FCC SAR Test Report

APPLICANT	:	Motorola Solutions, Inc.
EQUIPMENT	:	RFID Reader Module
BRAND NAME	:	MOTOROLA
MODEL NAME	:	21-121559
FCC ID	:	UZ721121559
STANDARD	:	FCC 47 CFR Part 2 (2.1093) ANSI/IEEE C95.1-1992 IEEE 1528-2003

The product was installed into WORKABOUT PRO 4 (Brand Name: MOTOROLA, Model Name: 7528XUHFN containing FCC ID: UZ7211486030B and 7528XPUHFN containing FCC IDs: UZ7211486030B & UZ77528PA) during test.

We, SPORTON INTERNATIONAL INC., would like to declare that the tested sample has been evaluated in accordance with the procedures and had been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC., the test report shall not be reproduced except in full.

Reviewed by: Eric Huang / Deputy Manager

Approved by: Jones Tsai / Manager

Testing Laboratory
1190

SPORTON INTERNATIONAL INC.
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Revision History

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA4O0805	Rev. 01	Initial issue of report	Oct. 31, 2014

1. Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for **Motorola Solutions, Inc., RFID Reader Module, 21-121559**, are as follows.

Equipment Class	Band	Highest SAR Summary	
		Extremity (Separation 0mm) 10g SAR (W/kg)	Highest Simultaneous Transmission 10g SAR (W/kg)
DSS	RFID	**2.84**	3.05
Date of Testing:		10/13/2014 ~ 10/21/2014	

This device is in compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (4.0 W/kg) specified in FCC 47 CFR part 2 (2.1093) and ANSI/IEEE C95.1-1992, and had been tested in accordance with the measurement methods and procedures specified in IEEE 1528-2003.

2. Administration Data

Testing Laboratory	
Test Site	SPORTON INTERNATIONAL INC.
Test Site Location	No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C. TEL: +886-3-327-3456 FAX: +886-3-328-4978

Applicant	
Company Name	Motorola Solutions, Inc.
Address	One Motorola Plaza, Holtsville, NY 11742-1300 USA

Manufacturer	
Company Name	Motorola Solutions, Inc.
Address	One Motorola Plaza, Holtsville, NY 11742-1300 USA

3. Guidance Standard

The Specific Absorption Rate (SAR) testing specification, method, and procedure for this device is in accordance with the following standards:

- FCC 47 CFR Part 2 (2.1093)
- ANSI/IEEE C95.1-1992
- IEEE 1528-2003
- FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r03
- FCC KDB 865664 D02 SAR Reporting v01r01
- FCC KDB 447498 D01 General RF Exposure Guidance v05r02
- FCC KDB 648474 D04 SAR Evaluation Considerations for Wireless Handsets v01r02
- FCC KDB 248227 D01 SAR meas for 802 11abg v01r02
- FCC KDB 941225 D01 3G SAR Procedures v03

4. Equipment Under Test (EUT)

4.1 General Information

Product Feature & Specification	
Equipment Name	RFID Reader Module
Brand Name	MOTOROLA
Model Name	21-121559
FCC ID	UZ721121559
Wireless Technology and Frequency Range	RFID: 902.75 MHz ~ 927.75 MHz
Modulation Type	・FHSS
EUT Stage	Identical Prototype

Host List		
Host 1	7528XPUFHN (with WA9903 RFID Antenna)	S/N: WPCACE100025C1
Host 2	7528XUFHN (with WA9903 RFID Antenna)	S/N: WPCACE100016C1
Host 3	7528XPUFHN (with WA9901 RFID Antenna)	S/N: WPCACE290410C3
Host 4	7528XUFHN (with WA9901 RFID Antenna)	S/N: WPCACE100024C1

MOTOROLA 7528XUHFN	
EUT	WORKABOUT PRO 4
Wireless Technology and Frequency Range	WLAN 2.4GHz Band: 2412 MHz ~ 2472 MHz WLAN 5.2GHz Band: 5180 MHz ~ 5240 MHz WLAN 5.3GHz Band: 5260 MHz ~ 5320 MHz WLAN 5.5GHz Band: 5500 MHz ~ 5700 MHz WLAN 5.8GHz Band: 5745 MHz ~ 5825 MHz Bluetooth: 2402 MHz ~ 2480 MHz
	・802.11a/b/g/n HT20 ・Bluetooth 2.1+EDR

MOTOROLA 7528XPUHFN	
EUT	WORKABOUT PRO 4
Wireless Technology and Frequency Range	GSM850: 824.2 MHz ~ 848.8 MHz GSM1900: 1850.2 MHz ~ 1909.8 MHz WCDMA Band V: 826.4 MHz ~ 846.6 MHz WCDMA Band II: 1852.4 MHz ~ 1907.6 MHz WLAN 2.4GHz Band: 2412 MHz ~ 2472 MHz WLAN 5.2GHz Band: 5180 MHz ~ 5240 MHz WLAN 5.3GHz Band: 5260 MHz ~ 5320 MHz WLAN 5.5GHz Band: 5500 MHz ~ 5700 MHz WLAN 5.8GHz Band: 5745 MHz ~ 5825 MHz Bluetooth: 2402 MHz ~ 2480 MHz
	・GPRS/EGPRS ・RMC 12.2Kbps Rel 99 ・HSDPA Rel 5, Cat10 ・HSUPA Rel 6, Cat6 ・802.11a/b/g/n HT20 ・Bluetooth 2.1+EDR

Remark:

1. RFID module (FCC ID: UZ721121559) will be integrated into the model name: 7528XP (contains WWAN and WLAN modules) and 7528X (contains WLAN module) host.
2. When the RFID is integrated, the model numbers become 7528XPUHFN (contains WWAN + WLAN + RFID modules) and 7528XUHFN (contains WLAN + RFID modules).
3. WLAN and RFID antennas can transmit simultaneously.

4.2 Maximum Tune-up Limit

Mode	Burst average power(dBm)	
	GSM 850	GSM 1900
GSM (GMSK, 1 Tx slot)	33.50	30.50
GPRS (GMSK, 1 Tx slot)	33.50	30.50
GPRS (GMSK, 2 Tx slots)	33.50	30.50
EDGE (8PSK, 1 Tx slot)	27.00	26.00
EDGE (8PSK, 2 Tx slots)	27.00	26.00

Mode	Average power(dBm)	
	WCDMA Band V	WCDMA Band II
AMR / RMC 12.2Kbps	24.5	24.5
HSDPA Subtest-1	24.5	24.5
HSUPA Subtest-5	24.5	24.5

Mode	Average power(dBm)		
	XRM	MRM	DRM
RFID Bandwidth 500KHz	30.0	30.0	27.0
RFID Bandwidth 200KHz	30.0		27.0

2.4GHz WLAN	IEEE 802.11 Average Power (dBm)					
	11b		11g		11n-HT20	
Channel	Main Antenna	Aux Antenna	Main Antenna	Aux Antenna	Main Antenna	Aux Antenna
Ch1	18.5	18.5	15	15	14	14
Ch6	18.5	18.5	16	16	14	14
Ch11	18.5	18.5	15	15	14	14
Ch12	15.5	15.5	12.5	12.5	9.0	9.0
Ch13	13.0	13.0	-1.0	-1.0	-1.0	-1.0

5GHz WLAN	IEEE 802.11 Average Power (dBm)			
	11a		11n-HT20	
	Main Antenna	Aux Antenna	Main Antenna	Aux Antenna
	15.5	15.5	15.5	15.5

Mode	Bluetooth Average Power (dBm)		
	1Mbps	2Mbps	3Mbps
	3.0	1.0	1.0

5. RF Exposure Limits

5.1 Uncontrolled Environment

Uncontrolled Environments are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure. The general population/uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity.

5.2 Controlled Environment

Controlled Environments are defined as locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, (i.e. as a result of employment or occupation). In general, occupational/controlled exposure limits are applicable to situations in which persons are exposed as a consequence of their employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. The exposure category is also applicable when the exposure is of a transient nature due to incidental passage through a location where the exposure levels may be higher than the general population/uncontrolled limits, but the exposed person is fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means.

Limits for Occupational/Controlled Exposure (W/kg)

Whole-Body	Partial-Body	Hands, Wrists, Feet and Ankles
0.4	8.0	20.0

Limits for General Population/Uncontrolled Exposure (W/kg)

Whole-Body	Partial-Body	Hands, Wrists, Feet and Ankles
0.08	1.6	4.0

1. Whole-Body SAR is averaged over the entire body, partial-body SAR is averaged over any 1gram of tissue defined as a tissue volume in the shape of a cube. SAR for hands, wrists, feet and ankles is averaged over any 10 grams of tissue defined as a tissue volume in the shape of a cube.

6. Specific Absorption Rate (SAR)

6.1 Introduction

SAR is related to the rate at which energy is absorbed per unit mass in an object exposed to a radio field. The SAR distribution in a biological body is complicated and is usually carried out by experimental techniques or numerical modeling. The standard recommends limits for two tiers of groups, occupational/controlled and general population/uncontrolled, based on a person's awareness and ability to exercise control over his or her exposure. In general, occupational/controlled exposure limits are higher than the limits for general population/uncontrolled.

