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-RP10488894JD04A V3.0
ISSUE DATE: 24 May 2016

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REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
--	30 Sept 2015	Initial Issue	--
1	29 February 2016	The following amendments are made in the report: 1. FCC ID of the sleeve is added on the front page 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 6.3., the word 'original' is added before report is added 5. In Section 10.2., host test separation distance note is added 6. 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	Sandhya Menon

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1. Attestation of Test Results

<table>
<tr><td>Applicant Name:</td><td colspan="4">Datecs Ltd</td></tr>
<tr><td>Application Purpose</td><td colspan="4">☒ Original Grant</td></tr>
<tr><td>DUT Description</td><td colspan="4">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.</td></tr>
<tr><td>Test Device is</td><td colspan="4">An identical prototype</td></tr>
<tr><td>Device category</td><td colspan="4">Portable</td></tr>
<tr><td>Exposure Category</td><td colspan="4">General Population/Uncontrolled Exposure (1g SAR limit: 1.6 W/kg)</td></tr>
<tr><td>Date Tested</td><td colspan="4">23 July 2015 to 17 August 2015</td></tr>
<tr><td rowspan="4">The highest reported SAR values</td><td rowspan="2">RF Exposure Conditions</td><td colspan="3">Equipment Class</td></tr>
<tr><td>DTS</td><td>UNII</td><td>DSS</td></tr>
<tr><td>Body</td><td>0.032 W/kg</td><td>0.232 W/kg</td><td>0.020 W/kg</td></tr>
<tr><td>Simultaneous Transmission</td><td>0.135 W/kg</td><td>0.335 W/kg</td><td>0.355 W/kg</td></tr>
<tr><td>Applicable Standards</td><td colspan="4">FCC 47 CFR part 2 (2.1093)
KDB publication
IEEE Std 1528-2013</td></tr>
<tr><td>Test Results</td><td colspan="4">Pass</td></tr>
</table>

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:
M. Naseer	Sandhya
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 Publications:
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 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

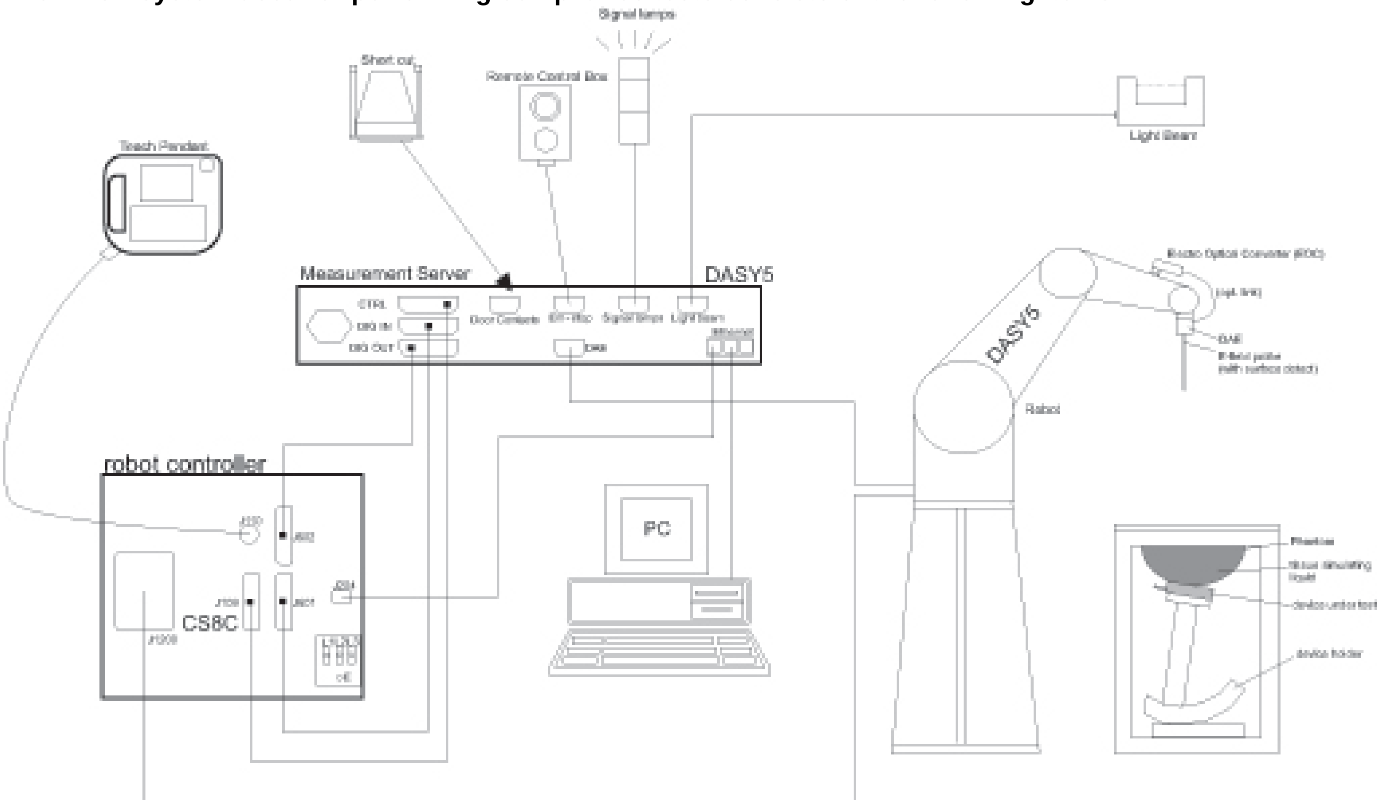
Pavilion A, Ashwood Park, Ashwood Way, Basingstoke, Hampshire, RG23 8BG UK	Facility Type
SAR Lab 59	Controlled Environment Chamber
SAR Lab 61	Controlled Environment Chamber

