
SUPPLEMENTARY TEST REPORT ON

The Specific Absorption Rate Assessment Of The Intermec Technologies Corporation
730 Handheld Computer.

Report Number: WS611453 – 01s1

December 2003

REPORT ON: The Specific Absorption Rate Assessment Of The Intermec Technologies Corporation 730 Handheld Computer.

Report No: WS611453 – 01s1

FCC ID: EHA-802CFI3

PREPARED FOR: Intermec Mobile Systems Division
550 Second Street S.E
Cedar Rapids
IA 52401

ATTESTATION: The wireless portable devices described within this report have been shown to be capable of compliance for localised specific absorption rate (SAR) for General Population/Uncontrolled Exposure Limits as defined in Both, RSS-102 Issue 1 (Provisional) September 25, 1999: and FCC standard Supplement C (Edition 01-01) to OET Bulletin 65 (Edition 97-01) of 1.6 W/kg

The devices were tested in accordance with the measurement procedures specified in Supplement C (Edition 01-01) to OET Bulletin 65 (Edition 97-01) and IEEE1528-200x (Draft December 2002).

All reported testing was carried out on a sample of equipment to demonstrate compliance with the above standards. The sample tested was found to comply with the requirements in the applied rules.



A. Miller
Senior SAR Test Engineer



APPROVED BY:

M Jenkins
Wireless Group Leader

DATED: 17th December 2003

DISTRIBUTION:	Intermec Technologies Corporation	Copy No:	1
	Intermec Technologies Corporation (CD ROM).	Copy No(s):	2
	BABT	Copy No.:	3
		Copy No.:	1

Note: The test results reported herein relate only to the item tested as identified above and on the Status Page.



CONTENTS

EXECUTIVE SUMMARY	3
1.1 Status	4
1.2 Summary	5
1.3 Test Result Summary	6
 TEST DETAILS	 7
2.1 Test Equipment	8
2.2 Test Software	8
2.3 Dielectric Properties of Simulant Liquids	9
2.4 Test Conditions	10
2.5 Measurement Uncertainty	10
2.6 SAR Measuring System Probe and Amplifier Specification Probe Calibration SAR Measurement Procedure	10
2.7 Draft IEEE std 1528 Test Positions OET65(c) Flat Phantom Test Position – Graphical Representation	10
2.8 SAR Distributions (Area Scans – 2D)	11
2.9 Test Positional Photographs	12
2.10 Record Photographs	13

For copyright details see page 16 of 16



EXECUTIVE SUMMARY

The Specific Absorption Rate Assessment Of The Intermec Technologies Corporation
730 Handheld Computer.

PROJECT MANAGER: M. FOLEY



1.1 STATUS

MANUFACTURING DESCRIPTION	Hand Held Computer Terminal
STATUS OF TEST	Specific Absorption Rate Testing
APPLICANT	Intermec Technologies Corporation
MANUFACTURER	Intermec Technologies Corporation
MODEL NUMBER / TYPE	730 Production Prototype Device
SERIAL / IMEI NUMBER	Agency-C2-04 (28010300024)
HARDWARE VERSION	730A1E4004002 (October 2003)
RADIO LAN	ActionTec Compact Flash Type II + 802.11b Card
TYPE	802CF13 (Ver. 8.00B)
POWER	17.5 dBm
RADIO BLUETOOTH	ActionTec UART/USB Bluetooth Module
TYPE	BTM210 (Version 0.6)
POWER	2.5 dBm
BATTERY MANUFACTURER	Intermec
TYPE OR MODEL NUMBER	318-011-004

TEST SPECIFICATIONS:

US Federal Government, Code of Federal Regulations, Title 47 Telecommunication, Chapter I
Federal Communications Commission, part 2, section 1093

Federal Communications Commission (FCC) OET Bulletin 65c, Edition 01-01, Evaluating
Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic
Fields – Additional Information for Evaluating Compliance of Mobile and Portable Devices with
FCC Limits for Human Exposure to Radiofrequency Emissions

