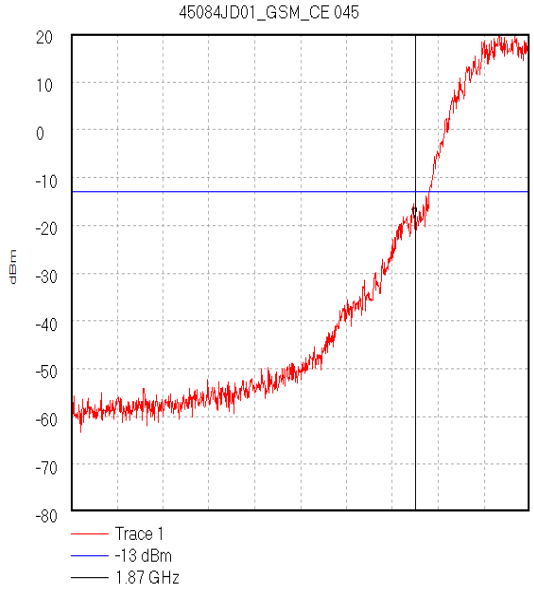


Start 1.86975 GHz; Stop 1.87075 GHz
Ref 20 dBm; Ref Offset 42.5 dB; 10 dB/div
RBW 3.0 kHz; VBW 3.0 kHz; Att 0 dB; Swp 340.0 mS
Marker 1.87 GHz, -19.61 dBm
Display Line: -13 dBm;
08/08/2003 15:30:49

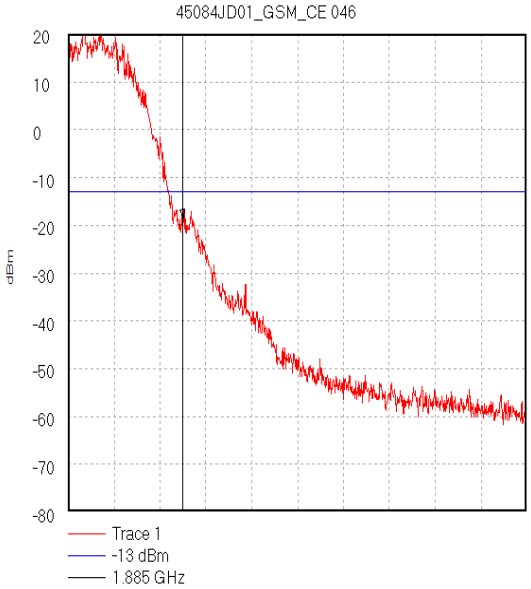
Transmitter Conducted Emissions at Block Edges: Section 2.1051/24.238 (Continued)

Results: Block B

Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
1870	-18.3	-13.0	5.3	Complied
1885	-18.6	-13.0	5.6	Complied



Start 1.86925 GHz; Stop 1.87025 GHz
Ref 20 dBm; Ref Offset 42.5 dB; 10 dB/div
RBW 3.0 kHz; VBW 3.0 kHz; Att 0 dB; Swp 340.0 mS
Marker 1.87 GHz, -18.34 dBm
Display Line: -13 dBm;
08/08/2003 15:32:30

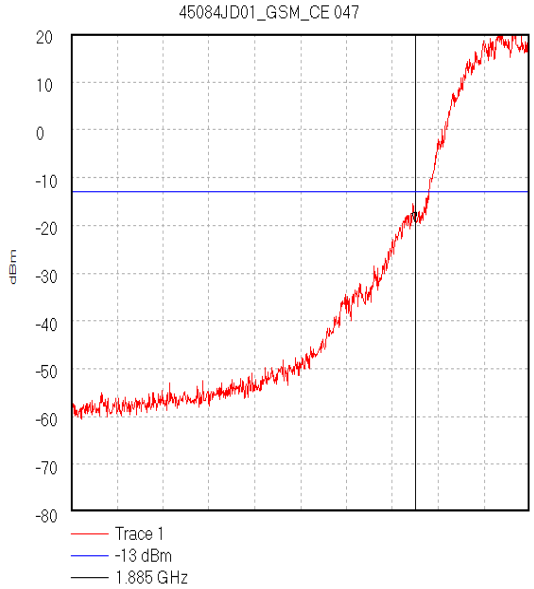


Start 1.88475 GHz; Stop 1.88575 GHz
Ref 20 dBm; Ref Offset 42.5 dB; 10 dB/div
RBW 3.0 kHz; VBW 3.0 kHz; Att 0 dB; Swp 340.0 mS
Marker 1.885 GHz, -18.59 dBm
Display Line: -13 dBm;
08/08/2003 15:34:16

