
REPORT ON

Limited FCC CFR 47: Part 15 C Testing in support of an
Application for Grant of Equipment Authorisation
of a Symbol 4121GPRS Hand Held Data Terminal

FCC ID: H9P4121GPRS

Report No OR612329/02 Issue 2

August 2004

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support of an Application for Grant of Equipment Authorisation
of a Symbol 4121GPRS Hand Held Data Terminal

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Report No OR612329/02 Issue 2

August 2004

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DATED

31-08-04

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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: Parts 15 B & C. The sample tested was found to comply with the requirements defined in the applied rules.

Test Engineers;



S Hartley



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 4121GPRS 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 One Symbol Plaza Holtsville 11742-1300, New York United States of America
TYPE NUMBER	4121GPRS
PART NUMBER	4121GPRS1
SERIAL NUMBER	FCC 2
HARDWARE VERSION	Rev 1 (To be released as Rev A)
DECLARED VARIANTS	41210000
TEST SPECIFICATION ISSUE/DATE	FCC CFR 47: Part 15, Subpart C October 2003
NUMBER OF ITEMS TESTED	One
SECURITY CLASSIFICATION OF EUT	Commercial In Confidence
INCOMING RELEASE DATE	Declaration of Build Status 14 th July 2004
DISPOSAL REFERENCE NUMBER DATE	Held pending disposal Not Applicable Not Applicable
ORDER NUMBER	EMEA 14281, dated 27 th May 2004
START OF TEST	27 th June 2004
FINISH OF TEST	26 th August 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

This report is Issue 2 and has been produced to cover several typing errors in the original test report, plus the addition of Conducted Emissions testing which was omitted from the original; this report supersedes the previous report OR612329/02 Issue 1.

The information contained within this report is intended to show limited verification of compliance of the Symbol Technologies Inc 4121GPRS 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 4121GPRS hand held data terminal, which offers Tri Band GSM/GPRS, 2.4GHz 802.11b Wireless LAN and Bluetooth connectivity.

The terminal utilizes the Motorola G18 GSM/GPRS module to offer GSM GPRS data connectivity. Also included in the terminal is 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".

41210000 Sub-equipped version (RLAN and Bluetooth only)

A sub-equipped version of the 4121GPRS Hand Held Data Terminal is also available; this version will offer 802.11b RLAN and Bluetooth connectivity only, as the Motorola GSM GPRS module is not included.

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.

The client has declared that the Symbol 21-64436 (RLAN) and the Motorola GSM GPRS modules are co-located, but that they are not capable of simultaneously transmitting.

The Symbol 21-64381 Bluetooth module is capable of simultaneously transmitting with the Motorola GSM GPRS module. Testing for this mode of operation is covered in BABT Test Report Reference Number OR612329/04.

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	4121GPRS		
PART NUMBER	4121GPRS1		
SERIAL NUMBER	SAMP0000 & SAMP0008		
HARDWARE VERSION	Rev 1 (to be released as Rev A)		
FCC ID	H9P4121GPRS		
INDUSTRY CANADA ID	1549D-4121GPRS		
TECHNICAL DESCRIPTION	The unit supplied for testing was a 4121GPRS hand held data terminal, which offers GPRS functionality, 2.4GHz 802.11b Wireless LAN and Bluetooth connectivity. The terminal utilizes the approved Motorola g18 module to offer GPRS functionality. Also included in the terminal is the approved LA-4137 Symbol Compact Flash 802.11b RLAN radio card and the 21-64831 Symbol Bluetooth module.		
BATTERY/POWER SUPPLY			
CHEMISTRY	Li Ion		
PART NUMBER	21-59510-02		
VOLTAGE	7.2v		
MODULES			
MANUFACTURING DESCRIPTION	RLAN Module	Bluetooth Marlin Module	GPRS Module
MANUFACTURER	Symbol Technologies Inc	Symbol Technologies Inc	Motorola
TYPE	LA4137	21-64381	G18
TRANSMITTER OPERATING BAND	2400-2483.5 MHz	2400-2483.5 MHz	GSM 900/1800/1900
RECEIVER OPERATING BAND	2400-2483.5 MHz	2400-2483.5 MHz	GSM 900/1800/1900
ITU DESIGNATION OF EMISSION	11M0F1D	1M00F1D	250KG7W
POWER	100mW	100mW (restricted in this terminal integration to 1 mW)	900 2W 1800/ 1900 1W
DHSS/FHSS/COMBINED OR OTHER	DSSS	FHSS	GMSK/ TDMA
FCC ID	H9PLA4137	H9P2164381	IHDT6AC1

Signature

 Date
 D of B S Serial No

 14th July 2004
 OS612329

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 on the Alternative Open Field Test Site identified in Appendix A and tested in accordance with the applicable specification.

