N° 1-6736
Scope available
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CERTIFICATE #3478.01

TEST REPORT

EUT Description	**WWAN module installed on Notebook PC**
Brand Name	**HP**
Model Name	**HSN-I50C**
FCC/IC ID	**FCC: B94HNI50CKL; IC: 21374-FM350GL**
Date of Test Start/End	**2022-11-25 / 2022-11-29**
Features	**WWAN (5G, LTE, UMTS), WLAN, BT** (see section 5)
Description	**Platform: HP HSN-I50C + Vendor 1 / Vendor 2 antennas**

Applicant	**HP Inc.**
Address (FCC)	**1501 Page Mill Road, Palo Alto CA 94304 USA**
Contact Person	**Sam Lin**
Telephone/Fax/ Email	**+886 237896331 / sam.lin2@hp.com**

Reference Standards	**FCC 47 CFR Part §2.1093** **RSS-102, issue 5** (see section 1)	
RF Exposure Environment	**Portable devices - General population/uncontrolled exposure**	
	SAR Result	SAR Limit
Maximum SAR Result & Limit	**1.12 W/kg (1g)**	**1.6 W/kg (1g)**
Min. test separation distance	**0mm to phantom, 9.4mm to antenna edge**	

Test Report identification	**221118-03.TR01**
Revision Control	**Rev. 01** **This test report revision replaces any previous test report revision** (see section 8)

The test results relate only to the samples tested.
Reference to accreditation shall be used only by full reproduction of test report.

Issued by	Reviewed by
Digitally signed by Edgar GARCIA Date: 2022.12.07 11:16:55 +01'00'	Digitally signed by Adel LOUNES Date: 2022.12.07 18:21:33 +01'00'
Edgar Garcia (SAR Engineer)	Adel LOUNES (Test Lead Engineer)

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Table of Contents

1. Standards, reference documents and applicable test methods

FCC	1. FCC Title 47 CFR Part §2.1093 – Radiofrequency radiation exposure evaluation: portable devices. 2020-10-01 Edition 2. FCC OET KDB 447498 D04 v01 General RF Exposure Guidance v01– RF Exposure Procedures and Equipment Authorization Policies for Mobile and Portable Devices. 3. FCC OET KDB 616217 D04 v01r02 – SAR Evaluation Considerations for Laptop, Notebook, Netbook and Tablet Computers. 4. FCC OET KDB 865664 D01 v01r04 – SAR Measurement Requirements for 100 MHz to 6 GHz. 5. FCC OET KDB 865664 D02 v01r02 – RF Exposure Compliance Reporting and Documentation Considerations. 6. FCC OET KDB 941225 D05 v02r05 – SAR Evaluation Considerations for LTE Devices. 7. FCC OET KDB 941225 D01 v03r01 – 3G SAR Measurement Procedures. 8. IEEE Std 1528-2013 – IEEE Recommended Practice Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communication Devices: Measurement Techniques… 9. TCB workshop November 2017; RF Exposure Procedures (LTE UL/DL Carrier Aggregation SAR) 10. TCB workshop October 2018; RF Exposure Procedures (LTE Inter-Band Uplink Carrier Aggregation –Interim Procedures) 11. TCB workshop November 2019; RF Exposure Policy Updates (5G NR FR1 NSA EN-DC UE SAR Evaluations) 12. TCB workshop November 2019; 5G NR/ EN-DC Compliance Test Configurations
ISED	1. ISED RSS 102, Issue 5 – Radio Frequency (RF) Exposure Compliance of Radio communication Apparatus (All Frequency Bands 2. ISED RSS-102 Supplementary Procedures SPR-001 SAR testing requirements with regard to bystanders for laptop type computers with antennas built-In on display screen (Laptop Mode / Tablet Mode) 3. ISED Notice 2020-DRS2020 Applicability of IEC/IEEE62209-1528 and IEC 62209 -3 standard 4. ISED Notice 2016-DRS001 – Applicability of latest FCC RF Exposure KDB Procedures and Other Procedures. 5. ISED Notice 2012-DRS0529 – SAR correction for measured conductivity and relative permittivity based on IEC 62209-2 standard. 6. FCC OET KDB KDB 447498 D01 V06 General RF Exposure Guidance – RF Exposure Procedures and Equipment Authorization Policies for Mobile and Portable Devices. 7. FCC OET KDB 616217 D04 v01r02 – SAR Evaluation Considerations for Laptop, Notebook, Netbook and Tablet Computers. 8. FCC OET KDB 865664 D01 v01r04 – SAR Measurement Requirements for 100 MHz to 6 GHz. 9. FCC OET KDB 865664 D02 v01r02 – RF Exposure Compliance Reporting and Documentation Considerations. 10. FCC OET KDB 941225 D05 v02r05 – SAR Evaluation Considerations for LTE Devices. 11. FCC OET KDB 941225 D01 v03r01 – 3G SAR Measurement Procedures. 12. IEC/IEEE 62209-1528:2020 Measurement procedure for the assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices – Part 1528: Human models, instrumentation, and procedures (Frequency range of 4 MHz to 10 GHz)

2. General conditions, competences and guarantees

- ✓ Tests performed under FCC standards identified in section 1 are covered by A2LA accreditation.
- ✓ Tests performed under ISED standards identified in section 1 are covered by Cofrac accreditation.
- ✓ Intel Corporation SAS Wireless RF Lab (Intel WRF Lab) is an ISO/IEC 17025:2017 laboratory accredited by the American Association for Laboratory Accreditation (A2LA) with the certificate number 3478.01.
- ✓ Intel Corporation SAS Wireless RF Lab (Intel WRF Lab) is an Accredited Test Firm recognized by the FCC, with Designation Number FR0011.
- ✓ Intel Corporation SAS Wireless RF Lab (Intel WRF Lab) is an ISO/IEC 17025:2017 testing laboratory accredited by the French Committee for Accreditation (Cofrac) with the certificate number 1-6736.
- ✓ Intel Corporation SAS Wireless RF Lab (Intel WRF Lab) is a Registered Test Site listed by ISED, with ISED #1000Y.
- ✓ Intel WRF Lab only provides testing services and is committed to providing reliable, unbiased test results and interpretations.
- ✓ Intel WRF Lab is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.
- ✓ Intel WRF Lab has developed calibration and proficiency programs for its measurement equipment to ensure correlated and reliable results to its customers.
- ✓ This report is only referred to the item that has undergone the test.
- ✓ This report does not imply an approval of the product by the Certification Bodies or competent Authorities.

3. Environmental Conditions

✓ At the site where the measurements were performed the following limits were not exceeded during the tests:

Temperature	21.5ºC ± 0.5ºC
Humidity	38% ± 3%
Liquid Temperature	21.5ºC ± 0.2ºC

4. Test samples

Sample	Control #	Description	Model	Serial #	Date of receipt	Antenna
#01	211027-02.S01	WWAN module installed on Notebook PC	HSN-I50C	0001760GQZ	2021-11-21	Vendor 1
#02	211027-02.S06	WWAN module installed on Notebook PC	HSN-I50C	0001760GQ0	2021-11-21	Vendor 2

5. EUT Features

The herein information is provided by the customer
Intel WRF Lab declines any responsibility for the accuracy of the stated customer provided information, especially if it has any impact on the correctness of test results presented in this report.

Brand Name	HP
Model Name	HSN-I50C
Prototype / Production	Production
Exposure Conditions	Body worn

Supported radios

The applicable frequency bands and operating modes are identified in the following table.

WWAN:

Mode	Bands	Supported Tx Mode			
		RMC	HSDPA	HSUPA	DC-HSDPA
WCDMA	FDD II (1850.0 – 1910.0 MHz)	✓	✓	✓	✓
	FDD IV (1710.0 – 1755.0 MHz)	✓	✓	✓	✓
	FDD V (824.0 – 849.0 MHz)	✓	✓	✓	✓

FDD/TDD	Bands	Modulations	Bandwidth					
			1.4	3	5	10	15	20
LTE FDD	Band 2 (1850.0 – 1910.0 MHz)	QPSK/16QAM/64QAM/256QAM	✓	✓	✓	✓	✓	✓
	Band 4 (1710.0 – 1755.0 MHz)	QPSK/16QAM/64QAM/256QAM	✓	✓	✓	✓	✓	✓
	Band 5 (824.0 – 849.0 MHz)	QPSK/16QAM/64QAM/256QAM	✓	✓	✓	✓		
	Band 7 (2500.0 – 2570.0 MHz)	QPSK/16QAM/64QAM/256QAM			✓	✓	✓	✓
	Band 12 (699.0 – 716.0 MHz)	QPSK/16QAM/64QAM/256QAM	✓	✓	✓	✓		
	Band 13 (777.0 – 787.0 MHz)	QPSK/16QAM/64QAM/256QAM			✓	✓		
	Band 14 (788.0 – 798.0 MHz)	QPSK/16QAM/64QAM/256QAM			✓	✓		
	Band 17 (704.0 – 716.0 MHz)	QPSK/16QAM/64QAM/256QAM			✓	✓		
	Band 25 (1850.0 – 1915.0 MHz)	QPSK/16QAM/64QAM/256QAM	✓	✓	✓	✓	✓	✓
	Band 26 (814.0 – 849.0 MHz)	QPSK/16QAM/64QAM/256QAM	✓	✓	✓	✓	✓	
	Band 30 (2305.0 – 2315.0 MHz)	QPSK/16QAM/64QAM/256QAM			✓	✓		
	Band 66 (1710.0 – 1780.0 MHz)	QPSK/16QAM/64QAM/256QAM	✓	✓	✓	✓	✓	✓
	Band 71 (663.0 – 698.0 MHz)	QPSK/16QAM/64QAM/256QAM			✓	✓	✓	✓
LTE TDD	Band 38 (2570.0 – 2620.0 MHz)	QPSK/16QAM/64QAM/256QAM			✓	✓	✓	✓
	Band 41 (2496.0 – 2690.0 MHz)	QPSK/16QAM/64QAM/256QAM			✓	✓	✓	✓
	Band 48 (3550.0 – 3700.0 MHz)	QPSK/16QAM/64QAM/256QAM			✓	✓	✓	✓

