
REPORT ON

FCC CFR 47: Part 15 Testing in support of an Application for Grant of Equipment Authorisation
of a Symbol 4111-CDMA Hand Held Data Terminal
FCC ID: H9P4111CDMA

Report No OR611456/01/Issue 2

October 2003

REPORT ON

FCC CFR 47: Part 15C Testing in support of an Application for
Grant of Equipment Authorisation of a Symbol 4111-CDMA
Hand Held Data Terminal

FCC ID: H9P4111CDMA

Report No OR611456/01/Issue 2

October 2003

PREPARED FOR

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APPROVED BY



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DATED

21 October 2003

DISTRIBUTION

Symbol Technologies Inc
TÜV Product Service

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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 compliance with FCC CFR 47: Part 15. The sample tested was found to comply with the requirements defined in the applied rules.

Test Engineers;



S Hartley



P Harrison



A Guy



G Lawler



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STATUS

OBJECTIVE	To undertake measurements to determine the Equipment Under Test's (EUT's) compliance with the specification.
MANUFACTURING DESCRIPTION	Hand Held Data Terminal
APPLICANT	Symbol Technologies Inc One Symbol Plaza Holtsville NY 11742-1300 New York United States of America
MANUFACTURERS TYPE NUMBER	4111-CDMA
MANUFACTURERS MODEL NUMBER	4111-GPRS0
SERIAL NUMBER	FCC CDMA 2
HARDWARE VERSION	Rev. 3
DECLARED VARIANTS	None
TEST SPECIFICATION NUMBER	FCC CFR 47: Part 15 Subpart C, August 2002
REGISTRATION NUMBER	OR611456/01
QUANTITY OF ITEMS TESTED	One
SECURITY CLASSIFICATION OF EUT	Unclassified
INCOMING RELEASE SERIAL NUMBER DATE	Declaration of Build Status OR611456 15 th August 2003
DISPOSAL REFERENCE NUMBER DATE	Held pending disposal N/A N/A
START OF TEST FINISH OF TEST	18 th August 2003 26 th August 2003
TEST ENGINEERS	S C Hartley P J Harrison A Guy G Lawler
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)



TEST RATIONALE

This report has been re-issued as Issue 2 to cover some typographical errors. This report is intended to replace the original report OR611456-01 Issued in October 2003.

The information contained within this report is intended to show verification of compliance of the Symbol Technologies Inc 4111-CDMA Hand Held Data Terminal to the requirements of FCC CFR 47: Part 15.

FCC ID H9P4111CDMA

The unit supplied for testing was a 4111-CDMA hand held data terminal, which offers CDMA Functionality, 2.4GHz 802.11b Wireless LAN and Bluetooth connectivity.

The terminal utilizes the Motorola C18 CDMA 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 21-58466 Symbol Bluetooth module. FCC ID numbers are detailed below:

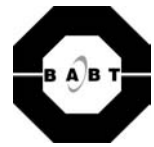
<u>Type:</u>	<u>Description</u>	<u>Approval</u>	<u>FCC ID</u>	<u>Date</u>
C18	Motorola CDMA module,	FCC CFR 47: Part 22/24	IHDT56CW1	24/03/2003
LA4137	Symbol Compact Flash RLAN Radio	FCC CFR 47: Part 15	H9PLA4137	21/03/2000
21-58466	Symbol Bluetooth Module	FCC CFR 47: Part 15	H9PSNAPPER	10/11/2002

This report details testing carried out in accordance with:

- FCC CFR 47: Part 15.247(b)(3), Maximum Peak Output Power
- FCC: Part 15.205, 15.209, Measurement at Band Edge (Marker Delta Method)
- FCC CFR 47: Part 15.247(c), Radiated Emissions

Location Of Testing

BABT Engineers, Steve Hartley, Anthony Guy, Phil Harrison, and Graeme Lawler, conducted all testing at the premises BABT, Segensworth Road, Fareham, Hampshire, PO15 5RH. Spurious Radiated Emissions measurements were performed in a 3 metre Anechoic Chamber. A complete site description is on file with the FCC Laboratory Division, Registration Number: 90987. See Annex A.



SYSTEM CONFIGURATION DURING EMC TESTING

The EUT was set-up simulating a typical user installation on the Alternative Open Field Test Site identified in Annex A, and tested in accordance with the specification.

The test software in the EUT enabled the Test Engineer to select full power and continuous transmit on the following channels;

2.4GHz RLAN functionality

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

The Output Power level (controlled by application software) was set to 169.

2.4GHz Bluetooth functionality

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

TEST SETUP PHOTOGRAPH

The photograph below shows the EUT configuration during Radiated Emission testing.



Photograph 1



EQUIPMENT INFORMATION

Equipment under Test (EUT):

Equipment: 4111-CDMA Hand Held Data Terminal
Manufacturer: Symbol Technologies Inc
Type No: 4111-CDMA
Model No. 4111-GPRS0
Serial No: FCC CDMA 2
Drawing Revision: Rev. 3

Instrumentation used for Emission Testing:

Instrument	Manufacturer	Type No	EMC No	Cal to
Screened Enclosure	Siemens	EAC 54300	2533	TU
Turntable & Controller	HD GmbH	HD 050	2528	TU
Antenna Mast	Emco	2070	-	TU
Antenna Mast Controller	Emco	2090	-	TU
Test Receiver	Hewlett Packard	8542E	2286	13 Dec 03
Bilog Antenna	Chase	CBL 6143	2860	11 Apr 04
Test Receiver	Rhode and Schwarz	ESIB 40	2917	04 Feb 04
Horn	EMCO	3115	2297	04 July 04
Horn (1 - 18GHz)	EMCO	3115	2397	04 July 04
Horn (18GHz - 40GHz)	Advanced Microtek	AM180HA-K-TU2	2945	20 May 04
Signal Generator	Hewlett Packard	8673B	953	05 Jun 04
Low Noise Amplifier (1 - 8GHz)	Miteq	AMF-3D-001080-18-13P	2457	TU
Low Noise Amplifier (8 - 18GHz)	Avantek	AWT 18036	1081	TU
Low Noise Amplifier (18 - 26GHz)	Avantek	AMT-26177-33	2072	TU
3GHz High Pass Filter	RLC Electronics	F-100-3000-5-R	INV 04467	TU
Barometer	diplex	-	1938	TU
Test Receiver	Rohde & Schwarz	ESIB 26	2958	05 Aug 04
Signal Generator	Marconi	2031	1979	21 Nov 03
Hygrometer	Rotronic	A1	INV4066	28 Nov 03

Instrumentation used for Maximum Power measurements

Instrument	Manufacturer	Type No	EMC No	Cal to
Test Receiver	Hewlett Packard	8542E	2286	13 Dec 03
Turntable & Controller	HD GmbH	HD 050	2528	TU
Antenna Mast	Emco	2070	-	TU
Antenna Mast Controller	Emco	2090	-	TU
Screened Enclosure	Siemens	EAC 54300	2533	TU
Horn	EMCO	3115	2297	04 July 04
Horn (1 - 18GHz)	EMCO	3115	2397	04 July 04
Barometer	diplex	-	1938	TU
Hygrometer	Rotronic	A1	INV4066	28 Nov 03
Test Receiver	Rohde & Schwarz	ESIB 26	2958	05 Aug 04
Signal Generator	Marconi	2031	1979	21 Nov 03

TU - Traceability Unscheduled

Instrumentation Used For Exercising The EUT

Instrument	Manufacturer	Type No	Serial No
CDMA Test Set	Rohde and Schwarz	CMU200	DE29213



MAXIMUM PEAK OUTPUT POWER: RLAN Mode

TEST PROCEDURE

Testing to the requirements of FCC CFR 47:Part 15 Subpart C, Section 15.247(b)(3), for Maximum Peak Output Power was carried out.

