MC Technologies Pty Ltd
ABN 82 057 105 549
176 Harrick Road
Keilor Park
Victoria Australia 3042

Ph: + 613 9365 1000
Fax: + 613 9331 7455
email: melb@emctech.com.au

Global Product Certification
EMC-EMF-Safety Approvals

SAR Test Report

Report Number: M120922F_R

Test Sample: TAIT Push to Talk Transceiver

Type: TPDB1A

FCC ID: CASTPDB1A
IC ID: 737A-TPDB1A

Tested For: TAIT Limited

Date of Issue: 11th January 2012

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SAR EVALUATION

TAIT Push to Talk Transceiver, **Type:** TPDB1A **Report Number:** M120922F

1.0 GENERAL INFORMATION

Test Sample:		TAIT Push to Talk Transceiver
Type:		TPDB1A
Serial Number:	**16-Key**	25385967
	4-Key	25405626
FCC ID:		CASTPDB1A
IC ID:		737A-TPDB1A
Hardware Version:		0006, band B1
Software Version:		0.13.00.0001
Manufacturer:		Tait Limited
Device Category:		Portable Transmitter
Test Device:		Production Unit / Prototype Sample
RF exposure Category:		Occupational/Aware user
Tested for:		TAIT Limited
Address:		558 Wairakei Road Christchurch 8140 New Zealand
Contact:		Bruce Jensen
Phone:		+64-3-357 0805
Fax:		+64-3-359 4632
Email:		bruce.jensen@taitradio.com
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) Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands) RSS-102 Issue 4 **IEC 62209-1:2006 and IEC 62209-2:2010** Human exposure to radio frequency fields from hand-held and body-mounted devices-Human models, instrumentation and procedures. **Part 1:** Procedure to determine the specific absorption rate (SAR) for hand- held devices used in close proximity to the ear (frequency range 300 MHz to 3 GHz) **Part 2:** Procedure to determine the specific absorption rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz
Statement Of Compliance:		The TAIT Push to Talk Transceiver, Type TPDB1A. Complied with FCC and IC Occupational/controlled RF exposure limits of 8.0mW/g per requirements of 47CFR2.1093(d)..
Test Dates:		2nd – 18th October, 18th – 20th December 2012, 10th – 11th January 2013
Test Officers:		**Peter Jakubiec** **Jason Cameron**
Authorised Signature:		**Chris Zombolas** **Technical Director**

2.0 DESCRIPTION OF DEVICE

2.1 Description of Test Sample

The device tested was a TAIT Push to Talk Transceiver, Type TPDB1A operating in the 150 MHz frequency band. It will be referred to as the device under test (DUT) throughout this report. The DUT has a set of external fixed length antennas and was tested in the Head and Body configurations of the phantom. There are two variants of the DUT available, one with 4 keys and one with 16 keys present on the outer case. The differences in construction are limited to the presence or lack thereof of some of the plastic keys, (i.e. the PCB and other internal electronics are identical). SAR testing was conducted on the 16-Key variant. Some SAR testing was done on the 4-key variant to confirm the SAR distribution is the same for both variants.

Operating Mode during Testing	: Continuous Wave 100% duty cycle
Operating Mode production sample	: 50% duty cycle
Modulation:	: FM
Device Power Rating for test sample and identical production unit	: 5 W
Device Dimensions (LxWxH)	: 137 x 60 x 32mm
Antenna type	: Helical
Applicable Head Configurations	: Face Frontal
Applicable Body Configurations	: Belt Clip Position
Battery Options	: 7.4V 2400mAh Li-ion Battery Pack : 7.4V 1880mAh Li-ion Battery Pack

2.2 Test sample Accessories

The radios are not shipped with any particular default battery or accessory. It is up to the customer to choose the combination of batteries and accessories which best fits the intended the use for the radio. See section 7.2 for an explanation of how the default accessories were selected for the purposes of testing to KDB643646.

2.2.1 Battery Types

Both 7.4V 2400 mAh Li-ion and 7.4V 1880mAh Li-ion battery packs are used to power the DUT. SAR measurements were performed with both 7.4 V battery packs.

2.2.2 Body Worn Accessories

Number of body worn accessories containing small metallic parts is sold with the DUT, which are listed in the table below. All of the listed accessories can be used in any combination of battery mentioned in section 2.2.1 above and any Audio Accessory mentioned in section 2.2.3 below.

Body Worn Accessory	**Part Number**	**Spacing between the phantom and the back of the DUT**
Nylon Case	T03-00038-0014	10 mm
Battery Clip	TPA-CA-201	14 mm
Leather Case with Battery Clip	T03-00038-0021	14 mm
Leather Case with Spring Clip	T03-00038-0005	17 mm
Leather Case D-Stud with Spring Clip	T03-00038-0007 + T03-00038-0023	31 mm
Leather Case D-Stud with Belt Loop	T03-00038-0007 + T03-00038-0022	42 mm

2.2.3 Audio Accessories

There are seven audio accessories available for DUT:

Audio Accessory	Part Number
Speaker- Microphone	T03-00045-CFAA
Speaker- Microphone	T03-00045-DMAA
Speaker- Microphone	T03-00045-BFAA
Headset-Microphone	T03-00046-EFAA
Headset-Microphone	T03-00046-DEAA
Earphone-Microphone	T03-00047-CBAA
Earphone-Microphone	T03-00047-BAAA

2.3 Test Signal, Frequency and Output Power

The DUT operates in the 150 MHz frequency band. The frequency range is 136 MHz to 174 MHz. The transmitter was configured into a test mode that ensured a continuous RF transmission for the duration of each SAR scan. The device transmission characteristics were also monitored during testing to confirm the device was transmitting continuously. The device was supplied with four sizes of antennas to accommodate the full operating frequency range. The low, mid and high antennas are designed for the ranges 136 MHz – 151 MHz, 150 MHz – 162 MHz and 162 MHz – 174 MHz respectively, and a wideband antenna that covers the range 136 MHz -174 MHz. FCC guidelines (KDB 643646 and a device specific KDB) were followed to determine the required SAR testing configurations. The device has an audio accessory output to which a supplied hands free speaker/microphone was connected during all testing in the body positions. Excluding the audio accessory there were no wires or other connections to the DUT during the SAR measurements.

Table: Test Frequencies

Frequency Range	Traffic Channels	Nominal Power (dBm)
136 – 174 MHz	1-13	37

2.4 Conducted Power Measurements

The conducted power of the DUT was measured in the 136 MHz to 174 MHz frequency range with a calibrated Power Meter. The results of this measurement are listed in table below.

Table: Frequency and Output Power

Channel	Channel Frequency MHz	Battery Type	Maximum Conducted Output Power dBm
1	136	Li-ion	37.00
2	143.5	Li-ion	37.04
3	145.5	Li-ion	37.01
4	150	Li-ion	37.07
5	151	Li-ion	37.06
6	155	Li-ion	37.01
7	156	Li-ion	37.01
8	162	Li-ion	36.99
9	164.5	Li-ion	36.97
10	168	Li-ion	36.95
11	174	Li-ion	36.99
12	-	-	-
13	173	Li-ion	37.06

2.5 Battery Status

The device battery was fully charged prior to commencement of measurements. Each SAR test was completed within 30 minutes. The battery condition was monitored by measuring the conducted RF at the antenna port before the commencement of each test and again after the completion of the test.

