



## TEST REPORT FROM RFI GLOBAL SERVICES LTD

Test of: Panasonic Mobile Comms Dev of Europe Ltd  
VS8x

To: FCC Part 24: 2007 (Subpart E)

**Test Report Serial No:**  
RFI/RPTE4/RP72841JD07A

**Supersedes Test Report Serial No:**  
RFI/RPTE3/RP72841JD07A

<b>This Test Report Is Issued Under The Authority Of Steve Flooks, Service Leader RPG:</b>		 <b>pp Brian Watson</b>
<b>Checked By:</b> <b>Brian Watson</b>		<b>Report Copy No: PDF01</b>
<b>Issue Date: 11 February 2008</b>		<b>Test Dates: 12 November 2007 to 25 November 2007</b>

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**RFI Global Services Ltd**

Pavilion A, Ashwood Park, Ashwood Way, Basingstoke, Hampshire RG23 8BG  
Telephone: +44 (0)1256 312000 Facsimile: +44 (0)1256 312001  
Email: [info@rfi-global.com](mailto:info@rfi-global.com) Website: [www.rfi-global.com](http://www.rfi-global.com)

Registered in England and Wales. Company number: 2117901

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                     **VS8x**

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## 1. Client Information

<b>Company Name:</b>	Panasonic Mobile Comms Dev of Europe Ltd
<b>Address:</b>	2 Gables Way Colthrop Thatcham Berkshire RG19 4ZB
<b>Contact Name:</b>	Mr M Hargreaves

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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)**

<b>Description:</b>	Mobile Handset
<b>Brand Name:</b>	SoftBank
<b>Model Name or Number:</b>	VS8x
<b>Serial Number:</b>	None Stated
<b>IMEI Number:</b>	004401220295543
<b>Hardware Version Number:</b>	Rev BA
<b>Software Version Number:</b>	920PVA01
<b>FCC ID Number:</b>	UCE207004A
<b>Country of Manufacture:</b>	Japan
<b>Date of Receipt:</b>	12 November 2007

<b>Description:</b>	Battery
<b>Brand Name:</b>	SoftBank
<b>Model Name or Number:</b>	EB-BS006JP
<b>Serial Number:</b>	None Stated
<b>Country of Manufacture:</b>	Japan
<b>Date of Receipt:</b>	12 November 2007

### **2.2. Description of EUT**

The equipment under test is a dual mode (W-CDMA/GSM) Cellular Mobile Telephone with Bluetooth & RFID.

### **2.3. Modifications Incorporated in EUT**

During the course of testing the EUT was not modified.

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## 2.4. Additional Information Related to Testing

Power Supply Requirement:	Internal battery supply of 3.7 V		
Intended Operating Environment:	Within GSM coverage		
Equipment Category:	Bluetooth, GSM/GPRS, Short Range Device, UMTS FDD I		
Type of Unit:	Portable (standalone battery powered device)		
Transmit Frequency Range:	1850 MHz to 1910 MHz		
Transmit Channels Tested:	Channel ID	Channel Number	Channel Frequency (MHz)
	Bottom	512	1850.2
	Middle	660	1879.8
	Top	810	1909.8
Receive Frequency Range:	1930 MHz to 1990 MHz		
Receive Channels Tested:	Channel ID	Channel Number	Channel Frequency (MHz)
	Bottom	512	1930.2
	Middle	660	1959.8
	Top	810	1989.8
Maximum Power Output (EIRP)	25.5 dBm		

## 2.5. Port Identification

Port	Description	Type/Length
1	Charge/Data port	Not Applicable
2	AV Out	1.8m multi-core
3	USIM	Not Applicable
4	Micro-SD	Dedicated micro-SD card port

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## **2.6. Support Equipment**

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

<b>Description:</b>	AC Charger
<b>Brand Name:</b>	SoftBank
<b>Model Name or Number:</b>	ZTDAA1
<b>Serial Number:</b>	None Stated
<b>Cable Length and Type:</b>	1.5m round twin core
<b>Connected to Port:</b>	Charge/Data port

<b>Description:</b>	DC Charger
<b>Brand Name:</b>	SoftBank
<b>Model Name or Number:</b>	PMJAA1
<b>Serial Number:</b>	None Stated
<b>Cable Length and Type:</b>	2.0m approx. / 2 core curl-cord
<b>Connected to Port:</b>	Charge/Data port

<b>Description:</b>	Personal Hands Free (stereo)
<b>Brand Name:</b>	Panasonic
<b>Model Name or Number:</b>	EB-EM003
<b>Serial Number:</b>	None Stated
<b>Cable Length and Type:</b>	1.8m Multicore
<b>Connected to Port:</b>	AV Out Port

<b>Description:</b>	Micro-SD Memory Card
<b>Brand Name:</b>	Panasonic
<b>Model Name or Number:</b>	Not Applicable
<b>Serial Number:</b>	Not Applicable
<b>Cable Length and Type:</b>	Not Applicable
<b>Connected to Port:</b>	Dedicated micro-SD card port

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### **3. Test Specifications, Methods and Procedures**

#### **3.1 Test Specifications**

Reference:	FCC Part 24 Subpart E: 2007 (Broadband PCS)
Title:	Code of Federal Regulations, Part 24 (47CFR24) Personal Communication Services.

#### **Methods and Procedures**

The methods and procedures used were as detailed in:

ANSI/TIA-603-B-2003

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 (2003)

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

ANSI C63.5 (1988)

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

ANSI C63.7 (1988)

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

CISPR 16-1: (1999)

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

#### **2.7. 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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### **3. Deviations from the Test Specification**

There were no deviations from the test specification.

