



TEST REPORT FROM RADIO FREQUENCY INVESTIGATION LTD.

Test Of: Remote Diagnostics Technology
Tempus 2000

To: FCC Part 24

Test Report Serial No:
RFI/MPTB1/RP45670JD01A

This Test Report Is Issued Under The Authority Of Richard Jacklin, Operations Director: 	Checked By: 
Tested By:  pp	Release Version No: PDF01
Issue Date: 15 January 2004	Test Dates: 05 December 2003 to 18 December 2003

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RADIO FREQUENCY INVESTIGATION LTD

Operations Department

**Test Of: Remote Diagnostics Technology
Tempus 2000
To: FCC Part 24**

TEST REPORT

S.No. RFI/MPTB1/RP45670JD01A

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1. Client Information

Company Name:	Remote Diagnostics Technologies Ltd.
Address:	The Old Coach House The Avenue Farleigh Wallop Basingstoke Hampshire RG25 2HT
Contact Name:	Mr C Hannan

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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:	RDT
Model Name or Number:	Tempus 2000
Unique Type Identification:	Part number 00-0002
Serial Number:	101
FCC ID Number:	ROS0002
Country of Manufacture:	UK
Date of Receipt:	05 December 2003

2.2. Description Of EUT

The equipment under test is a vital signs monitor designed for use in remote locations by trained non-medical expert personnel. The device monitors a variety of vital signs and transmits the data via existing wired or wireless (GSM) telecommunications that are available locally or in remote locations.

The device also incorporates an integral microphone and earpiece that allows the user to communicate with the Response centre. The Tempus 2000 is battery powered and has no connections to a mains supply.

2.3. Modifications Incorporated In EUT

The EUT was modified by bringing out a mouse and keyboard connection, This was done in order to run test software that enabled a GSM connection between the EUT and the test set.

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2.4. Additional Information Related To Testing

Power Supply Requirement: (Internal battery)	14.4 VDC		
Declared Battery End Point Voltage	12.5 VDC		
Intended Operating Environment:	Within GSM Network Coverage		
Equipment Category:	Portable		
Type of Unit:	Transceiver		
Weight:	8040 g including battery		
Dimensions:	269 x 291 x 253 mm		
Interface Ports:	None		
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)	27.6 dBm		

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2.5. Support Equipment

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

Description:	Keyboard
Brand Name:	Cherry
Model Name or Number:	ML4100
Serial Number:	C 036067
Cable Length and Type:	Screened serial cable 167 cm
Connected to Port:	Keyboard port brought out of enclosure (not fitted for production units)

Description:	Mouse
Brand Name:	Kensington
Model Name or Number:	Mouse in a box
Serial Number:	006D00130
Cable Length and Type:	Screened serial cable 163 cm
Connected to Port:	Mouse port brought out of enclosure (not fitted for production units)

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3. Test Specification, Methods And Procedures

3.1. Test Specifications

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 15.109)
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.

Reference:	FCC Part 2
Title:	Code of Federal Regulations, Part 2 (47CFR2) 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.

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4. Deviations From The Test Specification

None.

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5. Operation Of The EUT During Testing

5.1. Operating Conditions

During testing, the EUT was powered by a nominal 14.4 VDC Battery.

5.2. Operating Modes

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

Switched on and connected to the HP test set by a HyperTerminal session. NIBP/SpO2 and capnometer and ECGT modules were switched on.

5.3. Configuration And Peripherals

The EUT was tested in the following configuration:

In order to initiate a HyperTerminal session, a keyboard and mouse were connected to the unit. Note the client stated that would be worst case scenario regarding testing as the normal production units are not fitted with these peripherals.

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6. Summary Of Test Results

Range Of Measurements	Specification Reference	Port Type	Compliance Status
Idle Mode Radiated Spurious Emissions	C.F.R. 47 FCC Part 15: 2002 Section 15.109	Enclosure	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 Radiated Emissions	C.F.R. 47 FCC Part 24: 2002 Section 2.1053/24.238	Antenna	Complied
Transmitter Band Edges Radiated Emissions	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.

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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 8 for details of measurement uncertainties.

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8. Test Results

8.1. Idle Mode Radiated Spurious Emission: Section 15.109

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

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

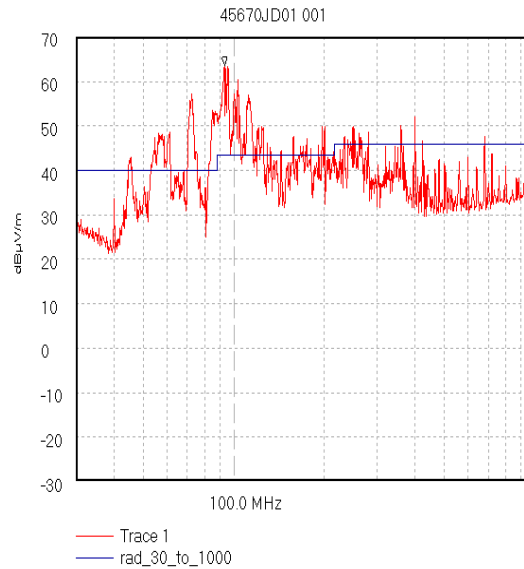
Result:

Frequency (MHz)	Antenna Polarity (H/V)	Q-P Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
45.829	Vert.	22.5	40.0	17.5	Complied
56.995	Vert.	30.0	40.0	10.0	Complied
61.180	Vert.	28.6	40.0	11.4	Complied
72.480	Vert.	39.8	40.0	0.2	Complied
72.061	Vert.	40.0	40.0	0.0	Complied
111.549	Vert.	30.3	43.5	13.2	Complied
120.273	Vert.	37.1	43.5	6.1	Complied
160.364	Vert.	39.6	43.5	3.9	Complied
197.562	Vert.	33.0	43.5	10.5	Complied
200.455	Vert.	39.3	43.5	4.2	Complied
233.864	Horiz.	40.1	46.0	5.9	Complied
525.513	Horiz.	33.0	46.0	13.0	Complied
263.252	Horiz.	31.0	46.0	15.0	Complied
280.637	Vert.	40.5	46.0	5.5	Complied
360.819	Horiz.	39.9	46.0	6.1	Complied
400.910	Vert.	44.0	46.0	2.0	Complied

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Idle Mode Radiated Spurious Emission: Section 15.109 (Continued)

