Gobi2000™ Module J9CGOBI2000-L 350x/2876 Notebook 1-g SAR Test Report

80-VP949-8 Rev. D

December 4, 2009

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Gobi2000™ Module J9CGOBI2000-L 350x/2876 Notebook 1-g SAR Test Report
80-VP949-8 Rev. D

Revision history

Revision	Date	Description
A	November 12, 2009	Initial release
B	November 16, 2009	Update collocated information; updated host model information
C	November 23, 2009	• Document title change • Host model reference changes
D	December 4, 2009	• Section 1.1 correction of antenna separation distance • Replace references to UNDP-1 with Gobi2000 module • Replace incorrect probe cal file and update equipment calibration table 6-2 • Replace incorrect DAE cal file and update equipment calibration table 6-2

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Overview

Test Report Reference:	80-VP949-8 Rev. D
Responsible Engineer:	John Forrester
Signature:	
Test Engineer:	Mark Ortlieb
Signature:	
Date of issue:	4 December 2009
Test Laboratory:	QUALCOMM Incorporated 5775 Morehouse Dr. San Diego CA 92121 (General Telephone) 1 858 587 1121
Model Tested:	Gobi2000 WWAN module with Lenovo model 350x/2876 netbook computer.
Test Specification Standard(s):	*FCC CFR47 Part 2.1093: Radiofrequency radiation exposure evaluation: portable devices* *FCC/OET Bulletin 65, including Supplement C, Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields* *FCC "SAR Measurement Procedures for 3G Devices" (October 2007)* *FCC "Mobile and Portable Device – RF Exposure Procedures and Equipment Authorization Policies" (KDB 447498)* *FCC "SAR Evaluation Considerations for Laptop Computers with Antennas Built-in on Display Screens" (KDB 616217)* *ANSI/IEEE P1528/D1.2 Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques*
Results:	The Gobi2000 module embedded in Lenovo host notebook model 350x/2876 complies with the requirements of the aforementioned standards and is in compliance with the FCC Part 2.1093 RF exposure limit.

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Tables

1. Test summary

1.1 Equipment tested

A Gobi2000 WWAN mPCIe card embedded in a Lenovo® notebook computer was tested for SAR compliance with FCC regulations. The host is representative of numerous models with the designations 3506, 3507, 3508 and 2876.

The model 350x/2876 netbook computer also has embedded Bluetooth and WLAN capabilities that were not tested as part of this test report. Separate test reports address WLAN RF exposure for WLAN transmitters. The WLAN and Bluetooth radios can transmit simultaneously with the WWAN radio, however collocated RF exposure is evaluated in a separate analysis from this report.

The WWAN antenna-to-user separation distance is 19.3 cm, and is therefore classified as a portable device requiring SAR measurement. The computer was tested for SAR in accordance with the FCC procedure KDB 616217 *SAR Evaluation Considerations for Laptop Computers with Antennas Built-in on Display Screens*.

1.2 Maximum (Worst Case Results)

Table 1-1 give SAR results for highest output power channels tested.

Table 1-1 Maximum SAR

Band	Mode	Channel	1 g SAR (mW/g)	Result
GSM850	GPRS-2UL	128	0.0281	Pass
PCS	EVDOr0	1175	0.00641	Pass

1.3 Measurement Uncertainty

Table 1-2 Measurement Uncertainty

Combined Standard Uncertainty	10.0%
Extended Standard Uncertainty (k=2)	20.1%

1.4 SAR Limits

Table 1-3 gives 1 gram SAR limits for general public for the frequency range of 10 MHz to 10 GHz as called out in FCC CFR 47 Part 2.1093.

Table 1-3 1 Gram SAR Limits

Localized SAR (head and trunk)	1.6 mW/g

2. EUT Description

2.1 General

Table 2-1 WWAN Module Information

WWAN Module Model	Gobi2000
WWAN Module FCC ID	J9CGOBI2000-L
WWAN Module Serial Number	11S60Y3182Z1ZHHZ98M02Z
WWAN Module Description	Gobi2000 is a PCI Express Mini Card with WWAN connectivity for the WCDMA/HSPA, GSM/GPRS/EDGE and CDMA2000 1x/1x-EVDO protocols, plus GPS position location.
Host(s) Tested:	Lenovo model 350x/2876
Host(s) Serial Number:	1S3506XXXLRL3172
WWAN Technologies	GSM/GPRS/EDGE CDMA 1x Rel0 CDMA EV-DO RevA WCDMA/HSPA
Equipment Categories	GPRS Category 10 EDGE Category 10 HSDPA Category 8 (Release 6) HSUPA Category 5 (Release 6)
TX Frequencies	GSM/GPRS/EDGE: 824.2 – 848.8 MHz GSM/GPRS/EDGE: 1850.2 – 1909.8 MHz CDMA 1x/EV-DO: 824.7 – 848.31 MHz CDMA 1x/EV-DO: 1851.25 – 1908.75 MHz WCDMA/HSPA: 826.4 – 846.6 MHz WCDMA/HSPA: 1852.4 – 1907.5 MHz Bands Not used in the United States: GSM/GPRS/EDGE: 880.2 – 914.8 MHz GSM/GPRS/EDGE: 1710.2 – 1784.8 MHz WCDMA/HSPA: 1922.6 – 1977.4 MHz
Duty Cycle(s)	CDMA/WCMDA: 100% GPRS 1 uplink slot: 12.5% GPRS 2 uplink slots: 25%
Power Supply	3.3Vdc supplied by host notebook computer

