KDB 865664 D01 SAR Measurement 100MHz to 6GHz
FCC 47 CFR part 2 (2.1093)

SAR EVALUATION REPORT

For

Barcode reader and Magnetic strip with Bluetooth

Model Name: Infinea TAB Mini (Linea TAB Mini)
(Contains FCC ID: YRWDATECSBT301)

Report Number UL-SAR-RP10488894JD03B V3.0
ISSUE DATE: 24 May 2016

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REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
--	15 December 2015	Initial Issue	--
1	29 February 2016	The following amendments are made in the report: 1. In Section 2,KDB list is updated to include latest KDB versions 2. In Section 2, typo in Test specification – purpose of test is amended 3. In Section 5, note added under the uncertainty budget tables 4. In Section 6.3., the date of the original report is added 5. In Section 7, the date of the original report is added 6. In Section 10.2., host test separation distance note is added 7. In Section 12.3., the FCC ID of the sleeve is added	Sandhya Menon
2	24 May 2016	The following amendments are made in the report: 1. FCC ID of the sleeve is updated 2. EUT description updated in section 6.1.	Sandhya Menon

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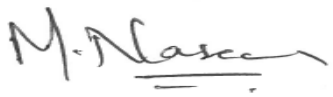
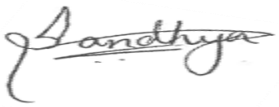
1. Attestation of Test Results

Applicant Name:	Datecs Ltd				
Application Purpose	☒ Original Grant				
Model Name	Infinea TAB mini (Linea TAB mini)				
Test Device is	An identical prototype				
Device category	Portable				
Exposure Category	General Population/Uncontrolled Exposure (1g SAR limit: 1.6 W/kg)				
Date Tested	27 April 2015 to 29 May 2015				
The highest reported SAR values	RF Exposure Conditions	Equipment Class			
		Licensed	DTS	UNII	DSS (BT)
Host Device Model: A1489	Standalone	1.232 W/kg	0.040 W/kg	0.166 W/kg	0.004 W/kg
	Simultaneous Transmission	1.454 W/kg	1.324 W/kg	1.454 W/kg	1.454 W/kg
Applicable Standards	FCC 47 CFR part 2 (2.1093) KDB publication IEEE Std 1528-2013				
Test Results	Pass				

UL VS Ltd. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL VS Ltd. based on interpretations and/or observations of test results. Measurement Uncertainties are in accordance with the above standard and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample(s), under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL VS Ltd. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL VS Ltd. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by UKAS. This report is written to support regulatory compliance of the applicable standards stated above.

Approved & Released By:	Prepared By:
	
Naseer Mirza Project Lead UL VS Ltd.	Sandhya Menon Senior Engineer UL VS Ltd.

2. Test Specification, Methods and Procedures

2.1. Test Specification

Reference:	KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04
Title:	SAR Measurement Requirements for 100 MHz to 6 GHz
Purpose of Test:	Field probes, tissue dielectric properties, SAR scans, measurement accuracy and variability of the measured results are discussed. The field probe and SAR scan requirements are derived from criteria considered in IEEE 1528: 2013.
The Equipment Under Test complied with the Specific Absorption Rate for general population/uncontrolled exposure limit of 1.6 W/kg as specified in FCC 47 CFR part 2 (2.1093) and ANSI C95.1-1992 and has been tested in accordance with the reference documents in section 2.2 of this report.	

2.2. Methods and Procedures Reference Documentation

The methods and procedures used were as detailed in:

IEEE 1528: 2013
IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques

Thomas Schmid, Oliver Egger and Neils Kuster, “Automated E-field scanning system for dosimetric assessments”, IEEE Transaction on microwave theory and techniques, Vol. 44, pp. 105-113, January 1996.

Neils Kuster, Ralph Kastle and Thomas Schmid, “Dosimetric evaluation of mobile communications equipment with known precision”, IEICE Transactions of communications, Vol. E80-B, No.5, pp. 645-652, May 1997.

FCC KDB Publication:
248227 D01 802.11 Wi-Fi SAR v02r02
447498 D01 General RF Exposure Guidance v06
447498 D03 Supplement C Cross-Reference v01
648474 D04 Handset SAR v01r03
941225 D01 3G SAR Procedures v03r01
941225 D05 SAR for LTE Devices v02r05
941225 D06 Hotspot Mode v02r01
865664 D01 SAR measurement 100 MHz to 6 GHz v01r04
865664 D02 SAR Reporting v01r02
Interim Sleeve Procedures
RF Exposure Procedures TCB Workshop April 2015

2.3. Definition of Measurement Equipment

The measurement equipment used complied with the requirements of the standards referenced in the methods & procedures section above. Appendix 1 contains a list of the test equipment used.

3. Facilities and Accreditation

The test sites and measurement facilities used to collect data are located at

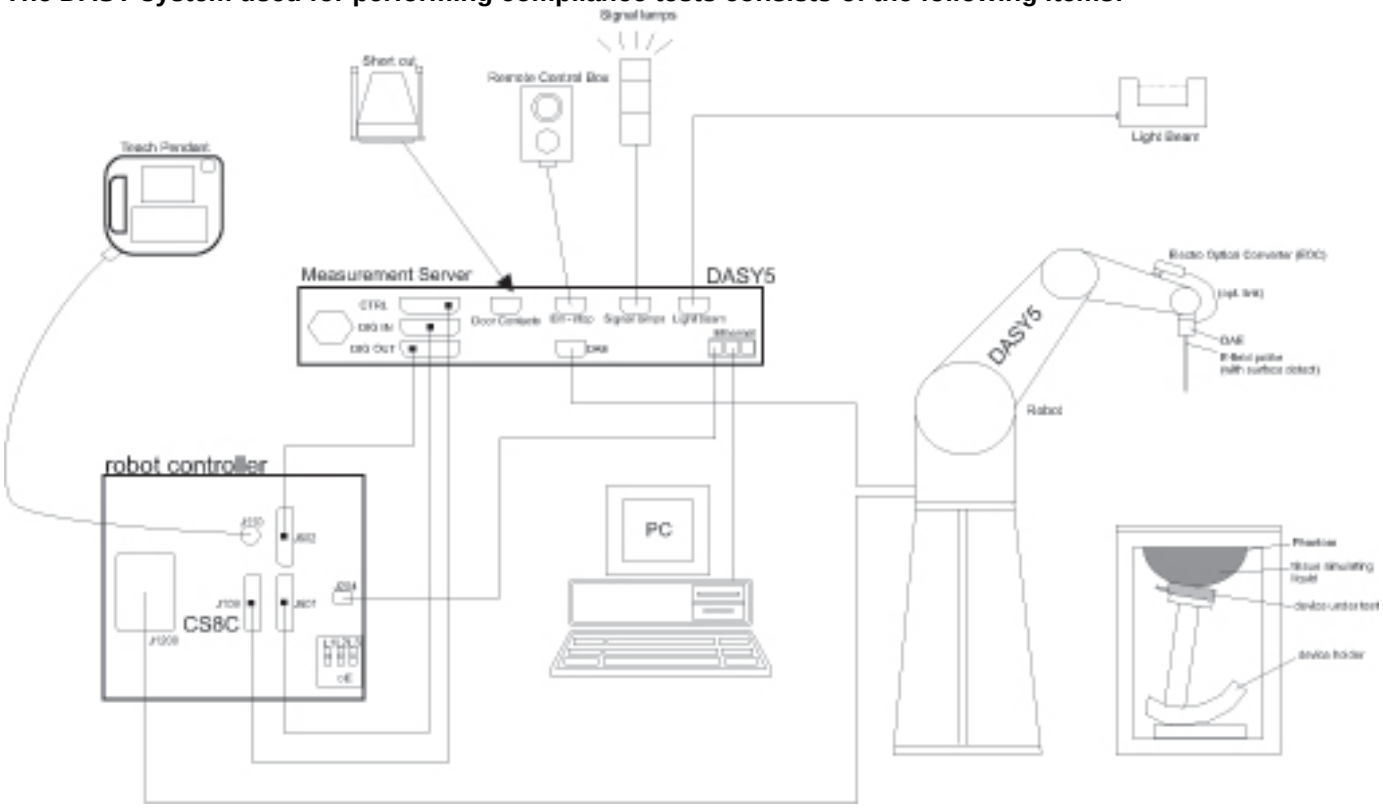
Pavilion A, Ashwood Park, Ashwood Way, Basingstoke, Hampshire, RG23 8BG UK	Facility Type
SAR Lab 57	Controlled Environment Chamber
SAR Lab 59	Controlled Environment Chamber
SAR Lab 60	Controlled Environment Chamber
SAR Lab 61	Controlled Environment Chamber

UL VS Ltd, is accredited by UKAS (United Kingdom Accreditation Service), Laboratory UKAS Code 0644.

