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

SAR EVALUATION REPORT

For

Digital Camera with, IEEE 802.11a/b/g/n/ac (MIMO 2x2) Radio

Model: X1D
Contains FCC ID: 2AEFAX1311

REPORT NUMBER UL-SAR-RP11179250JD06A V2.0
ISSUE DATE: 18 JULY 2016

Prepared for

VICTOR HASSELBLAD AB
UTVECKLINGSGATAN 2
GOTEBORG 41756
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REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
--	10 June 2016	Initial Issue	--
1	18 July 2016	The following amendments are made in the report: 1. Antenna Schematics included in section 11.1	Sandhya Menon

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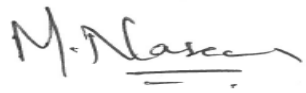
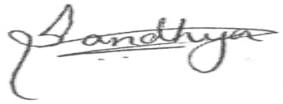
1. Attestation of Test Results

Applicant Name:	Victor Hasselblad AB				
Model:	X1D, Contains FCC ID: 2AEFAX1311				
Test Device is	An identical prototype				
Device category	Portable				
Exposure Category	General Population/Uncontrolled Exposure (1g SAR Body Exposure limit: 1.6 W/kg and 10g SAR Extremity Exposure limit: 4.0 W/kg)				
Date Tested	23 May 2016 to 26 May 2016				
The highest reported SAR values	RF Exposure Conditions	Equipment Class			
		Licensed	DTS	UNII	DSS
	Body	N/A	-*	0.100 W/kg	N/A
	Extremity	N/A	0.203 W/kg	0.331 W/kg	N/A
	Simultaneous Transmission	N/A	N/A	N/A	N/A
Applicable Standards	FCC 47 CFR part 2 (2.1093) KDB publication IEEE Std 1528-2013				
Test Results	Pass				

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

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

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

*No peak was detected for this mode

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 draft standard IEEE P1528-2011.

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 SAR guidance for IEEE 802.11 (Wi-Fi) transmitters v02r02
447498 D01 General RF Exposure Guidance v06
865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04
865664 D02 RF Exposure Reporting v01r02

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

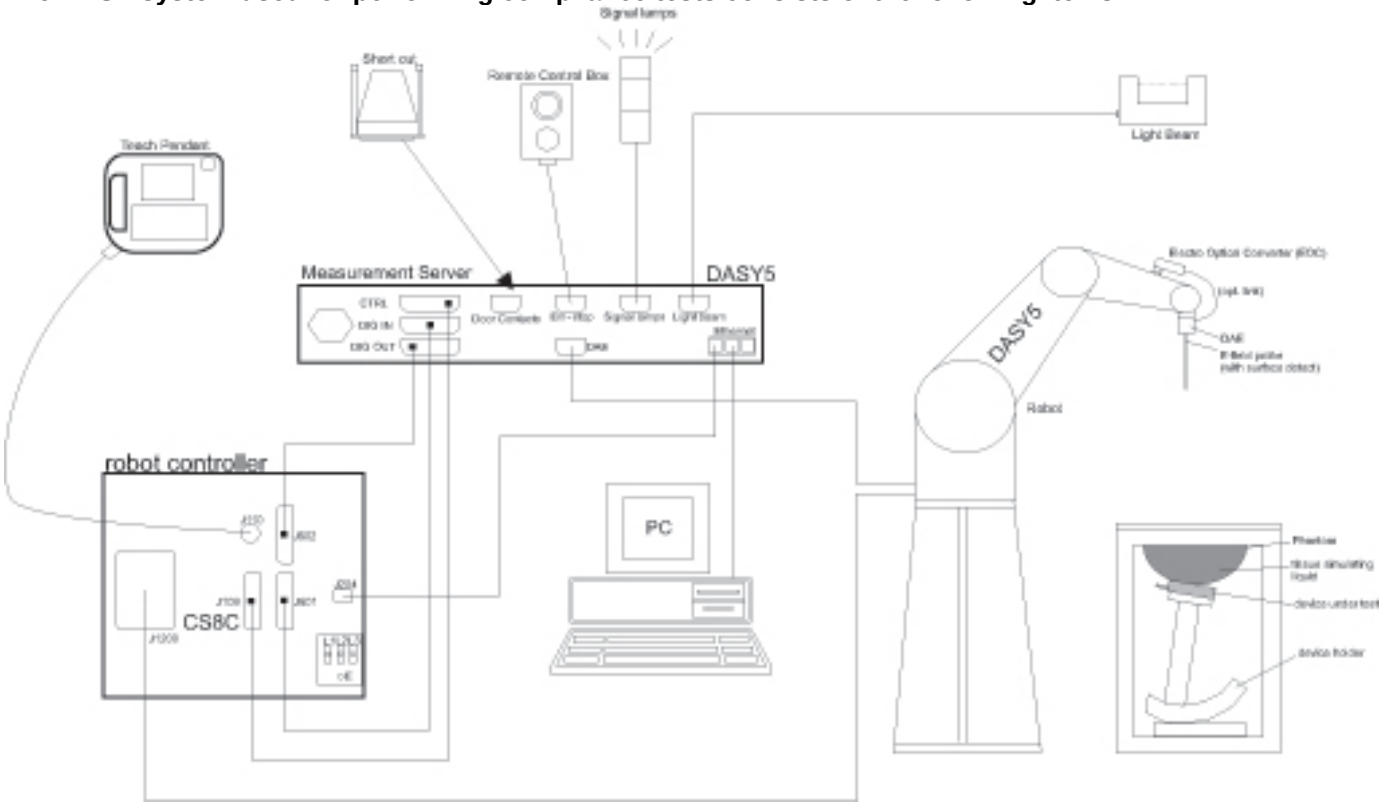
Pavilion A, Ashwood Park, Ashwood Way, Basingstoke, Hampshire, RG23 8BG UK	Facility Type
SAR Lab 57	Controlled Environment Chamber
SAR Lab 61	Controlled Environment Chamber

