



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: M071220

Test Sample: RF ID Transmitter

Model Number: ALR-9900-WR1

Tested For: Alien Technology Corporation

Date of Issue: 20th December 2007

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.



Nata Accredited Laboratory
Number: 5292

EMC Technologies is a NATA Accredited Laboratory complying with the requirements specified in ISO/IEC 17025 and results produced are traceable to national standards of measurement. This document shall not be reproduced, except in full.

CONTENTS

- 1.0 GENERAL INFORMATION 3**
- 2.0 DESCRIPTION OF DEVICE 4**
 - 2.1 Description of Test Sample 4
 - 2.2 Test Signal, Frequency and Output Power..... 4
 - 2.3 Conducted Power Measurements 4
- 2.4 DETAILS OF TEST LABORATORY 5**
 - 2.4.1 Location..... 5
 - 2.4.2 Accreditations..... 5
 - 2.4.3 Environmental Factors 5
- 3.0 DESCRIPTION OF SAR MEASUREMENT SYSTEM..... 6**
 - 3.1 Probe Positioning System 6
 - 3.2 E-Field Probe Type and Performance 6
 - 3.3 Data Acquisition Electronics 6
 - 3.4 Calibration and Validation Procedures and Data 6
 - 3.4.1 Validation Results @ 900 MHz..... 6
 - 3.4.2 Deviation from reference validation values 7
 - 3.4.3 Liquid Depth 15cm..... 7
 - 3.5 Phantom Properties (Size, Shape, Shell Thickness) 7
 - 3.6 Tissue Material Properties..... 8
 - 3.6.1 Liquid Temperature and Humidity 8
 - 3.7 Simulated Tissue Composition Used for SAR Test 8
 - 3.8 Device Holder for DASY4..... 8
- 4.0 SAR MEASUREMENT PROCEDURE USING DASY4..... 9**
- 5.0 MEASUREMENT UNCERTAINTY 10**
- 6.0 EQUIPMENT LIST AND CALIBRATION DETAILS..... 12**
- 7.0 SAR TEST METHOD..... 13**
 - 7.1 Description of the Test Positions (Body Worn) 13
 - 7.1.1 “Body Worn” Position..... 13
 - 7.2 List of All Test Cases (Antenna In/Out, Test Frequencies, User Modes)..... 13
 - 7.3 ARPANSA RF Exposure Limits for ACMA (Australia) 13
- 8.0 SAR MEASUREMENT RESULTS..... 14**
- 9.0 COMPLIANCE STATEMENT 14**
- APPENDIX A1 Test Sample Photographs 15**
- APPENDIX A2 Test Setup Photographs..... 17**
- APPENDIX B Plots Of The SAR Measurements..... 20**



This document shall not be copied or reproduced, except in full without the written permission of the Technical Director , EMC Technologies Pty. Ltd.

SAR EVALUATION
RF ID Transmitter, **Model:** ALR-9900-WR1
Report Number: M071220

1.0 GENERAL INFORMATION

Test Sample: RF ID Transmitter
Model Numbers (Antennas 1, 2 and 3): ALR-9610-AL, ALR-9611-CR, ALR 9608-C
Serial Numbers (Antennas 1 and 2): ALR-9610-AL-06-00808, ALR-9611-CR-06-11809
Manufacturer: Alien Technology Corporation

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

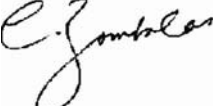
Tested for: Alien Technology Corporation
Address: 18220 Butterfield Boulevard, Morgan Hill C A 95037 USA
Contact: Bruce Grant
Phone: 03 9809 4707
Fax: 03 9809 0195
Mobile: 0407 053 963

Test Standard/s: Radiocommunications (Electromagnetic Radiation — Human Exposure) Standard 2007 (No. 1) Maximum Exposure Levels to Radiofrequency Fields – 3kHz to 300GHz, ARPANSA
Basic standard for the measurement of Specific Absorption Rate related to human exposure to electromagnetic fields from mobile phones (300MHz – 3GHz), EN 50361:2001

Statement Of Compliance: The RF ID Transmitter, Model: ALR-9900-WR1, Complied with the Australian Communications and Media Authority standard for human exposure to radio frequencies: General Public/Unaware user RF exposure limits of 2.0 mW/g for a 10g cube of tissue

Test Date: 18th December 2007

Test Officer: 
Peter Jakubiec
SAR Test Officer

Authorised Signature: 
Chris Zombolas
Technical Director



This document shall not be copied or reproduced, except in full without the written permission of the Technical Director , EMC Technologies Pty. Ltd.

2.0 DESCRIPTION OF DEVICE

2.1 Description of Test Sample

The device tested was a RF ID Transmitter, Model: ALR-9900-WR1 operating in 900 MHz frequency band. It has multiple integral fixed length antennas and was tested in the Body Worn configuration of the phantom.

Operating Mode during Testing	: Continuous Wave 100% duty cycle
Modulation:	: Continuous Wave
Nominal Power Output	: 30dBm (1W)
Device Dimensions (LxWxH) (Antenna 1)	: 195x285x45 mm
Device Dimensions (LxWxH) (Antenna 2)	: 195x285x45 mm
Device Dimensions (LxWxH) (Antenna 3)	: 133x133x18 mm
Applicable Head Configurations	: None
Applicable Body Configurations	: Body Worn Position
Battery Options	: N/A

2.2 Test Signal, Frequency and Output Power

The RF ID Transmitter operates between the frequency range of 920 MHz to 925 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.

2.3 Conducted Power Measurements

The conducted power of the device was measured at the middle channel with a calibrated Power Meter. The results of this measurement are listed in table below.

Table: Frequency and Output Power

Channel	Channel Frequency MHz	Maximum Conducted Output Power
4	922.75	32.13 dBm (1.63W)



This document shall not be copied or reproduced, except in full without the written permission of the Technical Director , EMC Technologies Pty. Ltd.

2.4 DETAILS OF TEST LABORATORY

2.4.1 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

2.4.2 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 2772.1:	RF and microwave radiation hazard measurement
ACMA:	Radiocommunications (Electromagnetic Radiation — Human Exposure) Standard 2007 (No. 1)
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 50361: 2001	Basic standard for the measurement of Specific Absorption Rate related to human exposure to electromagnetic fields from mobile phones (300MHz – 3GHz)
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.

2.4.3 Environmental Factors

The measurements were performed in a shielded room with no background network signals. The temperature in the laboratory was controlled to within 21.5 ± 1 °C, the humidity was 58%. 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 DASY4 SAR measurement system using the SN1377 probe is less than 5µV in both air and liquid mediums.



This document shall not be copied or reproduced, except in full without the written permission of the Technical Director , EMC Technologies Pty. Ltd.

3.0 DESCRIPTION OF SAR MEASUREMENT SYSTEM

3.1 Probe Positioning System

The measurements were performed with the state of the art automated near-field scanning system **DASY4 Version V4.7 Build 53** 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 DASY4 fully complies with the OET65 C (01-01), IEEE 1528 and EN50361 SAR measurement requirements.

3.2 E-Field Probe Type and Performance

The SAR measurements were conducted with the dosimetric probe ET3DV6 Serial: 1377 (manufactured by SPEAG) designed in the classical triangular configuration and optimised for dosimetric evaluation. The probe has been calibrated and found to be accurate to better than ± 0.25 dB. The probe is suitable for measurements close to material discontinuity at the surface of the phantom.

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 $200 \text{ M}\Omega$; the inputs are symmetrical and floating. Common mode rejection is above 80dB. Transmission to the PC-card is accomplished through an optical downlink for data and status information as well as an optical uplink for commands and the clock.