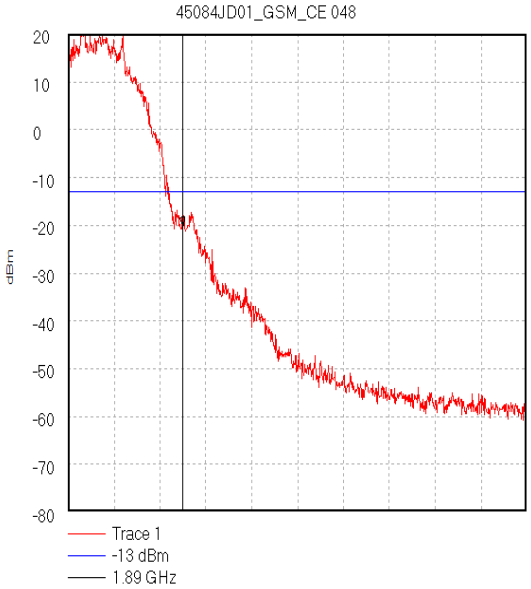
Transmitter Conducted Emissions at Block Edges: Section 2.1051/24.238 (Continued)

Results: Block E

Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
1885	-19.2	-13.0	6.2	Complied
1890	-20.3	-13.0	7.3	Complied



Start 1.88425 GHz; Stop 1.88525 GHz
Ref 20 dBm; Ref Offset 42.5 dB; 10 dB/div
RBW 3.0 kHz; VBW 3.0 kHz; Att 0 dB; Swp 340.0 mS
Marker 1.885 GHz, -19.2 dBm
Display Line: -13 dBm;
08/08/2003 15:36:52

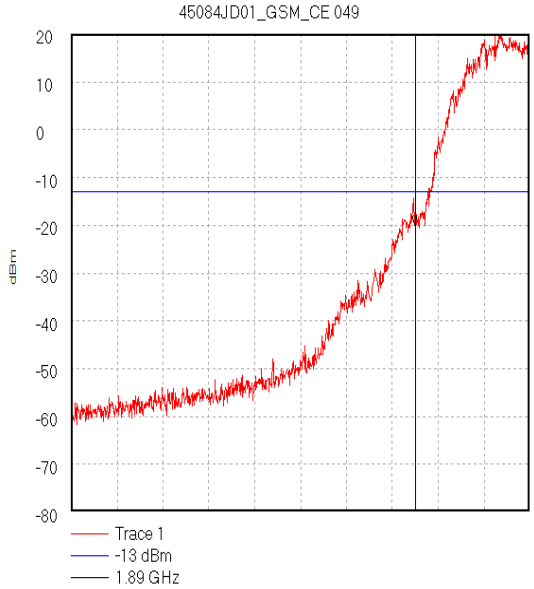


Start 1.88975 GHz; Stop 1.89075 GHz
Ref 20 dBm; Ref Offset 42.5 dB; 10 dB/div
RBW 3.0 kHz; VBW 3.0 kHz; Att 0 dB; Swp 340.0 mS
Marker 1.89 GHz, -20.29 dBm
Display Line: -13 dBm;
08/08/2003 15:39:07

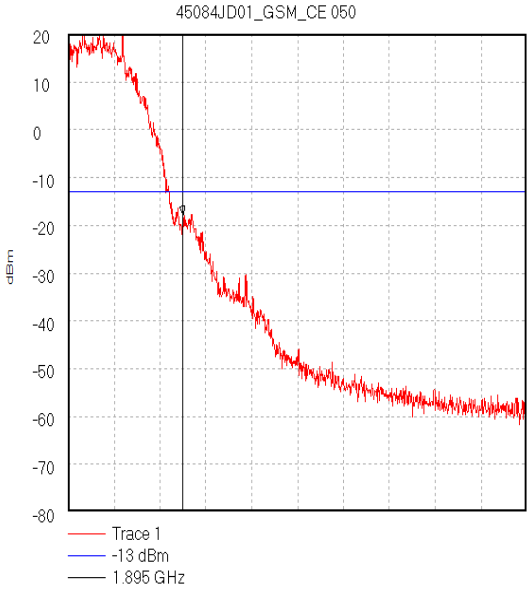
Transmitter Conducted Emissions at Block Edges: Section 2.1051/24.238 (Continued)

Results: Block F

Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
1890	-20.0	-13.0	7.0	Complied
1895	-18.0	-13.0	5.0	Complied



Start 1.88925 GHz; Stop 1.89025 GHz
Ref 20 dBm; Ref Offset 42.5 dB; 10 dB/div
RBW 3.0 kHz; VBW 3.0 kHz; Att 0 dB; Swp 340.0 mS
Marker 1.89 GHz, -19.99 dBm
Display Line: -13 dBm;
08/08/2003 15:41:03

