






# TEST REPORT FROM RADIO FREQUENCY INVESTIGATION LTD.

Test Of: Panasonic Mobile Communications Ltd.  
X70 Mobile Handset


To: FCC Part 15.247

**Test Report Serial No:**  
RFI/MPTB2/RP44839JD06A

**Supersedes Test Report Serial No:**  
RFI/MPTB1/RP44839JD06A

<b>This Test Report Is Issued Under The Authority Of Richard Jacklin, Operations Director:</b> 	<b>Checked By: Alan McHale</b> 
<b>Tested By:</b> 	<b>Release Version No: PDF01</b>
<b>Issue Date: 08 October 2003</b>	<b>Test Dates: 07 August 2003 to 15 August 2003</b>

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Radio Frequency Investigation Ltd, Ewhurst Park, Ramsdell, Basingstoke, Hampshire, RG26 5RQ, ENGLAND. Tel: +44 (0) 1256 851193 Fax: +44 (0) 1256 851192	Registered in England, No. 211 7901. Registered Office: Ewhurst Park, Ramsdell, Basingstoke, Hampshire RG26 5RQ	 UKAS TESTING 0644
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**RADIO FREQUENCY INVESTIGATION LTD**

**TEST REPORT**

**Operations Department**

**S.No. RFI/MPTB2/RP44839JD06A**

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**1. Client Information**

<b>Company Name:</b>	Panasonic Mobile Communications Ltd.
<b>Address:</b>	2 Gables Way, Colthrop, Thatcham, Berkshire, RG19 4ZB United Kingdom
<b>Contact Name:</b>	Mr Mike 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)**

#### **2.1.1. Radiated RF Sample**

<b>Brand Name:</b>	Panasonic
<b>Model Name or Number:</b>	X70
<b>Unique Type Identification:</b>	X70
<b>IMEI Number:</b>	004400622871349
<b>FCC ID Number:</b>	NWJ22B001A
<b>Country of Manufacture:</b>	China
<b>Date of Receipt:</b>	07 August 2003

#### **2.1.2. Conducted RF Sample**

<b>Brand Name:</b>	Panasonic
<b>Model Name or Number:</b>	X70
<b>Unique Type Identification:</b>	X70
<b>IMEI Number:</b>	0044006228700226
<b>FCC ID Number:</b>	NWJ22B001A
<b>Country of Manufacture:</b>	China
<b>Date of Receipt:</b>	07 August 2003

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## **2.2. Description Of EUT**

The equipment under test is a GSM tri-band (900, 1800 & 1900) camera mobile handset, which supports IR and Bluetooth. The GSM 900 and 1800 modes are intended for use only outside the USA.

## **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.

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**2.4. Additional Information Related To Testing**

<b>Power Supply Requirement: (Internal, lithium ion battery)</b>	3.7 V DC		
<b>Declared Battery Extreme Voltage Range</b>	4.2 V (Max), 3.46 V (Min)		
<b>Power Supply Requirement: (AC Battery Charger)</b>	Nominal 115V, 60 Hz AC Mains Supply		
<b>Intended Operating Environment:</b>	Within GSM Network Coverage		
<b>Equipment Category:</b>	Cellular Telephone		
<b>Type of Unit:</b>	Transceiver		
<b>Weight:</b>	92 g		
<b>Dimensions:</b>	87 mm(H) x 47 mm(W) x 23.9 mm(D)		
<b>Interface Ports:</b>	Charger Connection Headset Connection		
<b>Highest Fundamental Frequency</b>	2480 MHz		
<b>Transmit Frequency Range</b>	2402.0 MHz to 2480.0 MHz		
<b>Transmit Channels Tested</b>	<b>Channel ID</b>	<b>Channel Number</b>	<b>Channel Frequency (MHz)</b>
	Bottom	1	2402.0
	Middle	40	2441.0
	Top	79	2480.0
<b>Receive Frequency Range</b>	2402 MHz to 2480 MHz		
<b>Receive Channels Tested</b>	<b>Channel ID</b>	<b>Channel Number</b>	<b>Channel Frequency (MHz)</b>
	Bottom	1	2402.0
	Middle	40	2441.0
	Top	79	2480.0
<b>Antenna Gain</b>	1.6 dBi		
<b>Maximum Power Output (EIRP)</b>	1.0 dBm		

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## **2.5. Support Equipment**

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

<b>Description:</b>	Bluetooth Test Set (RFI Asset M1078)
<b>Brand Name:</b>	Anritsu
<b>Model Name or Number:</b>	MT8850A
<b>Serial Number:</b>	6K00000244
<b>Connected to Port:</b>	RF Link (Air Interface)

<b>Description:</b>	AC Charger
<b>Brand Name:</b>	Panasonic
<b>Model Name or Number:</b>	EB-CAX70UK
<b>Serial Number:</b>	001
<b>Connected to Port:</b>	Charger Connection

<b>Description:</b>	Headset
<b>Brand Name:</b>	Panasonic
<b>Model Name or Number:</b>	EB-UCX70
<b>Serial Number:</b>	001
<b>Connected to Port:</b>	Headset Connection



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### **3. Test Specification, Methods And Procedures**

#### **3.1. Test Specification**

<b>Reference:</b>	FCC Part 15 Subpart C: 2002 (Section 15.247)
<b>Title:</b>	Code of Federal Regulations, Part 15 (47CFR15) Radio Frequency Devices: Intentional Radiators
<b>Comments:</b>	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.
<b>Purpose of Test:</b>	To determine whether the equipment complied with the requirements of the specification for the purposes of certification.

<b>Reference:</b>	FCC Part 15 Subpart B: 2002 (Section 15.107 and 15.109)
<b>Title:</b>	Code of Federal Regulations, Part 15 (47CFR15) Radio Frequency Devices: Unintentional Radiators.
<b>Comments:</b>	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.
<b>Purpose of Test:</b>	To determine whether the equipment complied with the requirements of the specification for the purposes of certification.

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### **3.2. Methods And Procedures**

The methods and procedures used were as detailed in:

ANSI C63.2 (1987)

Title: American National Standard for Instrumentation - Electromagnetic noise and field strength.

ANSI C63.4 (2001)

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

ANSI C63.5 (1988)

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

ANSI C63.7 (1988)

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

CISPR 16-1: (1999)

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

DA00-705 (2000)

Title: Filing and Frequency Measurement Guidelines for Frequency Hopping Spread Spectrum Systems.

### **3.3. Definition Of Measurement Equipment**

The measurement equipment used complied with the requirements of the standards referenced in the Methods & Procedures section above. Appendix 1 contains a list of the test equipment used.

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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**

The EUT was tested in a normal laboratory environment.

During testing, the EUT was powered by a nominal 115V, 60 Hz AC mains supply.

### **5.2. Operating Modes**

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

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

Bluetooth mode transmitting on top, middle, bottom and hopping on all channels or in receive mode.

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### **5.3. Configuration And Peripherals**

The EUT was tested in the following configuration:

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

The EUT was commanded to operate on specific channels using an Anritsu Bluetooth test set.

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## **6. Summary Of Test Results**

<b>Range Of Measurements</b>	<b>Specification Reference</b>	<b>Port Type</b>	<b>Compliance Status</b>
Receiver Conducted Emissions (AC Mains)	C.F.R. 47 FCC Part 15: 2002 Section 15.107	AC Mains Terminals	Complied
Receiver Radiated Emissions	C.F.R. 47 FCC Part 15: 2002 Section 15.109	Antenna	Complied
Transmitter Conducted Emissions (AC Mains)	C.F.R. 47 FCC Part 15: 2002 Section 15.207	AC Mains Terminals	Complied
Transmitter 20 dB Bandwidth	C.F.R. 47 FCC Part 15: 2002 Section 15.247(a)(1)	Antenna Terminals	Complied
Transmitter Carrier Frequency Separation	C.F.R. 47 FCC Part 15: 2002 Section 15.247(a)(1)	Antenna Terminals	Complied
Transmitter Average Time of Occupancy	C.F.R. 47 FCC Part 15: 2002 Section 15.247(a)(1)(iii)	Antenna Terminals	Complied
Transmitter Maximum Peak Output Power	C.F.R. 47 FCC Part 15: 2002 Section 15.247(b)(1)	Antenna Terminals	Complied
Transmitter Conducted Emissions	C.F.R. 47 FCC Part 15: 2002 Section 15.247(c)	Antenna Terminals	Complied
Transmitter Radiated Emissions	C.F.R. 47 FCC Part 15: 2002 Section 15.247(c) Section 15.209(a)	Antenna	Complied
Transmitter Band Edge Conducted Emission	C.F.R. 47 FCC Part 15: 2002 Section 15.247(c)	Antenna Terminals	Complied
Transmitter Band Edge Radiated Emission	C.F.R. 47 FCC Part 15: 2002 Section 15.247(c) Section 15.209(a)	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 9 for details of measurement uncertainties.

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## **7.2. Receiver Conducted Emissions AC Mains: Section 15.107**

7.2.1. The EUT was configured as for AC conducted emissions measurements as described in section 8 of this report.

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

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

Frequency (MHz)	Line	Q-P Level (dB $\mu$ V)	Q-P Limit (dB $\mu$ V)	Margin (dB)	Result
0.403	Live	41.10	57.79	16.69	Complied
1.201	Live	42.65	56.00	13.35	Complied
1.339	Neutral	42.44	56.00	13.56	Complied
1.464	Live	47.02	56.00	8.98	Complied

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

Frequency (MHz)	Line	Avg Level (dB $\mu$ V)	Avg Limit (dB $\mu$ V)	Margin (dB)	Result
0.403	Live	35.44	47.79	12.35	Complied
1.201	Live	35.08	46.00	10.92	Complied
1.339	Neutral	31.65	46.00	14.35	Complied
1.464	Live	38.61	46.00	7.39	Complied

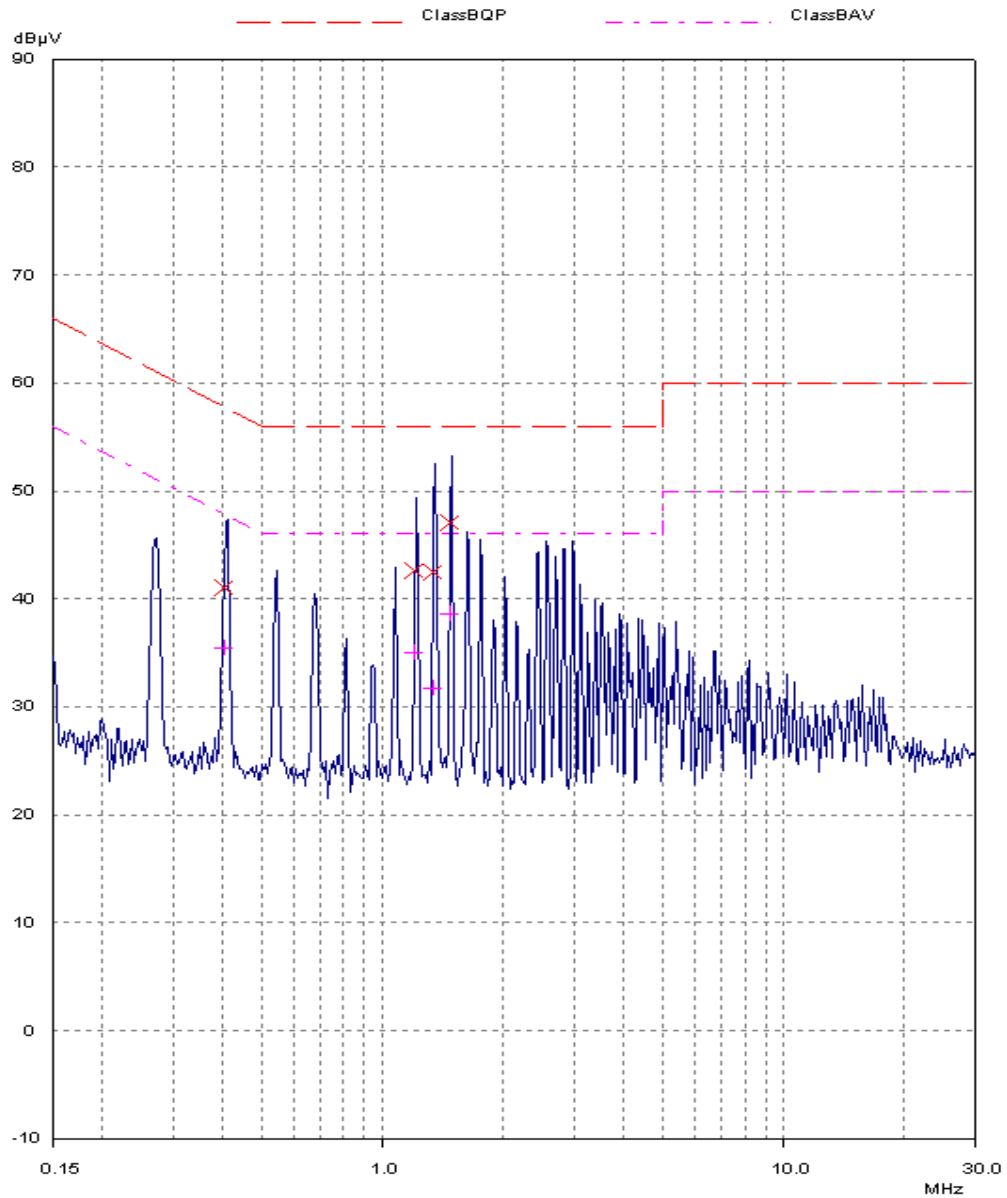


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**Receiver Conducted Emissions AC Mains: Section 15.107 (Continued)**



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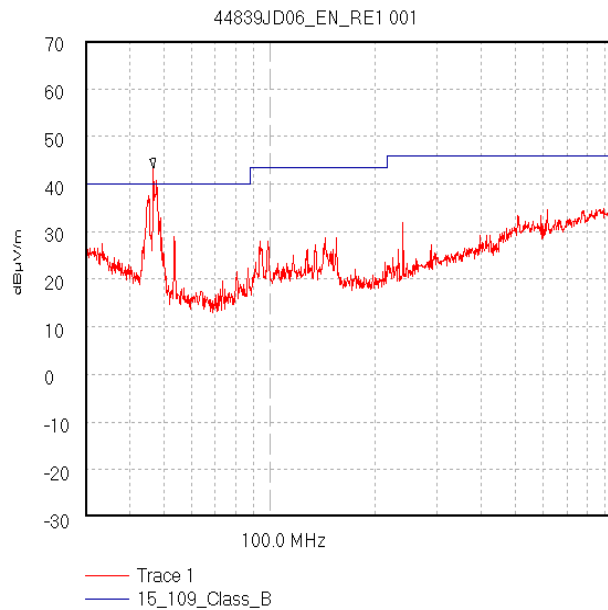
**7.3. Receiver Radiated Emissions: Section 15.109**

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

7.3.1.1. The EUT was configured as for radiated field strength emissions testing as described in Section 8 of this report.

