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SAR Test Report

Report Number: M130336R

This report is replacement for M130336 SAR report

Test Sample: Wireless Microphone Transceiver

Model Number: En2 TXP

Tested For: Audio Limited

Date of Issue: 21st October 2014

EMC Technologies Pty Ltd reports apply only to the specific samples tested under stated test conditions. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. EMC Technologies Pty Ltd shall have no liability for any deductions, inferences or generalisations drawn by the client or others from EMC Technologies Pty Ltd issued reports. This report shall not be used to claim, constitute or imply product endorsement by EMC Technologies Pty Ltd.

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SAR TEST REPORT

Wireless Microphone Transceiver, **Model:** En2 TXP **Report Number:** M130336R

1.0 GENERAL INFORMATION

Test Sample: Wireless Microphone Transceiver
Model Number: En2 TXP
Serial Numbers (7 samples) : 638735-01 / 638735-02 / 638735-03 / 638735-04 / 638735-05 /638735-06 / 638735-07
Hardware Version: VER.03
Software Version: VER.038-106
Manufacturer: Audio Limited

Device Category: Portable Transmitter
Test Device: Production Unit / Prototype Sample
RF exposure Category: General Public/Unaware user

Tested for: Audio Limited
Address: Progress Road, High Wycombe, HP12 4JD, UK
Contact: Lee Stone
Phone: +44 (0) 1494 511711
Fax: +44 (0) 1494 539600
Email: Lee.stone@audioltd.com

Test Standards:

1. FCC KDB 865664 D02 RF Exposure Compliance Reporting and Documentation Considerations v01r01
2. FCC KDB 447498 D01 Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies v05r01
   FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r01
3. RSS-102 Radio Frequency Exposure Compliance of Radio communication Apparatus (All Frequency Bands)
4. **IEC 62209-2:2010**
   Human exposure to radio frequency fields from hand-held and body-mounted 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

Statement Of Compliance: The Wireless Microphone Transceiver, Model En2 TXP complied with the FCC and RSS-102 General public/uncontrolled RF exposure limits of 1.6mW/g for 1g cube of tissue per requirements of 47CFR2.1093(d).

Test Dates: 30th July 2013 to 1st August 2013

Test Officer:

Peter Jakubiec

Authorised Signature:

Chris Zombolas
Technical Director

2.0 DESCRIPTION OF DEVICE

2.1 Description of Test Sample

The device tested was a Wireless Microphone Transceiver, Model: En2 TXP operating in 470 – 607.9 MHz and the 614.1 - 698 MHz frequency bands. It has an external detachable fixed length antenna and was tested in the Body Worn Belt Clip configuration of the phantom. It will be referred to as the device under test (DUT) throughout this report.

Operating Mode during Testing	: Continuous Wave 100% duty cycle
Modulation:	: FM
Device Power Rating for test sample and identical production unit	: 90 mW
Device Dimensions (LxWxH)	: 82mmx63mmx20mm
Antenna type	: Monopole
Applicable Body Configurations	: Body Worn Belt Position
Battery Options	: 1.5 V AA Lithium Battery Pack

2.2 Test sample Accessories

2.2.1 Battery Types

A 1.5 V Lithium Battery Pack is used to power the DUT. The maximum rated power is 90 mW. SAR measurements were performed with a standard 1.5 V battery.

2.3 Test Signal, Frequency and Output Power

The DUT is a 24-channel device that operates in the 470 - 607.9 MHz and 614.1 - 698 MHz frequency bands. The frequency ranges were:
sample 1: 470 MHz to 496 MHz
sample 2: 496 MHz to 524 MHz
sample 3: 512 to 542 MHz
sample 4: 542 to 572 MHz
sample 5: 572 to 607.9 MHz
sample 6: 614.1 MHz to 656 MHz
sample 7: 656 to 698 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. There were no wires or other connections to the Wireless Microphone Transmitter during the SAR measurements.

Table: Test Frequencies

Frequency Range	Traffic Channels	Nominal Power (dBm)
470 MHz	1	20
483 MHz	2	20
496 MHz	3	20
496 MHz	4	20
510 MHz	5	20
524 MHz	6	20
512 MHz	7	20
527 MHz	8	20
542 MHz	9	20
542 MHz	10	20
557 MHz	11	20
572 MHz	12	20
572 MHz	13	20

584 MHz	14	20
596 MHz	15	20
608 MHz	16	20
614 MHz	17	20
628 MHz	18	20
642 MHz	19	20
656 MHz	20	20
656 MHz	21	20
670 MHz	22	20
684 MHz	23	20
698 MHz	24	20

2.4 Conducted Power Measurements

The conducted power of the DUT was measured in the 470 – 607.9 and 614.1 - 698 MHz frequency range with a calibrated Power Meter. The results of this measurement are listed in table below. Please note that some of the measurements are outside the tune-up tolerance range, the high power readings are due to RF conducted power measurement uncertainties.

