



Global Product Certification
EMC-EMF-Safety Approvals

EMC 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

SAR Test Report

Report Number: M151005F_R
(Replacing M151005F)

Test Sample: Audio Limited Wireless Microphone

Model Number: TX1010

Tested For: Audio Ltd

Date of Issue: 1 September 2016

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Accreditation No. 5292

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SAR TEST REPORTAudio Limited Wireless Microphone, **Model: TX1010 Report Number: M151005F_R****1.0 GENERAL INFORMATION**

Test Sample: Audio Limited Wireless Microphone
Model Number: TX1010
Serial Numbers: Unit 470-548MHz – D064900-11; Unit 518-608MHz – D064900-13;
Hardware Version: Rev. A
Software Version: D00-28/01.01.0A
Manufacturer: Audio Ltd
FCC ID NRKTX1010
IC ID 20513-TX1010
Device Category: Portable Transmitter
Test Device: Production Unit / Prototype Sample
RF exposure Category: General Public/Unaware user
Tested for: Audio Ltd
Address: Audio House, Progress Road, High Wycombe, Buckinghamshire
 HP12 4JD UK
Contact: Lee Stone
Phone: 01494 511711
Email: Lee.Stone@audioltd.com

Test Standards: 447498 D01 General RF Exposure Guidance v06
 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04
 865664 D02 RF Exposure Reporting v01r02
 Radio Frequency Exposure Compliance of Radiocommunication
 Apparatus (All Frequency Bands) RSS-102
EN 62209-2:2010
 Human exposure to radio frequency fields from hand-held and
 bodymounted 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: 2013 Recommended Practice for Determining the Peak Spatial-Average
 Specific Absorption Rate (SAR) in the Human Head Due to Wireless
 Communications Devices: Measurement Techniques.

Statement Of Compliance: The Audio Limited Wireless Microphone, Model: TX1010, Complied
 with the FCC General public/uncontrolled RF exposure limits of
 1.6mW/g per requirements of 47CFR2.1093(d). It also complied with
 IC RSS-102 requirements.

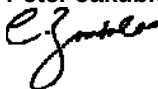
Highest Reported SAR: 450 MHz Band - 0.269mW/g
 600 MHz Band – 0.242 mW/g
Test Dates: 20th to 25th November 2015

Test Officer:



Peter Jakubiec

Authorised Signature:



Chris Zombolas
Technical Director



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2.0 DESCRIPTION OF DEVICE

2.1 Description of Test Sample

The device tested was an Audio Limited Wireless Microphone, Model: TX1010 operating in 450-608 MHz frequency band. It has an External fixed length antenna and was tested in the Belt Worn 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
Device Power Rating for test sample and identical production unit	: 45 mW +5mW/-15mW (50mW tune up)
Device Dimensions (LxWxH)	: 124 x 68 x 18mm
Antenna type	: Monopole
Applicable Head Configurations	: None
Applicable Body Configurations	: Belt Worn Position
Battery Options	: 1.5V 1500mAh Alkaline Battery; 1.5V 3200mAh Lithium Battery; 1.2V 2200mAh Ni-Mh Battery

2.2 Test sample Accessories

3.1 Battery Types

Two 1.5V or 1.2V AA Size Batteries are used to power the DUT, Model: TX1010. The maximum rated power is 50 mW. SAR measurements were performed with three battery types: 1.5V 1500mAh Alkaline Battery, 1.5V 3200mAh Lithium Battery and 1.2V 2200mAh Ni-Mh Battery.

2.3 Test Signal, Frequency and Output Power

The DUT operates in the 470 to 608 MHz frequency band. 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. Tune up tolerance stated by the manufacturer is 45mW +5mW/-15mW Therefore maximum power including tune up is 50mW for all channels.

Table: Test Frequencies

Frequency Range	Traffic Channels	Maximum Power including tune up tolerance (mW)
470 - 548 MHz	1,2,3,4,5,106,7	50
518 - 608 MHz	4,106,107,108,109,11	50



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2.4 Conducted Power Measurements

The conducted power of the DUT was measured in the 470 MHz to 608 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 mW
1	470	Alkaline	32.2
2	489.5	Alkaline	39.3
3	509	Alkaline	42.0
4	518	Alkaline	43.8
5	528.5	Alkaline	42.0
106	536	Alkaline	44.4
7	548	Alkaline	40.8
107	554	Alkaline	39.8
108	572	Alkaline	38.9
109	590	Alkaline	37.8
11	608	Alkaline	38.8

2.5 Battery Status

The device battery was fully charged prior to commencement of measurement.

