SAR TEST REPORT

for

MODEL NO. 1713

FCC ID: C3K1713

Test Report No. S-TR30-FCCSAR-3
Issue Date: 07/20/2015

FCC CFR 47 PART 2.1093
IEEE 1528- 2003

Prepared by
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TESTING CERT #3472.01

Report V2.0

Record of Revisions

Revision	Date	Section	Page(s)	Summary of Changes	Author/Revised By:
1.0	06/26/2015	All	All	First Version	Zack Gray
2.0	07/15/2015	All	All	Removed IC References	Zack Gray
		4.4	8	Added USB test cable length	
		8,9	12, 14	Justification on USB Cable length.	
3.0	07/20/2015	All	All	Replaced IEEE 1528-2013 with IEEE 1528-2003	Zack Gray

Microsoft

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Test Report Attestation

Microsoft Corporation
Model: 1713

Applicable Standards

Specification	Test Result
FCC CFR 47 PART 2.1093 IEEE 1528-2003	Pass

Microsoft EMC Laboratory attests that the product model identified in this report has been tested to and meets the requirements identified in the above standards. The test results in this report solely pertains to the specific sample tested, under the conditions and operating modes as provided by the customer.

This report shall not be used to claim product certification, approval, or endorsement by A2LA or any agency of any Government. Reproduction, duplication or publication of extracts from this test report is prohibited and requires prior written approval of Microsoft EMC Laboratory.

This test report replaces the previously issued report # S-TR30-FCCSAR-2 issued on 07/15/2015.

Written By: Zack Gray
SAR Test Lead

Reviewed/ Issued By: Sajay Jose
EMC/RF Compliance Lab Manager

1 Deviations from Standard

None.

2 Facilities and Accreditation

2.1 TEST FACILITY

All test facilities used to collect the test data are located at Microsoft EMC Laboratory: 17760 NE 67th Ct, Redmond, WA, 98052, USA.

2.2 ACCREDITATIONS

The lab is established and follows procedures as outlined in IEC/ISO 17025 and A2LA accreditation requirements.

A2LA Accredited Testing Certificate Number: 3472.01
Expiration Date: Aug 31, 2015

2.3 Test Equipment

The site and related equipment are constructed in conformance with the requirements of IEEE 1528-2003 and other equivalent applicable standards. The calibrations of the measuring instruments, including any accessories that may affect such calibration, are checked frequently to assure their accuracy. Adjustments are made and correction factors applied in accordance with instructions contained in the user manual for the measuring equipment.

3 Product Description

Company Name:	Microsoft Corporation
Address:	One Microsoft Way
City, State, Zip:	Redmond, WA 98052
Customer Contact:	Kitty Tam
Functional Description of EUT:	USB radio dongle for PC's
RF Exposure Conditions:	Body Exposure (General Population / Uncontrolled)
Model:	1713
Equipment Design State:	EV
Equipment Condition:	Good
Radio Information:	WLAN 2.4 GHz: 802.11g, 802.11n WLAN 5 GHz: 802.11a, 802.11n
Frequency of Operation:	WLAN: 2412 MHz – 2462 MHz 5150 MHz – 5250 MHz 5725 MHz – 5850 MHz (only Channel 5745MHz, 5765MHz, 5785MHz, 5805 MHz are used)
Modulations supported:	WLAN: BPSK, QPSK, 16-QAM, 64-QAM
Antenna Information:	2.4 GHz: 5.3 dBi 5 GHz: 4 dBi
Dates of Testing:	05/14/2015 – 05/27/2015

3.1 TEST CONFIGURATIONS

Radiated and Conducted measurements were performed with customer-provided test software MTK PC Based QA Tool V1.8 to program the EUT in continuous transmit mode.

3.2 ENVIRONMENTAL CONDITIONS

Ambient air temperature of the test site was within the range of 18 ºC to 25 ºC. Testing conditions were within tolerance and any deviations required from the EUT are reported.

3.3 EQUIPMENT MODIFICATIONS

No modifications were made during testing.

3.4 EQUIPMENT UNDER TEST

Description	Model Number	Serial Number
USB Dongle	1713	EV1-4-000667
USB Cable (39” length)	1713	X908728-001

3.4.1 Accessory Test Equipment

Description	Model Number	Serial Number
Lenovo Laptop PC	T410i	R8-F2M63 11/02
Lenovo Laptop PC	X1 Carbon	R9-0ARNB3 14/10

3.5 Supported Air Interfaces and Transmission Configurations

The EUT has three antennas which support the following air interfaces and transmission configurations. The antennas can only all transmit at the same time.