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## **4. Operation of the EUT during Testing**

### **4.1. Operating Modes**

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

- The EUT was operating in transmit mode at bottom, middle or top channels as required.
- For none transmit tests the EUT was set to idle mode.

### **4.2. Configuration and Peripherals**

The EUT was tested in the following configuration unless otherwise stated:

- The EUT was tested in worst case configuration with AC adaptor connected and powered via the 110V AC supply.

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## **5. Summary of Test Results**

Range of Measurements	Specification Reference	Port Type	Compliance Status
Idle Mode AC Conducted Spurious Emissions (150 kHz to 30 MHz)	C.F.R. 47 FCC Part 15: 2007 Section 15.107	AC Mains Input	Complied
Idle Mode Radiated Spurious Emissions	C.F.R. 47 FCC Part 15: 2007 Section 15.109	Enclosure	Complied
Transmitter Effective Isotropic Radiated Power (EIRP)	C.F.R. 47 FCC Part 24: 2007 Section 24.232	Antenna	Complied
Transmitter Frequency Stability (Temperature Variation)	C.F.R. 47 FCC Part 24: 2007 Section 24.235	Antenna	Complied
Transmitter Frequency Stability (Voltage Variation)	C.F.R. 47 FCC Part 24: 2007 Section 24.235	Antenna	Complied
Transmitter Occupied Bandwidth	C.F.R. 47 FCC Part 24: 2007 Section 24.238	Antenna	Complied
Transmitter Out of Band Radiated Emissions	C.F.R. 47 FCC Part 24: 2007 Section 2.1053/24.238	Antenna	Complied
Transmitter Band Edge Radiated Emissions	C.F.R. 47 FCC Part 24: 2007 Section 2.1053/24.238	Antenna	Complied

### **5.1. Location of Tests**

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

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IC Site Registration Number: 3485

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## **6. Measurements, Examinations and Derived Results**

### **6.1. General Comments**

This section contains test results only.

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

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## **6.2. Test Results**

### **6.2.1. Idle Mode AC Conducted Spurious Emissions:**

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

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

### **Results:**

#### **Quasi-Peak Detector Measurements on Live and Neutral Lines**

Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
0.194000	Live	45.3	63.9	18.6	Complied
0.206000	Live	47.9	63.4	15.5	Complied
0.518000	Neutral	33.8	56.0	22.2	Complied
0.834000	Neutral	33.4	56.0	22.6	Complied
1.082000	Live	34.0	56.0	22.0	Complied
1.146000	Neutral	32.6	56.0	23.4	Complied
1.382000	Live	35.4	56.0	20.6	Complied
1.566000	Live	37.2	56.0	18.8	Complied
1.850000	Live	38.6	56.0	17.4	Complied
1.862000	Live	38.2	56.0	17.8	Complied

#### **Average Detector Measurements on Live and Neutral Lines**

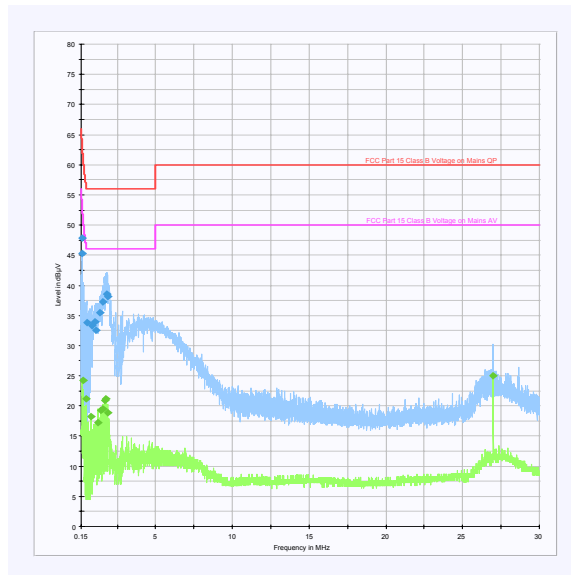
Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
0.294000	Live	24.2	50.4	26.2	Complied
0.486000	Live	21.1	46.2	25.1	Complied
0.782000	Live	18.3	46.0	27.7	Complied
1.250000	Neutral	17.2	46.0	28.8	Complied
1.462000	Live	19.2	46.0	26.8	Complied
1.562000	Live	19.5	46.0	26.5	Complied
1.670000	Live	21.0	46.0	25.0	Complied
1.774000	Live	21.1	46.0	24.9	Complied
1.862000	Live	18.9	46.0	27.1	Complied
26.998000	Live	25.0	50.0	25.0	Complied

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**Idle Mode AC Conducted Spurious Emissions: (Continued)**



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

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#### **6.2.2. Idle Mode Radiated Spurious Emissions:**