Table: Battery Details

Battery #1:	1.5V 1500mAh Alkaline Battery	Battery #2:	1.5V 3200mAh Lithium Battery
Model No.:	Duracell Ultra	Model No.:	Energizer Ultimate Ultra
Size.:	LR6 (AA)	Size.:	L91 (AA)
Battery #1:	1.2V 2200mAh Ni-Mh Battery		
Model No.:	DSE		
Size.:	HR6 (AA)		



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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	Radiofrequency Fields.
2011:	Part 2: Principles and methods of measurement and computation - 3kHz to 300 GHz.
ACMA:	Radio communications (Electromagnetic Radiation - Human Exposure) Standard 2014
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: 2013	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 49 to 54 %. 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 either the ET3DV6 E-field probe is less than 5µV in both air and liquid mediums.



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3.0 CALIBRATION AND VALIDATION PROCEDURES 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 450 and 600 MHz with the SPEAG 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.

3.1 System Check Results

The IEEE Std 1528 reference SAR values are derived numerically for a given phantom and dipole construction, at the frequencies listed below. These reference SAR values are obtained from the IEEE Std 1528 standard and are normalized to 1W.

The SPEAG calibration reference SAR value is the SAR validation result obtained in a specific dielectric liquid using the verification dipole during calibration. The measured ten-gram SAR should be within $\pm 10\%$ of the expected target reference values shown in table below.

Table: Deviation from reference validation values

Date	Frequency (MHz)	Measured SAR 1g (input power = 400mW)	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 (%)	Last Validation Date
24 th Nov. 2015	450	1.90	4.75	4.42	7.47	-	-	2/04/2015

Date	Frequency (MHz)	Measured SAR 1g (input power = 250mW)	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 (%)	Last Validation Date
25 th Nov. 2015	600	1.53	6.12	6.59	-7.13	-	-	16/10/2015

Note: All reference SAR values are normalized to 1W input power.

3.2 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: Temperature and Humidity recorded for each day

Date	Ambient Temperature ($^\circ\text{C}$)	Liquid Temperature ($^\circ\text{C}$)	Humidity (%)
24 th November 2015	20.5	20.2	50
25 th November 2015	20.3	20.0	51



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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 SAR value at a fixed location is used as a reference value for assessing the power drop of the DUT. 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 phantom is measured at a distance of 4.0 mm from the inner surface of the shell. The area covers the entire dimension of the DUT and the horizontal grid spacing is 15 mm x 15 mm. The actual largest Area Scan has dimensions of 130 mm x 300 mm 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 32 mm x 32 mm x 30 mm is assessed by measuring 5 x 5 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



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5.0 MEASUREMENT UNCERTAINTY

The uncertainty analysis is based on the template listed in the IEEE Std 1528 for both DUT 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	6.65	N	1.00	1	1	6.65	6.65	∞
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	∞
Modulation response	2.4	R	1.73	1	1	1.39	1.39	∞
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								
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	7.6	R	1.73	1	1	4.39	4.39	∞
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	3.4	R	1.73	0.78	0.71	0.77	0.70	∞
Temp. unc. - Permittivity	0.4	R	1.73	0.23	0.26	0.04	0.05	∞
Combined standard Uncertainty (u _c)						12.03	11.86	
Expanded Uncertainty (95% CONFIDENCE LEVEL)			k= 2			24.06	23.71	

Estimated total measurement uncertainty for the DASY5 measurement system was $\pm 12.03\%$. The extended uncertainty ($K = 2$) was assessed to be $\pm 24.06\%$ based on 95% confidence level. The uncertainty is not added to the measurement result.



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**Table: Uncertainty Budget for DASY5 Version 52 – DUT SAR test
IEC 62209-2 and 62209-1 (RSS-102)**

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	6.65	N	1.00	1	1	6.65	6.65	∞
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	∞
Modulation response	2.4	R	1.73	1	1	1.39	1.39	∞
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								
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	∞
Output Power Variation – SAR Drift Measurement	4.50	R	1.73	1	1	2.60	2.60	∞
Phantom and Setup								
Phantom Uncertainty	7.6	R	1.73	1	1	4.39	4.39	∞
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	0.43	1.60	1.08	∞
Liquid Permittivity – Measurement uncertainty	2.5	N	1.00	0.6	0.49	1.50	1.23	∞
Temp.unc. - Conductivity	3.4	R	1.73	0.78	0.71	1.53	1.39	∞
Temp. unc. - Permittivity	0.4	R	1.73	0.23	0.26	0.05	0.06	∞
Combined standard Uncertainty (u _c)						12.10	11.88	
Expanded Uncertainty (95% CONFIDENCE LEVEL)			k= 2			24.21	23.76	

Estimated total measurement uncertainty for the DASY5 measurement system was $\pm 12.10\%$. The extended uncertainty ($K = 2$) was assessed to be $\pm 24.21\%$ based on 95% confidence level. The uncertainty is not added to the measurement result.