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

3.4 Calibration and Validation Procedures and Data

Prior to the SAR assessment, the system validation kit was used to verify that the DASY4 was operating within its specifications. The validation was performed at 900 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, and must be within 10%.

3.4.1 Validation Results @ 900 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.

Table: Validation Results (Dipole: SPEAG D900V2 SN: 047)

1. Validation Date	2. ϵ_r (measured)	3. σ (mho/m) (measured)	4. Measured SAR 1g (mW/g)	5. Measured SAR 10g (mW/g)
18 th December 2007	40.3	0.96	2.74	1.75



This document shall not be copied or reproduced, except in full without the written permission of the Technical Director, EMC Technologies Pty. Ltd.

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 900 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 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 (900 MHz)

Frequency and Date	Measured SAR 10g (mW/g)	Measured SAR 10g (Normalized to 1W)	SPEAG Calibration reference SAR Value 10g (mW/g)	Deviation From SPEAG (%)	IEEE Std 1528 reference SAR value 10g (mW/g)	Deviation From IEEE (%)
900MHz 18 th December 2007	1.75	7.00	7.0	0.00	6.9	1.45

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 ± 0.5 cm.

3.5 Phantom Properties (Size, Shape, Shell Thickness)

The phantom used during the SAR validation was the "SAM" phantom from SPEAG. The phantom thickness is 2.0mm \pm 0.2 mm and was filled with the required tissue simulating liquid.

For SAR testing in the Body Worn position an AndreT Flat Phantom V9.1 was used. The phantom thickness is 2.0mm \pm 0.2 mm and the phantom was filled with the required tissue simulating liquid.



This document shall not be copied or reproduced, except in full without the written permission of the Technical Director, EMC Technologies Pty. Ltd.

3.6 Tissue Material Properties

The dielectric parameters of the body simulating liquid were measured prior to SAR assessment using the HP85070A dielectric probe kit and HP8753ES Network Analyser. The actual dielectric parameters are shown in the following table.

Table: Measured Body Simulating Liquid Dielectric Values

Frequency Band	ϵ_r (measured range)	ϵ_r (target)	σ (mho/m) (measured range)	σ (target)	ρ kg/m ³
922 MHz	53.3	55.0 \pm 5% (52.3 to 57.8)	1.06	1.05 \pm 5% (1.00 to 1.10)	1000

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

3.6.1 Liquid Temperature and Humidity

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

Table: Temperature and Humidity recorded for each day

Date	Ambient Temperature ($^\circ\text{C}$)	Liquid Temperature ($^\circ\text{C}$)	Humidity (%)
18 th December 2007	21.5	21.2	58.0

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 @ 900MHz
Volume of Liquid: 30 Litres

Approximate Composition	% By Weight
Distilled Water	41.05
Salt	1.35
Sugar	56.5
HEC	1.0
Bactericide	0.1

Table: Tissue Type: Muscle @ 900MHz
Volume of Liquid: 30 Litres

Approximate Composition	% By Weight
Distilled Water	56
Salt	0.76
Sugar	41.76
HEC	1.21
Bactericide	0.27

3.8 Device Holder for DASY4

A low loss clamp was used to position the device underneath the phantom surface. Small pieces of foam were then used to press the device against the phantom.

Refer to Appendix A2-A3 for photographs of device positioning



This document shall not be copied or reproduced, except in full without the written permission of the Technical Director, EMC Technologies Pty. Ltd.

4.0 SAR MEASUREMENT PROCEDURE USING DASY4

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

- a) A measurement of the SAR value at a fixed location is used as a reference value for assessing the power drop of the 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 flat section of the flat phantom is measured at a distance of 3.9 mm from the inner surface of the shell. The area covers the entire dimension of the head and the horizontal grid spacing is 20 mm x 20 mm. The actual Area Scan has dimensions of 171 mm x 121 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 30 mm x 30 mm x 30 mm is assessed by measuring 7 x 7 x 7 points. On the basis of this data set, the spatial peak SAR value is evaluated with the following procedure:
 - (i) The data at the surface are extrapolated, since the centre of the dipoles is 2.7 mm away from the tip of the probe and the distance between the surface and the lowest measuring point is 1.2 mm. The extrapolation is based on a least square algorithm. A polynomial of the fourth order is calculated through the points in z-axis. 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 and the power drift is recorded.



This document shall not be copied or reproduced, except in full without the written permission of the Technical Director , EMC Technologies Pty. Ltd.

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 DASY4 Version V4.7 Build 53 – EUT SAR test

a	b	c	d	e= f(d,k)	f	g	h=cxf/e	i=cxg/e	k
Uncertainty Component	Sec.	Tol. (%)	Prob. Dist.	Div.	C _i (1g)	C _i (10g)	1g u _i (%)	10g u _i (%)	v _i
Measurement System									
Probe Calibration (k=1) (standard calibration)	7.2.1	4.8	N	1	1	1	4.8	4.8	∞
Axial Isotropy	7.2.1	4.7	R	1.73	0.707	0.707	1.9	1.9	∞
Hemispherical Isotropy	7.2.1	9.6	R	1.73	0.707	0.707	3.9	3.9	∞
Boundary Effect	7.2.1	1	R	1.73	1	1	0.6	0.6	∞
Linearity	7.2.1	4.7	R	1.73	1	1	2.7	2.7	∞
System Detection Limits	7.2.1	1	R	1.73	1	1	0.6	0.6	∞
Readout Electronics	7.2.1	1	N	1	1	1	1.0	1.0	∞
Response Time	7.2.1	0.8	R	1.73	1	1	0.5	0.5	∞
Integration Time	7.2.1	2.6	R	1.73	1	1	1.5	1.5	∞
RF Ambient Conditions	7.2.3	0.05	R	1.73	1	1	0.0	0.0	∞
Probe Positioner Mechanical Tolerance	7.2.2	0.4	R	1.73	1	1	0.2	0.2	∞
Probe Positioning with respect to Phantom Shell	7.2.2	2.9	R	1.73	1	1	1.7	1.7	∞
Extrapolation, interpolation and Integration Algorithms for Max. SAR Evaluation	7.2.4	1	R	1.73	1	1	0.6	0.6	∞
Test Sample Related									
Test Sample Positioning	7.2.2	1.61	N	1	1	1	1.6	1.6	11
Device Holder Uncertainty	E.4.1	3.34	N	1	1	1	3.3	3.3	7
Output Power Variation – SAR Drift Measurement	7.2.3	11.76	R	1.73	1	1	6.8	6.8	∞
Phantom and Tissue Parameters									
Phantom Uncertainty (shape and thickness tolerances)	7.2.2	4	R	1.73	1	1	2.3	2.3	∞
Liquid Conductivity – Deviation from target values	7.2.3	5	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Conductivity – Measurement uncertainty	7.2.3	4.3	N	1	0.64	0.43	2.8	1.8	5
Liquid Permittivity – Deviation from target values	7.2.3	5	R	1.73	0.6	0.49	1.7	1.4	∞
Liquid Permittivity – Measurement uncertainty	7.2.3	4.3	N	1	0.6	0.49	2.6	2.1	5
Combined standard Uncertainty			RSS				11.9	11.5	154
Expanded Uncertainty (95% CONFIDENCE LEVEL)			k=2				23.9	23.09	

Estimated total measurement uncertainty for the DASY4 measurement system was ± 11.5 . The extended uncertainty ($K = 2$) was assessed to be ± 23.09 based on 95% confidence level. The uncertainty is not added to the measurement result.



