SAR Test Report

Report No.: AGCX0M130301S1

FCC ID	:	ONGORBIT5700T
APPLICATION PURPOSE	:	Original Equipment
PRODUCT DESIGNATION		WCDMA MOBILE PHONE
BRAND NAME	:	MAXWEST
MODEL NAME	:	Orbit 5700T
CLIENT	:	MAXWEST TELECOM
DATE OF ISSUE	:	Mar.22, 2013
STANDARD(S)	:	FCC Oet65 Supplement C June 2001 IEEE Std. 1528-2003, 47CFR § 2.1093
REPORT VERSION	:	V1.0

Attestation of Global Compliance(Shenzhen) Co., Ltd.

Report Revise Record

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0	/	Mar.22, 2013	Valid	Original Report

Test Report Certification

Applicant Name	:	MAXWEST TELECOM
Applicant Address	:	11037 warner ave #201 fountain valley, ca, 92708 USA
Manufacturer Name	:	MAXWEST TELECOM
Manufacturer Address	:	11037 warner ave #201 fountain valley, ca, 92708 USA
Product Designation	:	WCDMA MOBILE PHONE
Brand Name	:	MAXWEST
Model Name	:	Orbit 5700T
Different Description		N/A
EUT Voltage	:	DC3.7V by battery
Applicable Standard	:	FCC Oet65 Supplement C June 2001 IEEE Std. 1528-2003, 47CFR § 2.1093
Test Date	:	Mar.21, 2013
Test Results	:	MAX SAR MEASUREMENT(1g) Head:**0.385** W/Kg Body:**0.379**W/Kg (2G) Head: **0.427**W/Kg Body:**0.433** W/Kg (3G) (Maximum Scaling SAR SAR=**0.441** W/Kg)
Performed Location		Attestation of Global Compliance(Shenzhen) Co., Ltd. 2 F, Building 2, No.1-No.4, Chaxi Sanwei Technical Industrial Park, Gushu, Xixiang Street, Bao'an District, Shenzhen, China
Report Template		AGCRT-US-3G3/SAR (2013-03-01)

Documented By Vivi Zeng

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TABLE OF CONTENTS

1. General Information

1.1. EUT Description

General Information	
Product Designation	WCDMA MOBILE PHONE
Test Model	Orbit 5700T
Hardware Version	ORBIT5700T
Software Version	ORBIT5700TV5_8225_B517_20130311
Device Category	Portable
RF Exposure Environment	Uncontrolled
Antenna Type	Internal
GSM and GPRS	
Support Band	☒GSM 850 ☒PCS 1900 (U.S. Bands) ☒GSM 900 ☒DCS 1800 (Non-U.S. Bands)
GPRS Type	Class B
GPRS Class	Class 8,10 ,12(1Tx+4Rx, 2Tx+3Rx, 3Tx+2Rx, 4Tx+1Rx)
TX Frequency Range	GSM 850 : 824.2~848.8MHz; PCS 1900: 1850.2~1909.8MHz;
RX Frequency Range	GSM 850 : 869~894MHz PCS 1900: 1930~1990MHz
Release Version	R99
Type of modulation	GMSK for GSM/GPRS
Antenna Gain	1.0dBi
Max. Output Power (Avg. Burst Power)	GSM850: 31.59dBm(32.74dBm-Peak Power) PCS1900: 28.61dBm(29.71dBm-Peak Power)
Max. Output Power (Radiated)	GSM850: 30.72dBm- ERP PCS1900: 28.37dBm- EIRP
WCDMA	
Support Band	U.S. Bands: ☒UMTS FDD Band IV ☒UMTS FDD Band V Non-U.S. Bands: ☒UMTS FDD Band I ☐UMTS FDD Band III

HS Type	HSPA(HSUPA/HSDPA)
TX Frequency Range	WCDMA FDD Band V: 826.4-846.6MHz WCDMA FDD Band IV: 1712.5-1752.5MHz
RX Frequency Range	WCDMA FDD Band V: 869-894MHz WCDMA FDD Band IV:2110-2155MHz
Release Version	Rel-6
Type of modulation	QPSK
Antenna Gain	1.0dBi
Max. Output Power (Avg. Burst Power)	Band V: 23.46dBm (23.59dBm-Peak Power) Band IV:22.59dBm (22.93dBm-Peak Power)
Max. Output Power (Radiated)	Band V: 22.71dBm- ERP Band IV: 21.67dBm- EIRP
Bluetooth	
Bluetooth Version	☐V2.0 ☐V2.1 ☐V2.1+EDR ☒V3.0 ☐V3.0+EDR ☒V4.0
Operation Frequency	2402~2480MHz
Type of modulation	☒GFSK ☒∏/4-DQPSK ☒8-DPSK
Max. Output Power (Peak Conducted)	3.60dBm
Antenna Gain	0.8dBi
WIFI	
WIFI Specification	☐802.11a ☒802.11b ☒802.11g ☒802.11n(20) ☐802.11n(40)
Operation Frequency	2412~2462MHz
Avg. Burst Power	11b: 8.47dBm,11g: 6.76dBm,11n(20): 4.32dBm
Antenna Gain	Antenna (max): 0.8dBi
Accessories	
Battery	Brand name: MAXWEST Model No. : Orbit 5700T Voltage and Capacitance: 3.7 V &2100mA
Adapter	Brand name: MAXWEST Model No. : Orbit 5700T Input: AC 100-240V Output: DC 5V
Earphone	Brand name: MAXWEST Model No. : Orbit 5700T

Note: The sample used for testing is end product.

