

**TEST REPORT  
FROM  
RFI GLOBAL SERVICES LTD**

Test of: Sennheiser Communications A/S  
FLX 70, Bluetooth Headset

To: FCC Part 15.247: 2006 (Subpart C)

**Test Report Serial No:**  
RFI/RPTE2/RP49196JD05A

**Supersedes Test Report Serial No:**  
RFI/RPTE1/RP49196JD05A

**This Test Report Is Issued Under The Authority  
Of Michael Derby, Radio Performance Service Leader:**



**Tested By: Ian Watch**



pp

**Checked By: Michael Derby**



**Report Copy No: PDF01**

**Issue Date: 21 August 2007**

**Test Dates: 16 July 2007 to 18 July 2007**

"The *Bluetooth*® word mark and logos are owned by the Bluetooth SIG, Inc. and any use of such marks by RFI Global Services Ltd. is under license. Other trademarks and trade names are those of their respective owners."

This report is issued in Adobe Acrobat portable document format (PDF). It is only a valid copy of the report if it is being viewed in PDF format with the following security options not allowed: Changing the document, Selecting text and graphics, Adding or changing notes and form fields. This report may be copied in full. The results in this report apply only to the sample(s) tested.

**RFI Global Services Ltd**

Pavilion A, Ashwood Park, Ashwood Way, Basingstoke, Hampshire RG23 8BG

Telephone: +44 (0)1256 312000 Facsimile: +44 (0)1256 312001

Email: [info@rfi-global.com](mailto:info@rfi-global.com) Website: [www.rfi-global.com](http://www.rfi-global.com)

Registered in England and Wales. Company number:2117901

**RFI GLOBAL SERVICES LTD**

**Test Report**

**Serial No: RFI/RPTE2/RP49196JD05A**

**Page: 2 of 44**

**Issue Date: 21 August 2007**

**Test of: Sennheiser Communications A/S  
FLX 70, Bluetooth Headset**

**To: FCC Part 15.247: 2006 (Subpart C)**

---

This page has been left intentionally blank.

Test of: Sennheiser Communications A/S  
FLX 70, Bluetooth Headset

To: FCC Part 15.247: 2006 (Subpart C)

---

**Table of Contents**

1. Client Information ..... 4

2. Equipment Under Test (EUT) ..... 5

3. Test Specification, Methods and Procedures ..... 7

4. Deviations from the Test Specification ..... 7

5. Operation and Configuration of the EUT during Testing ..... 8

6. Summary of Test Results ..... 9

7. Measurements, Examinations and Derived Results ..... 10

8. Measurement Uncertainty ..... 32

9. Measurement Methods ..... 33

Appendix 1. Test Equipment Used ..... 40

Appendix 2. Test Configuration Drawings ..... 41

Test of: Sennheiser Communications A/S  
FLX 70, Bluetooth Headset

To: FCC Part 15.247: 2006 (Subpart C)

---

## 1. Client Information

<b>Company Name:</b>	Sennheiser Communications A/S
<b>Address:</b>	6 Langager Solrod Strand 2680 Denmark
<b>Contact Name:</b>	Ms E Mujan

Test of: Sennheiser Communications A/S  
FLX 70, Bluetooth Headset

To: FCC Part 15.247: 2006 (Subpart C)

---

## **2. Equipment Under Test (EUT)**

The following information (with the exception of the date of receipt) has been supplied by the customer:

### **2.1. Description of EUT**

The equipment under test is a *Bluetooth* Mono Headset.

### **2.2. Identification of Equipment Under Test (EUT)**

<b>Description:</b>	<i>Bluetooth</i> Headset
<b>Brand Name:</b>	Sennheiser
<b>Model Name or Number:</b>	FLX 70
<b>Serial Number:</b>	Sample 3
<b>FCC ID Number:</b>	DMOCBMDZH
<b>Country of Manufacture:</b>	China
<b>Date of Receipt:</b>	16 July 2007

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

During the course of testing the EUT was not modified.

### **2.4. Accessories**

No accessories were supplied with the EUT for testing.

### **2.5. Support Equipment**

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

Test of: Sennheiser Communications A/S  
FLX 70, Bluetooth Headset

To: FCC Part 15.247: 2006 (Subpart C)

## 2.6. Additional Information Related to Testing

<b>Intended Operating Environment:</b>	Commercial Within Bluetooth Coverage		
<b>Equipment Category:</b>	<i>Bluetooth</i>		
<b>Type of Unit:</b>	Portable (Standalone battery powered device)		
<b>Power Supply Requirement:</b>	Internal battery supply of 3.7 V		
<b>Maximum Power Output (ERP)</b>	2.8 dBm		
<b>Transmit Frequency Range:</b>	2402 MHz to 2480 MHz		
<b>Transmit Channels Tested:</b>	<b>Channel ID</b>	<b>Channel Number</b>	<b>Channel Frequency (MHz)</b>
	Bottom	0	2402
	Middle	39	2441
	Top	78	2480
<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	0	2402
	Middle	39	2441
	Top	78	2480

## 2.7. Port Identification

Port	Description
1	USB

Test of: Sennheiser Communications A/S  
FLX 70, Bluetooth Headset

To: FCC Part 15.247: 2006 (Subpart C)

---

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

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

<b>Reference:</b>	FCC Part 15.247: 2006 Subpart C
<b>Title:</b>	Code of Federal Regulations, Part 15.247 (47CFR15) (Intentional Radiators operating within the band 2400 MHz to 2483.5 MHz)

#### **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 (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.

#### **3.3. Definition of Measurement Equipment**

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

### **4. Deviations from the Test Specification**

There were no deviations from the test specification.

Test of: Sennheiser Communications A/S  
FLX 70, Bluetooth Headset

To: FCC Part 15.247: 2006 (Subpart C)

---

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

### **5.1. Operating Modes**

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

The EUT was set into a test mode, transmitting on the Bottom, Middle or Top channel, or hopping on all channels, as requested by each test case.

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

The EUT was tested in the following configuration:

Stand alone, battery powered.



Test of: Sennheiser Communications A/S  
FLX 70, Bluetooth Headset

To: FCC Part 15.247: 2006 (Subpart C)

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

<b>Range of Measurements</b>	<b>Specification Section Reference</b>	<b>Port Type</b>	<b>Compliance Status</b>
Idle Mode Radiated Spurious Emissions	Section 15.109	Antenna	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, UK.

FCC Site Registration Number: 90895

IC Site Registration Number: 3485

Test of: Sennheiser Communications A/S  
FLX 70, Bluetooth Headset

To: FCC Part 15.247: 2006 (Subpart C)

---

## **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.

Test of: Sennheiser Communications A/S  
FLX 70, Bluetooth Headset

To: FCC Part 15.247: 2006 (Subpart C)

---

## **7.2. Test Results**

### **7.2.1. 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 MHz to 1000 MHz)**

<b>Frequency (MHz)</b>	<b>Antenna Polarity</b>	<b>Quasi-Peak Level (dB<math>\mu</math>V/m)</b>	<b>Limit (dB<math>\mu</math>V/m)</b>	<b>Margin (dB)</b>	<b>Note(s)</b>
714.068	Horizontal	40.6	47.0	6.4	Complied