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

Frequency (MHz)	Ant. Pol.	Q-P Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
44.745	Vert.	23.5	40.0	16.5	Complied
46.664	Vert.	27.5	40.0	12.5	Complied
47.194	Vert.	19.8	40.0	20.2	Complied
240.000	Vert.	29.2	40.0	16.8	Complied



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 46.776 MHz, 43.34 dBµV/m  
 Limit/Mask: 15\_109\_Class\_B; ; Limit Test Failed  
 Transducer Factors: A1037  
 8/7/2003 5:19:14 PM

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**Receiver Radiated Emissions: Section 15.109 (Continued)****7.3.2. Electric Field Strength Measurements (Frequency Range: 1.0 to 20.0 GHz)****Highest Average Level:**

Frequency (GHz)	Antenna Polarity (H/V)	Average Detector level (dB $\mu$ V)	Antenna factor (dB)	Cable loss (dB)	Actual Average Level (dB $\mu$ V/m)	Average Limit (dB $\mu$ V/m)	Average Margin (dB)	Result
5.891	Horiz.	5.4	24.4	2.0	31.8	54.0	22.2	Complied

**Highest Peak Level:**

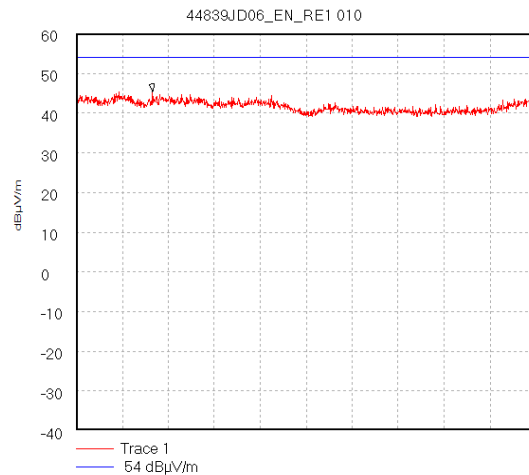
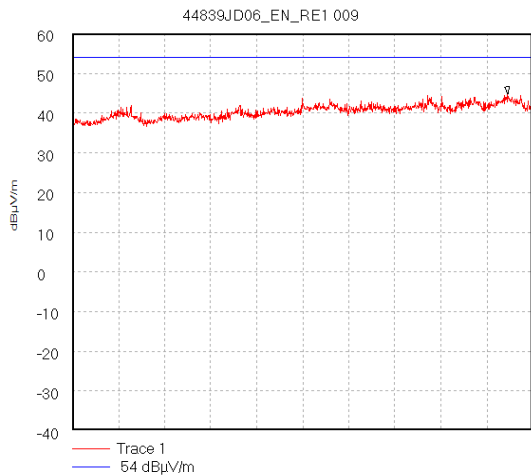
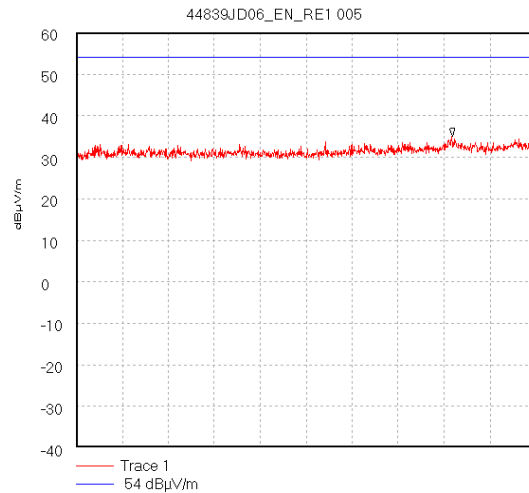
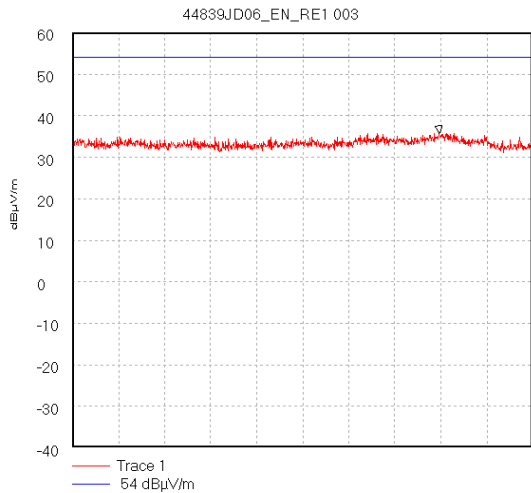
Frequency (GHz)	Antenna Polarity (H/V)	Peak Detector level (dB $\mu$ V)	Antenna factor (dB)	Cable loss (dB)	Actual Peak Level (dB $\mu$ V/m)	Peak Limit (dB $\mu$ V/m)	Peak Margin (dB)	Result
5.891	Horiz.	18.4	24.4	2.0	44.8	74.0	29.2	Complied

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**Receiver Radiated Emissions: Section 15.109 (Continued)**

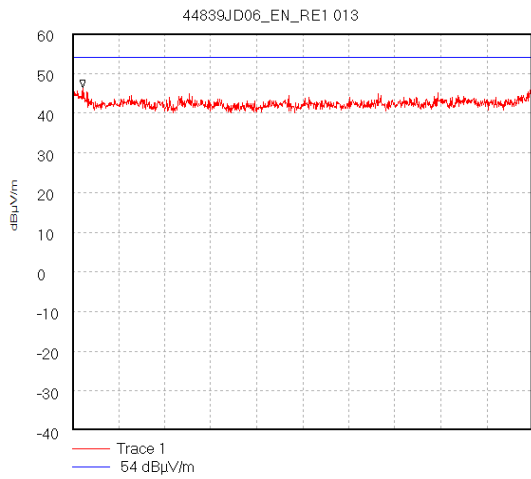


Test Of: **Panasonic Mobile Communications Ltd.**

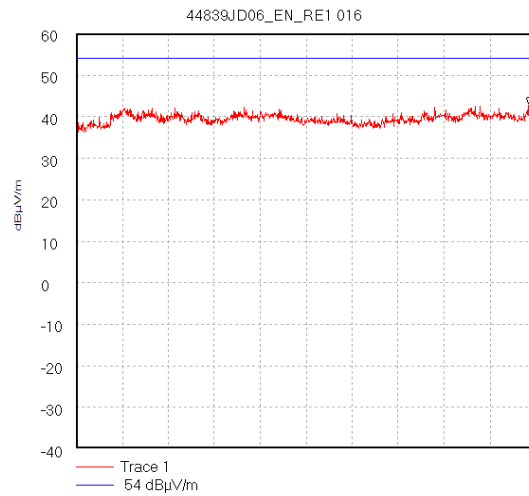
**X70 Mobile Handset**

To: **FCC Part 15.247**

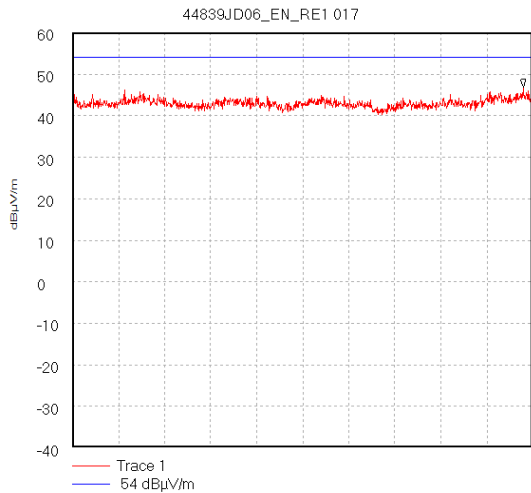
**Receiver Radiated Emissions: Section 15.109 (Continued)**



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, 46.39 dBµV/m  
Display Line: 54 dBµV/m;  
Transducer Factors: 8to12G\_Horn  
18/08/2003 14:27:48



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 17.920566 GHz, 42.74 dBµV/m  
Display Line: 54 dBµV/m;  
18/08/2003 14:41:16



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 19.96 GHz, 46.85 dBµV/m  
Display Line: 54 dBµV/m;  
18/08/2003 14:43:30

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#### **7.4. Transmitter Conducted Emissions AC Mains: Section 15.207**

7.4.1. The EUT was configured as for AC conducted emissions measurements as described in Section 8 of this report.

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

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

##### **Middle Channel**

Frequency (MHz)	Line	Q-P Level (dB $\mu$ V)	Q-P Limit (dB $\mu$ V)	Margin (dB)	Result
1.31396	Live	45.44	56.00	10.56	Complied
1.44602	Neutral	39.45	56.00	16.55	Complied
1.56263	Neutral	42.80	56.00	13.20	Complied

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

##### **Middle Channel**

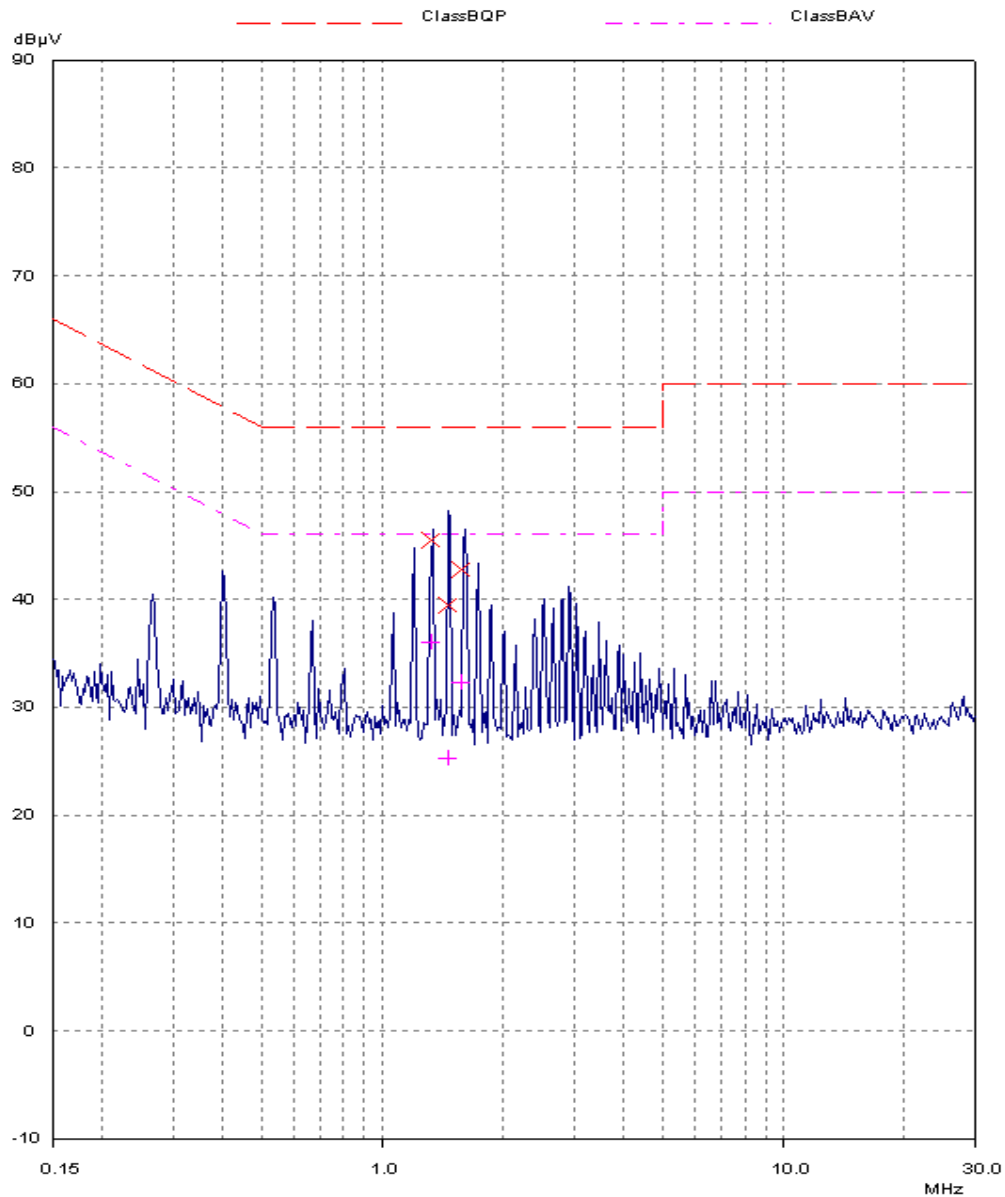
Frequency (MHz)	Line	Avg Level (dB $\mu$ V)	Avg Limit (dB $\mu$ V)	Margin (dB)	Result
1.31396	Live	36.07	46.00	9.93	Complied
1.44602	Neutral	25.33	46.00	20.67	Complied
1.56263	Neutral	32.29	46.00	13.71	Complied

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**Transmitter Conducted Emissions AC Mains: Section 15.207 (Continued)**



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**7.5. Transmitter 20 dB Bandwidth: Section 15.247(a)(1)**

7.5.1. The EUT was configured as for carrier frequency separation / 20 dB bandwidth measurements as described in Section 8 of this report.

7.5.2. Tests were performed to identify the 20 dB bandwidth.

Transmitter 20 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
793.6	None Specified	N/A	N/A



Title: Panasonic X70 0044006228700226 FCC 15.247 20dB Bandwidth

Comment A: 44839JD06\_FCC\_20dB\_Bandwidth\_001

Date: 13.AUG.2003 12:41:50



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**7.6. Transmitter Carrier Frequency Separation: Section 15.247(a)(1)**

7.6.1. The EUT was configured as for carrier frequency separation measurements as described in Section 8 of this report.

7.6.2. Tests were performed to identify the carrier frequency separation.

Transmitter Carrier Frequency Separation (kHz)	Limit (25 kHz or 20 dB BW whichever is greater) (kHz)	Margin (kHz)	Result
1006.0	793.6	212.4	Complied



Title: Panasonic X70 0044006228700226 FCC 15.247 Carrier Separation

Comment A: 44839JD06\_FCC\_Carrier\_Separation\_001

Date: 13.AUG.2003 14:11:19

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### **7.7. Transmitter Average Time of Occupancy: Section 15.247(a)(1)(iii)**

7.7.1. The EUT was configured as for average time of occupancy measurements as described in Section 8 of this report.

7.7.2. Tests were performed to identify the average time of occupancy.

<b>Emission Width (<math>\mu</math>s)</b>	<b>Number of Hopping Channels Employed</b>	<b>Number of Hops in 31.6 seconds</b>	<b>Average Time of Occupancy (s)</b>	<b>Limit (s)</b>	<b>Margin (s)</b>	<b>Result</b>
418.8	79	245	0.103	0.4	0.297	Complied

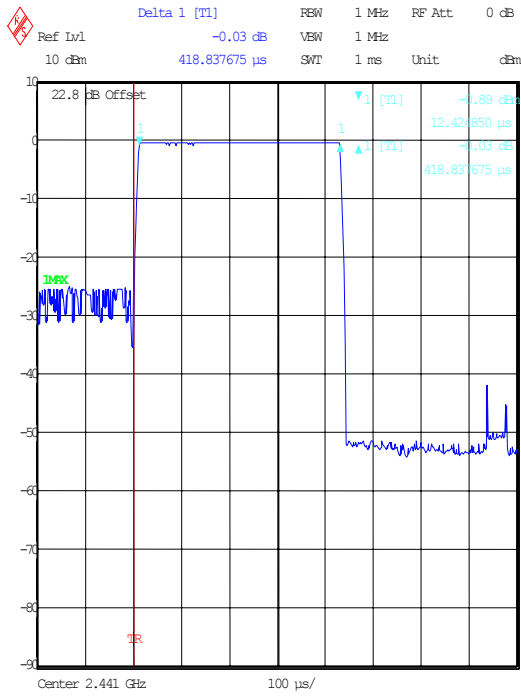
Operations Department

Test Of: Panasonic Mobile Communications Ltd.

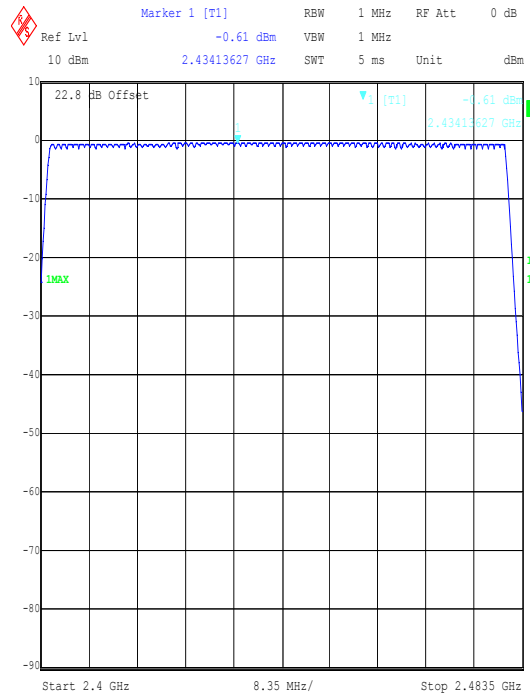
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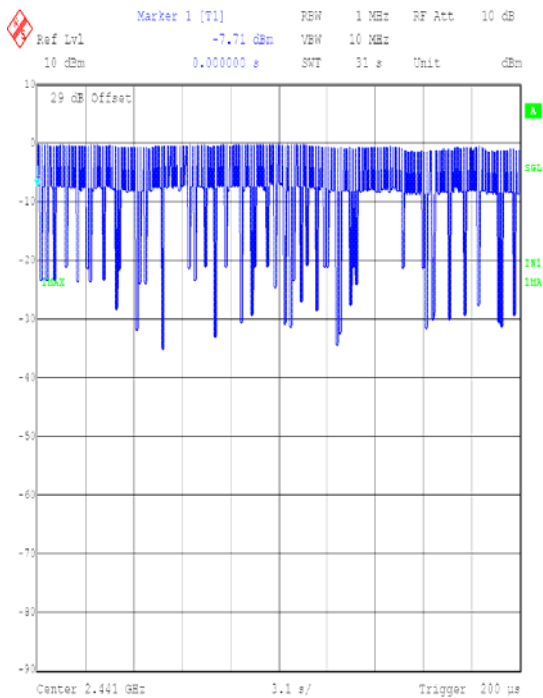
**Transmitter Average Time of Occupancy: Section 15.247(a)(1)(iii)  
(Continued)**



Title: Panasonic X70 0044006228700226 FCC 15.247 Time Occupancy  
 Comment A: 44839JD06\_FCC\_Time\_Occupancy\_001  
 Date: 13.AUG.2003 14:15:48



Title: Panasonic X70 0044006228700226 FCC 15.247 Time Occupancy  
 Comment A: 44839JD06\_FCC\_Time\_Occupancy\_002  
 Date: 13.AUG.2003 14:17:47



Title: FCC Part 15.247, Panasonic, Time of Occupancy  
 Comment A: 44839JD06\_FCC\_X70  
 Date: 13.AUG.2003 14:22:56

Test Of: Panasonic Mobile Communications Ltd.

