SAR Test Report

FOR:

Manufacturer: Trimble Navigation Limited
Model Name: 88161
FCC ID: JUP88161
IC ID: 1756A-88161

Test Report #: SAR_TRIM2-017-13001_FCC_IC

Date of Report: 2013-10-09

FCC Listed #:
A2LA Accredited

IC Recognized #
3462B-1

***CETECOM* Inc.**
411 Dixon Landing Road ◆ Milpitas, CA 95035 ◆ U.S.A.
Phone: + 1 (408) 586 6200 ◆ Fax: + 1 (408) 586 6299 ◆ E-mail: info@cetecomusa.com ◆ http://www.cetecom.com
CETECOM Inc. is a Delaware Corporation with Corporation number: 2905571

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1. Assessment

The following device was evaluated against the limits for general population uncontrolled exposure specified in FCC 2.1093 and RSS 102, Issue 4 according to measurement procedures specified in FCC OET Bulletin 65, Supplement C (Edition 01-01), additional FCC regulation as listed in chapter 5, and IEEE 1528:2003 and no deviations were ascertained during the course of the tests performed.

Company	Description	Model #
Trimble Navigation New Zealand	Geo Explorer 7 Series	88161

Responsible for Testing Laboratory:

Date	Section	Name	Signature
2013-10-09	Compliance	Franz Engert (Manager of Compliance)	Digitally signed by Franz Engert DN: cn=Franz Engert, c=US, o=CETECOM, ou=Complience, email=franz.engert@cetecom.com Date: 2013.10.14 18:12:01 -07'00'

Responsible for the Report:

Date	Section	Name	Signature
2013-10-09	Compliance	Josie Sabado (Test Lab Manager)	

The test results of this test report relate exclusively to the test item specified in Section 3.
CETECOM Inc. USA does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of CETECOM Inc. USA.

2. Administrative Data

2.1. Identification of the Testing Laboratory Issuing the SAR Test Report

Company Name:	CETECOM Inc.
Department:	Compliance
Address:	411 Dixon Landing Road Milpitas, CA 95035 U.S.A.
Telephone:	+1 (408) 586 6200
Fax:	+1 (408) 586 6299
Test Lab Manager:	Josie Sabado
Responsible Project Leader:	Yadvinder Garcha

2.2. Identification of the Client

Applicant's Name:	Trimble Navigation Limited
Street Address:	11 Birmingham Drive P.O. Box 8729
City/Zip Code	Riccarton, Christchurch 8440
Country	New Zealand
Contact Person:	Bruce Maule
Phone No.	+64 3.963.5628
Fax:	+64 3.963.5417
e-mail:	bruce_maule@trimble.com

2.3. Identification of the Manufacturer

Same as client above.

3. Equipment under Test (EUT)

3.1. General Specification of the Equipment under Test

EUT Description:	Industrial Handheld Computer
Model No:	88161
Marketing Name:	GeoExplorer® 7 Series handheld, Geo 7X
FCC ID:	JUP88161
IC ID:	1756A-88161
Product Type:	Portable
RF Exposure Environment:	General / Uncontrolled
Dimensions:	240 x 95 x 55 mm
Exposure Conditions:	Near Body and Handheld Extremity (UMPC procedures)
Power Back-Off Modes:	None
Antenna Type:	Cellular: PIFA Foil Antenna WLAN / BT: Pulse Antenna W3008 Omnidirectional
Operating Voltage Range:	9V (Low) / 11.1V (Nominal) / 15.75V (Max)
Operating Temperature Range:	–20°C ~ +60°C
Prototype/Production:	Identical Prototype

Supported Radios:	Cinterion PSX8 Module
	• Five-Bands UMTS
	  o 800, 850, 900, 1900, and 2100 MHz
	  o UMTS / HSPA+, 3GPP Release 6 / 7
	• Quad-Band GSM
	  o 850, 900, 1800, and 1900 MHz
	  o GSM / GPRS / EDGE Multislot Class 12
	• Dual Band CDMA 800 / 1900 MHz
	  o 3GPP2: 1xAdvanced, EV-DO Rev A.
	Murata LBEE19NJZC WLAN / BT module
	• Bluetooth v2.1 + EDR, Class 2
	• 802.11 b/g
	GPS receiver

Date of Testing:	07/16/2013 – 09/20/2013

3.2. Technical Specification of Supported Radios

Technology	Duty Cycle	Type(s) of Modulation	Band	Transmit Frequency Range (MHz)	Measured Maximum Conducted Output Power (dBm)
(E)GPRS	1 uplink timeslot: 12.5% 2 uplink timeslots: 25% 3 uplink timeslots: 37.5% 4 uplink timeslots: 50%	GMSK, 8PSK	GSM 850	824.2 – 848.8	33.05
			PCS 1900	1850.2 – 1909.8	30.3
WCDMA	100%	QPSK, 16 QAM	FDD II	1852.4 – 1907.6	24.5
			FDD V	826.4 – 846.6	24.11
CDMA	100%	QPSK, HPSK	Band Class 0	824.7 – 848.31	24.38
			Band Class 1	1851.25 – 1908.75	24.19
Bluetooth	46%	GFSK, π/4 DQPSK, 8DPSK	N/A	2402 – 2480	1.18
802.11 b/g	100%	BPSK, QPSK, 16-QAM, 64-QAM	N/A	2412 – 2462	14.38
GPS	N/A	N/A	L1	N/A	N/A[1]

NOTES:
1. Bands are supported by the EUT, but outside of the scope of this test report.

3.3. Identification of the Equipment Under Test (EUT)

EUT #	Serial Number	HW Version	SW Version	Comments
1	5315414830	Rev A	6.7.0	Radiated Sample
2	5315414839	Rev A	6.7.0	Radiated Sample
3	5315414835	Rev A	6.7.0	Conducted Sample
4	5315414837	Rev A	6.7.0	Conducted Sample

3.4. Identification of Accessory equipment

AE #	Type	Manufacturer	Model
1	Laser Accessory	Trimble Navigation Ltd.	Geo 7 Laser Rangefinder - 88185

3.5. Maximum SAR values

Band	Exposure Condition	Measured 1g SAR	Maximum Extrapolated 1g SAR[1]
GSM 850	Body	0.725	0.923
PCS 1900	Body	1.19	1.43
WCDMA FDD II	Body	1.32	**1.46**
WCDMA FDD V	Body	0.265	0.265
EVDO BC0	Body	0.222	0.238
EVDO BC1	Body	0.737	0.890
WLAN (DTS)	Body	0.056	0.077
Simultaneous Transmission	Body		**1.54**

NOTES:
1. Measured 1g SAR scaled to manufacturer stated output power upper tolerance limit.

Band	Exposure Condition	Measured 10g SAR	Maximum Extrapolated 10g SAR[1]
GSM 850	Extremity (Hands)	1.12	1.43
PCS 1900	Extremity (Hands)	1.26	**1.66**
WCDMA FDD II	Extremity (Hands)	1.23	1.38
WCDMA FDD V	Extremity (Hands)	0.271	0.271
EVDO BC0	Extremity (Hands)	0.289	0.310
EVDO BC1	Extremity (Hands)	1.05	1.27
WLAN (DTS)	Extremity (Hands)	0.092	0.127
Simultaneous Transmission	Extremity (Hands)		**1.79**

NOTES:
1. Measured 1g SAR scaled to manufacturer stated output power upper tolerance limit.

4. Subject of Investigation

The objective of the measurements done by CETECOM Inc. was the dosimetric assessment of the EUT described in section 3. The tests were performed in configurations for devices operated next to a person's body. The examinations were carried out with the dosimetric assessment system DASY52 described in Section 6.

