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PART 0 SAR CHAR REPORT

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APPLICANT:	**MICROSOFT CORPORATION**

Report Type: Part 0 SAR Characterization
DUT Type: Portable Computing Device
Model(s): 2077

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

Test results reported herein relate only to the item(s) tested.

RJ Ortanez
Executive Vice President

ilac-MRA
A2LA ACCREDITED
CERT #2041.01

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1 DEVICE UNDER TEST

1.1 Device Overview

This device uses the Qualcomm® Smart Transmit feature to control and manage transmitting power for 2G/3G/4G/5G WWAN operations and Qualcomm® FastConnect TAS feature for WLAN technologies in real time and to ensure the time-averaged RF exposure is in compliance with the FCC requirement at all times. Additionally, this device supports BT technologies, but the output power of these modems is not controlled by the Smart Transmit algorithm.

Band & Mode	Operating Modes	Tx Frequency
UMTS 850	Data	826.40 - 846.60 MHz
UMTS 1750	Data	1712.4 - 1752.6 MHz
UMTS 1900	Data	1852.4 - 1907.6 MHz
LTE Band 71	Data	665.5 - 695.5 MHz
LTE Band 12	Data	699.7 - 715.3 MHz
LTE Band 13	Data	779.5 - 784.5 MHz
LTE Band 14	Data	790.5 - 795.5 MHz
LTE Band 26	Data	814.7 - 848.3 MHz
LTE Band 5	Data	824.7 - 848.3 MHz
LTE Band 66	Data	1710.7 - 1779.3 MHz
LTE Band 4	Data	1710.7 - 1754.3 MHz
LTE Band 25	Data	1850.7 - 1914.3 MHz
LTE Band 2	Data	1850.7 - 1909.3 MHz
LTE Band 30	Data	2307.5 - 2312.5 MHz
LTE Band 41	Data	2498.5 - 2687.5 MHz
LTE Band 48	Data	3552.5 - 3697.5 MHz
NR Band n71	Data	665.5 - 695.5 MHz
NR Band n12	Data	701.5 - 713.5 MHz
NR Band n14	Data	790.5 - 795.5 MHz
NR Band n26	Data	816.5 - 846.5 MHz
NR Band n5	Data	826.5 - 846.5 MHz
NR Band n66	Data	1712.5 - 1777.5 MHz
NR Band n25	Data	1852.5 - 1912.5 MHz
NR Band n2	Data	1852.5 - 1907.5 MHz
NR Band n30	Data	2307.5 - 2312.5 MHz
NR Band n41	Data	2506.02 - 2679.99 MHz
NR Band n48	Data	3555 - 3694.98 MHz
NR Band n77	Data	3460.02 - 3540 MHz; 3710.01 - 3969.99 MHz
2.4 GHz WIFI	Data	2412 - 2472 MHz
5 GHz WIFI	Data	U-NII-1: 5180 - 5240 MHz U-NII-2A: 5260 - 5320 MHz U-NII-2C: 5500 - 5720 MHz U-NII-3: 5745 - 5825 MHz U-NII-4: 5845 - 5885 MHz
6 GHz WIFI	Data	U-NII-5: 5945 - 6415 MHz U-NII-6: 6435 - 6515 MHz U-NII-7: 6535 - 6875 MHz U-NII-8: 6875 - 7115 MHz
2.4 GHz Bluetooth	Data	2402 - 2480 MHz

1.2 Time-Averaging for SAR and Power Density

This device is enabled with Qualcomm® Smart Transmit algorithm and Qualcomm® FastConnect TAS feature to control and manage transmitting power in real time and to ensure that the time-averaged RF exposure from WWAN and WLAN is in compliance with FCC requirements. This Part 0 report shows SAR characterization of WWAN and WLAN radios. Characterization is achieved by determining P_{Limit} for WWAN and WLAN that corresponds to the exposure design targets after accounting for all device design related uncertainties, i.e., SAR_design_target (< FCC SAR limit) for WWAN and WLAN radios. The SAR characterization is denoted as SAR Char in this report. Section 1.3 includes a nomenclature of the specific terms used in this report.

The compliance test under the static transmission scenario and simultaneous transmission analysis are reported in Part 1 report. The validation of the time-averaging algorithm and compliance under the dynamic (time- varying) transmission scenario for WWAN technologies are reported in Part 2 report (report SN could be found in Section 1.4 – Bibliography).