Start 30.0 MHz; Stop 1.0 GHz - Log Scale
Ref 70 dBµV/m; Ref Offset 0.0 dB; 10 dB/div
RBW 120.0 kHz; VBW 100.0 kHz; Att 0 dB; Swp 380.0 mS
Peak 93.222 MHz, 63.66 dBµV/m
Limit/Mask: rad_30_to_1000; Limit Test Failed
Transducer Factors: A1037
05/12/2003 14:32:12

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

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Idle Mode Radiated Spurious Emission: Section 15.109 (Continued)**8.1.1. Electric Field Strength Measurements (Frequency Range 1.0 to 10.0 GHz)**

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

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

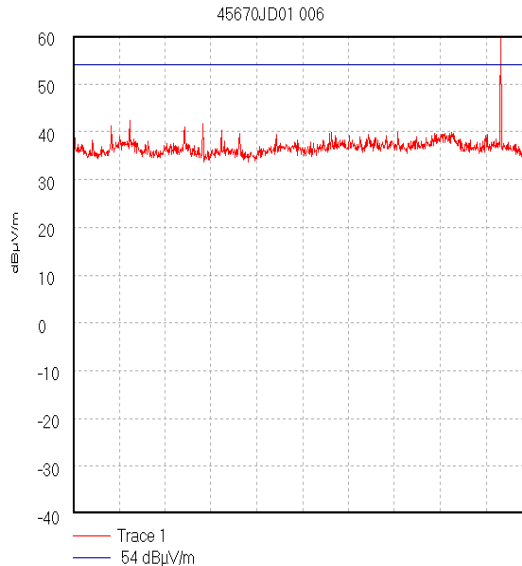
Result:**Highest Peak Level:**

Frequency (GHz)	Antenna Polarity (H/V)	Peak Detector level (dB μ V)	Antenna factor (dB)	Cable loss (dB)	Actual Peak Level (dB μ V/m)	Peak Limit (dB μ V/m)	Peak Margin (dB)	Result
1.0823	V	19.9	21.5	0.8	42.3	74.0	31.7	Complied
1.1227	H	21.7	21.6	0.8	44.1	74.0	29.9	Complied
1.2427	H	17.0	21.6	0.9	39.5	74.0	34.5	Complied
1.3229	V	19.3	21.7	0.9	41.9	74.0	32.1	Complied
1.3630	H	19.9	21.7	0.9	42.5	74.0	31.5	Complied
1.9301	H	7.1	22.0	1.2	30.2	74.0	43.8	Complied
3.6933	H	8.9	20.9	1.5	31.4	74.0	42.6	Complied
3.9866	H	10.0	21.0	1.6	32.6	74.0	41.4	Complied

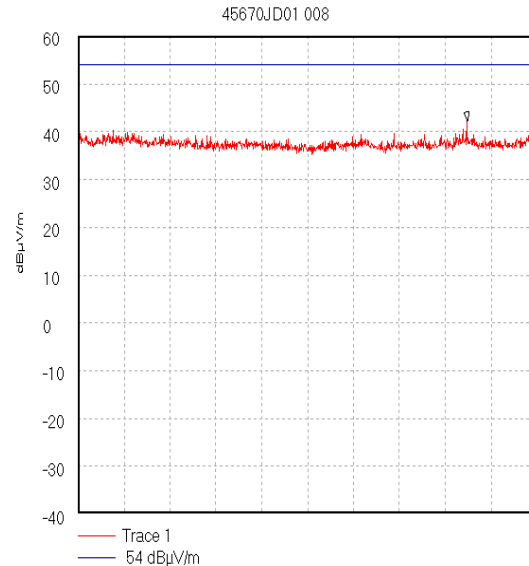
Highest Average Level:

Frequency (GHz)	Antenna Polarity (H/V)	Average Detector level (dB μ V)	Antenna factor (dB)	Cable loss (dB)	Actual Average Level (dB μ V/m)	Average Limit (dB μ V/m)	Average Margin (dB)	Result
1.0823	V	16.3	21.5	0.8	38.7	54.0	15.3	Complied
1.1227	H	15.0	21.6	0.8	37.4	54.0	16.6	Complied
1.2427	V	12.4	21.6	0.9	34.9	54.0	19.1	Complied
1.3229	V	13.6	21.7	0.9	36.2	54.0	17.8	Complied
1.3630	H	17.2	21.7	0.9	39.8	54.0	14.2	Complied
1.9301	H	-5.2	22.0	1.2	17.9	54.0	36.1	Complied
3.6933	H	-3.0	20.9	1.5	20.9	54.0	33.1	Complied
3.9866	H	-2.3	21.0	1.6	20.3	54.0	33.7	Complied

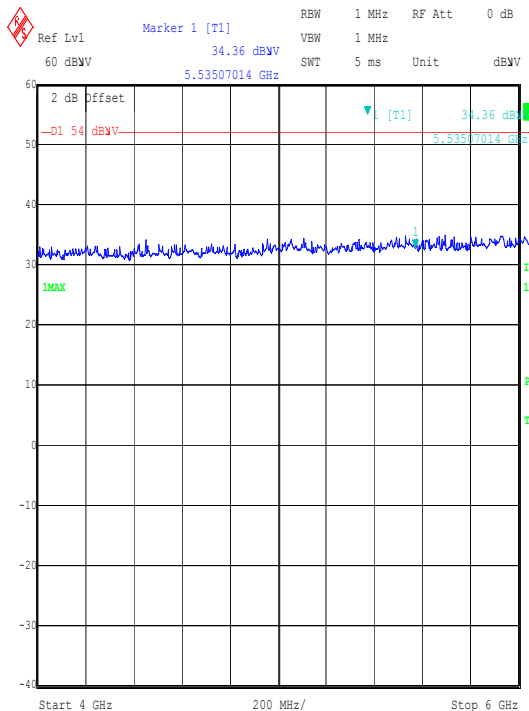
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Idle Mode Radiated Spurious Emission: Section 15.109 (Continued)

