TEST REPORT
FROM
RADIO FREQUENCY
INVESTIGATION LTD.

Test Of: Nokia Mobile Phones.
NHM-10 Model 3620

To: FCC Part 22 and 24

Test Report Serial No:
RFI/MPTB2/RP45157JD01A

Supersedes Test Report Serial No:
RFI/MPTB1/RP45157JD01A

This Test Report Is Issued Under The Authority Of Richard Jacklin, Operations Director: 	**Checked By:** 
Tested By: 	**Release Version No:** **PDF01**
Issue Date: 02 October 2003	**Test Dates: 19 August 2003 to 11 September 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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Table of Contents

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
Model Name or Number:	3620
Unique Type Identification:	NHM-10
IMEI Number:	004400211684517
FCC ID Number:	QFXNHM-10X
Country of Manufacture:	Finland
Date of Receipt:	20 August 2003

2.2. Description Of EUT

The equipment under test is a dual-band (850, 1900) camera mobile handset, which supports IR and Bluetooth (The Bluetooth part has been tested and is covered by RFI report RP45157JD01B).

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 lithium ion battery)	3.8V
Declared Battery End Point Voltage	4.2V (max), 3.45V (min)
Power Supply Requirement: (AC Battery Charger)	Nominal 115V, 60 Hz AC Mains supply
Intended Operating Environment:	Within GSM network coverage
Equipment Category:	Portable
Type of Unit:	Transceiver
Weight:	130 g
Dimensions:	130 x 55 x 23 mm
Interface Ports:	Charger & Accessory
Highest Fundamental Frequency	2480.0 MHz

Part 22

Transmit Frequency Range	824.0 MHz to 848.0 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	869.0 to 894.0 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)	31.9 dBm		

Part 24

Transmit Frequency Range	1850.0 MHz to 1910.0 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	1930.0 MHz to 1990.0 MHz		
Receive Channels Tested	**Channel ID**	**Channel Number**	**Channel Frequency (MHz)**
	Bottom	512	1930.2
	Middle	660	1960.0
	Top	810	1989.8
Maximum Power Output (EIRP)	32.8 dBm		

2.5. Accessories

The following accessories were used during testing:

Description:	Li-ion Battery
Brand Name:	Nokia
Model Name or Number:	BL-5C
Serial Number:	231804
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:	067530339979114 95A10001959
Cable Length And Type:	175 cm
Connected to Port:	Charger

Description:	Headset
Brand Name:	Nokia
Model Name or Number:	HDC-5
Serial Number:	0271467
Cable Length And Type:	108 cm
Connected to Port:	Accessory

Description:	Memory Card
Brand Name:	Nokia
Model Name or Number:	DTS-16
Serial Number:	HB288016MM1
Cable Length And Type:	N/A
Connected to Port:	Memory Card

2.6. 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

3. Test Specification, Methods And Procedures

3.1. Test Specifications

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.

Reference:	FCC Part 15 Subpart B: 2001 (Section 15.107 and 15.109)
Title:	Code of Federal Regulations, Part 15 (47CFR15) Radio Frequency Devices: Radio Frequency Devices.
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/TIA-603-B-2002
Land Mobile Communications Equipment, Measurements and performance Standards

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

During testing, the EUT was powered by a nominal 3.8 V DC Battery and connected to a 115 V 60 Hz AC Mains charger.

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 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 10º 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.

Receiver/Idle Modes:

Testing was performed with the call terminated from the GSM Test Simulator and the phone left in its Receiver/Idle modes.

5.3. Configuration And Peripherals

The EUT was tested in the following configuration:

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

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

6. Summary Of Test Results

Part 22

Range Of Measurements	Specification Reference	Port Type	Compliancy Status
Receiver/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
Receiver/Idle Mode Radiated Emissions	C.F.R. 47 FCC Part 15: 2002 Section 15.109	Antenna	Complied
Transmitter Effective Radiated Power (ERP)	C.F.R. 47 FCC Part 22: 2002 Section 22.913(a)	Antenna	Complied
Transmitter Frequency Stability (Temperature Variation)	C.F.R. 47 FCC Part 22: 2002 Section 22.355	Antenna	Complied
Transmitter Frequency Stability (Voltage Variation)	C.F.R. 47 FCC Part 22: 2002 Section 22.355	Antenna	Complied
Transmitter Occupied Bandwidth	C.F.R. 47 FCC Part 22: 2002 Section 2.1049(i)	Antenna	Complied
Transmitter Radiated Out of Band Emissions	C.F.R. 47 FCC Part 22: 2002 Section 2.1053/22.917	Antenna	Complied
Radiated Band Edges	C.F.R. 47 FCC Part 2: 2002 Section 2.1053	Antenna	Complied

Summary Of Test Results (Continued)

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	Antenna	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	Complied
Transmitter Frequency Stability (Voltage Variation)	C.F.R. 47 FCC Part 24: 2002 Section 24.235	Antenna	Complied
Transmitter Occupied Bandwidth	C.F.R. 47 FCC Part 24: 2002 Section 24.238	Antenna	Complied
Transmitter Out of Band Emissions	C.F.R. 47 FCC Part 24: 2002 Section 2.1053/24.238	Antenna	Complied
Radiated Band Edges	C.F.R. 47 FCC Part 2: 2002 Section 2.1053/24.238	Antenna	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 12 for details of measurement uncertainties.

8. Test Results FCC Part 22

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 emission levels on the AC mains line of the AC Charger whilst connected to the EUT.

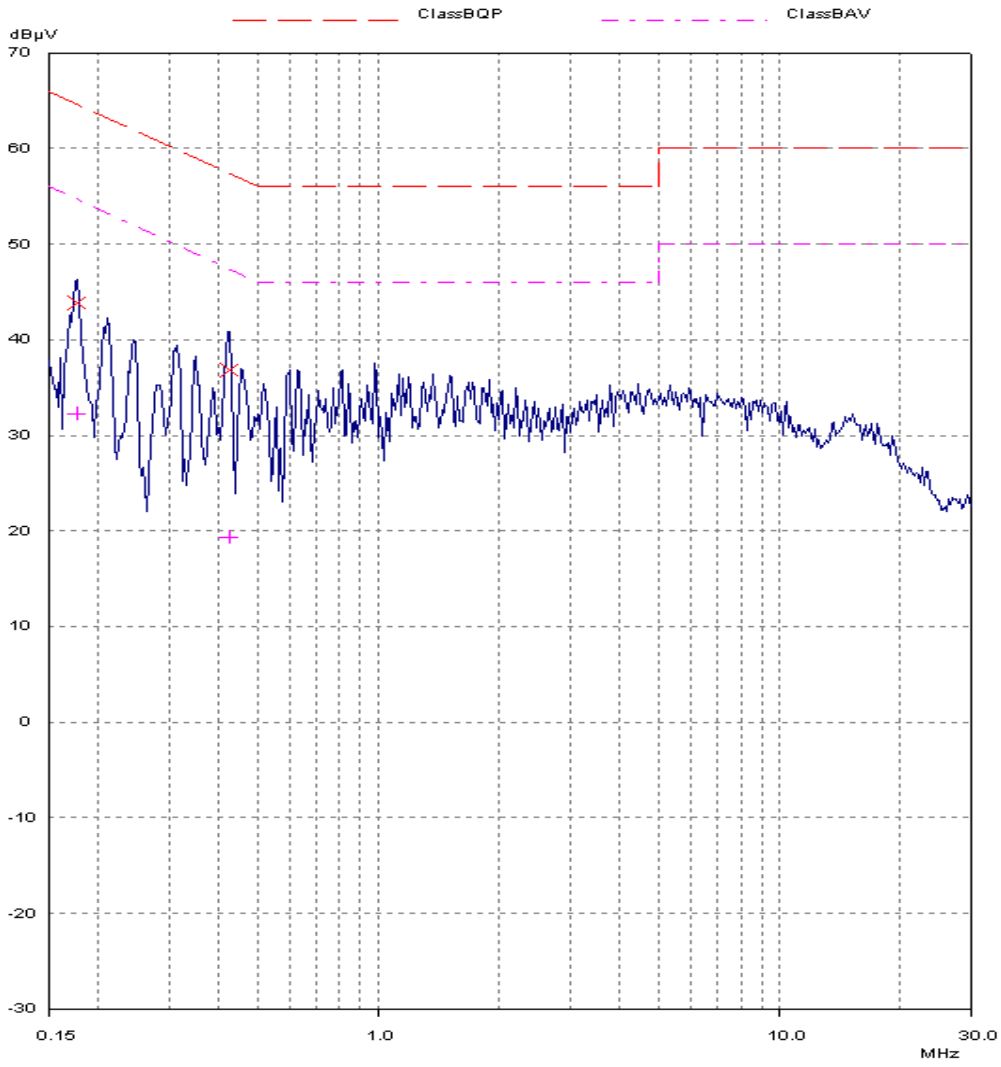
Results: Quasi-Peak Detector Measurements On Live And Neutral Lines

Frequency (MHz)	Line	Q-P Level (dBμV)	Q-P Limit (dBμV)	Margin (dB)	Result
0.17359	Live	44.5	64.8	20.3	Complied
0.46136	Live	35.1	56.7	21.6	Complied

Results: Average Detector Measurements On Live And Neutral Lines

Frequency (MHz)	Line	Av. Level (dBμV)	Av. Limit (dBμV)	Margin (dB)	Result
0.17359	Live	31.6	54.8	23.2	Complied
0.46136	Neutral	28.2	46.7	18.5	Complied

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



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

8.2. Receiver/Idle Mode Radiated Spurious Emission: Section 15.109

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

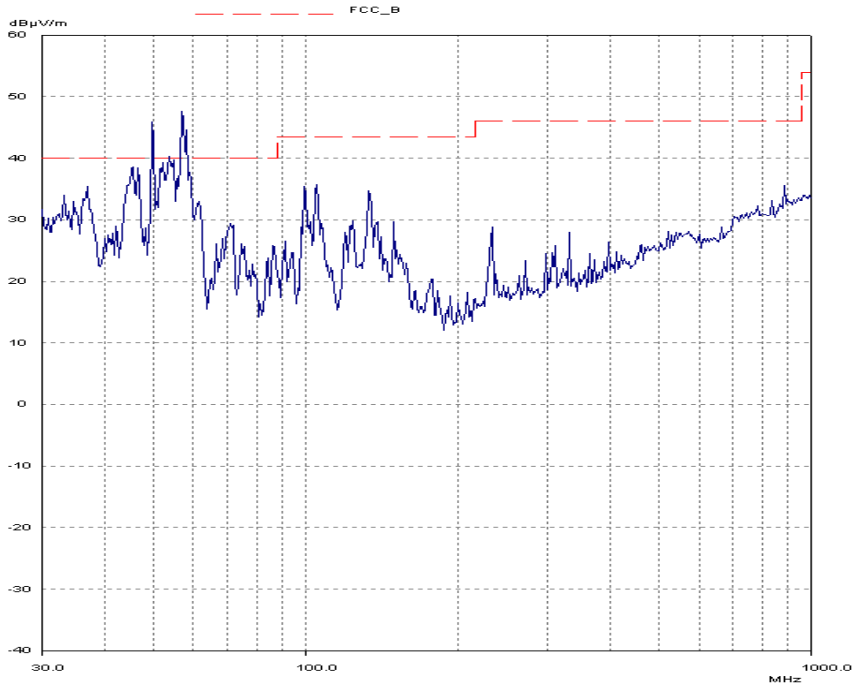
8.2.1.1. The EUT was configured as for radiated emissions testing as described in Section 9 of this report.

8.2.1.2. Tests were performed to identify the maximum radiated emissions levels while in receiver/idle mode.

Result:

Frequency (MHz)	Antenna. Polarity	Q-P Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
49.4738	Vert.	29.6	40.0	10.4	Complied
56.8615	Vert.	27.0	40.0	13.0	Complied

Note: these plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables. It can be seen in the tabulated data above that the final measurement on the emissions complies with the relevant limit.



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

Receiver/Idle Mode Radiated Spurious Emission: Section 15.109 (Continued)

8.2.2. Electric Field Strength Measurements (Frequency Range 1.0 to 20.0 GHz)

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

8.2.2.2. Tests were performed to identify the maximum receiver or idle mode radiated emission level present in the band 30 MHz to 5 x the highest fundamental frequency.

Result:

Highest Peak Level

Frequency (GHz)	Antenna. Polarity (H/V)	Peak Detector Level (dBµV)	Antenna Factor	Cable Loss	Actual Peak Level (dBµV/m)	Peak Level (dBµV/m)	Peak Margin (dB)	Result
3.9980	Vert.	17.9	23.4	1.6	42.9	74.0	31.1	Complied

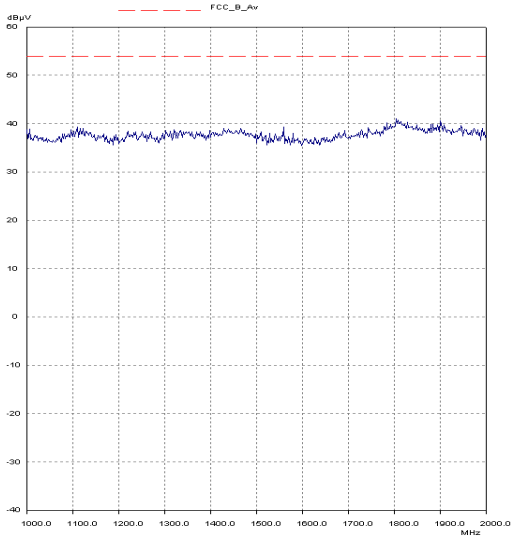
Note: There were no spurious emissions observed above the measurement analysers noise floor, as such the highest peak noise floor reading was recorded.