RSS-102 Issue 1 (Provisional) September 25, 1999: Evaluation Procedure for Mobile and
Portable Radio Transmitters with respect to Health Canada's Safety Code 6 for Exposure of
Humans to radio Frequency Fields

REFERENCES:

IEEE 1528 –200X: DRAFT Recommended Practice for Determining the Peak Spatial-Average
Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices:
Experimental Techniques

BABT REGISTRATION NUMBER:	WS611453.
RECEIPT OF TEST SAMPLES:	11 th December 2003.
START OF TEST:	11 th December 2003.
FINISH OF TEST:	11 th December 2003.



1.2 SUMMARY

This report must be read in conjunction with BABT report number WS611453 – 001 Issue 2.00, issued 17th December 2003.

This supplementary report covers additional test requirements necessitated by the addition of a modified ActionTec Compact Flash Type II + 802.11b Card.

SAR testing was performed with the device set in CW Mode placed against a Flat Phantom dimensions 220mmx200mmx150mm and with a sidewall thickness of 2.0mm. The phantom was filled to a depth of 150mm with 2450MHz Body simulant liquid. The dielectric properties were in accordance with the requirements for the dielectric properties specified in Supplement C (Edition 01-01) to OET Bulletin 65 (Edition 97-01).

SAR testing was carried out at the top, middle and bottom frequency of each of the device operating bands. The device was placed against the side of the flat phantom and was in contact, to simulate the worst-case position.

Intermec Technologies Pocket PC Model 730 had an integral antenna so that the requirement for testing with antenna extended and retracted was not applicable. The testing was performed with a fully charged battery for the positions for which higher SAR levels were recorded.

The device was then placed into the RLAN mode using onboard software supplied by the client, which enabled the device to be placed into a CW test mode. The channels 1, 6, 11 & 13 were selected in turn and the maximum SAR levels recorded

Testing was performed at the maximum power for SAR evaluation of the Compact Flash Wireless LAN radio card. This was achieved using client-supplied software, which enabled the device to be placed into a CW test mode at maximum power at the Test frequency/channel number specified for test.

The maximum 1g volume averaged SAR level measured for all the tests performed did not exceed the limits for General Population/Uncontrolled Exposure (W/kg) Partial Body of 1.6 W/kg. Level defined in Supplement C (Edition 01-01) to OET Bulletin 65 (97-01).



1.3 TEST RESULT SUMMARY

SYSTEM PERFORMANCE / VALIDATION CHECK RESULTS

Prior to formal testing being performed a System Check was performed in accordance with Appendix D IEEE1528 April 4th 2002 Draft Standard. The following results were obtained: -

Dipole Used	Frequency (MHz)	Max 1g SAR (W/kg)*	Percentage Drift on 1g Reference	Max 10g SAR (W/kg)*	Percentage Drift on 10g Reference
2450	2450	50.75*	-3.15%	23.66*	-1.42%

* Normalised to 1W

MAXIMUM SAR MEASUREMENT

DSSS 2450 MHz Specific Absorption Rate (Maximum SAR) 1g & 10g RLAN Results for Intermec Technologies Corporation Pocket PC Model 730 placed against the Flat Phantom (Body SAR)

Position	Channel Number	Frequency (MHz)	Max Spot (W/kg)	Max 1g SAR (W/kg)	Max 10g SAR (W/kg)	Area scan (Figure number)
2mm Side Touch – Front Top	6	2437	0.980	0.796	0.428	Figure 1
Limit for General Population (Uncontrolled Exposure) 1.6 W/kg (1g) & 2.0 W/kg (10g)						

OUTPUT POWER OF TEST DEVICE MEASUREMENT METHOD

Test Performed in accordance with FCC CFR 47: Part 15.247(b)(1).

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, who's input signal level into the antenna was adjusted until the received level matched that of the previously detected emission.

