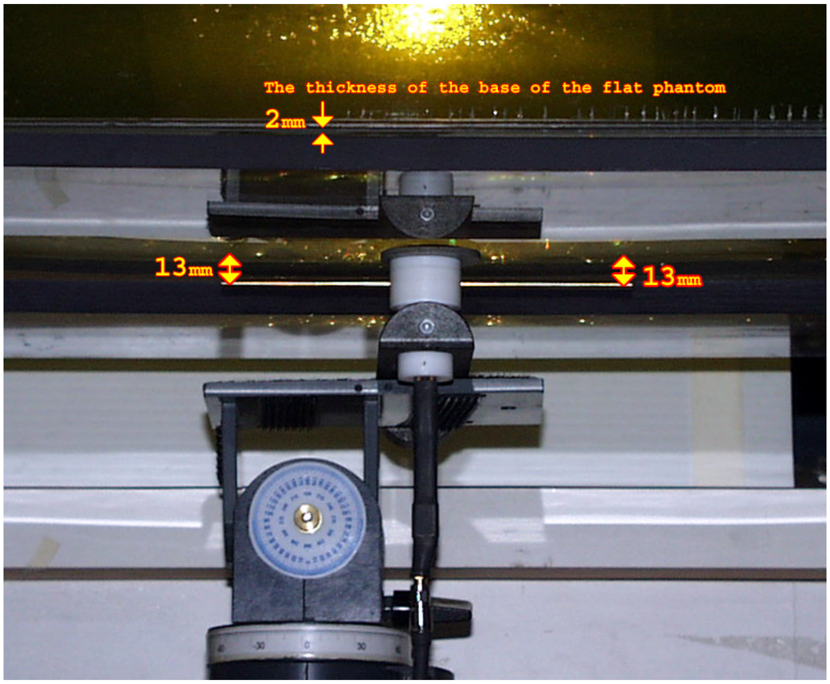
5.7. SAR MEASUREMENT SYSTEM VERIFICATION

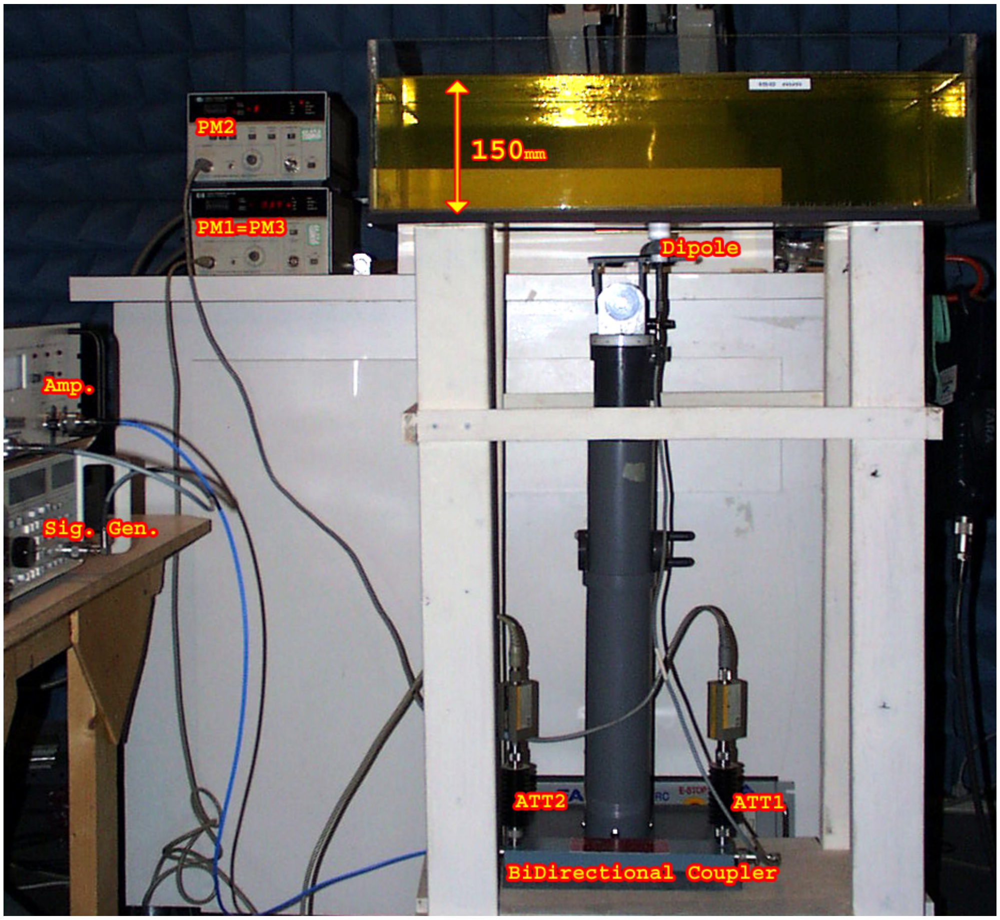
5.7.1. Standard Source

A half-wave dipole is positioned below the bottom of the phantom and centered with its axis parallel to the longest side of the phantom. The distance between the liquid filled phantom bottom surface and the center of the dipole axis, *s*, is chosen as specified IEEE 1528 at the specific test frequency (i.e. 15 mm at 835 MHz). A low loss and low dielectric constant spacer is used to establish the correct distance between the top surface of the dipole and the bottom surface of the phantom.



5.7.2. Standard Source Input Power Measurement

The system validation is performed as shown below or in Figure 7.1 in IEEE 1528.



First the power meter PM1 (including attenuator Att1) is connected to the cable to measure the forward power at the location of the dipole connector (X). The signal generator is adjusted for the desired forward power at the dipole connector (taking into account the attenuation of Att1) as read by power meter PM2. After connecting the cable to the dipole, the signal generator is readjusted for the same reading at power meter PM2. If the signal generator does not allow adjustment in 0.01dB steps, the remaining difference at PM2 must be taken into consideration. PM3 records the reflected power from the dipole to ensure that the value is not changed from the previous value. The reflected power was verified to be at least 20dB below the forward power.

5.7.3. System Validation Procedure

A complete 1g-averaged SAR measurement is performed. The measured 1g-averaged SAR value is normalized to a forward power of 1W to a half-wave dipole and compared with the reference SAR value for the reference dipole and flat phantom shown in columns 2 and 3 of Table 7.1 in IEEE 1528.

5.8. POWER MEASUREMENT

Whenever possible, a conducted power measurement is performed. To accomplish this, we utilize a fully charged battery, a calibrated power meter and a cable adapter provided by the manufacturer. The data of the cable and related circuit losses are also provided by the manufacturer. The power measurement is then performed across the operational band and the channel with the highest output power is recorded.

Power measurement is performed before and after the SAR to verify if the battery was delivering full power at the time of testing. A difference in output power would determine a need for battery replacement and to repeat the SAR test.

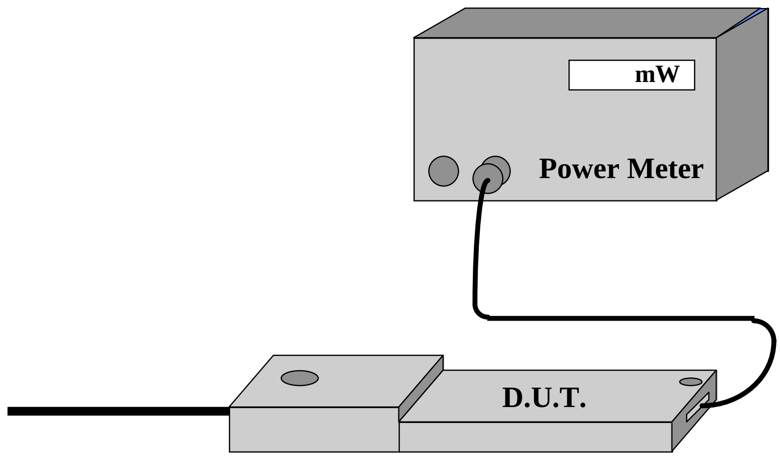


Figure 5.8. Measured Power + Cable and Switching Mechanism Loss

5.9. POSITIONING OF D.U.T.

The clear SAM phantom shell have been previously marked with a highly visible grid with a defined centre line, so it can easily be seen through the liquid simulated tissue. In the case of testing a cellular phone, this line is connecting the ear channel with the corner of the lips. The D.U.T. is then placed by centering the speaker with the ear channel and the center of the radio width with the corner of the mouth.

For HAND HELD devices (push-to-talk), or any other type of wireless transmitters postioned in front of the face, the D.U.T. will be positioned 2.5cm distance from a flat phantom to simulate the frontal facial position in use. All body-worn operating configurations are tested using a flat phantom. The length and width of the phantom is at least twice the corresponding dimensions of the test device, including its antenna.

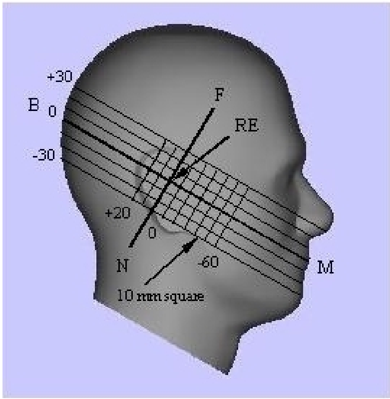


Figure 5.9.a. Side view of the phantom showing relevant marking

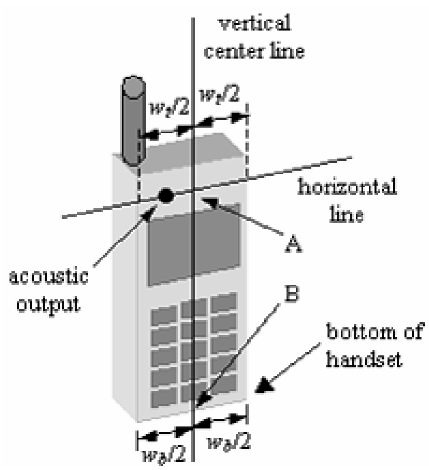


Figure 5.9.b. Handset vertical and horizontal reference lines – fixed case

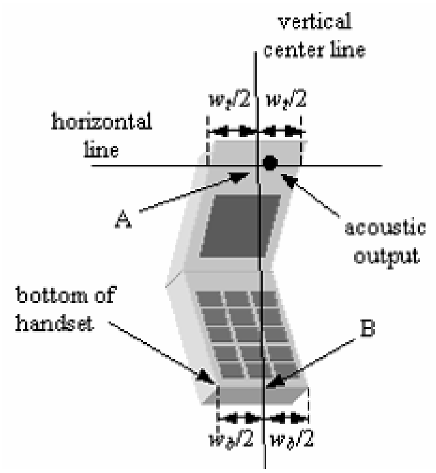


Figure 5.9.c. Handset vertical and horizontal reference lines – "clam-shell"

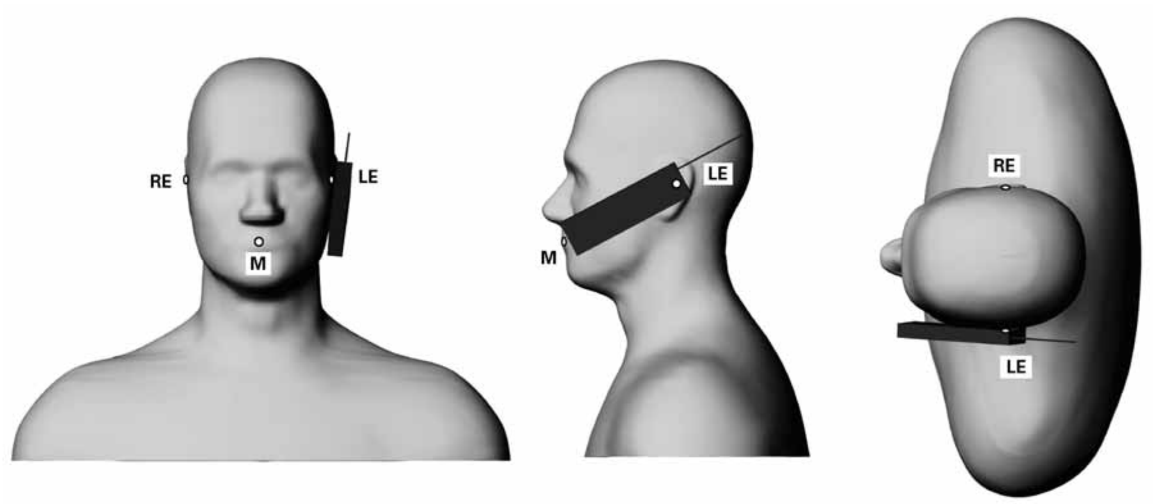


Figure 5.9.d. Phone position 1, "cheek" or "touch" position. The reference points for the right ear (RE), left ear (LE) and mouth (M), which define the reference plane for phone positioning, are indicated. The shoulders are shown for illustration purposes only.