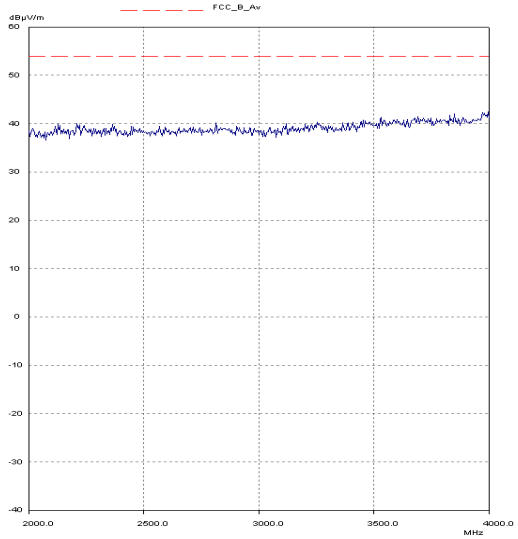
Highest Average Level:

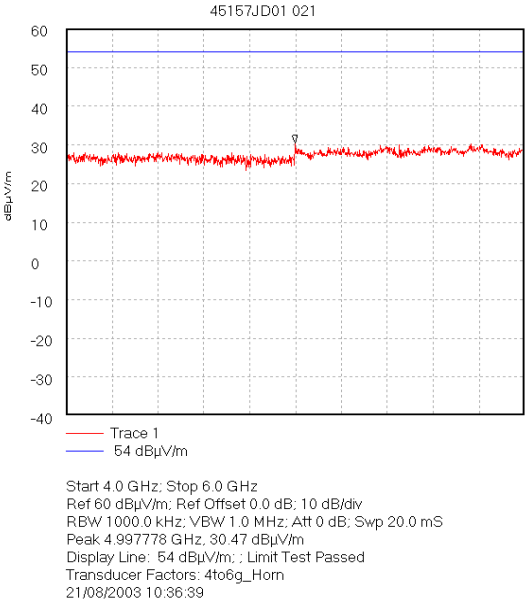
Frequency (GHz)	Antenna. Polarity (H/V)	Average Detector Level (dBµV)	Antenna Factor	Cable Loss	Actual Average Level (dBµV/m)	Average Limit (dBµV/m)	Peak Margin (dB)	Result
3.9980	Vert.	17.88	23.4	1.6	33.32	54.0	20.68	Complied

Note: There were no spurious emissions observed above the measurement analysers noise floor, as such the highest average noise floor reading was recorded.

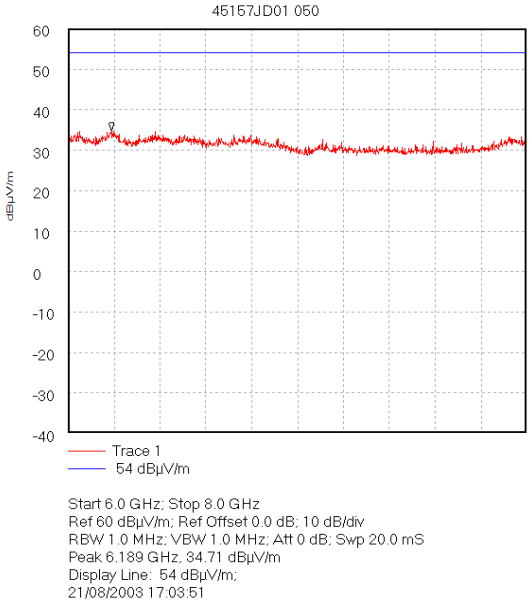
Idle Mode Radiated Spurious Emission: Section 15.109 (Continued)







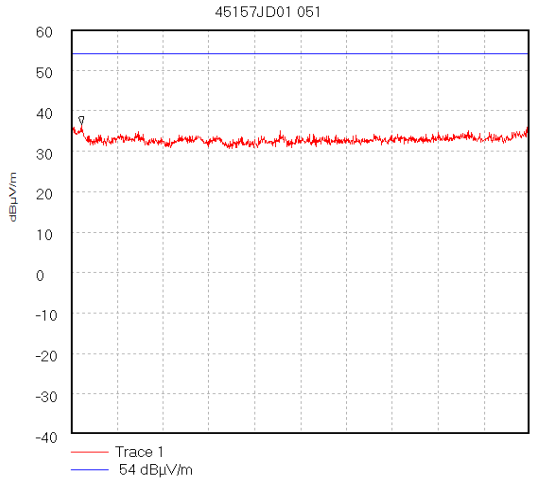
Start 4.0 GHz; Stop 6.0 GHz
Ref 60 dBµV/m; Ref Offset 0.0 dB; 10 dB/div
RBW 1000.0 kHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 4.997778 GHz, 30.47 dBµV/m
Display Line: 54 dBµV/m; ; Limit Test Passed
Transducer Factors: 4to6g_Horn
21/08/2003 10:36:39



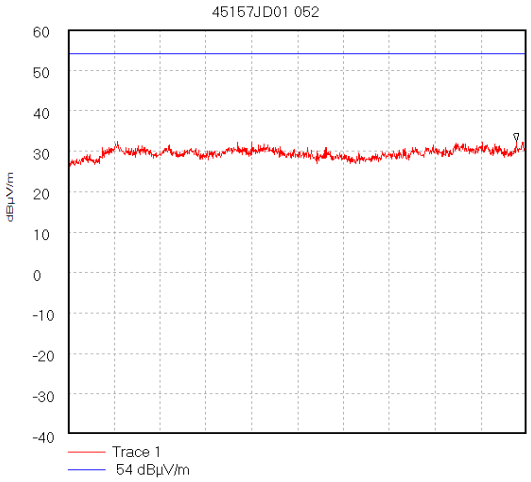
Start 6.0 GHz; Stop 8.0 GHz
Ref 60 dBµV/m; Ref Offset 0.0 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 6.189 GHz, 34.71 dBµV/m
Display Line: 54 dBµV/m;
21/08/2003 17:03:51

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

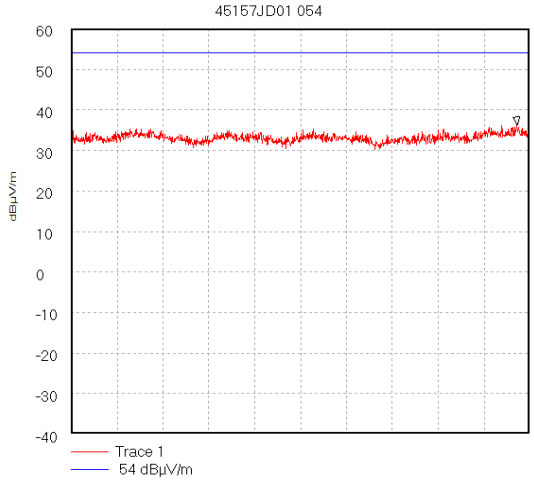
Idle Mode Radiated Spurious Emission: Section 15.109 (Continued)



Start 8.0 GHz; Stop 12.5 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 8.1 GHz, 36.57 dBµV/m
Display Line: 54 dBµV/m;
21/08/2003 17:06:16



Start 12.5 GHz; Stop 18.0 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 40.0 mS
Peak 17.878 GHz, 32.43 dBµV/m
Display Line: 54 dBµV/m;
21/08/2003 17:09:28



Start 18.0 GHz; Stop 20.0 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 19.944 GHz, 36.24 dBµV/m
Display Line: 54 dBµV/m;
21/08/2003 17:13:52

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

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

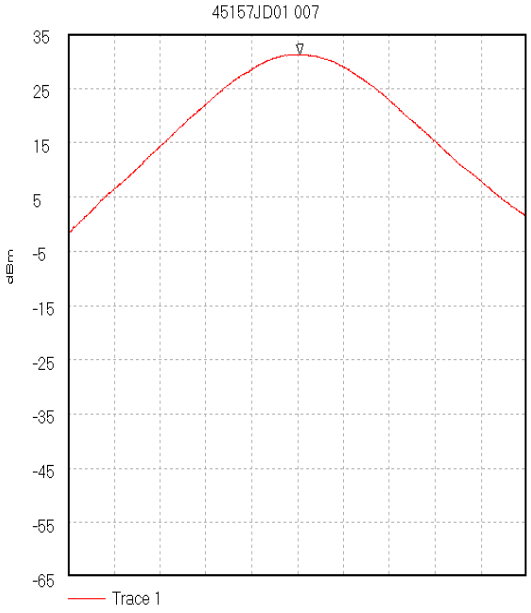
8.3.1. The EUT was configured as for Effective Radiated Power (ERP) as described in Section 9 of this report.

8.3.2. Tests were performed to identify the maximum effective radiated output power (ERP) from the EUT.

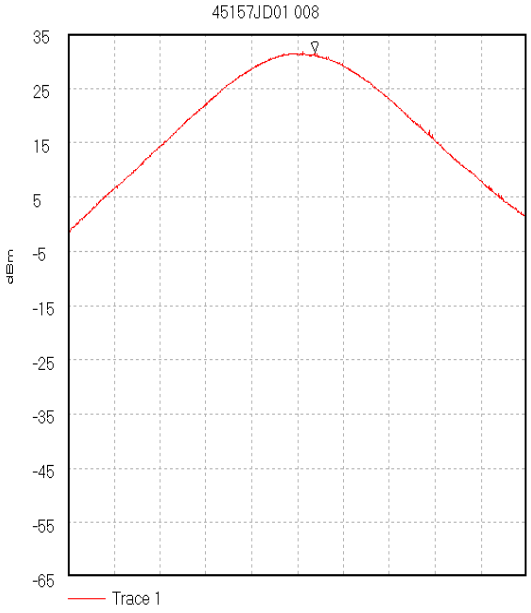
Results:

Channel	Measured Frequency (MHz)	Antenna Polarity (H/V)	Maximum Transmitter ERP (dBm)	Limit ERP (dBm)	Margin (dB)	Result
Bottom	824.2	Vert.	31.3	38.4	7.1	Complied
Middle	836.6	Vert.	31.6	38.4	6.8	Complied
Top	848.8	Vert.	31.9	38.4	6.5	Complied

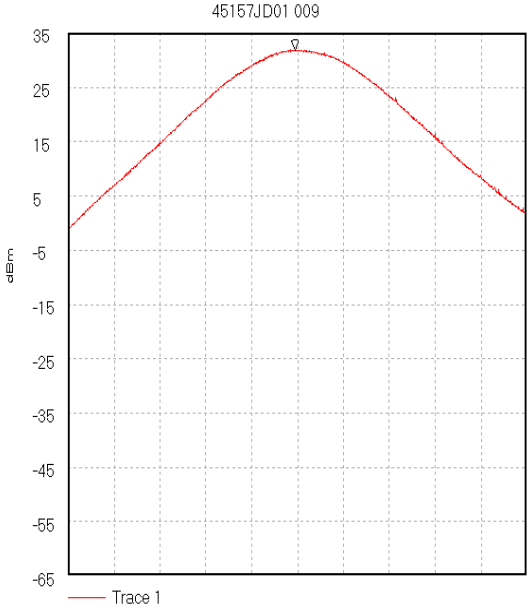
Transmitter Effective Radiated Power (ERP): Section 22.913(a) (Continued)



Centre 824.2 MHz; Span 5.0 MHz
Ref 35 dBm; Ref Offset 34.3 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 20 dB; Swp 20.0 mS
Marker 824.227778 MHz, 31.27 dBm
20/08/2003 15:05:44



Centre 836.6 MHz; Span 5.0 MHz
Ref 35 dBm; Ref Offset 35.3 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 20 dB; Swp 20.0 mS
Marker 836.788889 MHz, 31.58 dBm
20/08/2003 15:08:30



Centre 848.8 MHz; Span 5.0 MHz
Ref 35 dBm; Ref Offset 36.6 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 20 dB; Swp 20.0 mS
Marker 848.777778 MHz, 31.86 dBm
20/08/2003 15:15:32

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

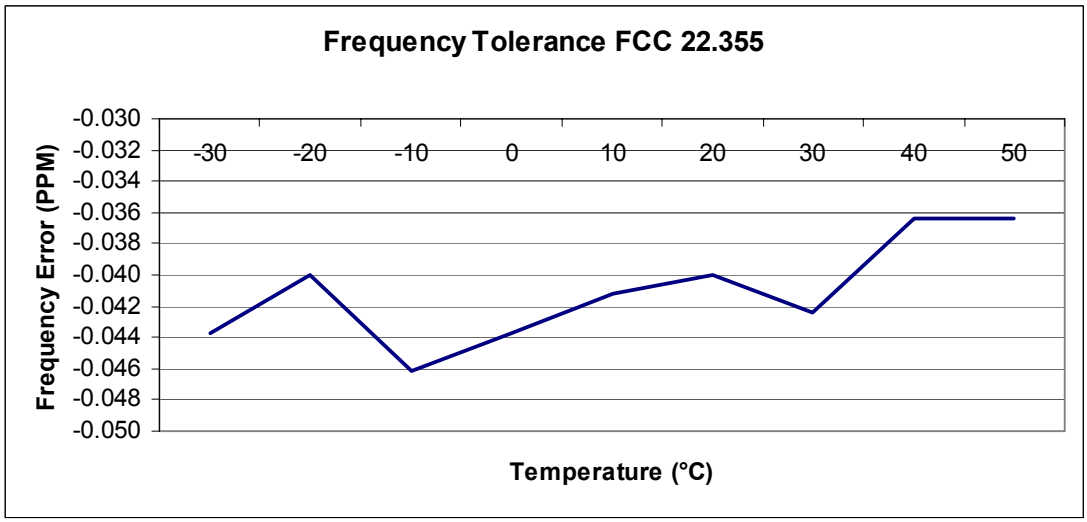
8.4.1. The EUT was configured as for frequency stability measurements as described in Section 9 of this report.