MAXIMUM POWER

Recorded from the Intermec Technologies Corporation 730 Handheld Computer.

Radio Device	Frequency (MHz)	Raw Result (dBm)	Substitution Level (dBm)	Cable Loss (dB)	Substitution Antenna Gain (dBi)	Result EIRP (dBm)	Result EIRP (mW)
RLAN	2437	-28.4	+5.0	Note 1	+9.1	+19.8*	95.5

* - See Note 2

Note 1: Cable loss was ignored as the signal level was measured at the input to the horn antenna.

Note 2: A correction factor of 5.7dB has been applied to arrive at the final EIPR result. This is the difference between the measurements on the test receiver in a 1MHz bandwidth and a wideband power meter, to overcome the measuring receiver and detector limitations.



TEST DETAILS

The Specific Absorption Rate Assessment Of The Intermec Technologies Corporation
730 Handheld Computer.

TEST ENGINEERS: A. MILLER



2.1 TEST EQUIPMENT

The following test equipment was used at BABT:

INSTRUMENT DESCRIPTION	MANUFACTURER	MODEL TYPE	INVENTORY NO.	SERIAL NUMBER	CALIBRATION DATES
Bench-top Robot	Mitsubishi	RV-E2	4691	EA009006	N/A
1900 MHz – Head Tissue Simulant	BABT	Head	N/A	Batch 4	25/11/03*
1900 MHz – Body Tissue Simulant	BABT	Body	N/A	Batch 1	25/11/03*
1900 MHz Calibration Dipole	BABT	IEEE1528	A	N/A	25/11/03*
RF Amplifier	Vectawave	10M-2.5G	4697	N/A	N/A
Directional Coupler	Krytar	1850	4651	N/A	TU
20dB Attenuator	Narda	766F-10	EMC 1791	1791	24/05/04 (due)
Power Meter	Rohde Schwarz	NRV	2472	860327/025	24/05/04 (due)
Hygrometer	Rotronic	I-1000	3230	N/A	04/10/04 (due)
Digital Thermometer	Digitron	T208	3178	N/A	16/06/04 (due)
Thermocouple	RS	219-4539	4859	N/A	16/06/04 (due)
SAR Probe	IndexSAR	IXP-050	N/A	84	18/03/04 (due)
Flat Phantom box 2mm side(200mm cube)	IndexSAR.	N/A	N/A	N/A	N/A

* Verified at time of test.

2.2 TEST SOFTWARE

The following software was used to control the BABT SARA2 System:

INSTRUMENT	VERSION NO.	DATE
SARA2 system	v.0.281	023/07/2002
Mitsubishi robot controller firmware revision	RV-E2 Version C9a	-
IXA-10 Probe amplifier	Version 2.5	-



2.3 DIELECTRIC PROPERTIES OF SIMULANT LIQUIDS

The dielectric properties of the tissue simulant liquids used for the SAR testing at BABT are as follows:-

FLUID TYPE AND FREQUENCY	RELATIVE PERMITTIVITY ϵ_r (e') TARGET	RELATIVE PERMITTIVITY ϵ_r (e') MEASURED	CONDUCTIVITY σ TARGET	CONDUCTIVITY σ MEASURED
Head 2450MHz	39.2	36.60	1.80 S/m	1.851
Body 2450MHz	52.7	51.02	1.95 S/m	1.991

Fluid Mass Density, $\rho = 1000 \text{ kg/m}^3$

The fluids were calibrated in our Laboratory and re-checked prior to any measurements being made against reference fluids stated in IEEE 1528-200X of 0.9% NaCl (Salt Solution) at 23°C and also for Dimethylsulphoxide (DMS) at 20°C.

