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NEAR-FIELD POWER DENSITY EVALUATION REPORT

Applicant Name:
Apple, Inc.
One Apple Park Way
Cupertino, CA 95014

Date of Testing:
06/24/2022 – 06/27/2022
Test Site/Location:
Element Washington DC LLC,
Morgan Hill, CA, USA
Document Serial No.:
1C2205090028-29.BCG (Rev 1)

FCC ID: **BCGA2764**

APPLICANT: **APPLE, INC.**

DUT Type: Tablet Device
Application Type: Certification
FCC Rule Part(s): CFR §2.1093
Model: A2764

Band & Mode	Tx Frequency	Measured psPD	Reported psPD
	MHz	W/m^2	W/m^2
5G NR - n258	24250 - 24450; 24750 - 25250	5.560	7.130
5G NR - n261	27500 - 28350	4.410	7.130
5G NR - n260	37000 - 40000	5.200	7.130
Total Exposure Ratio		**0.973**	
Verdict		**PASS**	

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

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

RJ Ortanez
Executive Vice President

ilac-MRA
ACCREDITED
CERT #2041.02

TABLE OF CONTENTS

1 DEVICE UNDER TEST

1.1 NR FR2 Checklist

NR FR2 Operations Information						
Form Factor	Tablet Device					
Channel Bandwidths per NR Band	NR Band n258: 50MHz, 100MHz					
Channel Bandwidths per NR Band	NR Band n261: 50MHz, 100MHz					
Channel Bandwidths per NR Band	NR Band n260: 50MHz, 100MHz					
Channel Numbers and Frequencies	Low		Mid		High	
	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
NR Band n258: 50MHz BW	2018333	24350.04	2025833	24800.04	2032915	25224.96
NR Band n258: 100MHz BW	2018333	24350.04	2025833	24800.04	2032499	25200.00
NR Band n261: 50MHz BW	2071249	27525.00	2077915	27924.96	2084581	28324.92
NR Band n261: 100MHz BW	2071665	27550.08	2077915	27924.96	2084165	28299.96
NR Band n260: 50MHz BW	2229583	37025.04	2254165	38499.96	2278749	39975.00
NR Band n260: 100MHz BW	2229999	37050.00	2254165	38499.96	2278331	39949.92
Subcarrier Spacing (kHz)	120					
Total Number of Supported Uplink CCs (SISO)	4					
Total Number of Supported Uplink CCs (MIMO)	4					
Total Number of Supported DL CCs	10					
CP-OFDM Modulations Supported in UL	QPSK, 16QAM, 64QAM					
DFT-s-OFDM Modulations Supported in UL	PI/2 BPSK, QPSK, 16QAM, 64QAM					
LTE Anchor Bands (n258)	2, 5, 12, 14, 30, 66					
LTE Anchor Bands (n261)	2, 5, 12, 13, 48, 66					
LTE Anchor Bands (n260)	2, 5, 12, 13, 14, 30, 48, 66					
Duplex Type (mmWave)	TDD					

1.2 Time-Averaging Algorithm for RF Exposure Compliance

This device is enabled with Qualcomm® Smart Transmit (GEN2) feature. This feature performs time averaging algorithm in real time to control and manage transmitting power and ensure the time-averaged RF exposure is in compliance with FCC requirements all the time. Refer to Compliance Summary document for detailed description of Qualcomm® Smart Transmit. Note that WLAN operations are not enabled with Smart Transmit.

The Smart Transmit algorithm maintains the time-averaged transmit power, in turn, time-averaged RF exposure of *SAR_design_target* or *PD_design_target*, below the predefined time-averaged power limit (i.e., P_{limit} for sub-6 radio, and *input.power.limit* for 5G mmW NR), for each characterized technology and band (see RF Exposure Part 0 Test Report).

Smart Transmit allows the device to transmit at higher power instantaneously when needed, but manages power limiting to maintain time-averaged transmit power to *input.power.limit*.

The purpose of this report (Part 1 test) is to demonstrate that the EUT meets FCC PD limits when transmitting in static transmission scenario at maximum allowable time-averaged power level given by *input.power.limit.*

1.3 Power Density Design Target and Uncertainty

Power Density Design Specifications	
PD_design_target (W/m²)	4.5
Design Related Total Uncertainty (dB)	2.0

1.4 Input Power Specifications

All power density measurements for this device were performed at the *input.power.limit* given in below tables. Input power is per antenna element and polarization for each antenna module. When input.power.limit is calculated to be above the maximum input power, the device is limited to the maximum input power.

Table 1-1
5G mmWave NR Band n258 Ant M2

Band	V Beam ID	H Beam ID	input.power.limit (dBm)
n258	0	-	6.2
n258	3	-	8.0
n258	6	-	8.5
n258	9	-	7.8
n258	13	-	5.6
n258	14	-	5.2
n258	15	-	4.1
n258	16	-	5.1
n258	25	-	3.8
n258	26	-	3.8
n258	27	-	6.3
n258	34	-	1.3
n258	35	-	1.3
n258	36	-	2.6
n258	37	-	1.6
n258	38	-	2.8
n258	49	-	1.3
n258	50	-	2.3
n258	51	-	2.2
n258	52	-	1.7
n258	-	128	8.1
n258	-	131	6.9
n258	-	134	8.3
n258	-	137	7.5
n258	-	141	5.2
n258	-	142	5.5
n258	-	143	5.2
n258	-	144	4.9
n258	-	153	5.3
n258	-	154	5.1
n258	-	155	4.5
n258	-	162	1.3
n258	-	163	1.8
n258	-	164	2.4
n258	-	165	1.9
n258	-	166	1.4
n258	-	177	1.3
n258	-	178	2.8
n258	-	179	2.6
n258	-	180	1.1
n258	0	128	2.5
n258	3	131	3.9
n258	6	134	4.8
n258	9	137	3.5
n258	13	141	2.3
n258	14	142	1.5
n258	15	143	1.2
n258	16	144	1.2
n258	25	153	1.3
n258	26	154	1.7
n258	27	155	1.7
n258	34	162	-2.9
n258	35	163	-2.8
n258	36	164	-1.0
n258	37	165	-2.5
n258	38	166	-2.4
n258	49	177	-2.9
n258	50	178	-1.6
n258	51	179	-1.3
n258	52	180	-2.8