1.2. Test Procedure

1	Setup the EUT and simulators as shown on above.
2	Turn on the power of all equipment.
3	EUT Communicate with 8960, and test them respectively at U.S. bands

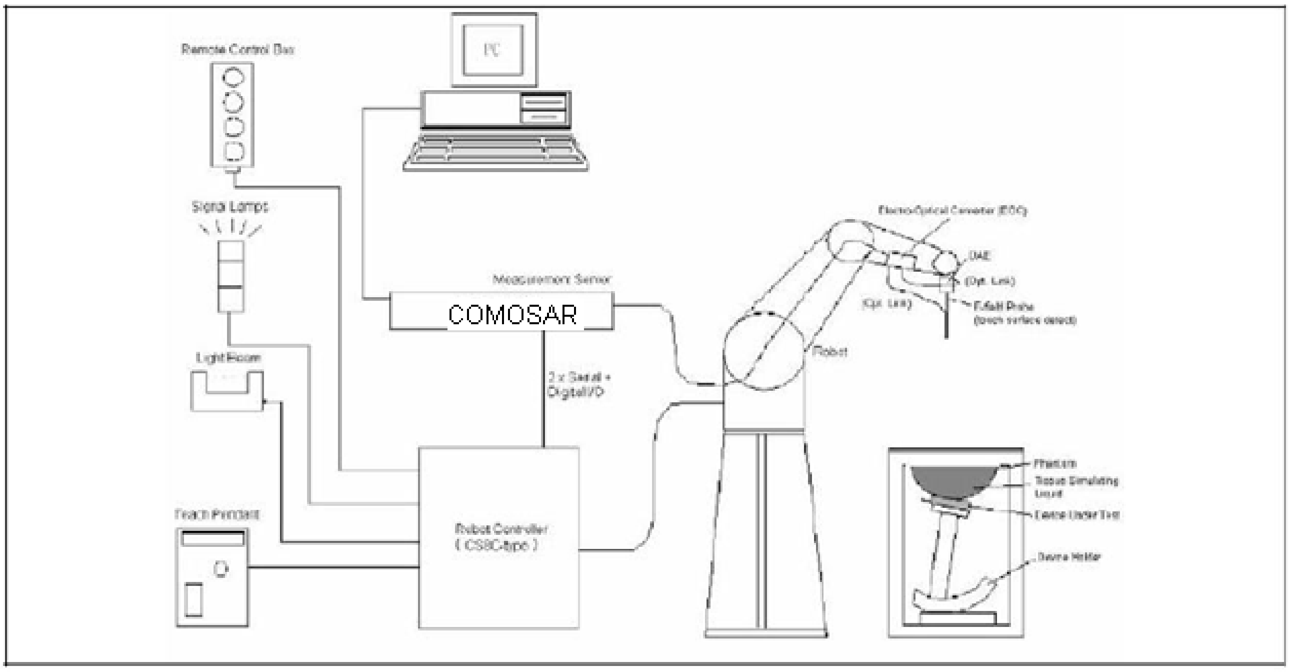
1.3. Test Environment

Ambient conditions in the laboratory:

Items	Required	Actual
Temperature (°C)	18-25	21± 2
Humidity (%RH)	30-70	55±2

2. SAR Measurement System

2.1. COMOSAR System Description



The COMOSAR system for performing compliance tests consists of the following items:

A standard high precision 6-axis robot with controller, teach pendant and software.

An arm extension for accommodating the data acquisition electronics (DAE).

A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection,
collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.

The Electro-optical converter (EOC) performs the conversion from optical to electrical signals for the digital Communicate to the DAE. To use optical surface detection, a special version of the EOC is required. The EOC signal is transmitted to the measurement server.

The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.

A computer running WinXP and the Opensar software.

Remote control and teach pendant as well as additional circuitry for robot safety such as warning lamps, etc.

The phantom, the device holder and other accessories according to the targeted measurement.

2.1.1. Applications

Predefined procedures and evaluations for automated compliance testing with all worldwide standards, e.g., IEEE 1528, OET 65, IEC 62209-1, IEC 62209-2, EN 50360, EN 50383 and others.

2.1.2. Area Scans

Area scans are defined prior to the measurement process being executed with a user
defined variable spacing between each measurement point (integral) allowing low uncertainty measurements to be conducted. Scans defined for FCC applications utilize a 10mm² step integral, with 1mm interpolation used to locate the peak SAR area used for zoom scan assessments.
When an Area Scan has measured all reachable points, it computes the field maxima found in the scanned area, within a range of the global maximum. The range (in dB) is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE 1528-2003, EN 50361 and IEC 62209 standards, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard (Japan).

2.1.3. Zoom Scan (Cube Scan Averaging)

Zoom Scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. A density of 1000 kg/m³ is used to represent the head and body tissue density and not the phantom liquid density, in order to be consistent with the definition of the liquid dielectric properties, i.e. the side length of the 1 g cube is 10mm, with the side length of the 10 g cube 21,5mm.
The zoom scan integer steps can be user defined so as to reduce uncertainty, but normal practice for typical test applications utilize a physical step of 7x7x7 (5mmx5mmx5mm) providing a volume of 30mm in the X & Y axis, and 30mm in the Z axis.

2.1.4. Uncertainty of Inter-/Extrapolation and Averaging

In order to evaluate the uncertainty of the interpolation, extrapolation and averaged SAR calculation algorithms of the Post processor, COMOSAR allows the generation of measurement grids which are artificially predefined by analytically based test functions. Therefore, the grids of area scans and zoom scans can be filled with uncertainty test data, according to the SAR benchmark functions of IEEE 1528.The three analytical functions shown in equations as below are used to describe the possible range of the expected SAR distributions for the tested handsets. The field gradients are covered by the spatially flat distribution f1, the spatially steep distribution f3 and f2 accounts for H-field cancellation on the phantom/tissue surface.

$$f_1(x,y,z) = Ae^{-\frac{z}{2a}} \cos^2\left(\frac{\pi}{2}\frac{\sqrt{x'^2+y'^2}}{5a}\right)$$

$$f_2(x,y,z) = Ae^{-\frac{z}{a}} \frac{a^2}{a^2+x'^2}\left(3-e^{-\frac{2z}{a}}\right)\cos^2\left(\frac{\pi}{2}\frac{y'}{3a}\right)$$

$$f_3(x,y,z) = A\frac{a^2}{\frac{a^2}{4}+x'^2+y'^2}\left(e^{-\frac{2z}{a}}+\frac{a^2}{2(a+2z)^2}\right)$$

2.2. COMOSAR E-Field Probe

The SAR measurement is conducted with the dissymmetric probe manufactured by SPEAG.
The probe is specially designed and calibrated for use in liquid with high permittivity. The dissymmetric probe has special calibration in liquid at different frequency.
SPEAG conducts the probe calibration in compliance with international and national standards (e.g. IEEE 1528, EN62209-1, IEC 62209, etc.) Under ISO17025. The calibration data are in Appendix D.