4. SAR Measurement System & Test Equipment

4.1. SAR Measurement System

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



- A standard high precision 6-axis robot with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- An isotropic Field probe optimized and calibrated for the targeted measurement.
- A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- The Electro-optical converter (EOC) performs the conversion from optical to electrical signals for the digital communication to the DAE. To use optical surface detection, a special version of the EOC is required. The EOC signal is transmitted to the measurement server.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.
- A computer running WinXP or Win7 and the DASY software.
- Remote control and teach pendant as well as additional circuitry for robot safety such as warning lamps, etc.
- The phantom, the device holder and other accessories according to the targeted measurement.

4.2. SAR Measurement Procedure

4.2.1. Normal SAR Measurement Procedure

Step 1: Power Reference Measurement

The Power Reference Measurement and Power Drift Measurements are for monitoring the power drift of the device under test in the batch process. The minimum distance of probe sensors to surface determines the closest measurement point to phantom surface. The minimum distance of probe sensors to surface is 2.1 mm. This distance cannot be smaller than the distance of sensor calibration points to probe tip as defined in the probe properties

Step 2: Area Scan

The Area Scan is used as a fast scan in two dimensions to find the area of high field values, before doing a fine measurement around the hot spot. The sophisticated interpolation routines implemented in DASY software can find the maximum locations even in relatively coarse grids. When an Area Scan has measured all reachable points, it computes the field maximal found in the scanned area, within a range of the global maximum. The range (in dB) is specified in the standards for compliance testing. For example, a 2 dB range is required in following standards: IEEE 1528 -2013 and IEC 62209-1: 2005 / IEC 62209-2: 2010 standards. If only one Zoom Scan follows the Area Scan, then only the absolute maximum will be taken as reference. For cases where multiple maximums are detected, the number of Zoom Scans has to be increased accordingly.

Area Scan Parameters extracted from KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz

	≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface	5 mm ± 1 mm	½·δ·ln(2) mm ± 0.5 mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location	30° ± 1°	20° ± 1°
Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}	≤ 2 GHz: ≤ 15 mm 2 – 3 GHz: ≤ 12 mm	3 – 4 GHz: ≤ 12 mm 4 – 6 GHz: ≤ 10 mm
	When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.	

Step 3: Zoom Scan

Zoom Scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The Zoom Scan measures points (refer to table below) within a cube whose base faces are centered on the maxima found in a preceding area scan job within the same procedure. When the measurement is done, the Zoom Scan evaluates the averaged SAR for 1 g and 10 g and displays these values next to the job's label.

Zoom Scan Parameters extracted from KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz

			≤ 3 GHz	> 3 GHz
Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}			≤ 2 GHz: ≤ 8 mm 2 – 3 GHz: ≤ 5 mm*	3 – 4 GHz: ≤ 5 mm* 4 – 6 GHz: ≤ 4 mm*
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{Zoom}(n)$		≤ 5 mm	3 – 4 GHz: ≤ 4 mm 4 – 5 GHz: ≤ 3 mm 5 – 6 GHz: ≤ 2 mm
	graded grid	$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface	≤ 4 mm	3 – 4 GHz: ≤ 3 mm 4 – 5 GHz: ≤ 2.5 mm 5 – 6 GHz: ≤ 2 mm
		$\Delta z_{Zoom}(n>1)$: between subsequent points	≤ $1.5 \cdot \Delta z_{Zoom}(n-1)$	
Minimum zoom scan volume	x, y, z		≥ 30 mm	3 – 4 GHz: ≥ 28 mm 4 – 5 GHz: ≥ 25 mm 5 – 6 GHz: ≥ 22 mm

Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details.

* When zoom scan is required and the *reported* SAR from the area scan based *1-g SAR estimation* procedures of KDB 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.

Step 4: Power drift measurement

The Power Drift Measurement measures the field at the same location as the most recent power reference measurement within the same procedure, and with the same settings. The Power Drift Measurement gives the field difference in dB from the reading conducted within the last Power Reference Measurement. This allows a user to monitor the power drift of the device under test within a batch process. The measurement procedure is the same as Step 1.

Step 5: Z-Scan (FCC only)

The Z Scan measures points along a vertical straight line. The line runs along the Z-axis of a one-dimensional grid. In order to get a reasonable extrapolation the extrapolated distance should not be larger than the step size in Z- direction.

4.3. Volumetric Scan Procedure

Step 1: Repeat Step 1-4 in Section 4.3

Step 2: Volume Scan

Volume Scans are used to assess peak SAR and averaged SAR measurements in largely extended 3-dimensional volumes within any phantom. This measurement does not need any previous area scan. The grid can be anchored to a user specific point or to the current probe location.

Step 3: Power drift measurement

The Power Drift Measurement measures the field at the same location as the most recent power reference measurement within the same procedure, and with the same settings. The Power Drift Measurement gives the field difference in dB from the reading conducted within the last Power Reference Measurement. This allows a user to monitor the power drift of the device under test within a batch process. The measurement procedure is the same as Step 1.

4.4. Test Equipment

The measuring equipment used to perform the tests documented in this report has been calibrated in accordance with the manufacturers' recommendations, and is traceable to recognized national standards.

UL No.	Instrument	Manufacturer	Type No.	Serial No.	Date Last Calibrated	Cal. Interval (Months)
A2109	Data Acquisition Electronics	SPEAG	DAE3	417	19 Mar 2015	12
A1234	Data Acquisition Electronics	SPEAG	DAE3	450	16 Sept 2014	12
A2111	Data Acquisition Electronics	SPEAG	DAE3	432	20 Aug 2014	12
A2546	Data Acquisition Electronics	SPEAG	DAE4	1435	15 Apr 2014	12
A2112	Probe	SPEAG	ET3 DV6	1586	22 May 2014	12
A2544	Probe	SPEAG	EX3 DV4	3994	17 Mar 2015	12
A2243	Probe	SPEAG	ES3 DV3	3304	21 Aug 2014	12
A2077	Probe	SPEAG	EX3 DV4	3814	18 Sept 2014	12
A1985	750 MHz Dipole Kit	SPEAG	D750V3	1011	16 Jan 2015	12
A2588	900 MHz Dipole Kit	SPEAG	D900V2	1d168	14 May 2014	12
A1190	1800 MHz Dipole Kit	SPEAG	D1800V2	264	18 Aug 2014	12
A1237	1900 MHz Dipole Kit	SPEAG	D1900V2	540	08 Dec 2014	12
A1322	2450 MHz Dipole Kit	SPEAG	D2450V2	725	08 Dec 2014	12
A1377	5.0 GHz Dipole Kit	SPEAG	D5GHzV2	1016	24 Feb 2015	12
GO591	Robot Power Supply	SPEAG	DASY4	None	Calibrated before use	-
G0610	Robot Power Supply	SPEAG	DASY52	None	Calibrated before use	-
G0611	Robot Power Supply	SPEAG	DASY52	None	Calibrated before use	-
G0612	Robot Power Supply	SPEAG	DASY52	None	Calibrated before use	-
M1653	Robot Arm	Staubli	RX908 L	F01/5J86A1/C/01	Calibrated before use	-
M1875	Robot Arm	Staubli	TX60 L	F13/5SC6F1/A/01	Calibrated before use	-
M1876	Robot Arm	Staubli	TX60 L	F14/5T5ZA1/A/01	Calibrated before use	-
M1877	Robot Arm	Staubli	TX60 L	F14/5UA6A1/A/01	Calibrated before use	-
A1328	Handset Positioner	SPEAG	Modification	SD 000 H01 DA	-	-
A1182	Handset Positioner	SPEAG	V3.0	None	-	-
A2443	Handset Positioner	SPEAG	MD4HHTV5	None	-	-
A172	Handset Positioner	SPEAG	MD4HHTV5	None	-	-
M1755	DAK Fluid Probe	SPEAG	SM DAK 040 CA	1089	Calibrated before use	-
M1015	Network Analyser	Agilent Technologies	8753ES	US39172406	26 Sept 2014	12
A2621	Digital Camera	Nikon	S3600	41010357	-	-
M1908	Signal Generator	R&S	SMIQ03B	1125555503	02 Dec 2014	12
M1839	Signal Generator	R&S	SME06	837633/001	27 Mar 2015	12
M1841	Dual Channel Power Meter	R & S	NRVD	834501/069	27 Mar 2015	12
M1044	Power Sensor	R & S	ZRPZ1	893350/0019	05 Sep 2014	12
M1842	Power Sensor	R & S	ZRPZ1	890212/015	27 Mar 2015	12
M1848	Power Sensor	R & S	ZRPZ1	831430/004	20 Apr 2015	12
M1847	Power Sensor	R & S	ZRPZ1	831430/003	20 Apr 2015	12
A2100	Directional Coupler	RF-Lambda	11101300748	None	Calibrated as part of system	-
A1097	Directional Coupler	MiDISCO	MDC6223-30	None	Calibrated as part of system	-