3.5.1 Supported Air Interfaces

Band	Air Interface	BW (MHz)		
		20	40	80
WLAN 2.4 GHz	802.11g	X		
	802.11n	X		
WLAN 5 GHz	802.11a	X		
	802.11n	X		

3.5.2 Transmission Configurations

Default Antenna
WLAN 2.4 GHz
WLAN 5 GHz

4 Highest Reported SAR Values

Exposure Condition	Equipment Class	Mode of Operation	Test Position	1-g Reported SAR (W/kg)
Body Exposure	DTS	802.11a	Horizontal Down 5mm	0.184
	NII	802.11a	Vertical Back 5mm	0.386

Reported SAR Values are obtained by scaling the measured SAR values up to the maximum allowable output power for each configuration using the following equation:

$$SAR = MEASURED * 10^{\frac{(PMAX-P)}{10}}$$

where

SAR = Reported SAR (W/kg)
MEASURED = Measured SAR (W/kg)
PMAX = Maximum Conducted Average Output Power (dBm)
P = Measured Conducted Average Output Power (dBm)

4.1 SAR Limits

The following are the relevant SAR limits for FCC and IC based on the recommendations of ANSI C95.1-1999:

Exposure Condition	Limit (W/kg)
Localized Body SAR	1.6 (1-g cube)

5 Test Equipment List

Manufacturer	Description	Model #	Serial /#	Cal. Due	Cal. Cycle
Agilent	Signal Generator	N5181A	MY50144791	12/18/2015	1 yr
PRANA	Power Amplifier + Directional Coupler	TU16	1305-1352	N/A	N/A
PRANA	Power Amplifier + Directional Coupler	UX15	1305-1355	N/A	N/A
Agilent	Power Meter	1914A	MY50901710	12/17/2015	1 yr
Agilent	Power Sensor	9304A	MY53040024	12/24/2015	1 yr
Agilent	Power Sensor	9304A	MY53040018	12/24/2015	1 yr
Agilent	Network Analyzer	E5071C	MY46316847	12/18/2015	1 yr
Agilent	Dielectric Probe Kit	85070E	MY44300740	N/A	N/A
SPEAG	DASY Data Acquisition Electronics	DAE4	1383	7/11/2015	1 yr
SPEAG	Dosimetric E-Field Probe	EX3DV4	3939	7/17/2015	1 yr
SPEAG	SAR Validation Dipole, 2450 MHz	D2450V2	916	07/16/2015	1 yr
SPEAG	SAR Validation Dipole, 5 GHz	D5GHzV2	1158	07/15/2015	1 yr
SPEAG	Elliptical Phantom	ELI V5.0	1217	N/A	N/A
SPEAG	Elliptical Phantom	ELI V5.0	1218	N/A	N/A
Thomas Scientific	Mini Thermometer	9327K19	130477954	09/08/2015	1 yr
MADGE TECH	Temperature, Humidity & Pressure Recorder	PRHTemp2000	P18058	11/12/2015	1 yr

6 Test Methodology

Test setup and procedure according to **IEEE 1528-2003 Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communication Devices: Measurement Techniques.**

In addition, the following publications were used as guidance.

For FCC testing and reporting, the following KDBs were adhered to:

- 447498 D01 General RF Exposure Guidance v05r02
- 865664 D01 SAR Measurements Requirements for 100 MHz to 6 GHz v01r03
- 865664 D02 RF Exposure Reporting v01r01
- 447498 D02 SAR Measurement Procedures for USB Dongle Transmitters v02
- 248227 D01 SAR Guidance for IEEE 802.11(Wi-Fi) Transmitters v02

7 Conducted RF Average Output Power Measurements

Bluetooth and WLAN output power measurements are made with the DUT connected to the power sensor of a broadband power meter.

*Power measurements were made with the DUT connected both directly to the USB port of a laptop and connected to the USB test cable. No discernible differences were seen in the power measurements of the two setups.