Full testing was performed on the device without the laser attachment accessory described in section 3.4. Spot check tests were performed on the device with that accessory for the worst-case in every wireless technology, frequency band, and exposure condition combination as indicated in FCC KDB **648474 D04 Handset SAR v01r01.**

4.1. The IEEE Standard C95.1 , FCC Exposure Criteria, and IC Exposure Criteria

The FCC limits are set by CFR 47 FCC rule parts 1.1307 and 2.1093. The IC limits are set by RSS 102, Issue 4. The limits are derived from the recommendations in IEEE C95.1-1999 (ANSI/IEEE C95.1-1999), "IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz."

4.2. SAR Limit

In this report the comparison between the exposure limits and the SAR data is made using the spatial peak SAR.

Having in mind a worst case consideration, the SAR limit is valid for uncontrolled environment and portable transmitters. The SAR values have to be averaged over a mass of 1g (SAR_{1g}) and 10g (SAR_{10g}) with the shape of a cube.

Standard	Exposure Condition	Average SAR (W/kg)	Mass Average (g)
OET Bulletin 65C	Partial-Body	1.6	1
OET Bulletin 65C	Hands, Wrists, Feet and Ankles	4.0	10
RSS 102, Issue 4	Localized Head and Trunk	1.6	1
RSS 102, Issue 4	Localized Limbs	4.0	10

5. Measurement Procedure

The Federal Communications Commission (FCC) requires routine dosimetric assessment of mobile telecom-communications devices, either by laboratory measurement techniques or by computational modeling, prior to equipment authorization or use. In 2001 the Commission's Office of Engineering and Technology has released Edition 01-01 of Supplement C to OET Bulletin 65. This revised edition, which replaces Edition 97-01, provides additional guidance and information for evaluating compliance of mobile and portable devices with FCC limits for human exposure to radiofrequency emissions. The following KDB Publications have also been used:

447498 D01 V05 – General RF Exposure Guidance
648474 D04 V01R01 – Handset SAR
865664 D01V01 – SAR measurement 100 MHz to 6 GHz
248227 D01 V01R02 – SAR Measurement Procedures for 802.11 a/b/g Transmitters
941225 D01 V02 – SAR Measurement Procedures for 3G Devices
941225 D03 V01 – Recommended SAR Test Reduction Procedures for GSM/GPRS/EDGE
941225 D07 V01R01 – UMPC Mini Tablet

Industry Canada (IC) requirements and measurement techniques regarding RF exposure are described in RSS-102, Issue 4, which refers to the latest version of IEEE 1528 and IEC 62209. IC follows many of the same procedures as applied for compliance with FCC requirements regarding EUT specific technologies and form factors. IC allows the use of the above listed KDBs in most aspects.

Additionally, a KDB inquiry was submitted for test procedures due to the shape of the EUT and to allow the use of alternate test procedures using 0 mm and 10 mm test separation distance. Guidance from this KDB was utilized in SAR evaluation. See Appendix B for test setup photographs.

5.1. General Requirements

SAR evaluation was performed in a laboratory with an environment which avoids influence on SAR measurements by ambient EM sources and any reflection from the environment itself. The ambient temperature was in the range of 20°C to 26°C and 30-70% humidity. Simulating liquid temperature did not deviate more than +/- 2°C throughout SAR evaluation.

5.2. Body-worn and Other Configurations

Phantom Requirements
For body-worn and other configurations a flat phantom shall be used which is comprised of material with electrical properties similar to the corresponding tissues.

Test Position
The body-worn configurations shall be tested with the supplied accessories (belt-clips, holsters, etc.) attached to the device in normal use configuration. Devices with a headset output shall be tested with a connected headset.

Test to be Performed

For purpose of determining test requirements, accessories may be divided into two categories: those that do not contain metallic components and those that do. For multiple accessories that do not contain metallic components, the device may be tested only with that accessory which provides the closest spacing to the body. For multiple accessories that contain metallic components, the device must be tested with each accessory that contains a unique metallic component. If multiple accessories share an identical metallic component, only the accessory that provides the closest spacing to the body must be tested. If the manufacturer provides none body-worn accessories a separation distance of 1.5 cm between the back of the device and the flat phantom is recommended. Other separation distances may be used, but they shall not exceed 2.5 cm. In these cases, the device may use body-worn accessories that provide a separation distance greater than that tested for the device provided however that the accessory contains no metallic components.

For devices with retractable antenna the SAR test shall be performed with the antenna fully extended and fully retracted. Other factors that may affect the exposure shall also be tested. For example, optional antennas or optional battery packs which may significantly change the volume, lengths, flip open/closed, etc. of the device, or any other accessories which might have the potential to considerably increase the peak spatial-average SAR value.

5.3. Procedure for assessing the peak spatial-average SAR

Step 1*:* Power reference measurement:

Prior to the SAR test, a local SAR measurement should be taken at a user-selected spatial reference point to monitor power variations during testing.

Step 2: Area scan

The measurement procedures for evaluating SAR associated with wireless handsets typically start with a coarse measurement grid in order to determine the approximate location of the local peak SAR values. This is referred to as the "area scan" procedure. The SAR distribution is scanned along the inside surface of typically half of the head of the phantom but at least larger than the areas projected (normal to the phantom's surface) by the handset and antenna. An example grid is given in Figure 4. The distance between the measured points and phantom surface should be less than 8 mm, and should remain constant (variation less than ± 1 mm) during the entire scan in order to determine the locations of the local peak SAR with sufficient precision. The distance between the measurement points should enable the detection of the location of local maximum with an accuracy of better than half the linear dimension of the tissue cube after interpolation. The resolution can also be tested using the functions in [IEEE 1528:2033] Annex E (see E.5.2). The approximate locations of the peak SARs should be determined from area scan. Since a given amplitude local peak with steep gradients may produce lower spatial-average SAR than slightly lower amplitude peaks with less steep gradients, it is necessary to evaluate the other peaks as well. However, since the spatial gradients of local SAR peaks are a function of wavelength inside the tissue simulating liquid and incident magnetic field strength, it is not necessary to evaluate peaks that are less than –2dB of the local maximum. Two-dimensional spline algorithms [Press, et al, 1996], [Brishoual, 2001] are typically used to determine the peaks and gradients within the scanned area. If the peak is closer than one-half of the linear dimension of the 1 g

or 10 g tissue cube to the scan border, the measurement area should be enlarged if possible, e.g., by tilting the probe or the phantom (see Figure 5).

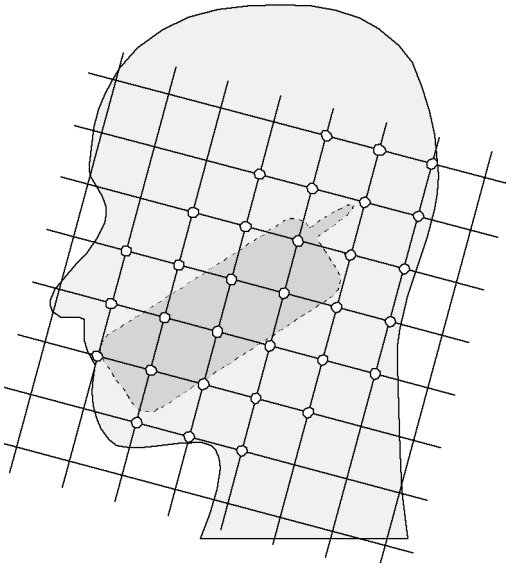

Figure 4 – Example of an area scan including the position of the handset. The scanned area (white dots) should be larger than the area projected by the handset and antenna.