UL No.	Instrument	Manufacturer	Type No.	Serial No.	Date Last Calibrated	Cal. Interval (Months)
A1938	Amplifier	Mini-Circuits	ZHL-42	QA0826002	Calibrated as part of system	-
A1474	Amplifier	Mini-Circuits	ZVE-8G	638700305	Calibrated as part of system	-
A2403	Amplifier	Mini-Circuits	ZHL-42W	15542	Calibrated as part of system	-

4.5. SAR System Specifications

Robot System	
Positioner:	Stäubli Unimation Corp. Robot Model: RX90L
Repeatability:	0.025 mm
No. of Axis:	6
Serial Number(s):	F01/5J86A1/A/01
Reach:	1185 mm
Payload:	3.5 kg
Control Unit:	CS7
Programming Language:	V+
Robot System	
Positioner:	Stäubli Unimation Corp. Robot Model: TX60L
Repeatability:	±0.030 mm
No. of Axis:	6
Serial Number(s):	F12/5MZ7A1/A/01; F14/5T5ZA1/A/01; F14/5UA6A1/A/01
Reach:	920 mm
Payload:	2.0 kg
Control Unit:	CS8C
Programming Language:	V+
Data Acquisition Electronic (DAE) System	
Serial Number:	DAE3 SN: 417, 432, 450 DAE4 SN: 1435
PC Controller	
PC:	Dell Precision 340
Operating System:	Windows 2000
Data Card:	DASY4 and DASY5 Measurement Servers
Serial Number:	1080
Data Converter	
Features:	Signal Amplifier, multiplexer, A/D converted and control logic.
Software:	DASY4 and DASY5 PRO Software
Connecting Lines:	Optical downlink for data and status info. Optical uplink for commands and clock.
PC Interface Card	
Function:	24 bit (64 MHz) DSP for real time processing Link to DAE3 and DAE4 16 bit A/D converter for surface detection system serial link to robot direct emergency stop output for robot.

SAR System Specifications (Continued):

E-Field Probe	
Model:	EX3DV6
Serial No:	3994; 3814
Construction:	Triangular core
Frequency:	10 MHz to 6 GHz
Linearity:	±0.2 dB (30 MHz to 6 GHz)
Probe Length (mm):	337
Probe Diameter (mm):	10
Tip Length (mm):	9
Tip Diameter (mm):	2.5
Sensor X Offset (mm):	1
Sensor Y Offset (mm):	1
Sensor Z Offset (mm):	1
E-Field Probe	
Model:	ES3DV3
Serial No:	3304
Construction:	Triangular core
Frequency:	10 MHz to >4 GHz
Linearity:	±0.2 dB (30 MHz to 4 GHz)
Probe Length (mm):	337
Probe Diameter (mm):	10
Tip Length (mm):	10
Tip Diameter (mm):	4
Sensor X Offset (mm):	2
Sensor Y Offset (mm):	2
Sensor Z Offset (mm):	2
E-Field Probe	
Model:	ET3DV6
Serial No:	1586
Construction:	Triangular core
Frequency:	10 MHz to 2.55GHz
Linearity:	±0.2 dB (30 MHz to 2.55GHz)
Probe Length (mm):	337
Probe Diameter (mm):	10
Tip Length (mm):	10
Tip Diameter (mm):	6.8
Sensor X Offset (mm):	2.7
Sensor Y Offset (mm):	2.7
Sensor Z Offset (mm):	2.7
Phantom	
Phantom:	Eli Phantom
Shell Material:	Fibreglass
Thickness:	2.0 ±0.1 mm

4.6. SAR Measurement Procedure

4.6.1. Normal SAR Measurement Procedure

Step 1: Power Reference Measurement

The Power Reference Measurement and Power Drift Measurements are for monitoring the power drift of the device under test in the batch process. The minimum distance of probe sensors to surface determines the closest measurement point to phantom surface. The minimum distance of probe sensors to surface is 2.1 mm. This distance cannot be smaller than the distance of sensor calibration points to probe tip as defined in the probe properties

Step 2: Area Scan

The Area Scan is used as a fast scan in two dimensions to find the area of high field values, before doing a fine measurement around the hot spot. The sophisticated interpolation routines implemented in DASY software can find the maximum locations even in relatively coarse grids. When an Area Scan has measured all reachable points, it computes the field maximal found in the scanned area, within a range of the global maximum. The range (in dB) is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE Standard 1528 and IEC 62209-1 / IEC 62209-2 standards. If only one Zoom Scan follows the Area Scan, then only the absolute maximum will be taken as reference. For cases where multiple maximums are detected, the number of Zoom Scans has to be increased accordingly.

Area Scan Parameters extracted from KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz

	≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface	5 ± 1 mm	½·δ·ln(2) ± 0.5 mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location	30° ± 1°	20° ± 1°
Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}	≤ 2 GHz: ≤ 15 mm 2 – 3 GHz: ≤ 12 mm	3 – 4 GHz: ≤ 12 mm 4 – 6 GHz: ≤ 10 mm
	When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.	

Step 3: Zoom Scan

Zoom Scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The Zoom Scan measures points (refer to table below) within a cube whose base faces are centered on the maxima found in a preceding area scan job within the same procedure. When the measurement is done, the Zoom Scan evaluates the averaged SAR for 1 g and 10 g and displays these values next to the job's label.

Zoom Scan Parameters extracted from KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz

			≤ 3 GHz	> 3 GHz
Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}			≤ 2 GHz: ≤ 8 mm 2 – 3 GHz: ≤ 5 mm*	3 – 4 GHz: ≤ 5 mm* 4 – 6 GHz: ≤ 4 mm*
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{Zoom}(n)$		≤ 5 mm	3 – 4 GHz: ≤ 4 mm 4 – 5 GHz: ≤ 3 mm 5 – 6 GHz: ≤ 2 mm
	graded grid	$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface	≤ 4 mm	3 – 4 GHz: ≤ 3 mm 4 – 5 GHz: ≤ 2.5 mm 5 – 6 GHz: ≤ 2 mm
		$\Delta z_{Zoom}(n>1)$: between subsequent points	≤ $1.5 \cdot \Delta z_{Zoom}(n-1)$	
Minimum zoom scan volume	x, y, z		≥ 30 mm	3 – 4 GHz: ≥ 28 mm 4 – 5 GHz: ≥ 25 mm 5 – 6 GHz: ≥ 22 mm

Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details.

* When zoom scan is required and the *reported* SAR from the area scan based *1-g SAR estimation* procedures of KDB 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.

Step 4: Power drift measurement

The Power Drift Measurement measures the field at the same location as the most recent power reference measurement within the same procedure, and with the same settings. The Power Drift Measurement gives the field difference in dB from the reading conducted within the last Power Reference Measurement. This allows a user to monitor the power drift of the device under test within a batch process. The measurement procedure is the same as Step 1.

Step 5: Z-Scan (FCC only)

The Z Scan measures points along a vertical straight line. The line runs along the Z-axis of a one-dimensional grid. In order to get a reasonable extrapolation the extrapolated distance should not be larger than the step size in Z- direction.

4.7. Volumetric Scan Procedure

Step 1: Repeat Step 1-4 in Section 4.3

Step 2: Volume Scan

Volume Scans are used to assess peak SAR and averaged SAR measurements in largely extended 3-dimensional volumes within any phantom. This measurement does not need any previous area scan. The grid can be anchored to a user specific point or to the current probe location.

Step 3: Power drift measurement

The Power Drift Measurement measures the field at the same location as the most recent power reference measurement within the same procedure, and with the same settings. The Power Drift Measurement gives the field difference in dB from the reading conducted within the last Power Reference Measurement. This allows a user to monitor the power drift of the device under test within a batch process. The measurement procedure is the same as Step 1.

5. Measurement Uncertainty

No measurement or test can ever be perfect and the imperfections give rise to error of measurement in the results. Consequently, the result of a measurement is only an approximation to the value of the measurand (the specific quantity subject to measurement) and is only complete when accompanied by a statement of the uncertainty of the approximation.

The expression of uncertainty of a measurement result allows realistic comparison of results with reference values and limits given in specifications and standards.

The uncertainty of the result may need to be taken into account when interpreting the measurement results.

