MOTOROLA

ACCREDITED
Certificate Number: 1449-01

FCC ID: AZ489FT7016
DECLARATION OF COMPLIANCE SAR ASSESSMENT Part 1 of 4

Government & Enterprise Mobility Solutions
EME Test Laboratory
8000 West Sunrise Blvd
Fort Lauderdale, FL. 33322

Date of Report: 3/20/06
Report Revision: A
Report ID: WDE1000_Rev A_060320_SR3388

Responsible Engineer:	Kim Uong (EME lead Eng.)
Date/s Tested:	2/13/06 – 3/10/06
Manufacturer/Location:	Motorola South Israel
Sector/Group/Div.:	MCIL Israel
Date submitted for test:	1/26/06
DUT Description:	WDE1000 (Wireless Device Enabler) with 2 transmitters: 802.11a@4.9GHz and 802.11b/g @ 2.4GHz
Test TX mode(s):	CW
Max. Power output:	0.126W for 4.94-4.99GHz; 0.079W for 2400-2483.5MHz
Nominal Power:	0.1Watt for 4.94-4.99GHz; 0.063W for 2400-2483.5MHz
Tx Frequency Bands:	4942.5-4987.5MHz (5MHz step size) ; 2412-2462MHz (5MHz step size)
Signaling type:	OFDM @4.9GHz; DSSS and OFDM @ 2.4GHz
Model(s) Tested:	F2889A
Model(s) Certified:	F2889A
Serial Number(s):	537SGA0057, 537SGA0060
Classification:	General Population/Uncontrolled
Rule Part(s):	15 & 90

Approved Accessories:
Antenna(s):
6487848V60 PIFA (on board ant) 2400-2483.5MHz 1/4Wave ; 2.5dBi gain
6487848V61 PIFA (on board ant) 4.94-4.99GHz 1/4Wave; 3.3dBi gain

Max. Calc. 1-g/10-g Avg. SAR: 0.43/0.24 W/kg (Body)

This reporting format is consistent with the test report guidelines of the TIA TSB-150 December 2004
The results and statements contained in this report pertain only to the device(s) evaluated.

Signature on file –Ken Enger
Ken Enger GEMS EME Lab Senior Resource Manager, Laboratory Director,

Approval Date: 3/20/06

Certification Date: 03/17/06

Certification No.: L1060363P

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APPENDICES

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Part 4 of 4

Report REVISION HISTORY

Date	Revision	Comments
3/17/06	O	Initial release
3/20/06	A	Modify to correct model # indicated in section 10, and add additional probe calibration information for probe SN3510 in Appendix B.

1.0 Introduction and Overview

This report details the utilization, test setup, test equipment, and test results of the Specific Absorption Rate (S.A.R.) measurements performed at the GEMS EME Test Lab for the model number F2889A of FCC ID: AZ489FT7016.

The test results presented herein clearly demonstrate compliance with FCC General Population/Uncontrolled RF Exposure limits of **1.6 W/kg** per the requirements of 47 CFR 2.1093(d).

2.0 Reference Standards and Guidelines

This product is designed to comply with the following national and international standards and guidelines.

- United States Federal Communications Commission, Code of Federal Regulations; Rule Part 47CFR § 2.1093 sub-part J:1999
- Federal Communications Commission, “Evaluating Compliance with FCC Guidelines for Human Exposure to Radio frequency Electromagnetic Fields”, OET Bulletin 65, Supplement C (Edition 01-01), FCC, Washington, D.C.: June 2001.
- IEEE 1528, 2003 "Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques"
- American National Standards Institute (ANSI) / Institute of Electrical and Electronic Engineers (IEEE) C95. 1-1992
- Institute of Electrical and Electronic Engineers (IEEE) C95.1-1999 Edition
- International Commission on Non-Ionizing Radiation Protection (ICNIRP) 1998
- Ministry of Health (Canada) Safety Code 6. Limits of Human Exposure to Radio frequency Electromagnetic Fields in the Frequency Range from 3 kHz to 300 GHz, 1999
- Australian Communications Authority Radiocommunications (Electromagnetic Radiation - Human Exposure) Standard 2003
- ANATEL, Brazil Regulatory Authority, Resolution No. 303 of July 2, 2002 "Regulation of the limitation of exposure to electrical, magnetic, and electromagnetic fields in the radio frequency range between 9KHz and 300 GHz." and “Attachment to resolution # 303 from July 2, 2002”

