FCC SAR Test Report

APPLICANT	:	**Zebra Technologies Corporation**
EQUIPMENT	:	**Mobile Computer**
BRAND NAME	:	**Zebra**
MODEL NAME	:	**TC80NH**
FCC ID	:	**UZ7TC80NH**
STANDARD	:	**FCC 47 CFR Part 2 (2.1093)** **ANSI/IEEE C95.1-1992** **IEEE 1528-2013**

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

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Revision History

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA573017	Rev. 01	Initial issue of report	Nov. 06, 2015
FA573017	Rev. 02	Add Holster2 SAR testing.	Dec. 07, 2015

1. Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for Zebra Technologies Corporation, Mobile Computer, TC80NH, are as follows.

Equipment Class	Frequency Band	Highest SAR Summary
		Body (Separation 0mm) 1g SAR (W/kg)
DTS	2.4GHz WLAN	0.38
NII	5.3GHz WLAN	1.16
	5.5GHz WLAN	**1.33**
	5.8GHz WLAN	1.20
Date of Testing:		2015/9/2 ~ 2015/12/5

This device is in compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (1.6 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 1528-2013 and FCC KDB publications

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 District, Taoyuan City, Taiwan (R.O.C.) TEL: +886-3-327-3456 FAX: +886-3-328-4978

Applicant	
Company Name	Zebra Technologies Corporation
Address	1 Zebra Plaza, Holtsville, NY 11742

Manufacturer	
Company Name	Zebra Technologies Corporation
Address	1 Zebra Plaza, Holtsville, NY 11742

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 1528-2013
- FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04
- FCC KDB 865664 D02 SAR Reporting v01r02
- FCC KDB 447498 D01 General RF Exposure Guidance v06
- FCC KDB 648474 D04 SAR Evaluation Considerations for Wireless Handsets v01r03
- FCC KDB 248227 D01 802.11 Wi-Fi SAR v02r02

4. Equipment Under Test (EUT) Information

4.1 General Information

Product Feature & Specification	
Equipment Name	Mobile Computer
Brand Name	Zebra
Model Name	TC80NH
FCC ID	UZ7TC80NH
Wireless Technology and Frequency Range	WLAN 2.4GHz Band: 2412 MHz ~ 2462 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 NFC : 13.56 MHz
Mode	· 802.11a/b/g/n HT20/HT40 · Bluetooth v2.1+EDR，Bluetooth v4.0-LE · NFC:ASK
HW Version	EV2
SW Version	91-23257-K-01-36-00-E1
FW Version	FUSION_QA_1.02.0.0.030
EUT Stage	Identical Prototype

Remark:
1. This device had three samples only difference is scanner. for RF Exposure evaluation is selected “SE965” as the main testing and “SE4750SR”, “SE4750MR” is select worse case found in “SE965” perform.
2. The two kinds of holster will attached with this product, for RF exposure is selected holster1 as the main tested, the holster2 will selected worst channel found in holster1 perform.
3. The WLAN and Bluetooth share the same antenna path and cannot transmit simultaneous at the same time.

Additional Information		
Sample 1	With SE965 Scanner, SN: 151965214E3001	
Sample 2	With SE4750SR Scanner, SN: 151905214E2865	
Sample 3	With SE4750MR Scanner, SN: 151925214E2914	
AC Adapter	Brand Name	MOTOROLA
	Model Name	86-14000-249R
Battery	Brand Name	Symbol
	Model Name	82-176054-01
USB Cable	Brand Name	Zebra
	Model Name	CBL-TC8X-USBCHG-01
Presentation Soft Holster1	Brand Name	Zebra
	Model Name	SG-TC8X-PMHLST-01
Quick Draw Soft Holster2	Brand Name	Zebra
	Model Name	SG-TC8X-QDHLST-01
Headset 1	Brand Name	Zebra
	Model Name	HDST-35MM-PTVP-01
Headset 2	Brand Name	Zebra
	Model Name	RCH51

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:

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

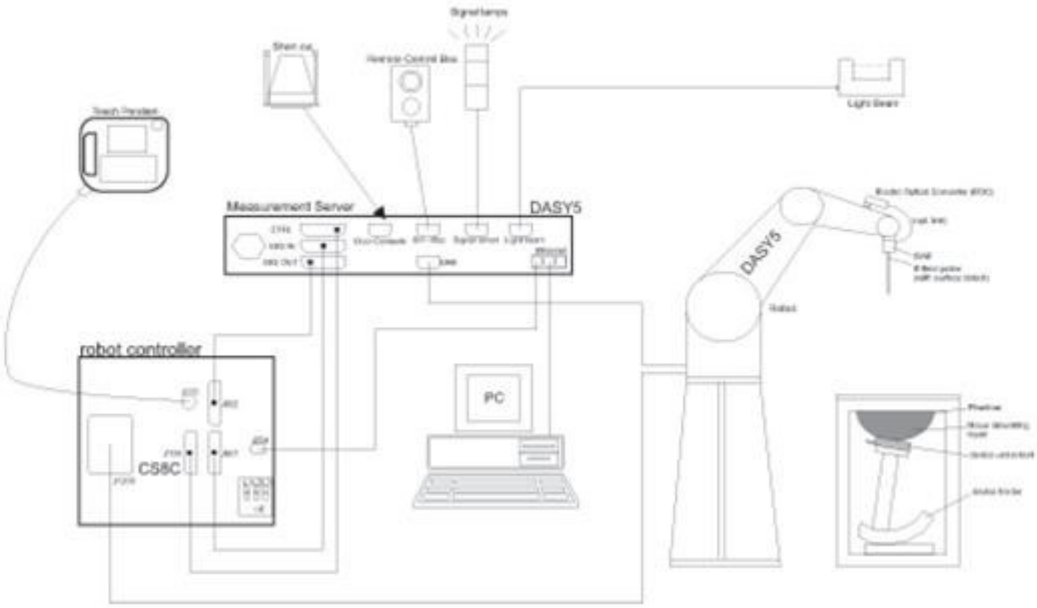
SAR is expressed in units of Watts per kilogram (W/kg)

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

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.

7.1 E-Field Probe

The SAR measurement is conducted with the dosimetric probe (manufactured by SPEAG).The probe is specially designed and calibrated for use in liquid with high permittivity. The dosimetric probe has special calibration in liquid at different frequency. This probe has a built in optical surface detection system to prevent from collision with phantom.

