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

SAR EVALUATION REPORT

For

INFINEA TAB 4 for iPad 4 (Contains FCC ID: YRWDATECSBT301)

Report Number UL-SAR-RP10488894JD04C V3.0
ISSUE DATE: 24 May 2016

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REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
--	30 September 2015	Initial Issue	--
1	29 February 2016	The following amendments are made in the report: 1. FCC ID of the sleeve is added 2. In Section 2,KDB list is updated to include latest KDB versions 3. In Section 2, typo in Test specification – purpose of test is amended 4. In Section 5, note added under the uncertainty budget tables 5. In Section 6.3., the word 'original' is added before the report number 6. In Sections 10.2. and 10.3., host test separation distance note is added 7. In Sections 12.3., the FCC ID of the sleeve is added 8. In Section 12.7., SAR baseline plots of runs that are not within ±15% are added	Sandhya Menon
2	24 May 2016	The following amendments are made in the report: 1. FCC ID of the sleeve is updated	Sandhya Menon

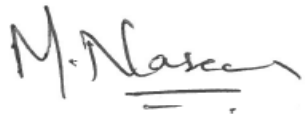
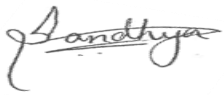
TABLE OF CONTENTS

1. Attestation of Test Results

Applicant Name:	Datecs				
Application Purpose	☒ Original Grant				
DUT Description	The Infinea TAB 4 includes a 1D or 2D barcode scanner and optional functions like 3-tracks magnetic card reader, secure MCR, contactless card reader, Bluetooth and a rechargeable battery in a very compact and durable protective case.				
Test Device is	An identical prototype				
Device category	Portable				
Exposure Category	General Population/Uncontrolled Exposure (1g SAR limit: 1.6 W/kg)				
Date Tested	23 July 2015 to 24 September 2015				
The highest reported SAR values	RF Exposure Conditions	Equipment Class			
		Licensed	DTS	UNII	DSS
	Body	1.460 W/kg	0.041 W/kg	0.222 W/kg	0.039 W/kg
	Simultaneous Transmission	1.589 W/kg	1.589 W/kg	1.570 W/kg	1.570 W/kg
Applicable Standards	FCC 47 CFR part 2 (2.1093) KDB publications 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 v02 r02
447498 D01 General RF Exposure Guidance v06
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

