Specific Absorption Rate (SAR) Test Report
for
Vocollect, Inc
on the
2.4 GHz portable transmitter
Model: TT-500

Test Report: J99007671
Date of Report: April 21, 1999

NVLAP Laboratory Code 200201-0
Accredited for testing to FCC Parts 15

Tested by:	C. K. Li	
Reviewer:	C. K. Li	

Table of Contents

1 JOB DESCRIPTION

1.1 Client Information

The EUT has been tested at the request of

Company:	Vocollect, Inc. 701 Rodi Road, Pittsburgh PA 15235
Name of contact:	Mr. Jim Logan
Telephone:	(412) 829-8145
Fax:	(412) 829-0972

1.2 Equipment under test (EUT)

Product Descriptions:

Equipment	2.4 GHz Spread Spectrum Radio		
Trade Name	Talkman	Model No.	TT-500
FCC ID	H9PLA3020	S/N No.	Not labeled
Category	Portable	RF Exposure	Uncontrolled Environment
Frequency Band (uplink)	2402 to 2480 MHz	System	Spread Spectrum

EUT Antenna Description			
Type	Dipole	Configuration	Fixed
Dimensions	6cm x 6cm PCB	Gain	2 dBi
Location	Internal. Distance between antenna and inside of the case = 4.32 cm		

Use of Product :	Voice/Data communications
Manufacturer:	SAME as above.
Production is planned:	[X] Yes, [ ] No
EUT receive date:	3/29/99
EUT received condition:	Good condition prototype
Test start date:	3/29/99
Test end date:	3/31/99

1.3 Test plan reference

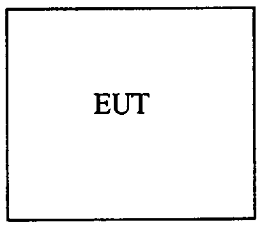
FCC rule part 2.1093, FCC Docket 96-326 & Supplement C to OET Bulletin 65

1.4 System test configuration

1.4.1 System block diagram & Support equipment

The diagram shown below details test configuration of the equipment under test .

Unit was tested as a Standalone unit.



S:	Shielded	U:	Unshield	F:	With Ferrite Core

Support equipment					
Equp. #	**Equipment**	**Manufacturer**	**Model #**	**S/N #**	**FCC ID**
None					

1.4.2 Test Position

Two test configurations were used to show compliance with the FCC RF human exposure requirements:

1.4.2.1 Configuration A

The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT was placed in the curved section of the head phantom to reflect the intended use configuration. The minimum distance between the body of the user and EUT is 1.0 cm (thickness of the padded belt) in normal usage. Appendix C describes the normal EUT wearing position and distance justification. During test, the EUT was placed direct contact with the outer shell of the head phantom which simulates the sharp of a human body. The 0cm distance between the EUT and the phantom shell represents the worst case condition (belt thickness = 0 cm) in RF coupling. The EUT was shifted left and right to ensure that the whole inside area of EUT was covered during SAR tests. Please refer to figure 1a below for the positions details.

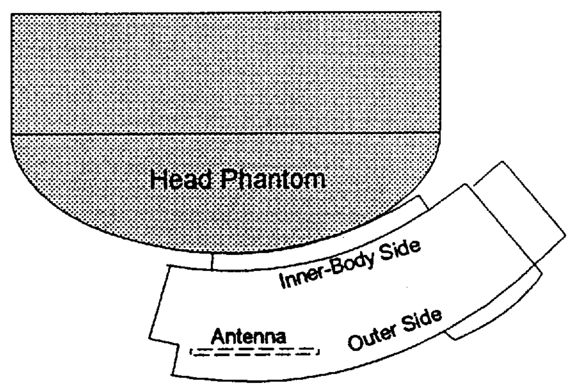


Figure 1a: Test Configuration A (Intended use position)

1.4.2.2 Configuration B

SAR Tests were performed using configuration B for the simulation of close proximity of other person (non-user) to the EUT. The test distance between the EUT case and Phantom was set at 10 mm. In this configuration, the internal antenna is in parallel with the flat phantom. Please refer to figure 1b below for the positions details.

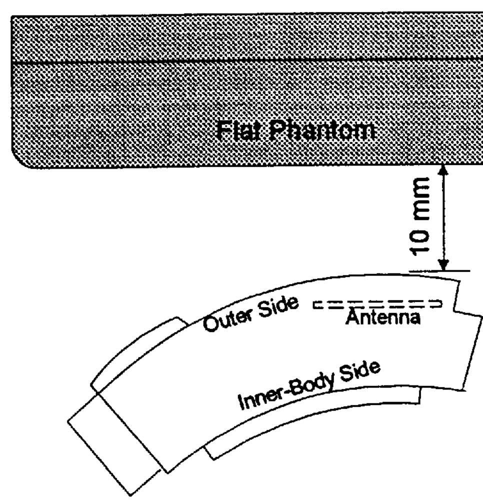


Figure 1b: Test Configuration B

1.4.3 Test Condition

During tests, the worst case data (max. RF coupling) was determined with following conditions:

EUT Antenna	Fixed, Internal	Orientation	N/A
Usage	Body worn	Distance between antenna axis and the liquid surface:	Configuration A: 4.5 cm Configuration B: 1.7 cm
Simulating human hand	Not Used	EUT Battery	Fully Charged
Power output	240 mW (Maximum)		

The spatial peak SAR values were accessed for lowest, middle and highest operating channels defined by the manufacturer.

Antenna port power measurement was performed, with the HP 435A power meter, before and after the SAR tests to ensure that the EUT operated at the highest power level.

1.5 Modifications required for compliance

No modifications were implemented by Intertek Testing Services.

1.6 Additions, deviations and exclusions from standards

Due to the unavailability of suitable body simulation tissue at 2.4 GHz, tests were performed using 1.8 GHz Brian simulation tissue. Using the Sensitivity factor S(x) given by test equipment manufacturer, the percentage change in SAR per percent change in the controlling parameter is calculated :

$$S(x) = \frac{\partial SAR / SAR}{\partial x / x}$$

Where the controlling parameters x are:

- S(x): SAR Sensitivities (given by equipment manufacturer)
- ε: Permitivity
- σ: Conductivity
- ρ: Brian density (= one over integration volume)
- d: Distance of radiator from the liquid surface

Measured SAR values at 2.4 GHz are approximately to be 20 % higher.

2 SAR EVALUATION

2.1 SAR Limits

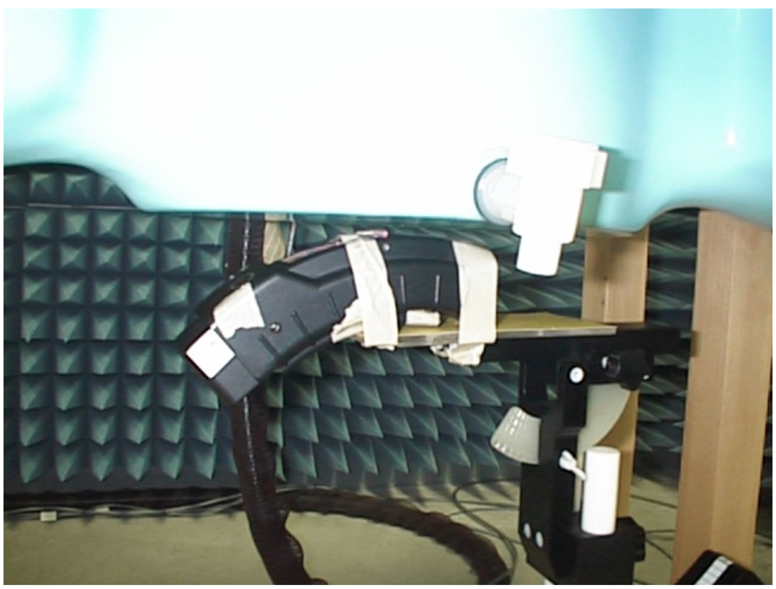
The following FCC limits for SAR apply to devices operate in General Population/Uncontrolled Exposure environment:

EXPOSURE (General Population/Uncontrolled Exposure environment)	SAR (W/kg)
Average over the whole body	0.08
Spatial Peak (1g)	1.60
Spatial Peak for hands, wrists, feet and ankles (10g)	4.00

2.2 Configuration Photographs

at 2450 MHz

Configuration A: Intended Usage



Configuration B:10 mm between outer case of EUT and Phantom

2.3 System Verification

Prior to the assessment, the system was verified to the ±5% of the specifications by using the system validation kit. The validation was performed at 1800 MHz.

