
REPORT ON

Simultaneous Transmitters: Limited FCC Testing in Support of an
Application for Grant of Equipment Authorisation
of a Symbol 4121CDMA Handheld Data Terminal

FCC ID: H9P4121CDMA

Report No OR613597/005 Issue 1

April 2005



Product Service



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DATED 26th April 2005


DISTRIBUTION Symbol Technologies Copy 1
BABT Copy 2
Copy No

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 & 24. The sample tested was found to comply with the requirements defined in the applied rules.

Test Engineers;


P Harrison


A Guy


G Lawler



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SECTION 1

REPORT SUMMARY

Simultaneous Transmitters: Limited FCC Testing in Support of an
Application for Grant of Equipment Authorisation
of a Symbol 4121CDMA Handheld Data Terminal

1.1 STATUS

EQUIPMENT UNDER TEST	Handheld 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	4121CDMA
PART NUMBER	4121CDMA0
SERIAL NUMBER	4MES0022
HARDWARE VERSION	Rev 5 (To be released as Rev A)
DECLARED VARIANTS	None
TEST SPECIFICATION/ISSUE/DATE	FCC CFR 47: Part 15, Subpart C, October 2003 and Part 24, Subpart E, October 2003
NUMBER OF ITEMS TESTED	One
SECURITY CLASSIFICATION OF EUT	Commercial In Confidence
INCOMING RELEASE DATE	Declaration of Build Status 24 March 2005
DISPOSAL REFERENCE NUMBER DATE	Held pending disposal Not Applicable Not Applicable
ORDER NUMBER DATE	4500405504 29 November 2004
START OF TEST	14 March 2005
FINISH OF TEST	1 April 2005
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 FCC 04-165 (ET Docket No 03-201 released 12 July 2004)

1.2 INTRODUCTION

The information contained within this report is intended to show limited verification of compliance of the Symbol Technologies Inc 4121CDMA Handheld Data Terminal to the requirements of FCC Specification Parts 15 C and 24, for Simultaneous Transmission of Co-Located Transmitters.

Testing was carried out in support of an application for Grant of Equipment Authorisation Type 2 Permissive Change in the name of Symbol Technologies Inc.

The purpose of this Test Report is to show compliance for Simultaneous Radio Operation of CDMA 1900 with Bluetooth.

Although testing is carried out against both FCC Specification Parts 15 C and 24, it is only a requirement for the EUT to comply with the least stringent limit when both Radios are transmitting. Therefore in this report only the limits for Part 24 have been applied.

Limited Conducted Emissions testing has been carried out with the CDMA 1900 and Bluetooth simultaneously transmitting, as the emissions detected were less than 5% of the specification limit it was determined, in agreement with the TCB that testing only need be carried out in simultaneous transmit.

Testing of the Symbol Compact Flash 802.11b RLAN radio card and Symbol 21-64831 Symbol Bluetooth module can be found in BABT Test Report Number OR613597/01.

Testing of the Motorola C18 module for 850MHz can be found in BABT Test Report Number OR613597/02.

Testing of the Motorola C18 module for 1900MHz can be found in BABT Test Report Number OR613597/03.

The Symbol Compact Flash 802.11b RLAN radio card integrated in this terminal is not designed to operate simultaneously with the Motorola C18 module or 21-64831 Symbol Bluetooth module and therefore these modules are tested independently, but are co-located.

The Symbol 21-64831 Symbol Bluetooth module and Motorola C18 module integrated in this terminal are designed to operate simultaneously and therefore these are tested in Simultaneous transmit mode. This testing can be found in this report and BABT Test Report Number OR613597/04.

In accordance with Part 15.207(c), Conducted Emissions testing has been performed as the EUT is battery powered and is capable of operation whilst connected to the AC Power Lines. For the Symbol Compact Flash 802.11b RLAN radio card the Conducted Emissions were performed and is recorded in BABT Test Report Number OR613597/01. Testing for the Motorola C18 module and 21-64831 Symbol Bluetooth module testing was performed in the worst case Simultaneous Transmit modes. The test results can be found in this report and BABT Test Report Number OR613597/04.



1.3 PRODUCT INFORMATION

1.3.1 Technical Description

The Equipment Under Test (EUT) was a 4121CDMA Handheld Data Terminal, which offers CDMA 800/1900, 802.11b Wireless LAN and Bluetooth connectivity.

The terminal utilizes the approved Motorola C18 module to offer CDMA 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.

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".