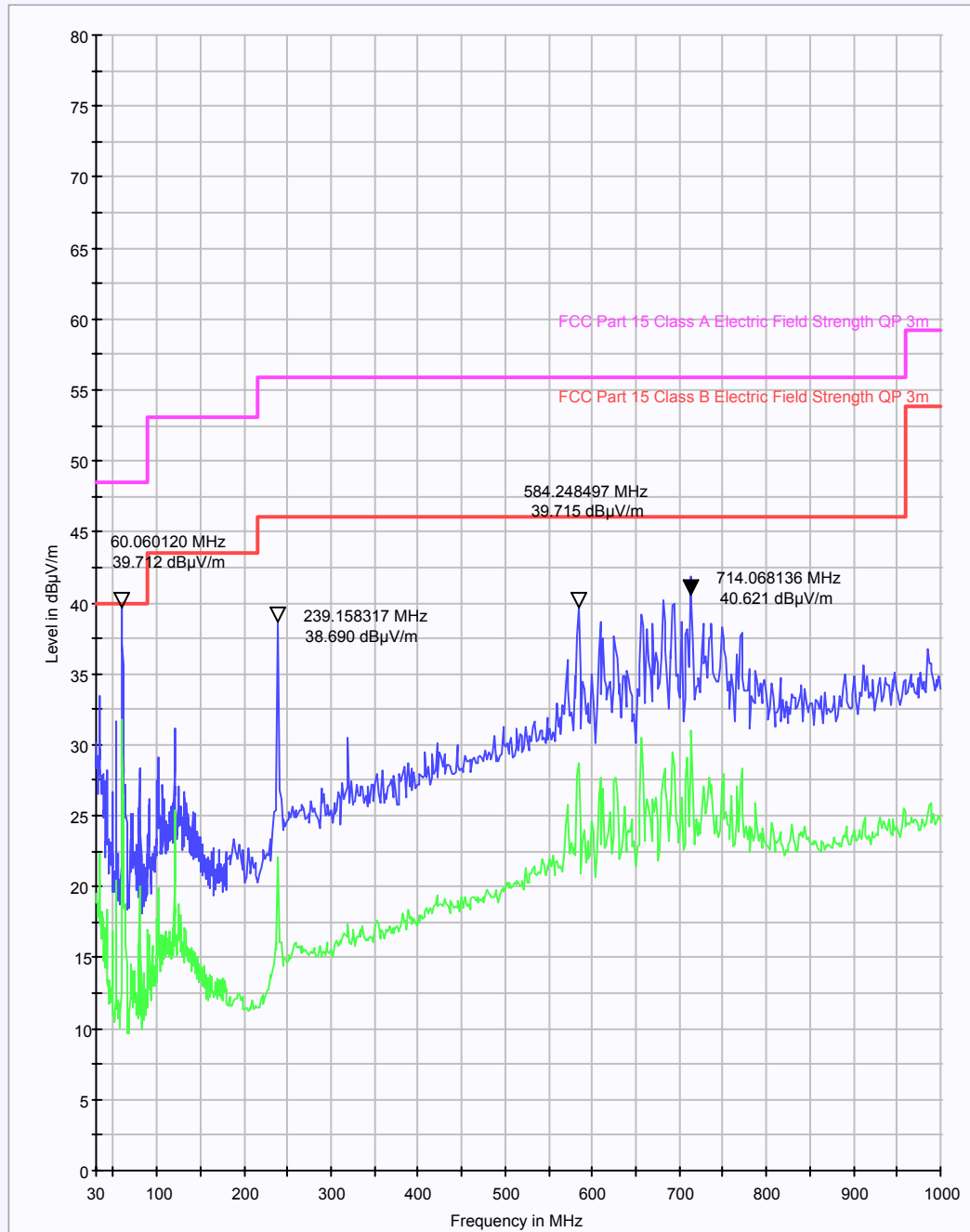
#### **Note(s):**

1. All other emissions measured were lower than the highest level shown in the table above.

Test of: Sennheiser Communications A/S  
FLX 70, Bluetooth Headset

To: FCC Part 15.247: 2006 (Subpart C)

**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.

Test of: Sennheiser Communications A/S  
FLX 70, Bluetooth Headset

To: FCC Part 15.247: 2006 (Subpart C)

---

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

#### Results:

#### Electric Field Strength Measurements (Frequency Range: 1 GHz 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)	Limit (dB $\mu$ V/m)	Margin (dB)	Results
3.915831	Horizontal	52.7	-6.1	46.6	54.0	7.4	Complied

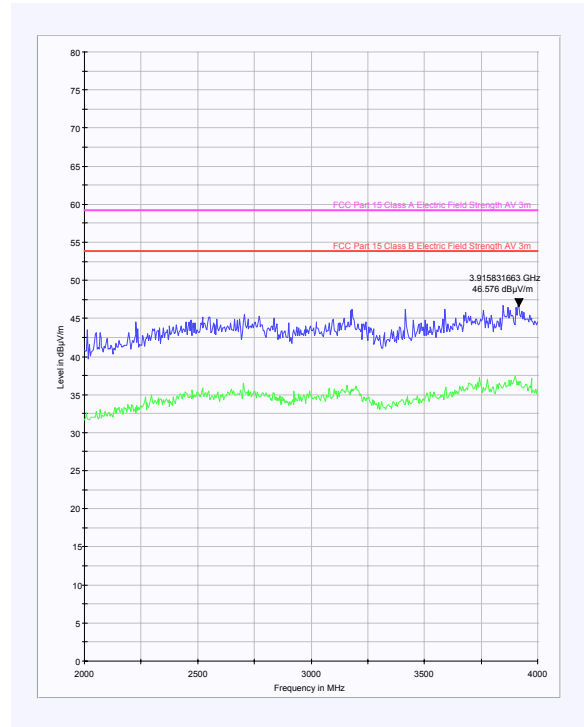
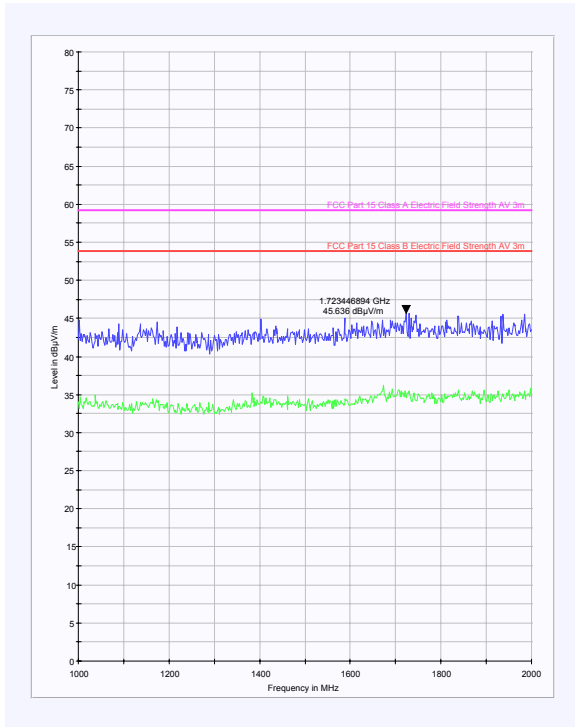
#### Note(s):

- No spurious emissions were detected above the noise floor of the measuring system; therefore, the highest peak noise floor reading was recorded, as shown in the table above. The peak level is compared to the average limit.*

Test of: Sennheiser Communications A/S  
FLX 70, Bluetooth Headset

To: FCC Part 15.247: 2006 (Subpart C)

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

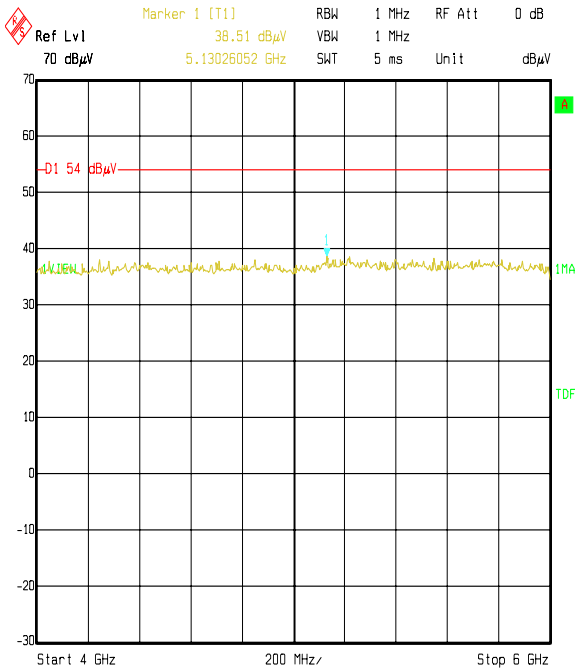


*Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.*

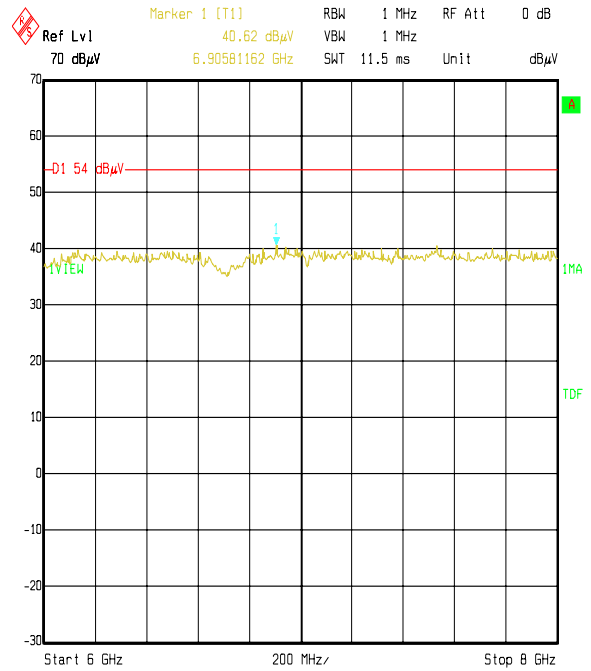
Test of: Sennheiser Communications A/S  
FLX 70, Bluetooth Headset

To: FCC Part 15.247: 2006 (Subpart C)

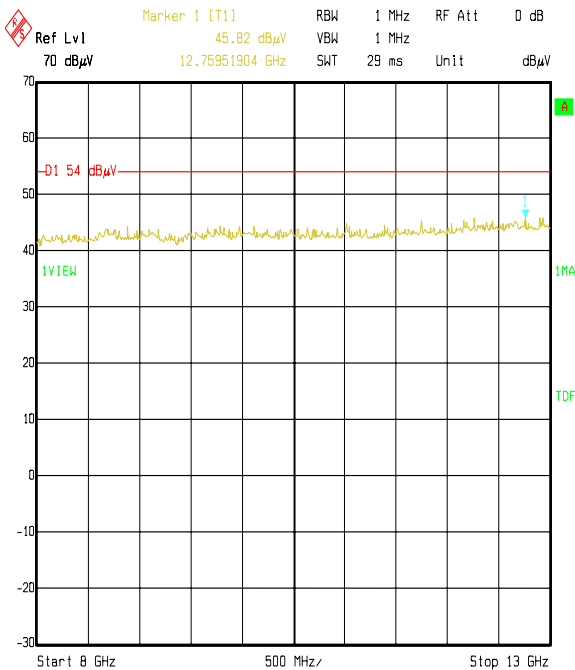
**Idle Mode Radiated Spurious Emissions: Section 15.109 (Continued)**