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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	6.65	N	1.00	1	1	6.65	6.65	∞
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	∞
Modulation response	0	R	1.73	1	1	0.00	0.00	∞
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	∞
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	3.4	R	1.73	0.78	0.71	0.77	0.70	∞
Temp. unc. - Permittivity	0.4	R	1.73	0.23	0.26	0.04	0.05	∞
Combined standard Uncertainty (u _c)						10.43	10.25	
Expanded Uncertainty (95% CONFIDENCE LEVEL)			k=	2		20.85	20.50	

Estimated total measurement uncertainty for the DASY5 measurement system was $\pm 10.43\%$. The extended uncertainty ($K = 2$) was assessed to be $\pm 20.85\%$ 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: 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	04-June-2016	
Data Acquisition Electronics	SPEAG	DAE3 V1	442	03-Dec-2015	✓
Probe E-Field - Dummy	SPEAG	DP1	N/A	Not applicable	
Probe E-Field	SPEAG	ET3DV6	1380	11-Dec-2015	✓
Probe E-Field	SPEAG	ET3DV6	1377	11-June-2016	
Probe E-Field	SPEAG	ES3DV6	3029	Not Used	
Probe E-Field	SPEAG	EX3DV4	3956	15-June-2016	
Probe E-Field	SPEAG	EX3DV4	7358	21- April-2016	
Validation Source 150 MHz	SPEAG	CLA150	4003	3-Dec-2016	
Antenna Dipole 300 MHz	SPEAG	D300V3	1012	11-Dec-2015	
Antenna Dipole 450 MHz	SPEAG	D450V3	1074	11-Dec-2015	✓
Antenna Dipole 600 MHz	SPEAG	D600V3	1008	16-Oct-2018	✓
Antenna Dipole 750 MHz	SPEAG	D750V2	1051	13-Dec-2016	✓
Antenna Dipole 900 MHz	SPEAG	D900V2	047	09-Dec-2017	
Antenna Dipole 1640 MHz	SPEAG	D1640V2	314	05-Dec-2017	
Antenna Dipole 1800 MHz	SPEAG	D1800V2	242	05-Dec-2017	
Antenna Dipole 1950 MHz	SPEAG	D1950V3	1113	6-Dec -2015	
Antenna Dipole 2300 MHz	SPEAG	D2300V2	1032	22-Aug-2016	
Antenna Dipole 2450 MHz	SPEAG	D2450V2	724	04-Dec-2015	
Antenna Dipole 2600 MHz	SPEAG	D2600V2	1044	13-Dec-2016	
Antenna Dipole 3500 MHz	SPEAG	D3500V2	1002	13-July-2013	
Antenna Dipole 5600 MHz	SPEAG	D5GHzV2	1008	16-Dec-2016	
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	86630A	3250A00328	*In test	✓
RF Power Meter	Hewlett Packard	437B	3125012786	*In test	✓
RF Power Sensor 0.01 - 18 GHz	Hewlett Packard	8481H	1545A01634	06-Oct-2016	✓
RF Power Meter	Rohde & Schwarz	NRP	101415	16-Oct-2016	
RF Power Sensor	Rohde & Schwarz	NRP - Z81	100174	19-Oct-2017	
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	03-Oct-2016	
Network Analyser	Hewlett Packard	8753ES	JP39240130	10-Nov-2015	
Network Analyser	Hewlett Packard	8753D	3410A04122	28-Jan-2016	✓
Dual Directional Coupler	Hewlett Packard	778D	1144 04700	*In test	✓
Dual Directional Coupler	NARDA	3022	75453	*In test	
Thermometer	Digitech	QM7217	T-103	27-Aug-2016	✓
Thermometer	Digitech	QM7217	T-104	15-Dec-2015	

* Calibrated during the test for the relevant parameters.



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7.0 SAR TEST METHOD

7.1 Description of the Test Positions (Belt Worn)

SAR measurements were performed in the “Belt Worn” position, measured in the flat section of the SPEAG ELI 4.0 phantom.

See Appendix A for photos of test positions.

7.1.1 “Belt Worn” Position

The device was tested in the (2.00 mm) flat section of the SPEAG phantom for the “Belt Worn” position. A Pouch made of non-metallic material is used to wear the DUT on the belt; the Pouch maintained a distance of approximately 7 mm between the back of the device and the flat phantom. The Transmitter was placed at the flat section of the phantom and suspended until the back of DUT touched the phantom. The Pouch was made of nylon 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 fixed antenna. The SAR was measured at six test channels with the test sample operating at maximum power, as specified in section 2.3.

