
SUPPLEMENTARY TEST REPORT

In support of the Application for Grant of Equipment Authorisation of the
Intermec Handheld Computer Terminal, 700C-SMC45

FCC ID: EHA700C-SMC45 - 1

July 2003

REPORT ON: Specific Absorption Rate testing of the Intermec 700C-SMC45 Dual Mode (DCS1900 (GPRS) / 802.11b RLAN) Handheld Computer Terminal.

Report No: WS610071 – 02s1

FCC ID: EHA700C-SMC45 - 1

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).

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements.



A. Miller
Senior SAR Test Engineer

APPROVED BY:



M Jenkins
Wireless Group Leader

DATED: 17th July 2003

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



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EXECUTIVE SUMMARY

Specific Absorption Rate testing of the Intermec 700C-SMC45
Dual Mode (DCS1900 (GPRS) / 802.11b RLAN) Handheld Computer Terminal.

PROJECT MANAGER: M. J. HARDY



1.1 STATUS

MANUFACTURING DESCRIPTION	Handheld Computer Terminal
STATUS OF TEST	Specific Absorption Rate Testing
APPLICANT	Intermec Technologies Corporation
MANUFACTURER	Intermec Technologies Corporation
TYPE OR MODEL NUMBER	700C Production Device
HARDWARE VERSION	245-227-207 (Drawing Number)
MULTISLOT CLASS	Class 10
GSM/GPRS 1900MHz BAND	Class 1 (PCS1900)
IMEI NUMBER	350450410043999
RADIO LAN	2.4GHz Direct Spread Spectrum
SOFTWARE VERSION	F310-03
BLUETOOTH MODULE	Alps/Socket BC01, part No. 805-608-002
SOFTWARE VERSION	HCI V11.3
BATTERY MANUFACTURER	Micropower Electronics
TYPE OR MODEL NUMBER	318-013-002

TEST SPECIFICATIONS:

Federal Communications Commission, Code of Federal Regulations, Title 47 (CFR47), Vol. 1, Chapter 1, Part 2 (§2.1091 and §2.1093).

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: WS610071 - 02.

RECEIPT OF TEST SAMPLES: 4th March 2003.

START OF TEST: 24th June 2003.

FINISH OF TEST: 24th June 2003.



1.2 SUMMARY

This report must be read in conjunction with BABT report number WS610071 – 02, issued 28th April 2003

This supplementary report covers additional test requirements for co-located SAR measurements caused by simultaneous transmission by two or more transmitters. For test configuration; See System & Device Settings below.

The 700C-SMC45 is a Handheld Computer Terminal, which offers DCS1900/GPRS and 2.4GHz Wireless LAN (11Mbps DSSS) connectivity

The data terminal utilises the Siemens GSM/GPRS module (Hardware Version S30880-S8300-A100-1) to offer GSM voice communication and GPRS functions. Testing for GSM and GPRS was carried out using antenna supplied by the client, Single band 'White spot' 805-606-104. Also installed is the approved Intel WCF2011BEWW Compact Flash Wireless LAN radio card and the approved Bluetooth module Alps/Socket BC01, part number 805-608-002.

These radios do transmit simultaneously, for co-located Specific Absorption Rate (SAR), consideration was given to the GSM/GPRS module co-located with the Compact Flash Wireless LAN radio card. See below.

SYSTEM & DEVICE SETTINGS

- i. The DCP settings for IXP-039 Amplifier were set to 20;20;20 (CW calibration settings)
- ii. The device was placed in a Multi-slot Class 10 application, GPRS transmit on two timeslots (Dominant Transmitter ON) and with Compact Flash Wireless LAN radio card (Co-located Transmitter OFF) and a SAR evaluation was performed..
- iii. Then the device was placed in a Multi-slot Class 10 application, GPRS transmit on two timeslots (Dominant Transmitter ON) and with Compact Flash Wireless LAN radio card (Co-located Transmitter ON) and a SAR evaluation was performed.

For Head SAR Measurements, testing was performed with the device placed against a Specific Anthropomorphic Mannequin (SAM) phantom as specified in the IEEE1528 draft standard. The phantom was filled with simulant liquid appropriate to the 1900MHz frequency band only. The dielectric properties were measured and found to be 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 performed at the Right ear of the phantom, at the 15 degree position with antenna 805-606-104 fitted only.