<ES3DV3 Probe>

Construction	Symmetric design with triangular core Interleaved sensors Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)	
Frequency	10 MHz – 4 GHz; Linearity: ±0.2 dB (30 MHz – 4 GHz)	
Directivity	±0.2 dB in TSL (rotation around probe axis) ±0.3 dB in TSL (rotation normal to probe axis)	
Dynamic Range	5 µW/g – >100 mW/g; Linearity: ±0.2 dB	
Dimensions	Overall length: 337 mm (tip: 20 mm) Tip diameter: 3.9 mm (body: 12 mm) Distance from probe tip to dipole centers: 2.0 mm	

<EX3DV4 Probe>

Construction	Symmetric design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)	
Frequency	10 MHz – >6 GHz Linearity: ±0.2 dB (30 MHz – 6 GHz)	
Directivity	±0.3 dB in TSL (rotation around probe axis) ±0.5 dB in TSL (rotation normal to probe axis)	
Dynamic Range	10 µW/g – >100 mW/g Linearity: ±0.2 dB (noise: typically <1 µW/g)	
Dimensions	Overall length: 337 mm (tip: 20 mm) Tip diameter: 2.5 mm (body: 12 mm) Typical distance from probe tip to dipole centers: 1 mm	

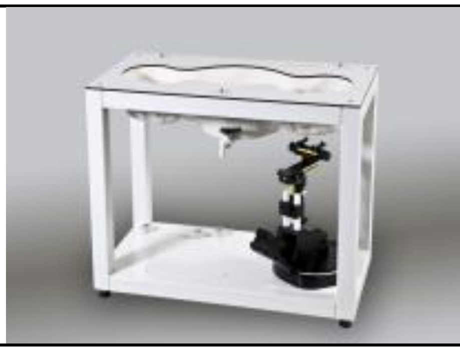
7.2 Data Acquisition Electronics (DAE)

The data acquisition electronics (DAE) consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder and control logic unit. Transmission to the measurement server is accomplished through an optical downlink for data and status information as well as an optical uplink for commands and the clock.

The input impedance of the DAE is 200 MOhm; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.

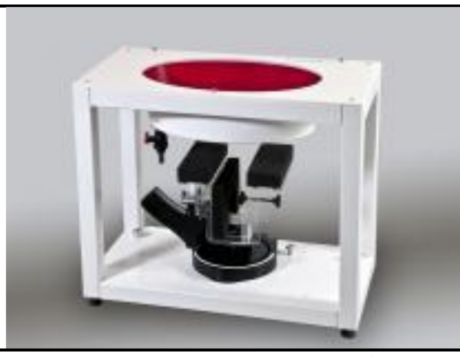
7.3 Phantom

<SAM Twin Phantom>

Shell Thickness	2 ± 0.2 mm; Center ear point: 6 ± 0.2 mm	
Filling Volume	Approx. 25 liters	
Dimensions	Length: 1000 mm; Width: 500 mm; Height: adjustable feet	
Measurement Areas	Left Hand, Right Hand, Flat Phantom	

The bottom plate contains three pair of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections. A white cover is provided to tap the phantom during off-periods to prevent water evaporation and changes in the liquid parameters. On the phantom top, three reference markers are provided to identify the phantom position with respect to the robot.

<ELI Phantom>

Shell Thickness	2 ± 0.2 mm (sagging: <1%)	
Filling Volume	Approx. 30 liters	
Dimensions	Major ellipse axis: 600 mm Minor axis: 400 mm	

The ELI phantom is intended for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI4 is fully compatible with standard and all known tissue simulating liquids.

7.4 Device Holder

<Mounting Device for Hand-Held Transmitter>

In combination with the Twin SAM V5.0/V5.0c or ELI phantoms, the Mounting Device for Hand-Held Transmitters enables rotation of the mounted transmitter device to specified spherical coordinates. At the heads, the rotation axis is at the ear opening. Transmitter devices can be easily and accurately positioned according to IEC 62209-1, IEEE 1528, FCC, or other specifications. The device holder can be locked for positioning at different phantom sections (left head, right head, flat). And upgrade kit to Mounting Device to enable easy mounting of wider devices like big smart-phones, e-books, small tablets, etc. It holds devices with width up to 140 mm.

Mounting Device for Hand-Held Transmitters

Mounting Device Adaptor for Wide-Phones

<Mounting Device for Laptops and other Body-Worn Transmitters>

The extension is lightweight and made of POM, acrylic glass and foam. It fits easily on the upper part of the mounting device in place of the phone positioned. The extension is fully compatible with the SAM Twin and ELI phantoms.

Mounting Device for Laptops

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 D01v01r04 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 D01v01r04 SAR measurement 100 MHz to 6 GHz.

<table>
<tr><th colspan="3"></th><th>$\leq$ 3 GHz</th><th>> 3 GHz</th></tr>
<tr><td colspan="3">Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}</td><td>$\leq$ 2 GHz: $\leq$ 8 mm
2 – 3 GHz: $\leq$ 5 mm*</td><td>3 – 4 GHz: $\leq$ 5 mm*
4 – 6 GHz: $\leq$ 4 mm*</td></tr>
<tr><td rowspan="3">Maximum zoom scan spatial resolution, normal to phantom surface</td><td colspan="2">uniform grid: $\Delta z_{Zoom}(n)$</td><td>$\leq$ 5 mm</td><td>3 – 4 GHz: $\leq$ 4 mm
4 – 5 GHz: $\leq$ 3 mm
5 – 6 GHz: $\leq$ 2 mm</td></tr>
<tr><td rowspan="2">graded grid</td><td>$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface</td><td>$\leq$ 4 mm</td><td>3 – 4 GHz: $\leq$ 3 mm
4 – 5 GHz: $\leq$ 2.5 mm
5 – 6 GHz: $\leq$ 2 mm</td></tr>
<tr><td>$\Delta z_{Zoom}(n>1)$: between subsequent points</td><td colspan="2">$\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$</td></tr>
<tr><td>Minimum zoom scan volume</td><td colspan="2">x, y, z</td><td>$\geq$ 30 mm</td><td>3 – 4 GHz: $\geq$ 28 mm
4 – 5 GHz: $\geq$ 25 mm
5 – 6 GHz: $\geq$ 22 mm</td></tr>
<tr><td colspan="5">Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details.
* When zoom scan is required and the <u>*reported*</u> SAR from the *area scan based 1-g SAR estimation* procedures of KDB 447498 is $\leq$ 1.4 W/kg, $\leq$ 8 mm, $\leq$ 7 mm and $\leq$ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.</td></tr>
</table>