This document shall not be copied or reproduced, except in full without the written permission of the Technical Director, EMC Technologies Pty. Ltd.

Table: Uncertainty Budget for DASY4 Version V4.7 Build 53 - Validation

a	b	c	d	e= f(d,k)	f	g	h=cxf/e	i=cxg/e	k
Uncertainty Component	Sec.	Tol. (6%)	Prob. Dist.	Div.	C _i (1g)	C _i (10g)	1g u _i (6%)	10g u _i (6%)	v _i
Measurement System									
Probe Calibration (k=1) (standard calibration)	E.2.1	4.8	N	1	1	1	4.8	4.8	∞
Axial Isotropy	E.2.2	4.7	R	1.73	1	1	2.7	2.7	∞
Hemispherical Isotropy	E.2.2	0	R	1.73	1	1	0.0	0.0	∞
Boundary Effect	E.2.3	1	R	1.73	1	1	0.6	0.6	∞
Linearity	E.2.4	4.7	R	1.73	1	1	2.7	2.7	∞
System Detection Limits	E.2.5	1	R	1.73	1	1	0.6	0.6	∞
Readout Electronics	E.2.6	1	N	1	1	1	1.0	1.0	∞
Response Time	E.2.7	0	R	1.73	1	1	0.0	0.0	∞
Integration Time	E.2.8	0	R	1.73	1	1	0.0	0.0	∞
RF Ambient Conditions	E.6.1	0.05	R	1.73	1	1	0.0	0.0	∞
Probe Positioner Mechanical Tolerance	E.6.2	0.4	R	1.73	1	1	0.2	0.2	∞
Probe Positioning with respect to Phantom Shell	E.6.3	2.9	R	1.73	1	1	1.7	1.7	∞
Extrapolation, interpolation and Integration Algorithms for Max. SAR Evaluation	E.5	1	R	1.73	1	1	0.6	0.6	∞
Test Sample Related									
Dipole Axis to Liquid Surface		2	R	1.73	1	1	1.2	1.2	∞
Power Drift		4.7	R	1.73	1	1	2.7	2.7	∞
Phantom and Tissue Parameters									
Phantom Uncertainty (shape and thickness tolerances)	E.3.1	4	R	1.73	1	1	2.3	2.3	∞
Liquid Conductivity – Deviation from target values	E.3.2	5	R	1.73	0.6	0.43	1.7	1.2	∞
Liquid Conductivity – Measurement uncertainty	E.3.3	2.5	N	1.73	0.6	0.43	0.9	0.6	5
Liquid Permittivity – Deviation from target values	E.3.2	5	R	1.73	0.6	0.49	1.7	1.4	∞
Liquid Permittivity – Measurement uncertainty	E.3.3	2.5	N	1.73	0.6	0.49	0.9	0.7	5
Combined standard Uncertainty			RSS				8.0	7.8	154
Expanded Uncertainty (95% CONFIDENCE LEVEL)			k=2				16.0	15.63	

Estimated total measurement uncertainty for the DASY4 measurement system was $\pm 7.8\%$. The extended uncertainty ($K = 2$) was assessed to be $\pm 15.63\%$ based on 95% confidence level. The uncertainty is not added to the Validation measurement result.



This document shall not be copied or reproduced, except in full without the written permission of the Technical Director, EMC Technologies Pty. Ltd.

6.0 EQUIPMENT LIST AND CALIBRATION DETAILS

Table: SPEAG DASY4 Version V4.7 Build 53

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	PO1A 6mm	1003	Not Applicable	
Data Acquisition Electronics	SPEAG	DAE3 V1	359	03-July-2008	✓
Data Acquisition Electronics	SPEAG	DAE3 V1	442	13-Oct-2007	
Probe E-Field - Dummy	SPEAG	DP1	N/A	Not applicable	
Probe E-Field	SPEAG	ET3DV6	1380	12-Dec-2007	
Probe E-Field	SPEAG	ET3DV6	1377	09-July-2008	✓
Probe E-Field	SPEAG	ES3DV6	3029	Not Used	
Probe E-Field	SPEAG	EX3DV4	3563	13-July-2008	
Antenna Dipole 300 MHz	SPEAG	D300V2	1005	26-Oct-2007	
Antenna Dipole 450 MHz	SPEAG	D450V2	1009	14-Dec-2008	
Antenna Dipole 900 MHz	SPEAG	D900V2	047	6-July-2008	✓
Antenna Dipole 1640 MHz	SPEAG	D1640V2	314	30-June-2008	
Antenna Dipole 1800 MHz	SPEAG	D1800V2	242	3-July-2008	
Antenna Dipole 1950 MHz	SPEAG	D1950V3	1113	5-March-2009	
Antenna Dipole 3500 MHz	SPEAG	D3500V2	1002	06-July-2008	
Antenna Dipole 2450 MHz	SPEAG	D2450V2	724	13-Dec-2008	
Antenna Dipole 5600 MHz	SPEAG	D5GHzV2	1008	07-Dec-2009	
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 Dual	Hewlett Packard	437B	3125012786	30-May-2008	✓
RF Power Sensor 0.01 - 18 GHz	Hewlett Packard	8481H	1545A01634	30-May-2008	✓
RF Power Meter Dual	Gigatronics	8542B	1830125	11-May-2008	✓
RF Power Sensor	Gigatronics	80301A	1828805	11-May-2008	✓
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	06-Sept-2008	
Network Analyser	Hewlett Packard	8753ES	JP39240130	02 Oct-2008	✓
Dual Directional Coupler	Hewlett Packard	778D	1144 04700	*In test	
Dual Directional Coupler	NARDA	3022	75453	*In test	✓



This document shall not be copied or reproduced, except in full without the written permission of the Technical Director , EMC Technologies Pty. Ltd.

7.0 SAR TEST METHOD

7.1 Description of the Test Positions (Body Worn)

SAR measurements were performed in the “Body Worn” position, measured in the flat section of the AndreT 9.1 phantom.

See Appendix A for photos of test positions.

7.1.1 “Body Worn” Position

The device was tested in the (2.00 mm) flat section of the AndreT phantom for the “Body Worn” position. Antenna 1 and 2 required multiple positions, (right tilt and left tilt), as shown in Appendix A2. The transceiver antenna was placed at centre of the flat section of the phantom and suspended until the transmitting (non-metallic) side was touching the phantom. The antenna was connected via cables to the Transceiver unit (Stationary Reader) for the duration of the SAR tests.

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

The SAR was measured with the test sample operating at maximum power, as specified in section 4.0.

7.3 ARPANSA RF Exposure Limits for ACMA (Australia)

Table: SAR Exposure Limits (General Public/Unaware User)

Spatial Peak SAR Limits For	
Head and Partial-Body:	2.0 mW/g (averaged over any 10g cube of tissue)
Hands, Wrists, Feet and Ankles:	4.0 mW/g (averaged over 10g cube of tissue)
Spatial Average SAR Limits For	
Whole Body:	0.08 mW/g



This document shall not be copied or reproduced, except in full without the written permission of the Technical Director , EMC Technologies Pty. Ltd.

8.0 SAR MEASUREMENT RESULTS

The SAR values averaged over 10 g tissue mass were determined for the sample device for the Body Worn configuration of the phantom.

Table: Antenna 1 SAR MEASUREMENT RESULTS – Body Worn position

1. Test Position	2. Plot No.	3. Test Freq (MHz)	4. Measured 10g SAR Results (mW/g)	5. Measured Drift (dB)
Body Worn Position Left Tilt	1	922.75	1.81	-0.333
Body Worn Position Right Tilt	2	922.75	1.85	-0.022

Note: The uncertainty of the system ($\pm 23.09\%$) has not been added to the results.

