

TEST REPORT

FCC SAR Test for SM-A176U
Class II Permissive Change

APPLICANT
SAMSUNG Electronics Co., Ltd.

REPORT NO.
HCT-SR-2512-FC002-R1

DATE OF ISSUE
December 30, 2025

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TEST REPORT

FCC Part 1 SAR Test
for Class II
Permissive Change

REPORT NO.

HCT-SR-2512-FC002-R1

DATE OF ISSUE

Dec. 30, 2025

FCC ID

A3LSMA176U

Applicant

SAMSUNG Electronics Co., Ltd
129, Samsung-ro, Yeongtong-gu, Suwon-Si, Gyeonggi-do, 16677, Korea

Product Name

Mobile Phone

Model Name

SM-A176U

Additional Model Name

SM-A176U1, SM-S176V

Application Type

Class II Permissive Change

Date of Test

Dec. 04, 2025

Location of Test

☒ Permanent Testing Lab ☐ On Site Testing Lab
(Address: 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Republic of Korea)

FCC Rule Part(s)

CFR § 2.1093

Test Results

PASS (SAR Limit : 1.6 W/kg)
Refer to the clause 3.2 Attestation of test result

REVISION HISTORY

The revision history for this test report is shown in table.

Revision No.	Date of Issue	Description
0	Dec. 12, 2025	Initial Issue
1	Dec. 30, 2025	Revised Typo

Notice

Content

The results shown in this test report only apply to the sample(s), as received, provided by the applicant, unless otherwise stated.

The test results have only been applied with the test methods required by the standard(s).

The laboratory is not accredited for the test results marked *.

Information provided by the applicant is marked **.

Test results provided by external providers are marked ***.

When confirmation of authenticity of this test report is required, please contact www.hct.co.kr

The test results in this test report are not associated with the ((KS Q) ISO/IEC 17025) accreditation by KOLAS (Korea Laboratory Accreditation Scheme) / A2LA (American Association for Laboratory Accreditation) that are under the ILAC (International Laboratory Accreditation Cooperation) Mutual Recognition Agreement (MRA).

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1. Test Regulations

The tests documented in this report were performed in accordance with FCC CFR § 2.1093, IEEE 1528-2013, ANSI C63.26-2015 the following FCC Published RF exposure KDB procedures:

- FCC KDB Publication 941225 D01 3G SAR Procedures v03r01
- FCC KDB Publication 941225 D06 Hot Spot SAR v02r01
- FCC KDB Publication 941225 D05 SAR for LTE Devices v02r05
- FCC KDB Publication 941225 D05A LTE Rel.10 KDB Inquiry sheet v01r02
- FCC KDB Publication 248227 D01 802.11 Wi-Fi SAR v02r02
- FCC KDB Publication 447498 D01 General RF Exposure Guidance v06
- FCC KDB Publication 648474 D04 Handset SAR v01r03
- FCC KDB Publication 865664 D01 SAR measurement 100 MHz to 6 GHz v01r04
- FCC KDB Publication 865664 D02 SAR Reporting v01r02
- FCC KDB Publication 690783 D01 SAR Listings on Grants v01r03
- FCC KDB Publication 971168 D01 Power Meas License Digital Systems v03r01

In Addition to the above, the following information was used.

- October 2013 TCB Workshop Notes (GPRS testing criteria)
- October 2014 TCB Workshop Notes (Overlapping LTE Bands)
- April 2015 TCB Workshop Notes (Overlapping LTE Bands Test exclusion)
- April 2015 TCB Workshop Notes (Simultaneous transmission summation clarified)
- October 2016 TCB Workshop Notes (Bluetooth Duty Factor)
- November 2017 TCBC Workshop Notes (LTE Carrier Aggregation)
- April 2018 TCBC Workshop Notes (LTE UL CA, DL CA SAR Test Exclusion)
- April 2022 TCBC Workshop Notes (Sum-Peak Location Separation Ratio)
- October 2024 TCBC Workshop Notes (CA-DL Test Reduction)

2. Test Location

2.1 Test Laboratory

Company Name	HCT Co., Ltd.
Address	74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Republic of Korea
Telephone	031-645-6300
Fax.	031-645-6401

2.2 Test Facilities

Our laboratories are accredited and approved by the following approval agencies according to ISO/IEC 17025.

Korea	National Radio Research Agency (Designation No. KR0032)
	KOLAS (Testing No. KT197)

3. Information of the EUT

3.1 General Information of the EUT

Model Name	SM-A176U
Additional Model Name	SM-A176U1, SM-S176V
Equipment Type	Mobile Phone
FCC ID	A3LSMA176U
Application Type	Class II Permissive Change
Applicant	SAMSUNG Electronics Co., Ltd.
Note	C2PC Tests were performed on the target power changes in the BT mode of this model. The simultaneous transmission analysis was performed considering the results of the basic model [Report no: HCT-SR-2510-FC003-R1] Please refer to the technical documentation for detailed C2PC changes.

3.2 Attestation of test result of device under test

The Highest Reported SAR						
Band	Tx. Frequency	Equipment Class	Reported SAR (W/kg)			
			1 g Head	1 g Body Worn	1 g Hotspot	10 g Extremity
Bluetooth	2 402 MHz ~ 2 480 MHz	DSS	0.05	0.18	0.18	N/A
Simultaneous SAR per KDB 690783 D01v01r03			1.48	1.01	1.01	<0.10
Date(s) of Tests:		Dec. 04, 2025				

Summary table of SAR measurement results		
SAR test Configuration	The Highest SAR (W/kg)	Distance (mm)
Head SAR	0.05	
Body-worn accessory	0.18	5
Product specific(wireless router)	0.18	5
Simultaneous transmission analysis	1.48	

Simultaneous transmissions analysis included measurement results of A3LSMA176U

[No: HCT-SR-2510-FC003-R1] and C2PC test Results

4. Device Under Test Description

4.1 DUT specification

Device Wireless specification overview		
Band & Mode	Operating Mode	Tx Frequency
GSM850	Voice / Data	824.2 MHz ~ 848.8 MHz
GSM1900	Voice / Data	1 850.2 MHz ~ 1 909.8 MHz
UMTS Band 2	Voice / Data	1 852.4 MHz ~ 1 907.6 MHz
UMTS Band 4	Voice / Data	1 712.4 MHz ~ 1 752.6 MHz
UMTS Band 5	Voice / Data	826.4 MHz ~ 846.6 MHz
LTE FDD Band 2 (PCS)	Voice / Data	1 850.7 MHz ~ 1 909.3 MHz
LTE FDD Band 4 (AWS)	Voice / Data	1 710.7 MHz ~ 1 754.3 MHz
LTE FDD Band 5 (Cell)	Voice / Data	824.7 MHz ~ 848.3 MHz
LTE FDD Band 7	Voice / Data	2 502.5 MHz ~ 2 567.5 MHz
LTE FDD Band 12	Voice / Data	699.7 MHz ~ 715.3 MHz
LTE FDD Band 13	Voice / Data	779.5 MHz ~ 784.5 MHz
LTE FDD Band 14	Voice / Data	790.5 MHz ~ 795.5 MHz
LTE FDD Band 25	Voice / Data	1 850.7 MHz ~ 1 914.3 MHz
LTE FDD Band 26	Voice / Data	814.7 MHz ~ 848.3 MHz
LTE FDD Band 30	Voice / Data	2 307.5 MHz ~ 2 312.5 MHz
LTE TDD Band 38	Voice / Data	2 572.5 MHz ~ 2 617.5 MHz
LTE TDD Band 41	Voice / Data	2 498.5 MHz ~ 2 687.5 MHz
LTE TDD Band 48	Voice / Data	3 552.5 MHz ~ 3 697.5 MHz
LTE FDD Band 66 (AWS)	Voice / Data	1 710.7 MHz ~ 1 779.3 MHz
LTE FDD Band 71	Voice / Data	665.5 MHz ~ 695.5 MHz
NR FDD Band n2 (PCS)	Voice / Data	1 852.5 MHz ~ 1 907.5 MHz
NR FDD Band n5	Voice / Data	826.5 MHz ~ 846.5 MHz
NR FDD Band n25 (PCS)	Voice / Data	1 852.5 MHz ~ 1 912.5 MHz
NR FDD Band n30	Voice / Data	2 307.5 MHz ~ 2 312.5 MHz
NR TDD Band n41	Voice / Data	2 501.01 MHz ~ 2 685 MHz
NR TDD Band n48	Voice / Data	3 555 MHz ~ 3 695.01 MHz
NR FDD Band n66	Voice / Data	1 712.5 MHz ~ 1 777.5 MHz
NR FDD Band n70	Voice / Data	1 697.5 MHz ~ 1 707.5 MHz
NR FDD Band n71	Voice / Data	665.5 MHz ~ 695.5 MHz
NR TDD Band n77	Voice / Data	3 705 MHz ~ 3 975 MHz
NR TDD Band n77 DoD	Voice / Data	3 445.01 MHz ~ 3 544.98 MHz
NR TDD Band n78	Voice / Data	3 705 MHz ~ 3 795 MHz
NR TDD Band n78 DoD	Voice / Data	3 455.01 MHz ~ 3 544.98 MHz
U-NII-1	Voice / Data	5 180 MHz ~ 5 240 MHz
U-NII-2A	Voice / Data	5 260 MHz ~ 5 320 MHz
U-NII-2C	Voice / Data	5 500 MHz ~ 5 720 MHz
U-NII-3	Voice / Data	5 745 MHz ~ 5 825 MHz
U-NII-4	Voice / Data	5 845 MHz ~ 5 885 MHz
2.4 GHz WLAN	Voice / Data	2 412 MHz ~ 2 462 MHz
Bluetooth / LE	Data	2 402 MHz ~ 2 480 MHz
NFC	Data	13.56 MHz
Device Description		
Device Serial Numbers	Mode	Serial Number
	WLAN 2.4G, 5G, BT	YHM1221M, YHM1115M
	The manufacturer has confirmed that the devices tested have the same physical, mechanical and thermal characteristics are within operational tolerances expected for production units.	

4.2 Time-Averaging Algorithm for RF Exposure Compliance

This WWAN/ WWAN/WLAN/BT Mode of DUT is equipped with an S.LSI chipset to which the Samsung S.LSI proprietary TAS (Time Average SAR) algorithm is applied. This DUT is enabled with the Samsung S.LSI proprietary TAS (Time Average SAR) algorithm for WWAN /WLAN Mode to control and manage transmitting power in real time and to ensure at all times the time-averaged RF exposure is in compliance with the FCC requirement.

FCC RF exposure limit is based on time averaged RF exposure. The SAR regulatory specification is defined over certain measurement duration allowing for time-averaging. The Samsung S.LSI proprietary TAS (Time Average SAR) algorithm has been designed to meet the compliance limits over the required duration, while still allowing dynamic control of transmit power to satisfy the performance of the system.

This feature performs time averaging SAR 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. The S.LSI TAS algorithms, implemented in WWAN and WLAN modes respectively, are independent and always comply with the FCC's RF exposure limit. Only the NFC mode of the device did not apply the time averaged SAR algorithm.

The Samsung S.LSI TAS algorithm allow the device to transmit at higher power instantaneously, as high as Pmax, when needed, but enforces power limiting to maintain time-averaged transmit power to Plimit. Below table shows Plimit NV settings and maximum tune up output power Pmax configured for this DUT for various transmit conditions (Radio SAR indicator RSI for Head /Body SAR of WWAN/WLAN Mode) Note that the device uncertainty for WLAN/WWAN is 1.0dB for this DUT.

