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Accreditation No.: **SCS 0108**

Client **Sporton-TW (Auden)**

Certificate No: **D750V3-1012_May16**

CALIBRATION CERTIFICATE

Object **D750V3 - SN:1012**

Calibration procedure(s) **QA CAL-05.v9**
Calibration procedure for dipole validation kits above 700 MHz

Calibration date: **May 18, 2016**

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

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards | ID # | Cal Date (Certificate No.) | Scheduled Calibration |
|-----------------------------|--------------------|---------------------------------|-----------------------|
| Power meter NRP | SN: 104778 | 06-Apr-16 (No. 217-02288/02289) | Apr-17 |
| Power sensor NRP-Z91 | SN: 103244 | 06-Apr-16 (No. 217-02288) | Apr-17 |
| Power sensor NRP-Z91 | SN: 103245 | 06-Apr-16 (No. 217-02289) | Apr-17 |
| Reference 20 dB Attenuator | SN: 5058 (20k) | 05-Apr-16 (No. 217-02292) | Apr-17 |
| Type-N mismatch combination | SN: 5047.2 / 06327 | 05-Apr-16 (No. 217-02295) | Apr-17 |
| Reference Probe EX3DV4 | SN: 7349 | 31-Dec-15 (No. EX3-7349_Dec15) | Dec-16 |
| DAE4 | SN: 601 | 30-Dec-15 (No. DAE4-601_Dec15) | Dec-16 |

| Secondary Standards | ID # | Check Date (in house) | Scheduled Check |
|---------------------------|----------------|-----------------------------------|------------------------|
| Power meter EPM-442A | SN: GB37480704 | 07-Oct-15 (No. 217-02222) | In house check: Oct-16 |
| Power sensor HP 8481A | SN: US37292783 | 07-Oct-15 (No. 217-02222) | In house check: Oct-16 |
| Power sensor HP 8481A | SN: MY41092317 | 07-Oct-15 (No. 217-02223) | In house check: Oct-16 |
| RF generator R&S SMT-06 | SN: 100972 | 15-Jun-15 (in house check Jun-15) | In house check: Oct-16 |
| Network Analyzer HP 8753E | SN: US37390585 | 18-Oct-01 (in house check Oct-15) | In house check: Oct-16 |

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

Issued: May 20, 2016

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Accreditation No.: **SCS 0108**

Glossary:

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

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- 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 | V52.8.8 |
| Extrapolation | Advanced Extrapolation | |
| Phantom | Modular Flat Phantom | |
| Distance Dipole Center - TSL | 15 mm | with Spacer |
| Zoom Scan Resolution | dx, dy, dz = 5 mm | |
| Frequency | 750 MHz \pm 1 MHz | |

Head TSL parameters

The following parameters and calculations were applied.

| | Temperature | Permittivity | Conductivity |
|---|---------------------|----------------|----------------------|
| Nominal Head TSL parameters | 22.0 °C | 41.9 | 0.89 mho/m |
| Measured Head TSL parameters | (22.0 \pm 0.2) °C | 41.6 \pm 6 % | 0.91 mho/m \pm 6 % |
| Head TSL temperature change during test | < 0.5 °C | ---- | ---- |

SAR result with Head TSL

| SAR averaged over 1 cm ³ (1 g) of Head TSL | Condition | |
|---|--------------------|--|
| SAR measured | 250 mW input power | 2.09 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 8.21 W/kg \pm 17.0 % (k=2) |

| SAR averaged over 10 cm ³ (10 g) of Head TSL | condition | |
|---|--------------------|--|
| SAR measured | 250 mW input power | 1.37 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 5.40 W/kg \pm 16.5 % (k=2) |

Body TSL parameters

The following parameters and calculations were applied.

| | Temperature | Permittivity | Conductivity |
|---|---------------------|----------------|----------------------|
| Nominal Body TSL parameters | 22.0 °C | 55.5 | 0.96 mho/m |
| Measured Body TSL parameters | (22.0 \pm 0.2) °C | 55.4 \pm 6 % | 1.00 mho/m \pm 6 % |
| Body TSL temperature change during test | < 0.5 °C | ---- | ---- |

SAR result with Body TSL

| SAR averaged over 1 cm ³ (1 g) of Body TSL | Condition | |
|---|--------------------|--|
| SAR measured | 250 mW input power | 2.25 W/kg |
| SAR for nominal Body TSL parameters | normalized to 1W | 8.72 W/kg \pm 17.0 % (k=2) |

| SAR averaged over 10 cm ³ (10 g) of Body TSL | condition | |
|---|--------------------|--|
| SAR measured | 250 mW input power | 1.47 W/kg |
| SAR for nominal Body TSL parameters | normalized to 1W | 5.73 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 | 54.0 Ω + 1.1 j Ω |
| Return Loss | - 28.1 dB |

Antenna Parameters with Body TSL

| | |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 50.0 Ω - 0.6 j Ω |
| Return Loss | - 44.7 dB |

General Antenna Parameters and Design

| | |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.036 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 |
| Manufactured on | September 29, 2009 |

DASY5 Validation Report for Head TSL

Date: 18.05.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN:1012

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

Medium parameters used: $f = 750$ MHz; $\sigma = 0.91$ S/m; $\epsilon_r = 41.6$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(10.28, 10.28, 10.28); Calibrated: 31.12.2015;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

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

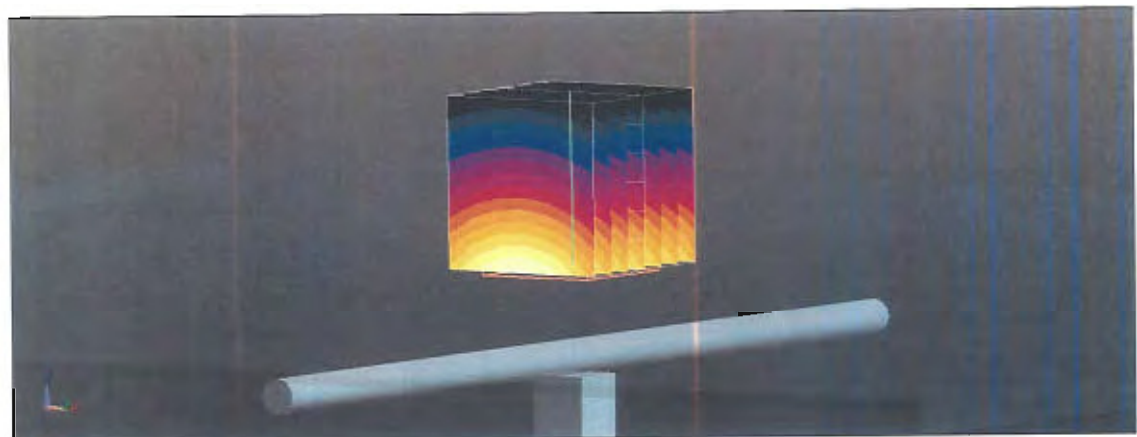
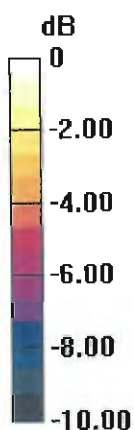
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 58.14 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 3.10 W/kg

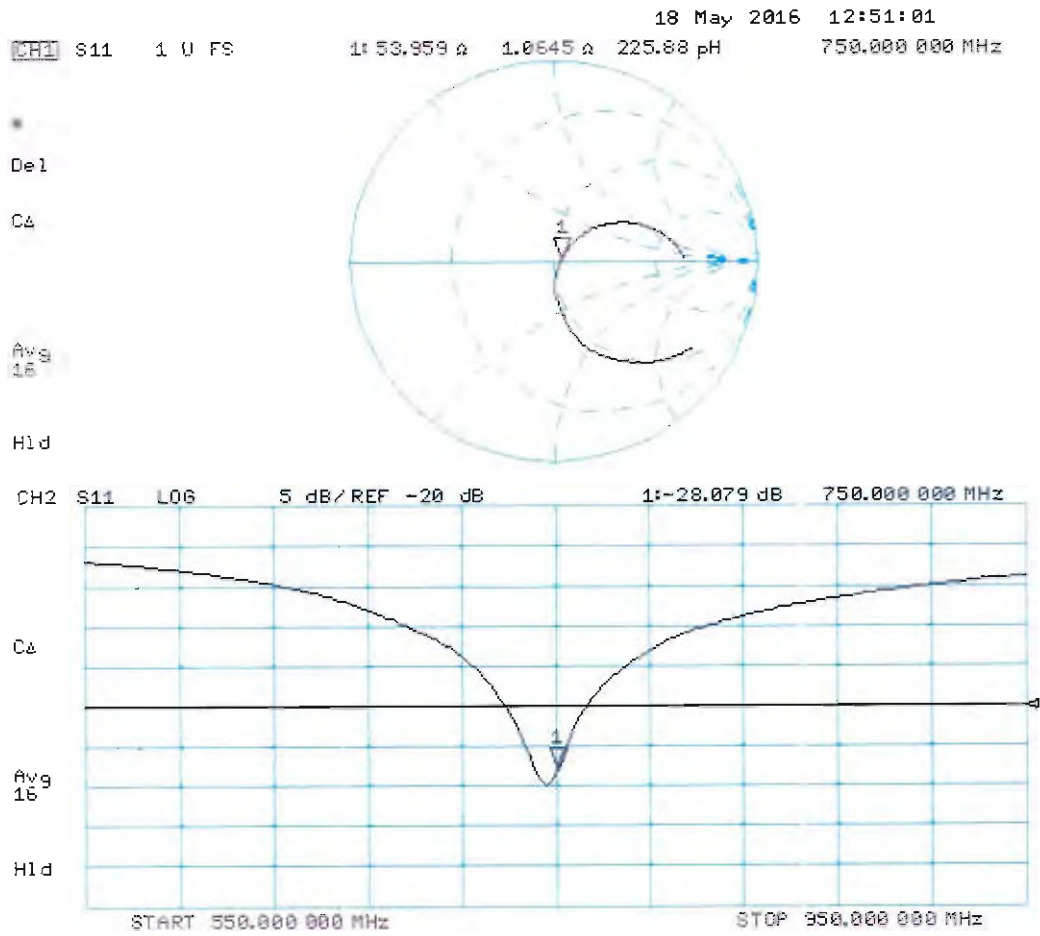
SAR(1 g) = 2.09 W/kg; SAR(10 g) = 1.37 W/kg

Maximum value of SAR (measured) = 2.76 W/kg



0 dB = 2.76 W/kg = 4.41 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 18.05.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN:1012

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

Medium parameters used: $f = 750$ MHz; $\sigma = 1$ S/m; $\epsilon_r = 55.4$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(9.99, 9.99, 9.99); Calibrated: 31.12.2015;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

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

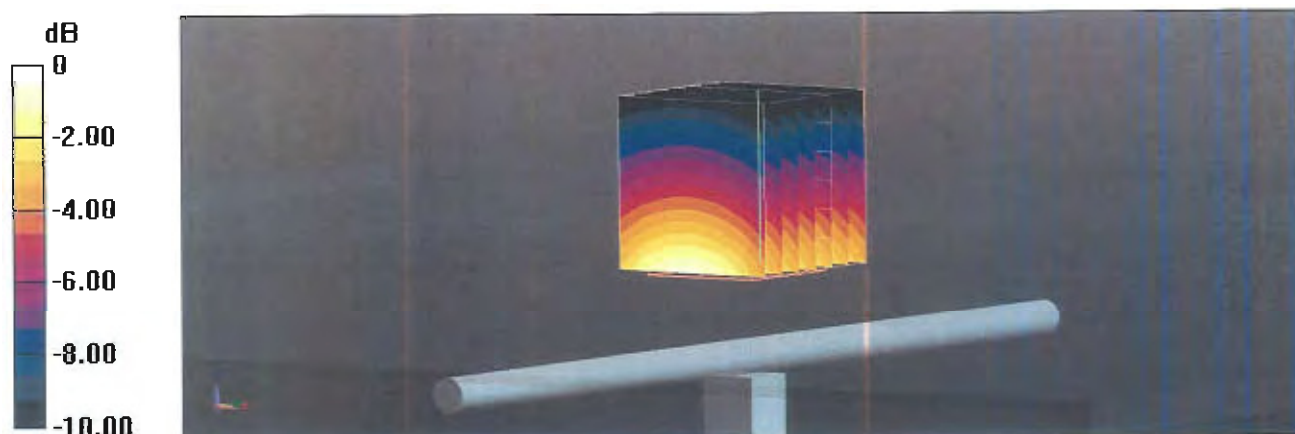
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 57.15 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 3.38 W/kg

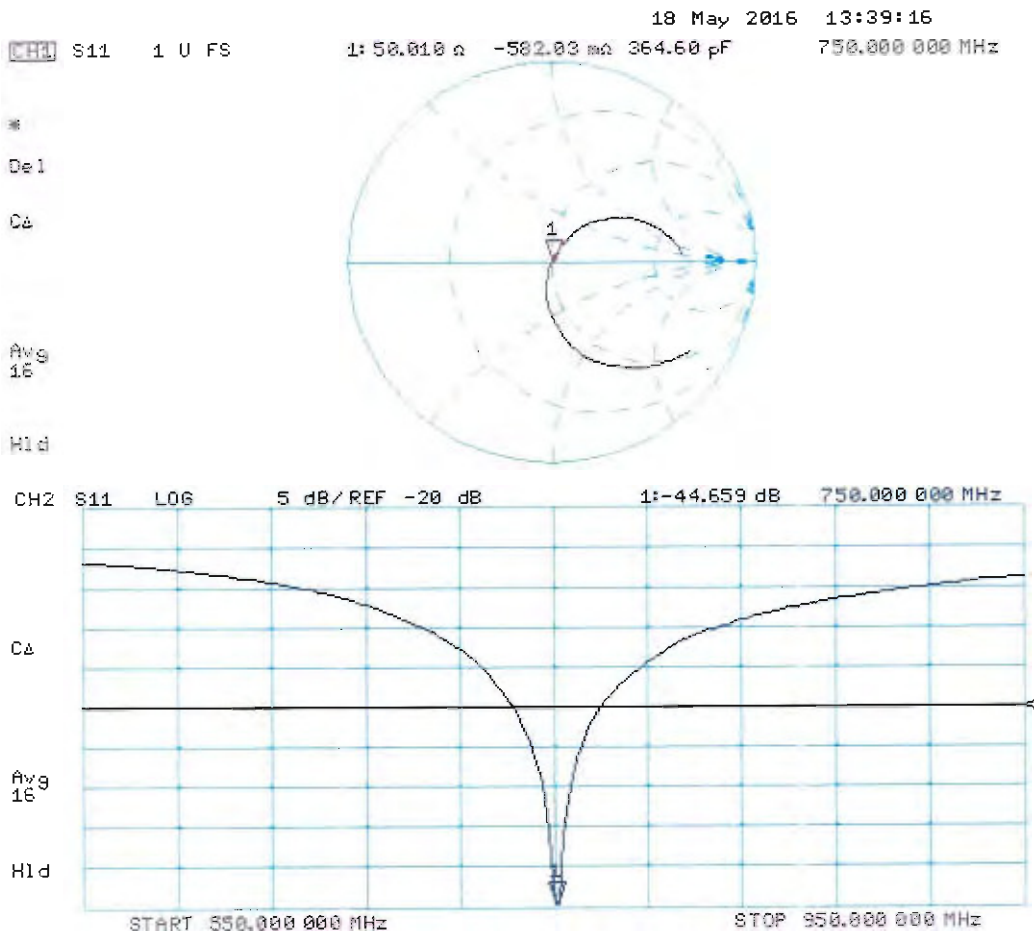
SAR(1 g) = 2.25 W/kg; SAR(10 g) = 1.47 W/kg

Maximum value of SAR (measured) = 2.98 W/kg



0 dB = 2.98 W/kg = 4.74 dBW/kg

Impedance Measurement Plot for Body TSL





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Accreditation No.: **SCS 0108**

Client **Sporton-TW (Auden)**

Certificate No: **D835V2-499_Mar17**

CALIBRATION CERTIFICATE

Object **D835V2 - SN:499**

Calibration procedure(s) **QA CAL-05.v9
Calibration procedure for dipole validation kits above 700 MHz**

Calibration date: **March 21, 2017**

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

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards | ID # | Cal Date (Certificate No.) | Scheduled Calibration |
|-----------------------------|--------------------|---------------------------------|-----------------------|
| Power meter NRP | SN: 104778 | 06-Apr-16 (No. 217-02288/02289) | Apr-17 |
| Power sensor NRP-Z91 | SN: 103244 | 06-Apr-16 (No. 217-02288) | Apr-17 |
| Power sensor NRP-Z91 | SN: 103245 | 06-Apr-16 (No. 217-02289) | Apr-17 |
| Reference 20 dB Attenuator | SN: 5058 (20k) | 05-Apr-16 (No. 217-02292) | Apr-17 |
| Type-N mismatch combination | SN: 5047.2 / 06327 | 05-Apr-16 (No. 217-02295) | Apr-17 |
| Reference Probe EX3DV4 | SN: 7349 | 31-Dec-16 (No. EX3-7349_Dec16) | Dec-17 |
| DAE4 | SN: 601 | 04-Jan-17 (No. DAE4-601_Jan17) | Jan-18 |

| Secondary Standards | ID # | Check Date (in house) | Scheduled Check |
|---------------------------|----------------|-----------------------------------|------------------------|
| Power meter EPM-442A | SN: GB37480704 | 07-Oct-15 (in house check Oct-16) | In house check: Oct-18 |
| Power sensor HP 8481A | SN: US37292783 | 07-Oct-15 (in house check Oct-16) | In house check: Oct-18 |
| Power sensor HP 8481A | SN: MY41092317 | 07-Oct-15 (in house check Oct-16) | In house check: Oct-18 |
| RF generator R&S SMT-06 | SN: 100972 | 15-Jun-15 (in house check Oct-16) | In house check: Oct-18 |
| Network Analyzer HP 8753E | SN: US37390585 | 18-Oct-01 (in house check Oct-16) | In house check: Oct-17 |

| | | | |
|----------------|---------------|-----------------------|-----------|
| | Name | Function | Signature |
| Calibrated by: | Leif Klynsner | Laboratory Technician | |

| | | | |
|--------------|---------------|-------------------|--|
| Approved by: | Katja Pokovic | Technical Manager | |
|--------------|---------------|-------------------|--|

Issued: March 23, 2017

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Glossary:

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

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- 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 | V52.8.8 |
| Extrapolation | Advanced Extrapolation | |
| Phantom | Modular Flat Phantom | |
| Distance Dipole Center - TSL | 15 mm | with Spacer |
| Zoom Scan Resolution | dx, dy, dz = 5 mm | |
| Frequency | 835 MHz \pm 1 MHz | |

Head TSL parameters

The following parameters and calculations were applied.

| | Temperature | Permittivity | Conductivity |
|---|---------------------|----------------|----------------------|
| Nominal Head TSL parameters | 22.0 °C | 41.5 | 0.90 mho/m |
| Measured Head TSL parameters | (22.0 \pm 0.2) °C | 40.7 \pm 6 % | 0.94 mho/m \pm 6 % |
| Head TSL temperature change during test | < 0.5 °C | ---- | ---- |

SAR result with Head TSL

| SAR averaged over 1 cm ³ (1 g) of Head TSL | Condition | |
|---|--------------------|------------------------------|
| SAR measured | 250 mW input power | 2.45 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 9.45 W/kg \pm 17.0 % (k=2) |

| SAR averaged over 10 cm ³ (10 g) of Head TSL | condition | |
|---|--------------------|------------------------------|
| SAR measured | 250 mW input power | 1.58 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 6.14 W/kg \pm 16.5 % (k=2) |

Body TSL parameters

The following parameters and calculations were applied.

| | Temperature | Permittivity | Conductivity |
|---|---------------------|----------------|----------------------|
| Nominal Body TSL parameters | 22.0 °C | 55.2 | 0.97 mho/m |
| Measured Body TSL parameters | (22.0 \pm 0.2) °C | 54.4 \pm 6 % | 1.01 mho/m \pm 6 % |
| Body TSL temperature change during test | < 0.5 °C | ---- | ---- |

SAR result with Body TSL

| SAR averaged over 1 cm ³ (1 g) of Body TSL | Condition | |
|---|--------------------|------------------------------|
| SAR measured | 250 mW input power | 2.50 W/kg |
| SAR for nominal Body TSL parameters | normalized to 1W | 9.67 W/kg \pm 17.0 % (k=2) |

| SAR averaged over 10 cm ³ (10 g) of Body TSL | condition | |
|---|--------------------|------------------------------|
| SAR measured | 250 mW input power | 1.63 W/kg |
| SAR for nominal Body TSL parameters | normalized to 1W | 6.35 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 | 52.0 Ω - 4.9 j Ω |
| Return Loss | - 25.7 dB |

Antenna Parameters with Body TSL

| | |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 47.5 Ω - 7.0 j Ω |
| Return Loss | - 22.4 dB |

General Antenna Parameters and Design

| | |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.390 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 |
| Manufactured on | July 10, 2003 |

DASY5 Validation Report for Head TSL

Date: 21.03.2017

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:499

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

Medium parameters used: $f = 835$ MHz; $\sigma = 0.94$ S/m; $\epsilon_r = 40.7$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(9.72, 9.72, 9.72); Calibrated: 31.12.2016;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.01.2017
- Phantom: Flat Phantom 4.9 (front); Type: QD 00L P49 AA; Serial: 1001
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

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

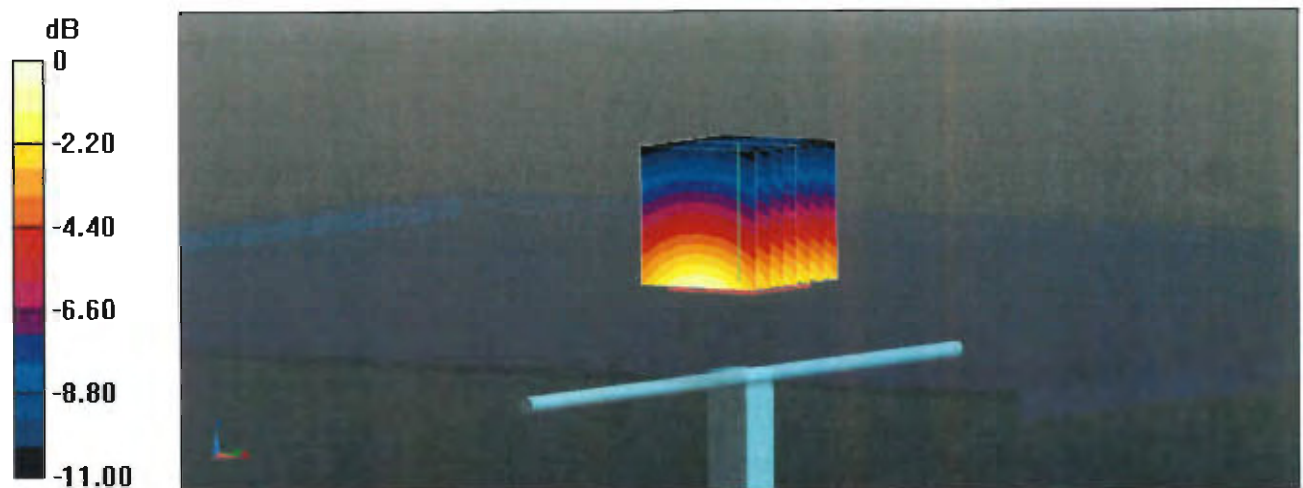
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 63.11 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 3.69 W/kg

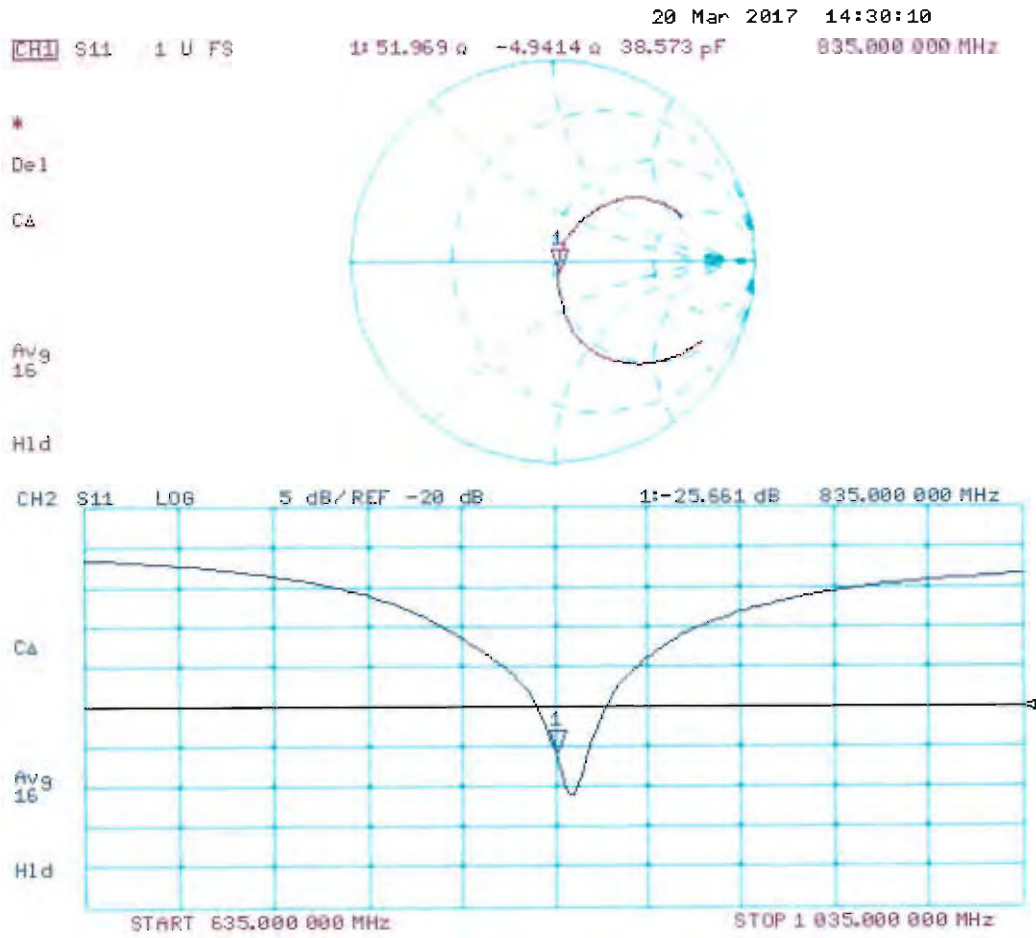
SAR(1 g) = 2.45 W/kg; SAR(10 g) = 1.58 W/kg

Maximum value of SAR (measured) = 3.29 W/kg



0 dB = 3.29 W/kg = 5.17 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 20.03.2017

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:499

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

Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 1.01 \text{ S/m}$; $\epsilon_r = 54.4$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(9.73, 9.73, 9.73); Calibrated: 31.12.2016;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.01.2017
- Phantom: Flat Phantom 4.9 (Back); Type: QD 00R P49 AA; Serial: 1005
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

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

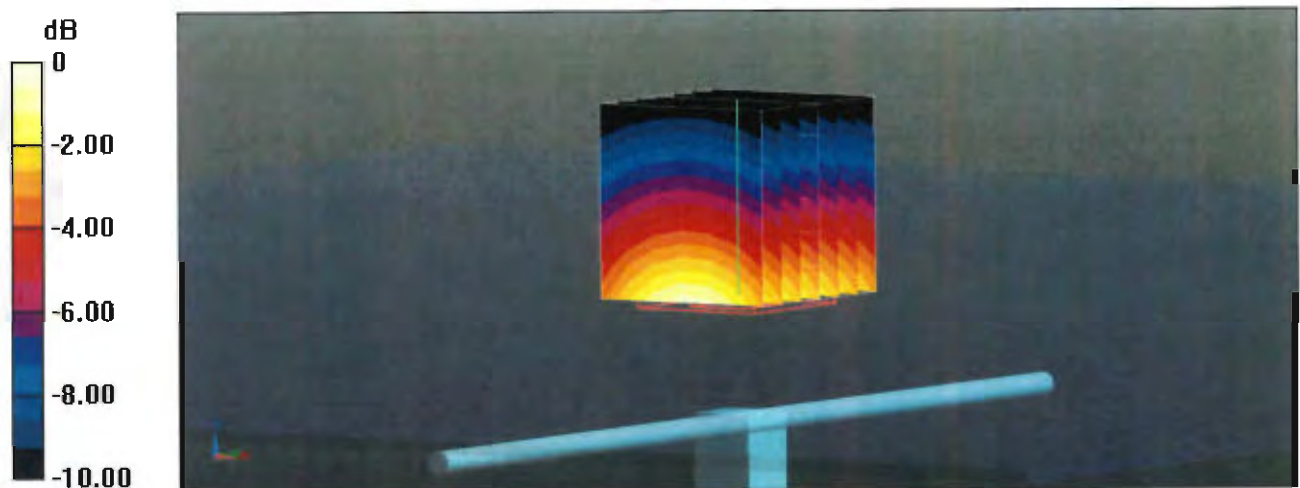
Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 61.02 V/m; Power Drift = -0.05 dB

Peak SAR (extrapolated) = 3.74 W/kg

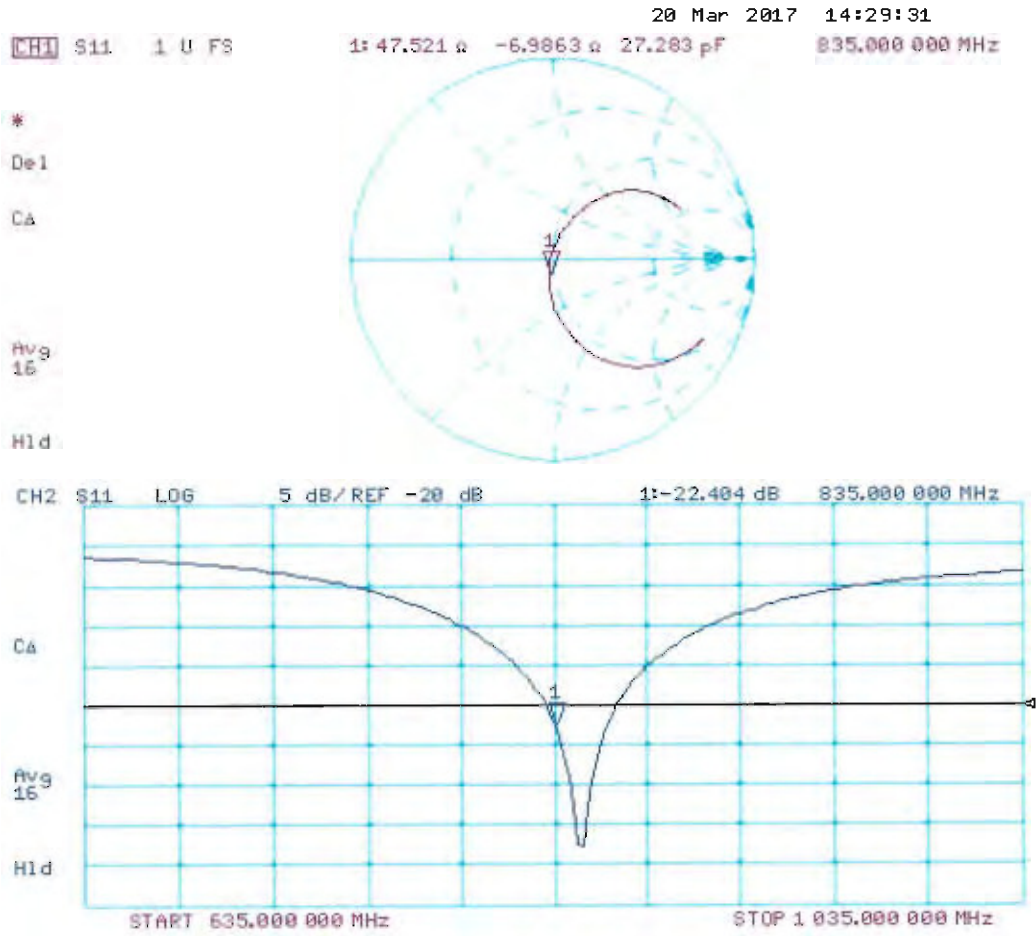
SAR(1 g) = 2.5 W/kg; SAR(10 g) = 1.63 W/kg

Maximum value of SAR (measured) = 3.32 W/kg



0 dB = 3.32 W/kg = 5.21 dBW/kg

Impedance Measurement Plot for Body TSL





Accredited by the Swiss Accreditation Service (SAS)
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Accreditation No.: **SCS 0108**

Client **Sporton-TW (Auden)**

Certificate No: **D1750V2-1068_Nov16**

CALIBRATION CERTIFICATE

Object **D1750V2 - SN:1068**

Calibration procedure(s) **QA CAL-05.v9
Calibration procedure for dipole validation kits above 700 MHz**

Calibration date: **November 16, 2016**

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

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards | ID # | Cal Date (Certificate No.) | Scheduled Calibration |
|-----------------------------|--------------------|---------------------------------|-----------------------|
| Power meter NRP | SN: 104778 | 06-Apr-16 (No. 217-02288/02289) | Apr-17 |
| Power sensor NRP-Z91 | SN: 103244 | 06-Apr-16 (No. 217-02288) | Apr-17 |
| Power sensor NRP-Z91 | SN: 103245 | 06-Apr-16 (No. 217-02289) | Apr-17 |
| Reference 20 dB Attenuator | SN: 5058 (20k) | 05-Apr-16 (No. 217-02292) | Apr-17 |
| Type-N mismatch combination | SN: 5047.2 / 06327 | 05-Apr-16 (No. 217-02295) | Apr-17 |
| Reference Probe EX3DV4 | SN: 7349 | 15-Jun-16 (No. EX3-7349_Jun16) | Jun-17 |
| DAE4 | SN: 601 | 30-Dec-15 (No. DAE4-601_Dec15) | Dec-16 |

| Secondary Standards | ID # | Check Date (in house) | Scheduled Check |
|---------------------------|----------------|-----------------------------------|------------------------|
| Power meter EPM-442A | SN: GB37480704 | 07-Oct-15 (in house check Oct-16) | In house check: Oct-18 |
| Power sensor HP 8481A | SN: US37292783 | 07-Oct-15 (in house check Oct-16) | In house check: Oct-18 |
| Power sensor HP 8481A | SN: MY41092317 | 07-Oct-15 (in house check Oct-16) | In house check: Oct-18 |
| RF generator R&S SMT-06 | SN: 100972 | 15-Jun-15 (in house check Oct-16) | In house check: Oct-18 |
| Network Analyzer HP 8753E | SN: US37390585 | 18-Oct-01 (in house check Oct-16) | In house check: Oct-17 |

Calibrated by: **Claudio Leubler** Name: Claudio Leubler Function: Laboratory Technician

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

Signature

Issued: November 17, 2016

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



Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 0108**

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

Glossary:

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

Calibration is Performed According to the Following Standards:

- a) 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
- b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- c) 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
- d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- e) 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 | V52.8.8 |
| Extrapolation | Advanced Extrapolation | |
| Phantom | Modular Flat Phantom | |
| Distance Dipole Center - TSL | 10 mm | with Spacer |
| Zoom Scan Resolution | dx, dy, dz = 5 mm | |
| Frequency | 1750 MHz \pm 1 MHz | |

Head TSL parameters

The following parameters and calculations were applied.

| | Temperature | Permittivity | Conductivity |
|---|---------------------|----------------|----------------------|
| Nominal Head TSL parameters | 22.0 °C | 40.1 | 1.37 mho/m |
| Measured Head TSL parameters | (22.0 \pm 0.2) °C | 39.1 \pm 6 % | 1.37 mho/m \pm 6 % |
| Head TSL temperature change during test | < 0.5 °C | ---- | ---- |

SAR result with Head TSL

| SAR averaged over 1 cm ³ (1 g) of Head TSL | Condition | |
|---|--------------------|--|
| SAR measured | 250 mW input power | 9.20 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 36.6 W/kg \pm 17.0 % (k=2) |

| SAR averaged over 10 cm ³ (10 g) of Head TSL | condition | |
|---|--------------------|--|
| SAR measured | 250 mW input power | 4.88 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 19.5 W/kg \pm 16.5 % (k=2) |

Body TSL parameters

The following parameters and calculations were applied.

| | Temperature | Permittivity | Conductivity |
|---|---------------------|----------------|----------------------|
| Nominal Body TSL parameters | 22.0 °C | 53.4 | 1.49 mho/m |
| Measured Body TSL parameters | (22.0 \pm 0.2) °C | 53.7 \pm 6 % | 1.49 mho/m \pm 6 % |
| Body TSL temperature change during test | < 0.5 °C | ---- | ---- |

SAR result with Body TSL

| SAR averaged over 1 cm ³ (1 g) of Body TSL | Condition | |
|---|--------------------|--|
| SAR measured | 250 mW input power | 9.04 W/kg |
| SAR for nominal Body TSL parameters | normalized to 1W | 36.2 W/kg \pm 17.0 % (k=2) |

| SAR averaged over 10 cm ³ (10 g) of Body TSL | condition | |
|---|--------------------|--|
| SAR measured | 250 mW input power | 4.85 W/kg |
| SAR for nominal Body TSL parameters | normalized to 1W | 19.4 W/kg \pm 16.5 % (k=2) |

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

| | |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 51.4 Ω + 3.9 j Ω |
| Return Loss | - 27.9 dB |

Antenna Parameters with Body TSL

| | |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 47.1 Ω + 2.7 j Ω |
| Return Loss | - 27.8 dB |

General Antenna Parameters and Design

| | |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.221 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 |
| Manufactured on | June 15, 2010 |

DASY5 Validation Report for Head TSL

Date: 16.11.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN:1068

Communication System: UID 0 - CW; Frequency: 1750 MHz

Medium parameters used: $f = 1750$ MHz; $\sigma = 1.37$ S/m; $\epsilon_r = 39.1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(8.46, 8.46, 8.46); Calibrated: 15.06.2016;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

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

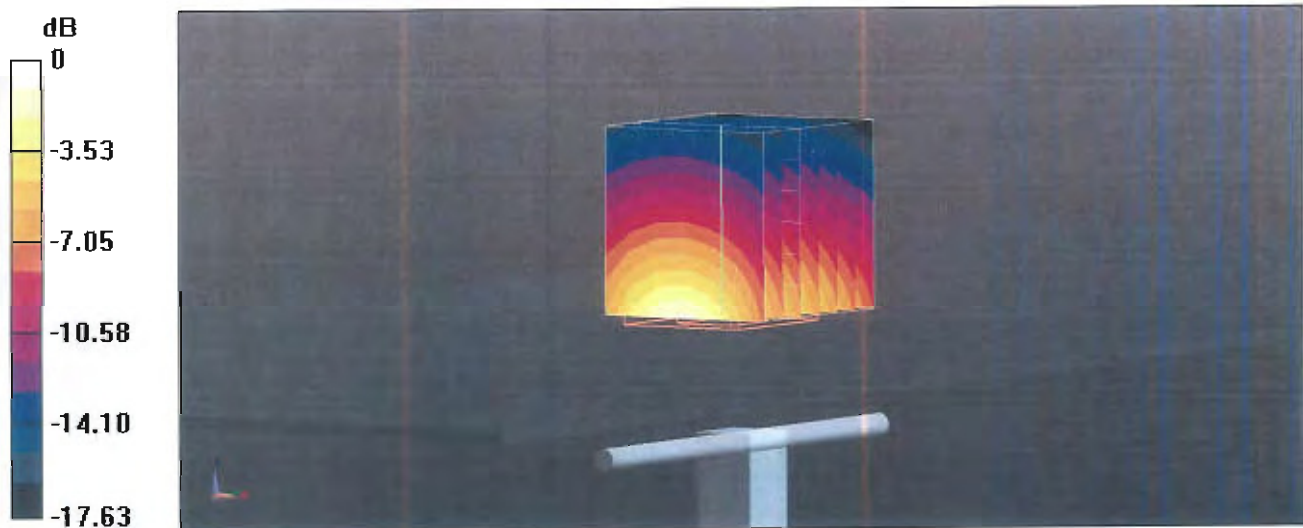
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 103.4 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 16.8 W/kg

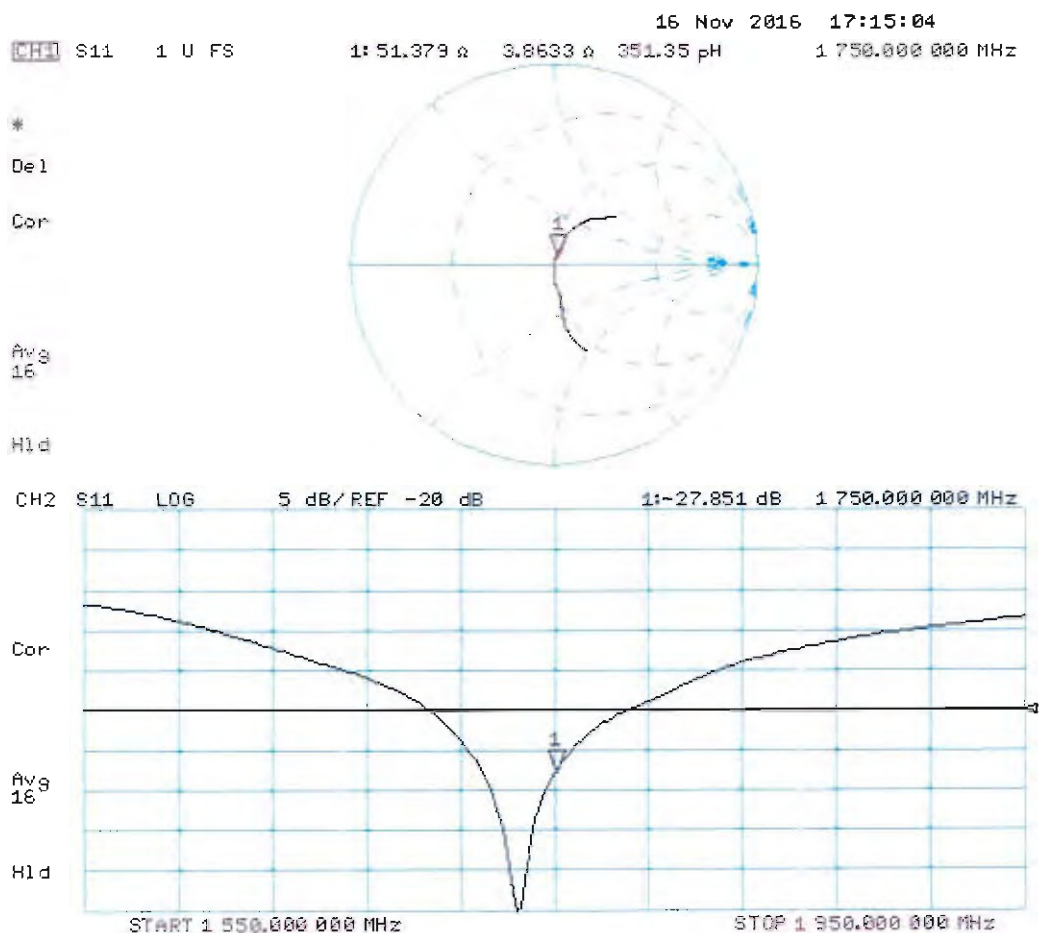
SAR(1 g) = 9.2 W/kg; SAR(10 g) = 4.88 W/kg

Maximum value of SAR (measured) = 14.0 W/kg



0 dB = 14.0 W/kg = 11.46 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 16.11.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN:1068

Communication System: UID 0 - CW; Frequency: 1750 MHz

Medium parameters used: $f = 1750$ MHz; $\sigma = 1.49$ S/m; $\epsilon_r = 53.7$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(8.25, 8.25, 8.25); Calibrated: 15.06.2016;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

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

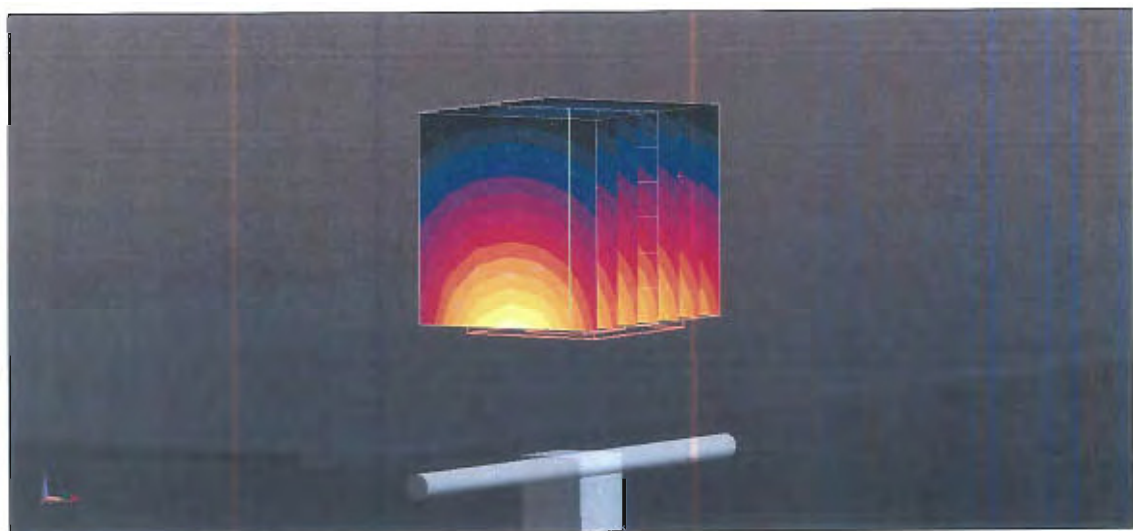
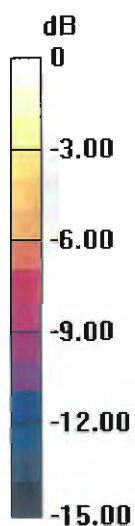
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 99.57 V/m; Power Drift = -0.06 dB

Peak SAR (extrapolated) = 15.8 W/kg

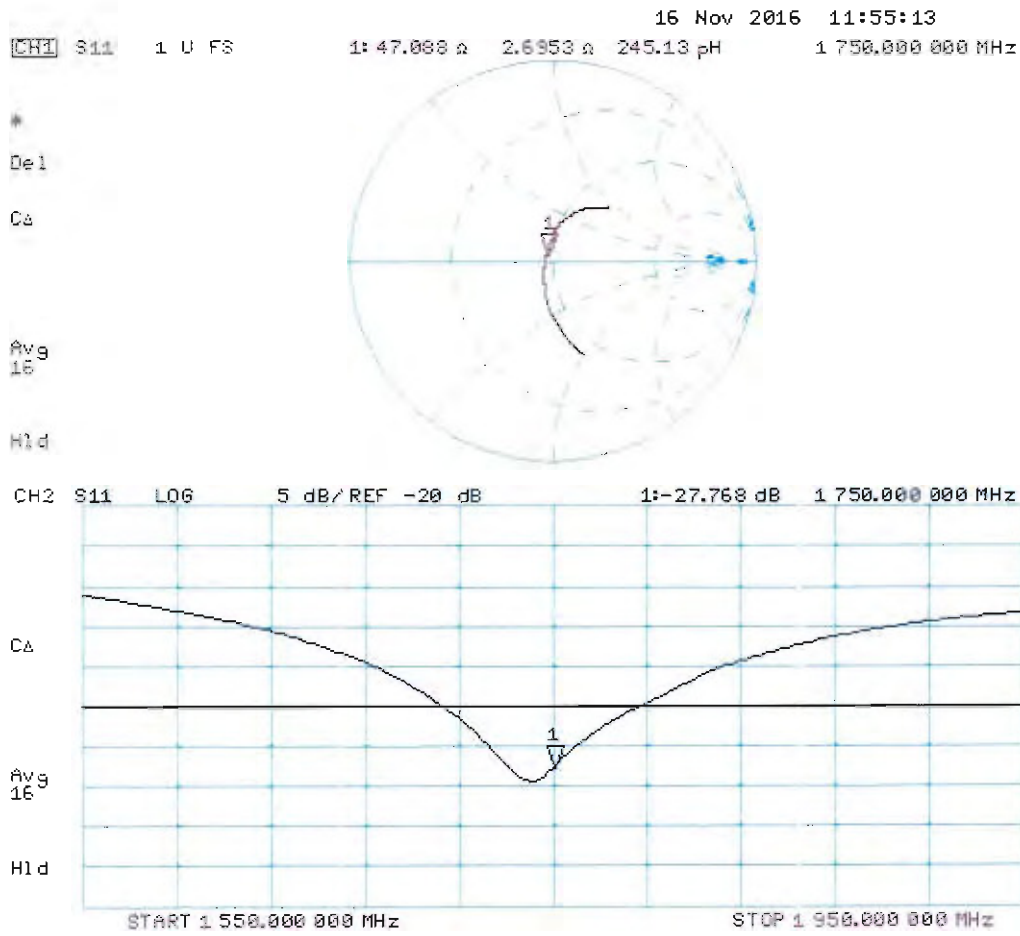
SAR(1 g) = 9.04 W/kg; SAR(10 g) = 4.85 W/kg

Maximum value of SAR (measured) = 13.5 W/kg



0 dB = 13.5 W/kg = 11.30 dBW/kg

Impedance Measurement Plot for Body TSL





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Accreditation No.: **SCS 0108**

Client **Sporton-TW (Auden)**

Certificate No: **D1900V2-5d041_Sep16**

CALIBRATION CERTIFICATE

Object **D1900V2 - SN:5d041**

Calibration procedure(s) **QA CAL-05.v9**
Calibration procedure for dipole validation kits above 700 MHz

Calibration date: **September 30, 2016**

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

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards | ID # | Cal Date (Certificate No.) | Scheduled Calibration |
|-----------------------------|--------------------|-----------------------------------|------------------------|
| Power meter NRP | SN: 104778 | 06-Apr-16 (No. 217-02288/02289) | Apr-17 |
| Power sensor NRP-Z91 | SN: 103244 | 06-Apr-16 (No. 217-02288) | Apr-17 |
| Power sensor NRP-Z91 | SN: 103245 | 06-Apr-16 (No. 217-02289) | Apr-17 |
| Reference 20 dB Attenuator | SN: 5058 (20k) | 05-Apr-16 (No. 217-02292) | Apr-17 |
| Type-N mismatch combination | SN: 5047.2 / 06327 | 05-Apr-16 (No. 217-02295) | Apr-17 |
| Reference Probe EX3DV4 | SN: 7349 | 15-Jun-16 (No. EX3-7349_Jun16) | Jun-17 |
| DAE4 | SN: 601 | 30-Dec-15 (No. DAE4-601_Dec15) | Dec-16 |
| Secondary Standards | ID # | Check Date (in house) | Scheduled Check |
| Power meter EPM-442A | SN: GB37480704 | 07-Oct-15 (No. 217-02222) | In house check: Oct-16 |
| Power sensor HP 8481A | SN: US37292783 | 07-Oct-15 (No. 217-02222) | In house check: Oct-16 |
| Power sensor HP 8481A | SN: MY41092317 | 07-Oct-15 (No. 217-02223) | In house check: Oct-16 |
| RF generator R&S SMT-06 | SN: 100972 | 15-Jun-15 (in house check Jun-15) | In house check: Oct-16 |
| Network Analyzer HP 8753E | SN: US37390585 | 18-Oct-01 (in house check Oct-15) | In house check: Oct-16 |

Calibrated by: **Jeton Kastrati** Function: **Laboratory Technician**

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

Signature

Issued: September 30, 2016

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Accreditation No.: **SCS 0108**

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

Glossary:

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

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- 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 | V52.8.8 |
| Extrapolation | Advanced Extrapolation | |
| Phantom | Modular Flat Phantom | |
| Distance Dipole Center - TSL | 10 mm | with Spacer |
| Zoom Scan Resolution | dx, dy, dz = 5 mm | |
| Frequency | 1900 MHz \pm 1 MHz | |

Head TSL parameters

The following parameters and calculations were applied.