1.3.3 Test Configuration

1.3.3.1 Sim Tx Mode

Bluetooth and 1900 Transmitting Simultaneously on the following frequencies;

Bluetooth	1900
2402MHz	1908.75MHz
2480MHz	1851.25MHz

1.3.4 DECLARATION OF BUILD STATUS

MAIN EUT			
MANUFACTURING DESCRIPTION	Handheld Data Terminal		
MANUFACTURER	Symbol Technologies Inc.		
TYPE	4121CDMA		
PART NUMBER	4121CDMA0		
SERIAL NUMBER	4XEQ0155,4XEQ0156, 4MES0022		
HARDWARE VERSION	Rev 5 (to be released as Rev A)		
FCC ID	H9P4121CDMA		
INDUSTRY CANADA ID	1549D-4121CDMA		
TECHNICAL DESCRIPTION	The 4121CDMA is a Handheld Data Terminal, which offers CDMA 800/1900, 802.11b Wireless LAN and Bluetooth connectivity. The terminal utilizes the approved Motorola C18 module to offer CDMA 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			
MANUFACTURING DESCRIPTION	Internal Lithium Ion Battery (Li ion)		
PART NUMBER	31-57157-01		
HARDWARE VERSION	Rev B		
VOLTAGE	7.2V		
MODULE			
MANUFACTURING DESCRIPTION	RLAN Module	Bluetooth Module	CDMA Module
MANUFACTURER	Symbol Technologies Inc	Symbol Technologies Inc	Motorola Inc.
TYPE	LA4137	21-64381	C18
ITU DESIGNATION OF EMISSION	11M0F1D	1M00F1D	1M25F9W
TRANSMITTER POWER	100mW	100mW (restricted in this terminal integration to 1 mW)	CDMA800: 0.32W CDMA1900: 0.32W
TRANSMITTER OPERATING BAND	2400-2483.5 MHz	2400-2483.5 MHz	824.7 to 848.31MHz 1851.25 to 1908.75MHz
RECEIVER OPERATING BAND	2400-2483.5 MHz	2400-2483.5 MHz	869.7 to 893.31MHz 1931.25 to 1988.75MHz
DHSS/FHSS/COMBINED OR OTHER	DSSS	FHSS	CDMA (1XRTT)
FCC ID	H9PLA4137	H9P2164381	IHDT56CW1
INDUSTRY CANADA ID	1549104431A	1549D-2164381	109O-CW1
ANCILLARIES			
MANUFACTURING DESCRIPTION	Belt Clip		
PART NUMBER	UPS-BC5000		
HARDWARE VERSION	Rev A		

Signature



Date

24th March 2005

D of B S Serial No

OS613957

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	15.207	Conducted Emissions	Pass	
2.2	24.238	Spurious Radiated Emissions	Pass	

1.5 TEST CONDITIONS

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

For all tests, the Symbol 4121CDMA Handheld Data Terminal was powered by its own internal battery, with the exception of Conducted Emissions where the EUT was placed in a Symbol single slot charger using a Symbol 50-24000-006 120V, 60Hz AC Power Supply Unit.

1.6 DEVIATIONS FROM THE STANDARD

Limited tests were applied in accordance with Symbol requirements.

1.7 MODIFICATION RECORD

Not Applicable

1.8 ALTERNATIVE TEST SITE

Under our group UKAS Accreditation, BABT conducted the following tests at our Maplewood Test Laboratory, as detailed in Appendix B.

- FCC: Part 24.238, Spurious Radiated Emissions 30MHz-1GHz

SECTION 2

TEST DETAILS

Simultaneous Transmitters: Limited FCC Testing in Support of an
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of a Symbol 4121CDMA Handheld Data Terminal

2.1 CONDUCTED EMISSIONS ON POWER LINES

2.1.1 Specification Reference

FCC CFR 47: Part 15 Subpart C, Section 15.207

2.1.2 Equipment Under Test

4121CDMA Handheld Data Terminal

2.1.3 Date of Test

31 March 2005

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 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 from a 120V, 60Hz supply.

2.1 CONDUCTED EMISSIONS ON POWER LINES - continued

2.1.6 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 Sim Tx Mode (see Section 1.3.3 for details).