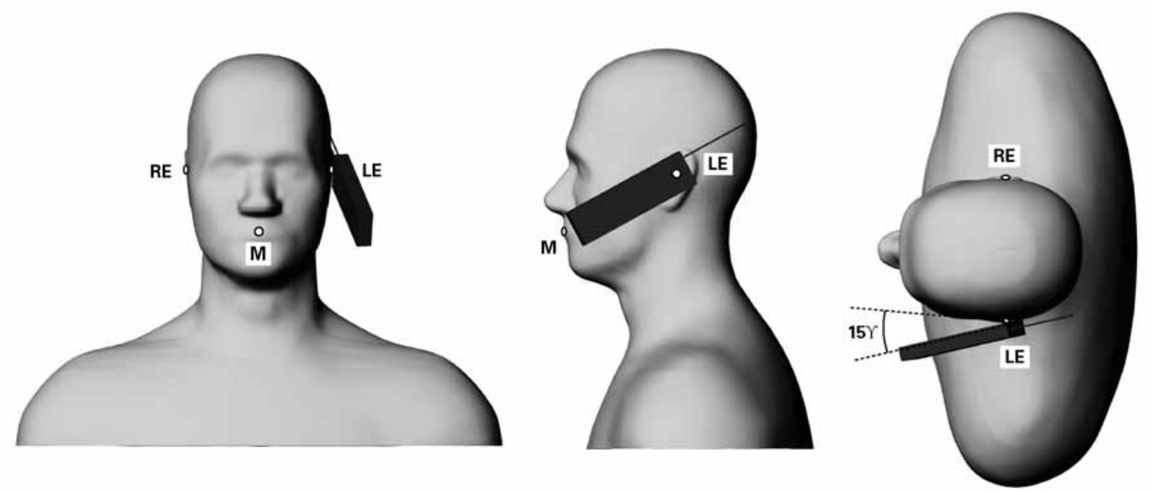


Figure 5.9.e. Phone position 2, "tilted position." The reference points for the right ear (RE), left ear (LE) and mouth (M), which define the reference plane for phone positioning, are indicated. The shoulders are shown for illustration purposes only.

5.10. SAR MEASUREMENT UNCERTAINTY

This uncertainty analysis covers the 3D-EMC Laboratory test procedure for Specific Absorption Rate (SAR) associated with wireless telephones and similar devices.

Standards Covered Are:

WGMTE 96/4 - Secretary SC211/B

FCC 96-326, ET Docket No. 93-62

Industry Canada RSS 102

ACA Radiocommunications (Electromagnetic Radiation – Human Exposure) Amendment Standard 2000 (No. 1)

The laboratory test procedure, and this uncertainty analysis, may be used to cover all standards above. It is based on test equipment and procedures specified by 3D-EMC Laboratories, Inc. located in Ft. Lauderdale, Florida.

5.10.1. Measurement Uncertainty

5.10.1.1. Measurement Uncertainty evaluation for handset SAR test

a	*b*	*c*	*d*	*e = f(d,k)*	*F*	*g*	*h = c x f / e*	*i = c x g / e*	*k*
Uncertainty Component	Sec.	**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	E1.1	3.0	N	1	1	1	3.0	3.0	∞
Axial Isotropy	E1.2	5.0	R	√3	0.7	0.7	2.0	2.0	∞
Hemispherical Isotropy	E1.2	8.0	R	√3	1	1	4.6	4.6	∞
Boundary Effect	E1.3	10.0	R	√3	1	1	5.8	5.8	∞
Linearity	E1.4	4.2	R	√3	1	1	2.4	2.4	∞
System Detection Limits	E1.5	2.0	R	√3	1	1	1.2	1.2	∞
Readout Electronics	E1.6	1.0	N	1	1	1	1.0	1.0	∞
Response Time	E1.7	1.5	R	√3	1	1	0.9	0.9	∞
Integration Time	E1.8	2.0	R	√3	1	1	1.2	1.2	∞
RF Ambient Conditions	E5.1	3.0	R	√3	1	1	1.7	1.7	∞
Probe Positioner Mechanical Tolerance	E5.2	1.0	R	√3	1	1	0.6	0.6	∞
Probe Positioning with respect to Phantom Shell	E5.3	3.0	R	√3	1	1	1.7	1.7	∞
Extrapolation, interpolation and Integration Algorithms for Max. SAR Evaluation	E4.2	3.5	R	√3	1	1	2.0	2.0	∞
Test sample Related									
Test Sample Positioning	E3.2.1	7.5	N	1	1	1	7.5	7.5	*11*
Device Holder Uncertainty	E3.1.1	6.5	N	1	1	1	6.5	6.5	*8*
Output Power Variation - SAR drift measurement	5.6.2	5.0	R	√3	1	1	2.9	2.9	∞
Phantom and Tissue Parameters									
Phantom Uncertainty (shape and thickness tolerances)	E2.1	4.0	R	√3	1	1	2.3	2.3	∞
Liquid Conductivity Target - tolerance	E2.2	5.0	R	√3	0.7	0.5	2.0	1.4	∞
Liquid Conductivity - measurement uncertainty	E2.2	4.0	R	√3	0.7	0.5	1.6	1.2	∞
Liquid Permittivity Target tolerance	E2.2	5.0	R	√3	0.6	0.5	1.7	1.4	∞
Liquid Permittivity - measurement uncertainty	E2.2	4.0	R	√3	0.6	0.5	1.4	1.2	∞
Combined Standard Uncertainty			RSS				14.3	14.2	
Expanded Uncertainty (95% confidence interval)							**28.5**	**28.3**	

5.10.1.2. *Measurement Uncertainty for System Performance Check*

a	*b*	*c*	*d*	*e = f(d,k)*	*f*	*g*	*h = c x f / e*	*i = c x g / e*	*k*
Uncertainty Component	**Sec.**	**Tol. (± %)**	**Prob. Dist.**	**Div.**	**c_i (1-g)**	**c_i (10-g)**	**1-g u_i (±%)**	**10-g u_i (±%)**	**v_i or v_{eff}**
Measurement System									
Probe Calibration	E1.1	3.0	N	1	1	1	3.0	3.0	∞
Axial Isotropy	E1.2	5.0	R	√3	0.7	0.7	2.0	2.0	∞
Hemispherical Isotropy	E1.2	8.0	R	√3	1	1	4.6	4.6	∞
Boundary Effect	E1.3	10.0	R	√3	1	1	5.8	5.8	∞
Linearity	E1.4	4.2	R	√3	1	1	2.4	2.4	∞
System Detection Limits	E1.5	2.0	R	√3	1	1	1.2	1.2	∞
Readout Electronics	E1.6	1.0	N	1	1	1	1.0	1.0	∞
Response Time	E1.7	1.5	R	√3	1	1	0.9	0.9	∞
Integration Time	E1.8	2.0	R	√3	1	1	1.2	1.2	∞
RF Ambient Conditions	E5.1	3.0	R	√3	1	1	1.7	1.7	∞
Probe Positioner Mechanical Tolerance	E5.2	0.4	R	√3	1	1	0.2	0.2	∞
Probe Positioning with respect to Phantom Shell	E5.3	3.0	R	√3	1	1	1.7	1.7	∞
Extrapolation, interpolation and Integration Algorithms for Max. SAR Evaluation	E4.2	3.5	R	√3	1	1	2.0	2.0	∞
Dipole									
Dipole Axis to Liquid Distance	7, X3.2	2.0	R	√3	1	1	1.2	1.2	∞
Input Power and SAR Drift Measurement	7, 5.6.2	3.0	R	√3	1	1	1.7	1.7	∞
Phantom and Tissue Parameters									
Phantom Uncertainty - shell thickness tolerance	E2.1	4.0	R	√3	1	1	2.3	2.3	∞
Liquid Conductivity – deviation from target values	E2.2	5.0	R	√3	0.7	0.5	2.0	1.4	∞
Liquid Conductivity - measurement uncertainty	E2.2	4.0	R	√3	0.7	0.5	1.6	1.2	∞
Liquid Permittivity – deviation from target values	E2.2	5.0	R	√3	0.6	0.5	1.7	1.4	∞
Liquid Permittivity - measurement uncertainty	E2.2	4.0	R	√3	0.6	0.5	1.4	1.2	∞
Combined Standard Uncertainty			RSS				10.0	9.9	
Expanded Uncertainty (95% confidence interval)							**20.1**	**19.8**	

EXHIBIT 6. SAR PRESCANS

6.1.1. Body Configuration

6.1.1.1. Test configurations used

Body-worn operating configurations should be tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in normal use configurations. Devices with a headset output should be tested with a headset connected to the device. The D.U.T. was placed against the phantom and tested in its appropriate holster as would normally be used by the end user. If the SAR measured at the middle channel for each test is at least 32.0 dB lower than the SAR limit, testing at the high and low channels is optional for such test configuration(s).

If the transmission band of the test device is less than 10 MHz, testing at the high and low frequency channels is optional.

When multiple accessories that do not contain metallic components are supplied with the device, the device may be tested with only the accessory that dictates the closest spacing to the body. When multiple accessories that contain metallic components are supplied with the device, the device must be tested with each accessory that contains a unique metallic component. If multiple accessories share an identical metallic component (e.g., the same metallic belt-clip used with different holsters with no other metallic components), only the accessory that dictates the closest spacing to the body must be tested.

Body-worn accessories may not always be supplied or available as options for some devices that are intended to be authorized for body-worn use. A separation distance of 1.5 cm between the back of the device and a flat phantom is recommended for testing body-worn SAR compliance under such circumstances. Other separation distances may be used, but they should not exceed 2.5 cm. In these cases, the device may use body-worn accessories that provide a separation distance greater than that tested for the device provided however that the accessory contains no metallic components..

6.1.1.2. Equipment permutation investigated for each orientation

Three configurations, the front of the D.U.T. against the phantom with the tip of the antenna in contact, the rear of the D.U.T. against the phantom with the tip of the antenna in contact and the top of the D.U.T. against the phantom with the tip of the antenna in contact, were investigated in order to find the worst case exposure.

