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WIFI 6 GHZ RF EXPOSURE EVALUATION

Applicant Name
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Date of Testing
12/15/2021 – 12/20/2021
Test Site/Location
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FCC ID:	**A3LSMS908JPN**
APPLICANT:	**SAMSUNG ELECTRONICS CO., LTD.**

DUT Type:	Portable Handset
Application Type:	Certification
FCC Rule Part(s):	CFR §2.1093
Model(s):	SC-52C, SCG14

Band & Mode	Tx Frequency	SAR			APD			PD
	MHz	1g Head (W/kg)	1g Body-worn (W/kg)	10g Phablet (W/kg)	Head (W/m^2)	Body-worn (W/m^2)	Phablet (W/m^2)	psPD (W/m^2)
WIFI 6 GHz	5935-7115	0.209	<0.1	0.485	1.050	0.409	7.800	6.744

Values above represent RF exposure evaluations during MIMO operations.

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.

Randy Ortanez
President

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CERT #2041.01

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1 DEVICE UNDER TEST

1.1 Device Overview

Band & Mode	Tx Frequency
U-NII-5	5935 - 6415 MHz
U-NII-6	6435 - 6525 MHz
U-NII-7	6535 - 6875 MHz
U-NII-8	6895 - 7115 MHz

1.2 Nominal and Maximum Output Power Specifications

The device operates using the following maximum and nominal output power specifications. SAR values were scaled to the maximum allowed power to determine compliance per KDB publication 447498 D01v06.

1.2.1 Maximum MIMO WLAN Output Power

Mode	Band	IEEE 802.11 (in dBm)			
		MIMO			
		a (CDD + STBC)		ax (SU) (CDD + STBC, SDM)	
		Nominal	Maximum	Nominal	Maximum
6 GHz WIFI (20MHz BW)	U-NII-5	12.0	13.0	12.0	13.0
	U-NII-6	14.0	15.0	14.0	15.0
	U-NII-7	14.0	15.0	14.0	15.0
	U-NII-8	14.0	15.0	14.0	15.0
6 GHz WIFI (40MHz BW)	U-NII-5			15.0	16.0
	U-NII-6				
	U-NII-7				
	U-NII-8				
6 GHz WIFI (80MHz BW)	U-NII-5			15.0	16.0
	U-NII-6				
	U-NII-7				
	U-NII-8				
6 GHz WIFI (160MHz BW)	U-NII-5			15.0	16.0
	U-NII-6				
	U-NII-7				
	U-NII-8				

1.3 DUT Antenna Locations

The overall dimensions of this device are > 9 x 5 cm. A diagram showing the location of the device antennas can be found in SAR Part 1 Report Appendix E. Since the diagonal dimension of this device is > 160 mm and <200 mm, it is considered a “phablet.” Exact antenna dimensions and separation distances are shown in the Technical Descriptions in the FCC filing

Table 1-1
Device Surfaces

Device Sides/Edges for Testing						
Mode	Back	Front	Top	Bottom	Right	Left
6 GHz WLAN MIMO	Yes	Yes	Yes	No	No	Yes

Note: Particular DUT edges were not required to be evaluated for phablet SAR if the edges were greater than 2.5 cm from the transmitting antenna according to FCC KDB Publication 648474 D04v01r03. The distances between the transmit antennas and the edges of the device are included in the filing. Wireless router mode is disabled for all 6 GHz WLAN operations.

1.4 Miscellaneous Testing Considerations

Per FCC guidance, SAR was performed using 6.5 GHz SAR probe calibration factors. FCC KDB 648474 and FCC KDB 248227 were followed for test positions, distances, and modes. Per TCB workshop October 2020 notes, 5 channels were tested. Absorbed power density (APD) using a 4cm^2 averaging area is reported based on SAR measurements. Incident power density is evaluated at 2mm ensuring that the resolution is sufficient such that integrated power density (iPD) between d=2mm and d=λ/5mm is ≥ -1dB per equipment manufacturer guidance. Power density results are scaled up for uncertainty above 30%.

Per FCC KDB Publication 648474 D04v01r03, this device is considered a "phablet" since the diagonal dimension is greater than 160mm and less than 200mm. Therefore, phablet SAR tests are required when wireless router mode does not apply or if wireless router 1g SAR > 1.2 W/kg.

6 GHz WIFI SAR results are used for simultaneous transmission analysis with the other transmitters. Analysis can be found in SAR Part 1 Report Appendix D.

1.5 Guidance Applied

- November 2017, October 2018, April 2019, November 2019, October 2020 TCBC Workshop Notes
- SPEAG DASY6 System Handbook
- SPEAG DASY6 Application Note (Interim Procedures for Devices Operating at 6-10 GHz) (Nov 2021)
- IEEE 1528-2013
- IEC TR 63170:2018
- IEC 62479:2010
- FCC KDB 865664 D02 v01r02
- FCC KDB 648474 D04 v01r03
- FCC KDB 248227 D01 v02r02
- FCC KDB 447498 D01 v06
- FCC KDB 865664 D01 v01r04

2 RF EXPOSURE LIMITS

2.1 Uncontrolled Environment

UNCONTROLLED ENVIRONMENTS are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure. The general population/uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity.

2.2 Controlled Environment

CONTROLLED ENVIRONMENTS are defined as locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, (i.e. as a result of employment or occupation). In general, occupational/controlled exposure limits are applicable to situations in which persons are exposed as a consequence of their employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. This exposure category is also applicable when the exposure is of a transient nature due to incidental passage through a location where the exposure levels may be higher than the general population/uncontrolled limits, but the exposed person is fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means.

2.3 RF Exposure Limits for Frequencies Below 6 GHz

Table 2-1
SAR Human Exposure Specified in ANSI/IEEE C95.1-1992 and Health Canada Safety Code 6

HUMAN EXPOSURE LIMITS		
	UNCONTROLLED ENVIRONMENT *General Population* (W/kg) or (mW/g)	CONTROLLED ENVIRONMENT *Occupational* (W/kg) or (mW/g)
Peak Spatial Average SAR Head	1.6	8.0
Whole Body SAR	0.08	0.4
Peak Spatial Average SAR Hands, Feet, Ankle, Wrists, etc.	4.0	20

1. The Spatial Peak value of the SAR averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.
2. The Spatial Average value of the SAR averaged over the whole body.
3. The Spatial Peak value of the SAR averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

2.4 RF Exposure Limits for Frequencies Above 6 GHz

Per §1.1310 (d)(3), the MPE limits are applied for frequencies above 6 GHz. Power Density is expressed in units of W/m^2 or mW/cm^2.

