REPORT ON

Specific Absorption Rate Testing of the Option NV
GE0301 Globetrotter Express Card

Doc Number 75901888 Report 01 Issue 2 **August 2007**

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REPORT ON Specific Absorption Rate Testing of the Option NV GE0301 Globetrotter Express Card

Doc Number: 75901888 Report 01 Issue 2

FCC ID NCMOGE0301

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ATTESTATION

The wireless portable device described within this report has been shown to be capable of compliance for localised specific absorption rate (SAR) for FCC standard Supplement C (Edition 01-01) to OET Bulletin 65 (Edition 97-01) and RSS-102 Issue 1 (Provisional) September 25, 1999 of 1.6 W/kg and European standard EN50361: 2002 of 2.0W/kg.

The measurements shown in this report were made in accordance with the procedures specified in Supplement C (Edition 01-01) to OET Bulletin 65 (Edition 97-01).

All reported testing was carried out on a sample of equipment to demonstrate compliance with the above standards. The sample tested was found to comply with the requirements in the applied rules.

V Kerai
Telecoms Engineer

APPROVED BY

T/J Pither
Authorised Signatory

DATED 7th August 2007

This report has been re-issued to include additional information in section 1.

Note: The test results reported herein relate only to the item tested as identified above and on the Status Page.

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CONTENTS

SECTION 1

REPORT SUMMARY

Specific Absorption Rate Testing of the Option NV
GE0301 Globetrotter Express Card

Max 1g SAR (W/kg)	0.183
The maximum 1g volume averaged SAR level measured for all the tests performed did not exceed the limits for General Population/Uncontrolled Exposure (W/kg) Partial Body of 1.6 W/kg. Level defined in Supplement C (Edition 01-01) to OET Bulletin 65 (97-01).	

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1.1 STATUS

MANUFACTURING DESCRIPTION	Option NV GE0301 Globetrotter Express Card
STATUS OF TEST	Specific Absorption Rate Testing
APPLICANT	Option NV
POWER CLASS	GSM 835 MHz Class 4 GSM 900 MHz Class 4 DCS 1800 MHz Class 1 PCS 1900 MHz Class 1
GPRS CLASS	Class B
GPRS MULTI-SLOT CLASS	12 (4Dn; 4Up; Sum5)
WCDMA FREQUENCY BAND	FDD1 (1922.4 to 1977.6 MHz) FDD2 (1852.4 to 1907.6 MHz) FDD5 (826.4 to 846.6 MHz)
WCDMA POWER CLASS	FDD I/II/V Power Class 3 (+24dBm)
MANUFACTURER	Option NV
TYPE OR MODEL NUMBER	GE0301
HARDWARE VERSION	4.0
SOFTWARE VERSION	2.7.0
IMEI NUMBER (Card 1)	004401440450076
IMEI NUMBER (Card 2)	004401440329700
SERIAL NUMBER (Card 1)	EE4473E074
SERIAL NUMBER (Card 2)	EE44739017
HOST 1 MANUFACTURER & MODEL	HP Compaq nc 6320
HOST 1 COUNTRY OF MANUFACTURE	China
HOST 2 MANUFACTURER & MODEL	Acer TravelMate 4260 Series
HOST 2 COUNTRY OF MANUFACTURE	China
POWER SUPPLY	Laptop used (Host 1 and Host 2 detailed above)

TEST SPECIFICATIONS:

1. FCC Publication Supplement C (Edition 01-01) to OET Bulletin 65 (Edition 97-01): Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields – Additional Information for evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions
2. IEEE 1528 – 2003: Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques.
3. IEEE Std C95.1-2005: IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3kHz to 300 GHz, Inst. of Electrical and Electronics Engineers, Inc.,2005.
4. ICNIRP: Guidelines for Limiting Exposure to Time-varying Electric, Magnetic, and Electromagnetic Fields (up to 300 GHz), In: Health Physics, Vol. 74, No. 4, 494-522, 1998.
5. ETSI TS 134 121-1 V7.4.0, Universal Mobile Telecomunications System (UMTS) ; User Equipment (UE) conformance specification; Radio transmission and reception (FDD)

1.1 STATUS - Continued

REFERENCES:

6. FCC OET SAR Measurement Procedures for 3G Devices – CDMA 2000 / Ev-DO – WCDMA / HSDPA (Rev. 1 - June 2006)
7. FCC OET Interim SAR Procedures for Release 6 HSPA Devices – Preliminary Draft, 06/06/2007
8. IMST SAR Report: SAR Report_7layers_6620_631_FCC_Body_850_1900_WCDMA II_V_Globetrotter Express_13, August 07

TUV REGISTRATION NUMBER:	75901888
RECEIPT OF TEST SAMPLES:	25th July 2007
START OF TEST:	25th July 2007
FINISH OF TEST:	26th July 2007

1.2 SUMMARY

The device supplied for Specific Absorption Rate (SAR) testing was the Option NV GE0301 Globetrotter Express Card, designed for worldwide connectivity by multi-standard (HSUPA, HSDPA, UMTS, EDGE and GPRS) and multi-band support. The card supports 850/900/1800/1900 EDGE/GSM as well as WCDMA 850/1900/2100 MHz HSUPA / HSDPA / UMTS. The UE Power class is 3 and the HSUPA category is 5, with the HSDPA category being 8.

There is a foldable receive-only antenna with one intended position for use. This test report covers partial testing for HSUPA/HSDPA as per the client's request. Limited body SAR testing was performed on FDD Band II and V on two identical test samples. The hardware and software build status of both cards are the same version as shown in section 1.1 of this report and have been declared functionally and electrically identical by the client, Option NV. The Option NV GE0301 was tested in two host laptops which were the HP Compaq nc 6320 and the Acer TravelMate 4260 Series.

Conducted output power measurements were made in accordance to the 3GPP 34.121 standard. The highest output power reading for HSDPA and HSUPA for the FDD II and V band was identified so that two sub-tests were run in each of the bands. The Anritsu 8815B Radio Communications Analyser which is capable of measuring W-CDMA/HSDPA terminals was used to establish the required test configuration for the GE0301 Globetrotter Express Card as per the FCC OET SAR Measurement Procedures for 3G Devices [6]. The HSDPA body SAR measurements were made using an FRC with H-set 1 and a 12.2kbps RMC configured in test loop mode 1. For FDD Band 2, SAR testing was conducted using the Acer TravelMate 4260 Series, which was the worst-case host found in the IMST SAR report [8]. For FDD Band 5, SAR testing was conducted using the HP Compaq nc 6320, which was the worst-case host found in the IMST SAR report [8]. The channel and sub-test which gave rise to the highest conducted output power measurement for HSDPA and HSUPA in each bands was selected to be measured, per the client's request and the results are contained within this test report. The output power measurements are contained within Section 1.3 of this report. The output power readings for HSPA did not exceed the WCDMA readings by 0.25dB and therefore, further measurements were not necessary.

SAR was selectively confirmed for other physical channel configurations (DPCCH & DPDCH_n) according to output power, exposure conditions and device operating capabilities as required. The Anritsu 8815B Radio Communications Analyser was initially configured with default settings and the parameters described in 3GPP TS 34.121 were applied. The channel parameters used for the device are contained in Section 1.4.

The UE is fully compliant with 3GPP standards defining required UMTS spreading factors.

- The DPCCH spreading factor is 256 per 3GPP TS 25.213 section 4.3.1.2.1.
- The DPDCH spreading factor is dependent on number of DPDCH channels and data range. For a single channel the spreading factor can range from 4 to 256. For more then one DPDCH channel the spreading factor is 4. Further details are defined by 3GPP in TS 25.213 section 4.3.1.2.1.
- HS-DPCCH spreading factor is 256. Further details can be found in 3GPP TS 25.213 section 4.3.1.2.2.

SAR testing on the body was conducted on the FDD 2 band in HSDPA Sub-test 3 mode and HSUPA Sub-test 5 mode with the Acer TravelMate 4260 Series host laptop being used. The rear of the laptop was in contact with the bottom of the flat phantom and therefore there was a 0mm separation distance. The Option NV GE0301 card (S/N: EE4473E074; IMEI: 004401440450076) had a 14mm separation distance from the bottom of the flat phantom. SAR testing was also conducted on the FDD 5 band in HSDPA Sub-test 3 mode and HSUPA Sub-test 1 mode with the HP Compaq nc 6320 host laptop being used. The rear of the laptop was in contact with the bottom of the flat phantom and therefore there was a 0mm separation distance. The Option NV GE0301

card (S/N: EE44739017; IMEI: 004401440329700) had a 11mm separation distance from the bottom of the flat phantom.

