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## PART 0 SAR CHAR REPORT

Applicant Name: Apple, Inc. One Apple Park Way Cupertino, CA 95014 Date of Testing: 05/20/2024 – 07/31/2024 Test Report Issue Date: 09/09/2024 Test Site/Location:

Element, Morgan Hill, CA, USA **Document Serial No.:** 1C2405200018-01.BCG

FCC ID: BCGA2995

APPLICANT: APPLE, INC.

**Report Type:** Part 0 SAR Characterization

**DUT Type:** Tablet Device Model(s): A2995, A2996

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





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## 1 DEVICE UNDER TEST

## 1.1 Device Overview

This device uses the Qualcomm® Gen2 Smart Transmit feature to control and manage transmitting power in real time and to ensure the time-averaged RF exposure is in compliance with the FCC requirement at all times for 3G/4G/5G WWAN operations. Additionally, this device supports WLAN/BT/802.15.4/NB-UNII technologies, but the output power of these modems is not controlled by the Smart Transmit algorithm.

Band & Mode	Operating	Tx Frequency	
Danu & Mode	Modes	1 x 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 17	Data	706.5 - 713.5 MHz	
LTE Band 13	Data	779.5 - 784.5 MHz	
LTE Band 14	Data	790.5 - 795.5 MHz	
LTE Band 26 (Cell)	Data	814.7 - 848.3 MHz	
LTE Band 5 (Cell)	Data	824.7 - 848.3 MHz	
LTE Band 66 (AWS)	Data	1710.7 - 1779.3 MHz	
LTE Band 4 (AWS)	Data	1710.7 - 1754.3 MHz	
LTE Band 25 (PCS)	Data	1850.7 - 1914.3 MHz	
LTE Band 2 (PCS)	Data	1850.7 - 1909.3 MHz	
LTE Band 30	Data	2307.5 - 2312.5 MHz	
LTE Band 7	Data	2502.5 - 2567.5 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 (Cell)	Data	816.5 - 846.5 MHz	
NR Band n5 (Cell)	Data	826.5 - 846.5 MHz	
NR Band n70	Data	1697.5 - 1707.5 MHz	
NR Band n66 (AWS)	Data	1712.5 - 1777.5 MHz	
NR Band n25 (PCS)	Data	1852.5 - 1912.5 MHz	
NR Band n2 (PCS)	Data	1852.5 - 1907.5 MHz	
NR Band n30	Data	2307.5 - 2312.5 MHz	
NR Band n7	Data	2502.5 - 2567.5 MHz	
NR Band n41	Data	2506.02 - 2679.99 MHz	
NR Band n48	Data	3550 - 3700 MHz	
NR Band n77 DoD	Data	3460.02 - 3540 MHz	
NR Band n77	Data	3710.01 - 3969.99 MHz	
2.4 GHz WIFI	Voice/Data	2412 - 2472 MHz	
		U-NII-1: 5180 - 5240 MHz	
5 GHz WIFI	Voice/Data	U-NII-2A: 5260 - 5320 MHz	
		U-NII-2C: 5500 - 5720 MHz	
		U-NII-3: 5745 - 5825 MHz	
		U-NII-5: 5935 - 6415 MHz U-NII-6: 6435 - 6515 MHz	
6 GHz WIFI	Voice/Data	U-NII-7: 6535 - 6875 MHz	
		U-NII-8: 6895 - 7115 MHz	
2.4 GHz Bluetooth	Data	2402 - 2480 MHz	
802.15.4	Data	2405 - 2475 MHz	
NB U-NII 1			
NB U-NII 3	Data	5733 - 5844 MHz	
wPT	N/A	13.56 MHz	
WFI	IN/A	13.30 IVITIZ	

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## 1.2 Time-Averaging for SAR and Power Density

This device is enabled with Qualcomm® Gen2 Smart Transmit algorithm to control and manage transmitting power in real time and to ensure that the time-averaged RF exposure from 3G/4G/5G Sub-6 NR WWAN is in compliance with FCC requirements. This Part 0 report shows SAR characterization of WWAN radios for 3G/4G/5G Sub-6 NR. Characterization is achieved by determining P<sub>Limit</sub> for 3G/4G/5G Sub-6 NR that corresponds to the exposure design targets after accounting for all device design related uncertainties, i.e., SAR\_design\_target (< FCC SAR limit) for sub-6 radio. 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
	P <sub>limit</sub>	Power level that corresponds to the exposure design
		target (SAR_design_target) after accounting for all device
3G/4G/5G		design related uncertainties
Sub-6 NR	$P_{max}$	Maximum tune up output power
Sub-6 INK	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	1C2405200018-02.BCG
RF Exposure Part 2 Test Report	1C2405200018-03.BCG
RF Exposure Compliance Summary	1C2405200018-04.BCG

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## 2 SAR 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 ( $\rho$ ). 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:

 $\sigma$  = conductivity of the tissue-simulating material (S/m)  $\rho$  = mass density of the tissue-simulating material (kg/m³) E = Total RMS electric field strength (V/m)

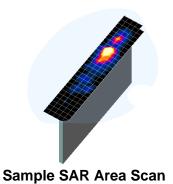
NOTE: The primary factors that control rate of energy absorption were found to be the wavelength of the incident field in relation to the dimensions and geometry of the irradiated organism, the orientation of the organism in relation to the polarity of field vectors, the presence of reflecting surfaces,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

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#### 2.2 SAR Measurement Procedure

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

- 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 . 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\*

	Maximum Area Scan Resolution (mm)			Maximum Zoom Scan Spatial Resolution (mm)		
Frequency	(Δx <sub>area</sub> , Δy <sub>area</sub> )	(Δx <sub>200m</sub> , Δy <sub>200m</sub> )	Uniform Grid	G	raded Grid	Volume (mm) (x,y,z)
			Δz <sub>zoom</sub> (n)	Δz <sub>zoom</sub> (1)*	Δz <sub>zoom</sub> (n>1)*	
≤ 2 GHz	≤ 15	≤8	≤5	≤4	$\leq 1.5*\Delta z_{zoom}(n-1)$	≥ 30
2-3 GHz	≤12	≤5	≤5	≤4	$\leq 1.5*\Delta z_{zoom}(n-1)$	≥ 30
3-4 GHz	≤ 12	≤5	≤4	≤3	$\leq 1.5*\Delta z_{zoom}(n-1)$	≥ 28
4-5 GHz	≤10	≤ 4	≤3	≤2.5	$\leq 1.5*\Delta z_{zoom}(n-1)$	≥ 25
5-6 GHz	≤ 10	≤ 4	≤2	≤2	$\leq 1.5*\Delta z_{zoom}(n-1)$	≥ 22

<sup>\*</sup>Also compliant to IEEE 1528-2013 Table 6

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## 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 tablet, 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 represent different exposure scenarios.

Table 3-1
DSI and Corresponding Exposure Scenarios

Scenario	Description	SAR Test Cases
(DSI = 1)	Device on body	Tablet SAR per KDB
(567 - 1)		Publication 616217 D04

## 3.2 SAR Design Target

SAR\_design\_target is determined by ensuring that it is less than FCC SAR limit after accounting for uncertainties specified by the manufacturer (see Table 3-2).

