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Report On

Specific Absorption Rate Testing of the
Sharp SHL24 Dual-band CDMA (800MHz_BC0, 1900MHz_BC6),
Quad-band GSM (GSM850/GSM900/DCS1800/PCS1900), WCDMA
(FDD I, FDD V), LTE (B01, B03, B11, B18), Dual-band mode cellular
phone with Bluetooth, WLAN, SRD(NFC,FeliCa) and GPS enabled

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This report has been up-issued to Issue 3 to add Bluetooth stand-alone and simultaneous transmission related information in Section 1.3.3 & 1.3.4 and expanded information regarding SAR test modes evaluated in Section 1.4.2.





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SECTION 1

REPORT SUMMARY

Specific Absorption Rate Testing of the
Sharp SHL24 Dual-band CDMA (800MHz_BC0, 1900MHz_BC6), Quad-band GSM
(GSM850/GSM900/DCS1800/PCS1900), WCDMA (FDD I, FDD V), LTE (B01, B03, B11, B18), Dual-
band mode cellular phone with Bluetooth, WLAN, SRD(NFC,FeliCa) and GPS enabled



1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Specific Absorption Rate Testing of the Sharp SHL24 Dual-band CDMA (800MHz_BC0, 1900MHz_BC6), Quad-band GSM (GSM850/GSM900/DCS1800/PCS1900), WCDMA (FDD I, FDD V), LTE (B01, B03, B11, B18), Dual-band mode cellular phone with Bluetooth, WLAN, SRD(NFC,FeliCa) and GPS enabled to the requirements of KDB 447498 – D01 v05 General RF Exposure Guidance.

Objective	To perform Specific Absorption Rate Testing to determine the Equipment Under Test's (EUT's) compliance with the requirements specified of KDB 447498 – D01 v05 General RF Exposure Guidance, for the series of tests carried out.
Applicant	Sharp Communication Compliance Ltd
Manufacturer	Sharp Corporation
Manufacturing Description	Mobile Handset
Model Number	SHL24
Power Class	GSM 850MHz Class 4 PCS 1900MHz Class 1 WCDMA FDD V Class 3
GPRS Class	B
GPRS Multi-slot Class	12
Serial/IMEI Number(s)	004401115003580 004401115003333 004401115003770
Number of Samples Tested	3
Hardware Version	PP1 CB292
Software Version	CB013 (UMTS Sample) AC020 (WLAN Sample)
Battery Cell Manufacturer	Sharp Corporation
Battery Model Number	Integral Battery; Non Removable
Battery Type	Lithium Ion; UBATIA235AFN1; DC 3.8V, 2120mAh
Test Specification/Issue/Date	KDB 447498 – D01 v05 General RF Exposure Guidance
Start of Test	06 January 2014
Finish of Test	13 October 2014
Related Document(s)	FCC 47CFR 2.1093: 2012 KDB 248227 - v01r02 (Rev 1.2) KDB 865664 – D01 v01 KDB 865664 – D02 v01 KDB 648474 – D04 v01 KDB 941225 - D01 v02 KDB 941225 – D06 v01 KDB 941225 – D02 v02r01 IEEE 1528-2003
Name of Engineer(s)	Nigel Grigsby Michael Mawby



1.2 BRIEF SUMMARY OF RESULTS

The measurements shown in this report were made in accordance with the procedures specified KDB 865664 – D01 v05.

The maximum 1g volume averaged stand-alone SAR found during this Assessment:

Max 1g SAR (W/kg) Body	0.69 (Measured)	0.91 (Scaled/Reported)
Max 1g SAR (W/kg) Hotspot	0.69 (Measured)	0.91 (Scaled/Reported)
Max 1g SAR (W/kg) Head	0.73 (Measured)	1.01 (Scaled/Reported)
The maximum 1g volume averaged SAR level measured for all the tests performed did not exceed the limits for General Population/Uncontrolled Exposure (W/kg) Partial Body of 1.6 W/kg.		

The maximum 1g volume averaged Stand-alone Reported SAR found during this Assessment for each supported mode, including highest simultaneous transmission SAR results:

Band	Test Configuration	Max Reported SAR (W/kg)	Highest Simultaneous Transmission SAR (W/kg)
GSM/GPRS/EGPRS 850	Head	1.01	1.20
	Body/Hotspot	0.79	
GSM/GPRS/EGPRS 1900	Head	0.72	
	Body/Hotspot	0.91	
WCDMA FDD V	Head	0.48	
	Body/Hotspot	0.71	
WLAN 2.4GHz	Head	0.20	1.20
	Body/Hotspot	0.29	
WLAN 5.22 GHz	Head	0.17	1.14
	Body/Hotspot	0.09	
WLAN 5.28 GHz	Head	0.14	
	Body/Hotspot	0.11	
WLAN 5.56 GHz	Head	0.19	
	Body/Hotspot	0.14	
The maximum 1g volume averaged SAR level measured for all the tests performed (including simultaneous transmission analysis results) did not exceed the limits for General Population/Uncontrolled Exposure (W/kg) Partial Body of 1.6 W/kg.			



1.3 TEST RESULTS SUMMARY

1.3.1 System Performance / Validation Check Results

Prior to formal testing being performed a System Check was performed in accordance with KDB 865664 and the results were compared against published data in Standard IEEE 1528-2003. The following results were obtained: -

System performance / Validation results

Date	Dipole Used	Frequency (MHz)	Max 1g SAR (W/kg)*	Percentage Drift on Reference
06/01/2014	835	835	10.19	-1.53
08/01/2014	835	835	10.41	-0.99
07/01/2014	1900	1900	42.23	5.46
08/01/2014	1900	1900	40.00	-2.41
07/01/2014	2450	2450	57.09	7.75
07/01/2014	2450	2450	60.09	6.95
06/01/2014	5000	5200	79.65	1.97
09/01/2014	5000	5200	91.91	8.95
06/01/2014	5000	5500	86.77	1.72
09//01/2014	5000	5500	78.96	-2.66
13/01/2014	5000	5500	81.03	-0.11

*Normalised to a forward power of 1W



1.3.2 Results Summary Tables

GSM 850MHz Head Specific Absorption Rate (Maximum SAR) 1g Results for the Sharp SHL24 Dual-band CDMA (800MHz_BC0, 1900MHz_BC6), Quad-band GSM (GSM850/GSM900/DCS1800/PCS1900), WCDMA (FDD I, FDD V), LTE (B01, B03, B11, B18), Dual-band mode cellular phone with Bluetooth, WLAN, SRD(NFC,FeliCa) and GPS enabled

Test Position	Channel Number	Frequency (MHz)	Measured Conducted Power (dBm)	Tune Up limit (dBm)	Measured 1g SAR (W/kg)	Scaled 1g SAR (W/kg)	Area scan (Figure number)
Left Cheek	189	836.4	32.43	33.5	0.46	0.59	Figure 6
Left 15°	189	836.4	32.43	33.5	0.33	0.42	Figure 7
Right Cheek	189	836.4	32.43	33.5	0.52	0.67	Figure 8
Right 15°	189	836.4	32.43	33.5	0.34	0.43	Figure 9

Limit for General Population (Uncontrolled Exposure) 1.6 W/kg (1g)
 KDB 447498 D01 - Testing of other required channels within the operation mode of a frequency band is not required when the reported 1g SAR for mid-band or highest output power channel is:
 ≤ 0.8W/kg when the transmission band is ≤ 100MHz
 ≤ 0.6W/kg when the transmission band is between 100MHz and 200MHz
 ≤ 0.4W/kg when the transmission band is ≥ 200MHz

GSM 850MHz GPRS Head Specific Absorption Rate (Maximum SAR) 1g Results for the Sharp SHL24 Dual-band CDMA (800MHz_BC0, 1900MHz_BC6), Quad-band GSM (GSM850/GSM900/DCS1800/PCS1900), WCDMA (FDD I, FDD V), LTE (B01, B03, B11, B18), Dual-band mode cellular phone with Bluetooth, WLAN, SRD(NFC,FeliCa) and GPS enabled

Test Position	Channel Number	Frequency (MHz)	Measured Conducted Power (dBm)	Tune Up limit (dBm)	Measured 1g SAR (W/kg)	Scaled 1g SAR (W/kg)	Area scan (Figure number)
Left Cheek	251	848.8	26.7	28.1	0.54	0.75	Figure 10
Left 15°	251	848.8	26.7	28.1	0.37	0.51	Figure 11
Right Cheek	251	848.8	26.7	28.1	0.59	0.81 *	Figure 12
Right 15°	251	848.8	26.7	28.1	0.34	0.47	Figure 13
Right Cheek	128	824.2	26.7	28.1	0.62	0.86 *	Figure 14
Right Cheek	189	836.4	26.7	28.1	0.73	1.01 *	Figure 15

Limit for General Population (Uncontrolled Exposure) 1.6 W/kg (1g)
 KDB 447498 D01 - Testing of other required channels within the operation mode of a frequency band is not required when the reported 1g SAR for mid-band or highest output power channel is:
 ≤ 0.8W/kg when the transmission band is ≤ 100MHz
 ≤ 0.6W/kg when the transmission band is between 100MHz and 200MHz
 ≤ 0.4W/kg when the transmission band is ≥ 200MHz
 * Testing was carried out on other channels within the band as the SAR for the highest output power channel measured >0.8W/kg



GSM 850MHz GPRS Body & Hotspot Configuration Specific Absorption Rate (Maximum SAR) 1g Results for the Sharp SHL24 Dual-band CDMA (800MHz_BC0, 1900MHz_BC6), Quad-band GSM (GSM850/GSM900/DCS1800/PCS1900), WCDMA (FDD I, FDD V), LTE (B01, B03, B11, B18), Dual-band mode cellular phone with Bluetooth, WLAN, SRD(NFC,FeliCa) and GPS enabled

Position		Channel Number	Frequency (MHz)	Measured Conducted Power (dBm)	Tune Up limit (dBm)	Measured 1g SAR (W/kg)	Scaled 1g SAR (W/kg)	Area scan (Figure number)
Spacing	Position							
10mm	Front Face	251	848.8	26.7	28.1	0.49	0.68	Figure 16
10mm	Rear Face	251	848.8	26.7	28.1	0.57	0.79	Figure 17
10mm	Right Edge	251	848.8	26.7	28.1	0.39	0.54	Figure 18
10mm	Left Edge	251	848.8	26.7	28.1	0.35	0.48	Figure 19
10mm	Bottom Edge	251	848.8	26.7	28.1	0.11	0.51	Figure 20

Limit for General Population (Uncontrolled Exposure) 1.6 W/kg (1g)
 KDB 447498 D01 - Testing of other required channels within the operation mode of a frequency band is not required when the reported 1g SAR for mid-band or highest output power channel is:
 ≤ 0.8W/kg when the transmission band is ≤ 100MHz
 ≤ 0.6W/kg when the transmission band is between 100MHz and 200MHz
 ≤ 0.4W/kg when the transmission band is ≥ 200MHz
 Testing was carried out with a 10mm separation distance to meet the requirements of KDB 941225 D06
 KDB – 648474 D04 - When the reported SAR for body-worn accessory, measured without a headset connected to the handset, is >1.2W/kg, the highest reported SAR configuration for that wireless mode and frequency band is repeated for that body worn accessory with a headset attached to the handset.

WCDMA FDD V Head Specific Absorption Rate (Maximum SAR) 1g Results for the Sharp SHL24 Dual-band CDMA (800MHz_BC0, 1900MHz_BC6), Quad-band GSM (GSM850/GSM900/DCS1800/PCS1900), WCDMA (FDD I, FDD V), LTE (B01, B03, B11, B18), Dual-band mode cellular phone with Bluetooth, WLAN, SRD(NFC,FeliCa) and GPS enabled

Test Position	Channel Number	Frequency (MHz)	Measured Conducted Power (dBm)	Tune Up limit (dBm)	Measured 1g SAR (W/kg)	Scaled 1g SAR (W/kg)	Area scan (Figure number)
Left Cheek	4232	846.4	23.01	24.2	0.45	0.59	Figure 21
Left 15°	4232	846.4	23.01	24.2	0.30	0.39	Figure 22
Right Cheek	4232	846.4	23.01	24.2	0.55	0.72	Figure 23
Right 15°	4232	846.4	23.01	24.2	0.37	0.49	Figure 24

Limit for General Population (Uncontrolled Exposure) 1.6 W/kg (1g)
 KDB 447498 D01 - Testing of other required channels within the operation mode of a frequency band is not required when the reported 1g SAR for mid-band or highest output power channel is:
 ≤ 0.8W/kg when the transmission band is ≤ 100MHz
 ≤ 0.6W/kg when the transmission band is between 100MHz and 200MHz
 ≤ 0.4W/kg when the transmission band is ≥ 200MHz



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WCDMA FDD V Body & Hotspot Configuration Specific Absorption Rate (Maximum SAR) 1g Results for the Sharp SHL24 Dual-band CDMA (800MHz_BC0, 1900MHz_BC6), Quad-band GSM (GSM850/GSM900/DCS1800/PCS1900), WCDMA (FDD I, FDD V), LTE (B01, B03, B11, B18), Dual-band mode cellular phone with Bluetooth, WLAN, SRD(NFC,FeliCa) and GPS enabled

Position		Channel Number	Frequency (MHz)	Measured Conducted Power (dBm)	Tune Up limit (dBm)	Measured 1g SAR (W/kg)	Scaled 1g SAR (W/kg)	Area scan (Figure number)
Spacing	Position							
10mm	Front Face	4232	846.4	23.01	24.2	0.50	0.66	Figure 25
10mm	Rear Face	4232	846.4	23.01	24.2	0.66	0.87 *	Figure 26
10mm	Right Edge	4232	846.4	23.01	24.2	0.39	0.51	Figure 27
10mm	Left Edge	4232	846.4	23.01	24.2	0.40	0.53	Figure 28
10mm	Bottom Edge	4232	846.4	23.01	24.2	0.10	0.13	Figure 29
10mm	Rear Face	4133	826.6	23.01	24.2	0.69	0.91 *	Figure 30
10mm	Rear Face	4175	835.0	23.01	24.2	0.68	0.90 *	Figure 31

Limit for General Population (Uncontrolled Exposure) 1.6 W/kg (1g)
 KDB 447498 D01 - Testing of other required channels within the operation mode of a frequency band is not required when the reported 1g SAR for mid-band or highest output power channel is:
 ≤ 0.8W/kg when the transmission band is ≤ 100MHz
 ≤ 0.6W/kg when the transmission band is between 100MHz and 200MHz
 ≤ 0.4W/kg when the transmission band is ≥ 200MHz
 * Testing was carried out on other channels within the band as the SAR for the highest output power channel measured >0.8W/kg
 Testing was carried out with a 10mm separation distance to meet the requirements of KDB 941225 D06
 KDB – 648474 D04 - When the reported SAR for body-worn accessory, measured without a headset connected to the handset, is >1.2W/kg, the highest reported SAR configuration for that wireless mode and frequency band is repeated for that body worn accessory with a headset attached to the handset.



PCS 1900MHz Head Specific Absorption Rate (Maximum SAR) 1g Results for the Sharp SHL24 Dual-band CDMA (800MHz_BC0, 1900MHz_BC6), Quad-band GSM (GSM850/GSM900/DCS1800/PCS1900), WCDMA (FDD I, FDD V), LTE (B01, B03, B11, B18), Dual-band mode cellular phone with Bluetooth, WLAN, SRD(NFC,FeliCa) and GPS enabled

Test Position	Channel Number	Frequency (MHz)	Measured Conducted Power (dBm)	Tune Up limit (dBm)	Measured 1g SAR (W/kg)	Scaled 1g SAR (W/kg)	Area scan (Figure number)
Left Cheek	512	1850.2	29.03	30.5	0.31	0.43	Figure 32
Left 15°	512	1850.2	29.03	30.5	0.11	0.15	Figure 33
Right Cheek	512	1850.2	29.03	30.5	0.22	0.31	Figure 34
Right 15°	512	1850.2	29.03	30.5	0.10	0.14	Figure 35
Limit for General Population (Uncontrolled Exposure) 1.6 W/kg (1g) KDB 447498 D01 - Testing of other required channels within the operation mode of a frequency band is not required when the reported 1g SAR for mid-band or highest output power channel is: ≤ 0.8W/kg when the transmission band is ≤ 100MHz ≤ 0.6W/kg when the transmission band is between 100MHz and 200MHz ≤ 0.4W/kg when the transmission band is ≥ 200MHz							

PCS 1900MHz GPRS Head Specific Absorption Rate (Maximum SAR) 1g Results for the Sharp SHL24 Dual-band CDMA (800MHz_BC0, 1900MHz_BC6), Quad-band GSM (GSM850/GSM900/DCS1800/PCS1900), WCDMA (FDD I, FDD V), LTE (B01, B03, B11, B18), Dual-band mode cellular phone with Bluetooth, WLAN, SRD(NFC,FeliCa) and GPS enabled

Test Position	Channel Number	Frequency (MHz)	Measured Conducted Power (dBm)	Tune Up limit (dBm)	Measured 1g SAR (W/kg)	Scaled 1g SAR (W/kg)	Area scan (Figure number)
Left Cheek	512	1850.2	23.29	24.9	0.33	0.48	Figure 36
Left 15°	512	1850.2	23.29	24.9	0.12	0.17	Figure 37
Right Cheek	512	1850.2	23.29	24.9	0.22	0.32	Figure 38
Right 15°	512	1850.2	23.29	24.9	0.10	0.14	Figure 39
Limit for General Population (Uncontrolled Exposure) 1.6 W/kg (1g) KDB 447498 D01 - Testing of other required channels within the operation mode of a frequency band is not required when the reported 1g SAR for mid-band or highest output power channel is: ≤ 0.8W/kg when the transmission band is ≤ 100MHz ≤ 0.6W/kg when the transmission band is between 100MHz and 200MHz ≤ 0.4W/kg when the transmission band is ≥ 200MHz							



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PCS 1900MHz GPRS Body & Hotspot Configuration Specific Absorption Rate (Maximum SAR) 1g Results for the Sharp SHL24 Dual-band CDMA (800MHz_BC0, 1900MHz_BC6), Quad-band GSM (GSM850/GSM900/DCS1800/PCS1900), WCDMA (FDD I, FDD V), LTE (B01, B03, B11, B18), Dual-band mode cellular phone with Bluetooth, WLAN, SRD(NFC,FeliCa) and GPS enabled

Position		Channel Number	Frequency (MHz)	Measured Conducted Power (dBm)	Tune Up limit (dBm)	Measured 1g SAR (W/kg)	Scaled 1g SAR (W/kg)	Area scan (Figure number)
Spacing	Position							
10mm	Front Face	512	1850.2	23.29	24.9	0.31	0.45	Figure 40
10mm	Rear Face	512	1850.2	23.29	24.9	0.37	0.54	Figure 41
10mm	Right Edge	512	1850.2	23.29	24.9	0.06	0.09	Figure 42
10mm	Bottom Edge	512	1850.2	23.29	24.9	0.49	0.71	Figure 43

Limit for General Population (Uncontrolled Exposure) 1.6 W/kg (1g)
 KDB 447498 D01 - Testing of other required channels within the operation mode of a frequency band is not required when the reported 1g SAR for mid-band or highest output power channel is:
 ≤ 0.8W/kg when the transmission band is ≤ 100MHz
 ≤ 0.6W/kg when the transmission band is between 100MHz and 200MHz
 ≤ 0.4W/kg when the transmission band is ≥ 200MHz
 Testing was carried out with a 10mm separation distance to meet the requirements of KDB 941225 D06
 KDB – 648474 D04 - When the reported SAR for body-worn accessory, measured without a headset connected to the handset, is >1.2W/kg, the highest reported SAR configuration for that wireless mode and frequency band is repeated for that body worn accessory with a headset attached to the handset.

WLAN 2450MHz Head Specific Absorption Rate (Maximum SAR) 1g Results for the Sharp SHL24 Dual-band CDMA (800MHz_BC0, 1900MHz_BC6), Quad-band GSM (GSM850/GSM900/DCS1800/PCS1900), WCDMA (FDD I, FDD V), LTE (B01, B03, B11, B18), Dual-band mode cellular phone with Bluetooth, WLAN, SRD(NFC,FeliCa) and GPS enabled

Test Position	Channel Number	Frequency (MHz)	Measured Conducted Power (dBm)	Tune Up limit (dBm)	Measured 1g SAR (W/kg)	Scaled 1g SAR (W/kg)	Area scan (Figure number)
Left Cheek	1	2412.0	15.01	15.5	0.15	0.17	Figure 44
Left 15°	1	2412.0	15.01	15.5	0.11	0.12	Figure 45
Right Cheek	1	2412.0	15.01	15.5	0.14	0.16	Figure 46
Right 15°	1	2412.0	15.01	15.5	0.18	0.20	Figure 47

Limit for General Population (Uncontrolled Exposure) 1.6 W/kg (1g)
 KDB 447498 D01 - Testing of other required channels within the operation mode of a frequency band is not required when the reported 1g SAR for mid-band or highest output power channel is:
 ≤ 0.8W/kg when the transmission band is ≤ 100MHz
 ≤ 0.6W/kg when the transmission band is between 100MHz and 200MHz
 ≤ 0.4W/kg when the transmission band is ≥ 200MHz



WLAN 2450MHz Body & Hotspot Configuration Specific Absorption Rate (Maximum SAR) 1g Results for the Sharp SHL24 Dual-band CDMA (800MHz_BC0, 1900MHz_BC6), Quad-band GSM (GSM850/GSM900/DCS1800/PCS1900), WCDMA (FDD I, FDD V), LTE (B01, B03, B11, B18), Dual-band mode cellular phone with Bluetooth, WLAN, SRD(NFC,FeliCa) and GPS enabled

Position		Channel Number	Frequency (MHz)	Measured Conducted Power (dBm)	Tune Up limit (dBm)	Measured 1g SAR (W/kg)	Scaled 1g SAR (W/kg)	Area scan (Figure number)
Spacing	Position							
10mm	Front Face	2412.0	15.01	15.01	15.5	0.05	0.06	Figure 48
10mm	Rear Face	2412.0	15.01	15.01	15.5	0.26	0.29	Figure 49
10mm	Left Edge	2412.0	15.01	15.01	15.5	0.13	0.15	Figure 50
10mm	Top Edge	2412.0	15.01	15.01	15.5	0.06	0.07	Figure 51

Limit for General Population (Uncontrolled Exposure) 1.6 W/kg (1g)
 KDB 447498 D01 - Testing of other required channels within the operation mode of a frequency band is not required when the reported 1g SAR for mid-band or highest output power channel is:
 ≤ 0.8W/kg when the transmission band is ≤ 100MHz
 ≤ 0.6W/kg when the transmission band is between 100MHz and 200MHz
 ≤ 0.4W/kg when the transmission band is ≥ 200MHz
 Testing was carried out with a 10mm separation distance to meet the requirements of KDB 941225 D06
 KDB – 648474 D04 - When the reported SAR for body-worn accessory, measured without a headset connected to the handset, is >1.2W/kg, the highest reported SAR configuration for that wireless mode and frequency band is repeated for that body worn accessory with a headset attached to the handset.

WLAN 5220MHz Head Specific Absorption Rate (Maximum SAR) 1g Results for the Sharp SHL24 Dual-band CDMA (800MHz_BC0, 1900MHz_BC6), Quad-band GSM (GSM850/GSM900/DCS1800/PCS1900), WCDMA (FDD I, FDD V), LTE (B01, B03, B11, B18), Dual-band mode cellular phone with Bluetooth, WLAN, SRD(NFC,FeliCa) and GPS enabled. (NUA)*

Test Position	Channel Number	Frequency (MHz)	Measured Conducted Power (dBm)	Tune Up limit (dBm)	Measured 1g SAR (W/kg)	Scaled 1g SAR (W/kg)	Area scan (Figure number)
Left Cheek	44	5220.0	13.99	14.0	0.14	0.14	Figure 52
Left 15°	44	5220.0	13.99	14.0	0.17	0.17	Figure 53
Right Cheek	44	5220.0	13.99	14.0	0.07	0.07	Figure 54
Right 15°	44	5220.0	13.99	14.0	0.16	0.16	Figure 55

Limit for General Population (Uncontrolled Exposure) 1.6 W/kg (1g)
 KDB 447498 D01 - Testing of other required channels within the operation mode of a frequency band is not required when the reported 1g SAR for mid-band or highest output power channel is:
 ≤ 0.8W/kg when the transmission band is ≤ 100MHz
 ≤ 0.6W/kg when the transmission band is between 100MHz and 200MHz
 ≤ 0.4W/kg when the transmission band is ≥ 200MHz
 KDB 248227 - v01r02 (Rev 1.2) – Testing was carried out on Channel 44 instead of the default test channel as this was the channel with the maximum output power.
 *(NUA) Not UKAS Accredited



WLAN 5220MHz Body & Hotspot Configuration Specific Absorption Rate (Maximum SAR) 1g Results for the Sharp SHL24 Dual-band CDMA (800MHz_BC0, 1900MHz_BC6), Quad-band GSM (GSM850/GSM900/DCS1800/PCS1900), WCDMA (FDD I, FDD V), LTE (B01, B03, B11, B18), Dual-band mode cellular phone with Bluetooth, WLAN, SRD(NFC,FeliCa) and GPS enabled. (NUA)*

Position		Channel Number	Frequency (MHz)	Measured Conducted Power (dBm)	Tune Up limit (dBm)	Measured 1g SAR (W/kg)	Scaled 1g SAR (W/kg)	Area scan (Figure number)
Spacing	Position							
10mm	Front Face	44	5220.0	13.99	14.0	**	-	n/a
10mm	Rear Face	44	5220.0	13.99	14.0	0.09	0.09	Figure 56
10mm	Left Edge	44	5220.0	13.99	14.0	0.06	0.06	Figure 57
10mm	Top Edge	44	5220.0	13.99	14.0	0.05	0.05	Figure 58

Limit for General Population (Uncontrolled Exposure) 1.6 W/kg (1g)
 KDB 447498 D01 - Testing of other required channels within the operation mode of a frequency band is not required when the reported 1g SAR for mid-band or highest output power channel is:
 ≤ 0.8W/kg when the transmission band is ≤ 100MHz
 ≤ 0.6W/kg when the transmission band is between 100MHz and 200MHz
 ≤ 0.4W/kg when the transmission band is ≥ 200MHz
 KDB 248227 - v01r02 (Rev 1.2) – Testing was carried out on Channel 44 instead of the default test channel as this was the channel with the maximum output power.
 Testing was carried out with a 10mm separation distance to meet the requirements of KDB 941225 D06
 KDB – 648474 D04 - When the reported SAR for body-worn accessory, measured without a headset connected to the handset, is >1.2W/kg, the highest reported SAR configuration for that wireless mode and frequency band is repeated for that body worn accessory with a headset attached to the handset.
 *(NUA) Not UKAS Accredited
 ** No data was recorded for this position due to SAR levels being below the SAR measurement system capability.

WLAN 5280MHz Head Specific Absorption Rate (Maximum SAR) 1g Results for the Sharp SHL24 Dual-band CDMA (800MHz_BC0, 1900MHz_BC6), Quad-band GSM (GSM850/GSM900/DCS1800/PCS1900), WCDMA (FDD I, FDD V), LTE (B01, B03, B11, B18), Dual-band mode cellular phone with Bluetooth, WLAN, SRD(NFC,FeliCa) and GPS enabled. (NUA)*

Test Position	Channel Number	Frequency (MHz)	Measured Conducted Power (dBm)	Tune Up limit (dBm)	Measured 1g SAR (W/kg)	Scaled 1g SAR (W/kg)	Area scan (Figure number)
Left Cheek	56	5280.0	13.97	14.0	0.14	0.14	Figure 59
Left 15°	56	5280.0	13.97	14.0	0.14	0.14	Figure 60
Right Cheek	56	5280.0	13.97	14.0	0.13	0.13	Figure 61
Right 15°	56	5280.0	13.97	14.0	0.12	0.12	Figure 62

Limit for General Population (Uncontrolled Exposure) 1.6 W/kg (1g)
 KDB 447498 D01 - Testing of other required channels within the operation mode of a frequency band is not required when the reported 1g SAR for mid-band or highest output power channel is:
 ≤ 0.8W/kg when the transmission band is ≤ 100MHz
 ≤ 0.6W/kg when the transmission band is between 100MHz and 200MHz
 ≤ 0.4W/kg when the transmission band is ≥ 200MHz
 KDB 248227 - v01r02 (Rev 1.2) – Testing was carried out on Channel 56 instead of the default test channel as this was the channel with the maximum output power.
 *(NUA) Not UKAS Accredited



WLAN 5280MHz Body & Hotspot Configuration Specific Absorption Rate (Maximum SAR) 1g Results for the Sharp SHL24 Dual-band CDMA (800MHz_BC0, 1900MHz_BC6), Quad-band GSM (GSM850/GSM900/DCS1800/PCS1900), WCDMA (FDD I, FDD V), LTE (B01, B03, B11, B18), Dual-band mode cellular phone with Bluetooth, WLAN, SRD(NFC,FeliCa) and GPS enabled. (NUA)*

Position		Channel Number	Frequency (MHz)	Measured Conducted Power (dBm)	Tune Up limit (dBm)	Measured 1g SAR (W/kg)	Scaled 1g SAR (W/kg)	Area scan (Figure number)
Spacing	Position							
10mm	Front Face	56	5280.0	13.97	14.0	**	-	n/a
10mm	Rear Face	56	5280.0	13.97	14.0	0.09	0.09	Figure 63
10mm	Left Edge	56	5280.0	13.97	14.0	0.07	0.07	Figure 64
10mm	Top Edge	56	5280.0	13.97	14.0	0.11	0.11	Figure 65

Limit for General Population (Uncontrolled Exposure) 1.6 W/kg (1g)

KDB 447498 D01 - Testing of other required channels within the operation mode of a frequency band is not required when the reported 1g SAR for mid-band or highest output power channel is:

- ≤ 0.8W/kg when the transmission band is ≤ 100MHz
- ≤ 0.6W/kg when the transmission band is between 100MHz and 200MHz
- ≤ 0.4W/kg when the transmission band is ≥ 200MHz

Testing was carried out with a 10mm separation distance to meet the requirements of KDB 941225 D06

KDB – 648474 D04 - When the reported SAR for body-worn accessory, measured without a headset connected to the handset, is >1.2W/kg, the highest reported SAR configuration for that wireless mode and frequency band is repeated for that body worn accessory with a headset attached to the handset.

KDB 248227 - v01r02 (Rev 1.2) – Testing was carried out on Channel 56 instead of the default test channel as this was the channel with the maximum output power.

*(NUA) Not UKAS Accredited

** No data was recorded for this position due to SAR levels being below the SAR measurement system capability.



WLAN 5560MHz Head Specific Absorption Rate (Maximum SAR) 1g Results for the Sharp SHL24 Dual-band CDMA (800MHz_BC0, 1900MHz_BC6), Quad-band GSM (GSM850/GSM900/DCS1800/PCS1900), WCDMA (FDD I, FDD V), LTE (B01, B03, B11, B18), Dual-band mode cellular phone with Bluetooth, WLAN, SRD(NFC,FeliCa) and GPS enabled. (NUA)*

Test Position	Channel Number	Frequency (MHz)	Measured Conducted Power (dBm)	Tune Up limit (dBm)	Measured 1g SAR (W/kg)	Scaled 1g SAR (W/kg)	Area scan (Figure number)
Left Cheek	112	5560.0	13.07	14.0	0.08	0.10	Figure 66
Left 15°	112	5560.0	13.07	14.0	0.15	0.19	Figure 67
Right Cheek	112	5560.0	13.07	14.0	0.10	0.12	Figure 68
Right 15°	112	5560.0	13.07	14.0	0.15	0.19	Figure 69

Limit for General Population (Uncontrolled Exposure) 1.6 W/kg (1g)
 KDB 447498 D01 - Testing of other required channels within the operation mode of a frequency band is not required when the reported 1g SAR for mid-band or highest output power channel is:
 ≤ 0.8W/kg when the transmission band is ≤ 100MHz
 ≤ 0.6W/kg when the transmission band is between 100MHz and 200MHz
 ≤ 0.4W/kg when the transmission band is ≥ 200MHz
 KDB 248227 - v01r02 (Rev 1.2) – Testing was carried out on Channel 112 instead of the default test channel as this was the channel with the maximum output power.
 *(NUA) Not UKAS Accredited

WLAN 5560MHz Body & Hotspot Configuration Specific Absorption Rate (Maximum SAR) 1g Results for the Sharp SHL24 Dual-band CDMA (800MHz_BC0, 1900MHz_BC6), Quad-band GSM (GSM850/GSM900/DCS1800/PCS1900), WCDMA (FDD I, FDD V), LTE (B01, B03, B11, B18), Dual-band mode cellular phone with Bluetooth, WLAN, SRD(NFC,FeliCa) and GPS enabled. (NUA)*

Position		Channel Number	Frequency (MHz)	Measured Conducted Power (dBm)	Tune Up limit (dBm)	Measured 1g SAR (W/kg)	Scaled 1g SAR (W/kg)	Area scan (Figure number)
Spacing	Position							
10mm	Front Face	112	5560.0	13.07	14.0	0.02	0.02	Figure 70
10mm	Rear Face	112	5560.0	13.07	14.0	0.11	0.14	Figure 71
10mm	Left Edge	112	5560.0	13.07	14.0	0.07	0.09	Figure 72
10mm	Top Edge	112	5560.0	13.07	14.0	0.11	0.14	Figure 73

Limit for General Population (Uncontrolled Exposure) 1.6 W/kg (1g)
 KDB 447498 D01 - Testing of other required channels within the operation mode of a frequency band is not required when the reported 1g SAR for mid-band or highest output power channel is:
 ≤ 0.8W/kg when the transmission band is ≤ 100MHz
 ≤ 0.6W/kg when the transmission band is between 100MHz and 200MHz
 ≤ 0.4W/kg when the transmission band is ≥ 200MHz
 Testing was carried out with a 10mm separation distance to meet the requirements of KDB 941225 D06
 KDB 248227 - v01r02 (Rev 1.2) – Testing was carried out on Channel 112 instead of the default test channel as this was the channel with the maximum output power.
 KDB – 648474 D04 - When the reported SAR for body-worn accessory, measured without a headset connected to the handset, is >1.2W/kg, the highest reported SAR configuration for that wireless mode and frequency band is repeated for that body worn accessory with a headset attached to the handset.
 *(NUA) Not UKAS Accredited



1.3.3 Standalone SAR Estimation

When the standalone SAR test exclusion of section 4.3.1 is applied to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to the following to determine simultaneous transmission SAR test exclusion. The estimated SAR is only used to determine simultaneous transmission SAR test exclusion; When SAR is estimated, it must be applied to determine the sum of 1-g SAR test exclusion. When SAR to peak location separation ratio test exclusion is applied, the highest reported SAR for simultaneous transmission can be an estimated standalone SAR if the estimated SAR is the highest among the simultaneously transmitting antennas (see KDB 690783).

$$\frac{(\text{max. power of channel, including tune-up tolerance, mW})/(\text{min. test separation distance, mm})^x}{[\sqrt{f}(\text{GHz})/7.5]} \text{ W/kg for test separation distances } \leq 50 \text{ mm;}$$

where x = 7.5 for 1-g SAR, and x = 18.75 for 10-g SAR

when the minimum test separation distance is <5mm, a distance of 5mm is applied.

Bluetooth Head SAR Estimation

Frequency	Maximum Power	Distance (mm)	Estimated SAR (W/kg)
2480	2.51	5	0.166

Bluetooth Body SAR Estimation

Frequency	Maximum Power	Distance (mm)	Estimated SAR (W/kg)
2480	2.51	10	0.081



1.3.4 Simultaneous Transmission

GPRS 850 MHz Simultaneous Transmission Analysis

Position	GPRS 850MHz 1g SAR (W/kg) CH 251 (Scaled SAR values)	BT 2.48 GHz 1g SAR (W/kg) (Estimated SAR values)	Σ 1g SAR (W/kg)
Head			
Left Cheek	0.75	0.17	0.92
Left 15°	0.51	0.17	0.68
Right Cheek	0.81	0.17	0.98
Right 15°	0.47	0.17	0.64
Right Cheek	1.01	0.17	1.18
Simultaneous Transmission KDB 447498 D01			

Position	GPRS 850MHz 1g SAR (W/kg) CH 251 (Scaled SAR values)	BT 2.48 GHz 1g SAR (W/kg) (Estimated SAR values)	Σ 1g SAR (W/kg)
Body			
Front Face	0.68	0.081	0.76
Rear Face	0.79	0.081	0.87
Top Edge	n/a	0.081	n/a
Bottom Edge	0.51	0.081	0.59
Left edge	0.48	0.081	0.56
Right Edge	0.54 (CH 189)	0.081	0.62
Simultaneous Transmission KDB 447498 D01 Testing was carried out with a 10mm separation distance to meet the requirements of KDB 941225 D06			

Position	GPRS 850MHz 1g SAR (W/kg) CH 251 (Scaled SAR values)	WLAN 2.4GHz 1g SAR (W/kg) CH 1 (Scaled SAR values)	Σ 1g SAR (W/kg)
Head			
Left Cheek	0.75	0.17	0.92
Left 15°	0.51	0.12	0.63
Right Cheek	0.81	0.16	0.97
Right 15°	0.47	0.20	0.67
Simultaneous Transmission KDB 447498 D01			

Position	GPRS 850MHz 1g SAR (W/kg) CH 189 * (Scaled SAR values)	WLAN 2.4GHz 1g SAR (W/kg) CH 1 (Scaled SAR values)	Σ 1g SAR (W/kg)
Head			
Right Cheek	1.01	0.16	1.17
Simultaneous Transmission KDB 447498 D01 * Testing was carried out on other channels within the band as the SAR for the highest output power channel measured >0.8W/kg			



Position	GPRS 850MHz 1g SAR (W/kg) CH 251 (Scaled SAR values)	WLAN 2.4GHz 1g SAR (W/kg) CH 1 (Scaled SAR values)	Σ 1g SAR (W/kg)
Body			
Front Face	0.68	0.06	0.74
Rear Face	0.79	0.29	1.08
Top Edge	n/a	0.07	n/a
Bottom Edge	0.51	n/a	n/a
Left edge	0.48	0.15	0.63
Right Edge	0.54	n/a	n/a
Simultaneous Transmission KDB 447498 D01 Testing was carried out with a 10mm separation distance to meet the requirements of KDB 941225 D06			

Position	GPRS 850MHz 1g SAR (W/kg) CH 251 (Scaled SAR values)	WLAN 5.22GHz 1g SAR (W/kg) CH 44 (Scaled SAR values)	Σ 1g SAR (W/kg)
Head			
Left Cheek	0.75	0.14	0.89
Left 15°	0.51	0.17	0.68
Right Cheek	0.81	0.07	0.88
Right 15°	0.47	0.16	0.63
Simultaneous Transmission KDB 447498 D01			

Position	GPRS 850MHz 1g SAR (W/kg) CH 189 * (Scaled SAR values)	WLAN 5.22GHz 1g SAR (W/kg) CH 44 (Scaled SAR values)	Σ 1g SAR (W/kg)
Head			
Right Cheek	1.01	0.07	1.08
Simultaneous Transmission KDB 447498 D01 * Testing was carried out on other channels within the band as the SAR for the highest output power channel measured >0.8W/kg			

Position	GPRS 850MHz 1g SAR (W/kg) CH 251 (Scaled SAR values)	WLAN 5.22GHz 1g SAR (W/kg) CH 44 (Scaled SAR values)	Σ 1g SAR (W/kg)
Body			
Front Face	0.68	0.00	0.68
Rear Face	0.79	0.09	0.88
Top Edge	n/a	0.05	n/a
Bottom Edge	0.51	n/a	n/a
Left edge	0.48	0.06	0.54
Right Edge	0.54	n/a	n/a
Simultaneous Transmission KDB 447498 D01 Testing was carried out with a 10mm separation distance to meet the requirements of KDB 941225 D06			



Position	GPRS 850MHz 1g SAR (W/kg) CH 251 (Scaled SAR values)	WLAN 5.28GHz 1g SAR (W/kg) CH 56 (Scaled SAR values)	Σ 1g SAR (W/kg)
Head			
Left Cheek	0.75	0.14	0.89
Left 15°	0.51	0.14	0.65
Right Cheek	0.81	0.13	0.94
Right 15°	0.47	0.12	0.59
Simultaneous Transmission KDB 447498 D01			

Position	GPRS 850MHz 1g SAR (W/kg) CH 189 * (Scaled SAR values)	WLAN 5.28GHz 1g SAR (W/kg) CH 56 (Scaled SAR values)	Σ 1g SAR (W/kg)
Head			
Right Cheek	1.01	0.13	1.14
Simultaneous Transmission KDB 447498 D01 * Testing was carried out on other channels within the band as the SAR for the highest output power channel measured >0.8W/kg			

Position	GPRS 850MHz 1g SAR (W/kg) CH 251 (Scaled SAR values)	WLAN 5.28GHz 1g SAR (W/kg) CH 56 (Scaled SAR values)	Σ 1g SAR (W/kg)
Body			
Front Face	0.68	0.00	0.68
Rear Face	0.79	0.09	0.88
Top Edge	n/a	0.11	n/a
Bottom Edge	0.51	n/a	n/a
Left edge	0.48	0.07	0.55
Right Edge	0.54	n/a	n/a
Simultaneous Transmission KDB 447498 D01 Testing was carried out with a 10mm separation distance to meet the requirements of KDB 941225 D06			

Position	GPRS 850MHz 1g SAR (W/kg) CH 251 (Scaled SAR values)	WLAN 5.56GHz 1g SAR (W/kg) CH 112 (Scaled SAR values)	Σ 1g SAR (W/kg)
Head			
Left Cheek	0.75	0.10	0.85
Left 15°	0.51	0.19	0.7
Right Cheek	0.81	0.12	0.93
Right 15°	0.47	0.19	0.66
Simultaneous Transmission KDB 447498 D01			



Position	GPRS 850MHz 1g SAR (W/kg) CH 189 * (Scaled SAR values)	WLAN 5.56GHz 1g SAR (W/kg) CH 112 (Scaled SAR values)	Σ 1g SAR (W/kg)
Head			
Right Cheek	1.01	0.12	1.13
Simultaneous Transmission KDB 447498 D01 * Testing was carried out on other channels within the band as the SAR for the highest output power channel measured >0.8W/kg			

Position	GPRS 850MHz 1g SAR (W/kg) CH 251 (Scaled SAR values)	WLAN 5.56GHz 1g SAR (W/kg) CH 112 (Scaled SAR values)	Σ 1g SAR (W/kg)
Body			
Front Face	0.68	0.02	0.7
Rear Face	0.79	0.14	0.93
Top Edge	n/a	0.14	n/a
Bottom Edge	0.51	n/a	n/a
Left edge	0.48	0.09	0.57
Right Edge	0.54	n/a	n/a
Simultaneous Transmission KDB 447498 D01 Testing was carried out with a 10mm separation distance to meet the requirements of KDB 941225 D06			

Simultaneous SAR measurements were not required as the sum of the 1g SAR measurements did not exceed 1.6 W/kg.



WCDMA FDD V Simultaneous Transmission Analysis

Position	WCDMA FDD V 1g SAR (W/kg) CH 4232 (Scaled SAR values)	BT 2.48 GHz 1g SAR (W/kg) (Estimated SAR values)	Σ 1g SAR (W/kg)
Head			
Left Cheek	0.59	0.17	0.76
Left 15°	0.39	0.17	0.56
Right Cheek	0.72	0.17	0.89
Right 15°	0.49	0.17	0.66
Simultaneous Transmission KDB 447498 D01			

Position	WCDMA FDD V 1g SAR (W/kg) CH 4232 (Scaled SAR values)	BT 2.48 GHz 1g SAR (W/kg) (Estimated SAR values)	Σ 1g SAR (W/kg)
Body			
Front Face	0.66	0.081	0.74
Rear Face	0.87	0.081	0.95
Top Edge	n/a	0.081	n/a
Bottom Edge	0.13	0.081	0.21
Left edge	0.53	0.081	0.61
Right Edge	0.51	0.081	0.59
Rear Face	0.91 (CH 4133)	0.081	0.99
Simultaneous Transmission KDB 447498 D01 Testing was carried out with a 10mm separation distance to meet the requirements of KDB 941225 D06			

Position	WCDMA FDD V 1g SAR (W/kg) CH 4232 (Scaled SAR values)	WLAN 2.4GHz 1g SAR (W/kg) CH 1 (Scaled SAR values)	Σ 1g SAR (W/kg)
Head			
Left Cheek	0.59	0.17	0.76
Left 15°	0.39	0.12	0.51
Right Cheek	0.72	0.16	0.88
Right 15°	0.49	0.20	0.69
Simultaneous Transmission KDB 447498 D01			



Position	WCDMA FDD V 1g SAR (W/kg) CH 4232 (Scaled SAR values)	WLAN 2.4GHz 1g SAR (W/kg) CH 1 (Scaled SAR values)	Σ 1g SAR (W/kg)
Body			
Front Face	0.66	0.06	0.72
Rear Face	0.87	0.29	1.16
Top Edge	n/a	0.07	n/a
Bottom Edge	0.13	n/a	n/a
Left edge	0.53	0.15	0.68
Right Edge	0.51	n/a	n/a
Simultaneous Transmission KDB 447498 D01 Testing was carried out with a 10mm separation distance to meet the requirements of KDB 941225 D06			

Position	WCDMA FDD V 1g SAR (W/kg) CH 4133 * (Scaled SAR values)	WLAN 2.4GHz 1g SAR (W/kg) CH 1 (Scaled SAR values)	Σ 1g SAR (W/kg)
Body			
Rear Face	0.91	0.29	1.2
Simultaneous Transmission KDB 447498 D01 Testing was carried out with a 10mm separation distance to meet the requirements of KDB 941225 D06 * Testing was carried out on other channels within the band as the SAR for the highest output power channel measured >0.8W/kg			

Position	WCDMA FDD V 1g SAR (W/kg) CH 4232 (Scaled SAR values)	WLAN 5.22GHz 1g SAR (W/kg) CH 44 (Scaled SAR values)	Σ 1g SAR (W/kg)
Head			
Left Cheek	0.59	0.14	0.73
Left 15°	0.39	0.17	0.56
Right Cheek	0.72	0.07	0.79
Right 15°	0.49	0.16	0.65
Simultaneous Transmission KDB 447498 D01			

Position	WCDMA FDD V 1g SAR (W/kg) CH 4232 (Scaled SAR values)	WLAN 5.22GHz 1g SAR (W/kg) CH 44 (Scaled SAR values)	Σ 1g SAR (W/kg)
Body			
Front Face	0.66	0.00	0.66
Rear Face	0.87	0.09	0.96
Top Edge	n/a	0.05	0.05
Bottom Edge	0.13	n/a	0.13
Left edge	0.53	0.06	0.59
Right Edge	0.51	n/a	0.51
Simultaneous Transmission KDB 447498 D01 Testing was carried out with a 10mm separation distance to meet the requirements of KDB 941225 D06			



Position	WCDMA FDD V 1g SAR (W/kg) CH 4133 * (Scaled SAR values)	WLAN 5.22GHz 1g SAR (W/kg) CH 44 (Scaled SAR values)	Σ 1g SAR (W/kg)
Body			
Rear Face	0.91	0.09	1.00
Simultaneous Transmission KDB 447498 D01 Testing was carried out with a 10mm separation distance to meet the requirements of KDB 941225 D06 * Testing was carried out on other channels within the band as the SAR for the highest output power channel measured >0.8W/kg			

Position	WCDMA FDD V 1g SAR (W/kg) CH 4232 (Scaled SAR values)	WLAN 5.28GHz 1g SAR (W/kg) CH 56 (Scaled SAR values)	Σ 1g SAR (W/kg)
Head			
Left Cheek	0.59	0.14	0.73
Left 15°	0.39	0.14	0.53
Right Cheek	0.72	0.13	0.85
Right 15°	0.49	0.12	0.61
Simultaneous Transmission KDB 447498 D01			

Position	WCDMA FDD V 1g SAR (W/kg) CH 4232 (Scaled SAR values)	WLAN 5.28GHz 1g SAR (W/kg) CH 56 (Scaled SAR values)	Σ 1g SAR (W/kg)
Body			
Front Face	0.66	0.00	0.66
Rear Face	0.87	0.09	0.96
Top Edge	n/a	0.11	n/a
Bottom Edge	0.13	n/a	n/a
Left edge	0.53	0.07	0.6
Right Edge	0.51	n/a	n/a
Simultaneous Transmission KDB 447498 D01 Testing was carried out with a 10mm separation distance to meet the requirements of KDB 941225 D06			

Position	WCDMA FDD V 1g SAR (W/kg) CH 4133 * (Scaled SAR values)	WLAN 5.28GHz 1g SAR (W/kg) CH 56 (Scaled SAR values)	Σ 1g SAR (W/kg)
Body			
Rear Face	0.91	0.09	1.0
Simultaneous Transmission KDB 447498 D01 Testing was carried out with a 10mm separation distance to meet the requirements of KDB 941225 D06 * Testing was carried out on other channels within the band as the SAR for the highest output power channel measured >0.8W/kg			



Position	WCDMA FDD V 1g SAR (W/kg) CH 4232 (Scaled SAR values)	WLAN 5.56GHz 1g SAR (W/kg) CH 112 (Scaled SAR values)	Σ 1g SAR (W/kg)
Head			
Left Cheek	0.59	0.10	0.69
Left 15°	0.39	0.19	0.58
Right Cheek	0.72	0.12	0.84
Right 15°	0.49	0.19	0.68
Simultaneous Transmission KDB 447498 D01			

Position	WCDMA FDD V 1g SAR (W/kg) CH 4232 (Scaled SAR values)	WLAN 5.56GHz 1g SAR (W/kg) CH 112 (Scaled SAR values)	Σ 1g SAR (W/kg)
Body			
Front Face	0.66	0.02	0.68
Rear Face	0.87	0.14	1.01
Top Edge	n/a	0.14	0.14
Bottom Edge	0.13	n/a	0.13
Left edge	0.53	0.09	0.62
Right Edge	0.51	n/a	0.51
Simultaneous Transmission KDB 447498 D01 Testing was carried out with a 10mm separation distance to meet the requirements of KDB 941225 D06			

Position	WCDMA FDD V 1g SAR (W/kg) CH 4133 * (Scaled SAR values)	WLAN 5.56GHz 1g SAR (W/kg) CH 112 (Scaled SAR values)	Σ 1g SAR (W/kg)
Body			
Rear Face	0.91	0.14	1.05
Simultaneous Transmission KDB 447498 D01 Testing was carried out with a 10mm separation distance to meet the requirements of KDB 941225 D06 * Testing was carried out on other channels within the band as the SAR for the highest output power channel measured >0.8W/kg			

Simultaneous SAR measurements were not required as the sum of the 1g SAR measurements did not exceed 1.6 W/kg.



GPRS 1900 MHz Simultaneous Transmission Analysis

Position	GPRS 1900MHz 1g SAR (W/kg) CH 512 (Scaled SAR values)	BT 2.48 GHz 1g SAR (W/kg) (Estimated SAR values)	Σ 1g SAR (W/kg)
Head			
Left Cheek	0.48	0.17	0.65
Left 15°	0.17	0.17	0.34
Right Cheek	0.32	0.17	0.49
Right 15°	0.14	0.17	0.31
Simultaneous Transmission KDB 447498 D01			

Position	GPRS 1900MHz 1g SAR (W/kg) CH 512 (Scaled SAR values)	BT 2.48 GHz 1g SAR (W/kg) (Estimated SAR values)	Σ 1g SAR (W/kg)
Body			
Front Face	0.45	0.081	0.53
Rear Face	0.54	0.081	0.62
Top Edge	n/a	0.081	n/a
Bottom Edge	0.71	0.081	0.79
Left edge	n/a	0.081	n/a
Right Edge	0.09	0.081	0.17
Simultaneous Transmission KDB 447498 D01 Testing was carried out with a 10mm separation distance to meet the requirements of KDB 941225 D06			

Position	GPRS 1900MHz 1g SAR (W/kg) CH 512 (Scaled SAR values)	WLAN 2.4GHz 1g SAR (W/kg) CH 1 (Scaled SAR values)	Σ 1g SAR (W/kg)
Head			
Left Cheek	0.48	0.17	0.65
Left 15°	0.17	0.12	0.29
Right Cheek	0.32	0.16	0.48
Right 15°	0.14	0.20	0.34
Simultaneous Transmission KDB 447498 D01			

Position	GPRS 1900MHz 1g SAR (W/kg) CH 512 (Scaled SAR values)	WLAN 2.4GHz 1g SAR (W/kg) CH 1 (Scaled SAR values)	Σ 1g SAR (W/kg)
Body			
Front Face	0.45	0.06	0.51
Rear Face	0.54	0.29	0.83
Top Edge	n/a	0.07	n/a
Bottom Edge	0.71	n/a	n/a
Left edge	n/a	0.15	n/a
Right Edge	0.09	n/a	n/a
Simultaneous Transmission KDB 447498 D01 Testing was carried out with a 10mm separation distance to meet the requirements of KDB 941225 D06			



Position	GPRS 1900MHz 1g SAR (W/kg) CH 512 (Scaled SAR values)	WLAN 5.2GHz 1g SAR (W/kg) CH 44 (Scaled SAR values)	Σ 1g SAR (W/kg)
Head			
Left Cheek	0.48	0.14	0.62
Left 15°	0.17	0.17	0.34
Right Cheek	0.32	0.07	0.39
Right 15°	0.14	0.16	0.30
Simultaneous Transmission KDB 447498 D01			

Position	GPRS 1900MHz 1g SAR (W/kg) CH 512 (Scaled SAR values)	WLAN 5.2GHz 1g SAR (W/kg) CH 44 (Scaled SAR values)	Σ 1g SAR (W/kg)
Body			
Front Face	0.45	0.00	0.45
Rear Face	0.54	0.09	0.63
Top Edge	n/a	0.05	n/a
Bottom Edge	0.71	n/a	n/a
Left edge	n/a	0.06	n/a
Right Edge	0.09	n/a	n/a
Simultaneous Transmission KDB 447498 D01 Testing was carried out with a 10mm separation distance to meet the requirements of KDB 941225 D06			

Position	GPRS 1900MHz 1g SAR (W/kg) CH 512 (Scaled SAR values)	WLAN 5.28GHz 1g SAR (W/kg) CH 56 (Scaled SAR values)	Σ 1g SAR (W/kg)
Head			
Left Cheek	0.48	0.14	0.62
Left 15°	0.17	0.14	0.31
Right Cheek	0.32	0.13	0.45
Right 15°	0.14	0.12	0.26
Simultaneous Transmission KDB 447498 D01			

Position	GPRS 1900MHz 1g SAR (W/kg) CH 512 (Scaled SAR values)	WLAN 5.28GHz 1g SAR (W/kg) CH 56 (Scaled SAR values)	Σ 1g SAR (W/kg)
Body			
Front Face	0.45	0.00	0.45
Rear Face	0.54	0.09	0.63
Top Edge	n/a	0.11	0.11
Bottom Edge	0.71	n/a	0.71
Left edge	n/a	0.07	0.07
Right Edge	0.09	n/a	0.09
Simultaneous Transmission KDB 447498 D01 Testing was carried out with a 10mm separation distance to meet the requirements of KDB 941225 D06			



Position	GPRS 1900MHz 1g SAR (W/kg) CH 512 (Scaled SAR values)	WLAN 5.56GHz 1g SAR (W/kg) CH 112 (Scaled SAR values)	Σ 1g SAR (W/kg)
Head			
Left Cheek	0.48	0.10	0.58
Left 15°	0.17	0.19	0.36
Right Cheek	0.32	0.12	0.44
Right 15°	0.14	0.19	0.33
Simultaneous Transmission KDB 447498 D01			

Position	GPRS 1900MHz 1g SAR (W/kg) CH 512 (Scaled SAR values)	WLAN 5.56GHz 1g SAR (W/kg) CH 112 (Scaled SAR values)	Σ 1g SAR (W/kg)
Body			
Front Face	0.45	0.02	0.47
Rear Face	0.54	0.14	0.68
Top Edge	n/a	0.14	0.14
Bottom Edge	0.71	n/a	0.71
Left edge	n/a	0.09	0.09
Right Edge	0.09	n/a	0.09
Simultaneous Transmission KDB 447498 D01 Testing was carried out with a 10mm separation distance to meet the requirements of KDB 941225 D06			

Simultaneous SAR measurements were not required as the sum of the 1g SAR measurements did not exceed 1.6 W/kg.