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)
A2547	Data Acquisition Electronics	SPEAG	DAE4	1438	25 Apr 2016	12
A2111	Data Acquisition Electronics	SPEAG	DAE4	432	25 Aug 2015	12
A2587	Probe	SPEAG	ES3 DV3	3341	25 Aug 2015	12
A2544	Probe	SPEAG	EX3 DV4	3994	21 Mar 2016	12
A1322	2450 MHz Dipole	SPEAG	D2450V2	725	10 Nov 2015	12
A2781	5.0 GHz Dipole Kit	SPEAG	D5GHzV2	1222	11 Aug 2015	12
G0591	Robot Power Supply	SPEAG	DASY4	None	Calibrated before use	-
G0612	Robot Power Supply	SPEAG	DASY52	None	Calibrated before use	-
M1653	Robot Arm	Staubli	RX90 L	F01/5J86A1/A/01	Calibrated before use	-
M1877	Robot Arm	Staubli	TX60 L	F14/5UA6A1/A/01	Calibrated before use	-
A2810	Handset Positioner	SPEAG	MD4HHTV5	None	-	-
A2172	Handset Positioner	SPEAG	MD4HHTV5	None	-	-
M1755	DAK Fluid Probe	SPEAG	SM DAK 040 CA	1089	Calibrated before use	-
M1855	Power Sensor	R & S	NRP-Z51	103246	05 Oct 2015	12
M1015	Network Analyser	Agilent Technologies	8753ES	US39172406	28 Sept 2015	12
A2621	Digital Camera	Nikon	S3600	41010357	-	-
M1768	Signal Generator	R & S	SME06	1038.6002.06	27 Nov 2015	12
M1838	Signal Generator	R & S	SME06	1038.6002.06	07 Apr 2016	12
M1841	Dual Channel Power Meter	R & S	NRVD	834501/069	31 Mar 2016	12
M263	Dual Channel Power Meter	R & S	NRVD	826558/004	02 Sep 2015	12
M1847	Power Sensor	R & S	ZRPZ1	831430/003	08 Apr 2016	12
M1848	Power Sensor	R & S	ZRPZ1	831430/004	08 Apr 2016	12
M1842	Power Sensor	R & S	ZRPZ1	890212/015	01 Apr 2016	12
M1843	Power Sensor	R & S	ZRPZ1	826515/018	01 Apr 2016	12
A2100	Directional Coupler	RF-Lambda	11101300748	None	Calibrated as part of system	-
A2099	Directional Coupler	RF-Lambda	11101300747	None	Calibrated as part of system	-
A2620	Amplifier	Mini-Circuits	ZHL-42	D080900-14	Calibrated as part of system	-
A2689	Amplifier	Mini-Circuits	ZVE-8G	910401427	Calibrated as part of system	-