The purpose of this report is to demonstrate that the DUT meets FCC SAR limits when transmitting in static transmission configurations at Plimit specified by manufacturer.

Measurement Condition: All conducted power and SAR measurements in this report were performed by Plimit in static Power condition.

Plim values in green indicate Plimit < Pmax			Plim values in grey indicate Plimit > Pmax		
Plimit corresponding to 0.7 W/kg (1g) SAR_Design_target			Pmax	Pmax	
SAR Exposure Position			Head	Body	Maximum
Averaging volume			1g	1g	Tune-up
separation Distance			0 mm	5 mm	Output Power
Mode	Band	Antenna	RSI=1	RSI=0	[dBm]
BT	2.4 GHz	F	22.5	17.1	10.0

Table 4-4 SAR Characterization

*Note all Plimit and maximum tune up output power Pmax 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., GSM, LTE TDD, 5G NR TDD).

*The maximum time-averaged output power (dBm) for any 2G/3G/4G/5G WWAN technology, band, and SAR Exposure condition=minimum of “Plimit” and “Maximum tune up output power: “Pmax” + 1dB device uncertainty.

The maximum time averaged output power means Plimit for each modes SAR values in this report were scaled to the maximum allowed output power to determine compliance per KDB Publication 447498 D01v06.

4.3 Power Reduction for SAR

In this model, the output Power of the DUT in WWAN/WLAN mode is controlled by the application of The Samsung S.LSI proprietary TAS (Time Average SAR) algorithm, with the output Power depending on the RSI of the predefined DUT. For output Power in modes other than BT, refer to the Basic model (No: HCT-SR-2510-FC003-R1).

4.3.1 Nominal and Maximum Output Power Specifications

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

4.3.1.1 Maximum Bluetooth output power

a. Bluetooth Maximum Conducted Output Power in Conducted Mode

MODE	DATA RATE	ANT1
BDR(in dBm)	1Mbps	10.0
EDR(in dBm)	2Mbps	7.0
	3Mbps	7.0

(Upper tolerance: target +1.0dB)

4.4 LTE Information

	Item.	Description
Frequency Range	LTE FDD Band 2 (PCS)	1 850.7 MHz ~ 1 909.3 MHz
	LTE FDD Band 4 (AWS)	1 710.7 MHz ~ 1 754.3 MHz
	LTE FDD Band 5 (Cell)	824.7 MHz ~ 848.3 MHz
	LTE FDD Band 7	2 502.5 MHz ~ 2 567.5 MHz
	LTE FDD Band 12	699.7 MHz ~ 715.3 MHz
	LTE FDD Band 13	779.5 MHz ~ 784.5 MHz
	LTE FDD Band 14	790.5 MHz ~ 795.5 MHz
	LTE FDD Band 25	1 850.7 MHz ~ 1 914.3 MHz
	LTE FDD Band 26	814.7 MHz ~ 848.3 MHz
	LTE FDD Band 30	2 307.5 MHz ~ 2 312.5 MHz
	LTE TDD Band 38	2 572.5 MHz ~ 2 617.5 MHz
	LTE TDD Band 41	2 498.5 MHz ~ 2 687.5 MHz
	LTE TDD Band 48	3 552.5 MHz ~ 3 697.5 MHz
	LTE FDD Band 66 (AWS)	1 710.7 MHz ~ 1 779.3 MHz
	LTE FDD Band 71	665.5 MHz ~ 695.5 MHz
Channel Bandwidths	LTE FDD Band 2 (PCS)	1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz
	LTE FDD Band 4 (AWS)	1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz
	LTE FDD Band 5 (Cell)	1.4 MHz, 3 MHz, 5 MHz, 10 MHz
	LTE FDD Band 7	5 MHz, 10 MHz, 15 MHz, 20 MHz
	LTE FDD Band 12	1.4 MHz, 3 MHz, 5 MHz, 10 MHz
	LTE FDD Band 13	5 MHz, 10 MHz
	LTE FDD Band 14	5 MHz, 10 MHz
	LTE FDD Band 25	1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz
	LTE FDD Band 26	1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz
	LTE FDD Band 30	5 MHz, 10 MHz
	LTE TDD Band 38	5 MHz, 10 MHz, 15 MHz, 20 MHz
	LTE TDD Band 41	5 MHz, 10 MHz, 15 MHz, 20 MHz
	LTE TDD Band 48	5 MHz, 10 MHz, 15 MHz, 20 MHz
	LTE FDD Band 66 (AWS)	1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz
	LTE FDD Band 71	5 MHz, 10 MHz, 15 MHz, 20 MHz

Ch. No.& Freq.(MHz)		Low / Low-Mid	Mid	Mid-High / High
LTE FDD Band 2 (PCS)	1.4 MHz	1 850.7 (18607)	1 880.0 (18900)	1 909.3 (19193)
	3 MHz	1 851.5 (18615)	1 880.0 (18900)	1 908.5 (19185)
	5 MHz	1 852.5 (18625)	1 880.0 (18900)	1 907.5 (19175)
	10 MHz	1 855.0 (18650)	1 880.0 (18900)	1 905.0 (19150)
	15 MHz	1 857.5 (18675)	1 880.0 (18900)	1 902.5 (19125)
	20 MHz	1 860.0 (18700)	1 880.0 (18900)	1 900.0 (19100)
LTE FDD Band 4 (AWS)	1.4 MHz	1 710.7 (19957)	1 732.5 (20175)	1 754.3 (20393)
	3 MHz	1 711.5 (19965)	1 732.5 (20175)	1 753.5 (20385)
	5 MHz	1 712.5 (19975)	1 732.5 (20175)	1 752.5 (20375)
	10 MHz	1 715.0 (20000)	1 732.5 (20175)	1 750.0 (20350)
	15 MHz	1 717.5 (20025)	1 732.5 (20175)	1 747.5 (20325)
	20 MHz		1 732.5 (20175)	
LTE FDD Band 5 (Cell)	1.4 MHz	824.7 (20407)	836.5 (20525)	848.3 (20643)
	3 MHz	825.5 (20415)	836.5 (20525)	847.5 (20635)
	5 MHz	826.5 (20425)	836.5 (20525)	846.5 (20625)
	10 MHz		836.5 (20525)	
LTE FDD Band 7	5 MHz	2 502.5 (20775)	2 535 (21100)	2 567.5 (21425)
	10 MHz	2 505 (20800)	2 535 (21100)	2 565 (21400)
	15 MHz	2 507.5 (20825)	2 535 (21100)	2 562.5 (21375)
	20 MHz	2 510 (20850)	2 535 (21100)	2 560 (21350)
LTE FDD Band 12	1.4 MHz	699.7 (23017)	707.5 (23095)	715.3 (23173)
	3 MHz	700.5 (23025)	707.5 (23095)	714.5 (23165)
	5 MHz	701.5 (23035)	707.5 (23095)	713.5 (23155)
	10 MHz		707.5 (23095)	
LTE FDD Band 13	5 MHz		782 (23230)	
	10 MHz		782 (23230)	
LTE FDD Band 14	5 MHz		793 (23330)	
	10 MHz		793 (23330)	
LTE FDD Band 25(PCS)	1.4 MHz	1 850.7 (26047)	1 882.5 (26365)	1 914.3 (26683)
	3 MHz	1 851.5 (26055)	1 882.5 (26365)	1 913.5 (26675)
	5 MHz	1 852.5 (26065)	1 882.5 (26365)	1 912.5 (26665)
	10 MHz	1 855 (26090)	1 882.5 (26365)	1 910 (26640)
	15 MHz	1 857.5 (26115)	1 882.5 (26365)	1 907.5 (26615)
	20 MHz	1 860 (26140)	1 882.5 (26365)	1 905 (26590)
LTE FDD Band 26 (Cell)	1.4 MHz	814.7 (26697)	831.5 (26865)	848.3 (27033)
	3 MHz	815.5 (26705)	831.5 (26865)	847.5 (27025)
	5 MHz	816.5 (26715)	831.5 (26865)	846.5 (27015)
	10 MHz	819.0 (26740)	831.5 (26865)	844.0 (26990)
	15 MHz		831.5 (26865)	
LTE FDD Band 30	5 MHz	2 307.5 (27685)	2 310 (27710)	2 312.5 (27735)
	10 MHz		2 310 (27710)	
LTE TDD Band 38	5 MHz	2 572.5 (37775)	2 595 (38000)	2 617.5 (38225)
	10 MHz	2 575 (37800)	2 595 (38000)	2 615 (38200)
	15 MHz	2 577.5 (37825)	2 595 (38000)	2 612.5 (38175)
	20 MHz	2 580 (37850)	2 595 (38000)	2 610 (38150)

Ch. No.& Freq.(MHz)		Low / Low-Mid		Mid		Mid-High / High		
LTE FDD Band 66 (AWS)	1.4 MHz	1 710.7 (131979)		1 745 (132322)		1 779.3 (132665)		
	3 MHz	1 711.5 (131987)		1 745 (132322)		1 778.5 (132657)		
	5 MHz	1 712.5 (131997)		1 745 (132322)		1 777.5 (132647)		
	10 MHz	1 715.0 (132022)		1 745 (132322)		1 775.0 (132622)		
	15 MHz	1 717.5 (132047)		1 745 (132322)		1 772.5 (132597)		
	20 MHz	1 720.0 (132072)		1 745 (132322)		1 770.0 (132572)		
LTE FDD Band 71	5 MHz	665.5 (133147)		680.5 (133297)		695.5 (133447)		
	10 MHz	668 (133172)		680.5 (133297)		693 (133422)		
	15 MHz	670.5 (133197)		680.5 (133297)		690.5 (133397)		
	20 MHz			680.5 (133297)				
LTE TDD Band 41	5 MHz	2 506.0(39750)	2 549.5(40185)	2 593.0(40620)	2 636.5(41055)	2 680.0(41490)		
	10 MHz	2 506.0(39750)	2 549.5(40185)	2 593.0(40620)	2 636.5(41055)	2 680.0(41490)		
	15 MHz	2 506.0(39750)	2 549.5(40185)	2 593.0(40620)	2 636.5(41055)	2 680.0(41490)		
	20 MHz	2 506.0(39750)	2 549.5(40185)	2 593.0(40620)	2 636.5(41055)	2 680.0(41490)		
LTE TDD Band 48	5 MHz	3 552.5(55265)		3 600.8(55748)		3 649.2(56232)		3 697.5(56715)
	10 MHz	3 555(55290)		3 601.7(55757)		3 648.3(56223)		3 695(56690)
	15 MHz	3 557.5(55315)		3 602.5(55765)		3 647.5(56215)		3 692.5(56665)
	20 MHz	3 560(55340)		3 603.3(55773)		3 646.7(56207)		3 690(56640)
UE Category			LTE Rel. 16, DL: Category 20, UL: Category 18					
Modulations Supported in UL			QPSK, 16QAM, 64QAM, 256 QAM					
LTE MPR Permanently implemented per 3GPP TS 36.101 section 6.2.3			Yes					
A-MPR disabled for SAR Testing.			Yes					
LTE Carrier Aggregation			This device supports Inter-Band & Intra-Band DL-link Carrier aggregations and Intra-Band UL-link Carrier aggregations. Detailed information in Technical Description document.					
LTE Release information			It supports only DL carrier aggregation. All other uplink communications are identical to the release 8 specifications. The following LTE Rel.16 Features are not supported: Relay, Hetnet, Enhanced eICI, MDH, cross-carrier Scheduling, Enhanced SC-FDMA,UL-CA.					

