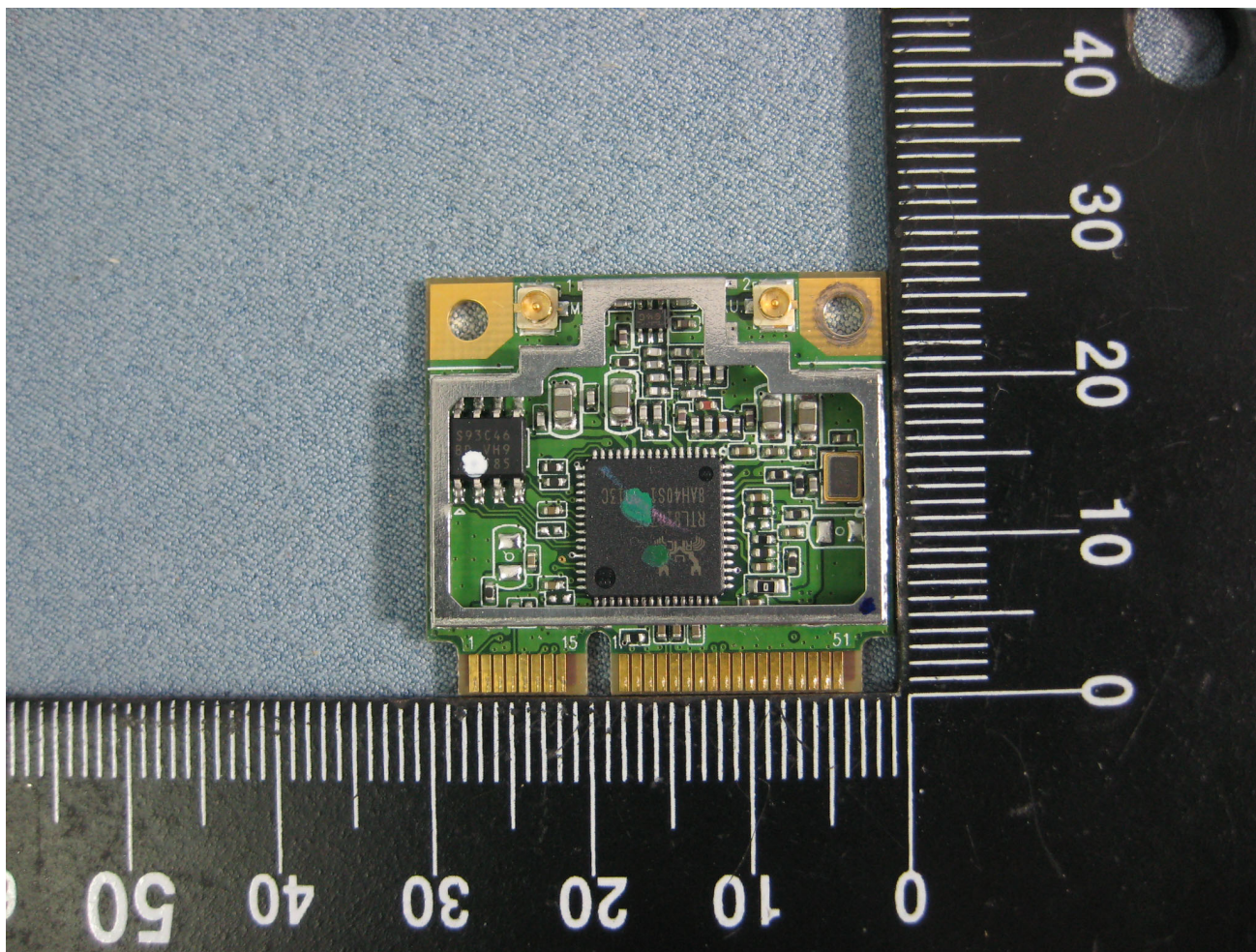


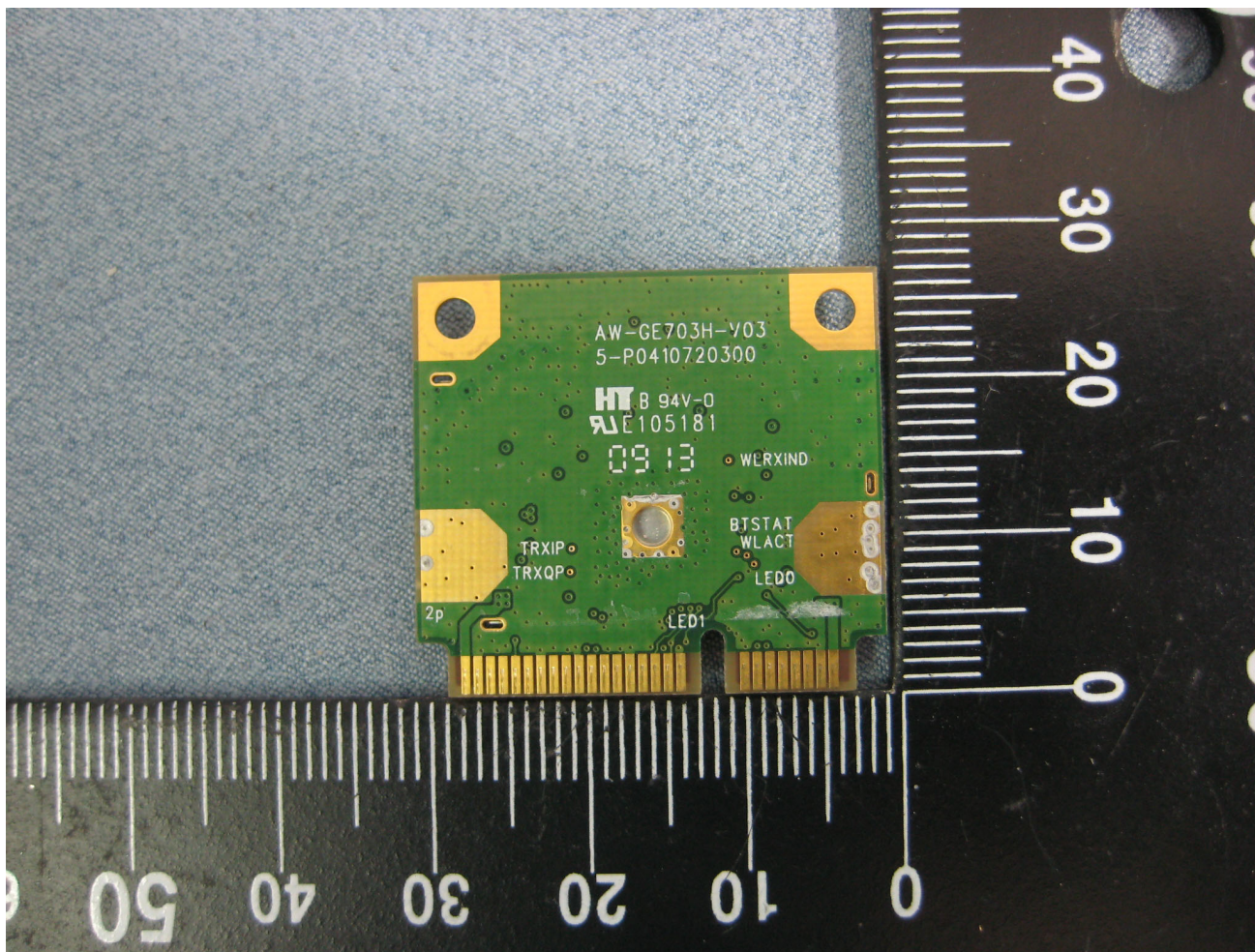
Report No : TSC-98-08-IN-03 (SAR)



Front View of WLAN2



Report No : TSC-98-08-IN-03 (SAR)



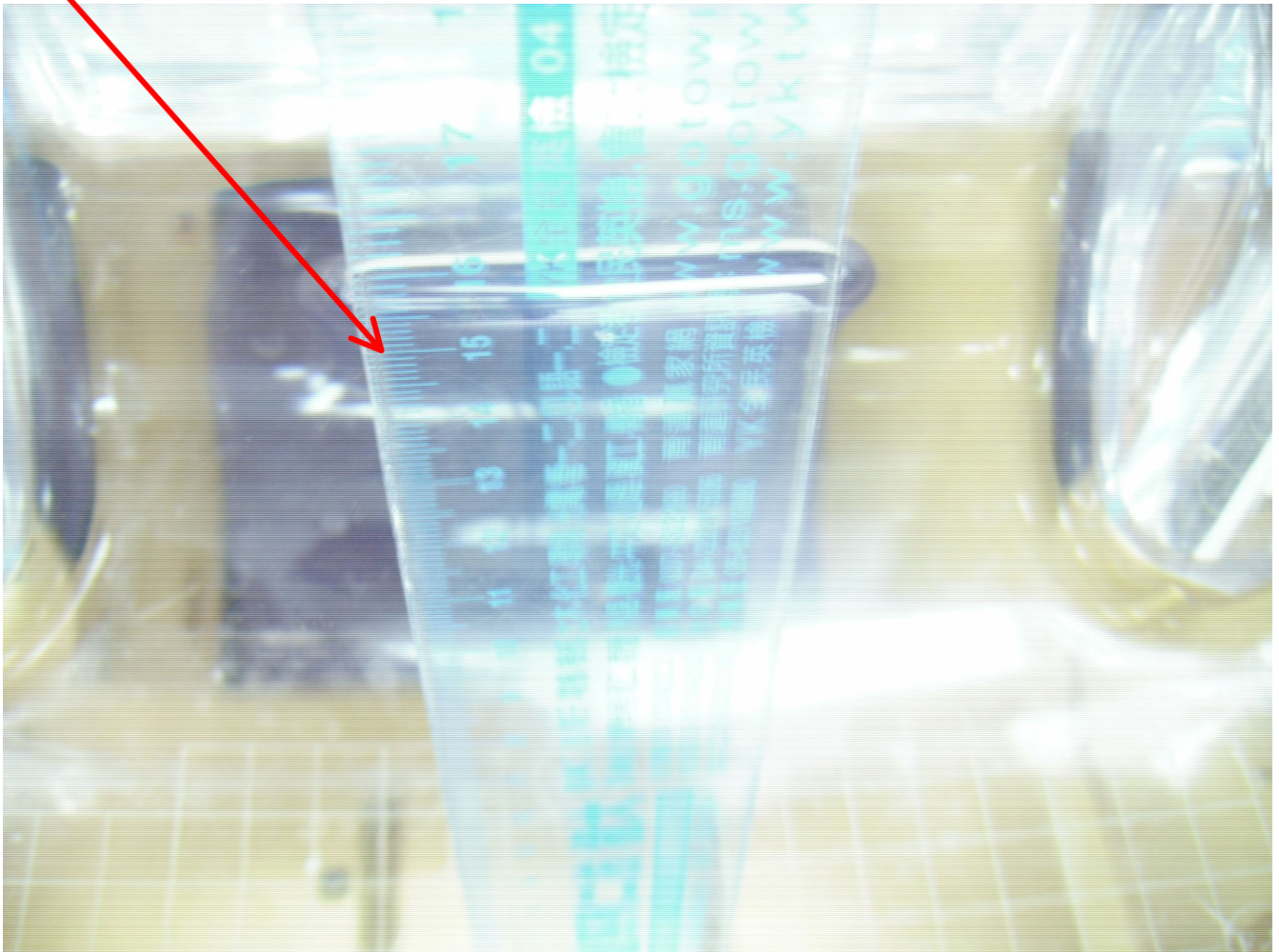
Rear View of WLAN2

Report No : TSC-98-08-IN-03 (SAR)

## A. TEST CONFIGURATIONS AND TEST DATA

### A.1 TEST CONFIGURATION

Liquid Level in Flat Phantom > 15cm





Report No : TSC-98-08-IN-03 (SAR)



802.11b/g Touch Position



**Chunghwa Telecom CO., Ltd**  
**Telecommunication Laboratories**  
**Testing & Certification Center**

TEL : +886 3 4244445  
FAX : +886 3 4202444  
ADDR. : 12, Lane 551, Min-Tsu Road Sec. 5  
Yang-Mei, Taoyuan, Taiwan , R.O.C.  
E-mail: [tsd@cht.com.tw](mailto:tsd@cht.com.tw)      <http://www.chttl.com.tw>

Report No : TSC-98-08-IN-03 (SAR)

### **A.3 TISSUE LIQUIDS Dielectric Parameter**

#### **A.3.1 2450 MHz TISSUE LIQUIDS Dielectric measurement data**

Tissue Data	
Epsilon	: 53.25 F/m
Sigma	: 1.93 S/m
Density	: 1000.00 kg/cu. m



Report No : TSC-98-08-IN-03 (SAR)

#### **A.4. TEST DATA**

##### **A.4.1 802.11b Mode**

##### **802.11b CH1 Touch Position**

### **SAR Test Report**

Report Date : 22-Sep-2009  
By Operator : 123  
Measurement Date : 22-Sep-2009  
Starting Time : 22-Sep-2009 12:13:20 PM  
End Time : 22-Sep-2009 12:28:55 PM  
Scanning Time : 935 secs

#### **Product Data**

Device Name : Luffy Plus  
Serial No. : S200i  
Type : Other  
Model : S200i  
Frequency : 2450.00 MHz  
Max. Transmit Pwr : 0.136 W  
Drift Time : 0 min(s)  
Length : 270 mm  
Width : 179 mm  
Depth : 34 mm  
Antenna Type : Internal  
Orientation : Touch  
Power Drift-Start : 0.441 W/kg  
Power Drift-Finish: 0.457 W/kg  
Power Drift (%) : 3.627  
Picture :

#### **Phantom Data**

Name : APREL-Uni  
Type : Uni-Phantom  
Size (mm) : 280 x 280 x 200  
Serial No. : User Define  
Location : Center  
Description : Uni\_Phantom

#### **Tissue Data**

Type : BODY  
Serial No. : 2450  
Frequency : 2450.00 MHz  
Last Calib. Date : 22-Sep-2009  
Temperature : 24.00 °C  
Ambient Temp. : 24.00 °C  
Humidity : 45.00 RH%  
Epsilon : 53.25 F/m  
Sigma : 1.93 S/m  
Density : 1000.00 kg/cu. m

#### **Probe Data**

Name : Probe 257 - CHTL  
Model : E020  
Type : E-Field Triangle  
Serial No. : 257



**Chunghwa Telecom CO., Ltd**  
**Telecommunication Laboratories**  
**Testing & Certification Center**

TEL : +886 3 4244445  
FAX : +886 3 4202444  
ADDR. : 12, Lane 551, Min-Tsu Road Sec. 5  
Yang-Mei, Taoyuan, Taiwan , R.O.C.  
E-mail: [tsd@cht.com.tw](mailto:tsd@cht.com.tw)      <http://www.chttl.com.tw>

**Report No : TSC-98-08-IN-03 (SAR)**

Last Calib. Date : 12-Dec-2008  
Frequency : 2450.00 MHz  
Duty Cycle Factor: 1  
Conversion Factor: 5  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V}/\text{m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56 mm

**Measurement Data**

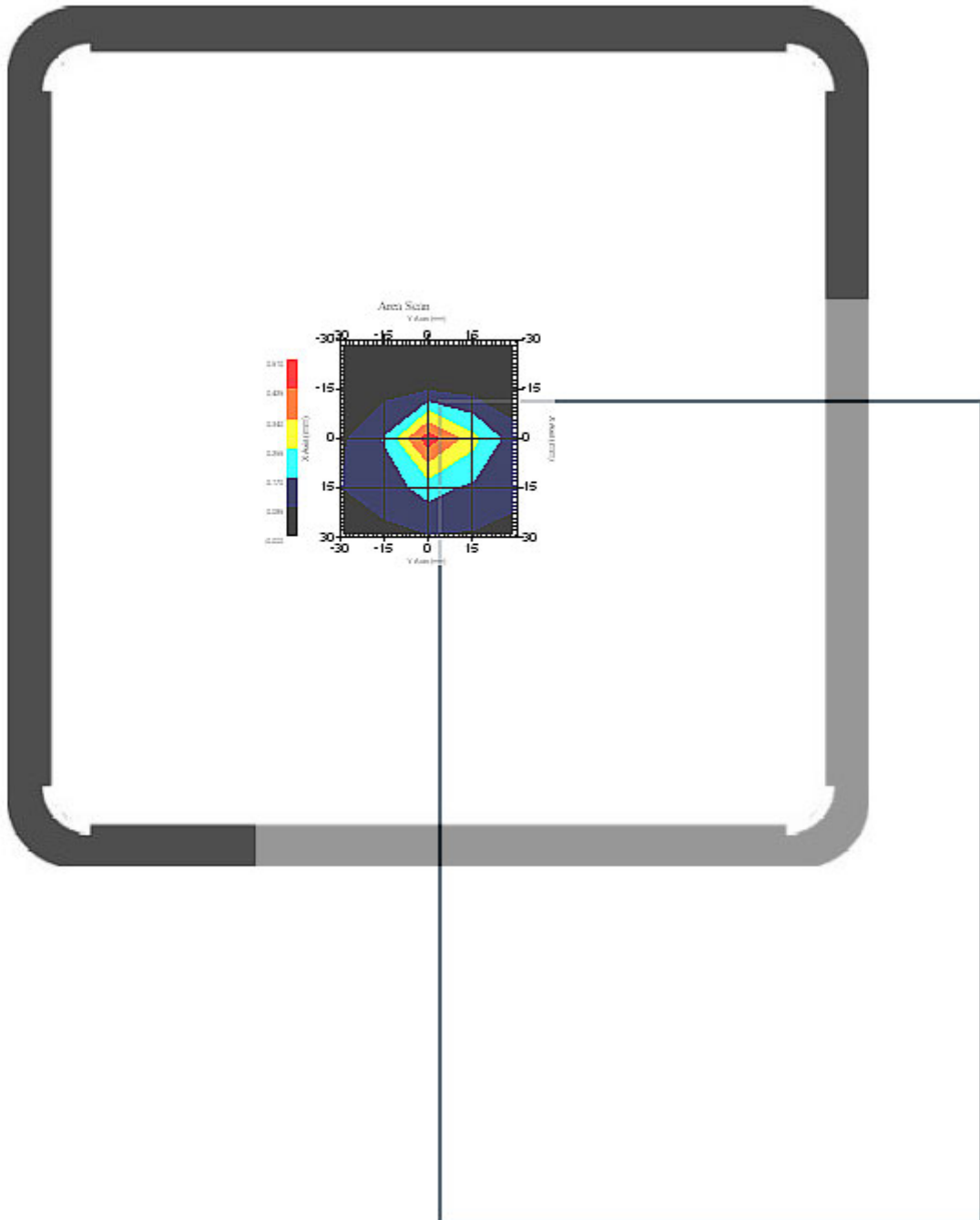
Crest Factor : 1  
Scan Type : Complete  
Tissue Temp. : 24.00 °C  
Ambient Temp. : 24.00 °C  
Set-up Date : 22-Sep-2009  
Set-up Time : 9:15:13 AM  
Area Scan : 5x5x1 : Measurement x=15mm, y=15mm, z=4mm  
Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