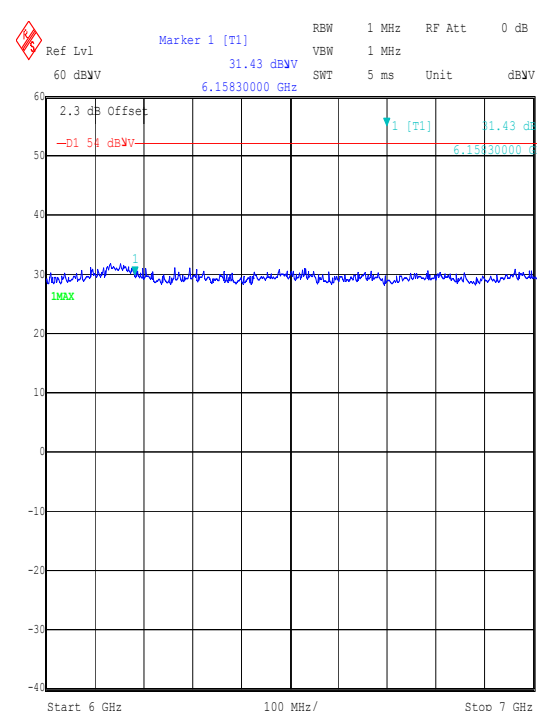
Start 1.0 GHz; Stop 2.0 GHz
Ref 60 dBμV/m; Ref Offset 0.0 dB; 10 dB/div
RBW 1000.0 kHz; VBW 1.0 MHz; Att 10 dB; Swp 20.0 mS
Peak 1.932 GHz; 60.6 dBμV/m
Display Line: 54 dBμV/m; Limit Test Failed
Transducer Factors: 1 to 2
05/12/2003 17:43:53



Start 2.0 GHz; Stop 4.0 GHz
Ref 60 dBμV/m; Ref Offset 0.0 dB; 10 dB/div
RBW 1000.0 kHz; VBW 1.0 MHz; Att 10 dB; Swp 20.0 mS
Peak 3.696 GHz; 42.18 dBμV/m
Display Line: 54 dBμV/m; Limit Test Passed
Transducer Factors: 2 to 4
05/12/2003 17:49:28



Title: 45670JD01 RDT FCC24.238 Radiated Emissions idle
Date: 9.DEC.2003 20:37:58

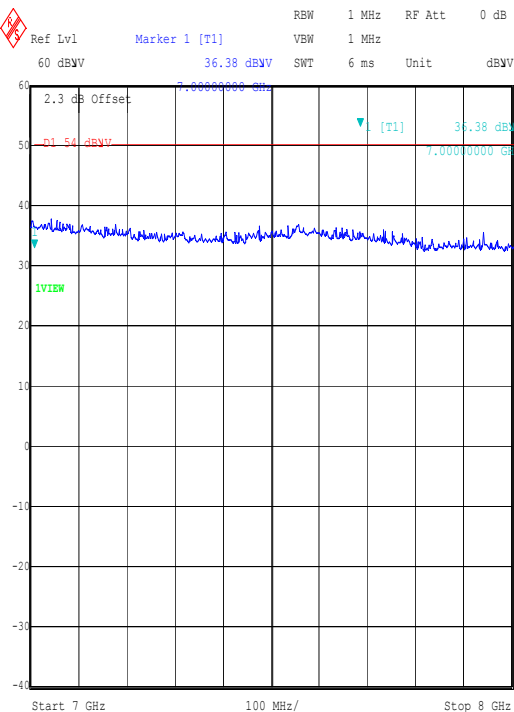


Title: 45670JD01 RDT FCC24.238 Radiated Emissions idle
Date: 9.DEC.2003 20:30:39

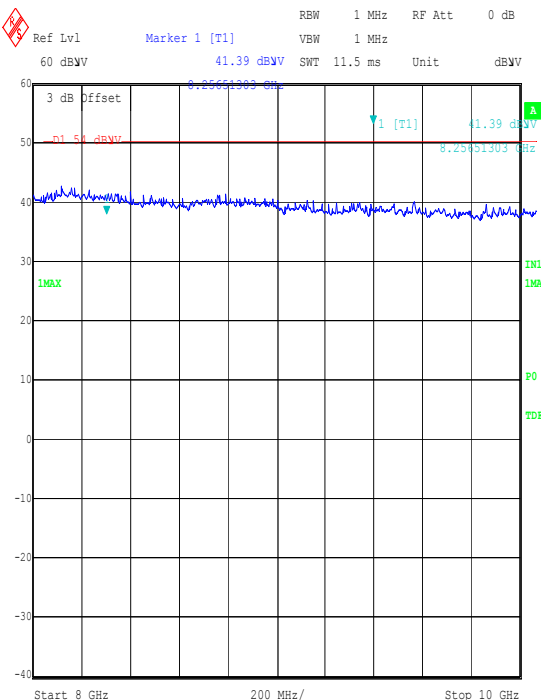
Note: these plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables. The emission in lot 6 is the test support simulator not the EUT.

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Idle Mode Radiated Spurious Emission: Section 15.109 (Continued)



Title: 45670JD01 RDT FCC24.238 Radiated Emissions idle
Date: 9,DEC,2003 20:28:56



Title: 45670JD01 RDT FCC24.238 Radiated Emissions idle
Date: 9,DEC,2003 20:17:57

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

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

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

8.2.2. 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	Vert.	19.2	33.0	13.8	Complied
Middle	1879.8	Horiz.	25.7	33.0	7.3	Complied
Top	1909.8	Horiz.	27.6	33.0	5.4	Complied

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

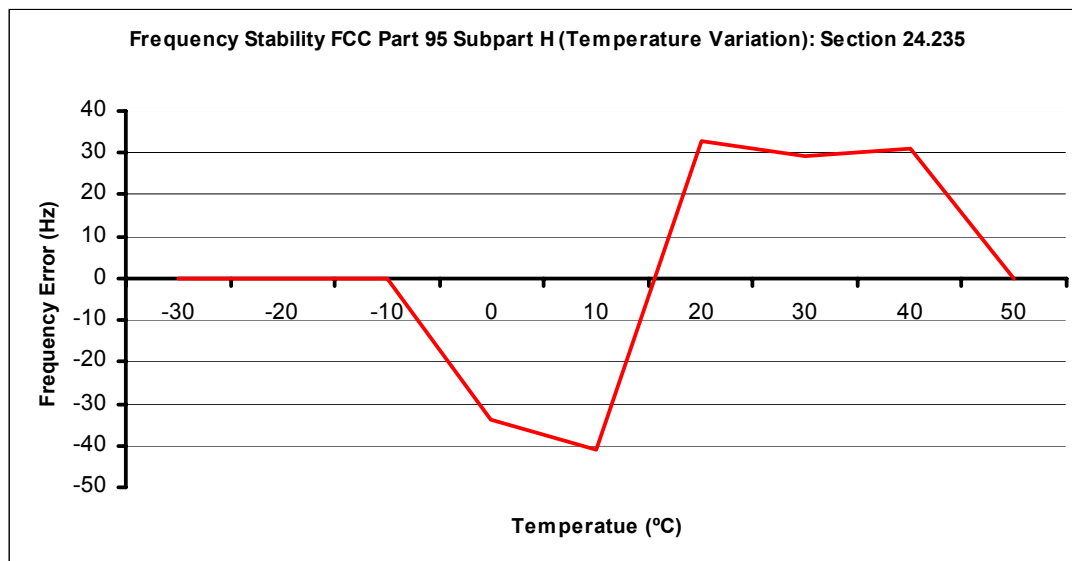
8.3.1. The EUT was configured as for frequency stability measurements as described in Section 9 of this report.