The SPEAG DASY SAR system uses a mechanical sensor detection to find the phantom surface. To decrease test time, the DASY software allows the operator to choose an option where the SAR probe will reuse measurement locations from a previous identical area scan. With this option enabled, the DASY system will not use mechanical sensor detection to find the phantom surface. Locations of each measurement point of the area scan is taken at the same locations as an identical area scan if one is available. Area scans that reused location of measurement points is noted in the result plots under DASY Configuration > Sensor-Surface.

Step 3: Zoom scan

In order to assess the peak spatial SAR values averaged over a 1 g and 10 g cube, fine resolution volume scans, called "zoom scans", are performed at the peak SAR locations determined during the “area scan.” The zoom scan volume should have at least 1.5 times the linear dimension of either a 1 g or a 10 g tissue cube for whichever peak spatial-average SAR is being evaluated. The peak local SAR locations that were determined in the area scan (interpolated value) should be on the centerline of the zoom scans. The centerline is the line that is normal to the surface and in the center of the volume scan. If this is not possible, the zoom scan can be shifted but not by more than half the dimension of the 1 g or a 10 g tissue cube.

The maximum spatial-average SAR is determined by a numerical analysis of the SAR values obtained in the volume of the zoom scan, whereby interpolation (between measured points) and extrapolation (between surface and closest measured points) routines should be applied. A 3-D-spline algorithm [Press, et al, 1996], [Kreyszig, 1983], [Brishoual, 2001] can be used for interpolation and a trapezoidal algorithm for the integration (averaging). Scan resolutions of larger than 2 mm can be used provided the uncertainty is evaluated according to E (see E.5).

In some areas of the phantom, such as the jaw and upper head region, the angle of the probe with respect to the line normal to the surface might become large, e.g., at angles larger than ± 30º (see Figure 5), which may increase the boundary effect to an unacceptable level. In these cases, a change in the orientation of the probe and/or the phantom is recommended during the zoom scan so that the angle between the probe housing tube and the line normal to the surface is significantly reduced (<30º).

Step 4: Power reference measurement

The local SAR should be measured at exactly the same location as in Step 1. The absolute value of the measurement drift (the difference between the SAR measured in Step 4 and Step 1) should be recorded in the uncertainty budget. It is recommended that the drift be kept within ± 5%. If this is not possible, even with repeat testing, additional information may be used to demonstrate the power stability during the test. Power reference measurements can be taken after each zoom scan, if more than one zoom scan is needed. However, the drift should always be referred to the initial state with fully charged battery.

5.4. Determination of the largest peak spatial-average SAR

In order to determine the largest value of the peak spatial-average SAR of a handset, all device positions, configurations and operational modes should be tested for each frequency band according to steps 1 to 3 below.

Step 1: The tests of 6.4 should be conducted at the channel that is closest to the center of the transmit frequency band (*fc*) for:

a) all device positions (cheek and tilt, for both left and right sides of the SAM phantom,

b) all configurations for each device position in (a), e.g. antenna extended and retracted, and

c) all operational modes for each device position in (a) and configuration in (b) in each frequency band, e.g. analog and digital.

If more than three frequencies need to be tested, (i.e., Nc > 3), then all frequencies, configurations and modes must be tested for all of the above positions.

Step 2: For the condition providing highest spatial peak SAR determined in Step 1 conduct all tests of 6.4 at all other test frequencies, e.g. lowest and highest frequencies. In addition, for all other conditions (device position, configuration and operational mode) where the spatial peak SAR value determined in Step 1 is within 3dB of the applicable SAR limit, it is recommended that all other test frequencies should be tested as well[1].

Step 3: Examine all data to determine the largest value of the peak spatial-average SAR found in Steps 1 to 2.

6. The Measurement System

6.1. Robot system specification

The SAR measurement system being used is the SPEAG DASY52 system, which consists of a Stäubli TX90XL 6-axis robot arm and CS8c controller, SPEAG SAR Probe, Data Acquisition Electronics, and SAM Twin Phantom. The robot is used to articulate the probe to programmed positions inside the phantom to obtain the SAR readings from the EUT.

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.

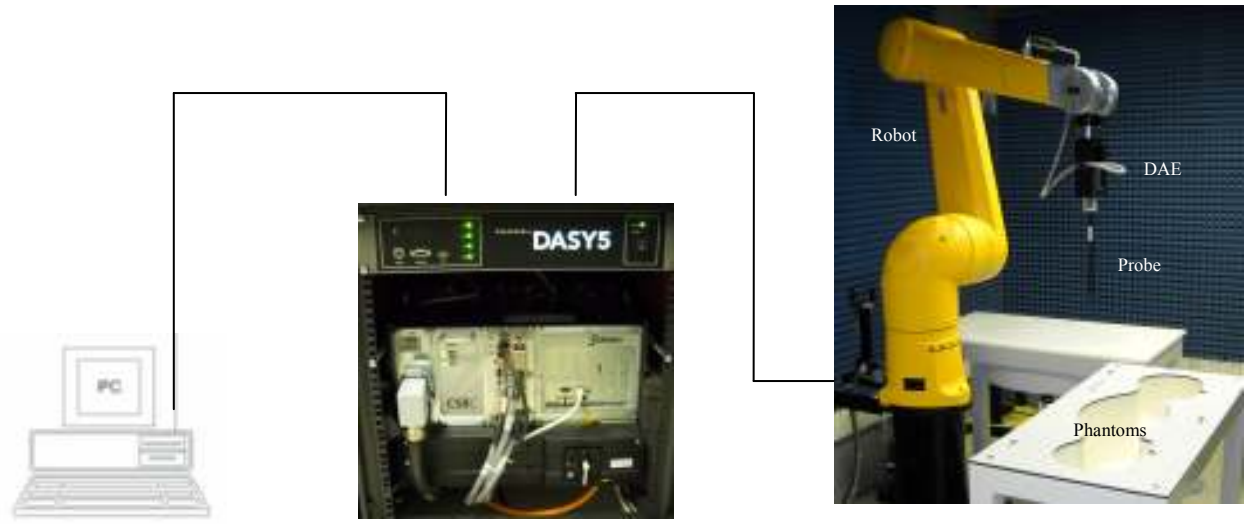

Figure 5: Schematic diagram of the SAR measurement system

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 centered at that point to determine volume averaged SAR level.

6.2. Isotropic E-Field Probe for Dosimetric Measurements

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 probe's calibration certificate.

6.3. Data Acquisition Electronics

The DAE contains a signal amplifier, multiplexer, 16bit A/D converter and control logic. It uses an optical link for communication with the DASY5 system. The DAE has a dynamic range of -100 to 300 mV. It also contains a two step probe touch detector for mechanical surface detection and emergency robot stop.

6.4. Phantoms

The Twin SAM V4.0 Phantom is designed to specifications defined in IEEE 1528, and IEC/EN 62209-1. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region.

Additionally, the Oval Flat ELI V4.0 Phantom is designed to specification defined in IEEE 1528, and IEC/EN 62209-2. It enables the dosimetric evaluation of body mounted usage.

6.5. Interpolation and Extrapolation schemes

The interpolation, extrapolation and maximum search routines are all based on the modifed Quadratic Shepard's method. The interpolation scheme combines a least-square fitted function method and a weighted average method which are the two basic types of computational interpolation and approximation. The routines construct a once-continuously differentiable function that interpolates the measurement values.

7. Uncertainty Assessment

Measurement uncertainty values were evaluated for SAR measurements performed by Cetecom Inc. The uncertainty values for components specified in *FCC Supplement C (01-01) to OET Bulletin 65 (97-01)* were evaluated according to the procedures of *IEEE 1528-200X December 29, 2002, NIST 1297 1994 edition and ISO Guide to the Expression of Uncertainty in Measurements (GUM)*.

