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# Report On

Specific Absorption Rate Testing of the  
XYZ Reality Limited, Atom Hard Hat.

Covering FCC 47CFR 2.1093, RSS 102 Issue 5 and related  
documents.

FCC ID:

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**COMMERCIAL-IN-CONFIDENCE**

Document 75952587 Report 24 Issue 1

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COMMERCIAL-IN-CONFIDENCE

**REPORT ON**

Specific Absorption Rate Testing of the  
XYZ Reality Limited, Atom Hard Hat.

Document 75952587 Report 23 Issue 1

December 2021

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**DATED**

16 December 2021



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## SECTION 1

### REPORT SUMMARY

Specific Absorption Rate Testing of the  
XYZ Reality Limited, Atom Hard Hat.



## 1.1 REPORT MODIFICATION RECORD

Alterations and additions to this report will be issued to the holders of each copy in the form of a complete document.

| Issue | Description of Change | Date of Issue |
|-------|-----------------------|---------------|
| 1     | First Issue           | <date>        |



## 1.2 INTRODUCTION

The information contained in this report is intended to show verification of the Specific Absorption Rate Testing of the XYZ Reality Limited, Atom Hard Hat. to the requirements of KDB 447498 D01 v06 General RF Exposure Guidance

|                               |   |
|-------------------------------|---|
| Objective                     | To perform Specific Absorption Rate Testing to determine the Equipment Under Test's (EUT's) compliance with the requirements specified of KDB 447498 D01 v06 General RF Exposure Guidance, for the series of tests carried out. |
| Applicant                     | XYZ Reality Limited   |
| Manufacturer                  | XYZ Reality Limited   |
| Manufacturing Description     | Protective Hard Hat with integrated eye protection and augmented reality  |
| Model                         | Atom Hard Hat   |
| Part Number                   | XYZ-12-01   |
| Serial/IMEI Number(s)         | Not serialised (Storix-ID 599374-29) – Radiated<br>Not serialised (Storix-ID 599374-118) – Conducted  |
| Number of Samples Tested      | 2   |
| Hardware Version              | Not Applicable  |
| Software Version              | Windows Certification Build   |
| Test Specification/Issue/Date | KDB 447498 D01 v06 General RF Exposure Guidance   |
| Order Number                  | XYZ0179   |
| Date of Receipt               | 08/06/2021  |
| Start of Test                 | 27/09/2021  |
| Finish of Test                | 01/10/2021  |
| Related Document(s)           | FCC 47CFR 2.1093<br>KDB 865664 – D01 v01r04<br>KDB 865664 – D02 v01r02<br>IEEE 1528-2013<br>KDB 248227 – D01 v02r02   |
| Name of Engineer(s)           | Ravish Foolchund  |



### 1.3 BRIEF SUMMARY OF RESULTS

The measurements shown in this report were made in accordance with the procedures specified KDB 447498 D01 v06 General RF Exposure Guidance.

The maximum volume averaged stand-alone SAR found during this Assessment:

|   |                 |               |
|---|-----------------|---------------|
| Max 1g SAR (W/kg) Head  | 4.21 (Measured) | 5.41 (Scaled) |
| Max 10g SAR (W/kg) Extremities  | 1.36 (Measured) | 1.85 (Scaled) |
| The maximum 1 g volume averaged SAR level measured for all the tests performed did not exceed the limits for Occupational Use/ Controlled Exposure (W/kg) Partial Body of 8.0 W/kg which is the relevant limit for testing according to the KDB 447498 D01 v06 General RF Exposure Guidance.    |                 |               |
| The maximum 10 g volume averaged SAR level measured for all the tests performed did not exceed the limits for Occupational Use/ Controlled Exposure (W/kg) (Extremities) of 20.0 W/kg which is the relevant limit for testing according to the KDB 447498 D01 v06 General RF Exposure Guidance. |                 |               |

The maximum volume averaged stand-alone Reported SAR found during this Assessment for each supported mode:

| RAT   | Band     | Test Configuration | Max Reported SAR (W/kg) |
|---|----------|--------------------|-------------------------|
| WLAN  | 2450 MHz | Head (1g)          | 5.41                    |
| Bluetooth   | 2450 MHz | Head (1g)          | 0.40*                   |
| 2.4GHz Proprietary Tracking Beacon  | 2450 MHz | Head (1g)          | 0.40*                   |
| WLAN  | 2450 MHz | Extremities (10g)  | 1.85                    |
| Bluetooth   | 2450 MHz | Extremities (10g)  | 0.24*                   |
| 2.4GHz Proprietary Tracking Beacon  | 2450 MHz | Extremities (10g)  | 0.02*                   |
| The maximum 1g volume averaged SAR level measured for all the tests performed (including simultaneous transmission analysis results) did not exceed the limits for Occupational Use/ Controlled Exposure (W/kg) Partial Body of 8.0 W/kg    |          |                    |                         |
| The maximum 10g volume averaged SAR level measured for all the tests performed (including simultaneous transmission analysis results) did not exceed the limits for Occupational Use/ Controlled Exposure (W/kg) (Extremities) of 20.0 W/kg |          |                    |                         |
| *Estimated values as per KDB 447498 D01 v06   |          |                    |                         |



Simultaneous Transmission:

SAR Test was performed for WLAN testing only, the device also has capability of simultaneous transmission of WLAN, Bluetooth and a proprietary tracking beacon. Bluetooth and tracking beacon meet the standalone low power exclusion requirements (See section 1.4.3). Estimated SAR values are applied for simultaneous transmission assessment.

Simultaneous Transmission.

| Position / Exposure  | WLAN-SISO<br>Antenna A<br>SAR (W/kg) | Bluetooth<br>SAR (W/kg) | 2.4GHz<br>Proprietary<br>Tracking<br>Beacon<br>SAR (W/kg) | Sum of SAR<br>(W/Kg) | Peak<br>Location<br>Separation<br>Ratio<br>required? | Peak Location<br>Separation<br>Ratio |
|----------------------|--------------------------------------|-------------------------|---|----------------------|--|--------------------------------------|
| Head (1g)            | 4.53                                 | 0.40                    | 0.40  | 5.33                 | No   | N/A                                  |
| Extremities<br>(10g) | 1.69                                 | 0.24                    | 0.02  | 1.95                 | No   | N/A                                  |

| Position / Exposure  | WLAN-SISO<br>Antenna B<br>SAR (W/kg) | Bluetooth<br>SAR (W/kg) | 2.4GHz<br>Proprietary<br>Tracking<br>Beacon<br>SAR (W/kg) | Sum of SAR<br>(W/Kg) | Peak<br>Location<br>Separation<br>Ratio<br>required? | Peak Location<br>Separation<br>Ratio |
|----------------------|--------------------------------------|-------------------------|---|----------------------|--|--------------------------------------|
| Head (1g)            | 5.41                                 | 0.40                    | 0.40  | <b>6.21</b>          | No   | N/A                                  |
| Extremities<br>(10g) | 1.85                                 | 0.24                    | 0.02  | <b>2.11</b>          | No   | N/A                                  |

| Position / Exposure  | WLAN-MIMO<br>Antenna A<br>SAR (W/kg) | WLAN-MIMO<br>Antenna B<br>SAR (W/kg) | Bluetooth<br>SAR (W/kg) | 2.4GHz<br>Proprietary<br>Tracking<br>Beacon<br>SAR (W/kg) | Sum of<br>SAR<br>(W/Kg) | Peak<br>Location<br>Separation<br>Ratio<br>required? | Peak<br>Location<br>Separation<br>Ratio |
|----------------------|--------------------------------------|--------------------------------------|-------------------------|---|-------------------------|--|---|
| Head (1g)            | 1.99                                 | 2.22                                 | 0.40                    | 0.40  | 5.01                    | No   | N/A                                     |
| Extremities<br>(10g) | 0.87                                 | 0.80                                 | 0.24                    | 0.02  | 1.93                    | No   | N/A                                     |



## 1.4 TEST RESULTS SUMMARY

### 1.4.1 System Performance / Validation Check Results

Prior to formal testing being performed a System Check was performed in accordance with KDB 865664 and the results were compared against published data in Standard IEEE 1528-2013. The following results were obtained: -

#### System performance / Validation results

| Date       | Frequency (MHz) | Fluid Type | Measured Max 1g SAR (W/kg) * | Max 1g SAR (W/kg) Target | Percentage Drift on Reference |
|------------|-----------------|------------|------------------------------|--------------------------|-------------------------------|
| 27/09/2021 | 2450            | HBBL       | 53.27                        | 52.40                    | 1.66                          |
| 28/09/2021 | 2450            | HBBL       | 54.07                        | 52.40                    | 3.19                          |
| 30/09/2021 | 2450            | HBBL       | 54.47                        | 52.40                    | 3.95                          |
| 01/10/2021 | 2450            | HBBL       | 54.67                        | 52.40                    | 4.33                          |

\*Normalised to a forward power of 1W



#### 1.4.2 Results Summary Tables

2.4 GHz WLAN - SISO Antenna A - 802.11b 20MHz 1Mbps:  
Specific Absorbtion Rate (Maximum SAR)

| Test Position  | Channel Number | Frequency (MHz) | Measured Average Power (dBm) | Tune Up (dBm) | SAR Scan Type | Measured 1g SAR (W/kg) | Scaled 1g SAR (W/kg) | Measured 10g SAR (W/kg) | Scaled 10g SAR (W/kg) | Scan Figure Number |
|--|----------------|-----------------|------------------------------|---------------|---------------|------------------------|----------------------|-------------------------|-----------------------|--------------------|
| 0mm Front Face   | 2              | 2417            | 20.21                        | 20.50         | Full          | 4.04                   | 4.32                 | 1.51                    | 1.62                  | C.1                |
| 0mm Front Face   | 10             | 2457            | 20.20                        | 20.50         | Full          | 4.13                   | 4.42                 | 1.58                    | 1.69                  | C.2                |
| 0mm Front Face   | 6              | 2437            | 20.01                        | 20.50         | Full          | 4.04                   | 4.53                 | 1.49                    | 1.67                  | C.3                |
| Limit for workers (Controlled Exposure) 10.0 W/kg (1g) (Head/Body) |                |                 |                              |               |               |                        |                      |                         |                       |                    |
| Limit for workers (Controlled Exposure) 20.0 W/kg (1g) (Limbs)     |                |                 |                              |               |               |                        |                      |                         |                       |                    |

2.4 GHz WLAN - SISO Antenna B - 802.11b 20MHz 1Mbps:  
Specific Absorbtion Rate (Maximum SAR)

| Test Position  | Channel Number | Frequency (MHz) | Measured Average Power (dBm) | Tune Up (dBm) | SAR Scan Type | Measured 1g SAR (W/kg) | Scaled 1g SAR (W/kg) | Measured 10g SAR (W/kg) | Scaled 10g SAR (W/kg) | Scan Figure Number |
|--|----------------|-----------------|------------------------------|---------------|---------------|------------------------|----------------------|-------------------------|-----------------------|--------------------|
| 0mm Front Face   | 6              | 2437            | 19.86                        | 20.50         | Full          | 4.03                   | 4.68                 | 1.47                    | 1.71                  | C.4                |
| 0mm Front Face   | 2              | 2417            | 19.75                        | 20.50         | Full          | 3.80                   | 4.52                 | 1.38                    | 1.64                  | C.5                |
| 0mm Front Face   | 11             | 2462            | 19.65                        | 20.50         | Full          | 4.21                   | 5.14                 | 1.51                    | 1.84                  | C.6                |
| Limit for workers (Controlled Exposure) 10.0 W/kg (1g) (Head/Body) |                |                 |                              |               |               |                        |                      |                         |                       |                    |
| Limit for workers (Controlled Exposure) 20.0 W/kg (1g) (Limbs)     |                |                 |                              |               |               |                        |                      |                         |                       |                    |

2.4 GHz WLAN - SISO Antenna A - 802.11g 20MHz 6Mbps:  
Specific Absorbtion Rate (Maximum SAR)

| Test Position  | Channel Number | Frequency (MHz) | Measured Average Power (dBm) | Tune Up (dBm) | SAR Scan Type | Measured 1g SAR (W/kg) | Scaled 1g SAR (W/kg) | Measured 10g SAR (W/kg) | Scaled 10g SAR (W/kg) | Scan Figure Number |
|--|----------------|-----------------|------------------------------|---------------|---------------|------------------------|----------------------|-------------------------|-----------------------|--------------------|
| 0mm Front Face   | 9              | 2452            | 19.90                        | 20.50         | Full          | 3.09                   | 3.55                 | 1.23                    | 1.41                  | C.7                |
| 0mm Front Face   | 3              | 2422            | 19.32                        | 20.50         | Full          | 2.62                   | 3.43                 | 1.03                    | 1.35                  | C.8                |
| 0mm Front Face   | 6              | 2437            | 19.06                        | 20.50         | Full          | 2.75                   | 3.82                 | 1.09                    | 1.52                  | C.9                |
| Limit for workers (Controlled Exposure) 10.0 W/kg (1g) (Head/Body) |                |                 |                              |               |               |                        |                      |                         |                       |                    |
| Limit for workers (Controlled Exposure) 20.0 W/kg (1g) (Limbs)     |                |                 |                              |               |               |                        |                      |                         |                       |                    |



2.4 GHz WLAN - SISO Antenna B - 802.11g 20MHz 6Mbps:  
Specific Absorbtion Rate (Maximum SAR)

| Test Position  | Channel Number | Frequency (MHz) | Measured Average Power (dBm) | Tune Up (dBm) | SAR Scan Type | Measured 1g SAR (W/kg) | Scaled 1g SAR (W/kg) | Measured 10g SAR (W/kg) | Scaled 10g SAR (W/kg) | Scan Figure Number |
|--|----------------|-----------------|------------------------------|---------------|---------------|------------------------|----------------------|-------------------------|-----------------------|--------------------|
| 0mm Front Face   | 6              | 2437            | 19.07                        | 20.50         | Full          | 3.36                   | 4.67                 | 1.14                    | 1.58                  | C.10               |
| 0mm Front Face   | 9              | 2452            | 19.15                        | 20.50         | Full          | 3.98                   | <b>5.41</b>          | 1.36                    | 1.85                  | C.11               |
| 0mm Front Face   | 3              | 2422            | 18.65                        | 20.50         | Full          | 3.29                   | 5.03                 | 1.16                    | 1.77                  | C.12               |
| Limit for workers (Controlled Exposure) 10.0 W/kg (1g) (Head/Body) |                |                 |                              |               |               |                        |                      |                         |                       |                    |
| Limit for workers (Controlled Exposure) 20.0 W/kg (1g) (Limbs)     |                |                 |                              |               |               |                        |                      |                         |                       |                    |

2.4 GHz WLAN - SISO Antenna A - 802.11n 20MHz:  
Specific Absorbtion Rate (Maximum SAR)

| Test Position  | Channel Number | Frequency (MHz) | Measured Average Power (dBm) | Tune Up (dBm) | SAR Scan Type | Measured 1g SAR (W/kg) | Scaled 1g SAR (W/kg) | Measured 10g SAR (W/kg) | Scaled 10g SAR (W/kg) | Scan Figure Number |
|--|----------------|-----------------|------------------------------|---------------|---------------|------------------------|----------------------|-------------------------|-----------------------|--------------------|
| 0mm Front Face   | 9              | 2452            | 19.78                        | 20.50         | Full          | 3.08                   | 3.63                 | 1.21                    | 1.43                  | C.13               |
| 0mm Front Face   | 6              | 2437            | 19.42                        | 20.50         | Full          | 2.73                   | 3.49                 | 1.08                    | 1.38                  | C.14               |
| 0mm Front Face   | 3              | 2422            | 19.14                        | 20.50         | Full          | 2.50                   | 3.43                 | 0.98                    | 1.34                  | C.15               |
| Limit for workers (Controlled Exposure) 10.0 W/kg (1g) (Head/Body) |                |                 |                              |               |               |                        |                      |                         |                       |                    |
| Limit for workers (Controlled Exposure) 20.0 W/kg (1g) (Limbs)     |                |                 |                              |               |               |                        |                      |                         |                       |                    |

2.4 GHz WLAN - SISO Antenna B - 802.11n 20MHz:  
Specific Absorbtion Rate (Maximum SAR)

| Test Position  | Channel Number | Frequency (MHz) | Measured Average Power (dBm) | Tune Up (dBm) | SAR Scan Type | Measured 1g SAR (W/kg) | Scaled 1g SAR (W/kg) | Measured 10g SAR (W/kg) | Scaled 10g SAR (W/kg) | Scan Figure Number |
|--|----------------|-----------------|------------------------------|---------------|---------------|------------------------|----------------------|-------------------------|-----------------------|--------------------|
| 0mm Front Face   | 9              | 2452            | 19.27                        | 20.50         | Full          | 3.95                   | 5.25                 | 1.35                    | 1.80                  | C.16               |
| 0mm Front Face   | 6              | 2437            | 18.96                        | 20.50         | Full          | 3.43                   | 4.91                 | 1.17                    | 1.67                  | C.17               |
| 0mm Front Face   | 3              | 2422            | 18.85                        | 20.50         | Full          | 3.59                   | 5.24                 | 1.24                    | 1.81                  | C.18               |
| Limit for workers (Controlled Exposure) 10.0 W/kg (1g) (Head/Body) |                |                 |                              |               |               |                        |                      |                         |                       |                    |
| Limit for workers (Controlled Exposure) 20.0 W/kg (1g) (Limbs)     |                |                 |                              |               |               |                        |                      |                         |                       |                    |



**2.4 GHz WLAN - MIMO Antenna A - 802.11g 20MHz 6Mbps:  
Specific Absorbtion Rate (Maximum SAR)**

| Test Position  | Channel Number | Frequency (MHz) | Measured Average Power (dBm) | Tune Up (dBm) | SAR Scan Type | Measured 1g SAR (W/kg) | Scaled 1g SAR (W/kg) | Measured 10g SAR (W/kg) | Scaled 10g SAR (W/kg) | Scan Figure Number |
|--|----------------|-----------------|------------------------------|---------------|---------------|------------------------|----------------------|-------------------------|-----------------------|--------------------|
| 0mm Front Face   | 6              | 2437            | 17.10                        | 17.50         | Full          | 1.79                   | 1.97                 | 0.71                    | 0.87                  | C.19               |
| 0mm Front Face   | 9              | 2452            | 17.09                        | 17.50         | Full          | 1.81                   | 1.99                 | 0.72                    | 0.79                  | C.20               |
| 0mm Front Face   | 3              | 2422            | 17.05                        | 17.50         | Full          | 1.77                   | 1.97                 | 0.71                    | 0.79                  | C.21               |
| Limit for workers (Controlled Exposure) 10.0 W/kg (1g) (Head/Body) |                |                 |                              |               |               |                        |                      |                         |                       |                    |
| Limit for workers (Controlled Exposure) 20.0 W/kg (1g) (Limbs)     |                |                 |                              |               |               |                        |                      |                         |                       |                    |

**2.4 GHz WLAN - MIMO Antenna A - 802.11g 20MHz 6Mbps:  
Specific Absorbtion Rate (Maximum SAR)**

| Test Position  | Channel Number | Frequency (MHz) | Measured Average Power (dBm) | Tune Up (dBm) | SAR Scan Type | Measured 1g SAR (W/kg) | Scaled 1g SAR (W/kg) | Measured 10g SAR (W/kg) | Scaled 10g SAR (W/kg) | Scan Figure Number |
|--|----------------|-----------------|------------------------------|---------------|---------------|------------------------|----------------------|-------------------------|-----------------------|--------------------|
| 0mm Front Face   | 6              | 2437            | 17.00                        | 17.50         | Full          | 1.90                   | 2.13                 | 0.68                    | 0.76                  | C.22               |
| 0mm Front Face   | 3              | 2422            | 16.95                        | 17.50         | Full          | 1.95                   | 2.22                 | 0.70                    | 0.80                  | C.23               |
| 0mm Front Face   | 9              | 2452            | 16.82                        | 17.50         | Full          | 1.89                   | 2.21                 | 0.67                    | 0.78                  | C.24               |
| Limit for workers (Controlled Exposure) 10.0 W/kg (1g) (Head/Body) |                |                 |                              |               |               |                        |                      |                         |                       |                    |
| Limit for workers (Controlled Exposure) 20.0 W/kg (1g) (Limbs)     |                |                 |                              |               |               |                        |                      |                         |                       |                    |



#### 1.4.3 Standalone SAR Estimation

When the standalone SAR test exclusion of section 4.3.1 is applied to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to the following to determine simultaneous transmission SAR test exclusion. The estimated SAR is only used to determine simultaneous transmission SAR test exclusion; When SAR is estimated, it must be applied to determine the sum of 1-g SAR test exclusion. When SAR to peak location separation ratio test exclusion is applied, the highest reported SAR for simultaneous transmission can be an estimated standalone SAR if the estimated SAR is the highest among the simultaneously transmitting antennas (see KDB 690783).

$(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm}) \cdot [\sqrt{f(\text{GHz})} / 7.5] \text{ W/kg}$  for test separation distances  $\leq 50 \text{ mm}$ ;

where  $x = 7.5$  for 1-g SAR, and  $x = 18.75$  for 10-g SAR

when the minimum test separation distance is  $< 5\text{mm}$ , a distance of 5mm is applied.

##### Bluetooth SAR Estimation

| Test Configuration | Frequency (MHz) | Maximum Power (mW) | Distance (mm) | Estimated SAR (W/kg) |
|--------------------|-----------------|--------------------|---------------|----------------------|
| Extremities (10g)  | 2480            | 14.12              | 5             | 0.24                 |
| Head (1g)          | 2480            | 14.12              | $>50$         | 0.40*                |

\* As per KDB 447498 D01 v06 -Section 4.3.2 b 2 (0.4 W/kg for 1-g SAR and 1.0 W/kg for 10-g SAR, when the test separation distance is  $> 50 \text{ mm}$ .)

##### Proprietary 2.4GHz Transmitter Estimation

| Test Configuration | Frequency (MHz) | Maximum Power (mW) | Distance (mm) | Estimated SAR (W/kg) |
|--------------------|-----------------|--------------------|---------------|----------------------|
| Extremities (10g)  | 2480            | 14.12              | 5             | 0.02                 |
| Head (1g)          | 2480            | 14.12              | $>50$         | 0.40*                |

\* As per KDB 447498 D01 v06 -Section 4.3.2 b 2 (0.4 W/kg for 1-g SAR and 1.0 W/kg for 10-g SAR, when the test separation distance is  $> 50 \text{ mm}$ .)

#### 1.4.4 Standalone SAR Test Exclusion Considerations (KDB 447498 D01)

The 1g SAR Test exclusion thresholds for 100 MHz to 6 GHz *test separation distances  $\leq 50 \text{ mm}$*  are determined by:

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

- $f(\text{GHz})$  is the RF channel transmit frequency in GHz.
- Power and distance are rounded to the nearest mW and mm before calculation.
- The result is rounded to one decimal place for comparison.
- When the maximum test separation distance is  $< 5 \text{ mm}$ , a distance of 5 mm is applied.

| RAT & Band                         | Frequency (MHz) | Power (dBm) | Power (mW) | Test Position | Distance (mm) | Threshold | Test Exclusion |
|------------------------------------|-----------------|-------------|------------|---------------|---------------|-----------|----------------|
| Bluetooth                          | 2480            | 11.5        | 14.0       | Head          | 50            | 0.4       | Yes            |
| 2.4GHz Proprietary Tracking Beacon | 2480            | 0.0         | 1.0        | Head          | 50            | 0.00      | Yes            |



The 10g SAR Test exclusion thresholds for 100 MHz to 6 GHz *test separation distances*  $\leq 50$  mm are determined by:

$[(\text{max power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] / f_{(\text{GHz})} \leq 7.5$ , where

- $f_{(\text{GHz})}$  is the RF channel transmit frequency in GHz.
- Power and distance are rounded to the nearest mW and mm before calculation.
- The result is rounded to one decimal place for comparison.
- When the maximum test separation distance is  $< 5$  mm, a distance of 5 mm is applied.

| RAT & Band                         | Frequency (MHz) | Power (dBm) | Power (mW) | Test Position | Distance (mm) | Threshold | Test Exclusion |
|------------------------------------|-----------------|-------------|------------|---------------|---------------|-----------|----------------|
| Bluetooth                          | 2480            | 11.5        | 14.0       | Head          | 5             | 4.4       | Yes            |
| 2.4GHz Proprietary Tracking Beacon | 2480            | 0.0         | 1.0        | Head          | 5             | 0.3       | Yes            |

#### 1.4.5 Technical Description

The equipment under test (EUT) was a XYZ Reality Limited, Atom Hard Hat. A full technical description can be found in the manufacturer's documentation.

#### 1.4.6 Test Configuration and Modes of Operation

The testing was performed with both integral batteries and an external battery supplied and manufactured by XYZ fitted to the helmet.

The helmet features Bluetooth, 2.4 GHz WLAN (802.11b,g,n) up to 2x2 MIMO and a proprietary ISM 2.4 GHz Tracking Beacon. The Bluetooth, tracking beacon transmitters meet the standalone exclusion requirement of KDB 447498 D01 v06.

All 2.4 GHz WLAN testing was performed on the outer surface of the outer shell of the helmet, the antennas are fitted to the inside of the outer shell (figures 8 and 9). The outer shell provides a separation distance of  $\sim 4$ mm between the phantom and the antenna, the separation distance between the antennas and the users head is greater than 50mm due to the lining of the helmet (figure 5). Head SAR testing was performed on the outside of the helmet as a conservative approach due to the closer separation distance. The helmet also incorporates an inner shell which will further attenuate the SAR in the head.

Conducted power measurements were performed for 802.11 b,g and n modes at the lowest data rate only.

Initially large area scans were performed that covered the whole of the helmet to determine no other unintended radiation is released. Due to the curvature of the helmet, smaller generic area scans were then used to find the worst-case positioning (worst-case deemed as yielding the highest SAR levels.) Full scans were then performed on all required channels in the worst-case positions for each antenna under evaluation.

Included in this report are descriptions of the test method; the equipment used and an analysis of the test uncertainties applicable and diagrams indicating the locations of maximum SAR for each test position along with photographs indicating the positioning of the EUT against the phantom as appropriate.



## 1.5 POWER MEASUREMENTS

### 1.5.1 Method

Measurements were performed using a power meter.

### 1.5.2 Conducted Power Measurements

Measurements were performed at the lowest data rate of each mode.

| Radio Access | Channel | Frequency | Measured Power | Measured Power | Tune -Up |
|--------------|---------|-----------|----------------|----------------|----------|
| 802.11 b     | 2       | 2417      | 20.21          | 19.75          | 20.50    |
| 802.11 b     | 6       | 2437      | 20.01          | 19.86          | 20.50    |
| 802.11 b     | 10      | 2457      | 20.2           | 19.77          | 20.50    |
| 802.11 b     | 11      | 2462      | 19.23          | 19.65          | 20.50    |
| 802.11 g     | 3       | 2422      | 19.32          | 18.65          | 20.50    |
| 802.11 g     | 6       | 2437      | 19.06          | 19.07          | 20.50    |
| 802.11 g     | 9       | 2452      | 19.9           | 19.15          | 20.50    |
| 802.11 n 20  | 3       | 2422      | 19.14          | 18.85          | 20.50    |
| 802.11 n 20  | 6       | 2437      | 19.42          | 18.96          | 20.50    |
| 802.11 n 20  | 9       | 2452      | 19.78          | 19.27          | 20.50    |

| Radio Access | Channel | Frequency | Measured Power | Measured Power | Tune -Up |
|--------------|---------|-----------|----------------|----------------|----------|
| 802.11 b     | 1       | 2412      | n/a            | n/a            | n/a      |
| 802.11 b     | 7       | 2442      | n/a            | n/a            | n/a      |
| 802.11 b     | 13      | 2472      | n/a            | n/a            | n/a      |
| 802.11 g     | 3       | 2422      | 17.05          | 16.95          | 17.50    |
| 802.11 g     | 6       | 2437      | 17.10          | 17.00          | 17.50    |
| 802.11 g     | 9       | 2452      | 17.09          | 16.82          | 17.50    |
| 802.11 n 20  | 3       | 2422      | 17.11          | 16.88          | 17.50    |
| 802.11 n 20  | 6       | 2437      | 17.06          | 16.96          | 17.50    |
| 802.11 n 20  | 9       | 2452      | 17.03          | 16.78          | 17.50    |



### Tune-Up Values

| Band   | B/W MHz | Channel | Freq MHz | Modulation | FCC SISO A (US) | FCC SISO B (US) | FCC MIMO (US) |
|--------|---------|---------|----------|------------|-----------------|-----------------|---------------|
| 2.4GHz | 20      | 1       | 2412     | OFDM-HTn20 | 15.50           | 16.50           | 14.00         |
| 2.4GHz | 20      | 1       | 2412     | OFDM-g     | 15.50           | 16.50           | 14.00         |
| 2.4GHz | 20      | 1       | 2412     | CCK        | 19.25           | 19.50           | 0.50          |
| 2.4GHz | 20      | 2       | 2417     | OFDM-HTn20 | 17.50           | 18.50           | 15.50         |
| 2.4GHz | 20      | 2       | 2417     | OFDM-g     | 17.50           | 18.50           | 15.50         |
| 2.4GHz | 20      | 2       | 2417     | CCK        | 20.50           | 20.50           | 0.50          |
| 2.4GHz | 20      | 3       | 2422     | OFDM-HTn20 | 20.50           | 20.50           | 17.50         |
| 2.4GHz | 20      | 3       | 2422     | OFDM-g     | 20.50           | 20.50           | 17.50         |
| 2.4GHz | 20      | 3       | 2422     | CCK        | 20.50           | 20.00           | 0.50          |
| 2.4GHz | 20      | 4       | 2427     | OFDM-HTn20 | 20.50           | 20.50           | 17.50         |
| 2.4GHz | 20      | 4       | 2427     | OFDM-g     | 20.50           | 20.50           | 17.50         |
| 2.4GHz | 20      | 4       | 2427     | CCK        | 20.50           | 20.50           | 0.50          |
| 2.4GHz | 20      | 5       | 2432     | OFDM-HTn20 | 20.50           | 20.50           | 17.50         |
| 2.4GHz | 20      | 5       | 2432     | OFDM-g     | 20.50           | 20.50           | 17.50         |
| 2.4GHz | 20      | 5       | 2432     | CCK        | 20.50           | 20.50           | 0.50          |
| 2.4GHz | 20      | 6       | 2437     | OFDM-HTn20 | 20.50           | 20.50           | 17.50         |
| 2.4GHz | 20      | 6       | 2437     | OFDM-g     | 20.50           | 20.50           | 17.50         |
| 2.4GHz | 20      | 6       | 2437     | CCK        | 20.50           | 20.50           | 0.50          |
| 2.4GHz | 20      | 7       | 2442     | OFDM-HTn20 | 20.50           | 20.50           | 17.50         |
| 2.4GHz | 20      | 7       | 2442     | OFDM-g     | 20.50           | 20.50           | 17.50         |
| 2.4GHz | 20      | 7       | 2442     | CCK        | 20.50           | 20.50           | 0.50          |
| 2.4GHz | 20      | 8       | 2447     | OFDM-HTn20 | 20.50           | 20.50           | 17.50         |
| 2.4GHz | 20      | 8       | 2447     | OFDM-g     | 20.50           | 20.50           | 17.50         |
| 2.4GHz | 20      | 8       | 2447     | CCK        | 20.50           | 20.50           | 0.50          |
| 2.4GHz | 20      | 9       | 2452     | OFDM-HTn20 | 20.50           | 20.50           | 17.50         |
| 2.4GHz | 20      | 9       | 2452     | OFDM-g     | 20.50           | 20.50           | 17.50         |
| 2.4GHz | 20      | 9       | 2452     | CCK        | 20.50           | 20.50           | 0.50          |
| 2.4GHz | 20      | 10      | 2457     | OFDM-HTn20 | 18.50           | 18.50           | 16.50         |
| 2.4GHz | 20      | 10      | 2457     | OFDM-g     | 18.50           | 18.50           | 16.50         |
| 2.4GHz | 20      | 10      | 2457     | CCK        | 20.50           | 20.50           | 0.50          |
| 2.4GHz | 20      | 11      | 2462     | OFDM-HTn20 | 16.00           | 16.00           | 14.50         |
| 2.4GHz | 20      | 11      | 2462     | OFDM-g     | 16.00           | 16.00           | 14.50         |
| 2.4GHz | 20      | 11      | 2462     | CCK        | 19.50           | 20.50           | 0.50          |
| 2.4GHz | 20      | 12      | 2467     | OFDM-HTn20 | 13.50           | 13.50           | 11.50         |
| 2.4GHz | 20      | 12      | 2467     | OFDM-g     | 13.50           | 13.50           | 11.50         |
| 2.4GHz | 20      | 12      | 2467     | CCK        | 17.50           | 17.50           | 0.50          |



|        |    |     |      |            |       |       |       |
|--------|----|-----|------|------------|-------|-------|-------|
| 2.4GHz | 20 | 13  | 2472 | OFDM-HTn20 | -5.50 | -5.50 | -8.00 |
| 2.4GHz | 20 | 13  | 2472 | OFDM-g     | -5.50 | -5.50 | -8.00 |
| 2.4GHz | 20 | 13  | 2472 | CCK        | 14.50 | 14.25 | 0.50  |
| 2.4GHz | 40 | 3F  | 2422 | OFDM-HT    | 13.50 | 13.00 | 11.50 |
| 2.4GHz | 40 | 4F  | 2427 | OFDM-HT    | 16.00 | 16.00 | 14.00 |
| 2.4GHz | 40 | 5F  | 2432 | OFDM-HT    | 16.00 | 16.00 | 14.00 |
| 2.4GHz | 40 | 6F  | 2437 | OFDM-HT    | 16.00 | 16.00 | 14.00 |
| 2.4GHz | 40 | 7F  | 2442 | OFDM-HT    | 15.50 | 15.50 | 14.50 |
| 2.4GHz | 40 | 8F  | 2447 | OFDM-HT    | 16.00 | 16.00 | 14.00 |
| 2.4GHz | 40 | 9F  | 2452 | OFDM-HT    | 14.50 | 14.00 | 12.50 |
| 2.4GHz | 40 | 10F | 2457 | OFDM-HT    | 11.00 | 10.50 | 10.50 |



## SECTION 2

### TEST DETAILS

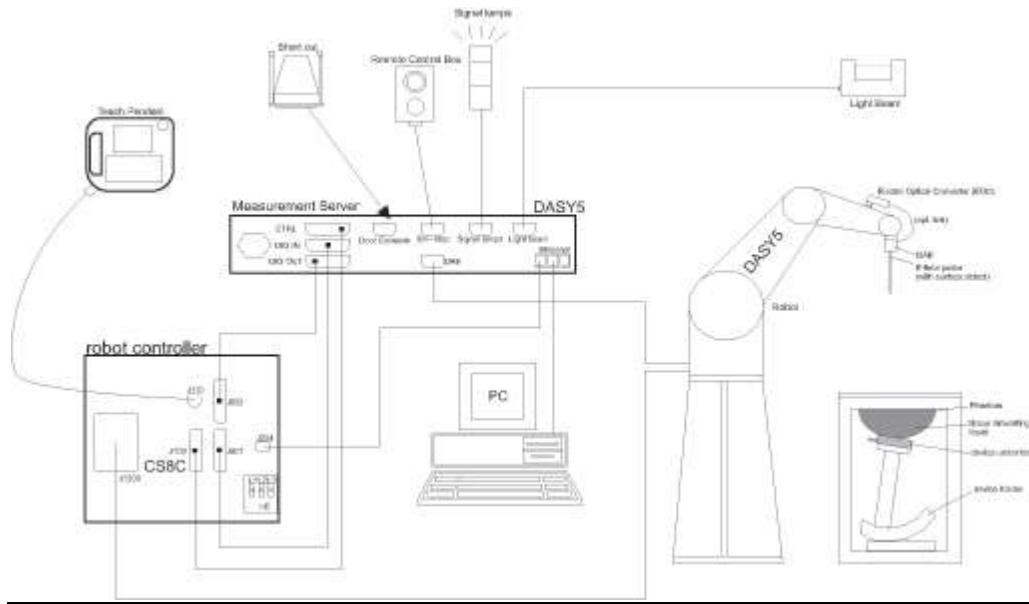
Specific Absorption Rate Testing of the  
XYZ Reality Limited, Atom Hard Hat.



## 2.1 DASY5 MEASUREMENT SYSTEM

### 2.1.1 System Description

The DASY5 system for performing compliance tests consists of the following items:



## Figure 1 System Description Diagram

A standard high precision 6-axis robot (Stäubli TX-RX family) with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).

An isotropic field probe optimized and calibrated for the targeted measurement.

A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.

The Electro-optical converter (EOC) performs the conversion from optical to electrical signals for the digital communication to the DAE. To use optical surface detection, a special version of the EOC is required. The EOC signal is transmitted to the measurement server.

The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.

The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.

A computer running the DASY software.

Remote control and teach pendant as well as additional circuitry for robot safety such as warning lamps, etc.



The device holder is constructed of low-loss Polyoxyethylene (POM) material. The holder features height and angle adjustment, to enable positioning of the device at the required test position.

The Elliptical (ELI) phantom is used for compliance testing of handheld and body-mounted wireless equipment. The phantom has a major axis of 600mm and a minor axis of 400mm. The volume of the phantom is 30 litres. The phantom is filled with a tissue simulant liquid to a depth greater than 150mm.



### 2.1.2 Probe Specification

The probes used by the DASY system are isotropic E-field probes, constructed with a symmetric design and a triangular core. The probes have built-in shielding against static charges and are contained within a PEEK enclosure material. These probes are specially designed and calibrated for use in liquids with high permittivities. The frequency range of the probes are from 6 MHz to 6 GHz.

### 2.1.3 Data Acquisition Electronics

The data acquisition electronics (DAE4 or DAE3) consist of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16-bit AD-converter and a command decoder with a control logic unit. Transmission to the measurement server is accomplished through an optical downlink for data and status information, as well as an optical uplink for commands and the clock.

The mechanical probe mounting device includes two different sensor systems for frontal and sideways probe contacts. They are used for mechanical surface detection and probe collision detection. The input impedance of both the DAE4 as well as of the DAE3 box is 200MOhm; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.

### 2.1.4 SAR Evaluation Description

The DASY5 software includes all numerical procedures necessary to evaluate the spatial peak SAR values.

Based on the IEEE 1528 standard, a new algorithm has been implemented. The spatial-peak SAR can be computed over any required mass.

The base for the evaluation is a "cube" measurement in a volume of 30mm<sup>3</sup> (7x7x7 points). The measured volume must include the 1 g and 10 g cubes with the highest averaged SAR values. For that purpose, the centre of the measured volume is aligned to the interpolated peak SAR value of a previously performed area scan. If the 10g cube or both cubes are not entirely inside the measured volumes, the system issues a warning regarding the evaluated spatial peak values within the Post processing engine (SEMCAD X). This means that if the measured volume is shifted, higher values might be possible. To get the correct values you can use a finer measurement grid for the area scan. In complicated field distributions, a large grid spacing for the area scan might miss some details and give an incorrectly interpolated peak location.

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

1. extraction of the measured data (grid and values) from the Zoom Scan
2. calculation of the SAR value at every measurement point based on all stored data (A/D values and measurement parameters)
3. generation of a high-resolution mesh within the measured volume
4. interpolation of all measured values from the measurement grid to the high-resolution grid
5. extrapolation of the entire 3-D field distribution to the phantom surface over the distance from sensor to surface
6. calculation of the averaged SAR within masses of 1 g and 10 g



## 2.1.5 Interpolation, Extrapolation and Detection of Maxima

The probe is calibrated at the centre of the dipole sensors which is located 1 to 2.7mm away from the probe tip. During measurements, the probe stops shortly above the phantom surface, depending on the probe and the surface detecting system. Both distances are included as parameters in the probe configuration file. The software always knows exactly how far away the measured point is from the surface. As the probe cannot directly measure at the surface, the values between the deepest measured point and the surface must be extrapolated.