Table 3-2 SAR\_design\_target Calculations

1g SAR (W/kg)					
Smart Tx Uncertainty	1.0 dB				
SAR_regulatory_limit	1.6 W/kg				
SAR_design_target	0.8 W/kg				

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#### 3.3 SAR Char

SAR test results corresponding to *Pmax* for each antenna/technology/band/DSI can be found in FCC SAR Part 1 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. When Plimit > Pmax and Ppart0=Pmax, calculated Plimit was used in the Smart Transmit EFS. 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 3-3.

Table 3-3 PLimit Determination

Device State Index (DSI)	PLimit Determination Scenarios
1	The worst-case SAR exposure is determined as maximum SAR normalized to the limit among:  1. Tablet SAR measured at 0 mm for Back, Top, Bottom, Right, Left surfaces

#### Note:

For DSI = 1,  $P_{limit}$  is calculated by:

 $P_{limit}$  corresponding to 1g Tablet SAR evaluation at 0 mm for back, top, bottom, left and right surfaces

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Table 3-4
SAR Characterizations

				• • • • •								
Exposure Scenario:	Ant 1a	Ant 1a Maximum	Ant 1b	Ant 1b Maximum	Ant 2	Ant 2 Maximum	Ant 3a	Ant 3a Maximum	Ant 3b	Ant 3b Maximum	Ant 4	Ant 4 Maximum
Averaging Volume:	1g	Tune-up	1g	Tune-up	1g	Tune-up	1g	Tune-up	1g	Tune-up	1g	Tune-up
Spacing:	0 mm	Output	0 mm	Output	0 mm	Output	0 mm	Output	0 mm	Output	0 mm	Output
DSI:	1	Power*	1	Power*	1	Power*	1	Power*	1	Power*	1	Power*
Technology/Band	Plimit corresponding to 0.8 W/kg	Pmax	Plimit corresponding to 0.8 W/kg	Pmax	Plimit corresponding to 0.8 W/kg	Pmax	Plimit corresponding to 0.8 W/kg	Pmax	Plimit corresponding to 0.8 W/kg	Pmax	Plimit corresponding to 0.8 W/kg	Pmax
UMTS 850	N/A	N/A	N/A	N/A	16.50	24.00	N/A	N/A	N/A	N/A	16.70	24.70
UMTS 1750	N/A	N/A	10.70	23.00	12.40	22.50	N/A	N/A	12.00	24.50	12.50	23.50
UMTS 1900	N/A	N/A	10.80	23.00	13.30	22.50	N/A	N/A	12.20	24.50	12.70	23.50
LTE Band 71	N/A	N/A	N/A	N/A	18.70	24.00	N/A	N/A	N/A	N/A	19.40	24.70
LTE Band 12	N/A	N/A	N/A	N/A	17.70	24.00	N/A	N/A	N/A	N/A	18.50	24.70
LTE Band 17	N/A	N/A	N/A	N/A	17.70	24.00	N/A	N/A	N/A	N/A	18.50	24.70
LTE Band 13	N/A	N/A	N/A	N/A	17.60	24.00	N/A	N/A	N/A	N/A	17.80	24.70
LTE Band 14	N/A	N/A	N/A	N/A	17.60	24.00	N/A	N/A	N/A	N/A	17.80	24.70
LTE Band 26	N/A	N/A	N/A	N/A	16.50	24.00	N/A	N/A	N/A	N/A	16.70	24.70
LTE Band 5	N/A	N/A	N/A	N/A	16.50	24.00	N/A	N/A	N/A	N/A	16.70	24.70
LTE Band 5 ULCA	N/A	N/A	N/A	N/A	16.50	24.00	N/A	N/A	N/A	N/A	16.70	24.70
LTE Band 4	N/A	N/A	10.70	25.00	12.40	24.00	N/A	N/A	12.00	24.50	12.50	23.50
LTE Band 66	N/A	N/A	10.70	25.00	12.40	24.00	N/A	N/A	12.00	24.50	12.50	23.50
LTE Band 2	N/A	N/A	10.80	23.00	13.30	22.50	N/A	N/A	12.20	24.50	12.70	23.50
LTE Band 25	N/A	N/A	10.80	23.00	13.30	22.50	N/A	N/A	12.20	24.50	12.70	23.50
LTE Band 30	N/A	N/A	11.80	23.00	11.90	22.00	N/A	N/A	13.60	25.00	12.50	21.70
LTE Band 7	N/A	N/A	11.70	23.00	11.80	22.00	N/A	N/A	12.70	25.00	10.40	24.00
LTE Band 7 ULCA	N/A	N/A	11.70	23.00	11.80	22.00	N/A	N/A	12.70	25.00	10.40	24.00
LTE Band 41 (PC3)	N/A	N/A	11.0	23.0	11.3	23.0	N/A	N/A	12.0	23.0	10.4	23.0
LTE Band 41 (PC3) ULCA	N/A	N/A	11.0	23.0	11.3	23.0	N/A	N/A	12.0	23.0	10.4	23.0
LTE Band 41 (PC2)	N/A	N/A	11.0	24.4	11.3	22.9	N/A	N/A	12.0	23.4	10.4	22.4
LTE Band 41 (PC2) ULCA	N/A	N/A	11.0	24.4	11.3	22.9	N/A	N/A	12.0	23.4	10.4	22.4
LTE Band 48	8.5	17.8	N/A	N/A	9.8	17.9	8.5	17.5	N/A	N/A	8.2	18.8
LTE Band 48 ULCA	8.5	17.8	N/A	N/A	9.8	17.9	8.5	17.5	N/A	N/A	8.2	18.8
NR Band n71	N/A	N/A	N/A	N/A	18.70	24.00	N/A	N/A	N/A	N/A	19.40	24.70
NR Band n12	N/A	N/A	N/A	N/A	17.70	24.00	N/A	N/A	N/A	N/A	18.50	24.70
NR Band n14	N/A	N/A	N/A	N/A	17.60	24.00	N/A	N/A	N/A	N/A	17.80	24.70
NR Band n26	N/A	N/A	N/A	N/A	16.50	24.00	N/A	N/A	N/A	N/A	16.70	24.70
NR Band n5	N/A	N/A	N/A	N/A	16.50	24.00	N/A	N/A	N/A	N/A	16.70	24.70
NR Band n70	N/A	N/A	10.70	25.00	12.40	24.00	N/A	N/A	12.00	24.50	12.50	23.50
NR Band n66	N/A	N/A	10.70	25.00	12.40	24.00	N/A	N/A	12.00	24.50	12.50	23.50
NR Band n2	N/A	N/A	10.80	23.00	13.30	22.50	N/A	N/A	12.20	24.50	12.70	23.50
NR Band n25	N/A	N/A	10.80	23.00	13.30	22.50	N/A	N/A	12.20	24.50	12.70	23.50
NR Band n30	N/A	N/A	11.80	23.00	11.90	22.00	N/A	N/A	13.60	25.00	12.50	21.70
NR Band n7	N/A	N/A	11.70	23.00	11.80	22.00	N/A	N/A	12.70	25.00	10.40	24.00
NR Band n41 (PC3)	N/A	N/A	11.00	25.00	11.30	25.00	N/A	N/A	12.00	25.00	10.40	25.00
NR Band n41 (PC2)	N/A	N/A	11.00	28.00	11.30	26.50	N/A	N/A	12.00	27.00	10.40	26.00
NR Band n77 (PC3)	8.60	22.30	N/A	N/A	10.30	22.30	7.70	24.70	N/A	N/A	10.20	24.70
NR Band n77 (PC2)	8.60	22.30	N/A	N/A	10.30	22.30	7.70	25.70	N/A	N/A	10.20	25.30

#### Notes:

- 1. \*Maximum tune up output power Pmax is used to configure EUT during RF tune up procedure. The maximum allowed output power is equal to maximum Tune up output power +0.7/-1.0 dB conducted power tolerance and +1.0/-1.0 dB conducted power tolerance for UHB.
- 2. All  $P_{limit}$  EFS and maximum tune up output power  $P_{max}$  levels entered in above Table correspond to average power levels after accounting for duty cycle in the case of TDD modulation schemes (for e.g., LTE TDD).