7.1. Measurement Uncertainty Budget according to IEEE 1528:2003

a	*b*	*c*	*d*	*e = f(d,k)*	*f*	*g = c x f / e*	*k*
Uncertainty Component	**Sec.**	**Tol. (± %)**	**Prob. Dist.**	**Div.**	**c_i (1-g)**	**1-g u_i (±%)**	**v_i**
Measurement System							
Probe Calibration	E2.1	5.5	N	1	1	5.5	∞
Axial Isotropy	E2.2	4.7	R	√3	0.7	1.9	∞
Hemispherical Isotropy	E2.2	9.6	R	√3	0.7	3.9	∞
Boundary Effect	E2.3	1.0	R	√3	1	0.6	∞
Linearity	E2.4	4.7	R	√3	1	2.7	∞
System Detection Limits	E2.5	1.0	R	√3	1	0.6	∞
Readout Electronics	E2.6	0.3	N	1	1	0.3	∞
Response Time	E2.7	0.8	R	√3	1	0.5	∞
Integration Time	E2.8	2.6	R	√3	1	1.5	∞
RF Ambient Noise	E6.1	3.0	R	√3	1	1.7	∞
RF Ambient Reflections	E6.1	3.0	R	√3	1	1.7	∞
Probe Positioner Mechanical Tolerance	E6.2	0.4	R	√3	1	0.2	∞
Probe Positioning with respect to Phantom Shell	E6.3	2.9	R	√3	1	1.7	∞
Extrapolation, interpolation and Integration Algorithms for Max. SAR Evaluation	E5.2	1.0	R	√3	1	0.6	∞
Test sample Related							
Test Sample Positioning	E4.2	2.9	N	1	1	2.9	*145*
Device Holder Uncertainty	E4.1	3.6	N	1	1	3.6	*5*
Output Power Variation - SAR drift measurement	6.6.2	5.0	R	√3	1	2.9	∞
Phantom and Tissue Parameters							
Phantom Uncertainty (shape and thickness tolerances)	E3.1	4.0	R	√3	1	2.3	∞
Liquid Conductivity Target - tolerance	E3.2	5.0	R	√3	0.7	1.8	∞
Liquid Conductivity - measurement uncertainty	E3.3	2.5	N	1	0.7	1.6	∞
Liquid Permittivity Target tolerance	E3.2	5.0	R	√3	0.6	1.7	∞
Liquid Permittivity - measurement uncertainty	E3.3	2.5	N	1	0.6	1.5	∞
Combined Standard Uncertainty			RSS			**± 10.7%**	
Expanded Uncertainty (95% CONFIDENCE INTERVAL)			*k*= 2.00705			**± 21.4%**	

A measurement uncertainty assessment has been undertaken following guidance given in IEC/EN-62209. Some of the uncertainty contributions are site-specific and, for these, CETECOM, Inc. has assessed the uncertainty contributions arising from local environmental and procedural factors. The resultant uncertainty budget, following the assessment template given IEC/EN-62209 is shown below:

7.1. Measurement Uncertainty Budget according to IEC 62209-2:2010

a	*b*	*c*	*d*	*e = f(d,k)*	*f*	*g = c x f / e*	*k*
Uncertainty Component	**Sec.**	**Tol. (± %)**	**Prob. Dist.**	**Div.**	c_i **(1-g)**	**1-g** u_i **(±%)**	v_i
Measurement System							
Probe Calibration	E2.1	5.5	N	1	1	5.5	∞
Axial Isotropy	E2.2	4.7	R	√3	0.7	1.9	∞
Hemispherical Isotropy	E2.2	9.6	R	√3	0.7	3.9	∞
Boundary Effect	E2.3	1.0	R	√3	1	0.6	∞
Linearity	E2.4	4.7	R	√3	1	2.7	∞
System Detection Limits	E2.5	1.0	R	√3	1	0.6	∞
Readout Electronics	E2.6	0.3	N	1	1	0.3	∞
Response Time	E2.7	0.8	R	√3	1	0.5	∞
Integration Time	E2.8	2.6	R	√3	1	1.5	∞
RF Ambient Noise	E6.1	3.0	R	√3	1	1.7	∞
RF Ambient Reflections	E6.1	3.0	R	√3	1	1.7	∞
Probe Positioner Mechanical Tolerance	E6.2	0.4	R	√3	1	0.2	∞
Probe Positioning with respect to Phantom Shell	E6.3	2.9	R	√3	1	1.7	∞
Extrapolation, interpolation and Integration Algorithms for Max. SAR Evaluation	E5.2	1.0	R	√3	1	0.6	∞
Test sample Related							
Test Sample Positioning	E4.2	2.9	N	1	1	2.9	*145*
Device Holder Uncertainty	E4.1	3.6	N	1	1	3.6	*5*
Output Power Variation - SAR drift measurement	6.6.2	5.0	R	√3	1	2.9	∞
Phantom and Tissue Parameters							
Phantom Uncertainty (shape and thickness tolerances)	E3.1	4.0	R	√3	1	2.3	∞
Liquid Conductivity Target - tolerance	E3.2	5.0	R	√3	0.43	1.2	∞
Liquid Conductivity - measurement uncertainty	E3.3	2.5	N	1	0.43	1.1	∞
Liquid Permittivity Target tolerance	E3.2	5.0	R	√3	0.49	1.4	∞
Liquid Permittivity - measurement uncertainty	E3.3	2.5	N	1	0.49	1.2	∞
Combined Standard Uncertainty			RSS			**± 10.5%**	
Expanded Uncertainty (95% CONFIDENCE INTERVAL)			*k*= 2.00705			**± 21.0%**	

8. Test results summary

8.1. Conducted Average Output Power

Measurement uncertainty for conducted measurements is ±0.5dB

Bluetooth

Average power measured using an average power meter.

Channel	Frequency [MHz]	Average Power [dBm]		
		GFSK	π/4 DQPSK	8-DPSK
0	2402	1.18	-1.9	-1.9
39	2441	0.88	-2	-1.9
78	2480	0.18	-2	-2
Upper Power Tolerance Limit		4	4	4

WLAN

Average power measured using an average power meter.

Channel	Frequency [MHz]	Average Power [dBm]	
		802.11b	802.11g
1	2412	14.38	12.18
6	2437	13.58	10.48
11	2462	12.98	9.78
Upper Power Tolerance Limit		15	15

GSM 850 Band – (E)GPRS

Average power measured using a Rhode and Schwarz CMU 200.

Number of Uplink Timeslots		Modulation	Channel / Frequency [MHz]						Burst Average Upper Power Tolerance Limit [dBm]
			128 / 824.2		190 / 836.6		251 / 848.8		
			Measured Burst Average Power [dBm]	Calculated Time Average Power [dBm]	Measured Burst Average Power [dBm]	Calculated Time Average Power [dBm]	Measured Burst Average Power [dBm]	Calculated Time Average Power [dBm]	
GPRS	1	GMSK	32.65	23.65	33.05	24.05	32.85	23.85	**33.5**
	2		30.05	24.05	30.05	24.05	30.15	24.15	**30.5**
	3		27.85	23.6	28.05	23.8	27.95	23.7	**28.7**
	4		26.75	23.75	26.45	23.45	26.85	23.85	**27.5**
EGPRS	1	GMSK	32.65	23.65	32.85	23.85	32.85	23.85	**33.5**
	2		30.05	24.05	30.05	24.05	30.15	24.15	**30.5**
	3		27.85	23.6	28.05	23.8	27.95	23.7	**28.7**
	4		26.75	23.75	26.45	23.45	26.85	23.85	**27.5**
	1	8PSK	26.75	17.75	26.75	17.75	26.75	17.75	**27.5**
	2		23.65	17.65	23.65	17.65	23.65	17.65	**24.5**
	3		21.95	17.7	22.05	17.8	21.85	17.6	**22.7**
	4		21.25	18.25	21.15	18.15	21.05	18.05	**21.5**

PCS 1900 Band - (E)GPRS

Average power measured using a Rhode and Schwarz CMU 200.