1.3 Nomenclature for Part 0 Report

Technology	Term	Description
WWAN, WLAN	P_{limit}	Power level that corresponds to the exposure design target (*SAR_design_target)* after accounting for all device design related uncertainties
	P_{max}	Maximum tune up output power
	SAR_design_target	Target SAR level < FCC SAR limit after accounting for all device design related uncertainties
	SAR Char	Table containing *Plimit* for all technologies and bands

1.4 Bibliography

Report Type	Report Serial Number
FCC SAR Evaluation Report (Part 1)	1M2312040120-01.C3K
RF Exposure Part 2 Test Report	1M2312040120-04.C3K
RF Exposure Compliance Summary	1M2312040120-03.C3K

2 SAR AND POWER DENSITY MEASUREMENTS

2.1 SAR Definition

Specific Absorption Rate is defined as the time derivative (rate) of the incremental energy (dU) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dV) of a given density (ρ). It is also defined as the rate of RF energy absorption per unit mass at a point in an absorbing body (see Equation 2-1).

Equation 2-1
SAR Mathematical Equation

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

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

$$SAR = \frac{\sigma \cdot E^2}{\rho}$$

where:

σ	=	conductivity of the tissue-simulating material (S/m)
ρ	=	mass density of the tissue-simulating material (kg/m^3)
E	=	Total RMS electric field strength (V/m)

NOTE: The primary factors that control rate of energy absorption were found to be the wavelength of the incident field in relation to the dimensions and geometry of the irradiated organism, the orientation of the organism in relation to the polarity of field vectors, the presence of reflecting surfaces, and whether conductive contact is made by the organism with a ground plane.[6]

2.2 SAR Measurement Procedure

The evaluation was performed using the following procedure compliant to FCC KDB Publication 865664 D01v01r04 and IEEE 1528-2013:

1. The SAR distribution at the exposed side of the head or body was measured at a distance no greater than 5.0 mm from the inner surface of the shell. The area covered the entire dimension of the device-head and body interface and the horizontal grid resolution was determined per FCC KDB Publication 865664 D01v01r04 (See Table 2-1) and IEEE 1528-2013.
2. The point SAR measurement was taken at the maximum SAR region determined from Step 1 to enable the monitoring of SAR fluctuations/drifts during the 1g/10g cube evaluation. SAR at this fixed point was measured and used as a reference value.

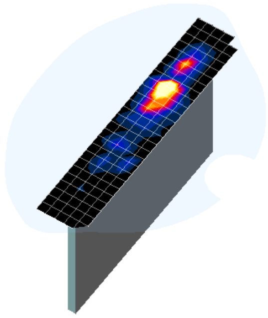

Figure 2-1
Sample SAR Area Scan

3. Based on the area scan data, the peak of the region with maximum SAR was determined by spline interpolation. Around this point, a volume was assessed according to the measurement resolution and volume size requirements of FCC KDB Publication 865664 D01v01r04 (See Table 2-1) and IEEE 1528-2013. On the

basis of this data set, the spatial peak SAR value was evaluated with the following procedure (see references or the DASY manual online for more details):

a. SAR values at the inner surface of the phantom are extrapolated from the measured values along the line away from the surface with spacing no greater than that in Table 2-1. The extrapolation was based on a least-squares algorithm. A polynomial of the fourth order was calculated through the points in the z-axis (normal to the phantom shell).

b. After the maximum interpolated values were calculated between the points in the cube, the SAR was averaged over the spatial volume (1g or 10g) using a 3D-Spline interpolation algorithm. The 3D-spline is composed of three one-dimensional splines with the “Not a knot” condition (in x, y, and z directions). The volume was then integrated with the trapezoidal algorithm. One thousand points (10 x 10 x 10) were obtained through interpolation, in order to calculate the averaged SAR.

c. All neighboring volumes were evaluated until no neighboring volume with a higher average value was found.

4. The SAR reference value, at the same location as step 2, was re-measured after the zoom scan was complete to calculate the SAR drift. If the drift deviated by more than 5%, the SAR test and drift measurements were repeated.

Table 2-1
Area and Zoom Scan Resolutions per FCC KDB Publication 865664 D01v01r04*

