

## TEST REPORT FROM RFI GLOBAL SERVICES LTD

Test of: Engineering and Security srl.  
Blue Audio.

To: FCC Part 15.247: 2004 (Subpart C)

**Test Report Serial No:**  
RFI\MPTE2\RP47410JD01A

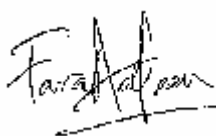
**Supersedes Test Report Serial No:**  
RFI\MPTE1\RP47410JD01A

**This Test Report Is Issued Under The Authority  
Of Andrew Brown, Operations Manager:**

A handwritten signature in blue ink, appearing to read 'Andrew Brown', written over the printed name.

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**Tested By: Fara Razally**

A handwritten signature in blue ink, appearing to read 'Fara Razally', written over the printed name.

**Checked By: Michael Derby**

A handwritten signature in blue ink, appearing to read 'Michael Derby', written over the printed name.

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**Report Copy No: PDF01**

**Issue Date: 26 October 2005**

**Test Dates: 13 July 2005 to 21 July 2005**

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Registered in England and Wales. Company number: 2117901

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## **1. Client Information**

<b>Company Name:</b>	Engineering and Security srl.
<b>Address:</b>	Via Isorelle, 19 16010 Savignone (Genova) Italy
<b>Contact Name:</b>	Mr G. Olive

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

The following information (with the exception of the Date of Receipt) has been supplied by the client:

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

Brand Name:	Blue Audio 2
Model Name or Number:	Blue Audio 2
Unique Type Identification:	Not Applicable
Serial Number:	None stated
Hardware Version:	2.0A
Software Version:	2.0A
FCC ID Number:	TOTBLUEAUDIO2
Country of Manufacture:	Italy
Date of Receipt:	14 July 2005

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## **2.2. Accessories**

The following accessories were supplied with the EUT:

<b>Description:</b>	Li-on Battery
<b>Brand Name:</b>	STILO Li-on Battery
<b>Model Name or Number:</b>	Not Applicable
<b>Serial Number:</b>	Not Applicable
<b>Cable Length and Type:</b>	Not Applicable
<b>Connected to Port:</b>	Not Applicable

<b>Description:</b>	Microphone
<b>Brand Name:</b>	STILO Microphone
<b>Model Name or Number:</b>	Not Applicable
<b>Serial Number:</b>	Not Applicable
<b>Cable Length and Type:</b>	Not Applicable
<b>Connected to Port:</b>	Not Applicable

<b>Description:</b>	Speaker
<b>Brand Name:</b>	STILO Speaker
<b>Model Name or Number:</b>	Not Applicable
<b>Serial Number:</b>	Not Applicable
<b>Cable Length and Type:</b>	Not Applicable
<b>Connected to Port:</b>	Not Applicable

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### **2.3. Description of EUT**

The equipment under test is a helmet intercom with Bluetooth technology. It supports headset and hands-free profile, when paired with an enabled cellular phone.

### **2.4. Modifications Incorporated in EUT**

During the course of testing the EUT was not modified.

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## **2.5. Additional Information Related to Testing**

<b>Power Supply Requirement:</b>	Internal battery supply of 3.6 V		
<b>Intended Operating Environment:</b>	Residential, commercial and Light Industry		
<b>Equipment Category:</b>	Short Range (Low Power), Bluetooth		
<b>Type of Unit:</b>	Portable (Standalone battery powered device)		
<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	1	2402
	Middle	40	2441
	Top	79	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	1	2402
	Middle	40	2441
	Top	79	2480
<b>Maximum Peak Power Output (EIRP):</b>	1.4 dBm (measured)		
<b>Occupied Bandwidth:</b>	889.780 kHz (measured)		

## **2.6. Port Identification**

Port	Description	Type/Length	Applicable
1	Enclosure	-	Y

## **2.7. Support Equipment**

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



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### **3. Test Results**

Reference:	FCC Part 15.247: 2004 Subpart C.
Title:	Code of Federal Regulations, Part 15.247 (47CFR22) (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 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**

None.

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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.

For all transmit mode measurements, the Bluetooth test mode was active and set to transmit on top, middle and bottom channels and hopping on all channels, as necessary, with the longest data packet size.

Receive mode measurements were performed with the EUT in Bluetooth mode and in its normal search mode.

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

The EUT was tested in the following configuration:

Standalone.

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

Range of Measurements	Specification Reference	Port Type	Compliance Status
Idle Mode Radiated Spurious Emissions	C.F.R. 47 FCC Part 15: 2004 Section 15.109	Antenna	Complied
Transmitter 20 dB Bandwidth	C.F.R. 47 FCC Part 15: 2004 Section 15.247(a)(1)	Antenna Terminals	Complied
Transmitter Carrier Frequency Separation	C.F.R. 47 FCC Part 15: 2004 Section 15.247(a)(1)	Antenna Terminals	Complied
Transmitter Average Time of Occupancy	C.F.R. 47 FCC Part 15: 2004 Section 15.247(a)(1)(iii)	Antenna Terminals	Complied
Transmitter Maximum Peak Output Power	C.F.R. 47 FCC Part 15: 2004 Section 15.247(b)(1)	Antenna Terminals	Complied
Transmitter Conducted Emissions	C.F.R. 47 FCC Part 15: 2004 Section 15.247(d)	Antenna Terminals	Complied
Transmitter Radiated Emissions	C.F.R. 47 FCC Part 15: 2004 Sections 15.247(d) & 15.209(a)	Antenna	Complied
Transmitter Band Edge Conducted Emissions	C.F.R. 47 FCC Part 15: 2004 Section 15.247(d)	Antenna Terminals	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, England.

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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 Radiated Spurious Emissions: Section 15.109 - Electric Field Strength Measurements (Frequency Range: 30 to 1000 MHz)**

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:**

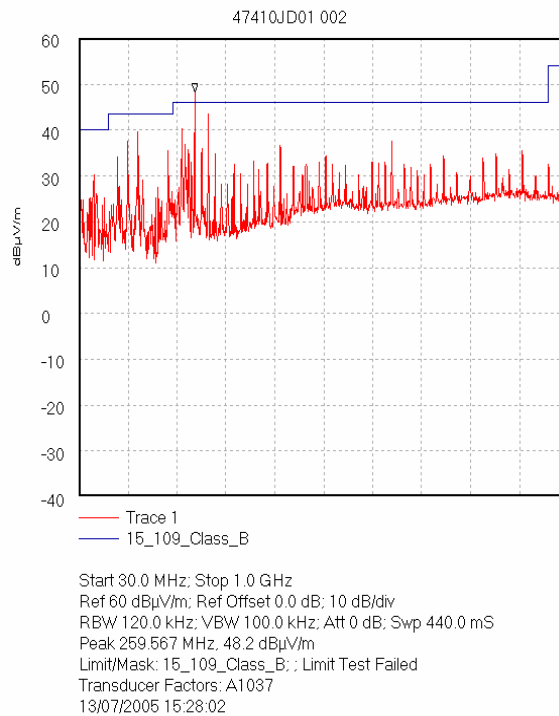
Frequency (MHz)	Antenna Polarity	Q-P Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
126.641	Vert.	39.3	43.5	4.2	Complied
146.656	Vert.	40.0	43.5	3.5	Complied
206.658	Vert.	35.5	43.5	8.0	Complied
233.991	Vert.	36.9	46.0	9.1	Complied
259.990	Vert.	39.5	46.0	6.5	Complied
285.983	Horiz.	41.3	46.0	4.7	Complied
298.989	Vert.	35.5	46.0	10.5	Complied
337.981	Vert.	32.6	46.0	13.4	Complied
403.008	Vert.	27.2	46.0	18.8	Complied
428.983	Vert.	25.1	46.0	20.9	Complied
480.962	Vert.	24.6	46.0	21.4	Complied
519.976	Horiz.	40.1	46.0	5.9	Complied
754.006	Vert.	30.0	46.0	16.0	Complied
857.988	Vert.	33.1	46.0	12.9	Complied
909.981	Vert.	32.0	46.0	14.0	Complied

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**Idle Mode Radiated Spurious Emissions: Section 15.109 - Electric Field Strength Measurements (Frequency Range: 30 to 1000 MHz) (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 - Electric Field Strength Measurements (Frequency Range: 1 to 12.5 GHz)**

**Results:**

**Highest Peak Level:**

Frequency (GHz)	Antenna Polarity	Detector Level (dBμV)	Antenna Factor (dB)	Cable Loss (dB)	Actual Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
4.2706	Vert.	9.3	24.2	2.0	35.5	74.0	38.5	Complied

**Highest Average Level:**

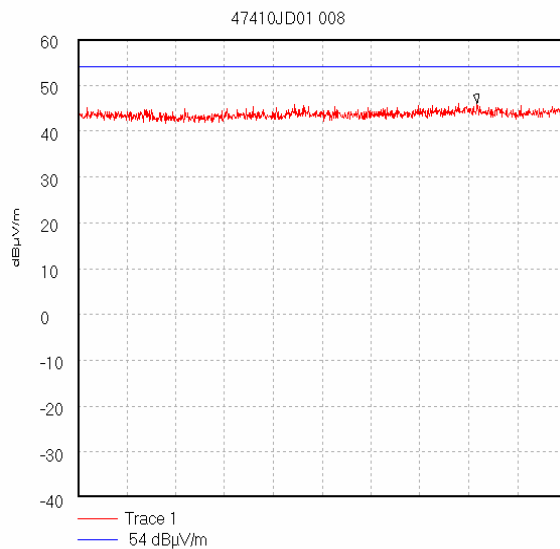
Frequency (GHz)	Antenna Polarity	Detector Level (dBμV)	Antenna Factor (dB)	Cable Loss (dB)	Actual Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
4.2706	Vert.	-10.6	24.2	2.0	15.6	54.0	38.4	Complied

