

# TEST REPORT



**DT&C Co., Ltd.**

42, Yurim-ro, 154Beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea, 17042  
Tel : 031-321-2664, Fax : 031-321-1664

1. Report No : DRRFCC2008-0083(1)
2. Customer
  - Name : BLUEBIRD INC.
  - Address : 3F, 115, Irwon-ro, Gangnam-gu, Seoul, South Korea
3. Use of Report : FCC Original Grant
4. Product Name / Model Name : Smart POS Payment Terminal / SP500  
FCC ID : SS4SP500
5. Test Method Used : IEEE 1528-2013 , FCC SAR KDB Publications (Details in test report)  
Test Specification : CFR 47 Part 2 subpart 2.1093
6. Date of Test : 2020.07.13 ~ 2020.07.29
7. Location of Test : ☒ Permanent Testing Lab ☐ On Site Testing
8. Testing Environment : Refer to attached test report
9. Test Result : Refer to attached test report.

The results shown in this test report refer only to the sample(s) tested unless otherwise stated.

|             |                                                                                                        |                                                                                                         |
|-------------|--------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|
| Affirmation | Tested by                                                                                              | Technical Manager                                                                                       |
|             | Name : BumJun Park  | Name : HakMin Kim  |

2020 . 09 . 03 .

**DT&C Co., Ltd.**

Not abided by KS Q ISO / IEC 17025 and KOLAS accreditation.

If this report is required to confirmation of authenticity, please contact to [report@dtnc.net](mailto:report@dtnc.net)

## Test Report Version

| Test Report No.    | Date          | Description            | Tested by   | Reviewed by |
|--------------------|---------------|------------------------|-------------|-------------|
| DRRFCC2008-0083    | Aug. 21, 2020 | Initial issue          | BumJun Park | HakMin Kim  |
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|                    |               |                        |             |             |
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# 1. DESCRIPTION OF DEVICE

## 1.1 General Information

|                                           |                                                                                                                                                                              |             |                 |                     |                     |
|-------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-----------------|---------------------|---------------------|
| EUT type                                  | Smart POS Payment Terminal                                                                                                                                                   |             |                 |                     |                     |
| FCC ID                                    | SS4SP500                                                                                                                                                                     |             |                 |                     |                     |
| Equipment model name                      | SP500                                                                                                                                                                        |             |                 |                     |                     |
| Equipment add model name                  | N/A                                                                                                                                                                          |             |                 |                     |                     |
| FCC & ISSED MRA Designation No.           | KR0034                                                                                                                                                                       |             |                 |                     |                     |
| ISED#                                     | 5470A                                                                                                                                                                        |             |                 |                     |                     |
| Equipment serial no.                      | Identical prototype                                                                                                                                                          |             |                 |                     |                     |
| Mode(s) of Operation                      | WCDMA 850, WCDMA 1900, LTE Band 12, 5, 4, 2, 2.4 G W-LAN (802.11b/g/n-HT20/n-HT40), 5 G W-LAN (802.11a/n-HT20/n-HT40), Bluetooth                                             |             |                 |                     |                     |
| TX Frequency Range                        | Band                                                                                                                                                                         | Mode        | Operating Modes | Bandwidth           | Frequency           |
|                                           | WCDMA 850                                                                                                                                                                    | WCDMA       | Voice/Data      | -                   | 826.4 ~ 846.6 MHz   |
|                                           | WCDMA 1900                                                                                                                                                                   | WCDMA       | Voice/Data      | -                   | 1852.4 ~ 1907.6 MHz |
|                                           | LTE Band 12                                                                                                                                                                  | LTE         | Voice/Data      | 1.4/3/5/10MHz       | 699.7 ~ 715.3 MHz   |
|                                           | LTE Band 5                                                                                                                                                                   | LTE         | Voice/Data      | 1.4/3/5/10MHz       | 824.7 ~ 848.3 MHz   |
|                                           | LTE Band 4                                                                                                                                                                   | LTE         | Voice/Data      | 1.4/3/5/10/15/20MHz | 1710.7 ~ 1754.3 MHz |
|                                           | LTE Band 2                                                                                                                                                                   | LTE         | Voice/Data      | 1.4/3/5/10/15/20MHz | 1850.7 ~ 1909.3 MHz |
|                                           | 2.4 GHz W-LAN                                                                                                                                                                | 802.11b/g/n | Voice/Data      | HT20/HT40           | 2412 ~ 2462 MHz     |
|                                           | 5.2 GHz W-LAN                                                                                                                                                                | 802.11a/n   | Voice/Data      | HT20                | 5180 ~ 5240 MHz     |
|                                           |                                                                                                                                                                              | 802.11n     | Voice/Data      | HT40                | 5190 ~ 5230 MHz     |
|                                           | 5.3 GHz W-LAN                                                                                                                                                                | 802.11a/n   | Voice/Data      | HT20                | 5260 ~ 5320 MHz     |
|                                           |                                                                                                                                                                              | 802.11n     | Voice/Data      | HT40                | 5270 ~ 5310 MHz     |
|                                           | 5.6 GHz W-LAN                                                                                                                                                                | 802.11a/n   | Voice/Data      | HT20                | 5500 ~ 5720 MHz     |
|                                           |                                                                                                                                                                              | 802.11n     | Voice/Data      | HT40                | 5510 ~ 5710 MHz     |
|                                           | 5.8 GHz W-LAN                                                                                                                                                                | 802.11a/n   | Voice/Data      | HT20                | 5745 ~ 5825 MHz     |
|                                           |                                                                                                                                                                              | 802.11n     | Voice/Data      | HT40                | 5755 ~ 5795 MHz     |
|                                           | Bluetooth                                                                                                                                                                    | -           | Data            | -                   | 2402 ~ 2480 MHz     |
| RX Frequency Range                        | WCDMA 850                                                                                                                                                                    | WCDMA       | Voice/Data      | -                   | 871.4 ~ 891.6 MHz   |
|                                           | WCDMA 1900                                                                                                                                                                   | WCDMA       | Voice/Data      | -                   | 1932.4 ~ 1987.6 MHz |
|                                           | LTE Band 12                                                                                                                                                                  | LTE         | Voice/Data      | 1.4/3/5/10MHz       | 729.7 ~ 745.3 MHz   |
|                                           | LTE Band 5                                                                                                                                                                   | LTE         | Voice/Data      | 1.4/3/5/10MHz       | 869.7 ~ 893.3 MHz   |
|                                           | LTE Band 4                                                                                                                                                                   | LTE         | Voice/Data      | 1.4/3/5/10/15/20MHz | 2110.7 ~ 2154.3 MHz |
|                                           | LTE Band 2                                                                                                                                                                   | LTE         | Voice/Data      | 1.4/3/5/10/15/20MHz | 1930.7 ~ 1989.3 MHz |
|                                           | 2.4 GHz W-LAN                                                                                                                                                                | 802.11b/g/n | Voice/Data      | HT20/HT40           | 2412 ~ 2462 MHz     |
|                                           | 5.2 GHz W-LAN                                                                                                                                                                | 802.11a/n   | Voice/Data      | HT20                | 5180 ~ 5240 MHz     |
|                                           |                                                                                                                                                                              | 802.11n     | Voice/Data      | HT40                | 5190 ~ 5230 MHz     |
|                                           | 5.3 GHz W-LAN                                                                                                                                                                | 802.11a/n   | Voice/Data      | HT20                | 5260 ~ 5320 MHz     |
|                                           |                                                                                                                                                                              | 802.11n     | Voice/Data      | HT40                | 5270 ~ 5310 MHz     |
|                                           | 5.6 GHz W-LAN                                                                                                                                                                | 802.11a/n   | Voice/Data      | HT20                | 5500 ~ 5720 MHz     |
|                                           |                                                                                                                                                                              | 802.11n     | Voice/Data      | HT40                | 5510 ~ 5710 MHz     |
|                                           | 5.8 GHz W-LAN                                                                                                                                                                | 802.11a/n   | Voice/Data      | HT20                | 5745 ~ 5825 MHz     |
|                                           |                                                                                                                                                                              | 802.11n     | Voice/Data      | HT40                | 5755 ~ 5795 MHz     |
|                                           | Bluetooth                                                                                                                                                                    | -           | Data            | -                   | 2402 ~ 2480 MHz     |
|                                           | Equipment Class                                                                                                                                                              | Band        | Reported SAR    |                     |                     |
| 1g SAR (W/kg)                             |                                                                                                                                                                              |             |                 |                     |                     |
|                                           |                                                                                                                                                                              | Body        |                 |                     |                     |
| PCB                                       | WCDMA 850                                                                                                                                                                    | 1.04        |                 |                     |                     |
| PCB                                       | WCDMA 1900                                                                                                                                                                   | 1.19        |                 |                     |                     |
| PCB                                       | LTE Band 12                                                                                                                                                                  | 0.34        |                 |                     |                     |
| PCB                                       | LTE Band 5                                                                                                                                                                   | 0.69        |                 |                     |                     |
| PCB                                       | LTE Band 4                                                                                                                                                                   | 0.81        |                 |                     |                     |
| PCB                                       | LTE Band 2                                                                                                                                                                   | 1.19        |                 |                     |                     |
| DTS                                       | 2.4 GHz W-LAN                                                                                                                                                                | 0.65        |                 |                     |                     |
| U-NII-1                                   | 5.2 GHz W-LAN                                                                                                                                                                | 0.78        |                 |                     |                     |
| U-NII-3                                   | 5.8 GHz W-LAN                                                                                                                                                                | 0.48        |                 |                     |                     |
| DSS                                       | Bluetooth                                                                                                                                                                    | 0.17        |                 |                     |                     |
| Simultaneous SAR per KDB 690783 D01v01r03 |                                                                                                                                                                              |             | 1.47            |                     |                     |
| FCC Equipment Class                       | Licensed Portable Transmitter (PCB)<br>Part 15 Spread Spectrum Transmitter(DSS)<br>Digital Transmission System(DTS)<br>Unlicensed National Information Infrastructure (UNII) |             |                 |                     |                     |
| Date(s) of Tests                          | 2020.07.13 ~ 2020.07.29                                                                                                                                                      |             |                 |                     |                     |
| Antenna Type                              | Internal Antenna                                                                                                                                                             |             |                 |                     |                     |
| Functions                                 | <ul style="list-style-type: none"><li>Simultaneous transmission between [WCDMA &amp; WLAN], [LTE &amp; WLAN].</li><li>VoIP is supported.</li></ul>                           |             |                 |                     |                     |

## 1.2 Power Reduction for SAR

There is no power reduction used for any band/mode implemented in this device for SAR purposes.

## 1.3 Nominal and Maximum Output Power Specifications

The Nominal and Maximum Output Power Specifications are in section 8 of this test report.

## 1.4 Simultaneous Transmission Capabilities

The Simultaneous Transmission Capabilities are in section 11 of this test report.

## 1.5 Miscellaneous SAR Test Considerations

### (A) BT for SAR configuration

Per FCC KDB 447498 D01v06, the **1g SAR exclusion threshold for distances < 50 mm** is defined by the following equation:

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

Based on the maximum conducted power of **Bluetooth** (rounded to the nearest mW) and the antenna to user separation distance,

**Bluetooth SAR was required:**  $[(15/5) \cdot \sqrt{2.480}] = 4.8 > 3.0$ .

Per KDB Publication 447498 D01v06, the maximum power of the channel was rounded to the nearest mW before calculation.

### (B) Tested sides for Body SAR configuration

(1) Per FCC KDB 447498 D01v06, the **1g SAR exclusion threshold for distances < 50 mm** is defined by the following equation:

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

**Table 1.4.1 SAR Test Exclusion for Edges (Antennas < 50 mm)**

| FREQUENCY |       | Mode/<br>Band | Service | Tune up<br>Max<br>Power<br>[mW] | # of Time<br>Slots | Separation Distance [mm] |        |       |      | Calculated Threshold Power [mW] |             |             |          |
|-----------|-------|---------------|---------|---------------------------------|--------------------|--------------------------|--------|-------|------|---------------------------------|-------------|-------------|----------|
| MHz       | Ch    |               |         |                                 |                    | Top                      | Bottom | Right | Left | Top                             | Bottom      | Right       | Left     |
| 846.6     | 4233  | WCDMA 850     | RMC     | 251                             | -                  | 155                      | 0      | 0     | 0    | > 50mm Note                     | 46.2 (O)    | 46.2 (O)    | 46.2 (O) |
| 1907.6    | 9538  | WCDMA 1900    | RMC     | 165                             | -                  | 155                      | 0      | 0     | 0    | > 50mm Note                     | 45.8 (O)    | 45.8 (O)    | 45.8 (O) |
| 707.5     | 23095 | LTE B12       | -       | 199                             | -                  | 155                      | 0      | 0     | 0    | > 50mm Note                     | 33.6 (O)    | 33.6 (O)    | 33.6 (O) |
| 836.5     | 20525 | LTE B5        | -       | 208                             | -                  | 155                      | 0      | 0     | 0    | > 50mm Note                     | 38.2 (O)    | 38.2 (O)    | 38.2 (O) |
| 1732.5    | 20175 | LTE B4        | -       | 186                             | -                  | 155                      | 0      | 0     | 0    | > 50mm Note                     | 49.0 (O)    | 49.0 (O)    | 49.0 (O) |
| 1900.0    | 19100 | LTE B2        | -       | 186                             | -                  | 155                      | 0      | 0     | 0    | > 50mm Note                     | 51.3 (O)    | 51.3 (O)    | 51.3 (O) |
| 2462.0    | 11    | 2.4 GHz W-LAN | -       | 39                              | -                  | 16                       | 136    | 80    | 3    | 3.9 (O)                         | > 50mm Note | > 50mm Note | 12.5 (O) |
| 5825.0    | 165   | 5 GHz W-LAN   | -       | 19                              | -                  | 16                       | 136    | 80    | 3    | 3.9 (O)                         | > 50mm Note | > 50mm Note | 9.6 (O)  |
| 2480.0    | 78    | Bluetooth     | -       | 15                              | -                  | 16                       | 136    | 80    | 3    | 1.5 (X)                         | > 50mm Note | > 50mm Note | 4.8 (O)  |

Note: Please refer to Table 1.4.2.

(2) Per FCC KDB 447498 D01v06, the **SAR exclusion threshold for distances > 50 mm** is defined by the following equation: (the SAR test exclusion threshold is determined according to the following, and as illustrated in KDB 447498 Appendix B.)

- 1)  $\{[\text{Power allowed at numeric threshold for 50 mm in step a)}] + [(\text{test separation distance} - 50 \text{ mm}) \cdot (f_{\text{GHz}}/150)]\}$  mW, for 100 MHz to 1500 MHz
- 2)  $\{[\text{Power allowed at numeric threshold for 50 mm in step a)}] + [(\text{test separation distance} - 50 \text{ mm}) \cdot 10]\}$  mW, for > 1500 MHz and  $\leq 6$  GHz

**Table 1.4.2 SAR Test Exclusion for Edges (Antennas > 50 mm)**

| FREQUENCY |       | Mode/<br>Band | Service | Tune up<br>Max<br>Power<br>[mW] | # of Time<br>Slots | Separation Distance [mm] |        |       |      | Calculated Threshold Power [mW] |             |             |             |
|-----------|-------|---------------|---------|---------------------------------|--------------------|--------------------------|--------|-------|------|---------------------------------|-------------|-------------|-------------|
| MHz       | Ch    |               |         |                                 |                    | Top                      | Bottom | Right | Left | Top                             | Bottom      | Right       | Left        |
| 846.6     | 4233  | WCDMA 850     | RMC     | 251                             | -                  | 155                      | 0      | 0     | 0    | 757 (X)                         | < 50mm Note | < 50mm Note | < 50mm Note |
| 1907.6    | 9538  | WCDMA 1900    | RMC     | 165                             | -                  | 155                      | 0      | 0     | 0    | 1159 (X)                        | < 50mm Note | < 50mm Note | < 50mm Note |
| 707.5     | 23095 | LTE B12       | -       | 199                             | -                  | 155                      | 0      | 0     | 0    | 659 (X)                         | < 50mm Note | < 50mm Note | < 50mm Note |
| 836.5     | 20525 | LTE B5        | -       | 208                             | -                  | 155                      | 0      | 0     | 0    | 750 (X)                         | < 50mm Note | < 50mm Note | < 50mm Note |
| 1732.5    | 20175 | LTE B4        | -       | 186                             | -                  | 155                      | 0      | 0     | 0    | 1159 (X)                        | < 50mm Note | < 50mm Note | < 50mm Note |
| 1900.0    | 19100 | LTE B2        | -       | 186                             | -                  | 155                      | 0      | 0     | 0    | 1159 (X)                        | < 50mm Note | < 50mm Note | < 50mm Note |
| 2462.0    | 11    | 2.4 GHz W-LAN | -       | 39                              | -                  | 16                       | 136    | 80    | 3    | < 50mm Note                     | 956 (X)     | 396 (X)     | < 50mm Note |
| 5825.0    | 165   | 5 GHz W-LAN   | -       | 19                              | -                  | 16                       | 136    | 80    | 3    | < 50mm Note                     | 922 (X)     | 362 (X)     | < 50mm Note |
| 2480.0    | 78    | Bluetooth     | -       | 15                              | -                  | 16                       | 136    | 80    | 3    | < 50mm Note                     | 956 (X)     | 396 (X)     | < 50mm Note |

Note: Please refer to Table 1.4.1.

**Table 1.4.3 Determined EUT sides for SAR Testing**

| Mode          | EUT Sides for SAR Testing |        |       |      |       |      |
|---------------|---------------------------|--------|-------|------|-------|------|
|               | Top                       | Bottom | Front | Rear | Right | Left |
| WCDMA 850     | X                         | O      | O     | O    | O     | O    |
| WCDMA 1900    | X                         | O      | O     | O    | O     | O    |
| LTE B12       | X                         | O      | O     | O    | O     | O    |
| LTE B5        | X                         | O      | O     | O    | O     | O    |
| LTE B4        | X                         | O      | O     | O    | O     | O    |
| LTE B2        | X                         | O      | O     | O    | O     | O    |
| 2.4 GHz W-LAN | O                         | X      | O     | O    | X     | O    |
| 5 GHz W-LAN   | O                         | X      | O     | O    | X     | O    |
| Bluetooth     | X                         | X      | O     | O    | X     | O    |

Note: Particular DUT edges were not required to be evaluated for SAR based on the SAR exclusion threshold in KDB 447498 D01v06.

### (C) Licensed Transmitter(s)

LTE SAR for the higher modulations and lower bandwidths were not tested since the maximum average output power of all required channels and configurations was not more than 0.5 dB higher than the highest bandwidth and the reported LTE SAR for the highest bandwidth was less than 1.45 W/kg for all configurations according to FCC KDB 941225 D05v02r04.

## 1.6 Guidance Applied

- IEEE 1528-2013
- FCC KDB Publication 941225 D01v03r01 (3G SAR Procedures)
- FCC KDB Publication 941225 D05v02r05 (SAR for LTE Devices)
- FCC KDB Publication 941225 D05Av01r02 (LTE Rel.10 KDB Inquiry Sheet)
- FCC KDB Publication 248227 D01v02r02 (802.11 Wi-Fi SAR)
- FCC KDB Publication 447498 D01v06 (General RF Exposure Guidance)
- FCC KDB Publication 648474 D04v01r03 (Handset SAR)
- FCC KDB Publication 941225 D07 v01r02 (UMPC Mini Tablet)
- FCC KDB Publication 690783 D01v01r03 (SAR Listings on Grants)
- FCC KDB Publication 865664 D01v01r04 (SAR Measurement 100 MHz to 6 GHz)
- FCC KDB Publication 865664 D02v01r02 (RF Exposure Reporting)
- April 2015 TCB Workshop Notes (Simultaneous transmission summation clarified)
- October 2016 TCB Workshop Notes (Bluetooth Duty Factor)

## 1.7 Device Serial Numbers

Several samples with identical hardware were used to support SAR testing. The manufacturer has confirmed that the device(s) tested have the same physical, mechanical and thermal characteristics and are within operational tolerances expected for production units. The serial numbers used for each test are indicated alongside the results in Section 10.

## 2. LTE INFORMATION

| LTE Information                                                                                                   |                                                                                                                                                                                                                                                                                                                     |         |                                 |          |                |
|-------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|---------------------------------|----------|----------------|
| FCC ID                                                                                                            | SS4SP500                                                                                                                                                                                                                                                                                                            |         |                                 |          |                |
| Form Factor                                                                                                       | Smart POS Payment Terminal                                                                                                                                                                                                                                                                                          |         |                                 |          |                |
| Frequency Range of each LTE transmission Band                                                                     | LTE Band 12 (699.7 ~ 715.3 MHz)<br>LTE Band 5 (Cell) (824.7 ~ 848.3 MHz)<br>LTE Band 4 (AWS) (1710.7 ~ 1754.3 MHz)<br>LTE Band 2 (PCS) (1850.7 ~ 1909.3 MHz)                                                                                                                                                        |         |                                 |          |                |
| Channel Bandwidths                                                                                                | LTE Band 12 : 1.4 MHz, 3 MHz, 5 MHz, 10 MHz<br>LTE Band 5 : 1.4 MHz, 3 MHz, 5 MHz, 10 MHz<br>LTE Band 4 : 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz<br>LTE Band 2 : 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz                                                                                               |         |                                 |          |                |
| Channel Number and Frequencies(MHz)                                                                               | Low                                                                                                                                                                                                                                                                                                                 | Low-Mid | Mid                             | Mid-High | High           |
| LTE Band 12: 1.4 MHz                                                                                              | 699.7 (23017)                                                                                                                                                                                                                                                                                                       | N/A     | 707.5 (23095)                   | N/A      | 715.3 (23173)  |
| LTE Band 12: 3 MHz                                                                                                | 700.5 (23025)                                                                                                                                                                                                                                                                                                       | N/A     | 707.5 (23095)                   | N/A      | 714.5 (23165)  |
| LTE Band 12: 5 MHz                                                                                                | 701.5 (23035)                                                                                                                                                                                                                                                                                                       | N/A     | 707.5 (23095)                   | N/A      | 713.5 (23155)  |
| LTE Band 12: 10 MHz                                                                                               | 704.0 (23060)                                                                                                                                                                                                                                                                                                       | N/A     | 707.5 (23095) <sup>Note1</sup>  | N/A      | 711.0 (23130)  |
| LTE Band 5 (Cell): 1.4 MHz                                                                                        | 824.7 (20407)                                                                                                                                                                                                                                                                                                       | N/A     | 836.5 (20525)                   | N/A      | 848.3 (20643)  |
| LTE Band 5 (Cell): 3 MHz                                                                                          | 825.5 (20415)                                                                                                                                                                                                                                                                                                       | N/A     | 836.5 (20525)                   | N/A      | 847.5 (20635)  |
| LTE Band 5 (Cell): 5 MHz                                                                                          | 826.5 (20425)                                                                                                                                                                                                                                                                                                       | N/A     | 836.5 (20525)                   | N/A      | 846.5 (20625)  |
| LTE Band 5 (Cell): 10 MHz                                                                                         | 829.0 (20450)                                                                                                                                                                                                                                                                                                       | N/A     | 836.5 (20525) <sup>Note2</sup>  | N/A      | 844.0 (20600)  |
| LTE Band 4 (AWS): 1.4 MHz                                                                                         | 1710.7 (19957)                                                                                                                                                                                                                                                                                                      | N/A     | 1732.5 (20175)                  | N/A      | 1754.3 (20393) |
| LTE Band 4 (AWS): 3 MHz                                                                                           | 1711.5 (19965)                                                                                                                                                                                                                                                                                                      | N/A     | 1732.5 (20175)                  | N/A      | 1753.5 (20385) |
| LTE Band 4 (AWS): 5 MHz                                                                                           | 1712.5 (19975)                                                                                                                                                                                                                                                                                                      | N/A     | 1732.5 (20175)                  | N/A      | 1752.5 (20375) |
| LTE Band 4 (AWS): 10 MHz                                                                                          | 1715.0 (20000)                                                                                                                                                                                                                                                                                                      | N/A     | 1732.5 (20175)                  | N/A      | 1750.0 (20350) |
| LTE Band 4 (AWS): 15 MHz                                                                                          | 1717.5 (20025)                                                                                                                                                                                                                                                                                                      | N/A     | 1732.5 (20175)                  | N/A      | 1747.5 (20325) |
| LTE Band 4 (AWS): 20 MHz                                                                                          | 1720.0 (20050)                                                                                                                                                                                                                                                                                                      | N/A     | 1732.5 (20175) <sup>Note3</sup> | N/A      | 1745.0 (20300) |
| LTE Band 2 (PCS): 1.4 MHz                                                                                         | 1850.7 (18607)                                                                                                                                                                                                                                                                                                      | N/A     | 1880.0 (18900)                  | N/A      | 1909.3 (19193) |
| LTE Band 2 (PCS): 3 MHz                                                                                           | 1851.5 (18615)                                                                                                                                                                                                                                                                                                      | N/A     | 1880.0 (18900)                  | N/A      | 1908.5 (19185) |
| LTE Band 2 (PCS): 5 MHz                                                                                           | 1852.5 (18625)                                                                                                                                                                                                                                                                                                      | N/A     | 1880.0 (18900)                  | N/A      | 1907.5 (19175) |
| LTE Band 2 (PCS): 10 MHz                                                                                          | 1855.0 (18650)                                                                                                                                                                                                                                                                                                      | N/A     | 1880.0 (18900)                  | N/A      | 1905.0 (19150) |
| LTE Band 2 (PCS): 15 MHz                                                                                          | 1857.5 (18675)                                                                                                                                                                                                                                                                                                      | N/A     | 1880.0 (18900)                  | N/A      | 1902.5 (19125) |
| LTE Band 2 (PCS): 20 MHz                                                                                          | 1860.0 (18700)                                                                                                                                                                                                                                                                                                      | N/A     | 1880.0 (18900)                  | N/A      | 1900.0 (19100) |
| UE Category                                                                                                       | 4                                                                                                                                                                                                                                                                                                                   |         |                                 |          |                |
| Modulations Supported in UL                                                                                       | QPSK, 16QAM                                                                                                                                                                                                                                                                                                         |         |                                 |          |                |
| LTE MPR Permanently implemented per 3GPP TS 36.101 section 6.2.3~6.2.52 (manufacturer attestation to be provided) | Yes                                                                                                                                                                                                                                                                                                                 |         |                                 |          |                |
| A-MPR (Additional MPR) disabled for SAR Testing?                                                                  | Yes                                                                                                                                                                                                                                                                                                                 |         |                                 |          |                |
| LTE Carrier Aggregation Possible Combinations                                                                     | LTE Carrier Aggregation is not supported.                                                                                                                                                                                                                                                                           |         |                                 |          |                |
| LTE Additional Information                                                                                        | This device does not support CA features on 3GPP Release 11.<br>All uplink communications are identical to the Release 8 Specifications.<br>The following LTE Release 11 Features are not supported:<br>Relay, HetNet, Enhanced MIMO, eCIC, WiFi Offloading, MDH, eMBMS, Cross-Carrier Scheduling, Enhanced SC-FDMA |         |                                 |          |                |

- Note(s)
1. LTE B12 can not contain three non-overlapping channels of 10 MHz bandwidth.  
Per KDB 941225 D05v02r05, 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.
  2. LTE B5(Cell) can not contain three non-overlapping channels of 10 MHz bandwidth.  
Per KDB 941225 D05v02r05, 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.
  3. LTE B4 (AWS) can not contain three non-overlapping channels of 20 MHz bandwidth.  
Per KDB 941225 D05v02r05, 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.

### 3. INTROCUCTION

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

The FCC has adopted the guidelines for evaluating the environmental effects of radio frequency radiation in ET Docket 93-62 on Aug. 6, 1996 to protect the public and workers from the potential hazards of RF emissions due to FCC-regulated portable devices. The safety limits used for the environmental evaluation measurements are based on the criteria published by the American National Standards Institute (ANSI) for localized specific absorption rate (SAR) in IEEE/ANSI C95.1-1992 Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz. The measurement procedure described in IEEE/ANSI C95.3-2002 Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields - RF and Microwave is used for guidance in measuring SAR due to the RF radiation exposure from the Equipment Under Test (EUT). These criteria for SAR evaluation are similar to those recommended by the National Council on Radiation Protection and Measurements (NCRP) in Biological Effects and Exposure Criteria for Radio frequency Electromagnetic Fields," NCRP Report No. 86 NCRP, 1986, Bethesda, MD 20814. SAR is a measure of the rate of energy absorption due to exposure to an RF transmitting source. SAR values have been related to threshold levels for potential biological hazards.

#### SAR Definition

Specific Absorption Rate (SAR) is defined as the time derivative (rate) of the incremental energy (dU) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dV) of a given density ( $\rho$ ) It is also defined as the rate of RF energy absorption per unit mass at a point in an absorbing body (see Fig. 3.1)

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

Fig. 3.1 SAR Mathematical Equation

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

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

where:

- $\sigma$  = conductivity of the tissue-simulating material (S/m)
- $\rho$  = mass density of the tissue-simulating material (kg/m<sup>3</sup>)
- E = Total RMS electric field strength (V/m)

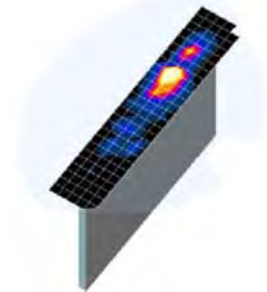
NOTE: The primary factors that control rate of energy absorption were found to be the wavelength of the incident field in relations to the dimensions and geometry of the irradiated organism, the orientation of the organism in relation to the polarity of field vectors, the presence of reflecting surfaces, and whether conductive contact is made by the organism with a ground plane.

## 4. DOSIMETRIC ASSESSMENT

### 4.1 Measurement Procedure

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

1. The SAR distribution at the exposed side of the head or body was measured at a distance no greater than 5.0 mm from the inner surface of the shell. The area covered the entire dimension of the device-head and body interface and the horizontal grid resolution was determined per FCC KDB Publication 865664 D01v01r04 (See Table 4.1) and IEEE1528-2013.
2. The point SAR measurement was taken at the maximum SAR region determined from Step 1 to enable the monitoring of SAR fluctuations/drifts during the 1g/10g cube evaluation. SAR at this fixed point was measured and used as a reference value.
3. Based on the area scan data, the peak of the region with maximum SAR was determined by spline interpolation. Around this point, a volume was assessed according to the measurement resolution and volume size requirements of FCC KDB Publication 865664 D01v01r04 (See Table 4.1) and IEEE 1528-2013. On the basis of this data set, the spatial peak SAR value was evaluated with the following procedure (see references or the DASY manual online for more details):
  - a. SAR values at the inner surface of the phantom are extrapolated from the measured values along the line away from the surface with spacing no greater than that in Table 4.1. The extrapolation was based on a least-squares algorithm. A polynomial of the fourth order was calculated through the points in the z-axis (normal to the phantom shell).
  - b. After the maximum interpolated values were calculated between the points in the cube, the SAR was averaged over the spatial volume (1g or 10g) using a 3D-Spline interpolation algorithm. The 3D-spline is composed of three one-dimensional splines with the "Not a knot" condition (in x, y, and z directions). The volume was then integrated with the trapezoidal algorithm. One thousand points (10 x 10 x 10) were obtained through interpolation, in order to calculate the averaged SAR.
  - c. All neighboring volumes were evaluated until no neighboring volume with a higher average value was found.
4. The SAR reference value, at the same location as step 2, was re-measured after the zoom scan was complete to calculate the SAR drift. If the drift deviated by more than 5%, the SAR test and drift measurements were repeated.



**Figure 4.1**  
**Sample SAR Area Scan**

|                                                                                                                                                                                                                                                                                                                                                           |                                           |                                                                                             | $\leq 3 \text{ GHz}$                                                                                                                                                                                                                                                   | $> 3 \text{ GHz}$                                                                                                             |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|---------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|
| Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface                                                                                                                                                                                                                                                    |                                           |                                                                                             | $5 \text{ mm} \pm 1 \text{ mm}$                                                                                                                                                                                                                                        | $\frac{1}{2} \cdot \delta \cdot \ln(2) \text{ mm} \pm 0.5 \text{ mm}$                                                         |
| Maximum probe angle from probe axis to phantom surface normal at the measurement location                                                                                                                                                                                                                                                                 |                                           |                                                                                             | $30^\circ \pm 1^\circ$                                                                                                                                                                                                                                                 | $20^\circ \pm 1^\circ$                                                                                                        |
| Maximum area scan spatial resolution: $\Delta x_{\text{Area}}, \Delta y_{\text{Area}}$                                                                                                                                                                                                                                                                    |                                           |                                                                                             | $\leq 2 \text{ GHz}: \leq 15 \text{ mm}$<br>$2 - 3 \text{ GHz}: \leq 12 \text{ mm}$                                                                                                                                                                                    | $3 - 4 \text{ GHz}: \leq 12 \text{ mm}$<br>$4 - 6 \text{ GHz}: \leq 10 \text{ mm}$                                            |
|                                                                                                                                                                                                                                                                                                                                                           |                                           |                                                                                             | When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be $\leq$ the corresponding x or y dimension of the test device with at least one measurement point on the test device. |                                                                                                                               |
| Maximum zoom scan spatial resolution: $\Delta x_{\text{Zoom}}, \Delta y_{\text{Zoom}}$                                                                                                                                                                                                                                                                    |                                           |                                                                                             | $\leq 2 \text{ GHz}: \leq 8 \text{ mm}$<br>$2 - 3 \text{ GHz}: \leq 5 \text{ mm}^*$                                                                                                                                                                                    | $3 - 4 \text{ GHz}: \leq 5 \text{ mm}^*$<br>$4 - 6 \text{ GHz}: \leq 4 \text{ mm}^*$                                          |
| Maximum zoom scan spatial resolution, normal to phantom surface                                                                                                                                                                                                                                                                                           | uniform grid: $\Delta z_{\text{Zoom}}(n)$ |                                                                                             | $\leq 5 \text{ mm}$                                                                                                                                                                                                                                                    | $3 - 4 \text{ GHz}: \leq 4 \text{ mm}$<br>$4 - 5 \text{ GHz}: \leq 3 \text{ mm}$<br>$5 - 6 \text{ GHz}: \leq 2 \text{ mm}$    |
|                                                                                                                                                                                                                                                                                                                                                           | graded grid                               | $\Delta z_{\text{Zoom}}(1)$ : between 1 <sup>st</sup> two points closest to phantom surface | $\leq 4 \text{ mm}$                                                                                                                                                                                                                                                    | $3 - 4 \text{ GHz}: \leq 3 \text{ mm}$<br>$4 - 5 \text{ GHz}: \leq 2.5 \text{ mm}$<br>$5 - 6 \text{ GHz}: \leq 2 \text{ mm}$  |
|                                                                                                                                                                                                                                                                                                                                                           |                                           | $\Delta z_{\text{Zoom}}(n>1)$ : between subsequent points                                   | $\leq 1.5 \cdot \Delta z_{\text{Zoom}}(n-1) \text{ mm}$                                                                                                                                                                                                                |                                                                                                                               |
| Minimum zoom scan volume                                                                                                                                                                                                                                                                                                                                  | x, y, z                                   |                                                                                             | $\geq 30 \text{ mm}$                                                                                                                                                                                                                                                   | $3 - 4 \text{ GHz}: \geq 28 \text{ mm}$<br>$4 - 5 \text{ GHz}: \geq 25 \text{ mm}$<br>$5 - 6 \text{ GHz}: \geq 22 \text{ mm}$ |
| Note: $\delta$ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see IEEE Std 1528-2013 for details.                                                                                                                                                                                                                     |                                           |                                                                                             |                                                                                                                                                                                                                                                                        |                                                                                                                               |
| * When zoom scan is required and the <u>reported</u> SAR from the <i>area scan based 1-g SAR estimation</i> procedures of KDB Publication 447498 is $\leq 1.4 \text{ W/kg}$ , $\leq 8 \text{ mm}$ , $\leq 7 \text{ mm}$ and $\leq 5 \text{ mm}$ zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz. |                                           |                                                                                             |                                                                                                                                                                                                                                                                        |                                                                                                                               |

Table 4.1 Area and Zoom Scan Resolutions per FCC KDB Publication 865664 D01v01r04\*

## 5. TEST CONFIGURATION POSITIONS FOR HANDSETS

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### 5.1 Device Holder

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

### 5.2 SAR Testing for Tablet per KDB Publication 616217 D04v01r02

Per FCC KDB Publication 616217 D04v01r02, the back surface and edges of the tablet should be tested for SAR compliance with the tablet touching the phantom. The SAR Exclusion Threshold in KDB 447498 D01v06 can be applied to determine SAR test exclusion for adjacent edge configurations. The closest distance from the antenna to an adjacent tablet edge is used to determine if SAR testing is required for the adjacent edges, with the adjacent edge positioned against the phantom and the edge containing the antenna positioned perpendicular to the phantom.

## 6. RF EXPOSURE LIMITS

### 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.

### 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 employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. This exposure category is also applicable when the exposure is of a transient nature due to incidental passage through a location where the exposure levels may be higher than the general population/uncontrolled limits, but the exposed person is fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means.

**Table 6.1.SAR Human Exposure Specified in ANSI/IEEE C95.1-1992**

|                                                        | HUMAN EXPOSURE LIMITS                       |                                           |
|--------------------------------------------------------|---------------------------------------------|-------------------------------------------|
|                                                        | General Public Exposure<br>(W/kg) or (mW/g) | Occupational Exposure<br>(W/kg) or (mW/g) |
| SPATIAL PEAK SAR *<br>(Brain)                          | 1.60                                        | 8.00                                      |
| SPATIAL AVERAGE SAR **<br>(Whole Body)                 | 0.08                                        | 0.40                                      |
| SPATIAL PEAK SAR ***<br>(Hands / Feet / Ankle / Wrist) | 4.00                                        | 20.0                                      |

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

Uncontrolled Environments are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure.

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).

## 7. FCC MEASUREMENT PROCEDURES

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Power measurements were performed using a base station simulator under digital average power.

### 7.1 Measured and Reported SAR

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

### 7.2 Procedures Used to Establish RF Signal for SAR

The following procedures are according to FCC KDB Publication 941225 D01v03r01.

The device was placed into a simulated call using a base station simulator in a RF shielded chamber. Establishing connections in this manner ensure a consistent means for testing SAR and are recommended for evaluating SAR [4]. Devices under test were evaluated prior to testing, with a fully charged battery and were configured to operate at maximum output power. In order to verify that the device was tested throughout the SAR test at maximum output power, the SAR measurement system measures a “point SAR” at an arbitrary reference point at the start and end of the 1 gram SAR evaluation, to assess for any power drifts during the evaluation. If the power drift deviated by more than 5%, the SAR test and drift measurements were repeated.

### 7.3 SAR Measurement Conditions for WCDMA (UMTS)

#### 7.3.1 Output Power Verification

Maximum output power is measured on the High, Middle and Low channels for each applicable transmission band according to the general descriptions in section 5.2 of 3GPP TS 34.121, using the appropriate RMC or AMR with TPC (transmit power control) set to all “1s”.

Maximum output power is verified on the High, Middle and Low channels according to the general, descriptions in section 5.2 of 3GPP TS 34.121 (release 5), using the appropriate RMC with TPC,(transmit power control) set to all “1s” or applying the required inner loop power control procedures to maintain maximum output power while HSUPA is active. Results for all applicable physical channel configurations (DPCCH, DPDCHn and spreading codes, HS-DPCCH etc) are tabulated in this test report. All configurations that are not supported by the DUT or cannot be measured due to technical or equipment limitations are identified.