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

Results: Bottom Channel (824.2 MHz)

Temperature (°C)	Nominal Frequency	Measured Frequency	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)	Margin (ppm)	Result
-30	824.2	824.199964	-36	-0.044	2.5	2.456	Complied
-20	824.2	824.199967	-33	-0.040	2.5	2.460	Complied
-10	824.2	824.199962	-38	-0.046	2.5	2.454	Complied
0	824.2	824.199964	-36	-0.044	2.5	2.465	Complied
10	824.2	824.199966	-34	-0.041	2.5	2.459	Complied
20	824.2	824.199967	-33	-0.040	2.5	2.460	Complied
30	824.2	824.199965	-35	-0.042	2.5	2.458	Complied
40	824.2	824.199970	-30	-0.036	2.5	2.464	Complied
50	824.2	824.199970	-30	-0.036	2.5	2.464	Complied

Frequency Variation From 824.2MHz

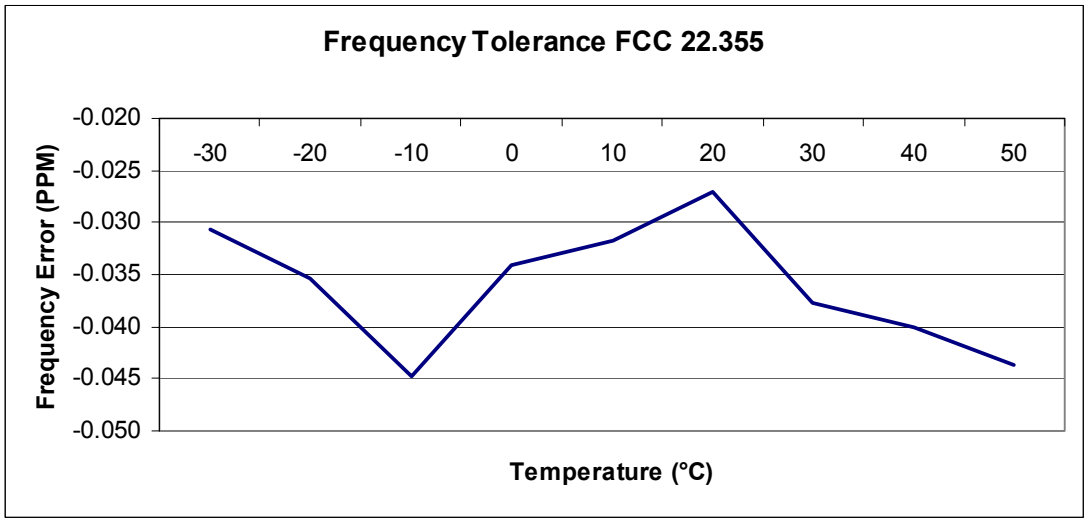


Transmitter Frequency Stability (Temperature Variation): Section 22.355 (Continued)

Results Top Channel (848.8 MHz)

Supply Voltage (V)	Nominal Frequency	Measured Frequency	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)	Margin (ppm)	Result
-30	848.8	848.799974	-26	-0.031	2.5	2.469	Complied
-20	848.8	848.799970	-30	-0.036	2.5	2.464	Complied
-10	848.8	848.799962	--38	-0.046	2.5	2.454	Complied
0	848.8	848.799971	-29	-0.034	2.5	2.466	Complied
10	848.8	848.799973	-27	-0.032	2.5	2.468	Complied
20	848.8	848.799977	-23	-0.0027	2.5	2.473	Complied
30	848.8	848.799968	-32	-0.038	2.5	2.462	Complied
40	848.8	848.799966	-34	-0.041	2.5	2.459	Complied
50	848.8	848.799963	-37	-0.044	2.5	2.456	Complied

Frequency Variation From 848.8 MHz



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

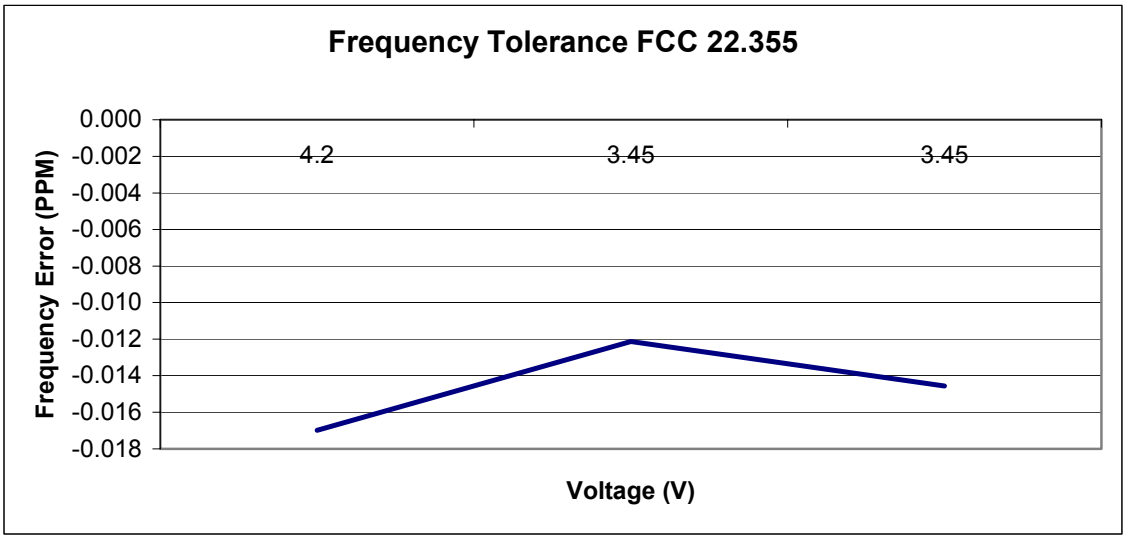
8.5.1. The EUT was configured as for frequency stability measurements as described in Section 9 of this report.

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

Results Bottom Channel (824.2 MHz)

Supply Voltage (V)	Nominal Frequency	Measured Frequency	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)	Margin (ppm)	Result
3.45	824.2	824.199986	-14	-0.016	2.5	2.484	Complied
3.8	824.2	824.199990	-10	-0.012	2.5	2.488	Complied
4.2	824.2	824.199988	-12	-0.014	2.5	2.486	Complied

Frequency Variation From 824.2 MHz

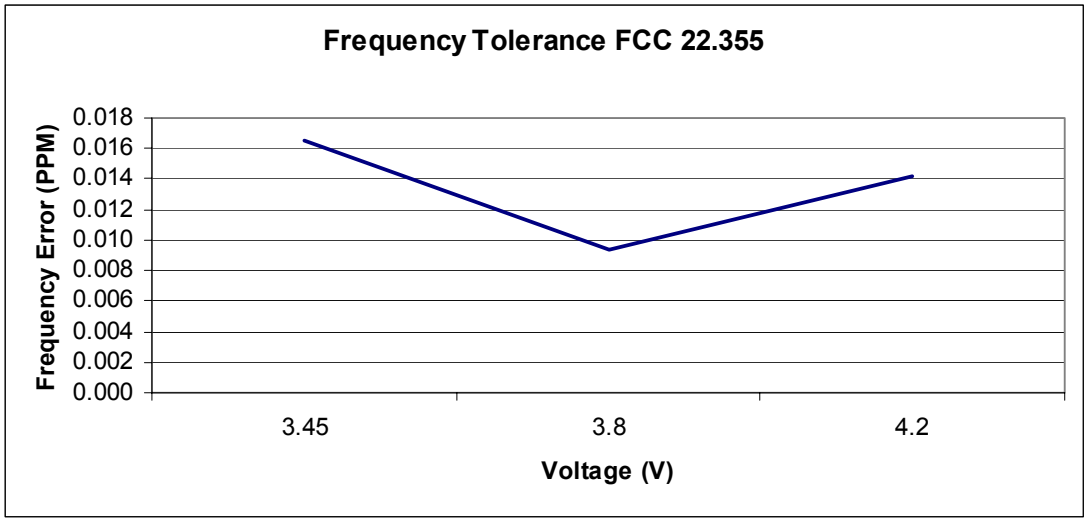


Transmitter Frequency Stability (Voltage Variation): Section 22.355 (Continued)

Results Top Channel (848.8 MHz)

Supply Voltage (V)	Nominal Frequency	Measured Frequency	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)	Margin (ppm)	Result
3.45	848.8	848.800014	14	0.016	2.5	2.484	Complied
3.8	848.8	848.800008	8	0.009	2.5	2.491	Complied
4.2	848.8	848.800012	12	0.014	2.5	2.486	Complied

Frequency Variation From 848.8 MHz



8.6. Transmitter Occupied Bandwidth: Section 2.1049(i)

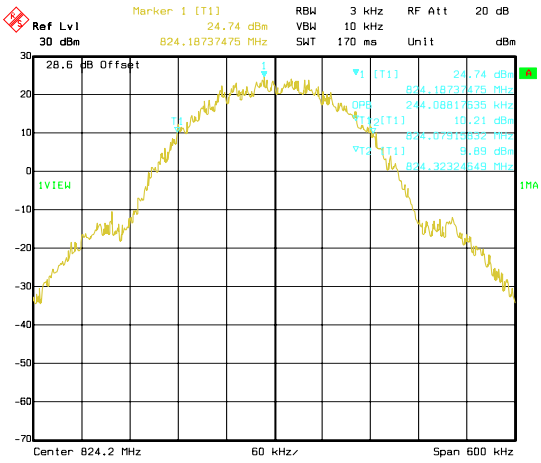
8.6.1. The EUT was configured as for Occupied Bandwidth measurements as described in Section 9 of this report.

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

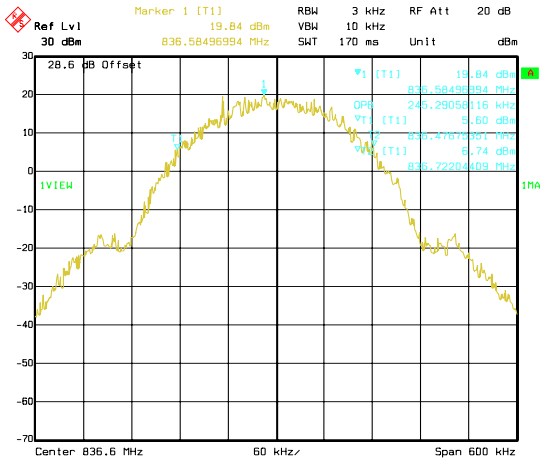
Results:

Channel	Frequency (MHz)	Resolution Bandwidth (kHz)	Video Bandwidth (kHz)	Occupied Bandwidth (kHz)
Bottom	824.2	3.0	10.0	244.088
Middle	836.6	3.0	10.0	245.290
Top	848.8	3.0	10.0	241.683

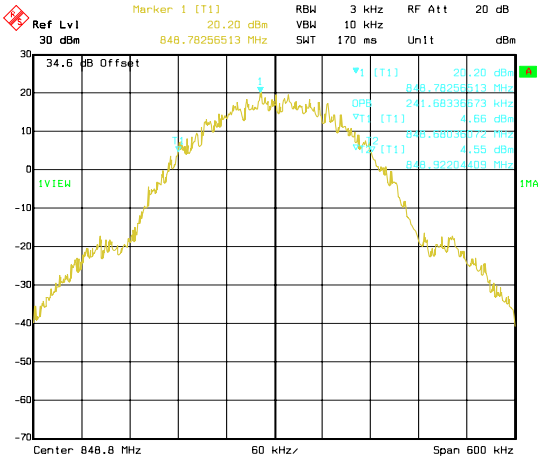
Transmitter Occupied Bandwidth: Section 2.1049(i) (Continued)



Title: Nokia EUT: NHM-10 004400211684558 Occupied Bandwidth.
Comment A: 45157JD01_FCC_P22_OCBW_TX_Bottom_Channel_001
Date: 29.AUG.2003 10:06:30



Title: Nokia EUT: NHM-10 004400211684558 Occupied Bandwidth.
Comment A: 45157JD01_FCC_P22_OCBW_TX_Middle_Channel_002
Date: 29.AUG.2003 10:08:31



Title: Nokia EUT: NHM-10 004400211684558 Occupied Bandwidth.
Comment A: 45157JD01_FCC_P22_OCBW_TX_Top_Channel_003
Date: 29.AUG.2003 10:10:05

Note: The occupied bandwidth is measured using the internal OBW function of the measurement analyser. The analyser automatically configures the measurement bandwidths to make an accurate measurement. The vital data is reported in the upper right portion of the screen. See attached graphs.

8.7. Transmitter Radiated Out of Band Emissions: Section 2.1053 & 22.917

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

8.7.2. Tests were performed to identify the maximum out of band transmitter radiated spurious emission level present in the band 30 MHz to 10 x the highest fundamental frequency.

Result: Bottom Channel

Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
6594.09	-45.47	-13.0	32.47	Complied

Result: Middle Channel

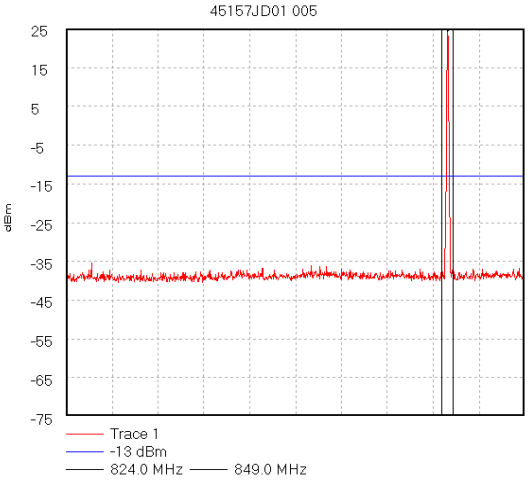
Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
6692.994	-45.24	-13.0	32.24	Complied

Result: Top Channel

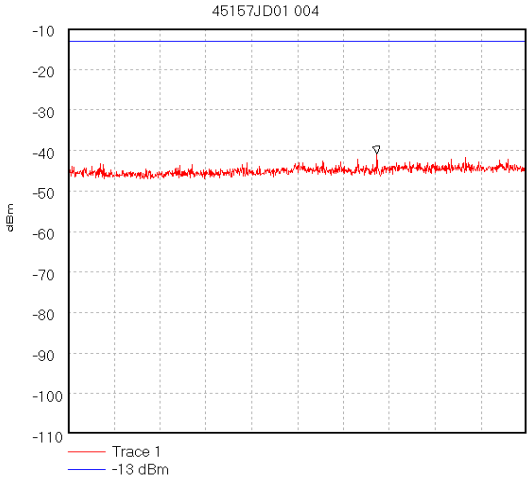
Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
6790.94	-47.37	-13.0	34.37	Complied

Note: All other emissions were at least 20 dB better than the stated limit.