Number of Uplink Timeslots		Modulation	Channel / Frequency [MHz]						Burst Average Upper Power Tolerance Limit [dBm]
			512 / 1850.2		661 / 1880		810 / 1909.8		
			Measured Burst Average Power [dBm]	Calculated Time Average Power [dBm]	Measured Burst Average Power [dBm]	Calculated Time Average Power [dBm]	Measured Burst Average Power [dBm]	Calculated Time Average Power [dBm]	
GPRS	1	GMSK	30.3	21.3	30	21	30.3	21.3	**30.5**
	2		26.9	20.9	27	21	26.9	20.9	**27.5**
	3		24.8	20.55	24.7	20.45	24.8	20.55	**25.7**
	4		23.7	20.7	23.3	20.3	23.6	20.6	**24.5**
EGPRS	1	GMSK	30.3	21.3	30	21	30.3	21.3	**30.5**
	2		26.9	20.9	27	21	26.9	20.9	**27.5**
	3		24.8	20.55	24.7	20.45	24.8	20.55	**25.7**
	4		23.7	20.7	23.3	20.3	23.6	20.6	**24.5**
	1	8PSK	25.1	16.1	25.2	16.2	25.9	16.9	**26.5**
	2		21.9	15.9	22	16	22.7	16.7	**23.5**
	3		20.1	15.85	20.2	15.95	21.1	16.85	**21.7**
	4		18.7	15.7	18.8	15.8	19.6	16.6	**20.5**

WCDMA

Average power measured using a Rhode and Schwarz CMU 200.

Band	Channel	Frequency [MHz]	Average Power [dBm] 12.2kbps RMC	Upper Power Tolerance Limit [dBm]
FDD II	9262	1852.4	24.35	24.5
	9400	1880	24.5	
	9538	1907.6	24.39	
FDD V	4132	826.4	24.05	24.5
	4175	835	24	
	4233	846.6	24.11	

HSDPA

Settings are according to FCC KDB 941225 D01, "SAR Measurement Procedures for 3G Devices" section "Release 5 HSDPA Data Devices"

Average power measured using a Rhode and Schwarz CMU 200. Reference Rhode and Schwarz application note 1CM72: Operation Guide for HSDPA Test Setup according to 3GPP TS 34.121, section 2.2.

Band	Channel	Frequency [MHz]	Average Power [dBm]			
			Sub-test 1	Sub-test 2	Sub-test 3	Sub-test 4
WCDMA FDD V	4132	826.4	24.51	24.47	24.03	24.01
	4175	835	24.48	24.44	24.27	24.23
	4233	846.6	24.66	24.64	24.24	24.52
WCDMA FDD II	9262	1852.4	24.21	24.06	23.81	23.87
	9400	1880	24.25	24.14	23.81	23.89
	9538	1907.6	24.5	24.46	24.16	24.19

HSUPA

Settings are according to FCC KDB 941225 D01, "SAR Measurement Procedures for 3G Devices" section "Release 6 HSPA Data Devices"

Average power measured using a Rhode and Schwarz CMU 200. Reference Rhode and Schwarz application note 1CM73: Operation Guide for HSUPA Test Setup according to 3GPP TS 34.121, section 2.1 and 2.2.

Band	Channel	Frequency [MHz]	Average Power [dBm]				
			Sub-test 1	Sub-test 2	Sub-test 3	Sub-test 4	Sub-test 5
WCDMA FDD V	4132	826.4	23.89	22.73	23.42	23	24.37
	4175	835	23.72	23.07	23.37	23.28	24.34
	4233	846.6	24.15	22.3	23.11	23	24.2
WCDMA FDD II	9262	1852.4	23.86	22.38	23.33	22.47	23.88
	9400	1880	23.78	22.38	23.13	22.48	23.4
	9538	1907.6	24.23	22.74	22.8	22.59	23.48

CDMA

Average power measured using a Rhode and Schwarz CMU 200.

Band	Channel	Frequency [MHz]	Average Power [dBm]		Upper Power Tolerance Limit [dBm]
			SO32, SCH0 Disabled	SO32, SCH0 Enabled	
BC0	1013	824.7	24.27	24.26	24.5
	374	836.52	24.23	24.15	
	777	848.31	24.05	23.97	
BC1	25	1851.25	23.31	23.3	24.5
	600	1880	23.2	23.31	
	1175	1908.75	23.54	23.44	

EV-DO

Average power measured using a Rhode and Schwarz CMU 200.

Band	Channel	Frequency [MHz]	Average Power [dBm]		Upper Power Tolerance Limit [dBm]
			Rel. 0	Rev A	
BC0	1013	824.7	24.24	24.38	24.5
	374	836.52	24.2	24.23	
	777	848.31	24.32	24.26	
BC1	25	1851.25	23.69	23.72	24.5
	600	1880	23.68	23.73	
	1175	1908.75	24.05	24.19	

8.2. Stand-Alone SAR Evaluation Exclusion

Antenna	Operation Mode	SAR Evaluation Exclusion Reason
WLAN	802.11g	According to KDB 248227, 802.11g is not required when the maximum average output power is < ¼ dB higher than that measured on the corresponding 802.11b channels.
Bluetooth	GFSK π/4 DQPSK 8DPSK	According to KDB 447498, Bluetooth is not required when [(*max. power of channel, including tune-up tolerance, mW*)/(*min. test separation distance, mm*)] · [√f(GHz)] ≤ 3.0. The highest power for Bluetooth is 4 dBm (2.5 mW) The test separation distance is 5 mm. The worst case frequency for Bluetooth is 2.480 GHz. (2.5 mW) / (5 mm) · √(2.480 GHz) = 0.8
Cellular	GSM 850 band, 8PSK Modulation	According to KDB 941225 and IEEE 1528-2003 footnote 11, SAR evaluation for low-power modes are required for devices that produced a peak SAR larger than one half of the compliance limit. The highest SAR value for GMSK is less than one half of the 1.6 W/kg limit.
Cellular	HSDPA	According to KDB 941225 and IEEE 1528-2003 footnote 11, SAR evaluation is not required when the maximum average output power is < ¼ dB higher than that measured on the corresponding channels without HSDPA using 12.2 kbps RMC and the maximum SAR for 12.2 kbps RMC is less than 1.2 W/kg.
Cellular	HSDPA, HSUPA	According to KDB 941225, SAR evaluation is not required when the maximum average output power is < ¼ dB higher than that measured on the corresponding channels without HSDPA using 12.2 kbps RMC and the maximum SAR for 12.2 kbps RMC is less than 1.2 W/kg.
Cellular	CDMA	According to KDB 941225, SAR evaluation is not required for 1x RTT when the maximum average output of each channel is less than ¼ dB higher than that measured in Subtype 0/1 Physical Layer configuration for Rev. 0.

8.3. Test Positions and Configurations

Exposure Condition	Distance	Position	Positioning Photo (Appendix B)
Body SAR	10 mm	Front - Cellular	Photo 1
		Cellular Back	Photo 2
		Right Edge	Photo 3
		Top Edge	Photo 4
		Front - WLAN	Photo 5
Extremity SAR	0 mm	Front - Cellular	Photo 6
		Back	Photo 7
		Right Edge	Photo 8
		Top Edge	Photo 9
		Front - WLAN	Photo 10

The EUT was tested at both 10mm distance for body SAR and 0mm distance for extremity SAR in accordance with KDB 941225 D07 UMPC Mini Tablet v01r01.

