SAR TEST REPORT

for

MODEL NO. 1769

FCC ID: C3K1769

Test Report No. S-TR105-FCCSAR-2
Issue Date: 4-13-2017

FCC CFR 47 PART 2.1093
IEEE 1528-2013

Prepared by
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A2LA ACCREDITED
TESTING CERT #3472.01

Report V4.1

Microsoft

1 Record of Revisions

Revision	Date	Section	Page(s)	Summary of Changes	Author/Revised By:
1.0	03/17/2017	All	All	First Version	Z. Gray
2.0	04/13/2017	All	All	Harmonized terminology, changing “Path” to “Chain” and “Aux” to “MIMO”	Z. Gray
		8.6.1-8.6.4	18-21	Corrected some 40 MHz, 80 MHz stated max power values.	
		11.4	27	Changed test positions labeled “back” to “bottom”	
		13.3.1	36	Removed “2.4 GHz” designation from table heading	
		17	43	Added statement on measurement uncertainty.	

Test Report Attestation

Microsoft Corporation
Model: 1769

Applicable Standards

Specification	Test Result
FCC CFR 47 PART 2.1093 IEEE 1528-2013	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 test report replaces the previously issued report #S-TR105-FCCSAR-1 issued by Microsoft EMC Labs.

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.

Written By: Zack Gray

SAR Test Lead

Reviewed/ Issued By: Sajay Jose

EMC/RF Compliance Lab Manager

Microsoft

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2 Deviations from Standard

None.

3 Facilities and Accreditation

3.1 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.

3.2 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, 2017

3.3 Test Equipment

The site and related equipment are constructed in conformance with the requirements of IEEE 1528-2013 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 are applied in accordance with instructions contained in the user manual for the measuring equipment.

4 Highest Reported SAR Values

Exposure Condition	Equipment Class	Mode of Operation	Test Position	1-g Reported SAR (W/kg)
Body Exposure	DTS	802.11g	Bottom 0mm	0.91
	NII	802.11a	Bottom 0mm	0.98
	Bluetooth	Bluetooth 1-DH5	Bottom 0mm	0.08
	Simultaneous Transmission	802.11a MIMO	Bottom 0mm	1.45

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	SN	Identifier	Cal. Due	Cal. Cycle
Agilent	Signal Generator	N5181A	MY50144778	SAR-040	4/29/2017	1 yr
Agilent	Signal Generator	N5181A	MY50144791	SAR-051	12/21/2017	1 yr
PRANA	Power Amplifier + Directional Coupler	TU16	1305-1353	SAR-045	N/A	N/A
PRANA	Power Amplifier + Directional Coupler	TU16	1305-1352	SAR-054	N/A	N/A
PRANA	Power Amplifier + Directional Coupler	UX15	1305-1354	SAR-046	N/A	N/A
PRANA	Power Amplifier + Directional Coupler	UX15	1305-1355	SAR-055	N/A	N/A
Agilent	Power Meter	1914A	MY50801712	SAR-041	5/4/2017	1 yr
Agilent	Power Meter	1914A	MY50901710	SAR-052	12/20/2017	1 yr
Agilent	Power Sensor	9304A	MY53040017	SAR-043	4/29/2017	1 yr
Agilent	Power Sensor	9304A	MY53040025	SAR-044	4/29/2017	1 yr
Agilent	Power Sensor	9304A	MY53040024	SAR-064	12/20/2017	1 yr
Agilent	Power Sensor	9304A	MY53040018	SAR-063	12/20/2017	1 yr
Agilent	Network Analyzer	E5071C	MY46316957	SAR-001	4/29/2017	1 yr
Agilent	Network Analyzer	E5071C	MY46316847	SAR-002	12/26/2017	1 yr
Agilent	Dielectric Probe Kit	85070E	MY44300740	SAR-004	N/A	N/A
Agilent	Dielectric Probe Kit	85070E	MY44300736	SAR-003	N/A	N/A
SPEAG	DASY Data Acquisition Electronics	DAE4	1383	SAR-034	5/18/2017	1 yr
SPEAG	DASY Data Acquisition Electronics	DAE4	1384	SAR-073	7/22/2017	1 yr
SPEAG	Dosimetric E-Field Probe	EX3DV4	3939	SAR-037	5/20/2017	1 yr
SPEAG	Dosimetric E-Field Probe	EX3DV4	3940	SAR-072	7/25/2017	1 yr

SPEAG	SAR Validation Dipole, 2450 MHz	D2450V2	916	SAR-023	05/16/2017	1 yr
SPEAG	SAR Validation Dipole, 5 GHz	D5GHzV2	1158	SAR-015	05/23/2017	1 yr
SPEAG	Elliptical Phantom	ELI V5.0	1217	N/A	N/A	N/A
SPEAG	Elliptical Phantom	ELI V5.0	1218	N/A	N/A	N/A
Thomas Scientific	Thermometer	1230N27	150530613	SAR-113	7/21/2017	1 yr
Thomas Scientific	Thermometer	1230N27	150530615	SAR-114	7/21/2017	1 yr
Thomas Scientific	Thermometer	1230N27	150530609	SAR-115	7/21/2017	1 yr
MadgeTech	THP Monitor	PRHTemp2000	25366	SAR-091	8/8/2017	1 yr
MadgeTech	THP Monitor	PRHTemp2000	25367	SAR-092	8/8/2017	1 yr

6 Product Description

Company Name:	Microsoft Corporation
Address:	One Microsoft Way
City, State, Zip:	Redmond, WA 98052
Customer Contact:	Mike Boucher
Functional Description of EUT:	Mobile Computing Device
RF Exposure Conditions:	Body Exposure
Model:	1769
Equipment Design State:	DV/Productions
Equipment Condition:	Good
Radio Information:	WLAN 2.4 GHz: 802.11b, 802.11g, 802.11n WLAN 5 GHz: 802.11a, 802.11n, 802.11ac Bluetooth™ (Basic and Enhanced Data Rates)
Frequency of Operation:	WLAN: 2412 MHz – 2462 MHz 5180 MHz – 5825 MHz Bluetooth: 2402-2480 MHz
Modulations supported:	WLAN: CCK, BPSK, QPSK, 16-QAM, 64-QAM Bluetooth: GFSK, $\frac{\pi}{4}$ DQPSK, and 8 DPSK
Antenna Information:	2.4 GHz: 3.4 dBi 5 GHz: 5.2 dBi
Dates of Testing:	12/02/2016 – 3/10/2017

6.1 TEST CONFIGURATIONS

Radiated and Conducted measurements were performed with customer-provided test software “WiFi Tool” (V2.7.5), which utilizes “DUT Labtool” (V2.0.0.77) provided by the module manufacturer, to program the EUT in continuous transmit mode.