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## 13 EQUIPMENT LIST

## For SAR measurements

Aglent	Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Aglett							MY45113242
Agent	Agilent		Spectrum Analyzer		N/A		
Applied   N.1.12.0.	Agilent	E4438C		11/14/2023	Annual	11/14/2024	MY45093852
Applied   N.1.12.0.	Agilent	E4438C	ESG Vector Signal Generator	11/15/2023	Annual	11/15/2024	MY45092078
Agent			MWC Vestor Firmal Constatos				MY47400015
Applied   \$7335   \$-\$ parameter Vester Network Analyses   \$1,200282   Annual   \$7,107,1073   Annual   \$7,107,107							
Applies							MY48180366
Ampeller Research   155056	Agilent	8753ES	S-Parameter Vector Network Analyzer	1/10/2024	Annual	1/10/2025	MY40001472
Appeller Research   1505/05/C	Agilent	8753ES	S-Parameter Vector Network Analyzer	7/21/2023	Annual	7/21/2024	US39170118
Appeller Research   1505/05	Amplifier Research	155166	Amplifier	CRT	N/A	CRT	433973
International Content							
Annibia   Schwarz   MEX							433974
Reducts   Changer   MRK	Amplifier Research	150A100C	Amplifier	CBT	N/A	CBT	350132
Reducts   Changer   MRK	Anritsu	MN8110B	I/O Adaptor	CBT	N/A	CBT	6261747881
Routh & Chemit							102583
Annthon							
Annthol	Rohde & Schwarz			1/31/2023	Biennial		102582
Annthus MTRESIC Radio Communications Analyses MTRESIC 57,707,2023 Annual 17/15/2023 62 Annual MTRESIC Radio Communication Analyses MTRESIC 57,707,2023 Annual 17/15/2023 62 Annual MTRESIC Radio Communication Analyses MTRESIC 57,707,2023 Annual 17/15/2023 62 Annual MTRESIC Radio Communication Analyses MTRESIC 57,707,2023 Annual 17/15/2023 62 Annual MTRESIC Radio Communication Analyses MTRESIC 57,707,2023 Annual 17/15/2023 62 Annual MTRESIC Radio Communication Analyses MTRESIC 57,707,2023 Annual 17/15/2023 62 Annual MTRESIC Radio Communication Analyses MTRESIC 57,707,2023 Annual 17/15/2023 62 Annual MTRESIC Radio Communication Residence 17/15/2023 Annual 17/15/2023 62 Annual MTRESIC Radio Communication Residence 17/15/2023 Annual 17/15/2023 62 Annual MTRESIC Radio Communication Residence 17/15/2023 Annual 17/15/2023 62 Annual MTRESIC Radio Communication Residence 17/15/2023 Annual 17/15/2023 62 Annual MTRESIC Radio Residence 17/15/2023 Annual 17/15/2023 62 Annual	Anritsu	MA2411B	Pulse Power Sensor	8/22/2023	Annual	8/22/2024	1726262
Annitro	Anritsu	MA2411B	Pulse Power Sensor	11/8/2023	Annual	11/8/2024	1027293
Annibis	Anritou	MATOR 21C	Padio Communication Analyzor MT9931C		Annual		6200901190
Annths							
Annibus   MTREDGA   Radio Communication Analyses MS SERIO   47/19/2023   Annibus   47/19/2023   62   Annibus   MTREDGA   Radio Communication Feet Station   47/19/2023   Annibus   47/19/2023   62   Annibus   MTREDGA   Radio Communication Feet Station   51/19/2023   Annibus   47/19/2023   62   Annibus   MTREDGA   Radio Communication Feet Station   51/19/2023   Annibus   47/19/2023   62   Annibus   MTREDGA   Radio Communication Feet Station   51/19/2023   Annibus   47/19/2023   62   Annibus   MTREDGA   Radio Communication Feet Station   51/19/2023   Annibus   47/19/2023   62   Annibus   MTREDGA   Radio Communication   51/19/2023   Annibus   47/19/2023   Annibus   47/19/2023   62   Annibus   MTREDGA   Radio Communication   47/19/2023   Annibus   47/1							6262150047
Annthrol	Anritsu	MT8821C	Radio Communication Analyzer MT8821C	5/30/2024	Annual	5/30/2025	6262044715
Annthrol	Anritsu	MT8821C	Radio Communication Analyzer MT8821C	7/5/2023	Annual	7/5/2024	6262150000
Annthu	Anritou	MATROODA		4/10/2024	Annual		6261987983
Annthrol							
Annibus							6272337436
Control Company	Anritsu	MA24106A	USB Power Sensor	12/4/2023	Annual	12/4/2024	1520501
Control Company	Anritsu	MA24106A	LISR Power Sensor	4/15/2024	Annual	4/15/2025	1827528
Control Company   4052							240174346
Control Company							
Control Company   6-90	Control Company	4052	Long Stem Thermometer	2/27/2024	Biennial	2/27/2026	240171096
Control Company   6967	Control Company	4052	Long Stem Thermometer	2/27/2024	Biennial	2/27/2026	240171059
Control Company   6967							240310280
Control Company							
Methodope							240310282
Page	Control Company	S66279	Therm./ Clock/ Humidity Monitor	2/16/2024	Biennial	2/16/2026	240140051
Exception   Extraction   MAX Signal Analyses		500-196-30	CD-6"ASX 6Inch Digital Caliper	2/16/2022	Triennial	2/16/2025	A20238413
Aglect   NS020A							
MICH.							MY54500644
Mini-Circuis	Agilent	N9020A	MXA Signal Analyzer	6/14/2024	Annual	6/14/2025	MY56470202
Mini-Circuits	MCL	BW-N6W5+	6dB Attenuator	CBT	N/A	CBT	1139
Mini-Ciccusts   NIP-1200+   Low Pass Rifer Cot 1000 Mart   CBT   N/A   CBT   Mini-Ciccusts   NIP-1200+   Low Pass Rifer Cot 12700 Mbt   CBT   N/A   CBT   Mini-Ciccusts   BW N-2009/S   Low Pass Rifer Cot 12700 Mbt   CBT   N/A   CBT   Mini-Ciccusts   BW N-2009/S   Power Attenuator   CBT   N/A   CBT   N/A   CBT   Mini-Ciccusts   BW N-2009/S   Power Attenuator   CBT   N/A   CBT   N/A   CBT   Mini-Ciccusts   BW N-2009/S   Power Attenuator (Low Pass Rifer Cot 12700 Mbt   CBT   N/A   N/	Mini-Circuits	V/I F-6000+	Low Pass Filter DC to 6000 MHz	CRT	N/A	CRT	N/A
Min-Circuits   NIP-1200+   Low Pass Rier Cts 1 2070 Mbrs   CBT							N/A
Mini-Circuis							
Mini-Circuiss   Power Attenuator	Mini-Circuits	NLP-1200+	Low Pass Filter DC to 1000 MHz	CBT	N/A	CBT	N/A
Mini-Circuiss   Power Attenuator	Mini-Circuits	NI P-2950+	Low Pass Filter DC to 2700 MHz	CRT	N/A	CRT	N/A
Mini-Circuits   ZUDC10-83-5+   Directional Coupler   CBT   N/A   CBT							1226
Name							
Nortable	Mini-Circuits	ZUDC10-83-S+	Directional Coupler	CBT	N/A	CBT	2050
Seebook	Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Seebook	Narda	BW-53W2	Attenuator (3dR)	CRT	N/A	CRT	120
Robbie & Schwarz         CMW500         Wideband fadio Communication Tester         4/19/2023         Annual         4/19/2025           Robbie & Schwarz         CMW500         Wideband fadio Communication Tester         4/12/2023         Annual         4/22/2025           Robbie & Schwarz         CMW500         Wideband fadio Communication Tester         4/12/2023         Annual         4/22/2025           SPRAG         DNS-15         Diebectivic Assessment XI         11/13/2023         Annual         11/13/2023           SPRAG         DNS-15         Portable Deleteric Xessessment XI         11/13/2023         Annual         11/13/2024           SPRAG         DNS-15         Portable Deleteric Xessessment XI         8/14/2023         Annual         11/13/2024           SPRAG         DNS-15         Portable Deleteric Xessessment XI         8/14/2023         Annual         11/13/2024           SPRAG         DNA         MAIA         Modulation and Audio Interference Analyser         N/A         N/A         N/A           SPRAG         DNA-12         Delectric Assessment XII (AMPI: 3/2014)         3/11/2023         Annual         5/11/2025           SPRAG         D1750V2         1750 MHz SAR Dipole         5/11/2022         Trienvial         5/11/2025           SPRAG         D175							
Robbie & Schwarz         CMW500         Wideband Radio Communication Tester         4/24/2023         Annual         4/24/2025           Robide & Schwarz         CMW500         Wideband Radio Communication Tester         4/21/2025         Annual         1/21/2025           Robide & Schwarz         CMW500         Wideband Radio Communication Tester         1/10/2023         Annual         1/10/2025           SPRAG         DNA-3.5         Postable Dielectric Assessment KI         8/14/2023         Annual         8/14/2023           SPRAG         DNAS-3.5         Postable Dielectric Assessment KI         8/14/2023         Annual         8/14/2023           SPRAG         MANA         Modulation and Audio Interference Analyzer         N/A         N/A         N/A           SPRAG         MANA         Modulation and Audio Interference Analyzer         N/A         N/A         N/A           SPRAG         DN-12         Dielectric Assessment KI (MW1-2004)         3/11/2024         Annual         3/11/2025           SPRAG         D1550V2         1750 MW1-540 Ripoble         9/6/2023         Annual         3/11/2024           SPRAG         D1550V2         1750 MW1-540 Ripoble         9/6/2023         Annual         3/11/2024           SPRAG         D1550V2         1750 MW1-540 Ripoble <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>1262</td>							1262