Peak Spatially Averaged Power Density was evaluated over a circular area of 4 cm^2 per interim FCC Guidance for near-field power density evaluations per October 2018 TCB Workshop notes.

Table 2-2
Human Exposure Limits Specified in FCC 47 CFR §1.1310

Human Exposure to Radiofrequency (RF) Radiation Limits		
Frequency Range [MHz]	**Power Density** [mW/cm^2]	**Average Time** [Minutes]
(A) Limits For Occupational / Controlled Environments		
1,500 – 100,000	5.0	6
(B) Limits For General Population / Uncontrolled Environments		
1,500 – 100,000	1.0	30

Note: 1.0 mW/cm^2 is 10 W/m^2

3 RF CONDUCTED POWERS

Table 3-1
6 GHz WLAN Maximum Average RF Power – 802.11a 20 MHz BW

6GHz (20MHz) 802.11a Conducted Power [dBm]				
Freq [MHz]	**Channel**	**ANT1**	**ANT2**	**MIMO**
5935	2	9.35	9.43	12.40
6075	25	9.34	9.22	12.29
6175	45	9.20	9.01	12.12
6275	65	9.36	9.30	12.34
6415	93	9.49	9.40	12.46
6875	185	11.26	11.80	14.55
7115	233	11.20	11.26	14.24

Table 3-2
6 GHz WLAN Maximum Average RF Power – 802.11ax 20 MHz BW

6GHz (20MHz) 802.11ax Conducted Power [dBm]				
Freq [MHz]	**Channel**	**ANT1**	**ANT2**	**MIMO**
5935	2	9.64	9.83	12.75
6075	25	9.29	9.36	12.34
6175	45	9.41	9.22	12.33
6275	65	9.72	9.50	12.62
6415	93	9.41	9.42	12.43
6875	185	11.50	11.81	14.67
7115	233	11.24	11.35	14.31

Table 3-3
6 GHz WLAN Maximum Average RF Power – 802.11ax 40 MHz BW

6GHz (40MHz) 802.11ax Conducted Power [dBm]				
Freq [MHz]	**Channel**	**ANT1**	**ANT2**	**MIMO**
5965	3	12.41	12.56	15.50
6085	27	12.30	12.33	15.33
6165	43	12.40	12.28	15.35
6285	67	12.62	12.57	15.61
6405	91	12.56	12.62	15.60
6845	179	12.47	12.42	15.46
6885	187	12.62	12.32	15.48
7005	211	12.01	12.92	15.50
7085	227	12.28	12.32	15.31

Table 3-4
6 GHz WLAN Maximum Average RF Power – 802.11ax 80 MHz BW

6GHz (80MHz) 802.11ax Conducted Power [dBm]				
Freq [MHz]	**Channel**	**ANT1**	**ANT2**	**MIMO**
6065	23	12.42	11.79	15.13
6305	71	12.99	12.70	15.86
6385	87	12.94	12.76	15.86
6465	103	12.63	12.02	15.34
6545	119	12.57	11.84	15.23
6705	151	12.71	11.89	15.33
6785	167	12.50	12.97	15.75
6865	183	12.65	12.60	15.63
7025	215	11.51	12.51	15.05

Table 3-5
6 GHz WLAN Maximum Average RF Power – 802.11ax 160 MHz BW

6GHz (160MHz) 802.11ax Conducted Power [dBm]				
Freq [MHz]	**Channel**	**ANT1**	**ANT2**	**MIMO**
6025	15	12.29	12.58	15.45
6185	47	12.37	12.28	15.33
6345	79	12.17	12.61	15.41
6505	111	12.74	12.16	15.47
6665	143	12.75	12.09	15.45
6825	175	12.14	12.65	15.41
6985	207	11.59	12.66	15.17

Justification for test configurations for WLAN per KDB Publication 248227 D01v02r02:

- Power measurements were performed for the transmission mode configuration with the highest maximum output power specified for production units.
- For transmission modes with identical maximum specified output power, channel bandwidth, modulation and data rates, power measurements were required for all identical configurations.

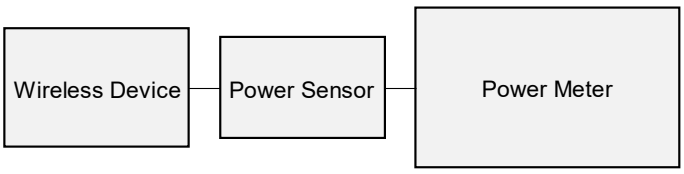

Figure 3-1
Power Measurement Setup

4 SYSTEM VERIFICATION

4.1 SAR Test System Verification

Table 4-1
Measured Tissue Properties

Calibrated for Tests Performed on:	Tissue Type	Tissue Temp During Calibration (˚C)	Measured Frequency (MHz)	Measured Conductivity, σ (S/m)	Measured Dielectric Constant, ε	TARGET Conductivity, σ (S/m)	TARGET Dielectric Constant, ε	% dev σ	% dev ε
12/20/2021	6500 Head	19.11	6065	5.747	32.913	5.557	35.022	*3.42%*	*-6.02%*
			6075	5.765	32.882	5.569	35.010	*3.52%*	*-6.08%*
			6275	5.999	32.477	5.805	34.770	*3.34%*	*-6.59%*
			6305	6.014	32.472	5.840	34.734	*2.98%*	*-6.51%*
			6475	6.230	32.084	6.041	34.530	*3.13%*	*-7.08%*
			6500	6.231	32.084	6.070	34.500	*2.65%*	*-7.00%*
			6545	6.302	31.909	6.122	34.446	*2.94%*	*-7.37%*
			6675	6.480	31.762	6.273	34.290	*3.30%*	*-7.37%*
			6785	6.597	31.661	6.400	34.158	*3.08%*	*-7.31%*
			6995	6.794	31.107	6.644	33.906	*2.26%*	*-8.26%*
			7025	6.795	31.003	6.680	33.870	*1.72%*	*-8.46%*

The above measured tissue parameters were used in the DASY software. The DASY software was used to perform interpolation to determine the dielectric parameters at the SAR test device frequencies (per KDB Publication 865664 D01v01r04 and IEEE 1528-2013 6.6.1.2). The tissue parameters listed in the SAR test plots may slightly differ from the table above due to significant digit rounding in the software.

The SAR measurement systems have implemented the SAR error compensation algorithms documented in IEC 62209-2 to automatically compensate the measured SAR results for deviations between the measured and required tissue dielectric parameters for all frequencies. The test lab has verified that the required SAR error compensation algorithm has been correctly applied to only scale up the measured SAR, not downward.