6.2 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.

6.3 EQUIPMENT MODIFICATIONS

No modifications were made during testing.

6.4 EQUIPMENT UNDER TEST

Model Number	Serial Number	SW Version	FW Version
1769	5372463857	Windows 10 Pro	6.811.0
1769	149963857	Windows 10 Pro	6.811.0

6.5 Supported Air Interfaces and Transmission Configurations

The EUT has two antennas which support the following air interfaces and transmission configurations. The antennas are labeled as Main Antenna (Chain B) and MIMO Antenna (Chain A).

6.5.1 Supported Air Interfaces

Band	Air Interface	BW (MHz)		
		20	40	80
WLAN 2.4 GHz	802.11b	X		
	802.11g	X		
	802.11n	X		
WLAN 5 GHz	802.11a	X		
	802.11n	X	X	
	802.11ac	X	X	X
2.4 GHz	Bluetooth	NA		
	BTLE	NA		

6.5.2 Transmission Configurations

Main Antenna (Chain B)	MIMO Antenna (Chain A)
WLAN 2.4 GHz	
	WLAN 2.4 GHz
WLAN 5 GHz	
	WLAN 5 GHz
WLAN 2.4 GHz	WLAN 2.4 GHz
WLAN 5 GHz	WLAN 5 GHz
Bluetooth	
Bluetooth	WLAN 2.4 GHz
Bluetooth	WLAN 5 GHz

7 Test Methodology

Test setup and procedure are performed according to **IEEE 1528-2013 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 SAR testing and reporting according to FCC standards the following KDBs were adhered to:

- 447498 D01 General RF Exposure Guidance v06
- 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04
- 865664 D02 RF Exposure Reporting v01r02
- 248227 D01 802.11Wi-Fi SAR v02r02
- 616217 D04 SAR for laptops and tablets v01r02

8 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.

8.1 Bluetooth Conducted Output Power Measurements

Channel	Frequency (MHz)	Conducted Average Output Power (dBm)			
		Modulation			Maximum Target Power
		GFSK	π/4-DPSK	8DPSK	
0	2402	3.65	0.78	0.75	5
39	2440	3.48	0.56	0.58	
78	2480	3.25	0.32	0.33	

8.2 Bluetooth LE Conducted Output Power Measurements

Channel	Frequency (MHz)	Conducted Average Output Power (dBm)	
		Measured	Maximum Target Power
0	2402	-0.36	5
19	2440	-0.35	
39	2480	-0.35	

8.3 WLAN Power Measurement Requirements

According to **KDB 248227 v02r02 Section 4,** maximum output power must be measured according to the default power measurement procedures below. When SAR measurement is required, power measurement is also required to confirm output power settings and to determine reported SAR. Additional power measurements may be necessary to determine SAR test reduction for test channels in a transmission mode. If the required power measurement is not included in the default configuration, it is typically measured immediately before and/or after the SAR measurement. Otherwise, when power measurement is not required for a transmission mode, the maximum output power and tune-up tolerance specified for production units can generally be used to determine SAR test exclusion and reduction.

The default power measurement procedures are:

1) Power must be measured at each transmit antenna port according to the DSSS and OFDM transmission configuration in each standalone and aggregated frequency band.
2) Power measurement is required for the transmission mode configuration with the highest maximum output power specified for production units.
   a) When the same higher maximum output power specification applies to multiple transmission modes, the largest channel bandwidth configuration with the lowest order modulation and lowest data rate is measured.
   b) When the same highest maximum output power is specified for multiple largest channel bandwidth configurations with the same lowest order modulation or lowest order modulation and lowest data rate, power measurement is required for all equivalent 802.11 configurations with the same maximum output power.
3) For each transmission mode configuration, power must be measured for the highest and lowest channels; and at the mid-band channel(s) when there are at least 3 channels. For configurations with multiple mid-band channels, due to an even number of channels, both channels should be measured.

8.4 Initial Test Configuration for OFDM Configurations

*The Initial Test Configuration was chosen according to KDB 248227 v02r02 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 channel. If multiple test channels have the same measured maximum output power, the channel chosen for SAR measurement is chosen by the following (applicable to subsequent test configuration as well).

1) The channel closest to mid-band frequency is selected for SAR measurement.
2) For channels with 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.

8.5 WLAN 2.4 GHz Conducted Output Power Measurements

Mode	Chann.	Freq. (MHz)	Maximum Conducted Average Output Power (dBm)							
			SISO (1 TX)				MIMO (2 TX)			
			Main Ant		MIMO Ant		Main Ant		MIMO Ant	
			Meas.	Max	Meas.	Max	Meas.	Max	Meas.	Max
802.11b 1Mbps	1	2412	10.75	12.5	11.15	12.5	-	12.5	-	12.5
	6	2437	11.3	12.5	12.04	12.5	-	12.5	-	12.5
	11	2462	11.18	12.5	12.1	12.5	-	12.5	-	12.5
	12	2467	-	11.5	-	11.5	-	11.5	-	11.5
	13	2472	-	9.5	-	9.5	-	9.5	-	9.5
802.11g 6Mbps	1	2412	-	12.5	-	12.5	-	12.5	-	12.5
	2	2417	14.08	14.5	14.50	14.5	-	14.5	-	14.5
	6	2437	14.15	14.5	14.50	14.5	-	14.5	-	14.5
	10	2457	14.15	14.5	14.42	14.5	-	14.5	-	14.5
	11	2462	-	12.5	-	12.5	-	12.5	-	12.5
	12	2467	-	10.5	-	10.5	-	10.5	-	10.5
	13	2472	-	8.5	-	8.5	-	8.5	-	8.5
802.11n HT20 MCS0	1	2412	-	12.5	-	12.5	-	12.5	-	12.5
	2	2417	-	14.5	-	14.5	-	14.5	-	14.5
	6	2437	-	14.5	-	14.5	-	14.5	-	14.5
	10	2457	-	14.5	-	14.5	-	14.5	-	14.5
	11	2462	-	12.5	-	12.5	-	12.5	-	12.5
	12	2467	-	10.5	-	10.5	-	10.5	-	10.5
	13	2472	-	8.5	-	8.5	-	8.5	-	8.5