6.2 SAR Definition

The SAR definition is the time derivative (rate) of the incremental energy (dW) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dv) of a given density (ρ). The equation description is as below:

$$\mathbf{SAR} = \frac{\mathbf{d}}{\mathbf{dt}}\left(\frac{\mathbf{dW}}{\mathbf{dm}}\right) = \frac{\mathbf{d}}{\mathbf{dt}}\left(\frac{\mathbf{dW}}{\boldsymbol{\rho}\mathbf{dv}}\right)$$

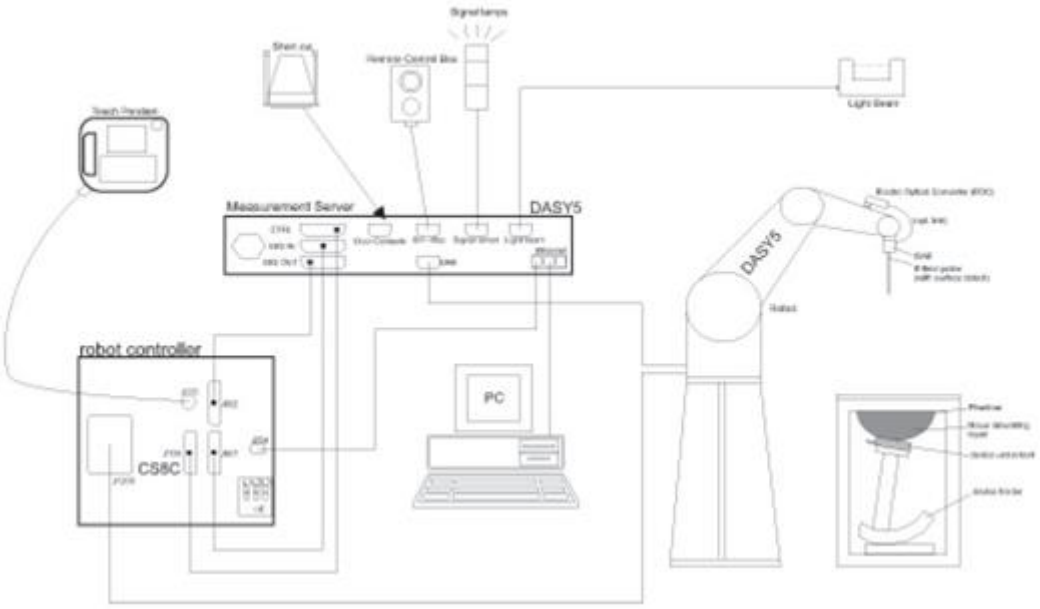
SAR is expressed in units of Watts per kilogram (W/kg)

$$\mathbf{SAR} = \frac{\boldsymbol{\sigma}|\mathbf{E}|^{\mathbf{2}}}{\boldsymbol{\rho}}$$

Where: σ is the conductivity of the tissue, ρ is the mass density of the tissue and E is the RMS electrical field strength.

7. System Description and Setup

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 DASY5 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.

8. Measurement Procedures

The measurement procedures are as follows:

<Conducted power measurement>

(a) For WWAN power measurement, use base station simulator to configure EUT WWAN transmission in conducted connection with RF cable, at maximum power in each supported wireless interface and frequency band.
(b) Read the WWAN RF power level from the base station simulator.
(c) For WLAN/BT power measurement, use engineering software to configure EUT WLAN/BT continuously transmission, at maximum RF power in each supported wireless interface and frequency band
(d) Connect EUT RF port through RF cable to the power meter, and measure WLAN/BT output power

<SAR measurement>

(a) Use base station simulator to configure EUT WWAN transmission in radiated connection, and engineering software to configure EUT WLAN/BT continuously transmission, at maximum RF power, in the highest power channel.
(b) Place the EUT in the positions as Appendix D demonstrates.
(c) Set scan area, grid size and other setting on the DASY software.
(d) Measure SAR results for the highest power channel on each testing position.
(e) Find out the largest SAR result on these testing positions of each band
(f) Measure SAR results for other channels in worst SAR testing position if the reported SAR of highest power channel is larger than 0.8 W/kg

According to the test standard, the recommended procedure for assessing the peak spatial-average SAR value consists of the following steps:

(a) Power reference measurement
(b) Area scan
(c) Zoom scan
(d) Power drift measurement

8.1 Spatial Peak SAR Evaluation

The procedure for spatial peak SAR evaluation has been implemented according to the test standard. It can be conducted for 1g and 10g, as well as for user-specific masses. The DASY software includes all numerical procedures necessary to evaluate the spatial peak SAR value.

The base for the evaluation is a "cube" measurement. The measured volume must include the 1g and 10g cubes with the highest averaged SAR values. For that purpose, the center of the measured volume is aligned to the interpolated peak SAR value of a previously performed area scan.

The entire evaluation of the spatial peak values is performed within the post-processing engine (SEMCAD). The system always gives the maximum values for the 1g and 10g cubes. The algorithm to find the cube with highest averaged SAR is divided into the following stages:

(a) Extraction of the measured data (grid and values) from the Zoom Scan
(b) Calculation of the SAR value at every measurement point based on all stored data (A/D values and measurement parameters)
(c) Generation of a high-resolution mesh within the measured volume
(d) Interpolation of all measured values form the measurement grid to the high-resolution grid
(e) Extrapolation of the entire 3-D field distribution to the phantom surface over the distance from sensor to surface
(f) Calculation of the averaged SAR within masses of 1g and 10g

8.2 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. This distance cannot be smaller than the distance of sensor calibration points to probe tip as defined in the probe properties.

8.3 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 found in the scanned area, within a range of the global maximum. The range (in dB0 is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE standard 1528 and IEC 62209 standards, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard (Japan), 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 FCC KDB 865664 D01v01r03 SAR measurement 100 MHz to 6 GHz.

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

8.4 Zoom Scan

Zoom scans are used assess the peak spatial SAR values within a cubic averaging volume containing 1 gram and 10 gram of simulated tissue. The zoom scan measures points (refer to table below) within a cube shoes 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 gram and 10 gram and displays these values next to the job's label.

Zoom scan parameters extracted from FCC KDB 865664 D01v01r03 SAR measurement 100 MHz to 6 GHz.

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

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

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

8.5 Volume Scan Procedures

The volume scan is used for assess overlapping SAR distributions for antennas transmitting in different frequency bands. It is equivalent to an oversized zoom scan used in standalone measurements. The measurement volume will be used to enclose all the simultaneous transmitting antennas. For antennas transmitting simultaneously in different frequency bands, the volume scan is measured separately in each frequency band. In order to sum correctly to compute the 1g aggregate SAR, the EUT remain in the same test position for all measurements and all volume scan use the same spatial resolution and grid spacing. When all volume scan were completed, the software, SEMCAD postprocessor can combine and subsequently superpose these measurement data to calculating the multiband SAR.

8.6 Power Drift Monitoring

All SAR testing is under the EUT install full charged battery and transmit maximum output power. In DASY measurement software, the power reference measurement and power drift measurement procedures are used for monitoring the power drift of EUT during SAR test. Both these procedures measure the field at a specified reference position before and after the SAR testing. The software will calculate the field difference in dB. If the power drifts more than 5%, the SAR will be retested.

9. Test Equipment List

Manufacturer	Name of Equipment	Type/Model	Serial Number	Calibration	
				Last Cal.	Due Date
SPEAG	835MHz System Validation Kit	D835V2	499	Mar. 24, 2014	Mar. 23, 2015
SPEAG	900MHz System Validation Kit	D900V2	1d135	Nov. 25, 2013	Nov. 24, 2014
SPEAG	1900MHz System Validation Kit	D1900V2	5d041	Mar. 21, 2014	Mar. 20, 2015
SPEAG	2450MHz System Validation Kit	D2450V2	736	Aug. 21, 2014	Aug. 20, 2015
SPEAG	5GHz System Validation Kit	D5GHzV2	1040	Jun. 20, 2014	Jun. 19, 2015
SPEAG	Data Acquisition Electronics	DAE4	778	Aug. 21, 2014	Aug. 20, 2015
SPEAG	Data Acquisition Electronics	DAE4	1338	Nov. 05, 2013	Nov. 04, 2014
SPEAG	Data Acquisition Electronics	DAE4	1279	Jul. 23, 2014	Jul. 22, 2015
SPEAG	Data Acquisition Electronics	DAE4	1399	Nov. 07, 2013	Nov. 06, 2014
SPEAG	Dosimetric E-Field Probe	ES3DV3	3296	Apr. 30, 2014	Apr. 29, 2015
SPEAG	Dosimetric E-Field Probe	EX3DV4	3935	Nov. 04, 2013	Nov. 03, 2014
SPEAG	Dosimetric E-Field Probe	EX3DV4	3954	Nov. 04, 2013	Nov. 03, 2014
SPEAG	Dosimetric E-Field Probe	EX3DV4	3955	Nov. 12, 2013	Nov. 11, 2014
Wisewind	Thermometer	ETP-101	TM560	Oct. 22, 2013	Oct. 21, 2014
Wisewind	Thermometer	ETP-101	TM685	Oct. 22, 2013	Oct. 21, 2014
Wisewind	Thermometer	HTC-1	TM642	Oct. 22, 2013	Oct. 21, 2014
Wisewind	Thermometer	HTC-1	TM281	Oct. 22, 2013	Oct. 21, 2014
Anritsu	Radio Communication Analyzer	MT8820C	6201074414	Feb. 11, 2014	Feb. 10, 2015
Agilent	Wireless Communication Test Set	E5515C	MY50266977	May. 27, 2014	May. 26, 2015
SPEAG	Device Holder	N/A	N/A	NCR	NCR
Agilent	Signal Generator	N5181A	MY50145381	Jan. 04, 2014	Jan. 03, 2015
SPEAG	Dielectric Probe Kit	DAKS-3.5	0004	Mar. 04, 2014	Mar. 03, 2015
Agilent	ENA Network Analyzer	E5071C	MY46101588	May. 31, 2014	May. 30, 2015
Anritsu	Power Meter	ML2495A	1036004	Aug. 09, 2014	Aug. 08, 2015
Anritsu	Power Sensor	MA2411B	1027253	Aug. 11, 2014	Aug. 10, 2015
R&S	Spectrum Analyzer	FSP 7	101131	Jul. 10, 2014	Jul. 09, 2015
Agilent	Dual Directional Coupler	778D	50422	Note1	
Woken	Attenuator 1	WK0602-XX	N/A	Note1	
PE	Attenuator 2	PE7005-10	N/A	Note1	
PE	Attenuator 3	PE7005- 3	N/A	Note1	
AR	Power Amplifier	5S1G4M2	0328767	Note1	
Mini-Circuits	Power Amplifier	ZVE-3W	162601250	Note1	
Mini-Circuits	Power Amplifier	ZHL-42W+	13440021344	Note1	

General Note:

1. Prior to system verification and validation, the path loss from the signal generator to the system check source and the power meter, which includes the amplifier, cable, attenuator and directional coupler, was measured by the network analyzer. The reading of the power meter was offset by the path loss difference between the path to the power meter and the path to the system check source to monitor the actual power level fed to the system check source.