Validation kit	Targeted SAR_{1g} (mW/g)	Measured SAR_{1g} (mW/g)
D1800V2, S/N #: 224	0.721	0.72

2.4 Evaluation Procedures

The SAR evaluation was performed with the following procedures:

a. SAR was measured at a fixed location above the reference point and used as a reference value for the assessing the power drop.

b. The SAR distribution at the exposed side of the body was measured at a distance of 2.3 mm from the inner surface of the shell in configuration A. The area covered the entire dimension of the head phantom and the horizontal grid spacing was 20 mm x 20 mm. Based on this data, the area of the maximum absorption was determined by spline interpolation.

c. Around this point, a volume of 32 mm x 32 mm x 34 mm was assessed by measuring 5 x 5 x 7 points. On the basis of this data set, the spatial peak SAR value was evaluated with the following procedure:

   I) The data at the surface were extrapolated, since the center of the dipoles is 2.7 mm away from the tip of the probe and the distance between the surface and the lowest measurement point is 1.6 mm. The extrapolation was based on a least square algorithm. A polynomial of the fourth order was calculated through the points in Z-axes. This polynomial was then used to evaluate the points between the surface and the probe tip.

   ii) The maximum interpolated value was searched with a straight-forward algorithm. Around this maximum the SAR values averaged over the spatial volumes (1g or 10g) were computed using the 3-D spline interpolation algorithm. The 3-D spline is composed of three one-dimensional splines with the "Not a knot" condition (in x, y and z directions). The volume was integrated with the trapezoidal algorithm. 1000 points (10 x 10 x 10) were interpolated to calculate the average.

   iii) All neighboring volumes were evaluated until no neighboring volume with a higher average value was found.

d. Re-measurement of the SAR value at the same location as in step a. above. If the value changed by more than 5 %, the evaluation was repeated.

2.5 Test Results

The results on the following page(s) were obtained when the device was tested in the condition described in this report. Detail measurement data and plots which reveal information about the location of the maximum SAR with respect to the device, are reported in Appendix A.

Trade Name:	Talkman	**Model No.:**	TT-500	
Serial No.:	Not Labeled	**Test Engineer:**	CK	

TEST CONDITIONS			
Ambient Temperature	22.6 °C	Relative Humidity	52 %
Test Signal Source	Test Mode	Signal Modulation	CW
Output Power Before SAR Test	240 mW	Output Power After SAR Test	240 mW
Test Duration	25 Min.	Number of Battery Change	1

Configuration A: Intended Use Position a)				
Channel	Operating Mode	Duty Cycle ratio	Antenna Position	Measured SAR_{1g} (mW/g)
2450 MHz	CW	1	4.3 cm from antenna to inside of EUT case	0.0331

Configuration B: 10 cm between EUT and Phantom				
Channel	Operating Mode	Duty Cycle ratio	Antenna Position	Measured SAR_{1g} (mW/g)
2402 MHz	CW	1	1.5 cm from antenna to inside of EUT case	0.688
2450 MHz	CW	1	1.5 cm from antenna to inside of EUT case	0.775
2480 MHz	CW	1	1.5 cm from antenna to inside of EUT case	0.619

Note: a) Worst case data were reported
b) Duty cycle factor included in the measured SAR data
c) Measured results are approximately 20% higher

3.1 TEST EQUIPMENT

3.2 Equipment List

The Specific Absorption Rate (SAR) tests were performed with the SPEAG model DASY 3 automated near-field scanning system which is package optimized for dosimetric evaluation of mobile radios [3]. The following major equipment/components were used for the SAR evaluations:

SAR Measurement System			
EQUIPMENT	SPECIFICATIONS	S/N #	CAL. DATE
Robot	**Stäubi RX60L**	597412-01	N/A
	Repeatability: ± 0.025mm Accuracy: 0.806×10^{-3} degree Number of Axes: 6		
E-Field Probe	**ET3DV5**	1333	03/18/99
	Frequency Range: 10 MHz to 6 GHz Linearity: ± 0.2 dB Directivity: ± 0.1 dB in brain tissue		
Data Acquisition	**DAE3**	358	2/99
	Measurement Range: 1μV to >200mV Input offset Voltage: < 1μV (with auto zero) Input Resistance: 200 M		
Phantom	**Generic Twin V3.0**	N/A	N/A
	Type: Generic Twin, Homogenous Shell Material: Fiberglass Thickness: 2 ± 0.1 mm Capacity: 20 liter Ear spacer: 4 mm (between EUT ear piece and tissue simulating liquid)		
Simulated Tissue	**Mixture**	N/A	03/25/99
	Please see section 6.2 for details		
Power Meter	**HP 435A w/ 8481H sensor**	1312A01255	02/01/99
	Frequency Range: 100kHz to 18 GHz Power Range: 300μW to 3W		

3.3 Brain Tissue Simulating Liquid

Ingredient	Frequency (1800-1900 MHz)
Water	53.93 %
Sugar	44.97 %
Salt	0 %
HEC	1.0 %
Bactericide	0.1 %

The dielectric parameters were verified prior to assessment using the HP 85070A dielectric probe kit and the HP 8753C network Analyzer. The dielectric parameters were:

Frequency (MHz)	$_r$*	*(mho/m)	**(kg/m^3)
1800	39.25 ± 5%	1.7 ± 10%	1000
1900	38.58 ± 5%	1.81 ± 10%	1000

* *worst case uncertainty of the HP 85070A dielectric probe kit*

** *worst case assumption*

3.4 E-Field Probe Calibration

Probes were calibrated by the manufacturer in the TEM cell IFI 110. To ensure consistency, a strict protocol was followed. The conversion factor (ConF) between this calibration and the measurement in the tissue simulation solution was performed by comparison with temperature measurement and computer simulations. Probe calibration factors are included in Appendix C.

3.5 Measurement Uncertainty

The total uncertainty for the evaluation of the spatial peak SAR values averaged over a cube of 1 g tissue mass has been assessed for this system to be less than ±20% [4]. This uncertainty includes probe, calibration, positioning and evaluation errors as well as errors in assessing the correct dielectric parameters for the brain simulating liquid, etc.

UNCERTAINTY BUDGET	
Source of Uncertainty	Uncertainty (±%)
Field Measurement Isotropy error in tissue-simulating liquid: <±0.2dB Frequency response: <±0.1dB Linearity: <±0.2dB Data acquisition and evaluation: <±0.05dB Probe calibration: <±10% ELF and RF disturbance: <±10μW/g	*13*
Spatial Peak Evaluation Extrapolation and interpolation error, and position error: <±0.1dB Integration and maximum search routine: <±0.1dB Inaccuracies in cube's shape:<±0.2dB	*7*
Tissue Calibration HP85070 dielectric probe	*10*
Total (rss)	**17.8**

3.6 Measurement Traceability

All measurements described in this report are traceable to National Institute of Standards and Technology (NIST) standards or appropriate national standards.

4.0 WARNING LABEL INFORMATION - USA

Not Applicable

5.0 REFERENCES

[1] ANSI, *ANSI/IEEE C95.1-1991: IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3kHz to 300 GHz*, The Institute of electrical and Electronics Engineers, Inc., New York, NY 10017, 1992

[2] Federal Communications Commission, "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields", OET Bulletin 65, FCC, Washington, D.C. 20554, 1997

[3] Thomas Schmid, Oliver Egger, and Niels Kuster, "Automated E-field scanning system for dosimetric assessments", *IEEE Transaction on Microwave Theory and Techniques*, vol. 44, pp. 105-113, Jan. 1996.

[4] Niels Kuster, Ralph Kastle, and Thomas Schmid, "Dosimetic evaluation of mobile communications equipment with know precision", IEICE Transactions on Communications, vol. E80-B, no. 5, pp.645-652, May 1997.