Frequency	Maximum Area Scan Resolution (mm) (Δx_{area}, Δy_{area})	Maximum Zoom Scan Resolution (mm) (Δx_{zoom}, Δy_{zoom})	Maximum Zoom Scan Spatial Resolution (mm)			Minimum Zoom Scan Volume (mm) (x,y,z)
			Uniform Grid	Graded Grid		
			$\Delta z_{zoom}(n)$	$\Delta z_{zoom}(1)$*	$\Delta z_{zoom}(n>1)$*	
≤ 2 GHz	≤ 15	≤ 8	≤ 5	≤ 4	≤ 1.5*$\Delta z_{zoom}(n-1)$	≥ 30
2-3 GHz	≤ 12	≤ 5	≤ 5	≤ 4	≤ 1.5*$\Delta z_{zoom}(n-1)$	≥ 30
3-4 GHz	≤ 12	≤ 5	≤ 4	≤ 3	≤ 1.5*$\Delta z_{zoom}(n-1)$	≥ 28
4-5 GHz	≤ 10	≤ 4	≤ 3	≤ 2.5	≤ 1.5*$\Delta z_{zoom}(n-1)$	≥ 25
5-6 GHz	≤ 10	≤ 4	≤ 2	≤ 2	≤ 1.5*$\Delta z_{zoom}(n-1)$	≥ 22

*Also compliant to IEEE 1528-2013 Table 6

3 SAR CHARACTERIZATION

3.1 DSI and SAR Determination

This device uses different Device State Index (DSI) to configure different time averaged power levels based on certain exposure scenarios. Depending on the detection scheme implemented in the smartphone, the worst-case SAR was determined by measurements for the relevant exposure conditions for that DSI. Detailed descriptions of the detection mechanisms are included in the operational description.

The device state index (DSI) conditions used in Table 3-1 and 3-2 represent different exposure scenarios.

Table 3-1
DSI and Corresponding Exposure Scenarios for Qualcomm® Smart Transmit algorithm

Scenario	Description	SAR Test Cases
Laptop mode or Tablet – No Motion (DSI = 3)	▪ Device transmits in laptop mode when keyboard accessory is attached and at an angle ≤210° or no motion is detected	*Laptop SAR per KDB Publication 616217 D04v01r02*
Tablet Mode (DSI=6)	▪ Device transmits in tablet when no keyboard accessory is attached, motion is detected, or keyboard accessory is attached at >210° angle	*Tablet SAR per KDB Publication 648474 D04v01r03*

Table 3-2
DSI and Corresponding Exposure Scenarios for Qualcomm® FastConnect TAS feature

Scenario	Description	SAR Test Cases
Laptop mode or Tablet – No Motion (DSI = 0)	▪ Device transmits in laptop mode when keyboard accessory is attached and at an angle ≤210° or no motion is detected	*Laptop SAR per KDB Publication 616217 D04v01r02*
Tablet Mode (DSI=1)	▪ Device transmits in tablet when no keyboard accessory is attached, motion is detected, or keyboard accessory is attached at >210° angle	*Tablet SAR per KDB Publication 648474 D04v01r03*

3.2 SAR Design Target

SAR_design_target is determined by ensuring that it is less than FCC SAR limit after accounting for total device designed related uncertainties specified by the manufacturer (see Table 3-3).

Table 3-3
***SAR_design_target* Calculations**

SAR_design_target	
$SAR\_design\_target < SAR\_regulatory\_limit \times 10^{\frac{-Total\ Uncertainty}{10}}$	
1g SAR (W/kg)	
Total Uncertainty	1.0 dB
SAR_regulatory_limit	1.6 W/kg
SAR_design_target	1.0 W/kg

3.3 SAR Char

SAR test results corresponding to *Pmax* for each antenna/technology/band/DSI can be found in Part 1 Test Report.

Plimit is calculated by linearly scaling with the measured SAR at the Ppart0 to correspond to the SAR_design_target. When Plimit < Pmax, Ppart0 was used as Plimit in the Smart Transmit EFS and Fast Connect BDF. When Plimit > Pmax and Ppart0=Pmax, calculated Plimit was used in the Smart Transmit EFS and Fast Connect BDF. All reported SAR obtained from the Ppart0 SAR tests was less than SAR_Design_target+ 1 dB Uncertainty. The final Plimit determination for each exposure scenario corresponding to SAR_design_target are shown in Table 3-4 and 3-5.

Table 3-4
***PLimit* Determination for Qualcomm® Smart Transmit algorithm**

Device State Index (DSI)	*PLimit* Determination Scenarios
3	P*limit* is calculated based on: • 1g Body Laptop SAR at 0 mm for bottom edge with keyboard accessory attached. • Tablet with no keyboard accessory and no motion detected at 25mm for back, top, right and left surfaces.
6	P_{limit} is calculated based on 1g Body Tablet SAR at 0 mm for back, top, bottom, right, and left surfaces with and without keyboard accessory.

