13 SAR TEST RESULTS

Test Condition:

1. SAR Measurement
   The distance between the EUT and the antenna of the emulator is more than 50 cm and the output power radiated from the emulator antenna is at least 30 dB less than the output power of EUT.

2	Environmental Conditions	Temperature	23°C
		Relative Humidity	57%
		Atmospheric Pressure	1019mbar

3 Test Date : Nov 27,2015-Nov 30,2015
Tested By : Damon Wang

Test Procedures:

1. Establish communication link between EUT and base station emulation by air link.
2. Consider the SAR test reduction per FCC KDB guide line. For GSM/GPRS/EGPRS, set EUT into highest output power channel with test mode which has the maximum source-based time-averaged burst power listed in power table. If the source-based time-average output power for each data mode of EGPRS is lower than that in normal GPRS mode, then testing under EGPRS mode is not necessary.
3. Place the EUT in the selected test position. (Cheek, tilt or flat)
4. Perform SAR testing at highest output power channel under the selected test mode. If the measured 1-g SAR is ≤ 0.8 W/kg, then testing for the other channel will not be performed.
5. When SAR is<0.8W/kg, no repeated SAR measurement is required

SAR measurement system will proceed the following basic steps:

1. Initial power reference measurement
2. Area Scan
3. Zoom Scan
4. Power drift measurement

SAR Summary Test Result:

Table 5: SAR Values of GSM 850MHz Band

Test Positions		Channel		Test Mode	Power(dBm)		SAR 1g(W/Kg), Limit(1.6W/kg)		Plot No.
		CH.	MHz		Maximum Turn-up Power(dBm)	Measured output power(dBm)	Measured SAR 1g(W/kg)	Scaled SAR 1g(W/kg)	
Right Head	Cheek	190	836.6	Voice call	33	32.70	0.109	0.12	--
	Tilt	190	836.6	Voice call	33	32.70	0.048	0.05	--
Left Head	Cheek	190	836.6	Voice call	33	32.70	**0.127**	**0.14**	**1**
	Tilt	190	836.6	Voice call	33	32.70	0.062	0.07	--
Body-worn (10mm Separation)	Front side	190	836.6	Voice call	33	32.70	0.151	0.16	--
	Back side	190	836.6	Voice call	33	32.70	**0.227**	**0.24**	**2**
Hotspot (10mm Separation)	Front side	190	836.6	GPRS Slot 2	32	31.32	0.183	0.21	--
	Back side	190	836.6	GPRS Slot 2	32	31.32	**0.270**	**0.32**	**3**
	Right EDGE	190	836.6	GPRS Slot 2	32	31.32	0.079	0.09	--
	Left EDGE	190	836.6	GPRS Slot 2	32	31.32	0.134	0.16	--
	Bottom EDGE	190	836.6	GPRS Slot 2	32	31.32	0.036	0.04	--

Table 6: SAR Values of WCDMA BAND Ⅴ

Test Positions		Channel		Test Mode	Power(dBm)		SAR 1g(W/Kg), Limit(1.6W/kg)		Plot No.
		CH.	MHz		Maximum Turn-up Power(dBm)	Measured output power(dBm)	Measured SAR 1g(W/kg)	Scaled SAR 1g(W/kg)	
Right Head	Cheek	4183	836.6	RMC 12.2kbps	23	22.46	0.106	0.12	--
	Tilt	4183	836.6	RMC 12.2kbps	23	22.46	0.052	0.06	--
Left Head	Cheek	4183	836.6	RMC 12.2kbps	23	22.46	**0.116**	**0.13**	**4**
	Tilt	4183	836.6	RMC 12.2kbps	23	22.46	0.063	0.08	--
Body-worn (10mm Separation)	Front side	4183	836.6	RMC 12.2kbps	23	22.46	0.122	0.14	--
	Back side	4183	836.6	RMC 12.2kbps	23	22.46	**0.222**	**0.25**	**5**
Hotspot (10mm Separation)	Front side	4183	836.6	RMC 12.2kbps	23	22.46	0.122	0.14	--
	Back side	4183	836.6	RMC 12.2kbps	23	22.46	**0.222**	**0.25**	**5**
	Right EDGE	4183	836.6	RMC 12.2kbps	23	22.46	0.073	0.08	--
	Left EDGE	4183	836.6	RMC 12.2kbps	23	22.46	0.124	0.14	--
	Bottom EDGE	4183	836.6	RMC 12.2kbps	23	22.46	0.032	0.04	--

Table 7: SAR Values of GSM 1900MHz Band

Test Positions		Channel		Test Mode	Power(dBm)		SAR 1g(W/Kg), Limit(1.6W/kg)		Plot No.
		CH.	MHz		Maximum Turn-up Power(dBm)	Measured output power(dBm)	Measured SAR 1g(W/kg)	Scaled SAR 1g(W/kg)	
Right Head	Cheek	661	1880	Voice call	30	29.43	**0.080**	**0.09**	**6**
	Tilt	661	1880	Voice call	30	29.43	0.026	0.03	--
Left Head	Cheek	661	1880	Voice call	30	29.43	0.080	0.09	--
	Tilt	661	1880	Voice call	30	29.43	0.027	0.03	--
Body-worn (10mm Separation)	Front side	661	1880	Voice call	30	29.43	0.138	0.16	--
	Back side	661	1880	Voice call	30	29.43	**0.194**	**0.22**	**7**
Hotspot (10mm Separation)	Front side	661	1880	GPRS Slot 3	26.5	25.99	0.191	0.21	--
	Back side	661	1880	GPRS Slot 3	26.5	25.99	**0.224**	**0.25**	**8**
	Right EDGE	661	1880	GPRS Slot 3	26.5	25.99	0.114	0.13	--
	Left EDGE	661	1880	GPRS Slot 3	26.5	25.99	0.079	0.09	--
	Bottom EDGE	661	1880	GPRS Slot 3	26.5	25.99	0.147	0.17	--

Table 8: SAR Values of WCDMA BAND Ⅱ

Test Positions		Channel		Test Mode	Power(dBm)		SAR 1g(W/Kg), Limit(1.6W/kg)		Plot No.
		CH.	MHz		Maximum Turn-up Power(dBm)	Measured output power(dBm)	Measured SAR 1g(W/kg)	Scaled SAR 1g(W/kg)	
Right Head	Cheek	9400	1880	RMC 12.2kbps	23	22.27	**0.203**	**0.24**	**9**
	Tilt	9400	1880	RMC 12.2kbps	23	22.27	0.058	0.07	--
Left Head	Cheek	9400	1880	RMC 12.2kbps	23	22.27	0.162	0.19	--
	Tilt	9400	1880	RMC 12.2kbps	23	22.27	0.053	0.06	--
Body-worn (10mm Separation)	Front side	9400	1880	RMC 12.2kbps	23	22.27	0.297	0.35	--
	Back side	9400	1880	RMC 12.2kbps	23	22.27	**0.378**	**0.45**	**10**
Hotspot (10mm Separation)	Front side	9400	1880	RMC 12.2kbps	23	22.27	0.297	0.35	--
	Back side	9400	1880	RMC 12.2kbps	23	22.27	**0.378**	**0.45**	**10**
	Right EDGE	9400	1880	RMC 12.2kbps	23	22.27	0.192	0.23	--
	Left EDGE	9400	1880	RMC 12.2kbps	23	22.27	0.141	0.17	--
	Bottom EDGE	9400	1880	RMC 12.2kbps	23	22.27	0.270	0.32	--

Table 9: SAR Values of WCDMA BANDⅣ

Test Positions		Channel		Test Mode	Power(dBm)		SAR 1g(W/Kg), Limit(1.6W/kg)		Plot No.
		CH.	MHz		Maximum Turn-up Power(dBm)	Measured output power(dBm)	Measured SAR 1g(W/kg)	Scaled SAR 1g(W/kg)	
Right Head	Cheek	1413	1732.6	RMC 12.2kbps	23	22.14	**0.061**	**0.07**	**11**
	Tilt	1413	1732.6	RMC 12.2kbps	23	22.14	0.018	0.02	--
Right Head	Cheek	1413	1732.6	RMC 12.2kbps	23	22.14	0.049	0.06	--
	Tilt	1413	1732.6	RMC 12.2kbps	23	22.14	0.028	0.03	--
Body-worn (10mm Separation)	Front side	1413	1732.6	RMC 12.2kbps	23	22.14	0.130	0.16	--
	Back side	1413	1732.6	RMC 12.2kbps	23	22.14	**0.234**	**0.29**	**12**
Hotspot (10mm Separation)	Front side	1413	1732.6	RMC 12.2kbps	23	22.14	0.130	0.16	--
	Back side	1413	1732.6	RMC 12.2kbps	23	22.14	**0.234**	**0.29**	**12**
	Right EDGE	1413	1732.6	RMC 12.2kbps	23	22.14	0.050	0.06	--
	Left EDGE	1413	1732.6	RMC 12.2kbps	23	22.14	0.022	0.03	--
	Bottom EDGE	1413	1732.6	RMC 12.2kbps	23	22.14	0.102	0.12	--

Note:1. KDB941225 D01-Body SAR is not required for HSDPA when the average output of each RF channel with HSDPA active is less than 0.25dB higher than measured without HSDPA using 12.2kbps RMC or the maximum SAR for 12.2kbps RMC<75% of the SAR limit.

2. KDB941225 D01-Body SAR is not required for handset with HSPA capabilities when the maximum average output of each RF channel with HSUPA/HSDPA active is less than 0.25dB higher than that measure without HSUPA/HSDPA using 12.2kbps RMC AND THE maximum SAR for 12.2kbps RMC is<75% of the SAR limit

Measurement variability consideration

According to KDB 865664 D01v01r04 section 2.8.1, repeated measurements are required following the procedures as below:

1. Repeated measurement is not required when the original highest measured SAR is < 0.80W/kg; steps 2) through 4) do not apply.
2. When the original highest measured SAR is ≥ 0.80 W/kg, repeat that measurement once.
3. Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is > 1.20 or when the original or repeated measurement is ≥ 1.45 W/kg (~ 10% from the 1-g SAR limit).
4. Perform a third repeated measurement only if the original, first or second repeated measurement is ≥ 1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.

No repeated SAR.

Simultaneous Transmission SAR Analysis.

List of Mode for Simultaneous Multi-band Transmission:

No.	Configurations	Head SAR	Body-worn SAR	Hotspot SAR
1	GSM(Voice) + WLAN(Data)	Yes	Yes	-
2	GPRS (Data) + WLAN(Data)	-	-	Yes
3	WCDMA (Voice)+ WLAN(Data)	Yes	Yes	-
4	HSDPA(Data) + WLAN(Data)	-	-	Yes
5	HSUPA(Data) + WLAN(Data)	-	-	Yes
6	GSM(Voice) + Bluetooth(Data)	Yes	Yes	-
7	GPRS (Data) + Bluetooth(Data)	-	-	Yes
8	WCDMA(Voice) + Bluetooth(Data)	Yes	Yes	-
9	HSDPA(Data)+ Bluetooth(Data)			Yes
10	HSUPA(Data) + Bluetooth(Data)			Yes

Remark:

1. GSM and WCDMA share the same antenna, and cannot transmit simultaneously.
2. WLAN and Bluetooth share the same antenna, and cannot transmit simultaneously.
3. According to the KDB 447498 D01 v06, when standalone SAR test exclusion applies to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to following to determine simultaneous transmission SAR test exclusion:
(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] • [√f(GHz)/x] W/kg for test separation distances ≤50 mm;
where x = 7.5 for 1-g SAR, and x = 18.75 for 10-g SAR.
For simultaneous transmission analysis, Bluetooth SAR is estimated per KDB 447498 D01 v06 as below:

WIFI:

Tune-Up Power (dBm)	Max. Power (mW)	Distance (mm	Frequency (GHz)	X	SAR(1g) 5mm	SAR(1g) 10mm
9.7	9.33	5/10	2.412	7.5	0.39	0.19

Bluetooth:

Tune-Up Power (dBm)	Max. Power (mW)	Distance (mm	Frequency (GHz)	X	SAR(1g) 5mm	SAR(1g) 10mm
9.0	7.94	5/10	2.480	7.5	0.33	0.17

4. The maximum SAR summation is calculated based onthe same configuration and test position

Head SAR

WWAN and WLAN

	WWAN（maximum）		WLAN(5mm)	Summed SAR (W/kg)
Position	Band	Scaled SAR (W/kg)	Scaled SAR (W/kg)	
Left Cheek	GSM850	0.14	0.39	0.53
Right Cheek	GSM1900	0.09	0.39	0.48
Left Cheek	WCDMA Band V	0.13	0.39	0.52
Right Cheek	WCDMA Band II	**0.24**	0.39	**0.63**
Right Cheek	WCDMA Band Ⅳ	0.07	0.39	0.46

WWAN and BT

	WWAN（maximum）		BT(5mm)	Summed SAR (W/kg)
Position	Band	Scaled SAR (W/kg)	Scaled SAR (W/kg)	
Left Cheek	GSM850	0.14	0.33	0.47
Right Cheek	GSM1900	0.09	0.33	0.42
Left Cheek	WCDMA Band V	0.13	0.33	0.46
Right Cheek	WCDMA Band II	**0.24**	0.33	**0.57**
Right Cheek	WCDMA Band Ⅳ	0.07	0.33	0.40

Remark: WIFI/BT the 1g SAR value is not being captured by the measurement system, the 1g-SAR value is conservatively used for simultaneous transmission analysis.