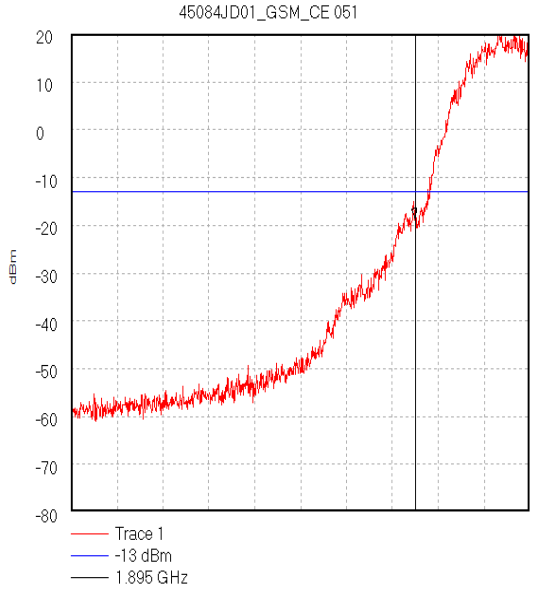


Start 1.89475 GHz; Stop 1.89575 GHz
Ref 20 dBm; Ref Offset 42.5 dB; 10 dB/div
RBW 3.0 kHz; VBW 3.0 kHz; Att 0 dB; Swp 340.0 mS
Marker 1.895 GHz, -17.98 dBm
Display Line: -13 dBm;
08/08/2003 15:43:00

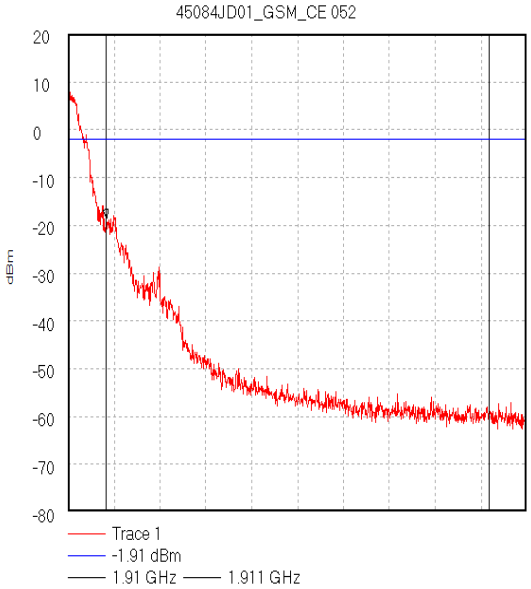
Transmitter Conducted Emissions at Block Edges: Section 2.1051/24.238 (Continued)

Results: Block C

Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
1895	-18.5	-13.0	5.5	Complied
1910	-18.6	-13.0	5.6	Complied



Start 1.89425 GHz; Stop 1.89525 GHz
Ref 20 dBm; Ref Offset 42.5 dB; 10 dB/div
RBW 3.0 kHz; VBW 3.0 kHz; Att 0 dB; Swp 340.0 mS
Marker 1.895 GHz, -18.49 dBm
Display Line: -13 dBm;
08/08/2003 15:45:05



Start 1.9099 GHz; Stop 1.9111 GHz
Ref 20 dBm; Ref Offset 42.5 dB; 10 dB/div
RBW 3.0 kHz; VBW 3.0 kHz; Att 0 dB; Swp 400.0 mS
Marker 1.91 GHz, -18.64 dBm
Display Line: -1.91 dBm;
08/08/2003 15:48:06

8.9. Transmitter Out of Band Emissions: Section 2.1053/24.238

8.9.1. The EUT was configured as for transmitter radiated emissions testing as described in Section 9 of this report.

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

Result: Bottom Channel

Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
3700.4	-22.4	-13.0	9.4	Complied

Result: Middle Channel

Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
3759.6	-22.8	-13.0	9.8	Complied

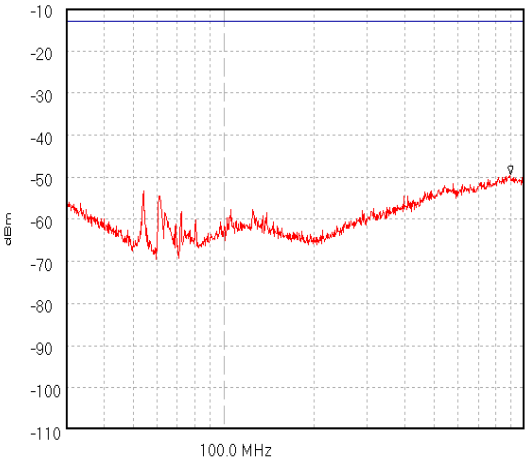
Result: Top Channel

Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
3819.6	-23.1	-13.0	10.1	Complied

**Note: Two emissions were detected at 1.962 GHz and 10.69 GHz (refer to plots 45084JD01_FCC_RE1 002 and 45084JD01_FCC_RE1 011 respectively). After further investigation of both emissions it was found that the emission at 1.962 GHz emanated from the CMU 200 Radio Communications Tester being used as support equipment and not from the EUT whilst the emission at 10.69 GHz was an ambient signal which was still present with the power removed from both the EUT and support equipment. Both these emissions were, therefore, disregarded.*