Table: Frequency and Output Power

Channel	Channel Frequency MHz	Battery Type	Maximum Conducted Output Power mW
1	470	Lithium 1.5 V	94.1
2	483	Lithium 1.5 V	99.6
3	496	Lithium 1.5 V	96.1
4	496	Lithium 1.5 V	105.4
5	510	Lithium 1.5 V	95.9
6	524	Lithium 1.5 V	92.1
7	512	Lithium 1.5 V	91.4
8	527	Lithium 1.5 V	94.0
9	542	Lithium 1.5 V	97.3
10	542	Lithium 1.5 V	84.1
11	557	Lithium 1.5 V	91.9
12	572	Lithium 1.5 V	94.4
13	572	Lithium 1.5 V	84.2
14	584	Lithium 1.5 V	93.1
15	596	Lithium 1.5 V	102.4
16	608	Lithium 1.5 V	104.8
17	614	Lithium 1.5 V	80.4
18	628	Lithium 1.5 V	88.1
19	642	Lithium 1.5 V	92.3
20	656	Lithium 1.5 V	93.3
21	656	Lithium 1.5 V	90.4
22	670	Lithium 1.5 V	94.9
23	684	Lithium 1.5 V	99.2
24	698	Lithium 1.5 V	100.9

2.5 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 conducted RF at the antenna port before the commencement of each test and again after the completion of the test.

Table: Battery Details

Battery : Lithium 1.5 V Ultimate Lithium Ennergizer **Model No.: AA – L91**

2.6 Details of Test Laboratory

2.6.1 Location

EMC Technologies Pty Ltd
176 Harrick Road
Keilor Park, (Melbourne) Victoria
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Facsimile: +61 3 9331 7455
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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:	Radiofrequency Fields. **Part 2:** Principles and methods of measurement and computation - 3kHz to 300 GHz.
ACMA:	Radio communications (Electromagnetic Radiation - Human Exposure) Standard 2003 + Amdt (No. 1):2007
FCC:	Guidelines for Human Exposure to RF Electromagnetic Field OET65C 01/01
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.com.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 21 ± 1 °C, the humidity was 37 % to 42 %. 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, EN62209-1 and EN62209-2 SAR 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 450MHz and 750 MHz with the SPEAG D450V3 and D750V3 calibrated dipoles.

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 @ 450, 750 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 250 mW (750 MHz) and 500 mW (450 MHz).

Table: Validation Results (Dipole: SPEAG D450V3 SN: 1074, SPEAG D750V3 SN: 1051)

1. Validation Date	2. ∈r (measured)	3. σ (S/m) (measured)	4. Measured SAR 1g (mW/g)	5. Measured SAR 10g (mW/g)
31 Jul 13 450 MHz	55.52	0.91	2.39	1.48
31 Jul 13 750 MHz	55.7	0.94	2.31	1.42
31 Jul 13 750 MHz	55.7	0.94	2.33	1.43
31 Jul 13 750 MHz	55.7	0.94	2.33	1.43
31 Jul 13 750 MHz	55.7	0.94	2.32	1.43
31 Jul 13 750 MHz	55.7	0.94	2.34	1.43
31 Jul 13 750 MHz (Target)	55.7	0.94	2.326 (Mean)	1.428 (Mean)
1st Aug 13 750 MHz	56.6	1.00	2.32	1.55

3.4.2 Deviation from reference validation values

The reference SAR values were derived using a reference dipole and flat phantom suitable for a centre frequency of 450 and 750 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 (D450V3 or D750V3) during calibration. The measured one-gram SAR should be within 10% of the expected target reference values shown in table below with the exception of the system check conducted in 600 MHz liquid using 600MHz probe calibration correction factors**.** This was conducted according to the procedures in 3.4.2 (2) of KDB 865664 as per results of a KDB enquiry.

Table: Deviation from reference validation values

Frequency in MHz	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 (%)
450	2.39	4.78	4.42	8.14	-	-
750 (in 600MHz liquid)	2.33	9.30	8.8	5.73 (target ±15%)	-	-
750	2.32	9.28	8.8	5.45	-	-

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.

3.5 Phantom Properties (Size, Shape, Shell Thickness)

For SAR testing in the Belt Clip position a SPEAG 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.

Liquid Depth 15cm

During the SAR measurement process the liquid level was maintained to a level of 15cm with a tolerance of 0.5cm.