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

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

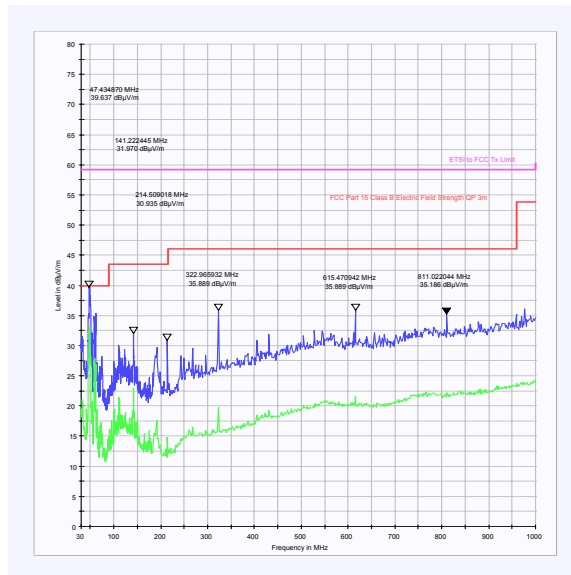
#### **Results:**

##### **Electric Field Strength Measurements (Frequency Range: 30 to 1000 MHz)**

Frequency (MHz)	Antenna Polarity	Q-P Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
49.520	Vertical	16.3	40.0	23.7	Complied
141.200	Vertical	16.6	43.5	26.9	Complied
216.001	Horizontal	23.6	46.0	22.4	Complied
324.000	Vertical	25.9	46.0	20.1	Complied
615.221	Horizontal	29.4	46.0	16.6	Complied
809.998	Horizontal	32.9	46.0	13.1	Complied

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### Idle Mode Radiated Spurious Emissions: (Continued)



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

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**6.2.3. Idle Mode Radiated Spurious Emissions:****Results:****Electric Field Strength Measurements (Frequency Range: 1 to 12.5 GHz)****Highest Peak Level:**

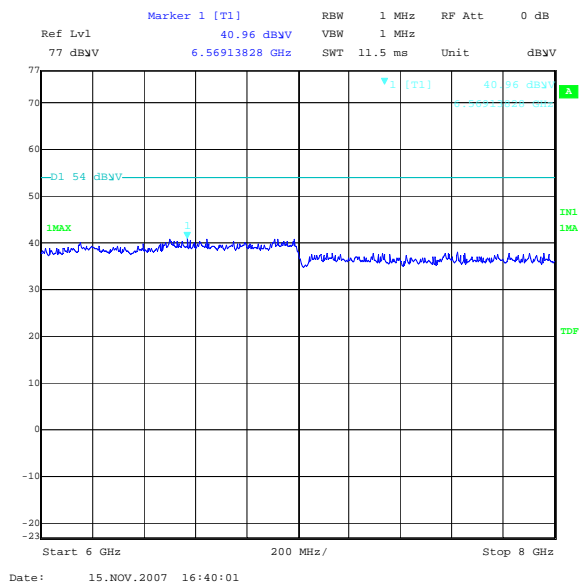
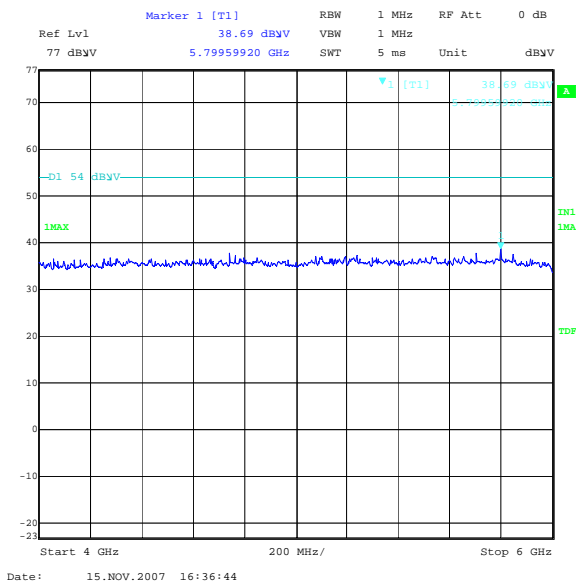
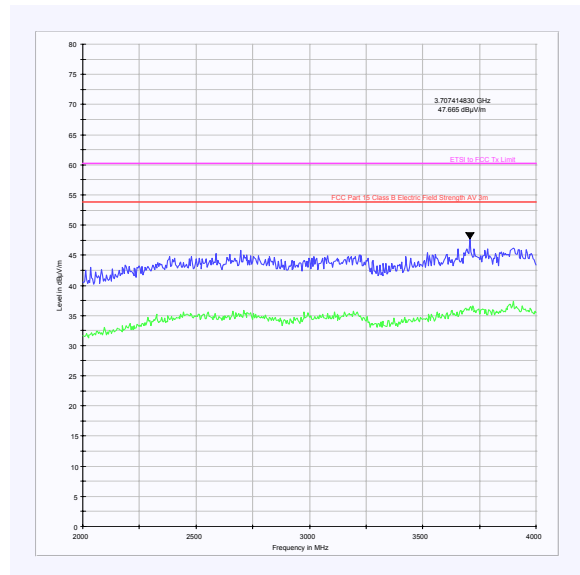
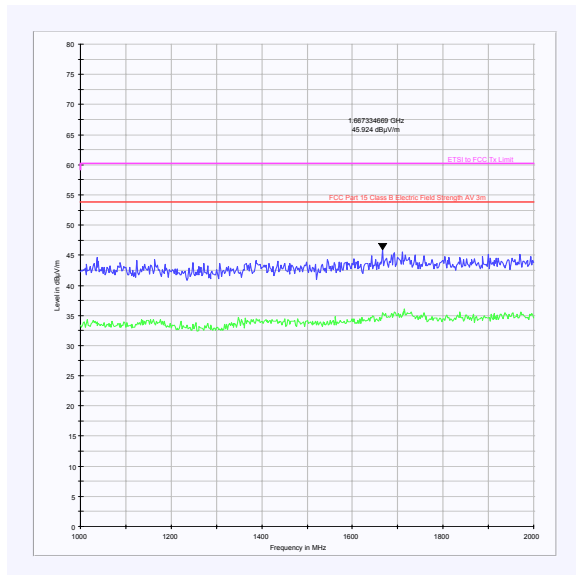
Frequency (GHz)	Antenna Polarity	Detector level (dB $\mu$ V)	Transducer factor (dB)	Actual Level (dB $\mu$ V/m)	Average Limit (dB $\mu$ V/m)	Margin (dB)	Result
3707.415	Vertical	45.1	2.6	47.7	54.0	6.3	Complied