**Other Data**

DUT Position : Touch  
Separation : 0  
Channel : Low - 1 (802.11b)



Report No : TSC-98-08-IN-03 (SAR)



1 gram SAR value : 0.397 W/kg  
10 gram SAR value : 0.187 W/kg  
Area Scan Peak SAR : 0.470 W/kg  
Zoom Scan Peak SAR : 0.900 W/kg





Report No : TSC-98-08-IN-03 (SAR)

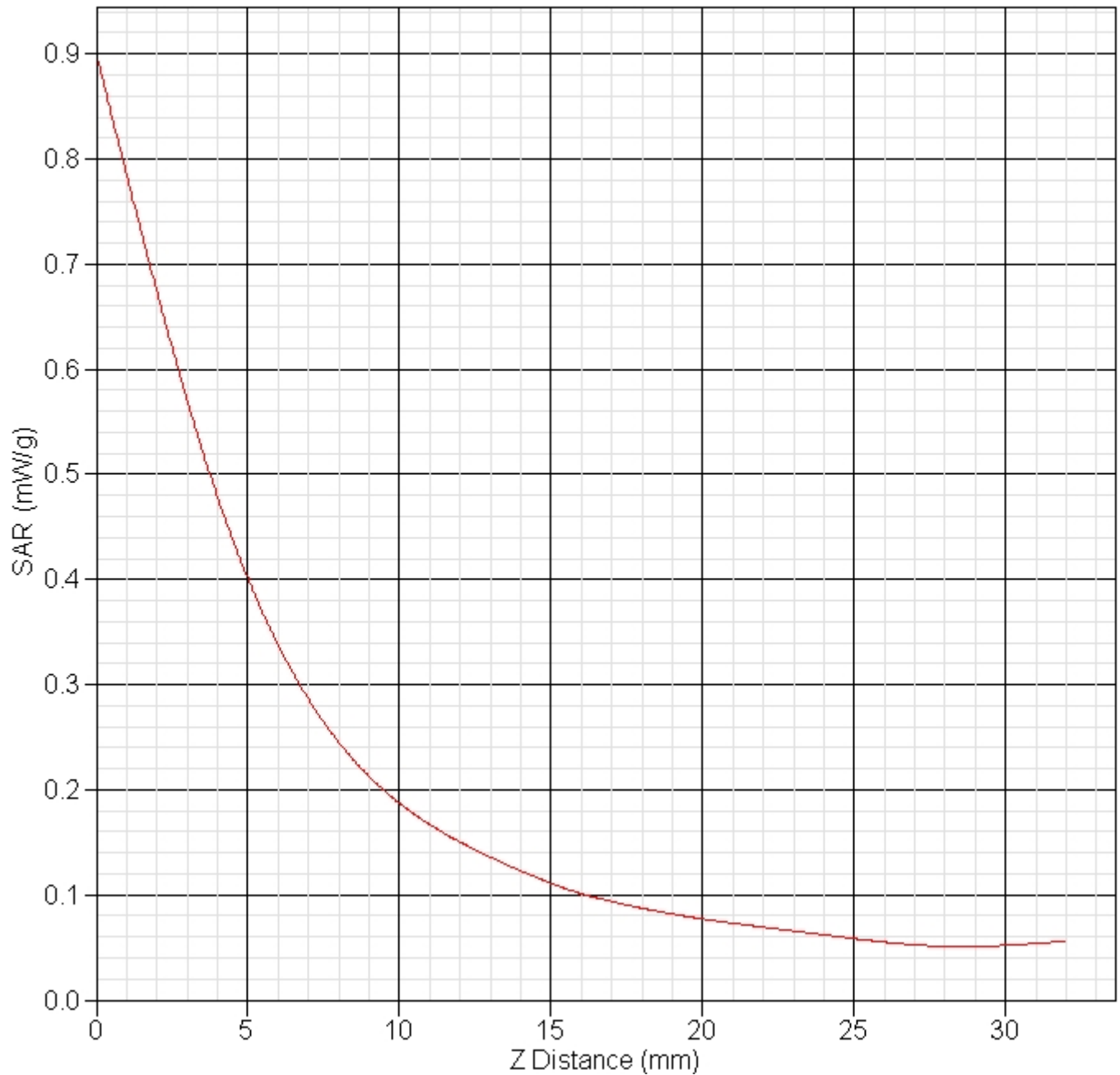
### Exposure Assessment Measurement Uncertainty

Source of Uncertainty	Tolerance Value	Probability Distribution	Divisor	$c_i^1$ (1-g)	$c_i^1$ (10-g)	Standard Uncertainty (1-g) %	Standard Uncertainty (10-g) %
Measurement System							
Probe Calibration	3.5	normal	1	1	1	3.5	3.5
Axial Isotropy	3.7	rectangular	$\sqrt{3}$	$(1-cp)^{1/2}$	$(1-cp)^{1/2}$	1.5	1.5
Hemispherical Isotropy	10.9	rectangular	$\sqrt{3}$	$\sqrt{cp}$	$\sqrt{cp}$	4.4	4.4
Boundary Effect	1.0	rectangular	$\sqrt{3}$	1	1	0.6	0.6
Linearity	4.7	rectangular	$\sqrt{3}$	1	1	2.7	2.7
Detection Limit	1.0	rectangular	$\sqrt{3}$	1	1	0.6	0.6
Readout Electronics	1.0	normal	1	1	1	1.0	1.0
Response Time	0.8	rectangular	$\sqrt{3}$	1	1	0.5	0.5
Integration Time	1.7	rectangular	$\sqrt{3}$	1	1	1.0	1.0
RF Ambient Condition	3.0	rectangular	$\sqrt{3}$	1	1	1.7	1.7
Probe Positioner Mech.	0.4	rectangular	$\sqrt{3}$	1	1	0.2	0.2
Restriction							
Probe Positioning with respect to Phantom Shell	2.9	rectangular	$\sqrt{3}$	1	1	1.7	1.7
Extrapolation and Integration	3.7	rectangular	$\sqrt{3}$	1	1	2.1	2.1
Test Sample Positioning	4.0	normal	1	1	1	4.0	4.0
Device Holder Uncertainty	2.0	normal	1	1	1	2.0	2.0
Drift of Output Power	3.6	rectangular	$\sqrt{3}$	1	1	2.1	2.1
Phantom and Setup							
Phantom Uncertainty(shape & thickness tolerance)	3.4	rectangular	$\sqrt{3}$	1	1	2.0	2.0
Liquid Conductivity(target)	5.0	rectangular	$\sqrt{3}$	0.7	0.5	2.0	1.4
Liquid Conductivity(meas.)	1.0	normal	1	0.7	0.5	0.7	0.5
Liquid Permittivity(target)	5.0	rectangular	$\sqrt{3}$	0.6	0.5	1.7	1.4
Liquid Permittivity(meas.)	1.0	normal	1	0.6	0.5	0.6	0.5
Combined Uncertainty		RSS				9.5	9.3
Combined Uncertainty (coverage factor=2)		Normal (k=2)				19.0	18.6



Report No : TSC-98-08-IN-03 (SAR)

**SAR-Z Axis**  
at Hotspot x:0.10 y:-0.30





**Chunghwa Telecom CO., Ltd**  
**Telecommunication Laboratories**  
**Testing & Certification Center**

TEL : +886 3 4244445  
FAX : +886 3 4202444  
ADDR. : 12, Lane 551, Min-Tsu Road Sec. 5  
Yang-Mei, Taoyuan, Taiwan, R.O.C.  
E-mail: [tsd@cht.com.tw](mailto:tsd@cht.com.tw) <http://www.chttl.com.tw>

Report No : TSC-98-08-IN-03 (SAR)

**802.11b CH6 Touch Position**

**SAR Test Report**

Report Date : 22-Sep-2009  
By Operator : 123  
Measurement Date : 22-Sep-2009  
Starting Time : 22-Sep-2009 01:08:05 PM  
End Time : 22-Sep-2009 01:23:55 PM  
Scanning Time : 950 secs

Product Data  
Device Name : Luffy Plus  
Serial No. : S200i  
Type : Other  
Model : S200i  
Frequency : 2450.00 MHz  
Max. Transmit Pwr : 0.136 W  
Drift Time : 0 min(s)  
Length : 270 mm  
Width : 179 mm  
Depth : 34 mm  
Antenna Type : Internal  
Orientation : Touch  
Power Drift-Start : 0.383 W/kg  
Power Drift-Finish: 0.400 W/kg  
Power Drift (%) : 4.430  
Picture :

Phantom Data  
Name : APREL-Uni  
Type : Uni-Phantom  
Size (mm) : 280 x 280 x 200  
Serial No. : User Define  
Location : Center  
Description : Uni\_Phantom

Tissue Data  
Type : BODY  
Serial No. : 2450  
Frequency : 2450.00 MHz  
Last Calib. Date : 22-Sep-2009  
Temperature : 24.00 °C  
Ambient Temp. : 24.00 °C  
Humidity : 45.00 RH%  
Epsilon : 53.25 F/m  
Sigma : 1.93 S/m  
Density : 1000.00 kg/cu. m

Probe Data  
Name : Probe 257 - CHTL  
Model : E020  
Type : E-Field Triangle  
Serial No. : 257  
Last Calib. Date : 12-Dec-2008  
Frequency : 2450.00 MHz  
Duty Cycle Factor: 1  
Conversion Factor: 5  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V}/\text{m})^2$   
Compression Point: 95.00 mV





**Chunghwa Telecom CO., Ltd**  
**Telecommunication Laboratories**  
**Testing & Certification Center**

TEL : +886 3 4244445  
FAX : +886 3 4202444  
ADDR. : 12, Lane 551, Min-Tsu Road Sec. 5  
Yang-Mei, Taoyuan, Taiwan , R.O.C.  
E-mail: [tsd@cht.com.tw](mailto:tsd@cht.com.tw)      <http://www.chttl.com.tw>

**Report No : TSC-98-08-IN-03 (SAR)**

Offset : 1.56 mm

**Measurement Data**

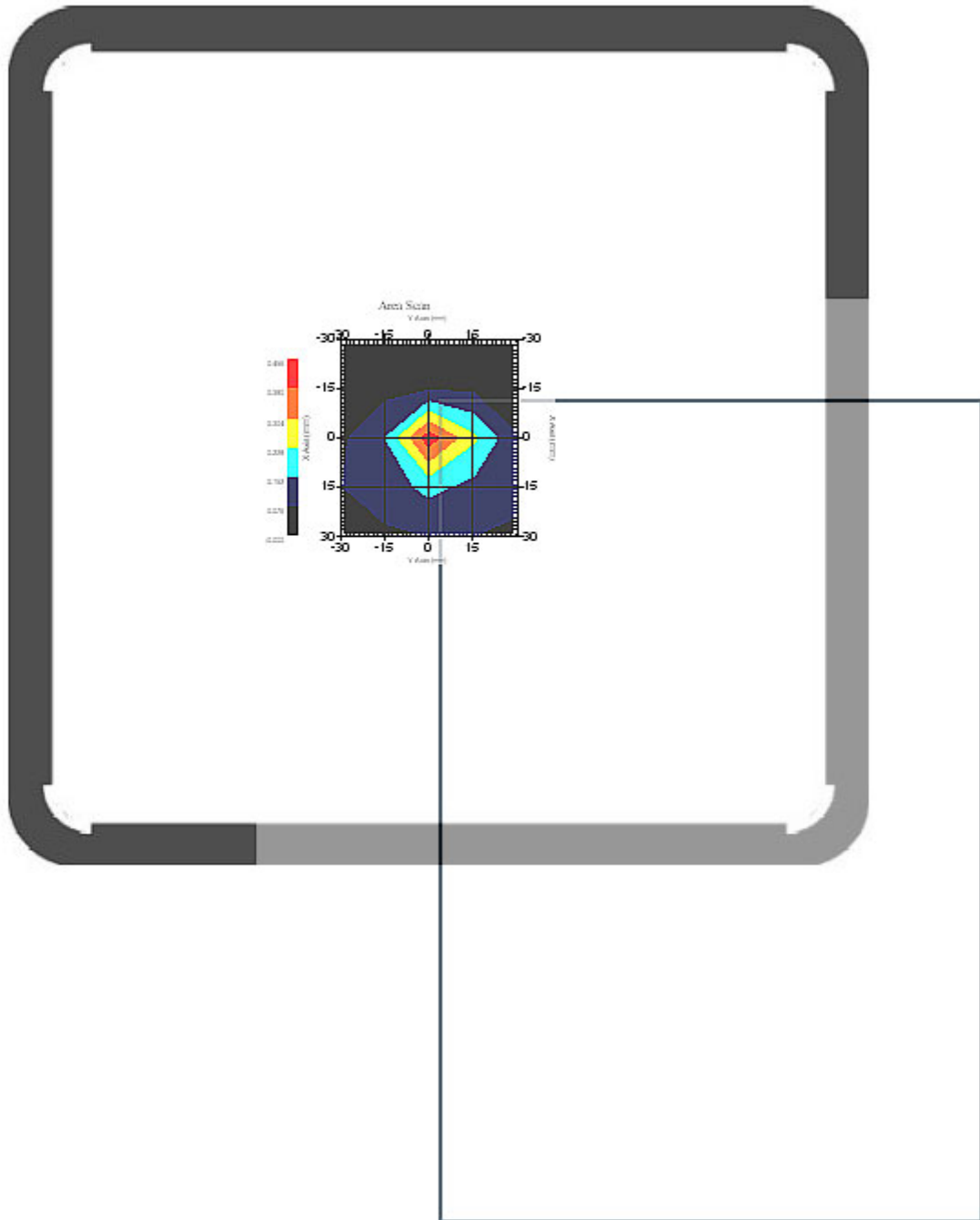
Crest Factor : 1  
Scan Type : Complete  
Tissue Temp. : 24.00 °C  
Ambient Temp. : 24.00 °C  
Set-up Date : 22-Sep-2009  
Set-up Time : 9:15:13 AM  
Area Scan : 5x5x1 : Measurement x=15mm, y=15mm, z=4mm  
Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

**Other Data**

DUT Position : Touch  
Separation : 0  
Channel : Mid - 6 (802.11b)



Report No : TSC-98-08-IN-03 (SAR)



1 gram SAR value : 0.359 W/kg  
10 gram SAR value : 0.171 W/kg  
Area Scan Peak SAR : 0.423 W/kg  
Zoom Scan Peak SAR : 0.780 W/kg



Report No : TSC-98-08-IN-03 (SAR)