Power measurements not listed are not required under the rules of **KDB 248227 v02r02 Section 4.**

Channels 12 and 13 are enabled but are not evaluated as SAR test channels since their power is lowered to meet band edge requirements. **(KDB 248227 Section 3.1)**

Since the power of channels 1 and 11 in 802.11g and 802.11n modes are reduced to meet band edge requirements, channels 2 and 10 are used as the low and high test channels respectively. **(KDB 248227 Section 3.1)**

8.6 WLAN 5 GHz Conducted Output Power Measurements

8.6.1 5.2 GHz Conducted Measurements (U-NII-1)

Mode	Chann.	Freq. (MHz)	Maximum Conducted Average Output Power (dBm)							
			SISO (1 TX)				MIMO (2 TX)			
			Main Ant		MIMO Ant		Main Ant		MIMO Ant	
			Meas.	Max	Meas.	Max	Meas.	Max	Meas.	Max
802.11a 6Mbps	36	5180	-	11.5	-	11.5	-	11.5	-	11.5
	40	5200	-	11.5	-	11.5	-	11.5	-	11.5
	44	5220	-	11.5	-	11.5	-	11.5	-	11.5
	48	5240	-	11.5	-	11.5	-	11.5	-	11.5
802.11n HT20 MCS0	36	5180	-	11.5	-	11.5	-	11.5	-	11.5
	40	5200	-	11.5	-	11.5	-	11.5	-	11.5
	44	5220	-	11.5	-	11.5	-	11.5	-	11.5
	48	5240	-	11.5	-	11.5	-	11.5	-	11.5
802.11n HT40 MCS0	38	5190	-	11.5	-	11.5	-	11.5	-	11.5
	46	5230	-	11.5	-	11.5	-	11.5	-	11.5
802.11ac VHT20 MCS0	36	5180	-	11.5	-	11.5	-	11.5	-	11.5
	40	5200	-	11.5	-	11.5	-	11.5	-	11.5
	44	5220	-	11.5	-	11.5	-	11.5	-	11.5
	48	5240	-	11.5	-	11.5	-	11.5	-	11.5
802.11ac VHT40 MCS0	38	5190	-	11.5	-	11.5	-	11.5	-	11.5
	46	5230	-	11.5	-	11.5	-	11.5	-	11.5
802.11ac VHT80 MCS0	42	5210	-	9.5	-	9.5	-	9.5	-	9.5

Conducted Power Measurements were not performed in the U-NII-1 band since SAR testing is excluded for it in this case by **KDB 248227 v02r02 Section 5.3.1.** See the section on WLAN 5.2 GHz SAR results in this report for further details.

8.6.2 5.3 GHz Conducted Measurements (U-NII-2A)

Mode	Chann.	Freq. (MHz)	Maximum Conducted Average Output Power (dBm)							
			SISO (1 TX)				MIMO (2 TX)			
			Main Ant		MIMO Ant		Main Ant		MIMO Ant	
			Meas.	Max	Meas.	Max	Meas.	Max	Meas.	Max
802.11a 6Mbps	52	5260	13.81	14.5	13.50	14.5	-	14.5	-	14.5
	56	5280	14.26	14.5	14.00	14.5	-	14.5	-	14.5
	60	5300	14.09	14.5	13.82	14.5	-	14.5	-	14.5
	64	5320	13.60	14.5	13.58	14.5	-	14.5	-	14.5
802.11n HT20 MCS0	52	5260	-	14.5	-	14.5	-	14.5	-	14.5
	56	5280	-	14.5	-	14.5	-	14.5	-	14.5
	60	5300	-	14.5	-	14.5	-	14.5	-	14.5
	64	5320	-	14.5	-	14.5	-	14.5	-	14.5
802.11n HT40 MCS0	54	5270	-	12.5	-	12.5	-	12.5	-	12.5
	62	5310	-	12.5	-	12.5	-	12.5	-	12.5
802.11ac VHT20 MCS0	52	5260	-	14.5	-	14.5	-	14.5	-	14.5
	56	5280	-	14.5	-	14.5	-	14.5	-	14.5
	60	5300	-	14.5	-	14.5	-	14.5	-	14.5
	64	5320	-	14.5	-	14.5	-	14.5	-	14.5
802.11ac VHT40 MCS0	54	5270	-	12.5	-	12.5	-	12.5	-	12.5
	62	5310	-	12.5	-	12.5	-	12.5	-	12.5
802.11ac VHT80 MCS0	56	5290	-	9.5	-	9.5	-	9.5	-	9.5

Power measurements not listed are not required under the rules of **KDB 248227 v02r02 Section 4.**

8.6.3 5.6 GHz Conducted Measurements (U-NII-2C)

Mode	Chann.	Freq. (MHz)	Maximum Conducted Average Output Power (dBm)							
			SISO (1 TX)				MIMO (2 TX)			
			Main Ant		MIMO Ant		Main Ant		MIMO Ant	
			Meas.	Max	Meas.	Max	Meas.	Max	Meas.	Max
802.11a 6Mbps	100	5500	14.50	14.5	14.30	14.5	-	14.5	-	14.5
	104	5520	-	14.5	-	14.5	-	14.5	-	14.5
	108	5540	-	14.5	-	14.5	-	14.5	-	14.5
	112	5560	-	14.5	-	14.5	-	14.5	-	14.5
	116	5580	14.50	14.5	14.47	14.5	-	14.5	-	14.5
	120	5600	14.50	14.5	14.48	14.5	-	14.5	-	14.5
	124	5620	-	14.5	-	14.5	-	14.5	-	14.5
	128	5640	-	14.5	-	14.5	-	14.5	-	14.5
	132	5660	-	14.5	-	14.5	-	14.5	-	14.5
	136	5680	-	14.5	-	14.5	-	14.5	-	14.5
	140	5700	14.10	14.5	14.12	14.5	-	14.5	-	14.5
802.11n HT20 MCS0	100	5500	-	14.5	-	14.5	-	14.5	-	14.5
	104	5520	-	14.5	-	14.5	-	14.5	-	14.5
	108	5540	-	14.5	-	14.5	-	14.5	-	14.5
	112	5560	-	14.5	-	14.5	-	14.5	-	14.5
	116	5580	-	14.5	-	14.5	-	14.5	-	14.5
	120	5600	-	14.5	-	14.5	-	14.5	-	14.5
	124	5620	-	14.5	-	14.5	-	14.5	-	14.5
	128	5640	-	14.5	-	14.5	-	14.5	-	14.5
	132	5660	-	14.5	-	14.5	-	14.5	-	14.5
	136	5680	-	14.5	-	14.5	-	14.5	-	14.5
	140	5700	-	14.5	-	14.5	-	14.5	-	14.5
802.11n HT40 MCS0	102	5510	-	12.5	-	12.5	-	12.5	-	12.5
	110	5550	-	12.5	-	12.5	-	12.5	-	12.5
	118	5590	-	12.5	-	12.5	-	12.5	-	12.5
	126	5630	-	12.5	-	12.5	-	12.5	-	12.5
	134	5670	-	12.5	-	12.5	-	12.5	-	12.5