Title: 49196JD05 FCC 15.247  
Comment A: RADIATED SPURIOUS EMISSIONS IDLE MODE  
Date: 17.JUL.2007 10:50:15



Title: 49196JD05 FCC 15.247  
Comment A: RADIATED SPURIOUS EMISSIONS IDLE MODE  
Date: 17.JUL.2007 14:04:55



Title: 49196JD05 FCC 15.247  
Comment A: RADIATED SPURIOUS EMISSIONS IDLE MODE  
Date: 17.JUL.2007 14:12:10

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

Test of: Sennheiser Communications A/S  
FLX 70, Bluetooth Headset

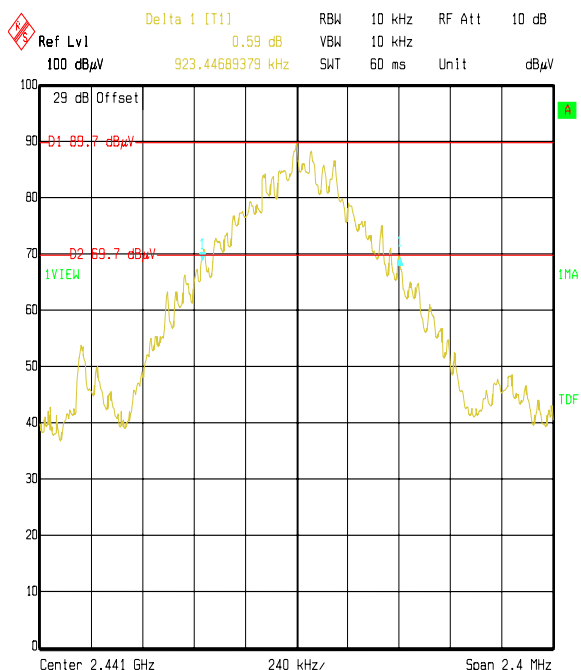
To: FCC Part 15.247: 2006 (Subpart C)

**7.2.3. 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)
923.447	None specified



Title: 49196JD05 FCC 15.247  
Comment A: TRANSMITTER 20dB BANDWIDTH  
Date: 18.JUL.2007 09:29:49



Test of: Sennheiser Communications A/S  
 FLX 70, Bluetooth Headset

To: FCC Part 15.247: 2006 (Subpart C)

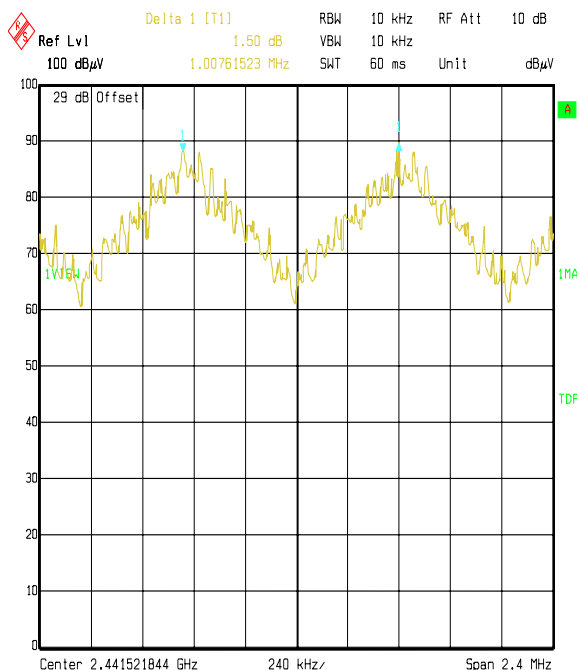
**7.2.4. Transmitter Carrier Frequency Separation: Section 15.247(a)(1)**

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 ( <sup>2</sup> / <sub>3</sub> of 20 dB BW) (kHz)	Margin (kHz)	Result
1007.615	615.631	391.984	Complied



Title: 49196JD05 FCC 15.247  
 Comment A: TRANSMITTER CARRIER FREQUENCY SEPARATION  
 Date: 18.JUL.2007 09:34:55

Test of: Sennheiser Communications A/S  
FLX 70, Bluetooth Headset

To: FCC Part 15.247: 2006 (Subpart C)

---

**7.2.5. 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.

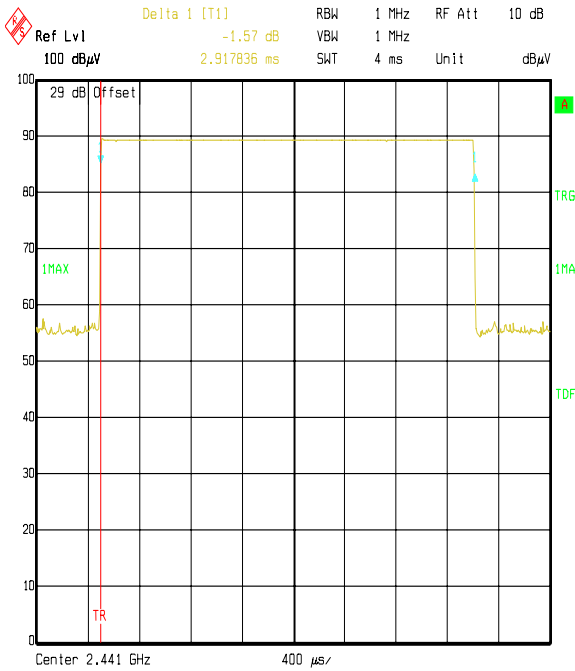
**Results:**

Emission Width ( $\mu$ s)	Number of Hops in 31.6 Seconds	Average Time of Occupancy (s)	Limit (s)	Margin (s)	Results
2917.836	71	0.207	0.4	0.193	Complied

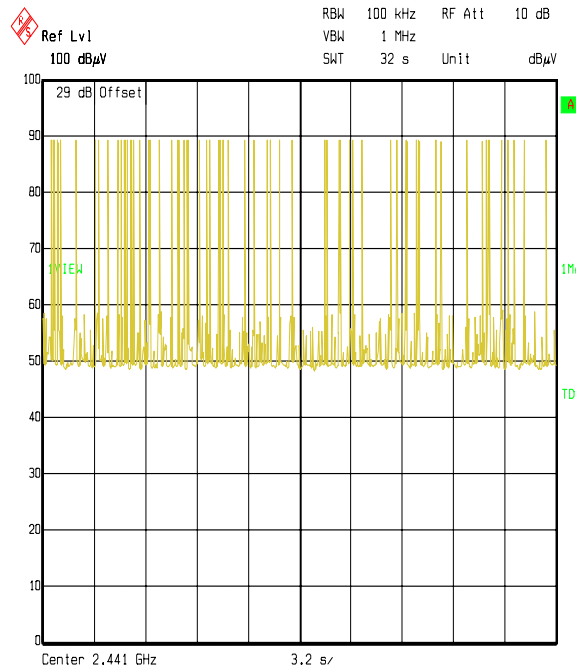
Test of: Sennheiser Communications A/S  
FLX 70, Bluetooth Headset

To: FCC Part 15.247: 2006 (Subpart C)

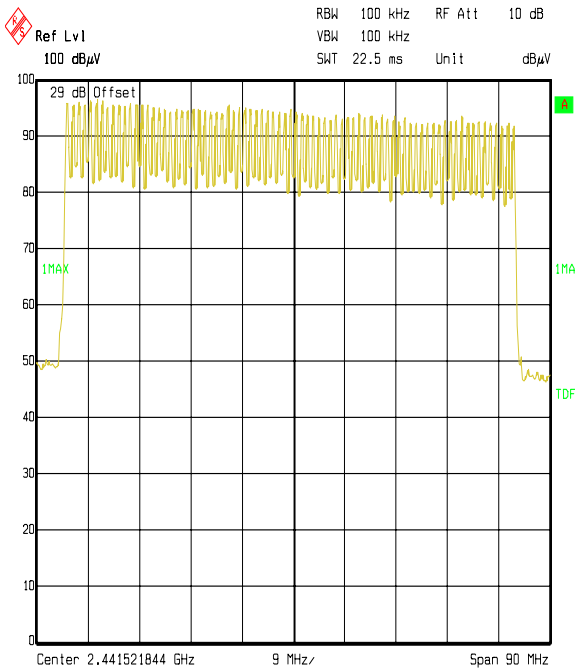
**7.2.5.1. Transmitter Average Time of Occupancy: Section 15.247(a)(1)(iii) (Continued)**



Title: 49196JD05 FCC 15.247  
Comment A: AVERAGE TIME OF OCCUPANCY, PULSE LENGTH  
Date: 18.JUL.2007 10:02:18



Title: 49196JD05 FCC 15.247  
Comment A: AVERAGE TIME OF OCCUPANCY, NUMBER OF HOPS  
Date: 18.JUL.2007 10:06:11



Title: 49196JD05 FCC 15.247  
Comment A: AVERAGE TIME OF OCCUPANCY, NUMBER OF CHANNELS  
Date: 18.JUL.2007 09:53:48

Test of: Sennheiser Communications A/S  
FLX 70, Bluetooth Headset

To: FCC Part 15.247: 2006 (Subpart C)

---

#### **7.2.6. 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:**

##### **Battery Powered Devices**

<b>Channel</b>	<b>EIRP (dBm)</b>	<b>Limit (dBm)</b>	<b>Margin (dB)</b>	<b>Results</b>
Bottom	2.8	30.0	27.2	Complied
Middle	0.1	30.0	29.9	Complied
Top	-2.7	30.0	32.7	Complied