## Exposure Assessment Measurement Uncertainty

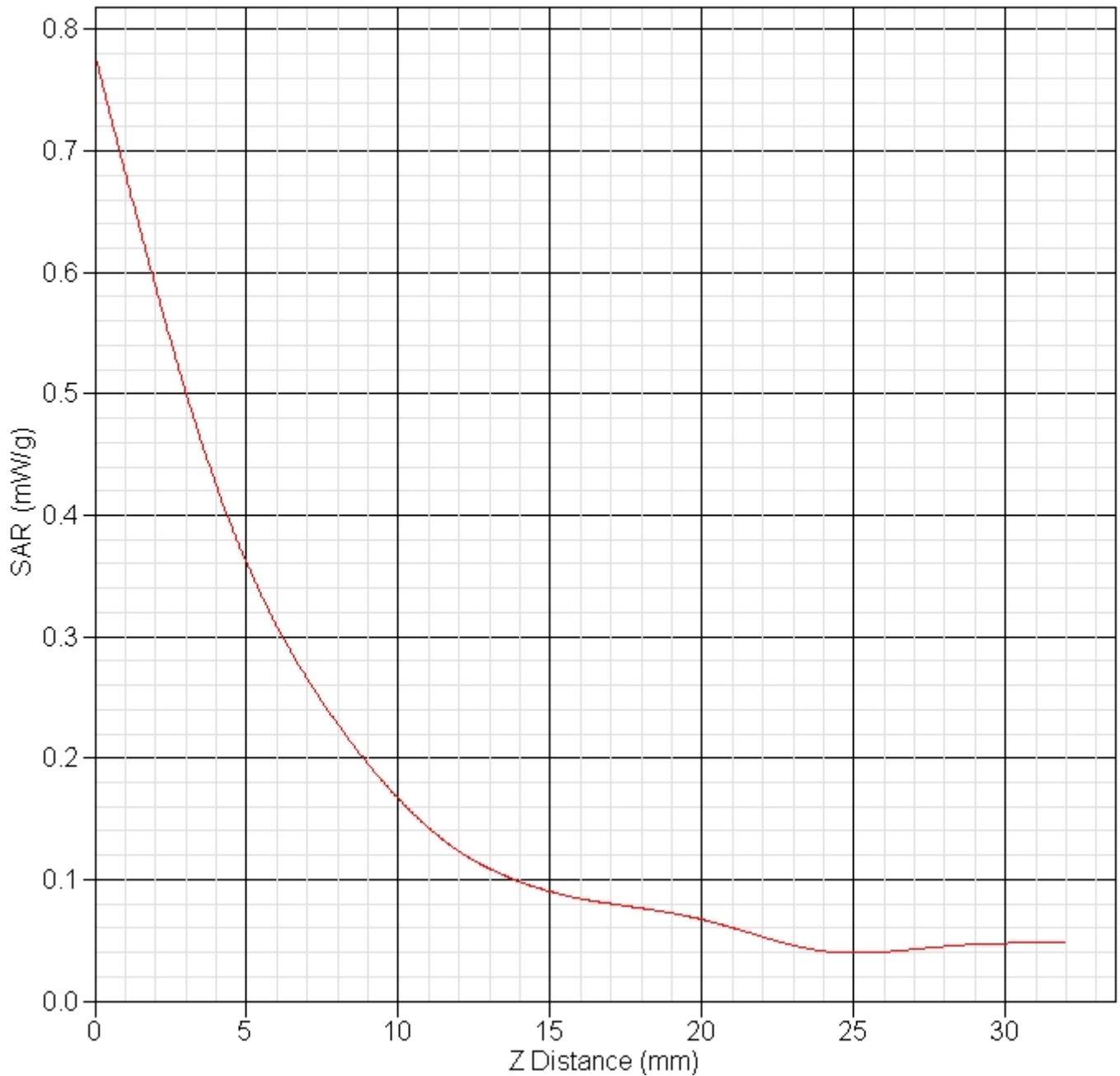
Source of Uncertainty	Tolerance Value	Probability Distribution	Divisor	$c_i^1$ (1-g)	$c_i^1$ (10-g)	Standard Uncertainty (1-g) %	Standard Uncertainty (10-g) %
Measurement System							
Probe Calibration	3.5	normal	1	1	1	3.5	3.5
Axial Isotropy	3.7	rectangular	$\sqrt{3}$	$(1-cp)^{1/2}$	$(1-cp)^{1/2}$	1.5	1.5
Hemispherical Isotropy	10.9	rectangular	$\sqrt{3}$	$\sqrt{cp}$	$\sqrt{cp}$	4.4	4.4
Boundary Effect	1.0	rectangular	$\sqrt{3}$	1	1	0.6	0.6
Linearity	4.7	rectangular	$\sqrt{3}$	1	1	2.7	2.7
Detection Limit	1.0	rectangular	$\sqrt{3}$	1	1	0.6	0.6
Readout Electronics	1.0	normal	1	1	1	1.0	1.0
Response Time	0.8	rectangular	$\sqrt{3}$	1	1	0.5	0.5
Integration Time	1.7	rectangular	$\sqrt{3}$	1	1	1.0	1.0
RF Ambient Condition	3.0	rectangular	$\sqrt{3}$	1	1	1.7	1.7
Probe Positioner Mech.	0.4	rectangular	$\sqrt{3}$	1	1	0.2	0.2
Restriction							
Probe Positioning with respect to Phantom Shell	2.9	rectangular	$\sqrt{3}$	1	1	1.7	1.7
Extrapolation and Integration	3.7	rectangular	$\sqrt{3}$	1	1	2.1	2.1
Test Sample Positioning	4.0	normal	1	1	1	4.0	4.0
Device Holder Uncertainty	2.0	normal	1	1	1	2.0	2.0
Drift of Output Power	4.4	rectangular	$\sqrt{3}$	1	1	2.5	2.5
Phantom and Setup							
Phantom Uncertainty(shape & thickness tolerance)	3.4	rectangular	$\sqrt{3}$	1	1	2.0	2.0
Liquid Conductivity(target)	5.0	rectangular	$\sqrt{3}$	0.7	0.5	2.0	1.4
Liquid Conductivity(meas.)	1.0	normal	1	0.7	0.5	0.7	0.5
Liquid Permittivity(target)	5.0	rectangular	$\sqrt{3}$	0.6	0.5	1.7	1.4
Liquid Permittivity(meas.)	1.0	normal	1	0.6	0.5	0.6	0.5
Combined Uncertainty		RSS				9.6	9.4
Combined Uncertainty (coverage factor=2)		Normal (k=2)				19.2	18.8





Report No : TSC-98-08-IN-03 (SAR)

**SAR-Z Axis**  
at Hotspot x:0.20 y:-0.30





**Chunghwa Telecom CO., Ltd**  
**Telecommunication Laboratories**  
**Testing & Certification Center**

TEL : +886 3 4244445  
 FAX : +886 3 4202444  
 ADDR. : 12, Lane 551, Min-Tsu Road Sec. 5  
 Yang-Mei, Taoyuan, Taiwan , R.O.C.  
 E-mail: [tsd@cht.com.tw](mailto:tsd@cht.com.tw)      <http://www.chttl.com.tw>

Report No : TSC-98-08-IN-03 (SAR)

**802.11b CH11 Touch Position**

**SAR Test Report**

Report Date : 22-Sep-2009  
 By Operator : 123  
 Measurement Date : 22-Sep-2009  
 Starting Time : 22-Sep-2009 01:27:33 PM  
 End Time : 22-Sep-2009 01:43:32 PM  
 Scanning Time : 959 secs

Product Data  
 Device Name : Luffy Plus  
 Serial No. : S200i  
 Type : Other  
 Model : S200i  
 Frequency : 2450.00 MHz  
 Max. Transmit Pwr : 0.136 W  
 Drift Time : 0 min(s)  
 Length : 270 mm  
 Width : 179 mm  
 Depth : 34 mm  
 Antenna Type : Internal  
 Orientation : Touch  
 Power Drift-Start : 0.363 W/kg  
 Power Drift-Finish: 0.379 W/kg  
 Power Drift (%) : 4.542  
 Picture :

Phantom Data  
 Name : APREL-Uni  
 Type : Uni-Phantom  
 Size (mm) : 280 x 280 x 200  
 Serial No. : User Define  
 Location : Center  
 Description : Uni\_Phantom

Tissue Data  
 Type : BODY  
 Serial No. : 2450  
 Frequency : 2450.00 MHz  
 Last Calib. Date : 22-Sep-2009  
 Temperature : 24.00 °C  
 Ambient Temp. : 24.00 °C  
 Humidity : 45.00 RH%  
 Epsilon : 53.25 F/m  
 Sigma : 1.93 S/m  
 Density : 1000.00 kg/cu. m

Probe Data  
 Name : Probe 257 - CHTL  
 Model : E020  
 Type : E-Field Triangle  
 Serial No. : 257  
 Last Calib. Date : 12-Dec-2008  
 Frequency : 2450.00 MHz  
 Duty Cycle Factor: 1  
 Conversion Factor: 5  
 Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V/m})^2$   
 Compression Point: 95.00 mV  
 Offset : 1.56 mm



**Chunghwa Telecom CO., Ltd**  
**Telecommunication Laboratories**  
**Testing & Certification Center**

TEL : +886 3 4244445  
FAX : +886 3 4202444  
ADDR. : 12, Lane 551, Min-Tsu Road Sec. 5  
Yang-Mei, Taoyuan, Taiwan , R.O.C.  
E-mail: [tsd@cht.com.tw](mailto:tsd@cht.com.tw)      <http://www.chttl.com.tw>

Report No : TSC-98-08-IN-03 (SAR)

Measurement Data

Crest Factor : 1  
Scan Type : Complete  
Tissue Temp. : 24.00 °C  
Ambient Temp. : 24.00 °C  
Set-up Date : 22-Sep-2009  
Set-up Time : 9:15:13 AM  
Area Scan : 5x5x1 : Measurement x=15mm, y=15mm, z=4mm  
Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

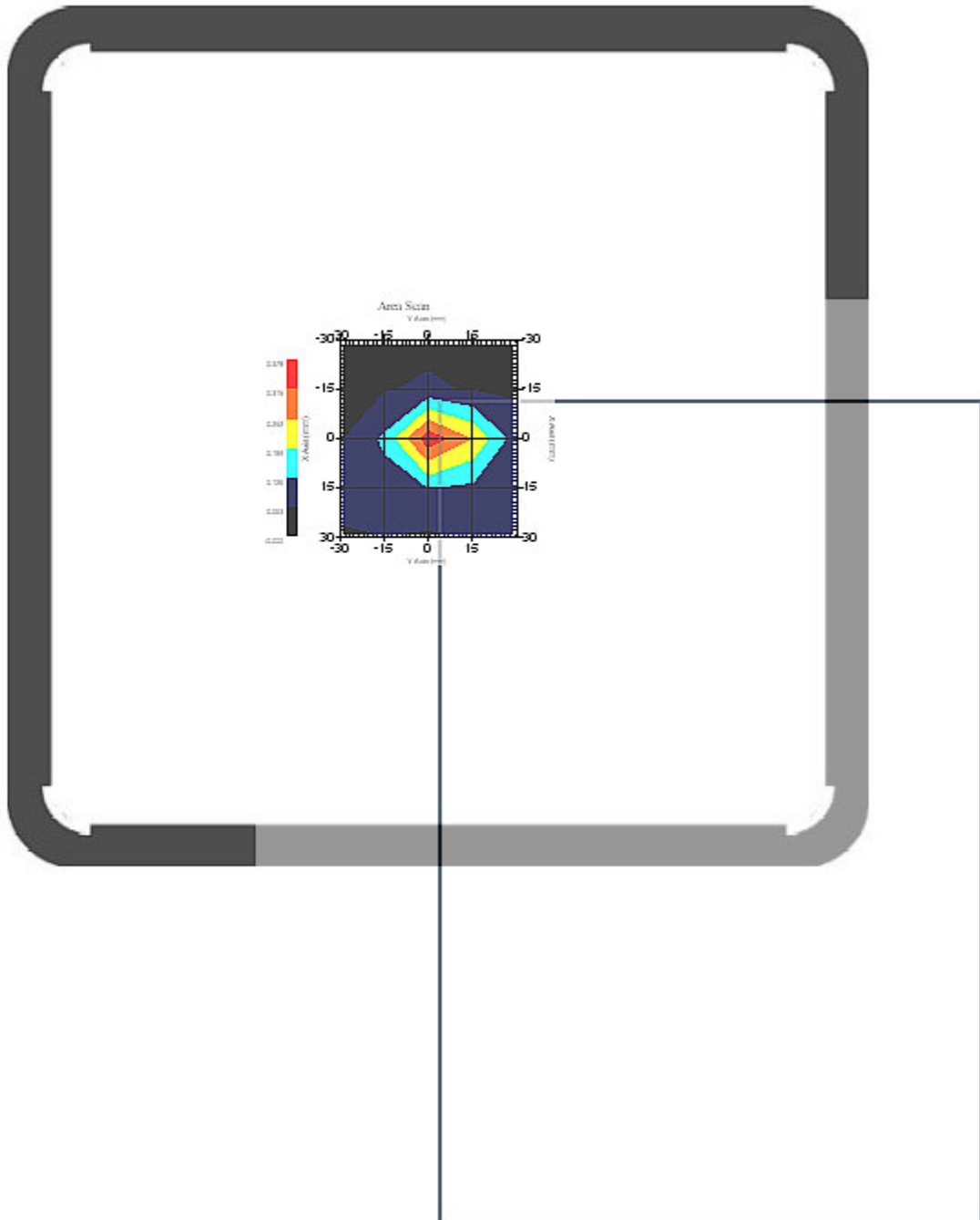
Other Data

DUT Position : Touch  
Separation : 0  
Channel : High - 11 (802.11b)





Report No : TSC-98-08-IN-03 (SAR)



1 gram SAR value : 0.272 W/kg  
10 gram SAR value : 0.135 W/kg  
Area Scan Peak SAR : 0.358 W/kg  
Zoom Scan Peak SAR : 0.650 W/kg



Report No : TSC-98-08-IN-03 (SAR)

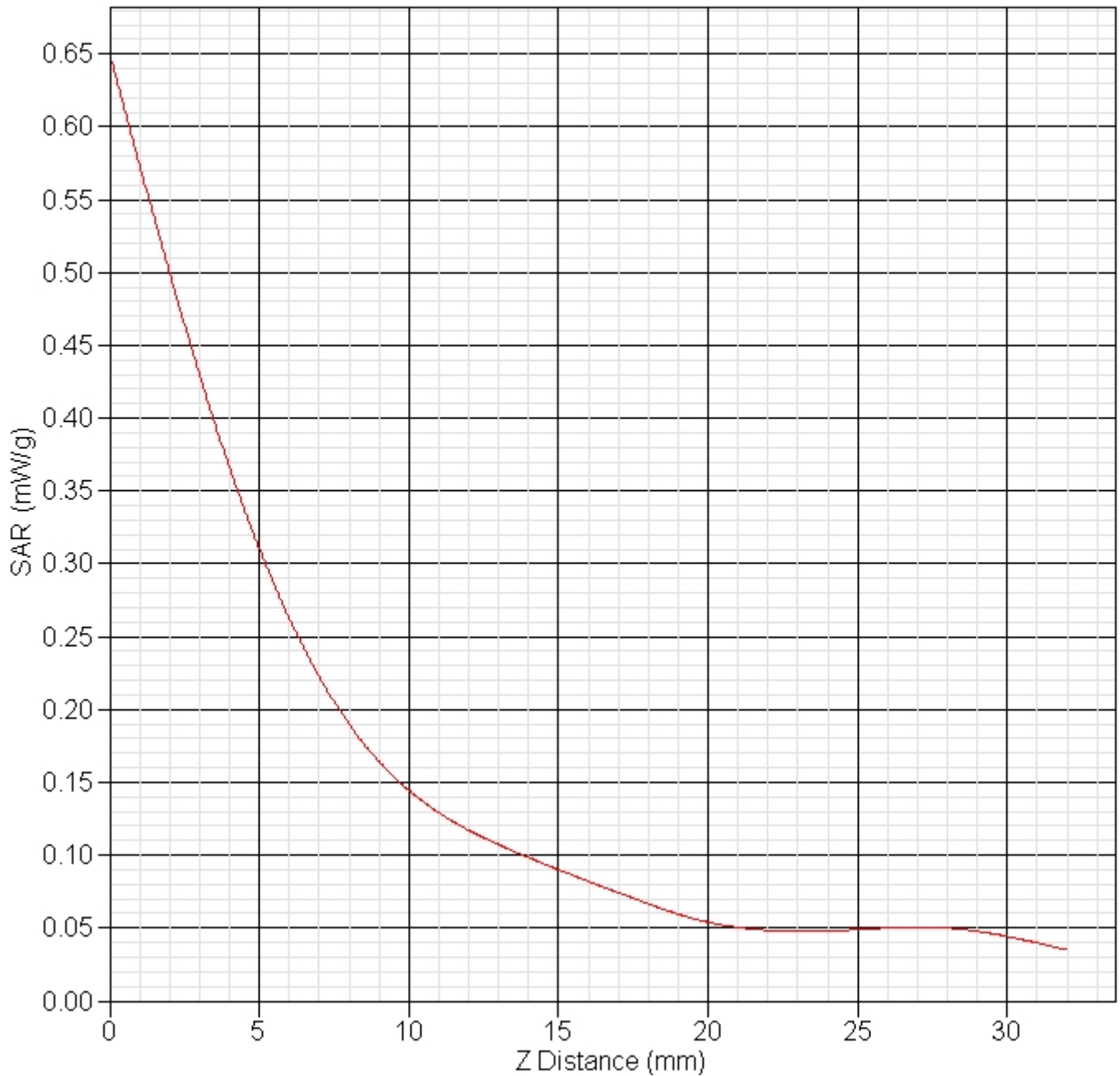
### Exposure Assessment Measurement Uncertainty

Source of Uncertainty	Tolerance Value	Probability Distribution	Divisor	$c_i^{-1}$ (1-g)	$c_i^{-1}$ (10-g)	Standard Uncertainty (1-g) %	Standard Uncertainty (10-g) %
Measurement System							
Probe Calibration	3.5	normal	1	1	1	3.5	3.5
Axial Isotropy	3.7	rectangular	$\sqrt{3}$	$(1-cp)^{1/2}$	$(1-cp)^{1/2}$	1.5	1.5
Hemispherical Isotropy	10.9	rectangular	$\sqrt{3}$	$\sqrt{cp}$	$\sqrt{cp}$	4.4	4.4
Boundary Effect	1.0	rectangular	$\sqrt{3}$	1	1	0.6	0.6
Linearity	4.7	rectangular	$\sqrt{3}$	1	1	2.7	2.7
Detection Limit	1.0	rectangular	$\sqrt{3}$	1	1	0.6	0.6
Readout Electronics	1.0	normal	1	1	1	1.0	1.0
Response Time	0.8	rectangular	$\sqrt{3}$	1	1	0.5	0.5
Integration Time	1.7	rectangular	$\sqrt{3}$	1	1	1.0	1.0
RF Ambient Condition	3.0	rectangular	$\sqrt{3}$	1	1	1.7	1.7
Probe Positioner Mech.	0.4	rectangular	$\sqrt{3}$	1	1	0.2	0.2
Restriction							
Probe Positioning with respect to Phantom Shell	2.9	rectangular	$\sqrt{3}$	1	1	1.7	1.7
Extrapolation and Integration	3.7	rectangular	$\sqrt{3}$	1	1	2.1	2.1
Test Sample Positioning	4.0	normal	1	1	1	4.0	4.0
Device Holder Uncertainty	2.0	normal	1	1	1	2.0	2.0
Drift of Output Power	4.5	rectangular	$\sqrt{3}$	1	1	2.6	2.6
Phantom and Setup							
Phantom Uncertainty(shape & thickness tolerance)	3.4	rectangular	$\sqrt{3}$	1	1	2.0	2.0
Liquid Conductivity(target)	5.0	rectangular	$\sqrt{3}$	0.7	0.5	2.0	1.4
Liquid Conductivity(meas.)	1.0	normal	1	0.7	0.5	0.7	0.5
Liquid Permittivity(target)	5.0	rectangular	$\sqrt{3}$	0.6	0.5	1.7	1.4
Liquid Permittivity(meas.)	1.0	normal	1	0.6	0.5	0.6	0.5
Combined Uncertainty		RSS				9.6	9.5
Combined Uncertainty (coverage factor=2)		Normal (k=2)				19.3	18.9