Power measurements not listed are not required under the rules of **KDB 248227 v02r02 Section 4.**

8.6.4 5.6 GHz Conducted Measurements (U-NII-2C) Continued

Mode	Chann.	Freq. (MHz)	Maximum Conducted Average Output Power (dBm)							
			SISO (1 TX)				MIMO (2 TX)			
			Main Ant		MIMO Ant		Main Ant		MIMO Ant	
			Meas.	Max	Meas.	Max	Meas.	Max	Meas.	Max
802.11ac VHT20 MCS0	100	5500	-	14.5	-	14.5	-	14.5	-	14.5
	104	5520	-	14.5	-	14.5	-	14.5	-	14.5
	108	5540	-	14.5	-	14.5	-	14.5	-	14.5
	112	5560	-	14.5	-	14.5	-	14.5	-	14.5
	116	5580	-	14.5	-	14.5	-	14.5	-	14.5
	120	5600	-	14.5	-	14.5	-	14.5	-	14.5
	124	5620	-	14.5	-	14.5	-	14.5	-	14.5
	128	5640	-	14.5	-	14.5	-	14.5	-	14.5
	132	5660	-	14.5	-	14.5	-	14.5	-	14.5
	136	5680	-	14.5	-	14.5	-	14.5	-	14.5
	140	5700	-	14.5	-	14.5	-	14.5	-	14.5
802.11ac VHT40 MCS0	102	5510	-	12.5	-	12.5	-	12.5	-	12.5
	110	5550	-	12.5	-	12.5	-	12.5	-	12.5
	118	5590	-	12.5	-	12.5	-	12.5	-	12.5
	126	5630	-	12.5	-	12.5	-	12.5	-	12.5
	134	5670	-	12.5	-	12.5	-	12.5	-	12.5
802.11ac VHT80 MCS0	106	5530	-	8.5	-	8.5	-	8.5	-	8.5
	122	5610	-	11.5	-	11.5	-	11.5	-	11.5

Power measurements not listed are not required under the rules of **KDB 248227 v02r02 Section 4.**

8.6.5 5.8 GHz Conducted Measurements (U-NII-3)

Mode	Chann.	Freq. (MHz)	Maximum Conducted Average Output Power (dBm)							
			SISO (1 TX)				MIMO (2 TX)			
			Main Ant		MIMO Ant		Main Ant		MIMO Ant	
			Meas.	Max	Meas.	Max	Meas.	Max	Meas.	Max
802.11a 6Mbps	149	5745	14.16	14.5	13.8	14.5	-	14.5	-	14.5
	153	5765	-	14.5	-	14.5	-	14.5	-	14.5
	157	5785	14.5	14.5	13.81	14.5	-	14.5	-	14.5
	161	5805	-	14.5	-	14.5	-	14.5	-	14.5
	165	5825	14.48	14.5	13.9	14.5	-	14.5	-	14.5
802.11n HT20 MCS0	149	5745	-	14.5	-	14.5	-	14.5	-	14.5
	153	5765	-	14.5	-	14.5	-	14.5	-	14.5
	157	5785	-	14.5	-	14.5	-	14.5	-	14.5
	161	5805	-	14.5	-	14.5	-	14.5	-	14.5
	165	5825	-	14.5	-	14.5	-	14.5	-	14.5
802.11n HT40 MCS0	151	5755	-	12.5	-	12.5	-	12.5	-	12.5
	159	5795	-	12.5	-	12.5	-	12.5	-	12.5
802.11ac VHT20 MCS0	149	5745	-	14.5	-	14.5	-	14.5	-	14.5
	153	5765	-	14.5	-	14.5	-	14.5	-	14.5
	157	5785	-	14.5	-	14.5	-	14.5	-	14.5
	161	5805	-	14.5	-	14.5	-	14.5	-	14.5
	165	5825	-	14.5	-	14.5	-	14.5	-	14.5
802.11ac VHT40 MCS0	151	5755	-	12.5	-	12.5	-	12.5	-	12.5
	159	5795	-	12.5	-	12.5	-	12.5	-	12.5
802.11ac VHT80 MCS0	155	5775	-	10.5	-	10.5	-	10.5	-	10.5

Power measurements not listed are not required under the rules of **KDB 248227 v02r02 Section 4.**

9 Test Configurations

9.1 Test Positions

The antennas are in the keyboard base. According to **KDB 616217 D04 Section 4.2**, SAR is only required for bottom of the keyboard base since the device does not support any tablet use conditions.

Exposure Condition	Phantom Used	DUT Test Position	Test Setup Photo (See Appendix)
Body	Flat Section (SAM, ELI, or Triple-Flat)	Bottom 0mm	Photo 1, Photo 2

10 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 – 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.