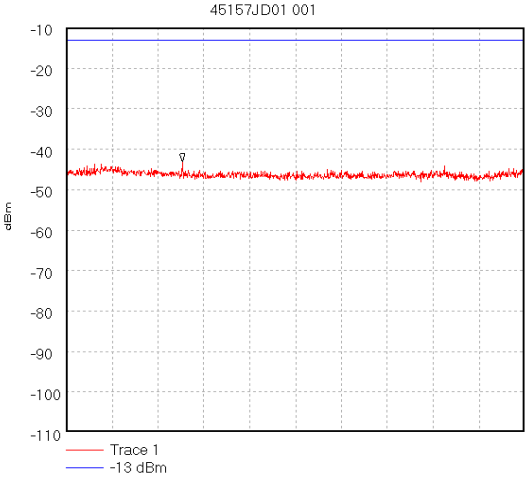
Transmitter Out of Band Emissions: Section 2.1053 & 22.917 (Continued)



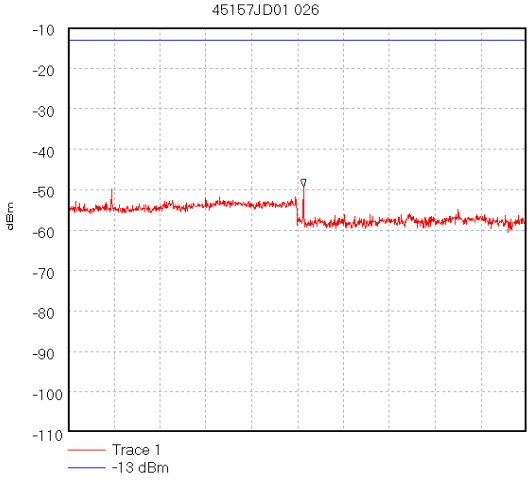
Start 30.0 MHz; Stop 1.0 GHz
Ref 25 dBm; Ref Offset 20.0 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 20 dB; Swp 20.0 mS
Peak 837.255556 MHz, 24.27 dBm
Display Line: -13 dBm;
19/08/2003 14:30:15



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 1.673333 GHz, -40.85 dBm
Display Line: -13 dBm;
19/08/2003 14:15:16



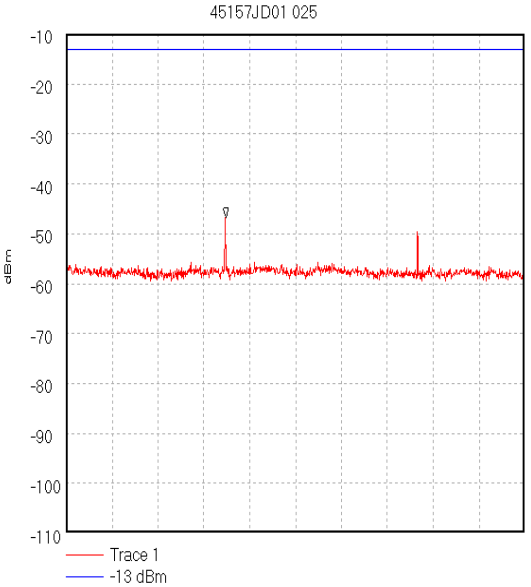
Start 2.0 GHz; Stop 4.0 GHz
Ref -10 dBm; Ref Offset 37.7 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 2.507 GHz, -43.16 dBm
Display Line: -13 dBm;
19/08/2003 13:54:48



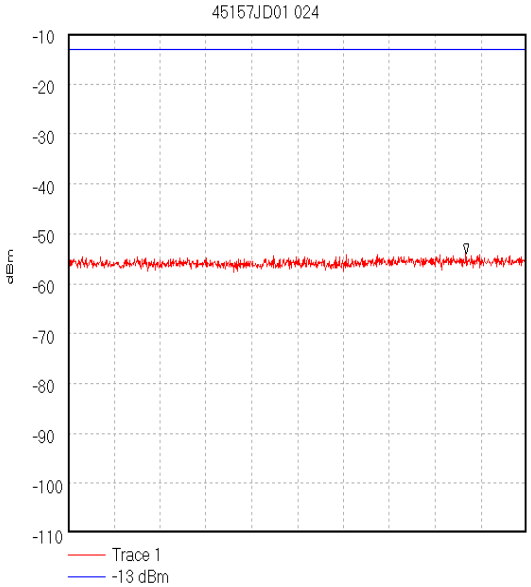
Start 4.0 GHz; Stop 6.0 GHz
Ref -10 dBm; Ref Offset 34.0 dB; 10 dB/div
RBW 1000.0 kHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 5.026667 GHz, -49.33 dBm
Display Line: -13 dBm; ; Limit Test Passed
21/08/2003 11:38:21

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

Transmitter Out of Band Emissions: Section 2.1053 & 22.917 (Continued)



Start 6.0 GHz; Stop 8.0 GHz
Ref -10 dBm; Ref Offset 36.2 dB; 10 dB/div
RBW 1000.0 kHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 6.695556 GHz, -46.76 dBm
Display Line: -13 dBm; ; Limit Test Passed
21/08/2003 11:33:47



Start 8.0 GHz; Stop 10.0 GHz
Ref -10 dBm; Ref Offset 39.0 dB; 10 dB/div
RBW 1000.0 kHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 9.735556 GHz, -54.08 dBm
Display Line: -13 dBm; ; Limit Test Passed
21/08/2003 11:28:09

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

8.8. Transmitter Radiated Emissions At Band Edges: Section 2.1053

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

8.8.2. Tests were performed to identify the maximum emission levels at the band edges of the frequency block of operation.

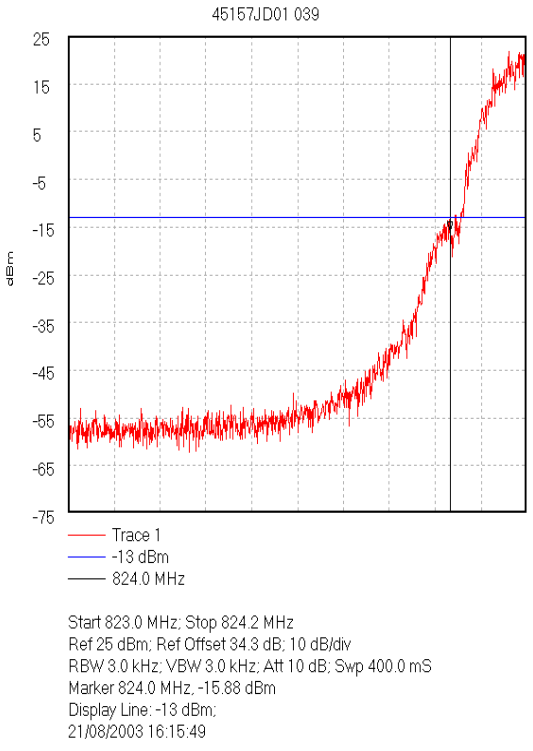
Results:

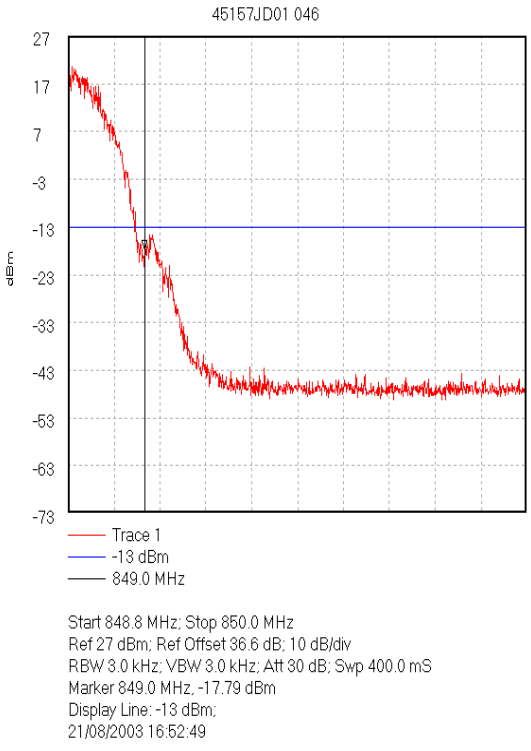
Bottom Band Edge

Frequency (MHz)	Peak Level (dBm)	Limit (dBm)	Margin (dB)	Result
824.0	-15.88	-13.0	2.88	Complied

Top Band Edge

Frequency (MHz)	Peak Level (dBm)	Limit (dBm)	Margin (dB)	Result
849.0	-17.79	-13.0	4.79	Complied





9. Measurement Methods – Part 22

9.1. 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 as requested by EIA/TIA-603-B. 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 level was observed.

The turntable was then rotated through 360 degrees and a 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 repeated with the EUT oriented in the Y and Z planes.

The highest peak reading taken in all 3 planes was recorded.

The entire procedure was then repeated with the test antenna set in the Vertical polarity.

Once a final maximum amplitude had been obtained, the EUT was substituted with a dipole antenna.

The centre of the substitution antenna was set to approximately the same centre location as the EUT.

The substitution antenna was set to the horizontal polarity.

The substitution antenna was matched into a signal generator using a 6dB or greater PAD.

The signal generator was tuned to the EUT 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.

Effective Radiated Power (ERP) (Continued)

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

Circumstances where the signal generator could not produce the desired power level, 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 EIRP.

Delta (dB) = EUT – SG

Where :

EUT = spectrum analyser indicated EUT raw level

SG = spectrum analyser indicated signal generator raw level

The signal generator actual ERP is calculated as:

ERP SG= Signal Generator Level - Cable Loss + Antenna Gain

The EUT ERP is calculated as:

ERP EUT = ERP SG + Delta.

9.2. FCC Part 2.1055: Frequency Stability

The EUT was situated within an environmental test chamber and connected to test equipment via an air link radiated from the antenna.

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.

9.3. Occupied Bandwidth

The EUT was connected to a spectrum analyser enabled with an occupied bandwidth function and a GSM test set via an air link.

Measurements were performed to determine the Occupied Bandwidth in accordance with FCC Part 2.1049. The Occupied Bandwidth was measured on 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 test simulator and using normal modulation, this was deemed as being worst case. The Occupied Bandwidth was measured in this configuration.

The Occupied Bandwidth was measured using the built in occupied bandwidth function of either the Rohde and Schwarz FSEB or ESIB 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. 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

9.5. 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 'n' times the highest fundamental frequency stated in section 2.5 of this report where 'n' is either 5 or 10 dependant upon whether the emission was produced via a transmitter/receiver or idle mode.

The pre-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.

The initial scans were performed using an antenna height of 1.5 m and at 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 20dB of this limit were measured where possible, on occasion; the receiver noise floor came within the 20dB boundary. On these occasions, the system noise floor may have been recorded.

An open area test site was then used with the EUT being set to the appropriate test distance.

A measurement 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 above procedure was repeated for the horizontal polarisation.

Once the final amplitude (maximised) had been obtained, the EUT was substituted with an 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.

Radiated Emissions (Continued)

The substitution antenna was matched into a signal generator using a 6dB or greater PAD.

The signal generator was tuned to the spurious emission frequency under investigation.

The test antenna was raised and lowered to obtain a maximum reading on the spectrum analyser.

The level of the signal generators output was then adjusted until the maximum level recorded earlier from the EUT 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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Radiated Emissions (Continued)

The standard states that an emission shall either be attenuated by at least 43+10 Log(P) dB below the transmitter power (P) for transmitters, where (P) is the maximum measured fundamental power for the channel under test, or at the limit specified in part 15.109/209 for receivers or idle modes.

The transmit limit always reduces to –13dBm as such, the limit line presented on the accompanying plots is set to –13dBm.

Any spurious emission measured is compared to the –13dBm limit or that specified in part 15. The requirement is for the emission to be less than the relevant limit to show compliance.

It should be noted that FCC Part 22.917 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 by calculating 1% of the bandwidth measured in the transmitter occupied bandwidth section of this report. The bandwidth were invariable calculated as a fraction, thus the next largest bandwidth was used. This was found to be 3 kHz

10. Test Results FCC Part 24

10.1. Idle Mode AC Conducted Spurious Emissions: Section 15.107

10.1.1. The EUT was configured as for AC conducted emissions measurements as described in Section 11 of this report.

10.1.2. Tests were performed to identify the maximum emission levels on the AC mains line of the AC Charger whilst connected to the EUT.

