

# FCC SAR Test Report

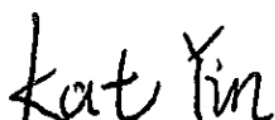
APPLICANT : Motorola Mobility LLC  
EQUIPMENT : Mobile Cellular Phone  
BRAND NAME : Motorola  
MODEL NAME : XT2149-1  
FCC ID : IHDT56ZW1  
STANDARD : FCC 47 CFR Part 2 (2.1093)

We, Sporton International (Kunshan) Inc, would like to declare that the tested sample has been evaluated in accordance with the procedures and had been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International (Kunshan) Inc., the test report shall not be reproduced except in full.



Reviewed by: Nick Hu / Supervisor



Approved by: Kat Yin / Manager



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**Sporton International (Kunshan) Inc.**

## 1. Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for **Motorola Mobility LLC, Mobile Cellular Phone, XT2149-1**, are as follows.

| Highest 1g SAR Summary                                                                                                                                                                                 |                |         |                                                  |                          |                            |                                                  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|---------|--------------------------------------------------|--------------------------|----------------------------|--------------------------------------------------|
| Equipment Class                                                                                                                                                                                        | Frequency Band |         | Head (Separation 0mm)                            | Hotspot (Separation 5mm) | Body-worn (Separation 5mm) | Highest Simultaneous Transmission 1g SAR (W/kg)  |
|                                                                                                                                                                                                        |                |         | 1g SAR (W/kg)                                    |                          |                            |                                                  |
| Licensed                                                                                                                                                                                               | LTE            | Band 42 | 0.99                                             | 0.97                     | 0.86                       | 1.50                                             |
|                                                                                                                                                                                                        | 5G NR          | n77/n78 | 0.38                                             | 0.49                     | 0.49                       |                                                  |
| Highest 10g SAR Summary                                                                                                                                                                                |                |         |                                                  |                          |                            |                                                  |
| Equipment Class                                                                                                                                                                                        | Frequency Band |         | Product Specific 10g SAR (W/kg) (Separation 0mm) |                          |                            | Highest Simultaneous Transmission 10g SAR (W/kg) |
| Licensed                                                                                                                                                                                               | 5G NR          | n77/n78 | 1.36                                             |                          |                            | 2.41                                             |
| Date of Testing:                                                                                                                                                                                       |                |         | 2021/6/29~ 2021/6/30                             |                          |                            |                                                  |
| Remark:                                                                                                                                                                                                |                |         |                                                  |                          |                            |                                                  |
| 1. This device supports 5G NR n77 and n78, they have the same frequency, both 5G NR bands have the same target power, and the same transmission path; therefore, SAR was only assessed for 5G NR n77.  |                |         |                                                  |                          |                            |                                                  |
| Declaration of Conformity:                                                                                                                                                                             |                |         |                                                  |                          |                            |                                                  |
| The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.                                           |                |         |                                                  |                          |                            |                                                  |
| Comments and Explanations:                                                                                                                                                                             |                |         |                                                  |                          |                            |                                                  |
| The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification. |                |         |                                                  |                          |                            |                                                  |

This device is in compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (1.6 W/kg for Partial-Body 1g SAR, 4.0 W/kg for Product Specific 10g SAR) specified in FCC 47 CFR part 2 (2.1093) and ANSI/IEEE C95.1-1992, and had been tested in accordance with the measurement methods and procedures specified in IEEE 1528-2013 and FCC KDB publications.

## 2. Administration Data

Sporton International (Kunshan) Inc. is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 5145.02.

| Testing Laboratory |                                                                                                                                                                          |                                |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|
| Test Firm          | Sporton International (Kunshan) Inc.                                                                                                                                     |                                |
| Test Site Location | No. 1098, Pengxi North Road, Kunshan Economic Development Zone<br>Jiangsu Province 215300 People's Republic of China<br>TEL : +86-512-57900158<br>FAX : +86-512-57900958 |                                |
| Test Site No.      | FCC Designation No.                                                                                                                                                      | FCC Test Firm Registration No. |
|                    | CN1257                                                                                                                                                                   | 314309                         |

| Applicant    |                                                     |
|--------------|-----------------------------------------------------|
| Company Name | Motorola Mobility LLC                               |
| Address      | 222 W, Merchandise Mart Plaza, Chicago IL 60654 USA |

| Manufacturer |                                                     |
|--------------|-----------------------------------------------------|
| Company Name | Motorola Mobility LLC                               |
| Address      | 222 W, Merchandise Mart Plaza, Chicago IL 60654 USA |

## 3. Guidance Applied

The Specific Absorption Rate (SAR) testing specification, method, and procedure for this device is in accordance with the following standards:

- FCC 47 CFR Part 2 (2.1093)
- ANSI/IEEE C95.1-1992
- IEEE 1528-2013
- FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04
- FCC KDB 865664 D02 SAR Reporting v01r02
- FCC KDB 447498 D01 General RF Exposure Guidance v06
- FCC KDB 648474 D04 SAR Evaluation Considerations for Wireless Handsets v01r03
- FCC KDB 248227 D01 802.11 Wi-Fi SAR v02r02
- FCC KDB 616217 D04 SAR for laptop and tablets v01r02
- FCC KDB 941225 D01 3G SAR Procedures v03r01
- FCC KDB 941225 D05 SAR for LTE Devices v02r05
- FCC KDB 941225 D05A Rel.10 LTE SAR Test Guidance v01r02
- FCC KDB 941225 D06 Hotspot Mode SAR v02r01

## **4. Equipment Under Test (EUT) Information**

### **4.1 General Information**

| <b>Product Feature &amp; Specification</b>           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Equipment Name</b>                                | Mobile Cellular Phone                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Brand Name</b>                                    | Motorola                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Model Name</b>                                    | XT2149-1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>FCC ID</b>                                        | IHDT56ZW1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>IMEI Code</b>                                     | SIM1: 358869830066656<br>SIM2: 358869830066664                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Wireless Technology and Frequency Range</b>       | GSM850: 824 MHz ~ 849 MHz<br>GSM1900: 1850 MHz ~ 1910 MHz<br>WCDMA Band II: 1850 MHz ~ 1910 MHz<br>WCDMA Band IV: 1710 MHz ~ 1755 MHz<br>WCDMA Band V: 824 MHz ~ 849 MHz<br>LTE Band 2: 1850 MHz ~ 1910 MHz<br>LTE Band 4: 1710 MHz ~ 1755 MHz<br>LTE Band 5: 824 MHz ~ 849 MHz<br>LTE Band 7: 2500 MHz ~ 2570 MHz<br>LTE Band 12: 699 MHz ~ 716 MHz<br>LTE Band 13: 777 MHz ~ 787 MHz<br>LTE Band 17: 704 MHz ~ 716 MHz<br>LTE Band 26: 814 MHz ~ 849 MHz<br>LTE Band 38: 2570 MHz ~ 2620 MHz<br>LTE Band 41: 2535 MHz ~ 2655 MHz<br>LTE Band 42: 3450 MHz ~ 3550MHz<br>LTE Band 66: 1710 MHz ~ 1780 MHz<br>5G NR n5 : 824 MHz ~ 849 MHz<br>5G NR n7 : 2500 MHz ~ 2570 MHz<br>5G NR n66 : 1710 MHz ~ 1780 MHz<br>5G NR n77: 3450 MHz ~ 3550 MHz, 3700 MHz ~ 3980 MHz<br>5G NR n78: 3450 MHz ~ 3550 MHz, 3700 MHz ~ 3800 MHz<br>WLAN 2.4GHz Band: 2400 MHz ~ 2483.5 MHz<br>WLAN 5.2GHz Band: 5150 MHz ~ 5250 MHz<br>WLAN 5.3GHz Band: 5250 MHz ~ 5350 MHz<br>WLAN 5.5GHz Band: 5470 MHz ~ 5720 MHz<br>WLAN 5.8GHz Band: 5735 MHz ~ 5850 MHz<br>Bluetooth: 2400 MHz ~ 2483.5 MHz<br>NFC: 13.56 MHz |
| <b>Mode</b>                                          | GSM/GPRS/EGPRS<br>RMC/AMR 12.2Kbps<br>HSDPA<br>HSUPA<br>DC-HSDPA<br>HSPA+(16QAM uplink)<br>LTE: QPSK, 16QAM, 64QAM<br>5G NR : CP-OFDM / DFT-s-OFDM, PI/2 BPSK, QPSK, 16QAM, 64QAM, 256QAM<br>WLAN 2.4GHz 802.11b/g/n HT20<br>WLAN 5GHz 802.11a/n HT20/HT40<br>WLAN 5GHz 802.11ac VHT20/VHT40/VHT80<br>Bluetooth BR/EDR/LE<br>NFC:ASK                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>HW Version</b>                                    | DVT2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>SW Version</b>                                    | RRS31.Q2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>GSM / (E)GPRS Transfer mode</b>                   | Class B – EUT cannot support Packet Switched and Circuit Switched Network simultaneously but can automatically switch between Packet and Circuit Switched Network.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>EUT Stage</b>                                     | Identical Prototype                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Remark:</b>                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 1. 802.11n-HT40 is not supported in 2.4GHz WLAN.     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 2. WLAN operation in 5600 MHz ~ 5650 MHz is notched. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

3. This device supports VoIP in GPRS, EGPRS, WCDMA and LTE (e.g. for 3rd-party VoIP), LTE supports VoLTE operation.
4. This device 2.4GHz WLAN support hotspot operation and Bluetooth support tethering applications.
5. This device 2.4GHz WLAN/5.2GHz WLAN/5.8GHz WLAN support hotspot operation, and 5.2GHz WLAN/5.8GHz WLAN supports WiFi Direct (GC/GO), and 5.3GHz / 5.5GHz supports WiFi Direct (GC only).
6. This device does not support DTM operation and supports GPRS/EGPRS mode up to multi-slot class 12.
7. There are two different types of EUT, According to the difference, we chose sample 1 to perform full SAR testing.
8. For dual SIM card mobile has two SIM slots and supports dual SIM dual standby. The WWAN radio transmission will be enabled by either one SIM at a time (single active). After pre-scan two SIM cards power, we found test result of the SIM1 was the worse, so we chose SIM1 slot to perform all tests.
9. The device implements Proximity sensors/receiver detect mechanism/hotspot trigger reduced power for the power management for SAR compliance at different exposure conditions (head, body-worn, hotspot, extremity). The device will invoke corresponding work scenarios power level base on frequency bands/antennas, which can refer to appendix E power table.
10. For Some WWAN bands, sensor on reduced power level higher than hotspot reduced power level, so front/back sensor on SAR can represent hotspot conservatively.
11. For WLAN when transmit simultaneous with WWAN, power reduction will be activated to head / hotspot/ extremity. For WLAN when transmit simultaneous with WWAN and proximity sensors trigger, power reduction will be activated to body-worn.
12. There are three headsets, only supplier different, so only chose one headset to perform SAR testing.
13. The device has two batteries with the same battery capacity, only Manufacturer is different. We only chose battery 1 to perform full SAR testing.
14. For 5G NR test, using FTM (Factory Test Mode) to perform SAR with default 100% transmission.
15. 5G NR supports CP-OFDM and DFT-s-OFDM modulation, for DFT-s-OFDM power is higher than CP-OFDM, so only show DFT-s-OFDM power table and chose DFT-s-OFDM to perform SAR testing.
16. For DFT-s-OFDM and CP-OFDM output power measurement reduction, according to 38.101 maximum power reduction for the CP-OFDM mode will not higher than DFT-s-OFDM mode, therefore, CP-OFDM measurement is unnecessary.
17. 5G NR NSA EN-DC mode, standalone SAR performed for 5G NR band with the maximum power, EN-DC SAR summed 5G NR standalone SAR and LTE standalone SAR, the result of EN-DC SAR is more conservatively.
18. NSA and SA mode should perform SAR separately. For the maximum power of NSA mode is the same as SA total power level, so NSA SAR can represent SA mode SAR.
19. 5G NR NSA mode, the power level is the same as 5G NR SA mode, so 5G NR NSA mode and SA mode power table only show one time.
20. This device supports 5G NR FR1 bands as following table, including NSA mode and SA mode.
21. This is a variant report, for model change note, please refer to the Operation Description exhibit submitted. Based on the similarity between two models, based on SW enable 5G NR FR1 n78 SA and added LTE Band 42, 5G NR FR1 n77/ n78(3450 MHz ~ 3550 MHz) for full SAR testing, for co-located SAR analysis, some cellular bands and WLAN/Bluetooth SAR test results are leverage from original report which can be referred to Sporton Report Number FA141508.

**<5G NR>**

| Mode | Band | Duplex | SCS(KHz) | Bandwidths(BW)                          |
|------|------|--------|----------|-----------------------------------------|
| NSA  | n5   | FDD    | 15       | 5, 10, 15, 20                           |
|      | n7   | FDD    | 15       | 5, 10, 15, 20                           |
|      | n66  | FDD    | 15       | 5, 10, 15, 20, 40                       |
|      | n77  | TDD    | 30       | 10, 15, 20, 40, 50, 60, 70, 80, 90, 100 |
|      | n78  | TDD    | 30       | 10, 15, 20, 40, 50, 60, 70, 80, 90, 100 |
| SA   | n78  | TDD    | 30       | 10, 15, 20, 40, 50, 60, 70, 80, 90, 100 |

## 4.2 General LTE SAR Test and Reporting Considerations

| Summarized necessary items addressed in KDB 941225 D05 v02r05           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |         |       |        |                                                                         |        |          |  |  |  |  |  |            |                                                               |  |  |  |  |  |          |         |         |       |        |        |        |      |     |     |     |      |      |      |     |        |     |     |     |      |      |      |     |        |     |     |     |      |      |      |     |        |     |     |     |      |      |      |     |        |     |     |     |      |      |      |     |         |     |  |  |  |  |  |     |
|-------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-------|--------|-------------------------------------------------------------------------|--------|----------|--|--|--|--|--|------------|---------------------------------------------------------------|--|--|--|--|--|----------|---------|---------|-------|--------|--------|--------|------|-----|-----|-----|------|------|------|-----|--------|-----|-----|-----|------|------|------|-----|--------|-----|-----|-----|------|------|------|-----|--------|-----|-----|-----|------|------|------|-----|--------|-----|-----|-----|------|------|------|-----|---------|-----|--|--|--|--|--|-----|
| FCC ID                                                                  | IHDT56ZW1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |         |       |        |                                                                         |        |          |  |  |  |  |  |            |                                                               |  |  |  |  |  |          |         |         |       |        |        |        |      |     |     |     |      |      |      |     |        |     |     |     |      |      |      |     |        |     |     |     |      |      |      |     |        |     |     |     |      |      |      |     |        |     |     |     |      |      |      |     |         |     |  |  |  |  |  |     |
| Equipment Name                                                          | Mobile Cellular Phone                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |         |       |        |                                                                         |        |          |  |  |  |  |  |            |                                                               |  |  |  |  |  |          |         |         |       |        |        |        |      |     |     |     |      |      |      |     |        |     |     |     |      |      |      |     |        |     |     |     |      |      |      |     |        |     |     |     |      |      |      |     |        |     |     |     |      |      |      |     |         |     |  |  |  |  |  |     |
| Operating Frequency Range of each LTE transmission band                 | LTE Band 2: 1850 MHz ~ 1910 MHz<br>LTE Band 4: 1710 MHz ~ 1755 MHz<br>LTE Band 5: 824 MHz ~ 849 MHz<br>LTE Band 7: 2500 MHz ~ 2570 MHz<br>LTE Band 12: 699 MHz ~ 716 MHz<br>LTE Band 13: 777 MHz ~ 787 MHz<br>LTE Band 17: 704 MHz ~ 716 MHz<br>LTE Band 26: 814 MHz ~ 849 MHz<br>LTE Band 38: 2570 MHz ~ 2620 MHz<br>LTE Band 41: 2535 MHz ~ 2655 MHz<br>LTE Band 42: 3450 MHz ~ 3550 MHz<br>LTE Band 66: 1710 MHz ~ 1780 MHz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |         |       |        |                                                                         |        |          |  |  |  |  |  |            |                                                               |  |  |  |  |  |          |         |         |       |        |        |        |      |     |     |     |      |      |      |     |        |     |     |     |      |      |      |     |        |     |     |     |      |      |      |     |        |     |     |     |      |      |      |     |        |     |     |     |      |      |      |     |         |     |  |  |  |  |  |     |
| Channel Bandwidth                                                       | LTE Band 2:1.4MHz, 3MHz, 5MHz, 10MHz, 15MHz, 20MHz<br>LTE Band 4:1.4MHz, 3MHz, 5MHz, 10MHz, 15MHz, 20MHz<br>LTE Band 5:1.4MHz, 3MHz, 5MHz, 10MHz<br>LTE Band 7: 5MHz, 10MHz, 15MHz, 20MHz<br>LTE Band 12:1.4MHz, 3MHz, 5MHz, 10MHz<br>LTE Band 13: 5MHz, 10MHz<br>LTE Band 17: 5MHz, 10MHz<br>LTE Band 26:1.4MHz, 3MHz, 5MHz, 10MHz, 15MHz<br>LTE Band 38: 5MHz, 10MHz, 15MHz, 20MHz<br>LTE Band 41: 5MHz, 10MHz, 15MHz, 20MHz<br>LTE Band 42: 5MHz, 10MHz, 15MHz, 20MHz<br>LTE Band 66:1.4MHz, 3MHz, 5MHz, 10MHz, 15MHz, 20MHz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |         |       |        |                                                                         |        |          |  |  |  |  |  |            |                                                               |  |  |  |  |  |          |         |         |       |        |        |        |      |     |     |     |      |      |      |     |        |     |     |     |      |      |      |     |        |     |     |     |      |      |      |     |        |     |     |     |      |      |      |     |        |     |     |     |      |      |      |     |         |     |  |  |  |  |  |     |
| uplink modulations used                                                 | QPSK / 16QAM / 64QAM                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |         |       |        |                                                                         |        |          |  |  |  |  |  |            |                                                               |  |  |  |  |  |          |         |         |       |        |        |        |      |     |     |     |      |      |      |     |        |     |     |     |      |      |      |     |        |     |     |     |      |      |      |     |        |     |     |     |      |      |      |     |        |     |     |     |      |      |      |     |         |     |  |  |  |  |  |     |
| LTE Voice / Data requirements                                           | Voice and Data                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |         |       |        |                                                                         |        |          |  |  |  |  |  |            |                                                               |  |  |  |  |  |          |         |         |       |        |        |        |      |     |     |     |      |      |      |     |        |     |     |     |      |      |      |     |        |     |     |     |      |      |      |     |        |     |     |     |      |      |      |     |        |     |     |     |      |      |      |     |         |     |  |  |  |  |  |     |
| LTE Release Version                                                     | R18, Cat13                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |         |       |        |                                                                         |        |          |  |  |  |  |  |            |                                                               |  |  |  |  |  |          |         |         |       |        |        |        |      |     |     |     |      |      |      |     |        |     |     |     |      |      |      |     |        |     |     |     |      |      |      |     |        |     |     |     |      |      |      |     |        |     |     |     |      |      |      |     |         |     |  |  |  |  |  |     |
| CA Support                                                              | Supported, Uplink and Downlink                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |         |       |        |                                                                         |        |          |  |  |  |  |  |            |                                                               |  |  |  |  |  |          |         |         |       |        |        |        |      |     |     |     |      |      |      |     |        |     |     |     |      |      |      |     |        |     |     |     |      |      |      |     |        |     |     |     |      |      |      |     |        |     |     |     |      |      |      |     |         |     |  |  |  |  |  |     |
| LTE MPR permanently built-in by design                                  | <table><tr><th colspan="8">Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 1, 2 and 3</th></tr><tr><th rowspan="2">Modulation</th><th colspan="6">Channel bandwidth / Transmission bandwidth (N<sub>RB</sub>)</th><th rowspan="2">MPR (dB)</th></tr><tr><th>1.4 MHz</th><th>3.0 MHz</th><th>5 MHz</th><th>10 MHz</th><th>15 MHz</th><th>20 MHz</th></tr><tr><td>QPSK</td><td>&gt; 5</td><td>&gt; 4</td><td>&gt; 8</td><td>&gt; 12</td><td>&gt; 16</td><td>&gt; 18</td><td>≤ 1</td></tr><tr><td>16 QAM</td><td>≤ 5</td><td>≤ 4</td><td>≤ 8</td><td>≤ 12</td><td>≤ 16</td><td>≤ 18</td><td>≤ 1</td></tr><tr><td>16 QAM</td><td>&gt; 5</td><td>&gt; 4</td><td>&gt; 8</td><td>&gt; 12</td><td>&gt; 16</td><td>&gt; 18</td><td>≤ 2</td></tr><tr><td>64 QAM</td><td>≤ 5</td><td>≤ 4</td><td>≤ 8</td><td>≤ 12</td><td>≤ 16</td><td>≤ 18</td><td>≤ 2</td></tr><tr><td>64 QAM</td><td>&gt; 5</td><td>&gt; 4</td><td>&gt; 8</td><td>&gt; 12</td><td>&gt; 16</td><td>&gt; 18</td><td>≤ 3</td></tr><tr><td>256 QAM</td><td colspan="6">≥ 1</td><td>≤ 5</td></tr></table> |         |       |        | Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 1, 2 and 3 |        |          |  |  |  |  |  | Modulation | Channel bandwidth / Transmission bandwidth (N <sub>RB</sub> ) |  |  |  |  |  | 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 |
| Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 1, 2 and 3 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |         |       |        |                                                                         |        |          |  |  |  |  |  |            |                                                               |  |  |  |  |  |          |         |         |       |        |        |        |      |     |     |     |      |      |      |     |        |     |     |     |      |      |      |     |        |     |     |     |      |      |      |     |        |     |     |     |      |      |      |     |        |     |     |     |      |      |      |     |         |     |  |  |  |  |  |     |
| Modulation                                                              | Channel bandwidth / Transmission bandwidth (N <sub>RB</sub> )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |         |       |        |                                                                         |        | 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      |  |  |  |  |  |            |                                                               |  |  |  |  |  |          |         |         |       |        |        |        |      |     |     |     |      |      |      |     |        |     |     |     |      |      |      |     |        |     |     |     |      |      |      |     |        |     |     |     |      |      |      |     |        |     |     |     |      |      |      |     |         |     |  |  |  |  |  |     |
| LTE A-MPR                                                               | In the base station simulator configuration, Network Setting value is set to NS_01 to disable A-MPR during SAR testing and the LTE SAR tests was transmitting on all TTI frames (Maximum TTI)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |         |       |        |                                                                         |        |          |  |  |  |  |  |            |                                                               |  |  |  |  |  |          |         |         |       |        |        |        |      |     |     |     |      |      |      |     |        |     |     |     |      |      |      |     |        |     |     |     |      |      |      |     |        |     |     |     |      |      |      |     |        |     |     |     |      |      |      |     |         |     |  |  |  |  |  |     |
| Spectrum plots for RB configuration                                     | A properly configured base station simulator was used for the SAR and power measurement; therefore, spectrum plots for each RB allocation and offset configuration are not included in the SAR report.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |         |       |        |                                                                         |        |          |  |  |  |  |  |            |                                                               |  |  |  |  |  |          |         |         |       |        |        |        |      |     |     |     |      |      |      |     |        |     |     |     |      |      |      |     |        |     |     |     |      |      |      |     |        |     |     |     |      |      |      |     |        |     |     |     |      |      |      |     |         |     |  |  |  |  |  |     |
| Power reduction applied to satisfy SAR compliance                       | Yes, head/body-worn/hotspot/extremity will trigger reduced power for some LTE bands, the detail please referred to section 14.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |         |       |        |                                                                         |        |          |  |  |  |  |  |            |                                                               |  |  |  |  |  |          |         |         |       |        |        |        |      |     |     |     |      |      |      |     |        |     |     |     |      |      |      |     |        |     |     |     |      |      |      |     |        |     |     |     |      |      |      |     |        |     |     |     |      |      |      |     |         |     |  |  |  |  |  |     |
| LTE Carrier Aggregation Combinations                                    | Inter-Band and Intra-Band possible combinations and the detail power verification please referred to section 14.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |         |       |        |                                                                         |        |          |  |  |  |  |  |            |                                                               |  |  |  |  |  |          |         |         |       |        |        |        |      |     |     |     |      |      |      |     |        |     |     |     |      |      |      |     |        |     |     |     |      |      |      |     |        |     |     |     |      |      |      |     |        |     |     |     |      |      |      |     |         |     |  |  |  |  |  |     |
| LTE Carrier Aggregation Additional Information                          | 1. This device supports LTE Carrier Aggregation (CA) in the uplink for 7C with two component carriers in the uplink. SAR Measurements and conducted powers were evaluated per FCC Guidance.<br>2. This device supports maximum of 2 carriers in the downlink and 2 carriers in the uplink. Additional following LTE Release features are not supported: Relay, HetNet, Enhanced MIMO, eICI, WiFi Offloading, MDH, eMBMA, Cross-Carrier Scheduling, Enhanced SC-FDMA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |         |       |        |                                                                         |        |          |  |  |  |  |  |            |                                                               |  |  |  |  |  |          |         |         |       |        |        |        |      |     |     |     |      |      |      |     |        |     |     |     |      |      |      |     |        |     |     |     |      |      |      |     |        |     |     |     |      |      |      |     |        |     |     |     |      |      |      |     |         |     |  |  |  |  |  |     |