2.2.1. Isotropic E-Field Probe Specification

Model	EP159	
Manufacture	Satimo	
frequency	0.3 GHz-3 GHz Linearity:±0.2dB(300 MHz-3 GHz)	
Dynamic Range	0.01W/Kg-100W/Kg Linearity:±0.2dB	
Dimensions	Overall length:330mm Length of individual dipoles:4.5mm Maximum external diameter:8mm Probe Tip external diameter:5mm Distance between dipoles/ probe extremity:2.7mm	
Application	High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields). Only probe which enables compliance testing for frequencies up to 3 GHz with precision of better 30%.	

2.3. Robot

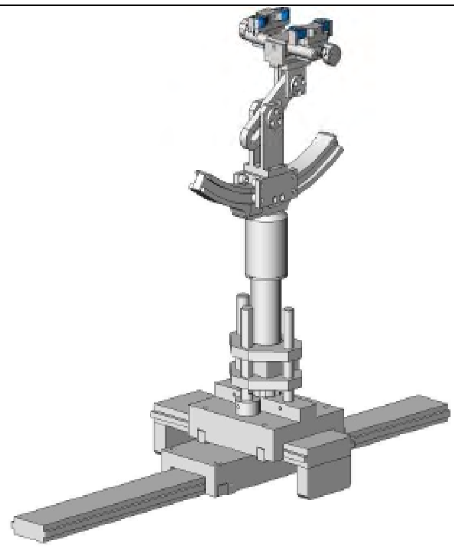
The COMOSAR system uses the high precision robots TX90 XL type out of the newer series from Satimo SA (France).For the 6-axis controller COMOSAR system, the KUKA robot controller version from Satimo is used.
The XL robot series have many features that are important for our application:

High precision (repeatability 0.02 mm)
High reliability (industrial design)
Jerk-free straight movements
Low ELF interference (the closed metallic construction shields against motor control fields)
6-axis controller

2.4. Video Positioning System

The video positioning system is used in OpenSAR to check the probe. Which is composed of a camera, LED, mirror and mechanical parts. The camera is piloted by the main computer with firewire link. During the process, the actual position of the probe tip with respect to the robot arm is measured, as well as the probe length and the horizontal probe offset. The software then corrects all movements, such that the robot coordinates are valid for the probe tip. The repeatability of this process is better than 0.1 mm. If a position has been taught with an aligned probe, the same position will be reached with another aligned probe within 0.1 mm, even if the other probe has different dimensions. During probe rotations, the probe tip will keep its actual position.	

2.5. Device Holder

The COMOSAR device holder is designed to cope with different positions given in the standard. It has two scales for the device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear reference points). The rotation center for both scales is the ear reference point (EPR). Thus the device needs no repositioning when changing the angles. The COMOSAR device holder has been made out of low-loss POM material having the following dielectric parameters: relative permittivity εr =3 and loss tangent δ = 0.02. The amount of dielectric material has been reduced in the closest vicinity of the device, since measurements have suggested that the influence of the clamp on the test results could thus be lowered.	

2.6. SAM Twin Phantom

The SAM twin phantom is a fiberglass shell phantom with 2mm shell thickness (except the ear region where shell thickness increases to 6mm). It has three measurement areas: Left head Right head Flat phantom	

The bottom plate contains three pair of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections. A white cover is provided to tap the phantom during off-periods to prevent water evaporation and changes in the liquid parameters. On the phantom top, three reference markers are provided to identify the phantom position with respect to the robot.

3. Tissue Simulating Liquid

3.1. The composition of the tissue simulating liquid

Ingredient	850MHz	850MHz	1800MHz	1800MHz	1900MHz	1900MHz
(% Weight)	Head	Body	Head	Body	Head	Body
Water	40.45	52.4	54.90	40.5	54.90	40.5
Salt	1.42	1.40	0.18	0.50	0.18	0.50
Sugar	57.6	45.0	0.00	58.0	0.00	58.0
HEC	0.40	1.00	0.00	0.50	0.00	0.50
Preventol	0.10	0.20	0.00	0.50	0.00	0.50
DGBE	0.00	0.00	44.92	0.00	44.92	0.00
TWEEN	0.00	0.00	0.00	0.00	0.00	0.00

3.2. Tissue Calibration Result

The dielectric parameters of the liquids were verified prior to the SAR evaluation using COMOSAR Dielectric Probe Kit and R&S Network Analyzer ZVL6 .

Tissue Stimulant Measurement for 850MHz					
Frequency (MHz)	**Parts**	**Description**	**Dielectric Parameters**		**Tissue Temp [°C]**
850MHz	Head	Reference result ±5% window	εr 41.50 39.425-43.575	δ[s/m] 0.90 0.855-0.945	N/A
		Mar.21, 2013	41.68	0.91	21
850MHz	Body	Reference result ±5% window	εr 55.20 52.44-57.96	δ[s/m] 0.97 0.9215-1.0185	N/A
		Mar.21, 2013	53.45	0.98	21

Tissue Stimulant Measurement for 1700 MHz					
Frequency (MHz)	**Parts**	**Description**	**Dielectric Parameters**		**Tissue Temp [°C]**
1700MHz	Head	Reference result ±5% window	εr 40.00 38.00-42.00	δ[s/m] 1.40 1.33-1.47	N/A
		Mar.21, 2013	41.36	1.43	21
	Body	Reference result ±5% window	εr 53.30 50.635-55.965	δ[s/m] 1.52 1.444-1.596	N/A
		Mar.21, 2013	53.15	1.49	21