Table: Antenna 2 SAR MEASUREMENT RESULTS – Body Worn position

1. Test Position	2. Plot No.	3. Test Freq (MHz)	4. Measured 10g SAR Results (mW/g)	5. Measured Drift (dB)
Body Worn Position Left Tilt	3	922.75	1.60	-0.202
Body Worn Position Right Tilt	4	922.75	1.55	-0.025

Note: The uncertainty of the system ($\pm 23.09\%$) has not been added to the results.

Table: Antenna 3 SAR MEASUREMENT RESULTS – Body Worn position

1. Test Position	2. Plot No.	3. Test Freq (MHz)	4. Measured 10g SAR Results (mW/g)	5. Measured Drift (dB)
Body Worn Position Primary Maxima (Cube 0)	5	922.75	1.61	-0.45
Body Worn Position Secondary Maxima (Cube 1)	6	922.75	1.27	-0.483

Note: The uncertainty of the system ($\pm 23.09\%$) has not been added to the results.

The ACMA (ARPANSA) SAR limit is 2.0 mW/g measured in a 10g cube of tissue.

9.0 COMPLIANCE STATEMENT

The RF ID Transmitter model ALR-9900-WR1 was tested on behalf of Alien Technology Corporation. It complied with the SAR requirements of the Australian Communications and Media Authority.

The highest SAR level recorded was 1.85 mW/g for a 10g cube. This value was measured in the "Body Worn" left tilt position, and was below the uncontrolled limit of 2.0 mW/g. The recorded SAR level complied with the limit however the compliance margin was less than the measurement uncertainty of $\pm 23.09\%$.



This document shall not be copied or reproduced, except in full without the written permission of the Technical Director, EMC Technologies Pty. Ltd.

APPENDIX A1 Test Sample Photographs

ALR-9610-AL (Antenna 1)



ALR-9611-CR (Antenna 2)



ALR-9608-C (Antenna 3)



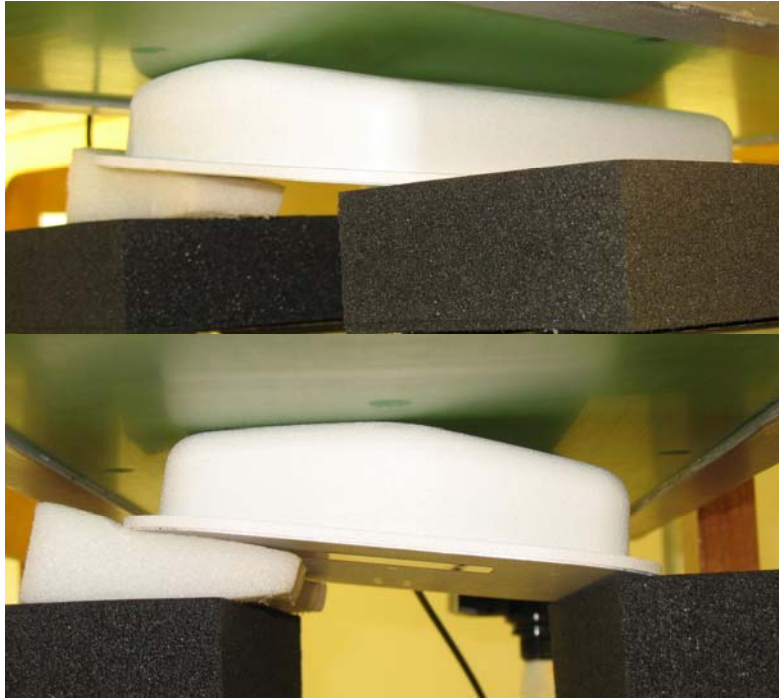
Transceiver Unit



This document shall not be copied or reproduced, except in full without the written permission of the Technical Director , EMC Technologies Pty. Ltd.

APPENDIX A2 Test Setup Photographs

Antenna 1 Body Worn Position Left Tilt

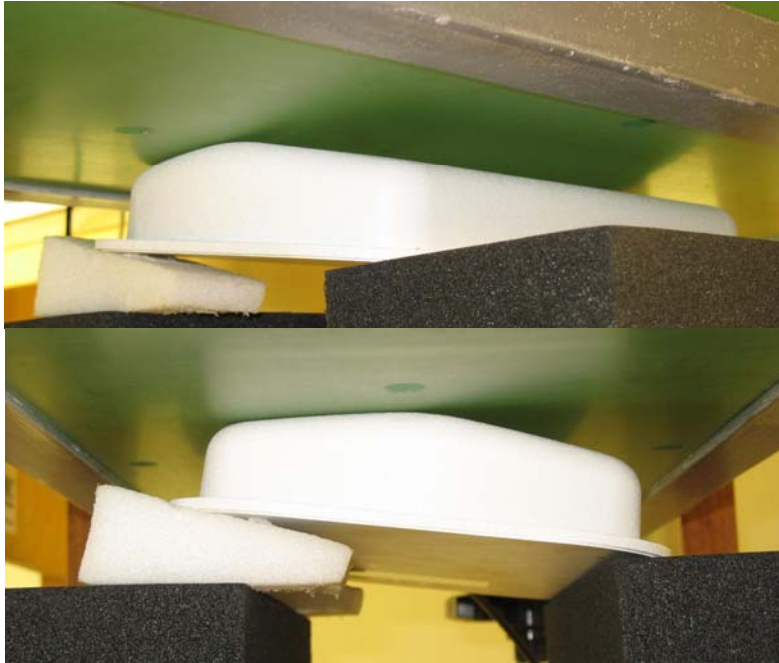


Antenna 1 Body Worn Position Right Tilt



This document shall not be copied or reproduced, except in full without the written permission of the Technical Director , EMC Technologies Pty. Ltd.