4.5 5G NR SUB 6 Information

Item.		Description
Frequency Range	NR FDD Band n2 (PCS)	1 852.5 MHz ~ 1 907.5 MHz
	NR FDD Band n5	826.5 MHz ~ 846.5 MHz
	NR FDD Band n25 (PCS)	1 852.5 MHz ~ 1 912.5 MHz
	NR FDD Band n30	2 307.5 MHz ~ 2 312.5 MHz
	NR TDD Band n41	2 501.01 MHz ~ 2 685 MHz
	NR TDD Band n48	3 555 MHz ~ 3 695.01 MHz
	NR FDD Band n66	1 712.5 MHz ~ 1 777.5 MHz
	NR FDD Band n70	1 697.5 MHz ~ 1 707.5 MHz
	NR FDD Band n71	665.5 MHz ~ 695.5 MHz
	NR TDD Band n77	3 705 MHz ~ 3 975 MHz
	NR TDD Band n77 DoD	3 445.01 MHz ~ 3 544.98 MHz
	NR TDD Band n78	3 705 MHz ~ 3 795 MHz
	NR TDD Band n78 DoD	3 455.01 MHz ~ 3 544.98 MHz
Channel Bandwidths	NR FDD Band n2 (PCS)	5 MHz, 10 MHz, 15 MHz, 20 MHz, 25 MHz, 30 MHz, 40 MHz
	NR FDD Band n5	5 MHz, 10 MHz, 15 MHz, 20 MHz
	NR FDD Band n25 (PCS)	5 MHz, 10 MHz, 15 MHz, 20 MHz, 25 MHz, 30 MHz, 40 MHz
	NR FDD Band n30	5 MHz, 10 MHz
	NR TDD Band n41	10 MHz, 15 MHz, 20 MHz, 30 MHz, 40 MHz, 50 MHz, 60 MHz, 70 MHz, 80 MHz, 90 MHz, 100 MHz
	NR TDD Band n48	10 MHz, 15 MHz, 20 MHz, 30 MHz, 40 MHz,
	NR FDD Band n66	5 MHz, 10 MHz, 15 MHz, 20 MHz, 25 MHz, 30 MHz, 40 MHz
	NR FDD Band n70	5 MHz, 10 MHz, 15 MHz
	NR FDD Band n71	5 MHz, 10 MHz, 15 MHz, 20 MHz
	NR TDD Band n77	10 MHz, 15 MHz, 20 MHz, 25 MHz, 30 MHz, 40 MHz, 50 MHz, 60 MHz, 70 MHz, 80 MHz, 90 MHz, 100 MHz
	NR TDD Band n77 DoD	10 MHz, 15 MHz, 20 MHz, 25 MHz, 30 MHz, 40 MHz, 50 MHz, 60 MHz, 70 MHz, 80 MHz, 90 MHz, 100 MHz
	NR TDD Band n78	10 MHz, 15 MHz, 20 MHz, 25 MHz, 30 MHz, 40 MHz, 50 MHz, 60 MHz, 70 MHz, 80 MHz, 90 MHz, 100 MHz
	NR TDD Band n78 DoD	10 MHz, 15 MHz, 20 MHz, 25 MHz, 30 MHz, 40 MHz, 50 MHz, 60 MHz, 70 MHz, 80 MHz, 90 MHz, 100 MHz

Ch. No.& Freq.(MHz)		Low / Low-Mid		Mid		Mid-High / High	
NR FDD Band n2 (PCS)	5 MHz	1 852.5(370500)		1 880(376000)		1 907.5(381500)	
	10 MHz	1 855(371000)		1 880(376000)		1 905(381000)	
	15 MHz	1 857.5(371500)		1 880(376000)		1 902.5(380500)	
	20 MHz	1 860(372000)		1 880(376000)		1 900(380000)	
	25 MHz	1 862.5(372500)		1 880(376000)		1 897.5(379500)	
	30 MHz	1 865(373000)		1 880(376000)		1 895(379000)	
	40 MHz	1 870(374000)		1 880(376000)		1 890(378000)	
NR FDD Band n5 (Cell)	5 MHz	826.5 (165300)		836.5(167300)		846.5 (169300)	
	10 MHz			836.5(167300)			
	15 MHz			836.5(167300)			
	20 MHz			836.5(167300)			
NR FDD Band n25	5 MHz	1 852.5(370500)		1 882.5(376500)		1 912.5(382500)	
	10 MHz	1 855(371000)		1 882.5(376500)		1 910(382000)	
	15 MHz	1 857.5(371500)		1 882.5(376500)		1 907.5(381500)	
	20 MHz	1 860(372000)		1 882.5(376500)		1 905(381000)	
	25 MHz	1 862.5(372500)		1 882.5(376500)		1 902.5(380500)	
	30 MHz	1 865(373000)		1 882.5(376500)		1 900(380000)	
	40 MHz			1 882.5(376500)			
NR FDD Band n30	5 MHz			2 310 (462000)			
	10 MHz			2 310 (462000)			
NR TDD Band n48	10 MHz	3 555(637000)		3 602.01(640134)	3 648(643200)	3 695.01(646334)	
	15 MHz	3 557.49(637166)		3 602.49(640166)	3 647.49(643166)	3 692.49(646166)	
	20 MHz	3 560.01(637334)		3 603.33(640222)	3 646.65(643110)	3 690(646000)	
	30 MHz	3 565.02 (637668)		3 605.01(640334)	3 645(643000)	3 684.99(645666)	
	40 MHz	3 570(638000)		3 624.99(641666)		3 679.98(645332)	
NR TDD Band n41	10 MHz	2 501.01(500202)	2 547(509400)	2 592.99(518598)	2 639.01(527802)	2 685(537000)	
	15 MHz	2 503.5(500700)	2 548.26(509652)	2 592.99(518598)	2 637.75(527550)	2 682.51(536502)	
	20 MHz	2 506.02(501204)	2 549.49(509898)	2 592.99(518598)	2 636.49(527298)	2 679.99(535998)	
	25 MHz	2 508.51(501702)	2 550.75(510150)	2 592.99(518598)	2 635.23(527046)	2 677.50(535500)	
	30 MHz	2 511(502200)	2 552.01(510402)	2 592.99(518598)	2 634(526800)	2 674.98(534996)	
	40 MHz	2 516.01(503202)	2 567.34(513468)		2 618.67(523734)	2 670(534000)	
	50 MHz	2 521.02(504204)		2 592.99(518598)		2 664.99(532998)	
	60 MHz	2 526(505200)		2 592.99(518598)		2 659.98(531996)	
	70 MHz	2 531.01(506202)				2 655(531000)	
	80 MHz	2 536.02(507204)				2 649.99(529998)	
	90 MHz	2 541(508200)				2 644.98(528996)	
	100 MHz			2 592.99(518598)			

Ch. No.& Freq.(MHz)		Low / Low-Mid		Mid		Mid-High / High	
NR FDD Band n66	5 MHz	1 712.5(342500)		1 745(349000)		1 777.5(355500)	
	10 MHz	1 715(343000)		1 745(349000)		1 775(355000)	
	15 MHz	1 717.5(343500)		1 745(349000)		1 772.5(354500)	
	20 MHz	1 720(344000)		1 745(349000)		1 770(354000)	
	25 MHz	1 722.5(344500)		1 745(349000)		1 767.5(353500)	
	30 MHz			1 745(349000)			
NR FDD Band n70	40 MHz	1 730(346000)		1 745(349000)		1 760(352000)	
	5 MHz	1 697.5(339500)				1 707.5(341500)	
	10 MHz	1 700(340000)		1 702.5(340500)		1 705 (341000)	
NR FDD Band n71	15 MHz			1 702.5(340500)			
	5 MHz	665.5(133100)		680.5(136100)		695.5(139100)	
	10 MHz	668(133600)		680.5(136100)		693(138600)	
	15 MHz			680.5(136100)			
NR TDD Band n77	20 MHz			680.5(136100)			
	10 MHz	3 705(647000)	3 759(650600)	3 813(654200)	3 867(657800)	3 921(661400)	3 975(665000)
	15 MHz	3 707.52(647168)	3 760.5(650700)	3 813.51(654234)	3 866.49(657766)	3 919.5(661300)	3 972.48(664832)
	20 MHz	3 710.01 (647334)	3 762 (650800)	3 813.99(654266)	3 866.01 (657734)	3 918 (661200)	3 969.99 (664666)
	25 MHz	3 712.5(647500)	3 763.5(650900)	3 814.5(654300)	3 865.5(657700)	3 916.5(661100)	3 967.5(664500)
	30 MHz	3 715.02 (647668)	3 765 (651000)	3 815.01(654334)	3 864.99 (657666)	3 915 (661000)	3 964.98 (664332)
	40 MHz	3 720 (648000)	3 768 (651200)	3 816 (654400)	3 864 (657600)	3 912 (660800)	3 960 (664000)
	50 MHz	3 725.01 (648334)	3 782.49 (652166)	3 840 (656000)		3 897.51 (659834)	3 954.99 (663666)
	60 MHz	3 730.02 (648668)	3 803.34(653556)			3 876.66(658444)	3 949.98 (663332)
	70 MHz	3 735 (649000)	3 804.99 (654336)			3 875.01 (658334)	3 945(663000)
	80 MHz	3 740.01 (649334)		3 840 (656000)			3 939.99 (662666)
	90 MHz	3 745.02 (649668)		3 840 (656000)		3 934.98 (662332)	
NR TDD Band n77 (DoD)	100 MHz	3 750 (650000)		3 840 (656000)		3 930 (662000)	
	10 MHz	3 455.01(630334)		3 500.01(633334)		3 544.98(636332)	
	15 MHz	3 457.5(630500)		3 500.01(633334)		3 542.49(636166)	
	20 MHz	3 460.02 (630668)		3 500.01 (633334)		3 540 (636000)	
	25 MHz	3 462.99(630866)		3 500.01(633334)		3 537(635800)	
	30 MHz	3 465 (631000)		3 500.01 (633334)		3 534.99 (635666)	
	40 MHz	3 470.01 (631334)				3 529.98 (635332)	
	50 MHz	3 475.02 (631668)				3 525 (635000)	
	60 MHz			3 500.01 (633334)			
	70 MHz			3 500.01 (633334)			
	80 MHz			3 500.01 (633334)			
NR TDD Band n78	90 MHz			3 500.01 (633334)			
	100 MHz			3 500.01 (633334)			
	10 MHz	3 705(647000)		3 750(650000)		3 795(653000)	
	15 MHz	3 707.5(647166)		3 750(650000)		3 792.48(652832)	
	20 MHz	3 710.01(647334)		3 750(650000)		3 789.99(652666)	
	25 MHz	3 712.5(647500)		3 750(650000)		3 787.5(652500)	
	30 MHz	3 715(647666)		3 750(650000)		3 784.98(652332)	
	40 MHz	3 720(647800)				3 780(652000)	
	50 MHz	3 725.01(648334)				3 774.99(651666)	
	60 MHz			3 750(650000)			
	70 MHz			3 750(650000)			
	80 MHz			3 750(650000)			
	90 MHz			3 750(650000)			
	100 MHz			3 750(650000)			