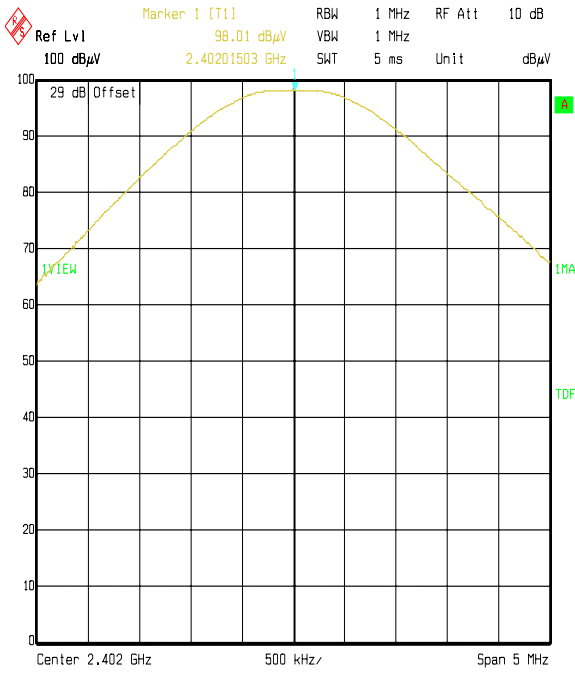
#### **Note(s):**

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

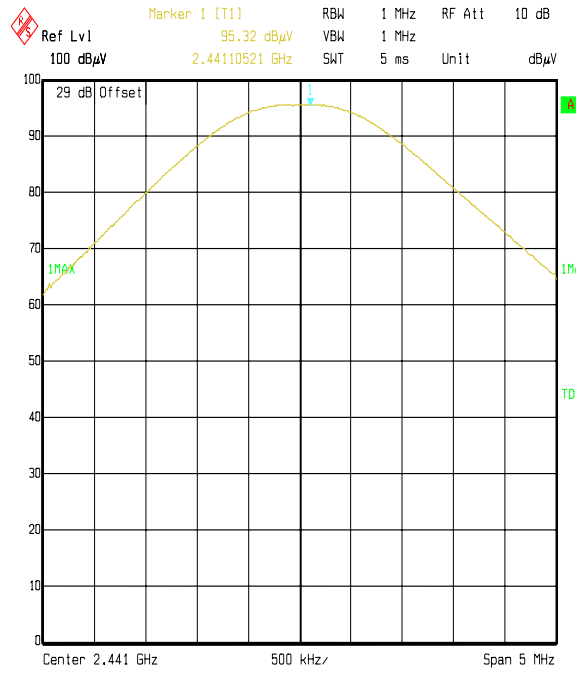
Test of: Sennheiser Communications A/S  
FLX 70, Bluetooth Headset

To: FCC Part 15.247: 2006 (Subpart C)

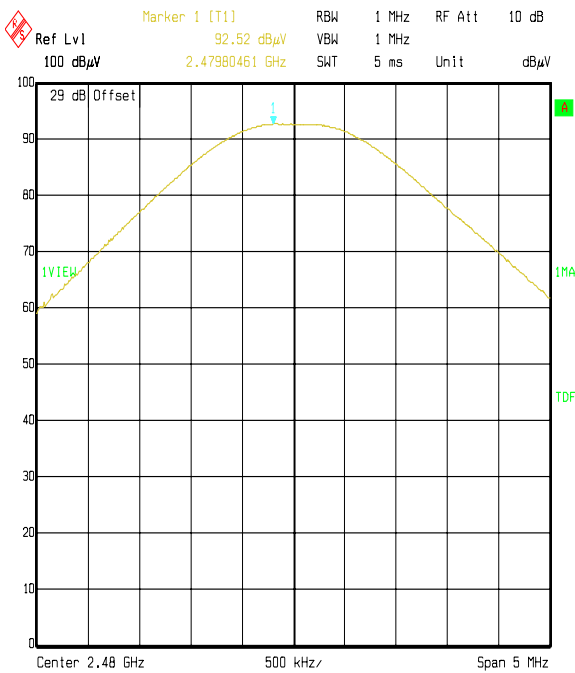
**Transmitter Maximum Peak Output Power: Section 15.247(b)(1) (Continued)**



Title: 49196JD05 FCC 15.247  
Comment A: EIRP BOTTOM CHANNEL  
Date: 18.JUL.2007 09:12:43



Title: 49196JD05 FCC 15.247  
Comment A: EIRP MIDDLE CHANNEL  
Date: 18.JUL.2007 09:16:16



Title: 49196JD05 FCC 15.247  
Comment A: EIRP TOP CHANNEL  
Date: 18.JUL.2007 09:19:11

Test of: Sennheiser Communications A/S  
FLX 70, Bluetooth Headset

To: FCC Part 15.247: 2006 (Subpart C)

---

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

**Results:**

**Electric Field Strength Measurements: 30 MHz 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
681.202	Horizontal	32.5	72.5	40.0	Complied

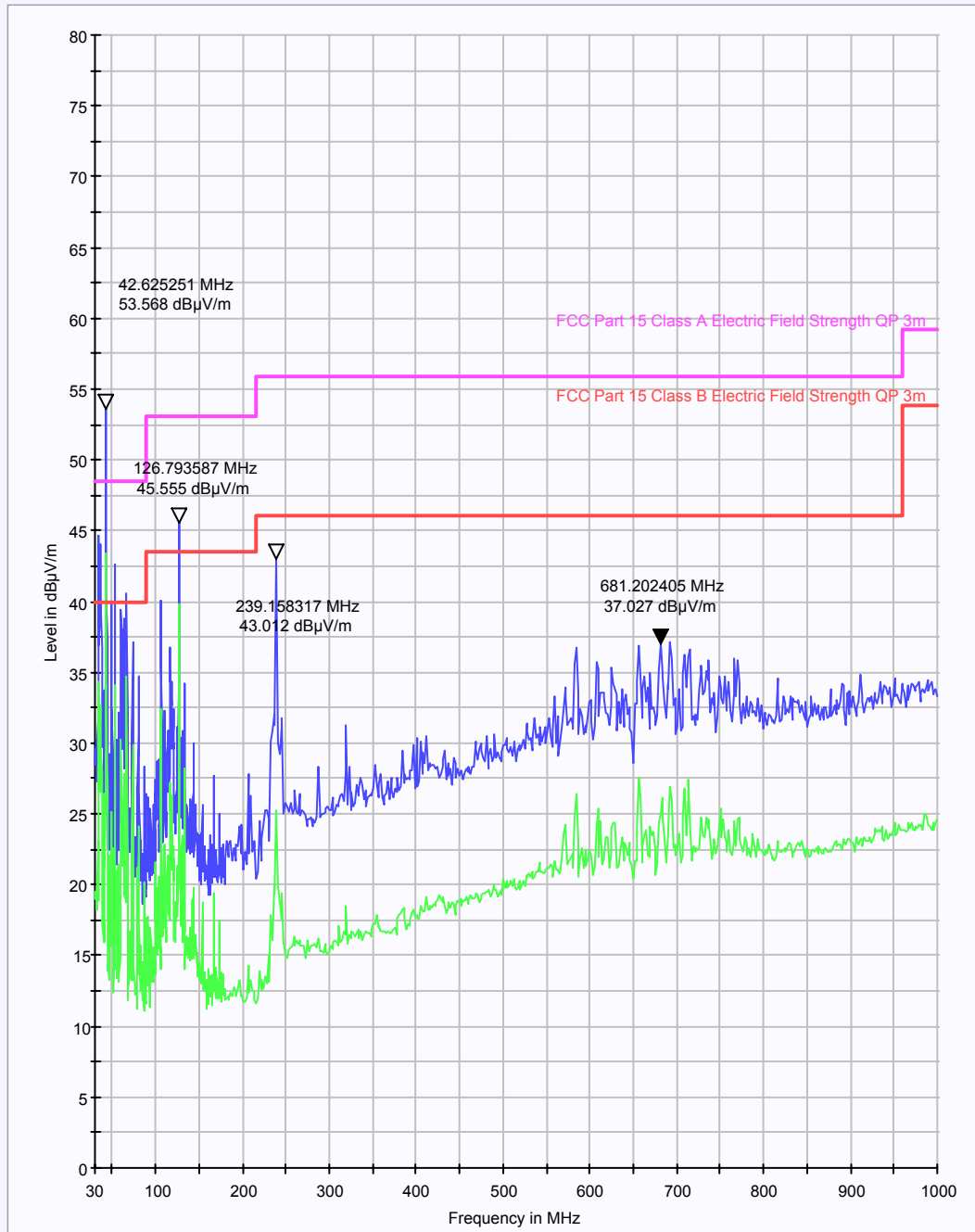
**Note(s):**

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

Test of: Sennheiser Communications A/S  
FLX 70, Bluetooth Headset

To: FCC Part 15.247: 2006 (Subpart C)

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



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

Test of: Sennheiser Communications A/S  
FLX 70, Bluetooth Headset

To: FCC Part 15.247: 2006 (Subpart C)

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

**Results:**

**Electric Field Strength Measurements (Frequency Range: 1 GHz to 25 GHz)**  
**(Emissions Occurring in 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)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
4.803987	Horizontal	57.2	-3.3	53.9	74.0	20.1	Complied