APPENDIX A - SAR EVALUATION DATA

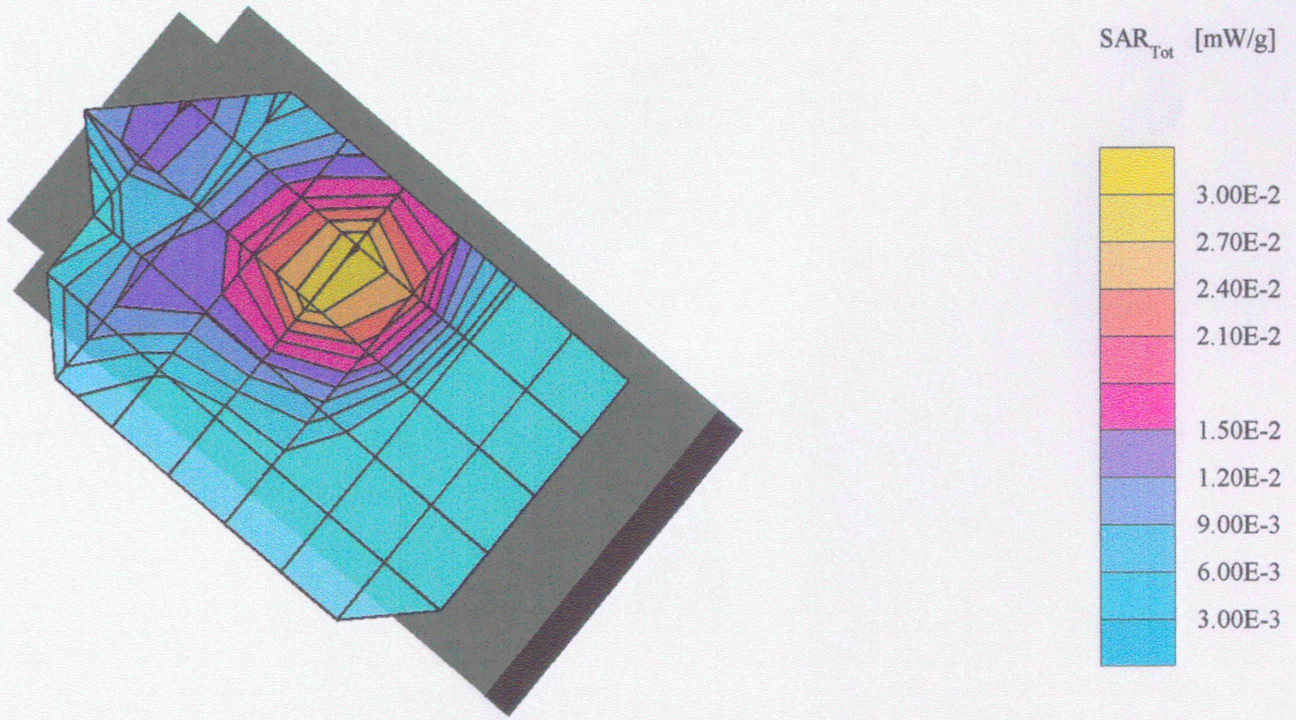
Please note that the graphical visualization of the phone position onto the SAR distribution gives only limited information on the current distribution of the device, since the curvature of the head results in graphical distortion. Full information can only be obtained either by H-field scans in free space or SAR evaluation with a flat phantom.

Powerdrift is the measurement of power drift of the device over one complete SAR scan.

Graph #	Configuration	Frequency	Description
1	A	2450 MHz	EUT touching head phantom
2	B	2402 MHz	EUT is 10mm from flat phantom
3	B	2450 MHz	EUT is 10mm from flat phantom
4	B	2480 MHz	EUT is 10mm from flat phantom

Talkman_25

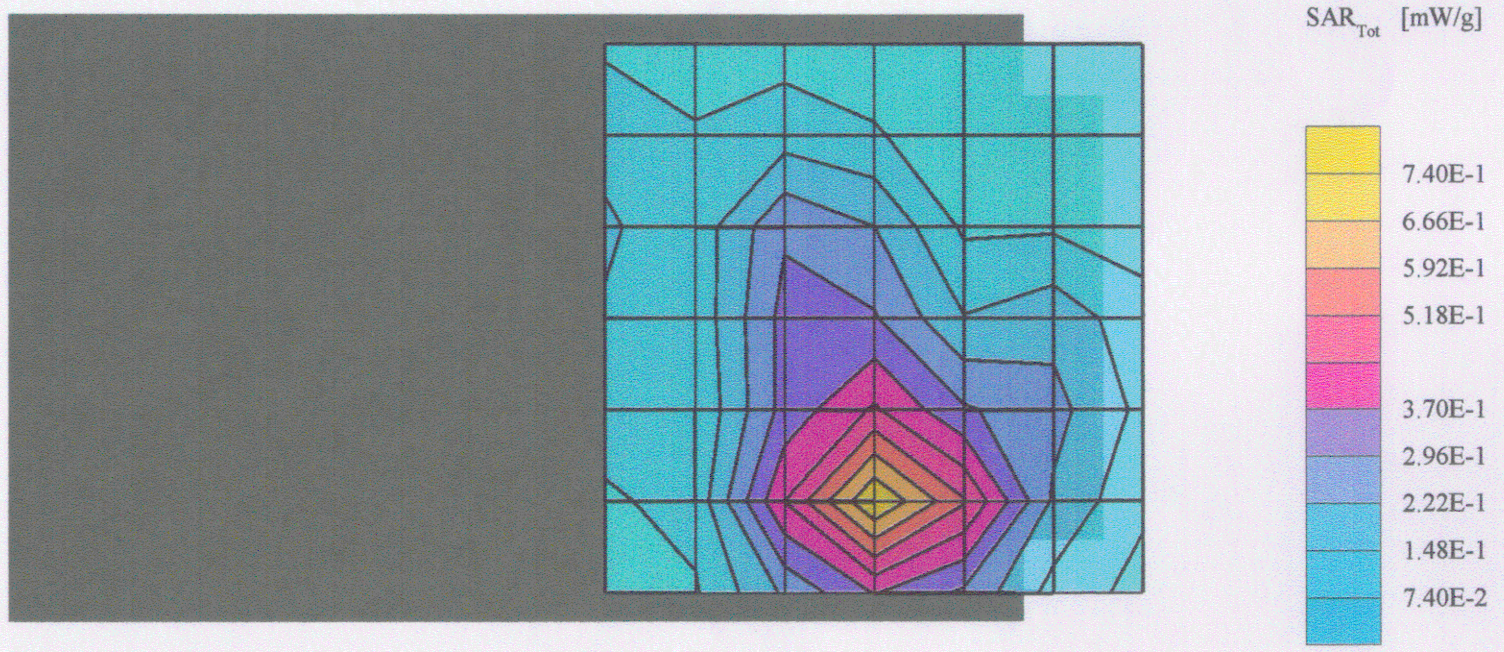
Phantom: Generic Twin; Section: Right Hand; Position: (80°,65°); Frequency: 2450 [MHz]
Probe: ET3DV5 - SN1333; ConvF(5.04,5.04,5.04); Crest Factor: 1.0; Muscle 2400 MHz: $\sigma = 2.36$ [mho/m] $\varepsilon_r = 35.7$ $\rho = 1.00$ [g/cm³]
Cube 5x5x7; SAR (1g): 0.0331 [mW/g], SAR (10g): 0.0149 [mW/g]; (Worst-case extrapolation)
Course:Dx = 20.0, Dy = 20.0, Dz = 10.0
Powerdrift: -0.66 dB, Antenna O/P = 240 mW, EUT touching phantom shell



2

Talkman_25

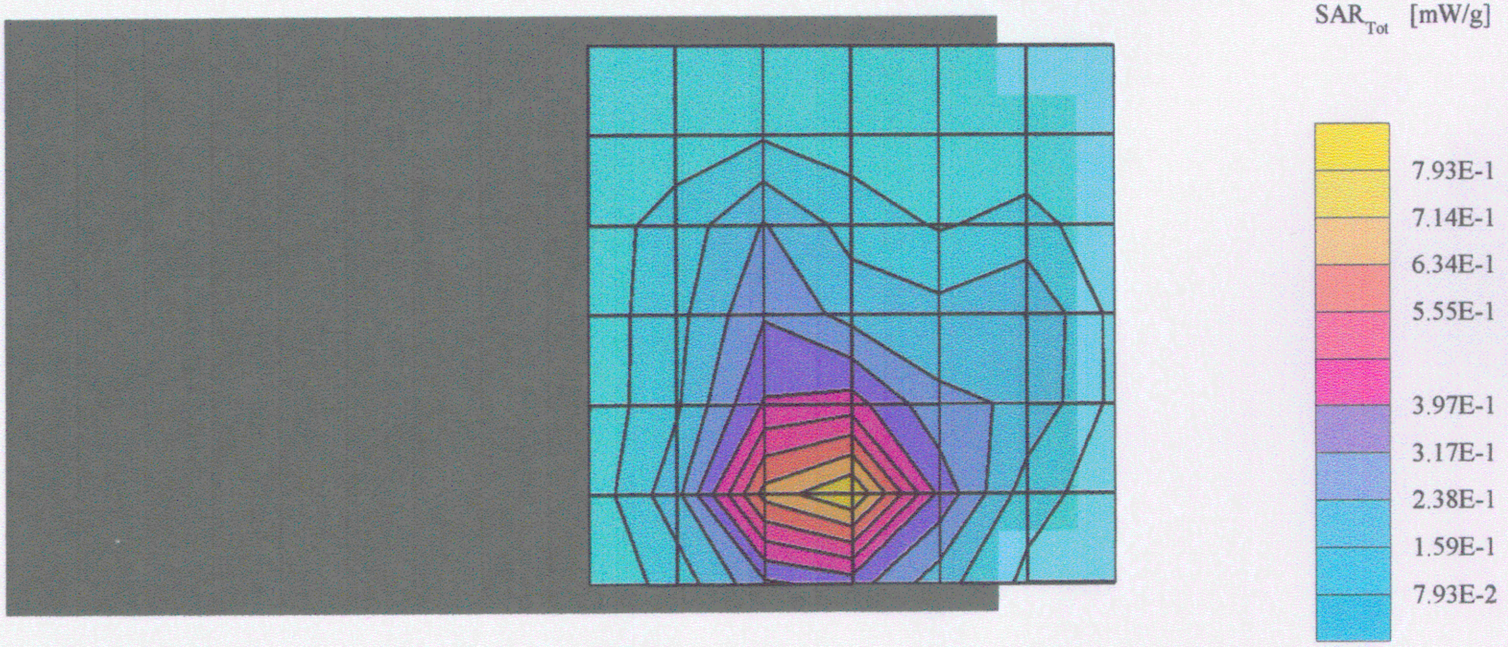
Phantom: Generic Twin; Section: Flat; Position: (90°,90°); Frequency: 2402 [MHz]
Probe: ET3DV5 - SN1333; ConvF(5.04,5.04,5.04); Crest Factor: 1.0; Muscle 2400 MHz: σ = 2.36 [mho/m] ε_r = 35.7 ρ = 1.00 [g/cm³]
Cube 5x5x7; SAR (1g): 0.688 [mW/g], SAR (10g): 0.336 [mW/g]; (Worst-case extrapolation)
Course:Dx = 15.0, Dy = 15.0, Dz = 10.0
Powerdrift: -0.41 dB, Antenna O/P = 240 mW. Keypad side facing phantom. EUT is 10mm from phatom.