Table 2-2 Host Notebook Information

Host Notebook Model	Lenovo model 350x/2876
WLAN FCC/IC ID(s)	TX2-RTL8191SE-L / 6317A-RTL8191SE
Bluetooth FCC/IC ID(s)	QDS-BRCM1046 / 4324A-BRCM1046
UWB FCC IC	N/A
WWAN Antenna(s)	PIFA model QADCFL3_WW_M
BT Antenna(s)	N/A
WLAN Antenna(s)	N/A
WWAN to user separation distance (cm)	19.3 cm
WLAN to user separation distance (cm)	19.3 cm
Bluetooth to user separation distance (cm)	N/A
WWAN to WLAN antenna separation distance (cm)	0.5 cm
WWAN to Bluetooth antenna separation distance (cm)	N/A

3. Conducted Transmit Power Results

Conducted transmit power was tested in accordance with FCC 3G procedures, 3GPP and 3GPP2 standards. The test procedure for configuring the EUT to transmit at maximum output power is section 9.

All transmit power results are based on an average detector. The rational and calculations determining the SAR configurations tested per the FCC procedure are detailed in Section 4. *SAR Test Matrix.*

Table 3-1 GPRS Maximum Average Transmit Power (dBm)

	GSM850 Channel			GSM1900 Channel		
Mode	**128**	**190**	**251**	**512**	**661**	**810**
GPRS 2UL	25.3	25.3	25.1	23.2	23.2	23.1

Table 3-2 CDMA 1x/EV-DO Maximum Average Transmit Power (dBm)

REV	**CDMA BCO (850MHz)**			**CDMA BC1 (1900MHz)**		
RC/TAP	**Low**	**Mid**	**High**	**Low**	**Mid**	**High**
RC3 (SO55)	24.10	23.92	24.14	24.29	24.50	24.53
RTAP rate = 153.6kbps	24.05	23.86	23.92	24.23	24.43	24.60
RETAP - payload size = 4096	23.68	23.51	23.42	23.77	24.11	24.15

Table 3-3 WCDMA/HSPA Maximum Average Transmit Power Results (dBm)

		Band V Channel			**Band II Channel**		
Mode	**3GPP Subtest**	**Low**	**Mid**	**High**	**Low**	**Mid**	**High**
Rel99	R99	24.70	23.73	24.09	24.72	24.62	24.75
Rel6 HSDPA	1	23.74	23.77	23.67	24.10	24.57	24.21
	2	23.75	23.81	23.67	24.18	24.61	24.12
	3	23.74	24.61	23.65	24.62	23.66	24.14
	4	23.76	23.89	23.71	24.02	24.60	24.09
Rel6 HSUPA	1	23.78	23.06	23.77	23.92	23.90	24.08
	2	22.42	22.01	21.94	22.30	22.96	22.52
	3	22.59	22.10	21.75	21.79	22.61	21.75
	4	23.56	23.26	23.26	23.17	23.22	23.52
	5	23.57	23.77	23.37	23.92	23.82	23.82

4. SAR Test Matrix

Table 4-1 describes the SAR configurations tested for the EUT and host notebook described in this report per the FCC. The configurations tested are based on the calculations in Table 4-3 below that are based on evaluation requirements summarized in Table 4-2 of the FCC procedure "SAR Evaluation Considerations for Laptop Computers with Antennas Built-in on Display Screens" released in December of 2007. The conducted powers used in the separation distance calculations is summarized in Table 4-2 below, which represents the highest transmit power test results from the conducted power data documented in this report. Per the FCC 3G Measurement procedures, modes have been omitted from Table 4-2 for the following reasons.

- Per FCC 3G 1x procedures, all modes have been eliminated that are less than 0.25dB greater than 1x RC3 (SO55)
- Per the FCC 3G procedures EV-DO Rev A has been omitted since the maximum transmit power results are less than the 1x RC3 and EV-DO Rel 0 test results.
- Per the FCC 3G procedures, HSDPA and HSUPA have been omitted since the maximum transmit power results are less than the R99 test results.

All SAR configurations are based on calculations for an individual transmitter or antenna. Simultaneous transmitter considerations have not been completed for these reasons:

- WWAN does not transmit simultaneously with WLAN
- Bluetooth Power is $<60/f_{(GHz)}$

Based on the high margin to the SAR limit, only the modes with the highest transmit power were tested. The conducted transmit power of other modes not tested for SAR were equal to or less than the modes tested for SAR and thus the tested SAR results are representative of the untested modes.

Table 4-1 SAR Testing Completed per FCC Laptop Procedures

Mode	Band	Channels	Rationale
GPRS 2UL	850 MHz	High	Test highest output channels since the antenna-to-user separation distance provided by host notebook computer is greater than the calculated antenna-to-user distance per Table 2 of FCC procedure.
EV-DO R0	1900 MHz	High	Test highest output channels since the antenna-to-user separation distance provided by host notebook computer is greater than the calculated antenna-to-user distance per Table 2 of FCC procedure. Note: Only EV-DO R0 is tested since the other modes are of equal or lesser transmit power.