**Note(s):**

- No spurious emissions were detected above the noise floor of the measuring receiver; therefore, the highest peak noise floor reading of the measuring receiver was recorded as shown in the table above. The peak level was compared to the average limit as opposed to being compared to the peak limit because this is the more onerous limit.*
- \*The emissions shown in the 8 GHz to 12.5 GHz pre-scan at approximately 10.687 GHz is an ambient and does not emanate from the EUT. This was disregarded for the purposes of measurement.*

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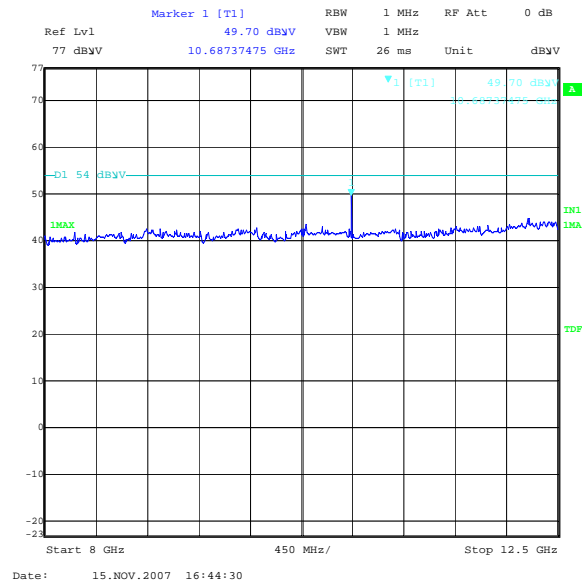
### Idle Mode Radiated Spurious Emissions: (Continued)



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 Emissions: (Continued)



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

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#### **6.2.4. Transmitter Effective Isotropic Radiated Power (EIRP):**

The EUT was configured as for effective isotropic radiated power as described in section 9 of this report.

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	Horizontal	24.9	33.0	8.1	Complied
Middle	1879.8	Horizontal	25.4	33.0	7.6	Complied
Top	1909.8	Horizontal	25.5	33.0	7.5	Complied

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### **6.2.5. Transmitter Frequency Stability (Temperature Variation):**

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

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

### **Results:**

#### **Bottom Channel (1850.2 MHz)**

Temperature (°C)	Frequency Error (Hz)	Measured Frequency (MHz)	Lower Band Edge Limit (MHz)	Margin (MHz)	Result
-30	-26	1850.199974	1850.0	0.199974	Complied
-20	-30	1850.199970	1850.0	0.199970	Complied
-10	-21	1850.199979	1850.0	0.199979	Complied
0	-10	1850.199990	1850.0	0.199990	Complied
10	-12	1850.199988	1850.0	0.199988	Complied
20	-10	1850.199990	1850.0	0.199990	Complied
30	-12	1850.199988	1850.0	0.199988	Complied
40	-21	1850.199979	1850.0	0.199979	Complied
50	-20	1850.199980	1850.0	0.199980	Complied

#### **Top Channel (1909.8 MHz)**

Temperature (°C)	Frequency Error (Hz)	Measured Frequency (MHz)	Upper Band Edge Limit (MHz)	Margin (MHz)	Result
-30	5	1909.800005	1910.0	0.199995	Complied
-20	3	1909.800003	1910.0	0.199997	Complied
-10	-10	1909.799990	1910.0	0.200010	Complied
0	-14	1909.799986	1910.0	0.200014	Complied
10	-10	1909.799990	1910.0	0.200010	Complied
20	-11	1909.799989	1910.0	0.200011	Complied
30	-14	1909.799986	1910.0	0.200014	Complied
40	-16	1909.799984	1910.0	0.200016	Complied
50	-10	1909.799990	1910.0	0.200010	Complied

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**6.2.6. Transmitter Frequency Stability (Voltage Variation):**

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

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
3.4	-2	1850.199998	1850	0.199998	Complied
3.7	-10	1850.199990	1850	0.199990	Complied
4.2	2	1850.200002	1850	0.200002	Complied

**Top Channel (1909.8 MHz)**

Supply Voltage (V)	Frequency Error (Hz)	Measured Frequency (MHz)	Lower Band Edge Limit (MHz)	Margin (MHz)	Result
3.4	-27	1909.799973	1910	0.200027	Complied
3.7	-11	1909.799989	1910	0.200011	Complied
4.2	-20	1909.799980	1910	0.200020	Complied

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#### **6.2.7. Transmitter Occupied Bandwidth:**

The EUT was configured as for occupied bandwidth measurements as described in section 9 of this report.