In DASY5, the choice of the coordinate system defining the location of the measurement points has no influence on the uncertainty of the interpolation, Maxima Search and extrapolation routines. The interpolation, extrapolation and maximum search routines are all based on the modified Quadratic Shepard's method. Thereby, the interpolation scheme combines a least-square fitted function method and a weighted average method which are the two basic types of computational interpolation and approximation. The DASY5 routines construct a once-continuously differentiable function that interpolates the measurement values as follows:

For each measurement point a trivariate (3-D) / bivariate (2-D) quadratic is computed. It interpolates the measurement values at the data point and forms a least-square fit to neighbouring measurement values. The spatial location of the quadratic with respect to the measurement values is attenuated by an inverse distance weighting. This is performed since the calculated quadratic will fit measurement values at nearby points more accurate than at points located further away.

After the quadratics are calculated for all measurement points, the interpolating function is calculated as a weighted average of the quadratics.

There are two control parameters that govern the behaviour of the interpolation method. One specifies the number of measurement points to be used in computing the least-square fits for the local quadratics. These measurement points are the ones nearest the input point for which the quadratic is being computed. The second parameter specifies the number of measurement points that will be used in calculating the weights for the quadratics to produce the final function. The input data points used there are the ones nearest the point at which the interpolation is desired. Appropriate defaults are chosen for each of the control parameters

The trivariate quadratics that have been previously computed for the 3-D interpolation and whose input data are at the closest distance from the phantom surface, are used in order to extrapolate the fields to the surface of the phantom.

In order to determine all the field maxima in 2-D (Area Scan) and 3-D (Zoom Scan), the measurement grid is refined by a default factor of 10 and the interpolation function is used to evaluate all field values between corresponding measurement points. Subsequently, a linear search is applied to find all the candidate maxima. In a last step, nonphysical maxima are removed and only those maxima which are within 2 dB of the global maximum value are retained.

In the Area Scan, the gradient of the interpolation function is evaluated to find all the extrema of the SAR distribution. The uncertainty on the locations of the extrema is less than 1/20 of the grid size. Only local maxima within 2 dB of the global maximum are searched and passed for the Zoom Scan measurement.

In the Zoom Scan, the interpolation function is used to extrapolate the Peak SAR from the lowest measurement points to the inner phantom surface (the extrapolation distance). The



uncertainty increases with the extrapolation distance. To keep the uncertainty within 1% for the 1 g and 10 g cubes, the extrapolation distance should not be larger than 5mm.

#### 2.1.6 Averaging and Determination of Spatial Peak SAR

The interpolated data is used to average the SAR over the 1g and 10g cubes by spatially discretising the entire measured volume. The resolution of this spatial grid used to calculate the averaged SAR is 1mm or about 42875 interpolated points. The resulting volumes are defined as cubical volumes containing the appropriate tissue parameters that are centred at the location. The location is defined as the centre of the incremental volume (voxel).

The spatial-peak SAR must be evaluated in cubical volumes containing a mass that is within 5% of the required mass. The cubical volume centred at each location, as defined above, should be expanded in all directions until the desired value for the mass is reached, with no surface boundaries of the averaging volume extending beyond the outermost surface of the considered region. In addition, the cubical volume should not consist of more than 10% of air. If these conditions are not satisfied, then the centre of the averaging volume is moved to the next location. Otherwise, the exact size of the final sampling cube is found using an inverse polynomial approximation algorithm, leading to results with improved accuracy. If one boundary of the averaging volume reaches the boundary of the measured volume during its expansion, it will not be evaluated at all. Reference is kept of all locations used and those not used for averaging the SAR. All average SAR values are finally assigned to the centred location in each valid averaging volume.

All locations included in an averaging volume are marked to indicate that they have been used at least once. If a location has been marked as used but has never been assigned to the centre of a cube, the highest averaged SAR value of all other cubical volumes which have used this location for averaging is assigned to this location. Only those locations that are not part of any valid averaging volume should be marked as unused. For the case of an unused location, a new averaging volume must be constructed which will have the unused location centred at one surface of the cube. The remaining five surfaces are expanded evenly in all directions until the required mass is enclosed, regardless of the amount of included air. Of the six possible cubes with one surface centred on the unused location, the smallest cube is used, which still contains the required mass.

If the final cube containing the highest averaged SAR touches the surface of the measured volume, an appropriate warning is issued within the Post-processing engine.



## **SECTION 3**

### **TEST EQUIPMENT USED**



### 3.1 TEST EQUIPMENT USED

The following test equipment was used at TÜV SÜD:

| Instrument Description                    | Manufacturer          | Model Type                             | TE Number | Cal Period (months) | Calibration Due Date |
|---|-----------------------|--|-----------|---------------------|----------------------|
| Thermometer                               | Digitron              | T208                                   | 64        | 12                  | 29-Oct-2021          |
| Thermocouple (Type K)                     | TUV SUD               | TYPE K                                 | 65        | 12                  | 29-Oct-2021          |
| Rubidium Standard                         | Rohde & Schwarz       | XSRM                                   | 1316      | 6                   | 3-Dec-2021           |
| Hygrometer                                | Rotronic              | I-1000                                 | 3068      | 12                  | 10-Aug-2022          |
| SAR 2450 MHz dipole                       | Speag                 | D2450V2                                | 3875      | 12                  | 10-Dec-2021          |
| Frequency Standard                        | Spectracom            | SecureSync 1200-0408-0601              | 4393      | 6                   | 3-Dec-2021           |
| Dielectric Assessment Kit                 | Speag                 | DAK 200MHz to 20GHz                    | 4690      | -                   | TU                   |
| Dielectric Probe Stand                    | Speag                 | Stand                                  | 4691      | -                   | TU                   |
| Laptop Device Holder                      | Speag                 | MDA4LAP                                | 4693      | -                   | TU                   |
| ENA Series network analyser               | Keysight Technologies | E5080A                                 | 5247      | 12                  | 25-Jan-2022          |
| Data Acquisition Electronics              | Speag                 | DAE 4 - SD 000 D04 BN                  | 5327      | 12                  | 9-Jun-2022           |
| Dosimetric SAR Probe                      | Speag                 | EX3DV4                                 | 5330      | 12                  | 18-Jun-2022          |
| Body Phantom                              | Speag                 | Oval Flat Phantom ELI v8.0             | 5332      | -                   | TU                   |
| Measurement server                        | Speag                 | DASY 6 Measurement Server              | 5337      | -                   | TU                   |
| Mounting Platform TX90XL Robot & Phantoms | Speag                 | MP6C-TX90XL Mounting Platform Extended | 5338      | -                   | TU                   |
| Robot                                     | Speag                 | TX90 XL Staubi Robot                   | 5340      | -                   | TU                   |
| Power Source for SAR system validation    | Speag                 | POWER SOURCE1-SE UMS 160 BA            | 5371      | 12                  | 16-Dec-2021          |
| MXA Signal Analyser                       | Keysight Technologies | N9020B                                 | 5529      | 24                  | 4-Mar-2022           |
| Signal Commissioning Unit                 | TUV SUD               | SCU002                                 | 5759      | 12                  | 30-Jun-2022          |
| USB Power Sensor                          | Boonton               | RTP5008                                | 5830      | 12                  | 10-May-2022          |
| USB Power Sensor                          | Boonton               | RTP5008                                | 5832      | 12                  | 10-May-2022          |
| Tissue Simulant Liquid                    | Speag                 | HBBL 600 -6000                         | Batch 1   | Weekly              | 4-Oct-2021           |

TU - Traceability Unscheduled



### 3.2 TEST SOFTWARE

The following software was used to control the TÜV SÜD DASY System.

| Instrument  | Version Number       |
|-------------|----------------------|
| DASY system | DASY52 52.10.2(1495) |



### 3.3 DIELECTRIC PROPERTIES OF SIMULANT LIQUIDS

The fluid properties of the simulant fluids used during routine SAR evaluation meet the dielectric properties required of KDB 865665.

The dielectric properties of the tissue simulant liquids used for the SAR testing at TÜV SÜD are as follows:-

| Fluid Type and Frequency | Relative Permittivity Target | Relative Permittivity Measured | Conductivity Target (S/m) | Conductivity Measured (S/m) | Date       | Fluid Temperature °C |
|--------------------------|------------------------------|--------------------------------|---------------------------|-----------------------------|------------|----------------------|
| HBBL @ 2450 MHz          | 39.20                        | 38.63                          | 1.80                      | 1.80                        | 27-09-2021 | 22.0                 |



## 3.4 TEST CONDITIONS

### 3.4.1 Test Laboratory Conditions

Ambient temperature: Within +15°C to +35°C.

The actual temperature during the testing ranged from 21.1°C to 21.8°C.

The actual humidity during the testing ranged from 42.1% to 61.1% RH.

### 3.4.2 Test Fluid Temperature Range

| Frequency | Fluid | Min Temperature °C | Max Temperature °C |
|-----------|-------|--------------------|--------------------|
| 2450 MHz  | HBBL  | 21.5               | 22.0               |

### 3.4.3 SAR Drift

The SAR Drift was within acceptable limits during scans. The maximum SAR Drift was recorded as 0.16 dB.



### 3.5 MEASUREMENT UNCERTAINTY

Full SAR Measurements, 300 MHz to 3 GHz

| Source of Uncertainty         | Uncertainty $\pm$ % | Probability distribution | Div  | $c_i$ (10g) | Standard Uncertainty $\pm$ % (10g) | $V_i(V_{eff})$ |
|-------------------------------|---------------------|--------------------------|------|-------------|------------------------------------|----------------|
| <b>Measurement System</b>     |                     |                          |      |             |                                    |                |
| Probe calibration             | 6.0                 | N                        | 1.00 | 1.00        | 6.0                                | Infinity       |
| Axial Isotropy                | 4.7                 | R                        | 1.73 | 0.70        | 1.9                                | Infinity       |
| Hemispherical Isotropy        | 9.6                 | R                        | 1.73 | 0.70        | 3.9                                | Infinity       |
| Boundary effect               | 1.0                 | R                        | 1.73 | 1.00        | 0.6                                | Infinity       |
| Linearity                     | 4.7                 | R                        | 1.73 | 1.00        | 2.7                                | Infinity       |
| System Detection limits       | 1.0                 | R                        | 1.73 | 1.00        | 0.6                                | Infinity       |
| Modulation response           | 2.4                 | R                        | 1.73 | 1.00        | 1.4                                | Infinity       |
| Readout electronics           | 0.3                 | N                        | 1.00 | 1.00        | 0.3                                | Infinity       |
| Response time                 | 0.8                 | R                        | 1.73 | 1.00        | 0.5                                | Infinity       |
| Integration time              | 2.6                 | R                        | 1.73 | 1.00        | 1.5                                | Infinity       |
| RF ambient noise              | 3.0                 | R                        | 1.73 | 1.00        | 1.7                                | Infinity       |
| RF ambient reflections        | 3.0                 | R                        | 1.73 | 1.00        | 1.7                                | Infinity       |
| Probe positioner              | 0.4                 | R                        | 1.73 | 1.00        | 0.2                                | Infinity       |
| Probe positioning             | 2.9                 | R                        | 1.73 | 1.00        | 1.7                                | Infinity       |
| Max SAR Evaluation            | 2.0                 | R                        | 1.73 | 1.00        | 1.2                                | Infinity       |
| Test sample related           |                     |                          |      |             |                                    |                |
| Device Positioning            | 2.9                 | N                        | 1.00 | 1.00        | 2.9                                | 145            |
| Device Holder                 | 3.6                 | N                        | 1.00 | 1.00        | 3.6                                | 5              |
| Input Power and SAR Drift     | 5.0                 | R                        | 1.73 | 1.00        | 2.9                                | Infinity       |
| Phantom and Setup             |                     |                          |      |             |                                    |                |
| Phantom uncertainty           | 6.1                 | R                        | 1.73 | 1.00        | 3.5                                | Infinity       |
| SAR Correction                | 1.9                 | R                        | 1.73 | 0.84        | 0.9                                | Infinity       |
| Liquid conductivity Meas.     | 2.5                 | R                        | 1.73 | 0.71        | 1.0                                | Infinity       |
| Liquid Permittivity Meas.     | 2.5                 | R                        | 1.73 | 0.26        | 0.4                                | Infinity       |
| Temp. Unc. Conductivity       | 3.4                 | R                        | 1.73 | 0.71        | 1.4                                | Infinity       |
| Temp. Unc. Permittivity       | 0.4                 | R                        | 1.73 | 0.26        | 0.1                                | Infinity       |
| Combined Standard Uncertainty | <b>RSS</b>          |                          |      |             | 11.1                               | 361            |
| Expanded Standard Uncertainty | <b>K=2</b>          |                          |      |             | 22.2                               |                |



## **SECTION 4**

### **PHOTOGRAPHS**



#### 4.1 TEST POSITIONAL PHOTOGRAPHS

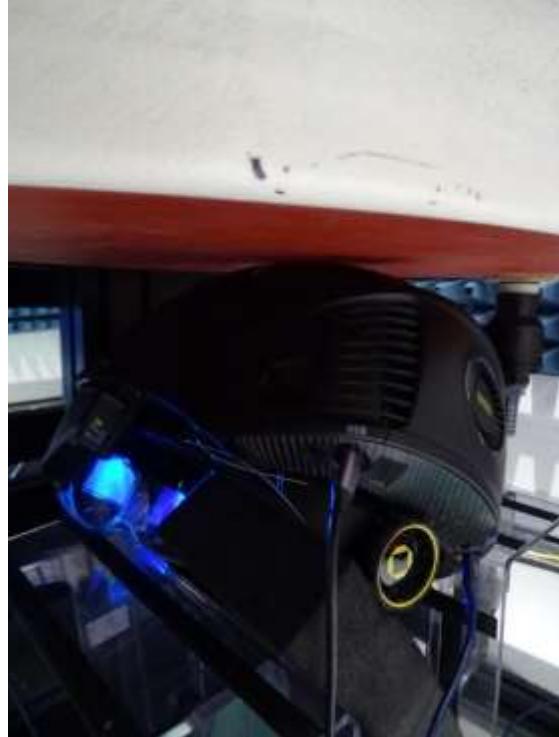


Figure 2: Worst case position for antenna A



Figure 3: Worst case position for antenna B



#### 4.2 PHOTOGRAPHS OF EQUIPMENT UNDER TEST (EUT)



Figure 4: General View - Front



Figure 5: General View - Rear



Figure 4: General View - Side



Figure 5: General View - Inner



Figure 6: - Inner Shell Removed



Figure 7: - Distance to Outer Shell



Figure 8: - Antenna A and B locations on the Outer Shell



Figure 9: - Antenna A and B, Spatial Separation



## SECTION 5

### ACCREDITATION, DISCLAIMERS AND COPYRIGHT



## 5.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT



This report relates only to the actual item/items tested.

Our UKAS Accreditation does not cover opinions and interpretations and any expressed are outside the scope of our UKAS Accreditation.

Results of tests not covered by our UKAS Accreditation Schedule are marked NUA (Not UKAS Accredited).

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**ANNEX A**

**PROBE CALIBRATION REPORT**



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

TÜV SÜD UK

Certificate No: EX3-7536\_Jun21

## CALIBRATION CERTIFICATE

Object EX3DV4 - SN:7536

Calibration procedure(s) QA CAL-01.v9, QA CAL-14.v6, QA CAL-23.v5, QA CAL-25.v7  
Calibration procedure for dosimetric E-field probes

Calibration date: June 18, 2021

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       | 09-Apr-21 (No. 217-03291/03292)   | Apr-22                 |
| Power sensor NRP-Z91       | SN: 103244       | 09-Apr-21 (No. 217-03291)         | Apr-22                 |
| Power sensor NRP-Z91       | SN: 103245       | 09-Apr-21 (No. 217-03292)         | Apr-22                 |
| Reference 20 dB Attenuator | SN: CC2552 (20x) | 09-Apr-21 (No. 217-03343)         | Apr-22                 |
| DAE4                       | SN: 660          | 23-Dec-20 (No. DAE4-660_Dec20)    | Dec-21                 |
| Reference Probe ES3DV2     | SN: 3013         | 30-Dec-20 (No. ES3-3013_Dec20)    | Dec-21                 |
| Secondary Standards        | ID               | Check Date (in house)             | Scheduled Check        |
| Power meter E4419B         | SN: GB41293874   | 06-Apr-18 (in house check Jun-20) | In house check: Jun-22 |
| Power sensor E4412A        | SN: MY41499087   | 06-Apr-18 (in house check Jun-20) | In house check: Jun-22 |
| Power sensor E4412A        | SN: 000110210    | 06-Apr-18 (in house check Jun-20) | In house check: Jun-22 |
| RF generator HP 8848C      | SN: US3642U01700 | 04-Aug-99 (in house check Jun-20) | In house check: Jun-22 |
| Network Analyzer EB358A    | SN: US410B0477   | 31-Mar-14 (in house check Oct-20) | In house check: Oct-21 |

| Calibrated by: | Name           | Function              | Signature |
|----------------|----------------|-----------------------|-----------|
|                | Jeton Kastrati | Laboratory Technician |           |
| Approved by:   | Kalja Pokovic  | Technical Manager     |           |

Issued: June 21, 2021

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

Certificate No: EX3-7536\_Jun21

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**Calibration Laboratory of**  
**Schmid & Partner**  
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#### Glossary:

|                       |  |
|-----------------------|--|
| TSL                   | tissue simulating liquid   |
| NORM $x,y,z$          | sensitivity in free space  |
| ConvF                 | sensitivity in TSL / NORM $x,y,z$  |
| DCP                   | diode compression point  |
| CF                    | crest factor (1/duty_cycle) of the RF signal   |
| A, B, C, D            | modulation dependent linearization parameters  |
| Polarization $\phi$   | $\phi$ rotation around probe axis  |
| Polarization $\theta$ | $\theta$ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., $\theta = 0$ 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:

- $NORM_{x,y,z}$ : Assessed for E-field polarization  $\theta = 0$  ( $f \leq 800$  MHz in TEM-cell;  $f > 1800$  MHz: R22 waveguide).  $NORM_{x,y,z}$  are only intermediate values, i.e., the uncertainties of  $NORM_{x,y,z}$  does not affect the E-field uncertainty inside TSL (see below ConvF).
- $NORM(f)x,y,z = NORM_{x,y,z} * frequency\_response$  (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.
- $DCP_{x,y,z}$ : 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
- $A_{x,y,z}; B_{x,y,z}; C_{x,y,z}; D_{x,y,z}; VR_{x,y,z}; A, B, C, D$  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  $NORM_{x,y,z} * ConvF$  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  $NORM_x$  (no uncertainty required).



EX3DV4 – SN:7536

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## DASY/EASY - Parameters of Probe: EX3DV4 - SN:7536

### Basic Calibration Parameters

|   | Sensor X | Sensor Y | Sensor Z | Unc (k=2)    |
|---|----------|----------|----------|--------------|
| Norm ( $\mu\text{V}/(\text{V}/\text{m})^2$ ) <sup>a</sup> | 0.56     | 0.62     | 0.65     | $\pm 10.1\%$ |
| DCP (mV) <sup>b</sup>                                     | 93.7     | 99.7     | 97.6     |              |

### Calibration Results for Modulation Response

| UID           | Communication System Name   |   | A<br>dB | B<br>dB/ $\mu\text{V}$ | C     | D<br>dB | VR<br>mV | Max<br>dev. | Max<br>Unc <sup>c</sup><br>(k=2) |
|---------------|-----------------------------|---|---------|------------------------|-------|---------|----------|-------------|----------------------------------|
| 0             | CW                          | X | 0.00    | 0.00                   | 1.00  | 0.00    | 135.0    | $\pm 2.5\%$ | $\pm 4.7\%$                      |
|               |                             | Y | 0.00    | 0.00                   | 1.00  |         | 140.4    |             |                                  |
|               |                             | Z | 0.00    | 0.00                   | 1.00  |         | 128.5    |             |                                  |
| 10352-<br>AAA | Pulse Waveform (200Hz, 10%) | X | 2.03    | 64.57                  | 9.42  | 10.00   | 60.0     | $\pm 4.8\%$ | $\pm 9.6\%$                      |
|               |                             | Y | 20.00   | 90.60                  | 19.90 |         | 60.0     |             |                                  |
|               |                             | Z | 2.89    | 67.95                  | 11.11 |         | 60.0     |             |                                  |
| 10353-<br>AAA | Pulse Waveform (200Hz, 20%) | X | 1.38    | 63.65                  | 8.27  | 6.99    | 80.0     | $\pm 3.4\%$ | $\pm 9.6\%$                      |
|               |                             | Y | 20.00   | 92.61                  | 19.76 |         | 80.0     |             |                                  |
|               |                             | Z | 2.68    | 69.17                  | 10.84 |         | 80.0     |             |                                  |
| 10354-<br>AAA | Pulse Waveform (200Hz, 40%) | X | 1.20    | 65.62                  | 8.54  | 3.98    | 95.0     | $\pm 1.8\%$ | $\pm 9.6\%$                      |
|               |                             | Y | 20.00   | 97.59                  | 20.87 |         | 95.0     |             |                                  |
|               |                             | Z | 20.00   | 86.87                  | 15.41 |         | 95.0     |             |                                  |
| 10355-<br>AAA | Pulse Waveform (200Hz, 60%) | X | 15.56   | 85.19                  | 14.00 | 2.22    | 120.0    | $\pm 1.0\%$ | $\pm 9.6\%$                      |
|               |                             | Y | 20.00   | 103.77                 | 22.60 |         | 120.0    |             |                                  |
|               |                             | Z | 20.00   | 92.50                  | 17.20 |         | 120.0    |             |                                  |
| 10387-<br>AAA | QPSK Waveform, 1 MHz        | X | 1.72    | 65.73                  | 15.00 | 1.00    | 150.0    | $\pm 1.8\%$ | $\pm 9.6\%$                      |
|               |                             | Y | 1.61    | 64.67                  | 14.16 |         | 150.0    |             |                                  |
|               |                             | Z | 1.83    | 67.12                  | 15.78 |         | 150.0    |             |                                  |
| 10388-<br>AAA | QPSK Waveform, 10 MHz       | X | 2.27    | 67.78                  | 15.69 | 0.00    | 150.0    | $\pm 1.0\%$ | $\pm 9.6\%$                      |
|               |                             | Y | 2.09    | 66.35                  | 14.82 |         | 150.0    |             |                                  |
|               |                             | Z | 2.43    | 69.12                  | 16.47 |         | 150.0    |             |                                  |
| 10396-<br>AAA | 64-QAM Waveform, 100 kHz    | X | 2.85    | 70.35                  | 18.91 | 3.01    | 150.0    | $\pm 0.8\%$ | $\pm 9.6\%$                      |
|               |                             | Y | 2.71    | 69.16                  | 18.19 |         | 150.0    |             |                                  |
|               |                             | Z | 2.94    | 70.91                  | 19.35 |         | 150.0    |             |                                  |
| 10399-<br>AAA | 64-QAM Waveform, 40 MHz     | X | 3.56    | 67.04                  | 15.79 | 0.00    | 150.0    | $\pm 0.8\%$ | $\pm 9.6\%$                      |
|               |                             | Y | 3.47    | 66.50                  | 15.37 |         | 150.0    |             |                                  |
|               |                             | Z | 3.52    | 67.01                  | 15.87 |         | 150.0    |             |                                  |
| 10414-<br>AAA | WLAN CCDF, 64-QAM, 40MHz    | X | 4.94    | 65.60                  | 15.56 | 0.00    | 150.0    | $\pm 1.9\%$ | $\pm 9.6\%$                      |
|               |                             | Y | 4.88    | 65.42                  | 15.35 |         | 150.0    |             |                                  |
|               |                             | Z | 4.84    | 65.39                  | 15.50 |         | 150.0    |             |                                  |

Note: For details on UID parameters see Appendix

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  $E^2$ -field uncertainty inside TSL (see Pages 5 and 6).

<sup>b</sup> Numerical linearization parameter; uncertainty not required.

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



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## DASY/EASY - Parameters of Probe: EX3DV4 - SN:7536

### Sensor Model Parameters

|   | C1<br>ff | C2<br>ff | $\alpha$<br>V <sup>-1</sup> | T1<br>ms.V <sup>-2</sup> | T2<br>ms.V <sup>-1</sup> | T3<br>ms | T4<br>V <sup>-2</sup> | T5<br>V <sup>-1</sup> | T6   |
|---|----------|----------|-----------------------------|--------------------------|--------------------------|----------|-----------------------|-----------------------|------|
| X | 49.5     | 372.25   | 35.96                       | 11.39                    | 0.00                     | 4.96     | 1.51                  | 0.14                  | 1.01 |
| Y | 45.9     | 342.63   | 35.35                       | 9.76                     | 0.00                     | 5.03     | 1.46                  | 0.14                  | 1.01 |
| Z | 46.7     | 349.47   | 35.68                       | 12.24                    | 0.00                     | 4.97     | 1.08                  | 0.21                  | 1.01 |

### Other Probe Parameters

|   |            |
|---|------------|
| Sensor Arrangement                            | Triangular |
| Connector Angle (")                           | -143.4     |
| 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     |

Note: Measurement distance from surface can be increased to 3-4 mm for an Area Scan job.



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## DASY/EASY - Parameters of Probe: EX3DV4 - SN:7536

### Calibration Parameter Determined in Head Tissue Simulating Media

| f (MHz) <sup>c</sup> | Relative Permittivity <sup>f</sup> | Conductivity (S/m) <sup>g</sup> | ConvF X | ConvF Y | ConvF Z | Alpha <sup>h</sup> | Depth <sup>i</sup> (mm) | Unc (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|--------------------|-------------------------|-----------|
| 450                  | 43.5                               | 0.87                            | 11.78   | 11.78   | 11.78   | 0.16               | 1.30                    | ± 13.3 %  |
| 750                  | 41.9                               | 0.89                            | 11.00   | 11.00   | 11.00   | 0.48               | 0.98                    | ± 12.0 %  |
| 835                  | 41.5                               | 0.90                            | 10.60   | 10.60   | 10.60   | 0.40               | 1.01                    | ± 12.0 %  |
| 900                  | 41.5                               | 0.97                            | 10.41   | 10.41   | 10.41   | 0.58               | 0.80                    | ± 12.0 %  |
| 1450                 | 40.5                               | 1.20                            | 9.20    | 9.20    | 9.20    | 0.42               | 0.80                    | ± 12.0 %  |
| 1640                 | 40.2                               | 1.31                            | 9.02    | 9.02    | 9.02    | 0.32               | 0.86                    | ± 12.0 %  |
| 1750                 | 40.1                               | 1.37                            | 8.98    | 8.98    | 8.98    | 0.31               | 0.86                    | ± 12.0 %  |
| 1900                 | 40.0                               | 1.40                            | 8.58    | 8.58    | 8.58    | 0.34               | 0.86                    | ± 12.0 %  |
| 2100                 | 39.8                               | 1.49                            | 8.49    | 8.49    | 8.49    | 0.35               | 0.86                    | ± 12.0 %  |
| 2300                 | 39.5                               | 1.67                            | 8.21    | 8.21    | 8.21    | 0.33               | 0.90                    | ± 12.0 %  |
| 2450                 | 39.2                               | 1.80                            | 7.82    | 7.82    | 7.82    | 0.34               | 0.90                    | ± 12.0 %  |
| 2600                 | 39.0                               | 1.98                            | 7.63    | 7.63    | 7.63    | 0.37               | 0.90                    | ± 12.0 %  |
| 5200                 | 36.0                               | 4.66                            | 5.48    | 5.48    | 5.48    | 0.40               | 1.80                    | ± 13.1 %  |
| 5300                 | 35.9                               | 4.76                            | 5.37    | 5.37    | 5.37    | 0.40               | 1.80                    | ± 13.1 %  |
| 5500                 | 35.6                               | 4.96                            | 4.90    | 4.90    | 4.90    | 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                            | 4.80    | 4.80    | 4.80    | 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 5 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 (ε and σ) 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 (ε and σ) 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.



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## DASY/EASY - Parameters of Probe: EX3DV4 - SN:7536

Calibration Parameter Determined in Body 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>H</sup> (mm) | Unc (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|--------------------|-------------------------|-----------|
| 2450                 | 52.7                               | 1.95                            | 7.80    | 7.80    | 7.80    | 0.39               | 0.90                    | ± 12.0 %  |
| 5200                 | 49.0                               | 5.30                            | 4.95    | 4.95    | 4.95    | 0.50               | 1.90                    | ± 13.1 %  |
| 5300                 | 48.9                               | 5.42                            | 4.85    | 4.85    | 4.85    | 0.50               | 1.90                    | ± 13.1 %  |
| 5500                 | 48.6                               | 5.65                            | 4.50    | 4.50    | 4.50    | 0.50               | 1.90                    | ± 13.1 %  |
| 5600                 | 48.5                               | 5.77                            | 4.41    | 4.41    | 4.41    | 0.50               | 1.90                    | ± 13.1 %  |
| 5800                 | 48.2                               | 6.00                            | 4.40    | 4.40    | 4.40    | 0.50               | 1.90                    | ± 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  $\alpha$ ) 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  $\alpha$ ) 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 3-8 GHz at any distance larger than half the probe tip diameter from the boundary.

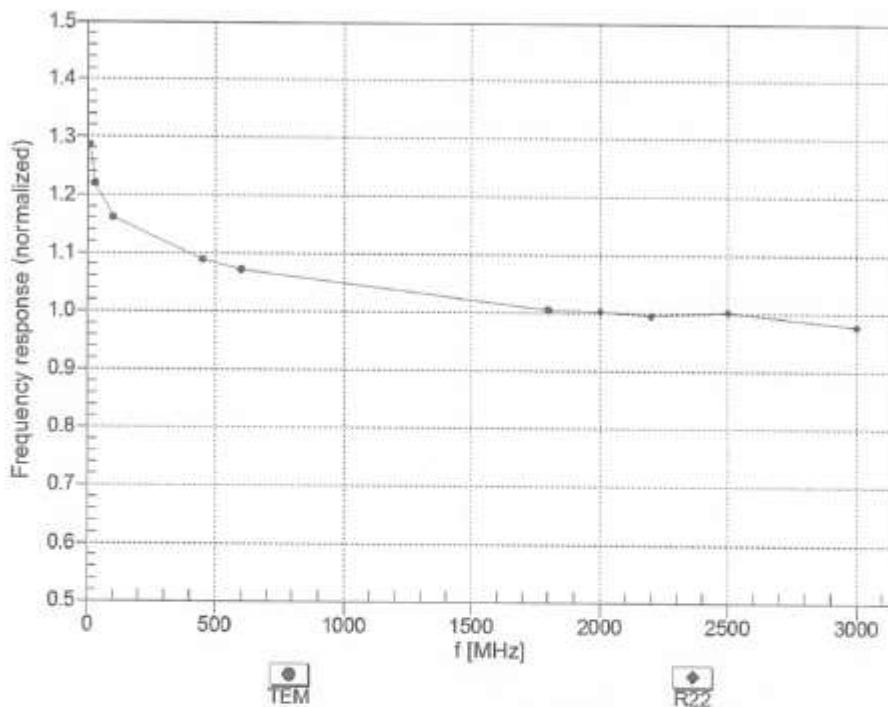


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## Frequency Response of E-Field

(TEM-Cell:ifi110 EXX, Waveguide: R22)



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

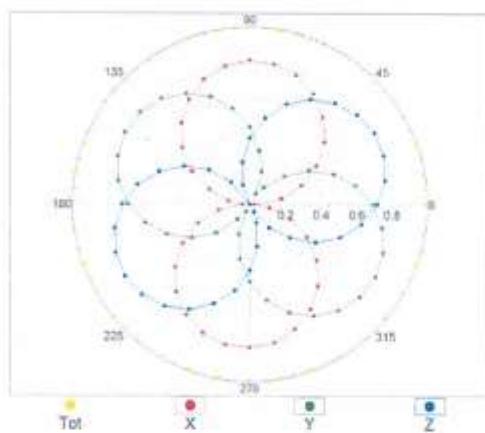


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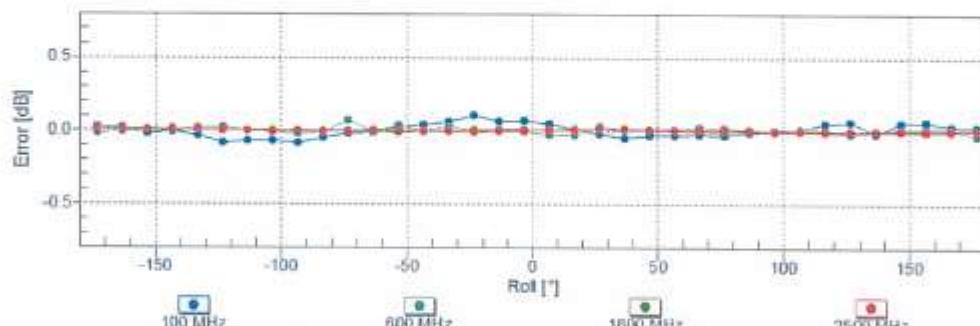
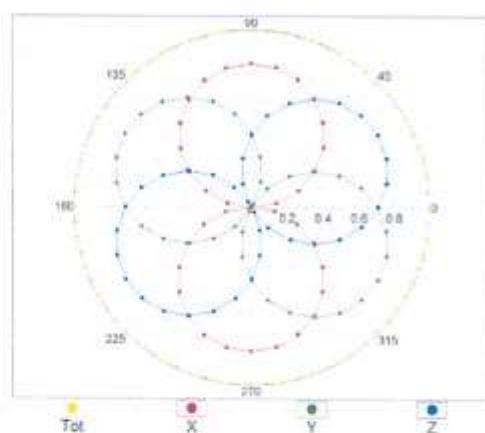
June 18, 2021

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

f=600 MHz, TEM



f=1800 MHz, R22

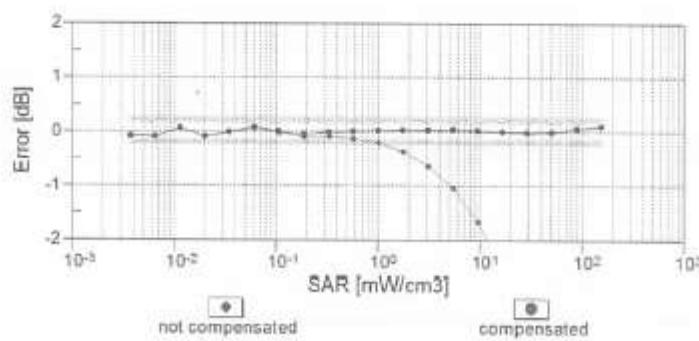
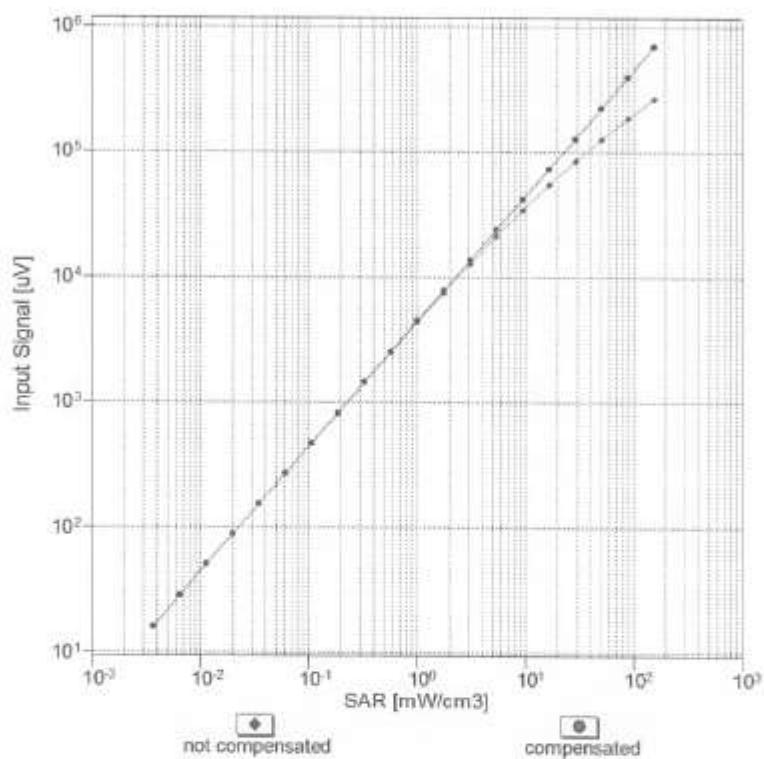
Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  ( $k=2$ )



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### Dynamic Range f(SAR<sub>head</sub>) (TEM cell, f<sub>eval</sub>= 1900 MHz)

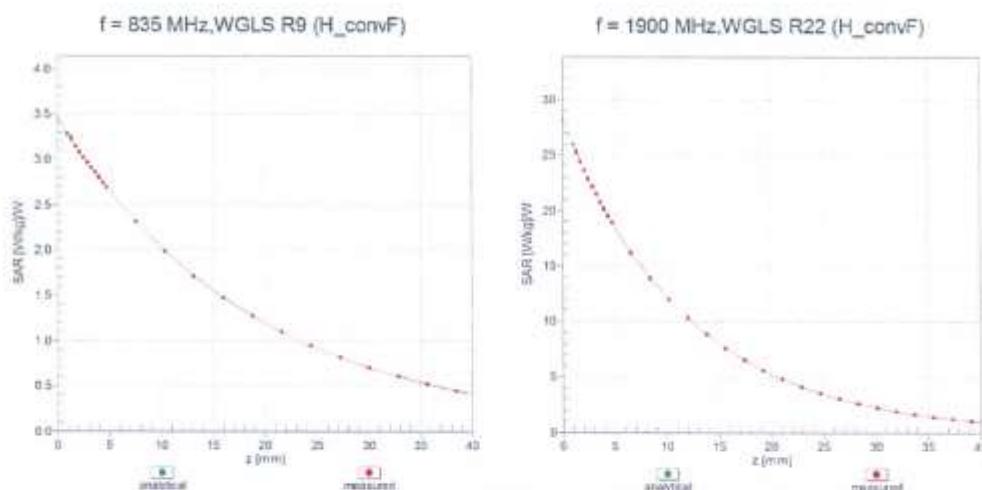
Uncertainty of Linearity Assessment:  $\pm 0.6\%$  ( $k=2$ )



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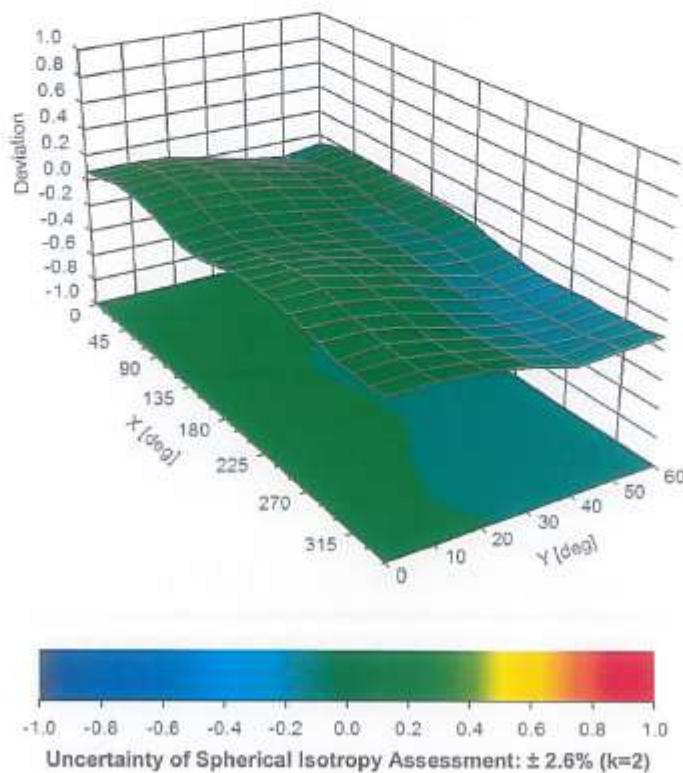
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## Conversion Factor Assessment