Body-worn SAR

WWAN and WLAN

	WWAN（maximum）		WLAN(10mm)	Summed SAR (W/kg)
Position	Band	Scaled SAR (W/kg)	Scaled SAR (W/kg)	
Back	GSM850	0.24	0.19	0.43
Back	GSM1900	0.22	0.19	0.41
Back	WCDMA Band V	0.25	0.19	0.44
Back	WCDMA Band II	**0.45**	0.19	**0.64**
Back	WCDMA Band Ⅳ	0.29	0.19	0.48

WWAN and BT

	WWAN（maximum）		BT(10mm)	Summed SAR (W/kg)
Position	Band	Scaled SAR (W/kg)	Scaled SAR (W/kg)	
Back	GSM850	0.24	0.17	0.41
Back	GSM1900	0.22	0.17	0.39
Back	WCDMA Band V	0.25	0.17	0.42
Back	WCDMA Band II	**0.45**	0.17	0.62
Back	WCDMA Band Ⅳ	0.29	0.17	0.46

Remark: WIFI/BT the 1g SAR value is not being captured by the measurement system, the 1g-SAR value is conservatively used for simultaneous transmission analysis.

Hotspot SAR

WWAN and WLAN

	WWAN（maximum）		WLAN(10mm)	Summed SAR (W/kg)
Position	Band	Scaled SAR (W/kg)	Scaled SAR (W/kg)	
Back	GSM850	0.32	0.19	0.51
Back	GSM1900	0.25	0.19	0.44
Back	WCDMA Band V	0.25	0.19	0.44
Back	WCDMA Band II	**0.45**	0.19	**0.64**
Back	WCDMA Band Ⅳ	0.29	0.19	0.48

WWAN and BT

	WWAN（maximum）		BT(10mm)	Summed SAR (W/kg)
Position	Band	Scaled SAR (W/kg)	Scaled SAR (W/kg)	
Back	GSM850	0.32	0.17	0.49
Back	GSM1900	0.25	0.17	0.42
Back	WCDMA Band V	0.25	0.17	0.42
Back	WCDMA Band II	**0.45**	0.17	**0.62**
Back	WCDMA Band Ⅳ	0.29	0.17	0.46

Remark: WIFI/BT the 1g SAR value is not being captured by the measurement system, the 1g-SAR value is conservatively used for simultaneous transmission analysis.

14 SAR MEASUREMENT REFERENCES

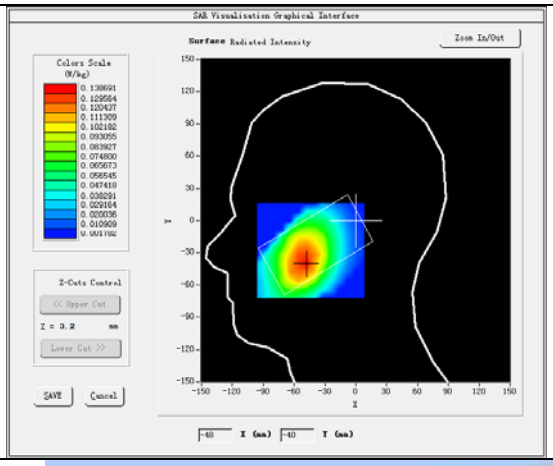
References

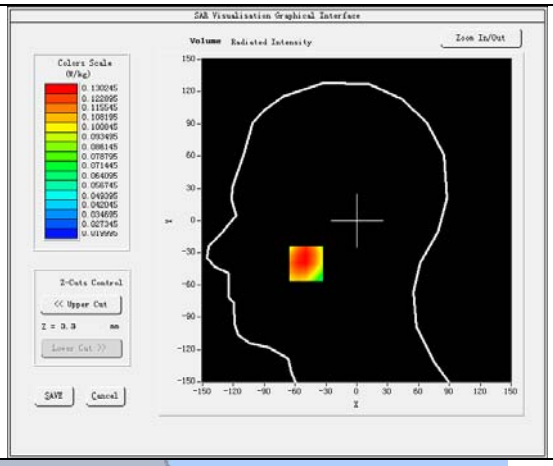
1. **FCC 47 CFR Part 2 "Frequency Allocations and Radio Treaty Matters; General Rules and Regulations"**
2. **IEEE Std. C95.1-2005, "IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3kHz to 300GHz", 2005**
3. **IEEE Std. 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices:Measurement Techniques", June 2013**
4. **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 30MHz to 6GHz)", April 2010**
5. **FCC KDB 447498 D01 v06, "Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies", Oct 23th, 2015**
6. **FCC KDB 941225 D01 v03r01, "3G SAR Measurement Procedures", Oct 23th, 2015**
7. **FCC KDB 941225 D06 v02r01, "SAR Evaluation Procedures for Portable Devices with Wireless Router Capabilities", Oct 23th, 2015**
8. **FCC KDB865664 D01 v01r04, "SAR Measurement Requirements 100MHz to 6GHz", Aug 7th, 2015**
9. **FCC KDB865664 D02 v01r02, "RF Exposure Compliance Reporting and Documentation Considerations ", Oct 23th", 2015**
10. **FCC KDB648474 D04 v01r03, "SAR Evaluation Considerations for Wireless Handsets", Oct 23th", 2015**
11. **FCC KDB 248227 D01 v01r02, SAR Guidance for IEEE 802.11 (Wi-Fi) Transmitters, Oct 23th, 2015.**

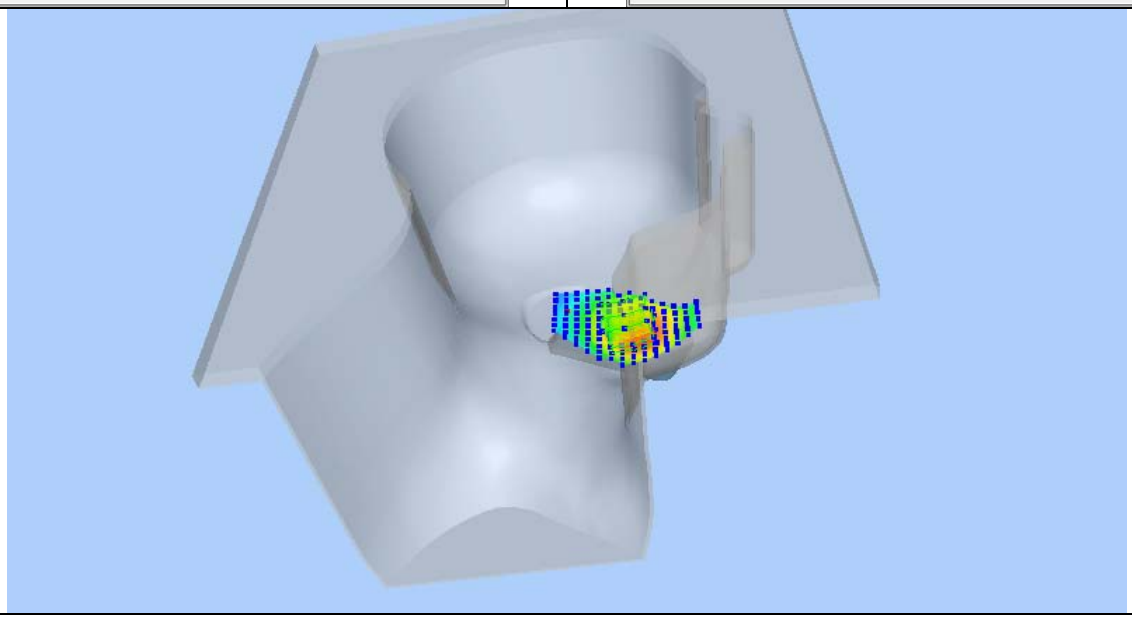
Maximum SAR measurement Plots

Plot 1: GSM850MHz, Middle channel (Left Head , Cheek)
Product Description:mobile phone
Model:s5005
Test Date:Nov 27,2015

Medium(liquid type)	HSL_850
Frequency (MHz)	836.60000
Relative permittivity (real part)	41.39
Conductivity (S/m)	0.91
Signal	GSM (Duty cycle: 1:8)
E-Field Probe	SN 07/15 EP249
Conversion Factor	5.26
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	1.63
SAR 10g (W/Kg)	0.098080
SAR 1g (W/Kg)	0.127143
SURFACE SAR	**VOLUME SAR**

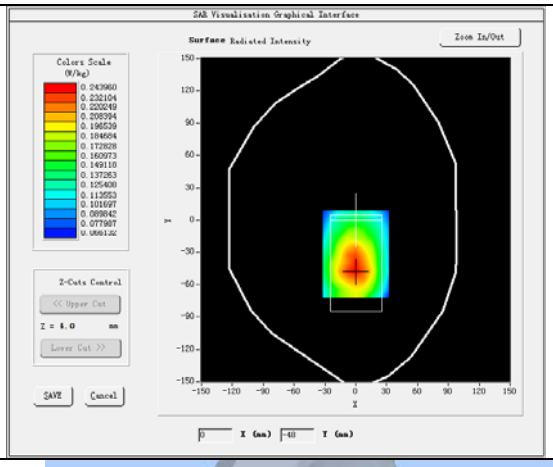


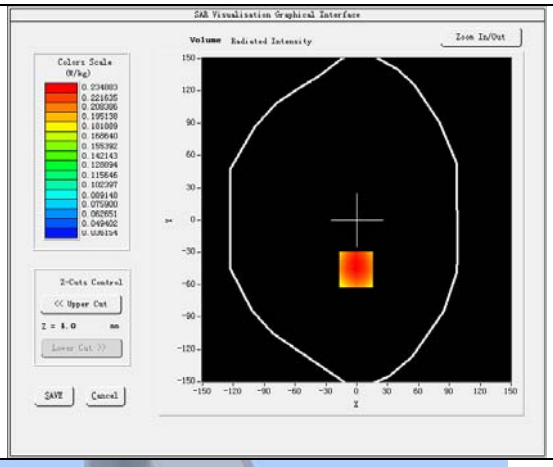


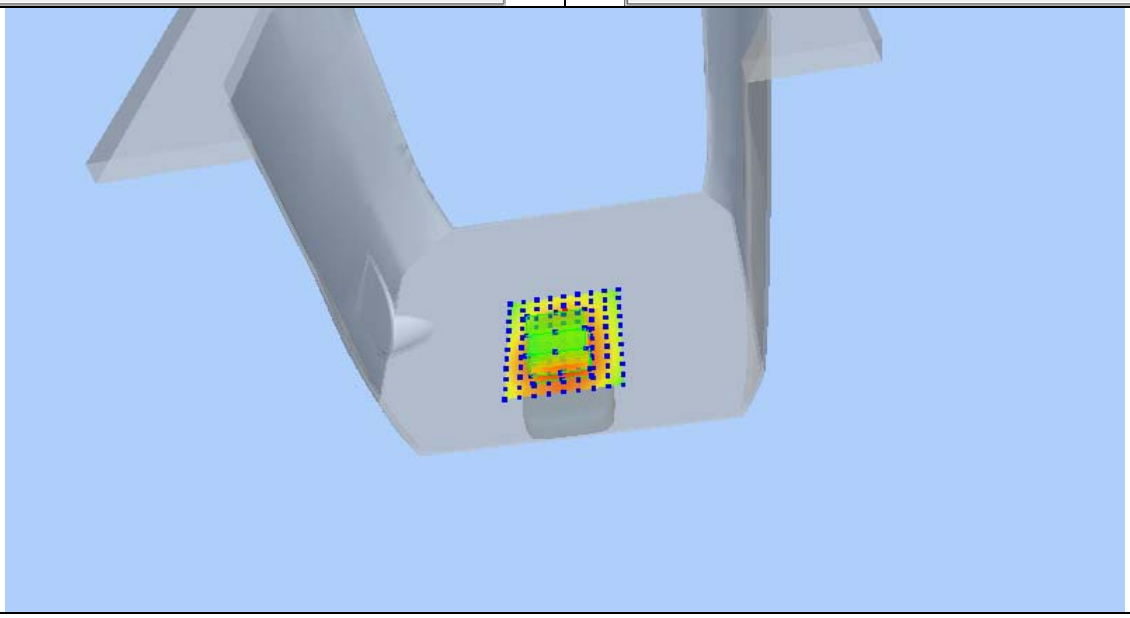


Plot 2: GSM850MHz, Middle channel (Body-worn, Back Surface)
Product Description:mobile phone
Model:s5005
Test Date: Nov 27,2015