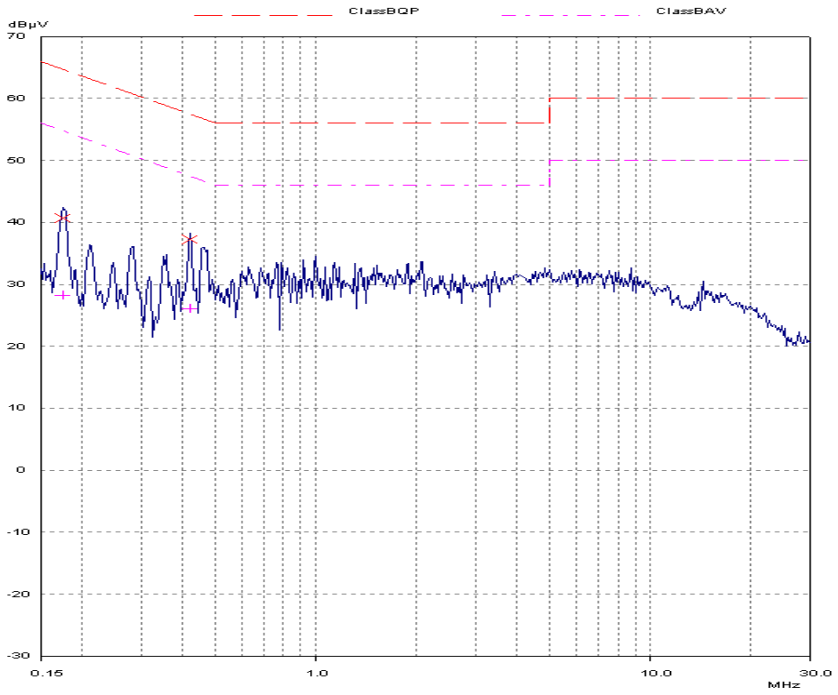
Results: Quasi-Peak Detector Measurements On Live And Neutral Lines

Frequency (MHz)	Line	Q-P Level (dBμV)	Q-P Limit (dBμV)	Margin (dB)	Result
0.175220	Live	40.7	64.7	24.0	Complied
0.419890	Live	37.2	57.5	20.3	Complied

Results: Average Detector Measurements On Live And Neutral Lines

Frequency (MHz)	Line	Av. Level (dBμV)	Av. Limit (dBμV)	Margin (dB)	Result
0.175220	Live	28.3	54.7	26.4	Complied
0.419890	Live	26.1	47.5	21.4	Complied

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



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

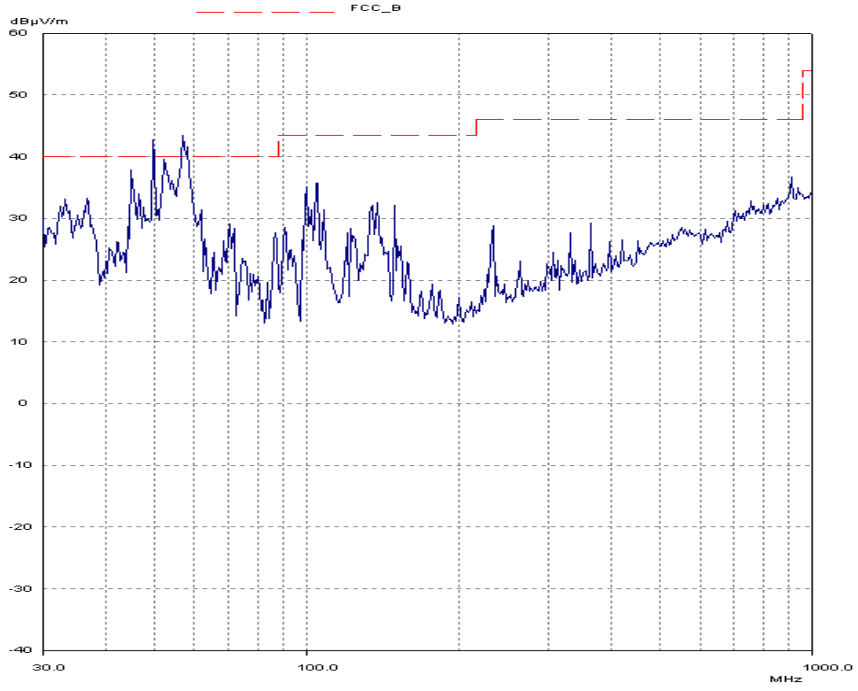
10.2. Idle Mode Radiated Spurious Emission: Section 15.109

10.2.1. The EUT was configured as for radiated emissions testing as described in Section 11 of this report.

10.2.2. Tests were performed to identify the maximum idle mode radiated emissions levels.

Result:

Frequency (MHz)	Antenna Polarity (H/V)	Q-P Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
49.495	Vert.	29.8	40.0	10.2	Complied
57.718	Vert.	27.4	40.0	12.6	Complied



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

Idle Mode Radiated Spurious Emission: Section 15.109 (Continued)

10.2.1. Electric Field Strength Measurements (Frequency Range 1.0 to 20.0 GHz)

10.2.1.1. The EUT was configured as for radiated emissions testing as described in Section 11 of this report.

10.2.1.2. Tests were performed to identify the maximum idle mode radiated emissions levels.

Result:

Highest Peak Level

Frequency (GHz)	Antenna. Polarity (H/V)	Peak Detector Level (dBµV)	Antenna Factor	Cable Loss	Actual Peak Level (dBµV/m)	Peak Limit (dBµV/m)	Peak Margin (dB)	Result
3.948	Vert.	18.1	23.4	1.6	43.1	74.0	30.9	Complied

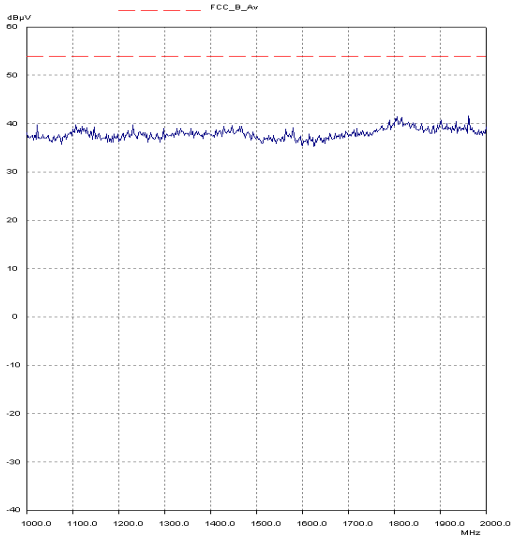
Note: There were no spurious emissions observed above the measurement analysers noise floor, as such the highest peak noise floor reading was recorded.

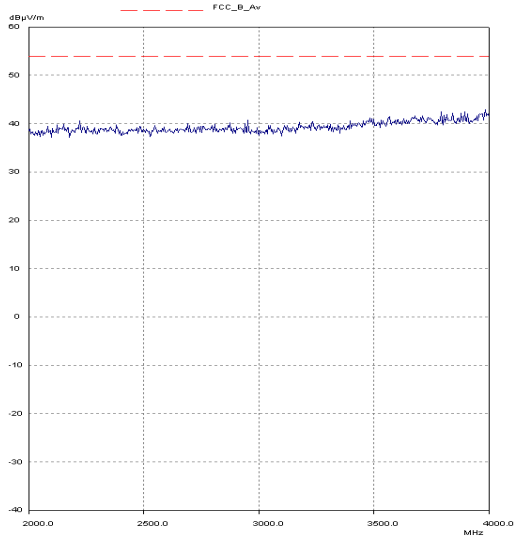
Highest Average Level:

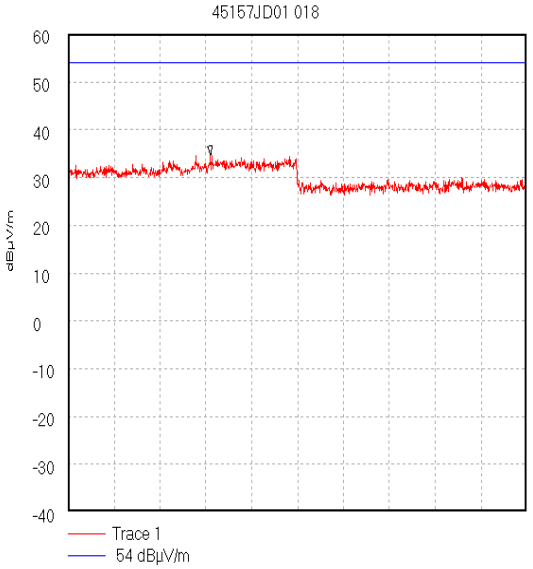
Frequency (GHz)	Antenna. Polarity (H/V)	Average Detector Level (dBµV)	Antenna Factor	Cable Loss	Actual Average Level (dBµV/m)	Average Limit (dBµV/m)	Peak Margin (dB)	Result
3.948	Vert.	8.8	23.4	1.6	33.8	54.0	20.2	Complied

Note: There were no spurious emissions observed above the measurement analysers noise floor, as such the highest average noise floor reading was recorded.

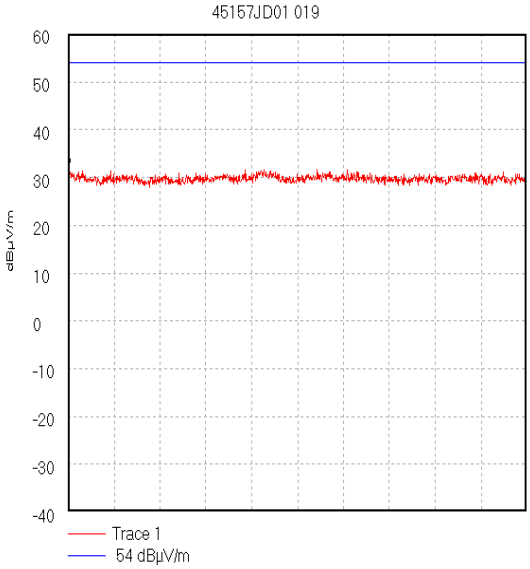
Idle Mode Radiated Spurious Emission: Section 15.109 (Continued)







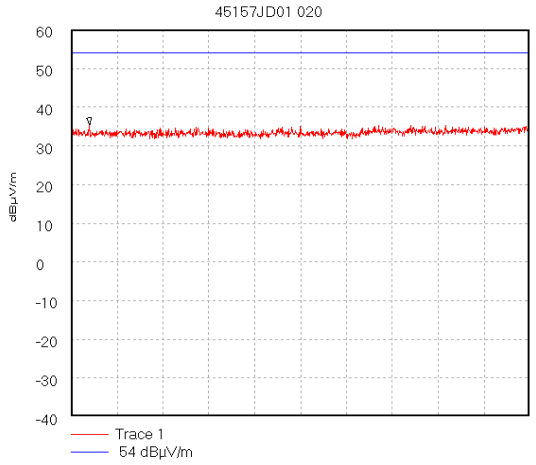
Start 4.0 GHz; Stop 6.0 GHz
Ref 60 dBµV/m; Ref Offset 0.0 dB; 10 dB/div
RBW 1000.0 kHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 4.62 GHz, 34.76 dBµV/m
Display Line: 54 dBµV/m; ; Limit Test Passed
Transducer Factors: 4to6g_Horn
21/08/2003 09:54:12



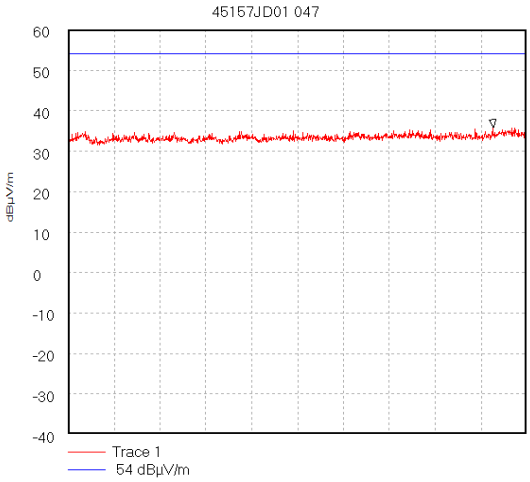
Start 6.0 GHz; Stop 8.0 GHz
Ref 60 dBµV/m; Ref Offset 0.0 dB; 10 dB/div
RBW 1000.0 kHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 6.0 GHz, 31.84 dBµV/m
Display Line: 54 dBµV/m; ; Limit Test Passed
Transducer Factors: 6to8g_Horn
21/08/2003 10:25:27

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

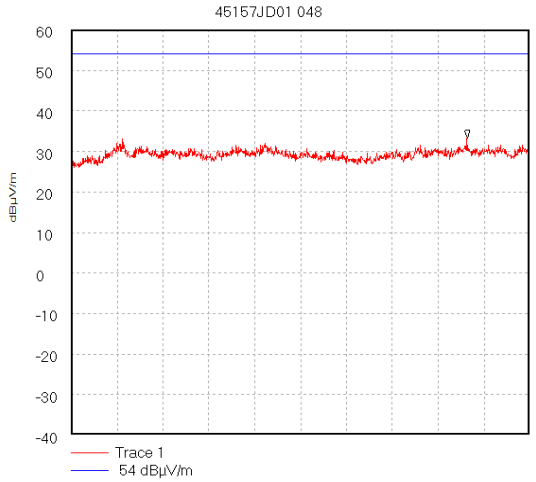
Idle Mode Radiated Spurious Emission: Section 15.109 (Continued)



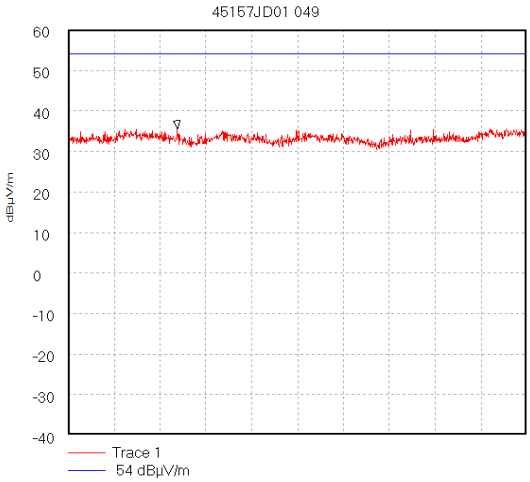
Start 8.0 GHz; Stop 10.0 GHz
Ref 60 dBµV/m; Ref Offset 0.0 dB; 10 dB/div
RBW 1000.0 kHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 8.08 GHz, 35.42 dBµV/m
Display Line: 54 dBµV/m; ; Limit Test Passed
Transducer Factors: 8to12G_Horn
21/08/2003 10:28:21



Start 10.0 GHz; Stop 12.5 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
Marker 12.317 GHz, 35.83 dBµV/m
Display Line: 54 dBµV/m;
21/08/2003 16:55:42



Start 12.5 GHz; Stop 18.0 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 40.0 mS
Peak 17.248 GHz, 33.29 dBµV/m
Display Line: 54 dBµV/m;
21/08/2003 17:00:09



Start 18.0 GHz; Stop 20.0 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 18.476 GHz, 35.63 dBµV/m
Display Line: 54 dBµV/m;
21/08/2003 17:01:41