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

Results Bottom Channel (1850.2 MHz)

Temp (°C)	Frequency Error (Hz)	Measured Frequency (MHz)	Lower Band Edge Limit (MHz)	Margin (MHz)	Result
-30	Unit switches off	-	1850.0	-	-
-20	Unit switches off	-	1850.0	-	-
-10	Unit switches off	-	1850.0	-	-
0	-34	1850.199966	1850.0	199.966	Complied
10	-41	1850.199959	1850.0	199.959	Complied
20	33	1850.200033	1850.0	200.033	Complied
30	29	1850.200029	1850.0	200.029	Complied
40	31	1850.200031	1850.0	200.031	Complied
50	Unit switches off	-	1850.0	-	-

Note: The unit is designed to power down when the ambient temperature rises above 40°C, or falls below 0°C. The unit was monitored at 1°C steps above and below these temperature points. The unit remained compliant within the range -4°C, and +44°C. Beyond these points the unit ceased to function and was not tested.

Frequency Variation From 1850.2MHz

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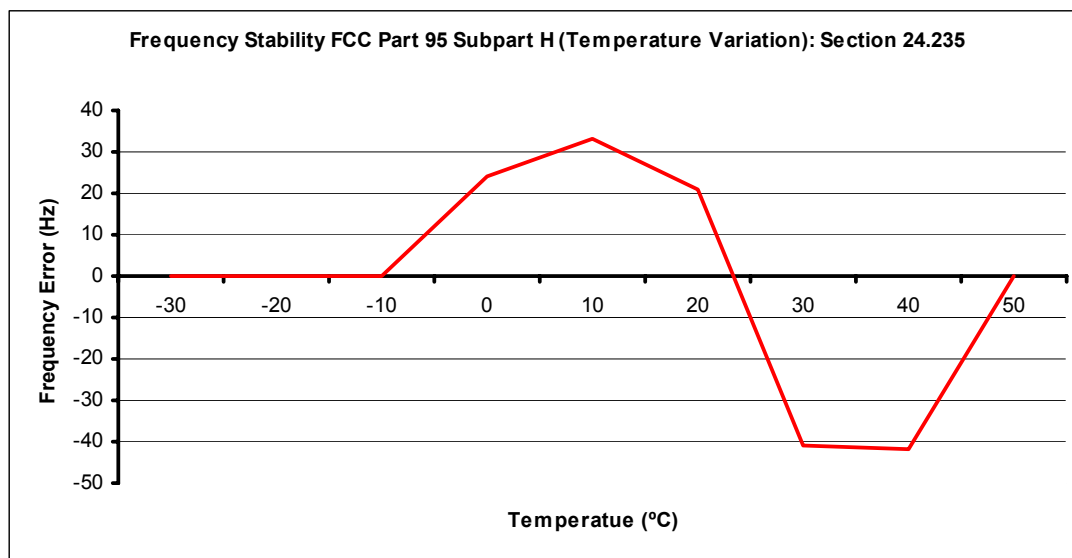
Tempus 2000

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Transmitter Frequency Stability (Temperature Variation): Section 24.235 (continued)**Results Top Channel (1909.8 MHz)**

Temp (°C)	Frequency Error (Hz)	Measured Frequency (MHz)	Upper Band Edge Limit (MHz)	Margin (kHz)	Result
-30	Unit switches off	-	1910.0	-	-
-20	Unit switches off	-	1910.0	-	-
-10	Unit switches off	-	1910.0	-	-
0	24	1909.800024	1910.0	199.976	Complied
10	33	1909.800033	1910.0	199.967	Complied
20	21	1909.800021	1910.0	199.979	Complied
30	-41	1909.799959	1910.0	200.041	Complied
40	-42	1909.799958	1910.0	200.042	Complied
50	Unit switches off	-	1910.0	-	-

Note: The unit is designed to power down when the ambient temperature rises above 40°C, or falls below 0°C. The unit was monitored at 1°C steps above and below these temperature points. The unit remained compliant within the range -4°C, and +44°C. Beyond these points the unit ceased to function and was not tested.

Frequency Variation From 1909.8MHz

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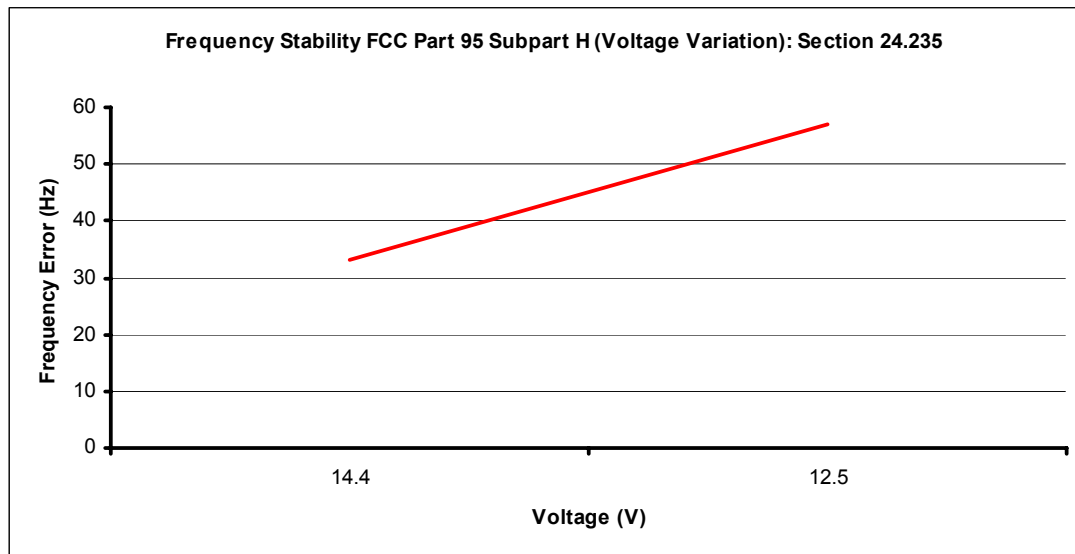
8.4. Transmitter Frequency Stability (Voltage Variation): Section 24.235

