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## **REPORT ON**

Limited FCC CFR 47: Part 15 C Testing in support of an  
Application for Grant of Equipment Authorisation  
of a Symbol 41210000 Hand Held Data Terminal

FCC ID: H9P41210000

Report No OR612329/05 Issue 1

October 2004

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support of an Application for Grant of Equipment Authorisation  
of a Symbol 41210000 Hand Held Data Terminal

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**DATED**

12-10-04

**DISTRIBUTION**

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**ENGINEERING STATEMENT**

The measurements shown in this report were made in accordance with the procedures described on test pages. All reported testing was carried out on a sample equipment to demonstrate limited compliance with FCC CFR 47: Part 15 C. The sample tested was found to comply with the requirements defined in the applied rules.

Test Engineers;

  
A Guy

  
G Lawler



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## **SECTION 1**

### **REPORT SUMMARY**

Limited FCC CFR 47: Part 15 C Testing in support of an  
Application for Grant of Equipment Authorisation  
of a Symbol 41210000 Hand Held Data Terminal



## 1.1 STATUS

|                                      |                                                                                                                                                                                                                      |
|--------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| EQUIPMENT UNDER TEST                 | Hand Held Data Terminal                                                                                                                                                                                              |
| OBJECTIVE                            | To undertake measurements to determine the Equipment Under Test's (EUT's) compliance with the specification.                                                                                                         |
| NAME AND ADDRESS OF CLIENT           | Symbol Technologies Inc<br>One Symbol Plaza<br>Holtsville<br>11742-1300, New York<br>United States of America                                                                                                        |
| TYPE NUMBER                          | 41210000                                                                                                                                                                                                             |
| PART NUMBER                          | 412100000                                                                                                                                                                                                            |
| SERIAL NUMBER                        | SAMP-0001 (FCC 2)                                                                                                                                                                                                    |
| HARDWARE VERSION                     | Rev 1 (To be released as Rev A)                                                                                                                                                                                      |
| DECLARED VARIANTS                    | None                                                                                                                                                                                                                 |
| TEST SPECIFICATION<br>ISSUE/DATE     | FCC CFR 47: Part 15, Subpart C<br>October 2003                                                                                                                                                                       |
| NUMBER OF ITEMS TESTED               | One                                                                                                                                                                                                                  |
| SECURITY CLASSIFICATION OF EUT       | Commercial In Confidence                                                                                                                                                                                             |
| INCOMING RELEASE<br>DATE             | Declaration of Build Status<br>10 <sup>th</sup> September 2004                                                                                                                                                       |
| DISPOSAL<br>REFERENCE NUMBER<br>DATE | Held pending disposal<br>Not Applicable<br>Not Applicable                                                                                                                                                            |
| ORDER NUMBER                         | PTP, 17 <sup>th</sup> September 2004                                                                                                                                                                                 |
| START OF TEST                        | 17 <sup>th</sup> September 2004                                                                                                                                                                                      |
| FINISH OF TEST                       | 24 <sup>th</sup> September 2004                                                                                                                                                                                      |
| RELATED DOCUMENTS                    | ANSI C63.4 2001. Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz. FCC Public Notice document (DA 00-705 released 30 March 2000) |



## **1.2 INTRODUCTION**

The information contained within this report is intended to show limited verification of compliance of the Symbol Technologies Inc 41210000 Hand Held Data Terminal to the requirements of FCC Specification Part 15 C.

Testing was carried out in support of an application for Grant of Equipment Authorisation in the name of Symbol Technologies Inc.



### **1.3 PRODUCT INFORMATION**

#### **1.3.1 Technical Description**

The unit supplied for testing was a 41210000 hand held data terminal, which offers 2.4GHz 802.11b Wireless LAN and Bluetooth connectivity.

The terminal utilizes the approved LA-4137 Symbol Compact Flash 802.11b RLAN radio card and the 21-64381 Symbol Bluetooth module. FCC ID numbers are detailed in Section 1.3.4 "Declaration of Build Status".

#### **1.3.2 Modes of Operation**

Modes of operation of the EUT during testing were as follows:

Applicable testing was carried out with the EUT transmitting at maximum power or receiving as detailed in Section 1.3.3 "Test Configuration".

The client has declared that the Symbol 21-64436 (RLAN) and the Symbol 21-64381 (Bluetooth) Modules are co-located, but that they are not capable of simultaneously transmitting.

#### **1.3.3 Test Configuration**

##### **1.3.3.1 RLAN Mode**

The EUT was running the program Symbol Trilogy-24 Diagnostics Test Tool T24CE.exe, which enabled the test engineer to select transmit or receive on the following channels and frequencies;

Channel 1: 2412MHz  
Channel 6: 2437MHz  
Channel 11: 2462MHz

##### **1.3.3.2 Bluetooth Mode**

The EUT was running the program Symbol Bluetooth Test Tool BTTools.exe, which enabled the test engineer to select transmit or receive on the following channels and frequencies;

Channel 2: 2402MHz  
Channel 41: 2441MHz  
Channel 80: 2480MHz



### 1.3.4 DECLARATION OF BUILD STATUS

| MAIN EUT                    |                                                                                                                                                                                                                                                                                            |                                                         |
|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|
| MANUFACTURING DESCRIPTION   | Hand Held Terminal                                                                                                                                                                                                                                                                         |                                                         |
| MANUFACTURER                | Symbol Technologies Inc                                                                                                                                                                                                                                                                    |                                                         |
| TYPE                        | 41210000                                                                                                                                                                                                                                                                                   |                                                         |
| PART NUMBER                 | 412100000                                                                                                                                                                                                                                                                                  |                                                         |
| SERIAL NUMBER               | SAMP-0001 (FCC2) & SAMP-0007 (Dot Spare)                                                                                                                                                                                                                                                   |                                                         |
| HARDWARE VERSION            | Rev 1 (to be released as Rev A)                                                                                                                                                                                                                                                            |                                                         |
| FCC ID                      | H9P41210000                                                                                                                                                                                                                                                                                |                                                         |
| INDUSTRY CANADA ID          | 1549D-41210000                                                                                                                                                                                                                                                                             |                                                         |
| TECHNICAL DESCRIPTION       | <p>The unit supplied for testing was a 41210000 hand held data terminal, which offers 2.4GHz 802.11b Wireless LAN and Bluetooth connectivity.</p> <p>The terminal utilizes the approved LA-4137 Symbol Compact Flash 802.11b RLAN radio card and the 21-64831 Symbol Bluetooth module.</p> |                                                         |
| BATTERY/POWER SUPPLY        |                                                                                                                                                                                                                                                                                            |                                                         |
| CHEMISTRY                   | Li Ion                                                                                                                                                                                                                                                                                     |                                                         |
| PART NUMBER                 | 21-59510-02                                                                                                                                                                                                                                                                                |                                                         |
| VOLTAGE                     | 7.2v                                                                                                                                                                                                                                                                                       |                                                         |
| MODULES                     |                                                                                                                                                                                                                                                                                            |                                                         |
| MANUFACTURING DESCRIPTION   | RLAN Module                                                                                                                                                                                                                                                                                | Bluetooth Marlin Module                                 |
| MANUFACTURER                | Symbol Technologies Inc                                                                                                                                                                                                                                                                    | Symbol Technologies Inc                                 |
| TYPE                        | LA4137                                                                                                                                                                                                                                                                                     | 21-64381                                                |
| TRANSMITTER OPERATING BAND  | 2400-2483.5 MHz                                                                                                                                                                                                                                                                            | 2400-2483.5 MHz                                         |
| RECEIVER OPERATING BAND     | 2400-2483.5 MHz                                                                                                                                                                                                                                                                            | 2400-2483.5 MHz                                         |
| ITU DESIGNATION OF EMISSION | 11M0F1D                                                                                                                                                                                                                                                                                    | 1M00F1D                                                 |
| POWER                       | 100mW                                                                                                                                                                                                                                                                                      | 100mW (restricted in this terminal integration to 1 mW) |
| DHSS/FHSS/COMBINED OR OTHER | DSSS                                                                                                                                                                                                                                                                                       | FHSS                                                    |
| FCC ID                      | H9PLA4137                                                                                                                                                                                                                                                                                  | H9P2164381                                              |

Signature

 Date  
 D of B S Serial No

 10<sup>th</sup> September 2004  
 OS612329-02

The unit used for the internal photographs in this report was not the EUT, but was supplied as an identical unit for photographs only. It is declared as being the same build status as the EUT.

BABT formally certifies that the manufacturer's declaration as reproduced in this report, is a true and accurate record of the original received from the applicant.



#### 1.4 BRIEF SUMMARY OF RESULTS

This report relates only to the actual item/items tested.

A brief summary of the tests carried out is shown below.

| Test | Spec Clause  | Test Description                   | Result | Levels/Comments |
|------|--------------|------------------------------------|--------|-----------------|
| 2.1  | 15.205       | Measurement at Band Edge           | Pass   | RLAN MODE       |
| 2.2  | 15.207       | Conducted Emissions on Power Lines | Pass   | RLAN MODE       |
| 2.3  | 15.247(b)(3) | Maximum Peak Output Power          | Pass   | RLAN MODE       |
| 2.4  | 15.247(c)    | Spurious Radiated Emissions        | Pass   | RLAN MODE       |
| 2.5  | 15.205       | Measurement at Band Edge           | Pass   | BLUETOOTH MODE  |
| 2.6  | 15.207       | Conducted Emissions on Power Lines | Pass   | BLUETOOTH MODE  |
| 2.7  | 15.247(b)(3) | Maximum Peak Output Power          | Pass   | BLUETOOTH MODE  |
| 2.8  | 15.247(c)    | Spurious Radiated Emissions        | Pass   | BLUETOOTH MODE  |



## **1.5 OPINIONS AND INTERPRETATIONS**

Our UKAS Accreditation does not cover opinions and interpretations and any expressed are outside the scope of our UKAS Accreditation.

## **1.6 TEST CONDITIONS**

The EUT was set-up simulating a typical user installation and was tested in accordance with the applicable specification.

For all tests, with the exception of Conducted Emissions on the Power Lines, the Symbol 41210000 Hand Held Data Terminal was powered by its own internal battery.