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	2450MHz System Validation Kit	D2450V2	735	Dec. 08, 2014	Dec. 07, 2015
SPEAG	2450MHz System Validation Kit	D2450V2	736	Aug. 20, 2015	Aug. 19, 2016
SPEAG	5GHz System Validation Kit	D5GHzV2	1006	Sep. 25, 2014	Sep. 24, 2015
SPEAG	5GHz System Validation Kit	D5GHzV2	1128	Jul. 20, 2015	Jul. 19, 2016
SPEAG	Data Acquisition Electronics	DAE3	577	Oct. 06, 2014	Oct. 05, 2015
SPEAG	Data Acquisition Electronics	DAE3	577	Sep. 24, 2015	Sep. 23, 2016
SPEAG	Data Acquisition Electronics	DAE4	1279	Jul. 21, 2015	Jul. 20, 2016
SPEAG	Data Acquisition Electronics	DAE3	495	May. 22, 2015	May. 21, 2016
SPEAG	Dosimetric E-Field Probe	EX3DV4	3931	Sep. 25, 2014	Sep. 24, 2015
SPEAG	Dosimetric E-Field Probe	EX3DV4	3931	Oct. 01, 2015	Sep. 30, 2016
SPEAG	Dosimetric E-Field Probe	EX3DV4	3954	Nov. 21, 2014	Nov. 20, 2015
SPEAG	Dosimetric E-Field Probe	EX3DV4	3925	May. 27, 2015	May. 26, 2016
Wisewind	Thermometer	ETP-101	TM560	Oct. 21, 2014	Oct. 20, 2015
WonDer	Thermometer	WD-5015	TM685	Oct. 21, 2014	Oct. 20, 2015
WonDer	Thermometer	WD-5015	TM685	Oct. 16, 2015	Oct. 15, 2016
Wisewind	Thermometer	HTC-1	TM642	Oct. 21, 2014	Oct. 20, 2015
SPEAG	Device Holder	N/A	N/A	N/A	N/A
SPEAG	SAM Phantom	QD000P40CD	1795	N/A	N/A
SPEAG	SAM Phantom	QD000P40CD	1644	N/A	N/A
SPEAG	SAM Phantom	QD000P40C	TP-1446	N/A	N/A
SPEAG	SAM Phantom	QD000P40CC	TP-1303	N/A	N/A
R&S	Signal Generator	MG3710A	6201502524	May. 25, 2015	May. 24, 2016
Agilent	ENA Network Analyzer	E5071C	MY46316648	Feb. 11, 2015	Feb. 10, 2016
SPEAG	Dielectric Probe Kit	DAK-3.5	1126	Jul. 21, 2015	Jul. 20, 2016
LINE SEIKI	Digital Thermometer	LKMelectronic	DTM3000SPEZIAL	Jul. 17, 2015	Jul. 16, 2016
Anritsu	Power Meter	ML2495A	1419002	May. 13, 2015	May. 12, 2016
Anritsu	Power Sensor	MA2411B	1339124	May. 13, 2015	May. 12, 2016
Anritsu	Spectrum Analyzer	MS2830A	6201396378	Jun. 17, 2015	Jun. 16, 2016
Agilent	Dual Directional Coupler	778D	50422	Note 1	
ATM	Dual Directional Coupler	C122H-10	P610410z-02	Note 1	
Woken	Attenuator 1	WK0602-XX	N/A	Note 1	
PE	Attenuator 2	PE7005-10	N/A	Note 1	
PE	Attenuator 3	PE7005- 3	N/A	Note 1	
AR	Power Amplifier	5S1G4M2	0328767	Note 1	
Mini-Circuits	Power Amplifier	ZVE-3W	162601250	Note 1	

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>

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
2450	MSL	22.2	1.892	54.001	1.95	52.70	-2.97	2.47	±5	2015/9/2
2450	MSL	22.3	1.950	52.300	1.95	52.70	0.00	-0.76	±5	2015/12/5
5300	MSL	22.2	5.528	47.830	5.42	48.90	1.99	-2.19	±5	2015/9/2
5250	MSL	22.3	5.540	46.900	5.40	49.00	2.59	-4.29	±5	2015/12/4
5600	MSL	22.2	5.948	47.125	5.77	48.50	3.08	-2.84	±5	2015/9/3
5600	MSL	22.3	6.000	46.300	5.77	48.50	3.99	-4.54	±5	2015/12/4
5800	MSL	22.2	6.195	46.858	6.00	48.20	3.25	-2.78	±5	2015/9/4
5750	MSL	22.3	6.210	46.000	5.94	48.30	4.55	-4.76	±5	2015/12/4

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 (%)
2015/9/2	2450	MSL	250	D2450V2-735	EX3DV4 - SN3931	DAE3 Sn577	12.70	51.10	50.80	-0.59
2015/12/5	2450	MSL	250	D2450V2-736	EX3DV4 - SN3931	DAE3 Sn577	12.10	51.90	48.4	-6.74
2015/9/2	5300	MSL	100	D5GHzV2-1006-5300	EX3DV4 - SN3954	DAE4 Sn1279	7.58	80.00	75.80	-5.25
2015/12/4	5250	MSL	100	D5GHzV2-1128-5250	EX3DV4 - SN3931	DAE3 Sn577	7.83	76.20	78.3	2.76
2015/9/3	5600	MSL	100	D5GHzV2-1006-5600	EX3DV4 - SN3925	DAE3 Sn495	9.05	85.20	90.50	6.22
2015/12/4	5600	MSL	100	D5GHzV2-1128-5600	EX3DV4 - SN3931	DAE3 Sn577	8.35	79.30	83.5	5.30
2015/9/4	5800	MSL	100	D5GHzV2-1006-5800	EX3DV4 - SN3925	DAE3 Sn495	8.22	78.40	82.20	4.85
2015/12/4	5750	MSL	100	D5GHzV2-1128-5750	EX3DV4 - SN3931	DAE3 Sn577	7.91	75.90	79.1	4.22