The Flat Phantom dimensions were 210mm x 210mm x 210mm with a sidewall thickness of 2.00mm. The phantom was filled to a minimum depth of 150mm with the appropriate Body simulant liquid. The dielectric properties were in accordance with the requirements for the dielectric properties specified in Supplement C (Edition 01-01) to OET Bulletin 65 (Edition 97-01).

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

The maximum 1g volume averaged SAR level measured for all the tests performed did not exceed the limits for General Population/Uncontrolled Exposure (W/kg) Partial Body of 1.6 W/kg. Level defined in Supplement C (Edition 01-01) to OET Bulletin 65 (97-01).

1.3 RF POWER OUTPUT – CONDUCTED

SPECIFICATION

ETSI TS 134 121-1 V7.4.0, Universal Mobile Telecommunications System (UMTS); User Equipment (UE) conformance specification; Radio transmission and reception (FDD)

METHOD

The conducted RF output power measurements were made at the RF output terminal of the EUT. The EUT was controlled via the Anritsu 8815B Radio Communications Analyser selecting the required modes of modulation and sub-sets. The power measurements below incorporate the path loss that was measured on the day for each device. The channel parameters used for the device are contained in Section 1.4.

RESULTS

Table 1: Maximum Transmit Power Measurements including Path Loss

Device: Option NV GE0301 (Card 1 – S/N: EE4473E074)

FDD Band V		**Frequency**		
		826.4	**836.4**	**846.6**
3GPP 34.121 Mode	HSPA Sub-test	Conducted Transmit Power (dBm)		
Rel99 12.2kbps RMC	N/A	21.45	21.18	21.08
Rel6 HSDPA	1	20.96	20.68	20.55
Rel6 HSDPA	2	21.04	20.80	20.70
Rel6 HSDPA	3	**21.09**	20.75	20.58
Rel6 HSDPA	4	20.56	20.36	20.86
Rel6 HSUPA	1	**20.48**	20.42	19.88
Rel6 HSUPA	2	18.84	18.30	18.50
Rel6 HSUPA	3	18.52	18.18	18.04
Rel6 HSUPA	4	18.34	19.25	17.90
Rel6 HSUPA	5	20.14	20.17	19.94

Table 2: Maximum Transmit Power Measurements including Path Loss

Device: Option NV GE0301 (Card 2 – S/N: EE44739017)

FDD Band II		**Frequency**		
		1852.4	**1880**	**1907.6**
3GPP 34.121 Mode	HSPA Sub-test	Conducted Transmit Power (dBm)		
Rel99	12.2kbps RMC	21.64	21.53	21.19
Rel6 HSDPA	1	21.27	21.10	20.74
Rel6 HSDPA	2	21.26	21.15	20.76
Rel6 HSDPA	3	**21.32**	21.20	20.85
Rel6 HSDPA	4	20.85	20.70	20.36
Rel6 HSUPA	1	20.77	20.77	19.68
Rel6 HSUPA	2	18.82	18.66	17.35
Rel6 HSUPA	3	19.05	18.78	18.95
Rel6 HSUPA	4	18.78	18.44	17.23
Rel6 HSUPA	5	**21.03**	19.71	19.48

1.4 CHANNEL PARAMETERS FOR HSDPA

Fixed Reference Channel H-Set 1

Parameter	Unit	Value	
Nominal Avg. Inf. Bit Rate	kbps	534	777
Inter-TTI Distance	TTI's	3	3
Number of HARQ Processes	Processes	2	2
Information Bit Payload (N_{INF})	Bits	3202	4664
MAC-d PDU size	Bits	336	336
Number Code Blocks	Blocks	1	1
Binary Channel Bits Per TTI	Bits	4800	7680
Total Available SML's in UE	SML's	19200	19200
Number of SML's per HARQ Proc.	SML's	9600	9600
Coding Rate		0.67	0.61
Number of Physical Channel Codes	Codes	5	4
Modulation		QPSK	16QAM
Note: The HS-DSCH shall be transmitted continuously with constant power but only every third TTI shall be allocated to the UE under test			

β values for transmitter characteristics tests with HS-DPCCH and E-DCH

Sub-test	β_c	β_d	β_d *(SF)*	β_c/β_d	β_{HS} *(Note1)*	β_{ec}	β_{ed} *(Note 5) (Note 6)*	β_{ed} *(SF)*	β_{ed} *(Codes)*	CM *(dB)* *(Note 2)*	MPR *(dB)* *(Note 2)*	*AG Index* *(Note 6)*	*E-TFCI*
1	11/15 *(Note 3)*	15/15 *(Note 3)*	64	11/15 *(Note 3)*	22/15	209/225	1309/225	4	1	1.0	0.0	20	75
2	6/15	15/15	64	6/15	12/15	12/15	94/75	4	1	3.0	2.0	12	67
3	15/15	9/15	64	15/9	30/15	30/15	$\beta_{ed}1$: 47/15 $\beta_{ed}2$: 47/15	4 4	2	2.0	1.0	15	92
4	2/15	15/15	64	2/15	4/15	2/15	56/75	4	1	3.0	2.0	17	71
5	15/15 *(Note 4)*	15/15 *(Note 4)*	64	15/15 *(Note 4)*	30/15	24/15	134/15	4	1	1.0	0.0	21	81

Note 1: Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 30/15 with β_{hs} = 30/15 * β_c .

Note 2: 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.

Note 3: For subtest 1 the β_c/β_d ratio of 11/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to β_c = 10/15 and β_d = 15/15.

Note 4: For subtest 5 the β_c/β_d ratio of 15/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to β_c = 14/15 and β_d = 15/15.

Note 5: In case of testing by UE using E-DPDCH Physical Layer category 1, Sub-test 3 is omitted according to TS25.306 Table 5.1g.

Note 6: β_{ed} can not be set directly, it is set by Absolute Grant Value.

1.5 TEST RESULT SUMMARY

SYSTEM PERFORMANCE / VALIDATION CHECK RESULTS

Prior to formal testing being performed a System Check was performed in accordance with OET 65 Supplement C (Edition 01-01) [5] and the results were compared against published data in Standard IEEE 1528-2003 [4]. The following results were obtained: -

Date	Dipole Used	Frequency (MHz)	Max 1g SAR (W/kg)	Percentage Drift on Reference	Max 10g SAR (W/kg)	Percentage Drift on Reference
26/07/2007	835	844.4	10.29	8.37%	6.78	9.41%
24/07/2007	1900	1883.6	40.60	2.26%	20.98	2.36%

*Normalised to a forward power of 1W

Table 3: WCDMA FDD II BODY Specific Absorption Rate (Maximum SAR) 1g & 10g Results for the GE0301 Globetrotter Express Card (Serial No.: EE4473E074) in HSDPA and HSUPA Modes (Host Laptop: Acer TravelMate 4260 Series)

Position		HSPA Mode	Channel Number	Frequency (MHz)	Max Spot SAR (W/kg)	Max 1g SAR (W/kg	Max 10g SAR (W/kg)	SAR Drift (%)	Area scan (Figure number)
Card Spacing From Phantom	Host Laptop Position								
14mm	0mm Rear Facing	HSDPA Sub-test 3	9262	1852.4	0.140	0.166	0.101	5.200	Figure 6
14mm	0mm Rear Facing	HSUPA Sub-test 5	9262	1852.4	0.140	0.169	0.101	3.700	Figure 7
Limit for General Population (Uncontrolled Exposure) 1.6 W/kg (1g) & 2.0 W/kg (10g)									

Table 4: WCDMA FDD V BODY Specific Absorption Rate (Maximum SAR) 1g & 10g Results for the GE0301 Globetrotter Express Card (Serial No.: EE44739017) in HSDPA and HSUPA Modes (Host Laptop: HP Compaq nc 6320)

Position		HSPA Mode	Channel Number	Frequency (MHz)	Max Spot SAR (W/kg)	Max 1g SAR (W/kg	Max 10g SAR (W/kg)	SAR Drift (%)	Area scan (Figure number)
Card Spacing From Phantom	Host Laptop Position								
11mm	0mm Rear Facing	HSDPA Sub-test 3	4132	826.4	0.150	0.174	0.118	-0.560	Figure 4
11mm	0mm Rear Facing	HSUPA Sub-test 1	4132	826.4	0.160	0.183	0.124	-0.920	Figure 5

SECTION 2

TEST DETAILS

Specific Absorption Rate Testing of the Option NV
GE0301 Globetrotter Express Card

2.1 SAR MEASUREMENT SYSTEM

2.1.1 ROBOT SYSTEM SPECIFICATION

The SAR measurement system being used is the IndexSAR SARA2 system, which consists of a Mitsubishi RV-E2 6-axis robot arm and controller, IndexSAR probe and amplifier and SAM phantom Head Shape. The robot is used to articulate the probe to programmed positions inside the phantom head to obtain the SAR readings from the DUT.

