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**SAR Test Report****Report Number: M040826 - TAIT ELECTRONICS -  
TPAH5A****Test Sample:** Handheld Transceiver  
**Model Number:** TPAH5A  
**Tested For:** Tait Electronics  
**FCC ID:** CASTPAH5A**Date of Issue:** 24<sup>th</sup> September 2004

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## CONTENTS

<b>1.0</b>	<b>GENERAL INFORMATION.....</b>	<b>3</b>
<b>2.0</b>	<b>DESCRIPTION OF DEVICE.....</b>	<b>4</b>
2.1	Description of Test Sample .....	4
2.2	Test sample Accessories .....	4
2.2.1	<i>Battery Types.....</i>	4
2.2.2	<i>Belt Clip.....</i>	4
2.2.3	<i>Pouch.....</i>	4
2.2.4	<i>Headset Output.....</i>	4
2.3	Test Signal, Frequency and Output Power.....	6
2.4	Battery Status.....	7
<b>2.5</b>	<b>DETAILS OF TEST LABORATORY.....</b>	<b>7</b>
2.5.1	<i>Location.....</i>	7
2.5.2	<i>Accreditations.....</i>	7
2.5.3	<i>Environmental Factors .....</i>	7
<b>3.0</b>	<b>DESCRIPTION OF SAR MEASUREMENT SYSTEM.....</b>	<b>8</b>
3.1	Probe Positioning System .....	8
3.2	E-Field Probe Type and Performance .....	8
3.3	Data Acquisition Electronics .....	8
3.4	Calibration and Validation Procedures and Data.....	8
3.4.1	<i>Validation Results @ 450MHz.....</i>	8
3.4.2	<i>Deviation from reference validation values .....</i>	9
3.4.3	<i>Liquid Depth 15cm.....</i>	9
3.5	Phantom Properties (Size, Shape, Shell Thickness) .....	10
3.6	Tissue Material Properties.....	11
3.6.1	<i>Liquid Temperature and Humidity .....</i>	11
3.7	Simulated Tissue Composition Used for SAR Test .....	12
3.8	Device Holder for DASY4.....	12
<b>4.0</b>	<b>SAR MEASUREMENT PROCEDURE USING DASY4.....</b>	<b>13</b>
<b>5.0</b>	<b>MEASUREMENT UNCERTAINTY.....</b>	<b>14</b>
<b>6.0</b>	<b>EQUIPMENT LIST AND CALIBRATION DETAILS.....</b>	<b>16</b>
<b>7.0</b>	<b>OET BULLETIN 65 – SUPPLEMENT C TEST METHOD.....</b>	<b>17</b>
7.1	Description of the Test Positions (Belt Clip and In front of face).....	17
7.1.1	<i>“Belt Clip Position”.....</i>	17
7.1.2	<i>“Belt Clip Position with Pouch” .....</i>	17
7.1.3	<i>“Belt Clip Position with Speaker Microphone” .....</i>	17
7.1.4	<i>“Face Position” .....</i>	17
7.1.5	<i>“Face Position with Speaker Microphone” .....</i>	17
7.2	List of All Test Cases (Antenna In/Out, Test Frequencies, User Modes).....	18
7.3	FCC RF Exposure Limits for Occupational/ Controlled Exposure.....	18
7.4	FCC RF Exposure Limits for Un-controlled/Non-occupational .....	18
<b>8.0</b>	<b>SAR MEASUREMENT RESULTS .....</b>	<b>20</b>
<b>9.0</b>	<b>COMPLIANCE STATEMENT .....</b>	<b>22</b>
<b>APPENDIX A1</b>	<b>TEST SAMPLE PHOTOGRAPHS .....</b>	<b>23</b>
<b>APPENDIX A2</b>	<b>TEST SETUP PHOTOGRAPHS .....</b>	<b>24</b>
<b>APPENDIX A3</b>	<b>TEST SETUP PHOTOGRAPHS .....</b>	<b>25</b>
<b>APPENDIX A4</b>	<b>TEST SET UP PHOTOGRAPHS .....</b>	<b>26</b>
<b>APPENDIX A5</b>	<b>TEST SET UP PHOTOGRAPHS .....</b>	<b>27</b>
<b>APPENDIX A6</b>	<b>TEST SET UP PHOTOGRAPHS .....</b>	<b>28</b>
<b>APPENDIX B</b>	<b>PLOTS OF THE SAR MEASUREMENTS .....</b>	<b>29</b>
<b>APPENDIX C</b>	<b>SAR TESTING EQUIPMENT CALIBRATION CERTIFICATE ATTACHMENTS .....</b>	<b>70</b>

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**SAR EVALUATION**  
**Tait Electronics Handheld Transceiver**  
**Model: TPAH5A**  
**Report Number: M040826 - TAIT ELECTRONICS - TPAH5A**  
**FCC ID: CASTPAH5A**

## 1.0 GENERAL INFORMATION

**Test Sample:** Handheld Transceiver  
**Device Category:** Portable  
**Test Device:** Production Unit  
**Model Number:** TPAH5A  
**FCC ID:** CASTPAH5A  
**RF exposure Category:** General Population/Uncontrolled

**Manufacturer:** Tait Electronics Ltd  
**Address:** 555 Wairakei Road, Christchurch New Zealand  
**Phone:** +64 3 357 0810  
**Fax:** +64 3 357 9269

**Test Standard/s:** Evaluating Compliance with FCC Guidelines For Human Exposure to Radiofrequency Electromagnetic Fields Supplement C (Edition 01-01) to OET Bulletin 65 (Edition 97-01)

**Statement Of Compliance:** The Tait Electronics Handheld Transceiver model TPAH5A Complied with the FCC Occupational/Controlled RF exposure limits of 8.0mW/g.

**Test Dates:** 10<sup>th</sup> to 14<sup>th</sup> September 2004

**Tested for:** Tait Electronics  
**Address:** 555 Wairakei Road, Christchurch, New Zealand  
**Contact:** Bruce Jensen  
**Phone:** +64 3 358 1026

**Test Officer:**   
**Peter Jakubiec**

**Authorised Signature:**   
**Aaron Sargent**  
B. Eng

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**SAR EVALUATION**  
**Tait Electronics Handheld Transceiver**  
**Model: TPAH5A**  
**Report Number: M040826 - TAIT ELECTRONICS - TPAH5A**

## 2.0 DESCRIPTION OF DEVICE

### 2.1 Description of Test Sample

The device tested was a Tait Electronics Handheld Transceiver operating in the 400 to 470MHz frequency band. It has an integral antenna and was tested in the Face and Belt-Clip configurations of the phantom.

