




# TEST REPORT FROM RFI GLOBAL SERVICES LTD

Test of: GN Netcom A/S  
A7010 *Bluetooth* Hub

To: FCC Part 15.247: 2006 (Subpart C)

**Test Report Serial No:**  
RFI/RPTE2/RP48143JD07A

**Supersedes Test Report Serial No:**  
RFI/RPTE1/RP48143JD07A

<p><b>This Test Report Is Issued Under The Authority Of Andrew Brown, Operations Manager:</b></p> 	
<p><b>Tested By: Ian Watch</b></p>  <p>pp</p>	<p><b>Checked By: Michael Derby</b></p>  <p>pp</p>
<p><b>Report Copy No: PDF01</b></p>	
<p><b>Issue Date: 15 November 2006</b></p>	<p><b>Test Dates: 25 October 2006 to 01 November 2006</b></p>

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## 1. Client Information

Company Name:	GN Netcom A/S
Address:	Metalbuen 66 Ballerup DK-27500 Denmark
Contact Name:	Jan Hildebrand

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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>	<i>Bluetooth</i> Hub
<b>Brand Name:</b>	Jabra
<b>Model Name or Number:</b>	A7010
<b>Serial Number:</b>	106
<b>Hardware Version Number:</b>	V9
<b>Software Version Number:</b>	2.0.0
<b>Country of Manufacture:</b>	China
<b>Date of Receipt:</b>	18 October 2006

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

The equipment under test is a '*Bluetooth* connectivity hub' that primes a headset for dual use by enabling a desk phone for wireless *Bluetooth* communication. Once the *Bluetooth* Hub is connected, the Jabra JX10 headset can be used with both a desk phone and a mobile phone (when paired).

The *Bluetooth* Hub also allows connection to a GN1000 (remote handset lifter) that automatically lifts and puts down the desk phone's handset. With this handset lifter, a tap on the headset answers or ends calls through the desk phone.

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

During the course of testing the EUT was not modified.

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#### 2.4. Accessories

The following accessories were supplied with the EUT during testing:

<b>Description:</b>	Remote Handset Lifter
<b>Brand Name:</b>	GN Netcom
<b>Model Name or Number:</b>	GN1000
<b>Serial Number:</b>	106
<b>Cable Length and Type:</b>	1.5m, 6 Core
<b>Connected to Port</b>	AUX socket on <i>Bluetooth</i> Hub

<b>Description:</b>	<i>Bluetooth</i> Hub Power Supply
<b>Brand Name:</b>	ATL Technology
<b>Model Name or Number:</b>	TEAD-41-070700V
<b>Part Number:</b>	26-00346
<b>Cable Length and Type:</b>	2.5m, 2 Core
<b>Connected to Port</b>	Power Supply Socket on <i>Bluetooth</i> Hub

<b>Description:</b>	Desk Phone – <i>Bluetooth</i> Hub Connection Cord
<b>Brand Name:</b>	Jabra
<b>Model Name or Number:</b>	8764-309
<b>Serial Number:</b>	Not Applicable
<b>Cable Length and Type:</b>	1.5m, 4 Core
<b>Connected to Port</b>	Telephone Base Unit

<b>Description:</b>	Telephone handset cable
<b>Brand Name:</b>	Not stated
<b>Model Name or Number:</b>	Not stated
<b>Serial Number:</b>	Not stated
<b>Cable Length and Type:</b>	>1.0m, multicore curled
<b>Connected to Port</b>	Telephone handset

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### 2.5. Additional Information Related to Testing

Power Supply Requirement:	Nominal 110V, 60 Hz AC Mains Supply		
Equipment Category:	<i>Bluetooth</i>		
Intended Operating Environment:	Within <i>Bluetooth</i> Coverage		
Type of Unit:	Base Station (Fixed Use)		
Transmit Frequency Range:	2402 to 2480 MHz		
Transmit Channels Tested:	<b>Channel ID</b>	<b>Channel Number</b>	<b>Channel Frequency (MHz)</b>
	Bottom	1	2402
	Middle	40	2441
	Top	79	2480
Receive Frequency Range:	2402 to 2480 MHz		
Receive Channels Tested:	<b>Channel ID</b>	<b>Channel Number</b>	<b>Channel Frequency (MHz)</b>
	Bottom	1	2402
	Middle	40	2441
	Top	79	2480
Maximum Power Output (ERP)	4.4 dBm		

### 2.6. Port Identification

Port	Description	Applicable
1	Telephone Base Unit	Yes
2	Telephone Handset	Yes
3	Handset Lifter (AUX Port)	Yes
4	Power Supply Socket	Yes
5	DS Port	No

### 2.7. Support Equipment

No support equipment was used to exercise the EUT during testing.

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

Reference:	FCC Part 15.247: 2006 Subpart C
Title:	Code of Federal Regulations, Part 15.247 (47CFR15) (Intentional Radiators operating within the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz)

#### **3.1. 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.

DA00-705 (2000)

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

#### **3.2. 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**

There were no deviations from the test specification.

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

### **5.1. Operating Modes**

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

The EUT was controlled using a laptop PC, running BlueTest software. The laptop PC was used to set up the EUT, then disconnected when the EUT was in the required channel and operating mode. All testes were performed with the PC disconnected from the EUT.

Transmit and Receive mode tests were performed with the EUT hopping on bottom, middle or top channels, or hopping over all channels, as per the specific requirements of each test case.

### **5.2. Configuration and Peripherals**

The EUT was tested in the following configuration:

All tests were performed on an EUT with on-board integral antenna, connected to the accessories detailed in this report.

All ports were terminated with accessories as specified by the customer during testing.

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## **6. Summary of Test Results**

<b>Range of Measurements</b>	<b>Section Reference</b>	<b>Port Type</b>	<b>Compliance Status</b>
Idle Mode AC Conducted Emissions (150 kHz to 30 MHz)	Section 15.107	AC Mains	Complied
Idle Mode Radiated Spurious Emissions	Section 15.109	Antenna	Complied
Transmitter AC Conducted Emissions (150 kHz to 30 MHz)	Section 15.207	AC Mains	Complied
Transmitter 20 dB Bandwidth	Section 15.247(a)(1)	Antenna	Complied
Transmitter Carrier Frequency Separation	Section 15.247(a)(1)	Antenna	Complied
Transmitter Average Time of Occupancy	Section 15.247(a)(1)(iii)	Antenna	Complied
Transmitter Maximum Peak Output Power	Section 15.247(b)(1)	Antenna	Complied
Transmitter Radiated Emissions	Sections 15.247(d) & 15.209(a)	Antenna	Complied
Transmitter Band Edge Radiated Emissions	Sections 15.247(d) & 15.209(a)	Antenna	Complied

### **6.1. 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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## **7. Measurements, Examinations and Derived Results**

### **7.1. 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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## 7.2. Test Results

### 7.2.1. Idle Mode AC Conducted Spurious Emissions: Section 15.107

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

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

### Results:

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

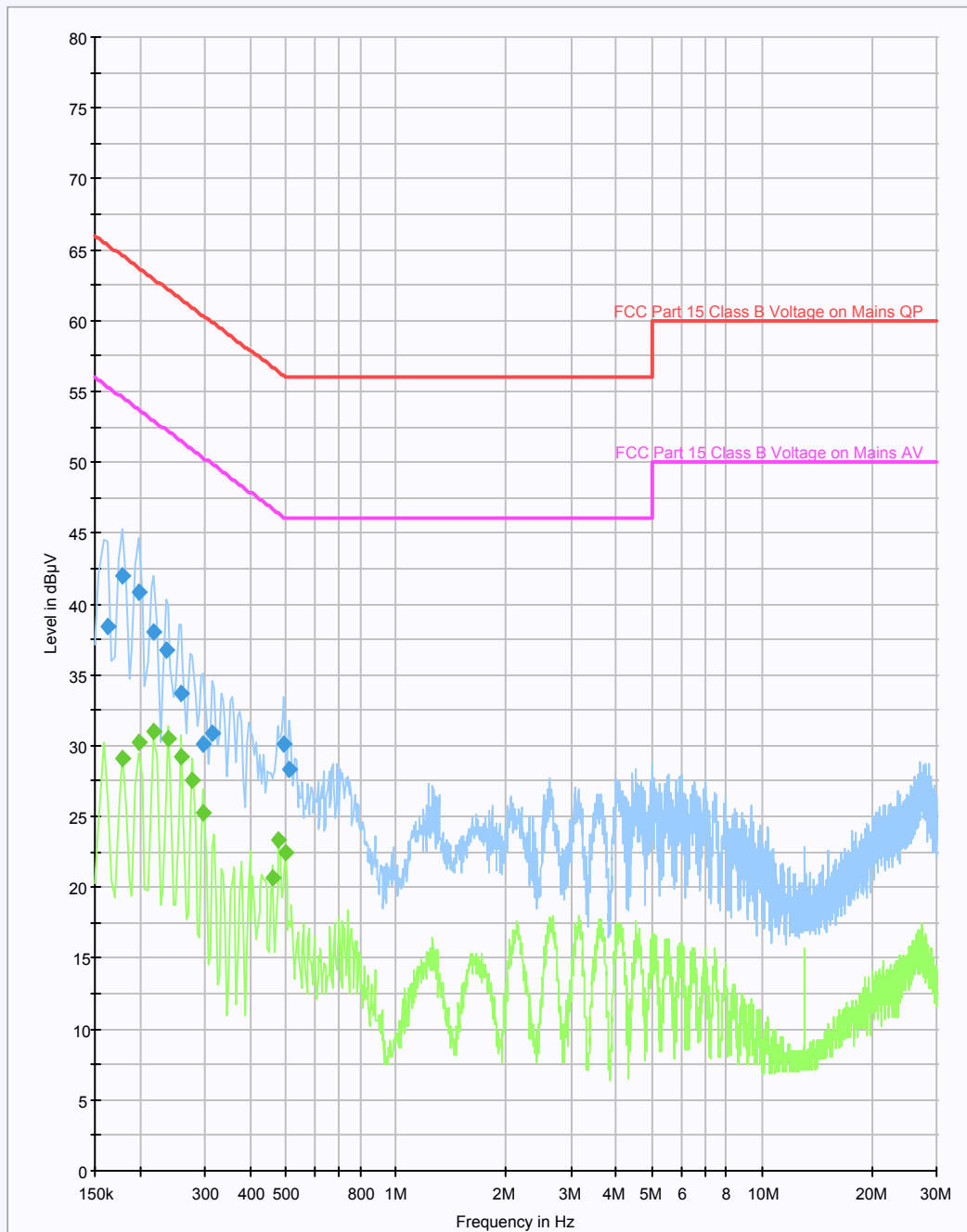
Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
0.162000	Live	38.4	65.4	27.0	Complied
0.178000	Live	42.0	64.6	22.6	Complied
0.198000	Live	40.8	63.7	22.9	Complied
0.218000	Live	38.0	62.9	24.9	Complied
0.234000	Neutral	36.7	62.3	25.6	Complied
0.258000	Live	33.7	61.5	27.8	Complied
0.298000	Live	30.2	60.3	30.1	Complied
0.314000	Live	30.8	59.9	29.1	Complied
0.494000	Neutral	30.2	56.1	25.9	Complied
0.510000	Neutral	28.3	56.0	27.7	Complied