Testing was performed at the maximum power for PCS1900 testing. This was achieved using a GSM test set, which controlled the handset at power level 0 (PCS1900). The Intermec 700C-SMC45 had a fixed external 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 all positions.

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.

Included in this report are descriptions of the test method; the equipment used and an analysis of the test uncertainties applicable and diagrams indicating the locations of maximum SAR for each test position along with photographs indicating the positioning of the device against either the right or left ear, as appropriate,



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
1900 MHz	1883.6	37.75*	-0.92%

* Normalised to 1W

DOMINANT TRANSMITTER ON CO-LOCATED TRANSMITTER OFF

Specific Absorption Rate (Maximum SAR) 1g Results for the Intermec 700C-SMC45 fitted with antenna 805-606-104

Position	Channel Number	Frequency (MHz)	Max Spot (W/kg)	Max 1g SAR (W/kg)	Area scan (Figure number)
SAM Phantom – HEAD Right Hand 15 Degrees	810	1909.8	0.57	0.491	Figure 1
Limit for General Population (Uncontrolled Exposure) 1.6 W/kg (1g)					

DOMINANT TRANSMITTER ON CO-LOCATED TRANSMITTER ON

Specific Absorption Rate (Maximum SAR) 1g Results for the Intermec 700C-SMC45 fitted with antenna 805-606-104.

Position	Channel Number	Frequency (MHz)	Max Spot (W/kg)	Max 1g SAR (W/kg)	Area scan (Figure number)
SAM Phantom – HEAD Left Hand 15 Degrees	PCS 810 DSS 11	PCS 1909.8 DSS* 2462	0.59	0.533	Figure 2
Limit for General Population (Uncontrolled Exposure) 1.6 W/kg (1g)					

*A CW Test Signal was used.



TEST DETAILS

Specific Absorption Rate testing of the Intermec 700C-SMC45
Dual Mode (DCS1900 (GPRS) / 802.11b RLAN) Handheld Computer Terminal.

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
SAM Phantom	Antennessa	SAM	N/A	36/02 FT15	N/A
1900 MHz – Head Tissue Simulant	BABT	Head	N/A	Batch 1	24/05/03*
1900 MHz Calibration Dipole	BABT	IEEE1528	4840	N/A	15/07/03 (due)
RF Amplifier	Vectawave	10M-2.5G	4697	N/A	N/A
GSM Test Set	Rohde & Schwarz	CMU200	4858	833870/015	17/06/04 (due)
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	02/10/03 (due)
Digital Thermometer	Digitron	T208	3178	N/A	24/08/03 (due)
Thermocouple	RS	219-4539	4859	N/A	24/08/03 (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 (ϵ') TARGET	RELATIVE PERMITTIVITY ϵ_r (ϵ') MEASURED	CONDUCTIVITY σ TARGET	CONDUCTIVITY σ MEASURED
Head 1900MHz	40.0	40.77	1.40 S/m	1.398

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 20°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)
	1900
Tissue Type	Head
Water	54.9
Salt (NaCl)	0.18
Sugar	0.0
HEC	0.0
Bactericide	0.0
Triton X-100	0.0
DGBE	44.92
Dielectric Constant	39.9
Conductivity (S/m)	1.42



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 21.7°C to 23.8°C.

The actual Humidity during the testing ranged from 21.1% to 34.5% RH.

Tissue simulating liquid temperature: +20°C to +23°C.

The actual tissue simulating liquid temperature was recorded to be 21.6°C to 23.0°C

2.5 MEASUREMENT UNCERTAINTY

Please refer to report number BABT Report WS610071 – 02 issued 28th April 2003 for full details

2.6 SAR MEASUREMENT SYSTEM

Please refer to report number BABT Report WS610071 – 02 issued 28th April 2003 for full details

2.7 TEST POSITIONS

Please refer to report number BABT Report WS610071 – 02 issued 28th April 2003 for full details