| Transmission (H, M, L) channel numbers and frequencies in each LTE band |                   |             |                  |             |                  |             |                  |             |                  |             |                  |             |
|-------------------------------------------------------------------------|-------------------|-------------|------------------|-------------|------------------|-------------|------------------|-------------|------------------|-------------|------------------|-------------|
| LTE Band 2                                                              |                   |             |                  |             |                  |             |                  |             |                  |             |                  |             |
|                                                                         | Bandwidth 1.4 MHz |             | Bandwidth 3 MHz  |             | Bandwidth 5 MHz  |             | Bandwidth 10 MHz |             | Bandwidth 15 MHz |             | Bandwidth 20 MHz |             |
|                                                                         | Ch. #             | Freq. (MHz) | Ch. #            | Freq. (MHz) | Ch. #            | Freq. (MHz) | Ch. #            | Freq. (MHz) | Ch. #            | Freq. (MHz) | Ch. #            | Freq. (MHz) |
| L                                                                       | 18607             | 1850.7      | 18615            | 1851.5      | 18625            | 1852.5      | 18650            | 1855        | 18675            | 1857.5      | 18700            | 1860        |
| M                                                                       | 18900             | 1880        | 18900            | 1880        | 18900            | 1880        | 18900            | 1880        | 18900            | 1880        | 18900            | 1880        |
| H                                                                       | 19193             | 1909.3      | 19185            | 1908.5      | 19175            | 1907.5      | 19150            | 1905        | 19125            | 1902.5      | 19100            | 1900        |
| LTE Band 4                                                              |                   |             |                  |             |                  |             |                  |             |                  |             |                  |             |
|                                                                         | Bandwidth 1.4 MHz |             | Bandwidth 3 MHz  |             | Bandwidth 5 MHz  |             | Bandwidth 10 MHz |             | Bandwidth 15 MHz |             | Bandwidth 20 MHz |             |
|                                                                         | Ch. #             | Freq. (MHz) | Ch. #            | Freq. (MHz) | Ch. #            | Freq. (MHz) | Ch. #            | Freq. (MHz) | Ch. #            | Freq. (MHz) | Ch. #            | Freq. (MHz) |
| L                                                                       | 19957             | 1710.7      | 19965            | 1711.5      | 19975            | 1712.5      | 20000            | 1715        | 20025            | 1717.5      | 20050            | 1720        |
| M                                                                       | 20175             | 1732.5      | 20175            | 1732.5      | 20175            | 1732.5      | 20175            | 1732.5      | 20175            | 1732.5      | 20175            | 1732.5      |
| H                                                                       | 20393             | 1754.3      | 20385            | 1753.5      | 20375            | 1752.5      | 20350            | 1750        | 20325            | 1747.5      | 20300            | 1745        |
| LTE Band 5                                                              |                   |             |                  |             |                  |             |                  |             |                  |             |                  |             |
|                                                                         | Bandwidth 1.4 MHz |             | Bandwidth 3 MHz  |             | Bandwidth 5 MHz  |             | Bandwidth 10 MHz |             | Bandwidth 15 MHz |             | Bandwidth 20 MHz |             |
|                                                                         | Ch. #             | Freq. (MHz) | Ch. #            | Freq. (MHz) | Ch. #            | Freq. (MHz) | Ch. #            | Freq. (MHz) | Ch. #            | Freq. (MHz) | Ch. #            | Freq. (MHz) |
| L                                                                       | 20407             | 824.7       | 20415            | 825.5       | 20425            | 826.5       | 20450            | 829         | 20475            | 830.5       | 20500            | 832         |
| M                                                                       | 20525             | 836.5       | 20525            | 836.5       | 20525            | 836.5       | 20525            | 836.5       | 20525            | 836.5       | 20525            | 836.5       |
| H                                                                       | 20643             | 848.3       | 20635            | 847.5       | 20625            | 846.5       | 20600            | 844         | 20575            | 842.5       | 20550            | 840         |
| LTE Band 7                                                              |                   |             |                  |             |                  |             |                  |             |                  |             |                  |             |
|                                                                         | Bandwidth 5 MHz   |             | Bandwidth 10 MHz |             | Bandwidth 15 MHz |             | Bandwidth 20 MHz |             | Bandwidth 25 MHz |             | Bandwidth 30 MHz |             |
|                                                                         | Ch. #             | Freq. (MHz) | Ch. #            | Freq. (MHz) | Ch. #            | Freq. (MHz) | Ch. #            | Freq. (MHz) | Ch. #            | Freq. (MHz) | Ch. #            | Freq. (MHz) |
| L                                                                       | 20775             | 2502.5      | 20800            | 2505        | 20825            | 2507.5      | 20850            | 2510        | 20875            | 2512.5      | 20900            | 2515        |
| M                                                                       | 21100             | 2535        | 21100            | 2535        | 21100            | 2535        | 21100            | 2535        | 21100            | 2535        | 21100            | 2535        |
| H                                                                       | 21425             | 2567.5      | 21400            | 2565        | 21375            | 2562.5      | 21350            | 2560        | 21325            | 2557.5      | 21300            | 2555        |
| LTE Band 12                                                             |                   |             |                  |             |                  |             |                  |             |                  |             |                  |             |
|                                                                         | Bandwidth 1.4 MHz |             | Bandwidth 3 MHz  |             | Bandwidth 5 MHz  |             | Bandwidth 10 MHz |             | Bandwidth 15 MHz |             | Bandwidth 20 MHz |             |
|                                                                         | Ch. #             | Freq. (MHz) | Ch. #            | Freq. (MHz) | Ch. #            | Freq. (MHz) | Ch. #            | Freq. (MHz) | Ch. #            | Freq. (MHz) | Ch. #            | Freq. (MHz) |
| L                                                                       | 23017             | 699.7       | 23025            | 700.5       | 23035            | 701.5       | 23060            | 704         | 23085            | 707         | 23110            | 710         |
| M                                                                       | 23095             | 707.5       | 23095            | 707.5       | 23095            | 707.5       | 23095            | 707.5       | 23095            | 707.5       | 23095            | 707.5       |
| H                                                                       | 23173             | 715.3       | 23165            | 714.5       | 23155            | 713.5       | 23130            | 711         | 23105            | 708.5       | 23080            | 706         |
| LTE Band 13                                                             |                   |             |                  |             |                  |             |                  |             |                  |             |                  |             |
|                                                                         | Bandwidth 5 MHz   |             |                  |             | Bandwidth 10 MHz |             |                  |             | Bandwidth 15 MHz |             |                  |             |
|                                                                         | Channel #         |             | Freq.(MHz)       |             | Channel #        |             | Freq.(MHz)       |             | Channel #        |             | Freq.(MHz)       |             |
| L                                                                       | 23205             |             | 779.5            |             | 23230            |             | 782              |             | 23255            |             | 784.5            |             |
| M                                                                       | 23230             |             | 782              |             | 23255            |             | 784.5            |             | 23280            |             | 787              |             |
| H                                                                       | 23255             |             | 784.5            |             | 23280            |             | 787              |             | 23305            |             | 790              |             |
| LTE Band 17                                                             |                   |             |                  |             |                  |             |                  |             |                  |             |                  |             |
|                                                                         | Bandwidth 5 MHz   |             |                  |             | Bandwidth 10 MHz |             |                  |             | Bandwidth 15 MHz |             |                  |             |
|                                                                         | Channel #         |             | Freq.(MHz)       |             | Channel #        |             | Freq. (MHz)      |             | Channel #        |             | Freq. (MHz)      |             |
| L                                                                       | 23755             |             | 706.5            |             | 23780            |             | 709              |             | 23805            |             | 712              |             |
| M                                                                       | 23790             |             | 710              |             | 23815            |             | 714              |             | 23840            |             | 718              |             |
| H                                                                       | 23825             |             | 713.5            |             | 23850            |             | 717              |             | 23875            |             | 721              |             |

| LTE Band 26 |                   |             |                  |             |                  |             |                  |             |                  |             |
|-------------|-------------------|-------------|------------------|-------------|------------------|-------------|------------------|-------------|------------------|-------------|
|             | Bandwidth 1.4 MHz |             | Bandwidth 3 MHz  |             | Bandwidth 5 MHz  |             | Bandwidth 10 MHz |             | Bandwidth 15 MHz |             |
|             | Ch. #             | Freq. (MHz) | Ch. #            | Freq. (MHz) | Ch. #            | Freq. (MHz) | Ch. #            | Freq. (MHz) | Ch. #            | Freq. (MHz) |
| L           | 26697             | 814.7       | 26705            | 815.5       | 26715            | 816.5       | 26740            | 819         | 26765            | 821.5       |
| M           | 26865             | 831.5       | 26865            | 831.5       | 26865            | 831.5       | 26865            | 831.5       | 26865            | 831.5       |
| H           | 27033             | 848.3       | 27025            | 847.5       | 27015            | 846.5       | 26990            | 844         | 26965            | 841.5       |
| LTE Band 38 |                   |             |                  |             |                  |             |                  |             |                  |             |
|             | Bandwidth 5 MHz   |             | Bandwidth 10 MHz |             | Bandwidth 15 MHz |             | Bandwidth 20 MHz |             |                  |             |
|             | Ch. #             | Freq. (MHz) | Ch. #            | Freq. (MHz) | Ch. #            | Freq. (MHz) | Ch. #            | Freq. (MHz) | Ch. #            | Freq. (MHz) |
| L           | 37775             | 2572.5      | 37800            | 2575        | 37825            | 2577.5      | 37850            | 2580        |                  |             |
| M           | 38000             | 2595        | 38000            | 2595        | 38000            | 2595        | 38000            | 2595        |                  |             |
| H           | 38225             | 2617.5      | 38200            | 2615        | 38175            | 2612.5      | 38150            | 2610        |                  |             |
| LTE Band 41 |                   |             |                  |             |                  |             |                  |             |                  |             |
|             | Bandwidth 5 MHz   |             | Bandwidth 10 MHz |             | Bandwidth 15 MHz |             | Bandwidth 20 MHz |             |                  |             |
|             | Ch. #             | Freq. (MHz) | Ch. #            | Freq. (MHz) | Ch. #            | Freq. (MHz) | Ch. #            | Freq. (MHz) | Ch. #            | Freq. (MHz) |
| L           | 40065             | 2537.5      | 40090            | 2540        | 40115            | 2542.5      | 40140            | 2545        |                  |             |
| LM          | 40385             | 2569.5      | 40390            | 2570        | 40395            | 2570.5      | 40400            | 2571        |                  |             |
| HM          | 40705             | 2601.5      | 40690            | 2600        | 40685            | 2599.5      | 40670            | 2598        |                  |             |
| H           | 41215             | 2652.5      | 41190            | 2650        | 41165            | 2647.5      | 41140            | 2645        |                  |             |

| LTE Band 42 |                 |             |                  |             |                  |             |                  |             |
|-------------|-----------------|-------------|------------------|-------------|------------------|-------------|------------------|-------------|
|             | Bandwidth 5 MHz |             | Bandwidth 10 MHz |             | Bandwidth 15 MHz |             | Bandwidth 20 MHz |             |
|             | Ch. #           | Freq. (MHz) | Ch. #            | Freq. (MHz) | Ch. #            | Freq. (MHz) | Ch. #            | Freq. (MHz) |
| L           | 42115           | 3452.5      | 42140            | 3455        | 42165            | 3457.5      | 42190            | 3460        |
| M           | 42590           | 3500        | 42590            | 3500        | 42590            | 3500        | 42590            | 3500        |
| H           | 43065           | 3547.5      | 43040            | 3545        | 43015            | 3542.5      | 42990            | 3540        |

| LTE Band 66 |                   |             |                 |             |                 |             |                  |             |                  |             |                  |             |
|-------------|-------------------|-------------|-----------------|-------------|-----------------|-------------|------------------|-------------|------------------|-------------|------------------|-------------|
|             | Bandwidth 1.4 MHz |             | Bandwidth 3 MHz |             | Bandwidth 5 MHz |             | Bandwidth 10 MHz |             | Bandwidth 15 MHz |             | Bandwidth 20 MHz |             |
|             | Ch. #             | Freq. (MHz) | Ch. #           | Freq. (MHz) | Ch. #           | Freq. (MHz) | Ch. #            | Freq. (MHz) | Ch. #            | Freq. (MHz) | Ch. #            | Freq. (MHz) |
| L           | 131979            | 1710.7      | 131987          | 1711.5      | 131997          | 1712.5      | 132022           | 1715        | 132047           | 1717.5      | 132072           | 1720        |
| M           | 132322            | 1745        | 132322          | 1745        | 132322          | 1745        | 132322           | 1745        | 132322           | 1745        | 132322           | 1745        |
| H           | 132665            | 1779.3      | 132657          | 1778.5      | 132647          | 1777.5      | 132622           | 1775        | 132597           | 1772.5      | 132572           | 1770        |

| 5G NR Information                                                         |                                                                                                |             |                 |             |                 |             |                 |             |                 |             |
|---------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|-------------|-----------------|-------------|-----------------|-------------|-----------------|-------------|-----------------|-------------|
| Operating Frequency Range of each 5G NR transmission band                 | 5G NR n5 : 824 MHz ~ 849 MHz                                                                   |             |                 |             |                 |             |                 |             |                 |             |
|                                                                           | 5G NR n7: 2500 MHz ~ 2570 MHz                                                                  |             |                 |             |                 |             |                 |             |                 |             |
|                                                                           | 5G NR n66: 1710 MHz ~ 1780 MHz                                                                 |             |                 |             |                 |             |                 |             |                 |             |
|                                                                           | 5G NR n77: 3450 MHz ~ 3550 MHz, 3700 MHz ~ 3980 MHz                                            |             |                 |             |                 |             |                 |             |                 |             |
|                                                                           | 5G NR n78: 3450 MHz ~ 3550 MHz, 3700 MHz ~ 3800 MHz                                            |             |                 |             |                 |             |                 |             |                 |             |
| Channel Bandwidth                                                         | 5G NR n5: 5MHz, 10MHz, 15MHz, 20MHz                                                            |             |                 |             |                 |             |                 |             |                 |             |
|                                                                           | 5G NR n7: 5MHz, 10MHz, 15MHz, 20MHz                                                            |             |                 |             |                 |             |                 |             |                 |             |
|                                                                           | 5G NR n66: 5MHz, 10MHz, 15MHz, 20MHz, 40MHz                                                    |             |                 |             |                 |             |                 |             |                 |             |
|                                                                           | 5G NR n77: 10MHz, 15MHz, 20MHz, 40MHz, 50MHz, 60MHz, 70MHz, 80MHz, 90MHz, 100MHz               |             |                 |             |                 |             |                 |             |                 |             |
|                                                                           | 5G NR n78: 10MHz, 15MHz, 20MHz, 40MHz, 50MHz, 60MHz, 70MHz, 80MHz, 90MHz, 100MHz               |             |                 |             |                 |             |                 |             |                 |             |
| SCS                                                                       | FDD: SCS15KHz, TDD: SCS30KHz                                                                   |             |                 |             |                 |             |                 |             |                 |             |
| uplink modulations used                                                   | DFT-s-OFDM: PI/2 BPSK / QPSK / 16QAM / 64QAM / 256QAM<br>CP-OFDM QPSK / 16QAM / 64QAM / 256QAM |             |                 |             |                 |             |                 |             |                 |             |
| A-MPR (Additional MPR) disabled for SAR Testing?                          | Yes                                                                                            |             |                 |             |                 |             |                 |             |                 |             |
| LTE Anchor Bands for n5                                                   | LTE B7                                                                                         |             |                 |             |                 |             |                 |             |                 |             |
| LTE Anchor Bands for n7                                                   | LTE B5/66                                                                                      |             |                 |             |                 |             |                 |             |                 |             |
| LTE Anchor Bands for n66                                                  | LTE B7                                                                                         |             |                 |             |                 |             |                 |             |                 |             |
| LTE Anchor Bands for n77                                                  | LTE B41                                                                                        |             |                 |             |                 |             |                 |             |                 |             |
| LTE Anchor Bands for n78                                                  | LTE B5/7/38/66                                                                                 |             |                 |             |                 |             |                 |             |                 |             |
| Transmission (H, M, L) channel numbers and frequencies in each 5G NR band |                                                                                                |             |                 |             |                 |             |                 |             |                 |             |
| NR Band 5                                                                 |                                                                                                |             |                 |             |                 |             |                 |             |                 |             |
|                                                                           | Bandwidth 5MHz                                                                                 |             | Bandwidth 10MHz |             | Bandwidth 15MHz |             | Bandwidth 20MHz |             |                 |             |
|                                                                           | Ch. #                                                                                          | Freq. (MHz) | Ch. #           | Freq. (MHz) | Ch. #           | Freq. (MHz) | Ch. #           | Freq. (MHz) |                 |             |
| L                                                                         | 165300                                                                                         | 826.5       | 165800          | 829         | 166300          | 831.5       | 166800          | 834         |                 |             |
| M                                                                         | 167300                                                                                         | 836.5       | 167300          | 836.5       | 167300          | 836.5       | 167300          | 836.5       |                 |             |
| H                                                                         | 169300                                                                                         | 846.5       | 168800          | 844         | 168300          | 841.5       | 167800          | 839         |                 |             |
| NR Band 7                                                                 |                                                                                                |             |                 |             |                 |             |                 |             |                 |             |
|                                                                           | Bandwidth 5MHz                                                                                 |             | Bandwidth 10MHz |             | Bandwidth 15MHz |             | Bandwidth 20MHz |             |                 |             |
|                                                                           | Ch. #                                                                                          | Freq. (MHz) | Ch. #           | Freq. (MHz) | Ch. #           | Freq. (MHz) | Ch. #           | Freq. (MHz) |                 |             |
| L                                                                         | 500500                                                                                         | 2502.5      | 501000          | 2505        | 501500          | 2507.5      | 502000          | 2510        |                 |             |
| M                                                                         | 507000                                                                                         | 2535        | 507000          | 2535        | 507000          | 2535        | 507000          | 2535        |                 |             |
| H                                                                         | 513500                                                                                         | 2567.5      | 513000          | 2565        | 512500          | 2562.5      | 512000          | 2560        |                 |             |
| NR Band 66                                                                |                                                                                                |             |                 |             |                 |             |                 |             |                 |             |
|                                                                           | Bandwidth 5MHz                                                                                 |             | Bandwidth 10MHz |             | Bandwidth 15MHz |             | Bandwidth 20MHz |             | Bandwidth 40MHz |             |
|                                                                           | Ch. #                                                                                          | Freq. (MHz) | Ch. #           | Freq. (MHz) | Ch. #           | Freq. (MHz) | Ch. #           | Freq. (MHz) | Ch. #           | Freq. (MHz) |
| L                                                                         | 342500                                                                                         | 1712.5      | 343000          | 1715        | 343500          | 1717.5      | 344000          | 1720        | 346000          | 1730        |
| M                                                                         | 349000                                                                                         | 1745        | 349000          | 1745        | 349000          | 1745        | 349000          | 1745        | 349000          | 1745        |
| H                                                                         | 355500                                                                                         | 1777.5      | 355000          | 1775        | 354500          | 1772.5      | 354000          | 1770        | 352000          | 1760        |

| NR Band 77      |             |                 |             |                 |             |                 |             |                 |             |                 |             |                 |             |                 |             |                 |             |                     |
|-----------------|-------------|-----------------|-------------|-----------------|-------------|-----------------|-------------|-----------------|-------------|-----------------|-------------|-----------------|-------------|-----------------|-------------|-----------------|-------------|---------------------|
| Bandwidth 10MHz |             | Bandwidth 15MHz |             | Bandwidth 20MHz |             | Bandwidth 40MHz |             | Bandwidth 50MHz |             | Bandwidth 60MHz |             | Bandwidth 70MHz |             | Bandwidth 80MHz |             | Bandwidth 90MHz |             | Bandwidth 100MHz    |
| Ch. #           | Freq. (MHz) | Ch. #           | Freq. (MHz) | Ch. #           | Freq. (MHz) | Ch. #           | Freq. (MHz) | Ch. #           | Freq. (MHz) | Ch. #           | Freq. (MHz) | Ch. #           | Freq. (MHz) | Ch. #           | Freq. (MHz) | Ch. #           | Freq. (MHz) | Ch. # Freq. (MHz)   |
| L               | 647000      | 3705            | 647168      | 3707.52         | 647334      | 3710.01         | 648000      | 3720            | 648334      | 3725.01         | 648668      | 3730.02         | 649000      | 3735            | 649334      | 3740.01         | 649668      | 3745.02 650000 3750 |
| M               | 656000      | 3840            | 656000      | 3840            | 656000      | 3840            | 656000      | 3840            | 656000      | 3840            | 656000      | 3840            | 656000      | 3840            | 656000      | 3840            | 656000      | 3840 656000 3840    |
| H               | 665000      | 3975            | 664834      | 3972.51         | 664668      | 3970.02         | 664000      | 3960            | 663668      | 3955.02         | 663334      | 3950.01         | 663000      | 3954            | 662668      | 3940.02         | 662334      | 3935.01 662000 3930 |

| NR Band 78      |             |                 |             |                 |             |                 |             |                 |             |                 |             |                 |             |                 |             |                 |             |                     |
|-----------------|-------------|-----------------|-------------|-----------------|-------------|-----------------|-------------|-----------------|-------------|-----------------|-------------|-----------------|-------------|-----------------|-------------|-----------------|-------------|---------------------|
| Bandwidth 10MHz |             | Bandwidth 15MHz |             | Bandwidth 20MHz |             | Bandwidth 40MHz |             | Bandwidth 50MHz |             | Bandwidth 60MHz |             | Bandwidth 70MHz |             | Bandwidth 80MHz |             | Bandwidth 90MHz |             | Bandwidth 100MHz    |
| Ch. #           | Freq. (MHz) | Ch. #           | Freq. (MHz) | Ch. #           | Freq. (MHz) | Ch. #           | Freq. (MHz) | Ch. #           | Freq. (MHz) | Ch. #           | Freq. (MHz) | Ch. #           | Freq. (MHz) | Ch. #           | Freq. (MHz) | Ch. #           | Freq. (MHz) | Ch. # Freq. (MHz)   |
| L               | 647000      | 3705            | 647168      | 3707.52         | 647334      | 3710.01         | 648000      | 3720            | 648334      | 3725.01         | 648668      | 3730.02         | 649000      | 3735            | 649334      | 3740.01         | 649668      | 3745.02 650000 3750 |
| M               | 650000      | 3750            | 650000      | 3750            | 650000      | 3750            | 650000      | 3750            | 650000      | 3750            | 650000      | 3750            | 650000      | 3750            | 650000      | 3750            | 650000      | 3750 650000 3750    |
| H               | 653000      | 3795            | 652834      | 3792.51         | 652668      | 3790.02         | 652000      | 3780            | 651668      | 3775.02         | 651334      | 3770.01         | 651000      | 3765            | 650668      | 3760.02         | 650334      | 3755.01 650000 3750 |



For 3450 MHz ~ 3550 MHz

| NR Band 77      |             |                 |             |                 |             |                 |             |                 |             |                 |             |                 |             |                 |             |                 |             |                  |             |
|-----------------|-------------|-----------------|-------------|-----------------|-------------|-----------------|-------------|-----------------|-------------|-----------------|-------------|-----------------|-------------|-----------------|-------------|-----------------|-------------|------------------|-------------|
| Bandwidth 10MHz |             | Bandwidth 15MHz |             | Bandwidth 20MHz |             | Bandwidth 40MHz |             | Bandwidth 50MHz |             | Bandwidth 60MHz |             | Bandwidth 70MHz |             | Bandwidth 80MHz |             | Bandwidth 90MHz |             | Bandwidth 100MHz |             |
| Ch. #           | Freq. (MHz) | Ch. #           | Freq. (MHz) | Ch. #           | Freq. (MHz) | Ch. #           | Freq. (MHz) | Ch. #           | Freq. (MHz) | Ch. #           | Freq. (MHz) | Ch. #           | Freq. (MHz) | Ch. #           | Freq. (MHz) | Ch. #           | Freq. (MHz) | Ch. #            | Freq. (MHz) |
| L 630334        | 3455.01     | 630550          | 3457.5      | 630668          | 3460.02     | 631334          | 3470.01     | 631668          | 3475.02     | 632000          | 3480        | 632334          | 3485.01     | 632668          | 3490.02     | 633000          | 3495        |                  |             |
| M 633334        | 3500.01     | 633334          | 3500.01     | 633334          | 3500.01     | 633334          | 3500.01     | 633334          | 3500.01     | 633334          | 3500.01     | 633334          | 3500.01     | 633334          | 3500.01     | 633334          | 3500.01     | 633334           | 3500.01     |
| H 636332        | 3544.98     | 636166          | 3542.49     | 636000          | 3540        | 635332          | 3529.98     | 635000          | 3525        | 634666          | 3519.99     | 634332          | 3514.98     | 634000          | 3510        | 633666          | 3504.99     |                  |             |

| NR Band 78      |             |                 |             |                 |             |                 |             |                 |             |                 |             |                 |             |                 |             |                 |             |                 |             |                  |             |
|-----------------|-------------|-----------------|-------------|-----------------|-------------|-----------------|-------------|-----------------|-------------|-----------------|-------------|-----------------|-------------|-----------------|-------------|-----------------|-------------|-----------------|-------------|------------------|-------------|
| Bandwidth 10MHz |             | Bandwidth 15MHz |             | Bandwidth 20MHz |             | Bandwidth 30MHz |             | Bandwidth 40MHz |             | Bandwidth 50MHz |             | Bandwidth 60MHz |             | Bandwidth 70MHz |             | Bandwidth 80MHz |             | Bandwidth 90MHz |             | Bandwidth 100MHz |             |
| Ch. #           | Freq. (MHz) | Ch. #           | Freq. (MHz) | Ch. #           | Freq. (MHz) | Ch. #           | Freq. (MHz) | Ch. #           | Freq. (MHz) | Ch. #           | Freq. (MHz) | Ch. #           | Freq. (MHz) | Ch. #           | Freq. (MHz) | Ch. #           | Freq. (MHz) | Ch. #           | Freq. (MHz) | Ch. #            | Freq. (MHz) |
| L 630334        | 3455.01     | 630550          | 3457.5      | 630668          | 3460.02     | 631000          | 3465        | 631334          | 3470.01     | 631668          | 3475.02     | 632000          | 3480        | 632334          | 3485.01     | 632668          | 3490.02     | 633000          | 3495        |                  |             |
| M 633334        | 3500.01     | 633334          | 3500.01     | 633334          | 3500.01     | 633334          | 3500.01     | 633334          | 3500.01     | 633334          | 3500.01     | 633334          | 3500.01     | 633334          | 3500.01     | 633334          | 3500.01     | 633334          | 3500.01     | 633334           | 3500.01     |
| H 636332        | 3544.98     | 636166          | 3542.49     | 636000          | 3540        | 635666          | 3534.99     | 635332          | 3529.98     | 635000          | 3525        | 634666          | 3519.99     | 634332          | 3514.98     | 634000          | 3510        | 633666          | 3504.99     |                  |             |

## 5. Maximum Tune-up Limit

### <WWAN Tune-up Limit>

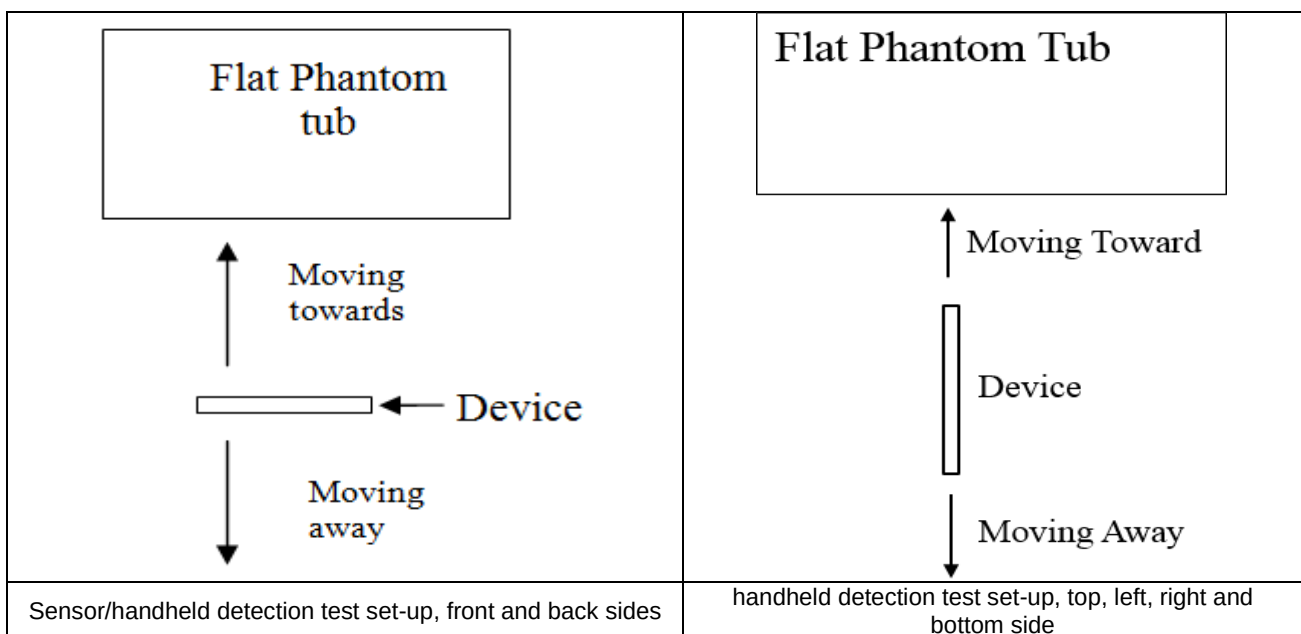
1. For some cellular band, the device has four WWAN Tx antennas, the antenna selection is based on the connection quality condition, and only one antenna will transmit at a time.
2. The device implements the power management and sensor detection for SAR compliance at different exposure conditions (head, body-worn, hotspot, extremity) and the device will manage to ensure the power level not exceeding the associated power table. Details about the power management decision and sensor detection are provided in the operational description.
3. Below table shows maximum tune up output power configured for this EUT for various transmit conditions by manufacturer, and the detail power measurement and tune-up limit refer to appendix E.