Bands	Modulation	SCS (KHz)	Bandwidth												
			5	10	15	20	25	30	40	50	60	70	80	90	100
N2 FDD (1850.0 – 1910.0 MHz)	PI/2 BPSK QPSK 16QAM 64QAM 256QAM	15 30	✓	✓ ✓	✓ ✓	✓ ✓									
N5 FDD (824.0 – 849.0 MHz)	PV2 BPSK QPSK 16QAM 64QAM 256QAM	15 30 60	✓	✓ ✓	✓ ✓	✓ ✓									
N7 FDD (2500.0 – 2570.0 MHz)	PV2 BPSK QPSK 16QAM 64QAM 256QAM	15 30	✓	✓ ✓	✓ ✓	✓ ✓									
N25 FDD (1850.0 – 1915 MHz)	PV2 BPSK QPSK 16QAM 64QAM 256QAM	15 30	✓	✓ ✓	✓ ✓	✓ ✓									
N30 FDD (2305.0 – 2315.0 MHz)	PV2 BPSK QPSK 16QAM 64QAM 256QAM	15 30	✓	✓ ✓											
N38 TDD (2570.0 – 2620.0 MHz)	PV2 BPSK QPSK 16QAM 64QAM 256QAM	15 30 60	✓	✓ ✓ ✓	✓ ✓ ✓	✓ ✓ ✓									
N41 TDD (2496.0 – 2690.0 MHz)	PV2 BPSK QPSK 16QAM 64QAM 256QAM	15 30				✓ ✓			✓ ✓	✓ ✓	✓		✓	✓	✓
N66 FDD (1710.0 – 1780.0 MHz)	PV2 BPSK QPSK 16QAM 64QAM 256QAM	15 30	✓	✓ ✓	✓ ✓	✓ ✓			✓ ✓						
N71 FDD (663.0 – 698.0 MHz)	PV2 BPSK QPSK 16QAM 64QAM 256QAM	15 30	✓	✓ ✓	✓ ✓	✓ ✓									
N77 TDD* (3700.0 – 3980.0 MHz)	PV2 BPSK QPSK 16QAM 64QAM 256QAM	15 30		✓ ✓	✓ ✓	✓ ✓			✓ ✓	✓ ✓	✓		✓	✓	✓
N78 TDD** (3700.0 – 3800.0 MHz)	PV2 BPSK QPSK 16QAM 64QAM 256QAM	15 30		✓ ✓	✓ ✓	✓ ✓			✓ ✓	✓ ✓	✓		✓	✓	✓

*FCC limits 5G NR B77 to 3700-3980MHz

** FCC limits 5G NR B78 to 3700-3800MHz

UL carrier aggregation LTE (Inter-Band)	UL carrier aggregation LTE (Intra-band)
2A – 5A	5B
2A – 12A	7C
2A – 13A	38C
2A – 14A	41C
2A – 48A	48C
4A – 5A	66B
4A – 12A	66C
4A – 13A	
5A – 7A	
5A – 30A	
5A – 48A	
5A – 66A	
12A – 30A	
12A – 66A	
13A – 48A	
13A – 66A	
14A – 30A	
14A – 66A	
25A – 26A	
48A – 66A	

EN/DC possible combinations	
NR 5G Band	Associated LTE Bands
N2A	5, 12, 13, 14
N5A	2, 7, 30, 66, 48
N66A	5, 12, 13, 48
N41A	2,66,41
N77A	2,5,12,13,14, 30,66, 41
N78A	2, 5, 7, 38

UL carrier aggregation 5G FR1
n2A – n5A
n5A – n66A

WLAN

Mode	UL Freq Range
802.11b/g/n/ax	2.4GHz (2400.0 – 2483.5 MHz)
802.11a/n/ac/ax	5.2GHz (5150.0 – 5250.0 MHz) 5.3GHz (5250.0 – 5350.0 MHz) 5.6GHz (5470.0 – 5725.0 MHz) 5.8GHz (5725.0 – 5850.0 MHz) 5.8GHz (5725.0 – 5875.0 MHz)
802.11ax	6.0GHz (5925.0 – 7250.0 MHz)
Bluetooth v5.2 & BLE	2.4GHz (2400.0 – 2483.5 MHz)

Antenna Information & Mapping

Antenna Information "information provided by the applicant"

The DUT has 2 WWAN TX antenna:

Transmitter	Ant 5 (TX/RX)	Ant 8 (TX/RX)
Manufacturer	Vendor 1	
Antenna type	PIFA antenna	PIFA antenna
Part number	6036B0303501 (81EABL15.G31)	6036B0302501 (81EABL15.G34)

Transmitter	Ant 5 (TX/RX)	Ant 8 (TX/RX)
Manufacturer	Vendor 2	
Antenna type	PIFA antenna	PIFA antenna
Part number	6036B0305001 (00-2602748450)	6036B0304701 (00-2602748750)

See Annex F for more details on antennas location.

WWAN Antenna Mapping

Configuration	Ant 5 (TX/RX)	Ant 8 (TX/RX)
WCDMA	LB / MHB	
LTE	LB / MHB	
		UHB
NR 5G SA	(LB / MHB)	
		UHB
LTE ULCA	LB	MHB /UHB
	MHB	UHB
	B41	UHB
NR 5G ENDC	LB	MHB / B41
	B41	N41
	MHB	B41/N41
	B41/N41	UHB
	MHB	UHB
NR 5G ULCA	LB	MHB

Note: For EN-DC mode the 4G and 5G carriers transmit on separate/same antennas.
For inter-bands on LTE and NR 5G ULCA the carriers transmit on separate/same antennas.

Simultaneous Transmission Configurations

WWAN Main + WWAN Aux+ WLAN 2.4GHz Main + BT Aux
WWAN Main + WWAN Aux + WLAN 2.4GHz Main + WLAN 2.4GHz Aux
WWAN Main + WWAN Aux + WLAN 5GHz Main + BT Aux
WWAN Main + WWAN Aux + WLAN 5GHz Main + WLAN 5GHz Aux
WWAN Main + WWAN Aux + WLAN 5GHz Main + WLAN 5GHz Aux + BT Aux

WLAN transmitter is considered in this report just for the simultaneous transmission evaluation with the WWAN module (See section B.5.4)

Additional information

- 5.60-5.65 GHz band (TDWR) is supported by the device
- Band gap is supported by the device
- Two different power settings are implemented in the DUT:
    - Max power for Notebook mode
    - Reduced power for Tablet mode
- The DUT does not support VoLTE, so Head Exposure is not considered for LTE and WCDMA modes. Maximum Power Reduction (MPR) is implemented according to 3GPP, and it is a permanent feature, built-in by design on the tune-up power:

Modulation	Channel bandwidth / #RB						MPR (Db)
	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	
QPSK	> 5	> 4	> 8	> 12	> 16	> 18	≤ 1
16 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 1
16 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 2
64 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≥18	≤ 2
64 QAM	> 5	> 4	> 8	> 12	>16	>18	≤ 3
256 QAM	≥1						≤ 5

- According to 3GPP 38-101-1, the UE is allowed to reduce the maximum output power due to higher order modulations and for channel bandwidths that meets both following criteria:
    - Channel bandwidth ≤ 100MHz.
    - Relative channel bandwidth ≤ 4% for TDD bands and ≤ 3% for FDD bands

Maximum power reduction (MPR) for power class 3			
Modulation	MPR (Db)		
	Edge RB allocations	Outer RB allocations	Inner RB allocations
DFT-s-OFDM PI/2 BPSK	≤ 3.5[1]	≤ 1.2[1]	≤ 0.2[1]
	0.5[2]	0.5[2]	0[2]
DFT-s-OFDM QPSK	≤ 1		0
DFT-s-OFDM 16 QAM	≤ 2		≤ 1
DFT-s-OFDM 64 QAM	≤ 2.5		
DFT-s-OFDM 256 QAM	4.5		
CP-OFDM QPSK	≤ 3		≤ 1.5
CP-OFDM 16 QAM	≤ 3		≤ 2
CP-OFDM 64 QAM	≤ 3.5		
CP-OFDM 256 QAM	≤ 6.5		
NOTE 1: Applicable for UE operating in TDD mode with PI/2 PBSK modulation and if the IE [P-Boost-BPSK] is set to 1 and 40% or less slots in radio frame are used for UL transmission for bands n40, n77, n78 and n79. NOTE 2: Applicable for UE operating in FDD mode, or in TDD mode in bands other than n40, n77, n78 and n79 and if the IE [Pboost-BPSK] is set to 0 and if more than 40% of slots in radio frame are used for UL transmission for bands n40, n77, n78 and n79.			

Maximum power reduction (MPR) for power class 2			
Modulation	MPR (Db)		
	Edge RB allocations	Outer RB allocations	Inner RB allocations
DFT-s-OFDM PI/2 BPSK	≤ 3.5	≤ 0.5	0
DFT-s-OFDM QPSK	≤ 3.5	≤ 1	0
DFT-s-OFDM 16 QAM	≤ 3.5	≤ 2	≤ 1
DFT-s-OFDM 64 QAM	≤ 3.5	≤ 2.5	
DFT-s-OFDM 256 QAM	≤ 4.5		
CP-OFDM QPSK	≤ 3.5	≤ 3	≤ 1.5
CP-OFDM 16 QAM	≤ 3.5	≤ 3	≤ 2
CP-OFDM 64 QAM	≤ 3.5		
CP-OFDM 256 QAM	≤ 6.5		

The maximum power reduction is applicable on the Tune up tolerance.

The following table indicates the power levels and tolerance for Laptop mode:

Maximum Output power specification + Tune up tolerance

Mode	Tx Ant	Technology	Bands	Class	Nominal (dBm)	Tolerance dB	Lower Tolerance (dBm)	Upper Tolerance (dBm)
Laptop	5	WCDMA/HSPA	FDD II (1850.0 – 1910.0 MHz)	3	16.5	±1	15.5	17.5
	5	WCDMA/HSPA	FDD IV (1710.0 – 1755.0 MHz)	3	16.5	±1	15.5	17.5
	5	WCDMA/HSPA	FDD V (824.0 – 849.0 MHz)	3	20.5	±1	19.5	21.5
	5	LTE	B2 (1850.0 – 1910.0 MHz)	3	16.5	±1	15.5	17.5
	5	LTE	B4 (1710.0 – 1755.0 MHz)	3	16.5	±1	15.5	17.5
	5	LTE	B5 (824.0 – 849.0 MHz)	3	20.5	±1	19.5	21.5
	5	LTE	B7 (2500.0 – 2570.0 MHz)	3	15.0	±1	14.0	16.0
	5	LTE	B12 (699.0 – 716.0 MHz)	3	21.0	±1	20.0	22.0
	5	LTE	B13 (777.0 – 787.0 MHz)	3	21.0	±1	20.0	22.0
	5	LTE	B14 (788.0 – 798.0 MHz)	3	20.5	±1	19.5	21.5
	5	LTE	B17 (704.0 – 716.0 MHz)	3	21.0	±1	20.0	22.0
	5	LTE	B25 (1850.0 – 1915.0 MHz)	3	16.5	±1	15.5	17.5
	5	LTE	B26 (814.0 – 849.0 MHz)	3	20.5	±1	19.5	21.5
	5	LTE	B30 (2305.0 – 2315.0 MHz)	3	16.5	±1	15.5	17.5
	5	LTE	B38 (2570.0 – 2620.0 MHz)	3	15.0	±1	14.0	16.0
	5	LTE	B41 (2496.0 – 2690.0 MHz)	3	15.0	±1	14.0	16.0
	5	LTE	B41-HPUE (2496.0 – 2690.0 MHz)	2	15.0	±1	14.0	16.0
	5	LTE	B66 (1710.0 – 1780.0 MHz)	3	16.5	±1	15.5	17.5
	5	LTE	B71 (663.0 – 698.0 MHz)	3	22.0	±1	21.0	23.0
	8	LTE	B2 (1850.0 – 1910.0 MHz)	3	18.0	±1	17.0	19.0
	8	LTE	B4 (1710.0 – 1755.0 MHz)	3	18.5	±1	17.5	19.5
	8	LTE	B7 (2500.0 – 2570.0 MHz)	3	19.0	±1	18.0	20.0
	8	LTE	B25 (1850.0 – 1915.0 MHz)	3	18.0	±1	17.0	19.0
	8	LTE	B30 (2305.0 – 2315.0 MHz)	3	18.0	±1	17.0	19.0
	8	LTE	B41 (2496.0 – 2690.0 MHz)	3	19.5	±1	18.5	20.5
	8	LTE	B41-HPUE(2496.0 – 2690.0 MHz)	2	19.5	±1	18.5	20.5
	8	LTE	B48 (3550.0 – 3700.0 MHz)	3	16.5	±1	15.5	17.5
	8	LTE	B66 (1710.0 – 1780.0 MHz)	3	18.5	±1	17.5	19.5
	5	5G NR	N2 (1850.0 – 1910.0 MHz)	3	16.5	±1	15.5	17.5
	5	5G NR	N5 (824.0 – 849.0 MHz)	3	20.5	±1	19.5	21.5
	5	5G NR	N7 (2500.0 – 2570.0 MHz)	3	15.0	±1	14.0	16.0
	5	5G NR	N25 (1850.0 – 1915.0 MHz)	3	16.5	±1	15.5	17.5
	5	5G NR	N30 (2305.0 – 2315.0 MHz)	3	16.5	±1	15.5	17.5
	5	5G NR	N38 (2570.0 – 2620.0 MHz)	3	15.0	±1	14.0	16.0
	5	5G NR	N41 (2496.0 – 2690.0 MHz)	3	15.0	±1	14.0	16.0
	5	5G NR	N41-HPUE(2496.0 – 2690.0 MHz)	2	15.0	±1	14.0	16.0
	5	5G NR	N66 (1710.0 – 1780.0 MHz)	3	16.5	±1	15.5	17.5
	5	5G NR	N71 (663.0 – 698.0 MHz)	3	22.0	±1	21.0	23.0
	5	5G NR	N77 (3700.0 – 3980.0 MHz)	3	15.5	±1	14.5	16.5
	5	5G NR	N77-HPUE(3700.0 – 3980.0 MHz)	2	15.5	±1	14.5	16.5
	5	5G NR	N78 (3700.0 – 3800.0 MHz)	3	15.5	±1	14.5	16.5
	5	5G NR	N78-HPUE(3700.0 – 3800.0 MHz)	3	15.5	±1	14.5	16.5
	8	5G NR	N2 (1850.0 – 1910.0 MHz)	3	18.0	±1	17.0	19.0
	8	5G NR	N38 (2570.0 – 2620.0 MHz)	3	19.0	±1	18.0	20.0
	8	5G NR	N41 (2496.0 – 2690.0 MHz)	3	19.5	±1	18.5	20.5
	8	5G NR	N41-HPUE(2496.0 – 2690.0 MHz)	2	19.5	±1	18.5	20.5
	8	5G NR	N66 (1710.0 – 1780.0 MHz)	3	18.5	±1	17.5	19.5
	8	5G NR	N77 (3700.0 – 3980.0 MHz)	3	17.5	±1	16.5	18.5
	8	5G NR	N77-HPUE(3700.0 – 3980.0 MHz)	2	17.5	±1	16.5	18.5
	8	5G NR	N78 (3700.0 – 3800.0 MHz)	3	17.0	±1	16.0	18.0
	8	5G NR	N78-HPUE(3700.0 – 3800.0 MHz)	3	17.0	±1	16.0	18.0

6. Remarks and comments

1. Only the plots for the test positions with the highest measured SAR per band/mode are included in Annex C as required per FCC OET KDB 865664 D02, paragraph 2.3.h.
2. Maximum transmission power on modulations 64QAM and 256QAM for LTE and 5G NR, are lower than other modulations QPSK and 16QAM. Therefore, according to engineering evaluation, we choose higher power modulations to perform all tests shown in the report.
3. This report includes only the test of bands LTE 71 & NR71. For all other cellular bands and configurations supported by the WWAN module, please refer to reports:
   - 211027-02.TR03
   - 211027-02.TR04
   - 211027-02.TR08
   - 211027-02.TR09

7. Test Verdicts summary

The statement of conformity to applicable standards in the table below are based on the measured values, without taking into account the measurement uncertainties.

Mode	Band (UL)	Highest Reported SAR (1g) (W/kg)	Verdict
LTE FDD	Band 71 (663.0 – 698.0 MHz)	1.12	Pass
5G NR FR1 FDD	Band 71 (663.0 – 698.0 MHz)	1.12	Pass

According to the FCC OET KDB 690783 D01, this is the summary of the values for the Grant Listing:

Highest Reported SAR (1g) (W/kg)				
Exposure Condition	Equipment Class			
	PCE	DTS	DSS	U-NII
Body Worn	1.12	0.40	0.40	0.40
Simultaneous Tx	Sum-SAR:3.41 SPLSR: 0.01	Sum-SAR:3.01 SPLSR: 0.01	Sum-SAR:3.41 SPLSR: 0.01	Sum-SAR:3.41 SPLSR: 0.01

Considering the results of the performed test according to FCC 47CFR Part 2.1093 and ISED RSS 102, Issue 5 the item under test is IN COMPLIANCE with the requested specifications specified in Section1. Standards, reference documents and applicable test methods

8. Document Revision History

Revision #	Modified by	Revision Details
Rev. 00	E.Garcia	First Issue
Rev. 01	E.Garcia	Corrected report name

Annex A. Test & System Description

A.1 SAR Definition

Specific Absorption rate is defined as the time derivative of the incremental energy (dW) absorbed by (dissipated in) and incremental mass (dm) contained in a volume element (dV) of a given density (ρ).

$$SAR = \frac{d}{dt} \cdot \left(\frac{dW}{dm}\right) = \frac{d}{dt} \cdot \left(\frac{dW}{\rho \cdot dV}\right)$$

SAR is expressed in units of watts per kilogram (W/kg). SAR can be related to the electric field at a point by

$$SAR = \frac{\sigma |E|^2}{\rho}$$

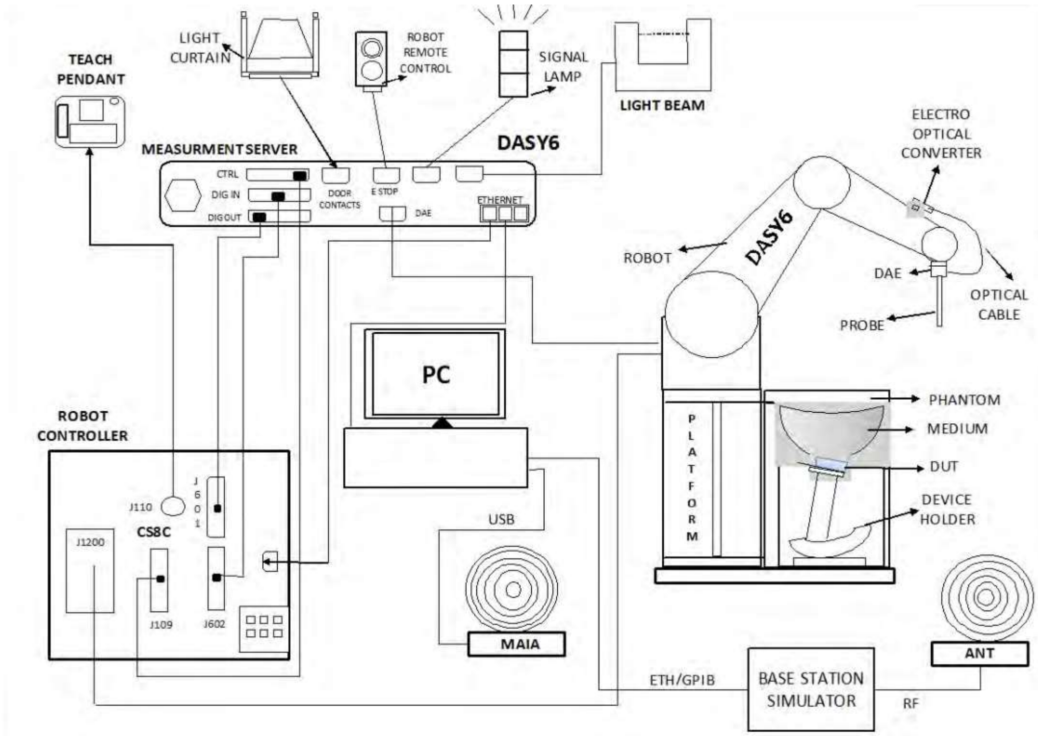
Where:

σ = Conductivity of the tissue (S/m)
ρ = Mass density of the tissue (kg/m3)
E = RMS electric field strength (V/m)

A.2 SAR Measurement System

A.2.1 SAR Measurement Setup

The DASY6 system for performing compliance tests consists of the following items:



- ✓ A standard high precision 6-axis robot (Staübli TX/RX family) with controller, teach pendant and software. It includes an arm extension for accommodating the data acquisition electronics (DAE)
- ✓ An isotropic field probe optimized and calibrated for the targeted measurements.
- ✓ A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- ✓ The Electro-optical Converter (EOC) performs the conversion from optical to electrical signals for the digital communication to the DAE. The EOC signal is transmitted to the measurement server.
- ✓ The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movements interrupts.
- ✓ The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.
- ✓ A computer running Win10 professional operating system and the DASY6 software.
- ✓ Remote control and teach pendant as well as additional circuitry for robot safety such as warning lamps, etc.
- ✓ The phantom, the device holder and other accessories according to the targeted measurement.
- ✓ MAIA is a hardware interface (Antenna) used to evaluate the modulation and audio interference characteristics of RF signals.
- ✓ ANT is an ultra-wideband antenna for use with the base station simulators over 698 MHz to 6GHz.
- ✓ The base station simulator is an equipment used for SAR cellular tests in order to emulate the cellular signals characteristics and behavior between a regular base station and the equipment under test.
- ✓ Tissue simulating liquid.
- ✓ System Validation dipoles.
- ✓ Network emulator.

A.2.2 E-Field Measurement Probe

The probe is constructed using three orthogonal dipole sensors arranged on an interlocking, triangular prism core. The probe has built-in shielding against static charges and is contained within a PEEK cylindrical enclosure material at the tip.

The probe's characteristics are:

Frequency Range	30MHz – 6GHz
Length	337 mm
Probe tip external diameter	2.5 mm
Typical distance between dipoles and the probe tip	1 mm
Axial Isotropy (in human-equivalent liquids)	±0.3 dB
Hemispherical Isotropy (in human-equivalent liquids)	±0.5 dB
Linearity	±0.2 dB
Maximum operating SAR	100 W/kg
Lower SAR detection threshold	0.001 W/kg

A.2.3 SAM Phantom

The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528 and IEC 62209-1. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by teaching three points with the robot.