Robbe & Schwarz         CMW500         Wideband Radio Communication Tester         4/22/2023         Annual         4/22/2025           Robbe & Schwarz         CMW500         Wideband Radio Communication Tester         4/12/2023         Annual         4/22/2025           SPRAG         DM-3.5         Debathed Redict Communication Tester         1/10/2023         Annual         1/11/2024           SPRAG         DM-3.5         Debathed Redict Communication Tester         1/11/2023         Annual         1/11/2024           SPRAG         DM-3.5         Debathed Redict Communication Tester         1/11/2023         Annual         1/11/2024           SPRAG         DMA-3.5         Debathed Redict Communication Tester         N/N         N/N         N/N           SPRAG         DMA-3         MMA         Modulation and Audio Interference Analyzer         N/N         N/N         N/N           SPRAG         DM-12         Debather Assessment KR         1/11/2023         Annual         1/11/2025           SPRAG         DM-12         Debather Assessment KR         1/11/2023         Annual         1/11/2025           SPRAG         DD-12         DM-12         Debather Assessment KR         1/11/2023         Annual         1/11/2025           SPRAG         DD-12         DM-1	Rohde & Schwarz	CMW500	Wideband Radio Communication Tester	4/19/2024	Annual	4/19/2025	151849
Robbe & Schwarz         CMW500         Wideband Radio Communication Tester         4/22/2023         Annual         4/22/2025           Robbe & Schwarz         CMW500         Wideband Radio Communication Tester         4/12/2023         Annual         4/22/2025           SPRAG         DM-3.5         Debathed Redict Communication Tester         1/10/2023         Annual         1/11/2024           SPRAG         DM-3.5         Debathed Redict Communication Tester         1/11/2023         Annual         1/11/2024           SPRAG         DM-3.5         Debathed Redict Communication Tester         1/11/2023         Annual         1/11/2024           SPRAG         DMA-3.5         Debathed Redict Communication Tester         N/N         N/N         N/N           SPRAG         DMA-3         MMA         Modulation and Audio Interference Analyzer         N/N         N/N         N/N           SPRAG         DM-12         Debather Assessment KR         1/11/2023         Annual         1/11/2025           SPRAG         DM-12         Debather Assessment KR         1/11/2023         Annual         1/11/2025           SPRAG         DD-12         DM-12         Debather Assessment KR         1/11/2023         Annual         1/11/2025           SPRAG         DD-12         DM-1	Rohde & Schwarz	CMW500	Widehand Radio Communication Tester	4/24/2024	Annual	4/24/2025	167284
Robbe & Schwarz         CMW500         Wideband Radio Communication Tenter         J.11/J.02035         Annual         11/J.1/2025           SPEAG         DAX-3.5         Polectic Assessment KI         11/J.1/2023         Annual         8/14/2023         Annual         8/14/2024         MANA         Modulation and Audio Interference Analyzer         N/A							106578
SPRAG         DM-3.5         Detective Assessment KI         11/3/2023         Annual         11/13/2024           SPRAG         DM-3.5         Potable Detective, Nessment KI         8/14/2023         Annual         11/13/2024           SPRAG         DMAS         3.5         Potable Detective, Nessment KI         8/14/2023         Annual         11/13/2023           SPRAG         DMAA         Modulation and Audio Interference Analyzer         N/A         N/A         N/A           SPRAG         DMAA         Modulation and Audio Interference Analyzer         N/A         N/A         N/A           SPRAG         DMA         Modulation and Audio Interference Analyzer         N/A         N/A         N/A           SPRAG         DMA         Modulation and Audio Interference Analyzer         N/A         N/A         N/A           SPRAG         DM-12         Objective Assessment KIR         19/12/2023         Annual         11/12/2024           SPRAG         DD1290/2         170 MHS ARD Double         9/12/2023         Annual         11/12/2023           SPRAG         DD1290/2         1200 MHS SAR Double         11/12/2023         Annual         11/12/2024           SPRAG         DD2000/2         2200 MHS SAR Double         11/12/2023         Annual							
SPEAG							131453
SPEAG	SPEAG	DAK-3.5	Dielectric Assessment Kit	11/13/2023	Annual	11/13/2024	1277
SPEAG         MAIA         Modulation and Audio Interference Analyzer         N/A         N/A         N/A           SPEAG         MAIA         Modulation and Audio Interference Analyzer         N/A         N/A         N/A           SPEAG         MAIA         Modulation and Audio Interference Analyzer         N/A         N/A         N/A           SPEAG         MAIA         Modulation and Audio Interference Analyzer         N/I/C         N/I/C         N/I/C           SPEAG         DAN-12         Delector Assessment (MAIP - 2012)         3/I/C         N/I/C         N/I/C <t< td=""><td>SPEAG</td><td>DAKS-3.5</td><td>Portable Dielectric Assessment Kit</td><td>8/14/2023</td><td>Annual</td><td>8/14/2024</td><td>1041</td></t<>	SPEAG	DAKS-3.5	Portable Dielectric Assessment Kit	8/14/2023	Annual	8/14/2024	1041
SPEAG	SDEAG.	MAIA		N/A			1237
SPEAG         MAA         Modulation and Audio Interference Analyser         N/A							
SPEAG	SPEAG	MAIA	Modulation and Audio Interference Analyzer	N/A	N/A	N/A	1331
SPRAG         D1750/2         170 Met SAR Dipole         \$10/2022         Trement         \$10/2025           SPRAG         D1750/2         170 Met SAR Dipole         \$10/2023         Annual         \$10/2025           SPRAG         D1250/2         170 Met SAR Dipole         8/8/2023         Annual         8/8/2024           SPRAG         D1250/2         1900 Met SAR Dipole         8/8/2023         Annual         8/8/2024           SPRAG         D1250/2         220 Met SAR Dipole         11/8/2023         Annual         8/8/2024           SPRAG         D1250/2         220 Met SAR Dipole         11/8/2021         Annual         8/8/2024           SPRAG         D1250/2         220 Met SAR Dipole         5/11/2022         Tremvial         11/8/2026           SPRAG         D250/0/2         220 Met SAR Dipole         5/11/2022         Tremvial         5/11/2025           SPRAG         D250/0/2         220 Met SAR Dipole         8/12/2022         Bermail         5/11/2025           SPRAG         D250/0/2         230 Met SAR Dipole         8/12/2021         Bermail         6/12/2024           SPRAG         D250/0/2         330 Met SAR Dipole         8/12/2022         Bermail         6/12/2024           SPRAG         D250/0	SPEAG	MAIA	Modulation and Audio Interference Analyzer	N/A	N/A	N/A	1390