For Conducted Emissions on Power Lines the EUT was configured as described in Section 1.3.3, but it was powered via a Symbol 41210000 Hand Held Data Terminal Charger, this in turn was powered by a Symbol 50-24000-006 120V, 60Hz Power Supply.

## **1.7 DEVIATIONS FROM THE STANDARD**

Not Applicable.

## **1.8 MODIFICATION RECORD**

Not Applicable.

## **1.9 ALTERNATIVE TEST SITE**

No alternative test site was used.



## **SECTION 2**

### **TEST DETAILS RLAN MODE**

Limited FCC CFR 47: Part 15 C Testing in support of an  
Application for Grant of Equipment Authorisation  
Of a Symbol 41210000 Hand Held Data Terminal



## **2.1 MEASUREMENT AT THE BAND EDGE (MARKER DELTA METHOD)**

### **2.1.1 Specification Reference**

FCC CFR 47: Part 15 Subpart C, Section 15.205

### **2.1.2 Equipment Under Test**

41210000 Hand Held Data Terminal

### **2.1.3 Date of Test**

20<sup>th</sup> September 2004

### **2.1.4 Test Equipment Used**

The major items of test equipment used for the above tests are identified as "Section 2.1" within the Test Equipment Used table shown in Section 3.1.

### **2.1.5 Test Procedure**

Test Performed in accordance with FCC Public Notice document (DA 00-705 released 30 March 2000).



## 2.1 MEASUREMENT AT THE BAND EDGE (MARKER DELTA METHOD) - continued

### 2.1.6 Test Results

The EUT met the requirements of FCC CFR 47: Part 15 Subpart C, Section 15.205 for Band Edge Measurements.

Measurements were made with the EUT in RLAN Mode (see Section 1.3.3 for details).

#### Step 1

Bottom Channel Fundamental Field Strength Measurement.

Peak measurements performed utilising a Resolution Bandwidth and Video Bandwidth of 1MHz.  
Average measurements performed utilising a Resolution Bandwidth of 1MHz and Video Bandwidth of 10Hz.

| Frequency | Antenna Polarisation | Height | Azimuth | Peak Field Strength | Average Field Strength |
|-----------|----------------------|--------|---------|---------------------|------------------------|
| MHz       | H/V                  | cm     | deg     | dB $\mu$ V/m        | dB $\mu$ V/m           |
| 2412      | H                    | 109    | 050     | 107.1               | 98.5                   |

#### Step 2

Determine Marker delta amplitude between 2412MHz (the fundamental) and 2390MHz (the Band Edge under investigation).

Using a span of 30MHz with Resolution Bandwidth and Video Bandwidth of 300kHz.

Marker Delta Amplitude = 51.6dB

#### Step 3

Subtracting the Marker Delta obtained from Step 2 from the 2412MHz Field Strength measurement from Step 1, gives following Result:

Peak of 55.5dB $\mu$ V/m (Limit is 74.0dB $\mu$ V/m)

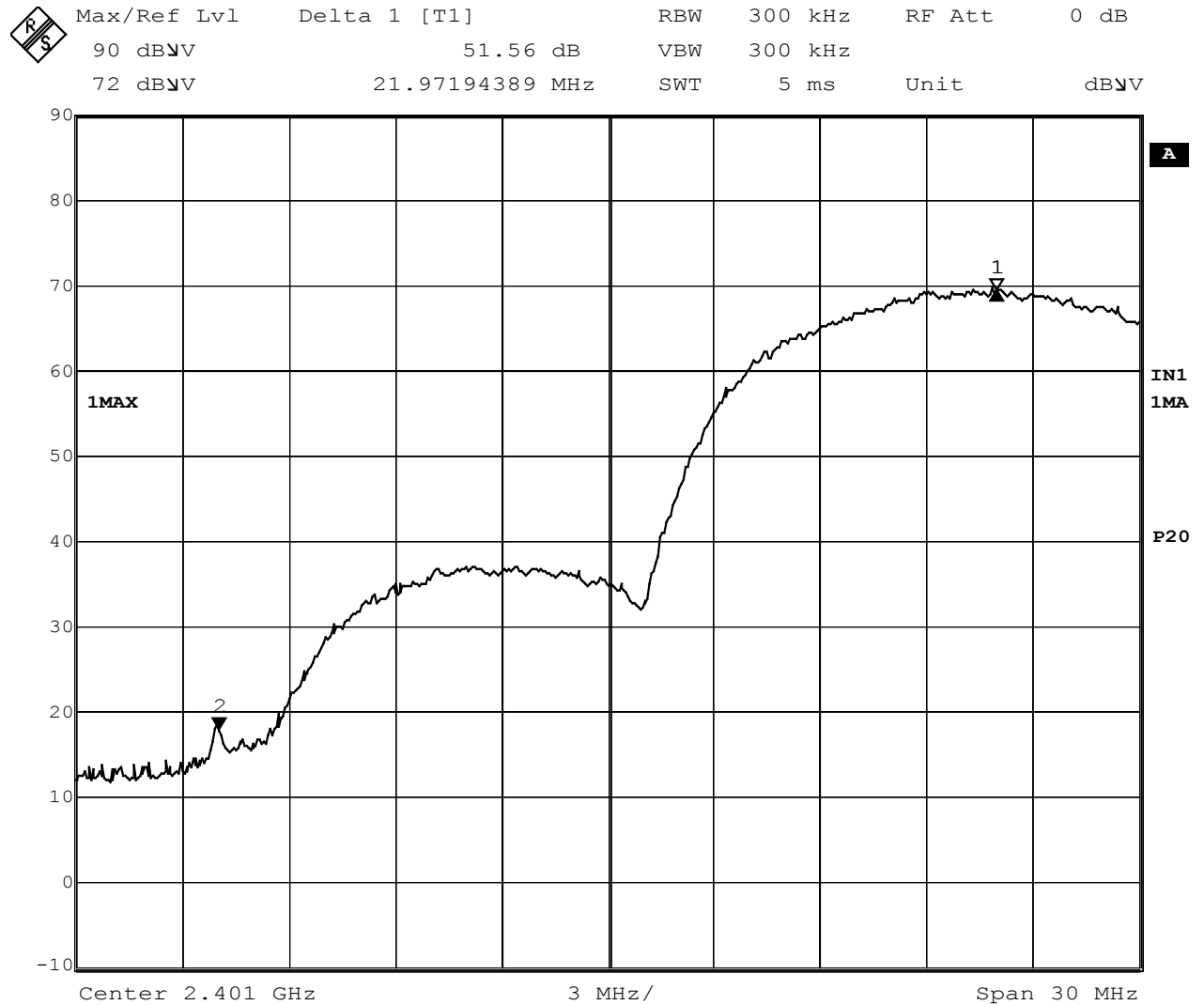
Average of 46.9dB $\mu$ V/m (Limit is 54.0dB $\mu$ V/m)



## 2.1 MEASUREMENT AT THE BAND EDGE (MARKER DELTA METHOD) - continued

### 2.1.6 Test Results - continued

Plot for RLAN Bottom Channel 2412MHz



Date: 20.SEP.2004 23:11:02



## 2.1 MEASUREMENT AT THE BAND EDGE (MARKER DELTA METHOD) - continued

### 2.1.6 Test Results - continued

The EUT met the requirements of FCC CFR 47: Part 15 Subpart C, Section 15.205 for Band Edge Measurements.

Measurements were made with the EUT in RLAN Mode (see Section 1.3.3 for details).

#### Step 1

Top Channel Fundamental Field Strength Measurement.

Peak measurements performed utilising a Resolution Bandwidth and Video Bandwidth of 1MHz.  
Average measurements performed utilising a Resolution Bandwidth of 1MHz and Video Bandwidth of 10Hz.

| Frequency | Antenna Polarisation | Height | Azimuth | Peak Field Strength | Average Field Strength |
|-----------|----------------------|--------|---------|---------------------|------------------------|
| MHz       | H/V                  | cm     | deg     | dB $\mu$ V/m        | dB $\mu$ V/m           |
| 2462      | H                    | 106    | 184     | 108.2               | 98.9                   |

#### Step 2

Determine Marker delta amplitude between 2462MHz (the fundamental) and 2483.5MHz (the Band Edge under investigation).

Using a span of 30MHz with Resolution Bandwidth and Video Bandwidth of 300kHz.

Marker Delta Amplitude = 58.6dB

#### Step 3

Subtracting the Marker Delta obtained from Step 2 from the 2483.5MHz Field Strength measurement from Step 1, gives following Result

Peak of 49.6dB $\mu$ V/m (Limit is 74.0dB $\mu$ V/m)