11 SAR Test Results

11.1 General SAR Testing Notes

- From **KDB 447498 D01 General RF Exposure Guidance v06**, the following test channel reduction was applied to each test position of an exposure condition in each wireless mode and configuration. Initial testing for each test position for each band was performed on the middle required test channel (or required test channel with the highest measured power for WLAN modes). 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

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

11.2 WLAN 2.4 GHz SAR Testing Notes

(Guidance from KDB 248227 v02r02)

- 802.11b was tested according to the requirements of to **KDB 248227 v02r02 Section 5.2.1 802.11b DSSS SAR Requirements.**
- SAR testing on 2.4 GHz OFDM modes was performed according to **KDB 248227 v02r02 Section 5.3 SAR Test Requirements for OFDM Configurations.**
  - 802.11g was chosen as the Initial Test Configuration for 2.4 GHz OFDM testing in accordance with the rules of KDB Section 5.3.2.
  - In accordance with KDB 248227 Section 5.3.3, when the reported SAR of the initial test configuration was > 0.8 W/kg, SAR measurement was performed for the subsequent next highest measured output power channel(s) in the initial test configuration until reported SAR was ≤ 1.2 W/kg or all required channels were tested.
  - Since the power of channels 1 and 11 in 802.11g and 802.11n modes are reduced to meet band edge requirements, channels 2 and 10 are used as the low and high test channels respectively. **(KDB 248227 Section 3.1)**

11.3 WLAN 2.4 GHz Main Antenna (Chain B) SAR Test Results

Mode	BW (MHz)	Ant.	Position	Ch.	Freq. (MHz)	Avg. Pwr. (dBM)	Max. Pwr. (dBm)	Meas. 1g SAR (W/kg)	Reported 1g SAR (W/kg)
802.11b 1 Mbps **1TX**	20	B	Bottom	6	2437	11.3	12.5	0.439	**0.58**
802.11g 6 Mbps **1TX**	20	B	Bottom	6	2437	14.15	14.5	0.819	**0.89**
	20	B	Bottom	10	2457	14.15	14.5	0.816	**0.88**

11.4 WLAN 2.4 GHz MIMO Antenna (Chain A) SAR Test Results

Mode	BW (MHz)	Ant.	Position	Ch.	Freq. (MHz)	Avg. Pwr. (dBM)	Max. Pwr. (dBm)	Meas. 1g SAR (W/kg)	Reported 1g SAR (W/kg)
802.11b 1 Mbps **1TX**	20	A	Bottom	11	2462	12.1	12.5	0.505	**0.55**
802.11g 6 Mbps **1TX**	20	A	Bottom	2	2417	14.5	14.5	0.757	**0.76**
	20	A	Bottom	6	2437	14.5	14.5	0.914	**0.91 (Plot 1)**
	20	A	Bottom	6	2437	14.5	14.5	0.843	**0.84 (Repeat)**

11.5 WLAN 5 GHz SAR Testing Notes

In accordance with **KDB 248227 D01 v02r02 Section 5:**

- 802.11a was used as the initial test configuration since it has the combination of highest declared maximum output power and lowest data rate.
- When the initial test channel had a reported SAR above 0.8 W/kg, the channel with next highest power was measured for SAR.
- Further channels in the initial test configuration were only measured when subsequent reported SAR values were above 1.2 W/kg.

11.6 WLAN 5.2 GHz SAR Test Results

According to **KDB 248227 v02r02 Section 5.3.1:**

When the same maximum output power is specified for both bands, begin SAR measurement in U-NII-2A band by applying the OFDM SAR requirements. If the highest *reported* SAR for a test configuration is ≤ 1.2 W/kg, SAR is not required for U-NII-1 band for that configuration (802.11 mode and exposure condition); otherwise, each band is tested independently for SAR.

Since the highest reported SAR in U-NII-2A is ≤ 1.2 W/kg (see following results), SAR testing was not performed in U-NII-1.

11.7 WLAN 5.3 GH Main Antenna (Chain B) SAR Test Results

Mode	BW (MHz)	Ant.	Position	Ch.	Freq. (MHz)	Avg. Pwr. (dBM)	Max. Pwr. (dBm)	Meas. 1g SAR (W/kg)	Reported 1g SAR (W/kg)
802.11a 6 Mbps **1TX**	20	B	Bottom	56	5280	14.26	14.5	0.417	**0.44**

11.8 WLAN 5.3 GHz MIMO Antenna (Chain A) SAR Test Results

Mode	BW (MHz)	Ant.	Position	Ch.	Freq. (MHz)	Avg. Pwr. (dBM)	Max. Pwr. (dBm)	Meas. 1g SAR (W/kg)	Reported 1g SAR (W/kg)
802.11a 6 Mbps **1TX**	20	A	Bottom	56	5280	14.0	14.5	0.588	**0.66 (Plot 2)**

11.9 WLAN 5.6 GHz Main Antenna (Chain B) SAR Test Results

Mode	BW (MHz)	Ant.	Position	Ch.	Freq. (MHz)	Avg. Pwr. (dBM)	Max. Pwr. (dBm)	Meas. 1g SAR (W/kg)	Reported 1g SAR (W/kg)
802.11a 6 Mbps **1TX**	20	B	Bottom	120	5600	14.5	14.5	0.776	**0.78 (Plot 3)**

11.10 WLAN 5.6 GHz MIMO Antenna (Chain A) SAR Test Results

Mode	BW (MHz)	Ant.	Position	Ch.	Freq. (MHz)	Avg. Pwr. (dBM)	Max. Pwr. (dBm)	Meas. 1g SAR (W/kg)	Reported 1g SAR (W/kg)
802.11a 6 Mbps **1TX**	20	A	Bottom	120	5600	14.48	14.5	0.67	**0.67**

11.11 WLAN 5.8 GHz Main Antenna (Chain B) SAR Test Results

Mode	BW (MHz)	Ant.	Position	Ch.	Freq. (MHz)	Avg. Pwr. (dBM)	Max. Pwr. (dBm)	Meas. 1g SAR (W/kg)	Reported 1g SAR (W/kg)
802.11a 6 Mbps **1TX**	20	B	Bottom	157	5785	14.5	14.5	0.419	**0.42**

11.12 WLAN 5.8 GHz MIMO Antenna (Chain A) SAR Test Results

Mode	BW (MHz)	Ant.	Position	Ch.	Freq. (MHz)	Avg. Pwr. (dBM)	Max. Pwr. (dBm)	Meas. 1g SAR (W/kg)	Reported 1g SAR (W/kg)
802.11a 6 Mbps **1TX**	20	A	Bottom	149	5745	13.8	14.5	0.648	**0.76**
	20	A	Bottom	157	5785	13.81	14.5	0.804	**0.94**
	20	A	Bottom	165	5825	13.9	14.5	0.851	**0.98 (Plot 4)**
	20	A	Bottom	165	5825	13.9	14.5	0.842	**0.97 (Repeat)**

11.13 Bluetooth SAR Test Results

Bluetooth SAR tests were performed to simplify simultaneous transmission SAR evaluation.