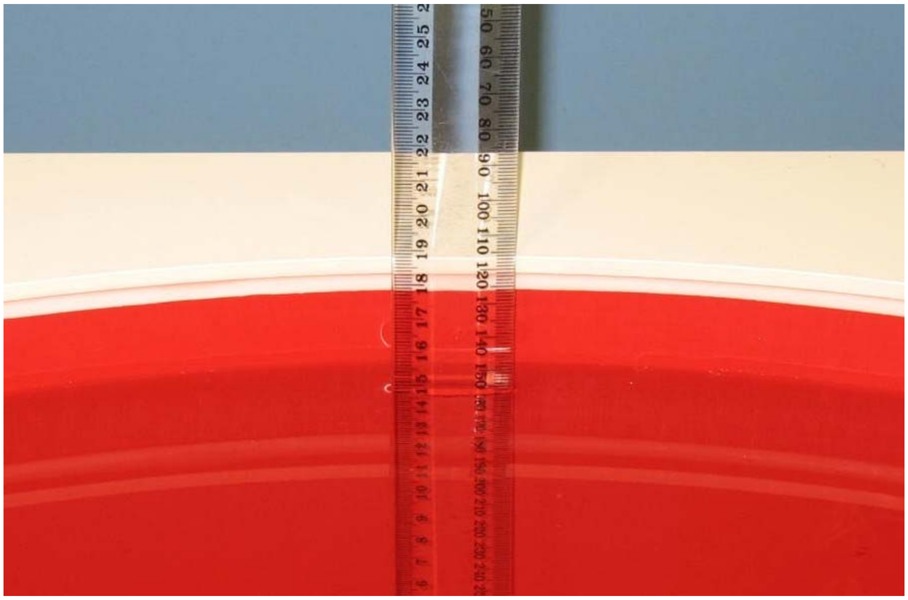

Photo of liquid Depth in Flat Phantom

Phantom Properties

The phantoms used during the testing comply with the IEEE 1528 and EN62209-1 and EN62209-2 SAR measurement requirements.

Table Phantom Properties

Phantom Properties	
Depth of Phantom	17 cm
Width of flat section	40 cm
Length of flat section	65 cm
Thickness of flat section	2.0mm +/-0.2mm (flat section)
Dielectric Constant	<5.0
Loss Tangent	<0.05

3.6 Tissue Material Properties

The dielectric parameters of the human tissue 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: Target Simulating Liquid Dielectric Values

Frequency Band	∈r (measured range)	∈r (target)	σ (mho/m) (measured range)	σ (target)	ρ kg/m^3
450MHz	54.8-55.5	56.7 ±5% (53.9 to 59.5)	0.912-0.988	0.94 ±5% (0.89 to 0.99)	1000
600MHz	55.3-56.3	56.1 ±5% (53.3 to 58.9)	0.908-0.981	0.95 ±5% (0.90 to 0.99)	1000
750MHz	56.6-57.6	55.4 ±5% (52.6 to 58.2)	0.918-1.00	0.96 ±5% (0.91 to 1.01)	1000

NOTE: The 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 (%)
31th July 2013	20.9	20.5	42
1st August 2013	21.5	21.3	37

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: @ 450MHz
Volume of Liquid: 30 Litres

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

Table: Tissue Type: @ 600MHz/750MHz
Volume of Liquid: 30 Litres

Approximate Composition	% By Weight
Distilled Water	41.05
Salt	1.45
Sugar	56.5
HEC	1.0
Bactericide	0.1

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 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 4 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 270 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 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 IEEE Std 1528-2003

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	6.7	N	1.00	1	1	6.70	6.70	∞
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	4.95	R	1.73	1	1	2.86	2.86	∞
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)						12.0	11.9	
Expanded Uncertainty (95% CONFIDENCE LEVEL)			k= 2			24.1	23.7	

Table: Uncertainty Budget for DASY5 Version 52 – DUT SAR test IEC62209-2

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	6.7	N	1	1	1	6.7	6.7	∞
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	∞
Linearity	4.7	R	1.73	1	1	2.71	2.71	∞
Modulation Response	2.4	R	1.73	1	1	1.39	1.39	∞
System Detection Limits	1	R	1.73	1	1	0.58	0.58	∞
Boundary Effects	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	∞
Post Processing	2	R	1.73	1	1	1.15	1.15	∞
Test Sample Related								
Device Holder	3.6	N	1.00	1	1	3.60	3.60	5
Test Sample Positioning	2.9	N	1.00	1	1	2.90	2.90	145
Power Scaling	0	R	1.73	1	1	0.00	0.00	∞
Power Drift	4.95	R	1.73	1	1	2.86	2.86	∞
Phantom and Setup								
Phantom Uncertainty	7.5	R	1.73	1	1	4.33	4.33	∞
SAR Correction	1.9	R	1.73	1	0.84	1.10	0.92	∞
Liquid Conductivity – Measurement uncertainty	2.5	N	1.00	0.64	0.43	1.60	1.08	∞
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)						11.8	11.7	748
Expanded Uncertainty (95% CONFIDENCE LEVEL)			k=	2		23.6	23.4	