#### 7.3.2 Body SAR Measurements

SAR for body exposure configurations is measured using the 12.2 kbps RMC with the TPC bits all “1s”.

### 7.3.3 Release 5 HSDPA Data Devices

The following procedures are applicable to HSDPA data devices operating under 3GPP Release 5. SAR is required for devices in body-worn accessory and other body exposure conditions, including handsets and data modems operating in various electronic devices. HSDPA operates in conjunction with WCDMA and requires an active DPCH. The default test configuration is to measure SAR in WCDMA with HSDPA remain inactive, to establish a radio link between the test device and a communication test set using a 12.2 kbps RMC configured in Test Loop Mode 1. SAR for HSDPA is selectively measured using the highest reported SAR configuration in WCDMA, with an FRC in H-set 1 and a 12.2 kbps RMC. SAR is selectively confirmed for other physical channel configurations (DPCH & DPCHn) according to exposure conditions, device operating capabilities and maximum output power specified for production units, including tune-up tolerance by applying the 3G SAR test reduction procedures. Maximum output power is verified according to the applicable versions of 3GPP TS 34.121. SAR must be measured based on these maximum output conditions and requirements in KDB Publication 447498, with respect to the UE Categories, and explained in the SAR report. When Maximum Power Reduction (MPR) applies, the implementations must be clearly identified in the SAR report to support test results according to Cubic Metric (CM) and, as appropriate, Enhanced MPR (E-MPR) requirements.

| Sub-test | $\beta_c$            | $\beta_d$            | $\beta_d$<br>(SF) | $\beta_c/\beta_d$    | $\beta_{hs}^{(1)}$ | CM (dB) <sup>(2)</sup> |
|----------|----------------------|----------------------|-------------------|----------------------|--------------------|------------------------|
| 1        | 2/15                 | 15/15                | 64                | 2/15                 | 4/15               | 0.0                    |
| 2        | 12/15 <sup>(3)</sup> | 15/15 <sup>(3)</sup> | 64                | 12/15 <sup>(3)</sup> | 24/15              | 1.0                    |
| 3        | 15/15                | 8/15                 | 64                | 15/8                 | 30/15              | 1.5                    |
| 4        | 15/15                | 4/15                 | 64                | 15/4                 | 30/15              | 1.5                    |

Note 1:  $\Delta_{ACK}$ ,  $\Delta_{NACK}$  and  $\Delta_{CQI} = 8 \Leftrightarrow A_{hs} = \beta_{hs}/\beta_c = 30/15 \Leftrightarrow \beta_{hs} = 30/15 * \beta_c$   
Note 2: CM = 1 for  $\beta_c/\beta_d = 12/15$ ,  $\beta_{hs}/\beta_c = 24/15$ .  
Note 3: For subtest 2 the  $\beta_c/\beta_d$  ratio of 12/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signaled gain factors for the reference TFC (TF1, TF1) to  $\beta_c = 11/15$  and  $\beta_d = 15/15$ .

Figure 7.1 Table 1

### 7.3.4 Release 6 HSUPA Data Devices

The following procedures are applicable to HSPA (HSUPA/HSDPA) data devices operating under 3GPP Release 6. SAR is required for devices in body-worn accessory and other body exposure conditions, including handsets and data modems operating in various electronic devices. HSUPA operates in conjunction with WCDMA and HSDPA. SAR is initially measured in WCDMA test configurations with HSPA remain inactive. The default test configuration is to establish a radio link between the test device and a communication test set to configure a 12.2 kbps RMC in Test Loop Mode 1. SAR for HSPA is selectively measured with HS-DPCCH, E-DPCCH and E-DPDCH, all enabled, along with a 12.2 kbps RMC using the highest reported SAR configuration in WCDMA with 12.2 kbps RMC only.

An FRC is configured according to HS-DPCCH Sub-test 1 using H-set 1 and QPSK. HSPA is configured according to E-DCH Sub-test 5 requirements. SAR for other HSPA sub-test configurations is confirmed selectively according to exposure conditions, E-DCH UE Category and maximum output power of production units, including tune-up tolerance by applying the 3G SAR test reduction procedure. Maximum output power is verified according to procedures in applicable versions of 3GPP TS 34.121. SAR must be measured based on these maximum output conditions and requirements in KDB Publication 447498, with respect to the UE Categories for HS-DPCCH and HSPA, and explained in the SAR report. When Maximum Power Reduction (MPR) applies, the implementations must be clearly identified in the SAR report to support test results according to Cubic Metric (CM) and, as appropriate, Enhanced MPR (E-MPR) requirements.

| Sub-test | $\beta_c$            | $\beta_d$            | $\beta_d$<br>(SF) | $\beta_c/\beta_d$    | $\beta_{hs}^{(1)}$ | $\beta_{ec}$ | $\beta_{ed}$                                 | $\beta_{ed}$<br>(SF) | $\beta_{ed}$<br>(codes) | CM <sup>(2)</sup><br>(dB) | MPR<br>(dB) | AG <sup>(4)</sup><br>Index | E-TFCI |
|----------|----------------------|----------------------|-------------------|----------------------|--------------------|--------------|----------------------------------------------|----------------------|-------------------------|---------------------------|-------------|----------------------------|--------|
| 1        | 11/15 <sup>(3)</sup> | 15/15 <sup>(3)</sup> | 64                | 11/15 <sup>(3)</sup> | 22/15              | 209/225      | 1039/225                                     | 4                    | 1                       | 1.0                       | 0.0         | 20                         | 75     |
| 2        | 6/15                 | 15/15                | 64                | 6/15                 | 12/15              | 12/15        | 94/75                                        | 4                    | 1                       | 3.0                       | 2.0         | 12                         | 67     |
| 3        | 15/15                | 9/15                 | 64                | 15/9                 | 30/15              | 30/15        | $\beta_{ed1}: 47/15$<br>$\beta_{ed2}: 47/15$ | 4                    | 2                       | 2.0                       | 1.0         | 15                         | 92     |
| 4        | 2/15                 | 15/15                | 64                | 2/15                 | 4/15               | 2/15         | 56/75                                        | 4                    | 1                       | 3.0                       | 2.0         | 17                         | 71     |
| 5        | 15/15 <sup>(4)</sup> | 15/15 <sup>(4)</sup> | 64                | 15/15 <sup>(4)</sup> | 30/15              | 24/15        | 134/15                                       | 4                    | 1                       | 1.0                       | 0.0         | 21                         | 81     |

Note 1:  $\Delta_{ACK}$ ,  $\Delta_{NACK}$  and  $\Delta_{CQI} = 8 \Leftrightarrow A_{hs} = \beta_{hs}/\beta_c = 30/15 \Leftrightarrow \beta_{hs} = 30/15 * \beta_c$   
Note 2: CM = 1 for  $\beta_c/\beta_d = 12/15$ ,  $\beta_{hs}/\beta_c = 24/15$ . For all other combinations of DPDCH, DPCH, HS-DPCCH, E-DPDCH and E-DPCCH the MPR is based on the relative CM difference.  
Note 3: For subtest 1 the  $\beta_c/\beta_d$  ratio of 11/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signaled gain factors for the reference TFC (TF1, TF1) to  $\beta_c = 10/15$  and  $\beta_d = 15/15$ .  
Note 4: For subtest 5 the  $\beta_c/\beta_d$  ratio of 15/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signaled gain factors for the reference TFC (TF1, TF1) to  $\beta_c = 14/15$  and  $\beta_d = 15/15$ .  
Note 5: Testing UE using E-DPDCH Physical Layer category 1 Sub-test 3 is not required according to TS 25.306 Table 5.1g.  
Note 6:  $\beta_{ed}$  cannot be set directly; it is set by Absolute Grant Value.

Figure 7.2 Table 2

## 7.4 SAR Measurement Conditions for LTE

LTE modes were tested according to FCC KDB 941225 D05v02r05 publication. Please see notes after the tabulated SAR data for required test configurations. Establishing connections with base station simulators ensure a consistent means for testing SAR and are recommended for evaluating SAR. The call simulator was used for LTE output power measurement and SAR testing. Closed loop power control was used so the UE transmits with maximum output power during SAR testing. SAR tests were performed with the same number of RB and RB offsets transmitting on all TTI frames (maximum TTI).

### 7.4.1 Spectrum Plots for RB Configurations

A properly configured base station simulator was used for SAR tests and power measurements. Therefore, spectrum plots for RB configurations were not required to be included in this report.

### 7.4.2 MPR

MPR is permanently implemented for this device by the manufacturer. The specific manufacturer target MPR is indicated alongside the SAR results. MPR is enabled for this device, according to 3GPP TS36. 101 Section 6.2.3 – 6.2.5 under Table 6.2.3-1.

### 7.4.3 A-MPR

A-MPR (Addition MPR) has been disabled for all SAR tests by setting NS=01 on the base station simulator.

### 7.4.4 Required RB Size and RB Offsets for SAR Testing

According to FCC KDB 941225 D05v02r05:

- a. Per Section 5.2.1, SAR is required for QPSK 1 RB Allocation for the largest bandwidth
  - i. The required channel and offset combination with the highest maximum output power is required for SAR.
  - ii. When the reported SAR is  $\leq 0.8$  W/kg, testing of the remaining RB offset configurations and required test channel is not required. Otherwise, SAR is required for the remaining required test channels using the RB offset configuration with highest output power for that channel.
  - iii. When the reported SAR for a required test channel is  $> 1.45$  W/kg, SAR is required for all RB offset configurations for that channel.
- b. Per Section 5.2.2, SAR is required for 50% RB allocation using the largest bandwidth following the same procedures outlined in Section 5.2.1.
- c. Per Section 5.2.3, QPSK SAR is not required for the 100% allocation when the highest maximum output power for the 100% allocation is less than the highest maximum output power of the 1 RB and 50% RB allocations and the reported SAR for the 1 RB and 50% RB allocations is  $< 0.8$  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. Per Section 5.2.4 and 5.3, SAR tests for higher order modulations and lower bandwidths configurations are not required when the conducted power of the required test configurations determined by Sections 5.2.1 through 5.2.3 is less than or equal to 0.5 dB higher than the equivalent configuration using QPSK modulation and when the QPSK SAR for those configurations is  $< 1.45$  W/kg.

## 7.5 SAR Testing with 802.11 Transmitters

The normal network operating configurations are not suitable for measuring the SAR of 802.11 b/g/n transmitters. Unpredictable fluctuations in network traffic and antenna diversity conditions can introduce undesirable variations in SAR results. The SAR for these devices should be measured using chipset based test mode software to ensure the results are consistent and reliable. See KDB Publication 248227D01v02r02 for more details.

### 7.5.1 General Device Setup

Chipset based test mode software is hardware dependent and generally varies among manufacturers. The device operating parameters established in test mode for SAR measurements must be identical to those programmed in production units, including output power levels, amplifier gain settings and other RF performance tuning parameters. The test frequencies should correspond to actual channel frequencies defined for domestic use. SAR for devices with switched diversity should be measured with only one antenna transmitting at a time during each SAR measurement, according to a fixed modulation and data rate. The same data pattern should be used for all measurements.

A periodic duty factor is required for current generation SAR systems to measure SAR. When 802.11 frame gaps are accounted for in the transmission, a maximum transmission duty factor of 92-96% is typically achievable in most test mode configurations. A minimum transmission duty factor of 85% is required to avoid certain hardware and device implementation issues related to wide range SAR scaling. The reported SAR is scaled to 100% transmission duty factor to determine compliance at the maximum tune-up tolerance limit.

### 7.5.2 U-NII and U-NII-2A

For devices that operate in only one of the U-NII-1 and U-NII-2A bands, the normally required SAR procedures for OFDM configurations are applied. For devices that operate in both U-NII bands using the same transmitter and antenna(s), SAR test reduction is determined according to the following, with respect to the highest reported SAR and maximum output power specified for production units. The procedures are applied independently to each exposure configuration; for example, head, body, hotspot mode etc.

- 1) When the same maximum output power is specified for both bands, begin SAR measurement in U-NII-2A band by applying the OFDM SAR requirements. If the highest reported SAR for a test configuration is  $\leq 1.2$  W/kg, SAR is not required for U-NII-1 band for that configuration (802.11 mode and exposure condition); otherwise, each band is tested independently for SAR.
- 2) When different maximum output power is specified for the bands, begin SAR measurement in the band with higher specified maximum output power. The highest reported SAR for the tested configuration is adjusted by the ratio of lower to higher specified maximum output power for the two bands. When the adjusted SAR is  $\leq 1.2$  W/kg, SAR is not required for the band with lower maximum output power in that test configuration; otherwise, each band is tested independently for SAR.

### 7.5.3 U-NII-2C and U-NII-3

The frequency range covered by U-NII-2C and U-NII-3 is 380 MHz (5.47 – 5.85 GHz), which requires a minimum of at least two SAR probe calibration frequency points to support SAR measurements.

When Terminal Doppler Weather Rader (TDWR) restriction applies, the channels at 5.60 – 5.65 GHz in U-NII-2C band must be disabled with acceptable mechanisms and documented in the equipment certification.

Unless band gap channels are permanently disabled, SAR must be considered for these channels. When band gap channels are disabled, each band is tested independently according to the normally required OFDM SAR measurements and probe calibration frequency points requirements.

### 7.5.4 Initial Test Position Procedure

For exposure conditions with multiple test positions, such as handset operating next to the ear, devices with hotspot mode or UMPC mini-tablet, procedures for initial test position can be applied. Using the transmission mode determined by the DSSS procedure or initial test configuration, area scans are measured for all position in an exposure condition. The test position with the highest extrapolated (peak) SAR is used as the initial test position. When reported SAR for the initial test position is  $\leq 0.4$  W/kg, no additional testing for the remaining test positions is required. Otherwise, SAR is evaluated at the subsequent highest peak SAR position until the reported SAR result is  $\leq 0.8$  W/kg or all test position are measured.

#### 7.5.5 2.4 GHz SAR Test Requirements

SAR is measured for 2.4 GHz 802.11b DSSS using either a fixed test position or, when applicable, the initial test position procedure. SAR test reduction is determined according to the following:

- 1) When the reported SAR of the highest measured maximum output power channel for the exposure configuration is  $\leq 0.8$  W/kg, no further SAR testing is required for 802.11b DSSS in that exposure configuration.
- 2) When the reported SAR is  $> 0.8$  W/kg, SAR is required for that exposure configuration using the next highest measured output power channel. When any reported SAR is  $> 1.2$  W/kg, SAR is required for the third channel; i.e., all channels require testing.

2.4 GHz 802.11 g/n OFDM are additionally evaluated for SAR if the highest reported SAR for 802.11b, adjusted by the ratio of the OFDM to DSSS specified maximum output power is  $> 1.2$  W/kg. When SAR is required for OFDM modes in 2.4 GHz band, the Initial Test Configuration Procedures should be followed.

#### 7.5.6 OFDM Transmission Mode and SAR Test Channel Selection

For the 2.4 GHz and 5 GHz bands, when the same maximum output power was specified for multiple OFDM transmission mode configurations in a frequency band or aggregated band, SAR is measured using the configuration with the largest channel bandwidth, lowest order modulation and lowest data rate. When the maximum output power of a channel is the same for equivalent OFDM configurations; for example, 802.11a and 802.11n or 802.11g and 802.11n with the same channel bandwidth, modulation and data rate etc., the lower order 802.11 mode i.e., 802.11a, then 802.11n or 802.11g then 802.11n is used for SAR measurement. When the maximum output power were the same for multiple test channels, either according to the default or additional power measurement requirements, SAR is measured using the channel closest to the middle of the frequency band or aggregated band. When there are multiple channels with the same maximum output power, SAR is measured using the higher number channel.

#### 7.5.7 Initial Test Configuration Procedure

For OFDM, in both 2.4 and 5 GHz bands, an initial test configuration is determined for each frequency band and aggregated band, according to the transmission mode with the highest maximum output power specified for SAR measurements. When the same maximum output is specified for multiple OFDM transmission mode configurations in a frequency band or aggregated band, SAR is measured using the configuration(s) with the largest channel bandwidth, lowest order modulation, and lowest data rate. The channel of the transmission mode with the highest average RF output conducted power will be the initial test configuration.

When the reported SAR is  $\leq 0.8$  W/kg, no additional measurements on other test channels are required.

Otherwise, SAR is evaluated using the subsequent highest average RF output channel until the reported SAR result is  $\leq 1.2$  W/kg or all channels are measured.

#### 7.5.8 Subsequent Test Configuration Procedures

For OFDM configurations, in each frequency band and aggregated band, SAR is evaluated for initial test configuration using the fixed test position or the initial test position procedure, when applicable. When the highest reported SAR for the initial test configuration, adjusted by the ratio of the subsequent test configuration to initial test configuration specified maximum output power is  $\leq 1.2$  W/kg, no additional SAR testing for the subsequent test configurations is required.

## 8. RF CONDUCTED POWERS

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

### 8.1 WCDMA Nominal and Maximum Output Power Spec and Conducted Powers

| 3GPP Release Version | Mode  |           |         | Cellular Band (dBm) | PCS Band (dBm) | 3GPP MPR (dB) |
|----------------------|-------|-----------|---------|---------------------|----------------|---------------|
| 99                   | WCDMA | Voice     | Maximum | 24.0                | 22.2           | -             |
|                      |       |           | Nominal | 23.5                | 21.7           | -             |
| 5                    | HSDPA | Subtest 1 | Maximum | 24.0                | 22.2           | 0             |
|                      |       |           | Nominal | 23.5                | 21.7           |               |
| 5                    |       | Subtest 2 | Maximum | 24.0                | 22.2           | 0             |
|                      |       |           | Nominal | 23.5                | 21.7           |               |
| 5                    |       | Subtest 3 | Maximum | 23.5                | 21.7           | 0.5           |
|                      |       |           | Nominal | 23.0                | 21.2           |               |
| 5                    |       | Subtest 4 | Maximum | 23.5                | 21.7           | 0.5           |
|                      |       |           | Nominal | 23.0                | 21.2           |               |
| 6                    | HSUPA | Subtest 1 | Maximum | 24.0                | 22.2           | 0             |
|                      |       |           | Nominal | 23.5                | 21.7           |               |
| 6                    |       | Subtest 2 | Maximum | 22.0                | 20.2           | 2             |
|                      |       |           | Nominal | 21.5                | 19.7           |               |
| 6                    |       | Subtest 3 | Maximum | 23.0                | 21.2           | 1             |
|                      |       |           | Nominal | 22.5                | 20.7           |               |
| 6                    |       | Subtest 4 | Maximum | 22.0                | 20.2           | 2             |
|                      |       |           | Nominal | 21.5                | 19.7           |               |
| 6                    |       | Subtest 5 | Maximum | 24.0                | 22.2           | 0             |
|                      |       |           | Nominal | 23.5                | 21.7           |               |

Table 8.2.1 WCDMA Nominal and Maximum Output Power Spec

| 3GPP Release Version | Mode  | 3GPP 34.121 Subtest | Cellular Band (dBm) |       |       | PCS Band (dBm) |       |       | 3GPP MPR (dB) |
|----------------------|-------|---------------------|---------------------|-------|-------|----------------|-------|-------|---------------|
|                      |       |                     | 4132                | 4183  | 4233  | 9262           | 9400  | 9538  |               |
| 99                   | WCDMA | 12.2 kbps RMC       | 23.99               | 23.91 | 23.92 | 22.16          | 22.19 | 22.03 | -             |
| 99                   |       | 12.2 kbps AMR       | -                   | -     | -     | -              | -     | -     | -             |
| 5                    | HSDPA | Subtest 1           | 23.66               | 23.61 | 23.62 | 21.89          | 21.91 | 21.63 | 0             |
| 5                    |       | Subtest 2           | 23.75               | 23.66 | 23.68 | 21.72          | 21.87 | 21.67 | 0             |
| 5                    |       | Subtest 3           | 23.17               | 23.08 | 23.14 | 21.23          | 21.28 | 21.08 | 0.5           |
| 5                    |       | Subtest 4           | 23.17               | 23.07 | 23.13 | 21.23          | 21.27 | 21.08 | 0.5           |
| 6                    | HSUPA | Subtest 1           | 23.39               | 23.37 | 23.38 | 21.52          | 21.25 | 21.00 | 0             |
| 6                    |       | Subtest 2           | 21.98               | 21.64 | 21.67 | 20.20          | 19.75 | 20.03 | 2             |
| 6                    |       | Subtest 3           | 22.60               | 22.58 | 22.59 | 20.67          | 20.61 | 20.52 | 1             |
| 6                    |       | Subtest 4           | 21.98               | 21.92 | 21.96 | 20.15          | 20.17 | 20.14 | 2             |
| 6                    |       | Subtest 5           | 23.68               | 23.64 | 23.65 | 21.78          | 21.94 | 21.71 | 0             |

Table 8.2.2 WCDMA Conducted Power

WCDMA SAR was tested under RMC 12.2 kbps with HSPA Inactive per KDB Publication 941225 D01v03r01. HSPA SAR was not required since the average output power of the HSPA subtests was not more than 0.25 dB higher than the RMC level and SAR was less than 1.2 W/kg.

The manufacturer declares that the HSDPA and HSUPA transmitter's power will not exceed the R99 maximum transmit power in devices based on Qualcomm's HSPA chipset solutions.



Figure 8.1 Power Measurement Setup

## 8.2 LTE Nominal and Maximum Output Power Spec and Conducted Powers

| Band & Mode | Modulated Average[dBm] |
|-------------|------------------------|
|             | Modulated Average[dBm] |
| LTE Band 12 | 23.0                   |
|             | 22.5                   |

Table 8.2.1.1 Nominal and Maximum Output Power Spec

### 1) LTE Band 12

| LTE Band 12 Conducted Power- 10 MHz Bandwidth |         |           |                       |  |                             |             |
|-----------------------------------------------|---------|-----------|-----------------------|--|-----------------------------|-------------|
| Modulation                                    | RB Size | RB Offset | Mid Channel           |  | MPR Allowed<br>Per 3GPP(dB) | MPR<br>(dB) |
|                                               |         |           | 23095 (707.5 MHz)     |  |                             |             |
|                                               |         |           | Conducted Power (dBm) |  |                             |             |
| QPSK                                          | 1       | 0         | 22.88                 |  | ≤ 1                         | 0           |
|                                               | 1       | 25        | 22.92                 |  |                             |             |
|                                               | 1       | 49        | 22.77                 |  |                             |             |
|                                               | 25      | 0         | 21.69                 |  |                             | 1           |
|                                               | 25      | 12        | 21.77                 |  |                             |             |
|                                               | 25      | 25        | 21.65                 |  |                             |             |
|                                               | 50      | 0         | 21.61                 |  |                             |             |
| 16QAM                                         | 1       | 0         | 21.94                 |  | ≤ 1                         | 1           |
|                                               | 1       | 25        | 21.95                 |  |                             |             |
|                                               | 1       | 49        | 21.83                 |  |                             |             |
|                                               | 25      | 0         | 20.86                 |  |                             |             |
|                                               | 25      | 12        | 20.92                 |  | ≤ 2                         | 2           |
|                                               | 25      | 25        | 20.83                 |  |                             |             |
|                                               | 50      | 0         | 20.79                 |  |                             |             |

Table 8.2.1.2 LTE Conducted Power

Note : LTE B12 can not contain three non-overlapping channels of 10 MHz bandwidth.

Per KDB 941225 D05v02r05, 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.

| LTE Band 12 Conducted Power- 5 MHz Bandwidth |         |           |                       |                   |                   |                             |             |   |
|----------------------------------------------|---------|-----------|-----------------------|-------------------|-------------------|-----------------------------|-------------|---|
| Modulation                                   | RB Size | RB Offset | Low Channel           | Mid Channel       | High Channel      | MPR Allowed<br>Per 3GPP(dB) | MPR<br>(dB) |   |
|                                              |         |           | 23035 (701.5 MHz)     | 23095 (707.5 MHz) | 23155 (713.5 MHz) |                             |             |   |
|                                              |         |           | Conducted Power (dBm) |                   |                   |                             |             |   |
| QPSK                                         | 1       | 0         | 22.75                 | 22.84             | 22.71             | ≤ 1                         | 0           |   |
|                                              | 1       | 12        | 22.83                 | 22.91             | 22.75             |                             |             |   |
|                                              | 1       | 24        | 22.73                 | 22.81             | 22.69             |                             |             |   |
|                                              | 12      | 0         | 21.54                 | 21.52             | 21.56             |                             | 1           |   |
|                                              | 12      | 6         | 21.66                 | 21.54             | 21.60             |                             |             |   |
|                                              | 12      | 13        | 21.53                 | 21.41             | 21.55             |                             |             |   |
|                                              | 25      | 0         | 21.65                 | 21.46             | 21.58             |                             | 1           |   |
| 16QAM                                        | 1       | 0         | 21.73                 | 21.80             | 21.71             | ≤ 1                         | 1           |   |
|                                              | 1       | 12        | 21.85                 | 21.88             | 21.83             |                             |             |   |
|                                              | 1       | 24        | 21.70                 | 21.75             | 21.68             |                             |             |   |
|                                              | 12      | 0         | 20.55                 | 20.50             | 20.48             |                             | ≤ 2         | 2 |
|                                              | 12      | 6         | 20.73                 | 20.63             | 20.60             |                             |             |   |
|                                              | 12      | 13        | 20.62                 | 20.50             | 20.45             |                             |             |   |
|                                              | 25      | 0         | 20.47                 | 20.62             | 20.49             |                             |             | 2 |

Table 8.2.1.3 LTE Conducted Power

| LTE Band 12 Conducted Power- 3 MHz Bandwidth |         |           |                       |                   |                   |                             |             |
|----------------------------------------------|---------|-----------|-----------------------|-------------------|-------------------|-----------------------------|-------------|
| Modulation                                   | RB Size | RB Offset | Low Channel           | Mid Channel       | High Channel      | MPR Allowed<br>Per 3GPP(dB) | MPR<br>(dB) |
|                                              |         |           | 23025 (700.5 MHz)     | 23095 (707.5 MHz) | 23165 (714.5 MHz) |                             |             |
|                                              |         |           | Conducted Power (dBm) |                   |                   |                             |             |
| QPSK                                         | 1       | 0         | 22.72                 | 22.75             | 22.71             | ≤ 1                         | 0           |
|                                              | 1       | 7         | 22.80                 | 22.83             | 22.78             |                             |             |
|                                              | 1       | 14        | 22.70                 | 22.72             | 22.65             |                             |             |
|                                              | 8       | 0         | 21.47                 | 21.51             | 21.50             |                             |             |
|                                              | 8       | 4         | 21.57                 | 21.54             | 21.55             |                             |             |
|                                              | 8       | 7         | 21.48                 | 21.52             | 21.47             |                             |             |
|                                              | 15      | 0         | 21.54                 | 21.47             | 21.54             | 1                           |             |
|                                              | 16QAM   | 1         | 0                     | 21.82             | 21.86             | 21.79                       | ≤ 1         |
| 1                                            |         | 7         | 21.92                 | 21.94             | 21.89             |                             |             |
| 1                                            |         | 14        | 21.80                 | 21.85             | 21.77             |                             |             |
| 8                                            |         | 0         | 20.64                 | 20.59             | 20.54             |                             |             |
| 8                                            |         | 4         | 20.75                 | 20.67             | 20.63             | ≤ 2                         | 2           |
| 8                                            |         | 7         | 20.48                 | 20.55             | 20.58             |                             |             |
| 15                                           |         | 0         | 20.64                 | 20.64             | 20.61             |                             |             |

Table 8.2.1.4 LTE Conducted Power

| LTE Band 12 Conducted Power~1.4 MHz Bandwidth |         |           |                       |                   |                   |                             |             |
|-----------------------------------------------|---------|-----------|-----------------------|-------------------|-------------------|-----------------------------|-------------|
| Modulation                                    | RB Size | RB Offset | Low Channel           | Mid Channel       | High Channel      | MPR Allowed<br>Per 3GPP(dB) | MPR<br>(dB) |
|                                               |         |           | 23017 (699.7 MHz)     | 23095 (707.5 MHz) | 23173 (715.3 MHz) |                             |             |
|                                               |         |           | Conducted Power (dBm) |                   |                   |                             |             |
| QPSK                                          | 1       | 0         | 22.73                 | 22.82             | 22.58             | ≤ 1                         | 0           |
|                                               | 1       | 2         | 22.84                 | 22.90             | 22.64             |                             |             |
|                                               | 1       | 5         | 22.59                 | 22.71             | 22.54             |                             |             |
|                                               | 3       | 0         | 22.65                 | 22.64             | 22.45             |                             | 0           |
|                                               | 3       | 2         | 22.71                 | 22.78             | 22.56             |                             |             |
|                                               | 3       | 3         | 22.59                 | 22.57             | 22.45             |                             |             |
|                                               | 6       | 0         | 21.61                 | 21.51             | 21.40             |                             |             |
| 16QAM                                         | 1       | 0         | 21.68                 | 21.73             | 21.58             | ≤ 1                         | 1           |
|                                               | 1       | 2         | 21.82                 | 21.93             | 21.73             |                             |             |
|                                               | 1       | 5         | 21.58                 | 21.71             | 21.55             |                             |             |
|                                               | 3       | 0         | 21.68                 | 21.73             | 21.64             |                             | 1           |
|                                               | 3       | 2         | 21.78                 | 21.85             | 21.69             |                             |             |
|                                               | 3       | 3         | 21.65                 | 21.70             | 21.55             |                             |             |
|                                               | 6       | 0         | 20.61                 | 20.36             | 20.35             |                             |             |
|                                               |         |           |                       |                   | ≤ 2               | 2                           |             |

Table 8.2.1.5 LTE Conducted Power

| Band & Mode |         | Modulated Average(dBm) |
|-------------|---------|------------------------|
| LTE Band 5  | Maximum | 23.2                   |
|             | Nominal | 22.7                   |

Table 8.2.2.1 Nominal and Maximum Output Power Spec

## 2) LTE Band 5 (Cell)

| LTE Band 5 (Cell) Conducted Power-- 10 MHz Bandwidth |         |           |                       |                             |             |
|------------------------------------------------------|---------|-----------|-----------------------|-----------------------------|-------------|
| Modulation                                           | RB Size | RB Offset | Mid Channel           | MPR Allowed<br>Per 3GPP(dB) | MPR<br>(dB) |
|                                                      |         |           | 20525 (836.5 MHz)     |                             |             |
|                                                      |         |           | Conducted Power (dBm) |                             |             |
| QPSK                                                 | 1       | 0         | 22.97                 | ≤ 1                         | 0           |
|                                                      | 1       | 25        | 22.85                 |                             |             |
|                                                      | 1       | 49        | 22.78                 |                             |             |
|                                                      | 25      | 0         | 21.66                 |                             | 1           |
|                                                      | 25      | 12        | 21.58                 |                             |             |
|                                                      | 25      | 25        | 21.55                 |                             |             |
|                                                      | 50      | 0         | 21.64                 | 1                           |             |
|                                                      | 16QAM   | 1         | 0                     | 22.11                       | ≤ 1         |
| 1                                                    |         | 25        | 21.95                 |                             |             |
| 1                                                    |         | 49        | 21.91                 |                             |             |
| 25                                                   |         | 0         | 20.71                 | ≤ 2                         | 2           |
| 25                                                   |         | 12        | 20.70                 |                             |             |
| 25                                                   |         | 25        | 20.63                 |                             |             |
| 50                                                   |         | 0         | 20.68                 |                             |             |

Table 8.2.2.2 LTE Conducted Power

Note : LTE B5(Cell) can not contain three non-overlapping channels of 10 MHz bandwidth.

Per KDB 941225 D05v02r05, 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.

| LTE Band 5 (Cell) Conducted Power– 5 MHz Bandwidth |         |           |                       |                   |                   |                             |             |
|----------------------------------------------------|---------|-----------|-----------------------|-------------------|-------------------|-----------------------------|-------------|
| Modulation                                         | RB Size | RB Offset | Low Channel           | Mid Channel       | High Channel      | MPR Allowed<br>Per 3GPP(dB) | MPR<br>(dB) |
|                                                    |         |           | 20425 (826.5 MHz)     | 20525 (836.5 MHz) | 20625 (846.5 MHz) |                             |             |
|                                                    |         |           | Conducted Power (dBm) |                   |                   |                             |             |
| QPSK                                               | 1       | 0         | 22.91                 | 22.90             | 22.87             | ≤ 1                         | 0           |
|                                                    | 1       | 12        | 22.73                 | 22.71             | 22.69             |                             |             |
|                                                    | 1       | 24        | 22.72                 | 22.67             | 22.60             |                             |             |
|                                                    | 12      | 0         | 21.65                 | 21.63             | 21.60             |                             |             |
|                                                    | 12      | 6         | 21.61                 | 21.60             | 21.57             |                             |             |
|                                                    | 12      | 13        | 21.58                 | 21.52             | 21.51             |                             |             |
|                                                    | 25      | 0         | 21.64                 | 21.61             | 21.56             | 1                           |             |
| 16QAM                                              | 1       | 0         | 21.85                 | 21.83             | 21.79             | ≤ 1                         | 1           |
|                                                    | 1       | 12        | 21.75                 | 21.68             | 21.65             |                             |             |
|                                                    | 1       | 24        | 21.68                 | 21.65             | 21.63             |                             |             |
|                                                    | 12      | 0         | 20.70                 | 20.60             | 20.55             | ≤ 2                         | 2           |
|                                                    | 12      | 6         | 20.56                 | 20.55             | 20.53             |                             |             |
|                                                    | 12      | 13        | 20.55                 | 20.53             | 20.50             |                             |             |
|                                                    | 25      | 0         | 20.65                 | 20.56             | 20.54             |                             |             |

Table 8.2.2.3 LTE Conducted Power

| LTE Band 5 (Cell) Conducted Power– 3 MHz Bandwidth |         |           |                       |                   |                   |                             |             |       |
|----------------------------------------------------|---------|-----------|-----------------------|-------------------|-------------------|-----------------------------|-------------|-------|
| Modulation                                         | RB Size | RB Offset | Low Channel           | Mid Channel       | High Channel      | MPR Allowed<br>Per 3GPP(dB) | MPR<br>(dB) |       |
|                                                    |         |           | 20415 (825.5 MHz)     | 20525 (836.5 MHz) | 20635 (847.5 MHz) |                             |             |       |
|                                                    |         |           | Conducted Power (dBm) |                   |                   |                             |             |       |
| QPSK                                               | 1       | 0         | 22.98                 | 22.87             | 22.81             | ≤ 1                         | 0           |       |
|                                                    | 1       | 7         | 22.81                 | 22.76             | 22.56             |                             |             |       |
|                                                    | 1       | 14        | 22.79                 | 22.62             | 22.51             |                             |             |       |
|                                                    | 8       | 0         | 21.64                 | 21.60             | 21.58             |                             |             |       |
|                                                    | 8       | 4         | 21.59                 | 21.56             | 21.53             |                             | 1           |       |
|                                                    | 8       | 7         | 21.57                 | 21.54             | 21.51             |                             |             |       |
|                                                    | 15      | 0         | 21.57                 | 21.51             | 21.50             |                             |             | 1     |
|                                                    | 16QAM   | 1         | 0                     | 22.09             | 22.06             |                             |             | 21.80 |
| 1                                                  |         | 7         | 21.95                 | 21.71             | 21.68             |                             |             |       |
| 1                                                  |         | 14        | 21.90                 | 21.67             | 21.50             |                             |             |       |
| 8                                                  |         | 0         | 20.81                 | 20.79             | 20.73             |                             |             |       |
| 8                                                  |         | 4         | 20.75                 | 20.70             | 20.58             | ≤ 2                         | 2           |       |
| 8                                                  |         | 7         | 20.64                 | 20.59             | 20.52             |                             |             |       |
| 15                                                 |         | 0         | 20.69                 | 20.66             | 20.59             |                             |             | 2     |
|                                                    |         |           |                       |                   |                   |                             |             |       |

Table 8.2.2.4 LTE Conducted Power

| LTE Band 5 (Cell) Conducted Power~ 1.4 MHz Bandwidth |         |           |                       |                   |                   |                             |             |     |   |
|------------------------------------------------------|---------|-----------|-----------------------|-------------------|-------------------|-----------------------------|-------------|-----|---|
| Modulation                                           | RB Size | RB Offset | Low Channel           | Mid Channel       | High Channel      | MPR Allowed<br>Per 3GPP(dB) | MPR<br>(dB) |     |   |
|                                                      |         |           | 20407 (824.7 MHz)     | 20525 (836.5 MHz) | 20643 (848.3 MHz) |                             |             |     |   |
|                                                      |         |           | Conducted Power (dBm) |                   |                   |                             |             |     |   |
| QPSK                                                 | 1       | 0         | 22.87                 | 22.79             | 22.74             | ≤ 1                         | 0           |     |   |
|                                                      | 1       | 2         | 22.79                 | 22.77             | 22.68             |                             |             |     |   |
|                                                      | 1       | 5         | 22.76                 | 22.67             | 22.57             |                             |             |     |   |
|                                                      | 3       | 0         | 22.78                 | 22.71             | 22.59             |                             |             |     |   |
|                                                      | 3       | 2         | 22.74                 | 22.63             | 22.52             |                             | 0           |     |   |
|                                                      | 3       | 3         | 22.70                 | 22.58             | 22.51             |                             |             |     |   |
|                                                      | 6       | 0         | 21.57                 | 21.51             | 21.50             |                             |             | 1   |   |
|                                                      | 1       | 0         | 21.96                 | 21.89             | 21.67             |                             |             |     |   |
| 16QAM                                                | 1       | 2         | 21.92                 | 21.83             | 21.61             | ≤ 1                         | 1           |     |   |
|                                                      | 1       | 5         | 21.72                 | 21.66             | 21.52             |                             |             |     |   |
|                                                      | 3       | 0         | 21.79                 | 21.70             | 21.66             |                             |             |     |   |
|                                                      | 3       | 2         | 21.75                 | 21.66             | 21.62             |                             |             |     |   |
|                                                      | 3       | 3         | 21.60                 | 21.55             | 21.51             |                             | 1           |     |   |
|                                                      | 6       | 0         | 20.65                 | 20.58             | 20.53             |                             |             | ≤ 2 | 2 |

Table 8.2.2.5 LTE Conducted Power

| Band & Mode |         | Modulated Average[dBm] |
|-------------|---------|------------------------|
| LTE Band 4  | Maximum | 22.7                   |
|             | Nominal | 22.2                   |

Table 8.2.3.1 Nominal and Maximum Output Power Spec

### 3) LTE Band 4

| LTE Band 4 (AWS) Conducted Power- 20 MHz Bandwidth |         |           |                       |                          |          |
|----------------------------------------------------|---------|-----------|-----------------------|--------------------------|----------|
| Modulation                                         | RB Size | RB Offset | Mid Channel           | MPR Allowed Per 3GPP(dB) | MPR (dB) |
|                                                    |         |           | 20175 (1732.5 MHz)    |                          |          |
|                                                    |         |           | Conducted Power (dBm) |                          |          |
| QPSK                                               | 1       | 0         | 22.53                 | ≤ 1                      | 0        |
|                                                    | 1       | 50        | 22.41                 |                          |          |
|                                                    | 1       | 99        | 22.33                 |                          |          |
|                                                    | 50      | 0         | 21.31                 |                          | 1        |
|                                                    | 50      | 25        | 21.21                 |                          |          |
|                                                    | 50      | 50        | 21.08                 |                          |          |
| 16QAM                                              | 100     | 0         | 21.28                 | ≤ 1                      | 1        |
|                                                    | 1       | 0         | 21.61                 |                          | 1        |
|                                                    | 1       | 50        | 21.58                 |                          |          |
|                                                    | 1       | 99        | 21.45                 |                          |          |
|                                                    | 50      | 0         | 20.47                 |                          | 2        |
|                                                    | 50      | 25        | 20.21                 |                          |          |
|                                                    | 50      | 50        | 20.17                 |                          |          |
|                                                    | 100     | 0         | 20.19                 |                          |          |
|                                                    |         |           |                       |                          | 2        |
|                                                    |         |           |                       |                          |          |

Table 8.2.3.2 LTE Conducted Power

Note: LTE B4 (AWS) can not contain three non-overlapping channels of 20 MHz bandwidth.