Report No : TSC-98-08-IN-03 (SAR)

**SAR-Z Axis**  
at Hotspot x:0.20 y:-0.40





**Chunghwa Telecom CO., Ltd**  
**Telecommunication Laboratories**  
**Testing & Certification Center**

TEL : +886 3 4244445  
FAX : +886 3 4202444  
ADDR. : 12, Lane 551, Min-Tsu Road Sec. 5  
Yang-Mei, Taoyuan, Taiwan , R.O.C.  
E-mail: [tsd@cht.com.tw](mailto:tsd@cht.com.tw) <http://www.chttl.com.tw>

Report No : TSC-98-08-IN-03 (SAR)

#### A.4.2 802.11g Mode

#### 802.11g CH1 Touch Position

### SAR Test Report

Report Date : 22-Sep-2009  
By Operator : 123  
Measurement Date : 22-Sep-2009  
Starting Time : 22-Sep-2009 02:32:05 PM  
End Time : 22-Sep-2009 02:47:40 PM  
Scanning Time : 935 secs

Product Data  
Device Name : Luffy Plus  
Serial No. : S200i  
Type : Other  
Model : S200i  
Frequency : 2450.00 MHz  
Max. Transmit Pwr : 0.136 W  
Drift Time : 0 min(s)  
Length : 270 mm  
Width : 179 mm  
Depth : 34 mm  
Antenna Type : Internal  
Orientation : Touch  
Power Drift-Start : 0.370 W/kg  
Power Drift-Finish: 0.370 W/kg  
Power Drift (%) : -0.004  
Picture :

Phantom Data  
Name : APREL-Uni  
Type : Uni-Phantom  
Size (mm) : 280 x 280 x 200  
Serial No. : User Define  
Location : Center  
Description : Uni\_Phantom

Tissue Data  
Type : BODY  
Serial No. : 2450  
Frequency : 2450.00 MHz  
Last Calib. Date : 22-Sep-2009  
Temperature : 24.00 °C  
Ambient Temp. : 24.00 °C  
Humidity : 45.00 RH%  
Epsilon : 53.25 F/m  
Sigma : 1.93 S/m  
Density : 1000.00 kg/cu. m

Probe Data  
Name : Probe 257 - CHTL  
Model : E020  
Type : E-Field Triangle  
Serial No. : 257  
Last Calib. Date : 12-Dec-2008  
Frequency : 2450.00 MHz  
Duty Cycle Factor: 1





**Chunghwa Telecom CO., Ltd**  
**Telecommunication Laboratories**  
**Testing & Certification Center**

TEL : +886 3 4244445  
FAX : +886 3 4202444  
ADDR. : 12, Lane 551, Min-Tsu Road Sec. 5  
Yang-Mei, Taoyuan, Taiwan , R.O.C.  
E-mail: [tsd@cht.com.tw](mailto:tsd@cht.com.tw)      <http://www.chttl.com.tw>

**Report No : TSC-98-08-IN-03 (SAR)**

Conversion Factor: 5  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V}/\text{m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56 mm

**Measurement Data**

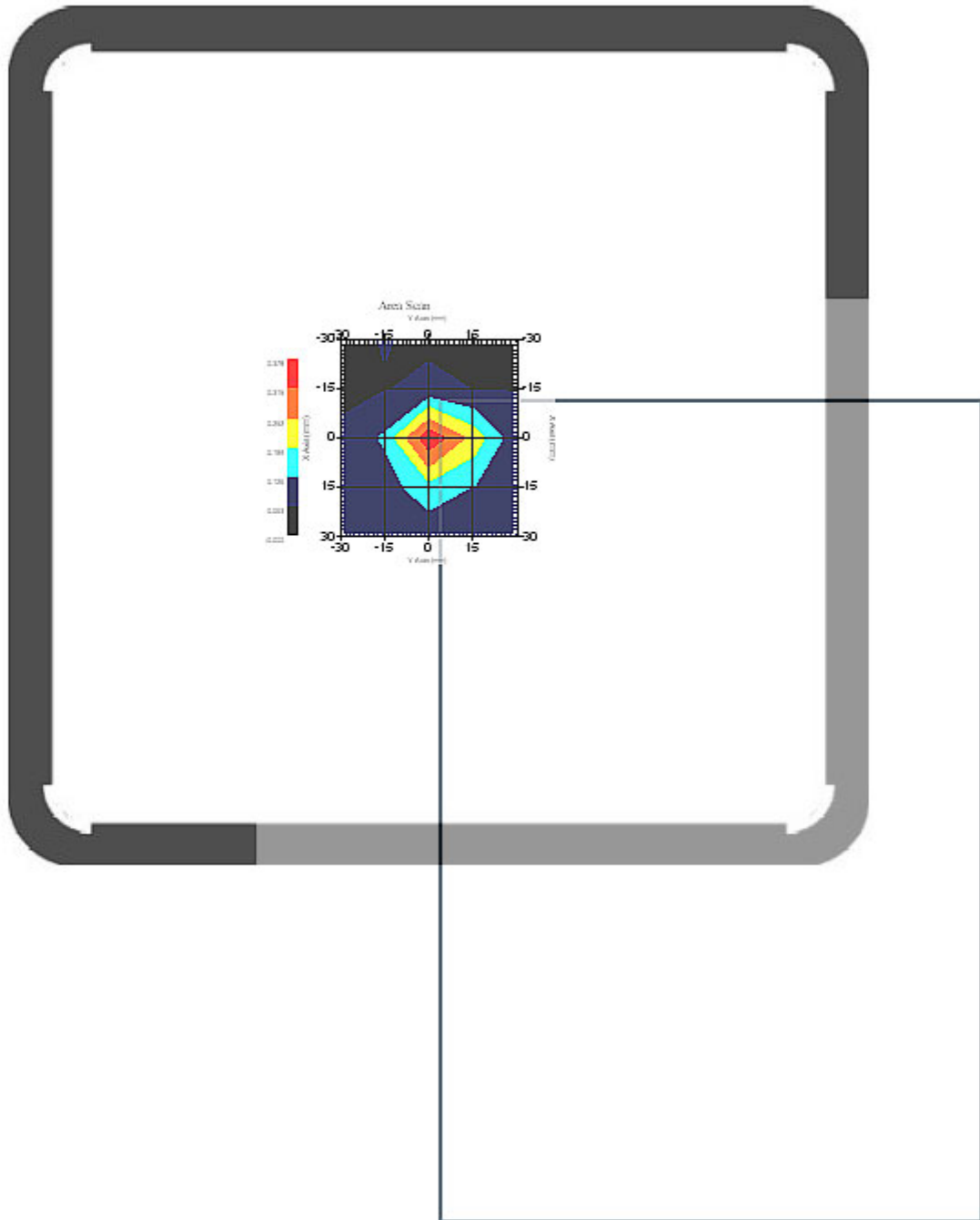
Crest Factor : 1  
Scan Type : Complete  
Tissue Temp. : 24.00 °C  
Ambient Temp. : 24.00 °C  
Set-up Date : 22-Sep-2009  
Set-up Time : 9:15:13 AM  
Area Scan : 5x5x1 : Measurement x=15mm, y=15mm, z=4mm  
Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

**Other Data**

DUT Position : Touch  
Separation : 0  
Channel : Low - 1 (802.11g)



Report No : TSC-98-08-IN-03 (SAR)



1 gram SAR value : 0.312 W/kg  
10 gram SAR value : 0.152 W/kg  
Area Scan Peak SAR : 0.365 W/kg  
Zoom Scan Peak SAR : 0.680 W/kg



Report No : TSC-98-08-IN-03 (SAR)

## Exposure Assessment Measurement Uncertainty

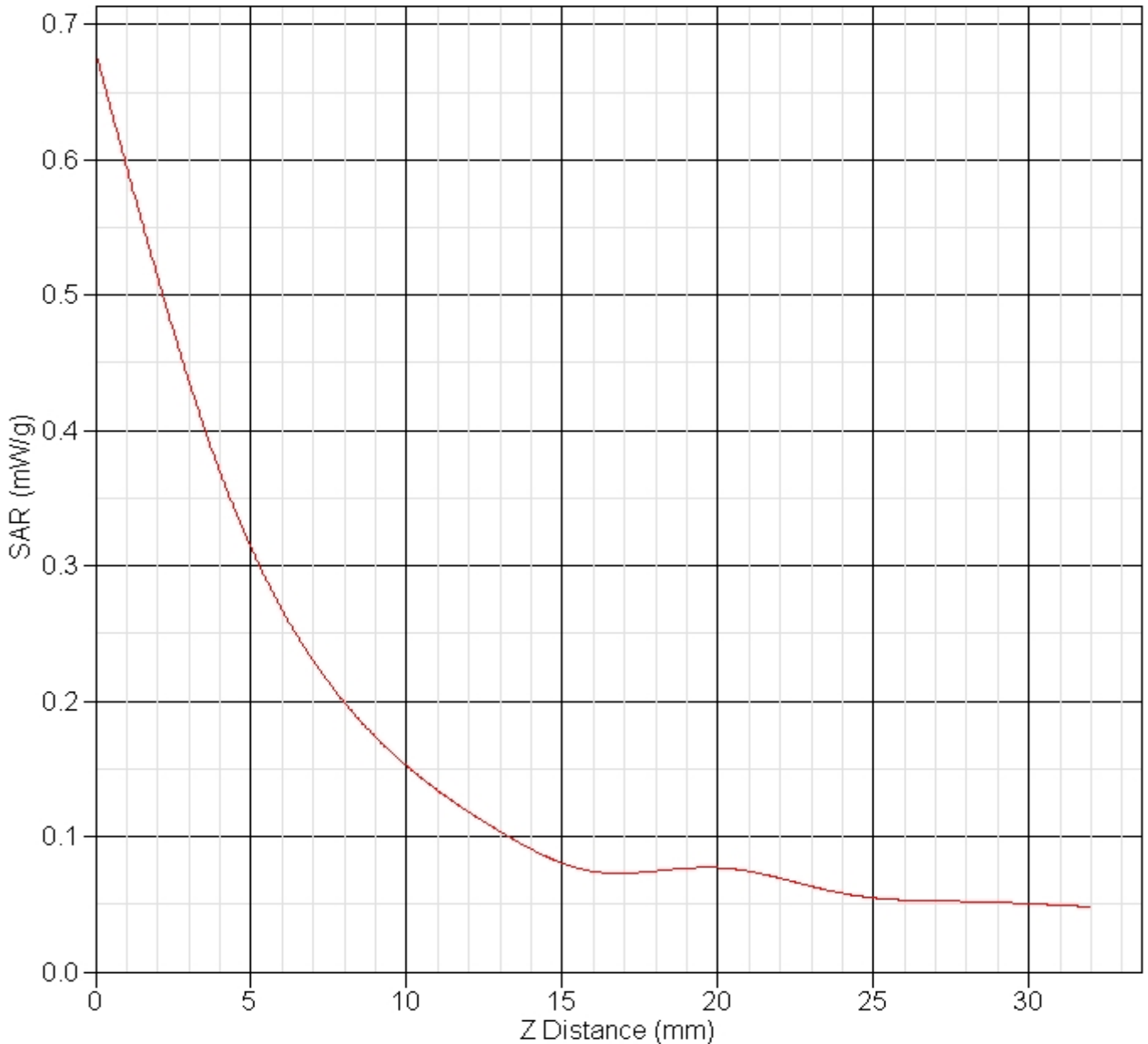
Source of Uncertainty	Tolerance Value	Probability Distribution	Divisor	$c_i^1$ (1-g)	$c_i^1$ (10-g)	Standard Uncertainty (1-g) %	Standard Uncertainty (10-g) %
Measurement System							
Probe Calibration	3.5	normal	1	1	1	3.5	3.5
Axial Isotropy	3.7	rectangular	$\sqrt{3}$	$(1-cp)^{1/2}$	$(1-cp)^{1/2}$	1.5	1.5
Hemispherical Isotropy	10.9	rectangular	$\sqrt{3}$	$\sqrt{cp}$	$\sqrt{cp}$	4.4	4.4
Boundary Effect	1.0	rectangular	$\sqrt{3}$	1	1	0.6	0.6
Linearity	4.7	rectangular	$\sqrt{3}$	1	1	2.7	2.7
Detection Limit	1.0	rectangular	$\sqrt{3}$	1	1	0.6	0.6
Readout Electronics	1.0	normal	1	1	1	1.0	1.0
Response Time	0.8	rectangular	$\sqrt{3}$	1	1	0.5	0.5
Integration Time	1.7	rectangular	$\sqrt{3}$	1	1	1.0	1.0
RF Ambient Condition	3.0	rectangular	$\sqrt{3}$	1	1	1.7	1.7
Probe Positioner Mech.	0.4	rectangular	$\sqrt{3}$	1	1	0.2	0.2
Restriction							
Probe Positioning with respect to Phantom Shell	2.9	rectangular	$\sqrt{3}$	1	1	1.7	1.7
Extrapolation and Integration	3.7	rectangular	$\sqrt{3}$	1	1	2.1	2.1
Test Sample Positioning	4.0	normal	1	1	1	4.0	4.0
Device Holder Uncertainty	2.0	normal	1	1	1	2.0	2.0
Drift of Output Power	0.0	rectangular	$\sqrt{3}$	1	1	0.0	0.0
Phantom and Setup							
Phantom Uncertainty(shape & thickness tolerance)	3.4	rectangular	$\sqrt{3}$	1	1	2.0	2.0
Liquid Conductivity(target)	5.0	rectangular	$\sqrt{3}$	0.7	0.5	2.0	1.4
Liquid Conductivity(measured)	1.0	normal	1	0.7	0.5	0.7	0.5
Liquid Permittivity(target)	5.0	rectangular	$\sqrt{3}$	0.6	0.5	1.7	1.4
Liquid Permittivity(measured)	1.0	normal	1	0.6	0.5	0.6	0.5
Combined Uncertainty		RSS				9.3	9.1
Combined Uncertainty		Normal (k=2)				18.6	18.2



Report No : TSC-98-08-IN-03 (SAR)

(coverage factor=2)							
------------------------	--	--	--	--	--	--	--

**SAR-Z Axis**  
at Hotspot x:0.20 y:-0.40





**Chunghwa Telecom CO., Ltd**  
**Telecommunication Laboratories**  
**Testing & Certification Center**

TEL : +886 3 4244445  
FAX : +886 3 4202444  
ADDR. : 12, Lane 551, Min-Tsu Road Sec. 5  
Yang-Mei, Taoyuan, Taiwan, R.O.C.  
E-mail: [tsd@cht.com.tw](mailto:tsd@cht.com.tw) <http://www.chttl.com.tw>

Report No : TSC-98-08-IN-03 (SAR)

**802.11g CH6 Touch Position**

**SAR Test Report**

Report Date : 22-Sep-2009  
By Operator : 123  
Measurement Date : 22-Sep-2009  
Starting Time : 22-Sep-2009 02:14:12 PM  
End Time : 22-Sep-2009 02:29:59 PM  
Scanning Time : 947 secs

Product Data  
Device Name : Luffy Plus  
Serial No. : S200i  
Type : Other  
Model : S200i  
Frequency : 2450.00 MHz  
Max. Transmit Pwr : 0.136 W  
Drift Time : 0 min(s)  
Length : 270 mm  
Width : 179 mm  
Depth : 34 mm  
Antenna Type : Internal  
Orientation : Touch  
Power Drift-Start : 0.317 W/kg  
Power Drift-Finish: 0.329 W/kg  
Power Drift (%) : 3.768  
Picture :

Phantom Data  
Name : APREL-Uni  
Type : Uni-Phantom  
Size (mm) : 280 x 280 x 200  
Serial No. : User Define  
Location : Center  
Description : Uni\_Phantom

Tissue Data  
Type : BODY  
Serial No. : 2450  
Frequency : 2450.00 MHz  
Last Calib. Date : 22-Sep-2009  
Temperature : 24.00 °C  
Ambient Temp. : 24.00 °C  
Humidity : 45.00 RH%  
Epsilon : 53.25 F/m  
Sigma : 1.93 S/m  
Density : 1000.00 kg/cu. m

Probe Data  
Name : Probe 257 - CHTL  
Model : E020  
Type : E-Field Triangle  
Serial No. : 257  
Last Calib. Date : 12-Dec-2008  
Frequency : 2450.00 MHz  
Duty Cycle Factor: 1  
Conversion Factor: 5  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V}/\text{m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56 mm