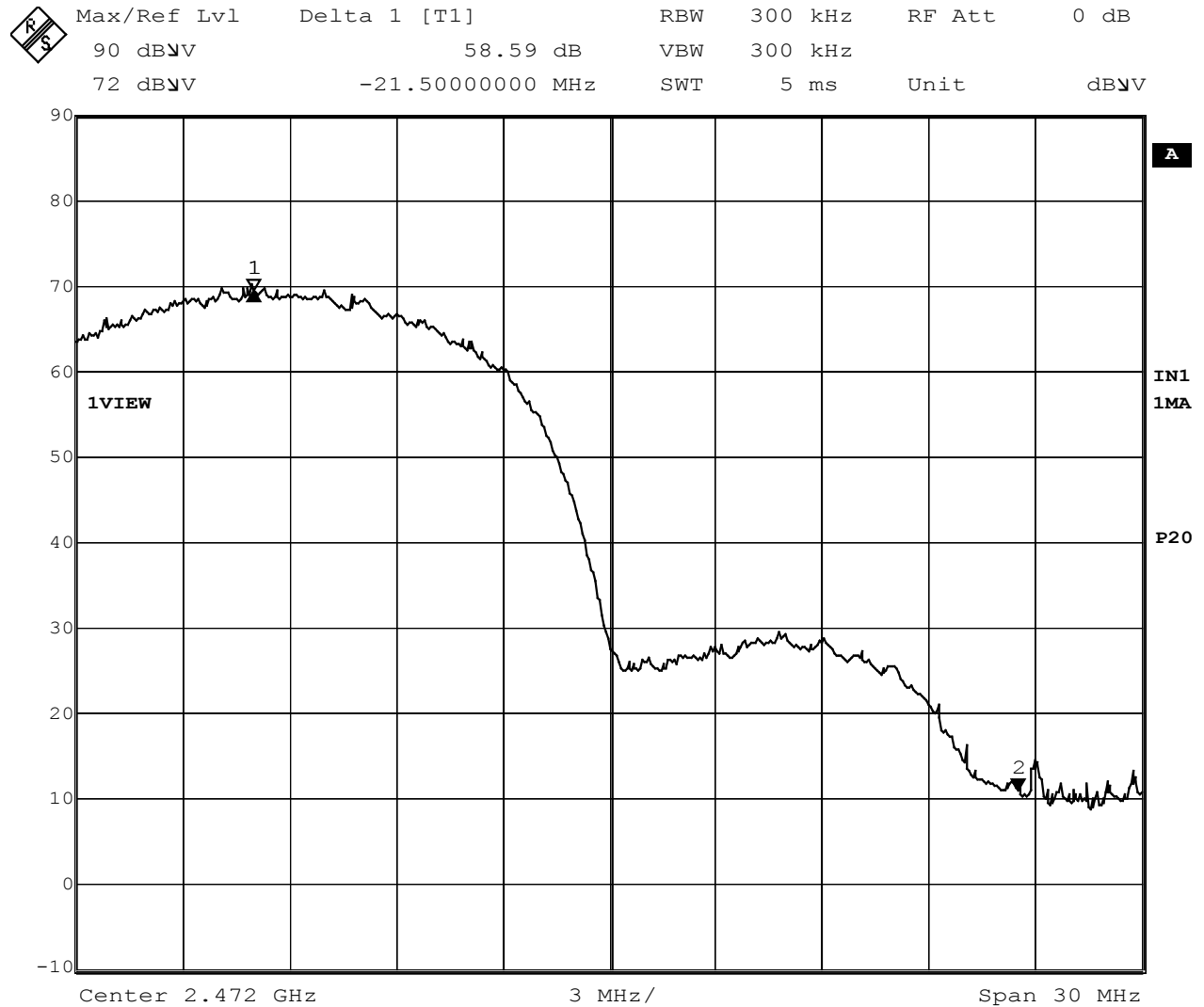
Average of 40.3dB $\mu$ V/m (Limit is 54.0dB $\mu$ V/m)



## 2.1 MEASUREMENT AT THE BAND EDGE (MARKER DELTA METHOD) - continued

### 2.1.6 Test Results - continued

Plot for RLAN Top Channel 2462MHz



Date: 20.SEP.2004 23:31:39



## **2.2 CONDUCTED EMISSIONS ON POWER LINES**

### **2.2.1 Specification Reference**

FCC CFR 47: Part 15 Subpart C, Section 15.207

### **2.2.2 Equipment Under Test**

41210000 Hand Held Data Terminal

### **2.3.3 Date of Test**

23<sup>rd</sup> September 2004

### **2.2.4 Test Equipment Used**

The major items of test equipment used for the above tests are identified as “Section 2.2” within the Test Equipment Used table shown in Section 3.1.

### **2.2.5 Test Procedure**

Test performed in accordance with ANSI C63.4.

Conducted Emission Measurements were undertaken within the semi-anechoic chamber. Emissions were measured on the Live and Neutral Lines in turn.

Emissions were formally measured using a Quasi-Peak and Average Detectors, which meet the CISPR requirements. The details of the worst-case emissions for the Live and Neutral Lines are presented in the following tables.

The EUT was supplied via the Charger from a 120V, 60Hz supply.



## 2.2 CONDUCTED EMISSIONS ON POWER LINES - continued

### 2.2.6 Test Results

The EUT met the Class B requirements of FCC CFR 47: Part 15 Subpart C, Section 15.207 for Conducted Emissions on the Live and Neutral Lines.

Measurements were made with the EUT in RLAN Mode (see Section 1.3.3 for details).

#### EUT Tx on Bottom Channel (2412MHz) – Live Line

| Emission Frequency (MHz) | Average Level (dBμV) | Quasi-Peak Level (dBμV) | Average Limit (dBμV) | Quasi-Peak Limit (dBμV) |
|--------------------------|----------------------|-------------------------|----------------------|-------------------------|
| 0.1500                   | 25.4                 | 46.4                    | 56.0                 | 66.0                    |
| 0.1787                   | 35.9                 | 48.9                    | 54.5                 | 64.5                    |
| 0.2128                   | 32.9                 | 43.8                    | 53.1                 | 63.1                    |
| 0.2844                   | 31.1                 | 39.7                    | 50.7                 | 60.7                    |
| 2.4842                   | 27.7                 | 33.4                    | 46.0                 | 56.0                    |
| 20.8310                  | 38.4                 | 41.7                    | 50.0                 | 60.0                    |

The margin between the specification requirements and all other emissions were 22.4dB or more below the specified Quasi-Peak limit and 30.4dB or more below the Average limit.

#### EUT Tx on Bottom Channel (2412MHz) – Neutral Line

| Emission Frequency (MHz) | Average Level (dBμV) | Quasi-Peak Level (dBμV) | Average Limit (dBμV) | Quasi-Peak Limit (dBμV) |
|--------------------------|----------------------|-------------------------|----------------------|-------------------------|
| 0.1500                   | 25.0                 | 46.3                    | 56.0                 | 66.0                    |
| 0.2129                   | 33.5                 | 44.3                    | 53.1                 | 63.1                    |
| 0.2484                   | 32.1                 | 40.2                    | 51.8                 | 61.8                    |
| 2.4489                   | 30.4                 | 35.8                    | 51.9                 | 61.9                    |
| 2.6968                   | 31.0                 | 36.3                    | 46.0                 | 56.0                    |
| 20.8310                  | 35.2                 | 40.9                    | 50.0                 | 60.0                    |

The margin between the specification requirements and all other emissions were 21.6dB or more below the specified Quasi-peak limit and 30.8dB or more below the specified Average limit.



## 2.2 CONDUCTED EMISSIONS ON POWER LINES - continued

### 2.2.6 Test Results - continued

#### EUT Tx on Middle Channel (2437MHz) – Live Line

| Emission Frequency (MHz) | Average Level (dBμV) | Quasi-Peak Level (dBμV) | Average Limit (dBμV) | Quasi-Peak Limit (dBμV) |
|--------------------------|----------------------|-------------------------|----------------------|-------------------------|
| 0.1500                   | 25.8                 | 46.5                    | 56.0                 | 66.0                    |
| 0.1593                   | 24.8                 | 44.7                    | 55.5                 | 65.5                    |
| 0.1668                   | 23.7                 | 44.0                    | 55.1                 | 65.1                    |
| 0.1780                   | 35.4                 | 48.7                    | 54.6                 | 64.6                    |
| 0.2129                   | 33.2                 | 44.4                    | 53.1                 | 63.1                    |
| 20.7179                  | 39.6                 | 43.6                    | 50.0                 | 60.0                    |

The margin between the specification requirements and all other emissions were 21.2dB or more below the specified Quasi-Peak limit and 39.6dB or more below the Average limit.

#### EUT Tx on Middle Channel (2437MHz) – Neutral Line

| Emission Frequency (MHz) | Average Level (dBμV) | Quasi-Peak Level (dBμV) | Average Limit (dBμV) | Quasi-Peak Limit (dBμV) |
|--------------------------|----------------------|-------------------------|----------------------|-------------------------|
| 0.1500                   | 25.4                 | 46.5                    | 56.0                 | 66.0                    |
| 0.1776                   | 35.9                 | 48.9                    | 54.6                 | 64.6                    |
| 0.2128                   | 33.7                 | 44.5                    | 53.1                 | 63.1                    |
| 0.2484                   | 32.8                 | 40.5                    | 51.8                 | 61.8                    |
| 2.4840                   | 29.7                 | 34.4                    | 46.0                 | 56.0                    |
| 20.7179                  | 39.7                 | 43.3                    | 50.0                 | 60.0                    |

The margin between the specification requirements and all other emissions were 21.4dB or more below the specified Quasi-peak limit and 30.4dB or more below the specified Average limit.



## 2.2 CONDUCTED EMISSIONS ON POWER LINES - continued

### 2.2.6 Test Results - continued

#### EUT Tx on Top Channel (2462MHz) – Live Line

| Emission Frequency (MHz) | Average Level (dBμV) | Quasi-Peak Level (dBμV) | Average Limit (dBμV) | Quasi-Peak Limit (dBμV) |
|--------------------------|----------------------|-------------------------|----------------------|-------------------------|
| 0.1500                   | 25.8                 | 46.7                    | 56.0                 | 66.0                    |
| 0.1776                   | 38.8                 | 50.2                    | 54.6                 | 64.6                    |
| 0.2126                   | 33.8                 | 44.5                    | 53.1                 | 63.1                    |
| 0.2477                   | 35.7                 | 37.0                    | 51.8                 | 61.8                    |
| 2.5123                   | 26.4                 | 30.6                    | 46.0                 | 56.0                    |
| 20.7054                  | 58.7                 | 31.8                    | 50.0                 | 60.0                    |

The margin between the specification requirements and all other emissions were 28.2dB or more below the specified Quasi-Peak limit and 30.0dB or more below the Average limit.

#### EUT Tx on Top Channel (2462MHz) – Neutral Line

| Emission Frequency (MHz) | Average Level (dBμV) | Quasi-Peak Level (dBμV) | Average Limit (dBμV) | Quasi-Peak Limit (dBμV) |
|--------------------------|----------------------|-------------------------|----------------------|-------------------------|
| 0.1502                   | 23.1                 | 41.9                    | 56.0                 | 66.0                    |
| 0.1664                   | 18.3                 | 39.9                    | 55.2                 | 65.2                    |
| 0.1824                   | 23.7                 | 38.1                    | 54.4                 | 64.4                    |
| 0.2125                   | 35.9                 | 41.8                    | 53.1                 | 63.1                    |
| 2.6199                   | 27.5                 | 30.3                    | 46.0                 | 56.0                    |
| 20.5689                  | 30.7                 | 33.2                    | 50.0                 | 60.0                    |

The margin between the specification requirements and all other emissions were 26.8dB or more below the specified Quasi-Peak limit and 36.8dB or more below the Average limit.