Prior to SAR assessment, the system is verified to ±10% of the SAR measurement on the reference dipole at the time of calibration by the calibration facility. Full system validation status and result summary can be found in Appendix F.

Table 4-2
System Verification Results

System Verification TARGET & MEASURED																				
SAR System #	Tissue Frequency (MHz)	Tissue Type	Date	Amb. Temp (°C)	Liquid Temp (°C)	Input Power (W)	Source SN	Probe SN	Measured SAR_{1g} (W/kg)	1 W Target SAR_{1g} (W/kg)	1 W Normalized SAR_{1g} (W/kg)	$Deviation_{1g}$ (%)	Measured SAR_{10g} (W/kg)	1 W Target SAR_{10g} (W/kg)	1 W Normalized SAR_{10g} (W/kg)	$Deviation_{10g}$ (%)	Measured 4cm² APD (W/m²)	1W Target 4cm² APD (W/m²)	1 W Normalized 4cm² APD (W/m²)	Deviation 4cm² APD (%)
O	6500	Head	12/20/2021	18.5	19.0	0.050	1019	7659	15.000	293.000	300.000	2.39%	2.740	53.600	54.800	2.24%	66.8000	1340.0000	1336.000	-0.30%

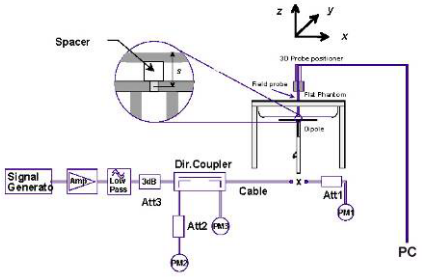

Figure 4-1
System Verification Setup Diagram

Figure 4-2
System Verification Setup Photo

4.2 Power Density Test System Verification

The system was verified to be within ±0.66 dB of the power density targets on the calibration certificate according to the test system specification in the user's manual and calibration facility recommendation. The 0.66 dB deviation threshold represents the expanded uncertainty for system performance checks using SPEAG's mmWave verification sources. The same spatial resolution and measurement region used in the source calibration was applied during the system check.

The measured power density distribution of verification source was also confirmed through visual inspection to have no noticeable differences, both spatially (shape) and numerically (level) from the distribution provided by the manufacturer, per November 2017 TCBC Workshop Notes.

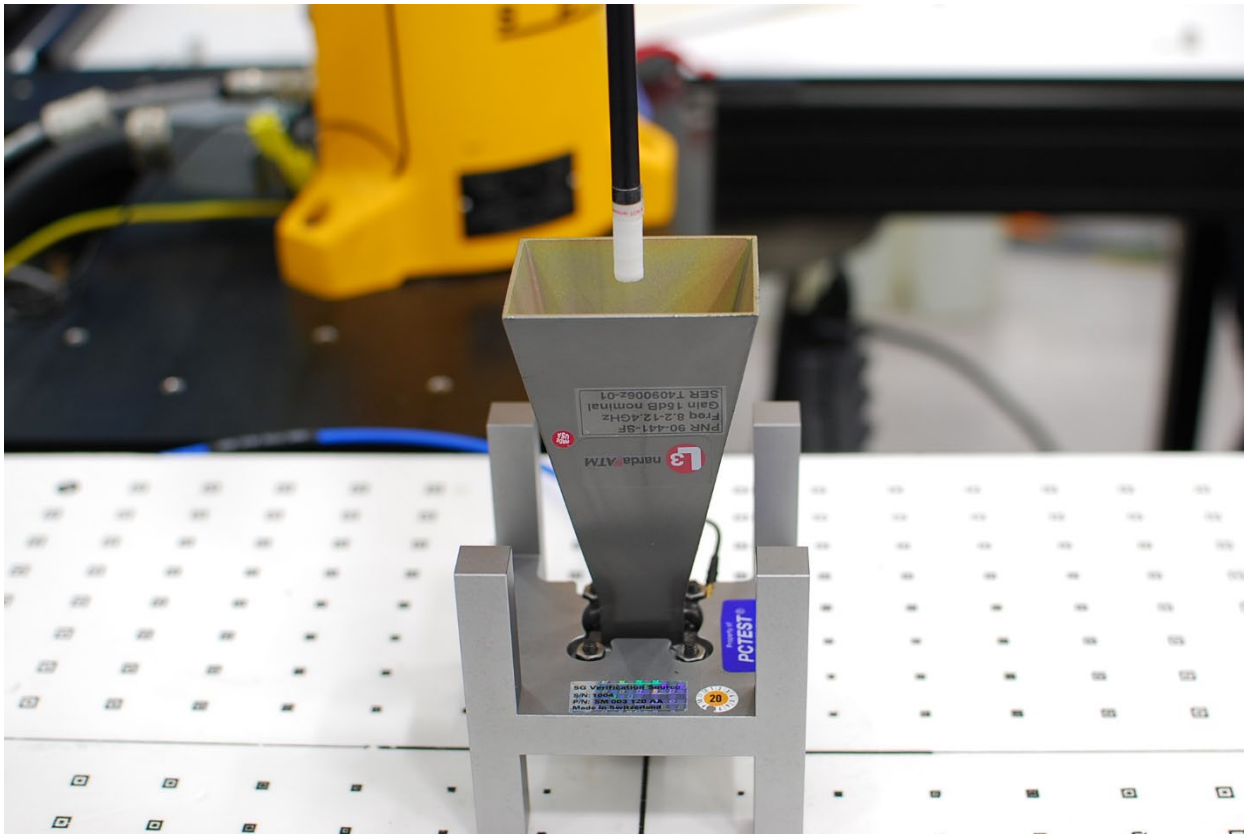

Figure 4-3
System Verification Setup Photo

Table 4-3
10 GHz Verifications

System Verification											
System	Frequency (GHz)	Date	Source S/N	Probe S/N	Prad (mW)	Normal psPD (W/m² over 4 cm²)		Deviation (dB)	Total psPD (W/m² over 4 cm²)		Deviation (dB)
						Measured	Target		Measured	Target	
Q	10	12/15/2021	1004	9364	86.1	49.00	50.70	-0.15	49.30	50.70	-0.12
Q	10	12/17/2021	1004	9364	86.1	49.50	50.70	-0.10	49.80	50.70	-0.08
Q	10	12/20/2021	1004	9364	86.1	48.40	50.70	-0.20	48.70	50.70	-0.17

Note: A **10 mm distance spacing** was used from the reference horn antenna aperture to the probe element.