Operating Mode during Testing	: Continuous Wave 100% duty cycle
Operating Mode production sample	: 50% duty cycle
Modulation Scheme	: Direct Frequency Modulation
Device Power Rating for test sample and identical production unit	: 4 Watts
Antenna type	: Helical
Applicable Head Configurations	: None
Applicable Body Worn-Configurations	: Belt-Clip and Face Position
Battery Options	: None

## 2.2 Test sample Accessories

### 2.2.1 Battery Types

A NiMh battery is used to power the Tait Electronics Handheld Transceiver Model: TPAB1A. The maximum rated power is 4W in the 400-470 MHz frequency band. SAR measurements were performed with a standard battery.

### 2.2.2 Belt Clip

One type of metallic belt clip is sold with the device. The belt clip is fixed to the back of the device and provides a spacing of 15 mm between the device and flat phantom. This metallic belt-clip was attached to the device during testing in the Belt-Clip position.

### 2.2.3 Pouch

A leather pouch is supplied with the device. The pouch provides a spacing of 40 mm between the device and flat phantom. The speaker microphone cable was connected during testing in the Belt-Clip with pouch position.

### 2.2.4 Headset Output

The device has a headset output to which a supplied Hands free speaker/microphone was connected to the device during all testing in the belt-clip position. See following photograph.

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**Photos of Accessories**

Microphone



Pouch and Belt loop



Antennas and Belt -Clip



Pouch and Belt loop



Two types of antennas are used with the TPAB1A both Whip and Mini-Helical. A tuned antenna is used for each of the frequency ranges 400, 435 and 470MHz. For SAR measurements all antennas were tested for all test positions.

**Table 1: Antenna Label Designation**

Frequency	Antenna Type	Designator
400MHz	Whip	Ant Low
435MHz	Whip	Ant Mid
470MHz	Whip	Ant High
400MHz	Mini-Helical	Ant Mini Low
435MHz	Mini-Helical	Ant Mini Mid
470MHz	Mini-Helical	Ant Mini High

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### 2.3 Test Signal, Frequency and Output Power

The Handheld Transceiver operates within the 400 to 470MHz frequency band.

The fixed frequency channels used in the testing are shown in Table 2. Excluding the speaker/microphone and other device accessories there were no wires or other connections to the Handheld Transceiver during the SAR measurements.

At the beginning and completion of the SAR tests the EUT was modified to accept a standard RF connector at the RF output of the device. The conducted power of the device was subsequently measured with a calibrated Power Meter. The results of this measurement taken after batteries were fitted are listed in table 2.

**Table 2: Frequency and Output Power**

<b>Channel</b>	<b>Channel Frequency MHz</b>	<b>Maximum Conducted Output Power Measured</b>
1	400	35.83
2	435	35.78
3	470	35.95

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## 2.4 Battery Status

The device battery was fully charged prior to commencement of measurement. Each SAR test was completed within 30 minutes. The battery condition was monitored by measuring the RF field at a defined position inside the phantom before the commencement of each test and again after the completion of the test. It was not possible to perform conducted power measurements at the output of the device, at the beginning and end of each scan due to lack of a suitable antenna port. The uncertainty associated with the power drift was less than 12% and was factored into the final SAR results.

## 2.5 DETAILS OF TEST LABORATORY

### 2.5.1 Location

EMC Technologies Pty Ltd - ACN/ABN: 82057105549  
57 Assembly Drive  
Tullamarine, (Melbourne) Victoria  
Australia 3043

**Telephone:** +61 3 9335 3333  
**Facsimile:** +61 3 9338 9260  
**email:** [melb@emctech.com.au](mailto:melb@emctech.com.au)  
**website:** [www.emctech.com.au](http://www.emctech.com.au)

### 2.5.2 Accreditations

EMC Technologies Pty. Ltd. is accredited by the National Association of Testing Authorities, Australia (NATA). **NATA Accredited Laboratory Number: 5292**

EMC Technologies Pty Ltd is NATA accredited for the following EMR standards:

<b>AS/NZS 2772.2:</b>	RF and microwave radiation hazard measurement
<b>ARPANSA:</b>	Radiation Protection Standard, maximum exposure to RF fields.
<b>ACA:</b>	Electromagnetic Radiation (Human Exposure) Standard :2003
<b>FCC:</b>	Guidelines for Human Exposure to RF Electromagnetic Field
<b>CENELEC:</b>	EN50361:2002
<b>IEEE:</b>	1528:2003

The scope of the NATA accreditation does not cover the SAR measurements in this report.

Refer to NATA website [www.nata.asn.au](http://www.nata.asn.au) for the full scope of accreditation.

### 2.5.3 Environmental Factors

The measurements were performed in a shielded room with no background network signals. The temperature in the laboratory was controlled to within  $20 \pm 1$  °C, the humidity was in the range 42% to 44%. The liquid parameters were measured daily prior to the commencement of each test. Tests were performed to check that reflections within the environment did not influence the SAR measurements. The noise floor of the DASY4 SAR measurement system using the SN1377 probe is less than 5µV in both air and liquid mediums.

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### 3.0 DESCRIPTION OF SAR MEASUREMENT SYSTEM

#### 3.1 Probe Positioning System

The measurements were performed with the state of the art automated near-field scanning system **DASY4 V4.2 Build 37** from Schmid & Partner Engineering AG (SPEAG). The system is based on a high precision 6-axis robot (working range greater than 1.1m), which positions the SAR measurement probes with a positional repeatability of better than  $\pm 0.02$  mm. The DASY4 fully complies with the OET65 C (01-01), IEEE 1528 and EN50361 SAR measurement requirements.

#### 3.2 E-Field Probe Type and Performance

The SAR measurements were conducted with the dosimetric probe ET3DV6 Serial: 1377 (manufactured by SPEAG) designed in the classical triangular configuration and optimised for dosimetric evaluation. The probe has been calibrated and found to be accurate to better than  $\pm 0.25$  dB. The probe is suitable for measurements close to material discontinuity at the surface of the phantom. The sensors of the probe are directly loaded with Schottky diodes and connected via highly resistive lines (length = 300 mm) to the data acquisition unit.

#### 3.3 Data Acquisition Electronics

The data acquisition electronics (DAE3) consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain switching multiplexer, a fast 16 bit AD-converter and a command decoder and control logic unit. The input impedance of the DAE3 box is 200 M $\Omega$ ; the inputs are symmetrical and floating. Common mode rejection is above 80dB. Transmission to the PC-card is accomplished through an optical downlink for data and status information as well as an optical uplink for commands and the clock.

The mechanical probe-mounting device includes two different sensor systems for frontal and sideways probe contacts. They are used for mechanical surface detection and probe collision detection.

#### 3.4 Calibration and Validation Procedures and Data

Prior to the SAR assessment, the system validation kit was used to verify that the DASY4 was operating within its specifications. The validation was performed at 450 MHz with the SPEAG D450V2 calibrated dipole.

The validation dipoles are highly symmetric and matched at the centre frequency for the specified liquid and distance to the phantom. The accurate distance between the liquid surface and the dipole centre is achieved with a distance holder that snaps onto the dipole.

System validation is performed by feeding a known power level into a reference dipole, set at a known distance from the phantom. The measured SAR is compared to the theoretically derived level.