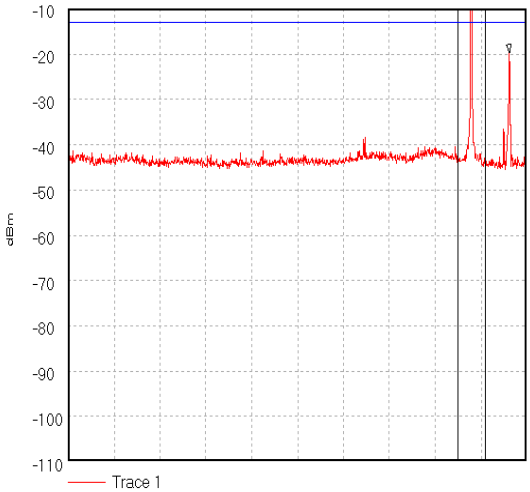
Transmitter Out of Band Emissions (Continued)

45084JD01_FCC_RE1 001



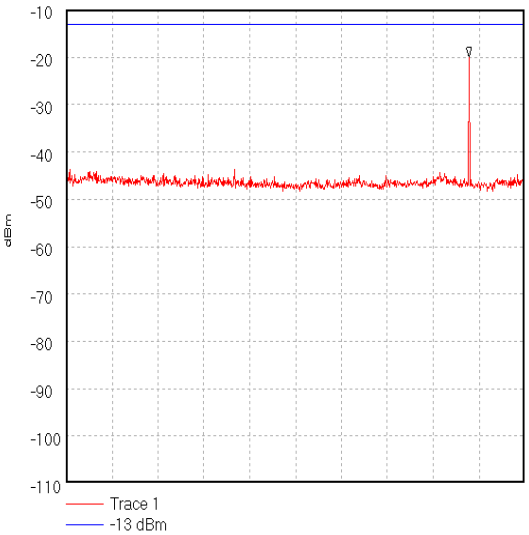
Start 30.0 MHz; Stop 1.0 GHz - Log Scale
Ref -10 dBm; Ref Offset 10.0 dB; 10 dB/div
RBW 120.0 kHz; VBW 100.0 kHz; Att 10 dB; Swp 380.0 mS
Peak 896.647 MHz, -49.43 dBm
Display Line: -13 dBm; ; Limit Test Passed
Transducer Factors: A1037
8/1/2003 10:20:24 AM

45084JD01_FCC_RE1 002



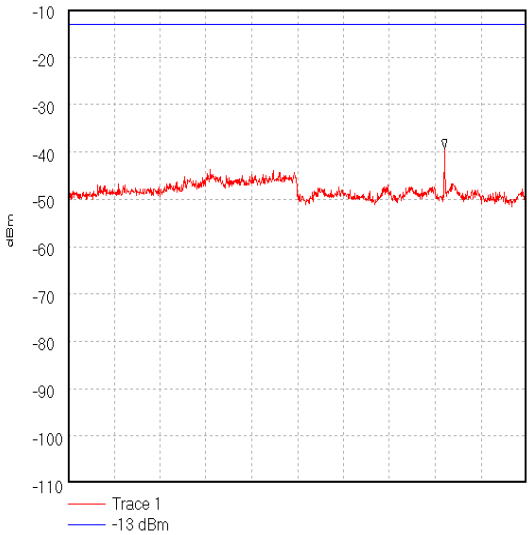
Start 1.0 GHz; Stop 2.0 GHz
Ref -10 dBm; Ref Offset 37.0 dB; 10 dB/div
RBW 1000.0 kHz; VBW 1.0 MHz; Att 10 dB; Swp 20.0 mS
Marker 1.962 GHz, -19.75 dBm
Display Line: -13 dBm; ; Limit Test Failed
8/1/2003 10:32:03 AM

45084JD01_FCC_RE1 003



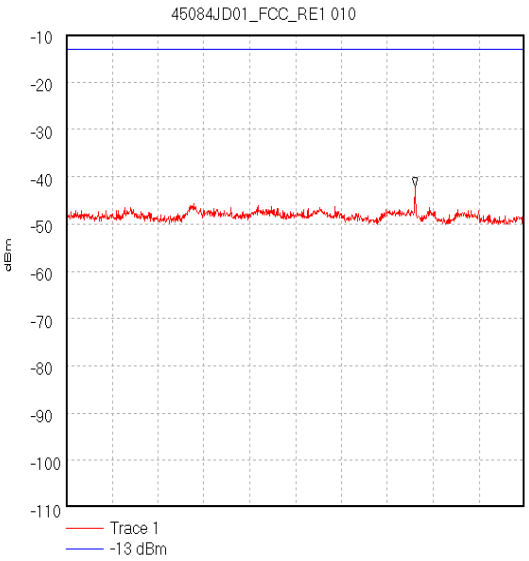
Start 2.0 GHz; Stop 4.0 GHz
Ref -10 dBm; Ref Offset 36.0 dB; 10 dB/div
RBW 1000.0 kHz; VBW 1.0 MHz; Att 10 dB; Swp 20.0 mS
Peak 3.758 GHz, -19.97 dBm
Display Line: -13 dBm; ; Limit Test Passed
8/1/2003 10:41:38 AM

