
REPORT ON

Limited FCC CFR 47: Parts 15 B and C Testing in support of an
Application for Grant of Equipment Authorisation
of a Symbol MC906R (RFID and 802.11b enabled) Mobile Computer

FCC ID: H9PMC906RA

Report No OR612330/01 Issue 1

August 2004

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Grant of Equipment Authorisation of a Symbol MC906R (RFID and
802.11b enabled) Mobile Computer

FCC ID: H9PMC906RA

Report No OR612330/01 Issue 1

August 2004

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DATED

13th August 2004

DISTRIBUTION

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ENGINEERING STATEMENT

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

Test Engineers;


M P Hardy


A Guy


S Hartley


G Lawler





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SECTION 1

REPORT SUMMARY

Limited FCC CFR 47: Parts 15 B and C Testing in support of an
Application for Grant of Equipment Authorisation
of a Symbol MC906R (RFID and 802.11b enabled) Mobile Computer



1.1 STATUS

EQUIPMENT UNDER TEST	MC906R Mobile Computer
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	MC906R (RFID and 802.11b enabled) Mobile Computer
PART NUMBER	MC906R-GK0HBEER4US (Colour)
SERIAL NUMBER	ALP78944
HARDWARE VERSION	Rev 04 (To be released as Rev A)
DECLARED VARIANTS	MC906R-GK0JBEER4US (Mono)
TEST SPECIFICATION ISSUE/DATE	FCC CFR 47: Part 15, Subparts B and C August 2002
NUMBER OF ITEMS TESTED	One
SECURITY CLASSIFICATION OF EUT	Commercial In Confidence
INCOMING RELEASE DATE	Declaration of Build Status 15 th July 2004
DISPOSAL REFERENCE NUMBER DATE	Held pending disposal Not Applicable Not Applicable
ORDER NUMBER DATE	EMEA 14241 19 th May 2004
START OF TEST	13 th June 2004
FINISH OF TEST	30 th July 2004
RELATED DOCUMENTS	ANSI C63.4 2001. Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz. FCC Public Notice document (DA 00-705 released 30 March 2000)



1.2 INTRODUCTION

The information contained within this report is intended to show limited verification of compliance of the Symbol Technologies Inc MC906R (RFID and 802.11b enabled) Mobile Computer to the requirements of FCC Specification Parts 15 B and C.

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



1.3 PRODUCT INFORMATION

1.3.1 Technical Description

The unit supplied for testing is a Symbol MC906R Mobile Computer, which offers 2.4GHz 802.11b Wireless LAN and RFID connectivity with the following options: Pico Imager; Colour (touch) display; 64/64-memory option; Pocket PC; Audio; RFID EPC C1.

The terminal utilises the Symbol 21-64436 Main Terminal Module with embedded RLAN Radio and the Alien ALR-9640-B RFID Module. FCC ID numbers are detailed in Section 1.3.4 "Declaration of Build Status".

1.3.2 Modes of Operation

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

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

The client has declared that the Symbol 802.11b and the Symbol RFID Modules are co-located, and that they are capable of simultaneously transmitting. Testing for this mode of operation is covered in BABT Test Report Reference Number OR612330-2.

1.3.3 Test Configuration

1.3.3.1 Test Configuration – RLAN Mode

RLAN Transmitting on the following channels and frequencies;

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

1.3.3.2 Test Configuration – RFID Mode

RFID Transmitting on the following channels and frequencies;

Bottom Channel:	902.8MHz
Middle Channel:	915.2MHz
Top Channel:	927.6MHz



1.3.4 DECLARATION OF BUILD STATUS

		MAIN EUT	
MANUFACTURER		Symbol Technologies Inc	
TYPE		MC906R	
PART NUMBER		MC906R-GK0HBEER4US	
SERIAL NUMBER		ALP78944	
HARDWARE VERSION		Rev 4 (To be released as Rev A)	
COUNTRY OF ORIGIN		USA	
POWER		7.2V	
FCC ID		H9PMC906RA	
INDUSTRY CANADA ID		1549D-MC906RA	
TECHNICAL DESCRIPTION		The unit supplied for testing is a Symbol MC906R Mobile Computer, which offers 2.4GHz 802.11b Wireless LAN and RFID connectivity with the following options: Pico Imager; Colour (touch) display; 64/64-memory option; Pocket PC; Audio; RFID EPC C1.	
BATTERY/POWER SUPPLY			
MANUFACTURING DESCRIPTION		Lithium Battery	
MANUFACTURER		Symbol Technologies Inc.	
PART NUMBER		21-65587-01	
VOLTAGE		7.2V	
MODULES			
MANUFACTURING DESCRIPTION		Main Terminal Module with Embedded RLAN Radio	Alien RFID Module
MANUFACTURER		Symbol Technologies Inc	Alien Technology
TYPE		21-64436	ALR-9640-B
DECLARED OUTPUT POWER		100mW	1W

MANUFACTURING DESCRIPTION		Mobile Computer	
TRANSMITTER OPERATING BAND			
RECEIVER OPERATING BAND		2400 – 2483.5MHz	902-928MHz
INTERMEDIATE FREQUENCIES		374MHz	Not available (Alien information)
ITU DESIGNATION OF EMISSION		11M0F1D	373KL1D
FCC ID		H9P2164436	Not Applicable
INDUSTRY CANADA ID		1549D-2164436	Not Applicable
DSSS/FHSS/COMBINED OR OTHER		DSSS	FHSS

Signature

Date
D of B S Serial No

15th July 2004
OR612330

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

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



1.4 BRIEF SUMMARY OF RESULTS

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

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

Test	Spec Clause	Test Description	Result	Levels/Comments
2.1	15.205	Measurement at Band Edge	Pass	RLAN
2.2	15.247(b)(3)	Maximum Peak Output Power (Radiated)	Pass	RLAN
2.3	15.247(c)	Spurious Radiated Emissions	Pass	RLAN
2.4	15.247(a)(1)	Channel Occupancy/Separation	Pass	RLAN
2.5	15.247(iii)	Channel Dwell Time	Pass	RFID
2.6	15.247(a)(1)	Number of Channels	Pass	RFID
2.7	15.247(a)(1)	20dB Bandwidth	Pass	RFID
2.8	15.247(b)(2)	Maximum Peak Output Power (Conducted)	Pass	RFID
2.9	15.247(b)(2)	Maximum Peak Output Power (Radiated)	Pass	RFID
2.10	15.247(c)	Spurious Conducted Emissions on Antenna Port	Pass	RFID
2.11	15.247(c)	Spurious Radiated Emissions	Pass	RFID
2.12	15.109	Radiated Emissions	Pass	RFID



1.5 OPINIONS AND INTERPRETATIONS

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

1.6 TEST CONDITIONS

1.6.1 Radiated Testing

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

The Symbol MC906R (RFID and 802.11b enabled) Mobile Computer was powered by its own internal battery and had a headset connected.

1.6.2 Conducted Testing

The EUT was tested via a temporary antenna connector. The EUT was set to transmit at its maximum output power using the following test modes where applicable:

Mode 1 – CW Transmission on Bottom, Middle and Top Channels

Mode 2 – Hopping on all Channels

The test result section details the mode utilised.

The Symbol MC906R (RFID and 802.11b enabled) Mobile Computer was powered by its own internal battery.

1.7 DEVIATIONS FROM THE STANDARD

Limited tests were applied in accordance with Symbol requirements.

1.8 MODIFICATION RECORD

Not Applicable.

1.9 ALTERNATIVE TEST SITE

No Alternative test site was used.



SECTION 2

TEST DETAILS RLAN MODE

Limited FCC CFR 47: Part 15 C Testing in support of an
Application for Grant of Equipment Authorisation
of a Symbol MC906R (RFID and 802.11b enabled) Mobile Computer



2.1 MEASUREMENT AT THE BAND EDGE (MARKER DELTA METHOD)

2.1.1 Specification Reference

FCC CFR 47: Part 15 Subpart C, Section 15.205

2.1.2 Equipment Under Test

MC906R Mobile Computer

2.1.3 Date of Test

13th July 2004

2.1.4 Test Equipment Used

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

2.1.5 Test Procedure

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



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

2.1.6 Test Results

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

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

Step 1

Bottom Channel Fundamental Field Strength Measurement.

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

Frequency	Antenna Polarisation	Height	Azimuth	Peak Field Strength	Average Field Strength
MHz	H/V	cm	deg	dB μ V/m	dB μ V/m
2412	H	116	87	112.6	103.8

Step 2

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

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

Marker Delta Amplitude = 57.3dB

Step 3

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

Peak of 55.3dB μ V/m (Limit is 74.0dB μ V/m)

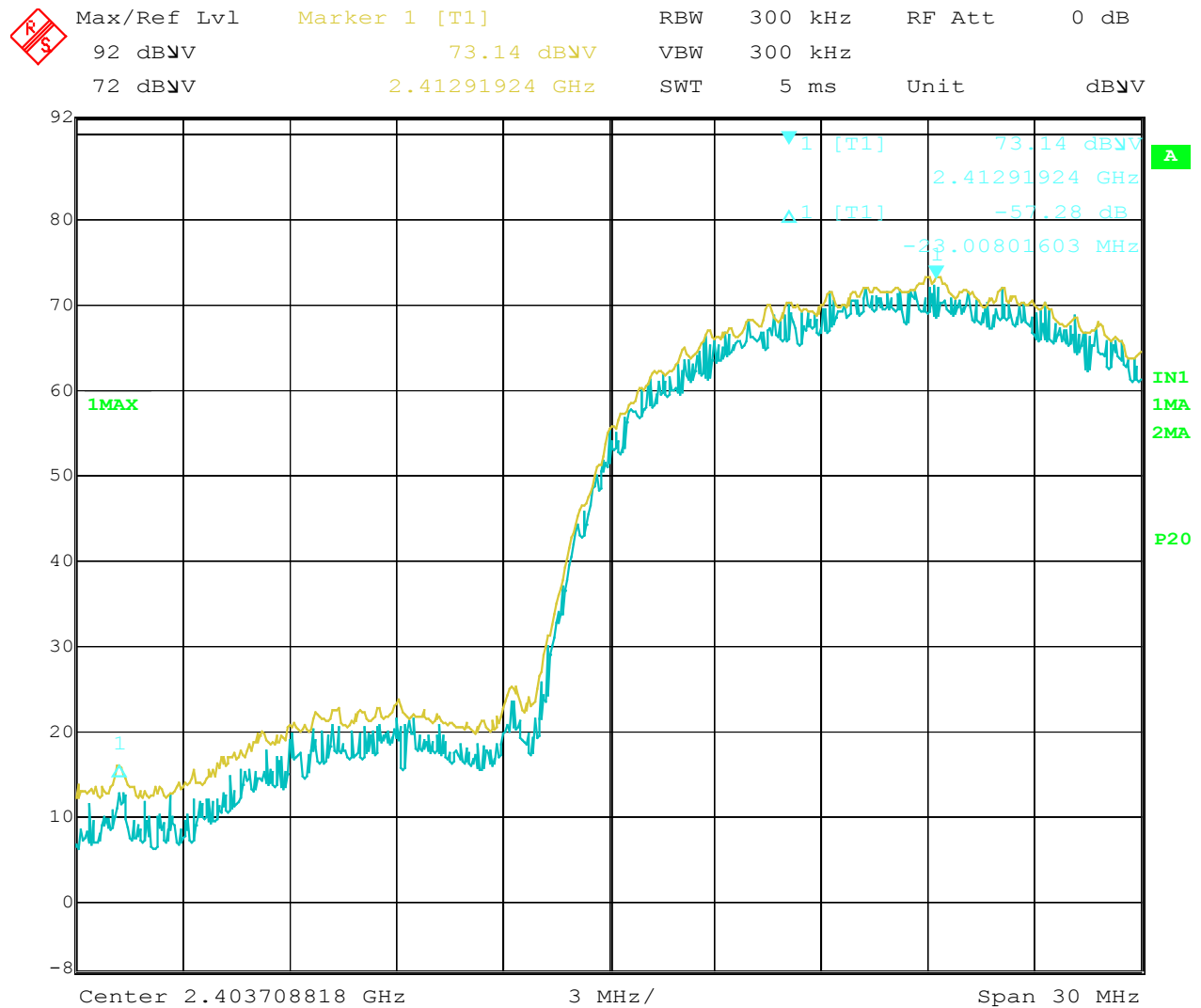
Average of 46.5dB μ V/m (Limit is 54.0dB μ V/m)



