REPORT ON

Limited FCC CFR 47: Part 15 Testing in support of an Application for Grant of Equipment Authorisation of a Symbol MC9060 Mobile Computer
FCC ID: H9PMC9060B

Report No OR611522/02 Issue 3 January 2004

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REPORT ON FCC CFR 47: Part 15 Testing in support of an Application for Grant of Equipment Authorisation of a Symbol MC9060 Mobile Computer

FCC ID: H9PMC9060B

Report No OR611522/02 Issue 3

January 2004

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DATED **21-01-04**

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

Test Engineers;

S Hartley A Guy G Lawler

UKAS TESTING 0141 Group

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STATUS

OBJECTIVE	To undertake measurements to determine the Equipment Under Test's (EUT's) compliance with the specification.
MANUFACTURING DESCRIPTION	MC9060 Mobile Computer
APPLICANT	Symbol Technologies Inc One Symbol Plaza Holtsville NY 11742-1300 New York United States of America
MANUFACTURERS TYPE NUMBER	MC9060
MANUFACTURERS PART NUMBER	MC9060-SKOH9AEA715
SERIAL NUMBER	BETAA01172 BETAA01163
HARDWARE VERSION	Rev 11
DECLARED VARIANTS	None
TEST SPECIFICATION NUMBER	FCC CFR 47: Part 15 Subpart C, August 2002
REGISTRATION NUMBER	OR611522
QUANTITY OF ITEMS TESTED	One
SECURITY CLASSIFICATION OF EUT	Unclassified
INCOMING RELEASE SERIAL NUMBER DATE	Declaration of Build Status OR611522
DISPOSAL REFERENCE NUMBER DATE	Held pending disposal N/A N/A
START OF TEST FINISH OF TEST	17th November 2003 19th January 2004
TEST ENGINEERS	A Guy S Hartley 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 9kHz to 40GHz. FCC Public Notice document (DA 00-705 released 30 March 2000)

TEST RATIONALE

This report has been re-issued as Issue 3, the original report carried the incorrect frequencies for Channel 1, 6 and 11 on page 13 these have now been replaced with the correct Channel frequencies . This report is intended to replace the original report OR611522/02/Issue 2 issued in January 2004.

The information contained within this report is intended to show verification of compliance of the Symbol Technologies Inc MC9060 Mobile Computer to the requirements of FCC Specification Part 15.

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

FCC ID H9PMC9060B

The unit supplied for testing was a MC9060 Mobile Computer, which offers 2.4GHz 802.11b Wireless LAN and Bluetooth connectivity.

For results of other tests, refer to the original TÜVPS test report OR611514/01 Issue 3.

The terminal utilizes the approved Symbol Main Terminal Module (MTM) with embedded 802.11b RLAN radio and the Symbol Bluetooth Module. FCC ID numbers are detailed below:

Type:	Description	Approval	FCC ID	Date
21-64436	Main Terminal Module	FCC Part15	H9P2164436	26/11/2003
21-64381	Symbol Bluetooth Module	FCC Part15	H9P2164381	11/2003

The radios integrated in this terminal are not designed to operate simultaneously and are therefore tested independently.

Sub-equipped version (RLAN only)
A sub-equipped version of the MC9060 is also available; this version will only offer 802.11b RLAN connectivity, as the Bluetooth module is not included.

Section 3 of the report details testing carried out in accordance with:

- FCC: Part 15.109, Spurious Radiated Emissions
- FCC: Part 15.205, 15.209, Measurement at Band Edge (Marker Delta Method)
- FCC: Part 15.247(b)(3), Maximum Peak Output Power
- FCC: Part 15.247(c), Spurious Radiated Emissions

Testing was performed on two separate samples;

- Serial No BETAA01172 was used for
  FCC: Part 15.109, Spurious Radiated Emissions
  FCC: Part 15.205, 15.209, Measurement at Band Edge (Marker Delta Method)
  FCC: Part 15.247(c), Spurious Radiated Emissions

- Serial No BETAA01163 was used for
  FCC: Part 15.247(b)(3), Maximum Peak Output Power

Location Of Testing

BABT Engineers, Steve Hartley, Tony Guy and Graeme Lawler, conducted all testing at the premises BABT, Segensworth Road, Fareham, Hampshire, PO15 5RH. 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.

For all tests, the Symbol MC9060 Mobile Computer was powered by its own internal battery and fitted with a Symbol Headset.

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

2.4GHz Bluetooth functionality

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

TEST SET UP PHOTOGRAPH

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

Photograph 1

EQUIPMENT INFORMATION

Equipment under Test (EUT):

Equipment:	**Mobile Computer**	**Headset**
Manufacturer:	Symbol Technologies Inc	Symbol Technologies Inc
Type No:	MC9060	VXI 61-SYB
Part No.	MC9060-SK0H9AEA715	50-11300-050
Serial No:	BETAA01172 BETAA01163	Not Serialised
Drawing Revision:	Rev 11	Rev A

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.

Test Equipment and Ancillaries Used For Test

Instrument	Manufacturer	Type No.	EMC No.
Room 5	Siemens and Matsushita	----	2533
ESIB Receiver	Rohde & Schwarz	ESIB 40	2972
EMI Receiver	Hewlett Packard	8542E	2286
Bilog Antenna	Chase	CBL 6143	2860
Turntable & Controller	HD	HD 050	2528
Antenna Mast	EMCO	2070	----
Antenna Mast Controller	EMCO	2090	----
Test Receiver	Rohde & Schwarz	ESIB 40	2917
Signal Generator	Hewlett Packard	8672A	411
Signal Generator	Hewlett Packard	8673B	953
High Pass Filter	RLC Electronics	F-100-3000-5-R	4467
Low Noise Amplifier (1GHz-8GHz)	Miteq	AMF-3D-001080-18-13P	2457
Horn	EMCO	3115	2297
Horn	EMCO	3155	2397
Horn	Advanced Microtek	AM180 HA-K-TU2	2945
Low Noise Amplifier (8GHz-18GHz)	Avantek	AWT-18036	1081
Low Noise Amplifier (18GHz-26GHz)	Avantek	AMT-26177-33	2072
Barometer	diplex	----	1938
Peak Power Analyser	Hewlett Packard	8990A	1670
Peak Power Sensor	Hewlett Packard	84812A	1662
Hygrometer	Rotronic	A1	3155
Hygrometer	Rotronic	A1	Inv 4066

Table of Instrumentation Used for Testing

Note(s)

1) All items are calibrated annually, except where labelled TU (Traceability Unscheduled). These items are calibrated within the test configurations using calibrated equipment from the tables above.

TEST RESULTS
RLAN MODE

MEASUREMENT AT THE BAND EDGE (Marker Delta Method)

TEST PROCEDURE

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'.

TEST RESULTS

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

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
MHz	H/V	cm	deg	dBµV/m	dBµV/m
2412	V	108	216	108.6	100.5

Table of Results for Measurement at the Band Edge

Step 2

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

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

Marker Delta Amplitude = 60.7dB

Step 3

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

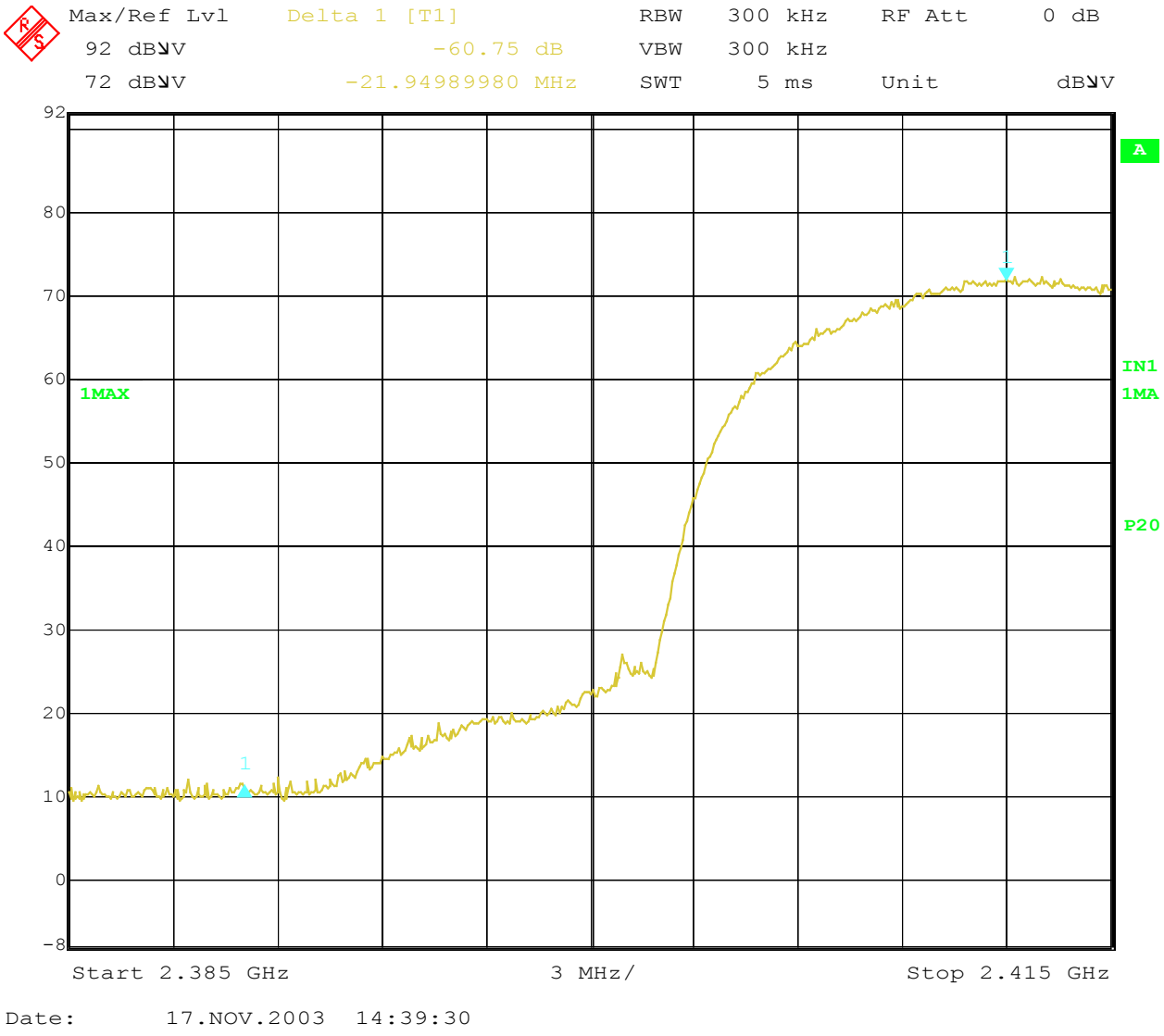
Peak of 47.9dBµV/m (Limit is 74.0dBµV/m)