Table 4-2 Maximum Transmit Power Summary (dBm)

	Cell			PCS		
Mode	Low	Mid	High	Low	Mid	High
EV-DO R0 RTAP-153.5K	24.05	23.86	23.92	24.23	24.43	24.60
GPRS 10	25.3	25.3	25.1	23.2	23.2	23.1
WCDMA Rel99	24.70	23.73	24.09	24.72	24.62	24.75

Table 4-3 SAR Evaluation Requirements per FCC laptop procedure
(Individual transmitter requirements)

		Maximum Average Conducted Power							
Technology	**Freq (MHz)**	**dBm**	**mW**	**60/F(GHz) (mW)**	**1/2*n (cm) per FCC Procedure**	**Minimum antenna-user dist (cm)**	**WWAN Antenna-User Distance (cm)**	**SAR Test Requirement per RF Conditions and Test Reduction Procedure**	**SAR Measured**
1x RC3	824	24.1	257.0	72.8	1	6	19.3	High Pwr Ch only	No
1x RC3	836	23.9	246.6	71.8	1	6	19.3	High Pwr Ch only	No
1x RC3	848	24.1	259.4	70.8	1	6	19.3	High Pwr Ch only	No
1EV-DO R0	824	24.1	254.1	72.8	1	6	19.3	High Pwr Ch only	No
1EV-DO R0	836	23.9	243.2	71.8	1	6	19.3	High Pwr Ch only	No
1EV-DO R0	848	23.9	246.6	70.8	1	6	19.3	High Pwr Ch only	No
R99	824	24.7	295.1	72.8	2	7	19.3	High Pwr Ch only	No
R99	836	23.7	236.0	71.8	1	6	19.3	High Pwr Ch only	No
R99	848	24.1	256.4	70.8	1	6	19.3	High Pwr Ch only	No
GPRS 2UL	824	25.3	341.9	72.8	2	7	19.3	High Pwr Ch only	**Yes**
GPRS 2UL	836	25.3	335.7	71.8	2	7	19.3	High Pwr Ch only	**No**
GPRS 2UL	848	25.1	325.8	70.8	2	7	19.3	High Pwr Ch only	**No**
1x RC3	1850	24.3	268.5	32.4	4	9	19.3	High Pwr Ch only	No
1x RC3	1880	24.5	281.8	31.9	4	9	19.3	High Pwr Ch only	No
1x RC3	1910	24.5	283.8	31.4	4	9	19.3	High Pwr Ch only	No
1EV-DO R0	1850	24.2	264.9	32.4	4	9	19.3	High Pwr Ch only	**No**
1EV-DO R0	1880	24.4	277.3	31.9	4	9	19.3	High Pwr Ch only	**No**
1EV-DO R0	1910	24.6	288.4	31.4	4	9	19.3	High Pwr Ch only	**Yes**
R99	1850	24.7	296.5	32.4	4	9	19.3	High Pwr Ch only	No
R99	1880	24.6	289.7	31.9	4	9	19.3	High Pwr Ch only	No
R99	1910	24.8	298.5	31.4	4	9	19.3	High Pwr Ch only	No
GPRS 2UL	1850	23.2	211.3	32.4	3	8	19.3	High Pwr Ch only	No
GPRS 2UL	1880	23.2	210.8	31.9	3	8	19.3	High Pwr Ch only	No
GPRS 2UL	1910	23.1	205.6	31.4	3	8	19.3	High Pwr Ch only	No

5. SAR Test Facility

5.1 General

Test Location	QUALCOMM Incorporated 5775 Morehouse Dr. San Diego CA 92121
Temperature Range	15-35 °C (23°C actual)
Humidity Range	25-75% (38% actual)
Pressure	860-1060 mbar (1015 mB)

All Qualcomm dosimetry equipment is operated within a shielded screen room manufactured by Lindgren RF Enclosures to provide isolation from external EM fields. The E-field probes of the DASY5 system are capable of detecting signals as low as 5µW/g in the liquid dielectric, and so external fields are minimized by the screen room, leaving the phone as the dominate radiation source. The floor of the screen room is reflective, so the phantom bench is placed on two ferrite panels measuring 2 ft^2 each, in order to minimize reflected energy that would otherwise re-enter the phantom and combine constructively or destructively with the desired results.

5.2 Dosimetry System

The dosimetry equipment consists of a complete state-of-the-art DASY5 dosimetry system manufactured and calibrated by Schmid & Partner Engineering AG of Zurich, Switzerland. The DASY5 system consists of a six axis robot, a robot controller, a teach pendant, automation software on a 3.16 GHz Intel Core®2 Duo CPU E8500 computer, data acquisition system, isotropic E-field probe, device positioning holder, and validation kit. The positioner was designed specifically for positioning laptops, and is made of low-loss materials: POM, acrylic glass and foam.

Figure 5-1 DASY5 system: Robot Arm, Controller box, Device Positioning Holder

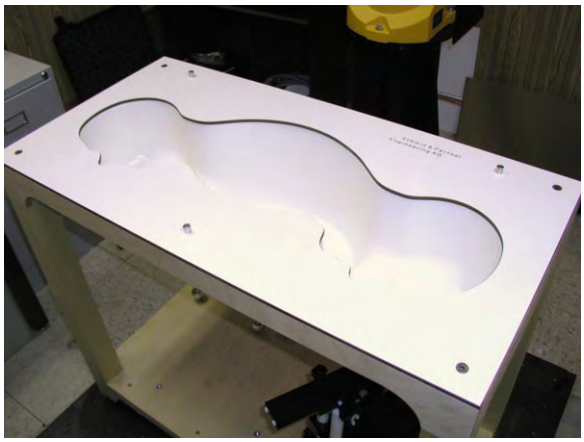
5.3 E-field probe

Manufactured by Schmid & Partner, Model ET3DV6. Calibrated by the manufacturer in head tissue simulating liquid at frequencies ranging from 835 MHz to 1.95 GHz. Dynamic range is said by the manufacturer to be 5 µW/gm to approx. 100 mW/g. The probe contains 3 small dipoles positioned symmetrically on a triangular core to provide for isotropic detection of the field. Each dipole contains a diode at the feed point that converts the RF signal to DC, which is conducted down a high impedance line to the data acquisition system.