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 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
14.4	33	1850.200033	1850	200.033	Complied
12.5	57	1850.200057	1850	200.057	Complied

Frequency Variation From 1850.2MHz

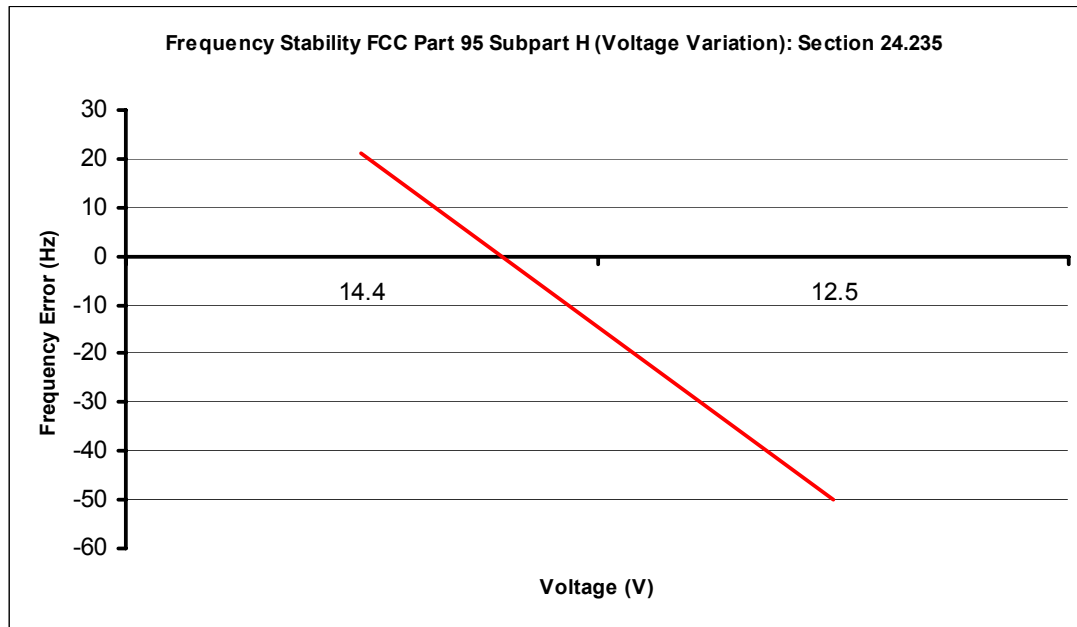
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Transmitter Frequency Stability (Voltage Variation): Section 24.235
(Continued)**Results Top Channel (1909.8 MHz)**

Supply Voltage (V)	Frequency Error (Hz)	Measured Frequency (MHz)	Lower Band Edge Limit (MHz)	Margin (MHz)	Result
14.4	21	1909.800021	1910	199.979	Complied
12.5	-50	1909.799950	1910	200.050	Complied

Frequency Variation From 1909.8MHz

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8.5. Transmitter Occupied Bandwidth: Section 24.238

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

8.5.2. 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	245.291
Middle	1879.8	3.0	10.0	249.291
Top	1909.8	3.0	10.0	245.291

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

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

8.6.2. 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
3700.4	-25.5	-13.0	12.5	Complied
5550.6	-51.6	-13.0	38.6	Complied
7400.8	-55.2	-13.0	42.2	Complied

Result: Middle Channel

Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
3759.6	-30.6	-13.0	17.6	Complied
5639.4	-53.0	-13.0	40.0	Complied
7519.2	-51.1	-13.0	38.1	Complied

Result: Top Channel

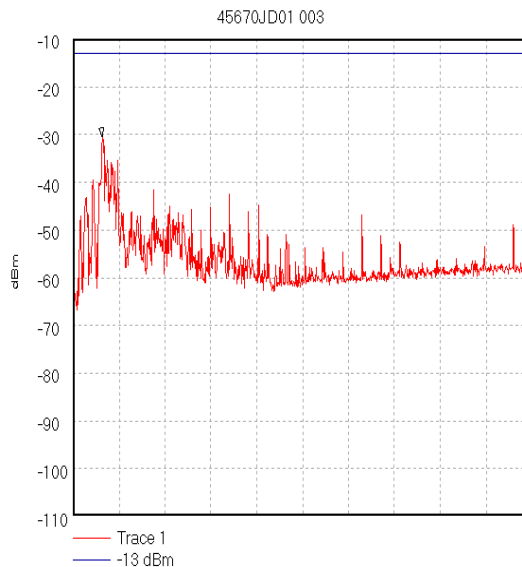
Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
3819.6	-26.0	-13.0	13.0	Complied
5729.4	-50.7	-13.0	37.7	Complied
7639.2	-45.7	-13.0	32.7	Complied

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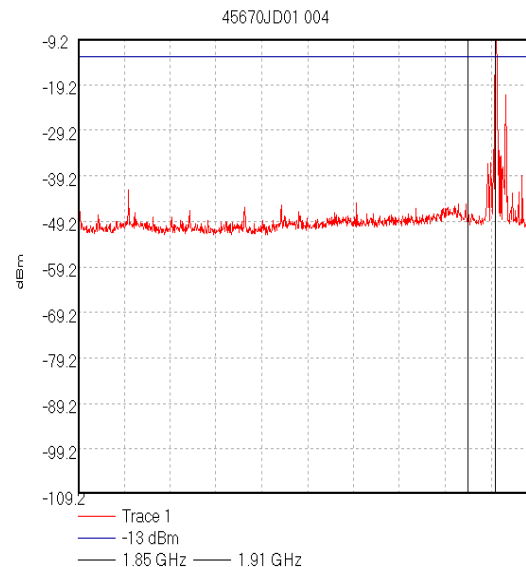
Tempus 2000