Tissue Stimulant Measurement for 1900 MHz					
Frequency (MHz)	**Parts**	**Description**	**Dielectric Parameters**		**Tissue Temp [°C]**
1900MHz	Head	Reference result ±5% window	εr 40.00 38.00-42.00	δ[s/m] 1.40 1.33-1.47	N/A
		Mar.21, 2013	40.18	1.39	21
1900MHz	Body	Reference result ±5% window	εr 53.30 50.635-55.965	δ[s/m] 1.52 1.444-1.596	N/A
		Mar.21, 2013	52.73	1.50	21

3.3. Tissue Dielectric Parameters for Head and Body Phantoms

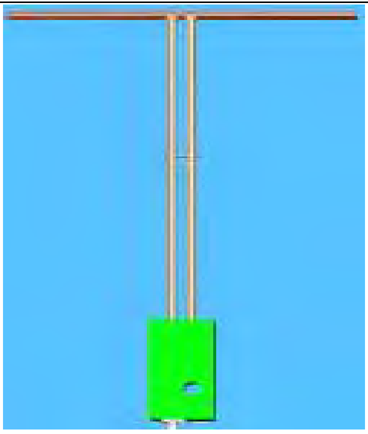
The head tissue dielectric parameters recommended by the IEEE SCC-34/SC-2 in P1528 have been incorporated in the following table. These head parameters are derived from planar layer models simulating the highest expected SAR for the dielectric properties and tissue thickness variations in a human head. Other head and body tissue parameters that have not been specified in P1528 are derived from the tissue dielectric parameters computed from the 4-Cole-Cole equations described in Reference [12] and extrapolated according to the head parameters specified in P1528.

Target Frequency (MHz)	head		body	
	εr	σ (S/m)	εr	σ (S/m)
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
850	**41.5**	**0.90**	**55.2**	**0.97**
900	41.5	0.97	55.0	1.05
915	41.5	1.01	55.0	1.06
1450	40.5	1.20	54.0	1.30
1610	40.3	1.29	53.8	1.40
1800 – 2000	**40.0**	**1.40**	**53.3**	**1.52**
2450	39.2	1.80	52.7	1.95
3000	38.5	2.40	52.0	2.73
5800	35.3	5.27	48.2	6.00

(εr = relative permittivity, σ = conductivity and ρ = 1000 kg/m3)

4. SAR Measurement Procedure

4.1. SAR System Validation
4.1.1. Validation Dipoles



The dipoles used is based on the IEEE-1528 standard, and is complied with mechanical and electrical specifications in line with the requirements of both IEEE and FCC Supplement C. the table below provides details for the mechanical and electrical Specifications for the dipoles.

Frequency	L (mm)	h (mm)	d (mm)
900 MHz	149	83.3	3.6
1800MHz	71.6	41.7	3.6
1900MHz	68	39.5	3.6

4.1.2. Validation Result

System Performance Check at 850 MHz &1700MHz&1900MHz				
Validation Kit: SN 46/11DIP 0G900-185				
Frequency [MHz]	Description	SAR [w/kg] 1g	SAR [w/kg] 10g	Tissue Temp.[°C]
850 MHz	Reference result ± 10% window	10.9 9.81 to 11.99	6.99 6.29 to 7.69	N/A
	Mar.21, 2013	11.04	6.79	21.0
Validation Kit: SN 46/11DIP 1G800-186				
Frequency [MHz]	Description	SAR [w/kg] 1g	SAR [w/kg] 10g	Tissue Temp.[°C]
1700 MHz	Reference result ± 10% window	38.4 34.56 to 42.24	20.1 18.09 to 22.11	N/A
	Mar.21, 2013	39.05	21.04	21
Validation Kit: SN 46/11DIP 1G900-187				
Frequency [MHz]	Description	SAR [w/kg] 1g	SAR [w/kg] 10g	Tissue Temp.[°C]
1900 MHz	Reference result ± 10% window	39.7 35.73 to 43.67	20.5 18.45 to 22.55	N/A
	Mar.21, 2013	41.14	20.98	21.0
Note: All SAR values are normalized to 1W forward power.				

4.2. SAR Measurement Procedure

The COMOSAR calculates SAR using the following equation,

$$SAR = \frac{\sigma|E|^2}{\rho}$$

σ: represents the simulated tissue conductivity
ρ: represents the tissue density

The EUT is set to transmit at the required power in line with product specification, at each frequency relating to the LOW, MID, and HIGH channel settings.

Pre-scans are made on the device to establish the location for the transmitting antenna, using a large area scan in either air or tissue simulation fluid.

The EUT is placed against the Universal Phantom where the maximum area scan dimensions are larger than the physical size of the resonating antenna. When the scan size is not large enough to cover the peak SAR distribution, it is modified by either extending the area scan size in both the X and Y directions, or the device is shifted within the predefined area.

The area scan is then run to establish the peak SAR location (interpolated resolution set at $1mm^2$) which is then used to orient the center of the zoom scan. The zoom scan is then executed and the 1g and 10g averages are derived from the zoom scan volume (interpolated resolution set at $1mm^3$).

When multiple peak SAR location were found during the same configuration or test mode, Zoom scan shall performed on each peak SAR location, only the peak point with maximum SAR value will be reported for the configuration or test mode.

5. SAR Exposure Limits

SAR assessments have been made in line with the requirements of IEEE-1528, FCC Supplement C, and comply with ANSI/IEEE C95.1-1992 “Uncontrolled Environments” limits. These limits apply to a location which is deemed as “Uncontrolled Environment” which can be described as a situation where the general public may be exposed to an RF source with no prior knowledge or control over their exposure.