The estimated total measurement uncertainty for the DASY5 measurement system was ± 12.0%. The extended uncertainty (K = 2) was assessed to be ±24.1% 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	6.7	N	1.00	1	1	6.70	6.70	∞
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	3.40	R	1.73	1	1	1.96	1.96	∞
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)						10.5	10.3	
Expanded Uncertainty (95% CONFIDENCE LEVEL)			k= 2			21.0	20.7	

Estimated total measurement uncertainty for the DASY5 measurement system was ± 10.5%. The extended uncertainty (K = 2) was assessed to be ±21.0% based on 95% confidence level. The uncertainty is not added to the 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	03-June-2014	
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	14-June-2014	
Probe E-Field	SPEAG	ES3DV6	3029	Not Used	
Probe E-Field	SPEAG	EX3DV4	3563	14-June-2014	
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	D750V3	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 (Belt Clip)

SAR measurements were performed in the “Belt Clip” position. The “Belt Clip” position was measured in the flat section of the SPEAG ELI 4.0 phantom.
See Appendix A for photos of test positions.

7.1.1 “Belt Clip” Position

The device was tested in the (2.00 mm) flat section of the SPEAG phantom for the “Belt Clip” position. A belt clip maintained a distance of 0 mm 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 metal and the device was connected with the microphone.

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

The device has a detachable antenna. The SAR was measured at 24 test channels with the test samples operating at maximum power, as specified in section 2.3.

7.3 FCC and RSS-102 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 and RSS-102 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 **Belt Clip** configuration of the phantom.

Table: SAR MEASUREMENT RESULTS – Belt Clip position

Test Position	Plot No.	DUT Sample No	Test Channel	Test Freq (MHz)	Measured 1g SAR Results (mW/g)	Tune-Up 1g SAR Results (mW/g)	Measured Drift (dB)
Body Worn Belt Clip	1	1	1	470.1	0.325	-	-0.03
	2		2	483	**0.334**	**0.335**	-0.01
	3		3	495.9	0.307	-	-0.03
System check	4	1		450	2.39	-	0.02
Body Worn Belt Clip	5	2	4	496.1	**0.396**	**0.396***	-0.03
	6		5	510	0.33	-	0.02
	7		6	523.9	0.225	-	-0.09
	8	3	7	512.1	0.301	-	-0.03
	9		8	527	**0.32**	**0.340**	-0.02
	10		9	541.9	0.31	-	0
	11	4	10	542.1	0.349	-	-0.04
	12		11	557	0.439	-	-0.01
	13		12	571.9	**0.462**	**0.489**	-0.03
System check	14	4		750	2.31	-	-0.03
	15			750	2.33	-	-0.07
	16			750	2.33	-	-0.06
	17			750	2.32	-	-0.06
	18			750	2.34	-	-0.06
Body Worn Belt Clip	19	5	13	572	0.385	-	-0.01
	20		14	584	0.474	-	-0.04
	21		15	596	0.547	-	-0.02
	22		16	607.9	**0.568**	**0.568***	0
	23	6	17	614.1	0.532	-	-0.01
	24		18	628	0.547	-	-0.03
	25		19	642	**0.609**	**0.660**	-0.05
System check	26			750	2.32	-	-0.04
Body Worn Belt Clip	27		20	655.9	0.595	-	-0.02
	28	7	21	656	0.646	**0.715**	-0.02
	29		22	670	**0.656**	**0.691**	-0.03
	30		23	684	0.63	-	-0.03
	31		24	697.9	0.561	-	-0.01

(*) The measured SAR value is equal to the tuned up SAR value if the measured conducted power is greater than 100 mW

Note: The uncertainty of the system (± 27 %) has not been added to the results.

The FCC and RSS-102 SAR limit for Non-occupational exposure is 1.6 m W/g measurement in a 1g cube of tissue.

9.0 COMPLIANCE STATEMENT

The Wireless Microphone Transceiver model En2 TXP was tested on behalf of Audio Limited. It complied with the FCC and RSS-102 SAR requirements.

The highest SAR level recorded was 0.656 mW/g for a 1g cube. The manufacturer's tune up power is stated to be 100 mW. After scaling the SAR value, using the formula **(100 mW × measured SAR value) / max. output conducted power at the channel frequency,** the maximum SAR value is **0.691 mW/g.** This value was measured in the "Body Worn Belt Clip" position, and was below the uncontrolled limit of 1.6 mW/g, even taking into account the measurement uncertainty of 27 %.