| TX. freq.             | Ant   | Default            | Head               |                      | Body worn          |                      | Hotspot            |                      | Handheld           |                      |
|-----------------------|-------|--------------------|--------------------|----------------------|--------------------|----------------------|--------------------|----------------------|--------------------|----------------------|
|                       |       | max. tune up limit | max. tune up limit | power reduction (dB) | max. tune up limit | power reduction (dB) | max. tune up limit | power reduction (dB) | max. tune up limit | power reduction (dB) |
| LTE Band42            | Ant 5 | 24.00              | 16.00              | 8.00                 | 21.00              | 3.00                 | 21.00              | 3.00                 | 21.00              | 3.00                 |
| FR1_N77-Only For ENDC | Ant 5 | 24.00              | 14.00              | 10.00                | 17.00              | 7.00                 | 16.50              | 7.50                 | 18.50              | 5.50                 |
| FR1_N78               | Ant 5 | 24.00              | 14.00              | 10.00                | 17.00              | 7.00                 | 16.50              | 7.50                 | 18.50              | 5.50                 |

## 6. Proximity Sensor Triggering Test

### 6.1 Proximity sensor triggering distances(Per KDB616217§6.2)

- Proximity sensor triggering distance testing was performed according to the procedures outlined in KDB 616217 D04 section 6.2, and EUT moving further away from the flat phantom and EUT moving toward the flat phantom were both assessed and the tissue-equivalent medium for highest frequency (5825MHz) and lowest (850MHz) frequency was used for proximity sensor triggering testing.
- Capacitive proximity sensor placed coincident with antenna elements at the bottom end of the phone are utilized to determine when the device comes in proximity of the user's body at the front or back or bottom side of the device. There is no need to do sensor coverage testing for the proximity sensor is designed to support sufficient detection range and sensitivity to cover regions of the sensors in all applicable directions since the proximity sensor entirely covers the antenna.
- When the proximity sensor is active, GSM850/1900, WCDMA band II/IV/V, LTE band 2/4/5/7/26/66/38/41/42, 5GNR n5/n7/n66 /n77/n78 and WLAN2.4GHz/5.2GHz/5.3GHz/5.5GHz/5.8GHz reduced power will be active for front or back body worn SAR.
- P-sensor can detect handheld state, WCDMA II/IV, LTE band 2/4/5/7/66/38/41/42, 5GNR n7/n66/n77/78 for front/back/bottom/top/right/left sides of product specific 10g SAR condition reduced powers will be active for handheld SAR.
- The proximity sensors used to detect the proximity of the user's body at the front or back or bottom side of the device use a detection threshold distance. The data shown in the sections below shows the distance(s).
- For verification of compliance of power reduction scheme, additional SAR testing with EUT transmitting at full RF power at a conservative trigger distance was performed for body worn:  
Front: [13 mm](#)  
Back: [19 mm](#)
- For verification of compliance of power reduction scheme, additional SAR testing with EUT transmitting at full RF power at a conservative trigger distance was performed for handheld:  
For ANT0  
Front: [10 mm](#)  
Back: [16 mm](#)  
Bottom side: [13 mm](#)  
For ANT1  
Front: [6 mm](#)  
Back: [14 mm](#)  
For ANT4  
Top side: [14 mm](#)  
For ANT5  
Top side: [7 mm](#)



### <P-Sensor>

| Proximity Sensor Triggering Distance (mm) |                |             |                |             |
|-------------------------------------------|----------------|-------------|----------------|-------------|
| Position                                  | Front          |             | Back           |             |
|                                           | Moving towards | Moving away | Moving towards | Moving away |
| Minimum                                   | 14             | 16          | 20             | 26          |

### <Handheld for ANT0>

| Position | Front          |             | Back           |             | Bottom Side    |             | Right Side     |             |
|----------|----------------|-------------|----------------|-------------|----------------|-------------|----------------|-------------|
|          | Moving towards | Moving away | Moving towards | Moving away | Moving towards | Moving away | Moving towards | Moving away |
| Minimum  | 11             | 13          | 17             | 19          | 14             | 19          | 5              | 8           |

### <Handheld for ANT1>

| Position | Front          |             | Back           |             | Bottom Side    |             | Left Side      |             |
|----------|----------------|-------------|----------------|-------------|----------------|-------------|----------------|-------------|
|          | Moving towards | Moving away | Moving towards | Moving away | Moving towards | Moving away | Moving towards | Moving away |
| Minimum  | 7              | 11          | 15             | 19          | 11             | 15          | 11             | 16          |

### <Handheld for ANT4>

| Position | Front          |             | Back           |             | Top Side       |             | Left Side      |             |
|----------|----------------|-------------|----------------|-------------|----------------|-------------|----------------|-------------|
|          | Moving towards | Moving away | Moving towards | Moving away | Moving towards | Moving away | Moving towards | Moving away |
| Minimum  | 10             | 12          | 14             | 17          | 15             | 19          | 5              | 9           |

### <Handheld for ANT5>

| Position | Front          |             | Back           |             | Top Side       |             |
|----------|----------------|-------------|----------------|-------------|----------------|-------------|
|          | Moving towards | Moving away | Moving towards | Moving away | Moving towards | Moving away |
| Minimum  | 6              | 8           | 6              | 9           | 8              | 10          |

### <Handheld for ANT6>

| Position | Front          |             | Back           |             | Top Side       |             | Right Side     |             |
|----------|----------------|-------------|----------------|-------------|----------------|-------------|----------------|-------------|
|          | Moving towards | Moving away | Moving towards | Moving away | Moving towards | Moving away | Moving towards | Moving away |
| Minimum  | 10             | 12          | 11             | 16          | 14             | 17          | 8              | 12          |

## **7. RF Exposure Limits**

### **7.1 Uncontrolled Environment**

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

### **7.2 Controlled Environment**

Controlled Environments are defined as locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, (i.e. as a result of employment or occupation). In general, occupational/controlled exposure limits are applicable to situations in which persons are exposed as a consequence of their employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. The 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.

**Limits for Occupational/Controlled Exposure (W/kg)**

| Whole-Body | Partial-Body | Hands, Wrists, Feet and Ankles |
|------------|--------------|--------------------------------|
| 0.4        | 8.0          | 20.0                           |

**Limits for General Population/Uncontrolled Exposure (W/kg)**

| Whole-Body | Partial-Body | Hands, Wrists, Feet and Ankles |
|------------|--------------|--------------------------------|
| 0.08       | 1.6          | 4.0                            |

Whole-Body SAR is averaged over the entire body, partial-body SAR is averaged over any 1gram of tissue defined as a tissue volume in the shape of a cube. SAR for hands, wrists, feet and ankles is averaged over any 10 grams of tissue defined as a tissue volume in the shape of a cube.

## **8. Specific Absorption Rate (SAR)**

### **8.1 Introduction**

SAR is related to the rate at which energy is absorbed per unit mass in an object exposed to a radio field. The SAR distribution in a biological body is complicated and is usually carried out by experimental techniques or numerical modeling. The standard recommends limits for two tiers of groups, occupational/controlled and general population/uncontrolled, based on a person's awareness and ability to exercise control over his or her exposure. In general, occupational/controlled exposure limits are higher than the limits for general population/uncontrolled.

### **8.2 SAR Definition**

The SAR definition is the time derivative (rate) of the incremental energy (dW) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dv) of a given density ( $\rho$ ). The equation description is as below:

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

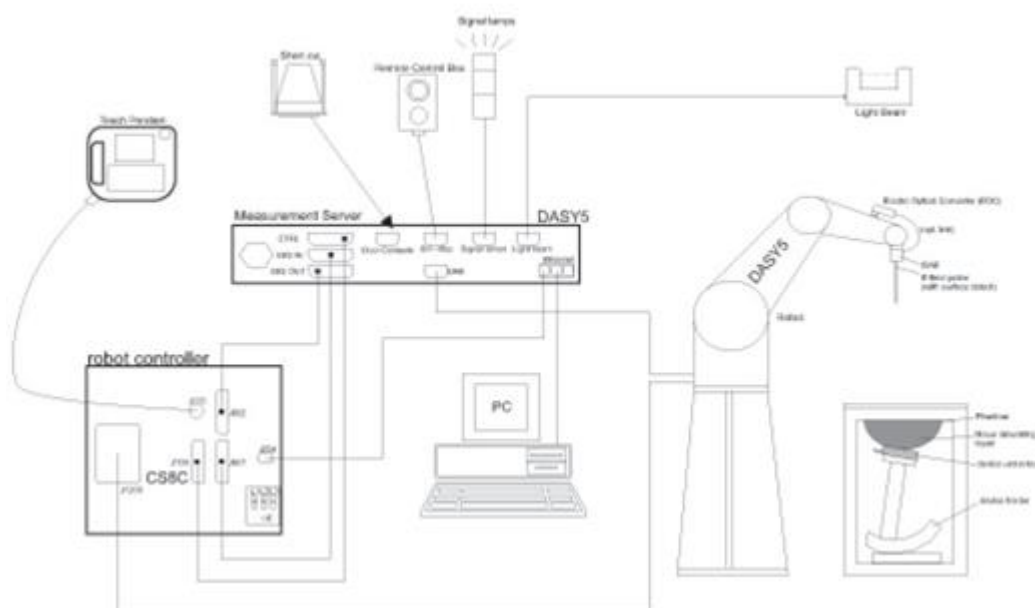
SAR is expressed in units of Watts per kilogram (W/kg)

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

Where:  $\sigma$  is the conductivity of the tissue,  $\rho$  is the mass density of the tissue and E is the RMS electrical field strength.

## 9. System Description and Setup

**The DASY system used for performing compliance tests consists of the following items:**



- A standard high precision 6-axis robot with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- An isotropic Field probe optimized and calibrated for the targeted measurement.
- 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. To use optical surface detection, a special version of the EOC is required. 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 movement interrupts.
- The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.
- A computer running WinXP or Win7 and the DASY5 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.

## 9.1 E-Field Probe

The SAR measurement is conducted with the dosimetric probe (manufactured by SPEAG). The probe is specially designed and calibrated for use in liquid with high permittivity. The dosimetric probe has special calibration in liquid at different frequency. This probe has a built in optical surface detection system to prevent from collision with phantom.

### <EX3DV4 Probe>

|                      |                                                                                                                                                           |                                                                                    |
|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
| <b>Construction</b>  | Symmetric design with triangular core<br>Built-in shielding against static charges<br>PEEK enclosure material (resistant to organic solvents, e.g., DGBE) |  |
| <b>Frequency</b>     | 10 MHz – >6 GHz<br>Linearity: $\pm 0.2$ dB (30 MHz – 6 GHz)                                                                                               |                                                                                    |
| <b>Directivity</b>   | $\pm 0.3$ dB in TSL (rotation around probe axis)<br>$\pm 0.5$ dB in TSL (rotation normal to probe axis)                                                   |                                                                                    |
| <b>Dynamic Range</b> | 10 $\mu$ W/g – >100 mW/g<br>Linearity: $\pm 0.2$ dB (noise: typically <1 $\mu$ W/g)                                                                       |                                                                                    |
| <b>Dimensions</b>    | Overall length: 337 mm (tip: 20 mm)<br>Tip diameter: 2.5mm (body: 12 mm)<br>Typical distance from probe tip to dipole centers: 1 mm                       |                                                                                    |

## 9.2 Data Acquisition Electronics (DAE)

The data acquisition electronics (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 measurement server is accomplished through an optical downlink for data and status information as well as an optical uplink for commands and the clock.

The input impedance of the DAE is 200 MOhm; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.



**Photo of DAE**

### 9.3 Phantom

#### <SAM Twin Phantom>

|                   |                                                         |                                                                                    |
|-------------------|---------------------------------------------------------|------------------------------------------------------------------------------------|
| Shell Thickness   | 2 ± 0.2 mm;<br>Center ear point: 6 ± 0.2 mm             |  |
| Filling Volume    | Approx. 25 liters                                       |                                                                                    |
| Dimensions        | Length: 1000 mm; Width: 500 mm; Height: adjustable feet |                                                                                    |
| Measurement Areas | Left Hand, Right Hand, Flat Phantom                     |                                                                                    |

The bottom plate contains three pair of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections. A white cover is provided to tap the phantom during off-periods to prevent water evaporation and changes in the liquid parameters. On the phantom top, three reference markers are provided to identify the phantom position with respect to the robot.

#### <ELI Phantom>

|                 |                                                  |                                                                                     |
|-----------------|--------------------------------------------------|-------------------------------------------------------------------------------------|
| Shell Thickness | 2 ± 0.2 mm (sagging: <1%)                        |  |
| Filling Volume  | Approx. 30 liters                                |                                                                                     |
| Dimensions      | Major ellipse axis: 600 mm<br>Minor axis: 400 mm |                                                                                     |

The ELI phantom is intended for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI4 is fully compatible with standard and all known tissue simulating liquids.

## 9.4 Device Holder

### <Mounting Device for Hand-Held Transmitter>

In combination with the Twin SAM V5.0/V5.0c or ELI phantoms, the Mounting Device for Hand-Held Transmitters enables rotation of the mounted transmitter device to specified spherical coordinates. At the heads, the rotation axis is at the ear opening. Transmitter devices can be easily and accurately positioned according to IEC 62209-1, IEEE 1528, FCC, or other specifications. The device holder can be locked for positioning at different phantom sections (left head, right head, flat). And upgrade kit to Mounting Device to enable easy mounting of wider devices like big smart-phones, e-books, small tablets, etc. It holds devices with width up to 140 mm.



Mounting Device for Hand-Held Transmitters



Mounting Device Adaptor for Wide-Phones

### <Mounting Device for Laptops and other Body-Worn Transmitters>

The extension is lightweight and made of POM, acrylic glass and foam. It fits easily on the upper part of the mounting device in place of the phone positioned. The extension is fully compatible with the SAM Twin and ELI phantoms.



Mounting Device for Laptops

## 10. Measurement Procedures

The measurement procedures are as follows:

### <Conducted power measurement>

- (a) For WWAN power measurement, use base station simulator to configure EUT WWAN transmission in conducted connection with RF cable, at maximum power in each supported wireless interface and frequency band.
- (b) Read the WWAN RF power level from the base station simulator.
- (c) For WLAN/BT power measurement, use engineering software to configure EUT WLAN/BT continuously transmission, at maximum RF power in each supported wireless interface and frequency band
- (d) Connect EUT RF port through RF cable to the power meter, and measure WLAN/BT output power

### <SAR measurement>

- (a) Use base station simulator to configure EUT WWAN transmission in radiated connection, and engineering software to configure EUT WLAN/BT continuously transmission, at maximum RF power, in the highest power channel.
- (b) Place the EUT in the positions as Appendix D demonstrates.
- (c) Set scan area, grid size and other setting on the DASY software.
- (d) Measure SAR results for the highest power channel on each testing position.
- (e) Find out the largest SAR result on these testing positions of each band
- (f) Measure SAR results for other channels in worst SAR testing position if the reported SAR of highest power channel is larger than 0.8 W/kg

According to the test standard, the recommended procedure for assessing the peak spatial-average SAR value consists of the following steps:

- (a) Power reference measurement
- (b) Area scan
- (c) Zoom scan
- (d) Power drift measurement

### 10.1 Spatial Peak SAR Evaluation

The procedure for spatial peak SAR evaluation has been implemented according to the test standard. It can be conducted for 1g and 10g, as well as for user-specific masses. The DASY software includes all numerical procedures necessary to evaluate the spatial peak SAR value.

The base for the evaluation is a "cube" measurement. The measured volume must include the 1g and 10g cubes with the highest averaged SAR values. For that purpose, the center of the measured volume is aligned to the interpolated peak SAR value of a previously performed area scan.

The entire evaluation of the spatial peak values is performed within the post-processing engine (SEMCAD). The system always gives the maximum values for the 1g and 10g cubes. The algorithm to find the cube with highest averaged SAR is divided into the following stages:

- (a) Extraction of the measured data (grid and values) from the Zoom Scan
- (b) Calculation of the SAR value at every measurement point based on all stored data (A/D values and measurement parameters)
- (c) Generation of a high-resolution mesh within the measured volume
- (d) Interpolation of all measured values from the measurement grid to the high-resolution grid
- (e) Extrapolation of the entire 3-D field distribution to the phantom surface over the distance from sensor to surface
- (f) Calculation of the averaged SAR within masses of 1g and 10g

## 10.2 Power Reference Measurement

The Power Reference Measurement and Power Drift Measurements are for monitoring the power drift of the device under test in the batch process. The minimum distance of probe sensors to surface determines the closest measurement point to phantom surface. This distance cannot be smaller than the distance of sensor calibration points to probe tip as defined in the probe properties.

## 10.3 Area Scan

The area scan is used as a fast scan in two dimensions to find the area of high field values, before doing a fine measurement around the hot spot. The sophisticated interpolation routines implemented in DASY software can find the maximum found in the scanned area, within a range of the global maximum. The range (in dB) is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE standard 1528 and IEC 62209 standards, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard (Japan), if only one zoom scan follows the area scan, then only the absolute maximum will be taken as reference. For cases where multiple maximums are detected, the number of zoom scans has to be increased accordingly.

Area scan parameters extracted from FCC KDB 865664 D01v01r04 SAR measurement 100 MHz to 6 GHz.

|                                                                                                        | $\leq 3$ GHz                                                                                                                                                                                                                                                           | $> 3$ GHz                                              |
|--------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|
| Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface | $5 \pm 1$ mm                                                                                                                                                                                                                                                           | $\frac{1}{2} \cdot \delta \cdot \ln(2) \pm 0.5$ 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: $\Delta x_{\text{Area}}, \Delta y_{\text{Area}}$                 | $\leq 2$ GHz: $\leq 15$ mm<br>$2 - 3$ GHz: $\leq 12$ mm                                                                                                                                                                                                                | $3 - 4$ GHz: $\leq 12$ mm<br>$4 - 6$ GHz: $\leq 10$ 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. |                                                        |

## 10.4 Zoom Scan

Zoom scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 gram and 10 gram of simulated tissue. The zoom scan measures points (refer to table below) within a cube whose base faces are centered on the maxima found in a preceding area scan job within the same procedure. When the measurement is done, the zoom scan evaluates the averaged SAR for 1 gram and 10 gram and displays these values next to the job's label.

Zoom scan parameters extracted from FCC KDB 865664 D01v01r04 SAR measurement 100 MHz to 6 GHz.

|                                                                                                                                                                                                                                                                                                             |                                           |                                                                                             | $\leq 3$ GHz                                          | $> 3$ GHz                                                                     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|---------------------------------------------------------------------------------------------|-------------------------------------------------------|-------------------------------------------------------------------------------|
| Maximum zoom scan spatial resolution: $\Delta x_{\text{Zoom}}, \Delta y_{\text{Zoom}}$                                                                                                                                                                                                                      |                                           |                                                                                             | $\leq 2$ GHz: $\leq 8$ mm<br>2 – 3 GHz: $\leq 5$ mm * | 3 – 4 GHz: $\leq 5$ mm*<br>4 – 6 GHz: $\leq 4$ mm*                            |
| Maximum zoom scan spatial resolution, normal to phantom surface                                                                                                                                                                                                                                             | uniform grid: $\Delta z_{\text{Zoom}}(n)$ |                                                                                             | $\leq 5$ mm                                           | 3 – 4 GHz: $\leq 4$ mm<br>4 – 5 GHz: $\leq 3$ mm<br>5 – 6 GHz: $\leq 2$ mm    |
|                                                                                                                                                                                                                                                                                                             | graded grid                               | $\Delta z_{\text{Zoom}}(1)$ : between 1 <sup>st</sup> two points closest to phantom surface | $\leq 4$ mm                                           | 3 – 4 GHz: $\leq 3$ mm<br>4 – 5 GHz: $\leq 2.5$ mm<br>5 – 6 GHz: $\leq 2$ 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                                   |                                                                                             | $\geq 30$ mm                                          | 3 – 4 GHz: $\geq 28$ mm<br>4 – 5 GHz: $\geq 25$ mm<br>5 – 6 GHz: $\geq 22$ mm |
| Note: $\delta$ 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 <i>reported</i> SAR from the <i>area scan based 1-g SAR estimation</i> procedures of KDB 447498 is $\leq 1.4$ W/kg, $\leq 8$ mm, $\leq 7$ mm and $\leq 5$ 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. |                                           |                                                                                             |                                                       |                                                                               |

## 10.5 Volume Scan Procedures

The volume scan is used to assess overlapping SAR distributions for antennas transmitting in different frequency bands. It is equivalent to an oversized zoom scan used in standalone measurements. The measurement volume will be used to enclose all the simultaneous transmitting antennas. For antennas transmitting simultaneously in different frequency bands, the volume scan is measured separately in each frequency band. In order to sum correctly to compute the 1g aggregate SAR, the EUT remain in the same test position for all measurements and all volume scan use the same spatial resolution and grid spacing. When all volume scan were completed, the software, SEMCAD postprocessor can combine and subsequently superpose these measurement data to calculating the multiband SAR.

## 10.6 Power Drift Monitoring

All SAR testing is under the EUT install full charged battery and transmit maximum output power. In DASY measurement software, the power reference measurement and power drift measurement procedures are used for monitoring the power drift of EUT during SAR test. Both these procedures measure the field at a specified reference position before and after the SAR testing. The software will calculate the field difference in dB. If the power drifts more than 5%, the SAR will be retested.

## 11. Test Equipment List

| Manufacturer    | Name of Equipment             | Type/Model  | Serial Number | Calibration |            |
|-----------------|-------------------------------|-------------|---------------|-------------|------------|
|                 |                               |             |               | Last Cal.   | Due Date   |
| SPEAG           | 3500MHz System Validation Kit | D3500V2     | 1037          | 2020/11/25  | 2021/11/24 |
| SPEAG           | Data Acquisition Electronics  | DAE4        | 1358          | 2021/4/26   | 2022/4/25  |
| SPEAG           | Dosimetric E-Field Probe      | EX3DV4      | 3935          | 2021/4/29   | 2022/4/28  |
| SPEAG           | SAM Twin Phantom              | SAM Twin    | TP-1697       | NCR         | NCR        |
| Testo           | Hygrometer                    | 608-H1      | 1241332102    | 2021/1/7    | 2022/1/6   |
| SPEAG           | Phone Positioner              | N/A         | N/A           | NCR         | NCR        |
| Anritsu         | Radio Communication Analyzer  | MT8821C     | 6201432831    | 2021/4/13   | 2022/4/12  |
| Agilent         | ENA Series Network Analyzer   | E5071C      | MY46106933    | 2020/8/1    | 2021/7/31  |
| SPEAG           | Dielectric Probe Kit          | DAK-3.5     | 1144          | 2020/12/2   | 2021/12/1  |
| Anritsu         | Vector Signal Generator       | MG3710A     | 6201682672    | 2021/1/7    | 2022/1/6   |
| Rohde & Schwarz | Power Meter                   | NRVD        | 102081        | 2020/8/13   | 2021/8/12  |
| Rohde & Schwarz | Power Sensor                  | NRV-Z5      | 100538        | 2020/8/13   | 2021/8/12  |
| Rohde & Schwarz | Power Sensor                  | NRV-Z5      | 100539        | 2020/8/13   | 2021/8/12  |
| EXA             | Spectrum Analyzer             | FSV7        | 101632        | 2021/1/7    | 2022/1/6   |
| FLUKE           | DIGITAC THERMOMETER           | 51II        | 97240029      | 2020/8/14   | 2021/8/13  |
| BONN            | POWER AMPLIFIER               | BLMA 2060-2 | 087193B       | Note 1      |            |
| Agilent         | Dual Directional Coupler      | 11691D      | MY48151020    | Note 1      |            |
| ARRA            | Power Divider                 | A3200-2     | N/A           | Note 1      |            |
| MCL             | Attenuation1                  | BW-S10W5+   | N/A           | Note 1      |            |
| MCL             | Attenuation2                  | BW-S10W5+   | N/A           | Note 1      |            |
| MCL             | Attenuation3                  | BW-S10W5+   | N/A           | Note 1      |            |

**Note:**

1. Prior to system verification and validation, the path loss from the signal generator to the system check source and the power meter, which includes the amplifier, cable, attenuator and directional coupler, was measured by the network analyzer. The reading of the power meter was offset by the path loss difference between the path to the power meter and the path to the system check source to monitor the actual power level fed to the system check.
2. Referring to KDB 865664 D01v01r04, the dipole calibration interval can be extended to 3 years with justification. The dipoles are also not physically damaged, or repaired during the interval.
3. The justification data of dipole can be found in appendix C. The return loss is < -20dB, within 20% of prior calibration, the impedance is within 5 ohm of prior calibration.

## 12. System Verification

### 12.1 Tissue Simulating Liquids

For the measurement of the field distribution inside the SAM phantom with DASY, the phantom must be filled with around 25 liters of homogeneous body tissue simulating liquid. For head SAR testing, the liquid height from the ear reference point (ERP) of the phantom to the liquid top surface is larger than 15 cm, which is shown in Fig. 12.1. For body SAR testing, the liquid height from the center of the flat phantom to the liquid top surface is larger than 15 cm, which is shown in Fig. 12.2.

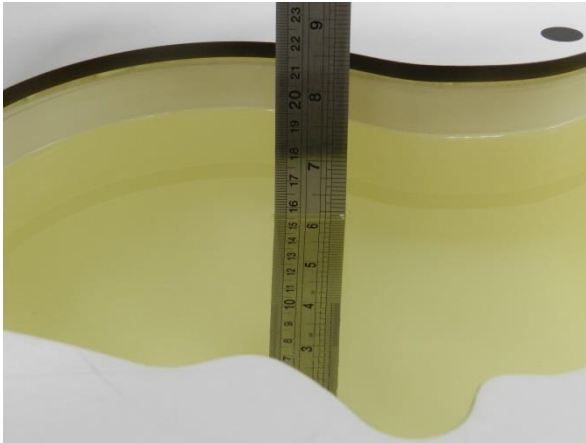


Fig 12.1 Photo of Liquid Height for Head SAR

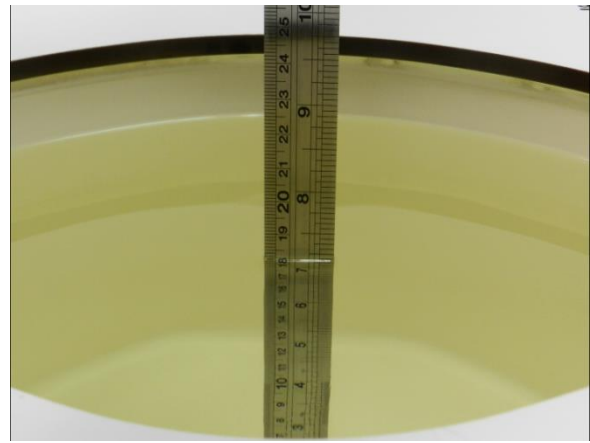


Fig 12.2 Photo of Liquid Height for Body SAR

## 12.2 Tissue Verification

The following tissue formulations are provided for reference only as some of the parameters have not been thoroughly verified. The composition of ingredients may be modified accordingly to achieve the desired target tissue parameters required for routine SAR evaluation.

| Frequency (MHz)  | Water (%) | Sugar (%) | Cellulose (%) | Salt (%) | Preventol (%) | DGBE (%) | Conductivity ( $\sigma$ ) | Permittivity ( $\epsilon_r$ ) |
|------------------|-----------|-----------|---------------|----------|---------------|----------|---------------------------|-------------------------------|
| For Head         |           |           |               |          |               |          |                           |                               |
| 750              | 41.1      | 57.0      | 0.2           | 1.4      | 0.2           | 0        | 0.89                      | 41.9                          |
| 835              | 40.3      | 57.9      | 0.2           | 1.4      | 0.2           | 0        | 0.90                      | 41.5                          |
| 1800, 1900, 2000 | 55.2      | 0         | 0             | 0.3      | 0             | 44.5     | 1.40                      | 40.0                          |
| 2450             | 55.0      | 0         | 0             | 0        | 0             | 45.0     | 1.80                      | 39.2                          |
| 2600             | 54.8      | 0         | 0             | 0.1      | 0             | 45.1     | 1.96                      | 39.0                          |

### <Tissue Dielectric Parameter Check Results>

| Frequency (MHz) | Tissue Type | Liquid Temp. (°C) | Conductivity ( $\sigma$ ) | Permittivity ( $\epsilon_r$ ) | Conductivity Target ( $\sigma$ ) | Permittivity Target ( $\epsilon_r$ ) | Delta ( $\sigma$ ) (%) | Delta ( $\epsilon_r$ ) (%) | Limit (%) | Date      |
|-----------------|-------------|-------------------|---------------------------|-------------------------------|----------------------------------|--------------------------------------|------------------------|----------------------------|-----------|-----------|
| 3500            | Head        | 22.6              | 2.795                     | 38.942                        | 2.91                             | 37.90                                | -3.95                  | 2.75                       | ±5        | 2021/6/29 |
| 3500            | Head        | 22.7              | 2.826                     | 39.043                        | 2.91                             | 37.90                                | -2.89                  | 3.02                       | ±5        | 2021/6/30 |

### 12.3 System Performance Check Results

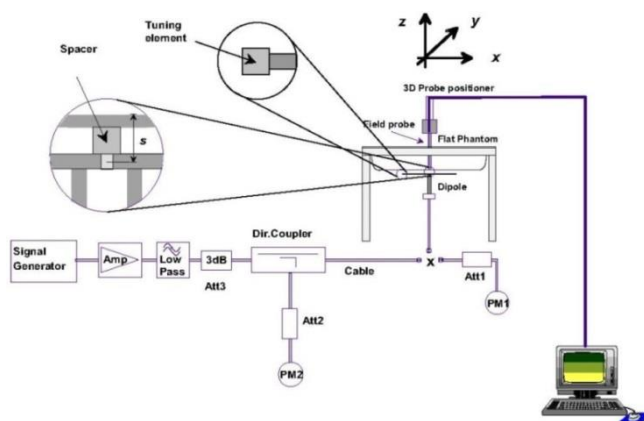
Comparing to the original SAR value provided by SPEAG, the verification data should be within its specification of 10 %. Below table shows the target SAR and measured SAR after normalized to 1W input power. The table below indicates the system performance check can meet the variation criterion and the plots can be referred to Appendix A of this report.