1.4 PRODUCT INFORMATION

1.4.1 Technical Description

The equipment under test (EUT) was a Sharp SHL24 Dual-band CDMA (800MHz_BC0, 1900MHz_BC6), Quad-band GSM (GSM850/GSM900/DCS1800/PCS1900), WCDMA (FDD I, FDD V), LTE (B01, B03, B11, B18), Dual-band mode cellular phone with Bluetooth, WLAN, SRD(NFC,FeliCa) and GPS enabled. A full technical description can be found in the manufacturer's documentation.

1.4.2 Test Configuration and Modes of Operation

The testing was performed with an integral battery supplied and manufactured by Sharp Corporation. The battery was fully charged before each measurement and there were no external connections.

For head SAR assessment, testing was performed with the device in the declared normal position of operation for GSM 850MHz, PCS 1900MHz, WCDMA FDD V, WLAN 2.4GHz and WLAN 5GHz frequency bands at maximum power. The device was placed against a Specific Anthropomorphic Mannequin (SAM) phantom. The phantom was filled with simulant liquid appropriate to the frequency band. The dielectric properties were measured and found to be in accordance with the requirements for the dielectric properties specified KDB 865665. Testing was performed at both the left and right ear of the phantom at both handset positions stated in the applied specification.

For body SAR assessment, testing was performed for GSM 850MHz, PCS 1900MHz, WCDMA FDD V, WLAN 2.4GHz and WLAN 5GHz frequency bands at maximum power. The device was placed at a distance of 10 mm from the bottom of the flat phantom for all body testing. The Flat Phantom dimensions were 245mm x 195mm x 200mm with a sidewall thickness of 2.00mm. The phantom was filled to a minimum depth of 150mm with the appropriate Body simulant liquid. The dielectric properties were in accordance with the requirements specified in KDB 865665. As the device is capable of hotspot configuration a 10mm separation distance was used to meet the requirements of KDB 941225 D06 Hotspot.

Testing was performed in each position at the frequency that gave the highest output power for each band. Some SAR levels were found to be > 0.80 W/kg (KDB 447498 D01) therefore additional testing was required at the relevant frequencies / channels of the bands. WLAN testing was achieved using the devices internal software, customer supplied software and settings supplied by the customer. The worse case data rate for WLAN testing was obtained from data provided by TUV. The worst case was deemed as the data rate which produced the highest level of conducted average power. For 2.4GHz WLAN this was 1Mbps for 802.11b. For 5GHz WLAN this was 6Mbps for 802.11a.

SAR testing for 802.11g/n and 802.11n/ac channels was not required to be carried out based on the measured maximum average output power being less than $\frac{1}{4}$ dB higher than that measured on the corresponding 802.11b and 802.11a channels respectively.

SAR testing for UMTS band V is measured using the 12.2 kbps RMC with the TPC bits configured to all 1's. SAR for other spreading codes and multiple DPDCHn was not required to be carried out based on the measured maximum average output power of each RF channel for each spreading code and DPDCHn configuration being less than $\frac{1}{4}$ dB higher than those measured in 12.2 kbps RMC. SAR testing for HSDPA and HSUPA was not required to be carried out based on the measured maximum average output of each RF channel with HSDPA/HSUPA active being less than $\frac{1}{4}$ dB higher than that measured without HSDPA using 12.2 kbps RMC.



Product Service

Included in this report are descriptions of the test method; the equipment used and an analysis of the test uncertainties applicable and diagrams indicating the locations of maximum SAR for each test position along with photographs indicating the positioning of the handset against the body as appropriate.



1.5 FCC POWER MEASUREMENTS

1.5.1 Method

Conducted power measurements were made using a power meter.

1.5.2 Conducted Power Measurements

GSM 850

Modulation	Frequency (MHz)	Conducted Carrier Power (dBm)	
		Peak	Average
GMSK - Voice	824.2	32.37	32.18
	836.4	32.62	32.43
	848.8	32.56	32.37
GMSK - GPRS	824.2	26.63	26.48
	836.4	26.67	26.63
	848.8	26.87	26.70

PCS 1900

Modulation	Frequency (MHz)	Conducted Carrier Power (dBm)	
		Peak	Average
GMSK - Voice	1850.2	29.22	29.03
	1880.0	29.08	28.93
	1909.8	28.86	28.72
GMSK - GPRS	1850.2	23.61	23.29
	1880.0	23.17	23.05
	1909.8	23.34	22.99

**WCDMA FDD V**

Modulation	Frequency (MHz)	Conducted Carrier Power (dBm)	
		Peak	Average
WCDMA - 12.2kbps RMC	826.6	26.51	22.85
	835.0	26.96	22.94
	846.4	26.77	23.01
WCDMA - 12.2kbps AMR with 3.4kbps SRB	826.6	26.55	22.87
	835.0	26.77	22.92
	846.4	26.73	22.97
WCDMA - HSDPA (Subtest #1)	826.6	25.44	21.73
	835.0	25.69	21.77
	846.4	25.91	21.97
WCDMA - HSDPA (Subtest #2)	826.6	27.07	21.32
	835.0	26.88	21.29
	846.4	27.22	21.40
WCDMA - HSDPA (Subtest #3)	826.6	26.83	20.77
	835.0	26.65	20.74
	846.4	26.90	20.82
WCDMA - HSDPA (Subtest #4)	826.6	26.55	20.43
	835.0	26.60	20.46
	846.4	26.91	20.66
WCDMA - HSUPA (Subtest #1)	826.6	27.24	21.42
	835.0	27.07	21.50
	846.4	27.28	21.58
WCDMA - HSUPA (Subtest #2)	826.6	26.96	20.28
	835.0	27.07	20.29
	846.4	27.57	20.48
WCDMA - 12.2kbps RMC WCDMA - HSUPA (Subtest #3)	826.6	27.04	21.49
	835.0	26.63	21.49
	846.4	26.91	21.60
WCDMA - HSUPA (Subtest #4)	826.6	25.52	21.78
	835.0	25.75	21.84
	846.4	26.29	21.95
WCDMA - HSUPA (Subtest #5)	826.6	27.01	21.30
	835.0	26.95	21.36
	846.4	26.94	21.37



WLAN

Modulation	Frequency (MHz)	Conducted Carrier Power (dBm)	
		Peak	Average
802.11(b) - 2.4 GHz – 1 Mbps	2412	17.96	15.01
	2437	17.91	14.85
	2462	17.64	14.59
802.11(g) - 2.4 GHz - 54 Mbps	2412	21.01	11.22
	2437	21.68	11.71
	2462	21.33	11.46
802.11 (n) - 2.4 GHz – 6.5Mbps	2412	21.26	11.56
	2437	21.30	11.80
	2462	20.72	11.29
802.11a - 5GHz - 6Mbps	5180	24.37	13.54
	5200	24.09	13.47
	5220	24.90	13.99
	5240	24.42	13.75
	5260	24.45	13.69
	5280	25.07	13.97
	5300	24.11	13.15
	5320	24.34	13.25
802.11a - 5GHz - 6Mbps	5500	23.43	12.54
	5520	23.45	12.76
	5540	23.56	12.82
	5560	23.85	13.07
	5580	24.03	13.01
	5600	23.41	12.45
	5620	23.62	12.67
	5640	23.72	12.81
	5660	23.66	12.72
	5680	23.44	12.73
	5700	23.17	12.36



Modulation	Frequency (MHz)	Conducted Carrier Power (dBm)	
		Peak	Average
802.11n20 - 5GHz – MCS0	5180	23.32	12.45
	5200	23.67	12.47
	5220	23.15	12.45
	5240	23.45	12.43
	5260	23.39	12.19
	5280	23.15	12.22
	5300	23.03	12.21
	5320	23.31	12.19
	5500	22.71	11.44
	5520	22.91	11.97
	5540	22.45	11.87
	5560	22.93	11.94
	5580	23.15	12.05
	5600	22.43	11.56
	5620	22.67	11.56
	5640	22.43	11.92
	5660	22.37	11.63
	5680	23.04	12.24
5700	22.03	11.43	
802.11n40 - 5GHz – MCS1	5190	23.75	12.16
	5230	23.60	12.42
	5270	23.32	12.19
	5310	23.42	12.06
	5510	23.14	11.67
	5550	23.16	11.76
	5590	22.94	11.68
	5630	23.10	11.79
	5670	22.80	11.77



Modulation	Frequency (MHz)	Conducted Carrier Power (dBm)	
		Peak	Average
802.11ac 20 - 5GHz – MCS2	5180	21.55	11.83
	5200	21.96	12.31
	5220	22.76	12.38
	5240	21.97	12.21
	5260	21.89	12.06
	5280	21.76	11.98
	5300	22.37	12.61
	5320	22.19	12.29
	5500	21.18	11.34
	5520	21.52	11.75
	5540	21.76	12.20
	5560	21.72	11.86
	5580	21.39	11.77
	5600	21.27	11.47
	5620	21.33	11.53
	5640	21.49	11.79
	5660	21.91	11.65
5680	21.51	11.76	
5700	20.83	11.30	
802.11ac 40 - 5GHz – MCS0	5190	22.39	12.01
	5230	22.66	12.32
	5270	22.71	12.25
	5310	22.20	12.01
	5510	21.86	11.48
	5550	22.38	12.07
	5590	22.06	11.70
	5630	22.37	11.93
	5670	22.08	11.86
802.11ac 80 - 5GHz – MCS0	5210	23.30	12.15
	5290	23.22	12.23
	5530	22.80	11.86



Bluetooth

Modulation	Frequency (MHz)	Conducted Carrier Power (dBm)	
		Peak	Average
DH5	2402	0.72	-1.8
	2441	0.07	-2.72
	2480	0.28	-2.25

1.5.3 Standalone SAR Test Exclusion Considerations (KDB 447498 D01)

The 1g SAR Test exclusion thresholds for 100 MHz to 6 GHz *test separation distances* ≤ 50 mm are determined by:

$$[(\text{max power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] / \sqrt{f (\text{GHz})} \leq 3.0, \text{ where}$$

- f (GHz) is the RF channel transmit frequency in GHz.
- Power and distance are rounded to the nearest mW and mm before calculation.
- The result is rounded to one decimal place for comparison.
- When the maximum test separation distance is < 5 mm, a distance of 5 mm is applied.

Band	Frequency (MHz)	Max Power		Test Position	Distance (mm)	Threshold	Test Exclusion
		(dBm)	(mW)				
GSM 850MHz	836.4	33.5	2238.72	Head	< 5	409.5	No
GPRS 850MHz	848.8	28.1	645.65	Head	< 5	119.0	No
GPRS 850MHz	848.8	28.1	645.65	Body	10	59.5	No
FDD V	846.4	24.2	263.03	Head	< 5	48.8	No
				Body	10	24.2	No
GSM 1900 GPRS 1900MHz GPRS 1900MHz	1850.2	30.5	1122.02	Head	< 5	305.2	No
		24.9	309.03	Head	< 5	84.1	No
		24.9	309.03	Body	10	42.0	No
WLAN 2.4 GHz	2412.0	15.5	35.48	Head	< 5	11.0	No
				Body	10	5.5	No
WLAN 5GHz	5220.0	14	25.12	Head	< 5	11.5	No
				Body	10	5.7	No
WLAN 5GHz	5280.0	14	25.12	Head	< 5	11.5	No
				Body	10	5.8	No
WLAN 5GHz	5560.0	14	25.12	Head	< 5	11.8	No
				Body	10	5.9	No
Bluetooth	2402.0	-1.8	0.66	Head	< 5	0.2	Yes
				Body	10	0.1	Yes



SECTION 2

TEST DETAILS

Specific Absorption Rate Testing of the
Sharp SHL24 Dual-band CDMA (800MHz_BC0, 1900MHz_BC6), Quad-band GSM
(GSM850/GSM900/DCS1800/PCS1900), WCDMA (FDD I, FDD V), LTE (B01, B03, B11, B18), Dual-
band mode cellular phone with Bluetooth, WLAN, SRD(NFC,FeliCa) and GPS enabled

2.1 SARA-C SAR MEASUREMENT SYSTEM

2.1.1 Robot System Specification

The SAR measurement system being used is the IndexSAR SARA-C system, which consists of a cartesian 6-axis robot jig, a dedicated robot controller, a straight IndexSAR probe, an L-shaped IndexSAR probe, a fast amplifier, and two phantoms: an upside-down SAM phantom, and a rectangular box phantom,

Figure 1. The L-probe is used in connection with measurements on DUTs held against the SAM phantom, while the straight probe is used exclusively in the box phantom. The robot is used to articulate the probe to programmed positions inside the phantom head to obtain SAR readings from the DUT.

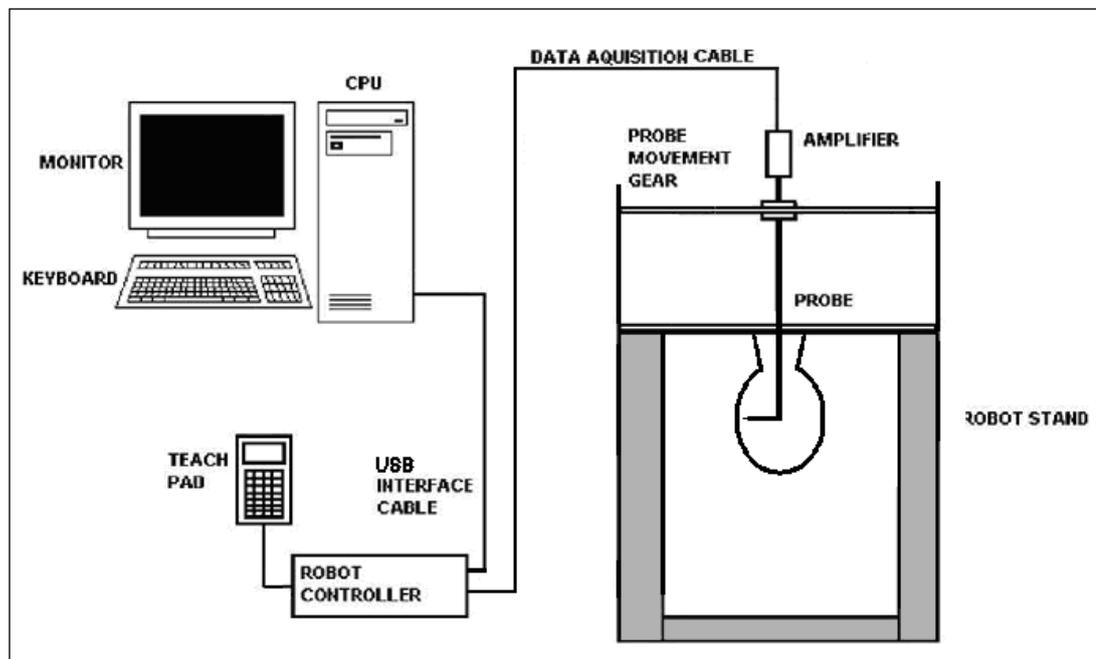


Figure 1 Schematic diagram of the SARA-C measurement system showing the L-probe and upside-down SAM phantom

The system is controlled remotely from a PC, which contains the software to drive the robot and data acquisition equipment. The software also displays the data obtained from test scans.

The position and digitised shape of the phantom heads are made available to the software for accurate positioning of the probe and reduction of set-up time. The SAM phantom heads are individually digitised using a Mitutoyo CMM machine to a precision of 0.001mm. The data is then converted into a shape format for the software, providing an accurate description of the phantom shell. Even with this accuracy, registration errors and deformation of the phantom when filled with 7 litres of fluid, can lead to probe placement errors of 1mm or more. For this reason, the L-probes house a 2-axis strain gauge unit, which allow the actual phantom wall position to be sensed to an accuracy of 0.3mm during probe movements.

In operation, the system first does an area (2D) scan within the liquid following the curve of the phantom wall at a fixed distance. When the maximum SAR point has been found, the system will then carry out a 3D scan centred at that point to determine volume averaged SAR level.



2.1.2 Probe and Amplifier Specification

IndexSAR isotropic immersible straight SAR probes

Straight probes are constructed using three orthogonal dipole sensors arranged on an interlocking, triangular prism core. The probes have built-in shielding against static charges and are contained within a PEEK cylindrical enclosure material at the tip. The tips come in either 5mm (typically for use up to 3GHz) or 2.5mm (above 3GHz) versions, model types IXP-050 and IXP-025 respectively.

Straight probes are calibrated by NPL in the UK.

Straight probes are used exclusively in the box phantom, to measure SAR from DUTs placed against the phantom base. In SARA2, straight probes were also used in the SAM phantom, but this is forbidden in SARA-C, where L-probes are demanded. NB the reverse is not true: L-probes can be used in the box phantom.

IndexSAR L-probes

The L-shaped probe is so designed to ensure the probe tip can remain perpendicular to the SAM phantom wall during scans. To allow for greater probe articulation freedom, the SAM phantom head has been turned upside down and the probe is inserted through the throat aperture, rather than through a small hole at the top of the head in the old SARA2 SAR measurement system.

Like the straight probes, L-probes also come in the same two tip sizes: IXP-020 (5mm) and IXP-021 (2.5mm).

L-probes are calibrated to national standards in-house by IndexSAR.

L-probes can be used either in the SAM head, or against the side wall of the box phantom.

IFA-020 Fast Amplifier

A block diagram of the fast probe amplifier electronics is shown below.

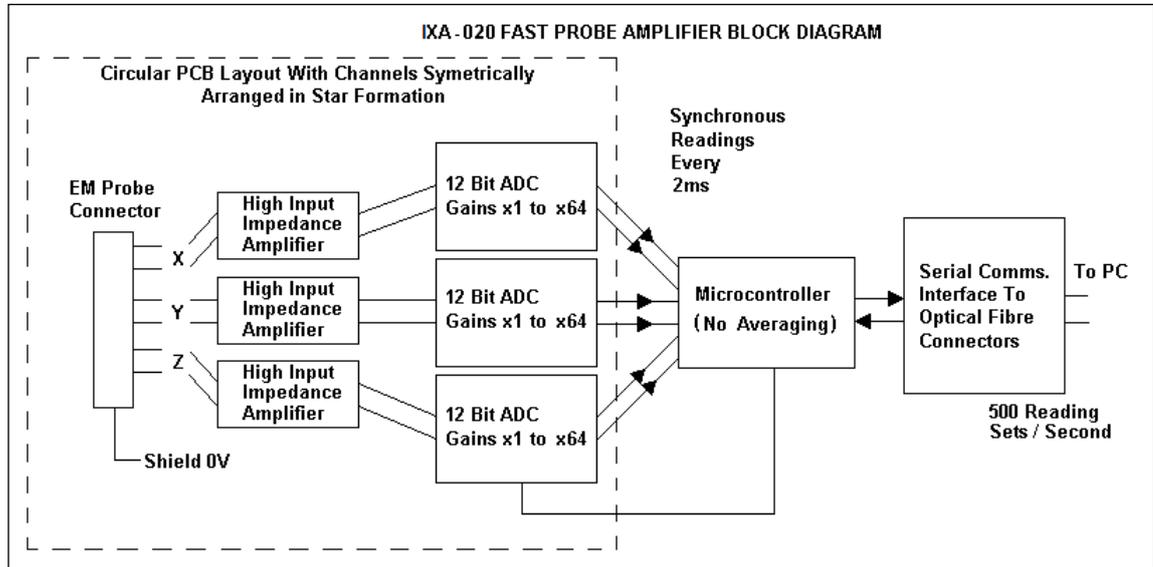


Figure 2 Schematic diagram of the fast amplifier

This amplifier has a time constant of approx. $50\mu\text{s}$, which is much faster than the SAR probe response time. The overall system time constant is therefore that of the probe ($<1\text{ms}$) and a reading containing data for all three channels is returned to the PC every 2ms. The conversion period is approx. $1\mu\text{s}$ at the start of each 2ms period. This enables the probe to follow pulse modulated signals of periods $\gg 2\text{ms}$. The PC software applies the linearisation procedure separately to each reading, so no linearisation corrections for the averaging of modulated signals are needed in this case.

The fast amplifier sampling rate can be adjusted via the SARA-C user interface from 1.7ms to 2.3ms. When not measuring CW signals, it is important to ensure that this probe reading rate and the modulated signal's pulse repetition rate are not unintentionally synchronised since this can lead to aliasing and a gross reduction in accuracy. For GSM signals, the default amplifier sampling rate of 2ms is entirely satisfactory, whereas changing it to 2.3ms (almost exactly half the GSM frame rate) could mean GSM bursts are always missed.

When aggregating 2ms samples to reduce the stochastic noise, it is equally important to match the number of samples with the longer-term timing structure of the modulation scheme. Taking GSM as an example again, since 120ms is the precise length of a GSM traffic channel multiframe, best practice would dictate that aggregated samples should cover exact multiples of this timescale. In this case, setting the number of samples to be aggregated to 120 (2 multiframes), or 240 samples (4 multiframes) should be ideal. Other signalling protocols would require changing these numbers as appropriate.



Phantoms

The Flat phantom used is a rectangular Perspex Box IndexSAR item IXB-2HF, dimensions 240 x 190 x 195mm (w x d x h). The base and one side wall are made of FR4 material which has specific dielectric properties and a tightly-controlled thickness. The base is used in tandem with straight probes, measuring either a DUT or a validation dipole, while the side wall is for performing validations with the L-probe. It is also feasible to perform measurements on body-worn devices with the L-probe against the side window, but only if the L-probe is suitably calibrated (ie if the measurement standard demands body and head fluids have the same dielectric properties).

The Specific Anthropomorphic Mannequin (SAM) Upright Phantom is fabricated using moulds generated from the CAD files as specified by CENELEC EN 62209-1: 2006.

2.1.3 SAR Measurement Procedure

Detailed measurement procedures for SARA-C are set out in a separate IndexSAR technical document ("SARA-C Operational Procedures")

A test set and dipole antenna control the handset via an air link and a low-mass phone holder can position the phone at either ear. Graduated scales are provided to set the phone in the 15 degree position. The upright phantom head holds approx. 7 litres of simulant liquid. The phantom is filled and emptied through the 110mm diameter penetration hole in the neck.

An area scan is performed inside the head at a fixed distance of 5mm from the curved surface on the source side. An algorithm presents the user with the location of any local hotspots and allows one to be selected for a follow-up 3D scan, looking at how the signal absorption varies with depth. A comparison between the start and end readings at a fixed distance from the DUT also enables the power drift during measurement to be assessed.

SARA-C Interpolation and Extrapolation schemes

SARA-C software contains support for both 2D cubic B-spline interpolation as well as 3D cubic B-spline interpolation. In addition, for extrapolation purposes, a proprietary curve-fitting routine is implemented as a weighted average of 3 different polynomial fits. The polynomial fitting procedures have been extensively tested by comparing the fitting coefficients generated by the SARA-C procedures with those obtained using the polynomial fit functions of Microsoft Excel when applied to the same test input data.

Interpolation of 2D area scan

The 2D cubic B-spline interpolation is used after the initial area scan at fixed distance from the phantom shell wall. The initial scan data are collected with approx. 115mm spatial resolution and spline interpolation is used to find the location of the local maximum to within a 1mm resolution for positioning the subsequent 3D scanning.

Extrapolation of 3D scan

For the 3D scan, data are collected on a spatially regular, but conformal, 3D grid having (by default) 6.4 mm steps in the lateral dimensions and 3.5 mm steps in the depth direction (away from the source). SARA-C enables full control over the selection of alternative step sizes in all directions.



The overall accuracy of the 1g and 10g SAR volume average depends largely on the accuracy with which the probe can be re-positioned in the head. Although the digitised shape of the head is available to the SARA-C software, a better positioning solution is to use strain gauges attached to the L-probe to feel for the actual surface and to base all movements relative to this positive detection. An even more precise, but time-consuming, method is to place the probe tip in positive contact against the phantom wall, then step backwards 0.01mm at a time while monitoring the recorded SAR reading. At the exact moment that the probe detaches from contact, the SAR reading will suddenly fall.

After the data collection, the data are extrapolated up to the shell wall in the depth direction to assign values to points in the 3D array which cannot be measured in practice because of the finite size of the sensor tip. For automated measurements inside the head, the distance of the closest plane from the wall cannot be less than 2.7mm (for 5mm probes) and 1.39mm (for 2.5mm probes), this being the distance of the probe sensors behind the front edge of the probe tip.

Interpolation of 3D scan and volume averaging

The procedure used in SARA-C for defining the volumes used in SAR averaging follow the method of adapting the surface of the 'cube' to conform with the curved inner surface of the phantom (see Appendix C.2.2.1 in EN 62209-1: 2006). This is called, here, the conformal scheme.

For each row of data in the depth direction, the data are extrapolated to the phantom wall, and interpolated to less than 1mm spacing and average values are calculated from the phantom surface for the row of data over distances corresponding to the requisite depth for 10g and 1g cubes. This results in two 2D arrays of data, one for 1g and the other for 10g masses, which are then cubic B-spline interpolated to sub mm lateral resolution. A search routine then moves an averaging square around through the 2D array and records the maximum value of the corresponding 1g and 10g volume averages.

The default step size is 3.5mm, but this is under user-control. The compromise is with time of scan, so it is not practical to make it much smaller or scan times become long and power-drop influences become larger.

The robot positioning system specification for the repeatability of the positioning (**dss** in EN 62209-1: 2006) is +/- 0.04mm.

2.1.4 Head Test Positions

This recommended practice specifies exactly two test positions for the handset against the head phantom, the “Cheek” position and the “tilted” position. The handset should be tested in both positions on the left and right sides of the SAM phantom. In each test position the centre of the earpiece of the device is placed directly at the entrance of the auditory canal. The angles mentioned in the test positions used are referenced to the line connecting both auditory canal openings. The plane this line is on is known as the reference plane. Testing is performed on the right and left-hand sides of the generic phantom head.

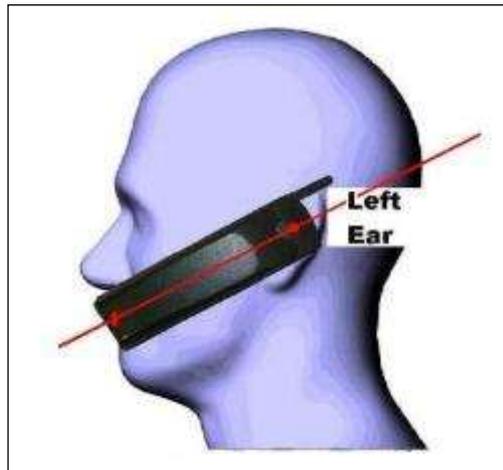


Figure 3 Side view of mobile next to head showing alignment

The Cheek Position

The Cheek Position is where the mobile is in the reference plane and the line between the mobile and the line connecting both auditory canal openings is reduced until any part of the mobile touches any part of the generic twin phantom head.

The 15° Position

The 15° Position is where the mobile is in the reference Cheek position and the phone is kept in contact with the auditory canal at the earpiece; the bottom of the phone is then tilted away from the phantom mouth by 15°.

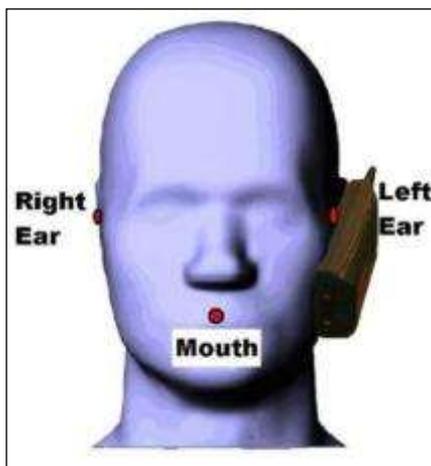


Figure 4 Cheek position

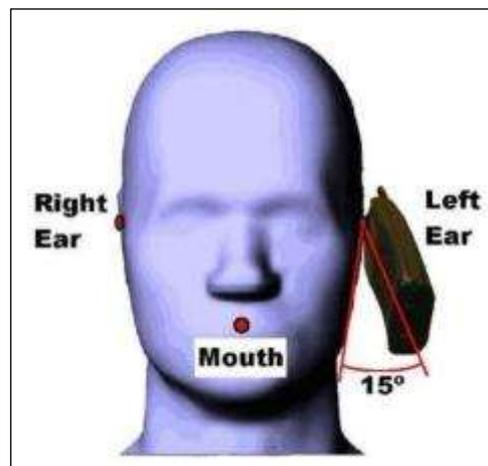


Figure 5 15° Tilt Position

2.2 GSM 850MHz HEAD SAR TEST RESULTS AND COURSE AREA SCANS – 2D

SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	08/01/2014-08:56:26	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	23.40°C	LIQUID SIMULANT:	850Head
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	41.89
RELATIVE HUMIDITY:	35.60%	CONDUCTIVITY:	0.899
PHANTOM S/NO:	IBX-040	LIQUID TEMPERATURE:	23.20°C
PHANTOM ROTATION:	N/A	MAX SAR Y-AXIS LOCATION:	57.80mm
DUT POSITION:	Left-Cheek	MAX SAR Z-AXIS LOCATION:	-116.60mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	23.880
TEST FREQUENCY:	836.4MHz	SAR 1g:	0.460 W/kg
TYPE OF MODULATION:	GMSK (Voice Mode)	SAR 10g:	N/A
MODN. DUTY CYCLE:	12.5%	SAR START:	0.487 W/kg
INPUT POWER LEVEL:	33.5dBm	SAR END:	0.514 W/kg
PROBE BATTERY LAST CHANGED:	08/01/2014	SAR DRIFT DURING SCAN:	5.500 %

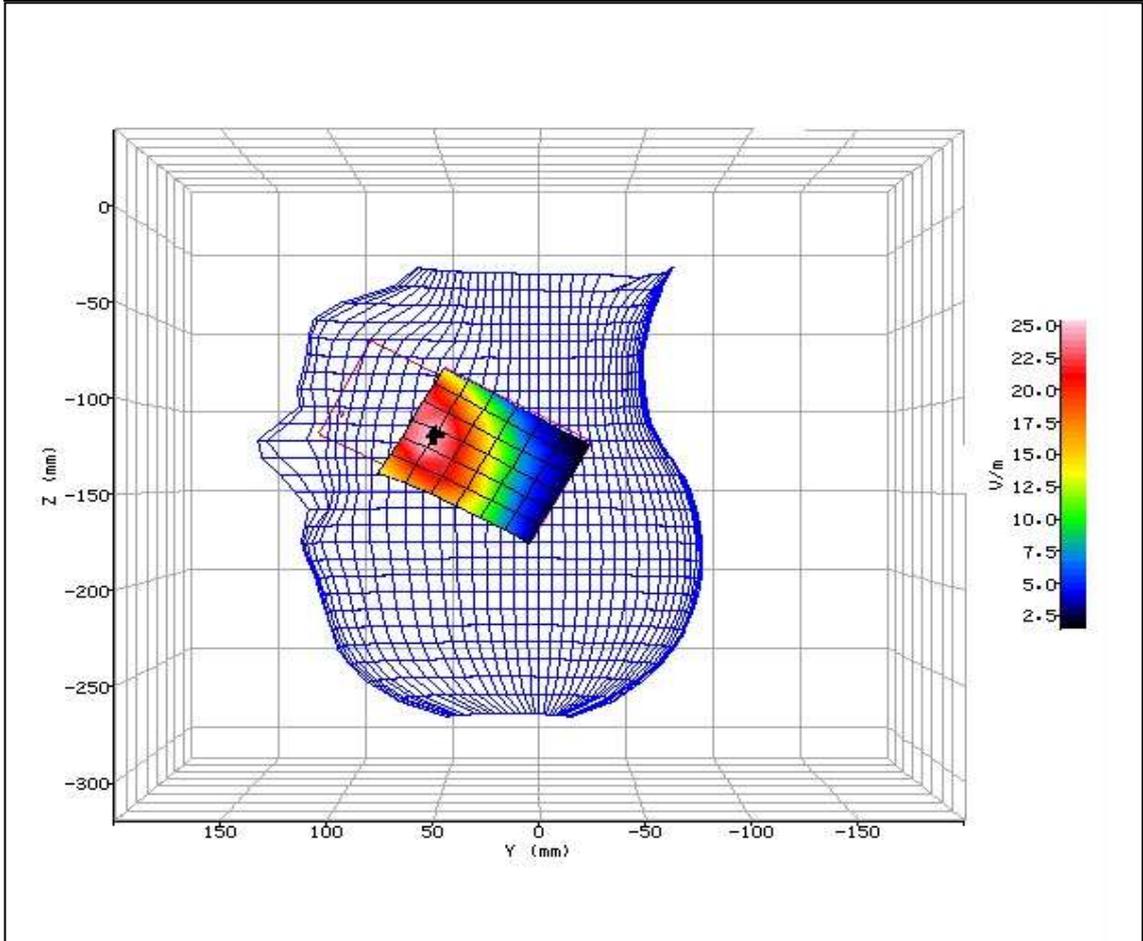


Figure 6: SAR Head Testing Results for the SHL24 Mobile Handset at 836.4MHz.



SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	08/01/2014-09:26:10	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	23.40°C	LIQUID SIMULANT:	850Head
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	41.89
RELATIVE HUMIDITY:	35.60%	CONDUCTIVITY:	0.899
PHANTOM S/NO:	IBX-040	LIQUID TEMPERATURE:	23.20°C
PHANTOM ROTATION:	N/A	MAX SAR Y-AXIS LOCATION:	48.30mm
DUT POSITION:	Left-15°	MAX SAR Z-AXIS LOCATION:	-130.80mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	18.786
TEST FREQUENCY:	836.4MHz	SAR 1g:	0.333 W/kg
TYPE OF MODULATION:	GMSK (Voice Mode)	SAR 10g:	N/A
MODN. DUTY CYCLE:	12.5%	SAR START:	0.309 W/kg
INPUT POWER LEVEL:	33.5dBm	SAR END:	0.288 W/kg
PROBE BATTERY LAST CHANGED:	08/01/2014	SAR DRIFT DURING SCAN:	-6.800 %

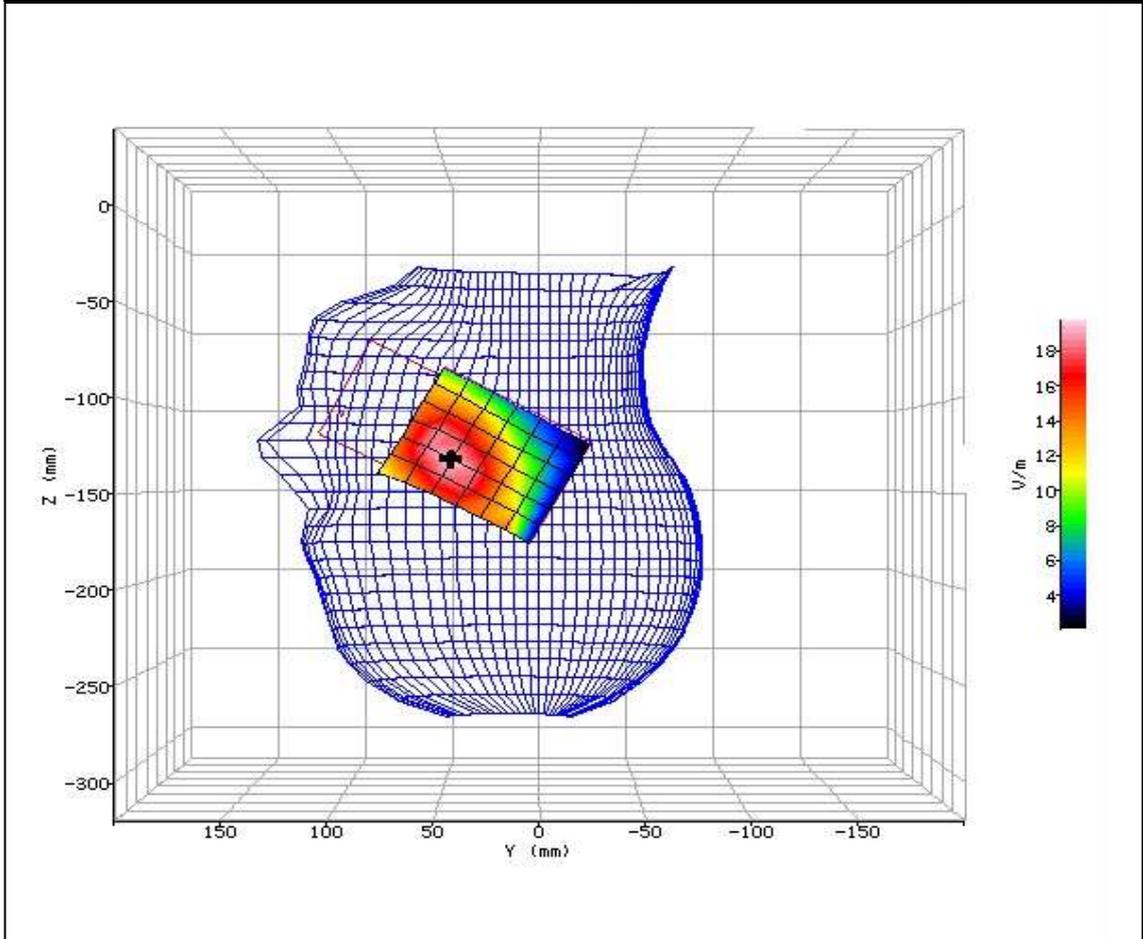


Figure 7: SAR Head Testing Results for the SHL24 Mobile Handset at 836.4MHz.



SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	08/01/2014-13:58:09	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	23.40°C	LIQUID SIMULANT:	850Head
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	41.89
RELATIVE HUMIDITY:	35.60%	CONDUCTIVITY:	0.899
PHANTOM S/NO:	IBX-040	LIQUID TEMPERATURE:	23.20°C
PHANTOM ROTATION:	N/A	MAX SAR Y-AXIS LOCATION:	59.70mm
DUT POSITION:	Right-Cheek	MAX SAR Z-AXIS LOCATION:	-116.70mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	23.729
TEST FREQUENCY:	836.4MHz	SAR 1g:	0.522 W/kg
TYPE OF MODULATION:	GMSK (Voice Mode)	SAR 10g:	N/A
MODN. DUTY CYCLE:	12.5%	SAR START:	0.523 W/kg
INPUT POWER LEVEL:	33.5dBm	SAR END:	0.537 W/kg
PROBE BATTERY LAST CHANGED:	08/01/2014	SAR DRIFT DURING SCAN:	2.700 %

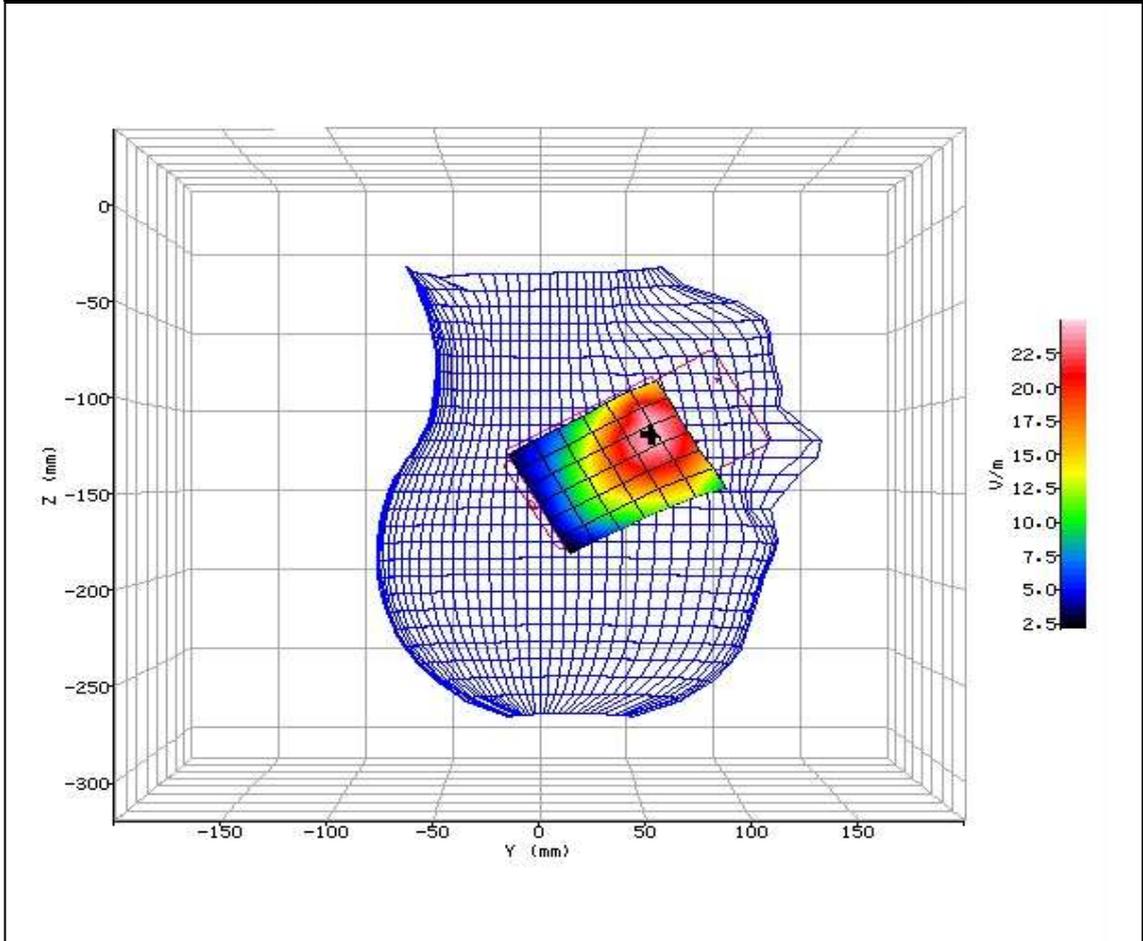


Figure 08: SAR Head Testing Results for the SHL24 Mobile Handset at 836.4MHz.



SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	08/01/2014-14:14:59	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	23.40°C	LIQUID SIMULANT:	850Head
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	41.89
RELATIVE HUMIDITY:	35.60%	CONDUCTIVITY:	0.899
PHANTOM S/NO:	IBX-040	LIQUID TEMPERATURE:	23.20°C
PHANTOM ROTATION:	N/A	MAX SAR Y-AXIS LOCATION:	45.30mm
DUT POSITION:	Right-15°	MAX SAR Z-AXIS LOCATION:	-130.00mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	18.922
TEST FREQUENCY:	836.4MHz	SAR 1g:	0.334 W/kg
TYPE OF MODULATION:	GMSK (Voice Mode)	SAR 10g:	N/A
MODN. DUTY CYCLE:	12.5%	SAR START:	0.299 W/kg
INPUT POWER LEVEL:	33.5dBm	SAR END:	0.315 W/kg
PROBE BATTERY LAST CHANGED:	08/01/2014	SAR DRIFT DURING SCAN:	5.400 %

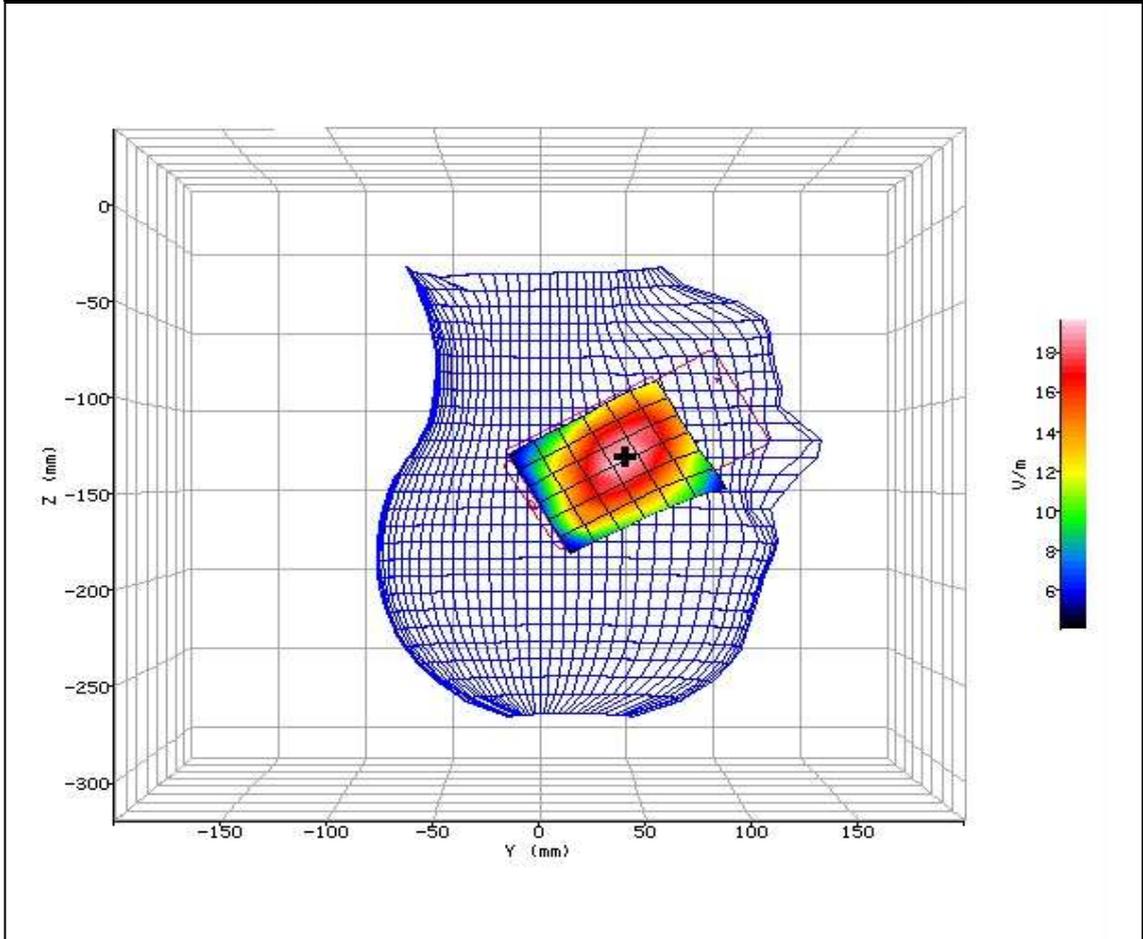


Figure 09: SAR Head Testing Results for the SHL24 Mobile Handset at 836.4MHz.

2.3 GSM 850MHz HEAD SAR TEST RESULTS AND COURSE AREA SCANS – 2D

SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	08/01/2014-11:44:16	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	23.40°C	LIQUID SIMULANT:	850Head
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	41.89
RELATIVE HUMIDITY:	35.60%	CONDUCTIVITY:	0.899
PHANTOM S/NO:	IBX-040	LIQUID TEMPERATURE:	23.20°C
PHANTOM ROTATION:	N/A	MAX SAR Y-AXIS LOCATION:	56.20mm
DUT POSITION:	Left-Cheek	MAX SAR Z-AXIS LOCATION:	-115.40mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	25.350
TEST FREQUENCY:	848.8MHz	SAR 1g:	0.538 W/kg
TYPE OF MODULATION:	GMSK (GPRS Mode)	SAR 10g:	N/A
MODN. DUTY CYCLE:	50%	SAR START:	0.562 W/kg
INPUT POWER LEVEL:	28.1dBm	SAR END:	0.549 W/kg
PROBE BATTERY LAST CHANGED:	08/01/2014	SAR DRIFT DURING SCAN:	-2.300 %

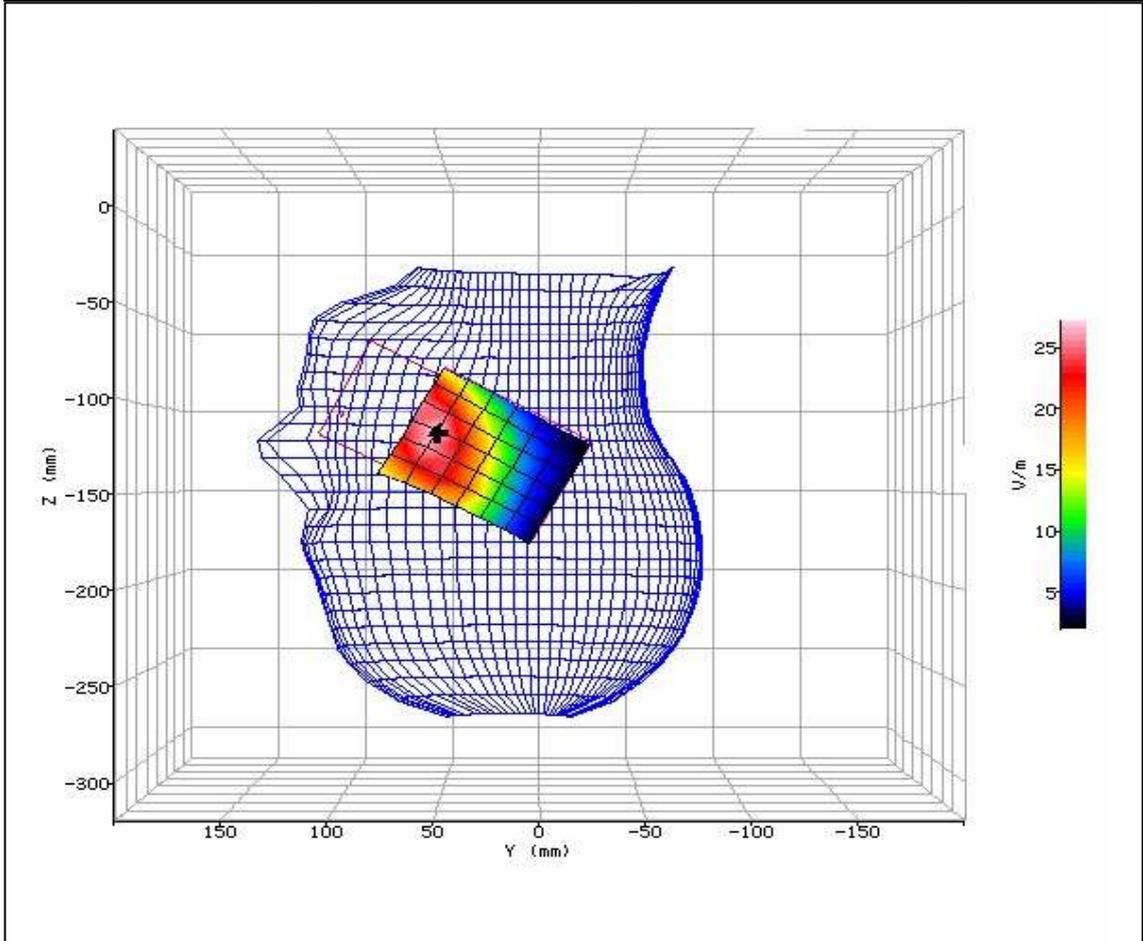


Figure 10: SAR Head Testing Results for the SHL24 Mobile Handset at 848.8MHz.



SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	08/01/2014-12:01:19	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	23.40°C	LIQUID SIMULANT:	850Head
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	41.89
RELATIVE HUMIDITY:	35.60%	CONDUCTIVITY:	0.899
PHANTOM S/NO:	IBX-040	LIQUID TEMPERATURE:	23.20°C
PHANTOM ROTATION:	N/A	MAX SAR Y-AXIS LOCATION:	49.50mm
DUT POSITION:	Left-15°	MAX SAR Z-AXIS LOCATION:	-128.20mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	20.644
TEST FREQUENCY:	848.8MHz	SAR 1g:	0.371 W/kg
TYPE OF MODULATION:	GMSK (GPRS Mode)	SAR 10g:	N/A
MODN. DUTY CYCLE:	50%	SAR START:	0.373 W/kg
INPUT POWER LEVEL:	28.1dBm	SAR END:	0.369 W/kg
PROBE BATTERY LAST CHANGED:	08/01/2014	SAR DRIFT DURING SCAN:	-1.100 %

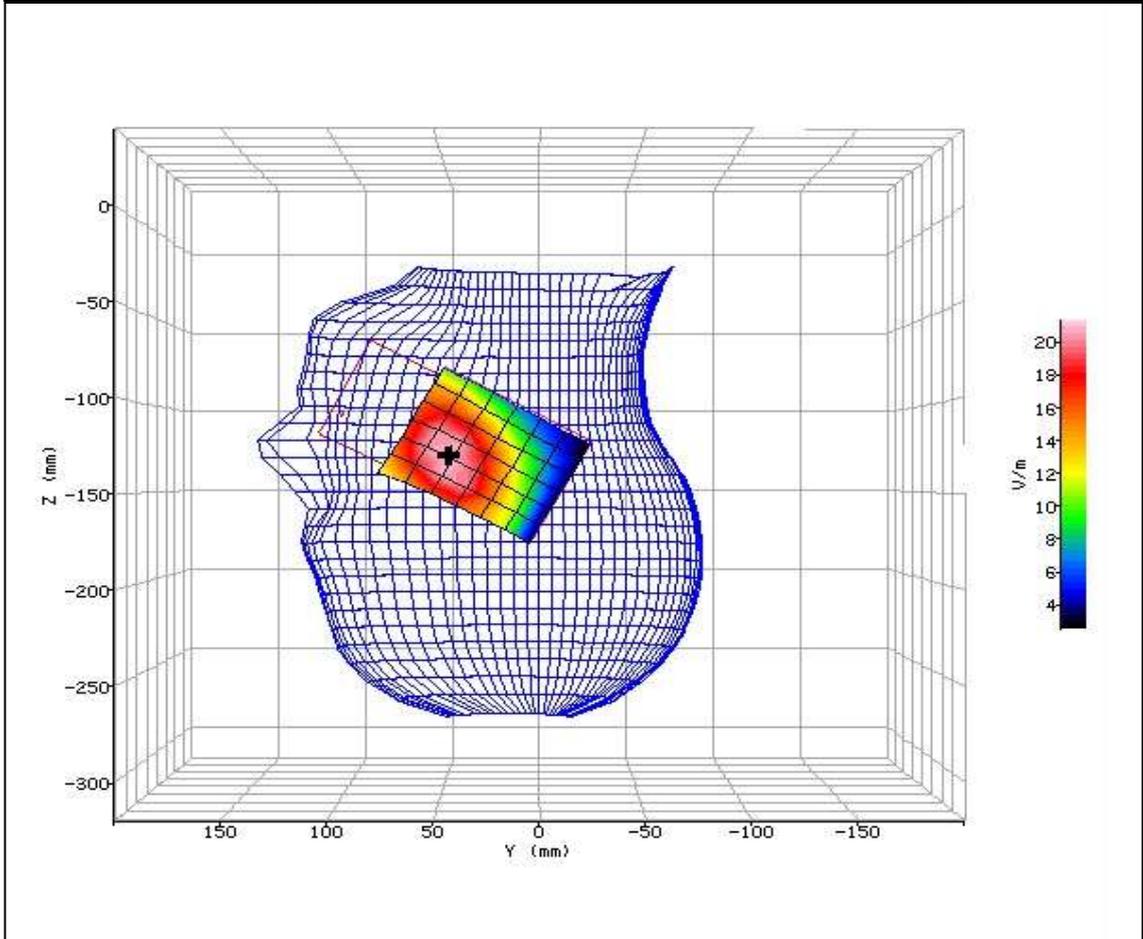


Figure 11: SAR Head Testing Results for the SHL24 Mobile Handset at 848.8MHz.



SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	08/01/2014-12:39:15	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	23.40°C	LIQUID SIMULANT:	850Head
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	41.89
RELATIVE HUMIDITY:	35.60%	CONDUCTIVITY:	0.899
PHANTOM S/NO:	IBX-040	LIQUID TEMPERATURE:	23.20°C
PHANTOM ROTATION:	N/A	MAX SAR Y-AXIS LOCATION:	59.80mm
DUT POSITION:	Right-Cheek	MAX SAR Z-AXIS LOCATION:	-113.90mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	25.071
TEST FREQUENCY:	848.8MHz	SAR 1g:	0.587 W/kg
TYPE OF MODULATION:	GMSK (GPRS Mode)	SAR 10g:	N/A
MODN. DUTY CYCLE:	50%	SAR START:	0.572 W/kg
INPUT POWER LEVEL:	28.1dBm	SAR END:	0.576 W/kg
PROBE BATTERY LAST CHANGED:	08/01/2014	SAR DRIFT DURING SCAN:	0.700 %

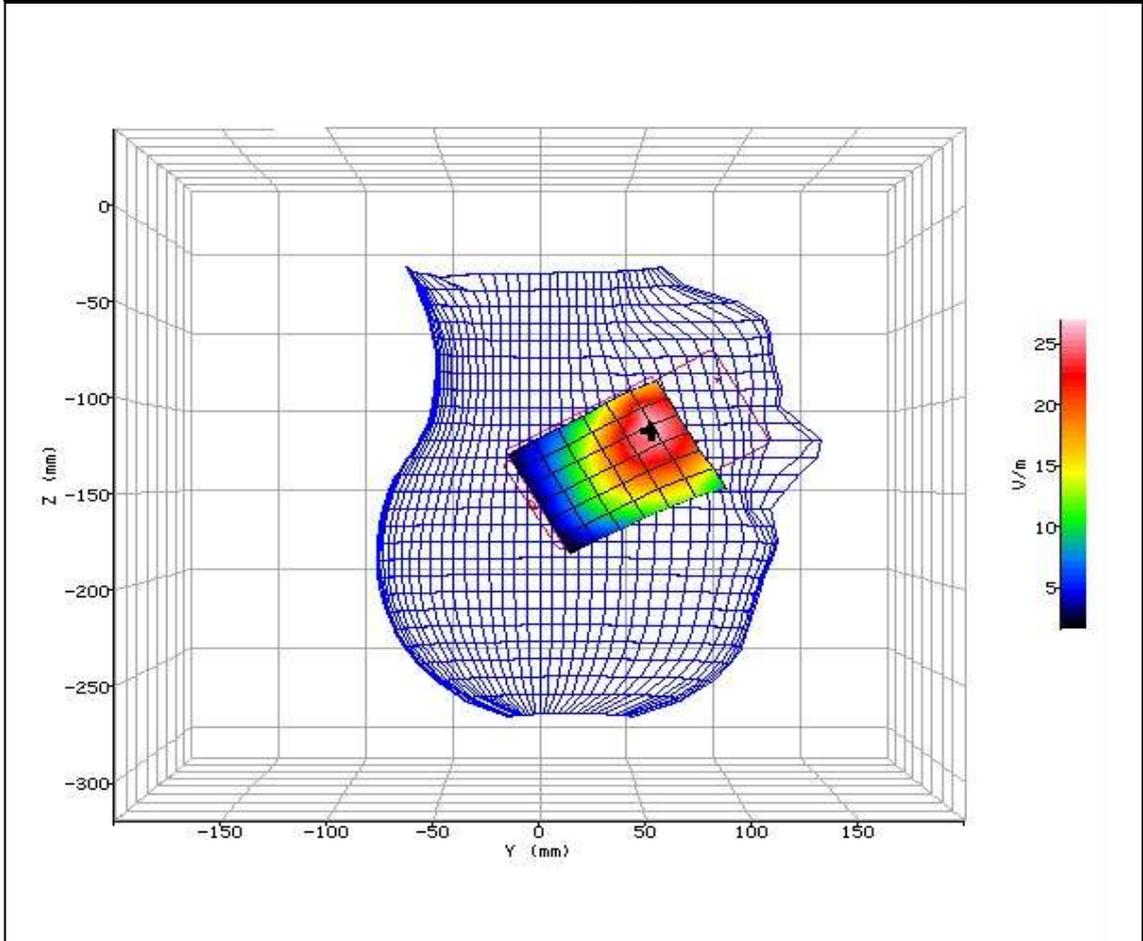


Figure 12: SAR Head Testing Results for the SHL24 Mobile Handset at 848.8MHz.



SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	08/01/2014-12:56:17	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	23.40°C	LIQUID SIMULANT:	850Head
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	41.89
RELATIVE HUMIDITY:	35.60%	CONDUCTIVITY:	0.899
PHANTOM S/NO:	IBX-040	LIQUID TEMPERATURE:	23.20°C
PHANTOM ROTATION:	N/A	MAX SAR Y-AXIS LOCATION:	44.10mm
DUT POSITION:	Right-15°	MAX SAR Z-AXIS LOCATION:	-128.00mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	18.513
TEST FREQUENCY:	848.8MHz	SAR 1g:	0.341 W/kg
TYPE OF MODULATION:	GMSK (GPRS Mode)	SAR 10g:	N/A
MODN. DUTY CYCLE:	50%	SAR START:	0.309 W/kg
INPUT POWER LEVEL:	28.1dBm	SAR END:	0.303 W/kg
PROBE BATTERY LAST CHANGED:	08/01/2014	SAR DRIFT DURING SCAN:	-1.900 %

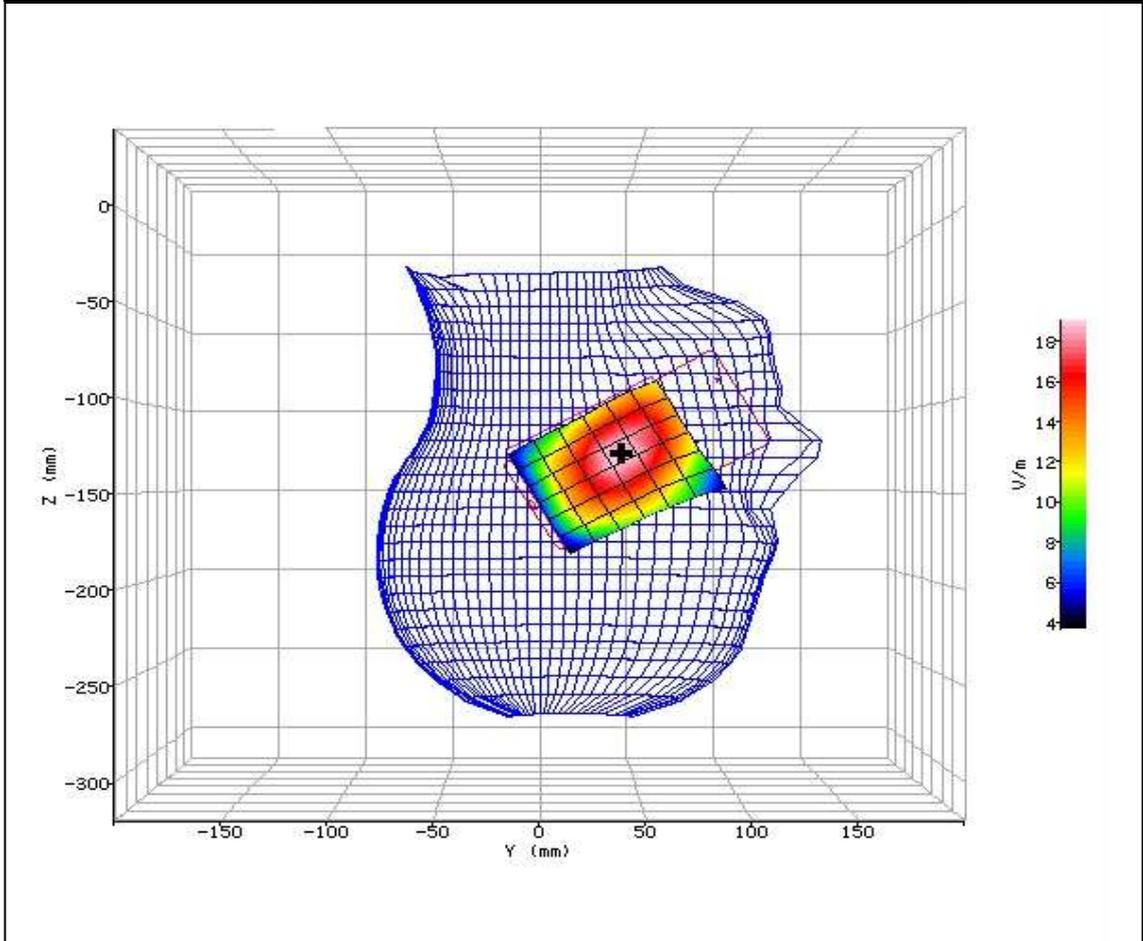


Figure 13: SAR Head Testing Results for the SHL24 Mobile Handset at 848.8MHz.



SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	10/01/2014-10:39:49	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	23.40°C	LIQUID SIMULANT:	850Head
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	41.89
RELATIVE HUMIDITY:	35.60%	CONDUCTIVITY:	0.899
PHANTOM S/NO:	IBX-040	LIQUID TEMPERATURE:	23.20°C
PHANTOM ROTATION:	N/A	MAX SAR Y-AXIS LOCATION:	58.70mm
DUT POSITION:	Right-Cheek	MAX SAR Z-AXIS LOCATION:	-115.60mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	20.696
TEST FREQUENCY:	824.2MHz	SAR 1g:	0.624 W/kg
TYPE OF MODULATION:	GMSK (GPRS Mode)	SAR 10g:	N/A
MODN. DUTY CYCLE:	50%	SAR START:	0.639 W/kg
INPUT POWER LEVEL:	28.1dBm	SAR END:	0.582 W/kg
PROBE BATTERY LAST CHANGED:	08/01/2014	SAR DRIFT DURING SCAN:	-8.500 %

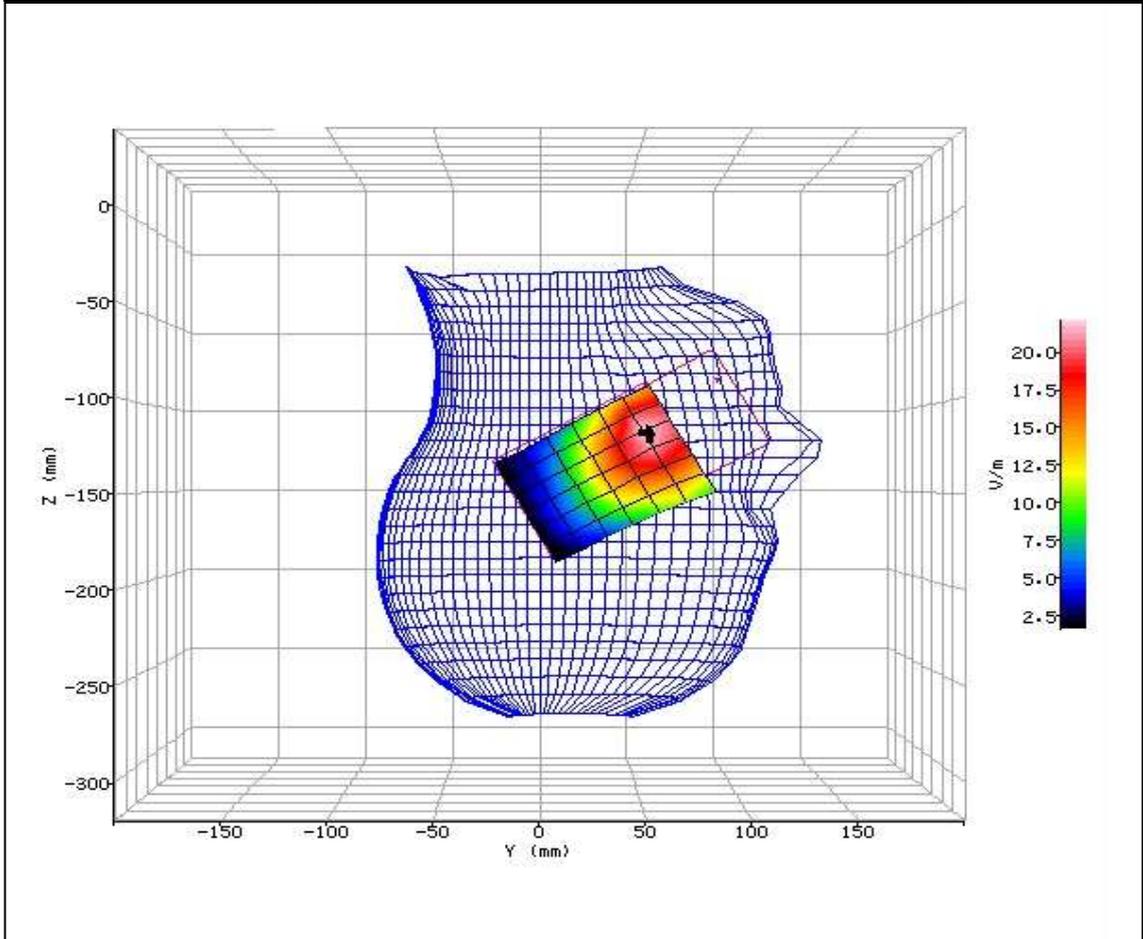


Figure 14: SAR Head Testing Results for the SHL24 Mobile Handset at 824.2MHz.



SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	10/01/2014-10:57:27	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	23.40°C	LIQUID SIMULANT:	850Head
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	41.89
RELATIVE HUMIDITY:	35.60%	CONDUCTIVITY:	0.899
PHANTOM S/NO:	IBX-040	LIQUID TEMPERATURE:	23.20°C
PHANTOM ROTATION:	N/A	MAX SAR Y-AXIS LOCATION:	58.40mm
DUT POSITION:	Right-Cheek	MAX SAR Z-AXIS LOCATION:	-115.00mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	21.805
TEST FREQUENCY:	836.4MHz	SAR 1g:	0.728 W/kg
TYPE OF MODULATION:	GMSK (GPRS Mode)	SAR 10g:	N/A
MODN. DUTY CYCLE:	50%	SAR START:	0.724 W/kg
INPUT POWER LEVEL:	28.1dBm	SAR END:	0.682 W/kg
PROBE BATTERY LAST CHANGED:	08/01/2014	SAR DRIFT DURING SCAN:	-5.800 %

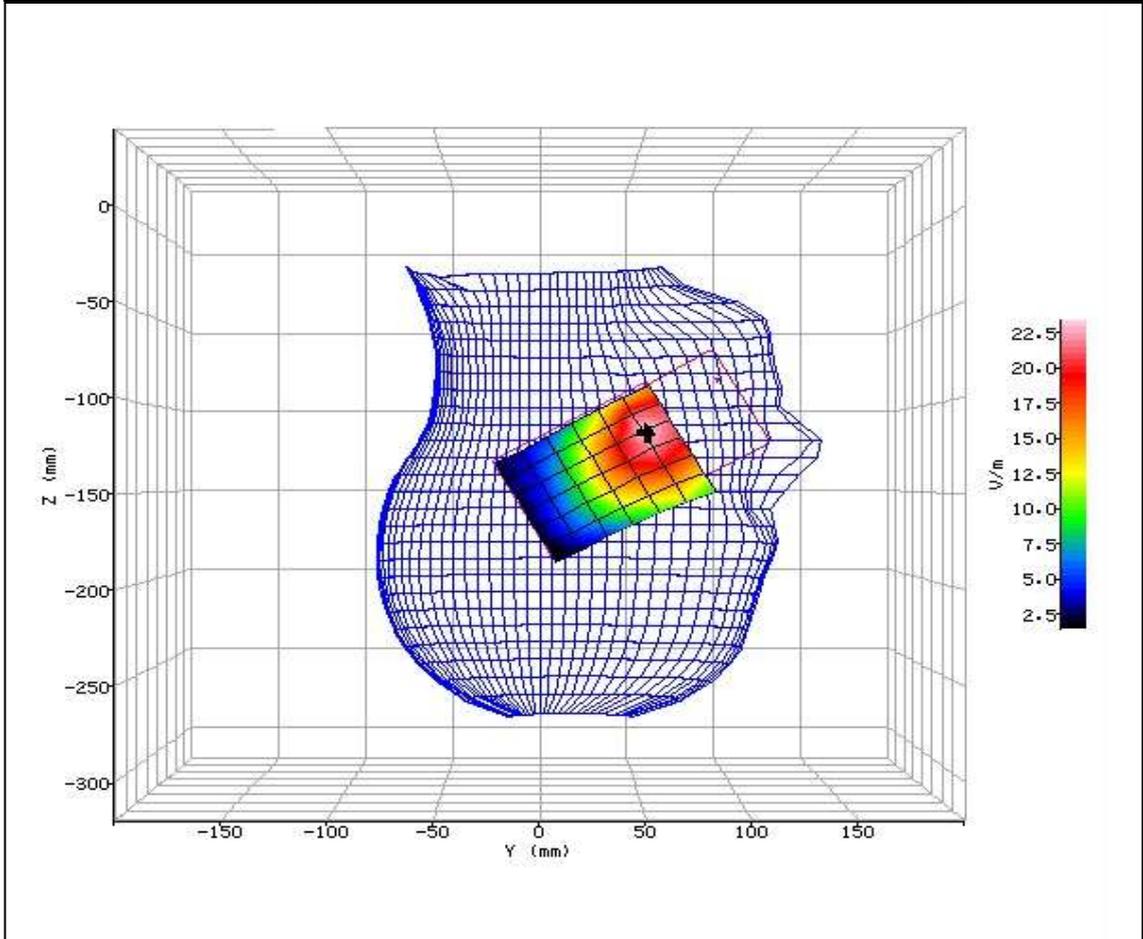


Figure 15: SAR Head Testing Results for the SHL24 Mobile Handset at 836.4MHz.

2.4 GSM 850MHz BODY SAR TEST RESULTS AND COURSE AREA SCANS – 2D

SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	07/01/2014-07:21:54	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	23.20°C	LIQUID SIMULANT:	850Body
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	56.73
RELATIVE HUMIDITY:	37.30%	CONDUCTIVITY:	1.010
PHANTOM S/NO:	IXB-2HF	LIQUID TEMPERATURE:	23.20°C
PHANTOM ROTATION:	N/A	MAX SAR X-AXIS LOCATION:	28.20mm
DUT POSITION:	10mm-Front Face	MAX SAR Y-AXIS LOCATION:	-5.10mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	22.928
TEST FREQUENCY:	848.8MHz	SAR 1g:	0.490 W/kg
TYPE OF MODULATION:	GMSK (GPRS Mode)	SAR 10g:	N/A
MODN. DUTY CYCLE:	50%	SAR START:	0.523 W/kg
INPUT POWER LEVEL:	28.1dBm	SAR END:	0.495 W/kg
PROBE BATTERY LAST CHANGED:	07/01/2014	SAR DRIFT DURING SCAN:	-5.400 %

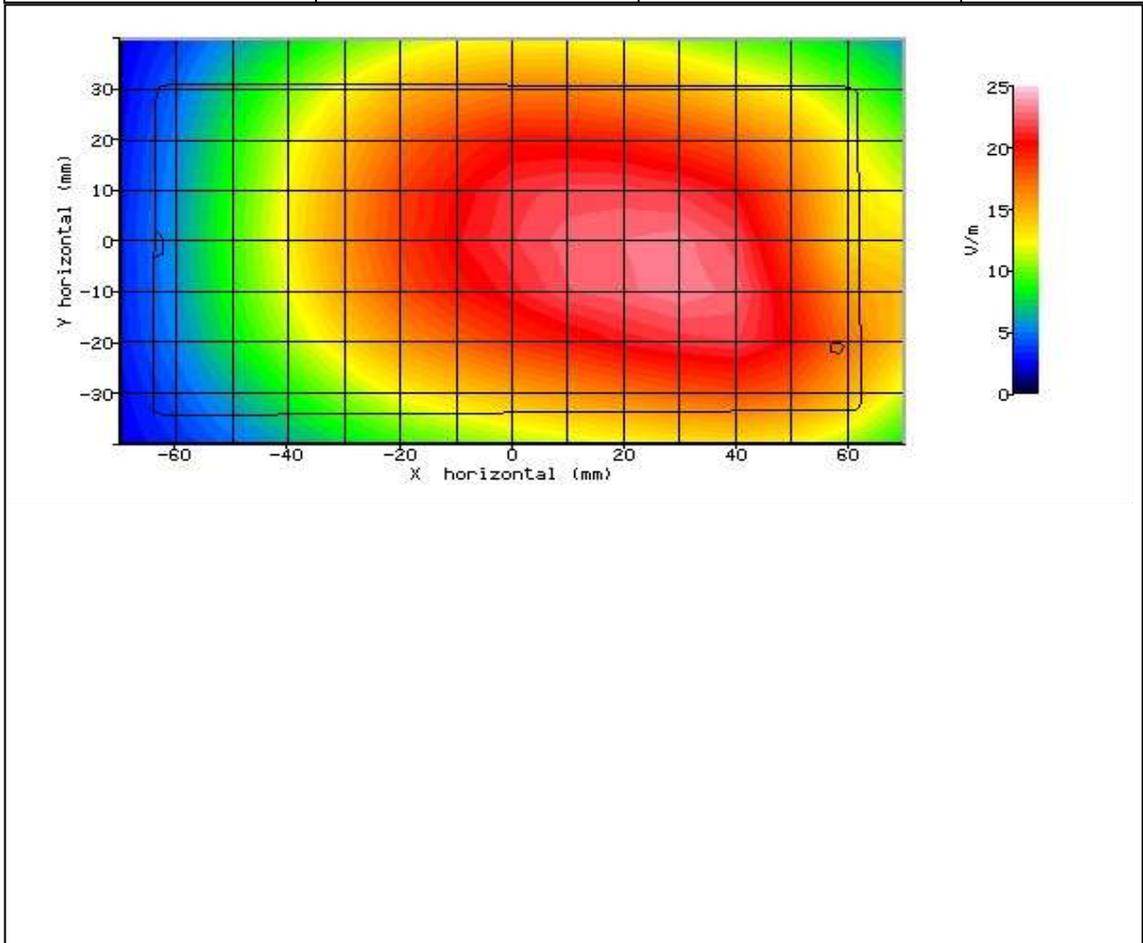


Figure 16: SAR Body Testing Results for the SHL24 Mobile Handset at 848.8MHz.



SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	07/01/2014-07:36:28	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	23.20°C	LIQUID SIMULANT:	850Body
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	56.73
RELATIVE HUMIDITY:	37.30%	CONDUCTIVITY:	1.010
PHANTOM S/NO:	IXB-2HF	LIQUID TEMPERATURE:	23.20°C
PHANTOM ROTATION:	N/A	MAX SAR X-AXIS LOCATION:	31.30mm
DUT POSITION:	10mm-Rear Face	MAX SAR Y-AXIS LOCATION:	8.50mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	23.726
TEST FREQUENCY:	848.8MHz	SAR 1g:	0.565 W/kg
TYPE OF MODULATION:	GMSK (GPRS Mode)	SAR 10g:	N/A
MODN. DUTY CYCLE:	50%	SAR START:	0.609 W/kg
INPUT POWER LEVEL:	28.1dBm	SAR END:	0.637 W/kg
PROBE BATTERY LAST CHANGED:	07/01/2014	SAR DRIFT DURING SCAN:	0.956 %

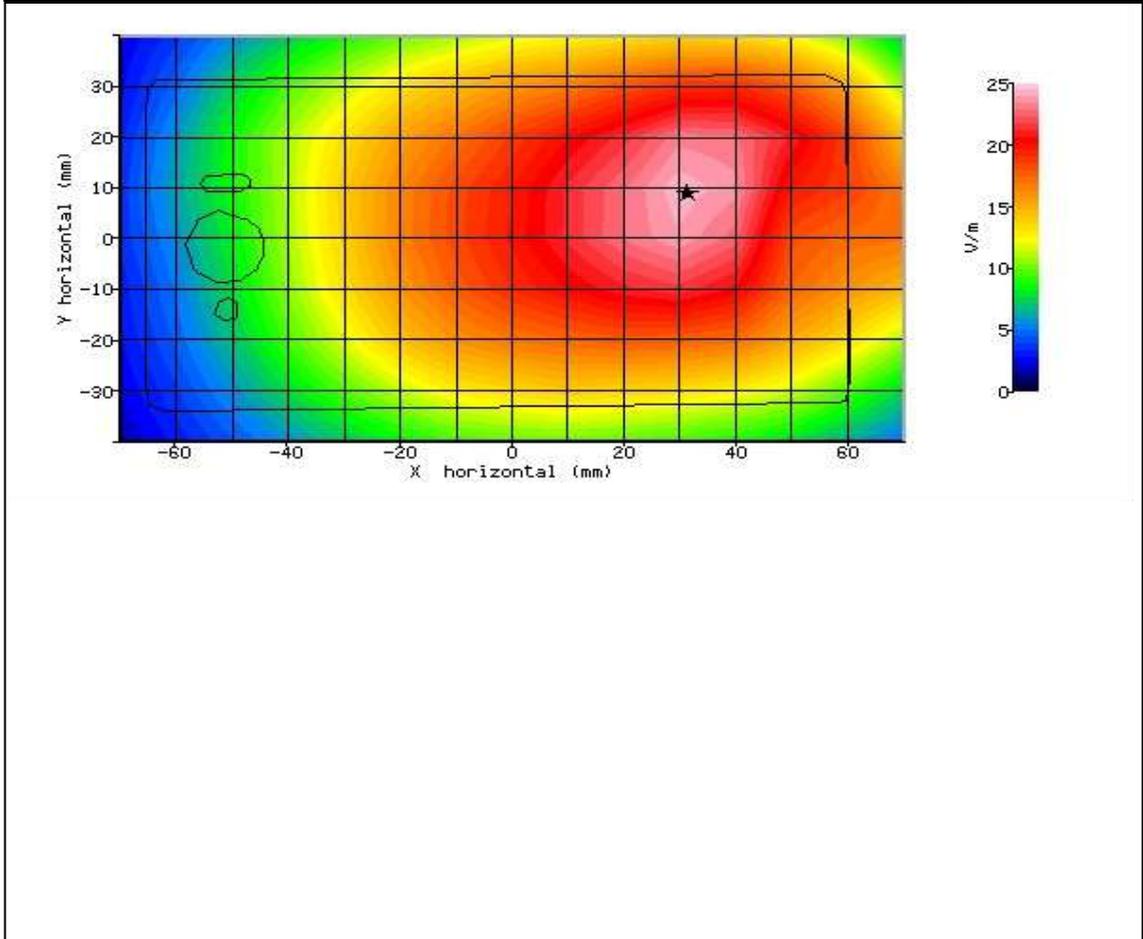


Figure 17: SAR Body Testing Results for the SHL24 Mobile Handset at 848.8MHz.



Product Service

SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	07/01/2014-08:15:58	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	23.20°C	LIQUID SIMULANT:	850Body
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	56.73
RELATIVE HUMIDITY:	37.30%	CONDUCTIVITY:	1.010
PHANTOM S/NO:	IXB-2HF	LIQUID TEMPERATURE:	23.20°C
PHANTOM ROTATION:	N/A	MAX SAR X-AXIS LOCATION:	1.60mm
DUT POSITION:	10mm-Right Edge	MAX SAR Y-AXIS LOCATION:	1.50mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	19.893
TEST FREQUENCY:	848.8MHz	SAR 1g:	0.388 W/kg
TYPE OF MODULATION:	GMSK (GPRS Mode)	SAR 10g:	N/A
MODN. DUTY CYCLE:	50%	SAR START:	0.414 W/kg
INPUT POWER LEVEL:	28.1dBm	SAR END:	0.393 W/kg
PROBE BATTERY LAST CHANGED:	07/01/2014	SAR DRIFT DURING SCAN:	-5.200 %

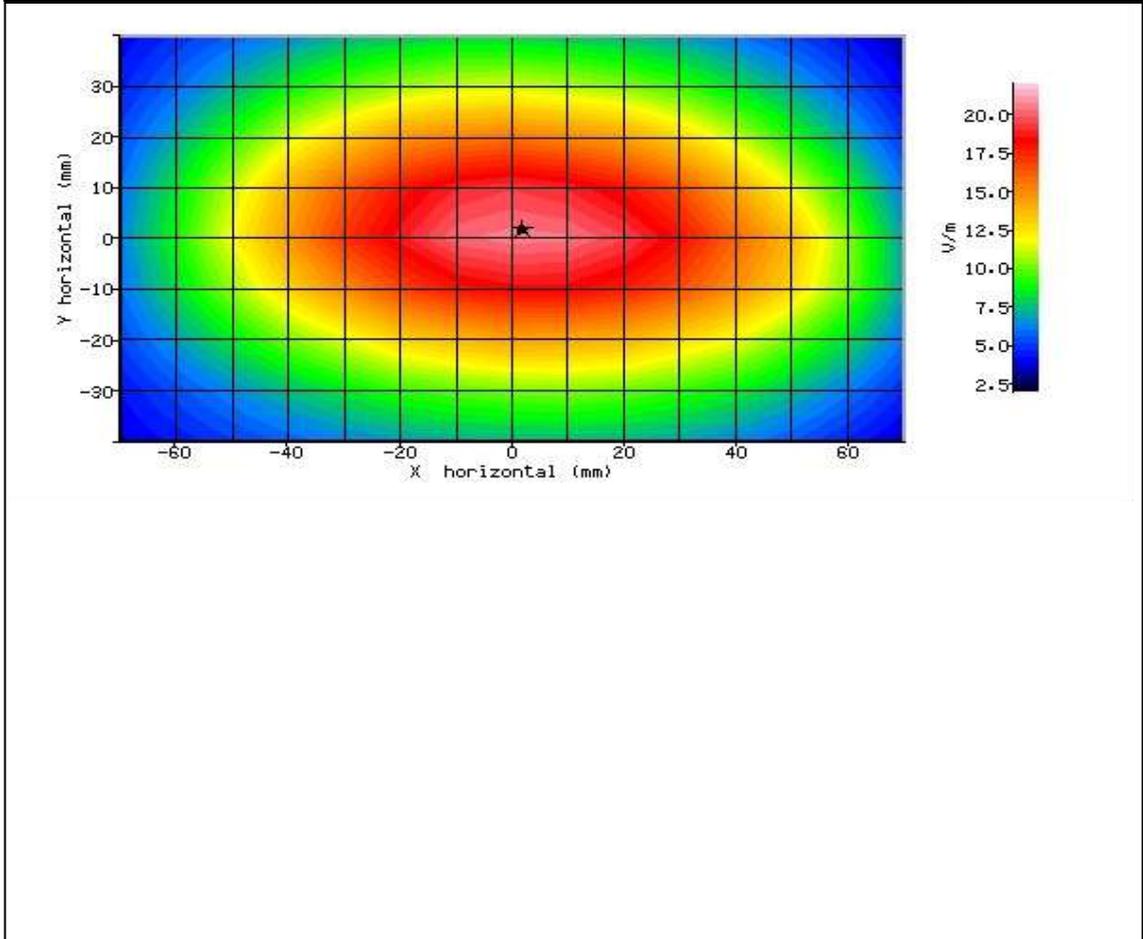


Figure 18: SAR Body Testing Results for the SHL24 Mobile Handset at 848.8MHz.



SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	07/01/2014-08:29:17	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	23.20°C	LIQUID SIMULANT:	850Body
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	56.73
RELATIVE HUMIDITY:	37.30%	CONDUCTIVITY:	1.010
PHANTOM S/NO:	IXB-2HF	LIQUID TEMPERATURE:	23.20°C
PHANTOM ROTATION:	N/A	MAX SAR X-AXIS LOCATION:	9.20mm
DUT POSITION:	10mm-Left Edge	MAX SAR Y-AXIS LOCATION:	1.30mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	18.558
TEST FREQUENCY:	848.8MHz	SAR 1g:	0.346 W/kg
TYPE OF MODULATION:	GMSK (GPRS Mode)	SAR 10g:	N/A
MODN. DUTY CYCLE:	50%	SAR START:	0.376 W/kg
INPUT POWER LEVEL:	28.1dBm	SAR END:	0.362 W/kg
PROBE BATTERY LAST CHANGED:	07/01/2014	SAR DRIFT DURING SCAN:	-3.800 %

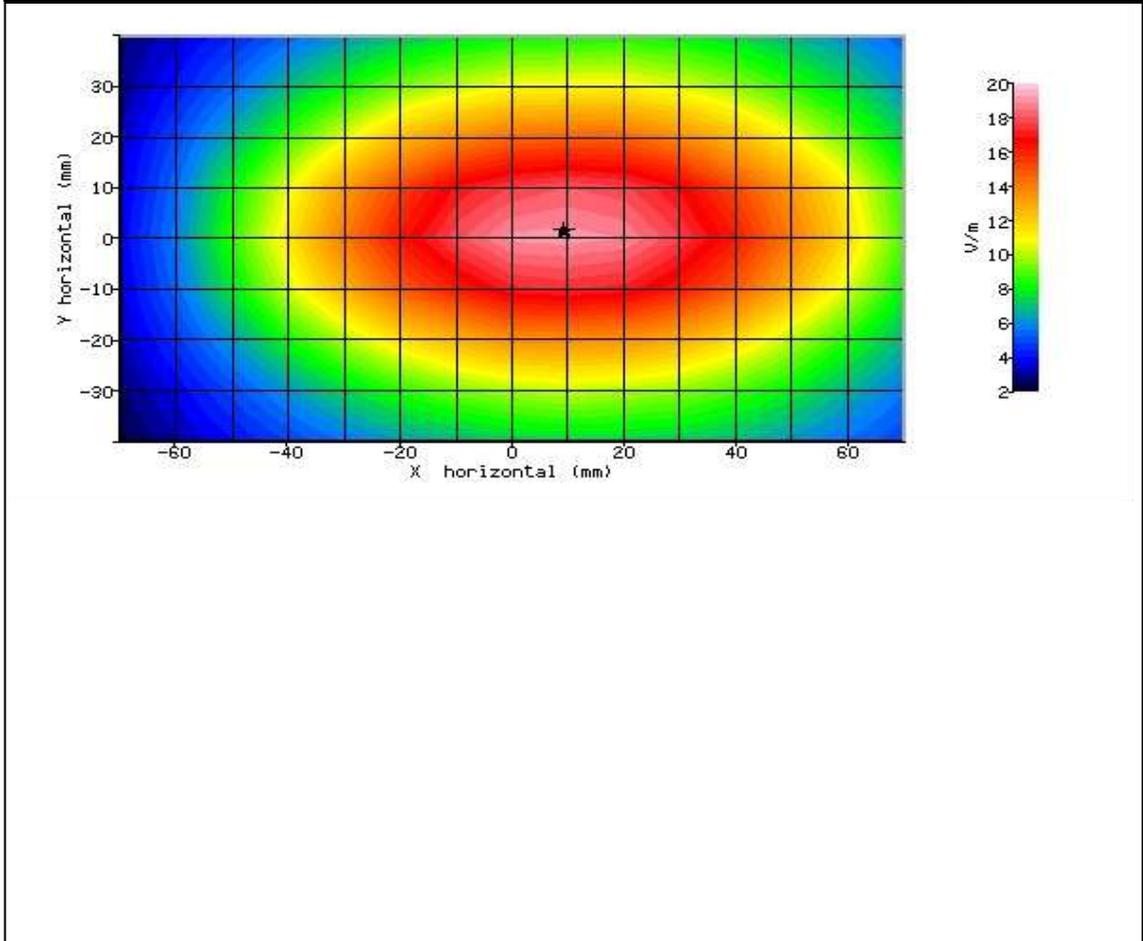


Figure 19: SAR Body Testing Results for the SHL24 Mobile Handset at 848.8MHz.



Product Service

SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	07/01/2014-08:58:26	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	23.20°C	LIQUID SIMULANT:	850Body
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	56.73
RELATIVE HUMIDITY:	37.30%	CONDUCTIVITY:	1.010
PHANTOM S/NO:	IXB-2HF	LIQUID TEMPERATURE:	23.20°C
PHANTOM ROTATION:	N/A	MAX SAR X-AXIS LOCATION:	2.40mm
DUT POSITION:	10mm-Bottom Edge	MAX SAR Y-AXIS LOCATION:	10.40mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	9.704
TEST FREQUENCY:	848.8MHz	SAR 1g:	0.109 W/kg
TYPE OF MODULATION:	GMSK (GPRS Mode)	SAR 10g:	N/A
MODN. DUTY CYCLE:	50%	SAR START:	0.122 W/kg
INPUT POWER LEVEL:	28.1dBm	SAR END:	0.125 W/kg
PROBE BATTERY LAST CHANGED:	07/01/2014	SAR DRIFT DURING SCAN:	2.700 %

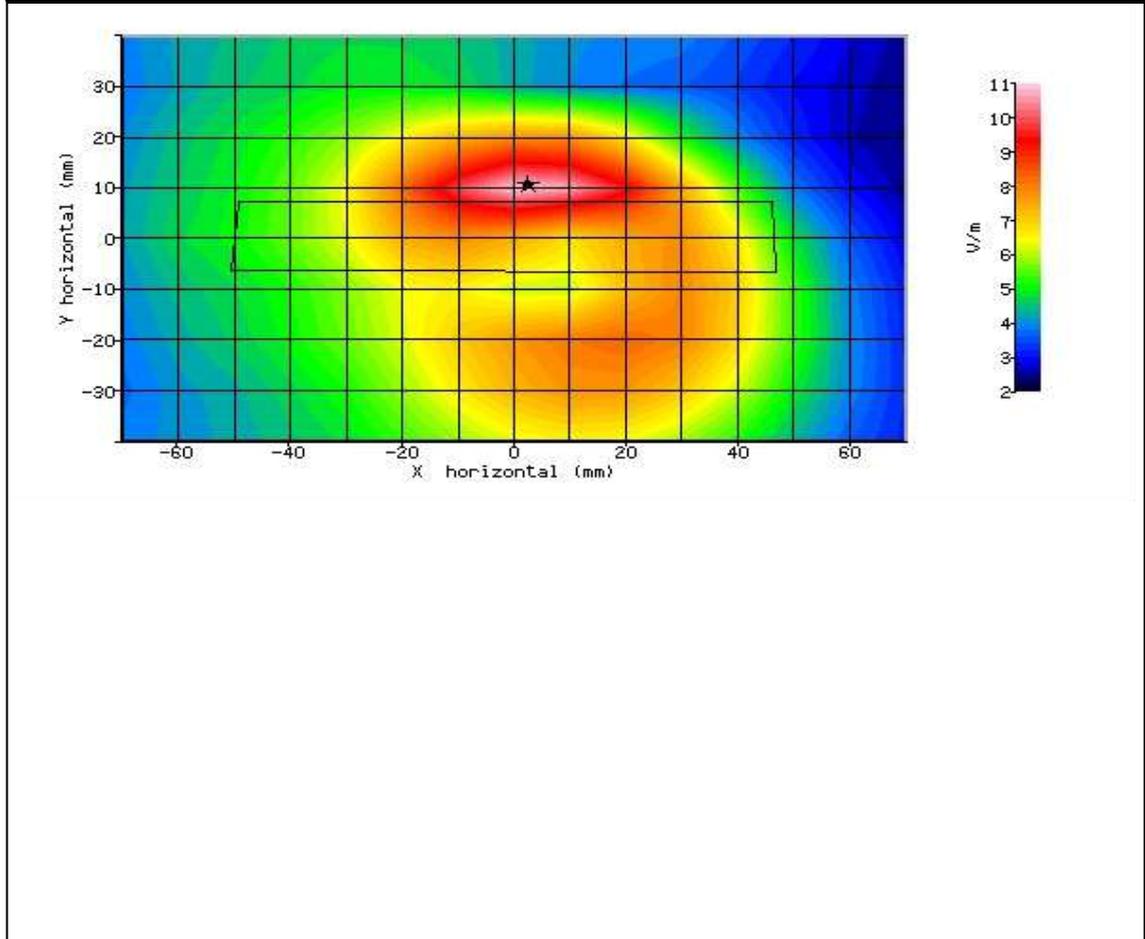


Figure 20: SAR Body Testing Results for the SHL24 Mobile Handset at 848.8MHz.

2.5 WCDMA FDD V HEAD SAR TEST RESULTS AND COURSE AREA SCANS – 2D

SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	08/01/2014-10:51:04	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	23.40°C	LIQUID SIMULANT:	850Head
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	41.89
RELATIVE HUMIDITY:	35.60%	CONDUCTIVITY:	0.899
PHANTOM S/NO:	IBX-040	LIQUID TEMPERATURE:	23.20°C
PHANTOM ROTATION:	N/A	MAX SAR Y-AXIS LOCATION:	57.40mm
DUT POSITION:	Left-Cheek	MAX SAR Z-AXIS LOCATION:	-117.50mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	22.888
TEST FREQUENCY:	846.4MHz	SAR 1g:	0.445 W/kg
TYPE OF MODULATION:	QPSK (RMC Mode)	SAR 10g:	N/A
MODN. DUTY CYCLE:	100%	SAR START:	0.463 W/kg
INPUT POWER LEVEL:	24.2dBm	SAR END:	0.474 W/kg
PROBE BATTERY LAST CHANGED:	08/01/2014	SAR DRIFT DURING SCAN:	2.400 %

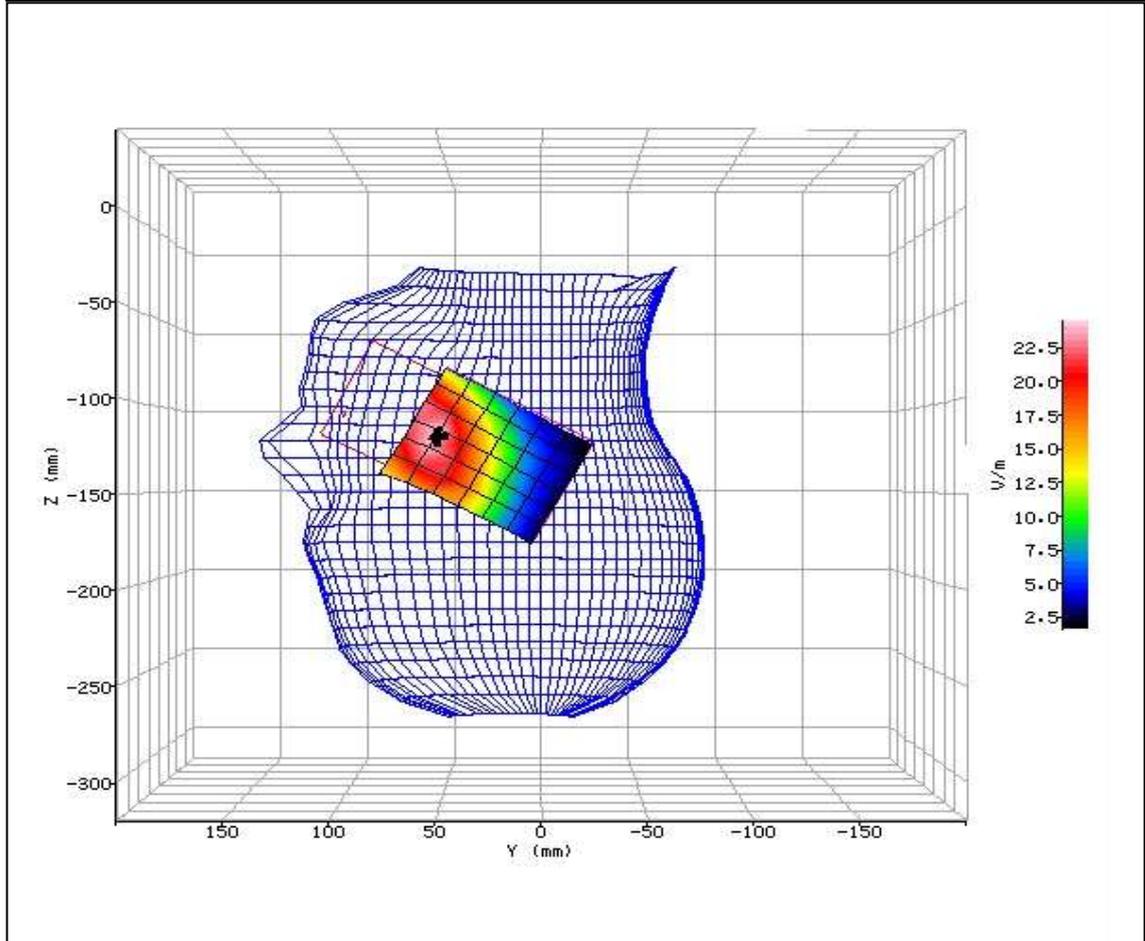


Figure 21: SAR Head Testing Results for the SHL24 Mobile Handset at 846.4MHz.



SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	08/01/2014-11:07:51	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	23.40°C	LIQUID SIMULANT:	850Head
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	41.89
RELATIVE HUMIDITY:	35.60%	CONDUCTIVITY:	0.899
PHANTOM S/NO:	IBX-040	LIQUID TEMPERATURE:	23.20°C
PHANTOM ROTATION:	N/A	MAX SAR Y-AXIS LOCATION:	48.20mm
DUT POSITION:	Left-15°	MAX SAR Z-AXIS LOCATION:	-132.20mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	18.665
TEST FREQUENCY:	846.4MHz	SAR 1g:	0.303 W/kg
TYPE OF MODULATION:	QPSK (RMC Mode)	SAR 10g:	N/A
MODN. DUTY CYCLE:	100%	SAR START:	0.296 W/kg
INPUT POWER LEVEL:	24.2dBm	SAR END:	0.302 W/kg
PROBE BATTERY LAST CHANGED:	08/01/2014	SAR DRIFT DURING SCAN:	2.000 %

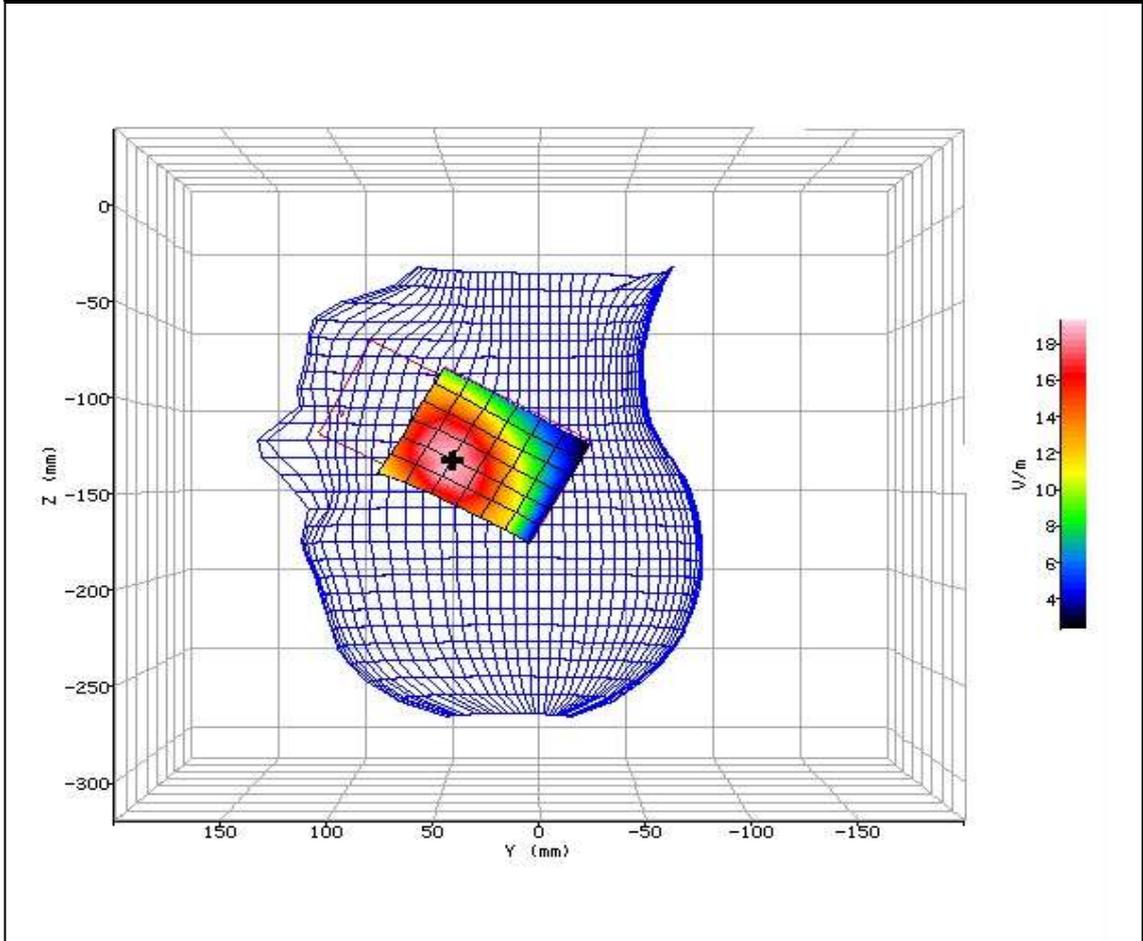


Figure 22: SAR Head Testing Results for the SHL24 Mobile Handset at 846.4MHz.



SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	08/01/2014-13:20:33	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	23.40°C	LIQUID SIMULANT:	850Head
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	41.89
RELATIVE HUMIDITY:	35.60%	CONDUCTIVITY:	0.899
PHANTOM S/NO:	IBX-040	LIQUID TEMPERATURE:	23.20°C
PHANTOM ROTATION:	N/A	MAX SAR Y-AXIS LOCATION:	59.20mm
DUT POSITION:	Right-Cheek	MAX SAR Z-AXIS LOCATION:	-114.20mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	24.466
TEST FREQUENCY:	846.4MHz	SAR 1g:	0.548 W/kg
TYPE OF MODULATION:	QPSK (RMC Mode)	SAR 10g:	N/A
MODN. DUTY CYCLE:	100%	SAR START:	0.548 W/kg
INPUT POWER LEVEL:	24.2dBm	SAR END:	0.552 W/kg
PROBE BATTERY LAST CHANGED:	08/01/2014	SAR DRIFT DURING SCAN:	0.700 %

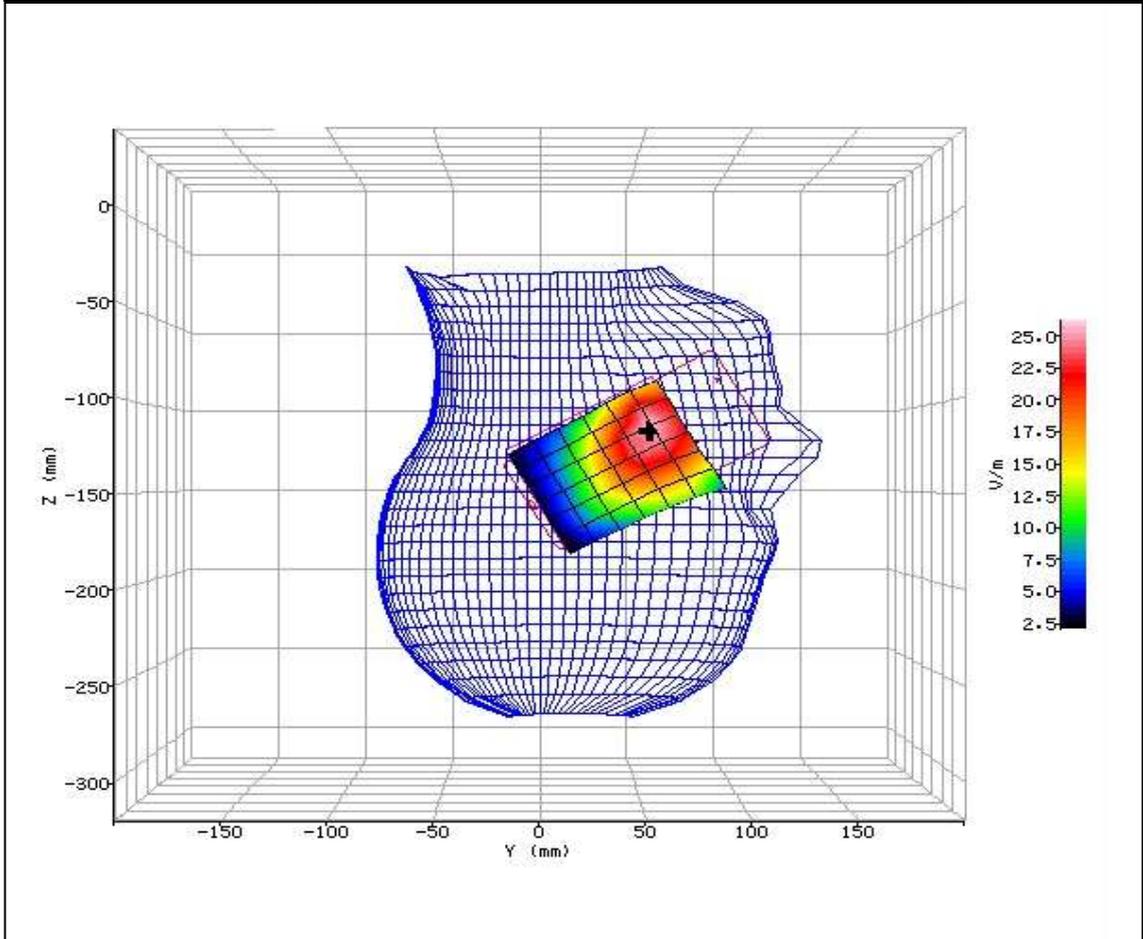


Figure 23: SAR Head Testing Results for the SHL24 Mobile Handset at 846.4MHz.



SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	08/01/2014-13:36:26	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	23.40°C	LIQUID SIMULANT:	850Head
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	41.89
RELATIVE HUMIDITY:	35.60%	CONDUCTIVITY:	0.899
PHANTOM S/NO:	IBX-040	LIQUID TEMPERATURE:	23.20°C
PHANTOM ROTATION:	N/A	MAX SAR Y-AXIS LOCATION:	44.90mm
DUT POSITION:	Right-15°	MAX SAR Z-AXIS LOCATION:	-126.20mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	19.844
TEST FREQUENCY:	846.4MHz	SAR 1g:	0.374 W/kg
TYPE OF MODULATION:	QPSK (RMC Mode)	SAR 10g:	N/A
MODN. DUTY CYCLE:	100%	SAR START:	0.364 W/kg
INPUT POWER LEVEL:	24.2dBm	SAR END:	0.370 W/kg
PROBE BATTERY LAST CHANGED:	08/01/2014	SAR DRIFT DURING SCAN:	1.600 %

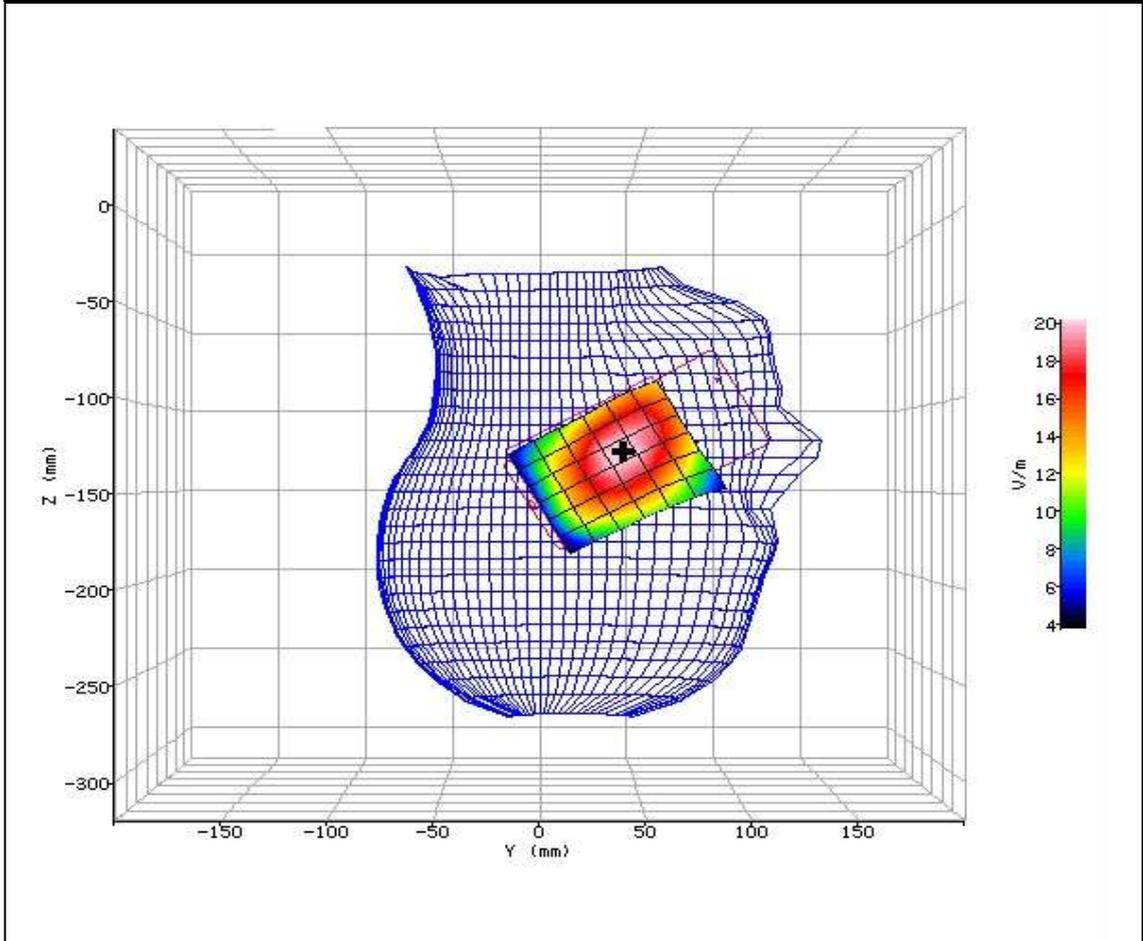


Figure 24: SAR Head Testing Results for the SHL24 Mobile Handset at 846.4MHz.