4.3. SAR System Specifications

Robot System	
Positioner:	Stäubli Unimation Corp. Robot Model: RX90L
Repeatability:	0.025 mm
No. of Axis:	6
Serial Number(s):	F01/5J86A1/A/01
Reach:	1185 mm
Payload:	3.5 kg
Control Unit:	CS7
Programming Language:	V+
Robot System	
Positioner:	Stäubli Unimation Corp. Robot Model: TX60L
Repeatability:	±0.030 mm
No. of Axis:	6
Serial Number:	F14/5UA6A1/A/01
Reach:	920 mm
Payload:	2.0 kg
Control Unit:	CS8C
Programming Language:	V+
Data Acquisition Electronic (DAE) System	
Serial Number:	DAE4 SN:1438 DAE4 SN:432
PC Controller	
PC:	Dell Precision 340
Operating System:	Windows 2000
Data Card:	DASY4 & 5 Measurement Servers
Serial Number:	1080
Data Converter	
Features:	Signal Amplifier, multiplexer, A/D converted and control logic.
Software:	DASY4 and 5 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 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:	ES3DV3
Serial No:	3341
Construction:	Triangular core
Frequency:	10 MHz to >4 GHz
Linearity:	±0.2 dB (30 MHz to 4 GHz)
Probe Length (mm):	337
Probe Diameter (mm):	10
Tip Length (mm):	10
Tip Diameter (mm):	4
Sensor X Offset (mm):	2
Sensor Y Offset (mm):	2
Sensor Z Offset (mm):	2
E-Field Probe	
Model:	EX3DV4
Serial No:	3994
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
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
Uncertainty- Freq. < 3GHz Body Configuration 1g	95%	±19.88%
Uncertainty- Freq. > 3GHz Body Configuration 1g	95%	±17.26%
Uncertainty- Freq. < 3GHz Head Configuration 10g	95%	±18.74%
Uncertainty- Freq. > 3GHz Head Configuration 10g	95%	±17.93%

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 – Freq. < 3GHz 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	8.520	8.520	Rectangular	1.7321	1.0000	4.919	4.919	∞
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	2.580	2.580	normal (k=1)	1.0000	1.0000	2.580	2.580	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)	2.470	2.470	normal (k=1)	1.0000	0.6400	1.581	1.581	5
B	Liquid Permittivity (target value)	5.000	5.000	Rectangular	1.7321	0.6000	1.732	1.732	∞
A	Liquid Permittivity (measured value)	2.430	2.430	normal (k=1)	1.0000	0.6000	1.458	1.458	5
	Combined standard uncertainty			t-distribution			10.14	10.14	>500
	Expanded uncertainty			k = 1.96			19.88	19.88	>500

5.2. Uncertainty – Freq. > 3GHz 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	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)	2.700	2.700	normal (k=1)	1.0000	0.6400	1.728	1.728	5
B	Liquid Permittivity (target value)	5.000	5.000	Rectangular	1.7321	0.6000	1.732	1.732	∞
A	Liquid Permittivity (measured value)	3.060	3.060	normal (k=1)	1.0000	0.6000	1.836	1.836	5
	Combined standard uncertainty			t-distribution			8.81	8.81	>500
	Expanded uncertainty			k = 1.96			17.26	17.26	>500