6.1.1.3. Comments on non-tested configurations

N/A

6.2. RECOMMENDED CAUTION STATEMENTS TO BE INCLUDED IN USERS MANUAL

In order for users to be aware of the body-worn operating requirements for meeting RF exposure compliance, operating instructions and caution statements should be included in the manual. The information should allow users to make informed decisions on the type of body-worn accessories and operating configurations that are appropriate for the device. The following are *examples* of typical statements that provide end-users with the necessary information about body-worn accessories:

Example 1. For a product that has the potential to be used in a body worn configuration and has been tested and certified with a specific accessory device(s):

"For body worn operation, this phone has been tested and meets the FCC RF exposure guidelines when used with the (*manufacturer name*) accessories supplied or designated for this product. Use of other accessories may not ensure compliance with FCC RF exposure guidelines. "

Example 2. For a product that has the potential to be used in a body worn configuration and has not been certified with a specific accessory device(s):

"For body worn operation, this phone has been tested and meets FCC RF exposure guidelines when used with an accessory that contains no metal and that positions the handset a minimum of (specified distance) from the body. Use of other accessories may not ensure compliance with FCC RF exposure guidelines."

Example 3. For a product that has the potential to be used in a body worn configuration with future manufacturer designed accessories:

"For body worn operation, this phone has been tested and meets the FCC RF exposure guidelines when used with a (*manufacturer name*) accessory designated for this product or when used with an accessory that contains no metal and that positions the handset a minimum of (specified distance) from the body."

6.3. PRESCAN DATA FOR WORST CONFIGURATION OF RF EXPSOSURE

6.3.1. Body Configuration

6.3.1.1. 2.4 GHz

Local SAR at an arbitrary vicinity of the antenna location inside the simulated tissue was measured respectively for the different data rate without changing the probe position to determine the worst case data rate to be used for the final evaluation as listed below.

802.11g	
Bit Rate [Mbps]	**Local SAR** [W/Kg] @ 2437 MHz
1	**0.09**
2	0.09
5.5	0.09
11	0.09
9	0.03
18	0.03
36	0.03
54	0.01

Once the worst case data rate had been determined, the 1g peak spatial-average SAR was measured using the thinnest host laptop PC provided by the manufacturer to investigate the minimum safety distance for compliance in three possible configuration under the normal usage of the D.U.T.; 1) Bottom of the host PC faced toward the phantom (lap-top position), 2) Edge of the card pointed toward the phantom (by-stander position) and 3) Top (Keyboard) of the host PC faced toward the phantom,

Configuration	**Antenna Position**	**Peak spatial-average SAR_{1g} (W/kg)**
802.11g, 1 Mbps, 2437 MHz, Top (Keyboard) of the host PC faced toward the phantom, 5 mm (5 + 0) separation distance b/w the top surface of the card and the phantom (Host PC in contact with the phantom, card inserted into the top PC slot)	Integrated	0.20 at 5 mm
802.11g, 1 Mbps, 2437 MHz, Bottom of the host PC faced toward the phantom, 8 mm (8 + 0) separation distance b/w the bottom surface of the card and the phantom (Host PC in contact with the phantom, card inserted into the bottom PC slot)	Integrated	**0.22** at 8 mm
802.11g, 1 Mbps, 2437 MHz, Edge of the card pointed toward the phantom, 0 mm (0 + 0) separation distance (Edge of the card in contact with the phantom)	Integrated	0.03 at 0 mm

6.3.1.2. 5.24 GHz

802.11a	
Bit Rate [Mbps]	**Local SAR [W/Kg] @ 5260 MHz**
9	**1.14**
18	0.86
36	0.50
54	0.06

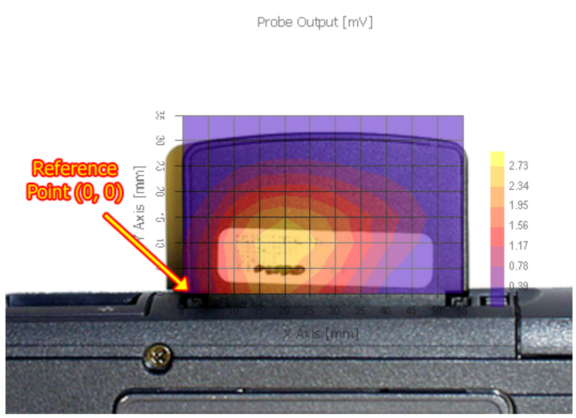
Configuration	**Antenna Position**	**Peak spatial-average SAR_{1g} (W/kg)**
802.11a, 9 Mbps, 5260 MHz, Top (Keyboard) of the host PC faced toward the phantom, 5 mm (5 + 0) separation distance b/w the top surface of the card and the phantom (Host PC in contact with the phantom, card inserted into the top PC slot)	Integrated	0.10 at 5 mm
802.11g, 9 Mbps, 5260 MHz, Bottom of the host PC faced toward the phantom, 8 mm (8 + 0) separation distance b/w the bottom surface of the card and the phantom (Host PC in contact with the phantom, card inserted into the bottom PC slot)	Integrated	**0.74** at 8 mm
802.11g, 9 Mbps, 5260 MHz, Edge of the card pointed toward the phantom, 0 mm (0 + 0) separation distance (Edge of the card in contact with the phantom)	Integrated	0.30 at 0 mm

EXHIBIT 7. SAR MEASUREMENT

7.1. BODY CONFIGURATION

7.1.1. 802.11g mode (ISM-2.4 band) *

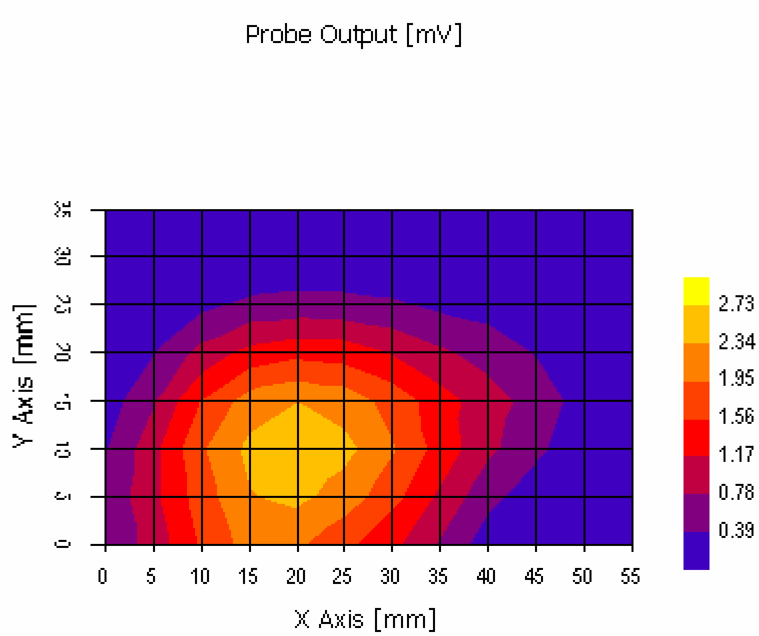
#	Configuration	Device Test Positions	Antenna Position	Freq. [MHz]	Channel	Ref. Local SAR Before [W/Kg]	Ref. Local SAR After [W/Kg]	MAX 1g SAR [W/Kg]
01	ISM-2.4 band, DSSS, 2437 MHz 1 Mbps data rate Bottom of the host PC faced toward the phantom, 8 mm (8 + 0) separation distance b/w the bottom surface of the card and the phantom (Host PC in contact with the phantom, card inserted into the bottom PC slot)	8 mm	Integrated	2412	01			
02		8 mm	Integrated	2437	06	0.10	0.09	0.22
03		8 mm	Integrated	2462	11			

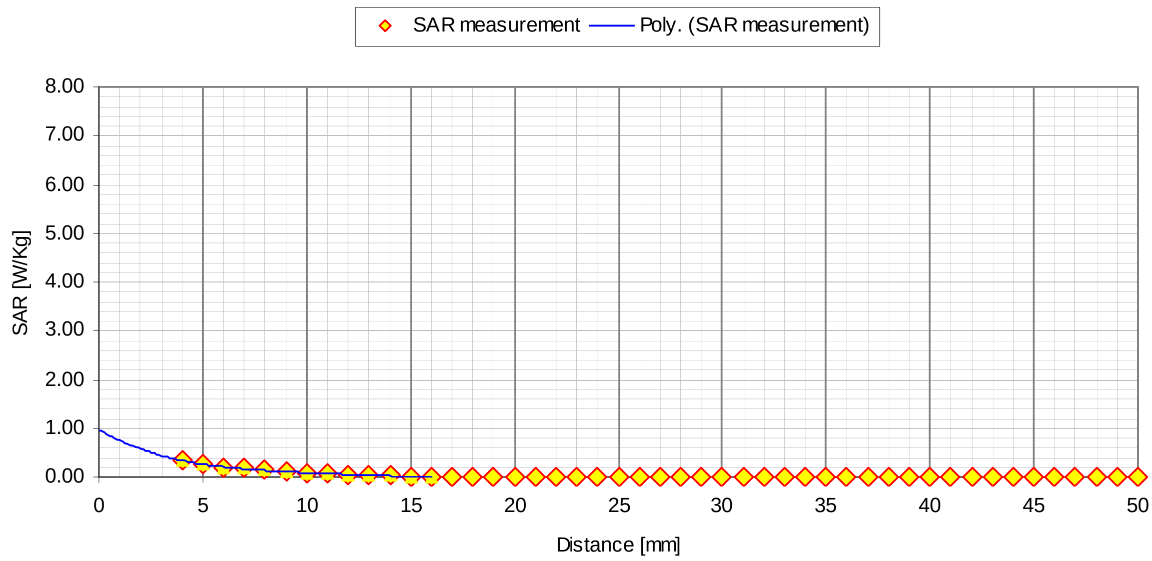


* If the SAR measured at the middle channel for each test configuration is at least 3.0 dB lower than the SAR limit, testing at the high and low channels is optional for such test configuration(s).

7.1.1.1. Bottom of the host PC faced toward the phantom, 8 mm (8 + 0) separation distance b/w the bottom surface of the card and the phantom

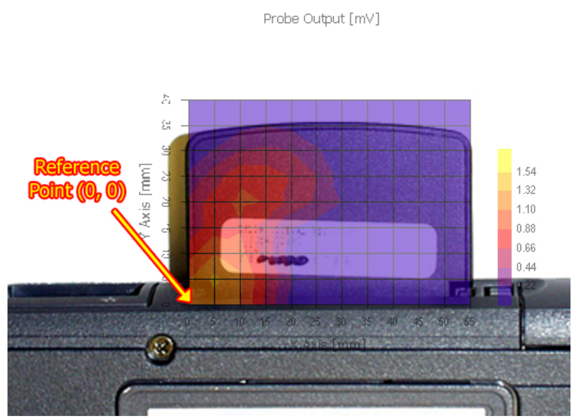
Test date [MM/DD/YYYY]	06/18/2003
Test by	JaeWook Choi
Room temperature [°C]	23
Room humidity [%]	30
Simulated tissue temperature [°C]	23
Separation distance, d [mm]	8 (8 + 0)
Test frequency [MHz]	2437
E-field Probe	M/N: E-TR, S/N: UT-0200-1, Sensor Offset: 2.0 mm
Sensor Factor (η_{Pd}) [mV/(mW/cm^2)]	10.8
Amplifier Settings (AS_1, AS_2, AS_3)	0.00660854, 0.00622568, 0.008540925
Tissue Type	Muscle
Measured conductivity [S/m]	1.96 (+0.5 %)
Measured dielectric constant	54.3 (+3.0 %)
Conversion Factor (γ)	4.028
Sensitivity (ζ) [W/Kg/mV]	1.699E-01
Power [dBm]	18.2 conducted
Measurement Volume Specification (X × Y × Z)	5 pts × 5 pts × 9 pts, 16 mm × 16 mm × 32 mm; Resolution: 4 mm × 4 mm × 4 mm
SAR_{1g} [W/Kg]	0.22