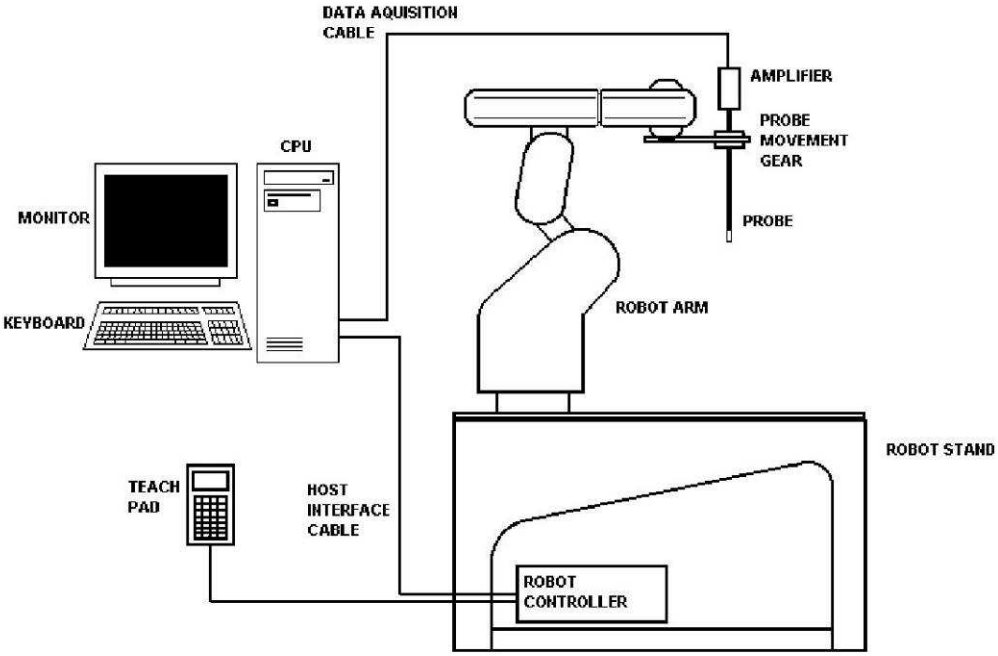

Figure 1: Schematic diagram of the SAR measurement system

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

The position and digitised shape of the phantom heads are made available to the software for accurate positioning of the probe and reduction of set-up time.
The SAM phantom heads are individually digitised using a Mitutoyo CMM machine to a precision of 0.001mm. The data is then converted into a shape format for the software, providing an accurate description of the phantom shell.

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

2.1 SAR MEASUREMENT SYSTEM

2.1.2 PROBE AND AMPLIFIER SPECIFICATION

IXP-050 IndexSAR Isotropic Immersible SAR probe
The probes are constructed using three orthogonal dipole sensors arranged on an interlocking, triangular prism core. The probes have built-in shielding against static charges and are contained within a PEEK cylindrical enclosure material at the tip.
Probe calibration is described in the following section.

IFA-010 Fast Amplifier

Technical description of IndexSAR IFA-010 Fast probe amplifier
A block diagram of the fast probe amplifier electronics is shown below.

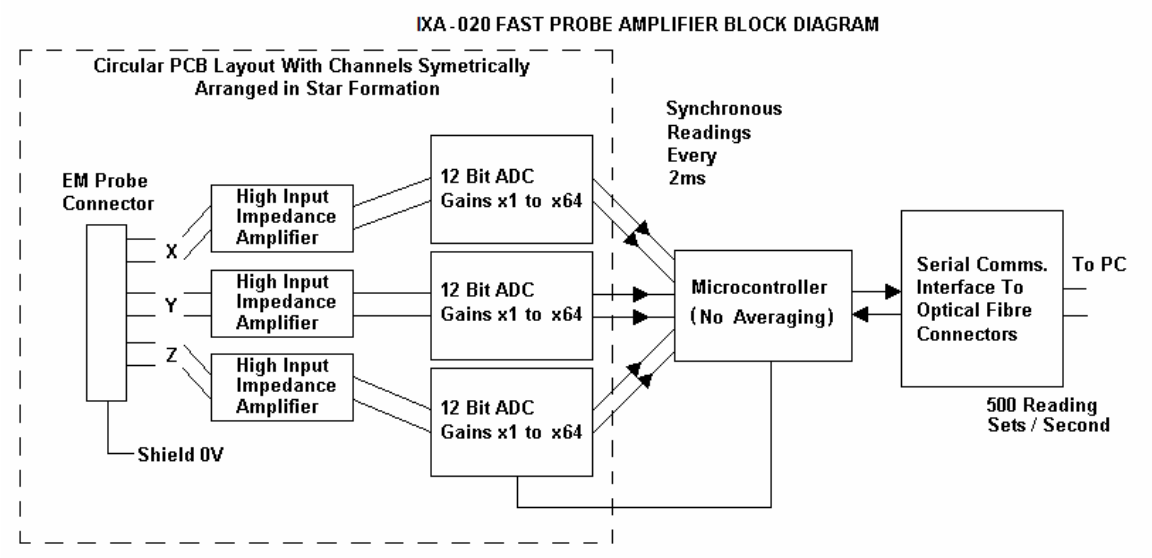

Figure 2: Block diagram of the fast probe amplifier electronic

This amplifier has a time constant of approx. 50µs, which is much faster than the SAR probe response time. The overall system time constant is therefore that of the probe (<1ms) and reading sets for all three channels (simultaneously) are returned every 2ms to the PC. The conversion period is approx. 1 µs at the start of each 2ms period. This enables the probe to follow pulse modulated signals of periods >>2ms. The PC software applies the linearization procedure separately to each reading, so no linearization corrections for the averaging of modulated signals are needed in this case. It is important to ensure that the probe reading frequency and the pulse period are not synchronised and the behaviour with pulses of short duration in comparison with the measurement interval need additional consideration.

Phantoms

The Cube phantom used is a Perspex Box IndexSAR item IXB-070. Dimensions of 200w x 200d x 200h (mm). This phantom is used with IndexSAR side bench IXM-030.

The Flat phantom used is a Rectangular Perspex Box IndexSAR item. Dimensions of 210w x 150d x 200h (mm). This phantom is used with IndexSAR upright bench. The phantom and robot alignment is assured by both mechanical and laser registration systems.