5.3. Uncertainty – Freq. < 3GHz Body Configuration 10g

Type	Source of uncertainty	+ Value	- Value	Probability Distribution	Divisor	$c_{i\ (10g)}$	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
B	Axial Isotropy	0.250	0.250	normal (k=1)	1.0000	1.0000	0.250	0.250	B
B	Hemispherical Isotropy	1.300	1.300	normal (k=1)	1.0000	1.0000	1.300	1.300	B
B	Spatial Resolution	0.500	0.500	Rectangular	1.7321	1.0000	0.289	0.289	B
B	Boundary Effect	0.769	0.769	Rectangular	1.7321	1.0000	0.444	0.444	B
B	Linearity	0.300	0.300	Rectangular	1.7321	1.0000	0.173	0.173	B
B	Detection Limits	0.200	0.200	Rectangular	1.7321	1.0000	0.115	0.115	B
B	Readout Electronics	0.160	0.160	normal (k=1)	1.0000	1.0000	0.160	0.160	B
B	Response Time	0.000	0.000	Rectangular	1.7321	1.0000	0.000	0.000	B
B	Integration Time	8.520	8.520	Rectangular	1.7321	1.0000	4.919	4.919	B
B	RF Ambient conditions	3.000	3.000	Rectangular	1.7321	1.0000	1.732	1.732	B
B	Probe Positioner Mechanical Restrictions	4.000	4.000	Rectangular	1.7321	1.0000	2.309	2.309	B
B	Probe Positioning with regard to Phantom Shell	2.850	2.850	Rectangular	1.7321	1.0000	1.645	1.645	B
B	Extrapolation and integration / Maximum SAR evaluation	5.080	5.080	Rectangular	1.7321	1.0000	2.933	2.933	B
A	Test Sample Positioning	1.170	1.170	normal (k=1)	1.0000	1.0000	1.170	1.170	A
A	Device Holder uncertainty	0.154	0.154	normal (k=1)	1.0000	1.0000	0.154	0.154	A
B	Phantom Uncertainty	4.000	4.000	Rectangular	1.7321	1.0000	2.309	2.309	B
B	Drift of output power	5.000	5.000	Rectangular	1.7321	1.0000	2.887	2.887	B
B	Liquid Conductivity (target value)	5.000	5.000	Rectangular	1.7321	0.4300	1.241	1.241	B
A	Liquid Conductivity (measured value)	2.340	2.340	normal (k=1)	1.0000	0.4300	1.006	1.006	A
B	Liquid Permittivity (target value)	5.000	5.000	Rectangular	1.7321	0.4900	1.415	1.415	B
A	Liquid Permittivity (measured value)	1.150	1.150	normal (k=1)	1.0000	0.4900	0.564	0.564	A
	Combined standard uncertainty			t-distribution			9.56	9.56	
	Expanded uncertainty			k = 1.96			18.74	18.74	

5.4. Uncertainty – Freq. > 3GHz Body Configuration 10g

Type	Source of uncertainty	+ Value	- Value	Probability Distribution	Divisor	$c_{i\ (10g)}$	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
B	Axial Isotropy	0.250	0.250	normal (k=1)	1.0000	1.0000	0.250	0.250	B
B	Hemispherical Isotropy	1.300	1.300	normal (k=1)	1.0000	1.0000	1.300	1.300	B
B	Spatial Resolution	0.500	0.500	Rectangular	1.7321	1.0000	0.289	0.289	B
B	Boundary Effect	0.769	0.769	Rectangular	1.7321	1.0000	0.444	0.444	B
B	Linearity	0.300	0.300	Rectangular	1.7321	1.0000	0.173	0.173	B
B	Detection Limits	0.200	0.200	Rectangular	1.7321	1.0000	0.115	0.115	B
B	Readout Electronics	0.160	0.160	normal (k=1)	1.0000	1.0000	0.160	0.160	B
B	Response Time	0.000	0.000	Rectangular	1.7321	1.0000	0.000	0.000	B
B	Integration Time	0.000	0.000	Rectangular	1.7321	1.0000	0.000	0.000	B
B	RF Ambient conditions	3.000	3.000	Rectangular	1.7321	1.0000	1.732	1.732	B
B	Probe Positioner Mechanical Restrictions	4.000	4.000	Rectangular	1.7321	1.0000	2.309	2.309	B
B	Probe Positioning with regard to Phantom Shell	2.850	2.850	Rectangular	1.7321	1.0000	1.645	1.645	B
B	Extrapolation and integration / Maximum SAR evaluation	5.080	5.080	Rectangular	1.7321	1.0000	2.933	2.933	B
A	Test Sample Positioning	2.510	2.510	normal (k=1)	1.0000	1.0000	2.510	2.510	A
A	Device Holder uncertainty	0.154	0.154	normal (k=1)	1.0000	1.0000	0.154	0.154	A
B	Phantom Uncertainty	4.000	4.000	Rectangular	1.7321	1.0000	2.309	2.309	B
B	Drift of output power	5.000	5.000	Rectangular	1.7321	1.0000	2.887	2.887	B
B	Liquid Conductivity (target value)	5.000	5.000	Rectangular	1.7321	0.6400	1.848	1.848	B
A	Liquid Conductivity (measured value)	3.550	3.550	normal (k=1)	1.0000	0.6400	2.272	2.272	A
B	Liquid Permittivity (target value)	5.000	5.000	Rectangular	1.7321	0.6000	1.732	1.732	B
A	Liquid Permittivity (measured value)	3.680	3.680	normal (k=1)	1.0000	0.6000	2.208	2.208	A
	Combined standard uncertainty			t-distribution			9.15	9.15	
	Expanded uncertainty			k = 1.96			17.93	17.93	