Table 3-5
***PLimit* Determination for Qualcomm® FastConnect TAS feature**

Device State Index (DSI)	*PLimit* Determination Scenarios
0	The worst-case SAR exposure is determined as the maximum SAR normalized to the limit (i.e. lowest P*limit)* among: • 1g Body Laptop SAR at 0 mm for bottom edge with keyboard accessory attached. • Tablet with no keyboard accessory and no motion detected at 25mm for back, top, right and left surfaces.
1	P_{limit} is calculated based on 1g Body Tablet SAR at 0 mm for back, top, bottom, right, and left surfaces with and without keyboard accessory.

Table 3-6
SAR Characterizations for Qualcomm® Smart Transmit algorithm

Exposure Scenario		Maximum Tune-Up Output Power*	Laptop or Tablet - No Motion	Tablet
Averaging Volume			1g	1g
Spacing			0, 25 mm	0 mm
DSI			3	6
Technology/Band	Antenna	Pmax		
UMTS 850	4	24.0	30.0	17.4
UMTS 1750	1	24.0	26.1	12.6
UMTS 1900	1	24.0	30.0	11.3
LTE Band 71	4	24.0	30.0	16.3
LTE Band 12	4	24.0	30.0	16.8
LTE Band 13	4	24.0	30.0	17.3
LTE Band 14	4	24.0	30.0	17.8
LTE Band 26	4	24.0	30.0	17.4
LTE Band 5	4	24.0	30.0	17.4
LTE Band 66/4	1	24.0	27.9	12.6
LTE Band 25	1	24.0	30.0	11.3
LTE Band 2	1	24.0	30.0	11.3
LTE Band 30	1	22.0	28.6	10.9
LTE Band 41 PC3	1	22.0	27.6	10.5
LTE Band 41 PC2	1	22.4	27.6	10.5
LTE Band 48	2	17.6	30.0	8.9
LTE Band 48	3	17.6	27.4	8.9
NR Band n71	4	24.0	30.0	16.3
NR Band n12	4	24.0	30.0	16.8
NR Band n14	4	24.0	30.0	17.8
NR Band n26	4	24.0	30.0	17.4
NR Band n5	4	24.0	30.0	17.4
NR Band n66	1	24.0	28.7	12.6
NR Band n66	4	24.0	30.0	14.7
NR Band n25/n2	1	24.0	28.7	11.3
NR Band n25/n2	4	24.0	30.0	13.9
NR Band n30	1	22.0	29.1	10.9
NR Band n30	4	22.0	30.0	11.3
NR Band n41 PC3	1	24.0	26.4	10.5
NR Band n41 PC3	4	24.0	29.2	11.8
NR Band n48	2	19.6	29.8	8.9
NR Band n48	3	19.6	27.3	8.9
NR Band n48	5	19.6	30.0	1.0
NR Band n48	8	19.6	30.0	-1.5
NR Band n77 PC3	2	24.0	24.0	8.8
NR Band n77 PC3	3	24.0	26.8	10.9
NR Band n77 PC3	5	22.5	30.0	1.0
NR Band n77 PC3	8	22.5	26.3	-1.5
NR Band n77 PC2	2	25.5	24.0	8.8
NR Band n77 PC2	3	25.5	26.8	10.9
NR Band n77 PC2	5	24.0	30.0	1.0
NR Band n77 PC2	8	24.0	26.3	-1.5

Table 3-7
SAR Characterizations for Qualcomm® FastConnect algorithm

Exposure Scenario			Maximum Tune-Up Output Power*	Laptop or Tablet - No Motion	Tablet
Averaging Volume				1g	1g
Spacing				0, 25 mm	0 mm
DSI				0	1
Technology/Band	Antenna	Antenna Group	Pmax		
2.4 GHz WIFI	6	AG0	20.5	32.9	13.75
2.4 GHz WIFI	7	AG1	20.5	32.2	13.5
5 GHz WIFI	6	AG0	20.0	23.7	7.75
5 GHz WIFI	7	AG1	20.0	24.5	7.0
6 GHz WIFI	6	AG0	19.0	20.8	7.75
6 GHz WIFI	7	AG1	19.0	19.1	7.25

Notes:

1. When $P_{max} < P_{limit}$, the DUT will operate at a power level up to P_{max}.
2. MIMO is not included in SAR CHAR due to the two antennas being in separate Antenna Groups.