To: FCC Part 24

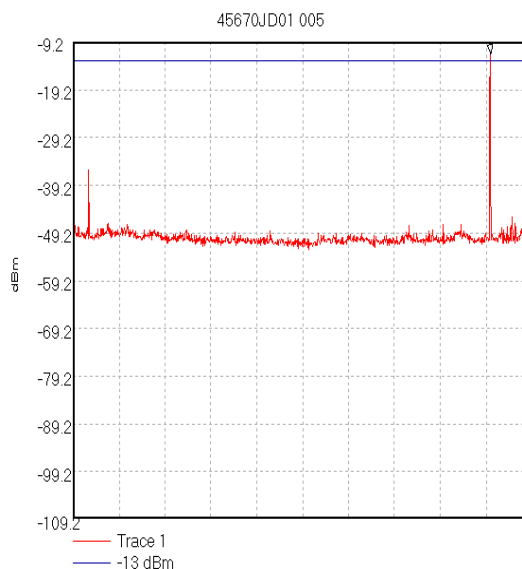
Issue Date: 15 January 2004

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

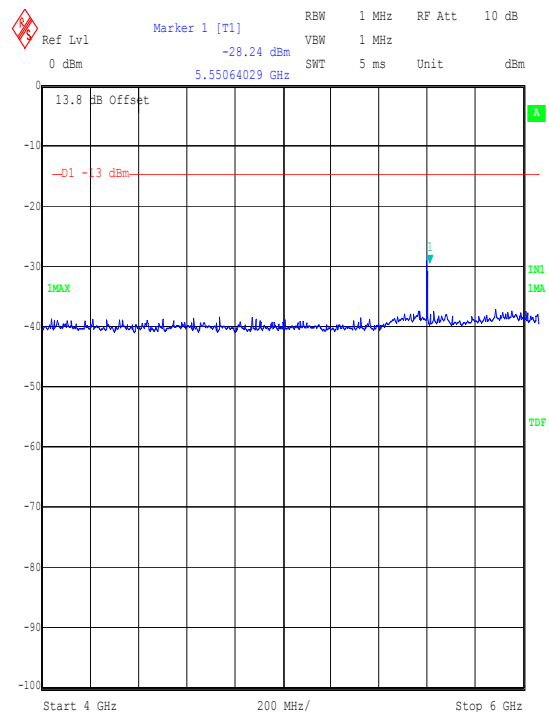
Start 30.0 MHz; Stop 1.0 GHz
Ref -10 dBm; Ref Offset 11.8 dB; 10 dB/div
RBW 120.0 kHz; VBW 100.0 kHz; Att 0 dB; Swp 440.0 mS
Peak 91.433 MHz, -30.51 dBm
Display Line: -13 dBm; Limit Test Passed
Transducer Factors: A1037
05/12/2003 16:32:25



Start 1.0 GHz; Stop 2.0 GHz
Ref -9.2 dBm; Ref Offset 11.8 dB; 10 dB/div
RBW 1000.0 kHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 1.911 GHz, -5.22 dBm
Display Line: -13 dBm; Limit Test Failed
Transducer Factors: 1 to 2
05/12/2003 16:50:41



Start 2.0 GHz; Stop 4.0 GHz
Ref -9.2 dBm; Ref Offset 11.8 dB; 10 dB/div
RBW 1000.0 kHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 3.82 GHz, -11.68 dBm
Display Line: -13 dBm; Limit Test Failed
Transducer Factors: 2 to 4
05/12/2003 16:58:43

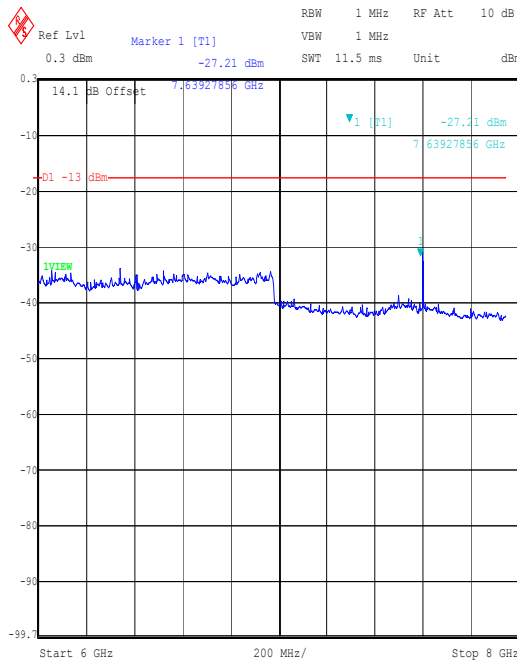


Title: 45670JD01 RDT FCC24.238 Radiated Emissions
Date: 8.DEC.2003 15:18:46

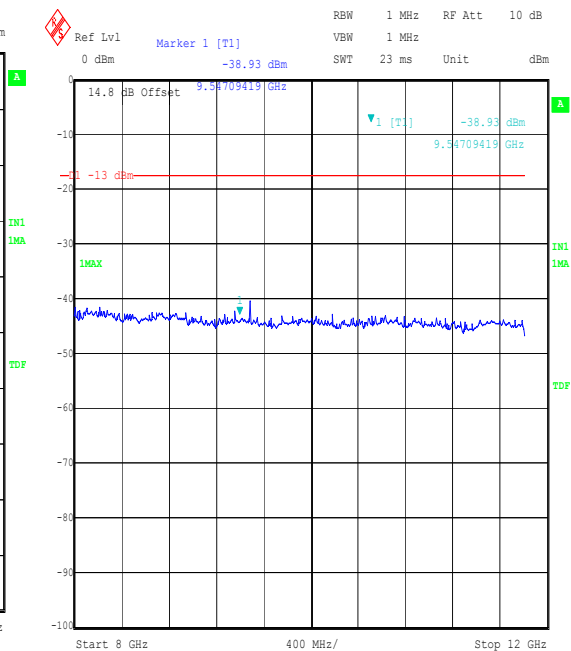
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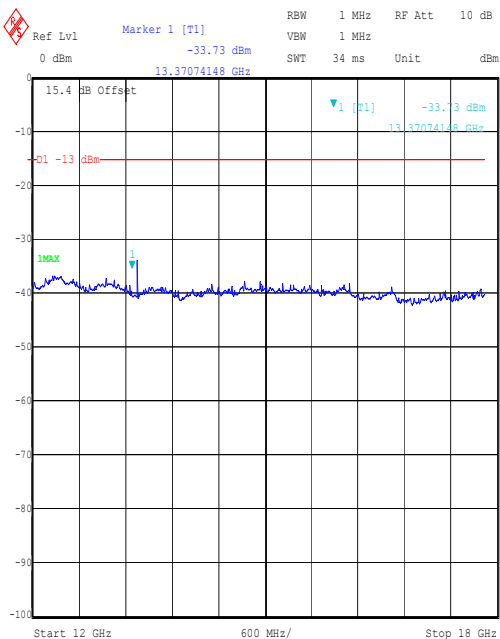
To: FCC Part 24