EUT Tx on Bluetooth Channel 2480MHz and CDMA 1900 1851.25MHz – Live Line

Emission Frequency (MHz)	Average Level (dBµV)	Quasi-Peak Level (dBµV)	Average Limit (dBµV)	Quasi-Peak Limit (dBµV)
0.1500	45.4	55.9	56.0	66.0
0.1850	40.6	50.1	54.3	64.3
0.2214	36.5	45.6	52.8	62.8
0.2582	32.9	41.3	51.5	61.5
0.2952	29.0	37.6	50.4	60.4
0.3321	30.9	36.2	49.4	59.4

The margin between the specification requirements and all other emissions were 23.2dB or more below the specified Quasi-Peak limit and 21.4dB or more below the Average limit.

EUT Tx on Bluetooth Channel 2480MHz and CDMA 1900 1851.25MHz – Neutral Line

Emission Frequency (MHz)	Average Level (dBµV)	Quasi-Peak Level (dBµV)	Average Limit (dBµV)	Quasi-Peak Limit (dBµV)
0.1500	46.1	56.3	56.0	66.0
0.1848	41.4	50.8	54.3	64.3
0.2214	37.4	46.2	52.7	62.7
0.2582	34.4	43.2	51.5	61.5
0.2954	28.6	37.7	50.4	60.4
0.3322	31.8	35.7	49.4	59.4

The margin between the specification requirements and all other emissions were 23.7dB or more below the specified Quasi-peak limit and 21.8dB or more below the specified Average limit.

2.1 CONDUCTED EMISSIONS ON POWER LINES - continued

2.1.6 Test Results - continued

EUT Tx on Bluetooth Channel 2402MHz and CDMA 1900 1908.75MHz – Live Line

Emission Frequency (MHz)	Average Level (dBµV)	Quasi-Peak Level (dBµV)	Average Limit (dBµV)	Quasi-Peak Limit (dBµV)
0.1501	47.1	57.7	56.0	66.0
0.1860	42.4	52.0	54.2	64.2
0.2214	37.9	47.4	52.8	62.8
0.2584	34.3	42.8	51.5	61.5
0.2955	29.6	39.1	50.4	60.4
0.3322	31.3	37.6	49.4	59.4

The margin between the specification requirements and all other emissions were 21.8dB or more below the specified Quasi-Peak limit and 20.8dB or more below the Average limit.

EUT Tx on Bluetooth Channel 2402MHz and CDMA 1900 1908.75MHz – Neutral Line

Emission Frequency (MHz)	Average Level (dBµV)	Quasi-Peak Level (dBµV)	Average Limit (dBµV)	Quasi-Peak Limit (dBµV)
0.1501	47.2	57.4	56.0	66.0
0.1847	43.0	52.3	54.3	64.3
0.2215	38.1	47.2	52.7	62.7
0.2582	35.1	44.0	51.5	61.5
0.2954	30.0	38.9	50.4	60.4
0.3691	31.3	36.6	48.5	58.5

The margin between the specification requirements and all other emissions were 21.9dB or more below the specified Quasi-peak limit and 20.4dB or more below the specified Average limit.

2.2 SPURIOUS RADIATED EMISSIONS

2.2.1 FCC CFR 47: Part 24 Subpart E, Section 24.238

2.2.2 Equipment Under Test

4121CDMA Handheld Data Terminal

2.2.3 Date of Test

22 March 2005

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.

A preliminary profile of the Spurious Radiated Emissions was obtained by operating the EUT on a remotely controlled turntable within the 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 Anechoic Chamber (3 metres) 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.



2.2 SPURIOUS RADIATED EMISSIONS - continued

2.2.5 Test Procedure - continued

The limits for Spurious Emissions have been calculated, as shown in the table below using the following formula:

Field Strength of Carrier - $(43 + 10\text{Log}(P))$

Where:

Field Strength is measured in dB μ V/m

P is Measured Transmitter Power in Watts

Test Mode	Carrier Frequency GHz	Carrier Field Strength dB μ V/m	Measured Power W	Limit for Spurious Emissions dB μ V/m
Sim Tx Mode	1851.25	130.2	1.32	86.0
Sim Tx Mode	1908.75	129.9	1.58	84.9

2.2 SPURIOUS RADIATED EMISSIONS - continued

2.2.6 Test Results

30MHz - 1GHz Frequency Range

Equipment Designation: Intentional Radiator.

The EUT met the requirements of FCC CFR 47: Part 24.238 for Radiated Emissions (30MHz – 1GHz).

EUT Tx on Bluetooth 2402MHz and 1900: 1908.75MHz

No additional emissions caused by intermodulation of the Bluetooth and CDMA 1900 transmitters simultaneously transmitting were detected.