Average of 39.8dBµV/m (Limit is 54.0dBµV/m)

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

TEST RESULTS - continued

Plot for Bottom Channel 2412MHz



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

TEST RESULTS - 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	dBµV/m	dBµV/m
2462	V	106	215	110.9	102.8

Table of Results for Measurements at the Band Edge

Step 2

Determine Marker delta amplitude between 2462MHz 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 59.9dB

Step 3

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

Peak of 51.0dBµV/m (Limit is 74.0dBµV/m)

Average of 42.9dBµV/m (Limit is 54.0dBµV/m)

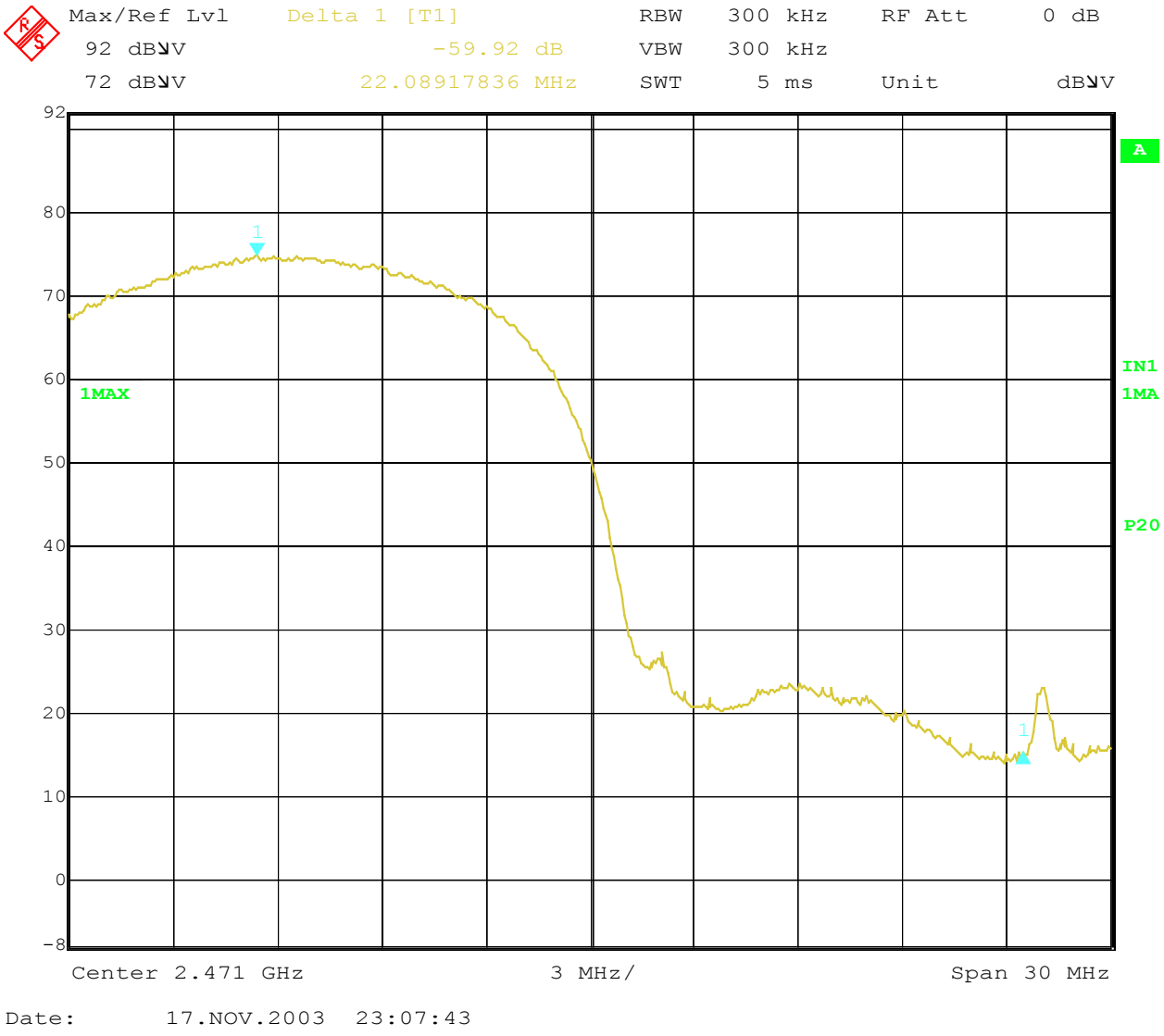
Procedure: Test Performed in accordance with FCC Public Notice document (DA 00-705 released 30 March 2000)

Performed by: G Lawler, EMC Engineer.

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

TEST RESULTS - continued

Plot for Top Channel 2462MHz



MAXIMUM PEAK OUTPUT POWER (EIRP Method)

TEST PROCEDURE

Testing to the requirements of FCC CFR 47: Part 15 Subpart C, Section 15.247(b)(1), for Maximum Peak Output Power was carried out.

The EUT contains an integral antenna and therefore the Maximum Peak Output Power measurement 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 System Configuration Section 1 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:

2412MHz
2437MHz
2462MHz

TEST RESULTS

The EUT met the requirements of FCC CFR 47: Part 15 Subpart C, Section 15.247(b)(1) for Maximum Peak Output Power.

Frequency (MHz)	Result EIRP (dBm)	Result EIRP (mW)
2412	13.4	21.9
2437	14.3	26.9
2462	16.6	45.7
Limit	< +36dBm or < 4W	

Table of Results for Maximum Peak Output Power

Procedure: Test Performed in accordance with FCC CFR 47: Part 15.247(b)(1) for Maximum Peak Output Power.

Performed by: G Lawler, EMC Engineer.

SPURIOUS RADIATED EMISSIONS

TEST PROCEDURE

Testing to the requirements of FCC CFR 47: Part 15 Subpart C, Section 15.247(c), for Radiated Emissions was carried out on the Measurement Test Facility detailed in Annex A. Section 15.247(c) also requires Sections 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 a CISPR Quasi-Peak detector.
1GHz - 25GHz emissions levels were then formally measured a 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.

2412MHz
2437MHz
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.

SPURIOUS RADIATED EMISSIONS - continued

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).

EUT Tx on Bottom Channel (2412MHz)

30MHz – 1GHz Alternative Open Area Test Site Results: The levels of the 6 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	dBµV/m	µV/m	dBµV/m	µV/m
189.7	V	100	37	22.5	13.3	43.5	150.0
195.9	V	100	280	21.9	12.4	43.5	150.0
527.2	V	100	240	32.5	42.2	46.0	200.0
575.0	V	100	240	30.3	32.7	46.0	200.0
623.1	H	125	178	35.2	57.5	46.0	200.0
748.0	H	108	221	33.0	44.7	46.0	200.0

Table of Results for Spurious Radiated Emissions

EUT Tx on Middle Channel (2437MHz)

30MHz – 1GHz Alternative Open Area Test Site Results: The levels of the 6 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	dBµV/m	µV/m	dBµV/m	µV/m
189.7	V	100	71	22.3	13.0	43.5	150.0
195.8	V	100	263	22.0	12.6	43.5	150.0
527.0	V	107	274	33.1	45.2	46.0	200.0
575.0	V	100	263	32.2	40.7	46.0	200.0
623.1	H	130	194	33.7	48.4	46.0	200.0
747.8	H	100	229	34.1	50.1	46.0	200.0

Table of Results for Spurious Radiated Emissions

SPURIOUS RADIATED EMISSIONS - continued

TEST RESULTS - continued

30MHz - 1GHz Frequency Range

EUT Tx on Top Channel (2462MHz)

30MHz – 1GHz Alternative Open Area Test Site Results: The levels of the 6 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	dBµV/m	µV/m	DBµV/m	µV/m
189.3	V	100	55	22.5	13.3	43.5	150.0
195.4	V	100	281	22.5	13.3	43.5	150.0
527.4	V	100	259	32.4	41.7	46.0	200.0
574.8	V	100	259	33.4	46.8	46.0	200.0
623.2	H	147	200	32.6	42.7	46.0	200.0
747.5	H	100	215	33.6	47.9	46.0	200.0

Table of Results for Spurious Radiated Emissions

ABBREVIATIONS FOR ABOVE TABLES

H	Horizontal Polarisation	V	Vertical Polarisation
Pol	Polarisation	Hgt	Height
deg	degree	Azm	Azimuth

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

Performed by: A Guy, EMC Engineers.

SPURIOUS RADIATED EMISSIONS - continued

TEST RESULTS - 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 Spurious Radiated Emissions (1GHz – 25GHz).

EUT Tx on Bottom Channel (2412MHz)

Note: measurement of the carrier frequency (2412MHz) produced a Field Strength of 102.9dBµV/m. Therefore the specification limit for any spurious emissions found outside of the Restricted Band table (Section 15.205) is 82.9dBµV/m (carrier level minus 20dB)

Frequency	Antenna		Turntable	Peak Field Strength	Peak Limit	Average* Field Strength	Average Limit
	Polarisation	Height	Azimuth				
GHz	H/V	cm	deg	dBµV/m	dBµV/m	dBµV/m	dBµV/m
1.094	V	173	360	50.3	74.0	33.7	54.0
4.076	V	114	278	55.5	74.0	52.4	54.0
4.822	H	100	253	52.2	74.0	38.3	54.0
8.152	H	100	258	54.2	74.0	45.6	54.0

Table of Results for Spurious Radiated Emissions

EUT Tx on Middle Channel (2437MHz)

Note: measurement of the carrier frequency (2437MHz) produced a Field Strength of 102.5dBµV/m. Therefore the specification limit for any spurious emissions found outside of the Restricted Band table (Section 15.205) is 82.5dBµV/m (carrier level minus 20dB)

Frequency	Antenna		Turntable	Peak Field Strength	Peak Limit	Average* Field Strength	Average Limit
	Polarisation	Height	Azimuth				
GHz	H/V	cm	deg	dBµV/m	dBµV/m	dBµV/m	dBµV/m
2.494	V	100	274	55.3	74.0	45.2	54.0
4.126	V	116	232	56.5	74.0	52.9	54.0
4.874	H	100	260	48.9	74.0	36.0	54.0
8.252	H	111	238	54.1	74.0	46.8	54.0

Table of Results for Radiated Emissions

SPURIOUS RADIATED EMISSIONS - continued

TEST RESULTS

1GHz - 25GHz Range

EUT Tx on Top Channel (2462MHz)

Note: measurement of the carrier frequency (2462MHz) produced a Field Strength of 104.8dBµV/m. Therefore the specification limit for any spurious emissions found outside of the Restricted Band table (Section 15.205) is 84.8dBµV/m (carrier level minus 20dB)

Frequency	Antenna		Turntable	Peak Field Strength	Peak Limit	Average* Field Strength	Average Limit
	Polarisation	Height	Azimuth				
GHz	H/V	cm	deg	dBµV/m	dBµV/m	dBµV/m	dBµV/m
2.484	V	107	213	58.2	74.0	53.2	54.0
2.499	V	128	215	52.6	74.0	41.2	54.0
4.176	V	101	246	54.7	74.0	51.2	54.0
4.924	H	100	274	52.1	74.0	38.7	54.0
8.352	H	114	220	53.8	74.0	47.1	54.0

Table of Results for Spurious Radiated Emissions

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

Performed by: S C Hartley, EMC Engineers.