The fluids were made at BABT under controlled conditions from the following OET(65)c formulae and reference made to Draft Standard IEEE1528-200x. The composition of ingredients may have been modified accordingly to achieve the desired target tissue parameters required for routine SAR evaluation:

Ingredients (% by weight)	Frequency (MHz)									
	450		835		915		1900		2450	
Tissue Type	Head	Body	Head	Body	Head	Body	Head	Body	Head	Body
Water	38.56	51.16	41.45	52.4	41.05	56.0	54.9	40.4	62.7	73.2
Salt (NaCl)	3.95	1.49	1.45	1.4	1.35	0.76	0.18	0.5	0.5	0.04
Sugar	56.32	46.78	56.0	45.0	56.5	41.76	0.0	58.0	0.0	0.0
HEC	0.98	0.52	1.0	1.0	1.0	1.21	0.0	1.0	0.0	0.0
Bactericide	0.19	0.05	0.1	0.1	0.1	0.27	0.0	0.1	0.0	0.0
Triton X-100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.8	0.0
DGBE	0.0	0.0	0.0	0.0	0.0	0.0	44.92	0.0	0.0	26.7
Dielectric Constant	43.42	58.0	42.54	56.1	42.0	56.8	39.9	54.0	39.8	52.5
Conductivity (S/m)	0.85	0.83	0.91	0.95	1.0	1.07	1.42	1.45	1.88	1.78



2.4 TEST CONDITIONS

Ambient Temperature: Within +15°C to +35°C at 20% RH to 75% RH.

The actual Temperature during the testing ranged from 21.8°C to 22.1°C.

The actual Humidity during the testing ranged from 41.4% to 49.6% RH.

Tissue simulating liquid temperature: +20°C to +25°C.

The actual tissue simulating liquid temperature was recorded to be 22.1°C to 23.1°C

2.5 MEASUREMENT UNCERTAINTY

Please refer to report number BABT Report WS611453 – 001, issued 5th December 2003. for full details

2.6 SAR MEASUREMENT SYSTEM

Please refer to report number BABT Report WS611453 – 001, issued 5th December 2003. for full details

2.7 TEST POSITIONS

Please refer to report number BABT Report WS611453 – 001, issued 5th December 2003. for full details



2.8 TEST RESULTS INCLUDING SAR DISTRIBUTIONS (AREA SCANS – 2D)

System.....	: IndexSAR SARA2	Power Drift.....	: 0.7dB
Date of Test	: 11/12/03	Battery Model	: 318-013-002
Lab Ambient.....	: 23.0 °C	Probe Serial Number	: IXP-050 0084
Device ID	: 700C	Liquid Simulant.....	: 2450MHz Body
Phantom	: Flat	Permittivity.....	: 51.02
Phantom S/No	: 2mmb	Conductivity.....	: 1.991
Phantom Rotation (deg).....	: 0	Liquid Ambient.....	: 23.1°C
Test Position	: Left Touch	Max SAR 'Y' Axis Location ..	: 0.0 mm
Antenna Position.....	: Internal	Max SAR 'Z' Axis Location ..	: -126.2 mm
Test Frequency	: 2437 MHz	SAR 1g	: 0.796 W/kg
Type of Modulation	: CW	SAR 10g	: 0.428 W/kg
Crest Factor	: 1.0	SAR Drift	: -0.082 dB
Diode Compression factor ..	: 20; 20; 20	Probe Conversion Factors....	: 0.468