Table 1-2
5G mmWave NR Band n258 Ant M3

Band	V Beam ID	H Beam ID	input.power.limit (dBm)
n258	1	-	5.0
n258	4	-	6.9
n258	7	-	8.0
n258	10	-	6.5
n258	17	-	2.6
n258	18	-	5.0
n258	19	-	4.5
n258	20	-	3.8
n258	28	-	4.1
n258	29	-	2.8
n258	30	-	3.4
n258	39	-	-0.1
n258	40	-	1.0
n258	41	-	1.0
n258	42	-	0.0
n258	43	-	1.8
n258	53	-	0.2
n258	54	-	1.5
n258	55	-	0.5
n258	56	-	0.1
n258	-	129	6.9
n258	-	132	5.7
n258	-	135	7.3
n258	-	138	6.1
n258	-	145	3.3
n258	-	146	4.4
n258	-	147	2.7
n258	-	148	3.2
n258	-	156	3.9
n258	-	157	2.7
n258	-	158	3.4
n258	-	167	-0.1
n258	-	168	1.1
n258	-	169	1.5
n258	-	170	0.5
n258	-	171	-0.5
n258	-	181	0.2
n258	-	182	0.9
n258	-	183	1.8
n258	-	184	-0.4
n258	1	129	1.0
n258	4	132	2.3
n258	7	135	3.3
n258	10	138	2.2
n258	17	145	-0.7
n258	18	146	-0.1
n258	19	147	-0.1
n258	20	148	-0.3
n258	28	156	-0.2
n258	29	157	-0.9
n258	30	158	0.0
n258	39	167	-4.5
n258	40	168	-3.3
n258	41	169	-2.7
n258	42	170	-4.1
n258	43	171	-3.5
n258	53	181	-4.4
n258	54	182	-2.7
n258	55	183	-3.4
n258	56	184	-4.4

Table 1-3
5G mmWave NR Band n258 Ant M0

Band	V Beam ID	H Beam ID	input.power.limit (dBm)
n258	2	-	5.4
n258	5	-	6.0
n258	8	-	5.7
n258	11	-	5.2
n258	12	-	5.2
n258	21	-	1.1
n258	22	-	2.2
n258	23	-	2.3
n258	24	-	2.1
n258	31	-	1.0
n258	32	-	1.7
n258	33	-	3.4
n258	44	-	-1.0
n258	45	-	-1.6
n258	46	-	-1.2
n258	47	-	-2.2
n258	48	-	0.3
n258	57	-	-0.4
n258	58	-	-1.7
n258	59	-	-1.2
n258	60	-	-1.5
n258	-	130	6.1
n258	-	133	6.4
n258	-	136	6.3
n258	-	139	6.1
n258	-	140	6.4
n258	-	149	2.5
n258	-	150	1.9
n258	-	151	2.4
n258	-	152	4.5
n258	-	159	1.9
n258	-	160	2.3
n258	-	161	2.3
n258	-	172	-1.1
n258	-	173	-1.2
n258	-	174	-0.9
n258	-	175	0.3
n258	-	176	0.8
n258	-	185	-1.1
n258	-	186	-0.9
n258	-	187	-0.2
n258	-	188	0.3
n258	2	130	1.1
n258	5	133	1.1
n258	8	136	1.1
n258	11	139	1.0
n258	12	140	1.3
n258	21	149	-2.2
n258	22	150	-2.3
n258	23	151	-2.0
n258	24	152	-0.7
n258	31	159	-1.7
n258	32	160	-1.3
n258	33	161	-0.7
n258	44	172	-4.7
n258	45	173	-5.3
n258	46	174	-5.1
n258	47	175	-5.4
n258	48	176	-3.4
n258	57	185	-4.7
n258	58	186	-5.3
n258	59	187	-5.3
n258	60	188	-4.7

Table 1-4
5G mmWave NR Band n261 Ant M2

Band	V Beam ID	H Beam ID	input.power.limit (dBm)
n261	0	-	5.4
n261	3	-	6.4
n261	6	-	6.7
n261	9	-	6.6
n261	13	-	2.9
n261	14	-	3.2
n261	15	-	2.9
n261	16	-	3.2
n261	25	-	3.0
n261	26	-	2.9
n261	27	-	3.8
n261	34	-	0.4
n261	35	-	0.5
n261	36	-	0.7
n261	37	-	0.5
n261	38	-	0.3
n261	49	-	0.2
n261	50	-	0.7
n261	51	-	0.8
n261	52	-	0.1
n261	-	128	6.1
n261	-	131	6.7
n261	-	134	7.2
n261	-	137	7.3
n261	-	141	3.3
n261	-	142	3.2
n261	-	143	3.6
n261	-	144	3.8
n261	-	153	4.4
n261	-	154	3.4
n261	-	155	3.6
n261	-	162	0.8
n261	-	163	1.3
n261	-	164	1.3
n261	-	165	0.3
n261	-	166	1.0
n261	-	177	0.8
n261	-	178	1.5
n261	-	179	0.7
n261	-	180	0.5
n261	0	128	1.8
n261	3	131	2.5
n261	6	134	3.0
n261	9	137	2.7
n261	13	141	-0.1
n261	14	142	-0.5
n261	15	143	-0.5
n261	16	144	-0.2
n261	25	153	-0.1
n261	26	154	-0.7
n261	27	155	-0.2
n261	34	162	-3.0
n261	35	163	-2.8
n261	36	164	-3.0
n261	37	165	-3.6
n261	38	166	-3.2
n261	49	177	-3.3
n261	50	178	-2.7
n261	51	179	-3.4
n261	52	180	-3.4

Table 1-5
5G mmWave NR Band n261 Ant M3

Band	V Beam ID	H Beam ID	input.power.limit (dBm)
n261	1	-	5.8
n261	4	-	6.5
n261	7	-	6.8
n261	10	-	7.0
n261	17	-	3.5
n261	18	-	3.5
n261	19	-	3.0
n261	20	-	3.1
n261	28	-	3.4
n261	29	-	3.1
n261	30	-	3.0
n261	39	-	0.6
n261	40	-	0.6
n261	41	-	1.0
n261	42	-	0.9
n261	43	-	0.1
n261	53	-	0.5
n261	54	-	0.9
n261	55	-	1.1
n261	56	-	0.3
n261	-	129	5.5
n261	-	132	5.9
n261	-	135	6.7
n261	-	138	6.6
n261	-	145	2.5
n261	-	146	2.6
n261	-	147	3.0
n261	-	148	3.5
n261	-	156	2.4
n261	-	157	2.9
n261	-	158	3.4
n261	-	167	0.3
n261	-	168	0.9
n261	-	169	1.0
n261	-	170	0.2
n261	-	171	0.2
n261	-	181	0.2
n261	-	182	1.2
n261	-	183	0.9
n261	-	184	-0.3
n261	1	129	1.4
n261	4	132	1.8
n261	7	135	2.6
n261	10	138	2.2
n261	17	145	-0.8
n261	18	146	-1.0
n261	19	147	-1.2
n261	20	148	-0.2
n261	28	156	-1.0
n261	29	157	-1.1
n261	30	158	-0.4
n261	39	167	-3.7
n261	40	168	-3.6
n261	41	169	-3.2
n261	42	170	-3.7
n261	43	171	-4.0
n261	53	181	-3.9
n261	54	182	-3.1
n261	55	183	-3.4
n261	56	184	-4.2