Per KDB 941225 D05v02r05, 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.

| LTE Band 4 (AWS) Conducted Power- 15 MHz Bandwidth |         |           |                       |                    |                    |                             |             |
|----------------------------------------------------|---------|-----------|-----------------------|--------------------|--------------------|-----------------------------|-------------|
| Modulation                                         | RB Size | RB Offset | Low Channel           | Mid Channel        | High Channel       | MPR Allowed<br>Per 3GPP(dB) | MPR<br>(dB) |
|                                                    |         |           | 20025 (1717.5 MHz)    | 20175 (1732.5 MHz) | 20325 (1747.5 MHz) |                             |             |
|                                                    |         |           | Conducted Power (dBm) |                    |                    |                             |             |
| QPSK                                               | 1       | 0         | 22.36                 | 22.42              | 22.35              | ≤ 1                         | 0           |
|                                                    | 1       | 36        | 22.30                 | 22.32              | 22.27              |                             |             |
|                                                    | 1       | 74        | 22.15                 | 22.18              | 22.13              |                             |             |
|                                                    | 36      | 0         | 21.29                 | 21.30              | 21.18              |                             | 1           |
|                                                    | 36      | 18        | 21.15                 | 21.19              | 21.11              |                             |             |
|                                                    | 36      | 37        | 21.13                 | 21.15              | 21.05              |                             |             |
|                                                    | 75      | 0         | 21.21                 | 21.23              | 21.11              |                             |             |
|                                                    | 16QAM   | 1         | 0                     | 21.50              | 21.55              | 21.35                       | ≤ 1         |
| 1                                                  |         | 36        | 21.30                 | 21.33              | 21.15              |                             |             |
| 1                                                  |         | 74        | 21.15                 | 21.17              | 21.13              |                             |             |
| 36                                                 |         | 0         | 20.24                 | 20.25              | 20.16              |                             |             |
| 36                                                 |         | 18        | 20.18                 | 20.19              | 20.15              | ≤ 2                         | 2           |
| 36                                                 |         | 37        | 20.11                 | 20.17              | 20.05              |                             |             |
| 75                                                 |         | 0         | 20.09                 | 20.16              | 20.07              |                             |             |
|                                                    |         |           |                       |                    |                    |                             |             |

Table 8.2.3.3 LTE Conducted Power

| LTE Band 4 (AWS) Conducted Power- 10 MHz Bandwidth |         |           |                       |                    |                    |                             |             |
|----------------------------------------------------|---------|-----------|-----------------------|--------------------|--------------------|-----------------------------|-------------|
| Modulation                                         | RB Size | RB Offset | Low Channel           | Mid Channel        | High Channel       | MPR Allowed<br>Per 3GPP(dB) | MPR<br>(dB) |
|                                                    |         |           | 20000 (1715.0 MHz)    | 20175 (1732.5 MHz) | 20350 (1750.0 MHz) |                             |             |
|                                                    |         |           | Conducted Power (dBm) |                    |                    |                             |             |
| QPSK                                               | 1       | 0         | 22.35                 | 22.42              | 22.33              | ≤ 1                         | 0           |
|                                                    | 1       | 25        | 22.34                 | 22.38              | 22.21              |                             |             |
|                                                    | 1       | 49        | 22.27                 | 22.28              | 22.16              |                             |             |
|                                                    | 25      | 0         | 21.19                 | 21.28              | 21.15              |                             |             |
|                                                    | 25      | 12        | 21.15                 | 21.25              | 21.10              |                             |             |
|                                                    | 25      | 25        | 21.12                 | 21.16              | 21.05              |                             |             |
|                                                    | 50      | 0         | 21.08                 | 21.11              | 21.05              | 1                           |             |
|                                                    | 16QAM   | 1         | 0                     | 21.53              | 21.56              | 21.42                       | ≤ 1         |
| 1                                                  |         | 25        | 21.41                 | 21.44              | 21.35              |                             |             |
| 1                                                  |         | 49        | 21.39                 | 21.40              | 21.30              |                             |             |
| 25                                                 |         | 0         | 20.17                 | 20.23              | 20.13              | ≤ 2                         | 2           |
| 25                                                 |         | 12        | 20.10                 | 20.11              | 20.08              |                             |             |
| 25                                                 |         | 25        | 20.09                 | 20.10              | 20.03              |                             |             |
| 50                                                 |         | 0         | 20.16                 | 20.17              | 20.11              |                             |             |

Table 8.2.3.4 LTE Conducted Power

| LTE Band 4 (AWS) Conducted Power– 5 MHz Bandwidth |         |           |                       |                    |                    |                             |             |
|---------------------------------------------------|---------|-----------|-----------------------|--------------------|--------------------|-----------------------------|-------------|
| Modulation                                        | RB Size | RB Offset | Low Channel           | Mid Channel        | High Channel       | MPR Allowed<br>Per 3GPP(dB) | MPR<br>(dB) |
|                                                   |         |           | 19975 (1712.5 MHz)    | 20175 (1732.5 MHz) | 20375 (1752.5 MHz) |                             |             |
|                                                   |         |           | Conducted Power (dBm) |                    |                    |                             |             |
| QPSK                                              | 1       | 0         | 22.40                 | 22.42              | 22.34              | ≤ 1                         | 0           |
|                                                   | 1       | 12        | 22.27                 | 22.38              | 22.19              |                             |             |
|                                                   | 1       | 24        | 22.24                 | 22.35              | 22.18              |                             |             |
|                                                   | 12      | 0         | 21.15                 | 21.20              | 21.14              |                             | 1           |
|                                                   | 12      | 6         | 21.14                 | 21.16              | 21.13              |                             |             |
|                                                   | 12      | 13        | 21.05                 | 21.08              | 21.03              |                             |             |
|                                                   | 25      | 0         | 21.13                 | 21.19              | 21.11              |                             |             |
| 16QAM                                             | 1       | 0         | 21.57                 | 21.60              | 21.34              | ≤ 1                         | 1           |
|                                                   | 1       | 12        | 21.31                 | 21.32              | 21.29              |                             |             |
|                                                   | 1       | 24        | 21.27                 | 21.30              | 21.25              |                             |             |
|                                                   | 12      | 0         | 20.16                 | 20.29              | 20.12              | ≤ 2                         | 2           |
|                                                   | 12      | 6         | 20.14                 | 20.20              | 20.09              |                             |             |
|                                                   | 12      | 13        | 20.11                 | 20.13              | 20.05              |                             |             |
|                                                   | 25      | 0         | 20.11                 | 20.17              | 20.10              |                             |             |

Table 8.2.3.5 LTE Conducted Power

| LTE Band 4 (AWS) Conducted Power- 3 MHz Bandwidth |         |           |                       |                    |                    |                             |             |
|---------------------------------------------------|---------|-----------|-----------------------|--------------------|--------------------|-----------------------------|-------------|
| Modulation                                        | RB Size | RB Offset | Low Channel           | Mid Channel        | High Channel       | MPR Allowed<br>Per 3GPP(dB) | MPR<br>(dB) |
|                                                   |         |           | 19965 (1711.5 MHz)    | 20175 (1732.5 MHz) | 20385 (1753.5 MHz) |                             |             |
|                                                   |         |           | Conducted Power (dBm) |                    |                    |                             |             |
| QPSK                                              | 1       | 0         | 22.39                 | 22.43              | 22.31              | ≤ 1                         | 0           |
|                                                   | 1       | 7         | 22.27                 | 22.30              | 22.22              |                             |             |
|                                                   | 1       | 14        | 22.25                 | 22.26              | 22.18              |                             |             |
|                                                   | 8       | 0         | 21.24                 | 21.28              | 21.20              |                             | 1           |
|                                                   | 8       | 4         | 21.17                 | 21.27              | 21.16              |                             |             |
|                                                   | 8       | 7         | 21.15                 | 21.24              | 21.13              |                             |             |
|                                                   | 15      | 0         | 21.18                 | 21.20              | 21.10              |                             |             |
|                                                   | 16QAM   | 1         | 0                     | 21.43              | 21.47              |                             | 21.40       |
| 1                                                 |         | 7         | 21.33                 | 21.38              | 21.32              |                             |             |
| 1                                                 |         | 14        | 21.25                 | 21.28              | 21.23              |                             |             |
| 8                                                 |         | 0         | 20.29                 | 20.39              | 20.27              | ≤ 2                         | 2           |
| 8                                                 |         | 4         | 20.27                 | 20.35              | 20.14              |                             |             |
| 8                                                 |         | 7         | 20.25                 | 20.28              | 20.11              |                             |             |
| 15                                                |         | 0         | 20.27                 | 20.30              | 20.26              |                             |             |

Table 8.2.3.6 LTE Conducted Power

| TE Band 4 (AWS) Conducted Power- 1.4 MHz Bandwidth |         |           |                    |                    |                    |                             |             |
|----------------------------------------------------|---------|-----------|--------------------|--------------------|--------------------|-----------------------------|-------------|
| Modulation                                         | RB Size | RB Offset | Low Channel        | Mid Channel        | High Channel       | MPR Allowed<br>Per 3GPP(dB) | MPR<br>(dB) |
|                                                    |         |           | 19957 (1710.7 MHz) | 20175 (1732.5 MHz) | 20393 (1754.3 MHz) |                             |             |
| Conducted Power (dBm)                              |         |           |                    |                    |                    |                             |             |
| QPSK                                               | 1       | 0         | 22.37              | 22.44              | 22.32              | ≤ 1                         | 0           |
|                                                    | 1       | 2         | 22.25              | 22.30              | 22.20              |                             |             |
|                                                    | 1       | 5         | 22.23              | 22.29              | 22.18              |                             |             |
|                                                    | 3       | 0         | 22.25              | 22.35              | 22.21              |                             | 0           |
|                                                    | 3       | 2         | 22.22              | 22.28              | 22.13              |                             |             |
|                                                    | 3       | 3         | 22.20              | 22.22              | 22.05              |                             |             |
|                                                    | 6       | 0         | 21.21              | 21.24              | 21.15              | 1                           |             |
| 16QAM                                              | 1       | 0         | 21.35              | 21.45              | 21.30              | ≤ 1                         | 1           |
|                                                    | 1       | 2         | 21.18              | 21.27              | 21.16              |                             |             |
|                                                    | 1       | 5         | 21.15              | 21.16              | 21.11              |                             |             |
|                                                    | 3       | 0         | 21.29              | 21.30              | 21.06              |                             | 1           |
|                                                    | 3       | 2         | 21.23              | 21.25              | 21.03              |                             |             |
|                                                    | 3       | 3         | 21.15              | 21.21              | 21.02              |                             |             |
|                                                    | 6       | 0         | 20.06              | 20.10              | 20.04              | ≤ 2                         | 2           |

Table 8.2.3.7 LTE Conducted Power

| Band & Mode | Modulated Average[dBm] |      |
|-------------|------------------------|------|
|             | Maximum                | 22.7 |
|             | Nominal                | 22.2 |

Table 8.2.4.1 Nominal and Maximum Output Power Spec

#### 4) LTE Band 2 (PCS)

| LTE Band 2 (PCS) Conducted Power– 20 MHz Bandwidth |         |           |                       |                    |                    |                             |             |
|----------------------------------------------------|---------|-----------|-----------------------|--------------------|--------------------|-----------------------------|-------------|
| Modulation                                         | RB Size | RB Offset | Low Channel           | Mid Channel        | High Channel       | MPR Allowed<br>Per 3GPP(dB) | MPR<br>(dB) |
|                                                    |         |           | 18700 (1860.0 MHz)    | 18900 (1880.0 MHz) | 19100 (1900.0 MHz) |                             |             |
|                                                    |         |           | Conducted Power (dBm) |                    |                    |                             |             |
| QPSK                                               | 1       | 0         | 22.55                 | 22.57              | 22.43              | ≤ 1                         | 0           |
|                                                    | 1       | 50        | 22.31                 | 22.33              | 22.16              |                             |             |
|                                                    | 1       | 99        | 22.33                 | 22.36              | 22.22              |                             |             |
|                                                    | 50      | 0         | 21.24                 | 21.26              | 21.21              |                             | 1           |
|                                                    | 50      | 25        | 21.15                 | 21.17              | 21.14              |                             |             |
|                                                    | 50      | 50        | 21.23                 | 21.25              | 21.20              |                             |             |
|                                                    | 100     | 0         | 21.21                 | 21.24              | 21.20              |                             |             |
| 16QAM                                              | 1       | 0         | 21.55                 | 21.57              | 21.50              | ≤ 1                         | 1           |
|                                                    | 1       | 50        | 21.40                 | 21.44              | 21.35              |                             |             |
|                                                    | 1       | 99        | 21.43                 | 21.45              | 21.41              |                             |             |
|                                                    | 50      | 0         | 20.31                 | 20.35              | 20.25              | ≤ 2                         | 2           |
|                                                    | 50      | 25        | 20.20                 | 20.21              | 20.15              |                             |             |
|                                                    | 50      | 50        | 20.28                 | 20.30              | 20.19              |                             |             |
|                                                    | 100     | 0         | 20.22                 | 20.28              | 20.16              |                             |             |

Table 8.2.4.2 LTE Conducted Power

| LTE Band 2 (PCS) Conducted Power~ 15 MHz Bandwidth |         |           |                    |                    |                    |                             |             |
|----------------------------------------------------|---------|-----------|--------------------|--------------------|--------------------|-----------------------------|-------------|
| Modulation                                         | RB Size | RB Offset | Low Channel        | Mid Channel        | High Channel       | MPR Allowed<br>Per 3GPP(dB) | MPR<br>(dB) |
|                                                    |         |           | 18675 (1857.5 MHz) | 18900 (1880.0 MHz) | 19125 (1902.5 MHz) |                             |             |
| Conducted Power (dBm)                              |         |           |                    |                    |                    |                             |             |
| QPSK                                               | 1       | 0         | 22.33              | 22.36              | 22.31              | ≤ 1                         | 0           |
|                                                    | 1       | 36        | 22.18              | 22.28              | 22.15              |                             |             |
|                                                    | 1       | 74        | 22.24              | 22.31              | 22.22              |                             |             |
|                                                    | 36      | 0         | 21.18              | 21.20              | 21.17              |                             | 1           |
|                                                    | 36      | 18        | 21.08              | 21.11              | 21.05              |                             |             |
|                                                    | 36      | 37        | 21.10              | 21.13              | 21.07              |                             |             |
|                                                    | 75      | 0         | 21.08              | 21.10              | 21.05              |                             |             |
| 16QAM                                              | 1       | 0         | 21.50              | 21.55              | 21.27              | ≤ 1                         | 1           |
|                                                    | 1       | 36        | 21.27              | 21.35              | 21.15              |                             |             |
|                                                    | 1       | 74        | 21.32              | 21.40              | 21.16              |                             |             |
|                                                    | 36      | 0         | 20.18              | 20.21              | 20.08              | ≤ 2                         | 2           |
|                                                    | 36      | 18        | 20.05              | 20.13              | 20.03              |                             |             |
|                                                    | 36      | 37        | 20.11              | 20.20              | 20.07              |                             |             |
|                                                    | 75      | 0         | 20.05              | 20.17              | 20.04              |                             |             |

Table 8.2.4.3 LTE Conducted Power

| LTE Band 2 (PCS) Conducted Power~ 10 MHz Bandwidth |         |           |                       |                    |                    |                             |             |
|----------------------------------------------------|---------|-----------|-----------------------|--------------------|--------------------|-----------------------------|-------------|
| Modulation                                         | RB Size | RB Offset | Low Channel           | Mid Channel        | High Channel       | MPR Allowed<br>Per 3GPP(dB) | MPR<br>(dB) |
|                                                    |         |           | 18650 (1855.0 MHz)    | 18900 (1880.0 MHz) | 19150 (1905.0 MHz) |                             |             |
|                                                    |         |           | Conducted Power (dBm) |                    |                    |                             |             |
| QPSK                                               | 1       | 0         | 22.47                 | 22.49              | 22.33              | ≤ 1                         | 0           |
|                                                    | 1       | 25        | 22.31                 | 22.34              | 22.20              |                             |             |
|                                                    | 1       | 49        | 22.35                 | 22.38              | 22.23              |                             |             |
|                                                    | 25      | 0         | 21.21                 | 21.25              | 21.18              |                             | 1           |
|                                                    | 25      | 12        | 21.13                 | 21.15              | 21.03              |                             |             |
|                                                    | 25      | 25        | 21.18                 | 21.20              | 21.05              |                             |             |
|                                                    | 50      | 0         | 21.04                 | 21.05              | 21.02              |                             | 1           |
| 16QAM                                              | 1       | 0         | 21.57                 | 21.58              | 21.49              | ≤ 1                         | 1           |
|                                                    | 1       | 25        | 21.15                 | 21.20              | 21.13              |                             |             |
|                                                    | 1       | 49        | 21.23                 | 21.28              | 21.21              |                             |             |
|                                                    | 25      | 0         | 20.31                 | 20.35              | 20.22              | ≤ 2                         | 2           |
|                                                    | 25      | 12        | 20.23                 | 20.25              | 20.15              |                             |             |
|                                                    | 25      | 25        | 20.26                 | 20.27              | 20.17              |                             |             |
|                                                    | 50      | 0         | 20.10                 | 20.14              | 20.05              | 2                           |             |

Table 8.2.4.4 LTE Conducted Power

| LTE Band 2 (PCS) Conducted Power~ 5 MHz Bandwidth |         |           |                       |                    |                    |                             |             |
|---------------------------------------------------|---------|-----------|-----------------------|--------------------|--------------------|-----------------------------|-------------|
| Modulation                                        | RB Size | RB Offset | Low Channel           | Mid Channel        | High Channel       | MPR Allowed<br>Per 3GPP(dB) | MPR<br>(dB) |
|                                                   |         |           | 18625 (1852.5 MHz)    | 18900 (1880.0 MHz) | 19175 (1907.5 MHz) |                             |             |
|                                                   |         |           | Conducted Power (dBm) |                    |                    |                             |             |
| QPSK                                              | 1       | 0         | 22.42                 | 22.48              | 22.39              | ≤ 1                         | 0           |
|                                                   | 1       | 12        | 22.28                 | 22.33              | 22.25              |                             |             |
|                                                   | 1       | 24        | 22.33                 | 22.35              | 22.30              |                             |             |
|                                                   | 12      | 0         | 21.21                 | 21.23              | 21.13              |                             | 1           |
|                                                   | 12      | 6         | 21.12                 | 21.16              | 21.08              |                             |             |
|                                                   | 12      | 13        | 21.13                 | 21.21              | 21.10              |                             |             |
|                                                   | 25      | 0         | 21.10                 | 21.16              | 21.09              |                             |             |
| 16QAM                                             | 1       | 0         | 21.61                 | 21.65              | 21.58              | ≤ 1                         | 1           |
|                                                   | 1       | 12        | 21.38                 | 21.40              | 21.35              |                             |             |
|                                                   | 1       | 24        | 21.40                 | 21.45              | 21.39              |                             |             |
|                                                   | 12      | 0         | 20.25                 | 20.29              | 20.19              | ≤ 2                         | 2           |
|                                                   | 12      | 6         | 20.15                 | 20.22              | 20.13              |                             |             |
|                                                   | 12      | 13        | 20.17                 | 20.25              | 20.15              |                             |             |
|                                                   | 25      | 0         | 20.15                 | 20.21              | 20.10              |                             |             |

Table 8.2.4.5 LTE Conducted Power

| LTE Band 2 (PCS) Conducted Power~ 3 MHz Bandwidth |         |           |                       |                    |                    |                             |             |
|---------------------------------------------------|---------|-----------|-----------------------|--------------------|--------------------|-----------------------------|-------------|
| Modulation                                        | RB Size | RB Offset | Low Channel           | Mid Channel        | High Channel       | MPR Allowed<br>Per 3GPP(dB) | MPR<br>(dB) |
|                                                   |         |           | 18615 (1851.5 MHz)    | 18900 (1880.0 MHz) | 19185 (1908.5 MHz) |                             |             |
|                                                   |         |           | Conducted Power (dBm) |                    |                    |                             |             |
| QPSK                                              | 1       | 0         | 22.50                 | 22.52              | 22.49              | ≤ 1                         | 0           |
|                                                   | 1       | 7         | 22.39                 | 22.40              | 22.13              |                             |             |
|                                                   | 1       | 14        | 22.41                 | 22.43              | 22.17              |                             |             |
|                                                   | 8       | 0         | 21.16                 | 21.19              | 21.10              |                             | 1           |
|                                                   | 8       | 4         | 21.07                 | 21.13              | 21.03              |                             |             |
|                                                   | 8       | 7         | 21.15                 | 21.18              | 21.09              |                             |             |
|                                                   | 15      | 0         | 21.12                 | 21.15              | 21.07              |                             |             |
| 16QAM                                             | 1       | 0         | 21.50                 | 21.57              | 21.40              | ≤ 1                         | 1           |
|                                                   | 1       | 7         | 21.25                 | 21.28              | 21.10              |                             |             |
|                                                   | 1       | 14        | 21.40                 | 21.44              | 21.35              |                             |             |
|                                                   | 8       | 0         | 20.25                 | 20.29              | 20.20              | ≤ 2                         | 2           |
|                                                   | 8       | 4         | 20.14                 | 20.24              | 20.11              |                             |             |
|                                                   | 8       | 7         | 20.20                 | 20.27              | 20.17              |                             |             |
|                                                   | 15      | 0         | 20.15                 | 20.20              | 20.13              |                             |             |

Table 8.2.4.6 LTE Conducted Power

| LTE Band 2 (PCS) Conducted Power~ 1.4 MHz Bandwidth |         |           |                       |                    |                    |                             |             |
|-----------------------------------------------------|---------|-----------|-----------------------|--------------------|--------------------|-----------------------------|-------------|
| Modulation                                          | RB Size | RB Offset | Low Channel           | Mid Channel        | High Channel       | MPR Allowed<br>Per 3GPP(dB) | MPR<br>(dB) |
|                                                     |         |           | 18607 (1850.7 MHz)    | 18900 (1880.0 MHz) | 19193 (1909.3 MHz) |                             |             |
|                                                     |         |           | Conducted Power (dBm) |                    |                    |                             |             |
| QPSK                                                | 1       | 0         | 22.47                 | 22.48              | 22.13              | ≤ 1                         | 0           |
|                                                     | 1       | 2         | 22.21                 | 22.25              | 22.00              |                             |             |
|                                                     | 1       | 5         | 22.25                 | 22.27              | 22.03              |                             |             |
|                                                     | 3       | 0         | 22.18                 | 22.20              | 22.10              |                             | 0           |
|                                                     | 3       | 2         | 22.05                 | 22.08              | 22.00              |                             |             |
|                                                     | 3       | 3         | 22.16                 | 22.18              | 22.05              |                             |             |
|                                                     | 6       | 0         | 21.12                 | 21.15              | 21.01              |                             | 1           |
| 16QAM                                               | 1       | 0         | 21.33                 | 21.38              | 21.24              | ≤ 1                         | 1           |
|                                                     | 1       | 2         | 21.11                 | 21.18              | 21.09              |                             |             |
|                                                     | 1       | 5         | 21.18                 | 21.25              | 21.15              |                             |             |
|                                                     | 3       | 0         | 21.16                 | 21.20              | 21.14              |                             | 1           |
|                                                     | 3       | 2         | 21.02                 | 21.04              | 21.01              |                             |             |
|                                                     | 3       | 3         | 21.11                 | 21.17              | 21.10              |                             |             |
|                                                     | 6       | 0         | 20.05                 | 20.11              | 20.04              | ≤ 2                         | 2           |

Table 8.2.4.7 LTE Conducted Power

### 8.3 WLAN Nominal and Maximum Output Power Spec and Conducted Powers

| Band (GHz) | Mode         | Ch   | Modulated Average[dBm] |         |
|------------|--------------|------|------------------------|---------|
|            |              |      | Maximum                | Nominal |
| 2.4        | 802.11b      | 1~11 | 16.0                   | 15.0    |
|            | 802.11g      | 1~11 | 14.0                   | 13.0    |
|            | 802.11n HT20 | 1~11 | 14.0                   | 13.0    |
|            | 802.11n HT40 | 1~11 | 14.0                   | 13.0    |

Table 8.3.1 Nominal and Maximum Output Power Spec

| Mode            | Freq. (MHz) | Channel | IEEE 802.11 (2.4 GHz) Conducted Power[dBm] |
|-----------------|-------------|---------|--------------------------------------------|
| 802.11b         | 2412        | 1       | 15.68                                      |
|                 | 2437        | 6       | 15.76                                      |
|                 | 2462        | 11      | 15.50                                      |
| 802.11g         | 2412        | 1       | 13.30                                      |
|                 | 2437        | 6       | 13.42                                      |
|                 | 2462        | 11      | 13.22                                      |
| 802.11n (HT-20) | 2412        | 1       | 13.75                                      |
|                 | 2437        | 6       | 13.74                                      |
|                 | 2462        | 11      | 13.78                                      |
| 802.11n (HT-40) | 2422        | 3       | 13.84                                      |
|                 | 2437        | 6       | 13.93                                      |
|                 | 2452        | 9       | 13.95                                      |

Table 8.3.2 IEEE 802.11 Average RF Power

| Band (GHz) | Mode            | Ch     | Modulated Average[dBm] |         |
|------------|-----------------|--------|------------------------|---------|
|            |                 |        | Maximum                | Nominal |
| 5 (UNII)   | 802.11a         | 36-165 | 13.0                   | 12.0    |
|            | 802.11n (20MHz) | 36-165 | 12.0                   | 11.0    |
|            | 802.11n (40MHz) | 38-159 | 12.0                   | 11.0    |

Table 8.3.3 Nominal and Maximum Output Power Spec

| Mode    | Freq. (MHz) | Channel | IEEE 802.11a (5 GHz) Conducted Power[dBm] |
|---------|-------------|---------|-------------------------------------------|
| 802.11a | 5180        | 36      | 12.71                                     |
|         | 5200        | 40      | 12.65                                     |
|         | 5220        | 44      | 12.80                                     |
|         | 5240        | 48      | 12.77                                     |
|         | 5260        | 52      | 12.89                                     |
|         | 5280        | 56      | 12.97                                     |
|         | 5300        | 60      | 12.81                                     |
|         | 5320        | 64      | 12.91                                     |
|         | 5500        | 100     | 12.66                                     |
|         | 5580        | 116     | 12.73                                     |
|         | 5660        | 132     | 12.82                                     |
|         | 5720        | 144     | 12.65                                     |
|         | 5745        | 149     | 12.74                                     |
|         | 5785        | 157     | 12.69                                     |
|         | 5825        | 165     | 12.79                                     |

Table 8.3.4 IEEE 802.11a Average RF Power

| Mode            | Freq. (MHz) | Channel | IEEE 802.11n HT20 (5 GHz) Conducted Power[dBm] |
|-----------------|-------------|---------|------------------------------------------------|
| 802.11n (HT-20) | 5180        | 36      | 11.86                                          |
|                 | 5200        | 40      | 11.75                                          |
|                 | 5220        | 44      | 11.79                                          |
|                 | 5240        | 48      | 11.72                                          |
|                 | 5260        | 52      | 11.85                                          |
|                 | 5280        | 56      | 11.89                                          |
|                 | 5300        | 60      | 11.79                                          |
|                 | 5320        | 64      | 11.81                                          |
|                 | 5500        | 100     | 11.72                                          |
|                 | 5580        | 116     | 11.79                                          |
|                 | 5660        | 132     | 11.82                                          |
|                 | 5720        | 144     | 11.80                                          |
|                 | 5745        | 149     | 11.66                                          |
|                 | 5785        | 157     | 11.71                                          |
|                 | 5825        | 165     | 11.78                                          |

Table 8.3.5 IEEE 802.11n HT20 Average RF Power

| Mode            | Freq. (MHz) | Channel | IEEE 802.11n HT40 (5 GHz) Conducted Power[dBm] |
|-----------------|-------------|---------|------------------------------------------------|
| 802.11n (HT-40) | 5190        | 38      | 11.82                                          |
|                 | 5230        | 46      | 11.77                                          |
|                 | 5270        | 54      | 11.69                                          |
|                 | 5310        | 62      | 11.75                                          |
|                 | 5510        | 102     | 11.68                                          |
|                 | 5550        | 110     | 11.81                                          |
|                 | 5670        | 134     | 11.89                                          |
|                 | 5710        | 142     | 11.85                                          |
|                 | 5755        | 151     | 11.76                                          |
|                 | 5795        | 159     | 11.71                                          |

Table 8.3.6 IEEE 802.11n HT40 Average RF Power

Justification for reduced test configurations for WIFI channels per KDB Publication 248227 D01v02r02:

- Power measurements were performed for the transmission mode configuration with the highest maximum output power specified for production units.
- For transmission modes with the same maximum output power specification, powers were measured for the largest channel bandwidth, lowest order modulation and lowest data rate.
- For transmission modes with identical maximum specified output power, channel bandwidth, modulation and data rates, power measurements were required for all identical configurations.
- For each transmission mode configuration, powers were measured for the highest and lowest channels; and at the mid-band channel(s) when there were at least 3 channels supported. For configurations with multiple mid-band channels, due to an even number of channels, both channels were measured.
- Output Power and SAR is not required for 802.11 g/n HT20/ac VHT20 channels when the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjust SAR is  $\leq 1.2$  W/kg.
- The underlined data rate and channel above were tested for SAR.

The average output powers of this device were tested by below configuration.

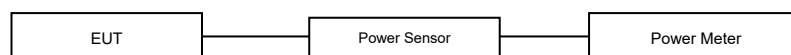


Figure 8.3 Power Measurement Setup

## 8.4 Bluetooth Conducted Powers

| Burst Modulated Average[dBm] |         |  |      |
|------------------------------|---------|--|------|
| Bluetooth<br>1 Mbps          | Maximum |  | 13.0 |
|                              | Nominal |  | 12.0 |
| Bluetooth<br>2 Mbps          | Maximum |  | 11.0 |
|                              | Nominal |  | 10.0 |
| Bluetooth<br>3 Mbps          | Maximum |  | 11.0 |
|                              | Nominal |  | 10.0 |
| Bluetooth<br>LE              | Maximum |  | 3.0  |
|                              | Nominal |  | 2.0  |

Table 8.4.1 Nominal and Maximum Output Power Spec (Burst)

| Frame Modulated Average[dBm] |         |  |       |
|------------------------------|---------|--|-------|
| Bluetooth<br>1 Mbps          | Maximum |  | 11.85 |
|                              | Nominal |  | 10.85 |
| Bluetooth<br>2 Mbps          | Maximum |  | 9.85  |
|                              | Nominal |  | 8.85  |
| Bluetooth<br>3 Mbps          | Maximum |  | 9.85  |
|                              | Nominal |  | 8.85  |
| Bluetooth<br>LE              | Maximum |  | 0.96  |
|                              | Nominal |  | -0.04 |

Table 8.4.2 Nominal and Maximum Output Power Spec (Frame)

| Channel | Frequency | Burst AVG Output Power (1Mbps) (dBm) | Frame AVG Output Power (1Mbps) (dBm) | Burst AVG Output Power (2Mbps) (dBm) | Frame AVG Output Power (2Mbps) (dBm) | Burst AVG Output Power (3Mbps) (dBm) | Frame AVG Output Power (3Mbps) (dBm) |
|---------|-----------|--------------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|
| Low     | 2402      | 11.91                                | 10.76                                | 9.97                                 | 8.82                                 | 9.96                                 | 8.81                                 |
| Mid     | 2441      | 12.79                                | 11.64                                | 10.89                                | 9.74                                 | 10.88                                | 9.73                                 |
| High    | 2480      | 11.47                                | 10.32                                | 9.49                                 | 8.34                                 | 9.49                                 | 8.34                                 |

Table 8.4.3 Bluetooth Burst and Frame Average RF Power

| Channel | Frequency | Burst AVG Output Power(LE) (dBm) | Frame AVG Output Power(LE) (dBm) |
|---------|-----------|----------------------------------|----------------------------------|
| Low     | 2402      | 2.54                             | 0.50                             |
| Mid     | 2440      | 2.93                             | 0.89                             |
| High    | 2480      | 2.53                             | 0.49                             |

Table 8.4.4 Bluetooth LE Burst and Frame Average RF Power

### Bluetooth Conducted Powers procedures

- Bluetooth (BDR, EDR)
  - 1) Enter DUT mode in EUT and operate it.  
When it operating, The EUT is transmitting at maximum power level and duty cycle fixed.
  - 2) Instruments and EUT were connected like Figure 8.4.1(A).
  - 3) The maximum output powers of BDR(1 Mbps), EDR(2, 3 Mbps) and each frequency were set by a Bluetooth Tester.
  - 4) Power levels were measured by a Power Meter.
- Bluetooth (LE)
  - 1) Enter LE mode in EUT and operate it.  
When it operating, The EUT is transmitting at maximum power level and duty cycle fixed.
  - 2) Instruments and EUT were connected like Figure 8.4.1(B).
  - 3) The average conducted output powers of LE and each frequency can measurement according to setting program in EUT.
  - 4) Power levels were measured by a Power Meter.