3

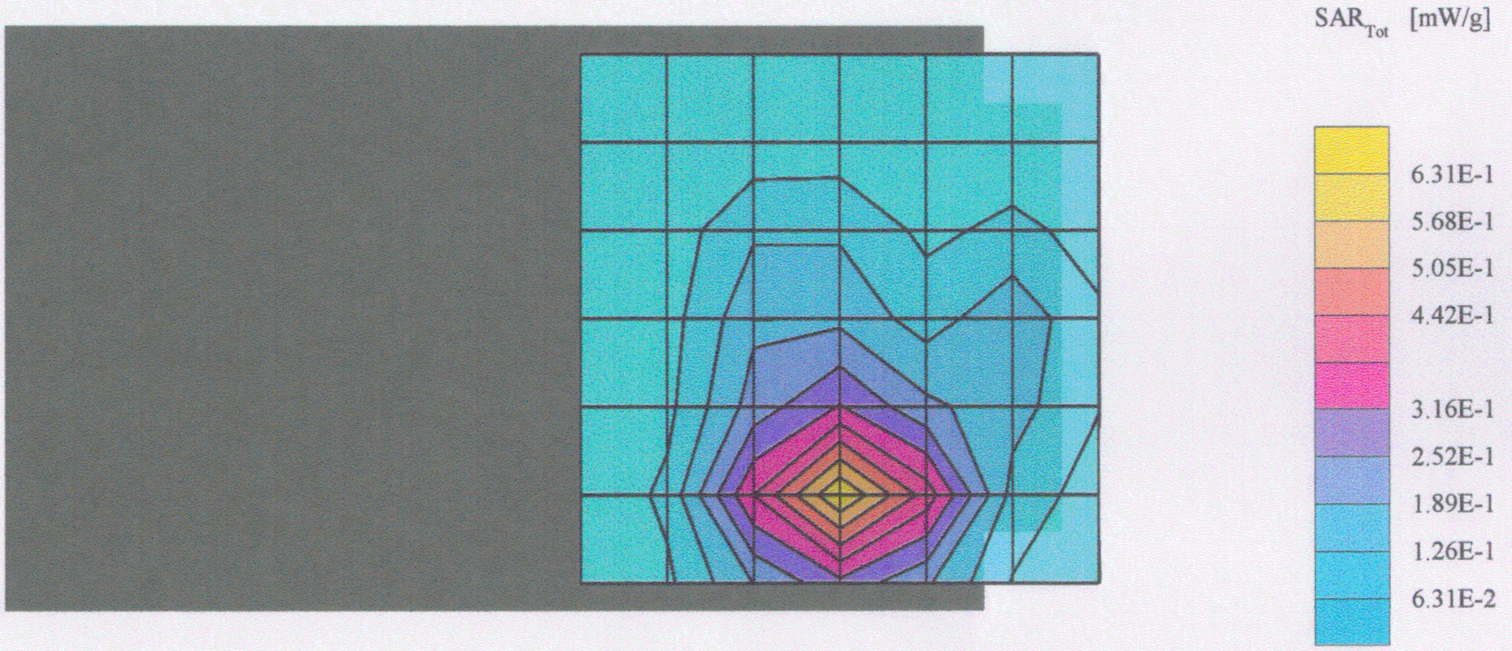
Talkman

Phantom: Generic Twin; Section: Flat; Position: (90°,90°); Frequency: 2450 [MHz]
Probe: ET3DV5 - SN1333; ConvF(5.04,5.04,5.04); Crest Factor: 1.0; Muscle 2400 MHz:σ = 2.36 [mho/m] ε_r = 35.7 ρ = 1.00 [g/cm³]
Cube 5x5x7; SAR (1g): 0.775 [mW/g], SAR (10g): 0.372 [mW/g]; (Worst-case extrapolation)
Course:Dx = 15.0, Dy = 15.0, Dz = 10.0
Powerdrift: -0.20 dB, Antenna O/P =240 mW. Keypad side facing phantom. EUT is 10mm from phantom



Talkman_25

Phantom: Generic Twin; Section: Flat; Position: (90°,90°); Frequency: 2480 [MHz]
Probe: ET3DV5 - SN1333; ConvF(5.04,5.04,5.04); Crest Factor: 1.0; Muscle 2400 MHz: σ = 2.36 [mho/m] ε_r = 35.7 ρ = 1.00 [g/cm³]
Cube 5x5x7; SAR (1g): 0.619 [mW/g], SAR (10g): 0.286 [mW/g]; (Worst-case extrapolation)
Course:Dx = 15.0, Dy = 15.0, Dz = 10.0
Powerdrift: -1.51 dB, 10mm distance



APPENDIX B - E-FIELD PROBE CALIBRATION DATA

Schmid & Partner
Engineering AG

Staffelstrasse 8, 8045 Zurich, Switzerland, Telefon +41 1 280 08 60, Fax +41 1 280 08 64

Probe ET3DV5

SN:1333

Manufactured:	December 1997
Calibrated:	January 1998
Recalibrated:	March 1999

Calibrated for System DASY3

Introduction

The performance of all probes is measured before delivery. This includes an assessment of the characteristic parameters, receiving patterns as a function of frequency, frequency response and relative accuracy. Furthermore, each probe is tested in use according to a dosimetric assessment protocol. The sensitivity parameters (NormX, NormY, NormZ), the diode compresion parameter (DCP) and the conversion factor (ConvF) of the probe and some of the measurement diagrams are given in the following.

The performance of the individual probes varies slightly due to tolerances arising from the manufacturing process. Since the lines are highly resistive (several MOhms), the offset and noise problem is greatly increased if signals in the low μV range are measured. Accurate measurement below 10 μW/g are possible if the following precautions are taken. 1) check the current grounding with the *multimeter*[1], i.e., low noise levels, 2) compensate the current *offset*[1], 3) use long integration time (approx. 10 seconds), 4) *calibrate*[1] before each measurement, 5) persons should avoid moving around the lab while measuring.

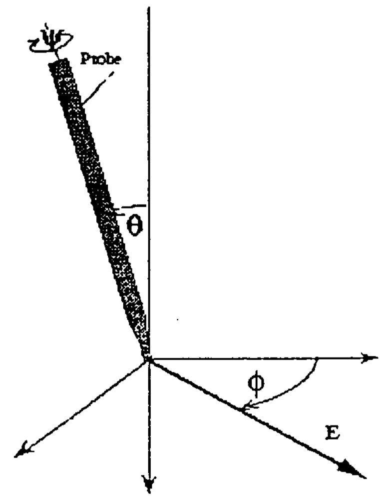


Fig 1: Due to the field distortion caused by the supporting material, the probe has two characteristic directions, referred to as angle ψ and θ.

Since the field distortion caused by the supporting material and the sheath is quite high in the θ direction, the receiving pattern is poor in air. However, the distortion in tissue equivalent material is much less because of its high dielectricity. In addition, the fields induced in the phantoms by dipole structures close to the body are dominently parallel to the surface. Thus, the error due to non-isotropy is much better than 1 dB for dosimetric assessments.

The probes are calibrated in the TEM cell ifi 110 although the field distribution in the cell is not very uniform and the frequency response is not very flat. To ensure consistency, a strict protocol is followed. The conversion factor (ConF) between this calibration and the measurement in the tissue simulation solution is performed by comparison with temperature measurements and computer simulations. This conversion factor is only valid for the specified tissue simulating liquids at the specified frequencies. If measurements have to be performed in solutions with other electrical properties or at other frequencies, the conversion factor has to be assessed by the same procedure.

As the probes have been constructed with printed resistive lines on ceramic substrates (thick film technique), the probe is very delicate with respect to mechanical shocks.

Attention:

Do not drop the probe or let the probe collide with any solid object. Never let the robot move without first activating the emergency stop feature (i.e., without first turning the data acquisition electronics on).

[1] Feature of the DASY Software Tool.