Table 1-6
5G mmWave NR Band n261 Ant M0

Band	V Beam ID	H Beam ID	input.power.limit (dBm)
n261	2	-	5.2
n261	5	-	5.6
n261	8	-	5.6
n261	11	-	5.5
n261	12	-	6.0
n261	21	-	3.3
n261	22	-	2.0
n261	23	-	2.4
n261	24	-	3.0
n261	31	-	2.3
n261	32	-	3.2
n261	33	-	3.2
n261	44	-	-0.2
n261	45	-	-0.9
n261	46	-	-1.5
n261	47	-	-1.2
n261	48	-	0.4
n261	57	-	-0.7
n261	58	-	-1.2
n261	59	-	-1.7
n261	60	-	-0.1
n261	-	130	5.4
n261	-	133	5.9
n261	-	136	6.2
n261	-	139	6.3
n261	-	140	6.4
n261	-	149	4.3
n261	-	150	2.3
n261	-	151	3.3
n261	-	152	2.9
n261	-	159	2.3
n261	-	160	2.9
n261	-	161	4.2
n261	-	172	-0.7
n261	-	173	-1.4
n261	-	174	-0.7
n261	-	175	0.1
n261	-	176	1.0
n261	-	185	-1.1
n261	-	186	-1.4
n261	-	187	0.4
n261	-	188	0.8
n261	2	130	2.0
n261	5	133	2.4
n261	8	136	2.7
n261	11	139	2.5
n261	12	140	2.4
n261	21	149	0.5
n261	22	150	-1.4
n261	23	151	-0.8
n261	24	152	-0.2
n261	31	159	-1.1
n261	32	160	0.0
n261	33	161	0.2
n261	44	172	-3.5
n261	45	173	-4.3
n261	46	174	-4.5
n261	47	175	-3.8
n261	48	176	-2.9
n261	57	185	-4.0
n261	58	186	-4.7
n261	59	187	-4.1
n261	60	188	-2.8

Table 1-4
5G mmWave NR Band n260 Ant M2

Band	V Beam ID	H Beam ID	input.power.limit (dBm)
n260	0	-	6.0
n260	3	-	6.0
n260	6	-	6.2
n260	9	-	7.0
n260	13	-	3.8
n260	14	-	3.4
n260	15	-	3.6
n260	16	-	3.0
n260	25	-	3.1
n260	26	-	3.8
n260	27	-	3.2
n260	34	-	0.6
n260	35	-	0.9
n260	36	-	0.8
n260	37	-	1.3
n260	38	-	0.9
n260	49	-	0.9
n260	50	-	0.9
n260	51	-	1.0
n260	52	-	1.7
n260	-	128	6.5
n260	-	131	6.5
n260	-	134	6.5
n260	-	137	7.2
n260	-	141	3.6
n260	-	142	4.1
n260	-	143	3.4
n260	-	144	3.5
n260	-	153	3.8
n260	-	154	3.9
n260	-	155	3.4
n260	-	162	1.8
n260	-	163	1.3
n260	-	164	1.1
n260	-	165	1.1
n260	-	166	1.2
n260	-	177	1.1
n260	-	178	1.1
n260	-	179	0.8
n260	-	180	1.4
n260	0	128	2.7
n260	3	131	2.9
n260	6	134	2.8
n260	9	137	3.9
n260	13	141	0.0
n260	14	142	0.4
n260	15	143	0.8
n260	16	144	-0.2
n260	25	153	0.0
n260	26	154	0.2
n260	27	155	0.0
n260	34	162	-2.6
n260	35	163	-2.4
n260	36	164	-2.2
n260	37	165	-2.4
n260	38	166	-2.7
n260	49	177	-2.7
n260	50	178	-2.5
n260	51	179	-2.7
n260	52	180	-2.4

Table 1-5
5G mmWave NR Band n260 Ant M3

Band	V Beam ID	H Beam ID	input.power.limit (dBm)
n260	1	-	5.2
n260	4	-	5.3
n260	7	-	5.5
n260	10	-	6.2
n260	17	-	3.2
n260	18	-	2.5
n260	19	-	2.8
n260	20	-	2.2
n260	28	-	2.3
n260	29	-	3.1
n260	30	-	2.3
n260	39	-	0.2
n260	40	-	0.3
n260	41	-	0.0
n260	42	-	0.9
n260	43	-	-0.1
n260	53	-	-0.1
n260	54	-	0.1
n260	55	-	0.3
n260	56	-	0.1
n260	-	129	5.6
n260	-	132	5.6
n260	-	135	5.7
n260	-	138	6.3
n260	-	145	3.4
n260	-	146	3.4
n260	-	147	2.7
n260	-	148	2.6
n260	-	156	2.9
n260	-	157	2.9
n260	-	158	2.5
n260	-	167	0.4
n260	-	168	0.4
n260	-	169	0.1
n260	-	170	-0.1
n260	-	171	0.5
n260	-	181	0.9
n260	-	182	0.2
n260	-	183	-0.3
n260	-	184	0.4
n260	1	129	1.8
n260	4	132	2.0
n260	7	135	2.0
n260	10	138	3.0
n260	17	145	-0.6
n260	18	146	-0.2
n260	19	147	-0.7
n260	20	148	-1.1
n260	28	156	-1.0
n260	29	157	-0.7
n260	30	158	-1.0
n260	39	167	-3.6
n260	40	168	-3.4
n260	41	169	-3.1
n260	42	170	-3.6
n260	43	171	-3.7
n260	53	181	-3.6
n260	54	182	-3.4
n260	55	183	-3.6
n260	56	184	-3.9