#### <1g SAR>

| Date      | Frequency (MHz) | Tissue Type | Input Power (mW) | Dipole S/N | Probe S/N | DAE S/N | Measured 1g SAR (W/kg) | Targeted 1g SAR (W/kg) | Normalized 1g SAR (W/kg) | Deviation (%) |
|-----------|-----------------|-------------|------------------|------------|-----------|---------|------------------------|------------------------|--------------------------|---------------|
| 2021/6/29 | 3500            | Head        | 50               | 1037       | 3935      | 1358    | 3.24                   | 68.00                  | 64.8                     | -4.71         |
| 2021/6/30 | 3500            | Head        | 50               | 1037       | 3935      | 1358    | 3.27                   | 68.00                  | 65.4                     | -3.82         |

#### <10g SAR>

| Date      | Frequency (MHz) | Tissue Type | Input Power (mW) | Dipole S/N | Probe S/N | DAE S/N | Measured 10g SAR (W/kg) | Targeted 10g SAR (W/kg) | Normalized 10g SAR (W/kg) | Deviation (%) |
|-----------|-----------------|-------------|------------------|------------|-----------|---------|-------------------------|-------------------------|---------------------------|---------------|
| 2021/6/29 | 3500            | Head        | 50               | 1037       | 3935      | 1358    | 1.23                    | 25.40                   | 24.6                      | -3.15         |
| 2021/6/30 | 3500            | Head        | 50               | 1037       | 3935      | 1358    | 1.23                    | 25.40                   | 24.6                      | -3.15         |



**Fig 12.3.1 System Performance Check Setup**



**Fig 12.3.2 Setup Photo**

## 13. RF Exposure Positions

### 13.1 Ear and handset reference point

Figure 12.1.1 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 15mm along the B-M (back-mouth) line behind the entrance-to-ear-canal (EEC) point, as shown in Figure 12.1.2 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 normal to the Reference Plane and perpendicular to both a line passing through RE and LE and the B-M line (see Figure 12.1.3). Both N-F and B-M lines should be marked on the exterior of the phantom shell to facilitate handset positioning. Posterior to the N-F line the ear shape is a flat surface with 6 mm thickness at each ERP, and forward of the N-F line the ear is truncated, as illustrated in Figure 12.1.2. The ear truncation is introduced to preclude the ear lobe from interfering with handset tilt, which could lead to unstable positioning at the cheek.

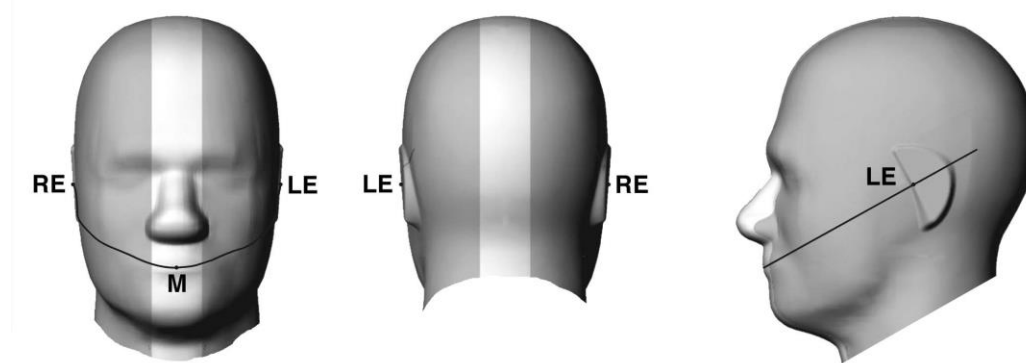


Fig 12.1.1 Front, back, and side views of SAM twin phantom

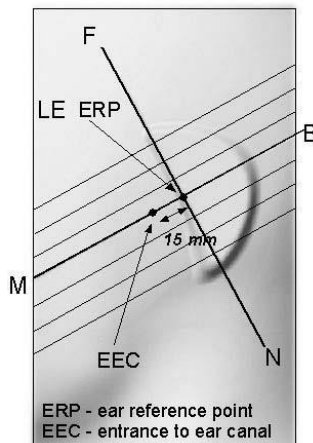


Fig 12.1.2 Close-up side view of phantom showing the ear region.

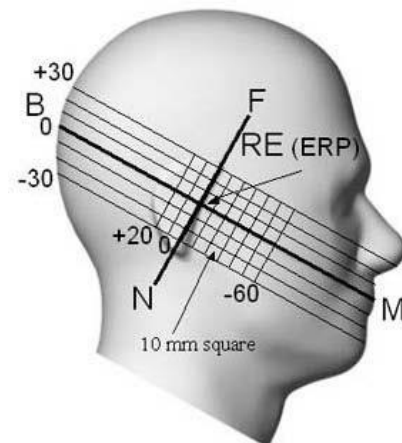


Fig 12.1.3 Side view of the phantom showing relevant markings and seven cross-sectional plane locations

### 13.2 Definition of the cheek position

1. Ready the handset for talk operation, if necessary. For example, for handsets with a cover piece (flip cover), open the cover. If the handset can transmit with the cover closed, both configurations must be tested.
2. Define two imaginary lines on the handset—the vertical centerline and the horizontal line. The vertical centerline passes through two points on the front side of the handset—the midpoint of the width  $w_t$  of the handset at the level of the acoustic output (point A in Figure 12.2.1 and Figure 12.2.2), and the midpoint of the width  $w_b$  of the bottom of the handset (point B). The horizontal line is perpendicular to the vertical centerline and passes through the center of the acoustic output (see Figure 12.2.1). The two lines intersect at point A. Note that for many handsets, point A coincides with the center of the acoustic output; however, the acoustic output may be located elsewhere on the handset. Also note that the vertical centerline is not necessarily parallel to the front face of the handset (see Figure 12.2.2), especially for clamshell handsets, handsets with flip covers, and other irregularly-shaped handsets.
3. Position the handset close to the surface of the phantom such that point A is on the (virtual) extension of the line passing through points RE and LE on the phantom (see Figure 12.2.3), such that the plane defined by the vertical centerline and the horizontal line of the handset is approximately parallel to the sagittal plane of the phantom.
4. Translate the handset towards the phantom along the line passing through RE and LE until handset point A touches the pinna at the ERP.
5. While maintaining the handset in this plane, rotate it around the LE-RE line until the vertical centerline is in the plane normal to the plane containing B-M and N-F lines, i.e., the Reference Plane.
6. Rotate the handset around the vertical centerline until the handset (horizontal line) is parallel to the N-F line.
7. While maintaining the vertical centerline in the Reference Plane, keeping point A on the line passing through RE and LE, and maintaining the handset contact with the pinna, rotate the handset about the N-F line until any point on the handset is in contact with a phantom point below the pinna on the cheek. See Figure 12.2.3. The actual rotation angles should be documented in the test report.

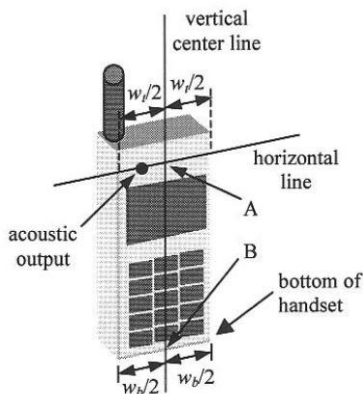


Fig 12.2.1 Handset vertical and horizontal reference lines—"fixed case"

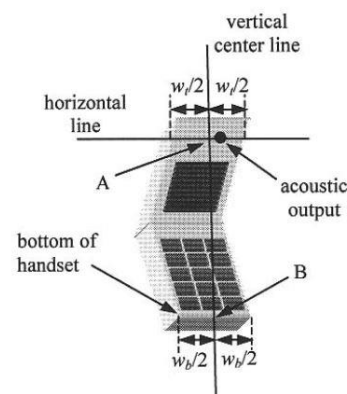


Fig 12.2.2 Handset vertical and horizontal reference lines—"clam-shell case"

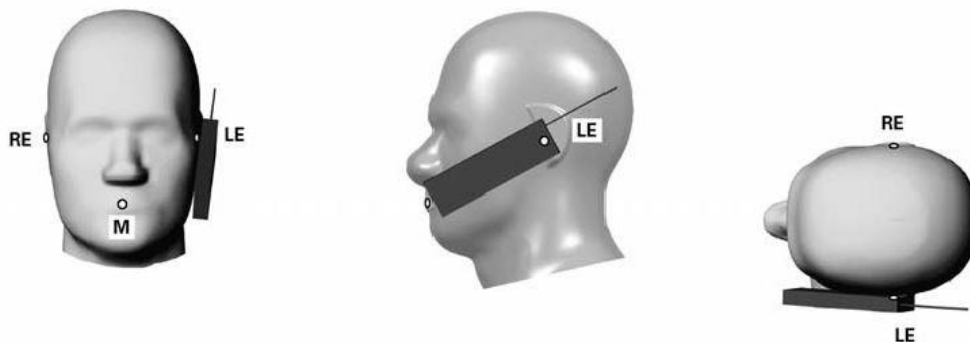


Fig 12.2.3 cheek or touch position. The reference points for the right ear (RE), left ear (LE), and mouth (M), which establish the Reference Plane for handset positioning, are indicated.

### 13.3 Definition of the tilt position

1. Ready the handset for talk operation, if necessary. For example, for handsets with a cover piece (flip cover), open the cover. If the handset can transmit with the cover closed, both configurations must be tested.
2. While maintaining the orientation of the handset, move the handset away from the pinna along the line passing through RE and LE far enough to allow a rotation of the handset away from the cheek by 15°.
3. Rotate the handset around the horizontal line by 15°.
4. While maintaining the orientation of the handset, move the handset towards the phantom on the line passing through RE and LE until any part of the handset touches the ear. The tilt position is obtained when the contact point is on the pinna. See Figure 12.3.1. If contact occurs at any location other than the pinna, e.g., the antenna at the back of the phantom head, the angle of the handset should be reduced. In this case, the tilt position is obtained if any point on the handset is in contact with the pinna and a second point

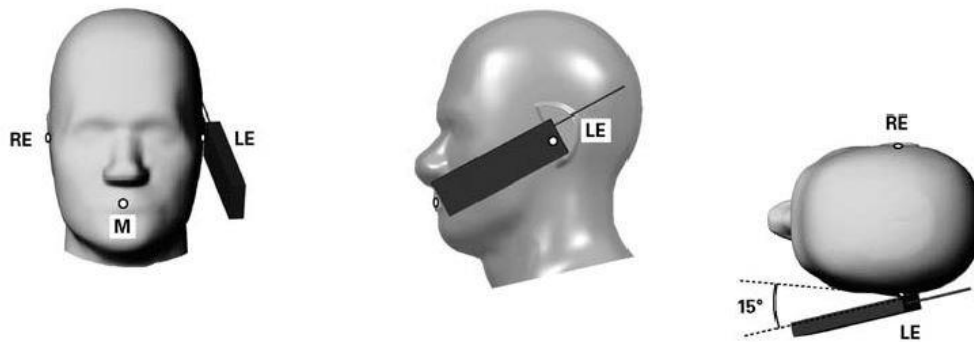


Fig 12.3.1 Tilt position. The reference points for the right ear (RE), left ear (LE), and mouth (M), which define the Reference Plane for handset positioning, are indicated.

### 13.4 Body Worn Accessory

Body-worn operating configurations are tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in a normal use configuration (see Figure 12.4). Per KDB648474 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 447498 D01v06 should be used to test for body-worn accessory SAR compliance, without a headset connected to it. This enables the test results for such configuration to be compatible with that required for hotspot mode when the body-worn accessory test separation distance is greater than or equal to that required for hotspot mode, when applicable. When the reported SAR for body-worn accessory, measured without a headset connected to the handset is  $> 1.2 \text{ W/kg}$ , the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body-worn accessory with a handset attached to the handset.

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 test with the device with each accessory. If multiple accessories share an identical metallic component (i.e. the same metallic belt-clip used with different holsters with no other metallic components) only the accessory that dictates the closest spacing to the body is tested.

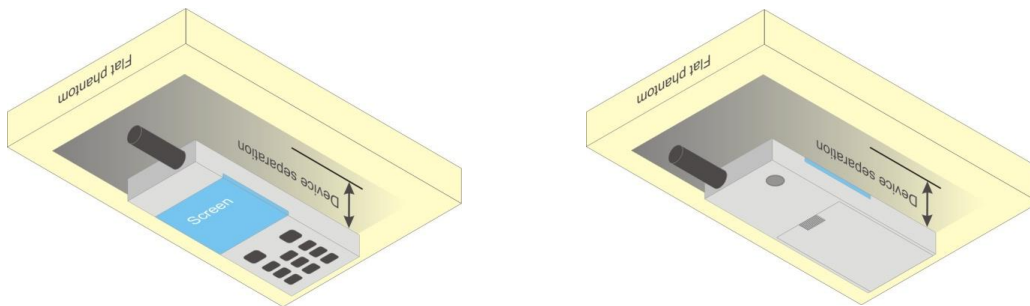


Fig 12.4 Body Worn Position

### 13.5 Product Specific 10g SAR Exposure

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, According to KDB648474 D04v01r03, the following phablet procedures should be applied to evaluate SAR compliance for each applicable wireless modes and frequency band. Devices marketed as phablets, regardless of form factors and operating characteristics must be tested as a phablet to determine SAR compliance

1. The normally required head and body-worn accessory SAR test procedures for handsets, including hotspot mode, must be applied.
2. The UMPC mini-tablet procedures must also be applied to test the SAR of all surfaces and edges with an antenna located at  $\leq 25\text{mm}$  from that surface or edge, in direct contact with a flat phantom, for 10-g extremity SAR according to the body-equivalent tissue dielectric parameters in KDB 865664 to address interactive hand use exposure conditions.6 The UMPC mini-tablet 1-g SAR at 5mm is not required. When hotspot mode applies, 10-g extremity SAR is required only for the surfaces and edges with hotspot mode 1-g reported SAR > 1.2 W/kg.

### 13.6 Wireless Router

Some battery-operated handsets have the capability to transmit and receive user through simultaneous transmission of WIFI simultaneously with a separate licensed transmitter. The FCC has provided guidance in FCC KDB Publication 941225 D06 v02r01 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 10mm from the front, back and edges of the device containing transmitting antennas within 2.5cm 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.

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.

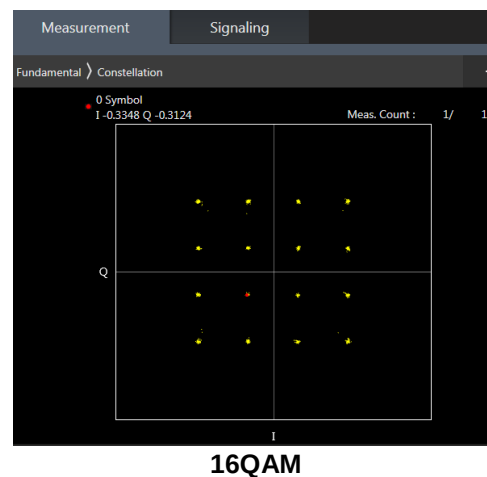
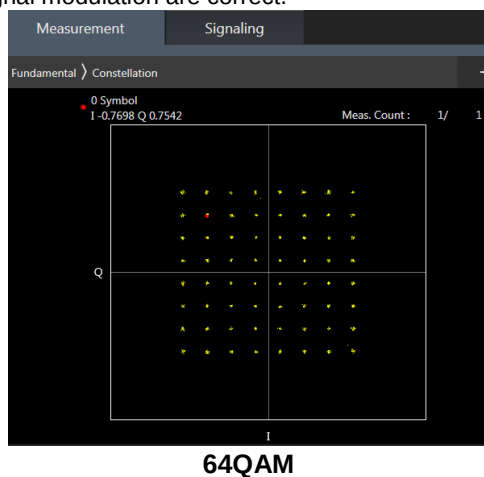
## 14. Conducted RF Output Power (Unit: dBm)

The detailed conducted power table can refer to Appendix E.

### <LTE Conducted Power>

#### General Note:

1. Anritsu MT8821C base station simulator was used to setup the connection with EUT; the frequency band, channel bandwidth, RB allocation configuration, modulation type are set in the base station simulator to configure EUT transmitting at maximum power and at different configurations which are requested to be reported to FCC, for conducted power measurement and SAR testing.
2. Per KDB 941225 D05v02r05, when a properly configured base station simulator is used for the SAR and power measurements, spectrum plots for each RB allocation and offset configuration is not required.
3. Per KDB 941225 D05v02r05, start with the largest channel bandwidth and measure SAR for QPSK with 1 RB allocation, using the RB offset and required test channel combination with the highest maximum output power for RB offsets at the upper edge, middle and lower edge of each required test channel.
4. Per KDB 941225 D05v02r05, 50% RB allocation for QPSK SAR testing follows 1RB QPSK allocation procedure.
5. Per KDB 941225 D05v02r05, 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  $\leq 0.8$  W/kg. Otherwise, SAR is measured for the highest output power channel; and if the reported SAR is  $> 1.45$  W/kg, the remaining required test channels must also be tested.
6. Per KDB 941225 D05v02r05, 16QAM/64QAM output power for each RB allocation configuration is  $>$  not  $\frac{1}{2}$  dB higher than the same configuration in QPSK and the reported SAR for the QPSK configuration is  $\leq 1.45$  W/kg; Per KDB 941225 D05v02r05, 16QAM/64QAM SAR testing is not required.
7. Per KDB 941225 D05v02r05, smaller bandwidth output power for each RB allocation configuration is  $>$  not  $\frac{1}{2}$  dB higher than the same configuration in the largest supported bandwidth, and the reported SAR for the largest supported bandwidth is  $\leq 1.45$  W/kg; Per KDB 941225 D05v02r05, smaller bandwidth SAR testing is not required.
8. According to 2017 TCB workshop, for 64 QAM and 16 QAM should be verified by checking the signal constellation with a call box to avoid incorrect maximum power levels due to MPR and other requirements associated with signal modulation, and the following figure is taken from the "Fundamental Measurement >> Modulation Analysis >> constellation" mode of the device connect to the MT8821C base station, therefore, the device 64QAM and 16QAM signal modulation are correct.



### <TDD LTE SAR Measurement>

TDD LTE configuration setup for SAR measurement

SAR was tested with a fixed periodic duty factor according to the highest transmission duty factor implemented for the device and supported by 3GPP.

- 3GPP TS 36.211 section 4.2 for Type 2 Frame Structure and Table 4.2-2 for uplink-downlink configurations
- “special subframe S” contains both uplink and downlink transmissions, it has been taken into consideration to determine the transmission duty factor according to the worst case uplink and downlink cyclic prefix requirements for UpPTS
- Establishing connections with base station simulators ensure a consistent means for testing SAR and recommended for evaluating SAR. The Anritsu MT8820C (firmware: #22.52#004) was used for LTE output power measurements and SAR testing.

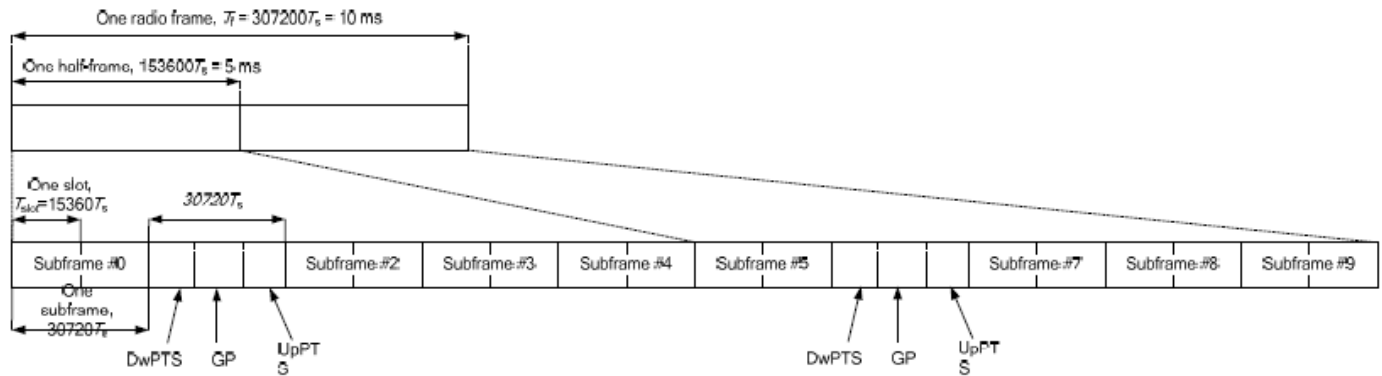


Figure 4.2-1: Frame structure type 2 (for 5 ms switch-point periodicity).

Table 4.2-2: Uplink-downlink configurations.

| Uplink-downlink configuration | Downlink-to-Uplink Switch-point periodicity | Subframe number |   |   |   |   |   |   |   |   |   |
|-------------------------------|---------------------------------------------|-----------------|---|---|---|---|---|---|---|---|---|
|                               |                                             | 0               | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 0                             | 5 ms                                        | D               | S | U | U | U | D | S | U | U | U |
| 1                             | 5 ms                                        | D               | S | U | U | D | D | S | U | U | D |
| 2                             | 5 ms                                        | D               | S | U | D | D | D | S | U | D | D |
| 3                             | 10 ms                                       | D               | S | U | U | U | D | D | D | D | D |
| 4                             | 10 ms                                       | D               | S | U | U | D | D | D | D | D | D |
| 5                             | 10 ms                                       | D               | S | U | D | D | D | D | D | D | D |
| 6                             | 5 ms                                        | D               | S | U | U | U | D | S | U | U | D |

Table 4.2-1: Configuration of special subframe (lengths of DwPTS/GP/UpPTS).

| Special subframe configuration | Normal cyclic prefix in downlink |                                |                                  | Extended cyclic prefix in downlink |                                |                                  |
|--------------------------------|----------------------------------|--------------------------------|----------------------------------|------------------------------------|--------------------------------|----------------------------------|
|                                | DwPTS                            | UpPTS                          |                                  | DwPTS                              | UpPTS                          |                                  |
|                                |                                  | Normal cyclic prefix in uplink | Extended cyclic prefix in uplink |                                    | Normal cyclic prefix in uplink | Extended cyclic prefix in uplink |
| 0                              | $6592 \cdot T_s$                 | $2192 \cdot T_s$               | $2560 \cdot T_s$                 | $7680 \cdot T_s$                   | $2192 \cdot T_s$               | $2560 \cdot T_s$                 |
| 1                              | $19760 \cdot T_s$                |                                |                                  | $20480 \cdot T_s$                  |                                |                                  |
| 2                              | $21952 \cdot T_s$                |                                |                                  | $23040 \cdot T_s$                  |                                |                                  |
| 3                              | $24144 \cdot T_s$                |                                |                                  | $25600 \cdot T_s$                  |                                |                                  |
| 4                              | $26336 \cdot T_s$                | $4384 \cdot T_s$               | $5120 \cdot T_s$                 | $7680 \cdot T_s$                   | $4384 \cdot T_s$               | $5120 \cdot T_s$                 |
| 5                              | $6592 \cdot T_s$                 |                                |                                  | $20480 \cdot T_s$                  |                                |                                  |
| 6                              | $19760 \cdot T_s$                |                                |                                  | $23040 \cdot T_s$                  |                                |                                  |
| 7                              | $21952 \cdot T_s$                |                                |                                  | $12800 \cdot T_s$                  | -                              | -                                |
| 8                              | $24144 \cdot T_s$                |                                |                                  | -                                  | -                              | -                                |
| 9                              | $13168 \cdot T_s$                |                                |                                  | -                                  | -                              | -                                |

| Special subframe (30720·T <sub>s</sub> ): Normal cyclic prefix in downlink (UpPTS) |                                |                                |                                  |
|------------------------------------------------------------------------------------|--------------------------------|--------------------------------|----------------------------------|
|                                                                                    | Special subframe configuration | Normal cyclic prefix in uplink | Extended cyclic prefix in uplink |
| Uplink duty factor in one special subframe                                         | 0~4                            | 7.13%                          | 8.33%                            |
|                                                                                    | 5~9                            | 14.3%                          | 16.7%                            |

| Special subframe(30720·T <sub>s</sub> ): Extended cyclic prefix in downlink (UpPTS) |                                |                                |                                  |
|-------------------------------------------------------------------------------------|--------------------------------|--------------------------------|----------------------------------|
|                                                                                     | Special subframe configuration | Normal cyclic prefix in uplink | Extended cyclic prefix in uplink |
| Uplink duty factor in one special subframe                                          | 0~3                            | 7.13%                          | 8.33%                            |
|                                                                                     | 4~7                            | 14.3%                          | 16.7%                            |

The highest duty factor is resulted from:

- Uplink-downlink configuration: 0. In a half-frame consisted of 5 subframes, uplink operation is in 3 uplink subframes and 1 special subframe.
- special subframe configuration: 5-9 for normal cyclic prefix in downlink, 4-7 for extended cyclic prefix in downlink
- for special subframe with extended cyclic prefix in uplink, the total uplink duty factor in one half-frame is:  $(3+0.167)/5 = 63.3\%$
- for special subframe with normal cyclic prefix in uplink, the total uplink duty factor in one half-frame is:  $(3+0.143)/5 = 62.9\%$
- For TDD LTE SAR measurement, the duty cycle 1:1.59 (62.9 %) was used perform testing and considering the theoretical duty cycle of 63.3% for extended cyclic prefix in the uplink, and the theoretical duty cycle of 62.9% for normal cyclic prefix in uplink, a scaling factor of extended cyclic prefix  $63.3\%/62.9\% = 1.006$  is applied to scale-up the measured SAR result. The scaled TDD LTE SAR = measured SAR (W/kg)\* Tune-up Scaling Factor\* scaling factor for extended cyclic prefix.