The phantom's characteristics are:

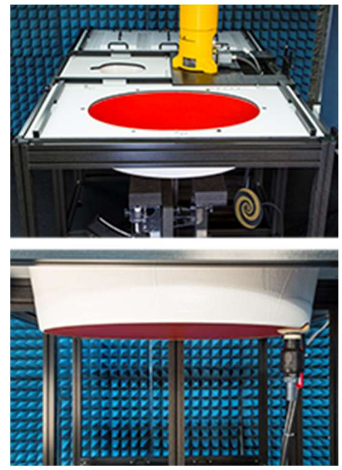
Material	Vinylester, glass fiber reinforced (VE-GF)
Shell thickness	2 mm ± 0.2 mm
Shell thickness at ERP	6 ± 0.2 mm
Filling volume	25 Liters
Dimensions	Length: 1000mm / Width: 500mm

A.2.4 Flat Phantom

Phantom for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI is fully compatible with the IEC 62209-2 standard and all known tissue simulating liquids. ELI has been optimized regarding its performance and can be integrated into our standard phantom tables. A cover prevents evaporation of the liquid. Reference markings on the phantom allow installation of the complete setup, including all predefined phantom positions and measurement grids, by teaching three points. The phantom is compatible with all SPEAG dosimetric probes and dipoles.

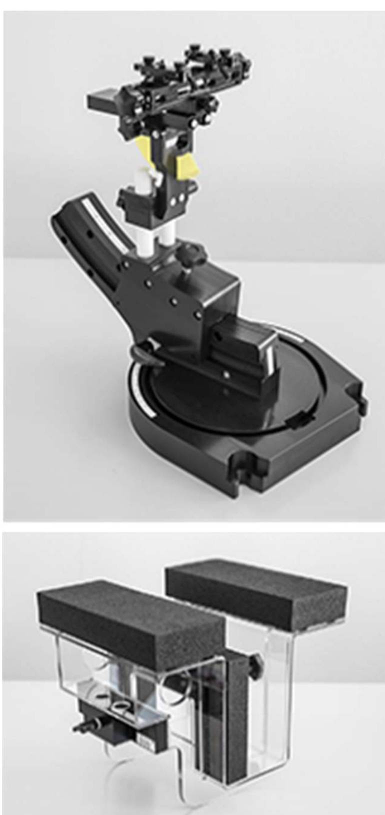
The phantom's characteristics are:

Material	Vinylester, glass fiber reinforced (VE-GF)
Shell thickness	2 mm ± 0.2 mm
Filling volume	30 Liters approx.
Dimensions	Major axis: 600mm / Minor axis: 400mm



A.2.5 Device Positioner

The SAR in the phantom is approximately inversely proportional to the square of the distance between the source and the liquid surface. For a source at 5 mm distance, a positioning uncertainty of 0.5 mm would produce a SAR uncertainty of 20%. Accurate device positioning is therefore crucial for accurate and repeatable measurements. The positions in which the devices must be measured are defined by the standards.



The DASY device holder is designed to cope with the different positions given in the standard. It has two scales for device rotation (with respect to the body axis) and device inclination (with respect to the line between the ear reference points). The rotation center for both scales is the ear reference point (ERP). Thus the device needs no repositioning when changing the angles.

The DASY device holder is constructed of low-loss POM material having the following dielectric parameters: relative permittivity ε=3 and loss tangent δ=0.02. The amount of dielectric material has been reduced in the closest vicinity of the device, since measurements have suggested that the influence of the clamp on the test results could thus be lowered.

A simple but effective and easy-to-use extension for the Mounting Device; facilitates testing of larger devices according to IEC 62209-2 (e.g., laptops, cameras, etc.); lightweight and fits easily on the upper part of the Mounting Device in place of the phone positioner. The extension is fully compatible with the Twin SAM, ELI and other Flat Phantoms.

A.3 Data Evaluation

- **Power Reference measurement**

The robot measures the E field in a specified reference position that can be either the selected section's grid reference point or a user point in this section at 4mm of the inner surface of the phantom, 2mm for frequencies above 3GHz.

- **Area Scan**

Measurement procedures for evaluating SAR from wireless handsets typically start with a coarse measurement grid to determine the approximate location of the local peak SAR values. This is known as the area-scan procedure. The SAR distribution is scanned along the inside surface of one side of the phantom head, at least for an area larger than the projection of the handset and antenna. The distance between the measured points and phantom surface should be less than 8 mm, and should remain constant (with variation less than ± 1 mm) during the entire scan in order to determine the locations of the local peak SAR with sufficient accuracy. The angle between the probe axis and the surface normal line is recommended but not required to be less than 30°. If this angle is larger than 30° and the closest point on the probe-tip housing to the phantom surface is closer than a probe diameter, the boundary effect may become larger and polarization dependent. This additional uncertainty needs to be analyzed and accounted for. To achieve this, modified test procedures and additional uncertainty analyses not described in this recommended practice may be required. The measurement and interpolation point spacing should be chosen such as to allow identification of the local peak locations to within one-half of the linear dimension of a side of the zoom-scan volume. Because a local peak having specific amplitude and steep gradients may produce a lower peak spatial-average SAR compared to peaks with slightly lower amplitude and less steep gradients, it is necessary to evaluate these other peaks as well. However, since the spatial gradients of local SAR peaks are a function of the wavelength inside the tissue-equivalent liquid and the incident magnetic field strength, it is not necessary to evaluate local peaks that are less than 2 dB or more below the global maximum peak. Two-dimensional spline algorithms (Brishoual et al. 2001; Press et al., 1996) are typically used to determine the peaks and gradients within the scanned area. If a peak is found at a distance from the scan border of less than one-half the edge dimension of the desired 1 g or 10 g cube, the measurement area should be enlarged if possible.

- **Zoom Scan**

To evaluate the peak spatial-average SAR values for 1 g or 10 g cubes, fine resolution volume scans, called zoom scans, are performed at the peak SAR locations identified during the area scan. The minimum zoom scan volume size should extend at least 1.5 times the edge dimension of a 1 g cube in all directions from the center of the scan volume, for both 1 g and 10 g peak spatial-average SAR evaluations. Along the phantom curved surfaces, the front face of the volume facing the tissue/liquid interface conforms to the curved boundary, to ensure that all SAR peaks are captured. The back face should be equally distorted to maintain the correct averaging mass. The flatness and orientation of the four side faces are unchanged from that of a cube whose orientation is within ± 30° of the line normal to the phantom at the center of the cube face next to the phantom surface. The peak local SAR locations that were determined in the area scan (interpolated values) should be used for the centers of the zoom scans. If a scan volume cannot be centered due to proximity of a phantom shape feature, the probe should be tilted to allow scan volume enlargement. If probe tilt is not feasible, the zoom-scan origin may be shifted, but not by more than half of the 1 g or 10 g cube edge dimension.

After the zoom-scan measurement, extrapolations from the closest measured points to the surface, for example along lines parallel to the zoom-scan centerline, and interpolations to a finer resolution between all measured and extrapolated points are performed. Extrapolation algorithm considerations are described in 6.5.3, and 3-D spline methods (Brishoual et al., 2001; Kreyszig, 1983; Press et al., 1996) can be used for interpolation. The peak spatial-average SAR is finally determined by a numerical averaging of the local SAR values in the interpolation grid, using for example a trapezoidal algorithm for the integration (averaging).

In some areas of the phantom, such as the jaw and upper head regions, the angle of the probe with respect to the line normal to the surface may be relatively large, e.g., greater than ± 30º, which could increase the boundary effect error to a larger level. In these cases, during the zoom scan a change in the orientation of the probe, the phantom, or both is recommended but not required for the duration of the zoom scan, so that the angle between the probe axis and the line normal to the surface is within 30º for all measurement points.

- **Power Drift measurement**

The robot re-measures the E-Field in the same reference location measured at the Power Reference. The drift measurement gives the field difference in dB from the first to the last reference reading. This allows a user to monitor the power drift of the device under test that must remain within a maximum variation of ±5%.

- **Post-processing**

The procedure for spatial peak SAR evaluation has been implemented according to the IEEE1528 and IEC 62209-1/2 standards. It can be conducted for 1g and 10g.

The software allows evaluations that combine measured data and robot positions, such as:

- ✓ Maximum search
- ✓ Extrapolation
- ✓ Boundary correction
- ✓ Peak search for averaged SAR

Interpolation between the measured points is performed when the resolution of the grid is not fine enough to compute the average SAR over a given mass.

Extrapolation routines are used to obtain SAR values between the lowest measurement points and the inner phantom surface. The extrapolation is determined by the surface detection distance and the probe sensor offset. Several measurements at different distances are necessary for the extrapolation.

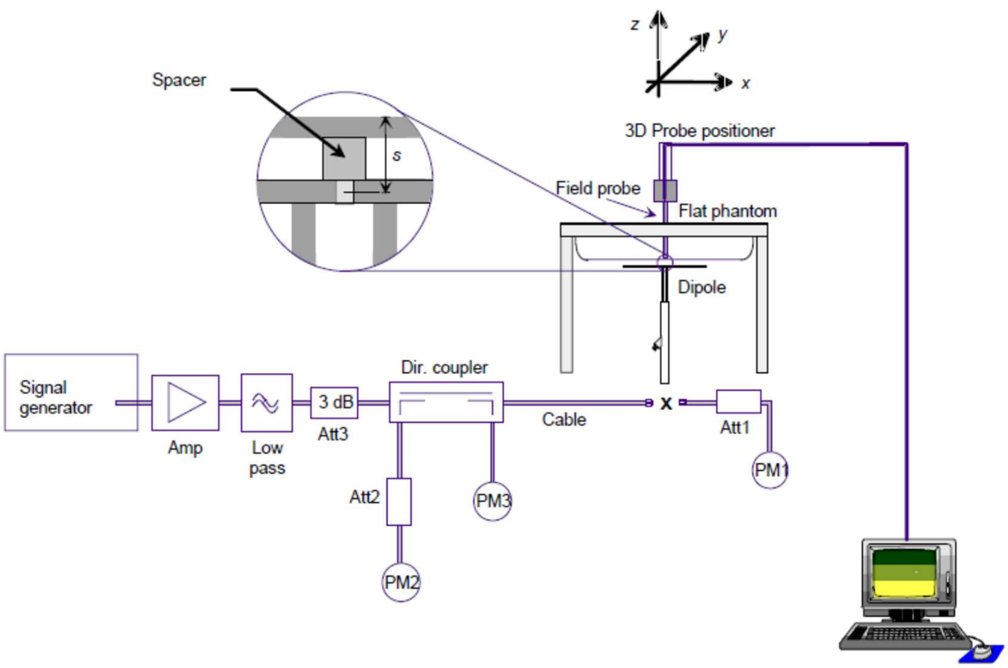
A.4 System and Liquid Check

A.4.1 System Check

The system performance check verifies that the system operates within its specifications. System and operator errors can be detected and corrected. It is recommended that the system performance check be performed prior to any usage of the system in order to guarantee reproducible results.

The system performance check uses normal SAR measurements in a simplified setup with a well characterized source. This setup was selected to give a high sensitivity to all parameters that might fail or vary over time. The system check does not intend to replace the calibration of the components, but indicates situations where the system uncertainty is exceeded due to drift or failure.

In the simplified setup for system check, the EUT is replaced by a calibrated dipole and the power source is replaced by a controlled continuous wave generated by a signal generator. The calibrated dipole must be placed beneath the flat phantom section of the phantom at the correct distance.