45084JD01_FCC_RE1 009

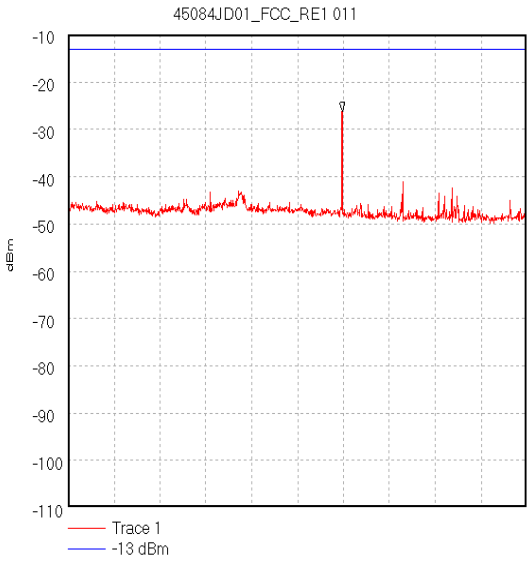


Start 4.0 GHz; Stop 6.0 GHz
Ref -10 dBm; Ref Offset 34.0 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 5.642222 GHz, -39.4 dBm
Display Line: -13 dBm;
05/08/2003 14:34:50

Transmitter Out of Band Emissions (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 7.522222 GHz, -42.09 dBm
Display Line: -13 dBm;
05/08/2003 14:39:45



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, -26.12 dBm
Display Line: -13 dBm;
05/08/2003 14:49:47

8.10. Transmitter Radiated Emissions At Band Edges: Section 2.1053/24.238

8.10.1. The EUT was configured as for transmitter radiated emissions testing described in Section 9 of this report.

8.10.2. 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

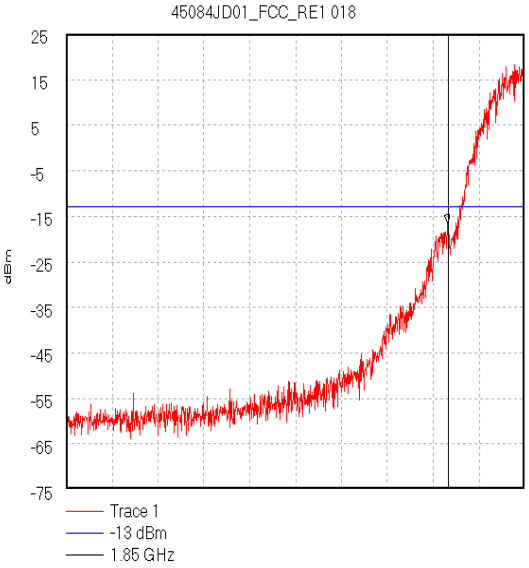
Frequency (MHz)	Spurious Emission (dBm)	Limit (dBm)	Margin (dB)	Result
1850	-16.6	-13.0	3.6	Complied

Top Band Edge

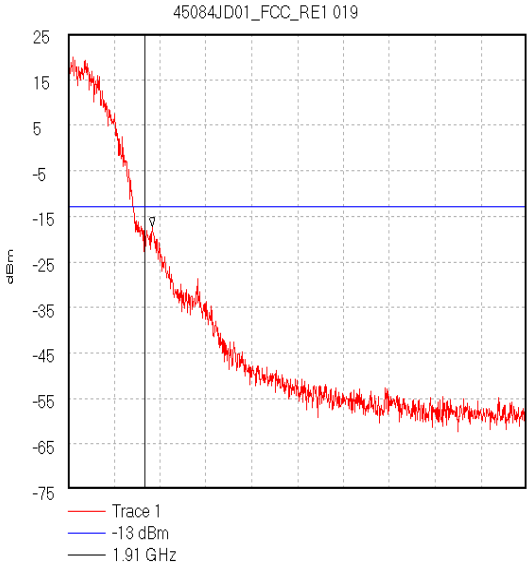
Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
1910	-18.9	-13.0	5.9	Complied

Note: The position of marker on plots 45084JD01_FCC_RE1 018 and 45084JD01_FCC_RE1 019 are incorrectly shown due to a glitch in the software used to transpose the on-screen image on the spectrum analyser to the PC holding the soft copy of the plot. Additionally the marker frequencies are incorrectly shown at 1.849999 GHz and 1.91002 GHz and not at 1.850 GHz and 1.910 GHz respectively as they should be. It is confirmed that the measurements were made at the actual band edge frequencies of 1.850 GHz and 1.910 GHz and the results given in the table above are valid for those frequencies.