7.1 Initial Test Configuration Channel

	Initial Test Configuration Channel

*The Initial Test Configuration was chosen according to **KDB 248227 v02 Section 5.3** from the mode with the highest maximum output power including tune-up tolerances, the highest channel bandwidth among those modes, the lowest order modulation, and the lowest data rate. The channel with the highest output power in that mode is chosen as the initial test configuration.

1) Channels with measured maximum output power within ¼ dB of each other are considered to have the same maximum output.
2) When there are multiple test channels with the same measured maximum output power, the channel closest to mid-band frequency is selected for SAR measurement.
3) When there are multiple test channels with the same measured maximum output power and equal separation from mid-band frequency; for example, high and low channels or two mid-band channels, the higher frequency (number) channel is selected for SAR measurement.

7.1 WLAN 2.4 GHz Conducted Output Power Measurements

Mode	CH.	Freq. (MHz)	Maximum Conducted Average Output Power (dBm)	
			Meas.	Max
802.11g 6Mbps	1	2412	7.6	8.5
	6	2437	7.66	8.5
	11	2462	8.5	8.5
802.11n HT20 MCS0	1	2412	N/A	8.5
	6	2437	N/A	8.5
	11	2462	N/A	8.5

According to KDB 248227 D01 SAR Guidance for IEEE 802.11(Wi-Fi) Transmitters v02, power measurement for 802.11n H20 mode is not required if both 802.11g and 802.11n HT20 modes have the same max power.

7.2 WLAN 5 GHz Conducted Output Power Measurements

7.2.1 5.2 GHz Conducted Measurements (U-NII-1)

Mode	CH.	Freq. (MHz)	Maximum Conducted Average Output Power (dBm)	
			Meas.	Max
802.11a 6Mbps	36	5180	7.95	8.5
	40	5200	7.84	8.5
	44	5220	8.05	8.5
	48	5240	8.06	8.5
802.11n HT20 MCS0	36	5180	N/A	8.5
	40	5200	N/A	8.5
	44	5220	N/A	8.5
	48	5240	N/A	8.5

7.2.2 5.8 GHz Conducted Measurements (U-NII-3)

Mode	CH.	Freq. (MHz)	Maximum Conducted Average Output Power (dBm)	
			Meas.	Max
802.11a 6Mbps	149	5745	7.71	8.5
	153	5765	7.85	8.5
	157	5785	7.6	8.5
	161	5805	7.89	8.5
802.11n HT20 MCS0	149	5745	N/A	8.5
	153	5765	N/A	8.5
	157	5785	N/A	8.5
	161	5805	N/A	8.5

According to KDB 248227 D01 SAR Guidance for IEEE 802.11(Wi-Fi) Transmitters v02, power measurement for 802.11n H20 mode is not required if both 802.11a and 802.11n HT20 modes have the same max power.

8 Test Configurations

8.1 Test Positions

From **KDB 447498 D02 v02** (SAR measurement procedures for USB Dongle Transmitter), 5mm separation test distance is used.

The typical Horizontal-Up USB connection (A), found in the majority of host computers, must be tested using an appropriate host computer. A host computer with either Vertical-Front (C) or Vertical-Back (D) USB connection should be used to test one of the vertical USB orientations. If a suitable host computer is not available for testing the Horizontal-Down (B) or the remaining Vertical USB orientation, a high quality USB cable, 12 inches or less, may be used for testing these other orientations. It must be documented that the USB cable does not influence the radiating characteristics and output power of the transmitter.

Horizontal-Up, Horizontal-Down, Vertical-Top orientations are tested using USB port of the host laptops. Since neither of the host laptops support Vertical-Front orientation using USB port, Vertical-Front orientation is tested with the EUT connect to a USB cable. The USB cable is longer than the 12” recommended in the standard, but since this is the same cable being marketed with the device it was deemed the most suitable for testing. The important criterion of documenting that “the USB cable does not influence the radiating characteristics and output power of the transmitter” was followed. The worst-case configuration in each band which was tested using a laptop was also tested with the USB cable to show that the cable does not influence the radiating characteristics of the transmitter. The same positions tested using both a laptop and cable showed no large deviations in SAR, as seen in the SAR Results section. Power measurements were also made with the device connected both directly to a laptop and to the cable, showing no discernable differences.

(A) Horizontal-Up | (B) Horizontal-Down | (C) Vertical-Front | (D) Vertical-Back

Note: These are USB connector orientations on laptop computers; USB dongles have the reverse configuration for plugging into the corresponding laptop computers.