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

Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
0.178000	Live	29.1	54.6	25.5	Complied
0.198000	Live	30.2	53.7	23.5	Complied
0.218000	Live	31.0	52.9	21.9	Complied
0.238000	Live	30.5	52.2	21.7	Complied
0.258000	Live	29.2	51.5	22.3	Complied
0.278000	Live	27.5	50.9	23.4	Complied
0.298000	Live	25.3	50.3	25.0	Complied
0.458000	Live	20.7	46.7	26.0	Complied
0.478000	Live	23.4	46.4	23.0	Complied
0.498000	Live	22.4	46.0	23.6	Complied

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



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

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### **7.2.2. Idle Mode Radiated Spurious Emissions: Section 15.109**

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

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

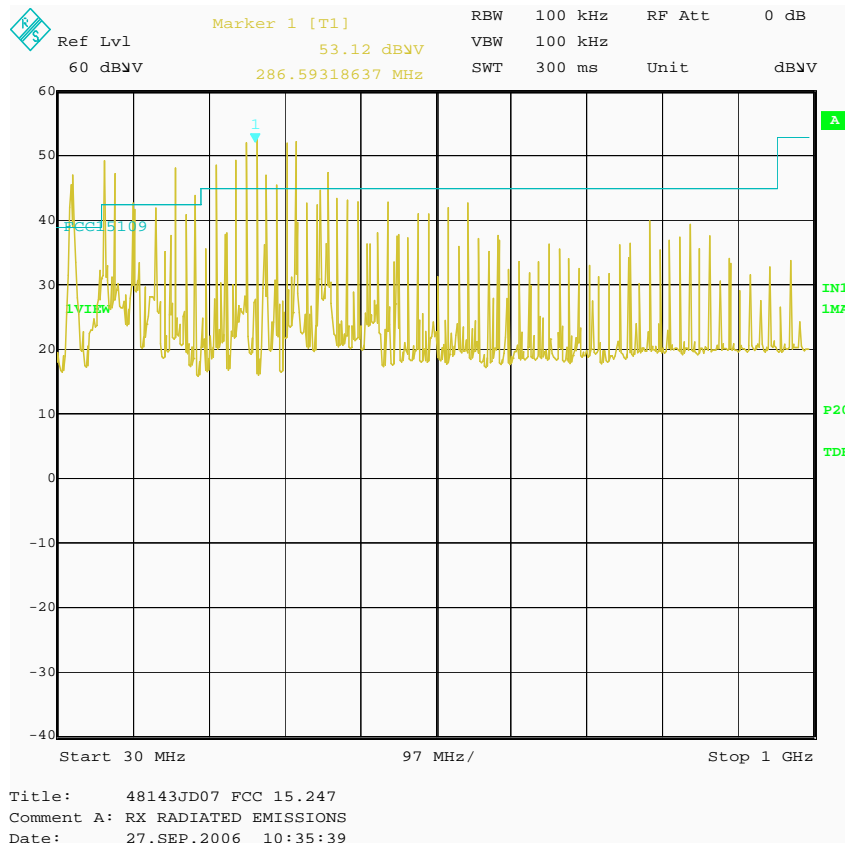
#### **Results:**

#### **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
156.001	Vertical	30.4	43.5	13.1	Complied
182.003	Vertical	37.0	43.5	6.5	Complied
234.003	Horizontal	35.6	46.0	10.4	Complied
286.002	Horizontal	35.2	46.0	10.8	Complied
325.004	Horizontal	37.8	46.0	8.2	Complied
338.007	Horizontal	37.1	46.0	8.9	Complied
377.006	Horizontal	36.0	46.0	10.0	Complied
455.008	Vertical	40.4	46.0	5.6	Complied

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**Idle Mode Radiated Spurious Emissions: Section 15.109 (Continued)**



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



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### 7.2.3. Idle Mode Radiated Spurious Emissions: Section 15.109

#### 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)	Peak Limit (dB $\mu$ V/m)	Margin (dB)	Result
1.040	Horizontal	53.9	-12.4	41.5	74.0	32.5	Complied

##### Highest Peak Level:

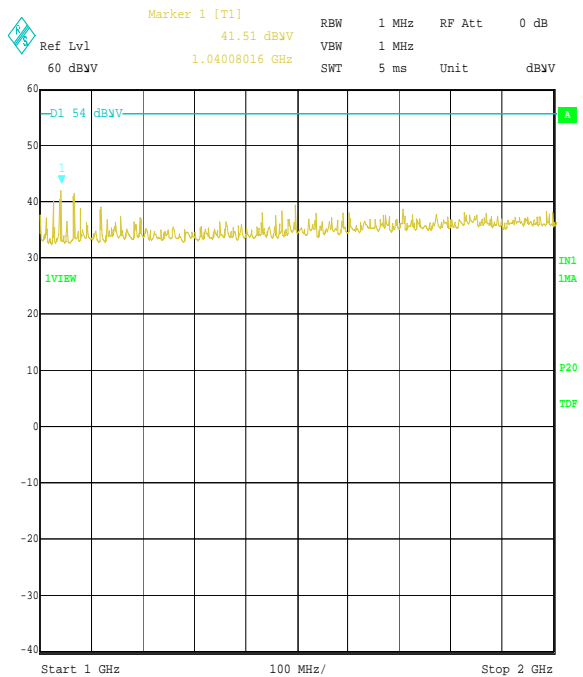
Frequency (GHz)	Antenna Polarity	Detector Level (dB $\mu$ V)	Transducer Factor (dB)	Actual Level (dB $\mu$ V/m)	Average Limit (dB $\mu$ V/m)	Margin (dB)	Result
1.040	Horizontal	53.9	-12.4	41.5	54.0	12.5	Complied

#### Note(s):

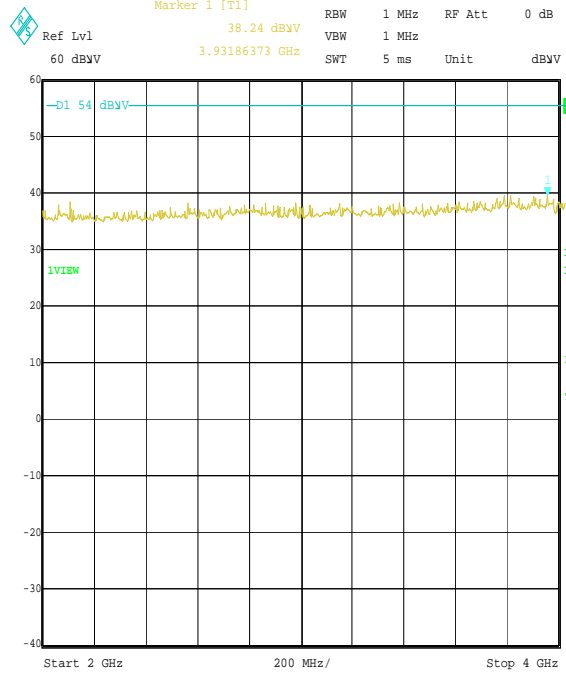
1. The peak measured level was compared to the average limit as opposed to being compared to the peak limit because this is the more onerous limit.