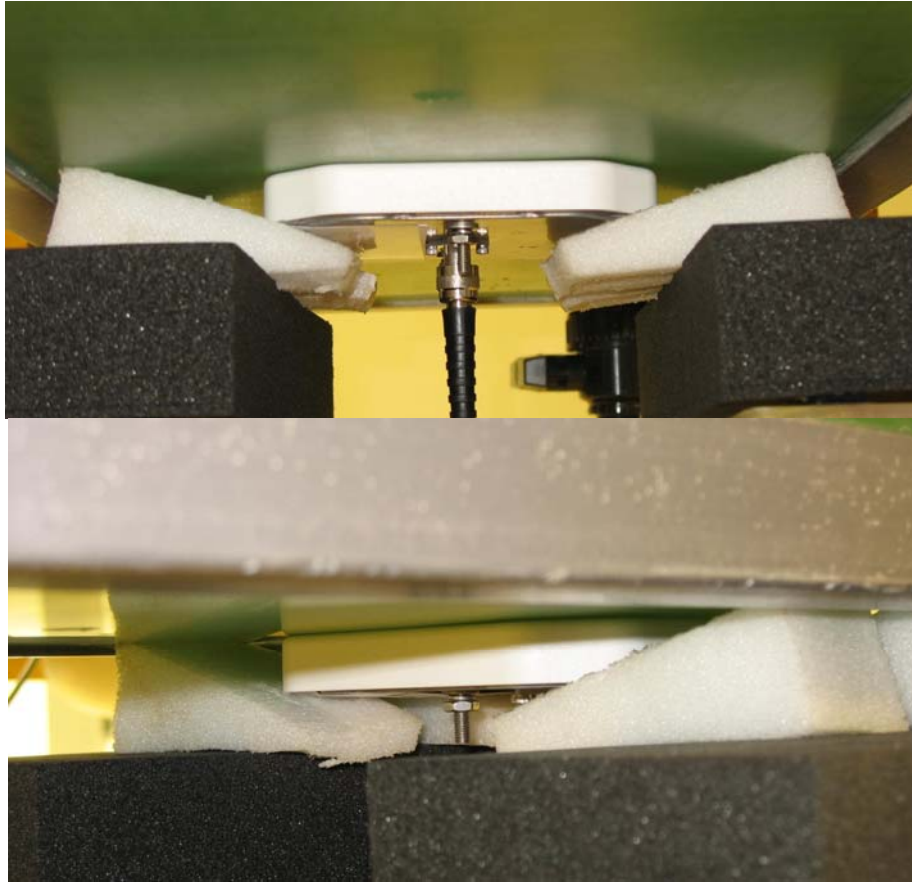
Antenna 2 Body Worn Position Left Tilt



Antenna 2 Body Worn Position Right Tilt



Antenna 3 Body Worn Position



APPENDIX B Plots Of The SAR Measurements

Plots of the measured SAR distributions inside the phantom are given in this Appendix for all tested configurations. The spatial peak SAR values were assessed with the procedure described in this report.

Table: SAR Measurement Plot Numbers (Antenna 1)

Test Position	Plot Number	Test Frequency (MHz)
Body Worn Position Left Tilt	1	922.75
Body Worn Position Right Tilt	2	922.75

Table: SAR Measurement Plot Numbers (Antenna 2)

Test Position	Plot Number	Test Frequency (MHz)
Body Worn Position Left Tilt	3	922.75
Body worn Position Right Tilt	4	922.75

Table: SAR Measurement Plot Numbers (Antenna 3)

Test Position	Plot Number	Test Frequency (MHz)
Body Worn Position (Cube 0)	5	922.75
Body Worn Position (Cube 1)	6	922.75

Table: Validation Plot Numbers

Date	Plot Number	Frequency
18 th December 2007	7	900



This document shall not be copied or reproduced, except in full without the written permission of the Technical Director , EMC Technologies Pty. Ltd.

Test Date: 18 December 2007

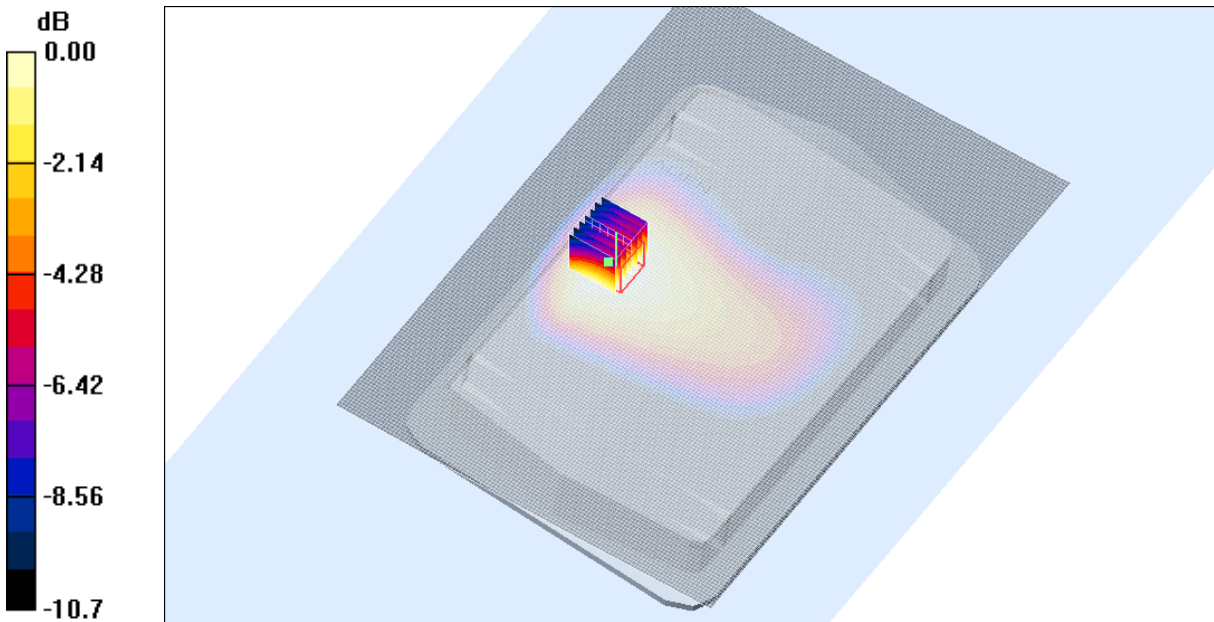
File Name: Body Left Tilt 900 MHz (DAE359 Probe1377) 18-12-07.da4

DUT: Alien Tech. RFID Transmitter ALR-9900; Type: Antenna ALR-9610-AL; Serial: ALR-9610-AL-06-00808

- * Communication System: CW 900 MHz; Frequency: 922.75 MHz; Duty Cycle: 1:1
- * Medium parameters used: $\sigma = 1.06205$ mho/m, $\epsilon_r = 53.295$; $\rho = 1000$ kg/m³
- Electronics: DAE3 Sn359; Probe: ET3DV6 - SN1377; ConvF(6.03, 6.03, 6.03)
- Phantom: Flat Phantom 9.1; Serial: P 9.1; Phantom section: Flat 2.2 Section

Channel 4 Test/Area Scan (171x121x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 2.80 mW/g

Channel 4 Test/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 40.5 V/m; Power Drift = -0.333 dB
Peak SAR (extrapolated) = 3.14 W/kg
SAR(1 g) = 2.48 mW/g; SAR(10 g) = 1.81 mW/g
Maximum value of SAR (measured) = 2.61 mW/g



0 dB = 2.61mW/g

SAR MEASUREMENT PLOT 1

Ambient Temperature
Liquid Temperature
Humidity

21.5 Degrees Celsius
21.2 Degrees Celsius
58.0 %



This document shall not be copied or reproduced, except in full without the written permission of the Technical Director , EMC Technologies Pty. Ltd.

Test Date: 18 December 2007

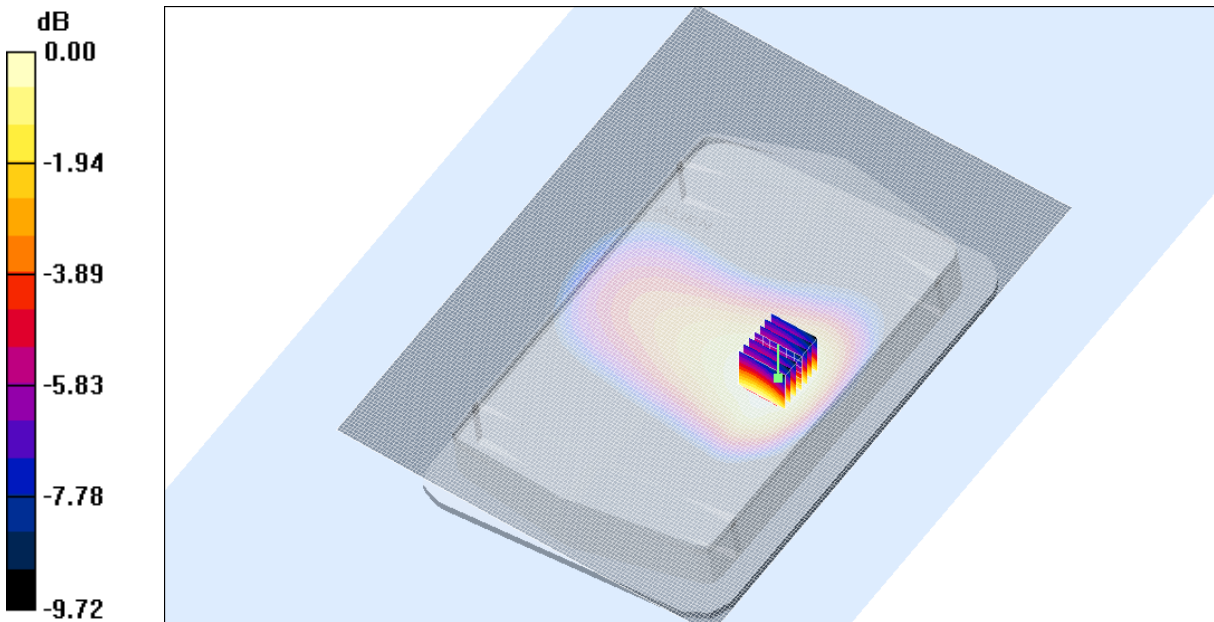
File Name: Body Right Tilt 900 MHz (DAE359 Probe1377) 18-12-07.da4