<u>USB Connector Orientations Implemented on Laptop Computers</u>

8.1.1 Test Positions Used

Exposure Condition	Phantom Used	DUT Test Position	Test Setup Photo (See Appendix)
Body	Flat Section (SAM, ELI, or Triple-Flat)	Horizontal Down 5mm using USB Port	Photo 1
		Horizontal Up 5mm using USB Port	Photo 2
		Vertical Back 5mm using USB Port	Photo 3
		Horizontal Down 5mm using USB cable	Photo 4
		Horizontal Up 5mm using USB cable	Photo 5
		Vertical Front 5mm using USB cable	Photo 6

9 SAR Test Procedures

The SAR Evaluation was performed in the following steps:

- **Power Reference Measurement.**
  The Power Measurement and Power Drift Measurements are for monitoring the power drift of the device under test. The minimum distance of probe sensors to surface determines the closest measurement point to phantom surface. The minimum distance of probe sensors to surface is set to 2mm for the EX3DV4 probe as recommended by SPEAG. The Power Reference Measurement is taken at a point close to the antenna whose output is being measured in order to maximize SNR, thus minimizing drift error.

- **Area Scan**
  The Area Scan is used as a fast scan in two dimensions to find the areas of high field values (or hot spots), before doing a fine measurement around the hotspot. The sophisticated interpolation routines implemented in DASY5 software can find the maximum locations even in relatively coarse grids. When an Area Scan has measured all reachable points, it computes the field maxima found and lists all maxima found in the scan area within a certain range of the global maximum. A 2 dB range is required by IEEE STD 1528. Zoom scans need only be performed on all secondary maxima within this range when the absolute maximum found is under 2 dB less than the SAR limit in question (i.e., less than 1 W/kg for the 1.6 W/kg SAR limit). Otherwise, the zoom scan is only performed at the highest maxima found in the area scan. The exception to this is in MIMO configurations where at least one zoom scan should be measured per transmit antenna.

  The following x-y grid spacings for the given transmitter frequency ranges are used for area scans in accordance with FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz:

  700 MHz – 2 GHz: ≤ 15 mm
  2 GHz – 3 GHz: ≤ 12 mm
  3 GHz – 4 GHz: ≤ 12 mm
  4 GHz – 6 GHz: ≤ 10 mm

- **Zoom Scan**
  Zoom Scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1g or 10g of simulated tissue. When the measurement is done, the Zoom Scan evaluates the averaged SAR for 1g and 10g and displays these values next to the job's label. The sides of the zoom scan cube should be parallel to the edges of the EUT when possible. The dimensions of a Zoom Scan and spacing between measurement points vary by frequency according to FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz, shown in Table 2 below:

Table 2: Zoom Scan Dimensions

Transmitter Frequency Range	Cube Dimensions	x-y coordinate spatial resolution	z coordinate spatial resolution
700 MHz – 2 GHz	≥ 30 mm	≤ 8 mm	≤ 5 mm
2 GHz – 3 GHz	≥ 28 mm	≤ 5 mm, *≤ 8 mm	≤ 4 mm
3 – 4 GHz	≥ 25 mm	≤ 5 mm, *≤ 7 mm	≤ 3 mm
4 – 6 GHz	≥ 22 mm	≤ 4 mm, *≤ 5 mm	≤ 2 mm

*optional x-y coordinate spatial resolution when Area Scan SAR ≤ 87.5% of applicable SAR limit

- **Power Drift Measurement**
  The Power Drift Measurement measures the field at the same location as the most recent power reference measurement within the same procedure, and with the same settings. The Power Drift Measurement gives the field difference in dB from the reading conducted within the last Power Reference Measurement. The absolute value of this difference must be ≤ 0.21 dB; if it is not, the entire test is repeated or the difference accounted for.

10 SAR Test Results

10.1 General SAR Testing Notes

- o All WLAN measurements were made with the device transmitting at 100% duty cycle.
- o Tissue-simulating liquid temperature was maintained within +/- 2°C of that which was measured during liquid verification.