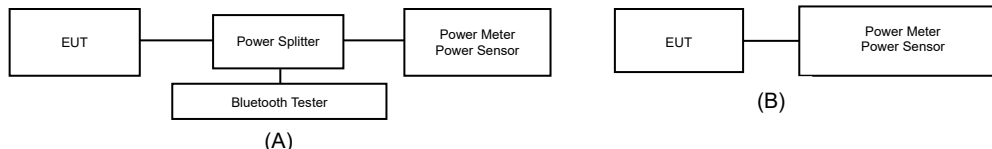


Figure 8.4.1 Average Power Measurement Setup

### Bluetooth Transmission Plot

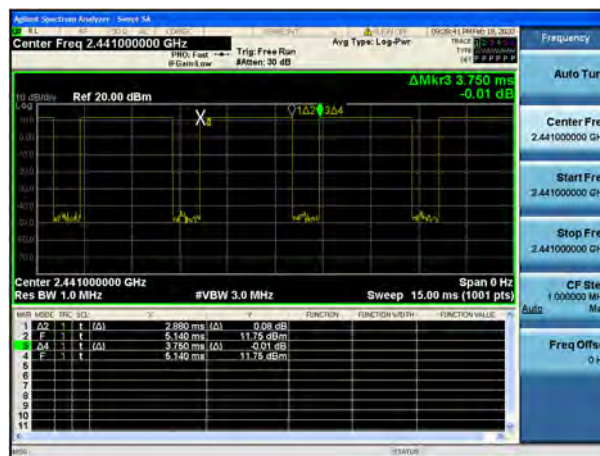


Figure 8.4.2 Bluetooth Transmission Plot

### Bluetooth Duty Cycle Calculation

$$\text{Duty Cycle} = \text{Pulse/Period} * 100\% = (2.880/3.750) * 100 = 76.8\%$$

## 9. SYSTEM VERIFICATION

### 9.1 Tissue Verification

| MEASURED TISSUE PARAMETERS |             |                   |                  |                          |                                          |                                     |                                            |                                       |                  |                        |
|----------------------------|-------------|-------------------|------------------|--------------------------|------------------------------------------|-------------------------------------|--------------------------------------------|---------------------------------------|------------------|------------------------|
| Date(s)                    | Tissue Type | Ambient Temp.[°C] | Liquid Temp.[°C] | Measured Frequency [MHz] | Target Dielectric Constant, $\epsilon_r$ | Target Conductivity, $\sigma$ (S/m) | Measured Dielectric Constant, $\epsilon_r$ | Measured Conductivity, $\sigma$ (S/m) | Er Deviation [%] | $\sigma$ Deviation [%] |
| Jul. 28. 2020              | 750 Head    | 22.1              | 21.9             | 707.5                    | 42.129                                   | 0.887                               | 42.432                                     | 0.863                                 | 0.72             | -2.71                  |
|                            |             |                   |                  | 750.0                    | 41.900                                   | 0.890                               | 41.878                                     | 0.903                                 | -0.05            | 1.46                   |
| Jul. 27. 2020              | 835 Head    | 22.3              | 22.0             | 826.4                    | 41.542                                   | 0.899                               | 42.743                                     | 0.887                                 | 2.89             | -1.33                  |
|                            |             |                   |                  | 829.0                    | 41.528                                   | 0.899                               | 42.712                                     | 0.889                                 | 2.85             | -1.11                  |
|                            |             |                   |                  | 835.0                    | 41.500                                   | 0.900                               | 42.628                                     | 0.894                                 | 2.72             | -0.67                  |
|                            |             |                   |                  | 836.5                    | 41.500                                   | 0.901                               | 42.607                                     | 0.896                                 | 2.67             | -0.55                  |
|                            |             |                   |                  | 836.6                    | 41.500                                   | 0.901                               | 42.605                                     | 0.896                                 | 2.66             | -0.55                  |
|                            |             |                   |                  | 844.0                    | 41.500                                   | 0.910                               | 42.510                                     | 0.902                                 | 2.43             | -0.88                  |
|                            |             |                   |                  | 846.6                    | 41.500                                   | 0.912                               | 42.478                                     | 0.904                                 | 2.36             | -0.88                  |
| Jul. 21. 2020              | 1800 Head   | 22.3              | 22.2             | 1712.4                   | 40.126                                   | 1.350                               | 41.083                                     | 1.303                                 | 2.38             | -3.48                  |
|                            |             |                   |                  | 1720.0                   | 40.114                                   | 1.354                               | 41.060                                     | 1.311                                 | 2.36             | -3.18                  |
|                            |             |                   |                  | 1732.4                   | 40.097                                   | 1.361                               | 41.023                                     | 1.323                                 | 2.31             | -2.79                  |
|                            |             |                   |                  | 1732.5                   | 40.097                                   | 1.361                               | 41.022                                     | 1.323                                 | 2.31             | -2.79                  |
|                            |             |                   |                  | 1745.0                   | 40.079                                   | 1.369                               | 40.969                                     | 1.335                                 | 2.22             | -2.48                  |
|                            |             |                   |                  | 1752.6                   | 40.069                                   | 1.373                               | 40.938                                     | 1.343                                 | 2.17             | -2.18                  |
|                            |             |                   |                  | 1770.0                   | 40.043                                   | 1.383                               | 40.859                                     | 1.360                                 | 2.04             | -1.66                  |
|                            |             |                   |                  | 1800.0                   | 40.000                                   | 1.400                               | 40.739                                     | 1.390                                 | 1.85             | -0.71                  |
|                            |             |                   |                  | 1850.2                   | 40.000                                   | 1.400                               | 41.373                                     | 1.389                                 | 3.43             | -0.79                  |
| Jul. 20. 2020              | 1900 Head   | 22.1              | 21.8             | 1852.4                   | 40.000                                   | 1.400                               | 41.367                                     | 1.391                                 | 3.42             | -0.64                  |
|                            |             |                   |                  | 1860.0                   | 40.000                                   | 1.400                               | 41.349                                     | 1.398                                 | 3.37             | -0.14                  |
|                            |             |                   |                  | 1880.0                   | 40.000                                   | 1.400                               | 41.283                                     | 1.418                                 | 3.21             | 1.29                   |
|                            |             |                   |                  | 1900.0                   | 40.000                                   | 1.400                               | 41.211                                     | 1.437                                 | 3.03             | 2.64                   |
|                            |             |                   |                  | 1907.6                   | 40.000                                   | 1.400                               | 41.183                                     | 1.443                                 | 2.96             | 3.07                   |
|                            |             |                   |                  | 1909.8                   | 40.000                                   | 1.400                               | 41.177                                     | 1.445                                 | 2.94             | 3.21                   |
|                            |             |                   |                  | 2402.0                   | 39.282                                   | 1.757                               | 39.485                                     | 1.808                                 | 0.52             | 2.90                   |
| Jul. 29. 2020              | 2450 Head   | 22.4              | 22.3             | 2412.0                   | 39.265                                   | 1.766                               | 39.444                                     | 1.820                                 | 0.46             | 3.06                   |
|                            |             |                   |                  | 2437.0                   | 39.222                                   | 1.788                               | 39.365                                     | 1.851                                 | 0.36             | 3.52                   |
|                            |             |                   |                  | 2441.0                   | 39.215                                   | 1.792                               | 39.352                                     | 1.856                                 | 0.35             | 3.57                   |
|                            |             |                   |                  | 2450.0                   | 39.200                                   | 1.800                               | 39.323                                     | 1.866                                 | 0.31             | 3.67                   |
|                            |             |                   |                  | 2462.0                   | 39.184                                   | 1.813                               | 39.290                                     | 1.879                                 | 0.27             | 3.64                   |
|                            |             |                   |                  | 2467.0                   | 39.177                                   | 1.818                               | 39.273                                     | 1.884                                 | 0.25             | 3.63                   |
|                            |             |                   |                  | 2472.0                   | 39.171                                   | 1.823                               | 39.251                                     | 1.889                                 | 0.20             | 3.62                   |
|                            |             |                   |                  | 2480.0                   | 39.160                                   | 1.832                               | 39.217                                     | 1.897                                 | 0.15             | 3.55                   |
|                            |             |                   |                  | 5180.0                   | 36.020                                   | 4.639                               | 35.312                                     | 4.645                                 | -1.97            | 0.13                   |
| Jul. 13. 2020              | 5200 Head   | 21.3              | 21.0             | 5190.0                   | 36.010                                   | 4.650                               | 35.289                                     | 4.655                                 | -2.00            | 0.11                   |
|                            |             |                   |                  | 5200.0                   | 36.000                                   | 4.660                               | 35.267                                     | 4.668                                 | -2.04            | 0.17                   |
|                            |             |                   |                  | 5210.0                   | 35.990                                   | 4.670                               | 35.253                                     | 4.681                                 | -2.05            | 0.24                   |
|                            |             |                   |                  | 5220.0                   | 35.980                                   | 4.680                               | 35.243                                     | 4.691                                 | -2.05            | 0.24                   |
|                            |             |                   |                  | 5230.0                   | 35.970                                   | 4.690                               | 35.230                                     | 4.700                                 | -2.06            | 0.21                   |
|                            |             |                   |                  | 5240.0                   | 35.960                                   | 4.700                               | 35.214                                     | 4.712                                 | -2.07            | 0.26                   |
|                            |             |                   |                  | 5745.0                   | 35.355                                   | 5.215                               | 34.509                                     | 5.365                                 | -2.39            | 2.88                   |
| Jul. 14. 2020              | 5800 Head   | 22.2              | 21.9             | 5755.0                   | 35.345                                   | 5.225                               | 34.497                                     | 5.377                                 | -2.40            | 2.91                   |
|                            |             |                   |                  | 5775.0                   | 35.325                                   | 5.245                               | 34.463                                     | 5.395                                 | -2.44            | 2.86                   |
|                            |             |                   |                  | 5785.0                   | 35.315                                   | 5.255                               | 34.440                                     | 5.408                                 | -2.48            | 2.91                   |
|                            |             |                   |                  | 5795.0                   | 35.305                                   | 5.265                               | 34.422                                     | 5.422                                 | -2.50            | 2.98                   |
|                            |             |                   |                  | 5800.0                   | 35.300                                   | 5.270                               | 34.414                                     | 5.428                                 | -2.51            | 3.00                   |
|                            |             |                   |                  | 5825.0                   | 35.275                                   | 5.296                               | 34.389                                     | 5.453                                 | -2.51            | 2.96                   |
|                            |             |                   |                  |                          |                                          |                                     |                                            |                                       |                  |                        |

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

#### Measurement Procedure for Tissue verification:

- 1) The network analyzer and probe system was configured and calibrated.
  - 2) The probe was immersed in the sample which was placed in a nonmagnetic container. Trapped air bubbles beneath the flange were minimized by placing the probe at a slight angle.
  - 3) The complex admittance with respect to the probe aperture was measured.
  - 4) The complex relative permittivity, for example from the below equation ( $\epsilon_r$  is relative permittivity and  $\mu_r$  is relative permeability).
- $$Y = \frac{j2\omega\epsilon_0\epsilon_r}{\ln(b/a)} \int_0^1 \int_0^{2\pi} \cos\phi \frac{\exp\left[-j\pi r \sqrt{\left(\mu_r\epsilon_r\epsilon_0\right)^{-1/2}}\right]}{r} d\phi/d\rho/d\rho$$
- where  $Y$  is the admittance of the probe in contact with the sample, the primed and unprimed coordinates refer to source and observation points, respectively,  $r^2 = \rho'^2 + \rho^2 - 2\rho'\rho\cos\phi$ ,  $\rho$  is the angular frequency, and  $j = \sqrt{-1}$ .

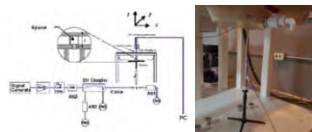
### 9.2 Test System Verification

Prior to assessment, the system is verified to the  $\pm 10\%$  of the specifications at using the SAR Dipole kit(s). (Graphic Plots Attached)

**Table 9.2.1 System Verification Results (1g)**

| SYSTEM DIPOLE VERIFICATION TARGET & MEASURED |             |                   |               |             |                    |                   |           |                  |                                     |                                   |                                         |               |
|----------------------------------------------|-------------|-------------------|---------------|-------------|--------------------|-------------------|-----------|------------------|-------------------------------------|-----------------------------------|-----------------------------------------|---------------|
| SAR System #                                 | Freq. [MHz] | SAR Dipole Kits   | Date(s)       | Tissue Type | Ambient Temp. [°C] | Liquid Temp. [°C] | Probe S/N | Input Power (mW) | 1 W Target SAR <sub>1g</sub> (W/kg) | Measured SAR <sub>1g</sub> (W/kg) | 1 W Normalized SAR <sub>1g</sub> (W/kg) | Deviation [%] |
| B                                            | 750         | D750V3, SN:1049   | Jul. 28. 2020 | Head        | 22.1               | 21.9              | 7368      | 250              | 8.47                                | 2.12                              | 8.48                                    | 0.12          |
| B                                            | 835         | D835V2, SN:4d159  | Jul. 27. 2020 | Head        | 22.3               | 22.0              | 7368      | 250              | 9.47                                | 2.41                              | 9.64                                    | 1.80          |
| B                                            | 1800        | D1800V2, SN:2d202 | Jul. 21. 2020 | Head        | 22.3               | 22.2              | 7368      | 100              | 39.6                                | 3.83                              | 38.30                                   | -3.28         |
| B                                            | 1900        | D1900V2, SN:5d176 | Jul. 20. 2020 | Head        | 22.1               | 21.8              | 7368      | 100              | 39.3                                | 4.01                              | 40.10                                   | 2.04          |
| B                                            | 2450        | D2450V2, SN:726   | Jul. 29. 2020 | Head        | 22.4               | 22.3              | 7368      | 100              | 51.2                                | 5.24                              | 52.40                                   | 2.34          |
| B                                            | 5200        | D5GHZV2, SN:1212  | Jul. 13. 2020 | Head        | 21.3               | 21.0              | 7368      | 100              | 80.2                                | 7.84                              | 78.40                                   | -2.24         |
| B                                            | 5800        | D5GHZV2, SN:1212  | Jul. 14. 2020 | Head        | 22.2               | 21.9              | 7368      | 100              | 81.5                                | 8.10                              | 81.00                                   | -0.61         |

Note1 : System Verification was measured with input 250 mW, 100 mW and normalized to 1W.  
Note2 : Full system validation status and results can be found in Appendix D.



**Figure 9.1 Dipole Verification Test Setup Diagram & Photo**

## 10. SAR TEST RESULTS

### 10.1 Standalone Body SAR Results

Table 10.1.1 WCDMA Body SAR

| MEASUREMENT RESULTS                               |      |               |         |                                      |                             |                     |                   |                            |                    |               |                     |                   |                               |            |
|---------------------------------------------------|------|---------------|---------|--------------------------------------|-----------------------------|---------------------|-------------------|----------------------------|--------------------|---------------|---------------------|-------------------|-------------------------------|------------|
| FREQUENCY                                         |      | Mode/<br>Band | Service | Maximum<br>Allowed<br>Power<br>[dBm] | Conducted<br>Power<br>[dBm] | Drift Power<br>[dB] | Spacing<br>[Side] | Device<br>Serial<br>Number | # of Time<br>Slots | Duty<br>Cycle | 1g<br>SAR<br>(W/kg) | Scaling<br>Factor | 1g<br>Scaled<br>SAR<br>(W/kg) | Plots<br># |
| MHz                                               | Ch   |               |         |                                      |                             |                     |                   |                            |                    |               |                     |                   |                               |            |
| 836.6                                             | 4183 | WCDMA 850     | RMC     | 24.00                                | 23.91                       | -0.030              | 5 mm [Bottom]     | FCC #1                     | N/A                | 1:1           | 0.344               | 1.021             | 0.351                         | A1         |
| 836.6                                             | 4183 | WCDMA 850     | RMC     | 24.00                                | 23.91                       | 0.040               | 5 mm [Front]      | FCC #1                     | N/A                | 1:1           | 0.279               | 1.021             | 0.285                         |            |
| 836.6                                             | 4183 | WCDMA 850     | RMC     | 24.00                                | 23.91                       | -0.020              | 5 mm [Rear #1]    | FCC #1                     | N/A                | 1:1           | 0.760               | 1.021             | 0.776                         |            |
| 826.4                                             | 4132 | WCDMA 850     | RMC     | 24.00                                | 23.99                       | -0.010              | 5 mm [Rear #2]    | FCC #1                     | N/A                | 1:1           | 1.040               | 1.002             | 1.042                         |            |
| 836.6                                             | 4183 | WCDMA 850     | RMC     | 24.00                                | 23.91                       | 0.020               | 5 mm [Rear #2]    | FCC #1                     | N/A                | 1:1           | 0.921               | 1.021             | 0.940                         |            |
| 846.6                                             | 4233 | WCDMA 850     | RMC     | 24.00                                | 23.92                       | 0.080               | 5 mm [Rear #2]    | FCC #1                     | N/A                | 1:1           | 0.931               | 1.019             | 0.949                         |            |
| 836.6                                             | 4183 | WCDMA 850     | RMC     | 24.00                                | 23.91                       | 0.010               | 5 mm [Right]      | FCC #1                     | N/A                | 1:1           | 0.208               | 1.021             | 0.212                         |            |
| 836.6                                             | 4183 | WCDMA 850     | RMC     | 24.00                                | 23.91                       | -0.100              | 5 mm [Left]       | FCC #1                     | N/A                | 1:1           | 0.254               | 1.021             | 0.259                         |            |
| 826.4                                             | 4132 | WCDMA 850     | RMC     | 24.00                                | 23.99                       | -0.050              | 5 mm [Rear #2]    | FCC #1                     | N/A                | 1:1           | 1.020               | 1.002             | 1.022                         |            |
| 826.4                                             | 4132 | WCDMA 850     | RMC     | 24.00                                | 23.99                       | 0.010               | 5 mm [Rear #2]    | FCC #1                     | N/A                | 1:1           | 1.000               | 1.002             | 1.002                         |            |
| 1852.4                                            | 9262 | WCDMA 1900    | RMC     | 22.20                                | 22.16                       | 0.160               | 5 mm [Bottom]     | FCC #1                     | N/A                | 1:1           | 0.926               | 1.009             | 0.934                         | A2         |
| 1880.0                                            | 9400 | WCDMA 1900    | RMC     | 22.20                                | 22.19                       | -0.000              | 5 mm [Bottom]     | FCC #1                     | N/A                | 1:1           | 1.040               | 1.002             | 1.042                         |            |
| 1907.6                                            | 9538 | WCDMA 1900    | RMC     | 22.20                                | 22.03                       | 0.190               | 5 mm [Bottom]     | FCC #1                     | N/A                | 1:1           | 1.130               | 1.040             | 1.175                         |            |
| 1880.0                                            | 9400 | WCDMA 1900    | RMC     | 22.20                                | 22.19                       | -0.070              | 5 mm [Front]      | FCC #1                     | N/A                | 1:1           | 0.284               | 1.002             | 0.285                         |            |
| 1852.4                                            | 9262 | WCDMA 1900    | RMC     | 22.20                                | 22.16                       | 0.050               | 5 mm [Rear #1]    | FCC #1                     | N/A                | 1:1           | 0.825               | 1.009             | 0.832                         |            |
| 1880.0                                            | 9400 | WCDMA 1900    | RMC     | 22.20                                | 22.19                       | -0.100              | 5 mm [Rear #1]    | FCC #1                     | N/A                | 1:1           | 1.110               | 1.002             | 1.112                         |            |
| 1907.6                                            | 9538 | WCDMA 1900    | RMC     | 22.20                                | 22.03                       | 0.060               | 5 mm [Rear #1]    | FCC #1                     | N/A                | 1:1           | 1.080               | 1.040             | 1.123                         |            |
| 1852.4                                            | 9262 | WCDMA 1900    | RMC     | 22.20                                | 22.16                       | -0.190              | 5 mm [Rear #2]    | FCC #1                     | N/A                | 1:1           | 0.962               | 1.009             | 0.991                         |            |
| 1880.0                                            | 9400 | WCDMA 1900    | RMC     | 22.20                                | 22.19                       | 0.180               | 5 mm [Rear #2]    | FCC #1                     | N/A                | 1:1           | 1.140               | 1.002             | 1.142                         |            |
| 1907.6                                            | 9538 | WCDMA 1900    | RMC     | 22.20                                | 22.03                       | 0.110               | 5 mm [Rear #2]    | FCC #1                     | N/A                | 1:1           | 1.140               | 1.040             | 1.186                         |            |
| 1880.0                                            | 9400 | WCDMA 1900    | RMC     | 22.20                                | 22.19                       | 0.030               | 5 mm [Right]      | FCC #1                     | N/A                | 1:1           | 0.115               | 1.002             | 0.115                         |            |
| 1880.0                                            | 9400 | WCDMA 1900    | RMC     | 22.20                                | 22.19                       | -0.020              | 5 mm [Left]       | FCC #1                     | N/A                | 1:1           | 0.465               | 1.002             | 0.466                         |            |
| 1907.6                                            | 9538 | WCDMA 1900    | RMC     | 20.20                                | 20.03                       | 0.110               | 5 mm [Rear #2]    | FCC #1                     | N/A                | 1:1           | 1.070               | 1.040             | 1.113                         |            |
| 1907.6                                            | 9538 | WCDMA 1900    | RMC     | 21.20                                | 20.03                       | 0.110               | 5 mm [Rear #2]    | FCC #1                     | N/A                | 1:1           | 1.100               | 1.309             | 1.440                         |            |
| ANSI / IEEE C95.1-1992- SAFETY LIMIT              |      |               |         |                                      |                             |                     |                   | Body                       |                    |               |                     |                   |                               |            |
| Spatial Peak                                      |      |               |         |                                      |                             |                     |                   | 1.6 W/kg (mW/g)            |                    |               |                     |                   |                               |            |
| Uncontrolled Exposure/General Population Exposure |      |               |         |                                      |                             |                     |                   | averaged over 1 gram       |                    |               |                     |                   |                               |            |

Note(s):  
1. Please refer to the Test photo (SAR) for details on the test position indicated by Blue entries represent.  
2. Purple entries represent SIM2 (This device supports Dual SIM and is 1 RF Path.) measurements.  
3. Orange entries represent variability measurements.

Table 10.1.2 LTE B12 Body SAR

| MEASUREMENT RESULTS                               |       |               |             |                                  |                       |                     |     |                |                            |      |            |             |               |                     |                   |                               |            |
|---------------------------------------------------|-------|---------------|-------------|----------------------------------|-----------------------|---------------------|-----|----------------|----------------------------|------|------------|-------------|---------------|---------------------|-------------------|-------------------------------|------------|
| FREQUENCY                                         |       | Mode/<br>Band | BW<br>[MHz] | Max<br>Allowed<br>Power<br>[dBm] | Cond.<br>PWR<br>[dBm] | Drift Power<br>[dB] | MPR | Position       | Device<br>Serial<br>Number | Mod. | RB<br>Size | RB<br>Offs. | Duty<br>Cycle | 1g<br>SAR<br>(W/kg) | Scaling<br>Factor | 1g<br>Scaled<br>SAR<br>(W/kg) | Plots<br># |
| MHz                                               | Ch    |               |             |                                  |                       |                     |     |                |                            |      |            |             |               |                     |                   |                               |            |
| 707.5                                             | 23095 | LTE B12       | 10          | 23.00                            | 22.92                 | 0.080               | 0   | 5 mm [Bottom]  | FCC #1                     | QPSK | 1          | 25          | 1:1           | 0.097               | 1.019             | 0.099                         | A3         |
| 707.5                                             | 23095 | LTE B12       | 10          | 22.00                            | 21.77                 | 0.130               | 1   | 5 mm [Bottom]  | FCC #1                     | QPSK | 25         | 12          | 1:1           | 0.084               | 1.054             | 0.089                         |            |
| 707.5                                             | 23095 | LTE B12       | 10          | 23.00                            | 22.92                 | 0.020               | 0   | 5 mm [Front]   | FCC #1                     | QPSK | 1          | 25          | 1:1           | 0.120               | 1.019             | 0.122                         |            |
| 707.5                                             | 23095 | LTE B12       | 10          | 22.00                            | 21.77                 | 0.080               | 1   | 5 mm [Front]   | FCC #1                     | QPSK | 25         | 12          | 1:1           | 0.098               | 1.054             | 0.103                         |            |
| 707.5                                             | 23095 | LTE B12       | 10          | 23.00                            | 22.92                 | 0.110               | 0   | 5 mm [Rear #1] | FCC #1                     | QPSK | 1          | 25          | 1:1           | 0.262               | 1.019             | 0.267                         |            |
| 707.5                                             | 23095 | LTE B12       | 10          | 22.00                            | 21.77                 | -0.090              | 1   | 5 mm [Rear #1] | FCC #1                     | QPSK | 25         | 12          | 1:1           | 0.226               | 1.054             | 0.238                         |            |
| 707.5                                             | 23095 | LTE B12       | 10          | 23.00                            | 22.92                 | 0.090               | 0   | 5 mm [Rear #2] | FCC #1                     | QPSK | 1          | 25          | 1:1           | 0.334               | 1.019             | 0.340                         |            |
| 707.5                                             | 23095 | LTE B12       | 10          | 22.00                            | 21.77                 | 0.040               | 1   | 5 mm [Rear #2] | FCC #1                     | QPSK | 25         | 12          | 1:1           | 0.277               | 1.054             | 0.292                         |            |
| 707.5                                             | 23095 | LTE B12       | 10          | 23.00                            | 22.92                 | 0.090               | 0   | 5 mm [Right]   | FCC #1                     | QPSK | 1          | 25          | 1:1           | 0.117               | 1.019             | 0.119                         |            |
| 707.5                                             | 23095 | LTE B12       | 10          | 22.00                            | 21.77                 | -0.010              | 1   | 5 mm [Right]   | FCC #1                     | QPSK | 25         | 12          | 1:1           | 0.098               | 1.054             | 0.103                         |            |
| 707.5                                             | 23095 | LTE B12       | 10          | 23.00                            | 22.92                 | 0.100               | 0   | 5 mm [Left]    | FCC #1                     | QPSK | 1          | 25          | 1:1           | 0.116               | 1.019             | 0.118                         |            |
| 707.5                                             | 23095 | LTE B12       | 10          | 22.00                            | 21.77                 | 0.010               | 1   | 5 mm [Left]    | FCC #1                     | QPSK | 25         | 12          | 1:1           | 0.103               | 1.054             | 0.109                         |            |
| 707.5                                             | 23095 | LTE B12       | 10          | 23.00                            | 22.92                 | 0.030               | 0   | 5 mm [Rear #2] | FCC #1                     | QPSK | 1          | 25          | 1:1           | 0.317               | 1.019             | 0.323                         |            |
| ANSI / IEEE C95.1-1992- SAFETY LIMIT              |       |               |             |                                  |                       |                     |     |                | Body                       |      |            |             |               |                     |                   |                               |            |
| Spatial Peak                                      |       |               |             |                                  |                       |                     |     |                | 1.6 W/kg (mW/g)            |      |            |             |               |                     |                   |                               |            |
| Uncontrolled Exposure/General Population Exposure |       |               |             |                                  |                       |                     |     |                | averaged over 1 gram       |      |            |             |               |                     |                   |                               |            |

Note(s):  
1. Please refer to the Test photo (SAR) for details on the test position indicated by Blue entries represent.  
2. Purple entries represent SIM2 (This device supports Dual SIM and is 1 RF Path.) measurements.

Table 10.1.3 LTE B5 Body SAR

| MEASUREMENT RESULTS                               |       |               |             |                                  |                       |                     |     |                |                            |      |            |             |               |                     |                   |                               |            |
|---------------------------------------------------|-------|---------------|-------------|----------------------------------|-----------------------|---------------------|-----|----------------|----------------------------|------|------------|-------------|---------------|---------------------|-------------------|-------------------------------|------------|
| FREQUENCY                                         |       | Mode/<br>Band | BW<br>[MHz] | Max<br>Allowed<br>Power<br>[dBm] | Cond.<br>PWR<br>[dBm] | Drift Power<br>[dB] | MPR | Position       | Device<br>Serial<br>Number | Mod. | RB<br>Size | RB<br>Offs. | Duty<br>Cycle | 1g<br>SAR<br>(W/kg) | Scaling<br>Factor | 1g<br>Scaled<br>SAR<br>(W/kg) | Plots<br># |
| MHz                                               | Ch    |               |             |                                  |                       |                     |     |                |                            |      |            |             |               |                     |                   |                               |            |
| 836.5                                             | 20525 | LTE B5        | 10          | 23.20                            | 22.97                 | 0.050               | 0   | 5 mm (Bottom)  | FCC #1                     | QPSK | 1          | 0           | 1:1           | 0.239               | 1.054             | 0.252                         | A4         |
| 836.5                                             | 20525 | LTE B5        | 10          | 22.20                            | 21.66                 | 0.080               | 1   | 5 mm (Bottom)  | FCC #1                     | QPSK | 25         | 0           | 1:1           | 0.178               | 1.132             | 0.201                         |            |
| 836.5                                             | 20525 | LTE B5        | 10          | 23.20                            | 22.97                 | 0.180               | 0   | 5 mm (Front)   | FCC #1                     | QPSK | 1          | 0           | 1:1           | 0.179               | 1.054             | 0.189                         |            |
| 836.5                                             | 20525 | LTE B5        | 10          | 22.20                            | 21.66                 | 0.000               | 1   | 5 mm (Front)   | FCC #1                     | QPSK | 25         | 0           | 1:1           | 0.139               | 1.132             | 0.157                         |            |
| 836.5                                             | 20525 | LTE B5        | 10          | 23.20                            | 22.97                 | 0.180               | 0   | 5 mm (Rear #1) | FCC #1                     | QPSK | 1          | 0           | 1:1           | 0.469               | 1.054             | 0.494                         |            |
| 836.5                                             | 20525 | LTE B5        | 10          | 22.20                            | 21.66                 | 0.030               | 1   | 5 mm (Rear #1) | FCC #1                     | QPSK | 25         | 0           | 1:1           | 0.378               | 1.132             | 0.428                         |            |
| 836.5                                             | 20525 | LTE B5        | 10          | 23.20                            | 22.97                 | 0.160               | 0   | 5 mm (Rear #2) | FCC #1                     | QPSK | 1          | 0           | 1:1           | 0.654               | 1.054             | 0.689                         |            |
| 836.5                                             | 20525 | LTE B5        | 10          | 22.20                            | 21.66                 | -0.070              | 1   | 5 mm (Rear #2) | FCC #1                     | QPSK | 25         | 0           | 1:1           | 0.414               | 1.132             | 0.469                         |            |
| 836.5                                             | 20525 | LTE B5        | 10          | 23.20                            | 22.97                 | 0.110               | 0   | 5 mm (Right)   | FCC #1                     | QPSK | 1          | 0           | 1:1           | 0.182               | 1.054             | 0.192                         |            |
| 836.5                                             | 20525 | LTE B5        | 10          | 22.20                            | 21.66                 | -0.080              | 1   | 5 mm (Right)   | FCC #1                     | QPSK | 25         | 0           | 1:1           | 0.127               | 1.132             | 0.144                         |            |
| 836.5                                             | 20525 | LTE B5        | 10          | 23.20                            | 22.97                 | -0.150              | 0   | 5 mm (Left)    | FCC #1                     | QPSK | 1          | 0           | 1:1           | 0.136               | 1.054             | 0.143                         |            |
| 836.5                                             | 20525 | LTE B5        | 10          | 22.20                            | 21.66                 | 0.020               | 1   | 5 mm (Left)    | FCC #1                     | QPSK | 25         | 0           | 1:1           | 0.107               | 1.132             | 0.121                         |            |
| 836.5                                             | 20525 | LTE B5        | 10          | 23.20                            | 22.97                 | 0.090               | 0   | 5 mm (Rear #2) | FCC #1                     | QPSK | 1          | 0           | 1:1           | 0.514               | 1.054             | 0.542                         |            |
| ANSI / IEEE C95.1-1992- SAFETY LIMIT              |       |               |             |                                  |                       |                     |     |                | Body                       |      |            |             |               |                     |                   |                               |            |
| Spatial Peak                                      |       |               |             |                                  |                       |                     |     |                | 1.6 W/kg (mW/g)            |      |            |             |               |                     |                   |                               |            |
| Uncontrolled Exposure/General Population Exposure |       |               |             |                                  |                       |                     |     |                | averaged over 1 gram       |      |            |             |               |                     |                   |                               |            |

Note(s):  
1. Please refer to the Test photo (SAR) for details on the test position indicated by Blue entries represent.  
2. Purple entries represent SIM2 (This device supports Dual SIM and is 1 RF Path.) measurements.

Table 10.1.4 LTE B4 Body SAR

| MEASUREMENT RESULTS                                                                                       |       |               |             |                                  |                       |                     |     |                |                                                 |      |            |             |               |                     |                   |                               |            |
|-----------------------------------------------------------------------------------------------------------|-------|---------------|-------------|----------------------------------|-----------------------|---------------------|-----|----------------|-------------------------------------------------|------|------------|-------------|---------------|---------------------|-------------------|-------------------------------|------------|
| FREQUENCY                                                                                                 |       | Mode/<br>Band | BW<br>[MHz] | Max<br>Allowed<br>Power<br>[dBm] | Cond.<br>PWR<br>[dBm] | Drift Power<br>[dB] | MPR | Position       | Device<br>Serial<br>Number                      | Mod. | RB<br>Size | RB<br>Offs. | Duty<br>Cycle | 1g<br>SAR<br>(W/kg) | Scaling<br>Factor | 1g<br>Scaled<br>SAR<br>(W/kg) | Plots<br># |
| MHz                                                                                                       | Ch    |               |             |                                  |                       |                     |     |                |                                                 |      |            |             |               |                     |                   |                               |            |
| 1732.5                                                                                                    | 20175 | LTE B4        | 20          | 22.70                            | 22.53                 | 0.100               | 0   | 5 mm [Bottom]  | FCC #1                                          | QPSK | 1          | 0           | 1:1           | 0.630               | 1.040             | 0.655                         |            |
| 1732.5                                                                                                    | 20175 | LTE B4        | 20          | 21.70                            | 21.31                 | 0.190               | 1   | 5 mm [Bottom]  | FCC #1                                          | QPSK | 50         | 0           | 1:1           | 0.505               | 1.094             | 0.552                         |            |
| 1732.5                                                                                                    | 20175 | LTE B4        | 20          | 22.70                            | 22.53                 | -0.160              | 0   | 5 mm [Front]   | FCC #1                                          | QPSK | 1          | 0           | 1:1           | 0.309               | 1.040             | 0.321                         |            |
| 1732.5                                                                                                    | 20175 | LTE B4        | 20          | 21.70                            | 21.31                 | -0.050              | 1   | 5 mm [Front]   | FCC #1                                          | QPSK | 50         | 0           | 1:1           | 0.240               | 1.094             | 0.263                         |            |
| 1732.5                                                                                                    | 20175 | LTE B4        | 20          | 22.70                            | 22.53                 | -0.040              | 0   | 5 mm [Rear #1] | FCC #1                                          | QPSK | 1          | 0           | 1:1           | 0.761               | 1.040             | 0.791                         |            |
| 1732.5                                                                                                    | 20175 | LTE B4        | 20          | 21.70                            | 21.31                 | 0.090               | 1   | 5 mm [Rear #1] | FCC #1                                          | QPSK | 50         | 0           | 1:1           | 0.597               | 1.094             | 0.653                         |            |
| 1732.5                                                                                                    | 20175 | LTE B4        | 20          | 22.70                            | 22.53                 | -0.030              | 0   | 5 mm [Rear #2] | FCC #1                                          | QPSK | 1          | 0           | 1:1           | 0.778               | 1.040             | 0.809                         | A5         |
| 1732.5                                                                                                    | 20175 | LTE B4        | 20          | 21.70                            | 21.31                 | -0.040              | 1   | 5 mm [Rear #2] | FCC #1                                          | QPSK | 50         | 0           | 1:1           | 0.634               | 1.094             | 0.694                         |            |
| 1732.5                                                                                                    | 20175 | LTE B4        | 20          | 21.70                            | 21.28                 | -0.040              | 1   | 5 mm [Rear #2] | FCC #1                                          | QPSK | 100        | 0           | 1:1           | 0.625               | 1.102             | 0.689                         |            |
| 1732.5                                                                                                    | 20175 | LTE B4        | 20          | 22.70                            | 22.53                 | 0.060               | 0   | 5 mm [Right]   | FCC #1                                          | QPSK | 1          | 0           | 1:1           | 0.159               | 1.040             | 0.165                         |            |
| 1732.5                                                                                                    | 20175 | LTE B4        | 20          | 21.70                            | 21.31                 | 0.060               | 1   | 5 mm [Right]   | FCC #1                                          | QPSK | 50         | 0           | 1:1           | 0.124               | 1.094             | 0.136                         |            |
| 1732.5                                                                                                    | 20175 | LTE B4        | 20          | 22.70                            | 22.53                 | 0.130               | 0   | 5 mm [Left]    | FCC #1                                          | QPSK | 1          | 0           | 1:1           | 0.760               | 1.040             | 0.790                         |            |
| 1732.5                                                                                                    | 20175 | LTE B4        | 20          | 21.70                            | 21.31                 | 0.100               | 1   | 5 mm [Left]    | FCC #1                                          | QPSK | 50         | 0           | 1:1           | 0.590               | 1.094             | 0.645                         |            |
| 1732.5                                                                                                    | 20175 | LTE B4        | 20          | 22.70                            | 22.53                 | 0.100               | 0   | 5 mm [Rear #2] | FCC #1                                          | QPSK | 1          | 0           | 1:1           | 0.751               | 1.040             | 0.781                         |            |
| ANSI / IEEE C95.1-1992- SAFETY LIMIT<br>Spatial Peak<br>Uncontrolled Exposure/General Population Exposure |       |               |             |                                  |                       |                     |     |                | Body<br>1.6 W/kg (mW/g)<br>averaged over 1 gram |      |            |             |               |                     |                   |                               |            |

Note(s):  
1. Please refer to the Test photo (SAR) for details on the test position indicated by Blue entries represent.  
2. Purple entries represent SIM2 (This device supports Dual SIM and is 1 RF Path.) measurements.

Table 10.1.5 LTE B2 Body SAR

| MEASUREMENT RESULTS                                                                                       |       |               |             |                                  |                       |                     |     |                |                            |                                                 |            |             |               |                     |                   |                               |            |
|-----------------------------------------------------------------------------------------------------------|-------|---------------|-------------|----------------------------------|-----------------------|---------------------|-----|----------------|----------------------------|-------------------------------------------------|------------|-------------|---------------|---------------------|-------------------|-------------------------------|------------|
| FREQUENCY                                                                                                 |       | Mode/<br>Band | BW<br>[MHz] | Max<br>Allowed<br>Power<br>[dBm] | Cond.<br>PWR<br>[dBm] | Drift Power<br>[dB] | MPR | Position       | Device<br>Serial<br>Number | Mod.                                            | RB<br>Size | RB<br>Offs. | Duty<br>Cycle | 1g<br>SAR<br>(W/kg) | Scaling<br>Factor | 1g<br>Scaled<br>SAR<br>(W/kg) | Plots<br># |
| MHz                                                                                                       | Ch    |               |             |                                  |                       |                     |     |                |                            |                                                 |            |             |               |                     |                   |                               |            |
| 1860.0                                                                                                    | 18700 | LTE B2        | 20          | 22.70                            | 22.55                 | -0.140              | 0   | 5 mm [Bottom]  | FCC #1                     | QPSK                                            | 1          | 0           | 1:1           | 0.848               | 1.035             | 0.878                         |            |
| 1860.0                                                                                                    | 18900 | LTE B2        | 20          | 22.70                            | 22.57                 | 0.010               | 0   | 5 mm [Bottom]  | FCC #1                     | QPSK                                            | 1          | 0           | 1:1           | 0.878               | 1.030             | 0.904                         |            |
| 1860.0                                                                                                    | 18900 | LTE B2        | 20          | 21.70                            | 21.26                 | -0.190              | 1   | 5 mm [Bottom]  | FCC #1                     | QPSK                                            | 50         | 0           | 1:1           | 0.733               | 1.107             | 0.811                         |            |
| 1860.0                                                                                                    | 18900 | LTE B2        | 20          | 21.70                            | 21.24                 | -0.140              | 1   | 5 mm [Bottom]  | FCC #1                     | QPSK                                            | 100        | 0           | 1:1           | 0.732               | 1.112             | 0.814                         |            |
| 1900.0                                                                                                    | 19100 | LTE B2        | 20          | 22.70                            | 22.43                 | -0.150              | 0   | 5 mm [Bottom]  | FCC #1                     | QPSK                                            | 1          | 0           | 1:1           | 0.984               | 1.064             | 1.047                         |            |
| 1860.0                                                                                                    | 18900 | LTE B2        | 20          | 22.70                            | 22.57                 | -0.010              | 0   | 5 mm [Front]   | FCC #1                     | QPSK                                            | 1          | 0           | 1:1           | 0.275               | 1.030             | 0.283                         |            |
| 1860.0                                                                                                    | 18900 | LTE B2        | 20          | 21.70                            | 21.26                 | -0.020              | 1   | 5 mm [Front]   | FCC #1                     | QPSK                                            | 50         | 0           | 1:1           | 0.213               | 1.107             | 0.236                         |            |
| 1860.0                                                                                                    | 18700 | LTE B2        | 20          | 22.70                            | 22.55                 | 0.150               | 0   | 5 mm [Rear #1] | FCC #1                     | QPSK                                            | 1          | 0           | 1:1           | 0.920               | 1.035             | 0.952                         |            |
| 1860.0                                                                                                    | 18700 | LTE B2        | 20          | 21.70                            | 21.24                 | 0.040               | 1   | 5 mm [Rear #1] | FCC #1                     | QPSK                                            | 50         | 0           | 1:1           | 0.741               | 1.112             | 0.824                         |            |
| 1860.0                                                                                                    | 18900 | LTE B2        | 20          | 22.70                            | 22.57                 | 0.040               | 0   | 5 mm [Rear #1] | FCC #1                     | QPSK                                            | 1          | 0           | 1:1           | 0.985               | 1.030             | 1.015                         |            |
| 1860.0                                                                                                    | 18900 | LTE B2        | 20          | 21.70                            | 21.26                 | 0.030               | 1   | 5 mm [Rear #1] | FCC #1                     | QPSK                                            | 50         | 0           | 1:1           | 0.829               | 1.107             | 0.918                         |            |
| 1860.0                                                                                                    | 18900 | LTE B2        | 20          | 21.70                            | 21.24                 | -0.010              | 1   | 5 mm [Rear #1] | FCC #1                     | QPSK                                            | 100        | 0           | 1:1           | 0.829               | 1.112             | 0.922                         |            |
| 1900.0                                                                                                    | 19100 | LTE B2        | 20          | 22.70                            | 22.43                 | 0.190               | 0   | 5 mm [Rear #1] | FCC #1                     | QPSK                                            | 1          | 0           | 1:1           | 1.090               | 1.064             | 1.160                         |            |
| 1900.0                                                                                                    | 19100 | LTE B2        | 20          | 21.70                            | 21.21                 | 0.040               | 1   | 5 mm [Rear #1] | FCC #1                     | QPSK                                            | 50         | 0           | 1:1           | 0.897               | 1.119             | 1.004                         |            |
| 1860.0                                                                                                    | 18700 | LTE B2        | 20          | 22.70                            | 22.55                 | -0.060              | 0   | 5 mm [Rear #2] | FCC #1                     | QPSK                                            | 1          | 0           | 1:1           | 1.060               | 1.035             | 1.097                         |            |
| 1860.0                                                                                                    | 18700 | LTE B2        | 20          | 21.70                            | 21.24                 | -0.110              | 1   | 5 mm [Rear #2] | FCC #1                     | QPSK                                            | 50         | 0           | 1:1           | 0.787               | 1.112             | 0.875                         |            |
| 1860.0                                                                                                    | 18900 | LTE B2        | 20          | 22.70                            | 22.57                 | -0.170              | 0   | 5 mm [Rear #2] | FCC #1                     | QPSK                                            | 1          | 0           | 1:1           | 1.120               | 1.030             | 1.154                         |            |
| 1860.0                                                                                                    | 18900 | LTE B2        | 20          | 21.70                            | 21.26                 | -0.170              | 1   | 5 mm [Rear #2] | FCC #1                     | QPSK                                            | 50         | 0           | 1:1           | 0.846               | 1.107             | 0.937                         |            |
| 1860.0                                                                                                    | 18900 | LTE B2        | 20          | 21.70                            | 21.24                 | -0.130              | 1   | 5 mm [Rear #2] | FCC #1                     | QPSK                                            | 100        | 0           | 1:1           | 0.847               | 1.112             | 0.942                         |            |
| 1900.0                                                                                                    | 19100 | LTE B2        | 20          | 22.70                            | 22.43                 | -0.150              | 0   | 5 mm [Rear #2] | FCC #1                     | QPSK                                            | 1          | 0           | 1:1           | 1.120               | 1.064             | 1.192                         | A6         |
| 1900.0                                                                                                    | 19100 | LTE B2        | 20          | 21.70                            | 21.21                 | 0.160               | 1   | 5 mm [Rear #2] | FCC #1                     | QPSK                                            | 50         | 0           | 1:1           | 0.922               | 1.119             | 1.032                         |            |
| 1860.0                                                                                                    | 18900 | LTE B2        | 20          | 22.70                            | 22.57                 | -0.010              | 0   | 5 mm [Right]   | FCC #1                     | QPSK                                            | 1          | 0           | 1:1           | 0.109               | 1.030             | 0.112                         |            |
| 1860.0                                                                                                    | 18900 | LTE B2        | 20          | 21.70                            | 21.26                 | 0.040               | 1   | 5 mm [Right]   | FCC #1                     | QPSK                                            | 50         | 0           | 1:1           | 0.085               | 1.107             | 0.094                         |            |
| 1860.0                                                                                                    | 18900 | LTE B2        | 20          | 22.70                            | 22.57                 | -0.130              | 0   | 5 mm [Left]    | FCC #1                     | QPSK                                            | 1          | 0           | 1:1           | 0.461               | 1.030             | 0.475                         |            |
| 1860.0                                                                                                    | 18900 | LTE B2        | 20          | 21.70                            | 21.26                 | 0.050               | 1   | 5 mm [Left]    | FCC #1                     | QPSK                                            | 50         | 0           | 1:1           | 0.359               | 1.107             | 0.397                         |            |
| 1860.0                                                                                                    | 18700 | LTE B2        | 20          | 22.70                            | 22.43                 | 0.040               | 1   | 5 mm [Rear #2] | FCC #1                     | QPSK                                            | 1          | 0           | 1:1           | 1.110               | 1.064             | 1.181                         |            |
| 1860.0                                                                                                    | 18700 | LTE B2        | 20          | 22.70                            | 22.43                 | -0.080              | 1   | 5 mm [Rear #2] | FCC #1                     | QPSK                                            | 1          | 0           | 1:1           | 1.110               | 1.064             | 1.181                         |            |
| ANSI / IEEE C95.1-1992- SAFETY LIMIT<br>Spatial Peak<br>Uncontrolled Exposure/General Population Exposure |       |               |             |                                  |                       |                     |     |                |                            | Body<br>1.6 W/kg (mW/g)<br>averaged over 1 gram |            |             |               |                     |                   |                               |            |

Note(s):  
1. Please refer to the Test photo (SAR) for details on the test position indicated by Blue entries represent.  
2. Purple entries represent SIM2 (This device supports Dual SIM and is 1 RF Path.) measurements.  
3. Orange entries represent variability measurements.