2.1 SAR Limits

EXPOSURE LIMITS	SAR (W/kg)	
	(General Population / Uncontrolled Exposure Environment)	(Occupational / Controlled Exposure Environment)
Spatial Average - ANSI - (averaged over the whole body)	0.08	0.4
Spatial Peak - ANSI - (averaged over any 1-g of tissue)	1.60	8.0
Spatial Peak – ICNIRP/ANSI - (hands/wrists/feet/ankles averaged over 10-g)	4.0	20.0
Localized SAR - ICNIRP - (Head and Trunk 10-g)	2.0	10.0

3.0 Description of Device Under Test (DUT)

FCC ID: AZ489FT7016 is the Wireless Device Enabler (WDE) PCMCIA card. It provides modem functionality so that a client is able to access the WLAN communication services provided by the system network. This network is an adaptation of an 802.11 System, which provides wireless access to an IP network using the 4.9 GHz licensed / 2.4 GHz unlicensed spectrum. The system enables the WLAN user to transmit and receive data at rates of up to 54 Megabits per second (Mbps) by using a version of the 802.11a standard which is adapted for use in the 4.9 GHz band using OFDM signaling, or 802.11b/g standard for the 2.4 GHz band using DSSS and OFDM signaling.

While this device will be marketed to and used by employees solely for work related operations such as data acquisition and transmission for public safety, it also meets the General Population / Uncontrolled limits. User training is the responsibility of these agencies, who can be expected to employ the usage instructions, safety information, and operational cautions set forth in the user's manual, instructional sessions or other means. Motorola also makes available to its customers training classes on the proper use of two-way radios and wireless data devices. This device may be used as a PCMCIA modem within a PC laptop.

FCC ID: AZ489FT7016 is capable of operating in the 4942.5-4987.5MHz; 2412-2462MHz bands. The rated conducted power is 0.1 Watt for 4942.5-4987.5MHz; 0.063W for 2412-2462MHz. The maximum conducted output power is 0.126 Watts and 0.079 Watts respectively as defined by the upper limit of the production line final test station.

Test Output Power

A table of the characteristic power slump versus time is provided in Appendix F.

4.0 Description of Test System

4.1 Descriptions of Robotics/probes/Readout Electronics

The laboratory utilizes a Dosimetric Assessment System (DASY4™) S.A.R. measurement system Version 4.6 build 23 manufactured by Schmid & Partner Engineering AG (SPEAG™), of Zurich Switzerland. The test system consists of a Stäubli RX90L robot with ET3DV6 and EX3DV3 E-Field probes. Please reference the SPEAG user manual and application notes for detailed probe, robot, and S.A.R. computational procedures. Section 5.0 presents relevant test equipment information. Appendices B and C present the applicable calibration certificates. The E-field probe first scans a coarse grid over a large area inside the phantom in order to locate the interpolated maximum S.A.R. distribution. After the coarse scan measurement, the probe is automatically moved to a position at the interpolated maximum. The subsequent scan can directly use this position as reference for the cube evaluations.

4.2 Description of Phantom(s)

4.2.1 Flat Phantom

Phantom Type	Phantom Material	Phantom Dimensions (cm)	Support structure opening dimensions (cm)	Support structure material	Loss Tangent (wood)
Flat	High Density Polyethylene (HDPE)	80x60x20x0.2	68.58x25.4	Wood	< 0.05

4.2.2 SAM Phantom

Phantom Type	Material Parameters	Material Thickness (mm)	Support structure material	Loss Tangent (wood)
SAMTP1234	200MHz -3GHz; Er = <5, Loss Tangent = <0.05	2mm +/- 0.2mm	Wood	< 0.05
SAMTP1208	200MHz -3GHz; Er = <5, Loss Tangent = <0.05	2mm +/- 0.2mm	Wood	< 0.05

4.3 Description of Equivalent tissues

Type of Simulated Tissue

The simulated tissue used is compliant to that specified in FCC Supplement C (Edition 01-01) to OET Bulletin 65 (Edition 97-01) .

The sugar based simulate tissue is produced by placing the correct measured amount of De-ionized water into a large container. Each of the dried ingredients are weighed and added to the water carefully to avoid clumping. If the solution has a high sugar concentration the water is pre-heated to aid in dissolving the ingredients. For Diacetin based simulates, sugar and HEC ingredients are not needed. The solution is mixed thoroughly, covered, and allowed to sit overnight prior to use.