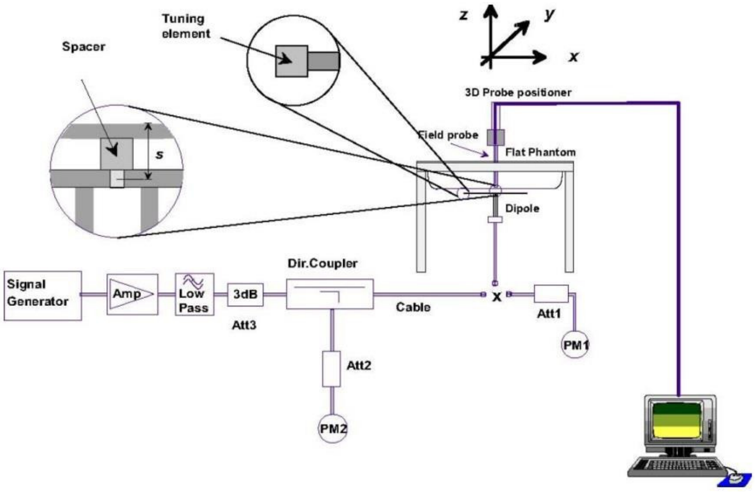


Fig 8.3.1 System Performance Check Setup

Fig 8.3.2 Setup Photo

11. Conducted RF Output Power (Unit: dBm)

<WLAN Conducted Power>

General Note:

1. Per KDB 248227 D01v02r02, SAR test reduction is determined according to 802.11 transmission mode configurations and certain exposure conditions with multiple test positions. In the 2.4 GHz band, separate SAR procedures are applied to DSSS and OFDM configurations to simplify DSSS test requirements. For OFDM, in both 2.4 and 5 GHz bands, an initial test configuration must be determined for each standalone and aggregated frequency band, according to the transmission mode configuration with the highest maximum output power specified for production units to perform SAR measurements. If the same highest maximum output power applies to different combinations of channel bandwidths, modulations and data rates, additional procedures are applied to determine which test configurations require SAR measurement. When applicable, an initial test position may be applied to reduce the number of SAR measurements required for next to the ear, UMPC mini-tablet or hotspot mode configurations with multiple test positions.
2. For 2.4 GHz 802.11b DSSS, either the initial test position procedure for multiple exposure test positions or the DSSS procedure for fixed exposure position is applied; these are mutually exclusive. For 2.4 GHz and 5 GHz OFDM configurations, the initial test configuration is applied to measure SAR using either the initial test position procedure for multiple exposure test position configurations or the initial test configuration procedures for fixed exposure test conditions. Based on the reported SAR of the measured configurations and maximum output power of the transmission mode configurations that are not included in the initial test configuration, the subsequent test configuration and initial test position procedures are applied to determine if SAR measurements are required for the remaining OFDM transmission configurations. In general, the number of test channels that require SAR measurement is minimized based on maximum output power measured for the test sample(s).
3. For OFDM transmission configurations in the 2.4 GHz and 5 GHz bands, When the same maximum power is specified for multiple transmission modes in a frequency band, the largest channel bandwidth, lowest order modulation, lowest data rate and lowest order 802.11a/g/n/ac mode is used for SAR measurement, on the highest measured output power channel for each frequency band.
4. DSSS and OFDM configurations are considered separately according to the required SAR procedures. SAR is measured in the initial test position using the 802.11 transmission mode configuration required by the DSSS procedure or initial test configuration and subsequent test configuration(s) according to the OFDM procedures.18 The initial test position procedure is described in the following:
   a. When the reported SAR of the initial test position is ≤ 0.4 W/kg, further SAR measurement is not required for the other test positions in that exposure configuration and 802.11 transmission mode combinations within the frequency band or aggregated band.
   b. When the reported SAR of the test position is > 0.4 W/kg, SAR is repeated for the 802.11 transmission mode configuration tested in the initial test position to measure the subsequent next closet/smallest test separation distance and maximum coupling test position on the highest maximum output power channel, until the report SAR is ≤ 0.8 W/kg or all required test position are tested.
   c. For all positions/configurations, when the reported SAR is > 0.8 W/kg, SAR is measured for these test positions/configurations on the subsequent next highest measured output power channel(s) until the reported SAR is ≤ 1.2 W/kg or all required channels are tested.

<2.4GHz WLAN>

	Mode	Channel	Frequency (MHz)	Data Rate	Average power (dBm)	Tune-Up Limit	Duty Cycle %
2.4GHz WLAN	802.11b	CH 1	2412	1Mbps	19.82	20.00	100.00
		CH 6	2437		19.76	20.00	
		CH 11	2462		18.73	20.00	
	802.11g	CH 1	2412	6Mbps	13.70	14.00	99.15
		CH 6	2437		18.85	19.00	
		CH 11	2462		12.86	13.00	
	802.11n-HT20	CH 1	2412	MCS0	13.73	14.00	99.10
		CH 6	2437		17.93	18.00	
		CH 11	2462		11.78	12.00	

<5GHz WLAN>

	Mode	Channel	Frequency (MHz)	Data Rate	Average power (dBm)	Tune-Up Limit	Duty Cycle %
5.2GHz WLAN	802.11a	CH 36	5180	6Mbps	16.17	17.00	99.15
		CH 40	5200		19.60	20.00	
		CH 44	5220		16.13	17.00	
		CH 48	5240		16.05	17.00	
	802.11n-HT20	CH 36	5180	MCS0	16.65	17.00	99.10
		CH 40	5200		18.66	19.00	
		CH 44	5220		16.13	17.00	
		CH 48	5240		16.29	17.00	
	802.11n-HT40	CH 38	5190	MCS0	14.80	15.00	98.79
		CH 46	5230		14.61	15.00	

	Mode	Channel	Frequency (MHz)	Data Rate	Average power (dBm)	Tune-Up Limit	Duty Cycle %
5.3GHz WLAN	802.11a	CH 52	5260	6Mbps	19.69	20.00	99.15
		CH 56	5280		19.40	20.00	
		CH 60	5300		17.51	18.00	
		CH 64	5320		17.12	18.00	
	802.11n-HT20	CH 52	5260	MCS0	18.96	19.00	99.10
		CH 56	5280		18.77	19.00	
		CH 60	5300		16.57	17.00	
		CH 64	5320		16.29	17.00	
	802.11n-HT40	CH 54	5270	MCS0	14.52	15.00	98.79
		CH 62	5310		14.57	15.00	