The reported expanded uncertainties below are based on a standard uncertainty multiplied by an appropriate coverage factor, such that a confidence level of approximately 95% is maintained. For the purposes of this document “approximately” is interpreted as meaning “effectively” or “for most practical purposes”.

Test Name	Confidence Level	Calculated Uncertainty
Uncertainty- GSM / GPRS / EDGE 850 / WCDMA FDD 5 / CDMA BC 0 / CDMA BC 10 / LTE Band 5 / LTE Band 13 / LTE Band 17 / LTE Band 26 Body Configurations 1g	95%	±18.36%
Uncertainty- WCDMA FDD 4 / CDMA BC15 / LTE Band 4 Body Configuration 1g	95%	±18.45%
Uncertainty- PCS / GPRS / EDGE 1900 / WCDMA FDD 2 / CDMA BC 1 / LTE Band 2 / LTE Band 25 Body Configuration 1g	95%	±18.26%
Uncertainty- Wi-Fi 2450 MHz Body Configuration 1g	95%	±18.35%
Uncertainty- Wi-Fi 5GHz Body Configuration 1g	95%	±19.90%

The methods used to calculate the above uncertainties are in line with those recommended within the various measurement specifications. Where measurement specifications do not include guidelines for the evaluation of measurement uncertainty, the published guidance of the appropriate accreditation body is followed.

Note: The calculated uncertainty depicted in the table above and shown in the following tables is indicative of the worst case amongst the bands listed.

5.1. Uncertainty Rate- GSM / GPRS / EDGE 850 / WCDMA FDD 5 / CDMA BC 0 / CDMA BC 10 / LTE Band 5 / LTE Band 13 / LTE Band 17 / LTE Band 26 Body Configuration 1g

Type	Source of uncertainty	+ Value	- Value	Probability Distribution	Divisor	$c_{i\ (1g)}$	Standard Uncertainty		υ_i or υ_{eff}
							+ u (%)	- u (%)	
B	Probe calibration	6.000	6.000	normal (k=1)	1.0000	1.0000	6.000	6.000	∞
B	Axial Isotropy	0.250	0.250	normal (k=1)	1.0000	1.0000	0.250	0.250	∞
B	Hemispherical Isotropy	1.300	1.300	normal (k=1)	1.0000	1.0000	1.300	1.300	∞
B	Spatial Resolution	0.500	0.500	Rectangular	1.7321	1.0000	0.289	0.289	∞
B	Boundary Effect	0.769	0.769	Rectangular	1.7321	1.0000	0.444	0.444	∞
B	Linearity	0.600	0.600	Rectangular	1.7321	1.0000	0.346	0.346	∞
B	Detection Limits	0.200	0.200	Rectangular	1.7321	1.0000	0.115	0.115	∞
B	Readout Electronics	0.160	0.160	normal (k=1)	1.0000	1.0000	0.160	0.160	∞
B	Response Time	0.000	0.000	Rectangular	1.7321	1.0000	0.000	0.000	∞
B	Integration Time	1.730	1.730	Rectangular	1.7321	1.0000	0.999	0.999	∞
B	RF Ambient conditions	3.000	3.000	Rectangular	1.7321	1.0000	1.732	1.732	∞
B	Probe Positioner Mechanical Restrictions	4.000	4.000	Rectangular	1.7321	1.0000	2.309	2.309	∞
B	Probe Positioning with regard to Phantom Shell	2.850	2.850	Rectangular	1.7321	1.0000	1.645	1.645	∞
B	Extrapolation and integration /Maximum SAR evaluation	5.080	5.080	Rectangular	1.7321	1.0000	2.933	2.933	∞
A	Test Sample Positioning	2.510	2.510	normal (k=1)	1.0000	1.0000	2.510	2.510	10
A	Device Holder uncertainty	0.154	0.154	normal (k=1)	1.0000	1.0000	0.154	0.154	10
B	Phantom Uncertainty	4.000	4.000	Rectangular	1.7321	1.0000	2.309	2.309	∞
B	Drift of output power	5.000	5.000	Rectangular	1.7321	1.0000	2.887	2.887	∞
B	Liquid Conductivity (target value)	5.000	5.000	Rectangular	1.7321	0.6400	1.848	1.848	∞
A	Liquid Conductivity (measured value)	2.000	2.000	normal (k=1)	1.0000	0.6400	1.280	1.280	5
B	Liquid Permittivity (target value)	5.000	5.000	Rectangular	1.7321	0.6000	1.732	1.732	∞
A	Liquid Permittivity (measured value)	1.560	1.560	normal (k=1)	1.0000	0.6000	0.936	0.936	5
	Combined standard uncertainty			t-distribution			9.37	9.37	>500
	Expanded uncertainty			k = 1.96			18.36	18.36	>500

5.2. Uncertainty -WCDMA FDD 4 / CDMA BC15 / LTE Band 4 Body Configuration 1g

Type	Source of uncertainty	+ Value	- Value	Probability Distribution	Divisor	$c_{i\ (1g)}$	Standard Uncertainty		υ_i or υ_{eff}
							+ u (%)	- u (%)	
B	Probe calibration	6.000	6.000	normal (k=1)	1.0000	1.0000	6.000	6.000	∞
B	Axial Isotropy	0.250	0.250	normal (k=1)	1.0000	1.0000	0.250	0.250	∞
B	Hemispherical Isotropy	1.300	1.300	normal (k=1)	1.0000	1.0000	1.300	1.300	∞
B	Spatial Resolution	0.500	0.500	Rectangular	1.7321	1.0000	0.289	0.289	∞
B	Boundary Effect	0.769	0.769	Rectangular	1.7321	1.0000	0.444	0.444	∞
B	Linearity	0.600	0.600	Rectangular	1.7321	1.0000	0.346	0.346	∞
B	Detection Limits	0.200	0.200	Rectangular	1.7321	1.0000	0.115	0.115	∞
B	Readout Electronics	0.160	0.160	normal (k=1)	1.0000	1.0000	0.160	0.160	∞
B	Response Time	0.000	0.000	Rectangular	1.7321	1.0000	0.000	0.000	∞
B	Integration Time	1.730	1.730	Rectangular	1.7321	1.0000	0.999	0.999	∞
B	RF Ambient conditions	3.000	3.000	Rectangular	1.7321	1.0000	1.732	1.732	∞
B	Probe Positioner Mechanical Restrictions	4.000	4.000	Rectangular	1.7321	1.0000	2.309	2.309	∞
B	Probe Positioning with regard to Phantom Shell	2.850	2.850	Rectangular	1.7321	1.0000	1.645	1.645	∞
B	Extrapolation and integration/ Maximum SAR evaluation	5.080	5.080	Rectangular	1.7321	1.0000	2.933	2.933	∞
A	Test Sample Positioning	2.460	2.460	normal (k=1)	1.0000	1.0000	2.460	2.460	10
A	Device Holder uncertainty	0.154	0.154	normal (k=1)	1.0000	1.0000	0.154	0.154	10
B	Phantom Uncertainty	4.000	4.000	Rectangular	1.7321	1.0000	2.309	2.309	∞
B	Drift of output power	5.000	5.000	Rectangular	1.7321	1.0000	2.887	2.887	∞
B	Liquid Conductivity (target value)	5.000	5.000	Rectangular	1.7321	0.6400	1.848	1.848	∞
A	Liquid Conductivity (measured value)	2.210	2.210	normal (k=1)	1.0000	0.6400	1.414	1.414	5
B	Liquid Permittivity (target value)	5.000	5.000	Rectangular	1.7321	0.6000	1.732	1.732	∞
A	Liquid Permittivity (measured value)	2.150	2.150	normal (k=1)	1.0000	0.6000	1.290	1.290	5
	Combined standard uncertainty			t-distribution			9.42	9.42	>500
	Expanded uncertainty			k = 1.96			18.45	18.45	>500