Limits for General Population/Uncontrolled Exposure (W/kg)

Type Exposure	Uncontrolled Environment Limit
Spatial Peak SAR (1g cube tissue for brain or body)	1.60 W/kg

6. Test Equipment List

Equipment description	Manufacturer/Model	Identification No.	Current calibration date	Next calibration date
SAR Probe	Satimo	SN 22/12 EP159	12/11/2012	12/10/2013
Phantom	Satimo	SN_4511_SAM90	Validated. No cal required.	Validated. No cal required.
Liquid	Satimo	-	Validated. No cal required.	Validated. No cal required.
Comm Tester	R&S - CMU200	069Y7-158-13-712	02/28/2013	02/27/2014
Comm Tester	Agilent-8960	GB46310822	10/22/2012	10/21/2013
Multimeter	Keithley 2000	1188656	02/28/2013	02/27/2014
Dipole	Satimo SID900	SN46/11 DIP 0G900-185	12/09/2011	12/08/2013
Dipole	Satimo SID1800	SN46/11 DIP 1G800-186	12/09/2011	12/08/2013
Dipole	Satimo SID1900	SN46/11 DIP 1G900-187	12/09/2011	12/08/2013
Amplifier	Aethercomm	SN 046	12/08/2012	12/07/2013
Signal Generator	Agilent-E4421B	MY43351603	5/29/2012	5/28/2013
Power Meter	HP E4418A	US38261498	02/28/2013	02/27/2014
Network Analyzer	Rhode & Schwarz ZVA	SN100132	02/28/2013	02/27/2014

Note: Per KDB 50824 Dipole SAR Validation Verification, AGC Lab has adopted 3 years calibration intervals. On annual basis, every measurement dipole has been evaluated and is in compliance with the following criteria:
1. There is no physical damage on the dipole;
2. System validation with specific dipole is within 10% of calibrated value;
3. Return-loss is within 20% of calibrated measurement;
4. Impedance is within 5Ω of calibrated measurement.

7. Measurement Uncertainty

Satimo Uncertainty Measurement uncertainty for 300 MHz to 6 GHz averaged over 1 gram / 10 gram.									
Error Description	Sec	Tol (±%)	Prob. Dist.	Div.	(Ci) 1g	(Ci) 10g	Std. Unc. (1g) (±%)	Std. Unc. (10g)(±%)	(Vi) Veff
Measurement System									
Probe Calibration	E.2.1	6	N	1	1	1	6	6	∞
Axial Isotropy	E.2.2	3	R	$\sqrt{3}$	$(1-c_p)^{1/2}$	$(1-c_p)^{1/2}$	1.22474	1.22474	∞
Hemispherical Isotropy	E.2.2	5	R	$\sqrt{3}$	$\sqrt{C_p}$	$\sqrt{C_p}$	2.04124	2.04124	∞
Boundary Effects	E.2.3	1	R	$\sqrt{3}$	1	1	0.57735	0.57735	∞
Linearity	E.2.4	5	R	$\sqrt{3}$	1	1	2.88675	2.88675	∞
System Detection Limits	E.2.5	1	R	$\sqrt{3}$	1	1	0.57735	0.57735	∞
Readout Electronics	E.2.6	0.5	N	1	1	1	0.5	0.5	∞
Response Time	E.2.7	0.2	R	$\sqrt{3}$	1	1	0.11547	0.11547	∞
Integration Time	E.2.8	2	R	$\sqrt{3}$	1	1	1.1547	1.1547	∞
RF Ambient Noise	E.6.1	3	R	$\sqrt{3}$	1	1	1.73205	1.73205	∞
Probe Positioner Mechanical Tolerance	E.6.2	2	R	$\sqrt{3}$	1	1	1.1547	1.1547	∞
Probe Positioning with Respect to Phantom Shell	E.6..3	1	R	$\sqrt{3}$	1	1	0.57735	0.57735	∞
Extrapolation,interpolation and Integration Algorithms for Max. SAR Evaluation	E.5.2	1.5	R	$\sqrt{3}$	1	1	0.86603	0.86603	∞
Dipole									
Device Positioning	8,E.4.2	1	N	$\sqrt{3}$	1	1	0.57735	0.57735	N-1
Power Drift	8.6.6.2	2	R	$\sqrt{3}$	1	1	1.1547	1.1547	∞
Phantom and Tissue Parameters									
Phantom Uncertainty	E.3.1	4	R	$\sqrt{3}$	1	1	2.3094	2.3094	∞
Liquid Conductivity (target)	E.3.2	5	R	$\sqrt{3}$	0.64	0.43	1.84752	1.2413	∞
Liquid Conductivity (meas.)	E.3.3	2.5	N	1	0.64	0.43	1.6	1.075	∞
Liquid Permittivity (target)	E.3.2	3	R	$\sqrt{3}$	0.6	0.49	1.03923	0.8487	∞
Liquid Permittivity (meas.)	E.3.3	2.5	N	1	0.6	0.49	1.5	1.225	M
Combined Standard Uncertainty			RSS				8.09272	7.9296	
Expanded Uncertainty (95%CONFIDENCE INTERVAL)			k				16.18544	15.8592	

8. Conducted Power Measurement

GSM BAND

Mode	Frequency(MHz)	Peak Power	Avg. Burst Power(dBm)	Duty cycle Factor(dBm)	Frame Power(dBm)
Maximum Power <1>					
GSM850	824.2	**32.74**	**31.59**	-9	22.59
	836.6	32.67	31.46	-9	22.46
	848.8	32.60	31.49	-9	22.49
GPRS850 (1 Slot)	824.2	32.66	31.40	-9	22.40
	836.6	32.62	31.31	-9	22.31
	848.8	32.59	30.30	-9	21.30
GPRS850 (2 Slot)	824.2	29.79	28.67	-6	**22.67**
	836.6	29.76	28.67	-6	22.67
	848.8	29.70	28.59	-6	22.59
GPRS850 (3 Slot)	824.2	27.66	26.65	-4.26	22.39
	836.6	27.61	26.66	-4.26	22.40
	848.8	27.59	26.60	-4.26	22.34
GPRS850 (4 Slot)	824.2	26.78	25.67	-3	22.67
	836.6	26.77	25.62	-3	22.62
	848.8	26.69	25.59	-3	22.59
PCS1900	1850.2	**29.71**	**28.61**	-9	19.61
	1880	29.67	28.58	-9	19.58
	1909.8	29.63	28.51	-9	19.51
GPRS1900 (1 Slot)	1850.2	29.76	28.46	-9	19.46
	1880	29.72	28.42	-9	19.42
	1909.8	29.69	28.39	-9	19.39
GPRS1900 (2 Slot)	1850.2	26.59	25.60	-6	19.60
	1880	26.57	25.59	-6	19.59
	1909.8	26.52	25.54	-6	19.54
GPRS1900 (3 Slot)	1850.2	25.07	24.47	-4.26	**20.21**
	1880	25.13	24.43	-4.26	20.17
	1909.8	25.11	24.40	-4.26	20.14
GPRS1900 (4 Slot)	1850.2	23.76	22.61	-3	19.61
	1880	23.7	22.59	-3	19.59
	1909.8	23.69	22.57	-3	19.57
Maximum Power <2>					
GSM 850	824.2	32.47	31.48	-9	22.48
PCS1900	1850.2	29.56	28.53	-9	19.53