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### **7.8.Transmitter Peak Output Power: Section 15.247(b)(1)**

7.8.1. The EUT was configured as for peak output power measurements as described in Section 8 of this report.

7.8.2. Tests were performed to identify the output power of the EUT.

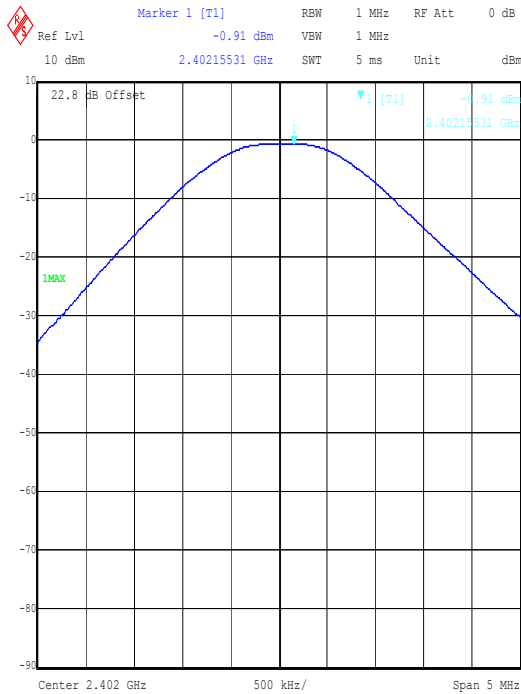
Channel	Input Voltage (AC)	Output Level (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Power Limit (dBm)	Margin (dB)	Result
Bottom	93.5	-0.9	1.6	0.7	30.0	30.9	Complied
Bottom	110.0	-0.9	1.6	0.7	30.0	30.9	Complied
Bottom	126.5	-0.9	1.6	0.7	30.0	30.9	Complied

Test Of: Panasonic Mobile Communications Ltd.

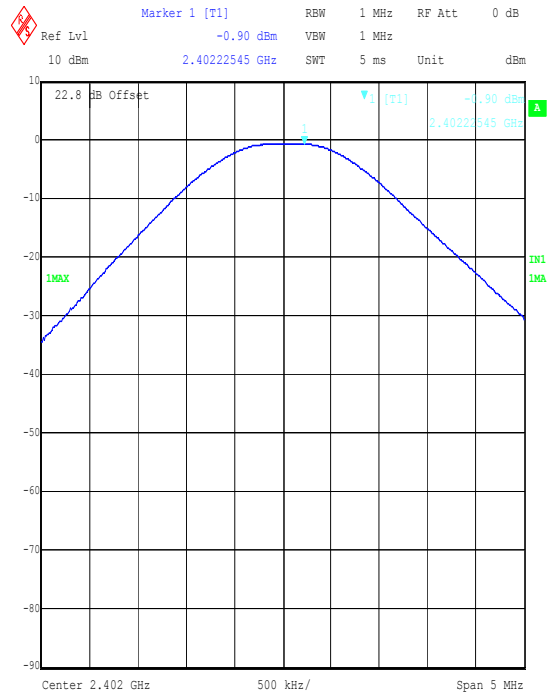
X70 Mobile Handset

To: FCC Part 15.247

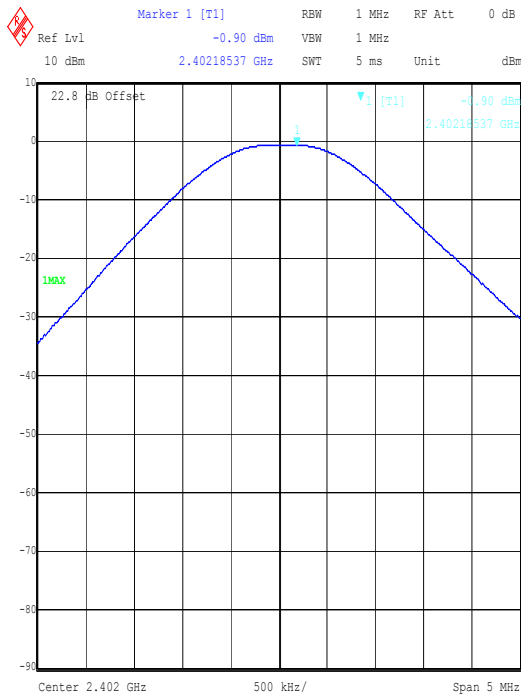
**Transmitter Peak Output Power: Section 15.247(b)(1) (Continued)**



Title: Panasonic X70 0044006228700226 FCC 15.247 Peak Output Power  
 Comment A: 44839JD06\_FCC\_Output\_Power\_Bottom\_LowV\_001  
 Date: 13.AUG.2003 15:20:43



Title: Panasonic X70 0044006228700226 FCC 15.247 Peak Output Power  
 Comment A: 44839JD06\_FCC\_Output\_Power\_Bottom\_NomV\_004  
 Date: 13.AUG.2003 15:11:41



Title: Panasonic X70 0044006228700226 FCC 15.247 Peak Output Power  
 Comment A: 44839JD06\_FCC\_Output\_Power\_Bottom\_HighV\_007  
 Date: 13.AUG.2003 15:15:17

Test Of: Panasonic Mobile Communications Ltd.

X70 Mobile Handset

To: FCC Part 15.247

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**Transmitter Peak Output Power: Section 15.247(b)(1) (Continued)**

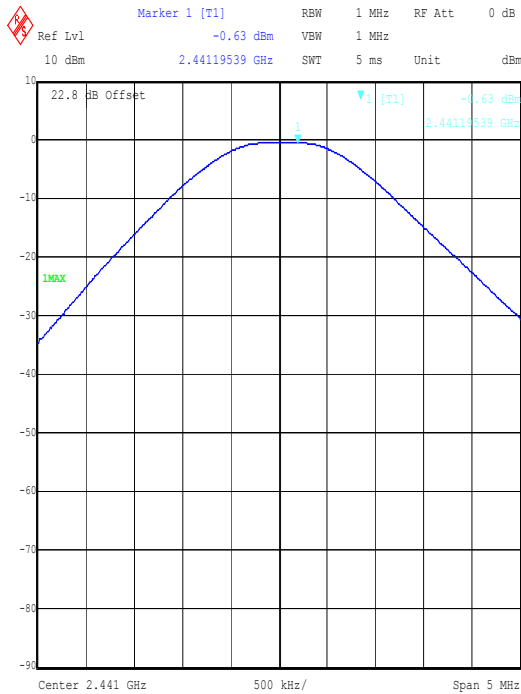
Channel	Input Voltage (AC)	Output Level (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Power Limit (dBm)	Margin (dB)	Result
Middle	93.5	-0.6	1.6	1.0	30.0	30.6	Complied
Middle	110.0	-0.6	1.6	1.0	30.0	30.6	Complied
Middle	126.5	-0.6	1.6	1.0	30.0	30.6	Complied

Test Of: Panasonic Mobile Communications Ltd.

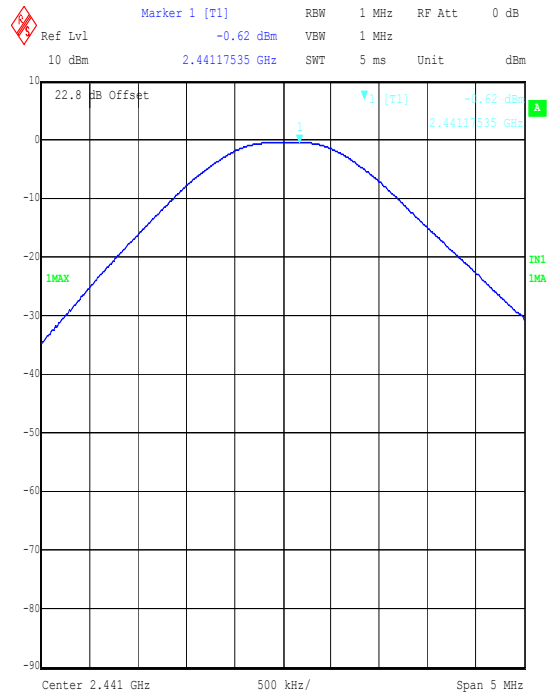
X70 Mobile Handset

To: FCC Part 15.247

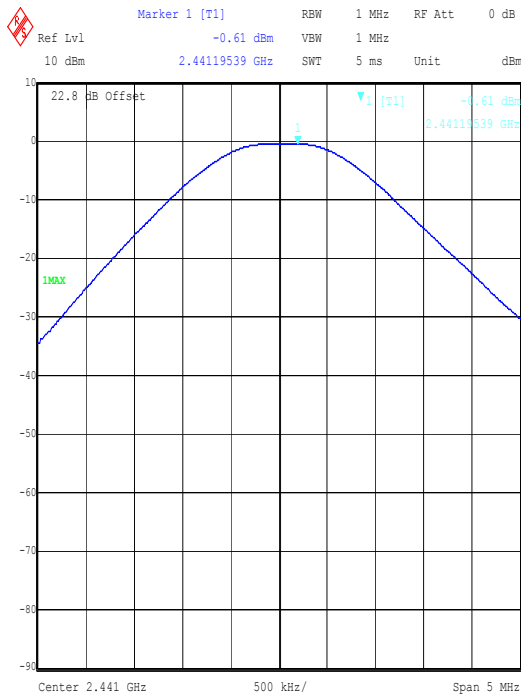
**Transmitter Peak Output Power: Section 15.247(b)(1) (Continued)**



Title: Panasonic X70 0044006228700226 FCC 15.247 Peak Output Power  
Comment A: 44839JD06\_FCC\_Output\_Power\_Middle\_LowV\_002  
Date: 13.AUG.2003 15:19:54



Title: Panasonic X70 0044006228700226 FCC 15.247 Peak Output Power  
Comment A: 44839JD06\_FCC\_Output\_Power\_Middle\_NomV\_005  
Date: 13.AUG.2003 15:12:17



Title: Panasonic X70 0044006228700226 FCC 15.247 Peak Output Power  
Comment A: 44839JD06\_FCC\_Output\_Power\_Middle\_HighV\_008  
Date: 13.AUG.2003 15:16:04

Test Of: Panasonic Mobile Communications Ltd.

X70 Mobile Handset

To: FCC Part 15.247

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**Transmitter Peak Output Power: Section 15.247(b)(1) (Continued)**

Channel	Input Voltage (AC)	Output Level (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Power Limit (dBm)	Margin (dB)	Result
Top	93.5	-0.6	1.6	1.0	30.0	30.6	Complied
Top	110.0	-0.7	1.6	0.9	30.0	30.7	Complied
Top	126.5	-0.7	1.6	0.9	30.0	30.7	Complied

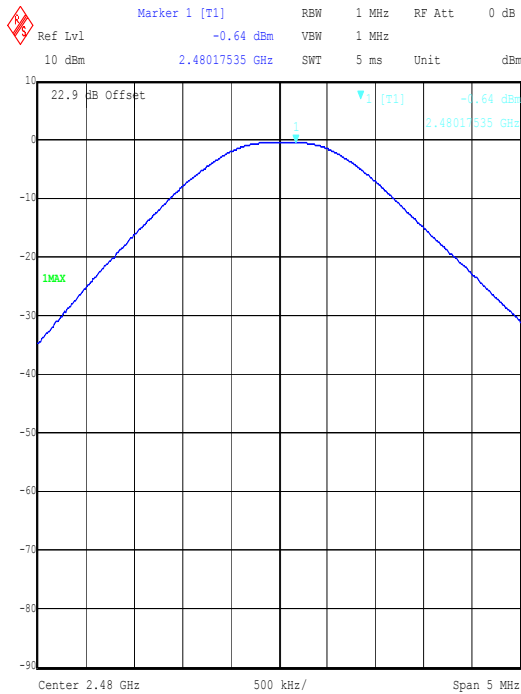


Test Of: Panasonic Mobile Communications Ltd.

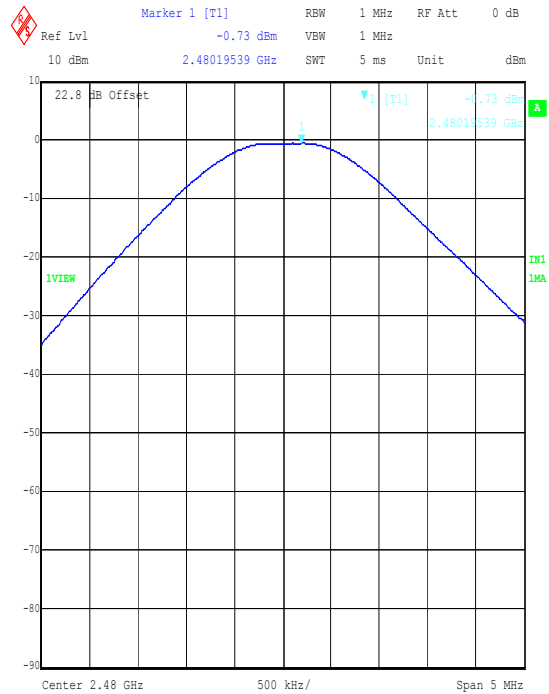
X70 Mobile Handset

To: FCC Part 15.247

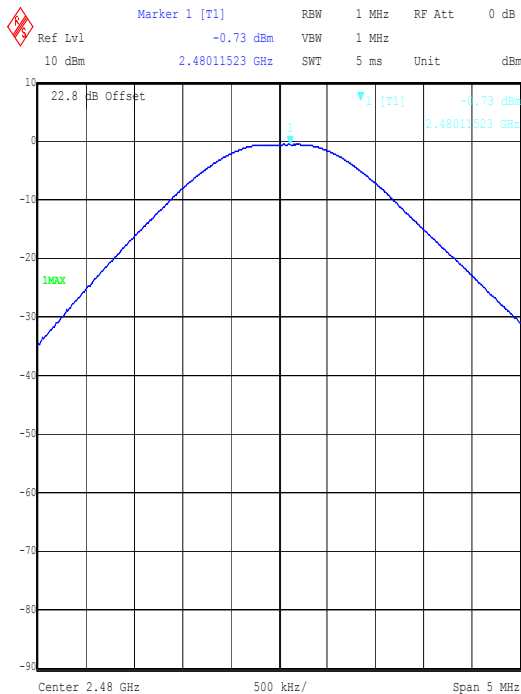
**Transmitter Peak Output Power: Section 15.247(b)(1) (Continued)**



Title: Panasonic X70 0044006228700226 FCC 15.247 Peak Output Power  
Comment A: 44839JD06\_FCC\_Output\_Power\_Top\_LowV\_003  
Date: 13.AUG.2003 15:18:51



Title: Panasonic X70 0044006228700226 FCC 15.247 Peak Output Power  
Comment A: 44839JD06\_FCC\_Output\_Power\_Top\_NomV\_006  
Date: 13.AUG.2003 15:13:01



Title: Panasonic X70 0044006228700226 FCC 15.247 Peak Output Power  
Comment A: 44839JD06\_FCC\_Output\_Power\_Top\_HighV\_009  
Date: 13.AUG.2003 15:16:42

Test Of: Panasonic Mobile Communications Ltd.