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

2.1.6 Test Results - continued

Plot for Bottom Channel 2412MHz



Date: 13.JUN.2004 16:57:05



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

2.1.6 Test Results - continued

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

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

Step 1

Bottom Channel Fundamental Field Strength Measurement.

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

Frequency	Antenna Polarisation	Height	Azimuth	Peak Field Strength	Average Field Strength
MHz	H/V	cm	deg	dB μ V/m	dB μ V/m
2462	H	135	81	112.5	104.4

Step 2

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

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

Marker Delta Amplitude = 58.0dB

Step 3

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

Peak of 54.4dB μ V/m (Limit is 74.0dB μ V/m)

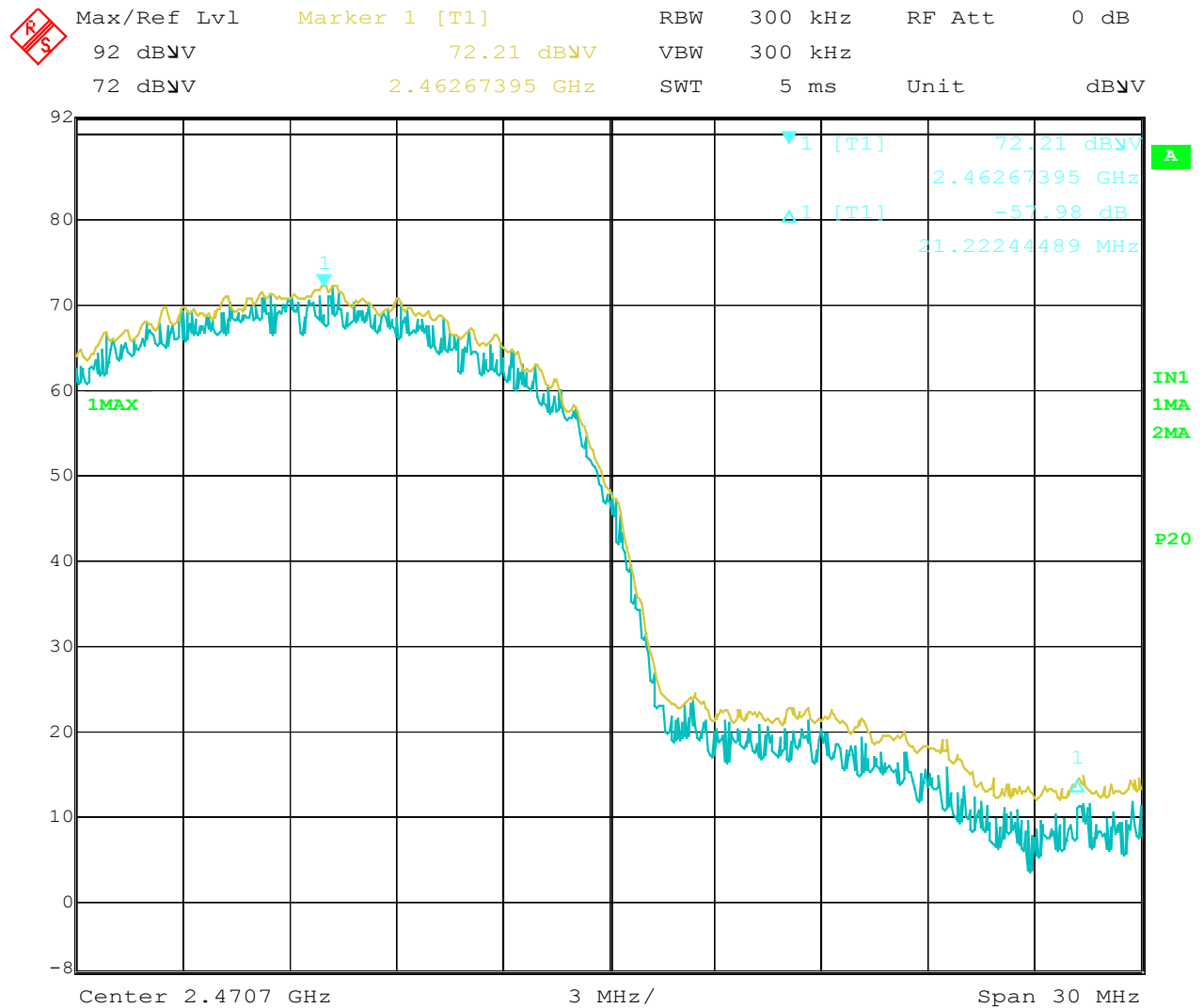
Average of 46.4dB μ V/m (Limit is 54.0dB μ V/m)



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

2.1.6 Test Results - continued

Plot for Top Channel 2462MHz



Date: 13.JUN.2004 17:10:18



2.2 MAXIMUM PEAK OUTPUT POWER (EIRP Method)

2.2.1 Specification Reference

FCC CFR 47: Part 15 Subpart C, Section 15.247(b)(2)

2.2.2 Equipment Under Test

MC906R Mobile Computer

2.2.3 Date of Test

14th June 2004

2.2.4 Test Equipment Used

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

2.2.5 Test Procedure

Test Performed in accordance with ANSI C63.4.

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

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



2.2 MAXIMUM PEAK OUTPUT POWER (EIRP Method) - continued

2.2.6 Test Results - continued

The EUT met the requirements of FCC CFR 47: Part 15 Subpart C, Section 15.247(b)(2) for Maximum Peak Output Power.

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

Frequency (MHz)	Result EIRP (dBm)	Result EIRP (mW)
2412	20.1	102.3
2437	20.6	114.8
2462	19.2	83.2
Limit	<+36dBm or <4W	



2.3 SPURIOUS RADIATED EMISSIONS

2.3.1 Specification Reference

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

2.3.2 Equipment Under Test

MC906R Mobile Computer

2.3.3 Date of Test

14th June 2004 to 30th July 2004

2.3.4 Test Equipment Used

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

2.3.5 Test Procedure

Test Performed in accordance with ANSI C63.4.

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

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

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

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

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

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

**2.3 SPURIOUS RADIATED EMISSIONS** - continued**2.3.5 Test Procedure** - continued

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

Test Mode	Carrier Frequency MHz	Carrier Field Strength dB μ V/m	Limit for Spurious Outside Restricted Band (Carrier F S -20dB) dB μ V/m
RLAN	2412	105.2	85.2
RLAN	2437	106.0	86.0
RLAN	2462	105.0	85.0



2.3 SPURIOUS RADIATED EMISSIONS - continued

2.3.6 Test Results

30MHz - 1GHz Frequency Range

Equipment Designation: Intentional Radiator.

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

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

EUT Tx on Bottom Channel (2412MHz)

Emission Frequency	Pol	Hgt	Azm	Field Strength at 3m		Specification Limit	
MHz	H/V	cm	deg	dBμV/m	μV/m	dBμV/m	μV/m
210.1	H	14.	89	31.2	36.3	43.5	150.0
224.9	H	138	98	30.9	35.0	46.0	200.0
239.6	H	131	116	31.7	38.5	46.0	200.0
269.1	H	100	132	31.0	35.5	46.0	200.0
394.9	H	233	102	29.2	28.8	46.0	200.0
748.0	H	100	83	40.3	103.5	46.0	200.0

EUT Tx on Middle Channel (2437MHz)

Emission Frequency	Pol	Hgt	Azm	Field Strength at 3m		Specification Limit	
MHz	H/V	cm	deg	dBμV/m	μV/m	dBμV/m	μV/m
202.7	H	148	108	30.4	33.1	43.5	150.0
210.1	H	151	91	31.7	38.5	43.5	150.0
224.9	H	125	106	30.9	35.0	46.0	200.0
239.6	H	131	116	31.1	35.9	46.0	200.0
269.1	H	118	125	31.7	38.5	46.0	200.0
748.0	H	100	77	42.4	131.8	46.0	200.0



2.3 SPURIOUS RADIATED EMISSIONS - continued

2.3.6 Test Results – continued

30MHz - 1GHz Frequency Range

EUT Tx on Top Channel (2462MHz)

Emission Frequency	Pol	Hgt	Azm	Field Strength at 3m		Specification Limit	
				dBμV/m	μV/m	dBμV/m	μV/m
202.7	H	110	110	29.2	28.8	43.5	150.0
210.1	H	155	87	31.6	38.0	43.5	150.0
224.9	H	118	100	30.9	35.1	46.0	200.0
240.0	H	127	115	31.1	35.9	46.0	200.0
269.3	H	120	119	31.2	36.3	46.0	200.0
748.0	H	100	76	42.2	128.8	46.0	200.0

ABBREVIATIONS FOR ABOVE TABLES

H Horizontal Polarisation
 Pol Polarisation
 deg degree

V Vertical Polarisation
 Hgt Height
 Azm Azimuth



2.3.6 Test Results - continued

1GHz – 25GHz Frequency Range

Equipment Designation: Intentional Radiator.