**Highest Average Level: Bottom Channel**

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
4.803987	Horizontal	50.2	-3.3	46.9	54.0	7.1	Complied

**Highest Peak Level: Middle Channel**

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
4.882004	Horizontal	59.4	-3.7	55.7	74.0	18.3	Complied

**Highest Average Level: Middle Channel**

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
4.882004	Horizontal	51.5	-3.7	47.8	54.0	6.2	Complied



Test of: Sennheiser Communications A/S  
FLX 70, Bluetooth Headset

To: FCC Part 15.247: 2006 (Subpart C)

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

**Highest Peak Level: Top Channel**

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
4.959919	Horizontal	60.6	-3.7	56.9	74.0	17.1	Complied

**Highest Average Level: Top Channel**

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
4.959919	Horizontal	53.4	-3.7	49.7	54.0	4.3	Complied

**Highest Peak 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
4.957915	Horizontal	60.2	-3.7	56.5	74.0	17.5	Complied

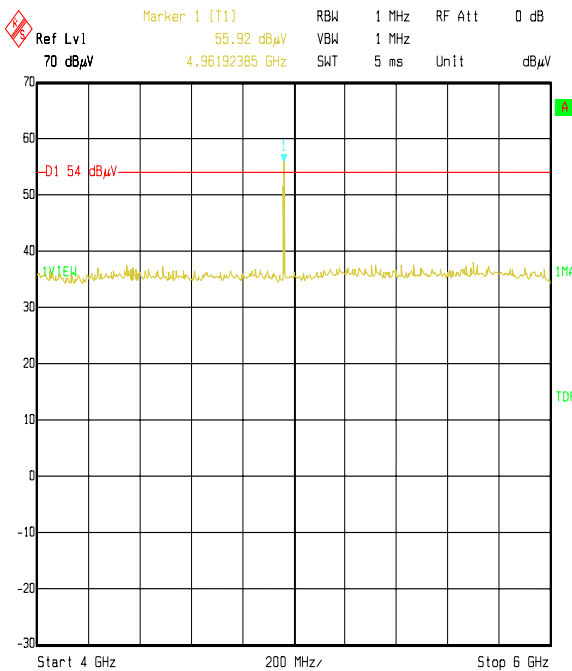
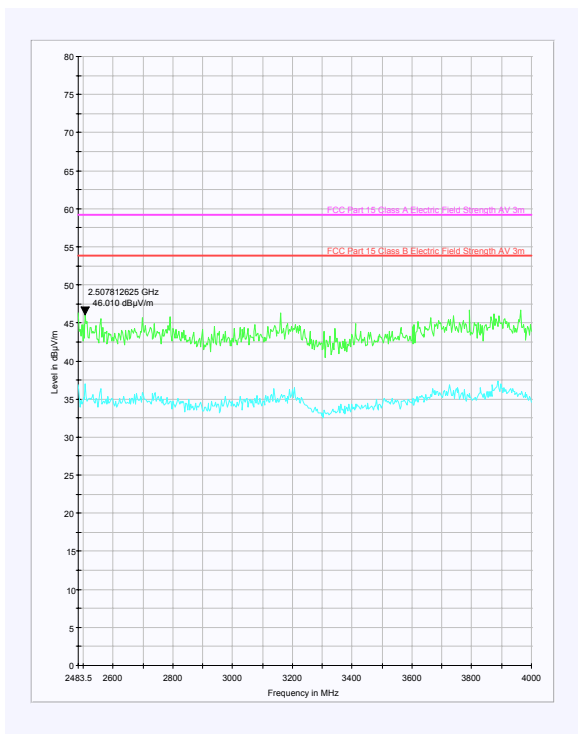
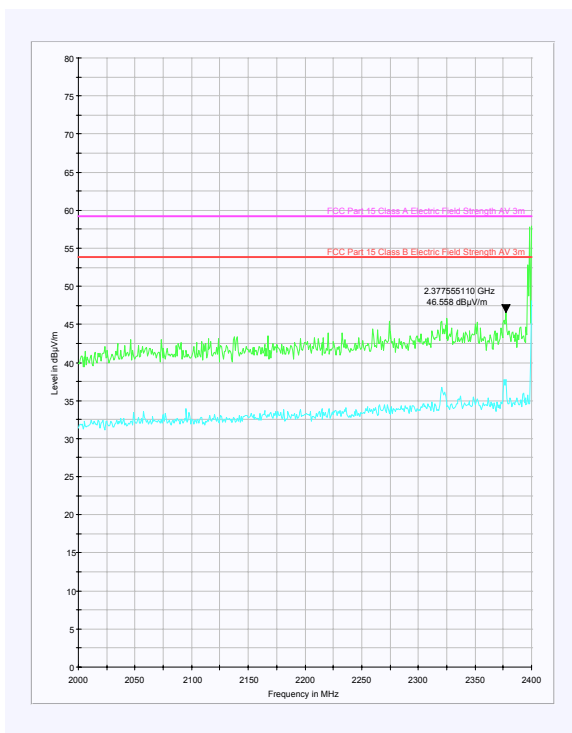
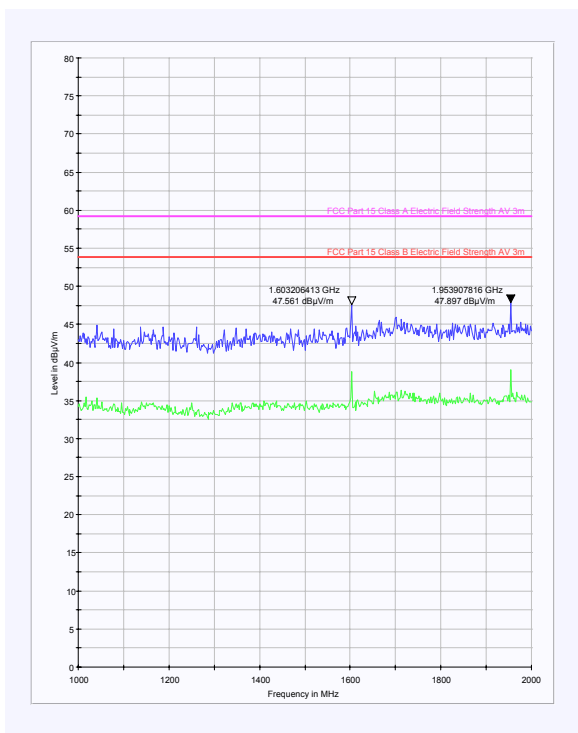
**Highest Average Level: Hopping Mode**

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
4.957915	Horizontal	39.4	-3.7	35.7	54.0	18.3	Complied

Test of: Sennheiser Communications A/S  
FLX 70, Bluetooth Headset

To: FCC Part 15.247: 2006 (Subpart C)

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



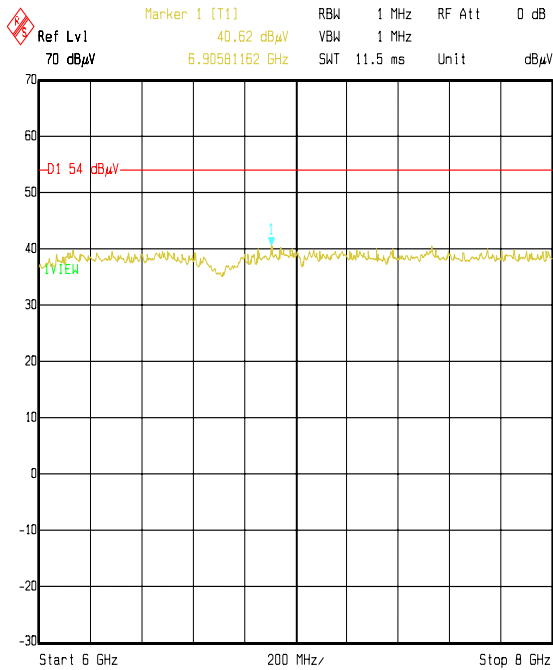
Title: 49196JD05 FCC 15.247  
 Comment A: RADIATED SPURIOUS EMISSIONS TRANSMIT MODE TOP CHANNEL  
 Date: 17.JUL.2007 13:38:00

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

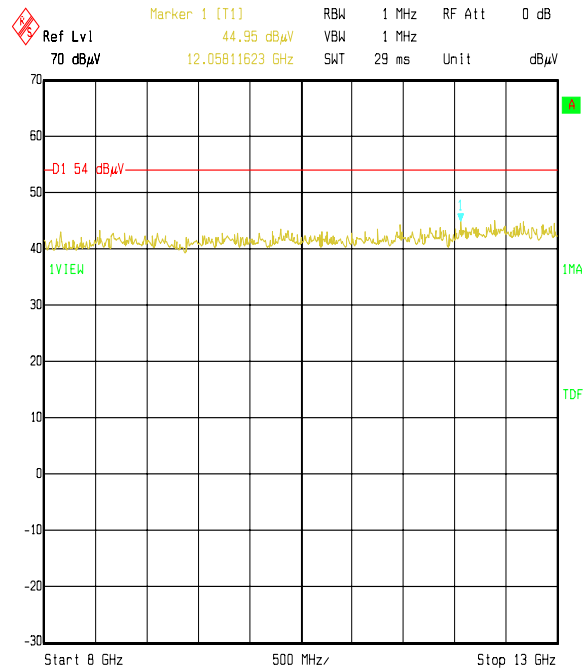
Test of: Sennheiser Communications A/S  
FLX 70, Bluetooth Headset