Transmitter Radiated Emissions At Band Edges (Continued)



Start 1.849 GHz; Stop 1.8502 GHz
Ref 25 dBm; Ref Offset 25.2 dB; 10 dB/div
RBW 3.0 kHz; VBW 10.0 kHz; Att 20 dB; Swp 400.0 mS
Marker 1.849999 GHz, -16.46 dBm
Display Line: -13 dBm;
Transducer Factors: 8to12G_Horn
05/08/2003 16:53:43



Start 1.9098 GHz; Stop 1.911 GHz
Ref 25 dBm; Ref Offset 25.2 dB; 10 dB/div
RBW 3.0 kHz; VBW 10.0 kHz; Att 20 dB; Swp 400.0 mS
Marker 1.91002 GHz, -17.35 dBm
Display Line: -13 dBm;
Transducer Factors: 8to12G_Horn
05/08/2003 16:58:02

9. Measurement Methods

9.1. Effective Isotropic Radiated Power (EIRP)

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

The EIRP was measured with the EUT arranged on a non-conducting turn table on a standard test site compliant with ANSI C63.4 – 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 EIRP was measured using a spectrum analyser.

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

Once the final amplitude (maximised) had been obtained, the EUT was substituted with a 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 EIRP was calculated as:-

EIRP = Signal Generator Level - Cable Loss + Antenna Gain

All measurements were performed using broadband Horn antennas.

Effective Isotropic Radiated Power (EIRP) (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 EIRP of the signal generator was calculated using the above formulae. The recorded delta was added to the calculated EIRP to obtain the substituted EUT EIRP.

The test equipment settings for EIRP measurements were as follows:

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

9.2. Frequency Stability

The EUT was situated within an environmental test chamber and connected directly to the GSM test set via an 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 and ensure they remained within specified operating parameters.

Measurements were made on the top, and bottom channels using the GSM test set described in Appendix 1.

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.

Once the environmental chamber had reached thermal equilibrium, the nominal frequency of the EUT was measured and recorded. The recorded frequency was compared to the applicants declared operating frequency band edges.

In order to show compliance, the measured frequency must remain within the declared frequency band.

The reported data shows the nominal frequency drift and its margin from the band edge. If this margin is positive, the result is compliant. If it goes negative, the result is a none compliance. There is also a frequency graph presented offering the frequency variation around nominal frequency.

9.3. 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 an access point on the EUT provided by the manufacturer.

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 EUT is a PCS phone, no modulation input port was available. A call was thus set up 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.

9.4. Conducted Emissions Measurements:

The test was performed in a laboratory environment.

Spurious emission measurements at the access point as provided by the manufacturer 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 access point on the EUT provided by the manufacturer 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 1 MHz 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.

Conducted Emissions Measurements (Continued)

The test equipment settings for were as follows:

Receiver Function	Settings
Detector Type:	Peak
Mode:	Max Hold
Bandwidth:	1 MHz >1 GHz
Bandwidth:	10 kHz <1 GHz
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.

9.5. 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

9.6. 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 EIRP was calculated as:-

EIRP = Signal Generator Level - Cable Loss + Antenna Gain

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 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

9.7. Idle Mode 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.

Idle Mode 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 1GHz	Final Measurements Above 1 GHz
Detector Type:	Peak	Quasi-Peak (CISPR)	Peak/Average
Mode:	Max Hold	Not applicable	Not applicable
Bandwidth:	(120 kHz < 1 GHz) (1 MHz > 1 GHz)	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

10. Measurement Uncertainty

10.1. 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.

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

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

10.4. 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
Conducted Block Edges	Not applicable	95%	+/- 1.2 dB
Effective Isotropic Radiated Power (EIRP)	Not applicable	95%	+/- 1.78 dB
Frequency Stability	Not applicable	95%	+/- 20 Hz
Minimum Bandwidth	Not applicable	95%	+/- 0.12 %
Occupied Bandwidth	1850 to 1910 MHz	95%	+/- 0.12 %
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

10.5. 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
A067	LISN	Rohde & Schwarz	ESH3-Z5	890603/002
A090	Narda Step Attenuator 0-60dB	Narda	743-60	01057
A1037	Chase Bilog Antenna	Chase EMC Ltd	CBL6112B	2413
A1141	HP 11691D	Hewlett Packerd	11691D	1212A02494
A197	Site 2 Controller SC144	Unknown	SC144	150720
A248	60 dB Variable Attenuator	Narda	743-60	01411
A254	WG 14 Microwave Horn	Flann Microwave	14240-20	139
A255	WG 16 Microwave Horn	Flann Microwave	16240-20	519
A259	Bilog Antenna	Chase	CBL6111	1513
A276	OATS Positioning Controller	Rohde & Schwarz	HCC	
A392	3 dB attenuator (9)	Suhner	6803.17.B	None
A428	WG 12 horn	Flann	12240-20	134
A430	WG 18 horn	Flann	18240-20	425
A433	WG 27 Straight	Flann	27441	None
C1001	Cable	Rosenberger	FA210A1020M30309	003
C1071	3m Rosenberger Cable	Rosenberger	FA21A1030M5050	Not Stated
C1077	1m Rosenberger Cable	Rosenberger	FA210A1010M5050	28462-2
C1079	Rosenberger 1m Cable	Rosenberger	FA210A1010M5050	28462-1
C1082	Rosenberger Cable 2m	Rosenberger	FA210A1020M5050	28463-1
C202	Rosenberger cable	Rosenberger	UFA 210A-1-1180-70X70	1543