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

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

EUT Tx on Bottom Channel (2412MHz)

Frequency	Antenna		Turntable	Peak Field Strength	Peak Limit	Average Field Strength	Average Limit
	Pol	Height	Azimuth				
GHz	H/V	cm	deg	dBµV/m	dBµV/m	dBµV/m	dBµV/m
4.076	V	100	042	57.4	74.0	50.5	54.0
4.824	V	100	017	54.2	74.0	41.0	54.0

EUT Tx on Middle Channel (2437MHz)

Frequency	Antenna		Turntable	Peak Field Strength	Peak Limit	Average Field Strength	Average Limit
	Pol	Height	Azimuth				
GHz	H/V	cm	deg	dBµV/m	dBµV/m	dBµV/m	dBµV/m
4.126	V	100	098	58.7	74.0	50.8	54.0
4.874	V	100	157	55.6	74.0	44.8	54.0

EUT Tx on Top Channel (2462MHz)

Frequency	Antenna		Turntable	Peak Field Strength	Peak Limit	Average Field Strength	Average Limit
	Pol	Height	Azimuth				
GHz	H/V	cm	deg	dBµV/m	dBµV/m	dBµV/m	dBµV/m
4.176	V	100	092	57.9	74.0	50.4	54.0
4.924	V	114	158	56.5	74.0	43.6	54.0

ABBREVIATIONS FOR ABOVE TABLES

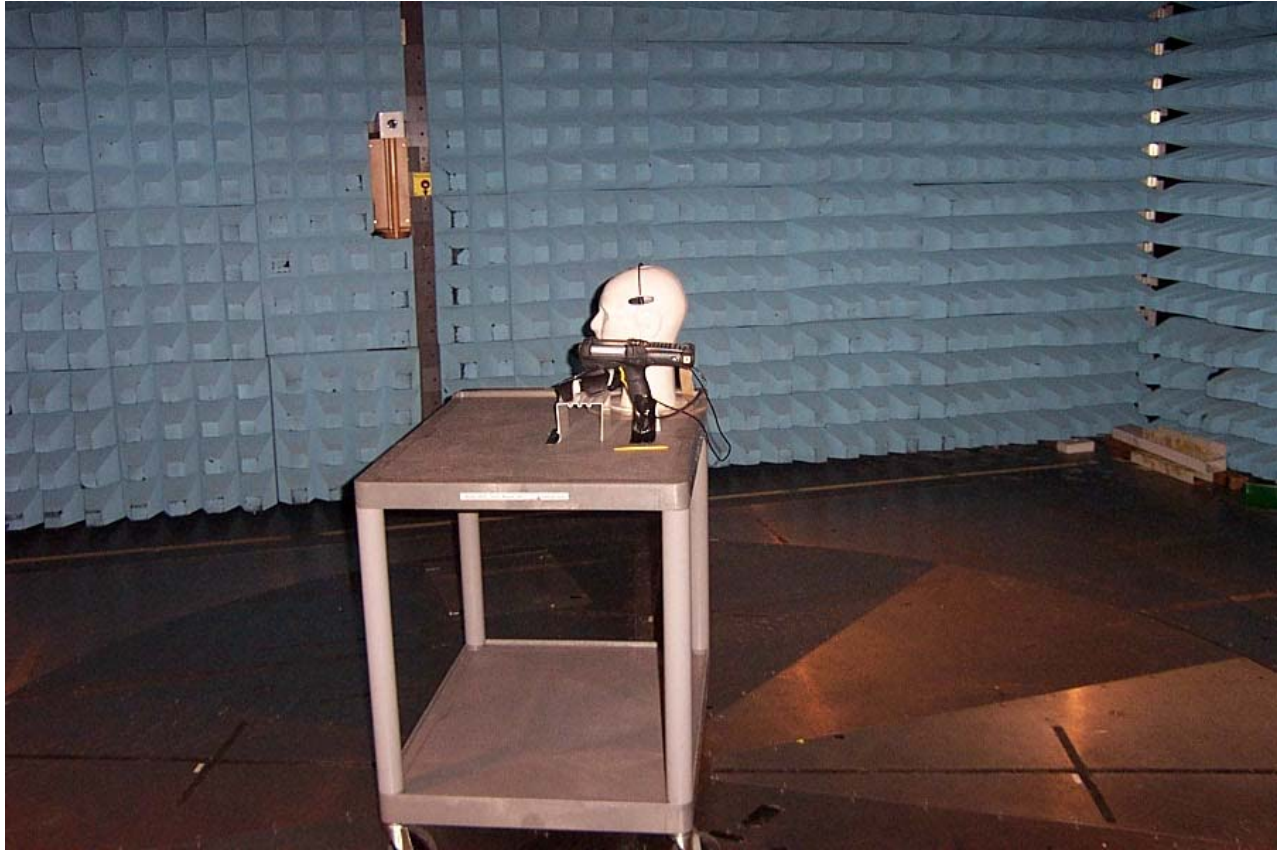
H Horizontal Polarisation
 Pol Polarisation
 deg degree

V Vertical Polarisation
 Hgt Height
 Azm Azimuth



2.3 SPURIOUS RADIATED EMISSIONS - continued

2.3.7 Set Up Photograph



Spurious Radiated Emissions Set Up Photograph



SECTION 2

TEST DETAILS RFID MODE

Limited FCC CFR 47: Parts 15 C Testing in support of an
Application for Grant of Equipment Authorisation
of a Symbol MC906R (RFID and 802.11b enabled) Mobile Computer



2.4 CHANNEL OCCUPANCY/SEPARATION

2.4.1 Specification Reference

FCC CFR 47: Part 15 Subpart C, Section 15.247(a)(1)

2.4.2 Equipment Under Test

MC906R Mobile Computer

2.4.3 Date of Test

17th June 2004

2.4.4 Test Equipment Used

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

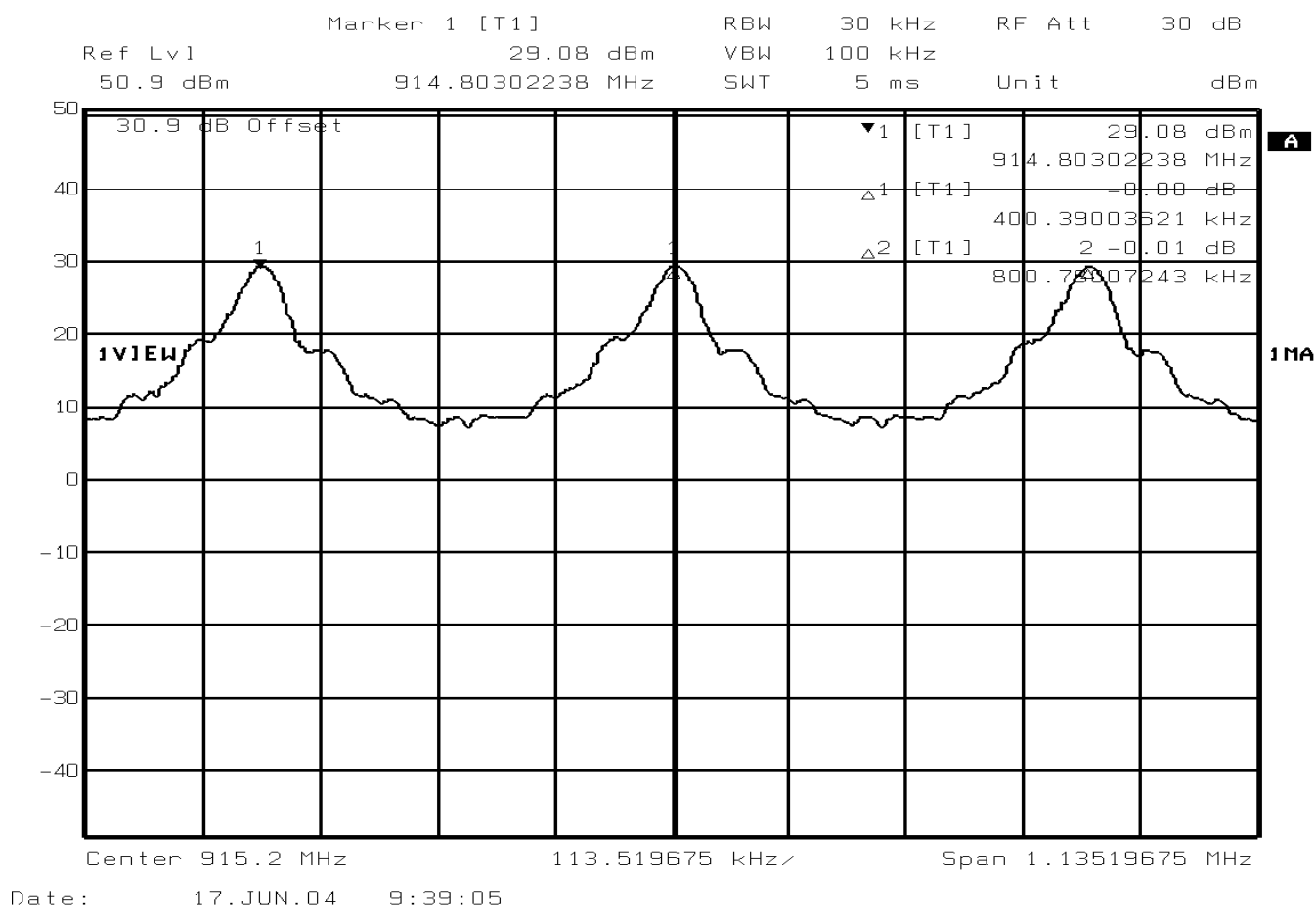
2.4.5 Test Procedure

The EUT was transmitted at maximum power into a Spectrum Analyser. The trace was set to Max Hold to store several adjacent channels on screen. Using the marker delta function, the markers were positioned to show the separation between adjacent channels.



2.4 CHANNEL OCCUPANCY/SEPARATION - continued

2.4.6 Test Results



The system channel separation is specified as being 400kHz. The measured channel separation from the plot above is: 400.390 kHz.

Limit	>25kHz
-------	--------

Remarks

The equipment met the requirements outlined in 15.247(a)(1).



2.5 CHANNEL DWELL TIME

2.5.1 Specification Reference

FCC Part 15.247(a)(iii)

2.5.2 Equipment Under Test

MC906R Mobile Computer

2.5.3 Date of Test

17th June 2004

2.5.4 Test Equipment Used

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

2.5.5 Test Procedure

Procedure: Test Performed in accordance with 15.247.