2.6 WCDMA FDD V BODY SAR TEST RESULTS AND COURSE AREA SCANS – 2D

SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	06/01/2014-15:23:04	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	23.50°C	LIQUID SIMULANT:	850Body
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	56.73
RELATIVE HUMIDITY:	35.10%	CONDUCTIVITY:	1.010
PHANTOM S/NO:	IXB-2HF	LIQUID TEMPERATURE:	23.50°C
PHANTOM ROTATION:	N/A	MAX SAR X-AXIS LOCATION:	25.40mm
DUT POSITION:	10mm-Front Face	MAX SAR Y-AXIS LOCATION:	-12.10mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	22.743
TEST FREQUENCY:	846.4MHz	SAR 1g:	0.499 W/kg
TYPE OF MODULATION:	QPSK (RMC Mode)	SAR 10g:	N/A
MODN. DUTY CYCLE:	100%	SAR START:	0.525 W/kg
INPUT POWER LEVEL:	24.2dBm	SAR END:	0.518 W/kg
PROBE BATTERY LAST CHANGED:	06/01/2014	SAR DRIFT DURING SCAN:	-1.200 %

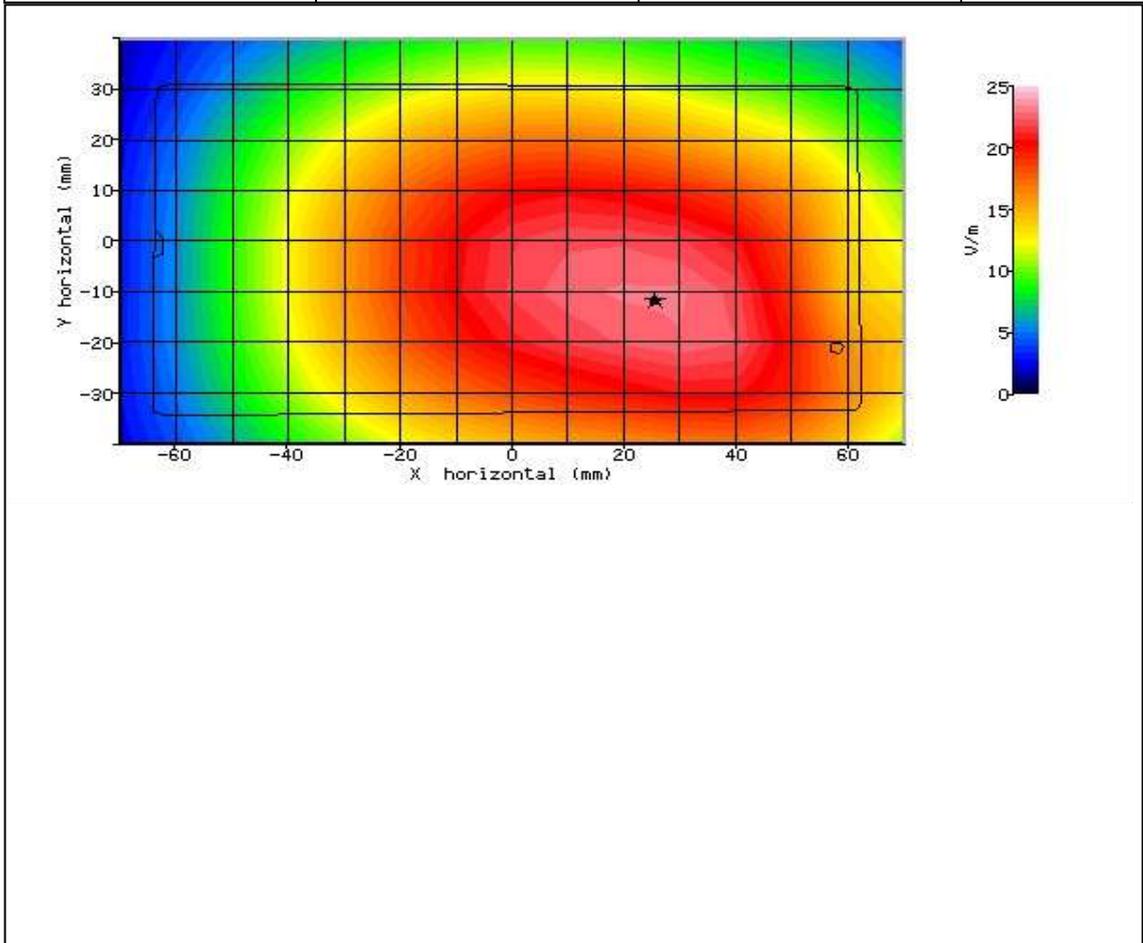


Figure 25: SAR Body Testing Results for the SHL24 Mobile Handset at 846.4MHz.



Product Service

SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	06/01/2014-15:36:31	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	23.50°C	LIQUID SIMULANT:	850Body
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	56.73
RELATIVE HUMIDITY:	35.10%	CONDUCTIVITY:	1.010
PHANTOM S/NO:	IXB-2HF	LIQUID TEMPERATURE:	23.50°C
PHANTOM ROTATION:	N/A	MAX SAR X-AXIS LOCATION:	33.10mm
DUT POSITION:	10mm-Rear Face	MAX SAR Y-AXIS LOCATION:	2.50mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	26.040
TEST FREQUENCY:	846.4MHz	SAR 1g:	0.663 W/kg
TYPE OF MODULATION:	QPSK (RMC Mode)	SAR 10g:	N/A
MODN. DUTY CYCLE:	100%	SAR START:	0.707 W/kg
INPUT POWER LEVEL:	24.2dBm	SAR END:	0.694 W/kg
PROBE BATTERY LAST CHANGED:	06/01/2014	SAR DRIFT DURING SCAN:	-1.800 %

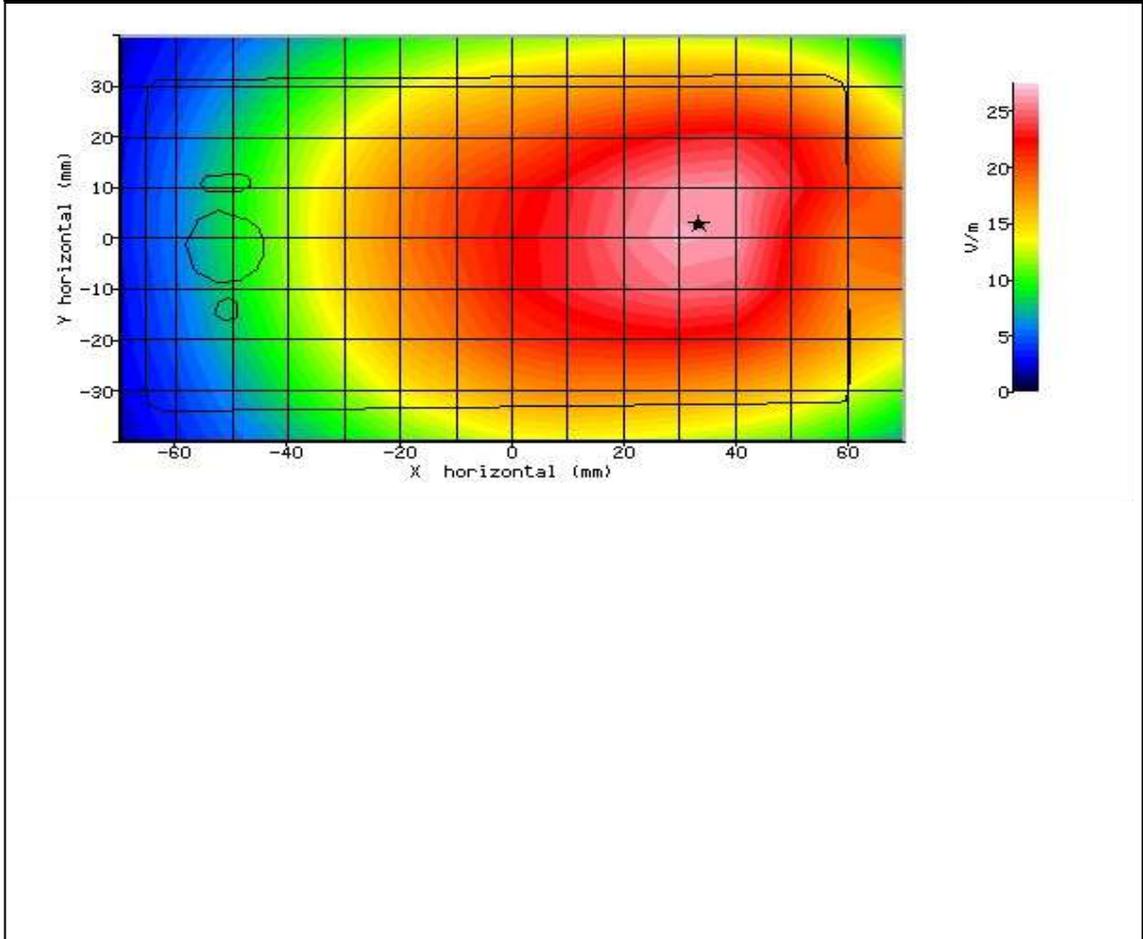


Figure 26: SAR Body Testing Results for the SHL24 Mobile Handset at 846.4MHz.



Product Service

SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	06/01/2014-16:04:10	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	23.50°C	LIQUID SIMULANT:	850Body
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	56.73
RELATIVE HUMIDITY:	35.10%	CONDUCTIVITY:	1.010
PHANTOM S/NO:	IXB-2HF	LIQUID TEMPERATURE:	23.50°C
PHANTOM ROTATION:	N/A	MAX SAR X-AXIS LOCATION:	3.80mm
DUT POSITION:	10mm-Right Edge	MAX SAR Y-AXIS LOCATION:	-4.80mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	19.740
TEST FREQUENCY:	846.4MHz	SAR 1g:	0.393 W/kg
TYPE OF MODULATION:	QPSK (RMC Mode)	SAR 10g:	N/A
MODN. DUTY CYCLE:	100%	SAR START:	0.426 W/kg
INPUT POWER LEVEL:	24.2dBm	SAR END:	0.428 W/kg
PROBE BATTERY LAST CHANGED:	06/01/2014	SAR DRIFT DURING SCAN:	0.500 %

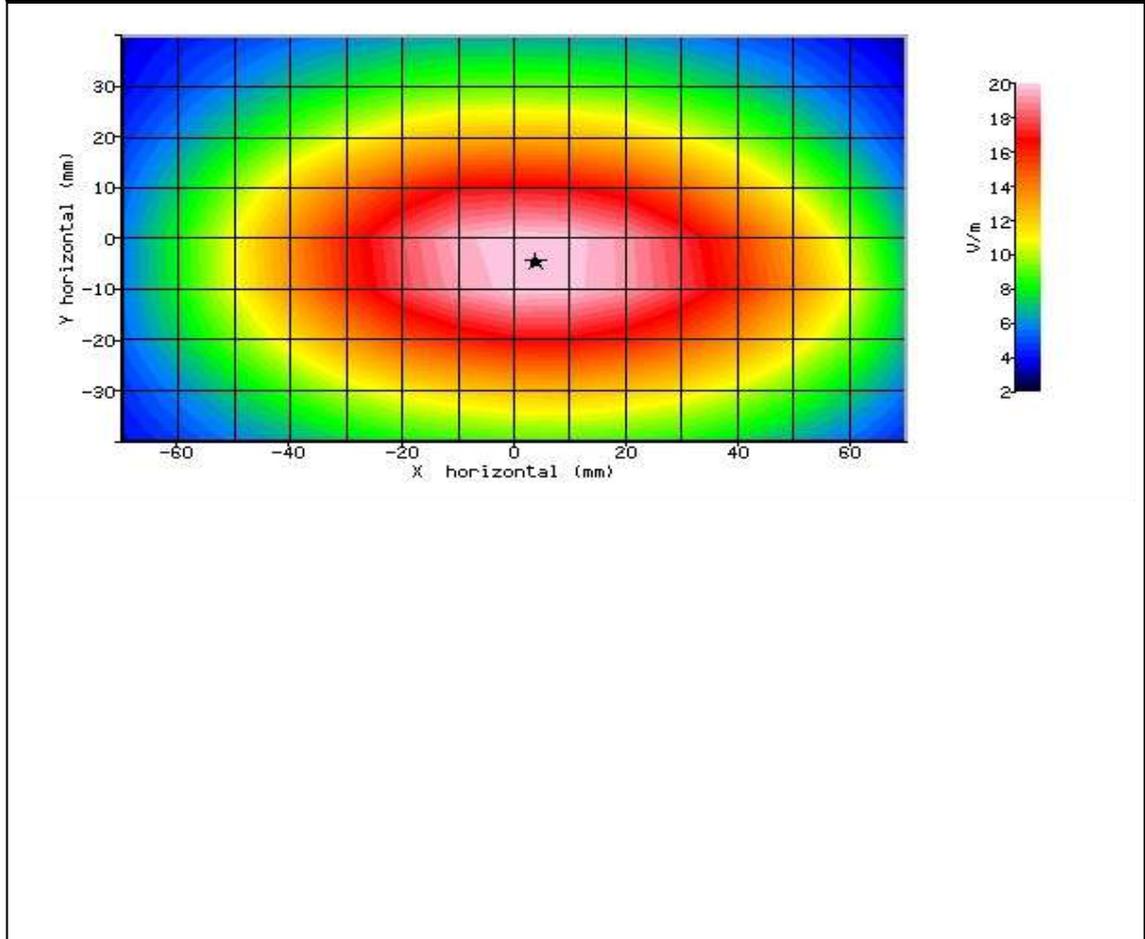


Figure 27: SAR Body Testing Results for the SHL24 Mobile Handset at 846.4MHz.



Product Service

SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	06/01/2014-16:19:41	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	23.50°C	LIQUID SIMULANT:	850Body
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	56.73
RELATIVE HUMIDITY:	35.10%	CONDUCTIVITY:	1.010
PHANTOM S/NO:	IXB-2HF	LIQUID TEMPERATURE:	23.50°C
PHANTOM ROTATION:	N/A	MAX SAR X-AXIS LOCATION:	8.70mm
DUT POSITION:	10mm-Left Edge	MAX SAR Y-AXIS LOCATION:	-4.30mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	20.119
TEST FREQUENCY:	846.4MHz	SAR 1g:	0.398 W/kg
TYPE OF MODULATION:	QPSK (RMC Mode)	SAR 10g:	N/A
MODN. DUTY CYCLE:	100%	SAR START:	0.422 W/kg
INPUT POWER LEVEL:	24.2dBm	SAR END:	0.424 W/kg
PROBE BATTERY LAST CHANGED:	06/01/2014	SAR DRIFT DURING SCAN:	0.500 %

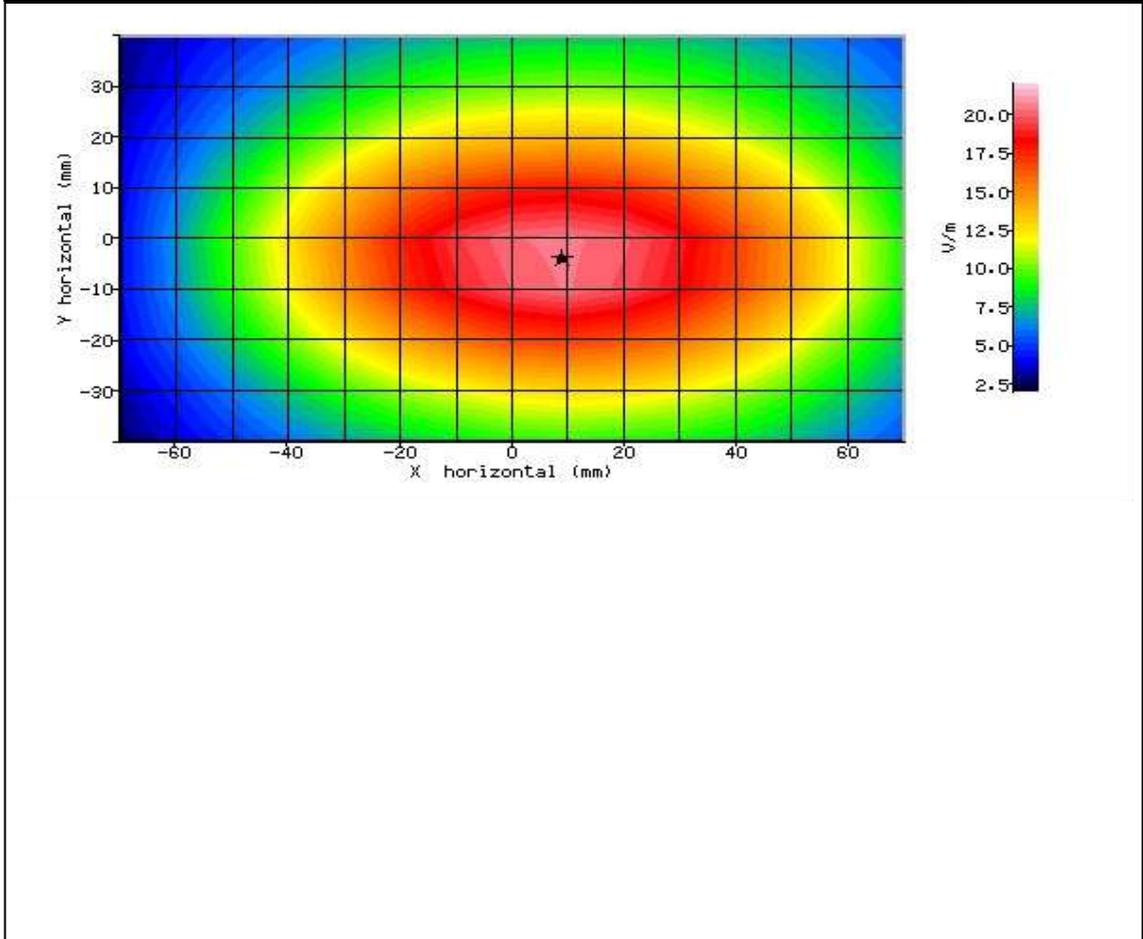


Figure 28: SAR Body Testing Results for the SHL24 Mobile Handset at 846.4MHz.



SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	06/01/2014-16:33:14	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	23.50°C	LIQUID SIMULANT:	850Body
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	56.73
RELATIVE HUMIDITY:	35.10%	CONDUCTIVITY:	1.010
PHANTOM S/NO:	IXB-2HF	LIQUID TEMPERATURE:	23.50°C
PHANTOM ROTATION:	N/A	MAX SAR X-AXIS LOCATION:	0.30mm
DUT POSITION:	10mm-Bottom Edge	MAX SAR Y-AXIS LOCATION:	1.30mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	9.591
TEST FREQUENCY:	846.4MHz	SAR 1g:	0.104 W/kg
TYPE OF MODULATION:	QPSK (RMC Mode)	SAR 10g:	N/A
MODN. DUTY CYCLE:	100%	SAR START:	0.116 W/kg
INPUT POWER LEVEL:	24.2dBm	SAR END:	0.118 W/kg
PROBE BATTERY LAST CHANGED:	06/01/2014	SAR DRIFT DURING SCAN:	0.985 %

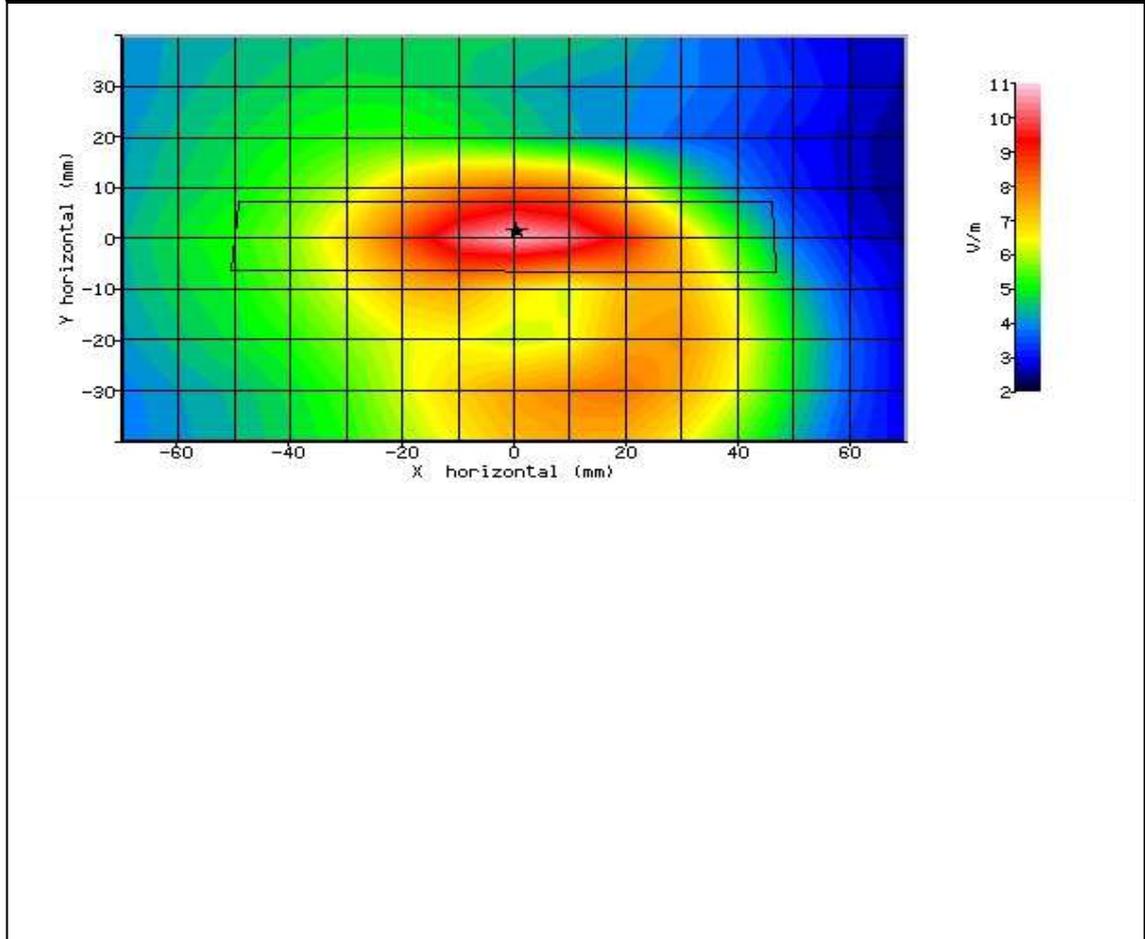


Figure 29: SAR Body Testing Results for the SHL24 Mobile Handset at 846.4MHz.



Product Service

SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	07/01/2014-06:43:24	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	23.20°C	LIQUID SIMULANT:	850Body
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	56.73
RELATIVE HUMIDITY:	37.30%	CONDUCTIVITY:	1.010
PHANTOM S/NO:	IXB-2HF	LIQUID TEMPERATURE:	23.20°C
PHANTOM ROTATION:	N/A	MAX SAR X-AXIS LOCATION:	30.70mm
DUT POSITION:	10mm-Rear Face	MAX SAR Y-AXIS LOCATION:	9.30mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	26.210
TEST FREQUENCY:	826.6MHz	SAR 1g:	0.687 W/kg
TYPE OF MODULATION:	QPSK (RMC Mode)	SAR 10g:	N/A
MODN. DUTY CYCLE:	100%	SAR START:	0.717 W/kg
INPUT POWER LEVEL:	24.2dBm	SAR END:	0.715 W/kg
PROBE BATTERY LAST CHANGED:	07/01/2014	SAR DRIFT DURING SCAN:	-0.300 %

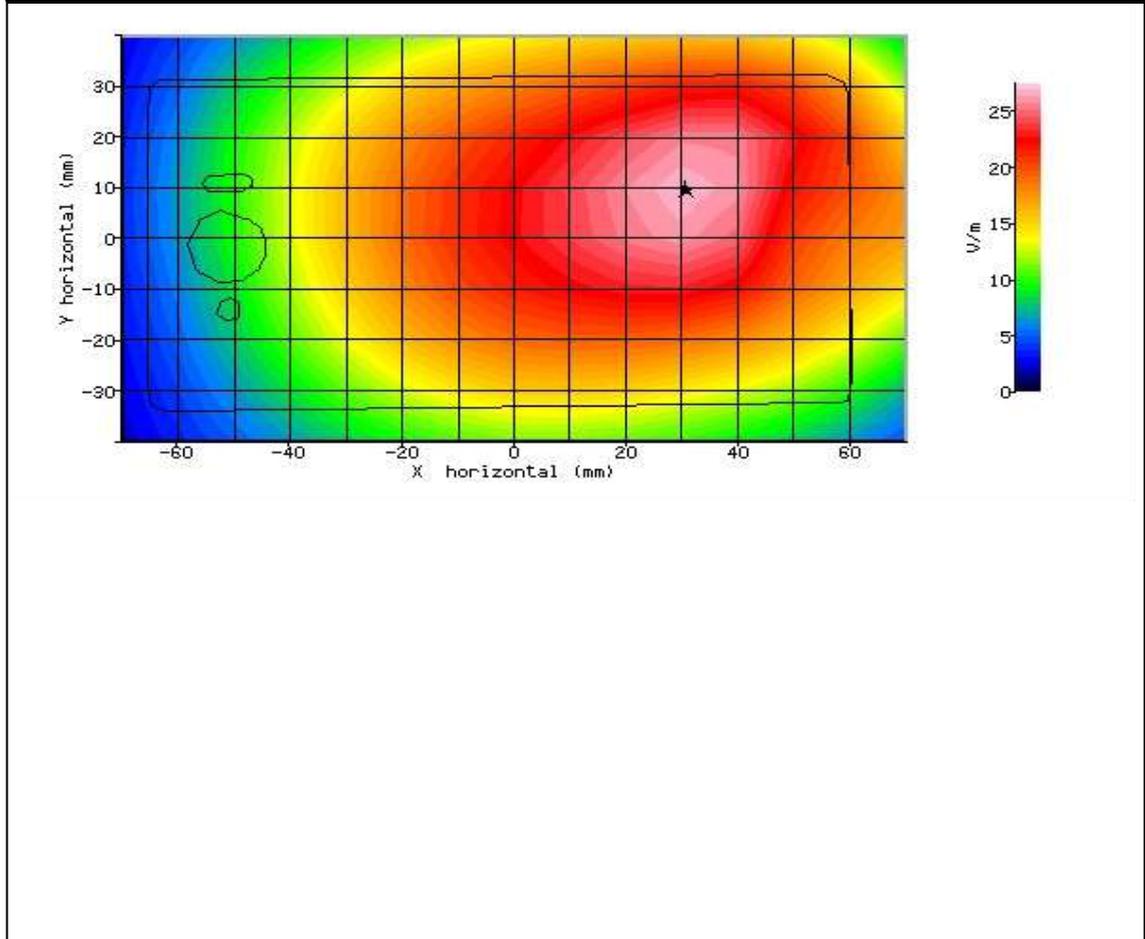


Figure 30: SAR Body Testing Results for the SHL24 Mobile Handset at 826.6MHz.



Product Service

SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	07/01/2014-06:55:40	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	23.20°C	LIQUID SIMULANT:	850Body
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	56.73
RELATIVE HUMIDITY:	37.30%	CONDUCTIVITY:	1.010
PHANTOM S/NO:	IXB-2HF	LIQUID TEMPERATURE:	23.20°C
PHANTOM ROTATION:	N/A	MAX SAR X-AXIS LOCATION:	30.50mm
DUT POSITION:	10mm-Rear Face	MAX SAR Y-AXIS LOCATION:	9.00mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	25.995
TEST FREQUENCY:	835MHz	SAR 1g:	0.679 W/kg
TYPE OF MODULATION:	QPSK (RMC Mode)	SAR 10g:	N/A
MODN. DUTY CYCLE:	100%	SAR START:	0.726 W/kg
INPUT POWER LEVEL:	24.2dBm	SAR END:	0.725 W/kg
PROBE BATTERY LAST CHANGED:	07/01/2014	SAR DRIFT DURING SCAN:	-0.200 %

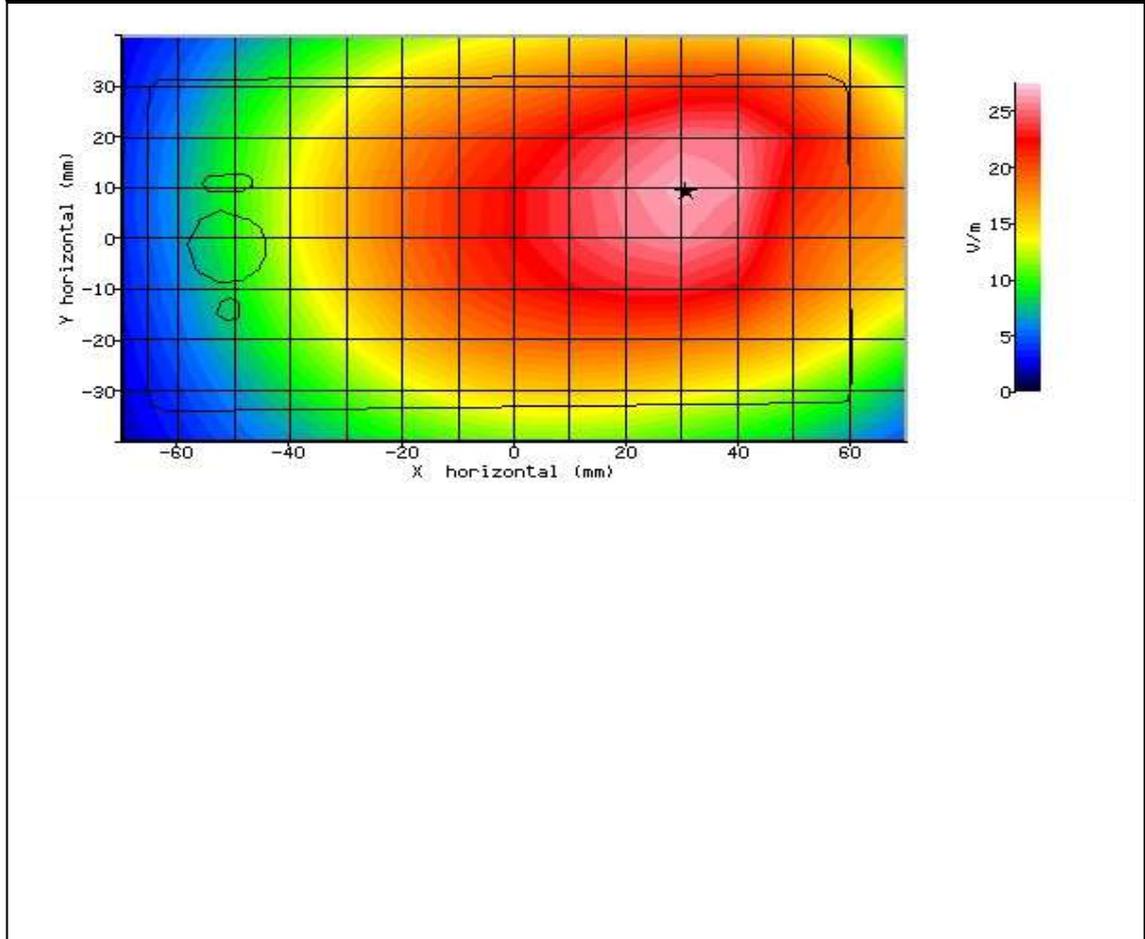


Figure 31: SAR Body Testing Results for the SHL24 Mobile Handset at 835MHz.

2.7 PCS 1900MHz HEAD SAR TEST RESULTS AND COURSE AREA SCANS – 2D

SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	08/01/2014-16:22:06	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	23.40°C	LIQUID SIMULANT:	1900Head
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	38.40
RELATIVE HUMIDITY:	35.10%	CONDUCTIVITY:	1.447
PHANTOM S/NO:	IBX-040	LIQUID TEMPERATURE:	23.20°C
PHANTOM ROTATION:	N/A	MAX SAR Y-AXIS LOCATION:	61.20mm
DUT POSITION:	Left-Cheek	MAX SAR Z-AXIS LOCATION:	-98.40mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	13.768
TEST FREQUENCY:	1850.2MHz	SAR 1g:	0.307 W/kg
TYPE OF MODULATION:	GMSK (Voice Mode)	SAR 10g:	N/A
MODN. DUTY CYCLE:	12.5%	SAR START:	0.296 W/kg
INPUT POWER LEVEL:	30.5dBm	SAR END:	0.323 W/kg
PROBE BATTERY LAST CHANGED:	08/01/2014	SAR DRIFT DURING SCAN:	6.600 %

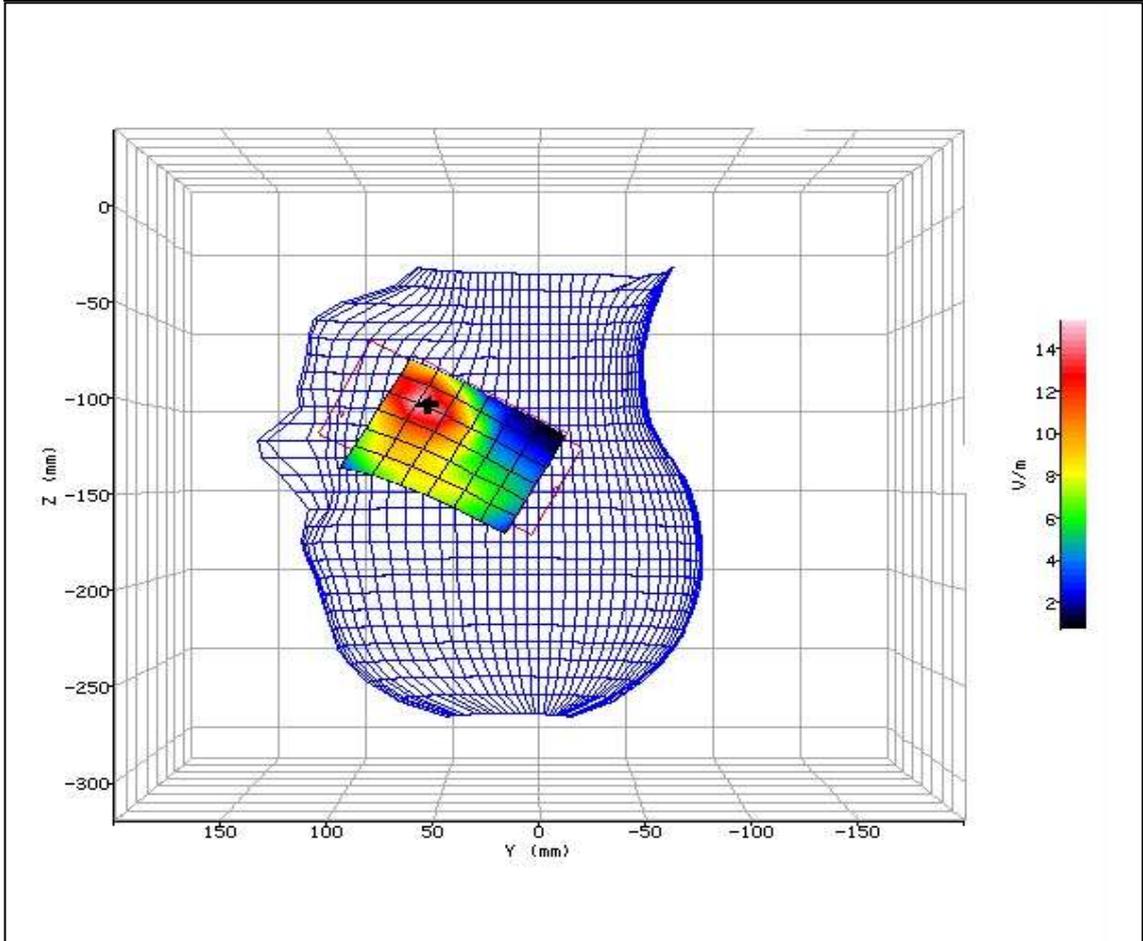


Figure 32: SAR Head Testing Results for the SHL24 Mobile Handset at 1850.2MHz.



SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	08/01/2014-16:39:03	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	23.40°C	LIQUID SIMULANT:	1900Head
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	38.40
RELATIVE HUMIDITY:	35.10%	CONDUCTIVITY:	1.447
PHANTOM S/NO:	IBX-040	LIQUID TEMPERATURE:	23.20°C
PHANTOM ROTATION:	N/A	MAX SAR Y-AXIS LOCATION:	26.70mm
DUT POSITION:	Left-15°	MAX SAR Z-AXIS LOCATION:	-153.60mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	7.463
TEST FREQUENCY:	1850.2MHz	SAR 1g:	0.108 W/kg
TYPE OF MODULATION:	GMSK (Voice Mode)	SAR 10g:	N/A
MODN. DUTY CYCLE:	12.5%	SAR START:	0.092 W/kg
INPUT POWER LEVEL:	30.5dBm	SAR END:	0.085 W/kg
PROBE BATTERY LAST CHANGED:	08/01/2014	SAR DRIFT DURING SCAN:	-7.600 %

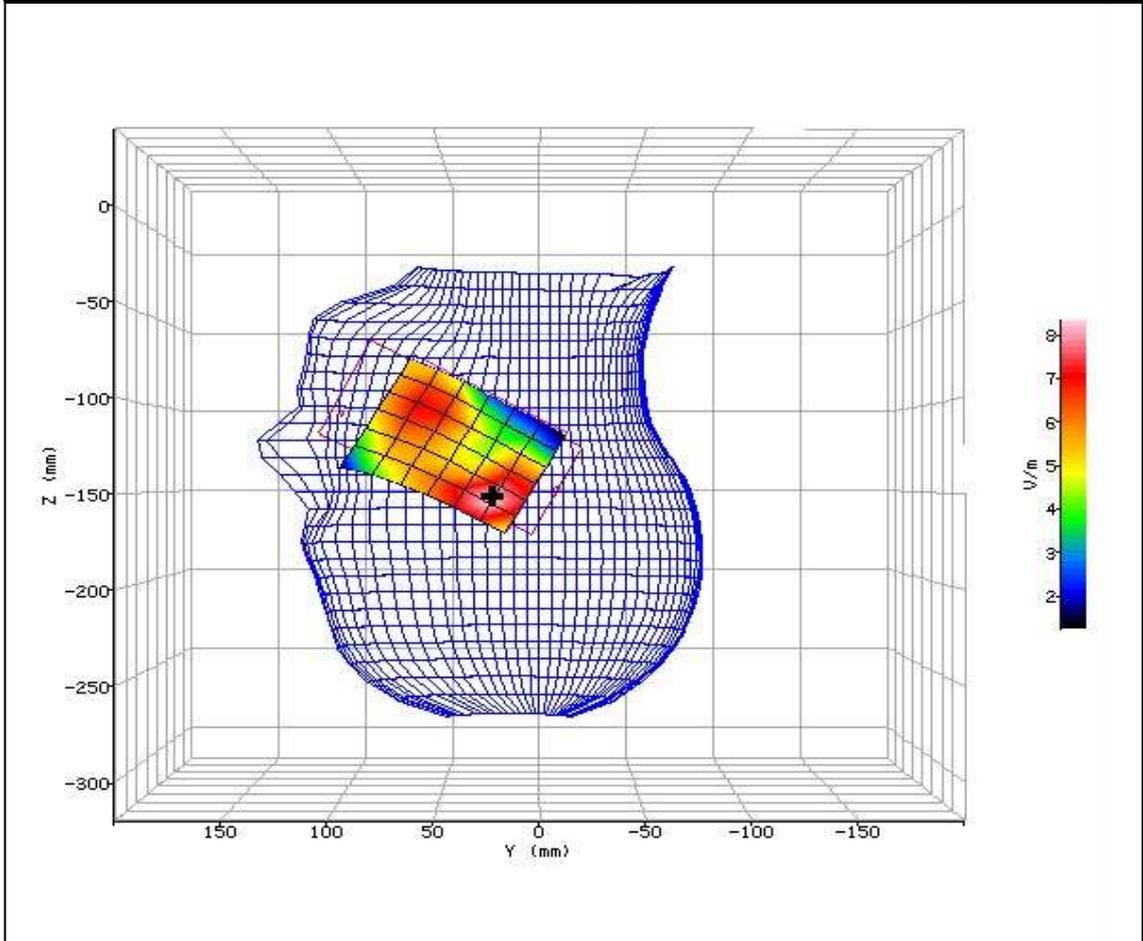


Figure 33: SAR Head Testing Results for the SHL24 Mobile Handset at 1850.2MHz.



SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	09/01/2014-08:53:21	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	22.80°C	LIQUID SIMULANT:	1900Head
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	38.40
RELATIVE HUMIDITY:	42.90%	CONDUCTIVITY:	1.447
PHANTOM S/NO:	IBX-040	LIQUID TEMPERATURE:	23.00°C
PHANTOM ROTATION:	N/A	MAX SAR Y-AXIS LOCATION:	66.00mm
DUT POSITION:	Right-Cheek	MAX SAR Z-AXIS LOCATION:	-98.10mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	11.903
TEST FREQUENCY:	1850.2MHz	SAR 1g:	0.218 W/kg
TYPE OF MODULATION:	GMSK (Voice Mode)	SAR 10g:	N/A
MODN. DUTY CYCLE:	12.5%	SAR START:	0.225 W/kg
INPUT POWER LEVEL:	30.5dBm	SAR END:	0.231 W/kg
PROBE BATTERY LAST CHANGED:	09/01/2014	SAR DRIFT DURING SCAN:	2.700 %

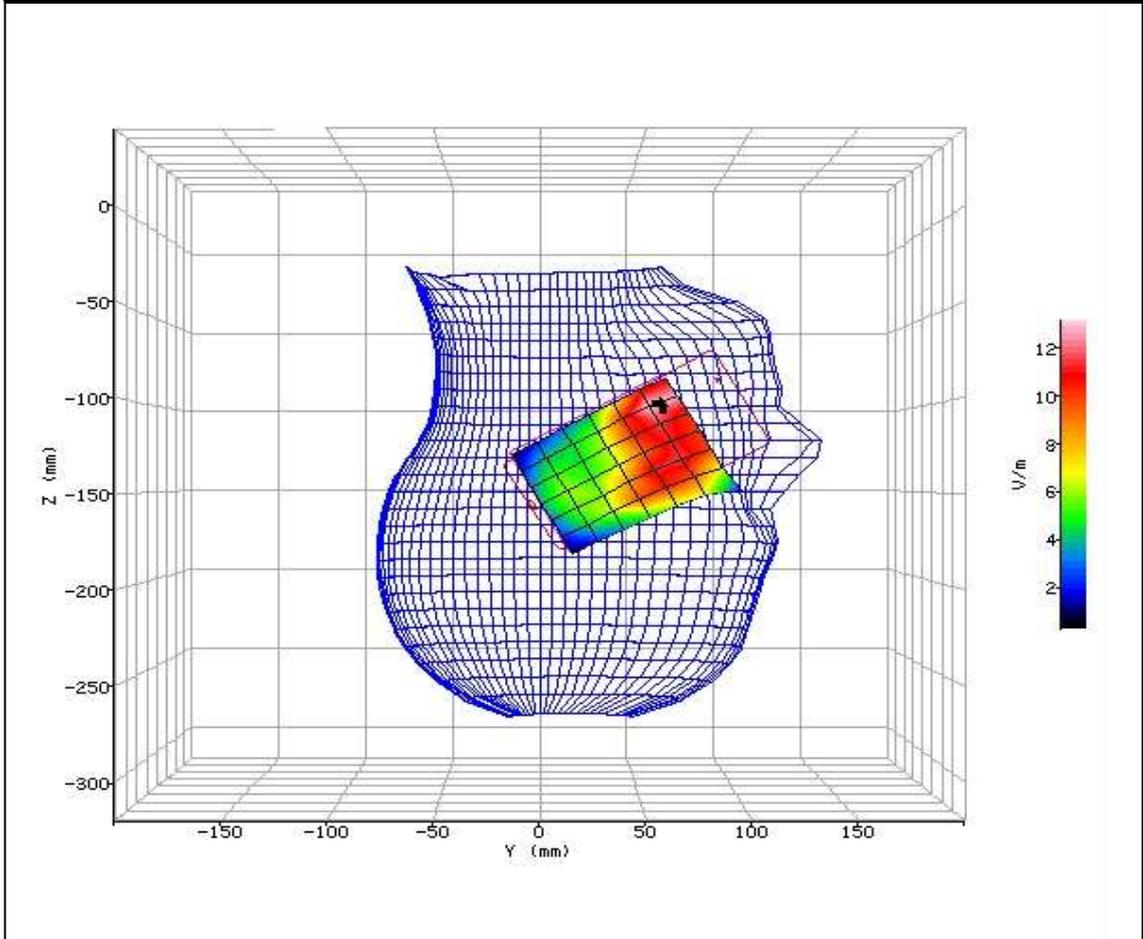


Figure 34: SAR Head Testing Results for the SHL24 Mobile Handset at 1850.2MHz.



SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	09/01/2014-09:11:21	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	22.80°C	LIQUID SIMULANT:	1900Head
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	38.40
RELATIVE HUMIDITY:	42.90%	CONDUCTIVITY:	1.447
PHANTOM S/NO:	IBX-040	LIQUID TEMPERATURE:	23.00°C
PHANTOM ROTATION:	N/A	MAX SAR Y-AXIS LOCATION:	15.90mm
DUT POSITION:	Right-15°	MAX SAR Z-AXIS LOCATION:	-150.10mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	7.167
TEST FREQUENCY:	1850.2MHz	SAR 1g:	0.096 W/kg
TYPE OF MODULATION:	GMSK (Voice Mode)	SAR 10g:	N/A
MODN. DUTY CYCLE:	12.5%	SAR START:	0.085 W/kg
INPUT POWER LEVEL:	30.5dBm	SAR END:	0.089 W/kg
PROBE BATTERY LAST CHANGED:	09/01/2014	SAR DRIFT DURING SCAN:	4.700 %

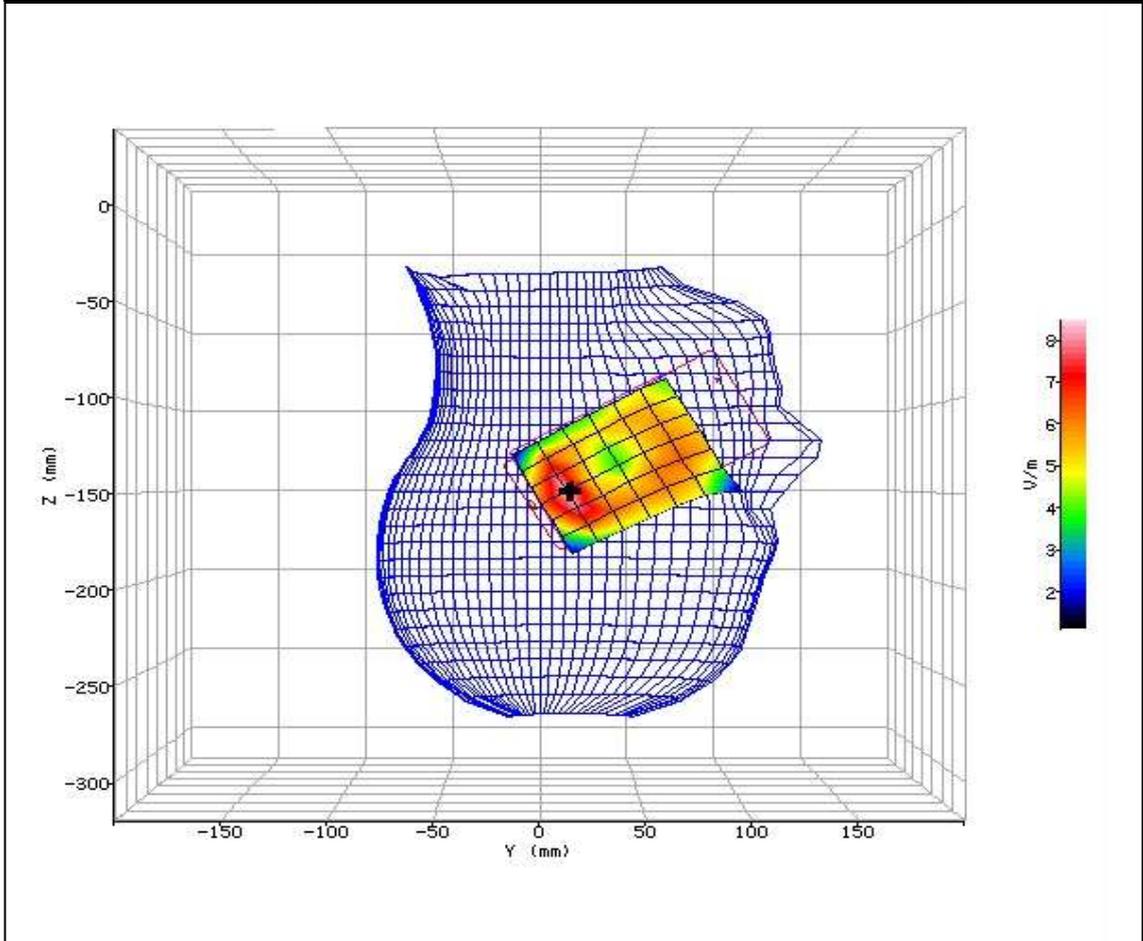


Figure 35: SAR Head Testing Results for the SHL24 Mobile Handset at 1850.2MHz.

2.8 PCS 1900MHz HEAD SAR TEST RESULTS AND COURSE AREA SCANS – 2D

SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	09/01/2014-06:49:45	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	22.80°C	LIQUID SIMULANT:	1900Head
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	38.40
RELATIVE HUMIDITY:	42.90%	CONDUCTIVITY:	1.447
PHANTOM S/NO:	IBX-040	LIQUID TEMPERATURE:	23.00°C
PHANTOM ROTATION:	N/A	MAX SAR Y-AXIS LOCATION:	60.60mm
DUT POSITION:	Left-Cheek	MAX SAR Z-AXIS LOCATION:	-97.40mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	14.830
TEST FREQUENCY:	1850.2MHz	SAR 1g:	0.329 W/kg
TYPE OF MODULATION:	GMSK (GPRS Mode)	SAR 10g:	N/A
MODN. DUTY CYCLE:	50%	SAR START:	0.335 W/kg
INPUT POWER LEVEL:	24.9dBm	SAR END:	0.343 W/kg
PROBE BATTERY LAST CHANGED:	09/01/2014	SAR DRIFT DURING SCAN:	2.400 %

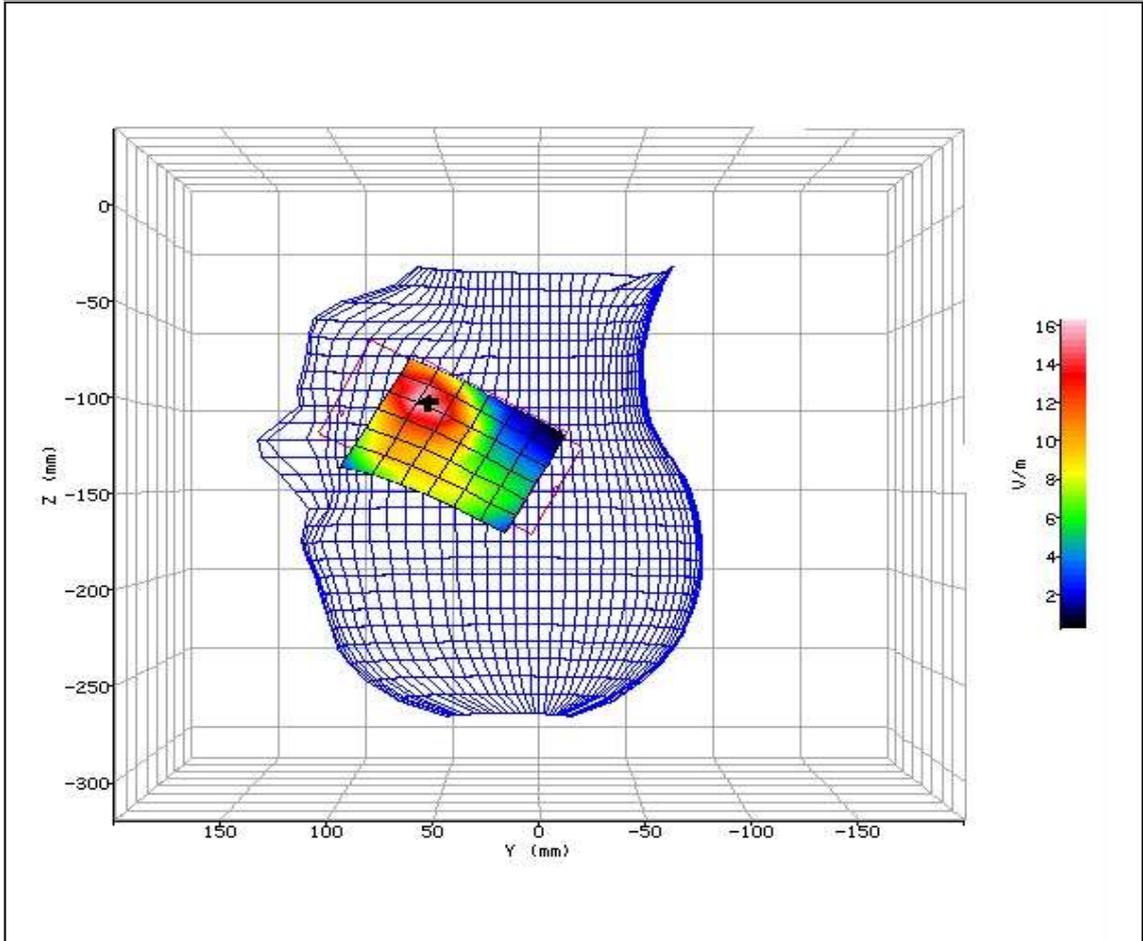


Figure 36: SAR Head Testing Results for the SHL24 Mobile Handset at 1850.2MHz.



SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	09/01/2014-07:06:18	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	22.80°C	LIQUID SIMULANT:	1900Head
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	38.40
RELATIVE HUMIDITY:	42.90%	CONDUCTIVITY:	1.447
PHANTOM S/NO:	IBX-040	LIQUID TEMPERATURE:	23.00°C
PHANTOM ROTATION:	N/A	MAX SAR Y-AXIS LOCATION:	26.70mm
DUT POSITION:	Left-15°	MAX SAR Z-AXIS LOCATION:	-153.60mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	7.557
TEST FREQUENCY:	1850.2MHz	SAR 1g:	0.115 W/kg
TYPE OF MODULATION:	GMSK (GPRS Mode)	SAR 10g:	N/A
MODN. DUTY CYCLE:	50%	SAR START:	0.090 W/kg
INPUT POWER LEVEL:	24.9dBm	SAR END:	0.093 W/kg
PROBE BATTERY LAST CHANGED:	09/01/2014	SAR DRIFT DURING SCAN:	3.300 %

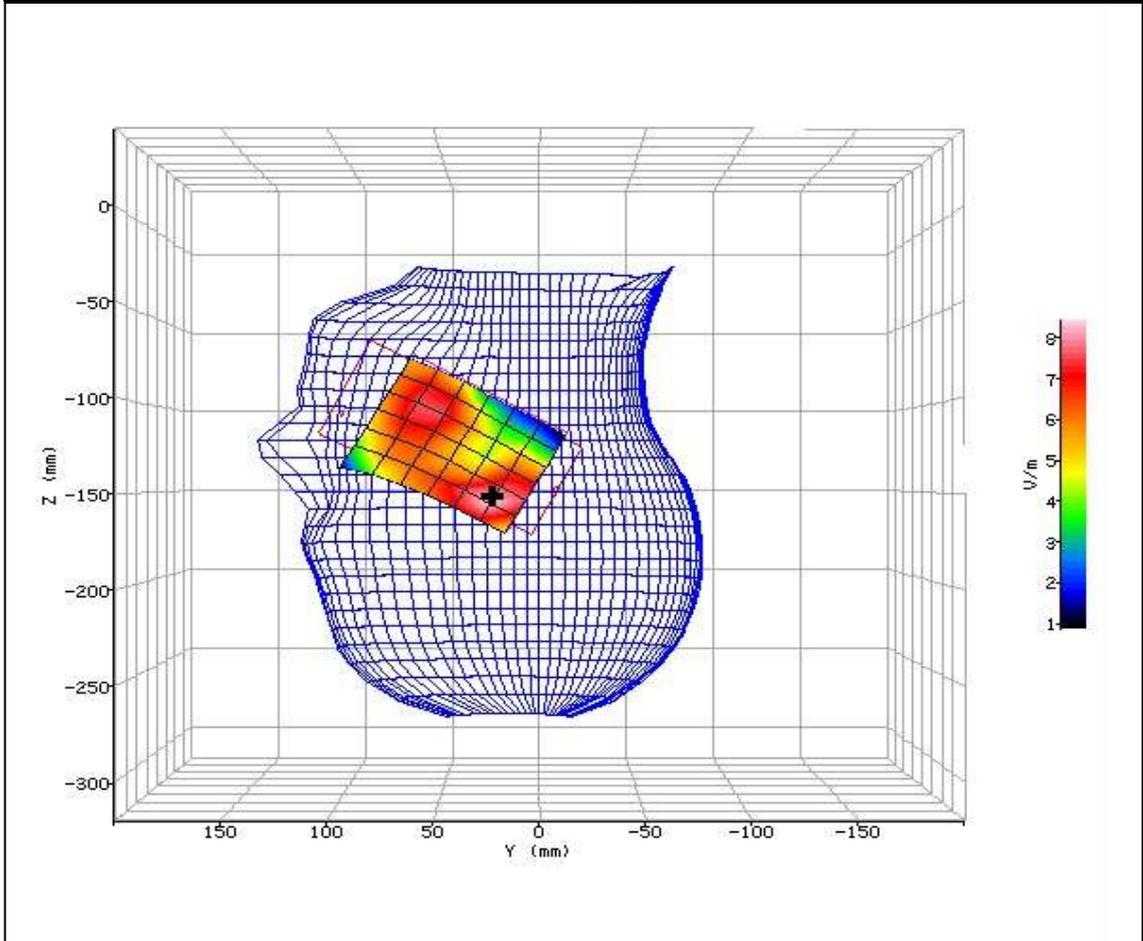


Figure 37: SAR Head Testing Results for the SHL24 Mobile Handset at 1850.2MHz.



SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	09/01/2014-07:49:23	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	22.80°C	LIQUID SIMULANT:	1900Head
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	38.40
RELATIVE HUMIDITY:	42.90%	CONDUCTIVITY:	1.447
PHANTOM S/NO:	IBX-040	LIQUID TEMPERATURE:	23.00°C
PHANTOM ROTATION:	N/A	MAX SAR Y-AXIS LOCATION:	63.80mm
DUT POSITION:	Right-Cheek	MAX SAR Z-AXIS LOCATION:	-99.10mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	12.616
TEST FREQUENCY:	1850.2MHz	SAR 1g:	0.220 W/kg
TYPE OF MODULATION:	GMSK (GPRS Mode)	SAR 10g:	N/A
MODN. DUTY CYCLE:	50%	SAR START:	0.243 W/kg
INPUT POWER LEVEL:	24.9dBm	SAR END:	0.240 W/kg
PROBE BATTERY LAST CHANGED:	09/01/2014	SAR DRIFT DURING SCAN:	-1.200 %

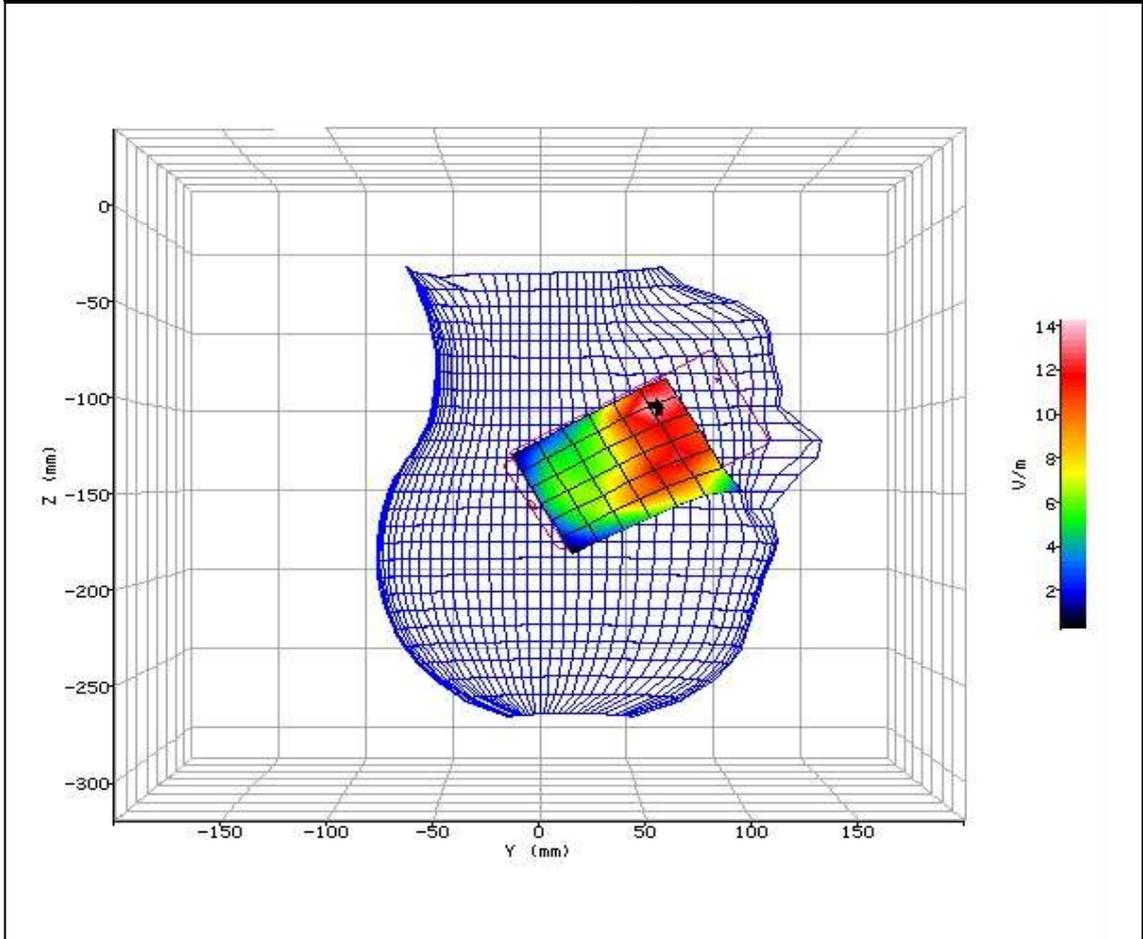


Figure 38: SAR Head Testing Results for the SHL24 Mobile Handset at 1850.2MHz.



SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	09/01/2014-08:08:13	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	22.80°C	LIQUID SIMULANT:	1900Head
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	38.40
RELATIVE HUMIDITY:	42.90%	CONDUCTIVITY:	1.447
PHANTOM S/NO:	IBX-040	LIQUID TEMPERATURE:	23.00°C
PHANTOM ROTATION:	N/A	MAX SAR Y-AXIS LOCATION:	16.50mm
DUT POSITION:	Right-15°	MAX SAR Z-AXIS LOCATION:	-149.70mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	7.545
TEST FREQUENCY:	1850.2MHz	SAR 1g:	0.097 W/kg
TYPE OF MODULATION:	GMSK (GPRS Mode)	SAR 10g:	N/A
MODN. DUTY CYCLE:	50%	SAR START:	0.097 W/kg
INPUT POWER LEVEL:	24.9dBm	SAR END:	0.094 W/kg
PROBE BATTERY LAST CHANGED:	09/01/2014	SAR DRIFT DURING SCAN:	-3.100 %

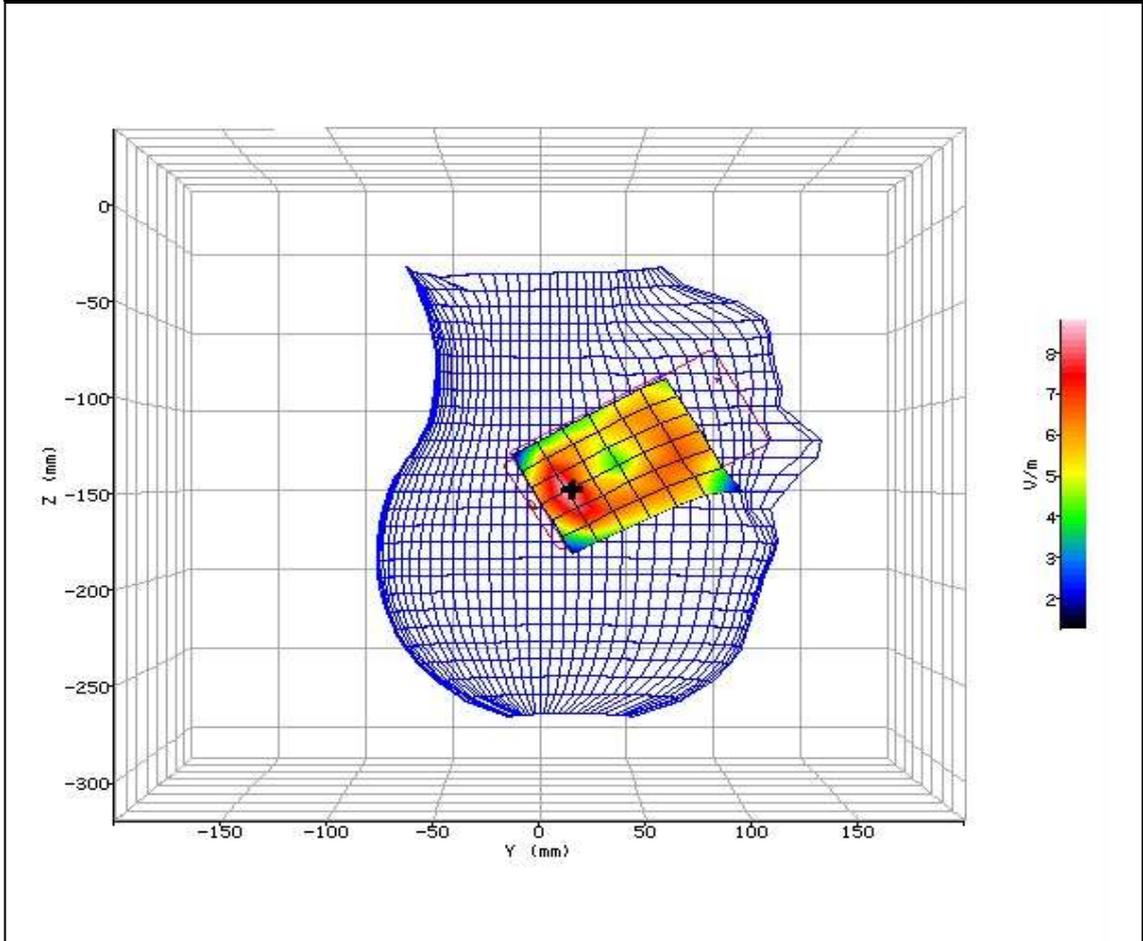


Figure 39: SAR Head Testing Results for the SHL24 Mobile Handset at 1850.2MHz.

2.9 PCS 1900MHz BODY SAR TEST RESULTS AND COURSE AREA SCANS – 2D

SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	07/01/2014-11:59:28	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	22.70°C	LIQUID SIMULANT:	1900Body
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	53.40
RELATIVE HUMIDITY:	37.30%	CONDUCTIVITY:	1.591
PHANTOM S/NO:	IXB-2HF	LIQUID TEMPERATURE:	23.20°C
PHANTOM ROTATION:	N/A	MAX SAR X-AXIS LOCATION:	43.70mm
DUT POSITION:	10mm-Front Face	MAX SAR Y-AXIS LOCATION:	-13.60mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	14.117
TEST FREQUENCY:	1850.2MHz	SAR 1g:	0.308 W/kg
TYPE OF MODULATION:	QPSK (RMC Mode)	SAR 10g:	N/A
MODN. DUTY CYCLE:	50%	SAR START:	0.335 W/kg
INPUT POWER LEVEL:	24.9dBm	SAR END:	0.319 W/kg
PROBE BATTERY LAST CHANGED:	07/01/2014	SAR DRIFT DURING SCAN:	-4.700 %

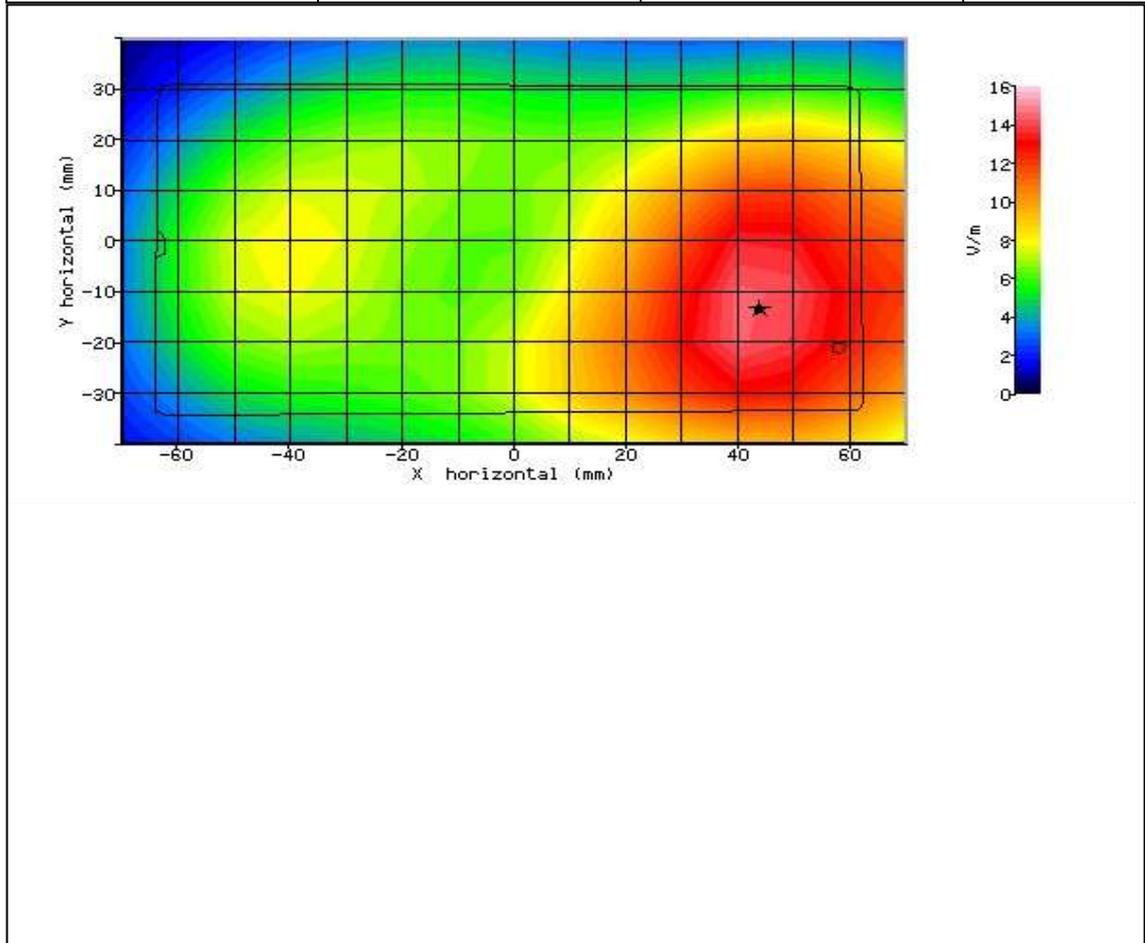


Figure 40: SAR Body Testing Results for the SHL24 Mobile Handset at 1850.2MHz.



Product Service

SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	07/01/2014-12:12:30	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	22.70°C	LIQUID SIMULANT:	1900Body
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	53.40
RELATIVE HUMIDITY:	37.30%	CONDUCTIVITY:	1.591
PHANTOM S/NO:	IXB-2HF	LIQUID TEMPERATURE:	23.20°C
PHANTOM ROTATION:	N/A	MAX SAR X-AXIS LOCATION:	35.70mm
DUT POSITION:	10mm-Rear Face	MAX SAR Y-AXIS LOCATION:	10.20mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	15.186
TEST FREQUENCY:	1850.2MHz	SAR 1g:	0.366 W/kg
TYPE OF MODULATION:	QPSK (RMC Mode)	SAR 10g:	N/A
MODN. DUTY CYCLE:	50%	SAR START:	0.394 W/kg
INPUT POWER LEVEL:	24.9dBm	SAR END:	0.385 W/kg
PROBE BATTERY LAST CHANGED:	07/01/2014	SAR DRIFT DURING SCAN:	-2.200 %

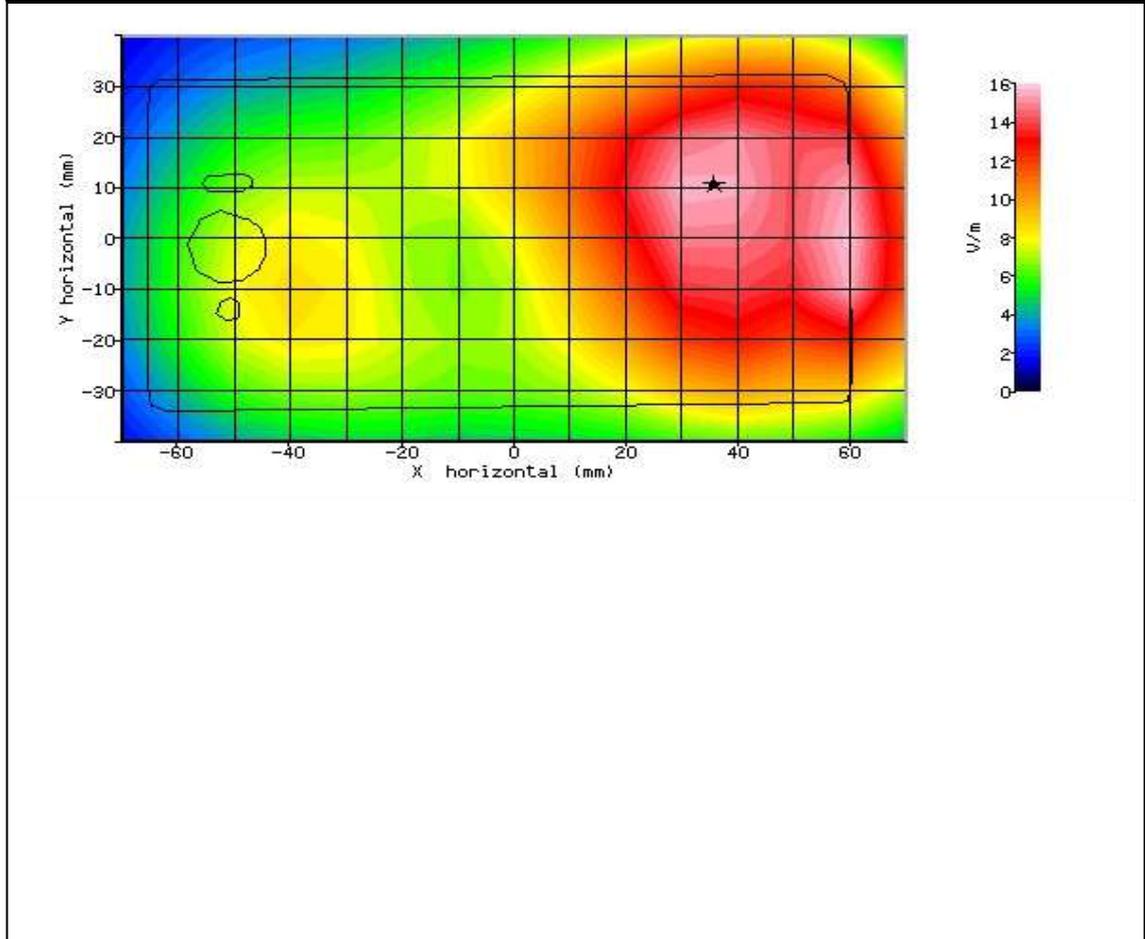


Figure 41: SAR Body Testing Results for the SHL24 Mobile Handset at 1850.2MHz.



Product Service

SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	07/01/2014-11:19:47	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	22.70°C	LIQUID SIMULANT:	1900Body
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	53.40
RELATIVE HUMIDITY:	37.30%	CONDUCTIVITY:	1.591
PHANTOM S/NO:	IXB-2HF	LIQUID TEMPERATURE:	23.20°C
PHANTOM ROTATION:	N/A	MAX SAR X-AXIS LOCATION:	55.00mm
DUT POSITION:	10mm-Right Edge	MAX SAR Y-AXIS LOCATION:	-0.70mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	6.168
TEST FREQUENCY:	1850.2MHz	SAR 1g:	0.063 W/kg
TYPE OF MODULATION:	QPSK (RMC Mode)	SAR 10g:	N/A
MODN. DUTY CYCLE:	50%	SAR START:	0.068 W/kg
INPUT POWER LEVEL:	24.9dBm	SAR END:	0.068 W/kg
PROBE BATTERY LAST CHANGED:	07/01/2014	SAR DRIFT DURING SCAN:	-3.000 %

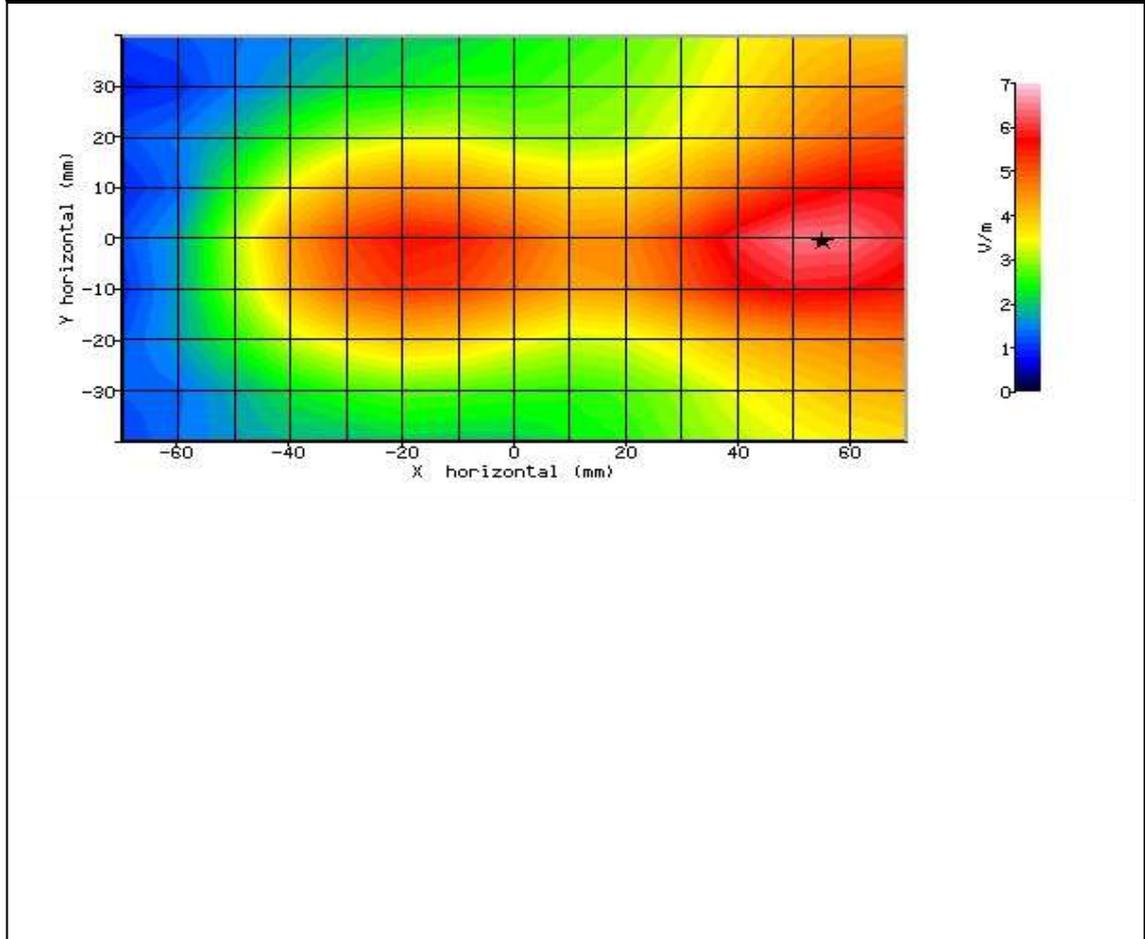


Figure 42: SAR Body Testing Results for the SHL24 Mobile Handset at 1850.2MHz.



Product Service

SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	07/01/2014-11:04:41	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	22.70°C	LIQUID SIMULANT:	1900Body
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	53.40
RELATIVE HUMIDITY:	37.30%	CONDUCTIVITY:	1.591
PHANTOM S/NO:	IXB-2HF	LIQUID TEMPERATURE:	23.20°C
PHANTOM ROTATION:	N/A	MAX SAR X-AXIS LOCATION:	-1.20mm
DUT POSITION:	10mm-Bottom Edge	MAX SAR Y-AXIS LOCATION:	2.20mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	16.837
TEST FREQUENCY:	1850.2MHz	SAR 1g:	0.486 W/kg
TYPE OF MODULATION:	QPSK (RMC Mode)	SAR 10g:	N/A
MODN. DUTY CYCLE:	50%	SAR START:	0.552 W/kg
INPUT POWER LEVEL:	24.9dBm	SAR END:	0.541 W/kg
PROBE BATTERY LAST CHANGED:	07/01/2014	SAR DRIFT DURING SCAN:	-1.900 %

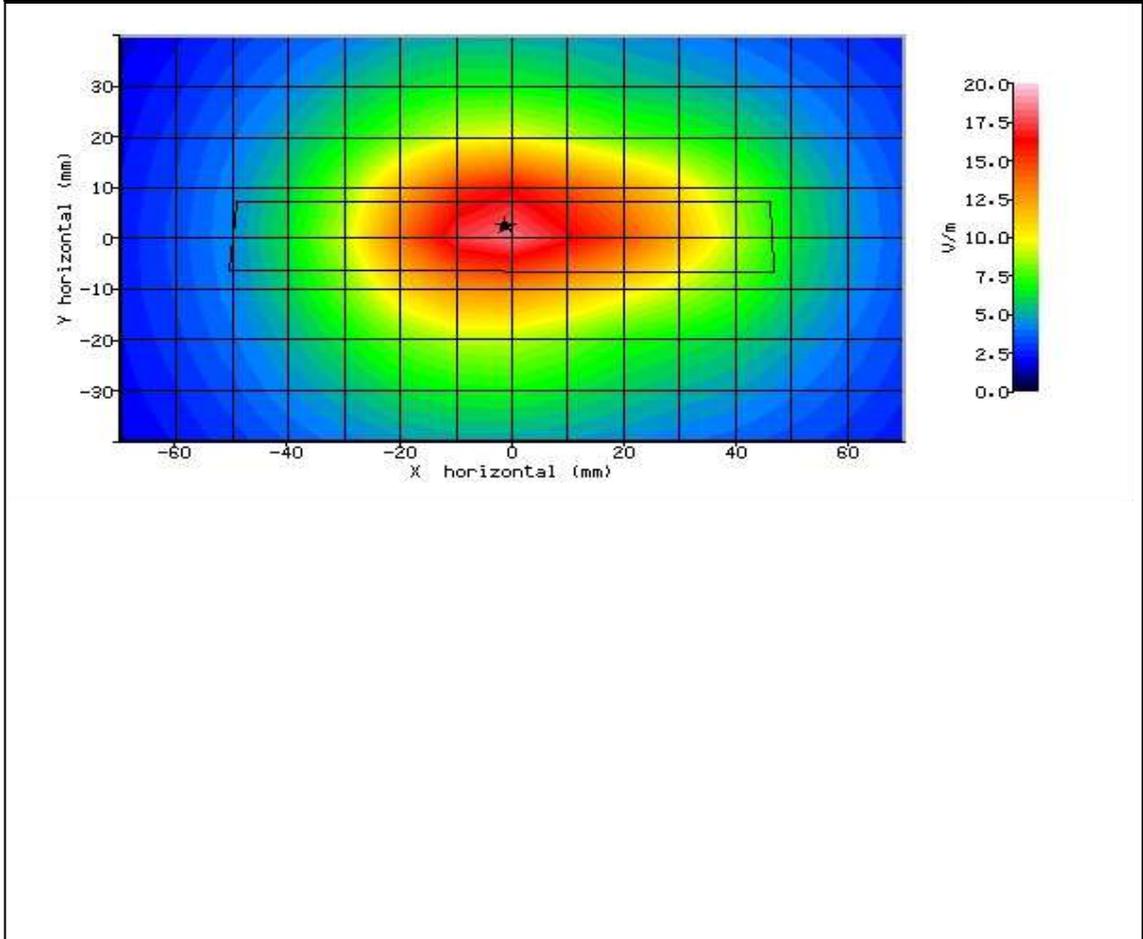


Figure 43: SAR Body Testing Results for the SHL24 Mobile Handset at 1850.2MHz.



2.10 WLAN 2450MHz HEAD SAR TEST RESULTS AND COURSE AREA SCANS – 2D

SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	07/01/2014-16:24:52	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	22.80°C	LIQUID SIMULANT:	2450Head
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	39.30
RELATIVE HUMIDITY:	40.20%	CONDUCTIVITY:	1.789
PHANTOM S/NO:	IBX-040	LIQUID TEMPERATURE:	23.10°C
PHANTOM ROTATION:	N/A	MAX SAR Y-AXIS LOCATION:	23.900mm
DUT POSITION:	Left-Cheek	MAX SAR Z-AXIS LOCATION:	-165.200mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	7.373
TEST FREQUENCY:	2412.0MHz	SAR 1g:	0.149 W/kg
TYPE OF MODULATION:	DSSS (WLAN)	SAR 10g:	N/A
MODN. DUTY CYCLE:	100%	SAR START:	0.128 W/kg
INPUT POWER LEVEL:	15.5dBm	SAR END:	0.129 W/kg
PROBE BATTERY LAST CHANGED:	07/01/2014	SAR DRIFT DURING SCAN:	0.800 %

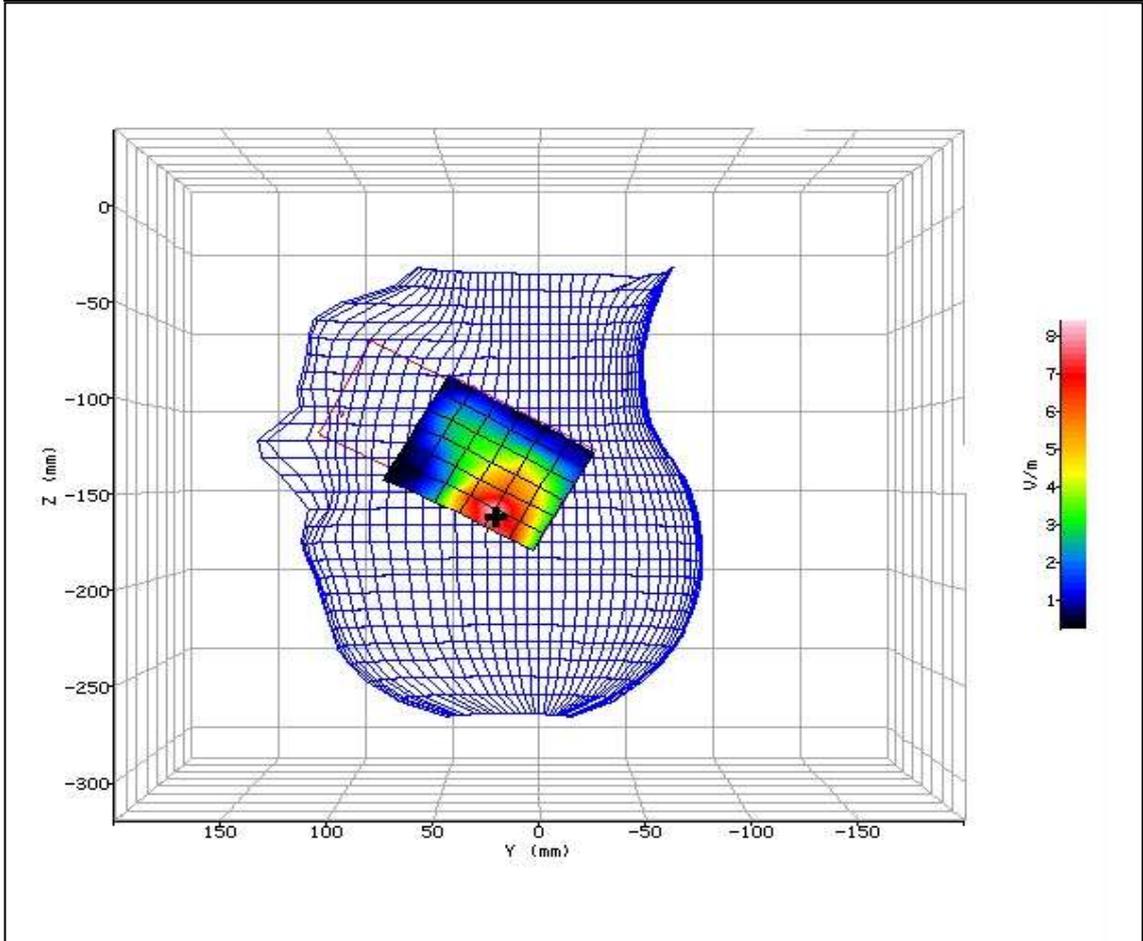


Figure 44: SAR Head Testing Results for the SHL24 Mobile Handset at 2412.0MHz.



SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	07/01/2014-16:43:26	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	22.80°C	LIQUID SIMULANT:	2450Head
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	39.30
RELATIVE HUMIDITY:	40.20%	CONDUCTIVITY:	1.789
PHANTOM S/NO:	IBX-040	LIQUID TEMPERATURE:	23.10°C
PHANTOM ROTATION:	N/A	MAX SAR Y-AXIS LOCATION:	17.600mm
DUT POSITION:	Left-15°	MAX SAR Z-AXIS LOCATION:	-163.400mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	6.301
TEST FREQUENCY:	2412.0MHz	SAR 1g:	0.109 W/kg
TYPE OF MODULATION:	DSSS (WLAN)	SAR 10g:	N/A
MODN. DUTY CYCLE:	100%	SAR START:	0.080 W/kg
INPUT POWER LEVEL:	15.5dBm	SAR END:	0.081 W/kg
PROBE BATTERY LAST CHANGED:	07/01/2014	SAR DRIFT DURING SCAN:	1.300 %

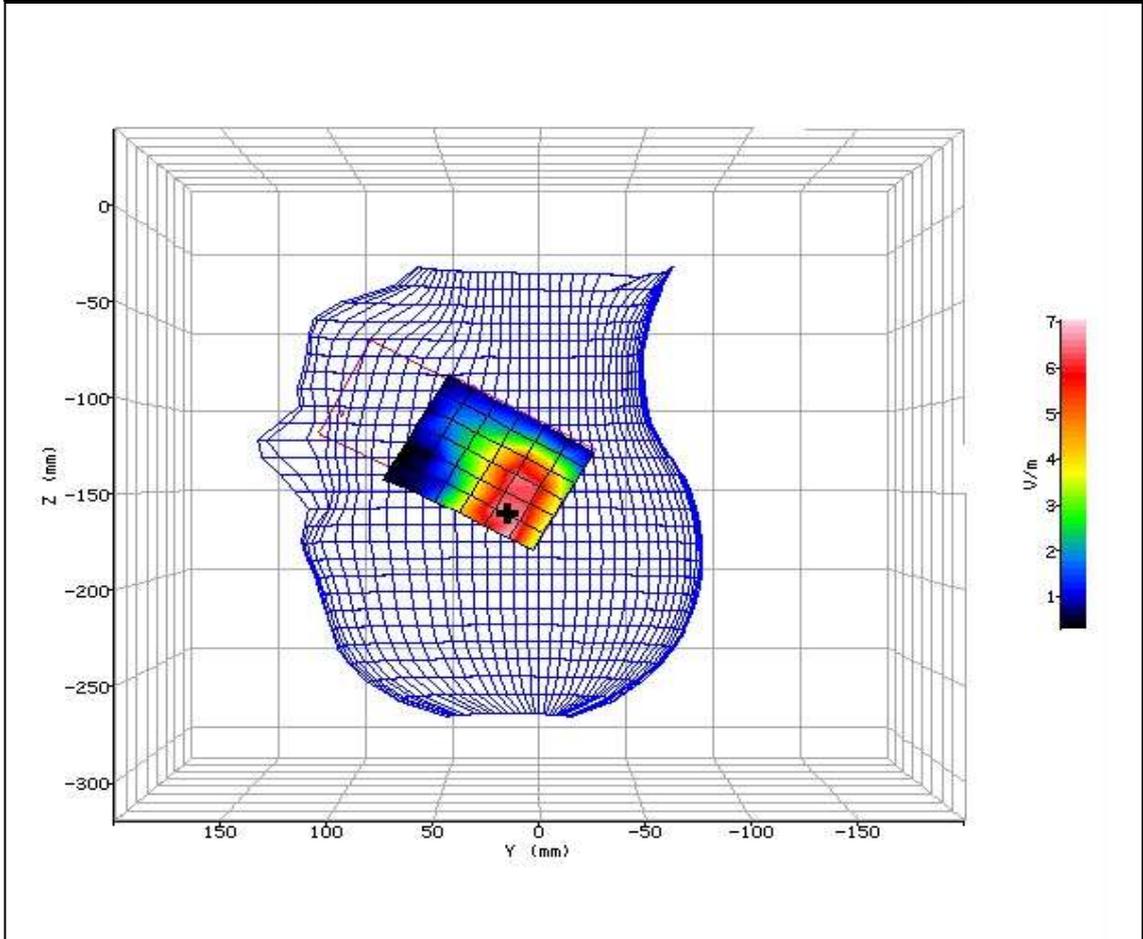


Figure 45: SAR Head Testing Results for the SHL24 Mobile Handset at 2412.0MHz.



SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	08/01/2014-06:26:17	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	23.30°C	LIQUID SIMULANT:	2450Head
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	39.30
RELATIVE HUMIDITY:	38.20%	CONDUCTIVITY:	1.789
PHANTOM S/NO:	IBX-040	LIQUID TEMPERATURE:	23.20°C
PHANTOM ROTATION:	N/A	MAX SAR Y-AXIS LOCATION:	18.300mm
DUT POSITION:	Right-Cheek	MAX SAR Z-AXIS LOCATION:	-151.000mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	7.569
TEST FREQUENCY:	2412.0MHz	SAR 1g:	0.144 W/kg
TYPE OF MODULATION:	DSSS (WLAN)	SAR 10g:	1.000 W/kg
MODN. DUTY CYCLE:	100%	SAR START:	0.125 W/kg
INPUT POWER LEVEL:	15.5dBm	SAR END:	0.127 W/kg
PROBE BATTERY LAST CHANGED:	08/07/2014	SAR DRIFT DURING SCAN:	1.600 %

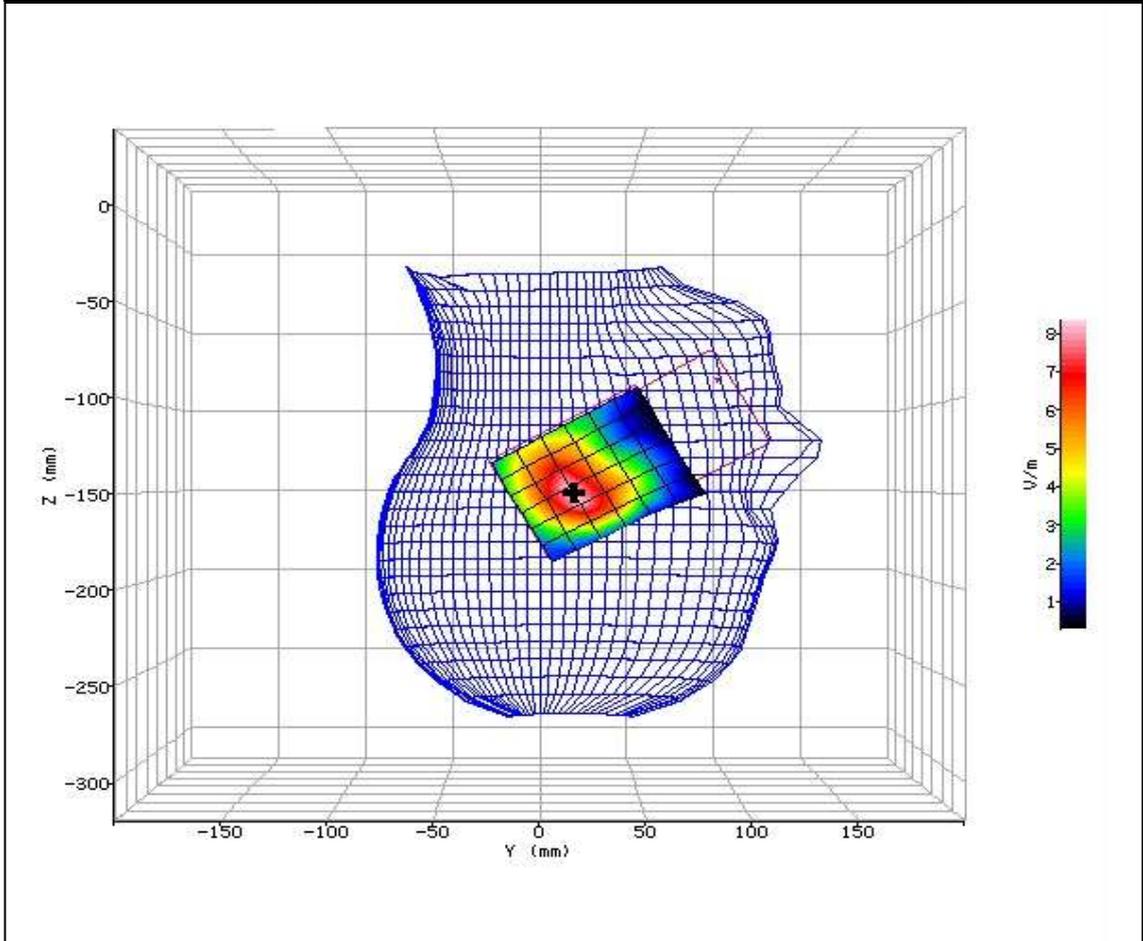


Figure 46: SAR Head Testing Results for the SHL24 Mobile Handset at 2412.0MHz.



SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	08/01/2014-06:43:09	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	23.30°C	LIQUID SIMULANT:	2450Head
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	39.30
RELATIVE HUMIDITY:	38.20%	CONDUCTIVITY:	1.789
PHANTOM S/NO:	IBX-040	LIQUID TEMPERATURE:	23.20°C
PHANTOM ROTATION:	N/A	MAX SAR Y-AXIS LOCATION:	13.800mm
DUT POSITION:	Right-15°	MAX SAR Z-AXIS LOCATION:	-155.400mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	7.480
TEST FREQUENCY:	2412.0MHz	SAR 1g:	0.177 W/kg
TYPE OF MODULATION:	DSSS (WLAN)	SAR 10g:	N/A
MODN. DUTY CYCLE:	100%	SAR START:	0.144 W/kg
INPUT POWER LEVEL:	15.5dBm	SAR END:	0.141 W/kg
PROBE BATTERY LAST CHANGED:	08/07/2014	SAR DRIFT DURING SCAN:	-2.100 %

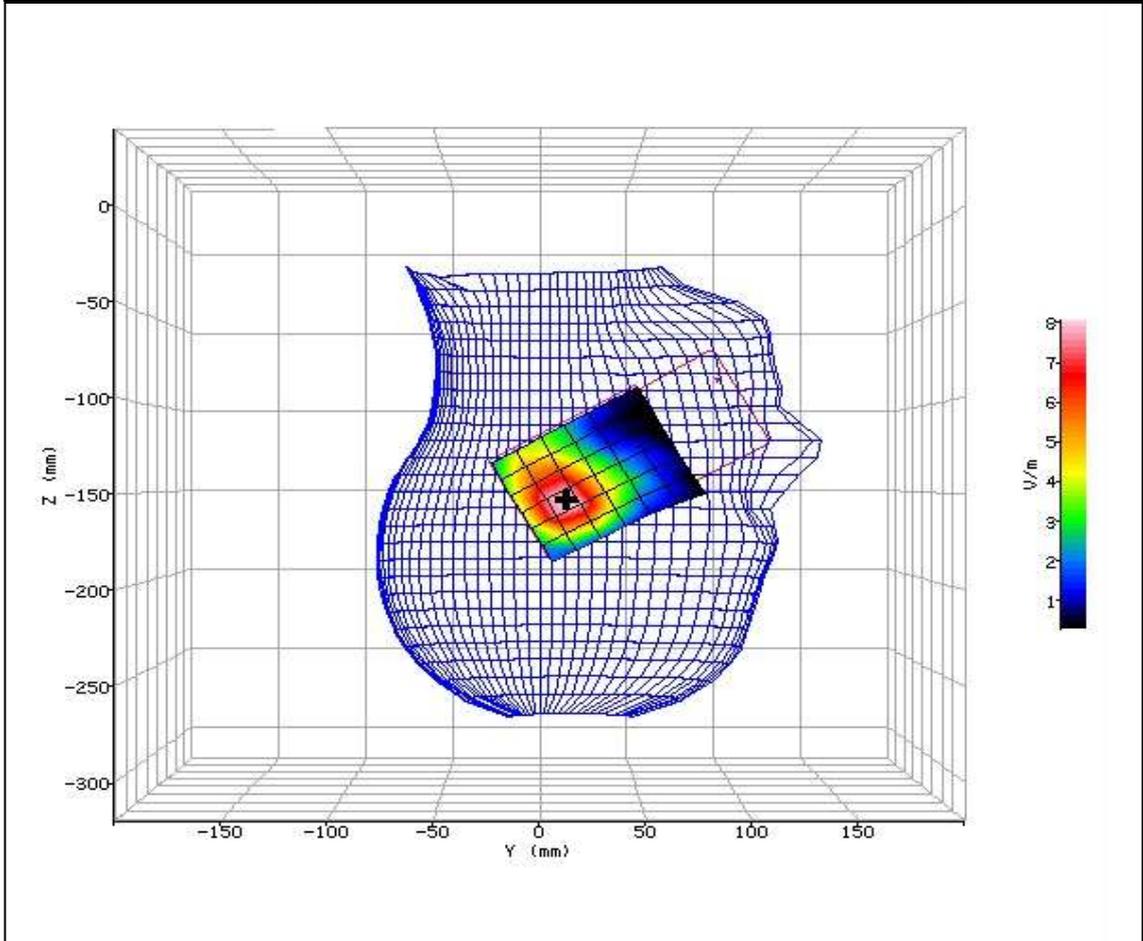


Figure 47: SAR Head Testing Results for the SHL24 Mobile Handset at 2412.0MHz.



2.11 WLAN 2450MHz BODY SAR TEST RESULTS AND COURSE AREA SCANS – 2D

SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	07/01/2014-13:37:34	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	22.80°C	LIQUID SIMULANT:	2450Body
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	51.26
RELATIVE HUMIDITY:	36.30%	CONDUCTIVITY:	1.972
PHANTOM S/NO:	IXB-2HF	LIQUID TEMPERATURE:	23.10°C
PHANTOM ROTATION:	N/A	MAX SAR X-AXIS LOCATION:	-48.300mm
DUT POSITION:	10mm-Front Face	MAX SAR Y-AXIS LOCATION:	-9.700mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	4.604
TEST FREQUENCY:	2412.0MHz	SAR 1g:	0.045 W/kg
TYPE OF MODULATION:	DSSS (WLAN)	SAR 10g:	N/A
MODN. DUTY CYCLE:	100%	SAR START:	0.046 W/kg
INPUT POWER LEVEL:	15.5dBm	SAR END:	0.046 W/kg
PROBE BATTERY LAST CHANGED:	07/01/2014	SAR DRIFT DURING SCAN:	-0.500 %

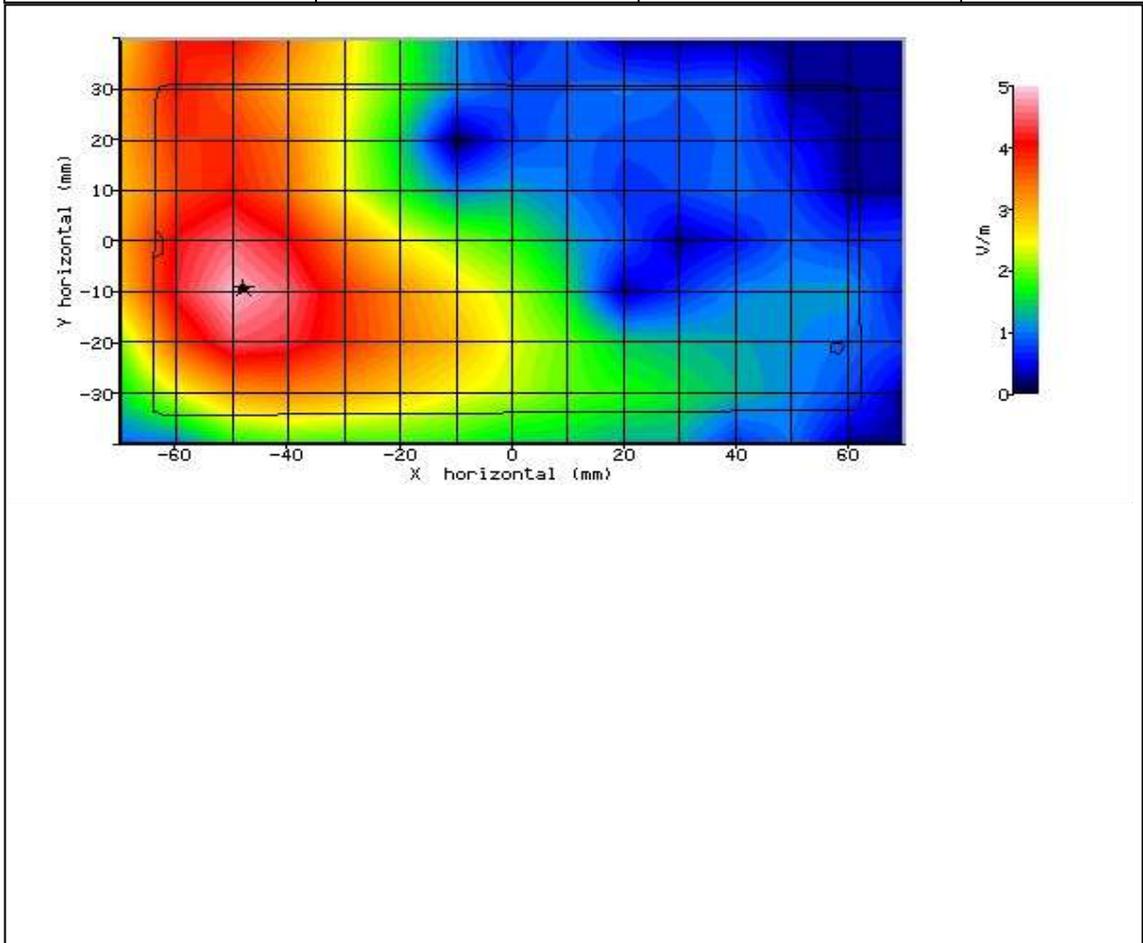


Figure 48: SAR Body Testing Results for the SHL24 Mobile Handset at 2412.0MHz.



SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	07/01/2014-13:50:34	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	22.80°C	LIQUID SIMULANT:	2450Body
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	51.26
RELATIVE HUMIDITY:	36.30%	CONDUCTIVITY:	1.972
PHANTOM S/NO:	IXB-2HF	LIQUID TEMPERATURE:	23.10°C
PHANTOM ROTATION:	N/A	MAX SAR X-AXIS LOCATION:	-50.600mm
DUT POSITION:	10mm-Rear Face	MAX SAR Y-AXIS LOCATION:	-30.000mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	9.513
TEST FREQUENCY:	2412.0MHz	SAR 1g:	0.259 W/kg
TYPE OF MODULATION:	DSSS (WLAN)	SAR 10g:	N/A
MODN. DUTY CYCLE:	100%	SAR START:	0.290 W/kg
INPUT POWER LEVEL:	15.5dBm	SAR END:	0.292 W/kg
PROBE BATTERY LAST CHANGED:	07/01/2014	SAR DRIFT DURING SCAN:	0.700 %

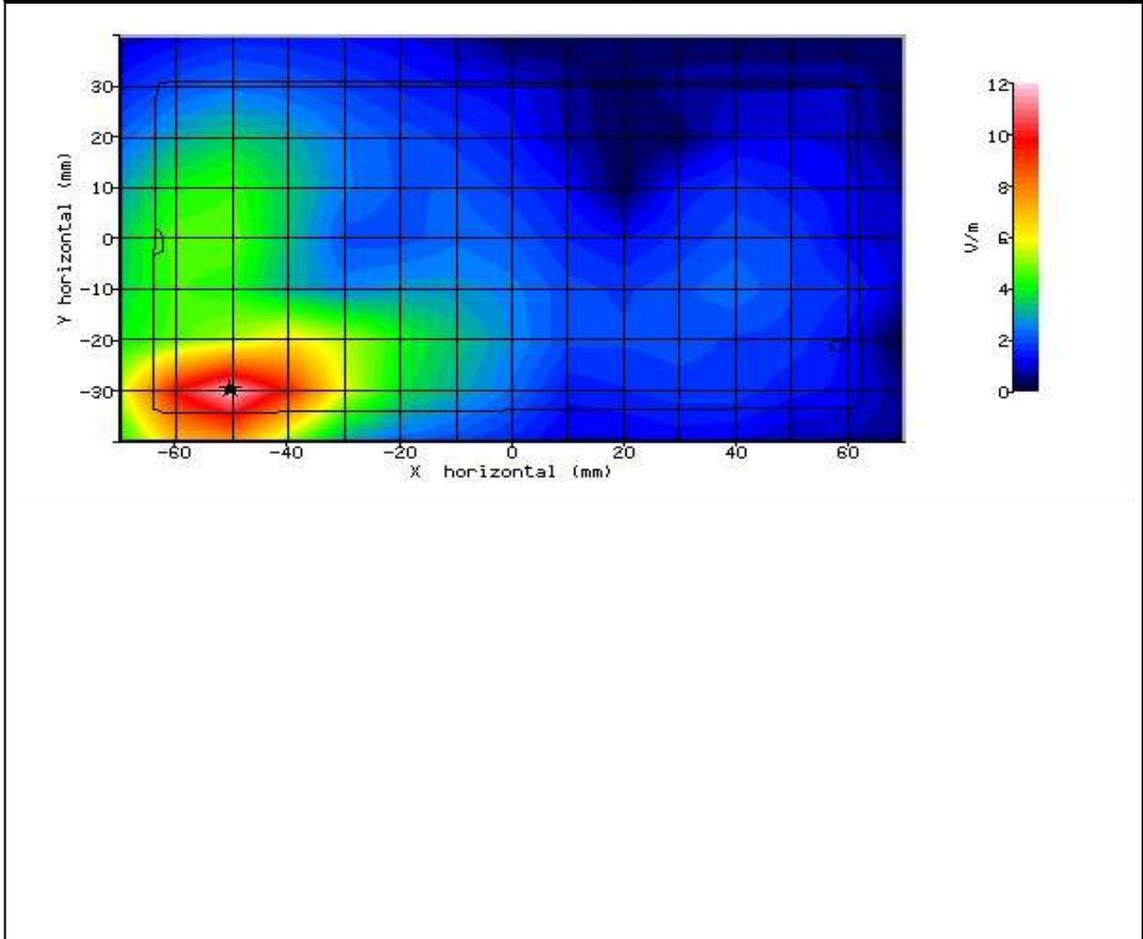


Figure 49: SAR Body Testing Results for the SHL24 Mobile Handset at 2412.0MHz.