Table 1-6
5G mmWave NR Band n260 Ant M0

Band	V Beam ID	H Beam ID	input.power.limit (dBm)
n260	2	-	11.2
n260	5	-	11.7
n260	8	-	11.7
n260	11	-	11.9
n260	12	-	9.6
n260	21	-	8.0
n260	22	-	9.0
n260	23	-	10.6
n260	24	-	8.3
n260	31	-	7.3
n260	32	-	7.8
n260	33	-	9.4
n260	44	-	4.8
n260	45	-	3.6
n260	46	-	6.4
n260	47	-	6.6
n260	48	-	5.3
n260	57	-	5.0
n260	58	-	4.4
n260	59	-	6.8
n260	60	-	5.5
n260	-	130	9.8
n260	-	133	10.1
n260	-	136	10.3
n260	-	139	10.4
n260	-	140	10.0
n260	-	149	7.5
n260	-	150	7.0
n260	-	151	7.9
n260	-	152	7.5
n260	-	159	7.3
n260	-	160	6.3
n260	-	161	7.6
n260	-	172	4.6
n260	-	173	4.1
n260	-	174	3.9
n260	-	175	4.0
n260	-	176	4.1
n260	-	185	4.5
n260	-	186	4.0
n260	-	187	4.4
n260	-	188	4.7
n260	2	130	6.5
n260	5	133	6.7
n260	8	136	6.7
n260	11	139	6.9
n260	12	140	5.6
n260	21	149	3.6
n260	22	150	5.6
n260	23	151	4.3
n260	24	152	3.5
n260	31	159	3.0
n260	32	160	3.8
n260	33	161	4.5
n260	44	172	0.9
n260	45	173	0.5
n260	46	174	0.7
n260	47	175	1.7
n260	48	176	0.6
n260	57	185	0.6
n260	58	186	0.9
n260	59	187	1.4
n260	60	188	1.0

1.5 DUT Antenna Locations

This device has the follow antenna arrays: Ant M0, Ant M2, Ant M3. Table below indicates the surfaces evaluated for near field power density (part 1) evaluation. Refer to RF Exposure Part 0 Test Report for justification of these worst-surfaces.

Table 1-7
5G mmWave NR Device Surfaces

Band	Antenna	Back	Front	Top	Bottom	Right	Left
n258	Ant M0	No	Yes	No	No	No	No
n258	Ant M2	No	No	Yes	No	No	No
n258	Ant M3	No	No	No	Yes	No	No
n261	Ant M0	No	Yes	No	No	No	No
n261	Ant M2	No	No	Yes	No	No	No
n261	Ant M3	No	No	No	Yes	No	No
n260	Ant M0	No	Yes	No	No	No	No
n260	Ant M2	No	No	Yes	No	No	No
n260	Ant M3	No	No	No	Yes	No	No

1.6 Simultaneous Transmission Capabilities

According to FCC KDB Publication 447498 D01v06, transmitters are considered to be operating simultaneously when there is overlapping transmission, with the exception of transmissions during network hand-offs with maximum hand-off duration less than 30 seconds.

This device contains multiple transmitters that may operate simultaneously, and therefore requires a simultaneous transmission analysis according to FCC KDB Publication 447498 D01v06 4.3.2 procedures.

Table 1-8
5G mmWave NR Simultaneous Tx

No.	Capable Transmit Configuration	Body
1	LTE + 5G NR	Yes
2	LTE + 5G NR + 2.4 GHz WI-FI	Yes
3	LTE + 5G NR + 5/6 GHz WI-FI	Yes
4	LTE + 5G NR + 2.4 GHz Bluetooth	Yes
5	LTE + 5G NR + 2.4 GHz WI-FI MIMO	Yes
6	LTE + 5G NR + 5/6 GHz WI-FI MIMO	Yes
7	LTE + 5G NR + 2.4 GHz Bluetooth (TXBF)	Yes
8	LTE + 5G NR + 2.4 GHz Bluetooth + 5/6 GHz WI-FI	Yes
9	LTE + 5G NR + 2.4 GHz Bluetooth + 5/6 GHz WI-FI MIMO	Yes
10	LTE + 5G NR + 2.4 GHz Bluetooth (TXBF) + 5/6 GHz WI-FI	Yes
11	LTE + 5G NR + 2.4 GHz Bluetooth (TXBF) + 5/6 GHz WI-FI MIMO	Yes
12	LTE + 5G NR + NB UNII	Yes
13	LTE + 5G NR + NB UNII + 2.4 GHz WIFI	Yes
14	LTE + 5G NR + NB UNII + 2.4 GHz WIFI MIMO	Yes
15	LTE + 5G NR + NB UNII (TXBF) + 2.4 GHz WIFI	Yes
16	LTE + 5G NR + NB UNII (TXBF) + 2.4 GHz WIFI MIMO	Yes
17	LTE + 5G NR + NB UNII (TXBF)	Yes
18	LTE + 5G NR + 2.4 GHz Bluetooth (TXBF)	Yes
19	LTE + 5G NR + 2.4 GHz WI-FI + 2.4 GHz Bluetooth	Yes

NOTE:
1. 2.4 GHz WLAN, and 2.4 GHz Bluetooth share the same antenna path and cannot transmit simultaneously.
2. All non-5G NR licensed modes share the same antenna path and cannot transmit simultaneously.
3. 5G NR bands cannot transmit simultaneously.
4. This device supports time averaging smart transmit algorithm in WWAN. Smart transmit adds directly the time-averaged RF exposure from 4G and time-averaged RF exposure from 5G mmW NR to ensure that the normalized RF exposure from both 4G and 5G mmW NR does not exceed FCC limit.

1.7 Guidance Applied

- November 2017, October 2018, April 2019, November 2019 TCBC Workshop Notes
- SPEAG DASY6 System Handbook
- IEC TR 63170:2018
- FCC KDB 865664 D02 v01r04
- FCC KDB 447498 D01 v02r01

1.8 Bibliography

Table 1-9
5G mmWave NR Bibliography

Report Type	Serial Number
Part 0 SAR	1C2205090028-25.BCG
Part 1 SAR	1C2205090028-26.BCG
Part 0 PD	1C2205090028-28.BCG
Power Density Simulation Report	
RF Exposure Compliance Summary Report	1C2205090028-30.BCG
Part 2	1C2205090028-27.BCG

2 MEASUREMENT SYSTEM

2.1 Measurement Setup

Peak spatially averaged power density (psPD) measurements for mmWave frequencies were performed using the DASY6 with cDASY6 5G module. The DASY6 is made by Schmid & Partner Engineering AG (SPEAG) in Zurich, Switzerland and consists of a high precision robotics system (Staubli), robot controller, desktop computer, near-field probe, probe alignment sensor, and the 5G phantom. The robot is a six-axis industrial robot, performing precise movements to position the probe to the location (points) of maximum electromagnetic field (EMF).