4 EQUIPMENT LIST

For SAR measurements

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Agilent	E4404B	Spectrum Analyzer	N/A	N/A	N/A	MY45113242
Agilent	E4438C	ESG Vector Signal Generator	10/10/2023	Annual	10/10/2024	MY42082659
Agilent	E4438C	ESG Vector Signal Generator	11/15/2023	Annual	11/15/2024	MY45092078
Agilent	N5182A	MXG Vector Signal Generator	11/14/2023	Annual	11/14/2024	US46240505
Agilent	N5182A	MXG Vector Signal Generator	7/4/2023	Annual	7/4/2024	MY48180366
Agilent	8753ES	S-Parameter Vector Network Analyzer	7/21/2023	Annual	7/21/2024	US39170118
Agilent	8753ES	S-Parameter Vector Network Analyzer	1/10/2024	Annual	1/10/2025	MY40001472
Agilent	E5515C	Wireless Communications Test Set	4/24/2019	Triennial	CBT	GB46310798
Agilent	E5515C	Wireless Communications Test Set	1/10/2024	Annual	1/10/2025	MY50262130
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	343972
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433971
Amplifier Research	150A100C	Amplifier	CBT	N/A	CBT	350132
Anritsu	MN8110B	I/O Adaptor	CBT	N/A	CBT	6261747881
Anritsu	ML2496A	Power Meter	6/15/2023	Annual	6/15/2024	1138001
Anritsu	MA2411B	Pulse Power Sensor	6/14/2023	Annual	6/14/2024	1911105
Anritsu	MA2411B	Pulse Power Sensor	6/15/2023	Annual	6/15/2024	1126066
Anritsu	MT8821C	Radio Communication Analyzer MT8821C	7/5/2023	Annual	7/5/2024	6262150000
Anritsu	MT8821C	Radio Communication Analyzer MT8821C	12/15/2023	Annual	12/15/2024	6200901190
Anritsu	MT8821C	Radio Communication Analyzer MT8821C	7/7/2023	Annual	7/7/2024	6262044715
Anritsu	MT8000A	Radio Communication Test Station	9/4/2023	Annual	9/4/2024	6272337405
Anritsu	MT8000A	Radio Communication Test Station	10/17/2023	Annual	10/17/2024	6262036828
Anritsu	MT8000A	Radio Communication Test Station	6/15/2023	Annual	6/15/2024	6261914237
Anritsu	MA24106A	USB Power Sensor	4/21/2023	Annual	4/21/2024	1349503
Anritsu	MA24106A	USB Power Sensor	10/31/2023	Annual	10/31/2024	1248508
Anritsu	MA24106A	USB Power Sensor	7/4/2023	Annual	7/4/2024	1244512
Control Company	4040	Therm./ Clock/ Humidity Monitor	1/15/2024	Annual	1/15/2025	160574418
Mitutoyo	500-196-30	CD-6"ASX 6Inch Digital Caliper	2/16/2022	Triennial	2/16/2025	A20238413
Keysight Technologies	N6705B	DC Power Analyzer	5/5/2021	Triennial	5/5/2024	MY53004059
Keysight Technologies	N9020A	MXA Signal Analyzer	10/17/2023	Annual	10/17/2024	MY51240479
Keysight Technologies	N9020A	MXA Signal Analyzer	4/6/2023	Annual	4/6/2024	MY48010233
Agilent	N9020A	MXA Signal Analyzer	10/17/2023	Annual	10/17/2024	MY51240479
Mini-Circuits	VLF-2950+	Low Pass Filter DC to 2700 MHz	CBT	N/A	CBT	N/A
Mini-Circuits	NLP-1200+	Low Pass Filter DC to 1000 MHz	CBT	N/A	CBT	N/A
Mini-Circuits	VLF-6000+	Low Pass Filter DC to 6000 MHz	7/5/2023	Annual	7/5/2024	31634
Mini-Circuits	ZUDC10-83-S+	Directional Coupler	CBT	N/A	CBT	2050
Mini-Circuits	ZUDC10-83-S+	Directional Coupler	7/5/2023	Annual	7/5/2024	2111
Seekonk	TSF-100	Torque Wrench	6/30/2023	Annual	6/30/2024	47639-29
Rohde & Schwarz	CMW500	Wideband Radio Communication Tester	8/14/2023	Annual	8/14/2024	161662
Rohde & Schwarz	CMW500	Wideband Radio Communication Tester	6/1/2023	Annual	6/1/2024	108843
Rohde & Schwarz	CMW500	Wideband Radio Communication Tester	7/4/2023	Annual	7/4/2024	166818
Rohde & Schwarz	CMW500	Wideband Radio Communication Tester	8/10/2023	Annual	8/10/2024	140144
SPEAG	DAK-3.5	Dielectric Assessment Kit	11/13/2023	Annual	11/13/2024	1277
SPEAG	DAK-3.5	Dielectric Assessment Kit	5/9/2023	Annual	5/9/2024	1070
SPEAG	DAKS-3.5	Portable Dielectric Assessment Kit	8/14/2023	Annual	8/14/2024	1041