DUT: Alien Tech. RFID Transmitter ALR-9900; Type: Antenna ALR-9610-AL; Serial: ALR-9610-AL-06-00808

- * Communication System: CW 900 MHz; Frequency: 922.75 MHz; Duty Cycle: 1:1
- * Medium parameters used: $\sigma = 1.06205$ mho/m, $\epsilon_r = 53.295$; $\rho = 1000$ kg/m³
- Electronics: DAE3 Sn359; Probe: ET3DV6 - SN1377; ConvF(6.03, 6.03, 6.03)
- Phantom: Flat Phantom 9.1; Serial: P 9.1; Phantom section: Flat 2.2 Section

Channel 4 Test/Area Scan (171x121x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 2.78 mW/g

Channel 4 Test/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 38.4 V/m; Power Drift = -0.022 dB
Peak SAR (extrapolated) = 3.16 W/kg
SAR(1 g) = 2.51 mW/g; SAR(10 g) = 1.85 mW/g
Maximum value of SAR (measured) = 2.65 mW/g



SAR MEASUREMENT PLOT 2

Ambient Temperature
Liquid Temperature
Humidity

21.5 Degrees Celsius
21.2 Degrees Celsius
58.0 %



This document shall not be copied or reproduced, except in full without the written permission of the Technical Director , EMC Technologies Pty. Ltd.

Test Date: 18 December 2007

File Name: Body Left Tilt 900 MHz (DAE359 Probe1377) 18-12-07.da4

DUT: Alien Tech. RFID Transmitter ALR-9900; Type: Antenna ALR-9611-CR; Serial: ALR-9611-CR-06-11809

* Communication System: CW 900 MHz; Frequency: 922.75 MHz; Duty Cycle: 1:1

* Medium parameters used: $\sigma = 1.06205$ mho/m, $\epsilon_r = 53.295$; $\rho = 1000$ kg/m³

- Electronics: DAE3 Sn359; Probe: ET3DV6 - SN1377; ConvF(6.03, 6.03, 6.03)

- Phantom: Flat Phantom 9.1; Serial: P 9.1; Phantom section: Flat 2.2 Section

Channel 4 Test/Area Scan (171x121x1): Measurement grid: dx=20mm, dy=20mm

Maximum value of SAR (interpolated) = 2.25 mW/g

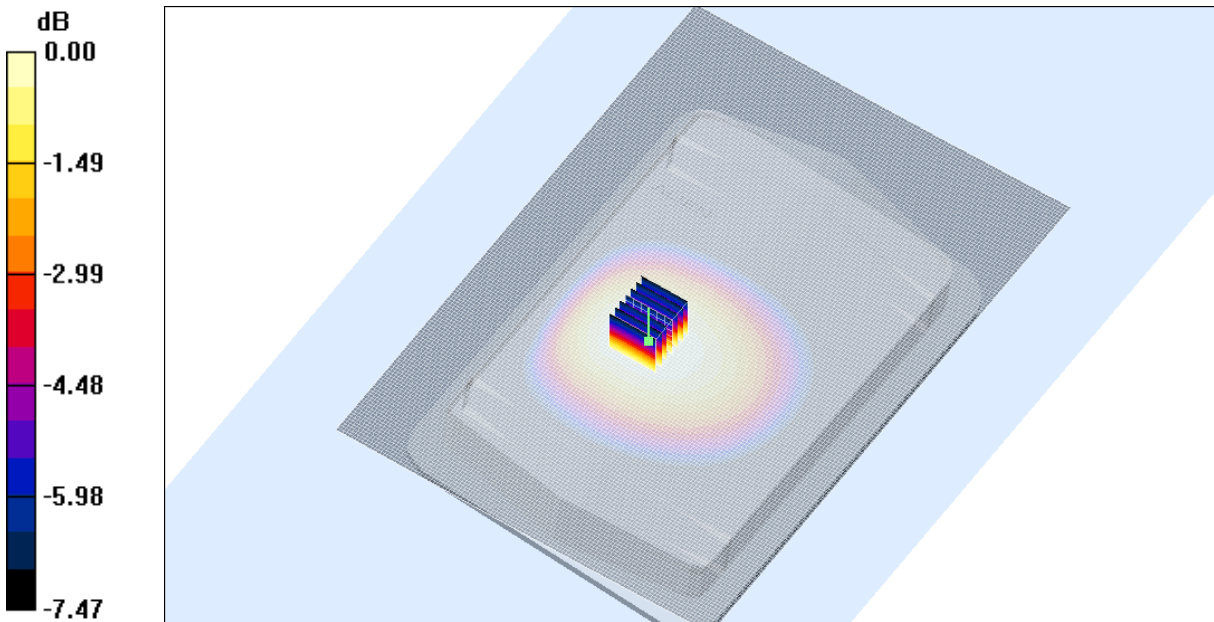
Channel 4 Test/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 43.1 V/m; Power Drift = -0.202 dB

Peak SAR (extrapolated) = 2.58 W/kg

SAR(1 g) = 2.11 mW/g; SAR(10 g) = 1.6 mW/g

Maximum value of SAR (measured) = 2.21 mW/g



0 dB = 2.21mW/g

SAR MEASUREMENT PLOT 3

Ambient Temperature
Liquid Temperature
Humidity

21.5 Degrees Celsius
21.2 Degrees Celsius
58.0 %



This document shall not be copied or reproduced, except in full without the written permission of the Technical Director, EMC Technologies Pty. Ltd.