To: FCC Part 15.247: 2006 (Subpart C)

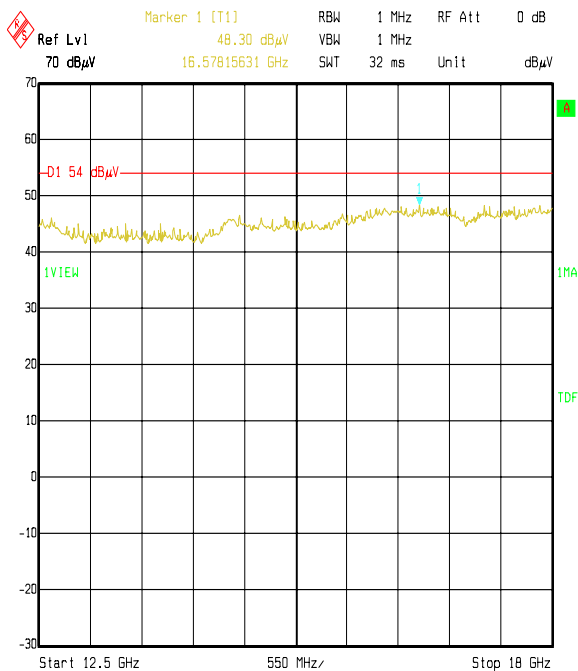
**Transmitter Radiated Emissions: Section 15.247(d) and 15.209(a) (Continued)**



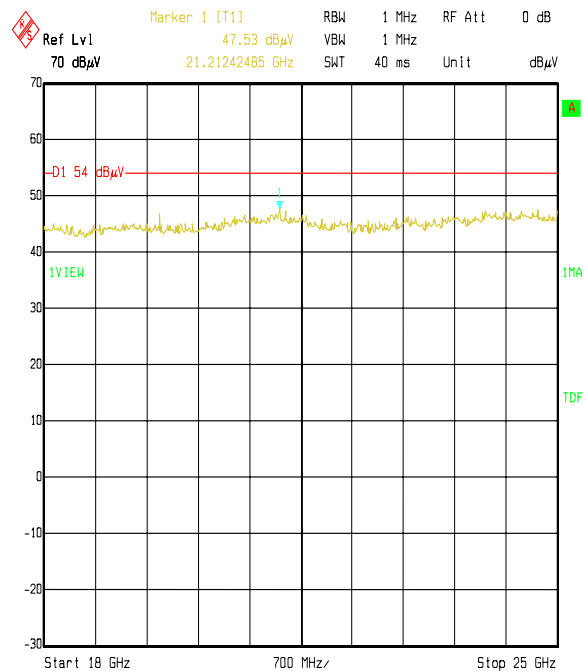
Title: 49196JD05 FCC 15.247  
Comment A: RADIATED SPURIOUS EMISSIONS TRANSMIT MODE TOP CHANNEL  
Date: 17.JUL.2007 14:02:28



Title: 49196JD05 FCC 15.247  
Comment A: RADIATED SPURIOUS EMISSIONS TRANSMIT MODE TOP CHANNEL  
Date: 17.JUL.2007 14:20:42



Title: 49196JD05 FCC 15.247  
Comment A: RADIATED SPURIOUS EMISSIONS TRANSMIT MODE TOP CHANNEL  
Date: 17.JUL.2007 14:27:34



Title: 49196JD05 FCC 15.247  
Comment A: RADIATED SPURIOUS EMISSIONS TRANSMIT MODE TOP CHANNEL  
Date: 17.JUL.2007 14:36:16

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

Test of: Sennheiser Communications A/S  
FLX 70, Bluetooth Headset

To: FCC Part 15.247: 2006 (Subpart C)

### **7.2.7. 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 (MHz)	Antenna Polarity	Detector Level (dB $\mu$ V)	Transducer Factor (dB)	Actual Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2400.0	Horizontal	50.8	-6.5	44.3	76.5	32.2	Complied
2483.5	Horizontal	53.3	-8.0	45.3	74.0	28.7	Complied

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

Frequency (MHz)	Antenna Polarity	Detector Level (dB $\mu$ V)	Transducer Factor (dB)	Actual Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2483.5	Horizontal	42.5	-8.0	34.5	54.0	19.5	Complied

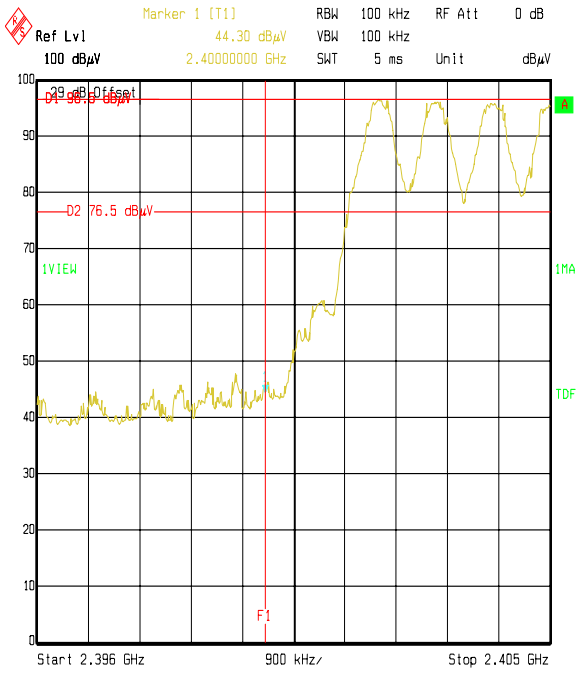
### **Note(s):**

1. The band edge at 2400 MHz is outside of a restricted band; therefore the limit is -20 dBc.
2. The band edge at 2483.5 MHz is within a restricted band; therefore the limit is FCC 15.209.

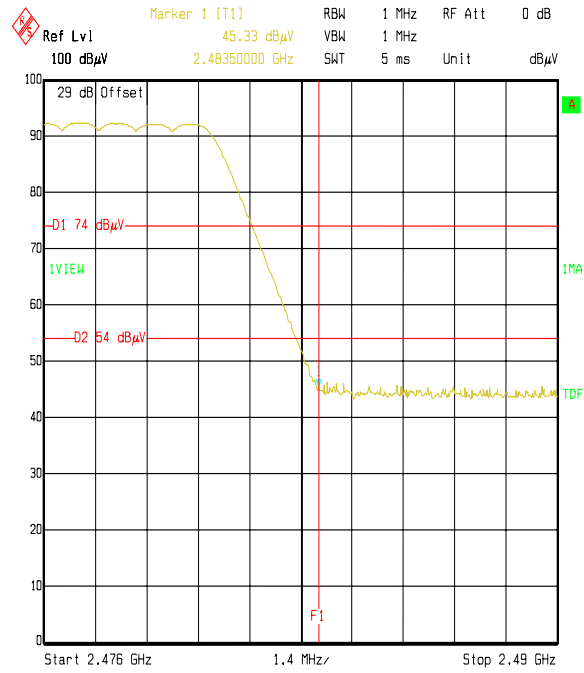
Test of: Sennheiser Communications A/S  
FLX 70, Bluetooth Headset

To: FCC Part 15.247: 2006 (Subpart C)

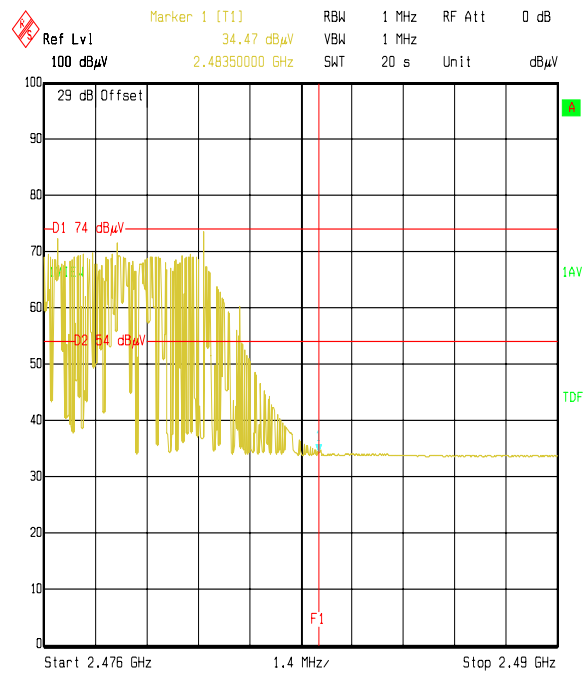
Transmitter Band Edge Radiated Emissions: Section 15.247(d) & 15.209(a) (Continued)



Title: 49196JD05 FCC 15.247  
 Comment A: TX BAND EDGE, HOPPING, PEAK DETECTOR  
 Date: 17.JUL.2007 15:33:40



Title: 49196JD05 FCC 15.247  
 Comment A: TX BAND EDGE, HOPPING, PEAK DETECTOR  
 Date: 17.JUL.2007 15:12:02



Title: 49196JD05 FCC 15.247  
 Comment A: TX BAND EDGE, HOPPING, AVERAGE DETECTOR  
 Date: 17.JUL.2007 15:27:05