##### 3.4.1 Validation Results @ 450MHz

The following table lists the dielectric properties of the tissue simulating liquid measured prior to each SAR validation. The results of the validation for each day are listed in columns 4 and 5. The forward power into the reference dipole for each SAR validation was adjusted to 250mW.

**Table 3: Validation Results (Dipole: SPEAG D450V2 SN: 1009)**

1. Validation Date	2. $\epsilon_r$ (measured)	3. $\sigma$ (mho/m) (measured)	4. Measured SAR 1g (mW/g)	5. Measured SAR 10g (mW/g)
10 <sup>th</sup> Sept 2004	43.9	0.87	1.32	0.852
11 <sup>th</sup> Sept 2004	44.0	0.87	1.32	0.849
13 <sup>th</sup> Sept 2004	43.2	0.89	1.34	0.863

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### 3.4.2 Deviation from reference validation values

The reference SAR values are derived using a reference dipole and flat phantom suitable for a centre frequency of 450MHz. These reference SAR values are obtained from the IEEE Std 1528-2003 and are normalized to 1W.

The SPEAG calibration reference SAR value is the SAR validation result obtained in a specific dielectric liquid using the validation dipole (D450V2) during calibration. The measured one-gram SAR should be within 10% of the expected target reference values shown in table 4 below.

**Table 4: Deviation from reference validation values**

Frequency and Date	Measured SAR 1g (mW/g)	Measured SAR 1g (Normalized to 1W)	SPEAG Calibration reference SAR Value 1g (mW/g )	Deviation From SPEAG (1g)	IEEE Std 1528 reference SAR value 1g (mW/g)	Deviation From IEEE (1g)
450MHz 10 <sup>th</sup> Sept 2004	1.32	5.28	4.97	6.2%	4.9	7.8%
450MHz 11 <sup>th</sup> Sept 2004	1.32	5.28	4.97	6.2%	4.9	7.8%
450MHz 13 <sup>th</sup> Sept 2004	1.34	5.36	4.97	7.8%	4.9	9.4%

NOTE: All reference validation values are referenced to 1W input power.

### 3.4.3 Liquid Depth 15cm

During the SAR measurement process the liquid level was maintained to a level of a least 15cm with a tolerance of  $\pm 0.2$ cm.

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**3.5 Phantom Properties (Size, Shape, Shell Thickness)**

The phantom used during the validations was the “Flat Phantom” model: PO1A V4.4e from SPEAG. It is a strictly validation phantom with a single thickness of 6mm and was filled with the required tissue simulating liquid. The flat phantom support structures were all non-metallic and spaced more than one device width away in transverse directions.

For SAR testing in the body worn positions an AndreT phantom was used. The phantom thickness is 2.0mm+/-0.2 mm and the phantom was filled with the required tissue simulating liquid. Table 4 provides a summary of the measured phantom properties. *Refer to Appendix D Part 5, for details of SAM phantom thickness tolerance, corresponding dielectric properties, and loss tangent.*

**Table 5: Phantom Properties (300MHz-2500MHz)**

Phantom Properties	Requirement for specific EUT	Measured
Depth of Phantom		200mm
Width of flat section		320mm
Length of flat section		870mm
Thickness of flat section	2.0mm 60.2mm (flat section)	2.08 – 2.20mm
Dielectric Constant	<5.0	4.603 @ 300MHz (worst-case frequency)
Loss Tangent	<0.05	0.0379 @ 2500MHz (worst-case frequency)

**Photo 1: AndreT 2mm Flat Phantom**



**Photo 2: AndreT 2mm Flat Phantom**



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### 3.6 Tissue Material Properties

The dielectric parameters of the brain simulating liquid were measured prior to SAR assessment using the HP85070A dielectric probe kit and HP8714B Network Analyser. The actual dielectric parameters are shown in the following table.

**Table 6: Measured Brain Simulating Liquid Dielectric Values**

Frequency Band	$\epsilon_r$ (measured range)	$\epsilon_r$ (target)	$\sigma$ (mho/m) (measured range)	$\sigma$ (target)	$\rho$ kg/m <sup>3</sup>
450MHz	43.6-43.9	43.5 $\pm$ 5% (41.3 to 45.6)	0.87-0.89	0.87 $\pm$ 5% (0.83 to 0.91)	1000

**Table 7: Measured Brain Simulating Liquid Dielectric Values**

Frequency Band	$\epsilon_r$ (measured range)	$\epsilon_r$ (target)	$\sigma$ (mho/m) (measured range)	$\sigma$ (target)	$\rho$ kg/m <sup>3</sup>
400MHz	44.8	44.2 $\pm$ 5% (42.0 to 46.4)	0.85	0.87 $\pm$ 5% (0.83 to 0.91)	1000
435MHz	44.0	43.7 $\pm$ 5% (41.5 to 45.9)	0.88	0.87 $\pm$ 5% (0.83 to 0.91)	1000
470MHz	43.2	43.4 $\pm$ 5% (41.2 to 45.6)	0.91	0.88 $\pm$ 5% (0.84 to 0.92)	1000

**Table 8: Measured Body Simulating Liquid Dielectric Values**

Frequency Band	$\epsilon_r$ (measured range)	$\epsilon_r$ (target)	$\sigma$ (mho/m) (measured range)	$\sigma$ (target)	$\rho$ kg/m <sup>3</sup>
400MHz	58.3-58.8	57.2 $\pm$ 5% (54.3 to 60.1)	0.89	0.93 $\pm$ 5% (0.88 to 0.98)	1000
435MHz	57.6-58.1	56.9 $\pm$ 5% (54.1 to 59.7)	0.92	0.94 $\pm$ 5% (0.89 to 0.99)	1000
470MHz	57.1-57.7	56.5 $\pm$ 5% (53.7 to 59.3)	0.95	0.94 $\pm$ 5% (0.89 to 0.99)	1000

NOTE: The brain and muscle liquid parameters were within the required tolerances of  $\pm$ 5%.

#### 3.6.1 Liquid Temperature and Humidity

The humidity and dielectric/ambient temperatures are recorded during the assessment of the tissue material dielectric parameters. The difference between the ambient temperature of the liquid during the dielectric measurement and the temperature during tests was less than  $|2|^\circ\text{C}$ .

**Table 9: Temperature and Humidity recorded for each day**

Date	Ambient Temperature ( $^\circ\text{C}$ )	Liquid Temperature ( $^\circ\text{C}$ )	Humidity (%)
10 <sup>th</sup> Sept 2004	20.8	20.3	47
11 <sup>th</sup> Sept 2004	20.4	19.7	47
13 <sup>th</sup> Sept 2004	22.0	20.0	45

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**3.7 Simulated Tissue Composition Used for SAR Test**

The tissue simulating liquids are created prior to the SAR evaluation and often require slight modification each day to obtain the correct dielectric parameters.