**<LTE Carrier Aggregation> (Downlink)**
**General Note:**

1. This device supports Carrier Aggregation on downlink for inter and intra band. For the device supports bands and bandwidths and configurations are provided as follow table was according to 3GPP.
2. In applying the existing power measurement procedures of KDB 941225 D05A for DL CA SAR test exclusion, only the subset with the largest number of combinations of frequency bands and CCs in each row need combination, and for this device that all the configurations were choose to power measurement.
3. The gray color table is covered by other combinations and no need to verify power.

| 2CC Downlink Carrier Aggregation |             |                                 |
|----------------------------------|-------------|---------------------------------|
| Number                           | Combination | Covered by Measurement Superset |
| 2CC #1                           | CA_41A-42A  |                                 |
| 2CC #2                           | CA_42C      |                                 |
| 2CC #3                           | CA_7A-42A   |                                 |

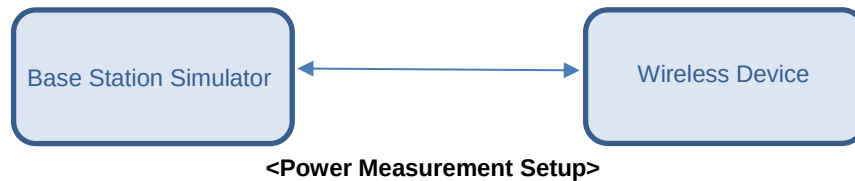
**LTE Carrier Aggregation Conducted Power (Downlink)**

- i. According to KDB941225 D05A v01r02, Uplink maximum output power measurement with downlink carrier aggregation active should be measured, using the highest output channel measured without downlink carrier aggregation, to confirm that uplink maximum output power with downlink carrier aggregation active remains within the specified tune-up tolerance limits and not more than ¼ dB higher than the maximum output measured without downlink carrier aggregation active.
- ii. Uplink maximum output power with downlink carrier aggregation active does not show more than ¼ dB higher than the maximum output power without downlink carrier aggregation active, therefore SAR evaluation with downlink carrier aggregation active can be excluded.
- iii. The device supports downlink two carrier aggregation. For power measurement were control and acknowledge data is sent on uplink channels that operate identical to specifications when downlink carrier aggregation is inactive.
- iv. Selected highest measured power when downlink carrier aggregation is inactive for conducted power comparison with downlink carrier aggregation is active, to confirm that when downlink carrier aggregation is active uplink maximum output power remains within the specified tune-up tolerance limits and not more than ¼ dB higher than the maximum output power measured when downlink carrier aggregation inactive.
- v. For inter-band CA, the SCC selected highest bandwidth and near the middle of its transmission band. For SCC DL RB size and offset will base on the PCC corresponding RB allocation.
- vi. For non-contiguous intra-band CA, the SCC selected to provide maximum separation from the PCC and must remain fully within the downlink transmission band.
- vii. For Intra-band, contiguous CA, the downlink channels selected to perform the uplink power measurement must satisfy 3GPP channel spacing (5.4.1A of 3GPP TS 36.521 or equivalent) and channel bandwidth (5.4.2A) requirements.

$$\text{Nominal channel spacing} = \left\lceil \frac{BW_{\text{Channel}(1)} + BW_{\text{Channel}(2)} - 0.1|BW_{\text{Channel}(1)} - BW_{\text{Channel}(2)}|}{0.6} \right\rceil 0.3 \text{ [MHz]}$$

### **LTE Carrier Aggregation Conducted Power (Uplink)**

1. This device supports uplink carrier aggregation for LTE CA\_7C with a maximum of two 20MHz component carriers. For intra band contiguous carrier aggregation scenarios, 3GPP 36.101 Table 6.2.2A-1 specifies that the aggregate maximum allowed output power is equivalent to the single carrier scenario. For the non-contiguously allocated resource blocks which the MPR level is determined by various RB separation and RB sizes requirement, and the allowed MPR levels, settings and the conducted powers are permanently implemented in this device per the 3GPP 36.36.101 section 6.2.3A.1.3 requirements.
2. According to FCC guidance, the output power with uplink CA active was measured for the high / middle / low channel configuration with the highest reported SAR for each exposure condition, the power was measured with wideband signal integration over both component carriers.
3. In applying the power measurement procedures of KDB 941225 D05A for DL CA to qualify for UL SAR test exclusion, power measurement is required only for the subset in each row with the largest combination of frequency bands and CCs
4. Maximum output power measurement is required for each UL CA configuration for the required test channels described in KDB 941225 D05. The required test channel should be associated with the UL PCC. For channels at the ends of a frequency band, the SCC and subsequent CCs are added to the side within the transmission band. Otherwise, the CCs should be added alternatively to either side of the PCC.



### **5G NR Output Power (Unit: dBm)**

#### **General Note:**

1. Following 5G NR n77/n78 support SCS 30KHz DFT/CP-OFDM, PI/2 BPSK/QPSK/16QAM/64QAM/256QAM, Bandwidth 10M/15M/20M/40M/50M/60M/70M/80M/90M/100M.
2. For 5G NR test procedure was following step similar FCC KDB 941225 D05:
  - a. For DFT-OFDM and CP-OFDM output power measurement reduction, according to 38.101 maximum power reduction for power class2 and 3, the CP-OFDM mode will not higher than DFT-OFDM mode, therefore, similar FCC KDB 941225 D05 procedure for other modulation output power for each RB allocation configuration is > not ½ dB higher than the same configuration in DFT-QPSK and the reported SAR for the DFT-QPSK configuration is ≤ 1.45 W/kg; CP-OFDM testing is not required.
  - b. For DFT-OFDM output power measurement reduction, according to 38.101 maximum power reduction for power class2 and 3, for 16QAM/64QMA/256QAM and smaller bandwidth output power will spot check largest channel bandwidth worst RB configuration to ensure the 16QAM/64QMA/256QAM and smaller bandwidth output power will not ½ dB higher than the same configuration in the largest supported bandwidth.
  - c. SAR testing start with the largest channel bandwidth and measure SAR for QPSK with 1 RB allocation, using the RB offset and required test channel combination with the highest maximum output power for RB offsets at the upper edge, middle and lower edge of each required test channel
  - d. 50% RB allocation for QPSK SAR testing follows 1RB QPSK allocation procedure
  - e. 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. Otherwise, SAR is measured for the highest output power channel; and if the reported SAR is > 1.45 W/kg, the remaining required test channels must also be tested
  - f. PI/2 BPSK/16QAM/64QAM/256QAM output powers according to 3GPP MPR will not ½ dB higher than the same configuration in QPSK, also reported SAR for the QPSK configuration is less than 1.45 W/kg, PI/2 BPSK/16QAM/64QAM/256QAM SAR testing are not required.
  - g. Smaller bandwidth output power for each RB allocation configuration for this device will not ½ dB higher than the same configuration in the largest supported bandwidth, and the reported SAR for the largest supported bandwidth is ≤ 1.45 W/kg, smaller bandwidth SAR testing is not required for this device
3. Due to test setup limitations, SAR testing for NR was performed using Factory Test Mode software to establish the connection and perform SAR with 100% transmission.
4. For 5G NR test, using FTM (Factory Test Mode) to perform SAR with default 100% transmission.
5. NSA and SA mode should perform SAR separately. For the maximum power of NSA mode is the same as SA total power level, so NSA SAR can represent SA mode SAR.
6. 5G NR NSA mode, the power level is the same as 5GNR SA mode, so 5GNR NSA mode and SA mode power table only show one time.
7. 5G NR supports CP-OFDM and DFT-s-OFDM modulation, for DFT-s-OFDM power is higher than CP-OFDM, so only show DFT-s-OFDM power table and chose DFT-s-OFDM to perform SAR testing.
8. For DFT-s-OFDM and CP-OFDM output power measurement reduction, according to 38.101 maximum power reduction for the CP-OFDM mode will not higher than DFT-s-OFDM mode, therefore, CP-OFDM measurement is unnecessary.
9. 5G NR NSA EN-DC mode, standalone SAR performed for 5GNR band with the maximum power, EN-DC SAR summed 5GNR standalone SAR and LTE standalone SAR , the result of EN-DC SAR is more conservatively.

**<3GPP 38.101 MPR for EN-DC>**
**Table 6.2.2-1 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 | $\leq 3.5^1$        | $\leq 1.2^1$         | $\leq 0.2^1$         |
|            |           | $\leq 0.5^2$        | $\leq 0.5^2$         | 0 <sup>2</sup>       |
|            | QPSK      | $\leq 1$            |                      | 0                    |
|            | 16 QAM    | $\leq 2$            |                      | $\leq 1$             |
|            | 64 QAM    | $\leq 2.5$          |                      |                      |
| CP-OFDM    | 256 QAM   | $\leq 4.5$          |                      |                      |
|            | QPSK      | $\leq 3$            |                      | $\leq 1.5$           |
|            | 16 QAM    | $\leq 3$            |                      | $\leq 2$             |
|            | 64 QAM    | $\leq 3.5$          |                      |                      |
|            | 256 QAM   | $\leq 6.5$          |                      |                      |

NOTE 1: Applicable for UE operating in TDD mode with Pi/2 BPSK modulation and UE indicates support for UE capability *powerBoosting-pi2BPSK* and if the IE *powerBoostPi2BPSK* is set to 1 and 40 % or less slots in radio frame are used for UL transmission for bands n40, n41, n77, n78 and n79. The reference power of 0 dB MPR is 26 dBm.

NOTE 2: Applicable for UE operating in FDD mode, or in TDD mode in bands other than n40, n41, n77, n78 and n79 with Pi/2 BPSK modulation and if the IE *powerBoostPi2BPSK* is set to 0 and if more than 40 % of slots in radio frame are used for UL transmission for bands n40, n41, n77, n78 and n79.

**Table 6.2.2-2 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 | $\leq 3.5$          | $\leq 0.5$           | 0                    |
|            | QPSK      | $\leq 3.5$          | $\leq 1$             | 0                    |
|            | 16 QAM    | $\leq 3.5$          | $\leq 2$             | $\leq 1$             |
|            | 64 QAM    | $\leq 3.5$          | $\leq 2.5$           |                      |
|            | 256 QAM   | $\leq 4.5$          |                      |                      |
| CP-OFDM    | QPSK      | $\leq 3.5$          | $\leq 3$             | $\leq 1.5$           |
|            | 16 QAM    | $\leq 3.5$          | $\leq 3$             | $\leq 2$             |
|            | 64 QAM    | $\leq 3.5$          |                      |                      |
|            | 256 QAM   | $\leq 6.5$          |                      |                      |

| FCC EN-DC     | UL LTE<br>LTE TX Ant | UL NR<br>NR Ant |
|---------------|----------------------|-----------------|
| DC_5A_n78A    | ANT_0                | ANT_5           |
| DC_7A_n78A    | ANT_0                | ANT_5           |
| DC_38A_n78A   | ANT_0                | ANT_5           |
| DC_66A_n78A   | ANT_1                | ANT_5           |
| DC_41A_n77A   | ANT_0                | ANT_5           |
| DC_7C_n78A    | ANT_0                | ANT_5           |
| DC_41C_n77A   | ANT_0                | ANT_5           |
| DC_5A-7A_n78A | ANT_0                | ANT_5           |

Note: 1. For EN-DC component, LTE band 7 for ANT 4 is limited to EN-DC active and they will act as anchor mode. When EN-DC is not active, LTE band 7 will not transmit.

2. DC\_5A-7A\_n78A is added this time in this report.



## **15. Antenna Location**

The detailed antenna location information can refer to SAR Test Setup Photos.

## 16. SAR Test Results

### General Note:

1. Per KDB 447498 D01v06, the reported SAR is the measured SAR value adjusted for maximum tune-up tolerance.
  - a. Tune-up scaling Factor = tune-up limit power (mW) / EUT RF power (mW), where tune-up limit is the maximum rated power among all production units.
  - b. For SAR testing of WLAN/Bluetooth signal with non-100% duty cycle, the measured SAR is scaled-up by the duty cycle scaling factor which is equal to "1/(duty cycle)"
  - c. For WWAN: Reported SAR(W/kg)= Measured SAR(W/kg)\*Tune-up Scaling Factor
  - d. For BT/WLAN: Reported SAR(W/kg)= Measured SAR(W/kg)\* Duty Cycle scaling factor \* Tune-up scaling factor
  - e. For TDD LTE SAR measurement, the duty cycle 1:1.59 (62.9 %) was used perform testing and considering the theoretical duty cycle of 63.3% for extended cyclic prefix in the uplink, and the theoretical duty cycle of 62.9% for normal cyclic prefix in uplink, a scaling factor of extended cyclic prefix 63.3%/62.9% = 1.006 is applied to scale-up the measured SAR result. The Reported TDD LTE SAR = measured SAR (W/kg)\* Tune-up Scaling Factor\* scaling factor for extended cyclic prefix.
2. Per KDB 447498 D01v06, for each exposure position, 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:
  - $\leq 0.8$  W/kg or  $2.0$  W/kg, for 1-g or 10-g respectively, when the transmission band is  $\leq 100$  MHz
  - $\leq 0.6$  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
  - $\leq 0.4$  W/kg or  $1.0$  W/kg, for 1-g or 10-g respectively, when the transmission band is  $\geq 200$  MHz
3. Per KDB 865664 D01v01r04, for each frequency band, repeated SAR measurement is required when the measured SAR is  $\geq 0.8$ W/kg. Per KDB 865664 D01v01r04, if the extremity repeated SAR is necessary, the same procedures should be adapted for measurements according to extremity and occupational exposure limits by applying a factor of 2.5 for extremity exposure and a factor of 5 for occupational exposure to the corresponding SAR thresholds.
4. Pre KDB648474 D04v01r03, 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. When headset SAR is less than or equal than without headset SAR, no need to verify the remaining channels for headset SAR.
5. The device implements Proximity sensors/receiver detect mechanism/hotspot trigger reduced power for the power management for SAR compliance at different exposure conditions (head, body-worn, hotspot, extremity).
6. The device will invoke corresponding work scenarios power level, which are provided in the operational description.
7. For Some WWAN bands, sensor on reduced power level higher than hotspot reduced power level, so front/back sensor on SAR can represent hotspot conservatively.
8. For WLAN when transmit simultaneous with WWAN, power reduction will be activated to head / hotspot/ extremity. For WLAN when transmit simultaneous with WWAN and proximity sensors trigger, power reduction will be activated to body-worn.
9. For 5G NR test, using FTM (Factory Test Mode) to perform SAR with default 100% transmission.
10. This device supports 5GNR FR1 bands, including NSA mode and SA mode.
11. NSA and SA mode should perform SAR separately. For the maximum power of NSA mode is the same as SA total power level, so NSA SAR can represent SA mode SAR.
12. 5GNR NSA mode, the power level is the same as 5GNR SA mode, so 5GNR NSA mode and SA mode power table only show one time.
13. 5G NR supports CP-OFDM and DFT-s-OFDM modulation, for DFT-s-OFDM power is higher than CP-OFDM, so only show DFT-s-OFDM power table and chose DFT-s-OFDM to perform SAR testing.
14. For DFT-s-OFDM and CP-OFDM output power measurement reduction, according to 38.101 maximum power reduction for the CP-OFDM mode will not higher than DFT-s-OFDM mode, therefore, CP-OFDM measurement is unnecessary.
15. Per KDB648474 D04v01r03, for smart phones with a display diagonal dimension  $> 15.0$  cm or an overall diagonal dimension  $> 16.0$  cm, when hotspot mode applies, 10-g extremity SAR is required only for the surfaces and edges with hotspot mode 1-g reported SAR  $> 1.2$  W/kg, however, when power reduction applies to hotspot mode the measured SAR must be scaled to the maximum output power (for handheld on state, the maximum full power means reduced power), including tolerance, allowed for phablet modes to compare with the 1.2 W/kg SAR test reduction threshold.
  - a. For this device SAR for WWAN/WLAN transmitter scaled to maximum output power mode for product specific 10g SAR is higher than 1.2W/kg of 5GNR n77/n78 therefore product specific 10g SAR is necessary.
  - b. WLAN 5.3/5.5GHz tested the product specific 10g SAR since it has no hotspot mode.
  - c. When 10-g product specific 10g SAR is considered, SAR thresholds is specified in the procedures for SAR test reduction and exclusion should be multiplied by 2.5.
8. For verification of compliance of power reduction scheme, additional SAR testing with EUT transmitting at full RF power at a conservative trigger distance was performed for body worn:  
 Front: [13 mm](#)  
 Back: [19 mm](#)
9. For verification of compliance of power reduction scheme, additional SAR testing with EUT transmitting at full RF power at

a conservative trigger distance was performed as followings. When located the same antenna, the worst SAR base on the same frequency bands chose to verify the full power distance SAR. These bands also with the same maximum full power(sensor off power level) and no need to do each band separately when located the same WWAN antenna and same proximity sensor triggered distance.

ANT5

Top side: [7 mm](#)

**LTE Note:**

1. Per KDB 941225 D05v02r05, start with the largest channel bandwidth and measure SAR for QPSK with 1 RB allocation, using the RB offset and required test channel combination with the highest maximum output power for RB offsets at the upper edge, middle and lower edge of each required test channel.
2. Per KDB 941225 D05v02r05, 50% RB allocation for QPSK SAR testing follows 1RB QPSK allocation procedure.
3. Per KDB 941225 D05v02r05, 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  $\leq 0.8$  W/kg. Otherwise, SAR is measured for the highest output power channel; and if the reported SAR is  $> 1.45$  W/kg, the remaining required test channels must also be tested.
4. Per KDB 941225 D05v02r05, 16QAM/64QAM output power for each RB allocation configuration is  $>$  not  $\frac{1}{2}$  dB higher than the same configuration in QPSK and the reported SAR for the QPSK configuration is  $\leq 1.45$  W/kg; Per KDB 941225 D05v02r05, 16QAM/64QAM SAR testing is not required.
5. Per KDB 941225 D05v02r05, smaller bandwidth output power for each RB allocation configuration is  $>$  not  $\frac{1}{2}$  dB higher than the same configuration in the largest supported bandwidth, and the reported SAR for the largest supported bandwidth is  $\leq 1.45$  W/kg; Per KDB 941225 D05v02r05, smaller bandwidth SAR testing is not required.
6. LTE band 7 located WWAN Ant4 only worked when EN-DC mode active, LTE band 7 can't transmit standalone. So tested those bands located WWAN ant4 in order to sum with 5GNR SAR as EN-DC SAR. LTE band 38 with the same power level as LTE band 41, so power table only show one time. LTE band 41 SAR can represent LTE band 38 SAR and sum with 5GNR as final EN-DC SAR.

**5G NR Note:**

1. For 5G NR test procedure was following step similar FCC KDB 941225 D05:
  - a. SAR testing start with the largest channel bandwidth and measure SAR for QPSK with 1 RB allocation, using the RB offset and required test channel combination with the highest maximum output power for RB offsets at the upper edge, middle and lower edge of each required test channel.
  - b. 50% RB allocation for QPSK SAR testing follows 1RB QPSK allocation procedure
  - c. 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  $\leq 0.8$  W/kg. Otherwise, SAR is measured for the highest output power channel; and if the reported SAR is  $> 1.45$  W/kg, the remaining required test channels must also be tested.
  - d. PI/2 BPSK/16QAM/64QAM/256QAM output powers according to 3GPP MPR will not  $\frac{1}{2}$  dB higher than the same configuration in PI/2 BPSK, also reported SAR for the QPSK configuration is less than 1.45 W/kg, PI/2 BPSK/16QAM/64QAM/256QAM SAR testing are not required.
  - e. Smaller bandwidth output power for each RB allocation configuration for this device will not  $\frac{1}{2}$  dB higher than the same configuration in the largest supported bandwidth, and the reported SAR for the largest supported bandwidth is  $\leq 1.45$  W/kg, smaller bandwidth SAR testing is not required for this device
  - f. For 5G FR1 n77 the maximum bandwidth does not support three non-overlapping channels, 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.



## 16.1 Head SAR

| Plot No. | Band        | BW (MHz) | Modulation | RB Size | RB offset | Test Position | Gap (mm) | Antenna | Power Reduction | Ch.    | Freq. (MHz) | Average Power (dBm) | Tune-Up Limit (dBm) | Tune-up Scaling Factor | Duty Cycle % | Duty Cycle Scaling Factor | Power Drift (dB) | Measured 1g SAR (W/kg) | Reported 1g SAR (W/kg) |
|----------|-------------|----------|------------|---------|-----------|---------------|----------|---------|-----------------|--------|-------------|---------------------|---------------------|------------------------|--------------|---------------------------|------------------|------------------------|------------------------|
| 3500MHz  |             |          |            |         |           |               |          |         |                 |        |             |                     |                     |                        |              |                           |                  |                        |                        |
|          | LTE Band 42 | 20M      | QPSK       | 1       | 0         | Right Cheek   | 0mm      | Ant 5   | Reduced         | 42590  | 3500        | 15.04               | 16.00               | 1.247                  | 62.9         | 1.006                     | 0.06             | 0.604                  | 0.758                  |
|          | LTE Band 42 | 20M      | QPSK       | 50      | 0         | Right Cheek   | 0mm      | Ant 5   | Reduced         | 42590  | 3500        | 13.89               | 15.00               | 1.291                  | 62.9         | 1.006                     | 0.02             | 0.525                  | 0.682                  |
|          | LTE Band 42 | 20M      | QPSK       | 1       | 0         | Right Tilted  | 0mm      | Ant 5   | Reduced         | 42590  | 3500        | 15.04               | 16.00               | 1.247                  | 62.9         | 1.006                     | 0.14             | 0.546                  | 0.685                  |
|          | LTE Band 42 | 20M      | QPSK       | 50      | 0         | Right Tilted  | 0mm      | Ant 5   | Reduced         | 42590  | 3500        | 13.89               | 15.00               | 1.291                  | 62.9         | 1.006                     | 0.06             | 0.447                  | 0.581                  |
|          | LTE Band 42 | 20M      | QPSK       | 1       | 0         | Left Cheek    | 0mm      | Ant 5   | Reduced         | 42590  | 3500        | 15.04               | 16.00               | 1.247                  | 62.9         | 1.006                     | 0.01             | 0.782                  | 0.981                  |
|          | LTE Band 42 | 20M      | QPSK       | 1       | 0         | Left Cheek    | 0mm      | Ant 5   | Reduced         | 42190  | 3460        | 14.77               | 16.00               | 1.327                  | 62.9         | 1.006                     | 0.01             | 0.723                  | 0.965                  |
|          | LTE Band 42 | 20M      | QPSK       | 1       | 0         | Left Cheek    | 0mm      | Ant 5   | Reduced         | 42990  | 3540        | 14.58               | 16.00               | 1.387                  | 62.9         | 1.006                     | 0.06             | 0.703                  | 0.981                  |
|          | LTE Band 42 | 20M      | QPSK       | 50      | 0         | Left Cheek    | 0mm      | Ant 5   | Reduced         | 42590  | 3500        | 13.89               | 15.00               | 1.291                  | 62.9         | 1.006                     | 0.07             | 0.641                  | 0.833                  |
|          | LTE Band 42 | 20M      | QPSK       | 50      | 0         | Left Cheek    | 0mm      | Ant 5   | Reduced         | 42190  | 3460        | 13.64               | 15.00               | 1.368                  | 62.9         | 1.006                     | 0.13             | 0.627                  | 0.863                  |
|          | LTE Band 42 | 20M      | QPSK       | 50      | 0         | Left Cheek    | 0mm      | Ant 5   | Reduced         | 42990  | 3540        | 13.67               | 15.00               | 1.358                  | 62.9         | 1.006                     | 0.12             | 0.622                  | 0.850                  |
|          | LTE Band 42 | 20M      | QPSK       | 100     | 0         | Left Cheek    | 0mm      | Ant 5   | Reduced         | 42590  | 3500        | 13.93               | 15.00               | 1.279                  | 62.9         | 1.006                     | 0.02             | 0.601                  | 0.774                  |
| 01       | LTE Band 42 | 20M      | QPSK       | 1       | 0         | Left Tilted   | 0mm      | Ant 5   | Reduced         | 42590  | 3500        | 15.04               | 16.00               | 1.247                  | 62.9         | 1.006                     | -0.07            | 0.788                  | 0.989                  |
|          | LTE Band 42 | 20M      | QPSK       | 1       | 0         | Left Tilted   | 0mm      | Ant 5   | Reduced         | 42190  | 3460        | 14.77               | 16.00               | 1.327                  | 62.9         | 1.006                     | 0.01             | 0.727                  | 0.971                  |
|          | LTE Band 42 | 20M      | QPSK       | 1       | 0         | Left Tilted   | 0mm      | Ant 5   | Reduced         | 42990  | 3540        | 14.58               | 16.00               | 1.387                  | 62.9         | 1.006                     | -0.07            | 0.705                  | 0.984                  |
|          | LTE Band 42 | 20M      | QPSK       | 50      | 0         | Left Tilted   | 0mm      | Ant 5   | Reduced         | 42590  | 3500        | 13.89               | 15.00               | 1.291                  | 62.9         | 1.006                     | -0.18            | 0.641                  | 0.833                  |
|          | LTE Band 42 | 20M      | QPSK       | 50      | 0         | Left Tilted   | 0mm      | Ant 5   | Reduced         | 42190  | 3460        | 13.64               | 15.00               | 1.368                  | 62.9         | 1.006                     | 0.09             | 0.627                  | 0.863                  |
|          | LTE Band 42 | 20M      | QPSK       | 50      | 0         | Left Tilted   | 0mm      | Ant 5   | Reduced         | 42990  | 3540        | 13.67               | 15.00               | 1.358                  | 62.9         | 1.006                     | -0.03            | 0.618                  | 0.844                  |
|          | LTE Band 42 | 20M      | QPSK       | 100     | 0         | Left Tilted   | 0mm      | Ant 5   | Reduced         | 42590  | 3500        | 13.93               | 15.00               | 1.279                  | 62.9         | 1.006                     | 0.13             | 0.623                  | 0.802                  |
|          | FR1 n77     | 100M     | QPSK       | 1       | 137       | Right Cheek   | 0mm      | Ant 5   | Reduced         | 633334 | 3500.01     | 12.74               | 14.00               | 1.337                  | 100          | 1.000                     | -0.07            | 0.168                  | 0.225                  |
|          | FR1 n77     | 100M     | QPSK       | 135     | 69        | Right Cheek   | 0mm      | Ant 5   | Reduced         | 633334 | 3500.01     | 12.53               | 14.00               | 1.403                  | 100          | 1.000                     | -0.07            | 0.175                  | 0.245                  |
|          | FR1 n77     | 100M     | QPSK       | 1       | 137       | Right Tilted  | 0mm      | Ant 5   | Reduced         | 633334 | 3500.01     | 12.74               | 14.00               | 1.337                  | 100          | 1.000                     | 0.05             | 0.171                  | 0.229                  |
|          | FR1 n77     | 100M     | QPSK       | 135     | 69        | Right Tilted  | 0mm      | Ant 5   | Reduced         | 633334 | 3500.01     | 12.53               | 14.00               | 1.403                  | 100          | 1.000                     | -0.07            | 0.171                  | 0.240                  |
| 02       | FR1 n77     | 100M     | QPSK       | 1       | 137       | Left Cheek    | 0mm      | Ant 5   | Reduced         | 633334 | 3500.01     | 12.74               | 14.00               | 1.337                  | 100          | 1.000                     | -0.03            | 0.283                  | 0.378                  |
|          | FR1 n77     | 100M     | QPSK       | 135     | 69        | Left Cheek    | 0mm      | Ant 5   | Reduced         | 633334 | 3500.01     | 12.53               | 14.00               | 1.403                  | 100          | 1.000                     | -0.11            | 0.263                  | 0.369                  |
|          | FR1 n77     | 100M     | QPSK       | 1       | 137       | Left Tilted   | 0mm      | Ant 5   | Reduced         | 633334 | 3500.01     | 12.74               | 14.00               | 1.337                  | 100          | 1.000                     | 0.06             | 0.231                  | 0.309                  |
|          | FR1 n77     | 100M     | QPSK       | 135     | 69        | Left Tilted   | 0mm      | Ant 5   | Reduced         | 633334 | 3500.01     | 12.53               | 14.00               | 1.403                  | 100          | 1.000                     | 0.03             | 0.252                  | 0.354                  |