For all tests, with the exception of Conducted Emissions on the Power Lines, the Symbol 4121GPRS 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 4121GPRS 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 4121GPRS 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

4121GPRS Hand Held Data Terminal

2.1.3 Date of Test

28th June 2004 and 30th June 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 μ V/m	dB μ V/m
2412	H	115	137	110.3	101.2

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 = 54.65dB

Step 3

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

Peak of 55.7dB μ V/m (Limit is 74.0dB μ V/m)

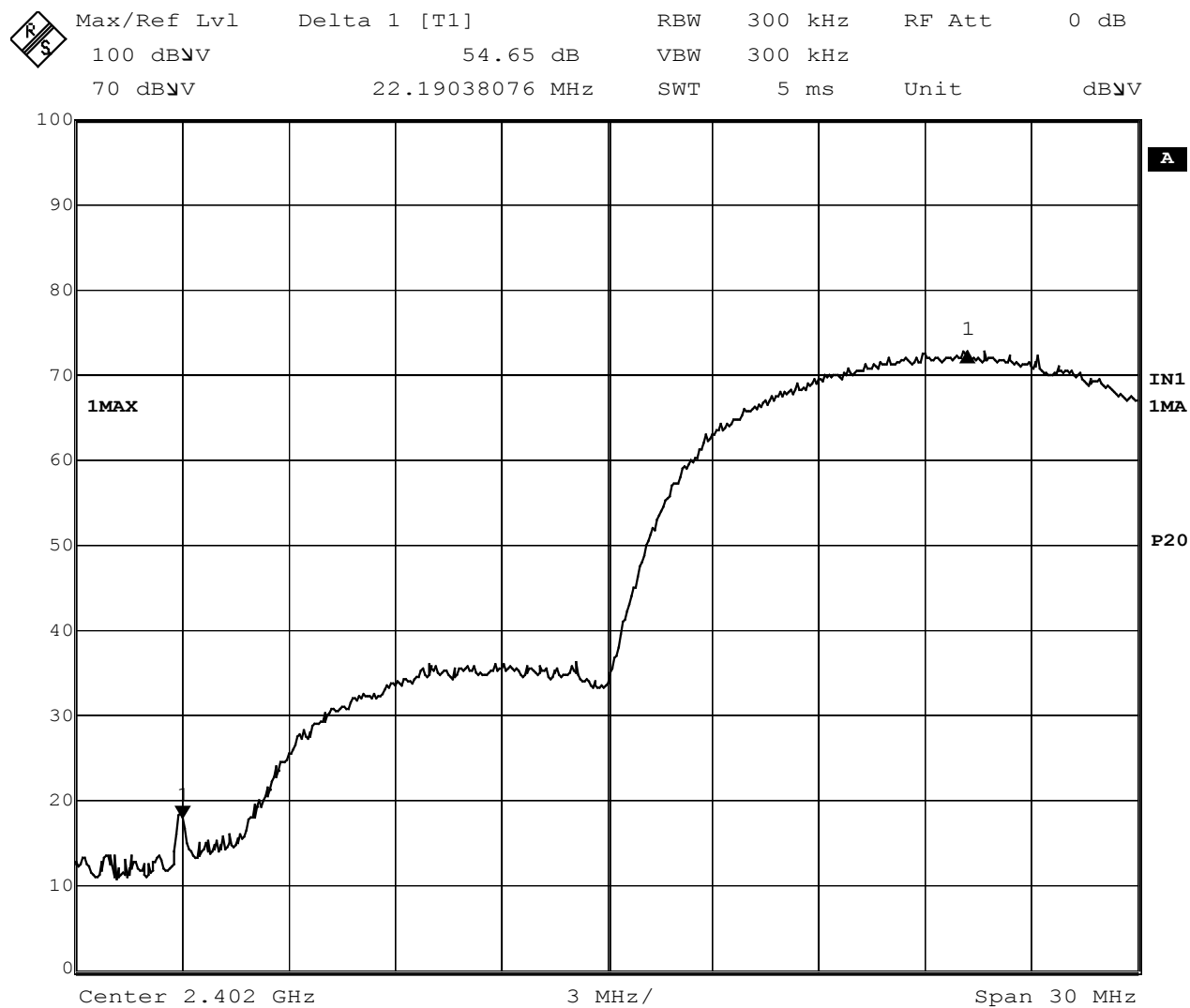
Average of 46.6dB μ V/m (Limit is 54.0dB μ V/m)