DASY3 - Parameters of Probe: ET3DV5 SN:1333

Sensitivity in Free Space

NormX	**2.34**	$\mu V/(V/m)^2$
NormY	**2.3**	$\mu V/(V/m)^2$
NormZ	**2.3**	$\mu V/(V/m)^2$

Diode Compression

DCP X	**100**	mV
DCP Y	**100**	mV
DCP Z	**100**	mV

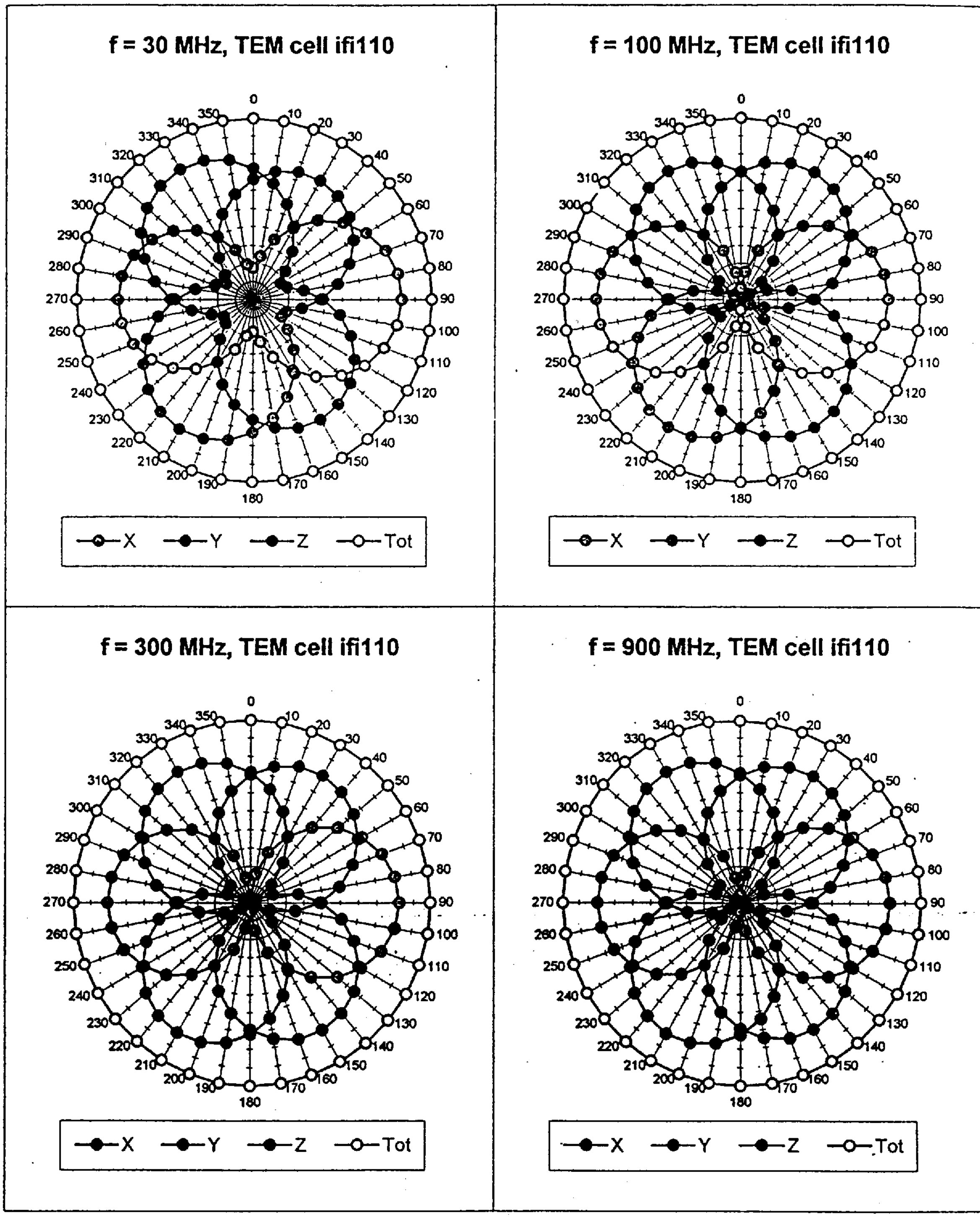
Sensitivity in Tissue Simulating Liquid

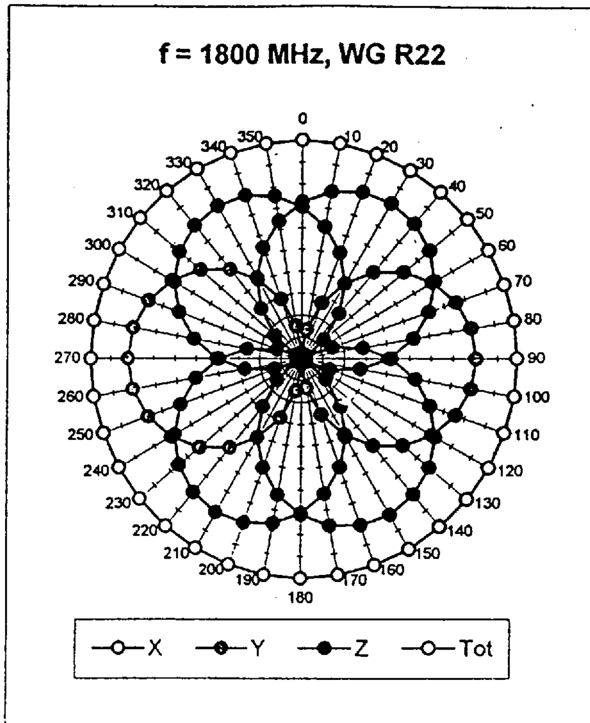
450 MHz	ConvF X	**6.38**	extrapolated	ε_r = 48 ± 5%
	ConvF Y	**6.38**	extrapolated	σ = 0.50 ± 10% mho/m
	ConvF Z	**6.38**	extrapolated	(brain tissue simulating liquid)
900 MHz	ConvF X	**6.03**	± 10%	ε_r = 42.5 ± 5%
	ConvF Y	**6.03**	± 10%	σ = 0.86 ± 10% mho/m
	ConvF Z	**6.03**	± 10%	(brain tissue simulating liquid)
1500 MHz	ConvF X	**5.55**	interpolated	ε_r = 41 ± 5%
	ConvF Y	**5.55**	interpolated	σ = 1.32 ± 10% mho/m
	ConvF Z	**5.55**	interpolated	(brain tissue simulating liquid)
1800 MHz	ConvF X	**5.31**	± 10%	ε_r = 41 ± 5%
	ConvF Y	**5.31**	± 10%	σ = 1.69 ± 10% mho/m
	ConvF Z	**5.31**	± 10%	(brain tissue simulating liquid)