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

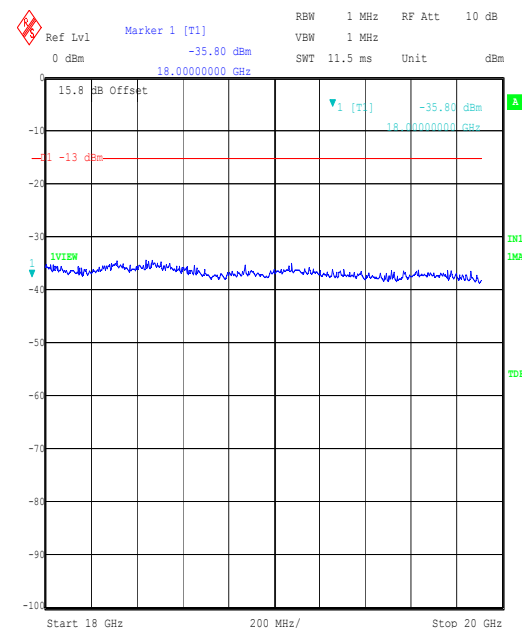
Title: 45670JD01 RDT FCC24.238 Radiated Emissions
Comment A: 4GHz to 6GHz
Date: 8.DEC.2003 15:52:06



Title: 45670JD01 RDT FCC24.238 Radiated Emissions
Comment A: 8GHz to 12GHz
Date: 8.DEC.2003 16:11:12



Title: 45670JD01 RDT FCC24.238 Radiated Emissions
Comment A: 12GHz to 18GHz
Date: 8.DEC.2003 16:22:56



Title: 45670JD01 RDT FCC24.238 Radiated Emissions
Comment A: 18GHz to 20GHz
Date: 8.DEC.2003 16:33:34

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.

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Transmitter Out of Band Radiated Emissions: Section 2.1051/24.238 (Continued)**Integrated Power Over 1 MHz Strip Band: 1911 to 1912 MHz**^{1st} 1 MHz block immediately outside adjacent frequency block

100 kHz Strip Number	Peak Power (nW/100 kHz)	100 kHz Strip Number	Peak Power (nW/100 kHz)
1	737.9	6	208.4
2	436.5	7	134.0
3	450.8	8	100.0
4	279.9	9	125.9
5	239.9	10	92.0
Total Peak Power:		2805.3nW/MHz	

Integrated Power Over 1 MHz Strip Band: 1912 to 1913 MHz^{2nd} 1 MHz block immediately outside adjacent frequency block

100 kHz Strip Number	Peak Power (nW/100 kHz)	100 kHz Strip Number	Peak Power (nW/100 kHz)
1	34.0	6	23.2
2	47.6	7	23.4
3	31.6	8	21.5
4	30.3	9	16.1
5	28.8	10	9.8
Total Peak Power:		266.3nw/MHz	

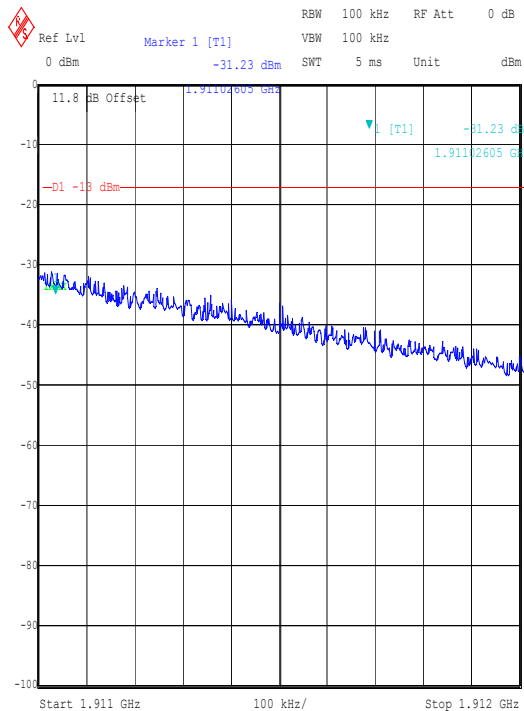
Result:

Band (MHz)	Peak Power (dBm/MHz)	Limit (dBm/MHz)	Margin (dB)	Status
1911 to 1912	-25.5	-13.0	12.5	Complied
1912 to 1913	-35.7	-13.0	22.7	Complied

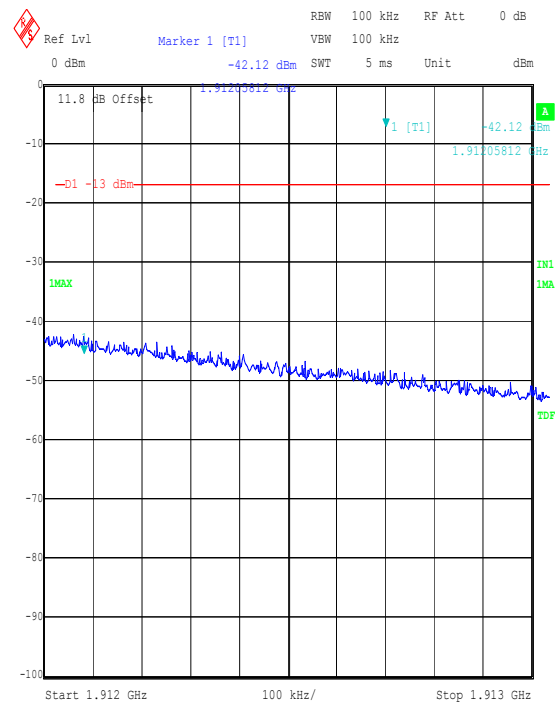
Test Of: Remote Diagnostics Technology

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

Title: 45670JD01 RDT Radiated 1MHz Strips
Date: 16.DEC.2003 16:39:40



Title: 45670JD01 RDT Radiated 1MHz Strips
Date: 16.DEC.2003 16:54:30

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.

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

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

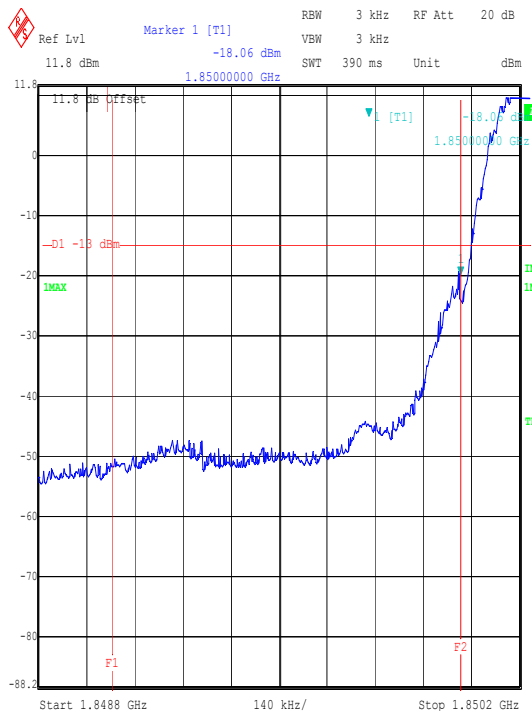
8.7.2. Tests were performed to identify the maximum emissions level at the band edges of the frequency band that the EUT will operate over.