Test Equipment Used (Continued)

RFI No.	Instrument	Manufacturer	Type No.	Serial No.
C453	Cable	Rosenberger	RG142XX-001-RFIB	C453-10081998
C457	Cable	Rosenberger	RG142XX-002-RFIB	C457-10081998
C461	Cable	Rosenberger	UFA210A-1-1182-704704	98H0305
C499	Cable	Rosenberger	FA210A1020M30309	001
C564	C564-N-2	Rosenberger	UFA 210A-1-0787-70x70	96L0226
E013	PCN Environmental Chamber	Sanyo	ATMOS chamber	None
G085	Generator	Hewlett Packard	83650L	3614A00104
M003	Spectrum Monitor	Rohde & Schwarz	EZM	883 580/008
M023	ESVP Receiver	Rohde & Schwarz	ESVP	872 991/027
M072	FSM Spectrum Analyser	Rohde & Schwarz	FSM	862 967/010 (RF) & 863 912/048 (Display)
M080	TestLab DMM	METEX	M8181B	AA163868
M115	Temperature/ Humidity Meter	RS Components	212-146	None
M127	Spectrum Analyser	Rohde & Schwarz	FSEB 30	842 659/016
M139	Digital Multimeter	Fluke	11	65830028
M141	Power Meter	Boonton	4220	33402BE
M150	Power Sensor	Boonton	51072	28473
M173	Turntable Controller	R.H.Electrical Services	RH351	3510020
S009	D.C. PSU	Farnell	PDD3502A	174
S201	Site 1	RFI	1	
S202	Site 2	RFI	2	S202-15011990
S207	Site 7	RFI	7	S202-15011990
S212	Site 12	RFI	12	

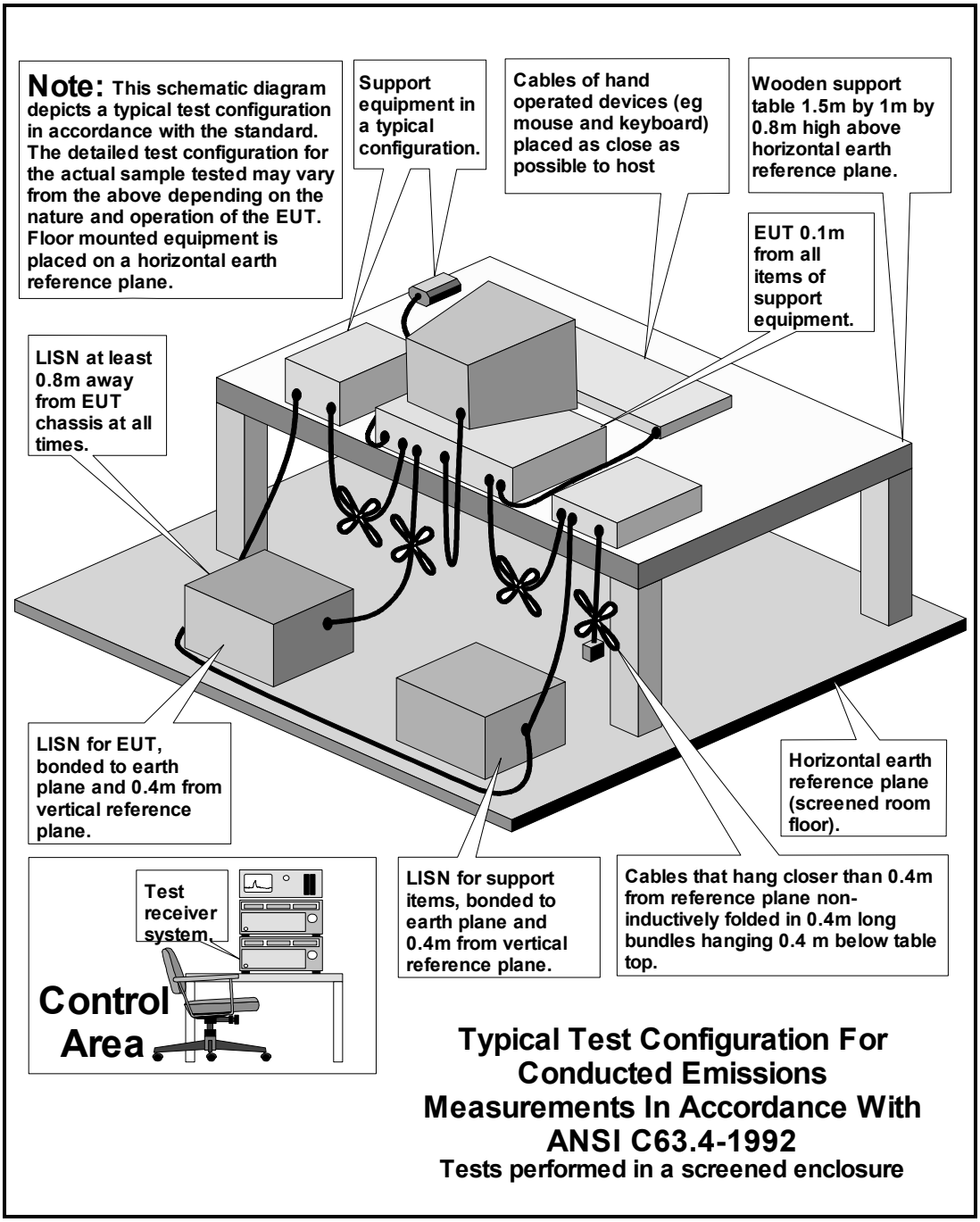
NB In accordance with UKAS requirements, all the measurement equipment is on a calibration schedule.