5.4 Phantom

The phantom is the Standard Anthropomorphic Model ("SAM") phantom supplied by Schmid & Partner AG, and is designed for compliance to the guidelines provided in standard IEEE P1528. It consists of a left and right side head for simulating phone usage on both sides of the head, as well as a flat area for simulating phone usage against the body. The phantom is constructed of fiberglass with 2 mm ±0.1mm shell thickness. The DASY5 system uses a homogeneous tissue phantom based on studies concerning energy absorption of the human head, and the different absorption rates between adults and children. These studies indicated that a homogeneous phantom should overestimate SAR by no more than 15% for 10 g averages and should not underestimate SAR.

Figure 5-2 SAM Phantom



5.5 Liquid Dielectric

The tissue-simulating liquid filling the phantom is mixed by Qualcomm staff per manufacturer instructions and regulatory standards. There are separate formulas for the various applicable frequencies. Before the test, the permittivity and conductivity were measured with an automated Hewlett-Packard 85070B dielectric probe in conjunction with a H-P 8752C network analyzer to monitor permittivity change due to evaporation and settling of ingredients. The electromagnetic parameters of the liquid were maintained as shown in Table 5-1. The target values were obtained from the FCC OET 65 Supplement C.

Table 5-1 Tissue Dielectric Properties at Time of Testing

		Permittivity (ε_r)				Conductivity (σ)			
Test Date	Frequency (MHz)	Measured Values	Target Values	Deviation (%)	Limit	Measured Values	Target Values	Deviation (%)	Limit
11/04/09	824.2	55.6	55.2	0.72%	±5%	0.934	0.97	-3.71%	±5%
	836.6	55.5	55.2	0.54%	±5%	0.948	0.97	-2.27%	±5%
	848.8	55.4	55.2	0.36%	±5%	0.949	0.97	-2.16%	±5%
11/05/09	1851.25	52.5	53.3	-1.50%	±5%	1.45	1.52	-4.61%	±5%
	1881.0	52.4	53.3	-1.69%	±5%	1.48	1.52	-2.63%	±5%
	1908.75	52.4	53.3	-1.69%	±5%	1.52	1.52	0.00%	±5%

25 L of each of the tissue simulating liquids were prepared using the following proportions of ingredients (percent by weight):

Body Liquids:

835 Mhz Body Tissue Simulating Liquid

Water – 50.8%
Salt – 9.94%
Preventol – 0.01%
Sugar – 48%

1900 Mhz Body Tissue Simulating Liquid

Water – 70.2%
Glycol Monobutyl Ether – 29.4%
Salt – 0.4%

6. System Specifications and Calibration

Figure 6-1 shows a diagram of the Schmid & Partner DASY5 system.