X70 Mobile Handset

To: FCC Part 15.247

**7.9. Transmitter Conducted Emissions: Section 15.247(c)**

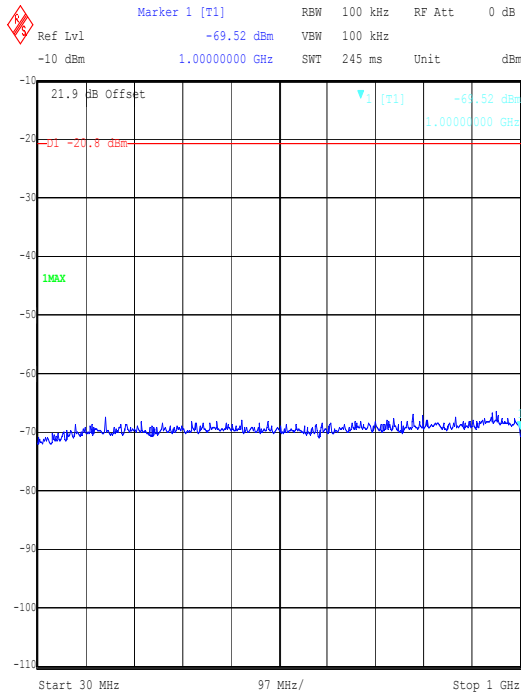
7.9.1. The EUT was configured as for conducted antenna port emissions measurements as described in Section 8 of this report.

7.9.2. Tests were performed to identify the maximum conducted emissions levels on the antenna port.

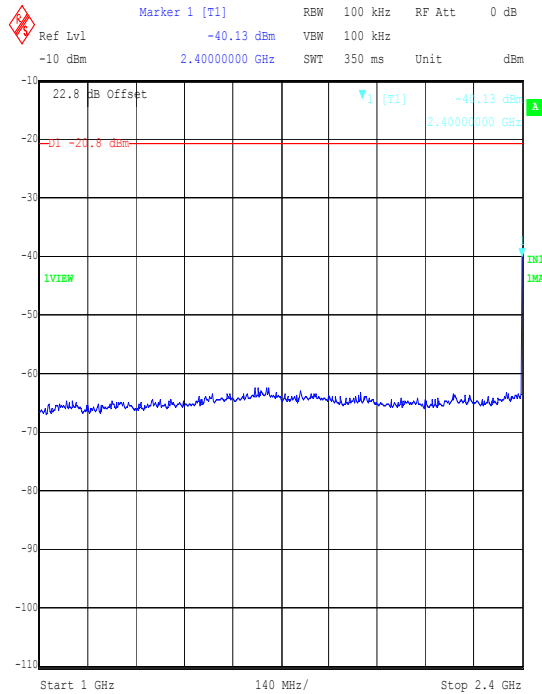
**Results:**

**Highest Peak level: Bottom Channel**

Frequency (GHz)	Peak Detector Level (dBm)	Peak Limit (dBm)	Peak Margin (dB)	Result
2.400	-40.1	-20.8	19.3	Complied



Title: Panasonic X70 0044006228700226 FCC 15.247 Conducted Spurious  
 Comment A: 44839JD06\_FCC\_CE\_Bottom\_001  
 Date: 13.AUG.2003 11:50:08



Title: Panasonic X70 0044006228700226 FCC 15.247 Conducted Spurious  
 Comment A: 44839JD06\_FCC\_CE\_Bottom\_002  
 Date: 13.AUG.2003 11:58:03

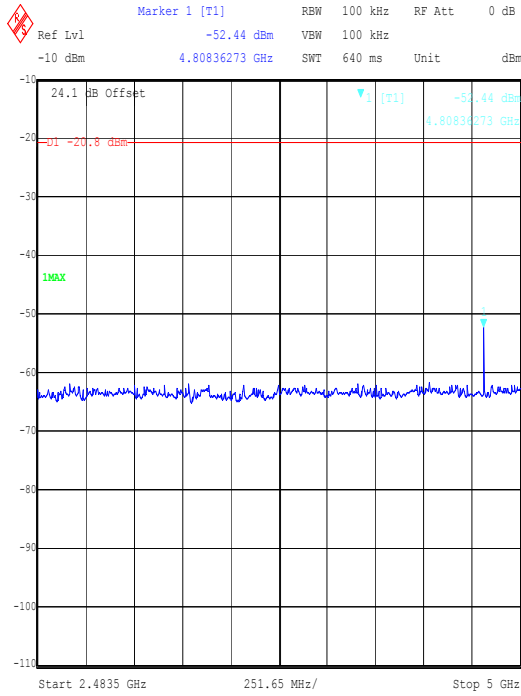
Operations Department

Test Of: Panasonic Mobile Communications Ltd.

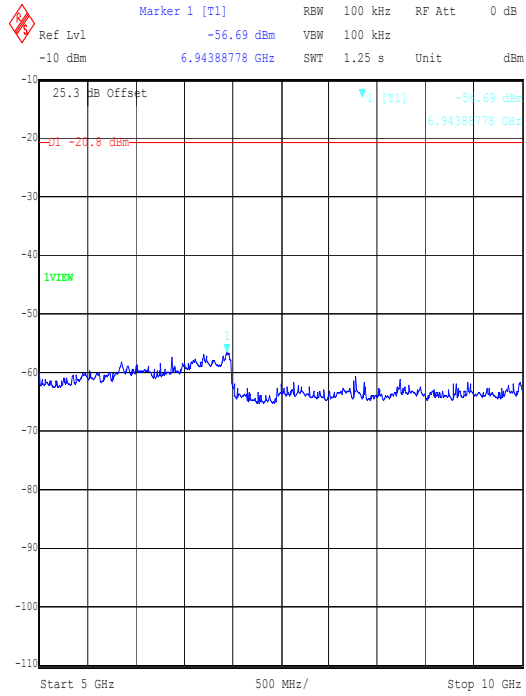
X70 Mobile Handset

To: FCC Part 15.247

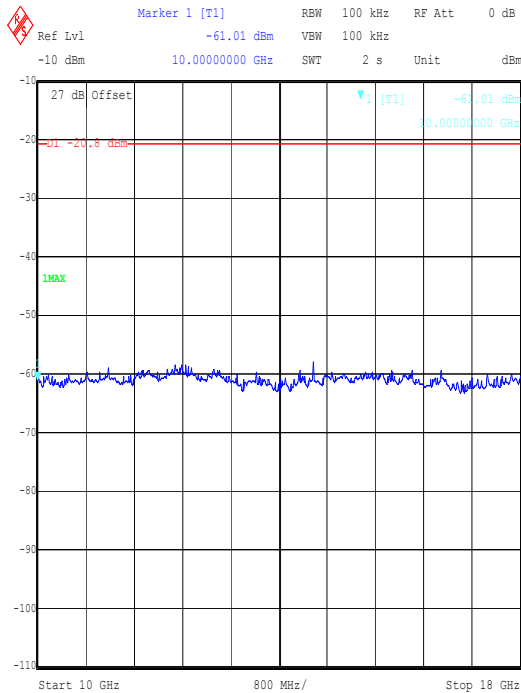
Transmitter Conducted Emissions: Section 15.247(c) (Continued)



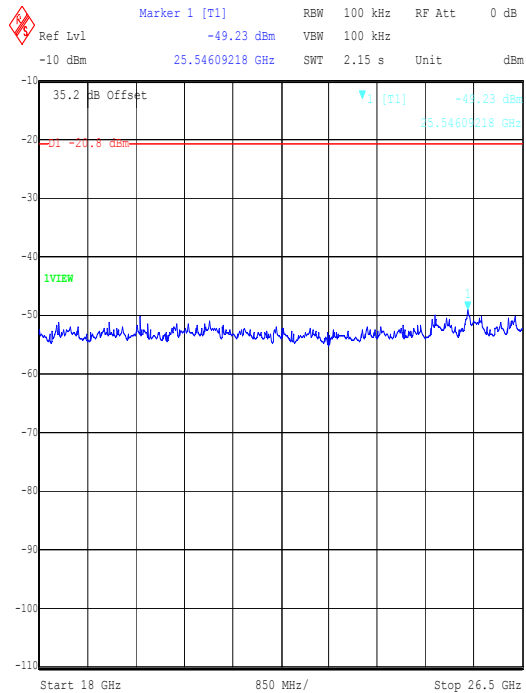
Title: Panasonic X70 0044006228700226 FCC 15.247 Conducted Spurious  
 Comment A: 44839JD06\_FCC\_CE\_Bottom\_003  
 Date: 13.AUG.2003 11:58:59



Title: Panasonic X70 0044006228700226 FCC 15.247 Conducted Spurious  
 Comment A: 44839JD06\_FCC\_CE\_Bottom\_004  
 Date: 13.AUG.2003 12:00:08



Title: Panasonic X70 0044006228700226 FCC 15.247 Conducted Spurious  
 Comment A: 44839JD06\_FCC\_CE\_Bottom\_005  
 Date: 13.AUG.2003 12:00:55



Title: Panasonic X70 0044006228700226 FCC 15.247 Conducted Spurious  
 Comment A: 44839JD06\_FCC\_CE\_Bottom\_006  
 Date: 13.AUG.2003 12:02:13

Test Of: Panasonic Mobile Communications Ltd.

X70 Mobile Handset

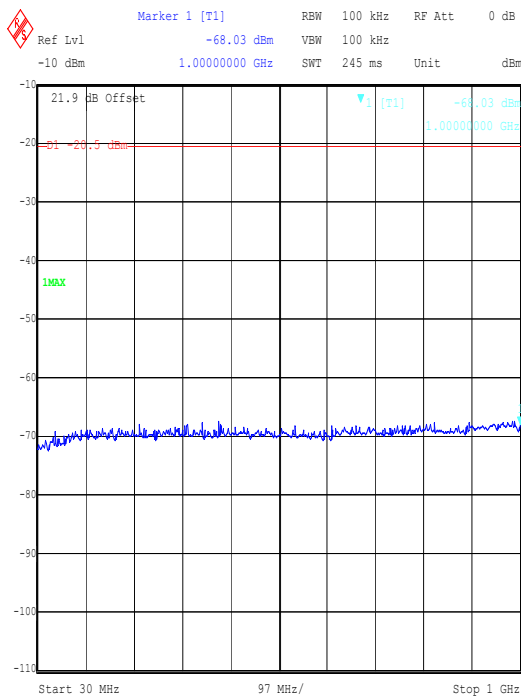
To: FCC Part 15.247

**Transmitter Conducted Emissions: Section 15.247(c) (Continued)**

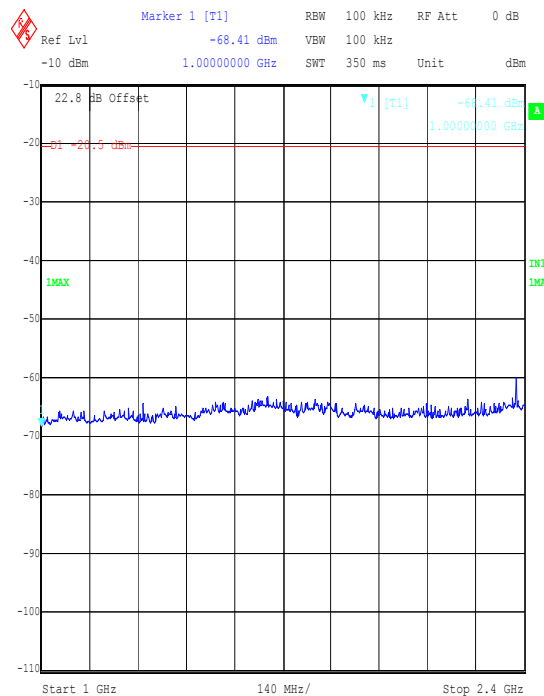
**Results:**

**Highest Peak level: Middle Channel**

Frequency (GHz)	Peak Detector Level (dBm)	Peak Limit (dBm)	Peak Margin (dB)	Result
4.884	-54.0	-20.5	33.5	Complied



Title: Panasonic X70 0044006228700226 FCC 15.247 Conducted Spurious  
 Comment A: 44839JD06\_FCC\_CE\_Middle\_007  
 Date: 13.AUG.2003 12:03:19



Title: Panasonic X70 0044006228700226 FCC 15.247 Conducted Spurious  
 Comment A: 44839JD06\_FCC\_CE\_Middle\_008  
 Date: 13.AUG.2003 12:04:00

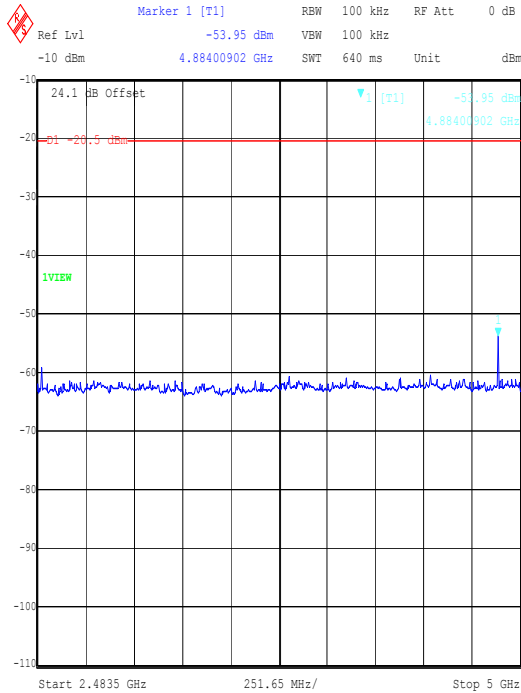
Operations Department

Test Of: Panasonic Mobile Communications Ltd.

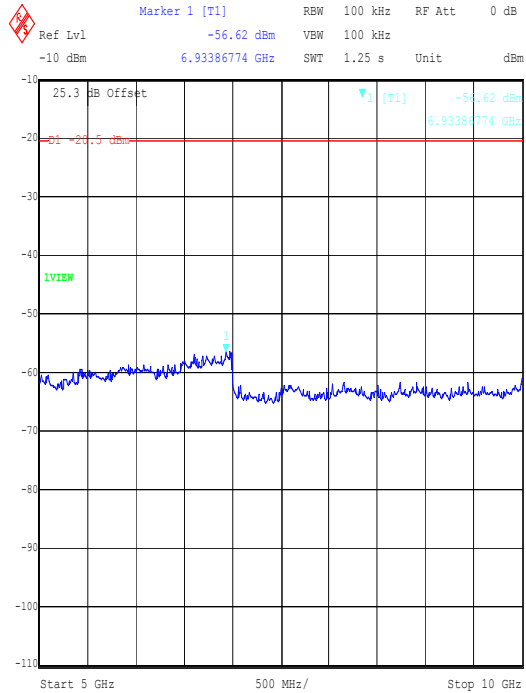
X70 Mobile Handset

To: FCC Part 15.247

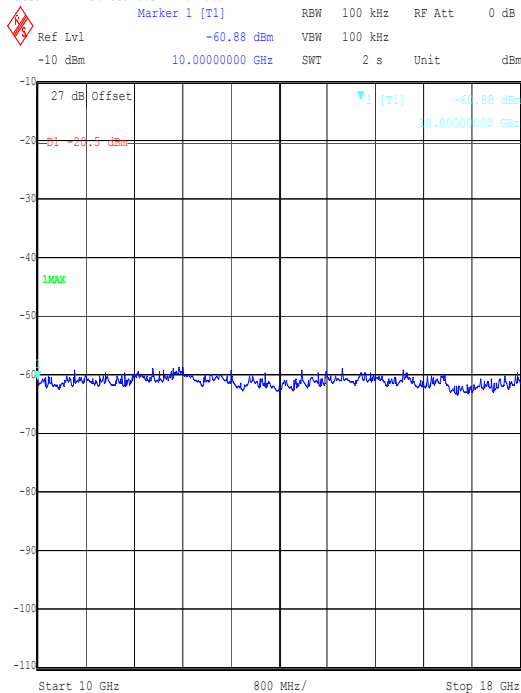
Transmitter Conducted Emissions: Section 15.247(c) (Continued)



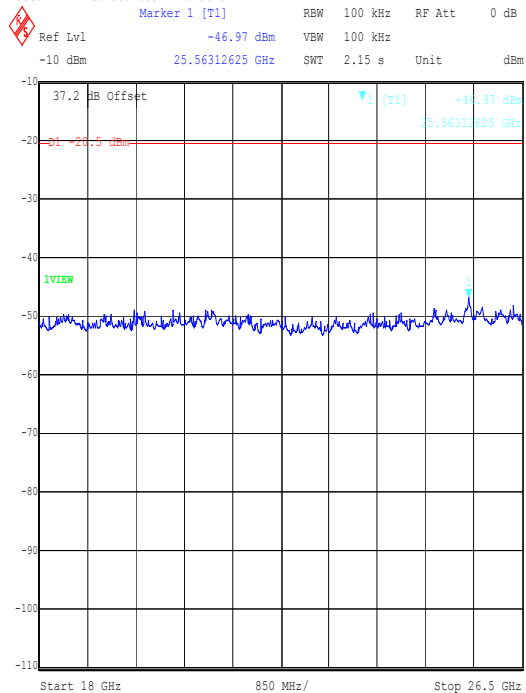
Title: Panasonic X70 0044006228700226 FCC 15.247 Conducted Spurious  
 Comment A: 44839JD06\_FCC\_CE\_Middle\_009  
 Date: 13.AUG.2003 12:22:08



Title: Panasonic X70 0044006228700226 FCC 15.247 Conducted Spurious  
 Comment A: 44839JD06\_FCC\_CE\_Middle\_010  
 Date: 13.AUG.2003 12:16:26



Title: Panasonic X70 0044006228700226 FCC 15.247 Conducted Spurious  
 Comment A: 44839JD06\_FCC\_CE\_Middle\_011  
 Date: 13.AUG.2003 12:17:20



Title: Panasonic X70 0044006228700226 FCC 15.247 Conducted Spurious  
 Comment A: 44839JD06\_FCC\_CE\_Middle\_012  
 Date: 13.AUG.2003 12:22:56

Test Of: Panasonic Mobile Communications Ltd.