Table: Battery Details

Battery #1:	7.4V 1880mAh (14Wh)	**Battery #2:**	7.4V 2400mAh (18Wh)
Model No.:	T03-00011-CAAA	**Model No.:**	T03-00011-aAAA
Serial No.:	25371663	**Serial No.:**	25368789

2.6 Details of Test Laboratory

2.6.1 Location

EMC Technologies Pty Ltd
176 Harrick Road
Keilor Park, (Melbourne) Victoria
Australia 3042

Telephone: +61 3 9365 1000
Facsimile: +61 3 9331 7455
email: melb@emctech.com.au
website: www.emctech.com.au

2.6.2 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 standards:

AS/NZS 2772.2:	RF and microwave radiation hazard measurement
ACMA:	Radio communications (Electromagnetic Radiation - Human Exposure) Standard 2003
FCC:	Guidelines for Human Exposure to RF Electromagnetic Field OET65C 01/01
CENELEC:	ES59005: 1998
EN 50360: 2001	Product standard to demonstrate the compliance of mobile phones with the basic restrictions related to human exposure to electromagnetic fields (300 MHz – 3 GHz)
EN 62209-1:2006	Human Exposure to radio frequency fields from hand-held and body-mounted wireless communication devices - Human models instrumentation and procedures. **Part 1:** Procedure to determine the specific absorption rate (SAR) for hand-held devices used in close proximity to the ear (300 MHz to 3 GHz)
EN 62209-2:2010	Human Exposure to radio frequency fields from hand-held and body-mounted wireless communication devices - Human models instrumentation and procedures **Part 2:** Procedure to determine the specific absorption rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz
IEEE 1528: 2003	Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head Due to Wireless Communications Devices: Measurement Techniques.

Refer to NATA website www.nata.asn.au for the full scope of accreditation.

2.6.3 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 ± 1 °C, the humidity was 37 to 51%. The liquid parameters were measured prior to the commencement of the tests. Tests were performed to check that reflections within the environment did not influence the SAR measurements. The noise floor of the DASY5 SAR measurement system using the SN1380 probe is less than 5μV in both air and liquid mediums.

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 **DASY5 Version 52** 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 ±0.02 mm. The DASY5 fully complies with the OET65 C (01-01), IEEE 1528 and EN50361SAR measurement requirements.

3.2 E-Field Probe Type and Performance

The SAR measurements were conducted with the dosimetric probe ET3DV6 Serial: 1380 (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 ±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 MΩ; 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 DASY5 was operating within its specifications. The validation was performed at 300 MHz with the SPEAG D300V3 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 @ 300 MHz

The following table lists the dielectric properties of the tissue simulating liquid measured prior to SAR validation. The results of the validation are listed in columns 4 and 5. The forward power into the reference dipole for each SAR validation was adjusted to 400mW.

Table: Validation Results (Dipole: SPEAG D300V2 SN: 1012)

1. Validation Date	2. ∈r (measured)	3. σ (mho/m) (measured)	4. Measured SAR 1g (mW/g)	5. Measured SAR 10g (mW/g)
10th October 2012	44.5	0.89	1.27	0.836
15th October 2012	43.2	0.86	1.24	0.817
16th October 2012	44.0	0.89	1.26	0.836
17th October 2012	44.5	0.87	1.25	0.832
18th December 2012	57.9	0.88	1.18	0.785
19th December 2012	57.7	0.90	1.19	0.788
20th December 2012	57.2	0.89	1.20	0.794
10th January 2013	57.7	0.88	1.18	0.780
11th January 2013	57.7	0.88	1.20	0.797

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 300 MHz. 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 (D300V3) during calibration. The measured one-gram SAR should be within 10% of the expected target reference values shown in table below.

Table: Deviation from reference validation values

Date	Measured SAR 1g (mW/g)	Measured SAR 1g (Normalized to 1W)	SPEAG Calibration reference SAR Value 1g (mW/g)	Deviation From SPEAG (%)	IEEE Std 1528 reference SAR value 1g (mW/g)	Deviation From IEEE (%)
10th October 2012	1.27	3.18	2.89	9.86	3.0	5.83
15th October 2012	1.24	3.10	2.89	7.27	3.0	3.33
16th October 2012	1.26	3.15	2.89	9.00	3.0	5.00
17th October 2012	1.25	3.13	2.89	8.13	3.0	4.17
18th December 2012	1.18	2.95	2.81	4.98	-	-
19th December 2012	1.19	2.98	2.81	5.87	-	-
20th December 2012	1.20	3.00	2.81	6.76	-	-
10th January 2013	1.18	2.95	2.81	4.98	-	-
11th January 2013	1.2	3.00	2.81	6.76	-	-

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 15cm with a tolerance of ±0.5cm. The following photo shows the depth of the liquid maintained during the testing.

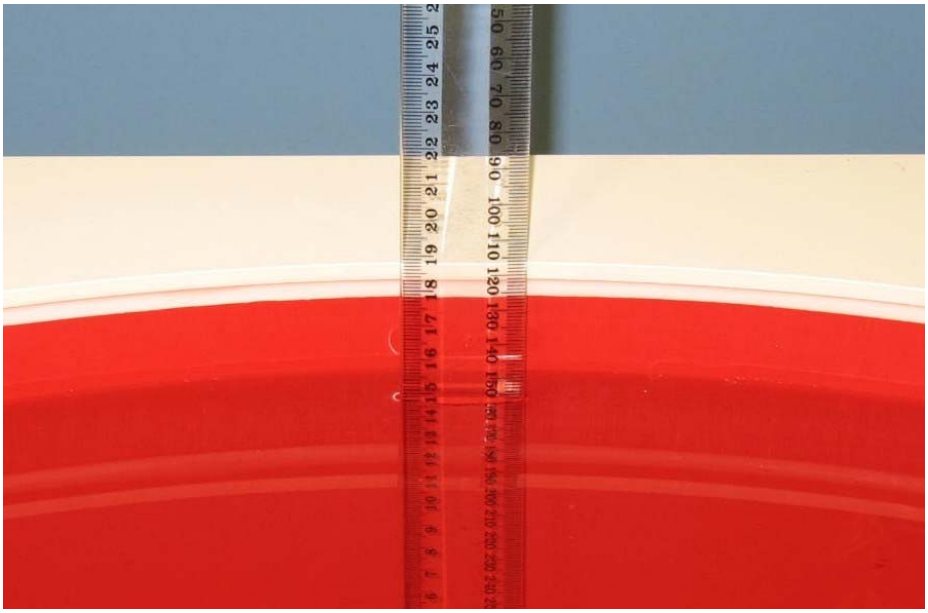


Photo of liquid Depth in Flat Phantom

3.5 Phantom Properties (Size, Shape, Shell Thickness)

For SAR testing in the Face Frontal and Belt Clip positions (also for the System Check) a SPEAG Flat Phantom ELI 4.0 was used. The phantom thickness is 2.0mm +/-0.2 mm and the phantom was filled with the required tissue simulating liquid. The table below provides a summary of the measured phantom properties

Photo 1: Flat Phantom ELI 4.0 2mm

3.6 Tissue Material Properties

The dielectric parameters of the 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: Measured Brain Simulating Liquid Dielectric Values