2.1 SAR MEASUREMENT SYSTEM

2.1.3 SAR MEASUREMENT PROCEDURE

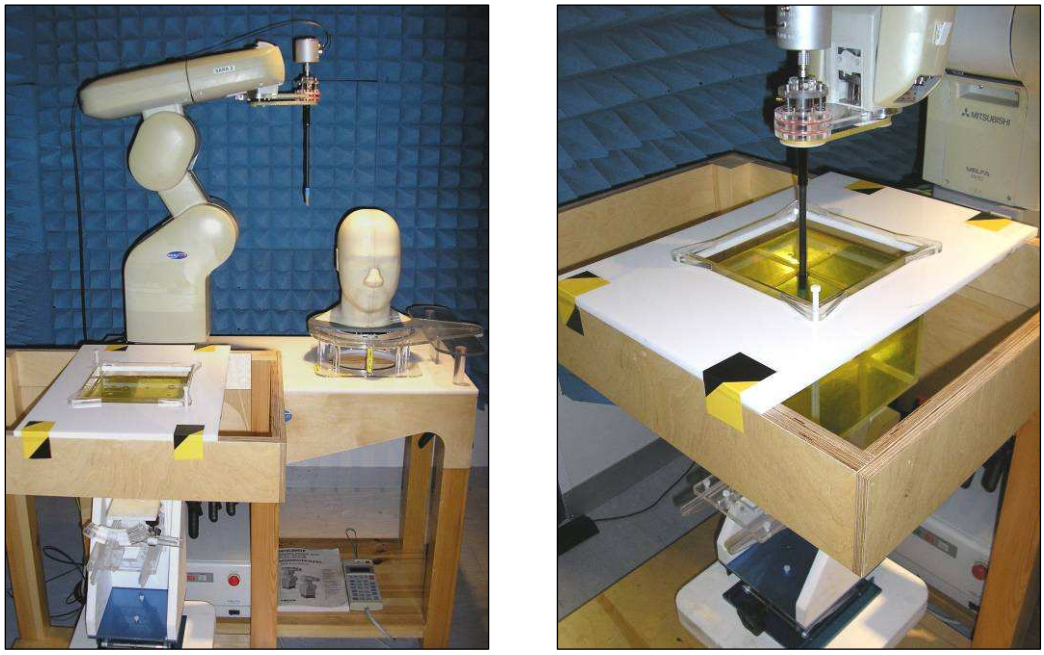

Figure 3: Principal components of the SAR measurement test bench

The major components of the test bench are shown in the picture above. A test set and dipole antenna control the handset via an air link and a low-mass phone holder can position the phone at either ear. Graduated scales are provided to set the phone in the 15 degree position. The upright phantom head holds approx. 7 litres of simulant liquid. The phantom is filled and emptied through a 45mm diameter penetration hole in the top of the head.

After an area scan has been done at a fixed distance of 8mm from the surface of the phantom on the source side, a 3D scan is set up around the location of the maximum spot SAR. First, a point within the scan area is visited by the probe and a SAR reading taken at the start of testing. At the end of testing, the probe is returned to the same point and a second reading is taken. Comparison between these start and end readings enables the power drift during measurement to be assessed.

SARA2 Interpolation and Extrapolation schemes
SARA2 software contains support for both 2D cubic B-spline interpolation as well as 3D cubic B-spline interpolation. In addition, for extrapolation purposes, a general n^{-th} order polynomial fitting routine is implemented following a singular value decomposition algorithm presented in [4]. A 4^{th} order polynomial fit is used by default for data extrapolation, but a linear-logarithmic fitting function can be selected as an option. The polynomial fitting procedures have been tested by comparing the fitting coefficients generated by the SARA2 procedures with those obtained using the polynomial fit functions of Microsoft Excel when applied to the same test input data.

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

2.1 SAR MEASUREMENT SYSTEM

2.1.3 SAR MEASUREMENT PROCEDURE

Extrapolation of 3D scan
For the 3D scan, data are collected on a spatially regular 3D grid having (by default) 6.4 mm steps in the lateral dimensions and 3.5 mm steps in the depth direction (away from the source). SARA2 enables full control over the selection of alternative step sizes in all directions.

The digitised shape of the head is available to the SARA2 software, which decides which points in the 3D array are sufficiently well within the shell wall to be 'visited' by the SAR probe. After the data collection, the data are extrapolated in the depth direction to assign values to points in the 3D array closer to the shell wall. A notional extrapolation value is also assigned to the first point outside the shell wall so that subsequent interpolation schemes will be applicable right up to the shell wall boundary.

Interpolation of 3D scan and volume averaging
The procedure used for defining the shape of the volumes used for SAR averaging in the SARA2 software follow the method of adapting the surface of the 'cube' to conform with the curved inner surface of the phantom (see Appendix C.2.2.1 in EN 50361:2001). This is called, here, the conformal scheme.

For each row of data in the depth direction, the data are extrapolated and interpolated to less than 1mm spacing and average values are calculated from the phantom surface for the row of data over distances corresponding to the requisite depth for 10g and 1g cubes. This results in two 2D arrays of data, which are then cubic B-spline interpolated to sub mm lateral resolution. A search routine then moves an averaging square around through the 2D array and records the maximum value of the corresponding 1g and 10g volume averages. For the definition of the surface in this procedure, the digitised position of the headshell surface is used for measurement in head-shaped phantoms. For measurements in rectangular, box phantoms, the distance between the phantom wall and the closest set of gridded data points is entered into the software.

For measurements in box-shaped phantoms, this distance is under the control of the user. The effective distance must be greater than 2.5mm as this is the tip-sensor distance and to avoid interface proximity effects, it should be at least 5mm. A value of 6 or 8mm is recommended. This distance is called **dbe** in EN 50361:2001.

For automated measurements inside the head, the distance cannot be less than 2.5mm, which is the radius of the probe tip and to avoid interface proximity effects, a minimum clearance distance of x mm is retained. The actual value of dbe will vary from point to point depending upon how the spatially-regular 3D grid points fit within the shell. The greatest separation is when a grid point is just not visited due to the probe tip dimensions. In this case the distance could be as large as the step-size plus the minimum clearance distance (i.e with x=5 and a step size of 3.5, **dbe** will be between 3.5 and 8.5mm).

The default step size (**dstep** in EN 50361:2001) used is 3.5mm, but this is under user-control. The compromise is with time of scan, so it is not practical to make it much smaller or scan times become long and power-drop influences become larger.

The robot positioning system specification for the repeatability of the positioning (**dss** in EN50361:2001) is +/- 0.04mm.

2.1 SAR MEASUREMENT SYSTEM

2.1.3 SAR MEASUREMENT PROCEDURE

The phantom shell is made by an industrial moulding process from the CAD files of the SAM shape, with both internal and external moulds. For the upright phantoms, the external shape is subsequently digitised on a Mitutoyo CMM machine (Euro C574) to a precision of 0.001mm. Wall thickness measurements made non-destructively with an ultrasonic sensor indicate that the shell thickness (**dph**) away from the ear is 2.0 +/- 0.1mm. The ultrasonic measurements were calibrated using additional mechanical measurements on available cut surfaces of the phantom shells.

For the upright phantom, the alignment is based upon registration of the rotation axis of the phantom on its 253mm-diameter baseplate bearing and the position of the probe axis when commanded to go to the axial position. A laser alignment tool is provided (procedure detailed elsewhere). This enables the registration of the phantom tip (**dmis**) to be assured to within approx. 0.2mm. This alignment is done with reference to the actual probe tip after installation and probe alignment. The rotational positioning of the phantom is variable – offering advantages for special studies, but locating pins ensure accurate repositioning at the principal positions (LH and RH ears).

2.2 MAXIMUM FDD V HSDPA (Sub-test 3) SAR TEST RESULT AND COURSE AREA SCAN – 2D

SYSTEM / SOFTWARE:	SARA2 / 2.39 VPM	**INPUT POWER DRIFT:**	0.0dBm
DATE / TIME:	26/07/2007 11:28:13	**DUT BATTERY MODEL/NO:**	N/A (Laptop)
FILENAME:	759010888_1.txt	**PROBE SERIAL NUMBER:**	0190
AMBIENT TEMPERATURE:	23.8℃	**LIQUID SIMULANT:**	850 Body
DEVICE UNDER TEST:	GE0301 Express Card	**RELATIVE PERMITTIVITY:**	56.57
RELATIVE HUMIDITY:	41.8%	**CONDUCTIVITY:**	0.992
PHANTOM S/NO:	FlatPhantom.csv	**LIQUID TEMPERATURE:**	22.4℃
PHANTOM ROTATION:	0°	**MAX SAR X-AXIS LOCATION:**	-8.00 mm
DUT POSITION:	11mm separation (card to phantom)	**MAX SAR Y-AXIS LOCATION:**	-22.00 mm
ANTENNA CONFIGURATION:	Fixed (Integral)	**MAX E FIELD:**	12.41 V/m
TEST FREQUENCY:	826.4MHz	**SAR 1g:**	0.174 W/kg
AIR FACTORS:	356 / 420 / 424	**SAR 10g:**	0.118 W/kg
CONVERSION FACTORS:	0.326 / 0.326 / 0.326	**SAR START:**	0.052 W/kg
TYPE OF MODULATION:	QPSK	**SAR END:**	0.052 W/kg
MODN. DUTY CYCLE:	100%; Crest Factor = 1	**SAR DRIFT DURING SCAN:**	-0.56 %
DIODE COMPRESSION FACTORS (V*200):	20 / 20 / 20	**PROBE BATTERY LAST CHANGED:**	25/07/2007
INPUT POWER LEVEL:	21.09 dBm	**EXTRAPOLATION:**	poly4