Measurement Data



**Chunghwa Telecom CO., Ltd**  
**Telecommunication Laboratories**  
**Testing & Certification Center**

TEL : +886 3 4244445  
FAX : +886 3 4202444  
ADDR. : 12, Lane 551, Min-Tsu Road Sec. 5  
Yang-Mei, Taoyuan, Taiwan , R.O.C.  
E-mail: [tsd@cht.com.tw](mailto:tsd@cht.com.tw)      <http://www.chttl.com.tw>

**Report No : TSC-98-08-IN-03 (SAR)**

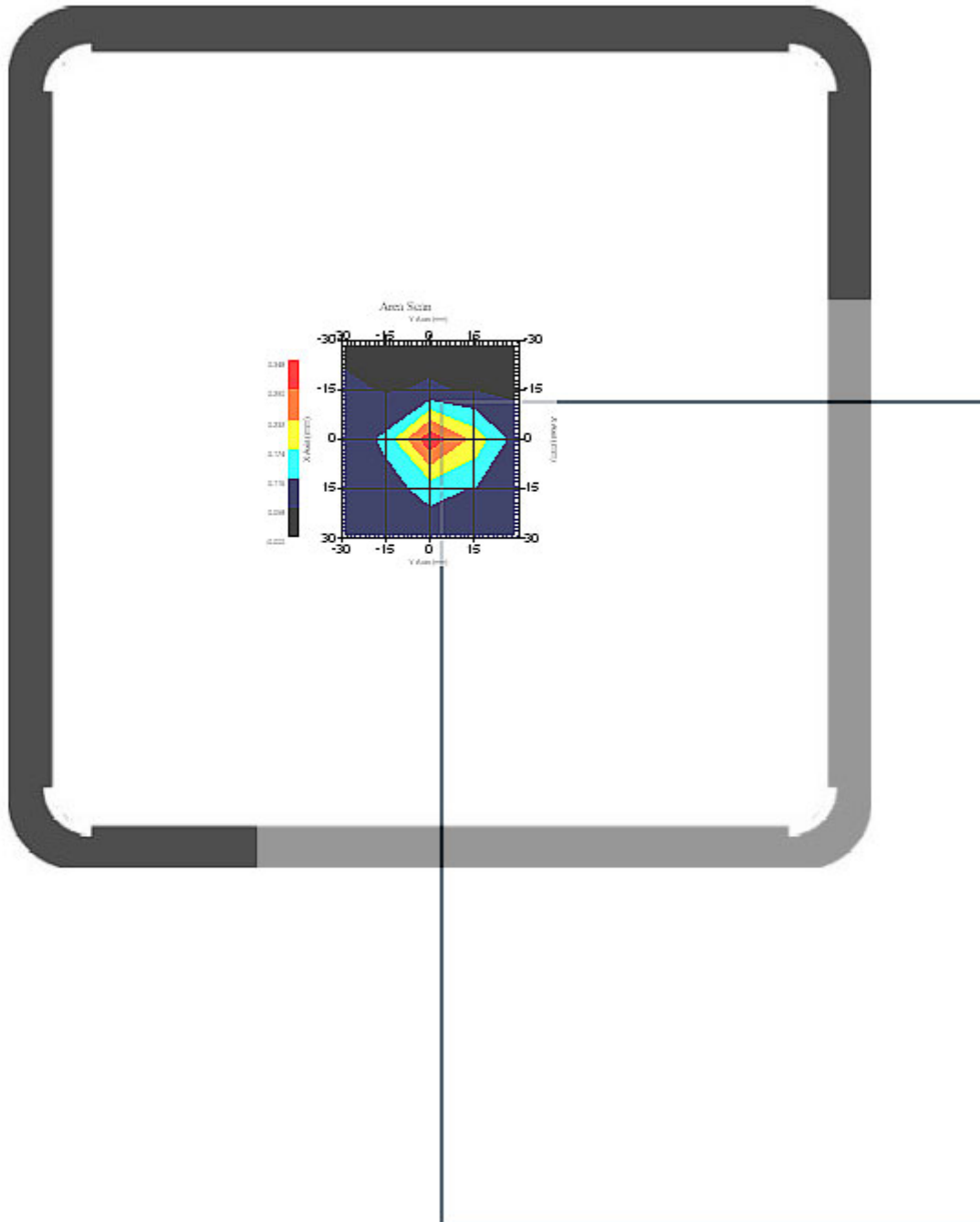
Crest Factor : 1  
Scan Type : Complete  
Tissue Temp. : 24.00 °C  
Ambient Temp. : 24.00 °C  
Set-up Date : 22-Sep-2009  
Set-up Time : 9:15:13 AM  
Area Scan : 5x5x1 : Measurement x=15mm, y=15mm, z=4mm  
Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

Other Data  
DUT Position : Touch  
Separation : 0  
Channel : Mid - 6 (802.11g)





Report No : TSC-98-08-IN-03 (SAR)



1 gram SAR value : 0.240 W/kg  
10 gram SAR value : 0.124 W/kg  
Area Scan Peak SAR : 0.330 W/kg  
Zoom Scan Peak SAR : 0.560 W/kg

Report No : TSC-98-08-IN-03 (SAR)

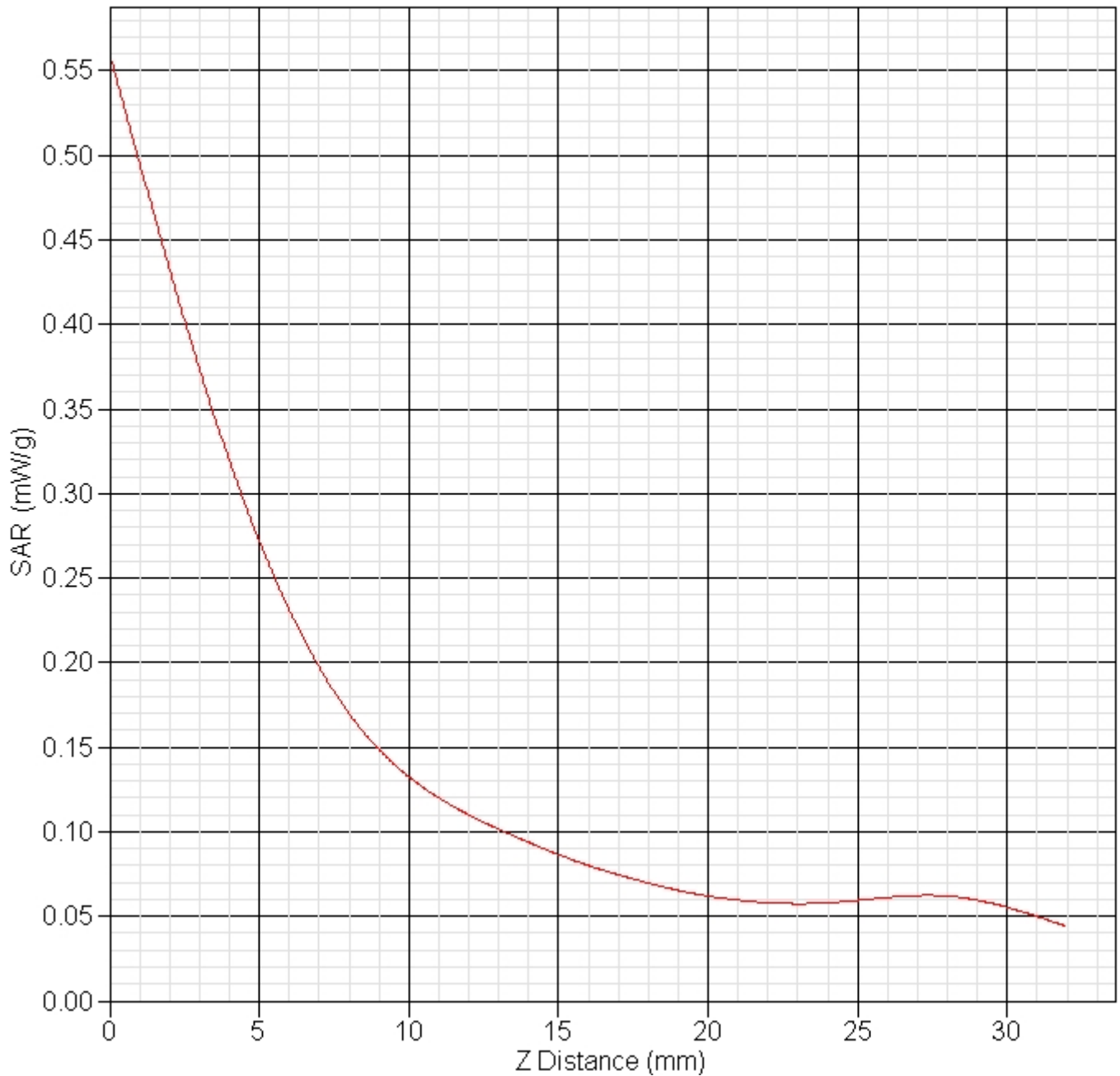
## Exposure Assessment Measurement Uncertainty

Source of Uncertainty	Tolerance Value	Probability Distribution	Divisor	$c_i^1$ (1-g)	$c_i^1$ (10-g)	Standard Uncertainty (1-g) %	Standard Uncertainty (10-g) %
Measurement System							
Probe Calibration	3.5	normal	1	1	1	3.5	3.5
Axial Isotropy	3.7	rectangular	$\sqrt{3}$	$(1-cp)^{1/2}$	$(1-cp)^{1/2}$	1.5	1.5
Hemispherical Isotropy	10.9	rectangular	$\sqrt{3}$	$\sqrt{cp}$	$\sqrt{cp}$	4.4	4.4
Boundary Effect	1.0	rectangular	$\sqrt{3}$	1	1	0.6	0.6
Linearity	4.7	rectangular	$\sqrt{3}$	1	1	2.7	2.7
Detection Limit	1.0	rectangular	$\sqrt{3}$	1	1	0.6	0.6
Readout Electronics	1.0	normal	1	1	1	1.0	1.0
Response Time	0.8	rectangular	$\sqrt{3}$	1	1	0.5	0.5
Integration Time	1.7	rectangular	$\sqrt{3}$	1	1	1.0	1.0
RF Ambient Condition	3.0	rectangular	$\sqrt{3}$	1	1	1.7	1.7
Probe Positioner Mech.	0.4	rectangular	$\sqrt{3}$	1	1	0.2	0.2
Restriction							
Probe Positioning with respect to Phantom Shell	2.9	rectangular	$\sqrt{3}$	1	1	1.7	1.7
Extrapolation and Integration	3.7	rectangular	$\sqrt{3}$	1	1	2.1	2.1
Test Sample Positioning	4.0	normal	1	1	1	4.0	4.0
Device Holder Uncertainty	2.0	normal	1	1	1	2.0	2.0
Drift of Output Power	3.8	rectangular	$\sqrt{3}$	1	1	2.2	2.2
Phantom and Setup							
Phantom Uncertainty(shape & thickness tolerance)	3.4	rectangular	$\sqrt{3}$	1	1	2.0	2.0
Liquid Conductivity(target)	5.0	rectangular	$\sqrt{3}$	0.7	0.5	2.0	1.4
Liquid Conductivity(meas.)	1.0	normal	1	0.7	0.5	0.7	0.5
Liquid Permittivity(target)	5.0	rectangular	$\sqrt{3}$	0.6	0.5	1.7	1.4
Liquid Permittivity(meas.)	1.0	normal	1	0.6	0.5	0.6	0.5
Combined Uncertainty		RSS				9.5	9.4
Combined Uncertainty (coverage factor=2)		Normal (k=2)				19.1	18.7



Report No : TSC-98-08-IN-03 (SAR)

**SAR-Z Axis**  
at Hotspot x:0.20 y:-0.30





**Chunghwa Telecom CO., Ltd**  
**Telecommunication Laboratories**  
**Testing & Certification Center**

TEL : +886 3 4244445  
 FAX : +886 3 4202444  
 ADDR. : 12, Lane 551, Min-Tsu Road Sec. 5  
 Yang-Mei, Taoyuan, Taiwan , R.O.C.  
 E-mail: [tsd@cht.com.tw](mailto:tsd@cht.com.tw)      <http://www.chttl.com.tw>

Report No : TSC-98-08-IN-03 (SAR)

**802.11g CH11 Touch Position**

**SAR Test Report**

Report Date : 22-Sep-2009  
 By Operator : 123  
 Measurement Date : 22-Sep-2009  
 Starting Time : 22-Sep-2009 01:56:11 PM  
 End Time : 22-Sep-2009 02:11:54 PM  
 Scanning Time : 943 secs

Product Data  
 Device Name : Luffy Plus  
 Serial No. : S200i  
 Type : Other  
 Model : S200i  
 Frequency : 2450.00 MHz  
 Max. Transmit Pwr : 0.136 W  
 Drift Time : 0 min(s)  
 Length : 270 mm  
 Width : 179 mm  
 Depth : 34 mm  
 Antenna Type : Internal  
 Orientation : Touch  
 Power Drift-Start : 0.277 W/kg  
 Power Drift-Finish: 0.282 W/kg  
 Power Drift (%) : 1.740  
 Picture :

Phantom Data  
 Name : APREL-Uni  
 Type : Uni-Phantom  
 Size (mm) : 280 x 280 x 200  
 Serial No. : User Define  
 Location : Center  
 Description : Uni\_Phantom

Tissue Data  
 Type : BODY  
 Serial No. : 2450  
 Frequency : 2450.00 MHz  
 Last Calib. Date : 22-Sep-2009  
 Temperature : 24.00 °C  
 Ambient Temp. : 24.00 °C  
 Humidity : 45.00 RH%  
 Epsilon : 53.25 F/m  
 Sigma : 1.93 S/m  
 Density : 1000.00 kg/cu. m

Probe Data  
 Name : Probe 257 - CHTL  
 Model : E020  
 Type : E-Field Triangle  
 Serial No. : 257  
 Last Calib. Date : 12-Dec-2008  
 Frequency : 2450.00 MHz  
 Duty Cycle Factor: 1  
 Conversion Factor: 5  
 Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V/m})^2$   
 Compression Point: 95.00 mV  
 Offset : 1.56 mm



**Chunghwa Telecom CO., Ltd**  
**Telecommunication Laboratories**  
**Testing & Certification Center**

TEL : +886 3 4244445  
FAX : +886 3 4202444  
ADDR. : 12, Lane 551, Min-Tsu Road Sec. 5  
Yang-Mei, Taoyuan, Taiwan , R.O.C.  
E-mail: [tsd@cht.com.tw](mailto:tsd@cht.com.tw)      <http://www.chttl.com.tw>

Report No : TSC-98-08-IN-03 (SAR)

Measurement Data

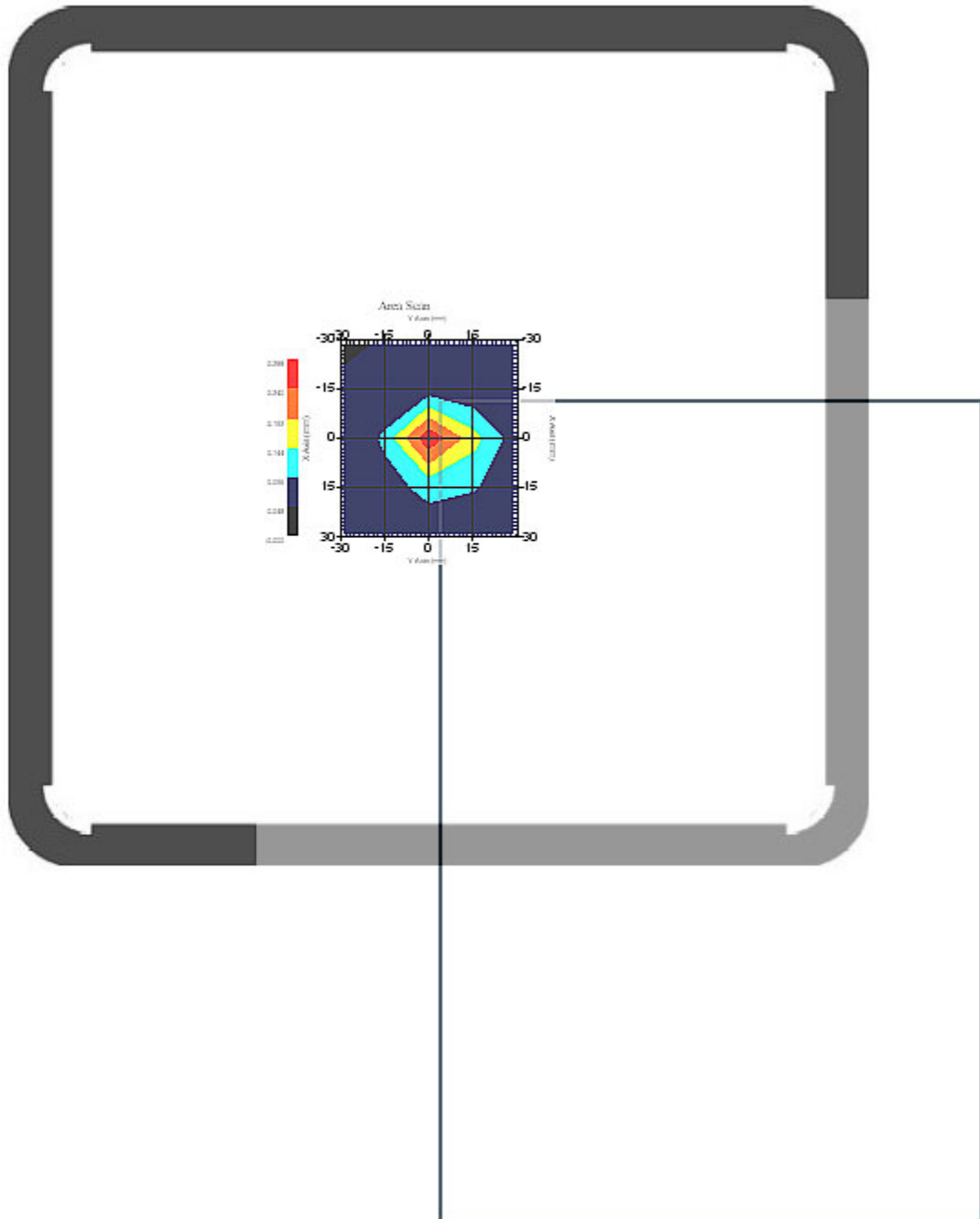
Crest Factor : 1  
Scan Type : Complete  
Tissue Temp. : 24.00 °C  
Ambient Temp. : 24.00 °C  
Set-up Date : 22-Sep-2009  
Set-up Time : 9:15:13 AM  
Area Scan : 5x5x1 : Measurement x=15mm, y=15mm, z=4mm  
Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