## Deviation from Isotropy in Liquid

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





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### Appendix: Modulation Calibration Parameters

| UID   | Rev | Communication System Name                           | Group     | PAR (dB) | Unc <sup>±</sup> (k=2) |
|-------|-----|---|-----------|----------|------------------------|
| 0     |     | CW  | CW        | 0.00     | ± 4.7 %                |
| 10010 | CAA | SAR Validation (Square, 100ms, 10ms)                | Test      | 10.00    | ± 9.6 %                |
| 10011 | CAB | UMTS-FDD (WCDMA)                                    | WCDMA     | 2.91     | ± 9.6 %                |
| 10012 | CAB | IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps)            | WLAN      | 1.87     | ± 9.6 %                |
| 10013 | CAB | IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps)       | WLAN      | 9.46     | ± 9.6 %                |
| 10021 | DAC | GSM-FDD (TDMA, GMSK)                                | GSM       | 9.39     | ± 9.6 %                |
| 10023 | DAC | GPRS-FDD (TDMA, GMSK, TN 0)                         | GSM       | 9.57     | ± 9.6 %                |
| 10024 | DAC | GPRS-FDD (TDMA, GMSK, TN 0-1)                       | GSM       | 6.56     | ± 9.6 %                |
| 10025 | DAC | EDGE-FDD (TDMA, 8PSK, TN 0)                         | GSM       | 12.62    | ± 9.6 %                |
| 10026 | DAC | EDGE-FDD (TDMA, 8PSK, TN 0-1)                       | GSM       | 9.55     | ± 9.6 %                |
| 10027 | DAC | GPRS-FDD (TDMA, GMSK, TN 0-1-2)                     | GSM       | 4.80     | ± 9.6 %                |
| 10028 | DAC | GPRS-FDD (TDMA, GMSK, TN 0-1-2-3)                   | GSM       | 3.55     | ± 9.6 %                |
| 10029 | DAC | EDGE-FDD (TDMA, 8PSK, TN 0-1-2)                     | GSM       | 7.78     | ± 9.6 %                |
| 10030 | CAA | IEEE 802.15.1 Bluetooth (GFSK, DH1)                 | Bluetooth | 5.30     | ± 9.6 %                |
| 10031 | CAA | IEEE 802.15.1 Bluetooth (GFSK, DH3)                 | Bluetooth | 1.87     | ± 9.6 %                |
| 10032 | CAA | IEEE 802.15.1 Bluetooth (GFSK, DH5)                 | Bluetooth | 1.16     | ± 9.6 %                |
| 10033 | CAA | IEEE 802.15.1 Bluetooth (Pi/4-DQPSK, DH1)           | Bluetooth | 7.74     | ± 9.6 %                |
| 10034 | CAA | IEEE 802.15.1 Bluetooth (Pi/4-DQPSK, DH3)           | Bluetooth | 4.53     | ± 9.6 %                |
| 10035 | CAA | IEEE 802.15.1 Bluetooth (Pi/4-DQPSK, DH5)           | Bluetooth | 3.83     | ± 9.6 %                |
| 10036 | CAA | IEEE 802.15.1 Bluetooth (8-DPSK, DH1)               | Bluetooth | 8.01     | ± 9.6 %                |
| 10037 | CAA | IEEE 802.15.1 Bluetooth (8-DPSK, DH3)               | Bluetooth | 4.77     | ± 9.6 %                |
| 10038 | CAA | IEEE 802.15.1 Bluetooth (8-DPSK, DH5)               | Bluetooth | 4.10     | ± 9.6 %                |
| 10039 | CAB | CDMA2000 (1xRTT, RC1)                               | CDMA2000  | 4.57     | ± 9.6 %                |
| 10042 | CAB | IS-54 / IS-136 FDD (TDMA/FDM, Pi/4-DQPSK, Halfrate) | AMPS      | 7.78     | ± 9.6 %                |
| 10044 | CAA | IS-91/EIA/TIA-553 FDD (FDMA, FM)                    | AMPS      | 0.00     | ± 9.6 %                |
| 10048 | CAA | DECT (TDD, TDMA/FDM, GFSK, Full Slot, 24)           | DECT      | 13.80    | ± 9.6 %                |
| 10049 | CAA | DECT (TDD, TDMA/FDM, GFSK, Double Slot, 12)         | DECT      | 10.79    | ± 9.6 %                |
| 10056 | CAA | UMTS-TDD (TD-SCDMA, 1.28 Mcps)                      | TD-SCDMA  | 11.01    | ± 9.6 %                |
| 10058 | DAC | EDGE-FDD (TDMA, 8PSK, TN 0-1-2-3)                   | GSM       | 6.52     | ± 9.6 %                |
| 10059 | CAB | IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps)            | WLAN      | 2.12     | ± 9.6 %                |
| 10060 | CAB | IEEE 802.11b WiFi 2.4 GHz (DSSS, 5.5 Mbps)          | WLAN      | 2.83     | ± 9.6 %                |
| 10061 | CAB | IEEE 802.11b WiFi 2.4 GHz (DSSS, 11 Mbps)           | WLAN      | 3.60     | ± 9.6 %                |
| 10062 | CAB | IEEE 802.11a/b WiFi 5 GHz (OFDM, 6 Mbps)            | WLAN      | 8.68     | ± 9.6 %                |
| 10063 | CAB | IEEE 802.11a/b WiFi 5 GHz (OFDM, 9 Mbps)            | WLAN      | 8.63     | ± 9.6 %                |
| 10064 | CAB | IEEE 802.11a/b WiFi 5 GHz (OFDM, 12 Mbps)           | WLAN      | 9.09     | ± 9.6 %                |
| 10065 | CAB | IEEE 802.11a/b WiFi 5 GHz (OFDM, 18 Mbps)           | WLAN      | 9.00     | ± 9.6 %                |
| 10066 | CAB | IEEE 802.11a/b WiFi 5 GHz (OFDM, 24 Mbps)           | WLAN      | 9.38     | ± 9.6 %                |
| 10067 | CAB | IEEE 802.11a/b WiFi 5 GHz (OFDM, 36 Mbps)           | WLAN      | 10.12    | ± 9.6 %                |
| 10068 | CAB | IEEE 802.11a/b WiFi 5 GHz (OFDM, 48 Mbps)           | WLAN      | 10.24    | ± 9.6 %                |
| 10069 | CAB | IEEE 802.11a/b WiFi 5 GHz (OFDM, 54 Mbps)           | WLAN      | 10.56    | ± 9.6 %                |
| 10071 | CAB | IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 8 Mbps)       | WLAN      | 9.83     | ± 9.6 %                |
| 10072 | CAB | IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 12 Mbps)      | WLAN      | 9.62     | ± 9.6 %                |
| 10073 | CAB | IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 16 Mbps)      | WLAN      | 9.94     | ± 9.6 %                |
| 10074 | CAB | IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 24 Mbps)      | WLAN      | 10.30    | ± 9.6 %                |
| 10075 | CAB | IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 36 Mbps)      | WLAN      | 10.77    | ± 9.6 %                |
| 10076 | CAB | IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 48 Mbps)      | WLAN      | 10.94    | ± 9.6 %                |
| 10077 | CAB | IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 54 Mbps)      | WLAN      | 11.00    | ± 9.6 %                |
| 10081 | CAB | CDMA2000 (1xRTT, RC3)                               | CDMA2000  | 3.97     | ± 9.6 %                |
| 10082 | CAB | IS-54 / IS-136 FDD (TDMA/FDM, Pi/4-DQPSK, Fullrate) | AMPS      | 4.77     | ± 9.6 %                |
| 10090 | DAC | GPRS-FDD (TDMA, GMSK, TN 0-4)                       | GSM       | 6.56     | ± 9.6 %                |
| 10097 | CAC | UMTS-FDD (HSDPA)                                    | WCDMA     | 3.98     | ± 9.6 %                |
| 10098 | DAC | UMTS-FDD (HSUPA, Subtest 2)                         | WCDMA     | 3.98     | ± 9.6 %                |



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| 10099 | CAC | EDGE-FDD (TDMA, 8PSK, TN 0-4)                  | GSM     | 9.55  | $\pm 9.6\%$ |
| 10100 | CAC | LTE-FDD (SC-FDMA, 100% RB, 20 MHz, QPSK)       | LTE-FDD | 5.67  | $\pm 9.6\%$ |
| 10101 | CAB | LTE-FDD (SC-FDMA, 100% RB, 20 MHz, 16-QAM)     | LTE-FDD | 6.42  | $\pm 9.6\%$ |
| 10102 | CAB | LTE-FDD (SC-FDMA, 100% RB, 20 MHz, 64-QAM)     | LTE-FDD | 6.60  | $\pm 9.6\%$ |
| 10103 | DAC | LTE-TDD (SC-FDMA, 100% RB, 20 MHz, QPSK)       | LTE-TDD | 9.29  | $\pm 9.6\%$ |
| 10104 | CAE | LTE-TDD (SC-FDMA, 100% RB, 20 MHz, 16-QAM)     | LTE-TDD | 9.97  | $\pm 9.6\%$ |
| 10105 | CAE | LTE-TDD (SC-FDMA, 100% RB, 20 MHz, 64-QAM)     | LTE-TDD | 10.01 | $\pm 9.6\%$ |
| 10108 | CAE | LTE-FDD (SC-FDMA, 100% RB, 10 MHz, QPSK)       | LTE-FDD | 5.80  | $\pm 9.6\%$ |
| 10109 | CAG | LTE-FDD (SC-FDMA, 100% RB, 10 MHz, 16-QAM)     | LTE-FDD | 6.43  | $\pm 9.6\%$ |
| 10110 | CAG | LTE-FDD (SC-FDMA, 100% RB, 5 MHz, QPSK)        | LTE-FDD | 5.75  | $\pm 9.6\%$ |
| 10111 | CAG | LTE-FDD (SC-FDMA, 100% RB, 5 MHz, 16-QAM)      | LTE-FDD | 6.44  | $\pm 9.6\%$ |
| 10112 | CAG | LTE-FDD (SC-FDMA, 100% RB, 10 MHz, 64-QAM)     | LTE-FDD | 6.59  | $\pm 9.6\%$ |
| 10113 | CAG | LTE-FDD (SC-FDMA, 100% RB, 5 MHz, 64-QAM)      | LTE-FDD | 6.62  | $\pm 9.6\%$ |
| 10114 | CAG | IEEE 802.11n (HT Greenfield, 13.5 Mbps, BPSK)  | WLAN    | 8.10  | $\pm 9.6\%$ |
| 10115 | CAG | IEEE 802.11n (HT Greenfield, 81 Mbps, 16-QAM)  | WLAN    | 8.46  | $\pm 9.6\%$ |
| 10116 | CAG | IEEE 802.11n (HT Greenfield, 135 Mbps, 64-QAM) | WLAN    | 8.15  | $\pm 9.6\%$ |
| 10117 | CAG | IEEE 802.11n (HT Mixed, 13.5 Mbps, BPSK)       | WLAN    | 8.07  | $\pm 9.6\%$ |
| 10118 | CAD | IEEE 802.11n (HT Mixed, 81 Mbps, 16-QAM)       | WLAN    | 8.59  | $\pm 9.6\%$ |
| 10119 | CAD | IEEE 802.11n (HT Mixed, 135 Mbps, 64-QAM)      | WLAN    | 8.13  | $\pm 9.6\%$ |
| 10140 | CAD | LTE-FDD (SC-FDMA, 100% RB, 15 MHz, 16-QAM)     | LTE-FDD | 6.49  | $\pm 9.6\%$ |
| 10141 | CAD | LTE-FDD (SC-FDMA, 100% RB, 15 MHz, 64-QAM)     | LTE-FDD | 6.53  | $\pm 9.6\%$ |
| 10142 | CAD | LTE-FDD (SC-FDMA, 100% RB, 3 MHz, QPSK)        | LTE-FDD | 5.73  | $\pm 9.6\%$ |
| 10143 | CAD | LTE-FDD (SC-FDMA, 100% RB, 3 MHz, 16-QAM)      | LTE-FDD | 6.35  | $\pm 9.6\%$ |
| 10144 | CAC | LTE-FDD (SC-FDMA, 100% RB, 3 MHz, 64-QAM)      | LTE-FDD | 6.65  | $\pm 9.6\%$ |
| 10145 | CAC | LTE-FDD (SC-FDMA, 100% RB, 1.4 MHz, QPSK)      | LTE-FDD | 5.76  | $\pm 9.6\%$ |
| 10148 | CAC | LTE-FDD (SC-FDMA, 100% RB, 1.4 MHz, 16-QAM)    | LTE-FDD | 6.41  | $\pm 9.6\%$ |
| 10147 | CAC | LTE-FDD (SC-FDMA, 100% RB, 1.4 MHz, 64-QAM)    | LTE-FDD | 6.72  | $\pm 9.6\%$ |
| 10148 | CAE | LTE-FDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM)      | LTE-FDD | 6.42  | $\pm 9.6\%$ |
| 10150 | CAE | LTE-FDD (SC-FDMA, 50% RB, 20 MHz, 64-QAM)      | LTE-FDD | 6.60  | $\pm 9.6\%$ |
| 10151 | CAE | LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK)        | LTE-TDD | 9.28  | $\pm 9.6\%$ |
| 10152 | CAE | LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM)      | LTE-TDD | 9.92  | $\pm 9.6\%$ |
| 10153 | CAE | LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 64-QAM)      | LTE-TDD | 10.05 | $\pm 9.6\%$ |
| 10154 | CAF | LTE-FDD (SC-FDMA, 50% RB, 10 MHz, QPSK)        | LTE-FDD | 5.75  | $\pm 9.6\%$ |
| 10155 | CAF | LTE-FDD (SC-FDMA, 50% RB, 10 MHz, 16-QAM)      | LTE-FDD | 6.43  | $\pm 9.6\%$ |
| 10156 | CAF | LTE-FDD (SC-FDMA, 50% RB, 5 MHz, QPSK)         | LTE-FDD | 5.79  | $\pm 9.6\%$ |
| 10157 | CAE | LTE-FDD (SC-FDMA, 50% RB, 5 MHz, 16-QAM)       | LTE-FDD | 6.49  | $\pm 9.6\%$ |
| 10158 | CAE | LTE-FDD (SC-FDMA, 50% RB, 10 MHz, 64-QAM)      | LTE-FDD | 6.62  | $\pm 9.6\%$ |
| 10159 | CAG | LTE-FDD (SC-FDMA, 50% RB, 5 MHz, 64-QAM)       | LTE-FDD | 6.56  | $\pm 9.6\%$ |
| 10160 | CAG | LTE-FDD (SC-FDMA, 50% RB, 15 MHz, QPSK)        | LTE-FDD | 5.82  | $\pm 9.6\%$ |
| 10161 | CAG | LTE-FDD (SC-FDMA, 50% RB, 15 MHz, 16-QAM)      | LTE-FDD | 6.43  | $\pm 9.6\%$ |
| 10162 | CAG | LTE-FDD (SC-FDMA, 50% RB, 15 MHz, 64-QAM)      | LTE-FDD | 6.58  | $\pm 9.6\%$ |
| 10166 | CAG | LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, QPSK)       | LTE-FDD | 5.46  | $\pm 9.6\%$ |
| 10167 | CAG | LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, 16-QAM)     | LTE-FDD | 6.21  | $\pm 9.6\%$ |
| 10168 | CAG | LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, 64-QAM)     | LTE-FDD | 6.79  | $\pm 9.6\%$ |
| 10169 | CAG | LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK)          | LTE-FDD | 5.73  | $\pm 9.6\%$ |
| 10170 | CAG | LTE-FDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM)        | LTE-FDD | 6.52  | $\pm 9.6\%$ |
| 10171 | CAE | LTE-FDD (SC-FDMA, 1 RB, 20 MHz, 64-QAM)        | LTE-FDD | 6.49  | $\pm 9.6\%$ |
| 10172 | CAE | LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK)          | LTE-TDD | 9.21  | $\pm 9.6\%$ |
| 10173 | CAE | LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM)        | LTE-TDD | 9.48  | $\pm 9.6\%$ |
| 10174 | CAF | LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 64-QAM)        | LTE-TDD | 10.25 | $\pm 9.6\%$ |
| 10175 | CAF | LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK)          | LTE-FDD | 5.72  | $\pm 9.6\%$ |
| 10176 | CAF | LTE-FDD (SC-FDMA, 1 RB, 10 MHz, 16-QAM)        | LTE-FDD | 6.52  | $\pm 9.6\%$ |
| 10177 | CAE | LTE-FDD (SC-FDMA, 1 RB, 5 MHz, QPSK)           | LTE-FDD | 5.73  | $\pm 9.6\%$ |
| 10178 | CAE | LTE-FDD (SC-FDMA, 1 RB, 5 MHz, 16-QAM)         | LTE-FDD | 6.52  | $\pm 9.6\%$ |
| 10179 | AAE | LTE-FDD (SC-FDMA, 1 RB, 10 MHz, 64-QAM)        | LTE-FDD | 6.50  | $\pm 9.6\%$ |
| 10180 | CAG | LTE-FDD (SC-FDMA, 1 RB, 5 MHz, 64-QAM)         | LTE-FDD | 6.50  | $\pm 9.6\%$ |



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| 10181 | CAG | LTE-FDD (SC-FDMA, 1 RB, 15 MHz, QPSK)         | LTE-FDD | 5.72  | $\pm 9.6\%$ |
| 10182 | CAG | LTE-FDD (SC-FDMA, 1 RB, 15 MHz, 16-QAM)       | LTE-FDD | 6.52  | $\pm 9.6\%$ |
| 10183 | CAG | LTE-FDD (SC-FDMA, 1 RB, 15 MHz, 64-QAM)       | LTE-FDD | 6.50  | $\pm 9.6\%$ |
| 10184 | CAG | LTE-FDD (SC-FDMA, 1 RB, 3 MHz, QPSK)          | LTE-FDD | 5.73  | $\pm 9.6\%$ |
| 10185 | CAI | LTE-FDD (SC-FDMA, 1 RB, 3 MHz, 16-QAM)        | LTE-FDD | 6.51  | $\pm 9.6\%$ |
| 10186 | CAG | LTE-FDD (SC-FDMA, 1 RB, 3 MHz, 64-QAM)        | LTE-FDD | 6.50  | $\pm 9.6\%$ |
| 10187 | CAG | LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, QPSK)        | LTE-FDD | 5.73  | $\pm 9.6\%$ |
| 10188 | CAG | LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, 16-QAM)      | LTE-FDD | 6.52  | $\pm 9.6\%$ |
| 10189 | CAE | LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, 64-QAM)      | LTE-FDD | 6.50  | $\pm 9.6\%$ |
| 10193 | CAE | IEEE 802.11n (HT Greenfield, 6.5 Mbps, BPSK)  | WLAN    | 8.09  | $\pm 9.6\%$ |
| 10194 | AAD | IEEE 802.11n (HT Greenfield, 39 Mbps, 16-QAM) | WLAN    | 8.12  | $\pm 9.6\%$ |
| 10195 | CAE | IEEE 802.11n (HT Greenfield, 65 Mbps, 64-QAM) | WLAN    | 8.21  | $\pm 9.6\%$ |
| 10196 | CAE | IEEE 802.11n (HT Mixed, 6.5 Mbps, BPSK)       | WLAN    | 8.10  | $\pm 9.6\%$ |
| 10197 | AAE | IEEE 802.11n (HT Mixed, 39 Mbps, 16-QAM)      | WLAN    | 8.13  | $\pm 9.6\%$ |
| 10198 | CAF | IEEE 802.11n (HT Mixed, 65 Mbps, 64-QAM)      | WLAN    | 8.27  | $\pm 9.6\%$ |
| 10219 | CAF | IEEE 802.11n (HT Mixed, 7.2 Mbps, BPSK)       | WLAN    | 8.03  | $\pm 9.6\%$ |
| 10220 | AAF | IEEE 802.11n (HT Mixed, 43.3 Mbps, 16-QAM)    | WLAN    | 8.13  | $\pm 9.6\%$ |
| 10221 | CAC | IEEE 802.11n (HT Mixed, 72.2 Mbps, 64-QAM)    | WLAN    | 8.27  | $\pm 9.6\%$ |
| 10222 | CAC | IEEE 802.11n (HT Mixed, 15 Mbps, BPSK)        | WLAN    | 8.06  | $\pm 9.6\%$ |
| 10223 | CAD | IEEE 802.11n (HT Mixed, 90 Mbps, 16-QAM)      | WLAN    | 8.48  | $\pm 9.6\%$ |
| 10224 | CAD | IEEE 802.11n (HT Mixed, 150 Mbps, 64-QAM)     | WLAN    | 8.08  | $\pm 9.6\%$ |
| 10225 | CAD | UMTS-FDD (HSPA+)                              | WCDMA   | 5.97  | $\pm 9.6\%$ |
| 10226 | CAD | LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, 16-QAM)      | LTE-TDD | 9.49  | $\pm 9.6\%$ |
| 10227 | CAD | LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, 64-QAM)      | LTE-TDD | 10.26 | $\pm 9.6\%$ |
| 10228 | CAD | LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, QPSK)        | LTE-TDD | 9.22  | $\pm 9.6\%$ |
| 10229 | DAC | LTE-TDD (SC-FDMA, 1 RB, 3 MHz, 16-QAM)        | LTE-TDD | 9.48  | $\pm 9.6\%$ |
| 10230 | CAC | LTE-TDD (SC-FDMA, 1 RB, 3 MHz, 64-QAM)        | LTE-TDD | 10.25 | $\pm 9.6\%$ |
| 10231 | CAC | LTE-TDD (SC-FDMA, 1 RB, 3 MHz, QPSK)          | LTE-TDD | 9.19  | $\pm 9.6\%$ |
| 10232 | CAD | LTE-TDD (SC-FDMA, 1 RB, 5 MHz, 16-QAM)        | LTE-TDD | 9.48  | $\pm 9.6\%$ |
| 10233 | CAD | LTE-TDD (SC-FDMA, 1 RB, 5 MHz, 64-QAM)        | LTE-TDD | 10.25 | $\pm 9.6\%$ |
| 10234 | CAD | LTE-TDD (SC-FDMA, 1 RB, 5 MHz, QPSK)          | LTE-TDD | 9.21  | $\pm 9.6\%$ |
| 10235 | CAD | LTE-TDD (SC-FDMA, 1 RB, 10 MHz, 16-QAM)       | LTE-TDD | 9.48  | $\pm 9.6\%$ |
| 10236 | CAD | LTE-TDD (SC-FDMA, 1 RB, 10 MHz, 64-QAM)       | LTE-TDD | 10.25 | $\pm 9.6\%$ |
| 10237 | CAD | LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK)         | LTE-TDD | 9.21  | $\pm 9.6\%$ |
| 10238 | CAB | LTE-TDD (SC-FDMA, 1 RB, 15 MHz, 16-QAM)       | LTE-TDD | 9.48  | $\pm 9.6\%$ |
| 10239 | CAB | LTE-TDD (SC-FDMA, 1 RB, 15 MHz, 64-QAM)       | LTE-TDD | 10.25 | $\pm 9.6\%$ |
| 10240 | CAB | LTE-TDD (SC-FDMA, 1 RB, 15 MHz, QPSK)         | LTE-TDD | 9.21  | $\pm 9.6\%$ |
| 10241 | CAB | LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, 16-QAM)    | LTE-TDD | 9.82  | $\pm 9.6\%$ |
| 10242 | CAD | LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, 64-QAM)    | LTE-TDD | 9.86  | $\pm 9.6\%$ |
| 10243 | CAD | LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, QPSK)      | LTE-TDD | 9.46  | $\pm 9.6\%$ |
| 10244 | CAD | LTE-TDD (SC-FDMA, 50% RB, 3 MHz, 16-QAM)      | LTE-TDD | 10.06 | $\pm 9.6\%$ |
| 10245 | CAG | LTE-TDD (SC-FDMA, 50% RB, 3 MHz, 64-QAM)      | LTE-TDD | 10.06 | $\pm 9.6\%$ |
| 10246 | CAG | LTE-TDD (SC-FDMA, 50% RB, 3 MHz, QPSK)        | LTE-TDD | 9.30  | $\pm 9.6\%$ |
| 10247 | CAG | LTE-TDD (SC-FDMA, 50% RB, 5 MHz, 16-QAM)      | LTE-TDD | 9.91  | $\pm 9.6\%$ |
| 10248 | CAG | LTE-TDD (SC-FDMA, 50% RB, 5 MHz, 64-QAM)      | LTE-TDD | 10.09 | $\pm 9.6\%$ |
| 10249 | CAG | LTE-TDD (SC-FDMA, 50% RB, 5 MHz, QPSK)        | LTE-TDD | 9.29  | $\pm 9.6\%$ |
| 10250 | CAG | LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 16-QAM)     | LTE-TDD | 9.81  | $\pm 9.6\%$ |
| 10251 | CAF | LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 64-QAM)     | LTE-TDD | 10.17 | $\pm 9.6\%$ |
| 10252 | CAF | LTE-TDD (SC-FDMA, 50% RB, 10 MHz, QPSK)       | LTE-TDD | 9.24  | $\pm 9.6\%$ |
| 10253 | CAF | LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 16-QAM)     | LTE-TDD | 9.90  | $\pm 9.6\%$ |
| 10254 | CAB | LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 64-QAM)     | LTE-TDD | 10.14 | $\pm 9.6\%$ |
| 10255 | CAB | LTE-TDD (SC-FDMA, 50% RB, 15 MHz, QPSK)       | LTE-TDD | 9.20  | $\pm 9.6\%$ |
| 10256 | CAB | LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 16-QAM)   | LTE-TDD | 9.96  | $\pm 9.6\%$ |
| 10257 | CAD | LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 64-QAM)   | LTE-TDD | 10.08 | $\pm 9.6\%$ |
| 10258 | CAD | LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, QPSK)     | LTE-TDD | 9.34  | $\pm 9.6\%$ |
| 10259 | CAD | LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 16-QAM)     | LTE-TDD | 9.98  | $\pm 9.6\%$ |



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| 10260 | CAG | LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 64-QAM)                 | LTE-TDD  | 9.97  | $\pm 9.6\%$ |
| 10261 | CAG | LTE-TDD (SC-FDMA, 100% RB, 3 MHz, QPSK)                   | LTE-TDD  | 9.24  | $\pm 9.6\%$ |
| 10262 | CAG | LTE-TDD (SC-FDMA, 100% RB, 5 MHz, 16-QAM)                 | LTE-TDD  | 9.83  | $\pm 9.6\%$ |
| 10263 | CAG | LTE-TDD (SC-FDMA, 100% RB, 5 MHz, 64-QAM)                 | LTE-TDD  | 10.16 | $\pm 9.6\%$ |
| 10264 | CAG | LTE-TDD (SC-FDMA, 100% RB, 5 MHz, QPSK)                   | LTE-TDD  | 9.23  | $\pm 9.6\%$ |
| 10265 | CAG | LTE-TDD (SC-FDMA, 100% RB, 10 MHz, 16-QAM)                | LTE-TDD  | 9.92  | $\pm 9.6\%$ |
| 10266 | CAF | LTE-TDD (SC-FDMA, 100% RB, 10 MHz, 64-QAM)                | LTE-TDD  | 10.07 | $\pm 9.6\%$ |
| 10267 | CAF | LTE-TDD (SC-FDMA, 100% RB, 10 MHz, QPSK)                  | LTE-TDD  | 9.30  | $\pm 9.6\%$ |
| 10268 | CAF | LTE-TDD (SC-FDMA, 100% RB, 15 MHz, 16-QAM)                | LTE-TDD  | 10.06 | $\pm 9.6\%$ |
| 10269 | CAB | LTE-TDD (SC-FDMA, 100% RB, 15 MHz, 64-QAM)                | LTE-TDD  | 10.13 | $\pm 9.6\%$ |
| 10270 | CAB | LTE-TDD (SC-FDMA, 100% RB, 15 MHz, QPSK)                  | LTE-TDD  | 9.58  | $\pm 9.6\%$ |
| 10274 | CAB | UMTS-FDD (HSUPA, Sublest 5, 3GPP Rel8.10)                 | WCDMA    | 4.87  | $\pm 9.6\%$ |
| 10275 | CAD | UMTS-FDD (HSUPA, Sublest 5, 3GPP Rel8.4)                  | WCDMA    | 3.96  | $\pm 9.6\%$ |
| 10277 | CAD | PHS (QPSK)  | PHS      | 11.81 | $\pm 9.6\%$ |
| 10278 | CAD | PHS (QPSK, BW 884MHz, Rolloff 0.5)                        | PHS      | 11.81 | $\pm 9.6\%$ |
| 10279 | CAG | PHS (QPSK, BW 884MHz, Rolloff 0.38)                       | PHS      | 12.18 | $\pm 9.6\%$ |
| 10290 | CAG | CDMA2000, RC1, SO55, Full Rate                            | CDMA2000 | 3.91  | $\pm 9.6\%$ |
| 10291 | CAG | CDMA2000, RC3, SO55, Full Rate                            | CDMA2000 | 3.46  | $\pm 9.6\%$ |
| 10292 | CAG | CDMA2000, RC3, SO32, Full Rate                            | CDMA2000 | 3.39  | $\pm 9.6\%$ |
| 10293 | CAG | CDMA2000, RC3, SO3, Full Rate                             | CDMA2000 | 3.50  | $\pm 9.6\%$ |
| 10295 | CAG | CDMA2000, RC1, SO3, 1/8th Rate 25 fr.                     | CDMA2000 | 12.49 | $\pm 9.6\%$ |
| 10297 | CAF | LTE-FDD (SC-FDMA, 50% RB, 20 MHz, QPSK)                   | LTE-FDD  | 5.81  | $\pm 9.6\%$ |
| 10298 | CAF | LTE-FDD (SC-FDMA, 50% RB, 3 MHz, QPSK)                    | LTE-FDD  | 5.72  | $\pm 9.6\%$ |
| 10299 | CAF | LTE-FDD (SC-FDMA, 50% RB, 3 MHz, 16-QAM)                  | LTE-FDD  | 6.39  | $\pm 9.6\%$ |
| 10300 | CAC | LTE-FDD (SC-FDMA, 50% RB, 3 MHz, 64-QAM)                  | LTE-FDD  | 6.60  | $\pm 9.6\%$ |
| 10301 | CAC | IEEE 802.16e WiMAX (29:18, 5ms, 10MHz, QPSK, PUSC)        | WiMAX    | 12.03 | $\pm 9.6\%$ |
| 10302 | CAB | IEEE 802.16e WiMAX (29:18, 5ms, 10MHz, QPSK, PUSC, 3CTRL) | WiMAX    | 12.57 | $\pm 9.6\%$ |
| 10303 | CAB | IEEE 802.16e WiMAX (31:15, 5ms, 10MHz, 64QAM, PUSC)       | WiMAX    | 12.52 | $\pm 9.6\%$ |
| 10304 | CAA | IEEE 802.16e WiMAX (29:18, 5ms, 10MHz, 64QAM, PUSC)       | WiMAX    | 11.86 | $\pm 9.6\%$ |
| 10305 | CAA | IEEE 802.16e WiMAX (31:15, 10ms, 10MHz, 64QAM, PUSC)      | WiMAX    | 15.24 | $\pm 9.6\%$ |
| 10306 | CAA | IEEE 802.16e WiMAX (29:18, 10ms, 10MHz, 64QAM, PUSC)      | WiMAX    | 14.67 | $\pm 9.6\%$ |
| 10307 | AAB | IEEE 802.16e WiMAX (29:18, 10ms, 10MHz, QPSK, PUSC)       | WiMAX    | 14.49 | $\pm 9.6\%$ |
| 10308 | AAB | IEEE 802.16e WiMAX (29:18, 10ms, 10MHz, 16QAM, PUSC)      | WiMAX    | 14.46 | $\pm 9.6\%$ |
| 10309 | AAB | IEEE 802.16e WiMAX (29:18, 10ms, 10MHz, 16QAM, AMC 2x3)   | WiMAX    | 14.58 | $\pm 9.6\%$ |
| 10310 | AAB | IEEE 802.16e WiMAX (29:18, 10ms, 10MHz, QPSK, AMC 2x3)    | WiMAX    | 14.57 | $\pm 9.6\%$ |
| 10311 | AAB | LTE-FDD (SC-FDMA, 100% RB, 15 MHz, QPSK)                  | LTE-FDD  | 6.06  | $\pm 9.6\%$ |
| 10313 | AAD | iDEN 1:3  | iDEN     | 10.51 | $\pm 9.6\%$ |
| 10314 | AAD | iDEN 1:6  | iDEN     | 13.48 | $\pm 9.6\%$ |
| 10315 | AAD | IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 96pc dc)         | WLAN     | 1.71  | $\pm 9.6\%$ |
| 10316 | AAD | IEEE 802.11g WiFi 2.4 GHz (ERP-OFDM, 6 Mbps, 96pc dc)     | WLAN     | 8.36  | $\pm 9.6\%$ |
| 10317 | AAA | IEEE 802.11a WiFi 5 GHz (OFDM, 6 Mbps, 96pc dc)           | WLAN     | 8.36  | $\pm 9.6\%$ |
| 10352 | AAA | Pulse Waveform (200Hz, 10%)                               | Generic  | 10.00 | $\pm 9.6\%$ |
| 10353 | AAA | Pulse Waveform (200Hz, 20%)                               | Generic  | 6.99  | $\pm 9.6\%$ |
| 10354 | AAA | Pulse Waveform (200Hz, 40%)                               | Generic  | 3.98  | $\pm 9.6\%$ |
| 10355 | AAA | Pulse Waveform (200Hz, 60%)                               | Generic  | 2.22  | $\pm 9.6\%$ |
| 10356 | AAA | Pulse Waveform (200Hz, 80%)                               | Generic  | 0.97  | $\pm 9.6\%$ |
| 10387 | AAA | QPSK Waveform, 1 MHz                                      | Generic  | 5.10  | $\pm 9.6\%$ |
| 10388 | AAA | QPSK Waveform, 10 MHz                                     | Generic  | 5.22  | $\pm 9.6\%$ |
| 10396 | AAA | 64-QAM Waveform, 100 kHz                                  | Generic  | 6.27  | $\pm 9.6\%$ |
| 10399 | AAA | 64-QAM Waveform, 40 MHz                                   | Generic  | 6.27  | $\pm 9.6\%$ |
| 10400 | AAD | IEEE 802.11ac WiFi (20MHz, 64-QAM, 99pc dc)               | WLAN     | 8.37  | $\pm 9.6\%$ |
| 10401 | AAA | IEEE 802.11ac WiFi (40MHz, 64-QAM, 99pc dc)               | WLAN     | 8.60  | $\pm 9.6\%$ |
| 10402 | AAA | IEEE 802.11ac WiFi (80MHz, 64-QAM, 99pc dc)               | WLAN     | 8.53  | $\pm 9.6\%$ |
| 10403 | AAB | CDMA2000 (1xEV-DO, Rev. D)                                | CDMA2000 | 3.76  | $\pm 9.6\%$ |
| 10404 | AAB | CDMA2000 (1xEV-DO, Rev. A)                                | CDMA2000 | 3.77  | $\pm 9.6\%$ |
| 10406 | AAD | CDMA2000, RC3, SO32, SCH0, Full Rate                      | CDMA2000 | 5.22  | $\pm 9.6\%$ |



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|-------|-----|--|----------|-------|-------------|
| 10410 | AAA | LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK, UL Sub=2,3,4,7,8,9)  | LTE-TDD  | 7.82  | $\pm 9.6\%$ |
| 10414 | AAA | WLAN CCDF, 64-QAM, 40MHz                                   | Generic  | 8.54  | $\pm 9.6\%$ |
| 10415 | AAA | IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 99pc dc)          | WLAN     | 1.54  | $\pm 9.6\%$ |
| 10416 | AAA | IEEE 802.11g WiFi 2.4 GHz (ERP-OFDM, 6 Mbps, 99pc dc)      | WLAN     | 8.23  | $\pm 9.6\%$ |
| 10417 | AAA | IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps, 99pc dc)          | WLAN     | 8.23  | $\pm 9.6\%$ |
| 10418 | AAA | IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 99pc, Long)  | WLAN     | 8.14  | $\pm 9.6\%$ |
| 10419 | AAA | IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 99pc, Short) | WLAN     | 8.19  | $\pm 9.6\%$ |
| 10422 | AAA | IEEE 802.11n (HT Greenfield, 7.2 Mbps, BPSK)               | WLAN     | 8.32  | $\pm 9.6\%$ |
| 10423 | AAA | IEEE 802.11n (HT Greenfield, 43.3 Mbps, 16-QAM)            | WLAN     | 8.47  | $\pm 9.6\%$ |
| 10424 | AAE | IEEE 802.11n (HT Greenfield, 72.2 Mbps, 64-QAM)            | WLAN     | 8.40  | $\pm 9.6\%$ |
| 10425 | AAE | IEEE 802.11n (HT Greenfield, 15 Mbps, BPSK)                | WLAN     | 8.41  | $\pm 9.6\%$ |
| 10426 | AAE | IEEE 802.11n (HT Greenfield, 90 Mbps, 16-QAM)              | WLAN     | 8.45  | $\pm 9.6\%$ |
| 10427 | AAB | IEEE 802.11n (HT Greenfield, 150 Mbps, 64-QAM)             | WLAN     | 8.41  | $\pm 9.6\%$ |
| 10430 | AAB | LTE-FDD (OFDMA, 5 MHz, E-TM 3.1)                           | LTE-FDD  | 8.28  | $\pm 9.6\%$ |
| 10431 | AAC | LTE-FDD (OFDMA, 10 MHz, E-TM 3.1)                          | LTE-FDD  | 8.38  | $\pm 9.6\%$ |
| 10432 | AAB | LTE-FDD (OFDMA, 15 MHz, E-TM 3.1)                          | LTE-FDD  | 8.34  | $\pm 9.6\%$ |
| 10433 | AAC | LTE-FDD (OFDMA, 20 MHz, E-TM 3.1)                          | LTE-FDD  | 8.34  | $\pm 9.6\%$ |
| 10434 | AAG | W-CDMA (BS Test Model 1, 64 DPCH)                          | WCDMA    | 8.60  | $\pm 9.6\%$ |
| 10435 | AAA | LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK, UL Sub)              | LTE-TDD  | 7.82  | $\pm 9.6\%$ |
| 10447 | AAA | LTE-FDD (OFDMA, 5 MHz, E-TM 3.1, Clipping 44%)             | LTE-FDD  | 7.56  | $\pm 9.6\%$ |
| 10448 | AAA | LTE-FDD (OFDMA, 10 MHz, E-TM 3.1, Clipping 44%)            | LTE-FDD  | 7.53  | $\pm 9.6\%$ |
| 10449 | AAC | LTE-FDD (OFDMA, 15 MHz, E-TM 3.1, Clipping 44%)            | LTE-FDD  | 7.51  | $\pm 9.6\%$ |
| 10450 | AAA | LTE-FDD (OFDMA, 20 MHz, E-TM 3.1, Clipping 44%)            | LTE-FDD  | 7.48  | $\pm 9.6\%$ |
| 10451 | AAA | W-CDMA (BS Test Model 1, 64 DPCH, Clipping 44%)            | WCDMA    | 7.59  | $\pm 9.6\%$ |
| 10453 | AAC | Validation (Square, 10ms, 1ms)                             | Test     | 10.00 | $\pm 9.6\%$ |
| 10456 | AAC | IEEE 802.11ac WiFi (180MHz, 64-QAM, 99pc dc)               | WLAN     | 8.63  | $\pm 9.6\%$ |
| 10457 | AAC | UMTS-FDD (DC-HSDPA)  | WCDMA    | 6.62  | $\pm 9.6\%$ |
| 10458 | AAC | CDMA2000 (1xEV-DO, Rev. B, 2 carriers)                     | CDMA2000 | 6.55  | $\pm 9.6\%$ |
| 10459 | AAC | CDMA2000 (1xEV-DO, Rev. B, 3 carriers)                     | CDMA2000 | 8.25  | $\pm 9.6\%$ |
| 10460 | AAC | UMTS-FDD (WCDMA, AMR)                                      | WCDMA    | 2.39  | $\pm 9.6\%$ |
| 10461 | AAC | LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, QPSK, UL Sub)             | LTE-TDD  | 7.82  | $\pm 9.6\%$ |
| 10462 | AAC | LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, 16-QAM, UL Sub)           | LTE-TDD  | 8.30  | $\pm 9.6\%$ |
| 10463 | AAD | LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, 64-QAM, UL Sub)           | LTE-TDD  | 8.56  | $\pm 9.6\%$ |
| 10464 | AAD | LTE-TDD (SC-FDMA, 1 RB, 3 MHz, QPSK, UL Sub)               | LTE-TDD  | 7.82  | $\pm 9.6\%$ |
| 10465 | AAC | LTE-TDD (SC-FDMA, 1 RB, 3 MHz, 16-QAM, UL Sub)             | LTE-TDD  | 8.32  | $\pm 9.6\%$ |
| 10466 | AAC | LTE-TDD (SC-FDMA, 1 RB, 3 MHz, 64-QAM, UL Sub)             | LTE-TDD  | 8.57  | $\pm 9.6\%$ |
| 10467 | AAA | LTE-TDD (SC-FDMA, 1 RB, 5 MHz, QPSK, UL Sub)               | LTE-TDD  | 7.82  | $\pm 9.6\%$ |
| 10468 | AAF | LTE-TDD (SC-FDMA, 1 RB, 5 MHz, 16-QAM, UL Sub)             | LTE-TDD  | 8.32  | $\pm 9.6\%$ |
| 10469 | AAD | LTE-TDD (SC-FDMA, 1 RB, 5 MHz, 64-QAM, UL Sub)             | LTE-TDD  | 8.56  | $\pm 9.6\%$ |
| 10470 | AAD | LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK, UL Sub)              | LTE-TDD  | 7.82  | $\pm 9.6\%$ |
| 10471 | AAC | LTE-TDD (SC-FDMA, 1 RB, 10 MHz, 16-QAM, UL Sub)            | LTE-TDD  | 8.32  | $\pm 9.6\%$ |
| 10472 | AAC | LTE-TDD (SC-FDMA, 1 RB, 10 MHz, 64-QAM, UL Sub)            | LTE-TDD  | 8.57  | $\pm 9.6\%$ |
| 10473 | AAA | LTE-TDD (SC-FDMA, 1 RB, 15 MHz, QPSK, UL Sub)              | LTE-TDD  | 7.82  | $\pm 9.6\%$ |
| 10474 | AAC | LTE-TDD (SC-FDMA, 1 RB, 15 MHz, 16-QAM, UL Sub)            | LTE-TDD  | 8.32  | $\pm 9.6\%$ |
| 10475 | AAD | LTE-TDD (SC-FDMA, 1 RB, 15 MHz, 64-QAM, UL Sub)            | LTE-TDD  | 8.57  | $\pm 9.6\%$ |
| 10477 | AAC | LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM, UL Sub)            | LTE-TDD  | 8.32  | $\pm 9.6\%$ |
| 10478 | AAC | LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 64-QAM, UL Sub)            | LTE-TDD  | 8.57  | $\pm 9.6\%$ |
| 10479 | AAC | LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, QPSK, UL Sub)           | LTE-TDD  | 7.74  | $\pm 9.6\%$ |
| 10480 | AAA | LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, 16-QAM, UL Sub)         | LTE-TDD  | 8.18  | $\pm 9.6\%$ |
| 10481 | AAA | LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, 64-QAM, UL Sub)         | LTE-TDD  | 8.45  | $\pm 9.6\%$ |
| 10482 | AAA | LTE-TDD (SC-FDMA, 50% RB, 3 MHz, QPSK, UL Sub)             | LTE-TDD  | 7.71  | $\pm 9.6\%$ |
| 10483 | AAA | LTE-TDD (SC-FDMA, 50% RB, 3 MHz, 16-QAM, Sub)              | LTE-TDD  | 8.39  | $\pm 9.6\%$ |
| 10484 | AAB | LTE-TDD (SC-FDMA, 50% RB, 3 MHz, 64-QAM, UL Sub)           | LTE-TDD  | 8.47  | $\pm 9.6\%$ |
| 10485 | AAB | LTE-TDD (SC-FDMA, 50% RB, 5 MHz, QPSK, UL Sub)             | LTE-TDD  | 7.59  | $\pm 9.6\%$ |
| 10486 | AAB | LTE-TDD (SC-FDMA, 50% RB, 5 MHz, 16-QAM, UL Sub)           | LTE-TDD  | 8.38  | $\pm 9.6\%$ |
| 10487 | AAC | LTE-TDD (SC-FDMA, 50% RB, 5 MHz, 64-QAM, UL Sub)           | LTE-TDD  | 8.60  | $\pm 9.6\%$ |