Ch. No.& Freq. (MHz)		Low / Low-Mid	Mid	Mid-High / High
NR TDD Band n78 (DoD)	10 MHz	3 455.01(630334)	3 500.01(633334)	3 544.98(636332)
	15 MHz	3 457.5(630500)	3 500.01(633334)	3 542.49(636166)
	20 MHz	3 460.02(630668)	3 500.01(633334)	3 540(636000)
	25 MHz	3 462.99(630866)	3 500.01(633334)	3 537(635800)
	30 MHz	3 465(631000)	3 500.01(633334)	3 534.99(635666)
	40 MHz	3 470.01(631334)		3 529.98(635332)
	50 MHz	3 475.02(631668)		3 525(635000)
	60 MHz		3 500.01(633334)	
	70 MHz		3 500.01(633334)	
	80 MHz		3 500.01(633334)	
	90 MHz		3 500.01(633334)	
100 MHz		3 500.01(633334)		
Item.			Description	
NR FDD Band n2/n5/n25/n30/n66/n70/n71 SCS			15 kHz	
NR TDD Band n41/n48/n77/n78 SCS			30 kHz	
3GPP Rel.			Rel.16	
A-MPR disabled for SAR Testing.			Yes	
5G NR UL/DL FR1			CP-OFDM: QPSK, 16QAM, 64QAM, 256QAM DFT-s-OFDM: $\pi/2$ -BPSK(UL Only), QPSK, 16QAM, 64QAM, 256QAM	
Non-Standalone & Standalone are supported. 5G NR FR1 Bands, except n30,n70,n78 are supported to NSA and SA Connectivity. n30,n70,n78 is only supported to SA connectivity More detailed specifications of the 5G NR bands are contained in the Technical description document.				
EN-DC Carrier Aggregation Possible Combinations			The technical description includes all the possible carrier aggregation combinations	
LTE Anchor Bands for NR Band n2 (PCS)			LTE Band 5/12/13/14/30/48/66	
LTE Anchor Bands for NR Band n5 (Cell)			LTE Band 2/30/48/66	
LTE Anchor Bands for NR Band n25			LTE Band 12/66	
LTE Anchor Bands for NR Band n30			N/A	
LTE Anchor Bands for NR Band n41			LTE Band 2/5/12/66/71	
LTE Anchor Bands for NR Band n48			LTE Band 2/66	
LTE Anchor Bands for NR Band n66 (AWS)			LTE Band 2/5/12/13/14/30/48/71	
LTE Anchor Bands for NR Band n70			N/A	
LTE Anchor Bands for NR Band n71			LTE Band 2/48/66	
LTE Anchor Bands for NR Band n77			LTE Band 2/5/12/13/14/30/66/71	
LTE Anchor Bands for NR Band n78			N/A	

4.6 DUT Antenna Locations

The overall dimensions of this device are > 9 X 5 cm. A diagram showing device antenna can be found in SAR_setup_photos. Since the diagonal dimension of this device is > 160 mm and < 200 mm, it is considered a “phablet”.

This model allows users to exchange data or media files with other Bluetooth enabled devices using Bluetooth, which means they can connect to other Bluetooth enabled devices via Bluetooth tethering. Therefore, SAR test was performed for additional simultaneous transmissions.

Head and Bluetooth Tethering SAR were evaluated for BT BR tethering applications.

Antenna	Mode/Band	Rear	Front	Left	Right	Top	Bottom
SUB2 [Ant F]	Bluetooth	Yes	Yes	Yes	No	Yes	No

Particular EUT edges were not required to be evaluated for Bluetooth Tethering and Hotspot SAR if the edges were > 25 mm from the transmitting antenna according to FCC KDB 941225 D06v02r01 on page 2.

The distance between the transmit antennas and the edges of the device are included in the filing.

- Note: All test configurations are based on front view position.

4.7 Near Field Communications (NFC) Antenna

This EUT has NFC operations. The NFC antenna is integrated into the device for this model. Therefore, all SAR tests were performed with the device which already incorporates the NFC antenna. A diagram showing the location of the NFC antenna can be found in SAR _ Setup_ photos.

4.8 SAR Summation Scenario

According to FCC KDB 447498 D01v06, transmitters are considered to be transmitting simultaneously when there is overlapping transmission, with the exception of transmissions during network hand-offs with maximum hand-off duration less than 30 seconds. Possible transmission paths for the EUT are shown below paths and are mode in same rectangle to indicate communication modes which share the same path. Modes which share the same transmission path cannot transmit simultaneously with one another.

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

Scenario
WWAN + 2.4 GHz Wi-Fi Ant.1
WWAN + 5 GHz Wi-Fi Ant.1
WWAN + Bluetooth Ant.1
WWAN + Bluetooth Ant.1 + 5 GHz Wi-Fi Ant.1

Note:

1. UMTS +WLAN scenario also represents the UMTS Voice/DATA + WLAN hotspot scenario.
2. VoIP is supported in GPRS/EDGE
3. The highest reported SAR for each exposure condition is used for SAR summation purpose.
4. Wi-Fi Hotspot is supported for 2.4 GHz/UNII-3 of 5 GHz WLAN.
5. Pre-installed VOIP applications are considered
6. Per the manufacturer, WIFI Direct is not expected to be used in conjunction with a held to ear or Body worn accessory voice call. Therefore, there are no simultaneous transmission scenarios involving WIFI Direct beyond that listed in the above table.
7. This device supports VoLTE/ VoWiFi.
8. LTE + 5G NR FR1 Scenarios are supported NSA and SA Connectivity.
9. NFC was evaluated for phablet based on expected usage conditions.

4.9 SAR Test Considerations

The C2PC test of the DUT was performed as the Bluetooth Ant. F power had been changed.
Please refer to the technical documentation for detailed C2PC changes.

5. Introduction

The FCC has adopted the guidelines for evaluating the environmental effects of radio frequency radiation in ET Docket 93-62 on Aug. 6, 1996 to protect the public and workers from the potential hazards of RF emissions due to FCC-regulated portable devices.

The safety limits used for the environmental evaluation measurements are based on the criteria published by the American National Standards Institute (ANSI) for localized specific absorption rate (SAR) in IEEE/ANSI C95.1-1992 Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz. 1992 by the Institute of Electrical and Electronics Engineers, Inc., New York 10017. The measurement procedure described in IEEE/ANSI C95.3-1992 Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields – RF and Microwave is used for guidance in measuring SAR due to the RF radiation exposure from the Equipment Under Test (EUT). These criteria for SAR evaluation are similar to those recommended by the National Council on Radiation Protection and Measurements (NCRP) in Biological Effects and Exposure Criteria for Radio Frequency Electromagnetic Fields,” NCRP Report No. 86 NCRP, 1986, Bethesda, MD 20814. SAR is a measure of the rate of energy absorption due to exposure to an RF transmitting source. SAR values have been related to threshold levels for potential biological hazards.

SAR Definition

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

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

Figure 1. SAR Mathematical Equation

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

Where:

- = conductivity of the tissue-simulant material (S/m)
- = mass density of the tissue-simulant material (kg/m^3)
- = 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 relations 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. Description of test equipment

6.1 SAR MEASUREMENT SETUP

These measurements are performed using the DASY4 automated dosimetric assessment system. It is made by Schmid & Partner Engineering AG (SPEAG) in Zurich, Switzerland. It consists of high precision robotics system (Staubli), robot controller, Pentium III computer, near-field probe, probe alignment sensor, and the generic twin phantom containing the brain equivalent material. The robot is a six-axis industrial robot performing precise movements to position the probe to the location (points) of maximum electromagnetic field (EMF) (see Figure.2).

A cell controller system contains the power supply, robot controller, teach pendant (Joystick), and remote control, is used to drive the robot motors. The PC with Windows XP or Windows 7 or Windows 10 or Windows 11 is working with SAR Measurement system DASY4 & DASY5 & DASY6 & DASY8 A/D interface card, monitor, mouse, and keyboard. The Staubli Robot is connected to the cell controller to allow software manipulation of the robot. A data acquisition electronic (DAE) circuit performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. is connected to the Electro-optical coupler (EOC). The EOC performs the conversion from the optical into digital electric signal of the DAE and transfers data to the PC plug-in card.

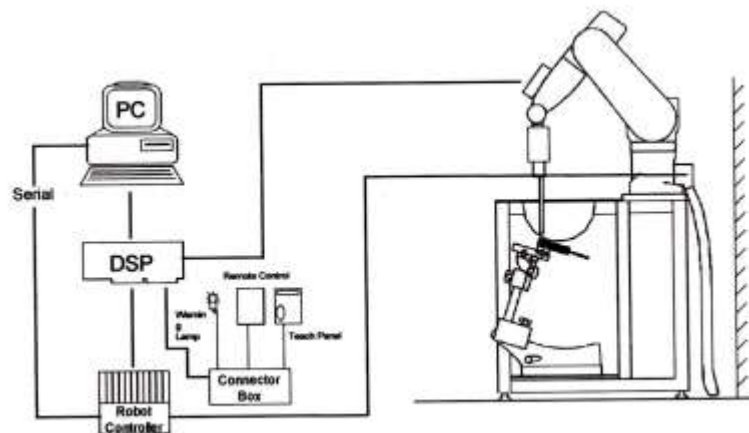


Figure 2. HCT SAR Lab. Test Measurement Set-up

The DAE consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder and control logic unit. Transmission to the PC-card is accomplished through an optical downlink for data and status information and an optical uplink for commands and clock lines. The mechanical probe mounting device includes two different sensor systems for frontal and sidewise probe contacts. They are also used for mechanical surface detection and probe collision detection. The robot uses its own controller with a built in VME-bus computer. The system is described in detail in.

7. SAR Measurement Procedure

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

1. The SAR distribution at the exposed side of the head or body was measured at a distance no more than 5.0 mm from the inner surface of the shell. The area covered the entire dimension of the DUT's head and body area and the horizontal grid resolution was depending on the FCC KDB 865664 D01v01r04 table 4-1 & IEEE 1528-2013.
2. Based on step, the area of the maximum absorption was determined by sophisticated interpolations routines implemented in DASY software. When an Area Scan has measured all reachable point. DASY system computes the field maximal found in the scanned are, within a range of the maximum. SAR at this fixed point was measured and used as a reference value.
3. Around this point, a volume was assessed according to the measurement resolution and volume size requirements of FCC KDB 865664 D01v01r04 table 4-1 and IEEE 1528-2013. On the basis of this data set, the spatial peak SAR value was evaluated with the following procedure (reference from the DASY manual.)
 - a. The data at the surface were extrapolated, since the center of the dipoles is no more than 2.7 mm away from the tip of the probe (it is different from the probe type) and the distance between the surface and the lowest measuring point is 1.2 mm. The extrapolation was based on a least square algorithm. A polynomial of the fourth order was calculated through the points in z-axes. This polynomial was then used to evaluate the points between the surface and the probe tip.
 - b. The maximum interpolated value was searched with a straight-forward algorithm. Around this maximum the SAR values averaged over the spatial volumes (1 g or 10 g) were computed using the 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 integrated with the trapezoidal algorithm. One thousand points (10 x 10 x 10) were interpolated to calculate the average.
 - 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. If the value changed by more than 5 %, the SAR evaluation and drift measurements were repeated.

Area scan and zoom scan resolution setting follow KDB 865664 D01v01r04 quoted below.