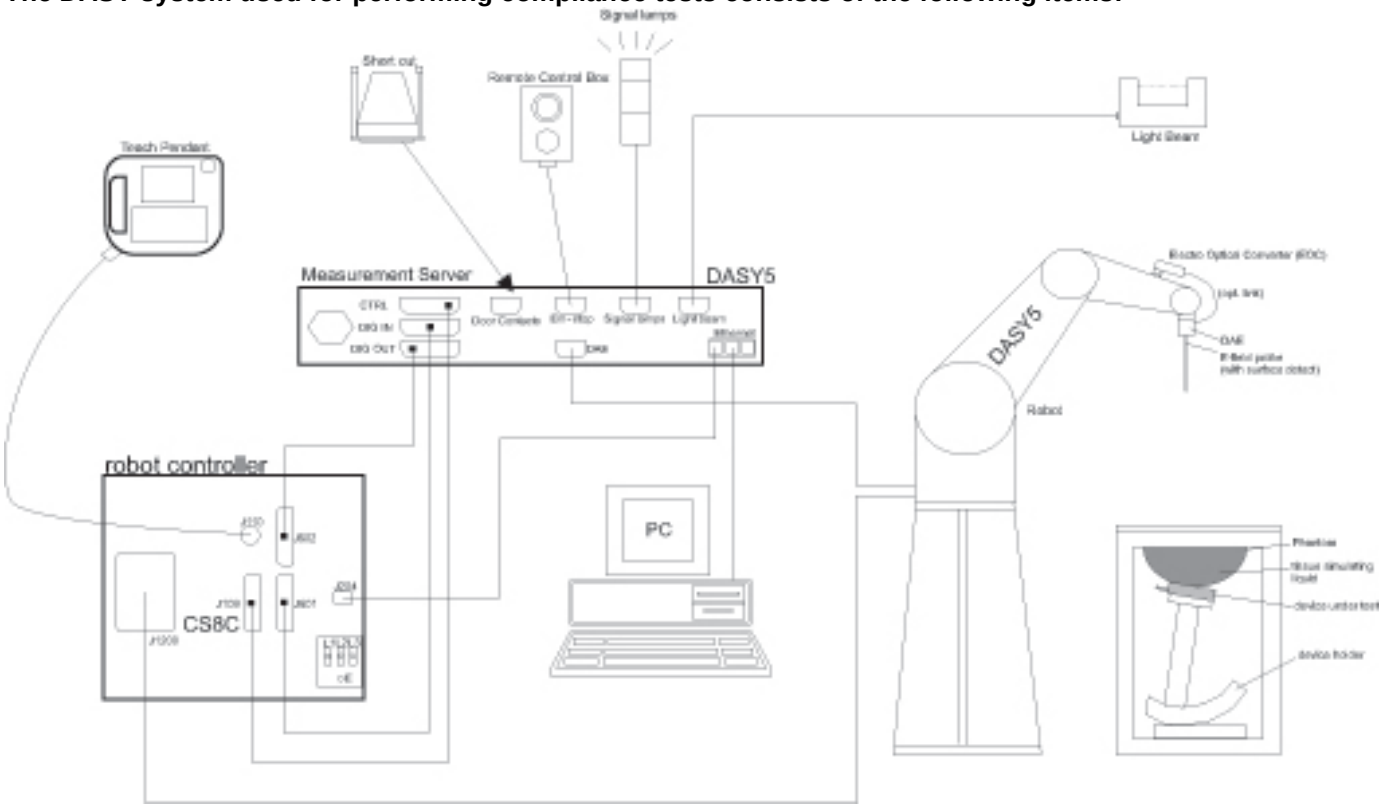
Pavilion A, Ashwood Park, Ashwood Way, Basingstoke, Hampshire, RG23 8BG UK	Facility Type
SAR Lab 57	Controlled Environment Chamber
SAR Lab 59	Controlled Environment Chamber
SAR Lab 60	Controlled Environment Chamber
SAR Lab 61	Controlled Environment Chamber

UL VS Limited is accredited by UKAS (United Kingdom Accreditation Service, Accredited to ISO/IEC 17025: 2005), 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 v01r04

	≤ 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·$\Delta z_{Zoom}(n-1)$	
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)
A2547	Data Acquisition Electronics	SPEAG	DAE4	1438	29 Apr 2015	12
A1234	Data Acquisition Electronics	SPEAG	DAE3	450	16 Sept 2014	12
A1184	Data Acquisition Electronics	SPEAG	DAE3	394	26 May 2015	12
A2111	Data Acquisition Electronics	SPEAG	DAE3	432	20 Aug 2014	12
A2546	Data Acquisition Electronics	SPEAG	DAE4	1435	20 Feb 2015	12
A2112	Probe	SPEAG	ET3 DV6	1586	22 May 2014	12
A2544	Probe	SPEAG	EX3 DV4	3994	17 Mar 2015	12
A2545	Probe	SPEAG	EX3 DV4	3995	28 Apr 2015	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	27 May 2015	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
G0591	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	RX90 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
M1768	Signal Generator	R&S	SME06	848050/005	01 Dec 2014	12
M1838	Signal Generator	R&S	SME06	831377/005	16 Apr 2015	12
M1841	Dual Channel Power Meter	R & S	NRVD	834501/069	27 Mar 2015	12
M263	Dual Channel Power Meter	R & S	NRVD	826558/004	04 Sep 2014	12
M1840	Dual Channel Power Meter	R & S	NRVD	844860/040	30 Apr 2015	12
M265	Power Sensor	R & S	ZRPZ1	893350/0017	05 Sep 2014	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

UL No.	Instrument	Manufacturer	Type No.	Serial No.	Date Last Calibrated	Cal. Interval (Months)
M1843	Power Sensor	R & S	ZRPZ1	826515/018	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	-
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	-

Note: All asset were in calibration during the course of testing.