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

SAR result with Head TSL

| SAR averaged over 1 cm³ (1 g) of Head TSL | Condition | |
|---|--------------------|--|
| SAR measured | 250 mW input power | 10.1 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 40.5 W/kg \pm 17.0 % (k=2) |

| SAR averaged over 10 cm³ (10 g) of Head TSL | condition | |
|---|--------------------|--|
| SAR measured | 250 mW input power | 5.33 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 21.4 W/kg \pm 16.5 % (k=2) |

Body TSL parameters

The following parameters and calculations were applied.

| | Temperature | Permittivity | Conductivity |
|--|---------------------|----------------|----------------------|
| Nominal Body TSL parameters | 22.0 °C | 53.3 | 1.52 mho/m |
| Measured Body TSL parameters | (22.0 \pm 0.2) °C | 53.6 \pm 6 % | 1.49 mho/m \pm 6 % |
| Body TSL temperature change during test | < 0.5 °C | ---- | ---- |

SAR result with Body TSL

| SAR averaged over 1 cm³ (1 g) of Body TSL | Condition | |
|---|--------------------|--|
| SAR measured | 250 mW input power | 9.58 W/kg |
| SAR for nominal Body TSL parameters | normalized to 1W | 38.8 W/kg \pm 17.0 % (k=2) |

| SAR averaged over 10 cm³ (10 g) of Body TSL | condition | |
|---|--------------------|--|
| SAR measured | 250 mW input power | 5.10 W/kg |
| SAR for nominal Body TSL parameters | normalized to 1W | 20.6 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 | 52.5 Ω + 8.0 j Ω |
| Return Loss | - 21.8 dB |

Antenna Parameters with Body TSL

| | |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 48.7 Ω + 7.6 j Ω |
| Return Loss | - 22.1 dB |

General Antenna Parameters and Design

| | |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.199 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 |
| Manufactured on | July 04, 2003 |

DASY5 Validation Report for Head TSL

Date: 28.09.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d041

Communication System: UID 0 - CW; Frequency: 1900 MHz

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.4$ S/m; $\epsilon_r = 40.5$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(7.99, 7.99, 7.99); Calibrated: 15.06.2016;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

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

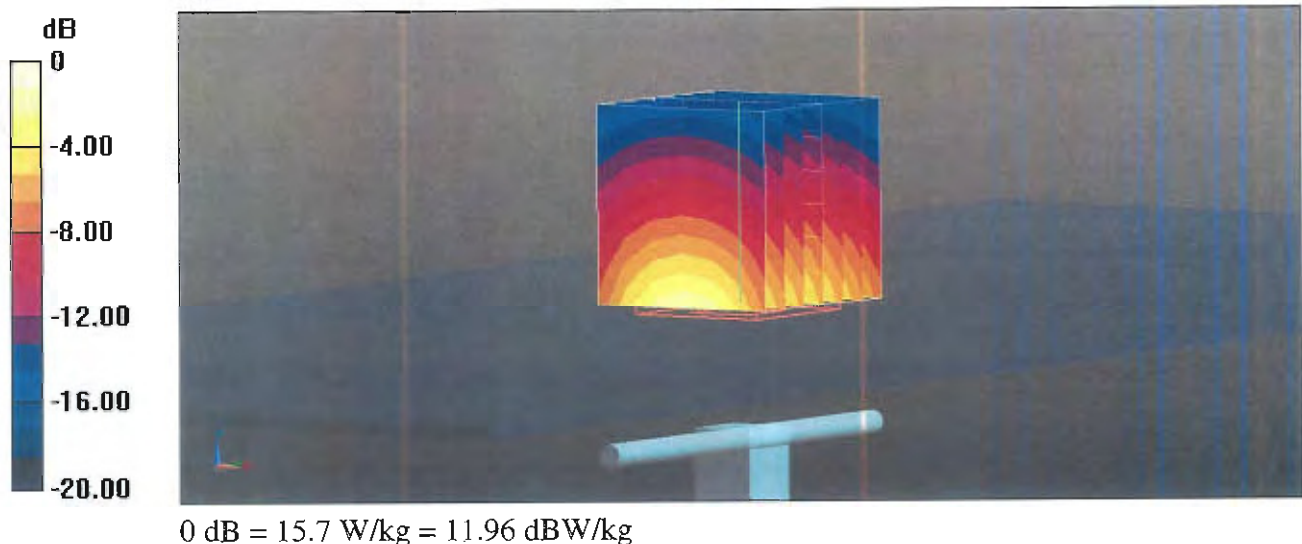
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 108.5 V/m; Power Drift = -0.02 dB

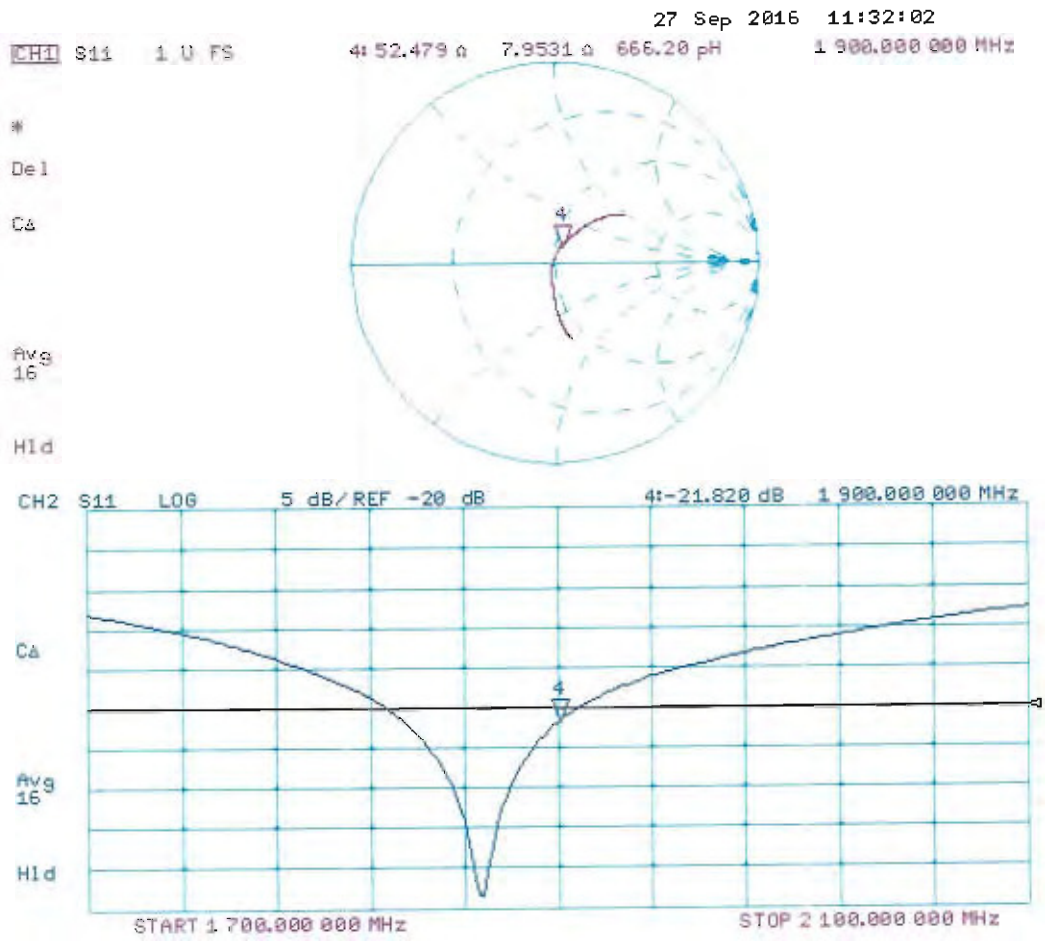
Peak SAR (extrapolated) = 19.0 W/kg

SAR(1 g) = 10.1 W/kg; SAR(10 g) = 5.33 W/kg

Maximum value of SAR (measured) = 15.7 W/kg



Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 30.09.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d041

Communication System: UID 0 - CW; Frequency: 1900 MHz

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.49$ S/m; $\epsilon_r = 53.6$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(8.03, 8.03, 8.03); Calibrated: 15.06.2016;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

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 = 102.7 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 16.7 W/kg

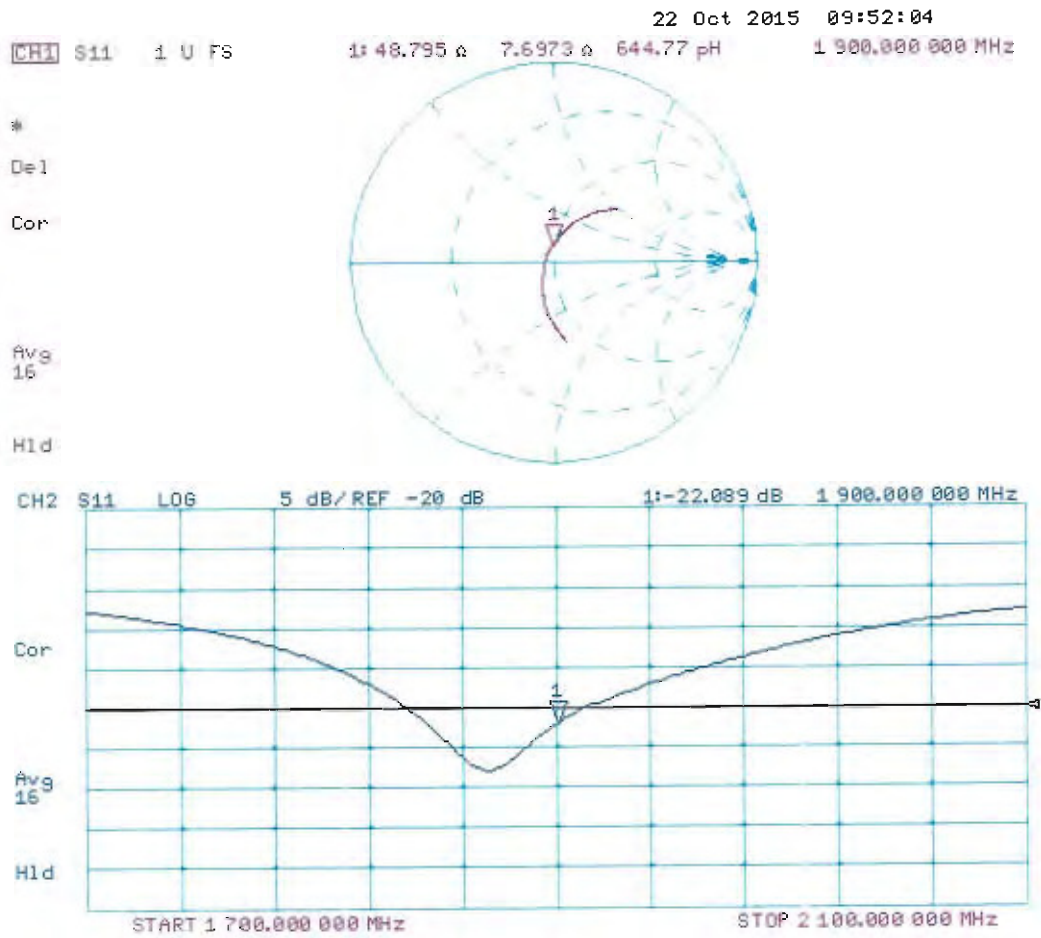
SAR(1 g) = 9.58 W/kg; SAR(10 g) = 5.1 W/kg

Maximum value of SAR (measured) = 14.3 W/kg



0 dB = 14.3 W/kg = 11.55 dBW/kg

Impedance Measurement Plot for Body TSL





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Accreditation No.: **SCS 0108**

Client **Sporton (Auden)**

Certificate No: **D2300V2-1006_Jan17**

CALIBRATION CERTIFICATE

Object **D2300V2 - SN:1006**

Calibration procedure(s) **QA CAL-05.v9
Calibration procedure for dipole validation kits above 700 MHz**

Calibration date: **January 25, 2017**

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

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards | ID # | Cal Date (Certificate No.) | Scheduled Calibration |
|-----------------------------|--------------------|-----------------------------------|------------------------|
| Power meter NRP | SN: 104778 | 06-Apr-16 (No. 217-02288/02289) | Apr-17 |
| Power sensor NRP-Z91 | SN: 103244 | 06-Apr-16 (No. 217-02288) | Apr-17 |
| Power sensor NRP-Z91 | SN: 103245 | 06-Apr-16 (No. 217-02289) | Apr-17 |
| Reference 20 dB Attenuator | SN: 5058 (20k) | 05-Apr-16 (No. 217-02292) | Apr-17 |
| Type-N mismatch combination | SN: 5047.2 / 06327 | 05-Apr-16 (No. 217-02295) | Apr-17 |
| Reference Probe EX3DV4 | SN: 7349 | 31-Dec-16 (No. EX3-7349_Dec16) | Dec-17 |
| DAE4 | SN: 601 | 04-Jan-17 (No. DAE4-601_Jan17) | Jan-18 |
| Secondary Standards | ID # | Check Date (in house) | Scheduled Check |
| Power meter EPM-442A | SN: GB37480704 | 07-Oct-15 (in house check Oct-16) | In house check: Oct-18 |
| Power sensor HP 8481A | SN: US37292783 | 07-Oct-15 (in house check Oct-16) | In house check: Oct-18 |
| Power sensor HP 8481A | SN: MY41092317 | 07-Oct-15 (in house check Oct-16) | In house check: Oct-18 |
| RF generator R&S SMT-06 | SN: 100972 | 15-Jun-15 (in house check Oct-16) | In house check: Oct-18 |
| Network Analyzer HP 8753E | SN: US37390585 | 18-Oct-01 (in house check Oct-16) | In house check: Oct-17 |

Calibrated by: **Johannes Kurikka** (Name) **Laboratory Technician** (Function)

Approved by: **Katja Pokovic** (Name) **Technical Manager** (Function)

Signature

Issued: January 25, 2017

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Accreditation No.: **SCS 0108**

Glossary:

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

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- 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 | V52.8.8 |
| Extrapolation | Advanced Extrapolation | |
| Phantom | Modular Flat Phantom | |
| Distance Dipole Center - TSL | 10 mm | with Spacer |
| Zoom Scan Resolution | dx, dy, dz = 5 mm | |
| Frequency | 2300 MHz \pm 1 MHz | |

Head TSL parameters

The following parameters and calculations were applied.

| | Temperature | Permittivity | Conductivity |
|---|---------------------|----------------|----------------------|
| Nominal Head TSL parameters | 22.0 °C | 39.5 | 1.67 mho/m |
| Measured Head TSL parameters | (22.0 \pm 0.2) °C | 38.5 \pm 6 % | 1.72 mho/m \pm 6 % |
| Head TSL temperature change during test | < 0.5 °C | ---- | ---- |

SAR result with Head TSL

| SAR averaged over 1 cm ³ (1 g) of Head TSL | Condition | |
|---|--------------------|------------------------------|
| SAR measured | 250 mW input power | 12.5 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 49.0 W/kg \pm 17.0 % (k=2) |

| SAR averaged over 10 cm ³ (10 g) of Head TSL | condition | |
|---|--------------------|------------------------------|
| SAR measured | 250 mW input power | 5.95 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 23.5 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 | 52.9 | 1.81 mho/m |
| Measured Body TSL parameters | (22.0 \pm 0.2) °C | 53.1 \pm 6 % | 1.85 mho/m \pm 6 % |
| Body TSL temperature change during test | < 0.5 °C | ---- | ---- |

SAR result with Body TSL

| SAR averaged over 1 cm ³ (1 g) of Body TSL | Condition | |
|---|--------------------|------------------------------|
| SAR measured | 250 mW input power | 12.1 W/kg |
| SAR for nominal Body TSL parameters | normalized to 1W | 47.9 W/kg \pm 17.0 % (k=2) |

| SAR averaged over 10 cm ³ (10 g) of Body TSL | condition | |
|---|--------------------|------------------------------|
| SAR measured | 250 mW input power | 5.81 W/kg |
| SAR for nominal Body TSL parameters | normalized to 1W | 23.1 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 | 49.7 Ω - 4.1 j Ω |
| Return Loss | - 27.8 dB |

Antenna Parameters with Body TSL

| | |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 45.6 Ω - 2.9 j Ω |
| Return Loss | - 25.1 dB |

General Antenna Parameters and Design

| | |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.167 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 |
| Manufactured on | December 23, 2006 |

DASY5 Validation Report for Head TSL

Date: 25.01.2017

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2300 MHz; Type: D2300V2; Serial: D2300V2 - SN:1006

Communication System: UID 0 - CW; Frequency: 2300 MHz

Medium parameters used: $f = 2300$ MHz; $\sigma = 1.72$ S/m; $\epsilon_r = 38.5$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(7.99, 7.99, 7.99); Calibrated: 31.12.2016;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.01.2017
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

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

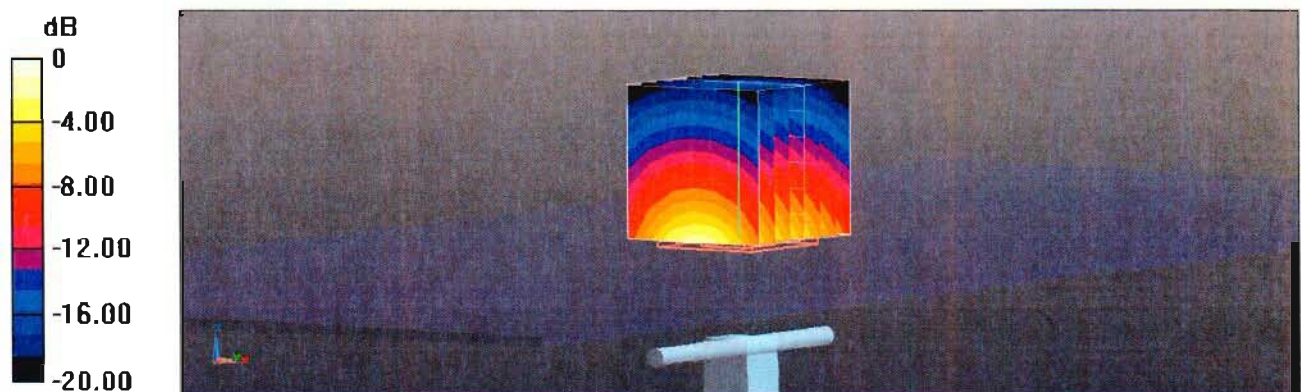
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 113.5 V/m; Power Drift = -0.05 dB

Peak SAR (extrapolated) = 25.3 W/kg

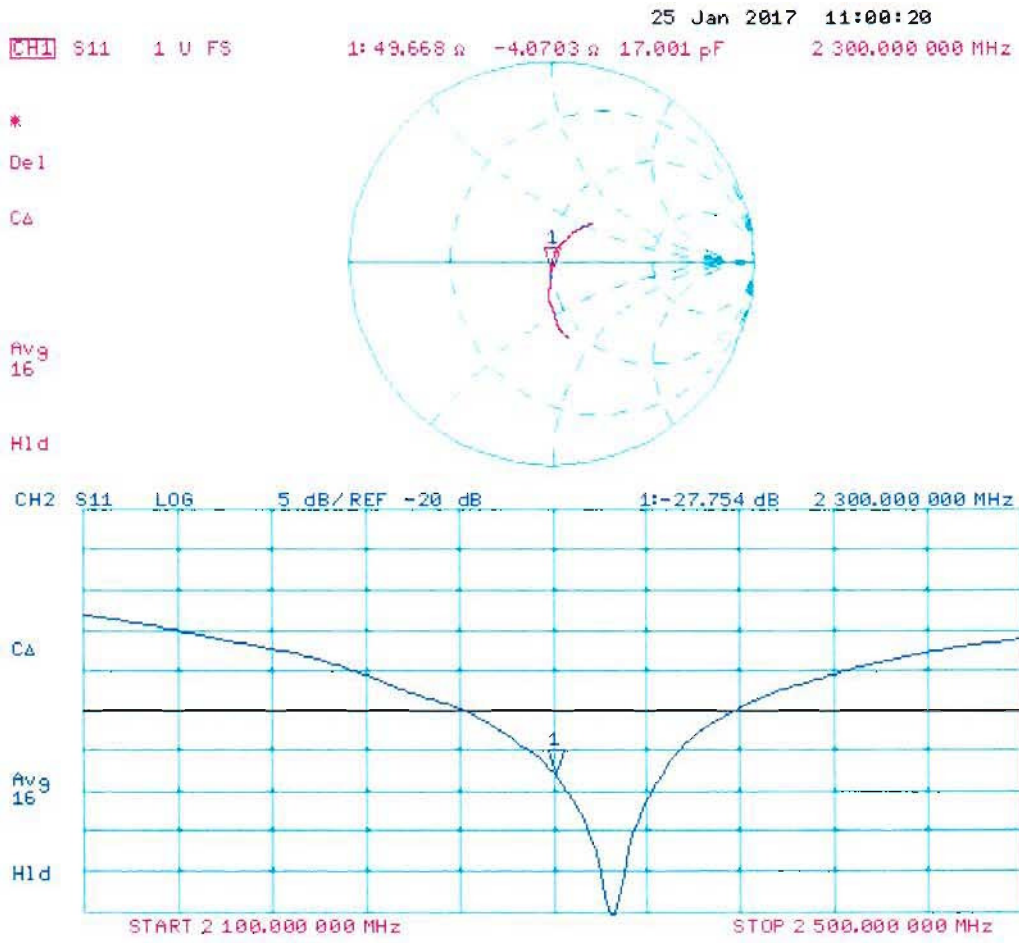
SAR(1 g) = 12.5 W/kg; SAR(10 g) = 5.95 W/kg

Maximum value of SAR (measured) = 20.3 W/kg



0 dB = 20.3 W/kg = 13.07 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 18.01.2017

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2300 MHz; Type: D2300V2; Serial: D2300V2 - SN:1006

Communication System: UID 0 - CW; Frequency: 2300 MHz

Medium parameters used: $f = 2300$ MHz; $\sigma = 1.85$ S/m; $\epsilon_r = 53.1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(7.79, 7.79, 7.79); Calibrated: 31.12.2016;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.01.2017
- Phantom: Flat Phantom 5.0 (back); Type: QD 000 P50 AA; Serial: 1002
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

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

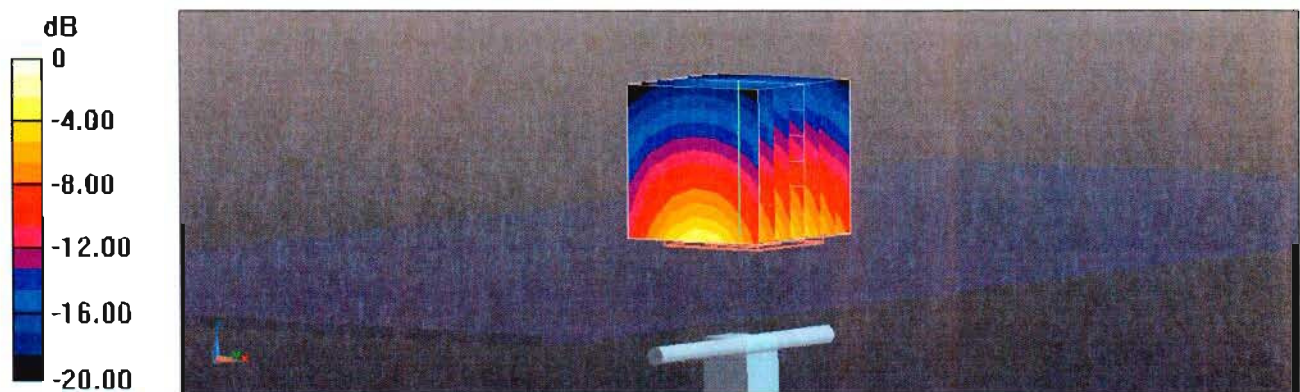
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 106.6 V/m; Power Drift = -0.06 dB

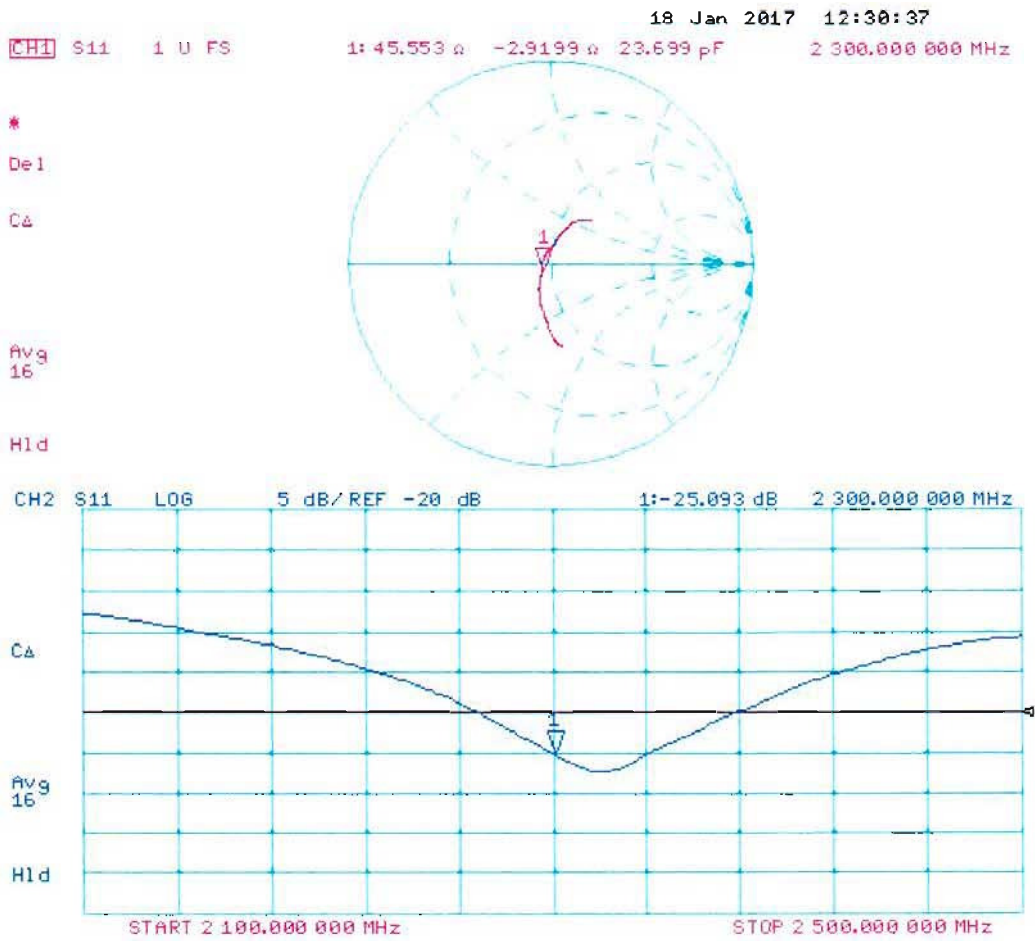
Peak SAR (extrapolated) = 23.9 W/kg

SAR(1 g) = 12.1 W/kg; SAR(10 g) = 5.81 W/kg

Maximum value of SAR (measured) = 19.5 W/kg



Impedance Measurement Plot for Body TSL





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

Accreditation No.: **SCS 0108**

Client **Sporton-TW (Auden)**

Certificate No: **D2450V2-926_Jul16**

CALIBRATION CERTIFICATE

Object **D2450V2 - SN:926**

Calibration procedure(s) **QA CAL-05.v9
Calibration procedure for dipole validation kits above 700 MHz**

Calibration date: **July 25, 2016**

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

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards | ID # | Cal Date (Certificate No.) | Scheduled Calibration |
|-----------------------------|--------------------|-----------------------------------|------------------------|
| Power meter NRP | SN: 104778 | 06-Apr-16 (No. 217-02288/02289) | Apr-17 |
| Power sensor NRP-Z91 | SN: 103244 | 06-Apr-16 (No. 217-02288) | Apr-17 |
| Power sensor NRP-Z91 | SN: 103245 | 06-Apr-16 (No. 217-02289) | Apr-17 |
| Reference 20 dB Attenuator | SN: 5058 (20k) | 05-Apr-16 (No. 217-02292) | Apr-17 |
| Type-N mismatch combination | SN: 5047.2 / 06327 | 05-Apr-16 (No. 217-02295) | Apr-17 |
| Reference Probe EX3DV4 | SN: 7349 | 15-Jun-16 (No. EX3-7349_Jun16) | Jun-17 |
| DAE4 | SN: 601 | 30-Dec-15 (No. DAE4-601_Dec15) | Dec-16 |
| Secondary Standards | ID # | Check Date (in house) | Scheduled Check |
| Power meter EPM-442A | SN: GB37480704 | 07-Oct-15 (No. 217-02222) | In house check: Oct-16 |
| Power sensor HP 8481A | SN: US37292783 | 07-Oct-15 (No. 217-02222) | In house check: Oct-16 |
| Power sensor HP 8481A | SN: MY41092317 | 07-Oct-15 (No. 217-02223) | In house check: Oct-16 |
| RF generator R&S SMT-06 | SN: 100972 | 15-Jun-15 (in house check Jun-15) | In house check: Oct-16 |
| Network Analyzer HP 8753E | SN: US37390585 | 18-Oct-01 (in house check Oct-15) | In house check: Oct-16 |

Calibrated by: **Michael Weber** Name: Michael Weber Function: Laboratory Technician

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

Signature

Issued: July 26, 2016

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



Accredited by the Swiss Accreditation Service (SAS)

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Glossary:

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

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- 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 | V52.8.8 |
| 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 ± 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 ± 0.2) °C | 38.0 ± 6 % | 1.86 mho/m ± 6 % |
| Head TSL temperature change during test | < 0.5 °C | ---- | ---- |

SAR result with Head TSL

| SAR averaged over 1 cm³ (1 g) of Head TSL | Condition | |
|---|--------------------|---------------------------------|
| SAR measured | 250 mW input power | 13.5 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 52.8 W/kg ± 17.0 % (k=2) |

| SAR averaged over 10 cm³ (10 g) of Head TSL | condition | |
|---|--------------------|---------------------------------|
| SAR measured | 250 mW input power | 6.22 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 24.5 W/kg ± 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 ± 0.2) °C | 51.8 ± 6 % | 2.03 mho/m ± 6 % |
| Body TSL temperature change during test | < 0.5 °C | ---- | ---- |

SAR result with Body TSL

| SAR averaged over 1 cm³ (1 g) of Body TSL | Condition | |
|---|--------------------|---------------------------------|
| SAR measured | 250 mW input power | 13.1 W/kg |
| SAR for nominal Body TSL parameters | normalized to 1W | 51.2 W/kg ± 17.0 % (k=2) |

| SAR averaged over 10 cm³ (10 g) of Body TSL | condition | |
|---|--------------------|---------------------------------|
| SAR measured | 250 mW input power | 6.07 W/kg |
| SAR for nominal Body TSL parameters | normalized to 1W | 24.0 W/kg ± 16.5 % (k=2) |

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

| | |
|--------------------------------------|-----------------------------|
| Impedance, transformed to feed point | $54.3 \Omega + 3.7 j\Omega$ |
| Return Loss | - 25.3 dB |

Antenna Parameters with Body TSL

| | |
|--------------------------------------|-----------------------------|
| Impedance, transformed to feed point | $50.3 \Omega + 5.0 j\Omega$ |
| Return Loss | - 26.0 dB |

General Antenna Parameters and Design

| | |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.155 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 |
| Manufactured on | September 26, 2013 |

DASY5 Validation Report for Head TSL

Date: 25.07.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz D2450V2; Type: D2450V2; Serial: D2450V2 - SN:926

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

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.86$ S/m; $\epsilon_r = 38$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(7.72, 7.72, 7.72); Calibrated: 15.06.2016;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

Dipole Calibration for Head Tissue/ $P_{in}=250$ mW, $d=10$ mm/Zoom Scan (7x7x7)/Cube 0:

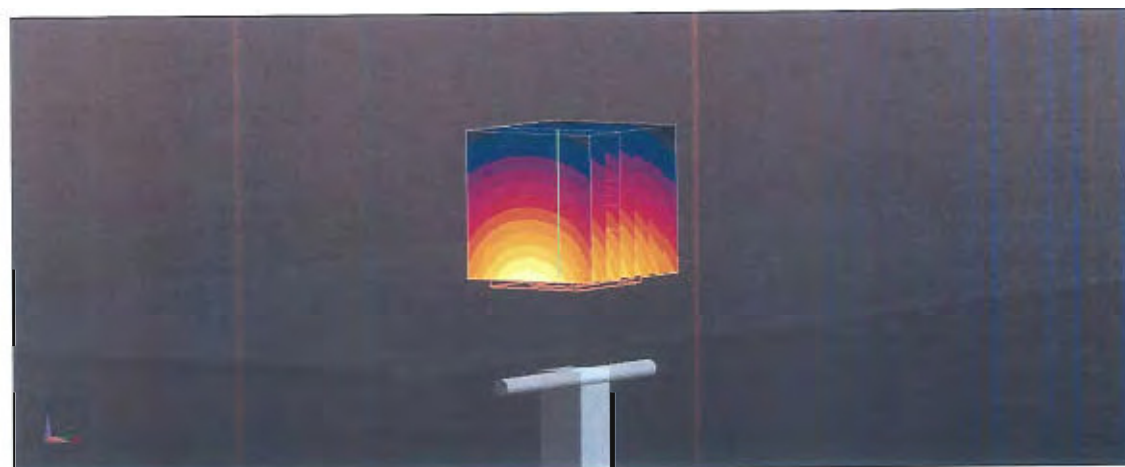
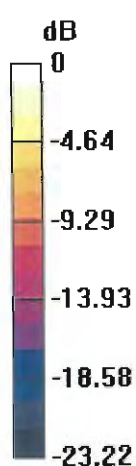
Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 114.2 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 27.6 W/kg

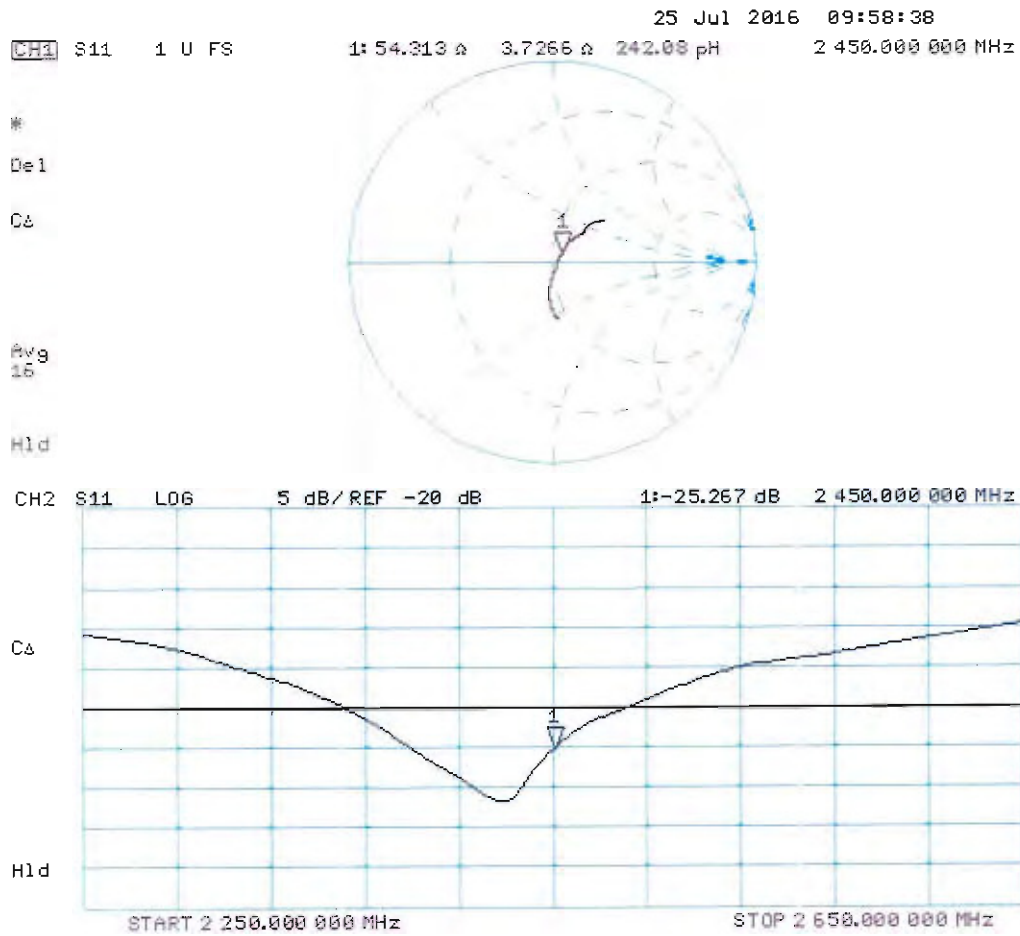
SAR(1 g) = 13.5 W/kg; SAR(10 g) = 6.22 W/kg

Maximum value of SAR (measured) = 22.3 W/kg



0 dB = 22.3 W/kg = 13.48 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 25.07.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz D2450V2; Type: D2450V2; Serial: D2450V2 - SN:926

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

Medium parameters used: $f = 2450$ MHz; $\sigma = 2.03$ S/m; $\epsilon_r = 51.8$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(7.79, 7.79, 7.79); Calibrated: 15.06.2016;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

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

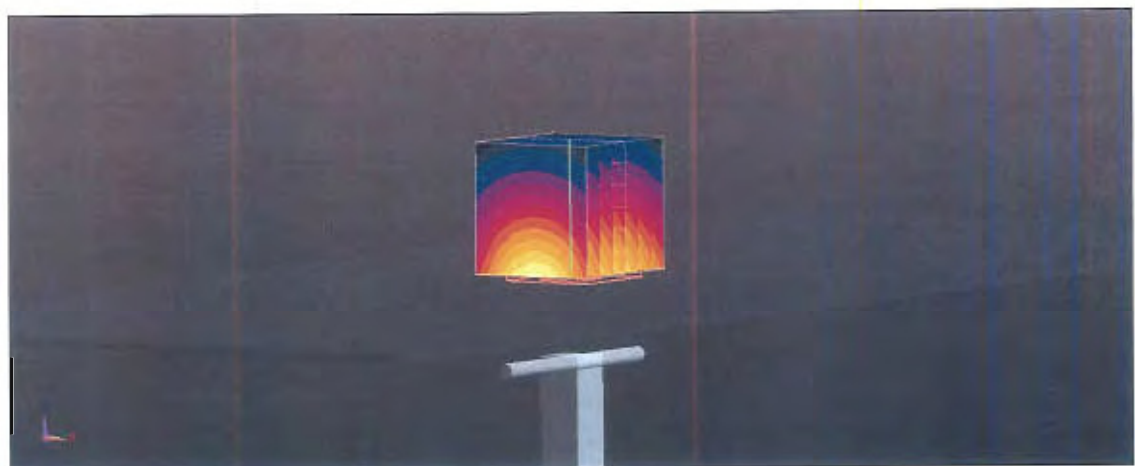
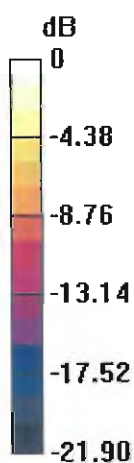
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 107.2 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 26.3 W/kg

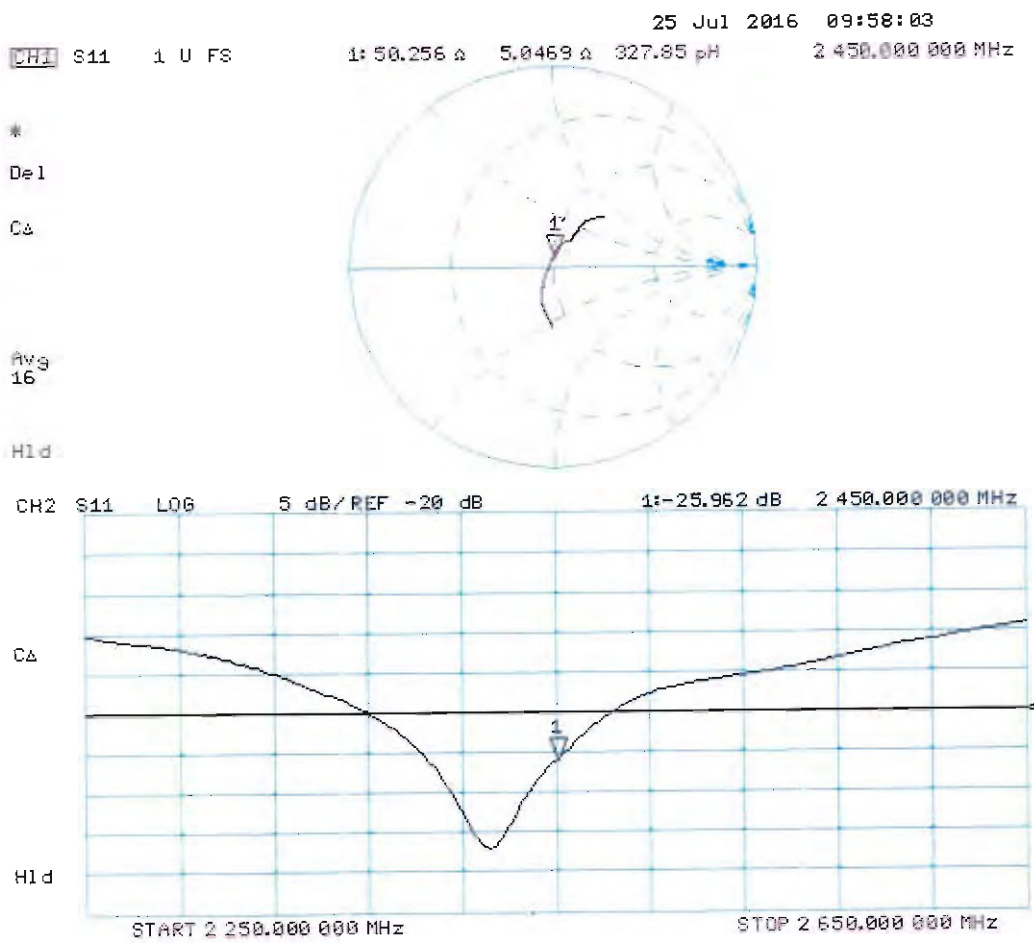
SAR(1 g) = 13.1 W/kg; SAR(10 g) = 6.07 W/kg

Maximum value of SAR (measured) = 21.4 W/kg



0 dB = 21.4 W/kg = 13.30 dBW/kg

Impedance Measurement Plot for Body TSL





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Client **Sporton_TW**

Certificate No: **Z16-97132**

CALIBRATION CERTIFICATE

Object **D2600V2 - SN: 1008**

Calibration Procedure(s) **FD-Z11-2-003-01**
Calibration Procedures for dipole validation kits

Calibration date: **August 30, 2016**

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

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards | ID # | Cal Date(Calibrated by, Certificate No.) | Scheduled Calibration |
|-------------------------|------------|--|-----------------------|
| Power Meter NRP2 | 101919 | 01-Jul-15 (CTTL, No.J15X04256) | Jun-16 |
| Power sensor NRP-Z91 | 101547 | 01-Jul-15 (CTTL, No.J15X04256) | Jun-16 |
| Reference Probe EX3DV4 | SN 3801 | 29-Jun-16(SPEAG,No.EX3-3801_Jun16) | Jun-17 |
| DAE4 | SN 777 | 22-Aug-16(CTTL-SPEAG,No.Z16-97138) | Aug-17 |
| Secondary Standards | ID # | Cal Date(Calibrated by, Certificate No.) | Scheduled Calibration |
| Signal Generator E4438C | MY49071430 | 01-Feb-16 (CTTL, No.J16X00893) | Jan-17 |
| Network Analyzer E5071C | MY46110673 | 26-Jan-16 (CTTL, No.J16X00894) | Jan-17 |

| | Name | Function | Signature |
|----------------|-------------|-----------------------------------|-----------|
| Calibrated by: | Zhao Jing | SAR Test Engineer | |
| Reviewed by: | Qi Dianyuan | SAR Project Leader | |
| Approved by: | Lu Bingsong | Deputy Director of the laboratory | |

Issued: September 1, 2016

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



Glossary:

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

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) For hand-held devices used in close proximity to the ear (frequency range of 300MHz to 3GHz)", February 2005
- IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)", March 2010
- KDB865664, 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%.