The equipment setup is shown below:

- ✓ Signal Generator
- ✓ Amplifier
- ✓ Directional coupler
- ✓ Power meter
- ✓ Calibrated dipole

First, the power meter PM1 (including attenuator Att1) is connected to the cable to measure the forward power at the location of the connector (x) to the system check source. The signal generator is adjusted for the desired forward power at the connector as read by power meter PM1 after attenuation Att1 and also as coupled through Att2 to PM2. After connecting the cable to the source, the signal generator is readjusted for the same reading at power meter PM2.

SAR results are normalized to a forward power of 1W to compare the values with the calibration reports results as described at IEEE 1528 and IEC 62209 standards.

A.4.2 Liquid Check

The dielectric parameters check is done prior to the use of the tissue simulating liquid. The verification is made by comparing the relative permittivity and conductivity to the values recommended by the applicable standards.

The liquid verification was performed using the following test setup:

- ✓ VNA (Vector Network Analyzer)
- ✓ Open-Short-Load calibration kit
- ✓ RF Cable
- ✓ Open-Ended Coaxial probe
- ✓ DAK software tool
- ✓ SAR Liquid
- ✓ De-ionized water
- ✓ Thermometer

These are the target dielectric properties of the tissue-equivalent liquid material as defined in FCC OET KDB 865664 D01.

Frequency	Body SAR	
(MHz)	ε_r (F/m)	σ (S/m)
150	61.9	0.80
300	58.2	0.92
450	56.7	0.94
835	55.2	0.97
900	55.0	1.05
1450	54.0	1.30
1800-2000	53.3	1.52
2450	52.7	1.95
3000	52.0	2.73
5800	48.2	6.00

(ε_r = relative permittivity, σ = conductivity and ρ = 1000 kg/m3)

The measurement system implement a SAR error compensation algorithm as documented in IEEE Std 1528-2013 (equivalent to draft standard IEEE P1528-2011) to automatically compensate the measured SAR results for deviations between the measured and required tissue dielectric parameters (applied to only scale up the measured SAR, and not downward) so, according to FCC OET KDB 865664 D01, the tolerance for ε_r and σ may be relaxed to ± 10%.

A.5 Test Equipment List

SAR system #1

ID #	Device	Type/Model	Serial Number	Manufacturer	Cal. Date	Cal. Due Date
001-000	6-Axis Robot	TX60 L	F12/5MZ3A1/A/01	STAÜBLI	NA	NA
001-002	Light Beam Unit	LB5/80	N/A	Di-soric	NA	NA
001-003	Laptop Holder	N/A	N/A	SPEAG	NA	NA
001-004	Robot Controller	CS8C	F12/5MZ3A1/C/01	STAÜBLI	NA	NA
001-005	Electro Optical Converter	EOC60	1076	SPEAG	NA	NA
003-007	Dosimetric E-field Probe	EX3DV4	7465	SPEAG	2022-07-11	2023-07-11
003-016	Data Acquisition Electronics	DAE	1705	SPEAG	2022-04-28	2023-04-28
001-008	Oval Flat Phantom	ELI V8.0	2059	SPEAG	NA	NA
001-009	Measurement Software	DASY6 V16.0	9-618AE2F1	SPEAG	NA	NA
001-010	MAIA Antenna	MAIA	1255	SPEAG	NA	NA
001-000	6-Axis Robot	TX60 L	F12/5MZ3A1/A/01	STAÜBLI	NA	NA

Shared equipment

ID #	Device	Type/Model	Serial Number	Manufacturer	Cal. Date	Cal. Due Date
123-000	USB Power Sensor	NRP-Z81	102278	R&S	2021-04-13	2023-04-13
124-000	USB Power Sensor	NRP-Z81	102279	R&S	2021-04-13	2023-04-13
099-000	Liquid measurement SW	DAK-3.5 V2.6.0.5	9-2687B491	SPEAG	NA	NA
369-000	Dielectric Probe Kit	DAK-3.5	1309	SPEAG	2021-03-10	2023-03-10
077-000	Coupler	CD0.5-8-20-30	1251-002	Amd-group	2022-08-26	2023-01-26
078-000	RF Cable	ST-18/SMAm/SMAm/48	-	Huber & Suhner	2022-08-26	2023-01-26
079-000	RF Cable	ST-18/SMAm/SMAm/48	-	Huber & Suhner	2022-08-26	2023-01-26
126-000	Vector Signal Generator	ESG E4438C	MY45092885	Agilent	2021-05-27	2023-05-27
327-000	Temp & Humidity Logger	RA32E-TH1-RAS	RA32-F0DED9	AVTECH	2021-03-09	2023-03-09
089-000	Vector Reflectometer R140	PLANAR R140	0190616	R&S	2021-09-02	2023-09-02
071-000	750 MHz System Validation Dipole	D750V3	1136	SPEAG	2021-01-21	2023-01-21
135-000	Network Emulator	CMW500	152721	R&S	2022-03-29	2024-03-29
023-000	5G Network Emulator	CMX500	101444	R&S	NA	NA

A.5.1 Tissue Simulant Liquid

TSL	Manufacturer / Model	Freq Range (MHz)	Main Ingredients
Body WideBand System	SPEAG MBBL600-6000V6 Batch 180206-04	600-6000	Ethanediol, Sodium petroleum sulfonate, Hexylene Glycol / 2-Methyl-pentane-2.4-diol, Alkoxylated alcohol

A.6 Measurement Uncertainty Evaluation

The system uncertainty evaluation is shown in the table below with a coverage factor of k = 2 to indicate a 95% level of confidence:

SPEAG DASY6 Uncertainty Budget According to IEC/IEEE 62209-1528 (4 MHz - 6 GHz) including IEEE 1528-2013 and IEC 62209-1/2016, IEC 62209-2/2010								
Symbol	Error Description	Uncert. Value	Prob Dist.	Div.	(ci) 1g	(ci) 10g	Std Unc. (1g)	Std Unc. (10g)
Measurement System Errors								
CF	*Probe Calibration*	±14.0 %	N	2	1	1	±7.0 %	±7.0 %
CF_{drift}	Probe Calibration Drift	±1.0 %	N	1	1	1	±1.0 %	±1.0 %
LIN	Probe Linearity	±4.7 %	R	√3	1	1	±2.7 %	±2.7 %
BBS	Broadband Signal	±3.0 %	N	2	1	1	±1.5 %	±1.5 %
ISO	*Axial Isotropy*	±4.7 %	R	√3	0.5	0.5	±1.4 %	±1.4 %
ISO	Hemispherical Isotropy	±9.6 %	R	√3	0.5	0.5	±2.8 %	±2.8 %
DAE	Data Acquisition	±0.3 %	N	1	1	1	±0.3 %	±0.3 %
AMB	RF Ambient	±1.8 %	N	1	1	1	±1.8 %	±1.8 %
Δ_{sys}	Probe Positioning	±0.2 %	N	1	0.33	0.33	±0.1 %	±0.1 %
DAT	Data Processing	±2.3 %	N	1	1	1	±2.3 %	±2.3 %
Phantom and Device Errors								
LIQ(σ)	Conductivity (meas.)$_{DAK}$	±2.5 %	N	1	0.78	0.71	±2.0 %	±1.8 %
LIQ(T_{σ})	Conductivity (temp.)$_{BB}$	±3.4 %	R	√3	0.78	0.71	±1.5 %	±1.4 %
EPS	Phantom Permittivity	±14.0 %	R	√3	0.25	0.25	±2.0 %	±2.0 %
DAS	Distance DUT - TSL	±2.0 %	N	1	2	2	±4.0 %	±4.0 %
H	Device Holder	±3.6 %	N	1	1	1	±3.6 %	±3.6 %
MOD	DUT Modulation$_m$	±2.4 %	R	√3	1	1	±1.4 %	±1.4 %
TAS	Time-average SAR	±2.6 %	R	√3	1	1	±1.5 %	±1.5 %
RF_{drift}	DUT drift	±5.0 %	N	1	1	1	±2.9 %	±2.9 %
Correction to the SAR results								
C(ε, σ)	Deviation to Target	±1.9 %	N	1	1	0.84	±1.9 %	±1.6 %
Combined Std. Uncertainty							±11.5 %	±11.4 %
Expanded STD Uncertainty							**±23.1 %**	**±22.9 %**

A.7 RF Exposure Limits

SAR assessments have been made in line with the requirements of FCC 47 CFR Part 2.1093 and ISED RSS 102 issue 5 on the limitation of exposure of the general population / uncontrolled exposure for portable devices.

Exposure Type	General Population / Uncontrolled Environment
Peak spatial-average SAR (averaged over any 1 gram of tissue)	**1.6 W/kg**
Whole body average SAR	**0.08 W/kg**
Peak spatial-average SAR (extremities) (averaged over any 10 grams of tissue)	**4.0 W/kg**

Annex B. Test Results

The herein test results were performed by:

Test case measurement	Test Personnel
Conducted measurement	F. Heurtematte
SAR measurement	E.Garcia

B.1 Test Conditions

B.1.1 Test SAR Test positions relative to the phantom

The device under test was a Notebook PC HSN-I50C using a set PIFA antennas. The device was operated utilizing proprietary software, and each channel was measured using a communication tester to determine the maximum average power.

The device has 1 power setting:

- Laptop mode

See section 5 for details about power values for the configuration
See Annex F.3 for information about the platform antenna configuration

Laptop mode
According to FCC OET KDB 616217 D04, laptop position should be tested for SAR compliance with the display screen opened at an angle of 90° to the keyboard compartment and the notebook bottom surface must be touching the phantom.

Notebook	WWAN Main
Position	Laptop

See B.1.2 for a more detailed list of the applied reductions.

See F.2 Test positions section for more information on the tested positions.

B.1.2 Evaluation Exclusion and Test Reductions

B.1.2.1 SAR evaluation exclusion

For FCC:

The SAR Test Exclusion Threshold in FCC OET KDB 447498 can be applied to determine SAR test exclusion for adjacent edge configurations. For 100MHz to 6GHz and test separation distances ≤50mm, the 1-g and 10-g SAR test exclusion thresholds are determined by the following formula:

$$[(\text{max. power of channel, including tune} - \text{up tolerance, mW})/(\text{min. test separation distance, mm})] \cdot \left[\sqrt{f_{(GHz)}}\right] \leq 3.0\ for\ 1g\ SAR, and \leq 7.5\ for\ 10g\ extremity\ SAR \quad (1)$$

Where:

- f(GHz) is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison
- The values 3.0 and 7.5 are referred to as numeric thresholds

The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm, and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.