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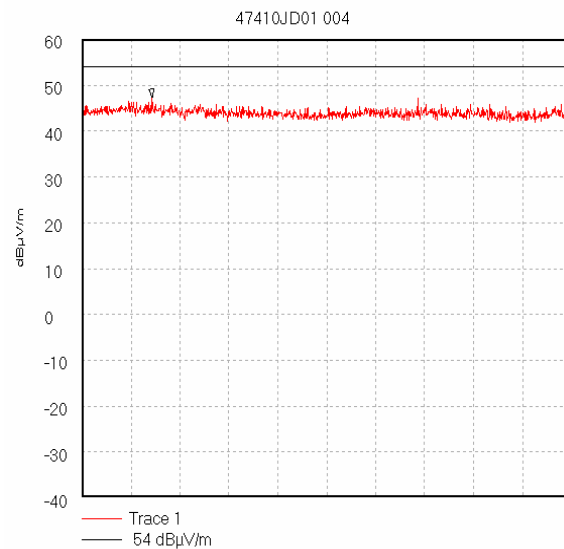


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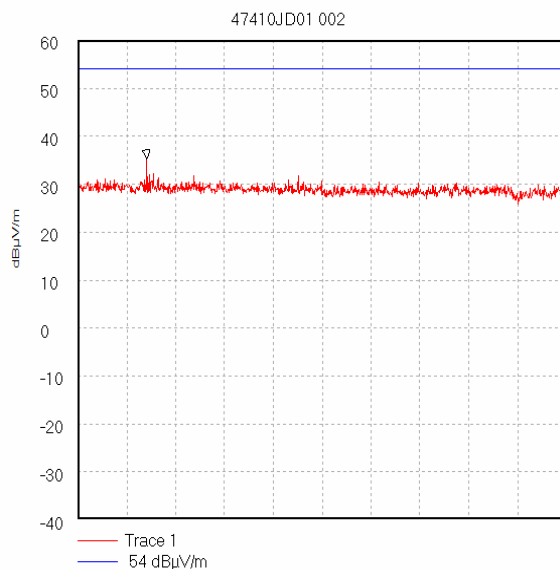
**Idle Mode Radiated Spurious Emissions: Section 15.109 - Electric Field Strength Measurements (Frequency Range: 1 to 12.5 GHz) (Continued)**



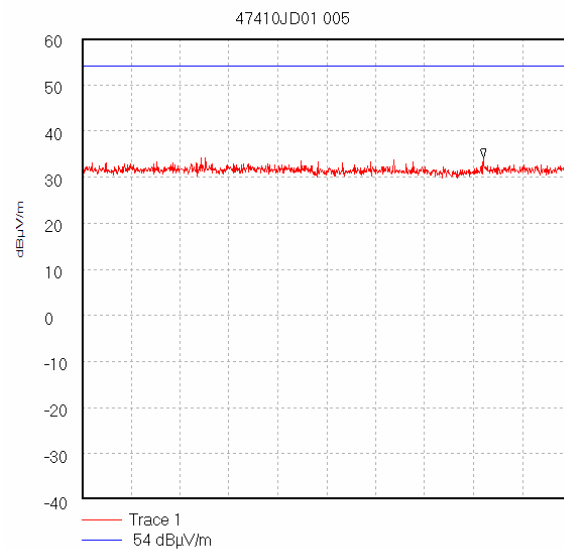
Start 1.0 GHz; Stop 2.0 GHz  
Ref 60 dBµV/m; Ref Offset 0.0 dB; 10 dB/div  
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS  
Peak 1.818 GHz; 46.09 dBµV/m  
Display Line: 54 dBµV/m;  
Transducer Factors: 1 to 2  
13/07/2005 16:11:26



Start 2.0 GHz; Stop 4.0 GHz  
Ref 60 dBµV/m; Ref Offset 0.0 dB; 10 dB/div  
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS  
Peak 2.287 GHz; 47.28 dBµV/m  
Display Line: 54 dBµV/m;  
Transducer Factors: 2 to 4  
13/07/2005 15:54:20



Start 4.0 GHz; Stop 6.0 GHz  
Ref 60 dBµV/m; Ref Offset -12.5 dB; 10 dB/div  
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS  
Peak 4.282 GHz; 35.35 dBµV/m  
Display Line: 54 dBµV/m;  
18/07/2005 16:11:07

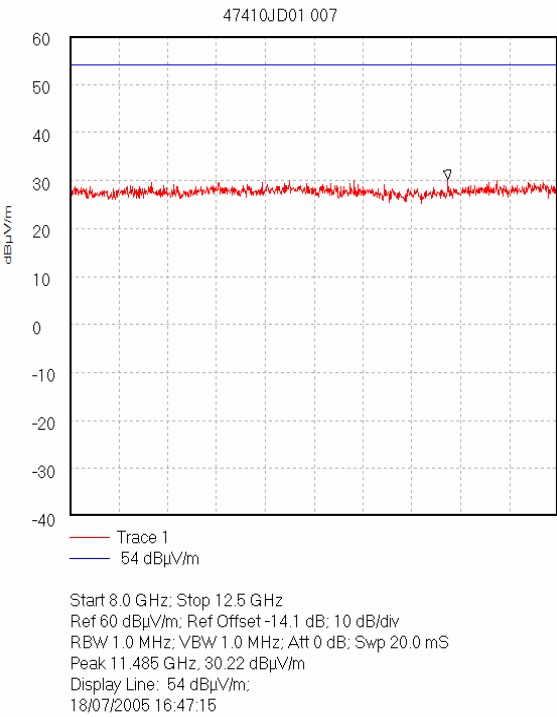


Start 6.0 GHz; Stop 8.0 GHz  
Ref 60 dBµV/m; Ref Offset -10.3 dB; 10 dB/div  
RBW 1.0 MHz; VBW 1.0 MHz; Att 10 dB; Swp 20.0 mS  
Peak 7.642 GHz; 34.21 dBµV/m  
Display Line: 54 dBµV/m;  
18/07/2005 16:32:10

**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 - Electric Field Strength Measurements (Frequency Range: 1 to 12.5 GHz) (Continued)**



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

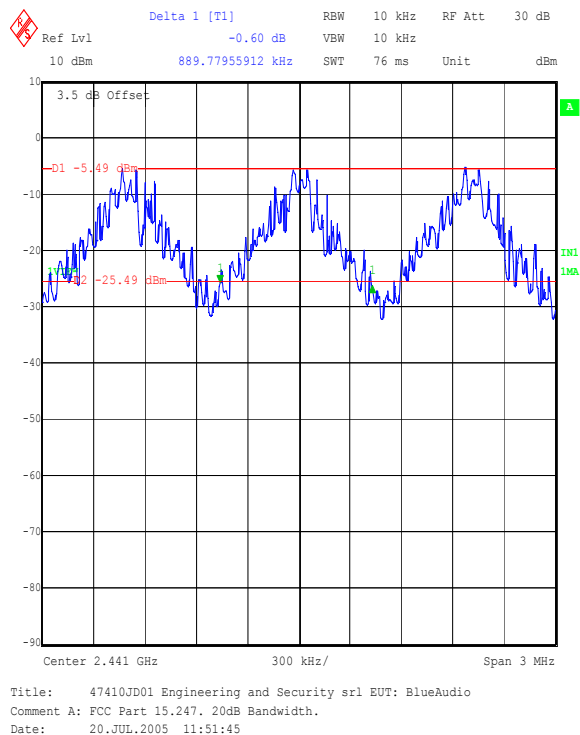
Test of: Engineering and Security srl.  
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### 7.2.3. Transmitter 20 dB Bandwidth: Section 12.247(a)(1)

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)
889.780	None Specified



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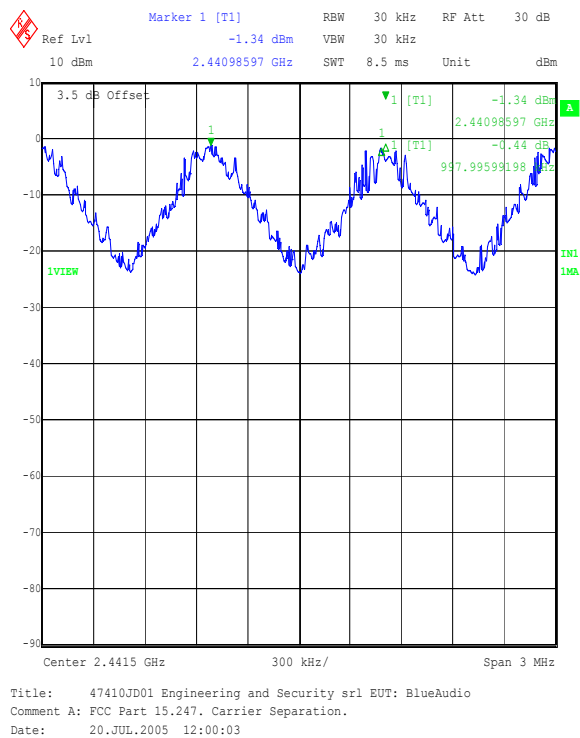
#### 7.2.4. Transmitter Carrier Frequency Separation: Section 15.247(a)(1)

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 ( $\geq 25$ kHz or $\geq 20$ dB or $\geq \frac{2}{3}$ of 20 dB BW) (kHz)	Margin (kHz)	Result
997.996	593.187	404.809	Complied



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**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 a period of                      seconds.