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/C/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):	F13/5SC6F1/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: 432, 450, 394 DAE4 SN: 1435, 1438
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:	EX3DV4
Serial No:	3994; 3995; 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:	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

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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.	

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			≤ 3 GHz	> 3 GHz
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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·$\Delta z_{Zoom}(n-1)$	
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

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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 BC0, BC10 / LTE Band 5, 13 Body Configurations 1g	95%	±18.36%
Uncertainty- PCS / GPRS / EDGE 1900 / WCDMA FDD 2 / CDMA BC 1 / 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 BC0, BC10 / LTE Band 5, 13 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 - PCS / GPRS / EDGE 1900 / WCDMA FDD 2 / CDMA BC 1 / 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

5.3. 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

5.4. 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

Barcode Scanner & Magnetic Reader (Sleeve)

DUT Description:	The Infinea TAB 4 includes a 1D or 2D barcode scanner and optional functions like 3-tracks magnetic card reader, secure MCR, contactless card reader, Bluetooth and a rechargeable battery in a very compact and durable protective case.
Model Number:	Infinea TAB 4
Serial Number:	MAR003417UN14
Hardware Version Number:	None Stated
Software Version Number:	Not Applicable
Country of Manufacture:	Bulgaria
Date of Receipt:	16 September 2014
EUT Dimensions:	115 x 51 x 45 mm (L x W x D)

Support Equipment (Host EUT)

DUT Description:	Tablet with cellular GSM/GPRS/EGPRS/WCDMA/HSPA+/DC-HSDPA/CDMA1xRTT/ EV-DO Rev 0, A, B / LTE radio, IEEE 802.11a/b/g/n radio and Bluetooth radio
Manufacturer:	Apple Inc
Model Number:	A1460
FCC ID:	BCGA1460
Support Equipment Serial Number:	**The following SAR Samples were used for radiated measurements:** DMPL86UWF18P: GSM850, WCDMA 5,CDMA BC0, CDMA BC10, LTE Band 5, LTE Band 13, LTE Band 25 DMPJ600EF6JJ: GSM1900, WCDMA 2, CDMA BC1, Wi-Fi 2.4 GHz, Wi-Fi 5.0 GHz, Bluetooth **The following SAR Samples were used for conducted measurements:** DMPJ600EF6JJ: All Cellular, Wi-Fi and Bluetooth bands.
Hardware Version Number:	None Stated
Software Version Number:	None Stated
Country of Manufacture:	China
Date of Receipt:	12 March 2015
EUT Dimensions:	241.2 x 185.7 x 9.4 mm (L x W x D)

6.2. Wireless Technologies

Barcode Scanner & Magnetic Reader (Sleeve)

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

Support Equipment (Host EUT)

	Model: A1460
Tx Frequencies	• GSM850: 824-849 MHz • GSM1900: 1850-1910 MHz • WCDMA Band 2: 1850-1910 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 • LTE Band 5: 824-849 MHz • LTE Band 13: 777-787 MHz • LTE Band 25: 1850-1915 MHz • 802.11 b/g/n: 2412-2462 MHz • 802.11a/n: 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 EUT

All nominal and maximum output power measurements are as documented in the original FCC SAR report **12U14507-9A** dated 10 August 2012**.**

7. RF Exposure Conditions (Test Configurations)

Standalone SAR measurements are performed on the Host EUT and compared with the original grant reported levels for all bands on the indicated worst case position in the original SAR report for the Host EUT.