SPRAG         D1750/2         170 Met SAR Dipole         \$10/2022         Trement         \$10/2025           SPRAG         D1750/2         170 Met SAR Dipole         \$10/2023         Annual         \$10/2025           SPRAG         D1250/2         170 Met SAR Dipole         8/8/2023         Annual         8/8/2024           SPRAG         D1250/2         1900 Met SAR Dipole         8/8/2023         Annual         8/8/2024           SPRAG         D1250/2         220 Met SAR Dipole         11/8/2023         Annual         8/8/2024           SPRAG         D1250/2         220 Met SAR Dipole         11/8/2021         Annual         8/8/2024           SPRAG         D1250/2         220 Met SAR Dipole         5/11/2022         Tremvial         11/8/2026           SPRAG         D250/0/2         220 Met SAR Dipole         5/11/2022         Tremvial         5/11/2025           SPRAG         D250/0/2         220 Met SAR Dipole         8/12/2022         Bermail         5/11/2025           SPRAG         D250/0/2         230 Met SAR Dipole         8/12/2021         Bermail         6/12/2024           SPRAG         D250/0/2         330 Met SAR Dipole         8/12/2022         Bermail         6/12/2024           SPRAG         D250/0	SPEAG	DAK-12	Dielectric Assessment Kit (AMHz - 3GHz)	3/11/2024	Annual	3/11/2025	1102
SPRAG							
SPEAG							1083
SPEAG	SPEAG	D1750V2	1750 MHz SAR Dipole	9/6/2023	Annual	9/6/2024	1104
SPEAG         D2450V2         2430 Met SAR Dipole         11/3/2021         Tremenal         11/3/2024           SPEAG         D2450V2         2430 Met SAR Dipole         5/11/2022         Tremenal         11/3/2024           SPEAG         D250V2         2430 Met SAR Dipole         5/11/2022         Tremenal         5/11/2025           SPEAG         D250V2         2600 Met SAR Dipole         5/11/2022         Tremenal         5/11/2025           SPEAG         D250V2         2600 Met SAR Dipole         6/12/2021         Tremenal         5/11/2025           SPEAG         D350V2         3300 Met SAR Dipole         6/12/2021         Tremenal         6/12/2024           SPEAG         D350VV2         3300 Met SAR Dipole         6/12/2021         Tremenal         6/12/2024           SPEAG         D350VV2         3700 Met SAR Dipole         6/12/2021         Tremenal         6/12/2024           SPEAG         D370VV2         3700 Met SAR Dipole         10/12/2021         Tremenal         6/12/2024           SPEAG         D350VV2         3900 Met SAR Dipole         12/12/2023         Tremenal         6/12/2024           SPEAG         D350VV2         36.0 St SAR Dipole         11/12/2023         Arennal         11/12/2024           S	SPEAG	D1900V2	1900 MHz SAR Dipole	8/8/2023	Annual	8/8/2024	5d180
SPEAG         D2450V2         2430 Met SAR Dipole         11/3/2021         Tremenal         11/3/2024           SPEAG         D2450V2         2430 Met SAR Dipole         5/11/2022         Tremenal         11/3/2024           SPEAG         D250V2         2430 Met SAR Dipole         5/11/2022         Tremenal         5/11/2025           SPEAG         D250V2         2600 Met SAR Dipole         5/11/2022         Tremenal         5/11/2025           SPEAG         D250V2         2600 Met SAR Dipole         6/12/2021         Tremenal         5/11/2025           SPEAG         D350V2         3300 Met SAR Dipole         6/12/2021         Tremenal         6/12/2024           SPEAG         D350VV2         3300 Met SAR Dipole         6/12/2021         Tremenal         6/12/2024           SPEAG         D350VV2         3700 Met SAR Dipole         6/12/2021         Tremenal         6/12/2024           SPEAG         D370VV2         3700 Met SAR Dipole         10/12/2021         Tremenal         6/12/2024           SPEAG         D350VV2         3900 Met SAR Dipole         12/12/2023         Tremenal         6/12/2024           SPEAG         D350VV2         36.0 St SAR Dipole         11/12/2023         Arennal         11/12/2024           S	CDCAC	D33001/3	2200 MH - CAD DII-	44/44/2022	Annual	44/44/2024	1064
SPEAG							
SPRAG         DDS00V2         200 Met SAR Dipole         511/2022         Tenental         5/11/2025           SPRAG         DDS00V2         2000 Met SAR Dipole         5/11/2022         Bermail         1/11/2023           SPRAG         DDS00V2         2000 Met SAR Dipole         6/9/2021         Bermail         6/9/2024           SPRAG         DDS00V2         3300 Met SAR Dipole         6/9/2021         Bermail         6/9/2024           SPRAG         DDS00V2         3300 Met SAR Dipole         6/9/2021         Bermail         6/9/2024           SPRAG         DD700V2         3700 Met SAR Dipole         6/9/2021         Tenenial         6/9/2024           SPRAG         DD700V2         3700 Met SAR Dipole         6/9/2021         Tenenial         6/9/2024           SPRAG         DD200V2         3900 Met SAR Dipole         6/10/2021         Tenenial         6/10/2024           SPRAG         DD300V2         3900 Met SAR Dipole         10/11/2023         Annual         11/11/2024           SPRAG         DS6MV2         5 6 tit SAR Dipole         10/11/2023         Annual         11/11/2024           SPRAG         DS5MV2         5 8 tit SAR Dipole         9/11/2023         Annual         11/11/2024           SPRAG         <							921
SPEAG   D3500V2   200 Met 546 Dipole   11/15/2022   Bernial   11/15/2024	SPEAG	D2450V2	2450 MHz SAR Dipole	5/11/2022	Triennial	5/11/2025	750
SPEAG   D3500V2   200 Met 546 Dipole   11/15/2022   Bernial   11/15/2024	SPEAG	D2600V2	2600 MHz SAR Dinole	5/11/2022	Triennial	5/11/2025	1042
SPEAG							1068
SPEAG							
SPEAG         D3700V2         370.0 Met SAR Dipole         69/2021         Treewal         69/2024           SPEAG         D3700V2         370.0 Met SAR Dipole         10/12/2024         Bermini         6/12/2024           SPEAG         D3200V2         390.0 Met SAR Dipole         6/12/2021         Bermini         6/12/2024           SPEAG         D3200V2         390.0 Met SAR Dipole         6/12/2021         Tremini         6/12/2024           SPEAG         D3200V2         390.0 Met SAR Dipole         11/12/2023         Tremini         6/12/2024           SPEAG         D556HV2         5.6 Stet SAR Dipole         11/12/2023         Bermini         11/12/2024           SPEAG         D556HV2         5.6 Stet SAR Dipole         11/12/2023         Bermini         11/12/2024           SPEAG         D750V3         750 Met SAR Dipole         9/13/2023         Amonal         9/13/2026           SPEAG         D750V3         750 Met SAR Dipole         9/13/2023         Amonal         9/13/2026           SPEAG         D750V3         750 Met SAR Dipole         11/18/2023         Bermini         11/18/2023           SPEAG         D153V3         858 Met SAR Dipole         11/18/2023         Bermini         11/18/2023           SPEAG <td>SPEAG</td> <td>D3500V2</td> <td>3500 MHz SAR Dipole</td> <td>6/9/2021</td> <td>Triennial</td> <td>6/9/2024</td> <td>1126</td>	SPEAG	D3500V2	3500 MHz SAR Dipole	6/9/2021	Triennial	6/9/2024	1126
SPEAG	SPEAG	D3500V2	3500 MHz SAR Dipole	8/17/2022	Biennial	8/17/2024	1055
SPEAG							1097
SPRAG         D3900VZ         3900 Met SAR Dipole         6/10/2021         Tremental         6/10/2024           SPRAG         D3900VZ         3900 Met SAR Dipole         12/12/2023         Annual         1/12/2024           SPRAG         D508VVZ         5 SRE SAR Dipole         11/12/2023         Annual         11/12/2024           SPRAG         D5 SKHVZ         6 S. Ditt SAR Dipole         10/11/2023         Annual         11/11/2024           SPRAG         D 550VZ         6 S. Ditt SAR Dipole         9/13/2023         Annual         9/13/2026           SPRAG         D 750V3         750 Met SAR Dipole         9/13/2023         Annual         9/13/2026           SPRAG         D 750V3         750 Met SAR Dipole         9/13/2023         Tremental         9/13/2026           SPRAG         D 835V2         8 SR Met SAR Dipole         11/18/2022         Bremial         11/18/2024           SPRAG         D 83V2         8 SR Met SAR Dipole         11/18/2023         Annual         11/18/2024           SPRAG         D 50 Ver. Source 100F4         10/04 Spata Ancested Retromos         10/13/2023         Annual         11/18/2024           SPRAG         D 50 Ver. Source 100F4         10/05 Spata Ancested Retromos         10/13/2023         Annual         1							
