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RF Exposure Part 0 Test Report

Applicant Name:
Microsoft Corporation
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Date of Testing:
04/23/2025 – 06/24/2025
Test Site/Location:
Element, Columbia, MD, USA
Document Serial No.:
1M2504010035-04.C3K (Rev1)

FCC ID (Licensed):	**C3K2119**
FCC ID (Unlicensed):	**C3K00002102A**
APPLICANT:	**MICROSOFT CORPORATION**

Report Type:	Part 0 SAR Characterization
DUT Type:	Modular Approval - Host Integration (Portable Computing Device)
Model(s):	2114, HWB-Q94

Note: This revised Test Report supersedes and replaces the previously issued test report on the same subject device for the same type of testing as indicated. Please discard or destroy the previously issued test report(s) and dispose of it accordingly.

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
ACCREDITED
CERT #2041.01

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1 DEVICE UNDER TEST

1.1 Device Overview

The equipment under test (EUT), Model 2119, is a portable computing device that incorporates two previously certified transmitter modules. The first is a WLAN/Bluetooth module authorized under FCC ID: C3K00002102A, and the second is a cellular module authorized under FCC ID: C3K2119. No hardware or software modifications have been made to either module for the purposes of this host integration. This report evaluates the host device for compliance with the applicable FCC rules, including assessment of co-location and simultaneous transmission conditions involving the integrated modules.

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	2501.01 - 2685 MHz
NR Band n48	Data	3555 - 3694.98 MHz
NR Band n77	Data	3455.01 - 3544.98 MHz; 3705 - 3975 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: 5935 - 6415 MHz U-NII-6: 6435 - 6515 MHz U-NII-7: 6535 - 6875 MHz U-NII-8: 6895 - 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 WWAN is in compliance with FCC requirements. This Part 0 report shows SAR characterization of WWAN and WLAN radios. Characterization is achieved by determining PLimit for 2G/3G/4G/5G/WLAN that corresponds to the exposure design targets after accounting for all device design related uncertainties, i.e., SAR_design_target (< FCC SAR limit). 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 and WLAN technologies are reported in their respective Part 2 SAR test reports (report SNs 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
RF Exposure Part 1 Test Report	1M2504010035-03.C3K
RF Exposure Part 2 WLAN Test Report	1M2504010035-12.C3K
RF Exposure Part 2 WWAN Test Report	1M2504010035-06.C3K
RF Exposure Compliance Summary Report	1M2504010035-05.C3K
RF Exposure Part 0 Test Report	1M2504010035-04.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:

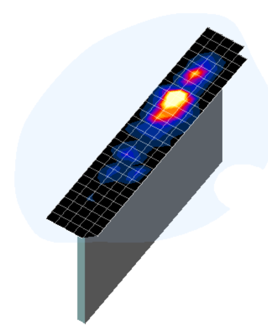

Figure 2-1
Sample SAR Area Scan

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.
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
No Motion (DSI = 3)	▪ No Motion is detected	*Laptop SAR per KDB Publication 616217 D04v01r02*
Motion (DSI = 6)	▪ Motion is detected	*Laptop SAR per KDB Publication 616217 D04v01r02*

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

Scenario	Description	SAR Test Cases
Motion (Pmax)	▪ No Motion is detected	*Laptop SAR per KDB Publication 616217 D04v01r02*
Motion (DSI = 1)	▪ Motion is detected	*Laptop SAR per KDB Publication 616217 D04v01r02*

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 Part 0 to correspond to the *SAR_design_target*. When *Plimit* < *Pmax*, *Ppart0* was used as Plimit in the Smart Transmit EFS and FastConnect BDF. When *Plimit* > *Pmax* and *Ppart0*=Pmax, calculated *Plimit* was used in the Smart Transmit EFS and FastConnect BDF. All reported SAR obtained from the Part 0 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 SAR at 25 mm
6	P_{limit} is calculated based on 1g Body SAR at 0 mm for the bottom surface of the keyboard