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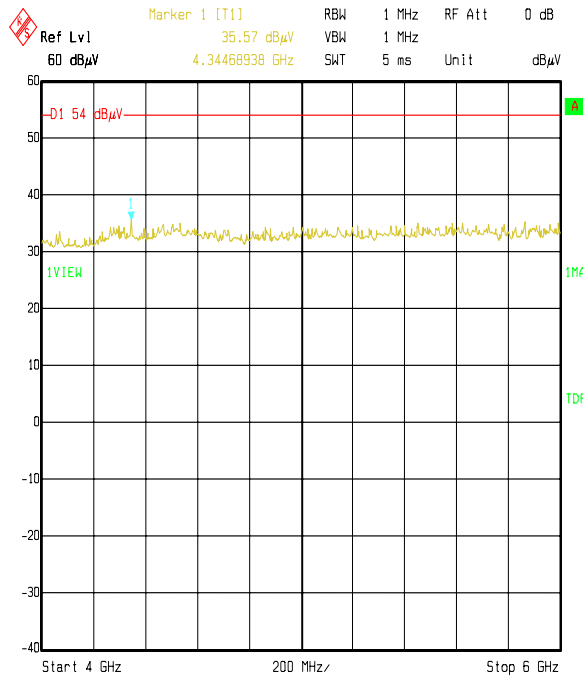
Idle Mode Radiated Spurious Emissions: Section 15.109 (Continued)



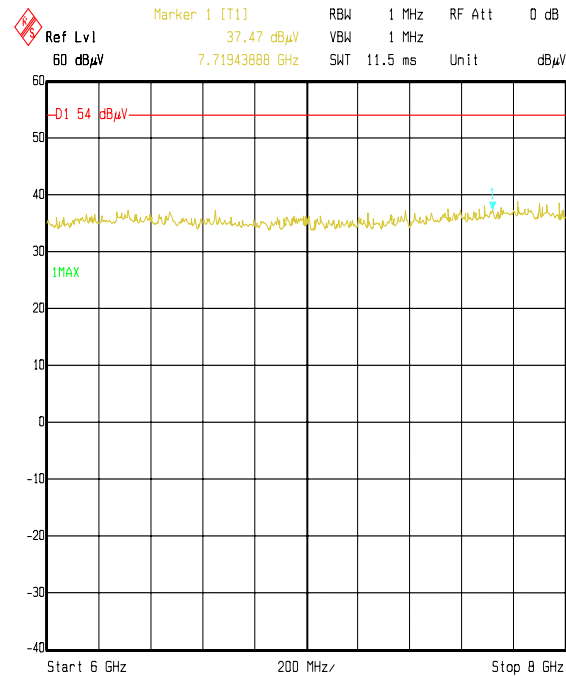
Title: 48143JD07 FCC 15.247  
 Comment A: RX RADIATED EMISSIONS  
 Date: 27.SEP.2006 10:13:08



Title: 48143JD07 FCC 15.247  
 Comment A: RX RADIATED EMISSIONS  
 Date: 27.SEP.2006 10:08:38



Title: 48143JD07 FCC15.247  
 Comment A: IDLE RADIATED EMISSIONS  
 Date: 30.OCT.2006 13:04:55

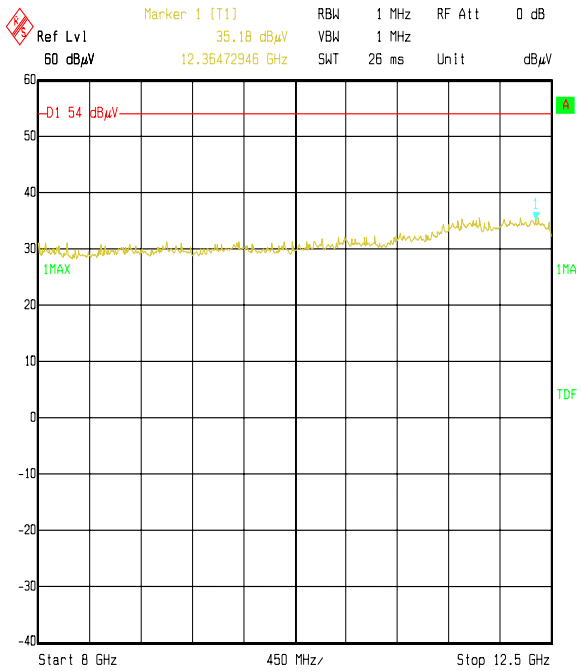


Title: 48143JD07 FCC15.247  
 Comment A: IDLE RADIATED EMISSIONS  
 Date: 30.OCT.2006 13:01:03

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: Section 15.109 (Continued)**



Title: 48143JD07 FCC15.247  
Comment A: IDLE RADIATED EMISSIONS  
Date: 30.OCT.2006 12:56:20

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

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#### **7.2.4. Transmitter AC Conducted Spurious Emissions: Section 15.207**

The EUT was configured for ac conducted emission measurements, as described in section 9 of this report. Tests were performed to identify the maximum emission levels present on the ac mains line of the EUT.

#### **Results:**

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

##### **Top Channel**

Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
0.234000	Live	31.4	52.3	20.9	Complied
0.254000	Live	30.6	51.6	21.0	Complied
0.274000	Live	29.0	51.0	22.0	Complied
0.390000	Live	24.2	48.1	23.9	Complied
0.410000	Live	24.8	47.6	22.8	Complied
0.430000	Live	24.8	47.3	22.5	Complied
0.450000	Live	24.7	46.9	22.2	Complied
0.470000	Live	25.8	46.5	20.7	Complied
0.486000	Live	28.9	46.2	17.3	Complied
0.506000	Live	25.0	46.0	21.0	Complied

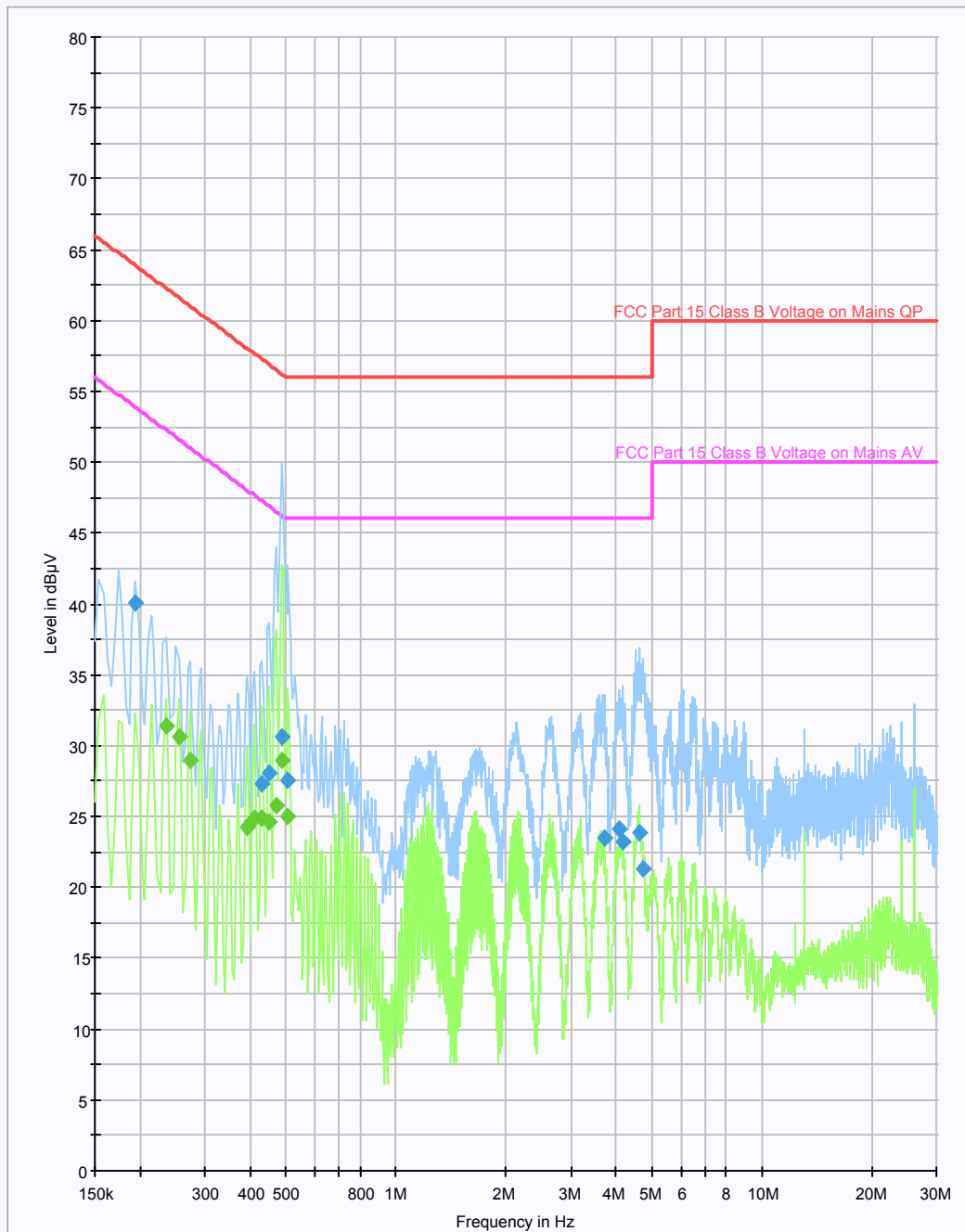
#### **Average Detector Measurements on Live and Neutral Lines**

##### **Top Channel**

Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
0.194000	Live	40.0	63.9	23.9	Complied
0.430000	Live	27.3	57.3	30.0	Complied
0.450000	Live	28.0	56.9	28.9	Complied
0.486000	Neutral	30.6	56.2	25.6	Complied
0.506000	Live	27.5	56.0	28.5	Complied
3.702000	Live	23.5	56.0	32.5	Complied
4.078000	Live	24.1	56.0	31.9	Complied
4.154000	Live	23.2	56.0	32.8	Complied
4.638000	Live	23.9	56.0	32.1	Complied
4.718000	Live	21.3	56.0	34.7	Complied

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



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

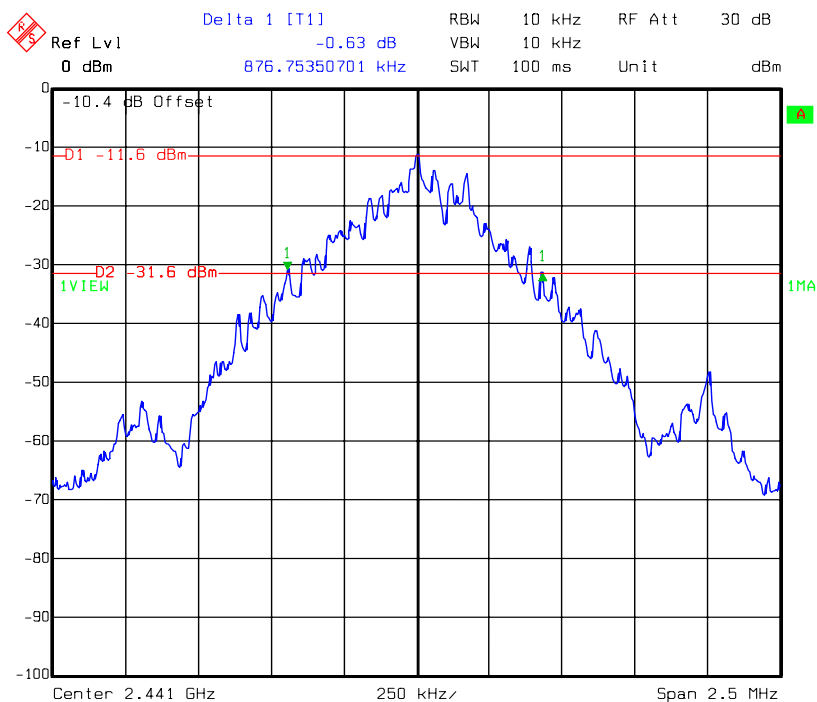
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**7.2.5. Transmitter 20 dB Bandwidth: Section 15.247(a)(1)**

The EUT was configured for 20 dB bandwidth measurements, as described in section 9 of this report. Tests were performed to identify the 20 dB bandwidth.