5 DATA SUMMARY

5.1 SAR and Absorbed Power Density Results

Table 5-1
6 GHz WLAN Head MIMO SAR

MEASUREMENT RESULTS																				
FREQUENCY		Mode	Service	Bandwidth [MHz]	Maximum Allowed Power (Ant 1) [dBm]	Conducted Power (Ant 1) [dBm]	Maximum Allowed Power (Ant 2) [dBm]	Conducted Power (Ant 2) [dBm]	Power Drift [dB]	Side	Test Position	Antenna Config.	Device Serial Number	Data Rate (Mbps)	Duty Cycle (%)	SAR (1g)	Scaling Factor (Power)	Scaling Factor (Duty Cycle)	Reported SAR (1g)	Plot #
MHz	Ch.															(W/kg)			(W/kg)	
6065.00	23	802.11ax	OFDM	80	13.0	12.42	13.0	11.79	-0.16	Right	Cheek	MIMO	0129M	68.1	90.6	0.143	1.322	1.104	0.209	A1
6305.00	71	802.11ax	OFDM	80	13.0	12.99	13.0	12.70	-0.16	Right	Cheek	MIMO	0129M	68.1	90.6	0.122	1.072	1.104	0.144	
6545.00	119	802.11ax	OFDM	80	13.0	12.57	13.0	11.84	-0.15	Right	Cheek	MIMO	0129M	68.1	90.6	0.054	1.306	1.104	0.078	
6785.00	167	802.11ax	OFDM	80	13.0	12.50	13.0	12.97	-0.17	Right	Cheek	MIMO	0129M	68.1	90.6	0.042	1.122	1.104	0.052	
7025.00	215	802.11ax	OFDM	80	13.0	11.51	13.0	12.51	0.11	Right	Cheek	MIMO	0129M	68.1	90.6	0.015	1.409	1.104	0.023	
6305.00	71	802.11ax	OFDM	80	13.0	12.99	13.0	12.70	0.10	Right	Tilt	MIMO	0129M	68.1	90.6	0.017	1.072	1.104	0.020	
6305.00	71	802.11ax	OFDM	80	13.0	12.99	13.0	12.70	-0.20	Left	Cheek	MIMO	0129M	68.1	90.6	0.059	1.072	1.104	0.070	
6305.00	71	802.11ax	OFDM	80	13.0	12.99	13.0	12.70	-0.04	Left	Tilt	MIMO	0129M	68.1	90.6	0.014	1.072	1.104	0.017	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population												Head 1.6 W/kg (mW/g) averaged over 1 gram								

Note: To achieve the 16 dBm maximum allowed MIMO power shown in the documentation, each antenna transmits at a maximum allowed power of 13 dBm.

Table 5-2
6 GHz WLAN Body-worn MIMO SAR

MEASUREMENT RESULTS																				
FREQUENCY		Mode	Service	Bandwidth [MHz]	Maximum Allowed Power (Ant 1) [dBm]	Conducted Power (Ant 1) [dBm]	Maximum Allowed Power (Ant 2) [dBm]	Conducted Power (Ant 2) [dBm]	Power Drift [dB]	Spacing (mm)	Antenna Config.	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle (%)	SAR (1g)	Scaling Factor (Power)	Scaling Factor (Duty Cycle)	Reported SAR (1g)	Plot #
MHz	Ch.															(W/kg)			(W/kg)	
6305.00	71	802.11ax	OFDM	80	13.0	12.99	13.0	12.70	-0.06	15	MIMO	0129M	68.1	Back	90.6	0.047	1.072	1.104	0.056	A2
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population												Body 1.6 W/kg (mW/g) averaged over 1 gram								

Note: To achieve the 16 dBm maximum allowed MIMO power shown in the documentation, each antenna transmits at a maximum allowed power of 13 dBm.

Table 5-3
6 GHz WLAN Phablet MIMO SAR

MEASUREMENT RESULTS																					
FREQUENCY		Mode	Service	Bandwidth [MHz]	Maximum Allowed Power (Ant 1) [dBm]	Conducted Power (Ant 1) [dBm]	Maximum Allowed Power (Ant 2) [dBm]	Conducted Power (Ant 2) [dBm]	Power Drift [dB]	Spacing (mm)	Antenna Config.	Peak Number	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle (%)	SAR (10g)	Scaling Factor (Power)	Scaling Factor (Duty Cycle)	Reported SAR (10g)	Plot #
MHz	Ch.																(W/kg)			(W/kg)	
6305.00	71	802.11ax	OFDM	80	13.0	12.99	13.0	12.70	0.19	0	MIMO	1	0129M	68.1	Back	90.6	0.200	1.072	1.104	0.237	
6305.00	71	802.11ax	OFDM	80	13.0	12.99	13.0	12.70	-0.09	0	MIMO	2	0129M	68.1	Back	90.6	0.146	1.072	1.104	0.173	
6305.00	71	802.11ax	OFDM	80	13.0	12.99	13.0	12.70	0.05	0	MIMO	N/A	0129M	68.1	Front	90.6	0.134	1.072	1.104	0.159	
6305.00	71	802.11ax	OFDM	80	13.0	12.99	13.0	12.70	0.17	0	MIMO	N/A	0129M	68.1	Top	90.6	0.015	1.072	1.104	0.018	
6065.00	23	802.11ax	OFDM	80	13.0	12.42	13.0	11.79	0.09	0	MIMO	N/A	0129M	68.1	Left	90.6	0.332	1.322	1.104	0.485	A3
6305.00	71	802.11ax	OFDM	80	13.0	12.99	13.0	12.70	0.02	0	MIMO	N/A	0129M	68.1	Left	90.6	0.263	1.072	1.104	0.311	
6545.00	119	802.11ax	OFDM	80	13.0	12.57	13.0	11.84	-0.03	0	MIMO	N/A	0129M	68.1	Left	90.6	0.168	1.306	1.104	0.242	
6785.00	167	802.11ax	OFDM	80	13.0	12.50	13.0	12.97	-0.07	0	MIMO	N/A	0129M	68.1	Left	90.6	0.176	1.122	1.104	0.218	
7025.00	215	802.11ax	OFDM	80	13.0	11.51	13.0	12.51	-0.04	0	MIMO	N/A	0129M	68.1	Left	90.6	0.093	1.409	1.104	0.145	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population															Phablet 4 W/kg (mW/g) averaged over 10 gram						

Note: To achieve the 16 dBm maximum allowed MIMO power shown in the documentation, each antenna transmits at a maximum allowed power of 13 dBm.