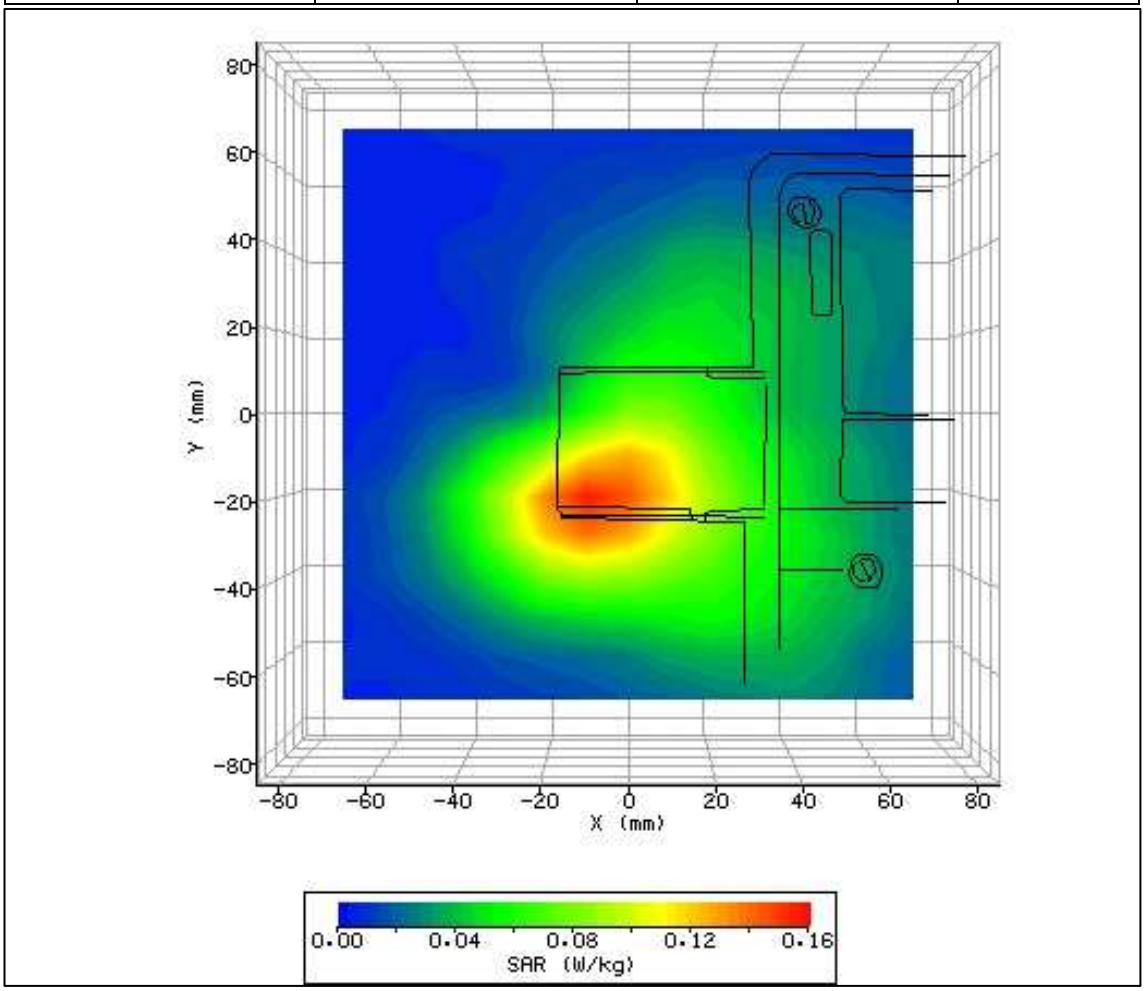

Figure 4: SAR Body Testing Results for the Option GE0301 Express Card (Serial No.: EE4473E074) in 11mm separation distance from bottom of flat phantom; Tested at 826.4MHz (HSDPA Sub-test 3) with Host Laptop HP Compaq nc 6320 in rear facing phantom configuration with 0mm separation distance used

2.2 MAXIMUM FDD V HSUPA (Sub-test 1) SAR TEST RESULT AND COURSE AREA SCAN – 2D

SYSTEM / SOFTWARE:	SARA2 / 2.39 VPM	**INPUT POWER DRIFT:**	0.0dBm
DATE / TIME:	26/07/2007 11:59:57	**DUT BATTERY MODEL/NO:**	N/A (Laptop)
FILENAME:	759010888_2.txt	**PROBE SERIAL NUMBER:**	0190
AMBIENT TEMPERATURE:	24.0℃	**LIQUID SIMULANT:**	850 Body
DEVICE UNDER TEST:	GE0301 Express Card	**RELATIVE PERMITTIVITY:**	56.57
RELATIVE HUMIDITY:	43.2%	**CONDUCTIVITY:**	0.992
PHANTOM S/NO:	FlatPhantom.csv	**LIQUID TEMPERATURE:**	22.4℃
PHANTOM ROTATION:	0°	**MAX SAR X-AXIS LOCATION:**	-5.00 mm
DUT POSITION:	11mm separation (card to phantom)	**MAX SAR Y-AXIS LOCATION:**	-19.00 mm
ANTENNA CONFIGURATION:	Fixed (Integral)	**MAX E FIELD:**	12.57 V/m
TEST FREQUENCY:	826.4MHz	**SAR 1g:**	0.183 W/kg
AIR FACTORS:	356 / 420 / 424	**SAR 10g:**	0.124 W/kg
CONVERSION FACTORS:	0.326 / 0.326 / 0.326	**SAR START:**	0.052 W/kg
TYPE OF MODULATION:	QPSK	**SAR END:**	0.052 W/kg
MODN. DUTY CYCLE:	100%; Crest Factor = 1	**SAR DRIFT DURING SCAN:**	-0.92 %
DIODE COMPRESSION FACTORS (V*200):	20 / 20 / 20	**PROBE BATTERY LAST CHANGED:**	25/07/2007
INPUT POWER LEVEL:	20.48 dBm	**EXTRAPOLATION:**	poly4