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

2.1.6 Test Results - continued

Plot for RLAN Bottom Channel 2412MHz



Date: 28.JUN.2004 20:40:35



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 μ V/m	dB μ V/m
2462	H	57	71.24	106.4	97.5

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 = 55.39dB

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 51.0dB μ V/m (Limit is 74.0dB μ V/m)

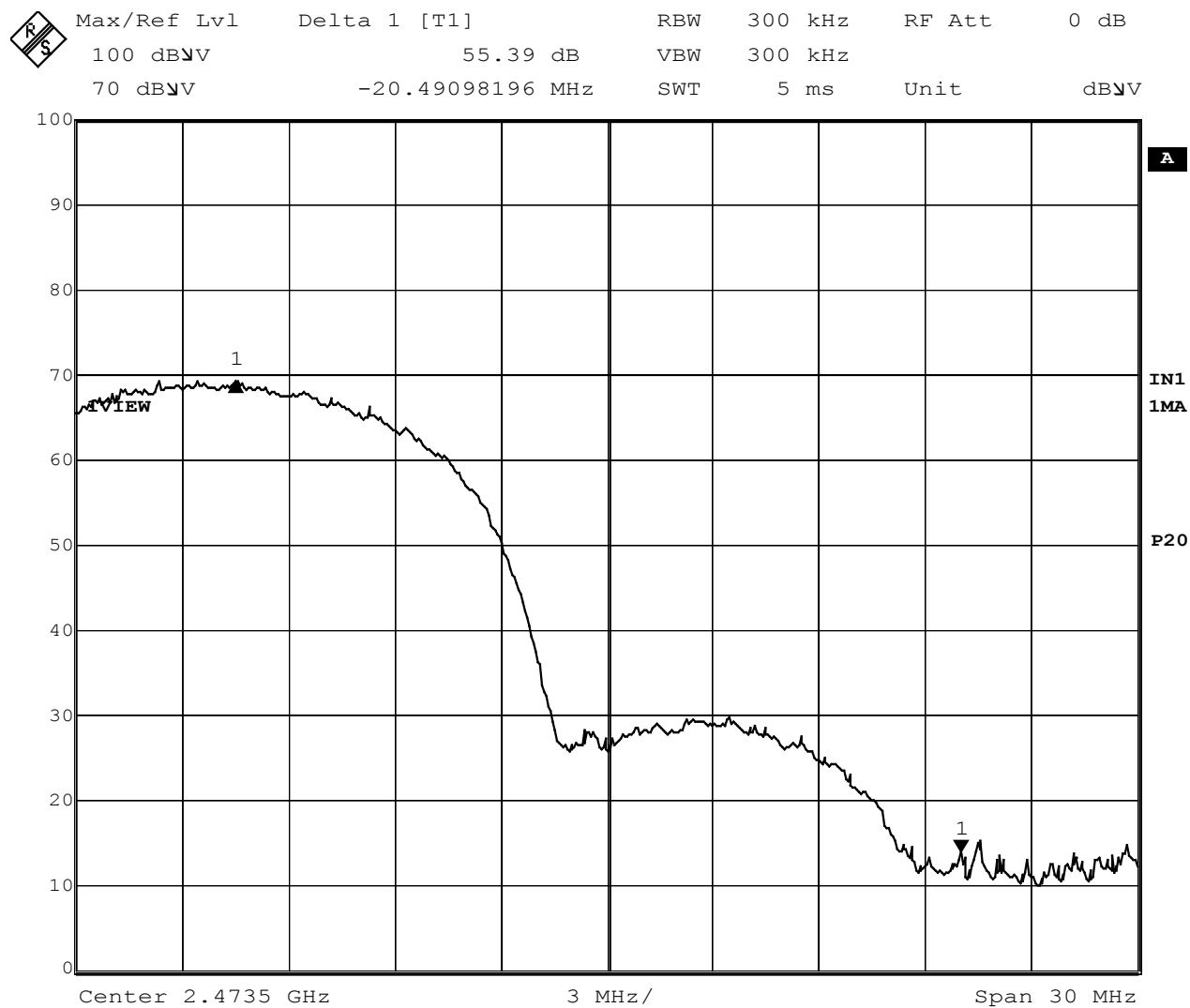
Average of 42.1dB μ V/m (Limit is 54.0dB μ V/m)



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

2.1.6 Test Results - continued

Plot for RLAN Top Channel 2462MHz



Date: 28.JUN.2004 21:14:32



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

4121GPRS Hand Held Data Terminal

2.3.3 Date of Test

26th August 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 Tables 2.2.1 – 2.2.6 respectively.