6. Equipment Under Test (EUT)

6.1. Identification of Equipment Under Test (EUT)

Serial Number:	**The following sample was used to perform radiated SAR measurements:** #4 **The following samples with serial numbers were used for the conducted power measurements:** #4
Hardware Version Number:	1601224 v01 1601211 v01 1601186 v03 1601183 v03 1601184 v02 1601185 v02 1601187 v02 1601188 v03 1601189 v01
Software Version Number:	2893
Country of Manufacture:	Sweden
Date of Receipt:	06 April 2016

DUT Description:	Digital Camera
Operating Configurations	Body-worn
Device dimension	Overall (Length x Width x Depth): 140 x 97 x 72 mm
Battery Options	☐ Standard – Lithium-ion battery ☒Extended (large capacity) - Removable Battery: 8.4 VDC (charging DC power input)

6.2. Wireless Technologies

Wireless technologies	Frequency bands	Operating mode	Duty Cycle
Wi-Fi	2.4 GHz	802.11b 802.11g 802.11n (HT20) 802.11n (HT40)	~100%
W-Fi	5.0 GHz	802.11a 802.11n (HT20) 802.11n (HT40) 802.11ac (VHT20) 802.11ac (VHT40) 802.11ac (VHT80)	~100%

Transmitter Frequency Allocation of EUT When Under Test:	Band: 2.4 / 5.0 GHz Wi-Fi 802.11a/n/ac (HT20 / HT40/HT80)						
	Rule	20 MHz BW Ch.#	Frq. (MHz)	40 MHz BW Ch.#	Frq. (MHz)	80 MHz BW Ch.#	Frq. (MHz)
	15.247	1	2412.0				
		6	2436.0				
		11	2462.0				
	5.2 U-NII-1	36	5180.0	38	5190.0		
		40	5200.0			42	5210.0
		44	5220.0	46	5230.0		
		48	5240.0				
	5.3 U-NII-2A	52	5260.0	54	5270.0		
		56	5280.0			58	5290.0
		60	5300.0	62	5310.0		
		64	5320.0				
	5.6 U-NII-2C	100	5500.0	102	5510.0		
		104	5520.0			106	5530.0
		108	5540.0	110	5550.0		
		112	5560.0				
		116	5580.0	118	5590.0		
		120	5600.0			122	5610.0
		124	5620.0	126	5630.0		
		128	5640.0				
		132	5660.0	134	5670.0		
		136	5680.0				
		140	5700.0				
	5.8 UNII-3	149	5745.0	151	5755.0		
		153	5765.0			155	5775.0
		157	5785.0	159	5795.0		
		161	5805.0				
		165	5825.0				
Antenna Type:	Internal integral						
Antenna Length:	Unknown						
Number of Antenna Positions:	Antenna 0 (Main)						1 fixed
	Antenna 1 (Aux)						1 fixed