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

Device State Index (DSI)	*PLimit* Determination Scenarios
1	P_{limit} is calculated based on 1g Body SAR at 0 mm for the bottom surface of the keyboard

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

Exposure Scenario		Maximum Tune-Up Output Power*	Body No Motion	Body Motion
Averaging Volume			1g	1g
Spacing			25mm	0mm
DSI			3	6
Technology/Band	Antenna	P_{max}	P_{limit}	P_{limit}
UMTS 850	5	24.0	32.0	21.2
UMTS 1750	1	24.0	26.7	17.2
UMTS 1900	1	24.0	29.9	16.4
LTE Band 71	2	24.0	33.6	21.0
LTE Band 71	5	24.0	32.8	20.7
LTE Band 12	2	24.0	32.6	20.5
LTE Band 12	5	24.0	32.7	20.2
LTE Band 13	2	24.0	32.4	20.4
LTE Band 13	5	24.0	32.2	20.9
LTE Band 14	2	24.0	33.1	20.4
LTE Band 14	5	24.0	34.1	20.9
LTE Band 26	2	24.0	34.4	21.1
LTE Band 26	5	24.0	31.9	21.2
LTE Band 5	2	24.0	33.7	21.1
LTE Band 5	5	24.0	31.7	21.2
LTE Band 66/4	1	24.5	27.9	17.2
LTE Band 25	1	24.5	29.9	16.4
LTE Band 2	1	24.5	27.7	16.4
LTE Band 30	1	21.3	26.5	15.0
LTE Band 41 PC2	1	22.4	26.0	16.5
LTE Band 41 PC3	1	22.5	26.0	16.5
LTE Band 41 PC2	6	22.4	22.9	16.4
LTE Band 41 PC3	6	22.5	22.9	16.4
LTE Band 48	1	18.0	28.1	15.8
LTE Band 48	6	18.0	26.6	14.5
NR Band n71	2	24.0	34.0	20.0
NR Band n71	5	24.0	33.5	19.9
NR Band n12	2	24.0	31.0	19.5
NR Band n12	5	24.0	33.4	19.2
NR Band n14	2	24.0	32.8	20.4
NR Band n14	5	24.0	35.7	20.9
NR Band n26	2	24.0	30.4	21.1
NR Band n26	5	24.0	31.6	21.2
NR Band n5	2	24.0	31.0	21.1
NR Band n5	5	24.0	31.8	21.2
NR Band n66	1	24.5	26.5	17.2
NR Band n25/n2	1	24.5	28.9	15.4
NR Band n30	1	21.3	25.5	15.0
NR Band n41 PC2	1	26.0	27.8	16.5
NR Band n41 PC3	1	24.5	27.8	16.5
NR Band n41 PC2	6	26.0	28.4	16.5
NR Band n41 PC3	6	24.5	28.4	16.5
NR Band n48 PC3	1	20.0	26.6	15.8
NR Band n48 PC3	3	20.0	28.5	13.5
NR Band n48 PC3	4	20.0	28.4	13.0
NR Band n48 PC3	6	20.0	24.4	14.5
NR Band n77 PC2	1	26.0	27.7	15.8
NR Band n77 PC3	1	24.0	27.7	15.8
NR Band n77 PC2	3	26.0	28.0	13.5
NR Band n77 PC3	3	24.0	28.0	13.5
NR Band n77 PC2	4	26.0	27.9	13.0
NR Band n77 PC3	4	24.0	27.9	13.0
NR Band n77 PC2	6	26.0	27.9	14.5
NR Band n77 PC3	6	24.0	27.9	14.5
NR Band n41 PC1.5 UL-MIMO	1	26.0	27.8	16.5
NR Band n41 PC1.5 UL-MIMO	6	26.0	28.4	16.5
NR Band n48 PC3 UL-MIMO	1	17.0	26.6	15.8
NR Band n48 PC3 UL-MIMO	6	17.0	24.4	14.5
NR Band n77 PC1.5 UL-MIMO	1	26.0	27.7	15.8
NR Band n77 PC1.5 UL-MIMO	6	26.0	27.9	14.5