SAR measurement
Poly. (SAR measurement)
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
SAR [W/Kg]
0
5
10
15
20
25
30
35
40
45
50
Distance [mm]

7.1.2. 802.11a mode (UNII band) *

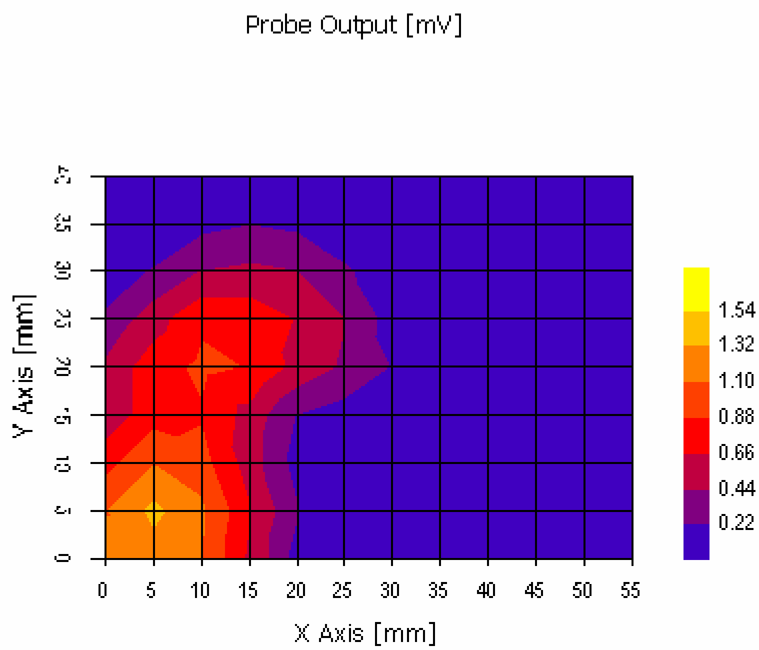
#	Configuration	Device Test Positions	Antenna Position	Freq. [MHz]	Channel	Ref. Local SAR Before [W/Kg]	Ref. Local SAR After [W/Kg]	MAX 1g SAR [W/Kg]
04	UNII band, OFDM, 5260 MHz 9 Mbps data rate Bottom of the host PC faced toward the phantom, 8 mm (8 + 0) separation distance b/w the bottom surface of the card and the phantom (Host PC in contact with the phantom, card inserted into the bottom PC slot)	0 mm	Integrated	5180	36			
05		0 mm	Integrated	5260	52	0.80	0.78	0.74
06		0 mm	Integrated	5320	64			

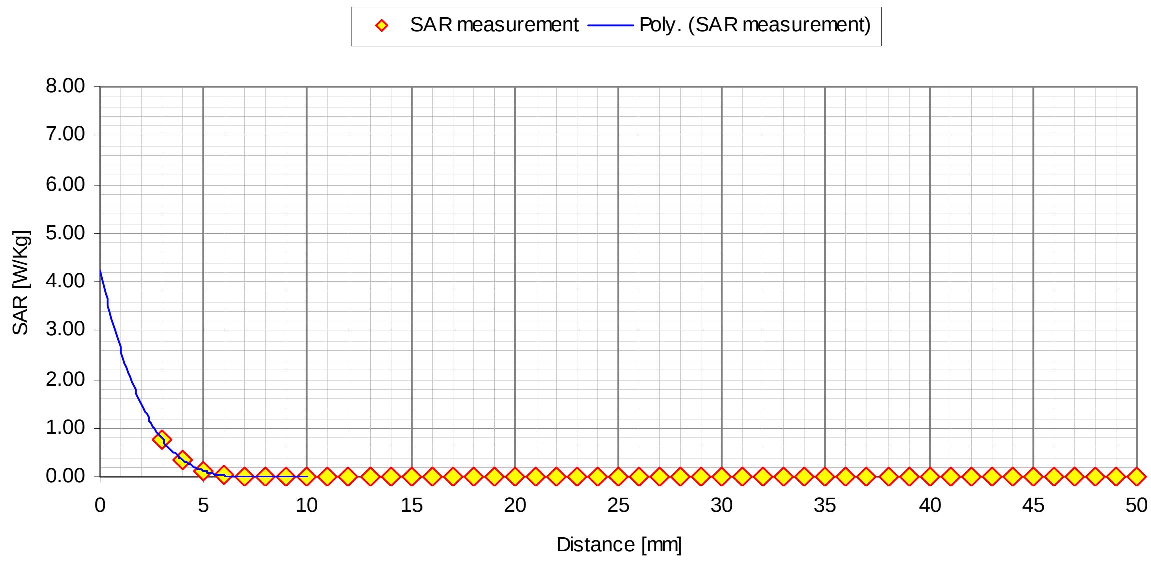


* If the SAR measured at the middle channel for each test configuration is at least 3.0 dB lower than the SAR limit, testing at the high and low channels is optional for such test configuration(s).

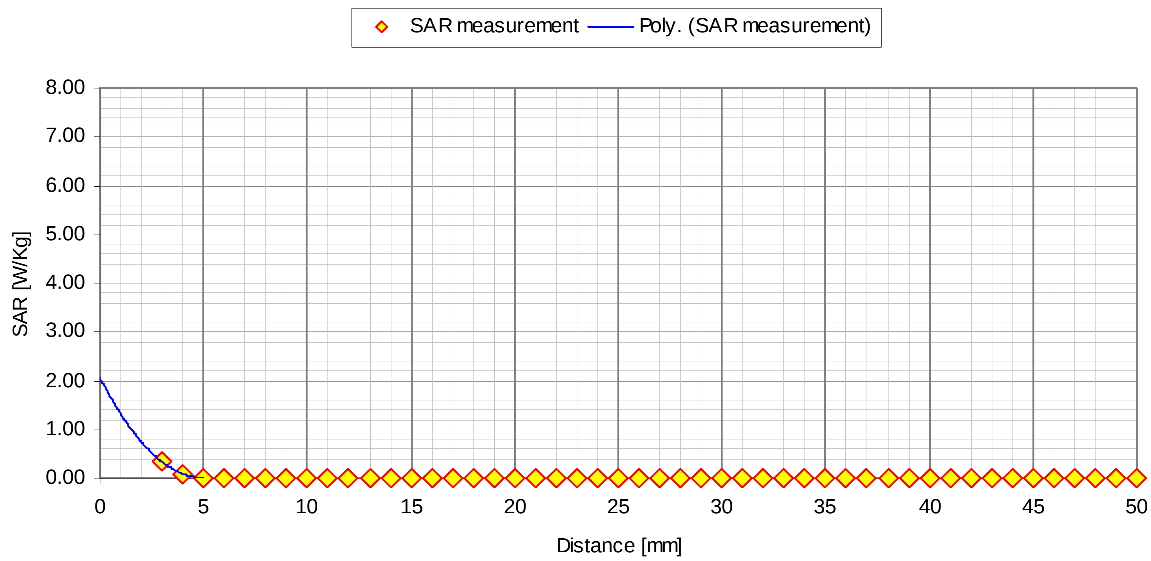
7.1.2.1. Bottom of the host PC faced toward the phantom, 8 mm (8 + 0) separation distance b/w the bottom surface of the card and the phantom

Test date [MM/DD/YYYY]	06/20/2003
Test by	JaeWook Choi
Room temperature [°C]	23
Room humidity [%]	30
Simulated tissue temperature [°C]	23
Separation distance, d [mm]	0 (0 + 0)
Test frequency [MHz]	5260
E-field Probe	M/N: E-TR, S/N: UT-0200-1, Sensor Offset: 2.0 mm
Sensor Factor (η_{Pd}) [mV/(mW/cm^2)]	10.8
Amplifier Settings (AS_1, AS_2, AS_3)	0.00596768, 0.00563160, 0.00779221
Tissue Type	Muscle
Measured conductivity [S/m]	5.55 (3.7 %)
Measured dielectric constant	47.3 (-3.5 %)
Conversion Factor (γ)	4.028
Sensitivity (ζ) [W/Kg/mV]	7.133E-01
Power [dBm]	19.0 conducted
Measurement Volume Specification (X × Y × Z)	5 pts × 5 pts × 13 pts, 12 mm × 12 mm × 12 mm; Resolution: 3 mm × 3 mm × 1 mm
SAR_{1g} [W/Kg]	1st peak: 0.74, 2nd peak: 0.20





< 1st Peak >



< 2nd peak >

EXHIBIT 8. TISSUE DIELECTRIC PARAMETER CALIBRATION

The tissue conductivity was calibrated in accordance with IEEE Std 1528-200X, Draft 6.1 November 14, 2000, Sponsor IEEE SCC 34

Tissue calibration type	HP Dielectric Strength Probe System (M/N: 85070C)		
Tissue calibration date [MM/DD/YYYY]	06/18/2003	06/18/2003	06/20/2003
Tissue calibrated by	JaeWook Choi	JaeWook Choi	JaeWook Choi
Room temperature [°C]	23	23	23
Room humidity [%]	30	30	30
Simulated tissue temperature [°C]	23	23	23
Tissue calibration frequency [MHz]	2450	2450	5240
Tissue Type	Brain	Muscle	Muscle
Target conductivity [S/m]	1.80	1.95	5.35
Target dielectric constant	39.2	52.7	49.0
Composition (by weight) [%]	DI Water (59.70 %) DGBE (4.76 %) Salt (0.50 %) Triton X-100 (35.04 %)	DI Water (76.19 %) DGBE (9.52 %) Triton X-100 (14.29 %)	DI Water (77.67 %) DGBE (2.91 %) Triton X-100 (19.42 %)
Measured conductivity [S/m]	1.81 (+0.6 %)	1.96 (+0.5 %)	5.55 (+3.7 %)
Measured dielectric constant	39.8 (+1.5 %)	54.3 (+3.0 %)	47.3 (-3.5 %)
Penetration depth (plane wave excitation) [mm]	18.8	20.1	6.7

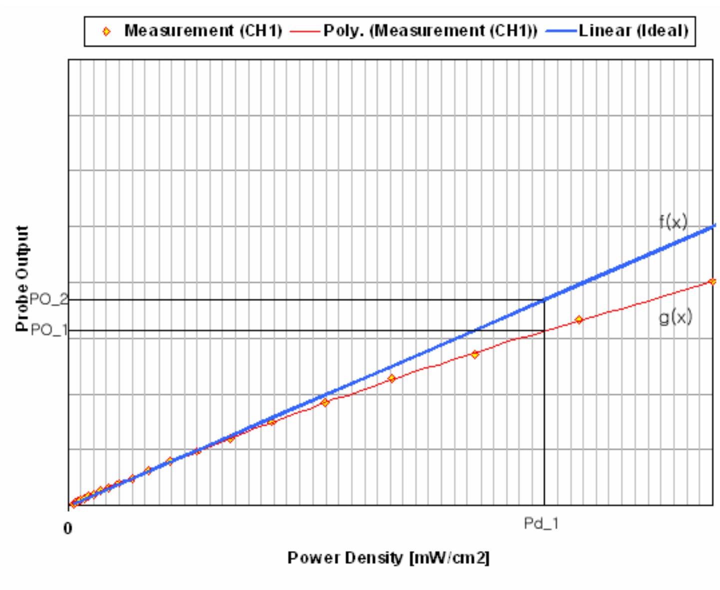
EXHIBIT 9. SAR SYSTEM CALIBRATION

9.1. GENERAL INFORMATION OF THE PROBE

Probe Type	E-Field Triangle, Isotropic
Model Number	E-TR
Serial Number	UT-0200-01
Manufacturer	3D-EMC Laboratory Inc.
Manufactured Date	February 2000
Probe Length [mm]	270
Probe offset [mm]	2.0
Probe Tip diameter [mm]	4.0
Sensor Factor (η_{Pd}) [mV/(mW/cm^2)]	10.8
Sensor Factor (η_{E2}) [mV/(V/m)^2]	10.8 / 3770