TEST RESULTS
BLUETOOTH MODE

MEASUREMENT AT THE BAND EDGE (Marker Delta Method)

TEST PROCEDURE

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'.

TEST RESULTS

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

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
MHz	H/V	cm	deg	dBµV/m	dBµV/m
2402	V	130	309	110.3	99.4

Table of Results for Measurement at the Band Edge

Step 2

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

Using a span of 20MHz with Resolution Bandwidth and Video Bandwidth of 200kHz.

Marker Delta Amplitude 58.1dB

Step 3

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

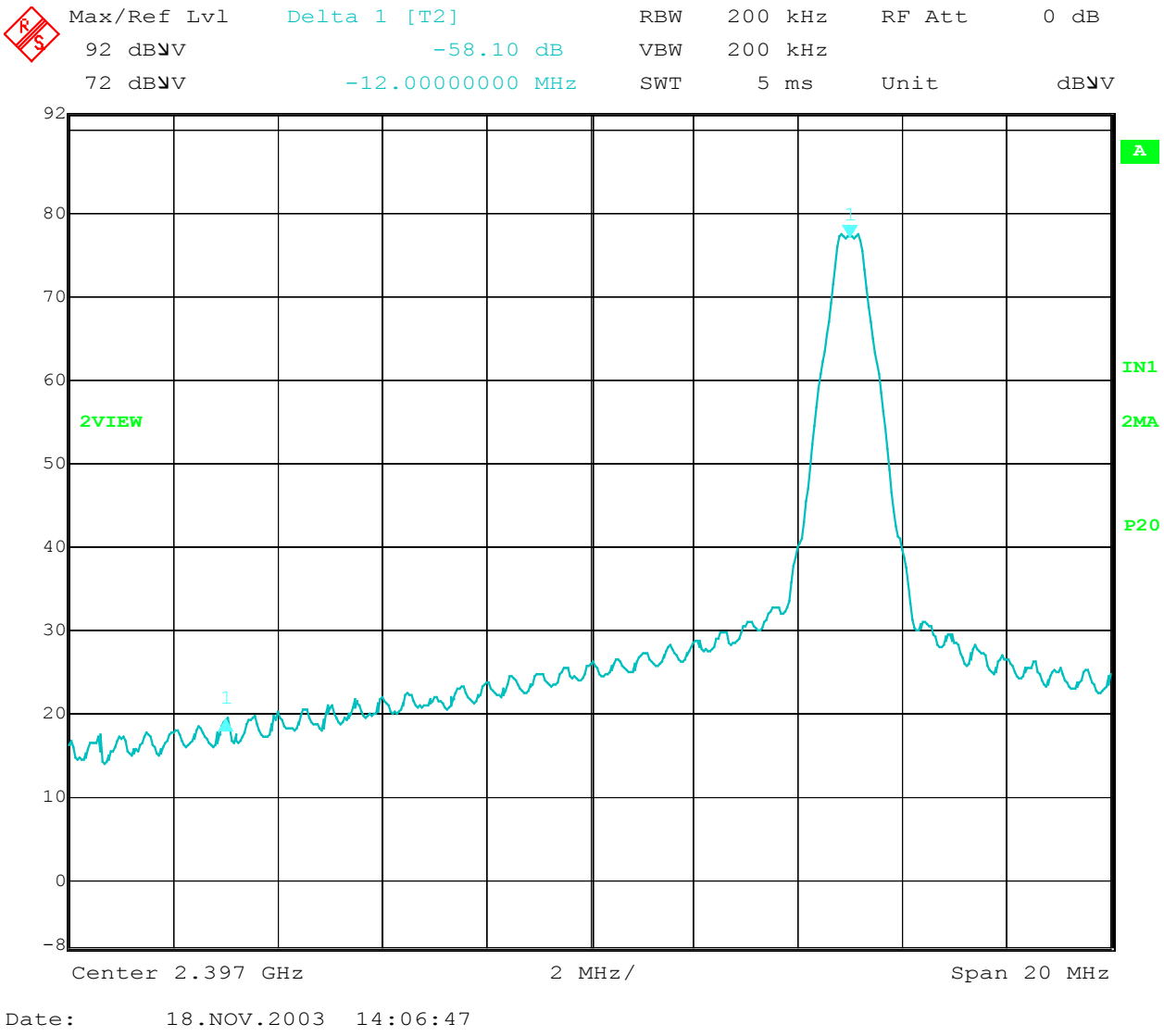
Peak of 52.2dBµV/m (Limit is 74.0dBµV/m)

Average of 41.3dBµV/m (Limit is 54.0dBµV/m)

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

TEST RESULTS - continued

Plot for Bottom Channel 2402MHz



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

TEST RESULTS - 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	dBµV/m	dBµV/m
2480	V	131	7	111.5	100.0

Table of Results for Measurements at the Band Edge

Step 2

Determine Marker delta amplitude between 2480MHz 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 62.0dB

Step 3

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

Peak of 49.5dBµV/m (Limit is 74.0dBµV/m)

Average of 38.0dBµV/m (Limit is 54.0dBµV/m)

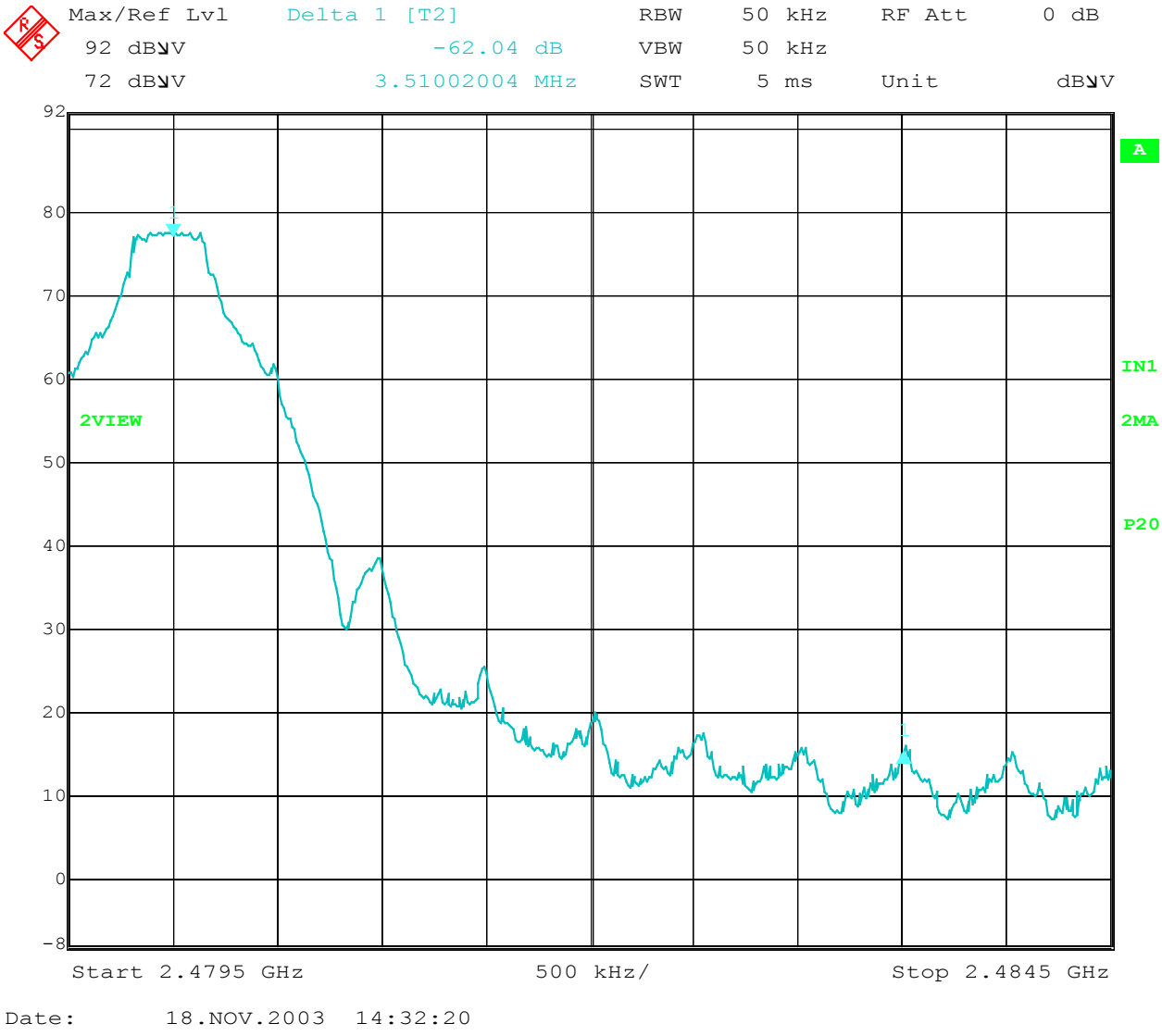
Procedure: Test Performed in accordance with FCC Public Notice document (DA 00-705 released 30 March 2000)

Performed by: S Hartley, EMC Engineer.

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

TEST RESULTS - continued

Plot for Top Channel 2480MHz



MAXIMUM PEAK OUTPUT POWER (EIRP Method)

TEST PROCEDURE

Testing to the requirements of FCC CFR 47: Part 15 Subpart C, Section 15.247(b)(1), for Maximum Peak Output Power was carried out.

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 System Configuration Section 1 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:

2402MHz
2441MHz
2480MHz

TEST RESULTS

The EUT met the requirements of FCC CFR 47: Part 15 Subpart C, Section 15.247(b)(1) for Maximum Peak Output Power.

Frequency (MHz)	Result EIRP (dBm)	Result EIRP (mW)
2402	13.4	21.7
2441	17.3	53.7
2480	13.8	24.0
Limit	< +36dBm or < 4W	

Table of Results for Maximum Peak Output Power

Procedure: Test Performed in accordance with FCC CFR 47: Part 15.247(b)(1) for Maximum Peak Output Power.

Performed by: G Lawler, EMC Engineer.