Noted that the 5GHz simulated tissue used for this WDE1000 testing is purchased from SPEAG; Therefore no composition indicated in this section for 5GHz simulated tissue.

Simulated Tissue Composition

% of listed ingredients	2450MHz	
	Head	Body
Sugar	NA	NA
DGBE (Glycol)	NA	NA
Diacetin	51	34.5
De ionized - Water	48.75	65.20
Salt	0.15	0.20
HEC	NA	NA
Bact.	0.1	0.1

Reference section 6.1 for target parameters

5.0 Additional Test Equipment

Equipment Type	Model Number	Serial Number	Calibration Due Date	Comments
Power Meter (HP)	437B	3125U21972	11/30/2006	
Power Meter (HP)	437B	3737U26425	11/30/2006	
Power Meter (HP)	N1912A	GB45100294	9/2/2006	
Power Sensor (HP)	8481H	2703A14631	10/11/2006	
Power Sensor (HP)	8481H	2703A09635	1/26/2007	
Power Sensor (HP)	8482B	3318A06773	3/22/2006	
Power Sensor (HP)	8482B	3318A07393	3/27/2007	
Power Sensor (HP)	N1921A	MY45240136	10/6/2006	
Power Sensor (HP)	N1921A	MY45240137	10/6/2006	
Bi-Directional Coupler (NARDA)	3022	77114	2/27/2006	1-4 GHz
Bi-Directional Coupler (NARDA)	3024	61136	5/10/2007	
Signal Generator (Agilent)	E4438C	MY42082269	1/11/2006	250 kHz-6.0 GHz
AMP (ComTech PST)	AR88258-10	M3Y6A00-1007	CNR	800- 2500 MHz
Tissue Station				
Network Analyzer (HP)	8753D	3410A06417	2/7/2006	30 KHz-3 GHz
Dielectric Probe Kit (HP)	85070C	US99360076	CNR	
Dipoles				
Speag Dipole	D2450V2	703	7/19/2006	
Speag Dipole	D2450V2	704	11/15/2006	
Speag Dipole	D5GHzV2	1017	11/22/2007	

6.0 SAR Measurement System Verification

The S.A.R. measurements were conducted with probe model/serial number ET3DV6/SN1547 EX3DV3/SN3510. The system performance check was conducted daily and within 24 hours prior to testing. DASY output files of the probe/dipole calibration certificates and system performance test results are included in appendices B, C, D respectively. The table below summarizes the system performance check results normalized to 1W.
Dipole validation scans at the head from SPEAG are provided in APPENDIX D. The GEMS EME lab validated the dipole to the applicable IEEE system performance targets. Within 24 hours system validation was performed using FCC body tissue parameters to generate the system performance target values for body at the applicable frequency. The results of the GEMS EME system performance validation are provided herein.

6.1 Equivalent Tissue Test Results

Simulated tissue prepared for S.A.R. measurements is measured daily and within 24 hours prior to actual S.A.R. testing to verify that the tissue is within 5% of target parameters at the center of the transmit band for 3GHz and below, and within 10% of target parameters at the center of the transmit band for frequency above 3GHz. This measurement is done using the Agilent (HP) probe kit model 85070C and a HP8753D Network Analyzer.

Actual versus Target tissue parameters
(2/13/06 - 3/9/06)

FCC Body				
Frequency (MHz)	Di-electric Constant Target	Di-electric Constant Meas. (Range)	Conductivity Target S/m	Conductivity Meas. (Range) S/m
2437	52.7	51.1-54.8	1.94	1.95-2.02
2450	52.7	51.0-52.2	1.95	1.96-2.03
4965	49.3	48.1-48.6	5.02	5.15-5.27
5000	49.3	48.0-48.1	5.07	5.19-5.26

6.2 System Check Test Results

Probe Serial #	Tissue Type	Probe Cal Date	Dipole Kit / Serial #	System Perf. Result when normalized to 1W (mW/g)	Reference S.A.R @ 1W (mW/g)	Test Date(s)
1547	FCC Body	8/25/05	D2450V2/ SN703	55.83 +/- 0.68	51.98 +/- 10%	2/13/06-2/15/06 (2 test days)
1547	FCC Body	8/25/05	D2450V2/ SN704	58.71	56.12 +/-10%	3/9/06
3510	FCC Body	12/2/05	D5GHzV2 / SN1017	68.01+/- 0.23	67. 78 +/-10%	2/20/06-2/22/06 (2 test days)

Note: See APPENDIX D for an explanation of the reference S.A.R. targets stated above.
(System performance results reflects the median performance +/- ½ of the test date(s) performance ranges)

The DASY4™ system is operated per the instructions in the DASY4™ Users Manual. The complete manual is available directly from SPEAG™. All measurement equipment used to assess EME S.A.R. compliance was calibrated according to 17025 A2LA guidelines.