10.2 WLAN 2.4 GHz SAR Testing Notes

(Guidance from KDB 248227 v02)

- o The initial test configuration channel in 802.11g was chosen as described and shown in section 8.
- o Testing was not performed for other channels of the initial test configuration (802.11g mode) since the reported SAR for the channel with highest power is ≤ 0.8 W/kg.
- o Testing in 802.11n mode was not performed since both 802.11g and 802.11n have the same maximum average output power.

10.3 WLAN 2.4 GHz SAR Test Results

Mode	Test Distance (mm)	Position	Ch.	Freq. (MHz)	Avg. Pwr. (dBM)	Max. Pwr. (dBm)	Meas. 1g SAR (W/kg)	Reported 1g SAR (W/kg)
802.11g 1 Mbps	5	Horizontal Up (USB Port)	11	2462	8.5	8.5	0.156	**0.156**
	5	Horizontal Down (USB Port)	11	2462	8.5	8.5	0.184	**0.184 (Plot 1)**
	5	Horizontal Down (USB Cable)	11	2462	8.5	8.5	0.18	**0.18**
	5	Vertical Back (USB Port)	11	2462	8.5	8.5	0.0209	**0.0209**
	5	Vertical Front (USB Cable)	11	2462	8.5	8.5	0.0139	**0.0139**

10.4 WLAN 5 GHz SAR Testing Notes

- The initial test configuration channel in 802.11a was chosen as described in Section 8.1.
- Testing was not performed for other channels of the initial test configuration (802.11a mode) since the reported SAR for the channel with highest power is ≤ 0.8 W/kg.
- Testing in 802.11n mode was not performed since both 802.11a and 802.11n have the same maximum average output power.

10.5 WLAN 5.2 GHz SAR Test Results

Mode	Test Distance (mm)	Position	Ch.	Freq. (MHz)	Avg. Pwr. (dBM)	Max. Pwr. (dBm)	Meas. 1g SAR (W/kg)	Reported 1g SAR (W/kg)
802.11a 6 Mbps	5	Horizontal Up (USB Port)	44	5220	8.05	8.5	0.279	**0.31 (Plot 2)**
	5	Horizontal Up (USB Cable)	44	5220	8.05	8.5	0.226	**0.251**
	5	Horizontal Down (USB Port)	44	5220	8.05	8.5	0.071	**0.078**
	5	Vertical Back (USB Port)	44	5220	8.05	8.5	0.094	**0.1**
	5	Vertical Front (USB Cable)	44	5220	8.05	8.5	0.006	**0.007**