10. System Verification

10.1 Tissue Verification

The following tissue formulations are provided for reference only as some of the parameters have not been thoroughly verified. The composition of ingredients may be modified accordingly to achieve the desired target tissue parameters required for routine SAR evaluation.

Frequency (MHz)	Water (%)	Sugar (%)	Cellulose (%)	Salt (%)	Preventol (%)	DGBE (%)	Conductivity (σ)	Permittivity (εr)
For Head								
750	41.1	57.0	0.2	1.4	0.2	0	0.89	41.9
835	40.3	57.9	0.2	1.4	0.2	0	0.90	41.5
900	40.3	57.9	0.2	1.4	0.2	0	0.97	41.5
1800, 1900, 2000	55.2	0	0	0.3	0	44.5	1.40	40.0
2450	55.0	0	0	0	0	45.0	1.80	39.2
2600	54.8	0	0	0.1	0	45.1	1.96	39.0
For Body								
750	51.7	47.2	0	0.9	0.1	0	0.96	55.5
835	50.8	48.2	0	0.9	0.1	0	0.97	55.2
900	50.8	48.2	0	0.9	0.1	0	1.05	55.0
1800, 1900, 2000	70.2	0	0	0.4	0	29.4	1.52	53.3
2450	68.6	0	0	0	0	31.4	1.95	52.7
2600	68.1	0	0	0.1	0	31.8	2.16	52.5

Simulating Liquid for 5GHz, Manufactured by SPEAG

Ingredients	(% by weight)
Water	64~78%
Mineral oil	11~18%
Emulsifiers	9~15%
Additives and Salt	2~3%

<Tissue Dielectric Parameter Check Results for 1g SAR>

Frequency (MHz)	Tissue Type	Liquid Temp. (℃)	Conductivity (σ)	Permittivity (ε_r)	Conductivity Target (σ)	Permittivity Target (ε_r)	Delta (σ) (%)	Delta (ε_r) (%)	Limit (%)	Date
835	MSL	22.3	0.969	54.882	0.97	55.20	-0.10	-0.58	±5	2014/10/16
1900	MSL	22.3	1.568	53.803	1.52	53.30	3.16	0.94	±5	2014/10/16

<Tissue Dielectric Parameter Check Results for 10g SAR>

Frequency (MHz)	Tissue Type	Liquid Temp. (℃)	Conductivity (σ)	Permittivity (ε_r)	Conductivity Target (σ)	Permittivity Target (ε_r)	Delta (σ) (%)	Delta (ε_r) (%)	Limit (%)	Date
900	MSL	22.6	1.039	56.226	1.05	55.00	-1.05	2.23	±5	2014/10/21
2450	MSL	22.4	1.931	53.584	1.95	52.70	-0.97	1.68	±5	2014/10/13
2450	MSL	22.3	1.930	53.269	1.95	52.70	-1.03	1.08	±5	2014/10/16
5300	MSL	22.5	5.264	47.249	5.42	48.90	-2.88	-3.38	±5	2014/10/14
5300	MSL	22.3	5.380	47.244	5.42	48.90	-0.74	-3.39	±5	2014/10/16

10.2 System Performance Check Results

Comparing to the original SAR value provided by SPEAG, the verification data should be within its specification of 10 %. Below table shows the target SAR and measured SAR after normalized to 1W input power. The table below indicates the system performance check can meet the variation criterion and the plots can be referred to Appendix A of this report.

Date	Frequency (MHz)	Tissue Type	Input Power (mW)	Dipole S/N	Probe S/N	DAE S/N	Measured 1g SAR (W/kg)	Targeted 1g SAR (W/kg)	Normalized 1g SAR (W/kg)	Deviation (%)
2014/10/16	835	MSL	250	D835V2-499	EX3DV4 - SN3954	DAE4 Sn1279	2.50	9.46	10.00	5.71
2014/10/16	1900	MSL	250	D1900V2-5d041	EX3DV4 - SN3954	DAE4 Sn1279	10.70	41.00	42.80	4.39

Date	Frequency (MHz)	Tissue Type	Input Power (mW)	Dipole S/N	Probe S/N	DAE S/N	Measured 10g SAR (W/kg)	Targeted 10g SAR (W/kg)	Normalized 10g SAR (W/kg)	Deviation (%)2
2014/10/21	900	MSL	250	D900V2-1d135	EX3DV4 - SN3955	DAE4 Sn1399	1.61	6.83	6.44	-5.71
2014/10/13	2450	MSL	250	D2450V2-736	ES3DV3 - SN3296	DAE4 Sn778	5.47	23.60	21.88	-7.29
2014/10/16	2450	MSL	250	D2450V2-736	EX3DV4 - SN3954	DAE4 Sn1279	5.61	23.60	22.44	-4.92
2014/10/14	5300	MSL	100	D5GHzV2-1040	EX3DV4 - SN3935	DAE4 Sn1338	2.14	22.00	21.40	-2.73
2014/10/16	5300	MSL	100	D5GHzV2-1040	EX3DV4 - SN3954	DAE4 Sn1279	2.18	22.00	21.80	-0.91

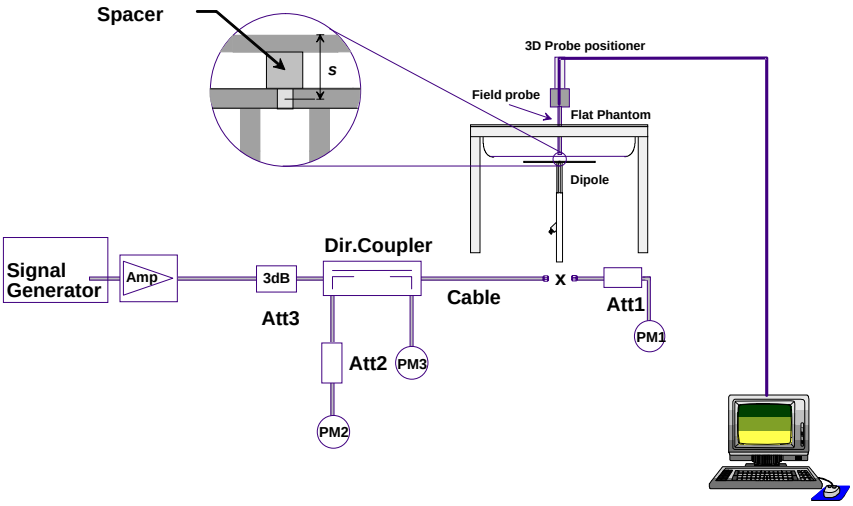


Fig 8.3.1 System Performance Check Setup

Fig 8.3.2 Setup Photo

11. Conducted RF Output Power (Unit: dBm)

<GSM Conducted Power>

Band GSM850	Burst Average Power (dBm)			Tune-up Limit (dBm)	Frame-Average Power (dBm)			Tune-up Limit (dBm)
TX Channel	128	189	251		128	189	251	
Frequency (MHz)	824.2	836.4	848.8		824.2	836.4	848.8	
GSM (GMSK, 1 Tx slot)	33.17	33.27	33.25	33.50	24.17	24.27	24.25	24.50
GPRS (GMSK, 1 Tx slot) – CS1	33.20	33.28	33.27	33.50	24.20	24.28	24.27	24.50
GPRS (GMSK, 2 Tx slots) – CS1	32.94	33.06	33.08	33.50	26.94	27.06	27.08	27.50
EDGE (8PSK, 1 Tx slot) – MCS5	26.92	26.89	26.90	27.00	17.92	17.89	17.90	18.00
EDGE (8PSK, 2 Tx slots) – MCS5	26.86	26.89	26.91	27.00	20.86	20.89	20.91	21.00

Band GSM1900	Burst Average Power (dBm)			Tune-up Limit (dBm)	Frame-Average Power (dBm)			Tune-up Limit (dBm)
TX Channel	512	661	810		512	661	810	
Frequency (MHz)	1850.2	1880	1909.8		1850.2	1880	1909.8	
GSM (GMSK, 1 Tx slot)	30.38	30.25	30.00	30.50	21.38	21.25	21.00	21.50
GPRS (GMSK, 1 Tx slot) – CS1	30.39	30.28	30.01	30.50	21.39	21.28	21.01	21.50
GPRS (GMSK, 2 Tx slots) – CS1	30.40	30.11	29.82	30.50	24.40	24.11	23.82	24.50
EDGE (8PSK, 1 Tx slot) – MCS5	25.91	25.89	25.66	26.00	16.91	16.89	16.66	17.00
EDGE (8PSK, 2 Tx slots) – MCS5	25.89	25.80	25.66	26.00	19.89	19.80	19.66	20.00