EUT Tx on Bluetooth 2480MHz and 1900: 1851.25MHz

No additional emissions caused by intermodulation of the Bluetooth and CDMA 1900 transmitters simultaneously transmitting were detected.

2.2 SPURIOUS RADIATED EMISSIONS - continued

2.2.6 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) and 24.238 for Radiated Emissions (1GHz – 25GHz).

EUT Tx on Bluetooth: 2402MHz and 1900: 1908.75MHz

No additional emissions caused by intermodulation of the Bluetooth and CDMA 1900 transmitters simultaneously transmitting were detected. Harmonics of both transmitters were detected and monitored, any significant differences from the single transmit modes are recorded below.

Frequency	Antenna		Turntable	Peak Field Strength	Peak Limit
	Pol	Height	Azimuth		
MHz	H/V	cm	deg	dBµV/m	dBµV/m
5727	V	145	272	75.4	84.9

EUT Tx on Bluetooth: 2480MHz and 1900: 1851.25MHz

No additional emissions caused by intermodulation of the Bluetooth and CDMA 1900 transmitters simultaneously transmitting were detected. Harmonics of both transmitters were detected and monitored, any significant differences from the single transmit modes are recorded below.

Frequency	Antenna		Turntable	Peak Field Strength	Peak Limit
	Pol	Height	Azimuth		
MHz	H/V	cm	deg	dBµV/m	dBµV/m
5553	H	100	279	67.8	86.0

ABBREVIATIONS FOR ABOVE TABLES

H	Horizontal Polarisation	V	Vertical Polarisation
Pol	Polarisation	deg	degree

SECTION 3

TEST EQUIPMENT USED

3.1 TEST EQUIPMENT USED

List of absolute measuring and other principal items of test equipment.

Instrument	Manufacturer	Type No	EMC / INV No	Cal. Due
Section 2.1				
Test Receiver	Rohde & Schwarz	ESH3	1020	24/09/2005
Spectrum Analyser	Rohde & Schwarz	EZM	1416	TU
Artificial Mains LISN	Rohde & Schwarz	ESH2-Z5	1915	28/04/2005
Transient Limiter	Hewlett Packard	11947A	2271	19/08/2005
Section 2.2(Octagon House Testing)				
Antenna Mast	Emco	1051-2	2182	TU
Emi Test Receiver	Rohde & Schwarz	ESIB40	2917	07/03/2006
Low Noise Amplifier	Miteq	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 Antenna	Emco	3115	2297	07/07/2005
Signal Generator	Hewlett Packard	8672A	411	02/03/2005
Signal Generator	Marconi	2031	1768	01/09/2005
3GHz High Pass Filter	RLC Electronics	F-100-3000-5-R	4969	10/03/2005
Section 2.2(Maplewood Testing)				
Amplifier 80-1000MHz	Amplifier Research	200W1000M7A	13.028	TU
Amplifier 800MHz-3GHz	Amplifier Research	30S13G	13.041	TU
Signal Generator	Rohde & Schwarz	SMY02	3.094	20/04/2005
Bilog	Chase	CBL6141	27.008	TU
Isotropic Field Probe	Amplifier Research	FP 6001	14.044	03/11/2005
Directional Coupler	Amplifier Research	DC 6080	-	TU
Directional Coupler	Amplifier Research	DC 7144	19.195	TU
Millivoltmeter	Rohde & Schwarz	NRVD	4.033	05/11/2005
Insertion Unit	Rohde & Schwarz	NRV-Z51	4.061	TU
50Ω attached to Dir. Coupler	-	-	-	TU
50Ω attached to Dir. Coupler	-	-	-	TU
Spectrum Analyser	Hewlett Packard	8562E	1.055	TU

3.2 MEASUREMENT UNCERTAINTY

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

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

ACCREDITATION, DISCLAIMERS AND COPYRIGHT

4.1 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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TÜV Product Service Limited

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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,

A handwritten signature in black ink that reads "Thomas W Phillips".

Thomas W Phillips
Electronics Engineer

APPENDIX B

MAPLEWOOD FCC SITE COMPLIANCE LETTER



FCC Compliance Letter

FEDERAL COMMUNICATIONS COMMISSION

Laboratory Division
7435 Oakland Mills Road
Columbia, MD 21046

June 28, 2004

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 chambers Room 5 & Site 6 (3 meters) and 3 & 10 meter OATS
Date of Listing: October 18, 2002

Dear Sir or Madam:

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,

A handwritten signature in black ink that reads "Thomas W. Phillips". The signature is written in a cursive style.

Thomas W Phillips
Electronics Engineer