Test Date: 18 December 2007

File Name: Body Right Tilt 900 MHz (DAE359 Probe1377) 18-12-07.da4

DUT: Alien Tech. RFID Transmitter ALR-9900; Type: Antenna ALR-9611-CR; Serial: ALR-9611-CR-06-11809

* Communication System: CW 900 MHz; Frequency: 922.75 MHz; Duty Cycle: 1:1

* Medium parameters used: $\sigma = 1.06205$ mho/m, $\epsilon_r = 53.295$; $\rho = 1000$ kg/m³

- Electronics: DAE3 Sn359; Probe: ET3DV6 - SN1377; ConvF(6.03, 6.03, 6.03)

- Phantom: Flat Phantom 9.1; Serial: P 9.1; Phantom section: Flat 2.2 Section

Channel 4 Test/Area Scan (171x121x1): Measurement grid: dx=20mm, dy=20mm

Maximum value of SAR (interpolated) = 2.13 mW/g

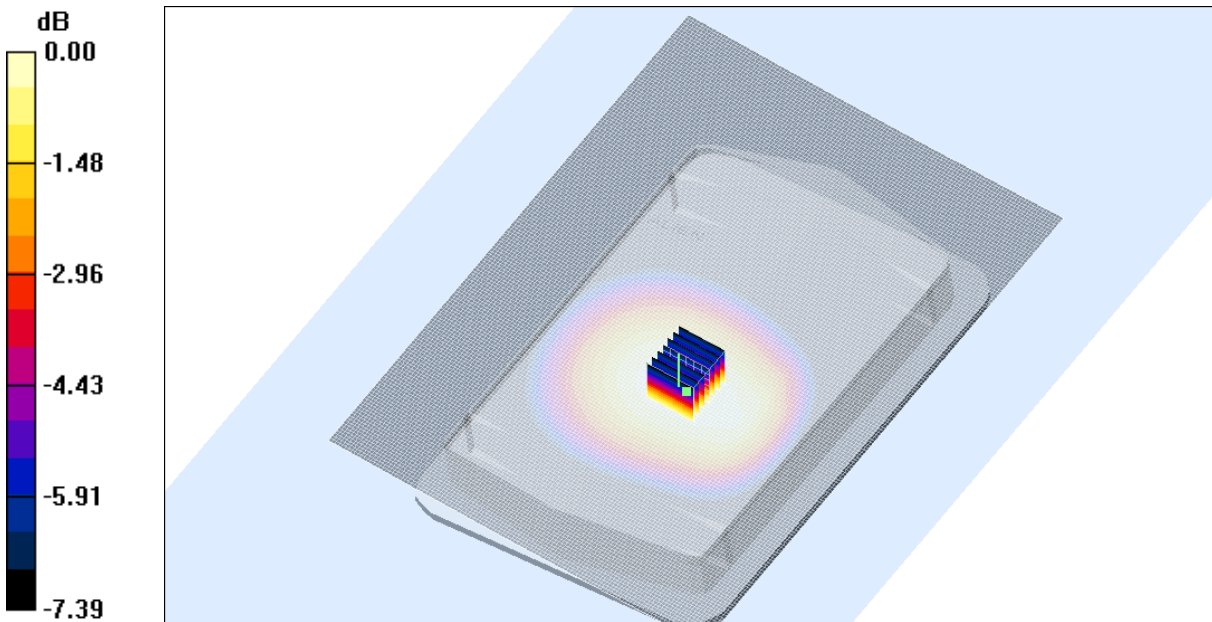
Channel 4 Test/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 38.9 V/m; Power Drift = -0.025 dB

Peak SAR (extrapolated) = 2.53 W/kg

SAR(1 g) = 2.04 mW/g; SAR(10 g) = 1.55 mW/g

Maximum value of SAR (measured) = 2.15 mW/g



0 dB = 2.15mW/g

SAR MEASUREMENT PLOT 4

Ambient Temperature
Liquid Temperature
Humidity

21.5 Degrees Celsius
21.2 Degrees Celsius
58.0 %



This document shall not be copied or reproduced, except in full without the written permission of the Technical Director , EMC Technologies Pty. Ltd.

Test Date: 18 December 2007

File Name: Body 900 MHz (DAE359 Probe1377) 18-12-07.da4

DUT: Alien Tech. RFID Transmitter ALR-9900; Type: Antenna ALR-9608-C; Serial: Prototype

* Communication System: CW 900 MHz; Frequency: 922.75 MHz; Duty Cycle: 1:1

* Medium parameters used: $\sigma = 1.06205$ mho/m, $\epsilon_r = 53.295$; $\rho = 1000$ kg/m³

- Electronics: DAE3 Sn359; Probe: ET3DV6 - SN1377; ConvF(6.03, 6.03, 6.03)

- Phantom: Flat Phantom 9.1; Serial: P 9.1; Phantom section: Flat 2.2 Section

Channel 4 Test/Area Scan (101x101x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 2.64 mW/g

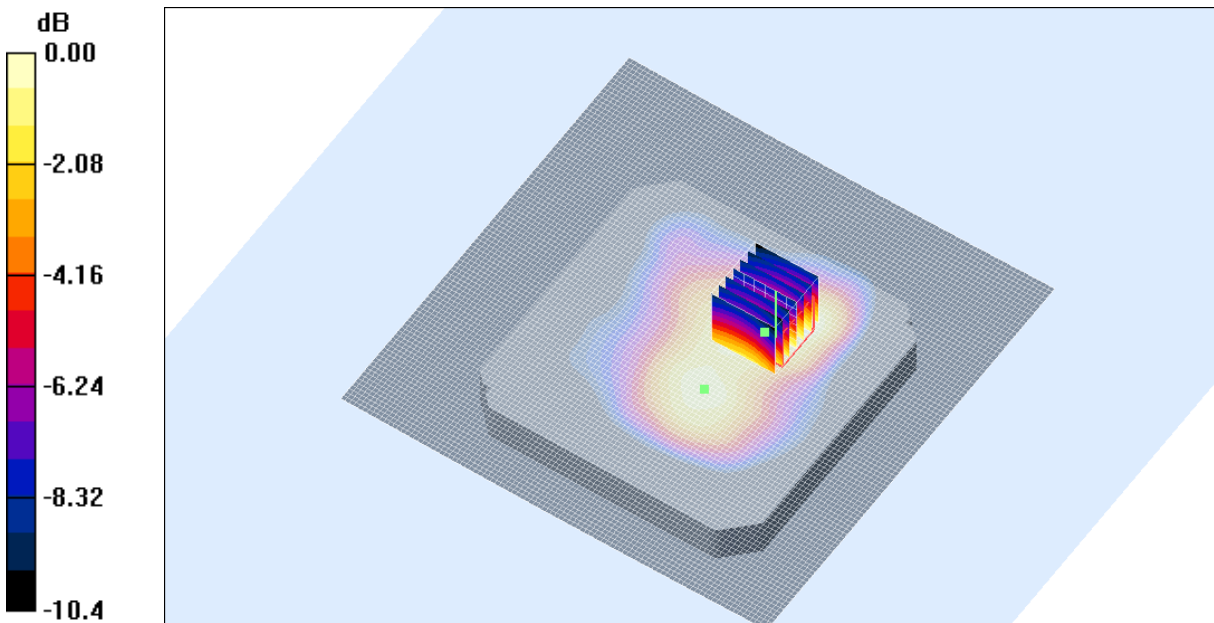
Channel 4 Test/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 41.5 V/m; Power Drift = -0.450 dB

Peak SAR (extrapolated) = 3.28 W/kg

SAR(1 g) = 2.36 mW/g; SAR(10 g) = 1.61 mW/g

Maximum value of SAR (measured) = 2.54 mW/g



SAR MEASUREMENT PLOT 5

Ambient Temperature
Liquid Temperature
Humidity

21.5 Degrees Celsius
21.2 Degrees Celsius
58.0 %



This document shall not be copied or reproduced, except in full without the written permission of the Technical Director, EMC Technologies Pty. Ltd.