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

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

10.3.1. The EUT was configured as for Effective Isotropic Radiated Power as described in Section 11 of this report.

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

Results:

Channel	Measured Frequency (MHz)	Antenna Polarity (H/V)	Maximum Transmitter EIRP (dBm)	Limit EIRP (dBm)	Margin (dB)	Result
Bottom	1850.2	Horiz.	32.8	33.0	0.2	Complied
Middle	1879.8	Horiz.	32.4	33.0	0.6	Complied
Top	1909.8	Horiz.	31.4	33.0	1.6	Complied

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

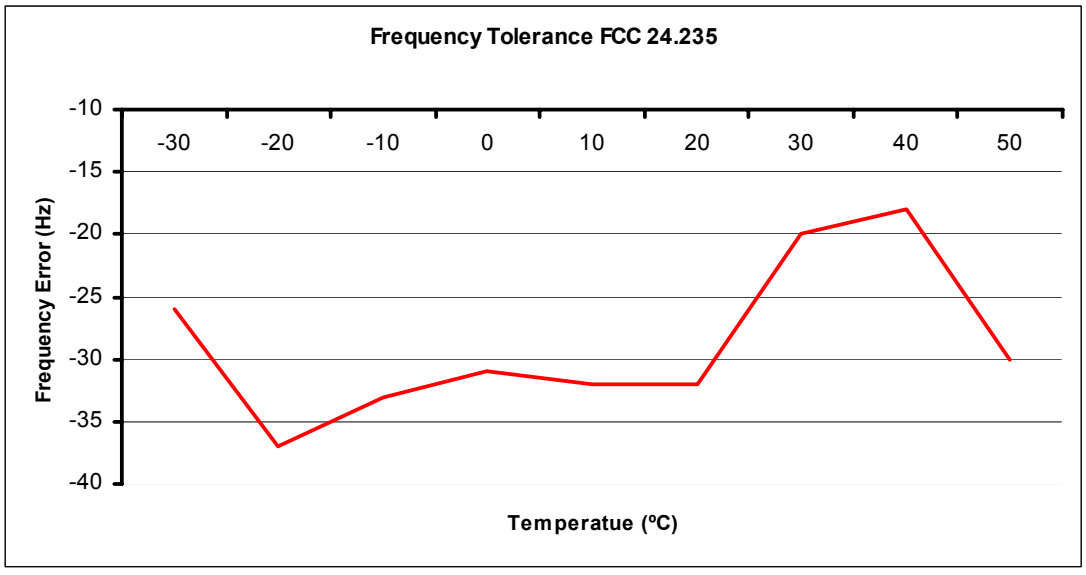
10.4.1. The EUT was configured as for frequency stability measurements as described in Section 11 of this report.

10.4.2. 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	-26	1850.199974	1850.0	0.199974	Complied
-20	-37	1850.199963	1850.0	0.199963	Complied
-10	-33	1850.199967	1850.0	0.199967	Complied
0	-31	1850.199969	1850.0	0.199969	Complied
10	-32	1850.199968	1850.0	0.199968	Complied
20	-32	1850.199968	1850.0	0.199968	Complied
30	-20	1850.199980	1850.0	0.199980	Complied
40	-18	1850.199982	1850.0	0.199982	Complied
50	-30	1850.199970	1850.0	0.199970	Complied

Frequency Variation From 1850.2MHz

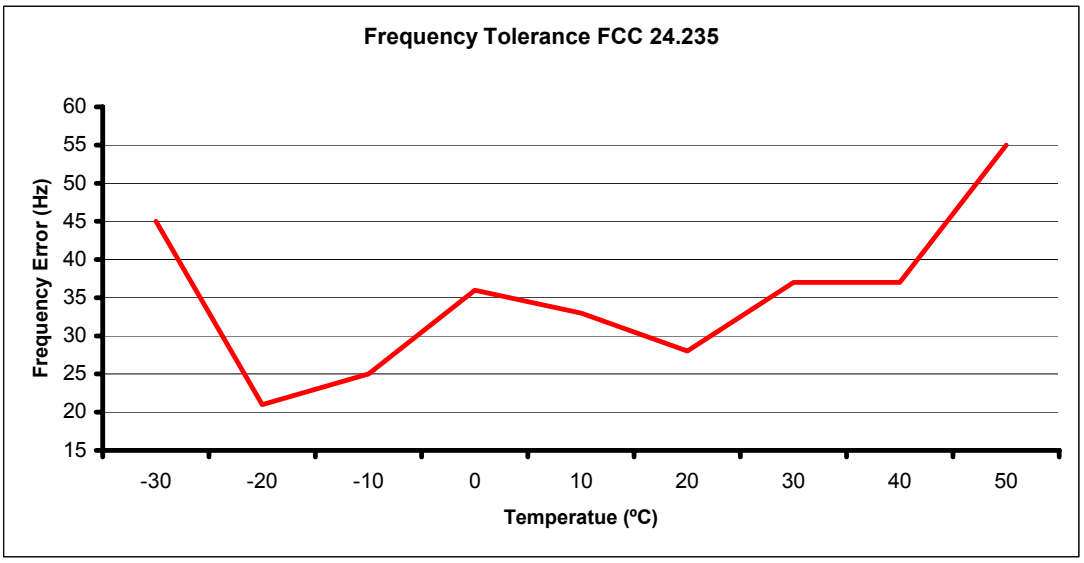


Transmitter Frequency Stability (Temperature Variation): Section 24.235 (continued)

Results Top Channel (1909.8 MHz)

Temp (ºC)	Frequency Error (Hz)	Measured Frequency (MHz)	Upper Band Edge Limit (MHz)	Margin (MHz)	Result
-30	45	1909.800045	1910.0	0.199955	Complied
-20	21	1909.800021	1910.0	0.199979	Complied
-10	25	1909.800025	1910.0	0.199975	Complied
0	36	1909.800036	1910.0	0.199964	Complied
10	33	1909.800033	1910.0	0.199967	Complied
20	28	1909.800028	1910.0	0.199972	Complied
30	37	1909.800037	1910.0	0.199963	Complied
40	37	1909.800037	1910.0	0.199963	Complied
50	55	1909.800055	1910.0	0.199945	Complied

Frequency Variation From 1909.8MHz



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

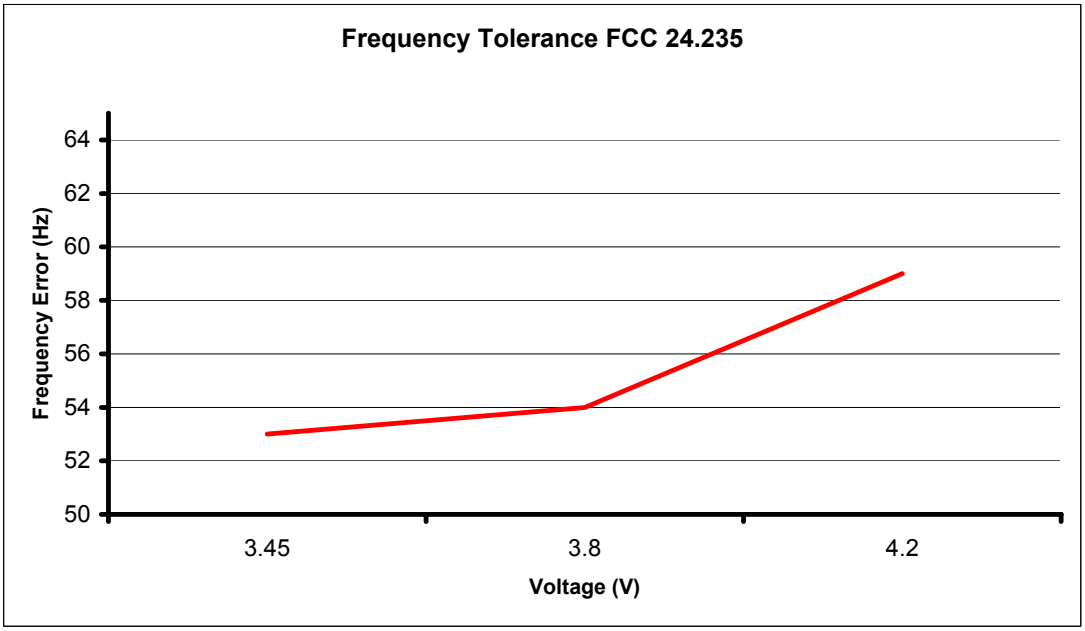
10.5.1. The EUT was configured as for frequency stability measurements as described in Section 11 of this report.

10.5.2. 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
3.45	53	1850.200053	1850.0	0.200053	Complied
3.8	54	1850.200054	1850.0	0.200054	Complied
4.2	59	1850.200059	1850.0	0.200059	Complied

Frequency Variation From 1850.2MHz

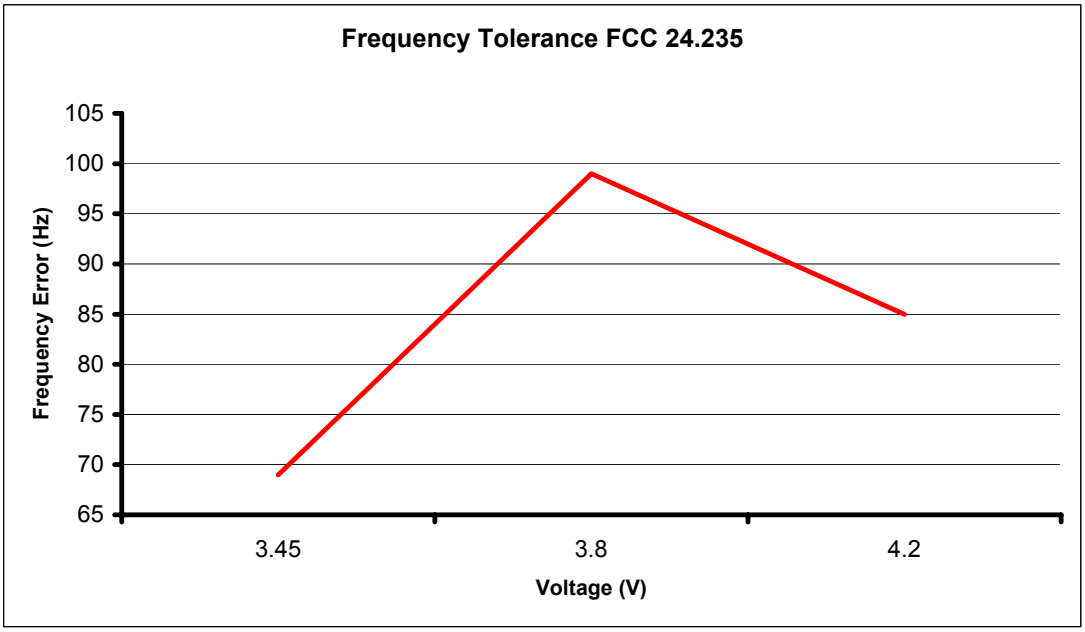


Transmitter Frequency Stability (Voltage Variation): Section 24.235 (Continued)

Results Top Channel (1909.8 MHz)

Supply Voltage (V)	Frequency Error (Hz)	Measured Frequency (MHz)	Lower Band Edge Limit (MHz)	Margin (MHz)	Result
3.45	69	1909.800069	1910	0.199931	Complied
3.8	99	1909.800099	1910	0.199901	Complied
4.2	85	1909.800085	1910	0.199915	Complied

Frequency Variation From 1909.8MHz



10.6. Transmitter Occupied Bandwidth: Section 24.238

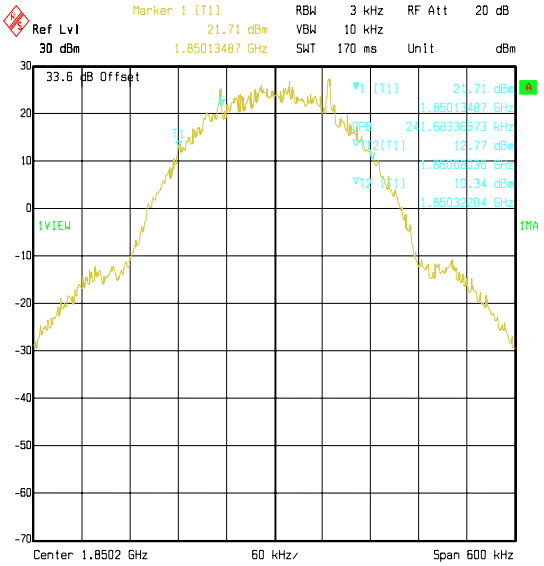
10.6.1. The EUT was configured as for Occupied Bandwidth measurements as described in Section 11 of this report.