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)
0.1776	39.6	49.1	54.7	64.7
0.2127	35.8	44.8	53.1	63.1
0.2481	32.5	40.3	51.8	61.8
2.5165	30.4	34.6	46.0	56.0
3.4386	32.9	34.8	46.0	56.0
21.8418	35.8	39.0	50.0	60.0

The margin between the specification requirements and all other emissions were 21.5dB or more below the specified Quasi-Peak limit and 19.2dB 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)
0.1778	38.0	47.1	54.6	64.6
0.2136	34.0	42.5	53.0	63.0
0.2490	30.8	38.8	51.8	61.8
2.6680	29.7	33.1	46.0	56.0
3.3795	31.3	34.4	46.0	56.0
21.5654	28.4	34.9	50.0	60.0

The margin between the specification requirements and all other emissions were 25.1dB or more below the specified Quasi-peak limit and 21.6dB 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)
0.1787	37.2	46.3	54.5	64.5
0.2137	33.7	41.9	53.0	63.0
0.2494	30.1	38.3	51.8	61.8
2.5639	29.5	33.3	56.0	66.0
3.3473	31.3	34.5	56.0	66.0
21.5781	33.1	37.2	50.0	60.0

The margin between the specification requirements and all other emissions were 23.5dB or more below the specified Quasi-Peak limit and 21.6dB 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)
0.1781	37.4	46.9	54.6	64.6
0.2847	31.9	37.7	50.7	60.7
2.5273	30.6	34.5	56.0	66.0
3.3459	32.5	35.0	56.0	66.0
3.5953	32.6	34.7	56.0	66.0
20.9655	32.7	36.3	50.0	60.0

The margin between the specification requirements and all other emissions were 23.0dB or more below the specified Quasi-peak limit and 18.7dB 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)
0.1770	38.6	48.1	54.6	64.6
0.2133	34.8	43.3	53.1	63.1
0.2488	31.1	39.5	51.8	61.8
2.6664	28.7	33.0	46.0	56.0
3.2708	31.5	34.1	46.0	56.0
21.8305	33.7	37.7	50.0	60.0

The margin between the specification requirements and all other emissions were 22.8dB or more below the specified Quasi-Peak limit and 20.6dB 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)
0.1774	40.1	50.0	54.6	64.6
0.2126	36.2	45.4	53.1	63.1
0.2480	32.7	40.8	51.8	61.8
0.2838	32.9	39.3	50.7	60.7
2.6955	31.0	35.0	46.0	56.0
21.5782	29.7	36.7	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 20.3dB or more below the Average limit.



2.2 CONDUCTED EMISSIONS ON POWER LINES - continued

2.2.7 Set Up Photographs -



Conducted Emissions Set Up Photograph



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

4121GPRS Hand Held Data Terminal

2.2.3 Date of Test

27th June 2004 and 29th June 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 (MHz)	Result EIRP (dBm)	Result EIRP (mW)
2412	14.7	29.51
2437	12.1	16.22
2462	9.5	8.91
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

4121GPRS Hand Held Data Terminal

2.3.3 Date of Test

28th June 2004 to 2nd July 2004

2.4.4 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.

2.4.5 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 GHz	Carrier Field Strength dB μ V/m	Limit for Spurious Outside Restricted Band (Carrier F S -20dB) dB μ V/m
Mode 1 (RLAN)	2412	102.6	82.6
Mode 1 (RLAN)	2437	100.2	80.2
Mode 1 (RLAN)	2462	100.7	80.7

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 MHz	Field Strength μ V/m	Quasi Peak Field Strength dB μ 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 Strength dB μ V/m	Peak Field Strength dB μ 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	
MHz	H/V	cm	deg	dBμV/m	μV/m	dBμV/m	μV/m
335.5	V	152	192	32.8	43.7	46.0	200.0
398.1	V	100	055	25.2	18.2	46.0	200.0
431.1	V	104	204	32.0	39.8	46.0	200.0
527.1	V	100	178	37.5	45.0	46.0	200.0
575.1	V	100	180	30.2	32.4	46.0	200.0
622.9	V	100	193	36.6	67.6	46.0	200.0