SPEAG							1002
SPEAG	SPEAG	D3900V2	3900 MHz SAR Dipole	6/10/2021	Triennial	6/10/2024	1073
SPEAG	SPEAG	D3900V2	3900 MHz SAR Dipole	12/21/2023	Annual	12/21/2024	1062
SPEAG							1066
SPARG							
SPEAG							1019
SPRAG         D835V2         B33 Met SAR Dipole         11/38/2022         Bennal         11/18/2024           SPRAG         CLA-13         Confleed top Antenna         11/38/2023         Annual         11/38/2024           SPRAG         SO Ver. Source DOFH         10/618 System Nerfication Antenna         10/13/2023         Annual         10/13/2024           SPRAG         SO Ver. Source DOFH         10/618 System Nerfication Antenna         10/13/2023         Annual         10/13/2024           SPRAG         DAS4         Daxy Data Acquisition Electronics         10/13/2023         Annual         10/12/2024           SPRAG         DAS4         Daxy Data Acquisition Electronics         10/12/2023         Annual         9/12/2026           SPRAG         DAS4         Daxy Data Acquisition Electronics         11/12/2024         Annual         19/12/2025           SPRAG         DAS4         Daxy Data Acquisition Electronics         10/12/2023         Annual         13/6/2025           SPRAG         DAS4         Daxy Data Acquisition Electronics         11/12/2023         Annual         11/12/2024           SPRAG         DAS4         Daxy Data Acquisition Electronics         11/12/2023         Annual         11/12/2024           SPRAG         DAS4         Daxy Data Acquisition El	SPEAG	D750V3	750 MHz SAR Dipole	9/13/2023	Annual	9/13/2024	1097
SPRAG	SPEAG	D750V3	750 MHz SAR Dipole	5/16/2022	Triennial	5/16/2025	1057
SPEAG							4d108
SPRAG         50 Ver. Source 100Hz         100Hz Sptate Acquisition Electronics         101/18/2023         Annual         101/18/2024           SPRAG         50 Ver. Source 100Hz         100Hz Sptate Acquisition Electronics         101/18/2023         Annual         101/18/2024           SPRAG         DAS4         Dasy Data Acquisition Electronics         101/18/2023         Annual         19/18/2023           SPRAG         DAS4         Dasy Data Acquisition Electronics         1/18/2023         Annual         9/12/2023           SPRAG         DAS4         Dasy Data Acquisition Electronics         1/18/2023         Annual         1/12/2024           SPRAG         DAS4         Dasy Data Acquisition Electronics         1/16/2024         Annual         1/16/2025           SPRAG         DAS4         Dasy Data Acquisition Electronics         1/16/2024         Annual         1/16/2025           SPRAG         DAS4         Dasy Data Acquisition Electronics         1/16/2024         Annual         1/16/2025           SPRAG         DAS4         Dasy Data Acquisition Electronics         1/16/2024         Annual         1/16/2025           SPRAG         DAS4         Dasy Data Acquisition Electronics         1/16/2024         Annual         1/16/2026           SPRAG         DAS4 <td< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td>1004</td></td<>							1004
SPEAG							
SPEAG							1006
SPEAG         DAS4         Dasy Data Acquisition Electronics         91/27023         Annual         91/27024           SPEAG         DAS4         Dasy Data Acquisition Electronics         2/8/2004         Annual         91/27025           SPEAG         DAS4         Dasy Data Acquisition Electronics         3/8/2003         Annual         3/8/2005           SPEAG         DAS4         Dasy Data Acquisition Electronics         101/8/2003         Annual         11/8/2003           SPEAG         DAS4         Dasy Data Acquisition Electronics         11/7/2023         Annual         12/7/2024           SPEAG         DAS4         Dasy Data Acquisition Electronics         3/8/2003         Annual         5/8/2005           SPEAG         DAS4         Dasy Data Acquisition Electronics         101/8/2003         Annual         5/8/2005           SPEAG         DAS4         Dasy Data Acquisition Electronics         101/8/2003         Annual         9/8/2003           SPEAG         DAS4         Dasy Data Acquisition Electronics         9/8/2003         Annual         9/8/2003           SPEAG         DAS4         Dasy Data Acquisition Electronics         9/8/2003         Annual         9/8/2004           SPEAG         DAS4         Dasy Data Acquisition Electronics         10/8/200	SPEAG	DAE4	Dasy Data Acquisition Electronics	10/18/2023	Annual	10/18/2024	1237
SPEAG	SPEAG	DAF4		9/12/2023	Annual	9/12/2024	1684
SPEAG							467
SPEAG							
SPEAG         DAS4         Day Data Acqualition Electronics         12/7/2023         Annual         12/7/2024           SPEAG         DAS4         Days Data Acqualition Electronics         18/8/2004         Annual         13/8/2005           SPEAG         DAS4         Days Data Acqualition Electronics         5/R/2004         Annual         5/R/2005           SPEAG         DAS4         Dasy Data Acqualition Electronics         10/18/2023         Annual         10/18/2024           SPEAG         DAS4         Dasy Data Acqualition Electronics         9/12/2023         Annual         9/R/2024           SPEAG         DAS4         Dasy Data Acqualition Electronics         9/12/2023         Annual         11/14/2023           SPEAG         DAS4         Dasy Data Acqualition Electronics         11/14/2023         Annual         11/14/2024           SPEAG         DAS4         Dasy Data Acqualition Electronics         11/14/2023         Annual         11/14/2024           SPEAG         ELIMINIVY3         ELIMINIVY3         Probe         10/12/2023         Annual         11/14/2024           SPEAG         EXDIVI4         SAR Probe         8/10/2023         Annual         8/10/2024           SPEAG         EXDIVI4         SAR Probe         10/12/2023							1408
SPEAG	SPEAG	DAE4	Dasy Data Acquisition Electronics	10/18/2023	Annual	10/18/2024	1333
SPEAG	SPEAG	DAF4	Dasy Data Acquisition Electronics	12/7/2023	Annual	12/7/2024	1644
SPARG				20,1,2020			604
SPEAG         DA64         Dasy Data Acquisition Electronics         10/18/2023         Annual         10/18/2024           SPEAG         DA64         Dasy Data Acquisition Electronics         9/8/2023         Annual         9/8/2024           SPEAG         DA64         Dasy Data Acquisition Electronics         9/12/2023         Annual         9/12/2024           SPEAG         DA64         Dasy Data Acquisition Electronics         9/12/2023         Annual         9/12/2024           SPEAG         DA64         Dasy Data Acquisition Electronics         11/14/2023         Annual         11/14/2024           SPEAG         ELIMINWY3         ELIMINWY3 Probe         109/2023         Annual         11/14/2024           SPEAG         EXXDV4         SAR Probe         8/10/2023         Annual         8/10/2024           SPEAG         EXXDV4         SAR Probe         10/12/2023         Annual         10/12/2024           SPEAG         EXXDV4         SAR Probe         3/11/2024         Annual         10/12/2024           SPEAG         EXXDV4         SAR Probe         3/11/2024         Annual         3/11/2025           SPEAG         EXXDV4         SAR Probe         3/11/2024         Annual         3/11/2025           SPEAG							
SPEAG							1683