2.2 SPEAG EUmmWVx Probe / E-Field 5G Probe

The EUmmWVx probe consists of two dipoles optimally arranged to obtain pseudo-vector information.

Frequency Range	750 MHz – 110 GHz
Dynamic Range	< 20 V/m – 10,000 V/m with PRE-10 (min < 50 V/m – 3,000 V/m)
Position Precision	< 0.2 mm (cDASY6)
Dimensions	Probe Overall Length: 320 mm Probe Body Diameter: 8 mm Probe Tip Length: 23 mm Probe Tip Diameter: Encapsulation 8 mm Distance from Probe Tip to Sensor X Calibration Point: 1.5 mm Distance from Probe Tip to Sensor Y Calibration Point: 1.5 mm
Applications	E-field measurements of 5G devices and other mm-wave transmitters operating above 10 GHz in < 2 mm distance from device (free-space) Power density, H-field and far-field analysis using total field reconstruction
Compatibility	cDASY6 + 5G-Module

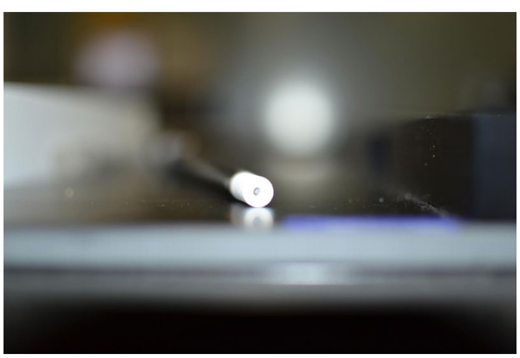
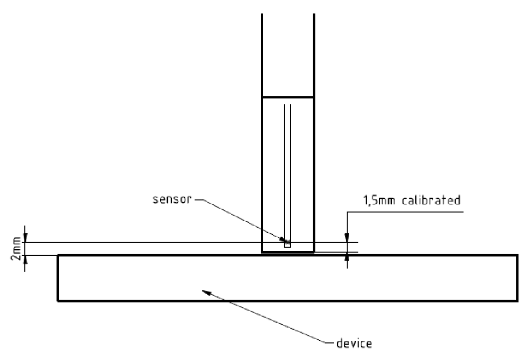

Figure 2-1
EUmmWVx Probe

2.3 Peak Spatially Averaged Power Density Assessment Based on E-field Measurements

Within a short distance from the transmitting source, power density was determined based on both electric and magnetic fields. Generally, the magnitude and phase of two components of either the E-field or H-field were needed on a sufficiently large surface to fully characterize the total E-field and H-field distributions. Nevertheless, solutions based on direct measurement of E-field and H-field can be used to compute power density. The general measurement approach used for this device was:

a) The local E field on the measurement surface was measured at a reference location where the field is well above the noise level. This reference level was used at the end of this procedure to assess output power drift of the DUT during the measurement.

b) The electric field on the measurement surface was scanned. Measurements are conducted according to the instructions provided by the measurement system manufacturer. Measurement spatial resolution can depend on the measured field characteristic and measurement methodology used by the system. The planar scan step size was configured at λ/4.

c) For cDASY6, H-field was calculated from the measured E-field using a reconstruction algorithm. As the power density calculation requires knowledge of both amplitude and phase, reconstruction algorithms can also be used to obtain field information from the measured E-field data (e.g. the phase from the amplitude if only the amplitude is measured). H-field and phase data was reconstructed from repeated measurements (three per measurement point) on two measurement planes separated by λ/4.

d) The total Peak spatially averaged power density (psPD) distribution on the evaluation surface is determined per the below equation. The spatial averaging area, *A*, is specified by the applicable exposure limits or regulatory requirements. A circular shape was used.

$$psPD = \frac{1}{2A_{av}} \iint_{A_{av}} || Re\{E \times H^*\} || \, dA$$

e) The maximum spatial-average on the evaluation surface is the final quantity to determine compliance against applicable limits.

f) The local E field reference value, at the same location as step 2, was re-measured after the scan was complete to calculate the power drift. If the drift deviated by more than 5%, the power density test and drift measurements were repeated.

2.4 Reconstruction Algorithm

Computation of the power density in general requires measurement information from the both E-field and H-field amplitudes and phases in the plane of incidence. Reconstruction of these quantities from pseudo-vector E-field measurements is feasible according to the manufacturer, as they are determined via Maxwell's equations. As such, the SPEAG reconstruction approach was based on the Gerchberg-Saxton algorithm, which benefits from the availability of the E-field polarization ellipse information obtained with the EUmmWVx probe.

3 RF EXPOSURE LIMITS FOR POWER DENSITY

3.1 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.

3.2 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.

3.3 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 3-1
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

4 SYSTEM VERIFICATION

4.1 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.