7.0 DUT Test Strategy and Methodology

The WDE1000 is a PCMCIA card operational at the body in conjunction with a PC laptop.

7.1 Test Plan

All options and accessories listed on the cover page of this report were considered in order to develop the S.A.R. test plan for this product. S.A.R. measurements were performed using a flat section of the SAM phantom with the applicable simulated tissue to assess performance at the body. Note that the device being assessed herein serves as a PCMCIA card and works in conjunction with a PC laptop device. The DUT was assessed using the following three PC laptops: Dell-D610 Model PP111, IBM - ThinkPad type 2373-F2G, and ML900 model # L3471A. Note that for this assessment the closest to the body of the two available PCMCIA slots on the laptops were used to assess the WDE1000 PCMCIA card. Due to the size of the laptop host and the resulting length of time required to complete a scan, all SAR measurements were performed with the coarse scan capturing only the area around the PCMCIA card. Also a rough coarse scan was done to cover the entire area of the lap top host with the PCMCIA card inserted to confirm the peak area. The DUT receives its supply power from the host devices.

Note that at 2412-2462MHz bands, a coarse-to-cube approximation methodology was utilized to determine the worst-case S.A.R. performance configuration for each applicable body location. The test configurations that produced the highest S.A.R. results for each body position using the coarse-to-cube approximation methodology were assessed using the full DASY4™ coarse and 7x7x7 cube scans. For 4942.5-4987.5MHz band, the full DASY4™ coarse and 8x8x8 cube scans were completed for all test configurations at this frequency band.

Assessments at the Body 2412-2462MHz band [Pages 11; Tables 1]

- The DUT was assessed at the TX center frequency of the 2412-2462MHz band, with the laptop display open and bottom of each of the three PC laptops against the phantom.

Assessments at the Body 4942.5-4987.5MHz band [Pages 11; Tables 2]

- The DUT was assessed at the TX center frequency of the 4942.5-4987.5MHz band, with the laptop display open and bottom of each of the three PC laptops against the phantom.

Shortened scan assessment at the Body [APPENDIX E Part 4 of 4]

- A "shortened" scan was performed using test configuration that produced the highest S.A.R. results overall. Note that the shortened scan is obtained by first running a coarse scan to find the peak area and then, using a newly charged battery, a cube scan only was performed. The shortened scan represents the cube scan performance results.

Rough Coarse scan [APPENDIX E Part 4 of 4]

- For each frequency band, a rough coarse scan was done to cover the entire area of the laptop host with the PCMCIA card inserted to confirm the peak area.

7.2 Device Positioning Procedures

Reference Appendix G for photos of the DUT tested positions.

7.2.1 Body

The DUT was inserted into the host devices that were placed against the flat section of the SAM phantom. A rough coarse scan was done using the 80x60x20 flat phantom to cover the entire area of the laptop host with the PCMCIA card inserted to confirm the peak area.

7.2.2 Head

NA

7.2.3 Face

NA

8.0 Environmental Test Conditions

The EME Laboratory ambient environment is well controlled resulting in very stable simulated tissue temperature and therefore stable dielectric properties. Simulated tissue temperature is measured prior to each scan to insure it is within +/ - 2^{o}C of the temperature at which the dielectric properties were determined. The liquid depth within the phantom used for measurements was 15cm +/- 0.5cm. Additional precautions are routinely taken to ensure the stability of the simulated tissue such as covering the phantoms when scans are not actively in process in order to minimize evaporation. The lab environment is continuously monitored. The table below presents the range and average environmental conditions during the S.A.R. tests reported herein:

	Target	Measured
Ambient Temperature	20 - 25 ˚C	Range: 21.8-23.3˚C Avg. 22.3˚C
Relative Humidity	30 - 70 %	Range: 26-57.1% Avg. 43.6%
Tissue Temperature	NA	Range: 20.0-21.5˚C Avg. 20.8 ˚C

The EME Lab RF environment uses a Spectrum Analyzer to monitor for extraneous large signal RF contaminants that could possibly affect the test results. If such unwanted signals are discovered the S.A.R scans are repeated.