7.2 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)

7.3 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 tissue mass were determined for the sample device for the Belt Worn configuration of the phantom.

Table: SAR MEASUREMENT RESULTS– Belt Worn position 450 MHz

Test Position	Plot No.	Test Mode	Test Ch.	Test Freq. (MHz)	SAR (1g) mW/g	Drift (dB)	ϵ_r (target 56.7 $\pm 5\%$ 53.9 to 59.5)	σ (target 0.94 $\pm 5\%$ 0.89 to 0.99)	Tune Up SAR mW/g
Body Worn Pouch 470-548 MHz Model Alkaline Battery 24-11-15	1.	CW	1	470	0.109	-0.2	55.3	0.92	0.169
Body Worn Pouch 470-548 MHz Model Alkaline Battery 24-11-15	2.	CW	2	489.5	0.131	-0.08	55.0	0.94	0.167
Body Worn Pouch 470-548 MHz Model Alkaline Battery 24-11-15	3.	CW	3	509	0.0919	0.01	54.7	0.95	0.109
Body Worn Pouch 470-548 MHz Model Alkaline Battery 24-11-15	4.	CW	5	528.5	0.0933	-0.06	54.3	0.97	0.111
Body Worn Pouch 470-548 MHz Model Alkaline Battery 24-11-15	5.	CW	7	548	0.0833	-0.12	54.1	0.99	0.102
Body Worn Pouch 470-548 MHz Model Lithium Battery 24-11-15	6.	CW	2	489.5	0.125	-0.09	55.0	0.94	0.159
Body Worn Pouch 470-548 MHz Model Ni-Mh Battery 24-11-15	7.	CW	2	489.5	0.118	-0.04	55.0	0.94	0.150
Body Worn Pouch 518-608 MHz Model Alkaline Battery 24-11-15	8.	CW	4	518	0.236	0.09	54.5	0.96	0.269
Body Worn Pouch 518-608 MHz Model Alkaline Battery 24-11-15	9.	CW	106	536	0.229	-0.13	54.3	0.98	0.258
Body Worn Pouch 518-608 MHz Model Lithium Battery 24-11-15	10.	CW	4	518	0.219	-0.08	54.5	0.96	0.250
Body Worn Pouch 518-608 MHz Model Ni-Mh Battery 24-11-15	11.	CW	4	518	0.219	-0.05	54.5	0.96	0.250
System Check 24-11-15	12.	CW	1	450	1.9	0.02	55.6	0.90	N/A

Note: The uncertainty of the system ($\pm 24.06\%$) has not been added to the results.



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Table: SAR MEASUREMENT RESULTS– Belt Worn position 600 MHz

Test Position	Plot No.	Test Mode	Test Ch.	Test Freq. (MHz)	SAR (1g) mW/g	Drift (dB)	ϵ_r (target 56.1 $\pm 5\%$ 53.3 to 58.9)	σ (target 0.95 $\pm 5\%$ 0.90 to 1.00)	Tune Up SAR mW/g
Body Worn Pouch 518-608 MHz Model Alkaline Battery 25-11-15	13.	CW	107	554	0.172	-0.12	57.0	0.90	0.216
Body Worn Pouch 518-608 MHz Model Alkaline Battery 25-11-15	14.	CW	108	572	0.149	-0.16	56.8	0.92	0.192
Body Worn Pouch 518-608 MHz Model Alkaline Battery 25-11-15	15.	CW	109	590	0.129	-0.13	56.6	0.93	0.171
Body Worn Pouch 518-608 MHz Model Alkaline Battery 25-11-15	16.	CW	11	608	0.101	-0.14	56.4	0.95	0.130
Body Worn Pouch 518-608 MHz Model Lithium Battery 25-11-15	17.	CW	107	554	0.193	0.05	57.0	0.90	0.242
Body Worn Pouch 518-608 MHz Model Ni-Mh Battery 25-11-15	18.	CW	107	554	0.179	-0.04	57.0	0.90	0.225
System Check 25-11-15	19.	CW	1	600	1.53	0.11	56.5	0.9382	N/A

Note: The uncertainty of the system ($\pm 24.06\%$) has not been added to the results.



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9.0 COMPLIANCE STATEMENT

The Audio Limited Wireless Microphone model TX1010 was tested on behalf of Audio Ltd. It complied with the FCC SAR requirements. It also complied with IC RSS-102 requirements.