**Results:**

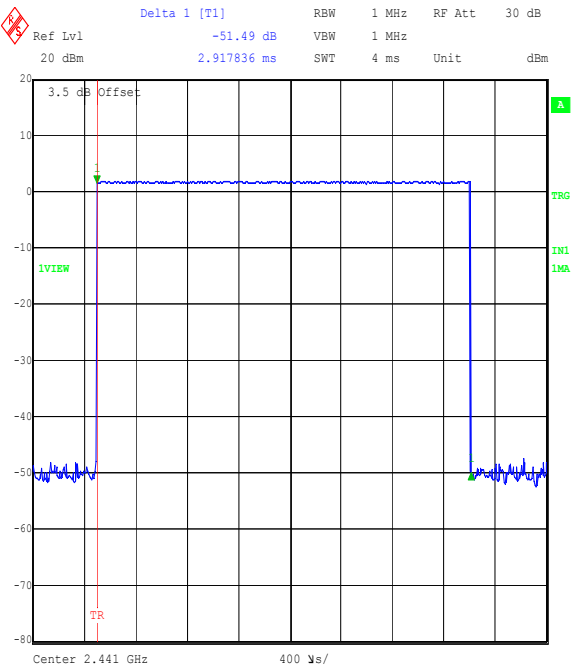
Emission Width (μs)	Number of Hops in 32 Seconds	Average Time of Occupancy (s)	Limit (s)	Margin (s)	Result
2917.836	84	0.245	0.4	0.155	Complied

**Note(s):**

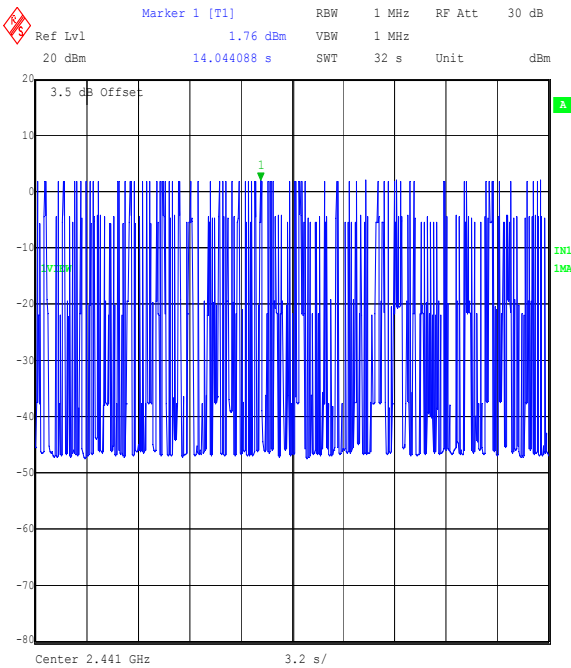
1. Tests were performed to identify the average time of occupancy ( $\leq 0.4$  seconds) and the number of channels used (which must be  $\geq 15$ ) in a 31.6 second period.
-

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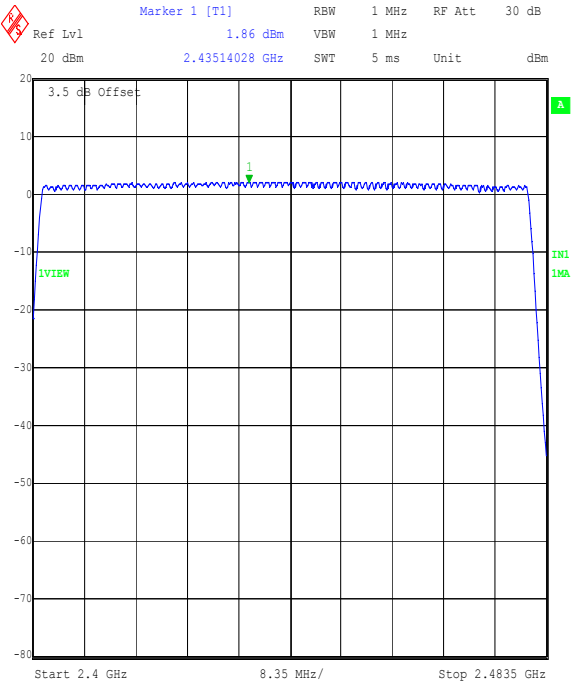
Transmitter Average Time of Occupancy: Section 15.247(a)(1) ((iii))



Title: 47410JD01 Engineering and Security srl EUT: BlueAudio  
Comment A: FCC Part 15.247. Centre of Hopping Channel. Emission Width.  
Date: 20.JUL.2005 11:30:34



Title: 47410JD01 Engineering and Security srl EUT: BlueAudio  
Comment A: FCC Part 15.247. Centre of Hopping Channel. 31.6s hops.  
Date: 20.JUL.2005 11:37:53



Comment A: Hopping on all channels. No of Hops.  
Date: 20.JUL.2005 10:39:06

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#### **7.2.6. Transmitter Maximum Peak Output Power: 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 (ERP) of the EUT.

#### **Results:**

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

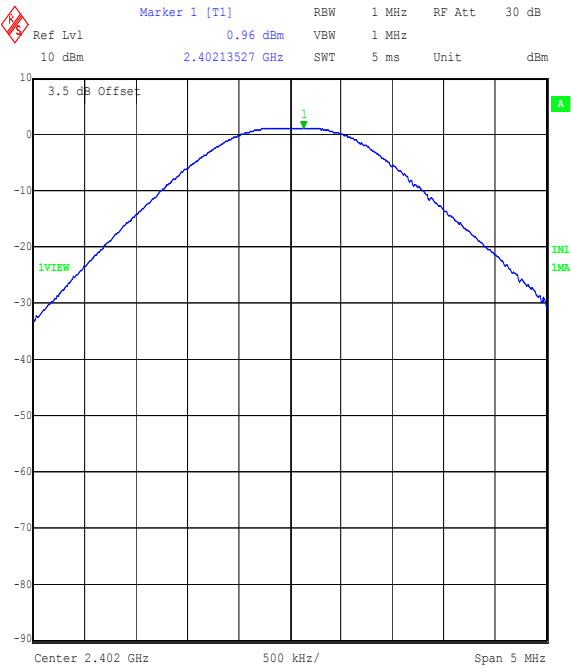
Channel	Conducted RF O/P Power (dBm)	Stated Antenna Gain (dB)	ERP or EIRP (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	1.0	0	1.0	30.0	29.0	Complied
Middle	1.4	0	1.4	30.0	28.6	Complied
Top	0.9	0	0.9	30.0	29.1	Complied

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

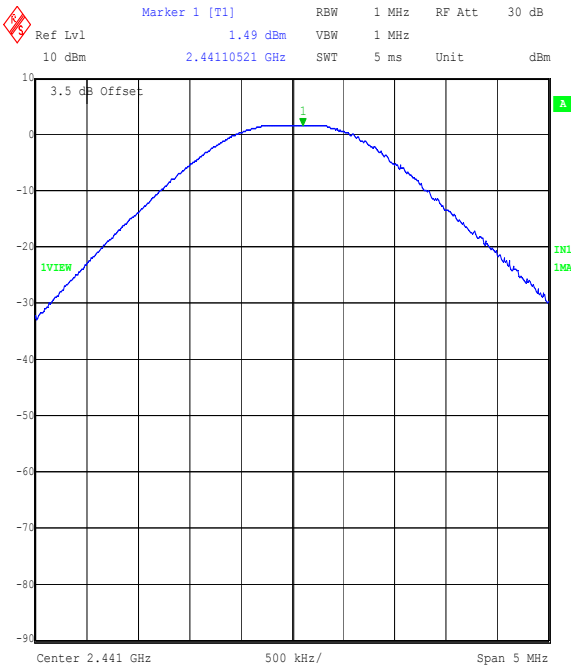
1. As per the requirements of Public Notice DA 00-705, the stated antenna gain of the EUT (0 dBi) when added to the highest (worst case) measured conducted peak of 1.4 dBm (from the table above) gives a de facto EIRP of 1.4 dBm. This is in compliance with the requirements of Section 15.247(b)(1) for de facto EIRP limitation, i.e. 1 watt (30 dBm).

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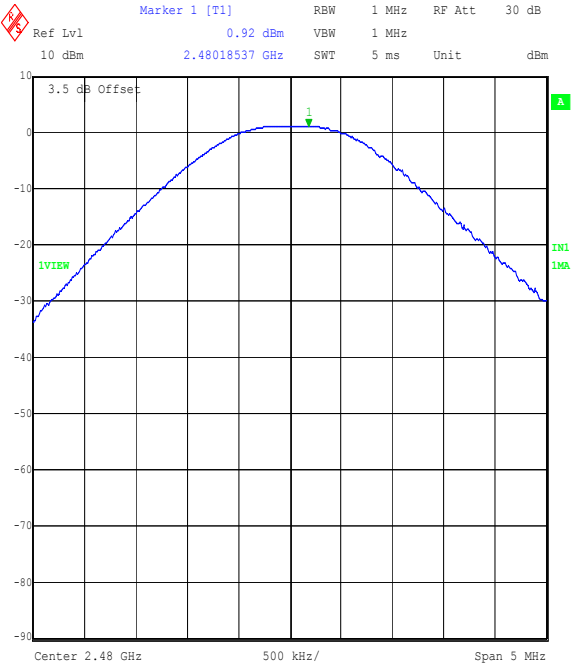
Transmitter Maximum Peak Output Power: Section 15.247(b)(3) (Continued)



Title: 47410JD01 Engineering and Security srl EUT: BlueAudio  
Comment A: FCC Part 15.247. Peak Output Power Bottom Channel.  
Date: 20.JUL.2005 11:45:42



Title: 47410JD01 Engineering and Security srl EUT: BlueAudio  
Comment A: FCC Part 15.247. Peak Output Power Middle Channel.  
Date: 20.JUL.2005 11:46:36



Title: 47410JD01 Engineering and Security srl EUT: BlueAudio  
Comment A: FCC Part 15.247. Peak Output Power Top Channel.  
Date: 20.JUL.2005 11:47:09



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### **7.2.7. Transmitter Conducted Emissions: Section 15.247(d)**

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

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

The limit lines shown in the plots below are set to a level 20 dB below the measured highest fundamental peak power.