Medium(liquid type)	MSL_850
Frequency (MHz)	836.60000
Relative permittivity (real part)	55.66
Conductivity (S/m)	0.96
Signal	GSM (Duty cycle: 1:8)
E-Field Probe	SN 07/15 EP249
Conversion Factor	5.46
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	0.40
SAR 10g (W/Kg)	0.163581
SAR 1g (W/Kg)	0.227225
SURFACE SAR	**VOLUME SAR**

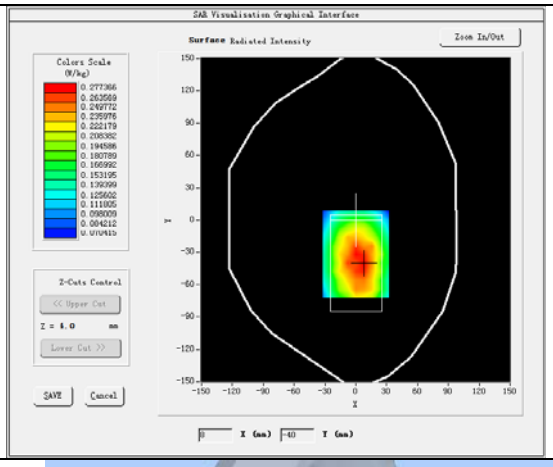


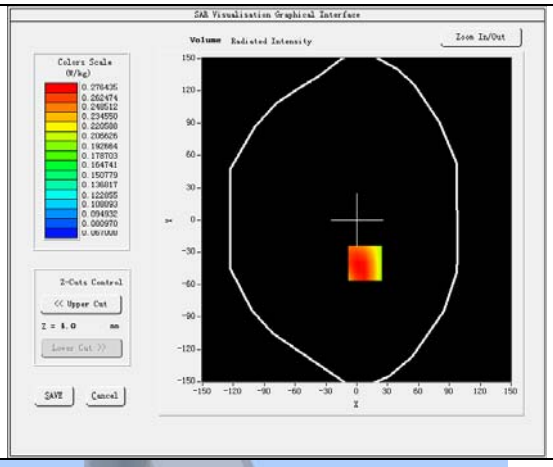


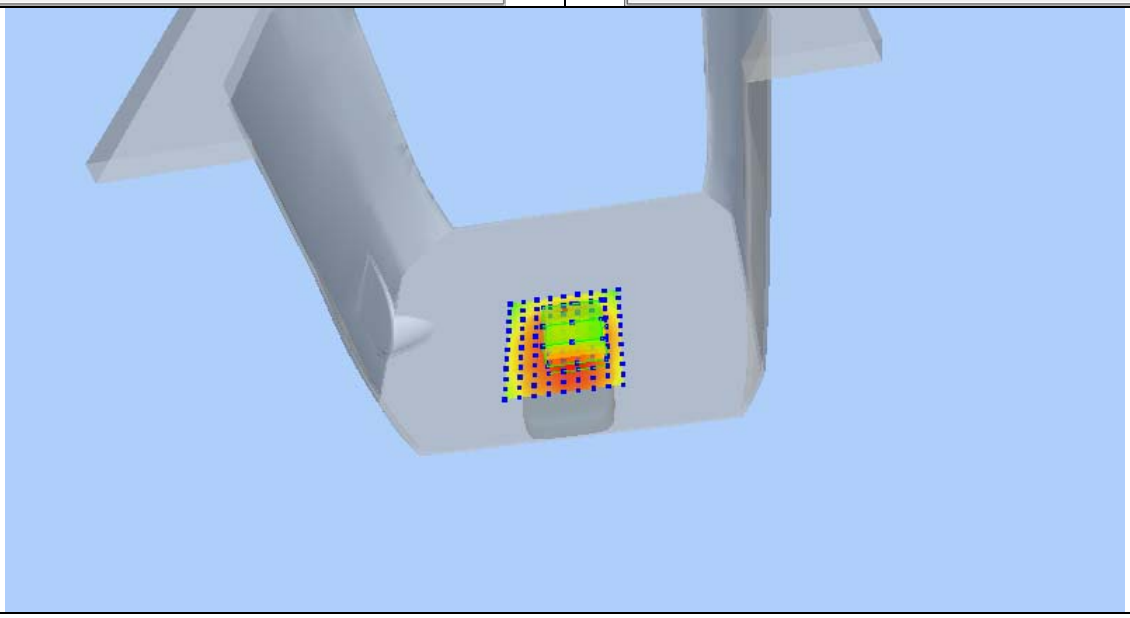


Plot 3: GPRS850MHz, Middle channel (Hotspot, Back Surface)
Product Description:mobile phone
Model:s5005
Test Date: Nov 27,2015

Medium(liquid type)	MSL_850
Frequency (MHz)	836.60000
Relative permittivity (real part)	55.66
Conductivity (S/m)	0.96
Signal	GPRS (Duty cycle: 1:4)
E-Field Probe	SN 07/15 EP249
Conversion Factor	5.46
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	0.72
SAR 10g (W/Kg)	0.197100
SAR 1g (W/Kg)	0.270343
SURFACE SAR	**VOLUME SAR**

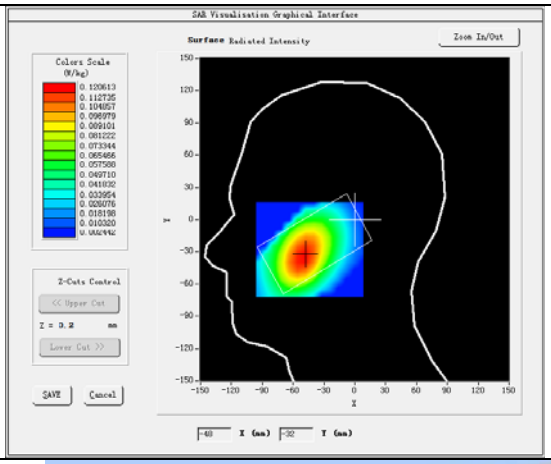


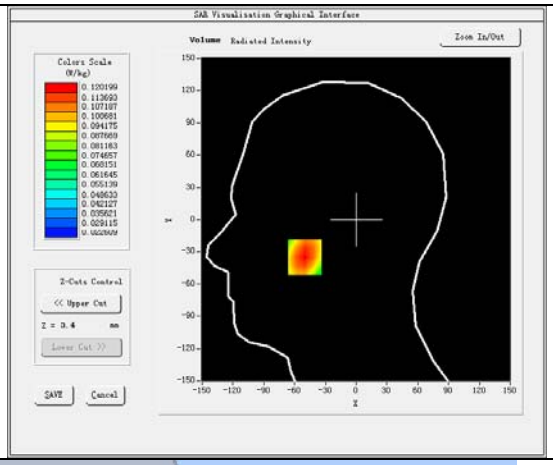


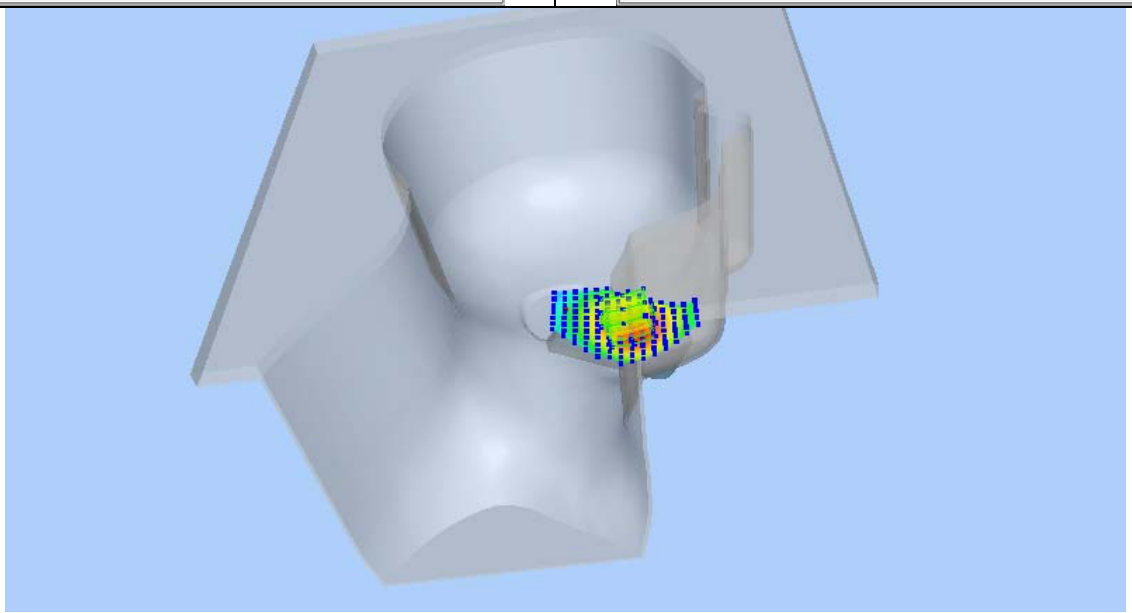


Plot 4: WCDMA BANDⅤ, Middle channel (Left Head Cheek)
Product Description: mobile phone
Model: s5005
Test Date: Nov 27,2015

Medium(liquid type)	HSL_850
Frequency (MHz)	836.6000
Relative permittivity (real part)	41.39
Conductivity (S/m)	0.91
Signal	WCDMA (Duty cycle: 1:1)
E-Field Probe	SN 07/15 EP249
Conversion Factor	5.26
Sensor-Surface	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	-2.39
SAR 10g (W/Kg)	0.087961
SAR 1g (W/Kg)	0.115895
SURFACE SAR	**VOLUME SAR**