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

System.....	: IndexSAR SARA2	Power Drift.....	: 0.1dB
Date of Test.....	: 24/06/03	Battery Model.....	: 318-013-002
Lab Ambient.....	: 23.1°C	Probe Serial Number.....	: IXP-050 0084
Device ID.....	: 700C	Liquid Simulant.....	: 1900MHz Head
Phantom.....	: SAM	Permittivity.....	: 40.77
Phantom S/No.....	: FT04	Conductivity.....	: 1.398
Phantom Rotation (deg).....	: 0	Liquid Ambient.....	: 22.7°C
Test Position.....	: Right 15 degrees	Max SAR 'Y' Axis Location...:	-40.8mm
Antenna Position.....	: External	Max SAR 'Z' Axis Location...:	-82.4mm
Test Frequency.....	: 1909.8 MHz	SAR 1g.....	: 0.491 W/kg
Type of Modulation.....	: GPRS	SAR 10g.....	: 0.282 W/kg
Crest Factor.....	: 4.0	SAR Drift.....	: 0.02 dB
Diode Compression factor ...:	20;20;20		

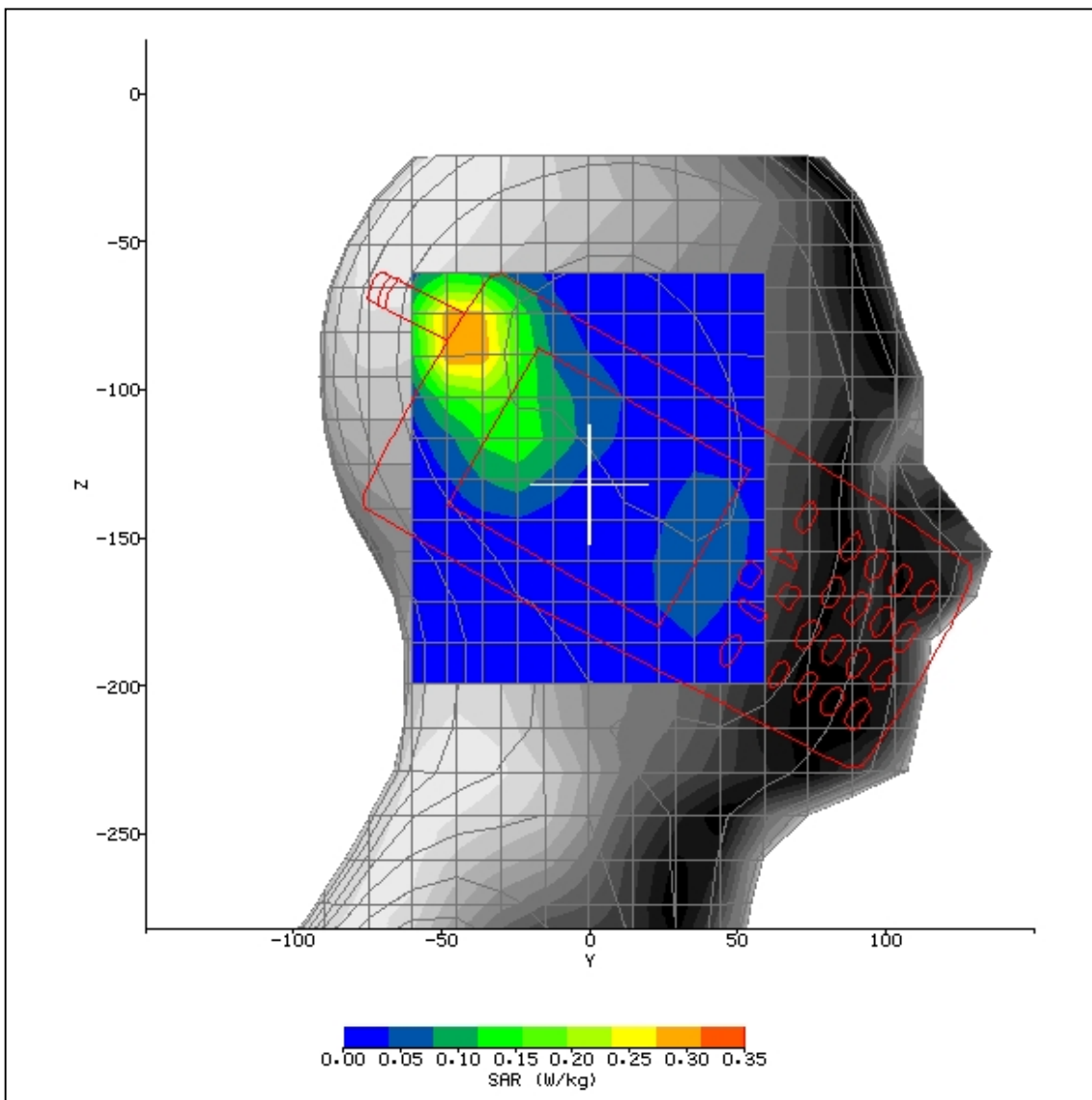


Figure 1 – Dominant Transmitter ON; Co-located transmitter OFF



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

System.....	: IndexSAR SARA2	Power Drift.....	: 0.4 dB
Date of Test	: 26/06/03	Battery Model	: 318-013-002
Lab Ambient.....	: 23.5°C	Probe Serial Number	: IXP-050 0084
Device ID	: 700C	Liquid Simulant.....	: 1900 MHz Head
Phantom	: SAM	Permittivity.....	: 40.77
Phantom S/No	: FT04	Conductivity.....	: 1.398
Phantom Rotation (deg).....	: 0	Liquid Ambient.....	: 22.6°C
Test Position	: Right 15 degrees	Max SAR 'Y' Axis Location ...	: -40.8 mm
Antenna Position.....	: External	Max SAR 'Z' Axis Location ...	: -85.2 mm
Test Frequency.....	: 1880 MHz & 2462MHz	SAR 1g	: 0.533 W/kg
Type of Modulation	: GPRS & CW	SAR 10g	: 0.311 W/kg
Crest Factor	: 4.0 & 1.0	SAR Drift	: 0.12 dB
Diode Compression factor ...	: 20;20;20		