The Spectrum Analyser was tuned to the test frequency. The device Output power setting was controlled via the 'Test Mode' on each handset being set to the conditions specified in the Configuration on page 5 of this document. The device was then rotated through 360 degrees until the highest power level was observed in both planes of polarisation. The device was then replaced with a substitution antenna, the signal to the antenna was adjusted to equal the related level detected from the device.

Maximum Peak Output Power measurements were made with the EUT set to continuous transmit at maximum power on the following channels:

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

TEST RESULTS

The EUT met the requirements of FCC CFR 47: Part 15.247(b)(3) for Maximum Peak Output Power, see the table below.

Frequency (MHz)	Result EIRP (dBm)	Result EIRP (mW)
2412	10.8	12.02
2437	11.6	14.45
2462	14.0	25.11

Limit	<4W or <+36dBm
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Table of Results for Maximum Peak Output Power

Procedure: Test Performed in accordance with ANSI C63.4.

Performed by: S Hartley, EMC Engineer.



RADIATED EMISSIONS: EUT in RLAN Mode

MEASUREMENT AT THE BAND EDGE (Marker Delta Method)

Testing to the requirements of FCC CFR 47: Part 15 Subpart C, Section 15.205, for Restricted Bands of Operation was carried out on the Measurement Test Facility detailed in Annex A..
The following Test Results were obtained using the FCC Public Notice document (DA 00-705 released 30 March 2000) for making measurements at the Band Edge, incorporating the 'Marker Delta Method'.

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.

Freq	Ant Pol	Hgt	Azi	Peak Field Strength	Average Field Strength
GHz	H/V	cm	deg	dB μ V/m	dB μ V/m
2.412	H	112	140	110.98	102.65

Table of Results for Measurement at the Band Edge

Step 2

Determine Marker delta amplitude between 2.412GHz fundamental and 2.390GHz the Band Edge under investigation.

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

Marker Delta Amplitude = 55.66dB

Step 3

Subtracting the Marker Delta obtained from Step 2 from the 2.412GHz Field Strength measurement from Step 1, gives following Result

Peak of 110.98dB μ V/m – 55.66dB (Delta) = 55.32dB μ V/m (Limit is 74.0dB μ V/m = Pass)

Average of 102.65dB μ V/m – 55.66dB (Delta) = 46.99dB μ V/m (Limit is 54.0dB μ V/m = Pass)



RADIATED EMISSIONS: EUT in RLAN Mode

MEASUREMENT AT THE BAND EDGE (Marker Delta Method) - continued

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.

Freq	Ant Pol	Hgt	Azi	Peak FS	Average FS
GHz	H/V	cm	deg	dB μ V/m	dB μ V/m
2.462	H	112	145	107.3	103.06

Table of Results for Measurement at the Band Edge

Step 2

Determine Marker delta amplitude between 2.462GHz fundamental and 2.4835GHz the Band Edge under investigation.

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

Marker Delta Amplitude = 59.63dB

Step 3

Subtracting the Marker Delta obtained from Step 2 from the 2.412GHz Field Strength measurement from Step 1, gives following Result

Peak of 107.3dB μ V/m – 59.63dB (Delta) = 47.67dB μ V/m (Limit is 74.0dB μ V/m = Pass)

Average of 103.06dB μ V/m – 59.63dB (Delta) = 43.43dB μ V/m (Limit is 54.0dB μ V/m = Pass)

EUT meets the measurement at the Band Edge requirements for the Top and Bottom Channel.

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

Performed by: P J Harrison, EMC Engineer.



RADIATED EMISSIONS: EUT in RLAN Mode

SPURIOUS RADIATED EMISSIONS

TEST PROCEDURE

Testing to the requirements of FCC CFR 47: Part 15 Subpart C, Section 15.247(c), for Radiated Electric Field Emissions was carried out on the Measurement Test Facility detailed in Annex A. Section 15.247(c) also requires Rule parts 15.205 and 15.209 to be applied.

A preliminary profile of the Radiated Emissions was obtained by operating the Equipment Under Test (EUT) on a remotely controlled turntable within a semi-anechoic chamber; measurements were taken at a 3m distance unless otherwise stated. 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, a search was made in the frequency range 30MHz to 25GHz. The list of worst case emissions was then confirmed or updated under Open Site conditions. Emission levels were maximised by adjusting the antenna height, antenna polarisation and turntable azimuth.

30MHz – 1GHz emissions levels were then formally measured using a CISPR Quasi-Peak detector. 1GHz – 25GHz emissions levels were then formally measured using Peak and Average detectors.

(Note: Peak measurements performed using a Resolution and Video Bandwidth of 1MHz, Average measurements performed using a Resolution Bandwidth of 1MHz and a Video Bandwidth of 10Hz)

The EUT was operating off its internal battery; the battery was replaced at regular intervals to ensure optimum performance of the EUT.

Measurements were made with the EUT transmitting on the following channels.

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

Radiated Emissions from 30MHz to 1GHz were made using a HP 8542E Test Receiver.

Radiated Emissions from 1GHz to 25GHz were made using a Rhode and Schwarz ESIB 40 Test Receiver.

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



RADIATED EMISSIONS TEST RESULTS: EUT in RLAN Mode - continued

SPURIOUS RADIATED EMISSIONS - continued

30MHz – 1GHz Frequency Range

Equipment Designation: Intentional Radiator.

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

EUT Tx on Bottom Channel (2.412GHz)

30MHz – 1GHz Alternative Open Area Test Site Results: The levels of the six highest emissions measured in accordance with the specification are presented below: -

Emission Frequency	Pol	Hgt	Azim	Field Strength at 3m		Specification Limit	
				MHz	H/V	cm	deg
239.5	H	100	0	31.5	37.6	46.0	200.0
335.5	V	140	2	30.3	32.7	46.0	200.0
431.3	V	100	189	36.8	69.2	46.0	200.0
497.6	V	100	178	33.5	47.3	46.0	200.0
527.1	V	100	172	41.8	123.0	46.0	200.0
623.0	V	100	177	42.7	136.5	46.0	200.0

Table of Results for Radiated Emissions

EUT Tx on Middle Channel (2.437GHz)

30MHz – 1GHz Alternative Open Area Test Site Results: The levels of the six highest emissions measured in accordance with the specification are presented below: -

Emission Frequency	Pol	Hgt	Azim	Field Strength at 3m		Specification Limit	
				MHz	H/V	cm	deg
239.5	H	100	0	31.3	36.7	46.0	200.0
335.5	V	135	2	30.2	32.4	46.0	200.0
431.3	V	120	183	37.4	74.1	46.0	200.0
497.6	V	100	190	34.9	55.6	46.0	200.0
527.1	V	100	186	41.7	121.6	46.0	200.0
623.0	V	100	174	42.2	128.8	46.0	200.0

Table of Results for Radiated Emissions



RADIATED EMISSIONS TEST RESULTS: EUT in RLAN Mode - continued

SPURIOUS RADIATED EMISSIONS - continued

30MHz - 1GHz Frequency Range

EUT Tx on Top Channel (2.462GHz)

30MHz – 1GHz Alternative Open Area Test Site Results: The levels of the six highest emissions measured in accordance with the specification are presented below: -

Emission Frequency	Pol	Hgt	Azm	Field Strength at 3m		Specification Limit	
				MHz	H/V	cm	deg
239.5	H	100	0	31.2	36.3	46.0	200.0
335.5	V	135	3	30.3	32.7	46.0	200.0
431.3	V	110	183	37.7	76.7	46.0	200.0
497.6	V	100	187	35.0	56.2	46.0	200.0
527.1	V	100	187	42.0	125.9	46.0	200.0
623.0	V	100	177	42.2	128.8	46.0	200.0

Table of Results for Radiated Emissions

ABBREVIATIONS FOR ABOVE TABLES

H Horizontal Polarisation
Pol Polarisation
deg degree

V Vertical Polarisation
Hgt Height
Azm Azimuth

Procedure: Test Performed in accordance with ANSI C63.4.