Table 3-7
SAR Characterizations for Qualcomm® FastConnect algorithm

Exposure Scenario			Maximum Tune-Up Output Power*	Body Motion
Averaging Volume				1g
Spacing				0mm
DSI				1
Technology/Band	Antenna	Antenna Group	P_{max}	P_{limit}
2.4 GHz WIFI	Chain 0	AG0	20.0	19.25
2.4 GHz WIFI	Chain 1	AG1	20.0	20.00
5 GHz WIFI - UNII-1	Chain 0	AG0	16.0	14.75
5 GHz WIFI - UNII-1	Chain 1	AG1	16.0	15.50
5 GHz WIFI - UNII-2C	Chain 0	AG0	16.0	13.25
5 GHz WIFI - UNII-2C	Chain 1	AG1	16.0	13.00
5 GHz WIFI - UNII-3	Chain 0	AG0	20.5	13.25
5 GHz WIFI - UNII-3	Chain 1	AG1	20.5	12.00
5 GHz WIFI - UNII-4	Chain 0	AG0	17.0	13.25
5 GHz WIFI - UNII-4	Chain 1	AG1	17.0	12.00
6 GHz WIFI	Chain 0	AG0	17.0	8.50
6 GHz WIFI	Chain 1	AG1	17.0	8.50

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.