### **Results:**

#### **Bottom Channel**

Frequency (MHz)	Peak Emission Level (dBm)	Peak Emission Level (dBc)	Limit (dBc)	Margin (dB)	Result
142.988	-70.8	-71.8	-20.0	51.8	Complied
599.985	-76.0	-77.0	-20.0	57.0	Complied
2245.832	-64.1	-65.1	-20.0	45.1	Complied
2557.847	-63.7	-64.7	-20.0	44.7	Complied
4803.687	-61.2	-62.2	-20.0	42.2	Complied

#### **Middle Channel**

Frequency (MHz)	Peak Emission Level (dBm)	Peak Emission Level (dBc)	Limit (dBc)	Margin (dB)	Result
142.997	-70.6	-72.0	-20.0	52.0	Complied
609.991	-72.6	-74.0	-20.0	54.0	Complied
2284.874	-64.4	-65.8	-20.0	45.8	Complied
2596.831	-64.5	-65.9	-20.0	45.9	Complied
4881.748	-62.5	-63.9	-20.0	43.9	Complied

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**Transmitter Conducted Emissions: Section 15.247(d) (Continued)****Top Channel**

Frequency (MHz)	Peak Emission Level (dBm)	Peak Emission Level (dBc)	Limit (dBc)	Margin (dB)	Result
143.000	-51.4	-50.5	-20.0	30.5	Complied
620.007	-76.1	-77.0	-20.0	57.0	Complied
2323.847	-69.4	-70.3	-20.0	50.3	Complied
2635.815	-65.3	-66.2	-20.0	46.2	Complied
4959.684	-66.0	-66.9	-20.0	46.9	Complied

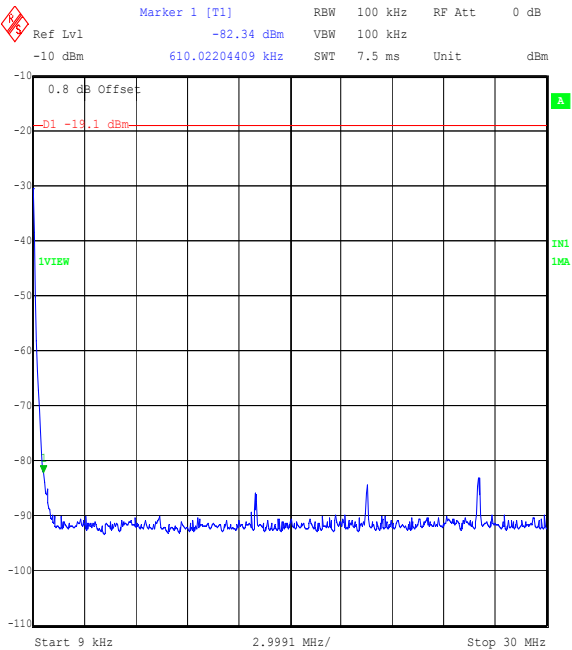
**Hopping Channel**

Frequency (MHz)	Peak Emission Level (dBm)	Peak Emission Level (dBc)	Limit (dBc)	Margin (dB)	Result
142.998	-70.5	-71.9	-20.0	51.9	Complied
610.030	-72.4	-73.8	-20.0	53.8	Complied
2324.379	-64.0	-65.4	-20.0	45.4	Complied
2561.971	-64.7	-66.1	-20.0	46.1	Complied
4818.341	-61.5	-62.4	-20.0	42.4	Complied

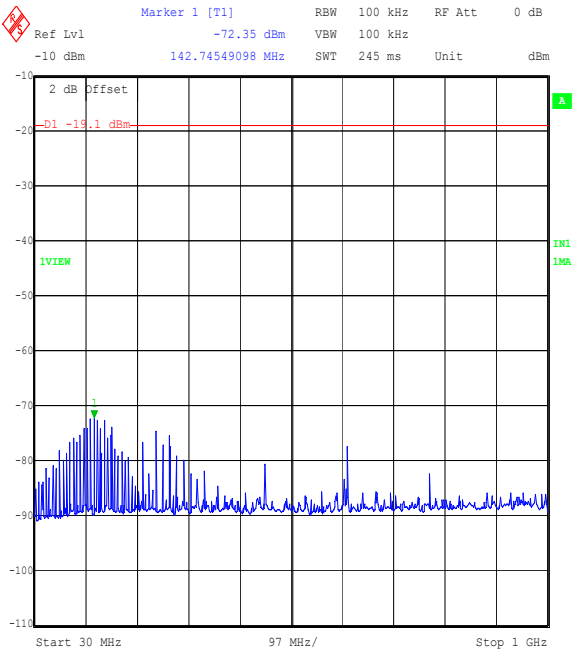
---

Test of: Engineering and Security srl.  
Blue Audio.  
To: FCC Part 15.247: 2004 (Subpart C)

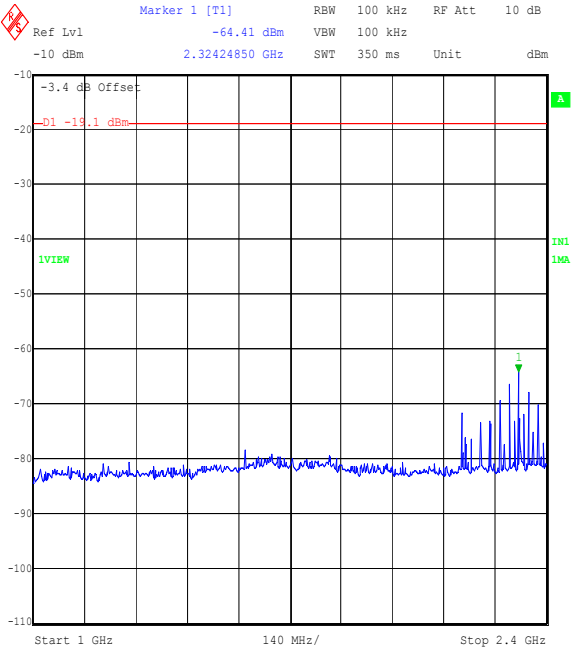
Transmitter Conducted Emissions: Section 15.247(d) (Continued)



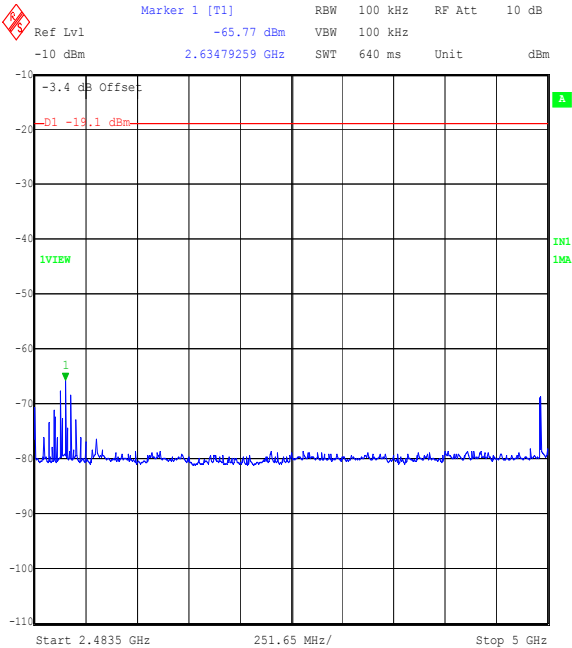
Title: 47410JD01 Engineering and Security srl EUT: BlueAudio  
Comment A: FCC Part 15.247. Transmitter Conducted Emissions EUT Operating on Top Channel.  
Date: 20.JUL.2005 14:07:51



Title: 47410JD01 Engineering and Security srl EUT: BlueAudio  
Comment A: FCC Part 15.247. Transmitter Conducted Emissions EUT Operating on Top Channel.  
Date: 20.JUL.2005 14:38:43



Title: 47410JD01 Engineering and Security srl EUT: BlueAudio  
Comment A: FCC Part 15.247. Transmitter Conducted Emissions EUT Operating on Top Channel.  
Date: 20.JUL.2005 14:40:19

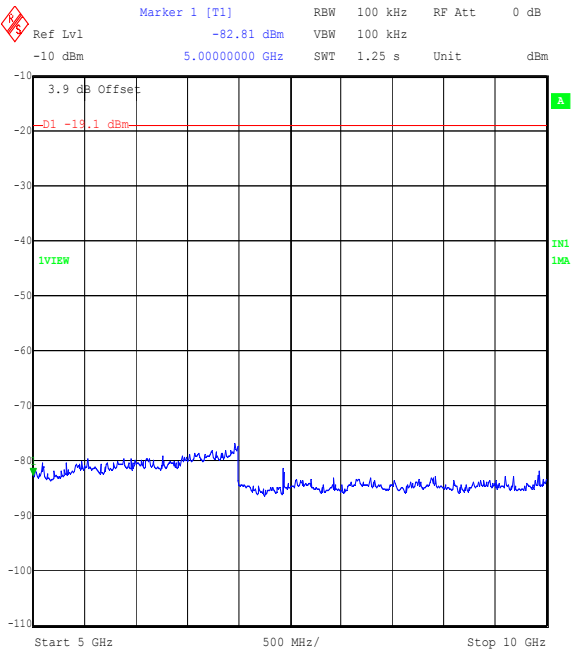


Title: 47410JD01 Engineering and Security srl EUT: BlueAudio  
Comment A: FCC Part 15.247. Transmitter Conducted Emissions EUT Operating on Top Channel.  
Date: 20.JUL.2005 14:48:59