Note 1:
The Frame Power (Source-based time-averaged Power) is scaled the maximum burst average power based on time slots. The calculated methods are show as following:
Frame Power = Max burst power (1 Up Slot) – 9 dB
Frame Power = Max burst power (2 Up Slot) – 6 dB
Frame Power = Max burst power (3 Up Slot) – 4.26 dB
Frame Power = Max burst power (4 Up Slot) – 3 dB

UMTS BAND V

Mode	Frequency (MHz)	Peak Power	Avg. Burst Power
WCDMA 850 RMC	826.4	**23.59**	**23.46**
	835.0	23.56	23.41
	846.6	23.51	23.38
WCDMA 850 AMR	826.4	23.49	23.38
	835.0	23.47	22.35
	846.6	23.42	22.32
HSPA Subtest 1	826.4	22.91	22.32
	835.0	22.86	22.33
	846.6	22.85	22.24
HSPA Subtest 2	826.4	22.82	22.28
	835.0	22.80	22.22
	846.6	22.77	22.26
HSPA Subtest 3	826.4	22.75	22.22
	835.0	22.77	22.23
	846.6	22.71	22.21
HSPA Subtest 4	826.4	22.67	22.29
	835.0	22.71	22.27
	846.6	22.67	22.25
HSPA Subtest 5	826.4	22.75	22.33
	835.0	22.78	22.32
	846.6	22.82	22.35

UMTS BAND IV

Mode	Frequency (MHz)	Peak Power	Avg. Burst Power
WCDMA 1700 RMC	1712.5	**22.93**	**22.59**
	1732.5	22.85	22.55
	1752.5	22.88	22.56
WCDMA 1700 AMR	1712.5	22.75	22.47
	1732.5	22.78	22.41
	1752.5	22.81	22.40
HSPA Subtest 1	1712.5	22.70	22.36
	1732.5	22.73	22.38
	1752.5	22.72	22.31
HSPA Subtest 2	1712.5	22.56	22.32
	1732.5	22.52	22.26
	1752.5	22.51	22.27
HSPA Subtest 3	1712.5	22.50	22.26
	1732.5	22.49	22.27
	1752.5	22.48	22.25
HSPA Subtest 4	1712.5	22.56	22.29
	1732.5	22.49	22.30
	1752.5	22.58	22.31
HSPA Subtest 5	1712.5	22.75	22.36
	1732.5	22.76	22.38
	1752.5	22.71	22.41

According to 3GPP 25.101 sub-clause 6.2.2 , the maximum output power is allowed to be reduced by following the table.

Table 6.1aA: UE maximum output power with HS-DPCCH and E-DCH

UE Transmit Channel Configuration	CM(db)	MPR(db)
For all combinations of ,DPDCH,DPCCH HS-DPDCH,E-DPDCH and E-DPCCH	$0 \leq CM \leq 3.5$	MAX(CM-1,0)
Note: CM=1 for β_c/β_d=12/15, β_{hs}/β_c=24/15.For all other combinations of DPDCH, DPCCH, HS-DPCCH, E-DPDCH and E-DPCCH the MPR is based on the relative CM difference.		

The device supports MPR to solve linearity issues (ACLR or SEM) due to the higher peak-to average ratios (PAR) of the HSUPA signal. This prevents saturating the full range of the TX DAC inside of device and provides a reduced power output to the RF transceiver chip according to the Cubic Metric (a function of the combinations of DPDCH, DPCCH, HS-DPCCH, E-DPDCH and E-DPCCH).

When E-DPDCH channels are present the beta gains on those channels are reduced firsts to try to get the power under the allowed limit. If the beta gains are lowered as far as possible, then a hard limiting is applied at the maximum allowed level.
The SW currently recalculates the cubic metric every time the beta gains on the E-DPDCH are reduced. The cubic metric will likely get lower each time this is done .However, there is no reported reduction of maximum output power in the HSUPA mode since the device also provides a compensation for the power back-off by increasing the gain of TX_AGC in the transceiver (PA) device.

The end effect is that the DUT output power is identical to the case where there is no MPR in the device.

9. Test Results

9.1. SAR Test Results Summary

9.1.1. Test position and configuration

Head SAR was performed with the device configured in the positions according to IEEE1528, and Body SAR was performed with the device 15mm from the phantom. Body SAR was also performed with the headset attached and without.

9.1.2. Body SAR with Headset

Testing with the headset was performed at the position and channels that resulted in the highest body SAR. This testing was performed with GPRS transmitting with 2/3/4 uplink timeslots. This operation mode represents the maximum SAR situation, when downloading data via GPRS and listening to music by headset. SAR without the headset attached was significantly higher than with the headset, and also was verified several times and confirmed, so the final test data shown were the worst case without headset. In the Body SAR test result table, body-worn means display of device down, body-front means display of device up.

9.1.3. Operation Mode

This is a multi-slot class 12 device capable of 4 uplink timeslots. During the head SAR test, the device was transmitting with maximum 1 uplink timeslot; during the body SAR test, it was transmitting with maximum 4 uplink timeslots. Additionally, this device doesn’t support dual transfer mode (DTM).