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 EUT. 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 standalone measurements on the Host EUT, the runs are repeated using the sleeve cover attached. Section 10 contains the SAR test results obtained with and without the Sleeve cover attached along with the deviation in results with respect to the original FCC SAR report **12U14507-9A** dated 10 August 2012**.**

8. Conducted output power measurements

This section contains the conducted power measurements that are carried out on the Host EUT prior to performing the standalone testing.

A1460

Technology/Band	Test Configuration	Proximity sensor	Mode	Channel #	Frequency (MHz)	Tune up Limit (dBm)
GSM850	Body	ON 2nd Stage	GPRS 2 Slots	190	836.60	25.30
GSM1900	Body	ON 2nd Stage	GPRS 2 Slots	810	1909.2	22.00
WCDMA Band 2	Body	ON 2nd Stage	RMC 12.2kbps	9538	1907.6	15.50
WCDMA Band 5	Body	ON 2nd Stage	RMC 12.2kbps	4183	836.60	19.40
CDMA BC0	Body	ON 2nd Stage	1xRTT RC3 SO32	384	836.50	19.30
CDMA BC1	Body	ON 2nd Stage	1xRTT RC3 SO32	600	1880.00	15.30
CDMA BC10	Body	ON 2nd Stage	1xRTT RC3 SO32	580	820.50	18.80
LTE Band 5	Body	ON 2nd Stage	QPSK 10MHz RB 25/0	20525	836.50	18.80
LTE Band 13	Body	ON 2nd Stage	QPSK 10MHz RB 25/24	23230	782.00	19.30
LTE Band 25	Body	ON 1st Stage	QPSK 20MHz RB 1/0	26365	1882.50	15.00

Technology/Band	Test Configuration	Mode	Channel #	Frequency (MHz)	Tune up Limit (dBm)
Wi-Fi 2.4 GHz	Body	802.11b	6	2437.0	16.50
Bluetooth	Body	GFSK	39	2441.0	13.00
Wi-Fi 5.2 GHz	Body	802.11n HT40	46	5230.0	15.50
Wi-Fi 5.3 GHz	Body	802.11a	52	5260.0	17.50
Wi-Fi 5.5 GHz	Body	802.11a	136	5680.0	18.00
Wi-Fi 5.8 GHz	Body	802.11a	149	5745.0	18.50

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

Target Frequency (MHz)	Body (FCC only)	
	ε_r	σ (S/m)
150	61.9	0.80
300	58.2	0.92
450	56.7	0.94
750	-	-
835	55.2	0.97
900	55.0	1.05
915	55.0	1.06
1450	54.0	1.30
1500	-	-
1610	53.8	1.40
1640	-	-
1750	-	-
1800	53.3	1.52
1900	53.3	1.52
2000	53.3	1.52
2100	-	-
2300	-	-
2450	52.7	1.95
2600	-	-
3000	52.0	2.73
3500	-	-
4000	-	-
4500	-	-
5000	49.3	5.07
5100	49.1	5.18
5200	49.0	5.30
5300	48.9	5.42
5400	48.7	5.53
5500	48.6	5.65
5600	48.5	5.77
5700	48.3	5.88
5800	48.2	6.00
6000	-	-

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	Body
D750V3	1011	16 Jan 2015	750	1g	8.54
				10g	5.66
D900V2	1d168	14 May 2014	900	1g	10.60
				10g	6.87
D1800V2	264	18 Aug 2014	1800	1g	37.80
				10g	20.10
D1900V2	540	08 Dec 2014	1900	1g	40.00
				10g	21.10
D2450V2	725	08 Dec 2014	2450	1g	49.90
				10g	23.20
D5GHzV2	1016	24 Feb 2015	5250	1g	76.00
				10g	21.20
			5600	1g	77.70
				10g	21.40
			5750	1g	74.40
				10g	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: 23/07/2015
Validation Dipole and Serial Number: D1900V2 SN: 540

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	1900	24.0	24.0	ε_r	53.30	52.70	-1.13	5.00
				σ	1.52	1.56	2.36	5.00
				1g SAR	40.00	40.40	1.00	5.00
				10g SAR	21.10	21.16	0.28	5.00