KDB 941225 D07 states that UMPC mini-tablet devices must be tested for 1-g SAR on all surfaces and side edges with a transmitting antenna located at ≤ 25 mm from that surface or edge. See antenna locations in Appendix B for antenna locations. The following positions / antenna combinations are excluded for the given distance:

- Bottom edge / cellular – 155mm
- Left edge / cellular – 74mm
- Bottom edge / WLAN - 37mm
- Top edge / WLAN – 192mm
- Left edge / WLAN – 83mm

UMPC Mode Positions			
Antenna	**Face / Edge**	**Antenna-Edge Distance (mm)**	**Tested**
Cellular	Front	5	Yes
	Back	5	Yes
	Bottom Edge	155	No
	Top Edge	13	Yes
	Left Edge	74	No
	Right Edge	5	Yes
WLAN / Bluetooth	Front	5	Yes
	Back	5	Yes
	Bottom Edge	37	No
	Top Edge	192	No
	Left Edge	83	No
	Right Edge	11	Yes

WLAN is tested with 100% duty cycle. According to SPEAG user manual section 27.2, CW can be assumed which results in crest factor 1.

High and low channels are evaluated for the worst case positions for at least one band and exposure condition regardless of the SAR value on the middle channel, according to guidance in Industry Canada Notice 2012-DRS1203. FCC only requires high and low channels be evaluated when the SAR value on the middle channel is more than 3 dB below the limit.

If the SAR value on the middle channel was more than 3dB below the limit, high and low channels were not evaluated.

For GSM bands, the uplink timeslot configuration with the highest source-based time-averaged output power is used for full SAR evaluation for body exposure positions. Spot check measurements for other uplink timeslot configurations are performed on the position with the highest measured SAR value to ensure compliance.

Full testing was performed on the device without the laser attachment accessory described in section 3.4. Spot check tests were performed on the device with that accessory for the worst-case in every wireless technology, frequency band, and exposure condition combination as indicated in FCC KDB **648474 D04 Handset SAR v01r01.**

8.4. SAR Results for Body Exposure

GSM 850

Operation Mode is in GPRS using GMSK modulation unless otherwise indicated.

Operation Mode	Channel	Frequency (MHz)	Position	SAR 1g (W/kg)	Measured Burst Average Power [dBm]	Upper Tolerance [dBm]	Extrapolated SAR 1g (W/kg)	Results (Appendix A)
4 Uplink Timeslots	190	836.6	Front 10mm	0.0453	26.45	27.5	**0.058**	Plot 1
			Back 10mm	0.725	26.45	27.5	**0.923**	Plot 2
			Top Edge 10mm	0.083	26.45	27.5	**0.106**	Plot 3
			Right Edge 10mm	0.026	26.45	27.5	**0.033**	Plot 4
3 Uplink Timeslots	190	836.6	Back 10mm	0.53	28.05	28.7	**0.616**	Plot 5
2 Uplink Timeslots	190	836.6	Back 10mm	0.432	30.05	30.5	**0.479**	Plot 6
1 Uplink Timeslots	190	836.6	Back 10mm	0.184	33.05	33.5	**0.204**	Plot 7
4 Uplink Timeslots	190	836.6	Back 10mm with Laser Accessory	0.026	26.45	27.5	**0.033**	Plot 8

GSM 1900

Operation Mode is in GPRS using GMSK modulation unless otherwise indicated.

Operation Mode	Channel	Frequency (MHz)	Position	SAR 1g (W/kg)	Measured Burst Average Power [dBm]	Upper Tolerance [dBm]	Extrapolated SAR 1g (W/kg)	Results (Appendix A)
4 Uplink Timeslots	661	1880	Front 10mm	0.074	23.3	24.5	**0.098**	Plot 9
			Back 10mm	0.261	23.3	24.5	**0.344**	Plot 10
			Top Edge 10mm	0.070	23.3	24.5	**0.092**	Plot 11
			Right Edge 10mm	0.893	23.3	24.5	**1.18**	Plot 12
3 Uplink Timeslots	661	1880	Right Edge 10mm	0.635	24.7	25.7	**0.799**	Plot 13
2 Uplink Timeslots	661	1880	Right Edge 10mm	0.722	27	27.5	**0.810**	Plot 14
1 Uplink Timeslots	661	1880	Right Edge 10mm	0.234	30	30.5	**0.263**	Plot 15
4 Uplink Timeslots	512	1850.2	Right Edge 10mm	1.19	23.7	24.5	**1.43**	Plot 16
	810	1909.8	Right Edge 10mm	0.822	23.6	24.5	**1.01**	Plot 17
4 Uplink Timeslots, EGPRS 8-PSK	512	1850.2	Right Edge 10mm	0.415	19.3	20.5	**0.547**	Plot 18
4 Uplink Timeslots	512	1850.2	Right Edge 10mm with Laser Accessory	1.11	23.7	24.5	**1.34**	Plot 19

FDD II

Operation Mode	Channel	Frequency (MHz)	Position	SAR 1g (W/kg)	Measured Burst Average Power [dBm]	Upper Tolerance [dBm]	**Extrapolated SAR 1g (W/kg)**	Results (Appendix A)
12.2 kbps RMC	**9400**	**1880**	Front 10mm	0.096	24	24.5	**0.108**	Plot 20
			Back 10mm	0.219	24	24.5	**0.246**	Plot 21
			Top Edge 10mm	0.068	24	24.5	**0.077**	Plot 22
			Right Edge 10mm	0.826	24	24.5	**0.927**	Plot 23
	9262	**1852.4**	Right Edge 10mm	1.29	24.05	24.5	**1.43**	Plot 24
	9538	**1907.6**	Right Edge 10mm	0.795	24.11	24.5	**0.87**	Plot 25
	9262	**1852.4**	Right Edge 10mm with Laser Accessory	1.32	24.05	24.5	**1.46**	Plot 26
	REPEATABILITY MEASUREMENT[1]							
	9262	**1852.4**	Right Edge 10mm with Laser Accessory	1.14	24.05	24.5	**1.26**	Plot 27

NOTES:

1. The radio of the largest SAR value / smallest SAR value for repeatability measurement is 1.32 / 1.14 = 1.16. According to KDB 865664 D01, a second repeated measurement is not required when the ratio is less than 1.20.

FDD V

Operation Mode	Channel	Frequency (MHz)	Position	SAR 1g (W/kg)	Measured Burst Average Power [dBm]	Upper Tolerance [dBm]	**Extrapolated SAR 1g (W/kg)**	Results (Appendix A)
12.2 kbps RMC	**4183**	**836.6**	Front 10mm	0.168	24.5	24.5	**0.168**	Plot 28
			Back 10mm	0.265	24.5	24.5	**0.265**	Plot 29
			Top Edge 10mm	0.079	24.5	24.5	**0.079**	Plot 30
			Right Edge 10mm	0.123	24.5	24.5	**0.123**	Plot 31
			Back 10mm with Laser Accessory	0.052	24.5	24.5	**0.052**	Plot 32

EVDO BC0

Operation Mode	Channel	Frequency (MHz)	Position	SAR 1g (W/kg)	Measured Burst Average Power [dBm]	Upper Tolerance [dBm]	**Extrapolated SAR 1g (W/kg)**	Results (Appendix A)
EV-DO Rel. 0	**384**	**836.52**	Front 10mm	0.063	24.2	24.5	**0.068**	Plot 33
			Back 10mm	0.222	24.2	24.5	**0.238**	Plot 34
			Top Edge 10mm	0.107	24.2	24.5	**0.069**	Plot 35
			Right Edge 10mm	0.056	24.2	24.5	**0.061**	Plot 36
			Back 10mm with Laser Accessory	0.021	24.2	24.5	**0.023**	Plot 37