Other Data

DUT Position : Touch  
Separation : 0  
Channel : High - 11 (802.11g)



Report No : TSC-98-08-IN-03 (SAR)



1 gram SAR value : 0.225 W/kg  
10 gram SAR value : 0.117 W/kg  
Area Scan Peak SAR : 0.281 W/kg  
Zoom Scan Peak SAR : 0.480 W/kg





Report No : TSC-98-08-IN-03 (SAR)

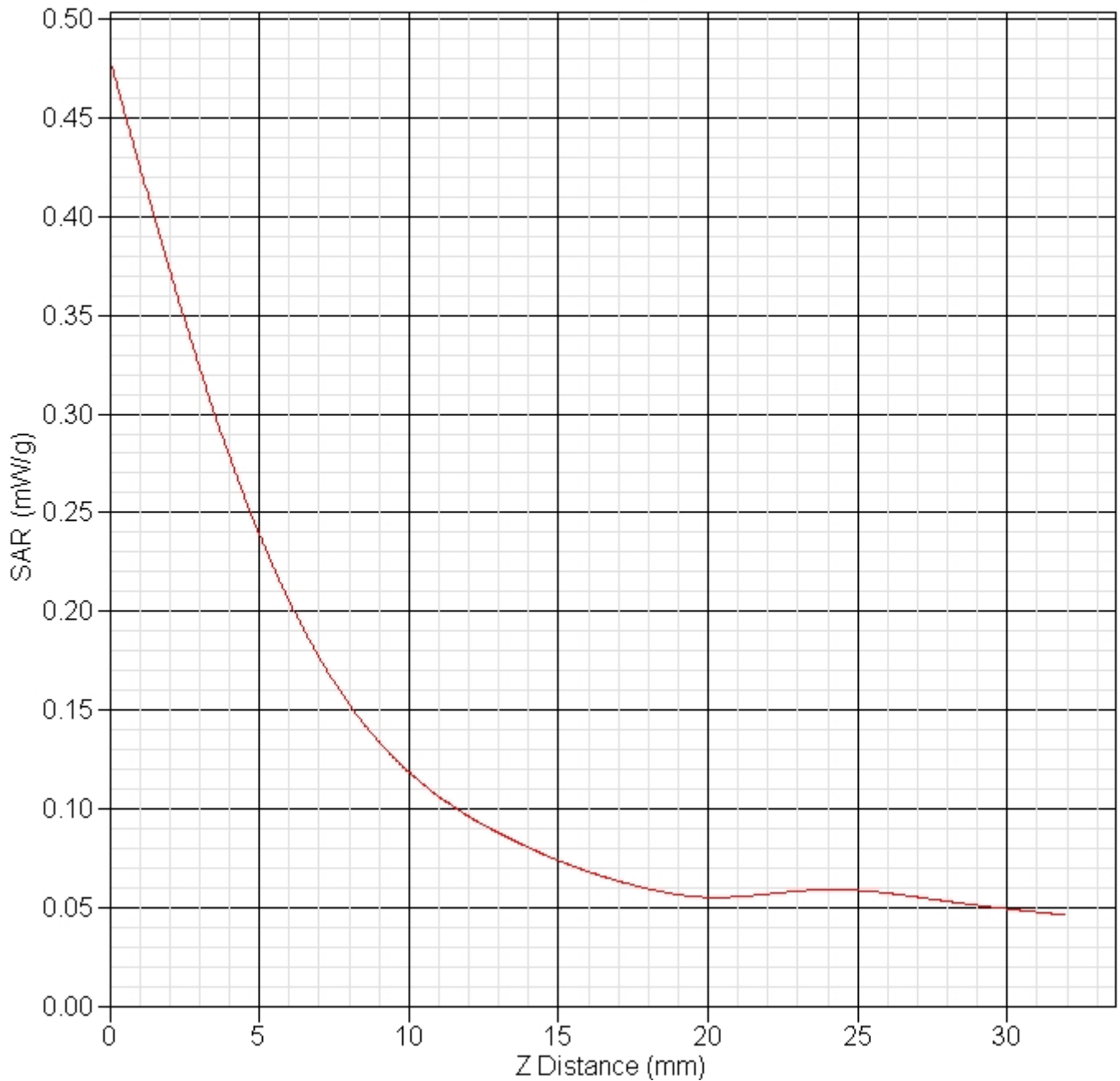
### Exposure Assessment Measurement Uncertainty

Source of Uncertainty	Tolerance Value	Probability Distribution	Divisor	$c_i^{-1}$ (1-g)	$c_i^{-1}$ (10-g)	Standard Uncertainty (1-g) %	Standard Uncertainty (10-g) %
Measurement System							
Probe Calibration	3.5	normal	1	1	1	3.5	3.5
Axial Isotropy	3.7	rectangular	$\sqrt{3}$	$(1-cp)^{1/2}$	$(1-cp)^{1/2}$	1.5	1.5
Hemispherical Isotropy	10.9	rectangular	$\sqrt{3}$	$\sqrt{cp}$	$\sqrt{cp}$	4.4	4.4
Boundary Effect	1.0	rectangular	$\sqrt{3}$	1	1	0.6	0.6
Linearity	4.7	rectangular	$\sqrt{3}$	1	1	2.7	2.7
Detection Limit	1.0	rectangular	$\sqrt{3}$	1	1	0.6	0.6
Readout Electronics	1.0	normal	1	1	1	1.0	1.0
Response Time	0.8	rectangular	$\sqrt{3}$	1	1	0.5	0.5
Integration Time	1.7	rectangular	$\sqrt{3}$	1	1	1.0	1.0
RF Ambient Condition	3.0	rectangular	$\sqrt{3}$	1	1	1.7	1.7
Probe Positioner Mech.	0.4	rectangular	$\sqrt{3}$	1	1	0.2	0.2
Restriction							
Probe Positioning with respect to Phantom Shell	2.9	rectangular	$\sqrt{3}$	1	1	1.7	1.7
Extrapolation and Integration	3.7	rectangular	$\sqrt{3}$	1	1	2.1	2.1
Test Sample Positioning	4.0	normal	1	1	1	4.0	4.0
Device Holder Uncertainty	2.0	normal	1	1	1	2.0	2.0
Drift of Output Power	1.7	rectangular	$\sqrt{3}$	1	1	1.0	1.0
Phantom and Setup							
Phantom Uncertainty(shape & thickness tolerance)	3.4	rectangular	$\sqrt{3}$	1	1	2.0	2.0
Liquid Conductivity(target)	5.0	rectangular	$\sqrt{3}$	0.7	0.5	2.0	1.4
Liquid Conductivity(meas.)	1.0	normal	1	0.7	0.5	0.7	0.5
Liquid Permittivity(target)	5.0	rectangular	$\sqrt{3}$	0.6	0.5	1.7	1.4
Liquid Permittivity(meas.)	1.0	normal	1	0.6	0.5	0.6	0.5
Combined Uncertainty		RSS				9.3	9.2
Combined Uncertainty (coverage factor=2)		Normal (k=2)				18.7	18.3



Report No : TSC-98-08-IN-03 (SAR)

**SAR-Z Axis**  
at Hotspot x:0.20 y:-0.40





**Chunghwa Telecom CO., Ltd**  
**Telecommunication Laboratories**  
**Testing & Certification Center**

TEL : +886 3 4244445  
FAX : +886 3 4202444  
ADDR. : 12, Lane 551, Min-Tsu Road Sec. 5  
Yang-Mei, Taoyuan, Taiwan , R.O.C.  
E-mail: [tsd@cht.com.tw](mailto:tsd@cht.com.tw) <http://www.chttl.com.tw>

Report No : TSC-98-08-IN-03 (SAR)

#### A. 4.3 Dipole Calibration Data

<p style="text-align: center;"><b>NCL CALIBRATION LABORATORIES</b></p> <p style="text-align: center;">Calibration File No: DC-961 Project Number: ISLB-D-2450S2-5416</p> <p style="text-align: center;"><b>C E R T I F I C A T E   O F   C A L I B R A T I O N</b></p> <p style="text-align: center;">It is certified that the equipment identified below has been calibrated in the <b>NCL CALIBRATION LABORATORIES</b> by qualified personnel following recognized procedures and using transfer standards traceable to NRC/NIST.</p> <p style="text-align: center;">WISB Validation Dipole</p> <p style="text-align: center;">Manufacturer: APREL Laboratories Part number: ALS-D-2450-S-2 Frequency: 2450 MHz Serial No: 2450-220-00753</p> <p style="text-align: center;">Customer: WISB</p> <p style="text-align: center;">Calibrated: 3<sup>rd</sup> February 2009 Released on: 5<sup>th</sup> February 2009</p> <p style="text-align: center;">This Calibration Certificate is incomplete Unless Accompanied with the Calibration Results Summary</p> <p style="text-align: center;">Released By: </p> <p style="text-align: center;"><b><u>NCL CALIBRATION LABORATORIES</u></b> 51 SPECTRUM WAY NEPEAN, ONTARIO CANADA K2R 1E6 Division of APREL Lab. TEL: (613) 820-4866 FAX: (613) 820-4162</p>
---



Report No : TSC-98-08-IN-03 (SAR)

**NCL Calibration Laboratories**

Division of APREL Laboratories.

**Conditions**

Dipole 2450-220-00753 was a re-calibration.

Ambient Temperature of the Laboratory: 22 °C +/- 0.5°C

Temperature of the Tissue: 21 °C +/- 0.5°C

We the undersigned attest that to the best of our knowledge the calibration of this device has been accurately conducted and that all information contained within this report has been reviewed for accuracy.

We the undersigned attest that to the best of our knowledge the calibration of this device has been accurately conducted and that all information contained within this report has been reviewed for accuracy.

Stuart Nicol

C. Teodorian

This page has been reviewed for content and attested to by signature within this document.



Report No : TSC-98-08-IN-03 (SAR)

**NCL Calibration Laboratories**

Division of APREL Laboratories.

**Calibration Results Summary**

The following results relate the Calibrated Dipole and should be used as a quick reference for the user.

**Mechanical Dimensions**

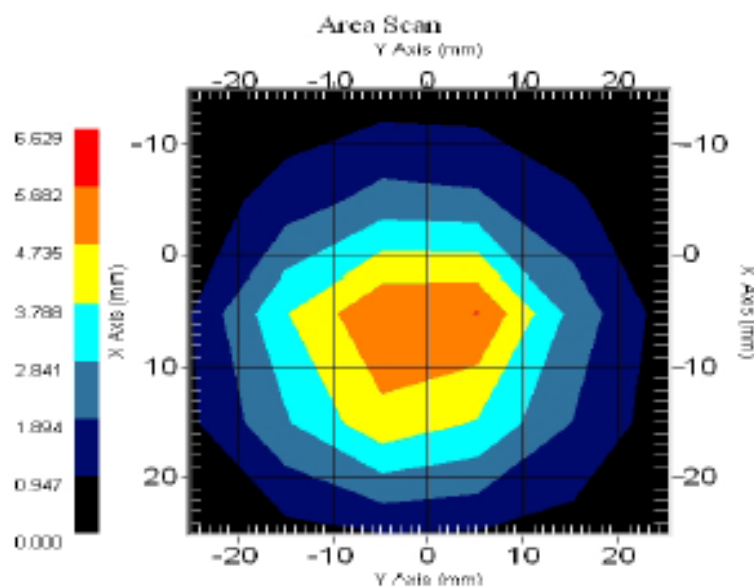
Length: 51.5 mm  
Height: 30.4 mm

**Electrical Specification**

SWR: 1.01 U  
Return Loss: -45.3 dB  
Impedance: 50.6  $\Omega$

**System Validation Results**

Frequency	1 Gram	10 Gram	Peak
2450 MHz	5.31	2.44	10.18



This page has been reviewed for content and attested to by signature within this document.

3



Report No : TSC-98-08-IN-03 (SAR)

#### **NCL Calibration Laboratories**

Division of APREL Laboratories.

### **Introduction**

This Calibration Report has been produced in line with the SSI Dipole Calibration Procedure SSI-TP-018-ALSAS. The results contained within this report are for Validation Dipole 2450-220-00753. The calibration routine consisted of a three-step process. Step 1 was a mechanical verification of the dipole to ensure that it meets the mechanical specifications. Step 2 was an Electrical Calibration for the Validation Dipole, where the SWR, Impedance, and the Return loss were assessed. Step 3 involved a System Validation using the ALSAS-10U, along with APREL E-020 130 MHz to 26 GHz E-Field Probe Serial Number 212.

### **References**

SSI-TP-018-ALSAS Dipole Calibration Procedure  
SSI-TP-018 Tissue Calibration Procedure  
IEEE 1528 "Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques"

### **Conditions**

Dipole 2450-220-00753 was a re-calibration.

Ambient Temperature of the Laboratory: 22 °C +/- 0.5°C  
Temperature of the Tissue: 20 °C +/- 0.5°C

This page has been reviewed for content and attested to by signature within this document.

4





Report No : TSC-98-08-IN-03 (SAR)

**NCL Calibration Laboratories**

Division of APREL Laboratories.

**Dipole Calibration Results**

**Mechanical Verification**

APREL Length	APREL Height	Measured Length	Measured Height
51.5 mm	30.4 mm	52.1 mm	31.0 mm

**Tissue Validation**

Head Tissue 2450 MHz	Measured
Dielectric constant, $\epsilon_r$	39.8
Conductivity, $\sigma$ [S/m]	1.88

This page has been reviewed for content and attested to by signature within this document.

5



Report No : TSC-98-08-IN-03 (SAR)

**NCL Calibration Laboratories**  
Division of APREL Laboratories.

**Electrical Calibration**

Test	Result
S11 R/L	-45.3 dB
SWR	1.01 U
Impedance	50.6 $\Omega$

The Following Graphs are the results as displayed on the Vector Network Analyzer.

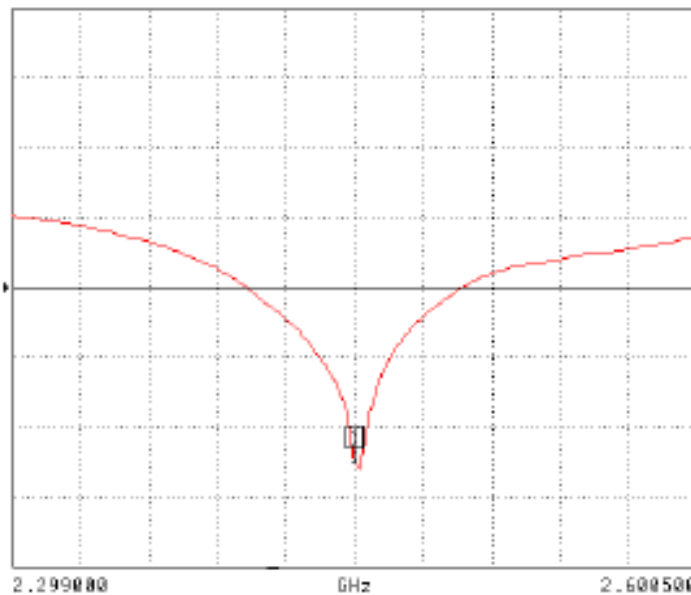
**S11 Parameter Return Loss**

S22 REVERSE REFLECTION

LOG MAGNITUDE

REF = -20.000 dB

18.000 dB/DIV



CH 1 - S22  
REFERENCE PLANE  
0.0000 mm

MARKER 1  
2.449750 GHz  
-45.338 dB

MARKER TO MAX  
MARKER TO MIN

MARKER READOUT  
FUNCTIONS

This page has been reviewed for content and attested to by signature within this document.

6

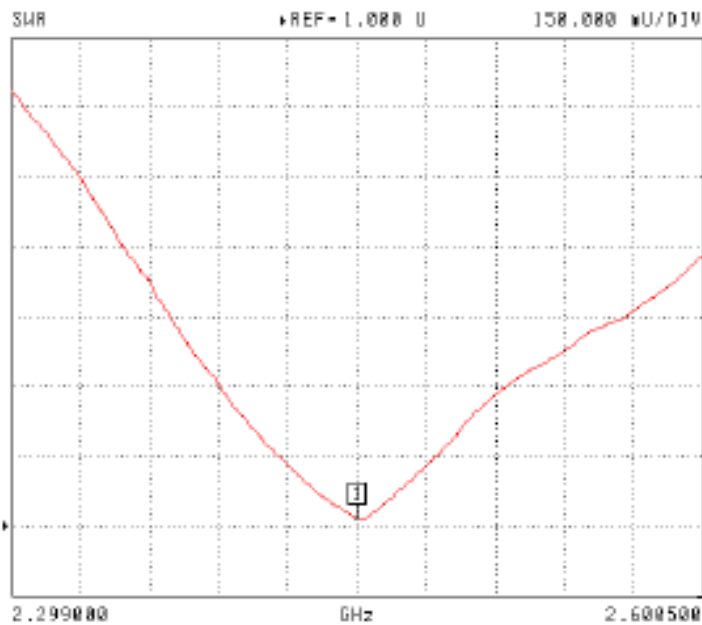


Report No : TSC-98-08-IN-03 (SAR)

**NCL Calibration Laboratories**  
Division of APREL Laboratories.

**SWR**

S22 REVERSE REFLECTION



CH 4 - S22  
REFERENCE PLANE  
0.0000 mm

MARKER 1  
2.449750 GHz  
1.014 U

MARKER TO MAX  
MARKER TO MIN

MARKER READOUT  
FUNCTIONS

This page has been reviewed for content and attested to by signature within this document.