**Results:**

Transmitter 20 dB Bandwidth (kHz)	Limit (kHz)
876.753	None specified



Title: 48143JD07 FCC 15.247  
 Comment A: TX 20 dB BANDWIDTH  
 Date: 01.NOV.2006 11:13:03

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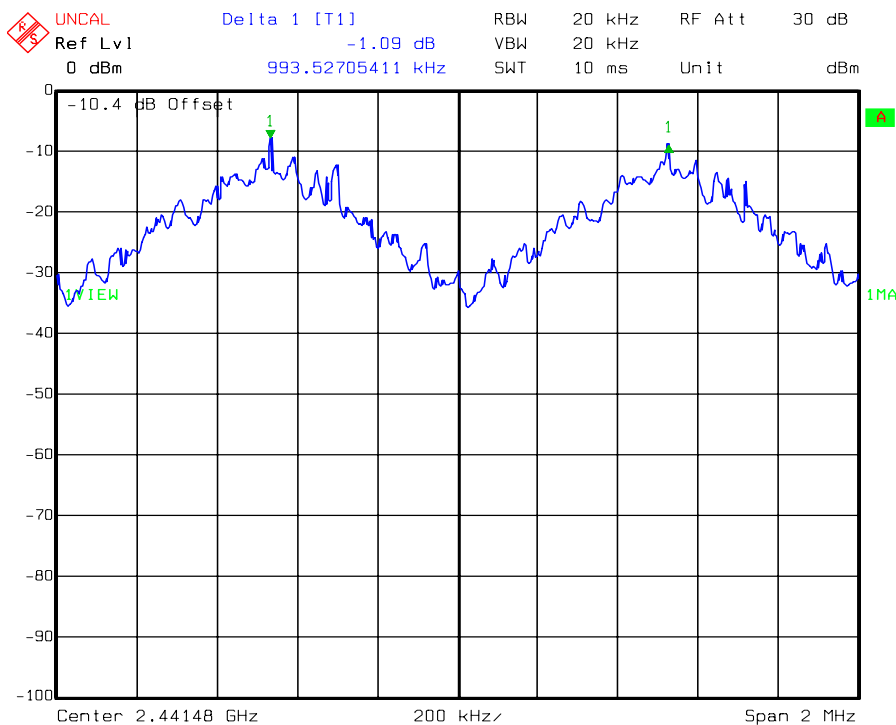
**7.2.6. Transmitter Carrier Frequency Separation: Section 15.247(a)(1)**

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

Tests were performed to identify the carrier frequency separation.

**Results:**

Transmitter Carrier Frequency Separation (kHz)	Limit (> 20 dB or $\frac{2}{3}$ of 20 dB BW) (kHz)	Margin (kHz)	Result
993.527	584.502	409.025	Complied



Title: 48143JD07 FCC 15.247  
 Comment A: TX CARRIER FREQUENCY SEPARATION  
 Date: 01.NOV.2006 11:25:52

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

The EUT was configured for average time of occupancy measurements as described in section 9 of this report.

Tests were performed to identify the average time of occupancy in number of channels (79) x 0.4 seconds. The calculated period is 31.6 seconds.

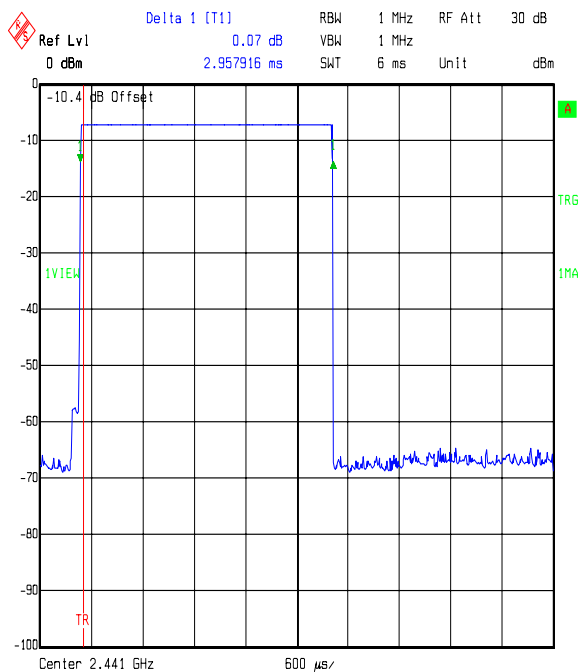
#### **Results:**

<b>Emission Width (<math>\mu</math>s)</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>
2957.916	110	0.3254	0.4	0.0746	Complied

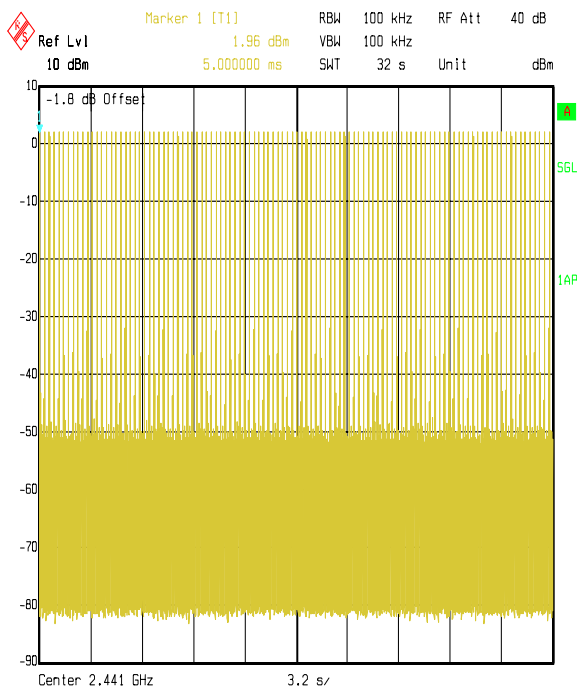


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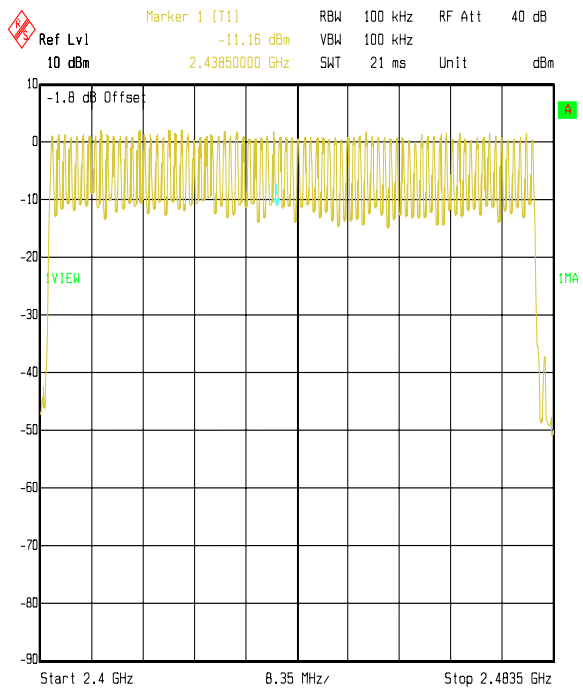
**Transmitter Average Time of Occupancy: Section 15.247(a)(1)(iii) (Continued)**



Title: 48143JD07 FCC 15.247  
 Comment A: TX AVERAGE TIME OF OCCUPANCY  
 Date: 01.NOV.2006 12:03:30



Title: 48143JD07  
 Date: 07.NOV.2006 11:28:04



Title: 48143JD07  
 Date: 07.NOV.2006 11:36:52

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### **7.2.8. Transmitter Maximum Peak Output Power: (EIRP) Section 15.247(b)(1)**

The EUT was configured for transmitter peak output power measurements, as described in Section 9 of this report.

Tests were performed to identify the transmitter maximum peak output power (EIRP) of the EUT.