For test separation distances > 50 mm, the 1-g and 10-g SAR test exclusion thresholds are determined using the following formulas:

$$\langle(Power\ allowed\ at\ numeric\ threshold\ for\ 50\ mm\ in\ (1)) + (test\ separation\ distance - 50\ mm) \cdot (f_{MHz}/150)\rangle mW, \quad for\ 100MHz\ to\ 1500MHz \quad (2)$$

$$\langle(Power\ allowed\ at\ numeric\ threshold\ for\ 50\ mm\ in\ (1)) + (test\ separation\ distance - 50\ mm) \cdot 10)\rangle mW, \quad for\ 1500MHz\ and\ \leq 6GHz \quad (3)$$

For ISED:

According to RSS-102 section 2.5.1, SAR evaluation is required if the separation distance between the user and/or bystander and the antenna and/or radiating element of the device is less than or equal to 20 cm, except when the device operates at or below the applicable output power level (adjusted for tune-up tolerance) for the specified separation distance defined in Table below:

SAR evaluation — Exemption limits for routine evaluation based on frequency and separation distance					
Frequency	**Exemption Limits (mW)**				
(MHz)	**At separation distance of ≤5 mm**	**At separation distance of 10 mm**	**At separation distance of 15 mm**	**At separation distance of 20 mm**	**At separation distance of 25 mm**
≤300	71 mW	101 mW	132 mW	162 mW	193 mW
450	52 mW	70 mW	88 mW	106 mW	123 mW
835	17 mW	30 mW	42 mW	55 mW	67 mW
1900	7 mW	10 mW	18 mW	34 mW	60 mW
2450	4 mW	7 mW	15 mW	30 mW	52 mW
3500	2 mW	6 mW	16 mW	32 mW	55 mW
5800	1 mW	6 mW	15 mW	27 mW	41 mW
Frequency	**Exemption Limits (mW)**				
(MHz)	**At separation distance of 30 mm**	**At separation distance of 35 mm**	**At separation distance of 40 mm**	**At separation distance of 45 mm**	**At separation distance of ≥50 mm**
≤300	223 mW	254 mW	284 mW	315 mW	345 mW
450	141 mW	159 mW	177 mW	195 mW	213 mW
835	80 mW	92 mW	105 mW	117 mW	130 mW
1900	99 mW	153 mW	225 mW	316 mW	431 mW
2450	83 mW	123 mW	173 mW	235 mW	309 mW
3500	86 mW	124 mW	170 mW	225 mW	290 mW
5800	56 mW	71 mW	85 mW	97 mW	106 mW

Test Exclusion

Antenna	Band Name	Output power		Separation distance to the body on mm	Position Laptop
		dBm	**mW**		
WWAN Ant5	LTE 71	23.00	199.52	<50	T
	NR 71	23.00	199.52	<50	T

T: Tested position
R: Reduced

See Annex F for a more detailed explanation of the separation distance related to the platform.

B.1.2.2 General SAR test reduction

According to FCC OET KDB 447498, testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid-band or highest output power channel is:

- ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz
- ≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz
- ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz

WLAN SAR Test reduction

Transmission Mode	SAR test exclusion/reduction
DSSS	According to FCC OET KDB 248227 D01, SAR is measured for 2.4 GHz 802.11b, SAR test reduction is determined according to the following: ▪ When the reported SAR of the highest measured maximum output power channel for the exposure configuration is ≤ 0.8 W/kg, no further SAR testing is required for 802.11b DSSS in that exposure configuration. ▪ When the reported SAR is > 0.8 W/kg, SAR is required for that exposure configuration using the next highest measured output power channel. When any reported SAR is > 1.2 W/kg, SAR is required for the third channel. According to FCC OET KDB 248227 D01, SAR is not required for 2.4 GHz OFDM conditions when the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg.
OFDM	According to FCC OET KDB 248227 D01, 802.11a/g/n/ac modes have the same specified maximum output power, largest channel bandwidth, lowest order modulation and lowest data rate, the lowest order 802.11 mode is selected; i.e., 802.11a is chosen over 802.11n then 802.11ac or 802.11g is chosen over 802.11n. According to FCC OET KDB 248227 D01, an *initial test configuration* is determined for OFDM and DSSS transmission modes according to the channel bandwidth, modulation and data rate combination(s) with the highest maximum output power specified for production units in each standalone and aggregated frequency band. SAR is measured using the highest measured maximum output power channel. SAR test reduction for subsequent highest output test channels is determined according to reported SAR of the initial test configuration. The *initial test configuration* for 5 GHz OFDM transmission modes is determined by the 802.11 configuration with the highest maximum output power specified for production units, including tune-up tolerance, in each standalone and aggregated frequency band. SAR for the initial test configuration is measured using the highest maximum output power channel determined by the default power measurement procedures. According to FCC OET KDB 248227 D01, when the reported SAR of the initial test configuration is > 0.8 W/kg, SAR measurement is required for subsequent next highest measured output power channel(s) in the initial test configuration until reported SAR is ≤ 1.2 W/kg or all required channels are tested.

WWAN SAR Test reduction

Transmission Mode	SAR test exclusion/reduction
HSDPA	According to FCC OET KDB 941225 D01, SAR evaluation is not required when the maximum average output power is < ¼ dB higher than the measured on the corresponding channels without HSDPA, using 12.2kbps RMC, and the maximum SAR for 12.2kbps RMC is < 1.2 W/kg.
HSUPA DC+HSDPA HSPA+	According to FCC OET KDB 941225 D01, SAR evaluation is not required when the maximum average output power is < ¼ dB higher than the measured on the corresponding channels without HSUPA, using 12.2kbps RMC, and the maximum SAR for 12.2kbps RMC is < 1.2 W/kg.
LTE	According to FCC OET KDB 941225 D05, testing of 100% RB allocation, higher order modulations or lower BW is not required when these conditions are met: o For QPSK with 100% RB allocation, SAR is not required when the highest maximum output power for 100 % RB allocation is less than the highest maximum output power in 50% and 1 RB allocations and the highest reported SAR for 1 RB and 50% RB allocation are ≤ 0.8 W/kg. o For each modulation besides QPSK, SAR is required only when the highest maximum output power for the configuration in the higher order modulation is > ½ dB higher than the same configuration in QPSK or when the reported SAR for the QPSK configuration is > 1.45 W/kg. o For lower BW, only measure SAR when the highest maximum output power of a configuration requiring testing in the smaller channel bandwidth is > ½ dB higher than the equivalent channel configurations in the largest channel bandwidth configuration or the reported SAR of a configuration for the largest channel bandwidth is > 1.45 W/kg. For LTE bands that do not support at least three non-overlapping channels in certain channel bandwidths, test the available non-overlapping channels instead. When a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing; therefore, the requirement for H, M, and L channels may not fully apply The conducted power for the higher order modulations i.e 64 QAM and 256 QAM has not been measured since the applicable MPR is respectively 2dB and 5dB.
5G NR	According to TCB workshop November 2019; RF Exposure Policy Updates (5G NR FR1 NSA EN-DC UE SAR Evaluations), the FCC OET KDB 941225 D05 rules apply.

B.2 Conducted Power Measurements – Notebook mode

B.2.1 LTE

B.2.1.1 LTE Band 71 FDD

Band	BW	Channel #	Freq (MHz)	% RB Allocation	RB Position	QPSK			16 QAM		
						Factory Upper Tolerance (dBm)	MPR	Measured Output Power (dBm)	Factory Upper Tolerance (dBm)	MPR	Measured Output Power (dBm)
LTE71	20 MHz	133297	680.5	1RB Low	1 Pos 0	23.00	0	21.85	23.00	1	21.36
				1RB Mid	1 Pos 50	23.00	0	21.91	23.00	1	19.86
				1RB High	1 Pos 99	23.00	0	21.86	23.00	1	19.79
				50% RB Low	50 Pos 0	23.00	1	20.83	23.00	2	21.34
				50% RB Mid	50 Pos 24	23.00	1	20.88	23.00	2	19.91
				50% RB High	50 Pos 50	23.00	1	20.90	23.00	2	19.97
				100% RB	100 Pos 0	23.00	1	20.91	23.00	2	21.38
	15 MHz	133297	680.5	1RB Low	1 Pos 0	23.00	0	21.79	23.00	1	20.78
				1RB Mid	1 Pos 50	23.00	0	20.80	23.00	1	19.85
				1RB High	1 Pos 99	23.00	0	20.82	23.00	1	19.85
				50% RB Low	50 Pos 0	23.00	1	21.92	23.00	2	21.35
				50% RB Mid	50 Pos 24	23.00	1	20.87	23.00	2	19.87
				50% RB High	50 Pos 50	23.00	1	20.88	23.00	2	19.84
				100% RB	100 Pos 0	23.00	1	21.94	23.00	2	21.24
	10 MHz	133172	668	1RB Low	1 Pos 0	23.00	0	21.81	23.00	1	20.81
				1RB Mid	1 Pos 50	23.00	0	21.86	23.00	1	20.83
				1RB High	1 Pos 99	23.00	0	21.85	23.00	1	20.86
				50% RB Low	50 Pos 0	23.00	1	20.86	23.00	2	19.88
				50% RB Mid	50 Pos 24	23.00	1	20.85	23.00	2	19.90
				50% RB High	50 Pos 50	23.00	1	20.92	23.00	2	19.97
				100% RB	100 Pos 0	23.00	1	20.89	23.00	2	19.86
		133297	680.5	1RB Low	1 Pos 0	23.00	0	21.82	23.00	1	20.83
				1RB Mid	1 Pos 38	23.00	0	21.93	23.00	1	20.91
				1RB High	1 Pos 74	23.00	0	21.83	23.00	1	20.82
				50% RB Low	38 Pos 0	23.00	1	20.96	23.00	2	20.00
				50% RB Mid	38 Pos 19	23.00	1	20.89	23.00	2	19.94
				50% RB High	38 Pos 39	23.00	1	20.90	23.00	2	19.92
				100% RB	75 Pos 0	23.00	1	20.93	23.00	2	19.93
		133422	693	1RB Low	1 Pos 0	23.00	0	21.83	23.00	1	20.92
				1RB Mid	1 Pos 38	23.00	0	21.90	23.00	1	20.97
				1RB High	1 Pos 74	23.00	0	21.87	23.00	1	20.94
				50% RB Low	38 Pos 0	23.00	1	20.91	23.00	2	20.00
				50% RB Mid	38 Pos 19	23.00	1	20.93	23.00	2	20.04
				50% RB High	38 Pos 39	23.00	1	20.92	23.00	2	20.01
				100% RB	75 Pos 0	23.00	1	20.94	23.00	2	19.94
	5 MHz	133147	665.5	1RB Low	1 Pos 0	23.00	0	21.88	23.00	1	21.34
				1RB Mid	1 Pos 24	23.00	0	21.92	23.00	1	21.36
				1RB High	1 Pos 49	23.00	0	21.93	23.00	1	21.35
				50% RB Low	25 Pos 0	23.00	1	20.84	23.00	2	19.91
				50% RB Mid	25 Pos 12	23.00	1	20.86	23.00	2	19.95
				50% RB High	25 Pos 24	23.00	1	20.83	23.00	2	19.94
				100% RB	50 Pos 0	23.00	1	20.85	23.00	2	19.91
		133297	680.5	1RB Low	1 Pos 0	23.00	0	22.05	23.00	1	21.17
				1RB Mid	1 Pos 24	23.00	0	22.04	23.00	1	21.15
				1RB High	1 Pos 49	23.00	0	21.98	23.00	1	21.12
				50% RB Low	25 Pos 0	23.00	1	20.98	23.00	2	20.02
				50% RB Mid	25 Pos 12	23.00	1	20.95	23.00	2	20.00
				50% RB High	25 Pos 24	23.00	1	20.92	23.00	2	19.96
				100% RB	50 Pos 0	23.00	1	20.94	23.00	2	19.96
		133447	695.5	1RB Low	1 Pos 0	23.00	0	21.97	23.00	1	21.07
				1RB Mid	1 Pos 24	23.00	0	21.98	23.00	1	21.06
				1RB High	1 Pos 49	23.00	0	21.98	23.00	1	21.06
				50% RB Low	25 Pos 0	23.00	1	20.93	23.00	2	19.97
				50% RB Mid	25 Pos 12	23.00	1	20.93	23.00	2	19.95
				50% RB High	25 Pos 24	23.00	1	20.91	23.00	2	19.90
				100% RB	50 Pos 0	23.00	1	20.96	23.00	2	19.90