## 16.2 Hotspot SAR

| Plot No. | Band        | BW (MHz) | Modulation | RB Size | RB offset | Test Position | Gap (mm) | Antenna | Power Reduction | Ch.    | Freq. (MHz) | Average Power (dBm) | Tune-Up Limit (dBm) | Tune-up Scaling Factor | Duty Cycle % | Duty Cycle Scaling Factor | Power Drift (dB) | Measured 1g SAR (W/kg) | Reported 1g SAR (W/kg) |
|----------|-------------|----------|------------|---------|-----------|---------------|----------|---------|-----------------|--------|-------------|---------------------|---------------------|------------------------|--------------|---------------------------|------------------|------------------------|------------------------|
| 3500MHz  |             |          |            |         |           |               |          |         |                 |        |             |                     |                     |                        |              |                           |                  |                        |                        |
|          | LTE Band 42 | 20M      | QPSK       | 1       | 0         | Front         | 5mm      | Ant 5   | Reduced         | 42590  | 3500        | 20.49               | 21.00               | 1.125                  | 62.9         | 1.006                     | 0.14             | 0.503                  | 0.569                  |
|          | LTE Band 42 | 20M      | QPSK       | 50      | 0         | Front         | 5mm      | Ant 5   | Reduced         | 42590  | 3500        | 19.87               | 20.00               | 1.030                  | 62.9         | 1.006                     | 0.16             | 0.416                  | 0.431                  |
|          | LTE Band 42 | 20M      | QPSK       | 1       | 0         | Back          | 5mm      | Ant 5   | Reduced         | 42590  | 3500        | 20.49               | 21.00               | 1.125                  | 62.9         | 1.006                     | 0.03             | 0.762                  | 0.862                  |
|          | LTE Band 42 | 20M      | QPSK       | 1       | 0         | Back          | 5mm      | Ant 5   | Reduced         | 42190  | 3460        | 20.14               | 21.00               | 1.219                  | 62.9         | 1.006                     | 0.04             | 0.701                  | 0.860                  |
|          | LTE Band 42 | 20M      | QPSK       | 1       | 0         | Back          | 5mm      | Ant 5   | Reduced         | 42990  | 3540        | 20.00               | 21.00               | 1.259                  | 62.9         | 1.006                     | 0.09             | 0.661                  | 0.837                  |
|          | LTE Band 42 | 20M      | QPSK       | 50      | 0         | Back          | 5mm      | Ant 5   | Reduced         | 42590  | 3500        | 19.87               | 20.00               | 1.030                  | 62.9         | 1.006                     | 0.03             | 0.565                  | 0.586                  |
|          | LTE Band 42 | 20M      | QPSK       | 100     | 0         | Back          | 5mm      | Ant 5   | Reduced         | 42590  | 3500        | 19.87               | 20.00               | 1.030                  | 62.9         | 1.006                     | 0.08             | 0.534                  | 0.554                  |
|          | LTE Band 42 | 20M      | QPSK       | 1       | 0         | Right Side    | 5mm      | Ant 5   | Reduced         | 42590  | 3500        | 20.49               | 21.00               | 1.125                  | 62.9         | 1.006                     | -0.15            | 0.115                  | 0.130                  |
|          | LTE Band 42 | 20M      | QPSK       | 50      | 0         | Right Side    | 5mm      | Ant 5   | Reduced         | 42590  | 3500        | 19.87               | 20.00               | 1.030                  | 62.9         | 1.006                     | -0.1             | 0.086                  | 0.089                  |
| 03       | LTE Band 42 | 20M      | QPSK       | 1       | 0         | Top Side      | 5mm      | Ant 5   | Reduced         | 42590  | 3500        | 20.49               | 21.00               | 1.125                  | 62.9         | 1.006                     | -0.09            | 0.859                  | 0.972                  |
|          | LTE Band 42 | 20M      | QPSK       | 1       | 0         | Top Side      | 5mm      | Ant 5   | Reduced         | 42190  | 3460        | 20.14               | 21.00               | 1.219                  | 62.9         | 1.006                     | 0.05             | 0.784                  | 0.961                  |
|          | LTE Band 42 | 20M      | QPSK       | 1       | 0         | Top Side      | 5mm      | Ant 5   | Reduced         | 42990  | 3540        | 20.00               | 21.00               | 1.259                  | 62.9         | 1.006                     | 0.11             | 0.761                  | 0.964                  |
|          | LTE Band 42 | 20M      | QPSK       | 50      | 0         | Top Side      | 5mm      | Ant 5   | Reduced         | 42590  | 3500        | 19.87               | 20.00               | 1.030                  | 62.9         | 1.006                     | -0.07            | 0.568                  | 0.589                  |
|          | LTE Band 42 | 20M      | QPSK       | 100     | 0         | Top Side      | 5mm      | Ant 5   | Reduced         | 42590  | 3500        | 19.87               | 20.00               | 1.030                  | 62.9         | 1.006                     | 0.01             | 0.543                  | 0.563                  |
|          | FR1 N77     | 100M     | QPSK       | 1       | 137       | Front         | 5mm      | Ant 5   | Reduced         | 633334 | 3500.01     | 15.46               | 17.00               | 1.426                  | 100          | 1.000                     | 0.05             | 0.209                  | 0.298                  |
|          | FR1 N77     | 100M     | QPSK       | 135     | 69        | Front         | 5mm      | Ant 5   | Reduced         | 633334 | 3500.01     | 15.23               | 17.00               | 1.503                  | 100          | 1.000                     | 0.04             | 0.213                  | 0.320                  |
|          | FR1 N77     | 100M     | QPSK       | 1       | 137       | Back          | 5mm      | Ant 5   | Reduced         | 633334 | 3500.01     | 15.46               | 17.00               | 1.426                  | 100          | 1.000                     | -0.12            | 0.293                  | 0.418                  |
| 04       | FR1 N77     | 100M     | QPSK       | 135     | 69        | Back          | 5mm      | Ant 5   | Reduced         | 633334 | 3500.01     | 15.23               | 17.00               | 1.503                  | 100          | 1.000                     | 0.07             | 0.325                  | 0.489                  |
|          | FR1 N77     | 100M     | QPSK       | 1       | 137       | Right Side    | 5mm      | Ant 5   | Reduced         | 633334 | 3500.01     | 15.46               | 16.50               | 1.271                  | 100          | 1.000                     | -0.13            | 0.026                  | 0.033                  |
|          | FR1 N77     | 100M     | QPSK       | 135     | 69        | Right Side    | 5mm      | Ant 5   | Reduced         | 633334 | 3500.01     | 15.23               | 16.50               | 1.340                  | 100          | 1.000                     | 0.05             | 0.026                  | 0.035                  |
|          | FR1 N77     | 100M     | QPSK       | 1       | 137       | Top Side      | 5mm      | Ant 5   | Reduced         | 633334 | 3500.01     | 15.46               | 16.50               | 1.271                  | 100          | 1.000                     | -0.13            | 0.319                  | 0.405                  |
|          | FR1 N77     | 100M     | QPSK       | 135     | 69        | Top Side      | 5mm      | Ant 5   | Reduced         | 633334 | 3500.01     | 15.23               | 16.50               | 1.340                  | 100          | 1.000                     | -0.16            | 0.333                  | 0.446                  |

## 16.3 Body Worn Accessory SAR

| Plot No. | Band        | BW (MHz) | Modulation | RB Size | RB offset | Test Position | Gap (mm) | Antenna | Power Reduction | Ch.    | Freq. (MHz) | Average Power (dBm) | Tune-Up Limit (dBm) | Tune-up Scaling Factor | Duty Cycle % | Duty Cycle Scaling Factor | Power Drift (dB) | Measured 1g SAR (W/kg) | Reported 1g SAR (W/kg) |
|----------|-------------|----------|------------|---------|-----------|---------------|----------|---------|-----------------|--------|-------------|---------------------|---------------------|------------------------|--------------|---------------------------|------------------|------------------------|------------------------|
| 3500MHz  |             |          |            |         |           |               |          |         |                 |        |             |                     |                     |                        |              |                           |                  |                        |                        |
|          | LTE Band 42 | 20M      | QPSK       | 1       | 0         | Front         | 5mm      | Ant 5   | Reduced         | 42590  | 3500        | 20.49               | 21.00               | 1.125                  | 62.9         | 1.006                     | 0.14             | 0.503                  | 0.569                  |
|          | LTE Band 42 | 20M      | QPSK       | 50      | 0         | Front         | 5mm      | Ant 5   | Reduced         | 42590  | 3500        | 19.87               | 20.00               | 1.030                  | 62.9         | 1.006                     | 0.16             | 0.416                  | 0.431                  |
| 05       | LTE Band 42 | 20M      | QPSK       | 1       | 0         | Back          | 5mm      | Ant 5   | Reduced         | 42590  | 3500        | 20.49               | 21.00               | 1.125                  | 62.9         | 1.006                     | 0.03             | 0.762                  | 0.862                  |
|          | LTE Band 42 | 20M      | QPSK       | 1       | 0         | Back          | 5mm      | Ant 5   | Reduced         | 42190  | 3460        | 20.14               | 21.00               | 1.219                  | 62.9         | 1.006                     | 0.04             | 0.701                  | 0.860                  |
|          | LTE Band 42 | 20M      | QPSK       | 1       | 0         | Back          | 5mm      | Ant 5   | Reduced         | 42990  | 3540        | 20.00               | 21.00               | 1.259                  | 62.9         | 1.006                     | 0.09             | 0.661                  | 0.837                  |
|          | LTE Band 42 | 20M      | QPSK       | 50      | 0         | Back          | 5mm      | Ant 5   | Reduced         | 42590  | 3500        | 19.87               | 20.00               | 1.030                  | 62.9         | 1.006                     | 0.03             | 0.565                  | 0.586                  |
|          | LTE Band 42 | 20M      | QPSK       | 100     | 0         | Back          | 5mm      | Ant 5   | Reduced         | 42590  | 3500        | 19.87               | 20.00               | 1.030                  | 62.9         | 1.006                     | 0.08             | 0.534                  | 0.554                  |
|          | LTE Band 42 | 20M      | QPSK       | 1       | 0         | Front         | 13mm     | Ant 5   | Full            | 42590  | 3500        | 22.99               | 24.00               | 1.262                  | 62.9         | 1.006                     | -0.09            | 0.358                  | 0.454                  |
|          | LTE Band 42 | 20M      | QPSK       | 1       | 0         | Back          | 19mm     | Ant 5   | Full            | 42590  | 3500        | 22.99               | 24.00               | 1.262                  | 62.9         | 1.006                     | 0.01             | 0.412                  | 0.523                  |
|          | FR1 N77     | 100M     | QPSK       | 1       | 137       | Front         | 5mm      | Ant 5   | Reduced         | 633334 | 3500.01     | 15.46               | 17.00               | 1.426                  |              | 1.000                     | 0.05             | 0.209                  | 0.298                  |
|          | FR1 N77     | 100M     | QPSK       | 135     | 69        | Front         | 5mm      | Ant 5   | Reduced         | 633334 | 3500.01     | 15.23               | 17.00               | 1.503                  |              | 1.000                     | 0.04             | 0.213                  | 0.320                  |
|          | FR1 N77     | 100M     | QPSK       | 1       | 137       | Back          | 5mm      | Ant 5   | Reduced         | 633334 | 3500.01     | 15.46               | 17.00               | 1.426                  |              | 1.000                     | -0.12            | 0.293                  | 0.418                  |
| 06       | FR1 N77     | 100M     | QPSK       | 135     | 69        | Back          | 5mm      | Ant 5   | Reduced         | 633334 | 3500.01     | 15.23               | 17.00               | 1.503                  |              | 1.000                     | 0.07             | 0.325                  | 0.489                  |
|          | FR1 N77     | 100M     | QPSK       | 1       | 137       | Front         | 13mm     | Ant 5   | Full            | 633334 | 3500.01     | 22.64               | 24.00               | 1.368                  |              | 1.000                     | 0.03             | 0.204                  | 0.279                  |
|          | FR1 N77     | 100M     | QPSK       | 135     | 69        | Front         | 13mm     | Ant 5   | Full            | 633334 | 3500.01     | 22.60               | 24.00               | 1.380                  |              | 1.000                     | 0.01             | 0.203                  | 0.280                  |
|          | FR1 N77     | 100M     | QPSK       | 1       | 137       | Back          | 19mm     | Ant 5   | Full            | 633334 | 3500.01     | 22.64               | 24.00               | 1.368                  |              | 1.000                     | 0.13             | 0.301                  | 0.412                  |
|          | FR1 N77     | 100M     | QPSK       | 135     | 69        | Back          | 19mm     | Ant 5   | Full            | 633334 | 3500.01     | 22.60               | 24.00               | 1.380                  |              | 1.000                     | 0.16             | 0.315                  | 0.435                  |

**16.4 Product Specific SAR**

| Plot No. | Band    | BW (MHz) | Modulation | RB Size | RB Offset | Test Position | Gap (mm) | Antenna | Power Reduction | Ch.    | Freq. (MHz) | Average Power (dBm) | Tune-Up Limit (dBm) | Tune-up Scaling Factor | Power Drift (dB) | Measured 10g SAR (W/kg) | Reported 10g SAR (W/kg) |
|----------|---------|----------|------------|---------|-----------|---------------|----------|---------|-----------------|--------|-------------|---------------------|---------------------|------------------------|------------------|-------------------------|-------------------------|
|          | FR1 N77 | 100M     | QPSK       | 1       | 137       | Top Side      | 0mm      | Ant 5   | Reduced         | 633334 | 3500.01     | 17.66               | 18.50               | 1.213                  | -0.13            | 0.997                   | 1.210                   |
| 07       | FR1 N77 | 100M     | QPSK       | 135     | 69        | Top Side      | 0mm      | Ant 5   | Reduced         | 633334 | 3500.01     | 17.21               | 18.50               | 1.346                  | 0.03             | 1.010                   | <b>1.359</b>            |
|          | FR1 N77 | 100M     | QPSK       | 1       | 137       | Top Side      | 7mm      | Ant 5   | Full            | 633334 | 3500.01     | 22.64               | 24.00               | 1.368                  | 0.01             | 0.426                   | 0.583                   |
|          | FR1 N77 | 100M     | QPSK       | 135     | 69        | Top Side      | 7mm      | Ant 5   | Full            | 633334 | 3500.01     | 22.60               | 24.00               | 1.380                  | 0.05             | 0.434                   | 0.599                   |

### 16.5 Repeated SAR Measurement

<1g>

| No. | Band        | BW (MHz) | Modulation | RB Size | RB Offset | Test Position | Gap (mm) | Antenna | Power Reduction | Ch.   | Freq. (MHz) | Average Power (dBm) | Tune-Up Limit (dBm) | Tune-up Scaling Factor | Duty Cycle % | Duty Cycle Scaling Factor | Power Drift (dB) | Measured 1g SAR (W/kg) | Ratio | Reported 1g SAR (W/kg) |
|-----|-------------|----------|------------|---------|-----------|---------------|----------|---------|-----------------|-------|-------------|---------------------|---------------------|------------------------|--------------|---------------------------|------------------|------------------------|-------|------------------------|
| 1st | LTE Band 42 | 20M      | QPSK       | 1       | 0         | Top Side      | 5mm      | Ant 5   | Reduced         | 42590 | 3500        | 20.49               | 21.00               | 1.125                  | 62.9         | 1.006                     | -0.09            | 0.859                  | 1     | 0.972                  |
| 2nd | LTE Band 42 | 20M      | QPSK       | 1       | 0         | Top Side      | 5mm      | Ant 5   | Reduced         | 42590 | 3500        | 20.49               | 21.00               | 1.125                  | 62.9         | 1.006                     | 0.08             | 0.842                  | 1.020 | 0.953                  |

#### General Note:

1. Per KDB 865664 D01v01r04, for each frequency band, repeated SAR measurement is required only when the measured SAR is  $\geq 0.8\text{W/kg}$ .
2. Per KDB 865664 D01v01r04, if the ratio among the repeated measurement is  $\leq 1.2$  and the measured SAR  $< 1.45\text{W/kg}$ , only one repeated measurement is required.
3. The ratio is the difference in percentage between original and repeated *measured SAR*.
4. All measurement SAR result is scaled-up to account for tune-up tolerance and is compliant.

## 17. Simultaneous Transmission Analysis

| No. | Simultaneous Transmission Configurations | Portable Handset |           |         |                          |
|-----|------------------------------------------|------------------|-----------|---------|--------------------------|
|     |                                          | Head             | Body-worn | Hotspot | Product specific 10g SAR |
| 1.  | WWAN + WLAN 2.4GHz                       | Yes              | Yes       | Yes     | Yes                      |
| 2.  | WWAN + WLAN 5GHz                         | Yes              | Yes       | Yes     | Yes                      |
| 3.  | WWAN + Bluetooth                         | Yes              | Yes       | Yes     | Yes                      |

### General Note:

- This device supports VoIP in GPRS, EGPRS, WCDMA, and LTE (e.g. for 3rd-party VoIP), LTE supports VoLTE operation.
- WWAN above includes 5G NR bands.
- EUT will choose each GSM, WCDMA, and LTE according to the network signal condition; therefore, they will not operate simultaneously at any moment.
- This device 2.4GHz WLAN support hotspot operation and Bluetooth support tethering applications.
- This device 2.4GHz WLAN/ 5.2GHz WLAN/5.8GHz WLAN support hotspot operation, and 5.2GHz WLAN/5.8GHz WLAN supports WLAN Direct (GC/GO), and 5.3GHz / 5.5GHz supports WLAN Direct (GC only).
- WLAN 2.4GHz and Bluetooth share the same antenna so can't transmit simultaneously.
- According to the EUT character, WLAN 5GHz and Bluetooth can't transmit simultaneously.
- Chose the worst zoom scan SAR of WLAN correspondingly for co-located with WWAN analysis.
- For head/hotspot/body-worn, we chose the worst zoom scan SAR of Bluetooth correspondingly for co-located with WWAN analysis.
- The reported SAR summation is calculated based on the same configuration and test position.
- For simultaneous transmission analysis of 5G NR SA, since the 5G NR NSA SAR can represent 5G NR SA SAR, therefore in this section did not additionally evaluate simultaneous transmission analysis related to 5G NR SA SAR.
- Per KDB 447498 D01v06, simultaneous transmission SAR is compliant if,
  - 1g Scalar SAR summation < 1.6W/kg and 10g Scalar SAR summation < 4.0W/kg.
  - $SPLSR = (SAR1 + SAR2)^{1.5} / (\min. \text{separation distance, mm})$ , and the peak separation distance is determined from the square root of  $[(x1-x2)^2 + (y1-y2)^2 + (z1-z2)^2]$ , where (x1, y1, z1) and (x2, y2, z2) are the coordinates of the extrapolated peak SAR locations in the zoom scan.
  - If  $SPLSR \leq 0.04$  for 1g SAR and  $SPLSR \leq 0.10$  for 10g SAR, simultaneously transmission SAR measurement is not necessary.
  - Simultaneously transmission SAR measurement, and the reported multi-band 1g SAR < 1.6W/kg and 10g SAR < 4.0W/kg.
- For simultaneously transmission SAR analysis, SAR values only considered which we did perform SAR testing on this report, and other test results were leverage from the parent model which referred to the original report Sporton Report Number FA141508.
- This is a variant report, for model change note, please refer to the Operation Description exhibit submitted. Based on the similarity between two models, based on SW enable 5G NR FR1 n78 SA and added LTE Band 42, 5G NR n77/ n78 (3450 MHz ~ 3550 MHz) for full SAR testing, for co-located SAR analysis, some cellular bands and WLAN/Bluetooth SAR test results are leverage from original report which can be referred to Sporton Report Number FA141508.

**17.1 Head Exposure Conditions**

| WWAN Band        | Exposure Position | 1             | 2                 | 3               | 4               | 1+2           | 1+3           | 1+4           |
|------------------|-------------------|---------------|-------------------|-----------------|-----------------|---------------|---------------|---------------|
|                  |                   | WWAN          | 2.4GHz WLAN Ant 6 | 5GHz WLAN Ant 6 | Bluetooth Ant 6 | Summed        | Summed        | Summed        |
|                  |                   | 1g SAR (W/kg) | 1g SAR (W/kg)     | 1g SAR (W/kg)   | 1g SAR (W/kg)   | 1g SAR (W/kg) | 1g SAR (W/kg) | 1g SAR (W/kg) |
| LTE Band 42Ant 5 | Right Cheek       | 0.758         | 0.511             | 0.513           | 0.034           | 1.27          | 1.27          | 0.79          |
|                  | Right Tilted      | 0.685         | 0.511             | 0.513           | 0.034           | 1.20          | 1.20          | 0.72          |
|                  | Left Cheek        | 0.981         | 0.511             | 0.513           | 0.034           | 1.49          | 1.49          | 1.02          |
|                  | Left Tilted       | 0.989         | 0.511             | 0.513           | 0.034           | 1.50          | <b>1.50</b>   | 1.02          |

**<5G NR>**

| WWAN Band        | FR1 Band      | Exposure Position | 1             | 5             | 2                 | 3               | 4               | 1+2+5         | 1+3+5         | 1+4+5         |
|------------------|---------------|-------------------|---------------|---------------|-------------------|-----------------|-----------------|---------------|---------------|---------------|
|                  |               |                   | WWAN          | FR1           | 2.4GHz WLAN Ant 6 | 5GHz WLAN Ant 6 | Bluetooth Ant 6 | Summed        | Summed        | Summed        |
|                  |               |                   | 1g SAR (W/kg) | 1g SAR (W/kg) | 1g SAR (W/kg)     | 1g SAR (W/kg)   | 1g SAR (W/kg)   | 1g SAR (W/kg) | 1g SAR (W/kg) | 1g SAR (W/kg) |
| LTE Band 5Ant 0  | FR1 n78 Ant 5 | Right Cheek       | 0.386         | 0.245         | 0.511             | 0.513           | 0.034           | 1.14          | 1.14          | 0.67          |
|                  |               | Right Tilted      | 0.187         | 0.240         | 0.511             | 0.513           | 0.034           | 0.94          | 0.94          | 0.46          |
|                  |               | Left Cheek        | 0.326         | 0.378         | 0.511             | 0.513           | 0.034           | 1.22          | 1.22          | 0.74          |
|                  |               | Left Tilted       | 0.175         | 0.354         | 0.511             | 0.513           | 0.034           | 1.04          | 1.04          | 0.56          |
| LTE Band 7Ant 0  | FR1 n78 Ant 5 | Right Cheek       | 0.287         | 0.245         | 0.511             | 0.513           | 0.034           | 1.04          | 1.05          | 0.57          |
|                  |               | Right Tilted      | 0.145         | 0.240         | 0.511             | 0.513           | 0.034           | 0.90          | 0.90          | 0.42          |
|                  |               | Left Cheek        | 0.346         | 0.378         | 0.511             | 0.513           | 0.034           | 1.24          | 1.24          | 0.76          |
|                  |               | Left Tilted       | 0.229         | 0.354         | 0.511             | 0.513           | 0.034           | 1.09          | 1.10          | 0.62          |
| LTE Band 38Ant 0 | FR1 n78 Ant 5 | Right Cheek       | 0.106         | 0.245         | 0.511             | 0.513           | 0.034           | 0.86          | 0.86          | 0.39          |
|                  |               | Right Tilted      | 0.063         | 0.240         | 0.511             | 0.513           | 0.034           | 0.81          | 0.82          | 0.34          |
|                  |               | Left Cheek        | 0.158         | 0.378         | 0.511             | 0.513           | 0.034           | 1.05          | 1.05          | 0.57          |
|                  |               | Left Tilted       | 0.121         | 0.354         | 0.511             | 0.513           | 0.034           | 0.99          | 0.99          | 0.51          |
| LTE Band 66Ant 1 | FR1 n78 Ant 5 | Right Cheek       | 0.198         | 0.245         | 0.511             | 0.513           | 0.034           | 0.95          | 0.96          | 0.48          |
|                  |               | Right Tilted      | 0.222         | 0.240         | 0.511             | 0.513           | 0.034           | 0.97          | 0.98          | 0.50          |
|                  |               | Left Cheek        | 0.354         | 0.378         | 0.511             | 0.513           | 0.034           | 1.24          | 1.25          | 0.77          |
|                  |               | Left Tilted       | 0.213         | 0.354         | 0.511             | 0.513           | 0.034           | 1.08          | 1.08          | 0.60          |
| LTE Band 41Ant 0 | FR1 n77 Ant 5 | Right Cheek       | 0.106         | 0.245         | 0.511             | 0.513           | 0.034           | 0.86          | 0.86          | 0.39          |
|                  |               | Right Tilted      | 0.063         | 0.240         | 0.511             | 0.513           | 0.034           | 0.81          | 0.82          | 0.34          |
|                  |               | Left Cheek        | 0.158         | 0.378         | 0.511             | 0.513           | 0.034           | 1.05          | 1.05          | 0.57          |
|                  |               | Left Tilted       | 0.121         | 0.354         | 0.511             | 0.513           | 0.034           | 0.99          | 0.99          | 0.51          |

## 17.2 Hotspot Exposure Conditions

| WWAN Band        | Exposure Position | 1             | 2                 | 3               | 4               | 1+2           | 1+3           | 1+4           |
|------------------|-------------------|---------------|-------------------|-----------------|-----------------|---------------|---------------|---------------|
|                  |                   | WWAN          | 2.4GHz WLAN Ant 6 | 5GHz WLAN Ant 6 | Bluetooth Ant 6 | Summed        | Summed        | Summed        |
|                  |                   | 1g SAR (W/kg) | 1g SAR (W/kg)     | 1g SAR (W/kg)   | 1g SAR (W/kg)   | 1g SAR (W/kg) | 1g SAR (W/kg) | 1g SAR (W/kg) |
| LTE Band 42Ant 5 | Front             | 0.569         | 0.194             | 0.152           | 0.072           | 0.76          | 0.72          | 0.64          |
|                  | Back              | 0.862         | 0.362             | 0.252           | 0.072           | 1.22          | 1.11          | 0.93          |
|                  | Left side         |               |                   |                 |                 | 0.00          | 0.00          | 0.00          |
|                  | Right side        | 0.130         | 0.116             | 0.108           | 0.072           | 0.25          | 0.24          | 0.20          |
|                  | Top side          | 0.972         | 0.188             | 0.379           | 0.072           | 1.16          | 1.35          | 1.04          |
|                  | Bottom side       |               |                   |                 |                 | 0.00          | 0.00          | 0.00          |