The RFID system is continually frequency hopping over 63 channels in a random sequence. The total amount of time spent on a single channel was measured as being 126.5ms. This can be seen in Figure 1. Over this transmission burst, the transmit time was measured as being 1.97ms, (Figure 2), and the off time calculated by the Transmit On and Transmit Off time combined, (Figure 3), minus the Transmit On time.

Transmit On Time:	1.97ms
Transmit On Time + Transmit Off Time:	3.55ms

Thus, Transmit Off Time	=	3.55ms – 1.97ms
	=	1.58ms

Thus, the duty cycle can be calculated as:

Duty Cycle	=	Tx On Time / (Tx On Time + Tx Off Time)
	=	1.97ms / (1.97ms + 1.58ms)
	=	55.5%

Thus, the Tx On Time over one burst is 1.09ms, (55.5%) and the Tx Off Time over one burst is 0.88ms, (44.5%).

The overall time between transmission on each channel was measured and is shown in Figure 4. The time between each transmission on the same channel was measured as being 8.1 seconds. Thus, in a 10 second period, a maximum of 2 transmissions on the same channel can occur. Therefore, the maximum transmit time on a single channel in a 10 second period is: 2 x 126.5ms = 253ms. Accounting for the duty cycle, the actual maximum transmit time in a 10 second period is: 253ms x 0.555 = 140ms.



2.5 CHANNEL DWELL TIME - continued

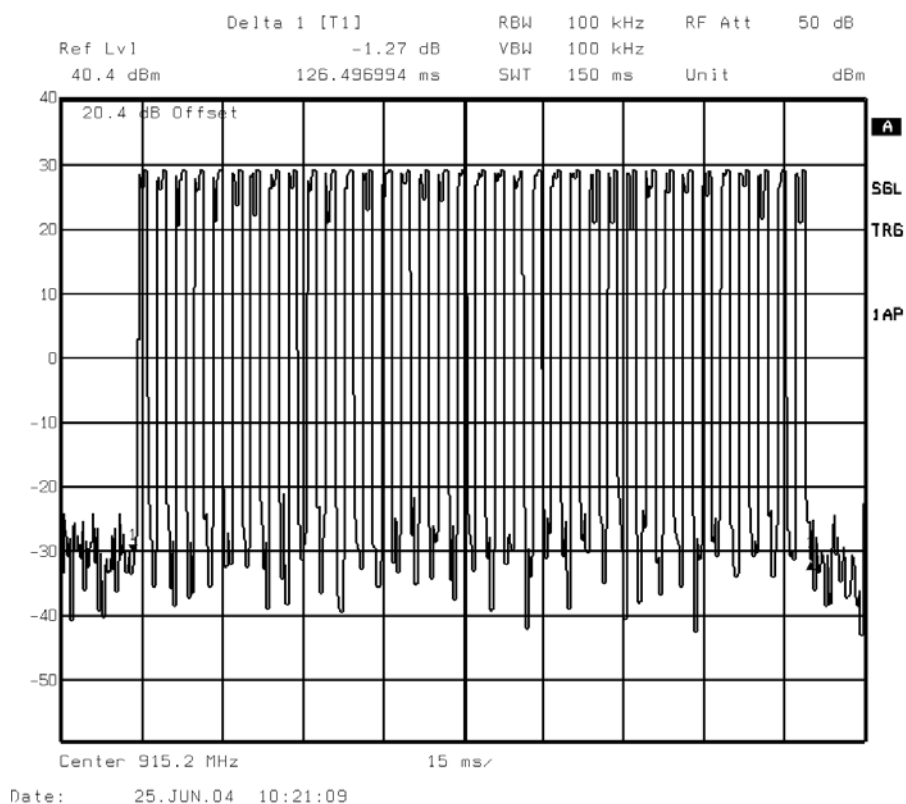
2.5.6 Test Results

Remarks

Thus, the transmitter dwell time meets the requirements specified in 15.247(a)(i) whilst the EUT is randomly frequency hopping over all 63 channels.

Limit

Occupancy time shall be less than 0.4 seconds in a 10 second period on any channel.

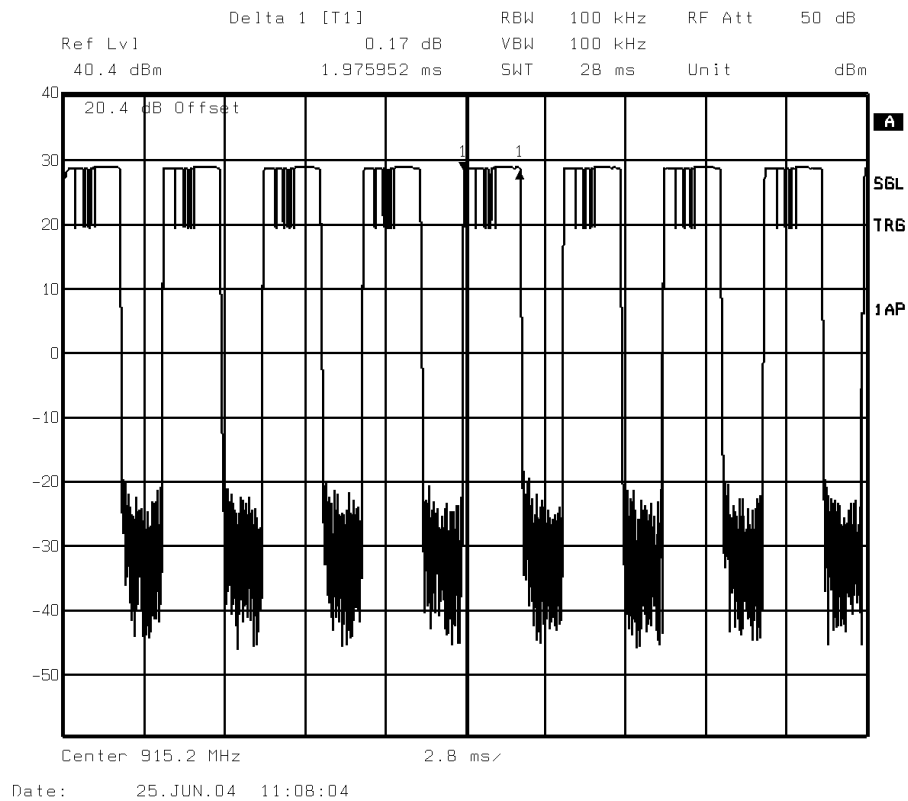


Transmit Burst



2.5 CHANNEL DWELL TIME - continued

2.5.6 Test Results - continued

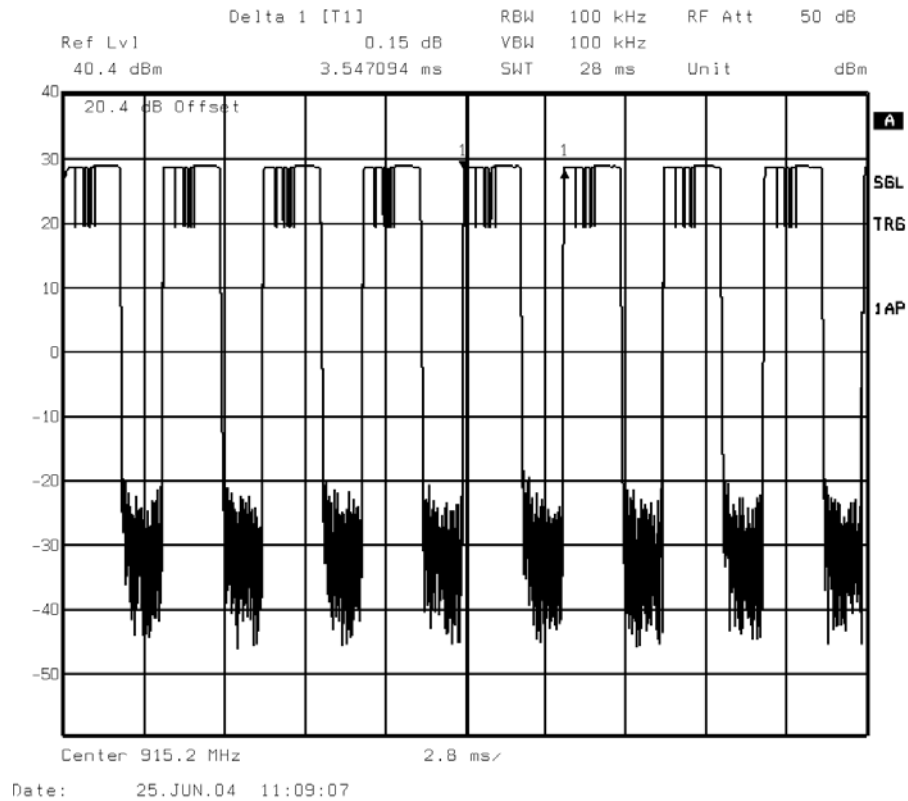


Transmit On Time During Transmit Burst



2.5 CHANNEL DWELL TIME - continued

2.5.6 Test Results - continued

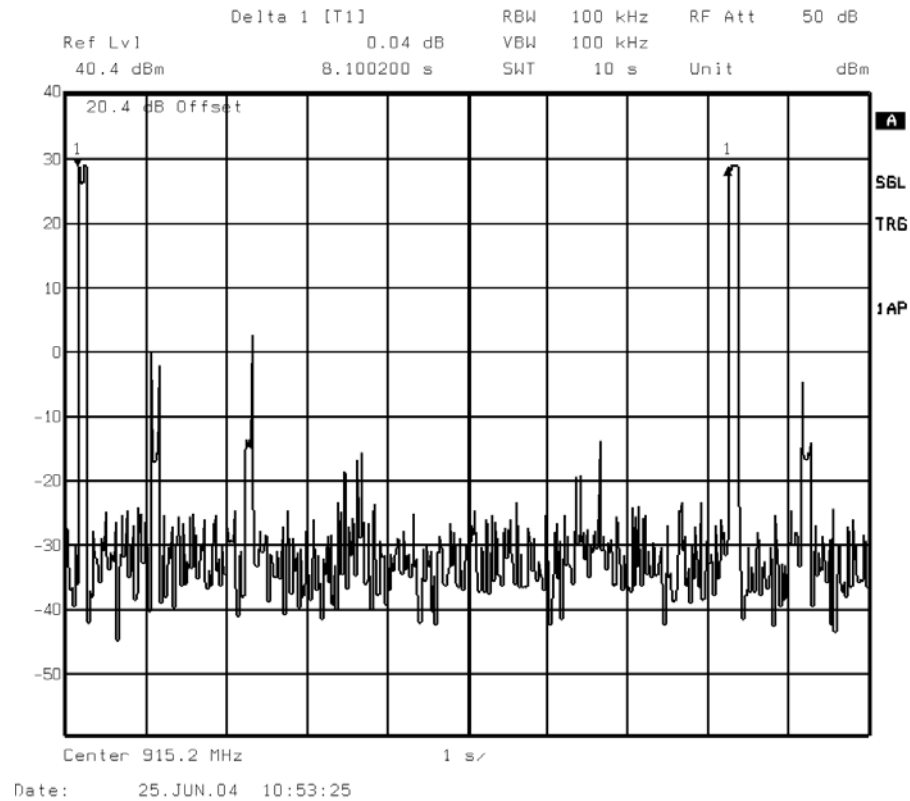


Transmit On and Off Time During Transmit Burst



2.5 CHANNEL DWELL TIME - continued

2.5.6 Test Results - continued



Time Between Transmit Bursts On The Same Channel



2.6 NUMBER OF CHANNELS

2.6.1 Specification Reference

FCC CFR 47: Part 15 Subpart C, Section 15.247(a)(1)