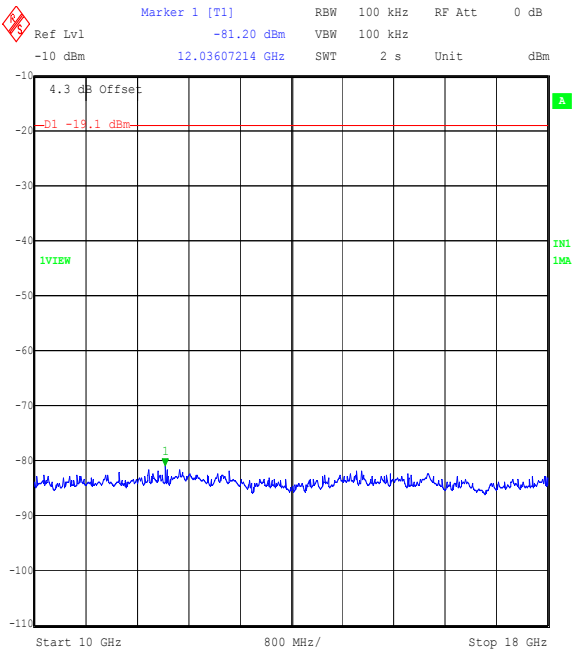
Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

Test of: Engineering and Security srl.  
Blue Audio.  
To: FCC Part 15.247: 2004 (Subpart C)

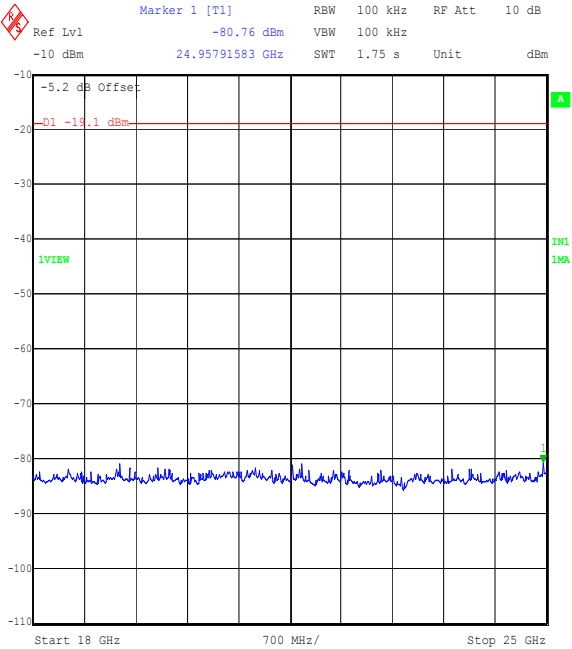
Transmitter Conducted Emissions: Section 15.247(d) (Continued)



Title: 47410JD01 Engineering and Security srl EUT: BlueAudio  
Comment A: FCC Part 15.247. Transmitter Conducted Emissions EUT Operati  
ng on Top Channel.  
Date: 20.JUL.2005 14:57:52



Title: 47410JD01 Engineering and Security srl EUT: BlueAudio  
Comment A: FCC Part 15.247. Transmitter Conducted Emissions EUT Operati  
ng on Top Channel.  
Date: 20.JUL.2005 14:58:58



Title: 47410JD01 Engineering and Security srl EUT: BlueAudio  
Comment A: FCC Part 15.247. Transmitter Conducted Emissions EUT Operati  
ng on Top Channel.  
Date: 20.JUL.2005 15:00:08

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

Test of: Engineering and Security srl.  
Blue Audio.  
To: FCC Part 15.247: 2004 (Subpart C)

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**7.2.8. Transmitter Radiated Emissions: Section 15.247(d) and 15.209(a) - Electric Field Strength Measurements: 30 to 1000 MHz (emissions occurring in the restricted bands)**

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:**

**Top Channel**

Frequency (MHz)	Antenna Polarity	Q-P Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
126.6406	Vert.	39.3	43.5	4.2	Complied
259.9899	Vert.	39.5	46.0	6.5	Complied
403.0008	Vert.	26.5	46.0	19.5	Complied

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Blue Audio.  
To: FCC Part 15.247: 2004 (Subpart C)

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**7.2.9. Transmitter Radiated Emissions: Section 15.247(d) and 15.209(a) - Electric Field Strength Measurements: 30 to 1000 MHz (emissions outside the restricted bands)**

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:**

**Top Channel**

Frequency (MHz)	Antenna Polarity	Peak Level (dB $\mu$ V/m)	-20 dBc Limit (dB $\mu$ V/m)	Margin (dB)	Result
146.656	Vert.	40.3	76.6	36.3	Complied
206.658	Vert.	35.0	76.6	41.6	Complied
233.991	Vert.	37.7	76.6	38.9	Complied
285.983	Horiz.	43.0	76.6	33.6	Complied
298.989	Vert.	35.2	76.6	41.4	Complied
337.981	Vert.	32.6	76.6	44.0	Complied
428.983	Vert.	25.8	76.6	50.8	Complied
480.962	Vert.	23.1	76.6	53.5	Complied
519.976	Horiz.	40.1	76.6	36.5	Complied
545.998	Vert.	23.0	76.6	53.6	Complied
727.980	Vert.	28.9	76.6	47.7	Complied
883.978	Vert.	34.5	76.6	42.1	Complied

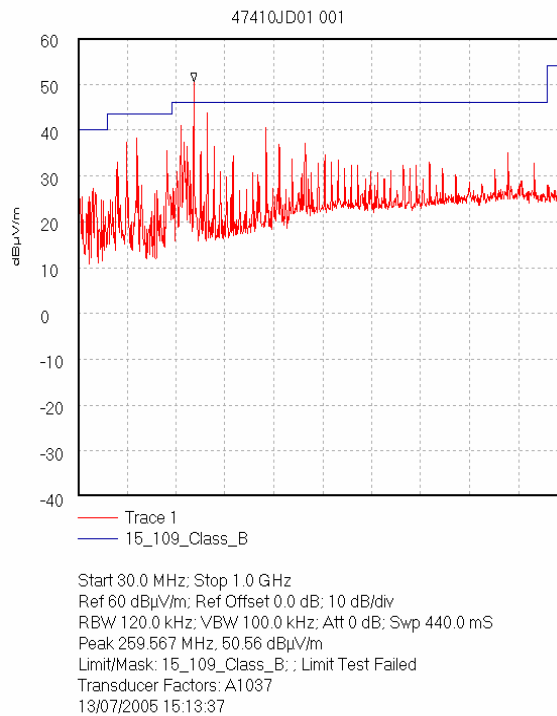
**Note(s):**

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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Blue Audio.  
To: FCC Part 15.247: 2004 (Subpart C)

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**Transmitter Radiated Emissions: Section 15.247(d) and 15.209(a) - Electric Field Strength Measurements: 30 to 1000 MHz (emissions outside the restricted bands) (Continued)**



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

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Test of: Engineering and Security srl.  
Blue Audio.  
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**7.2.10. Transmitter Radiated Emissions: Section 15.247(d) and 15.209(a) - Electric Field Strength Measurements (Frequency Range: 1 to 25.0 GHz) (emissions occurring in the restricted bands)**

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:**

**Highest Peak Level: Bottom Channel**

Frequency (GHz)	Antenna Polarity	Detector Level (dB $\mu$ V)	Antenna Factor (dB)	Cable Loss (dB)	Actual Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
4.8040	Vert.	12.2	24.2	2.0	38.4	74.0	35.6	Complied

**Highest Average Level: Bottom Channel**

Frequency (GHz)	Antenna Polarity	Detector Level (dB $\mu$ V)	Antenna Factor (dB)	Cable Loss (dB)	Actual Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
4.8040	Vert.	-2.4	24.2	2.0	23.8	54.0	30.2	Complied

**Highest Peak Level: Middle Channel**

Frequency (GHz)	Antenna Polarity	Detector Level (dB $\mu$ V)	Antenna Factor (dB)	Cable Loss (dB)	Actual Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
4.8819	Vert.	14.1	24.2	2.0	40.3	74.0	33.7	Complied

**Highest Average Level: Middle Channel**

Frequency (GHz)	Antenna Polarity	Detector Level (dB $\mu$ V)	Antenna Factor (dB)	Cable Loss (dB)	Actual Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
4.8819	Vert.	-2.8	24.2	2.0	23.4	54.0	30.6	Complied



Test of: Engineering and Security srl.  
Blue Audio.  
To: FCC Part 15.247: 2004 (Subpart C)

**Transmitter Radiated Emissions: Section 15.247(d) and 15.209(a) - Electric Field Strength Measurements (Frequency Range: 1 to 25.0 GHz) (emissions occurring in the restricted bands) (Continued)**

**Highest Peak Level: Top Channel**

Frequency (GHz)	Antenna Polarity	Detector Level (dB $\mu$ V)	Antenna Factor (dB)	Cable Loss (dB)	Actual Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
4.9595	Vert.	15.4	24.2	2.0	41.6	74.0	32.4	Complied

**Highest Average Level: Top Channel**

Frequency (GHz)	Antenna Polarity	Detector Level (dB $\mu$ V)	Antenna Factor (dB)	Cable Loss (dB)	Actual Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
4.9595	Vert.	-2.0	24.2	2.0	24.2	54.0	29.8	Complied