B.2.2 5G NR (FR1)

B.2.2.1 5G NR (FR1) Band 71 FDD Antenna 5

Band	BW	Modulation	Mode	RB Allocation	RB Offset	Factory upper tolerance (dBm)	Measured Output Power (dBm)		
							Frequency (MHz) / Channel		
							673.0	680.5	688.0
							134600	136100	137600
NR71	20	DFS-s OFDM	PI/2 BPSK	1RB Low	0	23.00		22.71	
			QPSK	1RB Low	0	23.00		22.79	
				1RB Mid	50	23.00		22.94	
				1RB High	99	23.00		22.54	
				50% RB Low	0	23.00		22.96	
				50% RB Mid	25	23.00		22.90	
				50% RB High	49	23.00		22.82	
				100% RB	0	23.00		22.88	
			16QAM	1RB Low	0	23.00		22.74	
			64QAM	1RB Low	0	23.00		22.58	
			256QAM	1RB Low	0	23.00		22.93	
		CP-OFDM	QPSK	1RB Low	0	23.00		22.71	
							Frequency (MHz) / Channel		
							670.5	680.5	690.5
							134100	136100	138100
	15	DFS-s OFDM	QPSK	1RB Low	0	23.00		22.90	
				50% RB Low	0	23.00		22.90	
							Frequency (MHz) / Channel		
							668.0	680.5	693.0
							133600	136100	138600
	10	DFS-s OFDM	QPSK	1RB Low	0	23.00	22.71	22.81	22.70
				50% RB Low	0	23.00	22.65	22.76	22.65
							Frequency (MHz) / Channel		
							665.5	680.5	695.5
							133100	136100	139100
	5	DFS-s OFDM	QPSK	1RB Low	0	23.00	22.90	23.00	22.86
				50% RB Low	0	23.00	22.87	22.76	22.84

*For all 5G NR testing, the factory upper tolerance includes MPR feature

B.3 Tissue Parameters Measurement

Body TSL

Body TSL	Target TSL		Measured TSL		Deviation %		
Freq (MHz)	ε'(F/m)	σ(S/m)	ε'(F/m)	σ(S/m)	Deviation ε'	Deviation σ	Date
750	55.53	0.96	54.55	1.02	-1.76	6.25	2022-11-28

See Annex D for more details.

B.4 System Check Measurements

Body Measurements

Frequency (MHz)	Average	Target SAR (W/kg)	Measured SAR (W/kg)	Forwarded power (mW)	Deviation to target (%)	Limit (%)	Date
750	1g	8.75	8.41	50	-3.92	±10	2022-11-28
	10g	5.72	5.48		-4.13		

See Annex E for more details.

B.5 SAR Test Results

B.5.1 LTE

B.5.1.1 LTE Band 71 FDD

Band	Antenna	BW (MHz)	Mod.	Channel Number	Freq (MHz)	Position	% RB Allocation	Scaling Factor (dB)	Measured SAR 1g (W/kg)	Reported SAR 1g (W/kg)	Plot #
LTE 71	Vendor1	20	QPSK	133297	680.5	Laptop	1RB Mid	1.09	0.86	1.10	
							50RB Mid	1.12	0.68	0.87	
							100RB Mid	1.09	0.68	0.87	
	Vendor2	20	QPSK	133297	680.5	Laptop	1RB Mid	1.09	0.87	1.12	**1**
							50RB Mid	1.12	0.69	0.89	
							100RB Mid	1.09	0.70	0.90	

B.5.2 5G NR

B.5.2.1 5G NR 71

Band	Antenna	BW (MHz)	Mod.	Channel Number	Freq (MHz)	Position	% RB Allocation	Scaling Factor (dB)	Measured SAR 1g (W/kg)	Reported SAR 1g (W/kg)	Plot #
NR 71	Vendor1	20	QPSK	136100	680.5	Laptop	1RB Mid	0.06	1.10	1.12	**2**
							50RB Mid	0.10	1.07	1.09	
							100RB Mid	0.12	1.06	1.09	
	Vendor2	20	QPSK	136100	680.5	Laptop	1RB Mid	0.06	0.99	1.01	
							50RB Mid	0.10	0.96	0.98	
							100RB Mid	0.12	0.93	0.96	

B.5.3 SAR Measurement Variability

According to FCC OET KDB 865664, SAR Measurement variability is assessed when the maximum initial measured SAR is ≥0.8 W/kg for a certain band/mode. If the measured SAR value of the initial repeated measurement is <1.45 W/kg with <20% variation, only one repeated measurement is required to confirm that the results are not expected to have substantial variations.
A second repeated measurement is required only if the measured results for the initial repeated measurement are within 10% of the SAR limit or vary by more than 20%.
A third repeated measurement is required only if the original, first or second repeated measurement ≥1.5W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurement is > 1.2.

Band / Mode	Position	Ch #	Freq. (MHz)	Measured SAR 1g (W/kg)	1st Repeated SAR 1g (W/kg)	2nd Repeated SAR 1g (W/kg)	Highest Ratio
NR 71/QPSK – 20MHz	Laptop	136100	680.5	1.10	1.09		1.01

B.5.4 Simultaneous Transmission SAR Evaluation

According to FCC OET KDB 447498, when the sum of 1g SAR for all simultaneously transmitting antennas in an operating mode and exposure condition combination is within the SAR limit, SAR test exclusion applies to that simultaneous transmission configuration.

As commented on section 3 and 6, this report only evaluates SAR for cellular transmission on the module, nevertheless, to consider all possible simultaneous transmissions on the device for compliance, WLAN SAR values are considered.

All the values stated in the table below are the worst case found for standalone measurement with disregard of the transmission mode or channel where the worst case was found.

Antenna	Position	Highest Reported SAR (1g) (W/kg)			
		WWAN	WLAN 2.4GHz	WLAN 5/6GHz	Bluetooth
WWAN (Ant 5)	Laptop	1.12			
WWAN (Ant 8)	Laptop	1.09**			
Main WLAN	Laptop		0.40*	0.40*	
Aux WLAN	Laptop		0.40*	0.40*	0.40*

*According to FCC OET KDB 447498, when standalone test exclusion is applied to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated to 0.4 W/Kg for 1-g SAR when the test separation is > 50mm in order to determine simultaneous transmission test exclusion.
** Max value on Ant 8 from reports:

- 211027-02.TR03
- 211027-02.TR04
- 211027-02.TR08
- 211027-02.TR09

Position	Simultaneous Tx Antenna Combination					Σ SAR 1g (W/Kg)	Limit (W/kg)
	#	WWAN Main 5	WWAN Aux 8	Main Antenna	Aux Antenna		
Laptop	1	Cellular	Cellular	WLAN 5/6GHz	WLAN 5/6GHz	**3.01**	1.6
	2	Cellular	Cellular	WLAN 5/6GHz	WLAN 5/6GHz+ BT	**3.41**	
	3	Cellular	Cellular	WLAN 5/6GHz	BT	**3.01**	
	4	Cellular	Cellular	WLAN 2.4GHz	WLAN 2.4GHz	**3.01**	
	5	Cellular	Cellular	WLAN 2.4GHz	BT	**3.01**	

In case the sum of SAR is larger than the limit, SAR test exclusion is determined by the SAR to peak location separation ratio (SPLSR). According to the last table possible simultaneous transmission combinations are identified for each position from 1 to 5, each combination will be analyzed by antenna pairs. Antenna pairs considered in one configuration won't be performed again in case they are repeated on the next simultaneous configuration:

Position	Ant. Pair case	Antenna	Reported SAR 1g (W/kg)	Σ SAR 1g (W/Kg)	Peak Location (mm) (x,y,z)	SAR to peak location separation ratio	Limit
Laptop	1a	WWAN (Ant 5)	1.12	2.21	(19.9, 137.4, -177)	0.01	0.04
		WWAN (Ant 8)	1.09		(6, -101.5, -176.4)		
	1b	WWAN (Ant 5)	1.12	1.52			
		Main WLAN 5/6GHz	0.40				
	1c	WWAN (Ant 5)	1.12	1.52			
		Aux WLAN 5/6GHz	0.40				
	1d	WWAN (Ant 8)	1.09	1.49			
		Main WLAN 5/6GHz	0.40				
	1e	WWAN (Ant 8)	1.09	1.49			
		Aux WLAN 5/6GHz	0.40				
	1f	Main WLAN 5/6GHz	0.40	0.80			
		Aux WLAN 5/6GHz	0.40				
	2a	WWAN (Ant 5)	1.12	1.52			
		Aux WLAN1 BT	0.40				
	2b	WWAN (Ant 8)	1.09	1.49			
		Aux WLAN1 BT	0.40				
	4a	WWAN (Ant 5)	1.12	1.42			
		Main WLAN 2.4GHz	0.40				
	4b	WWAN (Ant 5)	1.12	1.42			
		Aux WLAN 2.4GHz	0.40				
	4c	WWAN (Ant 8)	1.09	1.49			
		Main WLAN 2.4GHz	0.40				
	4d	WWAN (Ant 8)	1.09	1.49			
		Aux WLAN 2.4GHz	0.40				
	4e	Main WLAN 2.4GHz	0.40	0.80			
		Aux WLAN1 2.4GHz	0.40				

Annex C. Test System Plots

1. LTE Band 71, QPSK – 20MHz, CH133297, Ant Vendor 2

Device under Test Properties

Model, Manufacturer	Dimensions [mm]	S/N	DUT Type
HSN-I50C ,HP	295.0 x 220.0 x 17.0	0001760GQ0	Laptop

Exposure Conditions

Phantom Section, TSL	Position, Test Distance [mm]	Band	Group, UID	Frequency [MHz], Channel Number	Conversion Factor	TSL Conductivity [S/m]	TSL Permittivity
Flat, MSL	Laptop, 0.00	Band 71, E-UTRA/FDD	LTE-FDD, 10169-CAE	680.5, 133297	10.01	0.997	54.7