SPURIOUS RADIATED EMISSIONS

TEST PROCEDURE

Testing to the requirements of FCC CFR 47: Part 15 Subpart C, Section 15.247(c), for Radiated Emissions was carried out on the Measurement Test Facility detailed in Annex A. Section 15.247(c) also requires Sections 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 a CISPR Quasi-Peak detector.
1GHz - 25GHz emissions levels were then formally measured a 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.

2402MHz
2441MHz
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.

In accordance with FCC Public Notice DA 00-705, Released 30th March 2003, 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 20log(dwell time/100ms), 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 625µs x 5 = 3.125ms

Actual transmit time during this time slot is 2.905ms and the reply time slot after each DH5 packet is 625µs.

Total time slot length per channel 3.125 + 0.625 = 3.75ms.

Multiply Total time slot length per channel by 32 channels per hop sequence 32 x 3.75 = 120ms

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 x 2.905 = 5.81ms

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

SPURIOUS RADIATED EMISSIONS - continued

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).

EUT Tx on Bottom Channel (2402MHz)

30MHz – 1GHz Alternative Open Area Test Site Results: The levels of the 6 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	dBµV/m	µV/m	dBµV/m	µV/m
189.5	V	100	138	22.4	13.2	43.5	150.0
196.3	V	100	149	23.9	15.7	43.5	150.0
450.7	V	100	0	23.6	15.1	46.0	200.0
526.8	V	100	0	25.2	18.2	46.0	200.0
575.1	V	100	324	26.1	20.2	46.0	200.0
622.9	H	100	183	31.0	35.5	46.0	200.0

Table of Results for Spurious Radiated Emissions

EUT Tx on Middle Channel (2441MHz)

30MHz – 1GHz Alternative Open Area Test Site Results: The levels of the 6 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	dBµV/m	µV/m	dBµV/m	µV/m
189.5	V	100	134	22.3	13.0	43.5	150.0
196.5	V	100	152	22.7	13.6	45.3	150.0
451.1	V	100	0	23.9	15.7	46.0	200.0
527.7	V	100	0	24.7	17.2	46.0	200.0
574.8	V	100	332	26.7	21.6	46.0	200.0
623.3	H	100	191	28.9	27.9	46.0	200.0

Table of Results for Spurious Radiated Emissions

SPURIOUS RADIATED EMISSIONS - continued

TEST RESULTS - continued

30MHz - 1GHz Frequency Range

EUT Tx on Top Channel (2480MHz)

30MHz – 1GHz Alternative Open Area Test Site Results: The levels of the 6 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	dBµV/m	µV/m	dBµV/m	µV/m
189.4	V	100	128	23.8	15.5	43.5	150.0
196.3	V	100	166	23.8	15.5	43.5	150.0
450.9	V	100	0	24.8	17.4	46.0	200.0
526.4	V	100	0	26.6	21.4	46.0	200.0
575.1	V	100	322	28.2	25.7	46.0	200.0
622.9	H	100	196	29.7	30.5	46.0	200.0

Table of Results for Spurious Radiated Emissions

ABBREVIATIONS FOR ABOVE TABLES

H	Horizontal Polarisation	V	Vertical Polarisation
Pol	Polarisation	Hgt	Height
deg	degree	Azm	Azimuth

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

Performed by: G Lawler, EMC Engineers.

SPURIOUS RADIATED EMISSIONS - continued

TEST RESULTS - 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 Spurious Radiated Emissions (1GHz – 25GHz).

EUT Tx on Bottom Channel (2402MHz)

Note: measurement of the carrier frequency (2402MHz) produced a Field Strength of 109.7dBµV/m. Therefore the specification limit for any spurious emissions found outside of the Restricted Band table (Section 15.205) is 89.7dBµV/m (carrier level minus 20dB).

Frequency	Antenna		Turntable	Peak Field Strength	Peak Limit	Average* Field Strength	Average Limit
	Polarisation	Height	Azimuth				
GHz	H/V	cm	deg	dBµV/m	dBµV/m	dBµV/m	dBµV/m
2.370	V	132	310	56.5	74.0	20.9	54.0
2.498	V	132	6	59.5	74.0	25.1	54.0
4.602	V	145	174	57.9	74.0	25.7	54.0
4.804	V	114	173	73.8	74.0	39.5	54.0
5.006	V	116	185	60.0	74.0	27.8	54.0
7.262	V	105	182	63.0	74.0	30.7	54.0
12.010	H	129	222	64.1	74.0	30.0	54.0

Table of Results for Spurious Radiated Emissions

* The Average Field Strengths shown in the Tables above have been normalised by subtracting 24.7dB (Duty Cycle Correction Factor) from the measured Field Strength.

EUT Tx on Middle Channel (2441MHz)

Note: measurement of the carrier frequency (2441MHz) produced a Field Strength of 111.1dBµV/m. Therefore the specification limit for any spurious emissions found outside of the Restricted Band table (Section 15.205) is 91.1dBµV/m (carrier level minus 20dB).

Frequency	Antenna		Turntable	Peak Field Strength	Peak Limit	Average* Field Strength	Average Limit
	Polarisation	Height	Azimuth				
GHz	H/V	cm	deg	dBµV/m	dBµV/m	dBµV/m	dBµV/m
2.377	V	138	86	61.2	74.0	24.3	54.0
4.882	V	114	173	69.4	74.0	34.2	54.0
7.323	H	100	211	61.0	74.0	27.7	54.0
12.205	H	144	222	66.2	74.0	30.8	54.0

Table of Results for Radiated Emissions

* The Average Field Strengths shown in the Tables above have been normalised by subtracting 24.7dB (Duty Cycle Correction Factor) from the measured Field Strength.

SPURIOUS RADIATED EMISSIONS - continued

TEST RESULTS

1GHz - 25GHz Range

EUT Tx on Top Channel (2480MHz)

Note: measurement of the carrier frequency (2480MHz) produced a Field Strength of 111.2dBµV/m. Therefore the specification limit for any spurious emissions found outside of the Restricted Band table (Section 15.205) is 91.2dBµV/m (carrier level minus 20dB)

Frequency	Antenna		Turntable	Peak Field Strength	Peak Limit	Average* Field Strength	Average Limit
	Polarisation	Height	Azimuth				
GHz	H/V	cm	deg	dBµV/m	dBµV/m	dBµV/m	dBµV/m
2.320	V	135	87	54.7	74.0	20.2	54.0
2.448	V	131	74	62.6	91.2	NA	NA
4.960	V	112	173	70.7	74.0	37.0	54.0
5.617	H	100	245	45.9	91.2	NA	NA
6.782	H	121	205	51.7	91.2	NA	NA
7.439	H	118	219	60.7	74.0	24.7	54.0
9.920	H	105	253	50.8	91.2	NA	NA
12.400	H	115	187	59.8	74.0	24.0	54.0

Table of Results for Spurious Radiated Emissions

* The Average Field Strengths shown in the Tables above have been normalised by subtracting 24.7dB (Duty Cycle Correction Factor) from the measured Field Strength.

Note: The Measurements in the above table 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: A Guy & G Lawler, EMC Engineers.