9.2. PROBE LINEARITY AND DYNAMIC RANGE

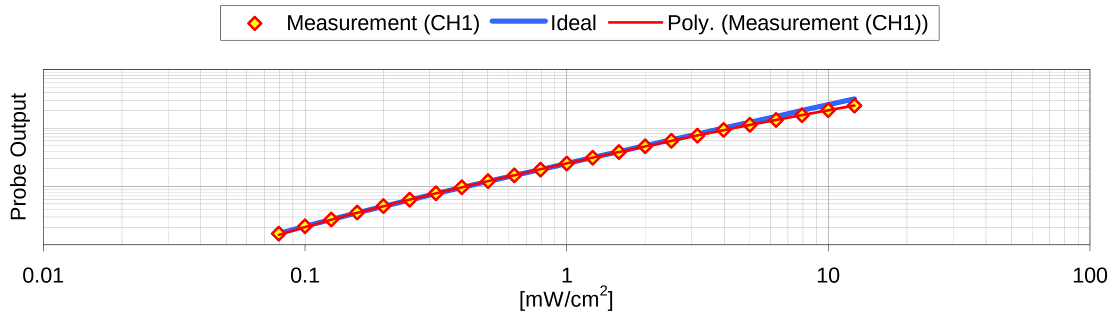
Each channel of the probe output over the range of the generated field's power density is recorded and stored as a diode compensation table to yield the polynomial equations, using the curve fitting algorithm, for the ideal diode response (linear) and the saturated diode response (the 3rd order). The linear equation and the inverse of the 3rd order polynomial equation are used to compensate for the saturated diode response to the ideal diode response.

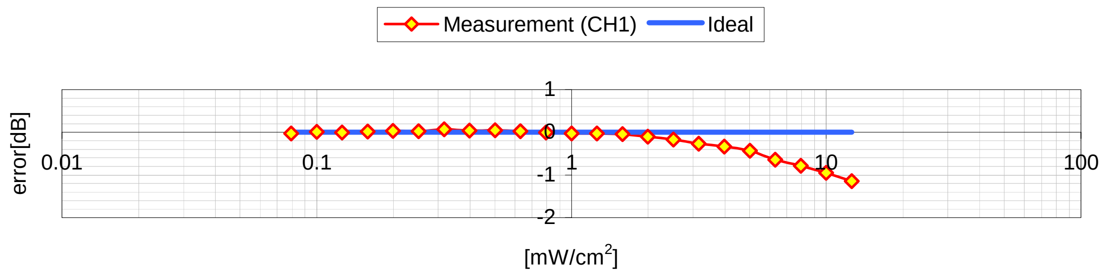


For example, Provided that linear equation, f, the 3rd order polynomial equation, g, and its inverse, g^{-1}, the saturated diode output $PO_{\_1}$ can be compensated to the ideal diode output $PO_{\_2}$ by the calculation as shown below.

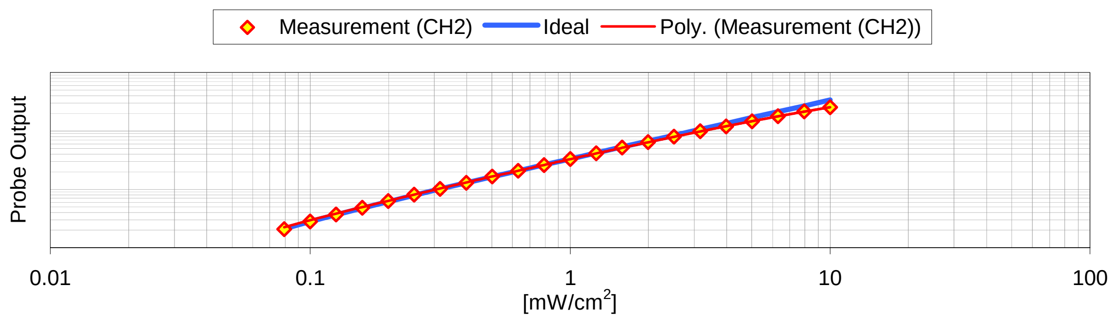
$Pd_{\_1} = g^{-1}(PO_{\_1})$,
$PO_{\_2} = f(Pd_{\_1}) = f(g^{-1}(PO_{\_1}))$

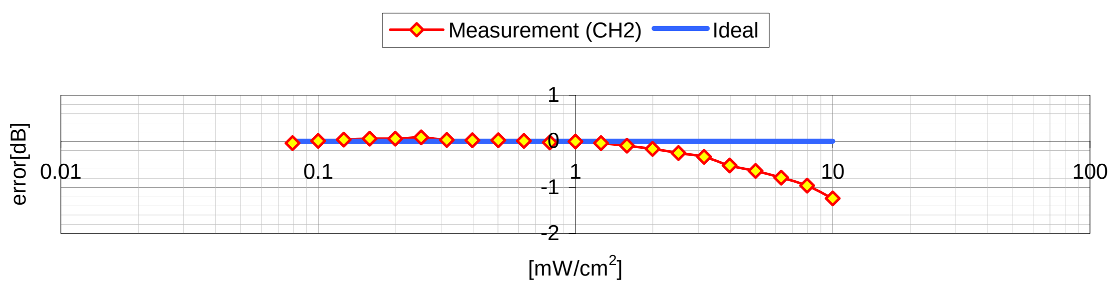
9.2.1. Channel 1



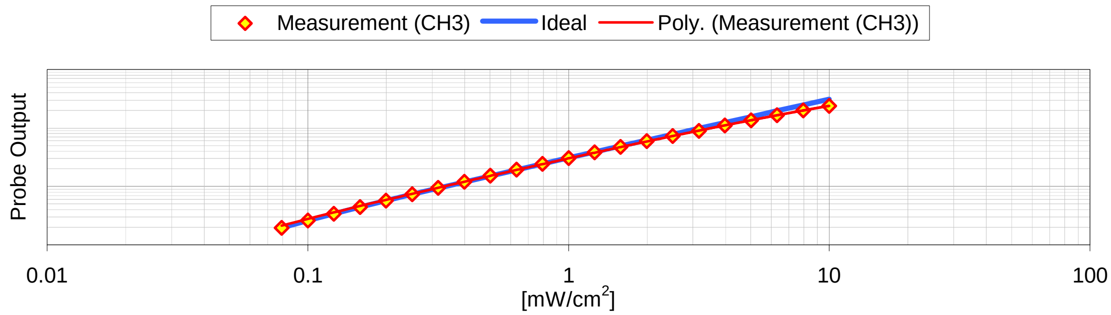


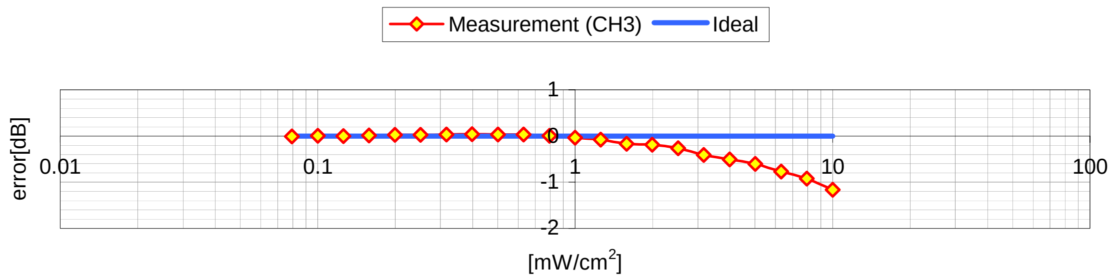
9.2.2. Channel 2





9.2.3. Channel 3





9.3. PROBE FREE SPACE CALIBRATION

9.3.1. Calibration Setup

9.3.1.1. 2.45 GHz

Calibration cell type	Waveguide
Model Number	13492
Serial Number	12463-1, 12463-2
Manufacturer	APOLLO
Input Power / Power Density [mW/(mW/cm^2)] @ 2450 [MHz]	24.7

9.3.1.2. 5.24 GHz

Calibration cell type	Waveguide
Model Number	11457-2
Serial Number	CO-05721-01, CO-05721-02
Manufacturer	APOLLO
Input Power / Power Density [mW/(mW/cm^2)] @ 5240 [MHz]	2.794

9.3.2. Amplifier Settings

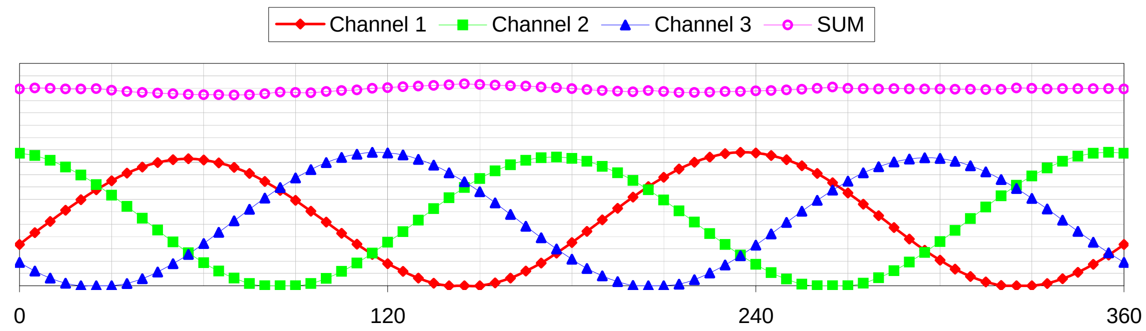
9.3.2.1. 2.45 GHz

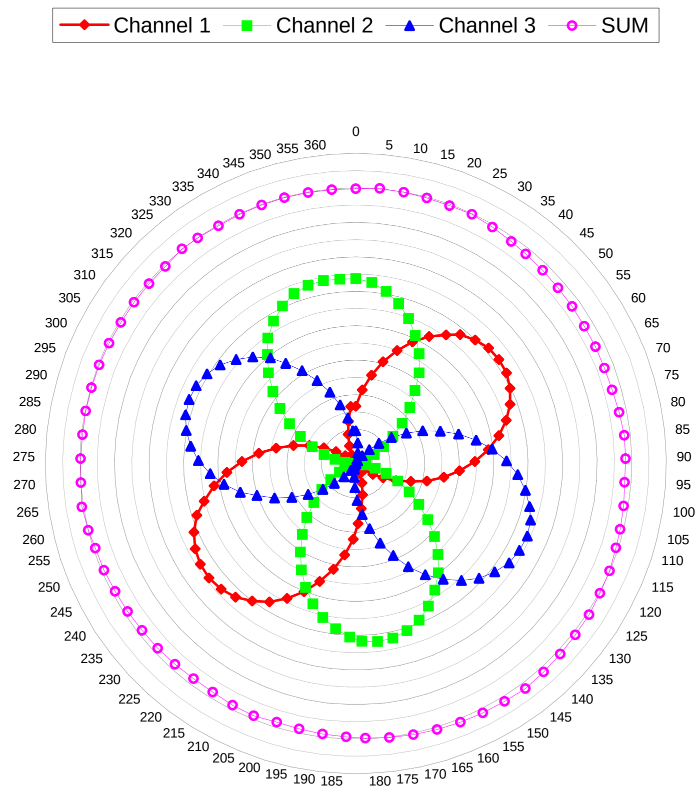
Calibration Date [MM/DD/YYYY]	09/23/2002
Calibrated by	JaeWook Choi
Calibration Frequency [MHz]	2450
Room Temperature [°C]	24
Room Humidity [%]	50
φ [°]	90
$\theta_1, \theta_2, \theta_3$ [°]	54.7, 54.7, 54.7
Pd [mW/cm^2]	2.0
V_{max1}	2,179
V_{max2}	2,313
V_{max3}	1,686
AS_1	0.00660854
AS_2	0.00622568
AS_3	0.00854093