Test of: Sennheiser Communications A/S  
FLX 70, Bluetooth Headset

To: FCC Part 15.247: 2006 (Subpart C)

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

**Results:**

**Peak Power Level Static Mode:**

Frequency (MHz)	Antenna Polarity	Detector Level (dB $\mu$ V)	Transducer Factor (dB)	Actual Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2400.0	Horizontal	52.3	-6.5	45.8	76.5	30.7	Complied
2483.5	Horizontal	55.1	-8.0	47.1	74.0	26.9	Complied

**Average Power Level Static Mode:**

Frequency (MHz)	Antenna Polarity	Detector Level (dB $\mu$ V)	Transducer Factor (dB)	Actual Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2843.5	Horizontal	46.1	-8.0	38.1	54.0	15.9	Complied

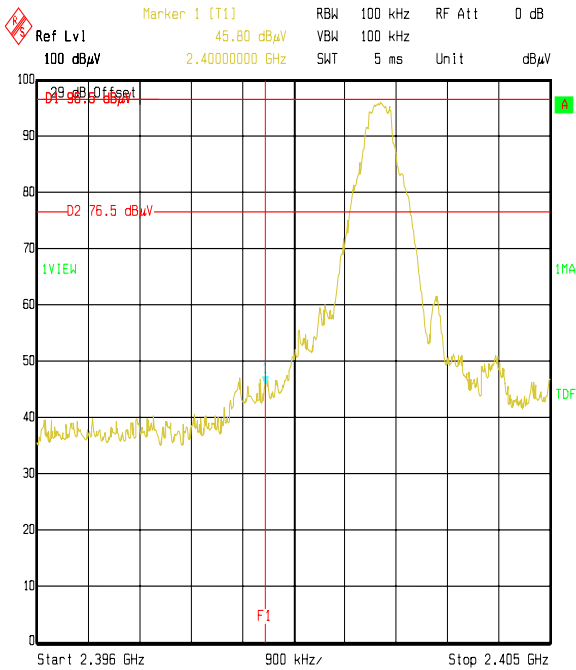
**Note(s):**

1. The band edge at 2400 MHz is outside of a restricted band; therefore the limit is -20 dBc.
2. The band edge at 2483.5 MHz is within a restricted band; therefore the limit is FCC 15.209.

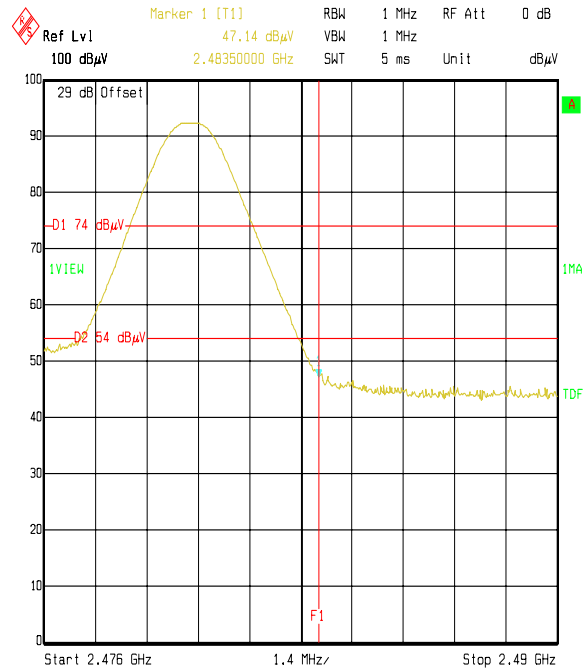
Test of: Sennheiser Communications A/S  
FLX 70, Bluetooth Headset

To: FCC Part 15.247: 2006 (Subpart C)

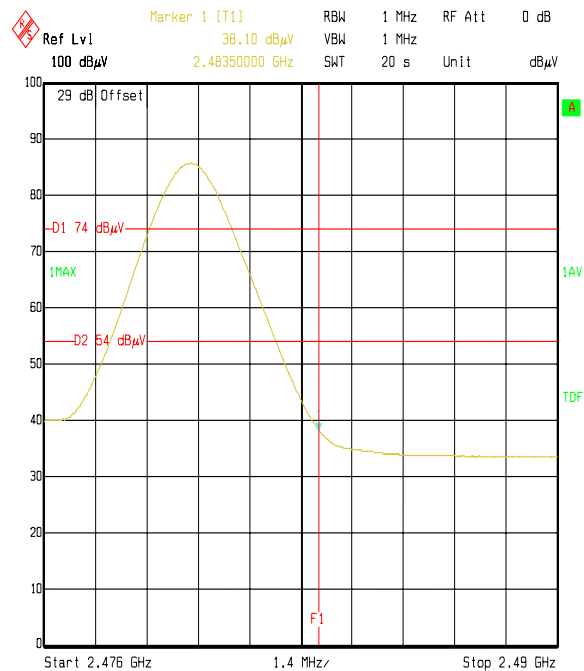
**Transmitter Band Edge Radiated Emissions: Section 15.247(d) & 15.209(a) (Continued)**



Title: 49196JD05 FCC 15.247  
Comment A: TX BAND EDGE, STATIC, PEAK DETECTOR  
Date: 18.JUL.2007 08:50:01



Title: 49196JD05 FCC 15.247  
Comment A: TX BAND EDGE, STATIC, TOP CHANNEL, PEAK DETECTOR  
Date: 17.JUL.2007 15:10:35



Title: 49196JD05 FCC 15.247  
Comment A: TX BAND EDGE, STATIC, TOP CHANNEL, AVERAGE DETECTOR  
Date: 17.JUL.2007 15:07:44

**Test of: Sennheiser Communications A/S  
FLX 70, Bluetooth Headset**

**To: FCC Part 15.247: 2006 (Subpart C)**

## **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”.

<b>Measurement Type</b>	<b>Range</b>	<b>Confidence Level (%)</b>	<b>Calculated Uncertainty</b>
Transmitter Maximum Peak Output Power, EIRP	1 GHz to 40 GHz	95%	±2.94 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.



Test of: Sennheiser Communications A/S  
FLX 70, Bluetooth Headset

To: FCC Part 15.247: 2006 (Subpart C)

---

## **9. Measurement Methods**

### **9.1. 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 horn antennas.

Test of: Sennheiser Communications A/S  
FLX 70, Bluetooth Headset

To: FCC Part 15.247: 2006 (Subpart C)

---

### **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:

<b>Receiver Function</b>	<b>Initial Scan</b>	<b>Final Measurements &lt;1 GHz</b>	<b>Final Measurements ≥1 GHz</b>
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

Test of: Sennheiser Communications A/S  
FLX 70, Bluetooth Headset

To: FCC Part 15.247: 2006 (Subpart C)

---

## **9.2. Carrier Frequency Separation / 20 dB Bandwidth**

The EUT and spectrum analyser was configured 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.

Test of: Sennheiser Communications A/S  
FLX 70, Bluetooth Headset

To: FCC Part 15.247: 2006 (Subpart C)

---

### **9.3. Average Time of Occupancy**

The EUT and spectrum analyser was configured 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 (in the time domain) and the sweep time was set to 32 seconds (the closest allowable setting to 31.6 seconds). This 32 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.

Test of: Sennheiser Communications A/S  
FLX 70, Bluetooth Headset

To: FCC Part 15.247: 2006 (Subpart C)

---

#### **9.4. Equivalent 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 polarity. 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:-

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

Test of: Sennheiser Communications A/S  
FLX 70, Bluetooth Headset

To: FCC Part 15.247: 2006 (Subpart C)

### Equivalent 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

Test of: Sennheiser Communications A/S  
FLX 70, Bluetooth Headset

To: FCC Part 15.247: 2006 (Subpart C)

---

### **9.5. 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).

Test of: Sennheiser Communications A/S  
FLX 70, Bluetooth Headset

To: FCC Part 15.247: 2006 (Subpart C)

### Appendix 1. Test Equipment Used

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Last Calibrated	Cal. Interval (Months)
A028	Horn Antenna	Eaton	91888-2	304	08 Jun 2006	36
A031	Horn Antenna	Eaton	91889-2	557	08 Jun 2006	36
A1037	Bilog Antenna	Chase EMC Ltd	CBL6112B	2413	20 Sep 2006	12
A1534	Preamplifier	Hewlett Packard	8449B OPT H02	3008A00405	Cal before use	-
A253	Horn Antenna	Flann Microwave	12240-20	128	17 Nov 2006	36
A254	Horn Antenna	Flann Microwave	14240-20	139	17 Nov 2006	36
A255	Horn Antenna	Flann Microwave	16240-20	519	17 Nov 2006	36
A256	Horn Antenna	Flann Microwave	18240-20	400	17 Nov 2006	36
A436	Horn Antenna	Flann Microwave	20240-20	330	24 Apr 2006	36
C1165	Cable	Rosenberger	FA210A1020007070	43189-1	05 Jun 2007	12
C1167	Cable	Rosenberger	FA210A1030007070	43190-01	05 Jun 2007	12
C1192	Cable	Rosenberger	FA210A1015M3030	27141-07	31 May 2007	12
C151	Cable	Rosenberger	UFA210A-1-1181-70x70	None	Cal before use	-
C160	Cable	Rosenberger	UFA210A-1-1181-70x70	None	Cal before use	-
C348	Cable	Rosenberger	UFA210A-1-1181-70x70	2993	Cal before use	-
M1242	Spectrum Analyser	Rohde & Schwarz	FSEM30	845986_022	08 Sep 2006	12
M1263	Test Receiver	Rohde & Schwarz	ESIB7	100265	25 Jan 2007	12
S202	3m OATS	RFI	2	S202-15011990	17 Nov 2006	12
S212	Screened Room	RFI	12	None	Not calibrated	-

**NB** In accordance with UKAS requirements, all the measurement equipment is on a calibration schedule. All equipment was within calibration at the time of the test.