6.3.Nominal and Maximum Output power: Wi-Fi

RF Air interface	Mode	Channel Nos.	Target + Max. Tolerances (dBm)		
			SISO Ant 0	SISO Ant 1	MIMO Ant 0 + Ant 1
Wi-Fi 2.4 GHz	802.11b	ALL	18.0	18.0	N/A
	802.11g	ALL	16.0	16.0	16.0
	802.11n HT20	ALL	15.0	15.0	15.0
	802.11n HT40	ALL	13.0	13.0	13.0

RF Air interface	Mode	Channel Nos.	Target + Max. Tolerances (dBm)		
			SISO Ant 0	SISO Ant 1	MIMO Ant 0 + Ant 1
Wi-Fi 5.2 / 5.3 / 5.5 / 5.8 GHz	802.11a	ALL	15.0	15.0	N/A
	802.11n HT20	ALL	14.0	14.0	14.0
	802.11n HT40	ALL	12.0	12.0	12.0
	802.11ac VHT80	ALL	10.0	10.0	10.0

6.4.Conducted Power Measurements Consideration

RF Air interface	Mode	Channel Nos.	Target + Max. Tolerances (dBm)		
			SISO Ant 0	SISO Ant 1	MIMO Ant 0 + Ant 1
Wi-Fi 2.4 GHz	802.11b	ALL	Yes	Yes	N/A
	802.11g	ALL	No	No	No
	802.11n HT20	ALL	No	No	No
	802.11n HT40	ALL	No	No	No

RF Air interface	Mode	Channel Nos.	Target + Max. Tolerances (dBm)		
			SISO Ant 0	SISO Ant 1	MIMO Ant 0 + Ant 1
Wi-Fi 5.2 / 5.3 / 5.5 / 5.8 GHz	802.11a	ALL	Yes	Yes	N/A
	802.11n HT20	ALL	No	No	No
	802.11n HT40	ALL	No	No	No
	802.11ac VHT80	ALL	No	No	No

7. RF Exposure Conditions (Test Configurations)

7.1. Configuration Consideration

Technology Antenna	Operating Mode	Configuration	Position	Antenna to Edge Separation	Evaluation Considered
Antenna 0 (WLAN ~ Main)	SISO	Body	Back Screen	>25	No
			Top of EUT	>25	Yes[1]
			Bottom of EUT	>25	No
			Left of EUT	>25	Yes[1]
			Right of EUT	>25	No
Antenna 1 (WLAN ~ Aux)	SISO	Body	Back Screen	>25	No
			Top of EUT	>25	Yes[1]
			Bottom of EUT	>25	No
			Left of EUT	>25	No
			Right of EUT	>25	No
Antenna 0 + Antenna 1	MIMO	Body	Back Screen	>25	No
			Edge 1	>25	No
			Edge 2	>25	No
			Edge 3	>25	No
			Bottom	>25	No

Note:

1. Prior to the SAR testing, the FCC was contacted and confirmation was obtained to test the edge with the antenna to edge distance closest to 25mm. Based on this confirmation, Top and/or Left of EUT was selected for SAR Evaluation.
2. Since the Antenna to edge separation of both antennas is >25mm and the Maximum power including tolerances for MIMO mode was lower than SISO mode, SAR evaluation was not considered for operation in MIMO mode.

7.2. SAR Test Exclusion Consideration

Frequency Band	Configuration(s)
	Body
WLAN 2.4GHz	No
WLAN 5.2GHz	No
WLAN 5.3GHz	No
WLAN 5.6GHz	No
WLAN 5.8GHz	No

Note:

1. As per KDB 447498 D01 General RF Exposure Guidance v06, The Frequency Bands with Rated Power including Upper tolerance, which qualify for **Standalone SAR Test Exclusion,** are as per the above table.
2. The details for the Maximum Rated Power and tolerance(s) can be found in section 6.