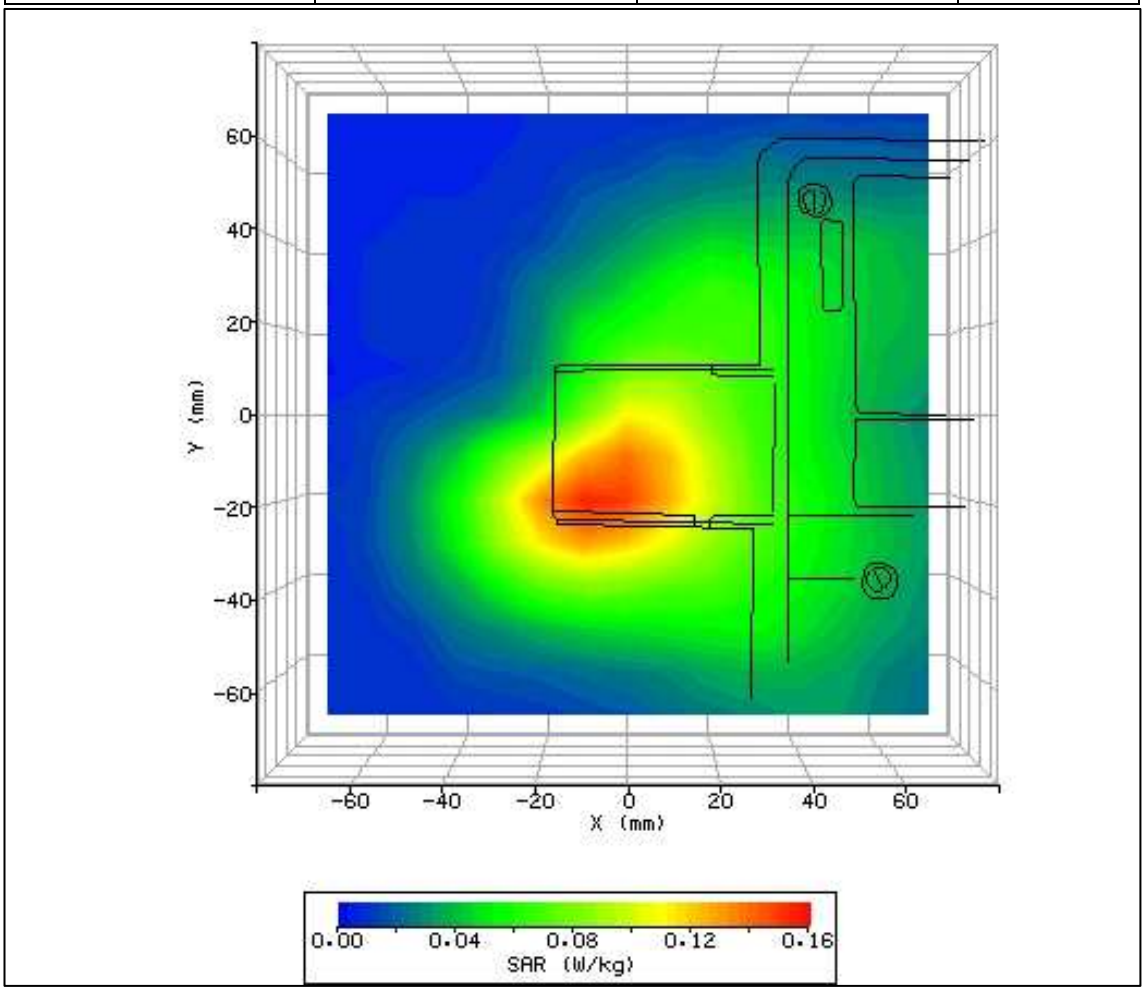

Figure 5: SAR Body Testing Results for the Option GE0301 Express Card (Serial No.: EE4473E074) in 11mm separation distance from bottom of flat phantom; Tested at 826.4MHz (HSUPA Sub-test 1) with Host Laptop HP Compaq nc 6320 in rear facing phantom configuration with 0mm separation distance used

2.2 MAXIMUM FDD II HSDPA (Sub-test 3) SAR TEST RESULT AND COURSE AREA SCAN – 2D

SYSTEM / SOFTWARE:	SARA2 / 2.39 VPM	**INPUT POWER DRIFT:**	0.0dBm
DATE / TIME:	25/07/2007 15:59:19	**DUT BATTERY MODEL/NO:**	N/A (Laptop)
FILENAME:	759010888_3.txt	**PROBE SERIAL NUMBER:**	0190
AMBIENT TEMPERATURE:	24.0℃	**LIQUID SIMULANT:**	1900 Body
DEVICE UNDER TEST:	GE0301 Express Card	**RELATIVE PERMITTIVITY:**	52.17
RELATIVE HUMIDITY:	59.2%	**CONDUCTIVITY:**	1.526
PHANTOM S/NO:	FlatPhantom.csv	**LIQUID TEMPERATURE:**	22.1℃
PHANTOM ROTATION:	0°	**MAX SAR X-AXIS LOCATION:**	-26.00 mm
DUT POSITION:	14mm separation (card to phantom)	**MAX SAR Y-AXIS LOCATION:**	-7.00 mm
ANTENNA CONFIGURATION:	Fixed (Integral)	**MAX E FIELD:**	9.65 V/m
TEST FREQUENCY:	1852.4MHz	**SAR 1g:**	0.166 W/kg
AIR FACTORS:	356 / 420 / 424	**SAR 10g:**	0.101 W/kg
CONVERSION FACTORS:	0.456 / 0.456 / 0.456	**SAR START:**	0.032 W/kg
TYPE OF MODULATION:	QPSK	**SAR END:**	0.034 W/kg
MODN. DUTY CYCLE:	100%; Crest Factor = 1	**SAR DRIFT DURING SCAN:**	5.22 %
DIODE COMPRESSION FACTORS (V*200):	20 / 20 / 20	**PROBE BATTERY LAST CHANGED:**	25/07/2007
INPUT POWER LEVEL:	21.32 dBm	**EXTRAPOLATION:**	poly4

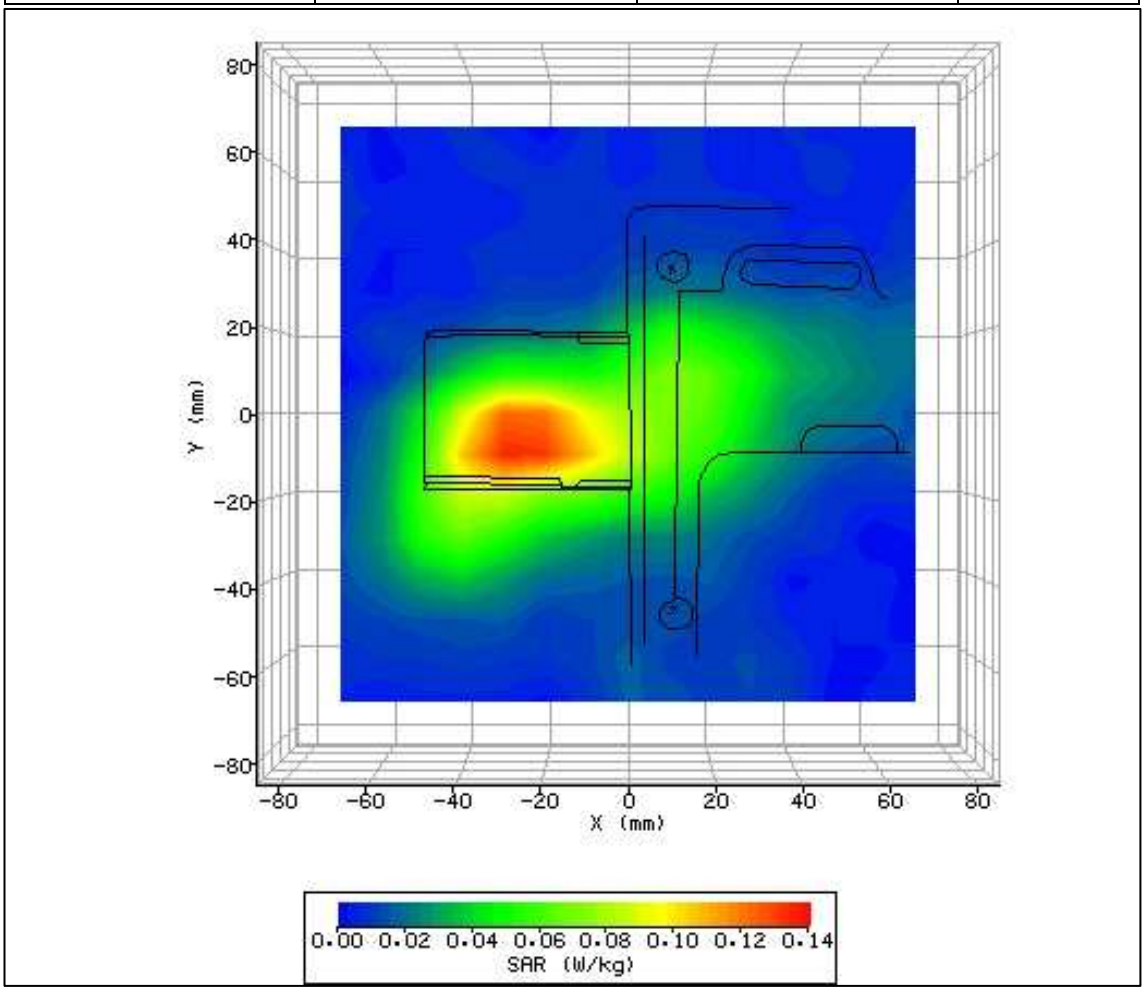

Figure 6: SAR Body Testing Results for the Option GE0301 Express Card (Serial No.: EE44739017) in 14mm separation distance from bottom of flat phantom; Tested at 1852.4MHz (HSDPA Sub-test 3) with Host Laptop Acer TravelMate 4260 Series in rear facing phantom configuration with 0mm separation distance used