Table 10.1.6 DTS Body SAR

| MEASUREMENT RESULTS                                                                                       |    |         |                             |                       |                  |                  |                      |                       |                                                 |            |               |                |                             |            |        |
|-----------------------------------------------------------------------------------------------------------|----|---------|-----------------------------|-----------------------|------------------|------------------|----------------------|-----------------------|-------------------------------------------------|------------|---------------|----------------|-----------------------------|------------|--------|
| FREQUENCY                                                                                                 |    | Mode    | Maximum Allowed Power [dBm] | Conducted Power [dBm] | Drift Power [dB] | Phantom Position | Device Serial Number | Peak SAR of Area Scan | Data Rate [Mbps]                                | Duty Cycle | 1g SAR (W/kg) | Scaling Factor | Scaling Factor (Duty Cycle) | SAR (W/kg) | Plot # |
| MHz                                                                                                       | Ch |         |                             |                       |                  |                  |                      |                       |                                                 |            |               |                |                             |            |        |
| 2437.0                                                                                                    | 6  | 802.11b | 16.00                       | 15.76                 | -0.140           | 5 mm [Top]       | FCC #2               | 0.028                 | 1                                               | 97.3       | 0.026         | 1.057          | 1.028                       | 0.028      |        |
| 2437.0                                                                                                    | 6  | 802.11b | 16.00                       | 15.76                 | -0.120           | 5 mm [Front]     | FCC #2               | 0.057                 | 1                                               | 97.3       | 0.056         | 1.057          | 1.028                       | 0.061      |        |
| 2437.0                                                                                                    | 6  | 802.11b | 16.00                       | 15.76                 | -0.180           | 5 mm [Rear #1]   | FCC #2               | 0.057                 | 1                                               | 97.3       | 0.055         | 1.057          | 1.028                       | 0.060      |        |
| 2437.0                                                                                                    | 6  | 802.11b | 16.00                       | 15.76                 | -0.010           | 5 mm [Rear #3]   | FCC #2               | 0.060                 | 1                                               | 97.3       | 0.058         | 1.057          | 1.028                       | 0.063      |        |
| 2437.0                                                                                                    | 6  | 802.11b | 16.00                       | 15.76                 | -0.110           | 5 mm [Left]      | FCC #2               | 0.585                 | 1                                               | 97.3       | 0.602         | 1.057          | 1.028                       | 0.654      | A7     |
| ANSI / IEEE C95.1-1992- SAFETY LIMIT<br>Spatial Peak<br>Uncontrolled Exposure/General Population Exposure |    |         |                             |                       |                  |                  |                      |                       | Body<br>1.6 W/kg (mW/g)<br>averaged over 1 gram |            |               |                |                             |            |        |

Note(s):  
1. Please refer to the Test photo (SAR) for details on the test position indicated by Blue entries represent.

| Adjusted SAR results for OFDM SAR                                                                         |    |               |         |                                      |                               |                    |                 |         |                                                 |                          |                                 |                    |
|-----------------------------------------------------------------------------------------------------------|----|---------------|---------|--------------------------------------|-------------------------------|--------------------|-----------------|---------|-------------------------------------------------|--------------------------|---------------------------------|--------------------|
| FREQUENCY                                                                                                 |    | Mode/ Antenna | Service | Maximum<br>Allowed<br>Power<br>[dBm] | 1g<br>Scaled<br>SAR<br>(W/kg) | FREQUENCY<br>[MHz] | Mode            | Service | Maximum<br>Allowed<br>Power<br>[dBm]            | Ratio of OFDM<br>to DSSS | 1g<br>Adjusted<br>SAR<br>(W/kg) | Determine OFDM SAR |
| MHz                                                                                                       | Ch |               |         |                                      |                               |                    |                 |         |                                                 |                          |                                 |                    |
| 2437.0                                                                                                    | 6  | 802.11b       | DSSS    | 16.0                                 | 0.654                         | 2437.0             | 802.11g         | OFDM    | 14.0                                            | 0.631                    | 0.413                           | X                  |
| 2437.0                                                                                                    | 6  | 802.11b       | DSSS    | 16.0                                 | 0.654                         | 2437.0             | 802.11n (HT-20) | OFDM    | 14.0                                            | 0.631                    | 0.413                           | X                  |
| 2437.0                                                                                                    | 6  | 802.11b       | DSSS    | 16.0                                 | 0.654                         | 2437.0             | 802.11n (HT-40) | OFDM    | 14.0                                            | 0.631                    | 0.413                           | X                  |
| ANSI / IEEE C95.1-1992- SAFETY LIMIT<br>Spatial Peak<br>Uncontrolled Exposure/General Population Exposure |    |               |         |                                      |                               |                    |                 |         | Body<br>1.6 W/kg (mW/g)<br>averaged over 1 gram |                          |                                 |                    |

Note: SAR is not required for the following 2.4 GHz OFDM conditions. When the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is  $\leq 1.2$  W/kg.

Table 10.1.7 UNII Body SAR

| MEASUREMENT RESULTS                                                                                       |    |         |                             |                       |                  |                  |                      |                       |                                                 |            |               |                |                             |                      |         |
|-----------------------------------------------------------------------------------------------------------|----|---------|-----------------------------|-----------------------|------------------|------------------|----------------------|-----------------------|-------------------------------------------------|------------|---------------|----------------|-----------------------------|----------------------|---------|
| FREQUENCY                                                                                                 |    | Mode    | Maximum Allowed Power [dBm] | Conducted Power [dBm] | Drift Power [dB] | Phantom Position | Device Serial Number | Peak SAR of Area Scan | Data Rate [Mbps]                                | Duty Cycle | 1g SAR (W/kg) | Scaling Factor | Scaling Factor (Duty Cycle) | 1g Scaled SAR (W/kg) | Plots # |
| MHz                                                                                                       | Ch |         |                             |                       |                  |                  |                      |                       |                                                 |            |               |                |                             |                      |         |
| 5220.0                                                                                                    | 44 | 802.11a | 13.00                       | 12.80                 | -0.030           | 5 mm [Top]       | FCC #2               | 0.143                 | 6                                               | 87.3       | 0.142         | 1.047          | 1.145                       | 0.170                |         |
| 5220.0                                                                                                    | 44 | 802.11a | 13.00                       | 12.80                 | -0.190           | 5 mm [Front]     | FCC #2               | 0.051                 | 6                                               | 87.3       | 0.043         | 1.047          | 1.145                       | 0.052                |         |
| 5220.0                                                                                                    | 44 | 802.11a | 13.00                       | 12.80                 | 0.010            | 5 mm [Rear #1]   | FCC #2               | 0.223                 | 6                                               | 87.3       | 0.220         | 1.047          | 1.145                       | 0.264                |         |
| 5220.0                                                                                                    | 44 | 802.11a | 13.00                       | 12.80                 | -0.010           | 5 mm [Rear #3]   | FCC #2               | 0.234                 | 6                                               | 87.3       | 0.234         | 1.047          | 1.145                       | 0.281                |         |
| 5220.0                                                                                                    | 44 | 802.11a | 13.00                       | 12.80                 | 0.090            | 5 mm [Left]      | FCC #2               | 0.645                 | 6                                               | 87.3       | 0.652         | 1.047          | 1.145                       | 0.782                | A8      |
| ANSI / IEEE C95.1-2005- SAFETY LIMIT<br>Spatial Peak<br>Uncontrolled Exposure/General Population Exposure |    |         |                             |                       |                  |                  |                      |                       | Body<br>1.6 W/kg (mW/g)<br>averaged over 1 gram |            |               |                |                             |                      |         |

Table 10.1.8 UNII Body SAR

| MEASUREMENT RESULTS                                                                                       |     |         |                             |                       |                  |                  |                      |                       |                                                 |            |               |                |                             |                      |        |
|-----------------------------------------------------------------------------------------------------------|-----|---------|-----------------------------|-----------------------|------------------|------------------|----------------------|-----------------------|-------------------------------------------------|------------|---------------|----------------|-----------------------------|----------------------|--------|
| FREQUENCY                                                                                                 |     | Mode    | Maximum Allowed Power [dBm] | Conducted Power [dBm] | Drift Power [dB] | Phantom Position | Device Serial Number | Peak SAR of Area Scan | Data Rate [Mbps]                                | Duty Cycle | 1g SAR (W/kg) | Scaling Factor | Scaling Factor (Duty Cycle) | 1g Scaled SAR (W/kg) | Plot # |
| MHz                                                                                                       | Ch  |         |                             |                       |                  |                  |                      |                       |                                                 |            |               |                |                             |                      |        |
| 5825.0                                                                                                    | 165 | 802.11a | 13.00                       | 12.79                 | 0.020            | 5 mm [Top]       | FCC #2               | 0.126                 | 6                                               | 87.3       | 0.122         | 1.050          | 1.145                       | 0.147                |        |
| 5825.0                                                                                                    | 165 | 802.11a | 13.00                       | 12.79                 | -0.030           | 5 mm [Front]     | FCC #2               | 0.034                 | 6                                               | 87.3       | 0.027         | 1.050          | 1.145                       | 0.032                |        |
| 5825.0                                                                                                    | 165 | 802.11a | 13.00                       | 12.79                 | -0.030           | 5 mm [Rear #1]   | FCC #2               | 0.199                 | 6                                               | 87.3       | 0.201         | 1.050          | 1.145                       | 0.242                |        |
| 5825.0                                                                                                    | 165 | 802.11a | 13.00                       | 12.79                 | -0.060           | 5 mm [Rear #3]   | FCC #2               | 0.205                 | 6                                               | 87.3       | 0.211         | 1.050          | 1.145                       | 0.254                |        |
| 5825.0                                                                                                    | 165 | 802.11a | 13.00                       | 12.79                 | 0.080            | 5 mm [Left]      | FCC #2               | 0.381                 | 6                                               | 87.3       | 0.401         | 1.050          | 1.145                       | 0.482                | A9     |
| ANSI / IEEE C95.1-1992- SAFETY LIMIT<br>Spatial Peak<br>Uncontrolled Exposure/General Population Exposure |     |         |                             |                       |                  |                  |                      |                       | Body<br>1.6 W/kg (mW/g)<br>averaged over 1 gram |            |               |                |                             |                      |        |

Table 10.1.9 Bluetooth Body SAR

| MEASUREMENT RESULTS                                                                                       |    |           |                             |                       |                  |                  |                      |                                                 |                |               |                |                             |                      |         |
|-----------------------------------------------------------------------------------------------------------|----|-----------|-----------------------------|-----------------------|------------------|------------------|----------------------|-------------------------------------------------|----------------|---------------|----------------|-----------------------------|----------------------|---------|
| FREQUENCY                                                                                                 |    | Mode      | Maximum Allowed Power [dBm] | Conducted Power [dBm] | Drift Power [dB] | Phantom Position | Device Serial Number | Rate [Mbps]                                     | Duty Cycle (%) | 1g SAR (W/kg) | Scaling Factor | Scaling Factor (Duty Cycle) | 1g Scaled SAR (W/kg) | Plots # |
| MHz                                                                                                       | Ch |           |                             |                       |                  |                  |                      |                                                 |                |               |                |                             |                      |         |
| 2441.0                                                                                                    | 39 | Bluetooth | 11.85                       | 11.64                 | 0.090            | 5 mm [Top]       | FCC #2               | 1                                               | 76.8           | 0.006         | 1.050          | 1.302                       | 0.008                |         |
| 2441.0                                                                                                    | 39 | Bluetooth | 11.85                       | 11.64                 | -0.060           | 5 mm [Front]     | FCC #2               | 1                                               | 76.8           | 0.008         | 1.050          | 1.302                       | 0.011                |         |
| 2441.0                                                                                                    | 39 | Bluetooth | 11.85                       | 11.64                 | -0.010           | 5 mm [Rear #1]   | FCC #2               | 1                                               | 76.8           | 0.016         | 1.050          | 1.302                       | 0.022                |         |
| 2441.0                                                                                                    | 39 | Bluetooth | 11.85                       | 11.64                 | -0.120           | 5 mm [Rear #3]   | FCC #2               | 1                                               | 76.8           | 0.016         | 1.050          | 1.302                       | 0.022                |         |
| 2441.0                                                                                                    | 39 | Bluetooth | 11.85                       | 11.64                 | 0.120            | 5 mm [Left]      | FCC #2               | 1                                               | 76.8           | 0.122         | 1.050          | 1.302                       | 0.167                | A10     |
| ANSI / IEEE C95.1-1992- SAFETY LIMIT<br>Spatial Peak<br>Uncontrolled Exposure/General Population Exposure |    |           |                             |                       |                  |                  |                      | Body<br>1.6 W/kg (mW/g)<br>averaged over 1 gram |                |               |                |                             |                      |         |

Note(s):  
1. Please refer to the Test photo (SAR) for details on the test position indicated by Blue entries represent.

## 10.2 SAR Test Notes

### General Notes:

1. The test data reported are the worst-case SAR values according to test procedures specified in IEEE 1528-2013, and FCC KDB Publication 447498 D01v06.
2. Batteries are fully charged at the beginning of the SAR measurements. A standard battery was used for all SAR measurements.
3. Liquid tissue depth was at least 15.0 cm for all frequencies.
4. The manufacturer has confirmed that the device(s) tested have the same physical, mechanical and thermal characteristics and are within operational tolerances expected for production units
5. SAR results were scaled to the maximum allowed power to demonstrate compliance per FCC KDB Publication 447498 D01v06.
6. Per FCC KDB Publication 648474 D04v01r03, body SAR was evaluated without a headset connected to the device. Since the standalone reported body SAR was not > 1.2 W/kg, no additional body SAR evaluations using a headset cable were performed.

### WCDMA (UMTS) Notes:

1. WCDMA (UMTS) mode in was tested under RMC 12.2 kbps with HSPA Inactive per KDB Publication 941225 D01v03r01. AMR and HSPA SAR was not required since the average output power of the HSPA subtests was not more than 0.25 dB higher than the RMC level and SAR was less than 1.2 W/kg.
2. Per FCC KDB Publication 447498 D01v06, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is  $\leq 0.8$  W/kg then testing at the other channels is not required for such test configuration(s). When the maximum output power variation across the required test channels is >  $\frac{1}{2}$  dB, instead of the middle channel, the highest output power channel was used.

### LTE Notes:

1. LTE Considerations: LTE test configurations are determined according to SAR Evaluation Considerations for LTE Devices in FCC KDB Publication 941225 D05v02r05. The general test procedures used for testing can be found in Section 8.4.4.
2. According to FCC KDB 941225 D05v02r05, when the reported SAR is  $\leq 0.8$  W/kg, testing of the 100% RB allocation and required test channels is not required.  
Otherwise, SAR is required for the remaining required test channels using the 1 RB, 50% RB and 100% RB allocation with highest output power for that channel.  
Only one channel, and as reported SAR values for 1 RB allocation and 50% RB allocation were less than 1.45 W/kg only the highest power RB offset for each allocation was required.
3. MPR is permanently implemented for this device by the manufacturer. The specific manufacturer target MPR is indicated alongside the SAR results. MPR is enabled for this device, according to 3GPP TS36. 101 Section 6.2.3 – 6.2.5 under Table 6.2.3-1.
4. A-MPR was disabled for all SAR tests by setting NS=1 on the base station simulator. SAR tests were performed with the same number of RB and RB offsets transmitting on all TTI frames (maximum TTI).
5. SAR test reduction is applied using the following criteria:  
Start with the largest channel bandwidth and measure SAR for QPSK with 1 RB, and 50% RB allocation, using the RB offset and required test channel combination with the highest maximum output power among RB offsets at the upper edge, middle and lower edge of each required test channel. When the reported SAR is > 0.8 W/kg, testing for other channels is performed at the highest output power level for 1 RB, and 50% RB configuration for that channel. Testing for 100% RB configuration is performed at the highest output power level for 100% RB configuration across the Low, Mid and High channel when the highest reported SAR for 1 RB and 50% RB are > 0.8 W/kg, Testing for the remaining required channels is not needed because the reported SAR for 100% RB Allocation < 1.45 W/kg. Testing for 16QAM modulation is not required because the reported SAR for QPSK is < 1.45 W/kg and its output power is not more than 0.5 dB higher than that a QPSK. Testing for the other channel bandwidths is not required because the reported SAR for the highest channel bandwidth is < 1.45 W/kg and its output power is not more than 0.5 dB higher than that of the highest channel bandwidth.

**WLAN Notes:**

1. The initial test position procedures were applied. The test position with the highest extrapolated peak SAR will be used as the initial test position. When reported SAR for the initial test position is  $\leq 0.4$  W/kg, no additional testing for the remaining test positions was required. Otherwise, SAR is evaluated at the subsequent highest peak SAR positions until the reported SAR result is  $\leq 0.8$  W/kg or all test positions are measured.
2. Justification for test configurations for WLAN per KDB Publication 248227 D01v02r02 for 2.4 GHz WIFI single transmission chain operations, the highest measured maximum output power channel for DSSS was selected for SAR measurement. SAR for OFDM modes (2.4 GHz 802.11g/n) was not required due to the maximum allowed powers and the highest reported DSSS SAR when the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output and the adjust SAR is  $\leq 1.2$  W/kg.
3. Justification for test configurations for WLAN per KDB Publication 248227 D01v02r02 for 5 GHz WIFI single transmission chain operations, the initial test configuration was selected according to the transmission mode with the highest maximum allowed powers. Other transmission modes were not investigated since the highest reported SAR for initial test configuration adjusted by the ratio of maximum output powers is less than 1.2 W/kg.
4. When the maximum reported 1g averaged SAR  $\leq 0.8$  W/kg, SAR testing on additional channels was not required. Otherwise, SAR for the next highest output power channel was required until the reported SAR result was  $\leq 1.20$  W/kg or all test channels were measured.
5. The device was configured to transmit continuously at the required data rate, channel bandwidth and signal modulation, using the highest transmission duty factor to determine compliance.

**Bluetooth Notes:**

1. Bluetooth SAR was measured with the device connected to a call with hopping disabled with DH5 operation and Tx test mode type. Per October 2016 TCB Workshop Notes, the reported SAR was scaled to the 100% transmission duty factor to determine compliance. Refer to section 8.4 for the time-domain plot and calculation for the duty factor of the device.

## 11. FCC MULTI-TX AND ANTENNA SAR CONSIDERATIONS

### 11.1 Introduction

The following procedures adopted from FCC KDB Publication 447498 D01v06 are applicable to handsets with built-in unlicensed transmitters such as 802.11b/g/n and Bluetooth devices which may simultaneously transmit with the licensed transmitter.

### 11.2 Simultaneous Transmission Procedures

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

### 11.3 Simultaneous Transmission Capabilities

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

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

**Table 11.3.1 Simultaneous SAR Cases**

| No. | Capable Transmit Configuration | Body SAR | Note |
|-----|--------------------------------|----------|------|
| 1   | WCDMA + Wi-Fi 2.4 GHz          | Yes      |      |
| 2   | WCDMA + Wi-Fi 5 GHz            | Yes      |      |
| 3   | WCDMA + Bluetooth 2.4 GHz      | Yes      |      |
| 4   | LTE + Wi-Fi 2.4 GHz            | Yes      |      |
| 5   | LTE + Wi-Fi 5 GHz              | Yes      |      |
| 6   | LTE + Bluetooth 2.4 GHz        | Yes      |      |

Notes:

- VoIP is supported in LTE, WCDMA
- WCDMA and LTE can not transmit simultaneously since they share the same chip.
- Bluetooth and WLAN (2.4 GHz, 5 GHz) are not operated at same time.

## 11.4 Body SAR Simultaneous Transmission Analysis

**Table 11.4.1 Simultaneous Transmission Scenario : 3G/4G + 2.4 GHz W-LAN (Body at 0 mm)**

| Exposure Condition | Mode        | Configuration | 3G/4G SAR (W/kg) | 2.4G W-LAN SAR (W/kg) | ΣSAR (W/kg)  |
|--------------------|-------------|---------------|------------------|-----------------------|--------------|
|                    |             |               | 1                | 2                     | 1+2          |
| Body SAR           | WCDMA 850   | Top           | -                | 0.028                 | 0.028        |
|                    |             | Bottom        | 0.351            | -                     | 0.351        |
|                    |             | Front         | 0.285            | 0.061                 | 0.346        |
|                    |             | Rear          | 1.042            | 0.063                 | <b>1.105</b> |
|                    |             | Right         | 0.212            | -                     | 0.212        |
|                    |             | Left          | 0.259            | 0.654                 | 0.913        |
|                    | WCDMA 1900  | Top           | -                | 0.028                 | 0.028        |
|                    |             | Bottom        | 1.175            | -                     | 1.175        |
|                    |             | Front         | 0.285            | 0.061                 | 0.346        |
|                    |             | Rear          | 1.186            | 0.063                 | <b>1.249</b> |
|                    |             | Right         | 0.115            | -                     | 0.115        |
|                    |             | Left          | 0.466            | 0.654                 | 1.120        |
|                    | LTE Band 12 | Top           | -                | 0.028                 | 0.028        |
|                    |             | Bottom        | 0.099            | -                     | 0.099        |
|                    |             | Front         | 0.122            | 0.061                 | 0.183        |
|                    |             | Rear          | 0.340            | 0.063                 | 0.403        |
|                    |             | Right         | 0.119            | -                     | 0.119        |
|                    |             | Left          | 0.118            | 0.654                 | <b>0.772</b> |
|                    | LTE Band 5  | Top           | -                | 0.028                 | 0.028        |
|                    |             | Bottom        | 0.252            | -                     | 0.252        |
|                    |             | Front         | 0.189            | 0.061                 | 0.250        |
|                    |             | Rear          | 0.689            | 0.063                 | 0.752        |
|                    |             | Right         | 0.192            | -                     | 0.192        |
|                    |             | Left          | 0.143            | 0.654                 | <b>0.797</b> |
|                    | LTE Band 4  | Top           | -                | 0.028                 | 0.028        |
|                    |             | Bottom        | 0.655            | -                     | 0.655        |
|                    |             | Front         | 0.321            | 0.061                 | 0.382        |
|                    |             | Rear          | 0.809            | 0.063                 | 0.872        |
|                    |             | Right         | 0.165            | -                     | 0.165        |
|                    |             | Left          | 0.790            | 0.654                 | <b>1.444</b> |
|                    | LTE Band 2  | Top           | -                | 0.028                 | 0.028        |
|                    |             | Bottom        | 1.047            | -                     | 1.047        |
|                    |             | Front         | 0.283            | 0.061                 | 0.344        |
|                    |             | Rear          | 1.192            | 0.063                 | <b>1.255</b> |
|                    |             | Right         | 0.112            | -                     | 0.112        |
|                    |             | Left          | 0.475            | 0.654                 | 1.129        |

**Table 11.4.2 Simultaneous Transmission Scenario : 3G/4G + 5.2 GHz W-LAN (Body at 0 mm)**

| Exposure Condition | Mode        | Configuration | 3G/4G SAR (W/kg) | 5.2G W-LAN SAR (W/kg) | ΣSAR (W/kg)  |
|--------------------|-------------|---------------|------------------|-----------------------|--------------|
|                    |             |               | 1                | 2                     | 1+2          |
| Body SAR           | WCDMA 850   | Top           | -                | 0.170                 | 0.170        |
|                    |             | Bottom        | 0.351            | -                     | 0.351        |
|                    |             | Front         | 0.285            | 0.052                 | 0.337        |
|                    |             | Rear          | 1.042            | 0.281                 | <b>1.323</b> |
|                    |             | Right         | 0.212            | -                     | 0.212        |
|                    |             | Left          | 0.259            | 0.782                 | 1.041        |
|                    | WCDMA 1900  | Top           | -                | 0.170                 | 0.170        |
|                    |             | Bottom        | 1.175            | -                     | 1.175        |
|                    |             | Front         | 0.285            | 0.052                 | 0.337        |
|                    |             | Rear          | 1.186            | 0.281                 | <b>1.467</b> |
|                    |             | Right         | 0.115            | -                     | 0.115        |
|                    |             | Left          | 0.466            | 0.782                 | 1.248        |
|                    | LTE Band 12 | Top           | -                | 0.170                 | 0.170        |
|                    |             | Bottom        | 0.099            | -                     | 0.099        |
|                    |             | Front         | 0.122            | 0.052                 | 0.174        |
|                    |             | Rear          | 0.340            | 0.281                 | 0.621        |
|                    |             | Right         | 0.119            | -                     | 0.119        |
|                    |             | Left          | 0.118            | 0.782                 | <b>0.900</b> |
|                    | LTE Band 5  | Top           | -                | 0.170                 | 0.170        |
|                    |             | Bottom        | 0.252            | -                     | 0.252        |
|                    |             | Front         | 0.189            | 0.052                 | 0.241        |
|                    |             | Rear          | 0.689            | 0.281                 | <b>0.970</b> |
|                    |             | Right         | 0.192            | -                     | 0.192        |
|                    |             | Left          | 0.143            | 0.782                 | 0.925        |
|                    | LTE Band 4  | Top           | -                | 0.170                 | 0.170        |
|                    |             | Bottom        | 0.655            | -                     | 0.655        |
|                    |             | Front         | 0.321            | 0.052                 | 0.373        |
|                    |             | Rear          | 0.809            | 0.281                 | 1.090        |
|                    |             | Right         | 0.165            | -                     | 0.165        |
|                    |             | Left          | 0.790            | 0.782                 | <b>1.572</b> |
|                    | LTE Band 2  | Top           | -                | 0.170                 | 0.170        |
|                    |             | Bottom        | 1.047            | -                     | 1.047        |
|                    |             | Front         | 0.283            | 0.052                 | 0.335        |
|                    |             | Rear          | <b>1.192</b>     | <b>0.281</b>          | <b>1.473</b> |
|                    |             | Right         | 0.112            | -                     | 0.112        |
|                    |             | Left          | 0.475            | 0.782                 | 1.257        |

**Table 11.4.3 Simultaneous Transmission Scenario : 3G/4G + 5.8 GHz W-LAN (Body at 0 mm)**

| Exposure Condition | Mode        | Configuration | 3G/4G SAR (W/kg) | 5.8G W-LAN SAR (W/kg) | ΣSAR (W/kg) |
|--------------------|-------------|---------------|------------------|-----------------------|-------------|
|                    |             |               | 1                | 2                     | 1+2         |
| Body SAR           | WCDMA 850   | Top           | -                | 0.147                 | 0.147       |
|                    |             | Bottom        | 0.351            | -                     | 0.351       |
|                    |             | Front         | 0.285            | 0.032                 | 0.317       |
|                    |             | Rear          | 1.042            | 0.254                 | 1.296       |
|                    |             | Right         | 0.212            | -                     | 0.212       |
|                    |             | Left          | 0.259            | 0.482                 | 0.741       |
|                    | WCDMA 1900  | Top           | -                | 0.147                 | 0.147       |
|                    |             | Bottom        | 1.175            | -                     | 1.175       |
|                    |             | Front         | 0.285            | 0.032                 | 0.317       |
|                    |             | Rear          | 1.186            | 0.254                 | 1.440       |
|                    |             | Right         | 0.115            | -                     | 0.115       |
|                    |             | Left          | 0.466            | 0.482                 | 0.948       |
|                    | LTE Band 12 | Top           | -                | 0.147                 | 0.147       |
|                    |             | Bottom        | 0.099            | -                     | 0.099       |
|                    |             | Front         | 0.122            | 0.032                 | 0.154       |
|                    |             | Rear          | 0.340            | 0.254                 | 0.594       |
|                    |             | Right         | 0.119            | -                     | 0.119       |
|                    |             | Left          | 0.118            | 0.482                 | 0.600       |
|                    | LTE Band 5  | Top           | -                | 0.147                 | 0.147       |
|                    |             | Bottom        | 0.252            | -                     | 0.252       |
|                    |             | Front         | 0.189            | 0.032                 | 0.221       |
|                    |             | Rear          | 0.689            | 0.254                 | 0.943       |
|                    |             | Right         | 0.192            | -                     | 0.192       |
|                    |             | Left          | 0.143            | 0.482                 | 0.625       |
|                    | LTE Band 4  | Top           | -                | 0.147                 | 0.147       |
|                    |             | Bottom        | 0.655            | -                     | 0.655       |
|                    |             | Front         | 0.321            | 0.032                 | 0.353       |
|                    |             | Rear          | 0.809            | 0.254                 | 1.063       |
|                    |             | Right         | 0.165            | -                     | 0.165       |
|                    |             | Left          | 0.790            | 0.482                 | 1.272       |
|                    | LTE Band 2  | Top           | -                | 0.147                 | 0.147       |
|                    |             | Bottom        | 1.047            | -                     | 1.047       |
|                    |             | Front         | 0.283            | 0.032                 | 0.315       |
|                    |             | Rear          | 1.192            | 0.254                 | 1.446       |
|                    |             | Right         | 0.112            | -                     | 0.112       |
|                    |             | Left          | 0.475            | 0.482                 | 0.957       |

**Table 11.4.4 Simultaneous Transmission Scenario : 3G/4G + Bluetooth (Body at 0 mm)**

| Exposure Condition | Mode        | Configuration | 3G/4G SAR (W/kg) | Bluetooth SAR (W/kg) | ΣSAR (W/kg) |
|--------------------|-------------|---------------|------------------|----------------------|-------------|
|                    |             |               | 1                | 2                    | 1+2         |
| Body SAR           | WCDMA 850   | Top           | -                | 0.008                | 0.008       |
|                    |             | Bottom        | 0.351            | -                    | 0.351       |
|                    |             | Front         | 0.285            | 0.011                | 0.296       |
|                    |             | Rear          | 1.042            | 0.022                | 1.064       |
|                    |             | Right         | 0.212            | -                    | 0.212       |
|                    |             | Left          | 0.259            | 0.167                | 0.426       |
|                    | WCDMA 1900  | Top           | -                | 0.008                | 0.008       |
|                    |             | Bottom        | 1.175            | -                    | 1.175       |
|                    |             | Front         | 0.285            | 0.011                | 0.296       |
|                    |             | Rear          | 1.186            | 0.022                | 1.208       |
|                    |             | Right         | 0.115            | -                    | 0.115       |
|                    |             | Left          | 0.466            | 0.167                | 0.633       |
|                    | LTE Band 12 | Top           | -                | 0.008                | 0.008       |
|                    |             | Bottom        | 0.099            | -                    | 0.099       |
|                    |             | Front         | 0.122            | 0.011                | 0.133       |
|                    |             | Rear          | 0.340            | 0.022                | 0.362       |
|                    |             | Right         | 0.119            | -                    | 0.119       |
|                    |             | Left          | 0.118            | 0.167                | 0.285       |
|                    | LTE Band 5  | Top           | -                | 0.008                | 0.008       |
|                    |             | Bottom        | 0.252            | -                    | 0.252       |
|                    |             | Front         | 0.189            | 0.011                | 0.200       |
|                    |             | Rear          | 0.689            | 0.022                | 0.711       |
|                    |             | Right         | 0.192            | -                    | 0.192       |
|                    |             | Left          | 0.143            | 0.167                | 0.310       |
|                    | LTE Band 4  | Top           | -                | 0.008                | 0.008       |
|                    |             | Bottom        | 0.655            | -                    | 0.655       |
|                    |             | Front         | 0.321            | 0.011                | 0.332       |
|                    |             | Rear          | 0.809            | 0.022                | 0.831       |
|                    |             | Right         | 0.165            | -                    | 0.165       |
|                    |             | Left          | 0.790            | 0.167                | 0.957       |
|                    | LTE Band 2  | Top           | -                | 0.008                | 0.008       |
|                    |             | Bottom        | 1.047            | -                    | 1.047       |
|                    |             | Front         | 0.283            | 0.011                | 0.294       |
|                    |             | Rear          | 1.192            | 0.022                | 1.214       |
|                    |             | Right         | 0.112            | -                    | 0.112       |
|                    |             | Left          | 0.475            | 0.167                | 0.642       |

## 11.5 Simultaneous Transmission Conclusion

The above numerical summed SAR results for all the worst-case simultaneous transmission conditions were below the SAR limit. Therefore, the above analysis is sufficient to determine that simultaneous transmission cases will not exceed the SAR limit and therefore no measured volumetric simultaneous SAR summation is required per FCC KDB Publication 447498 D01v06 and IEEE 1528-2013 Section 6.3.4.1.2.

## 12. SAR MEASUREMENT VARIABILITY

### 12.1 Measurement Variability

Per FCC KDB Publication 865664 D01v01r04, SAR measurement variability was assessed for each frequency band, which was determined by the SAR probe calibration point and tissue-equivalent medium used for the device measurements. When both head and body tissue-equivalent media were required for SAR measurements in a frequency band, the variability measurement procedures were applied to the tissue medium with the highest measured SAR, using the highest measured SAR configuration for that tissue-equivalent medium. These additional measurements were repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device was returned to ambient conditions (normal room temperature) with the battery fully charged before it was re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

SAR Measurement Variability was assessed using the following procedures for each frequency band:

1. When the original highest measured SAR is  $\geq 0.80$  W/kg, the measurement was repeated once.
2. A second repeated measurement was performed only if the ratio of largest to smallest SAR for the original and first repeated measurements was  $> 1.20$  or when the original or repeated measurement was  $\geq 1.45$  W/kg (~ 10% from the 1-g SAR limit).
3. A third repeated measurement was performed only if the original, first or second repeated measurement was  $\geq 1.5$  W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is  $> 1.20$ .
4. Repeated measurements are not required when the original highest measured SAR is  $< 0.80$  W/kg
5. The same procedures should be adapted for measurements according to extremity exposure limits by applying a factor of 2.5 for extremity exposure to the corresponding SAR thresholds.

**Table 12.1 Body SAR Measurement Variability Results**

| Frequency                                                                                                 |       | Mode       | Service | # of Time Slots | Spacing [Side] | Measured SAR (1g) | 1st Repeated SAR(1g)                            | Ratio | 2nd Repeated SAR(1g) | Ratio | 3rd Repeated SAR(1g) | Ratio |
|-----------------------------------------------------------------------------------------------------------|-------|------------|---------|-----------------|----------------|-------------------|-------------------------------------------------|-------|----------------------|-------|----------------------|-------|
| MHz                                                                                                       | Ch.   |            |         |                 |                | (W/kg)            | (W/kg)                                          |       | (W/kg)               |       | (W/kg)               |       |
| 826.4                                                                                                     | 4132  | WCDMA 850  | RMC     | -               | 5 mm [Rear #2] | 1.040             | 1.000                                           | 1.04  | -                    | -     | -                    | -     |
| 1907.6                                                                                                    | 9538  | WCDMA 1900 | RMC     | -               | 5 mm [Rear #2] | 1.110             | 1.100                                           | 1.01  | -                    | -     | -                    | -     |
| 1880.0                                                                                                    | 18900 | LTE B2     | -       | -               | 5 mm [Bottom]  | 1.120             | 1.110                                           | 1.01  | -                    | -     | -                    | -     |
| ANSI / IEEE C95.1-1992- SAFETY LIMIT<br>Spatial Peak<br>Uncontrolled Exposure/General Population Exposure |       |            |         |                 |                |                   | Body<br>1.6 W/kg (mW/g)<br>averaged over 1 gram |       |                      |       |                      |       |

### 12.2 Measurement Uncertainty

The measured SAR was  $< 1.5$  W/kg for 1g and  $< 3.75$  W/kg for 10g for all frequency bands. Therefore, per KDB Publication 865664 D01v01r04, the extended measurement uncertainty analysis per IEEE 1528-2013 was not required.