Product Service

SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	07/01/2014-14:14:27	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	22.80°C	LIQUID SIMULANT:	2450Body
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	51.26
RELATIVE HUMIDITY:	36.30%	CONDUCTIVITY:	1.972
PHANTOM S/NO:	IXB-2HF	LIQUID TEMPERATURE:	23.10°C
PHANTOM ROTATION:	N/A	MAX SAR X-AXIS LOCATION:	-52.600mm
DUT POSITION:	10mm-Left Edge	MAX SAR Y-AXIS LOCATION:	9.100mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	7.045
TEST FREQUENCY:	2412.0MHz	SAR 1g:	0.134 W/kg
TYPE OF MODULATION:	DSSS (WLAN)	SAR 10g:	N/A
MODN. DUTY CYCLE:	100%	SAR START:	0.150 W/kg
INPUT POWER LEVEL:	15.5dBm	SAR END:	0.146 W/kg
PROBE BATTERY LAST CHANGED:	07/01/2014	SAR DRIFT DURING SCAN:	-2.500 %

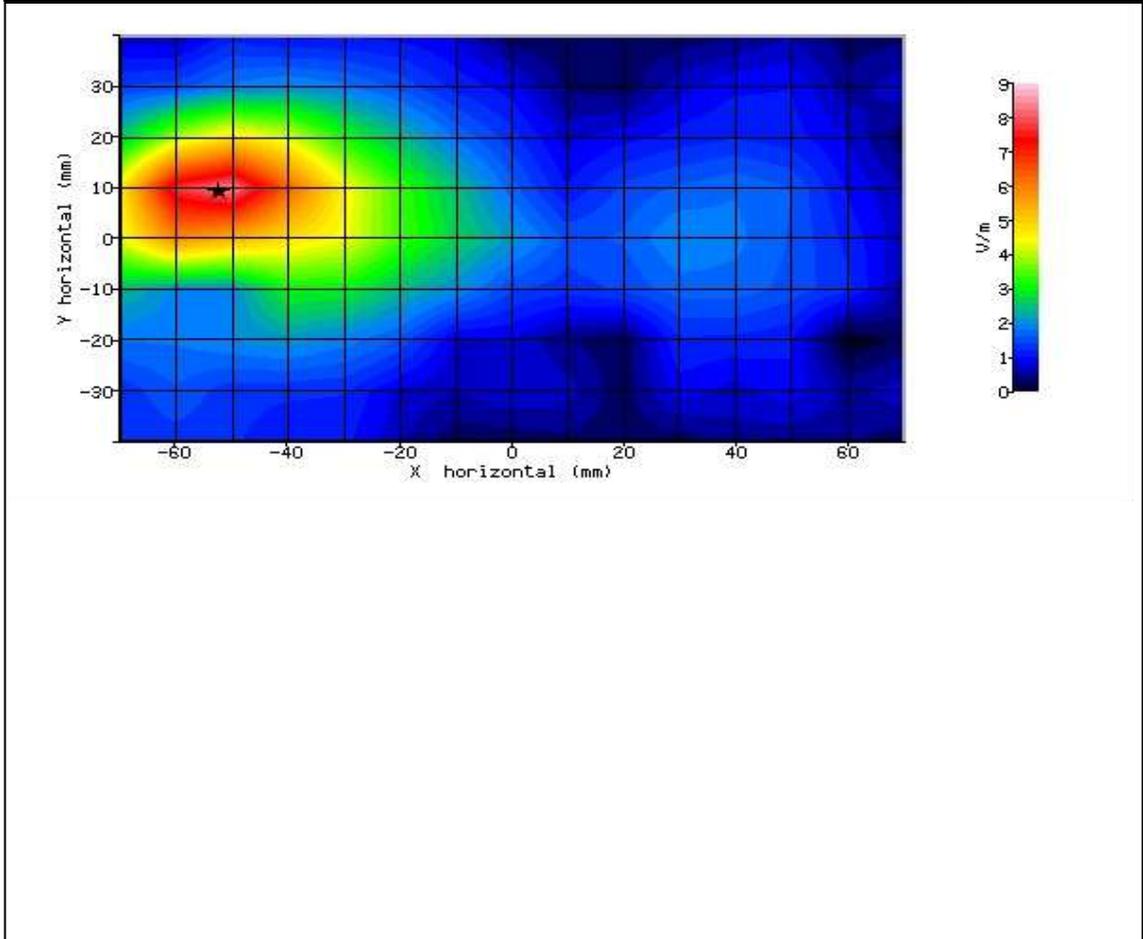


Figure 50: SAR Body Testing Results for the SHL24 Mobile Handset at 2412.0MHz.



SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	07/01/2014-14:28:26	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	22.80°C	LIQUID SIMULANT:	2450Body
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	51.26
RELATIVE HUMIDITY:	36.30%	CONDUCTIVITY:	1.972
PHANTOM S/NO:	IXB-2HF	LIQUID TEMPERATURE:	23.10°C
PHANTOM ROTATION:	N/A	MAX SAR X-AXIS LOCATION:	-9.500mm
DUT POSITION:	10mm-Top Edge	MAX SAR Y-AXIS LOCATION:	-4.000mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	5.093
TEST FREQUENCY:	2412.0MHz	SAR 1g:	0.058 W/kg
TYPE OF MODULATION:	DSSS (WLAN)	SAR 10g:	N/G
MODN. DUTY CYCLE:	100%	SAR START:	0.061 W/kg
INPUT POWER LEVEL:	15.5dBm	SAR END:	0.060 W/kg
PROBE BATTERY LAST CHANGED:	07/01/2014	SAR DRIFT DURING SCAN:	-1.400 %

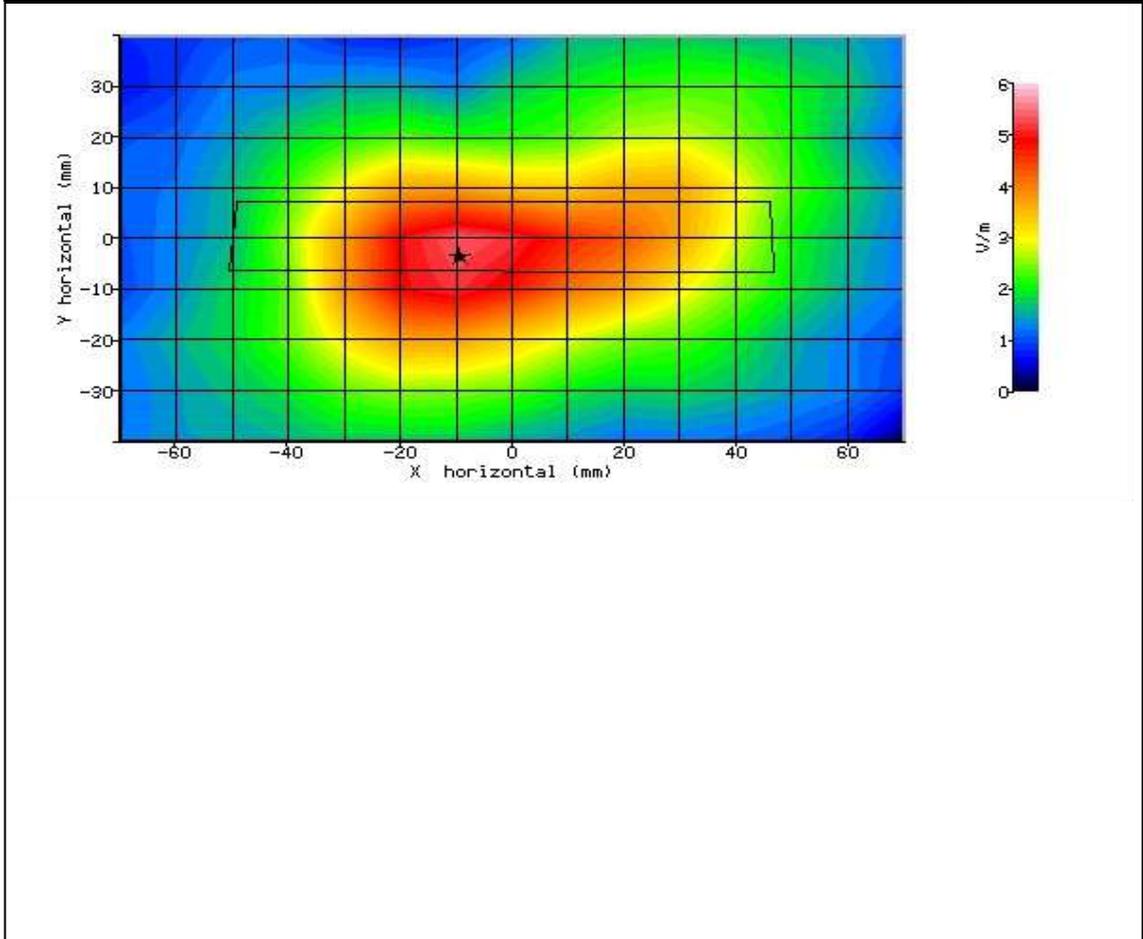


Figure 51: SAR Body Testing Results for the SHL24 Mobile Handset at 2412.0MHz.

2.12 WLAN 5220MHZ HEAD SAR TEST RESULTS AND COURSE AREA SCANS – 2D

SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	10/01/2014-08:21:56	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	22.80°C	LIQUID SIMULANT:	5000Head
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	34.92
RELATIVE HUMIDITY:	34.70%	CONDUCTIVITY:	4.539
PHANTOM S/NO:	IBX-040	LIQUID TEMPERATURE:	22.80°C
PHANTOM ROTATION:	N/A	MAX SAR Y-AXIS LOCATION:	19.100mm
DUT POSITION:	Left-Cheek	MAX SAR Z-AXIS LOCATION:	-169.600mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	3.452
TEST FREQUENCY:	5220.0MHz	SAR 1g:	0.141 W/kg
TYPE OF MODULATION:	OFDM (WLAN)	SAR 10g:	N/A
MODN. DUTY CYCLE:	100%	SAR START:	0.076 W/kg
INPUT POWER LEVEL:	14dBm	SAR END:	0.076 W/kg
PROBE BATTERY LAST CHANGED:	10/01/2014	SAR DRIFT DURING SCAN:	0.000 %

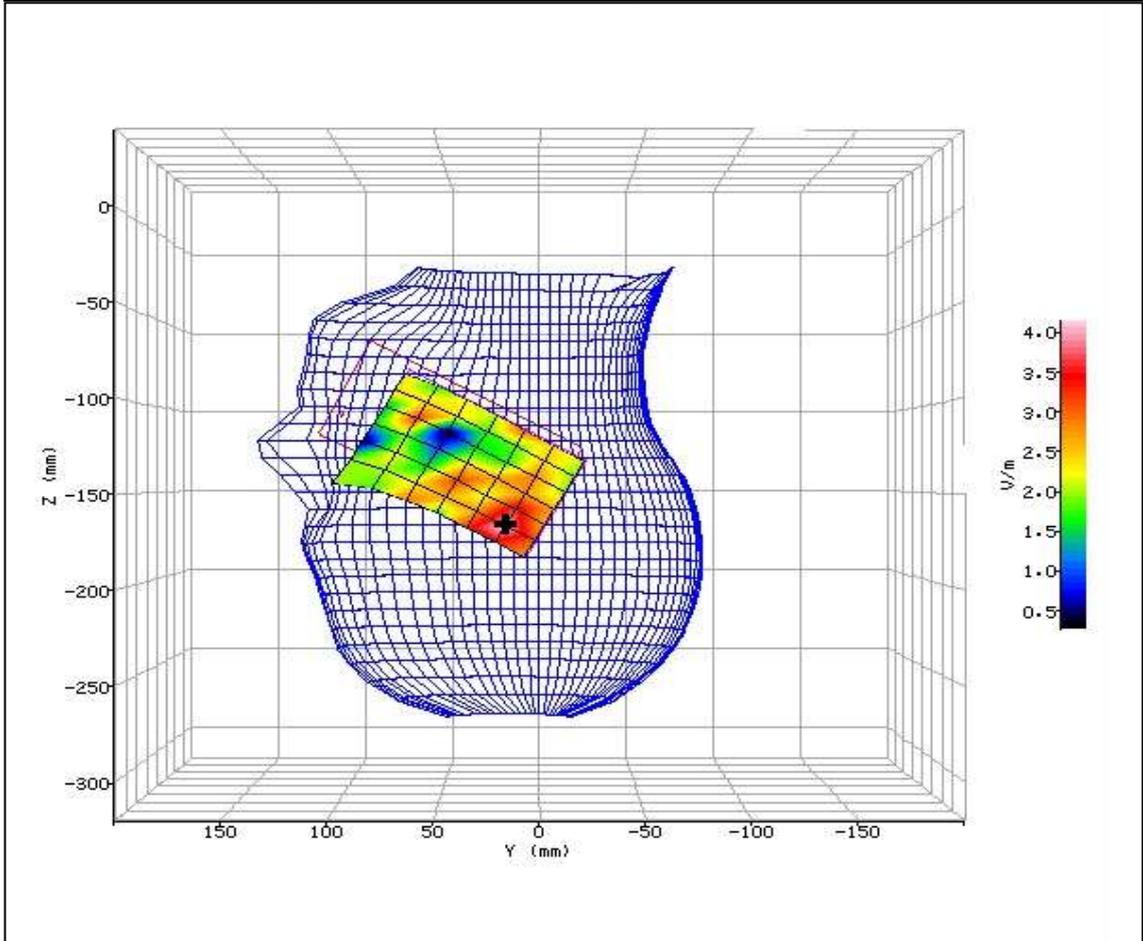


Figure 52: SAR Head Testing Results for the SHL24 Mobile Handset at 5220.0MHz. (NUA)



SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	10/01/2014-08:57:36	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	22.80°C	LIQUID SIMULANT:	5000Head
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	34.92
RELATIVE HUMIDITY:	34.70%	CONDUCTIVITY:	4.539
PHANTOM S/NO:	IBX-040	LIQUID TEMPERATURE:	22.80°C
PHANTOM ROTATION:	N/A	MAX SAR Y-AXIS LOCATION:	17.200mm
DUT POSITION:	Left-15°	MAX SAR Z-AXIS LOCATION:	-170.000mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	3.376
TEST FREQUENCY:	5220.0MHz	SAR 1g:	0.169 W/kg
TYPE OF MODULATION:	OFDM (WLAN)	SAR 10g:	N/A
MODN. DUTY CYCLE:	100%	SAR START:	0.084 W/kg
INPUT POWER LEVEL:	14dBm	SAR END:	0.077 W/kg
PROBE BATTERY LAST CHANGED:	10/01/2014	SAR DRIFT DURING SCAN:	-8.300 %

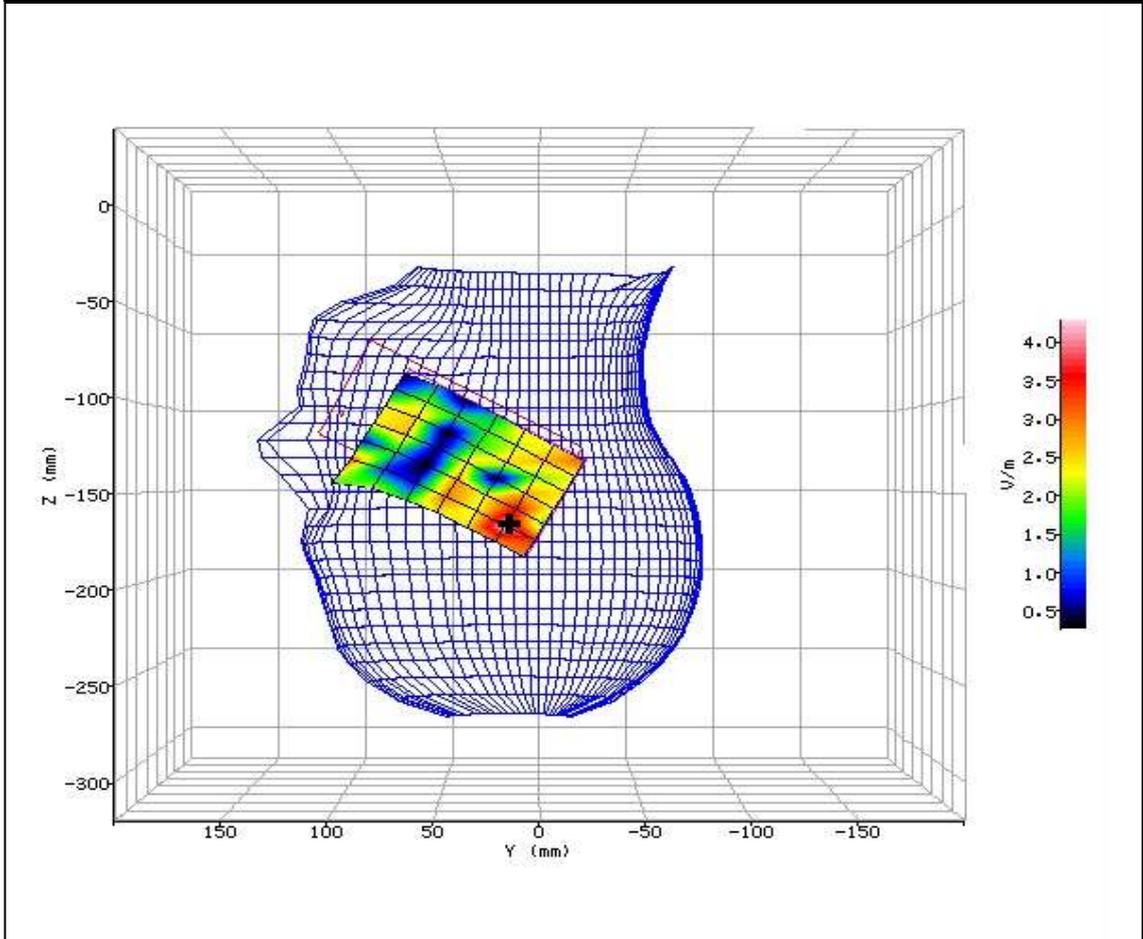


Figure 53: SAR Head Testing Results for the SHL24 Mobile Handset at 5220.0MHz. (NUA)



SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	10/01/2014-10:51:06	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	22.80°C	LIQUID SIMULANT:	5000Head
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	34.92
RELATIVE HUMIDITY:	34.70%	CONDUCTIVITY:	4.539
PHANTOM S/NO:	IBX-040	LIQUID TEMPERATURE:	22.80°C
PHANTOM ROTATION:	N/A	MAX SAR Y-AXIS LOCATION:	-7.400mm
DUT POSITION:	Right-Cheek	MAX SAR Z-AXIS LOCATION:	-132.900mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	3.279
TEST FREQUENCY:	5220.0MHz	SAR 1g:	0.074 W/kg
TYPE OF MODULATION:	OFDM (WLAN)	SAR 10g:	N/A
MODN. DUTY CYCLE:	100%	SAR START:	0.071 W/kg
INPUT POWER LEVEL:	14dBm	SAR END:	0.071 W/kg
PROBE BATTERY LAST CHANGED:	10/01/2014	SAR DRIFT DURING SCAN:	0.000 %

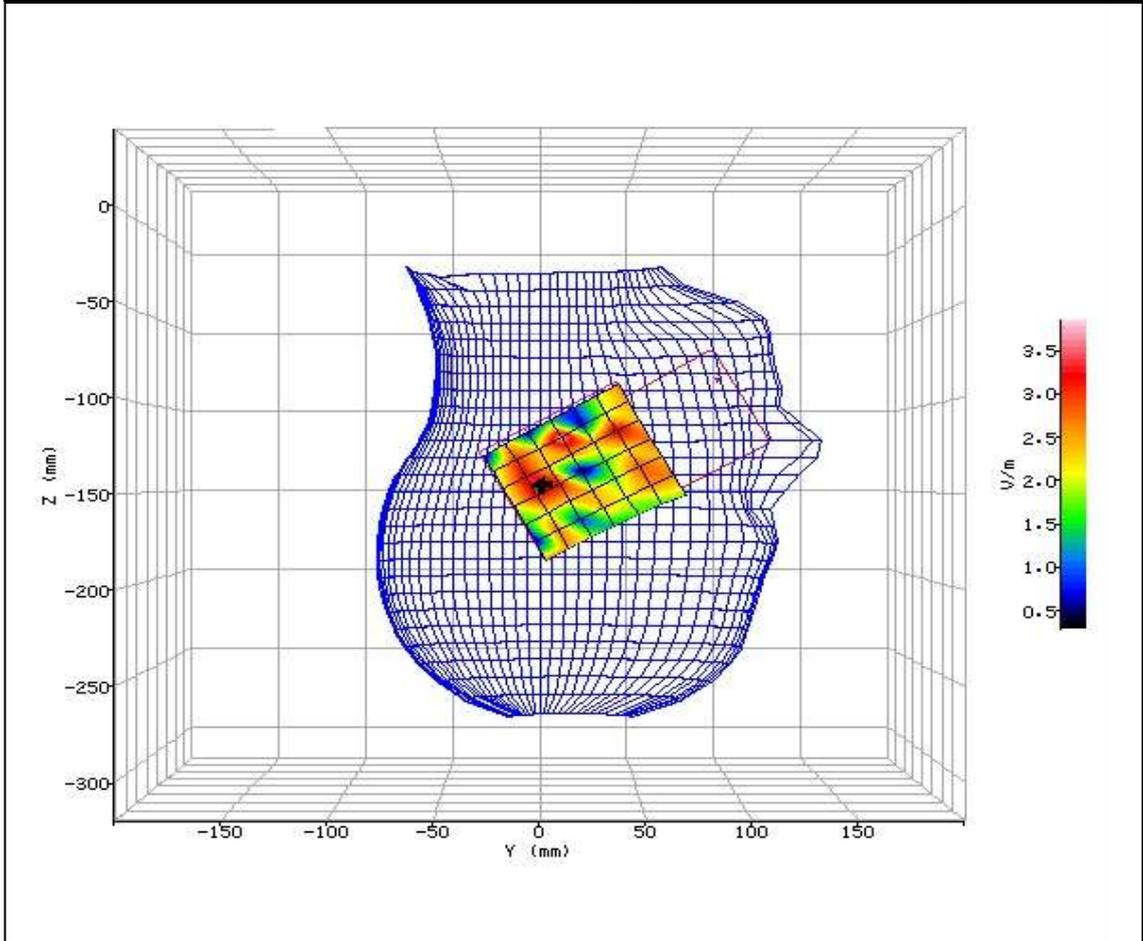


Figure 54: SAR Head Testing Results for the SHL24 Mobile Handset at 5220.0MHz. (NUA)



SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	10/01/2014-11:28:37	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	22.80°C	LIQUID SIMULANT:	5000Head
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	34.92
RELATIVE HUMIDITY:	34.70%	CONDUCTIVITY:	4.539
PHANTOM S/NO:	IBX-040	LIQUID TEMPERATURE:	22.80°C
PHANTOM ROTATION:	N/A	MAX SAR Y-AXIS LOCATION:	0.800mm
DUT POSITION:	Right-15°	MAX SAR Z-AXIS LOCATION:	-146.400mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	2.982
TEST FREQUENCY:	5220.0MHz	SAR 1g:	0.155 W/kg
TYPE OF MODULATION:	OFDM (WLAN)	SAR 10g:	N/A
MODN. DUTY CYCLE:	100%	SAR START:	0.041 W/kg
INPUT POWER LEVEL:	14dBm	SAR END:	0.041 W/kg
PROBE BATTERY LAST CHANGED:	10/01/2014	SAR DRIFT DURING SCAN:	0.000 %

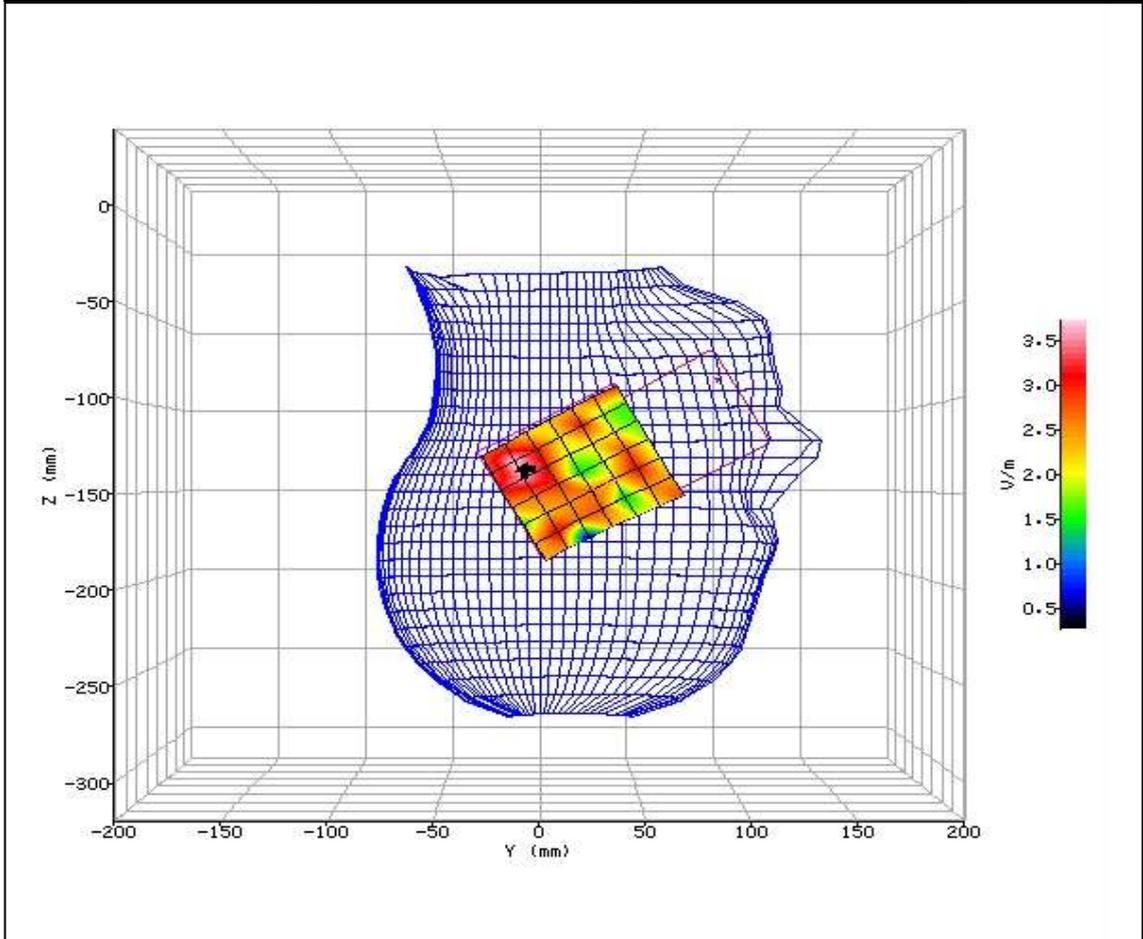


Figure 55: SAR Head Testing Results for the SHL24 Mobile Handset at 5220.0MHz. (NUA)
(NUA)



Product Service

2.13 WLAN 5220MHz BODY SAR TEST RESULTS AND COURSE AREA SCANS – 2D

Front Facing

SAR Body Testing Results for the SHL24 Mobile Handset at 5220.0MHz.

No data was recorded for this position due to SAR levels being below the SAR measurement system capability.



Product Service

SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	06/01/2014-08:42:46	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	22.80°C	LIQUID SIMULANT:	5000 Body
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	48.95
RELATIVE HUMIDITY:	36.80%	CONDUCTIVITY:	5.048
PHANTOM S/NO:	IXB-2HF	LIQUID TEMPERATURE:	22.70°C
PHANTOM ROTATION:	N/A	MAX SAR X-AXIS LOCATION:	-30.30mm
DUT POSITION:	10mm-Rear Face	MAX SAR Y-AXIS LOCATION:	-20.40mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	4.545
TEST FREQUENCY:	5220.0MHz	SAR 1g:	0.090 W/kg
TYPE OF MODULATION:	OFDM (WLAN)	SAR 10g:	N/A
MODN. DUTY CYCLE:	100%	SAR START:	0.154 W/kg
INPUT POWER LEVEL:	14dBm	SAR END:	0.159 W/kg
PROBE BATTERY LAST CHANGED:	06/01/2013	SAR DRIFT DURING SCAN:	3.500 %

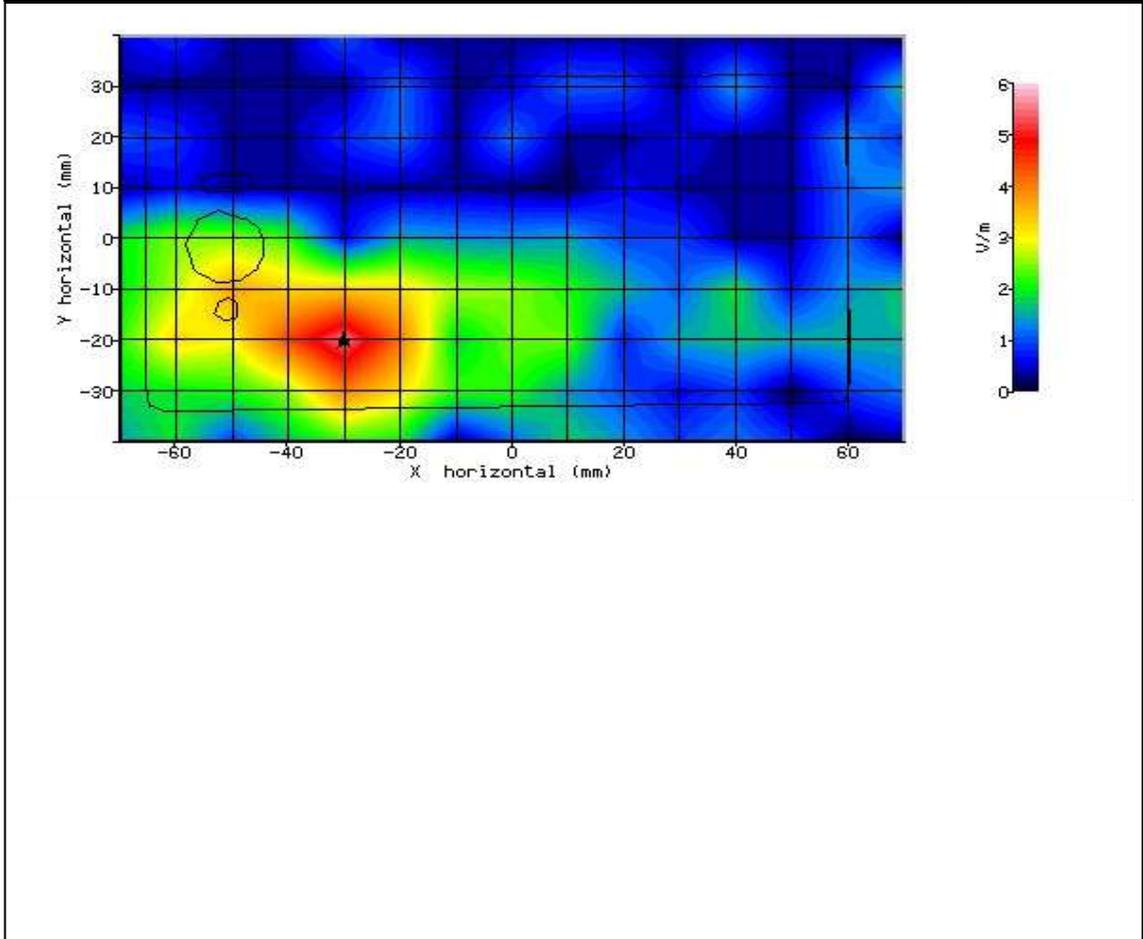


Figure 56: SAR Body Testing Results for the SHL24 Mobile Handset at 5220.0MHz. (NUA)



Product Service

SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	06/01/2014-09:17:17	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	22.80°C	LIQUID SIMULANT:	5000 Body
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	48.95
RELATIVE HUMIDITY:	36.80%	CONDUCTIVITY:	5.048
PHANTOM S/NO:	IXB-2HF	LIQUID TEMPERATURE:	22.70°C
PHANTOM ROTATION:	N/A	MAX SAR X-AXIS LOCATION:	-29.30mm
DUT POSITION:	10mm-Left Edge	MAX SAR Y-AXIS LOCATION:	17.50mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	3.414
TEST FREQUENCY:	5220.0MHz	SAR 1g:	0.059 W/kg
TYPE OF MODULATION:	OFDM (WLAN)	SAR 10g:	N/A
MODN. DUTY CYCLE:	100%	SAR START:	0.074 W/kg
INPUT POWER LEVEL:	14dBm	SAR END:	0.070 W/kg
PROBE BATTERY LAST CHANGED:	06/01/2013	SAR DRIFT DURING SCAN:	-5.100 %

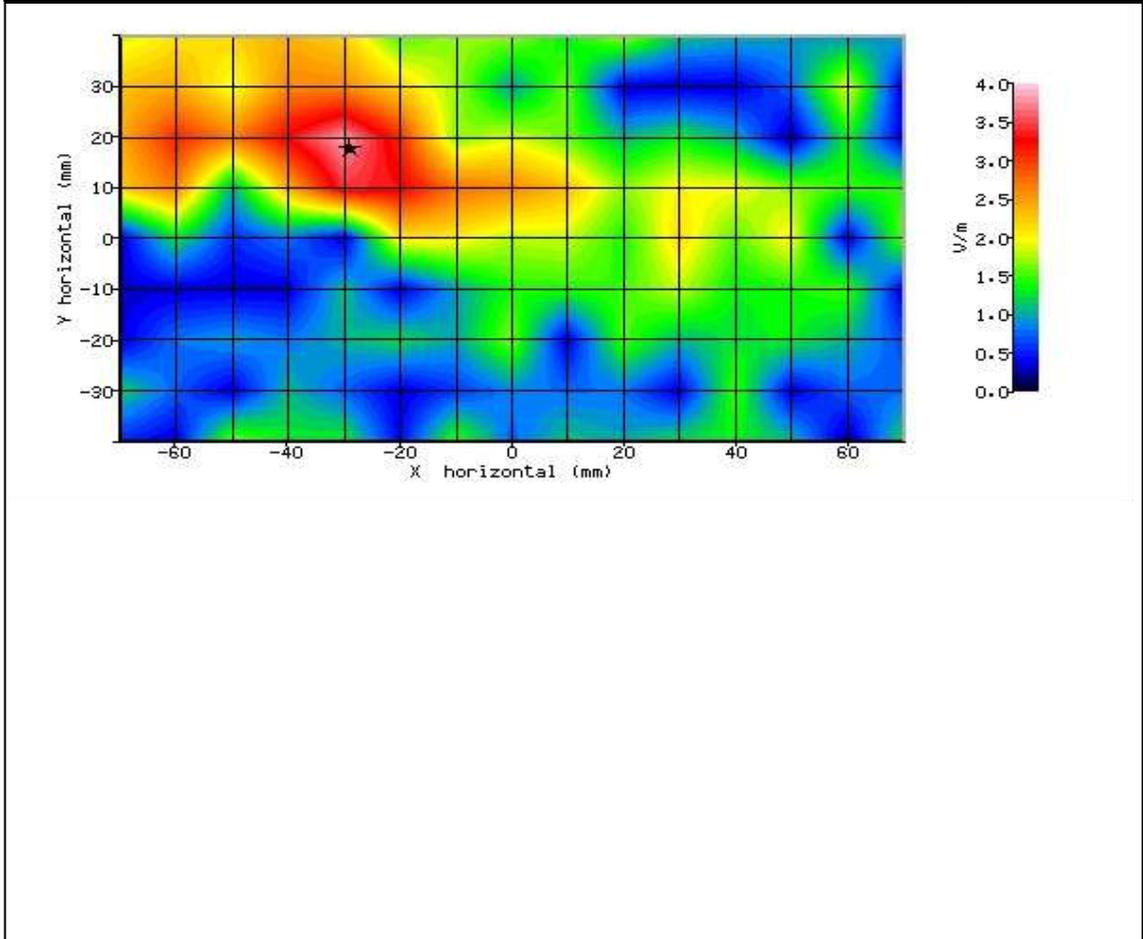


Figure 57: SAR Body Testing Results for the SHL24 Mobile Handset at 5220.0MHz. (NUA)



Product Service

SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	06/01/2014-09:33:13	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	22.80°C	LIQUID SIMULANT:	5000 Body
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	48.95
RELATIVE HUMIDITY:	36.80%	CONDUCTIVITY:	5.048
PHANTOM S/NO:	IXB-2HF	LIQUID TEMPERATURE:	22.70°C
PHANTOM ROTATION:	N/A	MAX SAR X-AXIS LOCATION:	31.60mm
DUT POSITION:	10mm-Top Edge	MAX SAR Y-AXIS LOCATION:	7.70mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	3.779
TEST FREQUENCY:	5220.0MHz	SAR 1g:	0.050 W/kg
TYPE OF MODULATION:	OFDM (WLAN)	SAR 10g:	N/A
MODN. DUTY CYCLE:	100%	SAR START:	0.098 W/kg
INPUT POWER LEVEL:	14dBm	SAR END:	0.098 W/kg
PROBE BATTERY LAST CHANGED:	06/01/2013	SAR DRIFT DURING SCAN:	0.000 %

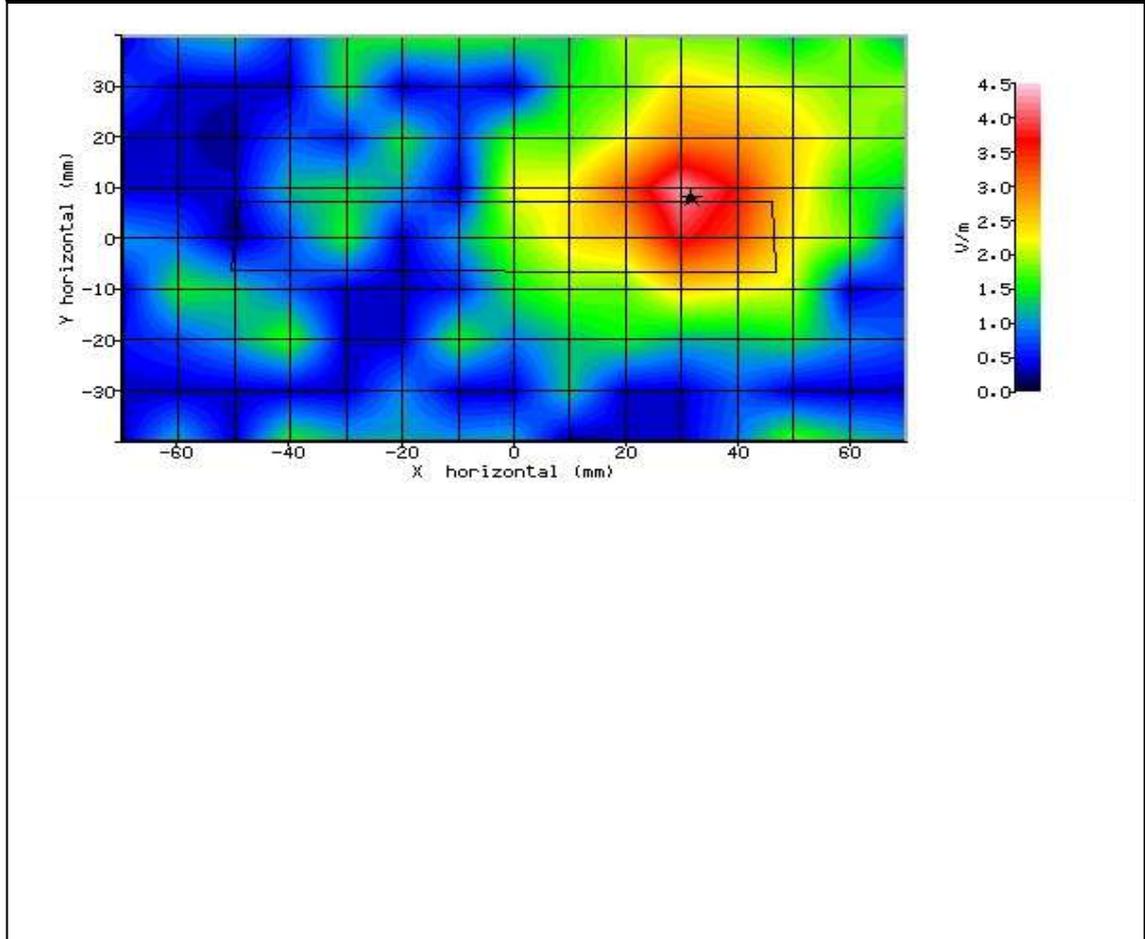


Figure 58: SAR Body Testing Results for the SHL24 Mobile Handset at 5220.0MHz. (NUA)

2.14 WLAN 5280MHz HEAD SAR TEST RESULTS AND COURSE AREA SCANS – 2D

SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	10/01/2014-13:15:44	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	22.80°C	LIQUID SIMULANT:	5000Head
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	34.92
RELATIVE HUMIDITY:	3.40%	CONDUCTIVITY:	4.539
PHANTOM S/NO:	IBX-040	LIQUID TEMPERATURE:	22.80°C
PHANTOM ROTATION:	N/A	MAX SAR Y-AXIS LOCATION:	14.10mm
DUT POSITION:	Left-Cheek	MAX SAR Z-AXIS LOCATION:	-176.10mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	3.705
TEST FREQUENCY:	5280.0MHz	SAR 1g:	0.139 W/kg
TYPE OF MODULATION:	OFDM (WLAN)	SAR 10g:	N/A
MODN. DUTY CYCLE:	100%	SAR START:	0.089 W/kg
INPUT POWER LEVEL:	14dBm	SAR END:	0.089 W/kg
PROBE BATTERY LAST CHANGED:	10/01/2014	SAR DRIFT DURING SCAN:	0.000 %

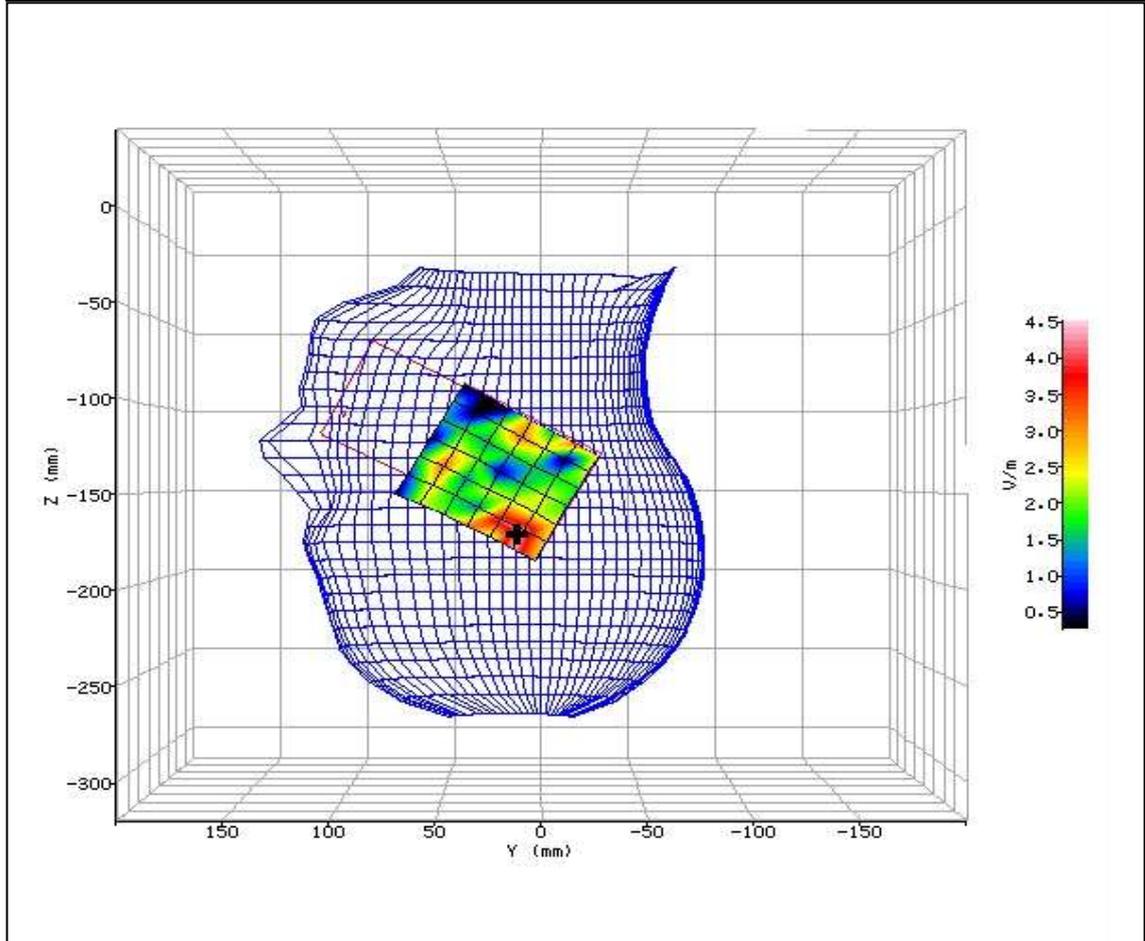


Figure 59: SAR Head Testing Results for the SHL24 Mobile Handset at 5280.0MHz. (NUA)



SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	10/01/2014-13:40:54	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	22.80°C	LIQUID SIMULANT:	5000Head
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	34.92
RELATIVE HUMIDITY:	3.40%	CONDUCTIVITY:	4.539
PHANTOM S/NO:	IBX-040	LIQUID TEMPERATURE:	22.80°C
PHANTOM ROTATION:	N/A	MAX SAR Y-AXIS LOCATION:	12.00mm
DUT POSITION:	Left-15°	MAX SAR Z-AXIS LOCATION:	-175.20mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	3.575
TEST FREQUENCY:	5280.0MHz	SAR 1g:	0.140 W/kg
TYPE OF MODULATION:	OFDM (WLAN)	SAR 10g:	N/A
MODN. DUTY CYCLE:	100%	SAR START:	0.094 W/kg
INPUT POWER LEVEL:	14dBm	SAR END:	0.094 W/kg
PROBE BATTERY LAST CHANGED:	10/01/2014	SAR DRIFT DURING SCAN:	0.000 %

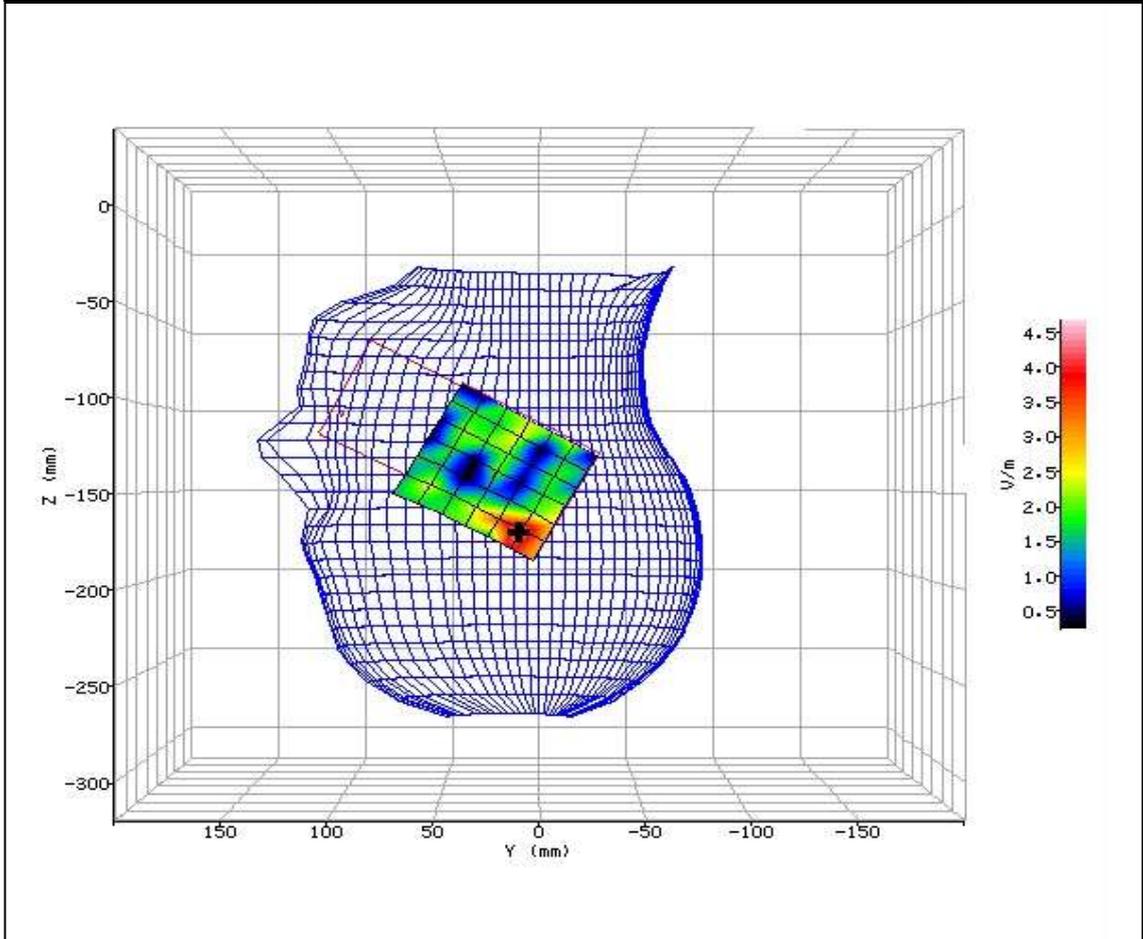


Figure 60: SAR Head Testing Results for the SHL24 Mobile Handset at 5280.0MHz. (NUA)



SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	10/01/2014-14:35:58	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	22.80°C	LIQUID SIMULANT:	5000Head
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	34.92
RELATIVE HUMIDITY:	3.40%	CONDUCTIVITY:	4.539
PHANTOM S/NO:	IBX-040	LIQUID TEMPERATURE:	22.80°C
PHANTOM ROTATION:	N/A	MAX SAR Y-AXIS LOCATION:	-9.10mm
DUT POSITION:	Right-Cheek	MAX SAR Z-AXIS LOCATION:	-135.90mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	3.400
TEST FREQUENCY:	5280.0MHz	SAR 1g:	0.131 W/kg
TYPE OF MODULATION:	OFDM (WLAN)	SAR 10g:	N/A
MODN. DUTY CYCLE:	100%	SAR START:	0.063 W/kg
INPUT POWER LEVEL:	14dBm	SAR END:	0.063 W/kg
PROBE BATTERY LAST CHANGED:	10/01/2014	SAR DRIFT DURING SCAN:	0.000 %

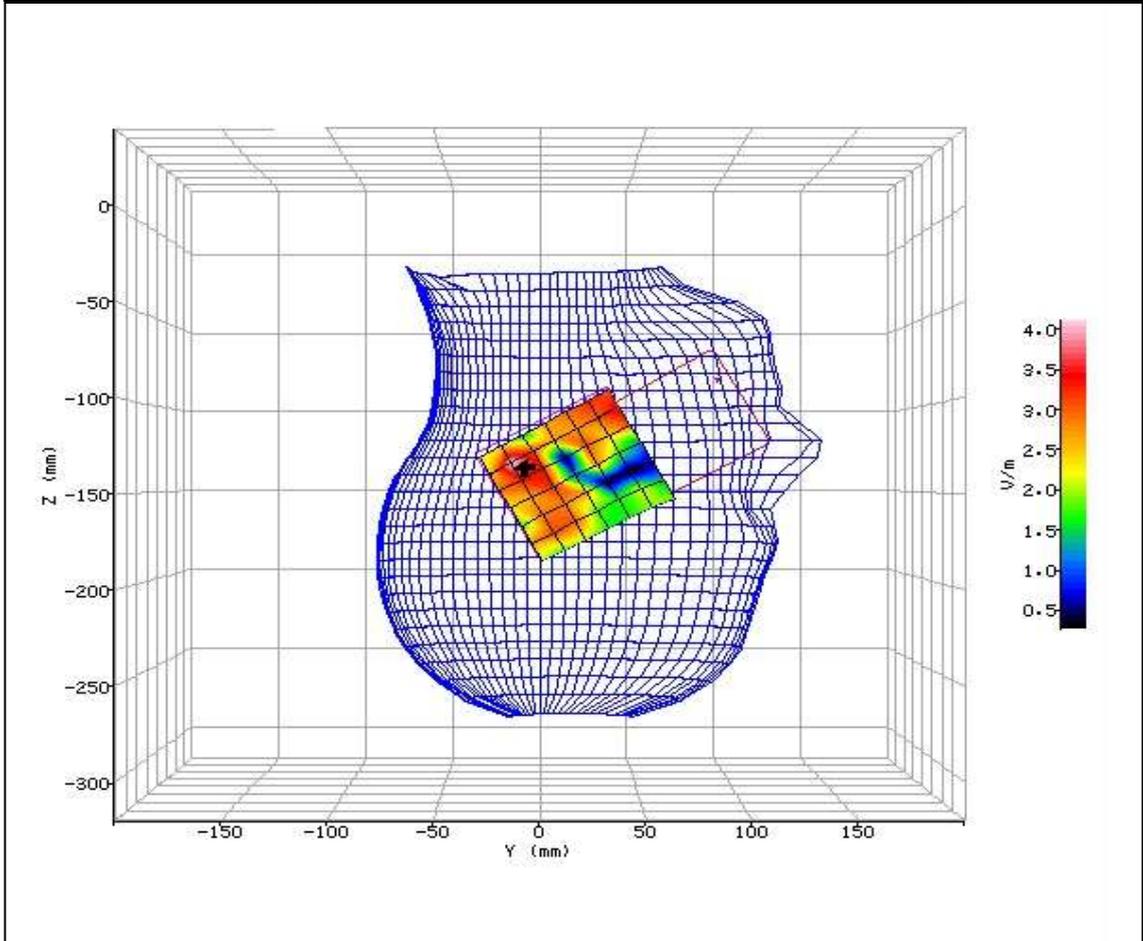


Figure 61: SAR Head Testing Results for the SHL24 Mobile Handset at 5280.0MHz. (NUA)



SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	10/01/2014-14:58:39	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	22.80°C	LIQUID SIMULANT:	5000Head
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	34.92
RELATIVE HUMIDITY:	3.40%	CONDUCTIVITY:	4.539
PHANTOM S/NO:	IBX-040	LIQUID TEMPERATURE:	22.80°C
PHANTOM ROTATION:	N/A	MAX SAR Y-AXIS LOCATION:	-12.30mm
DUT POSITION:	Right-15°	MAX SAR Z-AXIS LOCATION:	-135.70mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	3.477
TEST FREQUENCY:	5280.0MHz	SAR 1g:	0.116 W/kg
TYPE OF MODULATION:	OFDM (WLAN)	SAR 10g:	N/A
MODN. DUTY CYCLE:	100%	SAR START:	0.050 W/kg
INPUT POWER LEVEL:	14dBm	SAR END:	0.054 W/kg
PROBE BATTERY LAST CHANGED:	10/01/2014	SAR DRIFT DURING SCAN:	8.000 %

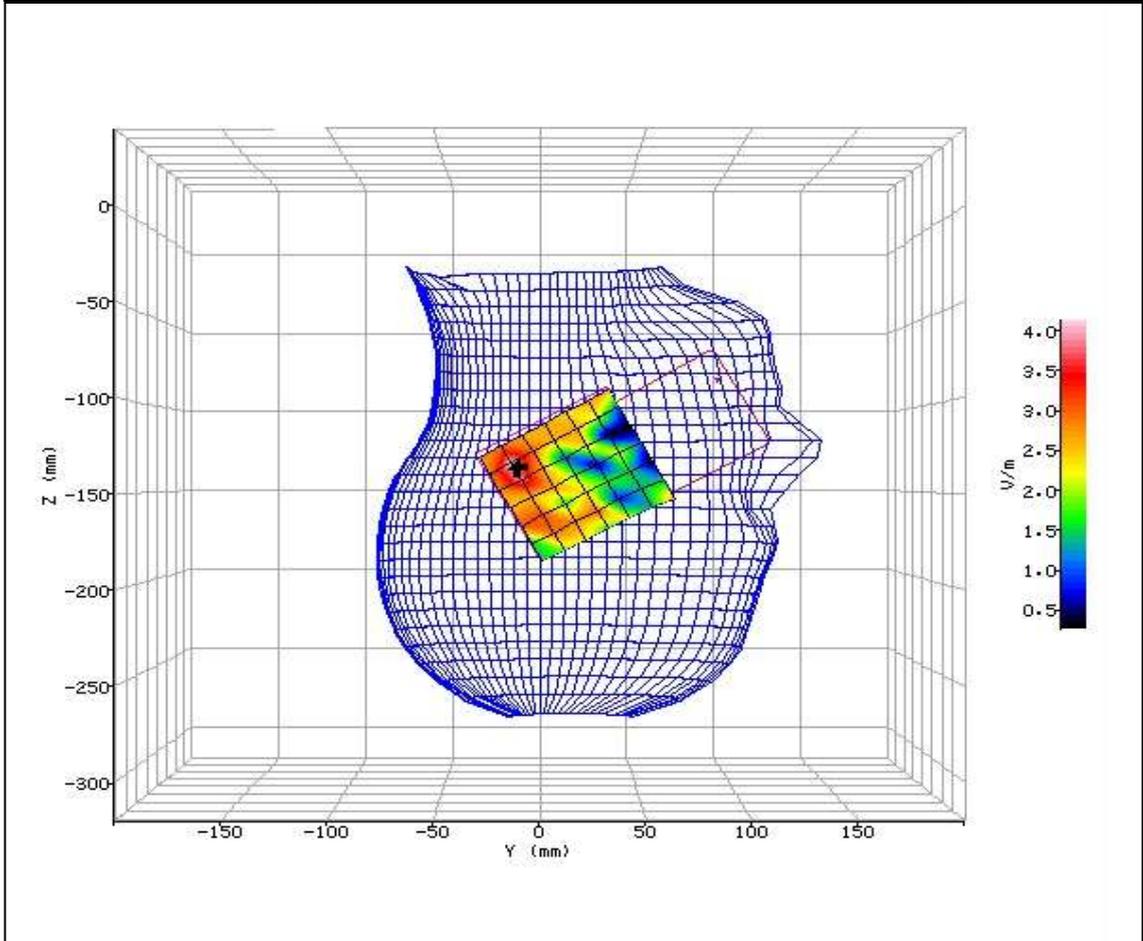


Figure 62: SAR Head Testing Results for the SHL24 Mobile Handset at 5280.0MHz. (NUA)



Product Service

2.15 WLAN 5280MHz BODY SAR TEST RESULTS AND COURSE AREA SCANS – 2D

Front Facing

SAR Body Testing Results for the SHL24 Mobile Handset at 5280.0MHz.