EVDO BC1

Operation Mode	Channel	Frequency (MHz)	Position	SAR 1g (W/kg)	Measured Burst Average Power [dBm]	Upper Tolerance [dBm]	**Extrapolated SAR 1g (W/kg)**	Results (Appendix A)
EV-DO Rel. 0	**600**	**1880**	Front 10mm	0.086	23.68	24.5	**0.103**	Plot 38
			Back 10mm	0.194	23.68	24.5	**0.234**	Plot 39
			Top Edge 10mm	0.045	23.68	24.5	**0.055**	Plot 40
			Right Edge 10mm	0.664	23.68	24.5	**0.802**	Plot 41
			Right Edge 10mm with Laser Accessory	0.737	23.68	24.5	**0.890**	Plot 42

WLAN 802.11b

Operation Mode	Channel	Frequency (MHz)	Position	SAR 1g (W/kg)	Measured Burst Average Power [dBm]	Upper Tolerance [dBm]	**Extrapolated SAR 1g (W/kg)**	Results (Appendix A)
DSSS with CCK, 1 Mbit/s	**6**	**2437**	Front 10mm	0.042	13.58	15	**0.058**	Plot 43
			Back 10mm	0.007	13.58	15	**0.009**	Plot 44
			Right Edge 10mm	0.056	13.58	15	**0.077**	Plot 45
			Right Edge 10mm with Laser Accessory	0.055	13.58	15	**0.076**	Plot 46

8.5. SAR Results for Extremity Exposure

GSM 850

Operation Mode is in GPRS using GMSK modulation unless otherwise indicated.

Operation Mode	Channel	Frequency (MHz)	Position	SAR 10g (W/kg)	Measured Burst Average Power [dBm]	Upper Tolerance [dBm]	Extrapolated SAR 10g (W/kg)	Results (Appendix A)
4 Uplink Timeslots	190	836.6	Front 0mm	0.127	26.45	27.5	**0.162**	Plot 47
			Back 0mm	1.12	26.45	27.5	**1.43**	Plot 48
			Top Edge 0mm	0.135	26.45	27.5	**0.172**	Plot 49
			Right Edge 0mm	0.032	26.45	27.5	**0.041**	Plot 50
3 Uplink Timeslots	190	836.6	Back 0mm	1.03	28.05	28.7	**1.20**	Plot 51
2 Uplink Timeslots	190	836.6	Back 0mm	0.689	30.05	30.5	**0.764**	Plot 52
1 Uplink Timeslots	190	836.6	Back 0mm	0.245	33.05	33.5	**0.272**	Plot 53
4 Uplink Timeslots	190	836.6	Back 0mm with Laser Accessory	0.027	26.45	27.5	**0.035**	Plot 54

GSM 1900

Operation Mode is in GPRS using GMSK modulation unless otherwise indicated.

Operation Mode	Channel	Frequency (MHz)	Position	SAR 10g (W/kg)	Measured Burst Average Power [dBm]	Upper Tolerance [dBm]	Extrapolated SAR 10g (W/kg)	Results (Appendix A)
4 Uplink Timeslots	661	1880	Front 0mm	0.102	23.3	24.5	**0.134**	Plot 55
			Back 0mm	0.444	23.3	24.5	**0.585**	Plot 56
			Top Edge 0mm	0.119	23.3	24.5	**0.153**	Plot 57
			Right Edge 0mm	1.26	23.3	24.5	**1.66**	Plot 58
3 Uplink Timeslots	661	1880	Right Edge 0mm	0.973	24.7	25.7	**1.23**	Plot 59
2 Uplink Timeslots	661	1880	Right Edge 0mm	0.823	27	27.5	**0.923**	Plot 60
1 Uplink Timeslots	661	1880	Right Edge 0mm	0.418	30	30.5	**0.469**	Plot 61
4 Uplink Timeslots	661	1880	Right Edge 0mm with Laser Accessory	1.2	23.3	24.5	**1.58**	Plot 62

FDD II

Operation Mode	Channel	Frequency (MHz)	Position	SAR 10g (W/kg)	Measured Burst Average Power [dBm]	Upper Tolerance [dBm]	**Extrapolated SAR 10g (W/kg)**	Results (Appendix A)
12.2 kbps RMC	**9400**	**1880**	Front 0mm	0.135	24	25	**0.151**	Plot 63
				0.094	24	25	**0.105**	
			Back 0mm	0.538	24	25	**0.604**	Plot 64
			Top Edge 0mm	0.113	24	25	**0.127**	Plot 65
			Right Edge 0mm	1.2	24	25	**1.35**	Plot 66
			Right Edge 0mm with Laser Accessory	1.23	24	25	**1.38**	Plot 67

FDD V

Operation Mode	Channel	Frequency (MHz)	Position	SAR 10g (W/kg)	Measured Burst Average Power [dBm]	Upper Tolerance [dBm]	**Extrapolated SAR 10g (W/kg)**	Results (Appendix A)
12.2 kbps RMC	**4183**	**836.6**	Front 0mm	0.183	24.5	25	**0.183**	Plot 68
			Back 0mm	0.271	24.5	25	**0.271**	Plot 69
			Top Edge 0mm	0.145	24.5	25	**0.145**	Plot 70
			Right Edge 0mm	0.195	24.5	25	**0.195**	Plot 71
			Back 0mm with Laser Accessory	0.045	24.5	25	**0.045**	Plot 72
				0.037	24.5	25	**0.037**	

EVDO BC0

Operation Mode	Channel	Frequency (MHz)	Position	SAR 10g (W/kg)	Measured Burst Average Power [dBm]	Upper Tolerance [dBm]	**Extrapolated SAR 10g (W/kg)**	Results (Appendix A)
EV-DO Rel. 0	**384**	**836.52**	Front 0mm	0.096	24.2	25	**0.103**	Plot 73
			Back 0mm	0.289	24.2	25	**0.310**	Plot 74
			Top Edge 0mm	0.107	24.2	25	**0.115**	Plot 75
			Right Edge 0mm	0.171	24.2	25	**0.183**	Plot 76
			Back 0mm with Laser Accessory	0.022	24.2	25	**0.023**	Plot 77

EVDO BC1

Operation Mode	Channel	Frequency (MHz)	Position	SAR 10g (W/kg)	Measured Burst Average Power [dBm]	Upper Tolerance [dBm]	**Extrapolated SAR 10g (W/kg)**	Results (Appendix A)
EV-DO Rel. 0	**600**	**1880**	Front 0mm	0.447	23.68	25	**0.540**	Plot 78
			Back 0mm	0.369	23.68	25	**0.446**	Plot 79
			Top Edge 0mm	0.103	23.68	25	**0.124**	Plot 80
			Right Edge 0mm	1.05	23.68	25	**1.27**	Plot 81
			Right Edge 0mm with Laser Accessory	0.980	23.68	25	**1.18**	Plot 82

WLAN 802.11b

Operation Mode	Channel	Frequency (MHz)	Position	SAR 10g (W/kg)	Measured Burst Average Power [dBm]	Upper Tolerance [dBm]	**Extrapolated SAR 10g (W/kg)**	Results (Appendix A)
DSSS with CCK, 1 Mbit/s	**6**	**2437**	Front 0mm	0.071	13.58	15	**0.098**	Plot 83
			Back 0mm	0.00686	13.58	15	**0.010**	Plot 84
			Right Edge 0mm	0.092	13.58	15	**0.128**	Plot 85
			Right Edge 0mm with Laser Accessory	0.092	13.58	15	**0.127**	Plot 86

8.6. Simultaneous Transmission SAR Evaluation Consideration

According to KDB 648474, SAR evaluation for simultaneous transmission can be excluded when specific requirements are satisfied.