	Mode	Channel	Frequency (MHz)	Data Rate	Average power (dBm)	Tune-Up Limit	Duty Cycle %
5.5GHz WLAN	802.11a	CH 100	5500	6Mbps	15.16	16.00	99.15
		CH 116	5580		19.57	20.00	
		CH 124	5620		19.02	19.50	
		CH 132	5660		18.88	19.00	
		CH 140	5700		16.25	17.00	
	802.11n-HT20	CH 100	5500	MCS0	15.26	16.00	99.10
		CH 116	5580		18.75	19.00	
		CH 124	5620		18.62	19.00	
		CH 132	5660		18.63	19.00	
		CH 140	5700		16.29	17.00	
	802.11n-HT40	CH 102	5510	MCS0	12.67	13.00	98.79
		CH 110	5550		14.76	15.00	
		CH 126	5630		14.59	15.00	
		CH 134	5670		14.69	15.00	

	Mode	Channel	Frequency (MHz)	Data Rate	Average power (dBm)	Tune-Up Limit	Duty Cycle %
5.8GHz WLAN	802.11a	CH 149	5745	MCS0	16.16	17.00	99.15
		CH 157	5785		18.95	19.00	
		CH 165	5825		17.66	18.00	
	802.11n-HT20	CH 149	5745	MCS0	16.29	17.00	99.10
		CH 157	5785		17.88	18.00	
		CH 165	5825		17.65	18.00	
	802.11n-HT40	CH 151	5755	MCS0	14.61	15.00	98.79
		CH 159	5795		14.59	15.00	

12. Bluetooth Exclusions Applied

Mode Band	Average power(dBm)	
	Bluetooth v2.1+EDR	Bluetooth v4.0+LE
2.4GHz Bluetooth	3.0	3.0

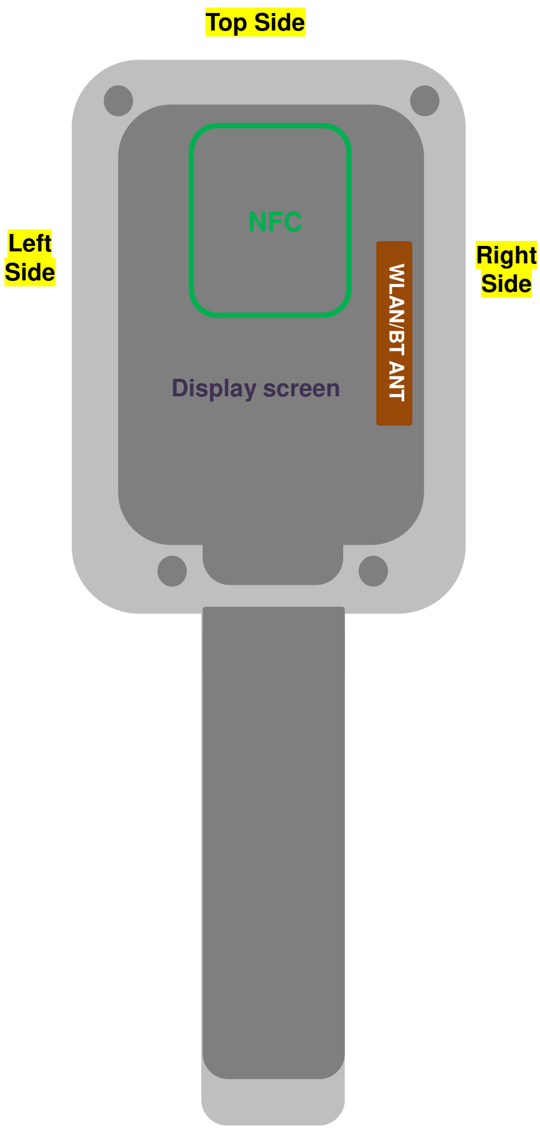
Note:

1. Per KDB 447498 D01v06, 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 D01v06, 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 0.63 which is <= 3, SAR testing is not required.

13. Antenna Location



Front View

14. SAR Test Results

General Note:

1. Per KDB 447498 D01v06, 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 WLAN: Reported SAR(W/kg)= Measured SAR(W/kg)* Duty Cycle scaling factor * Tune-up scaling factor
2. Per KDB 447498 D01v06, 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. This device had three samples only difference is scanner. for RF Exposure evaluation is selected “SE965” as the main testing and “SE4750SR”, “SE4750MR” is select worse case found in “SE965” perform.
4. The two kinds of holster will attached with this product, for RF exposure is selected holster1 as the main tested, the holster2 will selected worst channel found in holster1 perform.
5. Per KDB 648474 D04v01r03, for additional headset or scanner, need repeat SAR testing at the worst position, for each wireless mode and each band.
6. Per KDB 248227 D01v02r02, for 2.4GHz 802.11g/n SAR testing is not required when the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg.
7. Per KDB 248227 D01v02r02, for U-NII-1 Body SAR testing is not required when the U-NII-2A band highest reported SAR for a test configuration is ≤ 1.2 W/kg, SAR is not required for U-NII-1 band.
8. When the reported SAR of the test position is > 0.4 W/kg, SAR is repeated for the 802.11 transmission mode configuration tested in the initial test position to measure the subsequent next closet/smallest test separation distance and maximum coupling test position on the highest maximum output power channel, until the report SAR is ≤ 0.8 W/kg or all required test position are tested.
9. For all positions / configurations, when the reported SAR is > 0.8 W/kg, SAR is measured for these test positions / configurations on the subsequent next highest measured output power channel(s) until the reported SAR is ≤ 1.2 W/kg or all required channels are tested.
10. Pre KDB648474 D04v01r03, when the reported SAR for a body-worn accessory, measured without a headset connected to the handset, is > 1.2 W/kg, the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body-worn accessory with a headset attached to the handset.
11. The WLAN and Bluetooth share the same antenna path and cannot transmit simultaneous at the same time.
12. During SAR testing the WLAN transmission was verified using a spectrum analyzer.