2.6.2 Equipment Under Test

MC906R Mobile Computer

2.6.3 Date of Test

14th June 2004

2.6.4 Test Equipment Used

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

2.6.5 Test Procedure

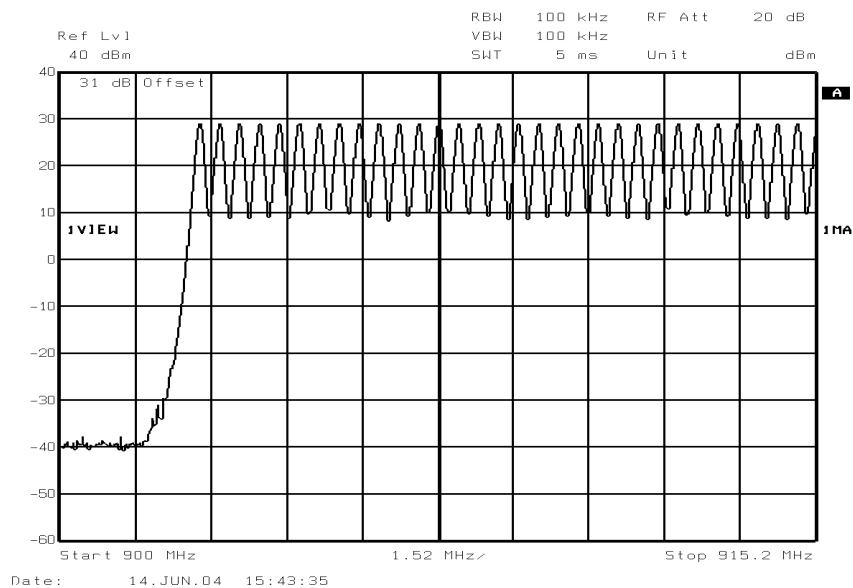
Test Performed in accordance with 15.247.

The EUT was connected to a Spectrum Analyser via a cable. The EUT was set to transmit on maximum power and hopping on all channels. The span was adjusted to show the individual channels. To reasonably display the number of channels, the occupied band was split into two traces. The display trace was set to Max Hold and the plots recorded.

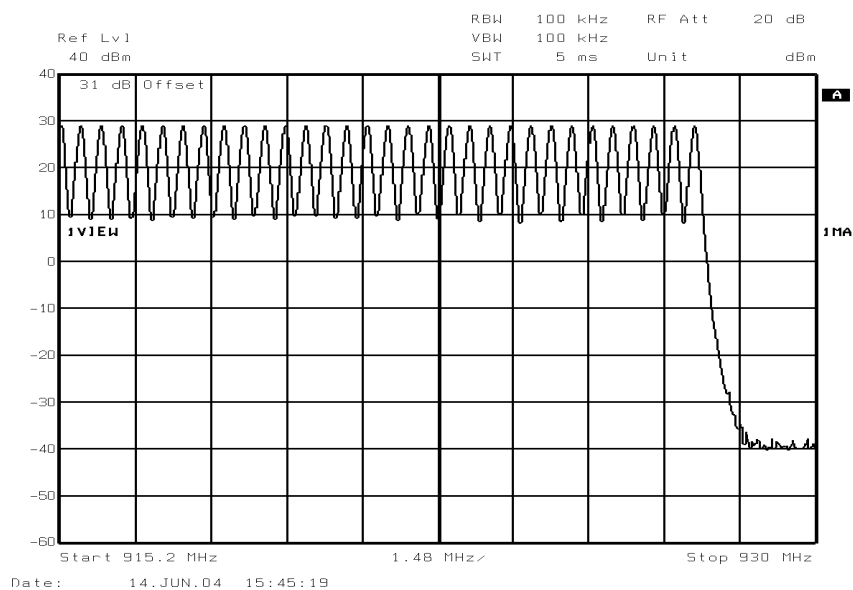


2.6 NUMBER OF CHANNELS - continued

2.6.6 Test Results



Trace Showing Channels 1 – 32



Trace Showing Channels 32 - 63

Limit	≥50 channels
-------	--------------

Remarks

EUT complies with CFR 47 15.247(a)(1)(iii). The EUT utilises more than 50 channels.



2.7 20dB BANDWIDTH

2.7.1 Specification Reference

FCC CFR 47: Part 15 Subpart C, Section 15.247(a)(1)

2.7.2 Equipment Under Test

MC906R Mobile Computer

2.7.3 Date of Test

15th June 2004

2.7.4 Test Equipment Used

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

2.7.5 Test Procedure

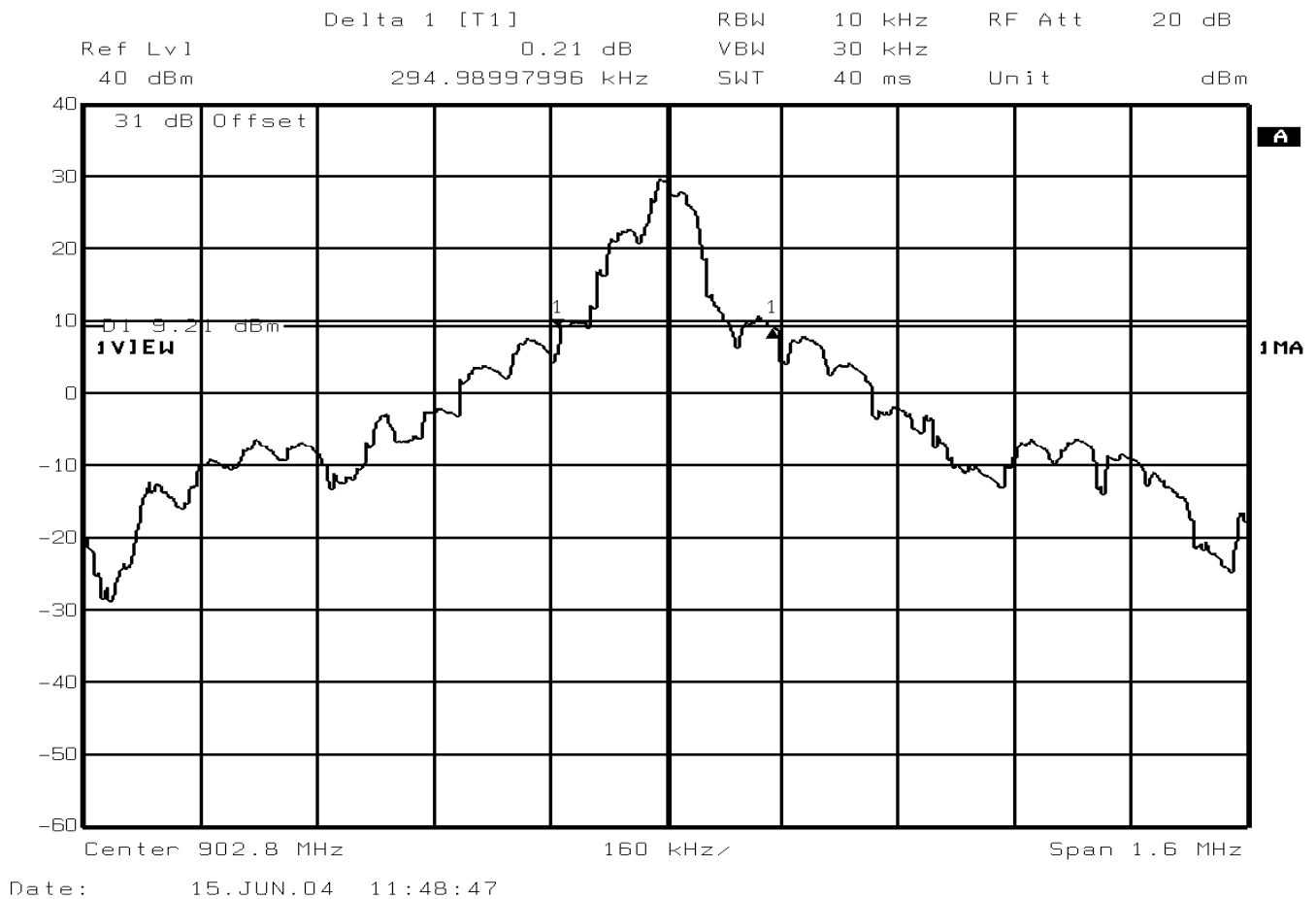
Test Performed in accordance with 15.247.