SPEAG	DAK-12	Dielectric Assessment Kit (4MHz - 3GHz)	3/11/2024	Annual	3/11/2025	1102
SPEAG	MAIA	Modulation and Audio Interference Analyzer	N/A	N/A	N/A	1379
SPEAG	MAIA	Modulation and Audio Interference Analyzer	N/A	N/A	N/A	1243
SPEAG	D750V3	750 MHz SAR Dipole	5/11/2023	Annual	5/11/2024	1003
SPEAG	D835V2	835 MHz SAR Dipole	1/18/2024	Annual	1/18/2025	4d132
SPEAG	D835V2	835 MHz SAR Dipole	4/13/2023	Annual	4/13/2024	4d119
SPEAG	D835V2	835 MHz SAR Dipole	5/11/2023	Annual	5/11/2024	4d180
SPEAG	D1750V2	1750 MHz SAR Dipole	10/20/2021	Triennial	10/20/2024	1150
SPEAG	D1750V2	1750 MHz SAR Dipole	1/18/2022	Biennial	1/18/2024	1148
SPEAG	D1765V2	1750 MHz SAR Dipole	5/14/2021	Triennial	5/14/2024	1008
SPEAG	D1900V2	1900 MHz SAR Dipole	2/21/2022	Biennial	2/21/2024	5d148
SPEAG	D1900V2	1900 MHz SAR Dipole	9/21/2021	Triennial	9/21/2024	5d149
SPEAG	D2300V2	2300 MHz SAR Dipole	8/25/2022	Biennial	8/25/2024	1073
SPEAG	D2300V2	2300 MHz SAR Dipole	6/12/2023	Annual	6/12/2024	1117
SPEAG	D2450V2	2450 MHz SAR Dipole	11/25/2021	Triennial	11/25/2024	981
SPEAG	D2450V2	2450 MHz SAR Dipole	8/18/2021	Triennial	8/18/2024	719
SPEAG	D2450V2	2450 MHz SAR Dipole	5/11/2023	Annual	5/11/2024	945
SPEAG	D2600V2	2600 MHz SAR Dipole	4/14/2021	Triennial	4/14/2024	1004
SPEAG	D2600V2	2600 MHz SAR Dipole	6/13/2022	Biennial	6/13/2024	1064
SPEAG	D3500V2	3500 MHz SAR Dipole	1/19/2021	Triennial	1/19/2024	1059
SPEAG	D3500V2	3500 MHz SAR Dipole	6/15/2023	Annual	6/15/2024	1127
SPEAG	D3500V2	3500 MHz SAR Dipole	1/10/2023	Biennial	1/10/2025	1097
SPEAG	D3700V2	3700 MHz SAR Dipole	1/13/2023	Annual	1/13/2024	1067
SPEAG	D3700V2	3700 MHz SAR Dipole	6/15/2023	Annual	6/15/2024	1096
SPEAG	D3700V2	3700 MHz SAR Dipole	1/9/2024	Annual	1/9/2025	1018
SPEAG	D3900V2	3900 MHz SAR Dipole	6/15/2023	Annual	6/15/2024	1074
SPEAG	D5GHzV2	5 GHz SAR Dipole	1/17/2024	Annual	1/17/2025	1191
SPEAG	D5GHzV2	5 GHz SAR Dipole	4/17/2023	Annual	4/17/2024	1237
SPEAG	D6.5GHzV2	6.5 GHz SAR Dipole	1/10/2024	Annual	1/10/2025	1018
SPEAG	D6.5GHzV2	6.5 GHz SAR Dipole	1/10/2024	Annual	1/10/2025	1020
SPEAG	DAE4	Dasy Data Acquisition Electronics	4/14/2023	Annual	4/14/2024	1407
SPEAG	DAE4	Dasy Data Acquisition Electronics	6/15/2023	Annual	6/15/2024	1334
SPEAG	DAE4	Dasy Data Acquisition Electronics	1/18/2023	Annual	1/18/2024	1530
SPEAG	DAE4	Dasy Data Acquisition Electronics	10/18/2023	Annual	10/18/2024	1638
SPEAG	DAE4	Dasy Data Acquisition Electronics	5/11/2023	Annual	5/11/2024	728
SPEAG	DAE4	Dasy Data Acquisition Electronics	2/16/2023	Annual	2/16/2024	1645
SPEAG	DAE4	Dasy Data Acquisition Electronics	1/9/2024	Annual	1/9/2025	1533
SPEAG	DAE4	Dasy Data Acquisition Electronics	1/20/2023	Annual	1/20/2024	1466
SPEAG	DAE4	Dasy Data Acquisition Electronics	1/16/2024	Annual	1/16/2025	1530
SPEAG	DAE4	Dasy Data Acquisition Electronics	5/16/2023	Annual	5/16/2024	1678
SPEAG	DAE4	Dasy Data Acquisition Electronics	9/6/2023	Annual	9/6/2024	1364
SPEAG	DAE4	Dasy Data Acquisition Electronics	10/18/2023	Annual	10/18/2024	1322
SPEAG	EX3DV4	SAR Probe	4/14/2023	Annual	4/14/2024	7659
SPEAG	EX3DV4	SAR Probe	6/15/2023	Annual	6/15/2024	7409
SPEAG	EX3DV4	SAR Probe	1/17/2024	Annual	1/17/2025	7713
SPEAG	EX3DV4	SAR Probe	2/9/2024	Annual	2/9/2025	7640
SPEAG	EX3DV4	SAR Probe	1/16/2024	Annual	1/16/2025	7565
SPEAG	EX3DV4	SAR Probe	9/12/2023	Annual	9/12/2024	7558
SPEAG	EX3DV4	SAR Probe	10/23/2023	Annual	10/23/2024	7547
SPEAG	EX3DV4	SAR Probe	5/9/2023	Annual	5/9/2024	7660
SPEAG	EX3DV4	SAR Probe	6/14/2023	Annual	6/14/2024	7661
SPEAG	EX3DV4	SAR Probe	1/11/2024	Annual	1/11/2025	7803
SPEAG	EX3DV4	SAR Probe	7/7/2023	Annual	7/7/2024	7410