9.1.5. SAR Test Results Summary

SAR MEASUREMENT								
Ambient Temperature (°C) : 21 ± 2					Relative Humidity (%): 55			
Liquid Temperature (°C) : 21 ± 2					Depth of Liquid (cm):>15			
Product: WCDMA MOBILE PHONE								
Test Mode: GSM850 with GMSK modulation								
Configuration			Antenna Position	Frequency		Power Drift (<±5%)	SAR (1g) (W/kg)	Limit (W/kg)
SIM	Position	Status		channel	MHz			
<1>	Left Head	Cheek	Fixed	128	824.2	--	--	--
				190	836.6	1.24	0.182	1.6
				251	848.8	--	--	--
		Tilted	Fixed	128	824.2	--	--	--
				190	836.6	-0.95	0.134	1.6
				251	848.8	--	--	--
	Right Head	Cheek	Fixed	128	824.2	--	--	--
				190	836.6	2.34	**0.275**	1.6
				251	848.8	--	--	--
		Tilted	Fixed	128	824.2	--	--	--
				190	836.6	-1.42	0.105	1.6
				251	848.8	--	--	--
<2>	Right	Cheek	Fixed	190	836.6	2.08	0.235	1.6
Note: when the 1-g SAR is ≤ 0.8 W/kg, testing for low and high channel is optional. refer to KDB 941225.								

SAR MEASUREMENT								
Ambient Temperature (°C) : 21 ± 2					Relative Humidity (%): 55			
Liquid Temperature (°C) : 21 ± 2					Depth of Liquid (cm):>15			
Product: WCDMA MOBILE PHONE								
Test Mode: GSM850 with GMSK modulation								
Configuration			Antenna Position	Frequency		Power Drift (<±5%)	SAR (1g) (W/kg)	Limit (W/kg)
SIM	Position	Status		channel	MHz			
<1>	Body back	GPRS 2 TS	Fixed	128	824.2	--	--	--
				190	836.6	1.52	**0.286**	1.6
				251	848.8	--	--	--
	Body Front	GPRS 2 TS	Fixed	128	824.2	--	--	--
				190	836.6	0.84	0.208	1.6
				251	848.8	--	--	--
	Body back	GPRS 2 TS with Earphone	Fixed	128	824.2	--	--	--
				190	836.6	2.12	0.263	1.6
				251	848.8	--	--	--
Note: when the 1-g SAR is ≤ 0.8 W/kg, testing for low and high channel is optional. refer to KDB 941225.								

SAR MEASUREMENT

Ambient Temperature (°C) : 21 ± 2	Relative Humidity (%): 55
Liquid Temperature (°C) : 21 ± 2	Depth of Liquid (cm):>15

Product: WCDMA MOBILE PHONE

Test Mode: PCS1900 with GMSK modulation

Configuration			Antenna Position	Frequency		Power Drift (<±5%)	SAR (1g) (W/kg)	Limit (W/kg)
SIM	Position	Status		channel	MHz			
<1>	Left Head	Cheek	Fixed	512	1850.2	--	--	--
				661	1880.0	2.02	**0.385**	1.6
				810	1909.8	--	--	--
		Tilted	Fixed	512	1850.2	--	--	--
				661	1880.0	2.12	0.064	1.6
				810	1909.8	--	--	--
	Right Head	Cheek	Fixed	512	1850.2	--	--	--
				661	1880.0	-0.95	0.238	1.6
				810	1909.8	--	--	--
		Tilted	Fixed	512	1850.2	--	--	--
				661	1880.0	2.53	0.097	1.6
				810	1909.8	--	--	--
<2>	Left	Cheek	Fixed	661	1880.0	-1.84	0.370	1.6

Note: when the 1-g SAR is ≤ 0.8 W/kg, testing for low and high channel is optional. refer to KDB 941225.

SAR MEASUREMENT

Ambient Temperature (°C) : 21 ± 2	Relative Humidity (%): 55
Liquid Temperature (°C) : 21 ± 2	Depth of Liquid (cm):>15

Product: WCDMA MOBILE PHONE

Test Mode: PCS1900 with GMSK modulation

Configuration			Antenna Position	Frequency		Power Drift (<±5%)	SAR (1g) (W/kg)	Limit (W/kg)
SIM	Position	Status		channel	MHz			
<1>	Body Back	GPRS 3 TS	Fixed	512	1850.2	--	--	--
				661	1880.0	0.95	**0.379**	1.6
				810	1909.8	--	--	--
	Body front	GPRS 3 TS	Fixed	512	1850.2	--	--	--
				661	1880.0	-1.21	0.215	1.6
				810	1909.8	--	--	--
	Body Back	GPRS 3 TS with Earphone	Fixed	512	1850.2	--	--	1.6
				661	1880.0	0.57	0.227	--
				810	1909.8	--	--	1.6

Note: when the 1-g SAR is ≤ 0.8 W/kg, testing for low and high channel is optional. refer to KDB 941225.

SAR MEASUREMENT

Ambient Temperature (°C) : 21 ± 2	Relative Humidity (%): 55
Liquid Temperature (°C) : 21 ± 2	Depth of Liquid (cm):>15

Product: WCDMA MOBILE PHONE

Test Mode: WCDMA Band V with QPSK modulation

Configuration			Antenna Position	Frequency		Power Drift (<±5%)	SAR (1g) (W/kg)	Limit (W/kg)
SIM	Position	Status		channel	MHz			
<1>	Left Head	Cheek	Fixed	4132	826.4	--	--	--
				4182	835.0	-0.95	**0.427**	1.6
				4233	846.6	--	--	--
		Tilted	Fixed	4132	826.4	--	--	--
				4182	835.0	1.21	0.300	1.6
				4233	846.6	--	--	--
	Right Head	Cheek	Fixed	4132	826.4	--	--	--
				4182	835.0	-0.67	0.295	1.6
				4233	846.6	--	--	--
		Tilted	Fixed	4132	826.4	--	--	--
				4182	835.0	0.94	0.259	1.6
				4233	846.6	--	--	--

Note: when the 1-g SAR is ≤ 0.8 W/kg, testing for low and high channel is optional. refer to KDB 941225.