9.3.2.2. 5.24 GHz

Calibration Date [MM/DD/YYYY]	07/31/2002
Calibrated by	JaeWook Choi
Calibration Frequency [MHz]	5,240
Room Temperature [°C]	24
Room Humidity [%]	30
φ [°]	90
$\theta_1, \theta_2, \theta_3$ [°]	54.7, 54.7, 54.7
Pd [mW/cm^2]	2.0
V_{max1}	2413
V_{max2}	2557
V_{max3}	1848
AS_1	0.00596768
AS_2	0.00563160
AS_3	0.00779221

9.3.3. Isotropic response





9.4. PROBE THERMAL TRANSFER CALIBRATION

9.4.1. 2.45 GHz

9.4.1.1. Calibration Setup

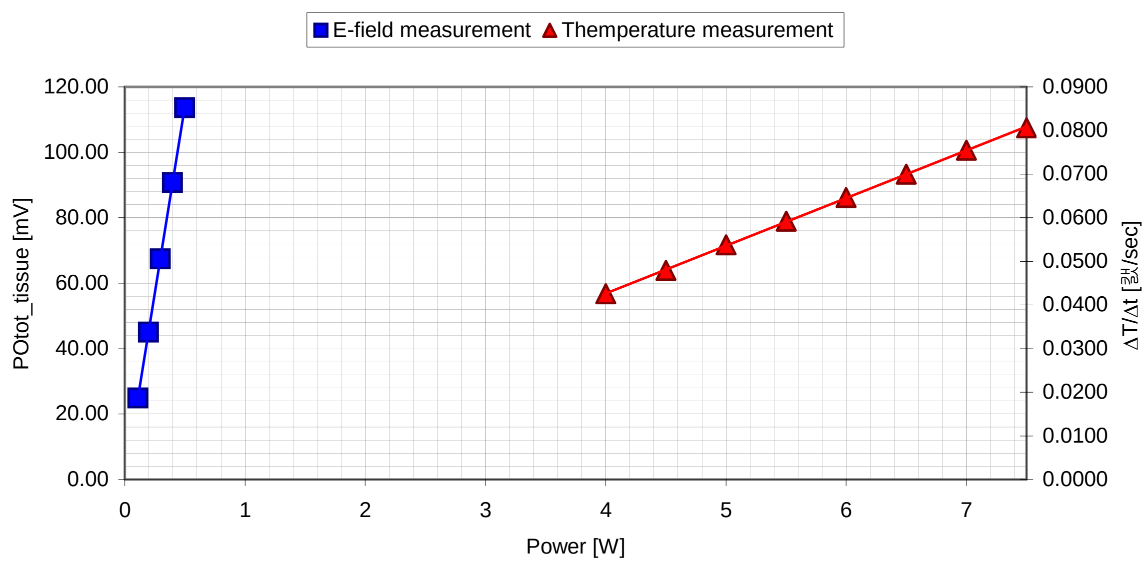
Calibration type	Thermal transfer calibration
Flat phantom dimension (W × L × H) [mm]	420 × 700 × 200
Flat phantom shell thickness (d_3) [mm]	2.0
Flat phantom shell permittivity	2.98
Calibration dipole dimension (L × h × d) [mm]	51.7 × 30.4 × 3.6
Sensor-to-Phantom (d_1) [mm]	5.0
Dipole-to-Phantom (d_2) [mm]	8.0
Sensor-to-Dipole ($d_1 + d_2 + d_3$) [mm]	15.0 (5.0 + 8.0 + 2.0)
Return Loss (at test frequency) [dB]	-24.0

9.4.1.2. Simulated Tissue

Tissue calibration type	HP Dielectric Strength Probe System	
Tissue calibration date [MM/DD/YYYY]	09/23/2002	09/23/2002
Tissue calibrated by	JaeWook Choi	JaeWook Choi
Room temperature [°C]	24	24
Room humidity [%]	50	50
Simulated tissue temperature [°C]	24	24
Tissue calibration frequency [MHz]	2450	2450
Tissue Type	Brain	Muscle
Target conductivity [S/m]	1.80	1.95
Target dielectric constant	39.2	52.7
Specific Heat Capacity [J/Kg/°C]	3,702	3,979
Mass Density [Kg/m3]	1,016	1,004
Measured conductivity [S/m]	1.88 (+4.6 %)	1.91 (-2.1 %)
Measured dielectric constant	37.6 (-4.0 %)	55.5 (+5.0 %)
Penetration depth (plane wave excitation) [mm]	17.6	20.9

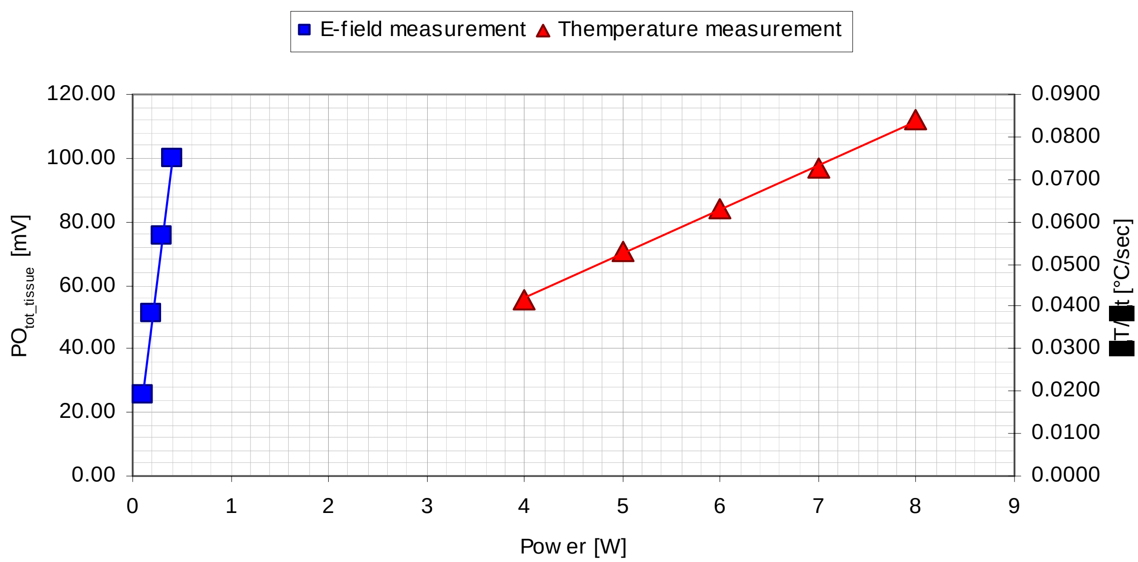
9.4.1.3. Conversion Factor for brain tissue

Calibration Date [MM/DD/YYYY]	09/25/2002
Calibration by	JaeWook Choi
Calibration Frequency [MHz]	2450
Room Temperature [°C]	24
Room Humidity [%]	45
Simulated Tissue Temperature [°C]	24
PO_{tot_tissue} [mV]	24.914 @ 0.11 [W] 45.029 @ 0.20 [W] 67.429 @ 0.30 [W] 90.743 @ 0.40 [W] 113.600 @ 0.50 [W]
$\delta(PO_{tot\_tissue})/\delta P$ [mV/W]	2210.9371429
$\Delta T/\Delta t$ [°C/ sec]	0.04255 @ 4.0 [W] 0.04791 @ 4.5 [W] 0.05381 @ 5.0 [W] 0.05921 @ 5.5 [W] 0.06463 @ 6.0 [W] 0.06998 @ 6.5 [W] 0.07551 @ 7.0 [W] 0.08063 @ 7.5 [W]
$\delta(\Delta T/\Delta t)/\delta P$ [°C/sec/W]	0.01091643
Conversion Factor (γ)	3.653



9.4.1.4. Conversion Factor for muscle tissue

Calibration Date [MM/DD/YYYY]	09/25/2002
Calibration by	JaeWook Choi
Calibration Frequency [MHz]	2450
Room Temperature [°C]	24
Room Humidity [%]	45
Simulated Tissue Temperature [°C]	24
PO_{tot_tissue} [mV]	25.569 @ 0.10 [W] 51.166 @ 0.20 [W] 75.544 @ 0.30 [W] 99.802 @ 0.40 [W]
$\delta(PO_{tot\_tissue})/\delta P$ [mV/W]	251.2469333
$\Delta T/\Delta t$ [°C/ sec]	0.04164 @ 4.0 [W] 0.05296 @ 5.0 [W] 0.06284 @ 6.0 [W] 0.07272 @ 7.0 [W] 0.08398 @ 8.0 [W]
$\delta(\Delta T/\Delta t)/\delta P$ [°C/sec/W]	0.010444000
Conversion Factor (γ)	4.028



9.4.2. 5.24 GHz

9.4.2.1. Calibration Setup

Calibration type	Thermal transfer calibration
Flat phantom dimension (W × L × H) [mm]	420 × 700 × 200
Flat phantom shell thickness (d_3) [mm]	2.0
Flat phantom shell permittivity	2.98
Calibration dipole dimension (L × h × d) [mm]	25.1 × 13.4 × 3.6
Sensor-to-Phantom (d_1) [mm]	5.0
Dipole-to-Phantom (d_2) [mm]	8.0
Sensor-to-Dipole ($d_1 + d_2 + d_3$) [mm]	15.0 (5.0 + 8.0 + 2.0)
Return Loss (at test frequency) [dB]	-21.0

9.4.2.2. Simulated Tissue

Tissue calibration type	HP Dielectric Strength Probe System
Tissue calibration date [MM/DD/YYYY]	07/31/2002
Tissue calibrated by	JaeWook Choi
Room temperature [°C]	24
Room humidity [%]	30
Simulated tissue temperature [°C]	24
Tissue calibration frequency [MHz]	5240
Tissue Type	Muscle
Target conductivity [S/m]	5.40
Target dielectric constant	48.5
Measured conductivity [S/m]	5.43 (+0.6 %)
Measured dielectric constant	48.8 (+0.6 %)
Penetration depth (plane wave excitation) [mm]	6.95

9.4.2.3. Conversion Factor

Calibration Date [MM/DD/YYYY]	07/31/2002
Calibration by	JaeWook Choi
Calibration Frequency [MHz]	5,240
Room Temperature [°C]	24
Room Humidity [%]	30
Simulated Tissue Temperature [°C]	23
PO_{tot_tissue} [mV]	6.668 @ 0.28 [W] 11.609 @ 0.49 [W] 16.193 @ 0.70 [W] 23.278 @ 0.99 [W]
$\delta(PO_{tot\_tissue})/\delta P$ [mV/W]	23.44599
$\Delta T/\Delta t$ [°C/ sec]	0.01525 @ 4.0 [W] 0.01940 @ 5.0 [W] 0.02343 @ 6.0 [W] 0.02732 @ 7.0 [W] 0.03152 @ 8.0 [W] 0.03549 @ 9.0 [W] 0.03943 @ 10.0 [W]
$\delta(\Delta T/\Delta t)/\delta P$ [°C/sec/W]	0.004029
Conversion Factor (γ)	2.721