## **2.3 MAXIMUM PEAK OUTPUT POWER (EIRP Method)**

### **2.3.1 Specification Reference**

FCC CFR 47: Part 15 Subpart C, Section 15.247(b)(3)

### **2.3.2 Equipment Under Test**

41210000 Hand Held Data Terminal

### **2.2.3 Date of Test**

20<sup>th</sup> September 2004

### **2.3.4 Test Equipment Used**

The major items of test equipment used for the above tests are identified as "Section 2.3" within the Test Equipment Used table shown in Section 3.1.

### **2.3.5 Test Procedure**

Test Performed in accordance with ANSI C63.4.

The EUT contains an integral antenna and therefore the Maximum Peak Output Power was made using the EIRP method.

The Spectrum Analyser was tuned to the test frequency. The device Output Power setting was controlled as specified in the Product Information, Section 1.5 of this document. The device was then rotated through 360 degrees until the highest power level was observed in both horizontal and vertical polarisation. The device was then replaced with a substitution antenna, whose input signal level into the antenna was adjusted until the received level matched that of the previously detected emission.



## 2.3 MAXIMUM PEAK OUTPUT POWER (EIRP Method) - continued

### 2.3.6 Test Results - continued

The EUT met the requirements of FCC CFR 47: Part 15 Subpart C, Section 15.247(b)(3) for Maximum Peak Output Power.

Measurements were made with the EUT in RLAN Mode (see Section 1.3.3 for details).

| Frequency<br>(MHz) | Result EIRP<br>(dBm) | Result EIRP<br>(mW) |
|--------------------|----------------------|---------------------|
| 2412               | 14.7                 | 29.5                |
| 2437               | 12.4                 | 17.4                |
| 2462               | 10.4                 | 11.0                |
| Limit              | <+36dBm or <4W       |                     |



## **2.4 SPURIOUS RADIATED EMISSIONS**

### **2.4.1 Specification Reference**

FCC CFR 47: Part 15 Subpart C, Section 15.247(c)

### **2.4.2 Equipment Under Test**

41210000 Hand Held Data Terminal

### **2.3.3 Date of Test**

20<sup>th</sup> – 22<sup>nd</sup> September 2004

### **2.4.4 Test Equipment Used**

The major items of test equipment used for the above tests are identified as “Section 2.4” within the Test Equipment Used table shown in Section 3.1.

### **2.4.5 Test Procedure**

Test Performed in accordance with ANSI C63.4.

FCC CFR 47: Part 15 Subpart C, Section 15.247(c), for Radiated Emissions also requires Sections 15.205 and 15.209 to be applied.

A preliminary profile of the Spurious Radiated Emissions was obtained by operating the EUT on a remotely controlled turntable within a semi-anechoic chamber. Measurements of emissions from the EUT were obtained with the Measurement Antenna in both Horizontal and Vertical Polarisations. The profiling produced a list of the worst-case emissions together with the EUT azimuth and antenna polarisation.

Using the information from the preliminary profiling of the EUT. The list of emissions was then confirmed or updated under Alternative Open Site conditions. Emission levels were maximised by adjusting the antenna height, antenna polarisation and turntable azimuth.

Emissions identified within the range 30MHz – 1GHz were then formally measured using a CISPR Quasi-Peak detector.

Emissions identified within the range 1GHz – 25GHz were then formally measured using Peak and Average Detectors, as appropriate.

The measurements were performed at a 3m distance unless otherwise stated.



## 2.4 SPURIOUS RADIATED EMISSIONS - continued

### 2.4.5 Test Procedure - continued

The limits for Spurious Emissions Outside the Restricted Bands have been measured and calculated as shown in the table below in accordance with 15.247(c):

| Test Mode     | Carrier Frequency<br>GHz | Carrier Field Strength<br>dB $\mu$ V/m | Limit for Spurious<br>Outside Restricted<br>Band<br>(Carrier F S -20dB)<br>dB $\mu$ V/m |
|---------------|--------------------------|----------------------------------------|-----------------------------------------------------------------------------------------|
| Mode 1 (RLAN) | 2412                     | 100.8                                  | 80.8                                                                                    |
| Mode 1 (RLAN) | 2437                     | 98.3                                   | 78.3                                                                                    |
| Mode 1 (RLAN) | 2462                     | 101.8                                  | 81.8                                                                                    |

The limits for Spurious Emissions Inside the Restricted Bands are in accordance with 15.205(a) & (b), which call up the limits in 15.209 (a)

| Frequency Range<br>MHz | Field Strength<br>$\mu$ V/m | Quasi Peak Field Strength<br>dB $\mu$ V/m |                                        |
|------------------------|-----------------------------|-------------------------------------------|----------------------------------------|
| 30-88                  | 100                         | 40.0                                      |                                        |
| 88-216                 | 150                         | 43.5                                      |                                        |
| 216-960                | 200                         | 46.0                                      |                                        |
| 960-1000               | 500                         | 54.0                                      |                                        |
| Above 1000             | 500                         | Average Field<br>Strength<br>dB $\mu$ V/m | Peak Field<br>Strength<br>dB $\mu$ V/m |
|                        |                             | 54.0                                      | 74.0                                   |



## 2.4 SPURIOUS RADIATED EMISSIONS - continued

### 2.4.6 Test Results

#### 30MHz - 1GHz Frequency Range

Equipment Designation: Intentional Radiator.

The EUT met the requirements of FCC CFR 47: Part 15 Subpart C, Section 15.247(c), 15.205 and 15.209 for Radiated Emissions (30MHz – 1GHz).

Measurements were made with the EUT in RLAN Mode (see Section 1.3.3 for details).

#### **EUT Tx on Bottom Channel (2412MHz)**

| Emission Frequency | Pol | Hgt | Azm | Field Strength at 3m |      | Specification Limit |       |
|--------------------|-----|-----|-----|----------------------|------|---------------------|-------|
|                    |     |     |     | dBμV/m               | μV/m | dBμV/m              | μV/m  |
| 335.4              | H   | 100 | 000 | 27.5                 | 23.7 | 46.0                | 200.0 |
| 335.4              | V   | 153 | 193 | 34.2                 | 51.3 | 46.0                | 200.0 |
| 431.3              | V   | 138 | 196 | 29.7                 | 30.5 | 46.0                | 200.0 |
| 527.2              | V   | 100 | 176 | 34.0                 | 50.1 | 46.0                | 200.0 |
| 623.0              | V   | 100 | 166 | 35.9                 | 62.4 | 46.0                | 200.0 |
| 718.8              | H   | 104 | 080 | 25.2                 | 18.2 | 46.0                | 200.0 |

#### **EUT Tx on Middle Channel (2437MHz)**

| Emission Frequency | Pol | Hgt | Azm | Field Strength at 3m |      | Specification Limit |       |
|--------------------|-----|-----|-----|----------------------|------|---------------------|-------|
|                    |     |     |     | dBμV/m               | μV/m | dBμV/m              | μV/m  |
| 335.5              | H   | 100 | 000 | 27.5                 | 23.7 | 46.0                | 200.0 |
| 335.5              | V   | 145 | 187 | 33.9                 | 49.5 | 46.0                | 200.0 |
| 431.3              | V   | 140 | 200 | 29.4                 | 29.5 | 46.0                | 200.0 |
| 527.1              | V   | 100 | 175 | 33.5                 | 47.3 | 46.0                | 200.0 |
| 622.9              | V   | 100 | 168 | 35.3                 | 58.2 | 46.0                | 200.0 |
| 718.8              | H   | 106 | 084 | 25.6                 | 19.1 | 46.0                | 200.0 |



## 2.4 SPURIOUS RADIATED EMISSIONS - continued

### 2.3.6 Test Results – continued

#### 30MHz - 1GHz Frequency Range

##### **EUT Tx on Top Channel (2462MHz)**

| Emission Frequency | Pol | Hgt | Azm | Field Strength at 3m |      | Specification Limit |       |
|--------------------|-----|-----|-----|----------------------|------|---------------------|-------|
|                    |     |     |     | dBμV/m               | μV/m | dBμV/m              | μV/m  |
| 335.3              | H   | 100 | 000 | 27.4                 | 23.4 | 46.0                | 200.0 |
| 335.5              | V   | 137 | 190 | 34.4                 | 52.5 | 46.0                | 200.0 |
| 431.4              | V   | 138 | 200 | 30.8                 | 34.7 | 46.0                | 200.0 |
| 527.0              | V   | 100 | 179 | 33.8                 | 49.0 | 46.0                | 200.0 |
| 623.1              | V   | 100 | 174 | 35.8                 | 61.7 | 46.0                | 200.0 |
| 718.9              | H   | 100 | 090 | 25.7                 | 19.3 | 46.0                | 200.0 |

#### ABBREVIATIONS FOR ABOVE TABLES

H      Horizontal Polarisation  
 Pol    Polarisation  
 deg    degree

V      Vertical Polarisation  
 Hgt    Height  
 Azm    Azimuth



## 2.4 SPURIOUS RADIATED EMISSIONS - continued

### 2.4.6 Test Results - continued

#### 1GHz - 25GHz Frequency Range

Equipment Designation: Intentional Radiator.

The EUT met the requirements of FCC CFR 47: Part 15 Subpart C, Section 15.247(c), 15.205 and 15.209 for Radiated Emissions (1GHz – 25GHz).

Measurements were made with the EUT in RLAN Mode (see Section 1.3.3 for details).