When stand-alone SAR evaluation is not required, SAR value is calculated as
(*max. power of channel, including tune-up tolerance, mW*)/(*min. test separation distance, mm*)]·[√f(GHz)/*x*] W/kg
where *x* = 7.5 for 1-g SAR, and *x* = 18.75 for 10-g SAR.

8.6.1. Body Exposure Simultaneous Transmission Evaluation

Bluetooth SAR calculated as:
[(2.5 mW) / (10 mm)]·[√2.48/7.5] = 0.052 W/kg

Position	Highest Scaled SAR 1g (W/kg)		
	WLAN	Bluetooth	Cellular
Front	0.058	0.052	0.168
Back	0.009	0.052	0.923
Right Edge	0.077	0.052	1.46

Position	Simultaneous Transmission Antenna Combinations	Sum of SAR 1g (W/kg)	SAR to Peak Location Separation Ratio[1]	Simultaneous Transmission Evaluation Exclusion Reason
Front	WLAN and Cellular	0.226	N/A	The sum of SAR values is less than 1.6. Simultaneous transmission evaluation is not required.
	Bluetooth and Cellular	0.220		
Back	WLAN and Cellular	0.932		
	Bluetooth and Cellular	0.975		
Right Edge	WLAN and Cellular	1.54		
	Bluetooth and Cellular	1.51		

NOTES:
1. SAR to Peak Location Separation Ratio is only calculated if the Sum of SAR 1g (W/kg) is equal to or greater than 1.6 W/kg.

8.6.2. Extremity Exposure Simultaneous Transmission Evaluation

Bluetooth SAR calculated as:

(2.5 mW) / (5 mm)]·[√2.48/18.75] = 0.042 W/kg

Position	Highest Scaled SAR 10g (W/kg)		
	WLAN	Bluetooth	Cellular
Front	0.098	0.042	0.540
Back	0.010	0.042	1.43
Right Edge	0.128	0.042	1.66

Position	Simultaneous Transmission Antenna Combinations	Sum of SAR 10g (W/kg)	SAR to Peak Location Separation Ratio[1]	Simultaneous Transmission Evaluation Exclusion Reason
Front	WLAN and Cellular	0.638	N/A	The sum of SAR values is less than 2.0. Simultaneous transmission evaluation is not required.
	Bluetooth and Cellular	0.582		
Back	WLAN and Cellular	1.44		
	Bluetooth and Cellular	1.47		
Right Edge	WLAN and Cellular	1.79		
	Bluetooth and Cellular	1.70		

NOTES:

1. SAR to Peak Location Separation Ratio is only calculated if the Sum of SAR 10g (W/kg) is equal to or greater than 2.0 W/kg.

8.7. Dipole verification

Prior to formal testing at each frequency a system verification was performed in accordance with IEEE 1528. The 1 Watt reference SAR value is taken from the SPEAG dipole calibration report as required by FCC KDB 450824 D01. All of the testing described in this report was performed within 24 hours of the system verification. The following results were obtained:

Date	Liquid Type	Frequency (MHz)	CW input at dipole feed (Watts)	1g SAR (W/kg)	1 Watt reference SAR value (W/kg)	Difference reference SAR value to normalized SAR	Results (Appendix A)
07-22-2013	MSL	835	1	9.53	9.57	-0.42%	Plot 87
07-23-2013	MSL	835	1	9.63	9.57	0.63%	Plot 88
07-24-2013	MSL	835	1	9.9	9.57	3.45%	Plot 89
08-19-2013	MSL	835	1	9.98	9.57	4.28%	Plot 90
08-21-2013	MSL	835	1	9.43	9.57	-1.46%	Plot 91
08-22-2013	MSL	835	1	9.4	9.57	-1.78%	Plot 92
09-11-2013	MSL	835	1	9.2	9.57	-3.87%	Plot 93
07-16-2013	MSL	1900	1	36.6	40.5	-9.63%	Plot 94
07-17-2013	MSL	1900	1	39	40.5	-3.7%	Plot 95
07-22-2013	MSL	1900	1	38	40.5	-6.17%	Plot 96
08-20-2013	MSL	1900	1	37	40.5	-8.64%	Plot 97
08-21-2013	MSL	1900	1	37.5	40.5	-7.41%	Plot 98
08-22-2013	MSL	1900	1	36.9	40.5	-8.89%	Plot 99
08-23-2013	MSL	1900	1	37.3	40.5	-7.9%	Plot 100
09-06-2013	MSL	1900	1	37.5	40.5	-7.41%	Plot 101
09-20-2013	MSL	1900	1	37.8	40.5	-6.67%	Plot 102
07-24-2013	MSL	2450	1	50.7	50.9	-0.39%	Plot 103

Date	Liquid Type	Frequency (MHz)	CW input at dipole feed (Watts)	10g SAR (W/kg)	1 Watt reference SAR value (W/kg)	Difference reference SAR value to normalized SAR	Results (Appendix A)
07-22-2013	MSL	835	1	6.3	6.36	-0.94%	Plot 87
07-23-2013	MSL	835	1	6.36	6.36	0%	Plot 88
07-24-2013	MSL	835	1	6.54	6.36	2.83%	Plot 89
08-19-2013	MSL	835	1	6.63	6.36	4.245%	Plot 90
08-21-2013	MSL	835	1	6.25	6.36	-1.73%	Plot 91
08-22-2013	MSL	835	1	6.25	6.36	-1.73%	Plot 92
09-11-2013	MSL	835	1	6.08	6.36	-4.4%	Plot 93
07-16-2013	MSL	1900	1	19.2	21.2	-9.43%	Plot 94
07-17-2013	MSL	1900	1	20.4	21.2	-3.77%	Plot 95
07-22-2013	MSL	1900	1	19.9	21.2	-6.13%	Plot 96
08-20-2013	MSL	1900	1	19.4	21.2	-8.49%	Plot 97
08-21-2013	MSL	1900	1	19.7	21.2	-7.08%	Plot 98
08-22-2013	MSL	1900	1	19.4	21.2	-8.49%	Plot 99
08-23-2013	MSL	1900	1	19.6	21.2	-7.55%	Plot 100
09-06-2013	MSL	1900	1	19.6	21.2	-7.55%	Plot 101
09-20-2013	MSL	1900	1	19.9	21.2	-6.13%	Plot 102
07-24-2013	MSL	2450	1	23.7	23.8	-0.42%	Plot 103

9. References

1. [IEEE 1999] IEEE Std C95.1-1999: IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz, Inst. of Electrical and Electronics Engineers, Inc., December 1998.

2. [IEEE 2003] IEEE Std 1528-2003: IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head From Wireless Communications Devices: Measurement Techniques. Inst. of Electrical and Electronics Engineers, Inc., December 2003.

3. [NIST 1994] NIST: Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results, Technical Note 1297 (TN1297), United States Department of Commerce Technology Administration, National Institute of Standards and Technology, September 1994.

4. [FCC 2001] Federal Communications Commission: Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields, Supplement C (Edition 01-01) to OET Bulletin 65 (Edition 97-01), FCC, June 2001.

5. [IC 2010] RSS-102: Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands), Industry Canada, Issue 4, March 2010.

6. [IC 2012] Notice 2012-DRS1203: RE: APPLICABILITY OF LATEST FCC RF EXPOSURE KDB PROCEDURES (PUBLICATION DATE: OCTOBER 24, 2012) AND OTHER PROCEDURES, Industry Canada, December 2012

10. Report History

Date	Report Name	Changes to report	Report prepared by
2013-10-09	SAR_TRIM2-017-13001_FCC_IC	First Version	J. Sabado