Mode	Ant.	Position	Ch.	Freq. (MHz)	Avg. Pwr. (dBM)	Max. Pwr. (dBm)	Meas. 1g SAR (W/kg)	Reported 1g SAR (W/kg)
BT 1-DH5	B	Top	39	2440	3.48	5	0.057	**0.08**

12 Repeated SAR Measurements

SAR measurements are repeated according to the rules of **KDB 865664 D01 v01r04 Section 2.8.1 SAR measurement variability**. SAR measurement variability must be assessed for each frequency band. The repeated measurement results below and their reported SAR values are also shown in the previous section, but are again shown here to demonstrate compliance with the requirement.

1) Repeated measurement is not required when the original highest measured SAR is < 0.80 W/kg; steps 2) through 4) do not apply.

2) When the original highest measured SAR is ≥ 0.80 W/kg, repeat that measurement once.

3) Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is > 1.20 or when the original or repeated measurement is ≥ 1.45 W/kg (~ 10% from the 1-g SAR limit).

4) Perform a third repeated measurement only if the original, first or second repeated measurement is ≥ 1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.

12.1 SAR Variability Repeat Measurements

Band (GHz)	Mode	BW (MHz)	Ant.	Position	Ch.	Freq. (MHz)	Orig. 1-g SAR Meas. (W/kg	Repeat 1-g SAR Meas. (W/kg)	Largest / Smallest Ratio
2.4	802.11g 1TX	20	A	Bottom	6	2437	0.914	0.843	**1.08**
5.8	802.11a 1TX	20	A	Bottom	165	5825	0.851	0.842	**1.01**

13 Simultaneous Transmission Evaluation

(**KDB 447498 D01 v06**) Simultaneous transmission SAR must be considered for all operating configurations and exposure conditions in which separate antennas can transmit signals at the same time. All such simultaneous transmission configurations must be shown to be compliant, which can be done in any of the following three ways:

1. The sum of the highest standalone *Reported* SAR values from each antenna in the configuration is less than the SAR limit.
2. The SAR to peak location separation ratio is ≤ 0.04. This ratio is calculated as:

$$\frac{(Reported\ SAR^{Antenna1} + Reported\ SAR^{Antenna2})^{1.5}}{Distance\ Beetween\ Antenna\ 1\ and\ Antenna\ 2\ peak\ SAR\ locations\ in\ mm}$$

3. When neither 1 nor 2 suffice, simultaneous transmission must be measured either by volume scans or multiple zoom scans so that each applicable air interface is tested at all antenna locations in question. The separate scans from the simultaneously transmitting antennas are then summed together point by point to obtain the simultaneous transmission measured SAR value. The reported simultaneous transmission SAR value must be less than the limit.

According to **KDB 248227 D01 WiFi SAR v02r02 Section 6.5**:

The simultaneous transmission SAR test exclusion provisions in KDB publication 447498 can be applied to avoid simultaneous transmission SAR measurement or to reduce the number of tests…To correctly apply simultaneous transmission SAR test exclusion, the reported standalone SAR results must be examined according to all combinations of channel bandwidths, maximum output power, 802.11 transmission modes frequency bands, exposure configurations, and test positions to determine if certain combinations may be considered collectively to apply the SAR test exclusion procedures according to the highest reported SAR for the group.

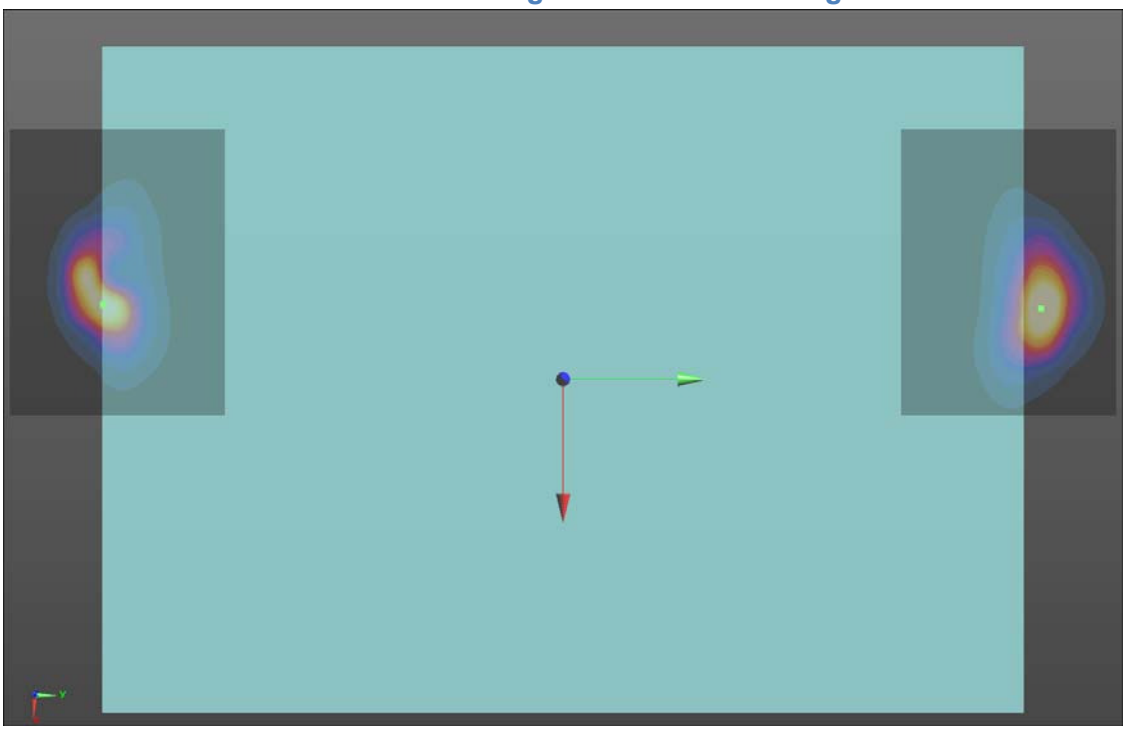
13.1 Important Standalone SAR values for Simultaneous Transmission Evaluation

The highest standalone values for each antenna and test position combination are listed here. These combinations represent the most conservative simultaneous transmission cases within each band even though some combinations evaluated will not actually transmit at the same time (ie, when the highest case within a band occurs in a different mode or channel for each antenna).