**Figure 6-1 Diagram of DASY5 System,
from S&P Applications Notes System Description and Setup**

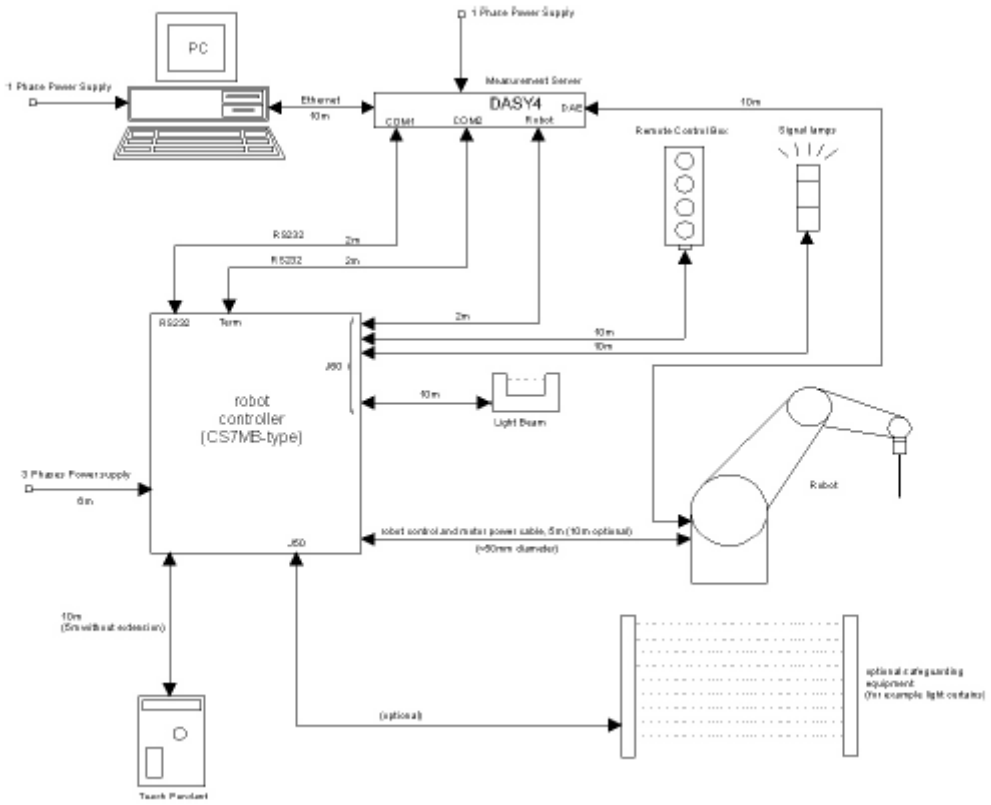


Table 6-1 Data Acquisition

Processor	Intel Core®2 Duo CPU E8500 GHz
Operating System	Microsoft® Windows® XP
Software	DASY5 V5.0 Build 120.0, Schmid & Partners Eng. AG, Switzerland SEMCAD X V13.4 Build 45.0
Surface Detection	Mechanical

Table 6-2 E-Field Probe

Offset tip to sensor center	2.7 mm
Offset surface to probe tip	1.8 ± 0.2
Frequency	30 MHz to 3.0 GHz
Dynamic Range	5μW/g to 100 mW/g
Isotropy	±0.15 dB (in brain liquid)

Table 6-3 Phantom

Dielectric	800 MHz band: homogeneous water/sugar/salt/ cellulose liquid 1900 MHz band: Homogeneous water/glycol/salt liquid
Shell	2 mm ± 0.2 mm polyester fiber glass
Ear	Integral model per SAM phantom specification

Table 6-4 Calibration

Equipment Mfr & Type	Serial number	Last Calibrated	Next Calibration
Schmid & Partner Engineering AG Dosimetric E-field Probe, ET3DV5	1733	17 September 2009	17 September 2010
Schmid & Partner Engineering AG dipole validation kit, D835V2	466	11 November 2008	11 November 2010
Schmid & Partner Engineering AG dipole validation kit, D1900V2	5d096	19 June 2008	19 June 2010
Schmid & Partner Engineering AG Data Acquisition Electronics, DAE3 V1	566	20 April 2009	20 April 2010
Gigatronics 8541C RF Power Meter	X18383	7 May 2009	7 May 2010
Gigatronics 80401A Power Sensor	X21267	7 May 2009	7 May 2010
Hewlett-Packard 8720ES Vector Network Analyzer	K100454	12 February 2009	12 February 2010
Hewlett-Packard 85070M Dielectric Probe System	N/A	N/A	N/A

7. SAR Measurement Procedure

7.1 EUT Configuration

The EUT was configured into the desired transmit configuration per the procedures defined in section 9.

7.2 Power Verification

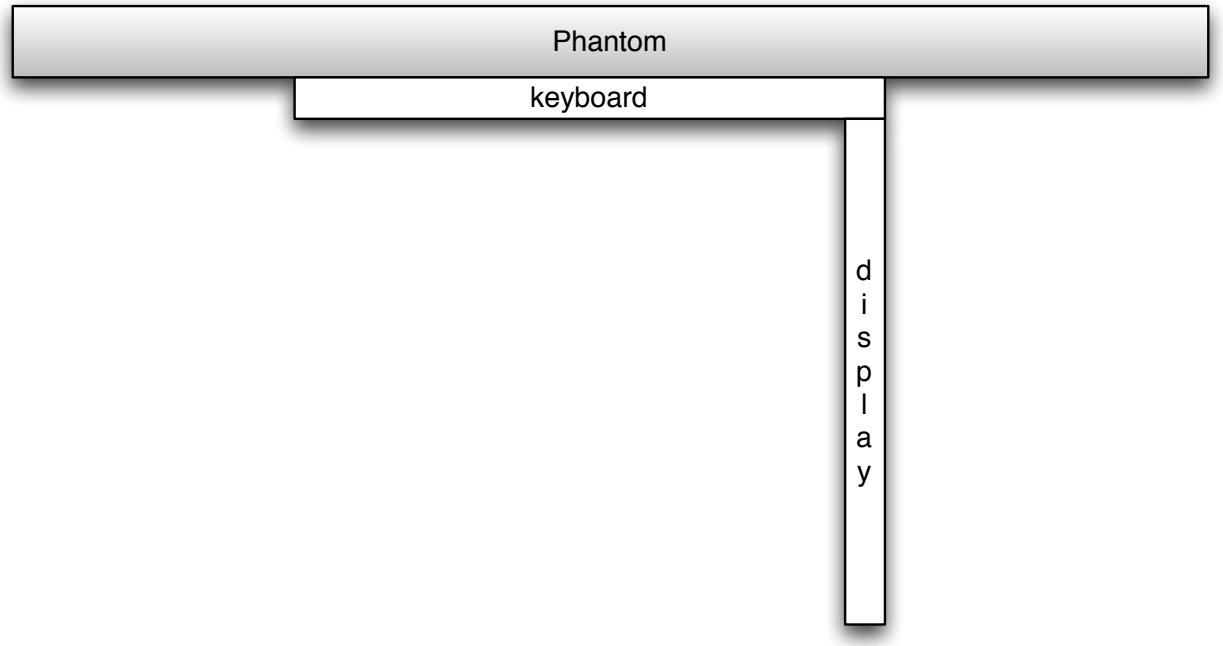
Prior to beginning SAR testing, conducted power was measured on the Gobi2000 module embedded in the host computer to verify functionally and the WWAN maximum transmit power values using the procedures defined in section 9. The results of the conducted power measurements are found in section 3.