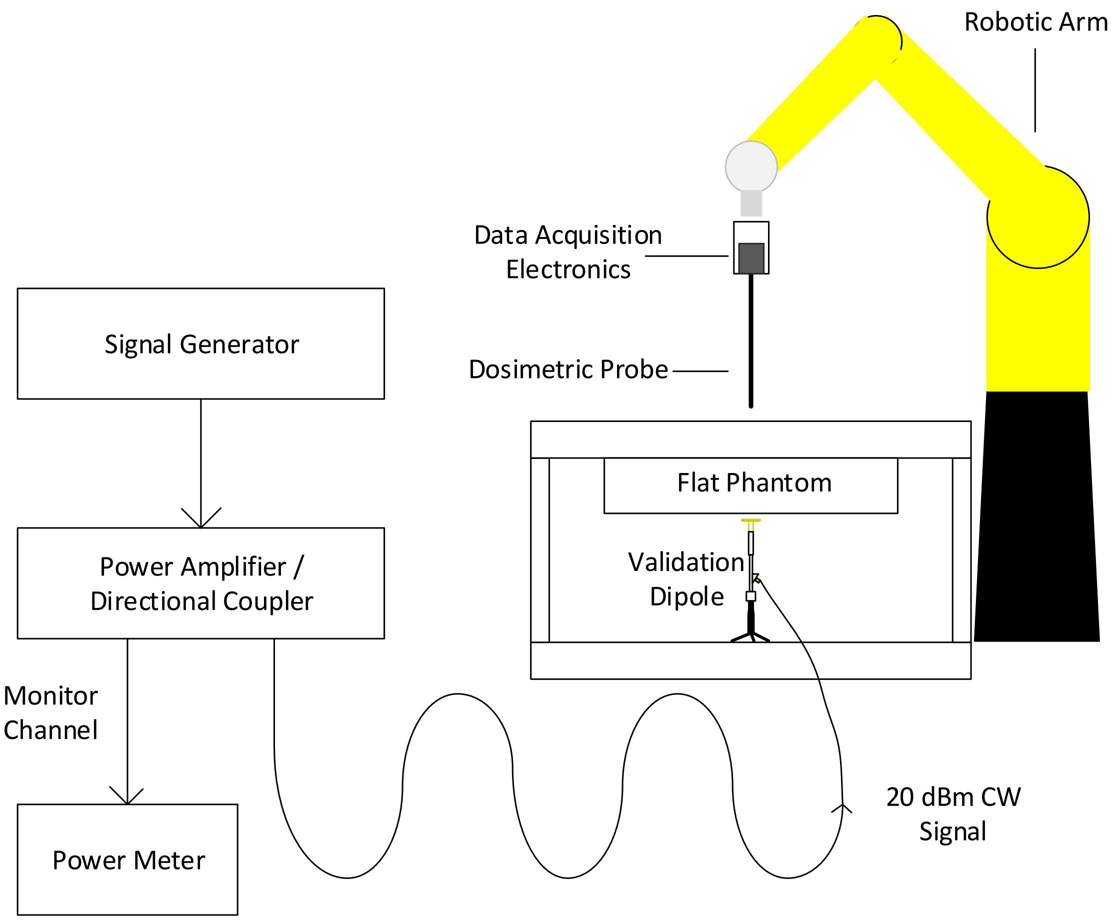
10.6 WLAN 5.8 GHz SAR Test Results

Mode	Test Distance (mm)	Position	Ch.	Freq. (MHz)	Avg. Pwr. (dBM)	Max. Pwr. (dBm)	Meas. 1g SAR (W/kg)	Reported 1g SAR (W/kg)
802.11a 6 Mbps	5	Horizontal Up (USB Port)	153	5765	7.85	8.5	0.313	**0.364**
	5	Horizontal Down (USB Port)	153	5765	7.85	8.5	0.067	**0.077**
	5	Vertical Back (USB Port)	153	5765	7.85	8.5	0.332	**0.386 (Plot 3)**
	5	Vertical Back (USB Cable)	153	5765	7.85	8.5	0.328	**0.381**
	5	Vertical Front (USB Cable)	153	5765	7.85	8.5	0.062	**0.072**

11 SAR System Verification

System Verifications were performed in accordance with **IEEE 1528-2003** and **KDB 865664 D01 v01r03.** Verifications were performed for each frequency band and within the valid range of each probe calibration point required for testing the device. The same SAR probe(s) and tissue-equivalent liquid combinations used with each SAR system for system verification were used for device testing. Verifications were performed before each series of SAR measurements using the same calibration point and tissue-equivalent medium and every three days thereafter when necessary.

The test setup diagram is shown below. A CW signal is created by a signal generator and fed through a power amplifier with directional coupler outputs. The forward output power is adjusted to 20 dBm while the coupled output power is normalized to 0dB for easy monitoring. When the forward power is attached to the dipole, the power is then adjusted if necessary so that the coupled channel again reads 0 dB on the power meter. Tissue-simulating liquid depth in the phantom is maintained to be at least 15 cm for frequencies below 3 GHz and 10 cm for frequencies above 5 GHz.



System Verification Setup

11.1 SAR System Verification Results

All verifications are performed with a 100 mW (20 dBm) input to the dipole. The resultant measured SAR is normalized to 1 W (30 dBm) for comparison to calibrated dipole targets. All normalized SAR system verification results were within 10% of the respective dipole target values.

Date	Tissue-Sim. Liquid	Dipole	Freq. (MHz)	Meas. 1-g SAR (W/kg)	Norm. 1-g SAR (W/kg)	Dipole Target 1-g SAR (W/kg)	Deviation from Target 1-g SAR (%)
5/12/2015	MSL	D2450V2_916	2450	5.38	53.8	51.7	**4.06 (Plot 4)**
5/15/2015	MBBL	D5GHzV2_1158	5200	7.13	71.3	76.7	**-7.04 (Plot 5)**
5/27/2015	MBBL	D5GHzV2_1158	5800	8.13	81.3	76.3	**6.55 (Plot 6)**

12 Tissue-Simulating Liquid Verification

(KDB 854664 D01 v01r03 Section 2.4) The tissue dielectric parameters of tissue-equivalent media used for SAR measurements must be characterized within a temperature range of 18°C to 25°C, measured with calibrated instruments and apparatuses, such as network analyzers and temperature probes. The temperature of the tissue-equivalent medium during SAR measurement must also be within 18°C to 25°C and within ± 2°C of the temperature when the tissue parameters are characterized. The tissue dielectric measurement system must be calibrated before use. The dielectric parameters must be measured before the tissue-equivalent medium is used in a series of SAR measurements. The parameters should be re-measured after each 3 – 4 days of use; or earlier if the dielectric parameters can become out of tolerance; for example, when the parameters are marginal at the beginning of the measurement series.