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

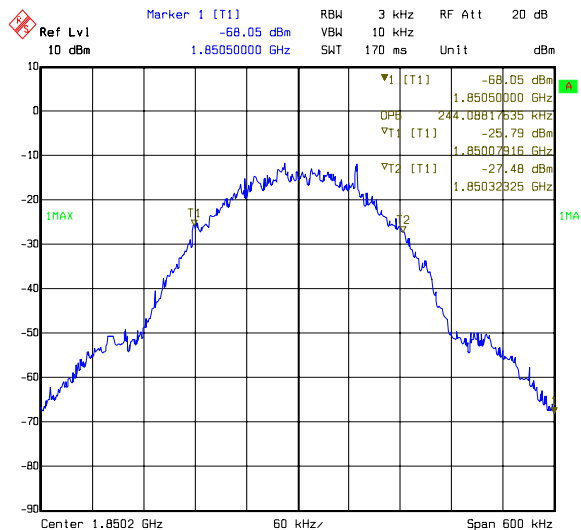
#### **Results:**

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

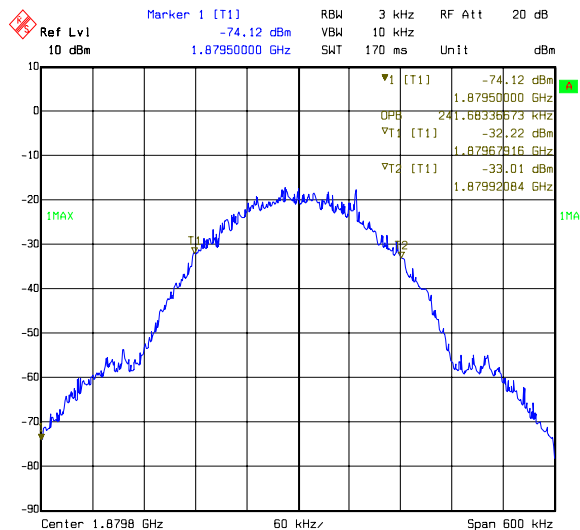
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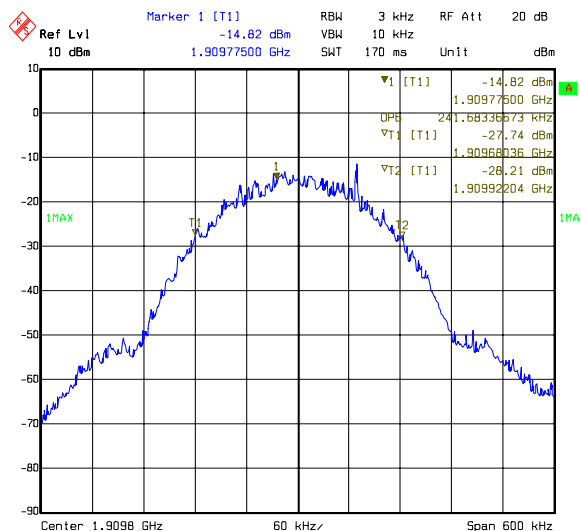
### Transmitter Occupied Bandwidth: (Continued)



Title: 72841J009 Panasonic FCC testing to Part 24  
Comment A: EUT: VS8x, Occupied Bandwidth Measurement.  
Date: 25.NOV.2007 14:10:53



Title: 72841J009 Panasonic FCC testing to Part 24  
Comment A: EUT: VS8x, Occupied Bandwidth Measurement.  
Date: 25.NOV.2007 14:12:50



Title: 72841J009 Panasonic FCC testing to Part 24  
Comment A: EUT: VS8x, Occupied Bandwidth Measurement.  
Date: 25.NOV.2007 14:06:59

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### **6.2.8. Transmitter Out of Band Radiated Emissions:**

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

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

### **Results:**

#### **Bottom Channel**

Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
3700.400	-30.3	-13.0	17.3	Complied
5550.589	-30.6	-13.0	17.6	Complied
7400.735	-33.6	-13.0	20.6	Complied
9250.632	-22.6	-13.0	9.4	Complied

#### **Middle Channel**

Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
3759.600	-31.7	-13.0	18.7	Complied
5639.369	-32.0	-13.0	19.0	Complied
7519.130	-35.2	-13.0	22.2	Complied
9399.130	-27.7	-13.0	14.7	Complied