element

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	10/23/2024	Annual	10/23/2025	MY45093852
Agilent	E4438C	ESG Vector Signal Generator	11/15/2024	Annual	11/15/2025	MY45092078
Agilent	N5182A	MXG Vector Signal Generator	7/9/2024	Annual	7/9/2025	MY48180366
Agilent	8753ES	S-Parameter Vector Network Analyzer	1/6/2025	Annual	1/6/2026	MY40001472
Agilent	8753ES	S-Parameter Vector Network Analyzer	9/25/2024	Annual	9/25/2025	MY40003841
Agilent	E5515C	Wireless Communications Test Set	CBT	N/A	CBT	GB46310798
Agilent	E5515C	Wireless Communications Test Set	CBT	N/A	CBT	GB41450275
Agilent	N4010A	Wireless Connectivity Test Set	N/A	N/A	N/A	GB46170464
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433973
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433974
Amplifier Research	150A100C	Amplifier	CBT	N/A	CBT	350132
Anritsu	MN8110B	I/O Adaptor	CBT	N/A	CBT	6261747881
Anritsu	ML2496A	Power Meter	7/15/2024	Annual	7/15/2025	1138001
Anritsu	ML2496A	Power Meter	6/24/2024	Annual	6/24/2025	1840005
Anritsu	MA2411B	Pulse Power Sensor	9/5/2024	Annual	9/5/2025	1726262
Anritsu	MA2411B	Pulse Power Sensor	10/21/2024	Annual	10/21/2025	1027293
Anritsu	MT8821C	Radio Communication Analyzer MT8821C	CBT	N/A	CBT	6200901190
Anritsu	MT8821C	Radio Communication Analyzer MT8821C	CBT	N/A	CBT	6201144419
Anritsu	MT8821C	Radio Communication Analyzer MT8821C	3/14/2025	Annual	3/14/2026	6262044715
Anritsu	MT8000A	Radio Communication Test Station	CBT	N/A	CBT	626196-7072
Anritsu	MT8000A	Radio Communication Test Station	CBT	N/A	CBT	6272337408
Anritsu	MT8000A	Radio Communication Test Station	CBT	N/A	CBT	6262036828
Anritsu	MT8000A	Radio Communication Test Station	4/11/2025	Annual	4/11/2026	6261987983
Anritsu	MT8000A	Radio Communication Test Station	3/11/2025	Annual	3/11/2026	6272337439
Anritsu	MT8000A	Radio Communication Test Station	11/12/2024	Annual	11/12/2025	6272337405
Anritsu	MA24106A	USB Power Sensor	7/10/2024	Annual	7/10/2025	1827530
Anritsu	MA24106A	USB Power Sensor	10/29/2024	Annual	10/29/2025	1248508
Mini-Circuits	PWR-4GHS	USB Power Sensor	6/12/2024	Annual	6/12/2025	12001070013
Control Company	4052	Long Stem Thermometer	2/27/2024	Biennial	2/27/2026	240174346
Control Company	4052	Long Stem Thermometer	2/27/2024	Biennial	2/27/2026	240171096
Control Company	4052	Long Stem Thermometer	2/27/2024	Biennial	2/27/2026	240171059
Control Company	4040	Therm./ Clock/ Humidity Monitor	4/15/2024	Biennial	4/15/2026	240310280
Control Company	4040	Therm./ Clock/ Humidity Monitor	4/15/2024	Biennial	4/15/2026	240310282
Control Company	S66279	Therm./ Clock/ Humidity Monitor	2/16/2024	Biennial	2/16/2026	240140051
Keysight Technologies	N9020A	MXA Signal Analyzer	7/8/2024	Annual	7/8/2025	MY48010233
Agilent	N9020A	MXA Signal Analyzer	6/14/2024	Annual	6/14/2025	MY56470202
MCL	BW-N6W5+	6dB Attenuator	CBT	N/A	CBT	1139
Mini-Circuits	VLF-6000+	Low Pass Filter DC to 6000 MHz	CBT	N/A	CBT	N/A
Mini-Circuits	VLF-6000+	Low Pass Filter DC to 6000 MHz	7/10/2024	Annual	7/10/2025	31634
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	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	NLP-2950+	Low Pass Filter DC to 2700 MHz	CBT	N/A	CBT	N/A
Mini-Circuits	BW-N20W5	Power Attenuator	CBT	N/A	CBT	1226
Mini-Circuits	ZUDC10-83-S+	Directional Coupler	CBT	N/A	CBT	2050
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Narda	BW-S3W2	Attenuator (3dB)	CBT	N/A	CBT	120
Seekonk	NC-100	Torque Wrench	CBT	N/A	CBT	22217
Seekonk	NC-100	Torque Wrench	4/2/2024	Biennial	4/2/2026	1262
Rohde & Schwarz	CMW500	Wideband Radio Communication Tester	6/10/2024	Annual	6/10/2025	168543
Rohde & Schwarz	CMW500	Wideband Radio Communication Tester	4/7/2025	Annual	4/7/2026	167284
Rohde & Schwarz	CMW500	Wideband Radio Communication Tester	1/28/2025	Annual	1/28/2026	135400
Rohde & Schwarz	CMW500	Wideband Radio Communication Tester	1/25/2025	Annual	1/25/2026	122206
Rohde & Schwarz	CMW500	Wideband Radio Communication Tester	12/10/2024	Annual	12/10/2025	167286
Rohde & Schwarz	CMW500	Wideband Radio Communication Tester	1/6/2025	Annual	1/6/2026	131454
Rohde & Schwarz	CMW500	Wideband Radio Communication Tester	4/9/2025	Annual	4/9/2026	145663