**Table 10: Tissue Type: Brain @ 450MHz**  
Volume of Liquid: 60 Litres

Approximate Composition	% By Weight
Distilled Water	38.56
Salt	3.95
Sugar	56.32
HEC	0.98
Bactericide	0.19

**Table 11: Tissue Type: Muscle @ 450MHz**  
Volume of Liquid: 60 Litres

Approximate Composition	% By Weight
Distilled Water	51.16
Salt	1.49
Sugar	46.78
HEC	0.52
Bactericide	0.05

\*Refer "OET Bulletin 65 97/01 P38"

**3.8 Device Holder for DASY4**

The DASY4 device holder supplied by SPEAG is designed to cope with different positions given in the standard. It has two scales for the device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear openings). The rotation centres for both scales is the ear opening. Thus the device needs no repositioning when changing the angles.

The DASY4 device holder is made of low-loss material having the following dielectric parameters: relative permittivity  $\epsilon=3$  and loss tangent  $\delta=0.02$ . The amount of dielectric material has been reduced in the closest vicinity of the device, to reduce the influence on the clamp on the test results.

A foam spacer is used to raise the device above the clamp of the device holder to minimise any affect on the radiation characteristics of the device. In cases where foam is not used the device is mounted so that the antenna is unobstructed.

*Refer to Appendix A2 for photograph of device positioning.*

#### 4.0 SAR MEASUREMENT PROCEDURE USING DASY4

The SAR evaluation was performed with the SPEAG DASY4 system. A summary of the procedure follows:

- a) A measurement of the SAR value at a fixed location is used as a reference value for assessing the power drop of the EUT. The SAR at this point is measured at the start of the test and then again at the end of the test.
- b) The SAR distribution at the exposed side of the head or the flat section of the flat phantom is measured at a distance of 3.9 mm from the inner surface of the shell. The area covers the entire dimension of the head and the horizontal grid spacing is 20 mm x 20 mm. The actual Area Scan has dimensions of 81mm x 161mm surrounding the test device. Based on this data, the area of the maximum absorption is determined by Spline interpolation.
- c) Around this point, a volume of 30 mm x 30 mm x 30 mm is assessed by measuring 7 x 7 x 7 points. On the basis of this data set, the spatial peak SAR value is evaluated with the following procedure:
  - (i) The data at the surface are extrapolated, since the centre of the dipoles is 2.7 mm away from the tip of the probe and the distance between the surface and the lowest measuring point is 1.3 mm. The extrapolation is based on a least square algorithm. A polynomial of the fourth order is calculated through the points in z-axes. This polynomial is then used to evaluate the points between the surface and the probe tip.
  - (ii) The maximum interpolated value is searched with a straightforward algorithm. Around this maximum the SAR values averaged over the spatial volumes (1 g and 10 g) are computed using the 3D-Spline interpolation algorithm. The 3D-Spline is composed of three one-dimensional splines with the "Not a knot"- condition (in x, y and z-direction). The volume is integrated with the trapezoidal – algorithm. One thousand points (10 x 10 x 10) are interpolated to calculate the averages.
  - (iii) All neighbouring volumes are evaluated until no neighbouring volume with a higher average value is found.
  - (iv) The SAR value at the same location as in Step (a) is again measured

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## 5.0 MEASUREMENT UNCERTAINTY

The uncertainty analysis is based on the template listed in the IEEE Std 1528-2003 for both Handset SAR tests and Validation uncertainty. The measurement uncertainty of a specific device is evaluated independently and the total uncertainty for both evaluations (95% confidence level) must be less than 30%.

**Table 12: Uncertainty Budget for DASY4 Version V4.2 Build 37 – EUT SAR test**

a	b	c	d	e= f(d,k)	f	g	h=cx/f/e	i=cxg/e	k
Uncertainty Component	Sec.	Tol. (%)	Prob. Dist.	Div.	C <sub>i</sub> (1g)	C <sub>i</sub> (10g)	1g u <sub>i</sub> (%)	10g u <sub>i</sub> (%)	v <sub>i</sub>
<b>Measurement System</b>									
Probe Calibration (k=1) (numerical calibration)	E.2.1	4.8	N	1	1	1	4.8	4.8	∞
Axial Isotropy	E.2.2	4.7	R	1.73	0.707	0.707	1.9	1.9	∞
Hemispherical Isotropy	E.2.2	9.6	R	1.73	0.707	0.707	3.9	3.9	∞
Boundary Effect	E.2.3	1	R	1.73	1	1	0.6	0.6	∞
Linearity	E.2.4	4.7	R	1.73	1	1	2.7	2.7	∞
System Detection Limits	E.2.5	1	R	1.73	1	1	0.6	0.6	∞
Readout Electronics	E.2.6	1	N	1	1	1	1.0	1.0	∞
Response Time	E.2.7	0.8	R	1.73	1	1	0.5	0.5	∞
Integration Time	E.2.8	2.6	R	1.73	1	1	1.5	1.5	∞
RF Ambient Conditions	E.6.1	0.05	R	1.73	1	1	0.0	0.0	∞
Probe Positioner Mechanical Tolerance	E.6.2	0.4	R	1.73	1	1	0.2	0.2	∞
Probe Positioning with respect to Phantom Shell	E.6.3	2.9	R	1.73	1	1	1.7	1.7	∞
Extrapolation, interpolation and Integration Algorithms for Max. SAR Evaluation	E.5	1	R	1.73	1	1	0.6	0.6	∞
<b>Test Sample Related</b>									
Test Sample Positioning	E.4.2	1.61	N	1	1	1	1.6	1.6	11
Device Holder Uncertainty	E.4.1	3.34	N	1	1	1	3.3	3.3	7
Output Power Variation – SAR Drift Measurement	6.6.2	12	R	1.73	1	1	6.9	6.9	∞
<b>Phantom and Tissue Parameters</b>									
Phantom Uncertainty (shape and thickness tolerances)	E.3.1	4	R	1.73	1	1	2.3	2.3	∞
Liquid Conductivity – Deviation from target values	E.3.2	5	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Conductivity – Measurement uncertainty	E.3.3	4.3	N	1	0.64	0.43	2.8	1.8	5
Liquid Permittivity – Deviation from target values	E.3.2	5	R	1.73	0.6	0.49	1.7	1.4	∞
Liquid Permittivity – Measurement uncertainty	E.3.3	4.3	N	1	0.6	0.49	2.6	2.1	5
Combined standard Uncertainty			RSS				12.0	11.6	154
Expanded Uncertainty (95% CONFIDENCE LEVEL)			k=2				24.0	23.3	

Estimated total measurement uncertainty for the DASY4 measurement system was  $\pm 12\%$ . The extended uncertainty (K = 2) was assessed to be  $\pm 24\%$  based on 95% confidence level. The uncertainty is not added to the measurement result.