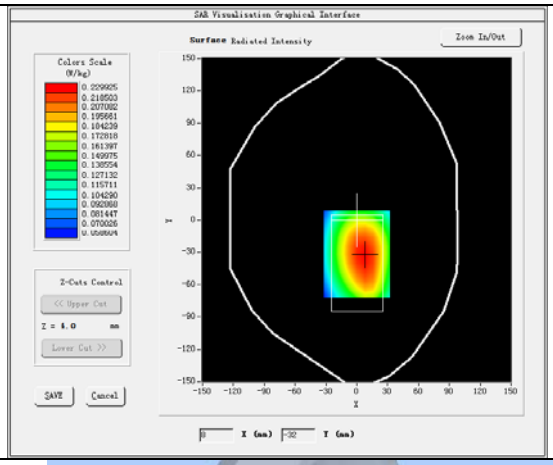


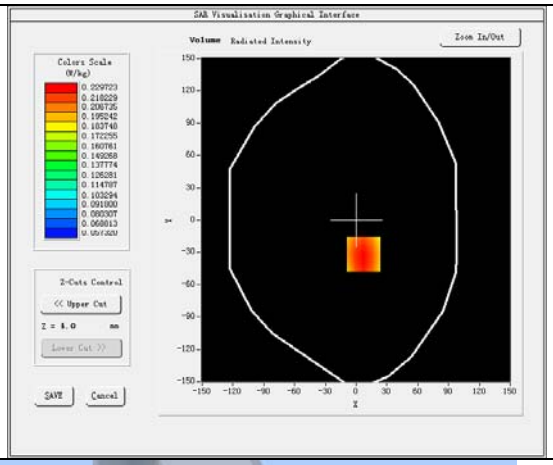


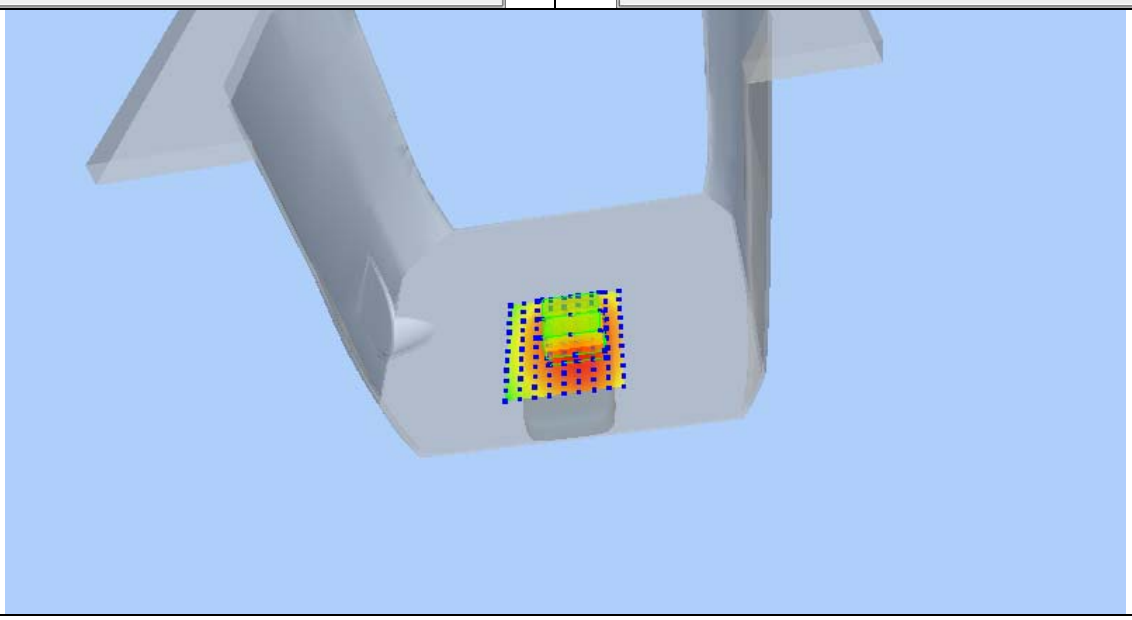


Plot 5: WCDMA BAND Ⅴ, Middle channel (Body-worn/Hotspot, Back Surface)
Product Description: mobile phone
Model: s5005
Test Date: Nov 27,2015

Medium(liquid type)	MSL_850
Frequency (MHz)	836.6000
Relative permittivity (real part)	55.66
Conductivity (S/m)	0.96
Signal	WCDMA (Duty cycle: 1:1)
E-Field Probe	SN 07/15 EP249
Conversion Factor	5.46
Sensor-Surface	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	-0.09
SAR 10g (W/Kg)	0.166312
SAR 1g (W/Kg)	0.222385
SURFACE SAR	**VOLUME SAR**

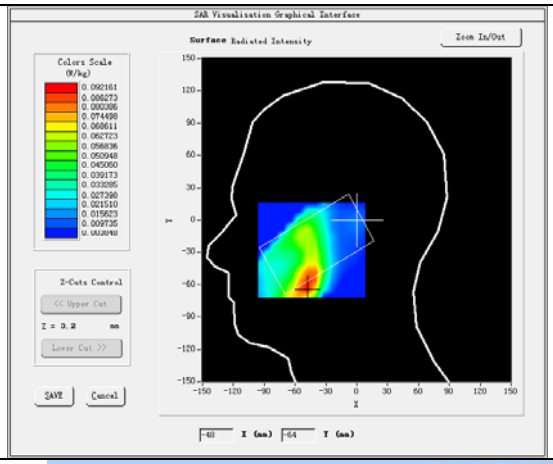


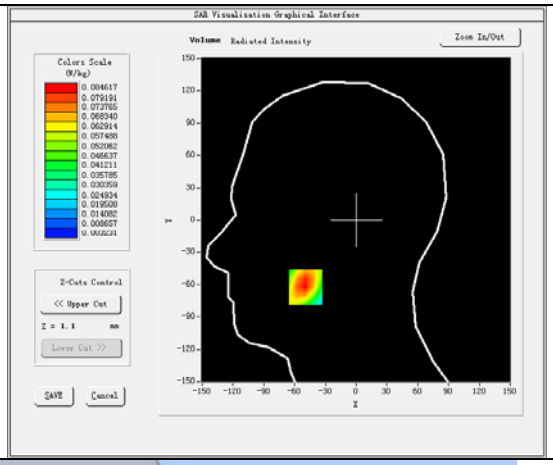


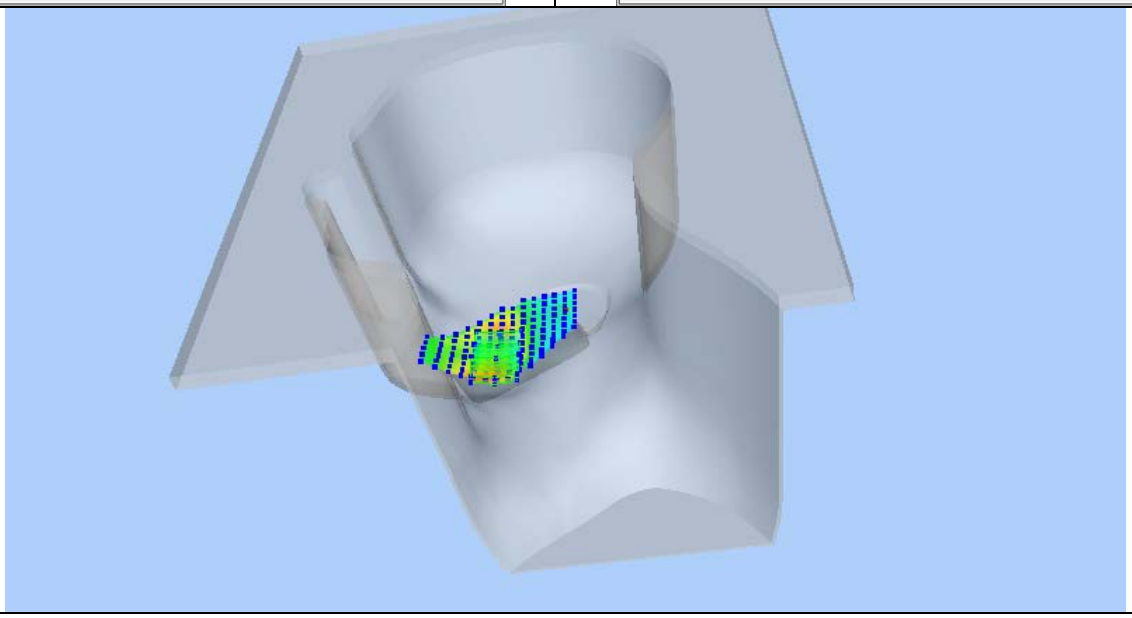


Plot 6: GSM1900, Middle channel (Right Head Cheek)
Product Description: mobile phone
Model: s5005
Test Date: Nov 30,2015

Medium(liquid type)	HSL_1900
Frequency (MHz)	1880.0000
Relative permittivity (real part)	40.51
Conductivity (S/m)	1.39
Signal	GSM (Duty cycle: 1:8)
E-Field Probe	SN 07/15 EP249
Conversion Factor	4.95
Sensor-Surface	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	-0.80
SAR 10g (W/Kg)	0.049872
SAR 1g (W/Kg)	0.080457
SURFACE SAR	**VOLUME SAR**

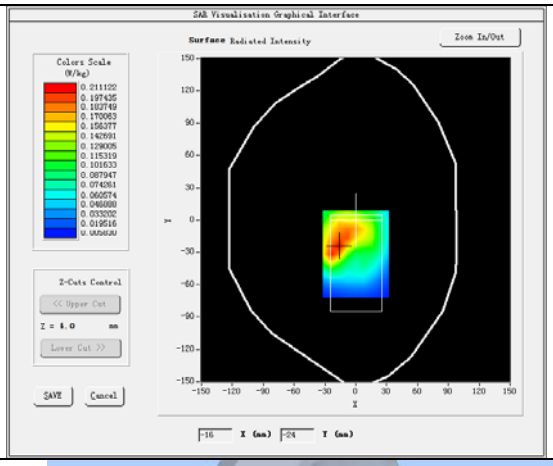


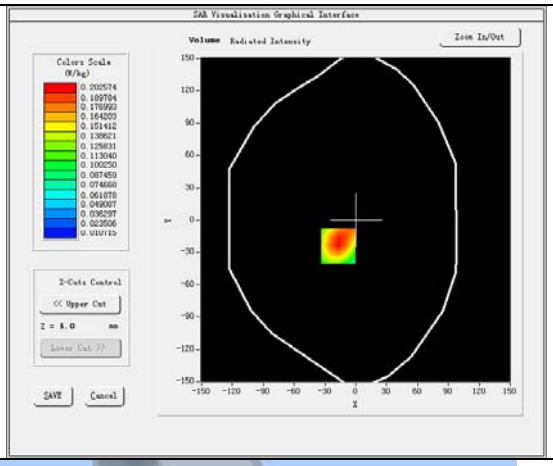


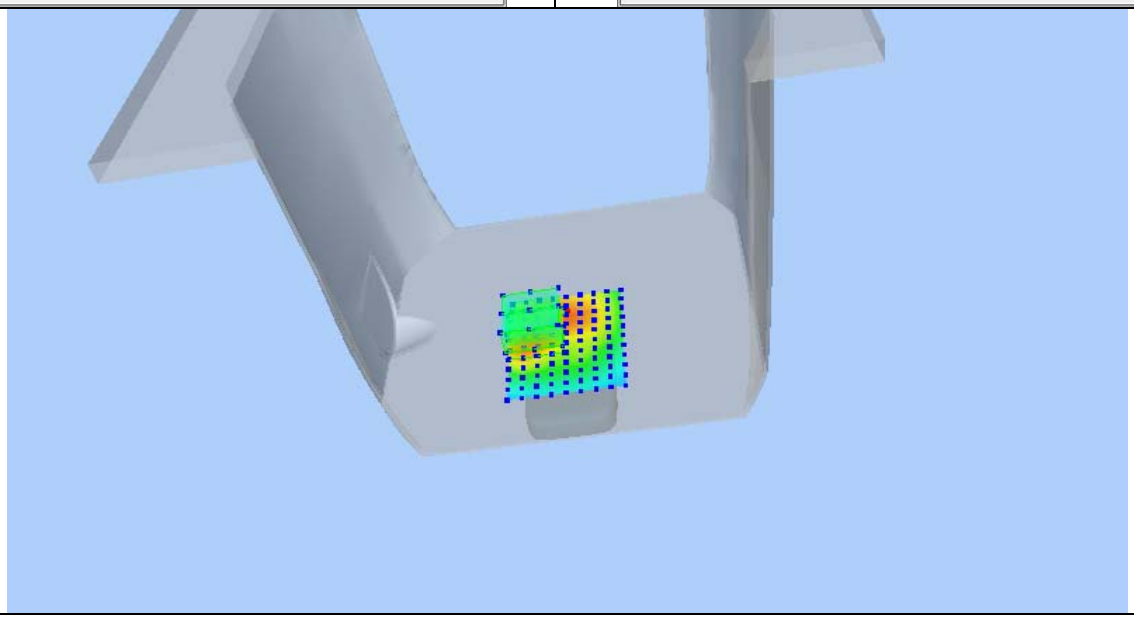


Plot 7: GSM1900, Middle channel (Body-worn, Back Surface)
Product Description: mobile phone
Model: s5005
Test Date: Nov 30,2015