#### **Top Channel**

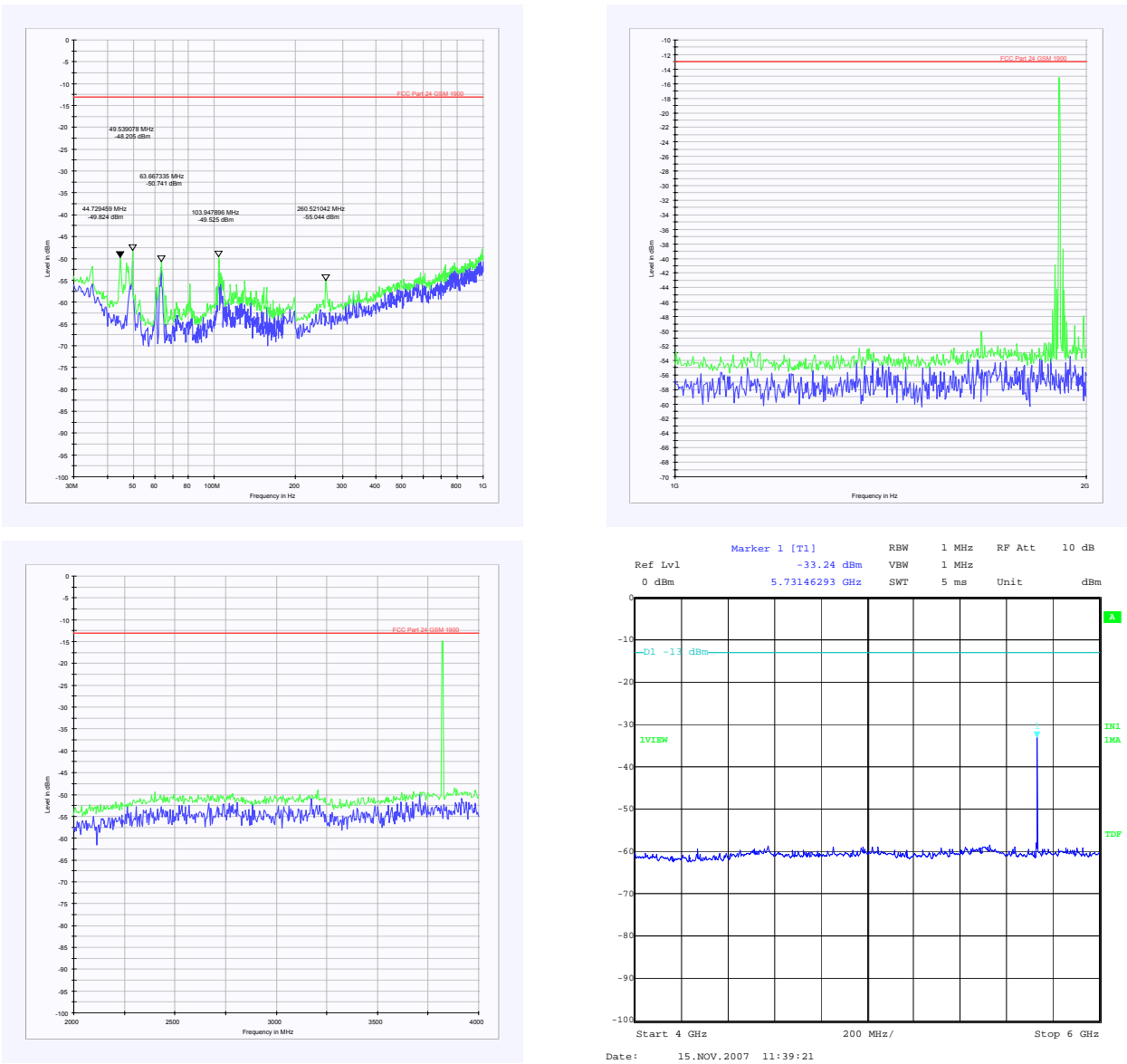
Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
3819.600	-30.4	-13.0	17.4	Complied
5729.443	-32.7	-13.0	19.7	Complied
7639.185	-32.0	-13.0	19.0	Complied
9549.007	-30.9	-13.0	17.9	Complied

### **Note(s):**

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

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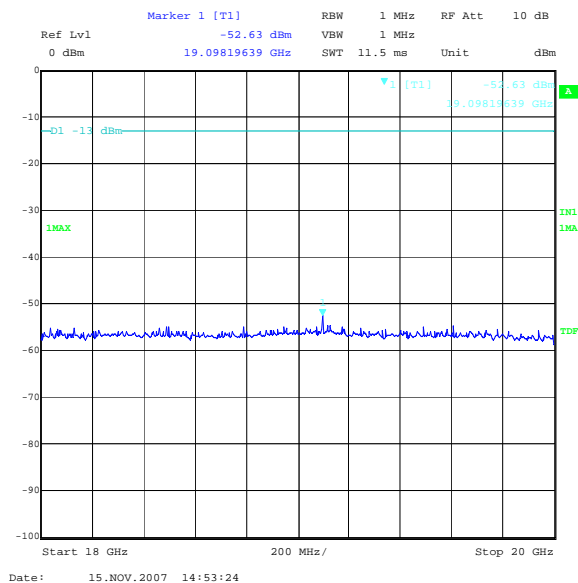
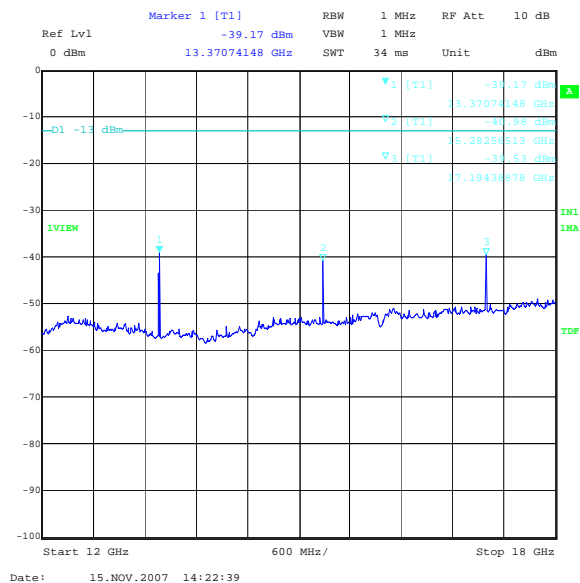
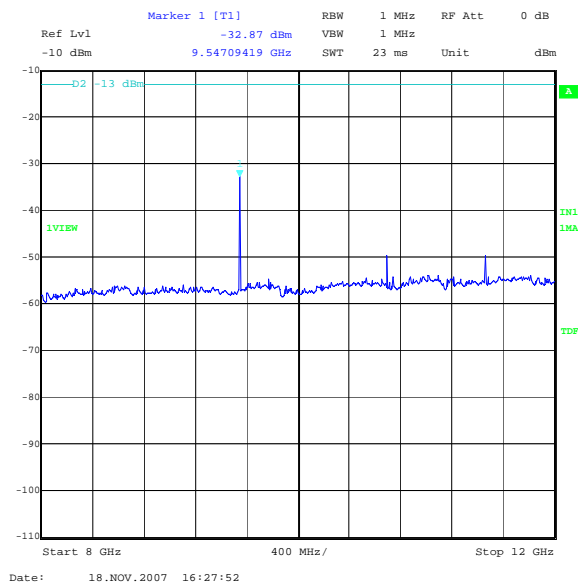
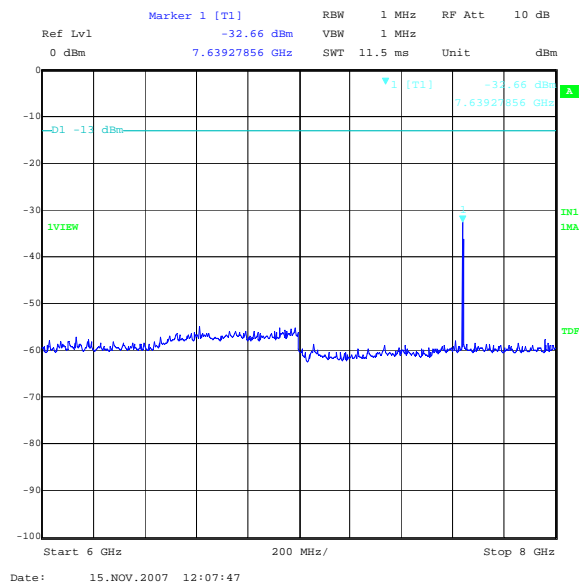


Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

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### Transmitter Out of Band Radiated Emissions: (Continued)



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

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### Transmitter Out of Band Radiated Emissions: (Continued)

#### Integrated Power Over 1 MHz Strip Band: 1911 to 1912 MHz

1<sup>st</sup> 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	345	6	202
2	313	7	164
3	271	8	144
4	264	9	128
5	186	10	116
Total Peak Power:		2133 nW/MHz	

#### Integrated Power Over 1 MHz Strip Band: 1912 to 1913 MHz

2<sup>nd</sup> 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	101	6	84
2	128	7	68
3	68	8	52
4	88	9	59
5	54	10	55
Total Peak Power:		757 nW/MHz	

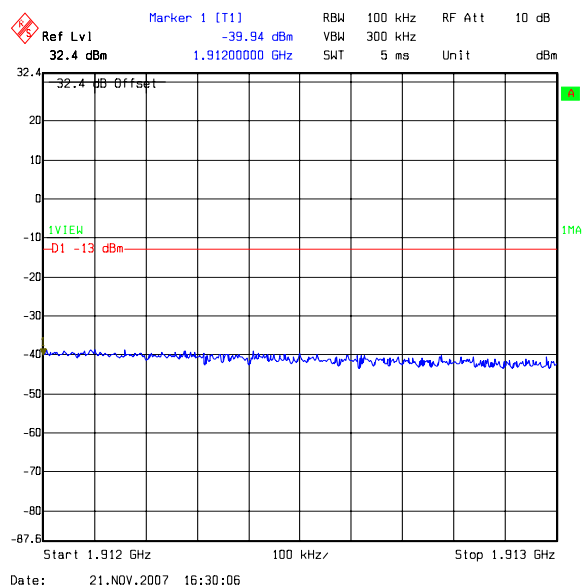
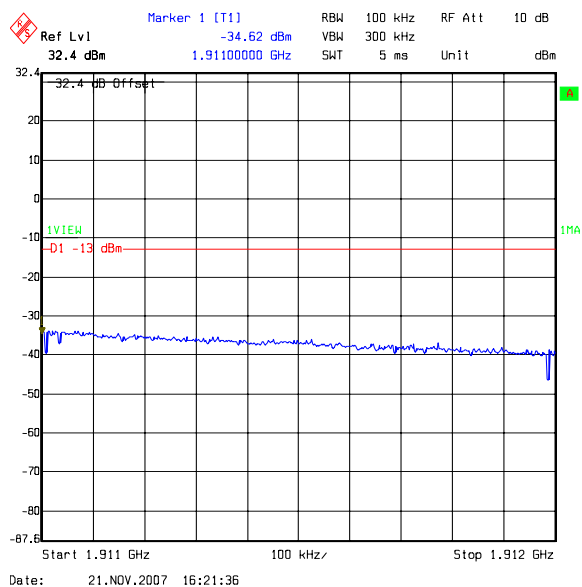
### Results:

Band (MHz)	Peak Power (nW/MHz)	Peak Power (dBm/MHz)	Limit (dBm/MHz)	Margin (dB)	Status
1911 to 1912	2133	-26.7	-13.0	13.7	Complied
1912 to 1913	757	-31.2	-13.0	18.2	Complied

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### Transmitter Out of Band Radiated Emissions: (Continued)



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

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**6.2.9. Transmitter Radiated Emissions at Band Edges:**

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

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

**Results:****Bottom Band Edge**

Frequency (MHz)	Spurious Emission (dBm)	Limit (dBm)	Margin (dB)	Result
1850	-18.4	-13.0	5.4	Complied

**Top Band Edge**

Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
1910	-20.2	-13.0	7.2	Complied

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## **7. Measurement Uncertainty**

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

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

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

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

<b>Measurement Type</b>	<b>Range</b>	<b>Confidence Level (%)</b>	<b>Calculated Uncertainty</b>
AC Conducted Spurious Emissions	0.15 MHz to 30 MHz	95%	+/- 3.25 dB
Effective Isotropic Radiated Power (EIRP)	Not applicable	95%	+/- 2.94 dB
Frequency Stability	Not applicable	95%	+/- 24.3 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%	+/- 2.94 dB
Radiated Spurious Emissions	1 GHz to 26 GHz	95%	+/- 2.94 dB

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

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## **8. Measurement Methods**

### **8.1. Conducted Output Power**

The EUT was connected to a spectrum analyser and to a GSM test set via suitable cables, RF attenuators and combiners.