<WCDMA Conducted Power>

Band			WCDMA V			WCDMA II		
TX Channel			4132	4182	4233	9262	9400	9538
Rx Channel			4357	4407	4458	9662	9800	9938
Frequency (MHz)			826.4	836.4	846.6	1852.4	1880	1907.6
MPR	3GPP Rel 99	RMC 12.2Kbps	24.18	24.23	24.24	24.26	24.35	24.17
0	3GPP Rel 6	HSDPA Subtest-1	24.12	24.11	24.22	24.19	24.34	24.12
0	3GPP Rel 6	HSDPA Subtest-2	24.06	24.06	24.16	24.08	24.25	24.05
0.5	3GPP Rel 6	HSDPA Subtest-3	23.78	23.77	23.79	23.84	23.92	23.75
0.5	3GPP Rel 6	HSDPA Subtest-4	23.50	23.61	23.68	23.80	23.84	23.70
0	3GPP Rel 6	HSUPA Subtest-1	23.43	23.52	23.87	23.98	24.09	24.03
2	3GPP Rel 6	HSUPA Subtest-2	22.80	22.81	22.83	22.84	22.93	22.75
1	3GPP Rel 6	HSUPA Subtest-3	22.81	22.92	23.33	22.89	22.99	22.95
2	3GPP Rel 6	HSUPA Subtest-4	22.80	22.88	22.79	22.87	22.86	22.88
0	3GPP Rel 6	HSUPA Subtest-5	24.07	24.03	24.19	24.19	24.28	24.07

<WLAN Conducted Power>

<2.4GHz WLAN Main Antenna>

Mode	Channel	Frequency (MHz)	Average power (dBm)			
			Data Rate			
			1Mbps	2Mbps	5.5Mbps	11Mbps
802.11b	CH 1	2412	17.94	17.91	17.75	17.74
	CH 6	2437	18.11	18.02	17.83	17.80
	CH 11	2462	17.34	17.23	17.18	17.17
	CH 12	2467	15.16	15.14	15.13	15.14
	CH 13	2472	12.78	12.76	12.77	12.70

Mode	Channel	Frequency (MHz)	Average power (dBm)							
			Data Rate							
			6Mbps	9Mbps	12Mbps	18Mbps	24Mbps	36Mbps	48Mbps	54Mbps
802.11g	CH 1	2412	13.26	13.22	13.23	13.25	13.24	13.24	13.20	13.20
	CH 6	2437	15.62	15.59	15.56	15.59	15.55	15.60	15.57	15.56
	CH 11	2462	14.87	14.83	14.82	14.85	14.84	14.86	14.85	14.81
	CH 12	2467	12.23	12.22	12.19	12.22	12.20	12.17	12.14	12.14
	CH 13	2472	-1.53	-1.58	-1.56	-1.54	-1.57	-1.54	-1.56	-1.54

Mode	Channel	Frequency (MHz)	Average power (dBm)							
			MCS Index							
			MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
802.11n-HT20	CH 1	2412	13.03	12.83	12.88	12.90	12.99	12.98	12.88	12.89
	CH 6	2437	13.99	13.87	13.88	13.91	13.97	13.96	13.92	13.92
	CH 11	2462	13.80	13.78	13.79	13.77	13.77	13.77	13.70	13.67
	CH 12	2467	8.52	8.46	8.47	8.50	8.51	8.47	8.45	8.46
	CH 13	2472	-1.21	-1.30	-1.24	-1.22	-1.22	-1.24	-1.28	-1.25

<2.4GHz WLAN Aux. Antenna>

Mode	Channel	Frequency (MHz)	Average power (dBm)			
			Data Rate			
			1Mbps	2Mbps	5.5Mbps	11Mbps
802.11b	CH 1	2412	17.78	17.62	17.59	17.64
	CH 6	2437	17.90	17.68	17.66	17.62
	CH 11	2462	17.22	17.01	16.75	16.73
	CH 12	2467	15.09	15.06	15.04	15.00
	CH 13	2472	12.92	12.85	12.15	12.09

Mode	Channel	Frequency (MHz)	Average power (dBm)							
			Data Rate							
			6Mbps	9Mbps	12Mbps	18Mbps	24Mbps	36Mbps	48Mbps	54Mbps
802.11g	CH 1	2412	13.18	13.11	13.20	13.21	13.18	13.15	13.14	13.14
	CH 6	2437	14.65	14.53	14.58	14.60	14.54	14.56	14.56	14.55
	CH 11	2462	13.97	13.86	13.93	13.95	13.92	13.91	13.93	13.89
	CH 12	2467	12.19	12.06	12.11	12.13	12.09	12.03	12.03	12.03
	CH 13	2472	-1.77	-1.89	-1.79	-1.78	-1.83	-1.83	-1.82	-1.80

Mode	Channel	Frequency (MHz)	Average power (dBm)							
			MCS Index							
			MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
802.11n-HT20	CH 1	2412	12.65	12.63	12.54	12.55	12.62	12.64	12.54	12.55
	CH 6	2437	13.67	13.56	13.57	13.59	13.66	13.65	13.61	13.61
	CH 11	2462	13.53	13.51	13.52	13.49	13.50	13.50	13.43	13.40
	CH 12	2467	8.30	8.28	8.29	8.28	8.28	8.29	8.27	8.28
	CH 13	2472	-1.40	-1.46	-1.50	-1.41	-1.43	-1.45	-1.44	-1.41

<5GHz WLAN Main Antenna>

WLAN 5GHz 802.11a Average Power (dBm)									
Power vs. Channel		Power vs. Data Rate							
Channel	Frequency (MHz)	6Mbps	9Mbps	12Mbps	18Mbps	24Mbps	36Mbps	48Mbps	54Mbps
CH 36	5180	14.99	14.86	14.83	14.79	14.72	14.67	14.69	14.65
CH 40	5200	14.88	14.75	14.72	14.68	14.61	14.56	14.58	14.54
CH 44	5220	14.76	14.71	14.67	14.68	14.60	14.51	14.47	14.42
CH 48	5240	14.97	14.83	14.70	14.60	14.46	14.40	14.34	14.29
CH 52	5260	15.31	15.21	15.16	14.99	14.91	14.81	14.72	14.68
CH 56	5280	15.36	15.26	15.21	15.04	14.96	14.86	14.77	14.73
CH 60	5300	15.20	14.87	14.78	14.61	14.54	14.49	14.41	14.39
CH 64	5320	15.12	14.88	14.81	14.72	14.70	14.58	14.54	14.52
CH 100	5500	14.58	14.51	14.16	14.03	13.92	13.90	13.86	13.84
CH 104	5520	14.36	14.29	13.94	13.81	13.70	13.68	13.64	13.62
CH 108	5540	14.82	14.75	14.40	14.27	14.16	14.14	14.10	14.08
CH 112	5560	14.80	14.75	14.70	14.60	14.57	14.49	14.44	14.13
CH 116	5580	14.60	14.55	14.50	14.40	14.37	14.29	14.24	13.93
CH 120	5600	15.29	15.24	15.19	15.09	15.06	14.98	14.93	14.62
CH 124	5620	15.13	15.08	15.03	14.93	14.90	14.82	14.77	14.46
CH 128	5640	15.25	15.20	15.15	15.05	15.02	14.94	14.89	14.58
CH 132	5660	15.23	15.18	15.13	15.03	15.00	14.92	14.87	14.56
CH 136	5680	15.02	15.02	14.77	14.71	14.65	14.61	14.56	14.52
CH 140	5700	15.42	15.26	15.17	15.11	15.05	15.01	14.96	14.92
CH 149	5745	15.23	15.21	15.15	15.17	15.21	15.18	15.15	15.14
CH 153	5765	14.63	14.61	14.55	14.57	14.61	14.58	14.55	14.54
CH 157	5785	15.07	15.04	14.99	15.02	15.03	15.04	15.05	15.04
CH 161	5805	14.30	14.27	14.22	14.25	14.26	14.27	14.28	14.27
CH 165	5825	14.31	14.28	14.25	14.26	14.30	14.27	14.27	14.24

WLAN 5GHz 802.11n-HT20 Average Power (dBm)									
Power vs. Channel		Power vs. MCS Index							
Channel	Frequency (MHz)	MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
CH 36	5180	14.98	14.95	14.91	14.88	14.86	14.83	14.82	14.78
CH 40	5200	14.90	14.87	14.83	14.80	14.78	14.75	14.74	14.70
CH 44	5220	15.00	14.98	14.96	14.92	14.89	14.91	14.85	14.83
CH 48	5240	14.95	14.92	14.90	14.87	14.88	14.85	14.86	14.81
CH 52	5260	15.28	15.26	15.23	15.19	15.21	15.23	15.20	15.22
CH 56	5280	14.79	14.77	14.74	14.70	14.72	14.74	14.71	14.73
CH 60	5300	14.66	14.61	14.56	14.58	14.54	14.51	14.52	14.57
CH 64	5320	14.54	14.48	14.42	14.46	14.43	14.39	14.35	14.34
CH 100	5500	13.99	13.92	13.88	13.85	13.89	13.91	13.94	13.91
CH 104	5520	13.89	13.82	13.78	13.75	13.79	13.81	13.84	13.81
CH 108	5540	14.16	14.09	14.05	14.02	14.06	14.08	14.11	14.08
CH 112	5560	14.15	14.08	14.04	14.01	14.05	14.07	14.10	14.07
CH 116	5580	14.12	14.10	14.05	13.99	14.06	14.06	14.02	14.08
CH 120	5600	14.32	14.30	14.25	14.19	14.26	14.26	14.22	14.28
CH 124	5620	14.85	14.83	14.78	14.72	14.79	14.79	14.75	14.81
CH 128	5640	15.22	15.20	15.15	15.09	15.16	15.16	15.12	15.18
CH 132	5660	15.38	15.36	15.31	15.25	15.32	15.32	15.28	15.34
CH 136	5680	14.82	14.80	14.75	14.69	14.76	14.76	14.72	14.78
CH 140	5700	14.96	14.93	14.87	14.83	14.89	14.88	14.86	14.87
CH 149	5745	13.25	13.22	13.19	13.23	13.21	13.15	13.18	13.18
CH 153	5765	13.67	13.64	13.61	13.65	13.63	13.57	13.60	13.60
CH 157	5785	13.59	13.45	13.43	13.48	13.46	13.46	13.41	13.41
CH 161	5805	13.66	13.52	13.50	13.55	13.53	13.53	13.48	13.48
CH 165	5825	13.86	13.77	13.77	13.80	13.83	13.84	13.85	13.83