Table 5-4
6 GHz WLAN Head MIMO Absorbed Power Density

MEASUREMENT RESULTS																	
FREQUENCY		Mode	Service	Bandwidth [MHz]	Maximum Allowed Power (Ant 1) [dBm]	Conducted Power (Ant 1) [dBm]	Maximum Allowed Power (Ant 2) [dBm]	Conducted Power (Ant 2) [dBm]	Power Drift [dB]	Side	Test Position	Antenna Config.	Device Serial Number	Data Rate (Mbps)	Duty Cycle (%)	Measured APD	Plot #
MHz	Ch.															W/m² (4cm²)	
6065.00	23	802.11ax	OFDM	80	13.0	12.42	13.0	11.79	-0.16	Right	Cheek	MIMO	0129M	68.1	90.6	1.050	A1
6305.00	71	802.11ax	OFDM	80	13.0	12.99	13.0	12.70	-0.16	Right	Cheek	MIMO	0129M	68.1	90.6	0.957	
6545.00	119	802.11ax	OFDM	80	13.0	12.57	13.0	11.84	-0.15	Right	Cheek	MIMO	0129M	68.1	90.6	0.330	
6785.00	167	802.11ax	OFDM	80	13.0	12.50	13.0	12.97	-0.17	Right	Cheek	MIMO	0129M	68.1	90.6	0.254	
7025.00	215	802.11ax	OFDM	80	13.0	11.51	13.0	12.51	0.11	Right	Cheek	MIMO	0129M	68.1	90.6	0.039	
6305.00	71	802.11ax	OFDM	80	13.0	12.99	13.0	12.70	0.10	Right	Tilt	MIMO	0129M	68.1	90.6	0.102	
6305.00	71	802.11ax	OFDM	80	13.0	12.99	13.0	12.70	-0.20	Left	Cheek	MIMO	0129M	68.1	90.6	0.462	
6305.00	71	802.11ax	OFDM	80	13.0	12.99	13.0	12.70	-0.04	Left	Tilt	MIMO	0129M	68.1	90.6	0.110	

Note: To achieve the 16 dBm maximum allowed MIMO power shown in the documentation, each antenna transmits at a maximum allowed power of 13 dBm.

Table 5-5
6 GHz WLAN Body-worn MIMO Absorbed Power Density

MEASUREMENT RESULTS																	
FREQUENCY		Mode	Service	Bandwidth [MHz]	Maximum Allowed Power (Ant 1) [dBm]	Conducted Power (Ant 1) [dBm]	Maximum Allowed Power (Ant 2) [dBm]	Conducted Power (Ant 2) [dBm]	Power Drift [dB]	Spacing (mm)	Antenna Config.	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle (%)	Measured APD	Plot #
MHz	Ch.															W/m² (4cm²)	
6305.00	71	802.11ax	OFDM	80	13.0	12.99	13.0	12.70	-0.06	15.0	MIMO	0129M	68.1	Back	90.6	0.409	A2

Note: To achieve the 16 dBm maximum allowed MIMO power shown in the documentation, each antenna transmits at a maximum allowed power of 13 dBm.

Table 5-6
6 GHz WLAN Phablet MIMO Absorbed Power Density

MEASUREMENT RESULTS																		
FREQUENCY		Mode	Service	Bandwidth [MHz]	Maximum Allowed Power (Ant 1) [dBm]	Conducted Power (Ant 1) [dBm]	Maximum Allowed Power (Ant 2) [dBm]	Conducted Power (Ant 2) [dBm]	Power Drift [dB]	Spacing (mm)	Antenna Config.	Peak Number	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle (%)	Measured APD	Plot #
MHz	Ch.																W/m² (4cm²)	
6305.00	71	802.11ax	OFDM	80	13.0	12.99	13.0	12.70	0.19	0	MIMO	1	0129M	68.1	Back	90.6	4.680	
6305.00	71	802.11ax	OFDM	80	13.0	12.99	13.0	12.70	-0.09	0	MIMO	2	0129M	68.1	Back	90.6	3.410	
6305.00	71	802.11ax	OFDM	80	13.0	12.99	13.0	12.70	0.05	0	MIMO	N/A	0129M	68.1	Front	90.6	3.080	
6305.00	71	802.11ax	OFDM	80	13.0	12.99	13.0	12.70	0.17	0	MIMO	N/A	0129M	68.1	Top	90.6	0.343	
6065.00	23	802.11ax	OFDM	80	13.0	12.42	13.0	11.79	0.09	0	MIMO	N/A	0129M	68.1	Left	90.6	7.800	A3
6305.00	71	802.11ax	OFDM	80	13.0	12.99	13.0	12.70	0.02	0	MIMO	N/A	0129M	68.1	Left	90.6	6.240	
6545.00	119	802.11ax	OFDM	80	13.0	12.57	13.0	11.84	-0.03	0	MIMO	N/A	0129M	68.1	Left	90.6	3.890	
6785.00	167	802.11ax	OFDM	80	13.0	12.50	13.0	12.97	-0.07	0	MIMO	N/A	0129M	68.1	Left	90.6	4.050	
7025.00	215	802.11ax	OFDM	80	13.0	11.51	13.0	12.51	-0.04	0	MIMO	N/A	0129M	68.1	Left	90.6	2.180	

Note: To achieve the 16 dBm maximum allowed MIMO power shown in the documentation, each antenna transmits at a maximum allowed power of 13 dBm.

SAR and Absorbed Power Density General Notes:

1. The test data reported are the worst-case SAR values according to test procedures specified in IEEE 1528-2013, and FCC KDB Publication 447498 D01v06.
2. Batteries are fully charged at the beginning of the SAR measurements.
3. Liquid tissue depth was at least 15.0 cm for all frequencies.
4. The manufacturer has confirmed that the device(s) tested have the same physical, mechanical, and thermal characteristics and are within operational tolerances expected for production units.
5. SAR results were scaled to the maximum allowed power to demonstrate compliance per FCC KDB Publication 447498 D01v06.
6. Device was tested using a fixed spacing for body-worn accessory testing. A separation distance of 15 mm was considered because the manufacturer has determined that there will be body-worn accessories available in the marketplace for users to support this separation distance.
7. Per FCC KDB Publication 648474 D04v01r03, body-worn SAR was evaluated without a headset connected to the device. Since the standalone reported body-worn SAR was ≤ 1.2 W/kg, no additional body-worn SAR evaluations using a headset cable were required.
8. Per FCC KDB Publication 648474 D04v01r03, this device is considered a "phablet" since the diagonal dimension is > 160 mm and < 200 mm. Therefore, phablet SAR tests are required when wireless router mode does not apply or if wireless router 1g SAR > 1.2 W/kg.
9. Unless otherwise noted, when 10g SAR measurement is considered, a factor of 2.5 is applied to the thresholds below.
10. Per FCC guidance, SAR was performed using 6.5 GHz SAR probe calibration factors. Per October 2020 TCB Workshop notes, 5 channels were tested. Absorbed power density (APD) using a 4cm2 averaging area is reported based on SAR measurements.