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| 10488 | AAC | LTE-TDD (SC-FDMA, 50% RB, 10 MHz, QPSK, UL Sub)     | LTE-TDD | 7.70 | $\pm 9.6\%$ |
| 10489 | AAC | LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 16-QAM, UL Sub)   | LTE-TDD | 8.31 | $\pm 9.6\%$ |
| 10490 | AAF | LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 64-QAM, UL Sub)   | LTE-TDD | 8.54 | $\pm 9.6\%$ |
| 10491 | AAF | LTE-TDD (SC-FDMA, 50% RB, 15 MHz, QPSK, UL Sub)     | LTE-TDD | 7.74 | $\pm 9.6\%$ |
| 10492 | AAF | LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 16-QAM, UL Sub)   | LTE-TDD | 8.41 | $\pm 9.6\%$ |
| 10493 | AAF | LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 64-QAM, UL Sub)   | LTE-TDD | 8.55 | $\pm 9.6\%$ |
| 10494 | AAF | LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK, UL Sub)     | LTE-TDD | 7.74 | $\pm 9.6\%$ |
| 10495 | AAF | LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM, UL Sub)   | LTE-TDD | 8.37 | $\pm 9.6\%$ |
| 10496 | AAE | LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 64-QAM, UL Sub)   | LTE-TDD | 8.54 | $\pm 9.6\%$ |
| 10497 | AAE | LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, QPSK, UL Sub)   | LTE-TDD | 7.67 | $\pm 9.6\%$ |
| 10498 | AAE | LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 16-QAM, UL Sub) | LTE-TDD | 8.40 | $\pm 9.6\%$ |
| 10499 | AAC | LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 64-QAM, UL Sub) | LTE-TDD | 8.68 | $\pm 9.6\%$ |
| 10500 | AAF | LTE-TDD (SC-FDMA, 100% RB, 3 MHz, QPSK, UL Sub)     | LTE-TDD | 7.67 | $\pm 9.6\%$ |
| 10501 | AAF | LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 16-QAM, UL Sub)   | LTE-TDD | 8.44 | $\pm 9.6\%$ |
| 10502 | AAB | LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 64-QAM, UL Sub)   | LTE-TDD | 8.52 | $\pm 9.6\%$ |
| 10503 | AAB | LTE-TDD (SC-FDMA, 100% RB, 5 MHz, QPSK, UL Sub)     | LTE-TDD | 7.72 | $\pm 9.6\%$ |
| 10504 | AAB | LTE-TDD (SC-FDMA, 100% RB, 5 MHz, 16-QAM, UL Sub)   | LTE-TDD | 8.31 | $\pm 9.6\%$ |
| 10505 | AAC | LTE-TDD (SC-FDMA, 100% RB, 5 MHz, 64-QAM, UL Sub)   | LTE-TDD | 8.54 | $\pm 9.6\%$ |
| 10506 | AAC | LTE-TDD (SC-FDMA, 100% RB, 10 MHz, QPSK, UL Sub)    | LTE-TDD | 7.74 | $\pm 9.6\%$ |
| 10507 | AAC | LTE-TDD (SC-FDMA, 100% RB, 10 MHz, 16-QAM, UL Sub)  | LTE-TDD | 8.36 | $\pm 9.6\%$ |
| 10508 | AAF | LTE-TDD (SC-FDMA, 100% RB, 10 MHz, 64-QAM, UL Sub)  | LTE-TDD | 8.55 | $\pm 9.6\%$ |
| 10509 | AAF | LTE-TDD (SC-FDMA, 100% RB, 15 MHz, QPSK, UL Sub)    | LTE-TDD | 7.99 | $\pm 9.6\%$ |
| 10510 | AAF | LTE-TDD (SC-FDMA, 100% RB, 15 MHz, 16-QAM, UL Sub)  | LTE-TDD | 8.49 | $\pm 9.6\%$ |
| 10511 | AAF | LTE-TDD (SC-FDMA, 100% RB, 15 MHz, 64-QAM, UL Sub)  | LTE-TDD | 8.51 | $\pm 9.6\%$ |
| 10512 | AAF | LTE-TDD (SC-FDMA, 100% RB, 20 MHz, QPSK, UL Sub)    | LTE-TDD | 7.74 | $\pm 9.6\%$ |
| 10513 | AAF | LTE-TDD (SC-FDMA, 100% RB, 20 MHz, 16-QAM, UL Sub)  | LTE-TDD | 8.42 | $\pm 9.6\%$ |
| 10514 | AAE | LTE-TDD (SC-FDMA, 100% RB, 20 MHz, 64-QAM, UL Sub)  | LTE-TDD | 8.45 | $\pm 9.6\%$ |
| 10515 | AAE | IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps, 99pc dc)   | WLAN    | 1.58 | $\pm 9.6\%$ |
| 10516 | AAE | IEEE 802.11b WiFi 2.4 GHz (DSSS, 5.5 Mbps, 99pc dc) | WLAN    | 1.57 | $\pm 9.6\%$ |
| 10517 | AAF | IEEE 802.11b WiFi 2.4 GHz (DSSS, 11 Mbps, 99pc dc)  | WLAN    | 1.58 | $\pm 9.6\%$ |
| 10518 | AAF | IEEE 802.11a/h WiFi 5 GHz (OFDM, 9 Mbps, 99pc dc)   | WLAN    | 8.23 | $\pm 9.6\%$ |
| 10519 | AAF | IEEE 802.11a/h WiFi 5 GHz (OFDM, 12 Mbps, 99pc dc)  | WLAN    | 8.39 | $\pm 9.6\%$ |
| 10520 | AAB | IEEE 802.11a/h WiFi 5 GHz (OFDM, 18 Mbps, 99pc dc)  | WLAN    | 8.12 | $\pm 9.6\%$ |
| 10521 | AAB | IEEE 802.11a/h WiFi 5 GHz (OFDM, 24 Mbps, 99pc dc)  | WLAN    | 7.97 | $\pm 9.6\%$ |
| 10522 | AAB | IEEE 802.11a/h WiFi 5 GHz (OFDM, 36 Mbps, 99pc dc)  | WLAN    | 8.45 | $\pm 9.6\%$ |
| 10523 | AAC | IEEE 802.11a/h WiFi 5 GHz (OFDM, 48 Mbps, 99pc dc)  | WLAN    | 8.08 | $\pm 9.6\%$ |
| 10524 | AAC | IEEE 802.11a/h WiFi 5 GHz (OFDM, 54 Mbps, 99pc dc)  | WLAN    | 8.27 | $\pm 9.6\%$ |
| 10525 | AAC | IEEE 802.11ac WiFi (20MHz, MCS0, 99pc dc)           | WLAN    | 8.36 | $\pm 9.6\%$ |
| 10526 | AAF | IEEE 802.11ac WiFi (20MHz, MCS1, 99pc dc)           | WLAN    | 8.42 | $\pm 9.6\%$ |
| 10527 | AAF | IEEE 802.11ac WiFi (20MHz, MCS2, 99pc dc)           | WLAN    | 8.21 | $\pm 9.6\%$ |
| 10528 | AAF | IEEE 802.11ac WiFi (20MHz, MCS3, 99pc dc)           | WLAN    | 8.36 | $\pm 9.6\%$ |
| 10529 | AAF | IEEE 802.11ac WiFi (20MHz, MCS4, 99pc dc)           | WLAN    | 8.36 | $\pm 9.6\%$ |
| 10531 | AAF | IEEE 802.11ac WiFi (20MHz, MCS6, 99pc dc)           | WLAN    | 8.43 | $\pm 9.6\%$ |
| 10532 | AAF | IEEE 802.11ac WiFi (20MHz, MCS7, 99pc dc)           | WLAN    | 8.29 | $\pm 9.6\%$ |
| 10533 | AAE | IEEE 802.11ac WiFi (20MHz, MCS8, 99pc dc)           | WLAN    | 8.38 | $\pm 9.6\%$ |
| 10534 | AAE | IEEE 802.11ac WiFi (40MHz, MCS0, 99pc dc)           | WLAN    | 8.45 | $\pm 9.6\%$ |
| 10535 | AAE | IEEE 802.11ac WiFi (40MHz, MCS1, 99pc dc)           | WLAN    | 8.45 | $\pm 9.6\%$ |
| 10536 | AAF | IEEE 802.11ac WiFi (40MHz, MCS2, 99pc dc)           | WLAN    | 8.32 | $\pm 9.6\%$ |
| 10537 | AAF | IEEE 802.11ac WiFi (40MHz, MCS3, 99pc dc)           | WLAN    | 8.44 | $\pm 9.6\%$ |
| 10538 | AAF | IEEE 802.11ac WiFi (40MHz, MCS4, 99pc dc)           | WLAN    | 8.54 | $\pm 9.6\%$ |
| 10540 | AAA | IEEE 802.11ac WiFi (40MHz, MCS6, 99pc dc)           | WLAN    | 8.39 | $\pm 9.6\%$ |
| 10541 | AAA | IEEE 802.11ac WiFi (40MHz, MCS7, 99pc dc)           | WLAN    | 8.46 | $\pm 9.6\%$ |
| 10542 | AAA | IEEE 802.11ac WiFi (40MHz, MCS8, 99pc dc)           | WLAN    | 8.65 | $\pm 9.6\%$ |
| 10543 | AAC | IEEE 802.11ac WiFi (40MHz, MCS9, 99pc dc)           | WLAN    | 8.65 | $\pm 9.6\%$ |
| 10544 | AAC | IEEE 802.11ac WiFi (80MHz, MCS0, 99pc dc)           | WLAN    | 8.47 | $\pm 9.6\%$ |
| 10545 | AAC | IEEE 802.11ac WiFi (80MHz, MCS1, 99pc dc)           | WLAN    | 8.65 | $\pm 9.6\%$ |

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| 10546 | AAC | IEEE 802.11ac WiFi (80MHz, MCS2, 99pc dc)               | WLAN | 8.35 | $\pm 9.6\%$ |
| 10547 | AAC | IEEE 802.11ac WiFi (80MHz, MCS3, 99pc dc)               | WLAN | 8.49 | $\pm 9.6\%$ |
| 10548 | AAC | IEEE 802.11ac WiFi (80MHz, MCS4, 99pc dc)               | WLAN | 8.37 | $\pm 9.6\%$ |
| 10550 | AAC | IEEE 802.11ac WiFi (80MHz, MCS6, 99pc dc)               | WLAN | 8.38 | $\pm 9.6\%$ |
| 10551 | AAC | IEEE 802.11ac WiFi (80MHz, MCS7, 99pc dc)               | WLAN | 8.50 | $\pm 9.6\%$ |
| 10552 | AAC | IEEE 802.11ac WiFi (80MHz, MCS8, 99pc dc)               | WLAN | 8.42 | $\pm 9.6\%$ |
| 10553 | AAC | IEEE 802.11ac WiFi (80MHz, MCS9, 99pc dc)               | WLAN | 8.45 | $\pm 9.6\%$ |
| 10554 | AAC | IEEE 802.11ac WiFi (160MHz, MCS0, 99pc dc)              | WLAN | 8.48 | $\pm 9.6\%$ |
| 10555 | AAC | IEEE 802.11ac WiFi (160MHz, MCS1, 99pc dc)              | WLAN | 8.47 | $\pm 9.6\%$ |
| 10556 | AAC | IEEE 802.11ac WiFi (160MHz, MCS2, 99pc dc)              | WLAN | 8.50 | $\pm 9.6\%$ |
| 10557 | AAC | IEEE 802.11ac WiFi (160MHz, MCS3, 99pc dc)              | WLAN | 8.52 | $\pm 9.6\%$ |
| 10558 | AAC | IEEE 802.11ac WiFi (160MHz, MCS4, 99pc dc)              | WLAN | 8.61 | $\pm 9.6\%$ |
| 10560 | AAC | IEEE 802.11ac WiFi (160MHz, MCS5, 99pc dc)              | WLAN | 8.73 | $\pm 9.6\%$ |
| 10561 | AAC | IEEE 802.11ac WiFi (160MHz, MCS7, 99pc dc)              | WLAN | 8.56 | $\pm 9.6\%$ |
| 10562 | AAC | IEEE 802.11ac WiFi (160MHz, MCS8, 99pc dc)              | WLAN | 8.69 | $\pm 9.6\%$ |
| 10563 | AAC | IEEE 802.11ac WiFi (160MHz, MCS9, 99pc dc)              | WLAN | 8.77 | $\pm 9.6\%$ |
| 10564 | AAC | IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 9 Mbps, 99pc dc)  | WLAN | 8.25 | $\pm 9.6\%$ |
| 10565 | AAC | IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 12 Mbps, 99pc dc) | WLAN | 8.45 | $\pm 9.6\%$ |
| 10566 | AAC | IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 18 Mbps, 99pc dc) | WLAN | 8.13 | $\pm 9.6\%$ |
| 10567 | AAC | IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 24 Mbps, 99pc dc) | WLAN | 8.00 | $\pm 9.6\%$ |
| 10568 | AAC | IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 36 Mbps, 99pc dc) | WLAN | 8.37 | $\pm 9.6\%$ |
| 10569 | AAC | IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 48 Mbps, 99pc dc) | WLAN | 8.10 | $\pm 9.6\%$ |
| 10570 | AAC | IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 54 Mbps, 99pc dc) | WLAN | 8.30 | $\pm 9.6\%$ |
| 10571 | AAC | IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 90pc dc)       | WLAN | 1.99 | $\pm 9.6\%$ |
| 10572 | AAC | IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps, 90pc dc)       | WLAN | 1.99 | $\pm 9.6\%$ |
| 10573 | AAC | IEEE 802.11b WiFi 2.4 GHz (DSSS, 5.5 Mbps, 90pc dc)     | WLAN | 1.98 | $\pm 9.6\%$ |
| 10574 | AAC | IEEE 802.11b WiFi 2.4 GHz (DSSS, 11 Mbps, 90pc dc)      | WLAN | 1.98 | $\pm 9.6\%$ |
| 10575 | AAC | IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 90pc dc)  | WLAN | 8.59 | $\pm 9.6\%$ |
| 10576 | AAC | IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 9 Mbps, 90pc dc)  | WLAN | 8.60 | $\pm 9.6\%$ |
| 10577 | AAC | IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 12 Mbps, 90pc dc) | WLAN | 8.70 | $\pm 9.6\%$ |
| 10578 | AAD | IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 18 Mbps, 90pc dc) | WLAN | 8.49 | $\pm 9.6\%$ |
| 10579 | AAD | IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 24 Mbps, 90pc dc) | WLAN | 8.36 | $\pm 9.6\%$ |
| 10580 | AAD | IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 36 Mbps, 90pc dc) | WLAN | 8.76 | $\pm 9.6\%$ |
| 10581 | AAD | IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 48 Mbps, 90pc dc) | WLAN | 8.35 | $\pm 9.6\%$ |
| 10582 | AAD | IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 54 Mbps, 90pc dc) | WLAN | 8.67 | $\pm 9.6\%$ |
| 10583 | AAD | IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps, 90pc dc)       | WLAN | 8.59 | $\pm 9.6\%$ |
| 10584 | AAD | IEEE 802.11a/h WiFi 5 GHz (OFDM, 9 Mbps, 90pc dc)       | WLAN | 8.60 | $\pm 9.6\%$ |
| 10585 | AAD | IEEE 802.11a/h WiFi 5 GHz (OFDM, 12 Mbps, 90pc dc)      | WLAN | 8.70 | $\pm 9.6\%$ |
| 10586 | AAD | IEEE 802.11a/h WiFi 5 GHz (OFDM, 18 Mbps, 90pc dc)      | WLAN | 8.49 | $\pm 9.6\%$ |
| 10587 | AAA | IEEE 802.11a/h WiFi 5 GHz (OFDM, 24 Mbps, 90pc dc)      | WLAN | 8.36 | $\pm 9.6\%$ |
| 10588 | AAA | IEEE 802.11a/h WiFi 5 GHz (OFDM, 36 Mbps, 90pc dc)      | WLAN | 8.76 | $\pm 9.6\%$ |
| 10589 | AAA | IEEE 802.11a/h WiFi 5 GHz (OFDM, 48 Mbps, 90pc dc)      | WLAN | 8.35 | $\pm 9.6\%$ |
| 10590 | AAA | IEEE 802.11a/h WiFi 5 GHz (OFDM, 54 Mbps, 90pc dc)      | WLAN | 8.67 | $\pm 9.6\%$ |
| 10591 | AAA | IEEE 802.11n (HT Mixed, 20MHz, MCS0, 90pc dc)           | WLAN | 8.63 | $\pm 9.6\%$ |
| 10592 | AAA | IEEE 802.11n (HT Mixed, 20MHz, MCS1, 90pc dc)           | WLAN | 8.79 | $\pm 9.6\%$ |
| 10593 | AAA | IEEE 802.11n (HT Mixed, 20MHz, MCS2, 90pc dc)           | WLAN | 8.64 | $\pm 9.6\%$ |
| 10594 | AAA | IEEE 802.11n (HT Mixed, 20MHz, MCS3, 90pc dc)           | WLAN | 8.74 | $\pm 9.6\%$ |
| 10595 | AAA | IEEE 802.11n (HT Mixed, 20MHz, MCS4, 90pc dc)           | WLAN | 8.74 | $\pm 9.6\%$ |
| 10596 | AAA | IEEE 802.11n (HT Mixed, 20MHz, MCS5, 90pc dc)           | WLAN | 8.71 | $\pm 9.6\%$ |
| 10597 | AAA | IEEE 802.11n (HT Mixed, 20MHz, MCS6, 90pc dc)           | WLAN | 8.72 | $\pm 9.6\%$ |
| 10598 | AAA | IEEE 802.11n (HT Mixed, 20MHz, MCS7, 90pc dc)           | WLAN | 8.50 | $\pm 9.6\%$ |
| 10599 | AAA | IEEE 802.11n (HT Mixed, 40MHz, MCS0, 90pc dc)           | WLAN | 8.79 | $\pm 9.6\%$ |
| 10600 | AAA | IEEE 802.11n (HT Mixed, 40MHz, MCS1, 90pc dc)           | WLAN | 8.88 | $\pm 9.6\%$ |
| 10601 | AAA | IEEE 802.11n (HT Mixed, 40MHz, MCS2, 90pc dc)           | WLAN | 8.82 | $\pm 9.6\%$ |
| 10602 | AAA | IEEE 802.11n (HT Mixed, 40MHz, MCS3, 90pc dc)           | WLAN | 8.94 | $\pm 9.6\%$ |
| 10603 | AAA | IEEE 802.11n (HT Mixed, 40MHz, MCS4, 90pc dc)           | WLAN | 9.03 | $\pm 9.6\%$ |



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|       |     |   |           |       |             |
|-------|-----|---|-----------|-------|-------------|
| 10604 | AAA | IEEE 802.11n (HT Mixed, 40MHz, MCS5, 90pc dc)     | WLAN      | 8.76  | $\pm 9.6\%$ |
| 10605 | AAA | IEEE 802.11n (HT Mixed, 40MHz, MCS6, 90pc dc)     | WLAN      | 8.97  | $\pm 9.6\%$ |
| 10606 | AAC | IEEE 802.11n (HT Mixed, 40MHz, MCS7, 90pc dc)     | WLAN      | 8.82  | $\pm 9.6\%$ |
| 10607 | AAC | IEEE 802.11ac WiFi (20MHz, MCS0, 90pc dc)         | WLAN      | 8.64  | $\pm 9.6\%$ |
| 10608 | AAC | IEEE 802.11ac WiFi (20MHz, MCS1, 90pc dc)         | WLAN      | 8.77  | $\pm 9.6\%$ |
| 10609 | AAC | IEEE 802.11ac WiFi (20MHz, MCS2, 90pc dc)         | WLAN      | 8.57  | $\pm 9.6\%$ |
| 10610 | AAC | IEEE 802.11ac WiFi (20MHz, MCS3, 90pc dc)         | WLAN      | 8.78  | $\pm 9.6\%$ |
| 10611 | AAC | IEEE 802.11ac WiFi (20MHz, MCS4, 90pc dc)         | WLAN      | 8.70  | $\pm 9.6\%$ |
| 10612 | AAC | IEEE 802.11ac WiFi (20MHz, MCS5, 90pc dc)         | WLAN      | 8.77  | $\pm 9.6\%$ |
| 10613 | AAC | IEEE 802.11ac WiFi (20MHz, MCS6, 90pc dc)         | WLAN      | 8.94  | $\pm 9.6\%$ |
| 10614 | AAC | IEEE 802.11ac WiFi (20MHz, MCS7, 90pc dc)         | WLAN      | 8.59  | $\pm 9.6\%$ |
| 10615 | AAC | IEEE 802.11ac WiFi (20MHz, MCS8, 90pc dc)         | WLAN      | 8.82  | $\pm 9.6\%$ |
| 10616 | AAC | IEEE 802.11ac WiFi (40MHz, MCS0, 90pc dc)         | WLAN      | 8.82  | $\pm 9.6\%$ |
| 10617 | AAC | IEEE 802.11ac WiFi (40MHz, MCS1, 90pc dc)         | WLAN      | 8.81  | $\pm 9.6\%$ |
| 10618 | AAC | IEEE 802.11ac WiFi (40MHz, MCS2, 90pc dc)         | WLAN      | 8.58  | $\pm 9.6\%$ |
| 10619 | AAC | IEEE 802.11ac WiFi (40MHz, MCS3, 90pc dc)         | WLAN      | 8.86  | $\pm 9.6\%$ |
| 10620 | AAC | IEEE 802.11ac WiFi (40MHz, MCS4, 90pc dc)         | WLAN      | 8.87  | $\pm 9.6\%$ |
| 10621 | AAC | IEEE 802.11ac WiFi (40MHz, MCS5, 90pc dc)         | WLAN      | 8.77  | $\pm 9.6\%$ |
| 10622 | AAC | IEEE 802.11ac WiFi (40MHz, MCS6, 90pc dc)         | WLAN      | 8.68  | $\pm 9.6\%$ |
| 10623 | AAC | IEEE 802.11ac WiFi (40MHz, MCS7, 90pc dc)         | WLAN      | 8.82  | $\pm 9.6\%$ |
| 10624 | AAC | IEEE 802.11ac WiFi (40MHz, MCS8, 90pc dc)         | WLAN      | 8.96  | $\pm 9.6\%$ |
| 10625 | AAC | IEEE 802.11ac WiFi (40MHz, MCS9, 90pc dc)         | WLAN      | 8.96  | $\pm 9.6\%$ |
| 10626 | AAC | IEEE 802.11ac WiFi (80MHz, MCS0, 90pc dc)         | WLAN      | 8.83  | $\pm 9.6\%$ |
| 10627 | AAC | IEEE 802.11ac WiFi (80MHz, MCS1, 90pc dc)         | WLAN      | 8.88  | $\pm 9.6\%$ |
| 10628 | AAC | IEEE 802.11ac WiFi (80MHz, MCS2, 90pc dc)         | WLAN      | 8.71  | $\pm 9.6\%$ |
| 10629 | AAC | IEEE 802.11ac WiFi (80MHz, MCS3, 90pc dc)         | WLAN      | 8.65  | $\pm 9.6\%$ |
| 10630 | AAC | IEEE 802.11ac WiFi (80MHz, MCS4, 90pc dc)         | WLAN      | 8.72  | $\pm 9.6\%$ |
| 10631 | AAC | IEEE 802.11ac WiFi (80MHz, MCS5, 90pc dc)         | WLAN      | 8.81  | $\pm 9.6\%$ |
| 10632 | AAC | IEEE 802.11ac WiFi (80MHz, MCS6, 90pc dc)         | WLAN      | 8.74  | $\pm 9.6\%$ |
| 10633 | AAC | IEEE 802.11ac WiFi (80MHz, MCS7, 90pc dc)         | WLAN      | 8.83  | $\pm 9.6\%$ |
| 10634 | AAC | IEEE 802.11ac WiFi (80MHz, MCS8, 90pc dc)         | WLAN      | 8.80  | $\pm 9.6\%$ |
| 10635 | AAC | IEEE 802.11ac WiFi (80MHz, MCS9, 90pc dc)         | WLAN      | 8.81  | $\pm 9.6\%$ |
| 10636 | AAC | IEEE 802.11ac WiFi (160MHz, MCS0, 90pc dc)        | WLAN      | 8.83  | $\pm 9.6\%$ |
| 10637 | AAC | IEEE 802.11ac WiFi (160MHz, MCS1, 90pc dc)        | WLAN      | 8.79  | $\pm 9.6\%$ |
| 10638 | AAC | IEEE 802.11ac WiFi (160MHz, MCS2, 90pc dc)        | WLAN      | 8.86  | $\pm 9.6\%$ |
| 10639 | AAC | IEEE 802.11ac WiFi (160MHz, MCS3, 90pc dc)        | WLAN      | 8.85  | $\pm 9.6\%$ |
| 10640 | AAC | IEEE 802.11ac WiFi (160MHz, MCS4, 90pc dc)        | WLAN      | 8.98  | $\pm 9.6\%$ |
| 10641 | AAC | IEEE 802.11ac WiFi (160MHz, MCS5, 90pc dc)        | WLAN      | 9.06  | $\pm 9.6\%$ |
| 10642 | AAC | IEEE 802.11ac WiFi (160MHz, MCS6, 90pc dc)        | WLAN      | 9.06  | $\pm 9.6\%$ |
| 10643 | AAC | IEEE 802.11ac WiFi (160MHz, MCS7, 90pc dc)        | WLAN      | 8.89  | $\pm 9.6\%$ |
| 10644 | AAC | IEEE 802.11ac WiFi (160MHz, MCS8, 90pc dc)        | WLAN      | 9.05  | $\pm 9.6\%$ |
| 10645 | AAC | IEEE 802.11ac WiFi (160MHz, MCS9, 90pc dc)        | WLAN      | 9.11  | $\pm 9.6\%$ |
| 10646 | AAC | LTE-TDD (SC-FDMA, 1 RB, 5 MHz, QPSK, UL Sub=2,7)  | LTE-TDD   | 11.96 | $\pm 9.6\%$ |
| 10647 | AAC | LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK, UL Sub=2,7) | LTE-TDD   | 11.96 | $\pm 9.6\%$ |
| 10648 | AAC | CDMA2000 (1x Advanced)                            | CDMA2000  | 3.45  | $\pm 9.6\%$ |
| 10652 | AAC | LTE-TDD (OFDMA, 5 MHz, E-TM 3.1, Clipping 44%)    | LTE-TDD   | 6.91  | $\pm 9.6\%$ |
| 10653 | AAC | LTE-TDD (OFDMA, 10 MHz, E-TM 3.1, Clipping 44%)   | LTE-TDD   | 7.42  | $\pm 9.6\%$ |
| 10654 | AAC | LTE-TDD (OFDMA, 15 MHz, E-TM 3.1, Clipping 44%)   | LTE-TDD   | 6.96  | $\pm 9.6\%$ |
| 10655 | AAC | LTE-TDD (OFDMA, 20 MHz, E-TM 3.1, Clipping 44%)   | LTE-TDD   | 7.21  | $\pm 9.6\%$ |
| 10658 | AAC | Pulse Waveform (200Hz, 10%)                       | Test      | 10.00 | $\pm 9.6\%$ |
| 10659 | AAC | Pulse Waveform (200Hz, 20%)                       | Test      | 6.99  | $\pm 9.6\%$ |
| 10660 | AAC | Pulse Waveform (200Hz, 40%)                       | Test      | 3.98  | $\pm 9.6\%$ |
| 10661 | AAC | Pulse Waveform (200Hz, 60%)                       | Test      | 2.22  | $\pm 9.6\%$ |
| 10662 | AAC | Pulse Waveform (200Hz, 80%)                       | Test      | 0.97  | $\pm 9.6\%$ |
| 10670 | AAC | Bluetooth Low Energy                              | Bluetooth | 2.19  | $\pm 9.6\%$ |
| 10671 | AAD | IEEE 802.11ax (20MHz, MCS0, 90pc dc)              | WLAN      | 9.09  | $\pm 9.6\%$ |

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|-------|-----|---------------------------------------|------|------|-------------|
| 10672 | AAD | IEEE 802.11ax (20MHz, MCS1, 90pc dc)  | WLAN | 8.57 | $\pm 9.6\%$ |
| 10673 | AAD | IEEE 802.11ax (20MHz, MCS2, 90pc dc)  | WLAN | 8.78 | $\pm 9.6\%$ |
| 10674 | AAD | IEEE 802.11ax (20MHz, MCS3, 90pc dc)  | WLAN | 8.74 | $\pm 9.6\%$ |
| 10675 | AAD | IEEE 802.11ax (20MHz, MCS4, 90pc dc)  | WLAN | 8.90 | $\pm 9.6\%$ |
| 10676 | AAD | IEEE 802.11ax (20MHz, MCS5, 90pc dc)  | WLAN | 8.77 | $\pm 9.6\%$ |
| 10677 | AAD | IEEE 802.11ax (20MHz, MCS6, 90pc dc)  | WLAN | 8.73 | $\pm 9.6\%$ |
| 10678 | AAD | IEEE 802.11ax (20MHz, MCS7, 90pc dc)  | WLAN | 8.78 | $\pm 9.6\%$ |
| 10679 | AAD | IEEE 802.11ax (20MHz, MCS8, 90pc dc)  | WLAN | 8.89 | $\pm 9.6\%$ |
| 10680 | AAD | IEEE 802.11ax (20MHz, MCS9, 90pc dc)  | WLAN | 8.80 | $\pm 9.6\%$ |
| 10681 | AAG | IEEE 802.11ax (20MHz, MCS10, 90pc dc) | WLAN | 8.62 | $\pm 9.6\%$ |
| 10682 | AAF | IEEE 802.11ax (20MHz, MCS11, 90pc dc) | WLAN | 8.83 | $\pm 9.6\%$ |
| 10683 | AAA | IEEE 802.11ax (20MHz, MCS0, 99pc dc)  | WLAN | 8.42 | $\pm 9.6\%$ |
| 10684 | AAC | IEEE 802.11ax (20MHz, MCS1, 99pc dc)  | WLAN | 8.26 | $\pm 9.6\%$ |
| 10685 | AAC | IEEE 802.11ax (20MHz, MCS2, 99pc dc)  | WLAN | 8.33 | $\pm 9.6\%$ |
| 10686 | AAC | IEEE 802.11ax (20MHz, MCS3, 99pc dc)  | WLAN | 8.28 | $\pm 9.6\%$ |
| 10687 | AAE | IEEE 802.11ax (20MHz, MCS4, 99pc dc)  | WLAN | 8.45 | $\pm 9.6\%$ |
| 10688 | AAE | IEEE 802.11ax (20MHz, MCS5, 99pc dc)  | WLAN | 8.29 | $\pm 9.6\%$ |
| 10689 | AAD | IEEE 802.11ax (20MHz, MCS6, 99pc dc)  | WLAN | 8.55 | $\pm 9.6\%$ |
| 10690 | AAE | IEEE 802.11ax (20MHz, MCS7, 99pc dc)  | WLAN | 8.29 | $\pm 9.6\%$ |
| 10691 | AAB | IEEE 802.11ax (20MHz, MCS8, 99pc dc)  | WLAN | 8.25 | $\pm 9.6\%$ |
| 10692 | AAA | IEEE 802.11ax (20MHz, MCS9, 99pc dc)  | WLAN | 8.29 | $\pm 9.6\%$ |
| 10693 | AAA | IEEE 802.11ax (20MHz, MCS10, 99pc dc) | WLAN | 8.25 | $\pm 9.6\%$ |
| 10694 | AAA | IEEE 802.11ax (20MHz, MCS11, 99pc dc) | WLAN | 8.57 | $\pm 9.6\%$ |
| 10695 | AAA | IEEE 802.11ax (40MHz, MCS0, 90pc dc)  | WLAN | 8.78 | $\pm 9.6\%$ |
| 10696 | AAA | IEEE 802.11ax (40MHz, MCS1, 90pc dc)  | WLAN | 8.91 | $\pm 9.6\%$ |
| 10697 | AAA | IEEE 802.11ax (40MHz, MCS2, 90pc dc)  | WLAN | 8.61 | $\pm 9.6\%$ |
| 10698 | AAA | IEEE 802.11ax (40MHz, MCS3, 90pc dc)  | WLAN | 8.89 | $\pm 9.6\%$ |
| 10699 | AAA | IEEE 802.11ax (40MHz, MCS4, 90pc dc)  | WLAN | 8.82 | $\pm 9.6\%$ |
| 10700 | AAA | IEEE 802.11ax (40MHz, MCS5, 90pc dc)  | WLAN | 8.73 | $\pm 9.6\%$ |
| 10701 | AAA | IEEE 802.11ax (40MHz, MCS6, 90pc dc)  | WLAN | 8.86 | $\pm 9.6\%$ |
| 10702 | AAA | IEEE 802.11ax (40MHz, MCS7, 90pc dc)  | WLAN | 8.70 | $\pm 9.6\%$ |
| 10703 | AAA | IEEE 802.11ax (40MHz, MCS8, 90pc dc)  | WLAN | 8.82 | $\pm 9.6\%$ |
| 10704 | AAA | IEEE 802.11ax (40MHz, MCS9, 90pc dc)  | WLAN | 8.56 | $\pm 9.6\%$ |
| 10705 | AAA | IEEE 802.11ax (40MHz, MCS10, 90pc dc) | WLAN | 8.69 | $\pm 9.6\%$ |
| 10706 | AAC | IEEE 802.11ax (40MHz, MCS11, 90pc dc) | WLAN | 8.66 | $\pm 9.6\%$ |
| 10707 | AAC | IEEE 802.11ax (40MHz, MCS0, 99pc dc)  | WLAN | 8.32 | $\pm 9.6\%$ |
| 10708 | AAC | IEEE 802.11ax (40MHz, MCS1, 99pc dc)  | WLAN | 8.55 | $\pm 9.6\%$ |
| 10709 | AAC | IEEE 802.11ax (40MHz, MCS2, 99pc dc)  | WLAN | 8.33 | $\pm 9.6\%$ |
| 10710 | AAC | IEEE 802.11ax (40MHz, MCS3, 99pc dc)  | WLAN | 8.29 | $\pm 9.6\%$ |
| 10711 | AAC | IEEE 802.11ax (40MHz, MCS4, 99pc dc)  | WLAN | 8.39 | $\pm 9.6\%$ |
| 10712 | AAC | IEEE 802.11ax (40MHz, MCS5, 99pc dc)  | WLAN | 8.67 | $\pm 9.6\%$ |
| 10713 | AAC | IEEE 802.11ax (40MHz, MCS6, 99pc dc)  | WLAN | 8.33 | $\pm 9.6\%$ |
| 10714 | AAC | IEEE 802.11ax (40MHz, MCS7, 99pc dc)  | WLAN | 8.26 | $\pm 9.6\%$ |
| 10715 | AAC | IEEE 802.11ax (40MHz, MCS8, 99pc dc)  | WLAN | 8.45 | $\pm 9.6\%$ |
| 10716 | AAC | IEEE 802.11ax (40MHz, MCS9, 99pc dc)  | WLAN | 8.30 | $\pm 9.6\%$ |
| 10717 | AAC | IEEE 802.11ax (40MHz, MCS10, 99pc dc) | WLAN | 8.48 | $\pm 9.6\%$ |
| 10718 | AAC | IEEE 802.11ax (40MHz, MCS11, 99pc dc) | WLAN | 8.24 | $\pm 9.6\%$ |
| 10719 | AAC | IEEE 802.11ax (80MHz, MCS0, 90pc dc)  | WLAN | 8.81 | $\pm 9.6\%$ |
| 10720 | AAC | IEEE 802.11ax (80MHz, MCS1, 90pc dc)  | WLAN | 8.87 | $\pm 9.6\%$ |
| 10721 | AAC | IEEE 802.11ax (80MHz, MCS2, 90pc dc)  | WLAN | 8.76 | $\pm 9.6\%$ |
| 10722 | AAC | IEEE 802.11ax (80MHz, MCS3, 90pc dc)  | WLAN | 8.55 | $\pm 9.6\%$ |
| 10723 | AAC | IEEE 802.11ax (80MHz, MCS4, 90pc dc)  | WLAN | 8.70 | $\pm 9.6\%$ |
| 10724 | AAC | IEEE 802.11ax (80MHz, MCS5, 90pc dc)  | WLAN | 8.90 | $\pm 9.6\%$ |
| 10725 | AAC | IEEE 802.11ax (80MHz, MCS6, 90pc dc)  | WLAN | 8.74 | $\pm 9.6\%$ |
| 10726 | AAC | IEEE 802.11ax (80MHz, MCS7, 90pc dc)  | WLAN | 8.72 | $\pm 9.6\%$ |
| 10727 | AAC | IEEE 802.11ax (80MHz, MCS8, 90pc dc)  | WLAN | 8.66 | $\pm 9.6\%$ |