#### **Results:**

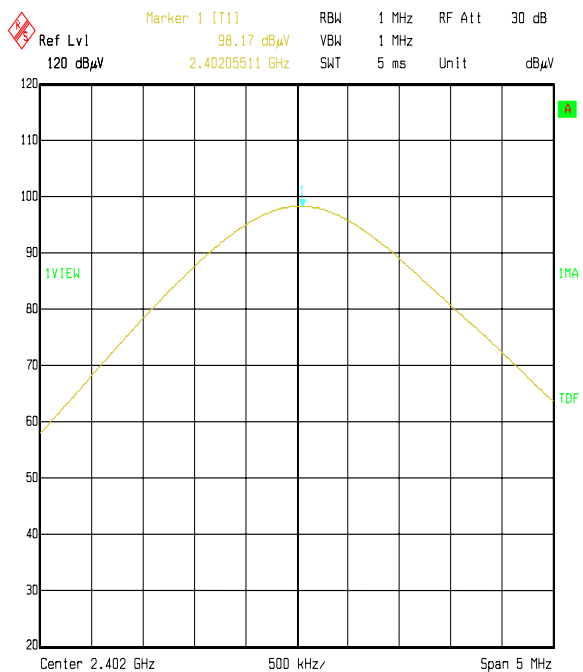
Channel	Input Voltage (AC)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	93.50	2.9	30.0	27.1	Complied
Bottom	110.00	2.9	30.0	27.1	Complied
Bottom	126.50	2.9	30.0	27.1	Complied
Middle	93.50	1.7	30.0	28.3	Complied
Middle	110.00	1.6	30.0	28.4	Complied
Middle	126.50	1.6	30.0	28.4	Complied
Top	93.50	4.4	30.0	25.6	Complied
Top	110.00	4.4	30.0	25.6	Complied
Top	126.50	4.4	30.0	25.6	Complied

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

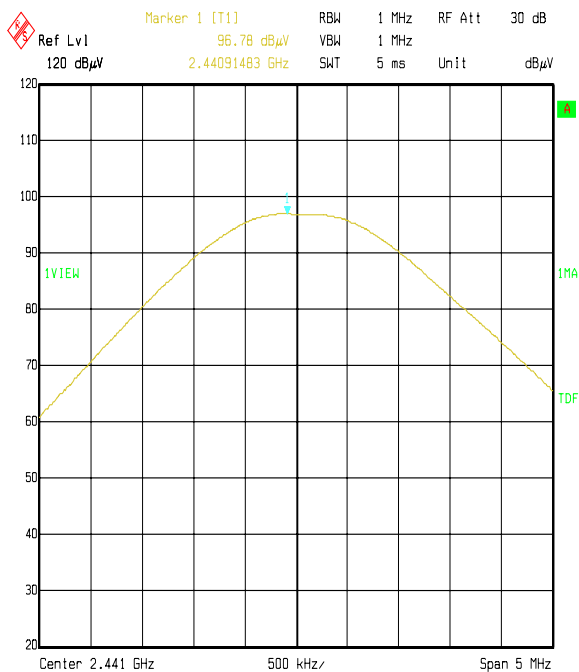
1. These tests were performed radiated; therefore the EUT antenna gain is encompassed in the final result and not measurable.

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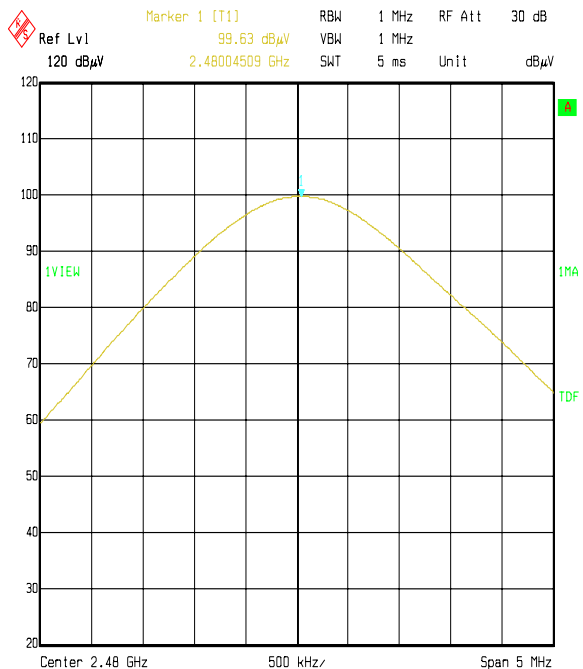
**Transmitter Maximum Peak Output Power: (EIRP) Section 15.247(b)(1) (Continued)**



Title: 48143JD07 FCC 15.247  
 Comment A: TX MAXIMUM PEAK OUTPUT POWER BOTTOM CHANNEL  
 Date: 30.OCT.2006 14:37:02



Title: 48143JD07 FCC 15.247  
 Comment A: TX MAXIMUM PEAK OUTPUT POWER MID CHANNEL  
 Date: 30.OCT.2006 14:47:36



Title: 48143JD07 FCC 15.247  
 Comment A: TX MAXIMUM PEAK OUTPUT POWER TOP CHANNEL  
 Date: 30.OCT.2006 14:41:29

Test of: GN Netcom A/S  
A7010 Bluetooth Hub  
To: FCC Part 15.247: 2006 (Subpart C)

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### **7.2.9. Transmitter Radiated Emissions: Section 15.247(d) and 15.209(a)**

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

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

#### **Results:**

#### **Electric Field Strength Measurements: 30 to 1000 MHz (emissions occurring in the restricted bands)**

##### **Top Channel**

Frequency (MHz)	Antenna Polarity	Q-P Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
130.002	Horizontal	37.1	43.5	6.4	Complied
325.003	Horizontal	32.3	46.0	13.7	Complied
403.005	Horizontal	38.8	46.0	7.2	Complied

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

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

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### **7.2.10. Transmitter Radiated Emissions: Section 15.247(d) and 15.209(a)**

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

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

#### **Results:**

#### **Electric Field Strength Measurements: 30 to 1000 MHz (emissions outside the restricted bands)**

##### **Top Channel**

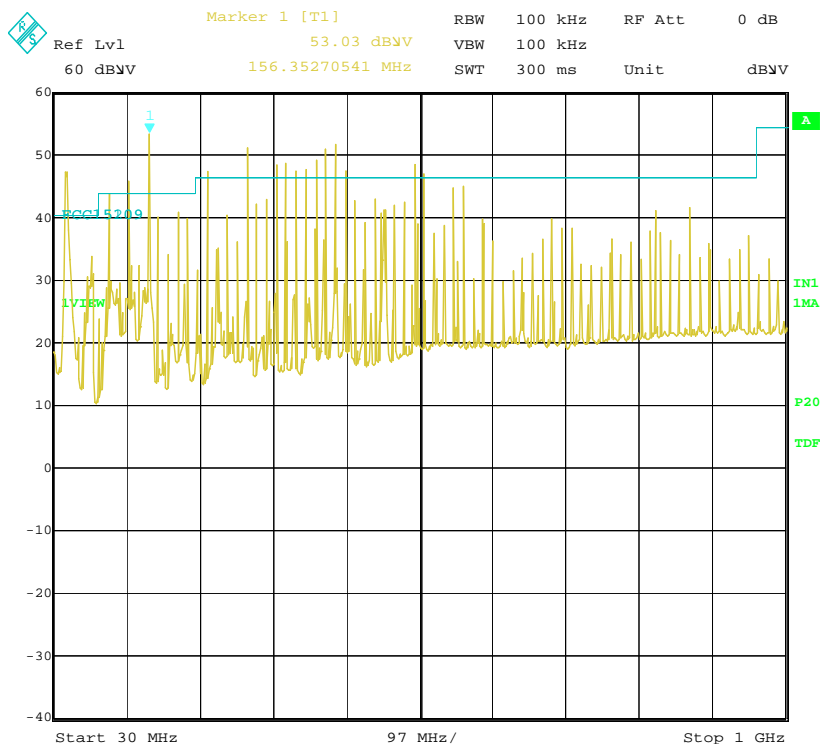
Frequency (MHz)	Antenna Polarity	Peak Level (dB $\mu$ V/m)	-20 dBc Limit (dB $\mu$ V/m)	Margin (dB)	Result
47.053	Horizontal	28.3	79.6	51.3	Complied
156.003	Horizontal	32.5	79.6	47.1	Complied
234.003	Horizontal	35.4	79.6	44.2	Complied
286.001	Horizontal	29.1	79.6	50.5	Complied
416.004	Horizontal	38.5	79.6	41.1	Complied
507.013	Horizontal	31.5	79.6	48.1	Complied
520.008	Horizontal	30.8	79.6	48.8	Complied
572.003	Horizontal	31.6	79.6	48.0	Complied
826.692	Horizontal	30.6	79.6	49.0	Complied
871.703	Vertical	30.4	79.6	49.2	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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**Transmitter Radiated Emissions: Section 15.247(d) and 15.209(a) (Continued)**



Title: 48143JD07 FCC 15.247  
Comment A: TX RADIATED EMISSIONS  
Date: 27.SEP.2006 10:55:18

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

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### **7.2.11. Transmitter Radiated Emissions: Section 15.247(d) and 15.209(a) -**

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

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

#### **Results:**

#### **Electric Field Strength Measurements (Frequency Range: 1 to 25 GHz) (emissions occurring in the restricted bands)**

##### **Highest Peak Level: Top Channel**

Frequency (GHz)	Antenna Polarity	Detector Level (dB $\mu$ V)	Transducer Factor (dB)	Actual Level (dB $\mu$ V/m)	Peak Limit (dB $\mu$ V/m)	Margin (dB)	Result
2.495	Vertical	53.8	-11.0	42.8	74.0	31.2	Complied

##### **Highest Peak Level: Top Channel**

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
2.495	Vertical	53.8	-11.0	42.8	54.0	11.2	Complied

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

1. The peak measured level was compared to the average limit as opposed to being compared to the peak limit because this is the more onerous limit.