Test of: Sennheiser Communications A/S  
FLX 70, Bluetooth Headset

To: FCC Part 15.247: 2006 (Subpart C)

---

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

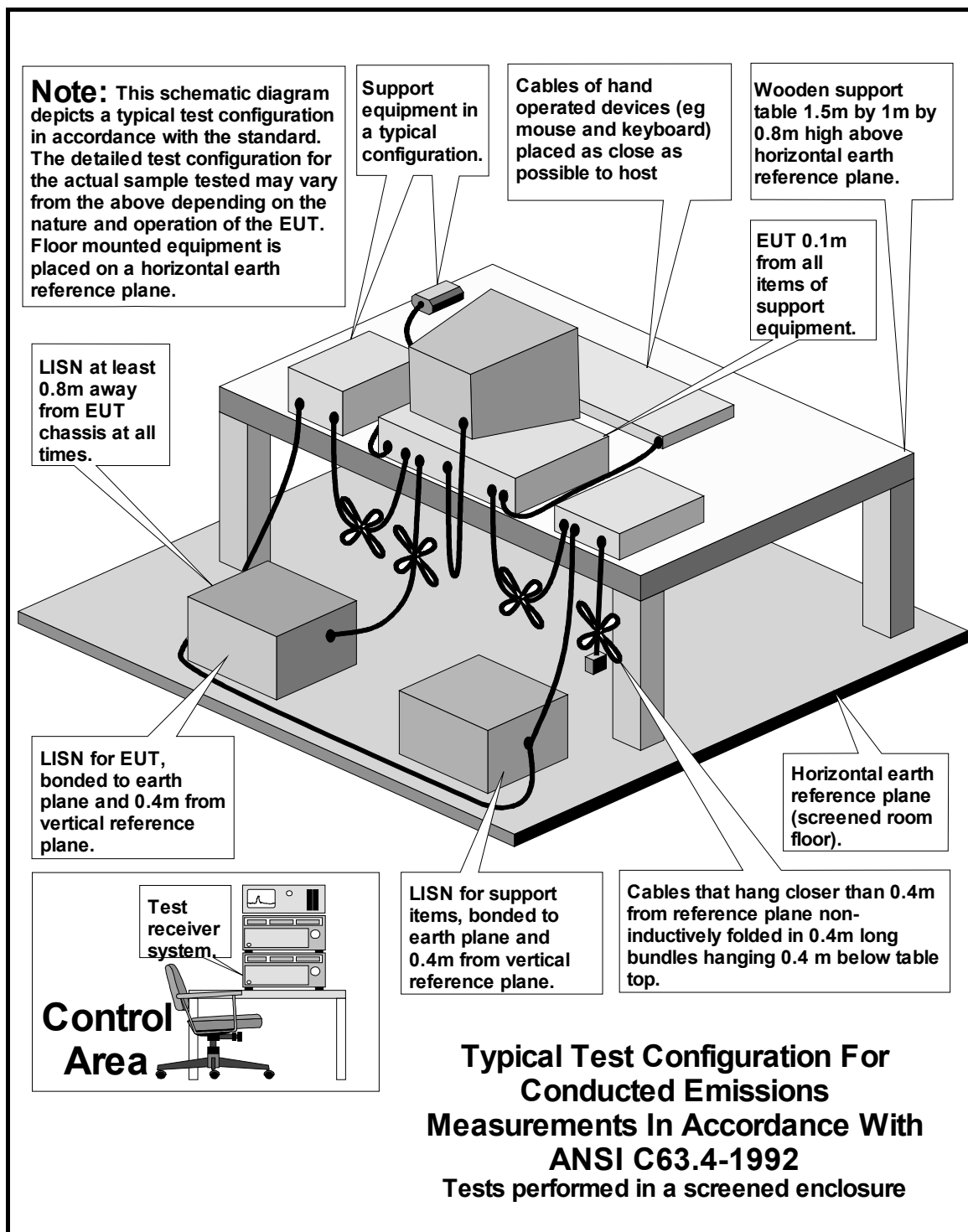
This appendix contains the following drawings:

<b>Drawing Reference Number</b>	<b>Title</b>
DRG\49196JD05A\EMICON	Test configuration for measurement of conducted emissions.
DRG\49196JD05A\EMIRAD	Test configuration for measurement of radiated emissions.

Test of: Sennheiser Communications A/S  
FLX 70, Bluetooth Headset

To: FCC Part 15.247: 2006 (Subpart C)

**DRG\49196JD05A\EMICON**

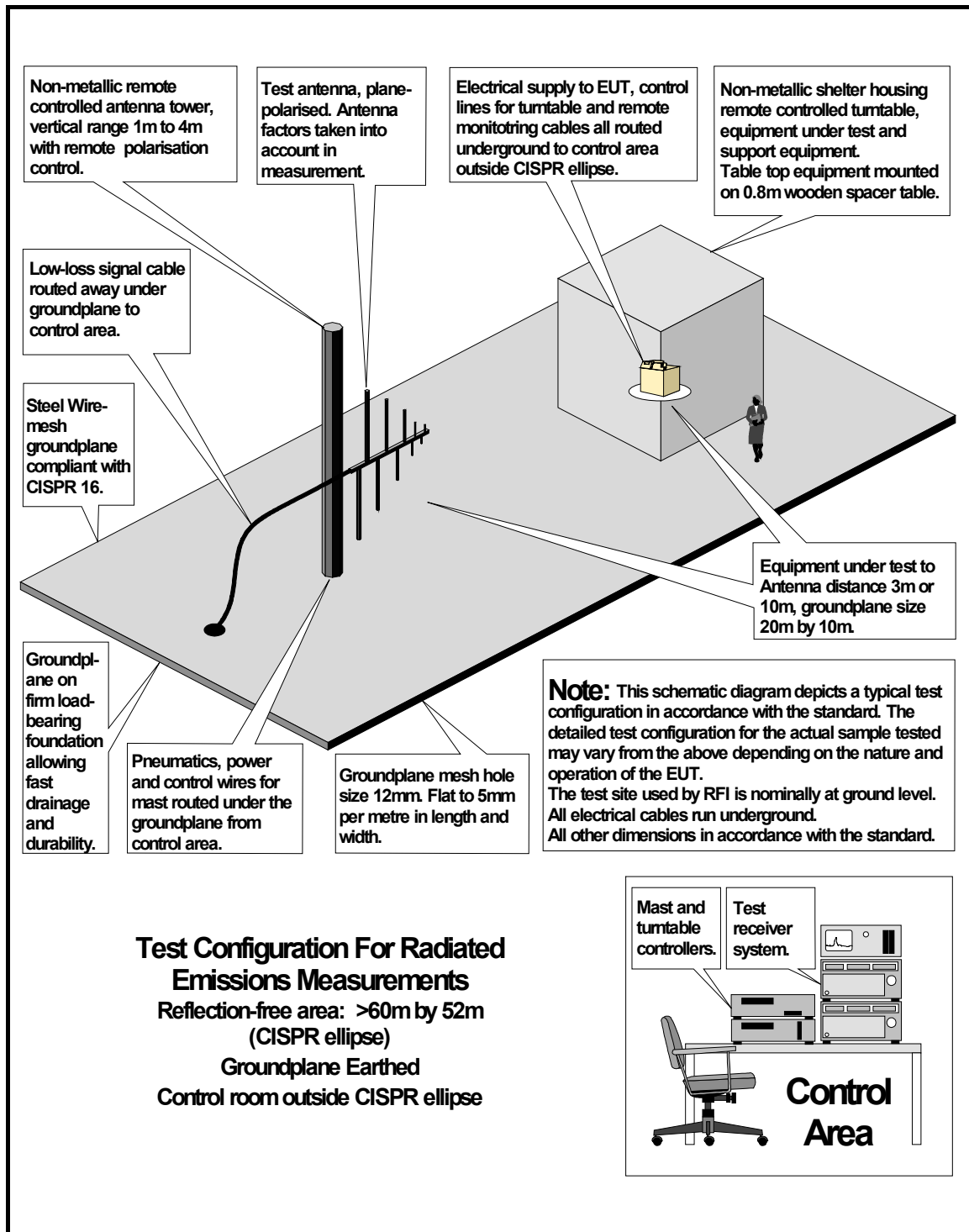


Note: This diagram is also applicable for the latest version of ANSI C63.4-2003

Test of: Sennheiser Communications A/S  
FLX 70, Bluetooth Headset

To: FCC Part 15.247: 2006 (Subpart C)

**DRG\49196JD05A\EMIRAD**



**RFI GLOBAL SERVICES LTD**

**Test Report**

**Serial No: RFI/RPTE2/RP49196JD05A**

**Page: 44 of 44**

**Issue Date: 21 August 2007**

**Test of: Sennheiser Communications A/S  
FLX 70, Bluetooth Headset**

**To: FCC Part 15.247: 2006 (Subpart C)**

---

This page has been left intentionally blank.