			$\leq 3 \text{ GHz}$	$> 3 \text{ GHz}$
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface			$5 \pm 1 \text{ mm}$	$\cdot \delta \cdot \ln(2) \pm 0.5 \text{ mm}$
Maximum probe angle from probe axis to phantom surface normal at the measurement location			$30^{\circ} \pm 1^{\circ}$	$20^{\circ} \pm 1^{\circ}$
Maximum area scan Spatial resolution: $\Delta x_{\text{Area}}, \Delta y_{\text{Area}}$			$\leq 2 \text{ GHz: } \leq 15 \text{ mm}$ $2\text{-}3 \text{ GHz: } \leq 12 \text{ mm}$	$3\text{-}4 \text{ GHz: } \leq 12 \text{ mm}$ $4\text{-}6 \text{ GHz: } \leq 10 \text{ mm}$
			When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be $\leq$ the corresponding x or y dimension of the test device with at least one measurement point on the test device.	
Maximum zoom scan Spatial resolution: $\Delta x_{\text{zoom}}, \Delta y_{\text{zoom}}$			$\leq 2 \text{ GHz: } \leq 8 \text{ mm}$ $2\text{-}3 \text{ GHz: } \leq 5 \text{ mm}^*$	$3\text{-}4 \text{ GHz: } \leq 5 \text{ mm}^*$ $4\text{-}6 \text{ GHz: } \leq 4 \text{ mm}^*$
Maximum zoom scan Spatial resolution normal to phantom surface	uniform grid: $\Delta z_{\text{zoom}}(n)$		$\leq 5 \text{ mm}$	$3\text{-}4 \text{ GHz: } \leq 4 \text{ mm}$ $4\text{-}5 \text{ GHz: } \leq 3 \text{ mm}$ $5\text{-}6 \text{ GHz: } \leq 2 \text{ mm}$
	graded grid	$\Delta z_{\text{zoom}}(1)$: between 1 st two Points closest to phantom surface	$\leq 4 \text{ mm}$	$3\text{-}4 \text{ GHz: } \leq 3 \text{ mm}$ $4\text{-}5 \text{ GHz: } \leq 2.5 \text{ mm}$ $5\text{-}6 \text{ GHz: } \leq 2 \text{ mm}$
		$\Delta z_{\text{zoom}}(n>1)$: between subsequent Points	$\leq 1.5 \cdot \Delta z_{\text{zoom}}(n-1)$	
Minimum zoom scan volume	x, y, z		$\geq 30 \text{ mm}$	$3\text{-}4 \text{ GHz: } \geq 28 \text{ mm}$ $4\text{-}5 \text{ GHz: } \geq 25 \text{ mm}$ $5\text{-}6 \text{ GHz: } \geq 22 \text{ mm}$
Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details. * When zoom scan is required and the reported SAR from the area scan based 1-g SAR estimation procedures of KDB447498 is $\leq 1.4 \text{ W/kg}$, $\leq 8 \text{ mm}$, $\leq 7 \text{ mm}$ and $\leq 5 \text{ mm}$ zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.				

8. Description of Test Position

8.1 EAR REFERENCE POINT

Figure 8-2 shows the front, back and side views of the SAM phantom. The center-of-mouth reference point is labeled “M”, the left ear reference point (ERP) is marked “LE”, and the right ERP is marked “RE.” Each ERP is on the B-M (back-mouth) line located 15 mm behind the entrance-to-ear-canal (EEC) point, as shown in Figure 6-1. The Reference Plane is defined as passing through the two ear reference points and point M. The line N-F (Neck-Front), also called the Reference Pivoting Line, is not perpendicular to the reference plane (See Figure 5-1), Line B-M is perpendicular to the N-F line. Both N-F and B-M lines are marked on the external phantom shell to facilitate handset positioning.

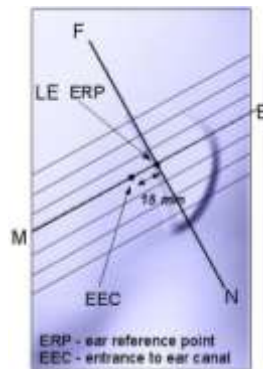


Figure 8-1
Close-up side view of ERP

8.2 Handset Reference Points

Two imaginary lines on the handset were established: the vertical centerline and the horizontal line. The device under test was placed in a normal operating position with the acoustic output located along the “vertical centerline” on the front of the device aligned to the “ear reference point” (see Figure 8-3). The acoustic output was then located at the same level as the center of the ear reference point. The device under test was positioned so that the “vertical centerline” was bisecting the front surface of the handset at its top and bottom edges, positioning the “ear reference point” on the outer surface of the both the left and right head phantoms on the ear reference point.



Figure 8-2
Front, back and side views of SAM Twin Phantom

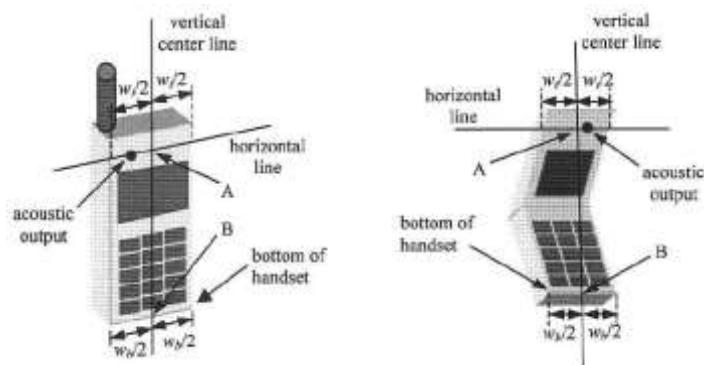


Figure 8-3. Handset vertical and horizontal reference lines

8.3 Device Holder

The device holder is made out of low-loss POM material having the following dielectric parameter; relative permittivity $\epsilon=3$ and loss tangent $\sigma=0.02$.

8.4 Position for Touch

Figure 8.4. shows Touch or touch position. The reference points for the right ear (RE), left ear (LE), and mouth (M), which establish the Reference Plane for handset positioning, are indicated.

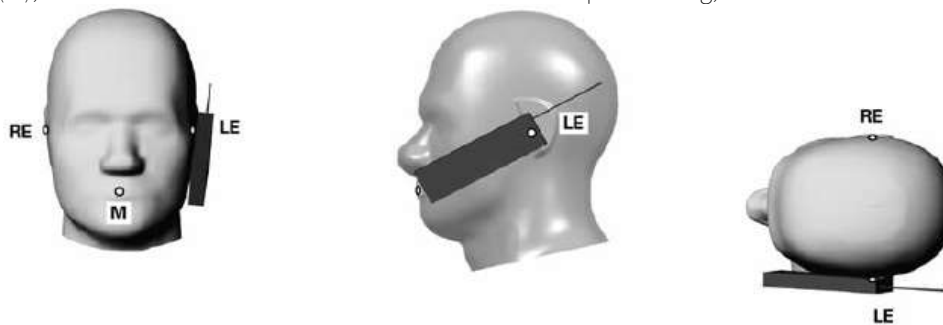


Figure 8.4 Touch/ Touch position of the wireless device

8.5 Definition of the “tilted” position

Figure 8.5. shows tilted position. Place the device in the Touch position. Then while maintaining the orientation of the device, retract the device parallel to the reference plane far enough away from the phantom to enable a rotation of the device by 15°.



Figure 8.5. Tilt 15° position of the wireless device

8.6 Body-Worn Accessory Configurations

Body-worn operating configurations are tested with the belt-dips and holsters attached to the device and positioned against a flat phantom in a normal use configuration (see Figure 8.6). Per FCC KDB Publication 648474 D04v01r03 Body-worn accessory exposure is typically related to voice mode operations when handsets are carried in Body-worn accessories. The Body-worn accessory procedures in FCC KDB Publication 447498 D01v06 should be used to test for Body-worn accessory SAR compliance, without a headset connected to it. When the reported SAR for a body-worn accessory, measured without a headset connected to the handset, is > 1.2 W/kg, the highest reported SAR configuration for that wireless mode and frequency Band should be repeated for that body-worn accessory with a headset attached to the handset.



Figure 8.6
Sample Body-Worn Diagram

Accessories for Body-worn operation configurations are divided into two categories: those that do not contain metallic components and those that do contain metallic components. When multiple accessories that do not contain metallic components are supplied with the device, the device is tested with only the accessory that dictates the closest spacing to the body. Then multiple accessories that contain metallic components are tested with the device with each accessory. If multiple accessories share an identical metallic component (i.e. the same metallic belt-dip used with different holsters with no other metallic components) only the accessory that dictates the closest spacing to the body is tested.

8.7 Wireless Router Configurations

Some battery-operated handsets have the capability to transmit and receive user data through simultaneous transmission of WIFI simultaneously with a separate licensed transmitter. The FCC has provided guidance in FCC KDB Publication 941225 D06v02r01 where SAR test considerations for handsets ($L \times W \geq 9\text{cm} \times 5\text{cm}$) are based on a composite test separation distance of 5 mm from the front back and edges of the device containing transmitting antennas within 2.5 cm of their edges, determined from general mixed use conditions for this type of devices. Since the hotspot SAR results may overlap with the Body-worn accessory SAR requirements, the more conservative configurations can be considered, thus excluding some Body-worn accessory SAR tests.

In the closed configuration, only a simple display/interaction of notifications occurs and overall dimensions are $< 9 \times 5\text{ cm}$. Therefore Per 941225 D06v02r01, when the device is closed, test separation for hotspot mode is 5 mm.

When the user enables the personal wireless router functions for the handset actual operations include simultaneous transmission of both the WIFI transmitter and another licensed transmitter. Both transmitters often do not transmit at the same transmitting frequency and thus cannot be evaluated for SAR under actual use conditions due to the limitations of the SAR assessment probes. Therefore, SAR must be evaluated for each frequency transmission and mode separately and spatially summed with the WIFI transmitter according to FCC KDB Publication 447498 D01v06 publication procedures. The Portable Hotspot feature on the handset was NOT activated during SAR assessments, to ensure the SAR measurements were evaluated for a single transmission frequency RF signal at a time.

8.8 Extremity Exposure Configurations

Devices that are designed or intended for use on extremities or mainly operated in extremity only exposure conditions: i.e., hands, wrists, feet and ankles, may require extremity SAR evaluation. When the device also operates in close proximity to the user's body, SAR compliance for the body is also required. The 1-g body and 10-g extremity SAR Exclusion Thresholds found in KDB Publication 447498 D01v06 should be applied to determine SAR test requirements.

For smart phones with a display diagonal dimension > 15.0 cm or an overall diagonal dimension > 16.0 cm that provide similar mobile web access and multimedia support found in mini-tablets or UMPC mini-tablets that support voice calls next to the ear. The phablets procedures outlined in KDB Publication 648474 D04 v01r03 should be applied to evaluate SAR compliance. A device marketed as phablets, regardless of form factors and operating characteristics must be tested as a phablet to determine SAR compliance. In addition to the normally required head and body-worm accessory SAR test procedures required for handsets, the UMPC mini-tablet procedures must also be applied to test the SAR of all surfaces and edges with an antenna ≤ 25 mm from that surface or edge, in direct contact with the phantom, for 10-g SAR. The UMPC mini-tablet 1-g SAR at 5 mm is not required. When hotspot mode applies, 10-g SAR is required only for the surfaces and edges with hotspot mode scaled to the maximum output power (including tolerance) is 1-g SAR > 1.2 W/kg.

8.9 Bluetooth tethering Configurations

Per May 2017 TCBC Workshop Document, When Bluetooth tethering applies, simultaneous transmission SAR needs consideration.

This model allows users to exchange data or media files with other Bluetooth enabled devices using Bluetooth, which means they can connect to other Bluetooth enabled devices via Bluetooth tethering. Therefore, SAR test was performed for additional simultaneous transmissions.

Head and Bluetooth tethering SAR were evaluated for BT BDR tethering applications.

9. RF Exposure Limits

HUMAN EXPOSURE	UNCONTROLLED ENVIRONMENT General Population (W/kg)	CONTROLLED ENVIRONMENT Occupational (W/kg)
SPATIAL PEAK SAR * (Partial Body)	1.6	8.0
SPATIAL AVERAGE SAR ** (Whole Body)	0.08	0.4
SPATIAL PEAK SAR *** (Hands / Feet / Ankle / Wrist)	4.0	20.0

NOTES:

* The Spatial Peak value of the SAR averaged over any 1 g of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

** The Spatial Average value of the SAR averaged over the whole-body.

*** The Spatial Peak value of the SAR averaged over any 10 g of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

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.