5.3. Uncertainty - PCS / GPRS / EDGE 1900 / WCDMA FDD 2 / CDMA BC 1 / LTE Band 2 / LTE Band 25 Body Configuration 1g

Type	Source of uncertainty	+ Value	- Value	Probability Distribution	Divisor	$c_{i\ (1g)}$	Standard Uncertainty		υ_i or υ_{eff}
							+ u (%)	- u (%)	
B	Probe calibration	6.000	6.000	normal (k=1)	1.0000	1.0000	6.000	6.000	∞
B	Axial Isotropy	0.250	0.250	normal (k=1)	1.0000	1.0000	0.250	0.250	∞
B	Hemispherical Isotropy	1.300	1.300	normal (k=1)	1.0000	1.0000	1.300	1.300	∞
B	Spatial Resolution	0.500	0.500	Rectangular	1.7321	1.0000	0.289	0.289	∞
B	Boundary Effect	0.769	0.769	Rectangular	1.7321	1.0000	0.444	0.444	∞
B	Linearity	0.600	0.600	Rectangular	1.7321	1.0000	0.346	0.346	∞
B	Detection Limits	0.200	0.200	Rectangular	1.7321	1.0000	0.115	0.115	∞
B	Readout Electronics	0.160	0.160	normal (k=1)	1.0000	1.0000	0.160	0.160	∞
B	Response Time	0.000	0.000	Rectangular	1.7321	1.0000	0.000	0.000	∞
B	Integration Time	1.730	1.730	Rectangular	1.7321	1.0000	0.999	0.999	∞
B	RF Ambient conditions	3.000	3.000	Rectangular	1.7321	1.0000	1.732	1.732	∞
B	Probe Positioner Mechanical Restrictions	4.000	4.000	Rectangular	1.7321	1.0000	2.309	2.309	∞
B	Probe Positioning with regard to Phantom Shell	2.850	2.850	Rectangular	1.7321	1.0000	1.645	1.645	∞
B	Extrapolation and integration / Maximum SAR evaluation	5.080	5.080	Rectangular	1.7321	1.0000	2.933	2.933	∞
A	Test Sample Positioning	1.860	1.860	normal (k=1)	1.0000	1.0000	1.860	1.860	10
A	Device Holder uncertainty	0.154	0.154	normal (k=1)	1.0000	1.0000	0.154	0.154	10
B	Phantom Uncertainty	4.000	4.000	Rectangular	1.7321	1.0000	2.309	2.309	∞
B	Drift of output power	5.000	5.000	Rectangular	1.7321	1.0000	2.887	2.887	∞
B	Liquid Conductivity (target value)	5.000	5.000	Rectangular	1.7321	0.6400	1.848	1.848	∞
A	Liquid Conductivity (measured value)	2.610	2.610	normal (k=1)	1.0000	0.6400	1.670	1.670	5
B	Liquid Permittivity (target value)	5.000	5.000	Rectangular	1.7321	0.6000	1.732	1.732	∞
A	Liquid Permittivity (measured value)	2.140	2.140	normal (k=1)	1.0000	0.6000	1.284	1.284	5
	Combined standard uncertainty			t-distribution			9.32	9.32	>500
	Expanded uncertainty			k = 1.96			18.26	18.26	>500

5.4. Uncertainty –Wi-Fi 2450 MHz Body Configuration 1g

Type	Source of uncertainty	+ Value	- Value	Probability Distribution	Divisor	$c_{i\ (1g)}$	Standard Uncertainty		υ_i or υ_{eff}
							+ u (%)	- u (%)	
B	Probe calibration	6.000	6.000	normal (k=1)	1.0000	1.0000	6.000	6.000	∞
B	Axial Isotropy	0.250	0.250	normal (k=1)	1.0000	1.0000	0.250	0.250	∞
B	Hemispherical Isotropy	1.300	1.300	normal (k=1)	1.0000	1.0000	1.300	1.300	∞
B	Spatial Resolution	0.500	0.500	Rectangular	1.7321	1.0000	0.289	0.289	∞
B	Boundary Effect	0.769	0.769	Rectangular	1.7321	1.0000	0.444	0.444	∞
B	Linearity	0.600	0.600	Rectangular	1.7321	1.0000	0.346	0.346	∞
B	Detection Limits	0.200	0.200	Rectangular	1.7321	1.0000	0.115	0.115	∞
B	Readout Electronics	0.160	0.160	normal (k=1)	1.0000	1.0000	0.160	0.160	∞
B	Response Time	0.000	0.000	Rectangular	1.7321	1.0000	0.000	0.000	∞
B	Integration Time	0.000	0.000	Rectangular	1.7321	1.0000	0.000	0.000	∞
B	RF Ambient conditions	3.000	3.000	Rectangular	1.7321	1.0000	1.732	1.732	∞
B	Probe Positioner Mechanical Restrictions	4.000	4.000	Rectangular	1.7321	1.0000	2.309	2.309	∞
B	Probe Positioning with regard to Phantom Shell	2.850	2.850	Rectangular	1.7321	1.0000	1.645	1.645	∞
B	Extrapolation and integration / Maximum SAR evaluation	5.080	5.080	Rectangular	1.7321	1.0000	2.933	2.933	∞
A	Test Sample Positioning	2.440	2.440	normal (k=1)	1.0000	1.0000	2.440	2.440	10
A	Device Holder uncertainty	0.154	0.154	normal (k=1)	1.0000	1.0000	0.154	0.154	10
B	Phantom Uncertainty	4.000	4.000	Rectangular	1.7321	1.0000	2.309	2.309	∞
B	Drift of output power	5.000	5.000	Rectangular	1.7321	1.0000	2.887	2.887	∞
B	Liquid Conductivity (target value)	5.000	5.000	Rectangular	1.7321	0.6400	1.848	1.848	∞
A	Liquid Conductivity (measured value)	2.260	2.260	normal (k=1)	1.0000	0.6400	1.446	1.446	5
B	Liquid Permittivity (target value)	5.000	5.000	Rectangular	1.7321	0.6000	1.732	1.732	∞
A	Liquid Permittivity (measured value)	2.150	2.150	normal (k=1)	1.0000	0.6000	1.290	1.290	5
	Combined standard uncertainty			t-distribution			9.36	9.36	>500
	Expanded uncertainty			k = 1.96			18.35	18.35	>500

5.5. Uncertainty - Wi-Fi 5GHz Body Configuration 1g

Type	Source of uncertainty	+ Value	- Value	Probability Distribution	Divisor	$c_{i\ (1g)}$	Standard Uncertainty		υ_i or υ_{eff}
							+ u (%)	- u (%)	
B	Probe calibration	6.550	6.550	normal (k=1)	1.0000	1.0000	6.550	6.550	∞
B	Axial Isotropy	0.250	0.250	normal (k=1)	1.0000	1.0000	0.250	0.250	∞
B	Hemispherical Isotropy	1.300	1.300	normal (k=1)	1.0000	1.0000	1.300	1.300	∞
B	Spatial Resolution	0.500	0.500	Rectangular	1.7321	1.0000	0.289	0.289	∞
B	Boundary Effect	0.769	0.769	Rectangular	1.7321	1.0000	0.444	0.444	∞
B	Linearity	0.600	0.600	Rectangular	1.7321	1.0000	0.346	0.346	∞
B	Detection Limits	0.200	0.200	Rectangular	1.7321	1.0000	0.115	0.115	∞
B	Readout Electronics	0.160	0.160	normal (k=1)	1.0000	1.0000	0.160	0.160	∞
B	Response Time	0.000	0.000	Rectangular	1.7321	1.0000	0.000	0.000	∞
B	Integration Time	0.000	0.000	Rectangular	1.7321	1.0000	0.000	0.000	∞
B	RF Ambient conditions	3.000	3.000	Rectangular	1.7321	1.0000	1.732	1.732	∞
B	Probe Positioner Mechanical Restrictions	4.000	4.000	Rectangular	1.7321	1.0000	2.309	2.309	∞
B	Probe Positioning with regard to Phantom Shell	2.850	2.850	Rectangular	1.7321	1.0000	1.645	1.645	∞
B	Extrapolation and integration / Maximum SAR evaluation	5.080	5.080	Rectangular	1.7321	1.0000	2.933	2.933	∞
A	Test Sample Positioning	1.960	1.960	normal (k=1)	1.0000	1.0000	1.960	1.960	10
A	Device Holder uncertainty	0.154	0.154	normal (k=1)	1.0000	1.0000	0.154	0.154	10
B	Phantom Uncertainty	4.000	4.000	Rectangular	1.7321	1.0000	2.309	2.309	∞
B	Drift of output power	5.000	5.000	Rectangular	1.7321	1.0000	2.887	2.887	∞
B	Liquid Conductivity (target value)	5.000	5.000	Rectangular	1.7321	0.6400	1.848	1.848	∞
A	Liquid Conductivity (measured value)	4.370	4.370	normal (k=1)	1.0000	0.6400	2.797	2.797	5
B	Liquid Permittivity (target value)	5.000	5.000	Rectangular	1.7321	0.6000	1.732	1.732	∞
A	Liquid Permittivity (measured value)	4.270	4.270	normal (k=1)	1.0000	0.6000	2.562	2.562	5
	Combined standard uncertainty			t-distribution			10.15	10.15	>450
	Expanded uncertainty			k = 1.96			19.90	19.90	>450

6. Device Under Test (DUT) Information

6.1. DUT Description

Phone Cover (Sleeve)