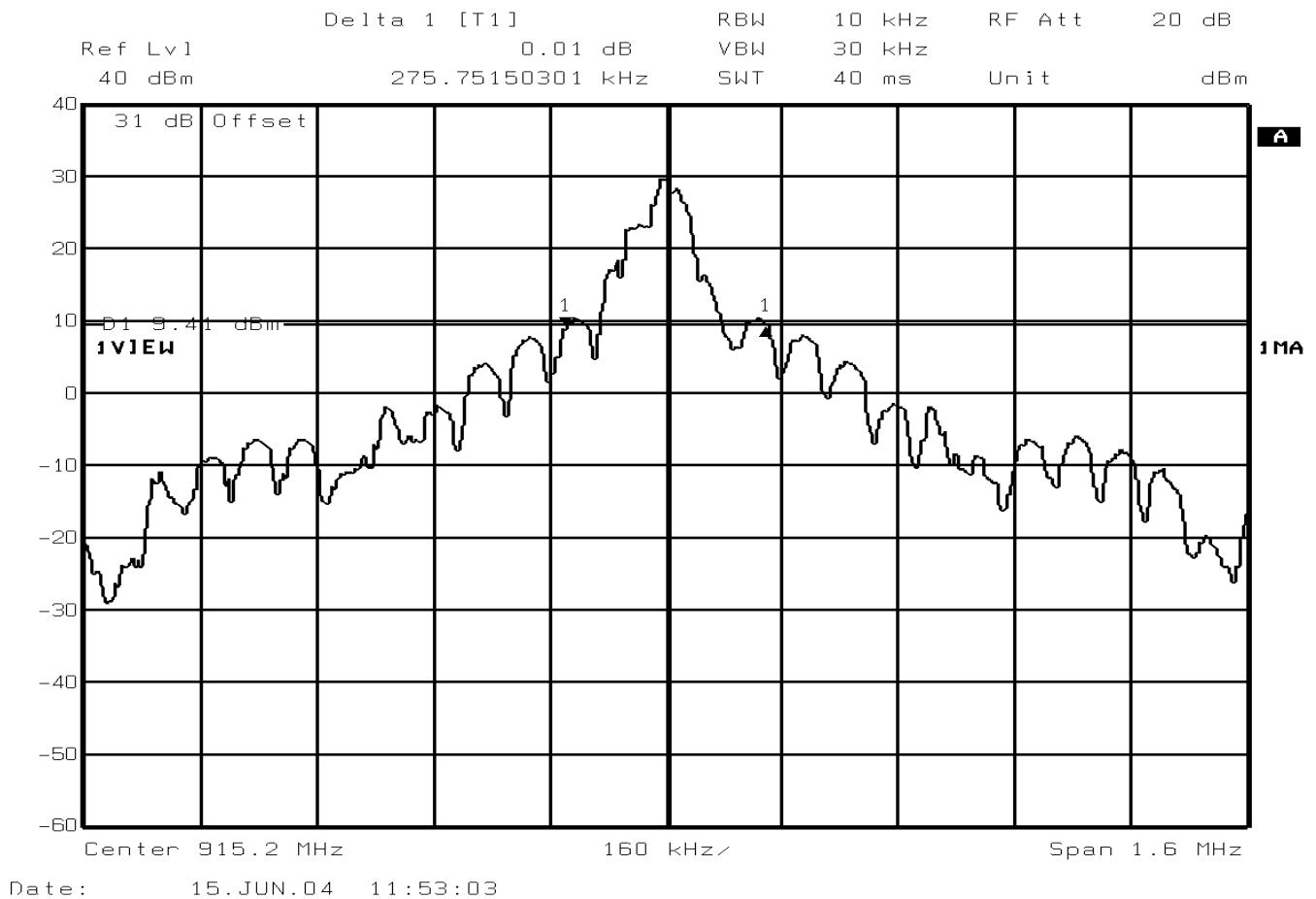
The EUT was transmitted at maximum power at all data rates via a cable to the Spectrum Analyser. The Analyser settings were adjusted to display the resultant trace on screen. The peak point of the trace was measured and the markers positioned to give the –20dBc points of the displayed spectrum.

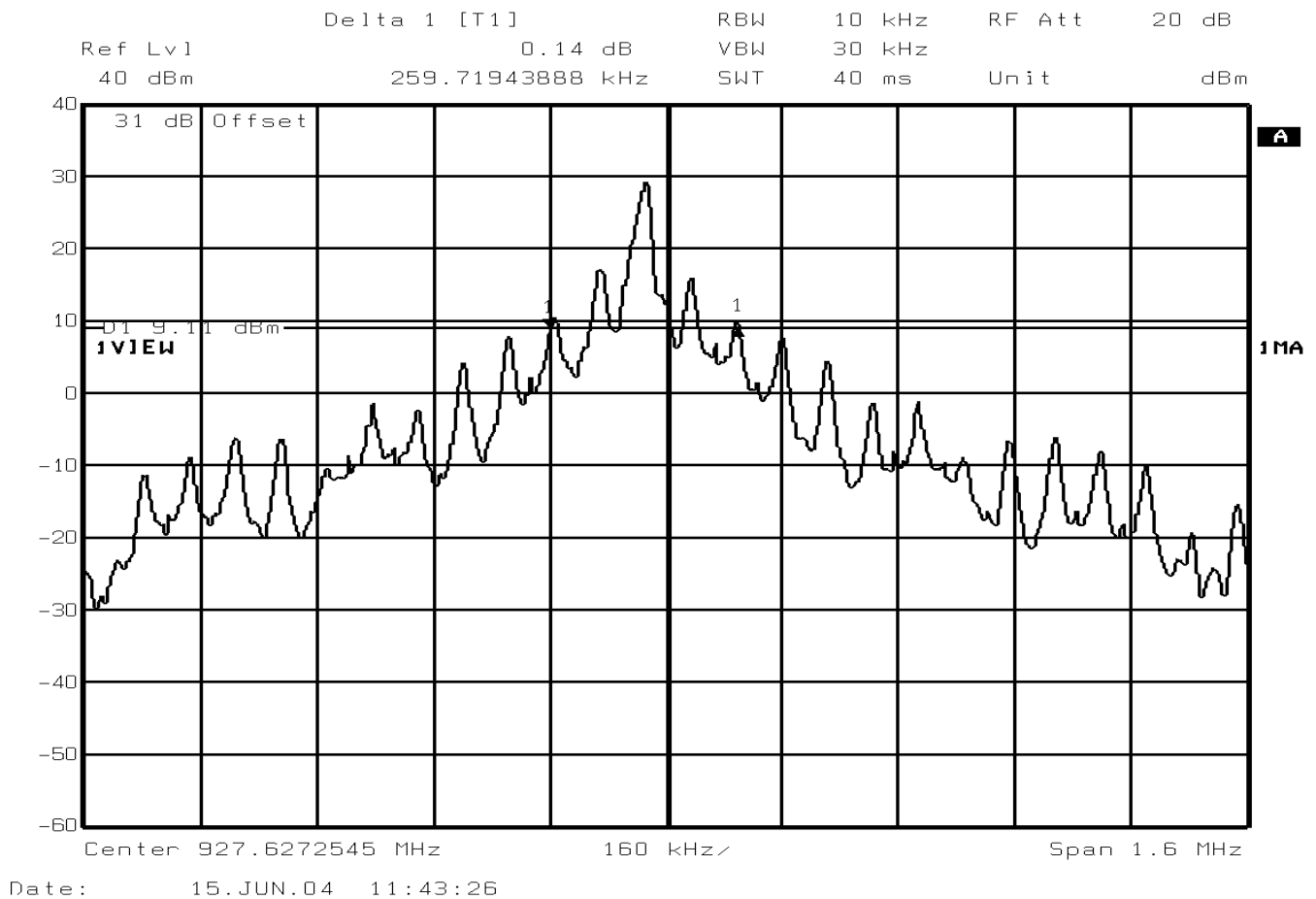
The measurement plots can be seen on the following pages.

2.7.6 Test Results

Frequency (MHz)	Data Rate	20dB Bandwidth (kHz)
902.8	RANDOM	294.98
915.2	RANDOM	275.75
927.6	RANDOM	259.72

**2.7 20dB BANDWIDTH - continued****2.7.6 Test Results - continued**902.8MHz – Maximum Power

**2.7 20dB BANDWIDTH - continued****2.7.6 Test Results - continued**915.2MHz – Maximum Power

**2.7 20dB BANDWIDTH - continued****2.7.6 Test Results - continued**927.6MHz – Maximum Power



2.8 MAXIMUM PEAK OUTPUT POWER (Conducted Method)

2.8.1 Specification Reference

FCC CFR 47: Part 15 Subpart C, Section 15.247(b)(2)

2.8.2 Equipment Under Test

MC906R Mobile Computer

2.8.3 Date of Test

16th June 2004

2.8.4 Test Equipment Used

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

2.8.5 Test Procedure

Test Performed in accordance with FCC CFR 47: Part 15.247(b)(2).

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

The EUT was connected to a Spectrum Analyser via a 30dB attenuator. The cable loss was measured (with attenuator) and entered as an offset on the Spectrum Analyser. The EUT was set to transmit at full power on the top, middle and bottom channels. The output power level was measured at the Spectrum Analyser.

**2.8 MAXIMUM PEAK OUTPUT POWER (Conducted Method) - continued****2.8.6 Test Results - continued**

The EUT met the requirements of FCC CFR 47: Part 15 Subpart C, Section 15.247(b)(2) for Maximum Peak Output Power.

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

Frequency (MHz)	Result (dBm)	Result (mW)
902.8	29.50	891.25
915.2	29.52	892.36
927.6	29.15	822.24
Limit	<+30dBm or <1W	



2.9 MAXIMUM PEAK OUTPUT POWER (EIRP Method)

2.9.1 Specification Reference

FCC CFR 47: Part 15 Subpart C, Section 15.247(b)(2)

2.9.2 Equipment Under Test

MC906R Mobile Computer

2.9.3 Date of Test

16th June 2004

2.9.4 Test Equipment Used

The major items of test equipment used for the above tests are identified as "Section 2.9" within the Test Equipment Used table shown in Section 3.1.

2.9.5 Test Procedure

Test Performed in accordance with ANSI C63.4.

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

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

**2.9 MAXIMUM PEAK OUTPUT POWER (EIRP Method) - continued****2.9.6 Test Results - continued**

The EUT met the requirements of FCC CFR 47: Part 15 Subpart C, Section 15.247(b)(2) for Maximum Peak Output Power.

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

Frequency (MHz)	Result EIRP (dBm)	Result EIRP (W)
902.8	32.95	1.97
915.2	33.61	2.30
927.6	34.29	2.69
Limit	<+36dBm or <4W	



2.10 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT

2.10.1 Specification Reference

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

2.10.2 Equipment Under Test

MC906R Mobile Computer

2.10.3 Date of Test

17th & 18th June 2004

2.10.4 Test Equipment Used

The major items of test equipment used for the above tests are identified as “Section 2.10” within the Test Equipment Used table shown in Section 3.1.

2.10.5 Test Procedure

Test Performed in accordance with FCC CFR 47: Part 15 Subpart C, Section 15.247(c).

In accordance with Part 15.247(c), Spurious Conducted Emissions from the antenna terminal were measured within the frequency spectrum investigated from 9kHz to 10 GHz. The EUT was set to transmit on full power, with random modulation. The EUT was tested hopping on all channels. The resolution and video bandwidths were set to 100kHz in accordance with Part 15.247.(c). The spectrum analyser detector was set to Max Hold.

For measuring the range 9kHz to 10GHz, a 30dB attenuator was used.

The Maximum “fundamental peak” level measured was used to determine the limit line as displayed on the following plots.