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### **7.2.12. Transmitter Radiated Emissions: Section 15.247(d) and 15.209(a)**

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

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

#### **Results:**

#### **Electric Field Strength Measurements (Frequency Range: 1 to 25 GHz) (emissions outside the restricted bands)**

##### **Highest Peak Level: Bottom Channel**

Frequency (GHz)	Antenna Polarity	Detector Level (dB $\mu$ V)	Transducer Factor (dB)	Actual Level (dB $\mu$ V/m)	-20 dBc Limit (dB $\mu$ V/m)	Margin (dB)	Result
1.653375	Vertical	50.5	-11.8	38.7	79.6	40.9	Complied

##### **Highest Peak Level: Middle Channel**

Frequency (GHz)	Antenna Polarity	Detector Level (dB $\mu$ V)	Transducer Factor (dB)	Actual Level (dB $\mu$ V/m)	-20 dBc Limit (dB $\mu$ V/m)	Margin (dB)	Result
1.653375	Vertical	50.5	-11.8	38.7	79.6	40.9	Complied

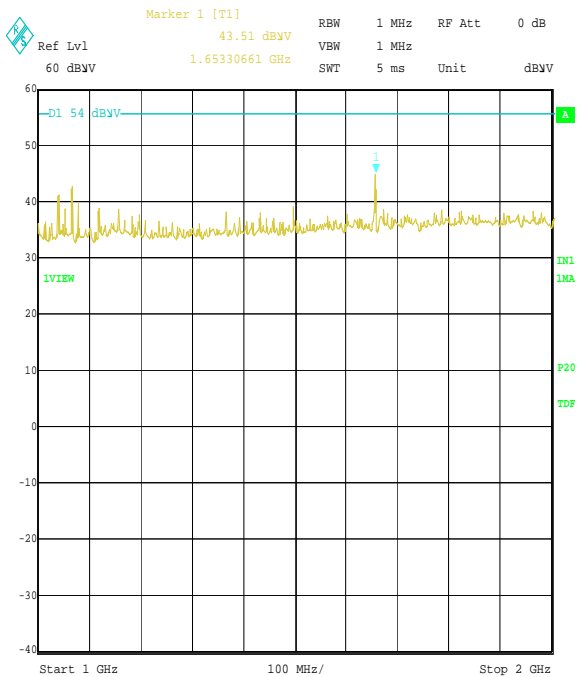
##### **Highest Peak Level: Top Channel**

Frequency (GHz)	Antenna Polarity	Detector Level (dB $\mu$ V)	Transducer Factor (dB)	Actual Level (dB $\mu$ V/m)	-20 dBc Limit (dB $\mu$ V/m)	Margin (dB)	Result
1.653375	Vertical	50.5	-11.8	38.7	79.6	40.9	Complied

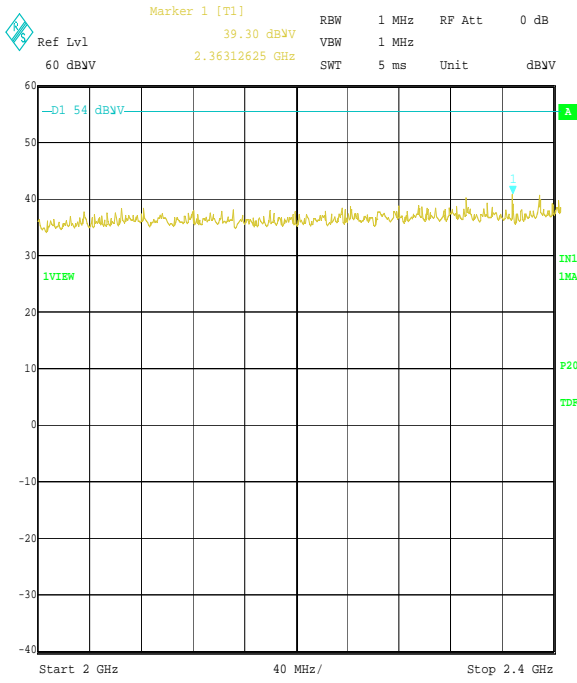


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**Transmitter Radiated Emissions: Section 15.247(d) and 15.209(a) (Continued)**



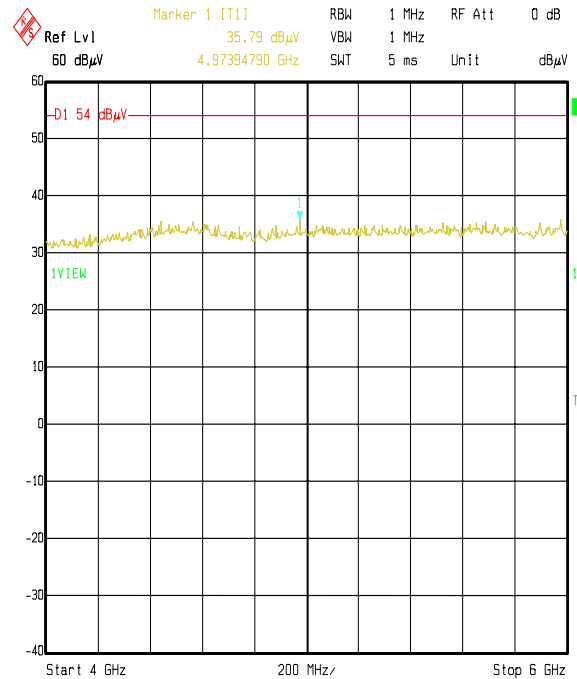
Title: 48143JD07 FCC 15.247  
 Comment A: TX RADIATED EMISSIONS  
 Date: 27.SEP.2006 09:43:58



Title: 48143JD07 FCC 15.247  
 Comment A: TX RADIATED EMISSIONS  
 Date: 27.SEP.2006 09:57:47



Title: 48143JD07 FCC 15.247  
 Comment A: TX RADIATED EMISSIONS  
 Date: 27.SEP.2006 10:02:45

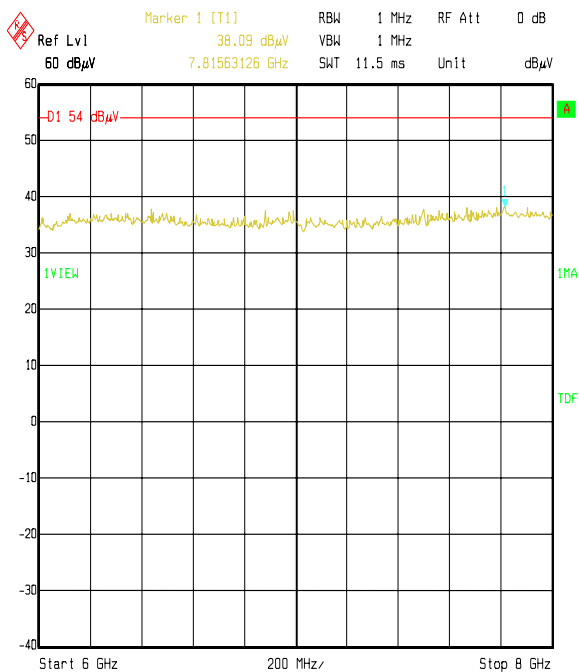


Title: 48143JD07 FCC15.247  
 Comment A: TX RADIATED EMISSIONS  
 Date: 30.OCT.2006 12:11:29

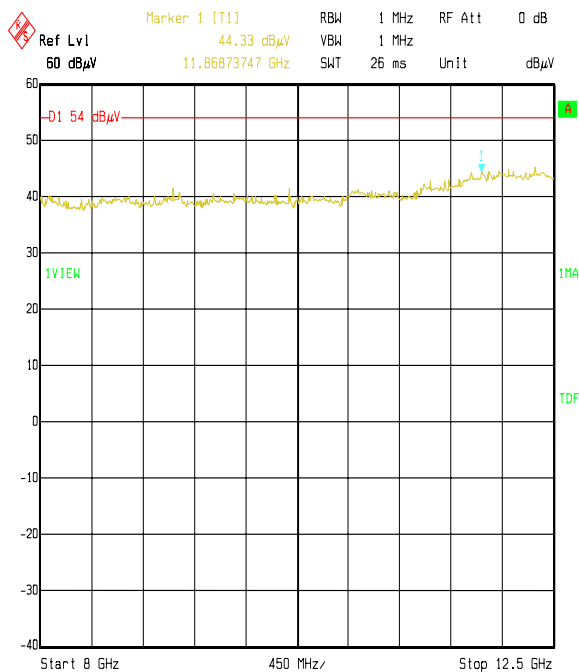
Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

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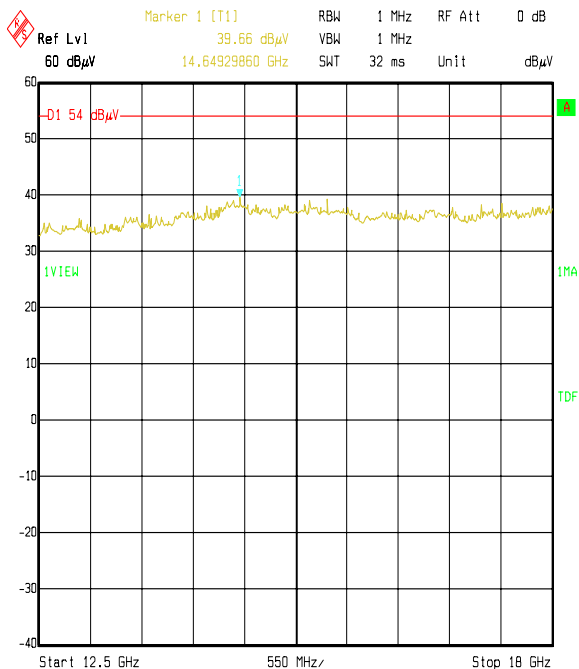
**Transmitter Radiated Emissions: Section 15.247(d) and 15.209(a) (Continued)**



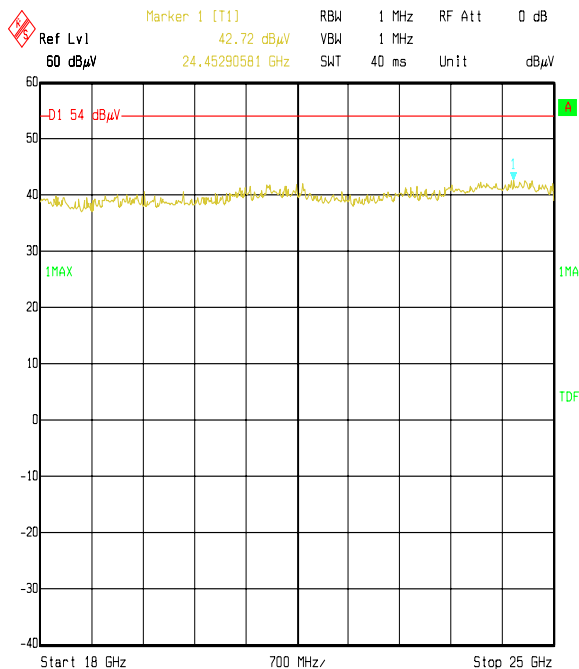
Title: 48143JD07 FCC15.247  
 Comment A: TX RADIATED EMISSIONS  
 Date: 30.OCT.2006 12:29:35



Title: 48143JD07 FCC15.247  
 Comment A: TX RADIATED EMISSIONS  
 Date: 30.OCT.2006 12:37:18



Title: 48143JD07 FCC15.247  
 Comment A: TX RADIATED EMISSIONS  
 Date: 30.OCT.2006 12:43:43



Title: 48143JD07 FCC15.247  
 Comment A: TX RADIATED EMISSIONS  
 Date: 30.OCT.2006 12:50:35

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

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

The EUT was configured for band edge compliance of radiated emission measurements as described in section 9 of this report.