14.1 Body-worn SAR

<WLAN SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	With Holster	Scanner	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	WLAN2.4GHz	802.11b 1Mbps	Front	0mm	Holster1	SE965	1	2412	19.82	20.00	1.042	100	1.000	0.03	0.020	0.021
	WLAN2.4GHz	802.11b 1Mbps	Back	0mm	Holster1	SE965	1	2412	19.82	20.00	1.042	100	1.000	0.05	0.062	0.065
	WLAN2.4GHz	802.11b 1Mbps	Left Side	0mm	Holster1	SE965	1	2412	19.82	20.00	1.042	100	1.000	-0.15	0.034	0.035
	WLAN2.4GHz	802.11b 1Mbps	Right Side	0mm	Holster1	SE965	1	2412	19.82	20.00	1.042	100	1.000	-0.06	0.221	0.230
	WLAN2.4GHz	802.11b 1Mbps	Right Side	0mm	Holster1	SE965	6	2437	19.76	20.00	1.057	100	1.000	-0.11	0.213	0.225
	WLAN2.4GHz	802.11b 1Mbps	Right Side	0mm	Holster1	SE965	11	2462	18.73	20.00	1.340	100	1.000	-0.13	0.163	0.218
01	WLAN2.4GHz	802.11b 1Mbps	Right Side	0mm	Holster1	SE4750SR	1	2412	19.82	20.00	1.042	100	1.000	-0.05	0.367	0.383
	WLAN2.4GHz	802.11b 1Mbps	Right Side	0mm	Holster1	SE4750MR	1	2412	19.82	20.00	1.042	100	1.000	0.16	0.254	0.265
	WLAN2.4GHz	802.11b 1Mbps	Left Side	0mm	Holster2	SE965	1	2412	19.82	20.00	1.042	100	1.000	0.008	0.044	0.046
	WLAN2.4GHz	802.11b 1Mbps	Right Side	0mm	Holster2	SE965	1	2412	19.82	20.00	1.042	100	1.000	-0.067	0.196	0.204
	WLAN2.4GHz	802.11b 1Mbps	Right Side	0mm	Holster2	SE4750SR	1	2412	19.82	20.00	1.042	100	1.000	-0.002	0.379	0.395
	WLAN2.4GHz	802.11b 1Mbps	Right Side	0mm	Holster2	SE4750MR	1	2412	19.82	20.00	1.042	100	1.000	0.053	0.212	0.221
	WLAN5GHz	802.11a 6Mbps	Front	0mm	Holster1	SE965	52	5260	19.69	20.00	1.074	99.15	1.009	0.14	0.013	0.014
	WLAN5GHz	802.11a 6Mbps	Back	0mm	Holster1	SE965	52	5260	19.69	20.00	1.074	99.15	1.009	-0.13	0.322	0.349
	WLAN5GHz	802.11a 6Mbps	Left Side	0mm	Holster1	SE965	52	5260	19.69	20.00	1.074	99.15	1.009	-0.14	0.040	0.043
02	WLAN5GHz	802.11a 6Mbps	Right Side	0mm	Holster1	SE965	52	5260	19.69	20.00	1.074	99.15	1.009	-0.13	1.070	1.160
	WLAN5GHz	802.11a 6Mbps	Right Side	0mm	Holster1	SE965	56	5280	19.40	20.00	1.148	99.15	1.009	0.06	0.981	1.136
	WLAN5GHz	802.11a 6Mbps	Right Side	0mm	Holster1	SE965	60	5300	17.51	18.00	1.119	99.15	1.009	0.06	0.557	0.629
	WLAN5GHz	802.11a 6Mbps	Right Side	0mm	Holster1	SE4750SR	52	5260	19.69	20.00	1.074	99.15	1.009	-0.19	0.768	0.832
	WLAN5GHz	802.11a 6Mbps	Right Side	0mm	Holster1	SE4750MR	52	5260	19.69	20.00	1.074	99.15	1.009	-0.1	0.954	1.034
	WLAN5GHz	802.11a 6Mbps	Left Side	0mm	Holster2	SE965	52	5260	19.69	20.00	1.074	99.15	1.009	0.01	0.017	0.018
	WLAN5GHz	802.11a 6Mbps	Right Side	0mm	Holster2	SE965	52	5260	19.69	20.00	1.074	99.15	1.009	0.008	0.589	0.638
	WLAN5GHz	802.11a 6Mbps	Right Side	0mm	Holster2	SE4750SR	52	5260	19.69	20.00	1.074	99.15	1.009	0.048	0.621	0.673
	WLAN5GHz	802.11a 6Mbps	Right Side	0mm	Holster2	SE4750MR	52	5260	19.69	20.00	1.074	99.15	1.009	-0.002	0.672	0.728