The maximum path loss across each measurement band was used as the reference level offset to ensure worst case

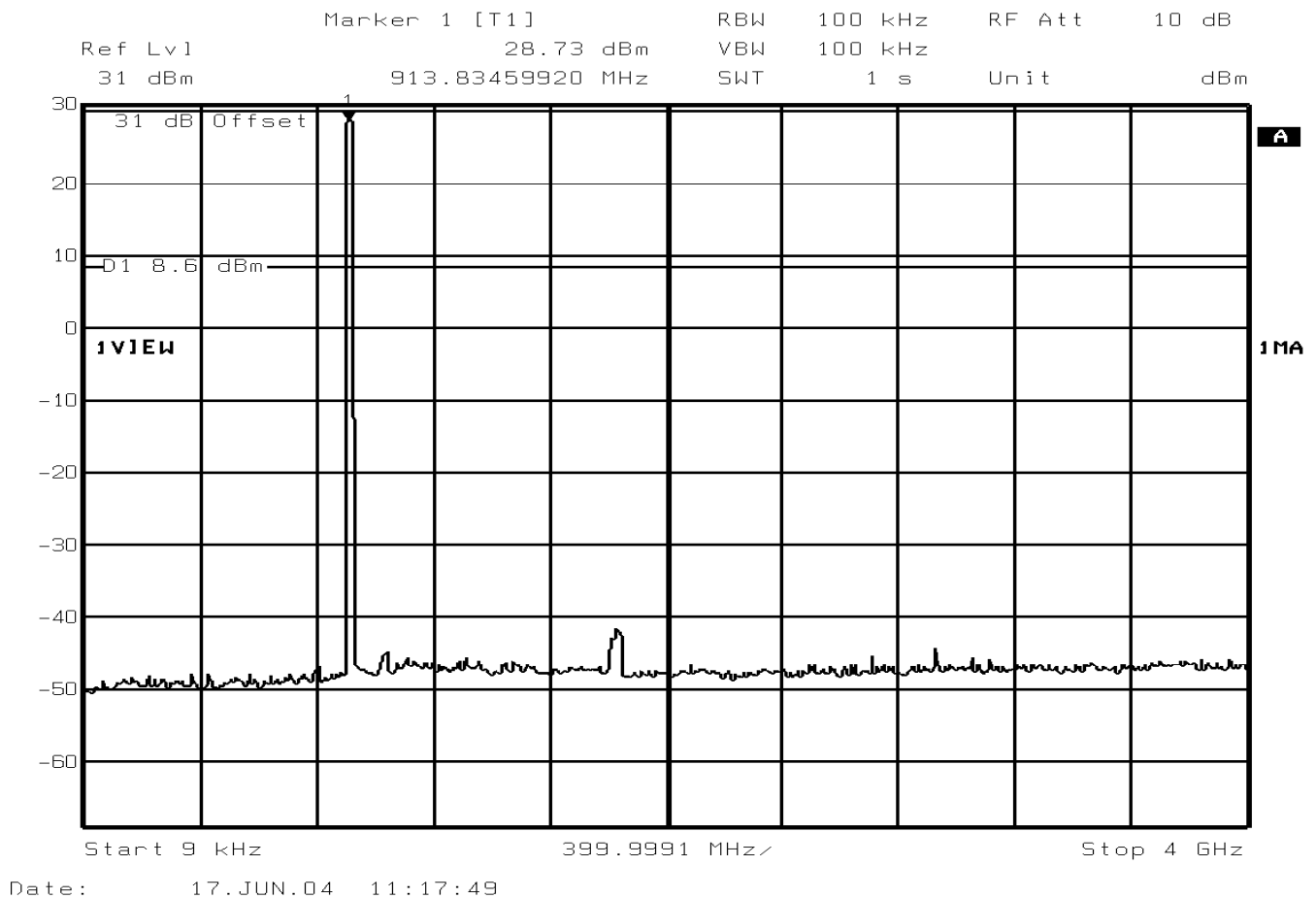


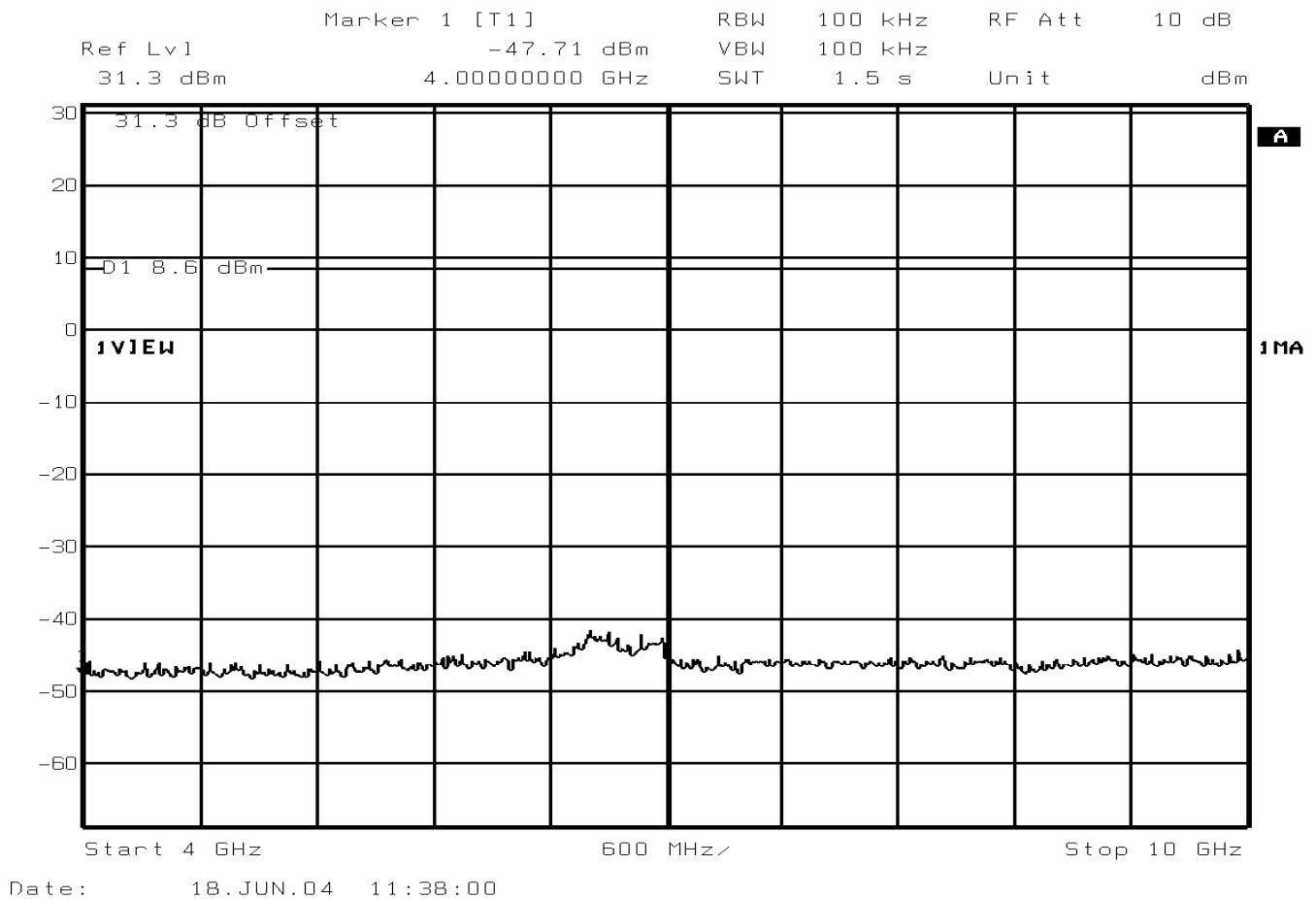
2.10 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT - continued

2.10.6 Test Results

The EUT met the requirements of FCC CFR 47: Part 15 Subpart C, Section 15.247(c) for Spurious Conducted Emissions on the Antenna Port.

The plots on the following pages show the EUT's Antenna Ports Spurious Conducted Emissions over the frequency range 9kHz to 10GHz.

**2.10 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT - continued****2.11.6 Test Results – continued**Spurious Conducted Emissions (9kHz – 4GHz)Maximum Power

**2.10 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT - continued****2.10.7 Test Results – continued**Spurious Conducted Emissions (4GHz – 10GHz)Maximum Power



2.11 SPURIOUS RADIATED EMISSIONS

2.11.1 Specification Reference

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

2.11.2 Equipment Under Test

MC906R Mobile Computer

2.11.3 Date of Test

14th to 25th June 2004

2.11.4 Test Equipment Used

The major items of test equipment used for the above tests are identified as “Section 2.11” within the Test Equipment Used table shown in Section 3.1.

2.11.5 Test Procedure

Test Performed in accordance with ANSI C63.4.

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

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

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

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

Emissions identified within the range 1GHz – 10GHz were then formally measured using Peak and Average Detectors, as appropriate.

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

**2.11 SPURIOUS RADIATED EMISSIONS** - continued**2.11.5 Test Procedure** - continued

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

Test Mode	Carrier Frequency MHz	Carrier Field Strength dB μ V/m	Limit for Spurious Outside Restricted Band (Carrier F S -20dB) dB μ V/m
RFID	902.8	123.9	103.9
RFID	915.2	125.8	105.8
RFID	927.6	124.7	104.7



2.11 SPURIOUS RADIATED EMISSIONS - continued

2.11.6 Test Results

30MHz - 1GHz Frequency Range

Equipment Designation: Intentional Radiator.

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

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

EUT Tx on Bottom Channel (902.8MHz)

Emission Frequency	Pol	Hgt	Azm	Field Strength at 3m		Specification Limit	
MHz	H/V	cm	deg	dBμV/m	μV/m	dBμV/m	μV/m
811.65	H	100	26	43.6	151.4	46.0	200.0
920.00	H	141	10	37.2	72.4	46.0	200.0
960.00	H	139	2	37.7	76.7	46.0	200.0

EUT Tx on Middle Channel (915.2MHz)

Emission Frequency	Pol	Hgt	Azm	Field Strength at 3m		Specification Limit	
MHz	H/V	cm	deg	dBμV/m	μV/m	dBμV/m	μV/m
800.80	H	100	29	39.6	95.5	46.0	200.0
921.90	H	144	6	40.2	102.3	46.0	200.0

EUT Tx on Top Channel (927.6MHz)

Emission Frequency	Pol	Hgt	Azm	Field Strength at 3m		Specification Limit	
MHz	H/V	cm	deg	dBμV/m	μV/m	dBμV/m	μV/m
862.8	H	149	17	35.3	58.2	46.0	200.0
942.8	H	150	9	36.9	70.0	46.0	200.0

ABBREVIATIONS FOR ABOVE TABLES

H Horizontal Polarisation
 Pol Polarisation
 deg degree

V Vertical Polarisation
 Hgt Height
 Azm Azimuth



2.11.6 Test Results - continued

1GHz - 10GHz Frequency Range

Equipment Designation: Intentional Radiator.