<Aux. Antenna>

WLAN 5GHz 802.11a Average Power (dBm)									
Power vs. Channel		Power vs. Data Rate							
Channel	Frequency (MHz)	6Mbps	9Mbps	12Mbps	18Mbps	24Mbps	36Mbps	48Mbps	54Mbps
CH 36	5180	14.94	14.87	14.83	14.72	14.65	14.56	14.52	14.51
CH 40	5200	14.86	14.79	14.75	14.64	14.56	14.47	14.44	14.43
CH 44	5220	14.75	14.72	14.52	14.40	14.34	14.29	14.30	14.29
CH 48	5240	14.96	14.93	14.90	14.79	14.71	14.70	14.66	14.68
CH 52	5260	15.28	15.24	15.19	14.98	14.90	14.93	14.91	14.87
CH 56	5280	15.22	15.18	15.13	14.92	14.83	14.86	14.85	14.81
CH 60	5300	15.07	15.03	14.93	14.80	14.77	14.78	14.79	14.82
CH 64	5320	15.00	14.90	14.78	14.77	14.72	14.75	14.77	14.76
CH 100	5500	14.54	14.49	14.39	14.31	14.28	14.32	14.30	14.35
CH 104	5520	13.91	13.87	13.77	13.64	13.61	13.61	13.63	13.66
CH 108	5540	14.64	14.54	14.42	14.41	14.36	14.38	14.41	14.40
CH 112	5560	14.61	14.56	14.46	14.38	14.35	14.38	14.37	14.42
CH 116	5580	14.58	14.56	14.48	14.42	14.39	14.37	14.41	14.34
CH 120	5600	14.99	14.97	14.89	14.83	14.80	14.77	14.82	14.75
CH 124	5620	15.12	15.08	15.04	14.97	14.93	14.87	14.91	14.94
CH 128	5640	15.19	15.15	15.11	15.04	15.00	14.94	14.98	15.01
CH 132	5660	15.12	15.08	15.04	14.97	14.93	14.86	14.91	14.94
CH 136	5680	14.79	14.77	14.70	14.75	14.78	14.75	14.73	14.72
CH 140	5700	15.39	15.35	15.31	15.24	15.20	15.14	15.18	15.21
CH 149	5745	14.93	14.91	14.84	14.89	14.93	14.90	14.87	14.86
CH 153	5765	14.85	14.83	14.76	14.81	14.84	14.81	14.79	14.78
CH 157	5785	14.92	14.88	14.80	14.86	14.87	14.88	14.89	14.88
CH 161	5805	14.20	14.16	14.08	14.14	14.14	14.15	14.17	14.16
CH 165	5825	14.24	14.00	13.94	13.98	14.02	13.99	13.99	13.96

WLAN 5GHz 802.11n-HT20 Average Power (dBm)									
Power vs. Channel		Power vs. MCS Index							
Channel	Frequency (MHz)	MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
CH 36	5180	14.92	14.88	14.81	14.80	14.78	14.76	14.76	14.79
CH 40	5200	14.88	14.84	14.77	14.76	14.74	14.72	14.72	14.75
CH 44	5220	14.90	14.84	14.78	14.79	14.80	14.77	14.75	14.70
CH 48	5240	14.91	14.87	14.82	14.77	14.69	14.70	14.72	14.72
CH 52	5260	15.22	15.20	15.18	15.14	15.15	15.09	15.08	15.13
CH 56	5280	14.74	14.72	14.70	14.66	14.67	14.61	14.60	14.65
CH 60	5300	14.56	14.52	14.46	14.37	14.41	14.38	14.36	14.37
CH 64	5320	14.47	14.41	14.34	14.31	14.22	14.25	14.23	14.26
CH 100	5500	13.84	13.78	13.73	13.75	13.74	13.72	13.70	13.71
CH 104	5520	13.88	13.84	13.78	13.69	13.73	13.70	13.68	13.69
CH 108	5540	14.07	14.01	13.94	13.91	13.82	13.85	13.83	13.86
CH 112	5560	14.09	14.03	13.98	14.00	13.99	13.97	13.95	13.96
CH 116	5580	13.99	13.93	13.88	13.89	13.86	13.83	13.81	13.82
CH 120	5600	14.29	14.23	14.18	14.19	14.16	14.13	14.11	14.12
CH 124	5620	14.83	14.79	14.76	14.78	14.74	14.73	14.74	14.73
CH 128	5640	15.05	15.01	14.98	15.00	14.96	14.95	14.96	14.95
CH 132	5660	14.94	14.90	14.87	14.89	14.85	14.84	14.85	14.84
CH 136	5680	14.80	14.76	14.73	14.75	14.71	14.70	14.71	14.70
CH 140	5700	14.84	14.80	14.77	14.79	14.75	14.74	14.75	14.74
CH 149	5745	12.94	12.91	12.87	12.91	12.88	12.85	12.93	12.93
CH 153	5765	13.39	13.36	13.32	13.36	13.33	13.30	13.38	13.38
CH 157	5785	13.55	13.50	13.52	13.50	13.52	13.52	13.47	13.47
CH 161	5805	13.57	13.52	13.54	13.52	13.54	13.54	13.49	13.49
CH 165	5825	13.68	13.56	13.60	13.63	13.64	13.65	13.64	13.66

<RFID Conducted Power>

General Note:

1. For RFID Body-worn SAR testing was selected 500 KHz bandwidth at MRM perform, due to it is highest average power.

Bandwidth 500KHz Average Power (dBm)							
Channel	Frequency	Modulation Type					
		XRM Ant0	XRM Ant1	MRM Ant0	MRM Ant1	DRM Ant0	DRM Ant1
00	902.75	28.90	28.89	28.99	28.85	26.70	26.71
24	914.75	28.91	28.85	28.95	28.87	26.91	26.90
49	927.25	28.97	28.84	28.90	28.90	26.75	26.76

Bandwidth 200KHz Average Power (dBm)					
Channel	Frequency	Modulation Type			
		XRM Ant0	XRM Ant1	DRM Ant0	DRM Ant1
00	902.60	28.80	28.70	26.97	26.90
60	914.60	28.85	28.72	26.86	26.80
124	927.40	28.85	28.82	26.71	26.72

12. Bluetooth Exclusions Applied

Mode Band	Average power(dBm)		
	GFSK	π/4-DQPSK	LE, GFSK
v2.1+EDR	3.0	1.0	1.0

Note:

1. Per KDB 447498 D01v05r02, 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
   - 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

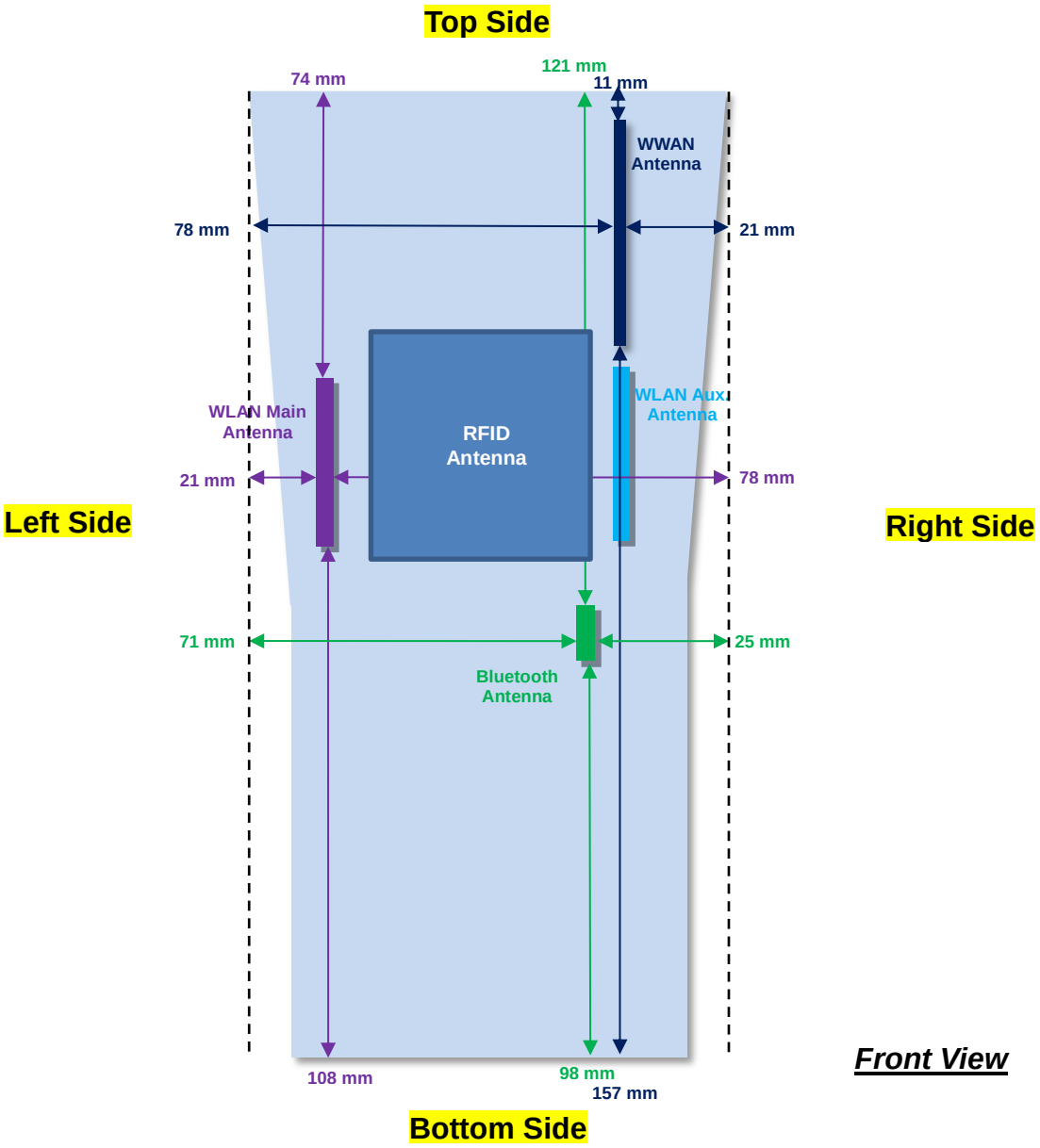
Bluetooth Max Power (dBm)	Separation Distance (mm)	Frequency (GHz)	exclusion thresholds
3	< 5	2.48	0.63