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. 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)
A1234	Data Acquisition Electronics	SPEAG	DAE3	450	16 Sept 2014	12
A2546	Data Acquisition Electronics	SPEAG	DAE4	1435	20 Feb 2015	12
A2545	Probe	SPEAG	EX3 DV4	3995	28 Apr 2015	12
A2077	Probe	SPEAG	EX3 DV4	3814	18 Sept 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
G0610	Robot Power Supply	SPEAG	DASY52	None	Calibrated before use	-
G0612	Robot Power Supply	SPEAG	DASY52	None	Calibrated before use	-
M1875	Robot Arm	Staubli	TX60 L	F13/5SC6F1/A/01	Calibrated before use	-
M1877	Robot Arm	Staubli	TX60 L	F14/5UA6A1/A/01	Calibrated before use	-
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	-	-
M1768	Signal Generator	R&S	SME06	848050/005	01 Dec 2014	12
M1838	Signal Generator	R&S	SME06	831377/005	16 Apr 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
M1842	Power Sensor	R & S	ZRPZ1	890212/015	27 Mar 2015	12
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	-
A1474	Amplifier	Mini-Circuits	ZVE-8G	638700305	Calibrated as part of system	-
A2403	Amplifier	Mini-Circuits	ZHL-42W	15542	Calibrated as part of system	-

4.3. SAR System Specifications

Robot System	
Positioner:	Stäubli Unimation Corp. Robot Model: TX60L
Repeatability:	±0.030 mm
No. of Axis:	6
Serial Number(s):	F13/5SC6F1/A/01; F14/5UA6A1/A/01
Reach:	920 mm
Payload:	2.0 kg
Control Unit:	CS8C
Programming Language:	V+
Data Acquisition Electronic (DAE) System	
Serial Number:	DAE3 SN: 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.
E-Field Probe	
Model:	EX3DV4
Serial No:	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
Phantom	
Phantom:	Eli Phantom
Shell Material:	Fibreglass
Thickness:	2.0 ±0.1 mm

4.4. SAR Measurement Procedure

4.4.1. 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	$\frac{1}{2}\cdot\delta\cdot\ln(2)$ 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

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

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.

4.5. 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- 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.