Medium(liquid type)	MSL_1900
Frequency (MHz)	1880.0000
Relative permittivity (real part)	53.82
Conductivity (S/m)	1.50
Signal	GSM (Duty cycle: 1:8)
E-Field Probe	SN 07/15 EP249
Conversion Factor	5.05
Sensor-Surface	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	-3.04
SAR 10g (W/Kg)	0.112595
SAR 1g (W/Kg)	0.194401
SURFACE SAR	**VOLUME SAR**

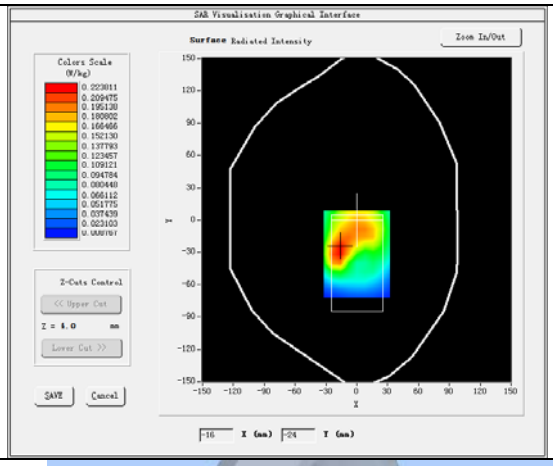


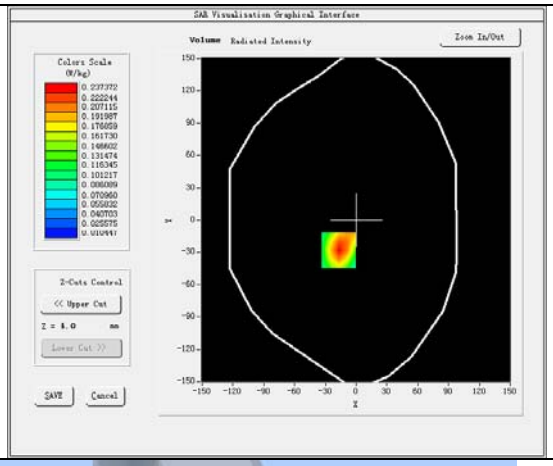


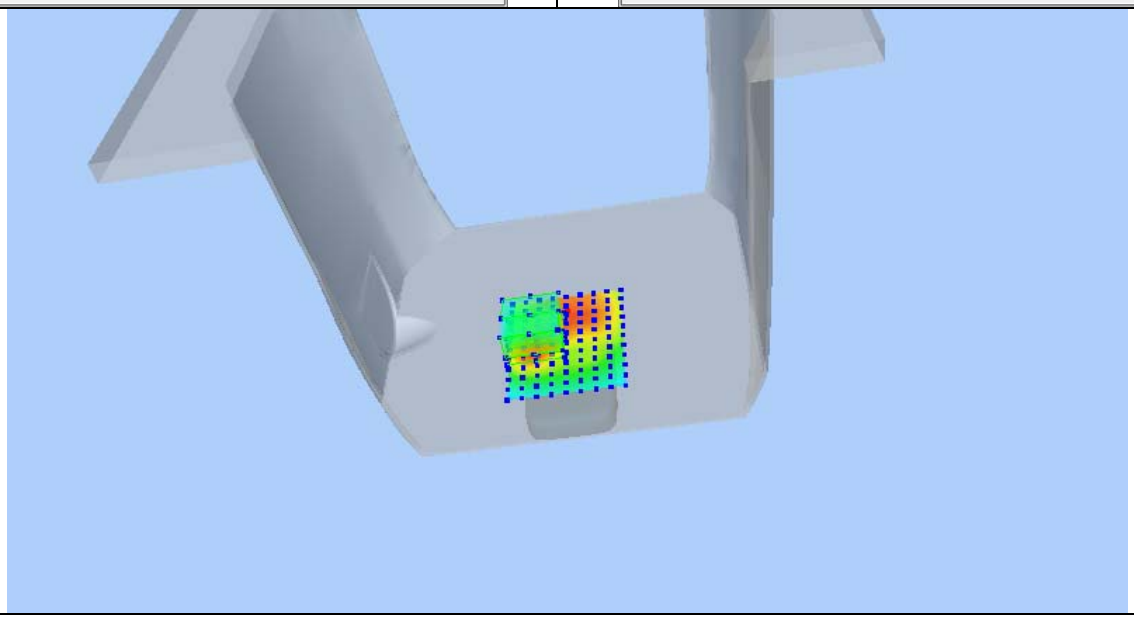


Plot 8: GPRS1900, Middle channel (Body, Back Surface)
Product Description: mobile phone
Model: s5005
Test Date: Nov 30,2015

Medium(liquid type)	MSL_1900
Frequency (MHz)	1880.0000
Relative permittivity (real part)	53.82
Conductivity (S/m)	1.50
Signal	GPRS (Duty cycle: 1:2.67)
E-Field Probe	SN 07/15 EP249
Conversion Factor	5.05
Sensor-Surface	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	-2.95
SAR 10g (W/Kg)	0.123672
SAR 1g (W/Kg)	0.223845
SURFACE SAR	**VOLUME SAR**

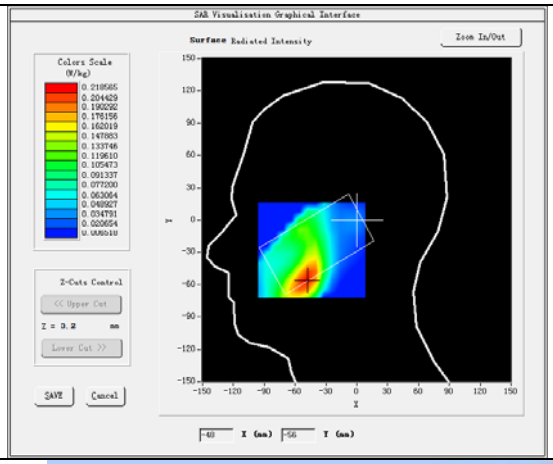


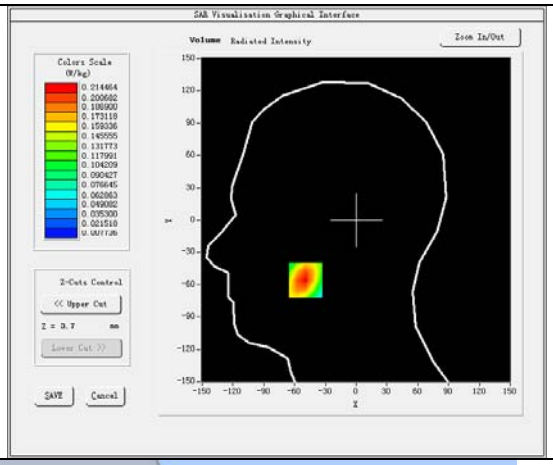


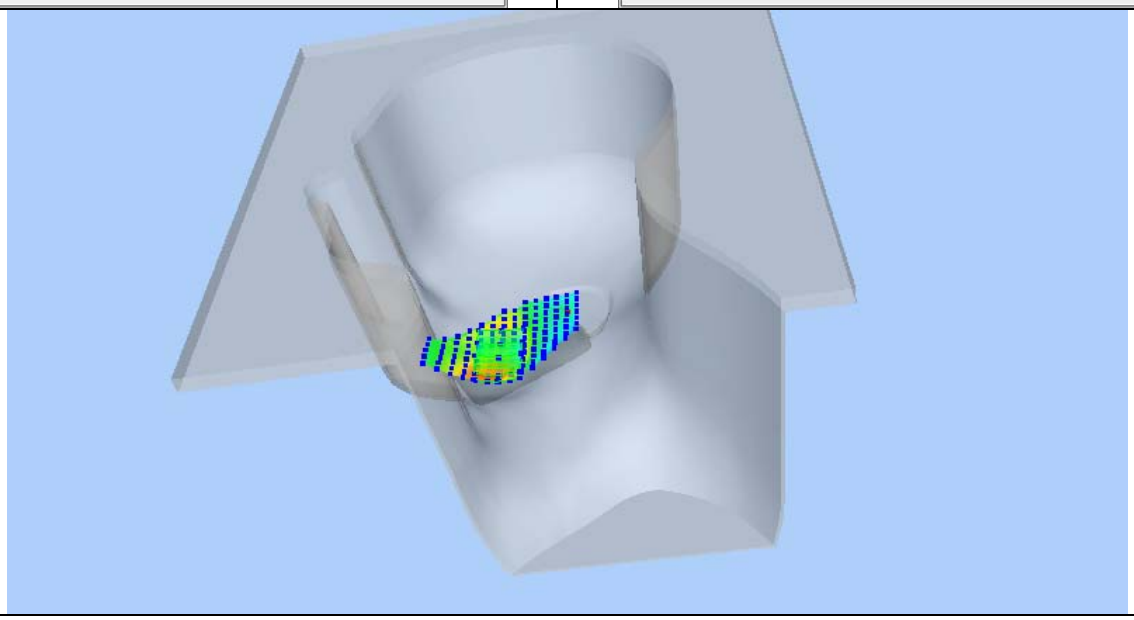


Plot 9: WCDMA BAND Ⅱ, Middle channel (Right Head Cheek)
Product Description: mobile phone
Model: s5005
Test Date: Nov 30,2015

Medium(liquid type)	HSL_1900
Frequency (MHz)	1880.0000
Relative permittivity (real part)	40.51
Conductivity (S/m)	1.39
Signal	WCDMA(Duty cycle: 1:1)
E-Field Probe	SN 07/15 EP249
Conversion Factor	4.95
Sensor-Surface	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	-2.82
SAR 10g (W/Kg)	0.122193
SAR 1g (W/Kg)	0.202889
SURFACE SAR	**VOLUME SAR**

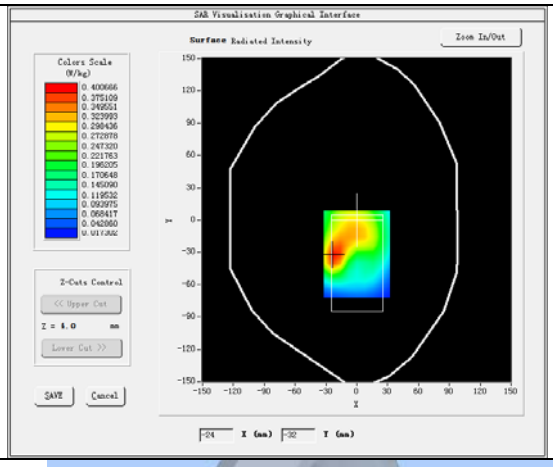


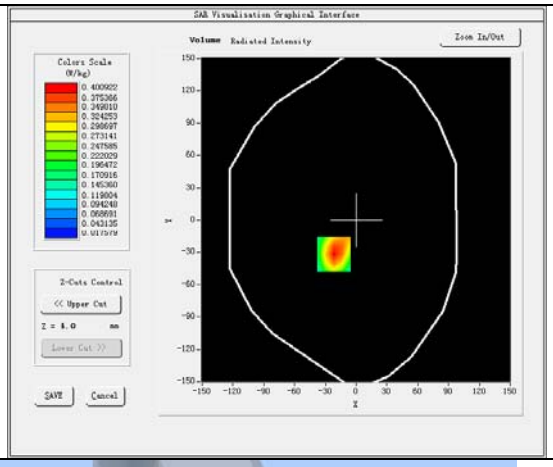


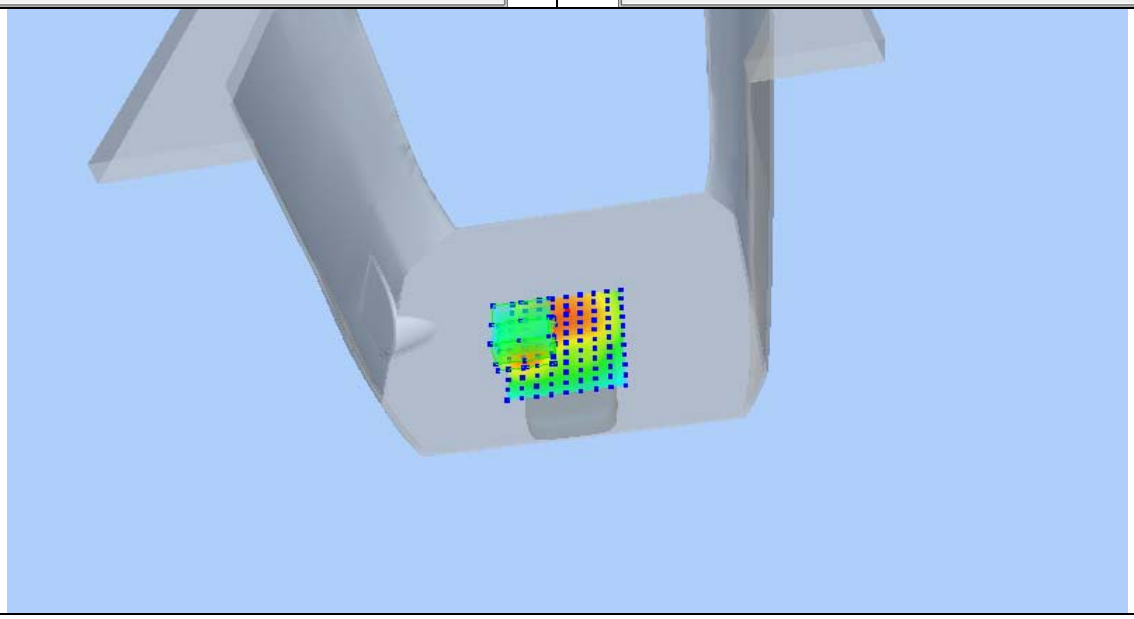


Plot 10: WCDMA BAND Ⅱ, Middle channel (Body-worn/Hotspot, Back Surface)
Product Description: mobile phone
Model: s5005
Test Date: Nov 30,2015