**Highest Peak Level: Hopping Channel**

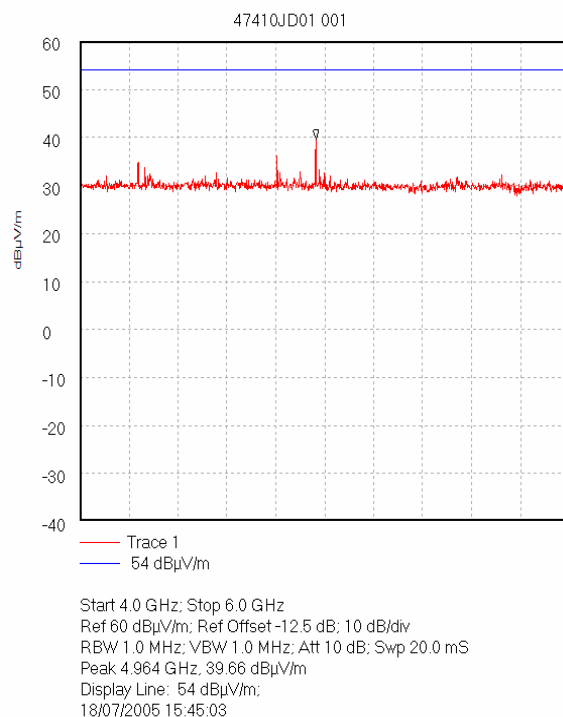
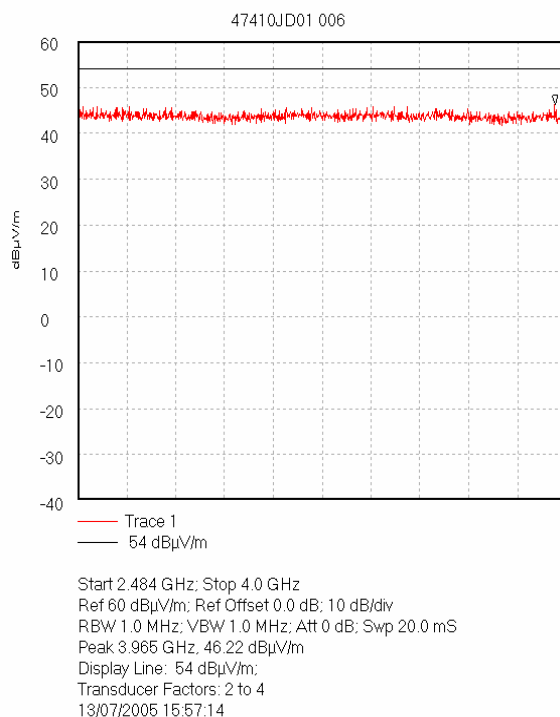
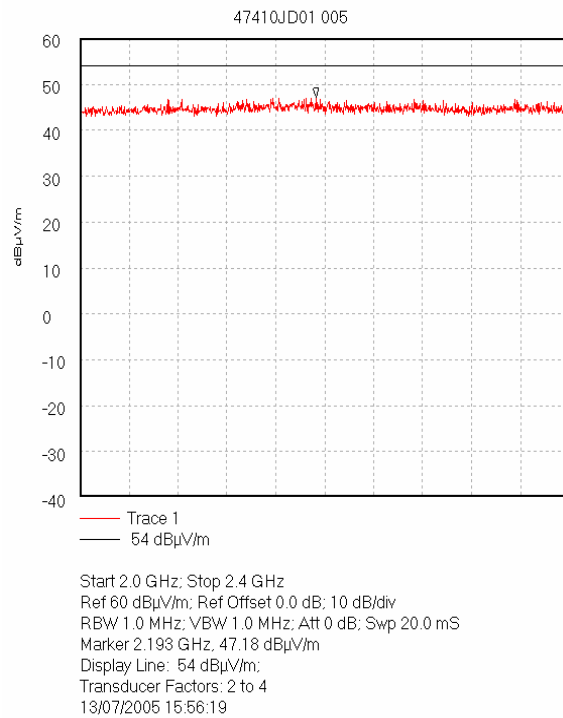
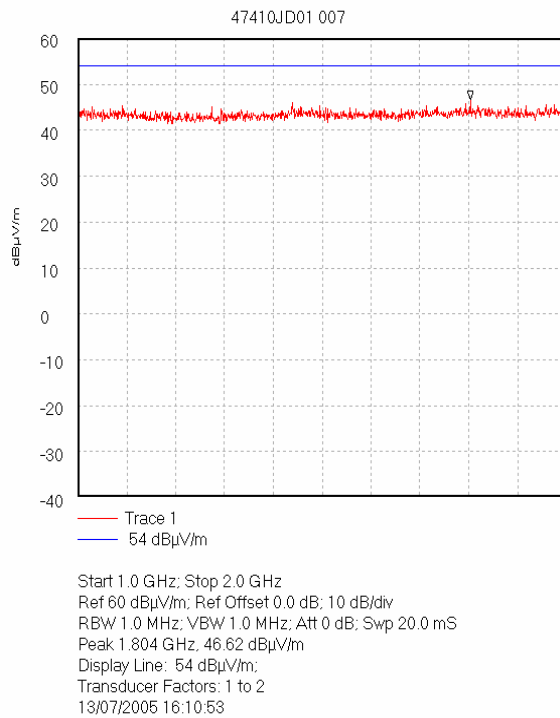
Frequency (GHz)	Antenna Polarity	Detector Level (dB $\mu$ V)	Antenna Factor (dB)	Cable Loss (dB)	Actual Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
4.8713	Vert.	14.5	24.2	2.0	40.7	74.0	33.3	Complied

**Highest Average Level: Hopping Channel**

Frequency (GHz)	Antenna Polarity	Detector Level (dB $\mu$ V)	Antenna Factor (dB)	Cable Loss (dB)	Actual Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
4.8713	Vert.	-7.8	24.2	2.0	18.4	54.0	35.6	Complied

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Blue Audio.  
To: FCC Part 15.247: 2004 (Subpart C)

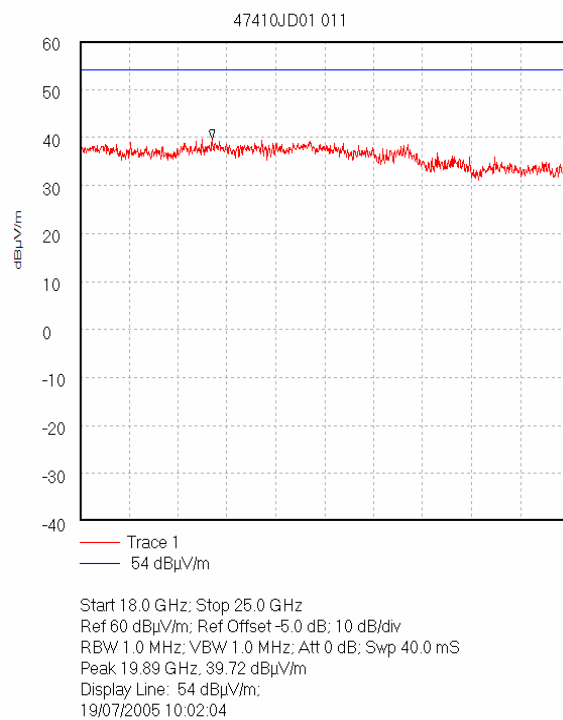
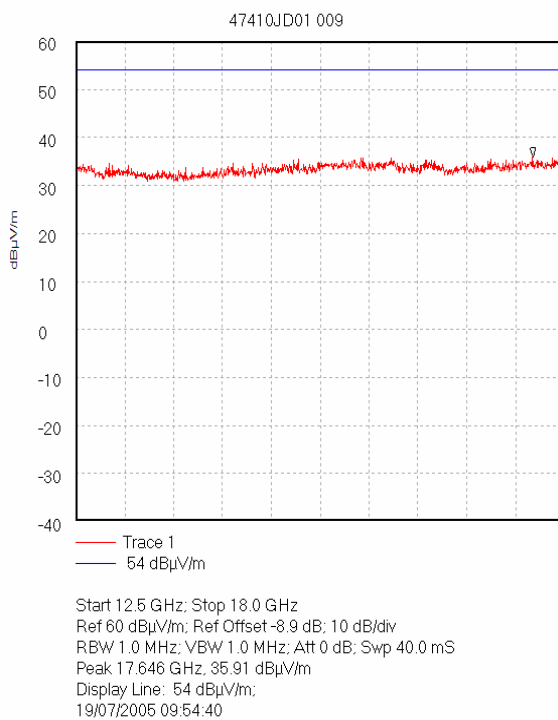
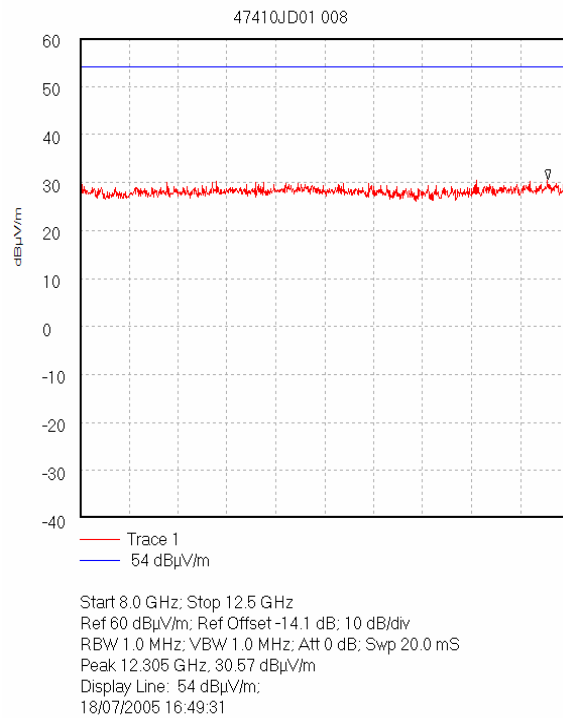
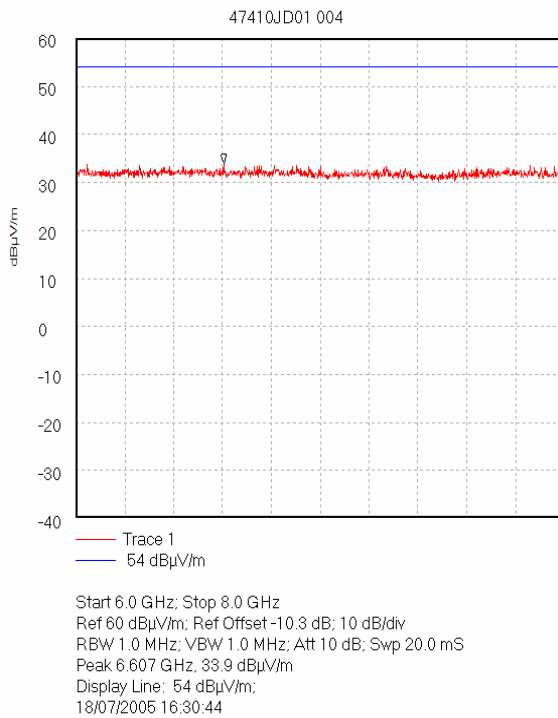
**Transmitter Radiated Emissions: Section 15.247(d) and 15.209(a) - Electric Field Strength Measurements (Frequency Range: 1 to 25.0 GHz) (emissions occurring in the restricted bands) (Continued)**



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

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Blue Audio.  
To: FCC Part 15.247: 2004 (Subpart C)

**Transmitter Radiated Emissions: Section 15.247(d) and 15.209(a) - Electric Field Strength Measurements (Frequency Range: 1 to 25.0 GHz) (emissions occurring in the restricted bands) (Continued)**



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

Test of: Engineering and Security srl.  
Blue Audio.  
To: FCC Part 15.247: 2004 (Subpart C)

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#### **7.2.11. Transmitter Band Edge Conducted Emissions: Section 15.247(d)**

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

Tests were performed to identify the maximum conducted band edge emission levels.