The EUT met the requirements of FCC CFR 47: Part 15 Subpart C, Section 15.247(c), 15.205 and 15.209 for Radiated Emissions (1GHz – 10GHz).

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

EUT Tx on Bottom Channel (902.8MHz)

Frequency	Antenna		Turntable	Peak Field Strength	Peak Limit	Average Field Strength	Average Limit
	Pol	Height	Azimuth				
GHz	H/V	cm	deg	dB μ V/m	dB μ V/m	dB μ V/m	dB μ V/m
1.805	V	112	53	51.5	103.9	N/A	N/A
2.707	V	100	233	55.6	74.0	41.7	54.0
4.514	V	100	109	53.6	74.0	42.4	54.0
5.417	V	104	73	65.8	74.0	52.3	54.0
7.221	V	100	97	49.8	109.9	N/A	N/A

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

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



2.11 SPURIOUS RADIATED EMISSIONS - continued

2.11.6 Test Results - continued

1GHz - 10GHz Frequency Range - continued

Equipment Designation: Intentional Radiator.

The EUT met the requirements of FCC CFR 47: Part 15 Subpart C, Section 15.247(c), 15.205 and 15.209 for Radiated Emissions (1GHz – 10GHz).

EUT Tx on Middle Channel (915.2MHz)

Frequency	Antenna		Turntable	Peak Field Strength	Peak Limit	Average Field Strength	Average Limit
	Pol	Height	Azimuth				
GHz	H/V	cm	deg	dBμV/m	dBμV/m	dBμV/m	dBμV/m
1.830	V	181	70	55.5	105.8	N/A	N/A
2.746	H	100	130	55.5	74.0	42.7	54.0
4.576	V	100	90	53.4	74.0	42.0	54.0
5.491	V	103	69	65.1	105.8	N/A	N/A
6.404	V	100	66	50.9	105.8	N/A	N/A
8.236	V	100	95	56.7	74.0	44.4	54.0

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

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



2.11 SPURIOUS RADIATED EMISSIONS - continued

2.11.6 Test Results – continued

1GHz - 10GHz Frequency Range

EUT Tx on Top Channel (927.6MHz)

Frequency	Antenna		Turntable	Peak Field Strength	Peak Limit	Average Field Strength	Average Limit
	Pol	Height	Azimuth				
GHz	H/V	cm	deg	dBμV/m	dBμV/m	dBμV/m	dBμV/m
1.855	V	107	89	54.1	104.7	N/A	N/A
2.783	H	100	128	57.3	74.0	46.5	54.0
4.637	V	100	107	53.2	74.0	51.9	54.0
5.565	V	100	70	63.0	104.7	N/A	N/A
6.329	V	100	68	53.6	104.7	N/A	N/A
6.492	V	114	138	50.6	104.7	N/A	N/A

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

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

ABBREVIATIONS FOR ABOVE TABLES

H Horizontal Polarisation
 Pol Polarisation
 deg degree

V Vertical Polarisation
 Hgt Height
 Azm Azimuth



SECTION 2

TEST DETAILS RECEIVE EMISSIONS

Limited FCC CFR 47: Parts 15 B Testing in support of an
Application for Grant of Equipment Authorisation
of a Symbol MC906R (RFID and 802.11b enabled) Mobile Computer



2.12 SPURIOUS RADIATED EMISSIONS

2.12.1 Specification Reference

FCC CFR 47: Part 15 Subpart B, Section 15.109

2.12.2 Equipment Under Test

MC906R Mobile Computer

2.12.3 Date of Test

30th July 2004

2.12.4 Test Equipment Used

The major items of test equipment used for the above tests are identified as “Section 2.12” within the Test Equipment Used table shown in Section 3.1.

2.12.5 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 a semi-anechoic chamber. Measurements of emissions from the EUT were obtained with the Measurement Antenna in both Horizontal and Vertical Polarisations. The profiling produced a list of the worst-case emissions together with the EUT azimuth and antenna polarisation.

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

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

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



2.12 SPURIOUS RADIATED EMISSIONS - continued

2.12.6 Test Results

Equipment Designation: Unintentional Radiator.

The EUT met the requirements of FCC CFR 47: Part 15 Subpart B, Section 15.109 for Spurious Radiated Emissions (30MHz – 1GHz).

Measurements were made with the EUT in Idle Mode.

EUT Idle Mode

The levels of the six highest emissions measured in accordance with the specification are presented below: -

Emission Frequency	Polarisation	Height	Azimuth	Field Strength		Limit	
MHz	Horizontal/ Vertical	cm	degree	dBµV/m	µV/m	dBµV/m	µV/m
195.4	V	167	083	38.7	86.1	43.5	150.0
202.8	H	120	162	34.9	55.6	43.5	150.0
202.9	V	142	089	40.6	107.2	43.5	150.0
210.1	V	100	094	40.1	101.2	43.5	150.0
217.5	V	126	093	39.7	96.7	43.5	150.0
224.9	V	146	100	38.1	80.4	46.0	200.0



SECTION 3

TEST EQUIPMENT USED



3.1 TEST EQUIPMENT USED

Instrument	Manufacturer	Type No	Serial No	EMC / INV No	Cal. Due
Sections 2.1					
Turntable Controller	H-D	HD 050	050/396	2528	TU
Antenna Mast	EMC	1051-2	9101-1570	2182	TU
Screened Room 5	SIE	EAC54300	NA	2533	TU
Test Receiver	ROH	ESIB40	100181	2972	08/11/04
Drg Antenna	EMC	3115	97015079	2397	04/07/04
Signal Generator	HEW	8672A	2016A01097	411	02/03/05
Attenuator	NAR	4768-6	-	2960	TU
Attenuator	NAR	4768-6	-	2959	TU
Sections 2.4, 2.5, 2.6, 2.7 and 2.10					
Attenuator	BIR	8343-100	921	1338	23/10/04
Attenuator	BIR	8308-200	N/S	1458	21/08/04
Analyser	ROH	FSEM	827156/006	I4034	05/01/05
Spectrum Analyser	HEW	8542E	3617A00165_00154	2286	18/05/05
Sections 2.12					
Spectrum Analyser	HEW	8542E	3617A00165_00154	2286	18/05/05
Bilog Antenna	SCH	CBL6143	5101	2965	12/09/04
Turntable Controller	H-D	HD 050	050/396	2528	TU
Antenna Mast	EMC	1051-2	9101-1570	2182	TU
Screened Room 5	SIE	EAC54300	NA	2533	TU
Digital Barometer	ORE	BAA913HG	NA	Room 5	TU
Sections 2.2, 2.3, 2.9 & 2.11					
Bilog Antenna	SCH	CBL6143	5101	2965	12/09/04
Turntable Controller	H-D	HD 050	050/396	2528	TU
Antenna Mast	EMC	1051-2	9101-1570	2182	TU
Screened Room 5	SIE	EAC54300	NA	2533	TU
Test Receiver	ROH	ESIB26	100212	2988	08/04/05
Attenuator	NAR	4768-6	-	2960	TU
Attenuator	NAR	4768-6	-	2959	TU
Attenuator	JFW	50FHC-020-20	-	2971	21/10/04
Antenna Bilog	SCH	CBL 6143	5053	2846	TU
Signal Generator	MAR	2031	119301/030	1741	29/10/04
Sections 2.8					
Signal Generator	ROH	SMX	883747-69	1415	26/01/05
Signal Generator	HEW	8673B	217A00421	953	05/06/04
Signal Source	ROH	SWM 02	894631-014	2477	10/01/05
Attenuator	BIR	8308-200	N/S	1458	21/08/04
Analyser	ROH	FSEM	827156/006	4034	05/01/05



3.1 TEST EQUIPMENT USED – Continued

Instrument	Manufacturer	Type No	Serial No	EMC / INV No	Cal. Due
Section 2.12					
Spectrum Analyser	HEW	8542E	3617A00165_00154	2286	18/05/05
Bilog Antenna	SCH	CBL6143	5101	2965	12/09/04
Turntable Controller	H-D	HD 050	050/396	2528	TU
Antenna Mast 6m	EMC	1051-2	9101-1570	2182	TU
Screened Room 5	SIE	EAC54300	NA	2533	TU
Test Receiver	ROH	ESIB40	100181	2972	08/11/04
Low Noise Amplifier	MIQ	AMF-3d-001080-18-13P	UNK	2457	TU
Amplifier	AVA	AWT-18036	F13365 8452	1081	26/06/04
Attenuator	NAR	4768-6		2960	TU
Signal Generator	MAR	2031	119301/030	1741	29/10/04
Emi Test Receiver	ROH	ESIB40	100142/040	2917	11/02/05
Signal Generator	MAR	2031	119530069	1979	30/10/04
Filter	DAA	MH-1500-7SS	811014-01	3879	02/10/04

Key To Manufacturers

AVA	Avantek
BIR	Bird
DAA	Daden Anthony Associates
EMC	Emco
H-D	No Data
HEW	Hewlett Packard
JFW	Jfw
LOR	Lorch
MAR	Marconi
MIQ	Miteq Corp
NAR	Narda
ORE	Oregon Scientific
RLC	RLC Electronics
ROH	Rohde & Schwarz
SCH	Schaffner
SIE	Siemens
WEI	Weinschel
THU	Thurlby



3.2 MEASUREMENT UNCERTAINTY

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

Test Discipline	Frequency / Parameter	MU
For Channel Occupancy/Separation	19.1kHz	N/A
For Maximum Output Power	Not Applicable	±0.5dB
For Number of Channels	Not Applicable	N/A
For 20dB Bandwidth	19.1kHz	±0.5dB
Radiated Emissions, Bilog Antenna, AOATS	30MHz to 1GHz Amplitude	5.1dB*
Radiated Emissions, Horn Antenna, AOATS	1GHz to 40GHz Amplitude	6.3dB*
Substitution Antenna, Radiated Field	30MHz to 18GHz Amplitude	2.6dB
For Peak Power Spectral Density	Not Applicable	±1.8dB
For Effective Radiated Power (ERP) measurements	Not Applicable	±1.45dBm

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

- * In accordance with CISPR 16-4
- † In accordance with UKAS Lab 34



SECTION 4

EUT PHOTOGRAPH



EUT PHOTOGRAPH



Side View



SECTION 5

ACCREDITATION, DISCLAIMERS AND COPYRIGHT



5.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT



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

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

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

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APPENDIX A

TITCHFIELD FCC SITE COMPLIANCE LETTER



FEDERAL COMMUNICATIONS COMMISSION

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

October 18, 2002

Registration Number: 90987

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

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

Gentlemen:

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

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

Sincerely,

**Thomas W Phillips
Electronics Engineer**