9.0 Test Results Summary

All S.A.R. results obtained by the tests described in Section 7.1 are listed below.

As noted in section 7.1, a coarse-to-cube approximation methodology, was utilized to ascertain the worst-case test configuration for each body location at 2412-2462MHz band. The worst case test configurations observed for each body location were then assessed using the full DASY4™ coarse and 7x7x7 cube methodology, and they are presented as bolded results. The 4942.5-4987.5MHz band assessed using the full DASY4™ coarse and 8x8x8 cube methodology.

The associated S.A.R. plots for the full scan at 2412-2462MHz band and the highest result for 4942.5-4987.5MHz band are provided in APPENDIX E. Appendix E also presents shortened S.A.R. cube scans to assess the validity of the calculated results presented herein. Note: The results of the shortened cube scans presented in Appendix E demonstrate that the scaling methodology used to determine the calculated S.A.R. results presented herein are valid.

Table1

Assessments at the Body 2412-2462MHz band												
Run Number/ SN	**Antenna Pos.**	**Freq. (MHz)**	**Battery**	**Test position**	**Carry Case**	**Additional attachments**	**Initial Power (W)**	**S.A.R. Drift (dB)**	**Meas. 1g-S.A.R. (mW/g)**	**Meas. 10g-S.A.R. (mW/g)**	**Max Calc. 1g-S.A.R. (mW/g)**	**Max Calc. 10g-S.A.R. (mW/g)**
DUT assessment at TX band center frequency using the PC laptop hosts against the phantom												
CM-Ab-060213-03/ 537SGA0060	Fix	2437.5	Host device battery supply	Bottom against phantom	Dell Laptop	DELL Laptop host device	0.081	0.0908	0.289	0.153	0.29	0.15
CM-Ab-060215-03/ 537SGA0060	Fix	2437.5	Host device battery supply	Bottom against phantom	ML900 Laptop	ML900 Laptop host device	0.081	-0.0306	0.123	0.0636	0.12	0.06
CM-Ab-060215-06/ 537SGA0060	Fix	2437.5	Host device battery supply	Bottom against phantom	IBM Laptop	IBM Laptop host device	0.080	0.0766	0.362	0.192	0.36	0.19
*CM-Ab-060309-02/ 537SGA0057	Fix	2437.5	Host device battery supply	Bottom against phantom	IBM Laptop	IBM Laptop host device	0.078	-0.0166	0.366	0.194	0.37	0.19
***Assessment with the highest test configuration above using the full DASY 4 coarse and 7x7x7 cube scan measurements.**												
CM-Ab-060309-03/ 537SGA0057	**Fix**	**2437.5**	**Host device battery supply**	**Bottom against phantom**	**IBM Laptop**	**IBM Laptop host device**	**0.079**	**-0.587**	**0.372**	**0.211**	**0.43**	**0.24**

Table 2

Assessments at the Body 4942.5-4987.5MHz band												
Run Number/ SN	**Antenna Pos.**	**Freq. (MHz)**	**Battery**	**Test position**	**Carry Case**	**Additional attachments**	**Initial Power (W)**	**S.A.R. Drift (dB)**	**Meas. 1g-S.A.R. (mW/g)**	**Meas. 10g-S.A.R. (mW/g)**	**Max Calc. 1g-S.A.R. (mW/g)**	**Max Calc. 10g-S.A.R. (mW/g)**
DUT assessment at TX band center frequency using the PC laptop hosts against the phantom												
CM-Ab-060220-04/ 537SGA0060	Fix	4965.0	Host device battery supply	Bottom against phantom	ML900 Laptop	ML900 Laptop host device	0.123	-0.0176	0.054	0.0232	0.06	0.02
CM-Ab-060220-07/ 537SGA0060	Fix	4965.0	Host device battery supply	Bottom against phantom	DELL Laptop	DELL Laptop host device	0.125	-0.171	0.0605	0.0231	0.06	0.02
CM-Ab-060222-04/ 537SGA0060	Fix	4965.0	Host device battery supply	Bottom against phantom	IBM Laptop	IBM Laptop host device	0.123	0.0975	0.180	0.0717	0.18	0.07

