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

SAR EVALUATION REPORT

For

Zensor Wireless Vital Signs Monitoring System

FCC ID: YVF-VS200 (Contains FCC ID: U30-G2M5477)
Model: PN0620

Report Number UL-SAR-RP10240858JD04A V3.0
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REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
--	29 September 2015	Initial Issue	--
1	01 October 2015	The following amendments were made in the report: 1. Customer address: typo corrected on front page 2. Model number: typo corrected on front page	Naseer Mirza
2	21 October 2015	The following amendments were made in the report: 1. Test configuration KDB inquiry details moved from section 10 to section 7.2	Naseer Mirza

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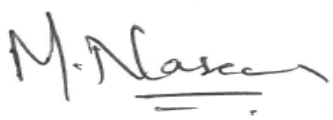
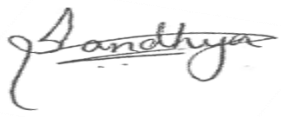
1. Attestation of Test Results

Applicant Name:	Intelesens Limited
Application Purpose	☒ Original Grant
FCC ID:	YVF-VS200 (Contains FCC ID: U30-G2M5477)
DUT Description	Zensor Wireless Vital Signs Monitoring System
Test Device is	An identical prototype
Device category	Portable
SAR Limits	
Exposure Category	Peak Spatial-average (1g of tissue)
General Population / Uncontrolled Exposure	1.6 W/kg
The highest reported SAR	
RF Exposure Conditions	**Equipment Class**
	DTS
Body	0.646 W/kg
Applicable Standards	FCC 47 CFR part 2 (2.1093) Published RF Exposure KDB Procedures IEEE Std 1528-2013
Date Tested	09 September 2015 to 10 September 2015
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 standard 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).	

2.2. Methods and Procedures Reference Documentation

The test documents in this report were performed in accordance with FCC 47 CFR § 2.1093, IEEE STD 1528-2013, the following FCC Published RF exposure KDB procedures and TCB methods and procedures workshop updates:

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

FCC KDB Publication:
447498 D01 General RF Exposure Guidance v05r02
865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04
865664 D02 RF Exposure Reporting v01r01
248227 D01 802 11 W-Fi SAR v02r01

2.3. Definition of Measurement Equipment

The measurement equipment used complied with the requirements of the standards referenced in the methods & procedures section above. Section 4.2 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