#### **EUT Tx on Bottom Channel (2412MHz)**

| Frequency | Antenna |        | Turntable | Peak Field Strength | Peak Limit | Average Field Strength | Average Limit |
|-----------|---------|--------|-----------|---------------------|------------|------------------------|---------------|
|           | Pol     | Height | Azimuth   |                     |            |                        |               |
| GHz       | H/V     | cm     | deg       | dBμV/m              | dBμV/m     | dBμV/m                 | dBμV/m        |
| 2.038     | H       | 115    | 215       | 57.4                | 80.8       | N/A                    | N/A           |
| 2.368     | H       | 100    | 128       | 51.8                | 74.0       | 40.0                   | 54.0          |
| 4.076     | V       | 106    | 168       | 53.1                | 74.0       | 50.8                   | 54.0          |
| 4.825     | V       | 104    | 166       | 61.3                | 74.0       | 47.4                   | 54.0          |

#### **EUT Tx on Middle Channel (2437MHz)**

| Frequency | Antenna |        | Turntable | Peak Field Strength | Peak Limit | Average Field Strength | Average Limit |
|-----------|---------|--------|-----------|---------------------|------------|------------------------|---------------|
|           | Pol     | Height | Azimuth   |                     |            |                        |               |
| GHz       | H/V     | cm     | deg       | dBμV/m              | dBμV/m     | dBμV/m                 | dBμV/m        |
| 2.063     | H       | 118    | 230       | 56.5                | 78.3       | N/A                    | N/A           |
| 2.327     | H       | 100    | 132       | 51.2                | 74.0       | 42.0                   | 54.0          |
| 4.126     | V       | 105    | 168       | 54.7                | 74.0       | 52.0                   | 54.0          |
| 4.874     | V       | 106    | 192       | 56.6                | 74.0       | 42.5                   | 54.0          |
| 6.189     | H       | 100    | 197       | 50.0                | 78.3       | N/A                    | N/A           |

EIRP Results are only taken for frequencies that fall Outside the Restricted Band in accordance 15.247(c.)

Note: The Measurements in the above tables marked N/A are Not Applicable because the frequency does not fall within the Restricted Band (15.205) and hence Average Measurements are not required.



## 2.4 SPURIOUS RADIATED EMISSIONS - continued

### 2.4.6 Test Results - continued

#### 1GHz - 25GHz Frequency Range - continued

##### **EUT Tx on Top Channel (2462MHz)**

| Frequency | Antenna |        | Turntable | Peak Field Strength | Peak Limit | Average Field Strength | Average Limit |
|-----------|---------|--------|-----------|---------------------|------------|------------------------|---------------|
|           | Pol     | Height | Azimuth   |                     |            |                        |               |
| GHz       | H/V     | cm     | deg       | dBμV/m              | dBμV/m     | dBμV/m                 | dBμV/m        |
| 2.088     | H       | 141    | 231       | 56.7                | 81.8       | N/A                    | N/A           |
| 2.352     | H       | 100    | 135       | 53.3                | 74.0       | 45.2                   | 54.0          |
| 2.374     | H       | 100    | 126       | 52.4                | 74.0       | 42.3                   | 54.0          |
| 2.385     | H       | 100    | 125       | 52.7                | 74.0       | 41.5                   | 54.0          |
| 4.176     | H       | 142    | 190       | 53.9                | 74.0       | 51.8                   | 54.0          |
| 4.923     | V       | 114    | 118       | 57.1                | 74.0       | 42.5                   | 54.0          |
| 6.260     | H       | 100    | 187       | 49.4                | 81.8       | N/A                    | N/A           |

EIRP Results are only taken for frequencies that fall Outside the Restricted Band in accordance 15.247(c.)

Note: The Measurements in the above tables marked N/A are Not Applicable because the frequency does not fall within the Restricted Band (15.205) and hence Average Measurements are not required.

#### **ABBREVIATIONS FOR ABOVE TABLES**

H      Horizontal Polarisation  
Pol    Polarisation  
deg    degree

V      Vertical Polarisation  
Hgt    Height  
Azm    Azimuth



## **SECTION 2**

### **TEST DETAILS BLUETOOTH MODE**

Limited FCC CFR 47: Part 15 C Testing in support of an  
Application for Grant of Equipment Authorisation  
Of a Symbol 41210000 Hand Held Data Terminal



## **2.5 MEASUREMENT AT THE BAND EDGE (MARKER DELTA METHOD)**

### **2.5.1 Specification Reference**

FCC CFR 47: Part 15 Subpart C, Section 15.205

### **2.5.2 Equipment Under Test**

41210000 Hand Held Data Terminal

### **2.5.3 Date of Test**

18<sup>th</sup> September 2004

### **2.5.4 Test Equipment Used**

The major items of test equipment used for the above tests are identified as "Section 2.5" within the Test Equipment Used table shown in Section 3.1.

### **2.1.6 Test Procedure**

Test Performed in accordance with FCC Public Notice document (DA 00-705 released 30 March 2000).



## 2.5 MEASUREMENT AT THE BAND EDGE (MARKER DELTA METHOD)

### 2.5.6 Test Results

The EUT met the requirements of FCC CFR 47: Part 15 Subpart C, Section 15.205 for Band Edge Measurements.

Measurements were made with the EUT in Bluetooth Mode (see Section 1.3.3 for details).

#### Step 1

Bottom Channel Fundamental Field Strength Measurement.

Peak measurements performed utilising a Resolution Bandwidth and Video Bandwidth of 1MHz.  
Average measurements performed utilising a Resolution Bandwidth of 1MHz and Video Bandwidth of 10Hz.

| Frequency | Antenna Polarisation | Height | Azimuth | Peak Field Strength | Average Field Strength |
|-----------|----------------------|--------|---------|---------------------|------------------------|
| MHz       | H/V                  | cm     | deg     | dB $\mu$ V/m        | dB $\mu$ V/m           |
| 2402      | V                    | 100    | 002     | 95.4                | 84.5                   |

#### Step 2

Determine Marker delta amplitude between 2402MHz (the fundamental) and 2390MHz (the Band Edge under investigation).

Using a span of 30MHz with Resolution Bandwidth and Video Bandwidth of 300kHz.

Marker Delta Amplitude = 49.9dB

#### Step 3

Subtracting the Marker Delta obtained from Step 2 from the 2402MHz Field Strength measurement from Step 1, gives following Result:

Peak of 45.5dB $\mu$ V/m (Limit is 74.0dB $\mu$ V/m)

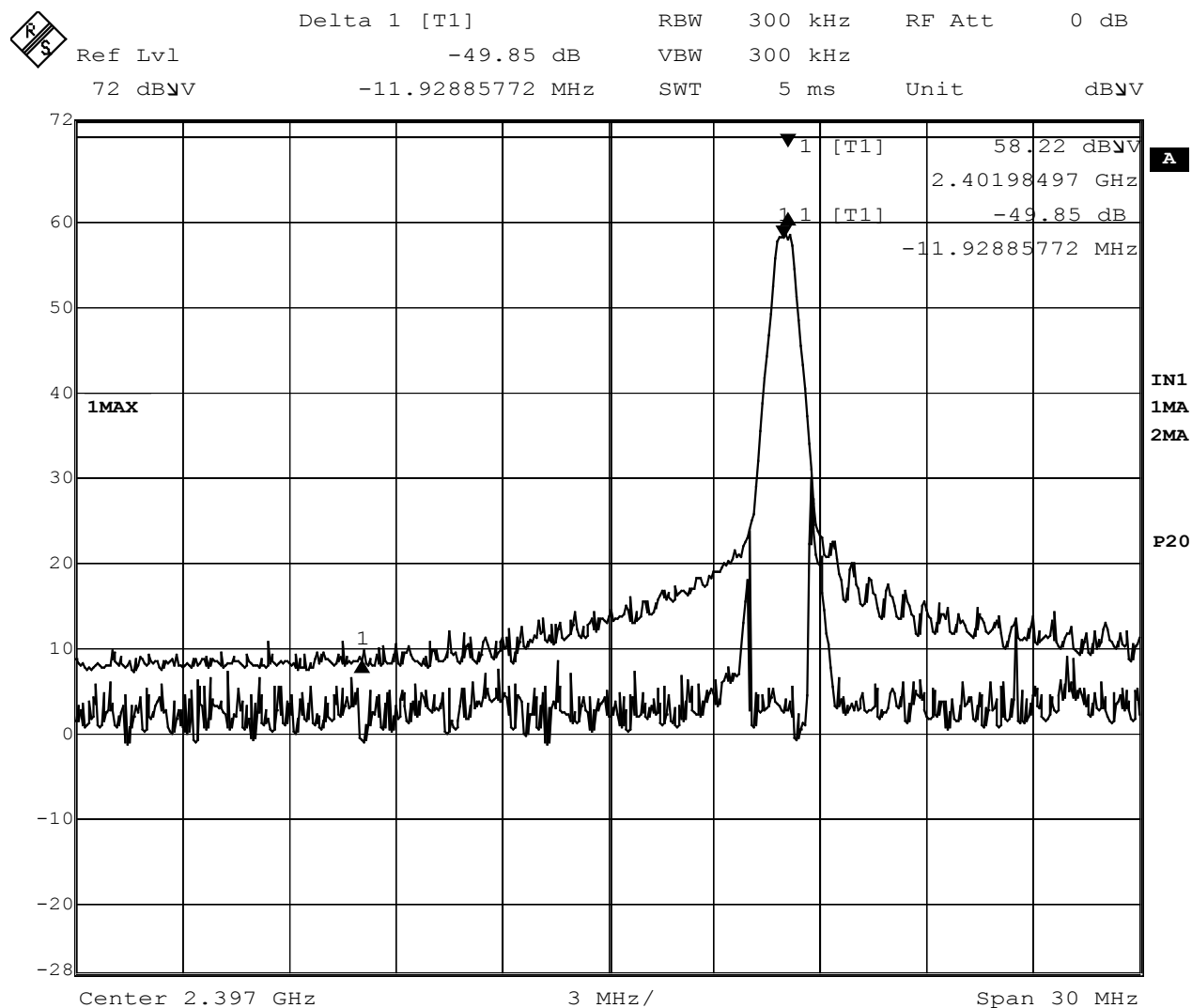
Average of 34.6dB $\mu$ V/m (Limit is 54.0dB $\mu$ V/m)



## 2.5 MEASUREMENT AT THE BAND EDGE (MARKER DELTA METHOD) - continued

### 2.5.6 Test Results - continued

Plot for Bluetooth Bottom Channel 2402MHz



Date: 18.SEP.2004 14:10:48



## 2.5 MEASUREMENT AT THE BAND EDGE (MARKER DELTA METHOD) - continued

### 2.5.6 Test Results - continued

The EUT met the requirements of FCC CFR 47: Part 15 Subpart C, Section 15.205 for Band Edge Measurements.