9.1 Highest S.A.R. results calculation methodology

The calculated maximum 1-gram and 10-gram averaged S.A.R. results reported herein for the full DASY ™ coarse and 7x7x7 cube measurements are determined by scaling the measured S.A.R. to account for power leveling variations and power slump. For this device the Maximum Calculated 1-gram and 10-gram averaged peak S.A.R. is calculated using the following formula:

Max. Calc. 1-g/10-g Avg. SAR = ((S.A.R. meas. / (10^(Pdrift/10)))*(Pmax/Pint))* DC%
P_{max} = Maximum Power (W)
P_{int} = Initial Power (W)
Pdrift = DASY drift results (dB) - (for conservative results positive drifts are not accounted for)
SAR_{meas}. = Measured 1 gram averaged peak S.A.R. (mW/g)
DC % = Transmission mode duty cycle in % where applicable
50% duty cycle is applied for PTT operation.

10.0 Conclusion

The highest Operational Maximum Calculated 1-gram and 10-gram average S.A.R. values found for FCC ID: AZ489FT7016 models F2889A.

At the Body: 1-g Avg. = 0.43 W/kg; 10-g Avg. = 0.24W/kg

These test results clearly demonstrate compliance with FCC General Population/Uncontrolled RF Exposure limits of **1.6W/kg** per the requirements of 47 CFR 2.1093(d).

APPENDIX A
Measurement Uncertainty

Table 1: Uncertainty Budget for Device Under Test: 30 – 3000 MHz

a	*b*	*c*	*d*	*e = f(d,k)*	*f*	*g*	*h = c x f / e*	*i = c x g / e*	*k*
Uncertainty Component	IEEE 1528 section	**Tol. (± %)**	**Prob Dist**	**Div.**	c_i (1 g)	c_i (10 g)	**1 g** u_i (±%)	**10 g** u_i (±%)	v_i
Measurement System									
Probe Calibration	E.2.1	5.9	N	1.00	1	1	5.9	5.9	∞
Axial Isotropy	E.2.2	4.7	R	1.73	0.707	0.707	1.9	1.9	∞
Hemispherical Isotropy	E.2.2	9.6	R	1.73	0.707	0.707	3.9	3.9	∞
Boundary Effect	E.2.3	1.0	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	1.0	R	1.73	1	1	0.6	0.6	∞
Readout Electronics	E.2.6	0.3	N	1.00	1	1	0.3	0.3	∞
Response Time	E.2.7	1.1	R	1.73	1	1	0.6	0.6	∞
Integration Time	E.2.8	1.1	R	1.73	1	1	0.6	0.6	∞
RF Ambient Conditions - Noise	E.6.1	3.0	R	1.73	1	1	1.7	1.7	∞
RF Ambient Conditions - Reflections	E.6.1	0.0	R	1.73	1	1	0.0	0.0	∞
Probe Positioner Mech. Tolerance	E.6.2	0.4	R	1.73	1	1	0.2	0.2	∞
Probe Positioning w.r.t Phantom	E.6.3	1.4	R	1.73	1	1	0.8	0.8	∞
Max. SAR Evaluation (ext., int., avg.)	E.5	3.4	R	1.73	1	1	2.0	2.0	∞
Test sample Related									
Test Sample Positioning	E.4.2	3.2	N	1.00	1	1	3.2	3.2	29
Device Holder Uncertainty	E.4.1	4.0	N	1.00	1	1	4.0	4.0	8
SAR drift	6.6.2	5.0	R	1.73	1	1	2.9	2.9	∞
Phantom and Tissue Parameters									
Phantom Uncertainty	E.3.1	4.0	R	1.73	1	1	2.3	2.3	∞
Liquid Conductivity (target)	E.3.2	5.0	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Conductivity (measurement)	E.3.3	3.3	N	1.00	0.64	0.43	2.1	1.4	∞
Liquid Permittivity (target)	E.3.2	5.0	R	1.73	0.6	0.49	1.7	1.4	∞
Liquid Permittivity (measurement)	E.3.3	1.9	N	1.00	0.6	0.49	1.1	0.9	∞
Combined Standard Uncertainty			RSS				11	11	411
Expanded Uncertainty (95% CONFIDENCE LEVEL)			*k*=2				22	22	