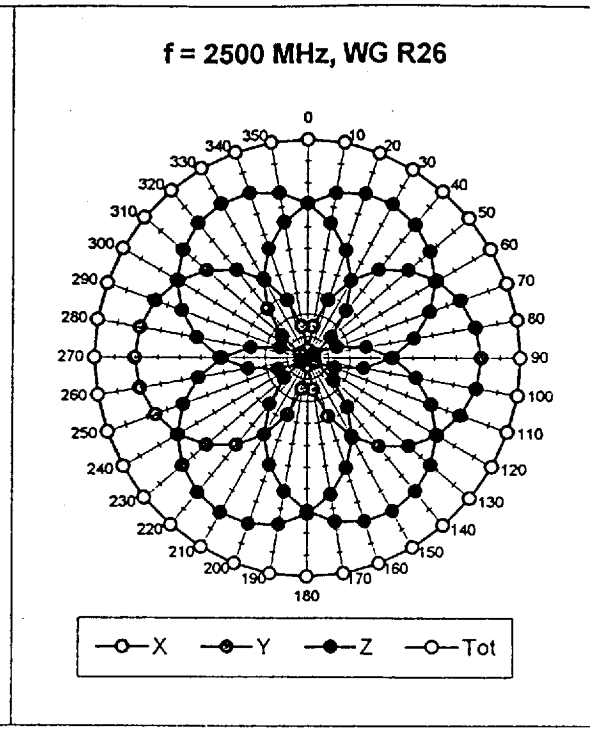
Sensor Offset

Probe Tip to Sensor Center	**2.7**	mm
Surface to Probe Tip	**1.7 ± 0.2**	mm

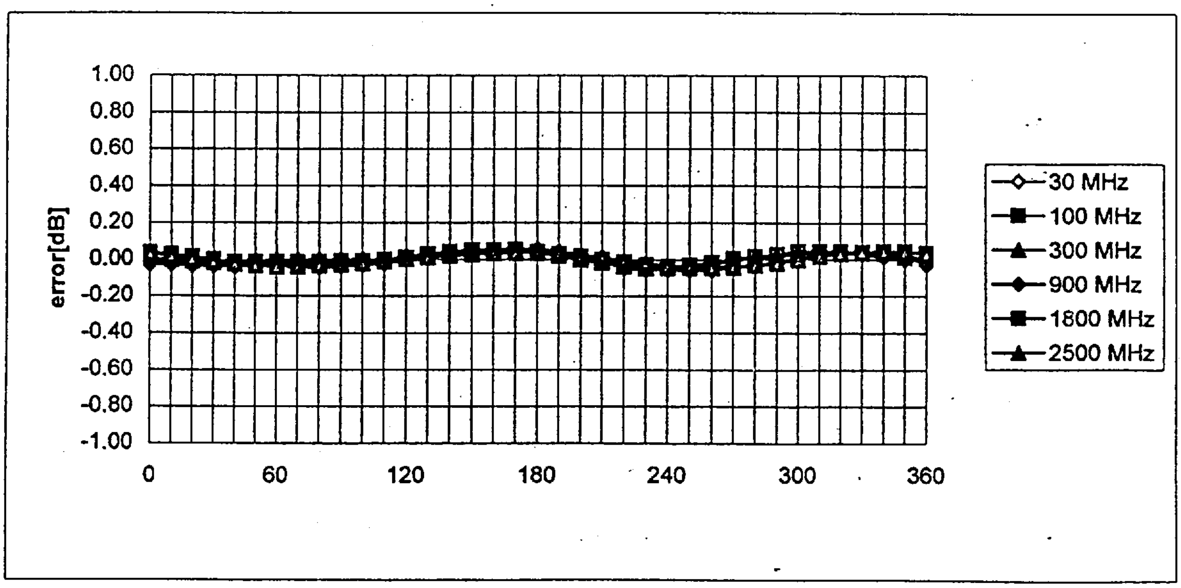
Receiving Pattern (φ), θ = 0°







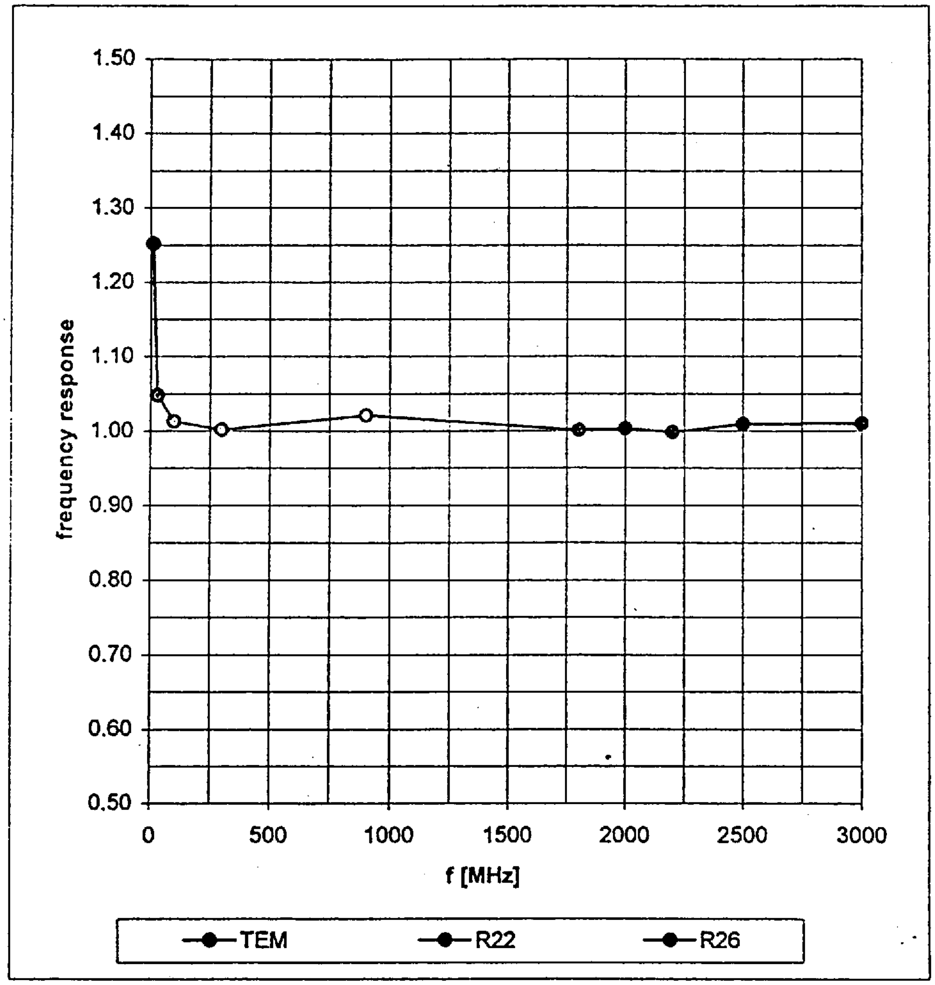
Isotropy Error (ϕ), θ = 0°



ET3DV5 SN:1333

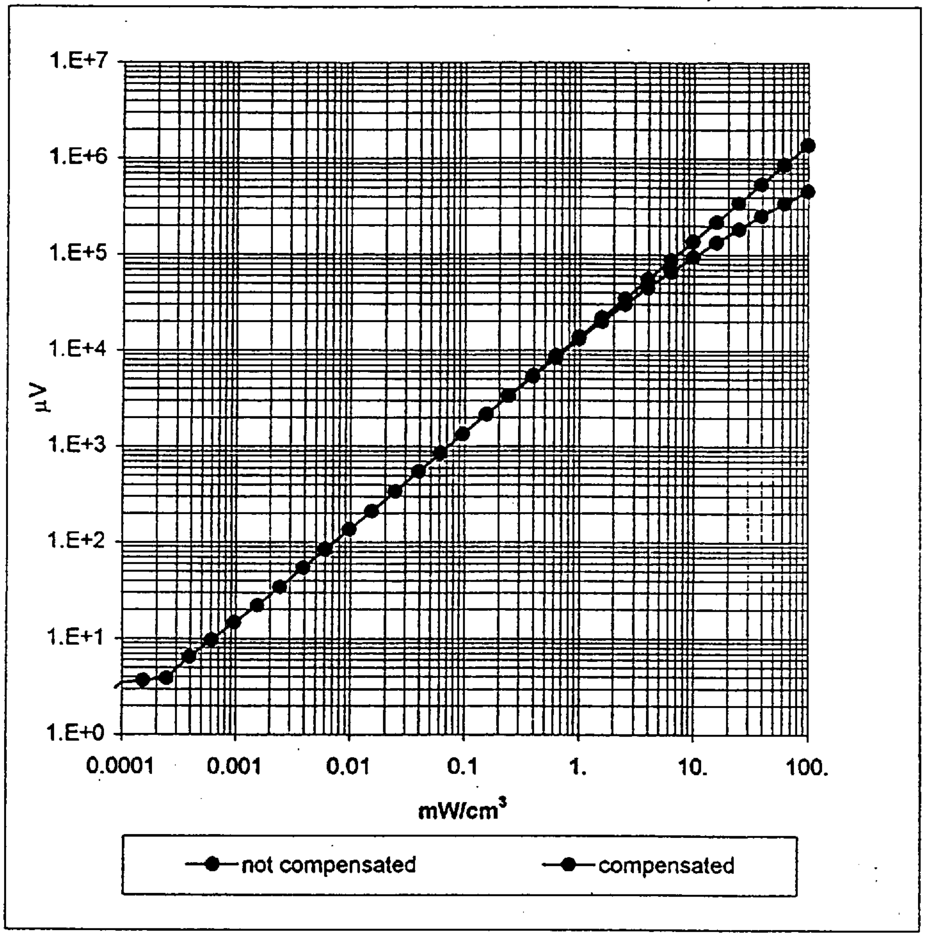
Frequency Response of E-Field

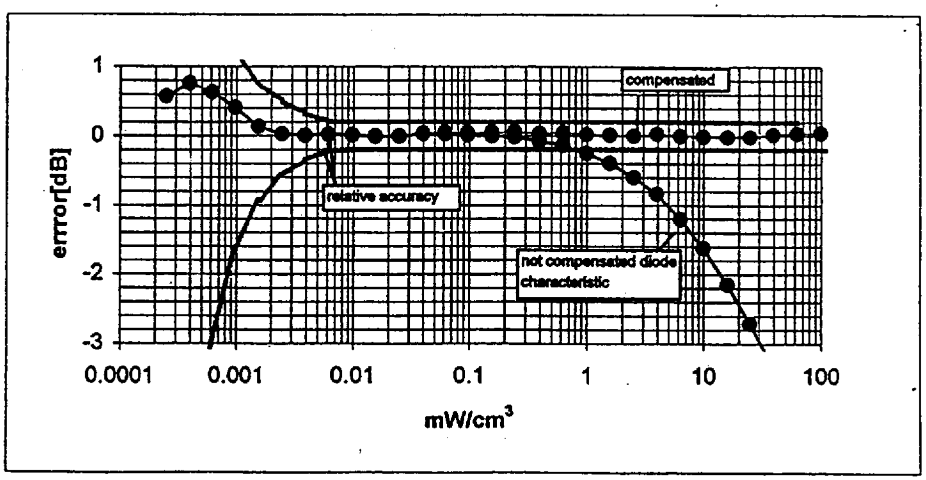
(TEM-Cell:ifi110, Waveguide R22, R26)