Performed by: G Lawler, EMC Engineer.



RADIATED EMISSIONS TEST RESULTS: EUT in RLAN Mode - continued

SPURIOUS RADIATED EMISSIONS - continued

1GHz - 25GHz Range

Equipment Designation: Intentional Radiator.

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

EUT Tx on Bottom Channel (2.412GHz)

Note: measurement of the carrier frequency (2.412GHz) produced a Field Strength of 103.9dBµV/m. Therefore the specification limit for any spurious emission found outside of the Restricted Band table (Section 15.205) is 83.9dBµV/m (carrier level minus 20dB).

Frequency	Antenna			Field Strength (Peak) at 3m	Limit (Peak)	Field Strength (Average) at 3m	Limit (Average)
	Polarisation	Height	Azimuth				
GHz	H/V	cm	deg	dBµV/m	dBµV/m	dBµV/m	dBµV/m
4.076	H	100	113	51.7	74.0	48.3	54.0
4.488	H	103	149	34.0	83.9	N/A	N/A
4.827	H	105	228	41.9	74.0	31.49	54.0
6.114	H	105	187	47.3	83.9	N/A	N/A
7.868	H	109	118	44.7	83.9	N/A	N/A

Table of Results for Radiated Emissions

EUT Tx on Middle Channel (2.437GHz)

Note: measurement of the carrier frequency (2.437GHz) produced a Field Strength of 103.7dBµV/m. Therefore the specification limit for any spurious emission found outside of the Restricted Band table (Section 15.205) is 83.7dBµV/m (carrier level minus 20dB).

Frequency	Antenna			Field Strength (Peak) at 3m	Limit (Peak)	Field Strength (Average) at 3m	Limit (Average)
	Polarisation	Height	Azimuth				
GHz	H/V	cm	deg	dBµV/m	dBµV/m	dBµV/m	dBµV/m
2.393	H	112	132	54.4	74.0	46.1	64.0
2.415	H	112	130	54.6	83.7	N/A	N/A
2.475	H	107	140	53.6	83.7	N/A	N/A
4.126	H	106	118	54.3	74.0	51.7	54.0
4.488	H	100	145	48.6	74.0	38.3	54.0
6.189	V	115	139	51.3	83.7	N/A	N/A

Table of Results for Radiated Emissions



RADIATED EMISSIONS TEST RESULTS: EUT in RLAN Mode - continued

SPURIOUS RADIATED EMISSIONS - continued

1GHz - 25GHz Range

EUT Tx on Top Channel (2.462GHz)

Note: measurement of the carrier frequency (2.462GHz) produced a Field Strength of 104.5dB μ V/m. Therefore the specification limit for any spurious emission found outside of the Restricted Band table (Section 15.205) is 84.5dB μ V/m (carrier level minus 20dB).

Frequency	Antenna			Field Strength (Peak) at 3m	Limit (Peak)	Field Strength (Average) at 3m	Limit (Average)
	Polarisation	Height	Azimuth				
GHz	H/V	cm	deg	dB μ V/m	dB μ V/m	dB μ V/m	dB μ V/m
2.088	H	145	153	69.5	84.5	N/A	N/A
2.400	H	108	138	54.9	84.5	N/A	N/A
2.374	H	112	135	61.7	74.0	50.0	54.0
4.488	H	101	147	42.4	84.5	N/A	N/A
4.926	H	129	153	53.3	74.0	40.8	54.0
6.261	H	104	183	50.4	84.5	N/A	N/A

Table of Results for Radiated Emissions

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.

Procedure: Test Performed in accordance with ANSI C63.4.

Performed by: P J Harrison, EMC Engineer.



MAXIMUM PEAK OUTPUT POWER: EUT in Bluetooth Mode

TEST PROCEDURE

Testing to the requirements of FCC Part 15 Subpart C, Section 15.247(b)(3), for Maximum Peak Output Power was carried out.

The Spectrum Analyser was tuned to the test frequency. The device Output power setting was controlled via the 'Test Mode' on each handset being set to the conditions specified in the Configuration on page 5 of this document. The device was then rotated through 360 degrees until the highest power level was observed in both planes of polarisation. The device was then replaced with a substitution antenna, the signal to the antenna was adjusted to equal the related level detected from the device.

Maximum Peak Output Power measurements were made with the EUT set to continuous transmit at maximum power on the following channels:

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

TEST RESULTS

The EUT met the requirements of FCC Part 15.247(b)(3) for Maximum Peak Output Power, see below.

Frequency (MHz)	Result EIRP (dBm)	Result EIRP (mW)
2402	-3.3	0.47
2441	-3.6	0.44
2480	-7.3	0.19

Limit	<1W or <+30dBm
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Table of Results for Maximum Peak Output Power

Procedure: Test Performed in accordance with ANSI C63.4.

Performed by: A Guy, EMC Engineer.



RADIATED EMISSIONS: EUT in Bluetooth Mode

MEASUREMENT AT THE BAND EDGE (Marker Delta Method)

Testing to the requirements of FCC CFR 47: Part 15 Subpart C, Section 15.205, for Restricted Bands of Operation was carried out on the Measurement Test Facility detailed in Annex A. The following Test Results were obtained using the FCC Public Notice document (DA 00-705 released 30 March 2000) for making measurements at the Band Edge, incorporating the 'Marker Delta Method'.

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.

Freq	Ant Pol	Hgt	Azi	Peak Field Strength	Average Field Strength
GHz	H/V	cm	deg	dB μ V/m	dB μ V/m
2.402	V	100	12	89.3	88.6

Table of Results for Measurement at the Band Edge

Step 2

Determine Marker delta amplitude between 2.402GHz fundamental and 2.390GHz the Band Edge under investigation.

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

Marker Delta Amplitude = 51.7dB

Step 3

Subtracting the Marker Delta obtained from Step 2 from the 2.402GHz Field Strength measurement from Step 1, gives following Result

Peak of 89.3dB μ V/m -51.7dB (Delta) = 37.6dB μ V/m (Limit is 74.0dB μ V/m = Pass)

Average of 88.6dB μ V/m -51.7dB (Delta) = 36.9dB μ V/m (Limit is 54.0dB μ V/m = Pass)



RADIATED EMISSIONS: EUT in Bluetooth Mode

MEASUREMENT AT THE BAND EDGE (Marker Delta Method) - continued

Step 1

Top Channel Fundamental Field Strength Measurement.