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**Table 13: Uncertainty Budget for DASY4 Version V4.2 Build 37 - Validation**

a	b	c	d	e= f(d,k)	f	g	h=cxf/e	i=cxg/e	k
Uncertainty Component	Sec.	Tol. (6%)	Prob. Dist.	Div.	C <sub>i</sub> (1g)	C <sub>i</sub> (10g)	1g u <sub>i</sub> (6%)	10g u <sub>i</sub> (6%)	v <sub>i</sub>
<b>Measurement System</b>									
Probe Calibration (k=1) (standard calibration)	E.2.1	4.4	N	1	1	1	4.4	4.4	∞
Axial Isotropy	E.2.2	4.7	R	1.73	1	1	2.7	2.7	∞
Hemispherical Isotropy	E.2.2	0	R	1.73	1	1	0.0	0.0	∞
Boundary Effect	E.2.3	8.3	R	1.73	1	1	4.8	4.8	∞
Linearity	E.2.4	4.7	R	1.73	1	1	2.7	2.7	∞
System Detection Limits	E.2.5	1	R	1.73	1	1	0.6	0.6	∞
Readout Electronics	E.2.6	1	N	1	1	1	1.0	1.0	∞
Response Time	E.2.7	0	R	1.73	1	1	0.0	0.0	∞
Integration Time	E.2.8	0	R	1.73	1	1	0.0	0.0	∞
RF Ambient Conditions	E.6.1	0.05	R	1.73	1	1	0.0	0.0	∞
Probe Positioner Mechanical Tolerance	E.6.2	0.4	R	1.73	1	1	0.2	0.2	∞
Probe Positioning with respect to Phantom Shell	E.6.3	2.9	R	1.73	1	1	1.7	1.7	∞
Extrapolation, interpolation and Integration Algorithms for Max. SAR Evaluation	E.5	3.9	R	1.73	1	1	2.3	2.3	∞
<b>Test Sample Related</b>									
Test Sample Positioning		1	R	1.73	1	1	0.6	0.6	∞
Device Holder Uncertainty		4.7	R	1.73	1	1	2.7	2.7	∞
<b>Phantom and Tissue Parameters</b>									
Phantom Uncertainty (shape and thickness tolerances)	E.3.1	4	R	1.73	1	1	2.3	2.3	∞
Liquid Conductivity – Deviation from target values	E.3.2	5	R	1.73	0.6	0.43	1.7	1.2	∞
Liquid Conductivity – Measurement uncertainty	E.3.3	10	N	1.73	0.6	0.43	3.5	2.5	5
Liquid Permittivity – Deviation from target values	E.3.2	5	R	1.73	0.6	0.49	1.7	1.4	∞
Liquid Permittivity – Measurement uncertainty	E.3.3	5	N	1.73	0.6	0.49	1.7	1.4	5
Combined standard Uncertainty			RSS				10.0	9.5	154
Expanded Uncertainty (95% CONFIDENCE LEVEL)			k=2				20.0	19.10	

Estimated total measurement uncertainty for the DASY4 measurement system was  $\pm 10.0\%$ . The extended uncertainty ( $K = 2$ ) was assessed to be  $\pm 20.0\%$  based on 95% confidence level. The uncertainty is not added to the Validation measurement result.

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## 6.0 EQUIPMENT LIST AND CALIBRATION DETAILS

**Table 14: SPEAG DASY4 Version 4.2 Build 37**

Equipment Type	Manufacturer	Model Number	Serial Number	Calibration Due	Used For this Test?
Robot - Six Axes	Staubli	RX90BL	N/A	Not applicable	Yes
Robot Remote Control	SPEAG	CS7MB	RX90B	Not applicable	Yes
SAM Phantom	SPEAG	N/A	1260	Not applicable	No
SAM Phantom	SPEAG	N/A	1060	Not applicable	No
Flat Phantom	SPEAG	PO1A V4.4e - 6mm	1003	Not Applicable	Yes
Data Acquisition Electronics	SPEAG	DAE3 V1	359	16-July-2004	No
Data Acquisition Electronics	SPEAG	DAE3 V1	442	09-Sept - 04	Yes
Probe E-Field - Dummy	SPEAG	DP1	N/A	Not applicable	No
Probe E-Field	SPEAG	ET3DV6	1380	18-July-2004	No
Probe E-Field	SPEAG	ET3DV6	1377	19-Sept - 04	Yes
Antenna Dipole 300 MHz	SPEAG	D300V2	1005	27- Nov-2005	No
Antenna Dipole 450 MHz	SPEAG	D450V2	1009	24-Jan-05	Yes
Antenna Dipole 900 MHz	SPEAG	D900V2	047	12-July-06	No
Antenna Dipole 1800 MHz	SPEAG	D1800V2	242	13-July-06	No
Antenna Dipole 2450 MHz	SPEAG	D2450V2	724	9-Nov-2004	No
RF Amplifier	Mini-Circuits	ZHL-42	N/A	Not applicable	Yes
RF Amplifier	Mini-Circuits	ZVE-8G	N/A	In test	No
Synthesized signal generator	Hewlett Packard	ESG-D3000A	GB37420238	In test	Yes
RF Power Meter Dual	Hewlett Packard	437B	3125012786	26-May-05	Yes
RF Power Sensor 0.01 - 18 GHz	Hewlett Packard	8481H	1545A01634	27-May-05	Yes
RF Power Meter Dual	Gigatronics	8542B	1830125	15-Jan-05	Yes
RF Power Sensor	Gigatronics	80301A	1828805	15-Jan-05	Yes
Network Analyser	Hewlett Packard	8714B	GB3510035	06-Sept-04	Yes
Dual Directional Coupler	Hewlett Packard	778D	1144 04700	In test	No

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## 7.0 OET BULLETIN 65 – SUPPLEMENT C TEST METHOD

### 7.1 Description of the Test Positions (Belt Clip and In front of face)

The accessories used with the EUT have the potential to change the SAR distribution. In order to characterise these accessories a number of test positions were devised.

SAR measurements were performed in the following positions:

1. Belt-Clip Position
2. Belt-Clip Position with Pouch
3. Belt-Clip Position with Speaker Microphone
4. Face Position
5. Face Position with Speaker Microphone

All test positions were measured in the flat section of the AndreT (PL870) phantom.  
*See Appendix A for photos of test positions.*

#### 7.1.1 “Belt Clip Position”

The device was tested in the 2.00mm flat section of the AndreT phantom for the “Belt Clip” position. A belt clip maintained a distance of approximately 15mm between the back of the device and the flat phantom. The Transceiver was placed at the flat section of the phantom and suspended until the Belt Clip touched the phantom. The belt clip was made of plastic and metallic parts and the device was connected with the hands free earpiece/microphone.

#### 7.1.2 “Belt Clip Position with Pouch”

The device was tested in the 2.00mm flat section of the AndreT phantom for the “Belt Clip with Pouch” position. A leather Pouch and Belt loop maintained a distance of approximately 40mm between the back of the device and the flat phantom. The Transceiver was placed at the flat section of the phantom and suspended until the Belt Clip touched the phantom. The belt loop was made of leather with metallic studs.