## 13. EQUIPMENT LIST

Table 13.1.1 Test Equipment Calibration

|                                     | Type                                               | Manufacturer           | Model                    | Cal.Date   | Next.Cal.Date | S/N             |
|-------------------------------------|----------------------------------------------------|------------------------|--------------------------|------------|---------------|-----------------|
| <input checked="" type="checkbox"/> | SEMITEC Engineering                                | SEMITEC                | N/A                      | N/A        | N/A           | Shield Room     |
| <input checked="" type="checkbox"/> | Robot                                              | SPEAG                  | TX60L                    | N/A        | N/A           | F14/5VR2A1/A/01 |
| <input checked="" type="checkbox"/> | Robot Controller                                   | SPEAG                  | CS8C                     | N/A        | N/A           | F14/5VR2A1/C/01 |
| <input checked="" type="checkbox"/> | Joystick                                           | SPEAG                  | N/A                      | N/A        | N/A           | D21142605A      |
| <input checked="" type="checkbox"/> | Intel Core i7-4770 3.40 GHz Windows 7 Professional | N/A                    | N/A                      | N/A        | N/A           | N/A             |
| <input checked="" type="checkbox"/> | Probe Alignment Unit LB                            | N/A                    | N/A                      | N/A        | N/A           | SE UKS 030 AA   |
| <input checked="" type="checkbox"/> | Device Holder                                      | SPEAG                  | SD000H01HA               | N/A        | N/A           | N/A             |
| <input checked="" type="checkbox"/> | Twin SAM Phantom                                   | SPEAG                  | QD000P40CD               | N/A        | N/A           | 1220            |
| <input checked="" type="checkbox"/> | Data Acquisition Electronics                       | SPEAG                  | DAE4V1                   | 2020-04-22 | 2021-04-22    | 1391            |
| <input checked="" type="checkbox"/> | Dosimetric E-Field Probe                           | SPEAG                  | EX3DV4                   | 2020-01-30 | 2021-01-30    | 7368            |
| <input checked="" type="checkbox"/> | 750MHz SAR Dipole                                  | SPEAG                  | D750V3                   | 2020-01-22 | 2022-01-22    | 1049            |
| <input checked="" type="checkbox"/> | 835MHz SAR Dipole                                  | SPEAG                  | D835V2                   | 2020-05-19 | 2022-05-19    | 4d159           |
| <input checked="" type="checkbox"/> | 1800MHz SAR Dipole                                 | SPEAG                  | D1800V2                  | 2020-03-20 | 2022-03-20    | 2d202           |
| <input checked="" type="checkbox"/> | 1900MHz SAR Dipole                                 | SPEAG                  | D1900V2                  | 2020-05-19 | 2022-05-19    | 5d176           |
| <input checked="" type="checkbox"/> | 2450MHz SAR Dipole                                 | SPEAG                  | D2450V2                  | 2019-09-19 | 2021-09-19    | 726             |
| <input checked="" type="checkbox"/> | 5GHz SAR Dipole                                    | SPEAG                  | D5GHzV2                  | 2020-02-27 | 2022-02-27    | 1212            |
| <input checked="" type="checkbox"/> | Network Analyzer                                   | Agilent                | E5071C                   | 2020-06-24 | 2021-06-24    | MY46106970      |
| <input checked="" type="checkbox"/> | Signal Generator                                   | Agilent                | E4438C                   | 2020-06-24 | 2021-06-24    | US41461520      |
| <input checked="" type="checkbox"/> | Amplifier                                          | RFBAY.Inc              | MPA-40-40                | 2019-12-16 | 2020-12-16    | 21151801        |
| <input checked="" type="checkbox"/> | Amplifier                                          | EMPOWER                | BBS3Q7ELU                | 2020-06-24 | 2021-06-24    | 1020            |
| <input checked="" type="checkbox"/> | High Power RF Amplifier                            | EMPOWER                | BBS3Q8CCJ                | 2020-06-24 | 2021-06-24    | 1005            |
| <input checked="" type="checkbox"/> | Power Meter                                        | HP                     | EBM-442A                 | 2019-12-16 | 2020-12-16    | GB37170267      |
| <input checked="" type="checkbox"/> | Power Meter                                        | HP                     | EPM-442A                 | 2019-12-16 | 2020-12-16    | GB37170413      |
| <input checked="" type="checkbox"/> | Power Sensor                                       | HP                     | 8481A                    | 2019-12-16 | 2020-12-16    | US37294267      |
| <input checked="" type="checkbox"/> | Power Sensor                                       | HP                     | 8481A                    | 2019-12-16 | 2020-12-16    | 3318A96566      |
| <input checked="" type="checkbox"/> | Power Sensor                                       | HP                     | 8481A                    | 2019-12-16 | 2020-12-16    | 2702A65976      |
| <input checked="" type="checkbox"/> | Dual Directional Coupler                           | Agilent                | 778D-012                 | 2019-12-16 | 2020-12-16    | 50228           |
| <input checked="" type="checkbox"/> | Directional Coupler                                | HP                     | 772D                     | 2020-06-24 | 2021-06-24    | 2889A01064      |
| <input checked="" type="checkbox"/> | Low Pass Filter 1GHz                               | Wainwright Instruments | WLK6-1000-1400-9000-60SS | 2020-06-24 | 2021-06-24    | 165             |
| <input checked="" type="checkbox"/> | Low Pass Filter 1.5GHz                             | Micro LAB              | LA-15N                   | 2020-06-24 | 2021-06-24    | 2               |
| <input checked="" type="checkbox"/> | Low Pass Filter 3.0GHz                             | Micro LAB              | LA-30N                   | 2020-06-24 | 2021-06-24    | 2               |
| <input checked="" type="checkbox"/> | Low Pass Filter 6.0GHz                             | Micro LAB              | LA-60N                   | 2019-12-16 | 2020-12-16    | 03942           |
| <input checked="" type="checkbox"/> | Attenuators(10 dB)                                 | WEINSCHEL              | 23-10-34                 | 2019-12-16 | 2020-12-16    | BP4387          |
| <input checked="" type="checkbox"/> | Attenuators                                        | Cernexwave             | CFADC2603U5              | 2020-06-24 | 2021-06-24    | C11711          |
| <input checked="" type="checkbox"/> | Dielectric Probe kit                               | SPEAG                  | DAK-3.5                  | 2019-11-19 | 2020-11-19    | 1092            |
| <input checked="" type="checkbox"/> | 8960 Series 10 Wireless Comms. Test Set            | Agilent                | E5515C                   | 2020-06-24 | 2021-06-24    | GB41321164      |
| <input checked="" type="checkbox"/> | Wideband Radio Communication Tester                | Rohde Schwarz          | CMW500                   | 2019-12-16 | 2020-12-16    | 101414          |
| <input checked="" type="checkbox"/> | Radio Communication Analyzer                       | Agilent                | E5515E                   | 2020-06-24 | 2021-06-24    | MY52113012      |
| <input checked="" type="checkbox"/> | Power Splitter                                     | Anritsu                | K241B                    | 2019-12-16 | 2020-12-16    | 1301183         |
| <input checked="" type="checkbox"/> | Bluetooth Tester                                   | TESCOM                 | TC-3000C                 | 2020-06-24 | 2021-06-24    | 3000C000563     |

### NOTE(S):

- The E-field probe was calibrated by SPEAG, by temperature measurement procedure. Dipole Verification measurement is performed by DT&C before each test. The brain and muscle simulating material are calibrated by DT&C using the dielectric probe system and network analyzer to determine the conductivity and permittivity (dielectric constant) of the brain and muscle-equivalent material. Each equipment item was used solely within its respective calibration period.
- CBT(Calibrated Before Testing). Prior to testing, the measurement paths containing a cable, amplifier, attenuator, coupler or filter were connected to a calibrated source (i.e. signal generator) to determine the losses of the measurement path. The power meter offset was then adjusted to compensate for the measurement system losses. This level offset is stored within the power meter before measurements are made. This calibration verification procedure applies to the system verification and output power measurements. The calibrated reading is then taken directly from the power meter after compensation of the losses for all final power measurements.

## 14. MEASUREMENT UNCERTAINTIES

### 750 MHz Head (SN: 7368)

| Error Description                    | Uncertainty value $\pm\%$ | Probability Distribution | Divisor    | (Ci) 1 g | (Ci) 10 g | Standard 1 g ( $\pm\%$ ) | Standard 10 g ( $\pm\%$ ) | vi 2 or Veff |
|--------------------------------------|---------------------------|--------------------------|------------|----------|-----------|--------------------------|---------------------------|--------------|
| <b>Measurement System</b>            |                           |                          |            |          |           |                          |                           |              |
| Probe calibration                    | 6.0                       | Normal                   | 1          | 1        | 1         | 6.0                      | 6.0                       | $\infty$     |
| Isotropy                             | 1.3                       | Normal                   | 1          | 1        | 1         | 1.3                      | 1.3                       | $\infty$     |
| Boundary Effects                     | 2.0                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 1.2                      | 1.2                       | $\infty$     |
| Probe Linearity                      | 0.3                       | Normal                   | 1          | 1        | 1         | 0.3                      | 0.3                       | $\infty$     |
| Probe modulation response            | 0.0                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 0.0                      | 0.0                       | $\infty$     |
| Detection limits                     | 0.25                      | Rectangular              | $\sqrt{3}$ | 1        | 1         | 0.14                     | 0.14                      | $\infty$     |
| Readout Electronics                  | 0.3                       | Normal                   | 1          | 1        | 1         | 0.3                      | 0.3                       | $\infty$     |
| Response time                        | 0.8                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 0.46                     | 0.46                      | $\infty$     |
| Integration time                     | 2.6                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 1.5                      | 1.5                       | $\infty$     |
| RF Ambient Conditions – Noise        | 3.0                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 1.7                      | 1.7                       | $\infty$     |
| RF Ambient Conditions – Reflections  | 3.0                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 1.7                      | 1.7                       | $\infty$     |
| Probe Positioner                     | 0.8                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 0.46                     | 0.46                      | $\infty$     |
| Probe Positioning                    | 6.7                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 3.9                      | 3.9                       | $\infty$     |
| Algorithms for Max. SAR Eval.        | 4.0                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 2.3                      | 2.3                       | $\infty$     |
| <b>Test Sample Related</b>           |                           |                          |            |          |           |                          |                           |              |
| Device Positioning                   | 2.9                       | Normal                   | 1          | 1        | 1         | 2.9                      | 2.9                       | 145          |
| Device Holder                        | 3.6                       | Normal                   | 1          | 1        | 1         | 3.6                      | 3.6                       | 5            |
| Power Drift                          | 5.0                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 2.9                      | 2.9                       | $\infty$     |
| SAR Scaling                          | 0.0                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 0.0                      | 0.0                       | $\infty$     |
| <b>Physical Parameters</b>           |                           |                          |            |          |           |                          |                           |              |
| Phantom Shell                        | 7.6                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 4.4                      | 4.4                       | $\infty$     |
| SAR correction                       | 0.0                       | Normal                   | 1          | 1        | 0.84      | 0.0                      | 0.0                       | $\infty$     |
| Liquid conductivity (Target)         | 5.0                       | Rectangular              | $\sqrt{3}$ | 0.64     | 0.43      | 1.8                      | 1.2                       | $\infty$     |
| Liquid conductivity (Meas.)          | 4.0                       | Normal                   | 1          | 0.78     | 0.71      | 3.1                      | 2.8                       | 10           |
| Liquid permittivity (Target)         | 5.0                       | Rectangular              | $\sqrt{3}$ | 0.60     | 0.49      | 1.7                      | 1.4                       | $\infty$     |
| Liquid permittivity (Meas.)          | 4.0                       | Normal                   | 1          | 0.23     | 0.26      | 0.9                      | 1.0                       | 10           |
| Temp. unc. - Conductivity            | 2.0                       | Rectangular              | $\sqrt{3}$ | 0.78     | 0.71      | 0.9                      | 0.8                       | $\infty$     |
| Temp. unc. - Permittivity            | 1.9                       | Rectangular              | $\sqrt{3}$ | 0.23     | 0.26      | 0.3                      | 0.3                       | $\infty$     |
| <b>Combined Standard Uncertainty</b> |                           |                          |            |          |           | <b>12</b>                | <b>11</b>                 | <b>330</b>   |
| <b>Expanded Uncertainty (k=2)</b>    |                           |                          |            |          |           | <b>24</b>                | <b>22</b>                 |              |

$$U(1\text{ g}) = k \cdot u_c$$

$$= 2 \cdot 12\%$$

$$= 24\% \text{ (The confidence level is about 95 \% } k = 2 \text{)}$$

$$U(10\text{ g}) = k \cdot u_c$$

$$= 2 \cdot 11\%$$

$$= 22\% \text{ (The confidence level is about 95 \% } k = 2 \text{)}$$

The above measurement uncertainties are according to IEEE Std 1528

### 835 MHz Head (SN: 7368)

| Error Description                    | Uncertainty value $\pm\%$ | Probability Distribution | Divisor    | (Ci) 1 g | (Ci) 10 g | Standard 1 g ( $\pm\%$ ) | Standard 10 g ( $\pm\%$ ) | vi 2 or Veff |
|--------------------------------------|---------------------------|--------------------------|------------|----------|-----------|--------------------------|---------------------------|--------------|
| <b>Measurement System</b>            |                           |                          |            |          |           |                          |                           |              |
| Probe calibration                    | 6.0                       | Normal                   | 1          | 1        | 1         | 6.0                      | 6.0                       | $\infty$     |
| Isotropy                             | 1.3                       | Normal                   | 1          | 1        | 1         | 1.3                      | 1.3                       | $\infty$     |
| Boundary Effects                     | 2.0                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 1.2                      | 1.2                       | $\infty$     |
| Probe Linearity                      | 0.3                       | Normal                   | 1          | 1        | 1         | 0.3                      | 0.3                       | $\infty$     |
| Probe modulation response            | 0.0                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 0.0                      | 0.0                       | $\infty$     |
| Detection limits                     | 0.25                      | Rectangular              | $\sqrt{3}$ | 1        | 1         | 0.14                     | 0.14                      | $\infty$     |
| Readout Electronics                  | 0.3                       | Normal                   | 1          | 1        | 1         | 0.3                      | 0.3                       | $\infty$     |
| Response time                        | 0.8                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 0.46                     | 0.46                      | $\infty$     |
| Integration time                     | 2.6                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 1.5                      | 1.5                       | $\infty$     |
| RF Ambient Conditions – Noise        | 3.0                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 1.7                      | 1.7                       | $\infty$     |
| RF Ambient Conditions – Reflections  | 3.0                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 1.7                      | 1.7                       | $\infty$     |
| Probe Positioner                     | 0.8                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 0.46                     | 0.46                      | $\infty$     |
| Probe Positioning                    | 6.7                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 3.9                      | 3.9                       | $\infty$     |
| Algorithms for Max. SAR Eval.        | 4.0                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 2.3                      | 2.3                       | $\infty$     |
| <b>Test Sample Related</b>           |                           |                          |            |          |           |                          |                           |              |
| Device Positioning                   | 2.9                       | Normal                   | 1          | 1        | 1         | 2.9                      | 2.9                       | 145          |
| Device Holder                        | 3.6                       | Normal                   | 1          | 1        | 1         | 3.6                      | 3.6                       | 5            |
| Power Drift                          | 5.0                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 2.9                      | 2.9                       | $\infty$     |
| SAR Scaling                          | 0.0                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 0.0                      | 0.0                       | $\infty$     |
| <b>Physical Parameters</b>           |                           |                          |            |          |           |                          |                           |              |
| Phantom Shell                        | 7.6                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 4.4                      | 4.4                       | $\infty$     |
| SAR correction                       | 0.0                       | Normal                   | 1          | 1        | 0.84      | 0.0                      | 0.0                       | $\infty$     |
| Liquid conductivity (Target)         | 5.0                       | Rectangular              | $\sqrt{3}$ | 0.64     | 0.43      | 1.8                      | 1.2                       | $\infty$     |
| Liquid conductivity (Meas.)          | 3.9                       | Normal                   | 1          | 0.78     | 0.71      | 3.0                      | 2.8                       | 10           |
| Liquid permittivity (Target)         | 5.0                       | Rectangular              | $\sqrt{3}$ | 0.60     | 0.49      | 1.7                      | 1.4                       | $\infty$     |
| Liquid permittivity (Meas.)          | 3.8                       | Normal                   | 1          | 0.23     | 0.26      | 0.9                      | 1.0                       | 10           |
| Temp. unc. - Conductivity            | 1.8                       | Rectangular              | $\sqrt{3}$ | 0.78     | 0.71      | 0.8                      | 0.7                       | $\infty$     |
| Temp. unc. - Permittivity            | 1.7                       | Rectangular              | $\sqrt{3}$ | 0.23     | 0.26      | 0.2                      | 0.3                       | $\infty$     |
| <b>Combined Standard Uncertainty</b> |                           |                          |            |          |           | <b>12</b>                | <b>11</b>                 | <b>330</b>   |
| <b>Expanded Uncertainty (k=2)</b>    |                           |                          |            |          |           | <b>24</b>                | <b>22</b>                 |              |

$$U(1\text{ g}) = k \cdot u_c$$

$$= 2 \cdot 12\%$$

$$= 24\% \text{ (The confidence level is about 95 \% } k = 2 \text{)}$$

$$U(10\text{ g}) = k \cdot u_c$$

$$= 2 \cdot 11\%$$

$$= 22\% \text{ (The confidence level is about 95 \% } k = 2 \text{)}$$

The above measurement uncertainties are according to IEEE Std 1528

## 1 800 MHz Head (SN: 7368)

| Error Description                    | Uncertainty value $\pm\%$ | Probability Distribution | Divisor    | (Ci) 1 g | (Ci) 10 g | Standard 1 g ( $\pm\%$ ) | Standard 10 g ( $\pm\%$ ) | vi 2 or Veff |
|--------------------------------------|---------------------------|--------------------------|------------|----------|-----------|--------------------------|---------------------------|--------------|
| <b>Measurement System</b>            |                           |                          |            |          |           |                          |                           |              |
| Probe calibration                    | 6.0                       | Normal                   | 1          | 1        | 1         | 6.0                      | 6.0                       | $\infty$     |
| Isotropy                             | 1.3                       | Normal                   | 1          | 1        | 1         | 1.3                      | 1.3                       | $\infty$     |
| Boundary Effects                     | 2.0                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 1.2                      | 1.2                       | $\infty$     |
| Probe Linearity                      | 0.3                       | Normal                   | 1          | 1        | 1         | 0.3                      | 0.3                       | $\infty$     |
| Probe modulation response            | 0.0                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 0.0                      | 0.0                       | $\infty$     |
| Detection limits                     | 0.25                      | Rectangular              | $\sqrt{3}$ | 1        | 1         | 0.14                     | 0.14                      | $\infty$     |
| Readout Electronics                  | 0.3                       | Normal                   | 1          | 1        | 1         | 0.3                      | 0.3                       | $\infty$     |
| Response time                        | 0.8                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 0.46                     | 0.46                      | $\infty$     |
| Integration time                     | 2.6                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 1.5                      | 1.5                       | $\infty$     |
| RF Ambient Conditions – Noise        | 3.0                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 1.7                      | 1.7                       | $\infty$     |
| RF Ambient Conditions – Reflections  | 3.0                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 1.7                      | 1.7                       | $\infty$     |
| Probe Positioner                     | 0.8                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 0.46                     | 0.46                      | $\infty$     |
| Probe Positioning                    | 6.7                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 3.9                      | 3.9                       | $\infty$     |
| Algorithms for Max. SAR Eval.        | 4.0                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 2.3                      | 2.3                       | $\infty$     |
| <b>Test Sample Related</b>           |                           |                          |            |          |           |                          |                           |              |
| Device Positioning                   | 2.9                       | Normal                   | 1          | 1        | 1         | 2.9                      | 2.9                       | 145          |
| Device Holder                        | 3.6                       | Normal                   | 1          | 1        | 1         | 3.6                      | 3.6                       | 5            |
| Power Drift                          | 5.0                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 2.9                      | 2.9                       | $\infty$     |
| SAR Scaling                          | 0.0                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 0.0                      | 0.0                       | $\infty$     |
| <b>Physical Parameters</b>           |                           |                          |            |          |           |                          |                           |              |
| Phantom Shell                        | 7.6                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 4.4                      | 4.4                       | $\infty$     |
| SAR correction                       | 0.0                       | Normal                   | 1          | 1        | 0.84      | 0.0                      | 0.0                       | $\infty$     |
| Liquid conductivity (Target)         | 5.0                       | Rectangular              | $\sqrt{3}$ | 0.64     | 0.43      | 1.8                      | 1.2                       | $\infty$     |
| Liquid conductivity (Meas.)          | 4.0                       | Normal                   | 1          | 0.78     | 0.71      | 3.1                      | 2.8                       | 10           |
| Liquid permittivity (Target)         | 5.0                       | Rectangular              | $\sqrt{3}$ | 0.60     | 0.49      | 1.7                      | 1.4                       | $\infty$     |
| Liquid permittivity (Meas.)          | 4.2                       | Normal                   | 1          | 0.23     | 0.26      | 1.0                      | 1.1                       | 10           |
| Temp. unc. - Conductivity            | 2.1                       | Rectangular              | $\sqrt{3}$ | 0.78     | 0.71      | 0.9                      | 0.9                       | $\infty$     |
| Temp. unc. - Permittivity            | 2.1                       | Rectangular              | $\sqrt{3}$ | 0.23     | 0.26      | 0.3                      | 0.3                       | $\infty$     |
| <b>Combined Standard Uncertainty</b> |                           |                          |            |          |           | <b>12</b>                | <b>11</b>                 | <b>330</b>   |
| <b>Expanded Uncertainty (k=2)</b>    |                           |                          |            |          |           | <b>24</b>                | <b>22</b>                 |              |

$$U(1\text{ g}) = k \cdot u_c$$

$$= 2 \cdot 12\%$$

$$= 24\% \text{ (The confidence level is about } 95\% \text{ } k = 2)$$

$$U(10\text{ g}) = k \cdot u_c$$

$$= 2 \cdot 11\%$$

$$= 22\% \text{ (The confidence level is about } 95\% \text{ } k = 2)$$

The above measurement uncertainties are according to IEEE Std 1528

## 1 900 MHz Head (SN: 7368)

| Error Description                    | Uncertainty value $\pm\%$ | Probability Distribution | Divisor    | (Ci) 1 g | (Ci) 10 g | Standard 1 g ( $\pm\%$ ) | Standard 10 g ( $\pm\%$ ) | vi 2 or Veff |
|--------------------------------------|---------------------------|--------------------------|------------|----------|-----------|--------------------------|---------------------------|--------------|
| <b>Measurement System</b>            |                           |                          |            |          |           |                          |                           |              |
| Probe calibration                    | 6.0                       | Normal                   | 1          | 1        | 1         | 6.0                      | 6.0                       | $\infty$     |
| Isotropy                             | 1.3                       | Normal                   | 1          | 1        | 1         | 1.3                      | 1.3                       | $\infty$     |
| Boundary Effects                     | 2.0                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 1.2                      | 1.2                       | $\infty$     |
| Probe Linearity                      | 0.3                       | Normal                   | 1          | 1        | 1         | 0.3                      | 0.3                       | $\infty$     |
| Probe modulation response            | 0.0                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 0.0                      | 0.0                       | $\infty$     |
| Detection limits                     | 0.25                      | Rectangular              | $\sqrt{3}$ | 1        | 1         | 0.14                     | 0.14                      | $\infty$     |
| Readout Electronics                  | 0.3                       | Normal                   | 1          | 1        | 1         | 0.3                      | 0.3                       | $\infty$     |
| Response time                        | 0.8                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 0.46                     | 0.46                      | $\infty$     |
| Integration time                     | 2.6                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 1.5                      | 1.5                       | $\infty$     |
| RF Ambient Conditions – Noise        | 3.0                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 1.7                      | 1.7                       | $\infty$     |
| RF Ambient Conditions – Reflections  | 3.0                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 1.7                      | 1.7                       | $\infty$     |
| Probe Positioner                     | 0.8                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 0.46                     | 0.46                      | $\infty$     |
| Probe Positioning                    | 6.7                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 3.9                      | 3.9                       | $\infty$     |
| Algorithms for Max. SAR Eval.        | 4.0                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 2.3                      | 2.3                       | $\infty$     |
| <b>Test Sample Related</b>           |                           |                          |            |          |           |                          |                           |              |
| Device Positioning                   | 2.9                       | Normal                   | 1          | 1        | 1         | 2.9                      | 2.9                       | 145          |
| Device Holder                        | 3.6                       | Normal                   | 1          | 1        | 1         | 3.6                      | 3.6                       | 5            |
| Power Drift                          | 5.0                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 2.9                      | 2.9                       | $\infty$     |
| SAR Scaling                          | 0.0                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 0.0                      | 0.0                       | $\infty$     |
| <b>Physical Parameters</b>           |                           |                          |            |          |           |                          |                           |              |
| Phantom Shell                        | 7.6                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 4.4                      | 4.4                       | $\infty$     |
| SAR correction                       | 0.0                       | Normal                   | 1          | 1        | 0.84      | 0.0                      | 0.0                       | $\infty$     |
| Liquid conductivity (Target)         | 5.0                       | Rectangular              | $\sqrt{3}$ | 0.64     | 0.43      | 1.8                      | 1.2                       | $\infty$     |
| Liquid conductivity (Meas.)          | 3.8                       | Normal                   | 1          | 0.78     | 0.71      | 3.0                      | 2.7                       | 10           |
| Liquid permittivity (Target)         | 5.0                       | Rectangular              | $\sqrt{3}$ | 0.60     | 0.49      | 1.7                      | 1.4                       | $\infty$     |
| Liquid permittivity (Meas.)          | 4.0                       | Normal                   | 1          | 0.23     | 0.26      | 0.9                      | 1.0                       | 10           |
| Temp. unc. - Conductivity            | 1.8                       | Rectangular              | $\sqrt{3}$ | 0.78     | 0.71      | 0.8                      | 0.7                       | $\infty$     |
| Temp. unc. - Permittivity            | 1.9                       | Rectangular              | $\sqrt{3}$ | 0.23     | 0.26      | 0.3                      | 0.3                       | $\infty$     |
| <b>Combined Standard Uncertainty</b> |                           |                          |            |          |           | <b>12</b>                | <b>11</b>                 | <b>330</b>   |
| <b>Expanded Uncertainty (k=2)</b>    |                           |                          |            |          |           | <b>24</b>                | <b>22</b>                 |              |

$$U(1\text{ g}) = k \cdot u_c$$

$$= 2 \cdot 12\%$$

$$= 24\% \text{ (The confidence level is about 95 \% } k = 2)$$

$$U(10\text{ g}) = k \cdot u_c$$

$$= 2 \cdot 11\%$$

$$= 22\% \text{ (The confidence level is about 95 \% } k = 2)$$

## 2 450 MHz Head

| Error Description                    | Uncertainty value $\pm\%$ | Probability Distribution | Divisor    | (Ci) 1 g | (Ci) 10 g | Standard 1 g ( $\pm\%$ ) | Standard 10 g ( $\pm\%$ ) | vi 2 or Veff |
|--------------------------------------|---------------------------|--------------------------|------------|----------|-----------|--------------------------|---------------------------|--------------|
| <b>Measurement System</b>            |                           |                          |            |          |           |                          |                           |              |
| Probe calibration                    | 6.0                       | Normal                   | 1          | 1        | 1         | 6.0                      | 6.0                       | $\infty$     |
| Isotropy                             | 1.3                       | Normal                   | 1          | 1        | 1         | 1.3                      | 1.3                       | $\infty$     |
| Boundary Effects                     | 2.0                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 1.2                      | 1.2                       | $\infty$     |
| Probe Linearity                      | 0.3                       | Normal                   | 1          | 1        | 1         | 0.3                      | 0.3                       | $\infty$     |
| Probe modulation response            | 0.0                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 0.0                      | 0.0                       | $\infty$     |
| Detection limits                     | 0.25                      | Rectangular              | $\sqrt{3}$ | 1        | 1         | 0.14                     | 0.14                      | $\infty$     |
| Readout Electronics                  | 0.3                       | Normal                   | 1          | 1        | 1         | 0.3                      | 0.3                       | $\infty$     |
| Response time                        | 0.8                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 0.46                     | 0.46                      | $\infty$     |
| Integration time                     | 2.6                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 1.5                      | 1.5                       | $\infty$     |
| RF Ambient Conditions – Noise        | 3.0                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 1.7                      | 1.7                       | $\infty$     |
| RF Ambient Conditions – Reflections  | 3.0                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 1.7                      | 1.7                       | $\infty$     |
| Probe Positioner                     | 0.8                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 0.46                     | 0.46                      | $\infty$     |
| Probe Positioning                    | 6.7                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 3.9                      | 3.9                       | $\infty$     |
| Algorithms for Max. SAR Eval.        | 4.0                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 2.3                      | 2.3                       | $\infty$     |
| <b>Test Sample Related</b>           |                           |                          |            |          |           |                          |                           |              |
| Device Positioning                   | 2.9                       | Normal                   | 1          | 1        | 1         | 2.9                      | 2.9                       | 145          |
| Device Holder                        | 3.6                       | Normal                   | 1          | 1        | 1         | 3.6                      | 3.6                       | 5            |
| Power Drift                          | 5.0                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 2.9                      | 2.9                       | $\infty$     |
| SAR Scaling                          | 0.0                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 0.0                      | 0.0                       | $\infty$     |
| <b>Physical Parameters</b>           |                           |                          |            |          |           |                          |                           |              |
| Phantom Shell                        | 7.6                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 4.4                      | 4.4                       | $\infty$     |
| SAR correction                       | 0.0                       | Normal                   | 1          | 1        | 0.84      | 0.0                      | 0.0                       | $\infty$     |
| Liquid conductivity (Target)         | 5.0                       | Rectangular              | $\sqrt{3}$ | 0.64     | 0.43      | 1.8                      | 1.2                       | $\infty$     |
| Liquid conductivity (Meas.)          | 4.2                       | Normal                   | 1          | 0.78     | 0.71      | 3.3                      | 3.0                       | 10           |
| Liquid permittivity (Target)         | 5.0                       | Rectangular              | $\sqrt{3}$ | 0.60     | 0.49      | 1.7                      | 1.4                       | $\infty$     |
| Liquid permittivity (Meas.)          | 4.0                       | Normal                   | 1          | 0.23     | 0.26      | 0.9                      | 1.0                       | 10           |
| Temp. unc. - Conductivity            | 2.0                       | Rectangular              | $\sqrt{3}$ | 0.78     | 0.71      | 0.9                      | 0.8                       | $\infty$     |
| Temp. unc. - Permittivity            | 1.8                       | Rectangular              | $\sqrt{3}$ | 0.23     | 0.26      | 0.2                      | 0.3                       | $\infty$     |
| <b>Combined Standard Uncertainty</b> |                           |                          |            |          |           | <b>12.</b>               | <b>12</b>                 | <b>330</b>   |
| <b>Expanded Uncertainty (k=2)</b>    |                           |                          |            |          |           | <b>24</b>                | <b>24</b>                 |              |

$$U(1\text{ g}) = k \cdot u_c$$

$$= 2 \cdot 12\%$$

$$= 24\% \text{ (The confidence level is about } 95\% \text{ } k = 2)$$

$$U(10\text{ g}) = k \cdot u_c$$

$$= 2 \cdot 12\%$$

$$= 24\% \text{ (The confidence level is about } 95\% \text{ } k = 2)$$

The above measurement uncertainties are according to IEEE Std 1528

### 5300 MHz Head (SN: 7368)

| Error Description                    | Uncertainty value $\pm\%$ | Probability Distribution | Divisor    | (Ci) 1 g | (Ci) 10 g | Standard 1 g ( $\pm\%$ ) | Standard 10 g ( $\pm\%$ ) | vi 2 or Veff |
|--------------------------------------|---------------------------|--------------------------|------------|----------|-----------|--------------------------|---------------------------|--------------|
| <b>Measurement System</b>            |                           |                          |            |          |           |                          |                           |              |
| Probe calibration                    | 6.55                      | Normal                   | 1          | 1        | 1         | 6.6                      | 6.6                       | $\infty$     |
| Isotropy                             | 1.3                       | Normal                   | 1          | 1        | 1         | 1.3                      | 1.3                       | $\infty$     |
| Boundary Effects                     | 2.0                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 1.2                      | 1.2                       | $\infty$     |
| Probe Linearity                      | 0.3                       | Normal                   | 1          | 1        | 1         | 0.3                      | 0.3                       | $\infty$     |
| Probe modulation response            | 0.0                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 0.0                      | 0.0                       | $\infty$     |
| Detection limits                     | 0.25                      | Rectangular              | $\sqrt{3}$ | 1        | 1         | 0.14                     | 0.14                      | $\infty$     |
| Readout Electronics                  | 0.3                       | Normal                   | 1          | 1        | 1         | 0.3                      | 0.3                       | $\infty$     |
| Response time                        | 0.8                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 0.46                     | 0.46                      | $\infty$     |
| Integration time                     | 2.6                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 1.5                      | 1.5                       | $\infty$     |
| RF Ambient Conditions – Noise        | 3.0                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 1.7                      | 1.7                       | $\infty$     |
| RF Ambient Conditions – Reflections  | 3.0                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 1.7                      | 1.7                       | $\infty$     |
| Probe Positioner                     | 0.8                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 0.46                     | 0.46                      | $\infty$     |
| Probe Positioning                    | 6.7                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 3.9                      | 3.9                       | $\infty$     |
| Algorithms for Max. SAR Eval.        | 4.0                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 2.3                      | 2.3                       | $\infty$     |
| <b>Test Sample Related</b>           |                           |                          |            |          |           |                          |                           |              |
| Device Positioning                   | 2.9                       | Normal                   | 1          | 1        | 1         | 2.9                      | 2.9                       | 145          |
| Device Holder                        | 3.6                       | Normal                   | 1          | 1        | 1         | 3.6                      | 3.6                       | 5            |
| Power Drift                          | 5.0                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 2.9                      | 2.9                       | $\infty$     |
| SAR Scaling                          | 0.0                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 0.0                      | 0.0                       | $\infty$     |
| <b>Physical Parameters</b>           |                           |                          |            |          |           |                          |                           |              |
| Phantom Shell                        | 7.6                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 4.4                      | 4.4                       | $\infty$     |
| SAR correction                       | 0.0                       | Normal                   | 1          | 1        | 0.84      | 0.0                      | 0.0                       | $\infty$     |
| Liquid conductivity (Target)         | 5.0                       | Rectangular              | $\sqrt{3}$ | 0.64     | 0.43      | 1.8                      | 1.2                       | $\infty$     |
| Liquid conductivity (Meas.)          | 3.8                       | Normal                   | 1          | 0.78     | 0.71      | 3.0                      | 2.7                       | 10           |
| Liquid permittivity (Target)         | 5.0                       | Rectangular              | $\sqrt{3}$ | 0.60     | 0.49      | 1.7                      | 1.4                       | $\infty$     |
| Liquid permittivity (Meas.)          | 4.2                       | Normal                   | 1          | 0.23     | 0.26      | 1.0                      | 1.1                       | 10           |
| Temp. unc. - Conductivity            | 1.8                       | Rectangular              | $\sqrt{3}$ | 0.78     | 0.71      | 0.8                      | 0.7                       | $\infty$     |
| Temp. unc. - Permittivity            | 2.0                       | Rectangular              | $\sqrt{3}$ | 0.23     | 0.26      | 0.3                      | 0.3                       | $\infty$     |
| <b>Combined Standard Uncertainty</b> |                           |                          |            |          |           | <b>12</b>                | <b>12</b>                 | <b>330</b>   |
| <b>Expanded Uncertainty (k=2)</b>    |                           |                          |            |          |           | <b>24</b>                | <b>24</b>                 |              |

$$U(1\text{ g}) = k \cdot u_c$$

$$= 2 \cdot 12\%$$

$$= 24\% \text{ (The confidence level is about } 95\% \text{ } k = 2)$$

$$U(10\text{ g}) = k \cdot u_c$$

$$= 2 \cdot 12\%$$

$$= 24\% \text{ (The confidence level is about } 95\% \text{ } k = 2)$$

The above measurement uncertainties are according to IEEE Std 1528

### 5500 MHz Head (SN: 7368)

| Error Description                    | Uncertainty<br>value ±% | Probability<br>Distribution | Divisor | (Ci)<br>1 g | (Ci)<br>10 g | Standard<br>1 g (± %) | Standard<br>10 g (± %) | vi 2 or<br>Veff |
|--------------------------------------|-------------------------|-----------------------------|---------|-------------|--------------|-----------------------|------------------------|-----------------|
| <b>Measurement System</b>            |                         |                             |         |             |              |                       |                        |                 |
| Probe calibration                    | 6.55                    | Normal                      | 1       | 1           | 1            | 6.6                   | 6.6                    | ∞               |
| Isotropy                             | 1.3                     | Normal                      | 1       | 1           | 1            | 1.3                   | 1.3                    | ∞               |
| Boundary Effects                     | 2.0                     | Rectangular                 | √3      | 1           | 1            | 1.2                   | 1.2                    | ∞               |
| Probe Linearity                      | 0.3                     | Normal                      | 1       | 1           | 1            | 0.3                   | 0.3                    | ∞               |
| Probe modulation response            | 0.0                     | Rectangular                 | √3      | 1           | 1            | 0.0                   | 0.0                    | ∞               |
| Detection limits                     | 0.25                    | Rectangular                 | √3      | 1           | 1            | 0.14                  | 0.14                   | ∞               |
| Readout Electronics                  | 0.3                     | Normal                      | 1       | 1           | 1            | 0.3                   | 0.3                    | ∞               |
| Response time                        | 0.8                     | Rectangular                 | √3      | 1           | 1            | 0.46                  | 0.46                   | ∞               |
| Integration time                     | 2.6                     | Rectangular                 | √3      | 1           | 1            | 1.5                   | 1.5                    | ∞               |
| RF Ambient Conditions – Noise        | 3.0                     | Rectangular                 | √3      | 1           | 1            | 1.7                   | 1.7                    | ∞               |
| RF Ambient Conditions – Reflections  | 3.0                     | Rectangular                 | √3      | 1           | 1            | 1.7                   | 1.7                    | ∞               |
| Probe Positioner                     | 0.8                     | Rectangular                 | √3      | 1           | 1            | 0.46                  | 0.46                   | ∞               |
| Probe Positioning                    | 6.7                     | Rectangular                 | √3      | 1           | 1            | 3.9                   | 3.9                    | ∞               |
| Algorithms for Max. SAR Eval.        | 4.0                     | Rectangular                 | √3      | 1           | 1            | 2.3                   | 2.3                    | ∞               |
| <b>Test Sample Related</b>           |                         |                             |         |             |              |                       |                        |                 |
| Device Positioning                   | 2.9                     | Normal                      | 1       | 1           | 1            | 2.9                   | 2.9                    | 145             |
| Device Holder                        | 3.6                     | Normal                      | 1       | 1           | 1            | 3.6                   | 3.6                    | 5               |
| Power Drift                          | 5.0                     | Rectangular                 | √3      | 1           | 1            | 2.9                   | 2.9                    | ∞               |
| SAR Scaling                          | 0.0                     | Rectangular                 | √3      | 1           | 1            | 0.0                   | 0.0                    | ∞               |
| <b>Physical Parameters</b>           |                         |                             |         |             |              |                       |                        |                 |
| Phantom Shell                        | 7.6                     | Rectangular                 | √3      | 1           | 1            | 4.4                   | 4.4                    | ∞               |
| SAR correction                       | 0.0                     | Normal                      | 1       | 1           | 0.84         | 0.0                   | 0.0                    | ∞               |
| Liquid conductivity (Target)         | 5.0                     | Rectangular                 | √3      | 0.64        | 0.43         | 1.8                   | 1.2                    | ∞               |
| Liquid conductivity (Meas.)          | 3.7                     | Normal                      | 1       | 0.78        | 0.71         | 2.9                   | 2.6                    | 10              |
| Liquid permittivity (Target)         | 5.0                     | Rectangular                 | √3      | 0.60        | 0.49         | 1.7                   | 1.4                    | ∞               |
| Liquid permittivity (Meas.)          | 3.9                     | Normal                      | 1       | 0.23        | 0.26         | 0.9                   | 1.0                    | 10              |
| Temp. unc. - Conductivity            | 1.8                     | Rectangular                 | √3      | 0.78        | 0.71         | 0.8                   | 0.7                    | ∞               |
| Temp. unc. - Permittivity            | 1.9                     | Rectangular                 | √3      | 0.23        | 0.26         | 0.3                   | 0.3                    | ∞               |
| <b>Combined Standard Uncertainty</b> |                         |                             |         |             |              | <b>12</b>             | <b>12</b>              | <b>330</b>      |
| <b>Expanded Uncertainty (k=2)</b>    |                         |                             |         |             |              | <b>24</b>             | <b>24</b>              |                 |

$$U(1\text{ g}) = k \cdot u_c$$

$$= 2 \cdot 12\%$$

$$= 24\% \text{ (The confidence level is about 95 \% } k = 2)$$

$$U(10\text{ g}) = k \cdot u_c$$

$$= 2 \cdot 12\%$$

$$= 24\% \text{ (The confidence level is about 95 \% } k = 2)$$

The above measurement uncertainties are according to IEEE Std 1528

**5800 MHz Head (SN: 7368)**

| Error Description                    | Uncertainty value $\pm\%$ | Probability Distribution | Divisor    | (Ci) 1 g | (Ci) 10 g | Standard 1 g ( $\pm\%$ ) | Standard 10 g ( $\pm\%$ ) | vi 2 or Veff |
|--------------------------------------|---------------------------|--------------------------|------------|----------|-----------|--------------------------|---------------------------|--------------|
| <b>Measurement System</b>            |                           |                          |            |          |           |                          |                           |              |
| Probe calibration                    | 6.55                      | Normal                   | 1          | 1        | 1         | 6.6                      | 6.6                       | $\infty$     |
| Isotropy                             | 1.3                       | Normal                   | 1          | 1        | 1         | 1.3                      | 1.3                       | $\infty$     |
| Boundary Effects                     | 2.0                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 1.2                      | 1.2                       | $\infty$     |
| Probe Linearity                      | 0.3                       | Normal                   | 1          | 1        | 1         | 0.3                      | 0.3                       | $\infty$     |
| Probe modulation response            | 0.0                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 0.0                      | 0.0                       | $\infty$     |
| Detection limits                     | 0.25                      | Rectangular              | $\sqrt{3}$ | 1        | 1         | 0.14                     | 0.14                      | $\infty$     |
| Readout Electronics                  | 0.3                       | Normal                   | 1          | 1        | 1         | 0.3                      | 0.3                       | $\infty$     |
| Response time                        | 0.8                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 0.46                     | 0.46                      | $\infty$     |
| Integration time                     | 2.6                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 1.5                      | 1.5                       | $\infty$     |
| RF Ambient Conditions – Noise        | 3.0                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 1.7                      | 1.7                       | $\infty$     |
| RF Ambient Conditions – Reflections  | 3.0                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 1.7                      | 1.7                       | $\infty$     |
| Probe Positioner                     | 0.8                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 0.46                     | 0.46                      | $\infty$     |
| Probe Positioning                    | 6.7                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 3.9                      | 3.9                       | $\infty$     |
| Algorithms for Max. SAR Eval.        | 4.0                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 2.3                      | 2.3                       | $\infty$     |
| <b>Test Sample Related</b>           |                           |                          |            |          |           |                          |                           |              |
| Device Positioning                   | 2.9                       | Normal                   | 1          | 1        | 1         | 2.9                      | 2.9                       | 145          |
| Device Holder                        | 3.6                       | Normal                   | 1          | 1        | 1         | 3.6                      | 3.6                       | 5            |
| Power Drift                          | 5.0                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 2.9                      | 2.9                       | $\infty$     |
| SAR Scaling                          | 0.0                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 0.0                      | 0.0                       | $\infty$     |
| <b>Physical Parameters</b>           |                           |                          |            |          |           |                          |                           |              |
| Phantom Shell                        | 7.6                       | Rectangular              | $\sqrt{3}$ | 1        | 1         | 4.4                      | 4.4                       | $\infty$     |
| SAR correction                       | 0.0                       | Normal                   | 1          | 1        | 0.84      | 0.0                      | 0.0                       | $\infty$     |
| Liquid conductivity (Target)         | 5.0                       | Rectangular              | $\sqrt{3}$ | 0.64     | 0.43      | 1.8                      | 1.2                       | $\infty$     |
| Liquid conductivity (Meas.)          | 3.8                       | Normal                   | 1          | 0.78     | 0.71      | 3.0                      | 2.7                       | 10           |
| Liquid permittivity (Target)         | 5.0                       | Rectangular              | $\sqrt{3}$ | 0.60     | 0.49      | 1.7                      | 1.4                       | $\infty$     |
| Liquid permittivity (Meas.)          | 4.0                       | Normal                   | 1          | 0.23     | 0.26      | 0.9                      | 1.0                       | 10           |
| Temp. unc. - Conductivity            | 1.8                       | Rectangular              | $\sqrt{3}$ | 0.78     | 0.71      | 0.8                      | 0.7                       | $\infty$     |
| Temp. unc. - Permittivity            | 1.9                       | Rectangular              | $\sqrt{3}$ | 0.23     | 0.26      | 0.3                      | 0.3                       | $\infty$     |
| <b>Combined Standard Uncertainty</b> |                           |                          |            |          |           | <b>12</b>                | <b>12</b>                 | <b>330</b>   |
| <b>Expanded Uncertainty (k=2)</b>    |                           |                          |            |          |           | <b>24</b>                | <b>24</b>                 |              |

$$U(1\text{ g}) = k \cdot u_c$$

$$= 2 \cdot 12\%$$

= 24 % (The confidence level is about 95 %  $k = 2$ )

$$U(10\text{ g}) = k \cdot u_c$$

$$= 2 \cdot 12\%$$

= 24 % (The confidence level is about 95 %  $k = 2$ )