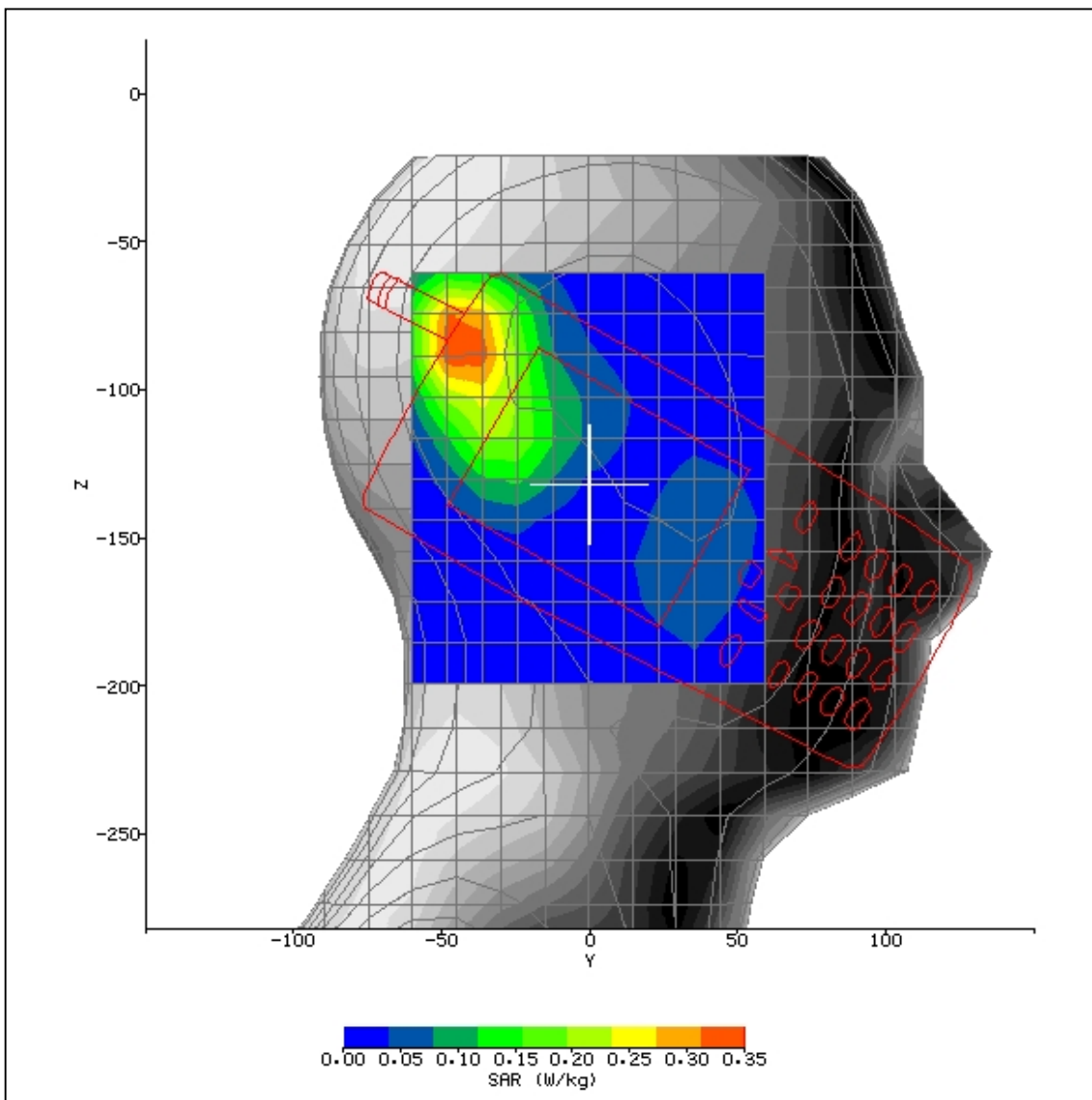


Figure 2 – Dominant Transmitter ON; Co-located transmitter ON



2.9 TEST POSITIONAL PHOTOGRAPHS

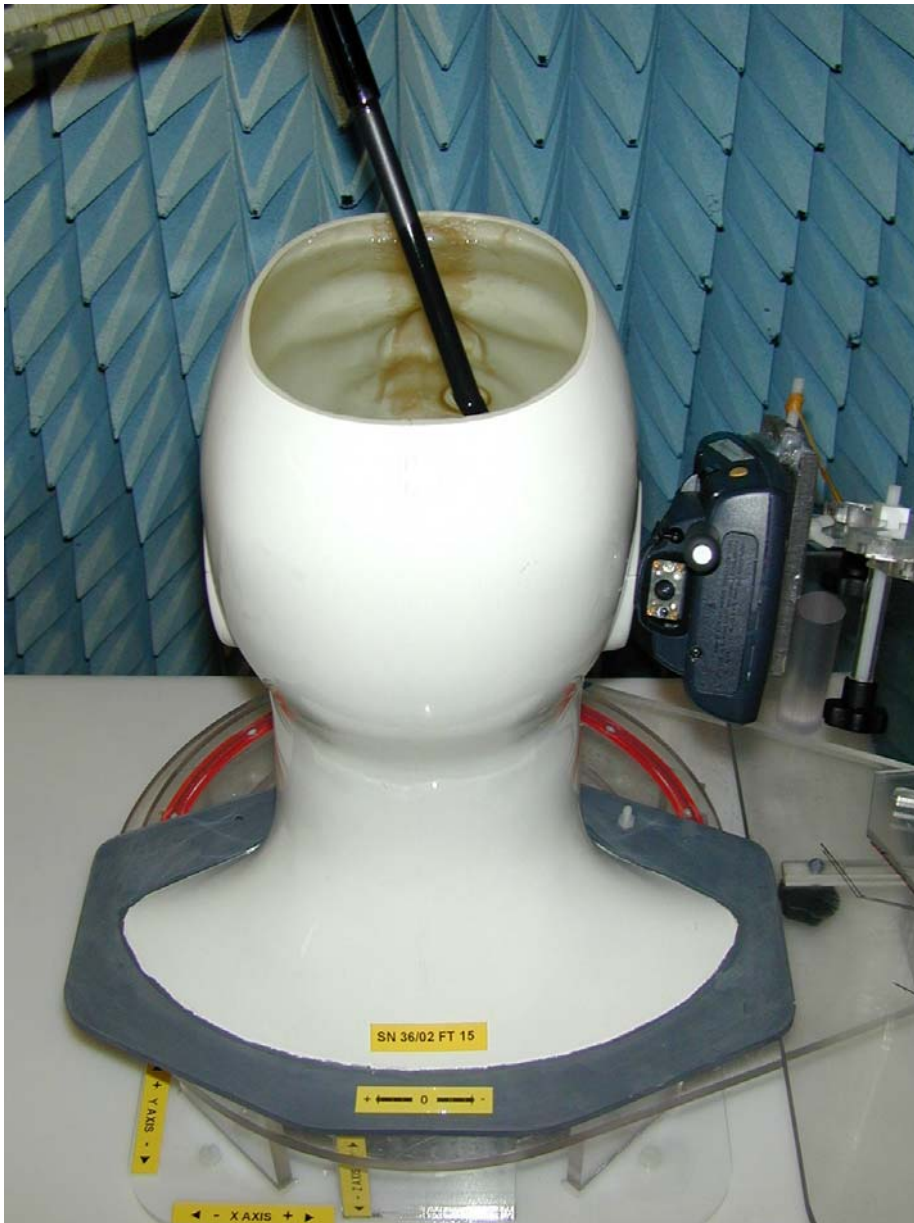


Figure 3. Positional photograph of 700C-SMC45 in the Right Hand 15 Degree Position



2.10 RECORD PHOTOGRAPHS



Figure 4. Rear View of the Intermec Handheld Computer Terminal, 700C-SMC45, Showing the vertical and horizontal lines (marked in red and with the carrying strap in position) used for the alignment procedure as defined in Draft IEEE Std1528. – December 29, 2002



2.10 RECORD PHOTOGRAPHS



Figure 5. Rear View of the Intermec Handheld Computer Terminal, 700C-SMC45, Showing the vertical and horizontal lines (marked in red and with the carrying strap moved out of position) used for the alignment procedure as defined in Draft IEEE Std1528. – December 29, 2002