Note:

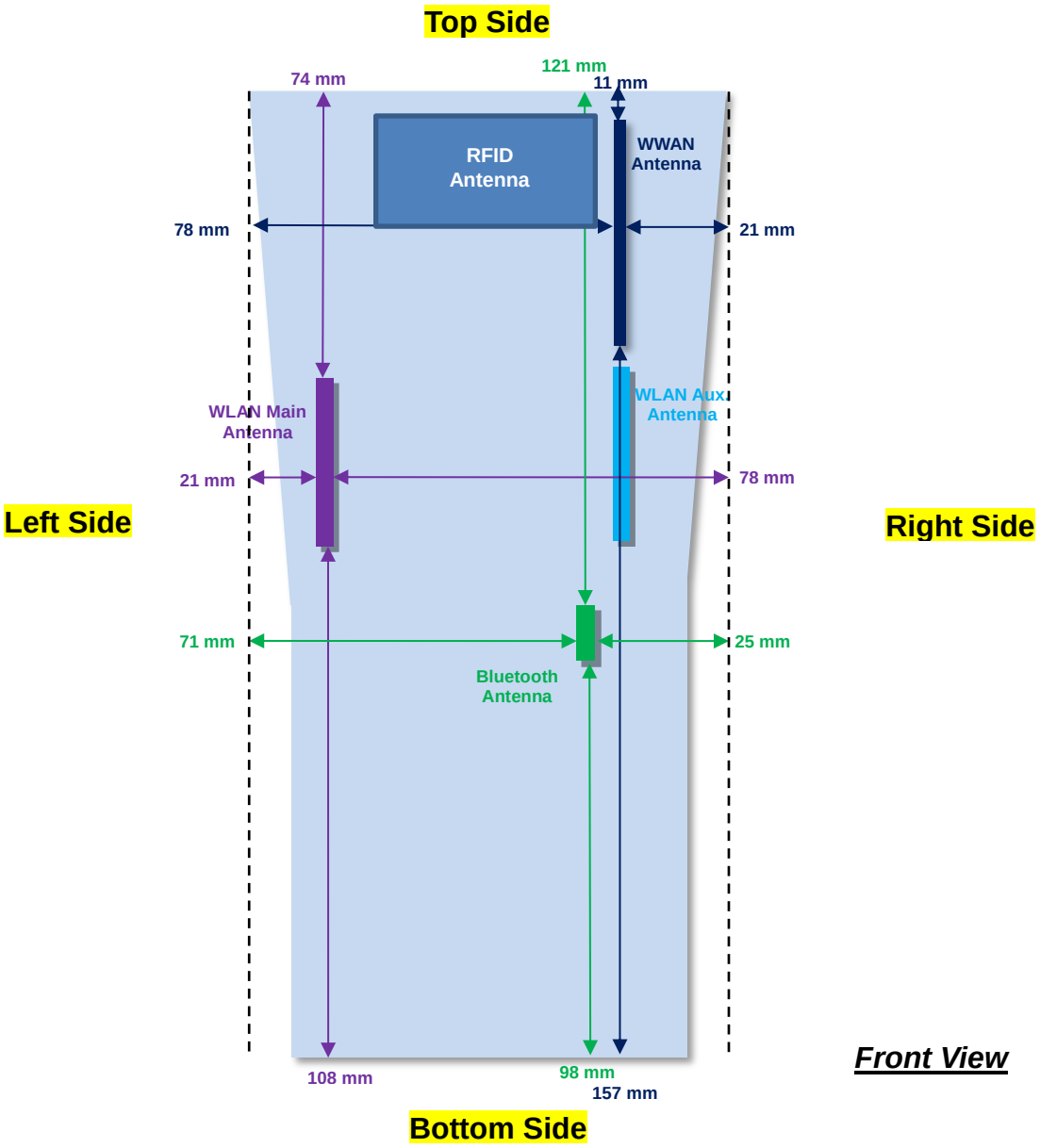
Per KDB 447498 D01v05r02, when the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion. The test exclusion threshold is 2.52 which is <= 3, SAR testing is not required.

13. Antenna Location

WA9903 RFID Antenna



WA9901 RFID Antenna



14. SAR Test Results

General Note:

1. Per KDB 447498 D01v05r02, the reported SAR is the measured SAR value adjusted for maximum tune-up tolerance.
   a. Tune-up scaling Factor = tune-up limit power (mW) / EUT RF power (mW), where tune-up limit is the maximum rated power among all production units.
   b. For SAR testing of WLAN signal with non-100% duty cycle, the measured SAR is scaled-up by the duty cycle scaling factor which is equal to "1/(duty cycle)"
   c. For WWAN / RFID: Reported SAR(W/kg)= Measured SAR(W/kg)*Tune-up Scaling Factor
   d. For WLAN: Reported SAR(W/kg)= Measured SAR(W/kg)* Duty Cycle scaling factor * Tune-up scaling factor
2. Per KDB 447498 D01v05r02, for each exposure position, 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
3. WWAN SAR spot check on each band worst case from WWAN module C2PC report number: FA3D2754, FCC ID: UZ77528PA.
4. Since WLAN 1g SAR values all were <0.4W/kg (WLAN module C2PC report number: FA3N0602, FCC ID: UZ7211486030B), and according to KDB447498 low SAR condition exemption testing, therefore WLAN SAR is not required.
5. For Extremity SAR, the highest Body SAR configuration from WLAN module C2PC report number: (FA3N0602, FCC ID: UZ7211486030B), selected for extremity SAR testing
6. Since RFID highest SAR position is the Back, therefore additional WLAN extremity SAR testing on the back perform transmit simultaneous analysis.
7. "RFID transmitter will be enabled only when the user control the keyboard, it's not expected the user's hand will contact the region above the display, therefore SAR scan of the area above the display is excluded"

14.1 Body Worn Accessory SAR

<GSM SAR>

Plot No.	Band	Mode	Test Position	Gap (cm)	Host	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	GSM850	GPRS (2 Tx slots)	Front	0.3cm	Host 1	251	848.8	33.08	33.50	1.102	0.17	0.489	0.539
01	GSM850	GPRS (2 Tx slots)	Front	0.3cm	Host 1	251	848.8	33.08	33.50	1.102	0.13	0.501	**0.552**
02	GSM1900	GPRS (2 Tx slots)	Back	1.5cm	Host 1	512	1850.2	30.40	30.50	1.002	-0.19	0.181	**0.181**
	GSM1900	GPRS (2 Tx slots)	Back	1.5cm	Host 1	512	1850.2	30.40	30.50	1.002	0.1	0.116	0.116

<WCDMA SAR>

Plot No.	Band	Mode	Test Position	Gap (cm)	Host	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	WCDMA V	RMC 12.2Kbps	Front	0.3cm	Host 1	4233	846.6	24.24	24.50	1.002	0.06	0.367	0.368
03	WCDMA V	RMC 12.2Kbps	Front	0.3cm	Host 1	4233	846.6	24.24	24.50	1.002	-0.02	0.378	**0.379**
04	WCDMA II	RMC 12.2Kbps	Back	1.5cm	Host 1	9400	1880	24.35	24.50	1.002	0	0.262	**0.263**
	WCDMA II	RMC 12.2Kbps	Back	1.5cm	Host 1	9400	1880	24.35	24.50	1.002	0.02	0.256	0.257