Table 2: Uncertainty Budget for System Check: 30 – 3000 MHz

a	*b*	*c*	*d*	*e = f(d,k)*	*f*	*g*	*h = c x f / e*	*i = c x g / e*	*k*
Uncertainty Component	IEEE 1528 section	**Tol. (± %)**	**Prob. Dist.**	**Div.**	c_i (1 g)	c_i (10 g)	**1 g** u_i (±%)	**10 g** u_i (±%)	v_i
Measurement System									
Probe Calibration	E.2.1	5.9	N	1.00	1	1	5.9	5.9	∞
Axial Isotropy	E.2.2	4.7	R	1.73	1	1	2.7	2.7	∞
Spherical Isotropy	E.2.2	9.6	R	1.73	0	0	0.0	0.0	∞
Boundary Effect	E.2.3	1.0	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	1.0	R	1.73	1	1	0.6	0.6	∞
Readout Electronics	E.2.6	0.3	N	1.00	1	1	0.3	0.3	∞
Response Time	E.2.7	1.1	R	1.73	1	1	0.6	0.6	∞
Integration Time	E.2.8	0.0	R	1.73	1	1	0.0	0.0	∞
RF Ambient Conditions - Noise	E.6.1	3.0	R	1.73	1	1	1.7	1.7	∞
RF Ambient Conditions - Reflections	E.6.1	0.0	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 w.r.t. Phantom	E.6.3	1.4	R	1.73	1	1	0.8	0.8	∞
Max. SAR Evaluation (ext., int., avg.)	E.5	3.4	R	1.73	1	1	2.0	2.0	∞
Dipole									
Dipole Axis to Liquid Distance	8, E.4.2	2.0	R	1.73	1	1	1.2	1.2	∞
Input Power and SAR Drift Measurement	8, 6.6.2	5.0	R	1.73	1	1	2.9	2.9	∞
Phantom and Tissue Parameters									
Phantom Uncertainty	E.3.1	4.0	R	1.73	1	1	2.3	2.3	∞
Liquid Conductivity (target)	E.3.2	5.0	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Conductivity (measurement)	E.3.3	3.3	R	1.73	0.64	0.43	1.2	0.8	∞
Liquid Permittivity (target)	E.3.2	5.0	R	1.73	0.6	0.49	1.7	1.4	∞
Liquid Permittivity (measurement)	E.3.3	1.9	R	1.73	0.6	0.49	0.6	0.5	∞
Combined Standard Uncertainty			RSS				9	9	99999
Expanded Uncertainty (95% CONFIDENCE LEVEL)			*k*=2				18	17	

Table 3: Uncertainty Budget for Device Under Test: 3 – 6 GHz

a	*b*	*c*	*d*	*e = f(d,k)*	*f*	*g*	*h = c x f / e*	*i = c x g / e*	*k*
Uncertainty Component	**IEEE 1528 section**	**Tol. (± %)**	**Prob Dist**	**Div.**	**c_i (1 g)**	**c_i (10 g)**	**1 g u_i (±%)**	**10 g u_i (±%)**	**v_i**
Measurement System									
Probe Calibration	E.2.1	8.3	N	1.00	1	1	8.3	8.3	∞
Axial Isotropy	E.2.2	4.7	R	1.73	0.707	0.707	1.9	1.9	∞
Hemispherical Isotropy	E.2.2	9.6	R	1.73	0.707	0.707	3.9	3.9	∞
Boundary Effect	E.2.3	2.0	R	1.73	1	1	1.2	1.2	∞
Linearity	E.2.4	4.7	R	1.73	1	1	2.7	2.7	∞
System Detection Limits	E.2.5	1.0	R	1.73	1	1	0.6	0.6	∞
Readout Electronics	E.2.6	0.3	N	1.00	1	1	0.3	0.3	∞
Response Time	E.2.7	1.1	R	1.73	1	1	0.6	0.6	∞
Integration Time	E.2.8	1.1	R	1.73	1	1	0.6	0.6	∞
RF Ambient Conditions - Noise	E.6.1	3.0	R	1.73	1	1	1.7	1.7	∞
RF Ambient Conditions - Reflections	E.6.1	0.0	R	1.73	1	1	0.0	0.0	∞
Probe Positioner Mech. Tolerance	E.6.2	1.0	R	1.73	1	1	0.6	0.6	∞
Probe Positioning w.r.t Phantom	E.6.3	4.0	R	1.73	1	1	2.3	2.3	∞
Max. SAR Evaluation (ext., int., avg.)	E.5	2.1	R	1.73	1	1	1.2	1.2	∞
Test sample Related									
Test Sample Positioning	E.4.2	3.2	N	1.00	1	1	3.2	3.2	29
Device Holder Uncertainty	E.4.1	4.0	N	1.00	1	1	4.0	4.0	8
SAR drift	6.6.2	5.0	R	1.73	1	1	2.9	2.9	∞
Phantom and Tissue Parameters									
Phantom Uncertainty	E.3.1	4.0	R	1.73	1	1	2.3	2.3	∞
Liquid Conductivity (target)	E.3.2	5.0	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Conductivity (measurement)	E.3.3	3.3	N	1.00	0.64	0.43	2.1	1.4	∞
Liquid Permittivity (target)	E.3.2	5.0	R	1.73	0.6	0.49	1.7	1.4	∞
Liquid Permittivity (measurement)	E.3.3	1.9	N	1.00	0.6	0.49	1.1	0.9	∞
Combined Standard Uncertainty			RSS				13	12	702
Expanded Uncertainty (95% CONFIDENCE LEVEL)			*k*=2				25	25	