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 E-mail: cttl@chinattl.com Http://www.chinattl.cn

Measurement Conditions

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

| | | |
|-------------------------------------|--------------------------|-------------|
| DASY Version | DASY52 | 52.8.8.1258 |
| Extrapolation | Advanced Extrapolation | |
| Phantom | Triple Flat Phantom 5.1C | |
| Distance Dipole Center - TSL | 10 mm | with Spacer |
| Zoom Scan Resolution | dx, dy, dz = 5 mm | |
| Frequency | 2600 MHz ± 1 MHz | |

Head TSL parameters

The following parameters and calculations were applied.

| | Temperature | Permittivity | Conductivity |
|--|-----------------|--------------|------------------|
| Nominal Head TSL parameters | 22.0 °C | 39.0 | 1.96 mho/m |
| Measured Head TSL parameters | (22.0 ± 0.2) °C | 39.4 ± 6 % | 1.97 mho/m ± 6 % |
| Head TSL temperature change during test | <1.0 °C | --- | --- |

SAR result with Head TSL

| | | |
|---|--------------------|-----------------------------------|
| SAR averaged over 1 cm³ (1 g) of Head TSL | Condition | |
| SAR measured | 250 mW input power | 14.2 mW / g |
| SAR for nominal Head TSL parameters | normalized to 1W | 56.8 mW / g ± 20.8 % (k=2) |
| SAR averaged over 10 cm³ (10 g) of Head TSL | Condition | |
| SAR measured | 250 mW input power | 6.40 mW / g |
| SAR for nominal Head TSL parameters | normalized to 1W | 25.6 mW / g ± 20.4 % (k=2) |

Body TSL parameters

The following parameters and calculations were applied.

| | Temperature | Permittivity | Conductivity |
|--|-----------------|--------------|------------------|
| Nominal Body TSL parameters | 22.0 °C | 52.5 | 2.16 mho/m |
| Measured Body TSL parameters | (22.0 ± 0.2) °C | 52.2 ± 6 % | 2.18 mho/m ± 6 % |
| Body TSL temperature change during test | <1.0 °C | --- | --- |

SAR result with Body TSL

| | | |
|---|--------------------|-----------------------------------|
| SAR averaged over 1 cm³ (1 g) of Body TSL | Condition | |
| SAR measured | 250 mW input power | 13.9 mW / g |
| SAR for nominal Body TSL parameters | normalized to 1W | 55.2 mW / g ± 20.8 % (k=2) |
| SAR averaged over 10 cm³ (10 g) of Body TSL | Condition | |
| SAR measured | 250 mW input power | 6.28 mW / g |
| SAR for nominal Body TSL parameters | normalized to 1W | 25.0 mW / g ± 20.4 % (k=2) |



Appendix

Antenna Parameters with Head TSL

| | |
|--------------------------------------|---------------|
| Impedance, transformed to feed point | 48.3Ω- 1.82jΩ |
| Return Loss | - 31.8dB |

Antenna Parameters with Body TSL

| | |
|--------------------------------------|---------------|
| Impedance, transformed to feed point | 45.8Ω- 1.91jΩ |
| Return Loss | - 26.4dB |

General Antenna Parameters and Design

| | |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.046 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: 08.30.2016

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1008

Communication System: UID 0, CW; Frequency: 2600 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 2600$ MHz; $\sigma = 1.974$ S/m; $\epsilon_r = 39.43$; $\rho = 1000$ kg/m³

Phantom section: Right Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 - SN3801; ConvF(6.64, 6.64, 6.64); Calibrated: 6/29/2016;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn777; Calibrated: 8/22/2016
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/1
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372)

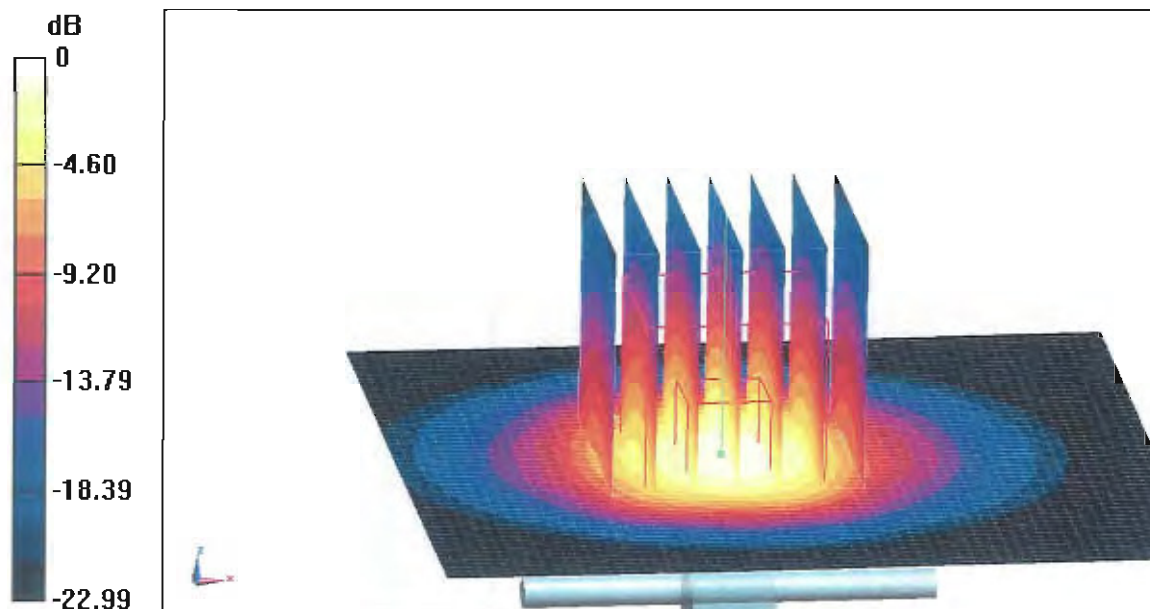
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 107.4 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 30.0 W/kg

SAR(1 g) = 14.2 W/kg; SAR(10 g) = 6.4 W/kg

Maximum value of SAR (measured) = 22.1 W/kg

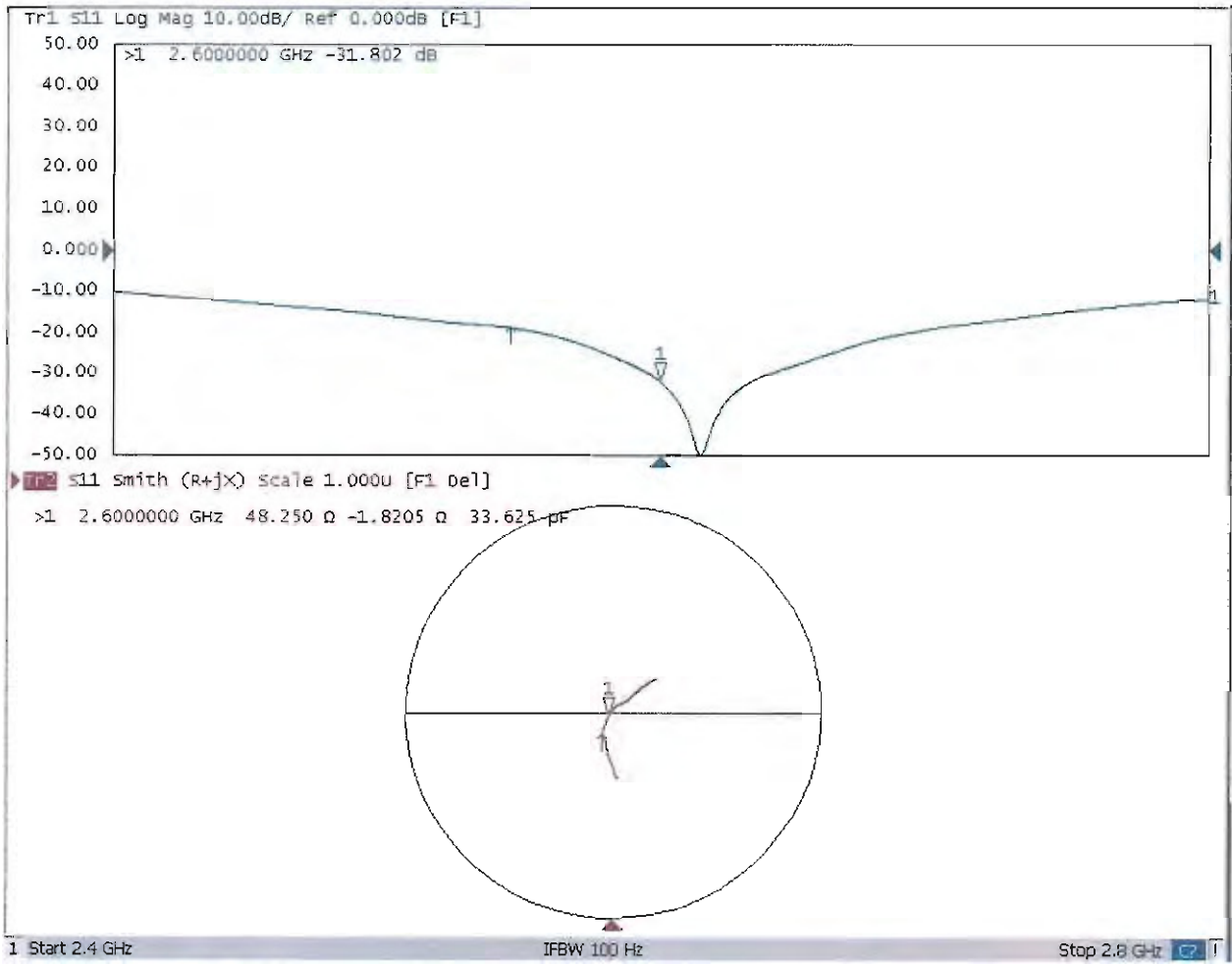


0 dB = 22.1 W/kg = 13.44 dBW/kg



Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
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Impedance Measurement Plot for Head TSL





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E-mail: cttl@chinattl.com Http://www.chinattl.cn

DASY5 Validation Report for Body TSL

Date: 08.30.2016

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1008

Communication System: UID 0, CW; Frequency: 2600 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 2600$ MHz; $\sigma = 2.184$ S/m; $\epsilon_r = 52.15$; $\rho = 1000$ kg/m³

Phantom section: Left Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 - SN3801; ConvF(6.7, 6.7,6.7); Calibrated: 6/29/2016;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn777; Calibrated: 8/22/2016
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/1
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372)

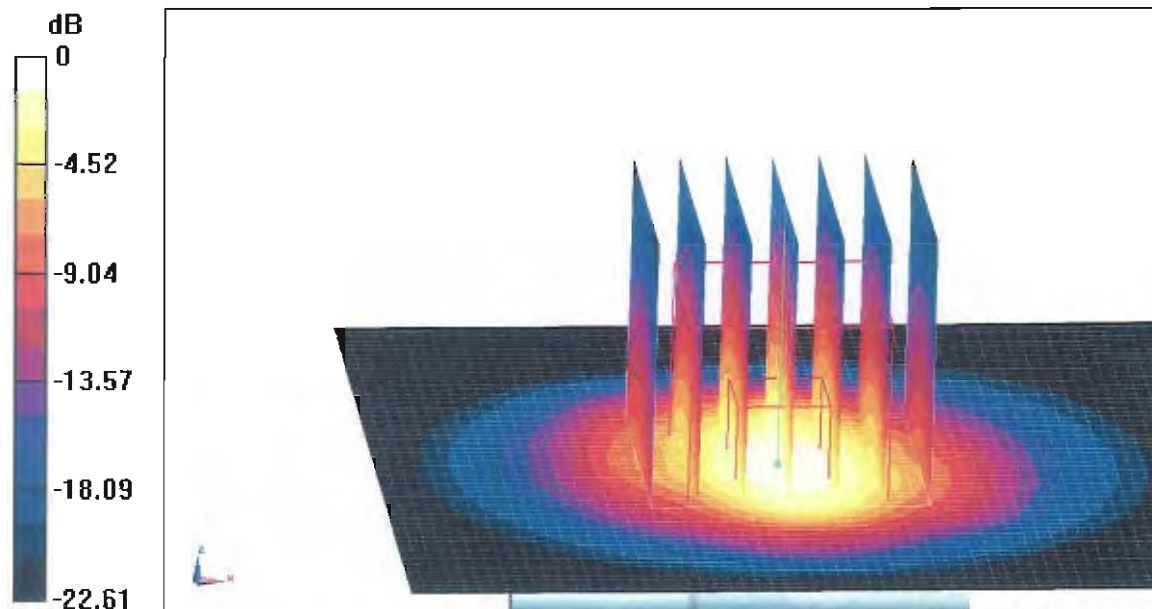
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 94.70 V/m; Power Drift = -0.00 dB

Peak SAR (extrapolated) = 28.8 W/kg

SAR(1 g) = 13.9 W/kg; SAR(10 g) = 6.28 W/kg

Maximum value of SAR (measured) = 21.3 W/kg

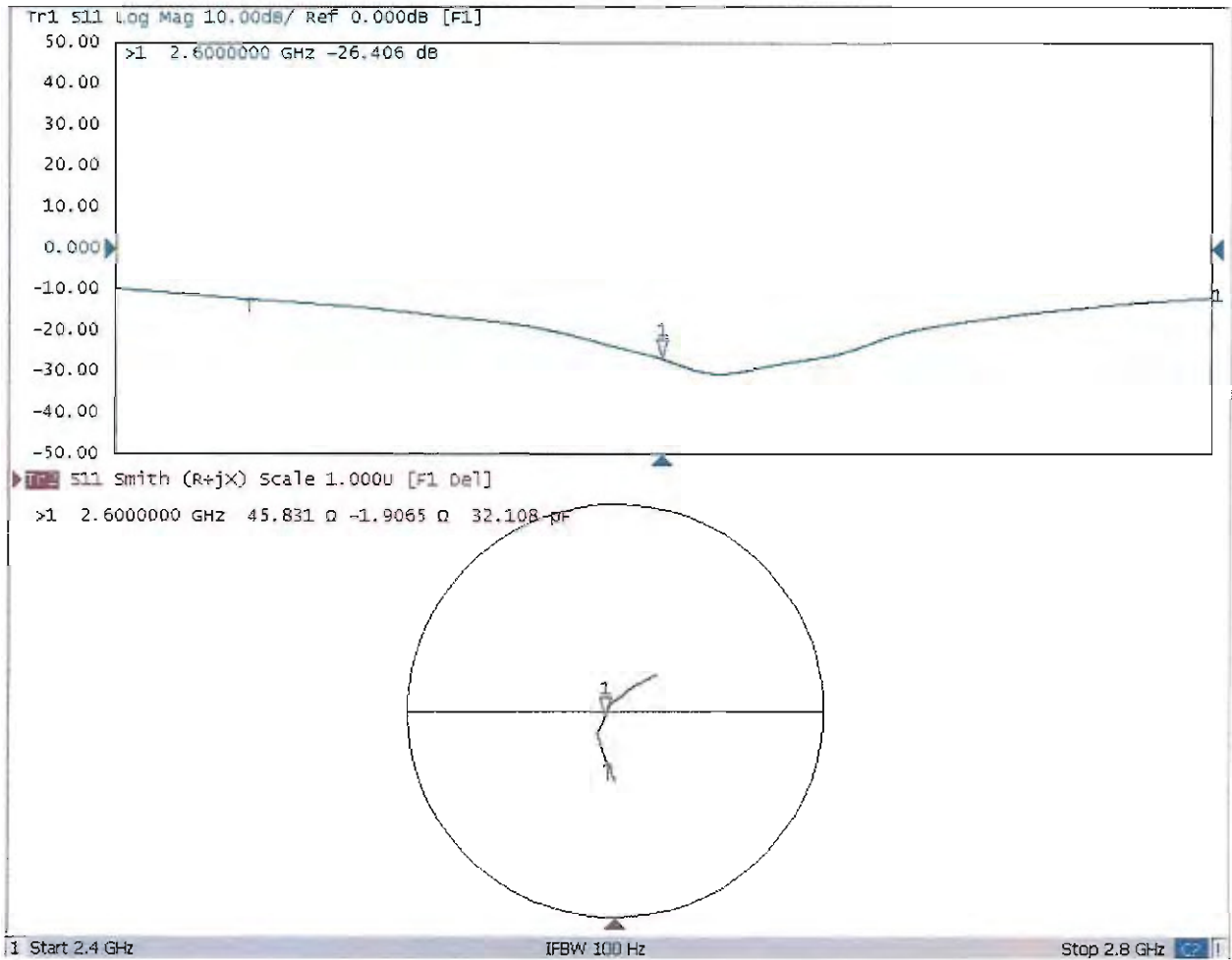


0 dB = 21.3 W/kg = 13.28 dBW/kg



Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com Http://www.chinattl.cn

Impedance Measurement Plot for Body TSL





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 **Sporton-TW (Auden)**

Certificate No: **D5GHzV2-1128_Jul16**

CALIBRATION CERTIFICATE

Object: **D5GHzV2 - SN:1128**

Calibration procedure(s): **QA CAL-22.v2**
Calibration procedure for dipole validation kits between 3-6 GHz

Calibration date: **July 27, 2016**

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

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards | ID # | Cal Date (Certificate No.) | Scheduled Calibration |
|-----------------------------|--------------------|---------------------------------|-----------------------|
| Power meter NRP | SN: 104778 | 06-Apr-16 (No. 217-02288/02289) | Apr-17 |
| Power sensor NRP-Z91 | SN: 103244 | 06-Apr-16 (No. 217-02288) | Apr-17 |
| Power sensor NRP-Z91 | SN: 103245 | 06-Apr-16 (No. 217-02289) | Apr-17 |
| Reference 20 dB Attenuator | SN: 5058 (20k) | 05-Apr-16 (No. 217-02292) | Apr-17 |
| Type-N mismatch combination | SN: 5047.2 / 06327 | 05-Apr-16 (No. 217-02295) | Apr-17 |
| Reference Probe EX3DV4 | SN: 3503 | 30-Jun-16 (No. EX3-3503_Jun16) | Jun-17 |
| DAE4 | SN: 601 | 30-Dec-15 (No. DAE4-601_Dec15) | Dec-16 |

| Secondary Standards | ID # | Check Date (in house) | Scheduled Check |
|---------------------------|----------------|-----------------------------------|------------------------|
| Power meter EPM-442A | SN: GB37480704 | 07-Oct-15 (No. 217-02222) | In house check: Oct-16 |
| Power sensor HP 8481A | SN: US37292783 | 07-Oct-15 (No. 217-02222) | In house check: Oct-16 |
| Power sensor HP 8481A | SN: MY41092317 | 07-Oct-15 (No. 217-02223) | In house check: Oct-16 |
| RF generator R&S SMT-06 | SN: 100972 | 15-Jun-15 (in house check Jun-15) | In house check: Oct-16 |
| Network Analyzer HP 8753E | SN: US37390585 | 18-Oct-01 (in house check Oct-15) | In house check: Oct-16 |

Calibrated by: **Claudio Leubler** (Name) / **Laboratory Technician** (Function)

Approved by: **Katja Pokovic** (Name) / **Technical Manager** (Function)

Signature:

Issued: July 27, 2016

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



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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Glossary:

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

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-2, "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 | V52.8.8 |
| Extrapolation | Advanced Extrapolation | |
| Phantom | Modular Flat Phantom V5.0 | |
| Distance Dipole Center - TSL | 10 mm | with Spacer |
| Zoom Scan Resolution | dx, dy = 4.0 mm, dz = 1.4 mm | Graded Ratio = 1.4 (Z direction) |
| Frequency | 5250 MHz ± 1 MHz 5600 MHz ± 1 MHz 5750 MHz ± 1 MHz | |

Head TSL parameters at 5250 MHz

The following parameters and calculations were applied.

| | Temperature | Permittivity | Conductivity |
|--|-----------------|--------------|------------------|
| Nominal Head TSL parameters | 22.0 °C | 35.9 | 4.71 mho/m |
| Measured Head TSL parameters | (22.0 ± 0.2) °C | 34.4 ± 6 % | 4.52 mho/m ± 6 % |
| Head TSL temperature change during test | < 0.5 °C | ---- | ---- |

SAR result with Head TSL at 5250 MHz

| SAR averaged over 1 cm³ (1 g) of Head TSL | Condition | |
|---|--------------------|---------------------------------|
| SAR measured | 100 mW input power | 7.87 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 77.9 W/kg ± 19.9 % (k=2) |

| SAR averaged over 10 cm³ (10 g) of Head TSL | condition | |
|---|--------------------|---------------------------------|
| SAR measured | 100 mW input power | 2.27 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 22.4 W/kg ± 19.5 % (k=2) |

Head TSL parameters at 5600 MHz

The following parameters and calculations were applied.

| | Temperature | Permittivity | Conductivity |
|---|-----------------|--------------|------------------|
| Nominal Head TSL parameters | 22.0 °C | 35.5 | 5.07 mho/m |
| Measured Head TSL parameters | (22.0 ± 0.2) °C | 33.9 ± 6 % | 4.86 mho/m ± 6 % |
| Head TSL temperature change during test | < 0.5 °C | ---- | ---- |

SAR result with Head TSL at 5600 MHz

| SAR averaged over 1 cm ³ (1 g) of Head TSL | Condition | |
|---|--------------------|-----------------------------------|
| SAR measured | 100 mW input power | 8.21 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 81.2 W / kg ± 19.9 % (k=2) |

| SAR averaged over 10 cm ³ (10 g) of Head TSL | condition | |
|---|--------------------|---------------------------------|
| SAR measured | 100 mW input power | 2.36 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 23.3 W/kg ± 19.5 % (k=2) |

Head TSL parameters at 5750 MHz

The following parameters and calculations were applied.

| | Temperature | Permittivity | Conductivity |
|---|-----------------|--------------|------------------|
| Nominal Head TSL parameters | 22.0 °C | 35.4 | 5.22 mho/m |
| Measured Head TSL parameters | (22.0 ± 0.2) °C | 33.7 ± 6 % | 5.02 mho/m ± 6 % |
| Head TSL temperature change during test | < 0.5 °C | ---- | ---- |

SAR result with Head TSL at 5750 MHz

| SAR averaged over 1 cm ³ (1 g) of Head TSL | Condition | |
|---|--------------------|---------------------------------|
| SAR measured | 100 mW input power | 7.92 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 78.3 W/kg ± 19.9 % (k=2) |

| SAR averaged over 10 cm ³ (10 g) of Head TSL | condition | |
|---|--------------------|---------------------------------|
| SAR measured | 100 mW input power | 2.27 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 22.4 W/kg ± 19.5 % (k=2) |

Body TSL parameters at 5250 MHz

The following parameters and calculations were applied.

| | Temperature | Permittivity | Conductivity |
|---|-----------------|--------------|------------------|
| Nominal Body TSL parameters | 22.0 °C | 48.9 | 5.36 mho/m |
| Measured Body TSL parameters | (22.0 ± 0.2) °C | 47.1 ± 6 % | 5.42 mho/m ± 6 % |
| Body TSL temperature change during test | < 0.5 °C | ---- | ---- |

SAR result with Body TSL at 5250 MHz

| SAR averaged over 1 cm ³ (1 g) of Body TSL | Condition | |
|---|--------------------|---------------------------------|
| SAR measured | 100 mW input power | 7.51 W/kg |
| SAR for nominal Body TSL parameters | normalized to 1W | 74.5 W/kg ± 19.9 % (k=2) |

| SAR averaged over 10 cm ³ (10 g) of Body TSL | condition | |
|---|--------------------|---------------------------------|
| SAR measured | 100 mW input power | 2.12 W/kg |
| SAR for nominal Body TSL parameters | normalized to 1W | 21.0 W/kg ± 19.5 % (k=2) |

Body TSL parameters at 5600 MHz

The following parameters and calculations were applied.

| | Temperature | Permittivity | Conductivity |
|---|-----------------|--------------|------------------|
| Nominal Body TSL parameters | 22.0 °C | 48.5 | 5.77 mho/m |
| Measured Body TSL parameters | (22.0 ± 0.2) °C | 46.5 ± 6 % | 5.88 mho/m ± 6 % |
| Body TSL temperature change during test | < 0.5 °C | ---- | ---- |

SAR result with Body TSL at 5600 MHz

| SAR averaged over 1 cm ³ (1 g) of Body TSL | Condition | |
|---|--------------------|---------------------------------|
| SAR measured | 100 mW input power | 7.86 W/kg |
| SAR for nominal Body TSL parameters | normalized to 1W | 78.0 W/kg ± 19.9 % (k=2) |

| SAR averaged over 10 cm ³ (10 g) of Body TSL | condition | |
|---|--------------------|---------------------------------|
| SAR measured | 100 mW input power | 2.21 W/kg |
| SAR for nominal Body TSL parameters | normalized to 1W | 21.9 W/kg ± 19.5 % (k=2) |

Body TSL parameters at 5750 MHz

The following parameters and calculations were applied.

| | Temperature | Permittivity | Conductivity |
|--|-----------------|--------------|------------------|
| Nominal Body TSL parameters | 22.0 °C | 48.3 | 5.94 mho/m |
| Measured Body TSL parameters | (22.0 ± 0.2) °C | 46.2 ± 6 % | 6.11 mho/m ± 6 % |
| Body TSL temperature change during test | < 0.5 °C | ---- | ---- |

SAR result with Body TSL at 5750 MHz

| SAR averaged over 1 cm³ (1 g) of Body TSL | Condition | |
|---|--------------------|---------------------------------|
| SAR measured | 100 mW input power | 7.67 W/kg |
| SAR for nominal Body TSL parameters | normalized to 1W | 76.1 W/kg ± 19.9 % (k=2) |

| SAR averaged over 10 cm³ (10 g) of Body TSL | condition | |
|---|--------------------|---------------------------------|
| SAR measured | 100 mW input power | 2.14 W/kg |
| SAR for nominal Body TSL parameters | normalized to 1W | 21.2 W/kg ± 19.5 % (k=2) |

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL at 5250 MHz

| | |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 51.6 Ω - 3.0 j Ω |
| Return Loss | - 29.5 dB |

Antenna Parameters with Head TSL at 5600 MHz

| | |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 56.1 Ω + 1.7 j Ω |
| Return Loss | - 24.6 dB |

Antenna Parameters with Head TSL at 5750 MHz

| | |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 53.9 Ω + 3.2 j Ω |
| Return Loss | - 26.2 dB |

Antenna Parameters with Body TSL at 5250 MHz

| | |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 49.8 Ω - 1.3 j Ω |
| Return Loss | - 37.6 dB |

Antenna Parameters with Body TSL at 5600 MHz

| | |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 57.4 Ω + 1.9 j Ω |
| Return Loss | - 23.0 dB |

Antenna Parameters with Body TSL at 5750 MHz

| | |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 54.8 Ω + 2.6 j Ω |
| Return Loss | - 25.6 dB |

General Antenna Parameters and Design

| | |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.203 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 |
| Manufactured on | September 08, 2011 |

DASY5 Validation Report for Head TSL

Date: 27.07.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1128

Communication System: UID 0 - CW; Frequency: 5250 MHz, Frequency: 5600 MHz, Frequency: 5750 MHz

Medium parameters used: $f = 5250$ MHz; $\sigma = 4.52$ S/m; $\epsilon_r = 34.4$; $\rho = 1000$ kg/m³

Medium parameters used: $f = 5600$ MHz; $\sigma = 4.86$ S/m; $\epsilon_r = 33.9$; $\rho = 1000$ kg/m³

Medium parameters used: $f = 5750$ MHz; $\sigma = 5.02$ S/m; $\epsilon_r = 33.7$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.42, 5.42, 5.42); Calibrated: 30.06.2016, ConvF(4.89, 4.89, 4.89); Calibrated: 30.06.2016, ConvF(4.85, 4.85, 4.85); Calibrated: 30.06.2016;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5250 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 73.50 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 28.9 W/kg

SAR(1 g) = 7.87 W/kg; SAR(10 g) = 2.27 W/kg

Maximum value of SAR (measured) = 18.1 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 73.50 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 32.4 W/kg

SAR(1 g) = 8.21 W/kg; SAR(10 g) = 2.36 W/kg

Maximum value of SAR (measured) = 19.6 W/kg

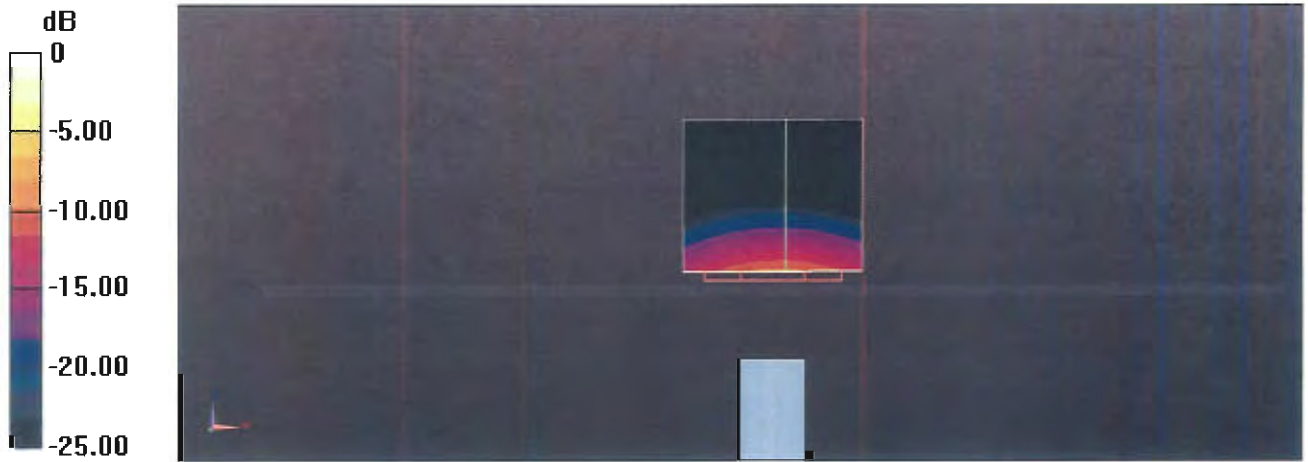
Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5750 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 71.33 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 32.0 W/kg

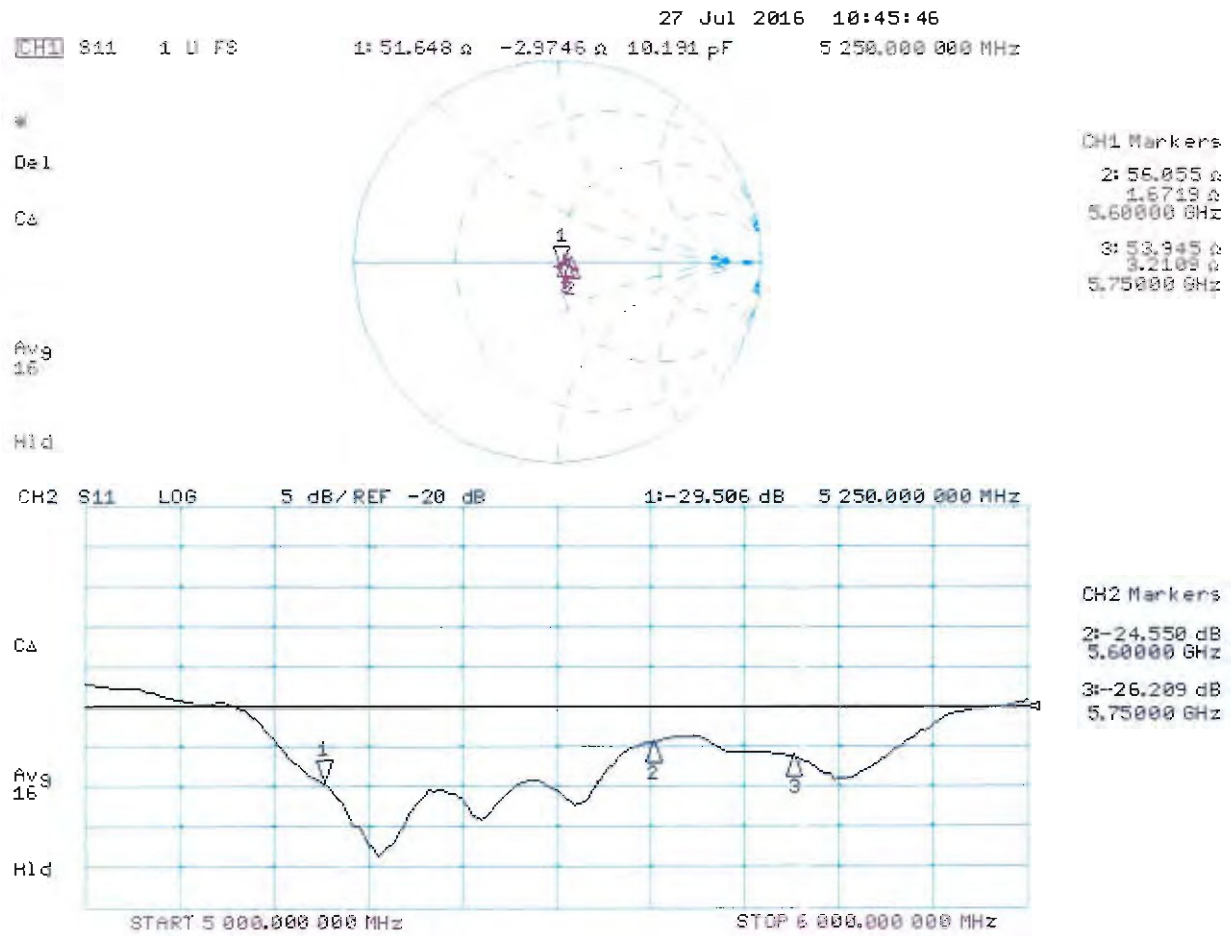
SAR(1 g) = 7.92 W/kg; SAR(10 g) = 2.27 W/kg

Maximum value of SAR (measured) = 19.0 W/kg



0 dB = 18.1 W/kg = 12.58 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 26.07.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1128

Communication System: UID 0 - CW; Frequency: 5250 MHz, Frequency: 5600 MHz, Frequency: 5750 MHz

Medium parameters used: $f = 5250$ MHz; $\sigma = 5.42$ S/m; $\epsilon_r = 47.1$; $\rho = 1000$ kg/m³

Medium parameters used: $f = 5600$ MHz; $\sigma = 5.88$ S/m; $\epsilon_r = 46.5$; $\rho = 1000$ kg/m³

Medium parameters used: $f = 5750$ MHz; $\sigma = 6.11$ S/m; $\epsilon_r = 46.2$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(4.85, 4.85, 4.85); Calibrated: 30.06.2016, ConvF(4.35, 4.35, 4.35); Calibrated: 30.06.2016, ConvF(4.3, 4.3, 4.3); Calibrated: 30.06.2016;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5250MHz/Zoom Scan,

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

Reference Value = 67.75 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 28.4 W/kg

SAR(1 g) = 7.51 W/kg; SAR(10 g) = 2.12 W/kg

Maximum value of SAR (measured) = 17.5 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan,

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

Reference Value = 67.02 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 32.5 W/kg

SAR(1 g) = 7.86 W/kg; SAR(10 g) = 2.21 W/kg

Maximum value of SAR (measured) = 18.7 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5750 MHz/Zoom Scan,

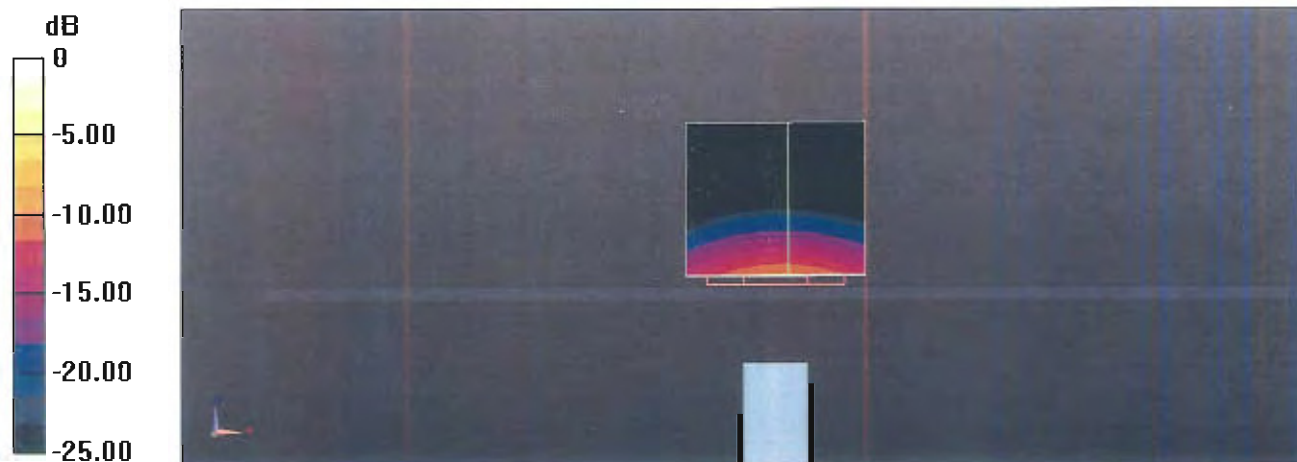
dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 65.29 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 33.1 W/kg

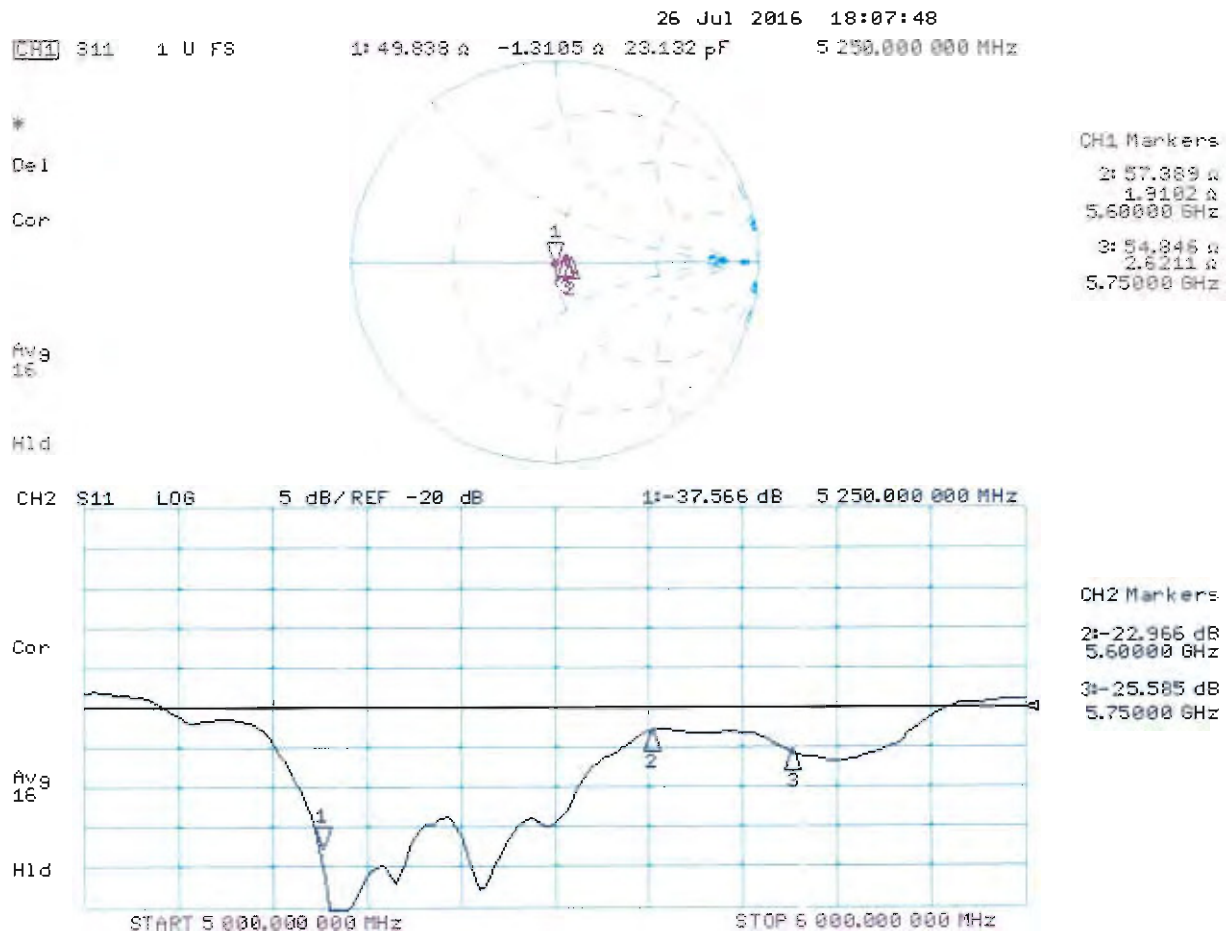
SAR(1 g) = 7.67 W/kg; SAR(10 g) = 2.14 W/kg

Maximum value of SAR (measured) = 18.5 W/kg



0 dB = 18.5 W/kg = 12.67 dBW/kg

Impedance Measurement Plot for Body TSL





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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Client **Sporton - ICC (Auden)**

Certificate No: **DAE4-1424_Feb17**

CALIBRATION CERTIFICATE

Object **DAE4 - SD 000 D04 BM - SN: 1424**

Calibration procedure(s) **QA CAL-06.v29
Calibration procedure for the data acquisition electronics (DAE)**

Calibration date: **February 16, 2017**

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

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards | ID # | Cal Date (Certificate No.) | Scheduled Calibration |
|-------------------------------|--------------------|----------------------------|------------------------|
| Keithley Multimeter Type 2001 | SN: 0810278 | 09-Sep-16 (No:19065) | Sep-17 |
| Secondary Standards | ID # | Check Date (in house) | Scheduled Check |
| Auto DAE Calibration Unit | SE UWS 053 AA 1001 | 05-Jan-17 (in house check) | In house check: Jan-18 |
| Calibrator Box V2.1 | SE UMS 006 AA 1002 | 05-Jan-17 (in house check) | In house check: Jan-18 |

| | | | |
|----------------|------------------------|--------------------------|---------------|
| Calibrated by: | Name Adrian Gehring | Function Technician | Signature |
| Approved by: | Fin Bornholt | Deputy Technical Manager | |

Issued: February 16, 2017

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Multilateral Agreement for the recognition of calibration certificates

Glossary

DAE data acquisition electronics
Connector angle information used in DASY system to align probe sensor X to the robot coordinate system.

Methods Applied and Interpretation of Parameters

- *DC Voltage Measurement:* Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- *Connector angle:* The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The following parameters as documented in the Appendix contain technical information as a result from the performance test and require no uncertainty.
 - *DC Voltage Measurement Linearity:* Verification of the Linearity at +10% and -10% of the nominal calibration voltage. Influence of offset voltage is included in this measurement.
 - *Common mode sensitivity:* Influence of a positive or negative common mode voltage on the differential measurement.
 - *Channel separation:* Influence of a voltage on the neighbor channels not subject to an input voltage.
 - *AD Converter Values with inputs shorted:* Values on the internal AD converter corresponding to zero input voltage
 - *Input Offset Measurement:* Output voltage and statistical results over a large number of zero voltage measurements.
 - *Input Offset Current:* Typical value for information; Maximum channel input offset current, not considering the input resistance.
 - *Input resistance:* Typical value for information: DAE input resistance at the connector, during internal auto-zeroing and during measurement.
 - *Low Battery Alarm Voltage:* Typical value for information. Below this voltage, a battery alarm signal is generated.
 - *Power consumption:* Typical value for information. Supply currents in various operating modes.

DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB = 6.1 μ V, full range = -100...+300 mV

Low Range: 1LSB = 61nV, full range = -1.....+3mV

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

| Calibration Factors | X | Y | Z |
|---------------------|---------------------------|---------------------------|---------------------------|
| High Range | 403.134 \pm 0.02% (k=2) | 403.619 \pm 0.02% (k=2) | 403.192 \pm 0.02% (k=2) |
| Low Range | 3.96929 \pm 1.50% (k=2) | 3.99683 \pm 1.50% (k=2) | 3.98424 \pm 1.50% (k=2) |

Connector Angle

| | |
|---|-------------------------------------|
| Connector Angle to be used in DASY system | 358.0 $^{\circ}$ \pm 1 $^{\circ}$ |
|---|-------------------------------------|

Appendix (Additional assessments outside the scope of SCS0108)

1. DC Voltage Linearity

| High Range | | Reading (μV) | Difference (μV) | Error (%) |
|------------|---------|---------------------------|------------------------------|-----------|
| Channel X | + Input | 200030.67 | -2.60 | -0.00 |
| Channel X | + Input | 20005.85 | 1.13 | 0.01 |
| Channel X | - Input | -20002.78 | 2.30 | -0.01 |
| Channel Y | + Input | 200031.94 | -1.24 | -0.00 |
| Channel Y | + Input | 20003.46 | -1.30 | -0.01 |
| Channel Y | - Input | -20006.16 | -1.09 | 0.01 |
| Channel Z | + Input | 200032.25 | -1.01 | -0.00 |
| Channel Z | + Input | 20004.24 | -0.48 | -0.00 |
| Channel Z | - Input | -20006.86 | -1.71 | 0.01 |

| Low Range | | Reading (μV) | Difference (μV) | Error (%) |
|-----------|---------|---------------------------|------------------------------|-----------|
| Channel X | + Input | 2001.70 | 0.52 | 0.03 |
| Channel X | + Input | 201.06 | -0.00 | -0.00 |
| Channel X | - Input | -198.66 | 0.27 | -0.13 |
| Channel Y | + Input | 2001.37 | 0.26 | 0.01 |
| Channel Y | + Input | 199.96 | -1.04 | -0.52 |
| Channel Y | - Input | -199.87 | -0.90 | 0.45 |
| Channel Z | + Input | 2000.87 | -0.15 | -0.01 |
| Channel Z | + Input | 199.84 | -1.10 | -0.55 |
| Channel Z | - Input | -200.34 | -1.29 | 0.65 |

2. Common mode sensitivity

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

| | Common mode Input Voltage (mV) | High Range Average Reading (μV) | Low Range Average Reading (μV) |
|-----------|--------------------------------|--|---|
| Channel X | 200 | -0.52 | -2.04 |
| | - 200 | 2.53 | 1.37 |
| Channel Y | 200 | -13.45 | -13.66 |
| | - 200 | 11.80 | 11.67 |
| Channel Z | 200 | -9.10 | -8.91 |
| | - 200 | 6.53 | 6.23 |

3. Channel separation

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

| | Input Voltage (mV) | Channel X (μV) | Channel Y (μV) | Channel Z (μV) |
|-----------|--------------------|-----------------------------|-----------------------------|-----------------------------|
| Channel X | 200 | - | 2.89 | -3.75 |
| Channel Y | 200 | 8.71 | - | 4.32 |
| Channel Z | 200 | 9.71 | 6.36 | - |

4. AD-Converter Values with inputs shorted

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

| | High Range (LSB) | Low Range (LSB) |
|-----------|------------------|-----------------|
| Channel X | 15953 | 15468 |
| Channel Y | 15877 | 15900 |
| Channel Z | 15869 | 13329 |

5. Input Offset Measurement

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Input 10M Ω

| | Average (μ V) | min. Offset (μ V) | max. Offset (μ V) | Std. Deviation (μ V) |
|-----------|--------------------|------------------------|------------------------|---------------------------|
| Channel X | 0.70 | -0.82 | 2.12 | 0.47 |
| Channel Y | -0.67 | -2.05 | 0.88 | 0.54 |
| Channel Z | -1.55 | -2.34 | -0.03 | 0.37 |

6. Input Offset Current

Nominal Input circuitry offset current on all channels: <25fA

7. Input Resistance (Typical values for information)

| | Zeroing (kOhm) | Measuring (MOhm) |
|-----------|----------------|------------------|
| Channel X | 200 | 200 |
| Channel Y | 200 | 200 |
| Channel Z | 200 | 200 |

8. Low Battery Alarm Voltage (Typical values for information)

| Typical values | Alarm Level (VDC) |
|----------------|-------------------|
| Supply (+ Vcc) | +7.9 |
| Supply (- Vcc) | -7.6 |

9. Power Consumption (Typical values for information)

| Typical values | Switched off (mA) | Stand by (mA) | Transmitting (mA) |
|----------------|-------------------|---------------|-------------------|
| Supply (+ Vcc) | +0.01 | +6 | +14 |
| Supply (- Vcc) | -0.01 | -8 | -9 |



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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Client **Sporton - TW (Auden)**

Certificate No: **DAE3-495_May16**

CALIBRATION CERTIFICATE

Object **DAE3 - SD 000 D03 AD - SN: 495**

Calibration procedure(s) **QA CAL-06.v29
Calibration procedure for the data acquisition electronics (DAE)**

Calibration date: **May 27, 2016**

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

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards | ID # | Cal Date (Certificate No.) | Scheduled Calibration |
|-------------------------------|--------------------|----------------------------|------------------------|
| Keithley Multimeter Type 2001 | SN: 0810278 | 09-Sep-15 (No:17153) | Sep-16 |
| Secondary Standards | ID # | Check Date (in house) | Scheduled Check |
| Auto DAE Calibration Unit | SE UWS 053 AA 1001 | 05-Jan-16 (in house check) | In house check: Jan-17 |
| Calibrator Box V2.1 | SE UMS 006 AA 1002 | 05-Jan-16 (in house check) | In house check: Jan-17 |

| | | | |
|----------------|-------------------|--------------------------|---------------|
| Calibrated by: | Name R.Mayoraz | Function Technician | Signature |
| Approved by: | Fin Bomholt | Deputy Technical Manager | |

Issued: May 27, 2016

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Glossary

DAE data acquisition electronics
Connector angle information used in DASY system to align probe sensor X to the robot coordinate system.

Methods Applied and Interpretation of Parameters

- *DC Voltage Measurement:* Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- *Connector angle:* The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The following parameters as documented in the Appendix contain technical information as a result from the performance test and require no uncertainty.
 - *DC Voltage Measurement Linearity:* Verification of the Linearity at +10% and -10% of the nominal calibration voltage. Influence of offset voltage is included in this measurement.
 - *Common mode sensitivity:* Influence of a positive or negative common mode voltage on the differential measurement.
 - *Channel separation:* Influence of a voltage on the neighbor channels not subject to an input voltage.
 - *AD Converter Values with inputs shorted:* Values on the internal AD converter corresponding to zero input voltage
 - *Input Offset Measurement:* Output voltage and statistical results over a large number of zero voltage measurements.
 - *Input Offset Current:* Typical value for information; Maximum channel input offset current, not considering the input resistance.
 - *Input resistance:* Typical value for information: DAE input resistance at the connector, during internal auto-zeroing and during measurement.
 - *Low Battery Alarm Voltage:* Typical value for information. Below this voltage, a battery alarm signal is generated.
 - *Power consumption:* Typical value for information. Supply currents in various operating modes.

DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB = 6.1 μ V, full range = -100...+300 mV

Low Range: 1LSB = 61nV, full range = -1.....+3mV

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

| Calibration Factors | X | Y | Z |
|---------------------|---------------------------|---------------------------|---------------------------|
| High Range | 404.392 \pm 0.02% (k=2) | 405.369 \pm 0.02% (k=2) | 405.725 \pm 0.02% (k=2) |
| Low Range | 3.95295 \pm 1.50% (k=2) | 3.99096 \pm 1.50% (k=2) | 3.96580 \pm 1.50% (k=2) |

Connector Angle

| | |
|---|------------------------------------|
| Connector Angle to be used in DASY system | 78.0 $^{\circ}$ \pm 1 $^{\circ}$ |
|---|------------------------------------|

Appendix (Additional assessments outside the scope of SCS0108)

1. DC Voltage Linearity

| High Range | Reading (μV) | Difference (μV) | Error (%) |
|-------------------|---------------------------|------------------------------|-----------|
| Channel X + Input | 199996.62 | 1.58 | 0.00 |
| Channel X + Input | 20000.74 | -0.12 | -0.00 |
| Channel X - Input | -19996.44 | 4.68 | -0.02 |
| Channel Y + Input | 199995.94 | 1.53 | 0.00 |
| Channel Y + Input | 20002.54 | 1.56 | 0.01 |
| Channel Y - Input | -19999.75 | 1.29 | -0.01 |
| Channel Z + Input | 199992.83 | -1.82 | -0.00 |
| Channel Z + Input | 20002.61 | 1.74 | 0.01 |
| Channel Z - Input | -19998.46 | 2.69 | -0.01 |

| Low Range | Reading (μV) | Difference (μV) | Error (%) |
|-------------------|---------------------------|------------------------------|-----------|
| Channel X + Input | 2001.48 | 0.75 | 0.04 |
| Channel X + Input | 201.55 | 0.46 | 0.23 |
| Channel X - Input | -198.32 | 0.30 | -0.15 |
| Channel Y + Input | 2000.13 | -0.57 | -0.03 |
| Channel Y + Input | 200.91 | -0.45 | -0.22 |
| Channel Y - Input | -199.30 | -0.77 | 0.39 |
| Channel Z + Input | 1999.63 | -0.96 | -0.05 |
| Channel Z + Input | 200.82 | -0.44 | -0.22 |
| Channel Z - Input | -199.88 | -1.27 | 0.64 |

2. Common mode sensitivity

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

| | Common mode Input Voltage (mV) | High Range Average Reading (μV) | Low Range Average Reading (μV) |
|-----------|--------------------------------|--|---|
| Channel X | 200 | 3.18 | 2.27 |
| | - 200 | -2.19 | -3.80 |
| Channel Y | 200 | 0.69 | 0.05 |
| | - 200 | -0.39 | -0.92 |
| Channel Z | 200 | 2.28 | 2.22 |
| | - 200 | -4.44 | -4.68 |

3. Channel separation

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

| | Input Voltage (mV) | Channel X (μV) | Channel Y (μV) | Channel Z (μV) |
|-----------|--------------------|-----------------------------|-----------------------------|-----------------------------|
| Channel X | 200 | - | -0.76 | -2.16 |
| Channel Y | 200 | 7.44 | - | -0.52 |
| Channel Z | 200 | 5.77 | 5.68 | - |

4. AD-Converter Values with inputs shorted

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

| | High Range (LSB) | Low Range (LSB) |
|-----------|------------------|-----------------|
| Channel X | 15817 | 17431 |
| Channel Y | 15765 | 17509 |
| Channel Z | 15903 | 17029 |

5. Input Offset Measurement

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Input 10M Ω

| | Average (μ V) | min. Offset (μ V) | max. Offset (μ V) | Std. Deviation (μ V) |
|-----------|--------------------|------------------------|------------------------|---------------------------|
| Channel X | -0.15 | -1.92 | 1.72 | 0.56 |
| Channel Y | 0.33 | -0.86 | 2.13 | 0.60 |
| Channel Z | -1.62 | -2.91 | -0.07 | 0.62 |

6. Input Offset Current

Nominal Input circuitry offset current on all channels: <25fA

7. Input Resistance (Typical values for information)

| | Zeroing (kOhm) | Measuring (MOhm) |
|-----------|----------------|------------------|
| Channel X | 200 | 200 |
| Channel Y | 200 | 200 |
| Channel Z | 200 | 200 |

8. Low Battery Alarm Voltage (Typical values for information)

| Typical values | Alarm Level (VDC) |
|----------------|-------------------|
| Supply (+ Vcc) | +7.9 |
| Supply (- Vcc) | -7.6 |

9. Power Consumption (Typical values for information)

| Typical values | Switched off (mA) | Stand by (mA) | Transmitting (mA) |
|----------------|-------------------|---------------|-------------------|
| Supply (+ Vcc) | +0.01 | +6 | +14 |
| Supply (- Vcc) | -0.01 | -8 | -9 |



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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Client **Sporton-TW (Auden)**

Certificate No: **DAE4-1399_Nov16**

CALIBRATION CERTIFICATE

Object **DAE4 - SD 000 D04 BM - SN: 1399**

Calibration procedure(s) **QA CAL-06.v29**
Calibration procedure for the data acquisition electronics (DAE)

Calibration date: **November 17, 2016**

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

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards | ID # | Cal Date (Certificate No.) | Scheduled Calibration |
|-------------------------------|--------------------|----------------------------|------------------------|
| Keithley Multimeter Type 2001 | SN: 0810278 | 09-Sep-16 (No:19065) | Sep-17 |
| Secondary Standards | ID # | Check Date (in house) | Scheduled Check |
| Auto DAE Calibration Unit | SE UWS 053 AA 1001 | 05-Jan-16 (in house check) | In house check: Jan-17 |
| Calibrator Box V2.1 | SE UMS 006 AA 1002 | 05-Jan-16 (in house check) | In house check: Jan-17 |

| | Name | Function | Signature |
|----------------|-------------------|--------------------------|-----------|
| Calibrated by: | Dominique Steffen | Technician | |
| Approved by: | Fin Bomholt | Deputy Technical Manager | |

Issued: November 17, 2016

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Glossary

DAE data acquisition electronics
Connector angle information used in DASY system to align probe sensor X to the robot coordinate system.