7

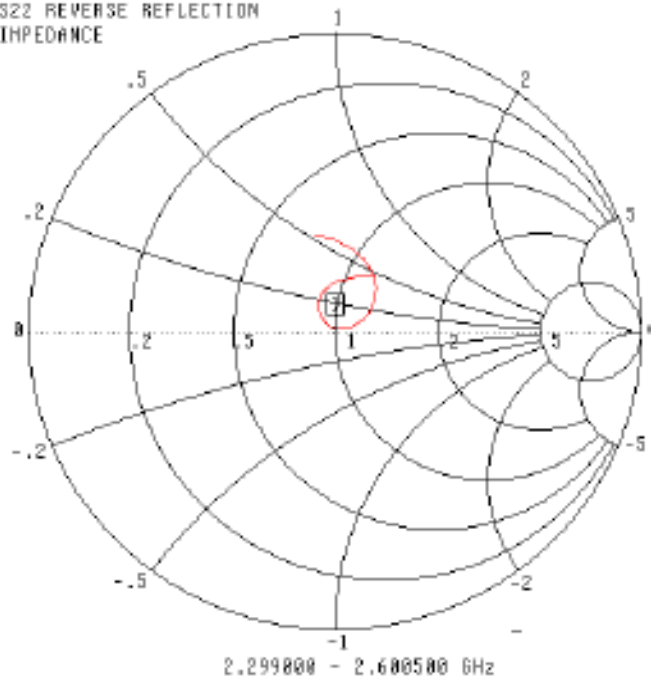


Report No : TSC-98-08-IN-03 (SAR)

**NCL Calibration Laboratories**  
Division of APREL Laboratories.

### Smith Chart Dipole Impedance

S22 REVERSE REFLECTION  
IMPEDANCE



CH 4 - S22  
REFERENCE PLANE  
0.0000 m

MARKER 1  
2.449750 GHz  
50.609  $\Omega$   
682.944 j $\omega$

MARKER TO MAX  
MARKER TO MIN

MARKER READOUT  
FUNCTIONS

This page has been reviewed for content and attested to by signature within this document.

8

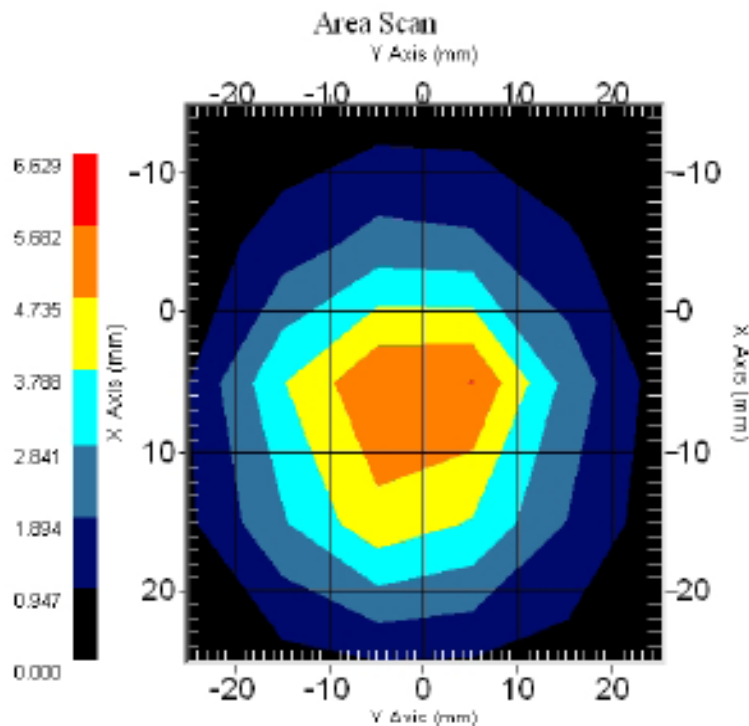


Report No : TSC-98-08-IN-03 (SAR)

**NCL Calibration Laboratories**  
Division of APREL Laboratories.

**System Validation Results Using the Electrically Calibrated Dipole**

Head Tissue Frequency	1 Gram	10 Gram	Peak Above Feed Point
2450 MHz	5.31	2.44	10.18



This page has been reviewed for content and attested to by signature within this document.

9



Report No : TSC-98-08-IN-03 (SAR)

**NCL Calibration Laboratories**

Division of APREL Laboratories.

**Test Equipment**

The test equipment used during Probe Calibration, manufacturer, model number and, current calibration status are listed and located on the main APREL server R:\NCL\Calibration Equipment\Instrument List May 2008.

This page has been reviewed for content and attested to by signature within this document.

10





**Chunghwa Telecom CO., Ltd**  
**Telecommunication Laboratories**  
**Testing & Certification Center**

TEL : +886 3 4244445  
FAX : +886 3 4202444  
ADDR. : 12, Lane 551, Min-Tsu Road Sec. 5  
Yang-Mei, Taoyuan, Taiwan, R.O.C.  
E-mail: [tsd@cht.com.tw](mailto:tsd@cht.com.tw) <http://www.chttl.com.tw>

Report No : TSC-98-08-IN-03 (SAR)

#### A.4.4 Probe Calibration Data

### NCL CALIBRATION LABORATORIES

Calibration File No.: CP-943

Client: CHTTL

## CERTIFICATE OF CALIBRATION

It is certified that the equipment identified below has been calibrated in the  
**NCL CALIBRATION LABORATORIES** by qualified personnel following recognized  
procedures and using transfer standards traceable to NRC/NIST.

Equipment: Miniature Isotropic RF Probe 1800 MHz

Manufacturer: APREL Laboratories

Model No.: ALS-E-020

Serial No.: 257

HEAD Calibration

Calibration Procedure: SSVDDB-TP-D01-032-E020-V2

Project No: SGL-ALS-E020-CAL-5395

Calibrated: 11<sup>th</sup> December 2008

Released on: 12<sup>th</sup> December 2008

This Calibration Certificate is incomplete Unless Accompanied with the Calibration Results Summary

Released By: \_\_\_\_\_

**NCL** CALIBRATION LABORATORIES

51 SPECTRUM WAY  
NEPEAN, ONTARIO  
CANADA K2R 1G6

Division of APREL Lab.  
TEL: (613) 820-4988  
FAX: (613) 820-4161



Report No : TSC-98-08-IN-03 (SAR)

**NCL Calibration Laboratories**

Division of APREL Laboratories

**Introduction**

This Calibration Report reproduces the results of the calibration performed in line with the SSI/DRB-TP-D01-032-E020-V2 E-Field Probe Calibration Procedure. The results contained within this report are for APREL E-Field Probe E-020 257.

**References**


SSI/DRB-TP-D01-032-E020-V2 E-Field Probe Calibration Procedure  
IEEE 1528 "Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head Due to Wireless Communications Devices: Experimental Techniques"  
SSI-TP-011 Tissue Calibration Procedure  
IEC 62209 "Human exposure to radio frequency fields from hand-held and Head-mounted wireless communication devices – Human models, instrumentation, and procedures –Part 1 & 2: Procedure to determine the Specific Absorption Rate (SAR) for hand-held devices used in close proximity of the ear (frequency range of 300 MHz to 3 GHz)"  
IEEE 1309 Draft Standard for Calibration of Electromagnetic Field Sensors and Probes, Excluding Antennas, from 9kHz to 40GHz

**Conditions**

Probe 257 is a re-calibration.

Ambient Temperature of the Laboratory: 22 °C +/- 0.5°C  
Temperature of the Tissue: 21 °C +/- 0.5°C

We the undersigned attest that to the best of our knowledge the calibration of this probe has been accurately conducted and that all information contained within this report has been reviewed for accuracy.

  
Stuart Nicol

  
Jesse Hones



Report No : TSC-98-08-IN-03 (SAR)

---

**NCL Calibration Laboratories**

Division of APREL Laboratories

**Calibration Results Summary**

Probe Type:	E-Field Probe E-020
Serial Number:	257
Frequency:	1800 MHz
Sensor Offset:	1.56 mm
Sensor Length:	2.5 mm
Tip Enclosure:	Ertalyte*
Tip Diameter:	<5 mm
Tip Length:	60 mm
Total Length:	290 mm

\*Resistive to recommended tissue recipes per IEEE-1528

**Sensitivity in Air**

Channel X:	$1.2 \mu\text{V}/(\text{V}/\text{m})^2$
Channel Y:	$1.2 \mu\text{V}/(\text{V}/\text{m})^2$
Channel Z:	$1.2 \mu\text{V}/(\text{V}/\text{m})^2$
Diode Compression Point:	95 mV



Report No : TSC-98-08-IN-03 (SAR)

**NCL Calibration Laboratories**

Division of APREL Laboratories

**Sensitivity in Head Tissue**

Frequency: 1800 MHz

Epsilon: 40.0 (+/-5%) Sigma: 1.40 S/m (+/-5%)

**ConvF**

Channel X: 5.5

Channel Y: 5.5

Channel Z: 5.5

Tissue sensitivity values were calculated using the load impedance of the APREL Laboratories Daq-Paq.

**Boundary Effect:**

Uncertainty resulting from the boundary effect is less than 2% for the distance between the tip of the probe and the tissue boundary, when less than 2.44mm.

**Spatial Resolution:**

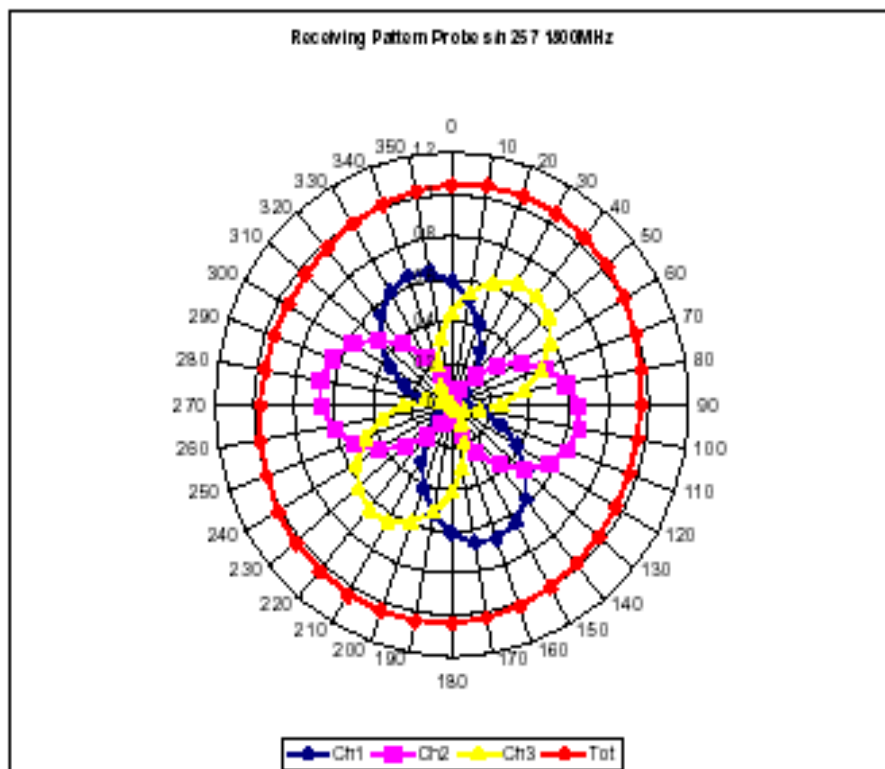
The measured probe tip diameter is 5 mm (+/- 0.01 mm) and therefore meets the requirements of SSI/DRB-TP-D01-032 for spatial resolution.



Report No : TSC-98-08-IN-03 (SAR)

**NCL Calibration Laboratories**  
Division of APREL Laboratories

### Receiving Pattern 1800 MHz (Air)

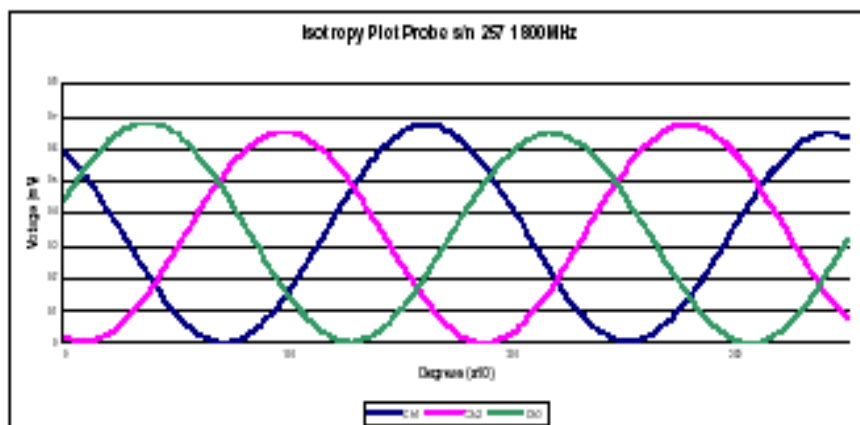
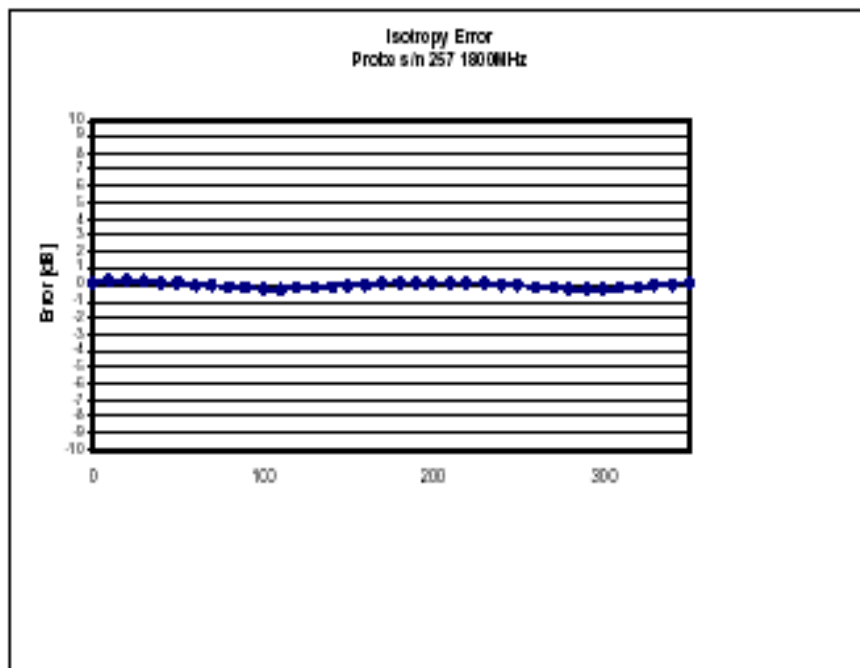




Report No : TSC-98-08-IN-03 (SAR)

**NCL Calibration Laboratories**  
Division of APREL Laboratories

### Isotropy Error 1800 MHz (Air)



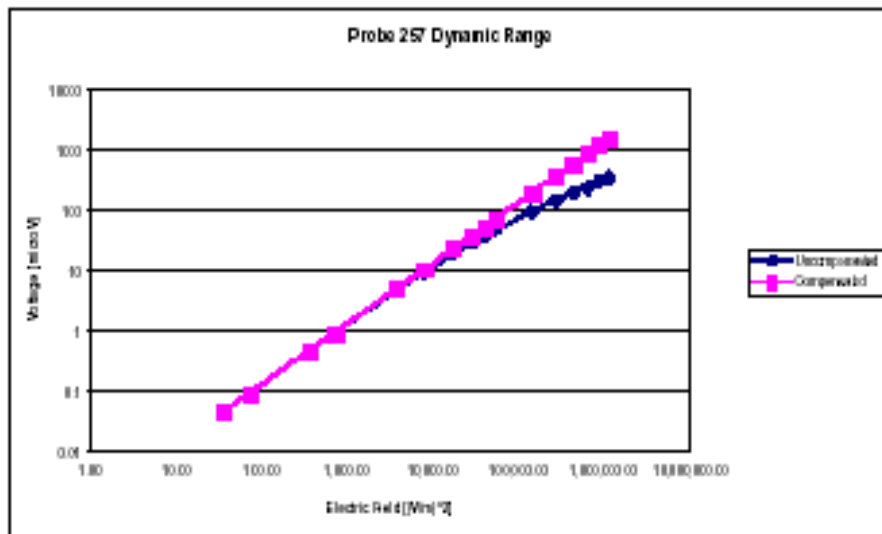
Isotropy in Tissue: 0.10 dB



Report No : TSC-98-08-IN-03 (SAR)

**NCL Calibration Laboratories**  
Division of APREL Laboratories

### Dynamic Range





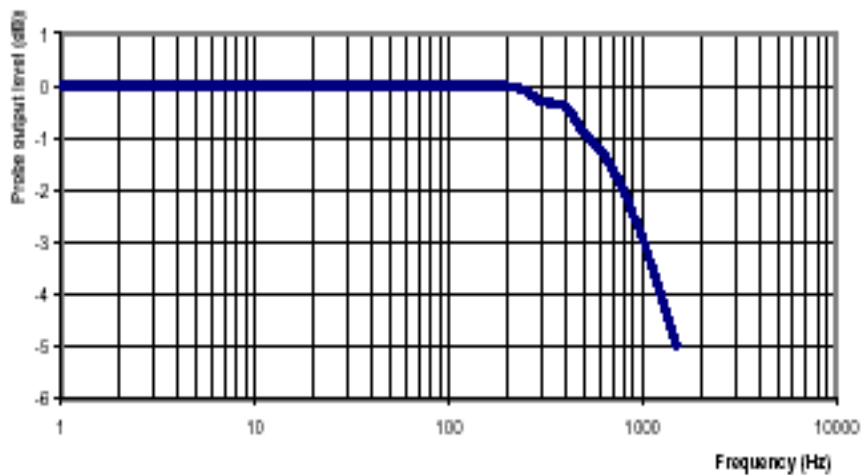
Report No : TSC-98-08-IN-03 (SAR)

**NCL Calibration Laboratories**

Division of APREL Laboratories

**Video Bandwidth**

Probe Frequency Characteristics



Video Bandwidth at 500 Hz      1 dB  
Video Bandwidth at 1000 Hz    3 dB





Report No : TSC-98-08-IN-03 (SAR)

**NCL Calibration Laboratories**

Division of APREL Laboratories

**Conversion Factor Uncertainty Assessment**

Frequency:	1800MHz
Epsilon: 40.0 (+/-5%)	Sigma: 1.40 S/m (+/-5%)
ConvF	
Channel X: 5.5	7%(K=2)
Channel Y: 5.5	7%(K=2)
Channel Z: 5.5	7%(K=2)

To minimize the uncertainty calculation all tissue sensitivity values were calculated using a load impedance of 5 M $\Omega$ .