WLAN Notes:

1. WIFI 6 GHz operations are limited to MIMO operations only (does not support stand-alone mode). Per KDB Publication 248227 D01v02r02, SAR for MIMO was evaluated by following the simultaneous SAR provisions from KDB Publication 447498 D01v06 by making a SAR measurement with both antennas transmitting simultaneously.
2. When the maximum reported 1g averaged SAR is ≤0.8 W/kg, SAR testing on additional channels was not required. Otherwise, SAR for the next highest output power channel was required until the reported SAR result was ≤ 1.20 W/kg for 1g evaluations or all test channels were measured.
3. The device was configured to transmit continuously at the required data rate, channel bandwidth and signal modulation, using the highest transmission duty factor supported by the test mode tools. The reported SAR was scaled to the 100% transmission duty factor to determine compliance. Procedures used to measure the duty factor are identical to that in the associated EMC test reports.
4. When 10g SAR measurement is considered, a factor of 2.5 is applied to the thresholds above.
5. When multiple SAR peaks were observed due to separation of the Ant 1 and Ant 2 while operating in MIMO mode, separate zoom scans were evaluated over each antenna location. Peak 1 represents the zoom scan centered over WIFI Antenna 1, while Peak 2 represents the zoom scan centered over WIFI Antenna 2.

5.2 Power Density Results

Table 5-7
6 GHz WLAN MIMO Power Density

MEASUREMENT RESULTS																			
Frequency (MHz)	Channel	Mode	Service	Bandwidth [MHz]	Power Drift (dB)	Spacing (mm)	Antenna Config.	DUT Serial Number	Data Rate (Mbps)	Side	Duty Cycle (%)	Grid Step (λ)	iPD (W/m²)	Scaling Factor for Measurement Uncertainty per IEC 62479	Normal psPD (W/m²)	Scaled Normal psPD (W/m²)	Total psPD (W/m²)	Scaled Total psPD (W/m²)	Plot #
6305.00	71	802.11ax	OFDM	80	-0.03	2	MIMO	0097M	68.1	Back	90.6	0.05	1.42	1.554	1.870	2.906	2.670	4.149	
6305.00	71	802.11ax	OFDM	80	-0.03	9.51	MIMO	0097M	68.1	Back	90.6	0.05	0.897	1.554	0.781	1.214	0.937	1.456	
6305.00	71	802.11ax	OFDM	80	-0.01	2	MIMO	0097M	68.1	Front	90.6	0.05	N/A	1.554	1.940	3.015	2.360	3.667	
6305.00	71	802.11ax	OFDM	80	0.12	2	MIMO	0097M	68.1	Top	90.6	0.05	N/A	1.554	0.602	0.936	0.717	1.114	
6065.00	23	802.11ax	OFDM	80	-0.07	2	MIMO	0097M	68.1	Left	90.6	0.05	N/A	1.554	2.960	4.600	4.340	6.744	A4
6305.00	71	802.11ax	OFDM	80	0.09	2	MIMO	0097M	68.1	Left	90.6	0.05	N/A	1.554	2.460	3.823	2.740	4.258	
6545.00	119	802.11ax	OFDM	80	0.01	2	MIMO	0097M	68.1	Left	90.6	0.05	N/A	1.554	1.610	2.502	1.870	2.906	
6785.00	167	802.11ax	OFDM	80	-0.16	2	MIMO	0097M	68.1	Left	90.6	0.05	N/A	1.554	1.450	2.253	1.850	2.875	
7025.00	215	802.11ax	OFDM	80	0.13	2	MIMO	0097M	68.1	Left	90.6	0.05	N/A	1.554	1.750	2.720	1.980	3.077	
47 CFR §1.1310 - SAFETY LIMIT Spatial Average Uncontrolled Exposure / General Population								Power Density 10 W/m² averaged over 4 cm²											

Power Density General Notes

1. The manufacturer has confirmed that the devices tested have the same physical, mechanical and thermal characteristics and are within operational tolerances expected for production units.
2. Batteries are fully charged at the beginning of the measurements. The DUT was connected to a wall charger for some measurements due to the test duration. It was confirmed that the charger plugged into this DUT did not impact the near-field PD test results.
3. Power density was calculated by repeated E-field measurements on two measurement planes separated by λ/4.
4. The device was configured to transmit continuously at the required data rate, channel bandwidth and signal modulation, using the highest transmission duty factor supported by the test mode tools.
5. Per FCC guidance and equipment manufacturer guidance, power density results were scaled according to IEC 62479:2010 for the portion of the measurement uncertainty > 30%. Total expanded uncertainty of 2.68 dB (85.4%) was used to determine the psPD measurement scaling factor.
6. Per equipment manufacturer guidance, power density was measured at d=2mm and d=λ/5mm using the same grid size and grid step size for some frequencies and surfaces. The integrated Power Density (iPD) was calculated based on these measurements. Since iPD ratio between the two distances is ≥ -1dB, the grid step was sufficient for determining compliance at d=2mm.
7. WIFI 6 GHz operations are limited to MIMO operations only (does not support stand-alone mode). psPD for MIMO was evaluated by making a measurement with both antennas transmitting simultaneously.