Performed in accordance with ANSI C63.4

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.

Freq	Ant Pol	Hgt	Azi	Peak Field Strength	Average Field Strength
GHz	H/V	cm	deg	dB μ V/m	dB μ V/m
2.480	V	100	13	84.5	84.0

Table of Results for Measurement at the Band Edge

Step 2

Determine Marker delta amplitude between 2.480GHz fundamental and 2.483GHz the Band Edge under investigation.

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

Marker Delta Amplitude = 47.3dB

Step 3

Subtracting the Marker Delta obtained from Step 2 from the 2.480GHz Field Strength measurement from Step 1, gives following Result

Peak of 84.5dB μ V/m -47.3 dB (Delta) = 37.2dB μ V/m (Limit is 74.0dB μ V/m = Pass)

Average of 84.0dB μ V/m -47.3 dB (Delta) = 36.7dB μ V/m (Limit is 54.0dB μ V/m = Pass)

EUT meets the measurement at the Band Edge requirements for the Top and Bottom Channel.

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

Performed by: A Guy, EMC Engineer.



RADIATED EMISSIONS: EUT in Bluetooth Mode

SPURIOUS RADIATED EMISSIONS

TEST PROCEDURE

Testing to the requirements of FCC CFR 47: Part 15 Subpart C, Section 15.247(c), for Radiated Electric Field Emissions was carried out on the Measurement Test Facility detailed in Annex A. Section 15.247(c) which also requires Rule parts 15.205 and 15.209 to be applied.

A preliminary profile of the Radiated Emissions was obtained by operating the Equipment Under Test (EUT) on a remotely controlled turntable within a semi-anechoic chamber; measurements were taken at a 3m distance unless otherwise stated. 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, a search was made in the frequency range 30MHz to 25GHz. The list of worst case emissions was then confirmed or updated under Open Site conditions. Emission levels were maximised by adjusting the antenna height, antenna polarisation and turntable azimuth.

30MHz - 1GHz emissions levels were then formally measured using a CISPR Quasi-Peak detector. 1GHz - 25GHz emissions levels were then formally measured using Peak and Average detectors.

(Note: Peak measurements performed using a Resolution and Video Bandwidth of 1MHz, Average measurements performed using a Resolution Bandwidth of 1MHz and a Video Bandwidth of 10Hz)

The EUT was operating off its internal battery; the battery was replaced at regular intervals to ensure optimum performance of the EUT.

Measurements were made with the EUT transmitting on the following channels.

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

Radiated Emissions from 30MHz to 1GHz were made using a HP 8542E Test Receiver.

Radiated Emissions from 1GHz to 25GHz were made using a Rhode and Schwarz ESIB 40 Test Receiver.

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



RADIATED EMISSIONS TEST RESULTS: EUT in Bluetooth Mode – continued

SPURIOUS RADIATED EMISSIONS - continued

30MHz - 1GHz Frequency Range

Equipment Designation: Intentional Radiator.

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

EUT Tx on Bottom Channel (2.402GHz)

30MHz – 1GHz Alternative Open Area Test Site Results : The levels of the six highest emissions measured in accordance with the specification are presented below :-

Emission Frequency	Pol	Hgt	Azm	Field Strength at 3m		Specification Limit	
				MHz	H/V	cm	deg
431.3	V	106	192	43.1	142.9	46.0	200.0
335.4	V	144	212	34.7	54.3	46.0	200.0
479.3	V	100	200	25.6	19.1	46.0	200.0
497.9	V	100	188	20.6	10.7	46.0	200.0
527.1	V	100	191	37.0	70.8	46.0	200.0
622.9	V	100	185	36.0	63.1	46.0	200.0

Table of Results for Radiated Emissions

EUT Tx on Middle Channel (2.441GHz)

30MHz – 1GHz Alternative Open Area Test Site Results : The levels of the six highest emissions measured in accordance with the specification are presented below :-

Emission Frequency	Pol	Hgt	Azm	Field Strength at 3m		Specification Limit	
				MHz	H/V	cm	deg
431.3	V	105	196	42.9	139.6	46.0	200.0
335.4	V	156	205	34.7	54.3	46.0	200.0
479.3	V	100	191	24.7	17.2	46.0	200.0
497.9	V	100	207	20.4	10.5	46.0	200.0
527.1	V	100	188	37.2	72.5	46.0	200.0
622.9	V	100	188	35.6	60.3	46.0	200.0

Table of Results for Radiated Emissions



RADIATED EMISSIONS TEST RESULTS: EUT in Bluetooth Mode - continued

SPURIOUS RADIATED EMISSIONS - continued

30MHz - 1GHz Frequency Range

EUT Tx on Top Channel (2.480GHz)

30MHz – 1GHz Alternative Open Area Test Site Results: The levels of the six highest emissions measured in accordance with the specification are presented below: -

Emission Frequency	Pol	Hgt	Azm	Field Strength at 3m		Specification Limit	
				MHz	H/V	cm	deg
431.3	V	103	206	43.3	146.2	46.0	200.0
335.5	V	146	204	34.9	55.6	46.0	200.0
479.3	V	100	203	25.4	18.6	46.0	200.0
498.1	V	100	189	19.8	9.8	46.0	200.0
527.1	V	100	197	37.1	71.6	46.0	200.0
623.0	V	100	175	36.1	63.8	46.0	200.0

Table of Results for Radiated Emissions

ABBREVIATIONS FOR ABOVE TABLES

H Horizontal Polarisation
Pol Polarisation
deg degree

V Vertical Polarisation
Hgt Height
Azm Azimuth

Procedure: Test Performed in accordance with ANSI C63.4.

Performed by: G Lawler, EMC Engineers.



RADIATED EMISSIONS TEST RESULTS: EUT in Bluetooth Mode - continued

SPURIOUS RADIATED EMISSIONS - continued

1GHz - 25GHz Range

Equipment Designation: Intentional Radiator.

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

EUT Tx on Bottom Channel (2.402GHz)

Frequency	Antenna			Field Strength (Peak) at 3m	Limit (Peak)	Field Strength (Average) at 3m	Limit (Average)
	Polarisation	Height	Azimuth				
GHz	H/V	cm	deg	dBµV/m	dBµV/m	dBµV/m	dBµV/m
4.8039	V	103	206	44.2	74.0	35.1	54.0

EUT Tx on Middle Channel (2.441GHz)

Frequency	Antenna			Field Strength (Peak) at 3m	Limit (Peak)	Field Strength (Average) at 3m	Limit (Average)
	Polarisation	Height	Azimuth				
GHz	H/V	cm	deg	dBµV/m	dBµV/m	dBµV/m	dBµV/m
4.8819	V	102	204	44.2	74.0	35.5	54.0

EUT Tx on Top Channel (2.480GHz)

Frequency	Antenna			Field Strength (Peak) at 3m	Limit (Peak)	Field Strength (Average) at 3m	Limit (Average)
	Polarisation	Height	Azimuth				
GHz	H/V	cm	deg	dBµV/m	dBµV/m	dBµV/m	dBµV/m
4.9599	V	100	210	47.1	74.0	40.5	54.0

Procedure: Test Performed in accordance with ANSI C63.4.

Performed by: A Guy, EMC Engineer.