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|-------|-----|---|---------------|------|-------------|
| 10728 | AAC | IEEE 802.11ax (80MHz, MCS9, 90pc dc)          | WLAN          | 8.65 | $\pm 9.6\%$ |
| 10729 | AAC | IEEE 802.11ax (80MHz, MCS10, 90pc dc)         | WLAN          | 8.64 | $\pm 9.6\%$ |
| 10730 | AAC | IEEE 802.11ax (80MHz, MCS11, 90pc dc)         | WLAN          | 8.67 | $\pm 9.6\%$ |
| 10731 | AAC | IEEE 802.11ax (80MHz, MCS0, 99pc dc)          | WLAN          | 8.42 | $\pm 9.6\%$ |
| 10732 | AAC | IEEE 802.11ax (80MHz, MCS1, 99pc dc)          | WLAN          | 8.46 | $\pm 9.6\%$ |
| 10733 | AAC | IEEE 802.11ax (80MHz, MCS2, 99pc dc)          | WLAN          | 8.40 | $\pm 9.6\%$ |
| 10734 | AAC | IEEE 802.11ax (80MHz, MCS3, 99pc dc)          | WLAN          | 8.25 | $\pm 9.6\%$ |
| 10735 | AAC | IEEE 802.11ax (80MHz, MCS4, 99pc dc)          | WLAN          | 8.33 | $\pm 9.6\%$ |
| 10736 | AAC | IEEE 802.11ax (80MHz, MCS5, 99pc dc)          | WLAN          | 8.27 | $\pm 9.6\%$ |
| 10737 | AAC | IEEE 802.11ax (80MHz, MCS6, 99pc dc)          | WLAN          | 8.36 | $\pm 9.6\%$ |
| 10738 | AAC | IEEE 802.11ax (80MHz, MCS7, 99pc dc)          | WLAN          | 8.42 | $\pm 9.6\%$ |
| 10739 | AAC | IEEE 802.11ax (80MHz, MCS8, 99pc dc)          | WLAN          | 8.29 | $\pm 9.6\%$ |
| 10740 | AAC | IEEE 802.11ax (80MHz, MCS9, 99pc dc)          | WLAN          | 8.48 | $\pm 9.6\%$ |
| 10741 | AAC | IEEE 802.11ax (80MHz, MCS10, 99pc dc)         | WLAN          | 8.40 | $\pm 9.6\%$ |
| 10742 | AAC | IEEE 802.11ax (80MHz, MCS11, 99pc dc)         | WLAN          | 8.43 | $\pm 9.6\%$ |
| 10743 | AAC | IEEE 802.11ax (160MHz, MCS0, 90pc dc)         | WLAN          | 8.94 | $\pm 9.6\%$ |
| 10744 | AAC | IEEE 802.11ax (160MHz, MCS1, 90pc dc)         | WLAN          | 9.16 | $\pm 9.6\%$ |
| 10745 | AAC | IEEE 802.11ax (160MHz, MCS2, 90pc dc)         | WLAN          | 8.93 | $\pm 9.6\%$ |
| 10746 | AAC | IEEE 802.11ax (160MHz, MCS3, 90pc dc)         | WLAN          | 9.11 | $\pm 9.6\%$ |
| 10747 | AAC | IEEE 802.11ax (160MHz, MCS4, 90pc dc)         | WLAN          | 9.04 | $\pm 9.6\%$ |
| 10748 | AAC | IEEE 802.11ax (160MHz, MCS5, 90pc dc)         | WLAN          | 8.93 | $\pm 9.6\%$ |
| 10749 | AAC | IEEE 802.11ax (160MHz, MCS6, 90pc dc)         | WLAN          | 8.90 | $\pm 9.6\%$ |
| 10750 | AAC | IEEE 802.11ax (160MHz, MCS7, 90pc dc)         | WLAN          | 8.79 | $\pm 9.6\%$ |
| 10751 | AAC | IEEE 802.11ax (160MHz, MCS8, 90pc dc)         | WLAN          | 8.82 | $\pm 9.6\%$ |
| 10752 | AAC | IEEE 802.11ax (160MHz, MCS9, 90pc dc)         | WLAN          | 8.81 | $\pm 9.6\%$ |
| 10753 | AAC | IEEE 802.11ax (160MHz, MCS10, 90pc dc)        | WLAN          | 9.00 | $\pm 9.6\%$ |
| 10754 | AAC | IEEE 802.11ax (160MHz, MCS11, 90pc dc)        | WLAN          | 8.94 | $\pm 9.6\%$ |
| 10755 | AAC | IEEE 802.11ax (160MHz, MCS0, 99pc dc)         | WLAN          | 8.64 | $\pm 9.6\%$ |
| 10756 | AAC | IEEE 802.11ax (160MHz, MCS1, 99pc dc)         | WLAN          | 8.77 | $\pm 9.6\%$ |
| 10757 | AAC | IEEE 802.11ax (160MHz, MCS2, 99pc dc)         | WLAN          | 8.77 | $\pm 9.6\%$ |
| 10758 | AAC | IEEE 802.11ax (160MHz, MCS3, 99pc dc)         | WLAN          | 8.69 | $\pm 9.6\%$ |
| 10759 | AAC | IEEE 802.11ax (160MHz, MCS4, 99pc dc)         | WLAN          | 8.58 | $\pm 9.6\%$ |
| 10760 | AAC | IEEE 802.11ax (160MHz, MCS5, 99pc dc)         | WLAN          | 8.49 | $\pm 9.6\%$ |
| 10761 | AAC | IEEE 802.11ax (160MHz, MCS6, 99pc dc)         | WLAN          | 8.58 | $\pm 9.6\%$ |
| 10762 | AAC | IEEE 802.11ax (160MHz, MCS7, 99pc dc)         | WLAN          | 8.49 | $\pm 9.6\%$ |
| 10763 | AAC | IEEE 802.11ax (160MHz, MCS8, 99pc dc)         | WLAN          | 8.53 | $\pm 9.6\%$ |
| 10764 | AAC | IEEE 802.11ax (160MHz, MCS9, 99pc dc)         | WLAN          | 8.54 | $\pm 9.6\%$ |
| 10765 | AAC | IEEE 802.11ax (160MHz, MCS10, 99pc dc)        | WLAN          | 8.54 | $\pm 9.6\%$ |
| 10766 | AAC | IEEE 802.11ax (160MHz, MCS11, 99pc dc)        | WLAN          | 8.51 | $\pm 9.6\%$ |
| 10767 | AAC | 5G NR (CP-OFDM, 1 RB, 5 MHz, QPSK, 15 kHz)    | 5G NR FR1 TDD | 7.99 | $\pm 9.6\%$ |
| 10768 | AAC | 5G NR (CP-OFDM, 1 RB, 10 MHz, QPSK, 15 kHz)   | 5G NR FR1 TDD | 8.01 | $\pm 9.6\%$ |
| 10769 | AAC | 5G NR (CP-OFDM, 1 RB, 15 MHz, QPSK, 15 kHz)   | 5G NR FR1 TDD | 8.01 | $\pm 9.6\%$ |
| 10770 | AAC | 5G NR (CP-OFDM, 1 RB, 20 MHz, QPSK, 15 kHz)   | 5G NR FR1 TDD | 8.02 | $\pm 9.6\%$ |
| 10771 | AAC | 5G NR (CP-OFDM, 1 RB, 25 MHz, QPSK, 15 kHz)   | 5G NR FR1 TDD | 8.02 | $\pm 9.6\%$ |
| 10772 | AAC | 5G NR (CP-OFDM, 1 RB, 30 MHz, QPSK, 15 kHz)   | 5G NR FR1 TDD | 8.23 | $\pm 9.6\%$ |
| 10773 | AAC | 5G NR (CP-OFDM, 1 RB, 40 MHz, QPSK, 15 kHz)   | 5G NR FR1 TDD | 8.03 | $\pm 9.6\%$ |
| 10774 | AAC | 5G NR (CP-OFDM, 1 RB, 50 MHz, QPSK, 15 kHz)   | 5G NR FR1 TDD | 8.02 | $\pm 9.6\%$ |
| 10775 | AAC | 5G NR (CP-OFDM, 50% RB, 5 MHz, QPSK, 15 kHz)  | 5G NR FR1 TDD | 8.31 | $\pm 9.6\%$ |
| 10776 | AAC | 5G NR (CP-OFDM, 50% RB, 10 MHz, QPSK, 15 kHz) | 5G NR FR1 TDD | 8.30 | $\pm 9.6\%$ |
| 10777 | AAC | 5G NR (CP-OFDM, 50% RB, 15 MHz, QPSK, 15 kHz) | 5G NR FR1 TDD | 8.30 | $\pm 9.6\%$ |
| 10778 | AAC | 5G NR (CP-OFDM, 50% RB, 20 MHz, QPSK, 15 kHz) | 5G NR FR1 TDD | 8.34 | $\pm 9.6\%$ |
| 10779 | AAC | 5G NR (CP-OFDM, 50% RB, 25 MHz, QPSK, 15 kHz) | 5G NR FR1 TDD | 8.42 | $\pm 9.6\%$ |
| 10780 | AAC | 5G NR (CP-OFDM, 50% RB, 30 MHz, QPSK, 15 kHz) | 5G NR FR1 TDD | 8.38 | $\pm 9.6\%$ |
| 10781 | AAC | 5G NR (CP-OFDM, 50% RB, 40 MHz, QPSK, 15 kHz) | 5G NR FR1 TDD | 8.38 | $\pm 9.6\%$ |
| 10782 | AAC | 5G NR (CP-OFDM, 50% RB, 50 MHz, QPSK, 15 kHz) | 5G NR FR1 TDD | 8.43 | $\pm 9.6\%$ |
| 10783 | AAC | 5G NR (CP-OFDM, 100% RB, 5 MHz, QPSK, 15 kHz) | 5G NR FR1 TDD | 8.31 | $\pm 9.6\%$ |

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| 10784 | AAC | 5G NR (CP-OFDM, 100% RB, 10 MHz, QPSK, 15 kHz)  | 5G NR FR1 TDD | 8.29 | $\pm 9.6 \%$ |
| 10785 | AAC | 5G NR (CP-OFDM, 100% RB, 15 MHz, QPSK, 15 kHz)  | 5G NR FR1 TDD | 8.40 | $\pm 9.6 \%$ |
| 10786 | AAC | 5G NR (CP-OFDM, 100% RB, 20 MHz, QPSK, 15 kHz)  | 5G NR FR1 TDD | 8.35 | $\pm 9.6 \%$ |
| 10787 | AAC | 5G NR (CP-OFDM, 100% RB, 25 MHz, QPSK, 15 kHz)  | 5G NR FR1 TDD | 8.44 | $\pm 9.6 \%$ |
| 10788 | AAC | 5G NR (CP-OFDM, 100% RB, 30 MHz, QPSK, 15 kHz)  | 5G NR FR1 TDD | 8.39 | $\pm 9.6 \%$ |
| 10789 | AAC | 5G NR (CP-OFDM, 100% RB, 40 MHz, QPSK, 15 kHz)  | 5G NR FR1 TDD | 8.37 | $\pm 9.6 \%$ |
| 10790 | AAC | 5G NR (CP-OFDM, 100% RB, 50 MHz, QPSK, 15 kHz)  | 5G NR FR1 TDD | 8.39 | $\pm 9.6 \%$ |
| 10791 | AAC | 5G NR (CP-OFDM, 1 RB, 5 MHz, QPSK, 30 kHz)      | 5G NR FR1 TDD | 7.83 | $\pm 9.6 \%$ |
| 10792 | AAC | 5G NR (CP-OFDM, 1 RB, 10 MHz, QPSK, 30 kHz)     | 5G NR FR1 TDD | 7.92 | $\pm 9.6 \%$ |
| 10793 | AAC | 5G NR (CP-OFDM, 1 RB, 15 MHz, QPSK, 30 kHz)     | 5G NR FR1 TDD | 7.95 | $\pm 9.6 \%$ |
| 10794 | AAC | 5G NR (CP-OFDM, 1 RB, 20 MHz, QPSK, 30 kHz)     | 5G NR FR1 TDD | 7.82 | $\pm 9.6 \%$ |
| 10795 | AAC | 5G NR (CP-OFDM, 1 RB, 25 MHz, QPSK, 30 kHz)     | 5G NR FR1 TDD | 7.84 | $\pm 9.6 \%$ |
| 10796 | AAC | 5G NR (CP-OFDM, 1 RB, 30 MHz, QPSK, 30 kHz)     | 5G NR FR1 TDD | 7.82 | $\pm 9.6 \%$ |
| 10797 | AAC | 5G NR (CP-OFDM, 1 RB, 40 MHz, QPSK, 30 kHz)     | 5G NR FR1 TDD | 8.01 | $\pm 9.6 \%$ |
| 10798 | AAC | 5G NR (CP-OFDM, 1 RB, 50 MHz, QPSK, 30 kHz)     | 5G NR FR1 TDD | 7.89 | $\pm 9.6 \%$ |
| 10799 | AAC | 5G NR (CP-OFDM, 1 RB, 60 MHz, QPSK, 30 kHz)     | 5G NR FR1 TDD | 7.93 | $\pm 9.6 \%$ |
| 10801 | AAC | 5G NR (CP-OFDM, 1 RB, 80 MHz, QPSK, 30 kHz)     | 5G NR FR1 TDD | 7.89 | $\pm 9.6 \%$ |
| 10802 | AAC | 5G NR (CP-OFDM, 1 RB, 90 MHz, QPSK, 30 kHz)     | 5G NR FR1 TDD | 7.87 | $\pm 9.6 \%$ |
| 10803 | AAE | 5G NR (CP-OFDM, 1 RB, 100 MHz, QPSK, 30 kHz)    | 5G NR FR1 TDD | 7.93 | $\pm 9.6 \%$ |
| 10805 | AAD | 5G NR (CP-OFDM, 50% RB, 10 MHz, QPSK, 30 kHz)   | 5G NR FR1 TDD | 8.34 | $\pm 9.6 \%$ |
| 10806 | AAD | 5G NR (CP-OFDM, 50% RB, 15 MHz, QPSK, 30 kHz)   | 5G NR FR1 TDD | 8.37 | $\pm 9.6 \%$ |
| 10809 | AAD | 5G NR (CP-OFDM, 50% RB, 30 MHz, QPSK, 30 kHz)   | 5G NR FR1 TDD | 8.34 | $\pm 9.6 \%$ |
| 10810 | AAD | 5G NR (CP-OFDM, 50% RB, 40 MHz, QPSK, 30 kHz)   | 5G NR FR1 TDD | 8.34 | $\pm 9.6 \%$ |
| 10812 | AAD | 5G NR (CP-OFDM, 50% RB, 50 MHz, QPSK, 30 kHz)   | 5G NR FR1 TDD | 8.35 | $\pm 9.6 \%$ |
| 10817 | AAD | 5G NR (CP-OFDM, 100% RB, 5 MHz, QPSK, 30 kHz)   | 5G NR FR1 TDD | 8.35 | $\pm 9.6 \%$ |
| 10818 | AAD | 5G NR (CP-OFDM, 100% RB, 10 MHz, QPSK, 30 kHz)  | 5G NR FR1 TDD | 8.34 | $\pm 9.6 \%$ |
| 10819 | AAD | 5G NR (CP-OFDM, 100% RB, 15 MHz, QPSK, 30 kHz)  | 5G NR FR1 TDD | 8.33 | $\pm 9.6 \%$ |
| 10820 | AAD | 5G NR (CP-OFDM, 100% RB, 20 MHz, QPSK, 30 kHz)  | 5G NR FR1 TDD | 8.30 | $\pm 9.6 \%$ |
| 10821 | AAC | 5G NR (CP-OFDM, 100% RB, 25 MHz, QPSK, 30 kHz)  | 5G NR FR1 TDD | 8.41 | $\pm 9.6 \%$ |
| 10822 | AAD | 5G NR (CP-OFDM, 100% RB, 30 MHz, QPSK, 30 kHz)  | 5G NR FR1 TDD | 8.41 | $\pm 9.6 \%$ |
| 10823 | AAC | 5G NR (CP-OFDM, 100% RB, 40 MHz, QPSK, 30 kHz)  | 5G NR FR1 TDD | 8.36 | $\pm 9.6 \%$ |
| 10824 | AAD | 5G NR (CP-OFDM, 100% RB, 50 MHz, QPSK, 30 kHz)  | 5G NR FR1 TDD | 8.39 | $\pm 9.6 \%$ |
| 10825 | AAD | 5G NR (CP-OFDM, 100% RB, 60 MHz, QPSK, 30 kHz)  | 5G NR FR1 TDD | 8.41 | $\pm 9.6 \%$ |
| 10827 | AAD | 5G NR (CP-OFDM, 100% RB, 80 MHz, QPSK, 30 kHz)  | 5G NR FR1 TDD | 8.42 | $\pm 9.6 \%$ |
| 10828 | AAE | 5G NR (CP-OFDM, 100% RB, 90 MHz, QPSK, 30 kHz)  | 5G NR FR1 TDD | 8.43 | $\pm 9.6 \%$ |
| 10829 | AAD | 5G NR (CP-OFDM, 100% RB, 100 MHz, QPSK, 30 kHz) | 5G NR FR1 TDD | 8.40 | $\pm 9.6 \%$ |
| 10830 | AAD | 5G NR (CP-OFDM, 1 RB, 10 MHz, QPSK, 60 kHz)     | 5G NR FR1 TDD | 7.63 | $\pm 9.6 \%$ |
| 10831 | AAD | 5G NR (CP-OFDM, 1 RB, 15 MHz, QPSK, 60 kHz)     | 5G NR FR1 TDD | 7.73 | $\pm 9.6 \%$ |
| 10832 | AAD | 5G NR (CP-OFDM, 1 RB, 20 MHz, QPSK, 60 kHz)     | 5G NR FR1 TDD | 7.74 | $\pm 9.6 \%$ |
| 10833 | AAD | 5G NR (CP-OFDM, 1 RB, 25 MHz, QPSK, 60 kHz)     | 5G NR FR1 TDD | 7.70 | $\pm 9.6 \%$ |
| 10834 | AAD | 5G NR (CP-OFDM, 1 RB, 30 MHz, QPSK, 60 kHz)     | 5G NR FR1 TDD | 7.75 | $\pm 9.6 \%$ |
| 10835 | AAD | 5G NR (CP-OFDM, 1 RB, 40 MHz, QPSK, 60 kHz)     | 5G NR FR1 TDD | 7.70 | $\pm 9.6 \%$ |
| 10836 | AAE | 5G NR (CP-OFDM, 1 RB, 50 MHz, QPSK, 60 kHz)     | 5G NR FR1 TDD | 7.66 | $\pm 9.6 \%$ |
| 10837 | AAD | 5G NR (CP-OFDM, 1 RB, 60 MHz, QPSK, 60 kHz)     | 5G NR FR1 TDD | 7.68 | $\pm 9.6 \%$ |
| 10839 | AAD | 5G NR (CP-OFDM, 1 RB, 80 MHz, QPSK, 60 kHz)     | 5G NR FR1 TDD | 7.70 | $\pm 9.6 \%$ |
| 10840 | AAD | 5G NR (CP-OFDM, 1 RB, 90 MHz, QPSK, 60 kHz)     | 5G NR FR1 TDD | 7.67 | $\pm 9.6 \%$ |
| 10841 | AAD | 5G NR (CP-OFDM, 1 RB, 100 MHz, QPSK, 60 kHz)    | 5G NR FR1 TDD | 7.71 | $\pm 9.6 \%$ |
| 10843 | AAD | 5G NR (CP-OFDM, 50% RB, 15 MHz, QPSK, 60 kHz)   | 5G NR FR1 TDD | 8.49 | $\pm 9.6 \%$ |
| 10844 | AAD | 5G NR (CP-OFDM, 50% RB, 20 MHz, QPSK, 60 kHz)   | 5G NR FR1 TDD | 8.34 | $\pm 9.6 \%$ |
| 10846 | AAD | 5G NR (CP-OFDM, 50% RB, 30 MHz, QPSK, 60 kHz)   | 5G NR FR1 TDD | 8.41 | $\pm 9.6 \%$ |
| 10854 | AAD | 5G NR (CP-OFDM, 100% RB, 10 MHz, QPSK, 60 kHz)  | 5G NR FR1 TDD | 8.34 | $\pm 9.6 \%$ |
| 10855 | AAD | 5G NR (CP-OFDM, 100% RB, 15 MHz, QPSK, 60 kHz)  | 5G NR FR1 TDD | 8.36 | $\pm 9.6 \%$ |
| 10856 | AAD | 5G NR (CP-OFDM, 100% RB, 20 MHz, QPSK, 60 kHz)  | 5G NR FR1 TDD | 8.37 | $\pm 9.6 \%$ |
| 10857 | AAD | 5G NR (CP-OFDM, 100% RB, 25 MHz, QPSK, 60 kHz)  | 5G NR FR1 TDD | 8.35 | $\pm 9.6 \%$ |
| 10858 | AAD | 5G NR (CP-OFDM, 100% RB, 30 MHz, QPSK, 60 kHz)  | 5G NR FR1 TDD | 8.36 | $\pm 9.6 \%$ |
| 10859 | AAD | 5G NR (CP-OFDM, 100% RB, 40 MHz, QPSK, 60 kHz)  | 5G NR FR1 TDD | 8.34 | $\pm 9.6 \%$ |



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| 10860 | AAD | 5G NR (CP-OFDM, 100% RB, 50 MHz, QPSK, 60 kHz)       | 5G NR FR1 TDD | 8.41 | $\pm 9.6\%$ |
| 10861 | AAD | 5G NR (CP-OFDM, 100% RB, 60 MHz, QPSK, 60 kHz)       | 5G NR FR1 TDD | 8.40 | $\pm 9.6\%$ |
| 10863 | AAD | 5G NR (CP-OFDM, 100% RB, 80 MHz, QPSK, 60 kHz)       | 5G NR FR1 TDD | 8.41 | $\pm 9.6\%$ |
| 10864 | AAE | 5G NR (CP-OFDM, 100% RB, 90 MHz, QPSK, 60 kHz)       | 5G NR FR1 TDD | 8.37 | $\pm 9.6\%$ |
| 10865 | AAD | 5G NR (CP-OFDM, 100% RB, 100 MHz, QPSK, 60 kHz)      | 5G NR FR1 TDD | 8.41 | $\pm 9.6\%$ |
| 10866 | AAD | 5G NR (DFT-s-OFDM, 1 RB, 100 MHz, QPSK, 30 kHz)      | 5G NR FR1 TDD | 5.68 | $\pm 9.6\%$ |
| 10868 | AAD | 5G NR (DFT-s-OFDM, 100% RB, 100 MHz, QPSK, 30 kHz)   | 5G NR FR1 TDD | 5.89 | $\pm 9.6\%$ |
| 10869 | AAD | 5G NR (DFT-s-OFDM, 1 RB, 100 MHz, QPSK, 120 kHz)     | 5G NR FR2 TDD | 5.75 | $\pm 9.6\%$ |
| 10870 | AAD | 5G NR (DFT-s-OFDM, 100% RB, 100 MHz, QPSK, 120 kHz)  | 5G NR FR2 TDD | 5.86 | $\pm 9.6\%$ |
| 10871 | AAD | 5G NR (DFT-s-OFDM, 1 RB, 100 MHz, 16QAM, 120 kHz)    | 5G NR FR2 TDD | 5.75 | $\pm 9.6\%$ |
| 10872 | AAD | 5G NR (DFT-s-OFDM, 100% RB, 100 MHz, 16QAM, 120 kHz) | 5G NR FR2 TDD | 6.52 | $\pm 9.6\%$ |
| 10873 | AAD | 5G NR (DFT-s-OFDM, 1 RB, 100 MHz, 64QAM, 120 kHz)    | 5G NR FR2 TDD | 6.61 | $\pm 9.6\%$ |
| 10874 | AAD | 5G NR (DFT-s-OFDM, 100% RB, 100 MHz, 64QAM, 120 kHz) | 5G NR FR2 TDD | 6.65 | $\pm 9.6\%$ |
| 10875 | AAD | 5G NR (CP-OFDM, 1 RB, 100 MHz, QPSK, 120 kHz)        | 5G NR FR2 TDD | 7.78 | $\pm 9.6\%$ |
| 10876 | AAD | 5G NR (CP-OFDM, 100% RB, 100 MHz, QPSK, 120 kHz)     | 5G NR FR2 TDD | 8.39 | $\pm 9.6\%$ |
| 10877 | AAD | 5G NR (CP-OFDM, 1 RB, 100 MHz, 16QAM, 120 kHz)       | 5G NR FR2 TDD | 7.95 | $\pm 9.6\%$ |
| 10878 | AAD | 5G NR (CP-OFDM, 100% RB, 100 MHz, 16QAM, 120 kHz)    | 5G NR FR2 TDD | 8.41 | $\pm 9.6\%$ |
| 10879 | AAD | 5G NR (CP-OFDM, 1 RB, 100 MHz, 64QAM, 120 kHz)       | 5G NR FR2 TDD | 8.12 | $\pm 9.6\%$ |
| 10880 | AAD | 5G NR (CP-OFDM, 100% RB, 100 MHz, 64QAM, 120 kHz)    | 5G NR FR2 TDD | 8.38 | $\pm 9.6\%$ |
| 10881 | AAD | 5G NR (DFT-s-OFDM, 1 RB, 50 MHz, QPSK, 120 kHz)      | 5G NR FR2 TDD | 5.75 | $\pm 9.6\%$ |
| 10882 | AAD | 5G NR (DFT-s-OFDM, 100% RB, 50 MHz, QPSK, 120 kHz)   | 5G NR FR2 TDD | 5.96 | $\pm 9.6\%$ |
| 10883 | AAD | 5G NR (DFT-s-OFDM, 1 RB, 50 MHz, 16QAM, 120 kHz)     | 5G NR FR2 TDD | 6.57 | $\pm 9.6\%$ |
| 10884 | AAD | 5G NR (DFT-s-OFDM, 100% RB, 50 MHz, 16QAM, 120 kHz)  | 5G NR FR2 TDD | 6.53 | $\pm 9.6\%$ |
| 10885 | AAD | 5G NR (DFT-s-OFDM, 1 RB, 50 MHz, 64QAM, 120 kHz)     | 5G NR FR2 TDD | 6.61 | $\pm 9.6\%$ |
| 10886 | AAD | 5G NR (DFT-s-OFDM, 100% RB, 50 MHz, 64QAM, 120 kHz)  | 5G NR FR2 TDD | 6.65 | $\pm 9.6\%$ |
| 10887 | AAD | 5G NR (CP-OFDM, 1 RB, 50 MHz, QPSK, 120 kHz)         | 5G NR FR2 TDD | 7.78 | $\pm 9.6\%$ |
| 10888 | AAD | 5G NR (CP-OFDM, 100% RB, 50 MHz, QPSK, 120 kHz)      | 5G NR FR2 TDD | 8.35 | $\pm 9.6\%$ |
| 10889 | AAD | 5G NR (CP-OFDM, 1 RB, 50 MHz, 16QAM, 120 kHz)        | 5G NR FR2 TDD | 8.02 | $\pm 9.6\%$ |
| 10890 | AAD | 5G NR (CP-OFDM, 100% RB, 50 MHz, 16QAM, 120 kHz)     | 5G NR FR2 TDD | 8.40 | $\pm 9.6\%$ |
| 10891 | AAD | 5G NR (CP-OFDM, 1 RB, 50 MHz, 64QAM, 120 kHz)        | 5G NR FR2 TDD | 8.13 | $\pm 9.6\%$ |
| 10892 | AAD | 5G NR (CP-OFDM, 100% RB, 50 MHz, 64QAM, 120 kHz)     | 5G NR FR2 TDD | 8.41 | $\pm 9.6\%$ |
| 10897 | AAD | 5G NR (DFT-s-OFDM, 1 RB, 5 MHz, QPSK, 30 kHz)        | 5G NR FR1 TDD | 5.66 | $\pm 9.6\%$ |
| 10898 | AAD | 5G NR (DFT-s-OFDM, 1 RB, 10 MHz, QPSK, 30 kHz)       | 5G NR FR1 TDD | 5.67 | $\pm 9.6\%$ |
| 10899 | AAD | 5G NR (DFT-s-OFDM, 1 RB, 15 MHz, QPSK, 30 kHz)       | 5G NR FR1 TDD | 5.67 | $\pm 9.6\%$ |
| 10900 | AAD | 5G NR (DFT-s-OFDM, 1 RB, 20 MHz, QPSK, 30 kHz)       | 5G NR FR1 TDD | 5.68 | $\pm 9.6\%$ |
| 10901 | AAD | 5G NR (DFT-s-OFDM, 1 RB, 25 MHz, QPSK, 30 kHz)       | 5G NR FR1 TDD | 5.68 | $\pm 9.6\%$ |
| 10902 | AAD | 5G NR (DFT-s-OFDM, 1 RB, 30 MHz, QPSK, 30 kHz)       | 5G NR FR1 TDD | 5.68 | $\pm 9.6\%$ |
| 10903 | AAD | 5G NR (DFT-s-OFDM, 1 RB, 40 MHz, QPSK, 30 kHz)       | 5G NR FR1 TDD | 5.68 | $\pm 9.6\%$ |
| 10904 | AAD | 5G NR (DFT-s-OFDM, 1 RB, 50 MHz, QPSK, 30 kHz)       | 5G NR FR1 TDD | 5.68 | $\pm 9.6\%$ |
| 10905 | AAD | 5G NR (DFT-s-OFDM, 1 RB, 60 MHz, QPSK, 30 kHz)       | 5G NR FR1 TDD | 5.68 | $\pm 9.6\%$ |
| 10906 | AAD | 5G NR (DFT-s-OFDM, 1 RB, 80 MHz, QPSK, 30 kHz)       | 5G NR FR1 TDD | 5.68 | $\pm 9.6\%$ |
| 10907 | AAD | 5G NR (DFT-s-OFDM, 50% RB, 5 MHz, QPSK, 30 kHz)      | 5G NR FR1 TDD | 5.78 | $\pm 9.6\%$ |
| 10908 | AAD | 5G NR (DFT-s-OFDM, 50% RB, 10 MHz, QPSK, 30 kHz)     | 5G NR FR1 TDD | 5.93 | $\pm 9.6\%$ |
| 10909 | AAD | 5G NR (DFT-s-OFDM, 50% RB, 15 MHz, QPSK, 30 kHz)     | 5G NR FR1 TDD | 5.96 | $\pm 9.6\%$ |
| 10910 | AAD | 5G NR (DFT-s-OFDM, 50% RB, 20 MHz, QPSK, 30 kHz)     | 5G NR FR1 TDD | 5.83 | $\pm 9.6\%$ |
| 10911 | AAD | 5G NR (DFT-s-OFDM, 50% RB, 25 MHz, QPSK, 30 kHz)     | 5G NR FR1 TDD | 5.93 | $\pm 9.6\%$ |
| 10912 | AAD | 5G NR (DFT-s-OFDM, 50% RB, 30 MHz, QPSK, 30 kHz)     | 5G NR FR1 TDD | 5.84 | $\pm 9.6\%$ |
| 10913 | AAD | 5G NR (DFT-s-OFDM, 50% RB, 40 MHz, QPSK, 30 kHz)     | 5G NR FR1 TDD | 5.84 | $\pm 9.6\%$ |
| 10914 | AAD | 5G NR (DFT-s-OFDM, 50% RB, 50 MHz, QPSK, 30 kHz)     | 5G NR FR1 TDD | 5.85 | $\pm 9.6\%$ |
| 10915 | AAD | 5G NR (DFT-s-OFDM, 50% RB, 60 MHz, QPSK, 30 kHz)     | 5G NR FR1 TDD | 5.83 | $\pm 9.6\%$ |
| 10916 | AAD | 5G NR (DFT-s-OFDM, 50% RB, 80 MHz, QPSK, 30 kHz)     | 5G NR FR1 TDD | 5.87 | $\pm 9.6\%$ |
| 10917 | AAD | 5G NR (DFT-s-OFDM, 50% RB, 100 MHz, QPSK, 30 kHz)    | 5G NR FR1 TDD | 5.94 | $\pm 9.6\%$ |
| 10918 | AAD | 5G NR (DFT-s-OFDM, 100% RB, 5 MHz, QPSK, 30 kHz)     | 5G NR FR1 TDD | 5.86 | $\pm 9.6\%$ |
| 10919 | AAD | 5G NR (DFT-s-OFDM, 100% RB, 10 MHz, QPSK, 30 kHz)    | 5G NR FR1 TDD | 5.86 | $\pm 9.6\%$ |
| 10920 | AAD | 5G NR (DFT-s-OFDM, 100% RB, 15 MHz, QPSK, 30 kHz)    | 5G NR FR1 TDD | 5.87 | $\pm 9.6\%$ |
| 10921 | AAD | 5G NR (DFT-s-OFDM, 100% RB, 20 MHz, QPSK, 30 kHz)    | 5G NR FR1 TDD | 5.84 | $\pm 9.6\%$ |



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| 10922 | AAD | 5G NR (DFT-s-OFDM, 100% RB, 25 MHz, QPSK, 30 kHz)   | 5G NR FR1 TDD | 5.82  | $\pm 9.6\%$ |
| 10923 | AAD | 5G NR (DFT-s-OFDM, 100% RB, 30 MHz, QPSK, 30 kHz)   | 5G NR FR1 TDD | 5.84  | $\pm 9.6\%$ |
| 10924 | AAD | 5G NR (DFT-s-OFDM, 100% RB, 40 MHz, QPSK, 30 kHz)   | 5G NR FR1 TDD | 5.84  | $\pm 9.6\%$ |
| 10925 | AAD | 5G NR (DFT-s-OFDM, 100% RB, 50 MHz, QPSK, 30 kHz)   | 5G NR FR1 TDD | 5.95  | $\pm 9.6\%$ |
| 10926 | AAD | 5G NR (DFT-s-OFDM, 100% RB, 60 MHz, QPSK, 30 kHz)   | 5G NR FR1 TDD | 5.84  | $\pm 9.6\%$ |
| 10927 | AAD | 5G NR (DFT-s-OFDM, 100% RB, 80 MHz, QPSK, 30 kHz)   | 5G NR FR1 TDD | 5.94  | $\pm 9.6\%$ |
| 10928 | AAD | 5G NR (DFT-s-OFDM, 1 RB, 5 MHz, QPSK, 15 kHz)       | 5G NR FR1 FDD | 5.52  | $\pm 9.6\%$ |
| 10929 | AAD | 5G NR (DFT-s-OFDM, 1 RB, 10 MHz, QPSK, 15 kHz)      | 5G NR FR1 FDD | 5.52  | $\pm 9.6\%$ |
| 10930 | AAD | 5G NR (DFT-s-OFDM, 1 RB, 15 MHz, QPSK, 15 kHz)      | 5G NR FR1 FDD | 5.52  | $\pm 9.6\%$ |
| 10931 | AAD | 5G NR (DFT-s-OFDM, 1 RB, 20 MHz, QPSK, 15 kHz)      | 5G NR FR1 FDD | 5.51  | $\pm 9.6\%$ |
| 10932 | AAB | 5G NR (DFT-s-OFDM, 1 RB, 25 MHz, QPSK, 15 kHz)      | 5G NR FR1 FDD | 5.51  | $\pm 9.6\%$ |
| 10933 | AAA | 5G NR (DFT-s-OFDM, 1 RB, 30 MHz, QPSK, 15 kHz)      | 5G NR FR1 FDD | 5.51  | $\pm 9.6\%$ |
| 10934 | AAA | 5G NR (DFT-s-OFDM, 1 RB, 40 MHz, QPSK, 15 kHz)      | 5G NR FR1 FDD | 5.51  | $\pm 9.6\%$ |
| 10935 | AAA | 5G NR (DFT-s-OFDM, 1 RB, 50 MHz, QPSK, 15 kHz)      | 5G NR FR1 FDD | 5.51  | $\pm 9.6\%$ |
| 10936 | AAC | 5G NR (DFT-s-OFDM, 50% RB, 5 MHz, QPSK, 15 kHz)     | 5G NR FR1 FDD | 5.90  | $\pm 9.6\%$ |
| 10937 | AAB | 5G NR (DFT-s-OFDM, 50% RB, 10 MHz, QPSK, 15 kHz)    | 5G NR FR1 FDD | 5.77  | $\pm 9.6\%$ |
| 10938 | AAB | 5G NR (DFT-s-OFDM, 50% RB, 15 MHz, QPSK, 15 kHz)    | 5G NR FR1 FDD | 5.90  | $\pm 9.6\%$ |
| 10939 | AAB | 5G NR (DFT-s-OFDM, 50% RB, 20 MHz, QPSK, 15 kHz)    | 5G NR FR1 FDD | 5.82  | $\pm 9.6\%$ |
| 10940 | AAB | 5G NR (DFT-s-OFDM, 50% RB, 25 MHz, QPSK, 15 kHz)    | 5G NR FR1 FDD | 5.89  | $\pm 9.6\%$ |
| 10941 | AAB | 5G NR (DFT-s-OFDM, 50% RB, 30 MHz, QPSK, 15 kHz)    | 5G NR FR1 FDD | 5.83  | $\pm 9.6\%$ |
| 10942 | AAB | 5G NR (DFT-s-OFDM, 50% RB, 40 MHz, QPSK, 15 kHz)    | 5G NR FR1 FDD | 5.85  | $\pm 9.6\%$ |
| 10943 | AAB | 5G NR (DFT-s-OFDM, 50% RB, 50 MHz, QPSK, 15 kHz)    | 5G NR FR1 FDD | 5.95  | $\pm 9.6\%$ |
| 10944 | AAB | 5G NR (DFT-s-OFDM, 100% RB, 5 MHz, QPSK, 15 kHz)    | 5G NR FR1 FDD | 5.81  | $\pm 9.6\%$ |
| 10945 | AAB | 5G NR (DFT-s-OFDM, 100% RB, 10 MHz, QPSK, 15 kHz)   | 5G NR FR1 FDD | 5.85  | $\pm 9.6\%$ |
| 10946 | AAC | 5G NR (DFT-s-OFDM, 100% RB, 15 MHz, QPSK, 15 kHz)   | 5G NR FR1 FDD | 5.83  | $\pm 9.6\%$ |
| 10947 | AAB | 5G NR (DFT-s-OFDM, 100% RB, 20 MHz, QPSK, 15 kHz)   | 5G NR FR1 FDD | 5.87  | $\pm 9.6\%$ |
| 10948 | AAB | 5G NR (DFT-s-OFDM, 100% RB, 25 MHz, QPSK, 15 kHz)   | 5G NR FR1 FDD | 5.94  | $\pm 9.6\%$ |
| 10949 | AAB | 5G NR (DFT-s-OFDM, 100% RB, 30 MHz, QPSK, 15 kHz)   | 5G NR FR1 FDD | 5.87  | $\pm 9.6\%$ |
| 10950 | AAB | 5G NR (DFT-s-OFDM, 100% RB, 40 MHz, QPSK, 15 kHz)   | 5G NR FR1 FDD | 5.94  | $\pm 9.6\%$ |
| 10951 | AAB | 5G NR (DFT-s-OFDM, 100% RB, 50 MHz, QPSK, 15 kHz)   | 5G NR FR1 FDD | 5.92  | $\pm 9.6\%$ |
| 10952 | AAB | 5G NR DL (CP-OFDM, TM 3.1, 5 MHz, 64-QAM, 15 kHz)   | 5G NR FR1 FDD | 8.25  | $\pm 9.6\%$ |
| 10953 | AAB | 5G NR DL (CP-OFDM, TM 3.1, 10 MHz, 64-QAM, 15 kHz)  | 5G NR FR1 FDD | 8.15  | $\pm 9.6\%$ |
| 10954 | AAB | 5G NR DL (CP-OFDM, TM 3.1, 15 MHz, 64-QAM, 15 kHz)  | 5G NR FR1 FDD | 8.23  | $\pm 9.6\%$ |
| 10955 | AAB | 5G NR DL (CP-OFDM, TM 3.1, 20 MHz, 64-QAM, 15 kHz)  | 5G NR FR1 FDD | 8.42  | $\pm 9.6\%$ |
| 10956 | AAB | 5G NR DL (CP-OFDM, TM 3.1, 5 MHz, 64-QAM, 30 kHz)   | 5G NR FR1 FDD | 8.14  | $\pm 9.6\%$ |
| 10957 | AAC | 5G NR DL (CP-OFDM, TM 3.1, 10 MHz, 64-QAM, 30 kHz)  | 5G NR FR1 FDD | 8.31  | $\pm 9.6\%$ |
| 10958 | AAB | 5G NR DL (CP-OFDM, TM 3.1, 15 MHz, 64-QAM, 30 kHz)  | 5G NR FR1 FDD | 8.61  | $\pm 9.6\%$ |
| 10959 | AAB | 5G NR DL (CP-OFDM, TM 3.1, 20 MHz, 64-QAM, 30 kHz)  | 5G NR FR1 FDD | 8.33  | $\pm 9.6\%$ |
| 10960 | AAB | 5G NR DL (CP-OFDM, TM 3.1, 5 MHz, 64-QAM, 15 kHz)   | 5G NR FR1 TDD | 9.32  | $\pm 9.6\%$ |
| 10961 | AAB | 5G NR DL (CP-OFDM, TM 3.1, 10 MHz, 64-QAM, 15 kHz)  | 5G NR FR1 TDD | 9.36  | $\pm 9.6\%$ |
| 10962 | AAB | 5G NR DL (CP-OFDM, TM 3.1, 15 MHz, 64-QAM, 15 kHz)  | 5G NR FR1 TDD | 9.40  | $\pm 9.6\%$ |
| 10963 | AAB | 5G NR DL (CP-OFDM, TM 3.1, 20 MHz, 64-QAM, 15 kHz)  | 5G NR FR1 TDD | 9.55  | $\pm 9.6\%$ |
| 10964 | AAB | 5G NR DL (CP-OFDM, TM 3.1, 5 MHz, 64-QAM, 30 kHz)   | 5G NR FR1 TDD | 9.29  | $\pm 9.6\%$ |
| 10965 | AAB | 5G NR DL (CP-OFDM, TM 3.1, 10 MHz, 64-QAM, 30 kHz)  | 5G NR FR1 TDD | 9.37  | $\pm 9.6\%$ |
| 10966 | AAB | 5G NR DL (CP-OFDM, TM 3.1, 15 MHz, 64-QAM, 30 kHz)  | 5G NR FR1 TDD | 9.55  | $\pm 9.6\%$ |
| 10967 | AAB | 5G NR DL (CP-OFDM, TM 3.1, 20 MHz, 64-QAM, 30 kHz)  | 5G NR FR1 TDD | 9.42  | $\pm 9.6\%$ |
| 10968 | AAB | 5G NR DL (CP-OFDM, TM 3.1, 100 MHz, 64-QAM, 30 kHz) | 5G NR FR1 TDD | 9.49  | $\pm 9.6\%$ |
| 10972 | AAB | 5G NR (CP-OFDM, 1 RB, 20 MHz, QPSK, 15 kHz)         | 5G NR FR1 TDD | 11.59 | $\pm 9.6\%$ |
| 10973 | AAB | 5G NR (DFT-s-OFDM, 1 RB, 100 MHz, QPSK, 30 kHz)     | 5G NR FR1 TDD | 9.06  | $\pm 9.6\%$ |
| 10974 | AAB | 5G NR (CP-OFDM, 100% RB, 100 MHz, 256-QAM, 30 kHz)  | 5G NR FR1 TDD | 10.28 | $\pm 9.6\%$ |