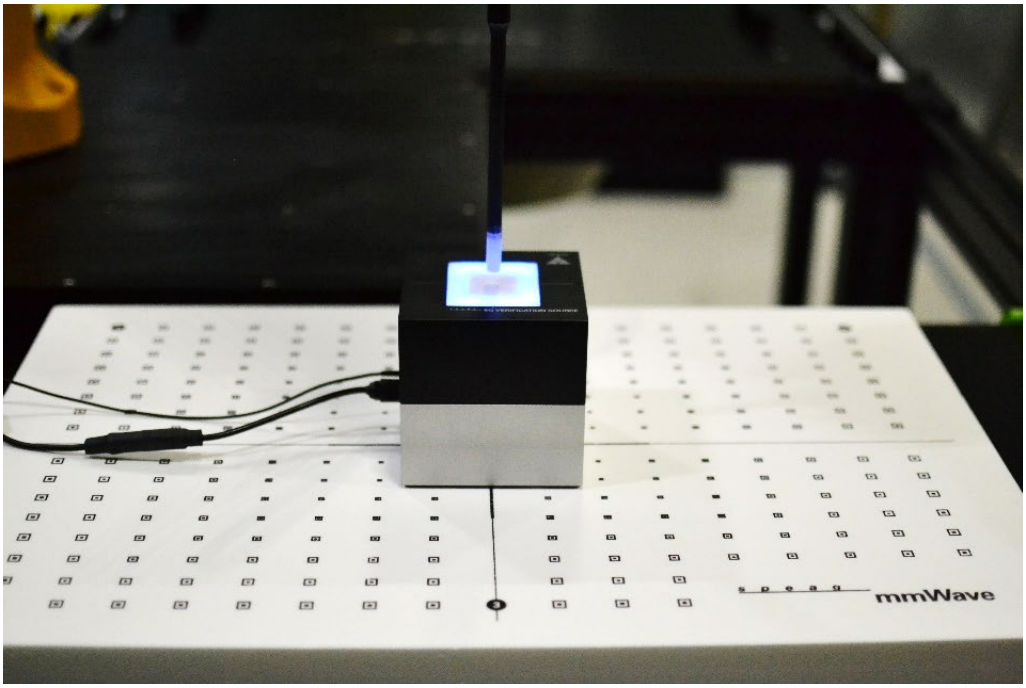

Figure 4-1
System Verification Setup Photo

Table 4-1
30 GHz Verifications

Syst.	Freq. (GHz)	Date	Source SN	Probe SN	Normal psPD (W/m^2 over 4 cm^2)		Deviation (dB)	Total psPD (W/m^2 over 4 cm^2)		Deviation (dB)
					measured	target		measured	target	
AM5	30	06/24/22	1015	9416	35.50	35.30	0.02	35.90	35.30	0.07
AM5	30	06/25/22	1015	9416	33.60	35.30	-0.21	33.70	35.30	-0.20
AM5	30	06/27/22	1015	9416	33.50	35.30	-0.23	33.80	35.30	-0.19
AM3	30	06/27/22	1015	9523	31.80	35.30	-0.45	32.00	35.30	-0.43

Note: A **10 mm distance spacing** was used from the reference horn antenna aperture to the probe element.
This includes 4.45 mm from the reference antenna horn aperture to the surface of the verification source plus 5.55 mm from the surface to the probe. The SPEAG software requires a setting of “5.55 mm” for the correct set up.

5 POWER DENSITY DATA @ INPUT.POWER.LIMIT

5.1 Power Density Results

Power density measurements were performed with DUT transmitting at *input.power.limit* for one single beam for each polarization (H & V) and one beam-pair, for each antenna on each worst-surface.

Table 5-1
5G mmWave NR Band n258

MEASUREMENT RESULTS														
Band	Antenna	Frequency	Channel	Beam ID1	Beam ID2	input.power.limit	Signal Type	DUT S/N	Power Drift	Distance	DUT Surface	Normal psPD	Total psPD	Plot #
		MHz		V	H	dBm			dB	mm		W/m²	W/m²	
n258	Ant M0	24800.04	Mid	47	-	-2.2	CW	VYQX9YKWQP	0.17	2	Front	3.020	3.530	
n258	Ant M0	25200.00	High	-	173	-1.2	CW	VYQX9YKWQP	-0.09	2	Front	4.360	5.560	A1
n258	Ant M0	24800.04	Mid	47	175	-5.4	CW	VYQX9YKWQP	0.18	2	Front	3.080	3.420	
n258	Ant M2	24350.04	Low	49	-	1.3	CW	KD5744RX4V	-0.14	2	Top	2.290	2.630	
n258	Ant M2	24800.04	Mid	-	180	1.1	CW	KD5744RX4V	0.14	2	Top	2.980	3.730	A2
n258	Ant M2	24350.04	Low	49	177	-2.9	CW	KD5744RX4V	0.17	2	Top	1.530	1.850	
n258	Ant M3	24800.04	Mid	39	-	-0.1	CW	KD5744RX4V	0.12	2	Bottom	2.650	3.120	A3
n258	Ant M3	25200.00	High	-	171	-0.5	CW	KD5744RX4V	-0.09	2	Bottom	2.270	2.900	
n258	Ant M3	24350.04	Low	39	167	-4.5	CW	KD5744RX4V	0.12	2	Bottom	1.700	1.940	
47 CFR §1.1310 - SAFETY LIMIT Spatial Average Uncontrolled Exposure / General Population								Power Density 10 W/m^2 averaged over 4 cm²						

Table 5-2
5G mmWave NR Band n261

MEASUREMENT RESULTS														
Band	Antenna	Frequency	Channel	Beam ID1	Beam ID2	input.power.limit	Signal Type	DUT S/N	Power Drift	Distance	DUT Surface	Normal psPD	Total psPD	Plot #
		MHz		V	H	dBm			dB	mm		W/m²	W/m²	
n261	Ant M0	27550.08	Low	59	-	-1.7	CW	KD5744RX4V	-0.13	2	Front	3.850	4.060	
n261	Ant M0	27550.08	Low	-	186	-1.4	CW	KD5744RX4V	-0.03	2	Front	3.720	4.120	A4
n261	Ant M0	27550.08	Low	58	186	-4.7	CW	KD5744RX4V	-0.08	2	Front	2.540	2.630	
n261	Ant M2	27924.96	Mid	52	-	0.1	CW	VYQX9YKWQP	-0.14	2	Top	2.640	3.320	
n261	Ant M2	27924.96	Mid	-	165	0.3	CW	VYQX9YKWQP	0.04	2	Top	3.770	4.410	A5
n261	Ant M2	27550.08	Low	37	165	-3.6	CW	VYQX9YKWQP	-0.01	2	Top	1.840	2.190	
n261	Ant M3	28299.96	High	43	-	0.1	CW	L9N6D6203T	-0.12	2	Bottom	2.760	3.500	
n261	Ant M3	27924.96	Mid	-	184	-0.3	CW	L9N6D6203T	0.16	2	Bottom	3.380	4.240	A6
n261	Ant M3	27924.96	Mid	56	184	-4.2	CW	L9N6D6203T	-0.20	2	Bottom	1.530	1.950	
47 CFR §1.1310 - SAFETY LIMIT Spatial Average Uncontrolled Exposure / General Population								Power Density 10 W/m² averaged over 4 cm²						