System Check 1900 Body
Date: 20/08/2015
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	23.0	ε_r	53.30	53.55	0.47	5.00
				σ	1.52	1.48	-2.92	5.00
				1g SAR	40.00	39.64	-0.90	5.00
				10g SAR	21.10	21.16	0.28	5.00

SAR Lab 59

System Check 1900 Body
Date: 13/08/2015
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	23.0	ε_r	53.30	50.92	-4.47	5.00
				σ	1.52	1.46	-4.24	5.00
				1g SAR	40.00	42.00	5.00	5.00
				10g SAR	21.10	22.12	4.83	5.00

System Check 2450 Body
Date: 23/07/2015
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	20.6	ε_r	52.70	50.97	-3.28	5.00
				σ	1.95	1.95	0.16	5.00
				1g SAR	49.90	48.00	-3.81	5.00
				10g SAR	23.20	22.32	-3.79	5.00

System Check 2450 Body
Date: 17/08/2015
Validation Dipole and Serial Number: D2450V2 SN: 725

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	2450	22.0	20.0	ε_r	52.70	50.47	-4.23	5.00
				σ	1.95	2.03	4.00	5.00
				1g SAR	49.90	48.40	-3.01	5.00
				10g SAR	23.20	22.24	-4.14	5.00

SAR Lab 60

System Check 750 Body
Date: 12/08/2015
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	21.9	ε_r	55.55	54.52	-1.85	5.00
				σ	0.96	0.97	1.04	5.00
				1g SAR	8.54	8.36	-2.11	5.00
				10g SAR	5.66	5.64	-0.35	5.00

System Check 900 Body
Date: 23/07/2015
Validation Dipole and Serial Number: D900V2 SN: 035

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	900	21.0	20.0	ε_r	55.00	54.17	-1.51	5.00
				σ	1.05	1.06	0.50	5.00
				1g SAR	10.80	10.28	-4.81	5.00
				10g SAR	6.97	6.80	-2.44	5.00

System Check 900 Body
Date: 10/08/2015
Validation Dipole and Serial Number: D900V2 SN: 035

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	900	23.0	22.0	ε_r	55.00	53.78	-2.22	5.00
				σ	1.05	1.07	1.62	5.00
				1g SAR	10.80	10.80	0.00	5.00
				10g SAR	6.97	7.16	2.73	5.00

System Check 900 Body
Date: 21/09/2015
Validation Dipole and Serial Number: D900V2 SN: 035

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	900	23.0	22.0	ε_r	55.00	54.75	-0.45	5.00
				σ	1.05	1.03	-1.52	5.00
				1g SAR	10.80	10.80	0.00	5.00
				10g SAR	6.97	7.12	2.15	5.00

SAR Lab 61

System Check 5.25/5.6/5.75 GHz Body
Date: 13/04/2015
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	48.27	-1.29	5.00
				σ	5.36	5.33	-0.53	5.00
				1g SAR	76.00	73.80	-2.89	5.00
				10g SAR	21.20	20.30	-4.25	5.00
Body	5600	24.0	23.0	ε_r	48.50	47.43	-2.21	5.00
				σ	5.77	5.88	1.91	5.00
				1g SAR	77.70	75.3-	-3.09	5.00
				10g SAR	21.40	20.40	-4.67	5.00
Body	5750	24.0	23.0	ε_r	48.30	47.05	-2.59	5.00
				σ	5.94	6.12	3.09	5.00
				1g SAR	74.40	74.00	-0.54	5.00
				10g SAR	20.50	20.00	-2.44	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 – Cellular