Measurements were made with the EUT in RLAN Mode (see Section 1.3.3 for details).

#### Step 1

Top Channel Fundamental Field Strength Measurement.

Peak measurements performed utilising a Resolution Bandwidth and Video Bandwidth of 1MHz.  
Average measurements performed utilising a Resolution Bandwidth of 1MHz and Video Bandwidth of 10Hz.

| Frequency | Antenna Polarisation | Height | Azimuth | Peak Field Strength | Average Field Strength |
|-----------|----------------------|--------|---------|---------------------|------------------------|
| MHz       | H/V                  | cm     | deg     | dBμV/m              | dBμV/m                 |
| 2480      | V                    | 100    | 000     | 96.2                | 83.0                   |

#### Step 2

Determine Marker delta amplitude between 2480MHz (the fundamental) and 2483.5MHz (the Band Edge under investigation).

Using a span of 30MHz with Resolution Bandwidth and Video Bandwidth of 300kHz.

Marker Delta Amplitude = 39.9dB

#### Step 3

Subtracting the Marker Delta obtained from Step 2 from the 2480MHz Field Strength measurement from Step 1, gives following Result

Peak of 56.3dBμV/m (Limit is 74.0dBμV/m)

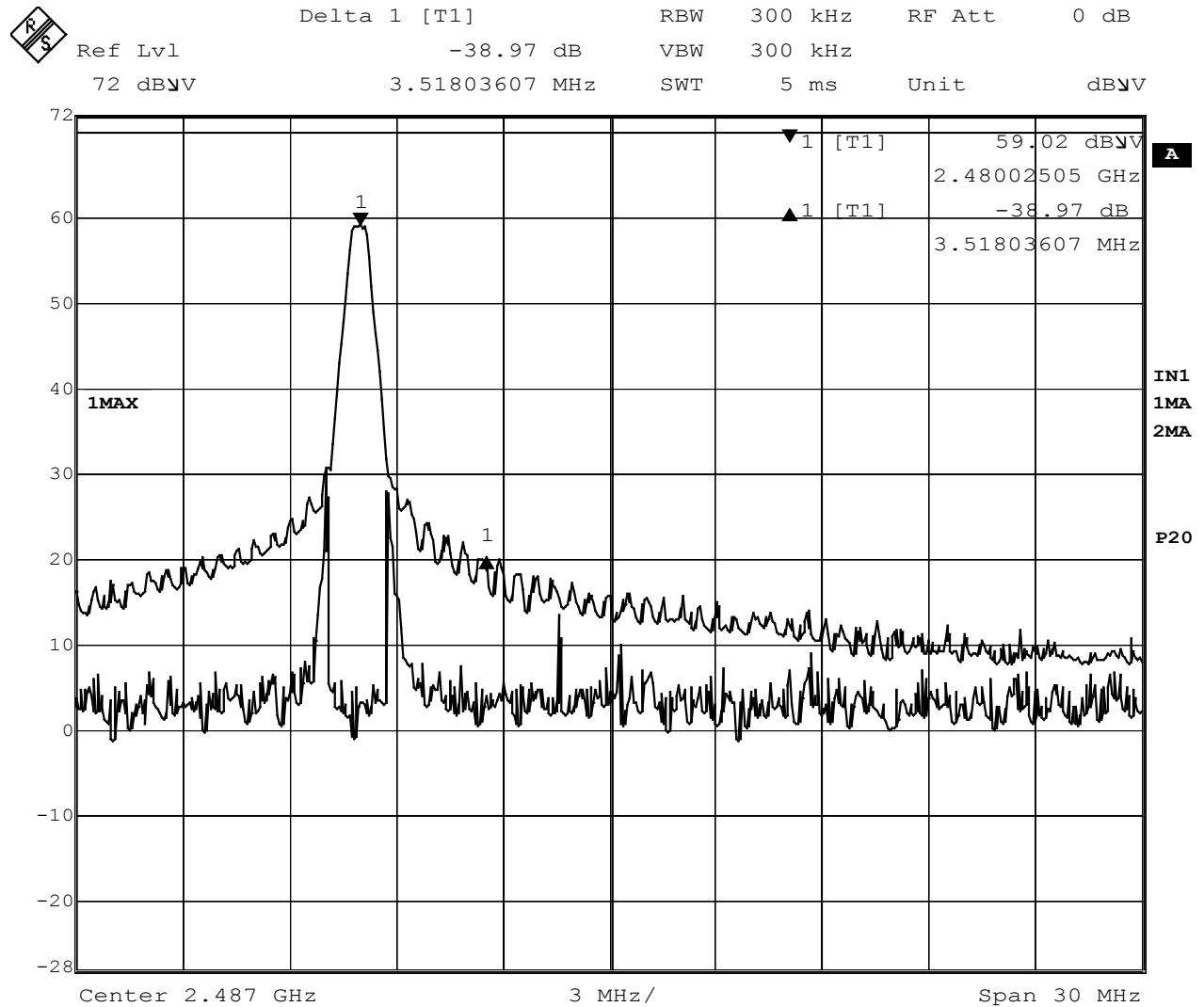
Average of 43.1dBμV/m (Limit is 54.0dBμV/m)



## 2.5 MEASUREMENT AT THE BAND EDGE (MARKER DELTA METHOD) - continued

### 2.5.6 Test Results - continued

Plot for Bluetooth Top Channel 2480MHz



Date: 18.SEP.2004 14:38:26



## **2.6 CONDUCTED EMISSIONS ON POWER LINES**

### **2.6.1 Specification Reference**

FCC CFR 47: Part 15 Subpart C, Section 15.207

### **2.6.2 Equipment Under Test**

41210000 Hand Held Data Terminal

### **2.3.4 Date of Test**

24<sup>th</sup> September 2004

### **2.6.4 Test Equipment Used**

The major items of test equipment used for the above tests are identified as "Section 2.6" within the Test Equipment Used table shown in Section 3.1.

### **2.6.5 Test Procedure**

Test performed in accordance with ANSI C63.4.

Conducted Emission Measurements were undertaken within the semi-anechoic chamber. Emissions were measured on the Live and Neutral Lines in turn.

Emissions were formally measured using a Quasi-Peak and Average Detectors, which meet the CISPR requirements. The details of the worst-case emissions for the Live and Neutral Lines are presented in the tables that follow.

The EUT was supplied via the Charger from a 120V, 60Hz supply.



## 2.6 CONDUCTED EMISSIONS ON POWER LINES - continued

### 2.6.6 Test Results

The EUT met the Class B requirements of FCC CFR 47: Part 15 Subpart C, Section 15.207 for Conducted Emissions on the Live and Neutral Lines.

Measurements were made with the EUT in RLAN Mode (see Section 1.3.3 for details).

#### EUT Tx on Bottom Channel (2402MHz) – Live Line

| Emission Frequency (MHz) | Average Level (dBμV) | Quasi-Peak Level (dBμV) | Average Limit (dBμV) | Quasi-Peak Limit (dBμV) |
|--------------------------|----------------------|-------------------------|----------------------|-------------------------|
| 0.1503                   | 25.8                 | 46.6                    | 56.0                 | 66.0                    |
| 0.1757                   | 37.1                 | 49.2                    | 54.7                 | 64.7                    |
| 0.2130                   | 33.2                 | 43.7                    | 53.1                 | 63.1                    |
| 0.2484                   | 33.4                 | 40.0                    | 51.8                 | 61.8                    |
| 0.2839                   | 27.7                 | 37.4                    | 50.7                 | 60.7                    |
| 20.5871                  | 37.1                 | 42.3                    | 50.0                 | 60.0                    |

The margin between the specification requirements and all other emissions were 23.3dB or more below the specified Quasi-Peak limit and 37.1dB or more below the Average limit.

#### EUT Tx on Bottom Channel (2402MHz) – Neutral Line

| Emission Frequency (MHz) | Average Level (dBμV) | Quasi-Peak Level (dBμV) | Average Limit (dBμV) | Quasi-Peak Limit (dBμV) |
|--------------------------|----------------------|-------------------------|----------------------|-------------------------|
| 0.1501                   | 25.4                 | 47.1                    | 56.0                 | 66.0                    |
| 0.1802                   | 36.7                 | 48.6                    | 54.5                 | 64.5                    |
| 0.2142                   | 33.5                 | 44.4                    | 53.0                 | 63.0                    |
| 0.2485                   | 33.7                 | 40.4                    | 51.8                 | 61.8                    |
| 2.6628                   | 30.3                 | 35.5                    | 46.0                 | 56.0                    |
| 20.8390                  | 37.2                 | 41.4                    | 50.0                 | 60.0                    |

The margin between the specification requirements and all other emissions were 21.4dB or more below the specified Quasi-Peak limit and 33.7dB or more below the Average limit.



## 2.6 CONDUCTED EMISSIONS ON POWER LINES - continued

### 2.6.6 Test Results - continued

#### EUT Tx on Middle Channel (2441MHz) – Live Line

| Emission Frequency (MHz) | Average Level (dBμV) | Quasi-Peak Level (dBμV) | Average Limit (dBμV) | Quasi-Peak Limit (dBμV) |
|--------------------------|----------------------|-------------------------|----------------------|-------------------------|
| 0.1500                   | 25.4                 | 46.3                    | 56.0                 | 66.0                    |
| 0.1606                   | 24.4                 | 44.6                    | 55.4                 | 65.4                    |
| 0.1772                   | 36.1                 | 48.9                    | 54.6                 | 64.6                    |
| 0.2130                   | 32.7                 | 43.1                    | 53.1                 | 63.1                    |
| 0.3552                   | 25.7                 | 31.2                    | 48.8                 | 58.8                    |
| 20.2420                  | 35.5                 | 40.2                    | 50.0                 | 60.0                    |

The margin between the specification requirements and all other emissions were 27.5dB or more below the specified Quasi-Peak limit and 36.1dB or more below the Average limit.