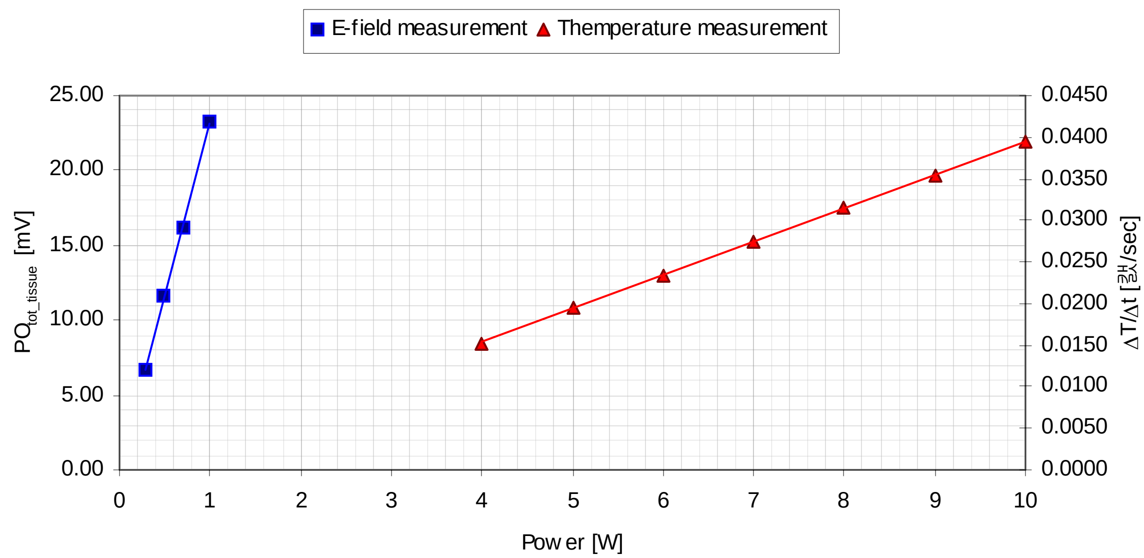


EXHIBIT 10. SAR SYSTEM VERIFICATION USING DIPOLE REFERENCE

10.1. 2.45 GHZ

10.1.1. Verification Setup

Flat phantom dimension (W × L × H) [mm]	420 × 700 × 200
Flat phantom shell thickness (d_3) [mm]	2.0
Flat phantom shell permittivity	2.98
Reference dipole dimension (L × h × d) [mm]	51.7 × 30.4 × 3.6
Dipole-to-Phantom (d_2) [mm]	8.0
Dipole-to-Liquid ($d_2 + d_3$) [mm]	10.0 (8.0 + 2.0)
Return Loss (at test frequency) [dB]	-24.0

10.1.2. Simulated Tissue

Tissue calibration type	HP Dielectric Strength Probe System
Tissue calibration date [MM/DD/YYYY]	06/18/2003
Tissue calibrated by	JaeWook Choi
Room temperature [°C]	23
Room humidity [%]	30
Simulated tissue temperature [°C]	23
Tissue calibration frequency [MHz]	2450
Tissue Type	Brain
Target conductivity [S/m]	1.81
Target dielectric constant	39.2
Specific Heat Capacity [J/Kg/°C]	3,702
Mass Density [Kg/m3]	1,016
Measured conductivity [S/m]	1.81 (+0.6 %)
Measured dielectric constant	39.8 (+1.5 %)
Penetration depth (plane wave excitation) [mm]	18.8

10.1.3. Verification Result

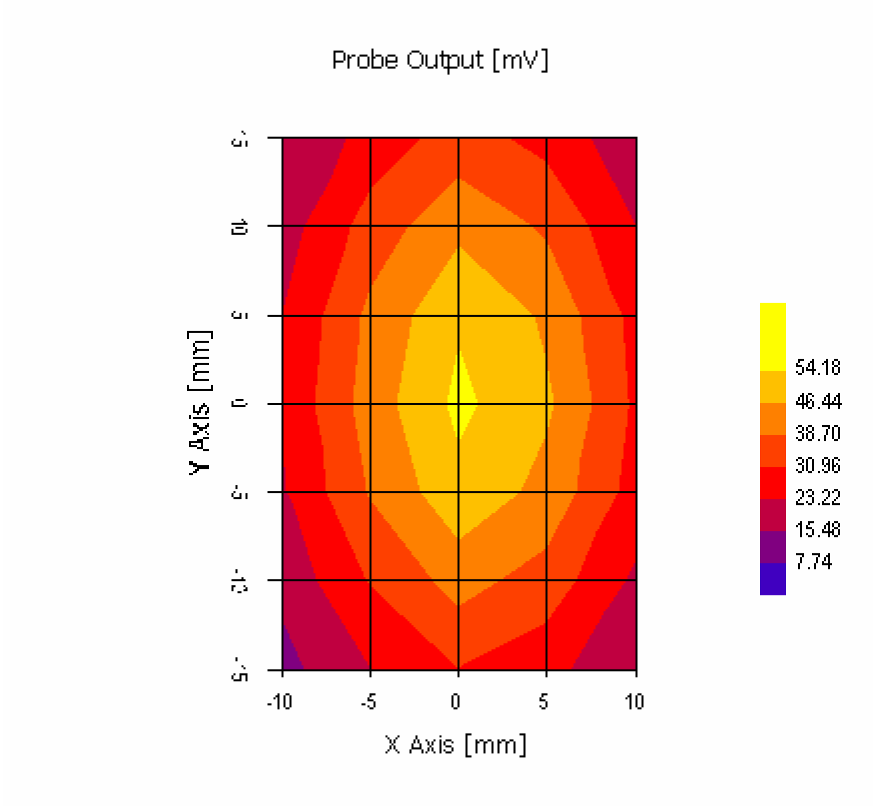
10.1.3.1. Reference SAR values*

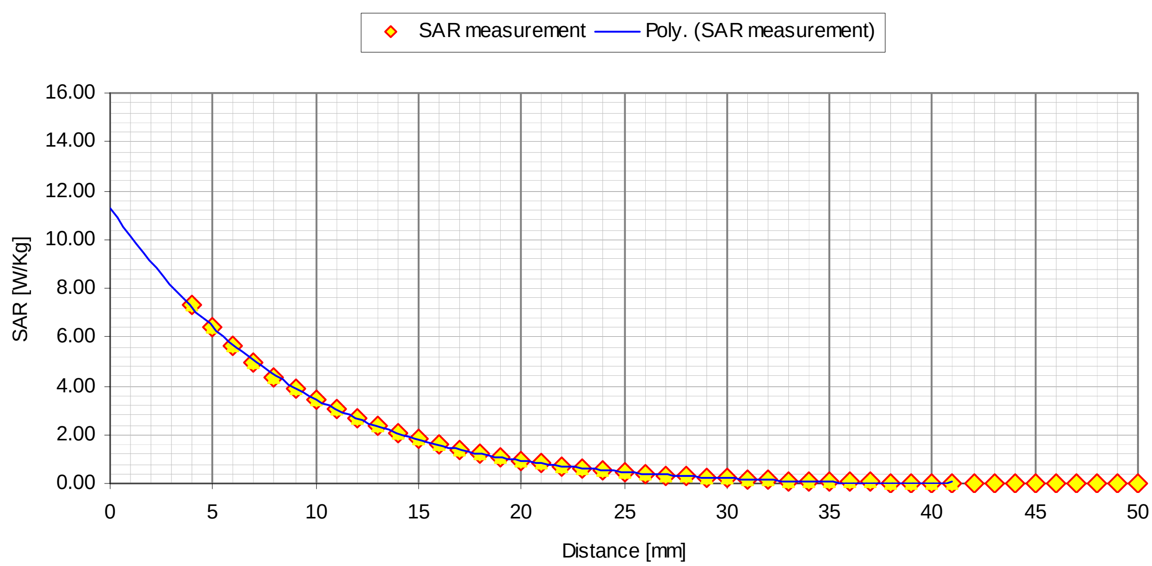
Reference SAR_{1g} [W/Kg]	52.4
Reference SAR_s [W/Kg]	104.2
Measured SAR_{1g} [W/Kg]	52.5
Measured SAR_s [W/Kg]	112.9

10.1.3.2. Brain tissue

Test date [MM/DD/YYYY]	06/18/2003
Test by	JaeWook Choi
Room temperature [°C]	23
Room humidity [%]	30
Simulated tissue temperature [°C]	23
Test frequency [MHz]	2450
E-field Probe	M/N: E-TR, S/N: UT-0200-1, Sensor Offset: 2.0 mm
Sensor Factor (η_{Pd}) [mV/(mW/cm^2)]	10.8
Amplifier Settings (AS_1, AS_2, AS_3)	0.00660854, 0.00622568, 0.008540925
Tissue Type	Brain
Measured conductivity [S/m]	1.81 (+0.6 %)
Measured dielectric constant	39.8 (+1.5 %)
Specific Heat Capacity [J/Kg/°C]	3,702
Mass Density [Kg/m3]	1,016
Conversion Factor (γ)	3.653
Sensitivity (ζ) [W/Kg/mV]	1.730E-01
Power [mW]	100 (forward power)
Measurement Volume Specification (X × Y × Z)	5 pts × 5 pts × 9 pts, 16 mm × 16 mm × 32 mm; Resolution: 4 mm × 4 mm × 4 mm
SAR_{1g} [W/Kg]	5.25
SAR_s [W/Kg]	11.29
Penetration Depth [mm]	16.5

* All SAR values in 10.1.3.1 are normalized to a forward power of 1 W.


Probe Output [mV]
Y Axis [mm]
X Axis [mm]
-10
-5
0
5
10
54.18
46.44
38.70
30.96
23.22
15.48
7.74


SAR measurement
Poly. (SAR measurement)
SAR [W/Kg]
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
0
5
10
15
20
25
30
35
40
45
50
Distance [mm]

10.2. 5.24 GHZ

10.2.1. Verification Setup

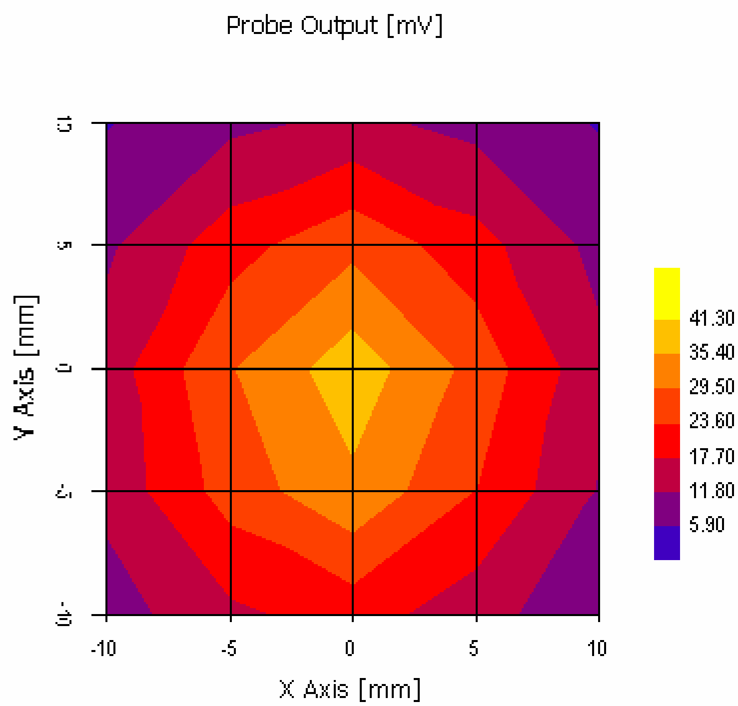
Flat phantom dimension (W × L × H) [mm]	420 × 700 × 200
Flat phantom shell thickness (d_3) [mm]	2.0
Flat phantom shell permittivity	2.98
Reference dipole dimension (L × h × d) [mm]	25.1 × 13.4 × 3.6
Dipole-to-Phantom (d_2) [mm]	8.0
Dipole-to-Liquid ($d_2 + d_3$) [mm]	10.0 (8.0 + 2.0)
Return Loss (at test frequency) [dB]	-18.0