Frequency Band	∈r (measured range)	∈r (target)	σ (mho/m) (measured range)	σ (target)	ρ kg/m^3
136MHz	53.7	52.3 ±5% (49.7 to 54.9)	0.73	0.76 ±5% (0.72 to 0.80)	1000
155MHz	53.4	52.3 ±5% (49.7 to 54.9)	0.74	0.76 ±5% (0.72 to 0.80)	1000
174MHz	52.8	52.3 ±5% (49.7 to 54.9)	0.75	0.76 ±5% (0.72 to 0.80)	1000

Table: Measured Body Simulating Liquid Dielectric Values

Frequency Band	∈r (measured range)	∈r (target)	σ (mho/m) (measured range)	σ (target)	ρ kg/m^3
136MHz	62.1-62.4	61.9 ±5% (58.8 to 65.0)	0.81	0.80 ±5% (0.76 to 0.84)	1000
156MHz	61.7-62.0	61.9 ±5% (58.8 to 65.0)	0.78-0.83	0.80 ±5% (0.76 to 0.84)	1000
174MHz	61.2-61.3	61.9 ±5% (58.8 to 65.0)	0.83	0.80 ±5% (0.76 to 0.84)	1000

NOTE: The brain and muscle liquid parameters were within the required tolerances of ±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|°C.

Table: Temperature and Humidity recorded for each day

Date	Ambient Temperature (°C)	Liquid Temperature (°C)	Humidity (%)
10th October 2012	20.9	20.5	37
15th October 2012	20.9	20.5	40
16th October 2012	20.7	20.4	42
17th October 2012	20.8	20.3	41
18th December 2012	19.7	19.6	50
19th December 2012	20.5	20.1	50
20th December 2012	21.0	20.8	51
10th January 2013	20.1	19.8	47
11th January 2013	20.0	19.6	42

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: Tissue Type: Brain @ 150MHz
Volume of Liquid: 60 Litres

Approximate Composition	% By Weight
Distilled Water	37.50
Salt	6.41
Sugar	55.56
HEC	0.48
Bactericide	0.05

Table: Tissue Type: Muscle @ 150MHz
Volume of Liquid: 60 Litres

Approximate Composition	% By Weight
Distilled Water	48.43
Salt	2.86
Sugar	48.13
HEC	0.53
Bactericide	0.06

3.8 Device Holder for DASY5

The DASY5 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 DASY5 device holder is made of low-loss material having the following dielectric parameters: relative permittivity ε=3 and loss tangent δ=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.

Refer to Appendix A2-A3 for photographs of device positioning

4.0 SAR MEASUREMENT PROCEDURE USING DASY5

The SAR evaluation was performed with the SPEAG DASY5 system. A summary of the procedure follows:

a) A measurement of the conducted power value at the antenna port is used as a reference value for assessing the power drop of the DUT. Also a measurement of the SAR value at a fixed location is used. The power 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 15 mm x 15 mm. The actual Area Scan has dimensions of 120 mm x 360 mm surrounding the test device hot spot location. Based on this data, the area of the maximum absorption is determined by Spline interpolation. A pre-scan is performed for each phantom configuration to ensure that entire hot spot is identified.

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 4 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

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: Uncertainty Budget for DASY5 Version 52 – DUT SAR test

Error Description	Uncert. Value	Prob. Dist.	Div.	C_i (1g)	C_i (10g)	1g u_i	10g u_i	v_i
Measurement System								
Probe Calibration	10	N	1.00	1	1	10.00	10.00	∞
Axial Isotropy	4.7	R	1.73	0.7	0.7	1.90	1.90	∞
Hemispherical Isotropy	9.6	R	1.73	0.7	0.7	3.88	3.88	∞
Boundary Effects	1	R	1.73	1	1	0.58	0.58	∞
Linearity	4.7	R	1.73	1	1	2.71	2.71	∞
System Detection Limits	1	R	1.73	1	1	0.58	0.58	∞
Readout Electronics	0.3	N	1.00	1	1	0.30	0.30	∞
Response Time	0.8	R	1.73	1	1	0.46	0.46	∞
Integration Time	2.6	R	1.73	1	1	1.50	1.50	∞
RF Ambient Noise	3	R	1.73	1	1	1.73	1.73	∞
RF Ambient Reflections	3	R	1.73	1	1	1.73	1.73	∞
Probe Positioner	0.4	R	1.73	1	1	0.23	0.23	∞
Probe Positioning	2.9	R	1.73	1	1	1.67	1.67	∞
Max. SAR Eval.	1	R	1.73	1	1	0.58	0.58	∞
Post Processing	2	R	1.73	1	1	1.15	1.15	∞
Test Sample Related								
Power Scaling	0	R	1.73	1	1	0.00	0.00	∞
Test Sample Positioning	2.9	N	1.00	1	1	2.90	2.90	145
Device Holder Uncertainty	3.6	N	1.00	1	1	3.60	3.60	5
Output Power Variation – SAR Drift Measurement	4.50	R	1.73	1	1	2.60	2.60	∞
Phantom and Setup								
Phantom Uncertainty	7.5	R	1.73	1	1	4.33	4.33	∞
Liquid Conductivity – Deviation from target values	5	R	1.73	0.64	0.43	1.85	1.24	∞
Liquid Permittivity – Deviation from target values	5	R	1.73	0.6	0.49	1.73	1.41	∞
Liquid Conductivity – Measurement uncertainty	2.5	N	1.00	0.64	0.71	1.60	1.78	∞
Liquid Permittivity – Measurement uncertainty	2.5	N	1.00	0.6	0.26	1.50	0.65	∞
Temp.unc. - Conductivity	1.7	R	1.73	0.78	0.71	0.77	0.70	∞
Temp. unc. - Permittivity	0.3	R	1.73	0.23	0.26	0.04	0.05	∞
Combined standard Uncertainty (u_c)						14.1	13.9	
Expanded Uncertainty (95% CONFIDENCE LEVEL)			k= 2			28.2	27.9	

Estimated total measurement uncertainty for the DASY5 measurement system was ±14.1%. The extended uncertainty (K = 2) was assessed to be ±28.2% based on 95% confidence level. The uncertainty is not added to the measurement result.