The above measurement uncertainties are according to IEEE Std 1528

## 15. CONCLUSION

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### Measurement Conclusion

The SAR measurement indicates that the EUT complies with the RF radiation exposure limits of the FCC. These measurements are taken to simulate the RF effects exposure under the worst-case conditions. Precise laboratory measures were taken to assure repeatability of the tests. The tested device complies with the requirements in respect to all parameters subject to the test. The test results and statements relate only to the item(s) tested.

Please note that the absorption and distribution of electromagnetic energy in the body are every complex phenomena that depend on the mass, shape, and size of the body, the orientation of the body with respect to the field vectors, and the electrical properties of both the body and the environment. Other variables that may play a substantial role impossible biological effect are those that characterize the environment (e.g. ambient temperature, air velocity, relative humidity, and body insulation) and those that characterize the individual (e.g. age, gender, activity level, debilitation, or disease).

Because innumerable factors may interact to determine the specific biological outcome of an exposure to electromagnetic fields, any protection guide shall consider maximal amplification of biological effects as a result of field-body interactions, environmental conditions, and physiological variables.

## 16. REFERENCES

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- [1] Federal Communications Commission, ET Docket 93-62, Guidelines for Evaluating the Environmental Effects of Radiofrequency Radiation, Aug. 1996.
- [2] ANSI/IEEE C95.1-2005, American National Standard safety levels with respect to human exposure to radiofrequency electromagnetic fields, 3kHz to 300GHz, New York: IEEE, 2006.
- [3] ANSI/IEEE C95.1-1992, American National Standard safety levels with respect to human exposure to radiofrequency electromagnetic fields, 3kHz to 300GHz, New York: IEEE, Sept. 1992.
- [4] ANSI/IEEE C95.3-2002, IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields - RF and Microwave, New York: IEEE, December 2002.
- [5] IEEE Standards Coordinating Committee 39 –Standards Coordinating Committee 34 – IEEE Std. 1528-2003, Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices.
- [6] NCRP, National Council on Radiation Protection and Measurements, Biological Effects and Exposure Criteria for Radio Frequency Electromagnetic Fields, NCRP Report No. 86, 1986. Reprinted Feb. 1995.
- [7] T. Schmid, O. Egger, N. Kuster, Automated E-field scanning system for dosimetric assessments, IEEE Transaction on Microwave Theory and Techniques, vol. 44, Jan. 1996, pp. 105-113.
- [8] K. Pokovic, T. Schmid, N. Kuster, Robust setup for precise calibration of E-field probes in tissue simulating liquids at mobile communications frequencies, ICECOM97, Oct. 1997, pp. -124.
- [9] K. Pokovic, T. Schmid, and N. Kuster, E-field Probe with improved isotropy in brain simulating liquids, Proceedings of the ELMAR, Zadar, Croatia, June 23-25, 1996, pp. 172-175.
- [10] Schmid & Partner Engineering AG, Application Note: Data Storage and Evaluation, June 1998, p2.
- [11] V. Hombach, K. Meier, M. Burkhardt, E. Kuhn, N. Kuster, The Dependence of EM Energy Absorption upon Human Modeling at 900 MHz, IEEE Transaction on Microwave Theory and Techniques, vol. 44 no. 10, Oct. 1996, pp. 1865-1873.
- [12] N. Kuster and Q. Balzano, Energy absorption mechanism by biological bodies in the near field of dipole antennas above 300MHz, IEEE Transaction on Vehicular Technology, vol. 41, no. 1, Feb. 1992, pp. 17-23.
- [13] G. Hartsgrrove, A. Kraszewski, A. Surowiec, Simulated Biological Materials for Electromagnetic Radiation Absorption Studies, University of Ottawa, Bio electromagnetics, Canada: 1987, pp. 29-36.
- [14] Q. Balzano, O. Garay, T. Manning Jr., Electromagnetic Energy Exposure of Simulated Users of Portable Cellular Telephones, IEEE Transactions on Vehicular Technology, vol. 44, no.3, Aug. 1995.
- [15] W. Gander, Computer mathematick, Birkhaeuser, Basel, 1992.
- [16] W.H. Press, S.A. Teukolsky, W.T. Vetterling, and B.P. Flannery, Numerical Recipes in C, The Art of Scientific Computing, Second edition, Cambridge University Press, 1992.
- [17] N. Kuster, R. Kastle, T. Schmid, Dosimetric evaluation of mobile communications equipment with known precision, IEEE Transaction on Communications, vol. E80-B, no. 5, May 1997, pp. 645-652.
- [18] CENELEC CLC/SC111B, European Prestandard (prENV 50166-2), Human Exposure to Electromagnetic Fields High-frequency: 10kHz-300GHz, Jan. 1995.
- [19] Prof. Dr. Niels Kuster, ETH, Eidgenössische Technische Hochschule Zürich, Dosimetric Evaluation of the Cellular Phone.

- [20] IEC 62209-1, Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices - Human models, instrumentation, and procedures - Part 1: Procedure to determine the specific absorption rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300MHz to 3 GHz), Feb. 2005.
- [21] Industry Canada RSS-102 Radio Frequency Exposure Compliance of Radio communication Apparatus (All Frequency Bands) Issue 5, March 2015.
- [22] Health Canada Safety Code 6 Limits of Human Exposure to Radio Frequency Electromagnetic Fields in the Frequency Range from 3 kHz – 300 GHz, 2009
- [23] FCC SAR Test Procedures for 2G-3G Devices, Mobile Hotspot and UMPC Devices KDB Publications 941225,D01-D07
- [24] SAR Measurement procedures for IEEE 802.11a/b/g KDB Publication 248227 D01v02
- [25] FCC SAR Considerations for Handsets with Multiple Transmitters and Antennas, KDB Publications 648474D02-D04
- [26] FCC SAR Evaluation Considerations for Laptop, Notebook, Netbook and Tablet Computers, FCC KDB Publication 616217 D04
- [27] FCC SAR Measurement and Reporting Requirements for 100MHz – 6 GHz, KDB Publications 865664 D01-D02
- [28] FCC General RF Exposure Guidance and SAR Procedures for Dongles, KDB Publication 447498, D01-D02
- [29] 615223 D01 802 16e Wi-Max SAR Guidance v01, Nov. 13, 2009
- [30] Anexo à Resolução No. 533, de 10 de September de 2009.
- [31] IEC 62209-2, Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices - Human models, instrumentation, and procedures - Part 2: Procedure to determine the specific absorption rate (SAR) for wireless communication devices used in close proximity to the human body(frequency range of 30 MHz to 6 GHz), Mar. 2010.

## **APPENDIX A. – Probe Calibration Data**

**Calibration Laboratory of**  
**Schmid & Partner**  
**Engineering AG**  
 Zeughausstrasse 43, 8004 Zurich, Switzerland



**S** Schweizerischer Kalibrierdienst  
**C** Service suisse d'étalonnage  
**S** Servizio svizzero di taratura  
**S** Swiss Calibration Service

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**

Client **DT&C (Dymstec)**

Certificate No: **EX3-7368\_Jan20**

## CALIBRATION CERTIFICATE

Object **EX3DV4 - SN:7368**

Calibration procedure(s) **QA CAL-01.v9, QA CAL-14.v5, QA CAL-23.v5, QA CAL-25.v7**  
 Calibration procedure for dosimetric E-field probes

Calibration date: **January 30, 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  $(22 \pm 3)^{\circ}\text{C}$  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       | 03-Apr-19 (No. 217-02892/02893)   | Apr-20                 |
| Power sensor NRP-Z91       | SN: 103244       | 03-Apr-19 (No. 217-02892)         | Apr-20                 |
| Power sensor NRP-Z91       | SN: 103245       | 03-Apr-19 (No. 217-02893)         | Apr-20                 |
| Reference 20 dB Attenuator | SN: S5277 (20x)  | 04-Apr-19 (No. 217-02894)         | Apr-20                 |
| DAE4                       | SN: 660          | 27-Dec-19 (No. DAE4-660_Dec19)    | Dec-20                 |
| Reference Probe ES3DV2     | SN: 3013         | 31-Dec-19 (No. ES3-3013_Dec19)    | Dec-20                 |
| Secondary Standards        | ID               | Check Date (in house)             | Scheduled Check        |
| Power meter E4419B         | SN: GB41293874   | 06-Apr-16 (in house check Jun-18) | In house check: Jun-20 |
| Power sensor E4412A        | SN: MY41498087   | 06-Apr-16 (in house check Jun-18) | In house check: Jun-20 |
| Power sensor E4412A        | SN: 000110210    | 06-Apr-16 (in house check Jun-18) | In house check: Jun-20 |
| RF generator HP 8648C      | SN: US3642U01700 | 04-Aug-99 (in house check Jun-18) | In house check: Jun-20 |
| Network Analyzer E8358A    | SN: US41080477   | 31-Mar-14 (in house check Oct-19) | In house check: Oct-20 |

|                                                                                                                 | Name           | Function              | Signature |
|-----------------------------------------------------------------------------------------------------------------|----------------|-----------------------|-----------|
| Calibrated by:                                                                                                  | Jeton Kastrati | Laboratory Technician |           |
| Approved by:                                                                                                    | Katja Pokovic  | Technical Manager     |           |
| Issued: January 30, 2020                                                                                        |                |                       |           |
| This calibration certificate shall not be reproduced except in full without written approval of the laboratory. |                |                       |           |

**Calibration Laboratory of**  
**Schmid & Partner**  
**Engineering AG**  
 Zeughausstrasse 43, 8004 Zurich, Switzerland



**S** Schweizerischer Kalibrierdienst  
**C** Service suisse d'étalonnage  
**S** Servizio svizzero di taratura  
 Swiss Calibration Service

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

### Glossary:

|                          |                                                                                                                                                         |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| TSL                      | tissue simulating liquid                                                                                                                                |
| NORM <sub>x,y,z</sub>    | sensitivity in free space                                                                                                                               |
| ConvF                    | sensitivity in TSL / NORM <sub>x,y,z</sub>                                                                                                              |
| DCP                      | diode compression point                                                                                                                                 |
| CF                       | crest factor (1/duty_cycle) of the RF signal                                                                                                            |
| A, B, C, D               | modulation dependent linearization parameters                                                                                                           |
| Polarization $\varphi$   | $\varphi$ rotation around probe axis                                                                                                                    |
| Polarization $\vartheta$ | $\vartheta$ rotation around an axis that is in the plane normal to probe axis (at measurement center),<br>i.e., $\vartheta = 0$ is normal to probe axis |
| Connector Angle          | information used in DASY system to align probe sensor X to the robot coordinate system                                                                  |

### 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"

### Methods Applied and Interpretation of Parameters:

- NORM<sub>x,y,z</sub>**: Assessed for E-field polarization  $\vartheta = 0$  ( $f \leq 900$  MHz in TEM-cell;  $f > 1800$  MHz: R22 waveguide). NORM<sub>x,y,z</sub> are only intermediate values, i.e., the uncertainties of NORM<sub>x,y,z</sub> does not affect the E<sup>2</sup>-field uncertainty inside TSL (see below ConvF).
- NORM(f)<sub>x,y,z</sub>** = NORM<sub>x,y,z</sub> \* frequency\_response (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF.
- DCP<sub>x,y,z</sub>**: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- PAR**: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- A<sub>x,y,z</sub>; B<sub>x,y,z</sub>; C<sub>x,y,z</sub>; D<sub>x,y,z</sub>; VR<sub>x,y,z</sub>**: A, B, C, D are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- ConvF and Boundary Effect Parameters**: Assessed in flat phantom using E-field (or Temperature Transfer Standard for  $f \leq 800$  MHz) and inside waveguide using analytical field distributions based on power measurements for  $f > 800$  MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORM<sub>x,y,z</sub> \* ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from  $\pm 50$  MHz to  $\pm 100$  MHz.
- Spherical isotropy (3D deviation from isotropy)**: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset**: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- Connector Angle**: The angle is assessed using the information gained by determining the NORM<sub>x</sub> (no uncertainty required).

EX3DV4 – SN:7368

January 30, 2020

## DASY/EASY - Parameters of Probe: EX3DV4 - SN:7368

### Basic Calibration Parameters

|                                                           | Sensor X | Sensor Y | Sensor Z | Unc (k=2) |
|-----------------------------------------------------------|----------|----------|----------|-----------|
| Norm ( $\mu\text{V}/(\text{V}/\text{m})^2$ ) <sup>A</sup> | 0.48     | 0.56     | 0.41     | ± 10.1 %  |
| DCP (mV) <sup>B</sup>                                     | 103.2    | 100.2    | 100.3    |           |

### Calibration Results for Modulation Response

| UID | Communication System Name |   | A<br>dB | B<br>dB $\sqrt{\mu\text{V}}$ | C   | D<br>dB | VR<br>mV | Max<br>dev. | Unc <sup>E</sup><br>(k=2) |
|-----|---------------------------|---|---------|------------------------------|-----|---------|----------|-------------|---------------------------|
| 0   | CW                        | X | 0.0     | 0.0                          | 1.0 | 0.00    | 185.3    | ± 3.5 %     | ± 4.7 %                   |
|     |                           | Y | 0.0     | 0.0                          | 1.0 |         | 173.0    |             |                           |
|     |                           | Z | 0.0     | 0.0                          | 1.0 |         | 174.3    |             |                           |

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%.

<sup>A</sup> The uncertainties of Norm X,Y,Z do not affect the E<sup>2</sup>-field uncertainty inside TSL (see Page 5).

<sup>B</sup> Numerical linearization parameter: uncertainty not required.

<sup>E</sup> Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

EX3DV4- SN:7368

January 30, 2020

## DASY/EASY - Parameters of Probe: EX3DV4 - SN:7368

### Other Probe Parameters

|                                               |            |
|-----------------------------------------------|------------|
| Sensor Arrangement                            | Triangular |
| Connector Angle (°)                           | -23.8      |
| Mechanical Surface Detection Mode             | enabled    |
| Optical Surface Detection Mode                | disabled   |
| Probe Overall Length                          | 337 mm     |
| Probe Body Diameter                           | 10 mm      |
| Tip Length                                    | 9 mm       |
| Tip Diameter                                  | 2.5 mm     |
| Probe Tip to Sensor X Calibration Point       | 1 mm       |
| Probe Tip to Sensor Y Calibration Point       | 1 mm       |
| Probe Tip to Sensor Z Calibration Point       | 1 mm       |
| Recommended Measurement Distance from Surface | 1.4 mm     |

EX3DV4– SN:7368

January 30, 2020

## DASY/EASY - Parameters of Probe: EX3DV4 - SN:7368

### Calibration Parameter Determined in Head Tissue Simulating Media

| f (MHz) <sup>C</sup> | Relative Permittivity <sup>F</sup> | Conductivity (S/m) <sup>F</sup> | ConvF X | ConvF Y | ConvF Z | Alpha <sup>G</sup> | Depth <sup>G</sup> (mm) | Unc (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|--------------------|-------------------------|-----------|
| 750                  | 41.9                               | 0.89                            | 9.89    | 9.89    | 9.89    | 0.64               | 0.82                    | ± 12.0 %  |
| 835                  | 41.5                               | 0.90                            | 9.67    | 9.67    | 9.67    | 0.56               | 0.84                    | ± 12.0 %  |
| 900                  | 41.5                               | 0.97                            | 9.46    | 9.46    | 9.46    | 0.38               | 1.05                    | ± 12.0 %  |
| 1750                 | 40.1                               | 1.37                            | 8.78    | 8.78    | 8.78    | 0.38               | 0.85                    | ± 12.0 %  |
| 1900                 | 40.0                               | 1.40                            | 8.43    | 8.43    | 8.43    | 0.29               | 0.85                    | ± 12.0 %  |
| 2450                 | 39.2                               | 1.80                            | 7.81    | 7.81    | 7.81    | 0.33               | 0.90                    | ± 12.0 %  |
| 2600                 | 39.0                               | 1.96                            | 7.44    | 7.44    | 7.44    | 0.35               | 0.90                    | ± 12.0 %  |
| 3500                 | 37.9                               | 2.91                            | 7.05    | 7.05    | 7.05    | 0.35               | 1.30                    | ± 13.1 %  |
| 3700                 | 37.7                               | 3.12                            | 6.98    | 6.98    | 6.98    | 0.35               | 1.30                    | ± 13.1 %  |
| 5200                 | 36.0                               | 4.66                            | 5.66    | 5.66    | 5.66    | 0.40               | 1.80                    | ± 13.1 %  |
| 5300                 | 35.9                               | 4.76                            | 5.45    | 5.45    | 5.45    | 0.40               | 1.80                    | ± 13.1 %  |
| 5500                 | 35.6                               | 4.96                            | 5.04    | 5.04    | 5.04    | 0.40               | 1.80                    | ± 13.1 %  |
| 5600                 | 35.5                               | 5.07                            | 4.85    | 4.85    | 4.85    | 0.40               | 1.80                    | ± 13.1 %  |
| 5800                 | 35.3                               | 5.27                            | 5.02    | 5.02    | 5.02    | 0.40               | 1.80                    | ± 13.1 %  |

<sup>C</sup> Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Validity of ConvF assessed at 6 MHz is 4-9 MHz, and ConvF assessed at 13 MHz is 9-19 MHz. Above 5 GHz frequency validity can be extended to ± 110 MHz.

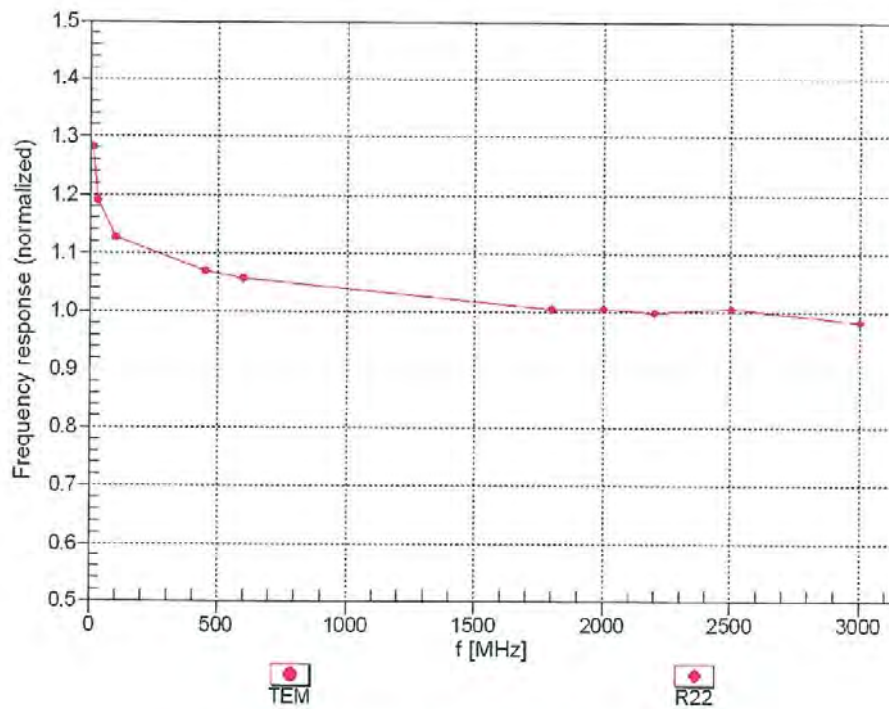
<sup>F</sup> At frequencies below 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

<sup>G</sup> Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

EX3DV4- SN:7368

January 30, 2020

## Frequency Response of E-Field (TEM-Cell:ifi110 EXX, Waveguide: R22)



Uncertainty of Frequency Response of E-field:  $\pm 6.3\%$  ( $k=2$ )

EX3DV4- SN:7368

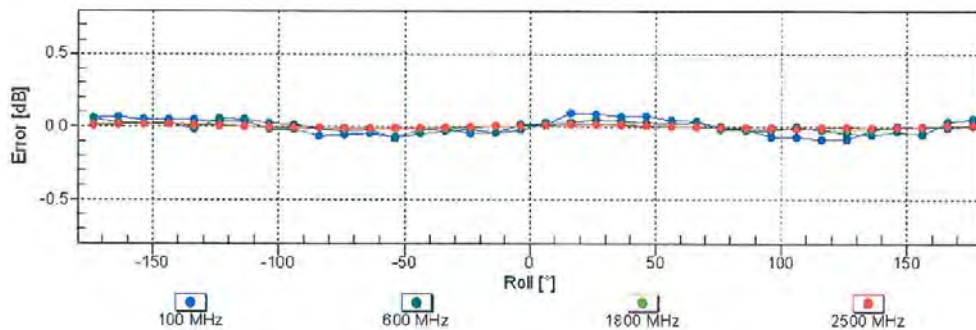
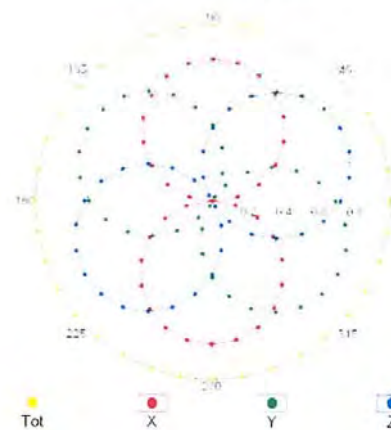
January 30, 2020

## Receiving Pattern ( $\phi$ ), $\theta = 0^\circ$

f=600 MHz,TEM



f=1800 MHz,R22

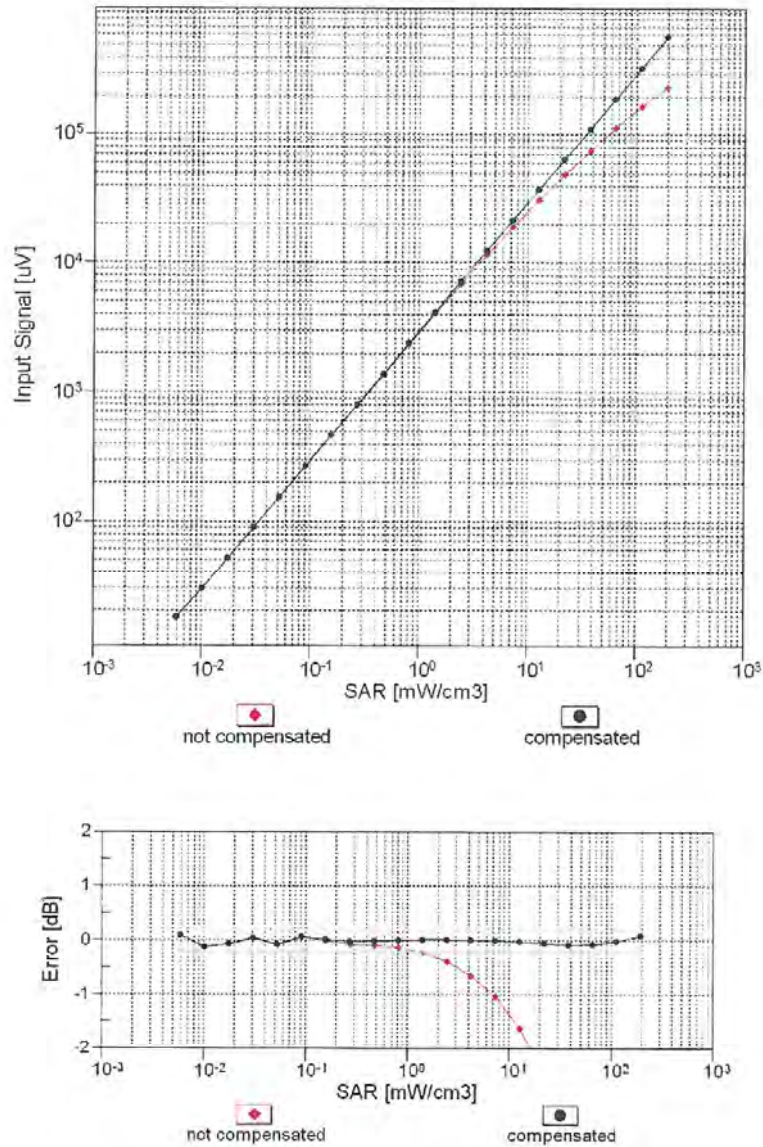


Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  (k=2)

EX3DV4- SN:7368

January 30, 2020

# Dynamic Range $f(\text{SAR}_{\text{head}})$ (TEM cell, $f_{\text{eval}} = 1900 \text{ MHz}$ )

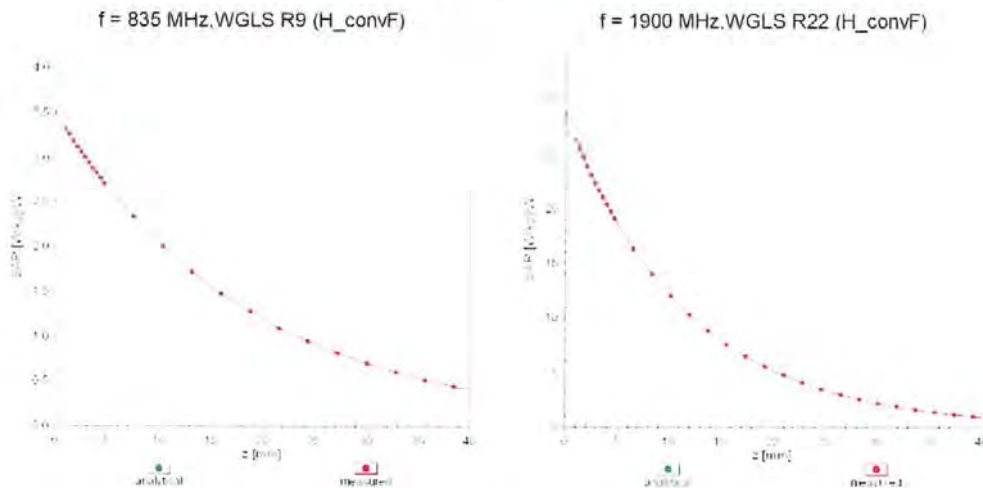


Uncertainty of Linearity Assessment:  $\pm 0.6\%$  ( $k=2$ )

EX3DV4- SN:7368

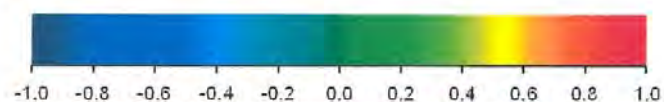
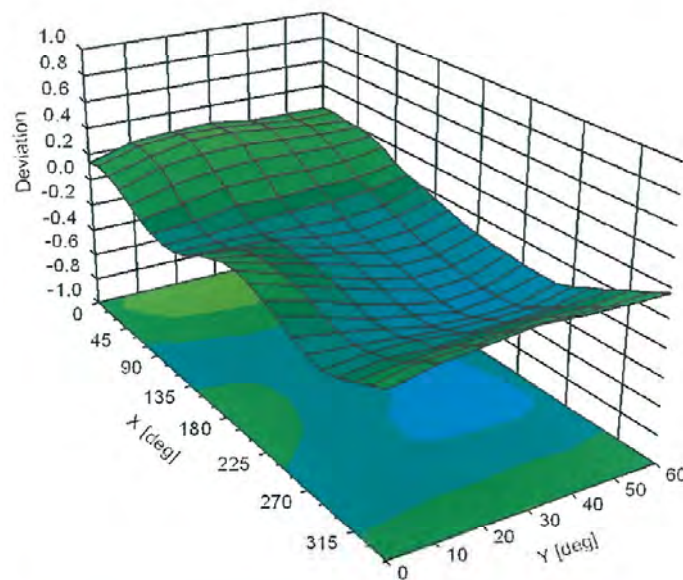
January 30, 2020

## Conversion Factor Assessment



## Deviation from Isotropy in Liquid

Error ( $\phi$ ,  $\theta$ ), f = 900 MHz



Uncertainty of Spherical Isotropy Assessment:  $\pm 2.6\%$  (k=2)

## **APPENDIX B. – Dipole Calibration Data**

**Calibration Laboratory of**  
**Schmid & Partner**  
**Engineering AG**  
 Zeughausstrasse 43, 8004 Zurich, Switzerland



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 Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 0108

Client **DT&C (Dymstec)**

Certificate No: D750V3-1049\_Jan20

## CALIBRATION CERTIFICATE

Object **D750V3 - SN:1049**

Calibration procedure(s) **QA CAL-05.v11**  
**Calibration Procedure for SAR Validation Sources between 0.7-3 GHz**

Calibration date: **January 22, 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 ± 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         | 03-Apr-19 (No. 217-02892/02893) | Apr-20                |
| Power sensor NRP-Z91        | SN: 103244         | 03-Apr-19 (No. 217-02892)       | Apr-20                |
| Power sensor NRP-Z91        | SN: 103245         | 03-Apr-19 (No. 217-02893)       | Apr-20                |
| Reference 20 dB Attenuator  | SN: 5058 (20k)     | 04-Apr-19 (No. 217-02894)       | Apr-20                |
| Type-N mismatch combination | SN: 5047.2 / 06327 | 04-Apr-19 (No. 217-02895)       | Apr-20                |
| Reference Probe EX3DV4      | SN: 7349           | 31-Dec-19 (No. EX3-7349_Dec19)  | Dec-20                |
| DAE4                        | SN: 601            | 27-Dec-19 (No. DAE4-601_Dec19)  | Dec-20                |

| Secondary Standards             | ID #           | Check Date (in house)             | Scheduled Check        |
|---------------------------------|----------------|-----------------------------------|------------------------|
| Power meter E4419B              | SN: GB39512475 | 30-Oct-14 (in house check Feb-19) | In house check: Oct-20 |
| Power sensor HP 8481A           | SN: US37292783 | 07-Oct-15 (in house check Oct-18) | In house check: Oct-20 |
| Power sensor HP 8481A           | SN: MY41092317 | 07-Oct-15 (in house check Oct-18) | In house check: Oct-20 |
| RF generator R&S SMT-06         | SN: 100972     | 15-Jun-15 (in house check Oct-18) | In house check: Oct-20 |
| Network Analyzer Agilent E8358A | SN: US41080477 | 31-Mar-14 (in house check Oct-19) | In house check: Oct-20 |

|                |               |                       |                                                                                       |
|----------------|---------------|-----------------------|---------------------------------------------------------------------------------------|
|                | Name          | Function              | Signature                                                                             |
| Calibrated by: | Lelf Klysner  | Laboratory Technician |  |
| Approved by:   | Katja Pokovic | Technical Manager     |  |

Issued: January 23, 2020

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 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.

|                              |                        |             |
|------------------------------|------------------------|-------------|
| DASY Version                 | DASY5                  | V52.10.3    |
| Extrapolation                | Advanced Extrapolation |             |
| Phantom                      | Modular Flat Phantom   |             |
| Distance Dipole Center - TSL | 15 mm                  | with Spacer |
| Zoom Scan Resolution         | dx, dy, dz = 5 mm      |             |
| Frequency                    | 750 MHz $\pm$ 1 MHz    |             |

### Head TSL parameters

The following parameters and calculations were applied.

|                                         | Temperature         | Permittivity   | Conductivity         |
|-----------------------------------------|---------------------|----------------|----------------------|
| Nominal Head TSL parameters             | 22.0 °C             | 41.9           | 0.89 mho/m           |
| Measured Head TSL parameters            | (22.0 $\pm$ 0.2) °C | 42.8 $\pm$ 6 % | 0.88 mho/m $\pm$ 6 % |
| Head TSL temperature change during test | < 0.5 °C            | ----           | ----                 |

### SAR result with Head TSL

| SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL | Condition          |                              |
|-------------------------------------------------------|--------------------|------------------------------|
| SAR measured                                          | 250 mW input power | 2.09 W/kg                    |
| SAR for nominal Head TSL parameters                   | normalized to 1W   | 8.47 W/kg $\pm$ 17.0 % (k=2) |

| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL | condition          |                              |
|---------------------------------------------------------|--------------------|------------------------------|
| SAR measured                                            | 250 mW input power | 1.38 W/kg                    |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 5.58 W/kg $\pm$ 16.5 % (k=2) |

### Body TSL parameters

The following parameters and calculations were applied.

|                                         | Temperature         | Permittivity   | Conductivity         |
|-----------------------------------------|---------------------|----------------|----------------------|
| Nominal Body TSL parameters             | 22.0 °C             | 55.5           | 0.96 mho/m           |
| Measured Body TSL parameters            | (22.0 $\pm$ 0.2) °C | 55.2 $\pm$ 6 % | 0.96 mho/m $\pm$ 6 % |
| Body TSL temperature change during test | < 0.5 °C            | ----           | ----                 |

### SAR result with Body TSL

| SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL | Condition          |                              |
|-------------------------------------------------------|--------------------|------------------------------|
| SAR measured                                          | 250 mW input power | 2.11 W/kg                    |
| SAR for nominal Body TSL parameters                   | normalized to 1W   | 8.43 W/kg $\pm$ 17.0 % (k=2) |

| SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL | condition          |                              |
|---------------------------------------------------------|--------------------|------------------------------|
| SAR measured                                            | 250 mW input power | 1.40 W/kg                    |
| SAR for nominal Body TSL parameters                     | normalized to 1W   | 5.60 W/kg $\pm$ 16.5 % (k=2) |

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

### Antenna Parameters with Head TSL

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 53.6 $\Omega$ - 2.2 j $\Omega$ |
| Return Loss                          | - 27.9 dB                      |

### Antenna Parameters with Body TSL

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 50.1 $\Omega$ - 4.1 j $\Omega$ |
| Return Loss                          | - 27.7 dB                      |

### General Antenna Parameters and Design

|                                  |          |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.035 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: 22.01.2020