The limit lines shown in the hopping mode plots below are set to a level 20 dB below the measured fundamental peak power, of the highest power level, contained within the band, in a 100 kHz bandwidth.

The limit lines shown in the static mode plots below are set to a level 20 dB below the measured fundamental peak power, of the channel closest to the lower or upper band edge, in a 100 kHz bandwidth.

#### **Results:**

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

Frequency (MHz)	Peak Emission Level (dBm)	Peak Emission Level (dBc)	Limit (dBc)	Margin (dB)	Result
2400.0	-59.7	-61.1	-20.0	41.1	Complied
2483.5	-65.5	-66.9	-20.0	46.9	Complied

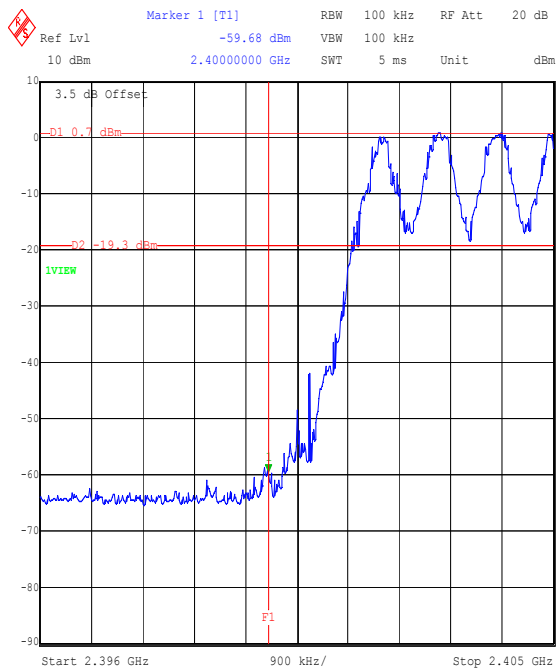
##### **Peak Power Level Static Mode:**

Frequency (MHz)	Peak Emission Level (dBm)	Peak Emission Level (dBc)	Limit (dBc)	Margin (dB)	Result
2400.0	-52.4	-53.4	-20.0	33.4	Complied
2483.5	-63.9	-64.8	-20.0	44.8	Complied

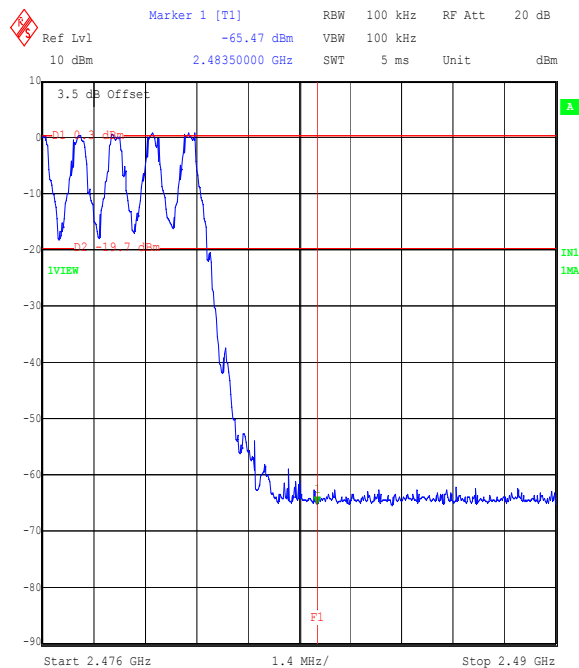
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Test of: Engineering and Security srl.  
Blue Audio.  
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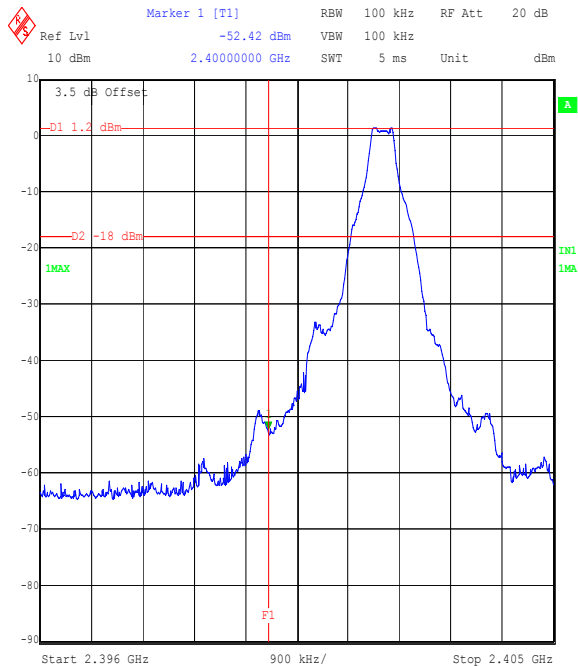
### Transmitter Band Edge Conducted Emissions: Section 15.247(d) (Continued)



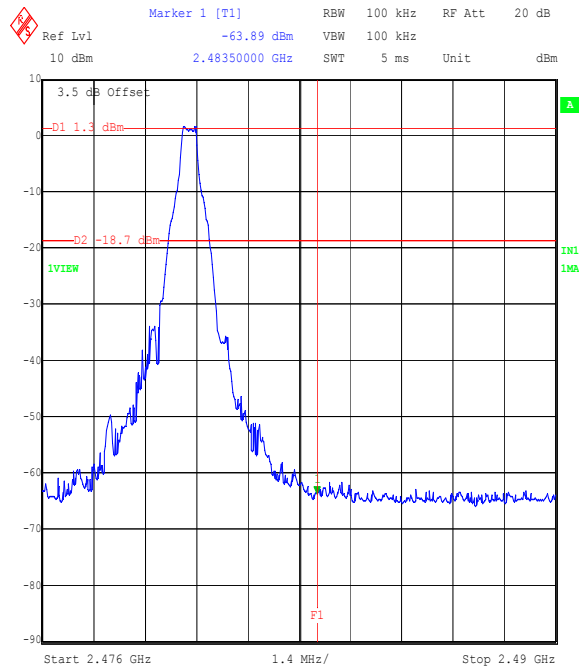
Title: 47410JD01 Engineering and Security srl EUT: BlueAudio  
Comment A: FCC Part 15.247. Cond Band Edge. Hopping on all channels  
Date: 20.JUL.2005 15:55:06



Title: 47410JD01 Engineering and Security srl EUT: BlueAudio  
Comment A: FCC Part 15.247. Cond Band Edge. Hopping on all channels  
Date: 20.JUL.2005 15:56:55



Title: 47410JD01 Engineering and Security srl EUT: BlueAudio  
Comment A: FCC Part 15.247. Cond Band Edge. Static on Bottom Channel.  
Date: 20.JUL.2005 15:52:39



Title: 47410JD01 Engineering and Security srl EUT: BlueAudio  
Comment A: FCC Part 15.247. Cond Band Edge. Static on Top Channel  
Date: 20.JUL.2005 15:58:43

Test of: Engineering and Security srl.  
Blue Audio.  
To: FCC Part 15.247: 2004 (Subpart C)

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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
Transmitter Maximum Peak Output Power	Not applicable	95%	± 0.46 dB
Conducted Emissions Antenna Port	30 MHz to 40 GHz	95%	± 1.2 dB
Transmitter Carrier Frequency Separation	Not applicable	95%	± 0.01 ppm
Transmitter Average Time of Occupancy	Not applicable	95%	± 10 %
20 dB Bandwidth	Not applicable	95%	± 0.12 %
Radiated Spurious Emissions	30 MHz to 1000 MHz	95%	± 5.26 dB
Radiated Spurious Emissions	1 GHz to 40 GHz	95%	± 3.03 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. 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.

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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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## **9.2. Conducted Antenna Port Emissions**

Conducted antenna port emissions measurements were performed using a 100 kHz bandwidth in accordance with the standard against the appropriate limits.

Prior to testing being performed a suitable RF attenuator and cable, were calibrated for the required frequency range. For each measurement range the calibrated level of the attenuator and cable were entered as an offset into the spectrum analyser to compensate for the losses in the measurement set up.

Initial measurements covering the entire measurement band in the form of swept scans were performed in order to identify frequencies on which the EUT was generating interference. This determined the frequencies on which final measurements were necessary. To make the final measurements a peak detector was used in conjunction with the appropriate detector IF measuring bandwidth.

Repetitive scans were performed to allow for emissions with low repetition rates.

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

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

The EUT and spectrum analyser was configured as for conducted antenna port 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 conducted antenna port 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. Peak Output Power**

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

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

To determine the transmitter output power, the EUT was operated at maximum power and a result was obtained from the spectrum analyser using peak detector and trace max hold.