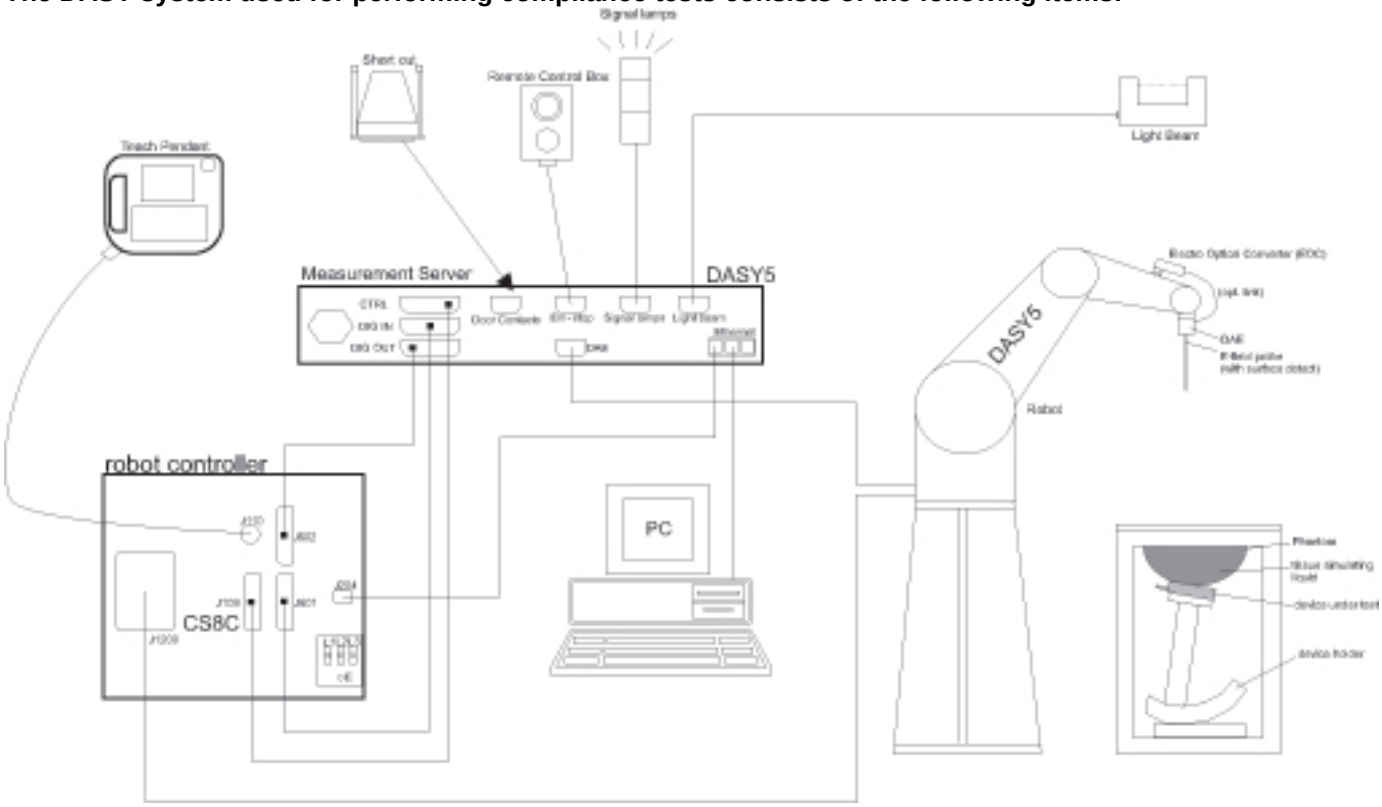
Pavilion A, Ashwood Park, Ashwood Way, Basingstoke, Hampshire, RG23 8BG UK	Facility Type
SAR Lab 56	Controlled Environment Chamber

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

<table>
<tr><td></td><td>≤ 3 GHz</td><td>> 3 GHz</td></tr>
<tr><td>Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface</td><td>5 mm ± 1 mm</td><td>½·δ·ln(2) mm ± 0.5 mm</td></tr>
<tr><td>Maximum probe angle from probe axis to phantom surface normal at the measurement location</td><td>30° ± 1°</td><td>20° ± 1°</td></tr>
<tr><td rowspan="2">Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}</td><td>≤ 2 GHz: ≤ 15 mm
2 – 3 GHz: ≤ 12 mm</td><td>3 – 4 GHz: ≤ 12 mm
4 – 6 GHz: ≤ 10 mm</td></tr>
<tr><td colspan="2">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.</td></tr>
</table>

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 v01r04

			≤ 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.