SAR MEASUREMENT

Ambient Temperature (°C) : 21 ± 2	Relative Humidity (%): 55
Liquid Temperature (°C) : 21 ± 2	Depth of Liquid (cm):>15

Product: WCDMA MOBILE PHONE

Test Mode: WCDMA Band V with QPSK modulation

Configuration			Antenna Position	Frequency		Power Drift (<±5%)	SAR (1g) (W/kg)	Limit (W/kg)
SIM	Position	Status		channel	MHz			
<1>	Body	RMC (towards grounds)	Fixed	4132	826.4	--	--	--
				4182	835.0	-0.86	**0.433**	1.6
				4233	846.6	--	--	--
		RMC (towards phantom)	Fixed	4132	826.4	--	--	--
				4182	835.0	0.63	0.170	1.6
				4233	846.6	--	--	--
		HSPA (towards grounds)	Fixed	4132	826.4	--	--	--
				4182	835.0	1.25	0.159	1.6
				4233	846.6	--	--	--
		HSPA Earphone (towards grounds)	Fixed	4132	826.4	--	--	--
				4182	835.0	0.63	0.257	1.6
				4233	846.6	--	--	--

Note: when the 1-g SAR is ≤ 0.8 W/kg, testing for low and high channel is optional. refer to KDB 941225.

SAR MEASUREMENT

Ambient Temperature (°C) : 21 ± 2	Relative Humidity (%): 55
Liquid Temperature (°C) : 21 ± 2	Depth of Liquid (cm):>15

Product: WCDMA MOBILE PHONE

Test Mode: WCDMA Band IV with QPSK modulation

Configuration			Antenna Position	Frequency		Power Drift (<±5%)	SAR (1g) (W/kg)	Limit (W/kg)
SIM	Position	Status		channel	MHz			
<1>	Left Head	Cheek	Fixed	1887	1712.5	--	--	--
				1987	1732.5	-0.96	**0.334**	1.6
				2087	1752.5	--	--	--
		Tilted	Fixed	1887	1712.5	--	--	--
				1987	1732.5	2.02	0.111	1.6
				2087	1752.5	--	--	--
	Right Head	Cheek	Fixed	1887	1712.5	--	--	--
				1987	1732.5	1.65	0.259	1.6
				2087	1752.5	--	--	--
		Tilted	Fixed	1887	1712.5	--	--	--
				1987	1732.5	-2.36	0.113	1.6
				2087	1752.5	--	--	--

Note: when the 1-g SAR is ≤ 0.8 W/kg, testing for low and high channel is optional. refer to KDB 941225.

SAR MEASUREMENT

Ambient Temperature (°C) : 21 ± 2	Relative Humidity (%): 55
Liquid Temperature (°C) : 21 ± 2	Depth of Liquid (cm):>15

Product: WCDMA MOBILE PHONE

Test Mode: WCDMA Band IV with QPSK modulation

Configuration			Antenna Position	Frequency		Power Drift (<±5%)	SAR (1g) (W/kg)	Limit (W/kg)
SIM	Position	Status		channel	MHz			
<1>	Body	RMC (towards grounds)	Fixed	1887	1712.5	--	--	--
				1987	1732.5	-0.03	**0.264**	1.6
				2087	1752.5	--	--	--
		RMC (towards phantom)	Fixed	1887	1712.5	--	--	--
				1987	1732.5	-0.01	0.117	1.6
				2087	1752.5	--	--	--
		HSPA (towards grounds)	Fixed	1887	1712.5	--	--	--
				1987	1732.5	-0.04	0.120	1.6
				2087	1752.5	--	--	--
		RMC Earphone (towards grounds)	Fixed	1887	1712.5	--	--	--
				1987	1732.5	-0.02	0.230	1.6
				2087	1752.5	--	--	--

Note: when the 1-g SAR is ≤ 0.8 W/kg, testing for low and high channel is optional. refer to KDB 941225.

Simultaneous Multi-band Transmission Evaluation:

Application Simultaneous Transmission information:

Position	Simultaneous state
Head	**1.WWAN(voice)+WLAN 2.4GHz band**
	2.WWAN(voice)+Bluetooth
Body	**4. WWAN(voice)+WLAN 2.4GHz band**
	5. WWAN(voice)+Bluetooth

NOTE:

1. WLAN and BT share the same antenna, and cannot transmit simultaneously.
2. Simultaneous with every transmitter must be the same test position.
3. Based upon KDB 447498 D01 v05, BT SAR is excluded as below table.
4. Based upon KDB 447498 D01 v05,for handsets the test separation distance is determined by the smallest distance between the outer surface of the device and the user; which is 0mm for head SAR AND 15mm for body-worn SAR.
5. If the test separation distance is <5mm,5mm is used for excluded SAR calculation.
6. For minimum test separation distance≦50mm,Bluetooth standalone SAR is excluded according to *[(max. power of channel , including tune-up tolerance, mW)/(min. test separation distance ,mm) ·[√f (GHz) /x] ≦3.0 for 1-g SAR and ≦7.5 for 10-g extremity SAR*
7. KDB 447498 / 4.3.2 (2) 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:
   a) (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.
   b) 0.4W/Kg for 1-g SAR and 1.0W/Kg for 10-g SAR, when the separation distance is >50mm.

		Maximum Power		Antenna to user (mm)	SAR exclusion threshold (mW)	SAR testing required （Yes/No）	Head (0mm gap)	Body (15mm gap)
		dBm	mW					
BT	Head	2.83	1.919	5	10	NO	0.0954 W/kg	0.0127 W/kg
	Body			15	29	NO		
WIFI	Head	8.47	7.031	5	10	NO	0.2942 W/kg	0.0392 W/kg
	Body			15	29	NO		

Maximum test results (WWAN) with BT and WIFI Simultaneous Transmission SAR:

Head (WWAN(voice)+BT): 0.427 W/kg +0.0954 W/kg = 0.5224 W/kg
Body (WWAN(voice) +BT): 0.433 W/kg +0.0127 W/kg = 0.4457 W/kg
Head (WWAN(voice)+WLAN): 0.427 W/kg +0.2942 W/kg = 0.7212 W/kg
Body (WWAN(voice)+WLAN): 0.433 W/kg+0.0392 W/kg = 0.4722 W/kg