10.2.2. Simulated Tissue

Tissue calibration type	HP Dielectric Strength Probe System
Tissue calibration date [MM/DD/YYYY]	06/20/2003
Tissue calibrated by	JaeWook Choi
Room temperature [°C]	23
Room humidity [%]	30
Simulated tissue temperature [°C]	23
Tissue calibration frequency [MHz]	5240
Tissue Type	Muscle
Target conductivity [S/m]	5.35
Target dielectric constant	49.0
Measured conductivity [S/m]	5.55 (+3.7 %)
Measured dielectric constant	47.3 (-3.5 %)
Penetration depth (plane wave excitation) [mm]	6.7

10.2.3. Verification Result

Test date [MM/DD/YYYY]	06/20/2003
Test by	JaeWook Choi
Room temperature [°C]	23
Room humidity [%]	30
Simulated tissue temperature [°C]	23
Separation distance, d [mm]	10 (8 + 2)
Test frequency [MHz]	5240
E-field Probe	M/N: E-TR, S/N: UT-0200-1, Sensor Offset: 2.0 mm
Sensor Factor (η_{Pd}) [mV/(mW/cm^2)]	10.8
Amplifier Settings (AS_1, AS_2, AS_3)	0.00596768, 0.00563160, 0.00779221
Tissue Type	Muscle
Measured conductivity [S/m]	5.55 (+3.7 %)
Measured dielectric constant	47.3 (-3.5 %)
Conversion Factor (γ)	2.721
Sensitivity (ζ) [W/Kg/mV]	7.120E-01
Power [mW]	250 (forward power)
Measurement Volume Specification (X × Y × Z)	5 pts × 5 pts × 13 pts, 12 mm × 12 mm × 12 mm; Resolution: 3 mm × 3 mm × 1 mm
SAR_{1g} [W/Kg]	13.32
SAR_s [W/Kg]	66.07
Penetration Depth [mm]	6.6



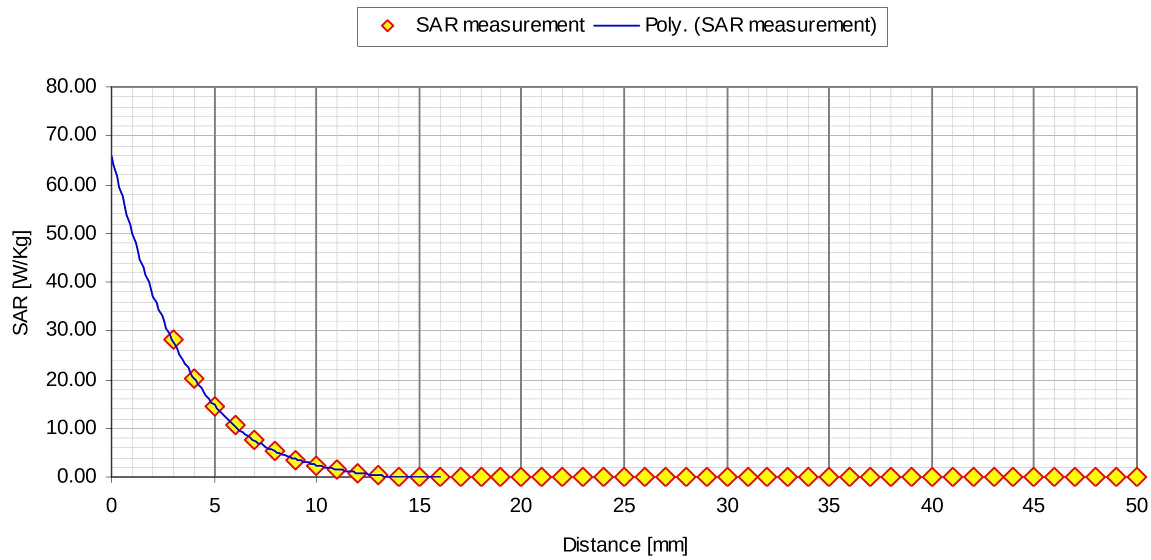

SAR measurement
Poly. (SAR measurement)
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
SAR [W/Kg]
0
5
10
15
20
25
30
35
40
45
50
Distance [mm]

EXHIBIT 11. MANUFACTURER'S DECLARATION ANTENNA ASSEMBLIES

Intersil Corporation

P.O. Box 343
3720 AH Bilthoven
The Netherlands
Rembrandtaan 1a
3723 BG Bilthoven
The Netherlands

telephone +31 (0)30 229 60 60
facsimile +31 (0)30 229 60 61

intersil

Date
03 July 2003

Your reference
--

To whom it may concern

Our reference
2003-mansup-545pq_1

Subject
Assembly / Configuration statement
for FCC ID: OSZ39001C

To whom it may concern,

This letter confirms that the following product:

Description: Intersil IEEE802.11a / g dual band WLAN Cardbus client card
Brand: Intersil
Model number: ISL39001C
FCC ID: OSZ39001C

is to be FCC certified and marketed in the following antenna configuration:

Antenna:	Skycross dual band PCB antenna
Gain:	1.7 dBi peak at 2450MHz
	3.1 dBi peak at 5320MHz

This device will be equipped with an antenna diversity option for RX mode only.
TX mode will not have this antenna diversity capability.
FCC SAR tests at Ultratech labs. have been performed in this non-diversity TX mode.

Yours sincerely,

Derick Sariredjo (derick.sariredjo@intersil.com)
Intersil Corp. The Netherlands (www.intersil.com)
Rembrandtlaan 1a, 3723 BG Bilthoven, The Netherlands
Phone: +31.30.225.9742
Fax: +31.30.229.6061

EXHIBIT 12. SAR CALCULATION SUMMARY

12.1. TERMINOLOGY

AS_i	Amplifier Setting for channel i (i = 1, 2, 3)
Pd	Power density at the measurement point [mW/cm^2]
PO_{tot_air}	Probe Output in the air [mV]
PO_{tot_tissue}	Probe Output in the simulated tissue [mV]
η_{E2}	Sensor Factor to the $|E|^2$, an arbitrary value 10.8/3,770 [mV/(V/m)^2]
η_{pd}	Sensor Factor to the uniform power density, an arbitrary value 10.8 [mV/(mW/cm^2)]
γ	Conversion factor; ratio of sensor response in air to response in the dielectric media
ζ	Sensitivity of the probe in the simulated tissue [W/Kg/mV]
c	Specific heat capacity of the simulated tissue [J/Kg/ ^{o}C]
$\sigma_{@cal}$	Conductivity of the simulated tissue during the thermal transfer calibration [S/m]
$\sigma_{@meas}$	Conductivity of the simulated tissue during the SAR measurement [S/m]
ρ	Mass density of the simulated tissue [Kg/m^3]
$\Delta T/\Delta t$	Initial rate of tissue heating, before thermal diffusion takes place [^{o}C /sec]

12.1.1. Sensor factor(η_{pd} and η_{E2}) in the air (Z_0 = 377[Ω])

$$\eta_{Pd} = 10.8[mV/(mW/cm)^2] \equiv \eta_{E2} = \frac{10.8}{3,770}[mV/(V/m)^2]$$

$$Pd[mW/cm^2] = \frac{PO_{tot}}{\eta_{Pd}} \quad , \quad |E|^2[(V/m)^2] = \frac{PO_{tot}}{\eta_{E2}} \quad \text{and} \quad SAR[W/Kg] = \frac{\sigma \times \frac{PO_{tot}}{\eta_{E2}}}{\rho}$$

12.1.2. Amplifier settings(AS_i) and probe output

$$AS_i = \frac{\eta_{Pd}}{V_{\max_i} - DC_i} \times \cos^2(\varphi - \theta_i) \times Pd$$

$$PO_1[mV] = (V_1 - DC_1) \times AS_1 \equiv |E_1|^2 \times \eta_{E2}$$

$$PO_2[mV] = (V_2 - DC_2) \times AS_2 \equiv |E_2|^2 \times \eta_{E2}$$

$$PO_3[mV] = (V_3 - DC_3) \times AS_3 \equiv |E_3|^2 \times \eta_{E2}$$

$$PO_{tot}[mV] \equiv |E|^2 \times \eta_{E2} = \left(|E_1|^2 + |E_2|^2 + |E_3|^2\right) \times \eta_{E2} = |E_1|^2 \times \eta_{E2} + |E_2|^2 \times \eta_{E2} + |E_3|^2 \times \eta_{E2}$$
$$\equiv PO_1 + PO_2 + PO_3$$

12.1.3. Conversion factor (γ) in the simulated tissue

$$\left|E_{tissue}\right|^2 = \frac{PO_{tot\_tissue}}{\eta_{E2}} \times \frac{1}{\gamma}$$

$$SAR_t = SAR_{tissue} = \frac{\sigma_{@cal} \times \left|E_{tissue}\right|^2}{\rho} = \frac{\sigma_{@cal} \times \frac{PO_{tot\_tissue}}{\eta_{E2}} \times \frac{1}{\gamma}}{\rho[Kg/m^3]} = \left(\frac{\sigma_{@cal} \times \frac{PO_{tot\_tissue}}{\eta_{E2}}}{\rho} \right) \times \frac{1}{\gamma} = SAR_{PO_{tot\_tissue}} \times \frac{1}{\gamma}$$

12.1.4. Conversion factor (γ) Calculation

$$\frac{\delta}{\delta P} SAR_t = \frac{\delta}{\delta P} SAR_{tissue}$$

$$\frac{\delta}{\delta P}\left(c \times \frac{\Delta T}{\Delta t} \right) = \frac{\delta}{\delta P}\left(\frac{\sigma_{@cal} \times \left|E_{tissue}\right|^2}{\rho} \right) = \frac{\delta}{\delta P}\left(\frac{\sigma_{@cal} \times \frac{PO_{tot\_tissue}}{\eta_{E2}} \times \frac{1}{\gamma}}{\rho} \right)$$

$$\gamma = \frac{\frac{\delta}{\delta P} SAR_{PO_{tot\_tissue}}}{\frac{\delta}{\delta P} SAR_t} = \frac{\frac{\sigma_{@cal} \times \frac{\frac{\delta}{\delta P} PO_{tot\_tissue}}{\eta_{E2}}}{\rho}}{c \times \frac{\delta}{\delta P} \frac{\Delta T}{\Delta t}} = \frac{\sigma_{@cal}}{\eta_{E2} \times c \times \rho} \times \frac{\frac{\delta}{\delta P} PO_{tot\_tissue}}{\frac{\delta}{\delta P} \frac{\Delta T}{\Delta t}}$$

12.1.5. Sensitivity (ζ) in the simulated tissue

$$\zeta[W/Kg/mV] = \frac{\sigma_{@meas}}{\eta_{E2} \times 1{,}000[Kg/m^3] \times \gamma}$$

12.1.6. SAR calculation

$$SAR[W/Kg] = \zeta[W/Kg/mV] \times PO_{tot\_tissue}[mV]$$