14.2 Extremity SAR

<RFID SAR>

Plot No.	Band	Mode	Test Position	Gap (cm)	Polarization	Host	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 10g SAR (W/kg)	Reported 10g SAR (W/kg)
	RFID 500KHz	MRM	Front	0cm	Vertical	Host 1	0	902.75	28.99	30.00	1.262	-0.02	0.066	0.083
	RFID 500KHz	MRM	Back	0cm	Vertical	Host 1	0	902.75	28.99	30.00	1.262	-0.06	1.230	1.552
	RFID 500KHz	MRM	Back	0cm	Vertical	Host 2	0	902.75	28.99	30.00	1.262	-0.01	1.310	1.653
	RFID 500KHz	MRM	Left Side	0cm	Vertical	Host 1	0	902.75	28.99	30.00	1.262	-0.04	0.532	0.671
	RFID 500KHz	MRM	Right Side	0cm	Vertical	Host 1	0	902.75	28.99	30.00	1.262	0.13	0.462	0.583
	RFID 500KHz	MRM	Front	0cm	Horizontal	Host 1	49	927.25	28.90	30.00	1.288	-0.04	0.081	0.104
	RFID 500KHz	MRM	Back	0cm	Horizontal	Host 1	49	927.25	28.90	30.00	1.288	-0.04	1.680	2.164
	RFID 500KHz	MRM	Back	0cm	Horizontal	Host 1	0	902.75	28.85	30.00	1.303	-0.16	1.790	2.333
	RFID 500KHz	MRM	Back	0cm	Horizontal	Host 1	24	914.75	28.87	30.00	1.297	-0.01	1.960	2.542
	RFID 500KHz	MRM	Back	0cm	Horizontal	Host 2	49	927.25	28.90	30.00	1.288	0.09	2.180	2.808
	RFID 500KHz	MRM	Back	0cm	Horizontal	Host 2	0	902.75	28.85	30.00	1.303	-0.18	1.860	2.424
05	RFID 500KHz	MRM	Back	0cm	Horizontal	Host 2	24	914.75	28.87	30.00	1.297	0.07	2.190	**2.841**
	RFID 500KHz	MRM	Left Side	0cm	Horizontal	Host 1	49	927.25	28.90	30.00	1.288	-0.07	0.365	0.470
	RFID 500KHz	MRM	Right Side	0cm	Horizontal	Host 1	49	927.25	28.90	30.00	1.288	-0.12	0.128	0.165
	RFID 500KHz	MRM	Front	0cm		Host 3	0	902.75	28.99	30.00	1.262	0	0.250	0.315
	RFID 500KHz	MRM	Back	0cm		Host 3	0	902.75	28.99	30.00	1.262	-0.04	0.339	0.428
	RFID 500KHz	MRM	Left Side	0cm		Host 3	0	902.75	28.99	30.00	1.262	-0.09	0.505	0.637
	RFID 500KHz	MRM	Left Side	0cm		Host 4	0	902.75	28.99	30.00	1.262	-0.03	0.422	0.532
	RFID 500KHz	MRM	Right Side	0cm		Host 3	0	902.75	28.99	30.00	1.262	-0.11	0.478	0.603

<WLAN SAR>

Plot No.	Band	Mode	Test Position	Gap (cm)	Antenna	Host	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 10g SAR (W/kg)	Reported 10g SAR (W/kg)
	WLAN 2.4GHz	802.11b 1Mbps	Back	0cm	Main	Host 1	6	2437	18.11	18.50	1.094	100	1.000	0	0.062	0.068
	WLAN 2.4GHz	802.11b 1Mbps	Left Side	0cm	Main	Host 1	6	2437	18.11	18.50	1.094	100	1.000	0.07	0.403	0.441
	WLAN 2.4GHz	802.11b 1Mbps	Left Side	0cm	Main	Host 2	6	2437	18.11	18.50	1.094	100	1.000	0.01	0.307	0.336
	WLAN 2.4GHz	802.11b 1Mbps	Back	0cm	Aux	Host 1	6	2437	17.90	18.50	1.148	100	1.000	-0.01	0.025	0.029
	WLAN 2.4GHz	802.11b 1Mbps	Right Side	0cm	Aux	Host 1	6	2437	17.90	18.50	1.148	100	1.000	-0.09	0.522	0.599
	WLAN 2.4GHz	802.11b 1Mbps	Right Side	0cm	Aux	Host 2	6	2437	17.90	18.50	1.148	100	1.000	-0.01	0.551	0.633
	WLAN 2.4GHz	802.11b 1Mbps	Back	0cm	Main	Host 3	6	2437	18.11	18.50	1.094	100	1.000	0.08	0.188	0.206
	WLAN 2.4GHz	802.11b 1Mbps	Left Side	0cm	Main	Host 3	6	2437	18.11	18.50	1.094	100	1.000	0.18	0.575	0.629
	WLAN 2.4GHz	802.11b 1Mbps	Left Side	0cm	Main	Host 4	6	2437	18.11	18.50	1.094	100	1.000	-0.1	0.565	0.618
	WLAN 2.4GHz	802.11b 1Mbps	Back	0cm	Aux	Host 3	6	2437	17.90	18.50	1.148	100	1.000	0.04	0.116	0.133
06	WLAN 2.4GHz	802.11b 1Mbps	Right Side	0cm	Aux	Host 3	6	2437	17.90	18.50	1.148	100	1.000	0.07	0.684	**0.785**
	WLAN 2.4GHz	802.11b 1Mbps	Right Side	0cm	Aux	Host 4	6	2437	17.90	18.50	1.148	100	1.000	-0.02	0.614	0.705
	WLAN 5GHz	802.11a 6Mbps	Back	0cm	Main	Host 1	56	5280	15.36	15.50	1.033	98.58	1.014	-0.09	0.014	0.015
07	WLAN 5GHz	802.11a 6Mbps	Left Side	0cm	Main	Host 1	56	5280	15.36	15.50	1.033	98.58	1.014	0.06	0.336	**0.352**
	WLAN 5GHz	802.11a 6Mbps	Left Side	0cm	Main	Host 2	56	5280	15.36	15.50	1.033	98.58	1.014	0.06	0.293	0.307
	WLAN 5GHz	802.11a 6Mbps	Back	0cm	Aux	Host 1	52	5260	15.28	15.50	1.052	97.87	1.022	-0.04	0.016	0.017
	WLAN 5GHz	802.11a 6Mbps	Right Side	0cm	Aux	Host 1	52	5260	15.28	15.50	1.052	97.87	1.022	-0.07	0.314	0.338
	WLAN 5GHz	802.11a 6Mbps	Right Side	0cm	Aux	Host 2	56	5260	15.28	15.50	1.052	97.87	1.022	-0.07	0.280	0.301
	WLAN 5GHz	802.11a 6Mbps	Back	0cm	Main	Host 3	56	5280	15.36	15.50	1.033	98.58	1.014	-0.14	0.064	0.067
	WLAN 5GHz	802.11a 6Mbps	Left Side	0cm	Main	Host 3	56	5280	15.36	15.50	1.033	98.58	1.014	0.16	0.253	0.265
	WLAN 5GHz	802.11a 6Mbps	Left Side	0cm	Main	Host 4	56	5280	15.36	15.50	1.033	98.58	1.014	-0.02	0.211	0.221
	WLAN 5GHz	802.11a 6Mbps	Back	0cm	Aux	Host 3	52	5260	15.28	15.50	1.052	97.87	1.022	-0.11	0.062	0.067
	WLAN 5GHz	802.11a 6Mbps	Right Side	0cm	Aux	Host 3	52	5260	15.28	15.50	1.052	97.87	1.022	-0.02	0.310	0.333
	WLAN 5GHz	802.11a 6Mbps	Right Side	0cm	Aux	Host 4	56	5260	15.28	15.50	1.052	97.87	1.022	-0.06	0.302	0.325

14.3 Repeated SAR Measurement

No.	Band	Mode	Test Position	Gap (cm)	Polarization	Host	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 10g SAR (W/kg)	Ratio	Reported 10g SAR (W/kg)
1st	RFID 500KHz	MRM	Back	0cm	Horizontal	Host 2	24	914.75	28.87	30.00	1.297	0.07	2.190	-	2.841
2nd	RFID 500KHz	MRM	Back	0cm	Horizontal	Host 2	24	914.75	28.87	30.00	1.297	-0.104	2.060	1.06	2.672

General Note:

1. Per KDB 865664 D01v01r03, for each frequency band, repeated 1g SAR measurement is required only when the measured 1g SAR is ≥0.8W/kg.
2. Per KDB 865664 D01v01r03, if the ratio among the 1g repeated measurement is ≤ 1.2 and the measured 1g SAR <1.45W/kg, only one repeated measurement is required.
3. Per KDB 865664 D01v01r03, if the extremity repeated SAR is necessary, the same procedures should be adapted for measurements according to extremity and occupational exposure limits by applying a factor of 2.5 for extremity exposure and a factor of 5 for occupational exposure to the corresponding SAR thresholds.
4. The ratio is the difference in percentage between original and repeated *measured SAR*.
5. All measurement SAR result is scaled-up to account for tune-up tolerance and is compliant.

15. Simultaneous Transmission Analysis

NO.	Simultaneous Transmission Configurations	Portable Device
1.	WWAN + WLAN	No
2.	WWAN + RFID	No
3.	WLAN + RFID	Yes
4.	Bluetooth + RFID	Yes

General Note:

1. The worst case WLAN and RFID reported SAR for each configuration was used for SAR summation. Therefore, the following summations represent the absolute worst cases for simultaneous transmission with WLAN and RFID.
2. EUT will choose either WLAN 2.4GHz or WLAN 5GHz according to the network signal condition; therefore, 2.4GHz WLAN and 5GHz WLAN will not operate simultaneously at any moment.
3. The Scaled SAR summation is calculated based on the same configuration and test position.
4. Per KDB 447498 D01v05r02, simultaneous transmission SAR is compliant if,
   i) Scalar SAR summation < 4.0W/kg.
   ii) SPLSR = (SAR1 + SAR2)^1.5 / (min. separation distance, mm), and the peak separation distance is determined from the square root of [(x1-x2)2 + (y1-y2)2 + (z1-z2)2], where (x1, y1, z1) and (x2, y2, z2) are the coordinates of the extrapolated peak SAR locations in the zoom scan.
   iii) If SPLSR ≤ 0.04, simultaneously transmission SAR measurement is not necessary.
   iv) Simultaneously transmission SAR measurement, and the reported multi-band SAR < 4W/kg.
5. For simultaneous transmission analysis, Bluetooth SAR is estimated per KDB 447498 D01v05r02 based on the formula below.
   i) (*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.
   ii) When the minimum separation distance is < 5mm, the distance is used 5mm to determine SAR test exclusion.
   iii) 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.