Band	Test Position	Air Interface	Ch.	Freq. (MHz)	Ant.	Peak SAR Location Coordinates (mm from Phantom origin)			Reported SAR (W/kg)
						X	Y	Z	
WLAN 2.4 GHz	Bottom	802.11g	6	2437	A	-22.0	160.8	1.1	0.91
	Bottom	802.11g	6	2437	B	-30.2	-155.8	1.1	0.89
U-NII-1	No Measurements Required								
U-NII-2A	Bottom	802.11a	56	5280	A	N/A			0.66
	Bottom	802.11a	56	5280	B	N/A			0.44
U-NII-2C	Bottom	802.11a	120	5600	A	N/A			0.67
	Bottom	802.11a	120	5600	B	N/A			0.78
U-NII-3	Bottom	802.11a	165	5825	A	N/A			0.98
	Bottom	802.11a	157	5785	B	N/A			0.42
2.4 GHz	Bottom	Bluetooth	39	2440	B	N/A			0.08

13.2 Illustration of Peak Locations Required for SPLSR Analysis

13.2.1 Bottom 0mm / Ant B 802.11g Ch. 6 / Ant A 802.11g Ch. 6



13.3 Simultaneous Transmission Evaluation Results

13.3.1 WLAN (Antenna B) + WLAN (Antenna A) Simultaneous Transmission Analysis

Exposure Condition	Test Position	SAR Value (W/kg)		Peak Location Sep. Distance (mm)	Simultaneous Transmission Evaluation Method Used	Result
		Main Antenna (Chain B)	MIMO Antenna (Chain A)			
2.4 GHz WLAN (Antenna B) + 2.4 GHz WLAN (Antenna A)						
Body	Bottom	0.89	0.91	316.7	SPLSR	SPSLR=0.008 Pass
U-NII-2A (Antenna B) + U-NII-2A (Antenna A)						
Body	Bottom	0.44	0.66	N/A	SUM	1.1 W/kg Pass
U-NII-2C (Antenna B) + U-NII-2C (Antenna A)						
Body	Bottom	0.78	0.67	N/A	SUM	1.45 W/kg Pass
U-NII-3 (Antenna B) + U-NII-3 (Antenna A)						
Body	Bottom	0.42	0.98	N/A	SUM	1.4 W/kg Pass

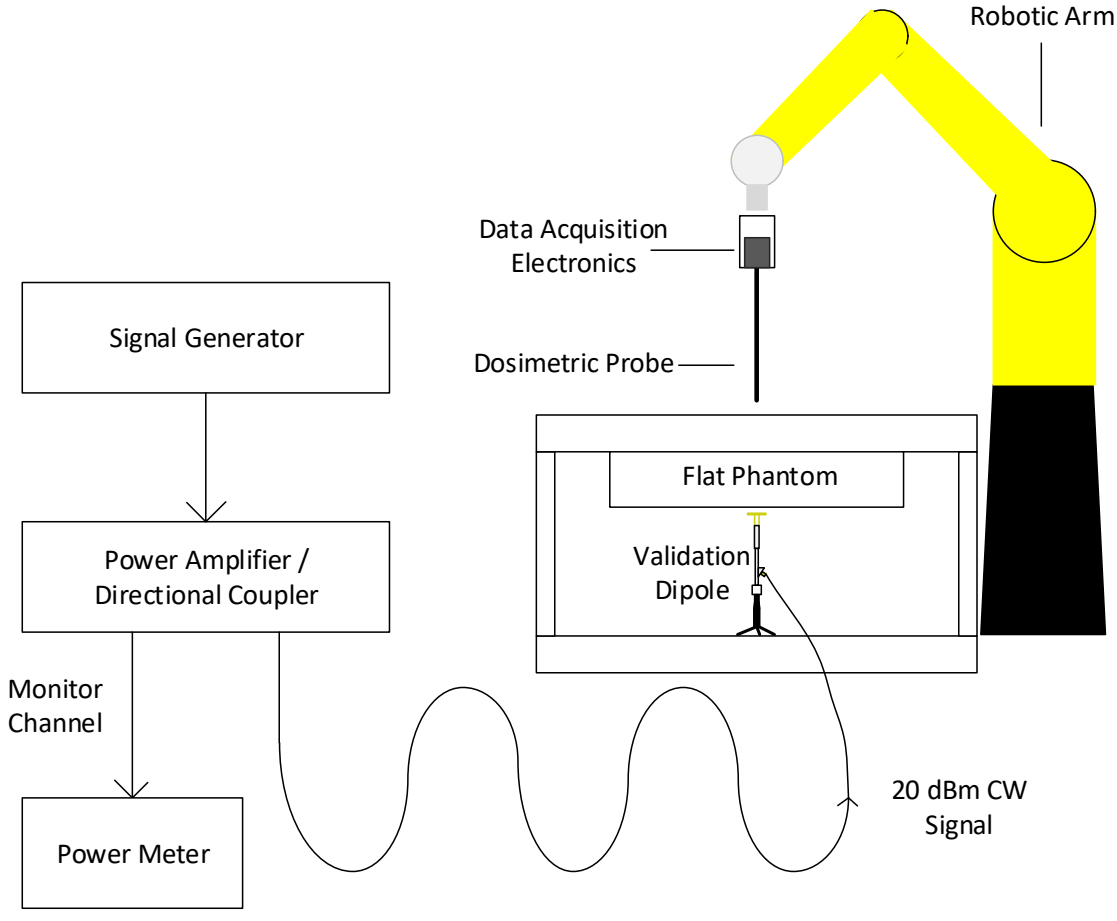
13.3.2 Bluetooth (Antenna B) + WLAN (Antenna A) Simultaneous Transmission Analysis

Exposure Condition	Test Position	SAR Value (W/kg)		Peak Location Sep. Distance (mm)	Simultaneous Transmission Evaluation Method Used	Result
		Main Antenna (Chain B)	MIMO Antenna (Chain A)			
Bluetooth (Antenna B) + 2.4 GHz WLAN (Antenna A)						
Body	Bottom	0.08	0.91	316.7	SUM	0.99 W/kg Pass
Bluetooth (Antenna B) + U-NII-2A (Antenna A)						
Body	Bottom	0.08	0.66	N/A	SUM	0.74 W/kg Pass
Bluetooth (Antenna B) + U-NII-2C (Antenna A)						
Body	Bottom	0.08	0.67	N/A	SUM	0.75 W/kg Pass
Bluetooth (Antenna B) + U-NII-3 (Antenna A)						
Body	Bottom	0.08	0.98	N/A	SUM	1.06 W/kg Pass