Table: Uncertainty Budget for DASY5 Version 52- Validation

Error Description	Uncert. Value	Prob. Dist.	Div.	C_i (1g)	C_i (10g)	1g u_i	10g u_i	v_i
Measurement System								
Probe Calibration	10	N	1.00	1	1	10.00	10.00	∞
Axial Isotropy	4.7	R	1.73	1	1	2.71	2.71	∞
Hemispherical Isotropy	9.6	R	1.73	0	0	0.00	0.00	∞
Boundary Effects	1	R	1.73	1	1	0.58	0.58	∞
Linearity	4.7	R	1.73	1	1	2.71	2.71	∞
System Detection Limits	1	R	1.73	1	1	0.58	0.58	∞
Readout Electronics	0.3	N	1.00	1	1	0.30	0.30	∞
Response Time	0	R	1.73	1	1	0.00	0.00	∞
Integration Time	0	R	1.73	1	1	0.00	0.00	∞
RF Ambient Noise	1	R	1.73	1	1	0.58	0.58	∞
RF Ambient Reflections	1	R	1.73	1	1	0.58	0.58	∞
Probe Positioner	0.8	R	1.73	1	1	0.46	0.46	∞
Probe Positioning	6.7	R	1.73	1	1	3.87	3.87	∞
Max. SAR Eval.	2	R	1.73	1	1	1.15	1.15	∞
Post Processing	2	R	1.73	1	1	1.15	1.15	∞
Dipole Related								
Deviation of exp. dipole	5.5	R	1.73	1	1	3.18	3.18	∞
Dipole Axis to Liquid Dist.	2	R	1.73	1	1	1.15	1.15	∞
Input power & SAR drift	5.00	R	1.73	1	1	2.89	2.89	∞
Phantom and Setup								
Phantom Uncertainty	4	R	1.73	1	1	2.31	2.31	∞
Liquid Conductivity – Deviation from target values	5	R	1.73	0.64	0.43	1.85	1.24	∞
Liquid Permittivity – Deviation from target values	5	R	1.73	0.6	0.49	1.73	1.41	∞
Liquid Conductivity – Measurement uncertainty	2.5	N	1.00	0.78	0.71	1.95	1.78	∞
Liquid Permittivity – Measurement uncertainty	2.5	N	1.00	0.26	0.26	0.65	0.65	∞
Temp.unc. - Conductivity	1.7	R	1.73	0.78	0.71	0.77	0.70	∞
Temp. unc. - Permittivity	0.3	R	1.73	0.23	0.26	0.04	0.05	∞
Combined standard Uncertainty (u_c)						13.1	12.9	
Expanded Uncertainty (95% CONFIDENCE LEVEL)			k= 2			26.1	25.8	

Estimated total measurement uncertainty for the DASY5 measurement system was ±13.1%. The extended uncertainty (K = 2) was assessed to be ±26.1% based on 95% confidence level. The uncertainty is not added to the Validation measurement result.

6.0 EQUIPMENT LIST AND CALIBRATION DETAILS

Table: SPEAG DASY5 Version 52

Equipment Type	Manufacturer	Model Number	Serial Number	Calibration Due	Used For this Test?
Robot - Six Axes	Staubli	RX90BL	N/A	Not applicable	✓
Robot Remote Control	SPEAG	CS7MB	RX90B	Not applicable	✓
SAM Phantom	SPEAG	N/A	1260	Not applicable	
SAM Phantom	SPEAG	N/A	1060	Not applicable	
Flat Phantom	AndreT	10.1	P 10.1	Not Applicable	
Flat Phantom	AndreT	9.1	P 9.1	Not Applicable	
Flat Phantom	SPEAG	ELI 4.0	1101	Not Applicable	✓
Data Acquisition Electronics	SPEAG	DAE3 V1	359	21-June-2013	
Data Acquisition Electronics	SPEAG	DAE3 V1	442	04-Dec-2013	✓
Probe E-Field - Dummy	SPEAG	DP1	N/A	Not applicable	
Probe E-Field	SPEAG	ET3DV6	1380	10-Dec-2013	✓
Probe E-Field	SPEAG	ET3DV6	1377	20-June-2013	
Probe E-Field	SPEAG	ES3DV6	3029	Not Used	
Probe E-Field	SPEAG	EX3DV4	3563	21-June-2013	
Probe E-Field	SPEAG	EX3DV4	3657	7-Dec-2013	
Antenna Dipole 300 MHz	SPEAG	D300V3	1012	11-Dec-2014	✓
Antenna Dipole 450 MHz	SPEAG	D450V3	1074	11-Dec-2014	
Antenna Dipole 750 MHz	SPEAG	D750V2	1051	9-Jan-2014	
Antenna Dipole 900 MHz	SPEAG	D900V2	047	22-June-2014	
Antenna Dipole 1640 MHz	SPEAG	D1640V2	314	20-June-2014	
Antenna Dipole 1800 MHz	SPEAG	D1800V2	242	20-June-2014	
Antenna Dipole 1950 MHz	SPEAG	D1950V3	1113	6-Dec -2014	
Antenna Dipole 2450 MHz	SPEAG	D2450V2	724	04-Dec-2014	
Antenna Dipole 2600 MHz	SPEAG	D2600V2	1044	10-Jan-2014	
Antenna Dipole 3500 MHz	SPEAG	D3500V2	1002	13-July-2013	
Antenna Dipole 5600 MHz	SPEAG	D5GHzV2	1008	14-Dec-2013	
RF Amplifier	EIN	603L	N/A	*In test	✓
RF Amplifier	Mini-Circuits	ZHL-42	N/A	*In test	
RF Amplifier	Mini-Circuits	ZVE-8G	N/A	*In test	
Synthesized signal generator	Hewlett Packard	ESG-D3000A	GB37420238	*In test	✓
RF Power Meter	Hewlett Packard	437B	3125012786	30-Aug-2013	✓
RF Power Sensor 0.01 - 18 GHz	Hewlett Packard	8481H	1545A01634	03-Sept-2013	✓
RF Power Meter	Rohde & Schwarz	NRP	101415	17-Sept-2013	
RF Power Sensor	Rohde & Schwarz	NRP - Z81	100174	17-Sept-2013	
RF Power Meter Dual	Hewlett Packard	435A	1733A05847	*In test	✓
RF Power Sensor	Hewlett Packard	8482A	2349A10114	*In test	✓
Network Analyser	Hewlett Packard	8714B	GB3510035	27-Sept-2013	✓
Network Analyser	Hewlett Packard	8753ES	JP39240130	5-Nov-2013	
Dual Directional Coupler	Hewlett Packard	778D	1144 04700	*In test	✓
Dual Directional Coupler	NARDA	3022	75453	*In test	

* Calibrated during the test for the relevant parameters.

7.0 SAR TEST METHOD

7.1 Description of the Test Positions (Head and Body)

SAR measurements were performed in the “Face Frontal” and “Belt Clip” positions. Both the “Face Frontal” and “Belt Clip” positions were measured in the flat section of the SPEAG 10.1 phantom.
See Appendix A for photos of test positions.

7.1.1 “Head Position”

The SAR evaluation was performed in the flat section of the SPEAG 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.

7.1.2 “Body Position”

The device was tested in the (2.00 mm) flat section of the SPEAG phantom for the body positions. The Transceiver was placed at the flat section of the phantom and suspended until the Belt Clip touched the phantom. The belt clips contained metal parts and the device was connected with the hands free earpiece/microphone.

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

There are two radio options, four antenna options, seven audio accessory options, two battery options and six combinations of body worn accessories, for a total of 672 possible body configurations and 16 possible head configurations. The test configurations chosen were according to KDB 643646 and a device specific KDB. There is no default battery or audio accessory defined by the manufacturer for the DUT. The chosen defaults in accordance with KDB 643646 are as follows:

- Default battery for the head positions was the high capacity battery, as it may be capable of delivering more current to the amplifier.
- Default battery for the body positions was the low capacity battery, as it provides the least amount of spacing between the transmitting antenna and the phantom.
- Default audio accessory for the body positions was the speaker microphone (“CFAA”), because the coiled cable was expected to re-radiate energy over a smaller area.
- There is no default body worn accessory supplied with the radio, and all combinations of body worn accessories were assessed.