Methods Applied and Interpretation of Parameters

- *DC Voltage Measurement:* Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- *Connector angle:* The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The following parameters as documented in the Appendix contain technical information as a result from the performance test and require no uncertainty.
 - *DC Voltage Measurement Linearity:* Verification of the Linearity at +10% and -10% of the nominal calibration voltage. Influence of offset voltage is included in this measurement.
 - *Common mode sensitivity:* Influence of a positive or negative common mode voltage on the differential measurement.
 - *Channel separation:* Influence of a voltage on the neighbor channels not subject to an input voltage.
 - *AD Converter Values with inputs shorted:* Values on the internal AD converter corresponding to zero input voltage
 - *Input Offset Measurement:* Output voltage and statistical results over a large number of zero voltage measurements.
 - *Input Offset Current:* Typical value for information; Maximum channel input offset current, not considering the input resistance.
 - *Input resistance:* Typical value for information: DAE input resistance at the connector, during internal auto-zeroing and during measurement.
 - *Low Battery Alarm Voltage:* Typical value for information. Below this voltage, a battery alarm signal is generated.
 - *Power consumption:* Typical value for information. Supply currents in various operating modes.

DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB = 6.1 μ V, full range = -100...+300 mV

Low Range: 1LSB = 61nV, full range = -1.....+3mV

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

| Calibration Factors | X | Y | Z |
|---------------------|---------------------------|---------------------------|---------------------------|
| High Range | 403.601 \pm 0.02% (k=2) | 403.860 \pm 0.02% (k=2) | 403.715 \pm 0.02% (k=2) |
| Low Range | 3.98192 \pm 1.50% (k=2) | 3.99210 \pm 1.50% (k=2) | 3.98028 \pm 1.50% (k=2) |

Connector Angle

| | |
|---|-------------------------------------|
| Connector Angle to be used in DASY system | 302.5 $^{\circ}$ \pm 1 $^{\circ}$ |
|---|-------------------------------------|

Appendix (Additional assessments outside the scope of SCS0108)

1. DC Voltage Linearity

| High Range | Reading (μV) | Difference (μV) | Error (%) |
|-------------------|---------------------------|------------------------------|-----------|
| Channel X + Input | 199995.88 | 1.05 | 0.00 |
| Channel X + Input | 20002.28 | 0.87 | 0.00 |
| Channel X - Input | -19998.50 | 2.29 | -0.01 |
| Channel Y + Input | 199993.59 | -1.44 | -0.00 |
| Channel Y + Input | 20000.11 | -1.26 | -0.01 |
| Channel Y - Input | -20001.82 | -0.91 | 0.00 |
| Channel Z + Input | 199995.29 | -0.07 | -0.00 |
| Channel Z + Input | 19998.72 | -2.63 | -0.01 |
| Channel Z - Input | -20002.93 | -1.99 | 0.01 |

| Low Range | Reading (μV) | Difference (μV) | Error (%) |
|-------------------|---------------------------|------------------------------|-----------|
| Channel X + Input | 2001.09 | -0.18 | -0.01 |
| Channel X + Input | 201.99 | 0.26 | 0.13 |
| Channel X - Input | -197.66 | 0.46 | -0.23 |
| Channel Y + Input | 2001.13 | -0.06 | -0.00 |
| Channel Y + Input | 200.58 | -0.99 | -0.49 |
| Channel Y - Input | -198.74 | -0.44 | 0.22 |
| Channel Z + Input | 2001.38 | 0.15 | 0.01 |
| Channel Z + Input | 200.84 | -0.68 | -0.34 |
| Channel Z - Input | -199.07 | -0.83 | 0.42 |

2. Common mode sensitivity

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

| | Common mode Input Voltage (mV) | High Range Average Reading (μV) | Low Range Average Reading (μV) |
|-----------|--------------------------------|--|---|
| Channel X | 200 | -4.94 | -6.62 |
| | - 200 | 8.38 | 6.51 |
| Channel Y | 200 | -6.22 | -6.54 |
| | - 200 | 5.04 | 4.27 |
| Channel Z | 200 | -6.68 | -6.74 |
| | - 200 | 4.86 | 5.05 |

3. Channel separation

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

| | Input Voltage (mV) | Channel X (μV) | Channel Y (μV) | Channel Z (μV) |
|-----------|--------------------|-----------------------------|-----------------------------|-----------------------------|
| Channel X | 200 | - | 4.65 | -1.72 |
| Channel Y | 200 | 9.38 | - | 6.88 |
| Channel Z | 200 | 8.80 | 6.72 | - |

4. AD-Converter Values with inputs shorted

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

| | High Range (LSB) | Low Range (LSB) |
|-----------|------------------|-----------------|
| Channel X | 15826 | 16053 |
| Channel Y | 16118 | 16526 |
| Channel Z | 15887 | 15918 |

5. Input Offset Measurement

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Input 10M Ω

| | Average (μ V) | min. Offset (μ V) | max. Offset (μ V) | Std. Deviation (μ V) |
|-----------|--------------------|------------------------|------------------------|---------------------------|
| Channel X | 0.11 | -0.73 | 0.73 | 0.27 |
| Channel Y | -0.19 | -1.32 | 1.76 | 0.44 |
| Channel Z | -0.78 | -2.06 | 0.51 | 0.41 |

6. Input Offset Current

Nominal Input circuitry offset current on all channels: <25fA

7. Input Resistance (Typical values for information)

| | Zeroing (kOhm) | Measuring (MOhm) |
|-----------|----------------|------------------|
| Channel X | 200 | 200 |
| Channel Y | 200 | 200 |
| Channel Z | 200 | 200 |

8. Low Battery Alarm Voltage (Typical values for information)

| Typical values | Alarm Level (VDC) |
|----------------|-------------------|
| Supply (+ Vcc) | +7.9 |
| Supply (- Vcc) | -7.6 |

9. Power Consumption (Typical values for information)

| Typical values | Switched off (mA) | Stand by (mA) | Transmitting (mA) |
|----------------|-------------------|---------------|-------------------|
| Supply (+ Vcc) | +0.01 | +6 | +14 |
| Supply (- Vcc) | -0.01 | -8 | -9 |



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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Client **Sporton - TW (Auden)**

Certificate No: **DAE4-778_May16**

CALIBRATION CERTIFICATE

Object **DAE4 - SD 000 D04 BM - SN: 778**

Calibration procedure(s) **QA CAL-06.v29
Calibration procedure for the data acquisition electronics (DAE)**

Calibration date: **May 12, 2016**

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

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards | ID # | Cal Date (Certificate No.) | Scheduled Calibration |
|-------------------------------|--------------------|----------------------------|------------------------|
| Keithley Multimeter Type 2001 | SN: 0810278 | 09-Sep-15 (No:17153) | Sep-16 |
| Secondary Standards | ID # | Check Date (in house) | Scheduled Check |
| Auto DAE Calibration Unit | SE UWS 053 AA 1001 | 05-Jan-16 (in house check) | In house check: Jan-17 |
| Calibrator Box V2.1 | SE UMS 006 AA 1002 | 05-Jan-16 (in house check) | In house check: Jan-17 |

| | | | |
|----------------|---------------------------|--------------------------|---------------|
| Calibrated by: | Name Dominique Steffen | Function Technician | Signature |
| Approved by: | Fin Bomholt | Deputy Technical Manager | |

Issued: May 12, 2016

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Glossary

DAE data acquisition electronics
Connector angle information used in DASY system to align probe sensor X to the robot coordinate system.

Methods Applied and Interpretation of Parameters

- *DC Voltage Measurement:* Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- *Connector angle:* The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The following parameters as documented in the Appendix contain technical information as a result from the performance test and require no uncertainty.
 - *DC Voltage Measurement Linearity:* Verification of the Linearity at +10% and -10% of the nominal calibration voltage. Influence of offset voltage is included in this measurement.
 - *Common mode sensitivity:* Influence of a positive or negative common mode voltage on the differential measurement.
 - *Channel separation:* Influence of a voltage on the neighbor channels not subject to an input voltage.
 - *AD Converter Values with inputs shorted:* Values on the internal AD converter corresponding to zero input voltage
 - *Input Offset Measurement:* Output voltage and statistical results over a large number of zero voltage measurements.
 - *Input Offset Current:* Typical value for information; Maximum channel input offset current, not considering the input resistance.
 - *Input resistance:* Typical value for information: DAE input resistance at the connector, during internal auto-zeroing and during measurement.
 - *Low Battery Alarm Voltage:* Typical value for information. Below this voltage, a battery alarm signal is generated.
 - *Power consumption:* Typical value for information. Supply currents in various operating modes.

DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB = 6.1 μ V, full range = -100...+300 mV

Low Range: 1LSB = 61nV, full range = -1.....+3mV

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

| Calibration Factors | X | Y | Z |
|---------------------|---------------------------|---------------------------|---------------------------|
| High Range | 404.712 \pm 0.02% (k=2) | 403.516 \pm 0.02% (k=2) | 405.068 \pm 0.02% (k=2) |
| Low Range | 3.98678 \pm 1.50% (k=2) | 3.96495 \pm 1.50% (k=2) | 4.00091 \pm 1.50% (k=2) |

Connector Angle

| | |
|---|--------------------------|
| Connector Angle to be used in DASY system | 270.0 \pm 1 $^{\circ}$ |
|---|--------------------------|

Appendix (Additional assessments outside the scope of SCS0108)

1. DC Voltage Linearity

| High Range | Reading (μV) | Difference (μV) | Error (%) |
|-------------------|---------------------------|------------------------------|-----------|
| Channel X + Input | 200032.14 | -1.38 | -0.00 |
| Channel X + Input | 20005.68 | 0.79 | 0.00 |
| Channel X - Input | -20003.61 | 1.31 | -0.01 |
| Channel Y + Input | 200030.28 | -3.73 | -0.00 |
| Channel Y + Input | 20006.01 | 1.25 | 0.01 |
| Channel Y - Input | -20003.00 | 1.89 | -0.01 |
| Channel Z + Input | 200035.46 | 1.52 | 0.00 |
| Channel Z + Input | 20002.36 | -2.31 | -0.01 |
| Channel Z - Input | -20008.31 | -3.27 | 0.02 |

| Low Range | Reading (μV) | Difference (μV) | Error (%) |
|-------------------|---------------------------|------------------------------|-----------|
| Channel X + Input | 2001.27 | 0.01 | 0.00 |
| Channel X + Input | 201.37 | 0.21 | 0.10 |
| Channel X - Input | -198.61 | -0.02 | 0.01 |
| Channel Y + Input | 2001.38 | 0.24 | 0.01 |
| Channel Y + Input | 200.13 | -0.97 | -0.48 |
| Channel Y - Input | -198.84 | -0.10 | 0.05 |
| Channel Z + Input | 2001.29 | 0.21 | 0.01 |
| Channel Z + Input | 200.34 | -0.69 | -0.34 |
| Channel Z - Input | -200.58 | -1.74 | 0.88 |

2. Common mode sensitivity

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

| | Common mode Input Voltage (mV) | High Range Average Reading (μV) | Low Range Average Reading (μV) |
|-----------|--------------------------------|--|---|
| Channel X | 200 | -4.35 | -5.61 |
| | - 200 | 7.07 | 5.78 |
| Channel Y | 200 | -1.79 | -1.82 |
| | - 200 | 0.49 | 0.20 |
| Channel Z | 200 | -12.55 | -12.56 |
| | - 200 | 10.17 | 10.19 |

3. Channel separation

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

| | Input Voltage (mV) | Channel X (μV) | Channel Y (μV) | Channel Z (μV) |
|-----------|--------------------|-----------------------------|-----------------------------|-----------------------------|
| Channel X | 200 | - | -0.66 | -2.54 |
| Channel Y | 200 | 8.70 | - | -0.26 |
| Channel Z | 200 | 3.71 | 7.16 | - |

4. AD-Converter Values with inputs shorted

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

| | High Range (LSB) | Low Range (LSB) |
|-----------|------------------|-----------------|
| Channel X | 16054 | 16869 |
| Channel Y | 16191 | 17846 |
| Channel Z | 16441 | 16314 |

5. Input Offset Measurement

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Input 10M Ω

| | Average (μ V) | min. Offset (μ V) | max. Offset (μ V) | Std. Deviation (μ V) |
|-----------|--------------------|------------------------|------------------------|---------------------------|
| Channel X | 0.48 | -0.60 | 1.44 | 0.42 |
| Channel Y | -0.09 | -1.42 | 2.50 | 0.58 |
| Channel Z | -1.11 | -2.45 | -0.19 | 0.45 |

6. Input Offset Current

Nominal Input circuitry offset current on all channels: <25fA

7. Input Resistance (Typical values for information)

| | Zeroing (kOhm) | Measuring (MOhm) |
|-----------|----------------|------------------|
| Channel X | 200 | 200 |
| Channel Y | 200 | 200 |
| Channel Z | 200 | 200 |

8. Low Battery Alarm Voltage (Typical values for information)

| Typical values | Alarm Level (VDC) |
|----------------|-------------------|
| Supply (+ Vcc) | +7.9 |
| Supply (- Vcc) | -7.6 |

9. Power Consumption (Typical values for information)

| Typical values | Switched off (mA) | Stand by (mA) | Transmitting (mA) |
|----------------|-------------------|---------------|-------------------|
| Supply (+ Vcc) | +0.01 | +6 | +14 |
| Supply (- Vcc) | -0.01 | -8 | -9 |



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Accreditation No.: **SCS 0108**

Client **Sporton - TW (Auden)**

Certificate No: **DAE3-577_Sep16**

CALIBRATION CERTIFICATE

Object **DAE3 - SD 000 D03 AA - SN: 577**

Calibration procedure(s) **QA CAL-06.v29
Calibration procedure for the data acquisition electronics (DAE)**

Calibration date: **September 28, 2016**

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

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards | ID # | Cal Date (Certificate No.) | Scheduled Calibration |
|-------------------------------|--------------------|----------------------------|------------------------|
| Keithley Multimeter Type 2001 | SN: 0810278 | 09-Sep-16 (No:19065) | Sep-17 |
| Secondary Standards | ID # | Check Date (in house) | Scheduled Check |
| Auto DAE Calibration Unit | SE UWS 053 AA 1001 | 05-Jan-16 (in house check) | In house check: Jan-17 |
| Calibrator Box V2.1 | SE UMS 006 AA 1002 | 05-Jan-16 (in house check) | In house check: Jan-17 |

Calibrated by: **Name** Eric Hainfeld **Function** Technician

Signature

Approved by: **Name** Fin Bomholt **Function** Deputy Technical Manager

Issued: September 28, 2016

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Accreditation No.: **SCS 0108**

Glossary

| | |
|-----------------|---|
| DAE | data acquisition electronics |
| Connector angle | information used in DASY system to align probe sensor X to the robot coordinate system. |

Methods Applied and Interpretation of Parameters

- *DC Voltage Measurement:* Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- *Connector angle:* The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The following parameters as documented in the Appendix contain technical information as a result from the performance test and require no uncertainty.
 - *DC Voltage Measurement Linearity:* Verification of the Linearity at +10% and -10% of the nominal calibration voltage. Influence of offset voltage is included in this measurement.
 - *Common mode sensitivity:* Influence of a positive or negative common mode voltage on the differential measurement.
 - *Channel separation:* Influence of a voltage on the neighbor channels not subject to an input voltage.
 - *AD Converter Values with inputs shorted:* Values on the internal AD converter corresponding to zero input voltage
 - *Input Offset Measurement:* Output voltage and statistical results over a large number of zero voltage measurements.
 - *Input Offset Current:* Typical value for information; Maximum channel input offset current, not considering the input resistance.
 - *Input resistance:* Typical value for information: DAE input resistance at the connector, during internal auto-zeroing and during measurement.
 - *Low Battery Alarm Voltage:* Typical value for information. Below this voltage, a battery alarm signal is generated.
 - *Power consumption:* Typical value for information. Supply currents in various operating modes.

DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB = 6.1 μ V, full range = -100...+300 mV

Low Range: 1LSB = 61nV, full range = -1.....+3mV

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

| Calibration Factors | X | Y | Z |
|---------------------|---------------------------|---------------------------|---------------------------|
| High Range | 403.533 \pm 0.02% (k=2) | 403.512 \pm 0.02% (k=2) | 403.819 \pm 0.02% (k=2) |
| Low Range | 3.92648 \pm 1.50% (k=2) | 3.94206 \pm 1.50% (k=2) | 3.96074 \pm 1.50% (k=2) |

Connector Angle

| | |
|---|-------------------------------------|
| Connector Angle to be used in DASY system | 190.0 $^{\circ}$ \pm 1 $^{\circ}$ |
|---|-------------------------------------|

Appendix (Additional assessments outside the scope of SCS0108)

1. DC Voltage Linearity

| High Range | | Reading (μV) | Difference (μV) | Error (%) |
|------------|---------|---------------------------|------------------------------|-----------|
| Channel X | + Input | 200038.14 | 2.56 | 0.00 |
| Channel X | + Input | 20010.51 | 5.45 | 0.03 |
| Channel X | - Input | -20002.01 | 3.17 | -0.02 |
| Channel Y | + Input | 200032.33 | -3.18 | -0.00 |
| Channel Y | + Input | 20006.38 | 1.35 | 0.01 |
| Channel Y | - Input | -20004.73 | 0.65 | -0.00 |
| Channel Z | + Input | 200031.49 | -4.11 | -0.00 |
| Channel Z | + Input | 20005.92 | 0.98 | 0.00 |
| Channel Z | - Input | -20007.03 | -1.64 | 0.01 |

| Low Range | | Reading (μV) | Difference (μV) | Error (%) |
|-----------|---------|---------------------------|------------------------------|-----------|
| Channel X | + Input | 2001.00 | -0.10 | -0.01 |
| Channel X | + Input | 201.47 | 0.40 | 0.20 |
| Channel X | - Input | -198.57 | 0.28 | -0.14 |
| Channel Y | + Input | 2001.38 | 0.31 | 0.02 |
| Channel Y | + Input | 200.40 | -0.54 | -0.27 |
| Channel Y | - Input | -199.63 | -0.73 | 0.37 |
| Channel Z | + Input | 2000.35 | -0.56 | -0.03 |
| Channel Z | + Input | 199.97 | -0.93 | -0.46 |
| Channel Z | - Input | -200.50 | -1.56 | 0.79 |

2. Common mode sensitivity

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

| | Common mode Input Voltage (mV) | High Range Average Reading (μV) | Low Range Average Reading (μV) |
|-----------|--------------------------------|--|---|
| Channel X | 200 | -2.76 | -4.30 |
| | - 200 | 6.04 | 3.73 |
| Channel Y | 200 | -14.29 | -14.35 |
| | - 200 | 12.74 | 12.77 |
| Channel Z | 200 | 3.10 | 2.81 |
| | - 200 | -5.90 | -5.65 |

3. Channel separation

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

| | Input Voltage (mV) | Channel X (μV) | Channel Y (μV) | Channel Z (μV) |
|-----------|--------------------|-----------------------------|-----------------------------|-----------------------------|
| Channel X | 200 | - | -1.07 | -3.44 |
| Channel Y | 200 | 8.43 | - | 0.12 |
| Channel Z | 200 | 5.44 | 4.83 | - |

4. AD-Converter Values with inputs shorted

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

| | High Range (LSB) | Low Range (LSB) |
|-----------|------------------|-----------------|
| Channel X | 16132 | 16062 |
| Channel Y | 16099 | 16321 |
| Channel Z | 16116 | 15372 |

5. Input Offset Measurement

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Input 10M Ω

| | Average (μ V) | min. Offset (μ V) | max. Offset (μ V) | Std. Deviation (μ V) |
|-----------|--------------------|------------------------|------------------------|---------------------------|
| Channel X | 0.37 | -1.07 | 1.49 | 0.43 |
| Channel Y | 1.21 | -0.41 | 3.21 | 0.59 |
| Channel Z | -1.38 | -2.63 | -0.30 | 0.45 |

6. Input Offset Current

Nominal Input circuitry offset current on all channels: <25fA

7. Input Resistance (Typical values for information)

| | Zeroing (kOhm) | Measuring (MOhm) |
|-----------|----------------|------------------|
| Channel X | 200 | 200 |
| Channel Y | 200 | 200 |
| Channel Z | 200 | 200 |

8. Low Battery Alarm Voltage (Typical values for information)

| Typical values | Alarm Level (VDC) |
|----------------|-------------------|
| Supply (+ Vcc) | +7.9 |
| Supply (- Vcc) | -7.6 |

9. Power Consumption (Typical values for information)

| Typical values | Switched off (mA) | Stand by (mA) | Transmitting (mA) |
|----------------|-------------------|---------------|-------------------|
| Supply (+ Vcc) | +0.01 | +6 | +14 |
| Supply (- Vcc) | -0.01 | -8 | -9 |



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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Client **Auden**

Certificate No: **DAE4-914_Jan17**

CALIBRATION CERTIFICATE

Object: DAE4 - SD 000 D04 BK - SN: 914

Calibration procedure(s): QA CAL-06.v29
Calibration procedure for the data acquisition electronics (DAE)

Calibration date: January 06, 2017

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

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards | ID # | Cal Date (Certificate No.) | Scheduled Calibration |
|-------------------------------|--------------------|----------------------------|------------------------|
| Keithley Multimeter Type 2001 | SN: 0810278 | 09-Sep-16 (No:19065) | Sep-17 |
| Secondary Standards | ID # | Check Date (in house) | Scheduled Check |
| Auto DAE Calibration Unit | SE UWS 053 AA 1001 | 05-Jan-16 (in house check) | In house check: Jan-17 |
| Calibrator Box V2.1 | SE UMS 006 AA 1002 | 05-Jan-16 (in house check) | In house check: Jan-17 |

| | | | |
|----------------|------------------------|--------------------------|---------------|
| Calibrated by: | Name Adrian Gehring | Function Technician | Signature |
| Approved by: | Fin Bomholt | Deputy Technical Manager | |

Issued: January 6, 2017

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Accreditation No.: **SCS 0108**

Glossary

| | |
|-----------------|---|
| DAE | data acquisition electronics |
| Connector angle | information used in DASY system to align probe sensor X to the robot coordinate system. |

Methods Applied and Interpretation of Parameters

- *DC Voltage Measurement:* Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- *Connector angle:* The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The following parameters as documented in the Appendix contain technical information as a result from the performance test and require no uncertainty.
 - *DC Voltage Measurement Linearity:* Verification of the Linearity at +10% and -10% of the nominal calibration voltage. Influence of offset voltage is included in this measurement.
 - *Common mode sensitivity:* Influence of a positive or negative common mode voltage on the differential measurement.
 - *Channel separation:* Influence of a voltage on the neighbor channels not subject to an input voltage.
 - *AD Converter Values with inputs shorted:* Values on the internal AD converter corresponding to zero input voltage
 - *Input Offset Measurement:* Output voltage and statistical results over a large number of zero voltage measurements.
 - *Input Offset Current:* Typical value for information; Maximum channel input offset current, not considering the input resistance.
 - *Input resistance:* Typical value for information: DAE input resistance at the connector, during internal auto-zeroing and during measurement.
 - *Low Battery Alarm Voltage:* Typical value for information. Below this voltage, a battery alarm signal is generated.
 - *Power consumption:* Typical value for information. Supply currents in various operating modes.

DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB = 6.1 μ V, full range = -100...+300 mV

Low Range: 1LSB = 61nV, full range = -1.....+3mV

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

| Calibration Factors | X | Y | Z |
|---------------------|---------------------------|---------------------------|---------------------------|
| High Range | 405.068 \pm 0.02% (k=2) | 404.262 \pm 0.02% (k=2) | 403.838 \pm 0.02% (k=2) |
| Low Range | 3.99100 \pm 1.50% (k=2) | 3.98852 \pm 1.50% (k=2) | 3.98993 \pm 1.50% (k=2) |

Connector Angle

| | |
|---|------------------------------------|
| Connector Angle to be used in DASY system | 63.0 $^{\circ}$ \pm 1 $^{\circ}$ |
|---|------------------------------------|

Appendix (Additional assessments outside the scope of SCS0108)

1. DC Voltage Linearity

| High Range | Reading (μV) | Difference (μV) | Error (%) |
|-------------------|---------------------------|------------------------------|-----------|
| Channel X + Input | 200030.35 | -2.48 | -0.00 |
| Channel X + Input | 20004.16 | -0.79 | -0.00 |
| Channel X - Input | -20002.66 | 2.18 | -0.01 |
| Channel Y + Input | 200031.50 | -1.21 | -0.00 |
| Channel Y + Input | 20001.20 | -3.60 | -0.02 |
| Channel Y - Input | -20005.09 | -0.13 | 0.00 |
| Channel Z + Input | 200030.04 | -2.90 | -0.00 |
| Channel Z + Input | 20001.59 | -3.09 | -0.02 |
| Channel Z - Input | -20005.25 | -0.22 | 0.00 |

| Low Range | Reading (μV) | Difference (μV) | Error (%) |
|-------------------|---------------------------|------------------------------|-----------|
| Channel X + Input | 2001.33 | 0.09 | 0.00 |
| Channel X + Input | 201.16 | -0.23 | -0.11 |
| Channel X - Input | -198.51 | 0.20 | -0.10 |
| Channel Y + Input | 2001.28 | 0.13 | 0.01 |
| Channel Y + Input | 200.65 | -0.57 | -0.28 |
| Channel Y - Input | -198.57 | 0.21 | -0.10 |
| Channel Z + Input | 2001.06 | -0.12 | -0.01 |
| Channel Z + Input | 200.14 | -1.11 | -0.55 |
| Channel Z - Input | -200.23 | -1.40 | 0.70 |

2. Common mode sensitivity

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

| | Common mode Input Voltage (mV) | High Range Average Reading (μV) | Low Range Average Reading (μV) |
|-----------|--------------------------------|--|---|
| Channel X | 200 | -12.74 | -14.35 |
| | -200 | 15.28 | 13.78 |
| Channel Y | 200 | -5.02 | -5.61 |
| | -200 | 4.04 | 3.96 |
| Channel Z | 200 | 5.14 | 5.29 |
| | -200 | -8.12 | -7.94 |

3. Channel separation

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

| | Input Voltage (mV) | Channel X (μV) | Channel Y (μV) | Channel Z (μV) |
|-----------|--------------------|-----------------------------|-----------------------------|-----------------------------|
| Channel X | 200 | - | 2.77 | -4.96 |
| Channel Y | 200 | 7.37 | - | 3.14 |
| Channel Z | 200 | 9.77 | 5.64 | - |

4. AD-Converter Values with inputs shorted

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

| | High Range (LSB) | Low Range (LSB) |
|-----------|------------------|-----------------|
| Channel X | 16120 | 13405 |
| Channel Y | 16156 | 16416 |
| Channel Z | 16016 | 14609 |

5. Input Offset Measurement

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Input 10MΩ

| | Average (μV) | min. Offset (μV) | max. Offset (μV) | Std. Deviation (μV) |
|-----------|--------------|------------------|------------------|---------------------|
| Channel X | 0.49 | -1.54 | 2.62 | 0.45 |
| Channel Y | 0.81 | -0.16 | 2.34 | 0.55 |
| Channel Z | -0.14 | -2.56 | 1.83 | 0.56 |

6. Input Offset Current

Nominal Input circuitry offset current on all channels: <25fA

7. Input Resistance (Typical values for information)

| | Zeroing (kOhm) | Measuring (MOhm) |
|-----------|----------------|------------------|
| Channel X | 200 | 200 |
| Channel Y | 200 | 200 |
| Channel Z | 200 | 200 |

8. Low Battery Alarm Voltage (Typical values for information)

| Typical values | Alarm Level (VDC) |
|----------------|-------------------|
| Supply (+ Vcc) | +7.9 |
| Supply (- Vcc) | -7.6 |

9. Power Consumption (Typical values for information)

| Typical values | Switched off (mA) | Stand by (mA) | Transmitting (mA) |
|----------------|-------------------|---------------|-------------------|
| Supply (+ Vcc) | +0.01 | +6 | +14 |
| Supply (- Vcc) | -0.01 | -8 | -9 |



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 E-mail: cttl@chinattl.com Http://www.chinattl.cn

Client

Auden

Certificate No: Z16-97054

CALIBRATION CERTIFICATE

Object EX3DV4 - SN:3578

Calibration Procedure(s) FD-Z11-2-004-01
 Calibration Procedures for Dosimetric E-field Probes

Calibration date: May 11, 2016

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

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards | ID # | Cal Date(Calibrated by, Certificate No.) | Scheduled Calibration |
|-------------------------|-------------|--|-----------------------|
| Power Meter NRP2 | 101919 | 01-Jul-15 (CTTL, No.J15X04256) | Jun-16 |
| Power sensor NRP-Z91 | 101547 | 01-Jul-15 (CTTL, No.J15X04256) | Jun-16 |
| Power sensor NRP-Z91 | 101548 | 01-Jul-15 (CTTL, No.J15X04256) | Jun-16 |
| Reference10dBAttenuator | 18N50W-10dB | 13-Mar-16(CTTL, No.J16X01547) | Mar-18 |
| Reference20dBAttenuator | 18N50W-20dB | 13-Mar-16(CTTL, No.J16X01548) | Mar-18 |
| Reference Probe EX3DV4 | SN 3617 | 26-Aug-15(SPEAG, No.EX3-3617_Aug15) | Aug-16 |
| DAE4 | SN 1331 | 21-Jan-16(SPEAG, No.DAE4-1331_Jan16) | Jan -17 |
| Secondary Standards | ID # | Cal Date(Calibrated by, Certificate No.) | Scheduled Calibration |
| SignalGeneratorMG3700A | 6201052605 | 01-Jul-15 (CTTL, No.J15X04255) | Jun-16 |
| Network Analyzer E5071C | MY46110673 | 26-Jan-16 (CTTL, No.J16X00894) | Jan -17 |

| | Name | Function | Signature |
|----------------|-------------|-----------------------------------|-----------|
| Calibrated by: | Yu Zongying | SAR Test Engineer | |
| Reviewed by: | Qi Dianyuan | SAR Project Leader | |
| Approved by: | Lu Bingsong | Deputy Director of the laboratory | |

Issued: May 13, 2016

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



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CALIBRATION LABORATORY

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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 Φ | Φ rotation around probe axis |
| Polarization θ | θ rotation around an axis that is in the plane normal to probe axis (at measurement center), i $\theta=0$ 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, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300MHz to 3GHz)", February 2005
- 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 $\theta=0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: waveguide). NORM_{x,y,z} are only intermediate values, i.e., the uncertainties of NORM_{x,y,z} does not effect the E^2 -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 (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}; VR_{x,y,z}; A,B,C** 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 valued 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 ± 50 MHz to ± 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).



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[Http://www.chinattl.cn](http://www.chinattl.cn)

Probe EX3DV4

SN: 3578

Calibrated: May 11, 2016

Calibrated for DASY/EASY Systems

(Note: non-compatible with DASY2 system!)



DASY/EASY – Parameters of Probe: EX3DV4 – SN: 3578

Basic Calibration Parameters

| | Sensor X | Sensor Y | Sensor Z | Unc (k=2) |
|--|----------|----------|----------|-----------|
| Norm($\mu\text{V}/(\text{V}/\text{m})^2$) ^A | 0.41 | 0.37 | 0.44 | ±10.8% |
| DCP(mV) ^B | 105.4 | 109.9 | 112.3 | |

Modulation Calibration Parameters

| UID | Communication System Name | | A dB | B dB· μV | C | D dB | VR mV | Unc ^E (k=2) |
|-----|---------------------------|---|------|---------------------|-----|------|-------|------------------------|
| 0 | CW | X | 0.0 | 0.0 | 1.0 | 0.00 | 183.7 | ±2.6% |
| | | Y | 0.0 | 0.0 | 1.0 | | 169.0 | |
| | | Z | 0.0 | 0.0 | 1.0 | | 189.6 | |

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%.

^A The uncertainties of Norm X, Y, Z do not affect the E²-field uncertainty inside TSL (see Page 5 and Page 6).

^B Numerical linearization parameter: uncertainty not required.

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



DASY/EASY – Parameters of Probe: EX3DV4 – SN: 3578

Calibration Parameter Determined in Head Tissue Simulating Media

| f [MHz] ^C | Relative Permittivity ^F | Conductivity (S/m) ^F | ConvF X | ConvF Y | ConvF Z | Alpha ^G | Depth ^G (mm) | Unct. (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|--------------------|-------------------------|-------------|
| 750 | 41.9 | 0.89 | 9.65 | 9.65 | 9.65 | 0.40 | 0.80 | ±12% |
| 835 | 41.5 | 0.90 | 9.48 | 9.48 | 9.48 | 0.13 | 1.68 | ±12% |
| 900 | 41.5 | 0.97 | 9.40 | 9.40 | 9.40 | 0.20 | 1.28 | ±12% |
| 1750 | 40.1 | 1.37 | 8.35 | 8.35 | 8.35 | 0.18 | 1.49 | ±12% |
| 1900 | 40.0 | 1.40 | 7.99 | 7.99 | 7.99 | 0.18 | 1.50 | ±12% |
| 2000 | 40.0 | 1.40 | 7.99 | 7.99 | 7.99 | 0.17 | 1.58 | ±12% |
| 2300 | 39.5 | 1.67 | 7.77 | 7.77 | 7.77 | 0.40 | 0.82 | ±12% |
| 2450 | 39.2 | 1.80 | 7.28 | 7.28 | 7.28 | 0.46 | 0.83 | ±12% |
| 2600 | 39.0 | 1.96 | 7.21 | 7.21 | 7.21 | 0.49 | 0.81 | ±12% |
| 3500 | 37.9 | 2.91 | 7.07 | 7.07 | 7.07 | 0.40 | 1.10 | ±13% |
| 5200 | 36.0 | 4.66 | 5.42 | 5.42 | 5.42 | 0.40 | 1.50 | ±13% |
| 5300 | 35.9 | 4.76 | 5.22 | 5.22 | 5.22 | 0.39 | 1.40 | ±13% |
| 5500 | 35.6 | 4.96 | 4.99 | 4.99 | 4.99 | 0.40 | 1.40 | ±13% |
| 5600 | 35.5 | 5.07 | 4.75 | 4.75 | 4.75 | 0.42 | 1.45 | ±13% |
| 5800 | 35.3 | 5.27 | 4.82 | 4.82 | 4.82 | 0.45 | 1.45 | ±13% |

^C Frequency validity of ±100MHz only applies for DASY v4.4 and higher (Page 2), else it is restricted to ±50MHz. The uncertainty is the RSS of ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

^F At frequency 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.

^G 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 the frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.



DASY/EASY – Parameters of Probe: EX3DV4 – SN: 3578

Calibration Parameter Determined in Body Tissue Simulating Media

| f [MHz] ^C | Relative Permittivity ^F | Conductivity (S/m) ^F | ConvF X | ConvF Y | ConvF Z | Alpha ^G | Depth ^G (mm) | Unct. (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|--------------------|-------------------------|-------------|
| 750 | 55.5 | 0.96 | 9.81 | 9.81 | 9.81 | 0.40 | 0.85 | ±12% |
| 835 | 55.2 | 0.97 | 9.53 | 9.53 | 9.53 | 0.16 | 1.51 | ±12% |
| 900 | 55.0 | 1.05 | 9.47 | 9.47 | 9.47 | 0.18 | 1.44 | ±12% |
| 1750 | 53.4 | 1.49 | 8.02 | 8.02 | 8.02 | 0.16 | 1.67 | ±12% |
| 1900 | 53.3 | 1.52 | 7.78 | 7.78 | 7.78 | 0.16 | 1.78 | ±12% |
| 2000 | 53.3 | 1.52 | 7.79 | 7.79 | 7.79 | 0.18 | 2.30 | ±12% |
| 2300 | 52.9 | 1.81 | 7.63 | 7.63 | 7.63 | 0.53 | 0.80 | ±12% |
| 2450 | 52.7 | 1.95 | 7.41 | 7.41 | 7.41 | 0.41 | 0.97 | ±12% |
| 2600 | 52.5 | 2.16 | 7.17 | 7.17 | 7.17 | 0.50 | 0.80 | ±12% |
| 3500 | 51.3 | 3.31 | 6.47 | 6.47 | 6.47 | 0.51 | 1.10 | ±13% |
| 5200 | 49.0 | 5.30 | 4.93 | 4.93 | 4.93 | 0.50 | 1.39 | ±13% |
| 5300 | 48.9 | 5.42 | 4.73 | 4.73 | 4.73 | 0.50 | 1.41 | ±13% |
| 5500 | 48.6 | 5.65 | 4.40 | 4.40 | 4.40 | 0.55 | 1.35 | ±13% |
| 5600 | 48.5 | 5.77 | 4.30 | 4.30 | 4.30 | 0.50 | 1.55 | ±13% |
| 5800 | 48.2 | 6.00 | 4.42 | 4.42 | 4.42 | 0.55 | 1.46 | ±13% |

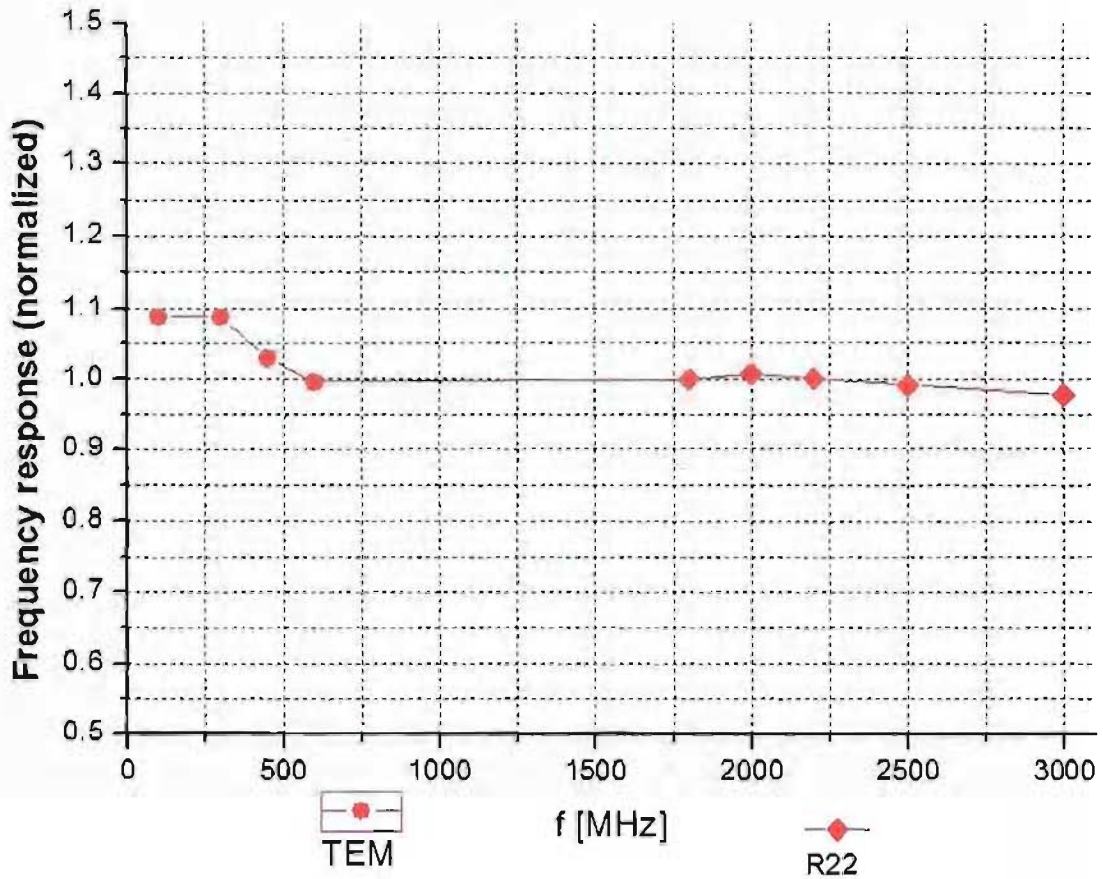
^C Frequency validity of ±100MHz only applies for DASY v4.4 and higher (Page 2), else it is restricted to ±50MHz. The uncertainty is the RSS of ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

^F At frequency 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.

^G 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 the frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.



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



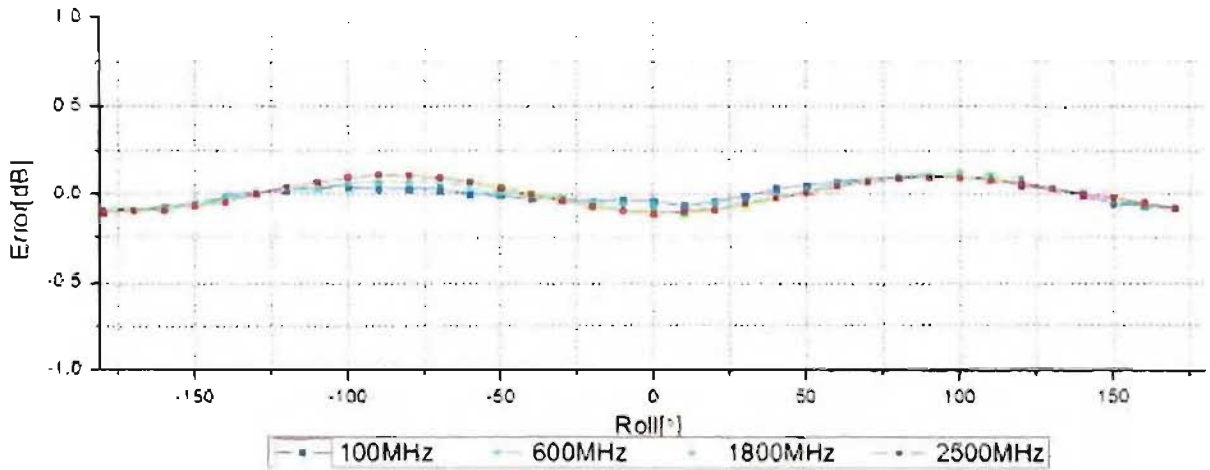
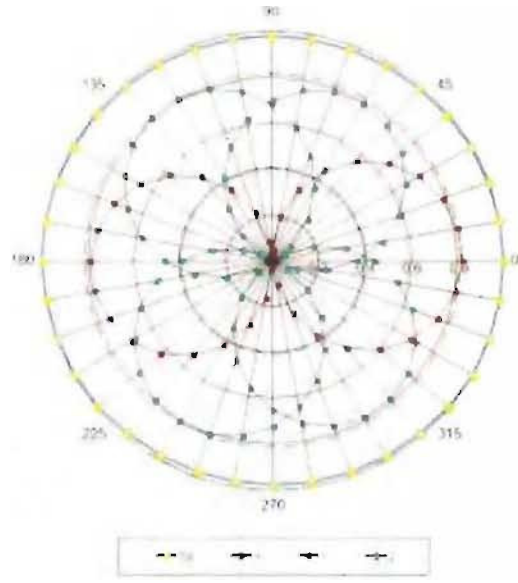
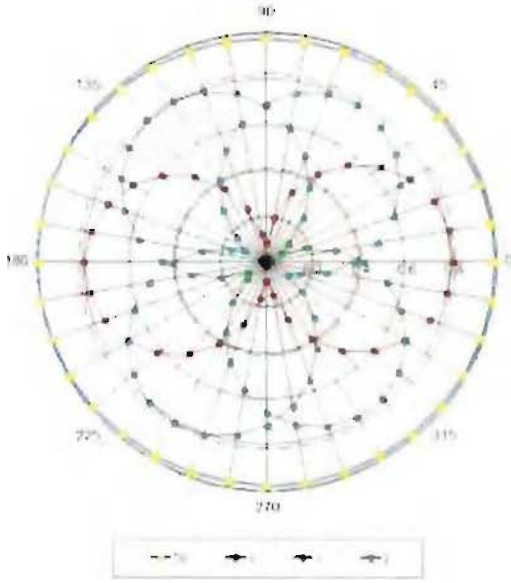
Uncertainty of Frequency Response of E-field: $\pm 7.5\%$ ($k=2$)



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

f=600 MHz, TEM

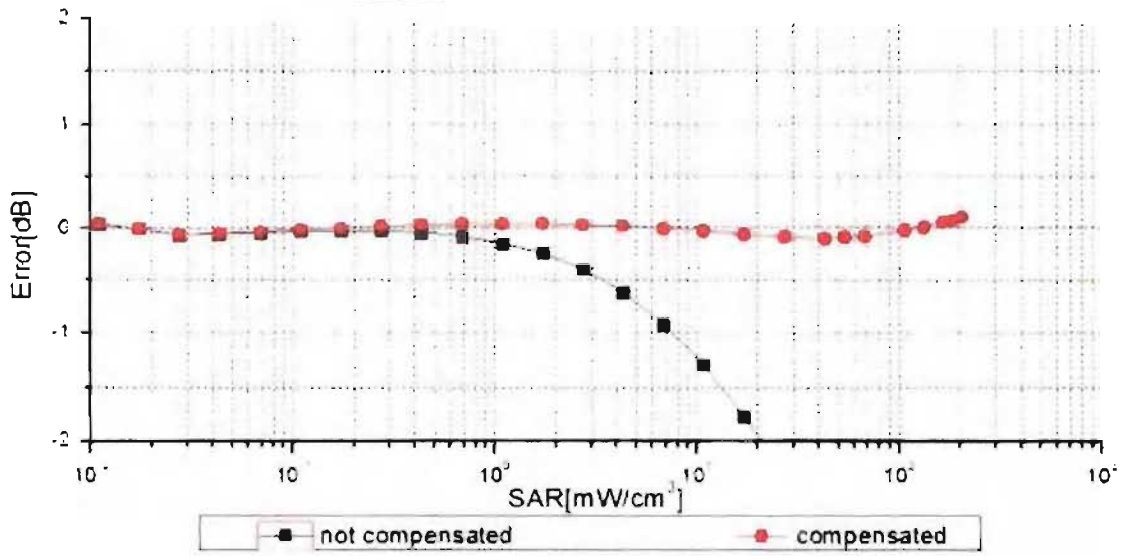
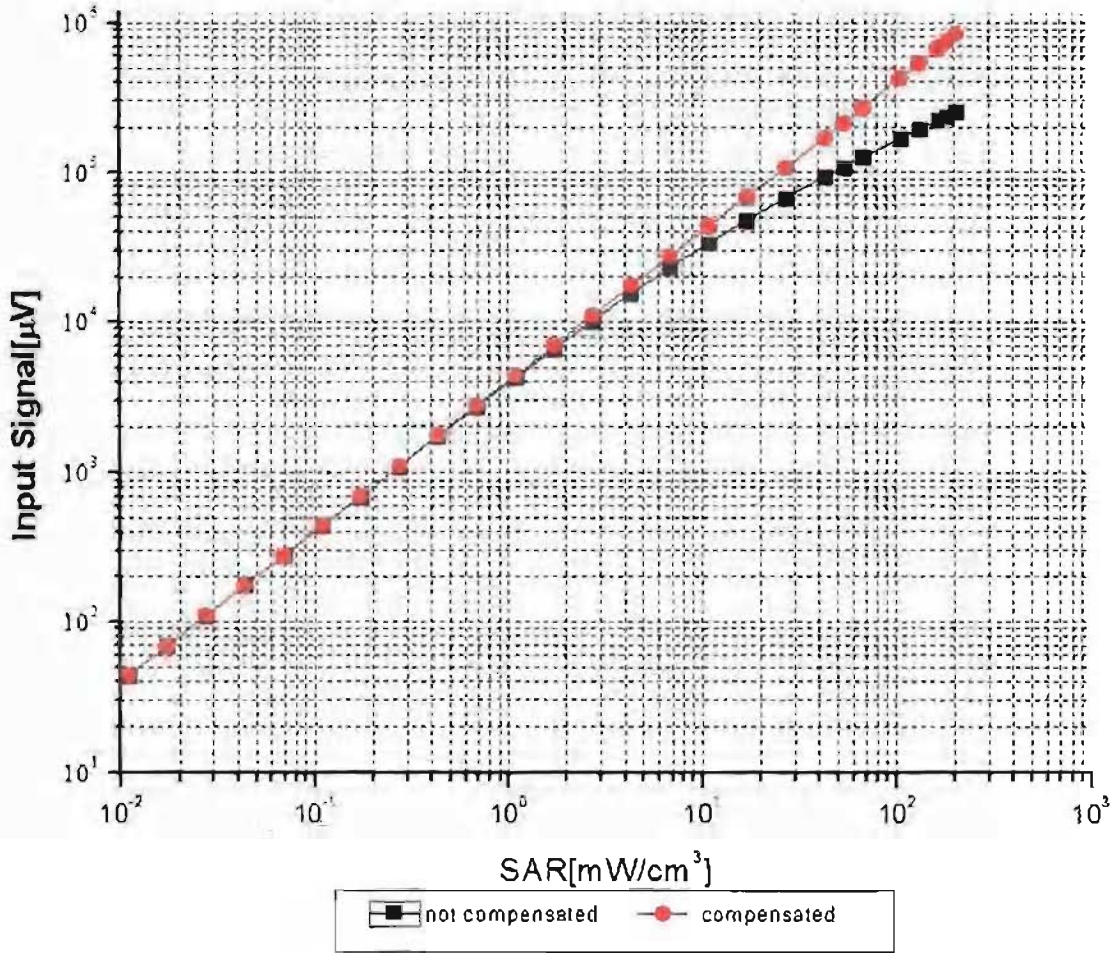
f=1800 MHz, R22



Uncertainty of Axial Isotropy Assessment: $\pm 0.9\%$ ($k=2$)



Dynamic Range f(SAR_{head}) (TEM cell, f = 900 MHz)



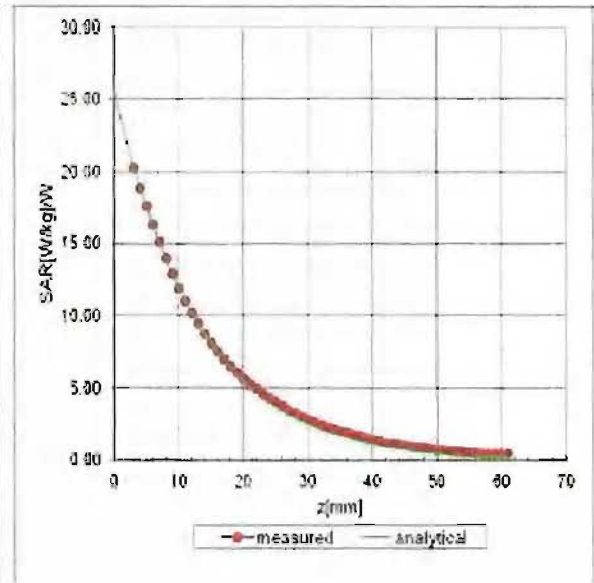
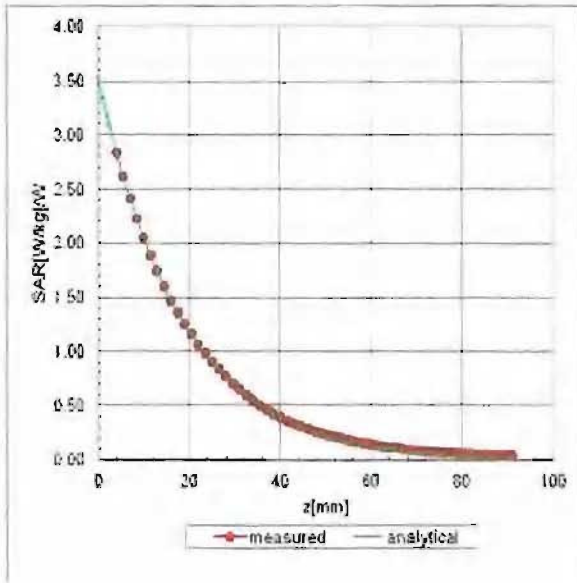
Uncertainty of Linearity Assessment: ±0.9% (k=2)



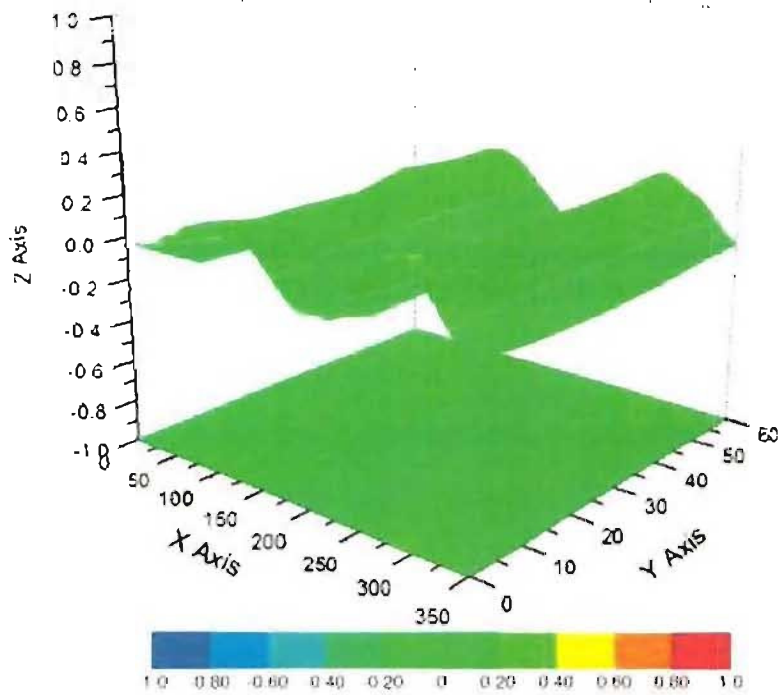
Conversion Factor Assessment

f=900 MHz, WGLS R9(H_convF)

f=1750 MHz, WGLS R22(H_convF)



Deviation from Isotropy in Liquid



Uncertainty of Spherical Isotropy Assessment: $\pm 2.8\%$ (K=2)



DASY/EASY – Parameters of Probe: EX3DV4 – SN: 3578

Other Probe Parameters

| | |
|---|------------|
| Sensor Arrangement | Triangular |
| Connector Angle (°) | 165.9 |
| Mechanical Surface Detection Mode | enabled |
| Optical Surface Detection Mode | disable |
| Probe Overall Length | 337mm |
| Probe Body Diameter | 10mm |
| Tip Length | 9mm |
| Tip Diameter | 2.5mm |
| Probe Tip to Sensor X Calibration Point | 1mm |
| Probe Tip to Sensor Y Calibration Point | 1mm |
| Probe Tip to Sensor Z Calibration Point | 1mm |
| Recommended Measurement Distance from Surface | 1.4mm |



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 **Sporton-ICC (Auden)**

Certificate No: **EX3-3976_Feb17**

CALIBRATION CERTIFICATE

Object **EX3DV4 - SN:3976**

Calibration procedure(s) **QA CAL-01.v9, QA CAL-14.v4, QA CAL-23.v5, QA CAL-25.v6
Calibration procedure for dosimetric E-field probes**

Calibration date: **February 21, 2017**

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 | 06-Apr-16 (No. 217-02288/02289) | Apr-17 |
| Power sensor NRP-Z91 | SN: 103244 | 06-Apr-16 (No. 217-02288) | Apr-17 |
| Power sensor NRP-Z91 | SN: 103245 | 06-Apr-16 (No. 217-02289) | Apr-17 |
| Reference 20 dB Attenuator | SN: S5277 (20x) | 05-Apr-16 (No. 217-02293) | Apr-17 |
| Reference Probe ES3DV2 | SN: 3013 | 31-Dec-16 (No. ES3-3013_Dec16) | Dec-17 |
| DAE4 | SN: 660 | 7-Dec-16 (No. DAE4-660_Dec16) | Dec-17 |
| Secondary Standards | ID | Check Date (in house) | Scheduled Check |
| Power meter E4419B | SN: GB41293874 | 06-Apr-16 (in house check Jun-16) | In house check: Jun-18 |
| Power sensor E4412A | SN: MY41498087 | 06-Apr-16 (in house check Jun-16) | In house check: Jun-18 |
| Power sensor E4412A | SN: 000110210 | 06-Apr-16 (in house check Jun-16) | In house check: Jun-18 |
| RF generator HP 8648C | SN: US3642U01700 | 04-Aug-99 (in house check Jun-16) | In house check: Jun-18 |
| Network Analyzer HP 8753E | SN: US37390585 | 18-Oct-01 (in house check Oct-16) | In house check: Oct-17 |

| | | | |
|---|--------------------------------|-----------------------------------|---------------------------|
| Calibrated by: | Name Claudio Leubler | Function Laboratory Technician | Signature |
| Approved by: | Name Katja Pokovic | Function Technical Manager | Signature |
| | | | Issued: February 27, 2017 |
| This calibration certificate shall not be reproduced except in full without written approval of the laboratory. | | | |



Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 0108**

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

Glossary:

| | |
|-----------------------|---|
| TSL | tissue simulating liquid |
| NORM _{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 φ | φ rotation around probe axis |
| Polarization ϑ | ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., ϑ = 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:

- a) 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
- b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- c) 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
- d) 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 ϑ = 0 (f ≤ 900 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 E²-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
- Ax,y,z; Bx,y,z; Cx,y,z; Dx,y,z; VRx,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 ≤ 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 ± 50 MHz to ± 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).