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

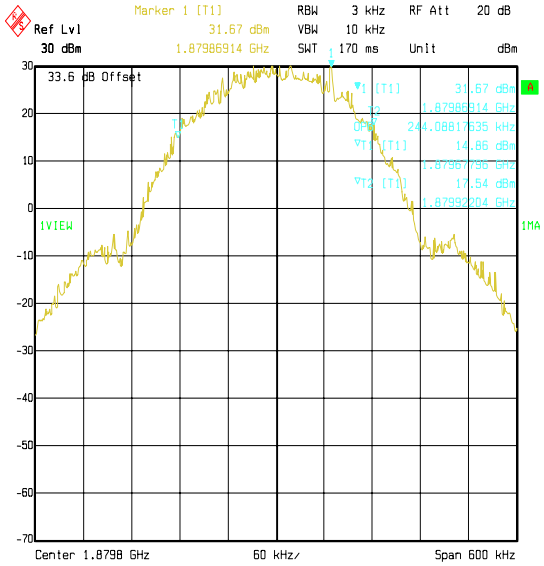
Results:

Channel	Frequency (MHz)	Resolution Bandwidth (kHz)	Video Bandwidth (kHz)	Occupied Bandwidth (kHz)
Bottom	1850.2	3.0	10.0	241.683
Middle	1879.8	3.0	10.0	244.088
Top	1909.8	3.0	10.0	245.291

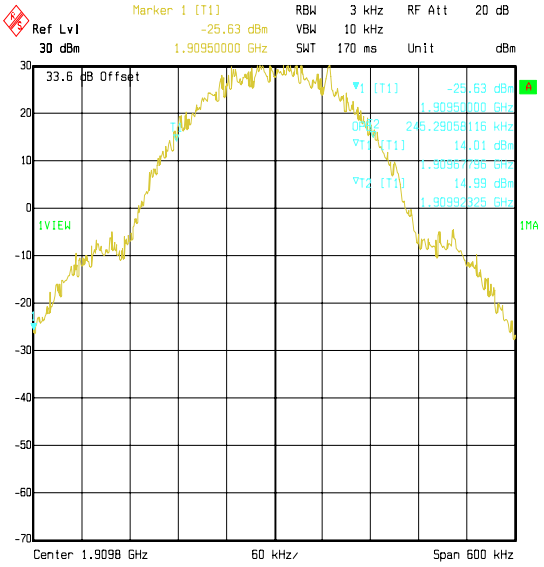
Transmitter Occupied Bandwidth: Section 24.238 (Continued)



Title: Nokia EUT: NHM-10 0044002116845S8 Occupied Bandwidth.
Comment A: 45157JD01_FCC_P24_OCBW_TX_Bottom_Channel_001
Date: 29.AUG.2003 9:54:07



Title: Nokia EUT: NHM-10 0044002116845S8 Occupied Bandwidth.
Comment A: 45157JD01_FCC_P24_OCBW_TX_Mid_Channel_002
Date: 29.AUG.2003 9:56:22



Title: Nokia EUT: NHM-10 0044002116845S8 Occupied Bandwidth.
Comment A: 45157JD01_FCC_P24_OCBW_TX_Top_Channel_003
Date: 29.AUG.2003 9:57:46

Note: The occupied bandwidth is measured using the internal OBW function of the measurement analyser. The analyser automatically configures the measurement bandwidths to make an accurate measurement. The vital data is reported in the upper right portion of the screen. See attached graphs.

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

10.7.1. The EUT was configured as for radiated emissions testing as described in Section 11 of this report.

10.7.2. Tests were performed to identify the maximum out of band transmitter radiated spurious emission level present in the band 30 MHz to 10 x the highest fundamental frequency.

Result: Bottom Channel

Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
7400.972	-27.0	-13.0	14.0	Complied

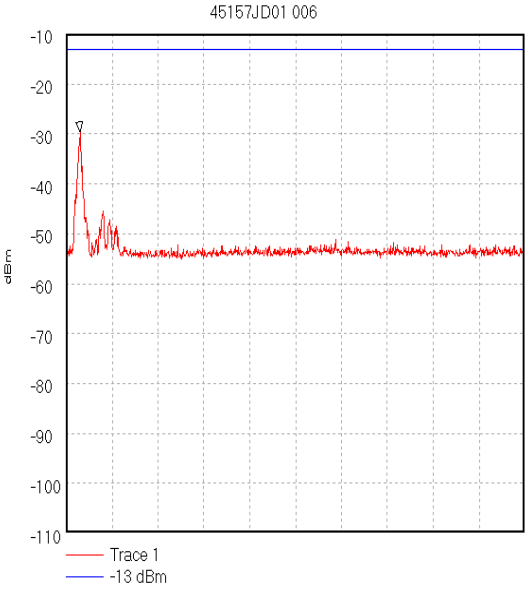
Result: Middle Channel

Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
7519.188	-29.2	-13.0	16.2	Complied

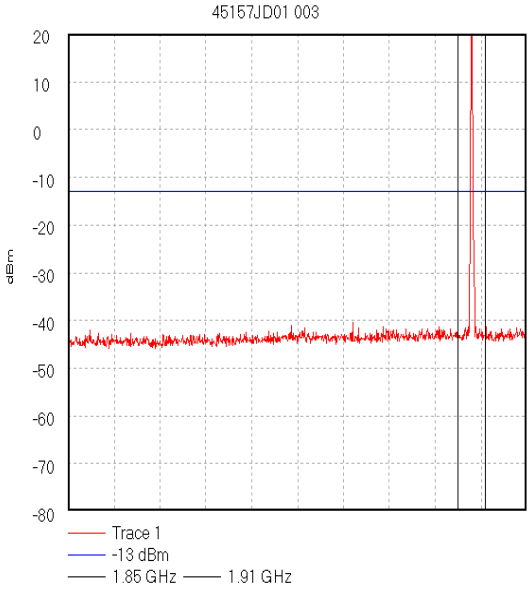
Result: Top Channel

Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
7639.361	-30.4	-13.0	17.4	Complied

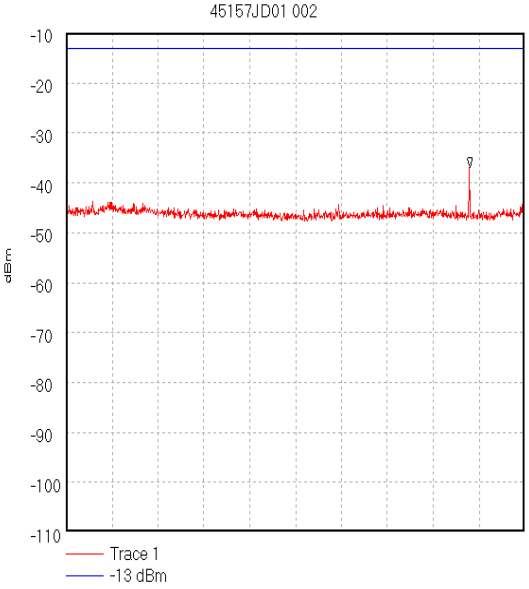
Transmitter Out of Band Emissions: Section 2.1053/24.238 (Continued)



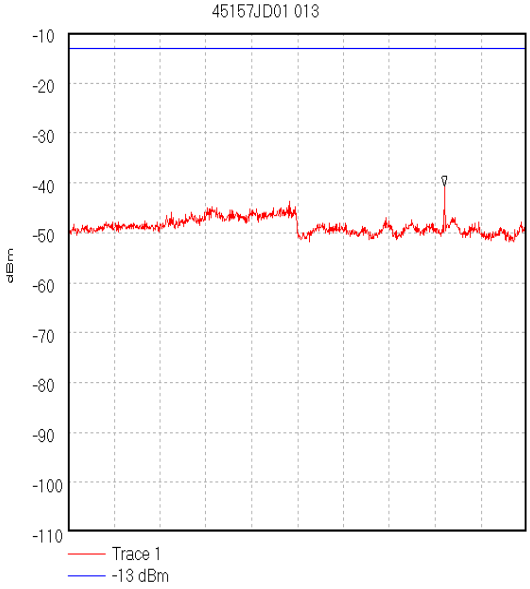
Start 30.0 MHz; Stop 1.0 GHz
Ref -10 dBm; Ref Offset 20.0 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 10 dB; Swp 20.0 mS
Peak 59.1 MHz, -29.6 dBm
Display Line: -13 dBm;
19/08/2003 14:34:21



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 10 dB; Swp 20.0 mS
Peak 1.88 GHz, 21.26 dBm
Display Line: -13 dBm;
19/08/2003 14:08:12



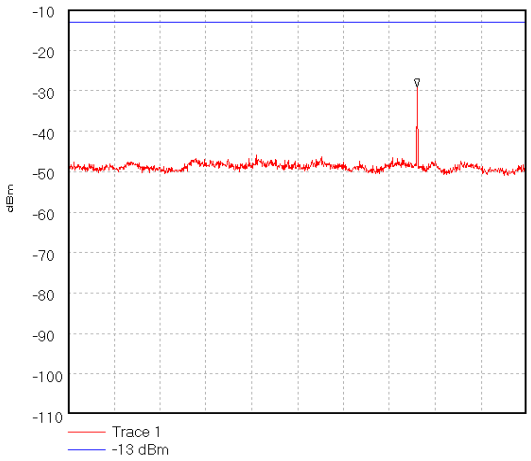
Start 2.0 GHz; Stop 4.0 GHz
Ref -10 dBm; Ref Offset 37.7 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 3.76 GHz, -36.84 dBm
Display Line: -13 dBm;
19/08/2003 13:58:25



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, -40.75 dBm
Display Line: -13 dBm;
20/08/2003 15:55:21

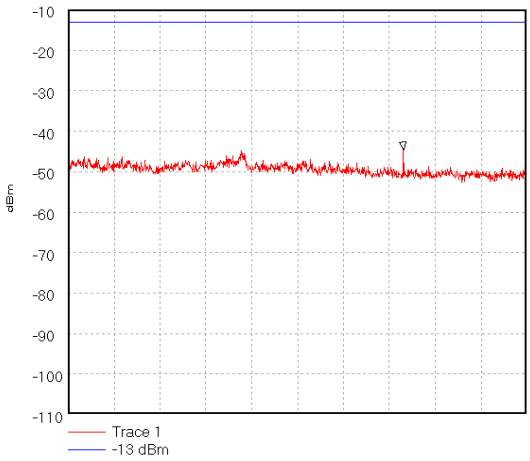
Transmitter Out of Band Emissions: Section 2.1053/24.238 (Continued)

45157JD01 014



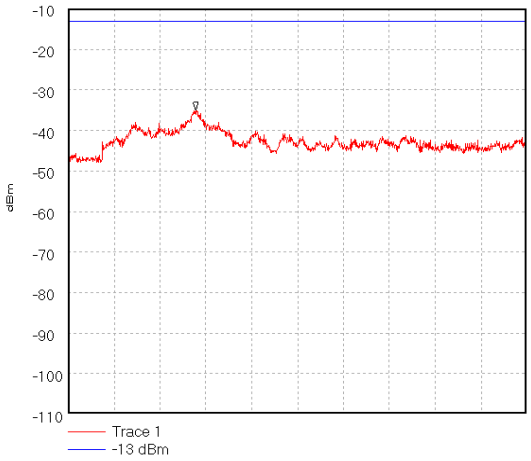
Start 6.0 GHz; Stop 8.0 GHz
Ref -10 dBm; Ref Offset 36.2 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 7.522222 GHz, -29.12 dBm
Display Line: -13 dBm;
20/08/2003 15:58:18

45157JD01 015



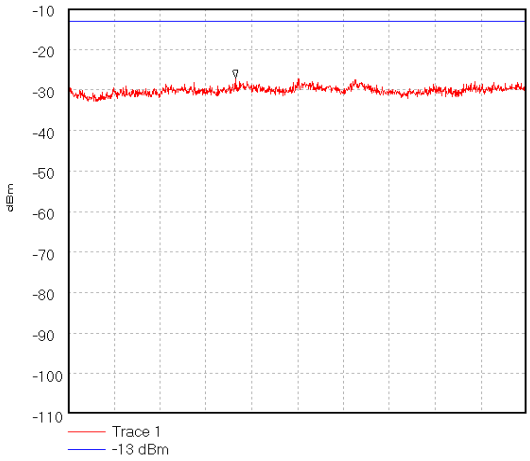
Start 8.0 GHz; Stop 12.5 GHz
Ref -10 dBm; Ref Offset 39.0 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 11.29 GHz, -44.71 dBm
Display Line: -13 dBm;
20/08/2003 16:39:52

45157JD01 016



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 14.027778 GHz, -35.03 dBm
Display Line: -13 dBm;
20/08/2003 16:42:30

45157JD01 017



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 18.728889 GHz, -27.06 dBm
Display Line: -13 dBm;
20/08/2003 16:45:24

Note: these plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables. If any final emission measurement fell below the limit by more than 20dB it was not recorded.

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

10.8.1. The EUT was configured as for radiated emissions testing described in Section 11 of this report.

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

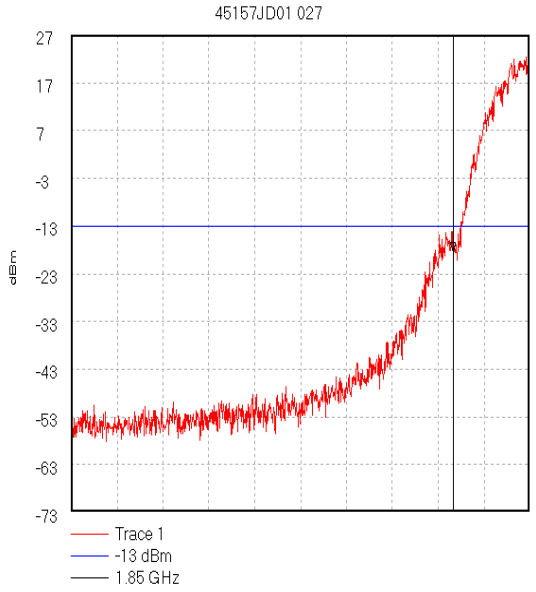
Results:

Bottom Band Edge

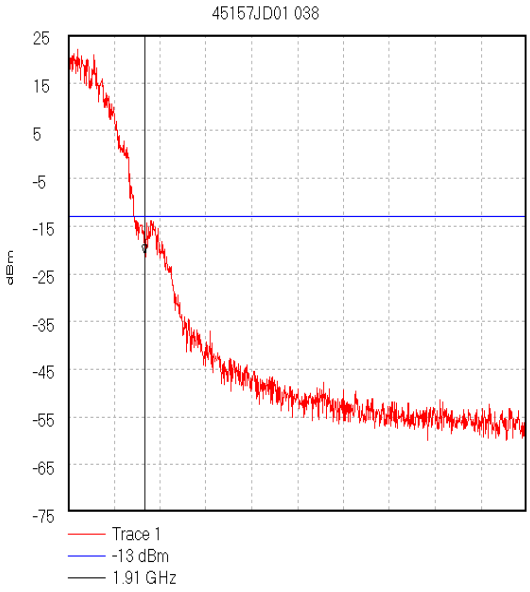
Frequency (MHz)	Spurious Emission (dBm)	Limit (dBm)	Margin (dB)	Result
1850.0	-18.5	-13.0	6.5	Complied

Top Band Edge

Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
1910.0	-21.0	-13.0	8.0	Complied



Start 1.849 GHz; Stop 1.8502 GHz
Ref 27 dBm; Ref Offset 26.3 dB; 10 dB/div
RBW 3.0 kHz; VBW 3.0 kHz; Att 20 dB; Swp 400.0 mS
Marker 1.85 GHz, -18.47 dBm
Display Line: -13 dBm;
21/08/2003 14:37:28



Start 1.9098 GHz; Stop 1.911 GHz
Ref 25 dBm; Ref Offset 24.4 dB; 10 dB/div
RBW 3.0 kHz; VBW 3.0 kHz; Att 20 dB; Swp 400.0 mS
Marker 1.91 GHz, -20.98 dBm
Display Line: -13 dBm;
21/08/2003 15:35:09

11. Measurement Methods – Part 24

11.1. 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 as required by EIA/TIA-603-B.