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN:1049**

Communication System: UID 0 - CW; Frequency: 750 MHz

Medium parameters used:  $f = 750 \text{ MHz}$ ;  $\sigma = 0.88 \text{ S/m}$ ;  $\epsilon_r = 42.8$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(10.07, 10.07, 10.07) @ 750 MHz; Calibrated: 31.12.2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.12.2019
- Phantom: Flat Phantom 4.9 (front); Type: QD 00L P49 AA; Serial: 1001
- DASY52 52.10.3(1513); SEMCAD X 14.6.13(7474)

### Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm

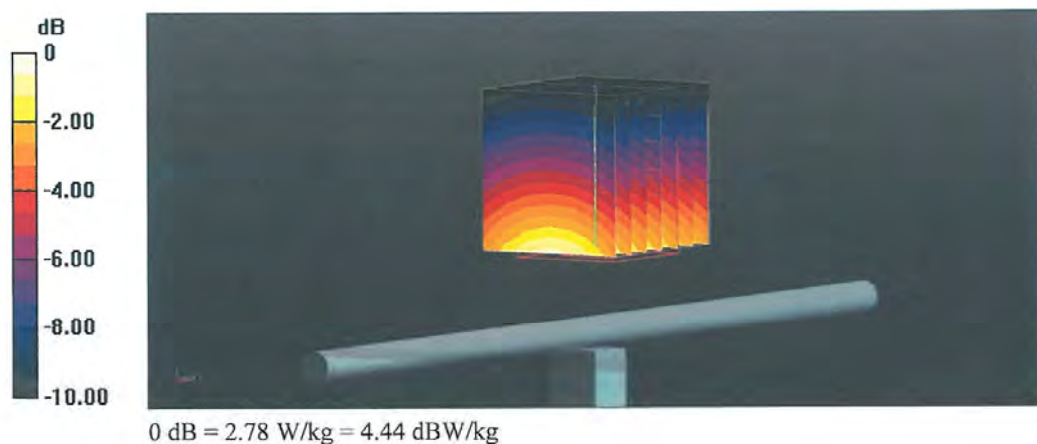
Reference Value = 59.52 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 3.11 W/kg

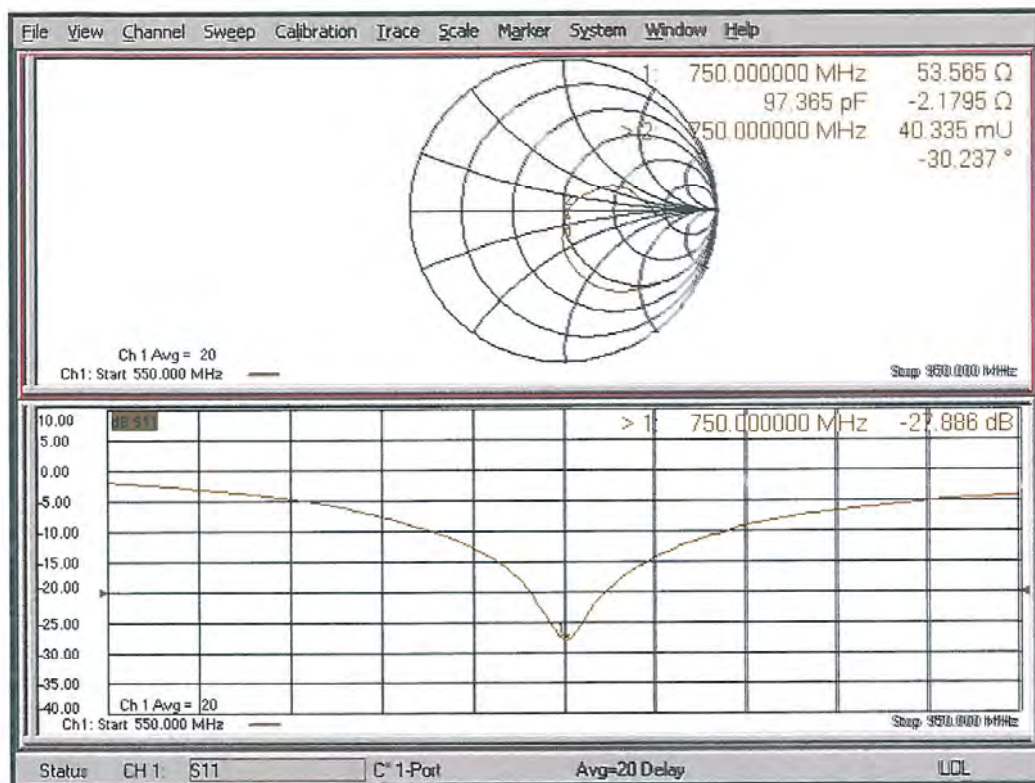
**SAR(1 g) = 2.09 W/kg; SAR(10 g) = 1.38 W/kg**

Ratio of SAR at M2 to SAR at M1 = 67.1%

Maximum value of SAR (measured) = 2.78 W/kg



# Impedance Measurement Plot for Head TSL



## DASY5 Validation Report for Body TSL

Date: 22.01.2020

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN:1049**

Communication System: UID 0 - CW; Frequency: 750 MHz

Medium parameters used:  $f = 750 \text{ MHz}$ ;  $\sigma = 0.96 \text{ S/m}$ ;  $\epsilon_r = 55.2$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(10.61, 10.61, 10.61) @ 750 MHz; Calibrated: 31.12.2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.12.2019
- Phantom: Flat Phantom 4.9 (Back); Type: QD 00R P49 AA; Serial: 1005
- DASY52 52.10.3(1513); SEMCAD X 14.6.13(7474)

### Dipole Calibration for Body Tissue/Pin=250 mW, $d=15\text{mm}$ /Zoom Scan (7x7x7)/Cube 0:

Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 60.29 V/m; Power Drift = -0.04 dB

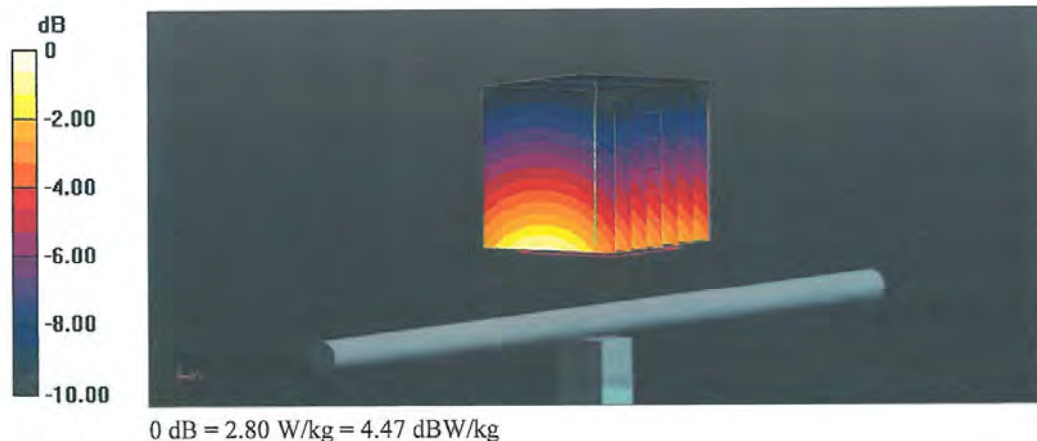
Peak SAR (extrapolated) = 3.16 W/kg

**SAR(1 g) = 2.11 W/kg; SAR(10 g) = 1.4 W/kg**

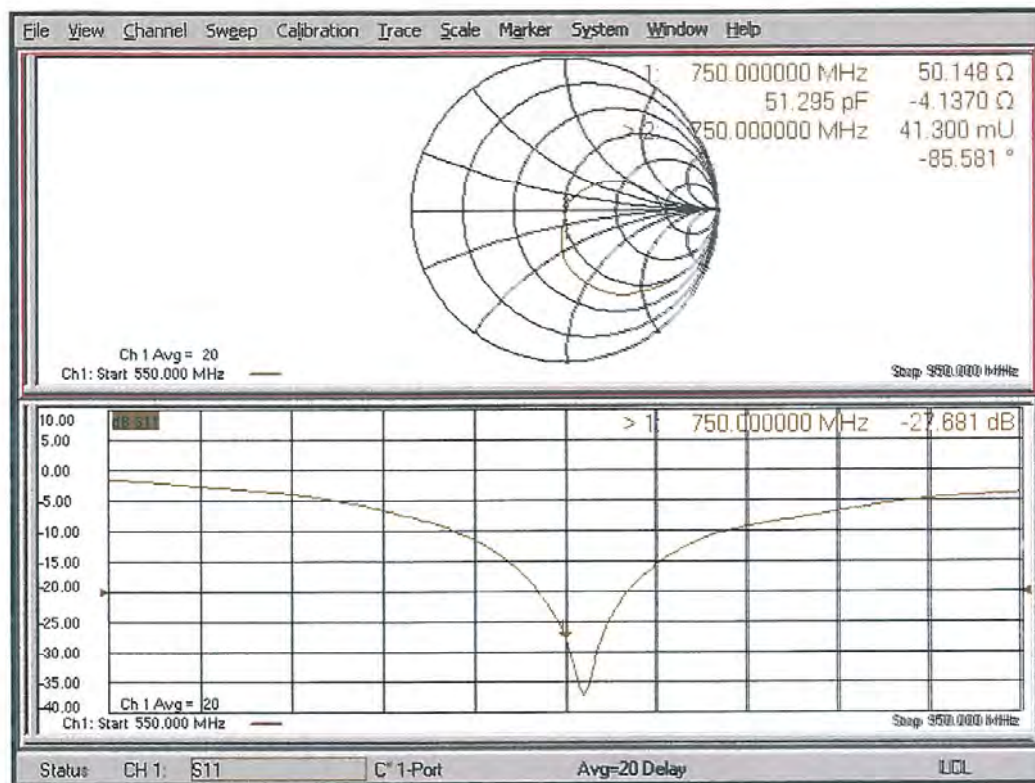
Smallest distance from peaks to all points 3 dB below = 16 mm

Ratio of SAR at M2 to SAR at M1 = 66.9%

Maximum value of SAR (measured) = 2.80 W/kg



### Impedance Measurement Plot for Body TSL



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Accreditation No.: **SCS 0108**

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Client **DT&C (Dymstec)**

Certificate No: **D835V2-4d159\_May20**

## CALIBRATION CERTIFICATE

Object **D835V2 - SN:4d159**

Calibration procedure(s) **QA CAL-05.v11**  
**Calibration Procedure for SAR Validation Sources between 0.7-3 GHz**

Calibration date: **May 19, 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  $(22 \pm 3)^\circ\text{C}$  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: 7349           | 31-Dec-19 (No. EX3-7349_Dec19)  | Dec-20                |
| DAE4                        | SN: 601            | 27-Dec-19 (No. DAE4-601_Dec19)  | Dec-20                |

| Secondary Standards             | ID #           | Check Date (in house)             | Scheduled Check        |
|---------------------------------|----------------|-----------------------------------|------------------------|
| Power meter E4419B              | SN: GB39512475 | 30-Oct-14 (in house check Feb-19) | In house check: Oct-20 |
| Power sensor HP 8481A           | SN: US37292783 | 07-Oct-15 (in house check Oct-18) | In house check: Oct-20 |
| Power sensor HP 8481A           | SN: MY41092317 | 07-Oct-15 (in house check Oct-18) | In house check: Oct-20 |
| RF generator R&S SMT-06         | SN: 100972     | 15-Jun-15 (in house check Oct-18) | In house check: Oct-20 |
| Network Analyzer Agilent E8358A | SN: US41080477 | 31-Mar-14 (in house check Oct-19) | In house check: Oct-20 |

|                |                         |                                   |               |
|----------------|-------------------------|-----------------------------------|---------------|
| Calibrated by: | Name<br>Jeffrey Katzman | Function<br>Laboratory Technician | Signature<br> |
| Approved by:   | Katja Pokovic           | Technical Manager                 |               |

Issued: May 22, 2020

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 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.

|                              |                        |             |
|------------------------------|------------------------|-------------|
| DASY Version                 | DASY5                  | V52.10.4    |
| Extrapolation                | Advanced Extrapolation |             |
| Phantom                      | Modular Flat Phantom   |             |
| Distance Dipole Center - TSL | 15 mm                  | with Spacer |
| Zoom Scan Resolution         | dx, dy, dz = 5 mm      |             |
| Frequency                    | 835 MHz $\pm$ 1 MHz    |             |

## Head TSL parameters

The following parameters and calculations were applied.

|                                         | Temperature         | Permittivity   | Conductivity         |
|-----------------------------------------|---------------------|----------------|----------------------|
| Nominal Head TSL parameters             | 22.0 °C             | 41.5           | 0.90 mho/m           |
| Measured Head TSL parameters            | (22.0 $\pm$ 0.2) °C | 42.0 $\pm$ 6 % | 0.93 mho/m $\pm$ 6 % |
| Head TSL temperature change during test | < 0.5 °C            | ----           | ----                 |

## SAR result with Head TSL

| SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL | Condition          |                              |
|-------------------------------------------------------|--------------------|------------------------------|
| SAR measured                                          | 250 mW input power | 2.42 W/kg                    |
| SAR for nominal Head TSL parameters                   | normalized to 1W   | 9.47 W/kg $\pm$ 17.0 % (k=2) |

| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL | condition          |                              |
|---------------------------------------------------------|--------------------|------------------------------|
| SAR measured                                            | 250 mW input power | 1.57 W/kg                    |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 6.17 W/kg $\pm$ 16.5 % (k=2) |

## Body TSL parameters

The following parameters and calculations were applied.

|                                         | Temperature         | Permittivity   | Conductivity         |
|-----------------------------------------|---------------------|----------------|----------------------|
| Nominal Body TSL parameters             | 22.0 °C             | 55.2           | 0.97 mho/m           |
| Measured Body TSL parameters            | (22.0 $\pm$ 0.2) °C | 55.5 $\pm$ 6 % | 0.99 mho/m $\pm$ 6 % |
| Body TSL temperature change during test | < 0.5 °C            | ----           | ----                 |

## SAR result with Body TSL

| SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL | Condition          |                              |
|-------------------------------------------------------|--------------------|------------------------------|
| SAR measured                                          | 250 mW input power | 2.41 W/kg                    |
| SAR for nominal Body TSL parameters                   | normalized to 1W   | 9.50 W/kg $\pm$ 17.0 % (k=2) |

| SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL | condition          |                              |
|---------------------------------------------------------|--------------------|------------------------------|
| SAR measured                                            | 250 mW input power | 1.59 W/kg                    |
| SAR for nominal Body TSL parameters                     | normalized to 1W   | 6.29 W/kg $\pm$ 16.5 % (k=2) |

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

### Antenna Parameters with Head TSL

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 51.5 $\Omega$ - 4.3 j $\Omega$ |
| Return Loss                          | - 27.0 dB                      |

### Antenna Parameters with Body TSL

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 47.3 $\Omega$ - 7.0 j $\Omega$ |
| Return Loss                          | - 22.3 dB                      |

### General Antenna Parameters and Design

|                                  |          |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.439 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: 19.05.2020

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d159**

Communication System: UID 0 - CW; Frequency: 835 MHz

Medium parameters used:  $f = 835$  MHz;  $\sigma = 0.93$  S/m;  $\epsilon_r = 42.0$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(9.89, 9.89, 9.89) @ 835 MHz; Calibrated: 31.12.2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.12.2019
- Phantom: Flat Phantom 4.9 (front); Type: QD 00L P49 AA; Serial: 1001
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

**Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:**

Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 62.34 V/m; Power Drift = -0.00 dB

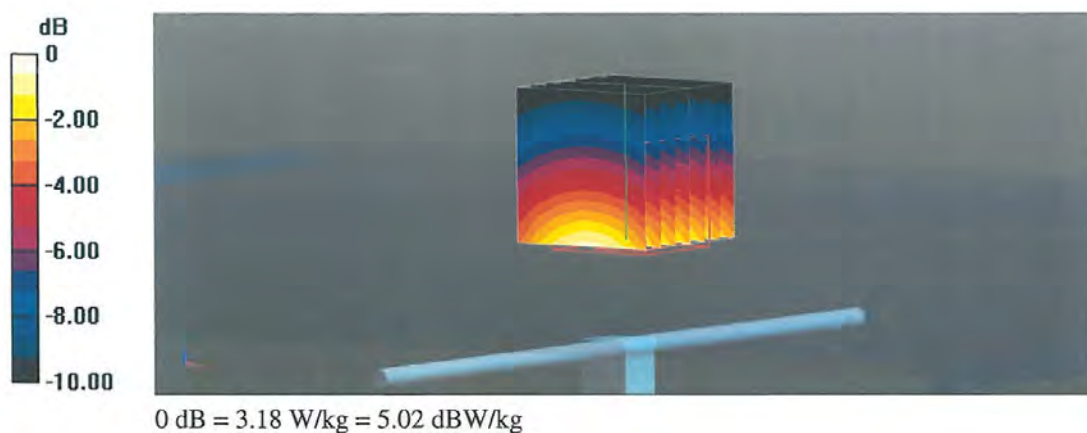
Peak SAR (extrapolated) = 3.58 W/kg

**SAR(1 g) = 2.42 W/kg; SAR(10 g) = 1.57 W/kg**

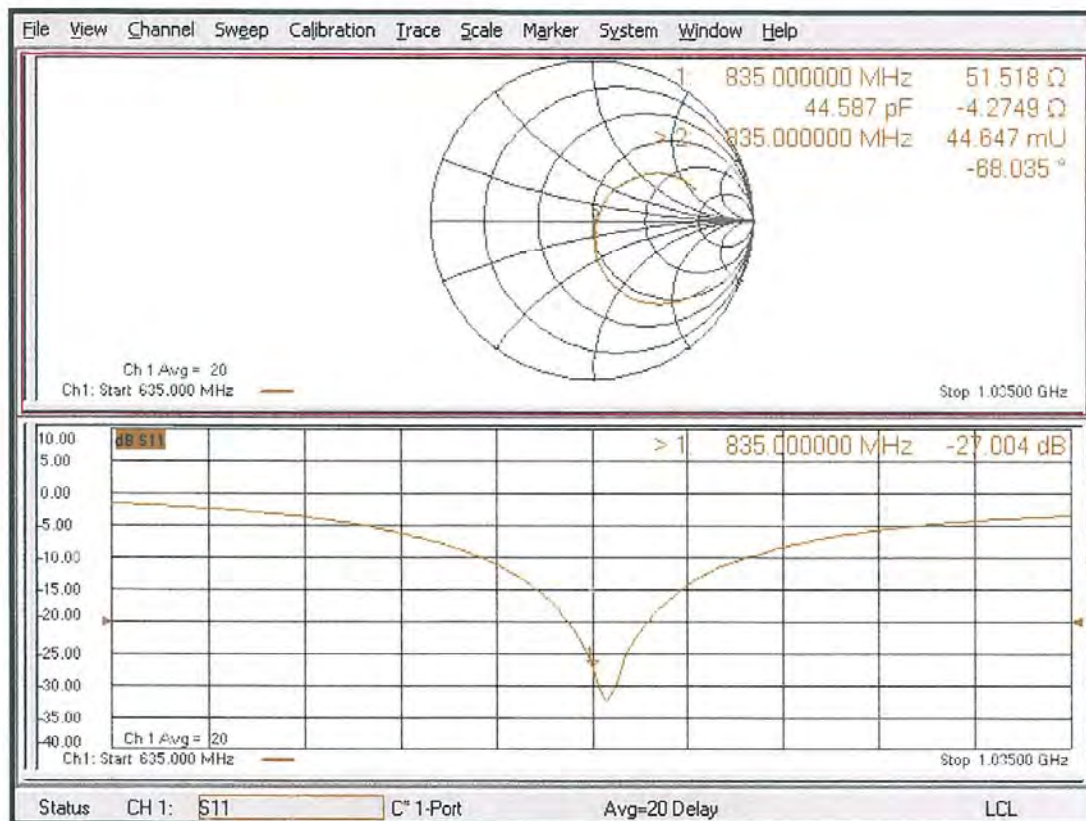
Smallest distance from peaks to all points 3 dB below = 17 mm

Ratio of SAR at M2 to SAR at M1 = 67.5%

Maximum value of SAR (measured) = 3.18 W/kg



### Impedance Measurement Plot for Head TSL



## DASY5 Validation Report for Body TSL

Date: 19.05.2020

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d159**

Communication System: UID 0 - CW; Frequency: 835 MHz

Medium parameters used:  $f = 835 \text{ MHz}$ ;  $\sigma = 0.99 \text{ S/m}$ ;  $\epsilon_r = 55.5$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(10.16, 10.16, 10.16) @ 835 MHz; Calibrated: 31.12.2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.12.2019
- Phantom: Flat Phantom 4.9 (Back); Type: QD 00R P49 AA; Serial: 1005
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

### Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$ 

Reference Value = 57.84 V/m; Power Drift = 0.00 dB

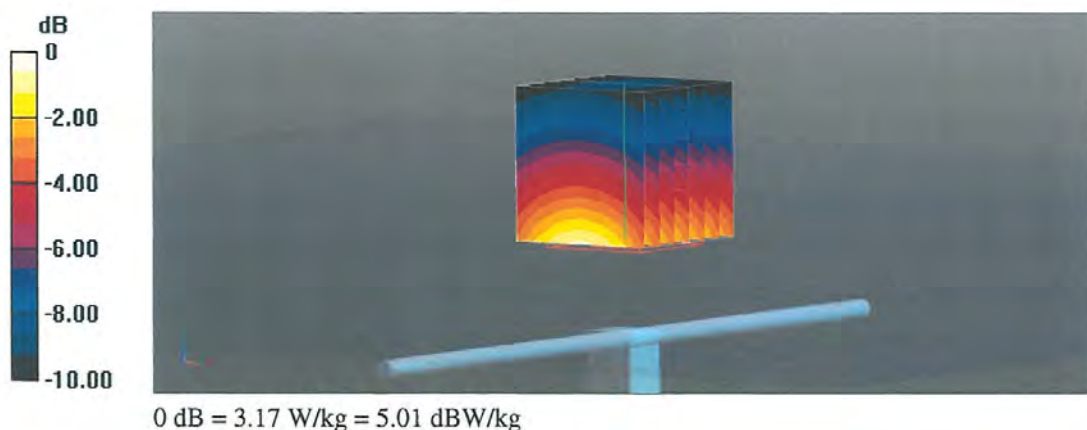
Peak SAR (extrapolated) = 3.53 W/kg

**SAR(1 g) = 2.41 W/kg; SAR(10 g) = 1.59 W/kg**

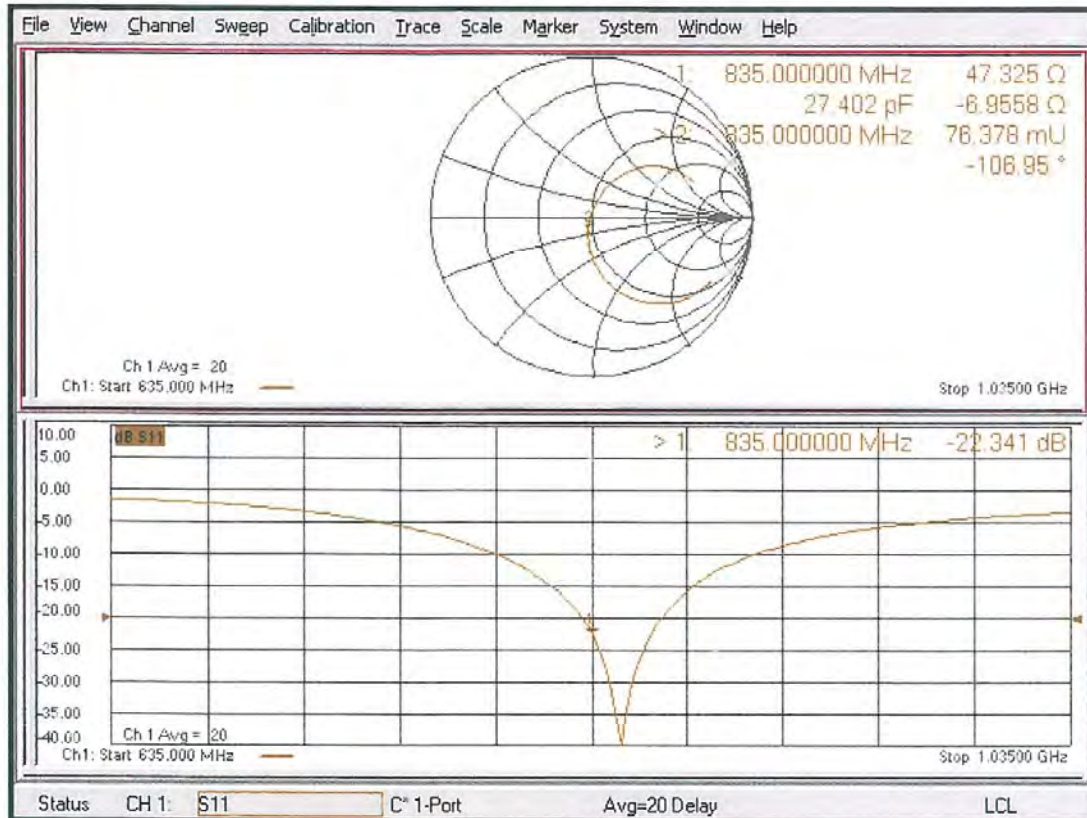
Smallest distance from peaks to all points 3 dB below = 15.3 mm

Ratio of SAR at M2 to SAR at M1 = 68.5%

Maximum value of SAR (measured) = 3.17 W/kg



### Impedance Measurement Plot for Body TSL



**Calibration Laboratory of**  
Schmid & Partner  
Engineering AG  
Zeughausstrasse 43, 8004 Zurich, Switzerland



**S** Schweizerischer Kalibrierdienst  
**C** Service suisse d'étalonnage  
**S** Servizio svizzero di taratura  
**S** Swiss Calibration Service

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 0108

Client **DT&C (Dymstec)**

Certificate No: D1800V2-2d202\_Mar20

## CALIBRATION CERTIFICATE

Object **D1800V2 - SN:2d202**

Calibration procedure(s) **QA CAL-05.v11**  
**Calibration Procedure for SAR Validation Sources between 0.7-3 GHz**

Calibration date: **March 20, 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  $(22 \pm 3)^{\circ}\text{C}$  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         | 03-Apr-19 (No. 217-02892/02893)   | Apr-20                 |
| Power sensor NRP-Z91            | SN: 103244         | 03-Apr-19 (No. 217-02892)         | Apr-20                 |
| Power sensor NRP-Z91            | SN: 103245         | 03-Apr-19 (No. 217-02893)         | Apr-20                 |
| Reference 20 dB Attenuator      | SN: 5058 (20k)     | 04-Apr-19 (No. 217-02894)         | Apr-20                 |
| Type-N mismatch combination     | SN: 5047.2 / 06327 | 04-Apr-19 (No. 217-02895)         | Apr-20                 |
| Reference Probe EX3DV4          | SN: 7349           | 31-Dec-19 (No. EX3-7349_Dec19)    | Dec-20                 |
| DAE4                            | SN: 601            | 27-Dec-19 (No. DAE4-601_Dec19)    | Dec-20                 |
| Secondary Standards             | ID #               | Check Date (in house)             | Scheduled Check        |
| Power meter E4419B              | SN: GB39512475     | 30-Oct-14 (in house check Feb-19) | In house check: Oct-20 |
| Power sensor HP 8481A           | SN: US37292783     | 07-Oct-15 (in house check Oct-18) | In house check: Oct-20 |
| Power sensor HP 8481A           | SN: MY41092317     | 07-Oct-15 (in house check Oct-18) | In house check: Oct-20 |
| RF generator R&S SMT-06         | SN: 100972         | 15-Jun-15 (in house check Oct-18) | In house check: Oct-20 |
| Network Analyzer Agilent E8358A | SN: US41080477     | 31-Mar-14 (in house check Oct-19) | In house check: Oct-20 |

|                |                 |                       |                                                                                       |
|----------------|-----------------|-----------------------|---------------------------------------------------------------------------------------|
|                | Name            | Function              | Signature                                                                             |
| Calibrated by: | Jeffrey Katzman | Laboratory Technician |  |
| Approved by:   | Katja Pokovic   | Technical Manager     |  |

Issued: March 20, 2020

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

**Calibration Laboratory of  
Schmid & Partner  
Engineering AG**  
Zeughausstrasse 43, 8004 Zurich, Switzerland



**S** Schweizerischer Kalibrierdienst  
**C** Service suisse d'étalonnage  
**S** Servizio svizzero di taratura  
**S** Swiss Calibration Service

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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.

|                              |                        |             |
|------------------------------|------------------------|-------------|
| DASY Version                 | DASY5                  | V52.10.4    |
| Extrapolation                | Advanced Extrapolation |             |
| Phantom                      | Modular Flat Phantom   |             |
| Distance Dipole Center - TSL | 10 mm                  | with Spacer |
| Zoom Scan Resolution         | dx, dy, dz = 5 mm      |             |
| Frequency                    | 1800 MHz $\pm$ 1 MHz   |             |

### Head TSL parameters

The following parameters and calculations were applied.

|                                         | Temperature         | Permittivity   | Conductivity         |
|-----------------------------------------|---------------------|----------------|----------------------|
| Nominal Head TSL parameters             | 22.0 °C             | 40.0           | 1.40 mho/m           |
| Measured Head TSL parameters            | (22.0 $\pm$ 0.2) °C | 40.5 $\pm$ 6 % | 1.37 mho/m $\pm$ 6 % |
| Head TSL temperature change during test | < 0.5 °C            | ----           | ----                 |

### SAR result with Head TSL

| SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL | Condition          |                              |
|-------------------------------------------------------|--------------------|------------------------------|
| SAR measured                                          | 250 mW input power | 9.75 W/kg                    |
| SAR for nominal Head TSL parameters                   | normalized to 1W   | 39.6 W/kg $\pm$ 17.0 % (k=2) |

| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL | condition          |                              |
|---------------------------------------------------------|--------------------|------------------------------|
| SAR measured                                            | 250 mW input power | 5.13 W/kg                    |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 20.7 W/kg $\pm$ 16.5 % (k=2) |

### Body TSL parameters

The following parameters and calculations were applied.

|                                         | Temperature         | Permittivity   | Conductivity         |
|-----------------------------------------|---------------------|----------------|----------------------|
| Nominal Body TSL parameters             | 22.0 °C             | 53.3           | 1.52 mho/m           |
| Measured Body TSL parameters            | (22.0 $\pm$ 0.2) °C | 53.1 $\pm$ 6 % | 1.48 mho/m $\pm$ 6 % |
| Body TSL temperature change during test | < 0.5 °C            | ----           | ----                 |

### SAR result with Body TSL

| SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL | Condition          |                              |
|-------------------------------------------------------|--------------------|------------------------------|
| SAR measured                                          | 250 mW input power | 9.59 W/kg                    |
| SAR for nominal Body TSL parameters                   | normalized to 1W   | 39.0 W/kg $\pm$ 17.0 % (k=2) |

| SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL | condition          |                              |
|---------------------------------------------------------|--------------------|------------------------------|
| SAR measured                                            | 250 mW input power | 5.04 W/kg                    |
| SAR for nominal Body TSL parameters                     | normalized to 1W   | 20.4 W/kg $\pm$ 16.5 % (k=2) |

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

### Antenna Parameters with Head TSL

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 48.6 $\Omega$ - 2.0 j $\Omega$ |
| Return Loss                          | - 32.2 dB                      |

### Antenna Parameters with Body TSL

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 45.0 $\Omega$ - 3.5 j $\Omega$ |
| Return Loss                          | - 23.8 dB                      |

### General Antenna Parameters and Design

|                                  |          |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.212 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: 20.03.2020

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 1800 MHz; Type: D1800V2; Serial: D1800V2 - SN:2d202**

Communication System: UID 0 - CW; Frequency: 1800 MHz

Medium parameters used:  $f = 1800$  MHz;  $\sigma = 1.37$  S/m;  $\epsilon_r = 40.5$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(8.64, 8.64, 8.64) @ 1800 MHz; Calibrated: 31.12.2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.12.2019
- 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=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 110.3 V/m; Power Drift = -0.01 dB

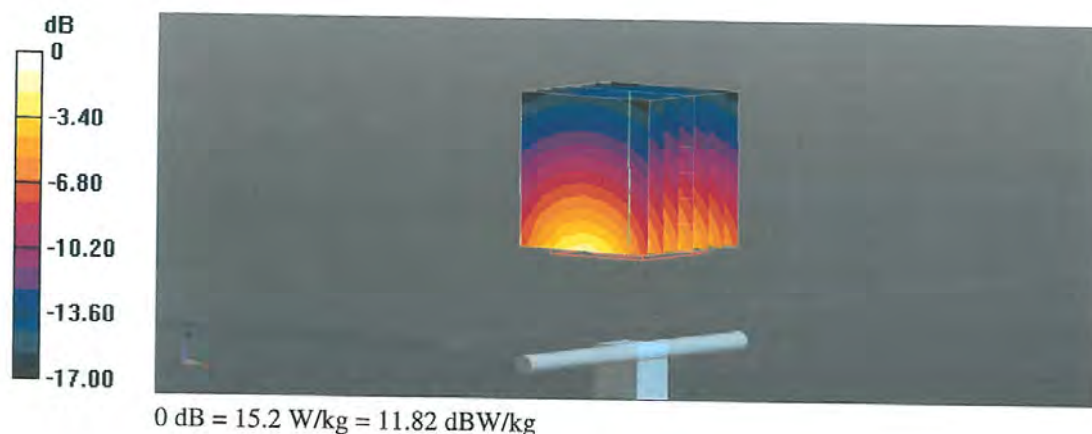
Peak SAR (extrapolated) = 18.1 W/kg

**SAR(1 g) = 9.75 W/kg; SAR(10 g) = 5.13 W/kg**

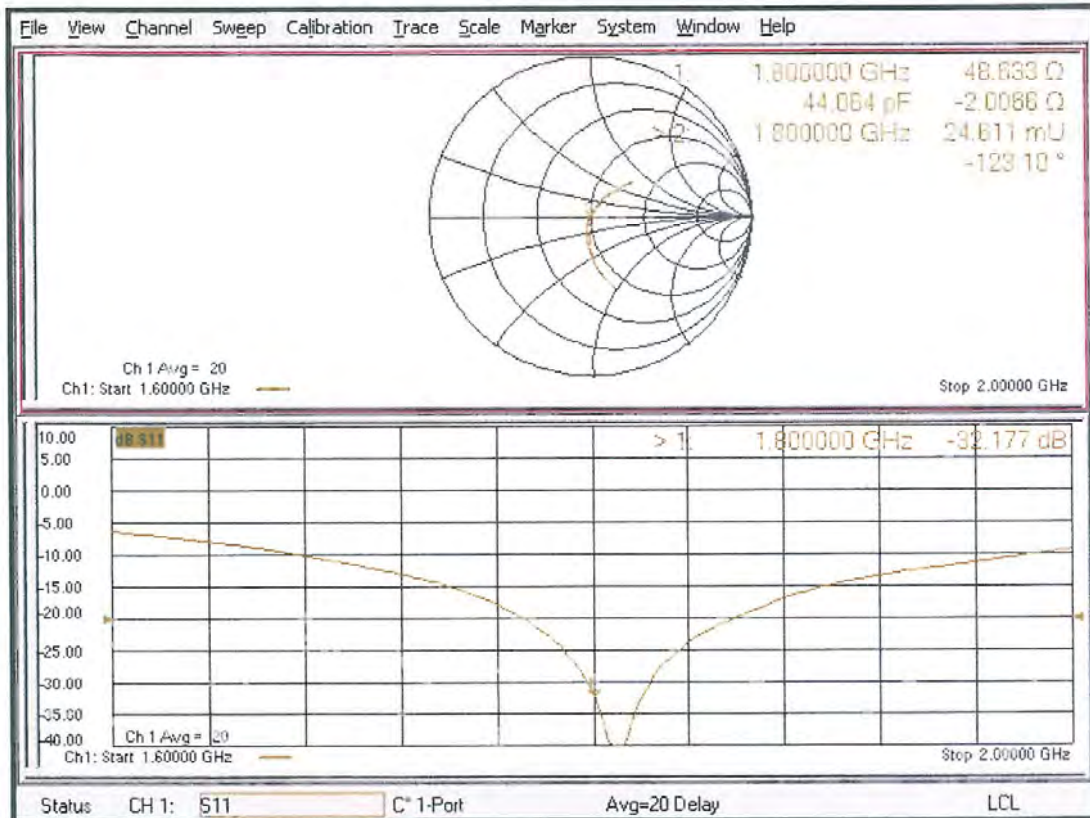
Smallest distance from peaks to all points 3 dB below = 10 mm

Ratio of SAR at M2 to SAR at M1 = 54.4%

Maximum value of SAR (measured) = 15.2 W/kg



### Impedance Measurement Plot for Head TSL



## DASY5 Validation Report for Body TSL

Date: 19.03.2020

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 1800 MHz; Type: D1800V2; Serial: D1800V2 - SN:2d202**

Communication System: UID 0 - CW; Frequency: 1800 MHz

Medium parameters used:  $f = 1800$  MHz;  $\sigma = 1.48$  S/m;  $\epsilon_r = 53.1$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(8.44, 8.44, 8.44) @ 1800 MHz; Calibrated: 31.12.2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.12.2019
- Phantom: Flat Phantom 5.0 (back); Type: QD 000 P50 AA; Serial: 1002
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

### Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 104.2 V/m; Power Drift = -0.07 dB

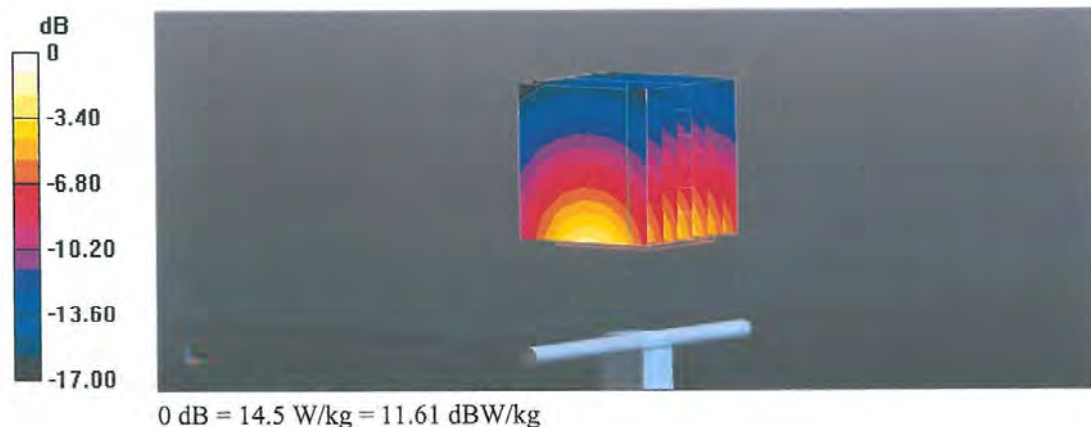
Peak SAR (extrapolated) = 17.1 W/kg

**SAR(1 g) = 9.59 W/kg; SAR(10 g) = 5.04 W/kg**

Smallest distance from peaks to all points 3 dB below = 9.8 mm

Ratio of SAR at M2 to SAR at M1 = 57.2%

Maximum value of SAR (measured) = 14.5 W/kg



### Impedance Measurement Plot for Body TSL