DUT Description:	The Infinea TAB mini is a small handheld secured payment terminal with barcode reader, Magnetic Stripe reader and Bluetooth. It is compatible with iPad mini, iPad mini with Retina display, iPad Air, iPhone 6 Plus and iPhone 6S Plus.
Model Number:	Infinea TAB mini
Serial Number:	MAR00341SUN14
Hardware Version Number:	MBN0100
Software Version Number:	None Stated
Country of Manufacture:	Bulgaria
Date of Receipt:	26 March 2015
EUT Dimensions:	103.0 x 88.0 x 23.5 mm (LxWxD)

Host Device

DUT Description	Model: A1490 is a tablet with cellular GSM/GPRS/EGPRS/WCDMA/HSPA+/DC-HSDPA/CDMA1xRTT/1x Advanced/ EV-DO Rev 0, A, B / LTE radio, IEEE 802.11a/b/g/n radio (MIMO 2X2) and Bluetooth radio.
Serial Number:	**The following SAR Samples were used for radiated measurements:** DLXM37CMFLMP:PCS1900, WCDMA 2/4/5, CDMA BC1, CDMA BC15, LTE Band 2/4/5/17/25/26 DLXM3BAUFLMJ: GSM850, CDMA BC0, CDMA BC10, LTE Band 13 DLXM3B9NFLMU:Wi-Fi 2.4GHz DLXN300YFT79: Wi-Fi 5.2/5.3/5.4/5.8 GHz **The following SAR Samples were used for conducted measurements:** DLXM37CMFLMP:PCS1900, WCDMA 2/4/5, CDMA BC1, CDMA BC15, LTE Band 2/4/5/17/25/26 DLXM3BAUFLMJ: GSM850, CDMA BC0, CDMA BC10, LTE Band 13, Wi-Fi 2.4GHz DLXN300YFT79: Wi-Fi 5.2/5.3/5.4/5.8 GHz

6.2. Wireless Technologies

Phone Cover (Sleeve)

Tx Frequencies	Bluetooth: 2402 – 2480 MHz
Mode	Bluetooth 2.0 Class 2

Host Device

	Model: A1490
Tx Frequencies	• GSM850: 824-849 MHz • GSM1900: 1850-1910 MHz • WCDMA Band 2: 1850-1910 MHz • WCDMA Band 4: 1710-1755 MHz • WCDMA Band 5: 824-849 MHz • CDMA BC 0: 824-849 MHz • CDMA BC 1: 1850-1910 MHz • CDMA BC10: 817.9-823.1 MHz • CDMA BC15: 1710-1754 MHz • LTE Band 2: 1850-1910 MHz • LTE Band 4: 1710-1755 MHz • LTE Band 5: 824-849 MHz • LTE Band 13: 777-787 MHz • LTE Band 17: 704-716 MHz • LTE Band 25: 1850-1915 MHz • LTE Band 26: 820-823 MHz • 802.11 a/b/g/n: 2412-2462 MHz 5180-5825 MHz • Bluetooth: 2402-2480 MHz
Mode	• GSM/GPRS/EGPRS • UMTS Rel 99 • HSDPA (Rel 7, CAT 14) • HSUPA (Rel 6, CAT 6) • DC-HSDPA (Rel 8, CAT 24) • HSPA+ (Rel 6, CAT 6) • CDMA 1xRTT • CDMA 1xAdvanced • EVDO Rev.0, Rev.A, Rev.B (Rel B in BC0 for 16QAM only) • 802.11 a/b/g/n HT20 • Bluetooth 4.0 LE

6.3. Nominal and Maximum Output Power

Host Device

All nominal and maximum output power measurements are as documented in the original FCC SAR report **13U15668-14** issued on **22 Sept 2013.**

7. RF Exposure Conditions (Test Configurations)

Baseline measurements are performed on the host device and compared to the original grant reported levels for all bands on the indicated worst case position in the original SAR report for the host device.

As per the interim sleeve procedure, the highest SAR configuration among the different wireless modes in each frequency band and any SAR configuration in the original report > 75% of the SAR limit; should be measured separately for head, body-worn accessories and hotspot modes when applicable on the host device. When the measured SAR values of the highest SAR configurations are identical (before rounding up), select the configuration with the highest maximum output power. The SAR results should be each scaled with respect to the power level tested by to determine compliance.

After completing the baseline measurements on the host device, the runs are repeated using the phone cover attached. Section 10 contains the SAR test results obtained with and without the phone cover attached along with the deviation in results with respect to the original report **13U15668-14.**

Bluetooth power measurements with sleeve attached are taken from the original FCC SAR report **13U15668-14** issued on **22 Sept 2013.**

8. Conducted output power measurements

This section contains the conducted power measurements that are carried out on the host device prior to performing the baseline testing.

A1490

Technology/Band	Test Configuration	Proximity sensor	Mode	Channel #	Frequency (MHz)	Measured Power (dBm)	Tune up Limit (dBm)
GSM850	Body	ON 2nd Stage	GPRS 2 Slots	251	848.8	23.40	24.50
GSM1900	Body	ON 2nd Stage	GPRS 2 Slots	810	1909.2	18.90	20.00
WCDMA Band 2	Body	ON 2nd Stage	RMC 12.2kbps	9538	1907.6	12.20	13.50
WCDMA Band 4	Body	ON 2nd Stage	RMC 12.2kbps	1413	1732.6	11.90	13.50
WCDMA Band 5	Body	ON 2nd Stage	RMC 12.2kbps	4132	826.4	17.90	18.75
CDMA BC0	Body	ON 2nd Stage	1xEVDO Rel 0	384	836.5	17.70	19.00
CDMA BC1	Body	ON 2nd Stage	1xRTT RC3 SO32	1175	1908.8	12.10	13.25
CDMA BC10	Body	ON 2nd Stage	1xRTT RC3 SO32	476	817.9	17.40	19.25
CDMA BC15	Body	ON 2nd Stage	1xRTT RC3 SO32	25	1711.3	12.30	13.50
LTE Band 2	Body	ON 1st Stage	QPSK 20MHz RB 50/49	18900	1880.0	21.10	22.00
LTE Band 4	Body	ON 1st Stage	QPSK 20MHz RB 50/0	20300	1745.0	21.70	23.25
LTE Band 5	Body	ON 2nd Stage	QPSK 10MHz RB 25/12	20525	836.5	17.80	18.75
LTE Band 13	Body	ON 2nd Stage	QPSK 10MHz RB 1/0	23230	782.0	17.70	19.25
LTE Band 17	Body	ON 2nd Stage	QPSK 10MHz RB 1/24	23790	710.0	18.00	19.00
LTE Band 25	Body	ON 1st Stage	QPSK 20MHz RB 100/0	26590	1905.0	20.70	21.75
LTE Band 26	Body	ON 2nd Stage	QPSK 5MHz RB 12/0	26763	821.3	17.90	18.75

Technology/Band	Test Configuration	Mode	Antenna	Channel #	Frequency (MHz)	Measured Power (dBm)	Tune up Limit (dBm)
WiFi 2.4 GHz	Body	802.11g CDD	2TX Ant 1	2	2417.0	16.50	16.50
WiFi 5.2 GHz	Body	802.11 n HT40 SIS0	1TX Ant 2	46	5230.0	15.80	16.00
WiFi 5.3 GHz	Body	802.11 a HT20 SISO	1TX Ant 2	60	5300.0	15.85	16.00
WiFi 5.5 GHz	Body	802.11 a HT20 SISO	1TX Ant 2	136	5680.0	15.00	15.00
WiFi 5.8 GHz	Body	802.11 a HT20 SISO	1TX Ant 2	157	5785.0	15.50	15.50

9. Dielectric Property Measurements & System Check

9.1.Tissue Dielectric Parameters

The temperature of the tissue-equivalent medium used during measurement must also be within 18°C to 25°C and within ± 2°C of the temperature when the tissue parameters are characterized.
The dielectric parameters must be measured before the tissue-equivalent medium is used in a series of SAR measurements. The parameters should be re-measured after each 3 – 4 days of use; or earlier if the dielectric parameters can become out of tolerance; for example, when the parameters are marginal at the beginning of the measurement series.
Tissue dielectric parameters were measured at the low, middle and high frequency of each operating frequency range of the test device.

FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz; IEEE1528:2013 & IEC 62209-1:2005

Target Frequency (MHz)	Head		Body (FCC only)	
	ε_r	σ (S/m)	ε_r	σ (S/m)
150	52.3	0.76	61.9	0.80
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
750	41.9	0.89	-	-
835	41.5	0.90	55.2	0.97
900	41.5	0.97	55.0	1.05
915	41.5	0.98	55.0	1.06
1450	40.5	1.20	54.0	1.30
1500	40.4	1.23	-	-
1610	40.3	1.29	53.8	1.40
1640	40.2	1.31	-	-
1750	40.1	1.37	-	-
1800	40	1.40	53.3	1.52
1900	40	1.40	53.3	1.52
2000	40	1.40	53.3	1.52
2100	39.8	1.49	-	-
2300	39.5	1.67	-	-
2450	39.2	1.80	52.7	1.95
2600	39	1.96	-	-
3000	38.5	2.40	52.0	2.73
3500	37.9	2.91	-	-
4000	37.4	3.43	-	-
4500	36.8	3.94	-	-
5000	36.2	4.45	49.3	5.07
5100	36.1	4.55	49.1	5.18
5200	36.0	4.66	49.0	5.30
5300	35.9	4.76	48.9	5.42
5400	35.8	4.86	48.7	5.53
5500	35.6	4.96	48.6	5.65
5600	35.5	5.07	48.5	5.77
5700	35.4	5.17	48.3	5.88
5800	35.3	5.27	48.2	6.00
6000	35.1	5.48	-	-

NOTE: For convenience, permittivity and conductivity values at some frequencies that are not part of the original data from Drossos et al. [B60] or the extension to 5800 MHz are provided (i.e., the values shown in italics). These values were linearly interpolated between the values in this table that are immediately above and below these values, except the values at 6000 MHz that were linearly extrapolated from the values at 3000 MHz and 5800 MHz.

9.2. System Check

SAR system verification is required to confirm measurement accuracy, according to the tissue dielectric media, probe calibration points and other system operating parameters required for measuring the SAR of a test device. The system verification must be performed for each frequency band and within the valid range of each probe calibration point required for testing the device. The same SAR probe(s) and tissue-equivalent media combinations used with each specific SAR system for system verification must be used for device testing. When multiple probe calibration points are required to cover substantially large transmission bands, independent system verifications are required for each probe calibration point. A system verification must be performed before each series of SAR measurements using the same probe calibration point and tissue-equivalent medium. Additional system verification should be considered according to the conditions of the tissue-equivalent medium and measured tissue dielectric parameters, typically every three to four days when the liquid parameters are re-measured or sooner when marginal liquid parameters are used at the beginning of a series of measurements.

9.3. Reference Target SAR Values

The reference SAR values are obtained from the calibration certificate of system validation dipoles. The measured values are normalised to 1 Watt.

System Dipole	Serial No.	Cal. Date	Freq. (MHz)	Target SAR Values (mW/g)		
				1g/10g	Head	Body
D750V3	1011	16 Jan 2015	750	1g	8.09	8.54
				10g	5.32	5.66
D900V2	1d168	14 May 2014	900	1g	10.30	10.60
				10g	6.60	6.87
D1800V2	264	18 Aug 2014	1800	1g	38.60	37.80
				10g	20.30	20.10
D1900V2	540	08 Dec 2014	1900	1g	40.10	40.00
				10g	20.90	21.10
D2450V2	725	08 Dec 2014	2450	1g	50.80	49.90
				10g	23.70	23.20
D5GHzV2	1016	24 Feb 2015	5250	1g	79.00	76.00
				10g	22.70	21.20
			5600	1g	80.90	77.70
				10g	23.00	21.40
			5750	1g	35.40	74.40
				10g	5.22	20.50

9.4. Dielectric Property Measurements & System Check Results

The 1-g SAR and 10-g SAR measured with a reference dipole, using the required tissue-equivalent medium at the test frequency, must be within 10% of the manufacturer calibrated dipole SAR target. The internal limit is set to 5%.

SAR Lab 57

System Check 1900 Body
Date: 30/04/2015
Validation Dipole and Serial Number: D1900V2 SN: 540

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	1900	23.0	22.7	ε_r	53.30	52.12	-2.21	5.00
				σ	1.52	1.51	-0.49	5.00
				1g SAR	40.00	39.04	-2.40	5.00
				10g SAR	21.10	20.92	-0.85	5.00

System Check 1900 Body
Date: 05/05/2015
Validation Dipole and Serial Number: D1900V2 SN: 540

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	1900	23.0	22.9	ε_r	53.30	53.12	-0.34	5.00
				σ	1.52	1.52	0.14	5.00
				1g SAR	40.00	41.20	3.00	5.00
				10g SAR	21.10	21.96	4.08	5.00

SAR Lab 59

System Check 1800 Body
Date: 05/05/2015
Validation Dipole and Serial Number: D1800V2 SN: 264

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	1800	23.0	22.0	ε_r	53.30	52.01	-2.42	5.00
				σ	1.52	1.54	1.58	5.00
				1g SAR	37.80	38.36	1.48	5.00
				10g SAR	20.10	19.60	-2.49	5.00

System Check 2450 Body
Date: 07/05/2015
Validation Dipole and Serial Number: D2450V2 SN: 725

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	2450	23.0	24.0	ε_r	52.70	50.93	-3.36	5.00
				σ	1.95	2.01	2.96	5.00
				1g SAR	49.90	49.20	-1.40	5.00
				10g SAR	23.20	22.76	-1.90	5.00

SAR Lab 60

System Check 750 Body
Date: 28/04/2015
Validation Dipole and Serial Number: D750V3 SN: 1011

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	750	23.0	22.5	ε_r	55.55	55.75	0.36	5.00
				σ	0.96	0.93	-3.60	5.00
				1g SAR	8.54	8.64	1.17	5.00
				10g SAR	5.66	5.86	3.18	5.00

System Check 900 Body
Date: 27/04/2015
Validation Dipole and Serial Number: D900V2 SN: 1d168

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	900	23.0	22.5	ε_r	55.00	52.97	-3.69	5.00
				σ	1.05	1.02	-3.05	5.00
				1g SAR	10.60	10.68	0.75	5.00
				10g SAR	6.87	7.12	3.64	5.00

SAR Lab 61

System Check 5.25/5.6/5.75 GHz Body
Date: 05/05/2015
Validation Dipole and Serial Number: D1016V2 SN: 1016

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	5250	24.0	23.0	ε_r	48.90	48.06	-1.72	5.00
				σ	5.36	5.44	5.36	5.00
				1g SAR	76.00	76.10	0.13	5.00
				10g SAR	21.20	21.20	0.00	5.00
Body	5600	24.0	23.0	ε_r	48.50	47.17	-2.74	5.00
				σ	5.77	5.98	3.69	5.00
				1g SAR	77.70	80.30	3.35	5.00
				10g SAR	21.40	22.20	3.74	5.00
Body	5750	24.0	23.0	ε_r	48.30	46.71	-3.29	5.00
				σ	5.94	6.19	4.22	5.00
				1g SAR	74.40	72.90	-2.02	5.00
				10g SAR	20.50	20.20	-1.46	5.00

10. Measurements, Examinations and Derived Results

10.1. General Comments

This section contains test results only.

Measurement uncertainties are evaluated in accordance with current best practice. Our reported expanded uncertainties are based on standard uncertainties, which are multiplied by an appropriate coverage factor to provide a statistical confidence level of approximately 95%. Please refer to section 5 for details of measurement uncertainties.