PHOTOGRAPHS OF THE 4111-CDMA

PHOTOGRAPHS OF EQUIPMENT



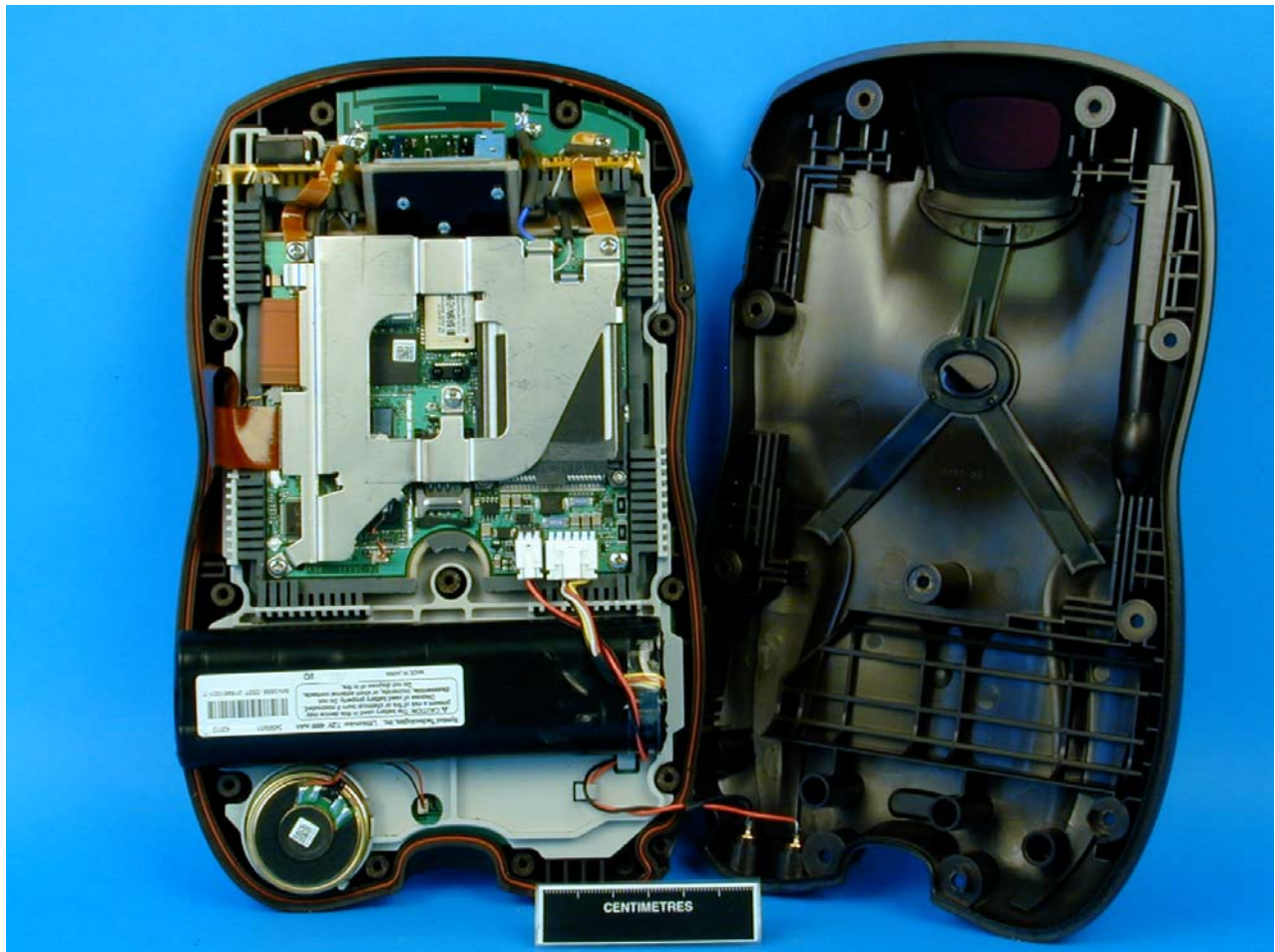
Photograph 2
4111-CDMA Front View

PHOTOGRAPHS OF EQUIPMENT



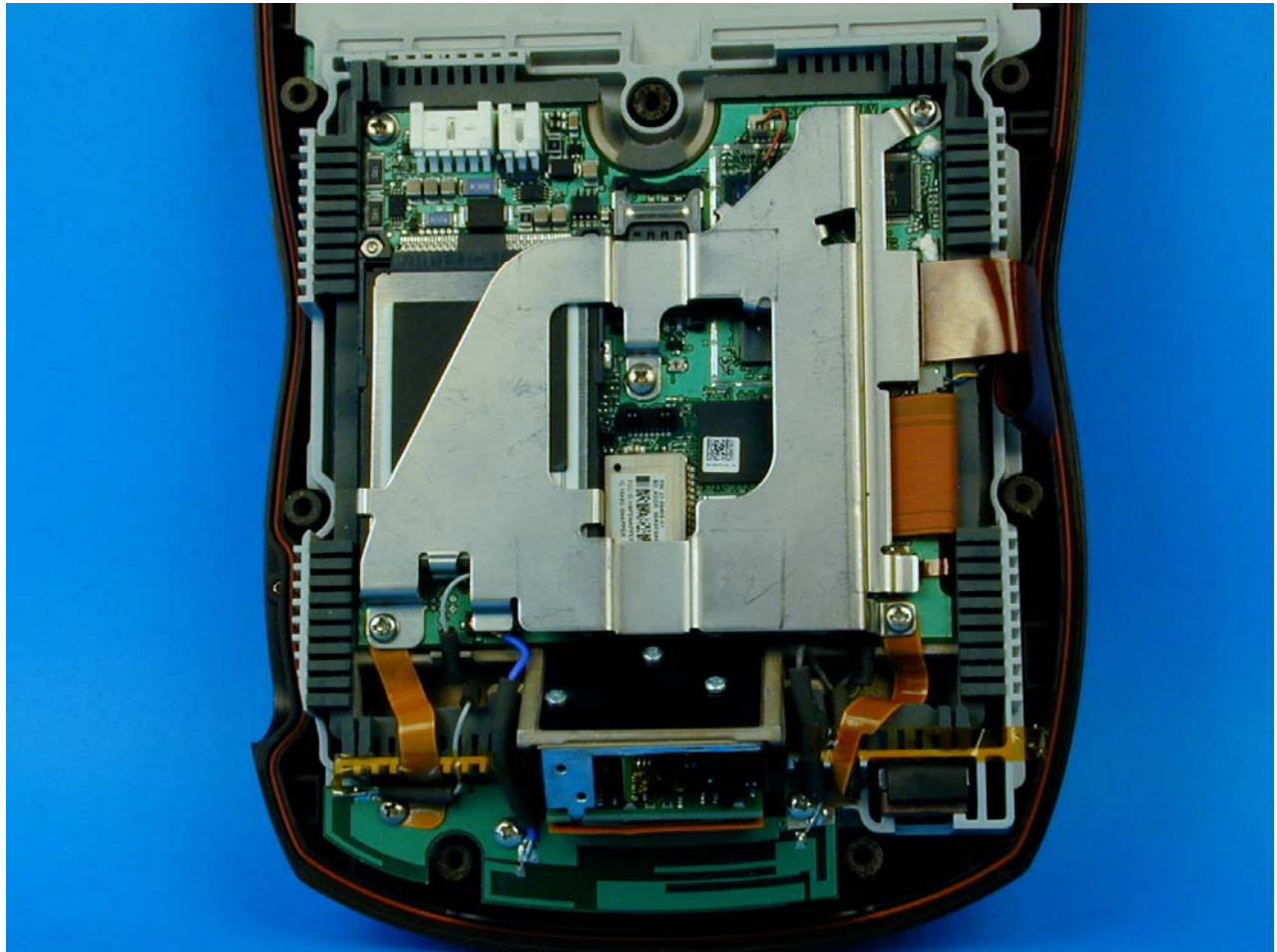
Photograph 3
4111-CDMA Rear View

PHOTOGRAPHS OF EQUIPMENT



Photograph 4
4111-CDMA Internal View

PHOTOGRAPHS OF EQUIPMENT



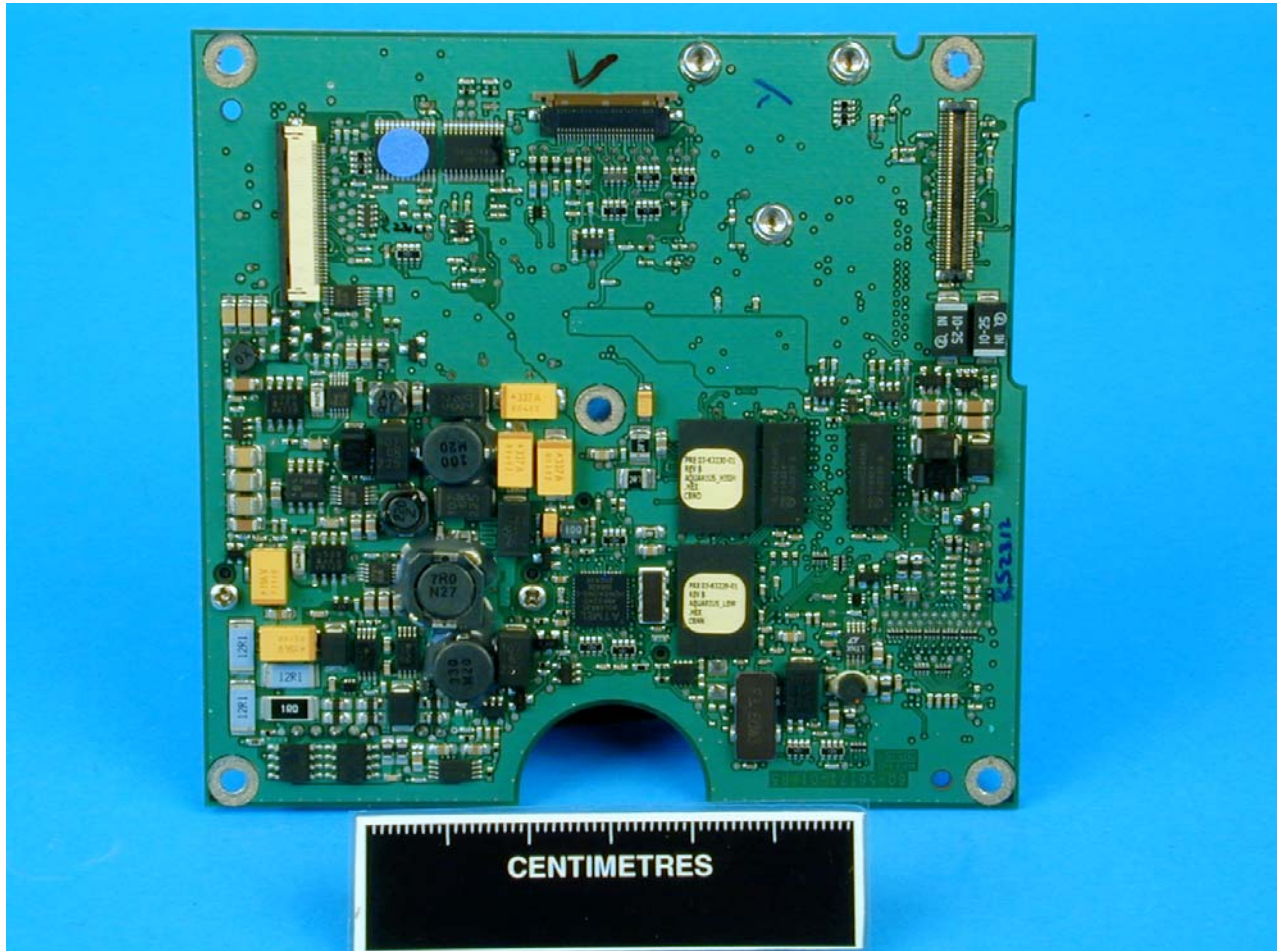
Photograph 5
4111-CDMA Internal View

PHOTOGRAPHS OF EQUIPMENT



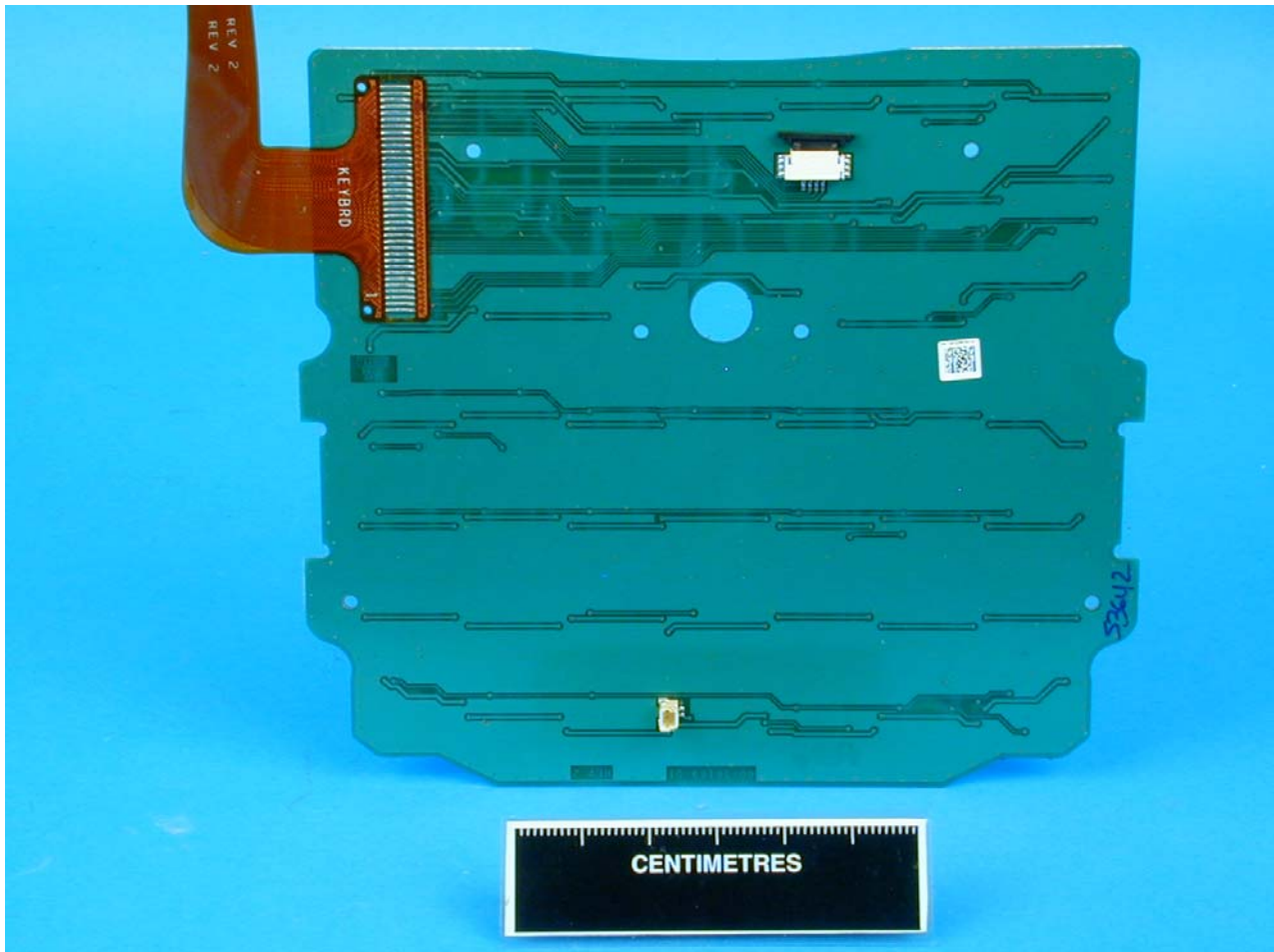
Photograph 6
4111-CDMA Internal View

PHOTOGRAPHS OF EQUIPMENT



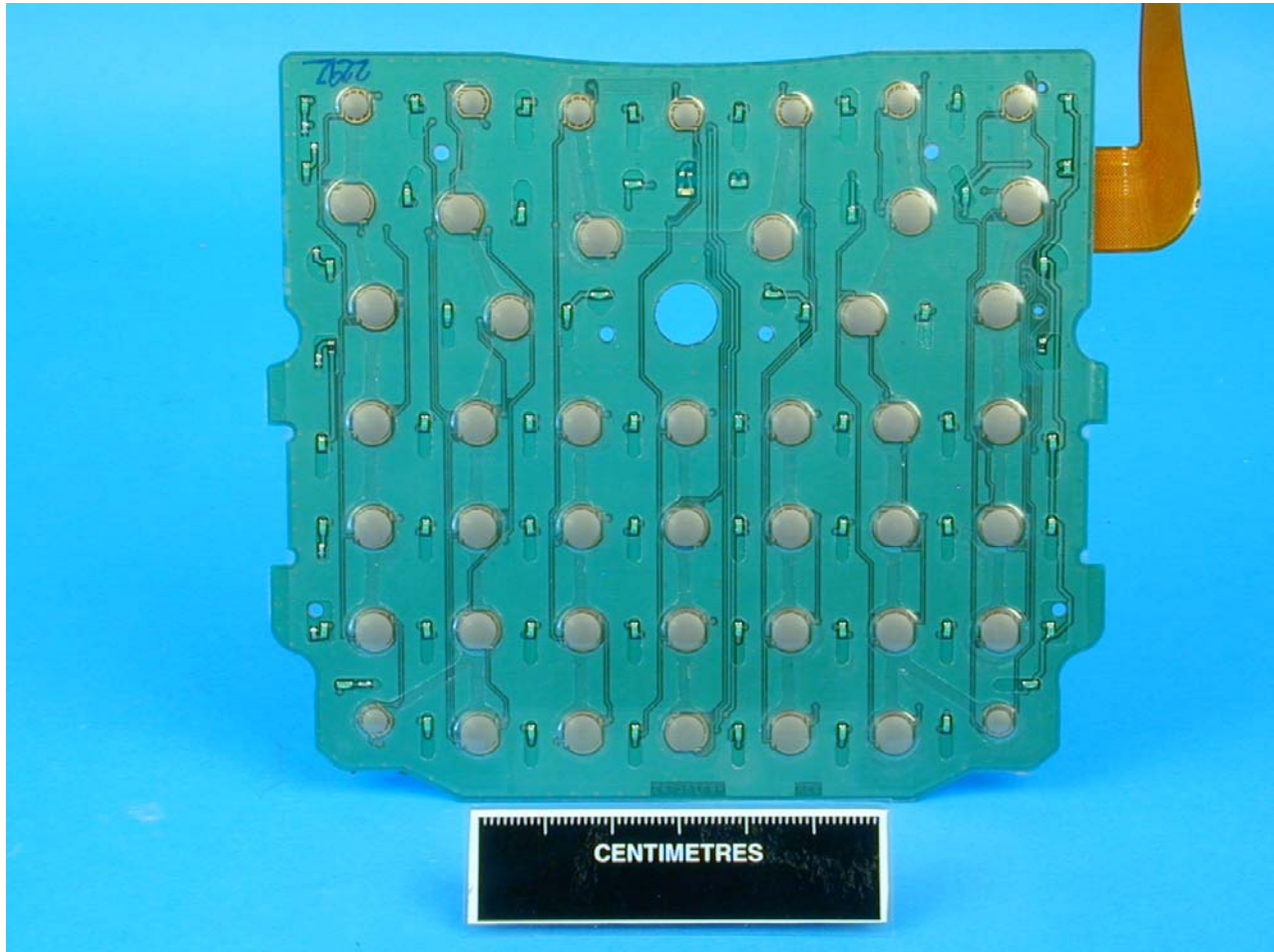
Photograph 7
4111-CDMA Internal View

PHOTOGRAPHS OF EQUIPMENT

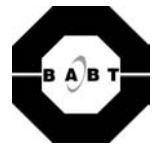