X70 Mobile Handset

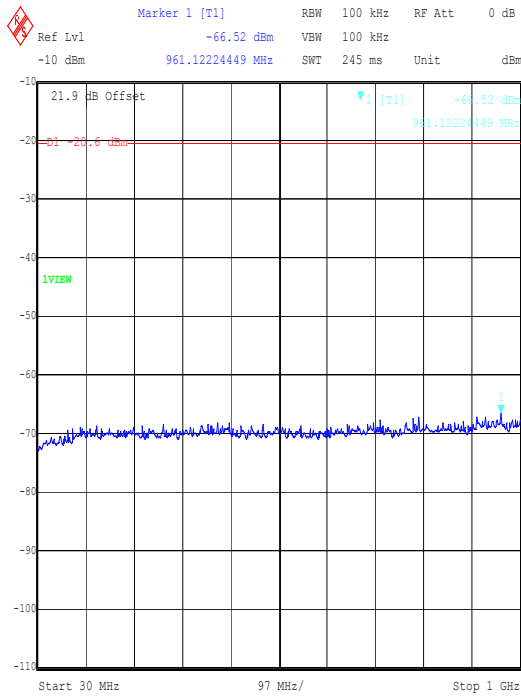
To: FCC Part 15.247

**Transmitter Conducted Emissions: Section 15.247(c) (Continued)**

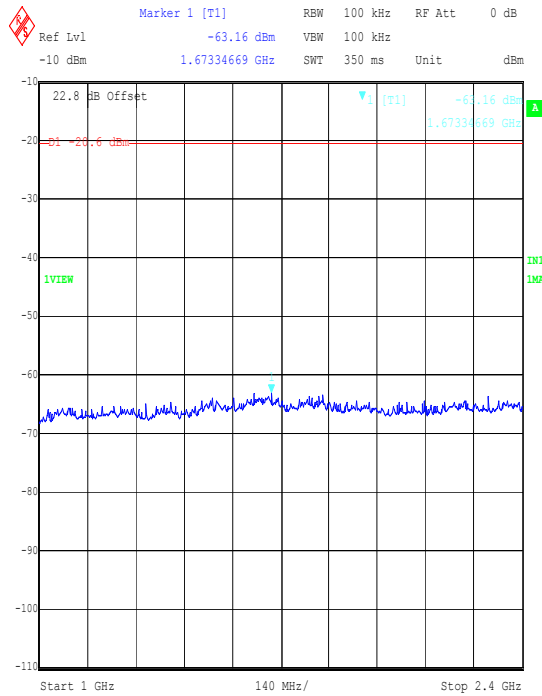
**Results:**

**Highest Peak level: Top Channel**

Frequency (GHz)	Peak Detector Level (dBm)	Peak Limit (dBm)	Peak Margin (dB)	Result
4.9647	-52.6	-20.6	32.0	Complied



Title: Panasonic X70 0044006228700226 FCC 15.247 Conducted Spurious  
 Comment A: 44839JD06\_FCC\_CE\_Top\_013  
 Date: 13.AUG.2003 12:23:59



Title: Panasonic X70 0044006228700226 FCC 15.247 Conducted Spurious  
 Comment A: 44839JD06\_FCC\_CE\_Top\_014  
 Date: 13.AUG.2003 12:25:16

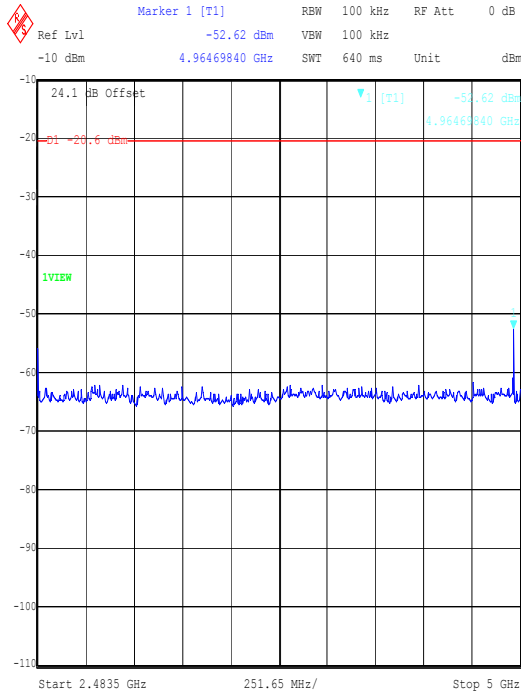
Operations Department

Test Of: Panasonic Mobile Communications Ltd.

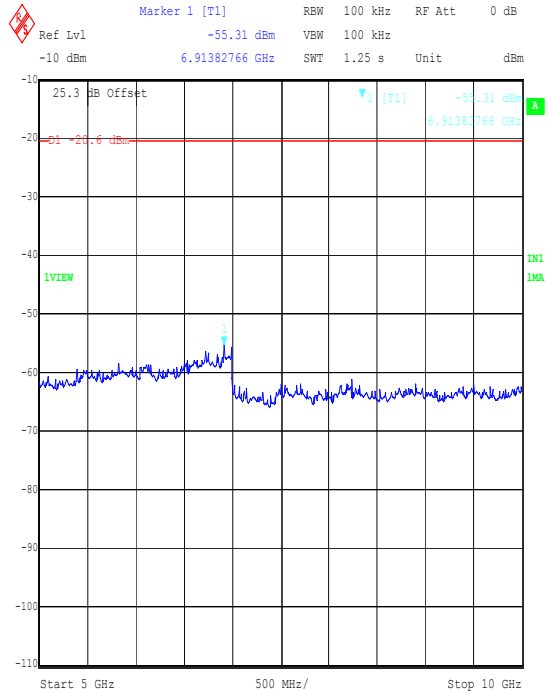
X70 Mobile Handset

To: FCC Part 15.247

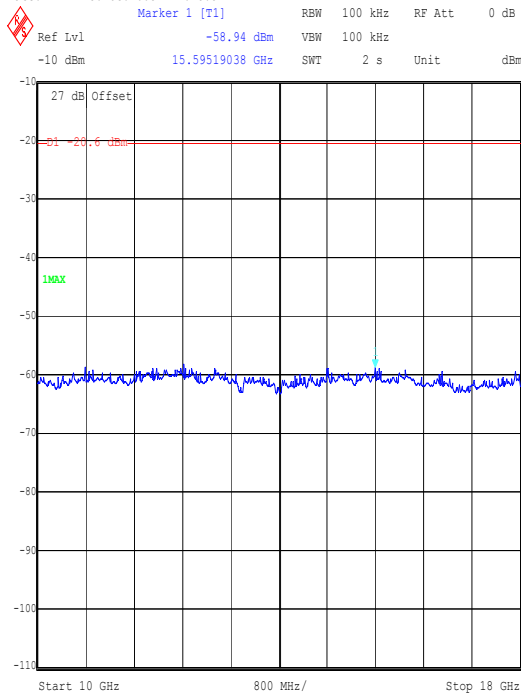
**Transmitter Conducted Emissions: Section 15.247(c) (Continued)**



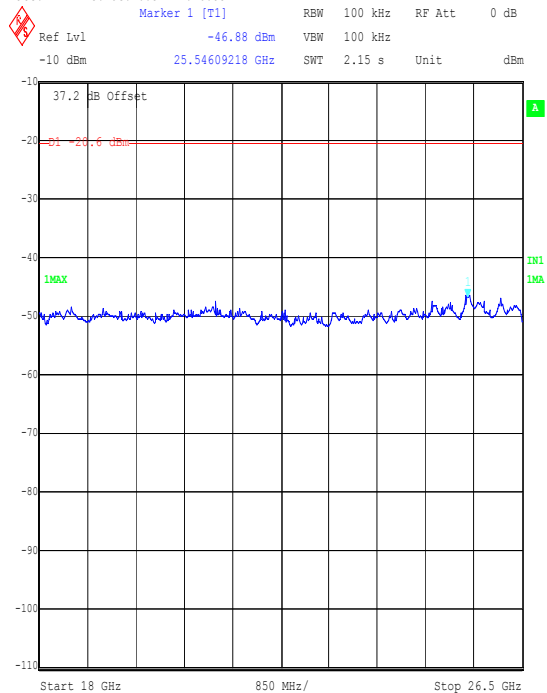
Title: Panasonic X70 0044006228700226 FCC 15.247 Conducted Spurious  
 Comment A: 44839JD06\_FCC\_CE\_Top\_015  
 Date: 13.AUG.2003 12:25:52



Title: Panasonic X70 0044006228700226 FCC 15.247 Conducted Spurious  
 Comment A: 44839JD06\_FCC\_CE\_Top\_016  
 Date: 13.AUG.2003 12:26:53



Title: Panasonic X70 0044006228700226 FCC 15.247 Conducted Spurious  
 Comment A: 44839JD06\_FCC\_CE\_Top\_017  
 Date: 21.AUG.2003 15:27:32



Title: Panasonic X70 0044006228700226 FCC 15.247 Conducted Spurious  
 Comment A: 44839JD06\_FCC\_CE\_Top\_018  
 Date: 21.AUG.2003 15:25:31

Test Of: Panasonic Mobile Communications Ltd.

X70 Mobile Handset

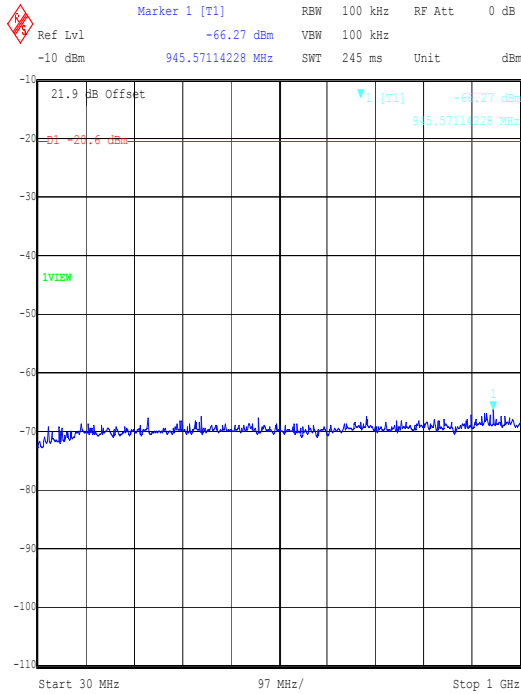
To: FCC Part 15.247

**Transmitter Conducted Emissions: Section 15.247(c) (Continued)**

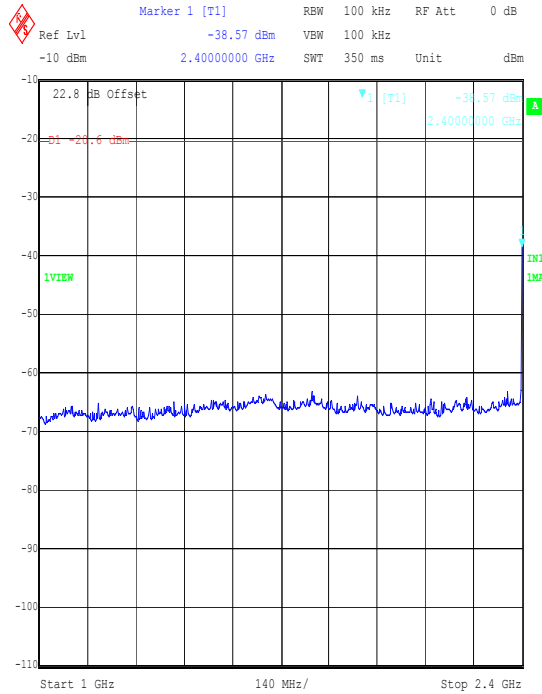
**Results:**

**Highest Peak level: Hopping All Channel**

Frequency (GHz)	Peak Detector Level (dBm)	Peak Limit (dBm)	Peak Margin (dB)	Result
2.400	-38.6	-20.6	18.0	Complied



Title: Panasonic X70 0044006228700226 FCC 15.247 Conducted Spurious  
 Comment A: 44839JD06\_FCC\_CE\_Hopping\_019  
 Date: 13.AUG.2003 12:29:28



Title: Panasonic X70 0044006228700226 FCC 15.247 Conducted Spurious  
 Comment A: 44839JD06\_FCC\_CE\_Hopping\_020  
 Date: 13.AUG.2003 12:30:13



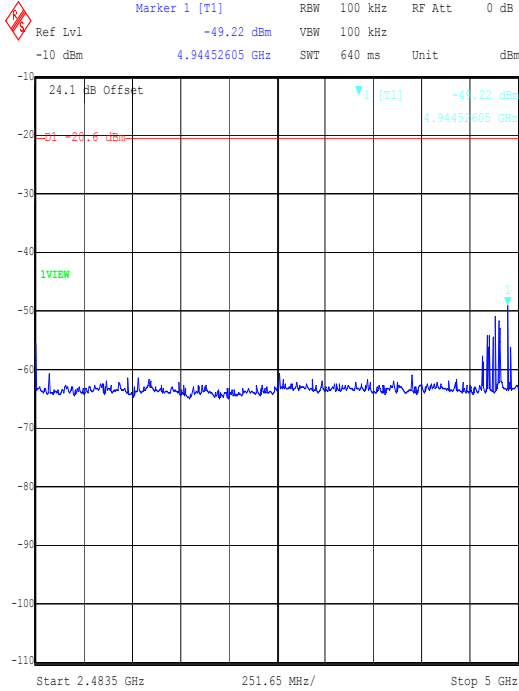
Operations Department

Test Of: Panasonic Mobile Communications Ltd.