2.10 RECORD PHOTOGRAPHS

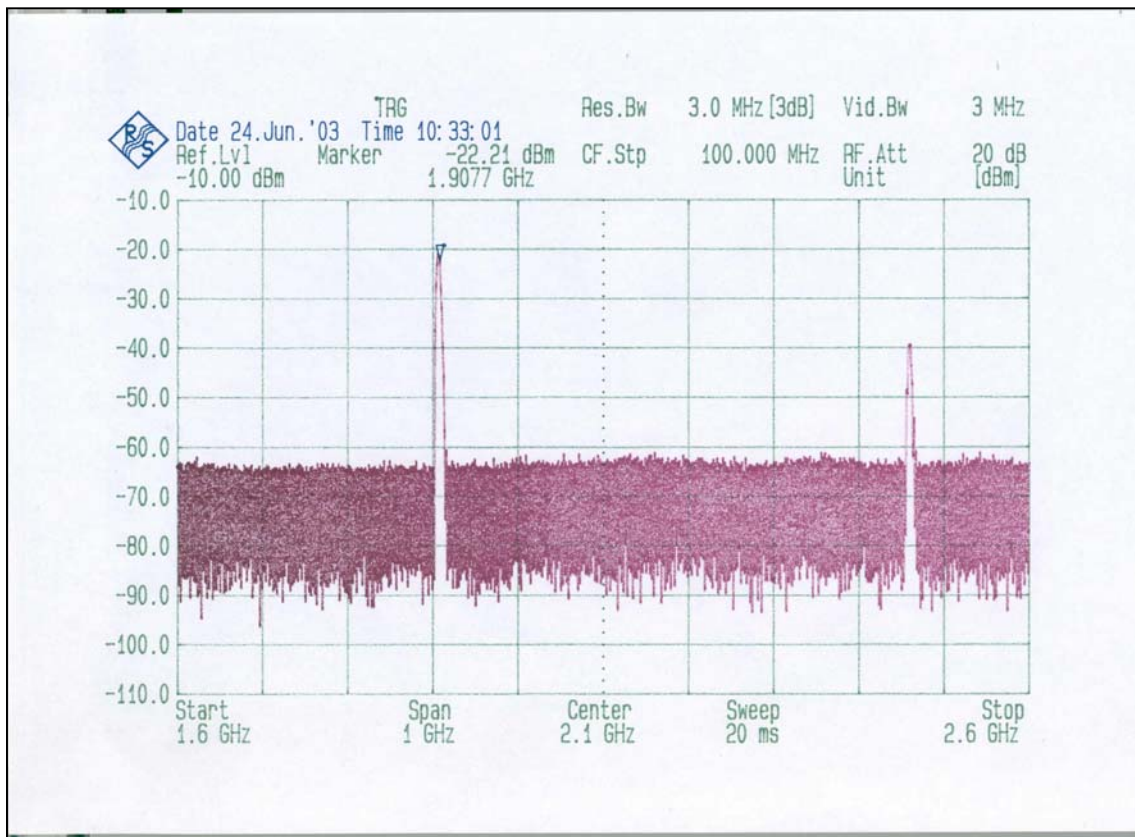


Figure 6. A Spectrum Analyzer image of the co-located signals for both the 1900MHz GPRS mode and 2462 MHz CW test mode



2.10 RECORD PHOTOGRAPHS

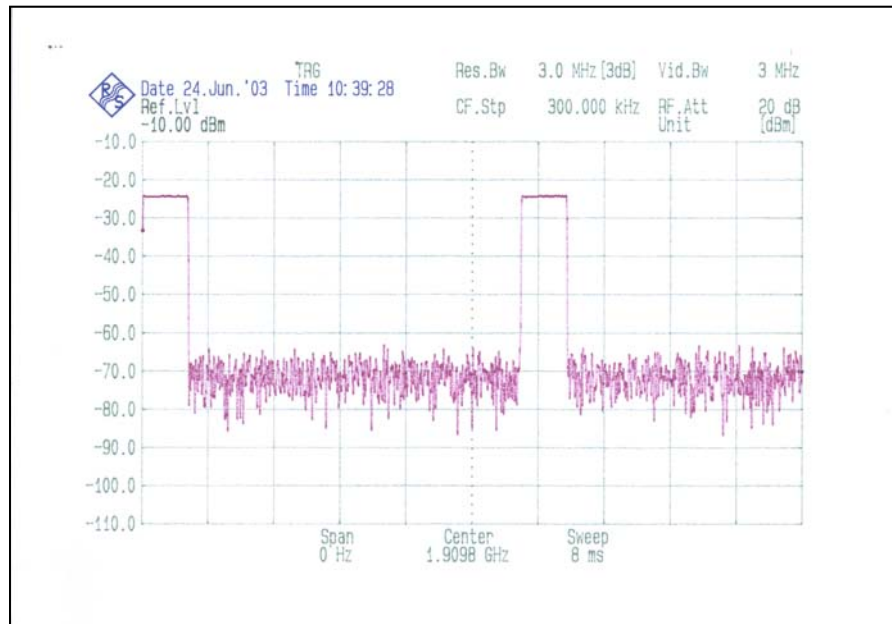


Figure 7. A Spectrum Analyzer image of the 1909.8 MHz GPRS signal showing one timeslot