2.2 MAXIMUM FDD II HSUPA (Sub-test 5) SAR TEST RESULT AND COURSE AREA SCAN – 2D

SYSTEM / SOFTWARE:	SARA2 / 2.39 VPM	**INPUT POWER DRIFT:**	0.0dBm
DATE / TIME:	25/07/2007 16:29:46	**DUT BATTERY MODEL/NO:**	N/A (Laptop)
FILENAME:	759010888_4.txt	**PROBE SERIAL NUMBER:**	0190
AMBIENT TEMPERATURE:	23.7℃	**LIQUID SIMULANT:**	1900 Body
DEVICE UNDER TEST:	GE0301 Express Card	**RELATIVE PERMITTIVITY:**	52.17
RELATIVE HUMIDITY:	58.5%	**CONDUCTIVITY:**	1.526
PHANTOM S/NO:	FlatPhantom.csv	**LIQUID TEMPERATURE:**	22.1℃
PHANTOM ROTATION:	0°	**MAX SAR X-AXIS LOCATION:**	-26.00 mm
DUT POSITION:	14mm separation (card to phantom)	**MAX SAR Y-AXIS LOCATION:**	-6.00 mm
ANTENNA CONFIGURATION:	Fixed (Integral)	**MAX E FIELD:**	9.61 V/m
TEST FREQUENCY:	1852.4MHz	**SAR 1g:**	0.169 W/kg
AIR FACTORS:	356 / 420 / 424	**SAR 10g:**	0.101 W/kg
CONVERSION FACTORS:	0.456 / 0.456 / 0.456	**SAR START:**	0.032 W/kg
TYPE OF MODULATION:	QPSK	**SAR END:**	0.033 W/kg
MODN. DUTY CYCLE:	100%; Crest Factor = 1	**SAR DRIFT DURING SCAN:**	3.70 %
DIODE COMPRESSION FACTORS (V*200):	20 / 20 / 20	**PROBE BATTERY LAST CHANGED:**	25/07/2007
INPUT POWER LEVEL:	21.03 dBm	**EXTRAPOLATION:**	poly4

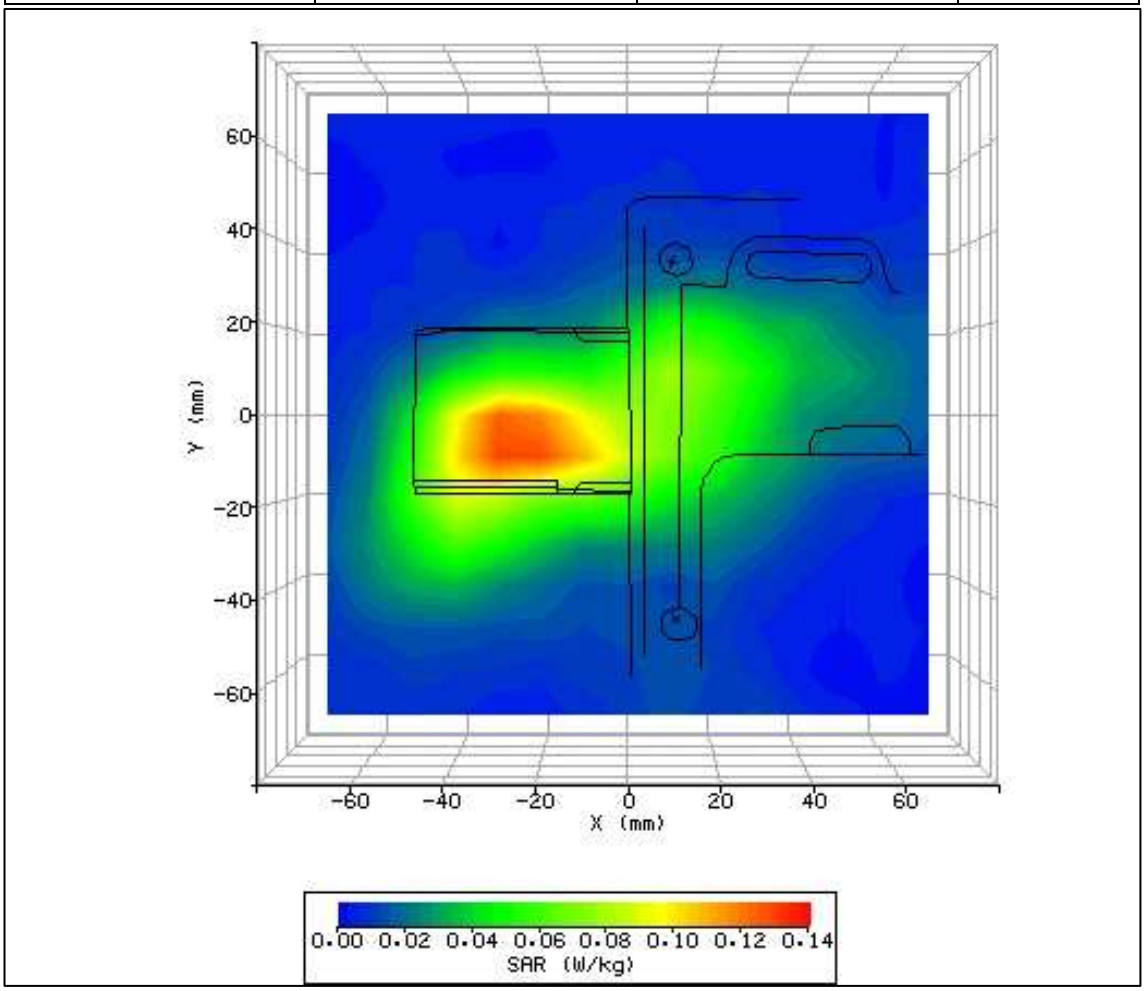

Figure 7: SAR Body Testing Results for the Option GE0301 Express Card (Serial No.: EE44739017) in 14mm separation distance from bottom of flat phantom; Tested at 1852.4MHz (HSUPA Sub-test 5) with Host Laptop Acer TravelMate 4260 Series in rear facing phantom configuration with 0mm separation distance used

SECTION 3

TEST EQUIPMENT

3.1 TEST EQUIPMENT

The following test equipment was used at TUV Product Service Ltd:

INSTRUMENT DESCRIPTION	MANUFACTURER	MODEL TYPE	TEST EQUIPMENT NO.	CALIBRATION DATES	
Bench-top Robot	Mitsubishi	RV-E2	156	N/A	N/A
Fast Probe Amplifier	IndexSAR Ltd.	IFA-010	1557	N/A	N/A
Side Bench 2	IndexSAR Ltd.	IXM-030	1571	N/A	N/A
Upright Bench 1	IndexSAR Ltd.	SARA2 system	1568	N/A	N/A
SAR Probe	IndexSAR Ltd.	IXP-050	1556	26/10/2006	26/10/2007
Radiocommunication Analyser	Anritsu	8815B	6200576541	N/A	N/A
Signal Generator	Hewlett Packard	E4422A	61	12/03/2007	12/03/2008
Power Meter	Rohde & Schwarz	NRV	52	17/05/2007	17/05/2008
RF Pre-Amplifier	IndexSAR Ltd.	0.8-3G	2415	N/A	N/A
Bi-Directional Coupler	Krytar	1850	58	27/01/2007	27/01/2008
20dB Attenuator	Narda	766F-10	483	01/06/2007	01/06/2008
Digital Thermometer	Digitron	T208	64	19/10/2006	19/10/2007
Thermocouple	Rohde & Schwarz	K	65	19/10/2006	19/10/2007
835MHz Body TEM	BABT	Batch 7	N/A	11/07/2007	11/08/2007
1900MHz Body TEM	BABT	Batch 3	N/A	11/07/2007	11/08/2007
835MHz Head TEM	BABT	Batch 11	N/A	11/07/2007	11/08/2007
1900MHz Head TEM	BABT	Batch 2	N/A	11/07/2007	11/08/2007
850 MHz Dipole	IndexSAR Ltd.	IEEE1528	N/A	26/07/2007	26/07/2007
1900 MHz Dipole	IndexSAR Ltd.	IEEE1528	N/A	24/07/2007	25/07/2007
Flat Phantom 2mm Side	IndexSAR Ltd.	HeadBox01	1563	N/A	N/A
200mm Cube Box Phantom (FlatPhantom.csv)	IndexSAR Ltd.	IXB-070	1565	N/A	N/A

3.2 TEST SOFTWARE

The following software was used to control the BABT SARA2 System:

INSTRUMENT	VERSION NO.	DATE
SARA2 system	v.2.3.9 VPM	09/09/2005
Mitsubishi robot controller firmware revision	RV-E2 Version C9a	-
IFA-10 Probe amplifier	Version 2.5	-

3.3 DIELECTRIC PROPERTIES OF SIMULANT LIQUIDS

The fluid properties of the simulant fluids used during routine SAR evaluation meet the dielectric properties required by EN50361:2001 & OET Bulletin 65 (Edition 97-01).

The fluids were calibrated in our Laboratory and re-checked prior to any measurements being made against reference fluids stated in IEEE 1528-2003 of 0.9% NaCl (Salt Solution) at 23ºC and also for Dimethylsulphoxide (DMS) at 21ºC.