Plot No.	Band	Mode	Test Position	Gap (mm)	With Holster	Headset	Scanner	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	WLAN5GHz	802.11a 6Mbps	Front	0mm	Holster1		SE965	116	5580	19.57	20.00	1.104	99.15	1.009	0.16	0.013	0.014
	WLAN5GHz	802.11a 6Mbps	Back	0mm	Holster1		SE965	116	5580	19.57	20.00	1.104	99.15	1.009	-0.05	0.317	0.353
	WLAN5GHz	802.11a 6Mbps	Left Side	0mm	Holster1		SE965	116	5580	19.57	20.00	1.104	99.15	1.009	-0.02	0.018	0.020
03	WLAN5GHz	802.11a 6Mbps	Right Side	0mm	Holster1		SE965	116	5580	19.57	20.00	1.104	99.15	1.009	-0.06	1.190	1.326
	WLAN5GHz	802.11a 6Mbps	Right Side	0mm	Holster1		SE965	124	5620	19.02	19.50	1.117	99.15	1.009	-0.01	1.080	1.217
	WLAN5GHz	802.11a 6Mbps	Right Side	0mm	Holster1		SE965	132	5660	18.88	19.00	1.028	99.15	1.009	-0.02	1.050	1.089
	WLAN5GHz	802.11a 6Mbps	Right Side	0mm	Holster1		SE965	140	5700	16.25	17.00	1.189	99.15	1.009	-0.08	0.394	0.472
	WLAN5GHz	802.11a 6Mbps	Right Side	0mm	Holster1		SE965	100	5500	15.16	16.00	1.213	99.15	1.009	0.09	0.347	0.425
	WLAN5GHz	802.11a 6Mbps	Right Side	0mm	Holster1		SE4750SR	116	5580	19.57	20.00	1.104	99.15	1.009	0.13	1.090	1.214
	WLAN5GHz	802.11a 6Mbps	Right Side	0mm	Holster1		SE4750MR	116	5580	19.57	20.00	1.104	99.15	1.009	-0.05	1.080	1.203
	WLAN5GHz	802.11a 6Mbps	Right Side	0mm	Holster1	Headset 1	SE965	116	5580	19.57	20.00	1.104	99.15	1.009	-0.04	1.020	1.136
	WLAN5GHz	802.11a 6Mbps	Right Side	0mm	Holster1	Headset 2	SE965	116	5580	19.57	20.00	1.104	99.15	1.009	-0.03	0.997	1.111
	WLAN5GHz	802.11a 6Mbps	Left Side	0mm	Holster2		SE965	116	5580	19.57	20.00	1.104	99.15	1.009	0.16	0.011	0.012
	WLAN5GHz	802.11a 6Mbps	Right Side	0mm	Holster2		SE965	116	5580	19.57	20.00	1.104	99.15	1.009	0.059	0.931	1.037
	WLAN5GHz	802.11a 6Mbps	Right Side	0mm	Holster2		SE4750SR	116	5580	19.57	20.00	1.104	99.15	1.009	-0.05	0.940	1.047
	WLAN5GHz	802.11a 6Mbps	Right Side	0mm	Holster2		SE4750MR	116	5580	19.57	20.00	1.104	99.15	1.009	0.107	0.853	0.950

Plot No.	Band	Mode	Test Position	Gap (mm)	With Holster	Scanner	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	WLAN5GHz	802.11a 6Mbps	Front	0mm	Holster1	SE965	157	5785	18.95	19.00	1.012	99.15	1.009	-0.13	0.012	0.012
	WLAN5GHz	802.11a 6Mbps	Back	0mm	Holster1	SE965	157	5785	18.95	19.00	1.012	99.15	1.009	-0.1	0.199	0.203
	WLAN5GHz	802.11a 6Mbps	Left Side	0mm	Holster1	SE965	157	5785	18.95	19.00	1.012	99.15	1.009	-0.13	0.012	0.012
	WLAN5GHz	802.11a 6Mbps	Right Side	0mm	Holster1	SE965	157	5785	18.95	19.00	1.012	99.15	1.009	-0.06	1.040	1.062
	WLAN5GHz	802.11a 6Mbps	Right Side	0mm	Holster1	SE965	165	5825	17.66	18.00	1.082	99.15	1.009	0.02	0.749	0.818
	WLAN5GHz	802.11a 6Mbps	Right Side	0mm	Holster1	SE965	149	5745	16.16	17.00	1.214	99.15	1.009	0.04	0.488	0.598
	WLAN5GHz	802.11a 6Mbps	Right Side	0mm	Holster1	SE4750SR	157	5785	18.95	19.00	1.012	99.15	1.009	0.1	1.070	1.093
04	WLAN5GHz	802.11a 6Mbps	Right Side	0mm	Holster1	SE4750MR	157	5785	18.95	19.00	1.012	99.15	1.009	0.12	1.170	1.195
	WLAN5GHz	802.11a 6Mbps	Left Side	0mm	Holster2	SE965	157	5785	18.95	19.00	1.012	99.15	1.009	0.156	0.009	0.009
	WLAN5GHz	802.11a 6Mbps	Right Side	0mm	Holster2	SE965	157	5785	18.95	19.00	1.012	99.15	1.009	0.081	0.378	0.386
	WLAN5GHz	802.11a 6Mbps	Right Side	0mm	Holster2	SE4750SR	157	5785	18.95	19.00	1.012	99.15	1.009	0.045	0.466	0.476
	WLAN5GHz	802.11a 6Mbps	Right Side	0mm	Holster2	SE4750MR	157	5785	18.95	19.00	1.012	99.15	1.009	0.01	0.460	0.470

14.2 Repeated SAR Measurement

No.	Band	Mode	Test Position	Gap (mm)	With Holster	Scanner	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Ratio	Reported 1g SAR (W/kg)
1st	WLAN5GHz	802.11a 6Mbps	Right Side	0mm	Holster1	SE965	52	5260	19.69	20.00	1.074	99.15	1.009	-0.13	1.070	-	1.160
2nd	WLAN5GHz	802.11a 6Mbps	Right Side	0mm	Holster1	SE965	52	5260	19.69	20.00	1.074	99.15	1.009	-0.07	1.010	1.06	1.094
1st	WLAN5GHz	802.11a 6Mbps	Right Side	0mm	Holster1	SE965	116	5580	19.57	20.00	1.104	99.15	1.009	-0.06	1.190	-	1.326
2nd	WLAN5GHz	802.11a 6Mbps	Right Side	0mm	Holster1	SE965	116	5580	19.57	20.00	1.104	99.15	1.009	-0.04	1.110	1.07	1.237
1st	WLAN5GHz	802.11a 6Mbps	Right Side	0mm	Holster1	SE4750MR	157	5785	18.95	19.00	1.012	99.15	1.009	0.12	1.170	-	1.195
2nd	WLAN5GHz	802.11a 6Mbps	Right Side	0mm	Holster1	SE4750MR	157	5785	18.95	19.00	1.012	99.15	1.009	0.02	1.120	1.04	1.144

General Note:

1. Per KDB 865664 D01v01r04, for each frequency band, repeated SAR measurement is required only when the measured SAR is ≥0.8W/kg.
2. Per KDB 865664 D01v01r04, if the ratio among the repeated measurement is ≤ 1.2 and the measured SAR <1.45W/kg, only one repeated measurement is required.
3. The ratio is the difference in percentage between original and repeated *measured SAR*.
4. All measurement SAR result is scaled-up to account for tune-up tolerance and is compliant.