The 4-key and 16-key variants of the radio are expected to produce the same SAR due to only minor variances in construction. The configurations of the 16-Key variant that yielded SAR results above 5.0W/kg were repeated with the 4-Key variant to confirm this.

The BFAA, CFAA and DMAA speaker microphones are also expected to produce the same SAR due to only minor variances in construction. The EFAA, BAAA and CBAA audio accessories are expected to produce the same SAR values due to very similar construction near the radio. The configuration utilising the default audio accessory that yielded the highest SAR result was repeated for all additional audio accessories. This was additional testing not required by KDB 643646.

Only one antenna can be used at a time. Only one audio accessory can be used at a time. Only one battery option can be used at a time. Some body worn accessories are only designed to be used in conjunction with other body worn accessories, and some can be used on their own. The various combinations of body worn accessories available are labelled A – F below. Any combination of body worn accessories can be used with any antenna, any audio accessory and any battery.

Table: Body Accessory Combinations

	Battery Clip	Nylon Case	Leather Case	Leather Case Spring Clip	D-Stud Spring Clip	D-Stud Belt Loop
Battery Clip	A		C			
Nylon Case		B				
Leather Case Spring Clip				D		
Leather Case D-Stud					E	F

7.2.1 Applicable Duty Cycle for PTT Radios

KDB 447498 D01 v04 Section 5a states that the RF exposure of a PTT device should be evaluated with a 50% duty cycle, if the actual duty cycle is <50%. The DUT operates in a half duplex mode, and is only transmitting while a mechanical PTT button is pressed. This is true for all modes of operation, including PABX/PSTN modes. The PTT button must be released periodically to facilitate two way communication, and during real world use the actual duty cycle would be much lower than 50%. The results in section 8.0 have been scaled to a 50% duty cycle, in accordance with KDB 447498.

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)

8.0 SAR MEASUREMENT RESULTS

The SAR values averaged over 1g tissue mass were determined for the sample device for the Head and Body configurations of the phantom.

8.1 SAR Measurement Results for 16 Key Radio

Table: SAR MEASUREMENT RESULTS

1. Test Position	2. Plot No.	3. Test Ch.	4. Test Freq (MHz)	5. Measured 1g SAR Results (mW/g)	5.1 Measured 1g SAR Results 50% Duty Cycle (mW/g)	6. Measured Drift (dB)	7. Antenna	8. Measured RF Power (dBm)
Face Frontal	1	2	143.5	1.74	0.870	-0.08	Low	36.91
	2	3	145.5	0.658	0.329	-0.12	Wide	36.95
	3	7	156.0	2.63	1.32	-0.18	Mid	37.16
	4	10	168.0	2.64	1.32	-0.10	High	36.99
Face Frontal*	5	10	168.0	3.05	1.53	-0.15	High	37.01
Body Worn Nylon Case*	6	1	136.0	2.09	1.05	-0.18	Low	36.98
	7	4	150.0	2.57	1.29	-0.11	Mid	37.05
	8	8	162.0	2.13	1.07	-0.06	High	37.00
	9	9	164.5	1.83	0.915	-0.13	Wide	36.98
Body Worn Nylon Case	10	4	150.0	4.86	2.43	-0.13	Mid	37.02
	11	8	162.0	3.77	1.89	-0.06	High	37.00
	12	9	164.5	2.36	1.18	-0.19	Wide	37.07
Body Worn Battery Clip*	13	1	136.0	2.47	1.24	-0.11	Low	36.95
	14	4	150.0	4.00	2.00	-0.10	Mid	37.01
	15	8	162.0	6.88	3.44	-0.15	High	36.97
	16	9	164.5	1.92	0.960	-0.18	Wide	36.92
Body Worn Battery Clip	17	8	162.0	5.85	2.93	-0.02	High	37.01
Body Worn Leather Case Battery Clip*	18	1	136.0	3.25	1.63	-0.17	Low	36.96
	19	4	150.0	2.86	1.43	-0.07	Mid	37.02
	20	8	162.0	5.47	2.74	-0.18	High	36.96
	21	9	164.5	1.74	0.870	-0.16	Wide	36.94
Body Worn Leather Case Battery Clip	22	8	162.0	5.23	2.62	-0.16	High	37.07

Note: The uncertainty of the system (± 28.2 %) has not been added to the results.
**Low capacity battery option used*

The FCC SAR limit for occupational exposure is 8.0mW/g measured in a 1g cube of tissue.

Table: SAR MEASUREMENT RESULTS

1. Test Position	2. Plot No.	3. Test Ch.	4. Test Freq (MHz)	5. Measured 1g SAR Results (mW/g)	5.1 Measured 1g SAR Results 50% Duty Cycle (mW/g)	6. Measured Drift (dB)	7. Antenna	8. Measured RF Power (dBm)
Body Worn Leather Case Spring Clip*	23	1	136.0	2.02	1.01	-0.11	Low	36.91
	24	4	150.0	2.69	1.35	-0.15	Mid	37.00
	25	7	156.0	4.94	2.47	0.05	Mid	36.82
	26	8	162.0	0.723	0.362	-0.05	Mid	36.83
	27	8	162.0	13.2	6.60	-0.18	High	36.99
	28	13	173.0	1.41	0.705	-0.11	High	37.06
	29	10	168.0	2.54	1.27	-0.16	High	36.97
	30	4	150.0	4.56	2.28	-0.18	Wide	37.13
	31	7	156.0	1.65	0.825	-0.01	Wide	36.84
	32	9	164.5	2.75	1.38	-0.17	Wide	36.97
	33	13	173.0	1.47	0.735	-0.20	Wide	37.02
Body Worn Leather Case Spring Clip	34	4	150.0	11.9	5.95	-0.11	Mid	37.14
	35	5	151.0	12.3	6.15	-0.16	Mid	37.18
	36	7	156.0	3.44	1.72	-0.17	Mid	36.97
	37	8	162.0	0.416	0.208	-0.18	Mid	37.09
	38	8	162.0	11.5	5.75	-0.12	High	37.01
	39	13	173.0	1.44	0.72	-0.11	High	37.08
	40	10	168.0	2.05	1.03	-0.08	High	37.07
	41	4	150.0	2.71	1.36	-0.10	Wide	37.11
	42	5	151.0	2.58	1.29	0.09	Wide	37.01
Leather Case Spring Clip + DEAA	43	5	151.0	7.07	3.54	-0.10	Mid	36.99
	44	7	156.0	1.97	0.985	-0.14	Mid	37.11
	45	8	162.0	0.514	0.257	0.01	Mid	37.01
	46	8	162.0	5.41	2.71	-0.03	High	36.98
Leather Case Spring Clip + DEAA*	47	8	162.0	7.96	3.98	-0.20	High	36.98
	48	10	168.0	0.350	0.175	-0.19	High	37.05
	49	13	173.0	0.583	0.292	-0.04	High	36.92
Leather Case Spring Clip + EFAA	50	5	151.0	7.77	3.89	-0.11	Mid	37.02
	51	7	156.0	3.55	1.78	-0.06	Mid	37.00
	52	8	162.0	0.318	0.159	-0.12	Mid	37.04
	53	8	162.0	9.60	4.80	-0.07	High	36.97
Leather Case Spring Clip + EFAA*	54	8	162.0	9.01	4.51	-0.16	High	36.99
	55	10	168.0	1.61	0.805	-0.17	High	37.12
	56	13	173.0	0.865	0.433	-0.05	High	36.95
Leather Case Spring Clip + DMAA*	57	8	162.0	9.87	4.94	-0.20	High	37.06
Leather Case Spring Clip + BFAA*	58	8	162.0	12.1	6.05	-0.20	High	37.11
Leather Case Spring Clip + CBAA*	59	8	162.0	8.88	4.44	-0.18	High	37.10
Leather Case Spring Clip + BAAA*	60	8	162.0	5.91	2.96	-0.11	High	37.09

Note: The uncertainty of the system (± 28.2 %) has not been added to the results.
**Low capacity battery option used*

The FCC SAR limit for occupational exposure is 8.0mW/g measured in a 1g cube of tissue.