The target parameters for the tissue-simulating liquids are obtained from the following table from KDB 865664 D01:

Target Frequency	Head		Body	
(MHz)	ε_r	σ (S/m)	ε_r	σ (S/m)
150	52.3	0.76	61.9	0.80
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
835	41.5	0.90	55.2	0.97
900	41.5	0.97	55.0	1.05
915	41.5	0.98	55.0	1.06
1450	40.5	1.20	54.0	1.30
1610	40.3	1.29	53.8	1.40
1800 – 2000	40.0	1.40	53.3	1.52
2450	39.2	1.80	52.7	1.95
3000	38.5	2.40	52.0	2.73
5800	35.3	5.27	48.2	6.00

(ε_r = relative permittivity, σ = conductivity and ρ = 1000 kg/m^3)

12.1 Tissue-Simulating Liquid Ingredients and Maintenance

The Tissue-simulating liquids were manufactured by SPEAG. The following information on the maintenance of

MSL 2450 Ingredients: Water, DGBE

MBBL 3500 – 5800 Ingredients: Water, Mineral Oil, Emulsifiers, Sodium Chloride

DGBE BASED LIQUIDS

DGBE is easily dissolved in water. Given a DGBE-water mixture, mainly water will evaporate, however DGBE will evaporate to a smaller percentage. For the frequency liquids around 2.5 GHz, no NaCl is contained and should therefore not be added for any corrections.
Evaporated water can be replaced and will mainly increase the permittivity, and to a small extent the conductivity, typically as follows:

HSLxxxxV2: permittivity 0.8 to 1.0 per % of water, conductivity 0 to 0.1 per % of water

MSLxxxxV2: permittivity 0.8 per % of water, conductivity 0 to 0.01 per % of water

OIL BASED LIQUIDS

Oil based liquids are an emulsion of a complex mixture of ingredients. Their appearance is yellow or brown transparent or slightly opaque / milky in most cases. Some older liquids may show a non-transparent upper zone with a creamy appearance after some time without stirring. Before using or handling the liquid, it must therefore be stirred to become entirely homogeneous. An opaque appearance is possible but will not influence the dielectric parameters if it is homogeneous during the measurement at the probe surface.
Evaporated water can be replaced and will increase the permittivity, and to a smaller extent the conductivity.

The **sensitivities to water addition** (% parameter increase per weight% water added) of oil based SPEAG broadband tissue simulating liquids at the frequencies of interest are typically in the following range:

HBBL3500-5800V5	at 3.5 GHz:	permittivity 0.79, conductivity 0.14
	at 5.5 GHz:	permittivity 0.83, conductivity 0.41
MBBL3500-5800V5	at 3.5 GHz:	permittivity 0.44, conductivity 0.00
	at 5.5 GHz:	permittivity 0.48, conductivity 0.18

The **temperature gradients** shall be observed especially during conductivity measurement:

HBBL3500-5800V5	at 3.5 GHz:	permittivity -0.07, conductivity -0.43 %/°C
	at 5.5 GHz:	permittivity -0.23, conductivity -0.96 %/°C
MBBL3500-5800V5	at 3.5 GHz:	permittivity -0.35, conductivity -1.14 %/°C
	at 5.5 GHz:	permittivity -0.08, conductivity -1.52 %/°C