Hardware Setup

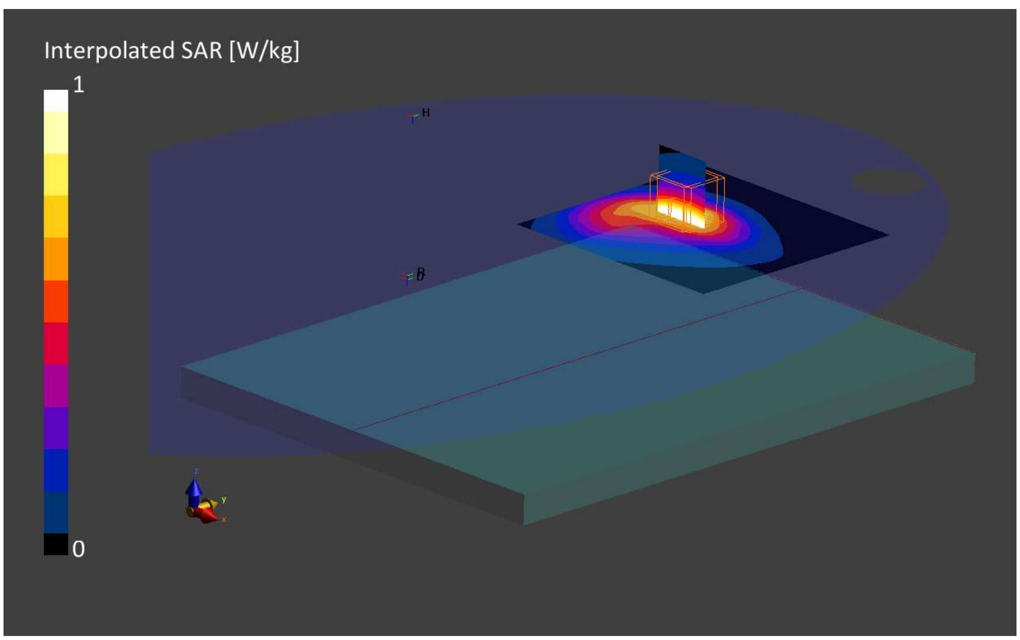
Phantom	TSL, Measured Date	Probe, Calibration Date	DAE, Calibration Date
ELI V8.0 (20deg probe tilt) - 2124	MBBL-600-6000, 2022-Nov-28	EX3DV4 - SN7465, 2022-07-18	DAE Sn1705, 2022-04-28

Scan Setup

	Area Scan	Zoom Scan
Grid Extents [mm]	120.0 x 120.0	30.0 x 30.0 x 30.0
Grid Steps [mm]	15.0 x 15.0	6.0 x 6.0 x 1.5
Sensor Surface [mm]	3.0	1.4
Graded Grid	Yes	Yes
Grading Ratio	1.5	1.5
MAIA	Confirmed by MAIA	Confirmed by MAIA
Surface Detection	VMS + 6p	VMS + 6p
Scan Method	Measured	Measured

Measurement Results

	Area Scan	Zoom Scan
Date	2022-11-28, 12:37	2022-11-28, 12:44
psSAR1g [W/Kg]	0.752	0.873
psSAR10g [W/Kg]	0.508	0.505
Power Drift [dB]	0.00	-0.02
Power Scaling	Disabled	Disabled
Scaling Factor [dB]		
TSL Correction	Positive Only	Positive Only
M2/M1 [%]		80.2
Dist 3dB Peak [mm]		9.7



2. NR FR1 Band 71, QPSK – 20MHz, CH136100, Ant Vendor 1

Device under Test Properties

Model, Manufacturer	Dimensions [mm]	S/N	DUT Type
HSN-I50C ,HP	295.0 x 220.0 x 17.0	0001760GQZ	Laptop

Exposure Conditions

Phantom Section, TSL	Position, Test Distance [mm]	Band	Group, UID	Frequency [MHz], Channel Number	Conversion Factor	TSL Conductivity [S/m]	TSL Permittivity
Flat, MSL	Laptop, 0.00	Band n71	5G NR FR1 FDD, 10931-AAB	680.5, 136100	10.01	0.997	54.7

Hardware Setup

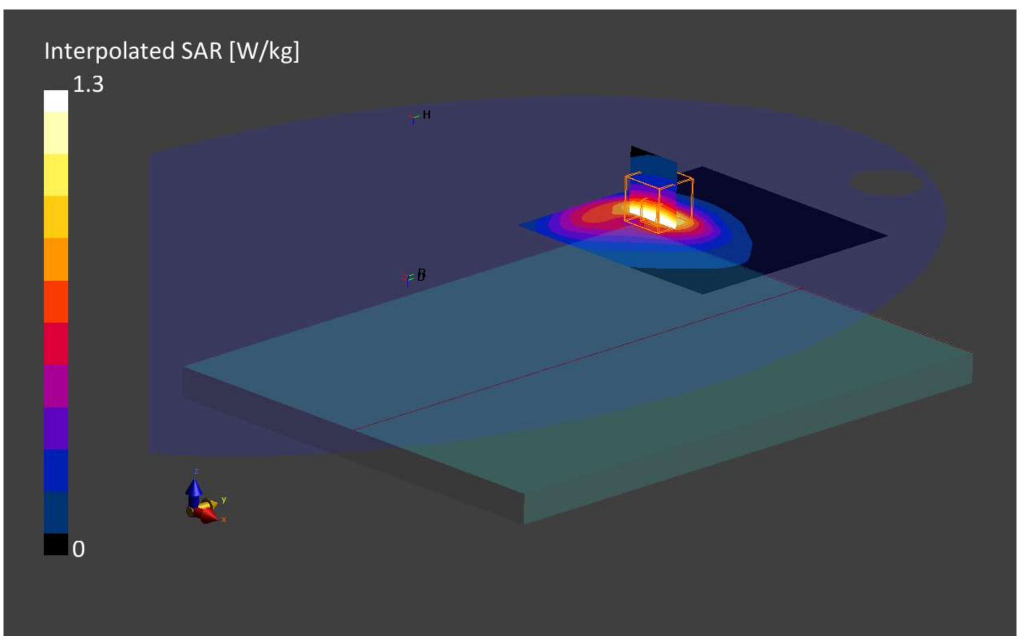
Phantom	TSL, Measured Date	Probe, Calibration Date	DAE, Calibration Date
ELI V8.0 (20deg probe tilt) - 2124	MBBL-600-6000, 2022-Nov-28	EX3DV4 - SN7465, 2022-07-18	DAE Sn1705, 2022-04-28

Scan Setup

	Area Scan	Zoom Scan
Grid Extents [mm]	120.0 x 120.0	30.0 x 30.0 x 30.0
Grid Steps [mm]	15.0 x 15.0	6.0 x 6.0 x 1.5
Sensor Surface [mm]	3.0	1.4
Graded Grid	Yes	Yes
Grading Ratio	1.5	1.5
MAIA	Confirmed by MAIA	Confirmed by MAIA
Surface Detection	VMS + 6p	VMS + 6p
Scan Method	Measured	Measured

Measurement Results

	Area Scan	Zoom Scan
Date	2022-11-29, 09:56	2022-11-29, 10:02
psSAR1g [W/Kg]	1.07	1.10
psSAR10g [W/Kg]	0.655	0.617
Power Drift [dB]	0.01	-0.03
Power Scaling	Disabled	Disabled
Scaling Factor [dB]		
TSL Correction	Positive Only	Positive Only
M2/M1 [%]		79.7
Dist 3dB Peak [mm]		9.6



3. System Check Body Liquid 750MHz

Device under Test Properties

Name, Manufacturer	Dimensions [mm]	S/N	DUT Type
Dipole 750MHz, SPEAG	50.0 x 10.0 x 8.0	1136	Validation Dipole

Exposure Conditions

Phantom Section, TSL	Position, Test Distance [mm]	Band	Group, UID	Frequency [MHz], Channel Number	Conversion Factor	TSL Conductivity [S/m]	TSL Permittivity
Flat MSL			,	750.0, 0	10.01	1.02	54.6

Hardware Setup

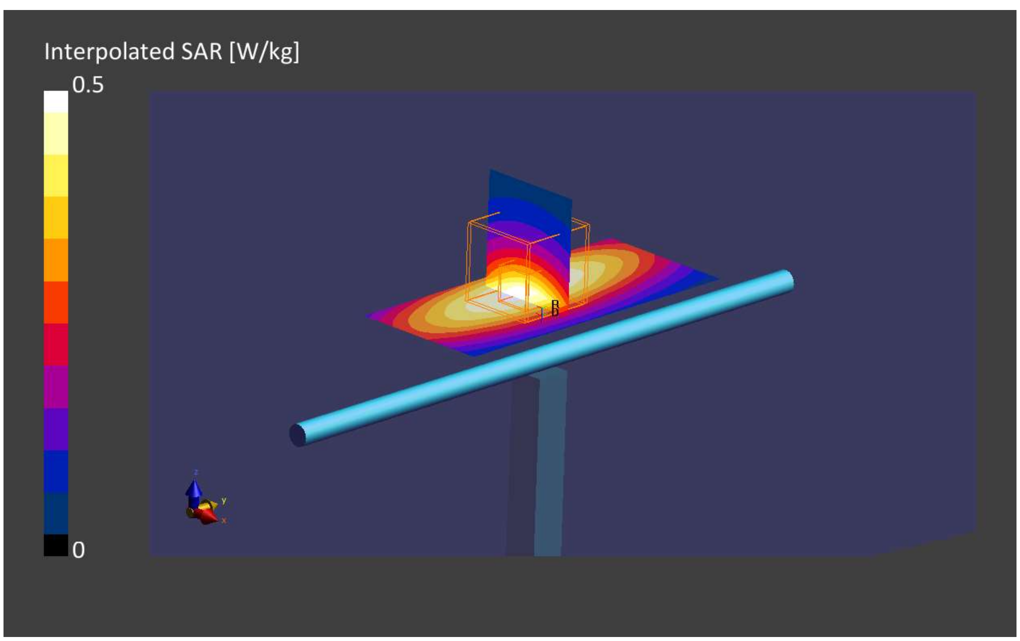
Phantom	TSL, Measured Date	Probe, Calibration Date	DAE, Calibration Date
ELI V8.0 (20deg probe tilt)	MBBL-600-6000, 2022-Nov-28	EX3DV4 - SN7465, 2022-07-18	DAE Sn1705, 2022-04-28

Scan Setup

	Area Scan	Zoom Scan
Grid Extents [mm]	40.0 x 90.0	30.0 x 30.0 x 30.0
Grid Steps [mm]	10.0 x 15.0	6.0 x 6.0 x 1.5
Sensor Surface [mm]	3.0	1.4
Graded Grid	Yes	Yes
Grading Ratio	1.5	1.5
MAIA	Confirmed by MAIA	Confirmed by MAIA
Surface Detection	VMS + 6p	VMS + 6p
Scan Method	Measured	Measured

Measurement Results

	Area Scan	Zoom Scan
Date	2022-11-28, 17:16	2022-11-28, 17:21
psSAR1g [W/Kg]	0.415	0.417
psSAR10g [W/Kg]	0.279	0.272
Power Drift [dB]	-0.05	0.00
Power Scaling	Disabled	Disabled
Scaling Factor [dB]		
TSL Correction	No correction	No correction
M2/M1 [%]		85.3
Dist 3dB Peak [mm]		18.0



Annex D. TSL Dielectric Parameters

D.1 Body 600MHz-900MHz

Freq. (MHz)	Target		2022-11-28 Measured	
	ε'(F/m)	σ(S/m)	ε'$_1$(F/m)	$σ_1$(S/m)
600	56.12	0.95	55.02	0.97
650	55.92	0.96	54.85	0.99
700	55.73	0.96	54.69	1.0
750	55.53	0.96	54.55	1.02
800	55.34	0.97	54.43	1.04
850	55.15	0.99	54.32	1.06
900	55.0	1.05	54.22	1.08

Permittivity	Conductivity