Table 5-3
5G mmWave NR Band n260

MEASUREMENT RESULTS														
Band	Antenna	Frequency	Channel	Beam ID1	Beam ID2	input.power.limit	Signal Type	DUT S/N	Power Drift	Distance	DUT Surface	Normal psPD	Total psPD	Plot #
		MHz		V	H	dBm			dB	mm		W/m²	W/m²	
n260	Ant M0	38499.96	Mid	45	-	3.6	CW	W46J2H7Y2C	-0.12	2	Front	2.510	3.140	
n260	Ant M0	38499.96	Mid	-	174	3.9	CW	W46J2H7Y2C	-0.12	2	Front	2.910	3.330	A7
n260	Ant M0	38499.96	Mid	45	173	0.5	CW	W46J2H7Y2C	0.19	2	Front	2.410	2.890	
n260	Ant M2	37050.00	Low	34	-	0.6	CW	VYQX9YKWQP	0.09	2	Top	3.220	3.960	
n260	Ant M2	38499.96	Mid	-	179	0.8	CW	VYQX9YKWQP	-0.14	2	Top	4.030	5.200	A8
n260	Ant M2	37050.00	Low	38	166	-2.7	CW	VYQX9YKWQP	-0.20	2	Top	1.910	2.390	
n260	Ant M3	37050.00	Low	43	-	-0.1	CW	VYQX9YKWQP	-0.17	2	Bottom	3.040	3.620	
n260	Ant M3	38499.96	Mid	-	183	-0.3	CW	VYQX9YKWQP	-0.20	2	Bottom	2.980	3.810	A9
n260	Ant M3	37050.00	Low	56	184	-3.9	CW	VYQX9YKWQP	0.17	2	Bottom	2.600	3.280	
47 CFR §1.1310 - SAFETY LIMIT Spatial Average Uncontrolled Exposure / General Population								Power Density 10 W/m² averaged over 4 cm²						

5.2 Power Density Test Notes

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.
3. Power density was calculated by repeated E-field measurements on two measurement planes separated by λ/4.
4. DUT was configured to transmit with a manufacturer provided test software to control specific antenna(s), Beam ID(s), and signal type to ensure the test configurations constant for the entire evaluation.
5. This device utilizes power reduction for some WLAN wireless modes and technologies for simultaneous transmission compliance. These mechanisms are assessed in the SAR Test Report.
6. *PD_design_target* of 4.50 W/m^2 was used with mmW device design related uncertainty of 2.0 dB.
7. *Input.power.limit* parameter for 5G mmW NR radio was calculated in RF Exposure Part 0 test report.
8. This device is enabled with Qualcomm® Smart Transmit feature to control and manage transmitting power in real time and to ensure that the time-averaged RF exposure from WWAN is in compliance with FCC requirements. Per FCC guidance for devices enabled with Qualcomm® Smart Transmit feature, 4G LTE and 5G mmW NR simultaneous transmission scenario does not need to be evaluated under Total Exposure Ratio (TER). The validation of the time-averaging algorithm and compliance under the Tx varying transmission scenario for WWAN technologies are reported in Part 2 report.
9. Per FCC guidance for devices enabled with Qualcomm® Smart Transmit feature, simultaneous transmission analysis is evaluated by combining the exposure from each WWAN and WLAN antenna. 5G mmW NR and WLAN simultaneous transmission scenario is evaluated under the Total Exposure Ratio (TER) in Appendix C.
10. The Beam IDs with one of the highest initial simulated power density for that surface was selected for Part 1 Power Density measurements.
11. The device was configured to transmit CW wave signal for testing. Per FCC guidance for devices enabled with Qualcomm® Smart Transmit feature, additional testing was not required for different modulations (CP-OFDM: QPSK, 16QAM, 64QAM, DFT-s-OFDM: PI/2BPSK, QPSK, 16QAM, 64QAM), RB configurations, component carriers, channel configurations (low channel, mid channel, high channel) since the smart transmit algorithm monitors powers on a per symbol basis, which is independent of these signal characteristics.
12. The device was configured to MIMO configuration with H and V polarization beams transmitting together.

6 COMBINED PD VERIFICATIONS

This device supports GEN2 Smart Transmit. The following verifications were performed per 80-w2112-4.

6.1 Verification Criteria 1 (Power Density per beam):

The measured psPD results from the previous section are confirmed to meet:

$$Measured\ psPD\ \leq \left(b_j * PD\_design\_target + total\ uncertainty\right) < FCC\ psPD\ limit$$

Table 6-1
5G mmWave NR mmWave Power Density Per Beam

PD_design_target (W/m^2)		4.5					
Total uncertainty (dB)		2.0					
Band	Antenna	Printed backoff value bj	Beam ID 1	Beam ID 2	Measured psPD	bj * PD_design_target + total uncertainty	FCC psPD Limit
					W/m²	W/m²	W/m²
n258	M0	0.9772	-	173	5.560	6.977	10
n258	M2	0.9772	-	180	3.730	6.977	10
n258	M3	0.9772	39	-	3.120	6.977	10
n261	M0	0.9772	-	186	4.120	6.977	10
n261	M2	0.9772	-	165	4.410	6.977	10
n261	M3	0.9772	-	184	4.240	6.977	10
n260	M0	0.9772	-	174	3.330	6.977	10
n260	M2	0.9772	-	179	5.200	6.977	10
n260	M3	0.9772	-	183	3.810	6.977	10

6.2 Verification Criteria 2 (combined Power Density):

Combined Power Density results in the below tables are confirmed to meet:

$$combined\ psPD = \left(c(p,j) * measured.psPD.beam_p + c(q,j) * measured.psPD.beam_q\right) \leq PD\_design\_target + total\ uncertainty$$

where,

$$meas.psPD.beam_i = measured\ 4cm^2\ PD\ for\ beam\ i, i = p, q$$
$$c(i,j) = \text{contribution factor from beam}_i \text{ to antenna}_j, i = p, q \text{ and } j = 0,1$$

$Beam_p$ = beam having the highest measured psPD among all beams tested for first antenna
$Beam_q$ = beam having the highest measured psPD among all beams tested for second antenna

Table 6-2
5G mmWave NR mmWave Highest Measured psPD

Band	Antenna	Beam ID 1	Beam ID 2	Surface	Measured psPD
					W/m²
n258	M0	-	173	Front	5.560
n258	M2	-	180	Top	3.730
n258	M3	39	-	Bottom	3.120
n261	M0	-	186	Front	4.120
n261	M2	-	165	Top	4.410
n261	M3	-	184	Bottom	4.240
n260	M0	-	174	Front	3.330
n260	M2	-	179	Top	5.200
n260	M3	-	183	Bottom	3.810