Medium(liquid type)	MSL_1900
Frequency (MHz)	1880.0000
Relative permittivity (real part)	53.82
Conductivity (S/m)	1.50
Signal	WCDMA(Duty cycle: 1:1)
E-Field Probe	SN 07/15 EP249
Conversion Factor	5.05
Sensor-Surface	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	-0.57
SAR 10g (W/Kg)	0.211984
SAR 1g (W/Kg)	0.378070
SURFACE SAR	**VOLUME SAR**

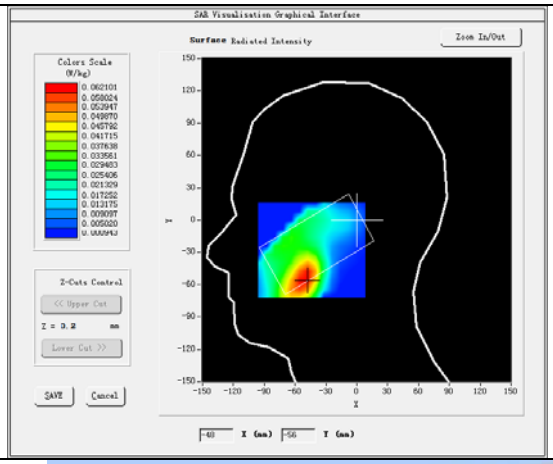


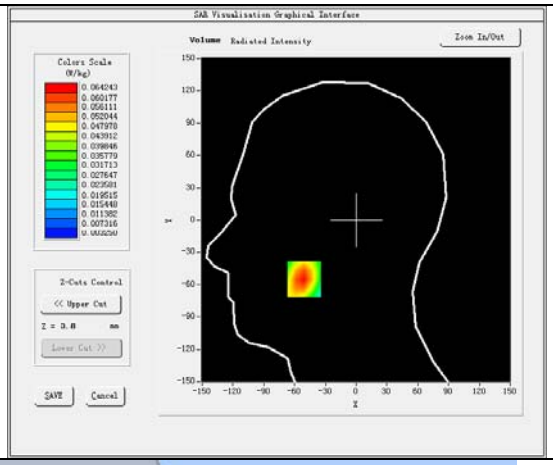


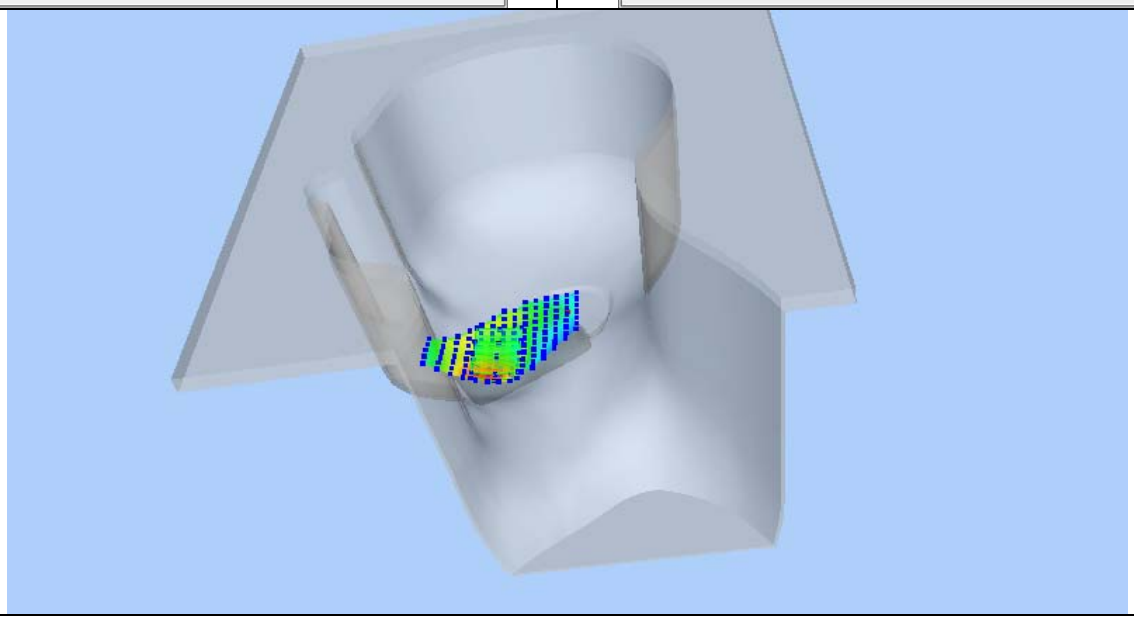


Plot 11: WCDMA BANDⅣ, Middle channel (Right Head Cheek)
Product Description: mobile phone
Model: s5005
Test Date: Nov 30,2015

Medium(liquid type)	HSL_1800
Frequency (MHz)	1732.6000
Relative permittivity (real part)	40.51
Conductivity (S/m)	1.39
Signal	WCDMA(Duty cycle: 1:1)
E-Field Probe	SN 07/15 EP249
Conversion Factor	4.23
Sensor-Surface	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	-0.46
SAR 10g (W/Kg)	0.037317
SAR 1g (W/Kg)	0.060721
SURFACE SAR	**VOLUME SAR**

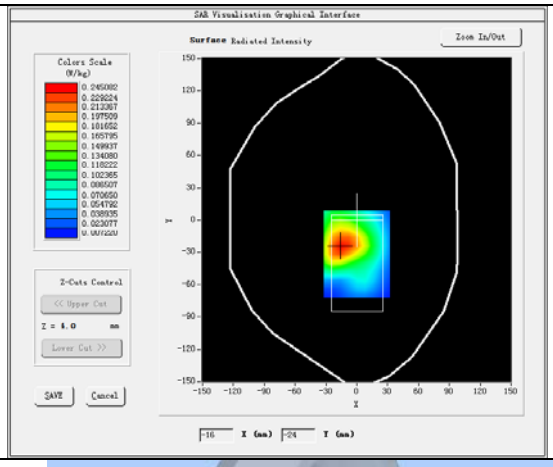


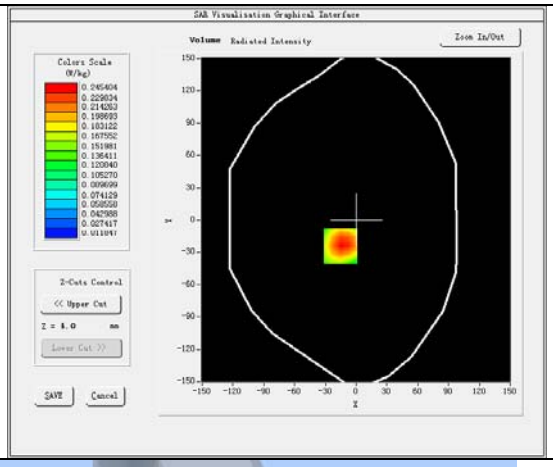


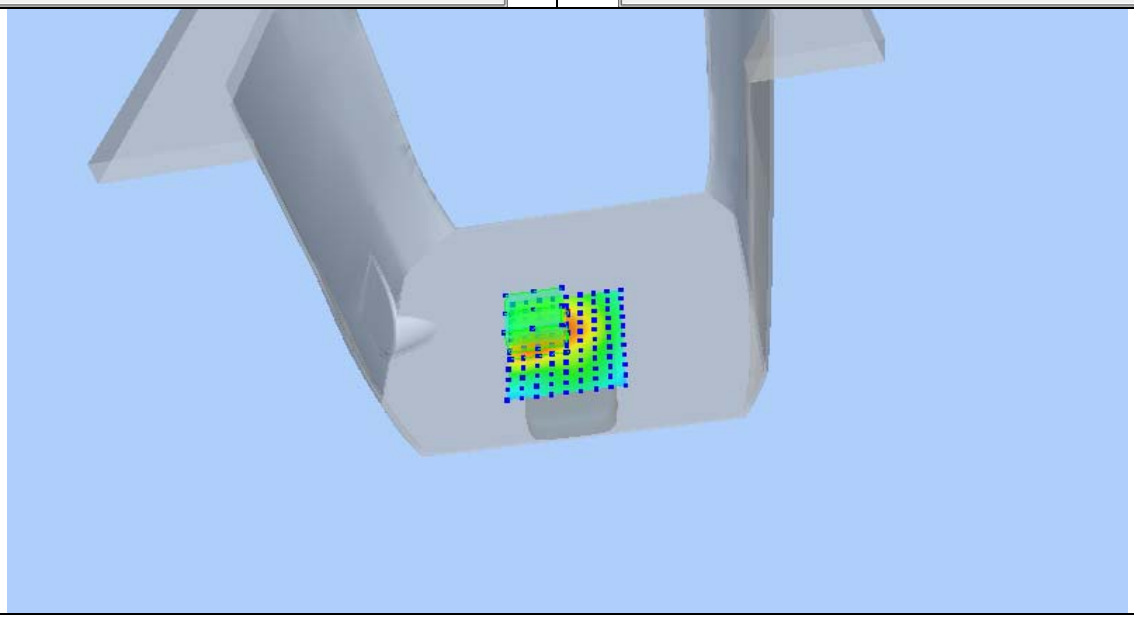


Plot 12: WCDMA BANDⅣ, Middle channel (Body-worn/Hotspot, Back Surface)
Product Description: mobile phone
Model: s5005
Test Date: Nov 30,2015

Medium(liquid type)	MSL_1800
Frequency (MHz)	1732.6000
Relative permittivity (real part)	53.20
Conductivity (S/m)	1.48
Signal	WCDMA(Duty cycle: 1:1)
E-Field Probe	SN 07/15 EP249
Conversion Factor	4.37
Sensor-Surface	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	-0.46
SAR 10g (W/Kg)	0.142800
SAR 1g (W/Kg)	0.234106
SURFACE SAR	**VOLUME SAR**







15 Calibration reports-Probe

COMOSAR E-Field Probe Calibration Report

Ref : ACR.307.1.15.SATU.A

WALTEK SERVICES (SHENZHEN) CO., LTD
1/F., FUKANGTAI BUILDING, WEST BAIMA ROAD, SONGGANG STREET
BAOAN DISTRICT, SHENZHEN GUANGDONG 518105, CHINA

MVG COMOSAR DOSIMETRIC E-FIELD PROBE
SERIAL NO.: SN 07/15 EP249

Calibrated at MVG US
2105 Barrett Park Dr. - Kennesaw, GA 30144

ACCREDITED
Calibration CERT #2246-02

Calibration Date: 10/19/2015

Summary:

This document presents the method and results from an accredited COMOSAR Dosimetric E-Field Probe calibration performed in MVG USA using the CALISAR / CALIBAIR test bench, for use with a COMOSAR system only. All calibration results are traceable to national metrology institutions.