PHOTOGRAPHS OF EQUIPMENT

Photograph 2
Front view

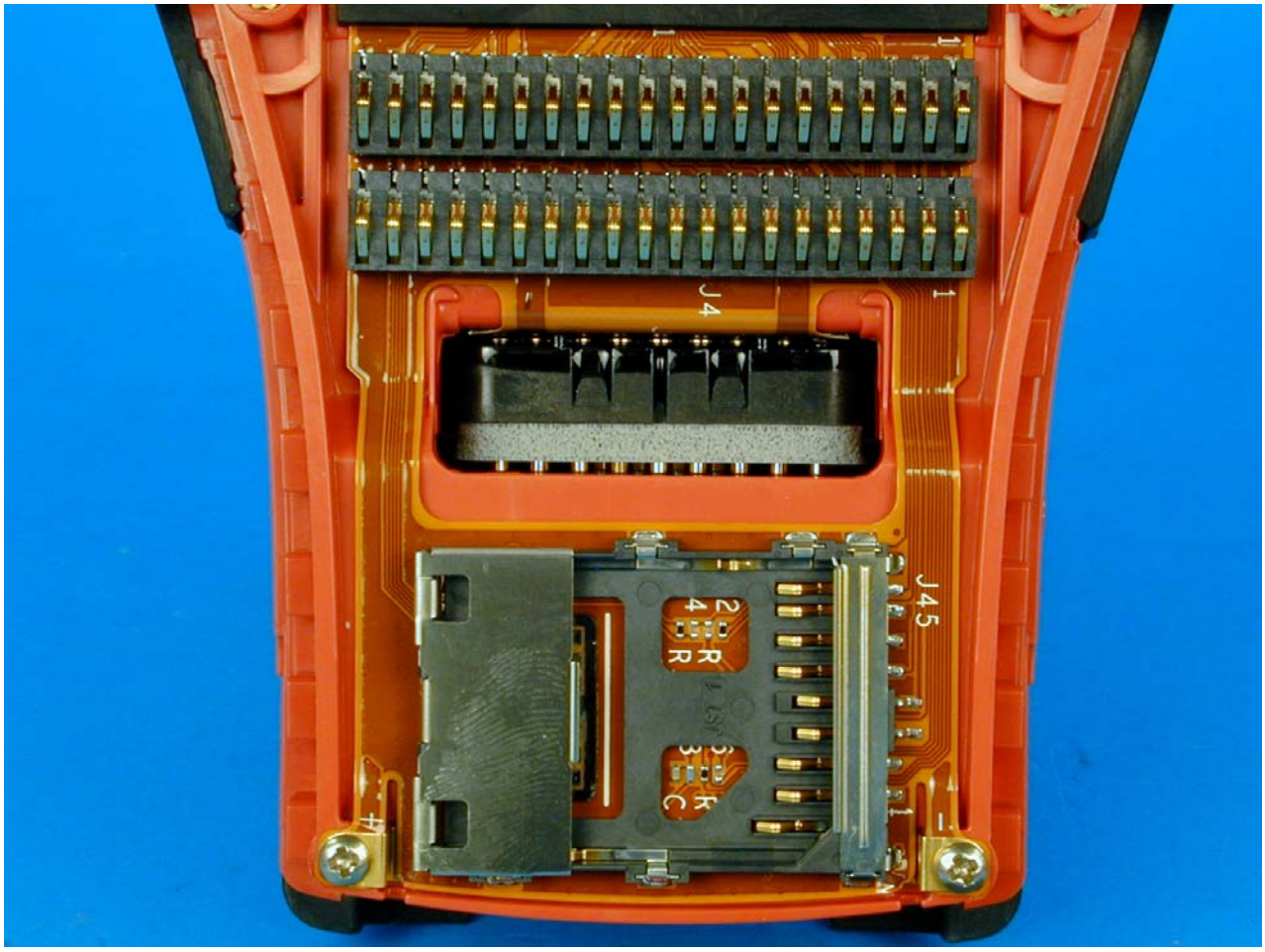
PHOTOGRAPHS OF EQUIPMENT

Photograph 3
Rear view

PHOTOGRAPHS OF EQUIPMENT

Photograph 4
Internal View 1

PHOTOGRAPHS OF EQUIPMENT

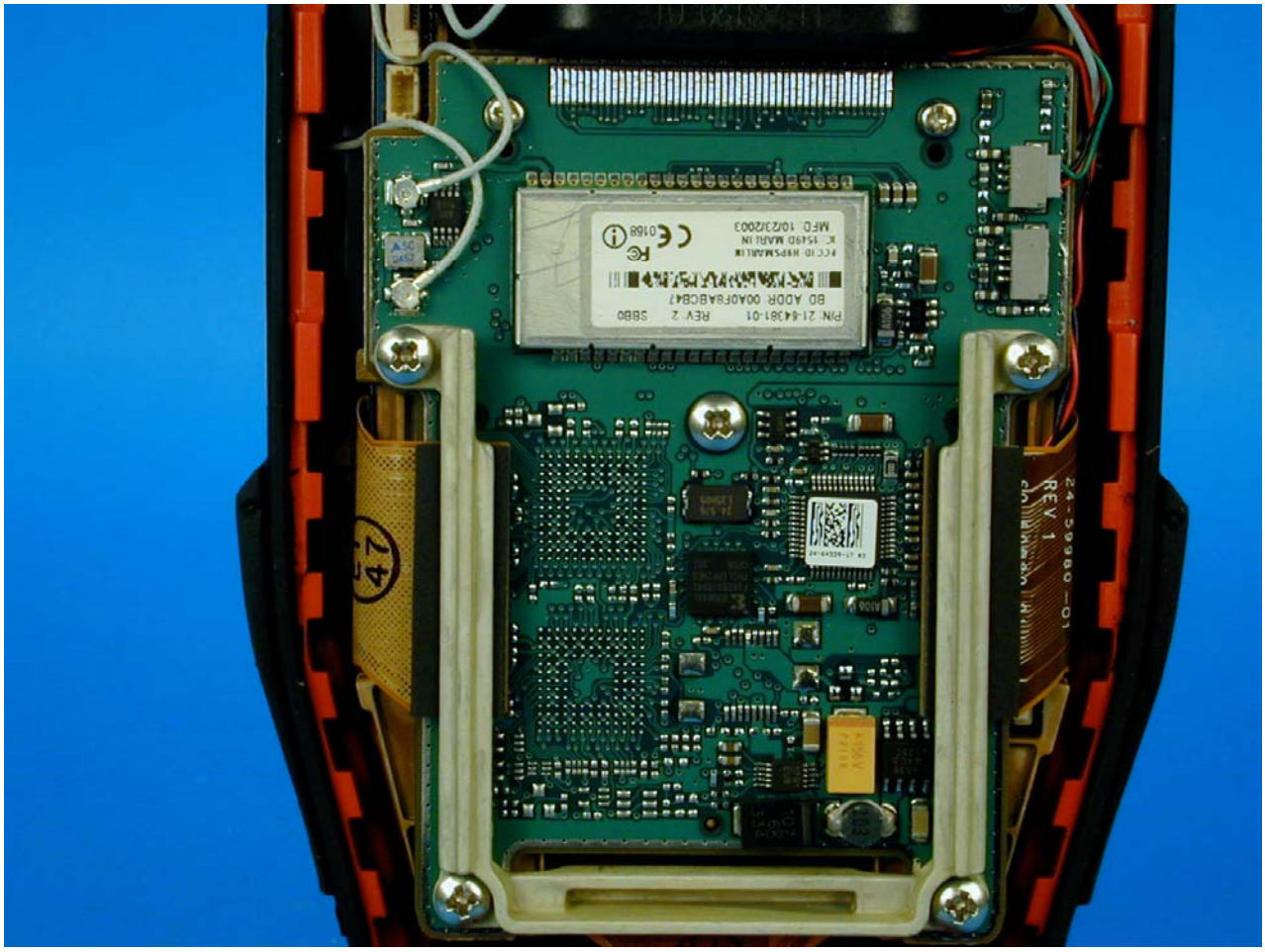


Photograph 5
Internal View 2

PHOTOGRAPHS OF EQUIPMENT

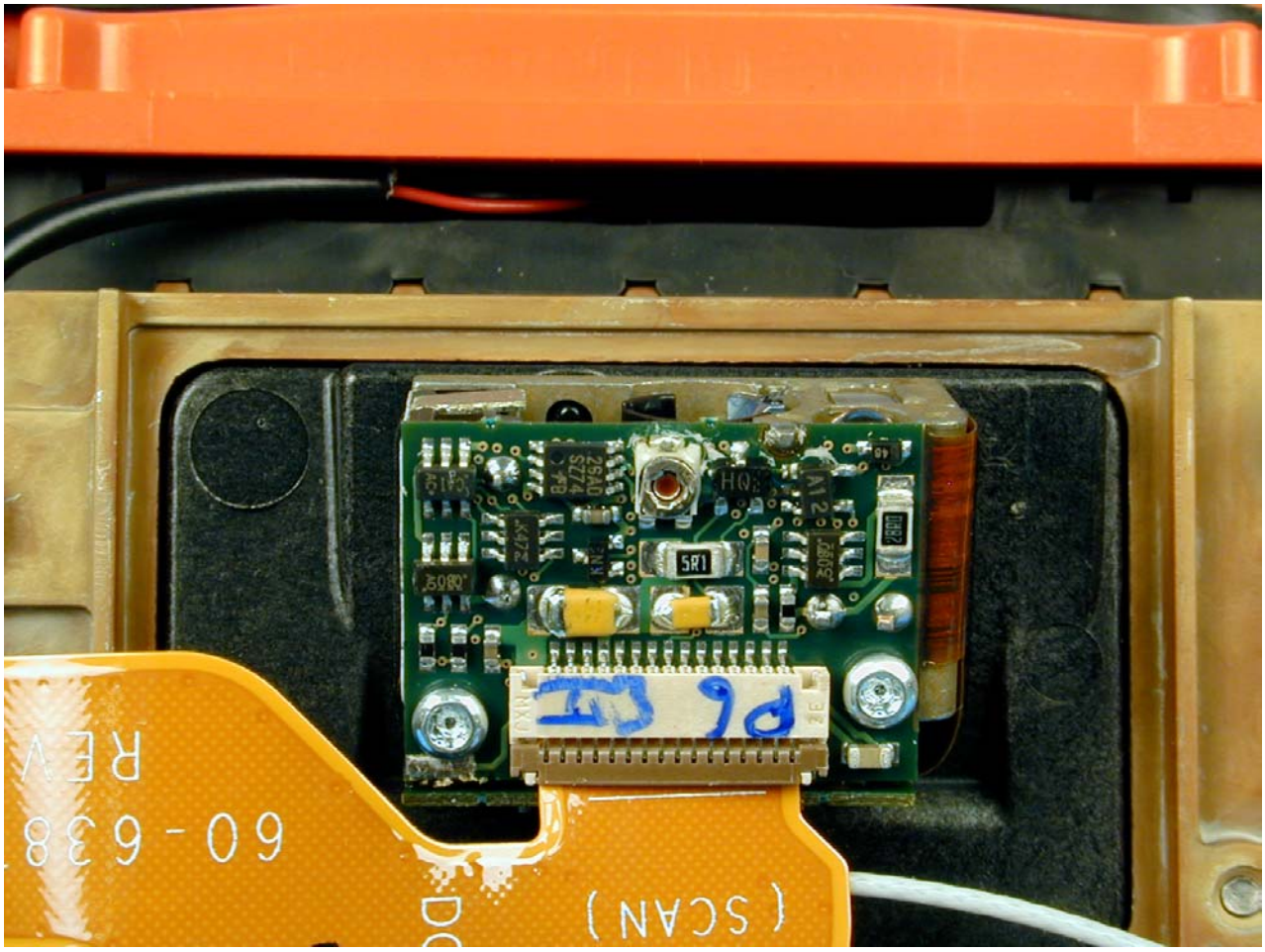
Photograph 6
Internal View 3

PHOTOGRAPHS OF EQUIPMENT



Photograph 7
Internal View 4

PHOTOGRAPHS OF EQUIPMENT

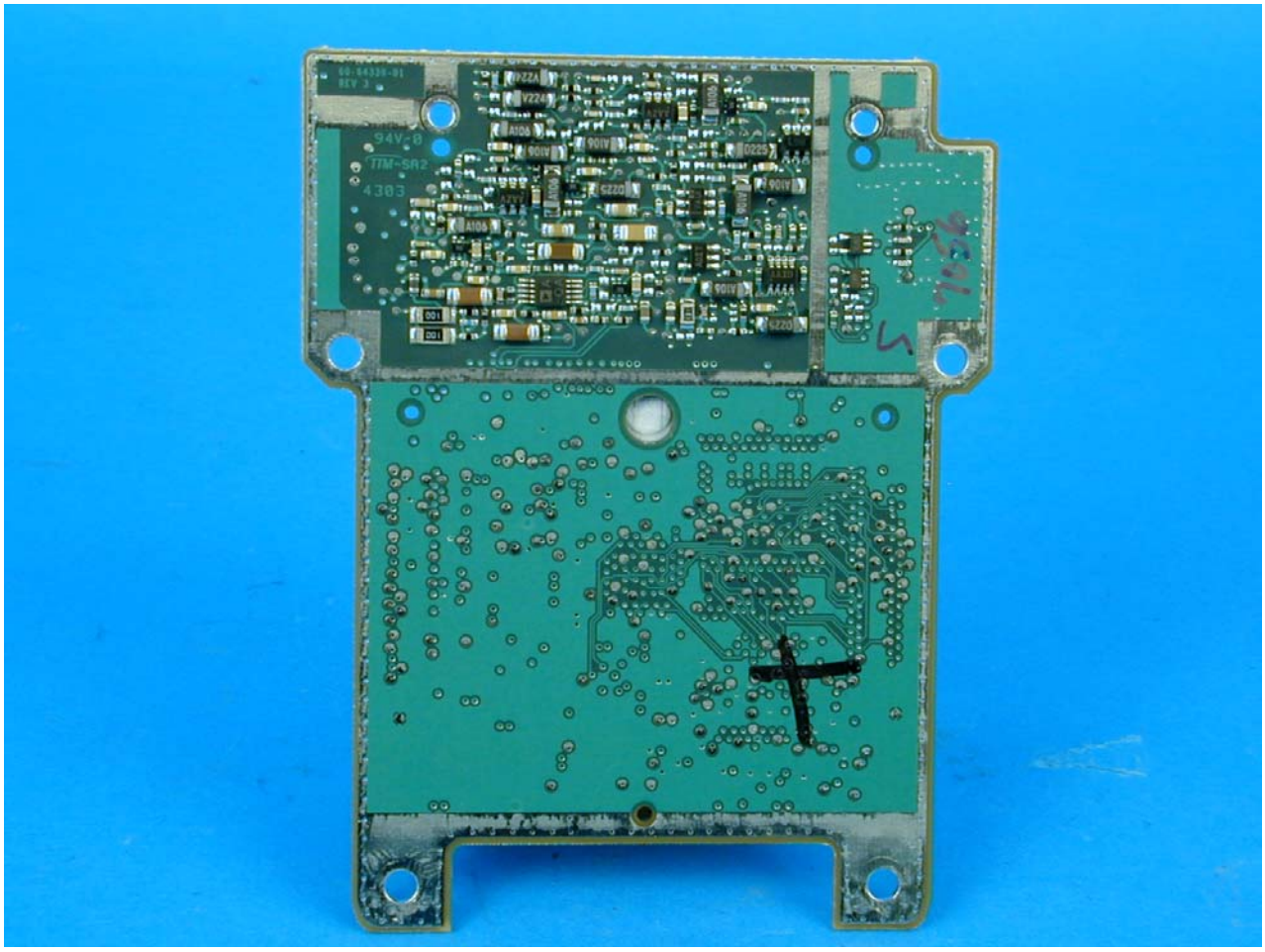


Photograph 8
Internal View 5

PHOTOGRAPHS OF EQUIPMENT

Photograph 9
Internal View 6

PHOTOGRAPHS OF EQUIPMENT