Probe EX3DV4

SN:3976

Manufactured: November 5, 2013
Calibrated: February 21, 2017

Calibrated for DASYS/EASY Systems
(Note: non-compatible with DASYS2 system!)

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3976

Basic Calibration Parameters

| | Sensor X | Sensor Y | Sensor Z | Unc (k=2) |
|---|----------|----------|----------|---------------|
| Norm ($\mu\text{V}/(\text{V}/\text{m})^2$) ^A | 0.48 | 0.49 | 0.54 | $\pm 10.1 \%$ |
| DCP (mV) ^B | 102.3 | 101.2 | 103.1 | |

Modulation Calibration Parameters

| UID | Communication System Name | | A dB | B dB $\sqrt{\mu\text{V}}$ | C | D dB | VR mV | Unc ^E (k=2) |
|-----|---------------------------|---|---------|------------------------------|-----|---------|----------|---------------------------|
| 0 | CW | X | 0.0 | 0.0 | 1.0 | 0.00 | 173.0 | $\pm 3.0 \%$ |
| | | Y | 0.0 | 0.0 | 1.0 | | 186.1 | |
| | | Z | 0.0 | 0.0 | 1.0 | | 174.0 | |

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%.

^A The uncertainties of Norm X,Y,Z do not affect the E²-field uncertainty inside TSL (see Pages 5 and 6).

^B Numerical linearization parameter: uncertainty not required.

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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3976

Calibration Parameter Determined in Head Tissue Simulating Media

| f (MHz) ^C | Relative Permittivity ^F | Conductivity (S/m) ^F | ConvF X | ConvF Y | ConvF Z | Alpha ^G | Depth ^G (mm) | Unc (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|--------------------|-------------------------|-----------|
| 750 | 41.9 | 0.89 | 10.96 | 10.96 | 10.96 | 0.38 | 0.95 | ± 12.0 % |
| 835 | 41.5 | 0.90 | 10.43 | 10.43 | 10.43 | 0.46 | 0.80 | ± 12.0 % |
| 900 | 41.5 | 0.97 | 10.28 | 10.28 | 10.28 | 0.49 | 0.80 | ± 12.0 % |
| 1750 | 40.1 | 1.37 | 8.93 | 8.93 | 8.93 | 0.33 | 0.80 | ± 12.0 % |
| 1900 | 40.0 | 1.40 | 8.62 | 8.62 | 8.62 | 0.39 | 0.80 | ± 12.0 % |
| 2000 | 40.0 | 1.40 | 8.61 | 8.61 | 8.61 | 0.29 | 0.80 | ± 12.0 % |
| 2450 | 39.2 | 1.80 | 7.83 | 7.83 | 7.83 | 0.32 | 0.88 | ± 12.0 % |
| 2600 | 39.0 | 1.96 | 7.60 | 7.60 | 7.60 | 0.36 | 0.87 | ± 12.0 % |
| 3700 | 37.7 | 3.12 | 7.60 | 7.60 | 7.60 | 0.25 | 1.20 | ± 13.1 % |
| 5250 | 35.9 | 4.71 | 5.56 | 5.56 | 5.56 | 0.35 | 1.80 | ± 13.1 % |
| 5600 | 35.5 | 5.07 | 4.98 | 4.98 | 4.98 | 0.40 | 1.80 | ± 13.1 % |
| 5750 | 35.4 | 5.22 | 5.16 | 5.16 | 5.16 | 0.40 | 1.80 | ± 13.1 % |

^C 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. Above 5 GHz frequency validity can be extended to ± 110 MHz.

^F 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.

^G 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.

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3976

Calibration Parameter Determined in Body Tissue Simulating Media

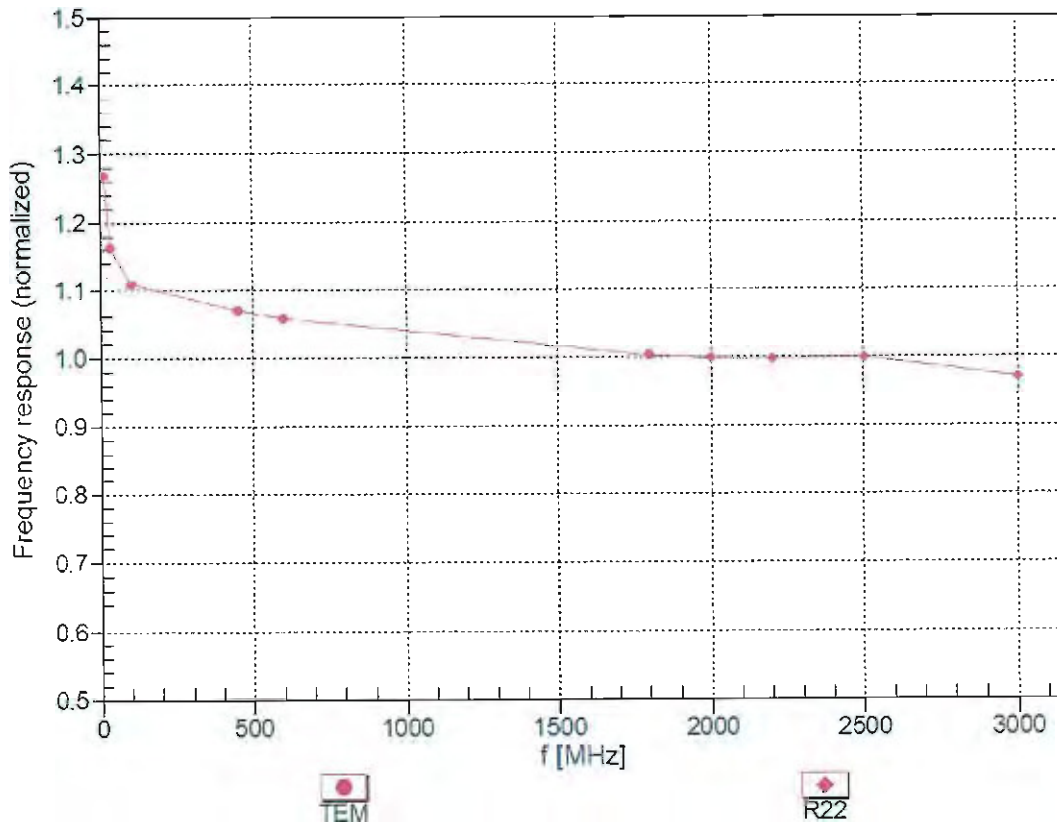
| f (MHz) ^C | Relative Permittivity ^F | Conductivity (S/m) ^F | ConvF X | ConvF Y | ConvF Z | Alpha ^G | Depth ^G (mm) | Unc (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|--------------------|-------------------------|-----------|
| 750 | 55.5 | 0.96 | 10.68 | 10.68 | 10.68 | 0.51 | 0.80 | ± 12.0 % |
| 835 | 55.2 | 0.97 | 10.41 | 10.41 | 10.41 | 0.48 | 0.80 | ± 12.0 % |
| 1750 | 53.4 | 1.49 | 8.57 | 8.57 | 8.57 | 0.37 | 0.80 | ± 12.0 % |
| 1900 | 53.3 | 1.52 | 8.31 | 8.31 | 8.31 | 0.41 | 0.80 | ± 12.0 % |
| 2450 | 52.7 | 1.95 | 7.93 | 7.93 | 7.93 | 0.30 | 0.92 | ± 12.0 % |
| 2600 | 52.5 | 2.16 | 7.59 | 7.59 | 7.59 | 0.28 | 0.92 | ± 12.0 % |
| 3700 | 51.0 | 3.55 | 6.84 | 6.84 | 6.84 | 0.30 | 1.20 | ± 13.1 % |
| 5250 | 48.9 | 5.36 | 4.87 | 4.87 | 4.87 | 0.40 | 1.90 | ± 13.1 % |
| 5600 | 48.5 | 5.77 | 4.03 | 4.03 | 4.03 | 0.50 | 1.90 | ± 13.1 % |
| 5750 | 48.3 | 5.94 | 4.33 | 4.33 | 4.33 | 0.50 | 1.90 | ± 13.1 % |

^C 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. Above 5 GHz frequency validity can be extended to ± 110 MHz.

^F 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.

^G 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.

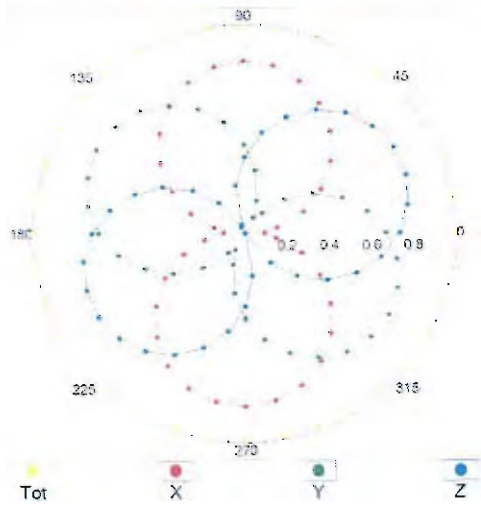
Frequency Response of E-Field (TEM-Cell:ifi110 EXX, Waveguide: R22)



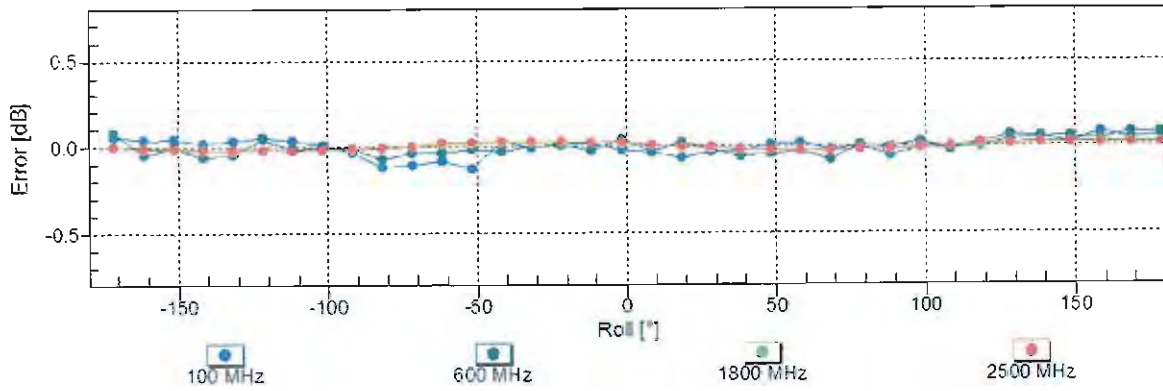
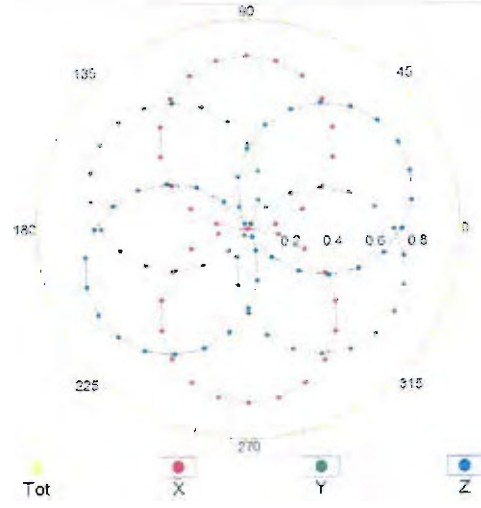
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ (k=2)

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

f=600 MHz, TEM

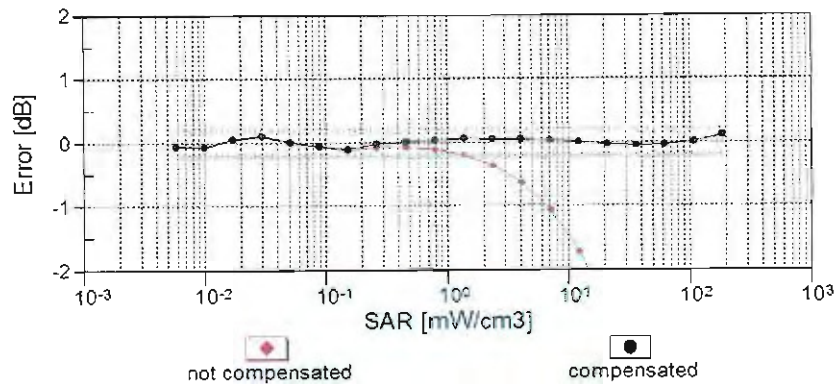
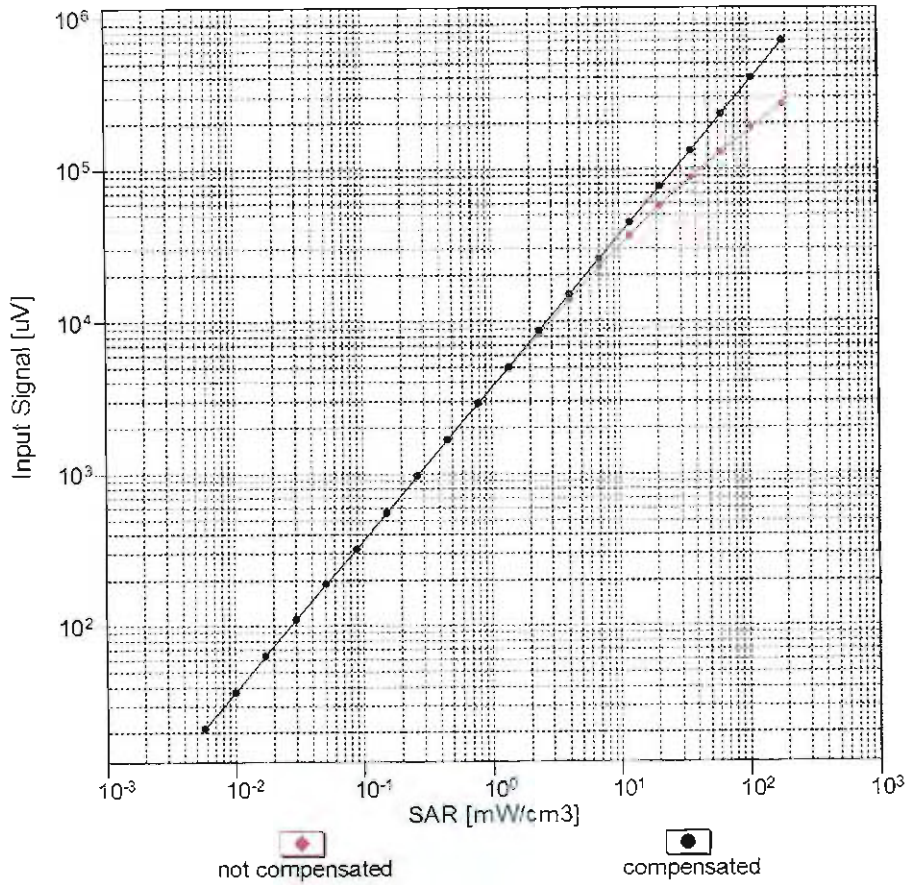


f=1800 MHz, R22



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

Dynamic Range f(SAR_{head}) (TEM cell , f_{eval}= 1900 MHz)

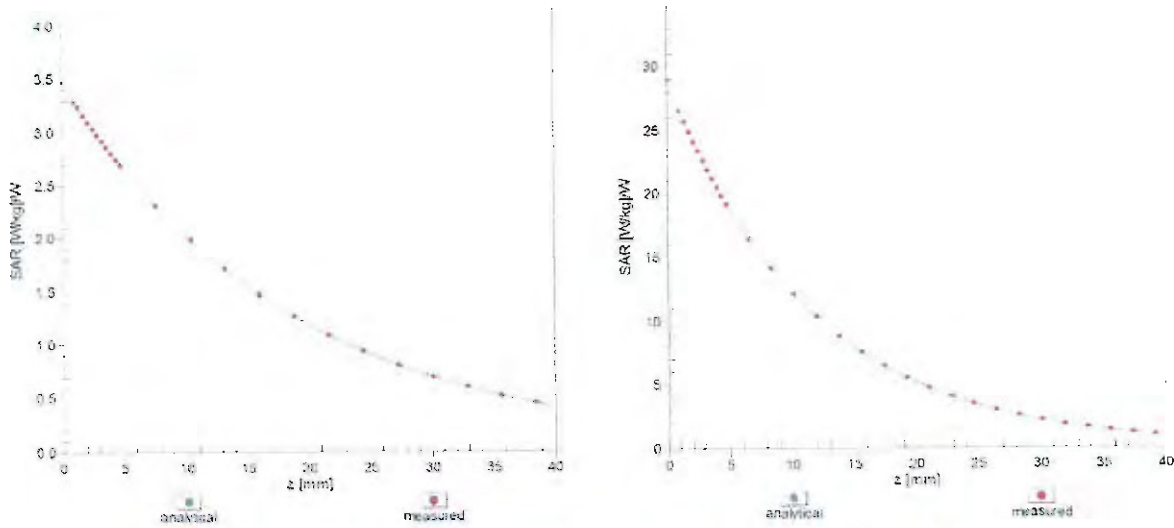


Uncertainty of Linearity Assessment: ± 0.6% (k=2)

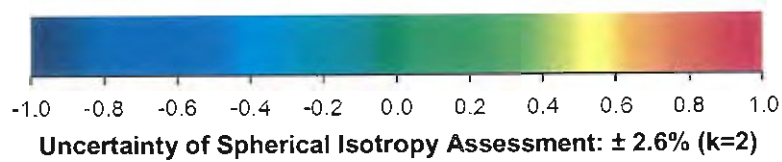
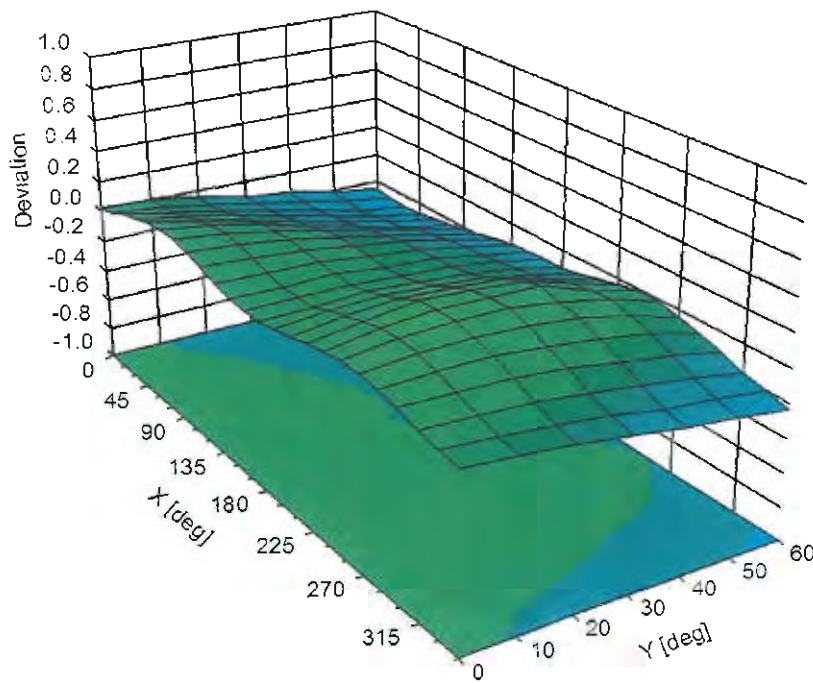
Conversion Factor Assessment

f = 835 MHz, WGLS R9 (H_convF)

f = 1900 MHz, WGLS R22 (H_convF)



Deviation from Isotropy in Liquid Error (ϕ, ϑ), f = 900 MHz



DASY/EASY - Parameters of Probe: EX3DV4 - SN:3976

Other Probe Parameters

| | |
|---|------------|
| Sensor Arrangement | Triangular |
| Connector Angle (°) | -1.6 |
| 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 |



Accredited by the Swiss Accreditation Service (SAS)
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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Client **Sporton-TW (Auden)**

Certificate No: **EX3-3925_May16**

CALIBRATION CERTIFICATE

Object **EX3DV4 - SN:3925**

Calibration procedure(s) **QA CAL-01.v9, QA CAL-14.v4, QA CAL-23.v5, QA CAL-25.v6
Calibration procedure for dosimetric E-field probes**

Calibration date: **May 26, 2016**

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

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards | ID | Cal Date (Certificate No.) | Scheduled Calibration |
|----------------------------|------------------|-----------------------------------|------------------------|
| Power meter NRP | SN: 104778 | 06-Apr-16 (No. 217-02288/02289) | Apr-17 |
| Power sensor NRP-Z91 | SN: 103244 | 06-Apr-16 (No. 217-02288) | Apr-17 |
| Power sensor NRP-Z91 | SN: 103245 | 06-Apr-16 (No. 217-02289) | Apr-17 |
| Reference 20 dB Attenuator | SN: S5277 (20x) | 05-Apr-16 (No. 217-02293) | Apr-17 |
| Reference Probe ES3DV2 | SN: 3013 | 31-Dec-15 (No. ES3-3013_Dec15) | Dec-16 |
| DAE4 | SN: 660 | 23-Dec-15 (No. DAE4-660_Dec15) | Dec-16 |
| Secondary Standards | ID | Check Date (in house) | Scheduled Check |
| Power meter E4419B | SN: GB41293874 | 06-Apr-16 (No. 217-02285/02284) | In house check: Jun-16 |
| Power sensor E4412A | SN: MY41498087 | 06-Apr-16 (No. 217-02285) | In house check: Jun-16 |
| Power sensor E4412A | SN: 000110210 | 06-Apr-16 (No. 217-02284) | In house check: Jun-16 |
| RF generator HP 8648C | SN: US3642U01700 | 04-Aug-99 (in house check Apr-13) | In house check: Jun-16 |
| Network Analyzer HP 8753E | SN: US37390585 | 18-Oct-01 (in house check Oct-15) | In house check: Oct-16 |

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

Issued: May 31, 2016

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



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Accreditation No.: **SCS 0108**

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Multilateral Agreement for the recognition of calibration certificates

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 φ | φ rotation around probe axis |
| Polarization ϑ | ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., $\vartheta = 0$ is normal to probe axis |
| Connector Angle | information used in DASY system to align probe sensor X to the robot coordinate system |

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- 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 $\vartheta = 0$ ($f \leq 900$ 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^2 -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 ± 50 MHz to ± 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).

Probe EX3DV4

SN:3925

Manufactured: March 8, 2013
Calibrated: May 26, 2016

Calibrated for DASY/EASY Systems
(Note: non-compatible with DASY2 system!)

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3925

Basic Calibration Parameters

| | Sensor X | Sensor Y | Sensor Z | Unc (k=2) |
|---|----------|----------|----------|--------------|
| Norm ($\mu\text{V}/(\text{V}/\text{m})^2$) ^A | 0.59 | 0.52 | 0.50 | $\pm 10.1\%$ |
| DCP (mV) ^B | 96.5 | 97.9 | 98.9 | |

Modulation Calibration Parameters

| UID | Communication System Name | | A dB | B dB $\sqrt{\mu\text{V}}$ | C | D dB | VR mV | Unc ^E (k=2) |
|-----|---------------------------|---|---------|------------------------------|-----|---------|----------|---------------------------|
| 0 | CW | X | 0.0 | 0.0 | 1.0 | 0.00 | 152.6 | $\pm 2.7\%$ |
| | | Y | 0.0 | 0.0 | 1.0 | | 143.7 | |
| | | Z | 0.0 | 0.0 | 1.0 | | 138.9 | |

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%.

^A The uncertainties of Norm X,Y,Z do not affect the E²-field uncertainty inside TSL (see Pages 5 and 6).

^B Numerical linearization parameter; uncertainty not required.

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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3925

Calibration Parameter Determined in Head Tissue Simulating Media

| f (MHz) ^C | Relative Permittivity ^F | Conductivity (S/m) ^F | ConvF X | ConvF Y | ConvF Z | Alpha ^G | Depth ^G (mm) | Unc (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|--------------------|-------------------------|-----------|
| 750 | 41.9 | 0.89 | 10.37 | 10.37 | 10.37 | 0.48 | 0.80 | ± 12.0 % |
| 835 | 41.5 | 0.90 | 9.92 | 9.92 | 9.92 | 0.47 | 0.81 | ± 12.0 % |
| 900 | 41.5 | 0.97 | 9.72 | 9.72 | 9.72 | 0.41 | 0.80 | ± 12.0 % |
| 1750 | 40.1 | 1.37 | 8.57 | 8.57 | 8.57 | 0.29 | 0.80 | ± 12.0 % |
| 1900 | 40.0 | 1.40 | 8.30 | 8.30 | 8.30 | 0.30 | 0.80 | ± 12.0 % |
| 2000 | 40.0 | 1.40 | 8.26 | 8.26 | 8.26 | 0.30 | 0.80 | ± 12.0 % |
| 2450 | 39.2 | 1.80 | 7.47 | 7.47 | 7.47 | 0.35 | 0.80 | ± 12.0 % |
| 2600 | 39.0 | 1.96 | 7.28 | 7.28 | 7.28 | 0.36 | 0.86 | ± 12.0 % |
| 3500 | 37.9 | 2.91 | 7.14 | 7.14 | 7.14 | 0.29 | 1.30 | ± 13.1 % |
| 5200 | 36.0 | 4.66 | 5.31 | 5.31 | 5.31 | 0.35 | 1.80 | ± 13.1 % |
| 5300 | 35.9 | 4.76 | 5.15 | 5.15 | 5.15 | 0.35 | 1.80 | ± 13.1 % |
| 5500 | 35.6 | 4.96 | 4.66 | 4.66 | 4.66 | 0.45 | 1.80 | ± 13.1 % |
| 5600 | 35.5 | 5.07 | 4.47 | 4.47 | 4.47 | 0.50 | 1.80 | ± 13.1 % |
| 5800 | 35.3 | 5.27 | 4.51 | 4.51 | 4.51 | 0.50 | 1.80 | ± 13.1 % |

^C 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. Above 5 GHz frequency validity can be extended to ± 110 MHz.

^F 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.

^G 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.

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3925

Calibration Parameter Determined in Body Tissue Simulating Media

| f (MHz) ^C | Relative Permittivity ^F | Conductivity (S/m) ^F | ConvF X | ConvF Y | ConvF Z | Alpha ^G | Depth ^G (mm) | Unc (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|--------------------|-------------------------|-----------|
| 750 | 55.5 | 0.96 | 10.18 | 10.18 | 10.18 | 0.49 | 0.80 | ± 12.0 % |
| 835 | 55.2 | 0.97 | 9.91 | 9.91 | 9.91 | 0.44 | 0.88 | ± 12.0 % |
| 900 | 55.0 | 1.05 | 9.96 | 9.96 | 9.96 | 0.47 | 0.80 | ± 12.0 % |
| 1750 | 53.4 | 1.49 | 8.30 | 8.30 | 8.30 | 0.34 | 0.80 | ± 12.0 % |
| 1900 | 53.3 | 1.52 | 8.00 | 8.00 | 8.00 | 0.38 | 0.80 | ± 12.0 % |
| 2000 | 53.3 | 1.52 | 8.18 | 8.18 | 8.18 | 0.37 | 0.80 | ± 12.0 % |
| 2450 | 52.7 | 1.95 | 7.64 | 7.64 | 7.64 | 0.36 | 0.80 | ± 12.0 % |
| 2600 | 52.5 | 2.16 | 7.38 | 7.38 | 7.38 | 0.26 | 0.80 | ± 12.0 % |
| 3500 | 51.3 | 3.31 | 6.73 | 6.73 | 6.73 | 0.29 | 1.30 | ± 13.1 % |
| 5200 | 49.0 | 5.30 | 4.39 | 4.39 | 4.39 | 0.50 | 1.90 | ± 13.1 % |
| 5300 | 48.9 | 5.42 | 4.22 | 4.22 | 4.22 | 0.50 | 1.90 | ± 13.1 % |
| 5500 | 48.6 | 5.65 | 4.02 | 4.02 | 4.02 | 0.55 | 1.90 | ± 13.1 % |
| 5600 | 48.5 | 5.77 | 3.85 | 3.85 | 3.85 | 0.60 | 1.90 | ± 13.1 % |
| 5800 | 48.2 | 6.00 | 3.85 | 3.85 | 3.85 | 0.60 | 1.90 | ± 13.1 % |

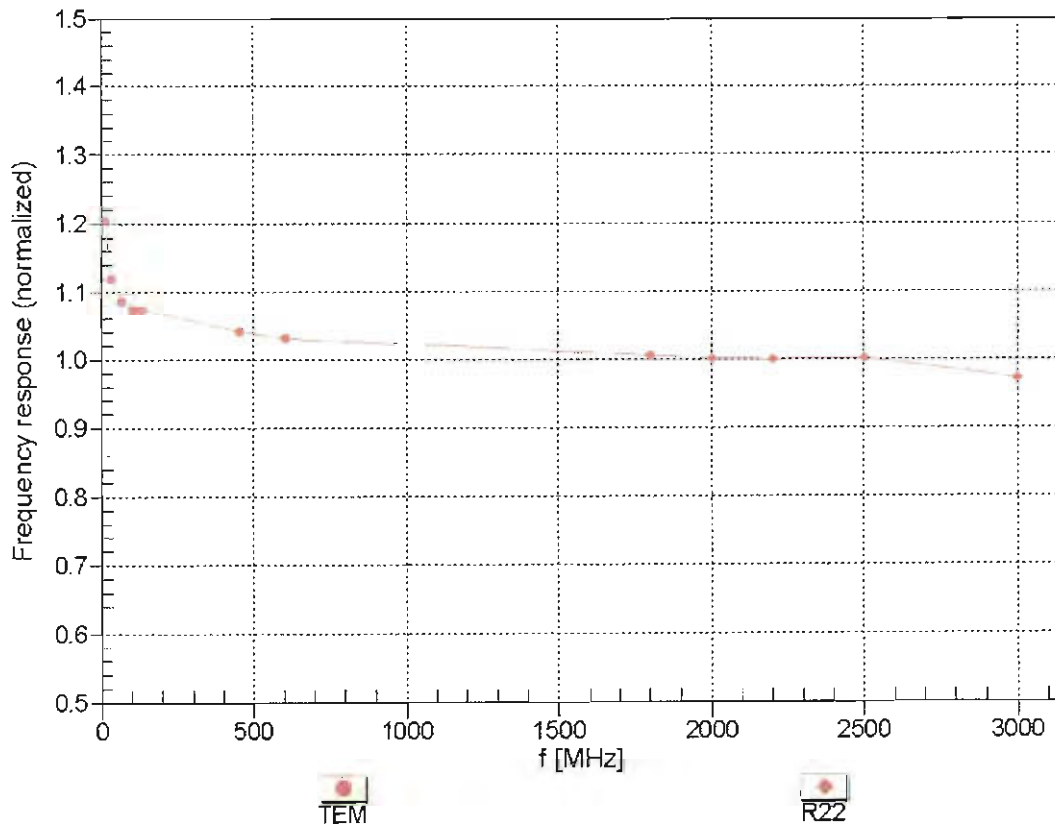
^C Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is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

^F 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.

^G 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.

Frequency Response of E-Field

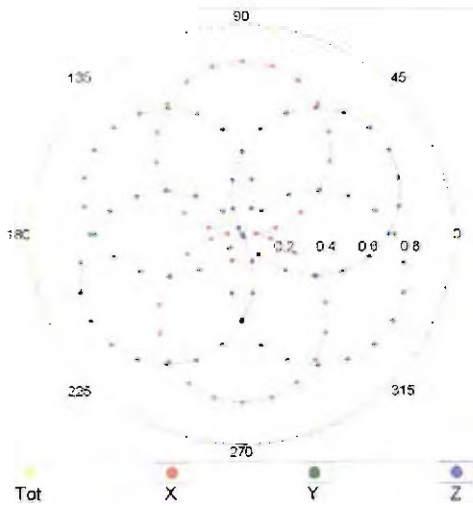
(TEM-Cell:ifi110 EXX, Waveguide: R22)



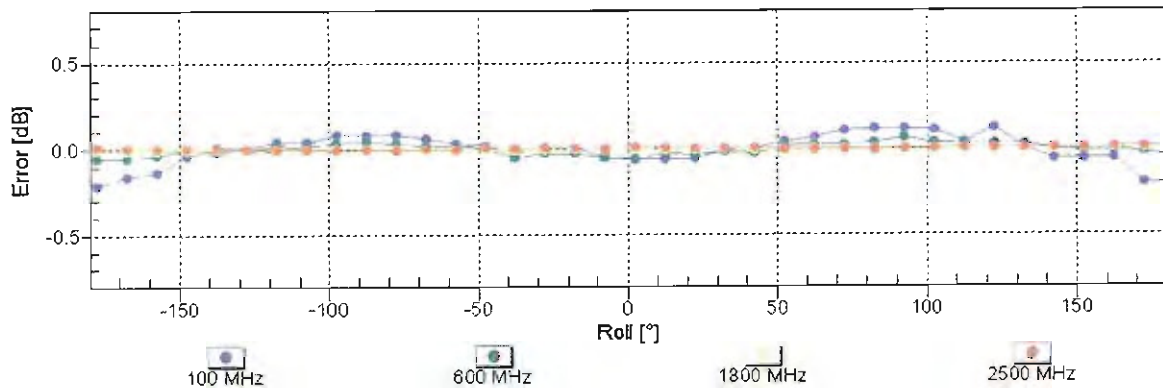
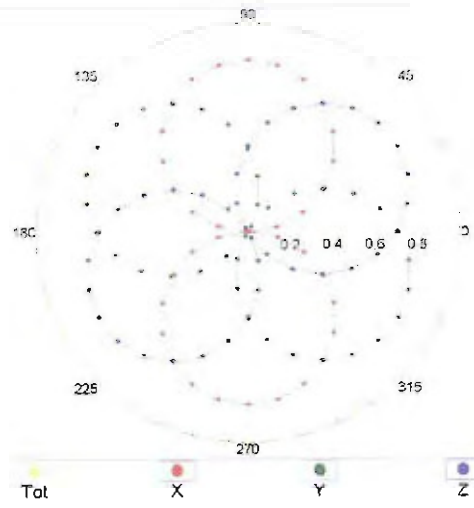
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ (k=2)

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

f=600 MHz,TEM

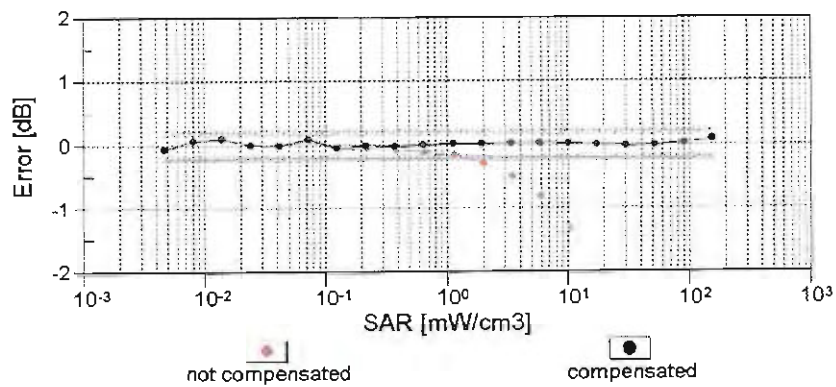
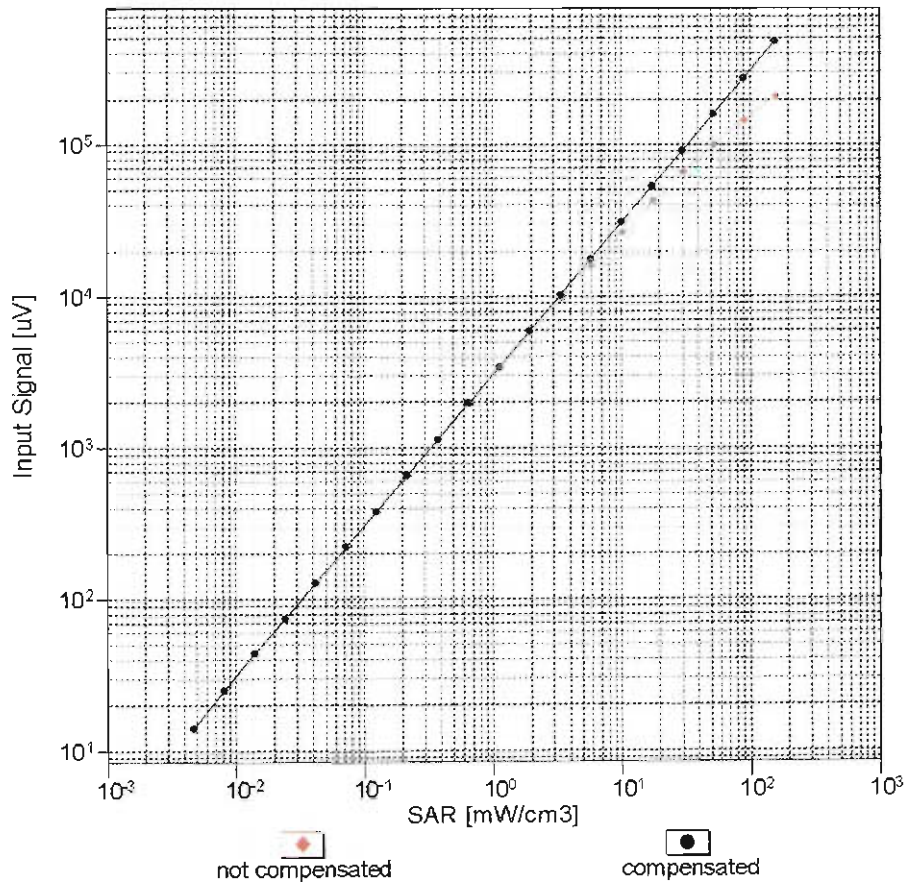


f=1800 MHz,R22



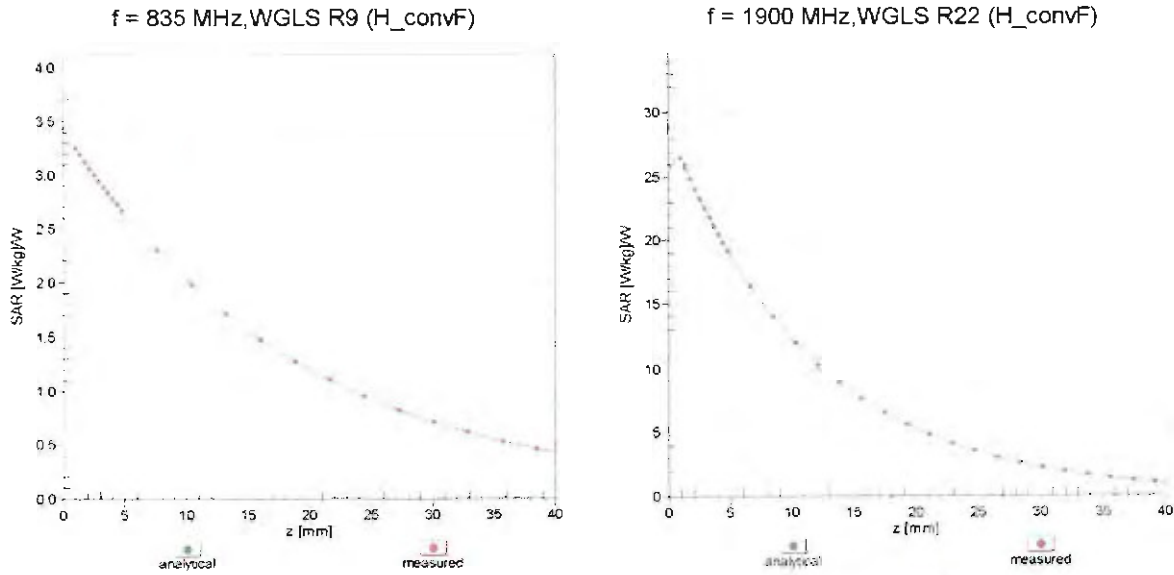
Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ (k=2)

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

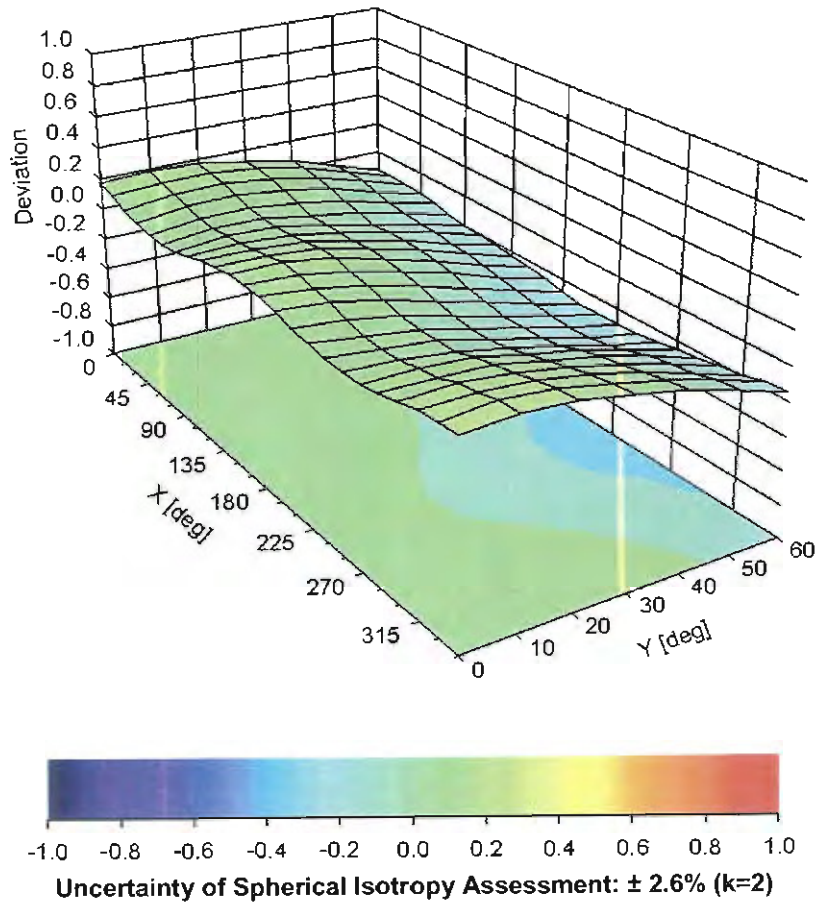


Uncertainty of Linearity Assessment: $\pm 0.6\%$ ($k=2$)

Conversion Factor Assessment



Deviation from Isotropy in Liquid Error (ϕ, ϑ), f = 900 MHz



DASY/EASY - Parameters of Probe: EX3DV4 - SN:3925

Other Probe Parameters

| | |
|---|------------|
| Sensor Arrangement | Triangular |
| Connector Angle (°) | 92.2 |
| 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 |



Accreditation No.: **SCS 0108**

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Multilateral Agreement for the recognition of calibration certificates

Client **Sporton-TW (Auden)**

Certificate No: **EX3-3955_Nov16**

CALIBRATION CERTIFICATE

Object **EX3DV4 - SN:3955**

Calibration procedure(s) **QA CAL-01.v9, QA CAL-14.v4, QA CAL-23.v5, QA CAL-25.v6**
Calibration procedure for dosimetric E-field probes

Calibration date: **November 24, 2016**

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

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards | ID | Cal Date (Certificate No.) | Scheduled Calibration |
|----------------------------|------------------|-----------------------------------|------------------------|
| Power meter NRP | SN: 104778 | 06-Apr-16 (No. 217-02288/02289) | Apr-17 |
| Power sensor NRP-Z91 | SN: 103244 | 06-Apr-16 (No. 217-02288) | Apr-17 |
| Power sensor NRP-Z91 | SN: 103245 | 06-Apr-16 (No. 217-02289) | Apr-17 |
| Reference 20 dB Attenuator | SN: S5277 (20x) | 05-Apr-16 (No. 217-02293) | Apr-17 |
| Reference Probe ES3DV2 | SN: 3013 | 31-Dec-15 (No. ES3-3013_Dec15) | Dec-16 |
| DAE4 | SN: 660 | 23-Dec-15 (No. DAE4-660_Dec15) | Dec-16 |
| Secondary Standards | ID | Check Date (in house) | Scheduled Check |
| Power meter E4419B | SN: GB41293874 | 06-Apr-16 (in house check Jun-16) | In house check: Jun-18 |
| Power sensor E4412A | SN: MY41498087 | 06-Apr-16 (in house check Jun-16) | In house check: Jun-18 |
| Power sensor E4412A | SN: 000110210 | 06-Apr-16 (in house check Jun-16) | In house check: Jun-18 |
| RF generator HP 8648C | SN: US3642U01700 | 04-Aug-99 (in house check Jun-16) | In house check: Jun-18 |
| Network Analyzer HP 8753E | SN: US37390585 | 18-Oct-01 (in house check Oct-16) | In house check: Oct-17 |

| | Name | Function | Signature |
|---|---------------|-----------------------|---------------------------|
| Calibrated by: | Leif Klysner | Laboratory Technician | |
| Approved by: | Katja Pokovic | Technical Manager | |
| | | | Issued: November 28, 2016 |
| This calibration certificate shall not be reproduced except in full without written approval of the laboratory. | | | |



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Accreditation No.: **SCS 0108**

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 φ | φ rotation around probe axis |
| Polarization ϑ | ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., $\vartheta = 0$ is normal to probe axis |
| Connector Angle | information used in DASY system to align probe sensor X to the robot coordinate system |

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- 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 $\vartheta = 0$ ($f \leq 900$ 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 E²-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 ± 50 MHz to ± 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).