8. Conducted output power measurements

8.1.RF Output Average Power Measurement: Wi-Fi

8.1.1. Wi-Fi 802.11b/g/n (2.4 GHz) - SISO

		Avg Power (dBm)		
		Antenna 0 (Main)	Antenna 1 (Aux)	
Channel Number	Frequency (MHz)	(6Mbps)	(6Mbps)	Operating Mode
1	2412	17.2	17.7	802.11b
6	2437	17.4	17.5	
11	2462	17.6	17.5	
12	2467	Not Supported	Not Supported	
13	2472	Not Supported	Not Supported	

8.1.2. Wi-Fi 802.11a/n/ac (5.0 GHz) – SISO

		Avg Power (dBm)		
		Antenna 0 (Main)	Antenna 1 (Aux)	
Channel Number	**Frequency (MHZ)**	**6 Mbps**	**6 Mbps**	**Operating Mode**
36	5180	15.0	14.7	802.11a
40	5200	14.8	14.4	
44	5220	14.9	14.4	
48	5240	14.8	14.8	
Channel Number	**Frequency (MHZ)**	**6 Mbps**	**6 Mbps**	
52	5260	14.8	14.6	
56	5280	14.8	14.6	
60	5300	14.6	14.5	
64	5320	14.4	14.6	
Channel Number	**Frequency (MHZ)**	**6 Mbps**	**6 Mbps**	
100	5500	14.4	14.4	
104	5520	14.5	14.5	
108	5540	14.3	14.6	
112	5560	14.4	14.4	
116	5580	14.5	14.5	
132	5660	14.3	14.3	
136	5680	14.4	14.6	
140	5700	14.3	14.4	
Channel Number	**Frequency (MHZ)**	**6 Mbps**	**6 Mbps**	
149	5745	14.5	14.4	
153	5765	14.5	14.3	
157	5785	14.5	14.2	
161	5805	14.5	14.4	
165	5825	14.0	14.5	

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.

IEEE 1528: 2013

Target Frequency (MHz)	Body (FCC only)	
	ε_r	ε_r
150	61.9	61.9
300	58.2	58.2
450	56.7	56.7
750	-	-
835	55.2	55.2
900	55.0	55.0
915	55.0	55.0
1450	54.0	54.0
1500	-	-
1610	53.8	53.8
1640	-	-
1750	-	-
1800	53.3	53.3
1900	53.3	53.3
2000	53.3	53.3
2100	-	-
2300	-	-
2450	52.7	52.7
2600	-	-
3000	52.0	52.0
3500	-	-
4000	-	-
4500	-	-
5000	49.3	49.3
5100	49.1	49.1
5200	49.0	49.0
5300	48.9	48.9
5400	48.7	48.7
5500	48.6	48.6
5600	48.5	48.5
5700	48.3	48.3
5800	48.2	48.2
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	10/10/2015	2450	1g	51.90
				10g	24.50
D5GHzV2	1222	11/08/2015	5250	1g	77.90
				10g	21.70
D5GHzV2	1222	11/08/2015	5600	1g	80.70
				10g	22.40
D5GHzV2	1222	11/08/2015	5750	1g	77.30
				10g	21.40

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 2450 Body
Date: 23/05/2016
Validation Dipole and Serial Number: D2440V2 SN: 725

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	2450	24.0	23.0	ε_r	52.70	50.49	-4.19	5.00
				σ	1.95	1.99	2.05	5.00
				1g SAR	51.90	52.80	1.73	5.00
				10g SAR	24.50	23.96	-2.20	5.00

SAR Lab 61

System Check 5.25/5.60/5.75 GHz Body
Date: 23/03/2016
Validation Dipole and Serial Number: D5GHzV2 SN: 1222

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	5250	24.0	24.0	ε_r	48.90	47.36	-3.15	5.00
				σ	5.36	5.35	-0.26	5.00
				1g SAR	77.90	81.20	4.24	5.00
				10g SAR	21.70	22.40	3.23	5.00
Body	5600	24.0	24.0	ε_r	48.50	46.62	-3.88	5.00
				σ	5.77	5.86	1.53	5.00
				1g SAR	80.70	84.50	4.71	5.00
				10g SAR	22.40	23.50	4.91	5.00
Body	5750	24.0	24.0	ε_r	48.30	46.26	-4.22	5.00
				σ	5.94	6.11	2.93	5.00
				1g SAR	77.30	76.30	-1.29	5.00
				10g SAR	21.40	21.10	-1.40	5.00