6 EQUIPMENT LIST

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Agilent	N9038A	MXE EMI Receiver	N/A	N/A	N/A	MY51210133
Rohde & Schwarz	FSW67	Signal / Spectrum Analyzer	N/A	N/A	N/A	103200
Sunol	JB5	Bi-Log Antenna (30M - 5GHz)	N/A	N/A	N/A	A051107
Emco	3115	Horn Antenna (1-18GHz)	N/A	N/A	N/A	9704-5182
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433975
SPEAG	EUmmWV3	EUmmWV3 Probe	6/21/2021	Annual	6/21/2022	9364
SPEAG	SM 003 100 AA	10 GHz System Verification Antenna	8/12/2021	Annual	8/12/2022	1004
SPEAG	DAE4ip	Dasy Data Acquisition Electronics	11/11/2021	Annual	11/11/2022	1638
SPEAG	EX3DV4	SAR Probe	6/29/2021	Annual	6/29/2022	7659
SPEAG	DAE4	Dasy Data Acquisition Electronics	6/21/2021	Annual	6/21/2022	1678
SPEAG	D6.5GHzV2	6.5GHz SAR Dipole	1/12/2021	Annual	1/12/2022	1019
Control Company	4352	Long Stem Thermometer	1/24/2020	Biennial	1/24/2022	200043634
Agilent	SMF100A	Signal Generator	5/7/2020	Biennial	5/7/2022	101590
Rohde & Schwarz	SMU200A	Vector Signal Generator	5/12/2020	Biennial	5/12/2022	104145
Agilent	8753ES	S-Parameter Vector Network Analyzer	2/2/2021	Annual	2/2/2022	US39170122
SPEAG	DAK-3.5	Dielectric Assessment Kit	5/12/2021	Annual	5/12/2022	1070
Control Company	4040	Therm./Clock/Humidity Monitor	3/6/2020	Biennial	3/6/2022	200170296
Insize	1108-150	Digital Caliper	1/17/2020	Biennial	1/17/2022	409193536
Agilent	SMF100A	Signal Generator	5/7/2020	Biennial	5/7/2022	101590
Rohde & Schwarz	SMU200A	Vector Signal Generator	5/12/2020	Biennial	5/12/2022	104145
Agilent	8753ES	S-Parameter Vector Network Analyzer	2/2/2021	Annual	2/2/2022	US39170122
SPEAG	DAK-3.5	Dielectric Assessment Kit	5/12/2021	Annual	5/12/2022	1070
MCL	BW-N6W5+	6dB Attenuator	CBT	N/A	CBT	1139
Narda	BW-S3W2	Attenuator (3dB)	CBT	N/A	CBT	120
MiniCircuits	VLF-6000+	Low Pass Filter	CBT	N/A	CBT	N/A
Keysight	772D	Dual Directional Coupler	CBT	N/A	CBT	MY52180215
Seekonk	NC-100	Torque Wrench	8/5/2020	Biennial	8/5/2022	N/A
Anritsu	MA2411B	Pulse Power Sensor	8/10/2021	Annual	8/10/2022	1207364
Anritsu	MA2411B	Pulse Power Sensor	3/9/2021	Annual	3/9/2022	1207470

Note:

1. Each equipment item was used solely within its respective calibration period.
2. 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.

7 MEASUREMENT UNCERTAINTIES

Applicable for SAR measurements:

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	1.732	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	∞
Uncertainty in SAR correction for deviations in permittivity and conductivity	E.3.2	1.9	N	1	1.0	0.8	1.9	1.6	∞
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	∞
Combined Standard Uncertainty (k=1)			RSS				13.5	13.4	191
Expanded Uncertainty (95% CONFIDENCE LEVEL)			k=2				27.1	26.9	

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

Applicable for Power Density Measurements:

a	b	c	d	e	f = c x f/e	g
Uncertainty Component	Unc. (± dB)	Prob. Dist.	Div.	c_i	u_i (± dB)	v_i
Measurement System						
Calibration	0.49	N	1	1	0.49	∞
Probe Correction	0.00	R	1.73	1	0.00	∞
Frequency Response	0.20	R	1.73	1	0.12	∞
Sensor Cross Coupling	0.00	R	1.73	1	0.00	∞
Isotropy	0.50	R	1.73	1	0.29	∞
Linearity	0.20	R	1.73	1	0.12	∞
Probe Scattering	0.00	R	1.73	1	0.00	∞
Probe Positioning offset	0.30	R	1.73	1	0.17	∞
Probe Positioning Repeatability	0.04	R	1.73	1	0.02	∞
Sensor MechanicalOffset	0.00	R	1.73	1	0.00	∞
Probe Spatial Resolution	0.00	R	1.73	1	0.00	∞
Field Impedence Dependance	0.00	R	1.73	1	0.00	∞
Amplitude and Phase Drift	0.00	R	1.73	1	0.00	∞
Amplitude and Phase Noise	0.04	R	1.73	1	0.02	∞
Measurement Area Truncation	0.00	R	1.73	1	0.00	∞
Data Acquisition	0.03	N	1	1	0.03	∞
Sampling	0.00	R	1.73	1	0.00	∞
Field Reconstruction	2.00	R	1.73	1	1.15	∞
Forward Transformation	0.00	R	1.73	1	0.00	∞
Power Density Scaling	0.00	R	1.73	1	0.00	∞
Spatial Averaging	0.10	R	1.73	1	0.06	∞
System Detection Limit	0.04	R	1.73	1	0.02	∞
Test Sample Related						
Probe Coupling with DUT	0.00	R	1.73	1	0.00	∞
Modulation Response	0.40	R	1.73	1	0.23	∞
Integration Time	0.00	R	1.73	1	0.00	∞
Response Time	0.00	R	1.73	1	0.00	∞
Device Holder Influence	0.10	R	1.73	1	0.06	∞
DUT alignment	0.00	R	1.73	1	0.00	∞
RF Ambient Conditions	0.04	R	1.73	1	0.02	∞
Ambient Reflections	0.04	R	1.73	1	0.02	∞
Immunity/Secondary Reception	0.00	R	1.73	1	0.00	∞
Drift of DUT	0.21	R	1.73	1	0.12	∞
Combined Standard Uncertainty (k=1)		RSS			1.34	∞
Expanded Uncertainty (95% CONFIDENCE LEVEL)		k=2			2.68	

9 CONCLUSION

9.1 Measurement Conclusion

The SAR and power density measurements indicate that the DUT complies with the RF radiation exposure limits of the FCC, with respect to all parameters subject to this test. These measurements were taken to simulate the RF effects of RF exposure under worst-case conditions. Precise laboratory measures were taken to assure repeatability of the tests. The results and statements relate only to the item(s) tested.

Please note that the RF Exposure and distribution of electromagnetic energy in the body are very complex phenomena that depend on the mass, shape, and size of the body, the orientation of the body with respect to the field vectors, and the electrical properties of both the body and the environment. Other variables that may play a substantial role in possible biological effects are those that characterize the environment (e.g. ambient temperature, air velocity, relative humidity, and body insulation) and those that characterize the individual (e.g. age, gender, activity level, debilitation, or disease). Because various factors may interact with one another to vary the specific biological outcome of an exposure to electromagnetic fields, any protection guide should consider maximal amplification of biological effects as a result of field-body interactions, environmental conditions, and physiological variables.

10 REFERENCES

[1] ANSI/IEEE C95.1-1992, American National Standard safety levels with respect to human exposure to radio frequency electromagnetic fields, 3kHz to 300GHz, New York: IEEE, Sept. 1992.