Table: SAR MEASUREMENT RESULTS

1. Test Position	2. Plot No.	3. Test Ch.	4. Test Freq (MHz)	5. Measured 1g SAR Results (mW/g)	5.1 Measured 1g SAR Results 50% Duty Cycle (mW/g)	6. Measured Drift (dB)	7. Antenna	8. Measured RF Power (dBm)
Leather Case Spring Clip + DMAA	61	5	151.0	10.6	5.30	-0.19	Mid	37.15
Leather Case Spring Clip + BFAA	62	5	151.0	7.64	3.82	-0.10	Mid	37.14
Leather Case Spring Clip + CBAA	63	5	151.0	10.1	5.05	-0.12	Mid	37.15
Leather Case Spring Clip + BAAA	64	5	151.0	7.02	3.51	-0.09	Mid	37.16
Body Worn Leather Case D-Stud Clip*	65	1	136.0	0.772	0.386	-0.20	Low	39.95
	66	4	150.0	1.48	0.740	-0.13	Mid	36.99
	67	8	162.0	4.10	2.05	-0.15	High	36.97
	68	9	164.5	2.16	1.08	-0.18	Wide	36.99
Body Worn Leather Case D-Stud Clip	69	5	151.0	2.01	1.01	-0.06	Mid	37.06
	70	8	162.0	9.85	4.93	-0.11	High	37.12
	71	10	168.0	2.48	1.24	-0.14	High	37.01
	72	9	164.5	1.43	0.715	-0.07	Wide	37.02
Body Worn Leather Case D-Stud Loop*	73	1	136.0	0.405	0.203	-0.10	Low	39.99
	74	4	150.0	0.075	0.038	-0.11	Mid	36.98
	75	8	162.0	0.521	0.261	-0.10	High	36.99
	76	9	164.5	0.534	0.267	-0.15	Wide	36.96
Body Worn Leather Case D-Stud Loop	77	9	164.5	0.384	0.192	-0.09	Wide	36.92

Note: The uncertainty of the system (± 28.2 %) has not been added to the results.
**Low capacity battery option used*

The FCC SAR limit for occupational exposure is 8.0mW/g measured in a 1g cube of tissue.

8.2 SAR Measurement Results for 4 Key Radio (Variant)

Table: SAR MEASUREMENT RESULTS

1. Test Position	2. Plot No.	3. Test Ch.	4. Test Freq (MHz)	5. Measured 1g SAR Results (mW/g)	5.1 Measured 1g SAR Results 50% Duty Cycle (mW/g)	6. Measured Drift (dB)	7. Antenna	8. Measured RF Power (dBm)
Body Worn Leather Case Spring Clip	78	5	151.0	12.4	6.20	-0.16	Mid	37.09
	79	8	162.0	11.8	5.90	-0.01	High	37.05
Body Worn Leather Case Spring Clip*	80	8	162.0	14.0	**7.00**	-0.12	High	37.00

Note: The uncertainty of the system (± 28.2 %) has not been added to the results.
**Low capacity battery option used*

The FCC SAR limit for occupational exposure is 8.0mW/g measured in a 1g cube of tissue.

Original test
Frequency outside allowed Part 90 range
Additional test applicable to device specific KDB enquiry

9.0 COMPLIANCE STATEMENT

The TAIT Push to Talk Transceiver model TPDB1A was tested on behalf of TAIT Limited. It complied with the FCC SAR requirements. It also complied with IC RSS-102 requirements.

The highest SAR level recorded was 14.0 mW/g for a 1g cube. After extrapolating to a 50% duty cycle the highest SAR level recorded was 7.00 mW/g for a 1g cube. This value was measured in the "body worn" position with the leather case with spring clip accessory (T03-00038-0005), and the 162MHz – 174MHz tuned antenna. The manufacturer's tune up power is stated to be 5.25W. Scaling the SAR value, the maximum SAR value is **7.35 mW/g**. The recorded SAR level complied with the limit however the compliance margin was less than the measurement uncertainty of 28.2 %.

APPENDIX A1 Test Sample Photographs

Battery 1

Battery 2

DUT

DUT

DUT 4-Key Variant

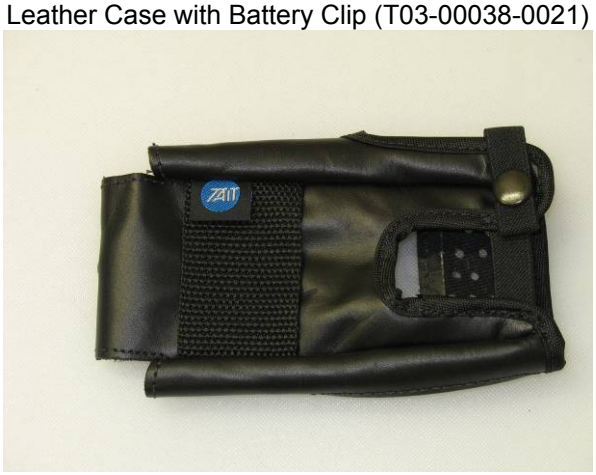
APPENDIX A2 Test Sample Photographs

Antenna Options

Nylon Case (T03-00038-0014)

Battery Clip (TPA-CA-201)

Leather Case with Battery Clip (T03-00038-0021)



Leather Case with Spring Clip (T03-00038-0005)

Spring Clip for Leather Case with D-Stud (T03-00038-0023)

APPENDIX A3 Test Sample Photographs

Leather Case D-Stud with Belt Loop
(T03-00038-0007 + T03-00038-0022)

Speaker- Microphone (T03-00045-CFAA)

Speaker-Microphone (T03-00045-DMAA)

Speaker-Microphone (T03-00045-BFAA)

Headset-Microphone (T03-00046-EFAA)

Headset-Microphone (T03-00046-DEAA)

APPENDIX A4 Test Sample Photographs

Earphone-Microphone (T03-00047-CBAA)

Earphone-Microphone (T03-00047-BAAA)