Note:

1. CBT (Calibrated Before Testing). Prior to testing, the measurement paths containing a cable, amplifier, attenuator, coupler or filter were connected to a calibrated source (i.e. a signal generator) to determine the losses of the measurement path. The power meter offset was then adjusted to compensate for the measurement system losses. This level offset is stored within the power meter before measurements are made. This calibration verification procedure applies to the system verification and output power measurements. The calibrated reading is then taken directly from the power meter after compensation of the losses for all final power measurements.
2. Each equipment item was used solely within its respective calibration period.

5 MEASUREMENT UNCERTAINTIES

Applicable for SAR Measurements < 6 GHz:

Uncertainty Component	IEEE 1528 Sec.	Tol. (± %)	Prob. Dist.	f(d,k) Div.	c_i 1gm	c_i 10 gms	c x f/e 1gm u_i (± %)	c x g/e 10gms u_i (± %)	v_i
Measurement System									
Probe Calibration	E.2.1	7	N	1	1	1	7.0	7.0	∞
Axial Isotropy	E.2.2	0.25	N	1	0.7	0.7	0.2	0.2	∞
Hemishperical Isotropy	E.2.2	1.3	N	1	0.7	0.7	0.9	0.9	∞
Boundary Effect	E.2.3	2	R	1.73	1	1	1.2	1.2	∞
Linearity	E.2.4	0.3	N	1	1	1	0.3	0.3	∞
System Detection Limits	E.2.4	0.25	R	1.73	1	1	0.1	0.1	∞
Modulation Response	E.2.5	4.8	R	1.73	1	1	2.8	2.8	∞
Readout Electronics	E.2.6	0.3	N	1	1	1	0.3	0.3	∞
Response Time	E.2.7	0.8	R	1.73	1	1	0.5	0.5	∞
Integration Time	E.2.8	2.6	R	1.73	1	1	1.5	1.5	∞
RF Ambient Conditions - Noise	E.6.1	3	R	1.73	1	1	1.7	1.7	∞
RF Ambient Conditions - Reflections	E.6.1	3	R	1.73	1	1	1.7	1.7	∞
Probe Positioner Mechanical Tolerance	E.6.2	0.8	R	1.73	1	1	0.5	0.5	∞
Probe Positioning w/ respect to Phantom	E.6.3	6.7	R	1.73	1	1	3.9	3.9	∞
Extrapolation, Interpolation & Integration algorithms for Max. SAR Evaluation	E.5	4	R	1.73	1	1	2.3	2.3	∞
Test Sample Related									
Test Sample Positioning	E.4.2	3.12	N	1	1	1	3.1	3.1	35
Device Holder Uncertainty	E.4.1	1.67	N	1	1	1	1.7	1.7	5
Output Power Variation - SAR drift measurement	E.2.9	5	R	1.73	1	1	2.9	2.9	∞
SAR Scaling	E.6.5	0	R	1.73	1	1	0.0	0.0	∞
Phantom & Tissue Parameters									
Phantom Uncertainty (Shape & Thickness tolerances)	E.3.1	7.6	R	1.73	1.0	1.0	4.4	4.4	∞
Liquid Conductivity - measurement uncertainty	E.3.3	4.3	N	1	0.78	0.71	3.3	3.0	76
Liquid Permittivity - measurement uncertainty	E.3.3	4.2	N	1	0.23	0.26	1.0	1.1	75
Liquid Conductivity - Temperature Uncertainty	E.3.4	3.4	R	1.73	0.78	0.71	1.5	1.4	∞
Liquid Permittivity - Temperature Unceritainty	E.3.4	0.6	R	1.73	0.23	0.26	0.1	0.1	∞
Liquid Conductivity - deviation from target values	E.3.2	5.0	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Permittivity - deviation from target values	E.3.2	5.0	R	1.73	0.60	0.49	1.7	1.4	∞
Combined Standard Uncertainty (k=1)			RSS				12.2	12.0	191
Expanded Uncertainty (95% CONFIDENCE LEVEL)			k=2				24.4	24.0	