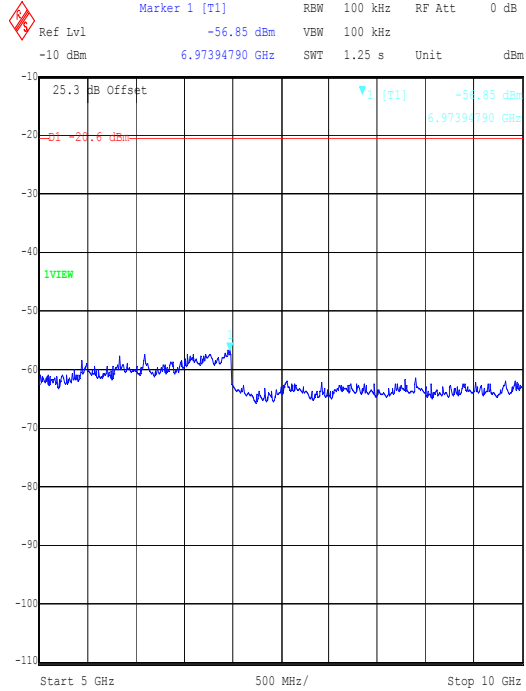
X70 Mobile Handset

To: FCC Part 15.247

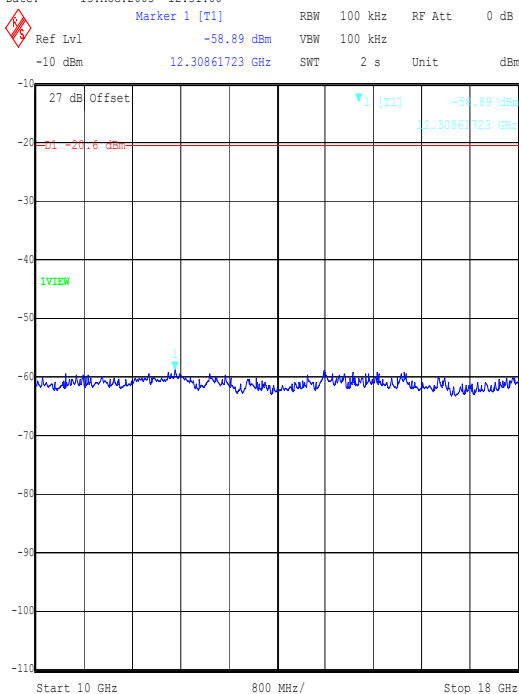
Transmitter Conducted Emissions: Section 15.247(c) (Continued)



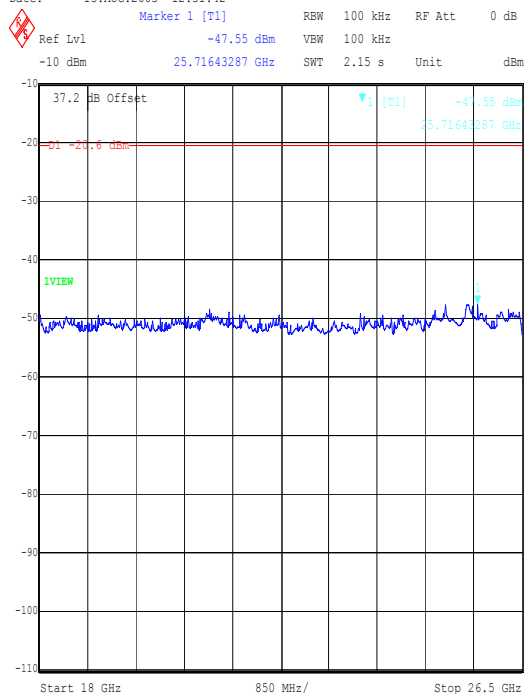
Title: Panasonic X70 0044006228700226 FCC 15.247 Conducted Spurious  
 Comment A: 44839JD06\_FCC\_CE\_Hopping\_021  
 Date: 13.AUG.2003 12:31:00



Title: Panasonic X70 0044006228700226 FCC 15.247 Conducted Spurious  
 Comment A: 44839JD06\_FCC\_CE\_Hopping\_022  
 Date: 13.AUG.2003 12:31:42



Title: Panasonic X70 0044006228700226 FCC 15.247 Conducted Spurious  
 Comment A: 44839JD06\_FCC\_CE\_Hopping\_023  
 Date: 13.AUG.2003 12:32:30



Title: Panasonic X70 0044006228700226 FCC 15.247 Conducted Spurious  
 Comment A: 44839JD06\_FCC\_CE\_Hopping\_024  
 Date: 13.AUG.2003 12:33:11

Test Of: **Panasonic Mobile Communications Ltd.**

**X70 Mobile Handset**

To: **FCC Part 15.247**

**7.10. Transmitter Radiated Emissions: Section 15.247(c) and 15.209(a)**

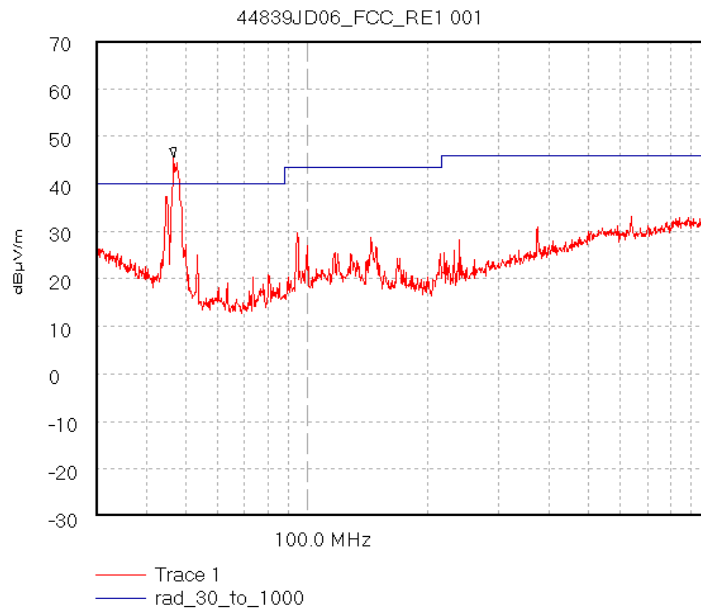
**7.10.1. Electric Field Strength Measurements: 30 to 1000 MHz.**

7.10.1.1. The EUT was configured as for radiated field strength measurements as described in Section 8 of this report.

7.10.1.2. Tests were performed to identify the maximum radiated emissions levels.

**Bottom Channel**

Frequency (MHz)	Ant. Pol.	Q-P Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
44.865	Vert.	16.5	40.0	23.5	Complied
46.663	Vert.	27.4	40.0	12.6	Complied
47.194	Vert.	19.7	40.0	20.3	Complied



Start 30.0 MHz; Stop 1.0 GHz - Log Scale  
 Ref 70 dBμV/m; Ref Offset 0.0 dB; 10 dB/div  
 RBW 68.966 kHz; VBW 100.0 kHz; Att 0 dB; Swp 260.0 mS  
 Peak 46.776 MHz, 45.58 dBμV/m  
 Limit/Mask: rad\_30\_to\_1000; ; Limit Test Failed  
 Transducer Factors: A1037  
 8/7/2003 3:46:43 PM

Test Of: Panasonic Mobile Communications Ltd.

X70 Mobile Handset

To: FCC Part 15.247

**Transmitter Radiated Emissions: Section 15.247(c) and 15.209(a) (continued)****7.10.2. Electric Field Strength Measurements: 1.0 to 26.5 GHz****Highest Average Level: Bottom Channel**

Frequency (GHz)	Antenna Polarity (H/V)	Average Detector level (dB $\mu$ V)	Antenna factor (dB)	Cable loss (dB)	Actual Average Level (dB $\mu$ V/m)	Average Limit (dB $\mu$ V/m)	Average Margin (dB)	Result
5.0377	Horiz.	3.2	24.4	2.0	29.6	54.0	24.4	Complied

**Highest Peak Level: Bottom Channel**

Frequency (GHz)	Antenna Polarity (H/V)	Peak Detector level (dB $\mu$ V)	Antenna factor (dB)	Cable loss (dB)	Actual Peak Level (dB $\mu$ V/m)	Peak Limit (dB $\mu$ V/m)	Peak Margin (dB)	Result
5.0377	Horiz.	17.0	24.4	2.0	43.4	74.0	30.6	Complied

**Highest Average Level: Middle Channel**

Frequency (GHz)	Antenna Polarity (H/V)	Average Detector level (dB $\mu$ V)	Antenna factor (dB)	Cable loss (dB)	Actual Average Level (dB $\mu$ V/m)	Average Limit (dB $\mu$ V/m)	Average Margin (dB)	Result
5.8711	Horiz.	5.3	24.4	2.0	31.7	54.0	22.3	Complied

**Highest Peak Level: Middle Channel**

Frequency (GHz)	Antenna Polarity (H/V)	Peak Detector level (dB $\mu$ V)	Antenna factor (dB)	Cable loss (dB)	Actual Peak Level (dB $\mu$ V/m)	Peak Limit (dB $\mu$ V/m)	Peak Margin (dB)	Result
5.8711	Horiz.	19.0	24.4	2.0	45.4	74.0	28.6	Complied

Test Of: Panasonic Mobile Communications Ltd.

X70 Mobile Handset

To: FCC Part 15.247

**Transmitter Radiated Emissions: Section 15.247(c) and 15.209(a) (continued)****Highest Average Level: Top Channel**

Frequency (GHz)	Antenna Polarity (H/V)	Average Detector level (dB $\mu$ V)	Antenna factor (dB)	Cable loss (dB)	Actual Average Level (dB $\mu$ V/m)	Average Limit (dB $\mu$ V/m)	Average Margin (dB)	Result
5.0622	Horiz.	3.5	24.4	2.0	29.9	54.0	24.1	Complied

**Highest Peak Level: Top Channel**

Frequency (GHz)	Antenna Polarity (H/V)	Peak Detector level (dB $\mu$ V)	Antenna factor (dB)	Cable loss (dB)	Actual Peak Level (dB $\mu$ V/m)	Peak Limit (dB $\mu$ V/m)	Peak Margin (dB)	Result
5.0622	Horiz.	17.8	24.4	2.0	44.2	74.0	29.8	Complied

**Highest Average Level: Hopping All Channels**

Frequency (GHz)	Antenna Polarity (H/V)	Average Detector level (dB $\mu$ V)	Antenna factor (dB)	Cable loss (dB)	Actual Average Level (dB $\mu$ V/m)	Average Limit (dB $\mu$ V/m)	Average Margin (dB)	Result
5.8803	Horiz.	5.6	24.4	2.0	32.0	54.0	22.0	Complied

**Highest Peak Level: Hopping All Channels**

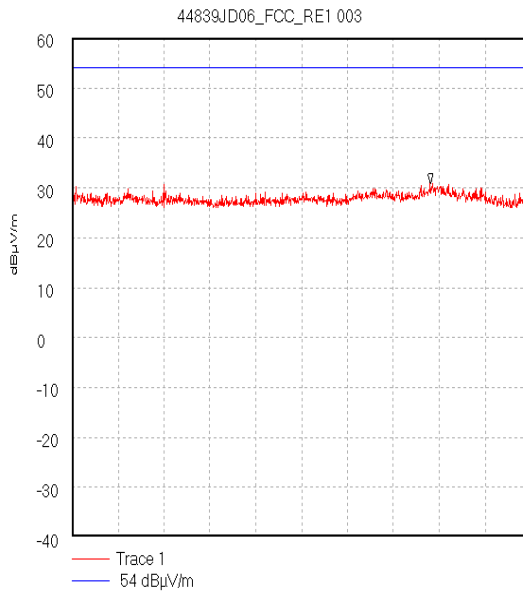
Frequency (GHz)	Antenna Polarity (H/V)	Peak Detector level (dB $\mu$ V)	Antenna factor (dB)	Cable loss (dB)	Actual Peak Level (dB $\mu$ V/m)	Peak Limit (dB $\mu$ V/m)	Peak Margin (dB)	Result
5.8803	Horiz.	19.3	24.4	2.0	45.7	74.0	28.3	Complied

Test Of: Panasonic Mobile Communications Ltd.

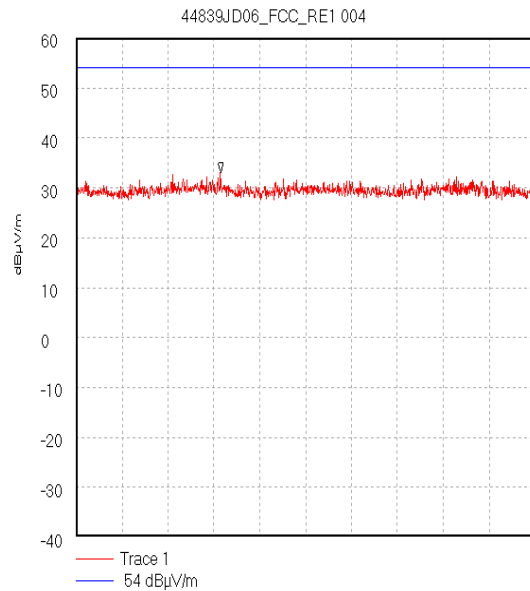
X70 Mobile Handset

To: FCC Part 15.247

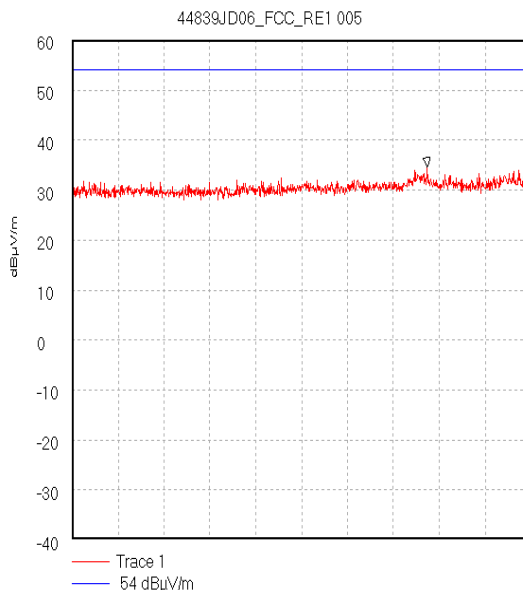
**Transmitter Radiated Emissions: Section 15.247(c) and 15.209(a) (continued)**



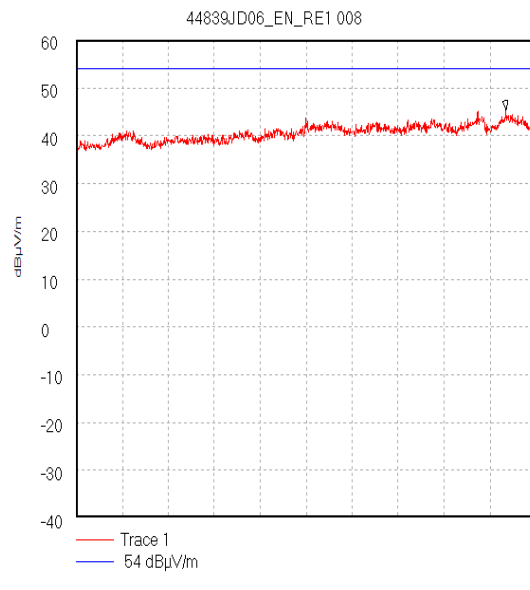
Start 1.0 GHz; Stop 2.0 GHz  
Ref 60 dBµV/m; Ref Offset 0.0 dB; 10 dB/div  
RBW 100.0 kHz; VBW 100.0 kHz; Att 0 dB; Swp 640.0 mS  
Peak 1.781 GHz; 30.8 dBµV/m  
Display Line: 54 dBµV/m; ; Limit Test Passed  
8/7/2003 4:02:29 PM



Start 2.0 GHz; Stop 2.4 GHz  
Ref 60 dBµV/m; Ref Offset 5.0 dB; 10 dB/div  
RBW 100.0 kHz; VBW 100.0 kHz; Att 0 dB; Swp 260.0 mS  
Peak 2.126 GHz; 33.11 dBµV/m  
Display Line: 54 dBµV/m; ; Limit Test Passed  
8/7/2003 4:06:04 PM



Start 2.484 GHz; Stop 4.0 GHz  
Ref 60 dBµV/m; Ref Offset 5.0 dB; 10 dB/div  
RBW 100.0 kHz; VBW 100.0 kHz; Att 0 dB; Swp 960.0 mS  
Peak 3.658 GHz; 34.54 dBµV/m  
Display Line: 54 dBµV/m; ; Limit Test Passed  
8/7/2003 4:07:34 PM