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15. 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]	$1/k^{(b)}$	$1/\sqrt{3}$	$1/\sqrt{6}$	$1/\sqrt{2}$

(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 15.1. 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	Divisor	(Ci) 1g	(Ci) 10g	Standard Uncertainty (1g) (±%)	Standard Uncertainty (10g) (±%)
Measurement System							
Probe Calibration	6.0	N	1	1	1	6.0	6.0
Axial Isotropy	4.7	R	1.732	0.7	0.7	1.9	1.9
Hemispherical Isotropy	9.6	R	1.732	0.7	0.7	3.9	3.9
Boundary Effects	1.0	R	1.732	1	1	0.6	0.6
Linearity	4.7	R	1.732	1	1	2.7	2.7
System Detection Limits	1.0	R	1.732	1	1	0.6	0.6
Modulation Response	3.2	R	1.732	1	1	1.8	1.8
Readout Electronics	0.3	N	1	1	1	0.3	0.3
Response Time	0.0	R	1.732	1	1	0.0	0.0
Integration Time	2.6	R	1.732	1	1	1.5	1.5
RF Ambient Noise	3.0	R	1.732	1	1	1.7	1.7
RF Ambient Reflections	3.0	R	1.732	1	1	1.7	1.7
Probe Positioner	0.4	R	1.732	1	1	0.2	0.2
Probe Positioning	2.9	R	1.732	1	1	1.7	1.7
Max. SAR Eval.	2.0	R	1.732	1	1	1.2	1.2
Test Sample Related							
Device Positioning	3.0	N	1	1	1	3.0	3.0
Device Holder	3.6	N	1	1	1	3.6	3.6
Power Drift	5.0	R	1.732	1	1	2.9	2.9
Power Scaling	0.0	R	1.732	1	1	0.0	0.0
Phantom and Setup							
Phantom Uncertainty	6.1	R	1.732	1	1	3.5	3.5
SAR correction	0.0	R	1.732	1	0.84	0.0	0.0
Liquid Conductivity Repeatability	0.2	N	1	0.78	0.71	0.1	0.1
Liquid Conductivity (target)	5.0	R	1.732	0.78	0.71	2.3	2.0
Liquid Conductivity (mea.)	2.5	R	1.732	0.78	0.71	1.1	1.0
Temp. unc. - Conductivity	3.4	R	1.732	0.78	0.71	1.5	1.4
Liquid Permittivity Repeatability	0.15	N	1	0.23	0.26	0.0	0.0
Liquid Permittivity (target)	5.0	R	1.732	0.23	0.26	0.7	0.8
Liquid Permittivity (mea.)	2.5	R	1.732	0.23	0.26	0.3	0.4
Temp. unc. - Permittivity	0.83	R	1.732	0.23	0.26	0.1	0.1
Combined Std. Uncertainty						11.4%	11.4%
Coverage Factor for 95 %						K=2	K=2
Expanded STD Uncertainty						22.9%	22.7%

Table 15.2. Uncertainty Budget for frequency range 300 MHz to 3 GHz

Error Description	Uncertainty Value (±%)	Probability	Divisor	(Ci) 1g	(Ci) 10g	Standard Uncertainty (1g) (±%)	Standard Uncertainty (10g) (±%)
Measurement System							
Probe Calibration	6.55	N	1	1	1	6.6	6.6
Axial Isotropy	4.7	R	1.732	0.7	0.7	1.9	1.9
Hemispherical Isotropy	9.6	R	1.732	0.7	0.7	3.9	3.9
Boundary Effects	2.0	R	1.732	1	1	1.2	1.2
Linearity	4.7	R	1.732	1	1	2.7	2.7
System Detection Limits	1.0	R	1.732	1	1	0.6	0.6
Modulation Response	3.2	R	1.732	1	1	1.8	1.8
Readout Electronics	0.3	N	1	1	1	0.3	0.3
Response Time	0.0	R	1.732	1	1	0.0	0.0
Integration Time	2.6	R	1.732	1	1	1.5	1.5
RF Ambient Noise	3.0	R	1.732	1	1	1.7	1.7
RF Ambient Reflections	3.0	R	1.732	1	1	1.7	1.7
Probe Positioner	0.4	R	1.732	1	1	0.2	0.2
Probe Positioning	6.7	R	1.732	1	1	3.9	3.9
Max. SAR Eval.	4.0	R	1.732	1	1	2.3	2.3
Test Sample Related							
Device Positioning	3.0	N	1	1	1	3.0	3.0
Device Holder	3.6	N	1	1	1	3.6	3.6
Power Drift	5.0	R	1.732	1	1	2.9	2.9
Power Scaling	0.0	R	1.732	1	1	0.0	0.0
Phantom and Setup							
Phantom Uncertainty	6.6	R	1.732	1	1	3.8	3.8
SAR correction	0.0	R	1.732	1	0.84	0.0	0.0
Liquid Conductivity Repeatability	0.2	N	1	0.78	0.71	0.1	0.1
Liquid Conductivity (target)	5.0	R	1.732	0.78	0.71	2.3	2.0
Liquid Conductivity (mea.)	2.5	R	1.732	0.78	0.71	1.1	1.0
Temp. unc. - Conductivity	3.4	R	1.732	0.78	0.71	1.5	1.4
Liquid Permittivity Repeatability	0.15	N	1	0.23	0.26	0.0	0.0
Liquid Permittivity (target)	5.0	R	1.732	0.23	0.26	0.7	0.8
Liquid Permittivity (mea.)	2.5	R	1.732	0.23	0.26	0.3	0.4
Temp. unc. - Permittivity	0.83	R	1.732	0.23	0.26	0.1	0.1
Combined Std. Uncertainty						12.5%	12.5%
Coverage Factor for 95 %						K=2	K=2
Expanded STD Uncertainty						25.0%	24.9%

Table 15.3. Uncertainty Budget for frequency range 3 GHz to 6 GHz

16. 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. 1528-2013, “IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques”, Sep 2013

[4] SPEAG DASY System Handbook

[5] FCC KDB 248227 D01 v02r02, “SAR Guidance for IEEE 802.11 (WiFi) Transmitters”, Oct 2015.

[6] FCC KDB 447498 D01 v06, “Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies”, Oct 2015

[7] FCC KDB 648474 D04 v01r03, “SAR Evaluation Considerations for Wireless Handsets”, Oct 2015.

[8] FCC KDB 865664 D01 v01r04, "SAR Measurement Requirements for 100 MHz to 6 GHz", Aug 2015.

[9] FCC KDB 865664 D02 v01r02, “RF Exposure Compliance Reporting and Documentation Considerations” Oct 2015.