The above measurement uncertainties are according to IEEE Std. 1528-2013

Applicable for SAR Measurements > 6 GHz:

Uncertainty Component	IEEE 1528 Sec.	Tol. (± %)	Prob. Dist.	f(d,k) Div.	c_i 1gm	c_i 10 gms	c x f/e 1gm u_i (± %)	c x g/e 10gms u_i (± %)	v_i
Measurement System									
Probe Calibration	E.2.1	9.3	N	1	1	1	9.3	9.3	∞
Axial Isotropy	E.2.2	0.25	N	1	0.7	0.7	0.2	0.2	∞
Hemishperical Isotropy	E.2.2	1.3	N	1	0.7	0.7	0.9	0.9	∞
Boundary Effect	E.2.3	2	R	1.73	1	1	1.2	1.2	∞
Linearity	E.2.4	0.3	N	1	1	1	0.3	0.3	∞
System Detection Limits	E.2.4	0.25	R	1.73	1	1	0.1	0.1	∞
Modulation Response	E.2.5	4.8	R	1.73	1	1	2.8	2.8	∞
Readout Electronics	E.2.6	0.3	N	1	1	1	0.3	0.3	∞
Response Time	E.2.7	0.8	R	1.73	1	1	0.5	0.5	∞
Integration Time	E.2.8	2.6	R	1.73	1	1	1.5	1.5	∞
RF Ambient Conditions - Noise	E.6.1	3	R	1.73	1	1	1.7	1.7	∞
RF Ambient Conditions - Reflections	E.6.1	3	R	1.73	1	1	1.7	1.7	∞
Probe Positioner Mechanical Tolerance	E.6.2	0.8	R	1.73	1	1	0.5	0.5	∞
Probe Positioning w/ respect to Phantom	E.6.3	6.7	R	1.73	1	1	3.9	3.9	∞
Extrapolation, Interpolation & Integration algorithms for Max. SAR Evaluation	E.5	4	R	1.73	1	1	2.3	2.3	∞
Test Sample Related									
Test Sample Positioning	E.4.2	3.12	N	1	1	1	3.1	3.1	35
Device Holder Uncertainty	E.4.1	1.67	N	1	1	1	1.7	1.7	5
Output Power Variation - SAR drift measurement	E.2.9	5	R	1.73	1	1	2.9	2.9	∞
SAR Scaling	E.6.5	0	R	1.73	1	1	0.0	0.0	∞
Phantom & Tissue Parameters									
Phantom Uncertainty (Shape & Thickness tolerances)	E.3.1	7.6	R	1.73	1.0	1.0	4.4	4.4	∞
Liquid Conductivity - measurement uncertainty	E.3.3	4.3	N	1	0.78	0.71	3.3	3.0	76
Liquid Permittivity - measurement uncertainty	E.3.3	4.2	N	1	0.23	0.26	1.0	1.1	75
Liquid Conductivity - Temperature Uncertainty	E.3.4	3.4	R	1.73	0.78	0.71	1.5	1.4	∞
Liquid Permittivity - Temperature Unceritainty	E.3.4	0.6	R	1.73	0.23	0.26	0.1	0.1	∞
Liquid Conductivity - deviation from target values	E.3.2	5.0	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Permittivity - deviation from target values	E.3.2	5.0	R	1.73	0.60	0.49	1.7	1.4	∞
Combined Standard Uncertainty (k=1)			RSS				13.8	13.6	191
Expanded Uncertainty (95% CONFIDENCE LEVEL)			k=2				27.6	27.1	

The above measurement uncertainties are according to IEEE Std. 1528-2013