The highest Measured SAR level was 0.236 mW/g for a 1g cube. The manufacturer's tune up power is stated to be 50 mW. Scaling the SAR value, the maximum Reported SAR value is **0.269 mW/g**. This value was measured for the 518-608 MHz Model in the "Body Worn" position with Alkaline Battery, and was below the uncontrolled limit of 1.6 mW/g, and also below the controlled limit of 8.0 mW/g, even taking into account the measurement uncertainty of 24.06 %.

The SAR test Variability check was not required because the highest measured SAR was less than 0.8 mW/g.



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10.0 MULTIBAND EVALUATION (SIMULTANEUS TRANSMISSION)

The Audio Limited Wireless Microphone model TX1010 contains a Bluetooth transmitter in addition to the main Wireless Microphone transmitter, both transmitters can transmit simultaneously.

The Bluetooth (BLE) RF power is 1mW max and the distance from BLE antenna to the user is less than 5mm. Testing of Standalone Bluetooth transmitter will not be needed. This is in accordance to the formula from 447498 D01 General RF Exposure Guidance v05r02 section 4.3.1 and RSS-102 section 2.5.1:

- 1) The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:

$$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f_{\text{GHz}}}] \leq 3.0 \text{ for 1-g SAR and } \leq 7.5 \text{ for 10-g extremity SAR,}^{25} \text{ where}$$

- f_{GHz} is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation²⁶
- The result is rounded to one decimal place for comparison
- 3.0 and 7.5 are referred to as the numeric thresholds in the step 2 below

$$[(1.1 \text{ mW}) / (5 \text{ mm})] \cdot (2.45 \text{ GHz}) = 0.344 \leq 3.0$$

Also:

- 2) When the standalone SAR test exclusion of section 4.3.1 is applied to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to the following to determine simultaneous transmission SAR test exclusion:³⁰

- $(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm}) \cdot [\sqrt{f_{\text{GHz}}/x}] \text{ W/kg for test separation distances } \leq 50 \text{ mm;}$
where $x = 7.5$ for 1-g SAR, and $x = 18.75$ for 10-g SAR.

$$[(1.1 \text{ mW}) / (5 \text{ mm})] \cdot (2.45 \text{ GHz}/7.5) = 0.046 \text{ mW/g}$$

This SAR estimation formula has been considered, in conjunction with the *SAR Test Exclusion Thresholds*, to result in substantially conservative SAR values of $\leq 0.4 \text{ W/kg}$. When SAR is estimated, the peak SAR location is assumed to be at the feed-point or geometric center of the antenna, whichever provides a smaller antenna separation distance, and must be clearly identified in test reports. The estimated SAR is only used to determine simultaneous transmission SAR test exclusion; it should not be reported as the standalone SAR. When SAR is estimated, it must be applied to determine the sum of 1-g SAR test exclusion. When SAR to peak location separation ratio test exclusion is applied, the highest reported SAR for simultaneous transmission can be an estimated standalone SAR if the estimated SAR is the highest among the simultaneously transmitting antennas (see KDB 690783). For conditions where the estimated SAR is overly conservative for certain conditions, the test lab may choose to perform standalone SAR measurements and use the measured SAR to determine simultaneous transmission SAR test exclusion. The estimated SAR values at selected frequencies, distances and power levels are illustrated in Appendix D.

The sum of the SAR of the BLE and the main transmitter is:

$$0.046 \text{ mW/g} + 0.296 \text{ mW/g} = 0.342 \text{ mW/g, which is below } 1.6 \text{ mW/g SAR limit.}$$



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RSS-102 Exemption Limits

2.5.1 Exemption Limits for Routine Evaluation — SAR Evaluation

SAR evaluation is required if the separation distance between the user and/or bystander and the antenna and/or radiating element of the device is less than or equal to 20 cm, except when the device operates at or below the applicable output power level (adjusted for tune-up tolerance) for the specified separation distance defined in [Table 1](#).

Table 1: SAR evaluation — Exemption limits for routine evaluation based on frequency and separation distance¹⁵					
Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of ≤5 mm	At separation distance of 10 mm	At separation distance of 15 mm	At separation distance of 20 mm	At separation distance of 25 mm
≤300	71 mW	101 mW	132 mW	162 mW	193 mW
450	52 mW	70 mW	88 mW	106 mW	123 mW
835	17 mW	30 mW	42 mW	55 mW	67 mW
1900	7 mW	10 mW	18 mW	34 mW	60 mW
2450	4 mW	7 mW	15 mW	30 mW	52 mW
3500	2 mW	6 mW	16 mW	32 mW	55 mW
5800	1 mW	6 mW	15 mW	27 mW	41 mW



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