No data was recorded for this position due to SAR levels being below the SAR measurement system capability.



SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	06/01/2014-11:13:31	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	22.80°C	LIQUID SIMULANT:	5000 Body
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	48.95
RELATIVE HUMIDITY:	36.80%	CONDUCTIVITY:	5.048
PHANTOM S/NO:	IXB-2HF	LIQUID TEMPERATURE:	22.70°C
PHANTOM ROTATION:	N/A	MAX SAR X-AXIS LOCATION:	-33.70mm
DUT POSITION:	10mm-Rear Face	MAX SAR Y-AXIS LOCATION:	-18.40mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	4.358
TEST FREQUENCY:	5280.0MHz	SAR 1g:	0.086 W/kg
TYPE OF MODULATION:	OFDM (WLAN)	SAR 10g:	N/A
MODN. DUTY CYCLE:	100%	SAR START:	0.132 W/kg
INPUT POWER LEVEL:	14dBm	SAR END:	0.140 W/kg
PROBE BATTERY LAST CHANGED:	06/01/2013	SAR DRIFT DURING SCAN:	6.500 %

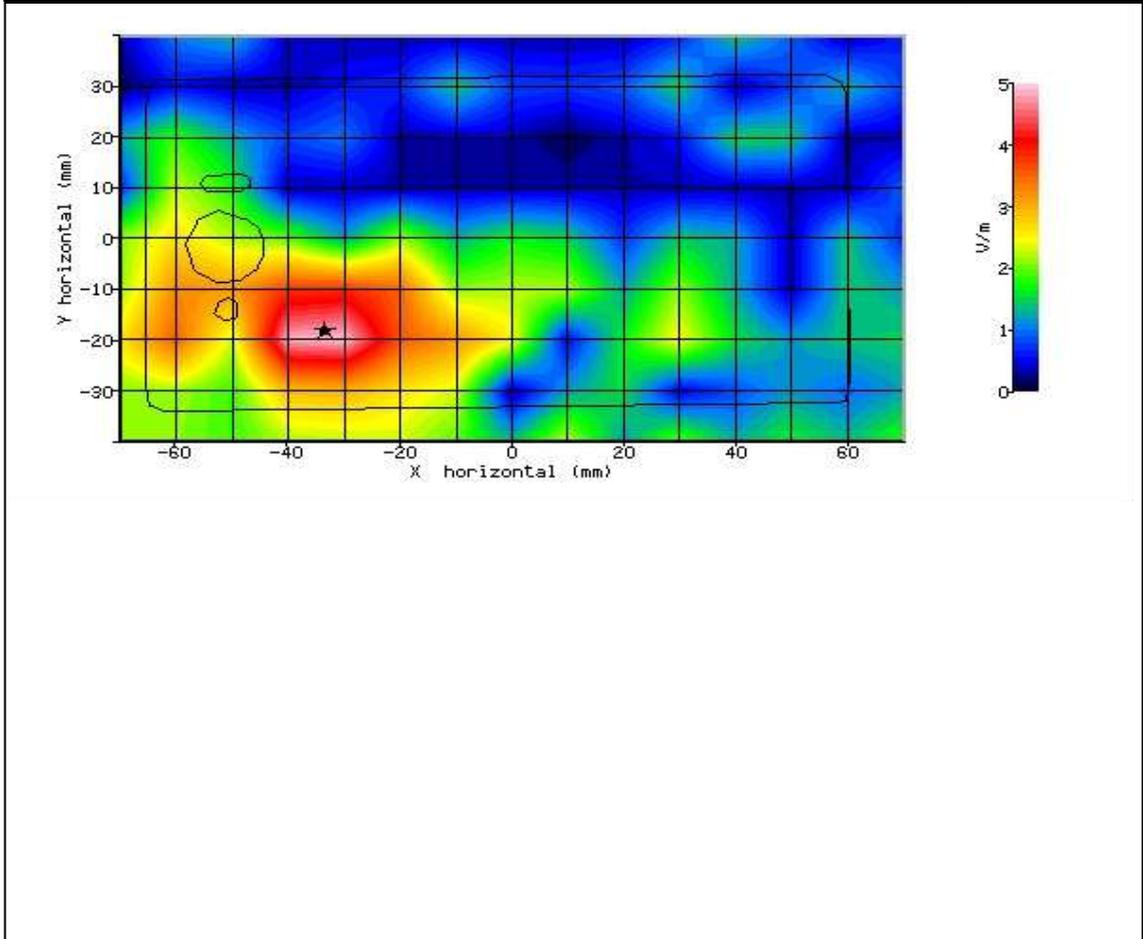


Figure 63: SAR Body Testing Results for the SHL24 Mobile Handset at 5280.0MHz. (NUA)



Product Service

SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	06/01/2014-10:46:54	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	22.80°C	LIQUID SIMULANT:	5000 Body
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	48.95
RELATIVE HUMIDITY:	36.80%	CONDUCTIVITY:	5.048
PHANTOM S/NO:	IXB-2HF	LIQUID TEMPERATURE:	22.70°C
PHANTOM ROTATION:	N/A	MAX SAR X-AXIS LOCATION:	-27.30mm
DUT POSITION:	10mm-Left Edge	MAX SAR Y-AXIS LOCATION:	16.50mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	3.304
TEST FREQUENCY:	5280.0MHz	SAR 1g:	0.070 W/kg
TYPE OF MODULATION:	OFDM (WLAN)	SAR 10g:	N/A
MODN. DUTY CYCLE:	100%	SAR START:	0.076 W/kg
INPUT POWER LEVEL:	14dBm	SAR END:	0.082 W/kg
PROBE BATTERY LAST CHANGED:	06/01/2013	SAR DRIFT DURING SCAN:	7.800 %

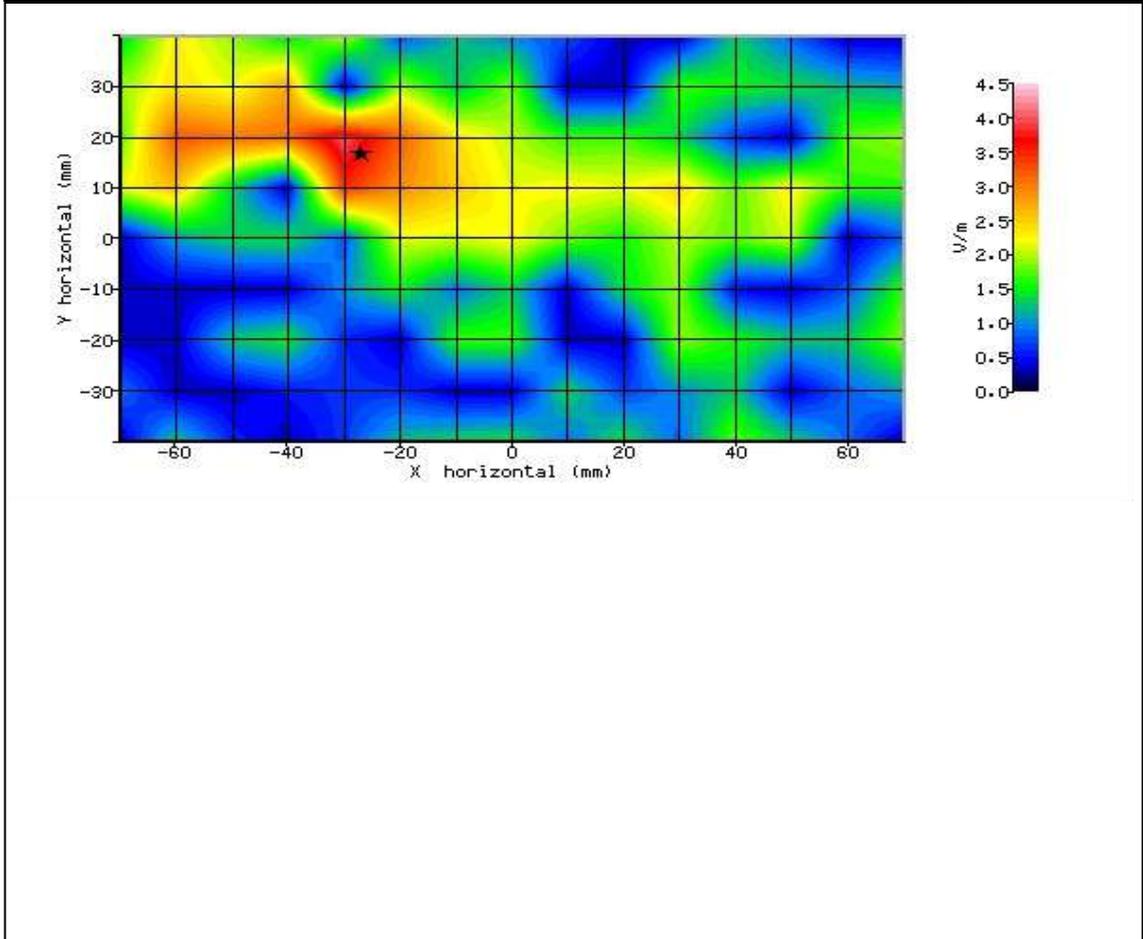


Figure 64: SAR Body Testing Results for the SHL24 Mobile Handset at 5280.0MHz. (NUA)



SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	06/01/2014-10:33:30	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	22.80°C	LIQUID SIMULANT:	5000 Body
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	48.95
RELATIVE HUMIDITY:	36.80%	CONDUCTIVITY:	5.048
PHANTOM S/NO:	IXB-2HF	LIQUID TEMPERATURE:	22.70°C
PHANTOM ROTATION:	N/A	MAX SAR X-AXIS LOCATION:	33.70mm
DUT POSITION:	10mm-Top Edge	MAX SAR Y-AXIS LOCATION:	10.60mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	3.893
TEST FREQUENCY:	5280.0MHz	SAR 1g:	0.110 W/kg
TYPE OF MODULATION:	OFDM (WLAN)	SAR 10g:	N/A
MODN. DUTY CYCLE:	100%	SAR START:	0.108 W/kg
INPUT POWER LEVEL:	14dBm	SAR END:	0.100 W/kg
PROBE BATTERY LAST CHANGED:	06/01/2013	SAR DRIFT DURING SCAN:	-7.300 %

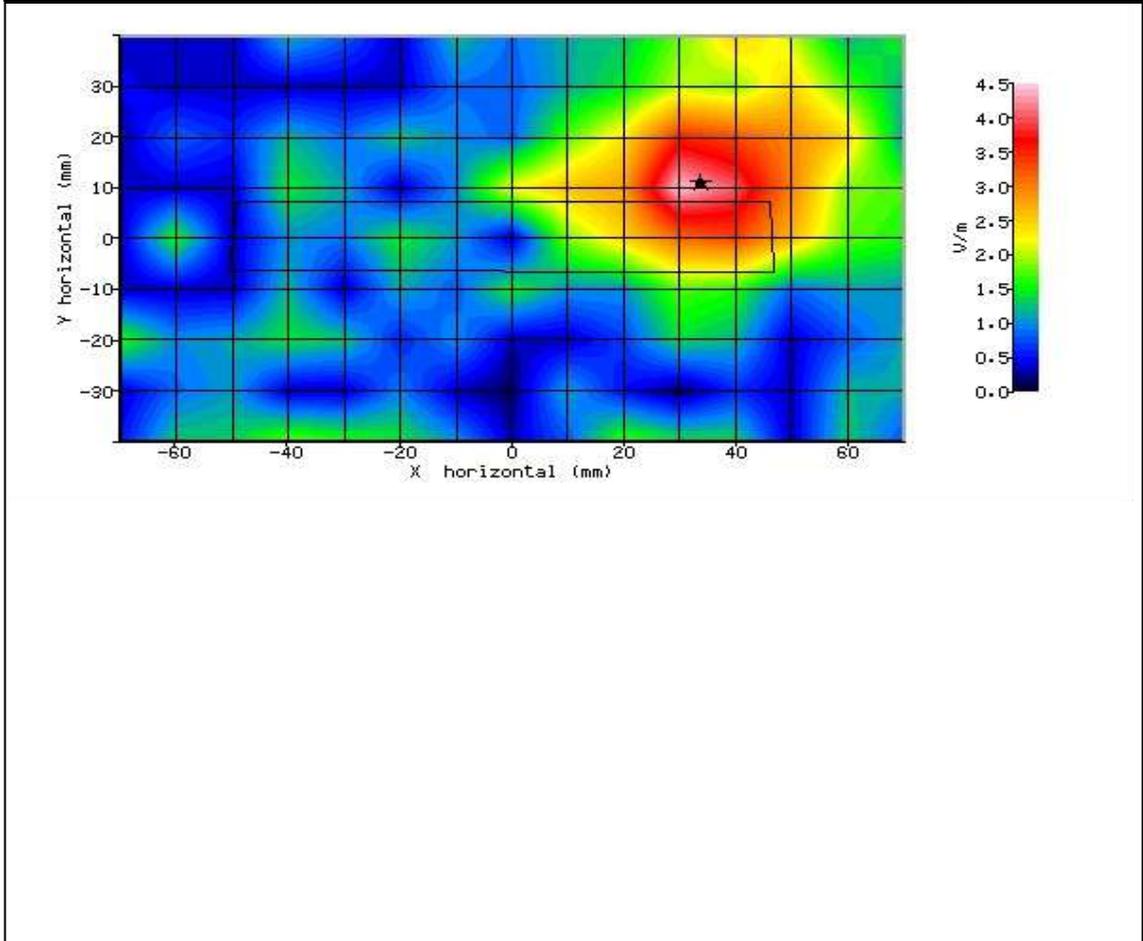


Figure 65: SAR Body Testing Results for the SHL24 Mobile Handset at 5280.0MHz. (NUA)



2.16 WLAN 5560MHz HEAD SAR TEST RESULTS AND COURSE AREA SCANS – 2D

SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	13/01/2014-07:19:17	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	22.80°C	LIQUID SIMULANT:	5000Head
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	39.30
RELATIVE HUMIDITY:	31.50%	CONDUCTIVITY:	1.789
PHANTOM S/NO:	IBX-040	LIQUID TEMPERATURE:	23.10°C
PHANTOM ROTATION:	N/A	MAX SAR Y-AXIS LOCATION:	11.20mm
DUT POSITION:	Left-Cheek	MAX SAR Z-AXIS LOCATION:	-172.90mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	3.414
TEST FREQUENCY:	5560.0MHz	SAR 1g:	0.081 W/kg
TYPE OF MODULATION:	OFDM (WLAN)	SAR 10g:	N/A
MODN. DUTY CYCLE:	100%	SAR START:	0.052 W/kg
INPUT POWER LEVEL:	14dBm	SAR END:	0.052 W/kg
PROBE BATTERY LAST CHANGED:	13/01/2014	SAR DRIFT DURING SCAN:	0.000 %

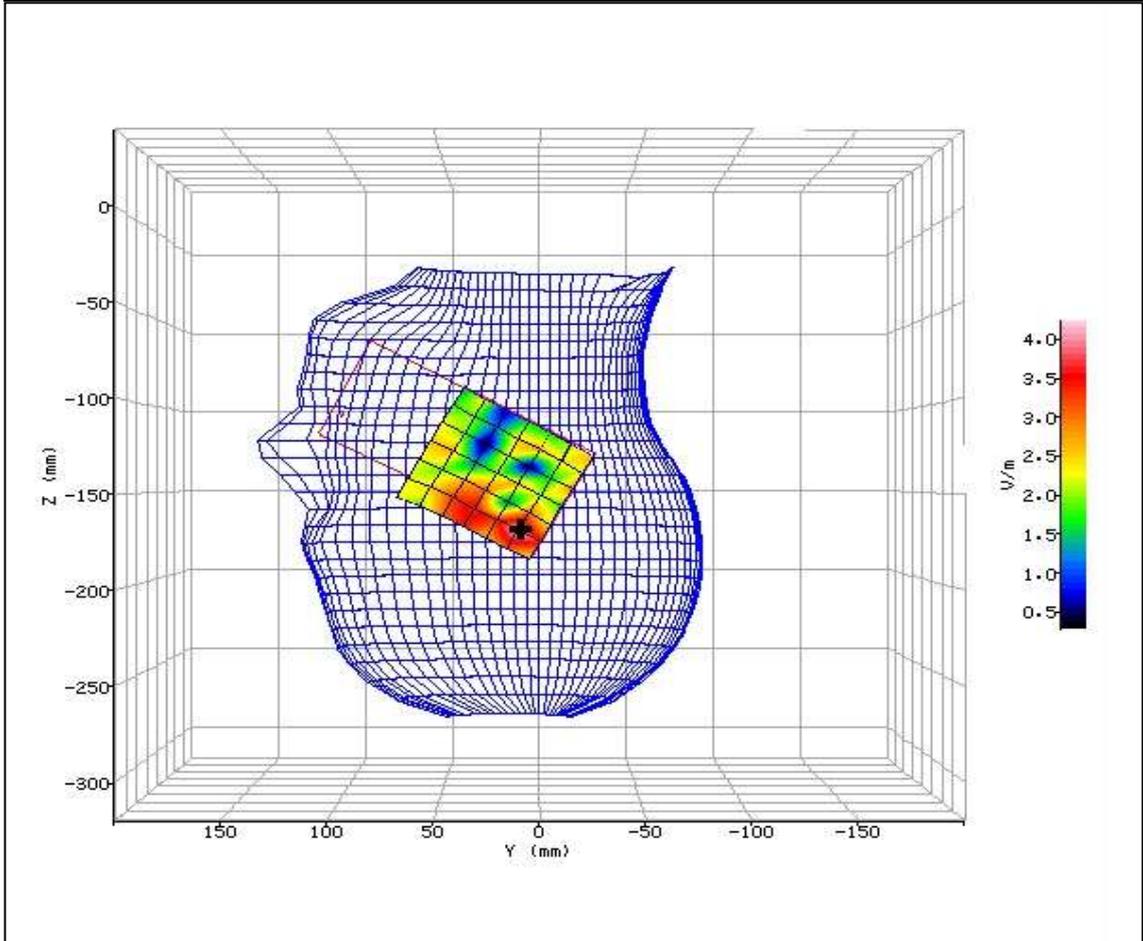


Figure 66: SAR Head Testing Results for the SHL24 Mobile Handset at 5560.0MHz. (NUA)



SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	13/01/2014-07:34:40	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	22.80°C	LIQUID SIMULANT:	5000Head
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	39.30
RELATIVE HUMIDITY:	31.50%	CONDUCTIVITY:	1.789
PHANTOM S/NO:	IBX-040	LIQUID TEMPERATURE:	23.10°C
PHANTOM ROTATION:	N/A	MAX SAR Y-AXIS LOCATION:	8.30mm
DUT POSITION:	Left-15°	MAX SAR Z-AXIS LOCATION:	-174.50mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	3.768
TEST FREQUENCY:	5560.0MHz	SAR 1g:	0.150 W/kg
TYPE OF MODULATION:	OFDM (WLAN)	SAR 10g:	N/A
MODN. DUTY CYCLE:	100%	SAR START:	0.104 W/kg
INPUT POWER LEVEL:	14dBm	SAR END:	0.104 W/kg
PROBE BATTERY LAST CHANGED:	13/01/2014	SAR DRIFT DURING SCAN:	0.000 %

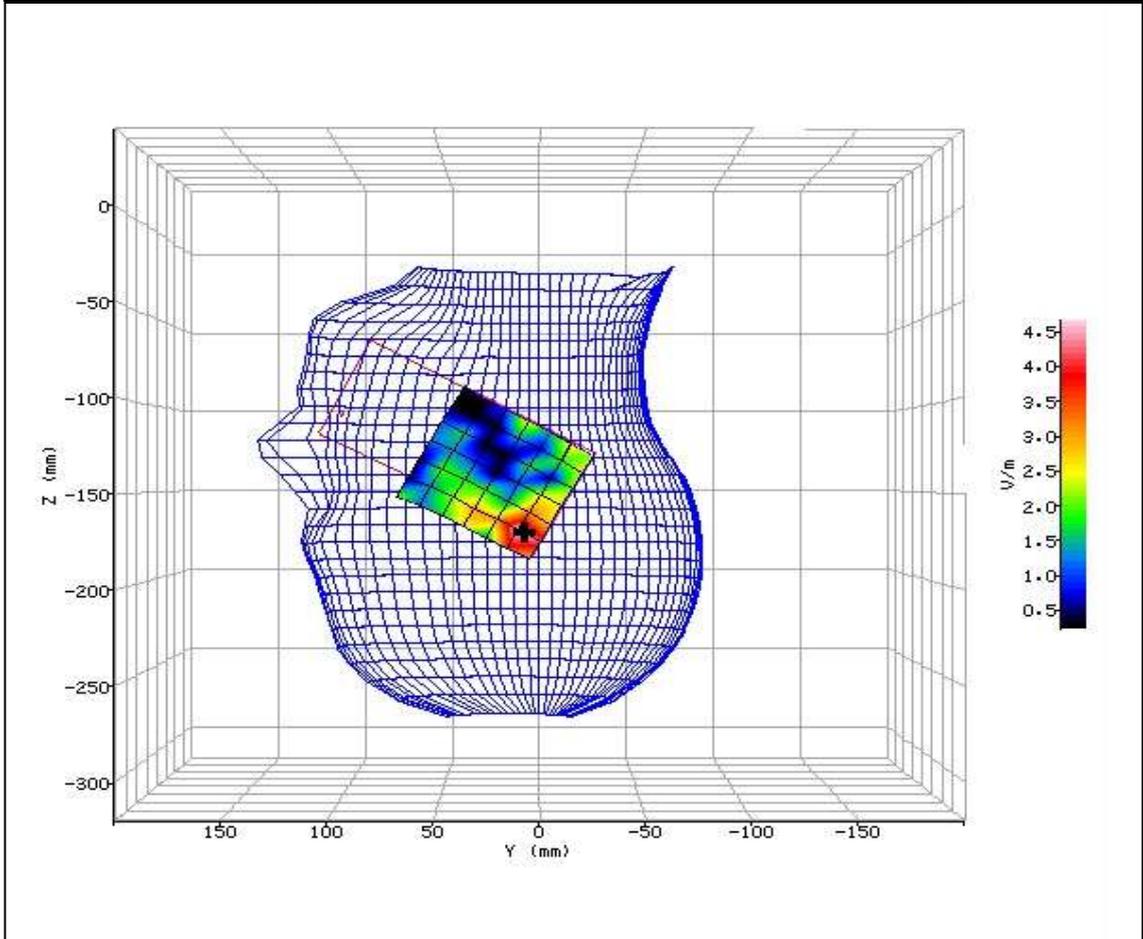


Figure 67: SAR Head Testing Results for the SHL24 Mobile Handset at 5560.0MHz. (NUA)



SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	13/01/2014-09:30:01	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	22.80°C	LIQUID SIMULANT:	5000Head
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	39.30
RELATIVE HUMIDITY:	31.50%	CONDUCTIVITY:	1.789
PHANTOM S/NO:	IBX-040	LIQUID TEMPERATURE:	23.10°C
PHANTOM ROTATION:	N/A	MAX SAR Y-AXIS LOCATION:	-5.90mm
DUT POSITION:	Right-Cheek	MAX SAR Z-AXIS LOCATION:	-134.90mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	3.177
TEST FREQUENCY:	5560.0MHz	SAR 1g:	0.098 W/kg
TYPE OF MODULATION:	OFDM (WLAN)	SAR 10g:	N/A
MODN. DUTY CYCLE:	100%	SAR START:	0.072 W/kg
INPUT POWER LEVEL:	14dBm	SAR END:	0.072 W/kg
PROBE BATTERY LAST CHANGED:	13/01/2014	SAR DRIFT DURING SCAN:	0.000 %

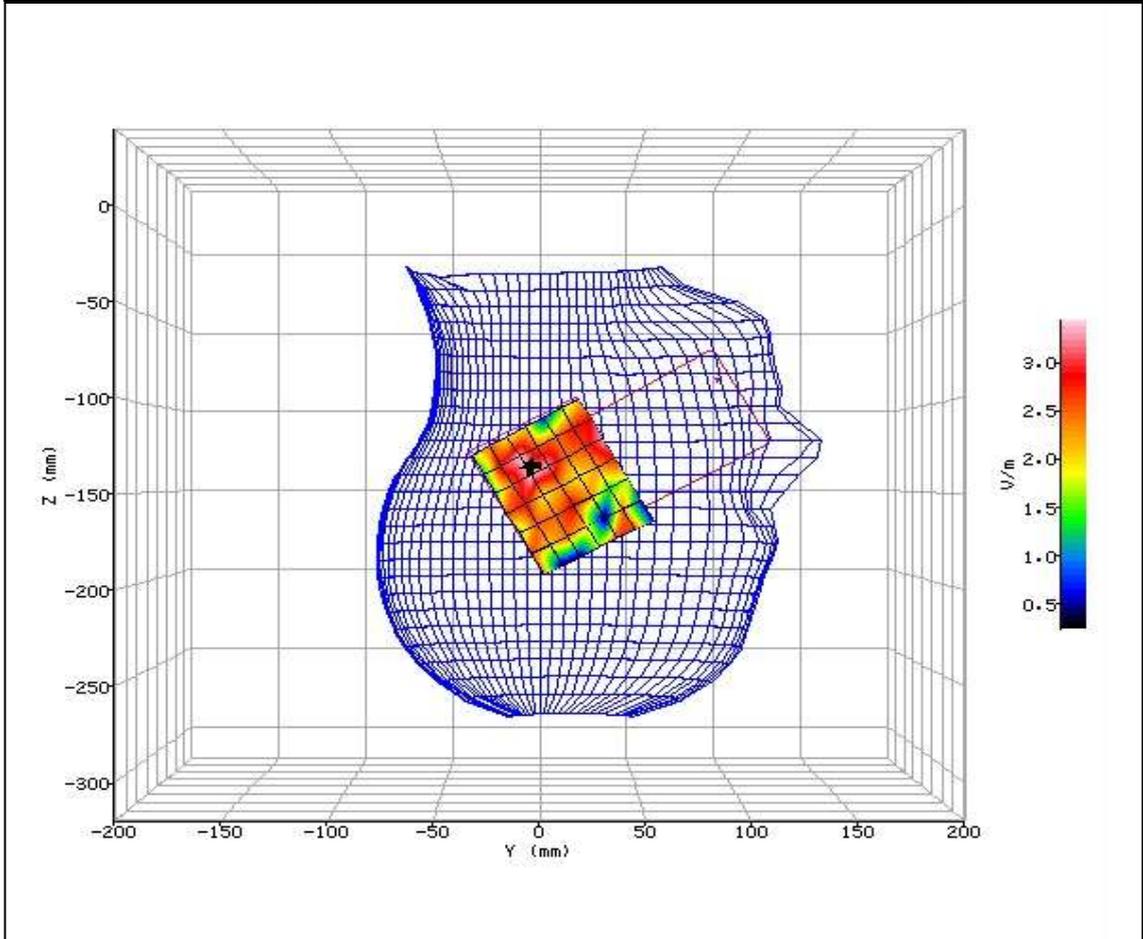


Figure 68: SAR Head Testing Results for the SHL24 Mobile Handset at 5560.0MHz. (NUA)



SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	13/01/2014-09:42:02	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	22.80°C	LIQUID SIMULANT:	5000Head
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	39.30
RELATIVE HUMIDITY:	31.50%	CONDUCTIVITY:	1.789
PHANTOM S/NO:	IBX-040	LIQUID TEMPERATURE:	23.10°C
PHANTOM ROTATION:	N/A	MAX SAR Y-AXIS LOCATION:	-7.70mm
DUT POSITION:	Right-15°	MAX SAR Z-AXIS LOCATION:	-137.40mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	3.538
TEST FREQUENCY:	5560.0MHz	SAR 1g:	0.147 W/kg
TYPE OF MODULATION:	OFDM (WLAN)	SAR 10g:	N/A
MODN. DUTY CYCLE:	100%	SAR START:	0.061 W/kg
INPUT POWER LEVEL:	14dBm	SAR END:	0.061 W/kg
PROBE BATTERY LAST CHANGED:	13/01/2014	SAR DRIFT DURING SCAN:	0.000 %

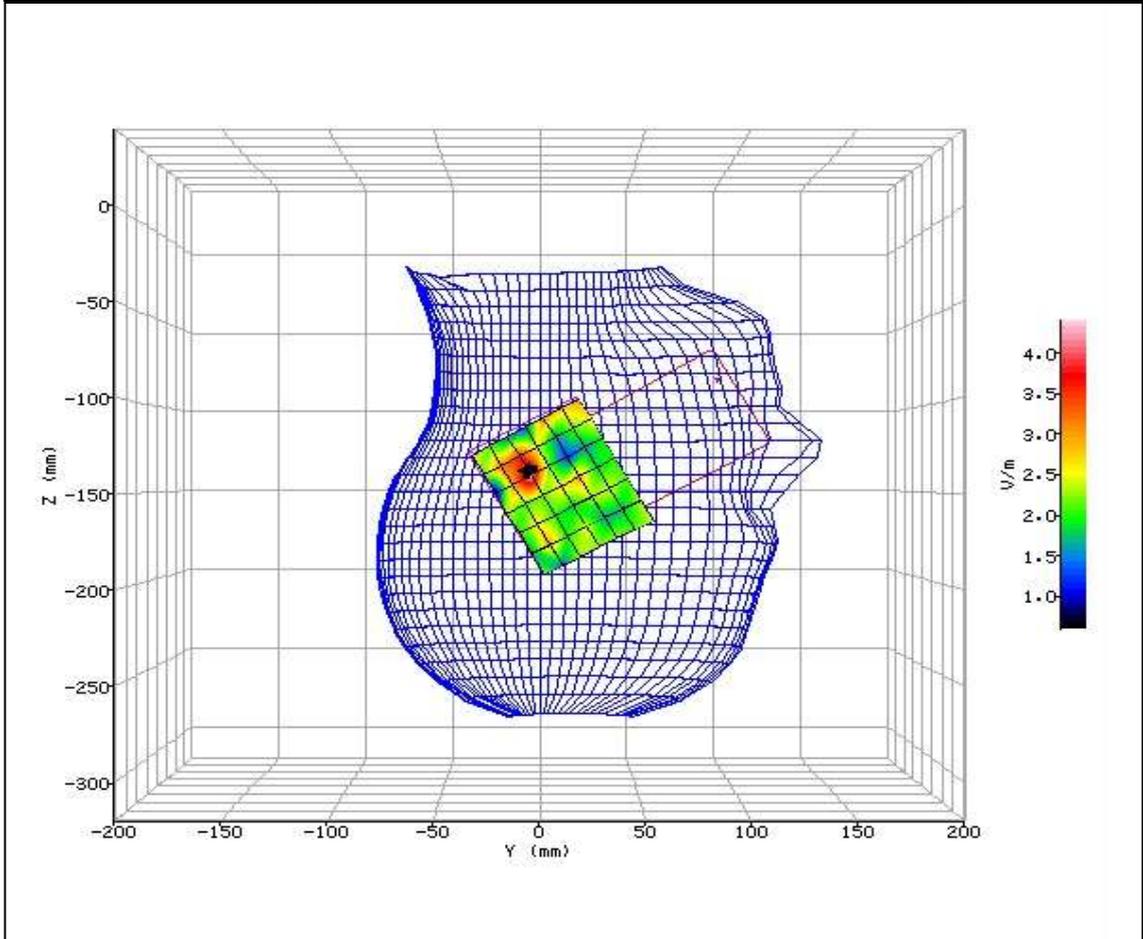


Figure 69: SAR Head Testing Results for the SHL24 Mobile Handset at 5560.0MHz. (NUA)



2.17 WLAN 5560MHz BODY SAR TEST RESULTS AND COURSE AREA SCANS – 2D

SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	06/01/2014-11:44:25	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	22.80°C	LIQUID SIMULANT:	5000 Body
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	47.99
RELATIVE HUMIDITY:	36.80%	CONDUCTIVITY:	5.488
PHANTOM S/NO:	IXB-2HF	LIQUID TEMPERATURE:	22.70°C
PHANTOM ROTATION:	N/A	MAX SAR X-AXIS LOCATION:	-30.100mm
DUT POSITION:	10mm-Front Face	MAX SAR Y-AXIS LOCATION:	34.100mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	1.949
TEST FREQUENCY:	5560.0MHz	SAR 1g:	0.023 W/kg
TYPE OF MODULATION:	OFDM (WLAN)	SAR 10g:	N/A
MODN. DUTY CYCLE:	100%	SAR START:	0.034 W/kg
INPUT POWER LEVEL:	14dBm	SAR END:	0.034 W/kg
PROBE BATTERY LAST CHANGED:	06/01/2013	SAR DRIFT DURING SCAN:	0.000 %

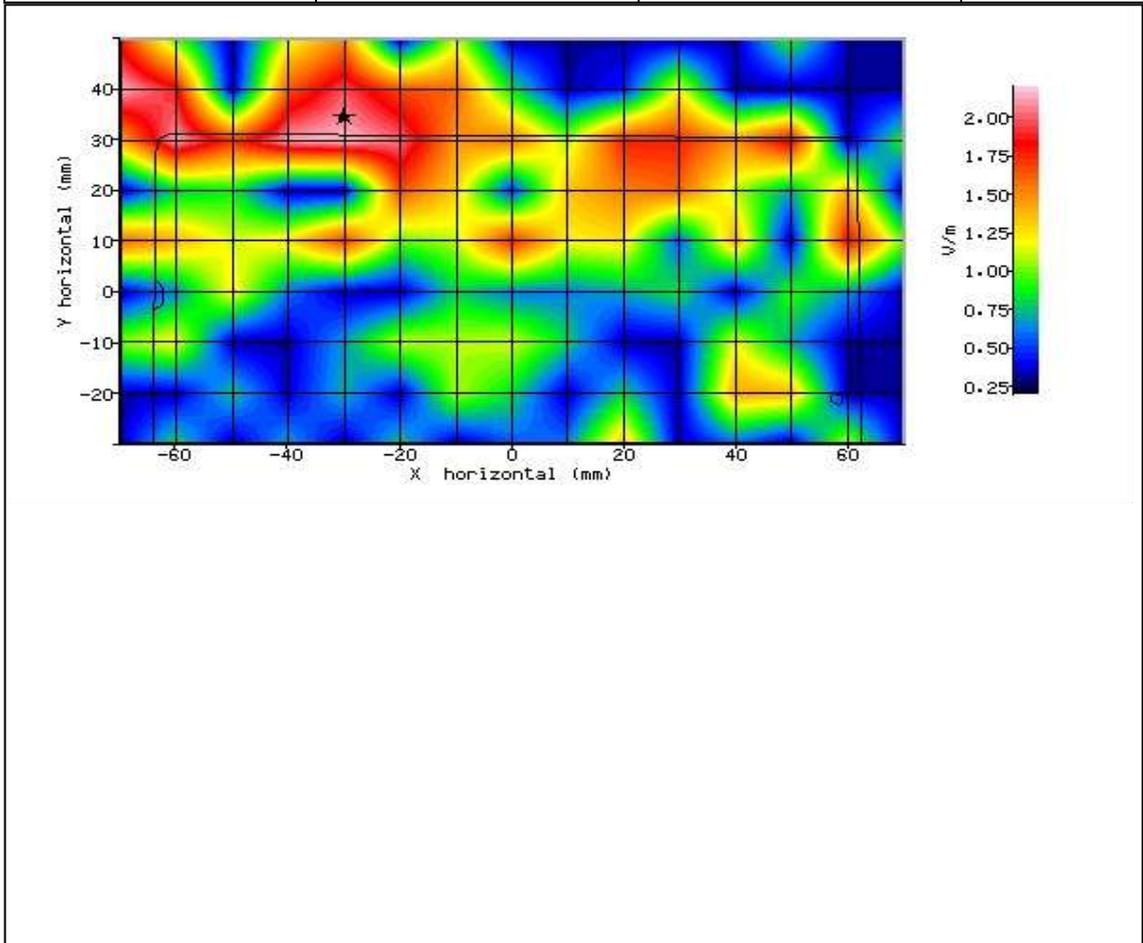


Figure 70: SAR Body Testing Results for the SHL24 Mobile Handset at 5560.0MHz. (NUA)



Product Service

SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	06/01/2014-11:56:35	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	22.80°C	LIQUID SIMULANT:	5000 Body
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	47.99
RELATIVE HUMIDITY:	36.80%	CONDUCTIVITY:	5.488
PHANTOM S/NO:	IXB-2HF	LIQUID TEMPERATURE:	22.70°C
PHANTOM ROTATION:	N/A	MAX SAR X-AXIS LOCATION:	-37.900mm
DUT POSITION:	10mm-Rear Face	MAX SAR Y-AXIS LOCATION:	-18.000mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	4.399
TEST FREQUENCY:	5560.0MHz	SAR 1g:	0.112 W/kg
TYPE OF MODULATION:	OFDM (WLAN)	SAR 10g:	N/A
MODN. DUTY CYCLE:	100%	SAR START:	0.154 W/kg
INPUT POWER LEVEL:	14dBm	SAR END:	0.164 W/kg
PROBE BATTERY LAST CHANGED:	06/01/2013	SAR DRIFT DURING SCAN:	6.200 %

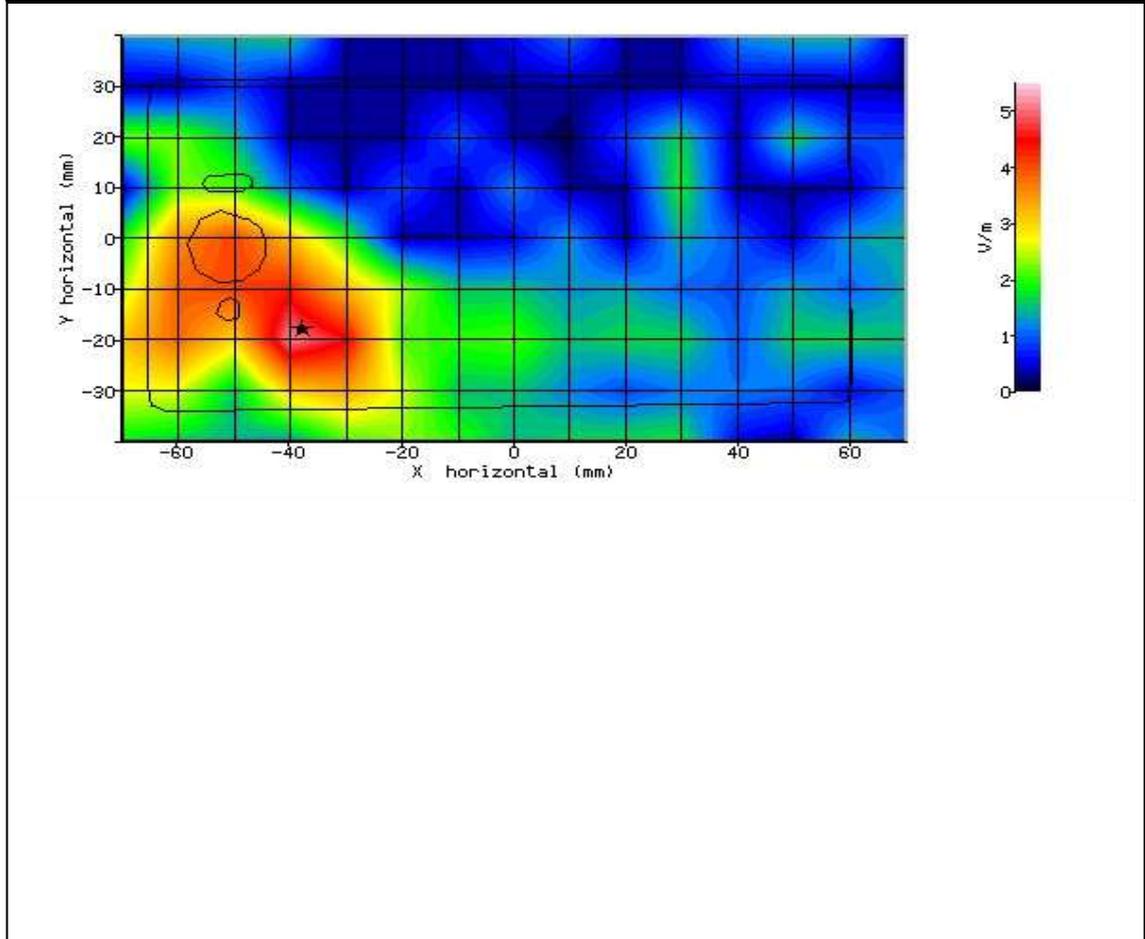


Figure 71: SAR Body Testing Results for the SHL24 Mobile Handset at 5560.0MHz. (NUA)



Product Service

SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	06/01/2014-12:27:43	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	22.80°C	LIQUID SIMULANT:	5000 Body
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	47.99
RELATIVE HUMIDITY:	36.80%	CONDUCTIVITY:	5.488
PHANTOM S/NO:	IXB-2HF	LIQUID TEMPERATURE:	22.70°C
PHANTOM ROTATION:	N/A	MAX SAR X-AXIS LOCATION:	-30.600mm
DUT POSITION:	10mm-Left Edge	MAX SAR Y-AXIS LOCATION:	12.100mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	3.665
TEST FREQUENCY:	5560.0MHz	SAR 1g:	0.067 W/kg
TYPE OF MODULATION:	OFDM (WLAN)	SAR 10g:	N/A
MODN. DUTY CYCLE:	100%	SAR START:	0.093 W/kg
INPUT POWER LEVEL:	14dBm	SAR END:	0.089 W/kg
PROBE BATTERY LAST CHANGED:	06/01/2013	SAR DRIFT DURING SCAN:	-4.300 %

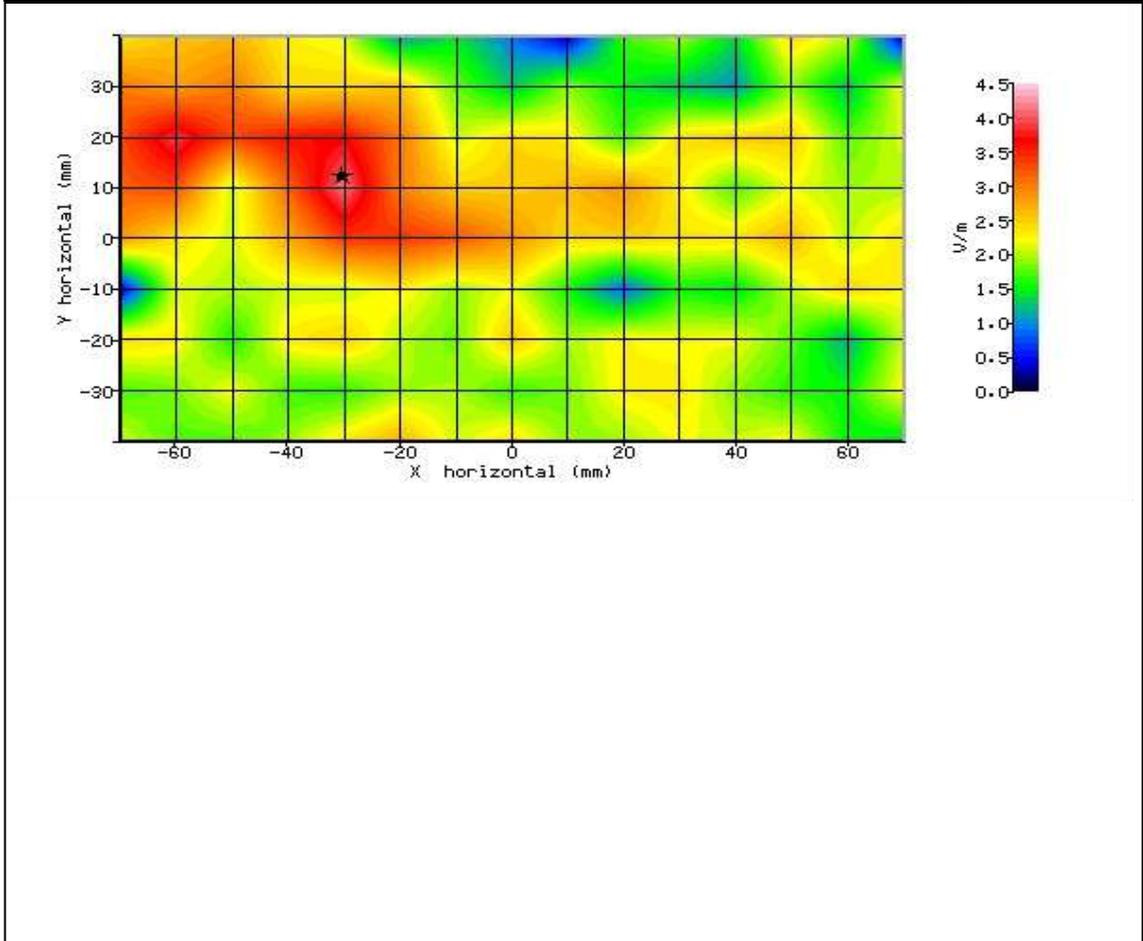


Figure 72: SAR Body Testing Results for the SHL24 Mobile Handset at 5560.0MHz. (NUA)



Product Service

SYSTEM / SOFTWARE:	SARA-C / v6.08.11	INPUT POWER DRIFT:	0 dB
DATE / TIME:	06/01/2014-12:41:25	DUT BATTERY MODEL/NO:	N/A
AMBIENT TEMPERATURE:	22.80°C	LIQUID SIMULANT:	5000 Body
DEVICE UNDER TEST:	SHL24	RELATIVE PERMITTIVITY:	47.99
RELATIVE HUMIDITY:	36.80%	CONDUCTIVITY:	5.488
PHANTOM S/NO:	IXB-2HF	LIQUID TEMPERATURE:	22.70°C
PHANTOM ROTATION:	N/A	MAX SAR X-AXIS LOCATION:	31.500mm
DUT POSITION:	10mm-Top Edge	MAX SAR Y-AXIS LOCATION:	11.200mm
ANTENNA CONFIGURATION:	N/A	MAX E FIELD:	4.643
TEST FREQUENCY:	5560.0MHz	SAR 1g:	0.109 W/kg
TYPE OF MODULATION:	OFDM (WLAN)	SAR 10g:	N/A
MODN. DUTY CYCLE:	100%	SAR START:	0.172 W/kg
INPUT POWER LEVEL:	14dBm	SAR END:	0.172 W/kg
PROBE BATTERY LAST CHANGED:	06/01/2013	SAR DRIFT DURING SCAN:	0.000 %

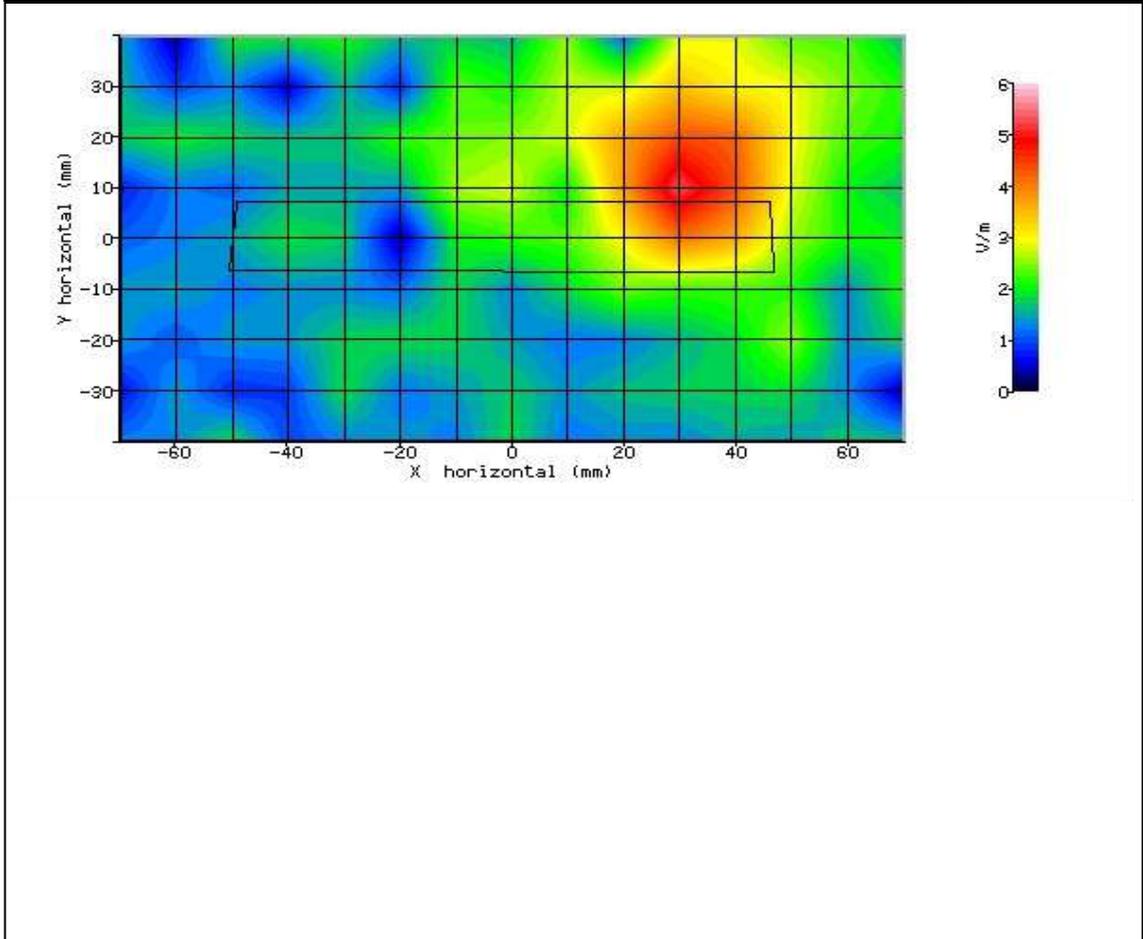


Figure 73: SAR Body Testing Results for the SHL24 Mobile Handset at 5560.0MHz. (NUA)



SECTION 3

TEST EQUIPMENT USED



3.1 TEST EQUIPMENT USED

The following test equipment was used at TÜV SÜD Product Service:

Instrument Description	Manufacturer	Model Type	TE Number	Cal Period (months)	Calibration Due Date
Signal Generator	Hewlett Packard	ESG4000A	38	12	23-May-2014
Radiocommunications Tester	Rohde & Schwarz	CMU 200	39	12	06-Dec-2014
10MHz - 2.5GHz, 3W, Amplifier	Vectawave Technology	VTL5400	51	-	TU
Directional Coupler	Krytar	1850	58	-	TU
Power Sensor	Rohde & Schwarz	NRV-Z1	60	12	14-Jun-2014
Signal Generator	Hewlett Packard	ESG4000A	61	12	22-May-2014
Thermometer	Digitron	T208	64	12	16-Jan-2014
Amplifier (5GHz)	IndexSar Ltd	5GHz	157	-	TU
Attenuator (Step, 11dB, 1W)	Hewlett Packard	8494H	425	-	TU
Directional Coupler	Hewlett Packard	11692D	452	-	TU
Attenuator (20dB, 10W)	Weinschel	37-20-34	482	12	17-Oct-2014
Attenuator (20dB, 20W)	Narda	766F-20	483	12	13-Jun-2014
Spectrum Analyser	Agilent Technologies	E7405A	1410	12	27-Sep-2014
Validation Amplifier (10MHz - 2.5GHz)	IndexSar Ltd	VBM2500-3	2415	-	TU
Hygrometer	Rotronic	I-1000	2784	12	3-Apr-2014
GSM Test Set	Rohde & Schwarz	CMU 200	2809	12	18-Jun-2014
Power Sensor	Rohde & Schwarz	NRV- Z5	2878	12	14-Jun-2014
Antenna (Omnidirectional)	Katherin Scala Division	OG-890/1990/DC	2905	-	TU
Power Meter	Rohde & Schwarz	NRVD	2979	12	25-May-2014
Dual Channel Power Meter	Rohde & Schwarz	NRVD	3259	12	14-Jun-2014
Signal Generator: 10MHz to 20GHz	Rohde & Schwarz	SMR20	3475	12	1-Feb-2014
Power Sensor	Rohde & Schwarz	NRV-Z1	3563	12	23-May-2014
Meter & T/C	R.S Components	Meter 615-8206 & Type K T/C	3612	12	8-Jul-2014
SAR 1800 MHz dipole	Speag	D1800V2	3855	-	O/P Mon
SAR 900 MHz dipole	Speag	D900V2	3856	-	O/P Mon
SAR 835 MHz dipole	Speag	D835V2	3857	-	O/P Mon
Part of SARAC System	IndexSar Ltd	Robot Controller	4076	-	TU
Part of SARAC System	IndexSar Ltd	Cartesian Leg Extension	4078	-	TU
Cartesian 4-axis Robot	IndexSar Ltd	SARAC	4079	-	TU
Part of SARAC System	IndexSar Ltd	Wooden Bench	4081	-	TU
Wideband Radio Communication Tester	Rohde & Schwarz	CMW 500	4144	12	17-Jul-2014
Head Phantom	IndexSar Ltd	IXB-040 Inverted SAM phantom	4254	-	TU
Flat Phantom	IndexSar Ltd	IXB-2HF 800-6000MHz	4255	-	TU
Flat Phantom	IndexSar Ltd	IXB-2HF 800-6000MHz	4256	-	TU
Spacer used to raise body phantom	IndexSar Ltd	Body Phantom Spacer	4260	-	TU
Part of SARAC System	IndexSar Ltd	Wooden Bench	4266	-	TU
Part of SARAC System	IndexSar Ltd	Robot Controller	4267	-	TU
Part of SARAC System	IndexSar Ltd	Cartesian Leg Extension	4268	-	TU
Cartesian 4-axis Robot	IndexSar Ltd	SARAC	4269	-	TU



Product Service

Instrument Description	Manufacturer	Model Type	TE Number	Cal Period (months)	Calibration Due Date
Digital thermo Hygrometer	Radio Spares	1260	4300	12	22-Mar-2014
SAR 5GHz Di-pole	Speag	D5GHzV2	4309	-	TU
Immersible SAR Probe	IndexSar Ltd	IXP-025	4310	24	07-Apr-2014
Immersible SAR Probe	IndexSar Ltd	IXP-021	4311	24	24-Oct-2014
Immersible SAR Probe	IndexSar Ltd	IPX-050	4313	24	7-Mar-2015
Immersible SAR Probe	IndexSar Ltd	IPX-020	4317	24	24-Apr-2015
Immersible SAR Probe	IndexSar Ltd	IPX-020	4318	24	24-Apr-2015
835MHz Head Fluid	IndexSar Ltd	Batch 20	N/A	1	31-Jan-2014
835MHz Body Fluid	IndexSar Ltd	Batch 13	N/A	1	31-Jan-2014
1900MHz Head Fluid	IndexSar Ltd	Batch 8	N/A	1	31-Jan-2014
1900MHz Body Fluid	IndexSar Ltd	Batch 4	N/A	1	31-Jan-2014
2450MHz Head Fluid	IndexSar Ltd	Batch 11	N/A	1	31-Jan-2014
2450MHz Body Fluid	IndexSar Ltd	Batch 7	N/A	1	31-Jan-2014
5000MHz Head Fluid	IndexSar Ltd	Batch 4	N/A	1	31-Jan-2014
5000MHz Body Fluid	IndexSar Ltd	Batch 3	N/A	1	31-Jan-2014

TU – Traceability Unscheduled



3.2 TEST SOFTWARE

The following software was used to control the TÜV SÜD Product Service SARAC System.