Photograph 8
4111-CDMA Internal View

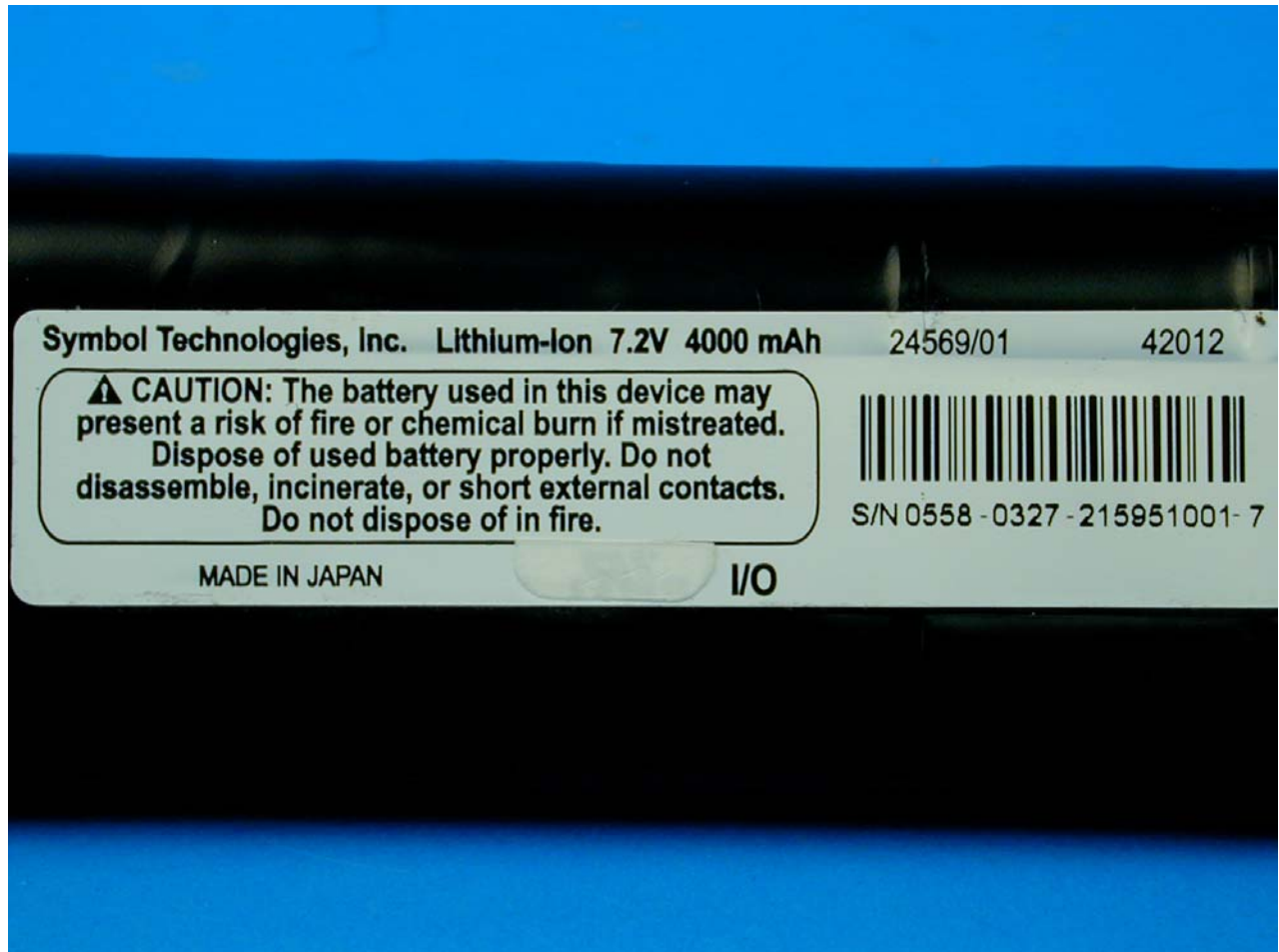
PHOTOGRAPHS OF EQUIPMENT



Photograph 9
4111-CDMA Internal View



PHOTOGRAPHS OF EQUIPMENT



Photograph 10
4111-CDMA Internal Battery Label View

PHOTOGRAPHS OF EQUIPMENT



Photograph 11
4111-CDMA Front View of C18 CDMA Module



PHOTOGRAPHS OF EQUIPMENT

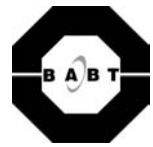


Photograph 12
4111-CDMA View of LA-4137 RLAN Card

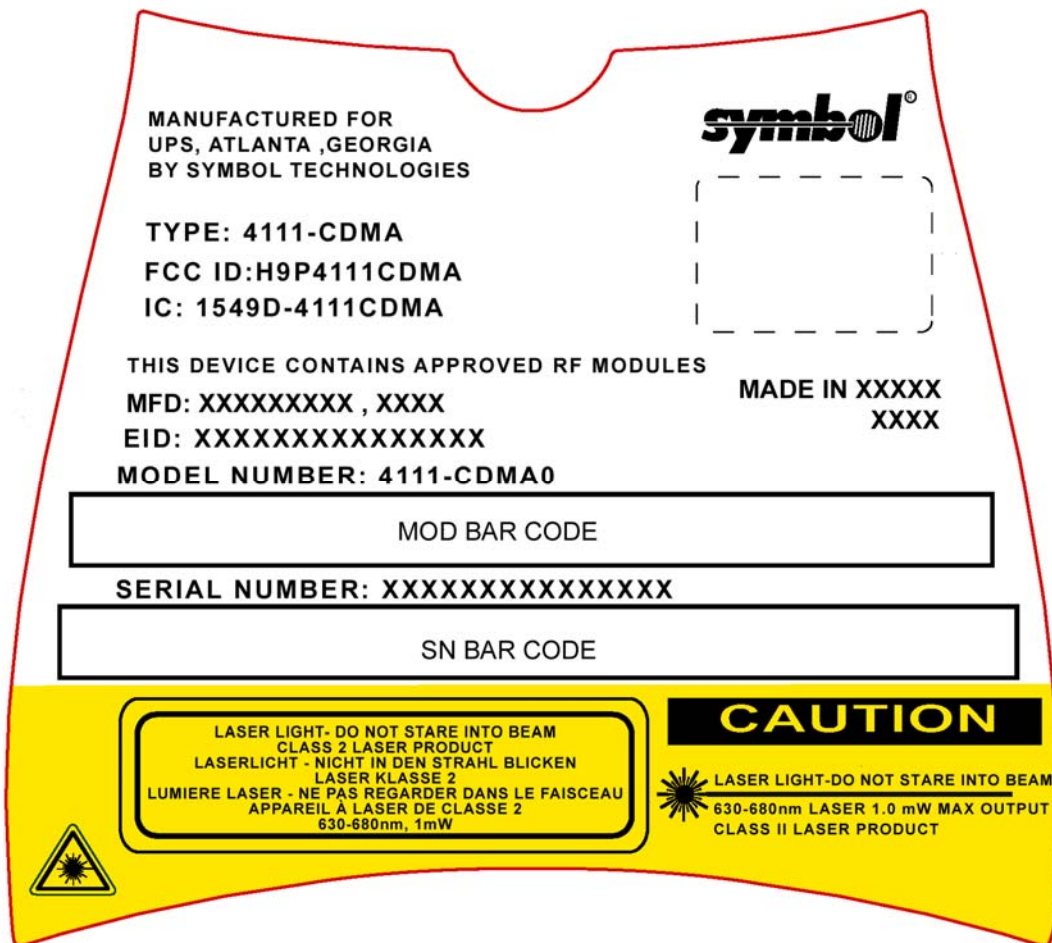
PHOTOGRAPHS OF EQUIPMENT



Photograph 13
4111-CDMA Front View of 21-58466 Bluetooth Module



MANUFACTURERS LABEL DIAGRAM



4111-CDMA Label View



MEASUREMENT UNCERTAINTY