Dielectric Property Measurements & System Check

UL No.	Instrument	Manufacturer	Type No.	Serial No.	Date Last Calibrated	Cal. Interval (Months)
A2109	Data Acquisition Electronics	SPEAG	DAE3	417	19 Mar 2015	12
A2436	Probe	SPEAG	ES3DV3	3335	23 July 2015	12
A1322	2450 MHz Dipole Kit	SPEAG	D2450V2	725	08 Dec 2014	12
G0528	Robot Power Supply	SPEAG	DASY4	None	Calibrated before use	-
M1047	Robot Arm	Staubli	RX908 L	F00/SD89A1/A/01	Calibrated before use	-
A1328	Handset Positioner	SPEAG	Modification	SD 000 H01 DA	-	-
A1182	Handset Positioner	SPEAG	V3.0	None	-	-
A2442	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
M1841	Dual Channel Power Meter	R & S	NRVD	834501/069	27 Mar 2015	12
M1044	Power Sensor	R & S	NRV-Z1	893350/0019	03 Sep 2015	12
M265	Power Sensor	R & S	NRV-Z1	893350/0017	03 Sep 2015	12
A2100	Directional Coupler	RF-Lambda	11101300748	None	Calibrated as part of system	-
A2403	Amplifier	Mini-Circuits	ZHL-42W	15542	Calibrated as part of system	-
S0570	SAR Lab	UL	Site 60	N/A	Calibrated before use	-
A2552	SAM Phantom	SPEAG	SAM a	1836	Calibrated before use	-

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):	F00/SD89A1/A/01
Reach:	1185 mm
Payload:	3.5 kg
Control Unit:	CS7
Programming Language:	V+
Data Acquisition Electronic (DAE) System	
Serial Number:	DAE3 SN: 417
PC Controller	
PC:	Dell Precision 340
Operating System:	Windows 2000
Data Card:	DASY4 Measurement Server
Serial Number:	1080
Data Converter	
Features:	Signal Amplifier, multiplexer, A/D converted and control logic.
Software:	DASY5 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 16 nit A/D converter for surface detection system serial link to robot direct emergency stop output for robot.
E-Field Probe	
Model:	ES3DV3
Serial No:	3335
Construction:	Triangular core
Frequency:	10 MHz to >4 GHz
Linearity:	±0.2 dB (30 MHz to 4 GHz)
Probe Length (mm):	337
Probe Diameter (mm):	10
Tip Length (mm):	10
Tip Diameter (mm):	4
Sensor X Offset (mm):	2
Sensor Y Offset (mm):	2
Sensor Z Offset (mm):	2
Phantom	
Phantom:	SAM Phantom
Shell Material:	Fibreglass
Thickness:	2.0 ±0.1 mm

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
Wi-Fi 2450 MHz Body Configuration 1g	95%	±17.59%

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		υ_i or υ_{eff}
							+ u (%)	- u (%)	
B	Probe calibration	5.050	5.050	normal (k=1)	1.0000	1.0000	5.050	5.050	∞
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	0.300	0.300	Rectangular	1.7321	1.0000	0.173	0.173	∞
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	2.440	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)	3.470	3.470	normal (k=1)	1.0000	0.6400	2.221	2.221	5
B	Liquid Permittivity (target value)	5.000	5.000	Rectangular	1.7321	0.6000	1.732	1.732	∞
A	Liquid Permittivity (measured value)	1.880	1.880	normal (k=1)	1.0000	0.6000	1.128	1.128	5
	Combined standard uncertainty			t-distribution			8.97	8.97	>500
	Expanded uncertainty			k = 1.96			17.59	17.59	>500

6. Equipment Under Test (EUT)

6.1. Identification of Equipment Under Test (EUT)

DUT Description:	Zensor Wireless Vital Signs Monitoring System
Serial Number/ IMEI Number:	Radiated Samples: 0006662273AF – Was used to perform SAR measurements. Conducted Sample: 00066614C028 – Was used to perform conducted power measurements.
Hardware Version Number:	3.0
Software Version Number:	2074
Country of Manufacture:	UK
Date of Receipt:	13 August 2015

6.2. Wireless Technologies

Wireless technologies	**Frequency bands**	**Operating mode**		**Duty Cycle**	
Wi-Fi	2450	802.11 b/g		100%	
Transmitter Frequency Range:		WiFi 802.11b/g	2412 to 2462 MHz		
Transmitter Frequency Allocation of EUT When Under Test:		**Bands**	**Channel Number**	**Channel Description**	**Frequency (MHz)**
		Wi-Fi 2.4GHz	1	Low	2412.0
			6	Middle	2437.0
			11	High	2462.0
			12	High	2467.0
			13	High	2472.0
Antenna Type:		Internal integral			
Number of Antenna Positions:		WLAN			1 fixed