Probe EX3DV4

SN:3955

Manufactured: August 6, 2013
Calibrated: November 24, 2016

Calibrated for DASY/EASY Systems
(Note: non-compatible with DASY2 system!)

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3955

Basic Calibration Parameters

| | Sensor X | Sensor Y | Sensor Z | Unc (k=2) |
|---|----------|----------|----------|---------------|
| Norm ($\mu\text{V}/(\text{V}/\text{m})^2$) ^A | 0.34 | 0.40 | 0.31 | $\pm 10.1 \%$ |
| DCP (mV) ^B | 100.5 | 101.5 | 97.2 | |

Modulation Calibration Parameters

| UID | Communication System Name | | A dB | B dB $\sqrt{\mu\text{V}}$ | C | D dB | VR mV | Unc ^E (k=2) |
|-----|---------------------------|---|---------|------------------------------|-----|---------|----------|---------------------------|
| 0 | CW | X | 0.0 | 0.0 | 1.0 | 0.00 | 128.6 | $\pm 3.3 \%$ |
| | | Y | 0.0 | 0.0 | 1.0 | | 140.6 | |
| | | Z | 0.0 | 0.0 | 1.0 | | 128.8 | |

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%.

^A The uncertainties of Norm X,Y,Z do not affect the E²-field uncertainty inside TSL (see Pages 5 and 6).

^B Numerical linearization parameter: uncertainty not required.

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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3955

Calibration Parameter Determined in Head Tissue Simulating Media

| f (MHz) ^C | Relative Permittivity ^F | Conductivity (S/m) ^F | ConvF X | ConvF Y | ConvF Z | Alpha ^G | Depth ^G (mm) | Unc (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|--------------------|-------------------------|-----------|
| 750 | 41.9 | 0.89 | 10.65 | 10.65 | 10.65 | 0.49 | 0.80 | ± 12.0 % |
| 835 | 41.5 | 0.90 | 10.33 | 10.33 | 10.33 | 0.44 | 0.80 | ± 12.0 % |
| 900 | 41.5 | 0.97 | 10.07 | 10.07 | 10.07 | 0.34 | 1.01 | ± 12.0 % |
| 1750 | 40.1 | 1.37 | 8.68 | 8.68 | 8.68 | 0.32 | 0.80 | ± 12.0 % |
| 1900 | 40.0 | 1.40 | 8.43 | 8.43 | 8.43 | 0.32 | 0.80 | ± 12.0 % |
| 2000 | 40.0 | 1.40 | 8.38 | 8.38 | 8.38 | 0.33 | 0.80 | ± 12.0 % |
| 2450 | 39.2 | 1.80 | 7.56 | 7.56 | 7.56 | 0.24 | 1.06 | ± 12.0 % |
| 2600 | 39.0 | 1.96 | 7.28 | 7.28 | 7.28 | 0.30 | 0.95 | ± 12.0 % |
| 5250 | 35.9 | 4.71 | 5.04 | 5.04 | 5.04 | 0.40 | 1.80 | ± 13.1 % |
| 5600 | 35.5 | 5.07 | 4.50 | 4.50 | 4.50 | 0.50 | 1.80 | ± 13.1 % |
| 5750 | 35.4 | 5.22 | 4.63 | 4.63 | 4.63 | 0.50 | 1.80 | ± 13.1 % |

^C 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. Above 5 GHz frequency validity can be extended to ± 110 MHz.

^F 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.

^G 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.

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3955

Calibration Parameter Determined in Body Tissue Simulating Media

| f (MHz) ^c | Relative Permittivity ^F | Conductivity (S/m) ^F | ConvF X | ConvF Y | ConvF Z | Alpha ^G | Depth (mm) ^G | Unc (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|--------------------|-------------------------|-----------|
| 750 | 55.5 | 0.96 | 10.42 | 10.42 | 10.42 | 0.38 | 0.90 | ± 12.0 % |
| 835 | 55.2 | 0.97 | 10.18 | 10.18 | 10.18 | 0.33 | 0.97 | ± 12.0 % |
| 1750 | 53.4 | 1.49 | 8.31 | 8.31 | 8.31 | 0.46 | 0.80 | ± 12.0 % |
| 1900 | 53.3 | 1.52 | 8.00 | 8.00 | 8.00 | 0.30 | 0.95 | ± 12.0 % |
| 2450 | 52.7 | 1.95 | 7.65 | 7.65 | 7.65 | 0.39 | 0.80 | ± 12.0 % |
| 2600 | 52.5 | 2.16 | 7.42 | 7.42 | 7.42 | 0.37 | 0.80 | ± 12.0 % |
| 5250 | 48.9 | 5.36 | 4.51 | 4.51 | 4.51 | 0.50 | 1.90 | ± 13.1 % |
| 5600 | 48.5 | 5.77 | 3.91 | 3.91 | 3.91 | 0.55 | 1.90 | ± 13.1 % |
| 5750 | 48.3 | 5.94 | 4.12 | 4.12 | 4.12 | 0.55 | 1.90 | ± 13.1 % |

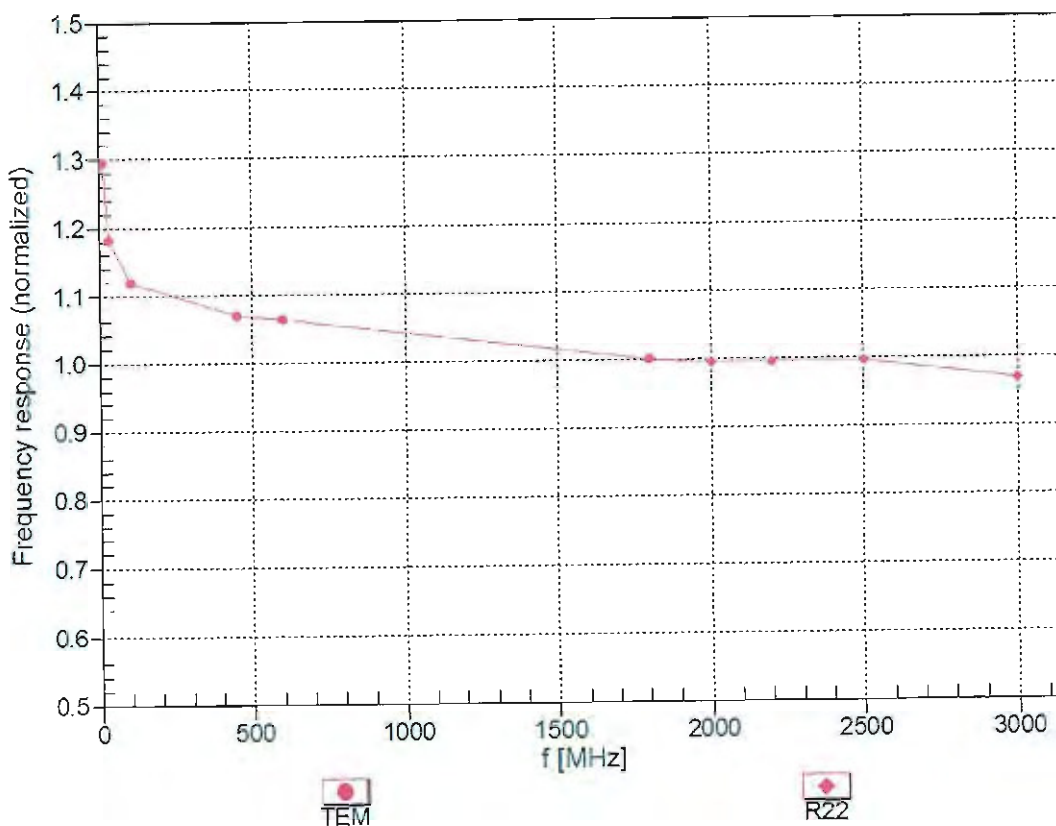
^c Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is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

^F 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.

^G 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.

Frequency Response of E-Field

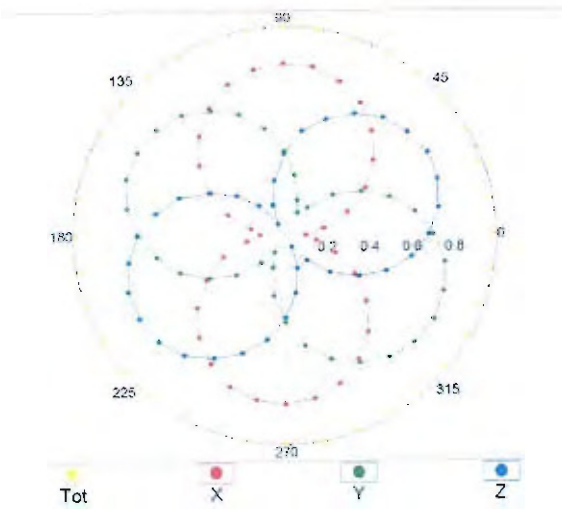
(TEM-Cell:ifi110 EXX, Waveguide: R22)



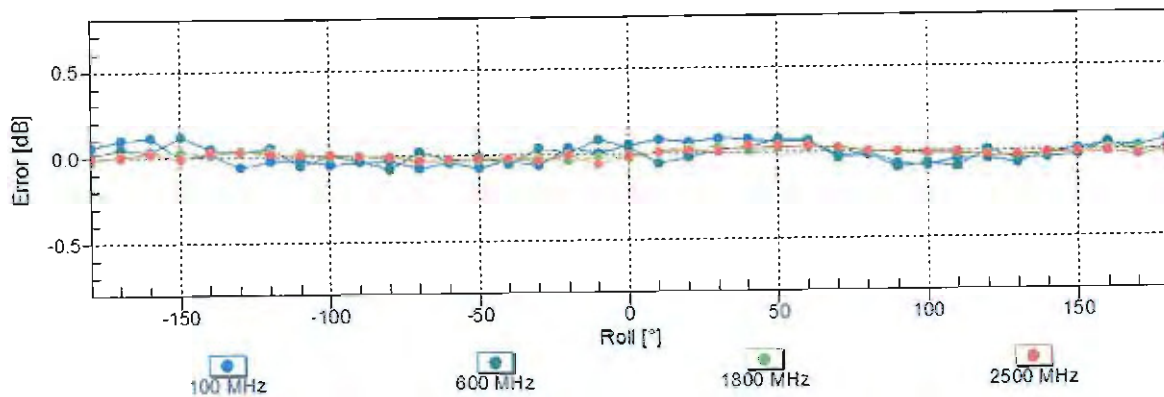
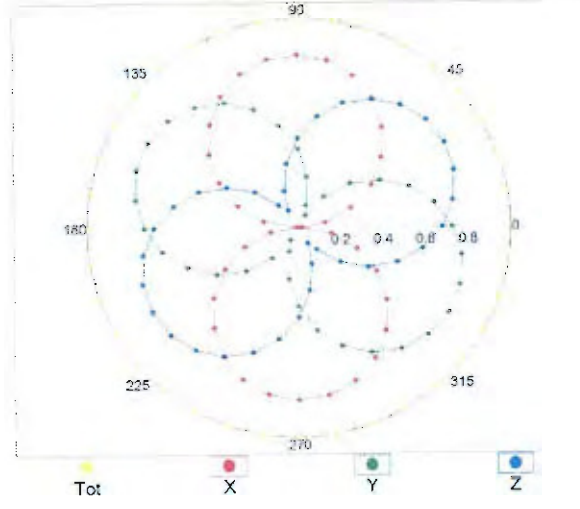
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ (k=2)

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

f=600 MHz, TEM

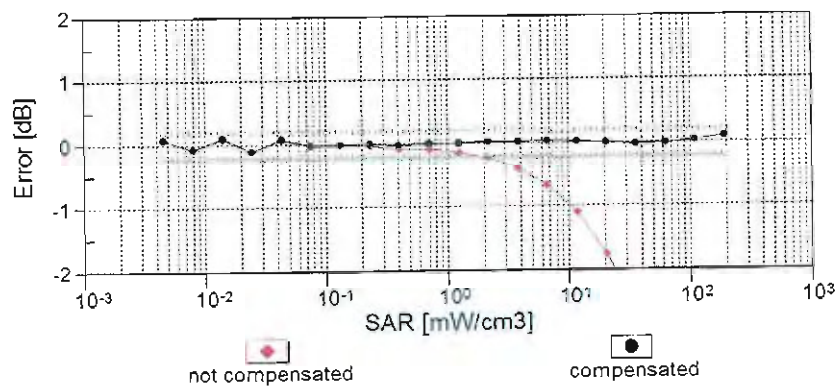
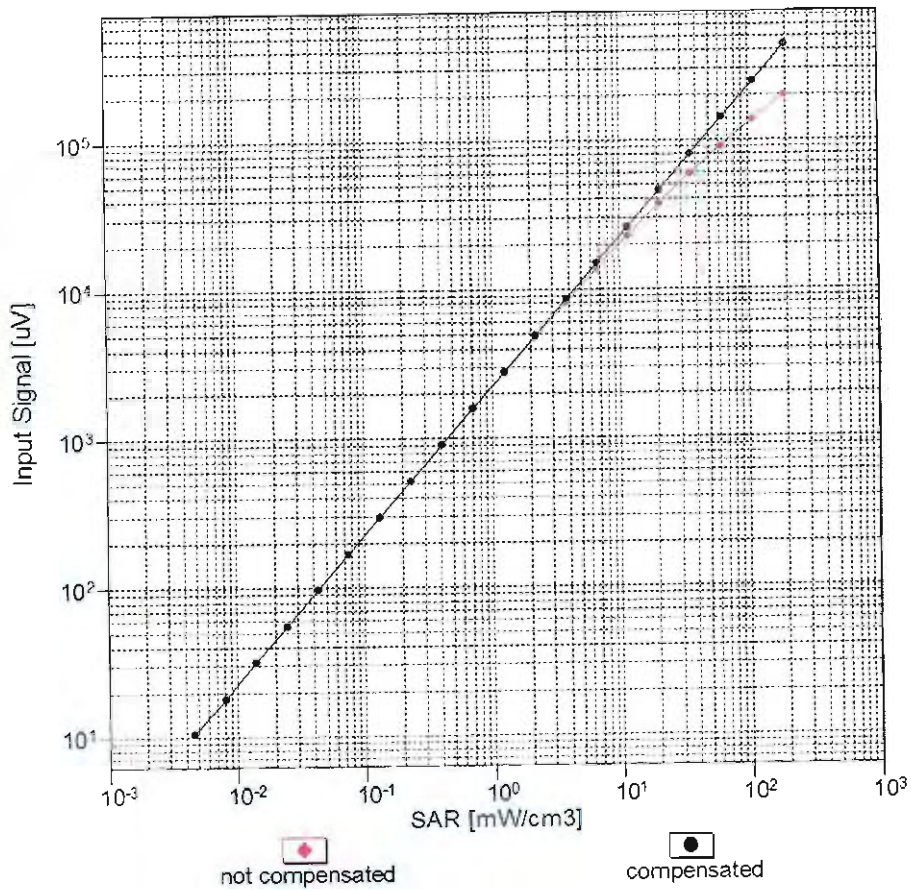


f=1800 MHz, R22



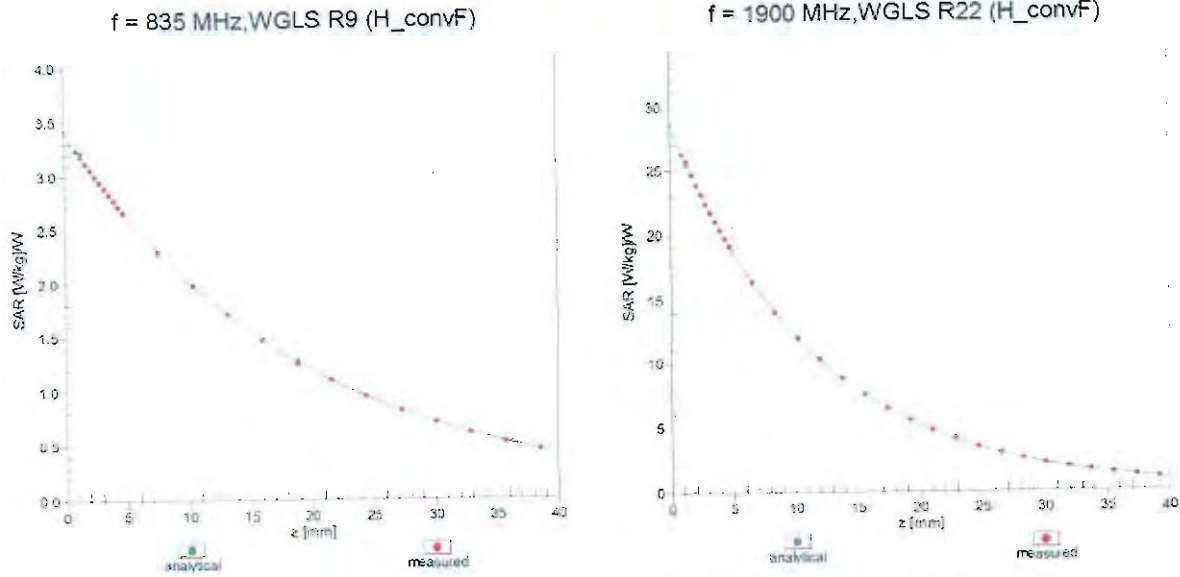
Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ ($k=2$)

Dynamic Range f(SAR_{head}) (TEM cell , f_{eval}= 1900 MHz)

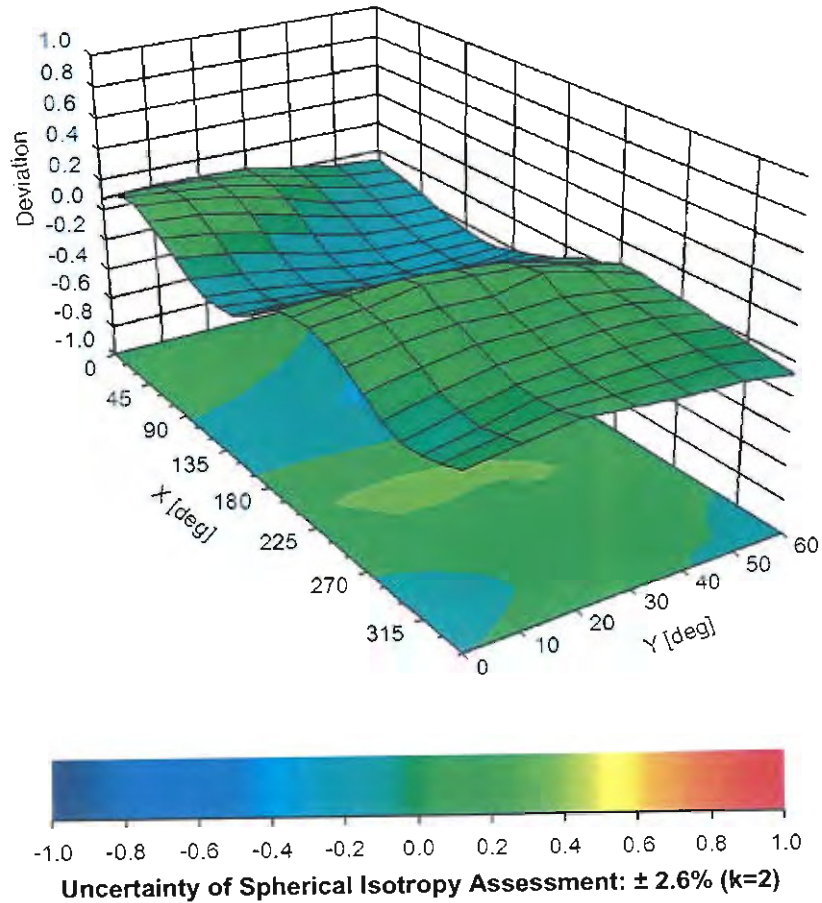


Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment



Deviation from Isotropy in Liquid Error (ϕ, θ), f = 900 MHz



DASY/EASY - Parameters of Probe: EX3DV4 - SN:3955

Other Probe Parameters

| | |
|---|------------|
| Sensor Arrangement | Triangular |
| Connector Angle (°) | 130.3 |
| 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 |



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Client

Sporton_TW

Certificate No: Z16-97123

CALIBRATION CERTIFICATE

Object ES3DV3 - SN:3270

Calibration Procedure(s) FD-Z11-2-004-01
Calibration Procedures for Dosimetric E-field Probes

Calibration date: August 26, 2016

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

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards | ID # | Cal Date(Calibrated by, Certificate No.) | Scheduled Calibration |
|-------------------------|-------------|--|-----------------------|
| Power Meter NRP2 | 101919 | 27-Jun-16 (CTTL, No.J16X04777) | Jun-17 |
| Power sensor NRP-Z91 | 101547 | 27-Jun-16 (CTTL, No.J16X04777) | Jun-17 |
| Power sensor NRP-Z91 | 101548 | 27-Jun-16 (CTTL, No.J16X04777) | Jun-17 |
| Reference10dBAttenuator | 18N50W-10dB | 13-Mar-16(CTTL,No.J16X01547) | Mar-18 |
| Reference20dBAttenuator | 18N50W-20dB | 13-Mar-16(CTTL, No.J16X01548) | Mar-18 |
| Reference Probe EX3DV4 | SN 7307 | 19-Feb-16(SPEAG,No.EX3-7307_Feb16) | Feb-17 |
| DAE4 | SN 1331 | 21-Jan-16(SPEAG, No.DAE4-1331_Jan16) | Jan -17 |
| Secondary Standards | ID # | Cal Date(Calibrated by, Certificate No.) | Scheduled Calibration |
| SignalGeneratorMG3700A | 6201052605 | 27-Jun-16 (CTTL, No.J16X04776) | Jun-17 |
| Network Analyzer E5071C | MY46110673 | 26-Jan-16 (CTTL, No.J16X00894) | Jan -17 |

| | Name | Function | Signature |
|----------------|-------------|-----------------------------------|-----------|
| Calibrated by: | Yu Zongying | SAR Test Engineer | |
| Reviewed by: | Qi Dianyuan | SAR Project Leader | |
| Approved by: | Lu Bingsong | Deputy Director of the laboratory | |

Issued: August 27, 2016

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



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 Φ | Φ rotation around probe axis |
| Polarization θ | θ rotation around an axis that is in the plane normal to probe axis (at measurement center), i $\theta=0$ 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, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300MHz to 3GHz)", February 2005
- 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 $\theta=0$ ($f \leq 900\text{MHz}$ in TEM-cell; $f > 1800\text{MHz}$: waveguide). NORM_{x,y,z} are only intermediate values, i.e., the uncertainties of NORM_{x,y,z} does not effect the E^2 -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 (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}; VR_{x,y,z}; A,B,C** 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 $f \leq 800\text{MHz}$) and inside waveguide using analytical field distributions based on power measurements for $f > 800\text{MHz}$. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty valued 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 $\pm 50\text{MHz}$ to $\pm 100\text{MHz}$.
- 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).



In Collaboration with
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CALIBRATION LABORATORY

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Probe ES3DV3

SN: 3270

Calibrated: August 26, 2016

Calibrated for DASY/EASY Systems

(Note: non-compatible with DASY2 system!)



DASY/EASY – Parameters of Probe: ES3DV3 - SN: 3270

Basic Calibration Parameters

| | Sensor X | Sensor Y | Sensor Z | Unc (k=2) |
|--|----------|----------|----------|-----------|
| Norm($\mu\text{V}/(\text{V}/\text{m})^2$) ^A | 1.09 | 1.22 | 1.19 | ±10.8% |
| DCP(mV) ^B | 100.9 | 103.3 | 101.0 | |

Modulation Calibration Parameters

| UID | Communication System Name | | A dB | B dB/ μV | C | D dB | VR mV | Unc ^E (k=2) |
|-----|---------------------------|---|---------|------------------------|-----|---------|----------|---------------------------|
| 0 | CW | X | 0.0 | 0.0 | 1.0 | 0.00 | 274.7 | ±2.7% |
| | | Y | 0.0 | 0.0 | 1.0 | | 295.4 | |
| | | Z | 0.0 | 0.0 | 1.0 | | 288.4 | |

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%.

^A The uncertainties of Norm X, Y, Z do not affect the E²-field uncertainty inside TSL (see Page 5 and Page 6).
^B Numerical linearization parameter: uncertainty not required.
^E Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.



DASY/EASY – Parameters of Probe: ES3DV3 - SN: 3270

Calibration Parameter Determined in Head Tissue Simulating Media

| f [MHz] ^C | Relative Permittivity ^F | Conductivity (S/m) ^F | ConvF X | ConvF Y | ConvF Z | Alpha ^G | Depth ^G (mm) | Unct. (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|--------------------|-------------------------|-------------|
| 750 | 41.9 | 0.89 | 6.19 | 6.19 | 6.19 | 0.50 | 1.35 | ± 12% |
| 835 | 41.5 | 0.90 | 6.03 | 6.03 | 6.03 | 0.42 | 1.47 | ± 12% |
| 900 | 41.5 | 0.97 | 6.09 | 6.09 | 6.09 | 0.37 | 1.61 | ± 12% |
| 1750 | 40.1 | 1.37 | 5.21 | 5.21 | 5.21 | 0.52 | 1.53 | ± 12% |
| 1900 | 40.0 | 1.40 | 5.08 | 5.08 | 5.08 | 0.55 | 1.50 | ± 12% |
| 2000 | 40.0 | 1.40 | 4.98 | 4.98 | 4.98 | 0.57 | 1.47 | ± 12% |
| 2100 | 39.8 | 1.49 | 5.02 | 5.02 | 5.02 | 0.68 | 1.41 | ± 12% |
| 2450 | 39.2 | 1.80 | 4.51 | 4.51 | 4.51 | 0.73 | 1.30 | ± 12% |
| 2600 | 39.0 | 1.96 | 4.37 | 4.37 | 4.37 | 0.90 | 1.13 | ± 12% |

^C Frequency validity above 300 MHz of ±100MHz only applies for DASY v4.4 and higher (Page 2), else it is restricted to ±50MHz. The uncertainty is the RSS of 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. Above 5 GHz frequency validity can be extended to ± 110 MHz.

^F At frequency 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.

^G 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 the frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.



DASY/EASY – Parameters of Probe: ES3DV3 - SN: 3270

Calibration Parameter Determined in Body Tissue Simulating Media

| f [MHz] ^C | Relative Permittivity ^F | Conductivity (S/m) ^F | ConvF X | ConvF Y | ConvF Z | Alpha ^G | Depth ^G (mm) | Unct. (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|--------------------|-------------------------|-------------|
| 750 | 55.5 | 0.96 | 6.09 | 6.09 | 6.09 | 0.50 | 1.35 | ± 12% |
| 835 | 55.2 | 0.97 | 6.01 | 6.01 | 6.01 | 0.42 | 1.60 | ± 12% |
| 1750 | 53.4 | 1.49 | 4.95 | 4.95 | 4.95 | 0.50 | 1.66 | ± 12% |
| 1900 | 53.3 | 1.52 | 4.70 | 4.70 | 4.70 | 0.53 | 1.64 | ± 12% |
| 2450 | 52.7 | 1.95 | 4.28 | 4.28 | 4.28 | 0.90 | 1.20 | ± 12% |
| 2600 | 52.5 | 2.16 | 4.12 | 4.12 | 4.12 | 0.90 | 1.18 | ± 12% |

^C Frequency validity above 300 MHz of ±100MHz only applies for DASY v4.4 and higher (Page 2), else it is restricted to ±50MHz. The uncertainty is the RSS of 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. Above 5 GHz frequency validity can be extended to ± 110 MHz.

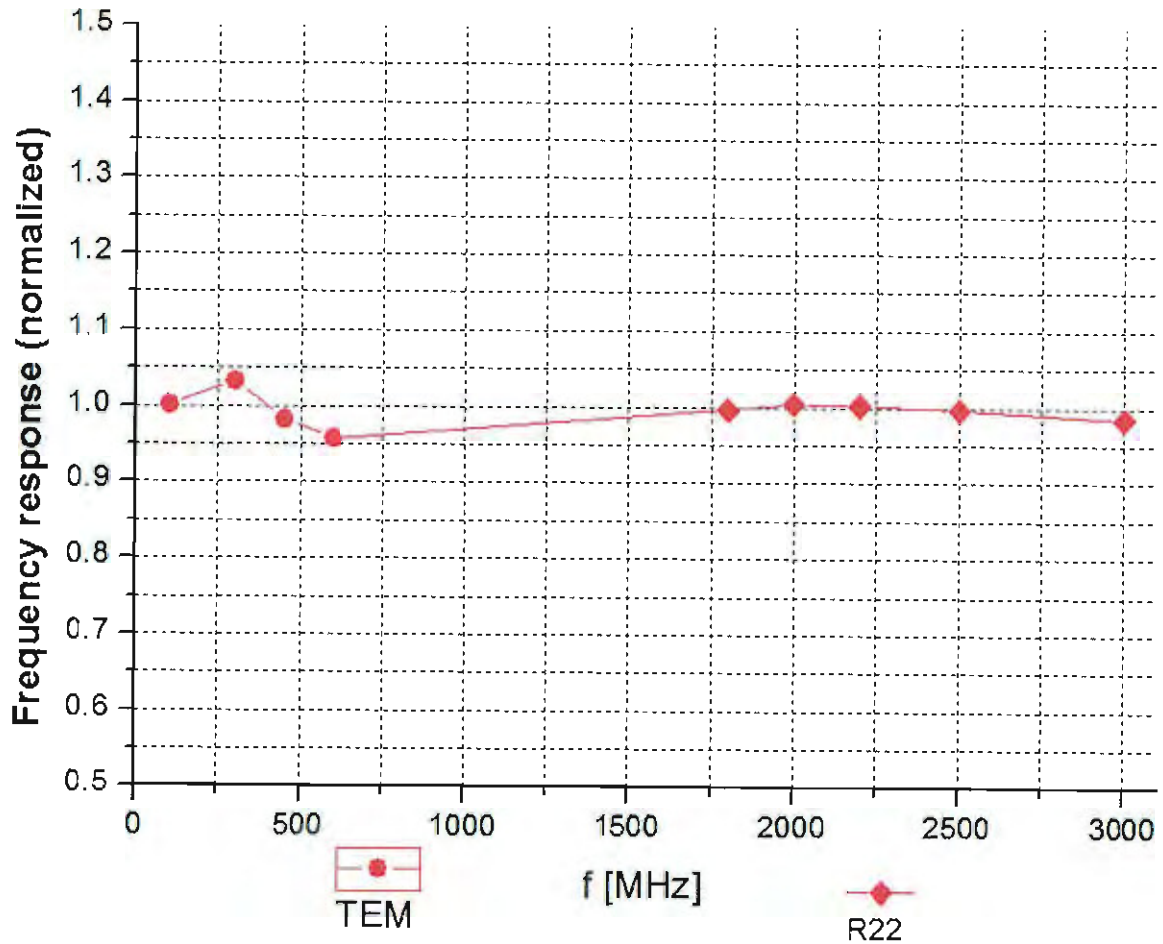
^F At frequency below 3 GHz, the validity of tissue parameters (ϵ and σ) can be relaxed to ±10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ϵ and σ) is restricted to ±5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

^G 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 the frequencies between 3-6 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)



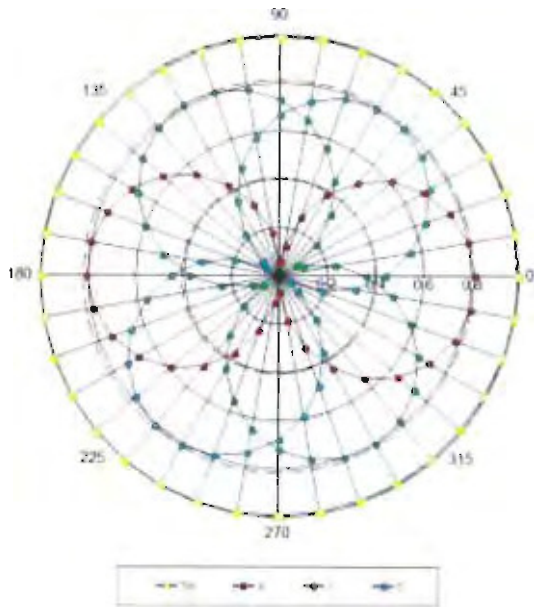
Uncertainty of Frequency Response of E-field: $\pm 7.5\%$ (k=2)



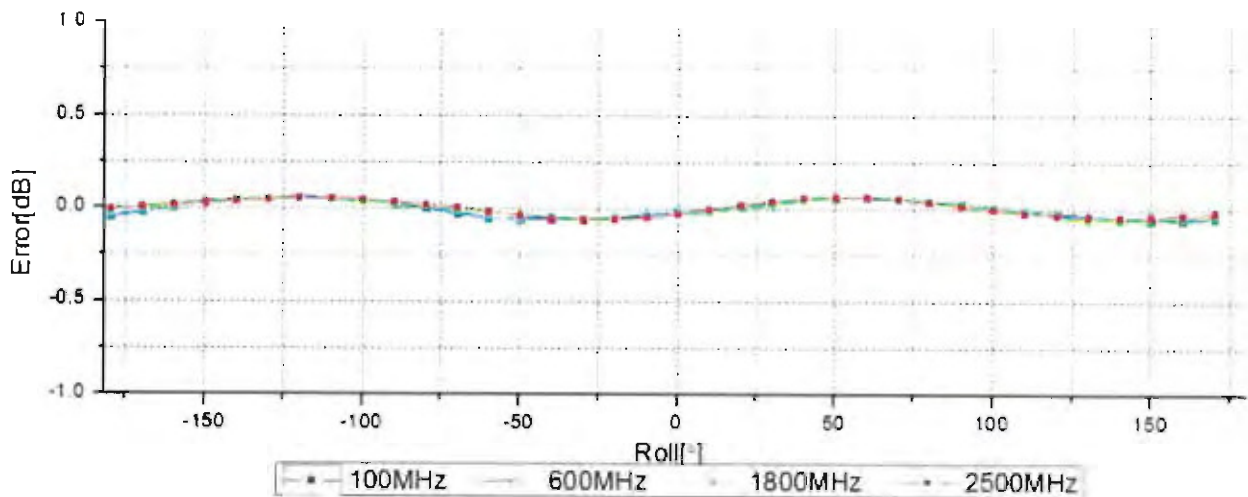
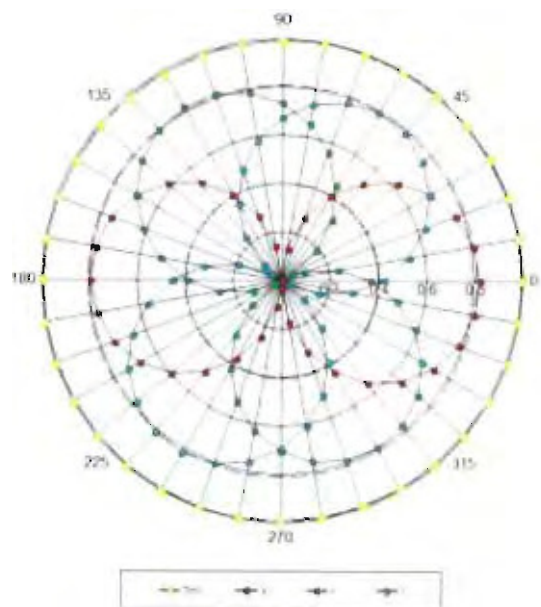
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E-mail: cttl@chinattl.com [Http://www.chinattl.cn](http://www.chinattl.cn)

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

f=600 MHz, TEM



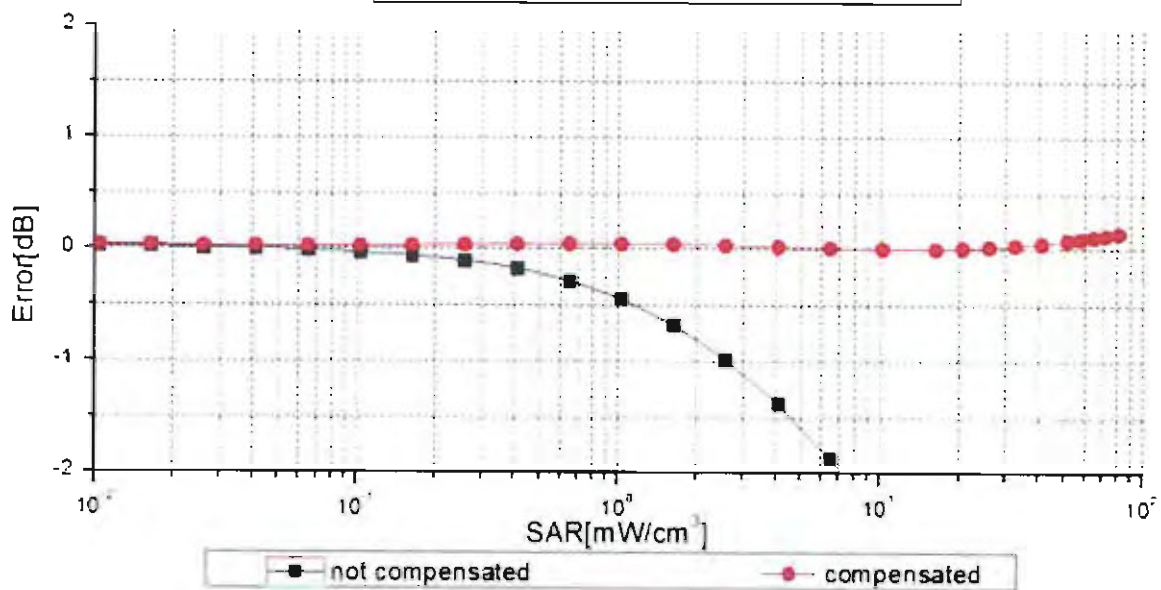
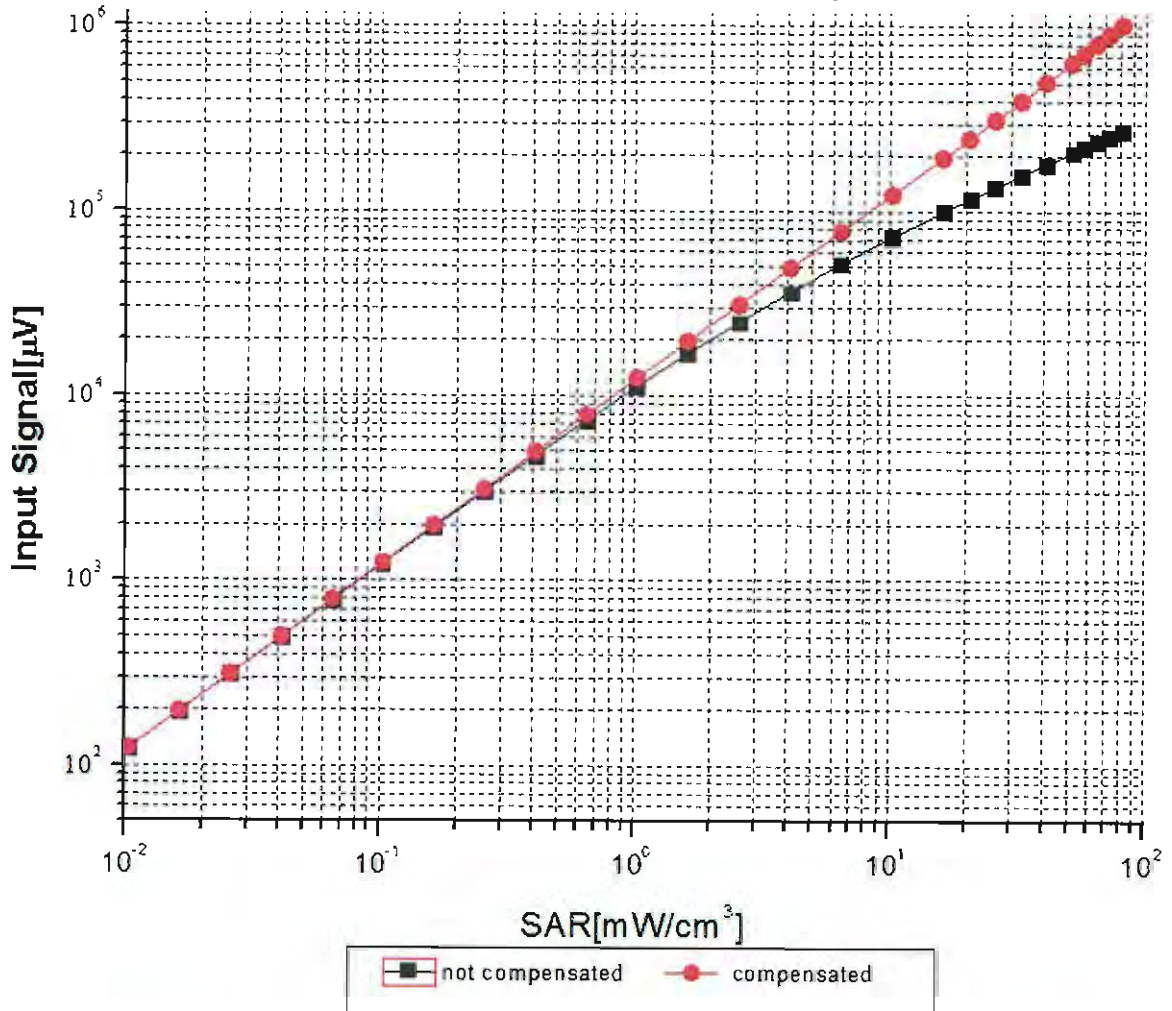
f=1800 MHz, R22



Uncertainty of Axial Isotropy Assessment: $\pm 0.9\%$ ($k=2$)



Dynamic Range f(SAR_{head}) (TEM cell, f = 900 MHz)



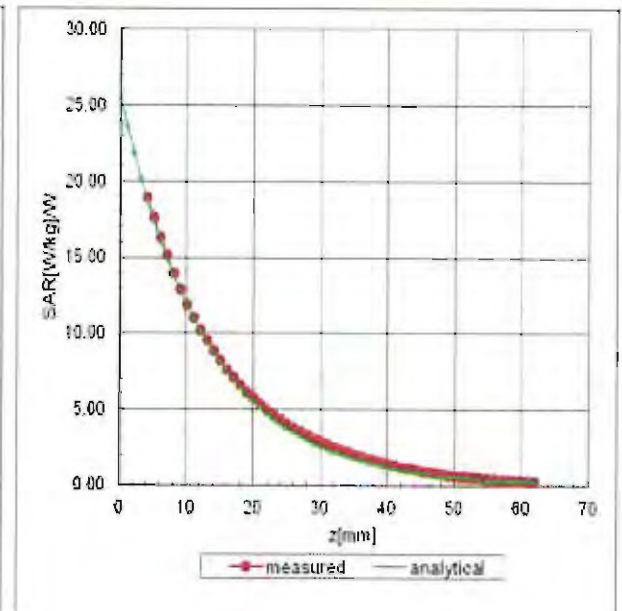
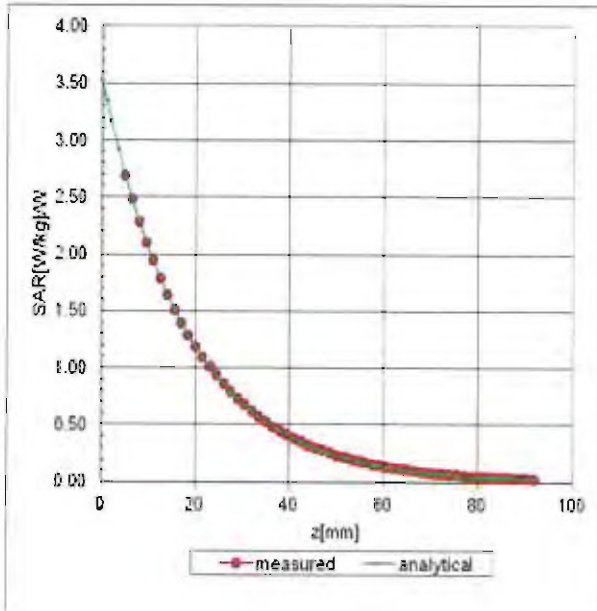
Uncertainty of Linearity Assessment: $\pm 0.9\%$ (k=2)



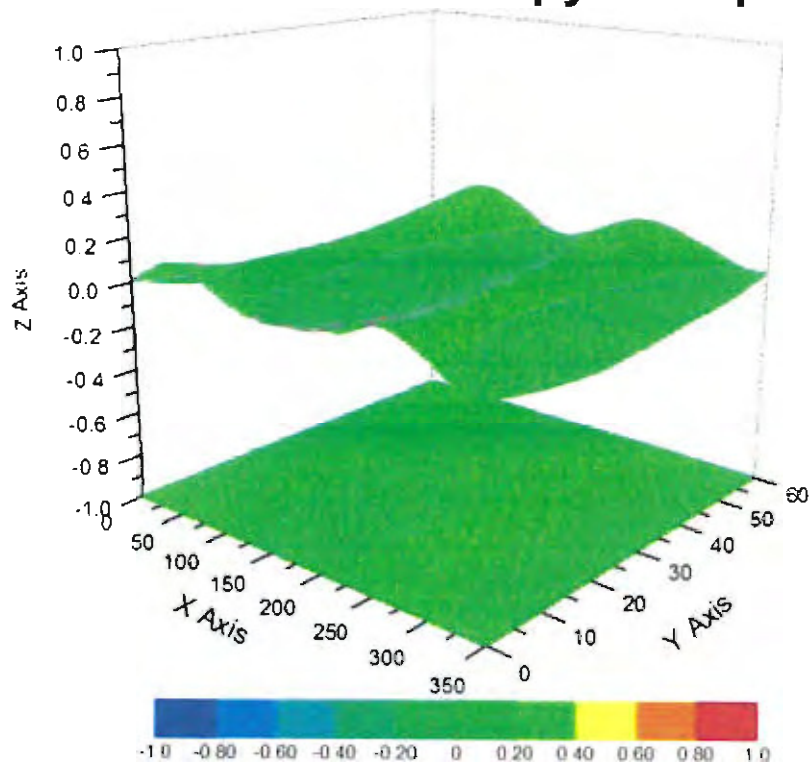
Conversion Factor Assessment

f=900 MHz, WGLS R9(H_convF)

f=1750 MHz, WGLS R22(H_convF)



Deviation from Isotropy in Liquid



Uncertainty of Spherical Isotropy Assessment: $\pm 2.8\%$ (K=2)



DASY/EASY – Parameters of Probe: ES3DV3 - SN: 3270

Other Probe Parameters

| | |
|--|-------------------|
| Sensor Arrangement | Triangular |
| Connector Angle (°) | 168.9 |
| Mechanical Surface Detection Mode | enabled |
| Optical Surface Detection Mode | disable |
| Probe Overall Length | 337mm |
| Probe Body Diameter | 10mm |
| Tip Length | 10mm |
| Tip Diameter | 4mm |
| Probe Tip to Sensor X Calibration Point | 2mm |
| Probe Tip to Sensor Y Calibration Point | 2mm |
| Probe Tip to Sensor Z Calibration Point | 2mm |
| Recommended Measurement Distance from Surface | 3mm |



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 **Sporton-TW (Auden)**

Certificate No: **EX3-3931_Oct16**

CALIBRATION CERTIFICATE

Object **EX3DV4 - SN:3931**

Calibration procedure(s) **QA CAL-01.v9, QA CAL-14.v4, QA CAL-23.v5, QA CAL-25.v6**
Calibration procedure for dosimetric E-field probes

Calibration date: **October 3, 2016**

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 | 06-Apr-16 (No. 217-02288/02289) | Apr-17 |
| Power sensor NRP-Z91 | SN: 103244 | 06-Apr-16 (No. 217-02288) | Apr-17 |
| Power sensor NRP-Z91 | SN: 103245 | 06-Apr-16 (No. 217-02289) | Apr-17 |
| Reference 20 dB Attenuator | SN: S5277 (20x) | 05-Apr-16 (No. 217-02293) | Apr-17 |
| Reference Probe ES3DV2 | SN: 3013 | 31-Dec-15 (No. ES3-3013_Dec15) | Dec-16 |
| DAE4 | SN: 660 | 23-Dec-15 (No. DAE4-660_Dec15) | Dec-16 |
| Secondary Standards | ID | Check Date (in house) | Scheduled Check |
| Power meter E4419B | SN: GB41293874 | 06-Apr-16 (in house check Jun-16) | In house check: Jun-18 |
| Power sensor E4412A | SN: MY41498087 | 06-Apr-16 (in house check Jun-16) | In house check: Jun-18 |
| Power sensor E4412A | SN: 000110210 | 06-Apr-16 (in house check Jun-16) | In house check: Jun-18 |
| RF generator HP 8648C | SN: US3642U01700 | 04-Aug-99 (in house check Jun-16) | In house check: Jun-18 |
| Network Analyzer HP 8753E | SN: US37390585 | 18-Oct-01 (in house check Oct-15) | In house check: Oct-16 |

| | Name | Function | Signature |
|---|---------------|-----------------------|-------------------------|
| Calibrated by: | Michael Weber | Laboratory Technician | |
| Approved by: | Katja Pokovic | Technical Manager | |
| | | | Issued: October 4, 2016 |
| This calibration certificate shall not be reproduced except in full without written approval of the laboratory. | | | |



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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

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 φ | φ rotation around probe axis |
| Polarization ϑ | ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., $\vartheta = 0$ is normal to probe axis |
| Connector Angle | information used in DASY system to align probe sensor X to the robot coordinate system |

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- 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 $\vartheta = 0$ ($f \leq 900$ 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 E²-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 ± 50 MHz to ± 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).