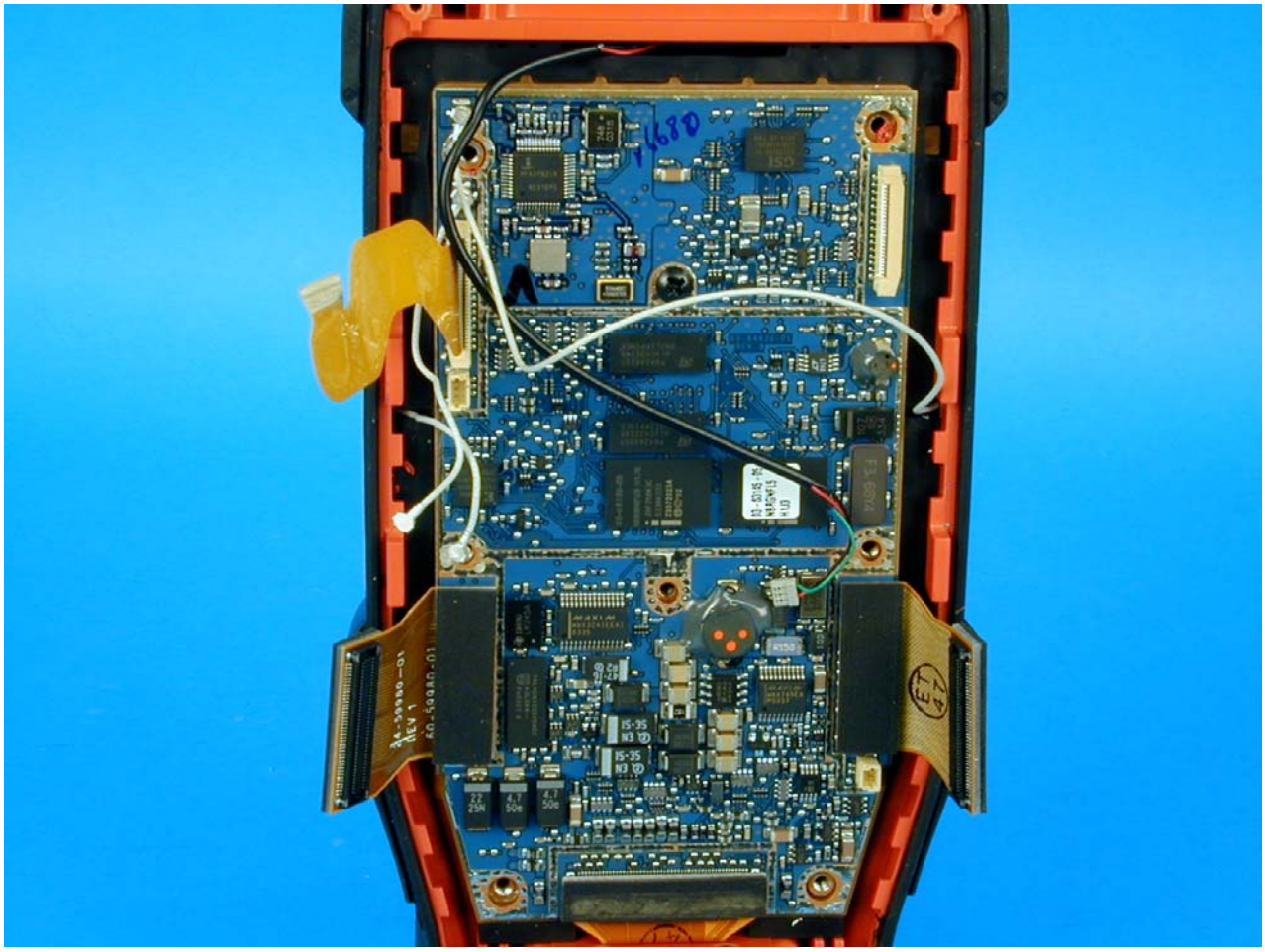


Photograph 10
Internal View 7

PHOTOGRAPHS OF EQUIPMENT

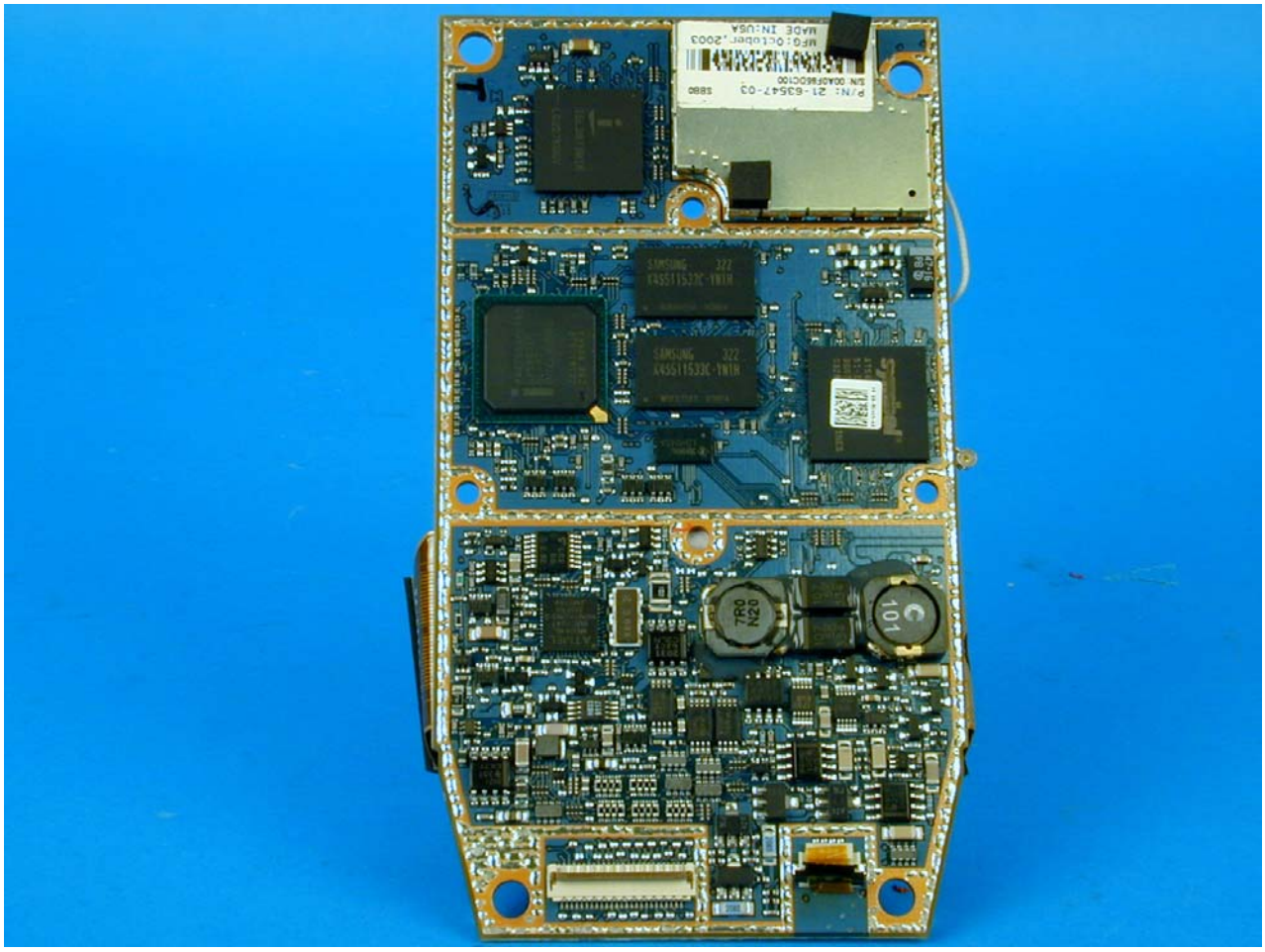
Photograph 11
Internal View 7

PHOTOGRAPHS OF EQUIPMENT



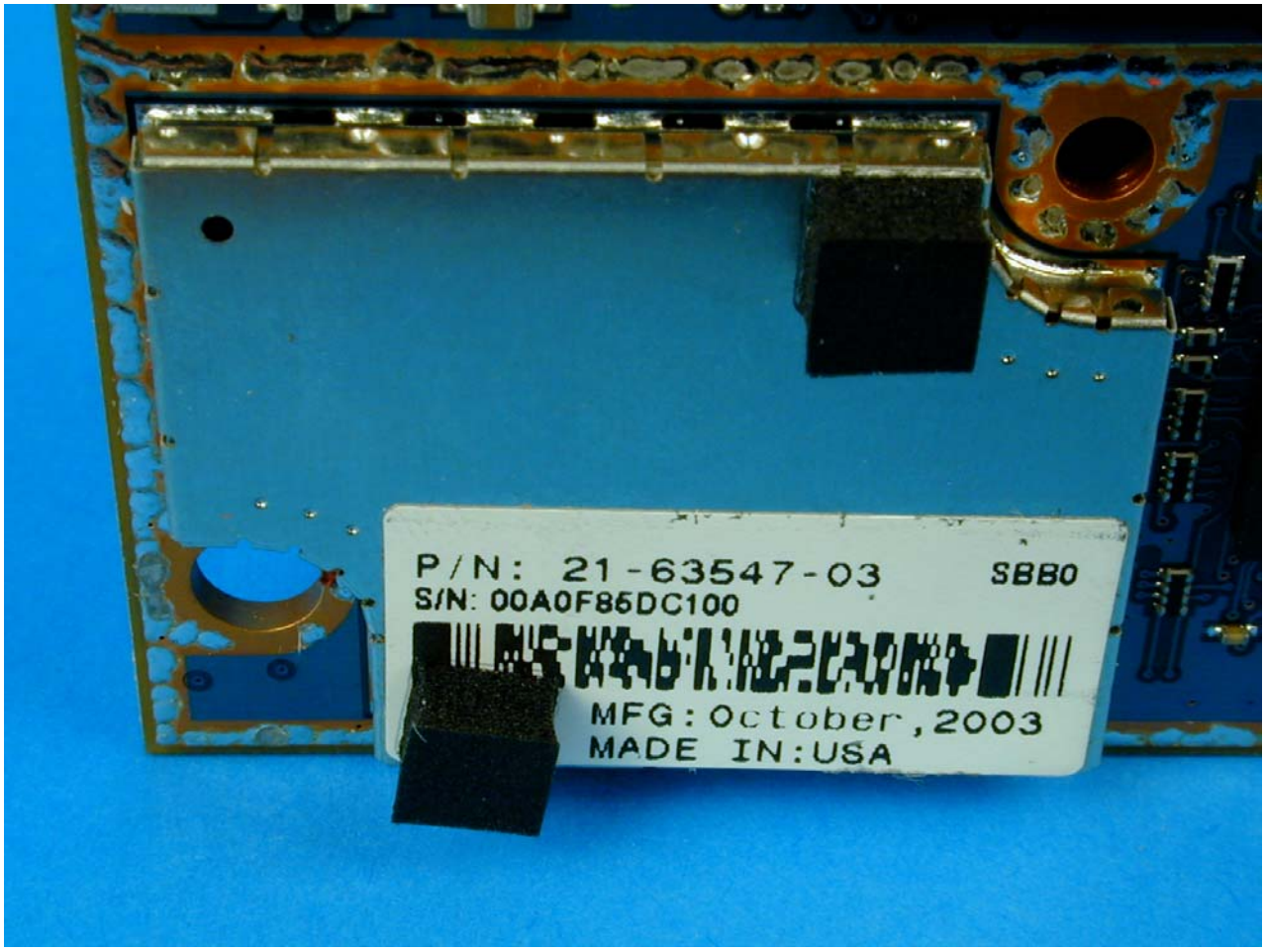
Photograph 12
Internal View 8

PHOTOGRAPHS OF EQUIPMENT



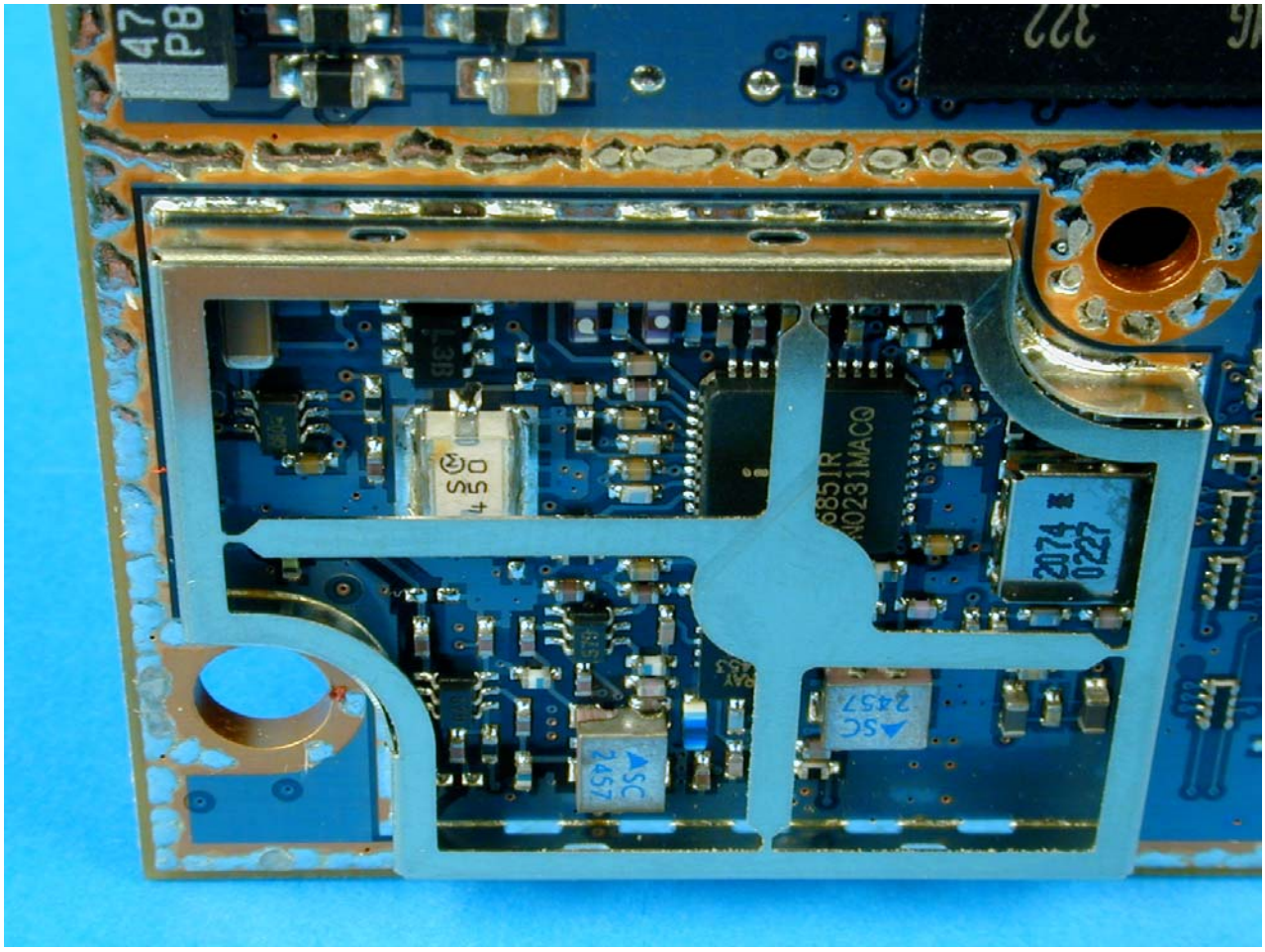
Photograph 13
Internal View 9

PHOTOGRAPHS OF EQUIPMENT



Photograph 14
Internal View 10

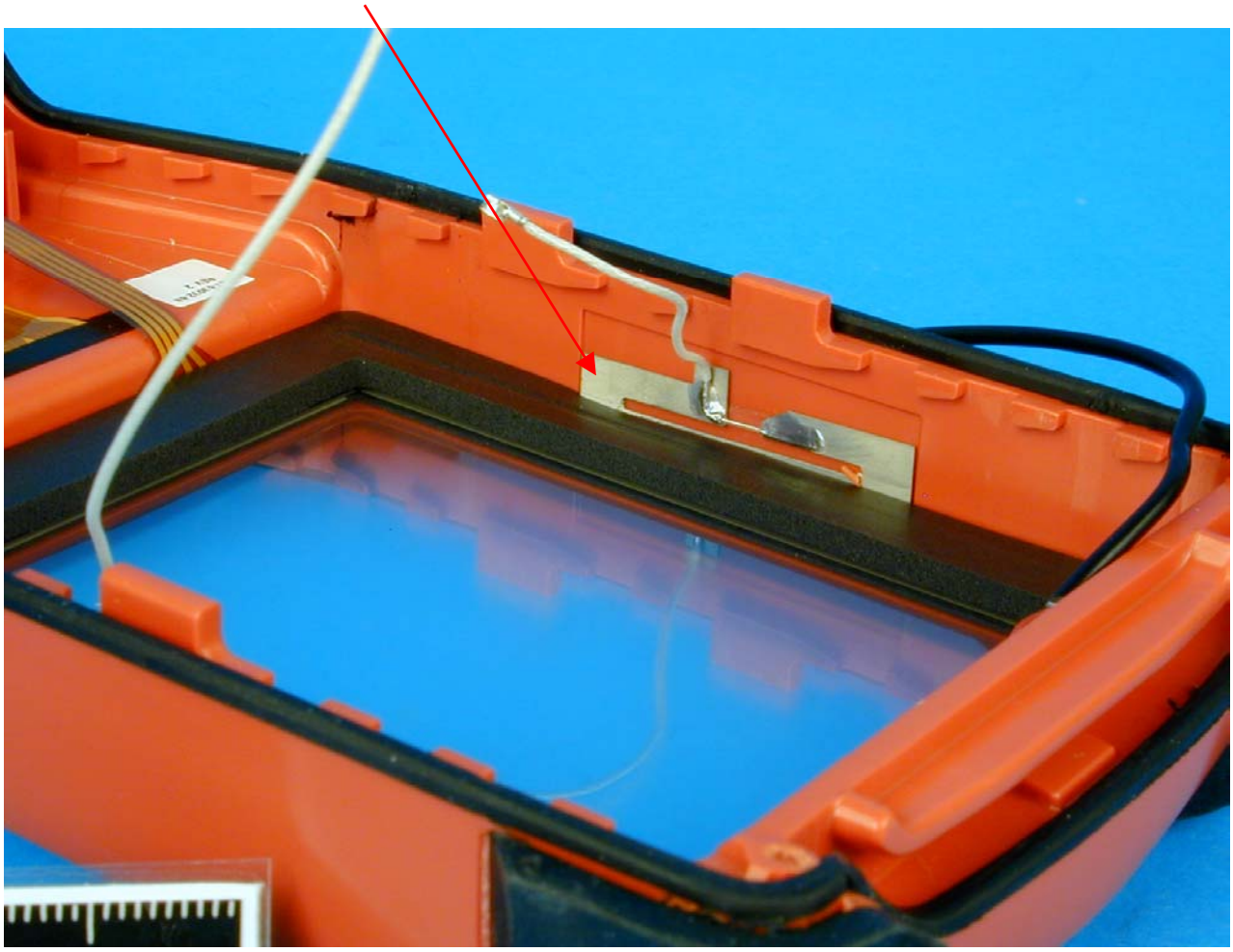
PHOTOGRAPHS OF EQUIPMENT



Photograph 15
Internal View 11

PHOTOGRAPHS OF EQUIPMENT

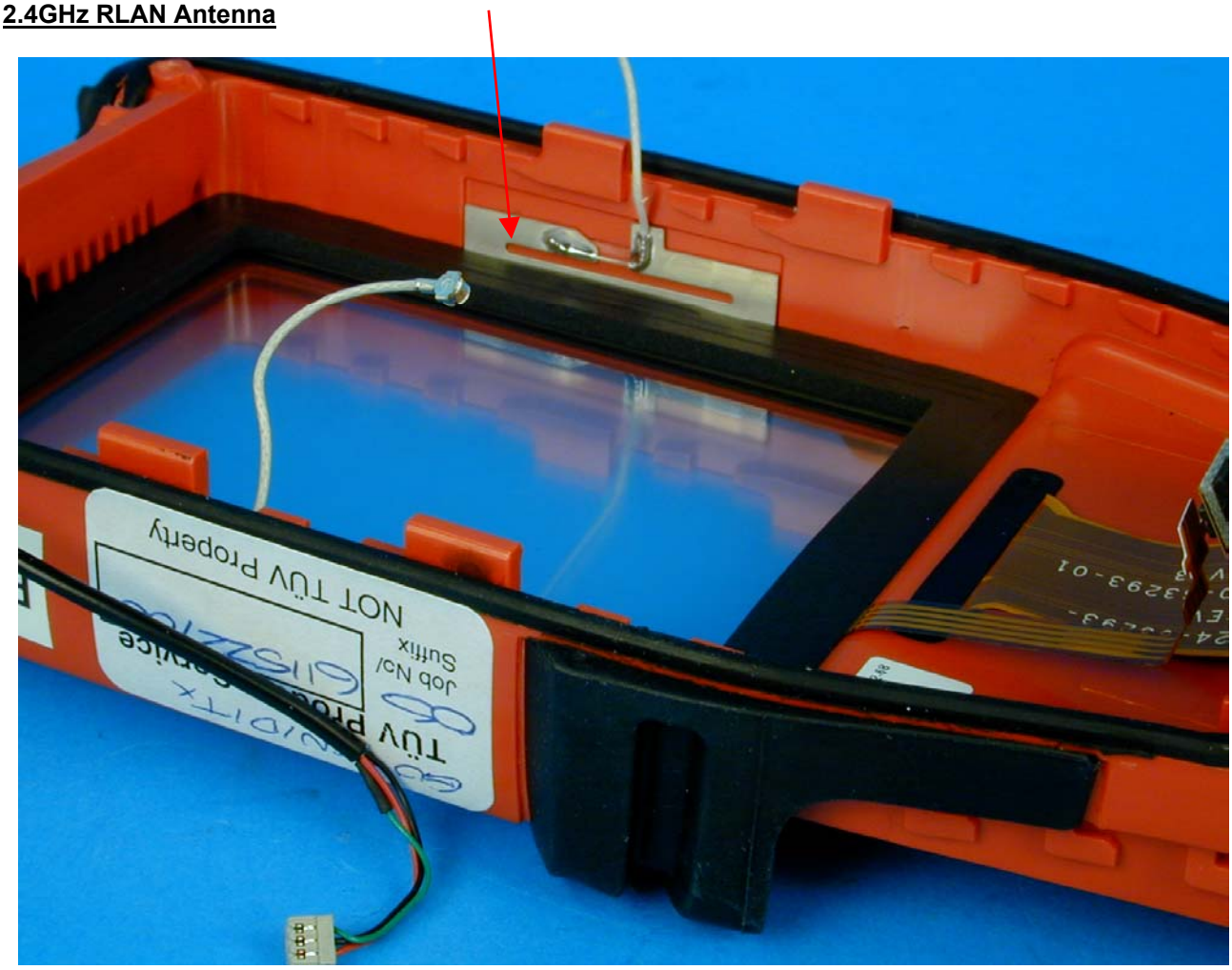
2.4GHz RLAN and Bluetooth Antenna (shared)