Results:**Bottom Band Edge**

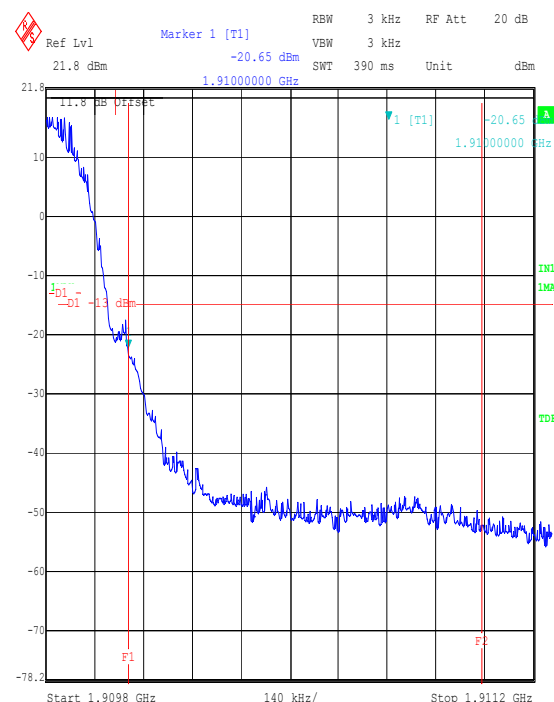
Frequency (MHz)	Spurious Emission (dBm)	Limit (dBm)	Margin (dB)	Result
1850	-16.1	-13.0	3.1	Complied

Top Band Edge

Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
1910	-20.7	-13.0	7.7	Complied



Title: 45670JD01 RDT Radiated at Band Edges (Bottom)
Date: 16.DEC.2003 15:14:05



Title: 45670JD01 RDT Radiated at Band Edges (Top)
Date: 16.DEC.2003 15:21:21

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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; therefore all radiated tests were performed with the unit operating into the integral antenna.

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

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

Once the final amplitude (maximised) had been obtained, the EUT was substituted with a 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 attenuator. The signal generator was tuned to the EUT's frequency under test.

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

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

All measurements were performed using broadband Horn antennas.

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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.

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

where :

EUT = spectrum analyser indicated EUT raw level

SG = spectrum analyser indicated signal generator raw level

The signal generator actual EIRP is calculated as:

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

The EUT EIRP is calculated as:

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

The test equipment settings for EIRP measurements were as follows:

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

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9.2. Frequency Stability

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

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

Measurements were also performed at voltage extremes between the declared nominal supply voltage and at the declared endpoint voltage (for battery operated equipment) or by varying the primary supply voltage from 85% to 115% of the nominal value for all other equipment types.

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.

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. In order to get the margin from the lower band edge, subtract the lower band edge limit from the measured frequency. The margin from the upper band edge is found by subtracting the measured frequency from the upper band edge limit. In order to show compliance the margin must be positive. A negative margin shows non-compliance.

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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 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 therefore 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 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 spectrum analyser user manual for this measurement, i.e., RBW $\leq$ 1% of occupied bandwidth. A value of 3 kHz was used.

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

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

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

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Transmitter Radiated Emissions (Continued)

The limit in the standard states that emissions shall be attenuated by at least $43 + 10 \log (P)$ dB below the transmitter power (P), where (P) is the maximum measured fundamental power for the channel under test. This limit always reduces to -13 dBm therefore, 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.

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 next largest available bandwidth above this calculated figure was, therefore, used i.e. 3 kHz.

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9.5. Receiver Radiated Emissions

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

Initial pre-scans covering the entire measurement band from the lowest generated frequency declared up to 5 times the highest unintentionally generated frequency 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.

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

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

Receiver Function	Initial Scan	Final Measurements Below 1 GHz	Final Measurements Above 1 GHz
Detector Type:	Peak	Quasi-Peak (CISPR)	Peak/Average
Mode:	Max Hold	Not applicable	Not applicable
Bandwidth:	(120 kHz < 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

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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
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 MHz to 1000 MHz	95%	+/- 5.26 dB
Radiated Spurious Emissions	1 GHz to 26 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.

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Appendix 1. Test Equipment Used

RFI No.	Instrument	Manufacturer	Type No.	Serial No.
A027	Horn Antenna	Eaton	9188-2	301
A031	2 to 4 GHz Eaton Horn Antenna	Eaton	91889-2	557
A253	WG 12 Microwave Horn	Flann Microwave	12240-20	128
A254	WG 14 Microwave Horn	Flann Microwave	14240-20	139
A259	Bilog Antenna	Chase	CBL6111	1513
A276	OATS Positioning Controller	Rohde & Schwarz	HCC	
A429	WG 16 horn	Flann	16240-20	561
A430	WG 18 horn	Flann	18240-20	425
A436	WG 20 horn	Flann	20240-20	330
C178	Cable	Rosenberger	UFA210A-1-1181-70x70	None
C461	Cable	Rosenberger	UFA210A-1-1182-704704	98H0305
E013	PCN Environmental Chamber	Sanyo	ATMOS chamber	None
M003	Spectrum Monitor	Rohde & Schwarz	EZM	883 580/008
M023	ESVP Receiver	Rohde & Schwarz	ESVP	872 991/027
M051	Multimeter	Fluke	75	52571394
M069	ESMI Spectrum Analyser / Receiver	Rohde & Schwarz	ESMI	829 808/007 (DU) / 827 063/008 (RU)
M090	Receiver / Spectrum Analyser System	Rohde & Schwarz	ESBI	DU:838494/005 RU:836833/001
M1013	GSM Test set	Hewlett Packard	8922M	3503U00372
M1068	Thermometer Digital	Iso-Tech	RS55	93102884
M1124	Rohde & Schwarz	Rohde & Schwarz	ESIB26	100046K
M173	Turntable Controller	R.H.Electrical Services	RH351	3510020
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.

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Appendix 2. Test Configuration Drawings

This appendix contains the following drawings:

Drawing Reference Number	Title
DRG\45670JD01\EMIRAD	Test configuration for measurement of radiated emissions

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DRG\45670JD01\EMIRAD