### <5G NR>

| WWAN Band        | FR1 Band      | Exposure Position | 1             | 5             | 2                 | 3               | 4               | 1+2+5         | 1+3+5         | 1+4+5         |
|------------------|---------------|-------------------|---------------|---------------|-------------------|-----------------|-----------------|---------------|---------------|---------------|
|                  |               |                   | WWAN          | FR1           | 2.4GHz WLAN Ant 6 | 5GHz WLAN Ant 6 | Bluetooth Ant 6 | Summed        | Summed        | Summed        |
|                  |               |                   | 1g SAR (W/kg) | 1g SAR (W/kg) | 1g SAR (W/kg)     | 1g SAR (W/kg)   | 1g SAR (W/kg)   | 1g SAR (W/kg) | 1g SAR (W/kg) | 1g SAR (W/kg) |
| LTE Band 5Ant 0  | FR1 n78 Ant 5 | Front             | 0.300         | 0.320         | 0.194             | 0.152           | 0.072           | 0.81          | 0.77          | 0.69          |
|                  |               | Back              | 0.550         | 0.489         | 0.362             | 0.252           | 0.072           | 1.40          | 1.29          | 1.11          |
|                  |               | Left side         | 0.066         |               |                   |                 |                 | 0.07          | 0.07          | 0.07          |
|                  |               | Right side        | 0.159         | 0.035         | 0.116             | 0.108           | 0.072           | 0.31          | 0.30          | 0.27          |
|                  |               | Top side          |               | 0.446         | 0.188             | 0.379           | 0.072           | 0.63          | 0.83          | 0.52          |
|                  |               | Bottom side       | 0.397         |               |                   |                 |                 | 0.40          | 0.40          | 0.40          |
| LTE Band 7Ant 0  | FR1 n78 Ant 5 | Front             | 0.423         | 0.320         | 0.194             | 0.152           | 0.072           | 0.94          | 0.90          | 0.82          |
|                  |               | Back              | 0.510         | 0.489         | 0.362             | 0.252           | 0.072           | 1.36          | 1.25          | 1.07          |
|                  |               | Left side         | 0.112         |               |                   |                 |                 | 0.11          | 0.11          | 0.11          |
|                  |               | Right side        | 0.089         | 0.035         | 0.116             | 0.108           | 0.072           | 0.24          | 0.23          | 0.20          |
|                  |               | Top side          |               | 0.446         | 0.188             | 0.379           | 0.072           | 0.63          | 0.83          | 0.52          |
|                  |               | Bottom side       | 0.506         |               |                   |                 |                 | 0.51          | 0.51          | 0.51          |
| LTE Band 38Ant 0 | FR1 n78 Ant 5 | Front             | 0.408         | 0.320         | 0.194             | 0.152           | 0.072           | 0.92          | 0.88          | 0.80          |
|                  |               | Back              | 0.510         | 0.489         | 0.362             | 0.252           | 0.072           | 1.36          | 1.25          | 1.07          |
|                  |               | Left side         | 0.130         |               |                   |                 |                 | 0.13          | 0.13          | 0.13          |
|                  |               | Right side        | 0.082         | 0.035         | 0.116             | 0.108           | 0.072           | 0.23          | 0.23          | 0.19          |
|                  |               | Top side          |               | 0.446         | 0.188             | 0.379           | 0.072           | 0.63          | 0.83          | 0.52          |
|                  |               | Bottom side       | 0.496         |               |                   |                 |                 | 0.50          | 0.50          | 0.50          |
| LTE Band 66Ant 1 | FR1 n78 Ant 5 | Front             | 0.344         | 0.320         | 0.194             | 0.152           | 0.072           | 0.86          | 0.82          | 0.74          |
|                  |               | Back              | 0.526         | 0.489         | 0.362             | 0.252           | 0.072           | 1.38          | 1.27          | 1.09          |
|                  |               | Left side         | 0.264         |               |                   |                 |                 | 0.26          | 0.26          | 0.26          |
|                  |               | Right side        |               | 0.035         | 0.116             | 0.108           | 0.072           | 0.15          | 0.14          | 0.11          |
|                  |               | Top side          |               | 0.446         | 0.188             | 0.379           | 0.072           | 0.63          | 0.83          | 0.52          |
|                  |               | Bottom side       | 0.364         |               |                   |                 |                 | 0.36          | 0.36          | 0.36          |
| LTE Band 41Ant 0 | FR1 n77 Ant 5 | Front             | 0.408         | 0.320         | 0.194             | 0.152           | 0.072           | 0.92          | 0.88          | 0.80          |
|                  |               | Back              | 0.510         | 0.489         | 0.362             | 0.252           | 0.072           | 1.36          | 1.25          | 1.07          |
|                  |               | Left side         | 0.130         |               |                   |                 |                 | 0.13          | 0.13          | 0.13          |
|                  |               | Right side        | 0.082         | 0.035         | 0.116             | 0.108           | 0.072           | 0.23          | 0.23          | 0.19          |
|                  |               | Top side          |               | 0.446         | 0.188             | 0.379           | 0.072           | 0.63          | 0.83          | 0.52          |
|                  |               | Bottom side       | 0.496         |               |                   |                 |                 | 0.50          | 0.50          | 0.50          |

**17.3 Body-Worn Accessory Exposure Conditions**

| WWAN Band        | Exposure Position | 1             | 2                 | 3               | 4               | 1+2           | 1+3           | 1+4           |
|------------------|-------------------|---------------|-------------------|-----------------|-----------------|---------------|---------------|---------------|
|                  |                   | WWAN          | 2.4GHz WLAN Ant 6 | 5GHz WLAN Ant 6 | Bluetooth Ant 6 | Summed        | Summed        | Summed        |
|                  |                   | 1g SAR (W/kg) | 1g SAR (W/kg)     | 1g SAR (W/kg)   | 1g SAR (W/kg)   | 1g SAR (W/kg) | 1g SAR (W/kg) | 1g SAR (W/kg) |
| LTE Band 42Ant 5 | Front             | 0.569         | 0.362             | 0.388           | 0.072           | 0.93          | 0.96          | 0.64          |
|                  | Back              | 0.862         | 0.362             | 0.388           | 0.072           | 1.22          | 1.25          | 0.93          |

**<5G NR>**

| WWAN Band        | FR1 Band      | Exposure Position | 1             | 5             | 2                 | 3               | 4               | 1+2+5         | 1+3+5         | 1+4+5         |
|------------------|---------------|-------------------|---------------|---------------|-------------------|-----------------|-----------------|---------------|---------------|---------------|
|                  |               |                   | WWAN          | FR1           | 2.4GHz WLAN Ant 6 | 5GHz WLAN Ant 6 | Bluetooth Ant 6 | Summed        | Summed        | Summed        |
|                  |               |                   | 1g SAR (W/kg) | 1g SAR (W/kg) | 1g SAR (W/kg)     | 1g SAR (W/kg)   | 1g SAR (W/kg)   | 1g SAR (W/kg) | 1g SAR (W/kg) | 1g SAR (W/kg) |
| LTE Band 5Ant 0  | FR1 n78 Ant 5 | Front             | 0.300         | 0.320         | 0.362             | 0.388           | 0.072           | 0.98          | 1.01          | 0.69          |
|                  |               | Back              | 0.550         | 0.489         | 0.362             | 0.388           | 0.072           | 1.40          | 1.43          | 1.11          |
| LTE Band 7Ant 0  | FR1 n78 Ant 5 | Front             | 0.423         | 0.320         | 0.362             | 0.388           | 0.072           | 1.11          | 1.13          | 0.82          |
|                  |               | Back              | 0.510         | 0.489         | 0.362             | 0.388           | 0.072           | 1.36          | 1.39          | 1.07          |
| LTE Band 38Ant 0 | FR1 n78 Ant 5 | Front             | 0.408         | 0.320         | 0.362             | 0.388           | 0.072           | 1.09          | 1.12          | 0.80          |
|                  |               | Back              | 0.510         | 0.489         | 0.362             | 0.388           | 0.072           | 1.36          | 1.39          | 1.07          |
| LTE Band 66Ant 1 | FR1 n78 Ant 5 | Front             | 0.344         | 0.320         | 0.362             | 0.388           | 0.072           | 1.03          | 1.05          | 0.74          |
|                  |               | Back              | 0.526         | 0.489         | 0.362             | 0.388           | 0.072           | 1.38          | 1.40          | 1.09          |
| LTE Band 41Ant 0 | FR1 n77 Ant 5 | Front             | 0.408         | 0.320         | 0.362             | 0.388           | 0.072           | 1.09          | 1.12          | 0.80          |
|                  |               | Back              | 0.510         | 0.489         | 0.362             | 0.388           | 0.072           | 1.36          | 1.39          | 1.07          |

**<Sensor off>**

| WWAN Band        | Exposure Position | 1                | 3                  | 1+3           |
|------------------|-------------------|------------------|--------------------|---------------|
|                  |                   | WWAN             | 5GHz WLAN<br>Ant 6 | Summed        |
|                  |                   | 1g SAR<br>(W/kg) | 1g SAR<br>(W/kg)   | 1g SAR (W/kg) |
| LTE Band 42Ant 5 | Front at 13mm     | 0.454            | 0.242              | 0.97          |
|                  | Back at 19mm      | 0.523            | 0.367              | 1.03          |

**<5G NR>**

| WWAN Band        | FR1 Band         | Exposure Position | 1                | 5                | 3                  | 1+3+5<br>Summed<br>1g SAR (W/kg) |
|------------------|------------------|-------------------|------------------|------------------|--------------------|----------------------------------|
|                  |                  |                   | WWAN             | FR1              | 5GHz WLAN<br>Ant 6 |                                  |
|                  |                  |                   | 1g SAR<br>(W/kg) | 1g SAR<br>(W/kg) | 1g SAR<br>(W/kg)   |                                  |
| LTE Band 5Ant 0  | FR1 n78<br>Ant 5 | Front at 13mm     | 0.298            | 0.280            | 0.242              | 0.82                             |
|                  |                  | Back at 19mm      | 0.243            | 0.435            | 0.367              | 1.05                             |
| LTE Band 7Ant 0  | FR1 n78<br>Ant 5 | Front at 13mm     | 0.721            | 0.285            | 0.242              | 1.25                             |
|                  |                  | Back at 19mm      | 0.413            | 0.435            | 0.367              | 1.22                             |
| LTE Band 38Ant 0 | FR1 n78<br>Ant 5 | Front at 13mm     | 0.290            | 0.285            | 0.242              | 0.82                             |
|                  |                  | Back at 19mm      | 0.244            | 0.435            | 0.367              | 1.05                             |
| LTE Band 66Ant 1 | FR1 n78<br>Ant 5 | Front at 13mm     | 0.584            | 0.285            | 0.242              | 1.11                             |
|                  |                  | Back at 19mm      | 0.249            | 0.435            | 0.367              | 1.05                             |
| LTE Band 41Ant 0 | FR1 n77<br>Ant 5 | Front at 13mm     | 0.290            | 0.285            | 0.242              | 0.82                             |
|                  |                  | Back at 19mm      | 0.244            | 0.435            | 0.367              | 1.05                             |

**17.4 Product Specific Exposure Conditions**
**<5G NR>**

| WWAN Band        | FR1 Band         | Exposure Position | 1                 | 5                 | 2                       | 3                     | 1+2+5            | 1+3+5            |
|------------------|------------------|-------------------|-------------------|-------------------|-------------------------|-----------------------|------------------|------------------|
|                  |                  |                   | WWAN              | FR1               | 2.4GHz<br>WLAN<br>Ant 6 | 5GHz<br>WLAN<br>Ant 6 | Summed           | Summed           |
|                  |                  |                   | 10g SAR<br>(W/kg) | 10g SAR<br>(W/kg) | 10g SAR<br>(W/kg)       | 10g SAR<br>(W/kg)     | 1g SAR<br>(W/kg) | 1g SAR<br>(W/kg) |
| LTE Band 5Ant 0  | FR1 n78<br>Ant 5 | Front             |                   |                   |                         |                       |                  |                  |
|                  |                  | Back              | 1.418             |                   | 0.987                   | 0.914                 | 2.41             | 2.33             |
|                  |                  | Left side         |                   |                   |                         |                       |                  |                  |
|                  |                  | Right side        |                   |                   |                         |                       |                  |                  |
|                  |                  | Top side          |                   | 1.359             |                         | 1.001                 | 1.36             | 2.36             |
|                  |                  | Bottom side       |                   |                   |                         |                       |                  |                  |
| LTE Band 7Ant 0  | FR1 n78<br>Ant 5 | Front             |                   |                   |                         |                       |                  |                  |
|                  |                  | Back              | 1.352             |                   | 0.987                   | 0.914                 | 2.34             | 2.27             |
|                  |                  | Left side         |                   |                   |                         |                       |                  |                  |
|                  |                  | Right side        |                   |                   |                         |                       |                  |                  |
|                  |                  | Top side          |                   | 1.359             |                         | 1.001                 | 1.36             | 2.36             |
|                  |                  | Bottom side       | 1.169             |                   |                         |                       | 1.17             | 1.17             |
| LTE Band 38Ant 0 | FR1 n78<br>Ant 5 | Front             |                   |                   |                         |                       |                  |                  |
|                  |                  | Back              | 1.337             |                   | 0.987                   | 0.914                 | 2.32             | 2.25             |
|                  |                  | Left side         |                   |                   |                         |                       |                  |                  |
|                  |                  | Right side        |                   |                   |                         |                       |                  |                  |
|                  |                  | Top side          |                   | 1.359             |                         | 1.001                 | 1.36             | 2.36             |
|                  |                  | Bottom side       | 1.123             |                   |                         |                       | 1.12             | 1.12             |
| LTE Band 66Ant 1 | FR1 n78<br>Ant 5 | Front             |                   |                   |                         |                       |                  |                  |
|                  |                  | Back              | 1.369             |                   | 0.987                   | 0.914                 | 2.36             | 2.28             |
|                  |                  | Left side         |                   |                   |                         |                       |                  |                  |
|                  |                  | Right side        |                   |                   |                         |                       |                  |                  |
|                  |                  | Top side          |                   | 1.359             |                         | 1.001                 | 1.36             | 2.36             |
|                  |                  | Bottom side       |                   |                   |                         |                       |                  |                  |
| LTE Band 41Ant 0 | FR1 n77<br>Ant 5 | Front             |                   |                   |                         |                       |                  |                  |
|                  |                  | Back              | 1.337             |                   | 0.987                   | 0.914                 | 2.32             | 2.25             |
|                  |                  | Left side         |                   |                   |                         |                       |                  |                  |
|                  |                  | Right side        |                   |                   |                         |                       |                  |                  |
|                  |                  | Top side          |                   | 1.359             |                         | 1.001                 | 1.36             | 2.36             |
|                  |                  | Bottom side       | 1.123             |                   |                         |                       | 1.12             | 1.12             |

Note: For extremity SAR, always chose higher SAR between 0mm 10g SAR and sensor off distance SAR to do co-located analysis.

**Test Engineer : Nick Hu, Seven Xu**

## **18. Uncertainty Assessment**

Per KDB 865664 D01 SAR measurement 100MHz to 6GHz, when the highest measured 1-g SAR within a frequency band is  $< 1.5$  W/kg and the measured 10-g SAR within a frequency band is  $< 3.75$  W/kg. The expanded SAR measurement uncertainty must be  $\leq 30\%$ , for a confidence interval of  $k = 2$ . If these conditions are met, extensive SAR measurement uncertainty analysis described in IEEE Std 1528-2013 is not required in SAR reports submitted for equipment approval. For this device, the highest measured 1-g SAR is less 1.5W/kg and highest measured 10-g SAR is less 3.75W/kg. Therefore, the measurement uncertainty table is not required in this report.

## **19. References**

- [1] FCC 47 CFR Part 2 "Frequency Allocations and Radio Treaty Matters; General Rules and Regulations"
- [2] ANSI/IEEE Std. C95.1-1992, "IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz", September 1992
- [3] IEEE Std. 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", Sep 2013
- [4] SPEAG DASY System Handbook
- [5] FCC KDB 865664 D01 v01r04, "SAR Measurement Requirements for 100 MHz to 6 GHz", Aug 2015.
- [6] FCC KDB 865664 D02 v01r02, "RF Exposure Compliance Reporting and Documentation Considerations" Oct 2015.
- [7] FCC KDB 447498 D01 v06, "Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies", Oct 2015
- [8] FCC KDB 648474 D04 v01r03, "SAR Evaluation Considerations for Wireless Handsets", Oct 2015.
- [9] FCC KDB 248227 D01 v02r02, "SAR Guidance for IEEE 802.11 (WiFi) Transmitters", Oct 2015.
- [10] FCC KDB 616217 D04 v01r02, "SAR Evaluation Considerations for Laptop, Notebook, Netbook and Tablet Computers", Oct 2015
- [11] FCC KDB 941225 D01 v03r01, "3G SAR MEAUREMENT PROCEDURES", Oct 2015
- [12] FCC KDB 941225 D05 v02r05, "SAR Evaluation Considerations for LTE Devices", Dec 2015
- [13] FCC KDB 941225 D05A v01r02, "Rel. 10 LTE SAR Test Guidance and KDB Inquiries", Oct 2015
- [14] FCC KDB 941225 D06 v02r01, "SAR Evaluation Procedures for Portable Devices with Wireless Router Capabilities", Oct 2015.

-----THE END-----



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## ***Appendix A. Plots of System Performance Check***

The plots are shown as follows.

**System Check\_Head\_3500MHz****DUT: D3500V2 - SN:1037**

Communication System: UID 0, CW (0); Frequency: 3500 MHz; Duty Cycle: 1:1

Medium: HSL\_3500 Medium parameters used:  $f = 3500$  MHz;  $\sigma = 2.795$  S/m;  $\epsilon_r = 38.942$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature : 23.4 °C; Liquid Temperature : 22.6 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3935; ConvF(7.16, 7.16, 7.16); Calibrated: 2021.4.29
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2021.4.26
- Phantom: SAM Twin Phantom; Type: SAM Twin; Serial: TP-1697
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

**Pin=50mW/Area Scan (91x91x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 6.48 W/kg

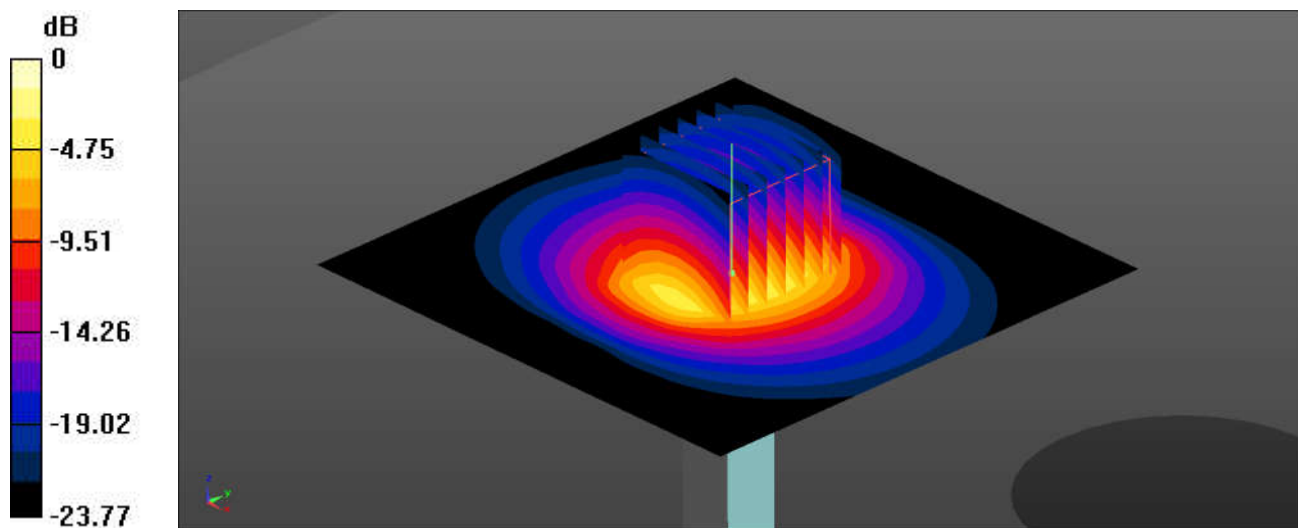
**Pin=50mW/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 48.67 V/m; Power Drift = -0.09 dB

Peak SAR (extrapolated) = 9.05 W/kg

**SAR(1 g) = 3.24 W/kg; SAR(10 g) = 1.23 W/kg**

Maximum value of SAR (measured) = 6.45 W/kg



0 dB = 6.45 W/kg = 8.10 dBW/kg

**System Check\_Head\_3500MHz****DUT: D3500V2 - SN:1037**

Communication System: UID 0, CW (0); Frequency: 3500 MHz; Duty Cycle: 1:1

Medium: HSL\_3500 Medium parameters used:  $f = 3500$  MHz;  $\sigma = 2.826$  S/m;  $\epsilon_r = 39.043$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature : 23.1 °C; Liquid Temperature : 22.7 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3935; ConvF(7.16, 7.16, 7.16); Calibrated: 2021.4.29
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2021.4.26
- Phantom: SAM Twin Phantom; Type: SAM Twin; Serial: TP-1697
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

**Pin=50mW/Area Scan (91x91x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 6.58 W/kg

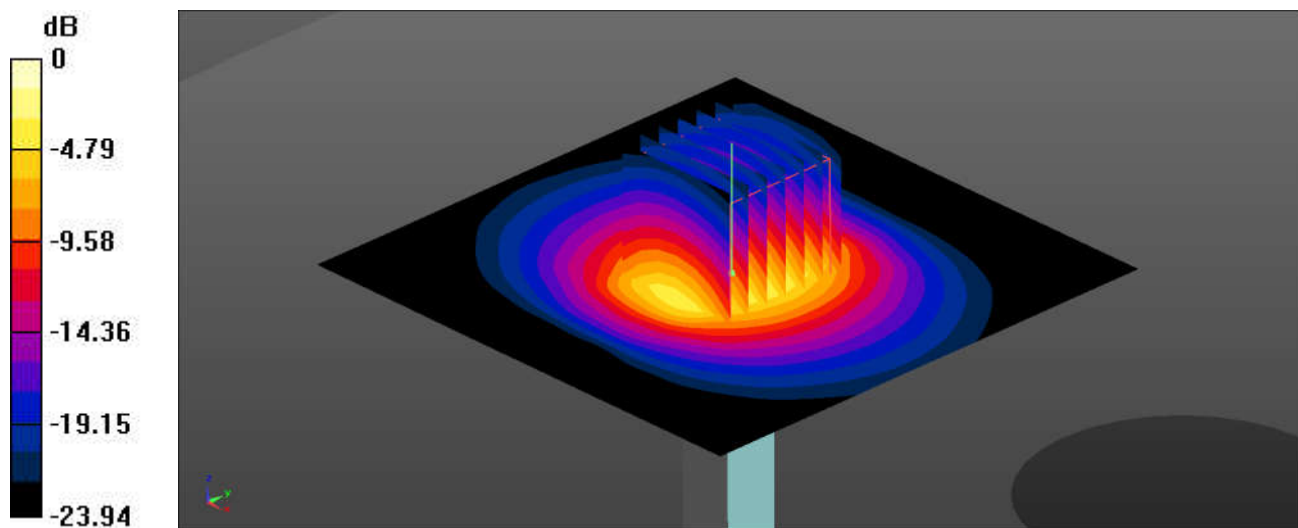
**Pin=50mW/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 49.06 V/m; Power Drift = -0.08 dB

Peak SAR (extrapolated) = 9.11 W/kg

**SAR(1 g) = 3.27 W/kg; SAR(10 g) = 1.23 W/kg**

Maximum value of SAR (measured) = 6.50 W/kg



0 dB = 6.50 W/kg = 8.13 dBW/kg



## ***Appendix B. Plots of High SAR Measurement***

The plots are shown as follows.

**01\_LTE Band 42\_20M\_QPSK\_1RB\_0Offset\_Left Tilted\_0mm\_Ch42590**

Communication System: UID 0, LTE-TDD (0); Frequency: 3500 MHz; Duty Cycle: 1:1.59

Medium: HSL\_3500 Medium parameters used:  $f = 3500$  MHz;  $\sigma = 2.795$  S/m;  $\epsilon_r = 38.942$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature : 23.4 °C; Liquid Temperature : 22.6 °C

**DASY5 Configuration:**

- Probe: EX3DV4 - SN3935; ConvF(7.16, 7.16, 7.16); Calibrated: 2021.4.29
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2021.4.26
- Phantom: SAM Twin Phantom; Type: SAM Twin; Serial: TP-1697
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

**Area Scan (101x121x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 1.51 W/kg

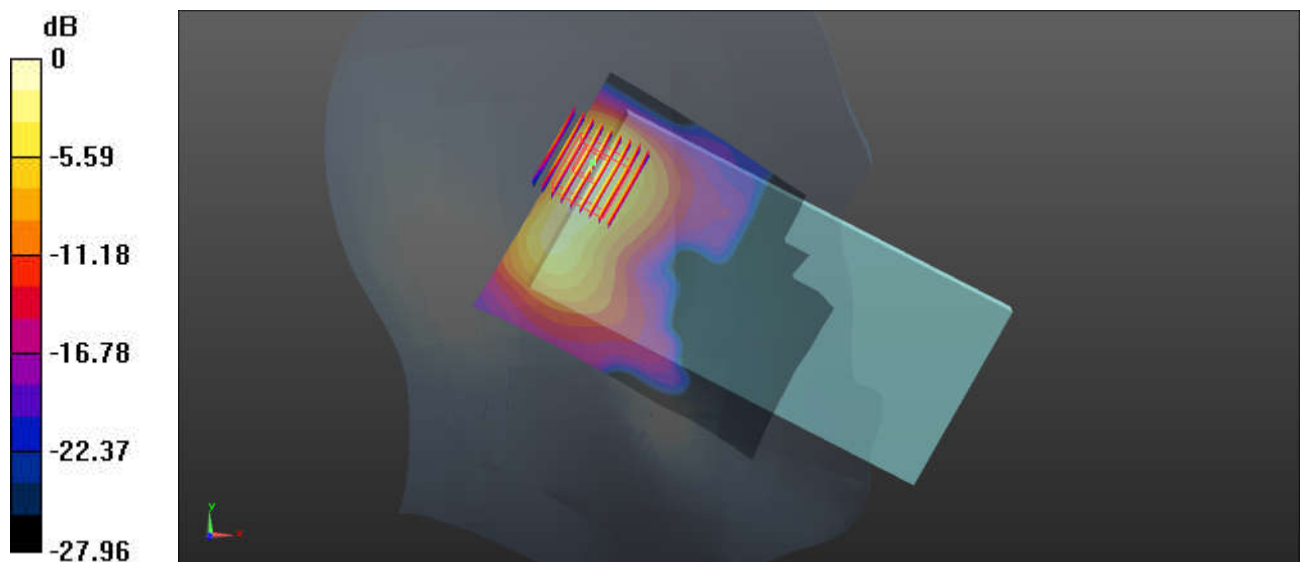
**Zoom Scan (9x9x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 21.19 V/m; Power Drift = -0.07 dB

Peak SAR (extrapolated) = 1.87 W/kg

**SAR(1 g) = 0.788 W/kg; SAR(10 g) = 0.332 W/kg**

Maximum value of SAR (measured) = 1.38 W/kg



0 dB = 1.38 W/kg = 1.40 dBW/kg

**02\_FR1 n77\_100M\_QPSK\_1RB\_137Offset\_Left Cheek\_0mm\_Ch633334**

Communication System: UID 0, 5G NR (0); Frequency: 3500.01 MHz; Duty Cycle: 1:1

Medium: HSL\_3500 Medium parameters used:  $f = 3500.01$  MHz;  $\sigma = 2.795$  S/m;  $\epsilon_r = 38.942$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature : 23.4 °C; Liquid Temperature : 22.6 °C

**DASY5 Configuration:**

- Probe: EX3DV4 - SN3935; ConvF(7.16, 7.16, 7.16); Calibrated: 2021.4.29
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2021.4.26
- Phantom: SAM Twin Phantom; Type: SAM Twin; Serial: TP-1697
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

**Area Scan (91x111x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 0.525 W/kg

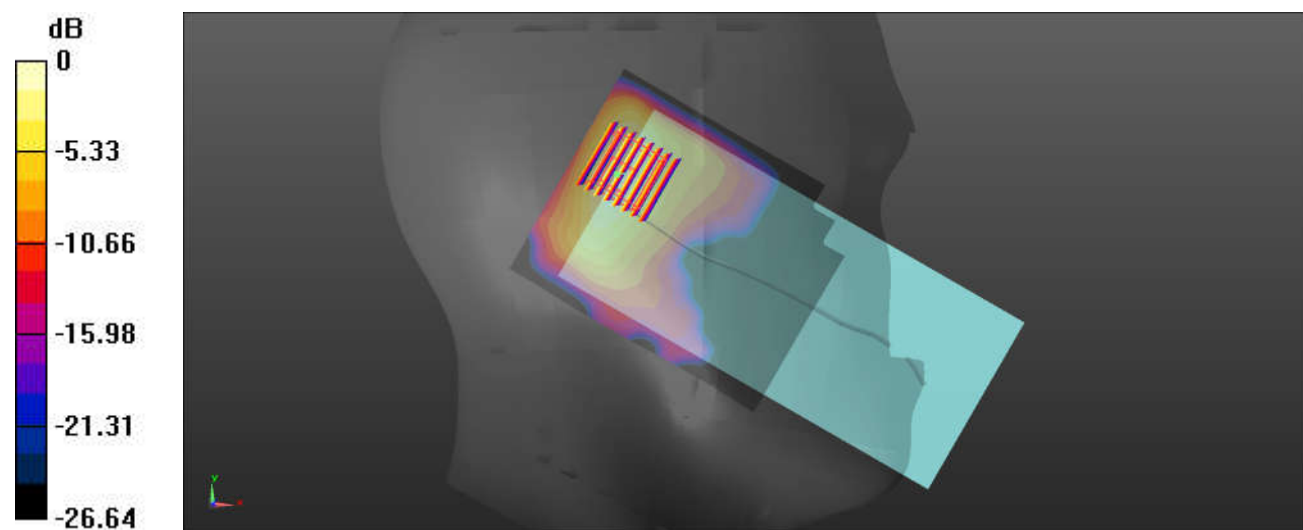
**Zoom Scan (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 13.38 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 0.908 W/kg