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



**ANNEX B**

**DIPOLE CALIBRATION REPORTS**



**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 **TÜV SÜD UK**Certificate No: **D2450V2-715\_Dec20**

## CALIBRATION CERTIFICATE

Object **D2450V2 - SN:715**Calibration procedure(s) **QA CAL-05.v11**  
 Calibration Procedure for SAR Validation Sources between 0.7-3 GHzCalibration date: **December 10, 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&amp;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. 217-03108)       | Apr-21                |
| Type-N mismatch combination | SN: 310982 / 06327 | 31-Mar-20 (No. 217-03104)       | Apr-21                |
| Reference Probe EX3DV4      | SN: 7405           | 29-Jun-20 (No. EX3-7405_Jun20)  | Jun-21                |
| DAE4                        | SN: 601            | 02-Nov-20 (No. DAE4-601_Nov20)  | Nov-21                |

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

| Calibrated by: | Name          | Function              | Signature |
|----------------|---------------|-----------------------|-----------|
|                | Leif Klysnier | Laboratory Technician |           |
| Approved by:   | Katja Pokovic | Technical Manager     |           |

Issued: December 10, 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

Accredited by the Swiss Accreditation Service (SAS)  
 The Swiss Accreditation Service is one of the signatories to the EA  
 Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

**Glossary:**

|              |                                 |
|--------------|---------------------------------|
| <b>TSL</b>   | tissue simulating liquid        |
| <b>ConvF</b> | sensitivity in TSL / NORM x,y,z |
| <b>N/A</b>   | 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                    | 2450 MHz $\pm$ 1 MHz   |             |

### Head TSL parameters

The following parameters and calculations were applied.

|   | Temperature         | Permittivity   | Conductivity         |
|---|---------------------|----------------|----------------------|
| Nominal Head TSL parameters             | 22.0 °C             | 39.2           | 1.80 mho/m           |
| Measured Head TSL parameters            | (22.0 $\pm$ 0.2) °C | 38.0 $\pm$ 6 % | 1.87 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 | 13.4 W/kg                    |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 52.3 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 | 6.16 W/kg                    |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 24.3 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             | 52.7           | 1.95 mho/m           |
| Measured Body TSL parameters            | (22.0 $\pm$ 0.2) °C | 51.3 $\pm$ 6 % | 2.04 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 | 13.6 W/kg                    |
| SAR for nominal Body TSL parameters                     | normalized to 1W   | 52.9 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 | 6.26 W/kg                    |
| SAR for nominal Body TSL parameters                     | normalized to 1W   | 24.6 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 | 52.9 $\Omega$ + 0.4 $j\Omega$ |
| Return Loss                          | - 30.8 dB                     |

**Antenna Parameters with Body TSL**

|                                      |                               |
|--------------------------------------|-------------------------------|
| Impedance, transformed to feed point | 49.0 $\Omega$ + 3.3 $j\Omega$ |
| Return Loss                          | - 29.2 dB                     |

**General Antenna Parameters and Design**

|                                  |          |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.156 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: 10.12.2020

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:715**

Communication System: UID 0 - CW; Frequency: 2450 MHz

Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.87$  S/m;  $\epsilon_r = 38$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN7405; ConvF(7.81, 7.81, 7.81) @ 2450 MHz; Calibrated: 29.06.2020
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 02.11.2020
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

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

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

Reference Value = 114.9 V/m; Power Drift = 0.03 dB

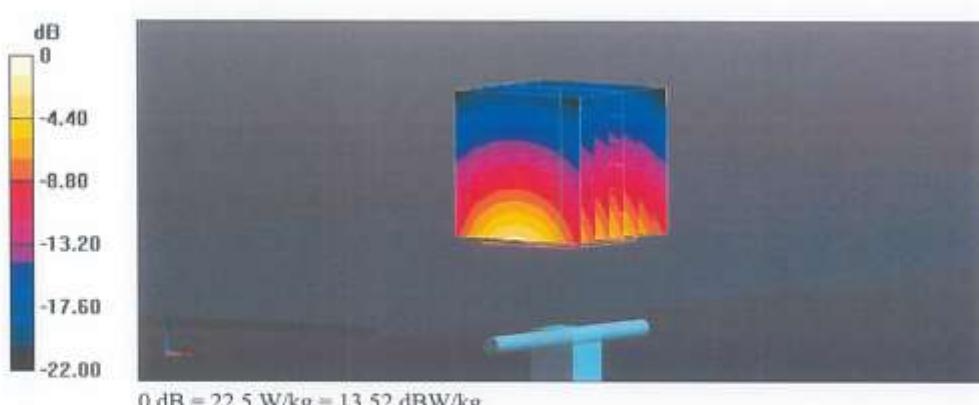
Peak SAR (extrapolated) = 27.5 W/kg

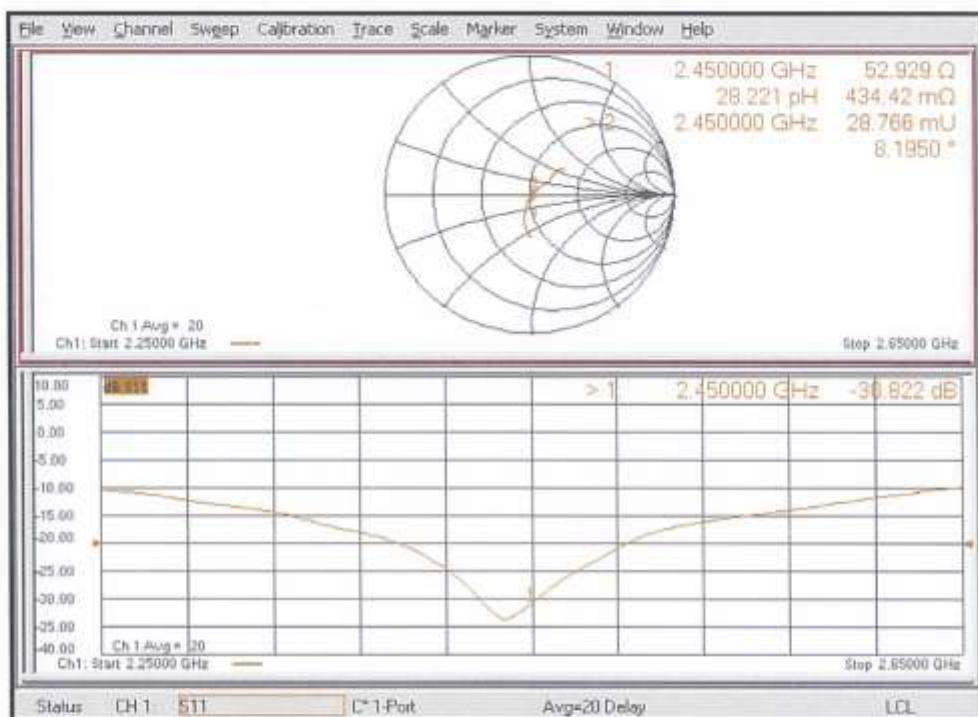
SAR(1 g) = 13.4 W/kg; SAR(10 g) = 6.16 W/kg

Smallest distance from peaks to all points 3 dB below = 9 mm

Ratio of SAR at M2 to SAR at M1 = 48.7%

Maximum value of SAR (measured) = 22.5 W/kg



**Impedance Measurement Plot for Head TSL**



## DASY5 Validation Report for Body TSL

Date: 10.12.2020

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:715**

Communication System: UID 0 - CW; Frequency: 2450 MHz

Medium parameters used:  $f = 2450$  MHz;  $\sigma = 2.04$  S/m;  $\epsilon_r = 51.3$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN7405; ConvF(7.75, 7.75, 7.75) @ 2450 MHz; Calibrated: 29.06.2020
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 02.11.2020
- 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 = 110.1 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 27.7 W/kg

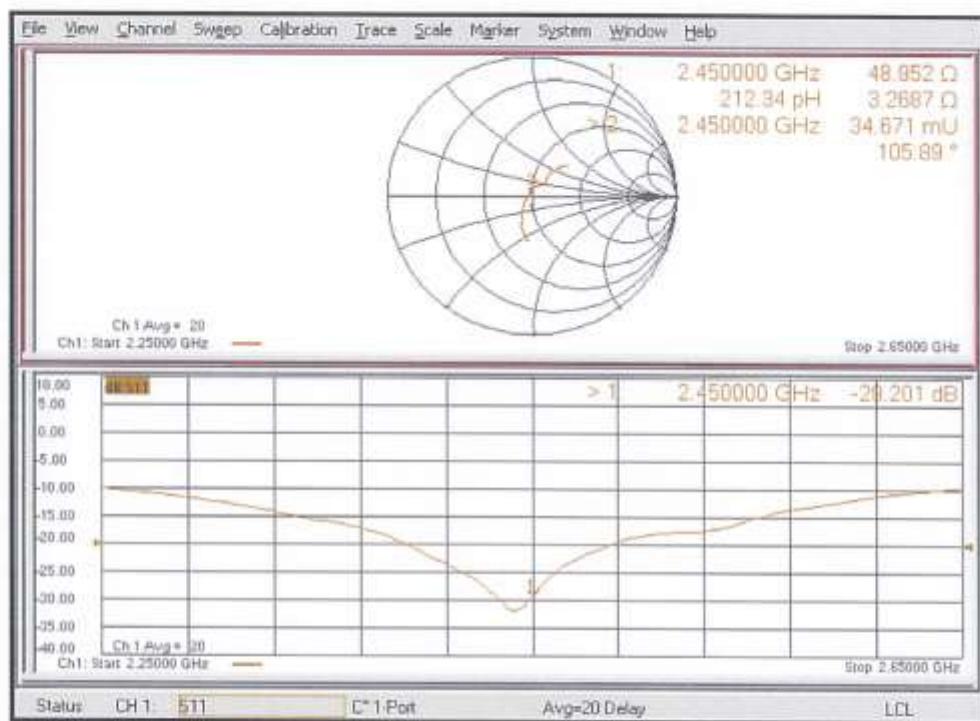
SAR(1 g) = 13.6 W/kg; SAR(10 g) = 6.26 W/kg

Smallest distance from peaks to all points 3 dB below = 9 mm

Ratio of SAR at M2 to SAR at M1 = 49.7%

Maximum value of SAR (measured) = 22.6 W/kg



**Impedance Measurement Plot for Body TSL**



**ANNEX C**

**TEST RESULTS**



## WLAN 2450 MHz

Date/Time: 27/09/21 14:09:51

Test Laboratory: TUV SUD

### DUT: Atom Hard Hat

Communication System: UID 10415 - AAA, IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 99pc duty cycle); Communication System Band: WLAN 2.4GHz (2412.0 - 2484.0 MHz); Frequency: 2457 MHz; Communication System PAR: 1.536 dB; PMF: 1.00925

Medium parameters used (interpolated):  $f = 2457$  MHz;  $\sigma = 1.809$  S/m;  $\epsilon_r = 38.617$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY Configuration:

Probe: EX3DV4 - SN7536; ConvF(7.82, 7.82, 7.82) @ 2457 MHz; Calibrated: 18/06/21

Modulation Compensation: PMR for UID 10415 - AAA, Calibrated: 18/06/21

Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 1.0, 31.0

Electronics: DAE4 Sn1584; Calibrated: 09/06/21

Phantom: ELI V8.0 (REAR); Type: QD OVA 004 Ax; Serial: 2102

DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

**802.11b/SISO ANTENNA A 20dBm High -FCC/Area Scan (101x101x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm

Info: Interpolated medium parameters used for SAR evaluation.  
Maximum value of SAR (interpolated) = 9.13 W/kg

**802.11b/SISO ANTENNA A 20dBm High -FCC/Zoom Scan (7x7x4)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm  
Reference Value = 50.93 V/m; Power Drift = -0.13 dB

Peak SAR (extrapolated) = 12.0 W/kg

**SAR(1 g) = 4.13 W/kg; SAR(10 g) = 1.58 W/kg** (SAR corrected for target medium)

Info: Interpolated medium parameters used for SAR evaluation.  
Maximum value of SAR (measured) = 8.72 W/kg

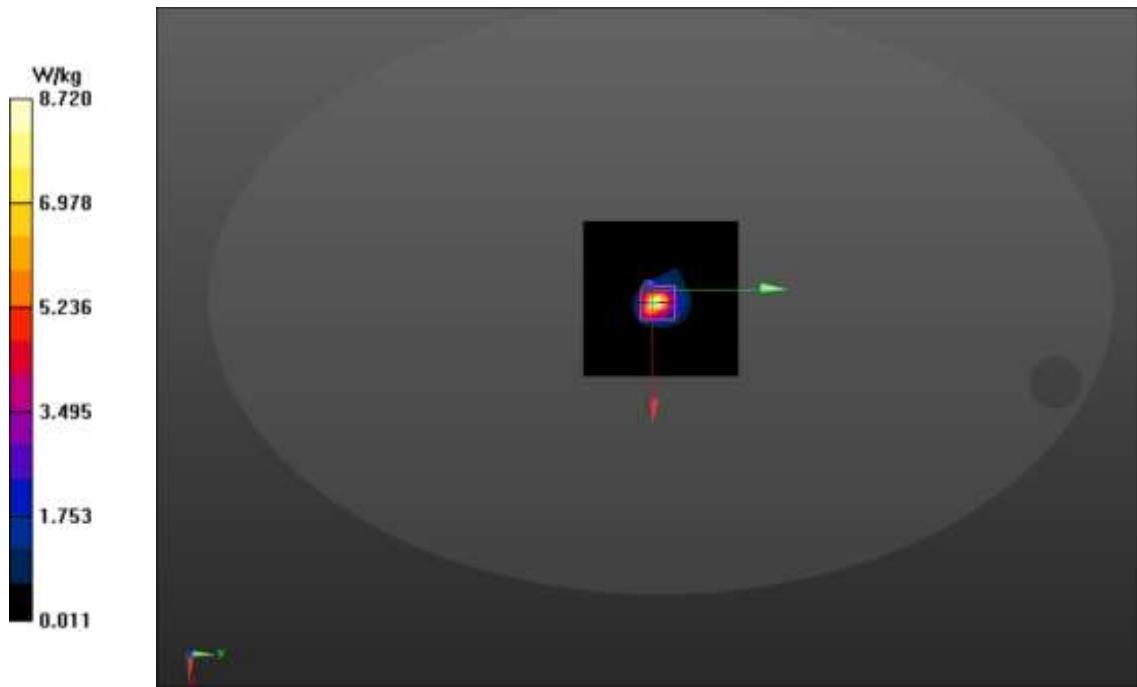


Figure C.1: SAR Head Testing Results for the Atom Hard Hat at 2417 MHz



Date/Time: 27/09/21 14:09:51

Test Laboratory: TUV SUD

**DUT: Atom Hard Hat**

Communication System: UID 10415 - AAA, IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 99pc duty cycle); Communication System Band: WLAN 2.4GHz (2412.0 - 2484.0 MHz); Frequency: 2457 MHz; Communication System PAR: 1.536 dB; PMF: 1.00925  
 Medium parameters used (interpolated):  $f = 2457$  MHz;  $\sigma = 1.809$  S/m;  $\epsilon_r = 38.617$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
 Phantom section: Flat Section  
 Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY Configuration:

Probe: EX3DV4 - SN7536; ConvF(7.82, 7.82, 7.82) @ 2457 MHz; Calibrated: 18/06/21

Modulation Compensation: PMR for UID 10415 - AAA, Calibrated: 18/06/21

Sensor-Surface: 1.4mm (Mechanical Surface Detection),  $z = 1.0, 31.0$

Electronics: DAE4 Sn1584; Calibrated: 09/06/21

Phantom: ELI V8.0 (REAR); Type: QD OVA 004 Ax; Serial: 2102

DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

**802.11b/SISO ANTENNA A 20dBm High -FCC/Area Scan (101x101x1):** Interpolated grid:  $dx=1.000$  mm,  $dy=1.000$  mm

**Info:** [Interpolated medium parameters used for SAR evaluation.](#)  
 Maximum value of SAR (interpolated) = 9.13 W/kg

**802.11b/SISO ANTENNA A 20dBm High -FCC/Zoom Scan (7x7x4)/Cube 0:** Measurement grid:  $dx=5$  mm,  $dy=5$  mm,  $dz=5$  mm  
 Reference Value = 50.93 V/m; Power Drift = -0.13 dB  
 Peak SAR (extrapolated) = 12.0 W/kg  
**SAR(1 g) = 4.13 W/kg; SAR(10 g) = 1.58 W/kg** (SAR corrected for target medium)

**Info:** [Interpolated medium parameters used for SAR evaluation.](#)  
 Maximum value of SAR (measured) = 8.72 W/kg

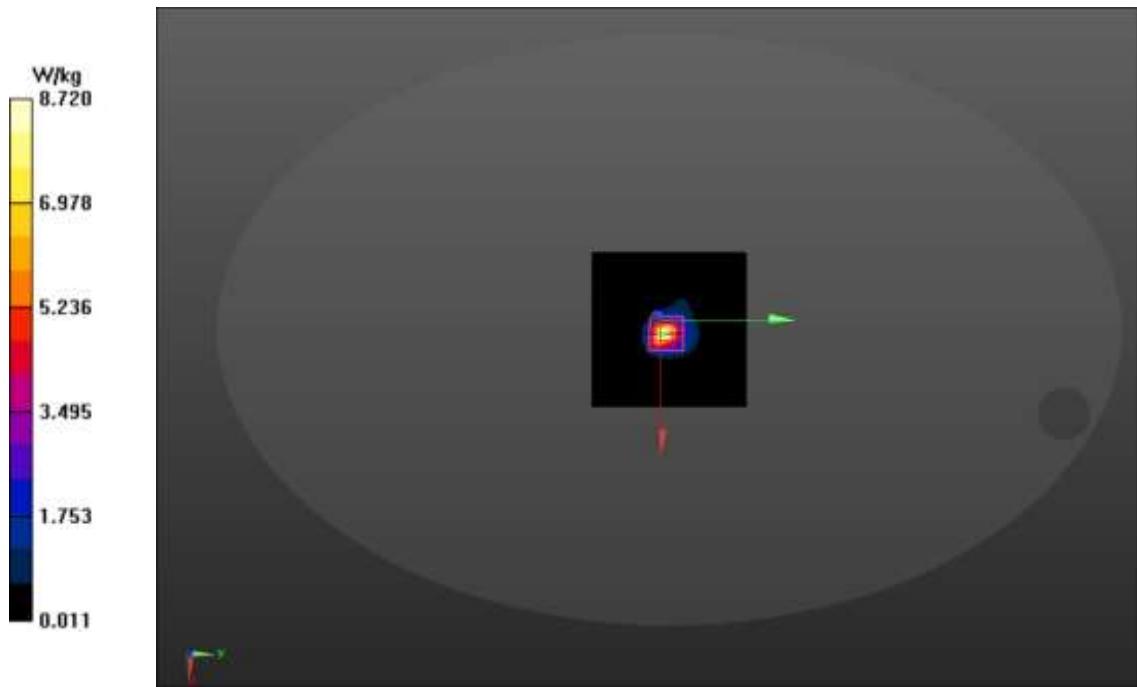


Figure C.2: SAR Head Testing Results for the Atom Hard Hat at 2457 MHz



Date/Time: 27/09/21 13:01:44

Test Laboratory: TUV SUD

**DUT: Atom Hard Hat**

Communication System: UID 10415 - AAA, IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 99pc duty cycle); Communication System Band: WLAN 2.4GHz (2412.0 - 2484.0 MHz); Frequency: 2437 MHz; Communication System PAR: 1.536 dB; PMF: 1.00925

Medium parameters used (interpolated):  $f = 2437 \text{ MHz}$ ;  $\sigma = 1.793 \text{ S/m}$ ;  $\epsilon_r = 38.647$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

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

DASY Configuration:

Probe: EX3DV4 - SN7536; ConvF(7.82, 7.82, 7.82) @ 2437 MHz; Calibrated: 18/06/21

Modulation Compensation: PMR for UID 10415 - AAA, Calibrated: 18/06/21

Sensor-Surface: 1.4mm (Mechanical Surface Detection),  $z = 1.0, 31.0$

Electronics: DAE4 Sn1584; Calibrated: 09/06/21

Phantom: ELI V8.0 (REAR); Type: QD OVA 004 Ax; Serial: 2102

DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

**802.11b/SISO ANTENNA A 20dBm Mid - FCC/Area Scan 4 (101x101x1):** Interpolated grid:  $dx=1.000 \text{ mm}$ ,  $dy=1.000 \text{ mm}$

**Info:** [Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 8.51 W/kg

**802.11b/SISO ANTENNA A 20dBm Mid - FCC/Zoom Scan (7x7x4)/Cube 0:** Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$   
Reference Value = 51.28 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 11.5 W/kg

**SAR(1 g) = 4.04 W/kg; SAR(10 g) = 1.49 W/kg** (SAR corrected for target medium)

**Info:** [Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 8.24 W/kg

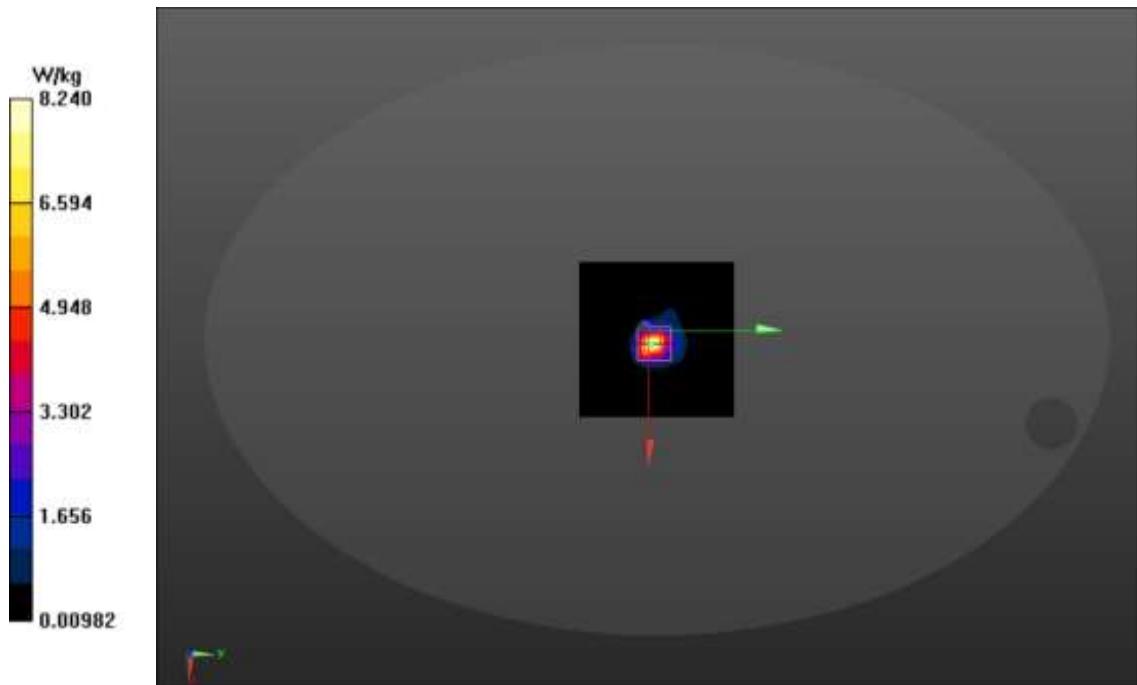


Figure C.3: SAR Head Testing Results for the Atom Hard Hat at 2437 MHz



Date/Time: 28/09/21 10:22:07

Test Laboratory: TUV SUD

**DUT: Atom Hard Hat**

Communication System: UID 10415 - AAA, IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 99pc duty cycle); Communication System Band: WLAN 2.4GHz (2412.0 - 2484.0 MHz); Frequency: 2437 MHz; Communication System PAR: 1.536 dB; PMF: 1.00925  
 Medium parameters used (interpolated):  $f = 2437 \text{ MHz}$ ;  $\sigma = 1.793 \text{ S/m}$ ;  $\epsilon_r = 38.647$ ;  $\rho = 1000 \text{ kg/m}^3$   
 Phantom section: Flat Section  
 Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY Configuration:

Probe: EX3DV4 - SN7536; ConvF(7.82, 7.82, 7.82) @ 2437 MHz; Calibrated: 18/06/21

Modulation Compensation: PMR for UID 10415 - AAA, Calibrated: 18/06/21

Sensor-Surface: 1.4mm (Mechanical Surface Detection),  $z = -4.0, 31.0$

Electronics: DAE4 Sn1584; Calibrated: 09/06/21

Phantom: ELI V8.0 (REAR); Type: QD OVA 004 Ax; Serial: 2102

DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

**802.11b/SISO ANTENNA B 20dBm Mid - FCC/Area Scan (101x101x1):** Interpolated grid:  $dx=1.000 \text{ mm}$ ,  $dy=1.000 \text{ mm}$

**Info:** [Interpolated medium parameters used for SAR evaluation.](#)  
 Maximum value of SAR (interpolated) = 8.79 W/kg

**802.11b/SISO ANTENNA B 20dBm Mid - FCC/Zoom Scan (11x11x7)/Cube 0:** Measurement grid:  $dx=3\text{mm}$ ,  $dy=3\text{mm}$ ,  $dz=1.4\text{mm}$   
 Reference Value = 65.21 V/m; Power Drift = 0.16 dB  
 Peak SAR (extrapolated) = 13.8 W/kg  
**SAR(1 g) = 4.03 W/kg; SAR(10 g) = 1.47 W/kg** (SAR corrected for target medium)

**Info:** [Interpolated medium parameters used for SAR evaluation.](#)  
 Maximum value of SAR (measured) = 8.65 W/kg

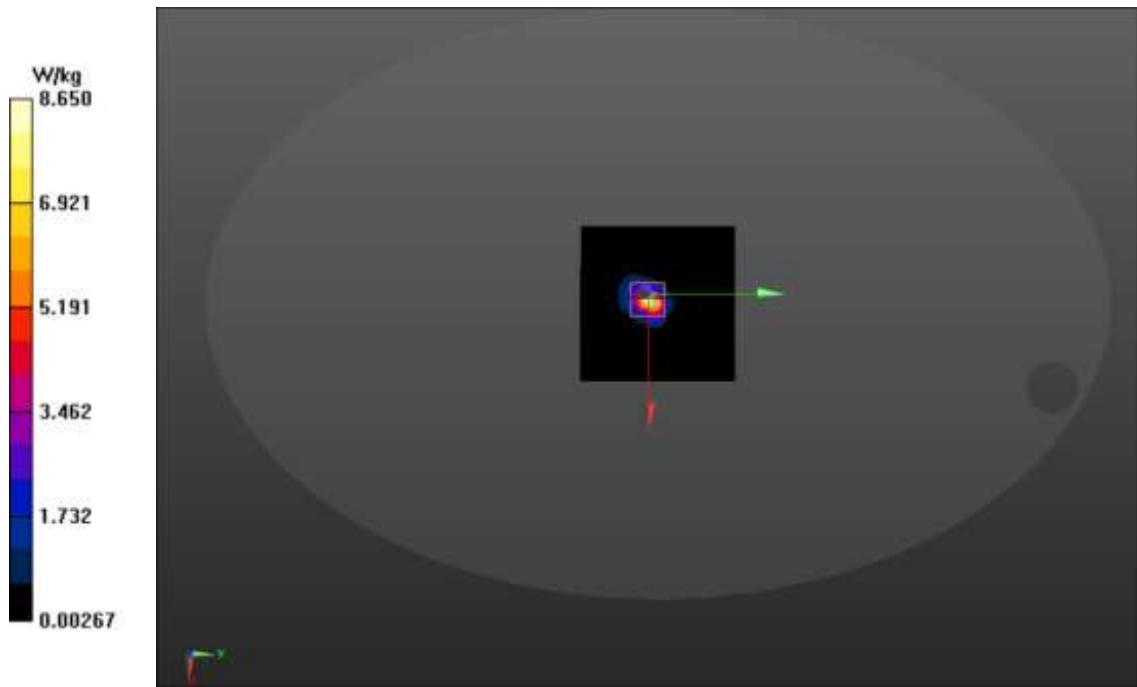


Figure C.4: SAR Head Testing Results for the Atom Hard Hat at 2437 MHz



Date/Time: 28/09/21 12:02:51

Test Laboratory: TUV SUD

**DUT: Atom Hard Hat**

Communication System: UID 10415 - AAA, IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 99pc duty cycle); Communication System Band: WLAN 2.4GHz (2412.0 - 2484.0 MHz); Frequency: 2417 MHz; Communication System PAR: 1.536 dB; PMF: 1.00925

Medium parameters used (interpolated):  $f = 2417 \text{ MHz}$ ;  $\sigma = 1.779 \text{ S/m}$ ;  $\epsilon_r = 38.675$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

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

DASY Configuration:

Probe: EX3DV4 - SN7536; ConvF(7.82, 7.82, 7.82) @ 2417 MHz; Calibrated: 18/06/21

Modulation Compensation: PMR for UID 10415 - AAA, Calibrated: 18/06/21

Sensor-Surface: 1.4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 1.4mm (Mechanical Surface Detection),  $z = -4.0, 31.0$

Electronics: DAE4 Sn1584; Calibrated: 09/06/21

Phantom: ELI V8.0 (REAR); Type: QD OVA 004 Ax; Serial: 2102

DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

**802.11b/SISO ANTENNA B 20dBm Low -FCC/Area Scan (101x101x1):** Interpolated grid:  $dx=1.000 \text{ mm}$ ,  $dy=1.000 \text{ mm}$

**Info:** [Interpolated medium parameters used for SAR evaluation.](#)  
Maximum value of SAR (interpolated) = 8.37 W/kg

**802.11b/SISO ANTENNA B 20dBm Low -FCC/Zoom Scan (11x11x7)/Cube 0:** Measurement grid:  $dx=3\text{mm}$ ,  $dy=3\text{mm}$ ,  $dz=1.4\text{mm}$

Reference Value = 43.62 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 12.8 W/kg

**SAR(1 g) = 3.8 W/kg; SAR(10 g) = 1.38 W/kg** (SAR corrected for target medium)

**Info:** [Interpolated medium parameters used for SAR evaluation.](#)  
Maximum value of SAR (measured) = 8.04 W/kg

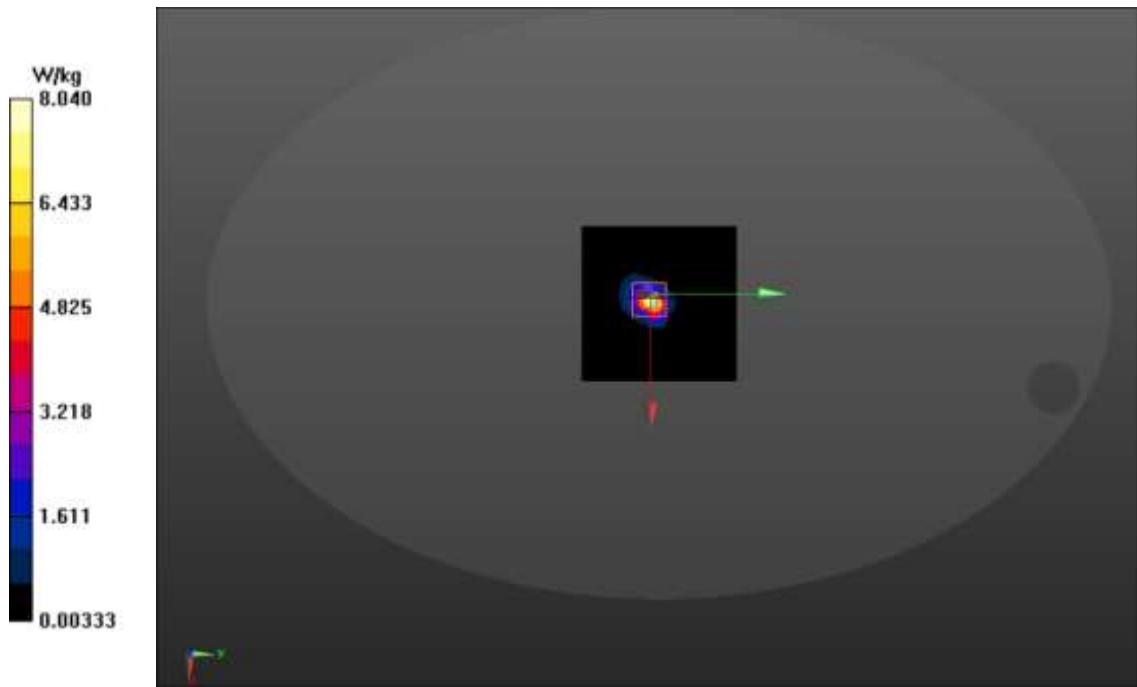


Figure C.5: SAR Head Testing Results for the Atom Hard Hat at 2417 MHz



Date/Time: 28/09/21 12:45:28

Test Laboratory: TUV SUD

**DUT: Atom Hard Hat**

Communication System: UID 10415 - AAA, IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 99pc duty cycle); Communication System Band: WLAN 2.4GHz (2412.0 - 2484.0 MHz); Frequency: 2462 MHz; Communication System PAR: 1.536 dB; PMF: 1.00925

Medium parameters used (interpolated):  $f = 2462$  MHz;  $\sigma = 1.812$  S/m;  $\epsilon_r = 38.609$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY Configuration:

Probe: EX3DV4 - SN7536; ConvF(7.82, 7.82, 7.82) @ 2462 MHz; Calibrated: 18/06/21

Modulation Compensation: PMR for UID 10415 - AAA, Calibrated: 18/06/21

Sensor-Surface: 1.4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 1.4mm (Mechanical Surface Detection),  $z = -4.0, 31.0$

Electronics: DAE4 Sn1584; Calibrated: 09/06/21

Phantom: ELI V8.0 (REAR); Type: QD OVA 004 Ax; Serial: 2102

DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

**802.11b/SISO ANTENNA B 20dBm High -FCC/Area Scan (101x101x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm

**Info: Interpolated medium parameters used for SAR evaluation.**  
Maximum value of SAR (interpolated) = 9.36 W/kg

**802.11b/SISO ANTENNA B 20dBm High -FCC/Zoom Scan (11x11x7)/Cube 0:** Measurement grid: dx=3mm, dy=3mm, dz=1.4mm  
Reference Value = 66.33 V/m; Power Drift = 0.02 dB  
Peak SAR (extrapolated) = 14.8 W/kg  
**SAR(1 g) = 4.21 W/kg; SAR(10 g) = 1.51 W/kg** (SAR corrected for target medium)

**Info: Interpolated medium parameters used for SAR evaluation.**  
Maximum value of SAR (measured) = 8.89 W/kg

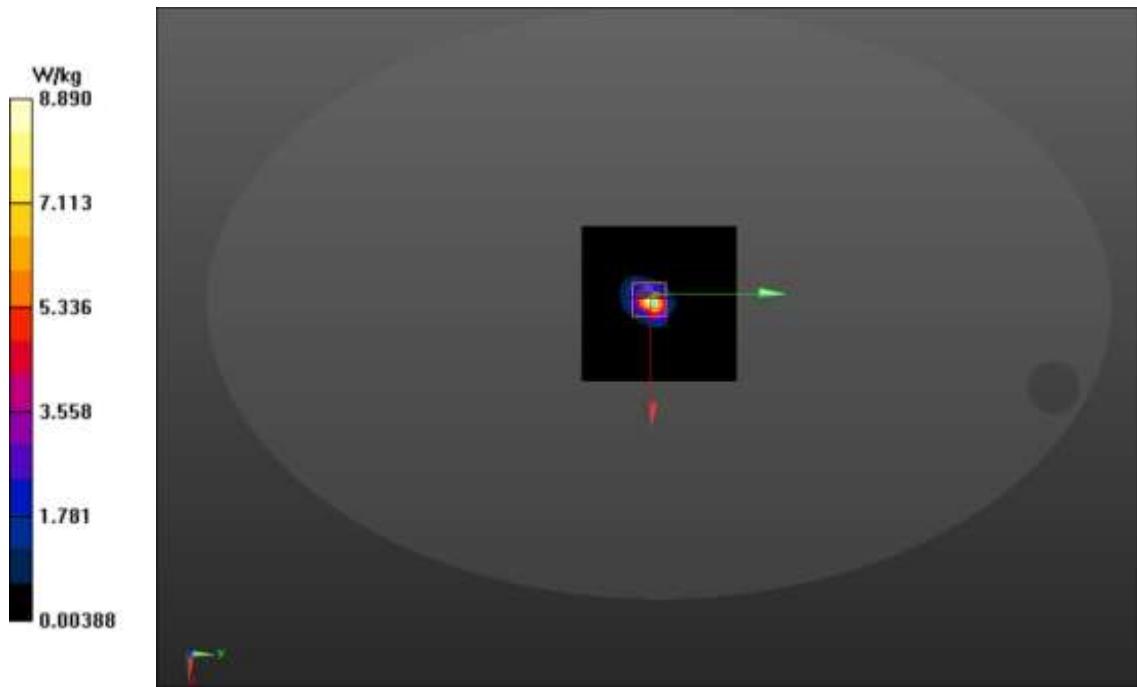


Figure C.6: SAR Head Testing Results for the Atom Hard Hat at 2462 MHz



Date/Time: 30/09/21 11:07:25

Test Laboratory: TUV SUD

**DUT: Atom Hard Hat**

Communication System: UID 10013 - CAB, IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps); Communication System Band: WLAN 2.4GHz (2412.0 - 2484.0 MHz); Frequency: 2452 MHz; Communication System PAR: 9.458 dB; PMF: 1.19124  
 Medium parameters used (interpolated):  $f = 2452$  MHz;  $\sigma = 1.805$  S/m;  $\epsilon_r = 38.625$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
 Phantom section: Flat Section  
 Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY Configuration:

Probe: EX3DV4 - SN7536; ConvF(7.82, 7.82, 7.82) @ 2452 MHz; Calibrated: 18/06/21

Modulation Compensation: PMR for UID 10013 - CAB, Calibrated: 18/06/21

Sensor-Surface: 1.4mm (Mechanical Surface Detection),  $z = -4.0, 31.0$

Electronics: DAE4 Sn1584; Calibrated: 09/06/21

Phantom: ELI V8.0 (REAR); Type: QD OVA 004 Ax; Serial: 2102

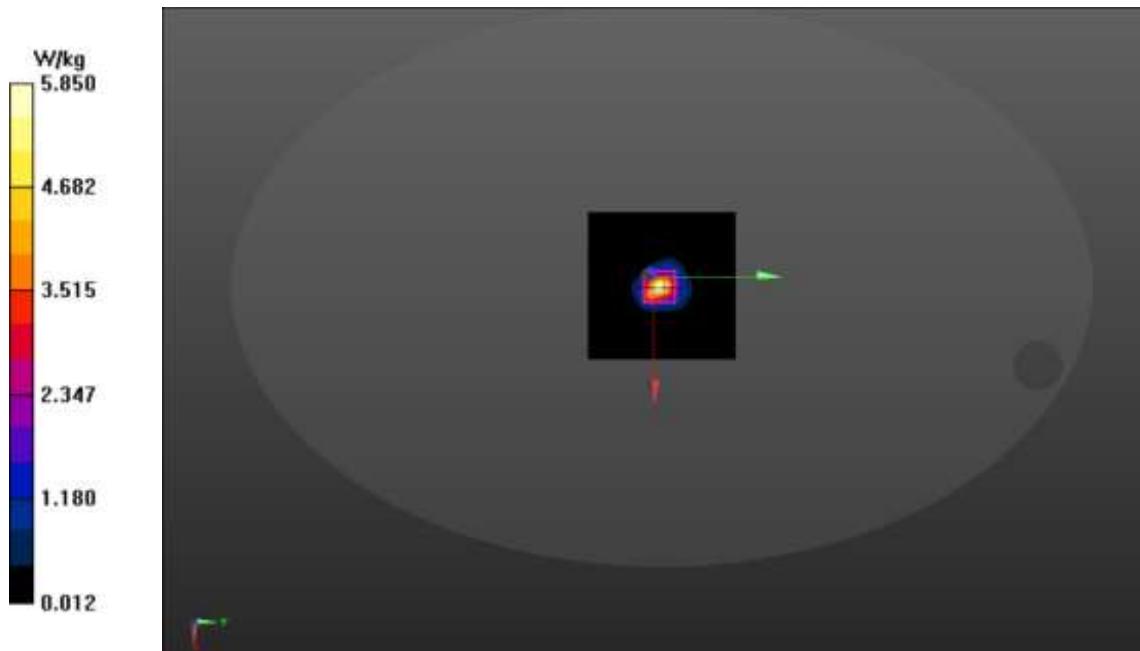
DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

**802.11g/SISO ANTENNA A 20dBm High CH9 -FCC/Area Scan (101x101x1):** Interpolated grid:  $dx=1.000$  mm,  $dy=1.000$  mm

**Info:** Interpolated medium parameters used for SAR evaluation.  
 Maximum value of SAR (interpolated) = 5.90 W/kg

**802.11g/SISO ANTENNA A 20dBm High CH9 -FCC/Zoom Scan 2 (11x11x7)/Cube 0:** Measurement grid:  $dx=3$  mm,  $dy=3$  mm,  $dz=1.4$  mm  
 Reference Value = 58.24 V/m; Power Drift = -0.07 dB  
 Peak SAR (extrapolated) = 11.4 W/kg  
**SAR(1 g) = 3.09 W/kg; SAR(10 g) = 1.23 W/kg** (SAR corrected for target medium)

**Info:** Interpolated medium parameters used for SAR evaluation.  
 Maximum value of SAR (measured) = 5.85 W/kg



**Figure C.7: SAR Head Testing Results for the Atom Hard Hat at 2452 MHz**



Date/Time: 30/09/21 10:27:53

Test Laboratory: TUV SUD

**DUT: Atom Hard Hat**

Communication System: UID 10013 - CAB, IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps); Communication System Band: WLAN 2.4GHz (2412.0 - 2484.0 MHz); Frequency: 2422 MHz; Communication System PAR: 9.458 dB; PMF: 1.19124  
 Medium parameters used (interpolated):  $f = 2422$  MHz;  $\sigma = 1.783$  S/m;  $\epsilon_r = 38.668$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
 Phantom section: Flat Section  
 Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY Configuration:

Probe: EX3DV4 - SN7536; ConvF(7.82, 7.82, 7.82) @ 2422 MHz; Calibrated: 18/06/21

Modulation Compensation: PMR for UID 10013 - CAB, Calibrated: 18/06/21

Sensor-Surface: 1.4mm (Mechanical Surface Detection),  $z = -4.0, 31.0$

Electronics: DAE4 Sn1584; Calibrated: 09/06/21

Phantom: ELI V8.0 (REAR); Type: QD OVA 004 Ax; Serial: 2102

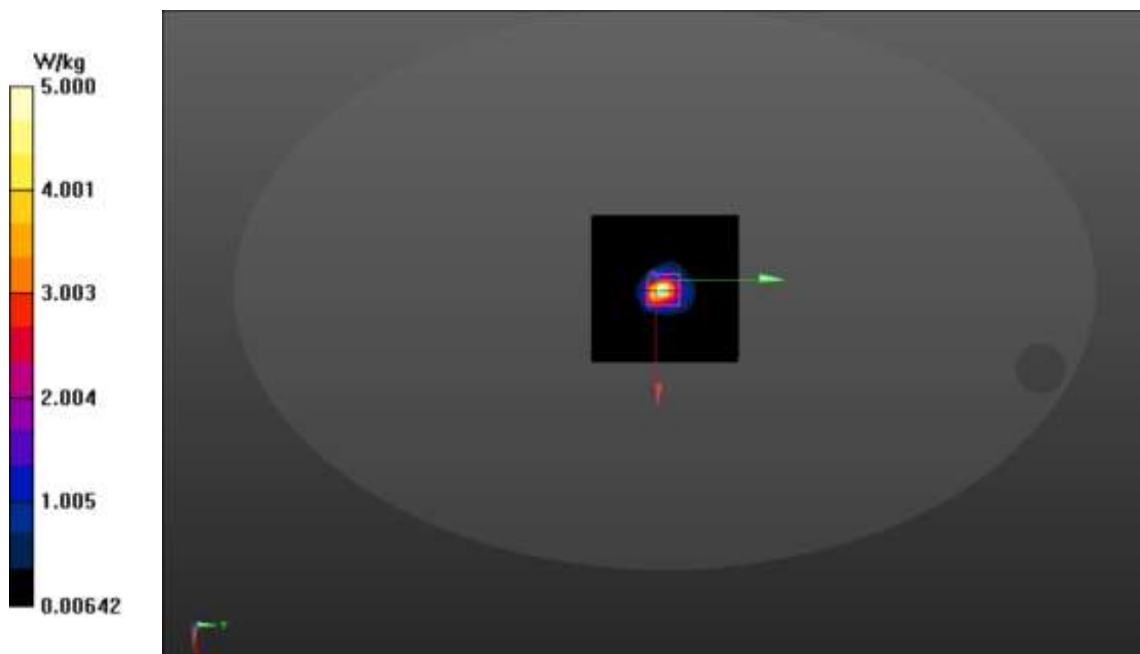
DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

**802.11g/SISO ANTENNA A 20dBm Low CH3 -FCC/Area Scan (101x101x1):** Interpolated grid:  $dx=1.000$  mm,  $dy=1.000$  mm

**Info:** [Interpolated medium parameters used for SAR evaluation.](#)  
 Maximum value of SAR (interpolated) = 5.33 W/kg

**802.11g/SISO ANTENNA A 20dBm Low CH3 -FCC/Zoom Scan (7x7x4)/Cube 0:** Measurement grid:  $dx=5$  mm,  $dy=5$  mm,  $dz=5$  mm  
 Reference Value = 54.99 V/m; Power Drift = -0.03 dB  
 Peak SAR (extrapolated) = 6.90 W/kg  
**SAR(1 g) = 2.62 W/kg; SAR(10 g) = 1.03 W/kg** (SAR corrected for target medium)

**Info:** [Interpolated medium parameters used for SAR evaluation.](#)  
 Maximum value of SAR (measured) = 5.00 W/kg



**Figure C.8: SAR Head Testing Results for the Atom Hard Hat at 2422 MHz**



Date/Time: 30/09/21 10:47:36

Test Laboratory: TUV SUD

**DUT: Atom Hard Hat**

Communication System: UID 10013 - CAB, IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps); Communication System Band: WLAN 2.4GHz (2412.0 - 2484.0 MHz); Frequency: 2437 MHz; Communication System PAR: 9.458 dB; PMF: 1.19124  
 Medium parameters used (interpolated):  $f = 2437$  MHz;  $\sigma = 1.793$  S/m;  $\epsilon_r = 38.647$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
 Phantom section: Flat Section  
 Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY Configuration:

Probe: EX3DV4 - SN7536; ConvF(7.82, 7.82, 7.82) @ 2437 MHz; Calibrated: 18/06/21

Modulation Compensation: PMR for UID 10013 - CAB, Calibrated: 18/06/21

Sensor-Surface: 1.4mm (Mechanical Surface Detection),  $z = -4.0, 31.0$

Electronics: DAE4 Sn1584; Calibrated: 09/06/21

Phantom: ELI V8.0 (REAR); Type: QD OVA 004 Ax; Serial: 2102

DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

**802.11g/SISO ANTENNA A 20dBm Mid CH6- FCC/Area Scan (101x101x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm

**Info:** [Interpolated medium parameters used for SAR evaluation.](#)  
 Maximum value of SAR (interpolated) = 5.60 W/kg

**802.11g/SISO ANTENNA A 20dBm Mid CH6- FCC/Zoom Scan (7x7x4)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm  
 Reference Value = 55.73 V/m; Power Drift = -0.10 dB  
 Peak SAR (extrapolated) = 7.17 W/kg  
**SAR(1 g) = 2.75 W/kg; SAR(10 g) = 1.09 W/kg** (SAR corrected for target medium)

**Info:** [Interpolated medium parameters used for SAR evaluation.](#)  
 Maximum value of SAR (measured) = 5.12 W/kg

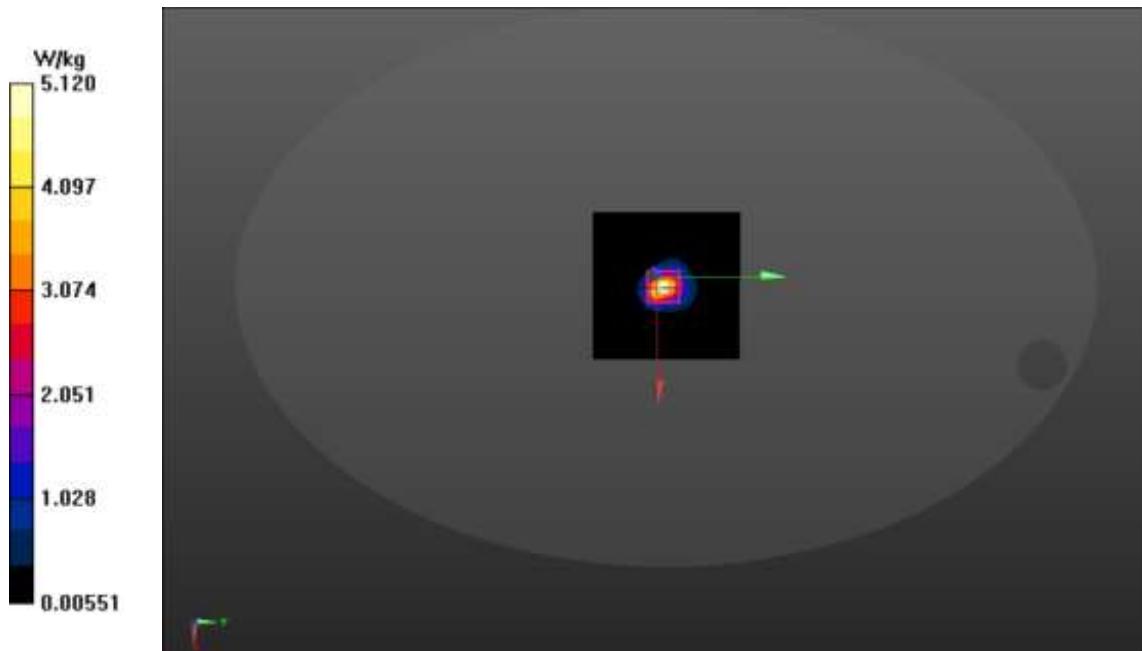


Figure C.9: SAR Head Testing Results for the Atom Hard Hat at 2437 MHz



Date/Time: 30/09/21 14:53:46

Test Laboratory: TUV SUD

**DUT: Atom Hard Hat**

Communication System: UID 10013 - CAB, IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps); Communication System Band: WLAN 2.4GHz (2412.0 - 2484.0 MHz); Frequency: 2437 MHz; Communication System PAR: 9.458 dB; PMF: 1.19124  
 Medium parameters used (interpolated):  $f = 2437$  MHz;  $\sigma = 1.793$  S/m;  $\epsilon_r = 38.647$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
 Phantom section: Flat Section  
 Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY Configuration:

Probe: EX3DV4 - SN7536; ConvF(7.82, 7.82, 7.82) @ 2437 MHz; Calibrated: 18/06/21

Modulation Compensation: PMR for UID 10013 - CAB, Calibrated: 18/06/21

Sensor-Surface: 1.4mm (Mechanical Surface Detection),  $z = -4.0, 31.0$

Electronics: DAE4 Sn1584; Calibrated: 09/06/21

Phantom: ELI V8.0 (REAR); Type: QD OVA 004 Ax; Serial: 2102

DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

**802.11g/SISO ANTENNA B 20dBm Mid CH6- FCC/Area Scan (101x101x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm

**Info:** [Interpolated medium parameters used for SAR evaluation.](#)  
 Maximum value of SAR (interpolated) = 6.50 W/kg

**802.11g/SISO ANTENNA B 20dBm Mid CH6- FCC/Zoom Scan (7x7x4)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm  
 Reference Value = 42.03 V/m; Power Drift = 0.15 dB  
 Peak SAR (extrapolated) = 9.93 W/kg  
**SAR(1 g) = 3.36 W/kg; SAR(10 g) = 1.14 W/kg** (SAR corrected for target medium)

**Info:** [Interpolated medium parameters used for SAR evaluation.](#)  
 Maximum value of SAR (measured) = 6.57 W/kg

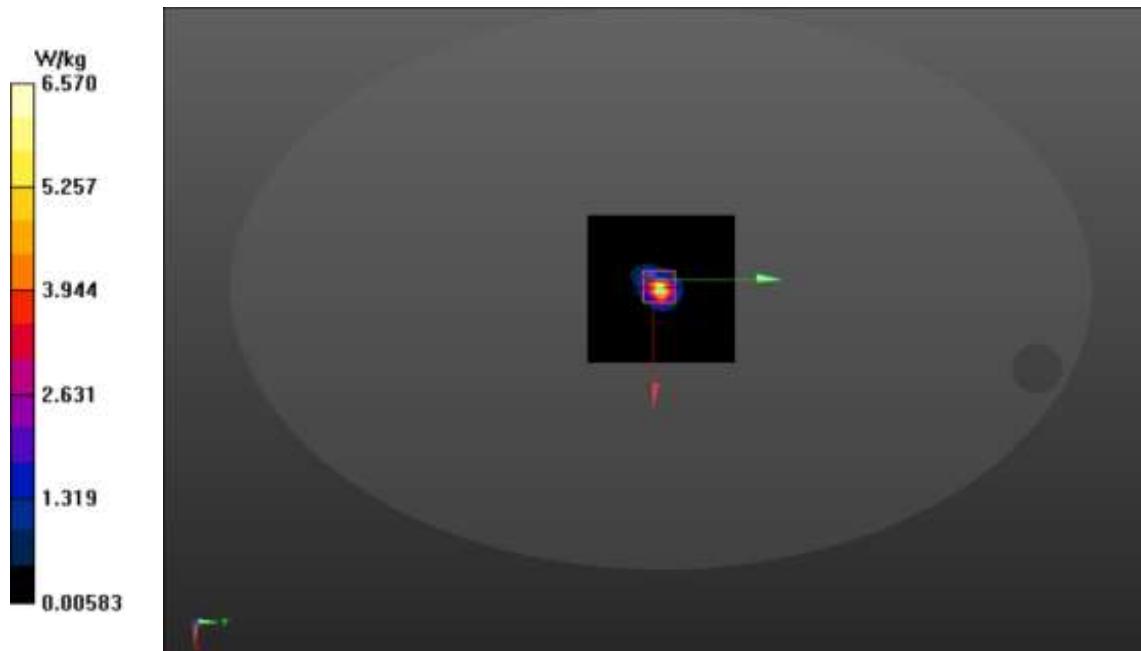


Figure C.10: SAR Head Testing Results for the Atom Hard Hat at 2437 MHz



Date/Time: 30/09/21 15:13:50

Test Laboratory: TUV SUD

**DUT: Atom Hard Hat**

Communication System: UID 10013 - CAB, IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps); Communication System Band: WLAN 2.4GHz (2412.0 - 2484.0 MHz); Frequency: 2452 MHz; Communication System PAR: 9.458 dB; PMF: 1.19124  
 Medium parameters used (interpolated):  $f = 2452$  MHz;  $\sigma = 1.805$  S/m;  $\epsilon_r = 38.625$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
 Phantom section: Flat Section  
 Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY Configuration:

Probe: EX3DV4 - SN7536; ConvF(7.82, 7.82, 7.82) @ 2452 MHz; Calibrated: 18/06/21

Modulation Compensation: PMR for UID 10013 - CAB, Calibrated: 18/06/21

Sensor-Surface: 1.4mm (Mechanical Surface Detection),  $z = 1.0, 31.0$

Electronics: DAE4 Sn1584; Calibrated: 09/06/21

Phantom: ELI V8.0 (REAR); Type: QD OVA 004 Ax; Serial: 2102

DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

**802.11g/SISO ANTENNA B 20dBm High CH9 -FCC/Area Scan (101x101x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm

**Info:** [Interpolated medium parameters used for SAR evaluation.](#)  
 Maximum value of SAR (interpolated) = 7.76 W/kg

**802.11g/SISO ANTENNA B 20dBm High CH9 -FCC/Zoom Scan (7x7x4)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm  
 Reference Value = 49.71 V/m; Power Drift = -0.01 dB  
 Peak SAR (extrapolated) = 11.7 W/kg  
**SAR(1 g) = 3.98 W/kg; SAR(10 g) = 1.36 W/kg** (SAR corrected for target medium)

**Info:** [Interpolated medium parameters used for SAR evaluation.](#)  
 Maximum value of SAR (measured) = 7.78 W/kg

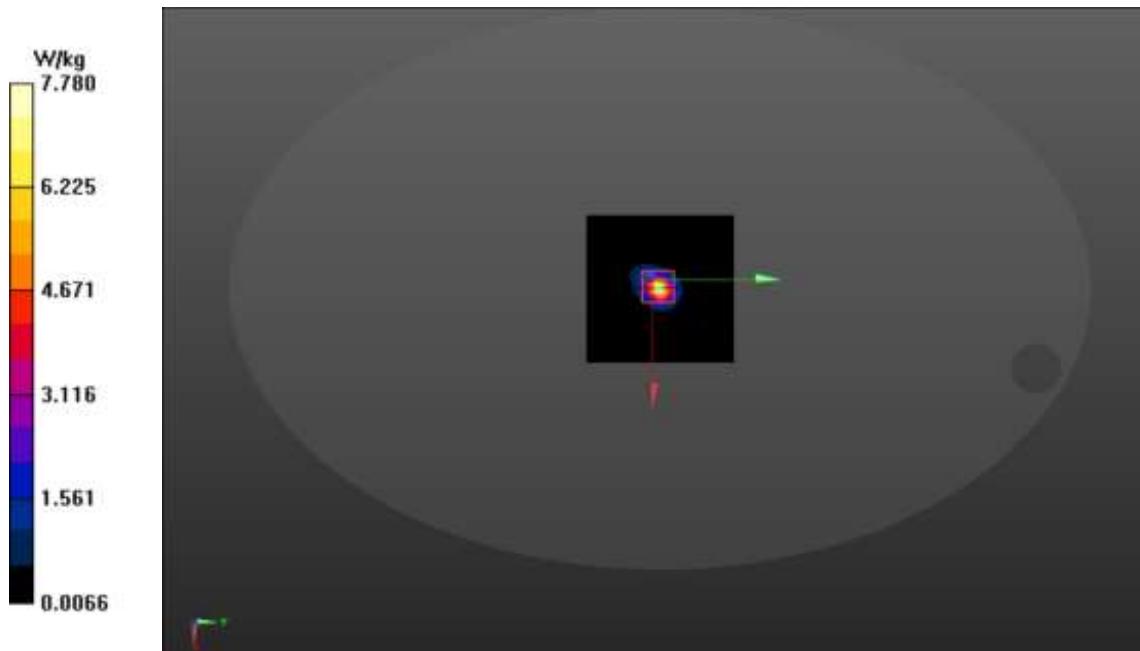


Figure C.11: SAR Head Testing Results for the Atom Hard Hat at 2452 MHz



Date/Time: 30/09/21 13:58:32

Test Laboratory: TUV SUD

**DUT: Atom Hard Hat**

Communication System: UID 10013 - CAB, IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps); Communication System Band: WLAN 2.4GHz (2412.0 - 2484.0 MHz); Frequency: 2422 MHz; Communication System PAR: 9.458 dB; PMF: 1.19124  
 Medium parameters used (interpolated):  $f = 2422$  MHz;  $\sigma = 1.783$  S/m;  $\epsilon_r = 38.668$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
 Phantom section: Flat Section  
 Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY Configuration:

Probe: EX3DV4 - SN7536; ConvF(7.82, 7.82, 7.82) @ 2422 MHz; Calibrated: 18/06/21

Modulation Compensation: PMR for UID 10013 - CAB, Calibrated: 18/06/21

Sensor-Surface: 1.4mm (Mechanical Surface Detection),  $z = -4.0, 31.0$

Electronics: DAE4 Sn1584; Calibrated: 09/06/21

Phantom: ELI V8.0 (REAR); Type: QD OVA 004 Ax; Serial: 2102

DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

**802.11g/SISO ANTENNA B 20dBm Low CH3 -FCC/Area Scan (101x101x1):** Interpolated grid:  $dx=1.000$  mm,  $dy=1.000$  mm

**Info:** [Interpolated medium parameters used for SAR evaluation.](#)  
 Maximum value of SAR (interpolated) = 6.65 W/kg

**802.11g/SISO ANTENNA B 20dBm Low CH3 -FCC/Zoom Scan (11x11x7)/Cube 0:** Measurement grid:  $dx=3$  mm,  $dy=3$  mm,  $dz=1.4$  mm  
 Reference Value = 42.46 V/m; Power Drift = 0.15 dB  
 Peak SAR (extrapolated) = 11.8 W/kg  
**SAR(1 g) = 3.29 W/kg; SAR(10 g) = 1.16 W/kg** (SAR corrected for target medium)

**Info:** [Interpolated medium parameters used for SAR evaluation.](#)  
 Maximum value of SAR (measured) = 6.67 W/kg

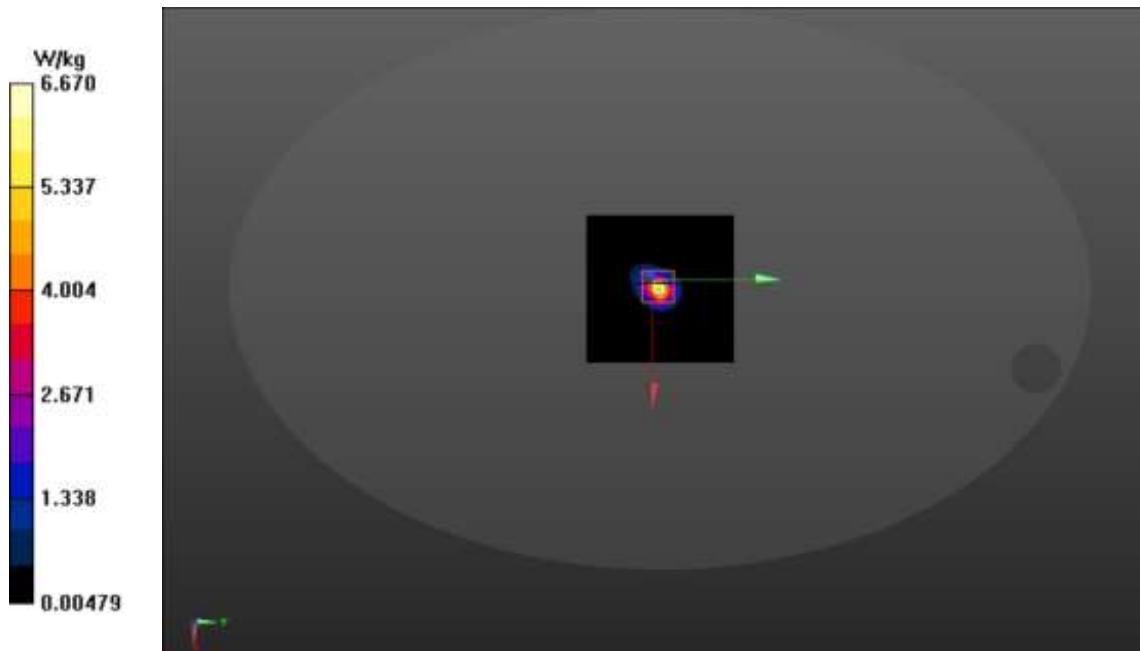


Figure C.12: SAR Head Testing Results for the Atom Hard Hat at 2422 MHz



Date/Time: 30/09/21 12:51:49

Test Laboratory: TUV SUD

**DUT: Atom Hard Hat**

Communication System: UID 10193 - CAC, IEEE 802.11n (HT Greenfield, 6.5 Mbps, BPSK); Communication System Band: WLAN 2.4GHz (2412.0 - 2484.0 MHz); Frequency: 2452 MHz; Communication System PAR: 8.092 dB; PMF: 1.01742  
 Medium parameters used (interpolated):  $f = 2452$  MHz;  $\sigma = 1.805$  S/m;  $\epsilon_r = 38.625$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
 Phantom section: Flat Section  
 Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY Configuration:

Probe: EX3DV4 - SN7536; ConvF(7.82, 7.82, 7.82) @ 2452 MHz; Calibrated: 18/06/21

Modulation Compensation: PMR for UID 10193 - CAC, Calibrated: 18/06/21

Sensor-Surface: 1.4mm (Mechanical Surface Detection),  $z = -4.0, 31.0$

Electronics: DAE4 Sn1584; Calibrated: 09/06/21

Phantom: ELI V8.0 (REAR); Type: QD OVA 004 Ax; Serial: 2102

DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

**802.11n/SISO ANTENNA A 20dBm Mid CH9- FCC/Area Scan (101x101x1):** Interpolated grid:  $dx=1.000$  mm,  $dy=1.000$  mm

**Info:** [Interpolated medium parameters used for SAR evaluation.](#)  
 Maximum value of SAR (interpolated) = 6.40 W/kg

**802.11n/SISO ANTENNA A 20dBm Mid CH9- FCC/Zoom Scan (7x7x4)/Cube 0:** Measurement grid:  $dx=5$ mm,  $dy=5$ mm,  $dz=5$ mm  
 Reference Value = 58.55 V/m; Power Drift = -0.10 dB  
 Peak SAR (extrapolated) = 7.98 W/kg  
**SAR(1 g) = 3.08 W/kg; SAR(10 g) = 1.21 W/kg** (SAR corrected for target medium)

**Info:** [Interpolated medium parameters used for SAR evaluation.](#)  
 Maximum value of SAR (measured) = 5.79 W/kg

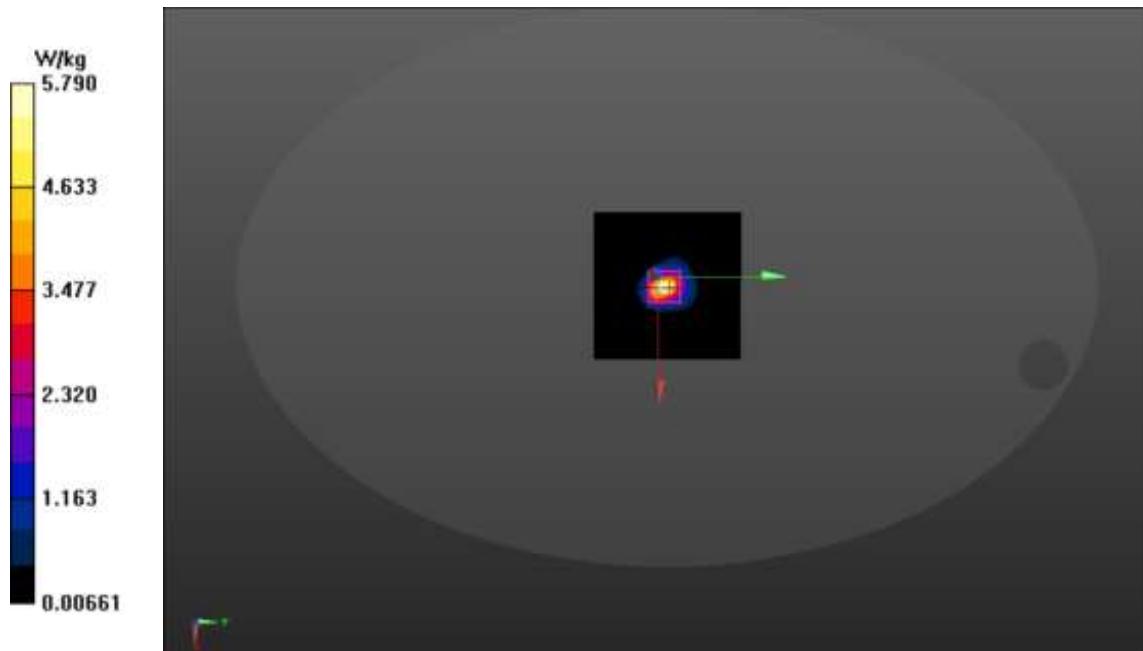


Figure C.13: SAR Head Testing Results for the Atom Hard Hat at 2452 MHz



Date/Time: 30/09/21 12:32:10

Test Laboratory: TUV SUD

**DUT: Atom Hard Hat**

Communication System: UID 10193 - CAC, IEEE 802.11n (HT Greenfield, 6.5 Mbps, BPSK); Communication System Band: WLAN 2.4GHz (2412.0 - 2484.0 MHz); Frequency: 2437 MHz; Communication System PAR: 8.092 dB; PMF: 1.01742  
 Medium parameters used (interpolated):  $f = 2437 \text{ MHz}$ ;  $\sigma = 1.793 \text{ S/m}$ ;  $\epsilon_r = 38.647$ ;  $\rho = 1000 \text{ kg/m}^3$   
 Phantom section: Flat Section  
 Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY Configuration:

Probe: EX3DV4 - SN7536; ConvF(7.82, 7.82, 7.82) @ 2437 MHz; Calibrated: 18/06/21

Modulation Compensation: PMR for UID 10193 - CAC, Calibrated: 18/06/21

Sensor-Surface: 1.4mm (Mechanical Surface Detection),  $z = -4.0, 31.0$

Electronics: DAE4 Sn1584; Calibrated: 09/06/21

Phantom: ELI V8.0 (REAR); Type: QD OVA 004 Ax; Serial: 2102

DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

**802.11n/SISO ANTENNA A 20dBm Mid CH6- FCC/Area Scan (101x101x1):** Interpolated grid:  $dx=1.000 \text{ mm}$ ,  $dy=1.000 \text{ mm}$

**Info:** [Interpolated medium parameters used for SAR evaluation.](#)  
 Maximum value of SAR (interpolated) = 5.57 W/kg

**802.11n/SISO ANTENNA A 20dBm Mid CH6- FCC/Zoom Scan (7x7x4)/Cube 0:** Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$   
 Reference Value = 55.61 V/m; Power Drift = 0.04 dB  
 Peak SAR (extrapolated) = 7.10 W/kg  
**SAR(1 g) = 2.73 W/kg; SAR(10 g) = 1.08 W/kg** (SAR corrected for target medium)

**Info:** [Interpolated medium parameters used for SAR evaluation.](#)  
 Maximum value of SAR (measured) = 5.07 W/kg

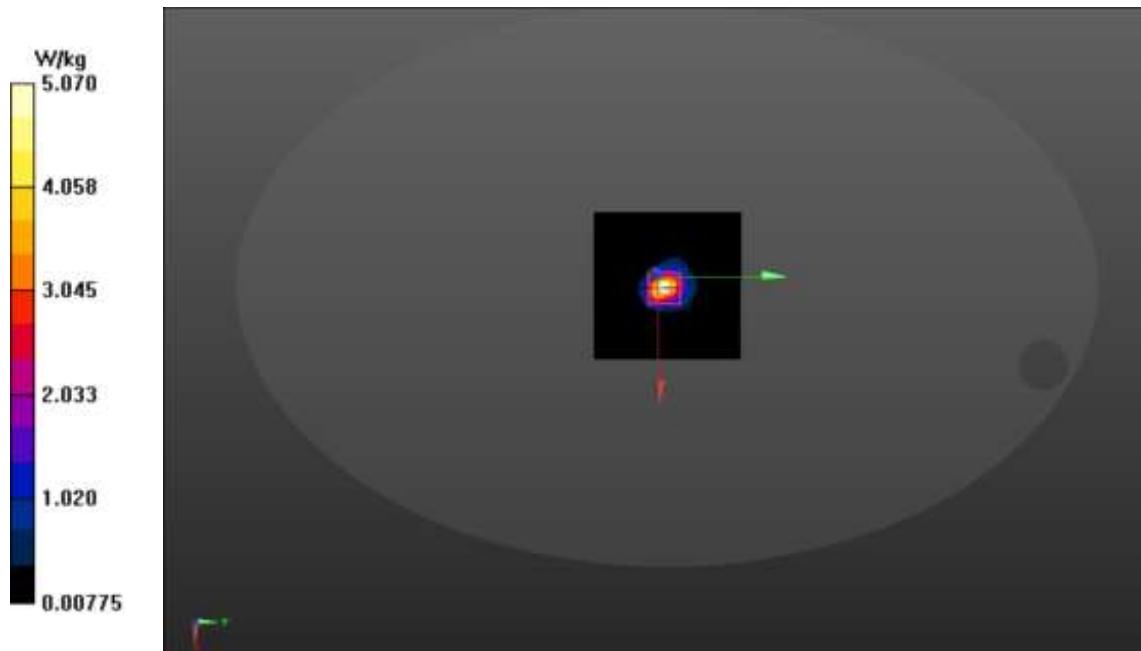


Figure C.14: SAR Head Testing Results for the Atom Hard Hat at 2437 MHz



Date/Time: 30/09/21 12:12:28

Test Laboratory: TUV SUD

**DUT: Atom Hard Hat**

Communication System: UID 10193 - CAC, IEEE 802.11n (HT Greenfield, 6.5 Mbps, BPSK); Communication System Band: WLAN 2.4GHz (2412.0 - 2484.0 MHz); Frequency: 2422 MHz; Communication System PAR: 8.092 dB; PMF: 1.01742  
 Medium parameters used (interpolated):  $f = 2422$  MHz;  $\sigma = 1.783$  S/m;  $\epsilon_r = 38.668$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
 Phantom section: Flat Section  
 Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY Configuration:

Probe: EX3DV4 - SN7536; ConvF(7.82, 7.82, 7.82) @ 2422 MHz; Calibrated: 18/06/21

Modulation Compensation: PMR for UID 10193 - CAC, Calibrated: 18/06/21

Sensor-Surface: 1.4mm (Mechanical Surface Detection),  $z = -4.0, 31.0$

Electronics: DAE4 Sn1584; Calibrated: 09/06/21

Phantom: ELI V8.0 (REAR); Type: QD OVA 004 Ax; Serial: 2102

DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

**802.11n/SISO ANTENNA A 20dBm Mid CH3- FCC/Area Scan (101x101x1):** Interpolated grid:  $dx=1.000$  mm,  $dy=1.000$  mm

**Info:** [Interpolated medium parameters used for SAR evaluation.](#)  
 Maximum value of SAR (interpolated) = 5.01 W/kg

**802.11n/SISO ANTENNA A 20dBm Mid CH3- FCC/Zoom Scan (7x7x4)/Cube 0:** Measurement grid:  $dx=5$  mm,  $dy=5$  mm,  $dz=5$  mm  
 Reference Value = 53.73 V/m; Power Drift = -0.08 dB  
 Peak SAR (extrapolated) = 6.59 W/kg  
**SAR(1 g) = 2.5 W/kg; SAR(10 g) = 0.984 W/kg** (SAR corrected for target medium)

**Info:** [Interpolated medium parameters used for SAR evaluation.](#)  
 Maximum value of SAR (measured) = 4.74 W/kg

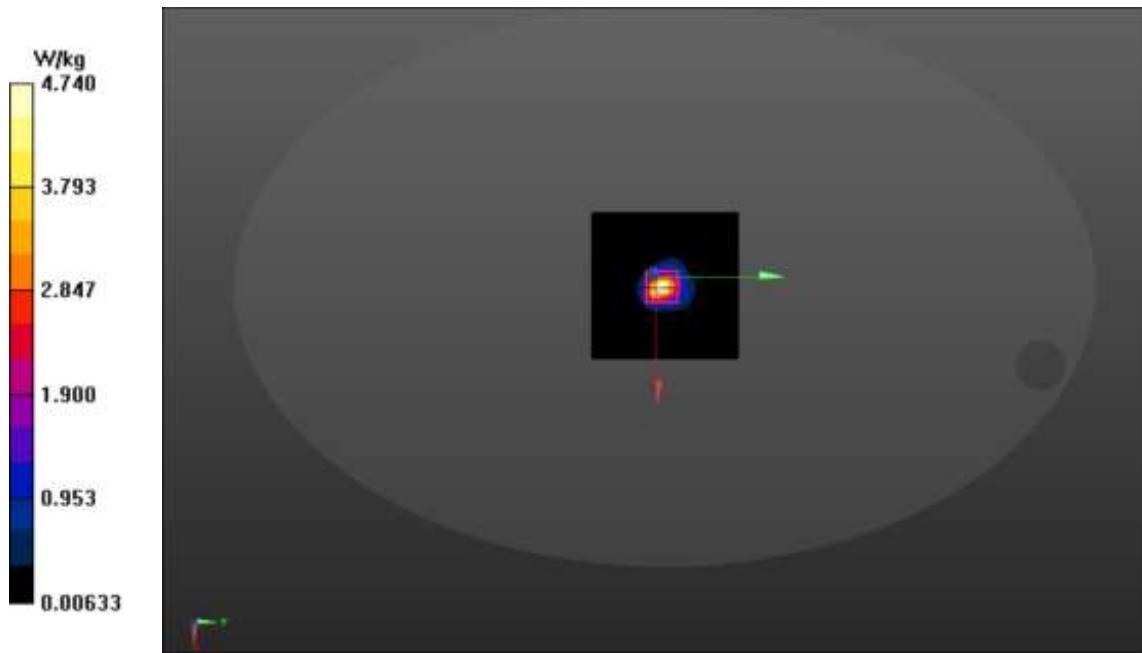


Figure C.15: SAR Head Testing Results for the Atom Hard Hat at 2422 MHz



Date/Time: 30/09/21 16:17:32

Test Laboratory: TUV SUD

**DUT: Atom Hard Hat**

Communication System: UID 10193 - CAC, IEEE 802.11n (HT Greenfield, 6.5 Mbps, BPSK); Communication System Band: WLAN 2.4GHz (2412.0 - 2484.0 MHz); Frequency: 2452 MHz; Communication System PAR: 8.092 dB; PMF: 1.01742  
 Medium parameters used (interpolated):  $f = 2452$  MHz;  $\sigma = 1.805$  S/m;  $\epsilon_r = 38.625$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
 Phantom section: Flat Section  
 Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY Configuration:

Probe: EX3DV4 - SN7536; ConvF(7.82, 7.82, 7.82) @ 2452 MHz; Calibrated: 18/06/21

Modulation Compensation: PMR for UID 10193 - CAC, Calibrated: 18/06/21

Sensor-Surface: 1.4mm (Mechanical Surface Detection),  $z = -4.0, 31.0$

Electronics: DAE4 Sn1584; Calibrated: 09/06/21

Phantom: ELI V8.0 (REAR); Type: QD OVA 004 Ax; Serial: 2102

DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

**802.11n/SISO ANTENNA B 20dBm Mid CH9- FCC/Area Scan (101x101x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm

**Info: Interpolated medium parameters used for SAR evaluation.**  
 Maximum value of SAR (interpolated) = 7.51 W/kg

**802.11n/SISO ANTENNA B 20dBm Mid CH9- FCC/Zoom Scan (7x7x4)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm  
 Reference Value = 49.22 V/m; Power Drift = 0.01 dB  
 Peak SAR (extrapolated) = 11.4 W/kg  
**SAR(1 g) = 3.95 W/kg; SAR(10 g) = 1.35 W/kg** (SAR corrected for target medium)

**Info: Interpolated medium parameters used for SAR evaluation.**  
 Maximum value of SAR (measured) = 7.48 W/kg

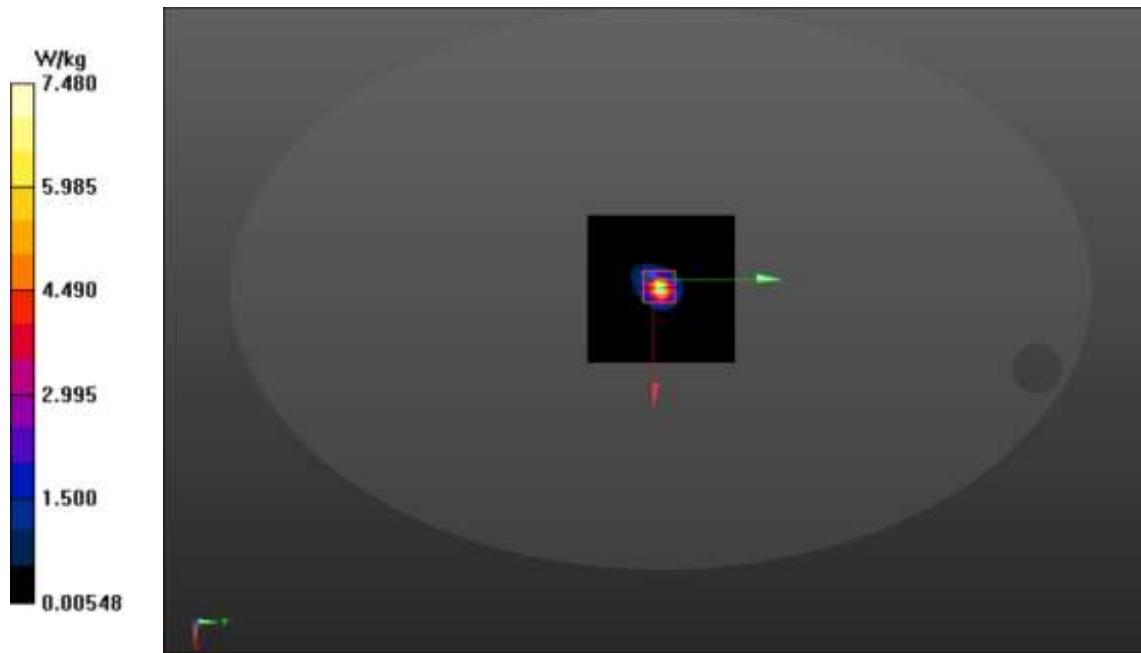


Figure C.16: SAR Head Testing Results for the Atom Hard Hat at 2452 MHz



Date/Time: 30/09/21 15:56:54

Test Laboratory: TUV SUD

**DUT: Atom Hard Hat**

Communication System: UID 10193 - CAC, IEEE 802.11n (HT Greenfield, 6.5 Mbps, BPSK); Communication System Band: WLAN 2.4GHz (2412.0 - 2484.0 MHz); Frequency: 2437 MHz; Communication System PAR: 8.092 dB; PMF: 1.01742  
 Medium parameters used (interpolated):  $f = 2437$  MHz;  $\sigma = 1.793$  S/m;  $\epsilon_r = 38.647$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
 Phantom section: Flat Section  
 Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY Configuration:

Probe: EX3DV4 - SN7536; ConvF(7.82, 7.82, 7.82) @ 2437 MHz; Calibrated: 18/06/21

Modulation Compensation: PMR for UID 10193 - CAC, Calibrated: 18/06/21

Sensor-Surface: 1.4mm (Mechanical Surface Detection),  $z = -4.0, 31.0$

Electronics: DAE4 Sn1584; Calibrated: 09/06/21

Phantom: ELI V8.0 (REAR); Type: QD OVA 004 Ax; Serial: 2102

DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

**802.11n/SISO ANTENNA B 20dBm Mid CH6- FCC/Area Scan (101x101x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm

**Info: Interpolated medium parameters used for SAR evaluation.**  
 Maximum value of SAR (interpolated) = 6.56 W/kg

**802.11n/SISO ANTENNA B 20dBm Mid CH6- FCC/Zoom Scan (7x7x4)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm  
 Reference Value = 42.14 V/m; Power Drift = 0.16 dB  
 Peak SAR (extrapolated) = 9.78 W/kg  
**SAR(1 g) = 3.43 W/kg; SAR(10 g) = 1.17 W/kg** (SAR corrected for target medium)

**Info: Interpolated medium parameters used for SAR evaluation.**  
 Maximum value of SAR (measured) = 6.71 W/kg

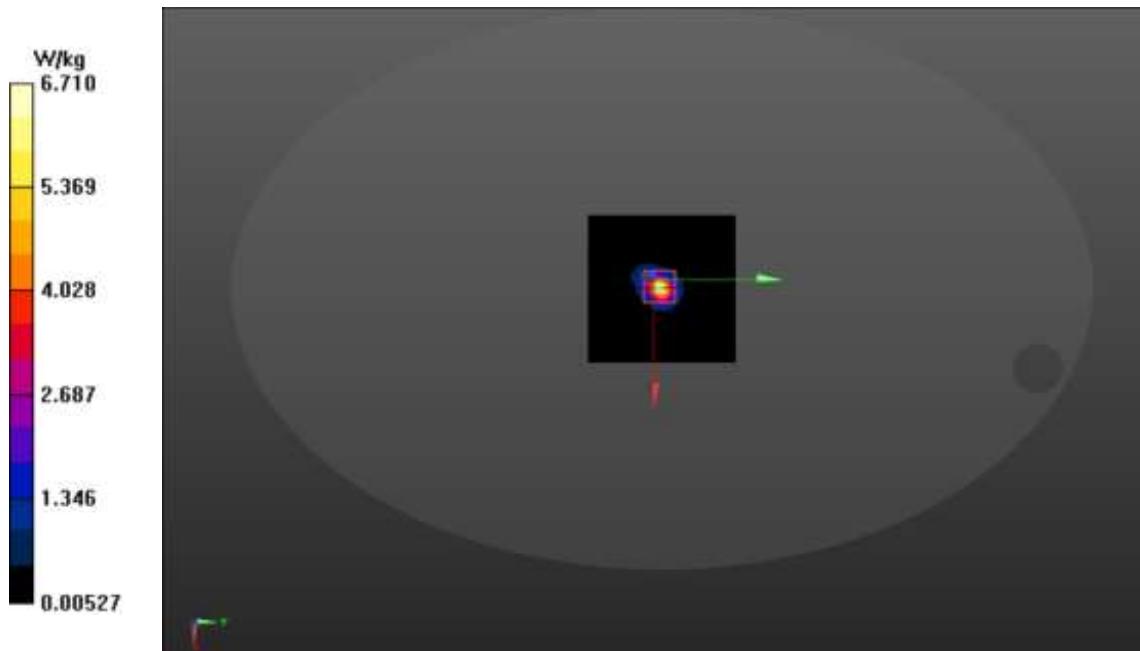


Figure C.17: SAR Head Testing Results for the Atom Hard Hat at 2437 MHz



Date/Time: 30/09/21 15:36:51

Test Laboratory: TUV SUD

**DUT: Atom Hard Hat**

Communication System: UID 10193 - CAC, IEEE 802.11n (HT Greenfield, 6.5 Mbps, BPSK); Communication System Band: WLAN 2.4GHz (2412.0 - 2484.0 MHz); Frequency: 2422 MHz; Communication System PAR: 8.092 dB; PMF: 1.01742  
 Medium parameters used (interpolated):  $f = 2422$  MHz;  $\sigma = 1.783$  S/m;  $\epsilon_r = 38.668$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
 Phantom section: Flat Section  
 Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY Configuration:

Probe: EX3DV4 - SN7536; ConvF(7.82, 7.82, 7.82) @ 2422 MHz; Calibrated: 18/06/21

Modulation Compensation: PMR for UID 10193 - CAC, Calibrated: 18/06/21

Sensor-Surface: 1.4mm (Mechanical Surface Detection),  $z = -4.0, 31.0$

Electronics: DAE4 Sn1584; Calibrated: 09/06/21

Phantom: ELI V8.0 (REAR); Type: QD OVA 004 Ax; Serial: 2102

DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

**802.11n/SISO ANTENNA B 20dBm Mid CH3- FCC/Area Scan (101x101x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm

**Info:** [Interpolated medium parameters used for SAR evaluation.](#)  
 Maximum value of SAR (interpolated) = 6.87 W/kg

**802.11n/SISO ANTENNA B 20dBm Mid CH3- FCC/Zoom Scan (7x7x4)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm  
 Reference Value = 43.59 V/m; Power Drift = 0.16 dB  
 Peak SAR (extrapolated) = 10.1 W/kg  
**SAR(1 g) = 3.59 W/kg; SAR(10 g) = 1.24 W/kg** (SAR corrected for target medium)

**Info:** [Interpolated medium parameters used for SAR evaluation.](#)  
 Maximum value of SAR (measured) = 7.02 W/kg

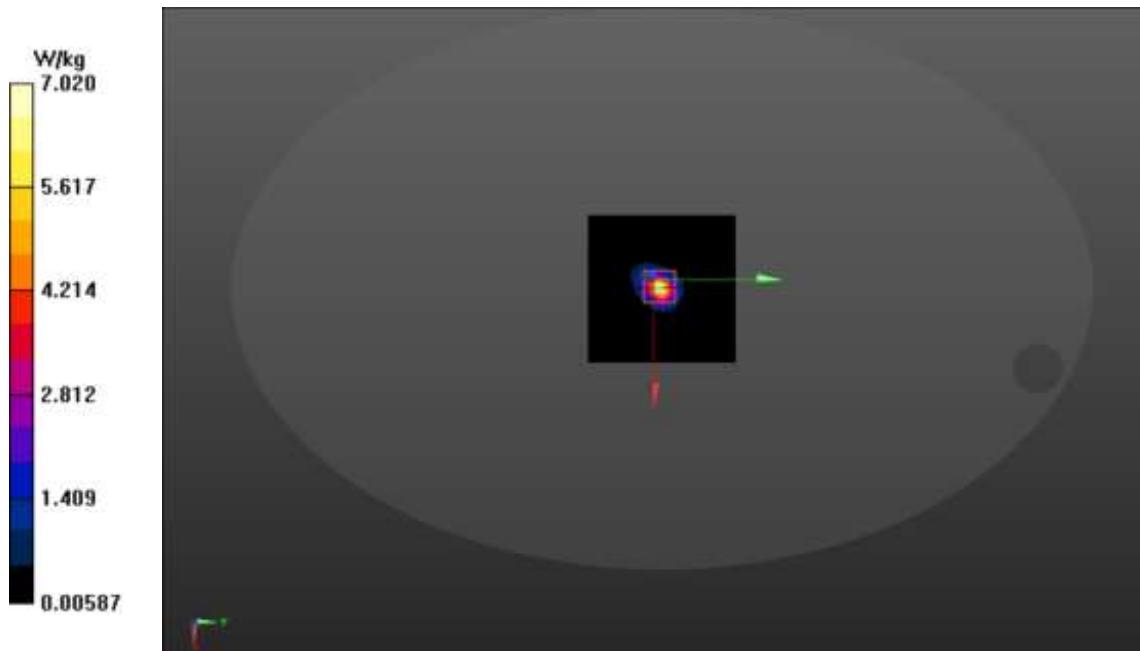


Figure C.18: SAR Head Testing Results for the Atom Hard Hat at 2422 MHz



Date/Time: 01/10/21 10:11:27

Test Laboratory: TUV SUD

**DUT: Atom Hard Hat**

Communication System: UID 10013 - CAB, IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps); Communication System Band: WLAN 2.4GHz (2412.0 - 2484.0 MHz); Frequency: 2437 MHz; Communication System PAR: 9.458 dB; PMF: 1.19124  
 Medium parameters used (interpolated):  $f = 2437$  MHz;  $\sigma = 1.793$  S/m;  $\epsilon_r = 38.647$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
 Phantom section: Flat Section  
 Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY Configuration:

Probe: EX3DV4 - SN7536; ConvF(7.82, 7.82, 7.82) @ 2437 MHz; Calibrated: 18/06/21

Modulation Compensation: PMR for UID 10013 - CAB, Calibrated: 18/06/21

Sensor-Surface: 1.4mm (Mechanical Surface Detection),  $z = -4.0, 31.0$

Electronics: DAE4 Sn1584; Calibrated: 09/06/21

Phantom: ELI V8.0 (REAR); Type: QD OVA 004 Ax; Serial: 2102

DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

**MIMO Mode Ant A/MIMO (Ant A) 17dBm Low CH6/Area Scan (101x101x1):** Interpolated grid:  $dx=1.000$  mm,  $dy=1.000$  mm

**Info:** [Interpolated medium parameters used for SAR evaluation.](#)  
 Maximum value of SAR (interpolated) = 3.44 W/kg

**MIMO Mode Ant A/MIMO (Ant A) 17dBm Low CH6/Zoom Scan (7x7x4)/Cube 0:** Measurement grid:  $dx=5$  mm,  $dy=5$  mm,  $dz=5$  mm  
 Reference Value = 32.19 V/m; Power Drift = -0.07 dB  
 Peak SAR (extrapolated) = 4.75 W/kg  
**SAR(1 g) = 1.79 W/kg; SAR(10 g) = 0.714 W/kg** (SAR corrected for target medium)

**Info:** [Interpolated medium parameters used for SAR evaluation.](#)  
 Maximum value of SAR (measured) = 3.48 W/kg

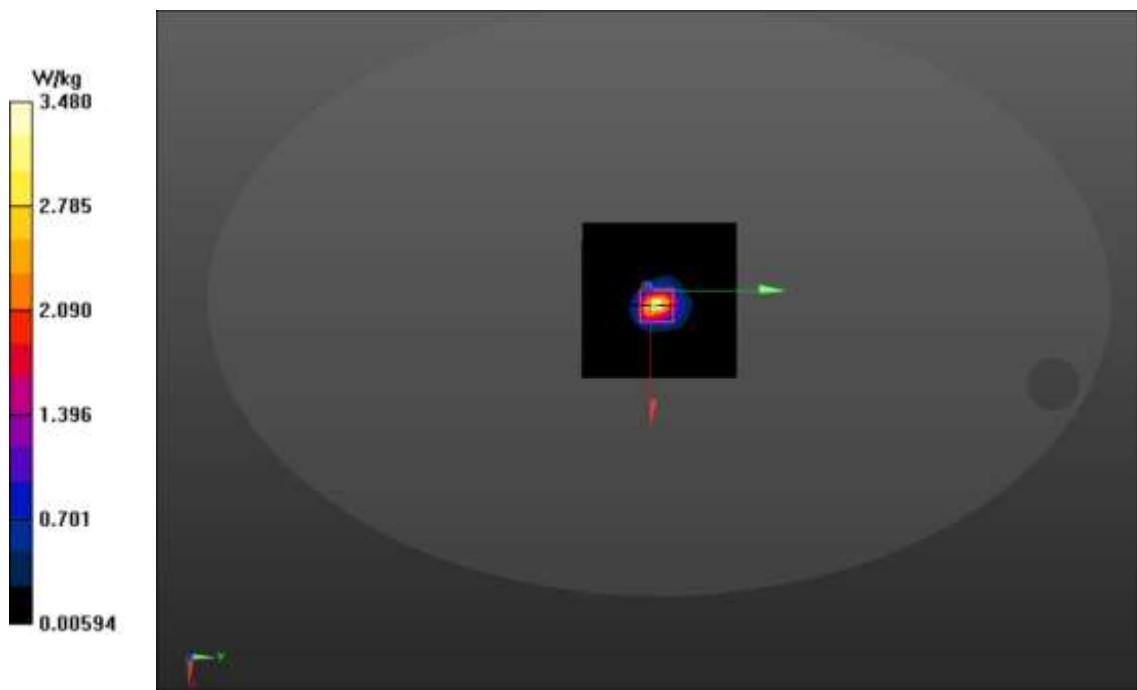


Figure C.19: SAR Head Testing Results for the Atom Hard Hat at 2437 MHz



Date/Time: 01/10/21 10:29:53

Test Laboratory: TUV SUD

**DUT: Atom Hard Hat**

Communication System: UID 10013 - CAB, IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps); Communication System Band: WLAN 2.4GHz (2412.0 - 2484.0 MHz); Frequency: 2452 MHz; Communication System PAR: 9.458 dB; PMF: 1.19124  
 Medium parameters used (interpolated):  $f = 2452$  MHz;  $\sigma = 1.805$  S/m;  $\epsilon_r = 38.625$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
 Phantom section: Flat Section  
 Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY Configuration:

Probe: EX3DV4 - SN7536; ConvF(7.82, 7.82, 7.82) @ 2452 MHz; Calibrated: 18/06/21

Modulation Compensation: PMR for UID 10013 - CAB, Calibrated: 18/06/21

Sensor-Surface: 1.4mm (Mechanical Surface Detection),  $z = -4.0, 31.0$

Electronics: DAE4 Sn1584; Calibrated: 09/06/21

Phantom: ELI V8.0 (REAR); Type: QD OVA 004 Ax; Serial: 2102

DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

**MIMO Mode Ant A/MIMO (Ant A) 17dBm Low CH9/Area Scan (101x101x1):** Interpolated grid:  $dx=1.000$  mm,  $dy=1.000$  mm

**Info:** [Interpolated medium parameters used for SAR evaluation.](#)  
 Maximum value of SAR (interpolated) = 3.55 W/kg

**MIMO Mode Ant A/MIMO (Ant A) 17dBm Low CH9/Zoom Scan (7x7x4)/Cube 0:** Measurement grid:  $dx=5$  mm,  $dy=5$  mm,  $dz=5$  mm  
 Reference Value = 32.08 V/m; Power Drift = -0.06 dB  
 Peak SAR (extrapolated) = 4.80 W/kg  
**SAR(1 g) = 1.81 W/kg; SAR(10 g) = 0.723 W/kg** (SAR corrected for target medium)

**Info:** [Interpolated medium parameters used for SAR evaluation.](#)  
 Maximum value of SAR (measured) = 3.54 W/kg

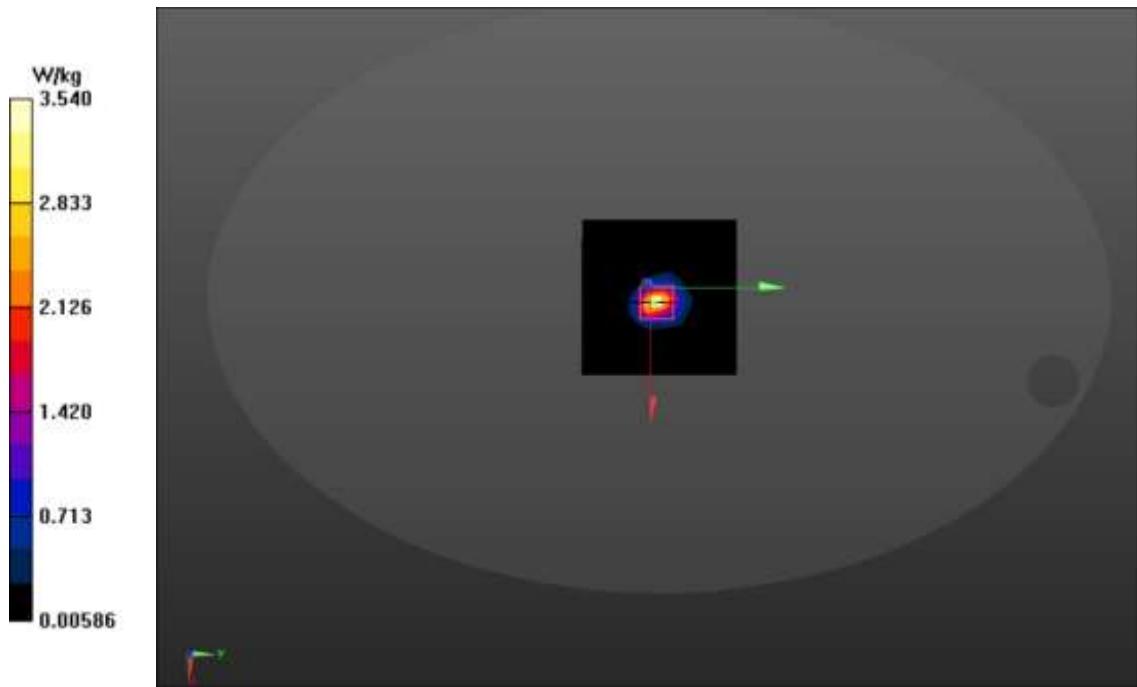


Figure C.20: SAR Head Testing Results for the Atom Hard Hat at 2452 MHz



Date/Time: 01/10/21 09:52:16

Test Laboratory: TUV SUD

Extremity - helmet

**DUT: Atom Hard Hat**

Communication System: UID 10013 - CAB, IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps); Communication System Band: WLAN 2.4GHz (2412.0 - 2484.0 MHz); Frequency: 2422 MHz; Communication System PAR: 9.458 dB; PMF: 1.19124  
 Medium parameters used (interpolated):  $f = 2422$  MHz;  $\sigma = 1.783$  S/m;  $\epsilon_r = 38.668$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
 Phantom section: Flat Section  
 Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY Configuration:

Probe: EX3DV4 - SN7536; ConvF(7.82, 7.82, 7.82) @ 2422 MHz; Calibrated: 18/06/21

Modulation Compensation: PMR for UID 10013 - CAB, Calibrated: 18/06/21

Sensor-Surface: 1.4mm (Mechanical Surface Detection),  $z = -4.0, 31.0$

Electronics: DAE4 Sn1584; Calibrated: 09/06/21

Phantom: ELI V8.0 (REAR); Type: QD OVA 004 Ax; Serial: 2102

DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

**MIMO Mode Ant A/MIMO (Ant A) 17dBm Low CH3/Area Scan (101x101x1):** Interpolated grid:  $dx=1.000$  mm,  $dy=1.000$  mm

**Info:** Interpolated medium parameters used for SAR evaluation.

Maximum value of SAR (interpolated) = 3.47 W/kg

**MIMO Mode Ant A/MIMO (Ant A) 17dBm Low CH3/Zoom Scan (7x7x4)/Cube 0:** Measurement grid:  $dx=5$  mm,  $dy=5$  mm,  $dz=5$  mm

Reference Value = 32.50 V/m; Power Drift = -0.12 dB

Peak SAR (extrapolated) = 4.66 W/kg

**SAR(1 g) = 1.77 W/kg; SAR(10 g) = 0.706 W/kg** (SAR corrected for target medium)

**Info:** Interpolated medium parameters used for SAR evaluation.

Maximum value of SAR (measured) = 3.45 W/kg

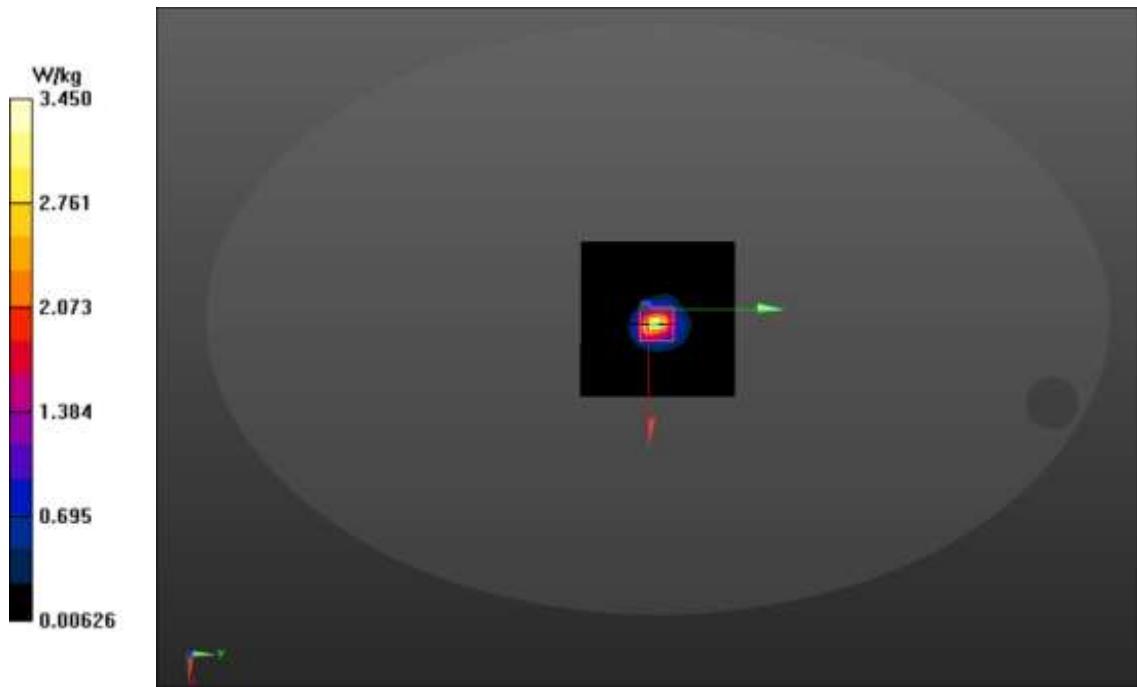


Figure C.21: SAR Head Testing Results for the Atom Hard Hat at 2422 MHz



Date/Time: 01/10/21 11:42:10

Test Laboratory: TUV SUD

Extremity - helmet

**DUT: Atom Hard Hat**

Communication System: UID 10013 - CAB, IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps); Communication System Band: WLAN 2.4GHz (2412.0 - 2484.0 MHz); Frequency: 2437 MHz; Communication System PAR: 9.458 dB; PMF: 1.19124  
 Medium parameters used (interpolated):  $f = 2437$  MHz;  $\sigma = 1.793$  S/m;  $\epsilon_r = 38.647$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
 Phantom section: Flat Section  
 Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY Configuration:

Probe: EX3DV4 - SN7536; ConvF(7.82, 7.82, 7.82) @ 2437 MHz; Calibrated: 18/06/21

Modulation Compensation: PMR for UID 10013 - CAB, Calibrated: 18/06/21

Sensor-Surface: 1.4mm (Mechanical Surface Detection),  $z = -4.0, 31.0$

Electronics: DAE4 Sn1584; Calibrated: 09/06/21

Phantom: ELI V8.0 (REAR); Type: QD OVA 004 Ax; Serial: 2102

DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

**MIMO Mode Ant B/MIMO (Ant B) 17dBm Low CH6/Area Scan (101x101x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm

**Info: Interpolated medium parameters used for SAR evaluation.**

Maximum value of SAR (interpolated) = 3.95 W/kg

**MIMO Mode Ant B/MIMO (Ant B) 17dBm Low CH6/Zoom Scan (7x7x4)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 33.16 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 5.42 W/kg

**SAR(1 g) = 1.9 W/kg; SAR(10 g) = 0.682 W/kg** (SAR corrected for target medium)

**Info: Interpolated medium parameters used for SAR evaluation.**

Maximum value of SAR (measured) = 3.96 W/kg

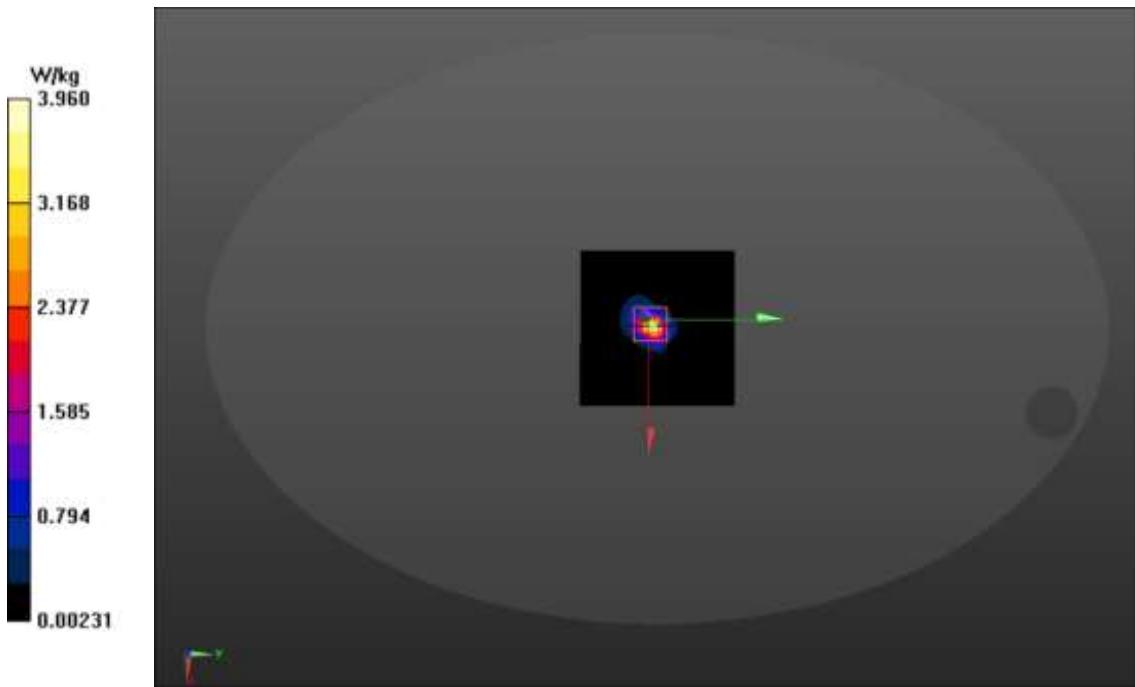


Figure C.22: SAR Head Testing Results for the Atom Hard Hat at 2437 MHz



Date/Time: 01/10/21 11:12:29

Test Laboratory: TUV SUD

Extremity - helmet

**DUT: Atom Hard Hat**

Communication System: UID 10013 - CAB, IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps); Communication System Band: WLAN 2.4GHz (2412.0 - 2484.0 MHz); Frequency: 2422 MHz; Communication System PAR: 9.458 dB; PMF: 1.19124  
 Medium parameters used (interpolated):  $f = 2422$  MHz;  $\sigma = 1.783$  S/m;  $\epsilon_r = 38.668$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
 Phantom section: Flat Section  
 Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY Configuration:

Probe: EX3DV4 - SN7536; ConvF(7.82, 7.82, 7.82) @ 2422 MHz; Calibrated: 18/06/21

Modulation Compensation: PMR for UID 10013 - CAB, Calibrated: 18/06/21

Sensor-Surface: 1.4mm (Mechanical Surface Detection),  $z = -4.0, 31.0$

Electronics: DAE4 Sn1584; Calibrated: 09/06/21

Phantom: ELI V8.0 (REAR); Type: QD OVA 004 Ax; Serial: 2102

DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

**MIMO Mode Ant B/MIMO (Ant B) 17dBm Low CH3/Area Scan (101x101x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm

**Info: Interpolated medium parameters used for SAR evaluation.**

Maximum value of SAR (interpolated) = 3.92 W/kg

**MIMO Mode Ant B/MIMO (Ant B) 17dBm Low CH3/Zoom Scan (7x7x4)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 33.71 V/m; Power Drift = -0.14 dB

Peak SAR (extrapolated) = 5.56 W/kg

**SAR(1 g) = 1.95 W/kg; SAR(10 g) = 0.699 W/kg** (SAR corrected for target medium)

**Info: Interpolated medium parameters used for SAR evaluation.**

Maximum value of SAR (measured) = 3.97 W/kg

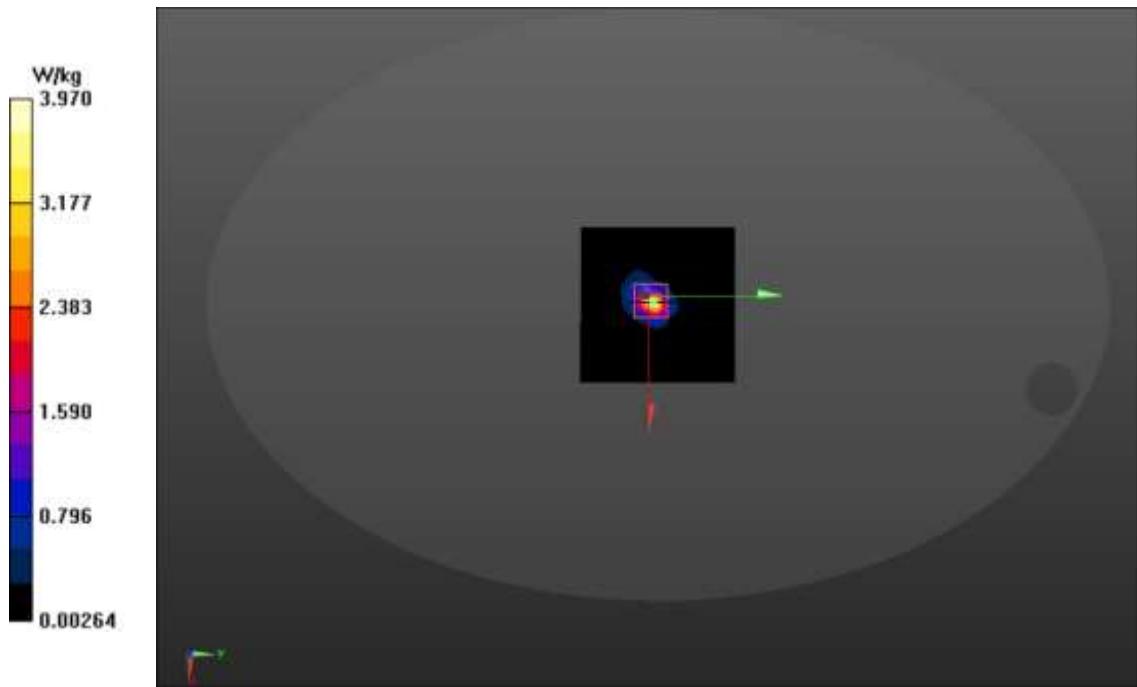


Figure C.23: SAR Head Testing Results for the Atom Hard Hat at 2422 MHz



Date/Time: 01/10/21 12:00:48

Test Laboratory: TUV SUD

Extremity - helmet

**DUT: Atom Hard Hat**

Communication System: UID 10013 - CAB, IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps); Communication System Band: WLAN 2.4GHz (2412.0 - 2484.0 MHz); Frequency: 2452 MHz; Communication System PAR: 9.458 dB; PMF: 1.19124  
 Medium parameters used (interpolated):  $f = 2452$  MHz;  $\sigma = 1.805$  S/m;  $\epsilon_r = 38.625$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
 Phantom section: Flat Section  
 Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY Configuration:

Probe: EX3DV4 - SN7536; ConvF(7.82, 7.82, 7.82) @ 2452 MHz; Calibrated: 18/06/21

Modulation Compensation: PMR for UID 10013 - CAB, Calibrated: 18/06/21

Sensor-Surface: 1.4mm (Mechanical Surface Detection),  $z = -4.0, 31.0$

Electronics: DAE4 Sn1584; Calibrated: 09/06/21

Phantom: ELI V8.0 (REAR); Type: QD OVA 004 Ax; Serial: 2102

DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

**MIMO Mode Ant B/MIMO (Ant B) 17dBm Low CH9/Area Scan (101x101x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm

**Info: Interpolated medium parameters used for SAR evaluation.**

Maximum value of SAR (interpolated) = 4.01 W/kg

**MIMO Mode Ant B/MIMO (Ant B) 17dBm Low CH9/Zoom Scan (7x7x4)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 33.26 V/m; Power Drift = -0.07 dB

Peak SAR (extrapolated) = 5.42 W/kg

**SAR(1 g) = 1.89 W/kg; SAR(10 g) = 0.673 W/kg** (SAR corrected for target medium)

**Info: Interpolated medium parameters used for SAR evaluation.**

Maximum value of SAR (measured) = 3.82 W/kg

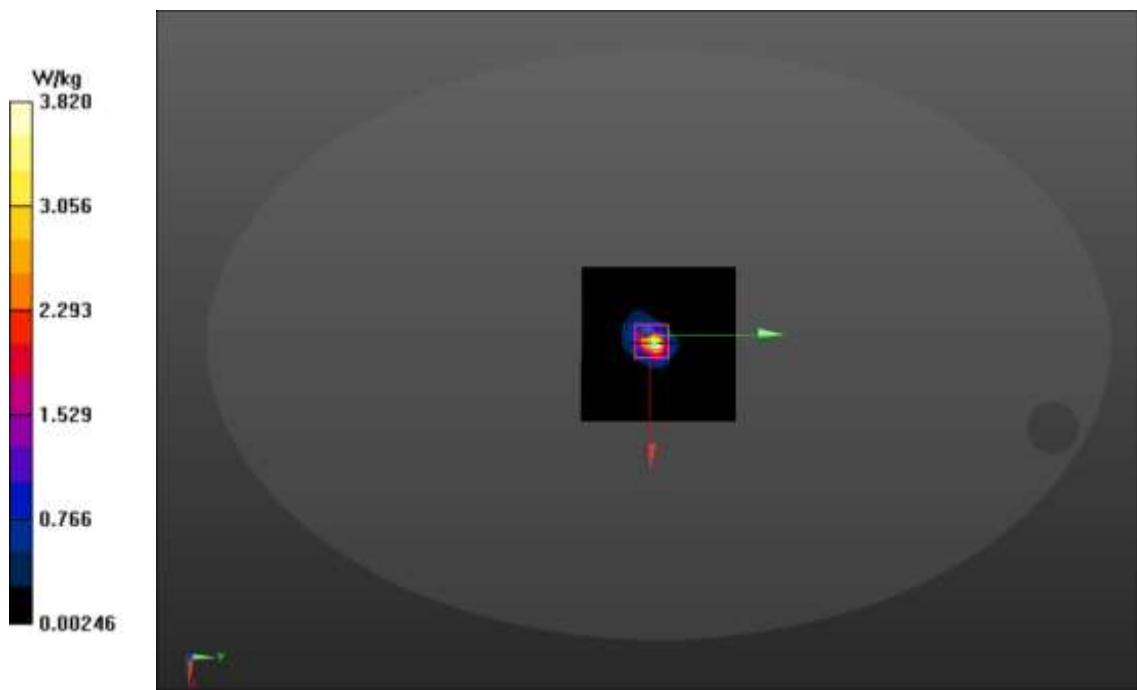


Figure C.24: SAR Head Testing Results for the Atom Hard Hat at 2452 MHz