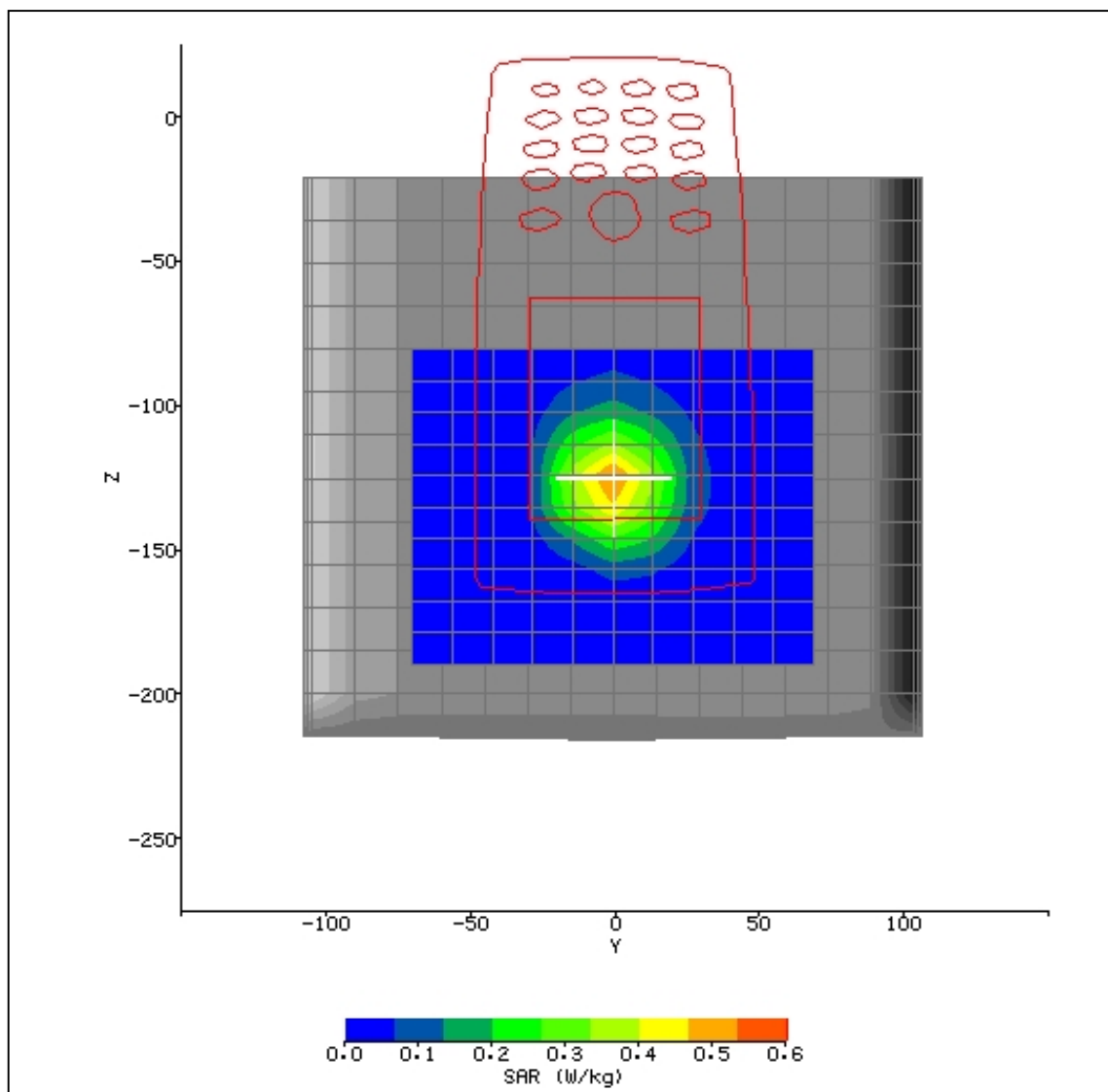


Figure 1



2.9 TEST POSITIONAL PHOTOGRAPHS



Figure 21. Positional photograph of 730 in the 0.0mm Touch Position



2.10 RECORD PHOTOGRAPHS



Figure 22. Front view of the Intermec 730 Handheld Computer.



2.10 RECORD PHOTOGRAPHS



Figure 23. Rear view of the Intermec 730 Handheld Computer.



2.10 RECORD PHOTOGRAPHS



Figure 24. Rear View of the Intermec 730 Handheld Computer, with the battery removed.



© 2003 BABT

This report must not be reproduced without the written permission of BABT.