14 SAR System Verification

System Verifications were performed in accordance with **IEEE 1528-2013** and **KDB 865664 D01 v01r04.** 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

14.1 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	Probe SN	Dipole	Freq. (MHz)	Meas. 1-g SAR (W/kg)	Norm. 1-g SAR (W/kg)	Dipole Target 1-g SAR (W/kg)	Dev. from Target 1-g SAR (%)
12/2/2016	MSL	3940	2450V2_916	2450	4.89	48.9	49.5	**-1.21**
1/19/2017	MSL	3940	2450V2_916	2450	4.78	47.8	49.5	**-3.43 (Plot 5)**
12/2/2016	MSL	3939	5GHV2_5d158	5300	7.75	77.5	76.8	**0.91**
1/30/2017	MSL	3939	5GHV2_5d158	5300	7.2	72.0	76.8	**-6.51 (Plot 6)**
12/5/2016	MSL	3939	5GHV2_5d158	5600	8.56	85.6	80.6	**6.20 (Plot 7)**
12/5/2016	MSL	3939	5GHV2_5d158	5800	7.85	78.5	78.3	**0.26**
3/10/2017	MSL	3939	5GHV2_5d158	5800	7.74	77.4	78.3	**-1.15 (Plot 8)**

15 Tissue-Simulating Liquid Verification

(KDB 854664 D01 v01r04 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)

15.1 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

15.2 Tissue-Simulating Liquid Measurements

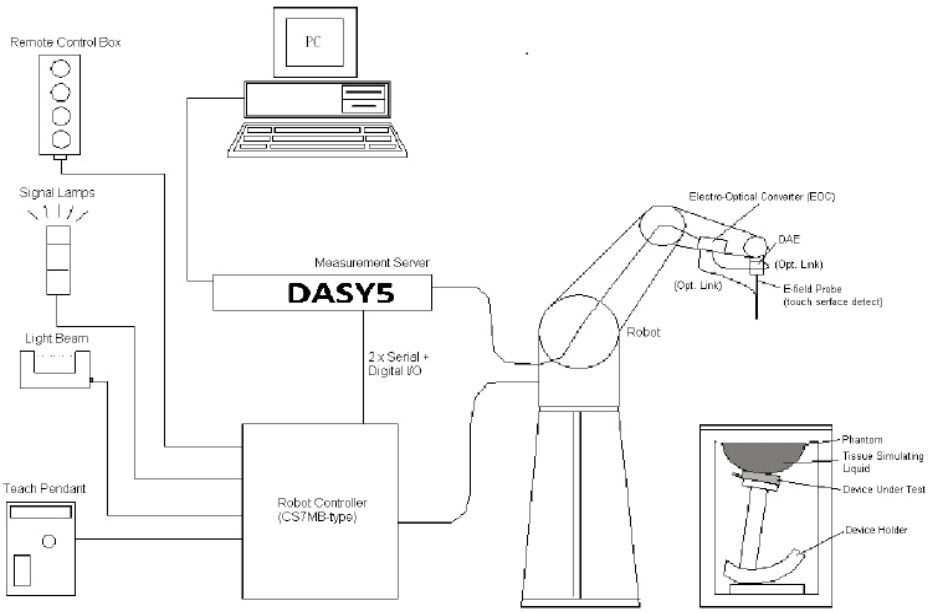
Date	Tissue-Simulating Liquid	Freq. (MHz)	Rel. Perm. ε'_r	Target ε'_r	ε'_r Dev. %	Cond. σ (S/m)	Target σ (S/m)	σ Dev. %
12/2/2016	MBBL 600-6000 160204-2 21.3 °C	2412	50.66	52.75	**-3.96**	2.000	1.91	**4.17**
		2437	50.62	52.72	**-3.98**	2.026	1.94	**4.43**
		2450	50.61	52.70	**-3.97**	2.039	1.95	**4.56**
		2462	50.6	52.68	**-3.95**	2.049	1.97	**4.01**
1/19/2017	MBBL 600-6000 160204-2 20.7 °C	2412	51.33	52.75	**-2.69**	1.968	1.91	**2.50**
		2437	51.29	52.72	**-2.71**	1.994	1.94	**2.78**
		2450	51.28	52.70	**-2.69**	2.006	1.95	**2.87**
		2462	51.27	52.68	**-2.68**	2.016	1.97	**2.34**
12/2/2016	MBBL 600-6000 160204-3 20.1 °C	5260	47.99	48.93	**-1.92**	5.443	5.37	**1.36**
		5300	47.72	48.88	**-2.37**	5.547	5.42	**2.41**
		5320	47.77	48.85	**-2.21**	5.582	5.44	**2.61**
12/5/2016	MBBL 600-6000 160204-3 19.9 °C	5550	46.67	48.54	**-3.85**	5.897	5.71	**3.27**
		5600	46.67	48.47	**-3.71**	5.972	5.77	**3.50**
		5700	46.44	48.34	**-3.93**	6.109	5.88	**3.89**
		5750	47.25	48.27	**-2.11**	5.724	5.94	**-3.64**
		5800	46.82	48.20	**-2.86**	6.132	6.00	**2.20**
1/30/2017	MBBL 600-6000 160204-3 21.2 °C	5260	46.88	48.93	**-4.19**	5.559	5.37	**3.52**
		5300	46.77	48.88	**-4.31**	5.617	5.42	**3.70**
		5320	46.72	48.85	**-4.36**	5.64	5.44	**3.68**
3/10/2017	MBBL 600-6000 160204-3 21.7 °C	5700	46.63	48.34	**-3.54**	5.928	5.88	**0.82**
		5750	46.37	48.27	**-3.94**	5.982	5.94	**0.71**
		5800	46.25	48.20	**-4.05**	6.035	6.00	**0.58**

16 System Specification

16.1 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

17 Measurement Uncertainty

KDB 865664 D01 v01r04 section 2.8.2 says:

Extensive 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 0.914 W/kg. Therefore, SAR measurement uncertainty analysis is not required for this report.

Overall SAR system measurement uncertainty is less than 30% with a confidence factor k=2 in order to meet standard requirements.

18 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_May16
    - Validation Dipole D5GHzV2-1158_May16
    - Dosimetric Probe EX3-DV4-3939_May16
    - Dosimetric Probe EX3-DV4-3940_Jul16

Microsoft

End of Test Report