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.

10. FCC SAR General Measurement Procedures

Power Measurements for licensed transmitters are performed using a base simulator under digital average power.

10.1 Measured and Reported SAR

Per FCC KDB Publication 447498 D01v06, when SAR is not measured at the maximum power level allowed for production units, the results must be scaled to the maximum tune-up tolerance limit according to the power applied to the individual channels tested to determine compliance. For simultaneous transmission, the measured aggregate SAR must be scaled according to the sum of the differences between the maximum tune-up tolerance and actual power used to test each transmitter. When SAR is measured at or scaled to the maximum tune-up tolerance limit, the results are referred to as Reported SAR. The highest reported SAR results are identified on the grant of equipment authorization according to procedures in KDB 690783 D01v01r03.

11. Output Power Specifications

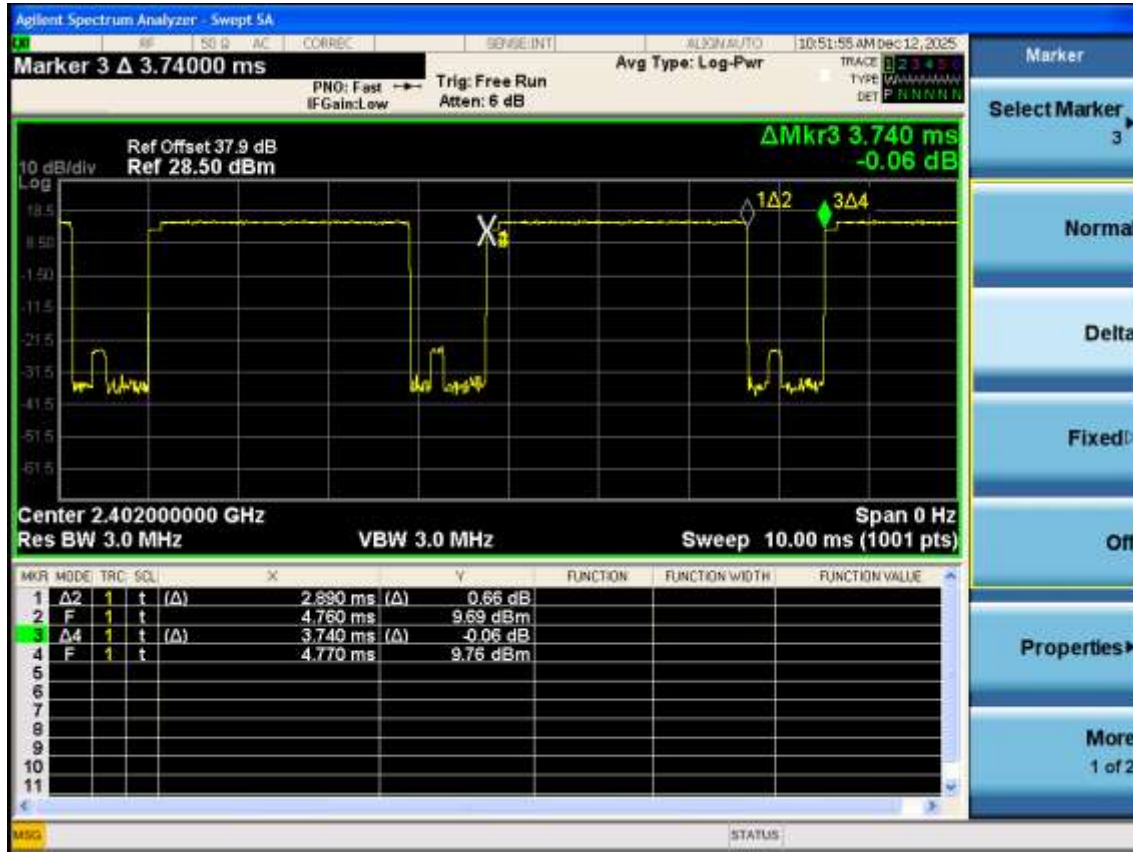
This device operates using the following maximum output power specifications. SAR values were scaled to the maximum allowed power to determine compliance per KDB publication 447498 D01v06.

11.1 Bluetooth Maximum Conducted Power

Bluetooth Burst Averaged-conducted power

Mode	Channel	Max. Average Conducted Power [dBm]
		Ant.1
DH5	0	9.66
	39	9.85
	78	9.02
2-DH5	0	6.45
	39	6.58
	78	6.15
3-DH5	0	6.46
	39	6.59
	78	6.17

Bluetooth DH 5 Mode



Duty Cycle

$$= (\text{BT-On time} / \text{BT-Full time}) = (2.890 / 3.740) = 0.773 \text{ (DH5)}$$

BT DH5 Maximum Duty Factor:

The theoretical maximum duty cycle defined by chipset manufacturer is 78.0 % In the ideal theory Duty Cycle, the test error tolerance [1%] of the test equipment was considered and applied to the measurement results. Duty cycle of DH5 measured by DUT was 77.3%, and the duty cycle was compensated by applying test error tolerance 1%. For more information on BT, please refer to the technical description document.

12. System Verification

12.1 Tissue Verification

The head simulating material is calibrated by HCT using the DAKS 3.5 to determine the conductivity and permittivity.

◆ BT

Table for Head Tissue Verification									
Date of Tests	Tissue Temp. (°C)	Tissue Type	Freq. (MHz)	Measured Conductivity σ (S/m)	Measured Dielectric Constant, ϵ	Target Conductivity σ (S/m)	Target Dielectric Constant, ϵ	% dev σ	% dev ϵ
12/04/25	19.3	2450H	2400	1.79	39.0	1.756	39.29	+ 1.94	- 0.74
			2450	1.84	39.4	1.800	39.20	+ 2.22	+ 0.51
			2500	1.88	39.2	1.855	39.14	+ 1.35	+ 0.15

12.2 System Verification

◆ BT

Freq. [MHz]	Date	Probe (S/N)	Dipole (S/N)	Liquid	Amb. Temp. [°C]	Liquid Temp. [°C]	1 W Target SAR _{1g} (Speag) [W/kg]	50 mW Measured SAR _{1g} [W/kg]	1 W Normalized SAR _{1g} [W/kg]	Dev. [%]	Limit [%]
2 450	12/04/25	3076	1049	Head	19.4	19.3	52.60	2.70	54.00	+ 2.66	± 10

12.3 SAR Test System Verification Procedure

SAR measurement was prior to assessment; the system is verified to the ± 10 % of the specifications at each frequency Band by using the system verification kit. (Graphic Plots Attached)

- Cabling the system, using the verification kit equipment.
- Dipole antenna was placed below the flat phantom.
- The measured one-gram SAR at the surface of the phantom above the dipole feed-point should be within 10 % of the target reference value.

Note;

SAR Verification was performed according to the FCC KDB 865664 D01v01r04.

13. SAR Test Data Summary

13.1 SAR Measurement Results

13.1.1 Head SAR Measurement Results

DSS Head SAR													
Frequency (MHz)	Ch.	Mode	Ant.	Band Width (MHz)	Tune-Up Limit (dBm)	Meas. Power (dBm)	Power Drift (dB)	Test Position	Meas. 1g SAR (W/kg)	Scaling Factor	Scaling Factor (Duty)	Reported SAR (W/kg)	Plot No.
2441	39	DH5	F	20	11.0	9.85	-0.06	Left Cheek	0.035	1.303	1.009	0.046	-
2441	39	DH5	F	20	11.0	9.85	-0.12	Left Tilt	0.038	1.303	1.009	0.050	-
2441	39	DH5	F	20	11.0	9.85	-0.17	Right Cheek	0.038	1.303	1.009	0.050	A1
2441	39	DH5	F	20	11.0	9.85	-0.16	Right Tilt	0.031	1.303	1.009	0.041	-
ANSI/ IEEE C95.1 - 2005- Safety Limit Spatial Peak Uncontrolled Exposure/ General Population								Head 1.6 W/kg Averaged over 1 gram					

13.1.2 Body Worn SAR Measurement Considerations

DSS Bodyworn SAR														
Frequency (MHz)	Ch.	Mode	Ant.	Band Width (MHz)	Tune-Up Limit (dBm)	Meas. Power (dBm)	Power Drift (dB)	Test Position	Distance	Meas. 1g SAR (W/kg)	Scaling Factor	Scaling Factor (Duty)	Reported SAR (W/kg)	Plot No.
2441	39	DH5	F	20	11.0	9.85	-0.02	Rear	5	0.133	1.303	1.009	0.175	B1
2441	39	DH5	F	20	11.0	9.85	-0.11	Front	5	0.015	1.303	1.009	0.020	-
ANSI/ IEEE C95.1 - 2005– Safety Limit Spatial Peak Uncontrolled Exposure/ General Population								Body 1.6 W/kg Averaged over 1 gram						

13.1.3 Hotspot SAR Measurement Considerations

DSS Tethering SAR														
Frequency (MHz)	Ch.	Mode	Ant.	Band Width (MHz)	Tune- Up Limit (dBm)	Meas. Power (dBm)	Power Drift (dB)	Test Position	Distance	Meas. 1g SAR (W/kg)	Scaling Factor	Scaling Factor (Duty)	Reported SAR (W/kg)	Plot No.
2441	39	DH5	F	20	11.0	9.85	-0.02	Rear	5	0.133	1.303	1.009	0.175	C1
2441	39	DH5	F	20	11.0	9.85	-0.11	Front	5	0.015	1.303	1.009	0.020	-
2441	39	DH5	F	20	11.0	9.85	0.11	Left	5	0.007	1.303	1.009	0.009	-
2441	39	DH5	F	20	11.0	9.85	0.03	Top	5	0.060	1.303	1.009	0.079	-
ANSI/IEEE C95.1 - 2005- Safety Limit Spatial Peak Uncontrolled Exposure/ General Population								Body 1.6 W/kg Averaged over 1 gram						

SAR Test Notes

General Notes:

1. The test data reported are the worst-case SAR values according to test procedures specified in IEEE 1528-2013, FCC KDB Procedure.
2. Batteries are fully charged at the beginning of the SAR measurements. A standard battery was used for all 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 447498 D01v06.
6. Device was tested using a fixed spacing for body-worn accessory testing. A separation distance of 5 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 648474 D04v01r03, SAR was evaluated without a headset connected to the device. Since the standalone reported SAR was 1.2 W/kg, no additional SAR evaluation using a headset cable were required.
8. The 1g SAR test for Body worn and Hotspot in WWAN mode and WLAN/BT mode of this DUT is performed at 5 mm separation distance, so 10g Phablet SAR is not required per FCC KDB 941225 D07 UMPC Mini Tablet v01r02.
9. Per FCC KDB 865664 D01v01r04, variability SAR measurement were performed when the measured SAR results for a frequency Band were greater than or equal to 0.8 W/kg for 1g SAR and >2 for 10g SAR Please see Section 15 for variability analysis.
10. This device utilizes power reduction for some wireless mode and technologies, as outlined in sec. 4 The maximum output power allowed for each transmitter and exposure condition was evaluated for SAR compliance based on expected use conditions and simultaneous scenarios.

Bluetooth Notes:

1. Bluetooth SAR was measured with the device connected to a call box with hopping disabled with DH5 operation and Tx Tests mode type. In the technical documentation, the maximum duty factor of the declared BT was applied to the SAR results. Please see sec.11 for the time-domain plot and calculation for duty factor of the device.
2. Head and Bluetooth tethering SAR were evaluated for BT BDR tethering applications.