6.3. Support Equipment

DUT Description:	Li-ion Battery
Model Name/Number:	zensor Monitor Battery (PN0678B)
Serial Numbers:	ZENBATT000171
Hardware Version Number:	None Stated
Software Version Number:	N/A
Country of Manufacture:	UK
Date of Receipt:	13 August 2015

DUT Description:	Dual lead ECG Electrode Array Patch
Model Name/Number:	None Stated
Serial Numbers:	None Stated
Hardware Version Number:	None Stated
Software Version Number:	N/A
Country of Manufacture:	UK
Date of Receipt:	13 August 2015

6.3. Nominal and Maximum Output Power

(From customer)

		RF Output Power (dBm)	
RF Air interface	**Mode**	**Target (dBm)**	**Max. tune-up tolerance limit (dB)**
Wi-Fi 2.4GHz	802.11b	18.0	-0.5 ~ +0.5
	802.11g	18.0	-0.5 ~ +0.5

7. RF Exposure Conditions (Test Configurations)

7.1. Operating Modes

The EUT was tested in the following operating mode(s) unless otherwise stated:

- 2.4 GHz WiFi802.11b/g Data allocated mode using 'bespoke firmware' software to excise mode ‘b’ and ‘g, with maximum power of up to 18.1 dBm for ‘b’ mode and 17.9 dBm for ‘g’ modes.

7.2. Configuration and Peripherals

The EUT was tested in the following configuration(s) unless otherwise stated:

- Standalone fully charged battery powered.

Body Configuration

a) The EUT was placed in a normal operating position where the centre of EUT was aligned with the centre reference point on the flat section of the ‘SAM’ phantom.

b) With the EUT touching the phantom at an imaginary centre line. The EUT was aligned with a marked plane (X and Y axis) consisting of two lines.

c) For the touch-safe position the EUT was gradually moved towards the flat section of the ‘SAM’ phantom until any point of the EUT touched the phantom.

d) For position(s) greater then 0mm separation the EUT was positioned as per the touch-safe position, and then the vertical height was decreased/adjusted as required.

e) SAR measurements were evaluated at maximum power and the unit was operated for an appropriate period prior to the evaluation in order to minimise the drift.

f) The device was keyed to operate continuously in the transmit mode for the duration of the test.

g) The location of the maximum spatial SAR distribution (peak) was determined relative to the EUT and its antenna.

h) The EUT was transmitting at full power throughout the duration of the test powered by a fully charged battery.

i) The test procedure was agreed with FCC prior to testing. The following configuration was agreed to be evaluated:

“The SAR test evaluation required on ‘Front of EUT Facing phantom’, ‘Back of EUT Facing phantom’ and ‘Front of EUT Facing Phantom with Electrode Array Attached onto the Fluid Sandwich’, this is most conservative exposure condition.

- Front of EUT Facing phantom: The Front will indirect-contact, when the other part of the body (e.g.: Hand, etc.) in contact.
- Back of EUT Facing phantom: This is how the EUT will be configured to user.
- Front of EUT Facing Phantom with Electrode Array Attached onto the Fluid Sandwich: This configuration is required to cover the scenario, in which EUT in sandwich between the ‘Body-worn’ and ‘Hand’.

The Front and Back of the EUT was tested. The Front of the EUT Facing Phantom was tested with the Electrode Array Attached and the EUT sandwich with a fluid in a plastic bag to compensate for supine-in-bed patient with front of device contacting arm away from wrist. The Fluid in the plastic had a depth of 10 cm.