Bluetooth Max Power	Exposure Position	Extremity
	Separation Distance	0 mm
3.0 dBm	Estimated 10g SAR (W/kg)	0.034 W/kg

15.1 Extremity Conditions

Exposure Position	1	2	3	1+2 Summed SAR (W/kg)	1+3 Summed SAR (W/kg)
	RFID	WLAN	Bluetooth		
	SAR (W/kg)	SAR (W/kg)	Estimated SAR (W/kg)		
Front	0.315		0.034	**0.32**	**0.35**
Back	2.841	0.206	0.034	**3.05**	**2.88**
Left Side	0.671	0.629	0.034	**1.30**	**0.71**
Right Side	0.603	0.785	0.034	**1.39**	**0.64**

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16. Uncertainty Assessment

The component of uncertainly may generally be categorized according to the methods used to evaluate them. The evaluation of uncertainly by the statistical analysis of a series of observations is termed a Type An evaluation of uncertainty. The evaluation of uncertainty by means other than the statistical analysis of a series of observation is termed a Type B evaluation of uncertainty. Each component of uncertainty, however evaluated, is represented by an estimated standard deviation, termed standard uncertainty, which is determined by the positive square root of the estimated variance.

A Type A evaluation of standard uncertainty may be based on any valid statistical method for treating data. This includes calculating the standard deviation of the mean of a series of independent observations; using the method of least squares to fit a curve to the data in order to estimate the parameter of the curve and their standard deviations; or carrying out an analysis of variance in order to identify and quantify random effects in certain kinds of measurement.

A type B evaluation of standard uncertainty is typically based on scientific judgment using all of the relevant information available. These may include previous measurement data, experience, and knowledge of the behavior and properties of relevant materials and instruments, manufacture's specification, data provided in calibration reports and uncertainties assigned to reference data taken from handbooks. Broadly speaking, the uncertainty is either obtained from an outdoor source or obtained from an assumed distribution, such as the normal distribution, rectangular or triangular distributions indicated in table below.

Uncertainty Distributions	Normal	Rectangular	Triangular	U-Shape
Multi-plying Factor[(a)]	1/k[(b)]	1/√3	1/√6	1/√2

(a) standard uncertainty is determined as the product of the multiplying factor and the estimated range of variations in the measured quantity

(b) κ is the coverage factor

Table 16.1. Standard Uncertainty for Assumed Distribution

The combined standard uncertainty of the measurement result represents the estimated standard deviation of the result. It is obtained by combining the individual standard uncertainties of both Type A and Type B evaluation using the usual "root-sum-squares" (RSS) methods of combining standard deviations by taking the positive square root of the estimated variances.

Expanded uncertainty is a measure of uncertainty that defines an interval about the measurement result within which the measured value is confidently believed to lie. It is obtained by multiplying the combined standard uncertainty by a coverage factor. Typically, the coverage factor ranges from 2 to 3. Using a coverage factor allows the true value of a measured quantity to be specified with a defined probability within the specified uncertainty range. For purpose of this document, a coverage factor two is used, which corresponds to confidence interval of about 95 %. The DASY uncertainty Budget is shown in the following tables.

Error Description	Uncertainty Value (±%)	Probability Distribution	Divisor	Ci (1g)	Ci (10g)	Standard Uncertainty (1g)	Standard Uncertainty (10g)
Measurement System							
Probe Calibration	6.0	Normal	1	1	1	± 6.0 %	± 6.0 %
Axial Isotropy	4.7	Rectangular	√3	0.7	0.7	± 1.9 %	± 1.9 %
Hemispherical Isotropy	9.6	Rectangular	√3	0.7	0.7	± 3.9 %	± 3.9 %
Boundary Effects	1.0	Rectangular	√3	1	1	± 0.6 %	± 0.6 %
Linearity	4.7	Rectangular	√3	1	1	± 2.7 %	± 2.7 %
System Detection Limits	1.0	Rectangular	√3	1	1	± 0.6 %	± 0.6 %
Readout Electronics	0.3	Normal	1	1	1	± 0.3 %	± 0.3 %
Response Time	0.8	Rectangular	√3	1	1	± 0.5 %	± 0.5 %
Integration Time	2.6	Rectangular	√3	1	1	± 1.5 %	± 1.5 %
RF Ambient Noise	3.0	Rectangular	√3	1	1	± 1.7 %	± 1.7 %
RF Ambient Reflections	3.0	Rectangular	√3	1	1	± 1.7 %	± 1.7 %
Probe Positioner	0.4	Rectangular	√3	1	1	± 0.2 %	± 0.2 %
Probe Positioning	2.9	Rectangular	√3	1	1	± 1.7 %	± 1.7 %
Max. SAR Eval.	1.0	Rectangular	√3	1	1	± 0.6 %	± 0.6 %
Test Sample Related							
Device Positioning	2.9	Normal	1	1	1	± 2.9 %	± 2.9 %
Device Holder	3.6	Normal	1	1	1	± 3.6 %	± 3.6 %
Power Drift	5.0	Rectangular	√3	1	1	± 2.9 %	± 2.9 %
Phantom and Setup							
Phantom Uncertainty	4.0	Rectangular	√3	1	1	± 2.3 %	± 2.3 %
Liquid Conductivity (Target)	5.0	Rectangular	√3	0.64	0.43	± 1.8 %	± 1.2 %
Liquid Conductivity (Meas.)	2.5	Normal	1	0.64	0.43	± 1.6 %	± 1.1 %
Liquid Permittivity (Target)	5.0	Rectangular	√3	0.6	0.49	± 1.7 %	± 1.4 %
Liquid Permittivity (Meas.)	2.5	Normal	1	0.6	0.49	± 1.5 %	± 1.2 %
Combined Standard Uncertainty						± 11.0 %	± 10.8 %
Coverage Factor for 95 %						K=2	
Expanded Uncertainty						**± 22.0 %**	**± 21.5 %**

Table 16.2. Uncertainty Budget for frequency range 300 MHz to 3 GHz

Error Description	Uncertainty Value (±%)	Probability Distribution	Divisor	Ci (1g)	Ci (10g)	Standard Uncertainty (1g)	Standard Uncertainty (10g)
Measurement System							
Probe Calibration	6.55	Normal	1	1	1	± 6.55 %	± 6.55 %
Axial Isotropy	4.7	Rectangular	√3	0.7	0.7	± 1.9 %	± 1.9 %
Hemispherical Isotropy	9.6	Rectangular	√3	0.7	0.7	± 3.9 %	± 3.9 %
Boundary Effects	2.0	Rectangular	√3	1	1	± 1.2 %	± 1.2 %
Linearity	4.7	Rectangular	√3	1	1	± 2.7 %	± 2.7 %
System Detection Limits	1.0	Rectangular	√3	1	1	± 0.6 %	± 0.6 %
Readout Electronics	0.3	Normal	1	1	1	± 0.3 %	± 0.3 %
Response Time	0.8	Rectangular	√3	1	1	± 0.5 %	± 0.5 %
Integration Time	2.6	Rectangular	√3	1	1	± 1.5 %	± 1.5 %
RF Ambient Noise	3.0	Rectangular	√3	1	1	± 1.7 %	± 1.7 %
RF Ambient Reflections	3.0	Rectangular	√3	1	1	± 1.7 %	± 1.7 %
Probe Positioner	0.8	Rectangular	√3	1	1	± 0.5 %	± 0.5 %
Probe Positioning	9.9	Rectangular	√3	1	1	± 5.7 %	± 5.7 %
Max. SAR Eval.	4.0	Rectangular	√3	1	1	± 2.3 %	± 2.3 %
Test Sample Related							
Device Positioning	2.9	Normal	1	1	1	± 2.9 %	± 2.9 %
Device Holder	3.6	Normal	1	1	1	± 3.6 %	± 3.6 %
Power Drift	5.0	Rectangular	√3	1	1	± 2.9 %	± 2.9 %
Phantom and Setup							
Phantom Uncertainty	4.0	Rectangular	√3	1	1	± 2.3 %	± 2.3 %
Liquid Conductivity (Target)	5.0	Rectangular	√3	0.64	0.43	± 1.8 %	± 1.2 %
Liquid Conductivity (Meas.)	2.5	Normal	1	0.64	0.43	± 1.6 %	± 1.1 %
Liquid Permittivity (Target)	5.0	Rectangular	√3	0.6	0.49	± 1.7 %	± 1.4 %
Liquid Permittivity (Meas.)	2.5	Normal	1	0.6	0.49	± 1.5 %	± 1.2 %
Combined Standard Uncertainty						± 12.8 %	± 12.6 %
Coverage Factor for 95 %						K=2	
Expanded Uncertainty						**± 25.6 %**	**± 25.2 %**

Table 16.3. Uncertainty Budget for frequency range 3 GHz to 6 GHz

17. References

[1] FCC 47 CFR Part 2 “Frequency Allocations and Radio Treaty Matters; General Rules and Regulations”

[2] ANSI/IEEE Std. C95.1-1992, “IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz”, September 1992

[3] IEEE Std. 1528-2003, “Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques”, December 2003

[4] SPEAG DASY System Handbook

[5] FCC KDB 248227 D01 v01r02, “SAR Measurement Procedures for 802.11 a/b/g Transmitters”, May 2007

[6] FCC KDB 447498 D01 v05r02, “Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies”, Feb 2014

[7] FCC KDB 648474 D04 v01r02, “SAR Evaluation Considerations for Wireless Handsets”, Dec 2013.

[8] FCC KDB 941225 D01 v03, “3G SAR MEAUREMENT PROCEDURES”, Oct 2014

[9] FCC KDB 865664 D01 v01r03, "SAR Measurement Requirements for 100 MHz to 6 GHz", Feb 2014.

[10] FCC KDB 865664 D02 v01r01, “RF Exposure Compliance Reporting and Documentation Considerations” May 2013.