12.2 Tissue-Simulating Liquid Measurements

Date	Tissue-Simulating Liquid	Freq. (MHz)	Rel. Perm. ε'$_r$	Target ε'$_r$	ε'$_r$ Dev. %	Cond. σ (S/m)	Target σ (S/m)	σ Dev. %
5/12/2015	MSL 2450 130710-1 22.7 °C	2412	52.51	52.75	**-0.47**	1.87	1.91	**-2.09**
		2437	52.37	52.72	**-0.63**	1.903	1.94	**-0.19**
		2450	52.3	52.70	**-0.76**	1.922	1.95	**-1.91**
		2462	52.23	52.68	**-0.89**	1.938	1.97	**-2.01**
5/15/2015	MBBL 3500-5800 130705-2 23 °C	5180	48.52	49.04	**-1.08**	5.426	5.28	**2.96**
		5200	48.42	49.01	**-1.22**	5.456	5.30	**3.14**
		5220	48.34	49	**-1.35**	5.485	5.33	**2.91**
		5240	48.31	48.9	**-1.21**	5.521	5.35	**3.20**
5/27/2015	MBBL 3500-5800 130705-1 23.2 °C	5740	47.85	48.25	**-0.83**	6.185	5.96	**3.81**
		5800	47.62	48.2	**1.18**	6.279	6	**4.65**
		5825	47.57	48.17	**1.25**	6.323	6.03	**4.86**

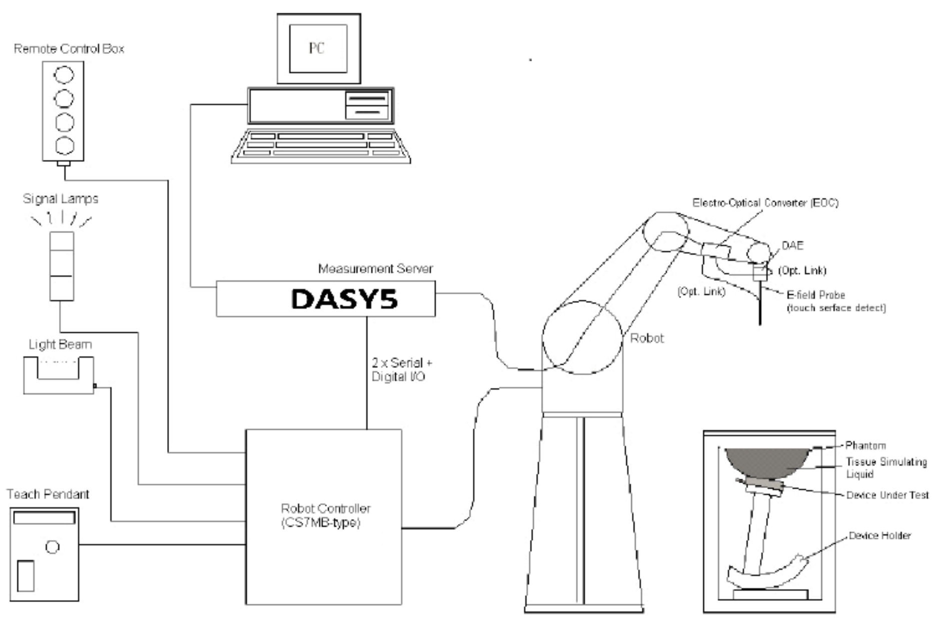
![Microsoft logo]

13 System Specification

13.1 SPEAG DASY5 SYSTEM

DASY 5 system performing SAR testing contains the following items, which are illustrated in the figure below.

- 6-axis robot (model: TX90XL) with controller and teach pendant.
- Dosimetric E-field probe.
- Light beam unit which allows automatic "tooling" of the probe.
- The electro-optical convertor (EOC) which is mounted on the robot arm.
- The data acquisition electronics (DAE).
- Elliptical Phantom
- Device holder.
- Remote control.
- PC.
- DASY5 software.
- Validation dipole.



DASY5 System Setup

14 Measurement Uncertainty

From KDB 865664 D01 v01r03 section 2.8.2:

SAR measurement uncertainty analysis is required in SAR reports only when the highest measured SAR in a frequency band is ≥ 1.5 W/kg for 1-g SAR.

The highest **measured** 1-g SAR in this report is 0.386 W/kg. Therefore, SAR measurement uncertainty analysis is not required for this report.

15 Appendices

The following are contained in the attached appendices:

- Highest SAR Test and SAR System Verification Plots
- SAR Test Setup Photos
- Calibration Report Documents for:
    - Validation Dipole D2450V2-916_Jul14
    - Validation Dipole D5GHzV2-1158_Jul14
    - Dosimetric Probe EX3-DV4-3939_Jul14

End of Test Report