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

#### **Results:**

##### **Electric Field Strength Measurements**

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

Frequency (GHz)	Antenna Polarity	Detector Level (dB $\mu$ V)	Transducer Factor (dB)	Actual Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2.4000	Vertical	60.3	-11.4	48.9	*79.1	30.2	Complied
2.4835	Vertical	66.2	-11.0	55.2	74.0	18.8	Complied

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

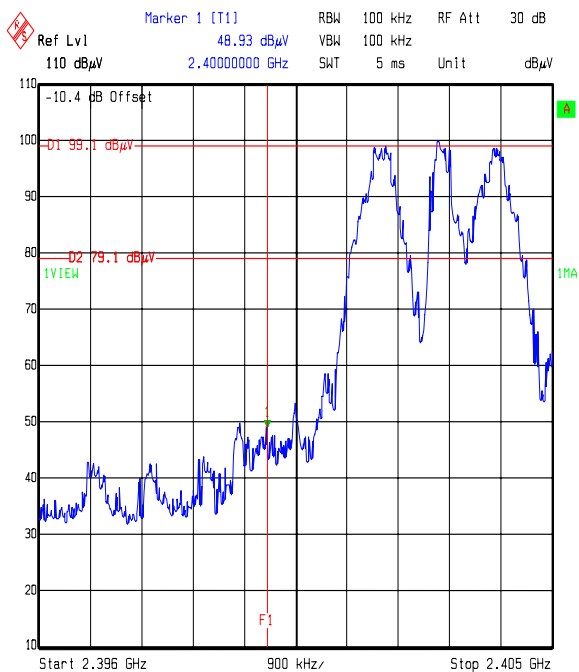
Frequency (GHz)	Antenna Polarity	Detector Level (dB $\mu$ V)	Transducer Factor (dB)	Actual Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2.4835	Vertical	62.6	-11.0	51.6	54.0	2.4	Complied

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

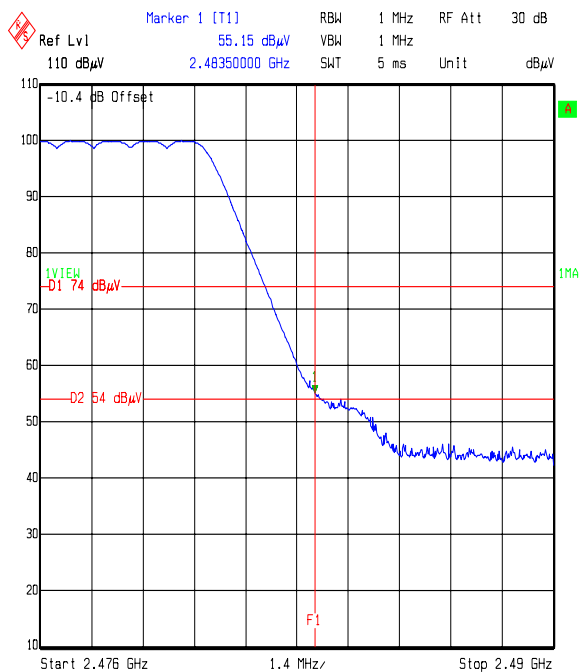
1. \*-20 dBc limit
2. Due to a coupled sweep time, the average measurement is over tested and the value shown here is higher than the true average level.

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



Title: 48143J007 FCC 15.247  
 Comment A: TX LOWER BAND EDGE RADIATED EMISSIONS HOPPING  
 Date: 01.NOV.2006 10:32:28



Title: 48143J007 FCC 15.247  
 Comment A: TX UPPER BAND EDGE RADIATED EMISSIONS HOPPING  
 Date: 01.NOV.2006 10:37:38

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

The EUT was configured for band edge compliance of radiated emission measurements as described in section 9 of this report.

Tests were performed to identify the average radiated band edge emissions.

#### **Results:**

##### **Peak Power Level Static Mode:**

Frequency (GHz)	Antenna Polarity	Detector Level (dB $\mu$ V)	Transducer Factor (dB)	Actual Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2.4000	Vertical	65.8	-11.4	54.4	*79.1	24.7	Complied
2.4835	Vertical	66.0	-11.0	55.0	74.0	19.0	Complied

##### **Average Power Level Static Mode:**

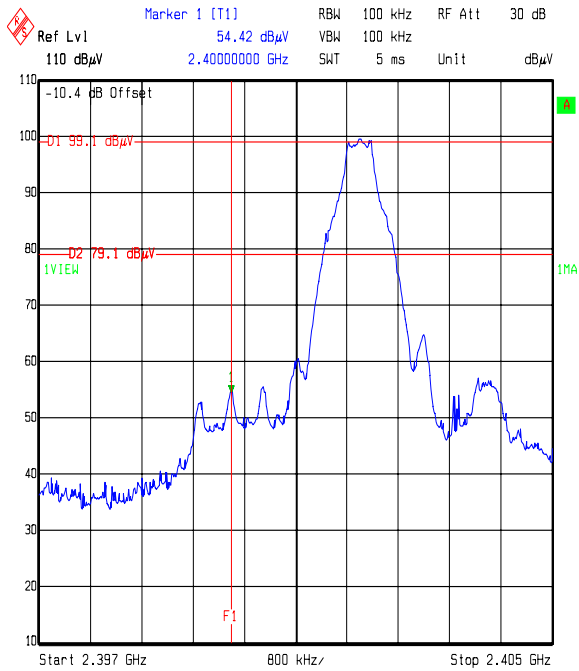
Frequency (GHz)	Antenna Polarity	Detector Level (dB $\mu$ V)	Transducer Factor (dB)	Actual Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2.4835	Vertical	62.3	-11.0	51.3	54.0	2.7	Complied

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

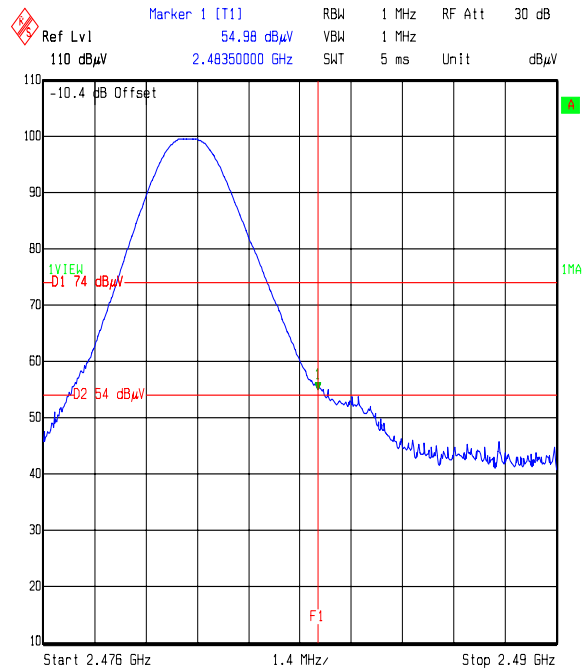
1. \*-20 dBc limit
2. Due to a coupled sweep time, the average measurement is over tested and the value shown here is higher than the true average level.

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



Title: 48143J007 FCC 15.247  
 Comment A: TX BAND EDGE RADIATED EMISSIONS BOTTOM CHANNEL  
 Date: 01.NOV.2006 10:22:42



Title: 48143J007 FCC 15.247  
 Comment A: TX BAND EDGE RADIATED EMISSIONS TOP CHANNEL  
 Date: 01.NOV.2006 10:55:09

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## **8. 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”.

Measurement Type	Range	Confidence Level (%)	Calculated Uncertainty
AC Conducted Spurious Emissions	0.15 MHz to 30 MHz	95%	±3.72 dB
Transmitter Maximum Peak Output Power	Not applicable	95%	±2.94 dB
Conducted Emissions Antenna Port	30 MHz to 40 GHz	95%	±0.28 dB
Transmitter Carrier Frequency Separation	Not applicable	95%	±11.4 ppm
Transmitter Average Time of Occupancy	Not applicable	95%	±0.3 ns
20 dB Bandwidth	Not applicable	95%	± 11.4 ppm
Radiated Spurious Emissions	30 MHz to 1000 MHz	95%	±4.64 dB
Radiated Spurious Emissions	1 GHz to 40 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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## **9. Measurement Methods**

### **9.1. 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 was powered with 110V 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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## **9.2. Radiated 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 on which the EUT 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 highest point of the noise floor was measured.

Where an emission fell inside a restricted band, measurements were made at the appropriate test 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. A peak detector was used for all other measurements.

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.

All measurements on the open area test site were performed using broadband antennas in both vertical and horizontal polarisations.

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. For small devices, the orientation was also changed to measure over the X, Y and Z orientations of the EUT itself.