#### 7.1.3 “Belt Clip Position with Speaker Microphone”

The device was tested in the 2.00mm flat section of the AndreT phantom for the “Belt Clip” position. A belt clip maintained a distance of approximately 15mm between the back of the device and the flat phantom. The Transceiver was placed at the flat section of the phantom and suspended until the Belt Clip touched the phantom. The belt clip was made of plastic and metallic parts and the device was connected with the hands free earpiece/microphone.

#### 7.1.4 “Face Position”

The SAR evaluation was performed in the flat section of the AndreT phantom. The device was placed 25mm from the phantom, this position is equivalent to the device placed in front of the nose. The supporting hand was not used.

#### 7.1.5 “Face Position with Speaker Microphone”

The SAR evaluation was performed in the flat section of the AndreT phantom. The device was placed 25mm from the phantom with the speaker microphone connected. This position is equivalent to the device placed in front of the nose.

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**7.2 List of All Test Cases (Antenna In/Out, Test Frequencies, User Modes)**

The device has a fixed antenna. The SAR was measured at three test channels with the test sample operating at maximum power, as specified in section 2.3.

**7.3 FCC RF Exposure Limits for Occupational/ Controlled Exposure**

Spatial Peak SAR Limits For:	
Partial-Body:	8.0 mW/g (averaged over any 1g cube of tissue)
Hands, Wrists, Feet and Ankles:	20.0 mW/g (averaged over 10g cube of tissue)

**7.4 FCC RF Exposure Limits for Un-controlled/Non-occupational**

Spatial Peak SAR Limits For:	
Partial-Body:	1.6 mW/g (averaged over any 1g cube of tissue)
Hands, Wrists, Feet and Ankles:	4.0 mW/g (averaged over 10g cube of tissue)

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## 8.0 SAR MEASUREMENT RESULTS

The SAR values averaged over 1 g and 10 g tissue masses were determined for the sample device for the Face and Belt-Clip configurations of the phantom.

Table 15: SAR MEASUREMENT RESULTS–Belt-Clip positions

1. Test Position	2. Ant Type	3. Plot No.	4. Test Channel	5. Test Freq (MHz)	6. Measured 1g SAR Results (mW/g)	7. Measured 1g SAR Results (mW/g) Extrapolated to 50% Duty Cycle	8. Conducted Power measured Before Test	9. Conducted Power measured After Test	10. Measured Drift (dB)
	Low	1	1	400	3.94	1.97	35.53	35.27	0.26
Belt-Clip	Mid	2	2	435	4.34	2.17	35.58	35.22	0.36
	High	3	3	470	5.00	2.50	35.95	35.58	0.37
	Mini Low	4	1	400	2.11	1.06	35.52	35.23	0.29
	Mini Mid	5	2	435	2.61	1.31	35.57	35.29	0.28
	Mini High	6	3	470	2.58	1.29	35.83	35.51	0.32
Belt-Clip with	Low	1	1	400	2.03	1.02	35.65	35.37	0.28
Pouch	Mid	2	2	435	1.70	0.85	35.67	35.28	0.39
	High	3	3	470	2.00	1.00	35.83	35.62	0.21
Belt-Clip with	Mini Low	4	1	400	1.09	0.55	35.83	35.37	0.46
Pouch	Mini Mid	5	2	435	1.33	0.67	35.78	35.36	0.42
	Mini High	6	3	470	1.43	0.72	35.90	35.57	0.33
Belt-Clip with	Low	1	1	400	6.16	3.08	35.37	35.05	0.32
Speaker Mic	Mid	2	2	435	5.01	2.51	34.56	34.24	0.32
	High	3	3	470	7.76	3.88	34.78	34.54	0.24
Belt-Clip with	Mini Low	<b>4</b>	<b>1</b>	<b>400</b>	<b>8.20</b>	<b>4.10</b>	<b>35.41</b>	<b>35.17</b>	<b>0.24</b>
Speaker Mic	Mini Mid	5	2	435	3.97	1.99	34.55	34.30	0.25
	Mini High	6	3	470	4.43	2.22	34.71	34.51	0.20

\*NOTE: The measurement uncertainty has not been added to the result.

**Table 16: SAR MEASUREMENT RESULTS– Face positions**

1. Test Position	2. Ant Type	3. Plot No.	4. Test Channel	5. Test Freq (MHz)	6. Measured 1g SAR Results (mW/g)	7. Measured 1g SAR Results (mW/g) Extrapolated to 50% Duty Cycle	8. Conducted Power measured Before Test	9. Conducted Power measured After Test	10. Measured Drift (dB)
	Low	1	1	400	3.14	1.57	35.56	35.29	0.27
Face Position	Mid	2	2	435	2.79	1.40	35.65	35.25	0.4
	High	3	3	470	3.49	1.75	35.95	35.65	0.3
	Mini Low	4	1	400	1.90	0.95	35.56	35.29	0.27
Face Position	Mini Mid	5	2	435	2.81	1.41	35.75	35.35	0.4
	Mini High	6	3	470	2.13	1.07	35.81	35.59	0.22
Face Position	Low	1	1	400	3.68	1.84	35.42	35.28	0.14
With SKR-MIC	Mid	2	2	435	2.73	1.37	34.66	34.27	0.39
	High	3	3	470	2.72	1.36	34.91	34.58	0.33
Face Position	Mini Low	4	1	400	5.71	2.86	35.40	35.25	0.15
With SKR-MIC	Mini Mid	5	2	435	2.46	1.23	34.65	34.20	0.45
	Mini High	6	3	470	2.70	1.35	34.85	34.54	0.31

\*NOTE: The measurement uncertainty has not been added to the result.

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## 9.0 COMPLIANCE STATEMENT

The Tait Electronics Model TPAH5A FCC ID: CASTPAH5A 400 to 470MHz band Handheld Transceiver was found to comply with the FCC SAR requirements.

After extrapolating to a 50% PTT duty the highest SAR level recorded was 4.10 mW/g for a 1g cube. This value was measured in channel 1 in the "Belt-Clip with Speaker Microphone". This level was below the Occupational/Controlled limit of 8.0 mW/g, even taking into account the measurement uncertainty of 24%.