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

In the frequency range 30MHz to 1000MHz

For Radiated Emissions, Quasi-Peak Measurements taken in Zero Span using the Hewlett Packard 8542E Test Receiver: -

Frequency	$\pm 2 \times 10^{-7} \times \text{Centre Frequency}$
Amplitude	+4.45dB (30-200MHz; 3m Measurements) -4.42dB (30-200MHz; 3m Measurements) +4.80dB (200-1000MHz; 3m Measurements) -3.81dB (200-1000MHz; 3m Measurements)

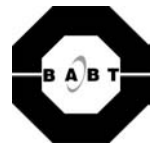
In the frequency range 1GHz to 25GHz

For Radiated Emissions, using the Rohde and Schwarz ESIB 40 Test Receiver: -

Frequency	$\pm 2 \times 10^{-7} \times \text{Centre Frequency}$
Amplitude	$\pm 3.4\text{dB}$

For Effective Isotropic Radiated Power (EIRP) measurements using the Rohde and Schwarz ESIB 40 Test Receiver: -

Amplitude	$\pm 1.45\text{dBm}$
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0141
Group

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

UKAS Accreditation's do not cover opinions and interpretations and any expressed herein are outside the scope of any UKAS Accreditation.

Results of tests not yet included in our UKAS Accreditation Schedule are marked NUA (Not UKAS Accredited).

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Annex A

FCC Measurement Facility Compliance Letter

(Comprising of 1 page)



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