Probe EX3DV4

SN:3931

| | |
|---------------|--------------------|
| Manufactured: | July 24, 2013 |
| Repaired: | September 27, 2016 |
| Calibrated: | October 3, 2016 |

Calibrated for DASY/EASY Systems
(Note: non-compatible with DASY2 system!)

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3931

Basic Calibration Parameters

| | Sensor X | Sensor Y | Sensor Z | Unc (k=2) |
|---|----------|----------|----------|---------------|
| Norm ($\mu\text{V}/(\text{V}/\text{m})^2$) ^A | 0.50 | 0.56 | 0.47 | $\pm 10.1 \%$ |
| DCP (mV) ^B | 99.3 | 102.3 | 99.2 | |

Modulation Calibration Parameters

| UID | Communication System Name | | A dB | B dB $\sqrt{\mu\text{V}}$ | C | D dB | VR mV | Unc ^E (k=2) |
|-----|---------------------------|---|---------|------------------------------|-----|---------|----------|---------------------------|
| 0 | CW | X | 0.0 | 0.0 | 1.0 | 0.00 | 165.2 | $\pm 2.2 \%$ |
| | | Y | 0.0 | 0.0 | 1.0 | | 169.6 | |
| | | Z | 0.0 | 0.0 | 1.0 | | 158.4 | |

Note: For details on UID parameters see Appendix.

Sensor Model Parameters

| | C1 fF | C2 fF | α V^{-1} | T1 $\text{ms}\cdot\text{V}^{-2}$ | T2 $\text{ms}\cdot\text{V}^{-1}$ | T3 ms | T4 V^{-2} | T5 V^{-1} | T6 |
|---|----------|----------|-----------------------------|-------------------------------------|-------------------------------------|----------|-----------------------|-----------------------|-------|
| X | 39.73 | 299.4 | 36.38 | 13.81 | 1.099 | 5.004 | 0.119 | 0.351 | 1.005 |
| Y | 59.82 | 447.7 | 35.85 | 21.83 | 1.546 | 5.045 | 0.719 | 0.472 | 1.007 |
| Z | 54.23 | 405.8 | 35.74 | 19.34 | 1.491 | 5.007 | 0.433 | 0.514 | 1.005 |

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%.

^A The uncertainties of Norm X,Y,Z do not affect the E^2 -field uncertainty inside TSL (see Pages 5 and 6).

^B Numerical linearization parameter: uncertainty not required.

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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3931

Calibration Parameter Determined in Head Tissue Simulating Media

| f (MHz) ^C | Relative Permittivity ^F | Conductivity (S/m) ^F | ConvF X | ConvF Y | ConvF Z | Alpha ^G | Depth ^G (mm) | Unc (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|--------------------|-------------------------|-----------|
| 750 | 41.9 | 0.89 | 10.68 | 10.68 | 10.68 | 0.47 | 0.86 | ± 12.0 % |
| 835 | 41.5 | 0.90 | 10.35 | 10.35 | 10.35 | 0.43 | 0.80 | ± 12.0 % |
| 900 | 41.5 | 0.97 | 10.09 | 10.09 | 10.09 | 0.44 | 0.86 | ± 12.0 % |
| 1450 | 40.5 | 1.20 | 8.73 | 8.73 | 8.73 | 0.45 | 0.80 | ± 12.0 % |
| 1750 | 40.1 | 1.37 | 8.68 | 8.68 | 8.68 | 0.37 | 0.80 | ± 12.0 % |
| 1900 | 40.0 | 1.40 | 8.42 | 8.42 | 8.42 | 0.34 | 0.80 | ± 12.0 % |
| 2000 | 40.0 | 1.40 | 8.43 | 8.43 | 8.43 | 0.37 | 0.80 | ± 12.0 % |
| 2300 | 39.5 | 1.67 | 7.94 | 7.94 | 7.94 | 0.28 | 0.86 | ± 12.0 % |
| 2450 | 39.2 | 1.80 | 7.60 | 7.60 | 7.60 | 0.36 | 0.84 | ± 12.0 % |
| 2600 | 39.0 | 1.96 | 7.37 | 7.37 | 7.37 | 0.31 | 0.97 | ± 12.0 % |
| 5250 | 35.9 | 4.71 | 5.38 | 5.38 | 5.38 | 0.35 | 1.80 | ± 13.1 % |
| 5600 | 35.5 | 5.07 | 4.68 | 4.68 | 4.68 | 0.40 | 1.80 | ± 13.1 % |
| 5750 | 35.4 | 5.22 | 4.84 | 4.84 | 4.84 | 0.40 | 1.80 | ± 13.1 % |

^C 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. Above 5 GHz frequency validity can be extended to ± 110 MHz.

^F 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.

^G 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.

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3931

Calibration Parameter Determined in Body Tissue Simulating Media

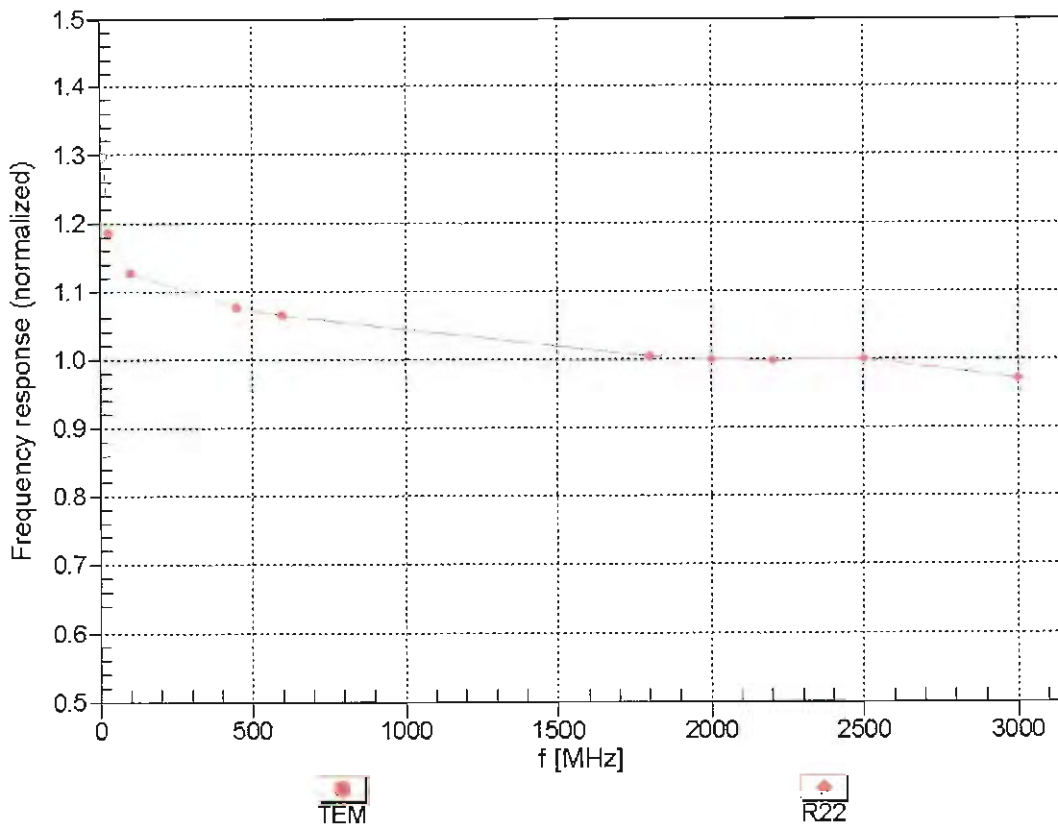
| f (MHz) ^C | Relative Permittivity ^F | Conductivity (S/m) ^F | ConvF X | ConvF Y | ConvF Z | Alpha ^G | Depth ^G (mm) | Unc (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|--------------------|-------------------------|-----------|
| 750 | 55.5 | 0.96 | 10.37 | 10.37 | 10.37 | 0.38 | 0.97 | ± 12.0 % |
| 835 | 55.2 | 0.97 | 10.14 | 10.14 | 10.14 | 0.36 | 0.99 | ± 12.0 % |
| 1450 | 54.0 | 1.30 | 8.53 | 8.53 | 8.53 | 0.31 | 0.80 | ± 12.0 % |
| 1750 | 53.4 | 1.49 | 8.45 | 8.45 | 8.45 | 0.37 | 0.80 | ± 12.0 % |
| 1900 | 53.3 | 1.52 | 8.14 | 8.14 | 8.14 | 0.33 | 0.90 | ± 12.0 % |
| 2300 | 52.9 | 1.81 | 7.96 | 7.96 | 7.96 | 0.39 | 0.80 | ± 12.0 % |
| 2450 | 52.7 | 1.95 | 7.73 | 7.73 | 7.73 | 0.38 | 0.85 | ± 12.0 % |
| 2600 | 52.5 | 2.16 | 7.46 | 7.46 | 7.46 | 0.25 | 0.95 | ± 12.0 % |
| 5250 | 48.9 | 5.36 | 4.57 | 4.57 | 4.57 | 0.50 | 1.90 | ± 13.1 % |
| 5600 | 48.5 | 5.77 | 3.71 | 3.71 | 3.71 | 0.60 | 1.90 | ± 13.1 % |
| 5750 | 48.3 | 5.94 | 4.01 | 4.01 | 4.01 | 0.60 | 1.90 | ± 13.1 % |

^C 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. Above 5 GHz frequency validity can be extended to ± 110 MHz.

^F 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.

^G 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.

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

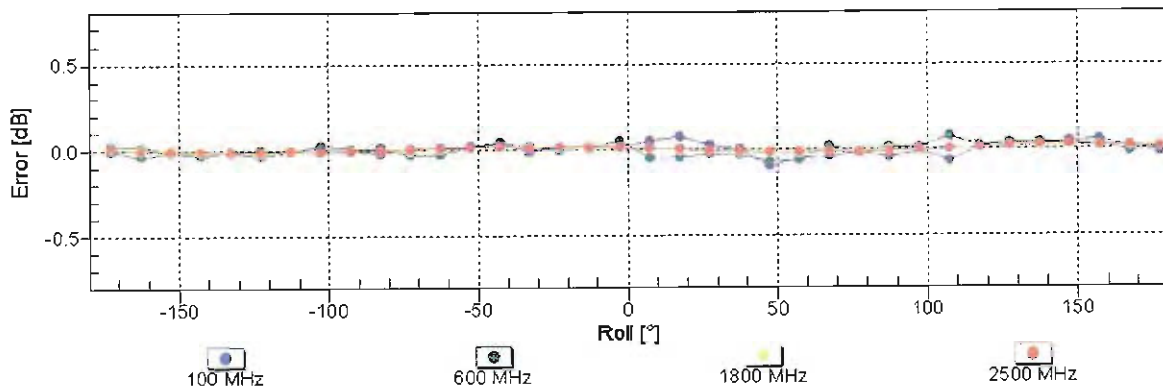
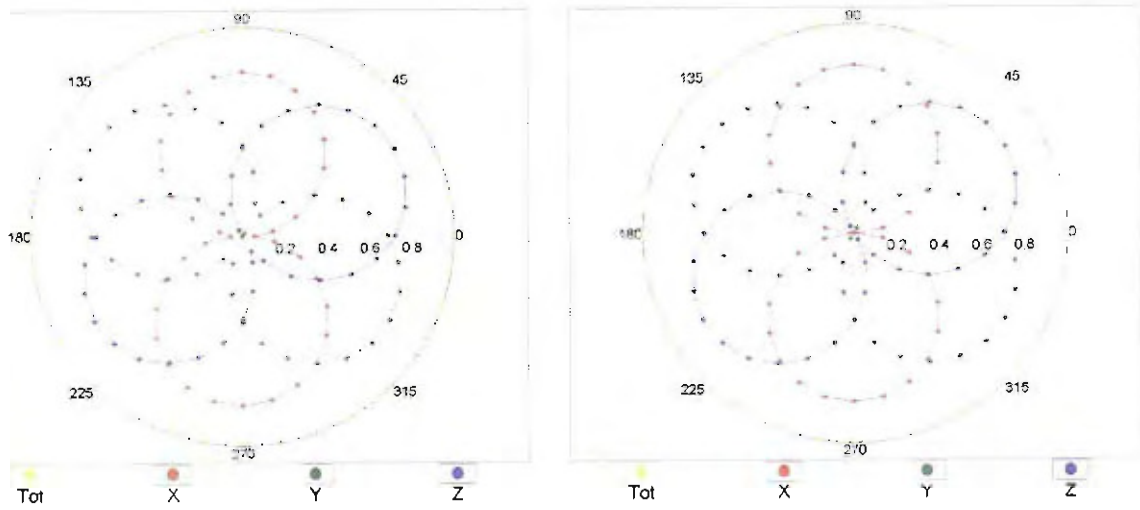


Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ ($k=2$)

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

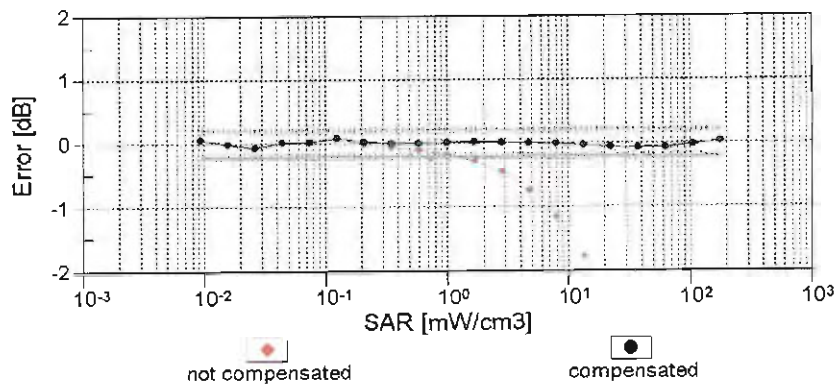
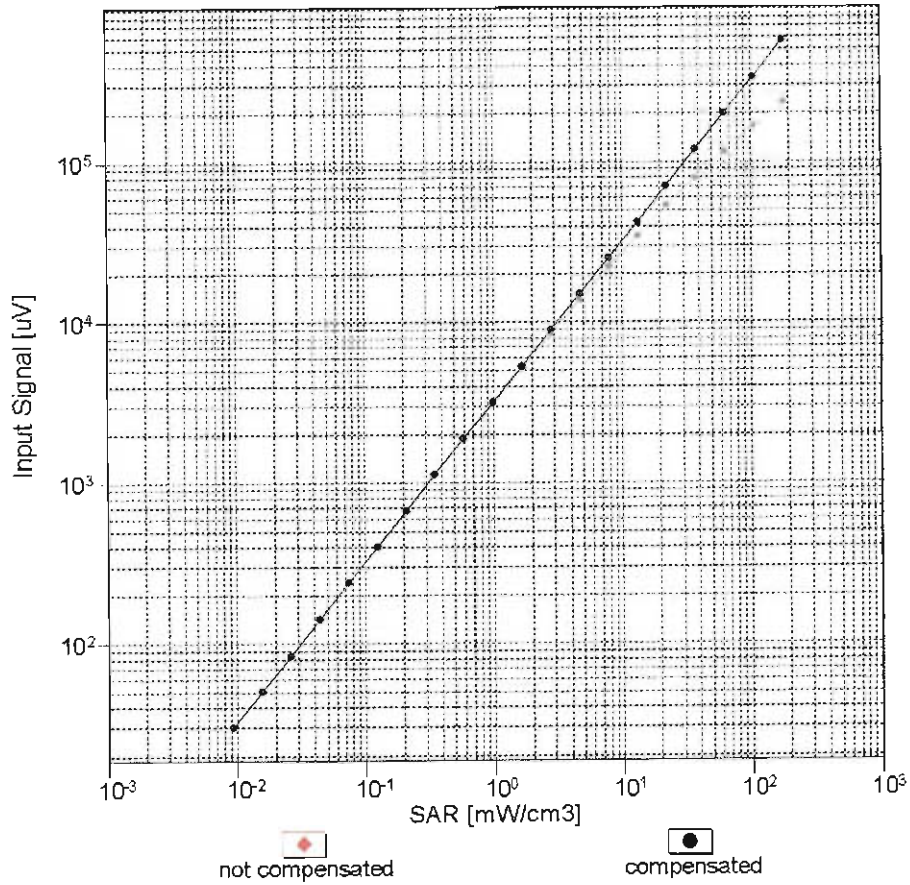
f=600 MHz,TEM

f=1800 MHz,R22



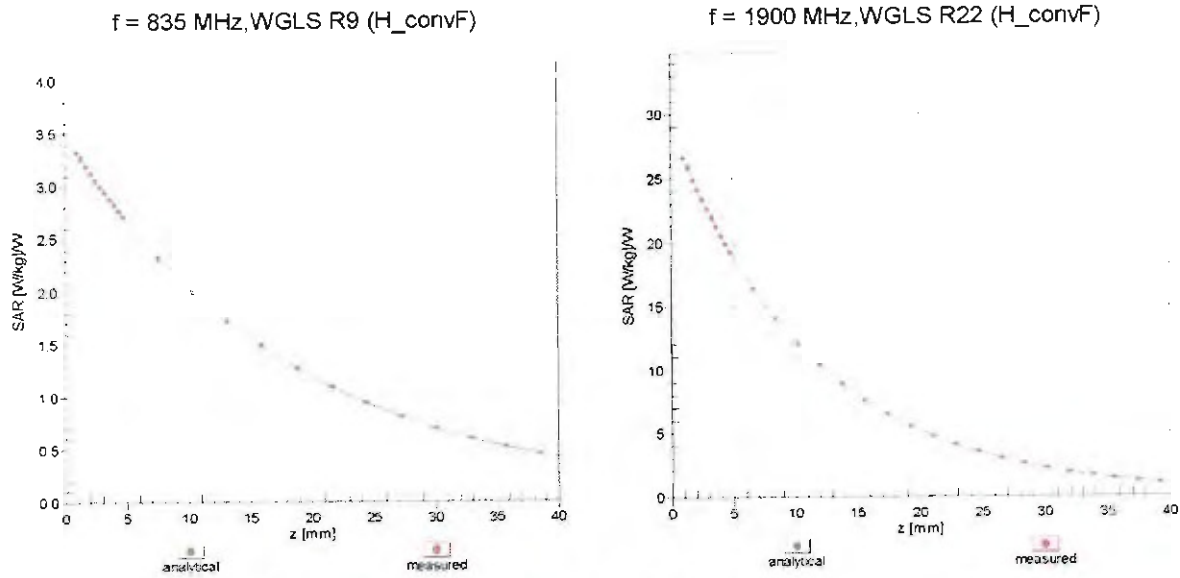
Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ ($k=2$)

Dynamic Range $f(SAR_{head})$ (TEM cell , $f_{eval} = 1900$ MHz)

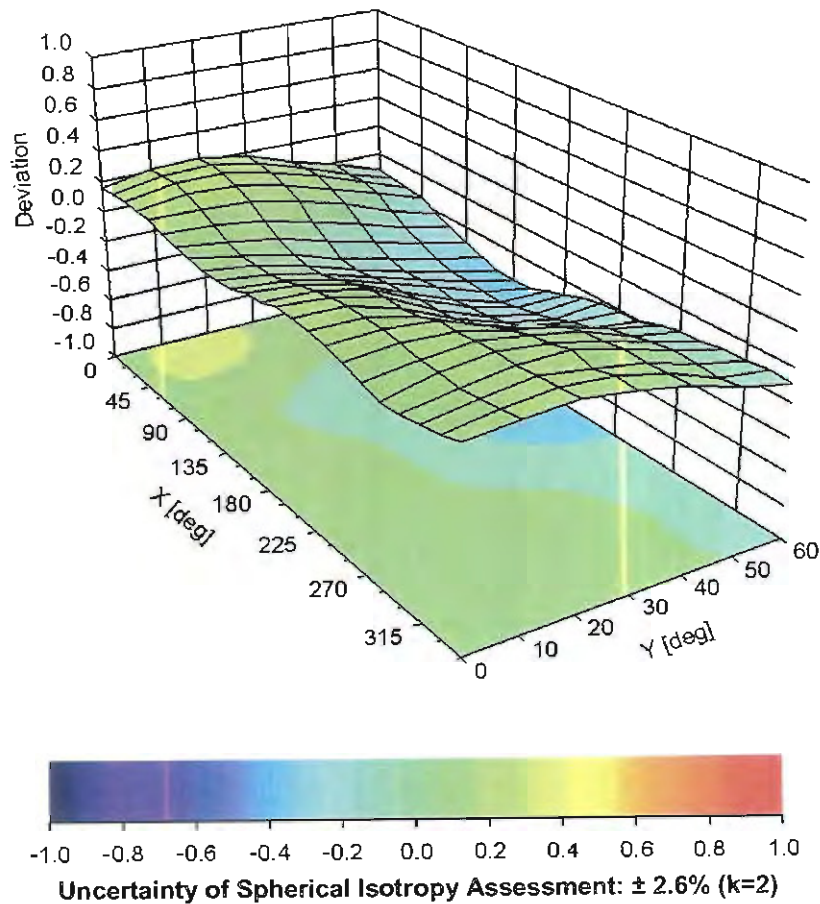


Uncertainty of Linearity Assessment: $\pm 0.6\%$ (k=2)

Conversion Factor Assessment



Deviation from Isotropy in Liquid Error (ϕ, ϑ), f = 900 MHz



DASY/EASY - Parameters of Probe: EX3DV4 - SN:3931

Other Probe Parameters

| | |
|---|------------|
| Sensor Arrangement | Triangular |
| Connector Angle (°) | 127.3 |
| 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 |

Appendix: Modulation Calibration Parameters

| UID | Communication System Name | | A dB | B dB $\sqrt{\mu V}$ | C | D dB | VR mV | Max Unc ^E (k=2) |
|---------------|---|---|---------|------------------------|-------|---------|----------|----------------------------------|
| 0 | CW | X | 0.00 | 0.00 | 1.00 | 0.00 | 165.2 | $\pm 2.2\%$ |
| | | Y | 0.00 | 0.00 | 1.00 | | 169.6 | |
| | | Z | 0.00 | 0.00 | 1.00 | | 158.4 | |
| 10010- CAA | SAR Validation (Square, 100ms, 10ms) | X | 3.48 | 69.31 | 12.63 | 10.00 | 20.0 | $\pm 9.6\%$ |
| | | Y | 5.87 | 75.87 | 16.27 | | 20.0 | |
| | | Z | 4.02 | 70.66 | 13.78 | | 20.0 | |
| 10011- CAB | UMTS-FDD (WCDMA) | X | 1.30 | 72.39 | 18.20 | 0.00 | 150.0 | $\pm 9.6\%$ |
| | | Y | 1.19 | 69.63 | 16.77 | | 150.0 | |
| | | Z | 1.01 | 66.38 | 14.76 | | 150.0 | |
| 10012- CAB | IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps) | X | 1.24 | 65.29 | 16.42 | 0.41 | 150.0 | $\pm 9.6\%$ |
| | | Y | 1.26 | 64.91 | 16.05 | | 150.0 | |
| | | Z | 1.20 | 63.67 | 14.96 | | 150.0 | |
| 10013- CAB | IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps) | X | 4.82 | 66.95 | 17.27 | 1.46 | 150.0 | $\pm 9.6\%$ |
| | | Y | 5.04 | 66.77 | 17.23 | | 150.0 | |
| | | Z | 4.95 | 66.50 | 16.90 | | 150.0 | |
| 10021- DAB | GSM-FDD (TDMA, GMSK) | X | 100.00 | 114.09 | 27.93 | 9.39 | 50.0 | $\pm 9.6\%$ |
| | | Y | 100.00 | 118.26 | 30.54 | | 50.0 | |
| | | Z | 25.45 | 96.76 | 24.27 | | 50.0 | |
| 10023- DAB | GPRS-FDD (TDMA, GMSK, TN 0) | X | 83.93 | 111.52 | 27.32 | 9.57 | 50.0 | $\pm 9.6\%$ |
| | | Y | 99.99 | 118.26 | 30.60 | | 50.0 | |
| | | Z | 19.40 | 92.86 | 23.18 | | 50.0 | |
| 10024- DAB | GPRS-FDD (TDMA, GMSK, TN 0-1) | X | 100.00 | 112.26 | 25.94 | 6.56 | 60.0 | $\pm 9.6\%$ |
| | | Y | 100.00 | 115.42 | 28.11 | | 60.0 | |
| | | Z | 100.00 | 112.41 | 26.50 | | 60.0 | |
| 10025- DAB | EDGE-FDD (TDMA, 8PSK, TN 0) | X | 5.67 | 76.70 | 28.63 | 12.57 | 50.0 | $\pm 9.6\%$ |
| | | Y | 15.06 | 105.00 | 40.92 | | 50.0 | |
| | | Z | 5.92 | 75.84 | 27.63 | | 50.0 | |
| 10026- DAB | EDGE-FDD (TDMA, 8PSK, TN 0-1) | X | 9.71 | 91.87 | 32.18 | 9.56 | 60.0 | $\pm 9.6\%$ |
| | | Y | 18.06 | 104.69 | 36.55 | | 60.0 | |
| | | Z | 11.21 | 92.21 | 31.55 | | 60.0 | |
| 10027- DAB | GPRS-FDD (TDMA, GMSK, TN 0-1-2) | X | 100.00 | 112.68 | 25.31 | 4.80 | 80.0 | $\pm 9.6\%$ |
| | | Y | 100.00 | 114.88 | 27.06 | | 80.0 | |
| | | Z | 100.00 | 111.26 | 25.19 | | 80.0 | |
| 10028- DAB | GPRS-FDD (TDMA, GMSK, TN 0-1-2-3) | X | 100.00 | 114.77 | 25.52 | 3.55 | 100.0 | $\pm 9.6\%$ |
| | | Y | 100.00 | 115.72 | 26.71 | | 100.0 | |
| | | Z | 100.00 | 111.32 | 24.54 | | 100.0 | |
| 10029- DAB | EDGE-FDD (TDMA, 8PSK, TN 0-1-2) | X | 6.19 | 82.03 | 27.36 | 7.80 | 80.0 | $\pm 9.6\%$ |
| | | Y | 10.55 | 92.05 | 31.00 | | 80.0 | |
| | | Z | 7.53 | 83.82 | 27.35 | | 80.0 | |
| 10030- CAA | IEEE 802.15.1 Bluetooth (GFSK, DH1) | X | 100.00 | 110.56 | 24.66 | 5.30 | 70.0 | $\pm 9.6\%$ |
| | | Y | 100.00 | 113.96 | 26.95 | | 70.0 | |
| | | Z | 100.00 | 110.53 | 25.16 | | 70.0 | |
| 10031- CAA | IEEE 802.15.1 Bluetooth (GFSK, DH3) | X | 100.00 | 116.75 | 24.95 | 1.88 | 100.0 | $\pm 9.6\%$ |
| | | Y | 100.00 | 117.62 | 26.11 | | 100.0 | |
| | | Z | 100.00 | 110.75 | 23.01 | | 100.0 | |

| | | | | | | | | |
|-----------|---|---|--------|--------|-------|-------|-------|---------|
| 10032-CAA | IEEE 802.15.1 Bluetooth (GFSK, DH5) | X | 100.00 | 131.18 | 29.75 | 1.17 | 100.0 | ± 9.6 % |
| | | Y | 100.00 | 125.29 | 28.26 | | 100.0 | |
| | | Z | 100.00 | 114.95 | 23.87 | | 100.0 | |
| 10033-CAA | IEEE 802.15.1 Bluetooth (PI/4-DQPSK, DH1) | X | 10.93 | 90.53 | 23.32 | 5.30 | 70.0 | ± 9.6 % |
| | | Y | 20.55 | 101.44 | 27.99 | | 70.0 | |
| | | Z | 7.67 | 84.45 | 21.88 | | 70.0 | |
| 10034-CAA | IEEE 802.15.1 Bluetooth (PI/4-DQPSK, DH3) | X | 5.70 | 84.58 | 20.06 | 1.88 | 100.0 | ± 9.6 % |
| | | Y | 5.85 | 85.75 | 22.03 | | 100.0 | |
| | | Z | 2.95 | 74.86 | 17.34 | | 100.0 | |
| 10035-CAA | IEEE 802.15.1 Bluetooth (PI/4-DQPSK, DH5) | X | 3.92 | 81.20 | 18.80 | 1.17 | 100.0 | ± 9.6 % |
| | | Y | 3.48 | 79.72 | 19.80 | | 100.0 | |
| | | Z | 2.10 | 71.76 | 15.97 | | 100.0 | |
| 10036-CAA | IEEE 802.15.1 Bluetooth (8-DPSK, DH1) | X | 15.13 | 95.54 | 24.90 | 5.30 | 70.0 | ± 9.6 % |
| | | Y | 28.86 | 107.18 | 29.66 | | 70.0 | |
| | | Z | 9.07 | 87.21 | 22.88 | | 70.0 | |
| 10037-CAA | IEEE 802.15.1 Bluetooth (8-DPSK, DH3) | X | 4.82 | 82.50 | 19.36 | 1.88 | 100.0 | ± 9.6 % |
| | | Y | 5.58 | 85.13 | 21.78 | | 100.0 | |
| | | Z | 2.82 | 74.36 | 17.11 | | 100.0 | |
| 10038-CAA | IEEE 802.15.1 Bluetooth (8-DPSK, DH5) | X | 4.08 | 82.09 | 19.24 | 1.17 | 100.0 | ± 9.6 % |
| | | Y | 3.57 | 80.38 | 20.14 | | 100.0 | |
| | | Z | 2.12 | 72.10 | 16.20 | | 100.0 | |
| 10039-CAB | CDMA2000 (1xRTT, RC1) | X | 5.80 | 88.31 | 21.06 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 2.44 | 75.65 | 18.16 | | 150.0 | |
| | | Z | 1.80 | 71.10 | 15.73 | | 150.0 | |
| 10042-CAB | IS-54 / IS-136 FDD (TDMA/FDM, PI/4-DQPSK, Halfrate) | X | 100.00 | 110.27 | 25.32 | 7.78 | 50.0 | ± 9.6 % |
| | | Y | 100.00 | 114.03 | 27.70 | | 50.0 | |
| | | Z | 32.06 | 97.64 | 22.93 | | 50.0 | |
| 10044-CAA | IS-91/EIA/TIA-553 FDD (FDMA, FM) | X | 0.00 | 105.67 | 0.52 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 0.00 | 101.10 | 0.34 | | 150.0 | |
| | | Z | 0.00 | 94.56 | 3.16 | | 150.0 | |
| 10048-CAA | DECT (TDD, TDMA/FDM, GFSK, Full Slot, 24) | X | 11.94 | 82.95 | 20.71 | 13.80 | 25.0 | ± 9.6 % |
| | | Y | 15.06 | 89.64 | 24.59 | | 25.0 | |
| | | Z | 9.78 | 81.31 | 21.11 | | 25.0 | |
| 10049-CAA | DECT (TDD, TDMA/FDM, GFSK, Double Slot, 12) | X | 15.54 | 88.48 | 21.39 | 10.79 | 40.0 | ± 9.6 % |
| | | Y | 23.79 | 97.14 | 25.51 | | 40.0 | |
| | | Z | 11.46 | 84.91 | 21.03 | | 40.0 | |
| 10056-CAA | UMTS-TDD (TD-SCDMA, 1.28 Mcps) | X | 13.32 | 89.14 | 23.36 | 9.03 | 50.0 | ± 9.6 % |
| | | Y | 16.34 | 93.59 | 26.16 | | 50.0 | |
| | | Z | 10.18 | 84.57 | 22.45 | | 50.0 | |
| 10058-DAB | EDGE-FDD (TDMA, 8PSK, TN 0-1-2-3) | X | 4.78 | 77.20 | 24.69 | 6.55 | 100.0 | ± 9.6 % |
| | | Y | 7.46 | 84.92 | 27.60 | | 100.0 | |
| | | Z | 5.76 | 78.94 | 24.73 | | 100.0 | |
| 10059-CAB | IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps) | X | 1.30 | 66.67 | 17.10 | 0.61 | 110.0 | ± 9.6 % |
| | | Y | 1.37 | 66.65 | 16.91 | | 110.0 | |
| | | Z | 1.27 | 64.87 | 15.53 | | 110.0 | |
| 10060-CAB | IEEE 802.11b WiFi 2.4 GHz (DSSS, 5.5 Mbps) | X | 100.00 | 139.37 | 36.42 | 1.30 | 110.0 | ± 9.6 % |
| | | Y | 100.00 | 134.75 | 34.85 | | 110.0 | |
| | | Z | 5.80 | 90.90 | 23.07 | | 110.0 | |

| | | | | | | | | |
|-----------|--|---|------|-------|-------|------|-------|---------|
| 10061-CAB | IEEE 802.11b WiFi 2.4 GHz (DSSS, 11 Mbps) | X | 4.16 | 86.26 | 24.31 | 2.04 | 110.0 | ± 9.6 % |
| | | Y | 6.78 | 92.08 | 26.03 | | 110.0 | |
| | | Z | 3.18 | 78.55 | 20.67 | | 110.0 | |
| 10062-CAB | IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps) | X | 4.62 | 66.99 | 16.77 | 0.49 | 100.0 | ± 9.6 % |
| | | Y | 4.83 | 66.75 | 16.66 | | 100.0 | |
| | | Z | 4.75 | 66.51 | 16.38 | | 100.0 | |
| 10063-CAB | IEEE 802.11a/h WiFi 5 GHz (OFDM, 9 Mbps) | X | 4.64 | 67.08 | 16.86 | 0.72 | 100.0 | ± 9.6 % |
| | | Y | 4.86 | 66.87 | 16.78 | | 100.0 | |
| | | Z | 4.77 | 66.60 | 16.47 | | 100.0 | |
| 10064-CAB | IEEE 802.11a/h WiFi 5 GHz (OFDM, 12 Mbps) | X | 4.89 | 67.27 | 17.04 | 0.86 | 100.0 | ± 9.6 % |
| | | Y | 5.19 | 67.18 | 17.02 | | 100.0 | |
| | | Z | 5.08 | 66.89 | 16.71 | | 100.0 | |
| 10065-CAB | IEEE 802.11a/h WiFi 5 GHz (OFDM, 18 Mbps) | X | 4.77 | 67.14 | 17.11 | 1.21 | 100.0 | ± 9.6 % |
| | | Y | 5.06 | 67.12 | 17.13 | | 100.0 | |
| | | Z | 4.94 | 66.80 | 16.79 | | 100.0 | |
| 10066-CAB | IEEE 802.11a/h WiFi 5 GHz (OFDM, 24 Mbps) | X | 4.78 | 67.15 | 17.25 | 1.46 | 100.0 | ± 9.6 % |
| | | Y | 5.09 | 67.18 | 17.31 | | 100.0 | |
| | | Z | 4.97 | 66.83 | 16.94 | | 100.0 | |
| 10067-CAB | IEEE 802.11a/h WiFi 5 GHz (OFDM, 36 Mbps) | X | 5.07 | 67.35 | 17.68 | 2.04 | 100.0 | ± 9.6 % |
| | | Y | 5.38 | 67.26 | 17.72 | | 100.0 | |
| | | Z | 5.26 | 66.92 | 17.34 | | 100.0 | |
| 10068-CAB | IEEE 802.11a/h WiFi 5 GHz (OFDM, 48 Mbps) | X | 5.11 | 67.30 | 17.84 | 2.55 | 100.0 | ± 9.6 % |
| | | Y | 5.48 | 67.51 | 18.02 | | 100.0 | |
| | | Z | 5.34 | 67.10 | 17.60 | | 100.0 | |
| 10069-CAB | IEEE 802.11a/h WiFi 5 GHz (OFDM, 54 Mbps) | X | 5.18 | 67.33 | 18.03 | 2.67 | 100.0 | ± 9.6 % |
| | | Y | 5.55 | 67.43 | 18.19 | | 100.0 | |
| | | Z | 5.42 | 67.05 | 17.77 | | 100.0 | |
| 10071-CAB | IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 9 Mbps) | X | 4.92 | 67.02 | 17.54 | 1.99 | 100.0 | ± 9.6 % |
| | | Y | 5.15 | 66.91 | 17.55 | | 100.0 | |
| | | Z | 5.05 | 66.61 | 17.20 | | 100.0 | |
| 10072-CAB | IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 12 Mbps) | X | 4.89 | 67.32 | 17.73 | 2.30 | 100.0 | ± 9.6 % |
| | | Y | 5.18 | 67.36 | 17.81 | | 100.0 | |
| | | Z | 5.06 | 66.97 | 17.41 | | 100.0 | |
| 10073-CAB | IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 18 Mbps) | X | 4.97 | 67.51 | 18.05 | 2.83 | 100.0 | ± 9.6 % |
| | | Y | 5.26 | 67.57 | 18.16 | | 100.0 | |
| | | Z | 5.13 | 67.15 | 17.71 | | 100.0 | |
| 10074-CAB | IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 24 Mbps) | X | 4.97 | 67.45 | 18.19 | 3.30 | 100.0 | ± 9.6 % |
| | | Y | 5.25 | 67.52 | 18.35 | | 100.0 | |
| | | Z | 5.12 | 67.08 | 17.88 | | 100.0 | |
| 10075-CAB | IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 36 Mbps) | X | 5.01 | 67.53 | 18.46 | 3.82 | 90.0 | ± 9.6 % |
| | | Y | 5.35 | 67.85 | 18.77 | | 90.0 | |
| | | Z | 5.20 | 67.32 | 18.23 | | 90.0 | |
| 10076-CAB | IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 48 Mbps) | X | 5.05 | 67.39 | 18.61 | 4.15 | 90.0 | ± 9.6 % |
| | | Y | 5.33 | 67.57 | 18.84 | | 90.0 | |
| | | Z | 5.20 | 67.09 | 18.32 | | 90.0 | |
| 10077-CAB | IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 54 Mbps) | X | 5.08 | 67.49 | 18.72 | 4.30 | 90.0 | ± 9.6 % |
| | | Y | 5.35 | 67.63 | 18.93 | | 90.0 | |
| | | Z | 5.23 | 67.15 | 18.41 | | 90.0 | |

| | | | | | | | | |
|-----------|---|---|--------|--------|-------|------|-------|---------|
| 10081-CAB | CDMA2000 (1xRTT, RC3) | X | 1.31 | 72.98 | 15.39 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 1.11 | 69.20 | 15.13 | | 150.0 | |
| | | Z | 0.87 | 65.58 | 12.79 | | 150.0 | |
| 10082-CAB | IS-54 / IS-136 FDD (TDMA/FDM, PI/4-DQPSK, Fullrate) | X | 0.85 | 60.00 | 5.02 | 4.77 | 80.0 | ± 9.6 % |
| | | Y | 1.21 | 60.81 | 6.24 | | 80.0 | |
| | | Z | 1.05 | 60.00 | 5.50 | | 80.0 | |
| 10090-DAB | GPRS-FDD (TDMA, GMSK, TN 0-4) | X | 100.00 | 112.28 | 25.96 | 6.56 | 60.0 | ± 9.6 % |
| | | Y | 100.00 | 115.46 | 28.15 | | 60.0 | |
| | | Z | 100.00 | 112.45 | 26.54 | | 60.0 | |
| 10097-CAB | UMTS-FDD (HSDPA) | X | 2.10 | 70.95 | 17.43 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 1.95 | 68.39 | 16.42 | | 150.0 | |
| | | Z | 1.81 | 67.01 | 15.42 | | 150.0 | |
| 10098-CAB | UMTS-FDD (HSUPA, Subtest 2) | X | 2.06 | 70.93 | 17.43 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 1.91 | 68.38 | 16.41 | | 150.0 | |
| | | Z | 1.77 | 66.95 | 15.38 | | 150.0 | |
| 10099-DAB | EDGE-FDD (TDMA, 8PSK, TN 0-4) | X | 9.76 | 91.94 | 32.20 | 9.56 | 60.0 | ± 9.6 % |
| | | Y | 18.08 | 104.66 | 36.54 | | 60.0 | |
| | | Z | 11.25 | 92.22 | 31.54 | | 60.0 | |
| 10100-CAB | LTE-FDD (SC-FDMA, 100% RB, 20 MHz, QPSK) | X | 3.35 | 72.13 | 17.90 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 3.43 | 71.55 | 17.33 | | 150.0 | |
| | | Z | 3.14 | 69.99 | 16.48 | | 150.0 | |
| 10101-CAB | LTE-FDD (SC-FDMA, 100% RB, 20 MHz, 16-QAM) | X | 3.28 | 68.30 | 16.59 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 3.42 | 68.10 | 16.32 | | 150.0 | |
| | | Z | 3.28 | 67.37 | 15.82 | | 150.0 | |
| 10102-CAB | LTE-FDD (SC-FDMA, 100% RB, 20 MHz, 64-QAM) | X | 3.39 | 68.25 | 16.67 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 3.51 | 67.99 | 16.38 | | 150.0 | |
| | | Z | 3.39 | 67.35 | 15.92 | | 150.0 | |
| 10103-CAB | LTE-TDD (SC-FDMA, 100% RB, 20 MHz, QPSK) | X | 6.41 | 75.89 | 20.51 | 3.98 | 65.0 | ± 9.6 % |
| | | Y | 7.77 | 77.49 | 21.00 | | 65.0 | |
| | | Z | 6.54 | 74.47 | 19.52 | | 65.0 | |
| 10104-CAB | LTE-TDD (SC-FDMA, 100% RB, 20 MHz, 16-QAM) | X | 6.38 | 73.95 | 20.45 | 3.98 | 65.0 | ± 9.6 % |
| | | Y | 7.62 | 75.73 | 21.18 | | 65.0 | |
| | | Z | 6.97 | 74.03 | 20.17 | | 65.0 | |
| 10105-CAB | LTE-TDD (SC-FDMA, 100% RB, 20 MHz, 64-QAM) | X | 5.88 | 72.23 | 19.98 | 3.98 | 65.0 | ± 9.6 % |
| | | Y | 7.31 | 74.91 | 21.13 | | 65.0 | |
| | | Z | 6.85 | 73.64 | 20.32 | | 65.0 | |
| 10108-CAC | LTE-FDD (SC-FDMA, 100% RB, 10 MHz, QPSK) | X | 2.91 | 71.53 | 17.82 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 3.02 | 70.68 | 17.15 | | 150.0 | |
| | | Z | 2.76 | 69.18 | 16.29 | | 150.0 | |
| 10109-CAC | LTE-FDD (SC-FDMA, 100% RB, 10 MHz, 16-QAM) | X | 2.95 | 68.44 | 16.61 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 3.08 | 67.93 | 16.28 | | 150.0 | |
| | | Z | 2.95 | 67.17 | 15.72 | | 150.0 | |
| 10110-CAC | LTE-FDD (SC-FDMA, 100% RB, 5 MHz, QPSK) | X | 2.39 | 71.08 | 17.59 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 2.47 | 69.75 | 16.86 | | 150.0 | |
| | | Z | 2.25 | 68.18 | 15.88 | | 150.0 | |
| 10111-CAC | LTE-FDD (SC-FDMA, 100% RB, 5 MHz, 16-QAM) | X | 2.79 | 70.36 | 17.30 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 2.80 | 68.64 | 16.65 | | 150.0 | |
| | | Z | 2.65 | 67.83 | 16.01 | | 150.0 | |

| | | | | | | | | |
|-----------|--|---|------|-------|-------|------|-------|---------|
| 10112-CAC | LTE-FDD (SC-FDMA, 100% RB, 10 MHz, 64-QAM) | X | 3.07 | 68.42 | 16.64 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 3.20 | 67.83 | 16.29 | | 150.0 | |
| | | Z | 3.07 | 67.16 | 15.79 | | 150.0 | |
| 10113-CAC | LTE-FDD (SC-FDMA, 100% RB, 5 MHz, 64-QAM) | X | 2.94 | 70.45 | 17.39 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 2.95 | 68.67 | 16.72 | | 150.0 | |
| | | Z | 2.81 | 67.97 | 16.15 | | 150.0 | |
| 10114-CAB | IEEE 802.11n (HT Greenfield, 13.5 Mbps, BPSK) | X | 5.09 | 67.47 | 16.77 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 5.23 | 67.24 | 16.53 | | 150.0 | |
| | | Z | 5.18 | 67.08 | 16.35 | | 150.0 | |
| 10115-CAB | IEEE 802.11n (HT Greenfield, 81 Mbps, 16-QAM) | X | 5.34 | 67.51 | 16.78 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 5.60 | 67.53 | 16.67 | | 150.0 | |
| | | Z | 5.52 | 67.36 | 16.50 | | 150.0 | |
| 10116-CAB | IEEE 802.11n (HT Greenfield, 135 Mbps, 64-QAM) | X | 5.18 | 67.67 | 16.79 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 5.36 | 67.51 | 16.58 | | 150.0 | |
| | | Z | 5.29 | 67.32 | 16.39 | | 150.0 | |
| 10117-CAB | IEEE 802.11n (HT Mixed, 13.5 Mbps, BPSK) | X | 5.07 | 67.38 | 16.74 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 5.24 | 67.25 | 16.55 | | 150.0 | |
| | | Z | 5.16 | 67.03 | 16.34 | | 150.0 | |
| 10118-CAB | IEEE 802.11n (HT Mixed, 81 Mbps, 16-QAM) | X | 5.42 | 67.71 | 16.89 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 5.67 | 67.69 | 16.76 | | 150.0 | |
| | | Z | 5.59 | 67.53 | 16.59 | | 150.0 | |
| 10119-CAB | IEEE 802.11n (HT Mixed, 135 Mbps, 64-QAM) | X | 5.17 | 67.64 | 16.79 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 5.33 | 67.45 | 16.57 | | 150.0 | |
| | | Z | 5.26 | 67.25 | 16.37 | | 150.0 | |
| 10140-CAB | LTE-FDD (SC-FDMA, 100% RB, 15 MHz, 16-QAM) | X | 3.41 | 68.25 | 16.57 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 3.56 | 67.99 | 16.30 | | 150.0 | |
| | | Z | 3.43 | 67.35 | 15.84 | | 150.0 | |
| 10141-CAB | LTE-FDD (SC-FDMA, 100% RB, 15 MHz, 64-QAM) | X | 3.54 | 68.37 | 16.75 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 3.68 | 68.01 | 16.43 | | 150.0 | |
| | | Z | 3.56 | 67.45 | 16.01 | | 150.0 | |
| 10142-CAC | LTE-FDD (SC-FDMA, 100% RB, 3 MHz, QPSK) | X | 2.25 | 71.96 | 17.48 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 2.26 | 69.83 | 16.74 | | 150.0 | |
| | | Z | 2.02 | 68.09 | 15.61 | | 150.0 | |
| 10143-CAC | LTE-FDD (SC-FDMA, 100% RB, 3 MHz, 16-QAM) | X | 2.82 | 72.22 | 17.26 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 2.71 | 69.55 | 16.65 | | 150.0 | |
| | | Z | 2.52 | 68.51 | 15.83 | | 150.0 | |
| 10144-CAC | LTE-FDD (SC-FDMA, 100% RB, 3 MHz, 64-QAM) | X | 2.29 | 68.06 | 14.75 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 2.50 | 67.47 | 15.19 | | 150.0 | |
| | | Z | 2.32 | 66.44 | 14.34 | | 150.0 | |
| 10145-CAC | LTE-FDD (SC-FDMA, 100% RB, 1.4 MHz, QPSK) | X | 1.16 | 65.56 | 11.35 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 1.65 | 68.53 | 14.65 | | 150.0 | |
| | | Z | 1.36 | 65.83 | 12.76 | | 150.0 | |
| 10146-CAC | LTE-FDD (SC-FDMA, 100% RB, 1.4 MHz, 16-QAM) | X | 1.35 | 63.40 | 9.39 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 3.12 | 72.00 | 15.52 | | 150.0 | |
| | | Z | 2.16 | 67.04 | 12.61 | | 150.0 | |
| 10147-CAC | LTE-FDD (SC-FDMA, 100% RB, 1.4 MHz, 64-QAM) | X | 1.53 | 64.72 | 10.19 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 4.03 | 75.63 | 17.18 | | 150.0 | |
| | | Z | 2.54 | 69.13 | 13.74 | | 150.0 | |