	Name	Function	Date	Signature
Prepared by :	Jérôme LUC	Product Manager	11/3/2015	
Checked by :	Jérôme LUC	Product Manager	11/3/2015	
Approved by :	Kim RUTKOWSKI	Quality Manager	11/3/2015	

	Customer Name
Distribution :	Waltek Services (Shenzhen) Co., Ltd

Issue	Date	Modifications
A	11/3/2015	Initial release

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1 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR DOSIMETRIC E FIELD PROBE
Manufacturer	MVG
Model	SSE5
Serial Number	SN 07/15 EP249
Product Condition (new / used)	New
Frequency Range of Probe	0.7 GHz-3GHz
Resistance of Three Dipoles at Connector	Dipole 1: R1=0.178 MΩ Dipole 2: R2=0.179 MΩ Dipole 3: R3=0.167 MΩ

A yearly calibration interval is recommended.

2 PRODUCT DESCRIPTION

2.1 GENERAL INFORMATION

MVG's COMOSAR E field Probes are built in accordance to the IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards.

Figure 1 – *MVG COMOSAR Dosimetric E field Dipole*

Probe Length	330 mm
Length of Individual Dipoles	4.5 mm
Maximum external diameter	8 mm
Probe Tip External Diameter	5 mm
Distance between dipoles / probe extremity	2.7 mm

3 MEASUREMENT METHOD

The IEEE 1528, OET 65 Bulletin C, CENELEC EN50361 and CEI/IEC 62209 standards provide recommended practices for the probe calibrations, including the performance characteristics of interest and methods by which to assess their affect. All calibrations / measurements performed meet the fore mentioned standards.

3.1 LINEARITY

The evaluation of the linearity was done in free space using the waveguide, performing a power sweep to cover the SAR range 0.01W/kg to 100W/kg.

3.2 SENSITIVITY

The sensitivity factors of the three dipoles were determined using a two step calibration method (air and tissue simulating liquid) using waveguides as outlined in the standards.

3.3 LOWER DETECTION LIMIT

The lower detection limit was assessed using the same measurement set up as used for the linearity measurement. The required lower detection limit is 10 mW/kg.

3.4 ISOTROPY

The axial isotropy was evaluated by exposing the probe to a reference wave from a standard dipole with the dipole mounted under the flat phantom in the test configuration suggested for system validations and checks. The probe was rotated along its main axis from 0 - 360 degrees in 15 degree steps. The hemispherical isotropy is determined by inserting the probe in a thin plastic box filled with tissue-equivalent liquid, with the plastic box illuminated with the fields from a half wave dipole. The dipole is rotated about its axis (0°–180°) in 15° increments. At each step the probe is rotated about its axis (0°–360°).

3.5 BOUNDARY EFFECT

The boundary effect is defined as the deviation between the SAR measured data and the expected exponential decay in the liquid when the probe is oriented normal to the interface. To evaluate this effect, the liquid filled flat phantom is exposed to fields from either a reference dipole or waveguide. With the probe normal to the phantom surface, the peak spatial average SAR is measured and compared to the analytical value at the surface.

4 MEASUREMENT UNCERTAINTY

The guidelines outlined in the IEEE 1528, OET 65 Bulletin C, CENELEC EN50361 and CEI/IEC 62209 standards were followed to generate the measurement uncertainty associated with an E-field probe calibration using the waveguide technique. All uncertainties listed below represent an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2, traceable to the Internationally Accepted Guides to Measurement Uncertainty.

Uncertainty analysis of the probe calibration in waveguide					
ERROR SOURCES	**Uncertainty value (%)**	**Probability Distribution**	**Divisor**	**ci**	**Standard Uncertainty (%)**
Incident or forward power	3.00%	Rectangular	$\sqrt{3}$	1	1.732%
Reflected power	3.00%	Rectangular	$\sqrt{3}$	1	1.732%
Liquid conductivity	5.00%	Rectangular	$\sqrt{3}$	1	2.887%
Liquid permittivity	4.00%	Rectangular	$\sqrt{3}$	1	2.309%
Field homogeneity	3.00%	Rectangular	$\sqrt{3}$	1	1.732%
Field probe positioning	5.00%	Rectangular	$\sqrt{3}$	1	2.887%

Field probe linearity	3.00%	Rectangular	$\sqrt{3}$	1	1.732%
Combined standard uncertainty					5.831%
Expanded uncertainty 95 % confidence level k = 2					12.0%

5 CALIBRATION MEASUREMENT RESULTS

Calibration Parameters	
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

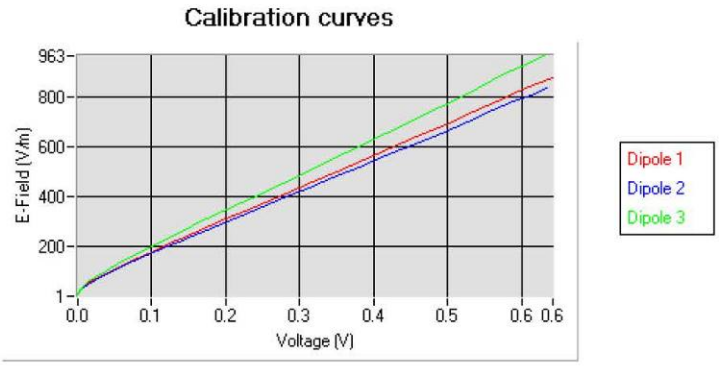
5.1 SENSITIVITY IN AIR

Normx dipole 1 (μV/(V/m)^2)	Normy dipole 2 (μV/(V/m)^2)	Normz dipole 3 (μV/(V/m)^2)
6.81	6.65	6.62

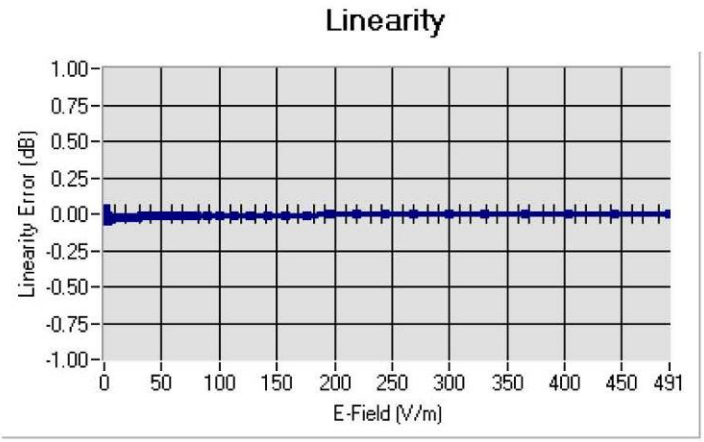
DCP dipole 1 (mV)	DCP dipole 2 (mV)	DCP dipole 3 (mV)
95	91	91

Calibration curves ei=f(V) (i=1,2,3) allow to obtain H-field value using the formula:

$$E = \sqrt{E_1^{\,2} + E_2^{\,2} + E_3^{\,2}}$$



5.2 LINEARITY



Linearity:±1.21% (+/-0.05dB)

5.3 SENSITIVITY IN LIQUID

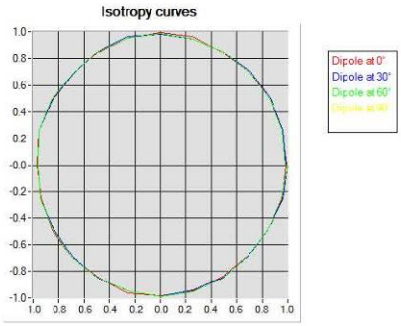
Liquid	Frequency (MHz +/- 100MHz)	Permittivity	Epsilon (S/m)	ConvF
HL750	750	42.24	0.90	4.97
BL750	750	56.85	0.99	5.11
HL850	835	43.02	0.90	5.26
BL850	835	53.72	0.98	5.46
HL900	900	42.47	0.99	5.03
BL900	900	56.97	1.09	5.22
HL1800	1800	42.24	1.40	4.23
BL1800	1800	53.53	1.53	4.37
HL1900	1900	40.79	1.42	4.95
BL1900	1900	54.47	1.57	5.05
HL2000	2000	40.52	1.44	4.44
BL2000	2000	54.18	1.56	4.57
HL2450	2450	38.73	1.81	4.32
BL2450	2450	53.23	1.96	4.49
HL2600	2600	38.54	1.95	4.26
BL2600	2600	52.07	2.23	4.40

LOWER DETECTION LIMIT: 8mW/kg

5.4 ISOTROPY

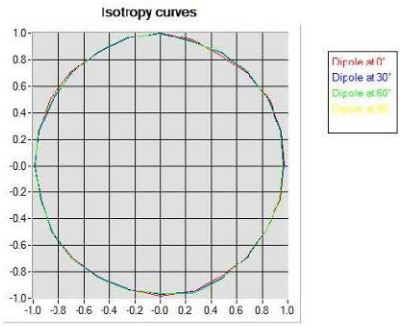
HL900 MHz

- Axial isotropy: 0.04 dB
- Hemispherical isotropy: 0.05 dB



HL1800 MHz

- Axial isotropy: 0.04 dB
- Hemispherical isotropy: 0.06 dB



6 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	**Manufacturer / Model**	**Identification No.**	**Current Calibration Date**	**Next Calibration Date**
Flat Phantom	MVG	SN-20/09-SAM71	Validated. No cal required.	Validated. No cal required.
COMOSAR Test Bench	Version 3	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rhode & Schwarz ZVA	SN100132	02/2013	02/2016
Reference Probe	MVG	EP 94 SN 37/08	10/2015	10/2016
Multimeter	Keithley 2000	1188656	12/2013	12/2016
Signal Generator	Agilent E4438C	MY49070581	12/2013	12/2016
Amplifier	Aethercomm	SN 046	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	HP E4418A	US38261498	12/2013	12/2016
Power Sensor	HP ECP-E26A	US37181460	12/2013	12/2016
Directional Coupler	Narda 4216-20	01386	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Waveguide	Mega Industries	069Y7-158-13-712	Validated. No cal required.	Validated. No cal required.
Waveguide Transition	Mega Industries	069Y7-158-13-701	Validated. No cal required.	Validated. No cal required.
Waveguide Termination	Mega Industries	069Y7-158-13-701	Validated. No cal required.	Validated. No cal required.

SAR Reference Dipole Calibration Report

Ref : ACR.92.3.15.SATU.A

WALTEK SERVICES (SHENZHEN) CO., LTD
1/F., FUKANGTAI BUILDING, WEST BAIMA ROAD, SONGGANG STREET
BAOAN DISTRICT, SHENZHEN GUANGDONG 518105, CHINA

MVG COMOSAR REFERENCE DIPOLE
FREQUENCY: 835 MHZ
SERIAL NO.: SN 09/15 DIP 0G835-358

Calibrated at MVG US
2105 Barrett Park Dr. - Kennesaw, GA 30144

ACCREDITED
Calibration CERT #2246-02

03/16/2015

Summary:

This document presents the method and results from an accredited SAR reference dipole calibration performed in MVG USA using the COMOSAR test bench. All calibration results are traceable to national metrology institutions.

	Name	Function	Date	Signature
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	Customer Name
Distribution :	Waltek Services (Shenzhen) Co., Ltd

Issue	Date	Modifications
A	4/2/2015	Initial release

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1 INTRODUCTION

This document contains a summary of the requirements set forth by the IEEE 1528, FCC KDBs and CEI/IEC 62209 standards for reference dipoles used for SAR measurement system validations and the measurements that were performed to verify that the product complies with the fore mentioned standards.

2 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR 835 MHz REFERENCE DIPOLE
Manufacturer	MVG
Model	SID835
Serial Number	SN 09/15 DIP 0G835-358
Product Condition (new / used)	New

A yearly calibration interval is recommended.

3 PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

MVG's COMOSAR Validation Dipoles are built in accordance to the IEEE 1528, FCC KDBs and CEI/IEC 62209 standards. The product is designed for use with the COMOSAR test bench only.

Figure 1 – *MVG COMOSAR Validation Dipole*

4 MEASUREMENT METHOD

The IEEE 1528, FCC KDBs and CEI/IEC 62209 standards provide requirements for reference dipoles used for system validation measurements. The following measurements were performed to verify that the product complies with the fore mentioned standards.