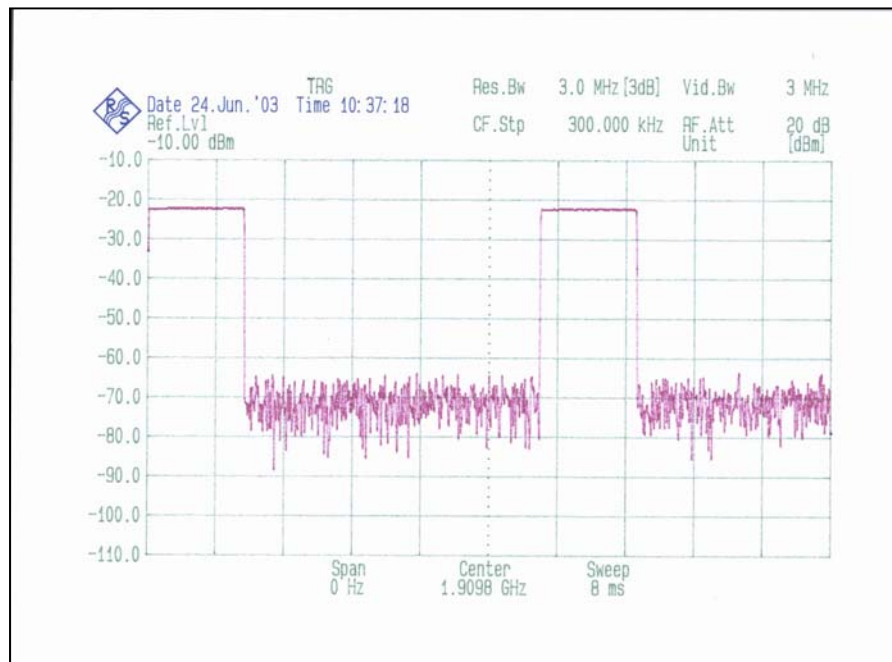


Figure 8. A Spectrum Analyzer image of the 1909.8 MHz GPRS signal showing two timeslots



ANNEX A

CO-LOCATED SAR EVALUATION (Information reprinted from report number WS610071 – 02 for reference only)

PHANTOM	POSITION	DOMINANT TRANSMITTER	ANTENNA	FREQUENCY	MODE	SECONDARY TRANSMITTER	FREQUENCY	MODE	DOMINANT TX MAX 1g SAR	SECONDARY TX MAX 1g SAR	DOMINANT MAX 1g SAR + SECONDARY MAX 1g SAR	CO-LOCATED MAX 1g SAR VALUE
HEAD FT04	RH 15 Degrees	Siemens SMC-45	805-606-102	1909.8MHz	GPRS	Intel WCF2011BEWW	2462MHz	CW	0.468W/kg	0.096W/kg	0.468W/kg+0.096W/kg	0.564W/kg
HEAD FT04	RH 15 Degrees	Siemens SMC-45	805-606-104	1909.8MHz	GPRS	Intel WCF2011BEWW	2462MHz	CW	0.550W/kg	0.096W/kg	0.550W/kg +0.096W/kg	0.646W/kg
BODY 2mm	0.0mm	Siemens SMC-45	805-606-102	1909.8MHz	GPRS	Intel WCF2011BEWW	2462MHz	CW	0.350W/kg	0.154W/kg*	0.350W/kg +0.154W/kg	0.504W/kg
BODY 2mm	0.0mm	Siemens SMC-45	805-606-104	1909.8MHz	GPRS	Intel WCF2011BEWW	2462MHz	CW	0.414W/kg	W/kg*	0.414W/kg +0.154W/kg	0.568W/kg
HEAD FT04	RH 15 Degrees	Siemens SMC-45	805-606-102	1909.8MHz	GSM	Intel WCF2011BEWW	2462MHz	CW	0.175W/kg	0.096W/kg	0.175W/kg+0.096W/kg	0.271W/kg
BODY 2mm	0.0mm	Siemens SMC-45	805-606-102	1850.2MHz	GSM	Intel WCF2011BEWW	2462MHz	CW	0.130W/kg	W/kg*	0.130W/kg +0.154W/kg	0.284W/kg

Note:

- * For body measurements refer to Celltech Reasearch Inc SAR Report Test Report S/N: 100202-284HN2. Test Date(s): October 18, 2002 FCC/IC SAR Evaluation
- ** No SAR testing was performed on the Approved Bluetooth Module installed in the 700C. See excerpt from Exhibit H: RF Exposure Report FCC ID: HN22011B

BLUETOOTH RADIO (FCC ID: HN2ATBM3-2)

ANTENNA TYPE	ANTENNA PART NO:	TRANSMIT FREQUENCY	MAX PEAK CONDUCTED OUTPUT POWER	ANTENNA GAIN	MINIMUM ANTENNA CABLE LOSS	POWER DENSITY @ 20cm	GENERAL POPULATION EXPOSURE LIMIT FROM 47 CFR 1.1310 (mW/cm ²)	RATIO OF POWER DENSITY TO THE EXPOSURE LIMIT
		(MHz)	(mW)	(dBi)	(dB)	(mW/cm ²)		
Internal Integral Antenna	ABTM3	2400	3.78	-5.77	0	0.00020	1	0.00020



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