SPEAG         DAE4         Dasy Data Acquisition flectronics         9/R/2023         Annual         9/R/2023           SPEAG         DAE4         Dasy Data Acquisition flectronics         9/12/2023         Annual         19/12/2024           SPEAG         DAE4         Dasy Data Acquisition flectronics         11/14/2023         Annual         11/14/2024           SPEAG         ELIMINIVY3         ELIMINIVY3 Probe         11/9/12/2023         Annual         11/9/2024           SPEAG         EXDV4         SAR Probe         8/10/2023         Annual         8/10/2024           SPEAG         EXDV4         SAR Probe         11/9/12/2023         Annual         10/2/2024           SPEAG         EXDV4         SAR Probe         10/1/2023         Annual         10/2/2024           SPEAG         EXDV4         SAR Probe         5/11/2023         Annual         10/1/2024           SPEAG         EXDV4         SAR Probe         3/11/2024         Annual         3/11/2025           SPEAG         EXDV4         SAR Probe         3/11/2024         Annual         3/11/2025           SPEAG         EXDV4         SAR Probe         3/11/2024         Annual         3/11/2025           SPEAG         EXDV4         SAR Probe	SPEAG	DAE4	Dasy Data Acquisition Electronics	10/18/2023	Annual	10/18/2024	793
SPEAG         DA64         Dasy Data Acquisition Electronics         9/12/2023         Annual         9/12/2024           SPEAG         DA64         Dasy Data Acquisition Electronics         11/14/2023         Annual         11/14/2024           SPEAG         ElumentW3         ElumentW3 Probe         109/2023         Annual         11/9/2024           SPEAG         EXDDV4         SAR Probe         8/10/2023         Annual         8/10/2024           SPEAG         EXDDV4         SAR Probe         109/2023         Annual         109/2024           SPEAG         EXDDV4         SAR Probe         10/2/2023         Annual         10/2/2024           SPEAG         EXDDV4         SAR Probe         3/11/2024         Annual         10/1/2023           SPEAG         EXDDV4         SAR Probe         3/11/2024         Annual         3/11/2025           SPEAG         EXDDV4         SAR Probe         3/11/2024	SPEAG	DAF4		9/8/2022	Annual	9/8/2024	1646
SPEAG         DMS4         Dasy Data Agreement         11/3/2023         Annual         11/3/2024           SPEAG         ELMINWV3         ELMINWV3         ELMINWV3         11/3/2024         Annual         11/3/2024           SPEAG         EXDDV4         SM Probe         8/10/2023         Annual         8/10/2024           SPEAG         EXDDV4         SM Probe         8/10/2023         Annual         8/10/2024           SPEAG         EXDDV4         SM Probe         10/1/2023         Annual         10/1/2024           SPEAG         EXDDV4         SM Probe         10/1/2023         Annual         10/1/2024           SPEAG         EXDDV4         SM Probe         3/11/2024         Annual         3/11/2025							1681
SPEAG         EUmmWV2         EUmmWV2 Probe         109/2023         Annual         10/9/2023           SPEAG         EXDV4         SAR Probe         8/10/2023         Annual         10/9/2023           SPEAG         EXDV4         SAR Probe         2/9/2024         Annual         2/9/2024           SPEAG         EXDV4         SAR Probe         10/2/2023         Annual         10/2/2024           SPEAG         EXDV4         SAR Probe         5/13/2023         Annual         10/2/2024           SPEAG         EXDV4         SAR Probe         3/11/2024         Annual         3/11/2025							
SPAG				11/14/2023	Annual	11/14/2024	1403
SPAG	SPEAG	EUmmWV3	EUmmWV3 Probe	10/9/2023	Annual	10/9/2024	9407
SPEAG         EXDIV4         SAR Probe         2/9/2004         Annual         2/9/2005           SPEAG         EXIDV4         SAR Probe         10/27/2024         Annual         10/27/2024           SPEAG         EXIDV4         SAR Probe         5/13/2022         Annual         5/13/2025           SPEAG         EXIDV4         SAR Probe         3/11/2024         Annual         3/11/2025           SPEAG         EXIDV4         SAR Probe         10/16/2024         Annual         3/11/2025           SPEAG         EXIDV4         SAR Probe         3/11/2024         Annual         3/11/2025           SPEAG         EXIDV4         SAR Probe         3/11/2024         Annual         3/11/2025           SPEAG         EXIDV4         SAR Probe         3/11/2024         Annual         3/11/2025							7668
SPEAG         EXDV4         SAR Probe         10/2/2023         Annual         10/2/2024           SPEAG         EXBV4         SAR Probe         5/13/2024         Annual         5/13/2025           SPEAG         EXBV4         SAR Probe         3/11/2020         Annual         3/11/2025           SPEAG         EXBV4         SAR Probe         10/16/2023         Annual         10/16/2024           SPEAG         EXBV4         SAR Probe         3/11/2024         Annual         3/11/2025           SPEAG         EXBV4         SAR Probe         3/11/2023         Annual         3/11/2025           SPEAG         EXBV4         SAR Probe         11/9/2024         Annual         1/19/2024							
SPEAG         EXDIV4         SAR Probe         5/13/2024         Annual         5/13/2025           SPEAG         EXIDV4         SAR Probe         3/11/2024         Annual         3/11/2025           SPEAG         EXIDV4         SAR Probe         10/16/2023         Annual         10/16/2024           SPEAG         EXIDV4         SAR Probe         3/11/2024         Annual         3/11/2025           SPEAG         EXIDV4         SAR Probe         3/11/2023         Annual         3/11/2025							7427
SPEAG         EXDIV4         SAR Probe         5/13/2024         Annual         5/13/2025           SPEAG         EXIDV4         SAR Probe         3/11/2024         Annual         3/11/2025           SPEAG         EXIDV4         SAR Probe         10/16/2023         Annual         10/16/2024           SPEAG         EXIDV4         SAR Probe         3/11/2024         Annual         3/11/2025           SPEAG         EXIDV4         SAR Probe         3/11/2023         Annual         3/11/2025	SPEAG	EX3DV4	SAR Probe	10/2/2023	Annual	10/2/2024	3949
SPEAG         EXBDV4         SAR Probe         3/11/2024         Annual         3/11/2025           SPEAG         EXDV4         SAR Probe         10/16/2023         Annual         10/16/2024           SPEAG         EXDV4         SAR Probe         3/11/2024         Annual         3/11/2025           SPEAG         EXDV4         SAR Probe         3/11/2023         Annual         11/9/2024           SPEAG         EXDV4         SAR Probe         11/9/2023         Annual         11/9/2024	SPEAG	EX3DV4		5/13/2024	Annual	5/13/2025	7682
SPEAG         EXIDV4         SAR Probe         10/16/2023         Annual         10/16/2024           SPEAG         EXIDV4         SAR Probe         3/11/2024         Annual         3/11/2025           SPEAG         EXIDV4         SAR Probe         11/9/2023         Annual         3/11/2025           SPEAG         EXIDV4         SAR Probe         11/9/2023         Annual         11/9/2024							763R
SPEAG         EXXDV4         SAR Probe         3/11/2024         Annual         3/11/2025           SPEAG         EXXDV4         SAR Probe         11/9/2023         Annual         11/9/2024				0,,		0,,	
SPEAG EX3DV4 SAR Probe 11/9/2023 Annual 11/9/2024				10/16/2023	Annual	10/16/2024	3746
	SPEAG	EX3DV4	SAR Probe	3/11/2024	Annual	3/11/2025	7421
	SDEAG	EX3D//4	SAR Prohe	11/9/2022	Annual	11/9/2024	7639
							7420
	SPEAG						
SPEAG         EX3DV4         SAR Probe         1/16/2024         Annual         1/16/2025           SPEAG         EX3DV4         SAR Probe         9/12/2023         Annual         9/12/2024	SPEAG		SAR Probe				7499 7782