EUT Tx on Middle Channel (2437MHz)

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	V	145	191	32.9	44.2	46.0	200.0
398.1	V	100	051	24.8	17.4	46.0	200.0
431.3	V	109	184	31.8	38.9	46.0	200.0
527.2	V	100	187	37.2	72.4	46.0	200.0
575.0	V	100	195	28.9	27.9	46.0	200.0
623.0	V	100	180	38.4	83.2	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
335.4	V	150	202	33.1	45.2	46.0	200.0
398.5	V	100	053	23.4	14.8	46.0	200.0
431.3	V	118	192	32.5	42.2	46.0	200.0
527.1	V	100	188	37.0	70.8	46.0	200.0
575.0	V	100	192	30.1	32.0	46.0	200.0
623.0	V	100	184	39.0	89.0	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
2.468	H	146	128	51.3	74.0	41.3	54.0
2.479	H	117	127	52.2	74.0	41.2	54.0
2.490	H	141	135	54.9	74.0	45.6	54.0
4.076	H	100	159	53.2	74.0	45.4	54.0
4.822	H	100	241	53.2	74.0	38.7	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
4.126	H	146	188	53.5	74.0	47.1	54.0

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
4.176	H	146	202	54.9	74.0	47.5	54.0



2.4 SPURIOUS RADIATED EMISSIONS - continued

2.4.7 Set Up Photograph



Spurious Radiated Emissions Set Up Photograph



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 4121GPRS 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

4121GPRS Hand Held Data Terminal

2.5.3 Date of Test

28th June 2004 and 30th June 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 μ V/m	dB μ V/m
2402	V	100	10	96.0	87.7

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 = 41.85dB

Step 3

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

Peak of 54.15dB μ V/m (Limit is 74.0dB μ V/m)

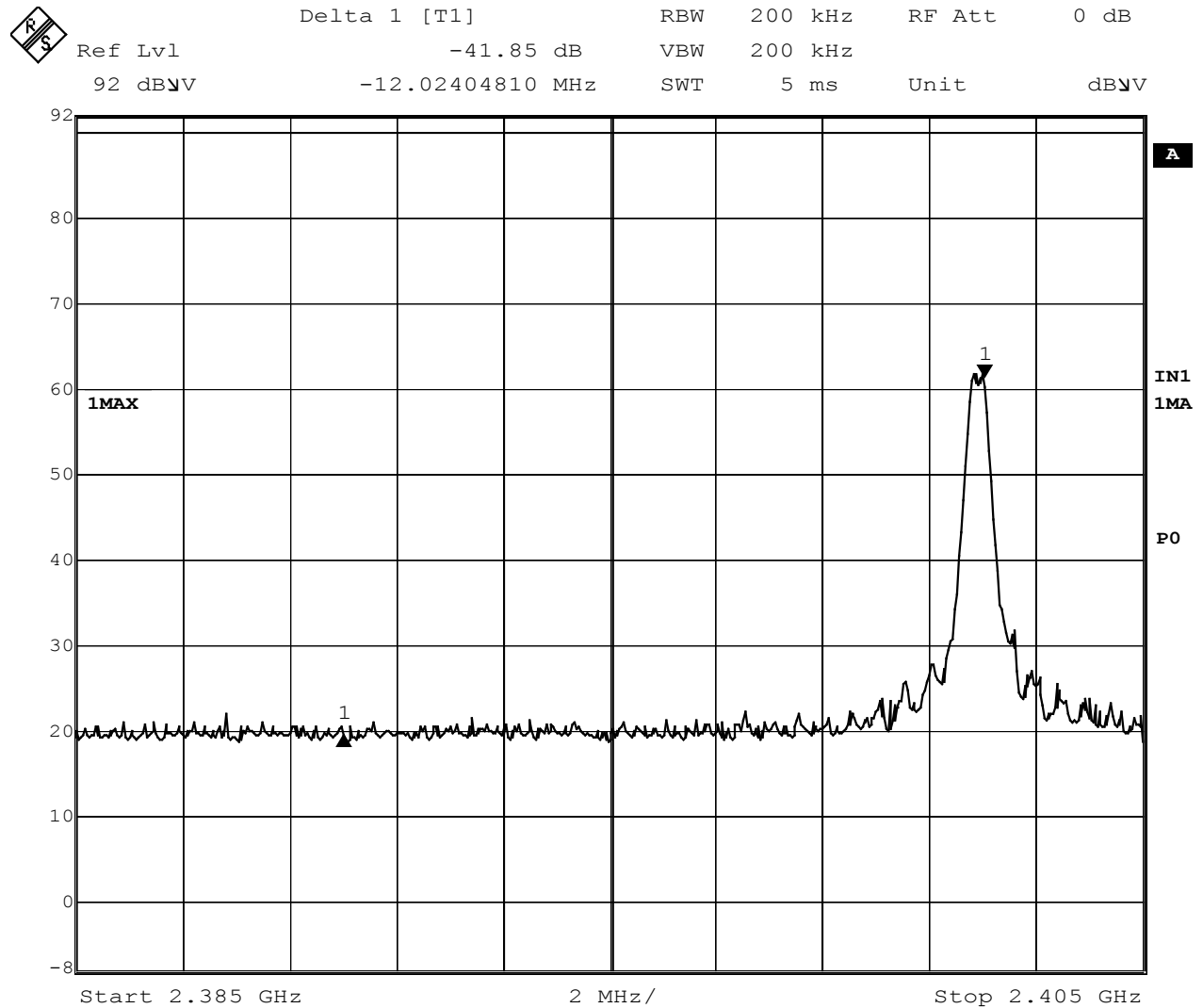
Average of 45.85dB μ V/m (Limit is 54.0dB μ V/m)