**Boundary Effect:**

For a distance of 2.4mm the evaluated uncertainty (increase in the probe sensitivity) is less than 2%.



Report No : TSC-98-08-IN-03 (SAR)

---

**NCL Calibration Laboratories**

Division of APREL Laboratories

**Test Equipment**

The test equipment used during Probe Calibration, manufacturer, model number and, current calibration status are listed and located on the main APREL server R:\NCL\Calibration Equipment\Instrument List May 2008.



**Chunghwa Telecom CO., Ltd**  
**Telecommunication Laboratories**  
**Testing & Certification Center**

TEL : +886 3 4244445  
FAX : +886 3 4202444  
ADDR. : 12, Lane 551, Min-Tsu Road Sec. 5  
Yang-Mei, Taoyuan, Taiwan , R.O.C.  
E-mail: [tsd@cht.com.tw](mailto:tsd@cht.com.tw) <http://www.chttl.com.tw>

Report No : TSC-98-08-IN-03 (SAR)

## NCL CALIBRATION LABORATORIES

Calibration File No.: CP-880

Client: QUIETEK

## CERTIFICATE OF CALIBRATION

It is certified that the equipment identified below has been calibrated in the  
**NCL CALIBRATION LABORATORIES** by qualified personnel following recognized  
procedures and using transfer standards traceable to NRC/NIST.

Equipment: Miniature Isotropic RF Probe 2450 MHz

Manufacturer: APREL Laboratories

Model No.: ALS-E-020

Serial No.: 266

BODY Calibration

Calibration Procedure: SSVDDB-TP-D01-032-E020-V2

Project No: QTKB-ALS-E20-CAL-5335

Calibrated: 9<sup>th</sup> May 2008

Released on: 9<sup>th</sup> May 2008

This Calibration Certificate is incomplete unless accompanied with the Calibration Results Summary

Released By: \_\_\_\_\_

**NCL** CALIBRATION LABORATORIES

51 SPECTRUM WAY  
NEPEAN, ONTARIO  
CANADA K2R 1G6

Division of APREL Lab.  
TEL: (613) 820-4933  
FAX: (613) 820-4161



Report No : TSC-98-08-IN-03 (SAR)

---

**NCL Calibration Laboratories**

Division of APREL Laboratories

**Introduction**

This Calibration Report reproduces the results of the calibration performed in line with the SSI/DRB-TP-D01-032-E020-V2 E-Field Probe Calibration Procedure. The results contained within this report are for APREL E-Field Probe E-020 265.

**References**

SSI/DRB-TP-D01-032-E020-V2 E-Field Probe Calibration Procedure  
IEEE 1528 "Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head Due to Wireless Communications Devices: Experimental Techniques"  
SSI-TP-011 Tissue Calibration Procedure  
IEC 62209 "Human exposure to radio frequency fields from hand-held and Head-mounted wireless communication devices – Human models, instrumentation, and procedures –Part 1 & 2: Procedure to determine the Specific Absorption Rate (SAR) for hand-held devices used in close proximity of the ear (frequency range of 300 MHz to 3 GHz)"  
IEEE 1309 Draft Standard for Calibration of Electromagnetic Field Sensors and Probes, Excluding Antennas, from 9kHz to 40GHz

**Conditions**

Probe 265 is a re-calibration.

Ambient Temperature of the Laboratory: 22 °C +/- 0.5°C  
Temperature of the Tissue: 21 °C +/- 0.5°C

We the undersigned attest that to the best of our knowledge the calibration of this probe has been accurately conducted and that all information contained within this report has been reviewed for accuracy.

  
\_\_\_\_\_  
Stuart Nicol

  
\_\_\_\_\_  
Jesse Hones



Report No : TSC-98-08-IN-03 (SAR)

---

**NCL Calibration Laboratories**

Division of APREL Laboratories

**Calibration Results Summary**

Probe Type:	E-Field Probe E-020
Serial Number:	265
Frequency:	2450 MHz
Sensor Offset:	1.56 mm
Sensor Length:	2.5 mm
Tip Enclosure:	Ertalyte*
Tip Diameter:	<5 mm
Tip Length:	60 mm
Total Length:	290 mm

\*Resistive to recommended tissue recipes per IEEE-1528

**Sensitivity in Air**

Channel X:	$1.2 \mu V/(V/m)^2$
Channel Y:	$1.2 \mu V/(V/m)^2$
Channel Z:	$1.2 \mu V/(V/m)^2$
Diode Compression Point:	95 mV



Report No : TSC-98-08-IN-03 (SAR)

---

**NCL Calibration Laboratories**

Division of APREL Laboratories

**Sensitivity in Body Tissue**

Frequency: 2450 MHz

Epsilon: 52.7 (+/-5%) Sigma: 1.95 S/m (+/-5%)

ConvF

Channel X: 3.55

Channel Y: 3.55

Channel Z: 3.55

Tissue sensitivity values were calculated using the load impedance of the APREL Laboratories Daq-Paq.

**Boundary Effect:**

Uncertainty resulting from the boundary effect is less than 2% for the distance between the tip of the probe and the tissue boundary, when less than 2.44mm.

**Spatial Resolution:**

The measured probe tip diameter is 5 mm (+/- 0.01 mm) and therefore meets the requirements of SSL/DRB-TP-D01-032 for spatial resolution.

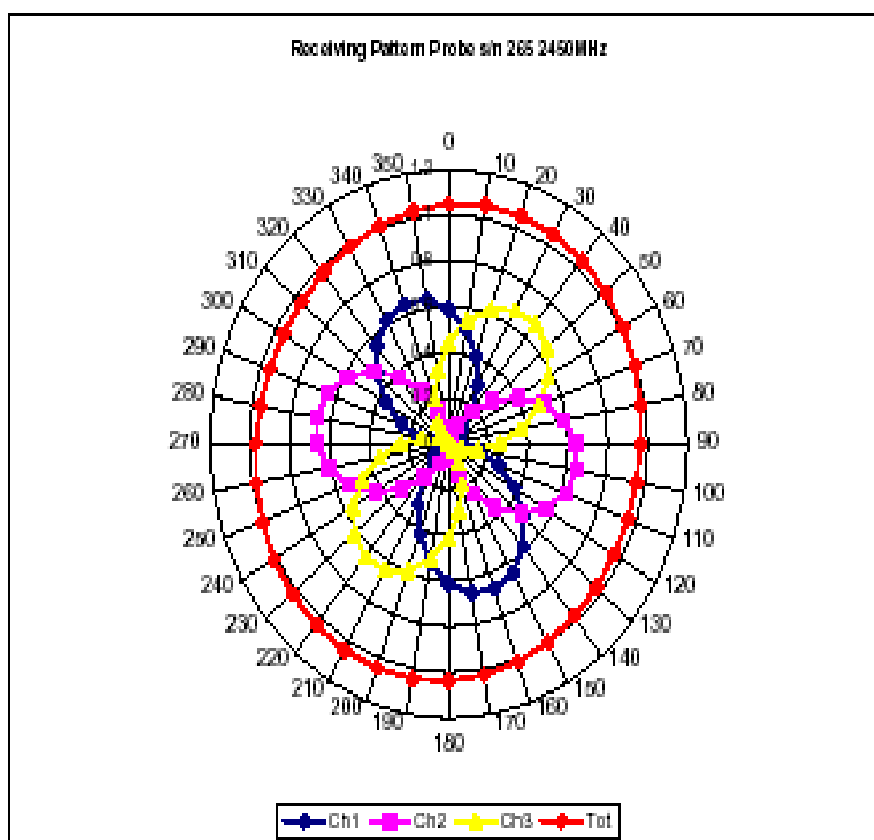


Report No : TSC-98-08-IN-03 (SAR)

**NCL Calibration Laboratories**

Division of APREL Laboratories

### Receiving Pattern 2450 MHz (Air)



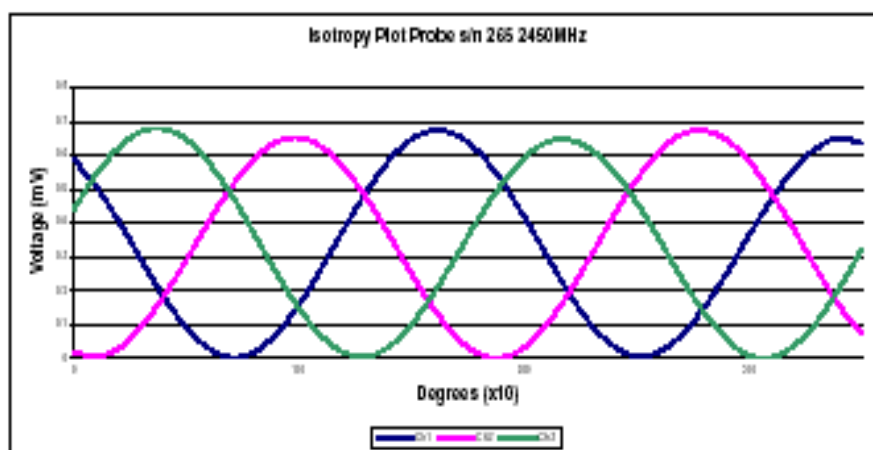
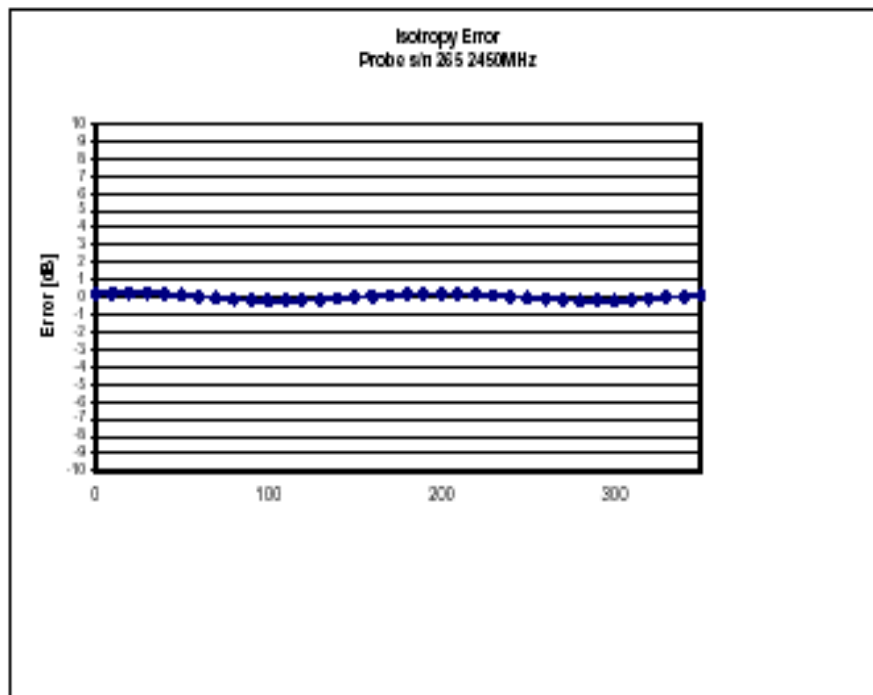


Report No : TSC-98-08-IN-03 (SAR)

**NCL Calibration Laboratories**

Division of APREL Laboratories

**Isotropy Error 2450 MHz (Air)**



Isotropy in Tissue:

0.10 dB



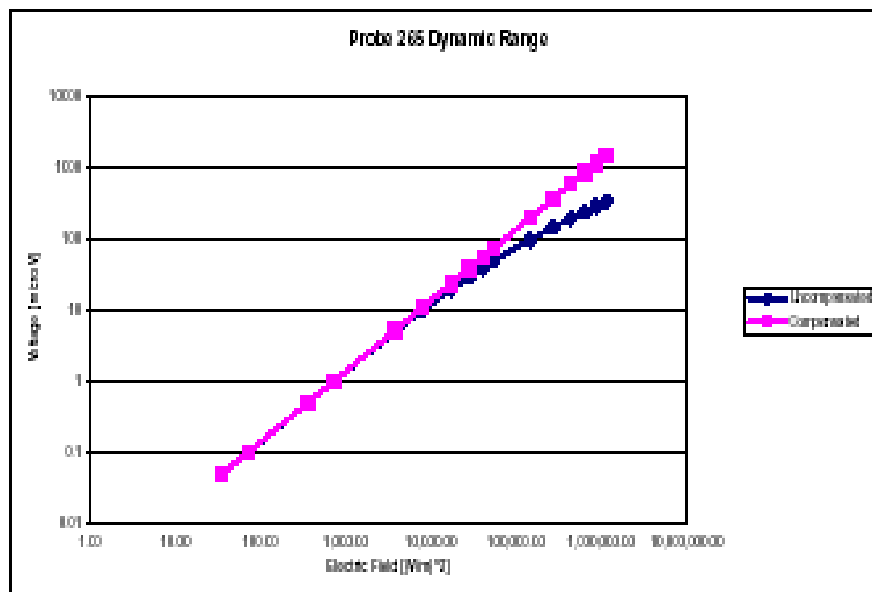


Report No : TSC-98-08-IN-03 (SAR)

**NCL Calibration Laboratories**

Division of APREL Laboratories

**Dynamic Range**





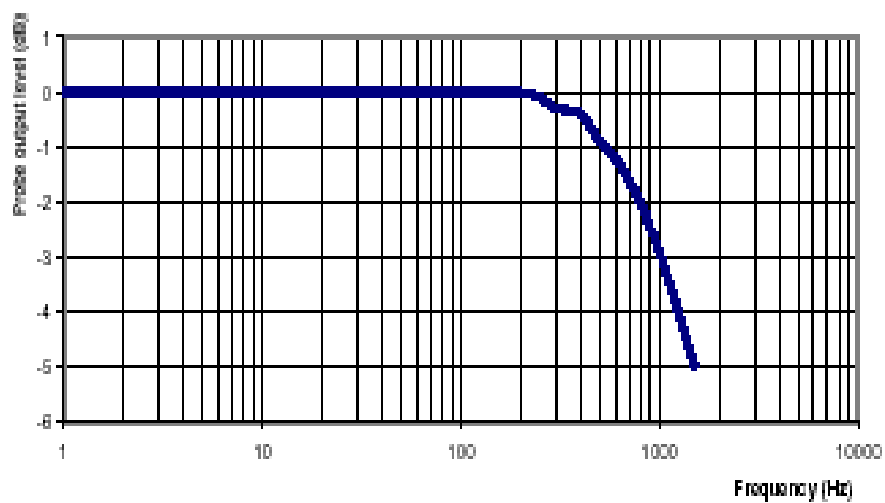
Report No : TSC-98-08-IN-03 (SAR)

**NCL Calibration Laboratories**

Division of APREL Laboratories

## Video Bandwidth

Probe Frequency Characteristics



Video Bandwidth at 500 Hz      1 dB  
Video Bandwidth at 1000 Hz      3 dB



Report No : TSC-98-08-IN-03 (SAR)

**NCL Calibration Laboratories**

Division of APREL Laboratories

**Conversion Factor Uncertainty Assessment**

Frequency: 2450MHz

Epsilon: 52.7 (+/-5%) Sigma: 1.95 S/m (+/-5%)

ConvF

Channel X: 3.55 7%(K=2)

Channel Y: 3.55 7%(K=2)

Channel Z: 3.55 7%(K=2)

To minimize the uncertainty calculation all tissue sensitivity values were calculated using a load impedance of 5 MΩ.

**Boundary Effect:**

For a distance of 2.4mm the evaluated uncertainty (increase in the probe sensitivity) is less than 2%.



Report No : TSC-98-08-IN-03 (SAR)

---

**NCL Calibration Laboratories**

Division of APREL Laboratories

**Test Equipment**

The test equipment used during Probe Calibration, manufacturer, model number and, current calibration status are listed and located on the main APREL server R:\NCL\Calibration Equipment\Instrument List May 2008.