5.1. Uncertainty - Wi-Fi 2450 MHz Body Configuration 1g

Type	Source of uncertainty	+ Value	- Value	Probability Distribution	Divisor	$c_{i\ (1g)}$	Standard Uncertainty + u (%)	Standard Uncertainty - u (%)	υ_i or υ_{eff}
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

5.2. 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 (LxWxD)

Support Equipment (Host EUT)

DUT Description:	Tablet with IEEE 802.11a/b/g/n radio and Bluetooth radio
Manufacturer:	Apple Inc.
Model Number:	A1458
FCC ID:	BCGA1458
Support Equipment Serial Number:	**The following SAR Sample was used for radiated measurements:** DLXJ8005F8P6: Wi-Fi 2.4 GHz, Wi-Fi 5.0 GHz and Bluetooth **The following SAR Sample was used for conducted measurements:** DLXJ8005F8P6: Wi-Fi 2.4 GHz, Wi-Fi 5.0 GHz and Bluetooth
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 (LxWxD)

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: A1458
Tx Frequencies	• 802.11 b/g/n: 2412-2462 MHz • 802.11a/n: 5180-5825 MHz • Bluetooth: 2402-2480 MHz
Mode	• 802.11 a/b/g/n HT20/HT40 • Bluetooth 4.0 LE

6.3. Nominal and Maximum Output Power

Host EUT

All nominal and maximum output power measurements are as documented in original FCC SAR report **12U14507-7** dated 10 May 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 **12U14507-7** dated 10 May 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.

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Technology/Band	Test Configuration	Mode	Channel Number	Frequency (MHz)	Tune up Limit (dBm)
Wi-Fi 2.4 GHz	Body	802.11b	6	2437.0	16.50
Bluetooth	Body	V2.1 + EDR, 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	157	5785.0	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
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%.

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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 61

System Check 5.25/5.6/5.75 GHz Body
Date: 04/08/2015
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	47.63	-2.60	5.00
				σ	5.36	5.36	-0.04	5.00
				1g SAR	76.00	74.30	-2.24	5.00
				10g SAR	21.20	8.40	-0.94	5.00
Body	5600	24.0	23.0	ε_r	48.50	46.75	-3.61	5.00
				σ	5.77	5.90	2.28	5.00
				1g SAR	77.70	78.20	0.64	5.00
				10g SAR	21.40	21.90	2.34	5.00
Body	5750	24.0	23.0	ε_r	48.30	47.98	6.07	5.00
				σ	5.94	5.94	2.14	5.00
				1g SAR	74.40	72.20	-2.96	5.00
				10g SAR	20.50	20.30	-0.98	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 – Wi-Fi 2.4 GHz / Wi-Fi 5.0 GHz / BT

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		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	1.110	16.50	1.200	1.200	8.11%	0.032	0.032	-97.2%	0.032	1
Bluetooth	Body	Edge 3 (Bottom)	GFSK (V2.1 + EDR)	39	2441.0	13.00	0.352	10.80	0.201	0.334	-5.23%	0.011	0.019	-94.6%	0.020	2
5.2GHz	Body	Edge 3 (Bottom)	802.11n HT40	46	5230.0	15.50	0.644	15.50	0.624	0.624	-3.11%	0.134	0.134	-79.2%	0.138	3
5.3GHz	Body	Edge 3 (Bottom)	802.11a	52	5260.0	17.50	1.090	17.50	0.986	0.986	-9.54%	0.193	0.193	-82.3%	0.213	4
5.5GHz	Body	Edge 3 (Bottom)	802.11a	136	5680.0	18.00	1.180	18.00	1.090	1.090	-7.63%	0.214	0.214	-81.9%	0.232	5
5.8GHz	Body	Edge 3 (Bottom)	802.11a	157	5785.0	18.50	1.190	18.50	1.080	1.080	-9.24%	0.175	0.175	-85.3%	0.193	6

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.

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 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.

10.3.2. 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 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. WLAN 2.4 GHz
2. WLAN 5.0 GHz
3. WLAN 5.0 GHz + WPAN

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			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)	WLAN 2.4GHz	Wi-Fi 2.4GHz	0.032	DTS	0.032	0.103	0.135	N/A
	WLAN 5.0GHz	Wi-Fi 5.5GHz	0.232	NII	0.232	0.103	0.335	N/A
	WLAN 5.0GHz + WPAN	Wi-Fi 5.5GHz	0.232	NII	0.252	0.103	0.355	N/A
		Bluetooth	0.020	DSS				