Table 4: Uncertainty Budget for System Check: 3 – 6 GHz

a	*b*	*c*	*d*	*e = f(d,k)*	*f*	*g*	*h = c x f / e*	*i = c x g / e*	*k*
Uncertainty Component	**IEEE 1528 section**	**Tol. (± %)**	**Prob. Dist.**	**Div.**	**c_i (1 g)**	**c_i (10 g)**	**1 g u_i (±%)**	**10 g u_i (±%)**	**v_i**
Measurement System									
Probe Calibration	E.2.1	8.3	N	1.00	1	1	8.3	8.3	∞
Axial Isotropy	E.2.2	4.7	R	1.73	1	1	2.7	2.7	∞
Spherical Isotropy	E.2.2	9.6	R	1.73	0	0	0.0	0.0	∞
Boundary Effect	E.2.3	2.0	R	1.73	1	1	1.2	1.2	∞
Linearity	E.2.4	4.7	R	1.73	1	1	2.7	2.7	∞
System Detection Limits	E.2.5	1.0	R	1.73	1	1	0.6	0.6	∞
Readout Electronics	E.2.6	0.3	N	1.00	1	1	0.3	0.3	∞
Response Time	E.2.7	1.1	R	1.73	1	1	0.6	0.6	∞
Integration Time	E.2.8	0.0	R	1.73	1	1	0.0	0.0	∞
RF Ambient Conditions - Noise	E.6.1	3.0	R	1.73	1	1	1.7	1.7	∞
RF Ambient Conditions - Reflections	E.6.1	0.0	R	1.73	1	1	0.0	0.0	∞
Probe Positioner Mechanical Tolerance	E.6.2	1.0	R	1.73	1	1	0.6	0.6	∞
Probe Positioning w.r.t. Phantom	E.6.3	4.0	R	1.73	1	1	2.3	2.3	∞
Max. SAR Evaluation (ext., int., avg.)	E.5	2.1	R	1.73	1	1	1.2	1.2	∞
Dipole									
Dipole Axis to Liquid Distance	8, E.4.2	2.0	R	1.73	1	1	1.2	1.2	∞
Input Power and SAR Drift Measurement	8, 6.6.2	5.0	R	1.73	1	1	2.9	2.9	∞
Phantom and Tissue Parameters									
Phantom Uncertainty	E.3.1	4.0	R	1.73	1	1	2.3	2.3	∞
Liquid Conductivity (target)	E.3.2	5.0	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Conductivity (measurement)	E.3.3	3.3	R	1.73	0.64	0.43	1.2	0.8	∞
Liquid Permittivity (target)	E.3.2	5.0	R	1.73	0.6	0.49	1.7	1.4	∞
Liquid Permittivity (measurement)	E.3.3	1.9	R	1.73	0.6	0.49	0.6	0.5	∞
Combined Standard Uncertainty			RSS				11	11	99999
Expanded Uncertainty (95% CONFIDENCE LEVEL)			*k*=2				21	21	

Notes for Tables 1 to 4

a) Column headings *a-k* are given for reference.
b) Tol. - tolerance in influence quantity.
c) Prob. Dist. – Probability distribution
d) N, R - normal, rectangular probability distributions
e) Div. - divisor used to translate tolerance into normally distributed standard uncertainty
f) *ci* - sensitivity coefficient that should be applied to convert the variability of the uncertainty component into a variability of SAR.
g) *ui* – SAR uncertainty
h) *vi* - degrees of freedom for standard uncertainty and effective degrees of freedom for the expanded uncertainty.