4.1 RETURN LOSS REQUIREMENTS

The dipole used for SAR system validation measurements and checks must have a return loss of -20 dB or better. The return loss measurement shall be performed against a liquid filled flat phantom, with the phantom constucted as outlined in the fore mentioned standards.

4.2 MECHANICAL REQUIREMENTS

The IEEE Std. 1528 and CEI/IEC 62209 standards specify the mechanical components and dimensions of the validation dipoles, with the dimensions frequency and phantom shell thickness dependent. The COMOSAR test bench employs a 2 mm phantom shell thickness therefore the dipoles sold for use with the COMOSAR test bench comply with the requirements set forth for a 2 mm phantom shell thickness.

5 MEASUREMENT UNCERTAINTY

All uncertainties listed below represent an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2, traceable to the Internationally Accepted Guides to Measurement Uncertainty.

5.1 RETURN LOSS

The following uncertainties apply to the return loss measurement:

Frequency band	Expanded Uncertainty on Return Loss
400-6000MHz	0.1 dB

5.2 DIMENSION MEASUREMENT

The following uncertainties apply to the dimension measurements:

Length (mm)	Expanded Uncertainty on Length
3 - 300	0.05 mm

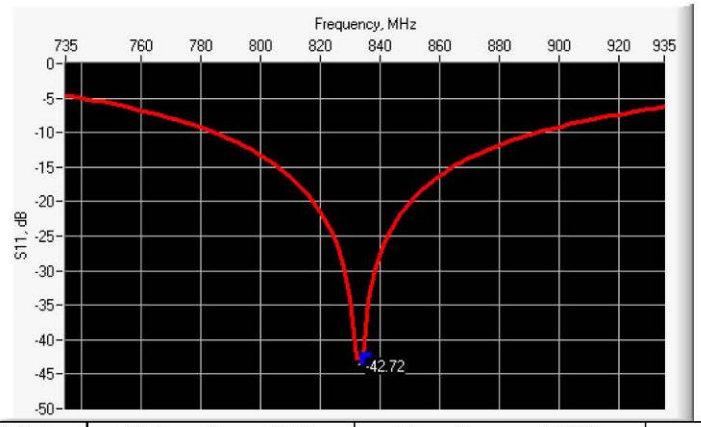
5.3 VALIDATION MEASUREMENT

The guidelines outlined in the IEEE 1528, FCC KDBs, CENELEC EN50361 and CEI/IEC 62209 standards were followed to generate the measurement uncertainty for validation measurements.

Scan Volume	Expanded Uncertainty
1 g	20.3 %
10 g	20.1 %

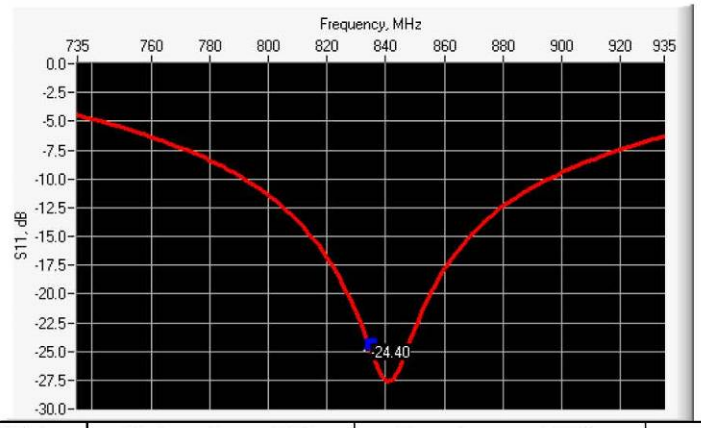
6 CALIBRATION MEASUREMENT RESULTS

6.1 RETURN LOSS AND IMPEDANCE IN HEAD LIQUID



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
835	-42.72	-20	50.7 Ω + 0.3 jΩ

6.2 RETURN LOSS AND IMPEDANCE IN BODY LIQUID



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
835	-24.40	-20	45.3 Ω + 3.7 jΩ

6.3 MECHANICAL DIMENSIONS

Frequency MHz	L mm		h mm		d mm	
	required	measured	required	measured	required	measured
300	420.0 ±1 %.		250.0 ±1 %.		6.35 ±1 %.	
450	290.0 ±1 %.		166.7 ±1 %.		6.35 ±1 %.	
750	176.0 ±1 %.		100.0 ±1 %.		6.35 ±1 %.	
835	161.0 ±1 %.	PASS	89.8 ±1 %.	PASS	3.6 ±1 %.	PASS
900	149.0 ±1 %.		83.3 ±1 %.		3.6 ±1 %.	
1450	89.1 ±1 %.		51.7 ±1 %.		3.6 ±1 %.	
1500	80.5 ±1 %.		50.0 ±1 %.		3.6 ±1 %.	
1640	79.0 ±1 %.		45.7 ±1 %.		3.6 ±1 %.	
1750	75.2 ±1 %.		42.9 ±1 %.		3.6 ±1 %.	
1800	72.0 ±1 %.		41.7 ±1 %.		3.6 ±1 %.	
1900	68.0 ±1 %.		39.5 ±1 %.		3.6 ±1 %.	
1950	66.3 ±1 %.		38.5 ±1 %.		3.6 ±1 %.	
2000	64.5 ±1 %.		37.5 ±1 %.		3.6 ±1 %.	
2100	61.0 ±1 %.		35.7 ±1 %.		3.6 ±1 %.	
2300	55.5 ±1 %.		32.6 ±1 %.		3.6 ±1 %.	
2450	51.5 ±1 %.		30.4 ±1 %.		3.6 ±1 %.	
2600	48.5 ±1 %.		28.8 ±1 %.		3.6 ±1 %.	
3000	41.5 ±1 %.		25.0 ±1 %.		3.6 ±1 %.	
3500	37.0±1 %.		26.4 ±1 %.		3.6 ±1 %.	
3700	34.7±1 %.		26.4 ±1 %.		3.6 ±1 %.	

7 VALIDATION MEASUREMENT

The IEEE Std. 1528, FCC KDBs and CEI/IEC 62209 standards state that the system validation measurements must be performed using a reference dipole meeting the fore mentioned return loss and mechanical dimension requirements. The validation measurement must be performed against a liquid filled flat phantom, with the phantom constructed as outlined in the fore mentioned standards. Per the standards, the dipole shall be positioned below the bottom of the phantom, with the dipole length centered and parallel to the longest dimension of the flat phantom, with the top surface of the dipole at the described distance from the bottom surface of the phantom.

7.1 HEAD LIQUID MEASUREMENT

Frequency MHz	Relative permittivity (ε_r')		Conductivity (σ) S/m	
	required	measured	required	measured
300	45.3 ±5 %		0.87 ±5 %	
450	43.5 ±5 %		0.87 ±5 %	

750	41.9 ±5 %		0.89 ±5 %	
835	41.5 ±5 %	PASS	0.90 ±5 %	PASS
900	41.5 ±5 %		0.97 ±5 %	
1450	40.5 ±5 %		1.20 ±5 %	
1500	40.4 ±5 %		1.23 ±5 %	
1640	40.2 ±5 %		1.31 ±5 %	
1750	40.1 ±5 %		1.37 ±5 %	
1800	40.0 ±5 %		1.40 ±5 %	
1900	40.0 ±5 %		1.40 ±5 %	
1950	40.0 ±5 %		1.40 ±5 %	
2000	40.0 ±5 %		1.40 ±5 %	
2100	39.8 ±5 %		1.49 ±5 %	
2300	39.5 ±5 %		1.67 ±5 %	
2450	39.2 ±5 %		1.80 ±5 %	
2600	39.0 ±5 %		1.96 ±5 %	
3000	38.5 ±5 %		2.40 ±5 %	
3500	37.9 ±5 %		2.91 ±5 %	

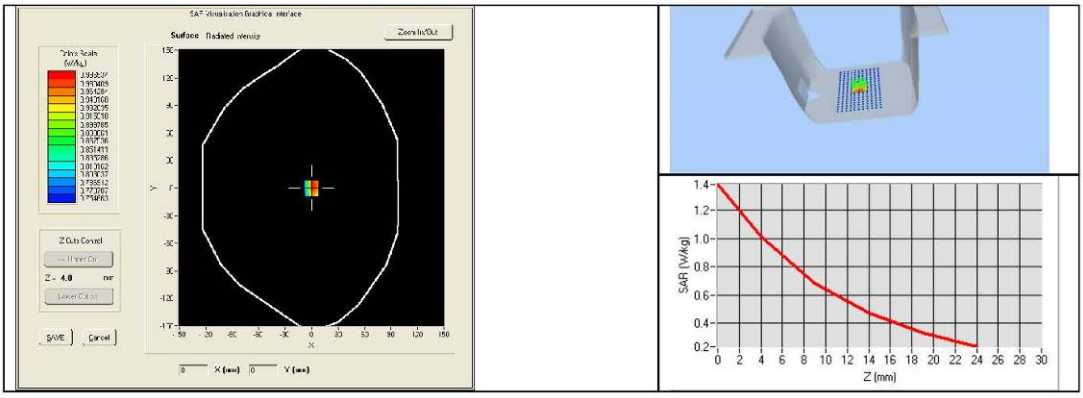
7.2 SAR MEASUREMENT RESULT WITH HEAD LIQUID

The IEEE Std. 1528 and CEI/IEC 62209 standards state that the system validation measurements should produce the SAR values shown below (for phantom thickness of 2 mm), within the uncertainty for the system validation. All SAR values are normalized to 1 W forward power. In bracket, the measured SAR is given with the used input power.

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Head Liquid Values: eps' : 42.1 sigma : 0.92
Distance between dipole center and liquid	15.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=8mm/dy=8m/dz=5mm
Frequency	835 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

Frequency MHz	1 g SAR (W/kg/W)		10 g SAR (W/kg/W)	
	required	measured	required	measured
300	2.85		1.94	
450	4.58		3.06	
750	8.49		5.55	

835	9.56	9.53 (0.95)	6.22	6.20 (0.62)
900	10.9		6.99	
1450	29		16	
1500	30.5		16.8	
1640	34.2		18.4	
1750	36.4		19.3	
1800	38.4		20.1	
1900	39.7		20.5	
1950	40.5		20.9	
2000	41.1		21.1	
2100	43.6		21.9	
2300	48.7		23.3	
2450	52.4		24	
2600	55.3		24.6	
3000	63.8		25.7	
3500	67.1		25	



7.3 BODY LIQUID MEASUREMENT

Frequency MHz	Relative permittivity (ε_r')		Conductivity (σ) S/m	
	required	measured	required	measured
150	61.9 ±5 %		0.80 ±5 %	
300	58.2 ±5 %		0.92 ±5 %	
450	56.7 ±5 %		0.94 ±5 %	
750	55.5 ±5 %		0.96 ±5 %	
835	55.2 ±5 %	PASS	0.97 ±5 %	PASS
900	55.0 ±5 %		1.05 ±5 %	
915	55.0 ±5 %		1.06 ±5 %	

1450	54.0 ±5 %		1.30 ±5 %	
1610	53.8 ±5 %		1.40 ±5 %	
1800	53.3 ±5 %		1.52 ±5 %	
1900	53.3 ±5 %		1.52 ±5 %	
2000	53.3 ±5 %		1.52 ±5 %	
2100	53.2 ±5 %		1.62 ±5 %	
2450	52.7 ±5 %		1.95 ±5 %	
2600	52.5 ±5 %		2.16 ±5 %	
3000	52.0 ±5 %		2.73 ±5 %	
3500	51.3 ±5 %		3.31 ±5 %	
5200	49.0 ±10 %		5.30 ±10 %	
5300	48.9 ±10 %		5.42 ±10 %	
5400	48.7 ±10 %		5.53 ±10 %	
5500	48.6 ±10 %		5.65 ±10 %	
5600	48.5 ±10 %		5.77 ±10 %	
5800	48.2 ±10 %		6.00 ±10 %	

7.4 SAR MEASUREMENT RESULT WITH BODY LIQUID

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Body Liquid Values: eps' : 53.8 sigma : 0.98
Distance between dipole center and liquid	15.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=8mm/dy=8m/dz=5mm
Frequency	835 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

Frequency MHz	1 g SAR (W/kg/W)	10 g SAR (W/kg/W)
	measured	measured
835	9.44 (0.94)	6.25 (0.62)