14. Simultaneous SAR Analysis

This device contains transmitters that may operate simultaneously. Therefore, simultaneous transmission analysis is required. Per KDB Publication 447498 D01v06 section 4.3.2 and IEEE 1528-2013 section 6.3.4.1.2, simultaneous transmission SAR test exclusion may be applied when the sum of 1g SAR and 10g SAR for all the simultaneous transmitting antennas in a specific a physical test configuration is $\leq 1.6\text{W/kg}$ for 1g SAR and $\leq 4\text{ W/kg}$ for 10g SAR. The different test positions in an exposure condition may be considered collectively to determine SAR exclusion according to the sum of 1g or 10g SAR.

The simultaneous transmission analysis was performed considering the results of the basic model
[Report no: HCT-SR-2510-FC003-R1]

14.1 Sub6 Antenna Groups

S.LSI Time average SAR(TAS) algorithm operates based on pre-defined sub6 antenna groups (AG). Sub6 Tx antennas in the device are grouped based on spatial variation of RF exposure distributions, where the RF exposure of one AG is mutually exclusive from other AG. This is accomplished by demonstrating either of below conditions for all exposure scenarios:

Sum of SAR of one antenna from each of the sub6 AGs and the RF exposure from radios outside TAS is less than regulatory limits. This condition must be demonstrated for all antenna combinations of sub6 AGs. This device supports two sub6 AG: AG0 and AG1, with AG0 having 1 antenna A and AG1 having 4 antennas (F, G, H, I). The conditions are verified through the following criteria.

The highest reported SAR at Plimit (or Pmax when Plimit > Pmax) for each antenna should be obtained out of all supported WWAN technologies and frequency bands for each exposure condition. Demonstrate that the sum of reported SAR of antenna from each of the sub6 AGs and the sum of RF exposure of TAS should be less than the regulatory limit as given below for each RSI.

Obtain the worst-case reported SAR for each antenna group (i.e., maximum reported SAR at Plimit (or Pmax when Plimit > Pmax) out of all supported technologies, frequency bands and antennas in AG0 and AG1), denoted as max.SAR.AG0 and max.SAR.AG1, and obtain the worst-case RF exposure, and demonstrate that the sum of these RF exposures meets

$$\text{Max.SAR.AG0} + \text{Max.SAR.AG1} + \text{Max.WLAN 5GHz} + \text{Max.Bluetooth} \leq 1.6 \text{ (for 1g SAR or 4.0 for 10g)}$$

If sum result with both antenna group and BT/WAN exceeds the FCC SAR limit of 1.6 W/kg 1g, 4.0W/kg 10g, can use below contents.

If the sum result with each antenna group and BT/WLAN exceeds the FCC SAR limit of 1.6 W/kg 1g, 4.0 W/kg 10g, the SPLSR was re-evaluated according to FCC KDB 447498 D01v06 4.3.2.

AG0, AG1, WLAN/BT are described in the table below.

AG0	
Ant.A	GSM 850, GSM 1900 / UMTS Band 2, UMTS Band 4, UMTS Band 5/ LTE Band 7, LTE Band 12, LTE Band 13, LTE Band 14, LTE Band 25, LTE Band 41, LTE Band 26, LTE Band 30, LTE Band 66, LTE Band 71 / NR Band n5, NR Band n25, NR Band n30, NR Band n41, NR Band n66, NR Band n70, NR Band n71

AG1	
Ant.F	LTE Band 2, LTE Band 66 NR Band n2, NR Band n66, NR Band n48 SRS3, NR Band n77 SRS3, n77 DoD SRS3
Ant.G	LTE Band 48 NR Band n48, NR Band n77, NR Band n77 DoD
Ant.I	NR Band n48 SRS2, NR Band n77 SRS2, n77 DoD SRS2
Ant.H	NR Band n48 SRS4, NR Band n77 SRS4, NR Band n77 DoD SRS4

WLAN/BT	
Ant.F	WLAN 2.4GHz, WLAN 5GHz, Bluetooth

NFC	
NFC	

14.2 Head SAR Simultaneous Transmission Analysis

The Maximum measurement result for AG0		
Position	Ant A	Max.AG0
Left Touch	0.576	0.576
Left Tilt	0.261	0.261
Right Touch	0.303	0.303
Right Tilt	0.294	0.294

The Maximum measurement result for AG1					
Position	Ant.F	Ant.G	Ant.I	Ant.H	Max.AG1
Left Touch	0.375	0.097	0.050	0.071	0.375
Left Tilt	0.283	0.087	0.048	0.061	0.283
Right Touch	0.731	0.306	0.075	0.011	0.731
Right Tilt	0.422	0.185	0.079	0.011	0.422

The measurement result for WLAN/BT				
Position	WLAN 2.4GHz Ant.F	WLAN 5GHz Ant.F	Bluetooth Ant.F	WLAN 5GHz+BT
Left Touch	0.271	0.442	0.046	0.488
Left Tilt	0.299	0.539	0.050	0.589
Right Touch	0.281	0.396	0.050	0.446
Right Tilt	0.301	0.635	0.041	0.676

Simultaneous Transmission analysis for Head SAR				
Position	AG0+AG1+WLAN2.4GHz	AG0+AG1+BT	AG0+AG1+ WLAN5GHz	AG0+AG1+WLAN5GHz+BT
Left Touch	1.222	0.997	1.393	1.439
Left Tilt	0.843	0.594	1.083	1.133
Right Touch	1.315	1.084	1.430	1.480
Right Tilt	1.017	0.757	1.351	1.392

14.3 Hotspot/BodyWorn SAR Simultaneous Transmission Analysis

The Maximum measurement result for AG0		
Position	Ant A	Max.AG0
Rear	1.186	1.186
Front	0.599	0.599
Left	0.416	0.416
Right	0.601	0.601
Top		
Bottom	0.978	0.978

The Maximum measurement result for AG1					
Position	Ant.F	Ant.G	Ant.I	Ant.H	Max.AG1
Rear	0.368	0.620	0.289	0.250	0.620
Front	0.321	0.078	0.047	0.005	0.321
Left	0.232	0.355			0.355
Right				0.097	0.097
Top	0.194	0.072	0.106		0.194
Bottom					

The measurement result for WLAN/BT				
Position	WLAN 2.4GHz Ant.F	WLAN 5GHz Ant.F	Bluetooth Ant.F	WLAN 5GHz+BT
Rear	0.477	0.339	0.175	0.514
Front	0.078	0.069	0.020	0.089
Left	0.048	0.020	0.009	0.029
Right				
Top	0.250	0.243	0.079	0.322
Bottom				

Simultaneous Transmission analysis for Body SAR				
Position	AG0+AG1+WLAN2.4GHz	AG0+AG1 +BT	AG0+AG1+WLAN5GHz	AG0+AG1+WLAN5GHz+BT
Rear	Sec 14.6.1.1	Sec 14.6.1.2	Sec 14.6.1.2	Sec 14.6.1.2
Front	0.998	0.940	0.989	1.009
Left	0.819	0.780	0.791	0.800
Right	0.698	0.698	0.698	0.698
Top	0.444	0.273	0.437	0.516
Bottom	0.978	0.978	0.978	0.978

14.4 Phablet SAR Simultaneous Transmission Analysis

Position	NFC	Worst
Rear	0.029	0.029
Front	0.000	0.000
Left	0.000	0.000
Right		
Top	0.000	0.000
Bottom		

14.5 SAR to Peak Location Separation Ratio (SPLSR)

FCC KDB 447498 D01v06 General RF Exposure Guidance introduces a new formula for calculating the SAR a Peak Location Separation Ratio (SPLSR) between pairs of simultaneously transmitting antennas:

$$SPLSR_i = (SAR_1 + SAR_2)^{1.5} / R_i$$

Where:

SAR₁ is the highest measured or estimated SAR for the first of a pair of simultaneous transmitting antennas, in a specific test operating mode and exposure condition

SAR₂ is the highest measured or estimated SAR for the second of a pair of simultaneous transmitting antennas, in the same test operating mode and exposure condition as the first

R_i is the separation distance between the pair of simultaneous transmitting antennas, When the SAR is measured, for both antennas in the pair, it is determined by the actual x, y and z coordinates in the 1-g SAR for each SAR peak location, based on the extrapolated and interpolated result in the zoom scan measurement, using the formula of $[(X_1 - X_2)^2 + (Y_1 - Y_2)^2 + (Z_1 - Z_2)^2]$

In order for a pair of simultaneous transmitting antennas with the sum 1-g of SAR > 1.6 W/kg and with the sum 10-g of SAR > 4 W/kg to qualify for exemption from Simultaneous Transmission SAR measurements, it has to satisfy the condition of:

$$(SAR_1 + SAR_2)^{1.5} / R_i \leq 0.04 \text{ for 1g SAR and } (SAR_1 + SAR_2)^{1.5} / R_i \leq 0.1 \text{ for 10g SAR}$$

14.6 Sum-Peak Location Separation Ratio

Per May 2022 TCB Workshop, this Procedure can only be applied when simultaneous transmission SAR is > 1.6 W/kg, it does not meet SPLSR criteria, and antenna pair is co-located

Test Procedure:

1. Instead of doing a small volume scan over a co-located antenna pair, sum the SAR value of the co-located pair and use that value in SPLSR calculation.
2. This calculation use the minimum distance between the spatially antenna and the closest antenna of the co-located antenna pair to be conservative
3. Sum-Peak Location Separation Ratio

14.6.1 Hotspot/BodyWorn(Rear) SPLSR Evaluation

Ant Group 0

Mode/Band	Antenna	X(mm)	Y(mm)	Z(mm)	Reported SAR [W/kg]
GSM850	Ant A	-2	79.5	-205	0.788
GSM1900	Ant A	-32.6	87.6	-206	0.917
UMTS B5	Ant A	8.5	73.5	-205	1.006
UMTS B4	Ant A	-33.5	81.0	-206	1.130
UMTS B2	Ant A	-32	81.0	-206	1.186
LTE Band 7	Ant A	-51.4	68.6	-212	0.745
LTE Band 12	Ant A	8.5	76.5	-205	0.831
LTE Band 13	Ant A	8.5	76.5	-205	0.880
LTE Band 14	Ant A	10	75.0	-205	0.961
LTE Band 25	Ant A	-35	73.5	-206	0.663
LTE Band 26	Ant A	13	73.5	-205	1.092
LTE Band 30	Ant A	-49	68.6	-212	0.779
LTE Band 41	Ant A	-49	71.0	-208	1.044
LTE Band 66	Ant A	-29	73.5	-206	0.480
LTE Band 71	Ant A	-3.5	85.5	-205	0.595
NR n5	Ant A	8.5	75.0	-205	1.075
NR n25	Ant A	-35	72.0	-207	0.960
NR n71	Ant A	10	73.5	-204	0.795
NR n30	Ant A	-50.2	72.0	-208	0.832
NR n66	Ant A	-35	72.0	-207	0.608
NR n41	Ant A	-49	75.0	-208	0.645
NR n70	Ant A	-48.5	72.0	-207	1.177

Ant Group 1

Mode/Band	Antenna	X(mm)	Y(mm)	Z(mm)	Reported SAR [W/kg]
LTE Band 2	Ant F	-42.5	-70.5	-205	0.368
LTE Band 66	Ant F	-39.5	-69.0	-206	0.334
NR n2	Ant F	-36.5	-74.0	-206	0.211
NR n66	Ant F	-35	-77.5	-207	0.336
NR n48 SRS3	Ant F	-45.5	-74.5	-207	0.068
NR n77 SRS3	Ant F	-45.1	-76.0	-207	0.053
LTE Band 48	Ant G	-58	-62.5	-207	0.413
NR n48	Ant G	-65.4	-62.4	-207	0.620
NR n77	Ant G	-58.8	-61.2	-207	0.569
NR n48 SRS2	Ant I	-13.5	-68.0	-207	0.157
NR n77 SRS2	Ant I	-13.5	-68.0	-207	0.289
NR n48 SRS4	Ant H	17	-48.5	-207	0.152
NR n77 SRS4	Ant H	16.5	-49.5	-207	0.250