Instrument	Version Number	Date
SARA-C system	v.6.08.11	06 June 2013
IFA-10 Probe amplifier	Version 2	-



3.3 DIELECTRIC PROPERTIES OF SIMULANT LIQUIDS

The fluid properties of the simulant fluids used during routine SAR evaluation meet the dielectric properties required KDB 865665.

IEEE 1528 Recipes

Frequency (MHz)	300	450		835	900			1450	1800				1900	1950	2000	2100		2450		3000	
Recipe#	1	1	3	1	1	2	3	1	1	2	2	3	1	2	4	1	1	2	2	3	2
Ingredients (% by weight)																					
1, 2-Propanediol							64.81														
Bactericide	0.19	0.19	0.50	0.10	0.10		0.50														0.50
Diacetin			48.90				49.20														49.45
DGBE								45.41	47.00	13.84	44.92		44.94	13.84	45.00	50.00	50.00	7.99	7.99		7.99
HEC	0.98	0.96		1.00	1.00																
NaCl	5.95	3.95	1.70	1.45	1.48	0.79	1.10	0.67	0.36	0.35	0.18	0.64	0.18	0.35					0.16	0.16	0.16
Sucrose	55.32	56.32		57.00	56.50																
Triton X-100										30.45				30.45					19.97	19.97	19.97
Water	37.56	38.56	48.90	40.45	40.92	34.40	49.20	53.80	52.64	55.36	54.90	49.43	54.90	55.36	55.00	50.00	50.00	71.88	71.88	49.75	71.88
Measured dielectric parameters																					
ϵ_r	46.00	43.40	44.30	41.60	41.20	41.80	42.70	40.9	39.3	41.00	40.40	39.20	39.90	41.00	40.10	37.00	36.80	41.10	40.30	39.20	37.90
σ (S/m)	0.86	0.85	0.90	0.90	0.98	0.97	0.99	1.21	1.39	1.38	1.40	1.40	1.42	1.38	1.41	1.40	1.51	1.55	1.88	1.82	2.46
Temp (°C)	22	22	20	22	22	22	20	22	22	21	22	20	21	21	20	22	22	20	20	20	20
Target dielectric parameters (Table 2)																					
ϵ_r	45.30	43.50	41.5	41.50	40.50	40.00										39.80	39.20	38.50			
σ (S/m)	0.87	0.87	0.9	0.97	1.20	1.40										1.49	1.80	2.40			

NOTE – Multiple columns for any single frequency are optional recipe #, reference: 1 (Kanda et al. [B185]), 2 (Vigneras [B143]), 3 (Peyman and Gabriel [B119]), 4 (Fukunaga et al [B50])

The dielectric properties of the tissue simulant liquids used for the SAR testing at TÜV SÜD Product Service are as follows:-

Fluid Type and Frequency	Relative Permittivity ϵ_R (ϵ') Target	Relative Permittivity ϵ_R (ϵ') Measured	Conductivity σ Target	Conductivity σ Measured
835MHz Head	41.5	41.89	0.90	0.899
835MHz Body	55.0	56.73	0.97	1.01
1900MHz Head	40.0	38.84	1.40	1.447
1900MHz Body	53.3	53.40	1.52	1.591
2450 MHz Head	39.2	39.30	1.8	1.789
2450MHz Body	52.7	51.26	1.95	1.972
5200MHz Head	36.0	34.92	4.66	4.539
5200MHz Body	49.0	48.95	5.30	5.048
5500MHz Head	35.6	34.09	4.96	4.872
5500MHz Body	48.6	47.99	5.65	5.488



Product Service

3.4 TEST CONDITIONS

3.4.1 Test Laboratory Conditions

Ambient temperature: Within +15°C to +35°C.

The actual temperature during the testing ranged from 22.7°C to 23.5°C.

The actual humidity during the testing ranged from 35.1% to 42.9% RH.

3.4.2 Test Fluid Temperature Range

Frequency	Body / Head Fluid	Min Temperature °C	Max Temperature °C
835MHz	Head	23.2	23.2
835MHz	Body	23.2	23.2
1900MHz	Head	23.0	23.2
1900MHz	Body	23.2	23.2
2450MHz	Head	23.1	23.2
2450MHz	Body	23.1	23.1
5200MHz	Head	22.8	22.8
5200MHz	Body	22.7	22.7
5500MHz	Head	23.1	23.1
5500MHz	Body	22.7	22.7

3.4.3 SAR Drift

The SAR Drift was within acceptable limits during scans. The maximum SAR Drift, drift due to the handset electronics, was recorded as 8.5% (1.098 dB) for head and 7.3% (1.079 dB) for body. The measurement uncertainty budget for this assessment includes the maximum SAR Drift figures for Head and/or Body as applicable.



3.5 MEASUREMENT UNCERTAINTY

Head SAR Measurements.

Source of Uncertainty	Description	Tolerance / Uncertainty ± %	Probability distribution	Div	c_i (1g)	Standard Uncertainty ± % (1g)	V_i or V_{eff}
<i>Measurement System</i>							
Probe calibration	7.2.1	8.73	N	1	1	8.73	∞
Isotropy	7.2.1.2	3.18	R	1.73	1	1.84	∞
Probe angle >30deg	additional	12.00	R	1.73	1	6.93	∞
Boundary effect	7.2.1.5	0.49	R	1.73	1	0.28	∞
Linearity	7.2.1.3	1.00	R	1.73	1	0.58	∞
Detection limits	7.2.1.4	0.00	R	1.73	1	0.00	∞
Readout electronics	7.2.1.6	0.30	N	1	1	0.30	∞
Response time	7.2.1.7	0.00	R	1.73	1	0.00	∞
Integration time (equiv.)	7.2.1.8	1.38	R	1.73	1	0.80	∞
RF ambient conditions	7.2.3.6	3.00	R	1.73	1	1.73	∞
Probe positioner mech. restrictions	7.2.2.1	5.35	R	1.73	1	3.09	∞
Probe positioning with respect to phantom shell	7.2.2.3	5.00	R	1.73	1	2.89	∞
Post-processing	7.2.4	7.00	R	1.73	1	4.04	∞
<i>Test sample related</i>							
Test sample positioning	7.2.2.4	1.50	R	1.73	1	0.87	∞
Device holder uncertainty	7.2.2.4.2	1.73	R	1.73	1	1.00	∞
Drift of output power	7.2.3.4	8.5	R	1.73	1	4.91	∞
<i>Phantom and set-up</i>							
Phantom uncertainty (shape and thickness tolerances)	7.2.2.2	2.01	R	1.73	1	1.16	∞
Liquid conductivity (target)	7.2.3.3	5.00	R	1.73	0.64	1.85	∞
Liquid conductivity (meas.)	7.2.3.3	5.00	N	1	0.64	3.20	∞
Liquid permittivity (target)	7.2.3.4	5.00	R	1.73	0.6	1.73	∞
Liquid permittivity (meas.)	7.2.3.4	3.00	N	1	0.6	1.80	∞
Combined standard uncertainty			RSS			11.80	
Expanded uncertainty (95% confidence interval)			K=2			23.60	



Body SAR Measurements.

Source of Uncertainty	Description	Tolerance / Uncertainty ± %	Probability distribution	Div	c_i (1g)	Standard Uncertainty ± % (1g)	V_i or V_{eff}
<i>Measurement System</i>							
Probe calibration	7.2.1	8.73	N	1	1	8.73	∞
Isotropy	7.2.1.2	3.18	R	1.73	1	1.84	∞
Boundary effect	7.2.1.5	0.49	R	1.73	1	0.28	∞
Linearity	7.2.1.3	1.00	R	1.73	1	0.58	∞
Detection limits	7.2.1.4	0.00	R	1.73	1	0.00	∞
Readout electronics	7.2.1.6	0.30	N	1	1	0.30	∞
Response time	7.2.1.7	0.00	R	1.73	1	0.00	∞
Integration time (equiv.)	7.2.1.8	1.38	R	1.73	1	0.80	∞
RF ambient conditions	7.2.3.6	3.00	R	1.73	1	1.73	∞
Probe positioner mech. restrictions	7.2.2.1	0.60	R	1.73	1	0.35	∞
Probe positioning with respect to phantom shell	7.2.2.3	2.00	R	1.73	1	1.15	∞
Post-processing	7.2.4	7.00	R	1.73	1	4.04	∞
<i>Test sample related</i>							
Test sample positioning	7.2.2.4	1.50	R	1.73	1	0.87	∞
Device holder uncertainty	7.2.2.4.2	1.73	R	1.73	1	1.00	∞
Drift of output power	7.2.3.4	7.3	R	1.73	1	4.21	∞
<i>Phantom and set-up</i>							
Phantom uncertainty (shape and thickness tolerances)	7.2.2.2	2.01	R	1.73	1	1.16	∞
Liquid conductivity (target)	7.2.3.3	5.00	R	1.73	0.64	1.85	∞
Liquid conductivity (meas.)	7.2.3.3	5.00	N	1	0.64	3.20	∞
Liquid permittivity (target)	7.2.3.4	5.00	R	1.73	0.6	1.73	∞
Liquid permittivity (meas.)	7.2.3.4	3.00	N	1	0.6	1.80	∞
Combined standard uncertainty			RSS			11.31	
Expanded uncertainty (95% confidence interval)			K=2			22.62	



Product Service

SECTION 4

ACCREDITATION, DISCLAIMERS AND COPYRIGHT



4.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT



This report relates only to the actual item/items tested.

Our UKAS Accreditation does not cover opinions and interpretations and any expressed are outside the scope of our UKAS Accreditation.

Results of tests not covered by our UKAS Accreditation Schedule are marked NUA (Not UKAS Accredited).

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Product Service

ANNEX A

PROBE CALIBRATION REPORT



Product Service



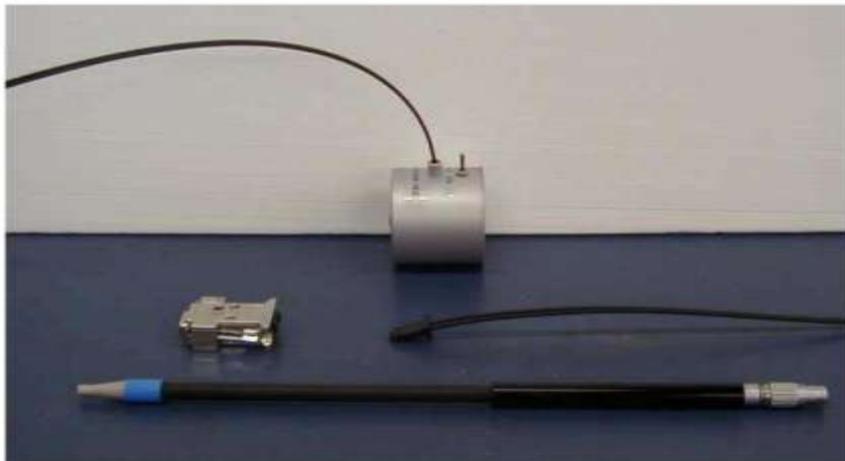
IMMERSIBLE SAR PROBE

CALIBRATION REPORT

Part Number: IXP – 050

S/N 0204

April 2013



Indexsar Limited
Oakfield House
Cudworth Lane
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Calibration Certificate 1304/0204
Date of Issue: 23rd April 2013
Immersible SAR Probe

Type:	IXP-050
Manufacturer:	IndexSAR, UK
Serial Number:	0204
Place of Calibration:	IndexSAR, UK
Date of Receipt of Probe:	N/A
Calibration Dates:	14 th January – 7 th March 2013
Customer:	TUV Sud

IndexSAR Ltd hereby declares that the IXP-050 Probe named above has been calibrated for conformity to the current versions of IEEE 1528, IEC 62209-1, IEC 62209-2, and FCC OET65 standards using the methods described in this calibration document. Where applicable, the standards used in the calibration process are traceable to the UK's National Physical Laboratory.

Calibrated by: *A. Brinklow* Technical Manager

Approved by: *[Signature]* Director

Please keep this certificate with the calibration document. When the probe is sent for a calibration check, please include the calibration document.



INTRODUCTION

Straight probes can work on either SARA-C (to measure SAR values in flat phantoms containing Body tissue simulant fluid) or on SARA2 (where they can measure either in a flat phantom with Body fluid, or in a SAM phantom containing Head fluid).

This Report presents measured calibration data for a particular Indexsar SAR probe (S/N 0204) for use on SARA-C only. **The calibration factors do not apply to, and will not give correct readings on, the IndexSAR SARA2 system.**

Indexsar probes are characterised using procedures that, where applicable, follow the recommendations of IEC 62209-1 [Ref 1], IEEE 1528 [Ref 2], IEC 62209-2 [Ref 3] and FCC OET65 [Ref 4] standards. The procedures incorporate techniques for probe linearisation, isotropy assessment and determination of liquid factors (conversion factors). Calibrations are determined by comparing probe readings with analytical computations in canonical test geometries (waveguides) using normalised power inputs.

Each step of the calibration procedure and the equipment used is described in the sections below.

CALIBRATION PROCEDURE

1. Objectives

The calibration process comprises the following stages

- 1) Determination of the channel sensitivity factors which optimise the probe's overall axial isotropy in 900MHz brain fluid
- 2) Measure the incidental spherical isotropy using these derived channel sensitivity factors.
- 3) Since isotropy and channel sensitivity factors are frequency independent, these channel sensitivity factors can be applied to model the exponential decay of SAR in a waveguide fluid cell at each frequency of interest, and hence derive the liquid conversion factors at that frequency.

2. Probe output

The probe channel output signals are linearised in the manner set out in Refs [1] - [4]. The following equation is utilized for each channel:

$$U_{in} = U_{op} + U_{op}^2 / DCP \quad (1)$$

where U_{in} is the linearised signal, U_{op} is the raw output signal in mV and DCP is the diode compression potential, also in mV.



DCP is determined from fitting equation (1) to measurements of U_{in} versus source feed power over the full dynamic range of the probe. The DCP is a characteristic of the Schottky diodes used as the sensors. For the IXP-020 probes with CW signals the DCP values are typically 100mV.

For this value of DCP, the typical linearity response of IXP-050 probes to CW and to GSM modulation is shown in Figure 7, along with departures of this same dataset from linearity.

In turn, measurements of E-field are determined using the following equation:

$$E_{liq}^2 \text{ (V/m)} = U_{inx} * \text{Air Factor}_x * \text{Liq Factor}_x + U_{iny} * \text{Air Factor}_y * \text{Liq Factor}_y + U_{inz} * \text{Air Factor}_z * \text{Liq Factor}_z \quad (3)$$

Here, "Air Factor" represents each channel's sensitivity, while "Liq Factor" represents the enhancement in signal level when the probe is immersed in tissue-simulant liquids at each frequency of interest.

3. Selecting channel sensitivity factors to optimise isotropic response

Within SARA-C, an L-probe's predominant mode of operation is with the tip pointing directly towards the source of radiation. Consequently, optimising the probe's response to boresight signals ("axial isotropy") is far more important than optimising its spherical isotropy (where the direction, as well as the polarisation angle, of the incoming radiation must be taken into account).

The setup for measuring the probe's axial isotropy is shown in **Error! Reference source not found.** Since isotropy is frequency-independent, measurements are normally made at a frequency of 900MHz as lower frequencies are more tolerant of positional inaccuracies.

A 900MHz waveguide containing head-fluid simulant is selected. Like all waveguides used during probe calibration, this particular waveguide contains two distinct sections: an air-filled launcher section, and a liquid cell section, separated by a dielectric matching window designed to minimise reflections at the air-liquid interface.

The waveguide stands in an upright position and the liquid cell section is filled with 900MHz brain fluid to within 10 mm of the open end. The depth of liquid ensures there is negligible radiation from the waveguide open top and that the probe calibration is not influenced by reflections from nearby objects.

During the measurement, a TE_{11} mode is launched into the waveguide by means of an N-type-to-waveguide adapter. The probe is then lowered vertically into the liquid until the tip is exactly 10mm above the centre of the dielectric window. This particular separation ensures that the probe is operating in a part of the waveguide where boundary corrections are not necessary.

Care must also be taken that the probe tip is centred while rotating.



The exact power applied to the input of the waveguide during this stage of the probe calibration is immaterial since only relative values are of interest while the probe rotates. However, the power must be sufficiently above the noise floor and free from drift.

The dedicated Indexsar calibration software rotates the probe in 10 degree steps about its axis, and at each position, an Indexsar 'Fast' amplifier samples the probe channels 500 times per second for 0.4 s. The raw U_{op} data from each sample are packed into 10 bytes and transmitted back to the PC controller via an optical cable. U_{linx} , U_{liny} and U_{linz} are derived from the raw U_{op} values and written to an Excel template.

Once data have been collected from a full probe rotation, the Air Factors are adjusted using a special Excel Solver routine to equalise the output from each channel and hence minimise the axial isotropy. This automated approach to optimisation removes the effect of human bias.

Figure 2 represents the output from each diode sensor as a function of probe rotation angle.

4. Measurement of Spherical Isotropy

As mentioned earlier, in SARA-C a straight probe is always positioned so as to be end-on to the incoming signal source. The probe's axial isotropy response is therefore far more important than its spherical isotropy, which is included here for completeness only.

The setup for assessing the probe's spherical isotropy is shown in Figure 1.

A box phantom containing 900MHz head fluid is irradiated by a tuned dipole, mounted to the side of the phantom on the SARA2 robot's seventh axis. During calibration, the spherical response is generated by rotating the probe about its axis in 15 degree steps and changing the dipole polarisation in 10 degree steps.

The relative channel sensitivities are fixed by the earlier measurement of, and optimisation for, axial isotropy. The effect on spherical isotropy is shown in Figure 3.

5. Determination of Conversion ("Liquid") Factors at each frequency of interest

A lookup table of conversion factors for a probe allows a SAR value to be derived at the measured frequencies, and for either brain or body fluid-simulant.

The method by which the conversion factors are assessed is based on the comparison between measured and analytical rates of decay of SAR with height above a dielectric window. This way, not only can the conversion factors for that frequency/fluid combination be determined, but an allowance can also be made for the scale and range of boundary layer effects.

The theoretical relationship between the SAR at the cross-sectional centre of the lossy waveguide as a function of the longitudinal distance (z) from the



dielectric separator is given by Equation 4:

$$SAR(z) = \frac{4(P_f - P_b)}{\rho ab \delta} e^{-2z/\delta} \quad (4)$$

Here, the density ρ is conventionally assumed to be 1000 kg/m³, ab is the cross-sectional area of the waveguide, and P_f and P_b are the forward and reflected power inside the lossless section of the waveguide, respectively. The penetration depth δ (which is the reciprocal of the waveguide-mode attenuation coefficient) is a property of the lossy liquid and is given by Equation (5).

$$\delta = \left[\operatorname{Re} \left\{ \sqrt{(\pi/a)^2 + j\omega\mu_0 (\sigma + j\omega\epsilon_0 \epsilon_r)} \right\} \right]^{-1} \quad (5)$$

where σ is the conductivity of the tissue-simulant liquid in S/m, ϵ_r is its relative permittivity, and ω is the radial frequency (rad/s). Values for σ and ϵ_r are obtained prior to each waveguide test using an Indexsar DiLine measurement kit, which uses the TEM method as recommended in [2]. σ and ϵ_r are both temperature- and fluid-dependent, so are best measured using a sample of the tissue-simulant fluid immediately prior to the actual calibration.

Wherever possible, all DiLine and calibration measurements should be made in the open laboratory at $22 \pm 2.0^\circ\text{C}$; if this is not possible, the values of σ and ϵ_r should reflect the actual temperature. Values employed for calibration are listed in the tables below.

By ensuring the liquid height in the waveguide is at least three penetration depths, reflections at the upper surface of the liquid are negligible. The power absorbed in the liquid is therefore determined solely from the waveguide forward and reflected power.

Different waveguides are used for 700MHz, 835/900MHz, 1450MHz, 1800/1900MHz, 2100/2450/2600MHz and 5200/5800MHz measurements. Table A.1 of [1] can be used for designing calibration waveguides with a return loss greater than 20 dB at the most important frequencies used for personal wireless communications, and better than 15dB for frequencies greater than 5GHz. Values for the penetration depth for these specific fixtures and tissue-simulating mixtures are also listed in Table A.1.

According to [1], this calibration technique provides excellent accuracy, with standard uncertainty of less than 3.6% depending on the frequency and medium. The calibration itself is reduced to power measurements traceable to a standard calibration procedure. The practical limitation to the frequency band of 800 to 5800 MHz because of the waveguide size is not severe in the context of compliance testing.

During calibration, the probe is lowered carefully until it is just touching the cross-sectional centre of the dielectric window. 200 samples are then taken and written to an Excel template file before moving the probe vertically



upwards. This cycle is repeated 150 times. The vertical separation between readings is determined from practical considerations of the expected SAR decay rate, and range from 0.2mm steps at low frequency, through 0.1mm at 2450MHz, down to 0.05mm at 5GHz.

Once the data collection is complete, a Solver routine is run which optimises the measured-theoretical fit by varying the conversion factor, and the boundary correction size and range.

For calibrations at 450MHz, where waveguide calibrations become unfeasible, a full 3D SAR scan over a tuned dipole is performed, and the conversion factor adjusted to make the measured 1g and 10g volume-averaged SAR values agree with published targets.

CALIBRATION FACTORS MEASURED FOR PROBE S/N 0204

The probe was calibrated at 450, 835, 900, 1800, 2100, 2450 and 2600MHz in liquid samples representing brain and body liquid at these frequencies.

The calibration was for CW signals only, and the axis of the probe was parallel to the direction of propagation of the incident field i.e. end-on to the incident radiation. The axial isotropy of the probe was measured by rotating the probe about its axis in 10 degree steps through 360 degrees in this orientation.

The reference point for the calibration is in the centre of the probe's cross-section at a distance of 2.7 mm from the probe tip in the direction of the probe amplifier. A value of 2.7 mm should be used for the tip to sensor offset distance in the software. The distance of 2.7mm for assembled probes has been confirmed by taking X-ray images of the probe tips (see Figure 8).

It is important that the diode compression point and air factors used in the software are the same as those quoted in the results tables, as these are used to convert the diode output voltages to a SAR value.

CALIBRATION EQUIPMENT

The table on page 20 indicates the calibration status of all test equipment used during probe calibration.



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MEASUREMENT UNCERTAINTIES

A complete measurement uncertainty analysis for the SARA-C measurement system has been published in Reference [6]. Table 17 from that document is re-created below, and lists the uncertainty factors associated just with the calibration of probes.

Source of uncertainty	Uncertainty value \pm %	Probability distribution	Divisor	c_i	Standard uncertainty $u_i \pm$ %	ν_i or ν_{eff}
Forward power	3.92	N	1.00	1	3.92	∞
Reflected power	4.09	N	1.00	1	4.09	∞
Liquid conductivity	1.308	N	1.00	1	1.31	∞
Liquid permittivity	1.271	N	1.00	1	1.27	∞
Field homogeneity	3.0	R	1.73	1	1.73	∞
Probe positioning	0.22	R	1.73	1	0.13	∞
Field probe linearity	0.2	R	1.73	1	0.12	∞
Combined standard uncertainty		RSS			6.20	

At the 95% confidence level, therefore, the expanded uncertainty is $\pm 12.4\%$



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SUMMARY OF CAL FACTORS FOR PROBE IXP-020 S/N 0204

Relative Channel Sensitivities (to optimise Axial Isotropy)				
	X	Y	Z	
Air Factors	91.78	66.90	81.32	(V/m) ² /mV
DCPs	100	100	100	mV

Measured Isotropy	(+/-) dB
Axial Isotropy	0.02
Spherical Isotropy	0.66

Additional Information	
Sensor offset (mm)	2.7
Elbow – Tip dimension (mm)	0.0



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SAR Conversion Factors/ Boundary Corrections							
Frequency* (MHz)	Head Fluid			Body Fluid			Notes
	SAR Conv Factor	Boundary Correction f(0)	Boundary Correction d(mm)	SAR Conv Factor	Boundary Correction f(0)	Boundary Correction d(mm)	
460	0.317	0	1	0.317	0	1	3
700	-	-	-	-	-	-	-
835	0.310	1.69	1.08	0.327	0.59	1.91	1,2
900	0.313	0.80	1.52	0.327	1.17	1.31	1,2
1450	-	-	-	-	-	-	-
1800	0.357	0.77	1.68	0.381	0.64	2.07	1,2
1900	0.366	0.71	1.83	0.388	0.64	2.12	1,2
2100	0.397	0.70	1.96	0.413	0.78	1.86	1,2
2450	0.397	1.09	1.44	0.440	1.09	1.51	1,2
2600	0.394	1.26	1.35	0.449	1.17	1.46	1,2
Notes							
1)	Calibrations done at 22°C +/-2°C						
2)	Waveguide calibration						
3)	By validation						

The valid frequency of SARA-C probe calibrations are $\pm 100\text{MHz}$ ($f < 300\text{MHz}$) and $\pm 200\text{MHz}$ ($f > 300\text{MHz}$)



PROBE SPECIFICATIONS

Indexsar probe 0204, along with its calibration, is compared with BSEN 62209-1 and IEEE standards recommendations (Refs [1] and [2]) in the Tables below. A listing of relevant specifications is contained in the tables below:

Dimensions	S/N 0204	BSEN [1]	IEEE [2]
Overall length (mm)	350		
Tip length (mm)	10		
Body diameter (mm)	12		
Tip diameter (mm)	5.2	8	8
Distance from probe tip to dipole centers (mm)	2.7		

Typical Dynamic range	S/N 0204	BSEN [1]	IEEE [2]
Minimum (W/kg)	0.01	<0.02	0.01
Maximum (W/kg) N.B. only measured to > 100 W/kg on representative probes	>100	>100	100

Isotropy (measured at 900MHz)	S/N 0204	BSEN [1]	IEEE [2]
Axial rotation with probe normal to source (+/- dB)	0.02	0.5	0.25
Spherical isotropy covering all orientations to source (+/- dB)	0.66	N/A	N/A

NB Isotropy is frequency independent

Construction	Each probe contains three orthogonal dipole sensors arranged on a triangular prism core, protected against static charges by built-in shielding, and covered at the tip by PEEK cylindrical enclosure material. No adhesives are used in the immersed section. Outer case materials are PEEK and heat-shrink sleeving.
Chemical resistance	Tested to be resistant to TWEEN20 and sugar/salt-based simulant liquids but probes should be removed, cleaned and dried when not in use. NOT recommended for use with glycol or soluble oil-based liquids.

**REFERENCES**

References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.

For a specific reference, subsequent revisions do not apply.

For a non-specific reference, the latest version applies.

- [1] IEC 62209-1.
Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices — Human models, instrumentation, and procedures — Part 1: Procedure to determine the specific absorption rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)
- [2] IEEE 1528
Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques
- [3] IEC 62209-2
Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices – Human models, Instrumentation, and procedures – Part 2: Procedure to determine the specific absorption rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)
- [4] FCC OET65
Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields
- [5] Indexsar Report IXS-0300, October 2007.
Measurement uncertainties for the SARA2 system assessed against the recommendations of BS EN 62209-1:2006
- [6] SARA-C SAR Testing System: Measurement Uncertainty, v1.0.3. October 2011.

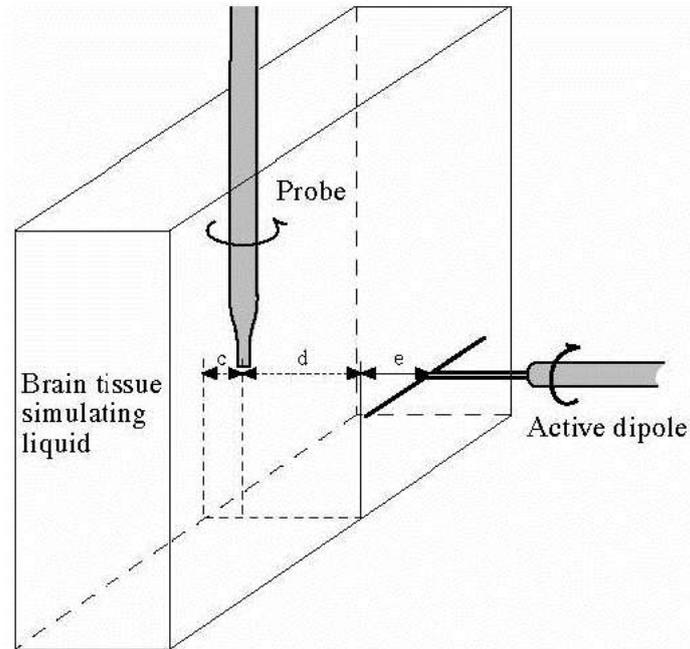


Figure 1. Spherical isotropy jig showing probe, dipole and box filled with simulated brain liquid (see Ref [2], Section A.5.2.1)

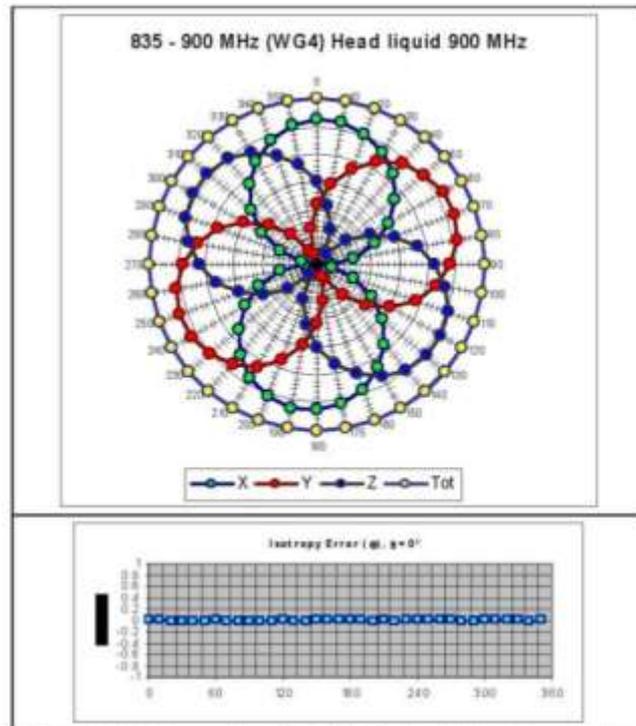


Figure 2. The axial isotropy of probe S/N 0204 obtained by rotating the probe in a liquid-filled waveguide at 900 MHz. (NB Axial Isotropy is frequency independent)

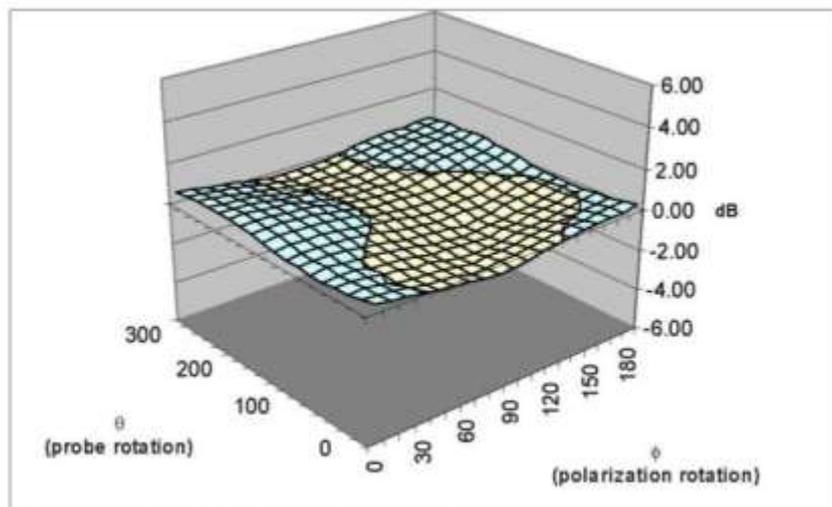


Figure 3 Spherical isotropy diagram after optimisation of relative channel sensitivities for axial isotropy

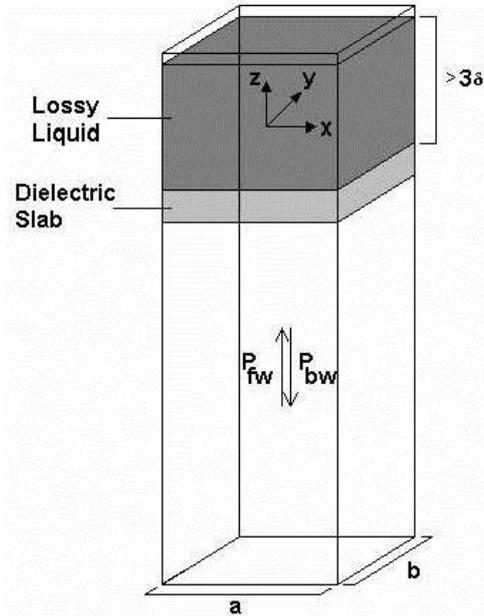


Figure 4. Geometry used for waveguide calibration (after Ref [2]. Section A.3.2.2)

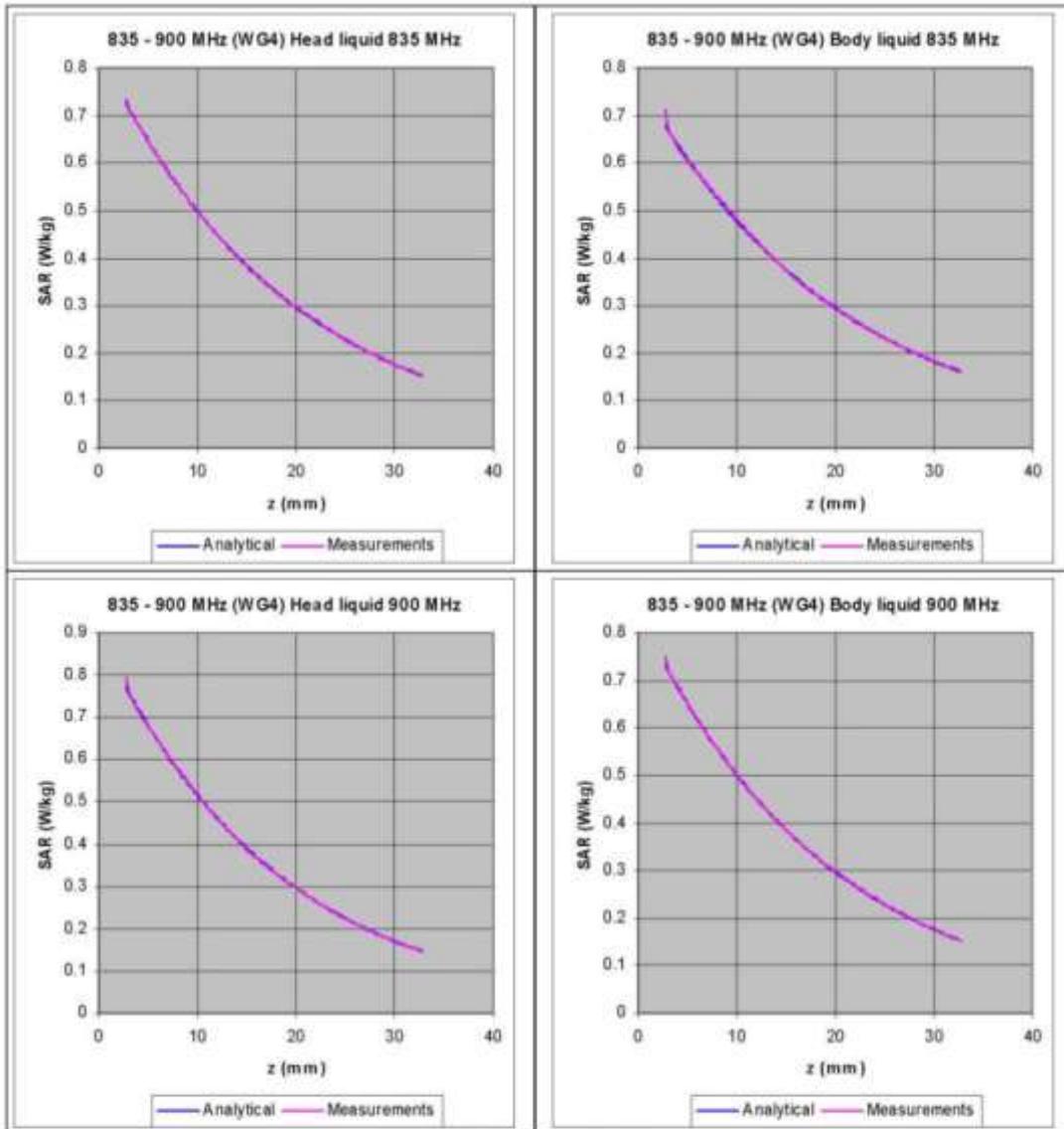
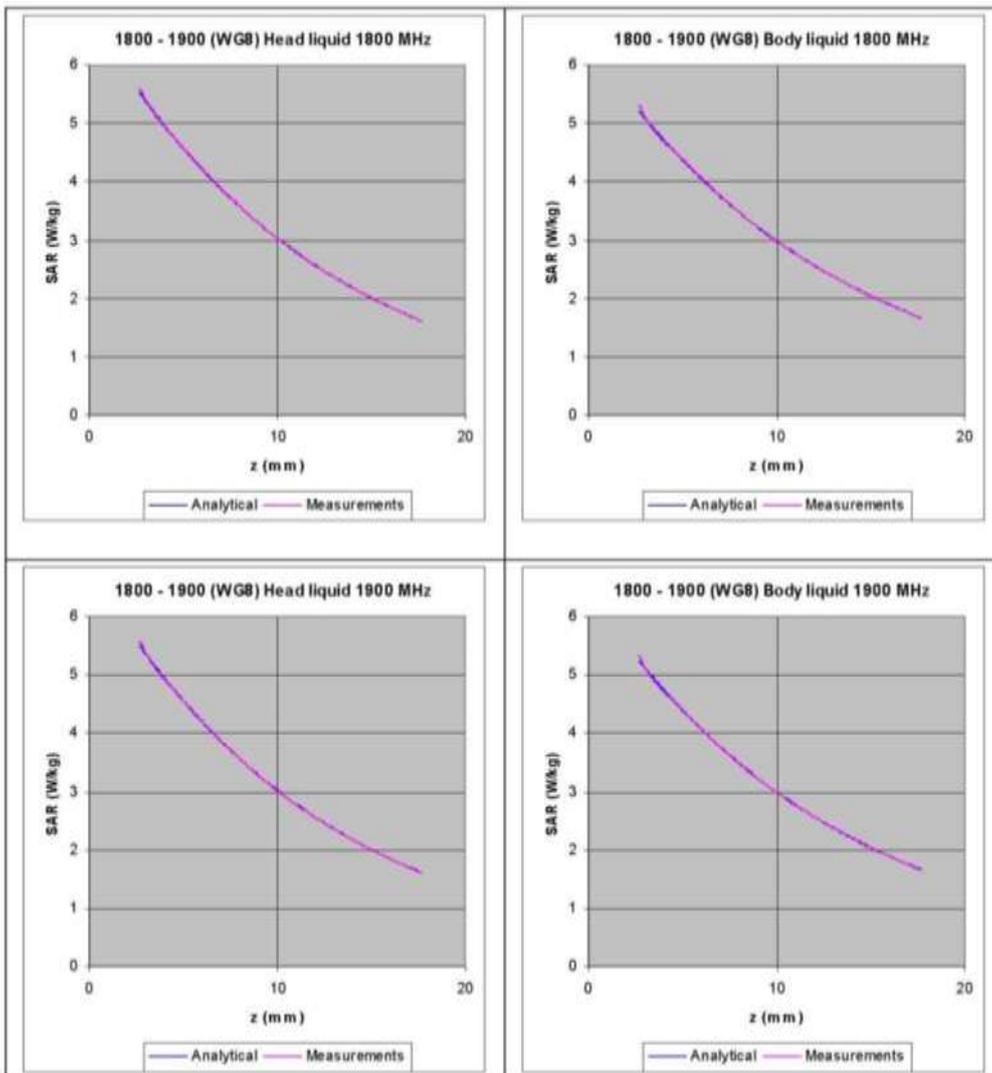
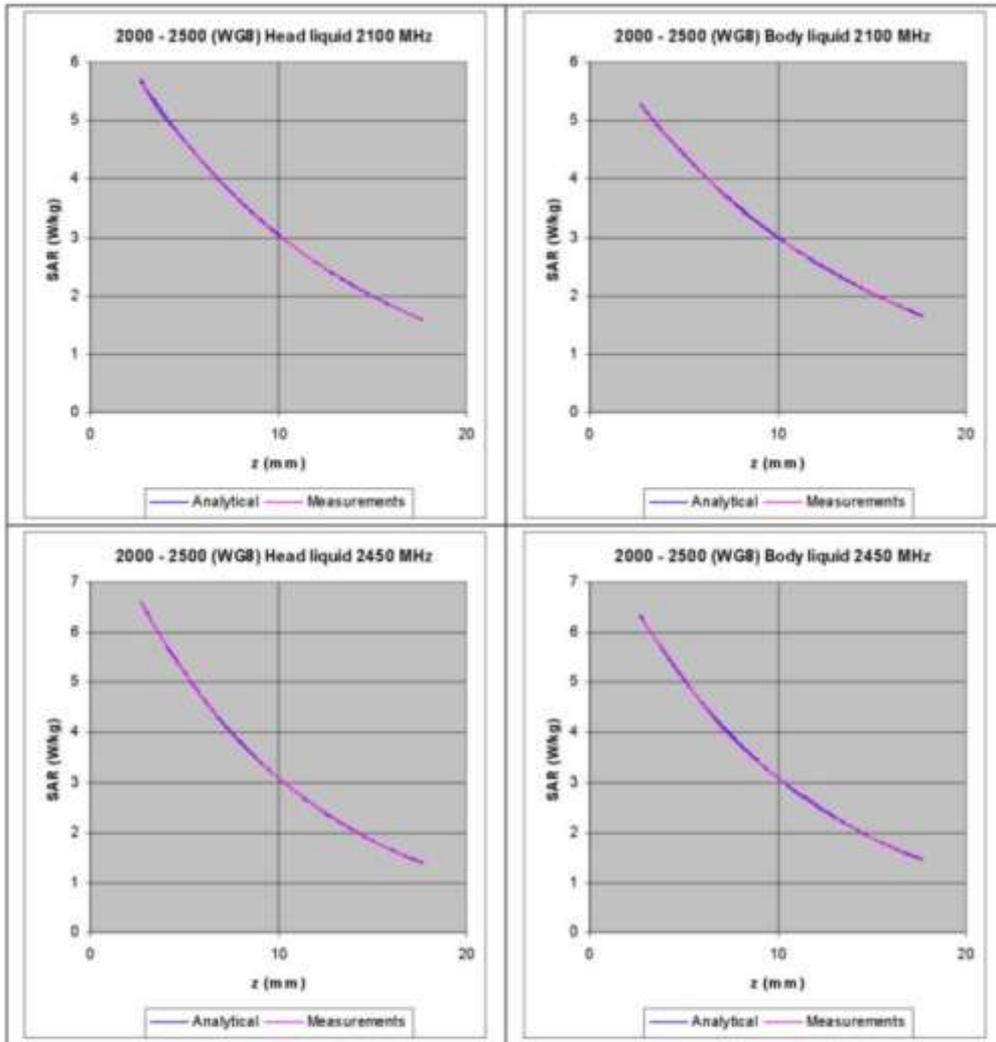


Figure 5. The measured SAR decay function along the centreline of the WG4 waveguide with conversion factors adjusted to fit to the theoretical function for the particular dimension, frequency, power and liquid properties employed.





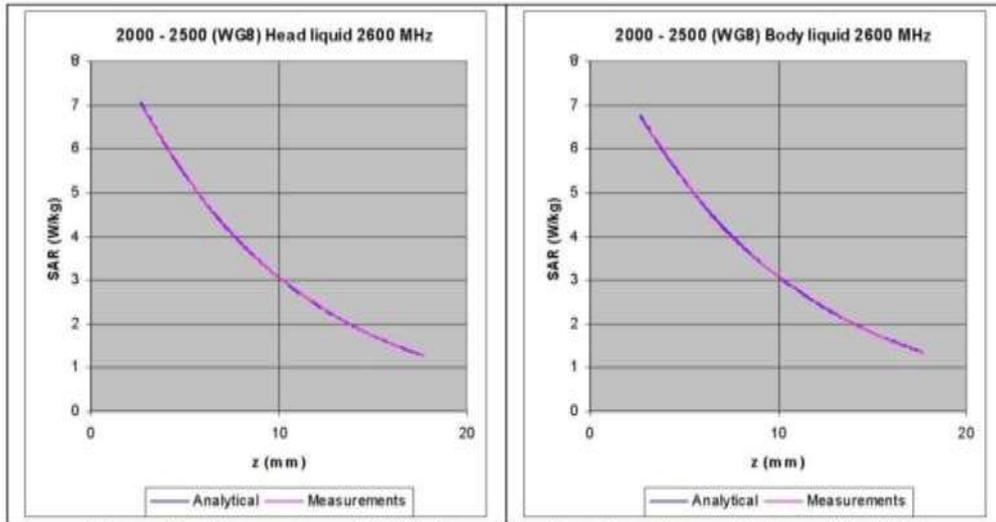


Figure 6 . The measured SAR decay function along the centreline of the R22 waveguide with conversion factors adjusted to fit to the theoretical function for the particular dimension, frequency, power and liquid properties employed.

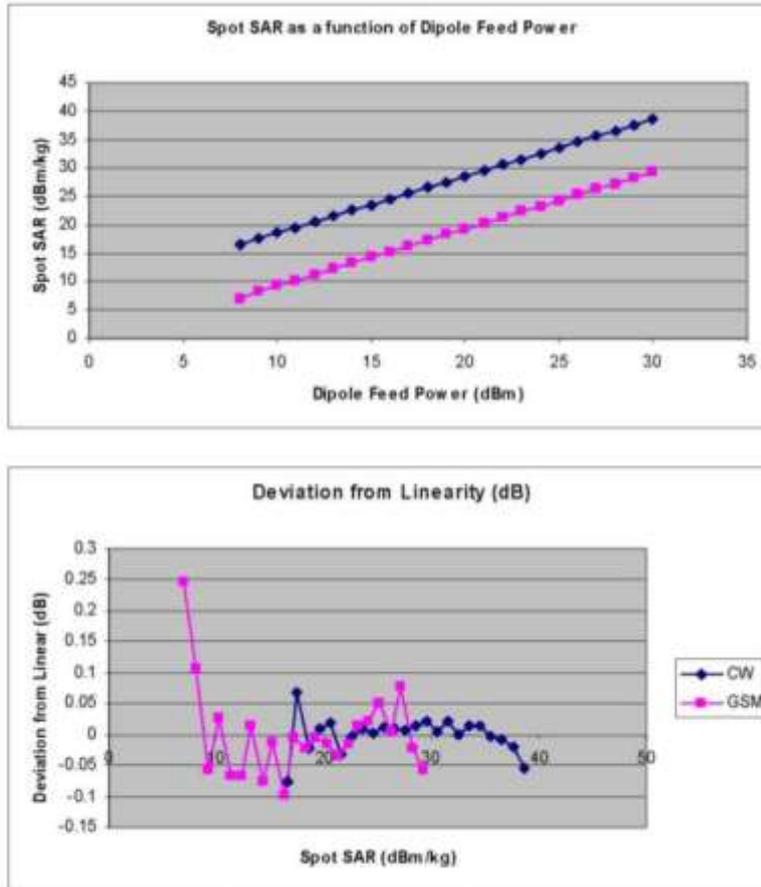


Figure 7 : The typical linearity response of IXP-050 probes to both CW (blue) and GSM (pink) modulation in close proximity to a source dipole. The top diagram shows the SAR reading as a function of dipole feed power, with GSM modulation being approx a factor of 8 (ie 9dB) lower than CW. The lower diagram shows the departure from linearity of the same two datasets.

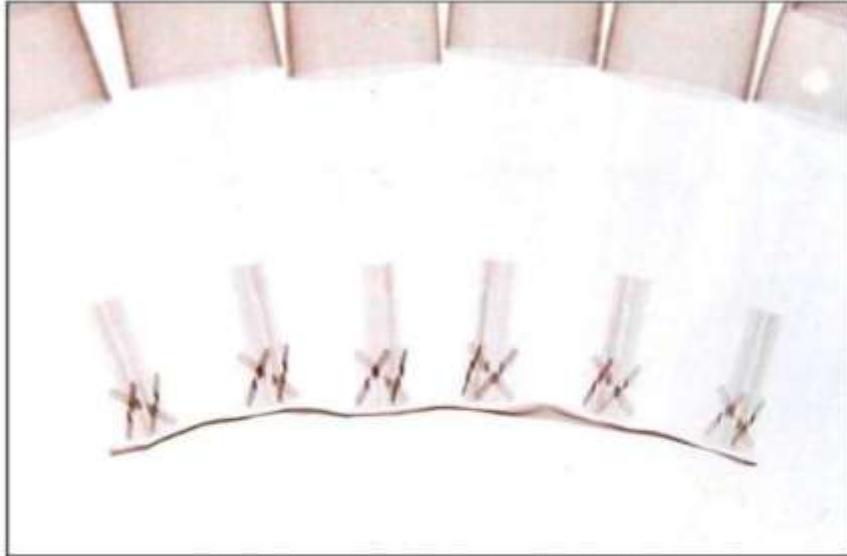


Figure 8 : X-ray positive image of 5mm probes



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Table indicating the dielectric parameters of the liquids used for calibrations at each frequency

Frequency (MHz)	Type	Relative Permittivity	Conductivity (S/m)	Relative Permittivity	Conductivity (S/m)	Relative Permittivity	Conductivity	Relative Permittivity	Conductivity
450	Head	44.33	0.835	43.5	0.87	1.9	-4.0	Pass	Pass
836		42.25	0.900	41.5	0.90	1.8	0.0	Pass	Pass
900		41.45	0.962	41.5	0.97	-0.1	-0.8	Pass	Pass
1800		39.52	1.395	40.0	1.40	-0.2	-0.4	Pass	Pass
1900		39.57	1.400	40.0	1.40	-0.8	0.0	Pass	Pass
2100		40.96	1.500	39.8	1.49	2.9	0.7	Pass	Pass
2450		39.81	1.821	39.2	1.80	1.6	1.2	Pass	Pass
2600		39.30	1.971	39.0	1.96	0.8	0.6	Pass	Pass
450	Body	57.53	0.902	56.7	0.94	1.5	-3.7	Pass	Pass
836		55.14	0.958	55.2	0.97	-0.1	-1.2	Pass	Pass
900		54.53	1.023	55	1.05	-0.9	-2.6	Pass	Pass
1800		53.07	1.521	53.3	1.52	-0.4	0.1	Pass	Pass
1900		52.85	1.533	53.3	1.52	-0.8	0.9	Pass	Pass
2100		52.92	1.568	53.2	1.52	1.4	-3.2	Pass	Pass
2450		52.90	1.967	52.7	1.95	0.4	0.4	Pass	Pass
2600		52.47	2.132	52.5	2.16	-0.1	-1.3	Pass	Pass



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IMMERSIBLE SAR PROBE

CALIBRATION REPORT

Part Number: IXP-020

S/N L0006

April 2013



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Calibration Certificate 1304/L0006
Date of Issue: 24 April 2013
Immersible SAR Probe

Table with calibration details: Type: IXP-020, Manufacturer: IndexSAR, UK, Serial Number: L0006, Place of Calibration: IndexSAR, UK, Date of Receipt of Probe: N/A, Calibration Dates: 15 March - 23 April 2013, Customer: TUV Sud

IndexSAR Ltd hereby declares that the IXP-050 Probe named above has been calibrated for conformity to the current versions of IEEE 1528, IEC 62209-1, IEC 62209-2, and FCC OET65 standards using the methods described in this calibration document. Where applicable, the standards used in the calibration process are traceable to the UK's National Physical Laboratory.

Calibrated by: A. Brinklow Technical Manager

Approved by: [Signature] Director

Please keep this certificate with the calibration document. When the probe is sent for a calibration check, please include the calibration document.



INTRODUCTION

L-shaped probes are designed solely for use on the SARA-C SAR-measuring system. They are not designed to work on SARA2.

This Report presents measured calibration data for a particular Indexsar SAR probe (S/N L0006) only and describes the procedures used for characterisation and calibration.

Indexsar probes are characterised using procedures that, where applicable, follow the recommendations of IEC 62209-1 [Ref 1], IEEE 1528 [Ref 2], IEC 62209-2 [Ref 3] and FCC OET65 [Ref 4] standards. The procedures incorporate techniques for probe linearisation, isotropy assessment and determination of liquid factors (conversion factors). Calibrations are determined by comparing probe readings with analytical computations in canonical test geometries (waveguides) using normalised power inputs.

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- 3) Since isotropy and channel sensitivity factors are frequency independent, these channel sensitivity factors can be applied to model the exponential decay of SAR in a waveguide fluid cell at each frequency of interest, and hence derive the liquid conversion factors at that frequency.

2. Probe output

The probe channel output signals are linearised in the manner set out in Refs [1] - [4]. The following equation is utilized for each channel:

$$U_{lin} = U_{op} + U_{op}^2 / DCP \quad (1)$$

where U_{lin} is the linearised signal, U_{op} is the raw output signal in mV and DCP is the diode compression potential, also in mV.

DCP is determined from fitting equation (1) to measurements of U_{lin} versus source feed power over the full dynamic range of the probe. The DCP is a