**SAR(1 g) = 0.283 W/kg; SAR(10 g) = 0.118 W/kg**

Maximum value of SAR (measured) = 0.563 W/kg



0 dB = 0.563 W/kg = -2.49 dBW/kg

**03\_LTE Band 42\_20M\_QPSK\_1RB\_0Offset\_Top Side\_5mm\_Ch42590**

Communication System: UID 0, LTE-TDD (0); Frequency: 3500 MHz; Duty Cycle: 1:1.59  
Medium: HSL\_3500 Medium parameters used:  $f = 3500$  MHz;  $\sigma = 2.826$  S/m;  $\epsilon_r = 39.043$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature : 23.1 °C; Liquid Temperature : 22.7 °C

**DASY5 Configuration:**

- Probe: EX3DV4 - SN3935; ConvF(7.16, 7.16, 7.16); Calibrated: 2021.4.29
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2021.4.26
- Phantom: SAM Twin Phantom; Type: SAM Twin; Serial: TP-1697
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

**Area Scan (51x101x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 1.71 W/kg

**Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 15.33 V/m; Power Drift = -0.09 dB

Peak SAR (extrapolated) = 2.47 W/kg

**SAR(1 g) = 0.859 W/kg; SAR(10 g) = 0.322 W/kg**

Maximum value of SAR (measured) = 1.71 W/kg

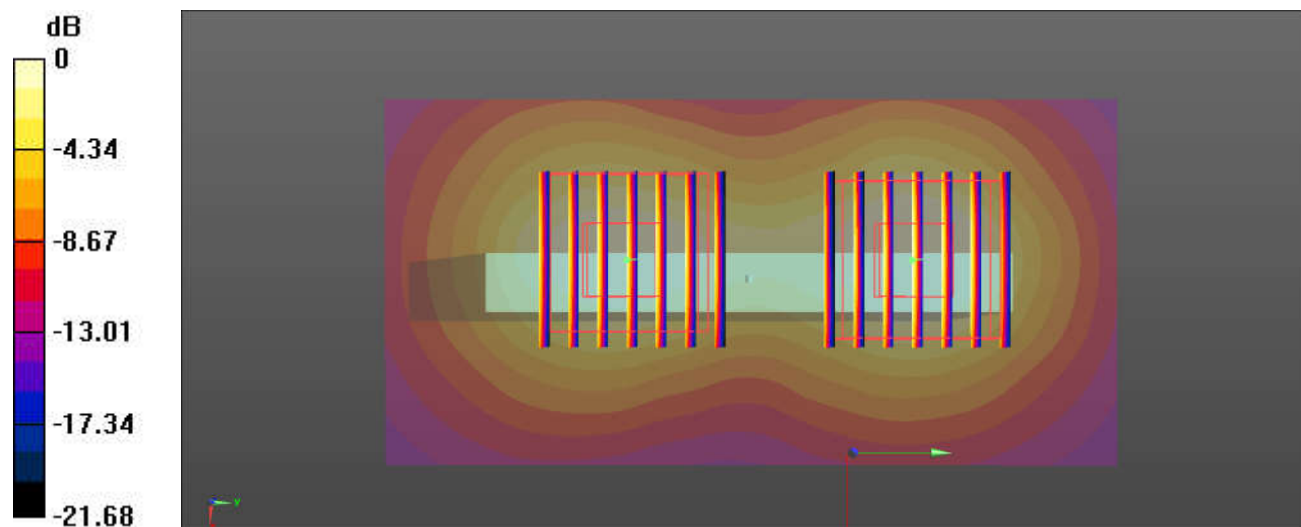
**Zoom Scan (7x7x7)/Cube 1:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 15.33 V/m; Power Drift = -0.09 dB

Peak SAR (extrapolated) = 1.68 W/kg

**SAR(1 g) = 0.627 W/kg; SAR(10 g) = 0.270 W/kg**

Maximum value of SAR (measured) = 1.16 W/kg



0 dB = 1.16 W/kg = 0.64 dBW/kg

**04\_FR1 N77\_100M\_QPSK\_135RB\_69Offset\_Back\_5mm\_Ch633334**

Communication System: UID 0, 5G NR (0); Frequency: 3500.01 MHz; Duty Cycle: 1:1

Medium: HSL\_3500 Medium parameters used:  $f = 3500.01$  MHz;  $\sigma = 2.826$  S/m;  $\epsilon_r = 39.043$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature : 23.1 °C; Liquid Temperature : 22.7 °C

**DASY5 Configuration:**

- Probe: EX3DV4 - SN3935; ConvF(7.16, 7.16, 7.16); Calibrated: 2021.4.29
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2021.4.26
- Phantom: SAM Twin Phantom; Type: SAM Twin; Serial: TP-1697
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

**Area Scan (91x101x1):** Interpolated grid:  $dx=1.000$  mm,  $dy=1.000$  mm

Maximum value of SAR (interpolated) = 0.691 W/kg

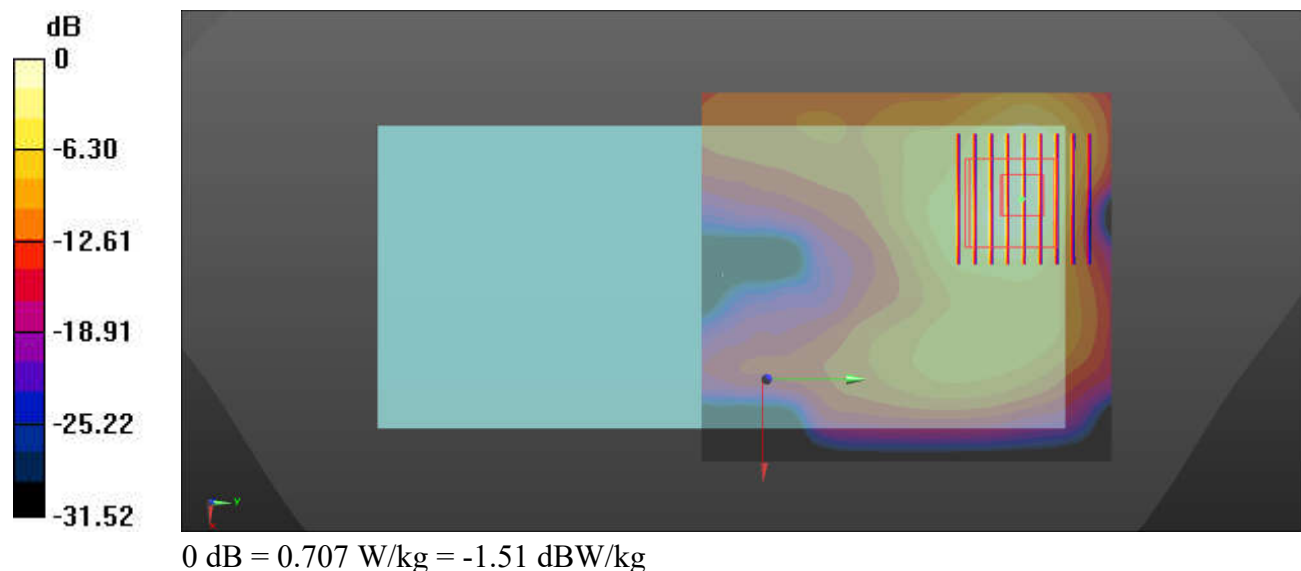
**Zoom Scan (9x9x7)/Cube 0:** Measurement grid:  $dx=4$ mm,  $dy=4$ mm,  $dz=1.4$ mm

Reference Value = 0.4600 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 1.20 W/kg

**SAR(1 g) = 0.325 W/kg; SAR(10 g) = 0.130 W/kg**

Maximum value of SAR (measured) = 0.707 W/kg



**05\_LTE Band 42\_20M\_QPSK\_1RB\_0Offset\_Back\_5mm\_Ch42590**

Communication System: UID 0, LTE-TDD (0); Frequency: 3500 MHz; Duty Cycle: 1:1.59

Medium: HSL\_3500 Medium parameters used:  $f = 3500$  MHz;  $\sigma = 2.826$  S/m;  $\epsilon_r = 39.043$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature : 23.1 °C; Liquid Temperature : 22.7 °C

**DASY5 Configuration:**

- Probe: EX3DV4 - SN3935; ConvF(7.16, 7.16, 7.16); Calibrated: 2021.4.29
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2021.4.26
- Phantom: SAM Twin Phantom; Type: SAM Twin; Serial: TP-1697
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

**Area Scan (101x111x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 1.62 W/kg

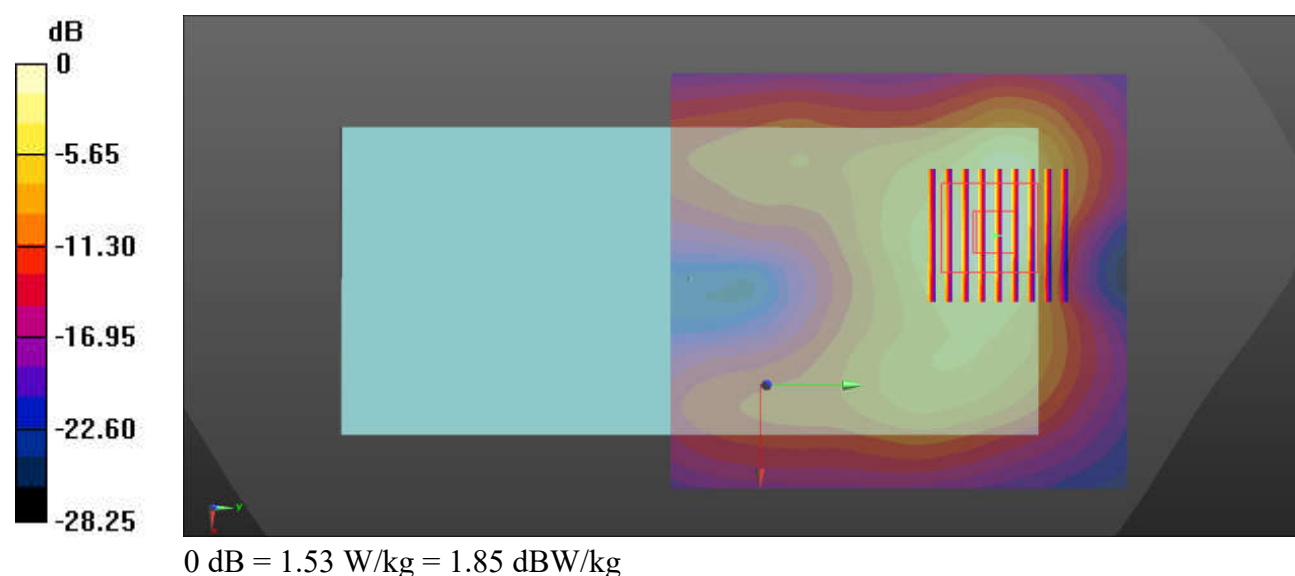
**Zoom Scan (9x9x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 1.695 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 2.34 W/kg

**SAR(1 g) = 0.762 W/kg; SAR(10 g) = 0.318 W/kg**

Maximum value of SAR (measured) = 1.53 W/kg



**06\_FR1 N77\_100M\_QPSK\_135RB\_69Offset\_Back\_5mm\_Ch633334**

Communication System: UID 0, 5G NR (0); Frequency: 3500.01 MHz; Duty Cycle: 1:1

Medium: HSL\_3500 Medium parameters used:  $f = 3500.01$  MHz;  $\sigma = 2.826$  S/m;  $\epsilon_r = 39.043$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature : 23.1 °C; Liquid Temperature : 22.7 °C

**DASY5 Configuration:**

- Probe: EX3DV4 - SN3935; ConvF(7.16, 7.16, 7.16); Calibrated: 2021.4.29
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2021.4.26
- Phantom: SAM Twin Phantom; Type: SAM Twin; Serial: TP-1697
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

**Area Scan (91x101x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 0.691 W/kg

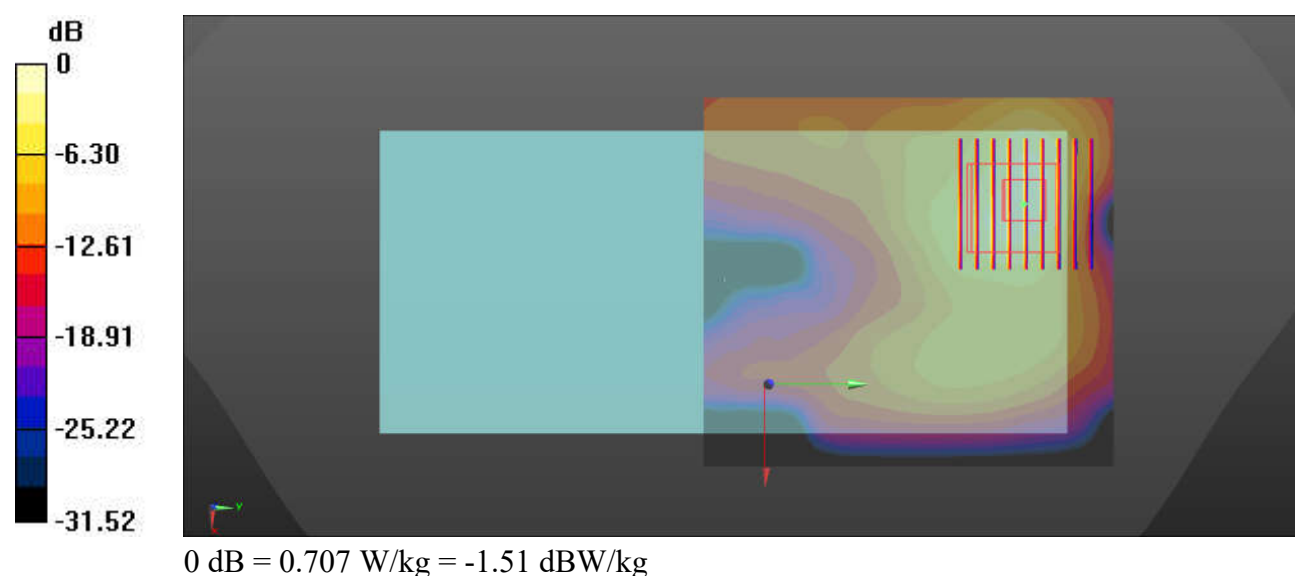
**Zoom Scan (9x9x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 0.4600 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 1.20 W/kg

**SAR(1 g) = 0.325 W/kg; SAR(10 g) = 0.130 W/kg**

Maximum value of SAR (measured) = 0.707 W/kg



**07\_FR1 N77\_100M\_QPSK\_135RB\_69Offset\_Top Side\_0mm\_Ch633334**

Communication System: UID 0, 5G NR (0); Frequency: 3500.01 MHz; Duty Cycle: 1:1

Medium: HSL\_3500 Medium parameters used:  $f = 3500.01$  MHz;  $\sigma = 2.826$  S/m;  $\epsilon_r = 39.043$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature : 23.1 °C; Liquid Temperature : 22.7 °C

**DASY5 Configuration:**

- Probe: EX3DV4 - SN3935; ConvF(7.16, 7.16, 7.16); Calibrated: 2021.4.29
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2021.4.26
- Phantom: SAM Twin Phantom; Type: SAM Twin; Serial: TP-1697
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

**Area Scan (51x101x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 8.62 W/kg

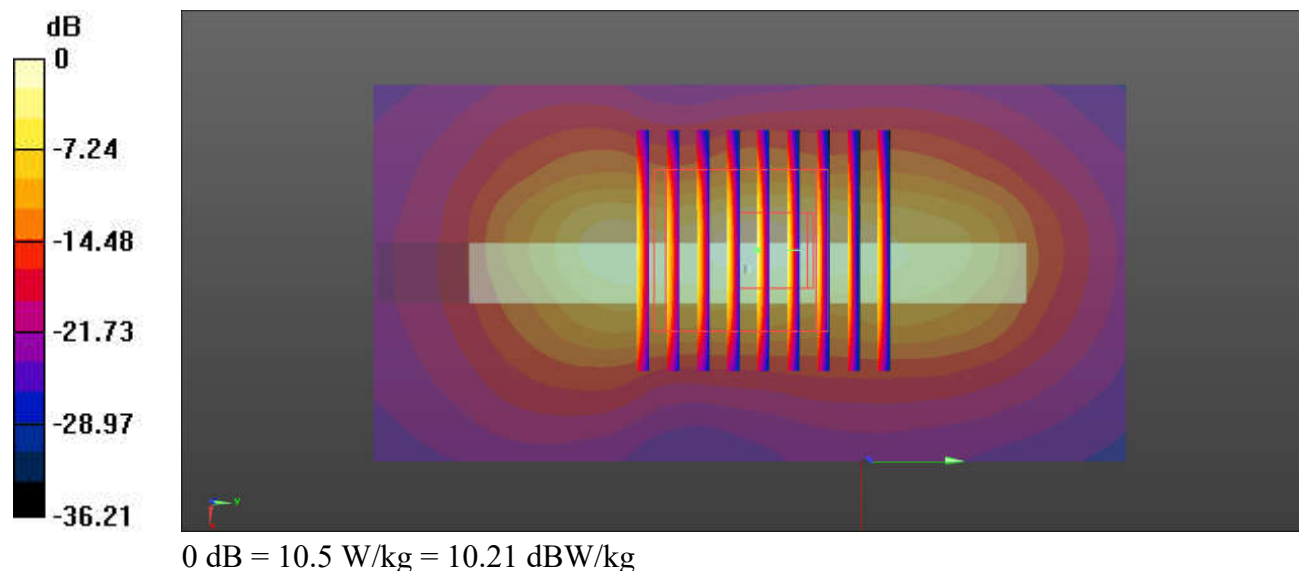
**Zoom Scan (9x9x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 53.26 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 32.5 W/kg

**SAR(1 g) = 3.68 W/kg; SAR(10 g) = 1.01 W/kg**

Maximum value of SAR (measured) = 10.5 W/kg





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## ***Appendix C.     DASY Calibration Certificate***

The DASY calibration certificates are shown as follows.



Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 0108**

The Swiss Accreditation Service is one of the signatories to the EA  
Multilateral Agreement for the recognition of calibration certificates

Client **Sporton**

Certificate No: **D3500V2-1037\_Nov20**

## CALIBRATION CERTIFICATE

Object **D3500V2 - SN:1037**

Calibration procedure(s) **QA CAL-22.v5  
Calibration Procedure for SAR Validation Sources between 3-10 GHz**

Calibration date: **November 25, 2020**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).  
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature ( $22 \pm 3$ )°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards           | ID #               | Cal Date (Certificate No.)      | Scheduled Calibration |
|-----------------------------|--------------------|---------------------------------|-----------------------|
| Power meter NRP             | SN: 104778         | 01-Apr-20 (No. 217-03100/03101) | Apr-21                |
| Power sensor NRP-Z91        | SN: 103244         | 01-Apr-20 (No. 217-03100)       | Apr-21                |
| Power sensor NRP-Z91        | SN: 103245         | 01-Apr-20 (No. 217-03101)       | Apr-21                |
| Reference 20 dB Attenuator  | SN: BH9394 (20k)   | 31-Mar-20 (No. 217-03106)       | Apr-21                |
| Type-N mismatch combination | SN: 310982 / 06327 | 31-Mar-20 (No. 217-03104)       | Apr-21                |
| Reference Probe EX3DV4      | SN: 3503           | 31-Dec-19 (No. EX3-3503_Dec19)  | Dec-20                |
| DAE4                        | SN: 601            | 02-Nov-20 (No. DAE4-601_Nov20)  | Nov-21                |

| Secondary Standards             | ID #           | Check Date (in house)             | Scheduled Check        |
|---------------------------------|----------------|-----------------------------------|------------------------|
| Power meter E4419B              | SN: GB39512475 | 30-Oct-14 (in house check Oct-20) | In house check: Oct-22 |
| Power sensor HP 8481A           | SN: US37292783 | 07-Oct-15 (in house check Oct-20) | In house check: Oct-22 |
| Power sensor HP 8481A           | SN: MY41092317 | 07-Oct-15 (in house check Oct-20) | In house check: Oct-22 |
| RF generator R&S SMT-06         | SN: 100972     | 15-Jun-15 (in house check Oct-20) | In house check: Oct-22 |
| Network Analyzer Agilent E8358A | SN: US41080477 | 31-Mar-14 (in house check Oct-20) | In house check: Oct-21 |

Calibrated by: **Jeffrey Katzman**      **Laboratory Technician**

Approved by: **Katja Pokovic**      **Technical Manager**

Signature

Issued: November 26, 2020

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.



Accredited by the Swiss Accreditation Service (SAS)

The Swiss Accreditation Service is one of the signatories to the EA  
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

### Glossary:

|       |                                 |
|-------|---------------------------------|
| TSL   | tissue simulating liquid        |
| ConvF | sensitivity in TSL / NORM x,y,z |
| N/A   | not applicable or not measured  |

### Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
- IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

### Additional Documentation:

- DASY4/5 System Handbook

### Methods Applied and Interpretation of Parameters:

- Measurement Conditions:** Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL:** The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss:** These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay:** One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured:** SAR measured at the stated antenna input power.
- SAR normalized:** SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:** The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor  $k=2$ , which for a normal distribution corresponds to a coverage probability of approximately 95%.

## Measurement Conditions

DASY system configuration, as far as not given on page 1.

|                                     |                            |                                  |
|-------------------------------------|----------------------------|----------------------------------|
| <b>DASY Version</b>                 | DASY5                      | V52.10.4                         |
| <b>Extrapolation</b>                | Advanced Extrapolation     |                                  |
| <b>Phantom</b>                      | Modular Flat Phantom       |                                  |
| <b>Distance Dipole Center - TSL</b> | 10 mm                      | with Spacer                      |
| <b>Zoom Scan Resolution</b>         | dx, dy = 4 mm, dz = 1.4 mm | Graded Ratio = 1.4 (Z direction) |
| <b>Frequency</b>                    | 3500 MHz $\pm$ 1 MHz       |                                  |

## Head TSL parameters

The following parameters and calculations were applied.

|                                                | Temperature         | Permittivity   | Conductivity         |
|------------------------------------------------|---------------------|----------------|----------------------|
| <b>Nominal Head TSL parameters</b>             | 22.0 °C             | 37.9           | 2.91 mho/m           |
| <b>Measured Head TSL parameters</b>            | (22.0 $\pm$ 0.2) °C | 38.6 $\pm$ 6 % | 2.93 mho/m $\pm$ 6 % |
| <b>Head TSL temperature change during test</b> | < 0.5 °C            | ----           | ----                 |

## SAR result with Head TSL

|                                                             |                    |                                                |
|-------------------------------------------------------------|--------------------|------------------------------------------------|
| <b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Head TSL</b> | Condition          |                                                |
| SAR measured                                                | 100 mW input power | 6.78 W/kg                                      |
| SAR for nominal Head TSL parameters                         | normalized to 1W   | <b>68.0 W/kg <math>\pm</math> 19.9 % (k=2)</b> |

|                                                               |                    |                                                |
|---------------------------------------------------------------|--------------------|------------------------------------------------|
| <b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Head TSL</b> | condition          |                                                |
| SAR measured                                                  | 100 mW input power | 2.53 W/kg                                      |
| SAR for nominal Head TSL parameters                           | normalized to 1W   | <b>25.4 W/kg <math>\pm</math> 19.5 % (k=2)</b> |

## Appendix (Additional assessments outside the scope of SCS 0108)

### Antenna Parameters with Head TSL

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 51.8 $\Omega$ - 2.1 j $\Omega$ |
| Return Loss                          | - 31.3 dB                      |

### General Antenna Parameters and Design

|                                  |          |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.141 ns |
|----------------------------------|----------|

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

### Additional EUT Data

|                 |       |
|-----------------|-------|
| Manufactured by | SPEAG |
|-----------------|-------|

## DASY5 Validation Report for Head TSL

Date: 25.11.2020

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 3500 MHz; Type: D3500V2; Serial: D3500V2 - SN:1037**

Communication System: UID 0 - CW; Frequency: 3500 MHz

Medium parameters used:  $f = 3500$  MHz;  $\sigma = 2.93$  S/m;  $\epsilon_r = 38.6$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(7.91, 7.91, 7.91) @ 3500 MHz; Calibrated: 31.12.2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 02.11.2020
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

**Dipole Calibration for Head Tissue/Pin=100 mW, d=10mm, f=3500MHz/Zoom Scan, dist=1.4mm (8x8x8)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 71.16 V/m; Power Drift = 0.07 dB

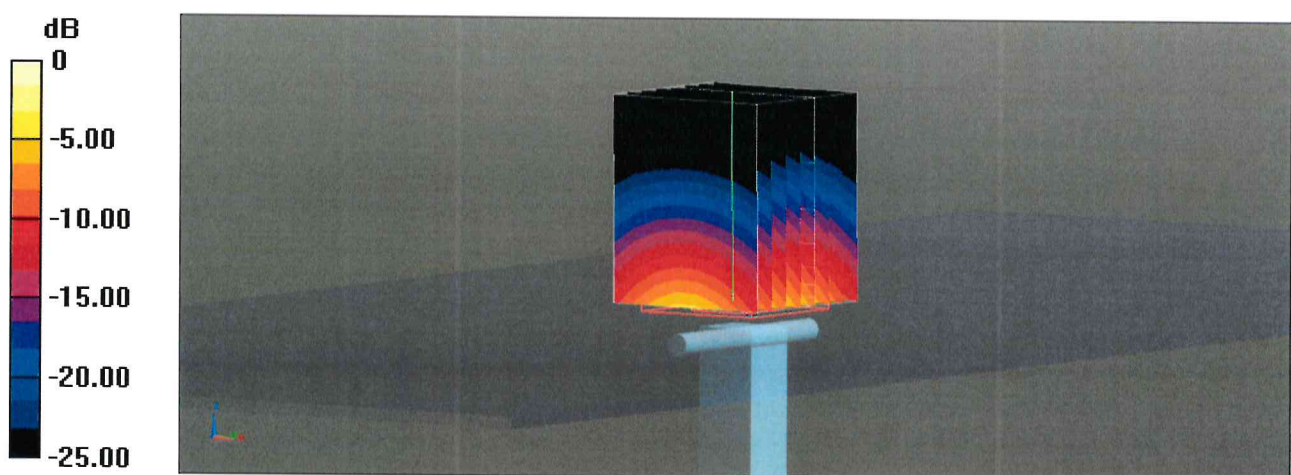
Peak SAR (extrapolated) = 18.3 W/kg

**SAR(1 g) = 6.78 W/kg; SAR(10 g) = 2.53 W/kg**

Smallest distance from peaks to all points 3 dB below = 8.4 mm

Ratio of SAR at M2 to SAR at M1 = 75.2%

Maximum value of SAR (measured) = 12.8 W/kg



0 dB = 12.8 W/kg = 11.07 dBW/kg

Impedance Measurement Plot for Head TSL