Rohde & Schwarz	CMW500	Wideband Radio Communication Tester	9/26/2024	Biennial	9/26/2026	110553
Rohde & Schwarz	CMW500	Wideband Radio Communication Tester	10/2/2024	Annual	10/2/2025	171000
Rohde & Schwarz	CMW500	Wideband Radio Communication Tester	4/3/2025	Annual	4/3/2026	167285
Rohde & Schwarz	CMW500	Wideband Radio Communication Tester	2/22/2025	Annual	2/22/2026	168527
Rohde & Schwarz	CMW500	Wideband Radio Communication Tester	1/6/2025	Annual	1/6/2026	150117
Rohde & Schwarz	CMW500	Wideband Radio Communication Tester	12/10/2024	Annual	12/10/2025	161616
SPEAG	DAK-3.5	Dielectric Assessment Kit	11/5/2024	Annual	11/5/2025	1277
SPEAG	DAKS-3.5	Portable Dielectric Assessment Kit	8/7/2024	Annual	8/7/2025	1041
SPEAG	MAIA	Modulation and Audio Interference Analyzer	N/A	N/A	N/A	1237
SPEAG	MAIA	Modulation and Audio Interference Analyzer	N/A	N/A	N/A	1331
SPEAG	MAIA	Modulation and Audio Interference Analyzer	N/A	N/A	N/A	1390
SPEAG	DAK-12	Dielectric Assessment Kit (4MHz - 3GHz)	3/10/2025	Annual	3/10/2026	1102
SPEAG	D750V3	750 MHz SAR Dipole	3/4/2025	Annual	3/4/2026	1054
SPEAG	D750V3	750 MHz SAR Dipole	10/7/2024	Annual	10/7/2025	1161
SPEAG	D835V2	835 MHz SAR Dipole	3/11/2024	Biennial	3/11/2026	4d133
SPEAG	D835V2	835 MHz SAR Dipole	1/18/2024	Biennial	1/18/2026	4d132
SPEAG	D1750V2	1750 MHz SAR Dipole	11/7/2024	Annual	11/7/2025	1150
SPEAG	D1750V2	1750 MHz SAR Dipole	1/13/2025	Annual	1/13/2026	1148
SPEAG	D1900V2	1900 MHz SAR Dipole	2/7/2025	Annual	2/7/2026	5d148
SPEAG	D1900V2	1900 MHz SAR Dipole	8/8/2022	Triennial	8/8/2025	5d080
SPEAG	D1900V2	1900 MHz SAR Dipole	7/10/2024	Annual	7/10/2025	5d149
SPEAG	D2300V2	2300 MHz SAR Dipole	6/4/2024	Annual	6/4/2025	1116
SPEAG	D2450V2	2450 MHz SAR Dipole	11/15/2022	Triennial	11/15/2025	797
SPEAG	D2450V2	2450 MHz SAR Dipole	8/7/2024	Annual	8/7/2025	719
SPEAG	D2600V2	2600 MHz SAR Dipole	11/15/2022	Triennial	11/15/2025	1071
SPEAG	D3500V2	3500 MHz SAR Dipole	1/10/2023	Triennial	1/10/2026	1097
SPEAG	D3500V2	3500 MHz SAR Dipole	1/12/2024	Biennial	1/12/2026	1059
SPEAG	D3700V2	3700 MHz SAR Dipole	1/13/2023	Triennial	1/13/2026	1067
SPEAG	D3700V2	3700 MHz SAR Dipole	1/9/2024	Biennial	1/9/2026	1018
SPEAG	D3900V2	3900 MHz SAR Dipole	10/19/2023	Biennial	10/19/2025	1056
SPEAG	D3900V2	3900 MHz SAR Dipole	6/10/2024	Annual	6/10/2025	1073
SPEAG	D5GHzV2	5 GHz SAR Dipole	2/21/2024	Biennial	2/21/2026	1057
SPEAG	D5GHzV2	5 GHz SAR Dipole	1/17/2024	Biennial	1/17/2026	1191
SPEAG	D6.5GHzV2	6.5 GHz SAR Dipole	2/4/2025	Annual	2/4/2026	1111
SPEAG	5G Verification Source 10GHz	10GHz System Verification Antenna	3/4/2025	Annual	3/4/2026	1002
SPEAG	DAE4	Dasy Data Acquisition Electronics	1/13/2025	Annual	1/13/2026	1530
SPEAG	DAE4	Dasy Data Acquisition Electronics	12/10/2024	Annual	12/10/2025	1450
SPEAG	DAE4	Dasy Data Acquisition Electronics	6/11/2024	Annual	6/11/2025	1334
SPEAG	DAE4	Dasy Data Acquisition Electronics	3/11/2025	Annual	3/11/2026	1415
SPEAG	DAE4	Dasy Data Acquisition Electronics	7/8/2024	Annual	7/8/2025	1677
SPEAG	DAE4	Dasy Data Acquisition Electronics	5/8/2024	Annual	5/8/2025	1678
SPEAG	DAE4	Dasy Data Acquisition Electronics	1/13/2025	Annual	1/13/2026	859
SPEAG	DAE4	Dasy Data Acquisition Electronics	2/6/2025	Annual	2/6/2026	665
SPEAG	DAE4	Dasy Data Acquisition Electronics	7/8/2024	Annual	7/8/2025	1583
SPEAG	DAE4	Dasy Data Acquisition Electronics	12/3/2024	Annual	12/3/2025	1278
SPEAG	DAE4ip	Dasy Data Acquisition Electronics	2/7/2025	Annual	2/7/2026	1638
SPEAG	EX3DV4	SAR Probe	1/7/2025	Annual	1/7/2026	7713
SPEAG	EX3DV4	SAR Probe	9/9/2024	Annual	9/9/2025	7670
SPEAG	EX3DV4	SAR Probe	6/17/2024	Annual	6/17/2025	7409
SPEAG	EX3DV4	SAR Probe	3/7/2025	Annual	3/7/2026	7488
SPEAG	EX3DV4	SAR Probe	7/5/2024	Annual	7/5/2025	7406
SPEAG	EX3DV4	SAR Probe	5/8/2024	Annual	5/8/2025	7660
SPEAG	EX3DV4	SAR Probe	1/8/2025	Annual	1/8/2026	7571
SPEAG	EX3DV4	SAR Probe	2/12/2025	Annual	2/12/2026	7417
SPEAG	EX3DV4	SAR Probe	6/28/2024	Annual	6/28/2025	7803
SPEAG	EX3DV4	SAR Probe	2/10/2025	Annual	2/10/2026	7570
SPEAG	EX3DV4	SAR Probe	4/7/2025	Annual	4/7/2026	7659
SPEAG	EUmmWV4	EUmmWV3 Probe	1/8/2025	Annual	1/8/2026	9389