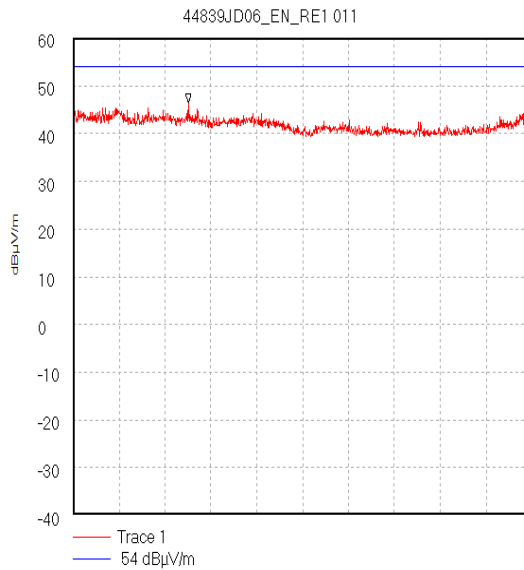
Start 4.0 GHz; Stop 6.0 GHz  
Ref 60 dBµV/m; Ref Offset 0.0 dB; 10 dB/div  
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS  
Peak 5.871111 GHz; 45.4 dBµV/m  
Display Line: 54 dBµV/m;  
Transducer Factors: 4to6g\_Horn  
18/08/2003 14:04:03

Test Of: **Panasonic Mobile Communications Ltd.**

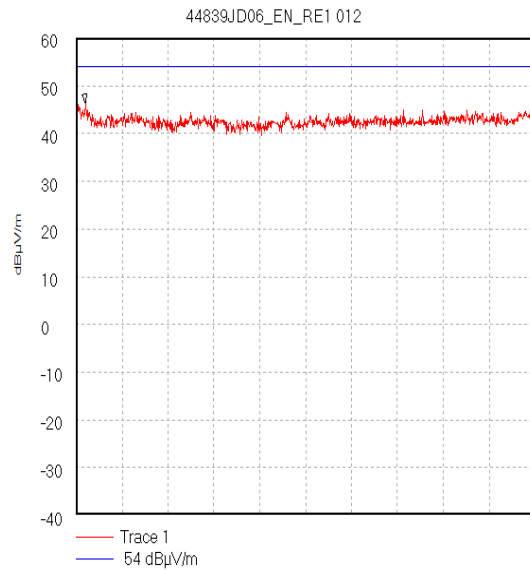
**X70 Mobile Handset**

To: **FCC Part 15.247**

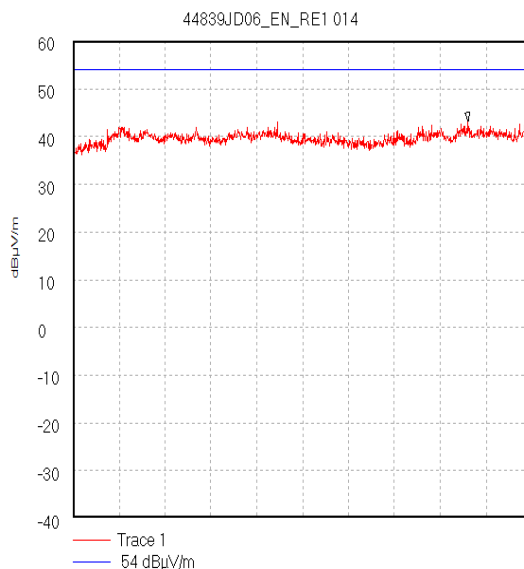
**Transmitter Radiated Emissions: Section 15.247(c) and 15.209(a) (continued)**



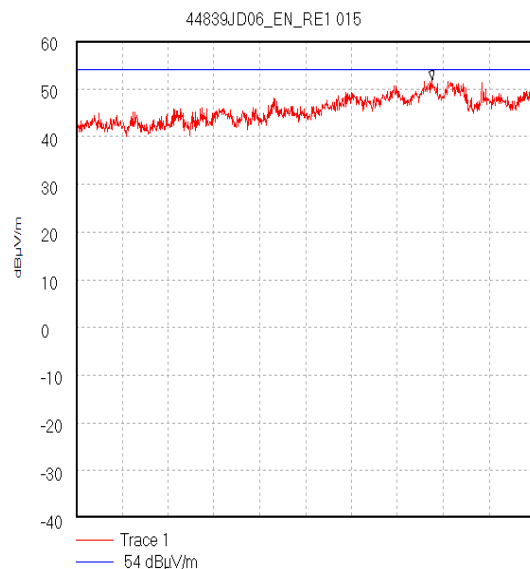
Start 6.0 GHz; Stop 8.0 GHz  
Ref 60 dBµV/m; Ref Offset 0.0 dB; 10 dB/div  
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS  
Peak 6.502222 GHz, 46.34 dBµV/m  
Display Line: 54 dBµV/m;  
Transducer Factors: 6to8g\_Horn  
18/08/2003 14:22:33



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 8.09 GHz, 46.37 dBµV/m  
Display Line: 54 dBµV/m;  
Transducer Factors: 8to12G\_Horn  
18/08/2003 14:25:55



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 17.236111 GHz, 43.19 dBµV/m  
Display Line: 54 dBµV/m;  
Transducer Factors: 12to18G\_Horn  
18/08/2003 14:33:41



Start 18.0 GHz; Stop 26.5 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 40.0 mS  
Peak 24.601667 GHz, 51.8 dBµV/m  
Display Line: 54 dBµV/m;  
Transducer Factors: 18to26  
18/08/2003 14:39:25

Test Of: Panasonic Mobile Communications Ltd.

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To: FCC Part 15.247

**7.11. Transmitter Band Edge Conducted Emissions: Section 15.247(c)**

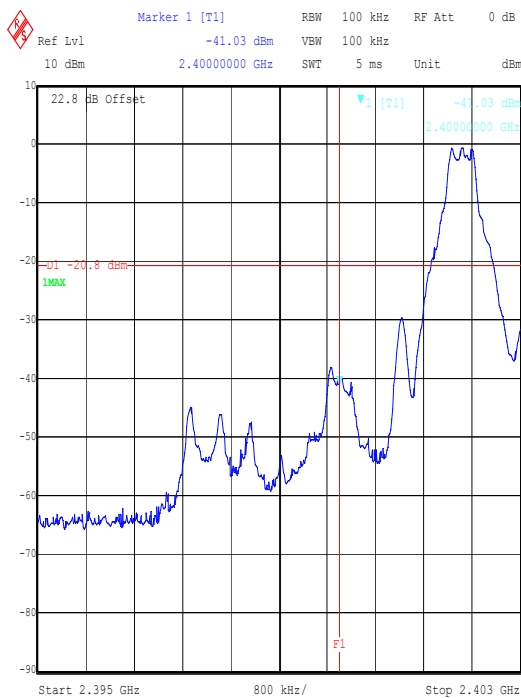
**7.11.1. Electric Field Strength Measurements**

7.11.1.1. The EUT was configured as for conducted antenna port emissions measurements as described in Section 8 of this report.

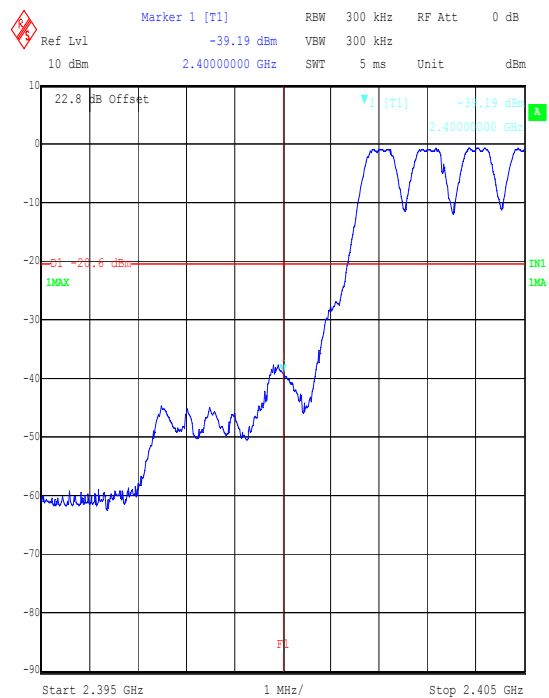
7.11.1.2. Tests were performed to identify the maximum conducted band edge emissions.

**Highest Peak Level Lower Band Edge**

Frequency (GHz)	Mode	Peak Detector level (dBm)	Peak Limit (dBm)	Peak Margin (dB)	Result
2.400	Static	-41.0	-20.8	20.1	Complied
2.400	Hopping	-39.2	-20.6	18.6	Complied



Title: Panasonic X70 0044006228700226 FCC 15.247 Lower Band-Edge  
 Comment A: 44839JD06\_FCC\_Lower\_band\_Edge\_Bottom\_002  
 Date: 13.AUG.2003 14:22:05



Title: Panasonic X70 0044006228700226 FCC 15.247 Lower Band-Edge  
 Comment A: 44839JD06\_FCC\_Lower\_band\_Edge\_Hopping\_001  
 Date: 13.AUG.2003 14:20:41

Test Of: Panasonic Mobile Communications Ltd.

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To: FCC Part 15.247

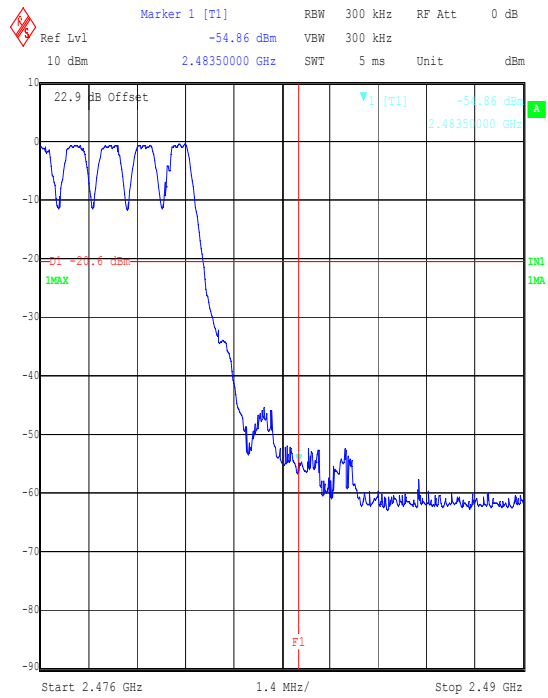
**Transmitter Band Edge Conducted Emissions: Section 15.247(c) (Continued)**

**Highest Peak Level Upper Band Edge**

Frequency (GHz)	Mode	Peak Detector level (dBm)	Peak Limit (dBm)	Peak Margin (dB)	Result
2.4835	Static	-57.5	-20.6	36.9	Complied
2.4835	Hopping	-54.9	-20.6	34.3	Complied



Title: Panasonic X70 0044006228700226 FCC 15.247 Upper Band-Edge  
 Comment A: 44839JD06\_FCC\_Upper\_band\_Edge\_Top\_001  
 Date: 13.AUG.2003 14:23:42



Title: Panasonic X70 0044006228700226 FCC 15.247 Upper Band-Edge  
 Comment A: 44839JD06\_FCC\_Upper\_band\_Edge\_Hopping\_002  
 Date: 13.AUG.2003 14:25:11



Test Of: Panasonic Mobile Communications Ltd.

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To: FCC Part 15.247

## **7.12. Transmitter Band Edge Radiated Emissions: Section 15.247(c) & 15.209(a)**

### **7.12.1. Electric Field Strength Measurements**

7.12.1.1. The EUT was configured as for band edge compliance of radiated emissions measurements as described in Section 8 of this report.

7.12.1.2. Tests were performed to identify the maximum radiated band edge emissions.

#### **Peak Power Level Hopping Mode:**

Frequency (GHz)	Antenna Polarity (H/V)	Actual Peak level (dBm)	Peak Limit (dBm)	Peak Margin (dB)	Result
2.4000	Horiz.	-47.1	-22.5	24.6	Complied

#### **Peak Power Level Hopping Mode:**

Frequency (GHz)	Antenna Polarity (H/V)	Peak Detector level (dB $\mu$ V)	Antenna factor (dB)	Cable loss (dB)	Actual Peak Level (dB $\mu$ V/m)	Peak Limit (dB $\mu$ V/m)	Peak Margin (dB)	Result
2.4835	Horiz.	23.7	21.1	2.0	46.8	74.0	27.2	Complied

#### **Average Power Level Hopping Mode:**

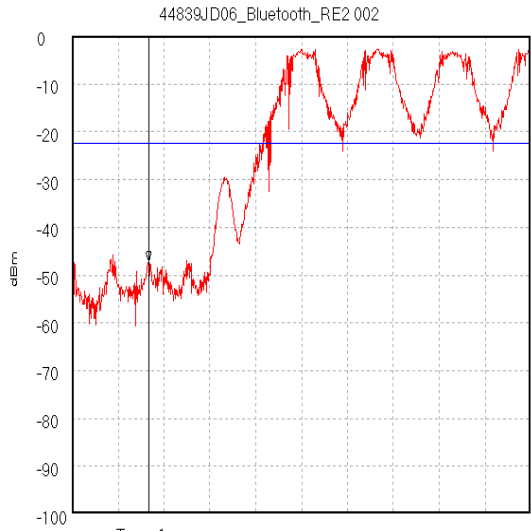
Frequency (GHz)	Antenna Polarity (H/V)	Average Detector level (dB $\mu$ V)	Antenna factor (dB)	Cable loss (dB)	Actual Average Level (dB $\mu$ V/m)	Average Limit (dB $\mu$ V/m)	Average Margin (dB)	Result
2.4835	Horiz.	15.0	21.1	2.0	38.1	54.0	15.9	Complied

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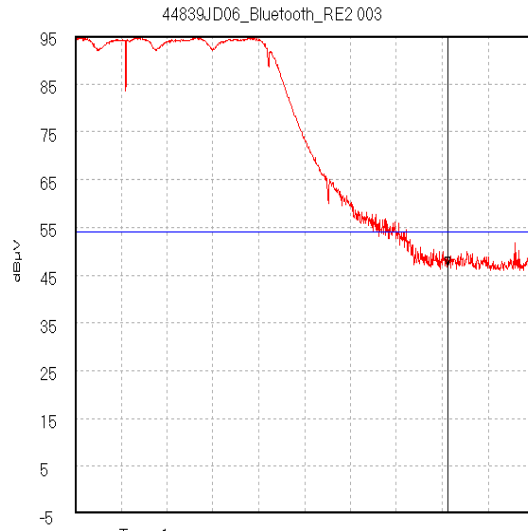
To: FCC Part 15.247

**Transmitter Band Edge Radiated Emissions: Section 15.247(c) & 15.209(a) (Continued)**



Trace 1  
-22.51 dBm  
2.4 GHz

Start 2.399 GHz; Stop 2.405 GHz  
Ref 0 dBm; Ref Offset 27.8 dB; 10 dB/div  
RBW 100.0 kHz; VBW 100.0 kHz; Att 0 dB; Swp 20.0 mS  
Marker 2.4 GHz, -47.13 dBm  
Display Line: -22.51 dBm;  
22/08/2003 14:45:43



Trace 1  
54 dBµV  
2.4835 GHz

Start 2.477 GHz; Stop 2.485 GHz  
Ref 95 dBµV; Ref Offset 2.0 dB; 10 dB/div  
RBW 1000.0 kHz; VBW 1.0 MHz; Att 10 dB; Swp 20.0 mS  
Marker 2.4835 GHz, 46.78 dBµV  
Display Line: 54 dBµV; ; Limit Test Failed  
22/08/2003 15:00:49

Test Of: Panasonic Mobile Communications Ltd.