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									Standalone MEASUREMENTS (Host EUT Only)				Host EUT + 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.
GSM 850	Body	Back	On (2nd stage)	GPRS 2 slots	190	836.60	25.30	1.190	24.40	0.965	1.187	-0.2%	1.130	1.390	16.8%	1.393	1
GSM 1900	Body	Back	On (2nd stage)	GPRS 2 slots	810	1909.80	22.00	1.190	20.60	0.817	1.128	-5.2%	1.000	1.380	16.0%	1.457	2
WCDMA Band 2	Body	Back	On (2nd stage)	Rel 99 RMC 12.2kbps	9538	1907.60	15.50	1.180	14.90	1.070	1.229	4.1%	1.140	1.309	10.9%	1.309	3
WCDMA Band 5	Body	Back	On (2nd stage)	Rel 99 RMC 12.2kbps	4183	836.60	19.40	1.150	18.40	1.040	1.309	13.9%	1.140	1.435	24.8%	1.435	4
CDMA BC0	Body	Back	On (2nd stage)	RC3 SO32	384	836.50	19.30	1.170	18.10	0.979	1.291	10.3%	1.070	1.411	20.6%	1.411	5
CDMA BC1	Body	Back	On (2nd stage)	RC3 SO32	600	1880.00	15.30	1.190	14.60	0.837	0.983	-17.4%	0.971	1.141	-4.1%	1.381	6
CDMA BC10	Body	Back	On (2nd stage)	RC3 SO32	580	820.50	18.80	1.180	17.70	0.816	1.051	-10.9%	0.940	1.211	2.6%	1.359	7
LTE Band 5	Body	Back	On (2nd stage)	QPSK 10MHz (RB 25/0)	20525	836.50	18.80	1.140	17.50	0.770	1.039	-8.9%	0.986	1.330	16.7%	1.460	8
LTE Band 13	Body	Back	On (2nd stage)	QPSK 10MHz (RB 25/24)	23230	782.00	19.30	1.190	17.90	0.975	1.346	13.1%	0.988	1.364	14.6%	1.364	9
LTE Band 25	Body	Back	On (2nd stage)	QPSK 20MHz (RB 1/0)	26365	1882.50	15.00	1.160	13.60	0.833	1.150	-0.9%	0.971	1.340	15.5%	1.352	10

10.3. Specific Absorption Rate - Test Results – Wi-Fi 2.4 GHz / Wi-Fi 5.0 GHz / BT

	WORST CASE DETERMINED FROM ORIGINAL FCC SAR REPORT							Standalone MEASUREMENTS (Host EUT Only)				Host EUT + Sleeve				
Technology/Band	Test Configuration		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.
2.4GHz	Body	Edge 3 (Bottom)	802.11b	6	2437.0	16.50	1.120	16.40	1.180	1.207	7.81%	0.040	0.041	-96.3%	0.041	11
Bluetooth	Body	Edge 3 (Bottom)	GFSK (V2.1 + EDR)	39	2441.0	13.00	0.356	10.20	0.191	0.364	2.23%	0.011	0.021	-94.1%	0.039	12
5.2GHz	Body	Edge 3 (Bottom)	802.11n HT40	46	5230.0	15.50	0.585	15.50	0.635	0.635	8.55%	0.134	0.134	-77.1%	0.134	13
5.3GHz	Body	Edge 3 (Bottom)	802.11a	52	5260.0	17.50	0.877	17.50	0.934	0.965	10.03%	0.203	0.203	-76.9%	0.203	14
5.5GHz	Body	Edge 3 (Bottom)	802.11a	136	5680.0	18.00	1.080	18.00	1.130	1.130	4.63%	0.164	0.164	-84.8%	0.164	15
5.8GHz	Body	Edge 3 (Bottom)	802.11a	149	5745.0	18.50	0.958	18.40	1.090	1.115	16.43%	0.217	0.222	-76.8%	0.222	16

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. The conducted power measurements were performed in accordance with the interim sleeve procedure on the host device, and the measured power levels were found to be within the manufacturer tolerance. A KDB Inquiry was raised to confirm that the measured power levels are within the acceptable range and that SAR testing could be performed with the sleeve.

4. 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.