7.3 Test Configurations

7.3.1 EUT Position

Figure 7-1 shows how the EUT netbook was positioned with respect to the phantom, using the lap-held position with the base flush against the phantom and the display oriented at 90° with respect to the phantom.

Figure 7-1 Lap-held position drawing



7.4 Scan procedure

The scan routine is set up as follows:
- Power verification measurement
- Area scan
- 7x7x7 cube (zoom) scan
- Robot movement to maximum location
- Z-axis scan
- Power verification re-test (Drift)

8. Measurement Uncertainty

The possible errors included in this measurement arise from device positioning uncertainty, device manufacturing uncertainty, liquid dielectric permittivity uncertainty, liquid dielectric conductivity uncertainty, and uncertainty due to disturbance of the fields by the probe.

Table 8-1 Measurement Uncertainty

	Uncertainty value (± %)	Prob. DIST	Div.	(ci) 1g	(ci) 10g	Std. Unc. (1g) (± %)	Std. Unc. (10g)	(vi) veff
Measurement System								
Probe Calibration	4.8	N	1	1	1	4.8	4.8	∞
Axial Isotropy	4.7	R	√3	0.7	0.7	1.9	1.9	∞
Hemispherical Isotropy	9.6	R	√3	0.7	0.7	3.9	3.9	∞
Boundary Effects	1	R	√3	1	1	0.6	0.6	∞
Linearity	4.7	R	√3	1	1	2.7	2.7	∞
System Detection Limits	1	R	√3	1	1	0.6	0.6	∞
Readout Electronics	1	N	1	1	1	1.0	1.0	∞
Response Time	0.8	R	√3	1	1	0.5	0.5	∞
Integration Time	2.6	R	√3	1	1	1.5	1.5	∞
RF Ambient Conditions	3	R	√3	1	1	1.7	1.7	∞
Probe Positioner	0.4	R	√3	1	1	0.2	0.2	∞
Probe Positioning	2.9	R	√3	1	1	1.7	1.7	∞
Max. SAR Eval.	1	R	√3	1	1	0.6	0.6	∞
Test Sample Related								
Device Positioning	2.9	N	1	1	1	2.9	2.9	145
Device Holder	3.6	N	1	1	1	3.6	3.6	5
Power Drift	5	R	√3	1	1	2.9	2.9	∞
Phantom and Setup								
Phantom Uncertainty	4	R	√3	1	1	2.3	2.3	∞
Liquid Conductivity (target)	5	R	√3	0.64	0.43	1.8	1.2	∞
Liquid Conductivity (meas.)	2.5	N	1	0.64	0.43	1.6	1.1	∞
Liquid Permittivity (target)	5	R	√3	0.6	0.49	1.7	1.4	∞
Liquid Permittivity (meas.)	2.5	N	1	0.6	0.49	1.5	1.2	∞
Combined Std. Uncertainty						10.3 %	10.0 %	330
Expanded STD Uncertainty						**20.6 %**	**20.1 %**	

9. EUT Configuration Procedure

9.1 EUT Test Frequencies

Table 9-1 Test Frequencies

	850 MHz						1900 MHz					
	Low		Mid		High		Low		Mid		High	
	Ch	Freq	Ch	Freq	Ch	Freq	Ch	Freq	Ch	Freq	Ch	Freq
GSM	128	824.2	190	836.6	251	848.8	512	1850.2	661	1880	810	1909.8
CDMA	1013	824.7	384	836.52	777	848.31	25	1851.25	600	1880	1175	1908.75
WCDMA	UL: 4132 DL: 4357	826.4	UL: 4182 DL: 4407	836.4	UL: 4233 DL: 4458	846.6	UL: 9262 DL: 9847	1852.4	UL: 9400 DL: 9800	1880	UL: 9538 DL: 9763	1907.6

9.2 Call Box Simulator Information

Table 9-2 Communications Test Box Information

Make	Agilent
Model	8960
Cal Date	8 April 2009
Serial Number	GB44052409
SW Revision	GSM TA E1968A-101 GPRS TA E1968A-102 EGPRS TA E1968A-103 WCDMA E1963A HSDPA TEST MODES E1963A-403 HSuPA TEST MODES E1963A-413 cdma 2000 TA E1962B 1xEV-DO TA E1966A 1xEV-DO FTM TA E1976A 1xEV-DO Release A E1966A-102 1xEV-DO RelA FTM E1976A-102

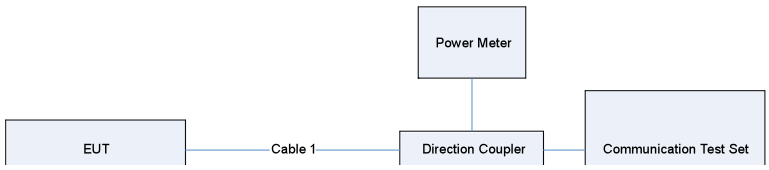
9.3 RF Power Measurement Procedure

9.3.1 Test Setup

Connect the transmitter output to communications test set as shown in Figure 9-1 and configure the EUT to operate at maximum power in a call per procedures defined in sections 9.4 . Measure the conducted transmit power at the frequencies defined in 9.1 .

Power measurements are completed using a power meter configured to measure average power. The cable loss must be measured for the specific frequencies under test and added as a correction factor for all the tests.

Figure 9-1 RF Output Power Test Setup



9.4 Base Station Emulator Settings and Test Procedures

9.4.1 For CDMA2000 1x/EVDO

Use CDMA2000 Rev 6 protocol in the call box.