## APPENDIX A1 TEST SAMPLE PHOTOGRAPHS

Tait Electronics  
Model: TPAH5A



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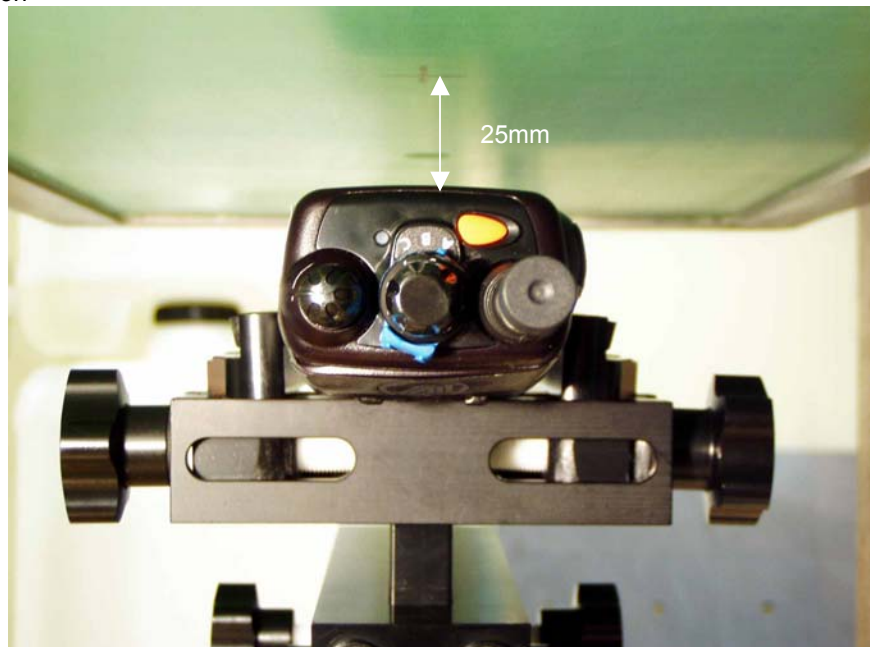
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## APPENDIX A2 TEST SETUP PHOTOGRAPHS

Face Position



Face Position

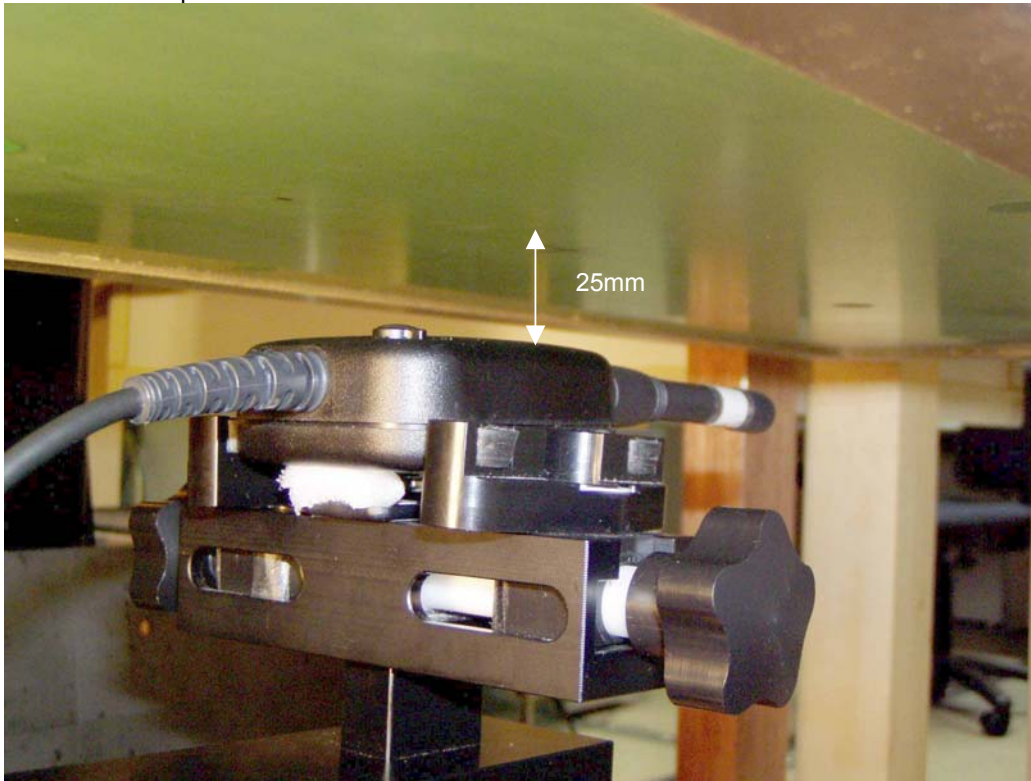


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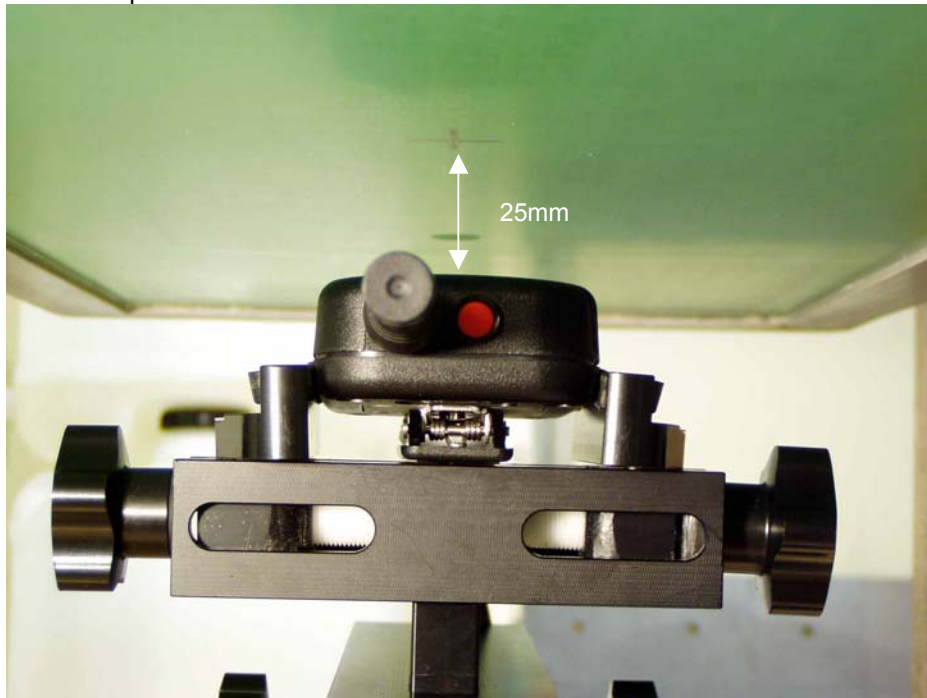
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### APPENDIX A3 TEST SETUP PHOTOGRAPHS

Face Position with Speaker Mic



Face Position with Speaker Mic



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### APPENDIX A4 TEST SET UP PHOTOGRAPHS