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### **Radiated Emissions (Continued)**

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 limits as stated in section 15.33

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 <1 GHz	Final Measurements ≥1 GHz
Detector Type:	Peak	Quasi-Peak (CISPR)	Peak / Average
Mode:	Max Hold	Not applicable	Max Hold
Bandwidth:	(120 kHz <1 GHz) (1 MHz ≥1 GHz)	120 kHz	1 MHz
Amplitude Range:	100 dB	100 dB	100 dB
Step Size:	Continuous sweep	Not applicable	Not applicable
Sweep Time:	Coupled	Not applicable	Not applicable

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### **9.3. 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 measurement analyser was configured to measure two adjacent channels whilst the EUT was in hopping mode. The spectrum analyser was configured with a resolution bandwidth and video bandwidth greater than 1% of the frequency span.

The analyser was set for a maximum hold scan to capture the profile of the signal. The peak points on the two adjacent channels were noted and the separation between them recorded.

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, at 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 line intercepted the power envelope of the emission.

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#### **9.4. 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 zero 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 zero span i.e. in the time domain and the sweep time was set to 32 seconds (the closest allowable setting to 31.6 seconds). This 31.6 second 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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### **9.5. 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 horn antenna. The centre of the substitution antenna was set to approximately the same centre location as the EUT. The substitution antenna was set to the horizontal polarity. The substitution antenna was matched into a signal generator using a 6 dB or greater attenuator. The signal generator was tuned to the EUT's frequency under test.

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

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

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### **Effective Isotropic Radiated Power (EIRP) (Continued)**

Circumstances where the signal generator could not produce the desired a power substitution was performed with the signal generator set to 0 dBm. The radiated signal was maximised as previously described. The level indicated on the measuring receiver was noted. The delta between this level and the maximum level for the EUT was calculated and also noted. The EIRP of the signal generator was calculated using the above formulae. The recorded delta was added to the calculated EIRP to obtain the substituted EUT EIRP.

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

where :

EUT = spectrum analyser indicated EUT raw level

SG = spectrum analyser indicated signal generator raw level

The signal generator actual EIRP is calculated as:

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

The EUT EIRP is calculated as:

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

The test equipment settings for EIRP measurements were as follows:

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

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### **9.6. 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  $\geq$  to 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 lower band edge of the allocated frequency band was produced. A marker was set to the level of the highest in band emission with a limit line set to 20 dB below this. The 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 upper band edge except that, as the upper band edge fell on a restricted band edge (as defined in section 15.205(a)), the limit for the restricted band was applied instead of the -20 dBc limit i.e. the general limits defined in section 15.209(a).

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

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### Appendix 1. Test Equipment Used

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Last Calibrated	Cal. Interval
A031	2 to 4 GHz Eaton Horn Antenna	Eaton	91889-2	557	08 Jun 06	36
A088	Y20 HM Variable Transformer	Zenith	Y20-HM	9029	Calibration not required	
A1037	Chase Bilog Antenna	Chase EMC Ltd	CBL6112B	2413	20 Sept 06	12
A1069	ESH3-Z5	Rohde & Schwarz	ESH3-Z5	837469/012	31 Jan 06	12
A1360	ESH3-Z2 Pulse Limiter	Rohde & Schwarz	ESH3-Z2	A1360-20112003	06 Sept 06	12
A1534	Preamplifier 1-26.5 GHz	Hewlett Packard	8449B OPT H02	3008A00405	Calibrate before use	
A254	WG 14 Microwave Horn	Flann Microwave	14240-20	139	17 Oct 06	36
A259	Bilog Antenna	Chase	CBL6111	1513	03 Mar 06	12
A428	WG 12 horn	Flann	12240-20	134	17 Oct 06	36
A429	WG 16 horn	Flann	16240-20	561	17 Oct 06	36
A430	WG 18 horn	Flann	18240-20	425	17 Oct 06	36
A436	WG 20 horn	Flann	20240-20	330	24 Apr 06	36
C1081	Cable 2m	Rosenberger	FA210A102 0M5050	28463-2	Calibrate before use	
C1164	1.5m N-type Cable	Rosenberger Micro-Coax	FA210A101 5007070	43188-1	Calibrate before use	
C1166	2m N-Type Cable	Rosenberger Micro-Coax	FA210A102 0007070	43189-02	Calibrate before use	
C151	Cable	Rosenberger	UFA210A-1-1181-70x70	None	Calibrate before use	
C160	Cables	Rosenberger	UFA210A-1-1181-70x70	None	Calibrate before use	
C342	Cable	Andrews	None	None	Calibrate before use	
C348	Cable	Rosenberger	UFA210A-1-1181-70x70	2993	Calibrate before use	
C363	BNC Cable	Rosenberger	RG142	None	Calibrate before use	
C375	Cable	Rosenberger	RG400	None	Calibrate before use	
M023	ESVP Receiver	Rohde & Schwarz	ESVP	872 991/027	10 Apr 06	12



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**Test Equipment Used (Continued)**

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Last Calibrated	Cal. Interval
M024	Spectrum Monitor	Rohde & Schwarz	EZM	873 952/006	Calibration not required	
M1242	FSEM30 Spectrum Analyser	Rohde & Schwarz, Inc.	FSEM30	845986_022	08 Sept 06	12
M1263	ESIB7	Rohde & Schwarz	ESIB7	100265	12 Jan 06	12
M127	Spectrum Analyser	Rohde & Schwarz	FSEB 30	842 659/016	07 Aug 06	12
S201	Site 1	RFI	1	OATS1	18 Jul 06	12
S202	Site 2	RFI	2	S202-15011990	Calibration not required	
S207	Site 7	RFI	7	-	Calibration not required	
S212	Site 12	RFI	12	-	Calibration not required	

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

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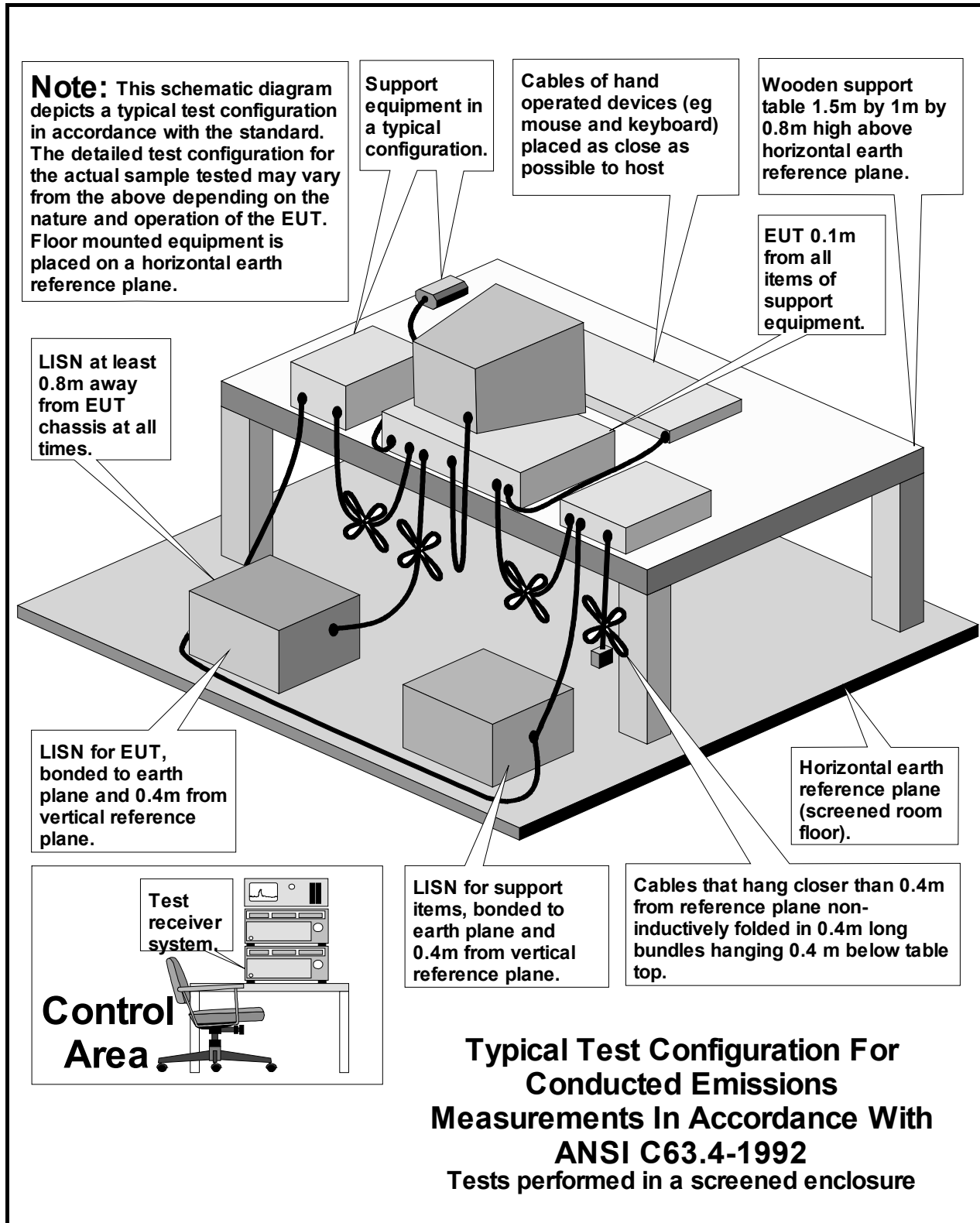
## **Appendix 2. Test Configuration Drawings**

This appendix contains the following drawings:

<b>Drawing Reference Number</b>	<b>Title</b>
DRG\48143JD07\EMICON	Test configuration for measurement of conducted emissions.
DRG\48143JD07\EMIRAD	Test configuration for measurement of radiated emissions.

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DRG\48143JD07\EMIRAD