10.2. Specific Absorption Rate - Test Results – A1490

For All SAR measurement in this report the 1g-SAR limit tested to is 1.6 W/Kg

WORST CASE DETERMINED FROM ORIGINAL FCC SAR REPORT									BASELINE MEASUREMENTS (Host Device)				Host Device + Sleeve				
Technology/ Band	Test Configuration		Proximity sensor	Mode	Channel #	Frequency (MHz)	Tune up Power (dBm)	Highest 1g Reported. SAR (W/Kg)	Meas. power (dBm)	Highest 1g SAR Meas. (W/Kg)	Highest 1g SAR Reported (W/Kg)	Difference	Highest 1g SAR Meas. (W/Kg)	Highest 1g SAR Reported (W/Kg)	Difference	Final Result for Report (W/kg)	Scan No.
GSM850	Body	Rear	ON 2nd Stage	GPRS 2 Slots	251	848.8	24.50	1.040	23.40	0.850	1.095	5.3%	0.622	0.801	-23.0%	0.801	1
GSM1900	Body	Rear	ON 2nd Stage	GPRS 2 Slots	810	1909.2	20.00	1.074	18.90	0.862	1.110	3.4%	0.437	0.563	-47.6%	0.563	2
WCDMA Band 2	Body	Rear	ON 2nd Stage	RMC 12.2kbps	9538	1907.6	13.50	1.130	12.20	0.909	1.226	8.5%	0.520	0.701	-37.9%	0.701	3
WCDMA Band 4	Body	Rear	ON 2nd Stage	RMC 12.2kbps	1413	1732.6	13.50	1.187	11.90	0.581	0.840	-29.3%	0.603	0.872	-26.6%	1.232	4
WCDMA Band 5	Body	Rear	ON 2nd Stage	RMC 12.2kbps	4132	826.4	18.75	1.180	17.90	1.050	1.277	8.2%	0.456	0.555	-53.0%	0.555	5
CDMA BC0	Body	Rear	ON 2nd Stage	1xEVDO Rel 0	384	836.5	19.00	1.190	17.70	0.975	1.315	10.5%	0.488	0.658	-44.7%	0.658	6
CDMA BC1	Body	Rear	ON 2nd Stage	1xRTT RC3 SO32	1175	1908.8	13.25	1.180	12.10	0.949	1.237	4.8%	0.490	0.639	-45.9%	0.639	7
CDMA BC10	Body	Rear	ON 2nd Stage	1xRTT RC3 SO32	476	817.9	19.25	1.170	17.40	0.881	1.349	15.3%	0.586	0.897	-23.3%	0.897	8
CDMA BC15	Body	Rear	ON 2nd Stage	1xRTT RC3 SO32	25	1711.3	13.50	1.190	12.30	0.940	1.239	4.1%	0.589	0.776	-34.8%	0.776	9
LTE Band 2	Body	Right Hand Side	ON 1st Stage	QPSK 20MHz RB 50/49	18900	1880.0	22.00	1.192	21.10	0.913	1.123	-5.8%	0.773	0.951	-20.2%	1.009	10
LTE Band 4	Body	Right Hand Side	ON 1st Stage	QPSK 20MHz RB 50/0	20300	1745.0	23.25	1.178	21.70	0.724	1.035	-12.2%	0.715	1.022	-13.3%	1.163	11
LTE Band 5	Body	Rear	ON 2nd Stage	QPSK 10MHz RB 25/12	20525	836.5	18.75	1.130	17.80	1.040	1.294	14.5%	0.308	0.383	-66.1%	0.383	12
LTE Band 13	Body	Rear	ON 2nd Stage	QPSK 10MHz RB 1/0	23230	782.0	19.25	1.192	17.70	0.950	1.357	13.9%	0.431	0.616	-48.3%	0.616	13
LTE Band 17	Body	Rear	ON 2nd Stage	QPSK 10MHz RB 1/24	23790	710.0	19.00	1.170	18.00	1.060	1.334	14.1%	0.265	0.334	-71.5%	0.334	14
LTE Band 25	Body	Right Hand Side	ON 1st Stage	QPSK 20MHz RB 100/0	26590	1905.0	21.75	1.180	20.70	0.848	1.080	-8.5%	0.754	0.960	-18.6%	1.049	15
LTE Band 26	Body	Rear	ON 2nd Stage	QPSK 5MHz RB 12/0	26763	821.3	18.75	1.180	17.90	1.070	1.301	10.3%	0.320	0.389	-67.0%	0.389	16

Specific Absorption Rate - Test Results – A1490 (Continued)

	WORST CASE DETERMINED FROM ORIGINAL FCC SAR REPORT								BASELINE MEASUREMENTS (Host Device)				Host Device + Sleeve				Scan No.
Technology/Band	Test Configuration		Mode	Antenna	Channel #	Frequency (MHz)	Tune up Power (dBm)	Highest 1g Reported. SAR (W/Kg)	Meas. power (dBm)	Highest 1g SAR Meas. (W/Kg)	Highest 1g SAR Reported (W/Kg)	Difference	Highest 1g SAR Meas. (W/Kg)	Highest 1g SAR Reported (W/Kg)	Difference	Final Result for Report (W/kg)	
WiFi 2.4 GHz	Body	Bottom	802.11g CDD	2TX Ant 1	2	2417.0	16.50	1.140	16.50	1.100	1.100	-3.5%	0.039	0.039	-99.8%	0.040	17
WiFi 5.2 GHz	Body	Bottom	802.11 n HT40 SIS0	1TX Ant 2	46	5230.0	16.00	0.866	15.80	0.509	0.533	-38.5%	0.091	0.095	-99.4%	0.155	19
WiFi 5.3 GHz	Body	Bottom	802.11 a HT20 SISO	1TX Ant 2	60	5300.0	16.00	0.970	15.85	0.614	0.636	-34.5%	0.105	0.109	-99.3%	0.166	20
WiFi 5.5 GHz	Body	Bottom	802.11 a HT20 SISO	1TX Ant 2	136	5680.0	15.00	0.796	15.00	0.765	0.765	-3.9%	0.116	0.116	-99.2%	0.121	21
WiFi 5.8 GHz	Body	Bottom	802.11 a HT20 SISO	1TX Ant 2	157	5785.0	15.50	0.703	15.50	0.522	0.522	-25.7%	0.098	0.098	-99.4%	0.132	22

Note(s):

* Body testing in the original report was performed at 0mm.

* Scaled 1g SAR Reported is calculated based on the following KDB inquiry response:
1. When the *reported* SAR of the test sample measured without accessory (sleeve) attached is equal to or higher than the *reported* SAR of the same test configuration in the original equipment certification filing, used the *reported* SAR of the test sample with accessory (sleeve) attached as the SAR result for the test configuration.

2. When the *reported* SAR of the test sample measured without accessory (sleeve) attached is lower than the *reported* SAR of the same test configuration in the original equipment certification filing, adjust the *reported* SAR of the test sample **with accessory (sleeve) attached** by the ratio of *reported* SAR in the original filing to the *reported* SAR of the test sample **without the accessory (sleeve) attached** as the SAR result for the test configuration.

3. Baseline SAR plots have been included for host device runs that were not within ±15% of the original report value. Please refer to section 12.7.

10.3. Bluetooth (Sleeve)

10.3.1. Standalone SAR Test Exclusion Considerations

The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:

[(max. power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)]·[√f(GHz)] ≤ 3.0, for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where

- $f_{(GHz)}$ is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison

The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.

Body-worn Accessory Exposure Conditions

Max. tune-up tolerance limit		Min. test separation distance (mm)	Frequency (GHz)	Result
(dBm)	(mW)			
4.0	2.5	10	2.40	0.39

Conclusion:

The computed value is < 3; therefore, Bluetooth qualifies for Standalone SAR test exclusion.

10.3.2. Estimated SAR

When the standalone SAR test exclusion is applied to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to following to determine simultaneous transmission SAR test exclusion:

- *(max. power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)]·[√f(GHz)/x]* W/kg for test separation distances ≤ 50 mm;
  where x = 7.5 for 1-g SAR, and x = 18.75 for 10-g SAR.
- 0.4 W/kg for 1-g SAR and 1.0 W/kg for 10-g SAR, when the test separation distances is > 50 mm.

Estimated SAR Result for Body-worn Accessory Conditions:

Test Configuration	Max. tune-up tolerance limit (mW)	Min. test separation distance (mm)	Frequency (GHz)	Estimated 1-g SAR (W/kg)
Back/Front	2.5	10	2.4	0.052

11. Simultaneous Transmission Analysis

According to the worst case configuration Simultaneous transmission analysis of worst cases is shown in the tables below.

Overall Worst Case:

1. WWAN + WLAN 2.4 GHz
2. WWAN + WLAN 5.0 GHz
3. WWAN + WPAN
4. WPAN + WLAN 5.0 GHz
5. WWAN + WLAN 5.0 GHz + WPAN

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			Host Device with Sleeve attached			Sleeve		
Exposure Configuration	**Combination under consideration**	**Technology Band**	**Highest Reported 1g SAR (W/kg)**	**Equipment Class**	**Highest Reported Sum-1g-SAR (W/kg)**	**Estimated Bluetooth 1g-SAR (W/kg)**	**Simultaneous transmission SUM (W/kg)**	**SPLSR Ratio**
BODY-WORN	WWAN + WLAN 2.4GHz	WCDMA Band 4	1.232	PCE	1.272	0.052	1.324	N/A
		Wi-Fi 2.4GHz	0.040	DTS				
	WWAN + WLAN 5.0GHz	WCDMA Band 4	1.232	PCE	1.398	0.052	1.450	N/A
		Wi-Fi 5.3GHz	0.166	NII				
	WWAN + WPAN	WCDMA Band 4	1.232	PCE	1.236	0.052	1.288	N/A
		*Bluetooth**	0.004	DSS				
	WLAN 5.0GHz + WPAN	WCDMA Band 4	1.232	PCE	1.402	0.052	1.454	N/A
		Wi-Fi 5.3GHz	0.166	NII				
		*Bluetooth**	0.004	DSS				

* Bluetooth SAR results for Host Device with sleeve attached are taken from Report **15U22277-S4.**