The fluids were made at BABT under controlled conditions from the following OET(65)c formulae and IEEE1528-2003. The composition of ingredients may have been modified accordingly to achieve the desired target tissue parameters required for routine SAR evaluation:

OET 65(c) Recipes

Ingredients (% by weight)	**Frequency (MHz)**									
	450		835		915		1900		2450	
Tissue Type	Head	Body	Head	Body	Head	Body	Head	Body	Head	Body
Water	38.56	51.16	41.45	52.4	41.05	56.0	54.9	40.4	62.7	73.2
Salt (NaCl)	3.95	1.49	1.45	1.4	1.35	0.76	0.18	0.5	0.5	0.04
Sugar	56.32	46.78	56.0	45.0	56.5	41.76	0.0	58.0	0.0	0.0
HEC	0.98	0.52	1.0	1.0	1.0	1.21	0.0	1.0	0.0	0.0
Bactericide	0.19	0.05	0.1	0.1	0.1	0.27	0.0	0.1	0.0	0.0
Triton X-100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.8	0.0
DGBE	0.0	0.0	0.0	0.0	0.0	0.0	44.92	0.0	0.0	26.7
Dielectric Constant	43.42	58.0	42.54	56.1	42.0	56.8	39.9	54.0	39.8	52.5
Conductivity (S/m)	0.85	0.83	0.91	0.95	1.0	1.07	1.42	1.45	1.88	1.78

IEEE 1528 Recipes

Frequency (MHz)	**300**	**450**		**835**	**900**			**1450**	**1800**				**1900**		**1950**	**2000**	**2100**		**2450**		**3000**
Recipe #	**1**	**1**	**3**	**1**	**1**	**2**	**3**	**1**	**1**	**2**	**2**	**3**	**1**	**2**	**4**	**1**	**1**	**2**	**2**	**3**	**1**
Ingredients (% by weight)																					
1,2-Propanediol						64.81															
Bactericide	0.19	0.19	0.5	0.1	0.1		0.5					0.5								0.5	
Diacetin			48.9				49.2					49.43								49.75	
DGBE								45.41	47	13.84	44.92		44.92	13.84	45	50	50	7.99	7.99		7.99
HEC	0.98	0.98		1	1																
NaCl	5.95	3.95	1.7	1.45	1.48	0.79	1.1	0.67	0.36	0.35	0.18	0.64	0.18	0.35				0.16	0.16		0.16
Sucrose	55.32	56.32		57	56.5																
Triton X-100										30.45				30.45				19.97	19.97		19.97
Water	37.56	38.56	48.9	40.45	40.92	34.4	49.2	53.82	52.64	55.36	54.9	49.43	54.9	55.36	55	50	50	71.88	71.88	49.75	71.88
Measured dielectric parameters																					
ε_r'	46	43.4	44.3	41.6	41.2	41.8	42.7	40.9	39.3	41	40.4	39.2	39.9	41	40.1	37	36.8	41.1	40.3	39.2	37.9
σ (S/m)	0.86	0.85	0.9	0.9	0.98	0.97	0.99	1.21	1.39	1.38	1.4	1.4	1.42	1.38	1.41	1.4	1.51	1.55	1.88	1.82	2.46
Temp. (°C)	22	22	20	22	22	22	20	22	22	21	22	20	21	21	20	22	22	20	20	20	20
Target dielectric parameters (Table 5-1)																					
ε_r'	45.3	43.5		41.5	41.5			40.5	40								39.8		39.2		38.5
σ (S/m)	0.87	0.87		0.9	0.97			1.2	1.4								1.49		1.8		2.4

3.3 DIELECTRIC PROPERTIES OF SIMULANT LIQUIDS

The dielectric properties of the tissue simulant liquids used for the SAR testing at BABT are as follows:-

FLUID TYPE	FREQUENCY	RELATIVE PERMITTIVITY εr (e') TARGET	RELATIVE PERMITTIVITY εr (e') MEASURED	CONDUCTIVITY σ TARGET	CONDUCTIVITY σ MEASURED
HEAD	835 MHz	41.50	42.14	0.90	0.917
BODY	835 MHz	55.00	56.57	0.97	0.992
HEAD	1900 MHz	40.00	39.26	1.40	1.39
BODY	1900 MHz	53.30	52.17	1.52	1.526

3.4 TEST CONDITIONS

TEST LABORATORY CONDITIONS

Ambient Temperature: Within +15°C to +35°C at 20% RH to 75% RH.
The actual Temperature during the testing ranged from 23.7°C to 24.0 °C.
The actual Humidity during the testing ranged from 41.8% to 59.2% RH.

TEST FLUID TEMPERATURE RANGE

FREQUENCY (MHZ)	835	835	1900	1900
BODY / HEAD FLUID	HEAD	BODY	HEAD	BODY
MIN TEMPERATURE (℃)	22.3	22.4	22.6	22.1
MAX TEMPERATURE (℃)	22.3	22.4	22.6	22.1

SAR DRIFT

The SAR Drift was within acceptable limits during scans. The maximum SAR Drift, drift due to the handset electronics, was recorded as 5.20% (0.220dB) for all of the testing. The value 5.20% has been included in the measurement uncertainty budget.

3.5 MEASUREMENT UNCERTAINTY

ERROR SOURCES	EN 50361 Description (Subclause)	Uncertainty (%)	Probability Distribution	Divisor	ci	ci^2	Standard Uncertainty (%)	Stand Uncert^2	(Stand Uncert^2) X (ci^2)
Measurement Equipment									
Calibration	7.2.1.1	10	Normal	2.00	1	1	5.00	25.00	25.00
Isotropy	7.2.1.2	10.6	Rectangular	1.73	1	1	6.12	37.45	37.45
Linearity	7.2.1.3	2.92	Rectangular	1.73	1	1	1.69	2.84	2.84
Probe Stability	-	2.46	Rectangular	1.73	1	1	1.42	2.02	2.02
Detection limits	7.2.1.4	0	Rectangular	1.73	1	1	0.00	0.00	0.00
Boundary effect	7.2.1.5	1.7	Rectangular	1.73	1	1	0.98	0.96	0.96
Measurement device	7.2.1.6	0	Normal	1.00	1	1	0.00	0.00	0.00
Response time	7.2.1.7	0	Normal	1.00	1	1	0.00	0.00	0.00
Noise	7.2.1.8	0	Normal	1.00	1	1	0.00	0.00	0.00
Integration time	7.2.1.9	2.3	Normal	1.00	1	1	2.30	5.29	5.29
Mechanical constraints									
Scanning system	7.2.2.1	0.57	Rectangular	1.73	1	1	0.33	0.11	0.11
Phantom shell	7.2.2.2	1.43	Rectangular	1.73	1	1	0.83	0.68	0.68
Matching between probe and phantom	7.2.2.3	2.86	Rectangular	1.73	1	1	1.65	2.73	2.73
Positioning of the phone 'Y' Co-ordinate	7.2.2.4	1.5	Normal	1.00	1	1	1.50	2.25	2.25
Positioning of the phone 'Z' Co-ordinate	7.2.2.4	1.73	Normal	1.00	1	1	1.73	2.99	2.99
Physical Parameters									
Liquid conductivity (deviation from target)	7.2.3.2	5	Rectangular	1.73	0.5	0.25	2.89	8.33	2.08
Liquid conductivity (measurement error)	7.2.3.2	15.3	Rectangular	1.73	0.5	0.25	8.83	78.03	19.51
Liquid permittivity (deviation from target)	7.2.3.3	5	Rectangular	1.73	0.5	0.25	2.89	8.33	2.08
Liquid permittivity (measurement error)	7.2.3.3	5	Rectangular	1.73	0.5	0.25	2.89	8.33	2.08
Drifts in output power of the phone, probe, temperature and humidity	7.2.3.4	5.2	Rectangular	1.73	1	1	3.00	9.01	9.01
Perturbation by the environment	7.2.3.5	3	Rectangular	1.73	1	1	1.73	3.00	3.00
Post-Processing									
SAR interpolation and extrapolation	7.2.4.1	2.4	Rectangular	1.73	1	1	1.39	1.92	1.92
Maximum SAR evaluation	7.2.4.2	2.4	Rectangular	1.73	1	1	1.39	1.92	1.92
Combined standard uncertainty	11.13						**Total**		**123.94**
Expanded uncertainty = (confidence interval of 95 %)	**22.27**	**%** (Using a Coverage Factor of K=2)							