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 < 6GHz:

a	b	c	d	e = f(d, k)	f	g	h = c x f/e	i = c x g/e	k
Uncertainty Component	IEEE 1528 Sec.	Tol. (± %)	Prob. Dist.	Div.	c_i 1gm	c_i 10 gms	1gm u_i (± %)	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	1.732	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	1.732	1	1	0.1	0.1	∞
Modulation Response	E.2.5	4.8	R	1.732	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	1.732	1	1	0.5	0.5	∞
Integration Time	E.2.8	2.6	R	1.732	1	1	1.5	1.5	∞
RF Ambient Conditions - Noise	E.6.1	3	R	1.732	1	1	1.7	1.7	∞
RF Ambient Conditions - Reflections	E.6.1	3	R	1.732	1	1	1.7	1.7	∞
Probe Positioner Mechanical Tolerance	E.6.2	0.8	R	1.732	1	1	0.5	0.5	∞
Probe Positioning w/ respect to Phantom	E.6.3	6.7	R	1.732	1	1	3.9	3.9	∞
Extrapolation, Interpolation & Integration algorithms for Max. SAR Evaluation	E.5	4	R	1.732	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	1.732	1	1	2.9	2.9	∞
SAR Scaling	E.6.5	0	R	1.732	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	1.732	0.78	0.71	1.5	1.4	∞
Liquid Permittivity - Temperature Unceritainty	E.3.4	0.6	R	1.732	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 > 6GHz:

a	b	c	d	e = f(d,k)	f	g	h = c x f/e	i = c x g/e	k
Uncertainty Component	IEEE 1528 Sec.	Tol. (± %)	Prob. Dist.	Div.	c_i 1gm	c_i 10 gms	1gm u_i (± %)	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