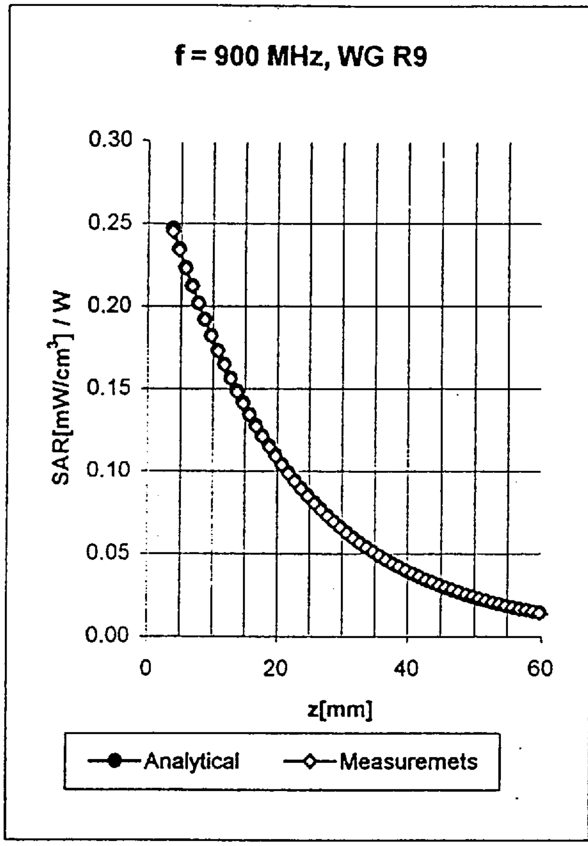
Dynamic Range f(SAR_{brain})

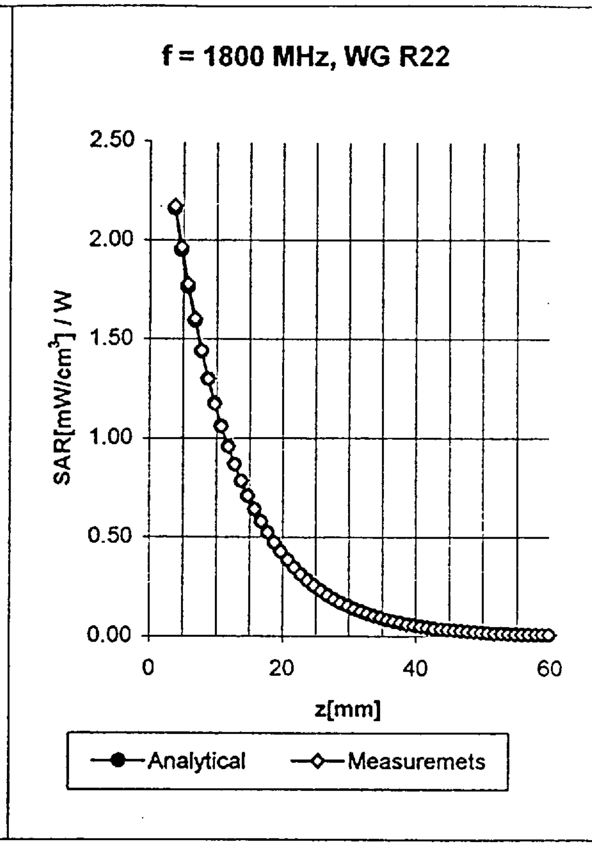
(TEM-Cell:ifi110)





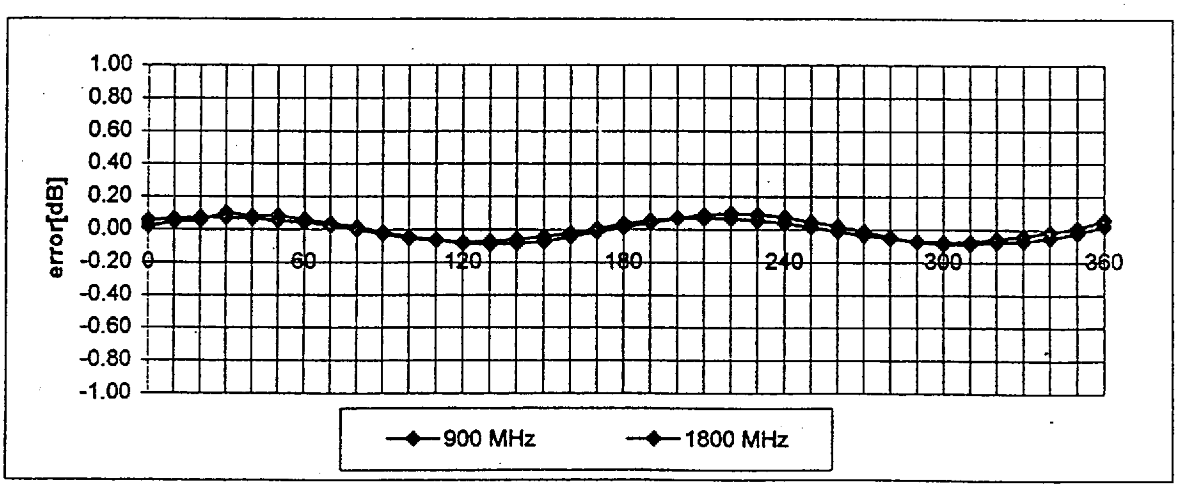
Conversion Factor Assessment





Receiving Pattern (ϕ)

(in brain tissue, z = 5 mm)



APPENDIX C – JUSTIFICATION LETTER FROM MANUFACTURER

Vocollect, Inc.
701 Rodi Road, Pittsburgh, PA 15235
412-829-8145 FAX 412-829-0972

February 22, 1999

Mr. Bill DeRouchey
Symbol Technologies, Inc.
2145 Hamilton Avenue
San Jose, CA 95125

H9PLA3020

Dear Bill:

1) Vocollect requests SAR testing for our Talkman Open product with the Symbol LA-3020-500 PC card radio.

2) We have added the Symbol radio to our BOM.

3) The measured distance from the skin to the antenna is at minimum 2.1 inches. The distance from the antenna to the inside of the case is 1.70 inches, and the product is mounted on a padded belt of at least 0.40 inch thickness (0.45+ inches typical). A second strap on the outside of padded belt secures the unit, so the full padding width (and probably more) is between the antenna and the skin.

4) We have added a sketch of the antenna orientation inside the Talkman Open.

5) Our human duty cycle is nominally 7 hours of operation per 24 hours, but is sometimes nominally worn for 8 hours per 24 hours (some workers don't remove the belt during breaks and lunch). Normal workweek is 40 or 44 hours per 7 days. Warehouse order pickers normally get a ½ hour lunch and two ¼ hour breaks. Per my email, we are interested in knowing how the sporadic nature of spread spectrum traffic, which is different than telephone protocols like CDMA and TDMA, is accounted for in the SAR measurement tests. Can we account in the tests that the level of transmitted traffic in our typical applications is far less than the level of transmitted traffic in other applications even on spread spectrum, such as voice over IP phones? i.e. Is the transmitter loaded using ping, or some other application? How often do transmissions occur? What size packets? Or is a carrier wave used?

6) Per our conversation, we have a customer expressing interest in Vocollect supporting a Symbol network. If these talks continue, we may at the last minute switch the SAR test to the 1 Mbps radio, to avoid any doubt we can support a Spring protocol network. You are now checking to see if you can supply us with the Spring protocol firmware now for the 2 Mbps radios, to mitigate this concern.

7) Since the SAR requirements are new, I am very interested in observing the tests and getting direct feedback from the testing organization.