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### **9.6. Band Edge Compliance of RF 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.
A027	Horn Antenna	Eaton	9188-2	301
A031	2 to 4 GHz Eaton Horn Antenna	Eaton	91889-2	557
A1141	HP 11691D	Hewlett Packerd	11691D	1212A02494
A1227	Pre Amplifier	Agilent	8449B	3008A01566
A254	WG 14 Microwave Horn	Flann Microwave	14240-20	139
A259	Bilog Antenna	Chase	CBL6111	1513
A276	OATS Positioning Controller	Rohde & Schwarz	HCC	
A392	3 dB attenuator (9)	Suhner	6803.17.B	None
A428	WG 12 horn	Flann	12240-20	134
A429	WG 16 horn	Flann	16240-20	561
A430	WG 18 horn	Flann	18240-20	425
A436	WG 20 horn	Flann	20240-20	330
A553	Bi-log Antenna	Chase	CBL6111A	1593
M003	Spectrum Monitor	Rohde & Schwarz	EZM	883 580/008
M023	ESVP Receiver	Rohde & Schwarz	ESVP	872 991/027
M028	FSB Spectrum Analyser	Rohde & Schwarz	FSB	860 001/009 (RF), 860 161/007 (Display)
M088	Receiver / Spectrum Analyser System	Rohde & Schwarz	ESBI	DU:835862/018 RU:835387/006
M1122	Boonton Electronics	Boonton Electronics	57340	3297
M1124	Rohde & Schwarz	Rohde & Schwarz	ESIB26	100046K
M1149	Anritsu	Anritsu	MT8852A	6K00001529
M128	Fluke 76 DVM	Fluke	76	65340273
M173	Turntable Controller	R.H.Electrical Services	RH351	3510020
S012	D.C. PSU	INSTEK	PS-6010	9564304
S201	Site 1	RFI	1	
S202	Site 2	RFI	2	S202-15011990
S207	Site 7	RFI	7	3297
S212	Site 12	RFI	12	

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

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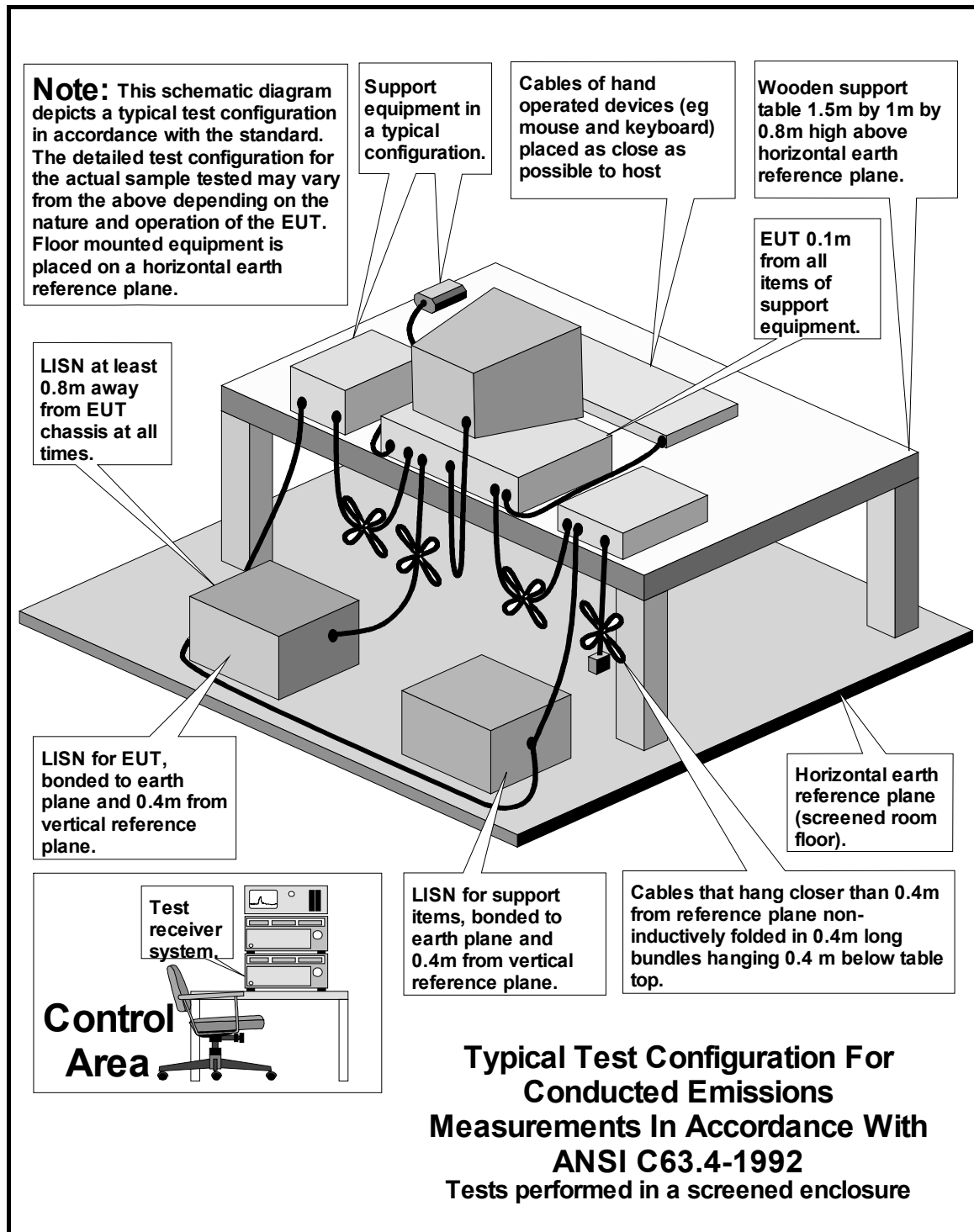
## **Appendix 2. Test Configuration Drawings**

This appendix contains the following drawings:

Drawing Reference Number	Title
DRG\47410JD01\EMICON	Test configuration for measurement of conducted emissions.
DRG\47410JD01\EMIRAD	Test configuration for measurement of radiated emissions.

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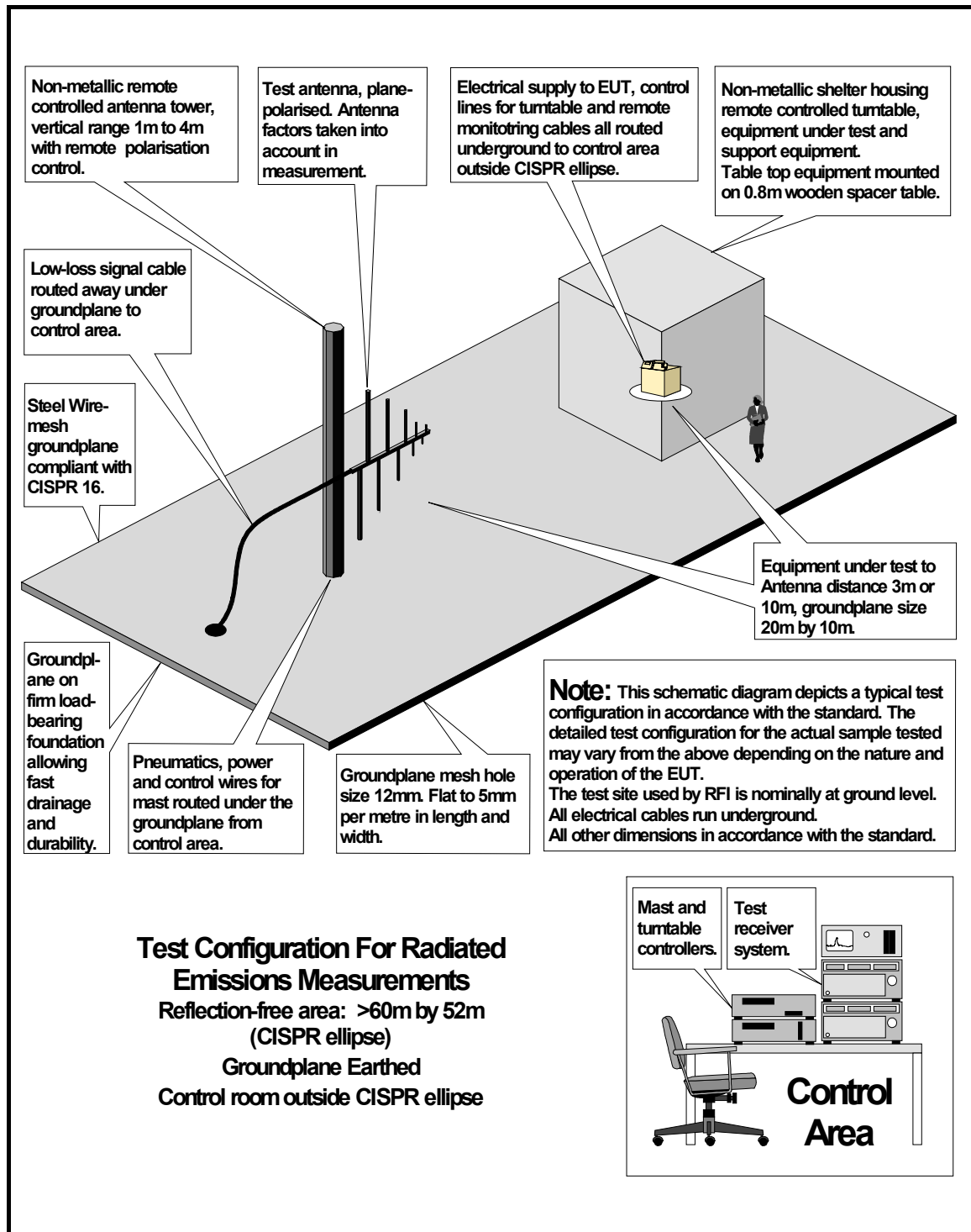
DRG\47410JD01\EMICON





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DRG\47410JD01\EMIRAD



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