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 level 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 maximum amplitude had been obtained, the EUT was substituted with a horn antenna.

The centre of the substitution antenna was set to approximately the same centre location as the EUT.

The substitution antenna was set to the horizontal polarity.

The substitution antenna was matched into a signal generator using a 6dB or greater PAD.

The signal generator was tuned to the EUT's frequency under test.

Effective Isotropic Radiated Power (EIRP) (Continued)

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

Circumstances where the signal generator could not produce the desired power level, 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.

Delta (dB) = EUT – SG

Where :

EUT = spectrum analyser indicated EUT raw level

SG = spectrum analyser indicated signal generator raw level

The signal generator actual EIRP is calculated as:

EIRP SG= Signal Generator Level - Cable Loss + Antenna Gain

The EUT EIRP is calculated as:

EIRP EUT = EIRP SG + Delta.

11.2. Frequency Stability

The EUT was situated within an environmental test chamber and connected directly to the GSM test set via an air link radiated from the antenna.

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.

11.3. Occupied Bandwidth

The EUT was connected to a spectrum analyser enabled with an occupied bandwidth function and a GSM test set via an air link.

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. This was deemed as being worst case. The Occupied Bandwidth was measured in this configuration.

The Occupied Bandwidth was measured using the built in occupied bandwidth function of either the Rohde and Schwarz FSEB or ESIB 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.

11.4. 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

11.5. 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 'n' times the highest fundamental frequency stated in section 2.5 of this report where 'n' is either 5 or 10 dependant upon whether the emission was produced via a transmitter/receiver or idle mode.

The pre-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.

The initial scans were performed using an antenna height of 1.5 m and at 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 20dB of this limit were measured where possible, on occasion; the receiver noise floor came within the 20dB boundary. On these occasions, the system noise floor may have been recorded.

An open area test site was then used with the EUT being set to the appropriate test distance.

A measurement 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 above procedure was repeated for the horizontal polarisation.

Once the final amplitude (maximised) had been obtained, the EUT was substituted with an 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.

Radiated Emissions (Continued)

The substitution antenna was matched into a signal generator using a 6dB or greater PAD.

The signal generator was tuned to the spurious emission frequency under investigation.

The test antenna was raised and lowered to obtain a maximum reading on the spectrum analyser.

The level of the signal generators output was then adjusted until the maximum level recorded earlier from the EUT 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

The standard states that an emission shall either be attenuated by at least 43+10 Log(P) dB below the transmitter power (P) for transmitters, where (P) is the maximum measured fundamental power for the channel under test, or at the limit specified in part 15.109/209 for receivers or idle modes.

The transmit limit always reduces to –13dBm as such, the limit line presented on the accompanying plots is set to –13dBm.

Any spurious emission measured is compared to the –13dBm limit or that specified in part 15. The requirement is for the emission to be less than the relevant limit to show 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 by calculating 1% of the bandwidth measured in the transmitter occupied bandwidth section of this report. The bandwidth were invariable calculated as a fraction, thus the next largest bandwidth was used. This was found to be 3 kHz

11.6. Measurement Uncertainty

11.6.1. 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.

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

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

11.6.4. 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 Isotropic Radiated Power (EIRP)	Not applicable	95%	+/- 1.78 dB
Effective Radiated Power (ERP)	Not applicable	95%	+/- 1.78 dB
Frequency Stability	Not applicable	95%	+/- 0.01 ppm
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

11.6.5. 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
A1141	HP 11691D	Hewlett Packard	11691D	1212A02494
A145	10 dB Attenuator	Narda	NONE	NONE
A197	Site 2 Controller SC144	Unknown	SC144	150720
A247	10 dB Attenuator	Narda	769-10	03712
A254	WG 14 Microwave Horn	Flann Microwave	14240-20	139
A255	WG 16 Microwave Horn	Flann Microwave	16240-20	519
A428	WG 12 horn	Flann Microwave	12240-20	134
A430	WG 18 horn	Flann Microwave	18240-20	425
A433	WG 27 Straight	Flann Microwave	27441	None
A553	Bi-log Antenna	Chase	CBL6111A	1593
A649	LISN	Rohde & Schwarz	ESH3-Z5	825562/008
C1067	Rosenberger Cable	Rosenberger	001	001
C1071	Rosenberger Cable	Rosenberger	FA21A1030M5050	Not Stated
C1077	Rosenberger Cable	Rosenberger	FA210A1010M5050	28462-2
C1079	Rosenberger Cable	Rosenberger	FA210A1010M5050	28462-1
C1082	Rosenberger Cable	Rosenberger	FA210A1020M5050	28463-1
C160	Rosenberger Cables	Rosenberger	UFA210A-1-1181-70x70	None
C202	Rosenberger Cable	Rosenberger	UFA 210A-1-1180-70X70	1543
C222	Rosenberger Cable	Rosenberger	UFA210A-1-1181-70x70	None
C346	Coaxial Cable	Rosenberger	UFA210A-1-1181-70x70	1932
C363	BNC Cable	Rosenberger	RG142	None
C364	BNC Cable	Rosenberger	RG142	None

Test Equipment Used (Continued)

RFI No.	Instrument	Manufacturer	Type No.	Serial No.
C453	Rosenberger Cable	Rosenberger	RG142XX-001-RFIB	C453-10081998
C457	Rosenberger Cable	Rosenberger	RG142XX-002-RFIB	C457-10081998
C564	C564-N-2	Rosenberger	UFA 210A-1-0787-70x70	96L0226
G085	Generator	Hewlett Packard	83650L	3614A00104
M072	FSM Spectrum Analyser	Rohde & Schwarz	FSM	862 967/010 (RF) & 863 912/048 (Display)
M090	Receiver / Spectrum Analyser System	Rohde & Schwarz	ESBI	DU:838494/005 RU:836833/001
M1013	GSM Test set	Hewlett Packard	8922M	3503U00372
M1014	DCS Test set	Hewlett Packard	83220E	3741U02702
M115	Temperature/ Humidity Meter	RS Components	212-146	None
M139	Digital Multimeter	Fluke	11	65830028
M505	Analyser Display Unit	Rohde & Schwarz	ESAI-D	825316/010
M506	RF unit	Rohde & Schwarz	ESBI-RF	827060/004
S003	Power Control	Zen	E08	736699
S201	Site 1	RFI	1	-
S202	Site 2	RFI	2	-
S207	Site 7	RFI	7	-
S209	Site 9	RFI	9	-
S212	Site 12	RFI	12	-

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

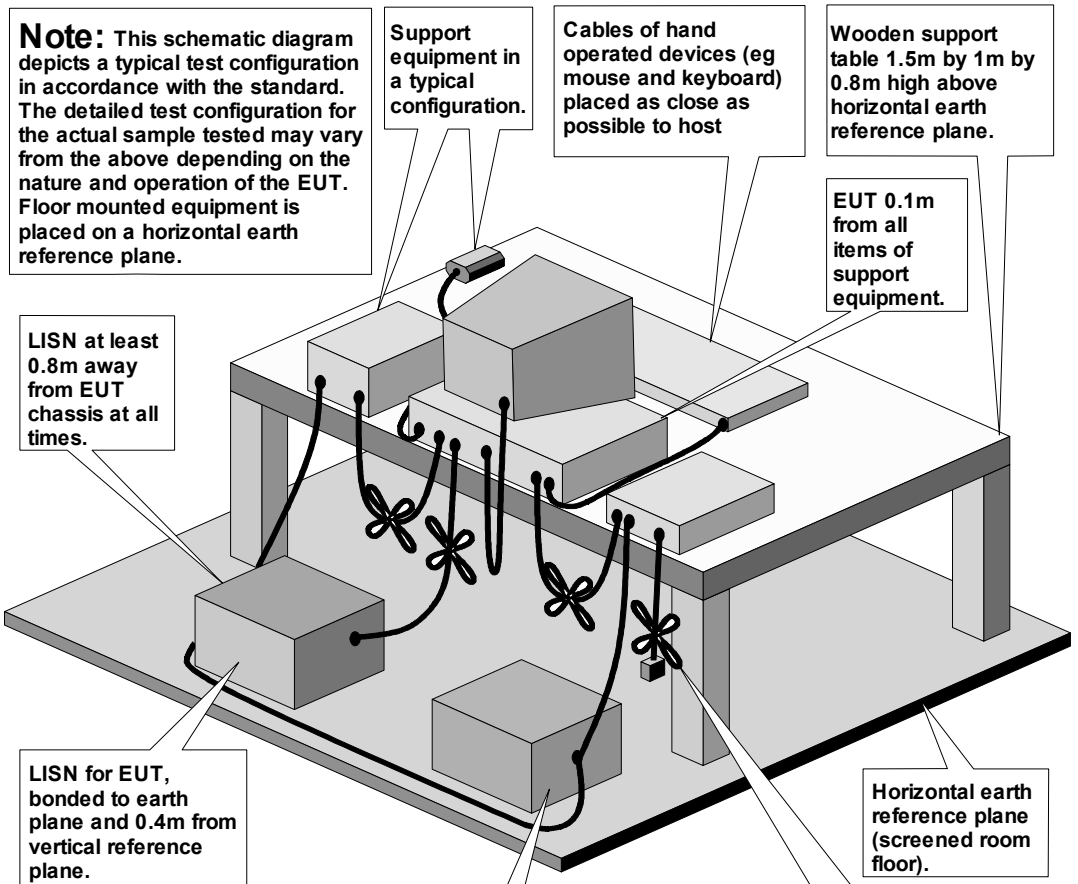
Appendix 2. Test Configuration Drawings

This appendix contains the following drawings:

Drawing Reference Number	Title
DRG\45157JD01\EMICON	Test configuration for measurement of conducted emissions
DRG\45157JD01\EMIRAD	Test configuration for measurement of radiated emissions

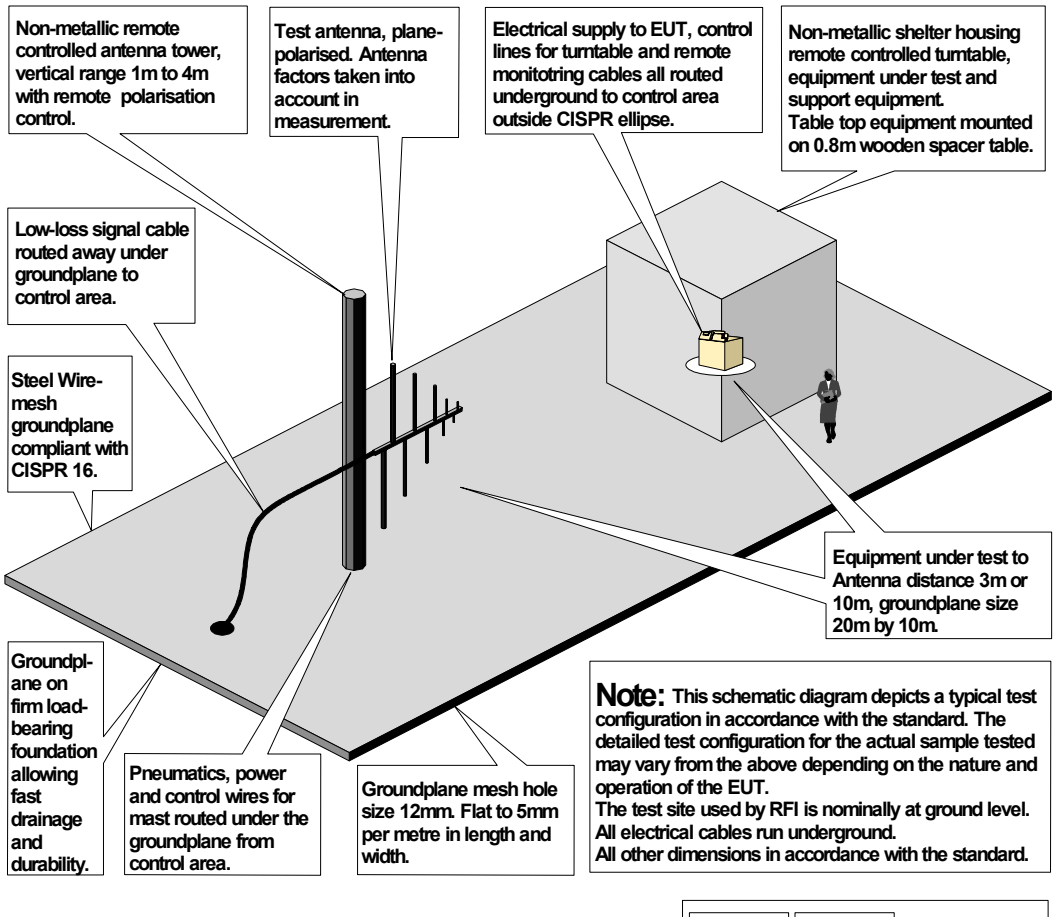
Test Of: Nokia Mobile Phones.
NHM-10 Model 3620
To: FCC Part 22 & 24

DRG\45157JD01\EMICON



Typical Test Configuration For Conducted Emissions Measurements In Accordance With ANSI C63.4-1992
Tests performed in a screened enclosure

DRG\45157JD01\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