10.4. Bluetooth (Sleeve)

10.4.1. 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 Exposure Conditions

Max. tune-up tolerance limit		Min. test separation distance (mm)	Frequency (GHz)	Result
(dBm)	(mW)			
4.0	2.5	5	2.40	0.80

Conclusion:

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

10.4.2. 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 Conditions:

Test Configuration	Max. tune-up tolerance limit (mW)	Min. test separation distance (mm)	Frequency (GHz)	Estimated 1-g SAR (W/kg)
Bottom	2.5	5	2.4	0.103

11. Simultaneous Transmission Analysis

KDB 447498 D01 General RF Exposure Guidance, introduces a new formula for calculating the SAR to Peak Location Ratio (SPLSR) between pairs of simultaneously transmitting antennas:

$$SPLSR = (SAR_1 + SAR_2)^{1.5} / Ri$$

Where:

SAR_1 is the highest reported or estimated SAR for the first of a pair of simultaneous transmitting antennas, in a specific test operating mode and exposure condition

SAR_2 is the highest reported or estimated SAR for the second of a pair of simultaneous transmitting antennas, in the same test operating mode and exposure condition as the first

Ri is the separation distance between the pair of simultaneous transmitting antennas. When the SAR is measured for both antennas in the pair, it is determined by the actual x, y, and z coordinates in the 1-g SAR for each SAR Peak Location; based on the extrapolated and interpolated result in the zoom scan measurement using the formula:

$$[(x_1-x_2)^2 + (y_1-y_2)^2 + (z_1-z_2)^2]$$

A new threshold of 0.04 is also introduced in the KDB 447498. Thus, in order for a pair of simultaneously transmitting antennas, with the sum of 1-g SAR > 1.6 W/kg, to qualify for exemption from Simultaneous Transmission SAR measurements, it has to satisfy the condition of:

$$(SAR_1 + SAR_2)^{1.5} / Ri < 0.04$$

When SAR is estimated, the peak SAR location is assumed to be at the feed-point or geometric center of the antenna, whichever provides a smaller antenna separation distance, and must be clearly identified in test reports. The estimated SAR is only used to determine simultaneous transmission SAR test exclusion; it should not be reported as the standalone SAR. When SAR is estimated, it must be applied to determine the sum of 1-g SAR test exclusion.

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

A1460

			Host EUT 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 (**Back** Configuration)	WWAN + WLAN 2.4GHz	LTE Band 5	1.460	PCE	1.486	0.103	1.589	N/A
		Wi-Fi 2.4GHz*	0.026	DTS				
	WWAN + WLAN 5.0GHz	LTE Band 5	1.460	PCE	1.463	0.103	1.566	N/A
		Wi-Fi 5.0GHz*	0.003	NII				
	WWAN + WPAN	LTE Band 5	1.460	PCE	1.464	0.103	1.567	N/A
		*Bluetooth**	0.004	DSS				
	WWAN + WLAN 5.0GHz + WPAN	LTE Band 5	1.460	PCE	1.467	0.103	1.570	N/A
		Wi-Fi 5.0GHz*	0.003	NII				
		*Bluetooth**	0.004	DSS				

*SAR test on 'Back of EUT' for the worst case channels in the bands WLAN 2.4GHz, WLAN 5.0GHz and Bluetooth were carried out for the purpose of determining the exact simultaneous transmission summation.

			Host EUT 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 (**Bottom** Configuration)	WWAN + WLAN 2.4GHz	WWAN	0.000	PCE	0.041	0.103	0.144	N/A
		Wi-Fi 2.4GHz	0.041	DTS				
	WWAN + WLAN 5.0GHz	WWAN	0.000	PCE	0.222	0.103	0.325	N/A
		Wi-Fi 5.0GHz	0.222	NII				
	WWAN + WPAN	WWAN	0.000	PCE	0.039	0.103	0.142	N/A
		Bluetooth	0.039	DSS				
	WWAN + WLAN 5.0GHz + WPAN	WWAN	0.000	PCE	0.261	0.103	0.364	N/A
		Wi-Fi 5.0GHz	0.222	NII				
		Bluetooth	0.039	DSS				