10. Measurements, Examinations and Derived Result

10.0.1. Wi-Fi 2.4 GHz – Body Testing
Max Reported SAR 1g: N/A

					Ant 0				Ant 1				
					Power (dBm)		1g: SAR Results (W/kg)		Power (dBm)		1g: SAR Results (W/kg)		
Mode or Modulation	Dist (mm)	EUT Position	Channel No.	Freq (MHz)	Tune up limit	Meas.	Meas. Level (W/kg)	Reported SAR (W/kg)	Tune up limit	Meas.	Meas. Level (W/kg)	Reported SAR (W/kg)	Scan No.
DBPSK (802.11b 1Mbps)	0	Left	11	2462.0	18.0	17.6	-	-	N/A				1
	0	Left	1	2412.0	18.0	17.2	-	-					2
	0	Left	6	2437.0	18.0	17.4	-	-					3

For scans 1-3, no peak was detected in order to perform zoom scan

10.0.2. Wi-Fi 2.4 GHz – Extremity Testing
Max Reported SAR 10g: 0.203 W/Kg

					Ant 0				Ant 1				
					Power (dBm)		10g: SAR Results (W/kg)		Power (dBm)		10g: SAR Results (W/kg)		
Mode or Modulation	Dist (mm)	EUT Position	Channel No.	Freq (MHz)	Tune up limit	Meas.	Meas. Level (W/kg)	Reported SAR (W/kg)	Tune up limit	Meas.	Meas. Level (W/kg)	Reported SAR (W/kg)	Scan No.
	0	Top	11	2462.0	18.0	17.6	0.011	0.012	N/A				4
	0	Top	1	2412.0	N/A				18.0	17.7	0.066	0.071	5
	0	Top	6	2437.0					18.0	17.5	0.113	0.127	6
	0	Top	11	2462.0					18.0	17.5	0.181	0.203	7

10.0.3. Wi-Fi 5.0 GHz – Body Testing
Max Reported SAR 1g: 0.100 W/kg

					Ant 0				Ant 1				
					Power (dBm)		1g: SAR Results (W/kg)		Power (dBm)		1g: SAR Results (W/kg)		
Mode or Modulation	Dist (mm)	EUT Position	Channel No.	Freq (MHz)	Tune up limit	Meas.	Meas. Level (W/kg)	Reported SAR (W/kg)	Tune up limit	Meas.	Meas. Level (W/kg)	Reported SAR (W/kg)	Scan No.
DBPSK (802.11b 1Mbps)	0	Left	52	5260.0	15.0	14.8	0.083	0.087	N/A				8
	0	Left	104	5520.0	15.0	14.5	0.021	0.024					9
	0	Left	149	5745.0	15.0	14.5	-	-					10
	0	Left	56	5280.0	15.0	14.8	0.065	0.068					11
	0	Left	64	5320.0	15.0	14.4	0.087	0.100					12

For scan 11, no peak was detected in order to perform zoom scan

10.0.4. Wi-Fi 5.0 GHz – Extremity Testing
Max Reported SAR 10g: 0.331 W/kg

					Ant 0				Ant 1				
					Power (dBm)		10g: SAR Results (W/kg)		Power (dBm)		10g: SAR Results (W/kg)		
Mode or Modulation	Dist (mm)	EUT Position	Channel No.	Freq (MHz)	Tune up limit	Meas.	Meas. Level (W/kg)	Reported SAR (W/kg)	Tune up limit	Meas.	Meas. Level (W/kg)	Reported SAR (W/kg)	Scan No.
DBPSK (802.11b 1Mbps)	0	Top	52	5260.0	15.0	14.8	0.264	0.276					13
	0	Top	104	5520.0	15.0	14.5	0.236	0.265					14
	0	Top	149	5745.0	15.0	14.5	0.131	0.147					15
	0	Top	48	5240.0	N/A				15.0	14.8	0.172	0.180	16
	0	Top	52	5260.0					15.0	14.6	0.150	0.164	17
	0	Top	108	5540.0					15.0	14.6	0.141	0.155	18
	0	Top	165	5825.0					15.0	14.5	0.238	0.267	19
	0	Top	56	5280.0	15.0	14.8	0.305	0.319	N/A				20
	0	Top	64	5320.0	15.0	14.4	0.288	0.331					21