1) Test for Reverse/Forward TCH RC1, Reverse/Forward TCH RC2, and RC3 Reverse FCH and demodulation of RC 3, 4 or 5.
    a. Set up a call using Fundamental Channel Test Mode 1 (RC1, SO 2) with 9600 bps data rate only.
    b. As per C.S0011 or TIA/EIA-98-F Table 4.4.5.2-1, set the test parameters as shown in Table 9-3.
    c. Send continuously ‘0’ power control bits to the Gobi2000 module.
    d. Measure the output power at Gobi2000 module’s antenna connector as recorded on the power meter with values corrected for cables losses.
    e. Repeat step b through d for Fundamental Channel Test Mode:
        i. RC1, SO55
        ii. RC2, SO9
        iii. RC2, SO55
        iv. RC3, SO55
2) Test for RC 3 Reverse FCH, RC3 Reverse SCH0 and demodulation of RC 3, 4 or 5.
    a. Set up a call using Supplemental Channel Test Mode 3 (RC 3, SO 32) with 9600 bps Fundamental Channel and 9600 bps SCH0 data rate.
    b. As per C.S0011 or TIA/EIA-98-F Table 4.4.5.2-2, set the test parameters as shown in Table 9-4.
    c. Send alternating ‘0’ and ‘1’ power control bits to the Gobi2000 module.
    d. Determine the active channel configuration. If the desired channel configuration is not the active channel configuration, increase Îor by 1 dB and repeat the verification. Repeat this step until the desired channel configuration becomes active.
    e. Measure the output power at the Gobi2000 module antenna connector.
    f. Decrease Îor by 0.5 dB.

g. Determine the active channel configuration. If the active channel configuration is the desired channel configuration, measure the output power at the Gobi2000 module's antenna connector.
h. Repeat step f and g until the output power no longer increases or the desired channel configuration is no longer active. Record the highest output power achieved with the desired channel configuration active.
i. Repeat step a through h ten times and average the result.

3) Test for RC3 Reverse FCH, RC 3 DCCH and demodulation of RC3, 4 or 5.
   a. Use the same procedure as described in 2).

Table 9-3 Parameters for Max. Power with a single traffic code channel, SR1

Parameter	Units	Value
$\hat{I}_{or}$	dBm/1.23 MHz	-104
$\frac{\text{Pilot } E_c}{I_{or}}$	dB	-7
$\frac{\text{Traffic } E_c}{I_{or}}$	dB	-7.4

Table 9-4 Parameters for Max. Power with multiple traffic code channel, SR1

Parameter	Units	Value
$\frac{\text{Pilot } E_c}{I_{or}}$	dB	-7
$\frac{\text{Traffic } E_c}{I_{or}}$	dB	-7.4

1xEV-DO

1) Use 1xEV-DO Rel 0 protocol in the call box.
   a. RTAP
      - Select Test Application Protocol to RTAP
      - Set RTAP Rate to 9.6 kbps
      - Generator Info -> Termination Parameters -> Max Forward Packet Duration -> 16 Slots
      - Set Îor to -60 dBm/1.23 MHz
      - Send continuously '0' power control bits
      - Measure the power at Gobi2000 antenna connector
      - Repeat above steps for RTAP Rate = 19.2 kbps, 38.4 kbps, 76.8 kbps and 153.6 kbps respectively
2) Use 1xEV-DO Rev A protocol in the call box.
   a. RETAP
      - Select Test Application Protocol to RETAP
      - F-Traffic Format -> 4 (1024, 2, 128) Canonical (307.2k, QPSK)
      - Set R-Data Pkt Size to 128
      - Protocol Subtype Config -> Release A Physical Layer Subtype -> Subtype 2 ->PL Subtype 2 Access Channel MAC Subtype -> Default (Subtype 0)

- Generator Info -> Termination Parameters -> Max Forward Packet Duration -> 16 Slots
  ->ACK R-Data After -> Subpacket 0 (All ACK)
- Set Îor to -60 dBm/1.23 MHz
- Send continuously '0' power control bits
- Measure the power at GOBI2000 module antenna connector
- Repeat above steps for R-Data Pkt Size = 256, 512, 768, 1024, 1536, 2048, 3072, 4096, 6144, 8192, 12288 respectively.
- Repeat above steps for R-Data Pkt Size = 256, 512, 768, 1024, 1536, 2048, 3072, 4096, 6144, 8192, 12288 respectively.

9.4.2 For WCDMA/HSDPA/HSUPA

Configure the call box to support all WCDMA tests in respect to the 3GPP 34.121 (listed in Table 9-5).
Rel99

1) Set a Test Mode 1 loop back with a 12.2kbps Reference Measurement Channel (RMC)
2) Set and send continuously Up power control commands to the Gobi 2000 module.