#### EUT Tx on Middle Channel (2441MHz) – Neutral Line

| Emission Frequency (MHz) | Average Level (dBμV) | Quasi-Peak Level (dBμV) | Average Limit (dBμV) | Quasi-Peak Limit (dBμV) |
|--------------------------|----------------------|-------------------------|----------------------|-------------------------|
| 0.1501                   | 25.4                 | 46.5                    | 56.0                 | 66.0                    |
| 0.1785                   | 37.1                 | 48.9                    | 54.5                 | 64.5                    |
| 0.2129                   | 33.1                 | 42.9                    | 53.1                 | 63.1                    |
| 0.2485                   | 32.3                 | 41.1                    | 51.8                 | 61.8                    |
| 2.6979                   | 30.9                 | 35.5                    | 46.0                 | 56.0                    |
| 20.4479                  | 38.6                 | 42.8                    | 50.0                 | 60.0                    |

The margin between the specification requirements and all other emissions were 20.7dB or more below the specified Quasi-Peak limit and 37.1dB or more below the Average limit.



## 2.6 CONDUCTED EMISSIONS ON POWER LINES - continued

### 2.6.6 Test Results - continued

#### EUT Tx on Top Channel (2480MHz) – Live Line

| Emission Frequency (MHz) | Average Level (dBμV) | Quasi-Peak Level (dBμV) | Average Limit (dBμV) | Quasi-Peak Limit (dBμV) |
|--------------------------|----------------------|-------------------------|----------------------|-------------------------|
| 0.1500                   | 25.8                 | 46.3                    | 56.0                 | 66.0                    |
| 0.1598                   | 24.8                 | 44.5                    | 55.5                 | 65.5                    |
| 0.1782                   | 35.2                 | 48.4                    | 54.6                 | 64.6                    |
| 0.2130                   | 32.6                 | 43.9                    | 53.1                 | 63.1                    |
| 0.2484                   | 31.7                 | 39.7                    | 51.8                 | 61.8                    |
| 20.2323                  | 38.4                 | 43.0                    | 50.0                 | 60.0                    |

The margin between the specification requirements and all other emissions were 22.1dB or more below the specified Quasi-Peak limit and 24.5dB or more below the Average limit.

#### EUT Tx on Top Channel (2480MHz) – Neutral Line

| Emission Frequency (MHz) | Average Level (dBμV) | Quasi-Peak Level (dBμV) | Average Limit (dBμV) | Quasi-Peak Limit (dBμV) |
|--------------------------|----------------------|-------------------------|----------------------|-------------------------|
| 0.1500                   | 25.4                 | 46.7                    | 56.0                 | 66.0                    |
| 0.1782                   | 35.9                 | 48.4                    | 54.6                 | 64.6                    |
| 0.2130                   | 32.9                 | 43.9                    | 53.1                 | 63.1                    |
| 0.2841                   | 33.4                 | 36.7                    | 50.7                 | 60.7                    |
| 2.6275                   | 28.5                 | 32.2                    | 46.0                 | 56.0                    |
| 20.2395                  | 38.2                 | 42.5                    | 50.0                 | 60.0                    |

The margin between the specification requirements and all other emissions were 24.0dB or more below the specified Quasi-peak limit and 18.4dB or more below the specified Average limit.



## **2.7 MAXIMUM PEAK OUTPUT POWER (EIRP Method)**

### **2.7.1 Specification Reference**

FCC CFR 47: Part 15 Subpart C, Section 15.247(b)(3)

### **2.7.2 Equipment Under Test**

41210000 Hand Held Data Terminal

### **2.5.3 Date of Test**

17<sup>th</sup> September 2004

### **2.7.4 Test Equipment Used**

The major items of test equipment used for the above tests are identified as "Section 2.7" within the Test Equipment Used table shown in Section 3.1.

### **2.7.5 Test Procedure**

Test Performed in accordance with ANSI C63.4.

The EUT contains an integral antenna and therefore the Maximum Peak Output Power was made using the EIRP method.

The Spectrum Analyser was tuned to the test frequency. The device Output Power setting was controlled as specified in the Product Information, Section 1.5 of this document. The device was then rotated through 360 degrees until the highest power level was observed in both horizontal and vertical polarisation. The device was then replaced with a substitution antenna, whose input signal level into the antenna was adjusted until the received level matched that of the previously detected emission.

**2.7 MAXIMUM PEAK OUTPUT POWER (EIRP Method) - continued****2.7.6 Test Results - continued**

The EUT met the requirements of FCC CFR 47: Part 15 Subpart C, Section 15.247(b)(3) for Maximum Peak Output Power.

Measurements were made with the EUT in Bluetooth Mode (see Section 1.3.3 for details).

| Frequency<br>(MHz) | Result EIRP<br>(dBm) | Result EIRP<br>(mW) |
|--------------------|----------------------|---------------------|
| 2402               | -0.6                 | 0.87                |
| 2441               | 0.1                  | 1.01                |
| 2480               | -2.4                 | 0.58                |
| Limit              | <+36dBm or <4W       |                     |



## **2.8 SPURIOUS RADIATED EMISSIONS**

### **2.8.1 Specification Reference**

FCC CFR 47: Part 15 Subpart C, Section 15.247(c)

### **2.8.2 Equipment Under Test**

41210000 Hand Held Data Terminal

### **2.8.3 Date of Test**

20<sup>th</sup> – 22<sup>nd</sup> September 2004

### **2.8.4 Test Equipment Used**

The major items of test equipment used for the above tests are identified as “Section 2.8” within the Test Equipment Used table shown in Section 3.1.

### **2.8.5 Test Procedure**

Test Performed in accordance with ANSI C63.4.

FCC CFR 47: Part 15 Subpart C, Section 15.247(c), for Radiated Emissions also requires Sections 15.205 and 15.209 to be applied.

A preliminary profile of the Spurious Radiated Emissions was obtained by operating the EUT on a remotely controlled turntable within a semi-anechoic chamber. Measurements of emissions from the EUT were obtained with the Measurement Antenna in both Horizontal and Vertical Polarisations. The profiling produced a list of the worst-case emissions together with the EUT azimuth and antenna polarisation.

Using the information from the preliminary profiling of the EUT. The list of emissions was then confirmed or updated under Alternative Open Site conditions. Emission levels were maximised by adjusting the antenna height, antenna polarisation and turntable azimuth.

Emissions identified within the range 30MHz – 1GHz were then formally measured using a CISPR Quasi-Peak detector.

Emissions identified within the range 1GHz – 25GHz were then formally measured using Peak and Average Detectors, as appropriate.

The measurements were performed at a 3m distance unless otherwise stated.



## 2.8 SPURIOUS RADIATED EMISSIONS - continued

### 2.8.5 Test Procedure - continued

The limits for Spurious Emissions Outside the Restricted Bands have been measured and calculated as shown in the table below:

| Test Mode          | Carrier Frequency<br>GHz | Carrier Field Strength<br>dB $\mu$ V/m | Limit for Spurious<br>Outside Restricted<br>Band<br>(Carrier F S -20dB)<br>dB $\mu$ V/m |
|--------------------|--------------------------|----------------------------------------|-----------------------------------------------------------------------------------------|
| Mode 2 (Bluetooth) | 2402                     | 94.4                                   | 74.4                                                                                    |
| Mode 2 (Bluetooth) | 2441                     | 97.8                                   | 77.8                                                                                    |
| Mode 2 (Bluetooth) | 2480                     | 95.2                                   | 75.2                                                                                    |

In accordance with FCC Public Notice DA 00-705, Released 30th March 2000, Section 15.247(c) Spurious Radiated Emissions "If the dwell time per channel of the hopping signal is less than 100ms, then the reading obtained with the 10Hz VBW may be further adjusted by a "duty cycle correction factor", derived from  $20\log(\text{dwell time}/100\text{ms})$ , in an effort to demonstrate compliance with the 15.209 limit the following adjustment has been calculated for use with Average Measurements only;

Dwell Time = 5.81ms this is derived from;

Total slot time per time slot for DH5 packet

$$625\mu\text{s} \times 5 = 3.125\text{ms}$$

Actual transmit time during this time slot is 2.905ms and the reply time slot after each DH5 packet is 625 $\mu$ s.

Total time slot length per channel

$$3.125 + 0.625 = 3.75\text{ms}.$$

Multiply Total time slot length per channel by 32 channels per hop sequence  
120ms

$$32 \times 3.75 =$$

It is therefore possible to have a maximum of two hop sequences in any given 100ms period, a single channel could occur twice within any 100ms time window.

$$2 \times 2.905 = 5.81\text{ms}$$

Therefore; the Bluetooth Duty Cycle Correction Factor for the EUT is  $20 \log (5.81/100) = -24.7\text{dB}$



## 2.8 SPURIOUS RADIATED EMISSIONS - continued

### 2.8.6 Test Results

#### 30MHz - 1GHz Frequency Range

Equipment Designation: Intentional Radiator.

The EUT met the requirements of FCC CFR 47: Part 15 Subpart C, Section 15.247(c), 15.205 and 15.209 for Radiated Emissions (30MHz – 1GHz).

Measurements were made with the EUT in Bluetooth Mode (see Section 1.3.3 for details).