Belt Clip Position



Belt Clip Position

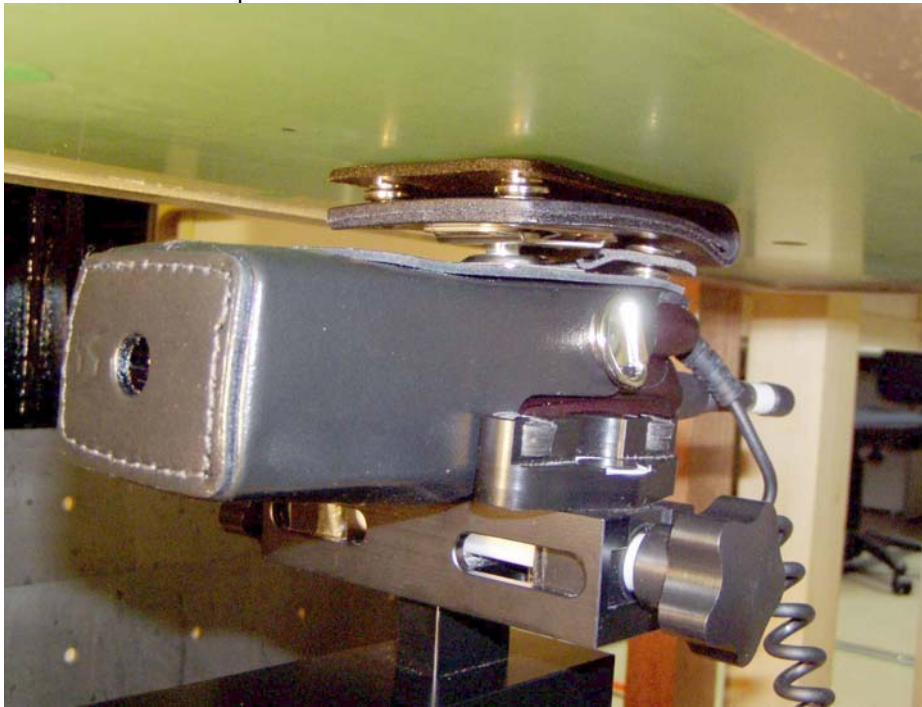


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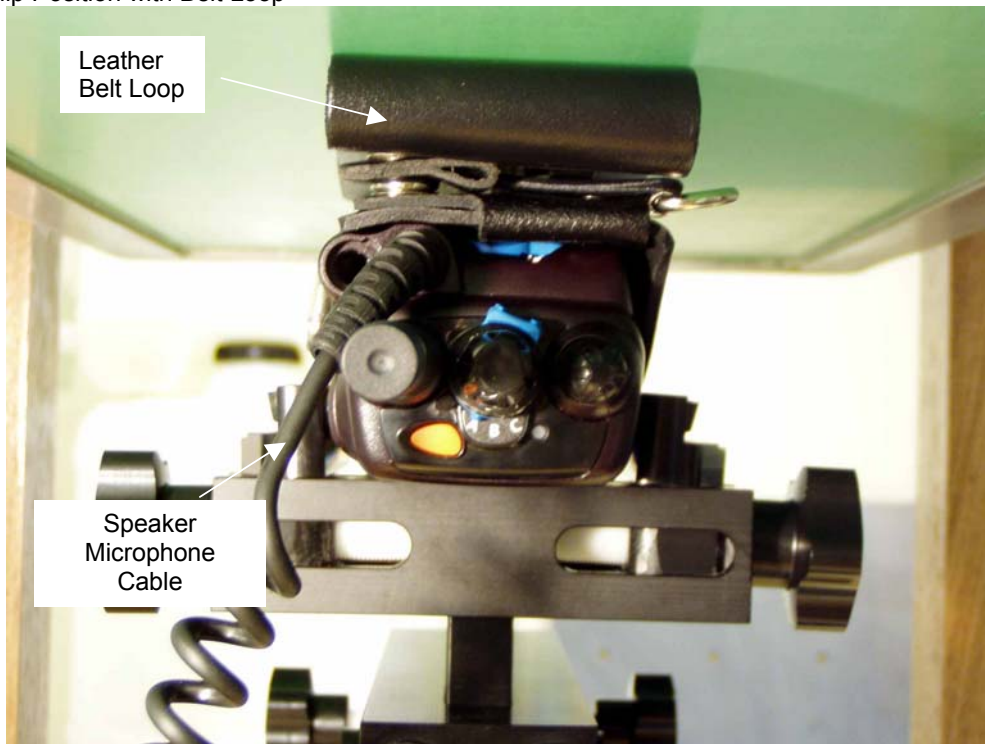
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## APPENDIX A5 TEST SET UP PHOTOGRAPHS

Belt Clip Position with Belt Loop



Belt Clip Position with Belt Loop

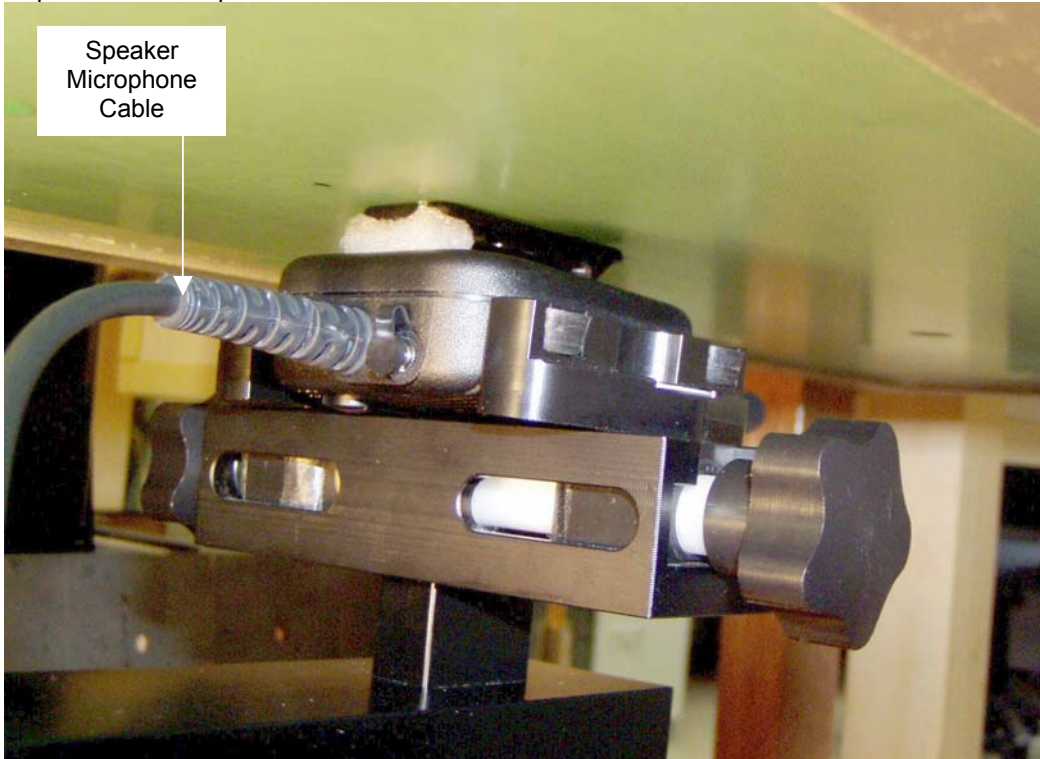


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### APPENDIX A6 TEST SET UP PHOTOGRAPHS

Belt Clip Position with speaker Mic



Belt Clip Position with speaker Mic



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