Appendix 2. Test Configuration Drawings

This appendix contains the following drawings:

Drawing Reference Number	Title
DRG\45084JD01\EMICON	Test configuration for measurement of conducted emissions
DRG\45084JD01\EMIRAD	Test configuration for measurement of radiated emissions

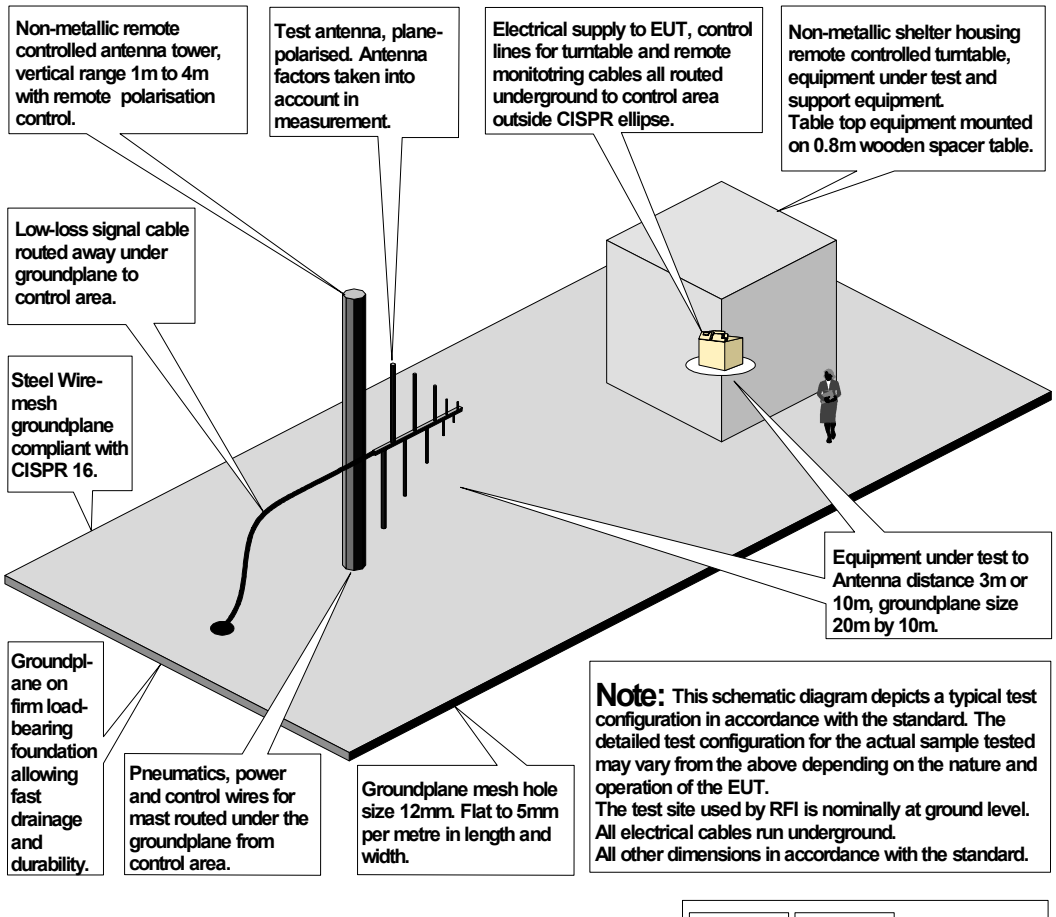
DRG\45084JD01\EMICON



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

Tests performed in a screened enclosure

DRG\45084JD01\EMIRAD



Note: This schematic diagram depicts a typical test configuration in accordance with the standard. The detailed test configuration for the actual sample tested may vary from the above depending on the nature and operation of the EUT.
The test site used by RFI is nominally at ground level.
All electrical cables run underground.
All other dimensions in accordance with the standard.

Test Configuration For Radiated Emissions Measurements

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

Groundplane Earthed

Control room outside CISPR ellipse