The connection was made to the EUT either via an antenna port or by antenna terminals made available by the client.

The total loss of the cables, attenuators and combiner were measured and entered as a reference level offset into the measuring receiver to correct for the losses.

The EUT was set to the required channel and the transmitter set to operate at full power.

A marker was set to the maximum indicated peak and the conducted power was recorded.

This test was performed on the bottom, middle and top channels.

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

Receiver Function	Setting
Detector Type:	Peak
Mode:	Max Hold
Bandwidth:	1 MHz
Amplitude Range:	100 dB
Step Size:	Continuous sweep
Sweep Time:	Coupled

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## **8.2. Effective Isotropic Radiated Power (EIRP)**

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

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

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

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

Once the final amplitude (maximised) had been obtained, the EUT was substituted with a 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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### **8.3. Frequency Stability**

The EUT was situated within an environmental test chamber and connected directly to the GSM test set via an access port.

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

Measurements were also performed at voltage extremes between the declared nominal supply voltage and at the declared endpoint voltage (for hand carried 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. If this margin is positive, the result is compliant. If it goes negative, the result is a non-compliance. There is also a frequency graph presented offering the frequency variation around nominal frequency.

### **8.4. Occupied Bandwidth**

The EUT was connected to a spectrum analyser enabled with an occupied bandwidth function and a GSM test set via a bi-directional coupler to its antenna port.

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 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  $\geq$  1% of occupied bandwidth. A value of 3 kHz was used.

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### **8.5. Transmitter Conducted Emissions Measurements**

The test was performed in a laboratory environment.

Spurious emission measurements at the antenna port were performed from the lowest declared frequency to 10 times the highest EUT fundamental frequency.

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

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

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

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

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

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

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

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

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### **8.6. AC Mains Conducted Emissions**

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

The test was performed in a shielded enclosure with the equipment arranged as detailed in the standard on a wooden bench using the floor of the screened enclosure as the ground reference plane. The EUT was powered with 115V 60 Hz AC mains supplied via a line impedance stabilisation network (LISN).

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

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

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

<b>Receiver Function</b>	<b>Initial Scan</b>	<b>Final Measurements</b>
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

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### **8.7. Transmitter Radiated Emissions**

Radiated emission 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:-

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

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.

All measurements were performed using broadband horn antennas.

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**Transmitter Radiated Emissions (Continued)**

It should be noted that FCC Part 24.238 states that the 1<sup>st</sup> 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.

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

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### **8.8. Receiver / Idle 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 the upper frequency detailed in Section 15.33(b) 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 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 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 – 2003 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 $\mu$ V plus cable loss and antenna factor.

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

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

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### Appendix 1. Test Equipment Used

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Last Calibrated	Cal. Interval (Months)
A028	Antenna	Eaton	91888-2	304	08 Jun 2006	36
A031	Antenna	Eaton	91889-2	557	08 Jun 2006	36
A037	Low Power Filter	RFI Ltd Basingstoke	004	A037	Calibrated before use	-
A031	Antenna	Eaton	91889-2	557	08 Jun 2006	36
A1394	Attenuator	HUBER + SUHNER AG	753459	6806.17.B	Calibrated before use	-
A1396	Attenuator	HUBER + SUHNER AG	757987	6810.17.B	Calibrated before use	-
A436	Antenna	Flann	20240-20	330	24 Apr 2006	36
A253	Antenna	Flann Microwave	12240-20	128	17 Nov 2006	36
A254	Antenna	Flann Microwave	14240-20	139	17 Nov 2006	36
A255	Antenna	Flann Microwave	16240-20	519	17 Nov 2006	36
A256	Antenna	Flann Microwave	18240-20	400	17 Nov 2006	36
A259	Antenna	Chase	CBL6111	1513	13 Mar 2007	12
E013	Environmental Chamber	Sanyo	ATMOS chamber	None	Calibrated before use	-
M023	Test Receiver	Rohde & Schwarz	ESVP	872 991/027	24 Apr 2007	12
M044	Test Receiver	Rohde & Schwarz	ESVP	891 845/026	06 Mar 2007	12
M1068	Thermometer	Iso-Tech	RS55	93102884	26 Jun 2007	12

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### Test Equipment Used (Continued)

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Last Calibrated	Cal. Interval (Months)
M1124	Spectrum Analyser	Rohde & Schwarz	ESIB26	100046K	20 Dec 2006	12
M1140	Radio Communications Analyser	Anritsu	MT8820A	6K0000647	Calibration not required	-
M1263	Test Receiver	Rohde & Schwarz	ESIB7	100265	25 Jan 2007	12
M1269	Multimeter	Fluke	179	90250210	05 Mar 2007	12
M1127	Spectrum Analyser	Rohde & Schwarz	FSEB 30	842 659/016	15 Aug 2007	12
S021	Dual DC Power Supply Unit	Thurlby Thandar Instruments	CPX200	061034	Calibration not required	-
S201	Open Area Test Site	RFI	1	None	25 May 2007	12
S202	Site 2	RFI	2	S202-15011990	Verified before use	-

**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\72841JD07\EMIRAD	Test configuration for measurement of radiated emissions.

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