HSDPA Rel 6

1) Establish a Test Mode 1 look back with both 1 12.2kbps RMC channel and a H-Set1 Fixed Reference Channel (FRC). With the 8820 this is accomplished by setting the signal Channel Coding to "Fixed Reference Channel" and configuring for HSET-1 QKSP.
2) Set beta values and HSDPA settings for HSDPA Sebtest1 according to Table 9-5
3) Send continuously Up power control commands to the Gobi2000 module
4) Measure the power at the Gobi2000 module's antenna connector using the power meter with modulated average detector
5) Repeat the measurement for the HSDPA Subtest2, 3 and 4 as given in Table 9-5

HSUPA Rel 6

1) Use UL RMC 12.2kbps and FRC H-Set1 QPSK, Test Mode 1 loop back. With the 8820 this is accomplished by setting the signal Channel Coding to "E-DCH Test Channel" and configuring the equipment category to Cat6_10ms.
2) Set the Absolute Grant for HSUPA Subtest1 according to Table 9-5
3) Set the Gobi2000 module power to be at least 5dB lower than the Maximum output power
4) Send power control bits to give one TPC_cmd = +1 command to the Gobi2000 module. If Gobi2000 module doesn't send any E-DPCH data with decreased E-TFCI within 500ms, then repeat this process until the decreased E-TFCI is reported.
5) Confirm that the E-TFCI transmitted by the Gobi2000 module is equal to the target E-TFCI in Table 9-5. If the E-TFCI transmitted by the Gobi2000 module is not equal to the target E-TFCI, then send power control bits to give one TPC_cmd = -1 command to the UE. If UE sends any E-DPCH data with decreased E-TFCI within 500 ms, send new power control bits to give one TPC_cmd = -1 command to the UE. Then confirm that the E-TFCI transmitted by the UE is equal to the target E-TFCI in Table 9-5. If the E-TFCI transmitted by the UE is not equal to the target E-TFCI, then fail the UE
6) Repeat the measurement for the HSUPA Subtest2, 3, 4 and 5 as given in Table 9-5

9.4.3 For GSM/GPRS/EGDE

- Configure the call box to support GPRS test.
- Configure for desired number of uplink transmit lots.
- Set MS_TX level to 0 (850 MHz) or 2 (1900MHz) to configure EUT to transmit at maximum output power.

Table 9-5 3GPP Rel99/HSPA Subtest Settings

	Mode	**Rel99**	**Rel6 HSDPA**	**Rel6 HSDPA**	**Rel6 HSDPA**	**Rel6 HSDPA**	**Rel6 HSUPA**	**Rel6 HSUPA**	**Rel6 HSUPA**	**Rel6 HSUPA**	**Rel6 HSUPA**
	Subtest	**-**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**5**
WCDMA General Settings	Loopback Mode	Test Mode 1	Test Mode 1				Test Mode 1				
	Rel99 RMC	12.2kbps RMC	12.2kbps RMC				12.2kbps RMC				
	HSDPA FRC	Not Applicable	H-Set1				H-Set1				
	HSUPA Test	Not Applicable	Not Applicable				HSUPA Loopback				
	Power Control Algorithm	Algorithm2	Algorithm2				Algorithm2				
	β_c	Not Applicable	2/15	12/15	15/15	15/15	11/15	6/15	15/15	2/15	15/15
	β_d	Not Applicable	15/15	15/15	8/15	4/15	15/15	15/15	9/15	15/15	15/15
	β_{ec}	Not Applicable	-	-	-	-	209/225	12/15	30/15	2/15	24/15
	β_c/β_d	8/15	2/15	12/15	15/8	15/4	11/15	6/15	15/9	2/15	15/15
	β_{hs}	Not Applicable	4/15	24/15	30/15	30/15	22/15	12/15	30/15	4/15	30/15
	β_{ed}	Not Applicable	Not Applicable				1309/225	94/75	47/15 47/15	56/75	134/15
HSDPA Specific Settings	DACK	Not Applicable	8				8				
	DNAK	Not Applicable	8				8				
	DCQI	Not Applicable	8				8				
	Ack-Nack repetition factor	Not Applicable	3				3				
	CQI Feedback (Table 5.2B.4)	Not Applicable	4ms				4ms				
	CQI Repetition Factor (Table 5.2B.4)	Not Applicable	2				2				
	$A_{hs} = \beta_{hs}/\beta_c$	Not Applicable	30/15				30/15				
HSUPA Specific Settings	D E-DPCCH	Not Applicable	Not Applicable				6	8	8	5	7
	DHARQ	Not Applicable	Not Applicable				0	0	0	0	0
	AG Index	Not Applicable	Not Applicable				20	12	15	17	21
	ETFCI (from 34.121 Table C.11.1.3)	Not Applicable	Not Applicable				75	67	92	71	81
	Associated Max UL Data Rate kbps	Not Applicable	Not Applicable				242.1	174.9	482.8	205.8	308.9
	Reference E_TFCIs	Not Applicable	Not Applicable				E-TFCI 11 E-TFCI PO 4 E-TFCI 67 E-TFCI PO 18 E-TFCI 71 E-TFCI PO 23 E-TFCI 75 E-TFCI PO 26 E-TFCI 81 E-TFCI PO 27		E-TFCI 11 E-TFCI PO 4 E-TFCI 92 E-TFCI PO 18	E-TFCI 11 E-TFCI PO 4 E-TFCI 67 E-TFCI PO 18 E-TFCI 71 E-TFCI PO 23 E-TFCI 75 E-TFCI PO 26 E-TFCI 81 E-TFCI PO 27	

10. Numerical SAR Data

10.1 Numerical Data

Table 10-1 shows the 1 g SAR test data for the two frequency bands tested (highest output power channel only from each band measured, see Section 4. *SAR Test Matrix* for rationale).

Table 10-1 Measured SAR Results

Band	Mode	Channel	Conducted power (dBm)	1 g SAR (mW/g)
GSM850	GPRS-2UL	128	25.3	0.0281
PCS	EVDOr0	1175	24.6	0.00641