Sincerely yours,

Jim Logan
Director, New Products

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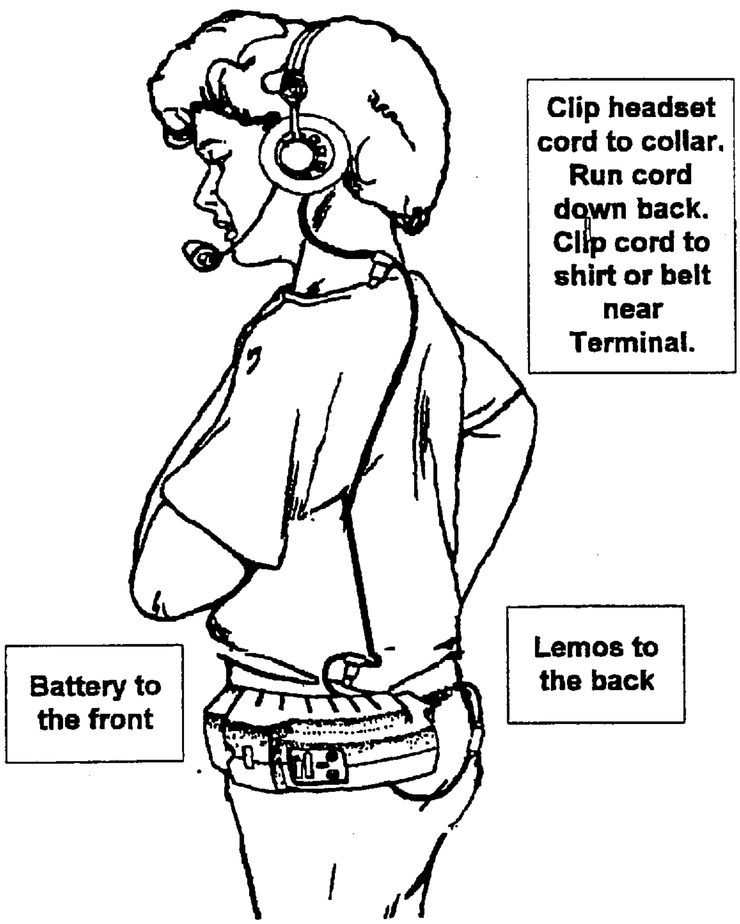
Wearing a Talkman and Headset

The following is the recommended method of wearing the Talkman and headset to minimize snagging the headset cord, and therefore damage to equipment or user.



- Wear the Talkman with the connectors facing backward and the battery facing forward. The headset cord should be routed up the user's back to keep it out of the way.
- Trap the headset cord behind the Talkman mounting "tongue" on the belt.
- Use one clip to attach the headset cord to the user's clothing or the Talkman belt at waist level. Use the other clip to attach the headset cord at shoulder level.
- The pronounced cord loop behind the Talkman is there to show the correct routing of the cord. **When wearing Talkman properly, this loop should be minimized.**

Talkman Open – 2.4 GHz Symbol Radio Information

Vocollect Antenna Specifications

Type:	Dipole
Gain:	2 dBi
Polarization:	Circular
Physical description:	Implemented on flat and rigid printed circuit board, internally mounted, parallel to the belt mounting loop.
Min distance from skin:	2.1 inches (1.70 inches to inside to belt loop plus 0.40 inches of padded belt)

Table 1: Bill of Materials- Talkman Open – Symbol Radio and Antenna

Item	Qty	Vocollect Part #	Vendor Part #	Supplier	Description
1	1	656022		Austin Antenna	ANTENNA PCB
2	1	606012	90174601	Huber-Suhner	CABLE ASSY, ANTENNA
3	1		LA-3020-500	Symbol	2 OR 1 MBPS RADIO, 500 mW

Image 1: 2.4 GHz Antenna PC Board

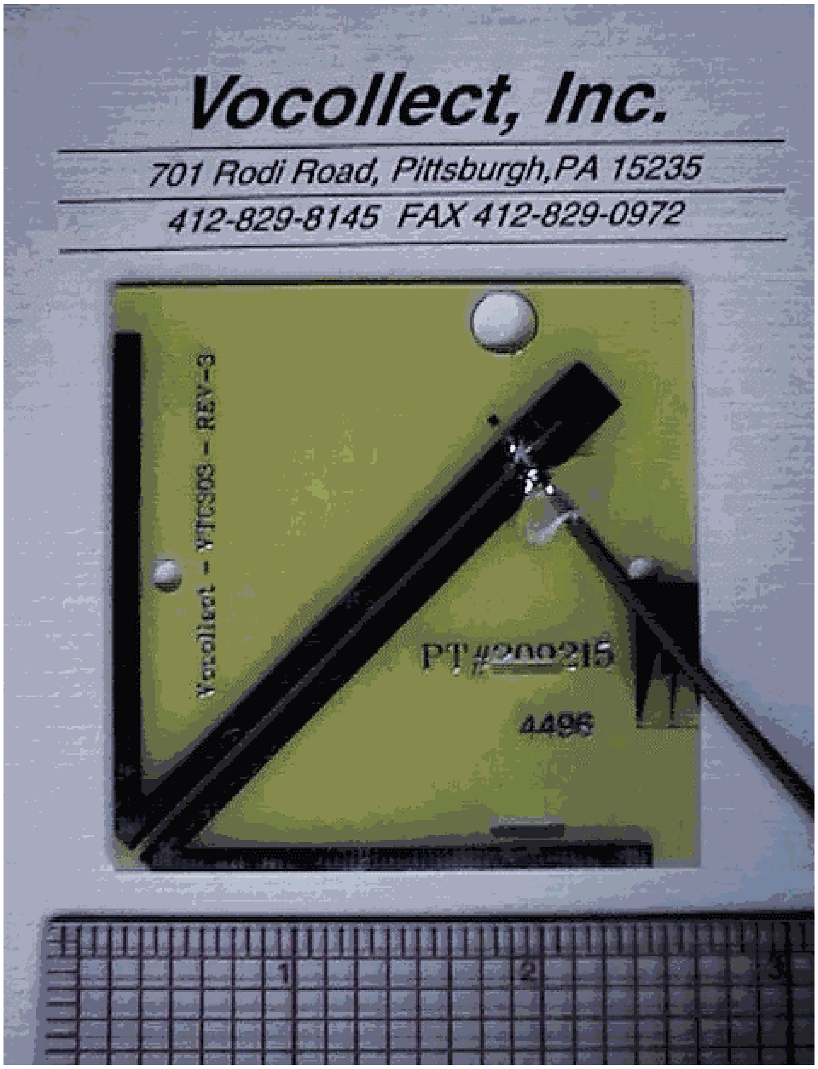


IMAGE 2: Beltworn Terminal - Drawing

IMAGE 3: Beltworn Terminal

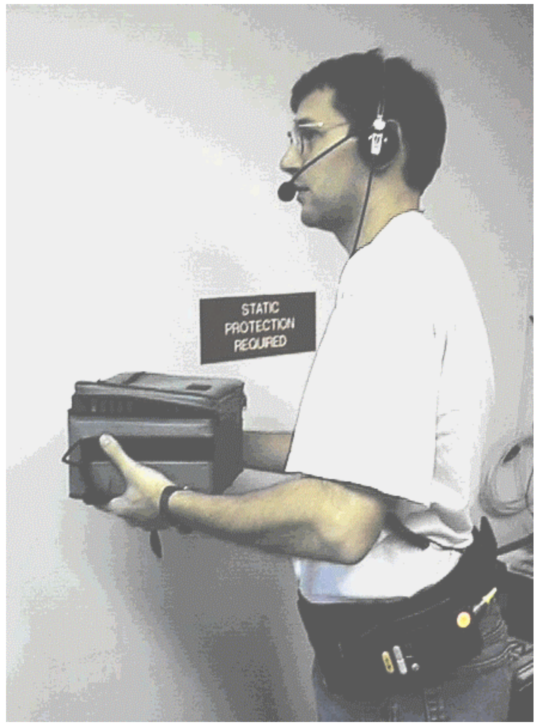


IMAGE 4: Drawing of Antenna Placement Inside Unit.

The antenna is mounted in the plane parallel to the belt loop and waist, 1.70 inches away from the belt loop used to connect the terminal to the padded mounting belt. Including the belt thickness, the radio is at least 2.1 inches distant from the skin.

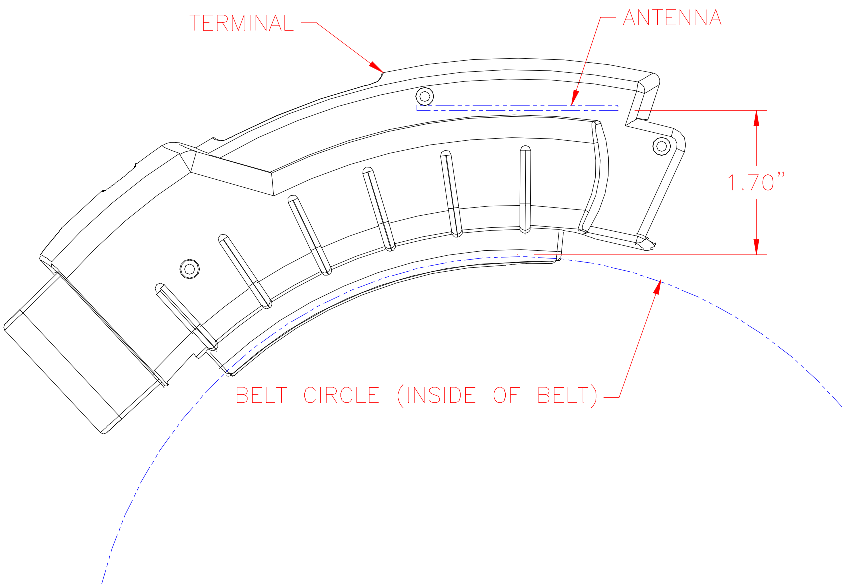


IMAGE 5: The unit mounts on a padded belt ½" thick.

The unit is connected to the belt be a secondary strap secured to the belt. The full width of the main padded belt remains between the terminal and user's body.