Table 6-3
Combined Power Density Band n258

Band	Beam ID	Contribution Factors per module location		
		M0	M2	M3
		Front	Top	Bottom
n258	173	1	0.0004	0.0001
	180	0.0005	1	0.0004
	39	0.0013	0.0001	1
Combined psPD (W/m^2)		5.566	3.733	3.122
[PD_design_target + total uncertainty] (W/m^2)		7.13	7.13	7.13

Table 6-4
Combined Power Density Band n261

Band	Beam ID	Contribution Factors per module location		
		M0	M2	M3
		Front	Top	Bottom
n261	186	1	0.0014	0.0002
	165	0.0003	1	0.0002
	184	0.0008	0.0001	1
Combined psPD (W/m^2)		4.125	4.416	4.242
[PD_design_target + total uncertainty] (W/m^2)		7.13	7.13	7.13

Table 6-5
Combined Power Density Band n260

Band	Beam ID	Contribution Factors per module location		
		M0	M2	M3
		Front	Top	Bottom
n260	174	1	0.0013	0.0027
	179	0.0002	1	0.0001
	183	0.0013	0.0003	1
Combined psPD (W/m^2)		3.336	5.205	3.820
[PD_design_target + total uncertainty] (W/m^2)		7.13	7.13	7.13

7 EQUIPMENT LIST

Table 7-1
5G mmWave NR Equipment List

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
-	WL25-1	Conducted Cable Set (25GHz)	N/A	Annual	N/A	WL25-1
-	WL40-1	Conducted Cable Set (40GHz)	N/A	Annual	N/A	WL40-1
Agilent	N9038A	MXE EMI Receiver	N/A	Annual	N/A	MY51210133
Agilent	N9030A	PXA Signal Analyzer (44GHz)	N/A	Annual	N/A	MY52350166
Emco	3116	Horn Antenna (18 - 40GHz)	N/A	Triennial	N/A	9203-2178
Rohde & Schwarz	ESU40	EMI Test Receiver (40GHz)	N/A	Annual	N/A	100348
Rohde & Schwarz	FSW67	Signal / Spectrum Analyzer	N/A	Annual	N/A	103200
Sunol	JB5	Bi-Log Antenna (30M - 5GHz)	N/A	Biennial	N/A	A051107
SPEAG	EUmmWV3	EUmmWV3 Probe	12/13/2021	Annual	12/13/2022	9416
SPEAG	EUmmWV4	EUmmWV4 Probe	1/31/2022	Annual	1/31/2023	9523
SPEAG	SM 003 100 AA	30GHz System Verification Ka- Band Source Antenna	10/19/2021	Annual	10/19/2022	1015
SPEAG	DAE4	Dasy Data Acquisition Electronics	12/13/2021	Annual	12/13/2022	1644
SPEAG	DAE4	Dasy Data Acquisition Electronics	2/22/2022	Annual	2/22/2023	1403
Agilent	N9030A	PXA Signal Analyzer (44GHz)	N/A	Annual	N/A	MY52350166
Emco	3115	Horn Antenna (1-18GHz)	N/A	Biennial	N/A	9704-5182
Keysight Technologies	N9030A	3Hz-44GHz PXA Signal Analyzer	N/A	Annual	N/A	MY49430494
Rohde & Schwarz	ESU26	EMI Test Receiver (26.5GHz)	N/A	Annual	N/A	100342
Sunol	JB5	Bi-Log Antenna (30M - 5GHz)	N/A	Biennial	N/A	A051107

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

8 MEASUREMENT UNCERTAINTIES

a	b	c	d	e	f = b x e/d	g
Uncertainty Component	Unc. (± dB)	Prob. Dist.	Div.	ci	ui (± dB)	vi
Calibration	0.49	N	1	1.0	0.49	∞
Probe correction	0	R	1.73	1.0	0.00	∞
Frequency Response (BW ≤ 1 GHz)	0.20	R	1.73	1.0	0.12	∞
Sensor cross coupling	0	R	1.73	1.0	0.00	∞
Isotropy	0.50	R	1.73	1.0	0.29	∞
Linearity	0.20	R	1.73	1.0	0.12	∞
Probe Scattering	0	R	1.73	1.0	0	∞
Probe Positioning Offset	0.30	R	1.73	1.0	0.17	∞
Probe Positioning Repeatability	0.04	R	1.73	1.0	0.02	∞
Sensor Mechanical Offset	0	R	1.73	1.0	0	∞
Probe Spatial Resolution	0	R	1.73	1.0	0	∞
Field Impedance Dependence	0	R	1.73	1.0	0	∞
Amplitude and phase drift	0	R	1.73	1.0	0	∞
Amplitude and phase noise	0.04	R	1.73	1.0	0.02	∞
Measurement area truncation	0	R	1.73	1.0	0	∞
Data acquisition	0.03	N	1	1.0	0.03	∞
Sampling	0	R	1.73	1.0	0	∞
Field Reconstruction	0.60	R	1.73	1.0	0.35	∞
Forward Transformation	0	R	1.73	1.0	0	∞
Power Density Scaling	-	R	1.73	1.0	-	∞
Spatial Averaging	0.10	R	1.73	1.0	0.06	∞
System Detection Limit	0.04	R	1.73	1.0	0.02	∞
Test Sample and Environmental Factors						
Probe Coupling with DUT	0	R	1.73	1.0	0	∞
Modulation Response	0.40	R	1.73	1.0	0.23	∞
Integration Time	0	R	1.73	1.0	0	∞
Response Time	0	R	1.73	1.0	0	∞
Device Holder Influence	0.10	R	1.73	1.0	0.06	∞
DUT Alignment	0	R	1.73	1.0	0	∞
RF Ambient Conditions	0.04	R	1.73	1.0	0.02	∞
Ambient Reflections	0.04	R	1.73	1.0	0.02	∞
Immunity / Secondary Reception	0	R	1.73	1.0	0	∞
Drift of the DUT	0.22	R	1.73	1.0	0.13	∞
Combined Standard Uncertainty (k=1)		RSS			0.76	∞
(95% CONFIDENCE LEVEL)		**k=2**			**1.53**	

9 CONCLUSION

9.1 Measurement Conclusion

The power density measurements and total exposure ratio analysis 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.

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[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)