Photograph 16
Antenna View 1

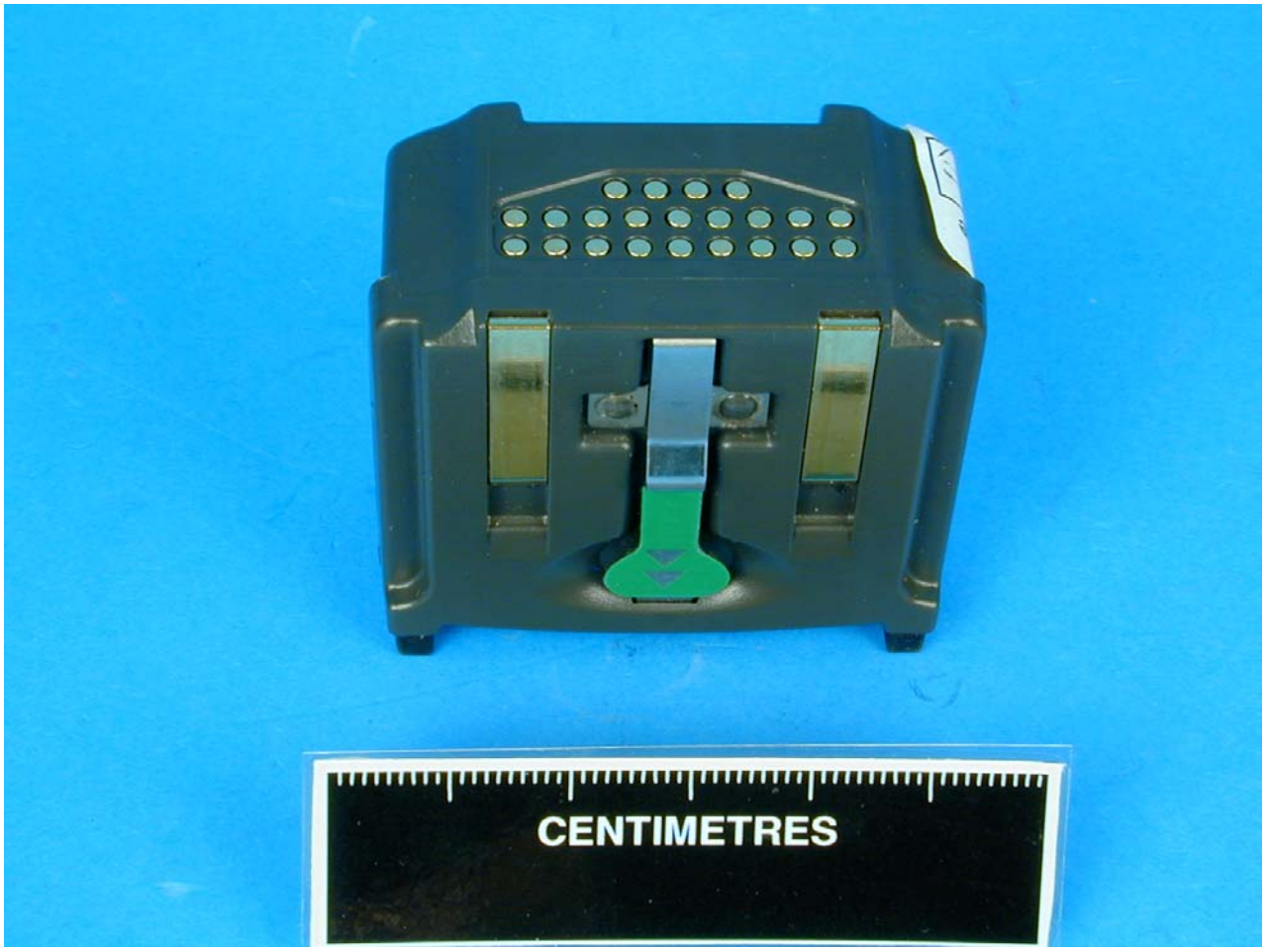
PHOTOGRAPHS OF EQUIPMENT

2.4GHz RLAN Antenna



Photograph 17
Antenna View 2

PHOTOGRAPHS OF EQUIPMENT



Photograph 18
Battery View

PHOTOGRAPHS OF EQUIPMENT

Photograph 19
Headset View

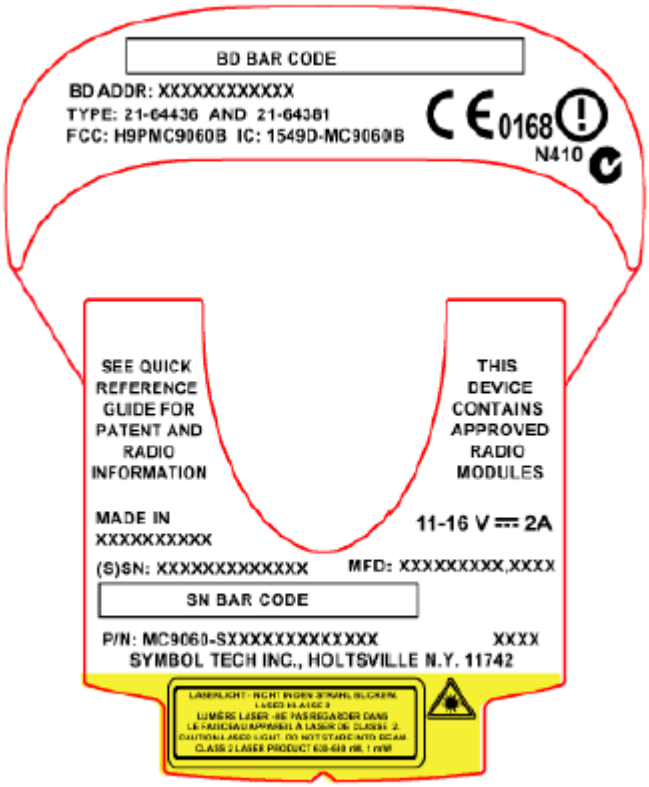
PHOTOGRAPHS OF EQUIPMENT

Photograph 20
Label View 1

PHOTOGRAPHS OF EQUIPMENT

Photograph 21
Label View 2

MANUFACTURER'S LABEL DRAWING



Not to scale

MEASUREMENT UNCERTAINTY

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

In the frequency range 30MHz to 1000MHz

For 6dB Bandwidth

Frequency	±210.894kHz
Amplitude	±0.5dB

For Maximum Output Power

Amplitude	±0.5dB

For Spurious Conducted Emissions

Amplitude	±3.0dB

For Radiated Emissions, Quasi-Peak Measurements using the ESVP Test Receiver and Bilog Antenna: -

Frequency	±5ppm + 500Hz
Amplitude	±4.1dB

In the frequency range 1GHz to 25GHz

For Spurious Radiated Emissions measurements: -

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

For Peak Power Spectral Density

Amplitude	±1.8dB

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).

ANNEX A
FCC SITE COMPLIANCE LETTERS

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

Thomas W Phillips
Electronics Engineer