DUT Audio Accessory Connector

Body Accessory D-Stud Connector

APPENDIX A5 Test Sample Photographs

Body Accessory Configuration A with Default Battery and Audio Accessory

APPENDIX A6 Test Sample Photographs

Body Accessory Configuration B with Default Battery and Audio Accessory

APPENDIX A7 Test Sample Photographs

Body Accessory Configuration C with Default Battery and Audio Accessory

APPENDIX A8 Test Sample Photographs

Body Accessory Configuration D with Default Battery and Audio Accessory

APPENDIX A9 Test Sample Photographs

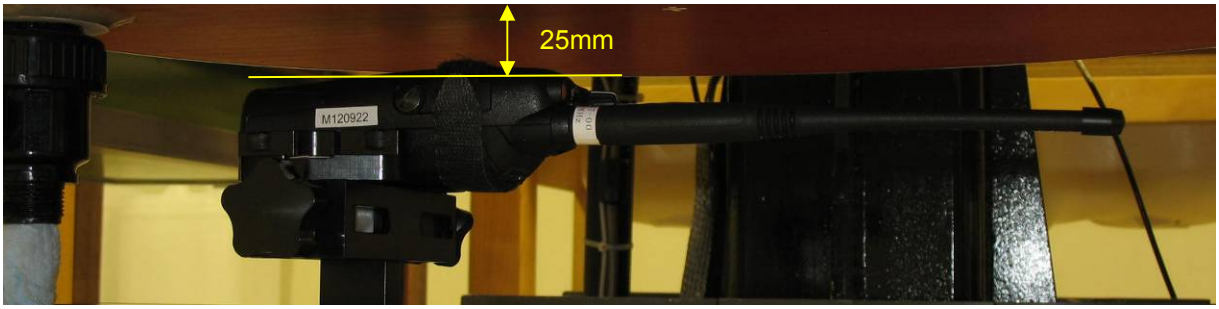
Body Accessory Configuration E with Default Battery and Audio Accessory

APPENDIX A10 Test Sample Photographs

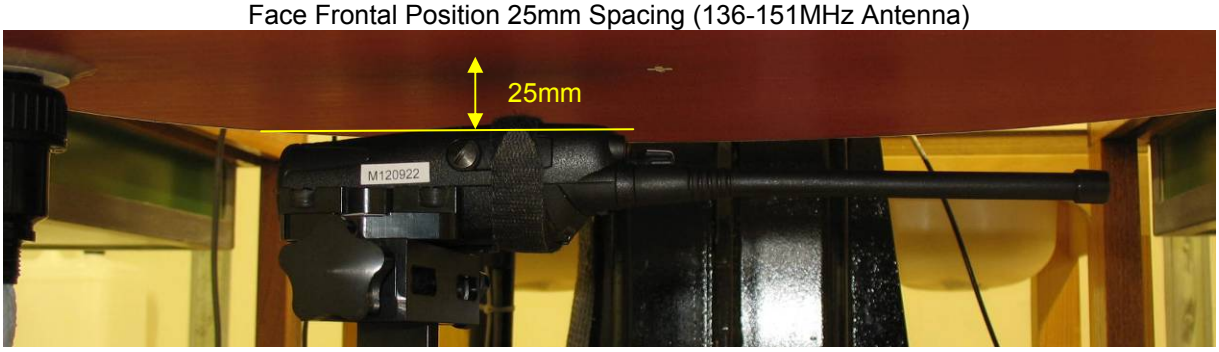
Body Accessory Configuration F with Default Battery and Audio Accessory

APPENDIX A4 Test Setup Photographs

Face Frontal Position 25mm Spacing (136-174MHz Antenna)

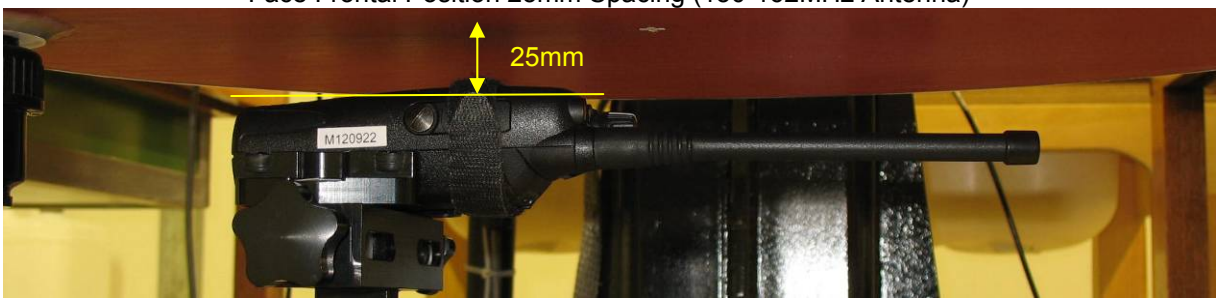


Face Frontal Position 25mm Spacing (136-151MHz Antenna)

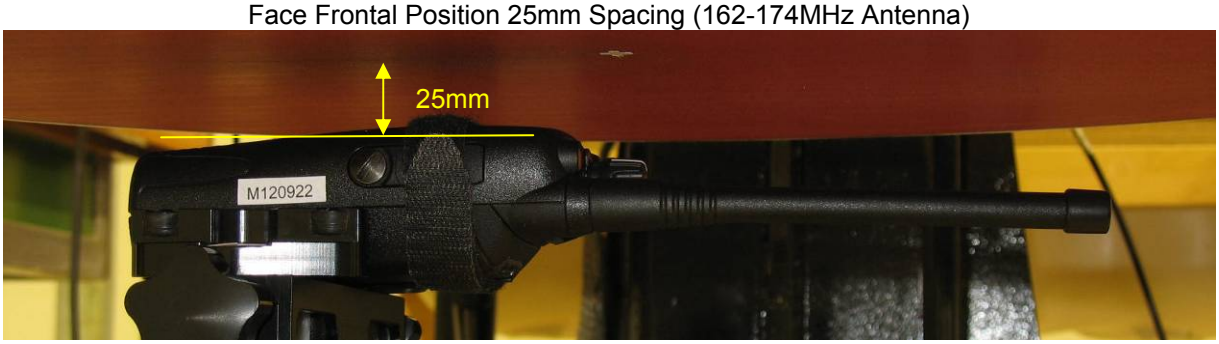


APPENDIX A5 Test Setup Photographs

Face Frontal Position 25mm Spacing (150-162MHz Antenna)

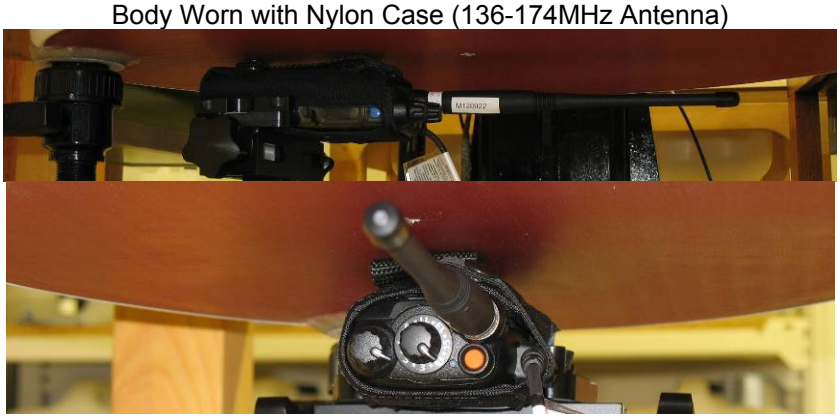


Face Frontal Position 25mm Spacing (162-174MHz Antenna)