WLAN/BT

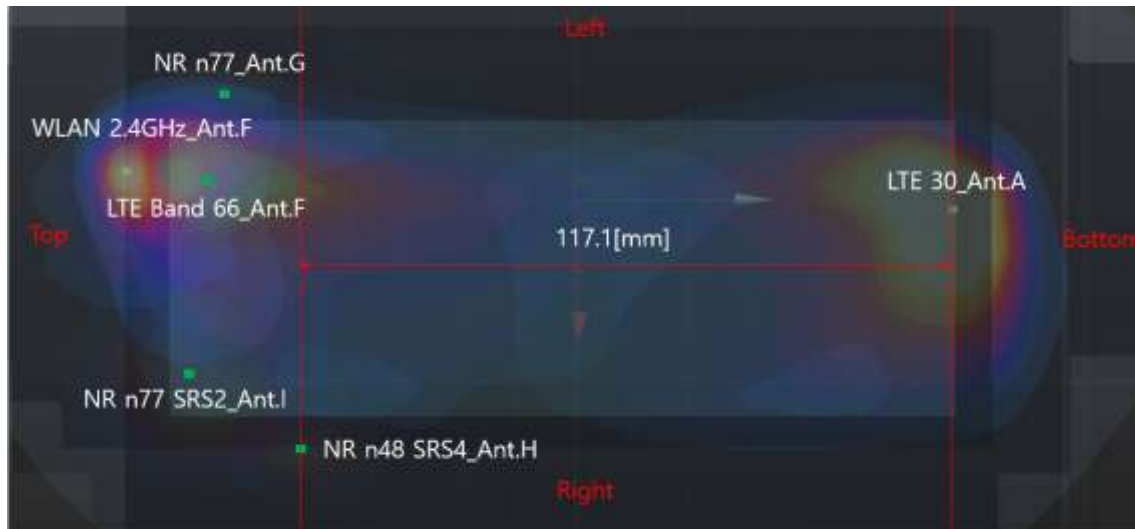
Mode/Band	Antenna	X(mm)	Y(mm)	Z(mm)	Reported SAR [W/kg]
WLAN2.4GHz	Ant F	-41.8	-89.8	-208	0.477
WLAN5GHz	Ant F	-35.7	-79.6	-207	0.339
BT	Ant F	-39.2	-80.5	-207	0.175

14.6.1.1 Group analysis SPLSR AG0 + AG1 + WLAN 2.4GHz

	AG0	AG1	WLAN 2.4GHz
Min Y-axis(mm)	68.6		
Max SAR(W/kg)	1.186		
Max Y-axis(mm)		-48.5	-89.8
Max SAR(W/kg)		0.620	0.477
AG0, (AG1, WLAN2.4 GHz) Distance(mm)		117.1	
(AG1+WLAN 2.4 GHz) SAR(W/kg)		1.097	
(AG0+AG1+WLAN 2.4 GHz) SAR(W/kg)		2.283	
AG0, AG1+WLAN 2.4GHz (SPLSR)		0.029	

SPLSR Plot for AG0 + AG1 + WLAN 2.4GHz

AG0 + AG1 + WLAN 2.4GHz

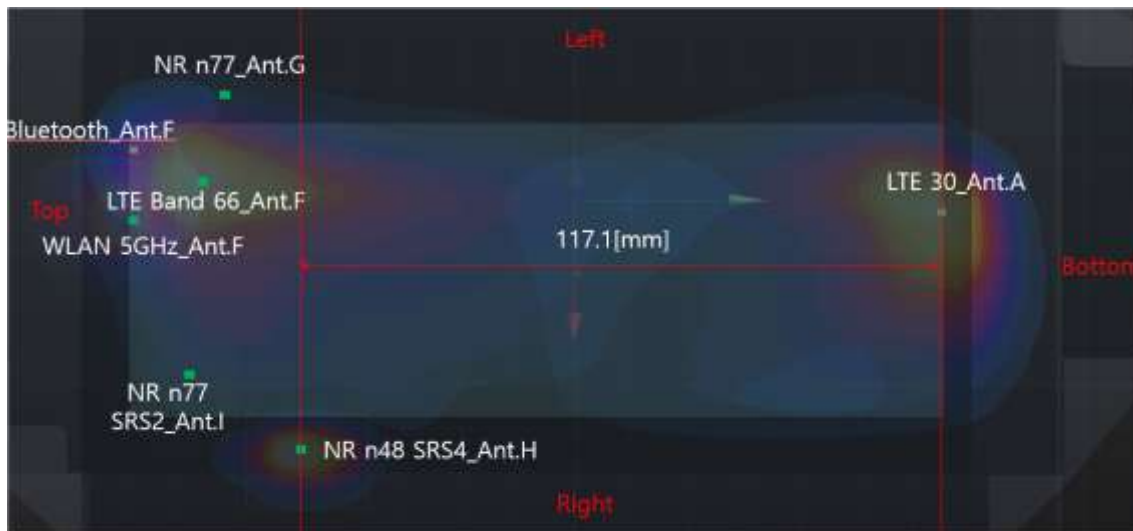


14.6.1.2 Group analysis SPLSR AG0 + AG1 + WLAN 5GHz + BT

	AG0	AG1	WLAN 5GHz+BT
Min Y-axis(mm)	68.6		
Max SAR(W/kg)	1.186		
Max Y-axis(mm)		-48.5	-79.6
Max SAR(W/kg)		0.620	0.514
AG0, (AG1, WLAN/BT) Distance(mm)		117.1	
(AG1+5 GHz WLAN+BT) SAR(W/kg)		1.134	
AG0+(AG1+5 GHz WLAN+BT) SAR(W/kg)		2.284	
AG0, (AG1+5 GHz WLAN+BT)(SPLSR)		0.030	

SPLSR Plot for AG0 + AG1 + WLAN 5GHz + BT

AG0 + AG1 + WLAN 5GHz + BT



15. SAR Measurement Variability and Uncertainty

In accordance with KDB procedure 865664 D01v01r04 SAR measurement 100 MHz to 6 GHz, SAR additional measurements are repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency Band. The test device should be returned to ambient conditions (normal room temperature) with the battery fully charged before it is re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

SAR Measurement variability was assessed using the following procedures for each frequency Band:

- 1) Repeated measurement is not required when the original highest measured SAR is < 0.80 W/kg for 1g SAR or < 2.0 W/kg for 10g SAR; steps 2) through 4) do not apply.
- 2) When the original highest measured 1g SAR is ≥ 0.80 W/kg or 10g SAR ≥ 2.0 W/kg, repeat that measurement once.
- 3) Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is > 1.20 or when the original or repeated measurement is ≥ 1.45 W/kg for 1g SAR or ≥ 3.625 W/kg for 10g SAR (~ 10% from the 1-g SAR limit).
- 4) Perform a third repeated measurement only if the original, first or second repeated measurement is ≥ 1.5 W/kg for 1g SAR or ≥ 3.75 W/kg for 10g SAR and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20 .

16. Measurement Uncertainty

The measured SAR was <1.5 W/Kg for 1g SAR and <3.75 W/Kg, for 10g SAR for all frequency Bands. Therefore, per KDB Publication 865664 D01v01r04, the extended measurement uncertainty analysis per IEEE1528-2013 was not required.

17. SAR Test Equipment List

Manufacturer	Type / Model	S/N	Calib. Date	Calib.Interval	Calib.Due
SPEAG	SAM Phantom	-	N/A	N/A	N/A
HP	SAR System Control PC	-	N/A	N/A	N/A
Staubli	CS8Cspeag-TX90	F08/5AJ0A1/C/01	N/A	N/A	N/A
Staubli	TX90 XLspeag	F08/5AJ0A1/A/01	N/A	N/A	N/A
Staubli	Teach Pendant (Joystick)	S-0008	N/A	N/A	N/A
TESTO	175-H1/Thermometer	40331949309	12/26/2024	Annual	12/26/2025
SPEAG	DAE4	1720	04/23/2025	Annual	04/23/2026
SPEAG	E-Field Probe ES3DV3	3076	07/22/2025	Annual	07/22/2026
SPEAG	Dipole D2450V2	1049	03/13/2025	Annual	03/13/2026
Agilent	Power Meter E4419B	MY41291386	09/13/2025	Annual	09/13/2026
Agilent	Power Meter N1911A	MY45101406	05/19/2025	Annual	05/19/2026
Agilent	Power Sensor 8481A	SG1091286	09/09/2025	Annual	09/09/2026
Agilent	Power Meter E4419B	MY41291386	09/13/2025	Annual	09/13/2026
Agilent	Power Meter N1911A	MY45101406	05/19/2025	Annual	05/19/2026
Agilent	Power Sensor 8481A	SG1091286	09/09/2025	Annual	09/09/2026
H.P	Power Sensor 8481A	MY41090873	01/13/2025	Annual	01/13/2026
Agilent	Wideband Power Sensor N1921A	MY55220026	08/07/2025	Annual	08/07/2026
Agilent	11636B/Power Divider	58698	01/13/2025	Annual	01/13/2026
SPEAG	DAKS 3.5	1038	01/20/2025	Annual	01/20/2026
H.P	Network Analyzer /8753E	JP38451384	08/19/2025	Annual	08/19/2026
Protek	NETWORK ANALYZER	X11-15305	02/10/2025	Annual	02/10/2026
Agilent	SIGNAL GENERATOR N5182A	MY47070230	03/18/2025	Annual	03/18/2026
EMPOWER	RF Power Amplifier	1084	05/20/2025	Annual	05/20/2026
MICRO LAB	LP Filter / LA-30N	-	09/15/2025	Annual	09/15/2026
Agilent	Attenuator (3dB) 8693B	MY39260298	08/18/2025	Annual	08/18/2026
HP	Attenuator (20dB) 8493C	09271	08/18/2025	Annual	08/18/2026
RF KOREA	Attenuator (30dB)	A-0830	06/24/2025	Annual	06/24/2026
Agilent	Directional Bridge 86205A	3140A04581	04/18/2025	Annual	04/18/2026
Agilent	MXA Signal Analyzer N9020A	MY50510407	06/09/2025	Annual	06/09/2026
HP	Dual Directional Coupler	16072	09/15/2025	Annual	09/15/2026
ROHDE&SCHWARZ	BLUETOOTH TESTER CBT	100272	01/13/2025	Annual	01/13/2026

Note: All measurements were performed within the valid calibration period of the specific equipment.

* The E-field probe was calibrated by SPEAG, by the waveguide technique procedure. Dipole Verification measurement is performed by HCT Lab. before each test. The brain/body simulating material is calibrated by HCT using the DAKS 3.5 to determine the conductivity and permittivity (dielectric constant) of the brain/body-equivalent material.

18. Conclusion

The SAR and RF Exposure measurement indicates that the EUT complies with the RF radiation exposure limits of the ANSI/ IEEE C95.1 - 2005.

These measurements were taken to simulate the RF effects 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 absorption 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.

19. References

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Appendix A. DUT Ant. Information & SETUP PHOTO

Please refer to test DUT Ant. Information & setup photo file no. as follows:

Report No.
HCT-SR-2512-FC002-P