[2] IEC TR 63170:2018, Measurement Procedure for the Evaluation of Power Density Related to Human Exposure to Radiofrequency Fields from Wireless Communication Devices Operating between 6 GHz and 100 GHz

[3] IEC TR 62630 : 2010, Guidance for Evaluating Exposure from Multiple Electromagnetic Sources

[4] K. Pokovic, T. Schmid, J. Frohlich, and N. Kuster. Novel Probes and Evaluation Procedures to Assess Field Magnitude and Polarization. IEEE Transactions on Electromagnetic Compatibility 42(2): 240 -244, 2000

[5] R. W. Gerchberg and W. O. Saxton. A Practical Algorithm for the Determination of Phase from Image and Diffraction Plane Pictures. Optik 35(2): 237 – 246, 1972

[6] A. P. Anderson and S. Sali. New Possibilities for Phaseless Microwave Diagnostics. Part 1: Error Reduction Techniques. IEE Proceedings H – Microwaves, Antennas and Propagation 132(5): 290 – 298, 1985

[7] FCC KDB 865664 D02 v01r04: SAR Measurement Requirements for 100 MHz to 6 GHz. Federal Communications Commission – Office of Engineering and Technology, Laboratory Division.

[8] FCC KDB 447498 D01 v02r01: RF Exposure Procedures and Equipment Authorization Policies for Mobile and Portable Devices. Federal Communications Commission – Office of Engineering and Technology, Laboratory Division.

[9] November 2017 Telecommunications Certification Body Council (TCBC) Workshop Notes

[10] October 2018 Telecommunications Certification Body Council (TCBC) Workshop Notes

[11] April 2019 Telecommunications Certification Body Council (TCBC) Workshop Notes

[12] November 2019 Telecommunications Certification Body Council (TCBC) Workshop Notes

[13] SPEAG DASY6 System Handbook (September 2019)

[14] SPEAG DASY6 Application Note (Interim Procedures for Devices Operating at 6-10 GHz)

[15] Federal Communications Commission, ET Docket 93-62, Guidelines for Evaluating the Environmental Effects of Radiofrequency Radiation, Aug. 1996.

[16] ANSI/IEEE C95.1-2005, American National Standard safety levels with respect to human exposure to radio frequency electromagnetic fields, 3kHz to 300GHz, New York: IEEE, 2006.

[17] ANSI/IEEE C95.3-2002, IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields - RF and Microwave, New York: IEEE, December 2002.

[18] IEEE Standards Coordinating Committee 39 –Standards Coordinating Committee 34 – IEEE Std. 1528-2013, IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques.

[19] NCRP, National Council on Radiation Protection and Measurements, Biological Effects and Exposure Criteria for RadioFrequency Electromagnetic Fields, NCRP Report No. 86, 1986. Reprinted Feb. 1995.

[20] T. Schmid, O. Egger, N. Kuster, Automated E-field scanning system for dosimetric assessments, IEEE Transaction on Microwave Theory and Techniques, vol. 44, Jan. 1996, pp. 105-113.

[21] K. Pokovic, T. Schmid, N. Kuster, Robust setup for precise calibration of E-field probes in tissue simulating liquids at mobile communications frequencies, ICECOM97, Oct. 1997, pp. 1 -124.

[22] K. Pokovic, T. Schmid, and N. Kuster, E-field Probe with improved isotropy in brain simulating liquids, Proceedings of the ELMAR, Zadar, Croatia, June 23-25, 1996, pp. 172-175.

[23] Schmid & Partner Engineering AG, Application Note: Data Storage and Evaluation, June 1998, p2.

[24] V. Hombach, K. Meier, M. Burkhardt, E. Kuhn, N. Kuster, The Dependence of EM Energy Absorption upon Human Modeling at 900 MHz, IEEE Transaction on Microwave Theory and Techniques, vol. 44 no. 10, Oct. 1996, pp. 1865-1873.

[25] N. Kuster and Q. Balzano, Energy absorption mechanism by biological bodies in the near field of dipole antennas above 300MHz, IEEE Transaction on Vehicular Technology, vol. 41, no. 1, Feb. 1992, pp. 17-23.

[26] G. Hartsgrove, A. Kraszewski, A. Surowiec, Simulated Biological Materials for Electromagnetic Radiation Absorption Studies, University of Ottawa, Bioelectromagnetics, Canada: 1987, pp. 29-36.

[27] Q. Balzano, O. Garay, T. Manning Jr., Electromagnetic Energy Exposure of Simulated Users of Portable Cellular Telephones, IEEE Transactions on Vehicular Technology, vol. 44, no.3, Aug. 1995.

[28] W. Gander, Computermathematick, Birkhaeuser, Basel, 1992.

[29] W.H. Press, S.A. Teukolsky, W.T. Vetterling, and B.P. Flannery, Numerical Recipes in C, The Art of Scientific Computing, Second edition, Cambridge University Press, 1992.

[30] N. Kuster, R. Kastle, T. Schmid, Dosimetric evaluation of mobile communications equipment with known precision, IEEE Transaction on Communications, vol. E80-B, no. 5, May 1997, pp. 645-652.

[31] CENELEC CLC/SC111B, European Prestandard (prENV 50166-2), Human Exposure to Electromagnetic Fields High-frequency: 10kHz-300GHz, Jan. 1995.

[32] Prof. Dr. Niels Kuster, ETH, Eidgenössische Technische Hoschschule Zürich, Dosimetric Evaluation of the Cellular Phone.

[33] IEC 62209-1, Measurement procedure for the assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices - Part 1: Devices used next to the ear (Frequency range of 300 MHz to 6 GHz), July 2016.

[34] Innovation, Science, Economic Development Canada RSS-102 Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands) Issue 5, March 2015.

[35] Health Canada Safety Code 6 Limits of Human Exposure to Radio Frequency Electromagnetic Fields in the Frequency Range from 3 kHz – 300 GHz, 2015

[36] FCC SAR Test Procedures for 2G-3G Devices, Mobile Hotspot and UMPC Devices KDB Publications 941225, D01-D07

[37] SAR Measurement Guidance for IEEE 802.11 Transmitters, KDB Publication 248227 D01

[38] FCC SAR Considerations for Handsets with Multiple Transmitters and Antennas, KDB Publications 648474 D03-D04

[39] FCC SAR Evaluation Considerations for Laptop, Notebook, Netbook and Tablet Computers, FCC KDB Publication 616217 D04

[40] FCC SAR Measurement and Reporting Requirements for 100MHz – 6 GHz, KDB Publications 865664 D01-D02

[41] FCC General RF Exposure Guidance and SAR Procedures for Dongles, KDB Publication 447498, D01-D02

[42] Anexo à Resolução No. 533, de 10 de Septembro de 2009.

[43] IEC 62209-2, Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices - Human models, instrumentation, and procedures - Part 2: Procedure to determine the specific absorption rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz), Mar. 2010.