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

2.5.6 Test Results - continued

Plot for Bluetooth Bottom Channel 2402MHz



Date: 30.JUN.2004 09:40:27



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	dB μ V/m	dB μ V/m
2480	V	119	11	94.4	86.4

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 = 40.93dB

Step 3

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

Peak of 53.47dB μ V/m (Limit is 74.0dB μ V/m)

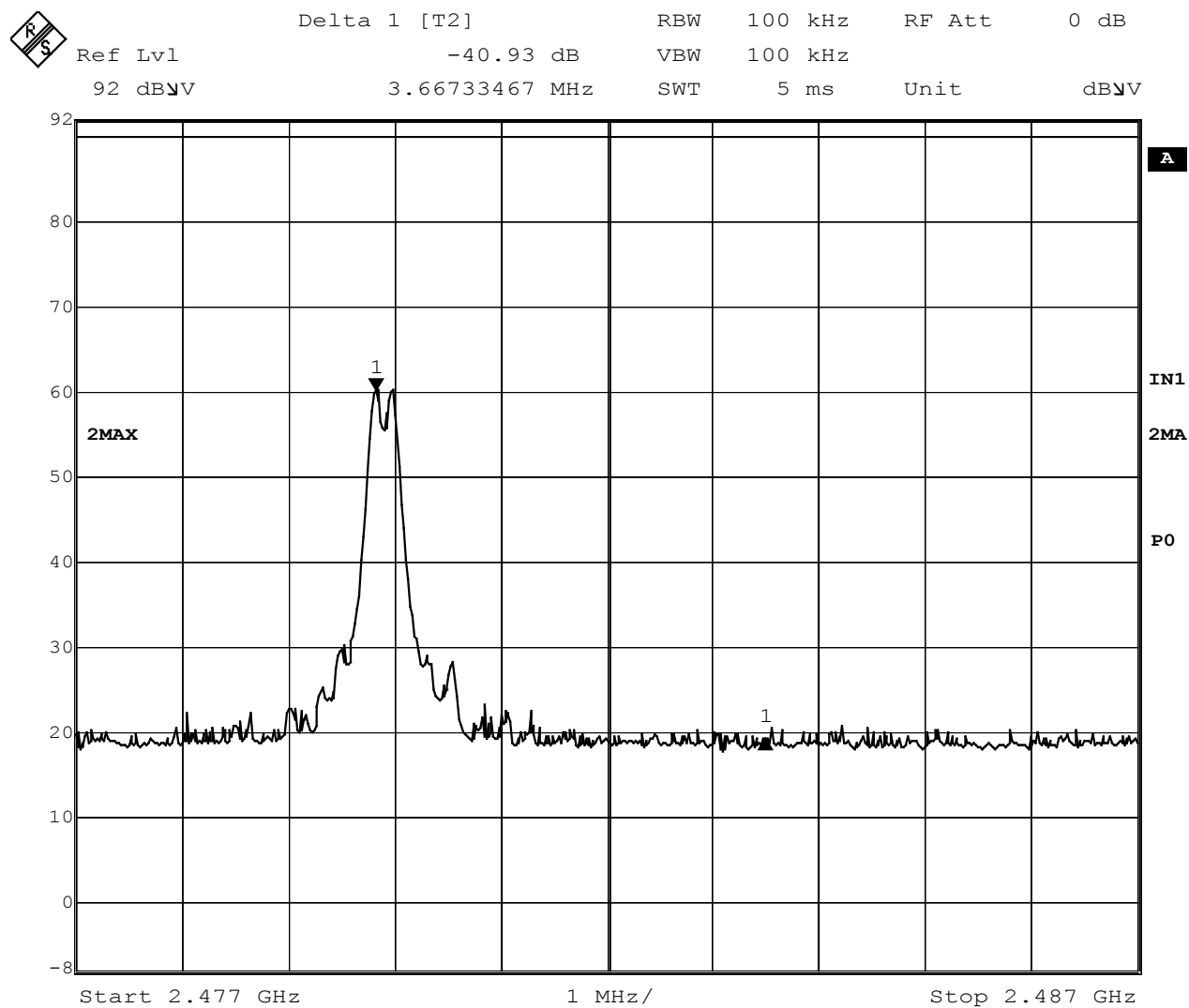
Average of 45.47dB μ V/m (Limit is 54.0dB μ V/m)