8. Conducted Output Power Measurements

8.1. Conducted Power Measurements Wi-Fi802.11b/g

Channel Number	Frequency (MHZ)	Tx Power (dBm)	Note
1	2412.0	17.9	**2.4GHz 802.11b** (1Mbps)
6	2437.0	18.0	
11	2462.0	18.1	
12	2467.0	17.9	
13	2472.0	17.8	
1	2412.0	17.7	**2.4GHz 802.11g** (6Mbps)
6	2437.0	17.6	
11	2462.0	17.9	
12	2467.0	17.6	
13	2472.0	17.6	

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)	Head		Body	
	ε_r	σ (S/m)	ε_r	σ (S/m)
150	52.3	0.76	61.9	0.80
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
750	41.9	0.89		
835	41.5	0.90	55.2	0.97
900	41.5	0.97	55.0	1.05
915	41.5	0.98	55.0	1.06
1450	40.5	1.20	54.0	1.30
1610	40.3	1.29	53.8	1.40
1750	40.1	1.37		
1800	40.0	1.40	53.3	1.52
1900	40.0	1.40	53.3	1.52
2000	40.0	1.40	53.3	1.52
2450	39.2	1.80	52.7	1.95
3000	38.5	2.40	52.0	2.73
5000	36.2	4.45	49.3	5.07
5100	36.1	4.55	49.1	5.18
5200	36.0	4.66	49.0	5.30
5300	35.9	4.76	48.9	5.42
5400	35.8	4.86	48.7	5.53
5500	35.6	4.96	48.6	5.65
5600	35.5	5.07	48.5	5.77
5700	35.4	5.17	48.3	5.88
5800	35.3	5.27	48.2	6.00
6000	35.1	5.48		

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

9.2. System Check

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

9.3. Reference Target SAR Values

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

System Dipole	Serial No.	Cal. Date	Freq. (MHz)	Target SAR Values (mW/g)	
				1g/10g	Body
D2450V2	725	08/12/2015	2450	1g	49.90
				10g	23.20

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%.

Site 56
System check 2450 Body
Date: 07/09/2015
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 ℃	23.0 ℃	**εr**	52.70	51.23	-2.79	5.00
				σ	1.95	2.03	4.10	5.00
				1g	49.90	51.20	2.61	5.00
				10g	23.20	23.56	1.55	5.00

Band: Wi-Fi 2.4GHz

Channel Number	Channel Description	Frequency (MHz)	Parameters	
1	Low	2412.0	**εr**	51.40
			σ	1.99
6	Middle	2437.0	**εr**	51.30
			σ	2.02
11	High	2462.0	**εr**	51.20
			σ	2.05

10.Measured SAR Results

SAR Test Reduction criteria are as follows:

KDB 447498 D01 General RF Exposure Guidance:

Testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid-band or highest output power channel is:

- ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz
- ≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz
- ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz

10.1. Specific Absorption Rate - Test Results
For All SAR measurement in this report the 1g-SAR limit tested to is 1.6 W/Kg

10.1.1. WLAN 2.4GHz – Body-worn Configuration 1g

Max Reported SAR = 0.646 (W/kg)

					Power (dBm)		1g : SAR Results (W/kg)		
Mode or Modulation	Dist (mm)	Test Position	Channel No.	Freq (MHz)	Tune-up limit	Meas.	Zoom Scan		Scan No.
							Meas.	Reported	
DBPSK	0	Back	11	2462.0	18.5	18.1	0.589	0.646	1
DBPSK	0	Front	11	2462.0	18.5	18.1	0.112	0.123	2
DBPSK	0	Front*	11	2462.0	18.5	18.1	0.131	0.144	3*
DBPSK	0	Back	1	2412.0	18.5	18.0	0.346	0.388	4
DBPSK	0	Back	6	2437.0	18.5	17.9	0.310	0.356	5

Note:
***** The Front of the EUT Facing Phantom was tested with the Electrode Array Attached and the EUT sandwich with a fluid in a plastic bag to compensate for supine-in-bed patient with front of device contacting arm away from wrist. The Fluid in the plastic had a depth of 10 cm.