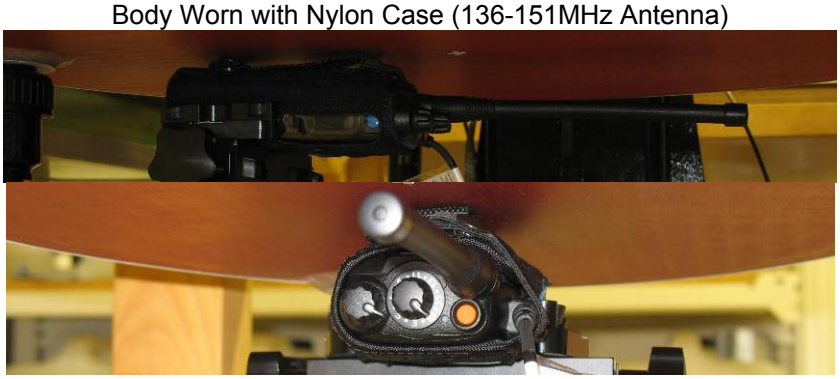


APPENDIX A6 Test Setup Photographs

Body Worn with Nylon Case (136-174MHz Antenna)



Body Worn with Nylon Case (136-151MHz Antenna)



Body Worn with Nylon Case (150-162MHz Antenna)

Body Worn with Nylon Case (162-174MHz Antenna)

APPENDIX A7 Test Setup Photographs

Body Worn with Battery Clip (136-174MHz Antenna)

Body Worn with Battery Clip (136-151MHz Antenna)

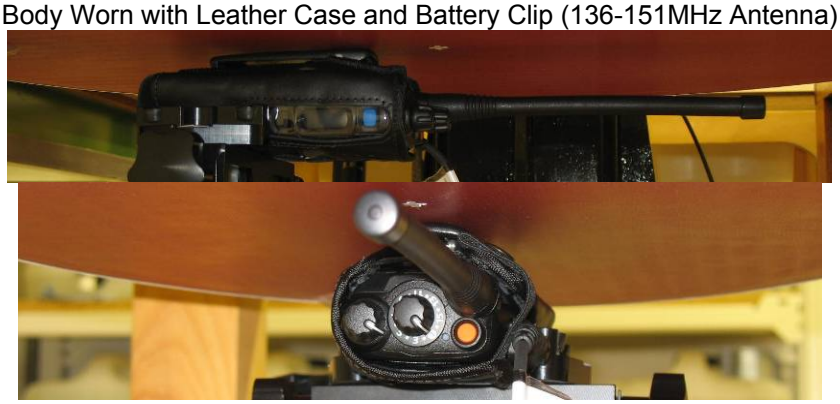
Body Worn with Battery Clip (150-162MHz Antenna)

Body Worn with Battery Clip (162-174MHz Antenna)

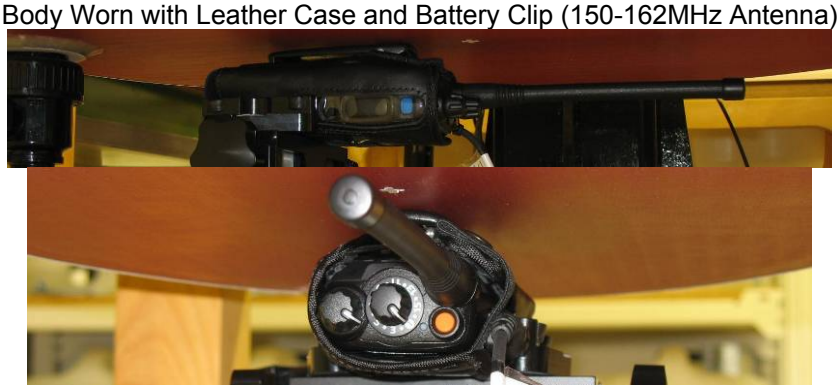
APPENDIX A8 Test Setup Photographs

Body Worn with Leather Case and Battery Clip (136-174MHz Antenna)

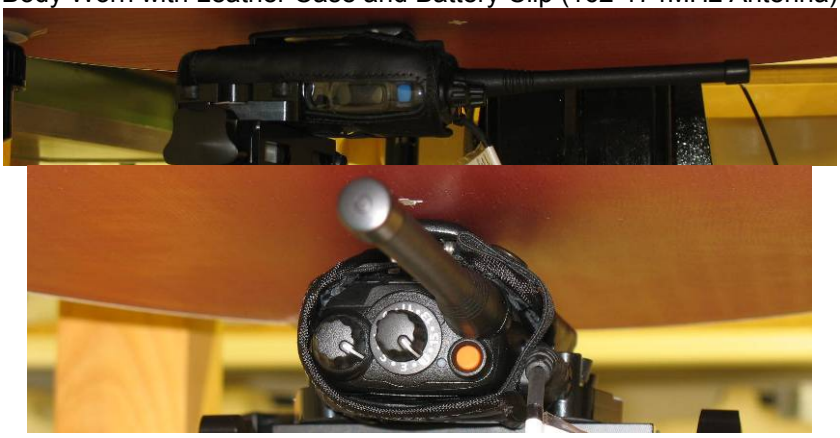
Body Worn with Leather Case and Battery Clip (136-151MHz Antenna)



Body Worn with Leather Case and Battery Clip (150-162MHz Antenna)



Body Worn with Leather Case and Battery Clip (162-174MHz Antenna)



APPENDIX A9 Test Setup Photographs

Body Worn with Leather Case and Spring Clip (136-174MHz Antenna)

Body Worn with Leather Case and Spring Clip (136-151MHz Antenna)

Body Worn with Leather Case and Spring Clip (150-162MHz Antenna)

Body Worn with Leather Case and Spring Clip (162-174MHz Antenna)

APPENDIX A10 Test Setup Photographs

Body Worn with Leather Case and D-Stud Clip (136-174MHz Antenna)

Body Worn with Leather Case and D-Stud Clip (136-151MHz Antenna)

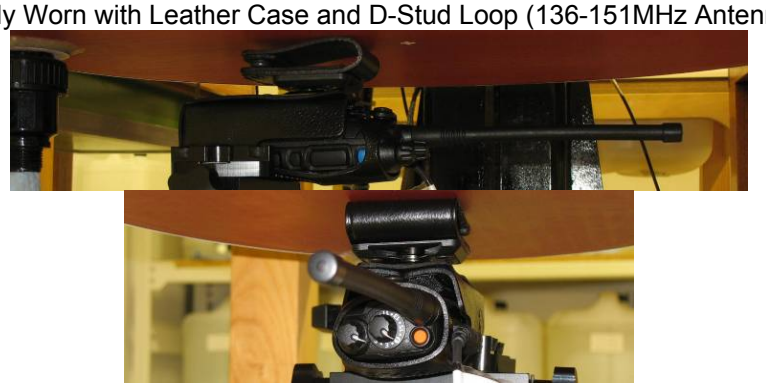
Body Worn with Leather Case and D-Stud Clip (150-162MHz Antenna)

Body Worn with Leather Case and D-Stud Clip (162-174MHz Antenna)

APPENDIX A11 Test Setup Photographs

Body Worn with Leather Case and D-Stud Loop (136-174MHz Antenna)

Body Worn with Leather Case and D-Stud Loop (136-151MHz Antenna)



Body Worn with Leather Case and D-Stud Loop (150-162MHz Antenna)

Body Worn with Leather Case and D-Stud Loop (162-174MHz Antenna)