#### **EUT Tx on Bottom Channel (2402MHz)**

| Emission Frequency | Pol | Hgt | Azm | Field Strength at 3m |      | Specification Limit |       |
|--------------------|-----|-----|-----|----------------------|------|---------------------|-------|
| MHz                | H/V | cm  | deg | dBμV/m               | μV/m | dBμV/m              | μV/m  |
| 335.5              | H   | 100 | 000 | 28.0                 | 25.1 | 46.0                | 200.0 |
| 431.6              | V   | 129 | 195 | 28.9                 | 27.9 | 46.0                | 200.0 |
| 528.4              | V   | 100 | 183 | 33.9                 | 49.5 | 46.0                | 200.0 |
| 622.3              | H   | 100 | 239 | 26.3                 | 20.7 | 46.0                | 200.0 |
| 622.6              | V   | 100 | 177 | 35.4                 | 58.9 | 46.0                | 200.0 |
| 719.6              | H   | 100 | 000 | 28.0                 | 25.1 | 46.0                | 200.0 |

#### **EUT Tx on Middle Channel (2441MHz)**

| Emission Frequency | Pol | Hgt | Azm | Field Strength at 3m |      | Specification Limit |       |
|--------------------|-----|-----|-----|----------------------|------|---------------------|-------|
| MHz                | H/V | cm  | deg | dBμV/m               | μV/m | dBμV/m              | μV/m  |
| 335.5              | H   | 100 | 018 | 28.6                 | 26.9 | 46.0                | 200.0 |
| 335.9              | V   | 154 | 194 | 34.7                 | 54.3 | 46.0                | 200.0 |
| 431.3              | V   | 125 | 175 | 29.6                 | 30.2 | 46.0                | 200.0 |
| 527.9              | V   | 100 | 179 | 34.0                 | 50.1 | 46.0                | 200.0 |
| 623.0              | H   | 117 | 246 | 29.0                 | 28.2 | 46.0                | 200.0 |
| 623.0              | V   | 100 | 165 | 35.4                 | 58.9 | 46.0                | 200.0 |



## 2.8 SPURIOUS RADIATED EMISSIONS - continued

### 2.6.7 Test Results – continued

#### 30MHz - 1GHz Frequency Range

#### **EUT Tx on Top Channel (2480MHz)**

| Emission Frequency | Pol | Hgt | Azm | Field Strength at 3m |      | Specification Limit |       |
|--------------------|-----|-----|-----|----------------------|------|---------------------|-------|
| MHz                | H/V | cm  | deg | dBμV/m               | μV/m | dBμV/m              | μV/m  |
| 335.2              | H   | 100 | 010 | 29.0                 | 28.2 | 46.0                | 200.0 |
| 336.0              | V   | 144 | 200 | 35.0                 | 56.2 | 46.0                | 200.0 |
| 431.2              | V   | 130 | 127 | 30.1                 | 32.0 | 46.0                | 200.0 |
| 527.7              | V   | 100 | 188 | 34.4                 | 52.5 | 46.0                | 200.0 |
| 622.7              | V   | 100 | 170 | 36.1                 | 63.8 | 46.0                | 200.0 |
| 622.9              | H   | 120 | 235 | 29.6                 | 30.2 | 46.0                | 200.0 |

#### **ABBREVIATIONS FOR ABOVE TABLES**

H      Horizontal Polarisation  
 Pol    Polarisation  
 deg    degree

V      Vertical Polarisation  
 Hgt    Height  
 Azm    Azimuth



## **2.8 SPURIOUS RADIATED EMISSIONS - continued**

### **2.8.6 Test Results - continued**

#### **1GHz - 25GHz Frequency Range**

Equipment Designation: Intentional Radiator.

The EUT met the requirements of FCC CFR 47: Part 15 Subpart C, Section 15.247(c), 15.205 and 15.209 for Radiated Emissions (1GHz – 25GHz).

Measurements were made with the EUT in Bluetooth Mode (see Section 1.3.3 for details).

#### **EUT Tx on Bottom Channel (2402MHz)**

No EUT emissions were detected above the system noise floor, which was at least 25dB below the limit.

#### **EUT Tx on Middle Channel (2441MHz)**

No EUT emissions were detected above the system noise floor, which was at least 25dB below the limit.

#### **EUT Tx on Top Channel (2480MHz)**

No EUT emissions were detected above the system noise floor, which was at least 25dB below the limit.



### **SECTION 3**

#### **TEST EQUIPMENT USED**



### 3.1 TEST EQUIPMENT USED

| Instrument                  | Manufacturer      | Type No              | EMC / INV No | Cal. Due   |
|-----------------------------|-------------------|----------------------|--------------|------------|
| Section 2.1, 2.4, 2.5 & 2.8 |                   |                      |              |            |
| Turntable Controller        | HD Gmbh           | HD 050               | 2528         | TU         |
| Antenna Mast                | Emco              | 1051-2               | 2182         | TU         |
| Screened Room 5             | Siemens           | EAC54300             | 2533         | TU         |
| EMI Test Receiver           | Rohde & Schwarz   | ESIB40               | 2917         | 11/02/2005 |
| Antenna                     | Emco              | 3115                 | 2397         | 07/07/2005 |
| Signal Generator            | Hewlett Packard   | 8672A                | 411          | 02/03/2005 |
| Digital Barometer           | Oregon Scientific | BAA913HG             | Room 5       | TU         |
| Attenuator                  | Narda             | 4768-6               | 2959         | TU         |
| Emi Test Receiver           | Rohde & Schwarz   | ESIB26               | 2989         | 08/04/2005 |
| Low Noise Amplifier         | Miteq Corp        | AMF-3d-001080-18-13P | 2457         | TU         |
| Solid State Amplifier       | Avantek           | AWT-18036            | 1081         | 26/06/2005 |
| Signal Amplifier            | Avantek           | AMT-26177-33         | 2072         | 25/06/2005 |
| Drg Horn Ant                | Emco              | 3115                 | 2297         | 07/07/2005 |
| Signal Generator            | Hewlett Packard   | 8673B                | 953          | 10/06/2005 |
| Attenuator Fixed            | Narda             | 4768-3               | 2962         | TU         |
| Attenuator 10dB             | Marconi           | 6534/3               | 1494         | TU         |
| Attenuator Fixed            | Marconi           | 4768-3               | 2961         | TU         |
| Signal Generator            | Marconi           | 2031                 | 1979         | 30/10/2004 |
| Standard 20dB Gain Horn     | Flann             | 2024-20              | 1396         | TU         |
| Signal Generator            | Rohde & Schwarz   | SMR 40               | 2768         | 18/10/2004 |
| Spectrum Analyser           | Hewlett Packard   | 8542E                | 2286         | 18/05/2005 |
| Bilog Antenna               | Schaffner         | CBL6143              | 2965         | 12/09/2006 |
| 3GHz High Pass Filter       | RLC Electronics   | F-100-3000-5-R       | 4969         | 10/03/2005 |
| Section 2.2 & 2.6           |                   |                      |              |            |
| Spectrum Monitor            | Rohde & Schwarz   | EZM                  | 1416         | TU         |
| Three Phase LISN            | Rohde & Schwarz   | ESH2-Z5              | 1584         | 02/10/2004 |
| Screened Room 5             | Siemens           | EAC54300             | 2533         | TU         |
| Test Receiver               | Rohde & Schwarz   | ESH3                 | 1020         | 24/09/2005 |
| Transient Limiter           | Hewlett Packard   | 11947A               | 2243         | 24/01/2005 |
| Section 2.3 & 2.7           |                   |                      |              |            |
| EMI Test Receiver           | ROH               | ESIB26               | 2989         | 08/04/2005 |
| Signal Generator            | HEW               | 8673B                | 953          | 10/06/2005 |
| Attenuator Fixed            | NAR               | 4768-3               | 2962         | TU         |
| Screened Room 5             | SIE               | EAC54300             | 2533         | TU         |
| Emi Test Receiver           | ROH               | ESIB26               | 2989         | 08/04/2005 |
| Peak Power Ana              | HEW               | 8990A                | 1670         | 24/08/2005 |
| Power Sensor                | HEW               | 84812A               | 1662         | 24/08/2005 |
| Turntable Controller        | HD Gmbh           | HD 050               | 2528         | TU         |
| Antenna Mast                | Emco              | 1051-2               | 2182         | TU         |
| Screened Room 5             | Siemens           | EAC54300             | 2533         | TU         |
| Horn Antenna                | Emco              | 3115                 | 2297         | 07/07/2005 |
| Antenna                     | Emco              | 3115                 | 2397         | 07/07/2005 |
| Digital Barometer           | Oregon Scientific | BAA913HG             | Room 5       | TU         |



### 3.2 MEASUREMENT UNCERTAINTY

For a 95% confidence level, the measurement uncertainties for defined systems are: -

| Test Discipline                          | Frequency / Parameter     | MU     |
|------------------------------------------|---------------------------|--------|
| Conducted Emissions, LISN                | 150kHz to 30MHz Amplitude | 3.2dB* |
| Radiated Emissions, Bilog Antenna, AOATS | 30MHz to 1GHz Amplitude   | 5.1dB* |
| Substitution Antenna, Radiated Field     | 30MHz to 18GHz Amplitude  | 2.6dB  |
| Radiated Emissions, Horn Antenna, AOATS  | 1GHz to 40GHz Amplitude   | 6.3dB* |
| Substitution Antenna, Radiated Field     | 30MHz to 18GHz Amplitude  | 2.6dB  |

Worst case error for both Time and Frequency measurement 12 parts in  $10^6$ .

\* In accordance with CISPR 16-4



## **SECTION 4**

### **EUT PHOTOGRAPH**



## EUT PHOTOGRAPH



Front View



## **SECTION 5**

### **ACCREDITATION, DISCLAIMERS AND COPYRIGHT**



## 5.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT



This report relates only to the actual item/items tested.

Our UKAS Accreditation does not cover opinions and interpretations and any expressed are outside the scope of our UKAS Accreditation.

Results of tests not covered by our UKAS Accreditation Schedule are marked NUA  
(Not UKAS Accredited).

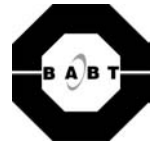
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## **APPENDIX A**

### **TITCHFIELD FCC SITE COMPLIANCE LETTER**



**FEDERAL COMMUNICATIONS COMMISSION**

**Laboratory Division  
7435 Oakland Mills Road  
Columbia, MD 21046**

October 18, 2002

Registration Number: 90987

TUV Product Service Ltd  
Segensworth Road  
Titchfield  
Fareham, Hampshire, PO15 5RH  
United Kingdom  
Attention: Kevan Adsetts

Re: Measurement facility located at Titchfield  
Anechoic chamber (3 meters) and 3 & 10 meter OATS  
Date of Listing: October 18, 2002

Gentlemen:

Your request for registration of the subject measurement facility has been reviewed and found to be in compliance with the requirements of Section 2.948 of the FCC rules. The information has, therefore, been placed on file and the name of your organization added to the list of facilities whose measurement data will be accepted in conjunction with applications for Certification under Parts 15 or 18 of the Commission's Rules. Please note that the file must be updated for any changes made to the facility and the registration must be renewed at least every three years.

Measurement facilities that have indicated that they are available to the public to perform measurement services on a fee basis may be found on the FCC website [www.fcc.gov](http://www.fcc.gov) under E-Filing, OET Equipment Authorization Electronic Filing, Test Firms.

Sincerely,

Thomas W Phillips  
Electronics Engineer