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

2.5.6 Test Results - continued

Plot for Bluetooth Top Channel 2480MHz



Date: 30.JUN.2004 09:58:11



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

4121GPRS Hand Held Data Terminal

2.3.4 Date of Test

26th August 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 Tables 2.6.1 – 2.6.6 respectively.

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)
0.1779	37.2	47.0	54.6	64.6
0.2137	32.5	41.7	53.0	63.0
0.2491	33.2	38.2	51.8	61.8
0.2848	31.7	37.8	50.7	60.7
2.5979	29.0	33.4	46.0	56.0
21.7160	26.9	33.6	50.0	60.0

The margin between the specification requirements and all other emissions were 23.6dB or more below the specified Quasi-Peak limit and 23.1dB 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)
0.1779	37.4	47.3	54.6	64.6
0.2135	32.6	41.8	53.0	63.0
0.2491	33.6	38.9	51.8	61.8
2.6336	30.6	35.1	46.0	56.0
2.8102	30.9	35.8	46.0	56.0
20.7014	31.8	35.0	50.0	60.0

The margin between the specification requirements and all other emissions were 25.0dB or more below the specified Quasi-Peak limit and 20.5dB 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)
0.1779	37.0	46.7	54.6	64.6
0.2133	32.5	41.5	53.0	63.0
0.2491	33.1	37.7	51.8	61.8
2.5629	28.7	33.4	46.0	56.0
2.6344	28.9	33.3	46.0	56.0
21.8302	26.5	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 23.5dB 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)
0.1778	37.2	46.9	54.6	64.6
0.2138	32.6	41.4	53.0	63.0
0.2492	33.5	38.6	51.8	61.8
2.4913	30.0	34.4	46.0	56.0
2.5984	30.7	35.0	46.0	56.0
21.6082	29.3	35.3	50.0	60.0

The margin between the specification requirements and all other emissions were 24.7dB or more below the specified Quasi-Peak limit and 20.8dB 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)
0.1779	37.0	46.6	54.6	64.6
0.2137	32.1	41.3	53.0	63.0
0.2492	32.9	37.9	51.8	61.8
2.5989	29.1	33.4	46.0	56.0
2.6705	28.7	32.9	46.0	56.0
21.8380	27.5	34.3	50.0	60.0

The margin between the specification requirements and all other emissions were 25.7dB or more below the specified Quasi-Peak limit and 22.5dB 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)
0.1778	37.0	46.7	54.6	64.6
0.2135	32.1	41.2	53.0	63.0
0.2484	32.4	38.3	51.8	61.8
2.5638	30.3	35.2	46.0	56.0
2.6704	30.3	34.7	46.0	56.0
21.6082	28.8	36.1	50.0	60.0

The margin between the specification requirements and all other emissions were 23.9dB or more below the specified Quasi-peak limit and 21.2dB 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