Test Date: 18 December 2007

File Name: Body 900 MHz Cube 2 (DAE359 Probe1377) 18-12-07.da4

DUT: Alien Tech. RFID Transmitter ALR-9900; Type: Antenna ALR-9608-C; Serial: Prototype

* Communication System: CW 900 MHz; Frequency: 922.75 MHz; Duty Cycle: 1:1

* Medium parameters used: $\sigma = 1.06205$ mho/m, $\epsilon_r = 53.295$; $\rho = 1000$ kg/m³

- Electronics: DAE3 Sn359; Probe: ET3DV6 - SN1377; ConvF(6.03, 6.03, 6.03)

- Phantom: Flat Phantom 9.1; Serial: P 9.1; Phantom section: Flat 2.2 Section

Channel 4 Test/Area Scan (101x101x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 2.64 mW/g

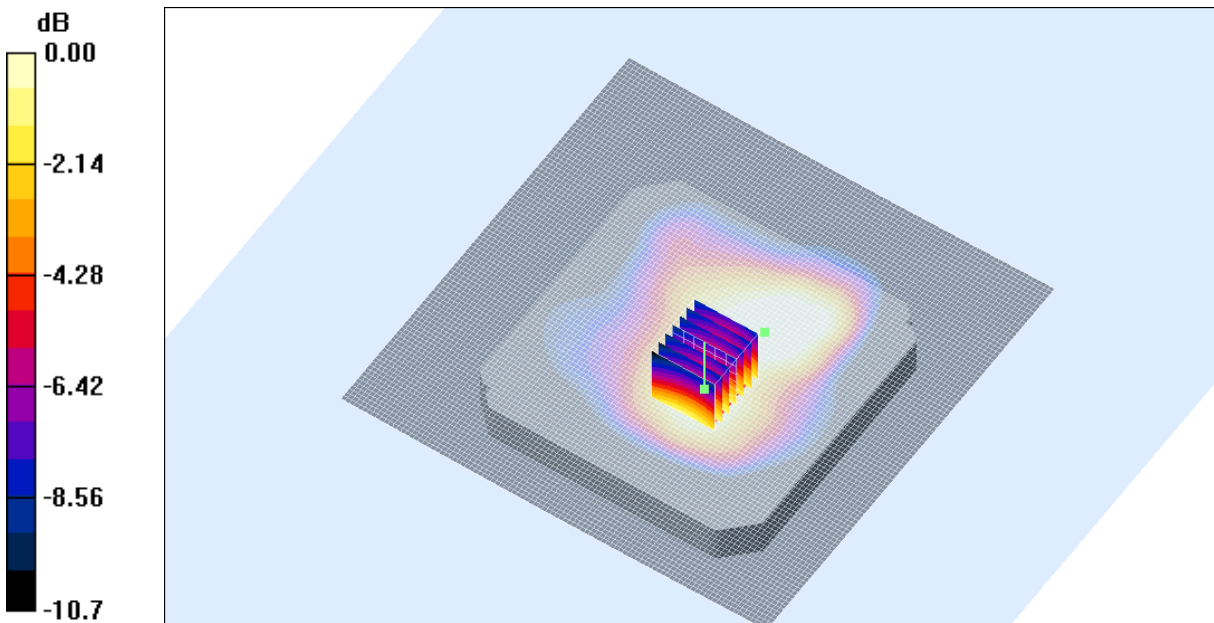
Channel 4 Test/Zoom Scan (7x7x7)/Cube 1: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 41.5 V/m; Power Drift = -0.483 dB

Peak SAR (extrapolated) = 2.69 W/kg

SAR(1 g) = 1.83 mW/g; SAR(10 g) = 1.27 mW/g

Maximum value of SAR (measured) = 1.95 mW/g



0 dB = 1.95mW/g

SAR MEASUREMENT PLOT 6

Ambient Temperature
Liquid Temperature
Humidity

21.5 Degrees Celsius
21.2 Degrees Celsius
58.0 %



This document shall not be copied or reproduced, except in full without the written permission of the Technical Director , EMC Technologies Pty. Ltd.

Test Date: 18 December 2007

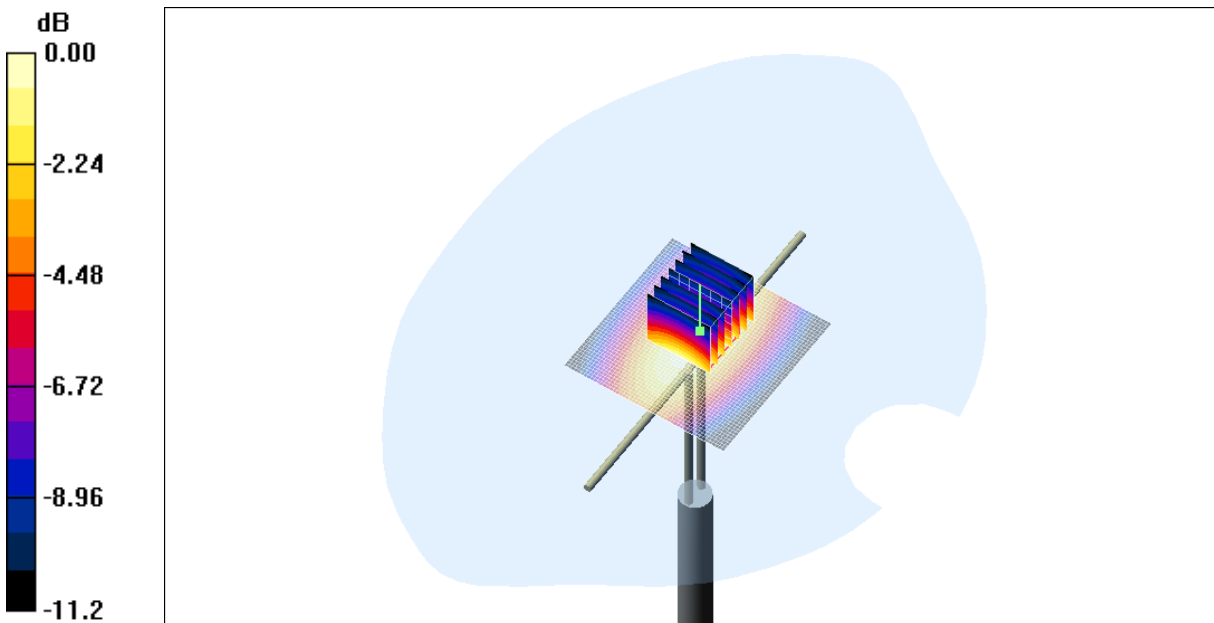
File Name: Validation 900 MHz (DAE359 Probe1377) 18-12-07.da4

DUT: Dipole 900 MHz; Type: DV900; Serial: 047

- * Communication System: CW 900 MHz; Frequency: 900 MHz; Duty Cycle: 1:1
- * Medium parameters used: $\sigma = 0.955032$ mho/m, $\epsilon_r = 40.3151$; $\rho = 1000$ kg/m³
- Electronics: DAE3 Sn359; Probe: ET3DV6 - SN1377; ConvF(6.43, 6.43, 6.43)
- Phantom: SAM 12; Serial: 1060; Phantom section: Flat Section

Channel 1 Test/Area Scan (51x51x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 2.92 mW/g

Channel 1 Test/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.9 V/m; Power Drift = 0.038 dB
Peak SAR (extrapolated) = 4.20 W/kg
SAR(1 g) = 2.74 mW/g; SAR(10 g) = 1.75 mW/g
Maximum value of SAR (measured) = 2.98 mW/g



0 dB = 2.98mW/g

SAR MEASUREMENT PLOT 7

Ambient Temperature
Liquid Temperature
Humidity

21.5 Degrees Celsius
21.2 Degrees Celsius
58.0 %



This document shall not be copied or reproduced, except in full without the written permission of the Technical Director , EMC Technologies Pty. Ltd.