#### 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.

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# 14 MEASUREMENT UNCERTAINTIES

Applicable for SAR measurements < 6 GHz:

a	b	С	d	e=	f	g	h =	i =	k
ű		Ü	u			9			
				f(d,k)			c x f/e	cxg/e	
	1528	Tol.	Prob.		$\mathbf{c}_{i}$	C <sub>i</sub>	1gm	10gms	
Uncertainty Component	Sec.	(± %)	Dist.	Div.	1gm	10 gms	$\mathbf{u}_{i}$	u <sub>i</sub>	V <sub>i</sub>
							(± %)	(± %)	
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	8
Linearity	E.2.4	0.3	N	1	1	1	0.3	0.3	8
System Detection Limits	E.2.4	0.25	R	1.732	1	1	0.1	0.1	8
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	8
RF Ambient Conditions - Noise	E.6.1	3	R	1.732	1	1	1.7	1.7	8
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	8
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	E5	4	R	1.732	1	1	2.3	2.3	8
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)	E3.1	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	E3.4	3.4	R	1.732	0.78	0.71	1.5	1.4	∞
Liquid Permittivity - Temperature Unceritainty	E3.4	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	E3.2	5.0	R	1.73	0.60	0.49	1.7	1.4	∞
Combined Standard Uncertainty (k=1)							12.2	12.0	191
								1	
Expanded Uncertainty			k=2				24.4	24.0	

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

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Applicable for SAR measurements > 6 GHz:

cable for SAR measurements > 6 GHz:									
а	b	С	d	e=	f	g	h =	i =	k
				f(d,k)			c x f/e	c x g/e	
	IEEE	Tol.	Prob.		Ci	C <sub>i</sub>	1gm	10gms	
Uncertainty Component	1528 Sec.	(± %)	Dist.	Div.	1gm	10 gms	u <sub>i</sub>	u <sub>i</sub>	V <sub>i</sub>
	000.					_	(± %)	(± %)	,
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	1.732	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 ⊟ectronics	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	E5	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)	E3.1	7.6	R	1.73	1.0	1.0	4.4	4.4	8
Liquid Conductivity - measurement uncertainty	E3.3	4.3	N	1	0.78	0.71	3.3	3.0	76
Liquid Permittivity - measurement uncertainty	E3.3	4.2	N	1	0.23	0.26	1.0	1.1	75
Liquid Conductivity - Temperature Uncertainty	E3.4	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	E3.2	5.0	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Permittivity - deviation from target values	E3.2	5.0	R	1.73	0.60	0.49	1.7	1.4	∞
Combined Standard Uncertainty (k=1)	1		RSS	1		1	13.8	13.6	191
Expanded Uncertainty			k=2				27.6	27.1	
(95% CONFIDENCE LEVEL)									

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

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