4121GPRS Hand Held Data Terminal

2.5.3 Date of Test

27th June 2004 and 29th June 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 (MHz)	Result EIRP (dBm)	Result EIRP (mW)
2402	-0.6	0.87
2441	1.2	1.32
2480	-1.2	0.76
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

4121GPRS Hand Held Data Terminal

2.3.4 Date of Test

28th June 2004 to 2nd July 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 GHz	Carrier Field Strength dB μ V/m	Limit for Spurious Outside Restricted Band (Carrier F S -20dB) dB μ V/m
Mode 2 (Bluetooth)	2402	95.4	75.4
Mode 2 (Bluetooth)	2441	95.6	75.6
Mode 2 (Bluetooth)	2480	93.5	73.5

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 μ 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	V	147	200	33.4	46.8	46.0	200.0
431.3	V	117	196	32.0	39.9	46.0	200.0
498.2	V	100	188	20.8	11.0	46.0	200.0
527.2	V	100	192	36.9	70.0	46.0	200.0
575.1	V	100	188	29.4	29.5	46.0	200.0
623.0	V	100	190	38.6	85.1	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	V	146	211	32.9	44.2	46.0	200.0
431.3	V	120	183	31.8	38.9	46.0	200.0
497.4	V	100	182	24.0	15.8	46.0	200.0
527.1	V	100	193	37.4	74.1	46.0	200.0
575.1	V	100	186	29.5	29.9	46.0	200.0
623.0	V	100	190	38.6	85.1	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	Azim	Field Strength at 3m		Specification Limit	
				dBμV/m	μV/m	dBμV/m	μV/m
335.5	V	140	189	32.2	40.7	46.0	200.0
431.3	V	121	177	31.9	39.4	46.0	200.0
527.1	V	100	197	37.7	76.7	46.0	200.0
575.1	V	100	189	29.5	29.9	46.0	200.0
623.0	V	100	188	38.2	81.3	46.0	200.0
718.8	H	100	250	27.1	22.8	46.0	200.0

ABBREVIATIONS FOR ABOVE TABLES

H Horizontal Polarisation
 Pol Polarisation
 deg degree

V Vertical Polarisation
 Hgt Height
 Azim 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 & 2.5				
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
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	16/09/2004
Transient Limiter	Hewlett Packard	11947A	2243	24/01/2005
Section 2.3 & 2.7				
Turntable Controller	HD Gmbh	HD 050	2528	TU
Antenna Mast	Emco	1051-2	2182	TU
Screened Room 5	Siemens	EAC54300	2533	TU
Test Receiver	Rohde & Schwarz	ESIB40	2917	11/02/2005
Horn Antenna	Emco	3115	2297	07/07/2005
Antenna	Emco	3115	2397	07/07/2004
Digital Barometer	Oregon Scientific	BAA913HG	Room 5	TU
Attenuator	Marconi	6534/3	1494	TU
Signal Generator	Hewlett Packard	8672A	411	02/03/2005
Section 2.4 & 2.8				
Turntable Controller	HD Gmbh	HD 050	2528	TU
Antenna Mast	Emco	1051-2	2182	TU
Screened Room 5	Siemens	EAC54300	2533	TU
Test Receiver	Rohde & Schwarz	ESIB40	2917	11/02/2005
Antenna	Emco	3115	2397	07/07/2005
Low Noise Amplifier	Miteq Corp	AMF-3d-001080-18-13P	2457	TU
Amplifier	Avantek	AWT-18036	1081	26/06/2005
Signal Generator	Hewlett Packard	8672A	411	02/03/2005
Attenuator	Narda	4768-6	2959	TU
Low Noise Amplifier	Narda	NARDA DB02-0447	2936	28/04/2005
Antenna	Flann	2024-20	1396	TU
Digital Barometer	Oregon Scientific	BAA913HG	Room 5	TU
Attenuator Fixed	Narda	4768-3	2961	TU
Field Probe	Amp Research	FM5004	2826	TU
Bilog Antenna	Schaffner	CBL6143	2965	12/09/2004



3.2 MEASUREMENT UNCERTAINTY

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

Test Discipline	Frequency / Parameter	MU
For Maximum Output Power	Not Applicable	±0.5dB
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).

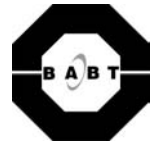
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APPENDIX A

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 under E-Filing, OET Equipment Authorization Electronic Filing, Test Firms.

Sincerely,

Thomas W Phillips
Electronics Engineer