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To: FCC Part 15.247

**Transmitter Band Edge Radiated Emissions: Section 15.247(c) & 15.209(a) (Continued)**

**Peak Power Level Static Mode:**

Frequency (GHz)	Antenna Polarity (H/V)	Actual Peak level (dBm)	Peak Limit (dBm)	Peak Margin (dB)	Result
2.4000	Horiz.	-48.3	-22.6	25.7	Complied

**Peak Power Static Mode:**

Frequency (GHz)	Antenna Polarity (H/V)	Peak Detector level (dBµV)	Antenna factor (dB)	Cable loss (dB)	Actual Peak Level (dBµV/m)	Peak Limit (dBµV/m)	Peak Margin (dB)	Result
2.4835	Horiz.	25.1	21.1	2.0	48.2	74.0	25.8	Complied

**Average Power Level Static Mode:**

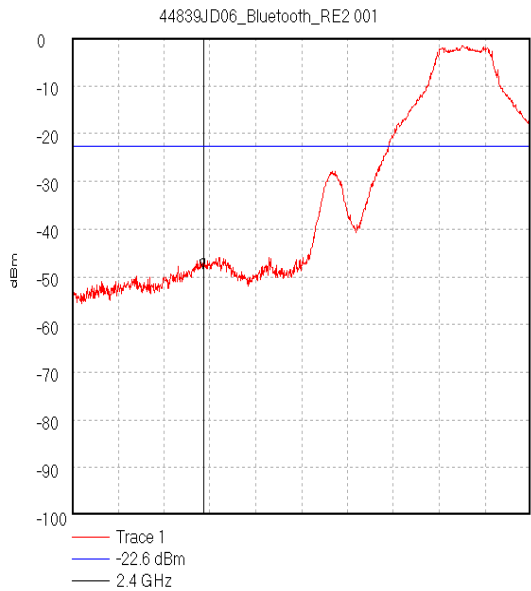
Frequency (GHz)	Antenna Polarity (H/V)	Average Detector level (dBµV)	Antenna factor (dB)	Cable loss (dB)	Actual Average Level (dBµV/m)	Average Limit (dBµV/m)	Average Margin (dB)	Result
2.4835	Horiz.	16.4	21.1	2.0	35.5	54.0	18.5	Complied

Test Of: Panasonic Mobile Communications Ltd.

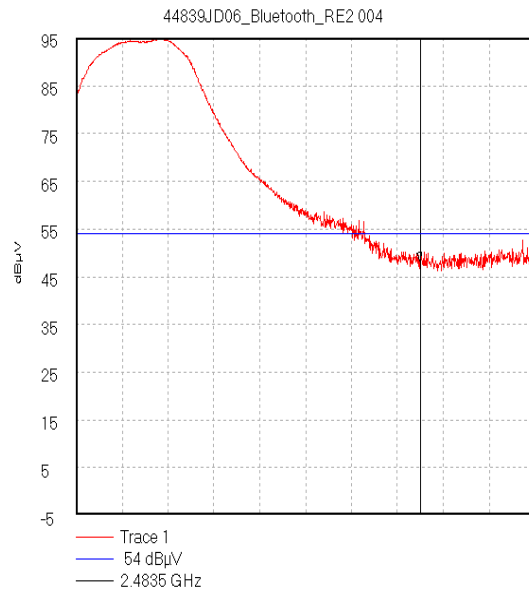
X70 Mobile Handset

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**Transmitter Band Edge Radiated Emissions: Section 15.247(c) & 15.209(a) (Continued)**



Start 2.399 GHz; Stop 2.4025 GHz  
Ref 0 dBm; Ref Offset 27.8 dB; 10 dB/div  
RBW 100.0 kHz; VBW 100.0 kHz; Att 0 dB; Swp 20.0 mS  
Marker 2.4 GHz, -48.33 dBm  
Display Line: -22.6 dBm;  
22/08/2003 14:32:54



Start 2.479 GHz; Stop 2.485 GHz  
Ref 95 dBµV; Ref Offset 2.0 dB; 10 dB/div  
RBW 1000.0 kHz; VBW 1.0 MHz; Att 10 dB; Swp 20.0 mS  
Marker 2.4835 GHz, 48.18 dBµV  
Display Line: 54 dBµV; ; Limit Test Failed  
22/08/2003 15:04:21

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## **8. Measurement Methods**

### **8.1. 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. The EUT powered with 115 V 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 EUT was configured in accordance with section 5.2 of this report.

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)*
Mode:	Max Hold	Not applicable
Bandwidth:	9 kHz	9 kHz
Amplitude Range:	100 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

\* In some instances an Average detector function may also have been used, where this was the case it would have been documented in the relevant section.

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## **8.2. Radiated Field Strength Emissions**

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

Initial measurements covering the entire measurement band in the form of swept scans in a shielded enclosure were performed in order to identify frequencies on which the EUT was generating interference. This determined the frequencies from the EUT that should be re-measured in full on the open area test site. In order to minimise the time taken for the swept measurements, a Peak detector was used in conjunction with the appropriate detector IF measuring bandwidth (see table below). Repetitive scans were performed to allow for emissions with low repetition rates.

The initial scans were performed using an antenna height of 1.5 m and a measurement distance of 3 m. Following the initial scans, graphs were produced giving an overview of the emissions from the EUT plotted against the appropriate specification limit. Any emission within 20 dB of the limit were then measured on the open area test site, except in cases where the noise floor was within 20 dB of the limit, in these cases the emission between the noise floor and the limit line or the highest point of the noise floor was measured.

In either case the measurement was made at the appropriate distance using a measuring receiver with a Quasi-Peak detector for measurements below 1000 MHz and an Average and Peak detector for measurements above 1000 MHz.

All measurements on the open area test site were performed using broadband antennas.

On the open area test site, at each frequency where a signal was to be measured, the trace was maximised by rotating a turntable through 360°. The angle at which the maximum signal was observed was locked out. For frequencies below 1000 MHz the test antenna was varied in height between 1 m and 4 m in order to further maximise the target emission.

For frequencies above 1000 MHz where a horn antenna was used, height searching was performed to locate the optimal height of the horn with respect to the EUT. At this point the horn was locked off and the turntable was again rotated through 360° to maximise the target signal. It should be noted that the received signal from the EUT would diminish very quickly after it exits the beam width of the horn antenna, for this reason it may not be necessary to fully height search with the horns.

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.

Scans were performed to the upper frequency limit as stated in 15.33(a)(1)

Final measurements were performed on the worst-case configuration as described in Part 15.31(i).

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### Radiated Field Strength Emissions (Continued)

The EUT was configured in accordance with section 5.2 of this report for radiated emissions testing.

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

Receiver Function	Initial Scan Below 1000 MHz	Final Measurements Below 1000 MHz
Detector Type:	Peak	Quasi-Peak (CISPR)
Mode:	Max Hold	Not applicable
Bandwidth:	100 kHz	120 kHz
Amplitude Range:	100 dB	100 dB
Measurement Time:	Not applicable	> 1 s
Observation Time:	Not applicable	> 15 s
Step Size:	Continuous sweep	Not applicable
Sweep Time:	Coupled	Not applicable

Receiver Function	Initial Scan Above 1000 MHz	Final Measurements Above 1000 MHz
Detector Type:	Peak	Peak/Average
Mode:	Max Hold	Max Hold where applicable
Bandwidth:	100 kHz	1 MHz
Amplitude Range:	100 dB	100 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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### **8.3. Carrier Frequency Separation / 20 dB Bandwidth**

The EUT and spectrum analyser was configured as for radiated measurements, And as per FCC Public Notice DA 00-705, Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems.

To determine the bandwidth and separation of each transmission channel the analyser was configured to measure two adjacent channels.

To determine the occupied bandwidth, a resolution bandwidth of 10 kHz was used, which is greater than 1% of the 20 dB bandwidth. A video bandwidth of a least the same value was used. The analyser was set for a maximum hold scan to capture the profile of the signal. The peak level was then determined, and a reference line was drawn 20 dB below the peak level. The bandwidth was determined at the points where the 20 dB reference crossed the profile of the emission.



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#### **8.4. Average Time of Occupancy**

The EUT and spectrum analyser was configured as for radiated measurements, and as per FCC Public Notice DA 00-705, Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems.

First the maximum packet length was determined on the centre channel.

The measurement analyser was configured to the time domain mode by setting the span to 0 with a sweep time sufficiently wide enough to measure one pulse.

The EUT was configured to operate in normal mode of operation.

The pulse width of one transmission was then recorded.

The measurement analyser was then configured in 0 span with the time domain and a 31.6 second sweep time. This period was determined by multiplying the number of channels the device operates over (79) by 0.4 seconds.

The number of transmissions within this period was noted and multiplied by the pulse width recorded earlier. This gives the maximum occupancy over 31.6 seconds.

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### **8.5. Peak Output Power**

The EUT and spectrum analyser were configured as for radiated measurements, And as per FCC Public Notice DA 00-705, Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems.

Prior to testing being performed a suitable RF attenuator and cable were calibrated for the required frequencies. For each frequency to be measured, the calibrated level of the attenuator and cable were entered as an offset into a wideband power meter to compensate for the measurement set up.

To determine the transmitter output power, the EUT was operated at maximum power and a result was obtained from the wideband power meter.

The EUT was configured in accordance with section 5.2 of this report

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### **8.6. Band Edge Compliance of RF Radiated Emissions**

The EUT and spectrum analyser were configured as for Radiated measurements, And as per FCC Public Notice DA 00-705, Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems.

To determine band-edge compliance, the analyser resolution bandwidth was set to  $\geq 1\%$  of the analyser span. The video bandwidth was set to be no less than the resolution bandwidth. The sweep was set to auto and the detector to peak. The trace was set to max hold and a trace was produced.

A plot of the upper band edge of the allocated frequency band was produced. A limit line was set to the level of the highest in-band emission with a further limit line set to 20 dB below this. A marker was then placed on the highest out of band emission (The specification states that either the band edge level must be measured or the highest out of band emission, whichever is the greater). The plots show that the highest out of band emission complies with the 20 dBc Limit. The above procedure was then repeated for the lower band edge.

If the upper or lower band edges fell on a restricted band edge then the limit set for the restricted band would be applied instead of the 20 dBc limit.

(Final measurements were performed on the worst-case configuration as described in Part 15.31(i).)

The EUT was configured in accordance with section 5.2 of this report

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## **9. Measurement Uncertainty**

9.1. 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.

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

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

9.4. 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".

<b>Measurement Type</b>	<b>Range</b>	<b>Confidence Level (%)</b>	<b>Calculated Uncertainty</b>
AC Conducted Spurious Emissions	0.15 MHz to 30.0 MHz	95%	+/- 3.25 dB
Carrier Output Power	Not applicable	95%	+/- 0.46 dB
Conducted Emissions Antenna Port	9 kHz to 26.5 GHz	95%	+/- 1.2 dB
Time Occupancy	Not applicable	95%	+/- 10 %
Channel Separation	Not applicable	95%	+/- 10 %
Minimum Bandwidth	Not applicable	95%	+/- 0.12 %
Occupied Bandwidth	Not applicable	95%	+/- 0.12 %
Radiated Spurious Emissions	30.0 MHz to 1000.0 MHz	95%	+/- 5.26 dB
Radiated Spurious Emissions	1.0 GHz to 26.5 GHz	95%	+/- 1.78 dB

9.5. 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
A049	370 BNM 5W Termination	Narda	370 BNM	None
A197	Site 2 Controller SC144	Unknown	SC144	150720
A253	WG 12 Microwave Horn	Flann Microwave	12240-20	128
A254	WG 14 Microwave Horn	Flann Microwave	14240-20	139
A255	WG 16 Microwave Horn	Flann Microwave	16240-20	519
A256	WG 18 Microwave Horn	Flann Microwave	18240-20	400
A259	Bilog Antenna	Chase	CBL6111	1513
A274	3 Phase Surge CDN	Schaffner	CDN 113	220
A427	WG 14 horn	Flann	14240-20	150
A428	WG 12 horn	Flann	12240-20	134
A430	WG 18 horn	Flann	18240-20	425
A436	WG 20 horn	Flann	20240-20	330
C1079	Rosenberger 1m Cable	Rosenberger	FA210A1010M 5050	28462-1
C1080	Rosenberger Cable 3m	Rosenberger	FA210A1030M 5050	28464-1
C1081	Rosenberger Cable 2m	Rosenberger	FA210A1020M 5050	28463-2
C461	Cable	Rosenberger	UFA210A-1- 1182-704704	98H0305
C468	N-Type Coaxial Cable	Rosenberger	UFA210A-1- 3937-504504	98L0440
M003	Spectrum Monitor	Rohde & Schwarz	EZM	883 580/008
M023	ESVP Receiver	Rohde & Schwarz	ESVP	872 991/027
M072	FSM Spectrum Analyser	Rohde & Schwarz	FSM	862 967/010 (RF) & 863 912/048 (Display)
M1093	Will tek	Will tek	4202S	0513018
M173	Turntable Controller	R.H.Electrical Services	RH351	3510020
S201	Site 1	RFI	1	

**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:

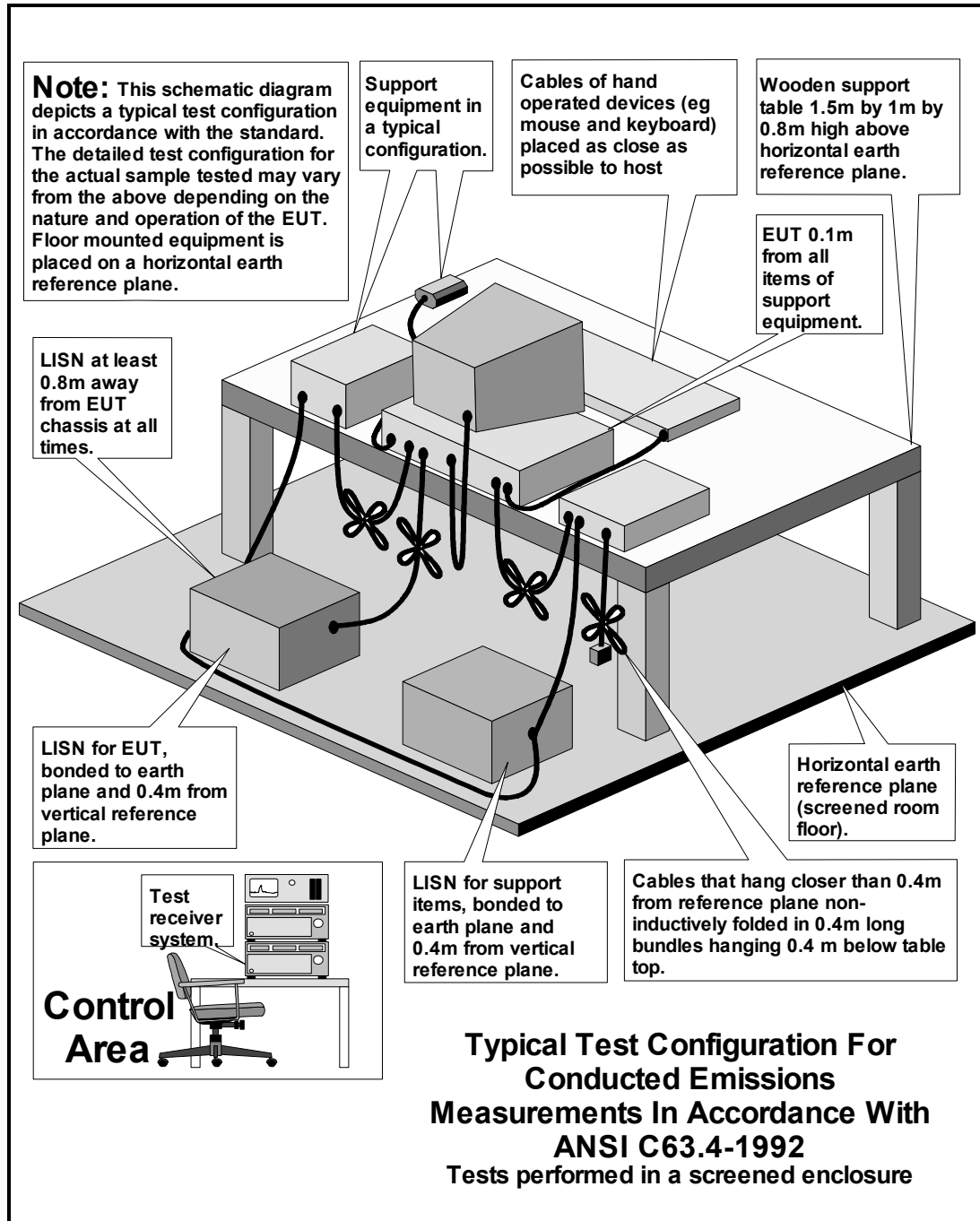
<b>Drawing Reference Number</b>	<b>Title</b>
DRG\44439JD06\EMICON	Test configuration for measurement of conducted emissions
DRG\44439JD06\EMIRAD	Test configuration for measurement of radiated emissions

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DRG\44439JD06\EMICON



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DRG\44439JD06\EMIRAD