| | | | | | | | | |
|-----------|--|---|------|-------|-------|------|-------|---------|
| 10149-CAB | LTE-FDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM) | X | 2.96 | 68.52 | 16.66 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 3.09 | 67.99 | 16.32 | | 150.0 | |
| | | Z | 2.96 | 67.23 | 15.77 | | 150.0 | |
| 10150-CAB | LTE-FDD (SC-FDMA, 50% RB, 20 MHz, 64-QAM) | X | 3.08 | 68.50 | 16.69 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 3.21 | 67.88 | 16.33 | | 150.0 | |
| | | Z | 3.08 | 67.21 | 15.83 | | 150.0 | |
| 10151-CAB | LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK) | X | 7.03 | 79.10 | 21.82 | 3.98 | 65.0 | ± 9.6 % |
| | | Y | 8.21 | 79.75 | 22.00 | | 65.0 | |
| | | Z | 7.10 | 77.15 | 20.67 | | 65.0 | |
| 10152-CAB | LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM) | X | 5.92 | 73.94 | 20.06 | 3.98 | 65.0 | ± 9.6 % |
| | | Y | 7.21 | 75.88 | 21.03 | | 65.0 | |
| | | Z | 6.48 | 73.87 | 19.84 | | 65.0 | |
| 10153-CAB | LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 64-QAM) | X | 6.35 | 75.11 | 20.94 | 3.98 | 65.0 | ± 9.6 % |
| | | Y | 7.55 | 76.62 | 21.69 | | 65.0 | |
| | | Z | 6.87 | 74.79 | 20.60 | | 65.0 | |
| 10154-CAC | LTE-FDD (SC-FDMA, 50% RB, 10 MHz, QPSK) | X | 2.46 | 71.67 | 17.92 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 2.54 | 70.24 | 17.15 | | 150.0 | |
| | | Z | 2.30 | 68.63 | 16.17 | | 150.0 | |
| 10155-CAC | LTE-FDD (SC-FDMA, 50% RB, 10 MHz, 16-QAM) | X | 2.79 | 70.40 | 17.33 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 2.80 | 68.64 | 16.65 | | 150.0 | |
| | | Z | 2.66 | 67.83 | 16.02 | | 150.0 | |
| 10156-CAC | LTE-FDD (SC-FDMA, 50% RB, 5 MHz, QPSK) | X | 2.17 | 72.73 | 17.45 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 2.14 | 70.24 | 16.79 | | 150.0 | |
| | | Z | 1.88 | 68.21 | 15.48 | | 150.0 | |
| 10157-CAC | LTE-FDD (SC-FDMA, 50% RB, 5 MHz, 16-QAM) | X | 2.21 | 69.24 | 14.98 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 2.36 | 68.31 | 15.46 | | 150.0 | |
| | | Z | 2.15 | 66.99 | 14.43 | | 150.0 | |
| 10158-CAC | LTE-FDD (SC-FDMA, 50% RB, 10 MHz, 64-QAM) | X | 2.95 | 70.56 | 17.46 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 2.95 | 68.72 | 16.76 | | 150.0 | |
| | | Z | 2.82 | 68.03 | 16.20 | | 150.0 | |
| 10159-CAC | LTE-FDD (SC-FDMA, 50% RB, 5 MHz, 64-QAM) | X | 2.36 | 69.87 | 15.32 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 2.49 | 68.78 | 15.76 | | 150.0 | |
| | | Z | 2.27 | 67.50 | 14.75 | | 150.0 | |
| 10160-CAB | LTE-FDD (SC-FDMA, 50% RB, 15 MHz, QPSK) | X | 2.90 | 70.47 | 17.47 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 2.94 | 69.28 | 16.77 | | 150.0 | |
| | | Z | 2.76 | 68.21 | 16.07 | | 150.0 | |
| 10161-CAB | LTE-FDD (SC-FDMA, 50% RB, 15 MHz, 16-QAM) | X | 2.98 | 68.55 | 16.64 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 3.10 | 67.79 | 16.29 | | 150.0 | |
| | | Z | 2.98 | 67.13 | 15.77 | | 150.0 | |
| 10162-CAB | LTE-FDD (SC-FDMA, 50% RB, 15 MHz, 64-QAM) | X | 3.10 | 68.74 | 16.76 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 3.21 | 67.84 | 16.35 | | 150.0 | |
| | | Z | 3.09 | 67.25 | 15.86 | | 150.0 | |
| 10166-CAC | LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, QPSK) | X | 3.31 | 69.42 | 19.40 | 3.01 | 150.0 | ± 9.6 % |
| | | Y | 3.85 | 69.94 | 19.41 | | 150.0 | |
| | | Z | 3.63 | 68.92 | 18.65 | | 150.0 | |
| 10167-CAC | LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, 16-QAM) | X | 3.89 | 72.11 | 19.78 | 3.01 | 150.0 | ± 9.6 % |
| | | Y | 4.89 | 73.20 | 20.04 | | 150.0 | |
| | | Z | 4.45 | 71.60 | 19.05 | | 150.0 | |

| | | | | | | | | |
|-----------|--|---|-------|--------|-------|------|-------|---------|
| 10168-CAC | LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, 64-QAM) | X | 4.43 | 75.02 | 21.48 | 3.01 | 150.0 | ± 9.6 % |
| | | Y | 5.37 | 75.20 | 21.21 | | 150.0 | |
| | | Z | 4.92 | 73.76 | 20.36 | | 150.0 | |
| 10169-CAB | LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK) | X | 2.61 | 67.65 | 18.68 | 3.01 | 150.0 | ± 9.6 % |
| | | Y | 3.41 | 71.01 | 19.90 | | 150.0 | |
| | | Z | 3.09 | 68.90 | 18.61 | | 150.0 | |
| 10170-CAB | LTE-FDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM) | X | 3.32 | 73.16 | 21.10 | 3.01 | 150.0 | ± 9.6 % |
| | | Y | 5.09 | 78.14 | 22.55 | | 150.0 | |
| | | Z | 4.27 | 74.69 | 20.88 | | 150.0 | |
| 10171-AAB | LTE-FDD (SC-FDMA, 1 RB, 20 MHz, 64-QAM) | X | 2.74 | 69.02 | 18.13 | 3.01 | 150.0 | ± 9.6 % |
| | | Y | 4.10 | 73.53 | 19.72 | | 150.0 | |
| | | Z | 3.48 | 70.44 | 18.07 | | 150.0 | |
| 10172-CAB | LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK) | X | 5.53 | 83.56 | 25.72 | 6.02 | 65.0 | ± 9.6 % |
| | | Y | 21.34 | 105.31 | 32.41 | | 65.0 | |
| | | Z | 7.30 | 84.26 | 24.94 | | 65.0 | |
| 10173-CAB | LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM) | X | 10.58 | 92.60 | 26.95 | 6.02 | 65.0 | ± 9.6 % |
| | | Y | 29.30 | 105.74 | 30.57 | | 65.0 | |
| | | Z | 12.37 | 90.08 | 25.23 | | 65.0 | |
| 10174-CAB | LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 64-QAM) | X | 7.41 | 85.53 | 24.05 | 6.02 | 65.0 | ± 9.6 % |
| | | Y | 21.20 | 98.69 | 27.99 | | 65.0 | |
| | | Z | 10.53 | 86.42 | 23.55 | | 65.0 | |
| 10175-CAC | LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK) | X | 2.58 | 67.36 | 18.42 | 3.01 | 150.0 | ± 9.6 % |
| | | Y | 3.37 | 70.66 | 19.64 | | 150.0 | |
| | | Z | 3.05 | 68.56 | 18.35 | | 150.0 | |
| 10176-CAC | LTE-FDD (SC-FDMA, 1 RB, 10 MHz, 16-QAM) | X | 3.33 | 73.19 | 21.11 | 3.01 | 150.0 | ± 9.6 % |
| | | Y | 5.10 | 78.16 | 22.56 | | 150.0 | |
| | | Z | 4.27 | 74.71 | 20.89 | | 150.0 | |
| 10177-CAE | LTE-FDD (SC-FDMA, 1 RB, 5 MHz, QPSK) | X | 2.60 | 67.50 | 18.51 | 3.01 | 150.0 | ± 9.6 % |
| | | Y | 3.40 | 70.83 | 19.75 | | 150.0 | |
| | | Z | 3.07 | 68.74 | 18.46 | | 150.0 | |
| 10178-CAC | LTE-FDD (SC-FDMA, 1 RB, 5 MHz, 16-QAM) | X | 3.30 | 73.00 | 21.00 | 3.01 | 150.0 | ± 9.6 % |
| | | Y | 5.02 | 77.85 | 22.40 | | 150.0 | |
| | | Z | 4.22 | 74.44 | 20.74 | | 150.0 | |
| 10179-CAC | LTE-FDD (SC-FDMA, 1 RB, 10 MHz, 64-QAM) | X | 3.00 | 71.00 | 19.50 | 3.01 | 150.0 | ± 9.6 % |
| | | Y | 4.55 | 75.67 | 20.98 | | 150.0 | |
| | | Z | 3.82 | 72.37 | 19.31 | | 150.0 | |
| 10180-CAC | LTE-FDD (SC-FDMA, 1 RB, 5 MHz, 64-QAM) | X | 2.73 | 68.97 | 18.09 | 3.01 | 150.0 | ± 9.6 % |
| | | Y | 4.08 | 73.43 | 19.65 | | 150.0 | |
| | | Z | 3.47 | 70.35 | 18.01 | | 150.0 | |
| 10181-CAB | LTE-FDD (SC-FDMA, 1 RB, 15 MHz, QPSK) | X | 2.59 | 67.48 | 18.51 | 3.01 | 150.0 | ± 9.6 % |
| | | Y | 3.39 | 70.81 | 19.74 | | 150.0 | |
| | | Z | 3.07 | 68.71 | 18.45 | | 150.0 | |
| 10182-CAB | LTE-FDD (SC-FDMA, 1 RB, 15 MHz, 16-QAM) | X | 3.30 | 72.98 | 20.99 | 3.01 | 150.0 | ± 9.6 % |
| | | Y | 5.01 | 77.82 | 22.39 | | 150.0 | |
| | | Z | 4.21 | 74.41 | 20.73 | | 150.0 | |
| 10183-AAA | LTE-FDD (SC-FDMA, 1 RB, 15 MHz, 64-QAM) | X | 2.73 | 68.94 | 18.08 | 3.01 | 150.0 | ± 9.6 % |
| | | Y | 4.07 | 73.40 | 19.64 | | 150.0 | |
| | | Z | 3.46 | 70.33 | 18.00 | | 150.0 | |

| | | | | | | | | |
|-----------|---|---|------|-------|-------|------|-------|---------|
| 10184-CAC | LTE-FDD (SC-FDMA, 1 RB, 3 MHz, QPSK) | X | 2.60 | 67.52 | 18.53 | 3.01 | 150.0 | ± 9.6 % |
| | | Y | 3.40 | 70.86 | 19.76 | | 150.0 | |
| | | Z | 3.08 | 68.76 | 18.47 | | 150.0 | |
| 10185-CAC | LTE-FDD (SC-FDMA, 1 RB, 3 MHz, 16-QAM) | X | 3.31 | 73.05 | 21.03 | 3.01 | 150.0 | ± 9.6 % |
| | | Y | 5.04 | 77.90 | 22.43 | | 150.0 | |
| | | Z | 4.23 | 74.49 | 20.77 | | 150.0 | |
| 10186-AAC | LTE-FDD (SC-FDMA, 1 RB, 3 MHz, 64-QAM) | X | 2.74 | 69.01 | 18.12 | 3.01 | 150.0 | ± 9.6 % |
| | | Y | 4.10 | 73.47 | 19.68 | | 150.0 | |
| | | Z | 3.48 | 70.39 | 18.03 | | 150.0 | |
| 10187-CAC | LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, QPSK) | X | 2.61 | 67.58 | 18.60 | 3.01 | 150.0 | ± 9.6 % |
| | | Y | 3.41 | 70.90 | 19.81 | | 150.0 | |
| | | Z | 3.09 | 68.80 | 18.52 | | 150.0 | |
| 10188-CAC | LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, 16-QAM) | X | 3.41 | 73.70 | 21.42 | 3.01 | 150.0 | ± 9.6 % |
| | | Y | 5.24 | 78.69 | 22.84 | | 150.0 | |
| | | Z | 4.38 | 75.22 | 21.18 | | 150.0 | |
| 10189-AAC | LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, 64-QAM) | X | 2.80 | 69.41 | 18.40 | 3.01 | 150.0 | ± 9.6 % |
| | | Y | 4.20 | 73.97 | 19.98 | | 150.0 | |
| | | Z | 3.56 | 70.83 | 18.32 | | 150.0 | |
| 10193-CAB | IEEE 802.11n (HT Greenfield, 6.5 Mbps, BPSK) | X | 4.49 | 67.07 | 16.51 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 4.67 | 66.69 | 16.32 | | 150.0 | |
| | | Z | 4.59 | 66.49 | 16.09 | | 150.0 | |
| 10194-CAB | IEEE 802.11n (HT Greenfield, 39 Mbps, 16-QAM) | X | 4.64 | 67.34 | 16.63 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 4.86 | 67.05 | 16.43 | | 150.0 | |
| | | Z | 4.77 | 66.83 | 16.21 | | 150.0 | |
| 10195-CAB | IEEE 802.11n (HT Greenfield, 65 Mbps, 64-QAM) | X | 4.68 | 67.36 | 16.65 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 4.90 | 67.06 | 16.44 | | 150.0 | |
| | | Z | 4.82 | 66.86 | 16.22 | | 150.0 | |
| 10196-CAB | IEEE 802.11n (HT Mixed, 6.5 Mbps, BPSK) | X | 4.48 | 67.10 | 16.51 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 4.68 | 66.78 | 16.36 | | 150.0 | |
| | | Z | 4.60 | 66.57 | 16.12 | | 150.0 | |
| 10197-CAB | IEEE 802.11n (HT Mixed, 39 Mbps, 16-QAM) | X | 4.66 | 67.35 | 16.64 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 4.88 | 67.07 | 16.45 | | 150.0 | |
| | | Z | 4.79 | 66.86 | 16.22 | | 150.0 | |
| 10198-CAB | IEEE 802.11n (HT Mixed, 65 Mbps, 64-QAM) | X | 4.68 | 67.37 | 16.65 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 4.91 | 67.08 | 16.45 | | 150.0 | |
| | | Z | 4.82 | 66.87 | 16.23 | | 150.0 | |
| 10219-CAB | IEEE 802.11n (HT Mixed, 7.2 Mbps, BPSK) | X | 4.44 | 67.14 | 16.49 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 4.63 | 66.80 | 16.32 | | 150.0 | |
| | | Z | 4.55 | 66.58 | 16.08 | | 150.0 | |
| 10220-CAB | IEEE 802.11n (HT Mixed, 43.3 Mbps, 16-QAM) | X | 4.65 | 67.31 | 16.63 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 4.87 | 67.06 | 16.44 | | 150.0 | |
| | | Z | 4.79 | 66.83 | 16.21 | | 150.0 | |
| 10221-CAB | IEEE 802.11n (HT Mixed, 72.2 Mbps, 64-QAM) | X | 4.69 | 67.30 | 16.64 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 4.91 | 67.01 | 16.44 | | 150.0 | |
| | | Z | 4.83 | 66.81 | 16.22 | | 150.0 | |
| 10222-CAB | IEEE 802.11n (HT Mixed, 15 Mbps, BPSK) | X | 5.04 | 67.37 | 16.73 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 5.22 | 67.27 | 16.55 | | 150.0 | |
| | | Z | 5.14 | 67.04 | 16.34 | | 150.0 | |

| | | | | | | | | |
|-----------|---|---|-------|--------|-------|------|-------|---------|
| 10223-CAB | IEEE 802.11n (HT Mixed, 90 Mbps, 16-QAM) | X | 5.33 | 67.57 | 16.84 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 5.58 | 67.57 | 16.72 | | 150.0 | |
| | | Z | 5.46 | 67.24 | 16.46 | | 150.0 | |
| 10224-CAB | IEEE 802.11n (HT Mixed, 150 Mbps, 64-QAM) | X | 5.08 | 67.48 | 16.71 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 5.27 | 67.38 | 16.53 | | 150.0 | |
| | | Z | 5.19 | 67.14 | 16.31 | | 150.0 | |
| 10225-CAB | UMTS-FDD (HSPA+) | X | 2.82 | 67.14 | 15.84 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 2.95 | 66.38 | 15.78 | | 150.0 | |
| | | Z | 2.86 | 65.91 | 15.30 | | 150.0 | |
| 10226-CAA | LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, 16-QAM) | X | 11.41 | 94.07 | 27.52 | 6.02 | 65.0 | ± 9.6 % |
| | | Y | 31.67 | 107.27 | 31.09 | | 65.0 | |
| | | Z | 13.11 | 91.16 | 25.67 | | 65.0 | |
| 10227-CAA | LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, 64-QAM) | X | 11.04 | 92.14 | 26.24 | 6.02 | 65.0 | ± 9.6 % |
| | | Y | 24.12 | 100.92 | 28.72 | | 65.0 | |
| | | Z | 11.71 | 88.12 | 24.16 | | 65.0 | |
| 10228-CAA | LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, QPSK) | X | 7.63 | 90.07 | 28.10 | 6.02 | 65.0 | ± 9.6 % |
| | | Y | 23.55 | 107.62 | 33.18 | | 65.0 | |
| | | Z | 10.51 | 91.21 | 27.39 | | 65.0 | |
| 10229-CAB | LTE-TDD (SC-FDMA, 1 RB, 3 MHz, 16-QAM) | X | 10.66 | 92.71 | 26.99 | 6.02 | 65.0 | ± 9.6 % |
| | | Y | 29.42 | 105.79 | 30.60 | | 65.0 | |
| | | Z | 12.45 | 90.17 | 25.27 | | 65.0 | |
| 10230-CAB | LTE-TDD (SC-FDMA, 1 RB, 3 MHz, 64-QAM) | X | 10.25 | 90.80 | 25.74 | 6.02 | 65.0 | ± 9.6 % |
| | | Y | 22.68 | 99.76 | 28.30 | | 65.0 | |
| | | Z | 11.15 | 87.26 | 23.80 | | 65.0 | |
| 10231-CAB | LTE-TDD (SC-FDMA, 1 RB, 3 MHz, QPSK) | X | 7.27 | 89.04 | 27.66 | 6.02 | 65.0 | ± 9.6 % |
| | | Y | 22.20 | 106.36 | 32.73 | | 65.0 | |
| | | Z | 10.05 | 90.30 | 27.01 | | 65.0 | |
| 10232-CAB | LTE-TDD (SC-FDMA, 1 RB, 5 MHz, 16-QAM) | X | 10.64 | 92.69 | 26.99 | 6.02 | 65.0 | ± 9.6 % |
| | | Y | 29.42 | 105.80 | 30.60 | | 65.0 | |
| | | Z | 12.43 | 90.15 | 25.26 | | 65.0 | |
| 10233-CAB | LTE-TDD (SC-FDMA, 1 RB, 5 MHz, 64-QAM) | X | 10.23 | 90.76 | 25.73 | 6.02 | 65.0 | ± 9.6 % |
| | | Y | 22.67 | 99.78 | 28.30 | | 65.0 | |
| | | Z | 11.14 | 87.24 | 23.80 | | 65.0 | |
| 10234-CAB | LTE-TDD (SC-FDMA, 1 RB, 5 MHz, QPSK) | X | 6.99 | 88.15 | 27.23 | 6.02 | 65.0 | ± 9.6 % |
| | | Y | 20.93 | 105.02 | 32.23 | | 65.0 | |
| | | Z | 9.64 | 89.40 | 26.60 | | 65.0 | |
| 10235-CAB | LTE-TDD (SC-FDMA, 1 RB, 10 MHz, 16-QAM) | X | 10.65 | 92.73 | 27.00 | 6.02 | 65.0 | ± 9.6 % |
| | | Y | 29.50 | 105.86 | 30.62 | | 65.0 | |
| | | Z | 12.44 | 90.18 | 25.27 | | 65.0 | |
| 10236-CAB | LTE-TDD (SC-FDMA, 1 RB, 10 MHz, 64-QAM) | X | 10.34 | 90.92 | 25.77 | 6.02 | 65.0 | ± 9.6 % |
| | | Y | 22.93 | 99.94 | 28.35 | | 65.0 | |
| | | Z | 11.22 | 87.34 | 23.83 | | 65.0 | |
| 10237-CAB | LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK) | X | 7.28 | 89.10 | 27.69 | 6.02 | 65.0 | ± 9.6 % |
| | | Y | 22.38 | 106.55 | 32.79 | | 65.0 | |
| | | Z | 10.07 | 90.36 | 27.03 | | 65.0 | |
| 10238-CAB | LTE-TDD (SC-FDMA, 1 RB, 15 MHz, 16-QAM) | X | 10.61 | 92.67 | 26.98 | 6.02 | 65.0 | ± 9.6 % |
| | | Y | 29.40 | 105.80 | 30.59 | | 65.0 | |
| | | Z | 12.41 | 90.13 | 25.25 | | 65.0 | |

| | | | | | | | | |
|-----------|--|---|-------|--------|-------|------|------|---------|
| 10239-CAB | LTE-TDD (SC-FDMA, 1 RB, 15 MHz, 64-QAM) | X | 10.19 | 90.73 | 25.72 | 6.02 | 65.0 | ± 9.6 % |
| | | Y | 22.65 | 99.78 | 28.31 | | 65.0 | |
| | | Z | 11.11 | 87.22 | 23.79 | | 65.0 | |
| 10240-CAB | LTE-TDD (SC-FDMA, 1 RB, 15 MHz, QPSK) | X | 7.26 | 89.06 | 27.67 | 6.02 | 65.0 | ± 9.6 % |
| | | Y | 22.30 | 106.48 | 32.77 | | 65.0 | |
| | | Z | 10.04 | 90.32 | 27.01 | | 65.0 | |
| 10241-CAA | LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, 16-QAM) | X | 7.75 | 81.08 | 25.21 | 6.98 | 65.0 | ± 9.6 % |
| | | Y | 10.21 | 83.82 | 26.43 | | 65.0 | |
| | | Z | 8.73 | 80.32 | 24.52 | | 65.0 | |
| 10242-CAA | LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, 64-QAM) | X | 6.80 | 78.38 | 24.02 | 6.98 | 65.0 | ± 9.6 % |
| | | Y | 9.63 | 82.52 | 25.83 | | 65.0 | |
| | | Z | 8.38 | 79.47 | 24.10 | | 65.0 | |
| 10243-CAA | LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, QPSK) | X | 5.61 | 75.06 | 23.46 | 6.98 | 65.0 | ± 9.6 % |
| | | Y | 7.74 | 79.46 | 25.50 | | 65.0 | |
| | | Z | 6.88 | 76.70 | 23.79 | | 65.0 | |
| 10244-CAB | LTE-TDD (SC-FDMA, 50% RB, 3 MHz, 16-QAM) | X | 4.85 | 72.20 | 16.09 | 3.98 | 65.0 | ± 9.6 % |
| | | Y | 8.02 | 78.99 | 20.43 | | 65.0 | |
| | | Z | 6.19 | 74.48 | 17.94 | | 65.0 | |
| 10245-CAB | LTE-TDD (SC-FDMA, 50% RB, 3 MHz, 64-QAM) | X | 4.70 | 71.53 | 15.74 | 3.98 | 65.0 | ± 9.6 % |
| | | Y | 7.89 | 78.48 | 20.19 | | 65.0 | |
| | | Z | 6.13 | 74.10 | 17.74 | | 65.0 | |
| 10246-CAB | LTE-TDD (SC-FDMA, 50% RB, 3 MHz, QPSK) | X | 5.22 | 76.54 | 18.28 | 3.98 | 65.0 | ± 9.6 % |
| | | Y | 8.14 | 82.43 | 21.79 | | 65.0 | |
| | | Z | 5.87 | 76.86 | 19.08 | | 65.0 | |
| 10247-CAB | LTE-TDD (SC-FDMA, 50% RB, 5 MHz, 16-QAM) | X | 4.92 | 73.01 | 17.55 | 3.98 | 65.0 | ± 9.6 % |
| | | Y | 6.62 | 76.59 | 20.16 | | 65.0 | |
| | | Z | 5.63 | 73.71 | 18.45 | | 65.0 | |
| 10248-CAB | LTE-TDD (SC-FDMA, 50% RB, 5 MHz, 64-QAM) | X | 4.84 | 72.32 | 17.23 | 3.98 | 65.0 | ± 9.6 % |
| | | Y | 6.62 | 76.08 | 19.95 | | 65.0 | |
| | | Z | 5.66 | 73.31 | 18.26 | | 65.0 | |
| 10249-CAB | LTE-TDD (SC-FDMA, 50% RB, 5 MHz, QPSK) | X | 7.10 | 81.85 | 21.45 | 3.98 | 65.0 | ± 9.6 % |
| | | Y | 9.09 | 84.35 | 23.13 | | 65.0 | |
| | | Z | 6.82 | 79.25 | 20.73 | | 65.0 | |
| 10250-CAB | LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 16-QAM) | X | 6.14 | 76.72 | 21.07 | 3.98 | 65.0 | ± 9.6 % |
| | | Y | 7.40 | 78.29 | 22.09 | | 65.0 | |
| | | Z | 6.54 | 75.95 | 20.75 | | 65.0 | |
| 10251-CAB | LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 64-QAM) | X | 5.70 | 74.17 | 19.61 | 3.98 | 65.0 | ± 9.6 % |
| | | Y | 7.04 | 76.19 | 20.94 | | 65.0 | |
| | | Z | 6.27 | 74.04 | 19.64 | | 65.0 | |
| 10252-CAB | LTE-TDD (SC-FDMA, 50% RB, 10 MHz, QPSK) | X | 7.47 | 82.32 | 22.88 | 3.98 | 65.0 | ± 9.6 % |
| | | Y | 8.82 | 83.02 | 23.29 | | 65.0 | |
| | | Z | 7.18 | 79.27 | 21.49 | | 65.0 | |
| 10253-CAB | LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 16-QAM) | X | 5.82 | 73.49 | 19.80 | 3.98 | 65.0 | ± 9.6 % |
| | | Y | 6.99 | 75.20 | 20.79 | | 65.0 | |
| | | Z | 6.34 | 73.34 | 19.64 | | 65.0 | |
| 10254-CAB | LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 64-QAM) | X | 6.20 | 74.53 | 20.56 | 3.98 | 65.0 | ± 9.6 % |
| | | Y | 7.35 | 75.96 | 21.41 | | 65.0 | |
| | | Z | 6.71 | 74.22 | 20.33 | | 65.0 | |

| | | | | | | | | |
|-----------|---|---|------|-------|-------|------|------|---------|
| 10255-CAB | LTE-TDD (SC-FDMA, 50% RB, 15 MHz, QPSK) | X | 6.71 | 78.47 | 21.74 | 3.98 | 65.0 | ± 9.6 % |
| | | Y | 7.84 | 79.18 | 22.03 | | 65.0 | |
| | | Z | 6.83 | 76.67 | 20.70 | | 65.0 | |
| 10256-CAA | LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 16-QAM) | X | 3.47 | 67.38 | 12.72 | 3.98 | 65.0 | ± 9.6 % |
| | | Y | 6.90 | 76.38 | 18.57 | | 65.0 | |
| | | Z | 5.11 | 71.48 | 15.77 | | 65.0 | |
| 10257-CAA | LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 64-QAM) | X | 3.38 | 66.76 | 12.32 | 3.98 | 65.0 | ± 9.6 % |
| | | Y | 6.74 | 75.67 | 18.20 | | 65.0 | |
| | | Z | 5.05 | 70.99 | 15.48 | | 65.0 | |
| 10258-CAA | LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, QPSK) | X | 3.49 | 70.18 | 14.59 | 3.98 | 65.0 | ± 9.6 % |
| | | Y | 6.78 | 79.22 | 19.98 | | 65.0 | |
| | | Z | 4.80 | 73.56 | 17.06 | | 65.0 | |
| 10259-CAB | LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 16-QAM) | X | 5.42 | 74.50 | 18.87 | 3.98 | 65.0 | ± 9.6 % |
| | | Y | 6.93 | 77.16 | 20.83 | | 65.0 | |
| | | Z | 5.98 | 74.51 | 19.26 | | 65.0 | |
| 10260-CAB | LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 64-QAM) | X | 5.41 | 74.15 | 18.72 | 3.98 | 65.0 | ± 9.6 % |
| | | Y | 6.95 | 76.90 | 20.74 | | 65.0 | |
| | | Z | 6.03 | 74.34 | 19.21 | | 65.0 | |
| 10261-CAB | LTE-TDD (SC-FDMA, 100% RB, 3 MHz, QPSK) | X | 6.87 | 81.15 | 21.70 | 3.98 | 65.0 | ± 9.6 % |
| | | Y | 8.53 | 83.00 | 22.95 | | 65.0 | |
| | | Z | 6.70 | 78.62 | 20.83 | | 65.0 | |
| 10262-CAB | LTE-TDD (SC-FDMA, 100% RB, 5 MHz, 16-QAM) | X | 6.12 | 76.64 | 21.02 | 3.98 | 65.0 | ± 9.6 % |
| | | Y | 7.39 | 78.26 | 22.06 | | 65.0 | |
| | | Z | 6.53 | 75.90 | 20.71 | | 65.0 | |
| 10263-CAB | LTE-TDD (SC-FDMA, 100% RB, 5 MHz, 64-QAM) | X | 5.69 | 74.15 | 19.60 | 3.98 | 65.0 | ± 9.6 % |
| | | Y | 7.03 | 76.18 | 20.94 | | 65.0 | |
| | | Z | 6.26 | 74.03 | 19.63 | | 65.0 | |
| 10264-CAB | LTE-TDD (SC-FDMA, 100% RB, 5 MHz, QPSK) | X | 7.38 | 82.08 | 22.77 | 3.98 | 65.0 | ± 9.6 % |
| | | Y | 8.75 | 82.86 | 23.22 | | 65.0 | |
| | | Z | 7.12 | 79.11 | 21.41 | | 65.0 | |
| 10265-CAB | LTE-TDD (SC-FDMA, 100% RB, 10 MHz, 16-QAM) | X | 5.92 | 73.94 | 20.06 | 3.98 | 65.0 | ± 9.6 % |
| | | Y | 7.20 | 75.88 | 21.03 | | 65.0 | |
| | | Z | 6.48 | 73.87 | 19.85 | | 65.0 | |
| 10266-CAB | LTE-TDD (SC-FDMA, 100% RB, 10 MHz, 64-QAM) | X | 6.35 | 75.09 | 20.93 | 3.98 | 65.0 | ± 9.6 % |
| | | Y | 7.55 | 76.61 | 21.68 | | 65.0 | |
| | | Z | 6.86 | 74.78 | 20.59 | | 65.0 | |
| 10267-CAB | LTE-TDD (SC-FDMA, 100% RB, 10 MHz, QPSK) | X | 7.01 | 79.05 | 21.80 | 3.98 | 65.0 | ± 9.6 % |
| | | Y | 8.19 | 79.71 | 21.98 | | 65.0 | |
| | | Z | 7.09 | 77.11 | 20.65 | | 65.0 | |
| 10268-CAB | LTE-TDD (SC-FDMA, 100% RB, 15 MHz, 16-QAM) | X | 6.54 | 73.87 | 20.51 | 3.98 | 65.0 | ± 9.6 % |
| | | Y | 7.70 | 75.41 | 21.18 | | 65.0 | |
| | | Z | 7.12 | 73.89 | 20.25 | | 65.0 | |
| 10269-CAB | LTE-TDD (SC-FDMA, 100% RB, 15 MHz, 64-QAM) | X | 6.52 | 73.47 | 20.39 | 3.98 | 65.0 | ± 9.6 % |
| | | Y | 7.63 | 74.96 | 21.06 | | 65.0 | |
| | | Z | 7.08 | 73.52 | 20.16 | | 65.0 | |
| 10270-CAB | LTE-TDD (SC-FDMA, 100% RB, 15 MHz, QPSK) | X | 6.72 | 76.10 | 20.81 | 3.98 | 65.0 | ± 9.6 % |
| | | Y | 7.77 | 76.91 | 21.02 | | 65.0 | |
| | | Z | 7.04 | 75.13 | 20.02 | | 65.0 | |

| | | | | | | | | |
|-----------|--|---|--------|--------|-------|------|-------|---------|
| 10274-CAB | UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.10) | X | 2.68 | 67.93 | 16.00 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 2.70 | 66.71 | 15.69 | | 150.0 | |
| | | Z | 2.60 | 66.12 | 15.13 | | 150.0 | |
| 10275-CAB | UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.4) | X | 1.86 | 71.35 | 17.51 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 1.79 | 69.27 | 16.54 | | 150.0 | |
| | | Z | 1.60 | 67.20 | 15.22 | | 150.0 | |
| 10277-CAA | PHS (QPSK) | X | 2.51 | 62.07 | 7.69 | 9.03 | 50.0 | ± 9.6 % |
| | | Y | 3.60 | 65.47 | 10.92 | | 50.0 | |
| | | Z | 3.21 | 64.00 | 9.69 | | 50.0 | |
| 10278-CAA | PHS (QPSK, BW 884MHz, Rolloff 0.5) | X | 4.14 | 68.90 | 13.57 | 9.03 | 50.0 | ± 9.6 % |
| | | Y | 8.03 | 79.56 | 19.93 | | 50.0 | |
| | | Z | 5.72 | 73.56 | 16.82 | | 50.0 | |
| 10279-CAA | PHS (QPSK, BW 884MHz, Rolloff 0.38) | X | 4.23 | 69.12 | 13.72 | 9.03 | 50.0 | ± 9.6 % |
| | | Y | 8.23 | 79.82 | 20.06 | | 50.0 | |
| | | Z | 5.85 | 73.80 | 16.95 | | 50.0 | |
| 10290-AAB | CDMA2000, RC1, SO55, Full Rate | X | 2.16 | 75.12 | 16.21 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 1.91 | 71.91 | 16.34 | | 150.0 | |
| | | Z | 1.49 | 68.32 | 14.21 | | 150.0 | |
| 10291-AAB | CDMA2000, RC3, SO55, Full Rate | X | 1.24 | 72.30 | 15.09 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 1.08 | 68.86 | 14.96 | | 150.0 | |
| | | Z | 0.85 | 65.38 | 12.66 | | 150.0 | |
| 10292-AAB | CDMA2000, RC3, SO32, Full Rate | X | 13.33 | 104.67 | 25.79 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 1.50 | 74.81 | 18.02 | | 150.0 | |
| | | Z | 1.03 | 68.79 | 14.75 | | 150.0 | |
| 10293-AAB | CDMA2000, RC3, SO3, Full Rate | X | 100.00 | 135.60 | 33.89 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 2.41 | 82.36 | 21.43 | | 150.0 | |
| | | Z | 1.44 | 73.75 | 17.42 | | 150.0 | |
| 10295-AAB | CDMA2000, RC1, SO3, 1/8th Rate 25 fr. | X | 11.05 | 85.41 | 22.93 | 9.03 | 50.0 | ± 9.6 % |
| | | Y | 8.87 | 82.92 | 23.80 | | 50.0 | |
| | | Z | 7.57 | 79.23 | 21.65 | | 50.0 | |
| 10297-AAA | LTE-FDD (SC-FDMA, 50% RB, 20 MHz, QPSK) | X | 2.93 | 71.67 | 17.91 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 3.03 | 70.79 | 17.22 | | 150.0 | |
| | | Z | 2.77 | 69.28 | 16.35 | | 150.0 | |
| 10298-AAB | LTE-FDD (SC-FDMA, 50% RB, 3 MHz, QPSK) | X | 1.80 | 70.98 | 15.29 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 1.94 | 70.01 | 16.02 | | 150.0 | |
| | | Z | 1.64 | 67.53 | 14.38 | | 150.0 | |
| 10299-AAB | LTE-FDD (SC-FDMA, 50% RB, 3 MHz, 16-QAM) | X | 2.25 | 68.93 | 13.39 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 3.57 | 73.44 | 16.90 | | 150.0 | |
| | | Z | 2.68 | 69.23 | 14.47 | | 150.0 | |
| 10300-AAB | LTE-FDD (SC-FDMA, 50% RB, 3 MHz, 64-QAM) | X | 1.52 | 63.47 | 9.92 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 2.60 | 68.00 | 13.77 | | 150.0 | |
| | | Z | 2.12 | 65.38 | 11.93 | | 150.0 | |
| 10301-AAA | IEEE 802.16e WiMAX (29:18, 5ms, 10MHz, QPSK, PUSC) | X | 4.73 | 66.14 | 17.79 | 4.17 | 50.0 | ± 9.6 % |
| | | Y | 5.14 | 66.14 | 17.98 | | 50.0 | |
| | | Z | 4.87 | 65.30 | 17.38 | | 50.0 | |
| 10302-AAA | IEEE 802.16e WiMAX (29:18, 5ms, 10MHz, QPSK, PUSC, 3 CTRL symbols) | X | 5.19 | 66.64 | 18.43 | 4.96 | 50.0 | ± 9.6 % |
| | | Y | 5.69 | 67.11 | 18.91 | | 50.0 | |
| | | Z | 5.42 | 66.20 | 18.24 | | 50.0 | |

| | | | | | | | | |
|-----------|---|---|------|-------|-------|-------|-------|---------|
| 10303-AAA | IEEE 802.16e WiMAX (31:15, 5ms, 10MHz, 64QAM, PUSC) | X | 4.96 | 66.34 | 18.27 | 4.96 | 50.0 | ± 9.6 % |
| | | Y | 5.48 | 66.96 | 18.88 | | 50.0 | |
| | | Z | 5.20 | 65.95 | 18.14 | | 50.0 | |
| 10304-AAA | IEEE 802.16e WiMAX (29:18, 5ms, 10MHz, 64QAM, PUSC) | X | 4.76 | 66.23 | 17.80 | 4.17 | 50.0 | ± 9.6 % |
| | | Y | 5.21 | 66.54 | 18.19 | | 50.0 | |
| | | Z | 4.96 | 65.68 | 17.56 | | 50.0 | |
| 10305-AAA | IEEE 802.16e WiMAX (31:15, 10ms, 10MHz, 64QAM, PUSC, 15 symbols) | X | 4.83 | 70.07 | 20.50 | 6.02 | 35.0 | ± 9.6 % |
| | | Y | 5.51 | 71.60 | 22.16 | | 35.0 | |
| | | Z | 4.98 | 69.23 | 20.55 | | 35.0 | |
| 10306-AAA | IEEE 802.16e WiMAX (29:18, 10ms, 10MHz, 64QAM, PUSC, 18 symbols) | X | 4.91 | 68.09 | 19.77 | 6.02 | 35.0 | ± 9.6 % |
| | | Y | 5.42 | 68.18 | 20.25 | | 35.0 | |
| | | Z | 5.11 | 67.47 | 19.73 | | 35.0 | |
| 10307-AAA | IEEE 802.16e WiMAX (29:18, 10ms, 10MHz, QPSK, PUSC, 18 symbols) | X | 4.83 | 68.37 | 19.78 | 6.02 | 35.0 | ± 9.6 % |
| | | Y | 5.47 | 69.61 | 21.06 | | 35.0 | |
| | | Z | 5.07 | 67.89 | 19.81 | | 35.0 | |
| 10308-AAA | IEEE 802.16e WiMAX (29:18, 10ms, 10MHz, 16QAM, PUSC) | X | 4.84 | 68.69 | 19.98 | 6.02 | 35.0 | ± 9.6 % |
| | | Y | 5.46 | 69.92 | 21.24 | | 35.0 | |
| | | Z | 5.05 | 68.12 | 19.96 | | 35.0 | |
| 10309-AAA | IEEE 802.16e WiMAX (29:18, 10ms, 10MHz, 16QAM, AMC 2x3, 18 symbols) | X | 4.94 | 68.23 | 19.88 | 6.02 | 35.0 | ± 9.6 % |
| | | Y | 5.52 | 68.51 | 20.43 | | 35.0 | |
| | | Z | 5.19 | 67.72 | 19.88 | | 35.0 | |
| 10310-AAA | IEEE 802.16e WiMAX (29:18, 10ms, 10MHz, QPSK, AMC 2x3, 18 symbols) | X | 4.88 | 68.25 | 19.79 | 6.02 | 35.0 | ± 9.6 % |
| | | Y | 5.44 | 69.18 | 20.91 | | 35.0 | |
| | | Z | 5.08 | 67.61 | 19.74 | | 35.0 | |
| 10311-AAA | LTE-FDD (SC-FDMA, 100% RB, 15 MHz, QPSK) | X | 3.31 | 70.70 | 17.41 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 3.40 | 70.05 | 16.83 | | 150.0 | |
| | | Z | 3.13 | 68.65 | 16.04 | | 150.0 | |
| 10313-AAA | iDEN 1:3 | X | 4.31 | 74.90 | 16.96 | 6.99 | 70.0 | ± 9.6 % |
| | | Y | 5.76 | 76.90 | 17.84 | | 70.0 | |
| | | Z | 4.08 | 72.13 | 15.67 | | 70.0 | |
| 10314-AAA | iDEN 1:6 | X | 7.33 | 84.94 | 23.33 | 10.00 | 30.0 | ± 9.6 % |
| | | Y | 7.31 | 83.11 | 22.80 | | 30.0 | |
| | | Z | 4.98 | 76.71 | 20.14 | | 30.0 | |
| 10315-AAB | IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 96pc duty cycle) | X | 1.15 | 65.39 | 16.53 | 0.17 | 150.0 | ± 9.6 % |
| | | Y | 1.15 | 64.64 | 15.92 | | 150.0 | |
| | | Z | 1.10 | 63.46 | 14.86 | | 150.0 | |
| 10316-AAB | IEEE 802.11g WiFi 2.4 GHz (ERP-OFDM, 6 Mbps, 96pc duty cycle) | X | 4.52 | 67.01 | 16.57 | 0.17 | 150.0 | ± 9.6 % |
| | | Y | 4.73 | 66.76 | 16.44 | | 150.0 | |
| | | Z | 4.65 | 66.51 | 16.17 | | 150.0 | |
| 10317-AAB | IEEE 802.11a WiFi 5 GHz (OFDM, 6 Mbps, 96pc duty cycle) | X | 4.52 | 67.01 | 16.57 | 0.17 | 150.0 | ± 9.6 % |
| | | Y | 4.73 | 66.76 | 16.44 | | 150.0 | |
| | | Z | 4.65 | 66.51 | 16.17 | | 150.0 | |
| 10400-AAC | IEEE 802.11ac WiFi (20MHz, 64-QAM, 99pc duty cycle) | X | 4.62 | 67.36 | 16.62 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 4.87 | 67.12 | 16.43 | | 150.0 | |
| | | Z | 4.77 | 66.88 | 16.19 | | 150.0 | |
| 10401-AAC | IEEE 802.11ac WiFi (40MHz, 64-QAM, 99pc duty cycle) | X | 5.32 | 67.33 | 16.68 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 5.49 | 67.16 | 16.50 | | 150.0 | |
| | | Z | 5.43 | 67.01 | 16.32 | | 150.0 | |

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|-----------|--|---|--------|--------|-------|------|-------|---------|
| 10402-AAC | IEEE 802.11ac WiFi (80MHz, 64-QAM, 99pc duty cycle) | X | 5.60 | 67.66 | 16.72 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 5.79 | 67.68 | 16.60 | | 150.0 | |
| | | Z | 5.72 | 67.47 | 16.40 | | 150.0 | |
| 10403-AAB | CDMA2000 (1xEV-DO, Rev. 0) | X | 2.16 | 75.12 | 16.21 | 0.00 | 115.0 | ± 9.6 % |
| | | Y | 1.91 | 71.91 | 16.34 | | 115.0 | |
| | | Z | 1.49 | 68.32 | 14.21 | | 115.0 | |
| 10404-AAB | CDMA2000 (1xEV-DO, Rev. A) | X | 2.16 | 75.12 | 16.21 | 0.00 | 115.0 | ± 9.6 % |
| | | Y | 1.91 | 71.91 | 16.34 | | 115.0 | |
| | | Z | 1.49 | 68.32 | 14.21 | | 115.0 | |
| 10406-AAB | CDMA2000, RC3, SO32, SCH0, Full Rate | X | 100.00 | 127.59 | 32.37 | 0.00 | 100.0 | ± 9.6 % |
| | | Y | 100.00 | 123.98 | 31.83 | | 100.0 | |
| | | Z | 14.26 | 95.15 | 24.05 | | 100.0 | |
| 10410-AAA | LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK, UL Subframe=2,3,4,7,8,9) | X | 100.00 | 124.06 | 30.89 | 3.23 | 80.0 | ± 9.6 % |
| | | Y | 100.00 | 119.95 | 30.07 | | 80.0 | |
| | | Z | 11.66 | 89.63 | 21.52 | | 80.0 | |
| 10415-AAA | IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 99pc duty cycle) | X | 1.06 | 64.51 | 16.01 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 1.04 | 63.51 | 15.25 | | 150.0 | |
| | | Z | 1.01 | 62.60 | 14.33 | | 150.0 | |
| 10416-AAA | IEEE 802.11g WiFi 2.4 GHz (ERP-OFDM, 6 Mbps, 99pc duty cycle) | X | 4.49 | 67.08 | 16.58 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 4.67 | 66.72 | 16.37 | | 150.0 | |
| | | Z | 4.59 | 66.53 | 16.14 | | 150.0 | |
| 10417-AAA | IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps, 99pc duty cycle) | X | 4.49 | 67.08 | 16.58 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 4.67 | 66.72 | 16.37 | | 150.0 | |
| | | Z | 4.59 | 66.53 | 16.14 | | 150.0 | |
| 10418-AAA | IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 99pc duty cycle, Long preamble) | X | 4.49 | 67.30 | 16.63 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 4.65 | 66.87 | 16.37 | | 150.0 | |
| | | Z | 4.58 | 66.67 | 16.15 | | 150.0 | |
| 10419-AAA | IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 99pc duty cycle, Short preamble) | X | 4.50 | 67.22 | 16.62 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 4.68 | 66.82 | 16.38 | | 150.0 | |
| | | Z | 4.60 | 66.63 | 16.16 | | 150.0 | |
| 10422-AAA | IEEE 802.11n (HT Greenfield, 7.2 Mbps, BPSK) | X | 4.61 | 67.18 | 16.61 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 4.80 | 66.83 | 16.39 | | 150.0 | |
| | | Z | 4.73 | 66.64 | 16.18 | | 150.0 | |
| 10423-AAA | IEEE 802.11n (HT Greenfield, 43.3 Mbps, 16-QAM) | X | 4.75 | 67.46 | 16.71 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 5.00 | 67.20 | 16.53 | | 150.0 | |
| | | Z | 4.91 | 66.98 | 16.30 | | 150.0 | |
| 10424-AAA | IEEE 802.11n (HT Greenfield, 72.2 Mbps, 64-QAM) | X | 4.68 | 67.42 | 16.69 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 4.91 | 67.14 | 16.49 | | 150.0 | |
| | | Z | 4.82 | 66.93 | 16.27 | | 150.0 | |
| 10425-AAA | IEEE 802.11n (HT Greenfield, 15 Mbps, BPSK) | X | 5.29 | 67.59 | 16.82 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 5.47 | 67.41 | 16.61 | | 150.0 | |
| | | Z | 5.41 | 67.25 | 16.44 | | 150.0 | |
| 10426-AAA | IEEE 802.11n (HT Greenfield, 90 Mbps, 16-QAM) | X | 5.31 | 67.68 | 16.86 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 5.48 | 67.44 | 16.63 | | 150.0 | |
| | | Z | 5.41 | 67.26 | 16.44 | | 150.0 | |

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|-----------|--|---|--------|--------|-------|------|-------|---------|
| 10427-AAA | IEEE 802.11n (HT Greenfield, 150 Mbps, 64-QAM) | X | 5.29 | 67.52 | 16.78 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 5.50 | 67.46 | 16.63 | | 150.0 | |
| | | Z | 5.43 | 67.26 | 16.43 | | 150.0 | |
| 10430-AAA | LTE-FDD (OFDMA, 5 MHz, E-TM 3.1) | X | 4.63 | 73.67 | 19.48 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 4.38 | 70.39 | 18.28 | | 150.0 | |
| | | Z | 4.34 | 70.59 | 18.21 | | 150.0 | |
| 10431-AAA | LTE-FDD (OFDMA, 10 MHz, E-TM 3.1) | X | 4.15 | 67.84 | 16.60 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 4.40 | 67.31 | 16.45 | | 150.0 | |
| | | Z | 4.29 | 67.04 | 16.16 | | 150.0 | |
| 10432-AAA | LTE-FDD (OFDMA, 15 MHz, E-TM 3.1) | X | 4.45 | 67.57 | 16.66 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 4.69 | 67.19 | 16.47 | | 150.0 | |
| | | Z | 4.59 | 66.95 | 16.22 | | 150.0 | |
| 10433-AAA | LTE-FDD (OFDMA, 20 MHz, E-TM 3.1) | X | 4.70 | 67.46 | 16.71 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 4.93 | 67.18 | 16.52 | | 150.0 | |
| | | Z | 4.84 | 66.96 | 16.29 | | 150.0 | |
| 10434-AAA | W-CDMA (BS Test Model 1, 64 DPCH) | X | 4.94 | 75.22 | 19.61 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 4.49 | 71.19 | 18.31 | | 150.0 | |
| | | Z | 4.45 | 71.43 | 18.22 | | 150.0 | |
| 10435-AAA | LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK, UL Subframe=2,3,4,7,8,9) | X | 100.00 | 123.75 | 30.75 | 3.23 | 80.0 | ± 9.6 % |
| | | Y | 100.00 | 119.75 | 29.98 | | 80.0 | |
| | | Z | 11.13 | 88.92 | 21.27 | | 80.0 | |
| 10447-AAA | LTE-FDD (OFDMA, 5 MHz, E-TM 3.1, Clipping 44%) | X | 3.46 | 68.09 | 15.85 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 3.73 | 67.44 | 16.02 | | 150.0 | |
| | | Z | 3.59 | 67.02 | 15.56 | | 150.0 | |
| 10448-AAA | LTE-FDD (OFDMA, 10 MHz, E-TM 3.1, Clipping 44%) | X | 4.01 | 67.64 | 16.48 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 4.23 | 67.09 | 16.31 | | 150.0 | |
| | | Z | 4.12 | 66.82 | 16.01 | | 150.0 | |
| 10449-AAA | LTE-FDD (OFDMA, 15 MHz, E-TM 3.1, Clipping 44%) | X | 4.28 | 67.42 | 16.58 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 4.48 | 67.02 | 16.38 | | 150.0 | |
| | | Z | 4.39 | 66.78 | 16.12 | | 150.0 | |
| 10450-AAA | LTE-FDD (OFDMA, 20 MHz, E-TM 3.1, Clipping 44%) | X | 4.48 | 67.25 | 16.58 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 4.66 | 66.95 | 16.38 | | 150.0 | |
| | | Z | 4.58 | 66.72 | 16.14 | | 150.0 | |
| 10451-AAA | W-CDMA (BS Test Model 1, 64 DPCH, Clipping 44%) | X | 3.33 | 68.18 | 15.32 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 3.67 | 67.76 | 15.79 | | 150.0 | |
| | | Z | 3.50 | 67.23 | 15.24 | | 150.0 | |
| 10456-AAA | IEEE 802.11ac WiFi (160MHz, 64-QAM, 99pc duty cycle) | X | 6.23 | 68.21 | 17.00 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 6.33 | 68.03 | 16.78 | | 150.0 | |
| | | Z | 6.26 | 67.85 | 16.61 | | 150.0 | |
| 10457-AAA | UMTS-FDD (DC-HSDPA) | X | 3.79 | 65.76 | 16.30 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 3.86 | 65.36 | 16.10 | | 150.0 | |
| | | Z | 3.82 | 65.17 | 15.85 | | 150.0 | |
| 10458-AAA | CDMA2000 (1xEV-DO, Rev. B, 2 carriers) | X | 3.05 | 67.01 | 14.29 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 3.48 | 67.05 | 15.31 | | 150.0 | |
| | | Z | 3.32 | 66.56 | 14.71 | | 150.0 | |
| 10459-AAA | CDMA2000 (1xEV-DO, Rev. B, 3 carriers) | X | 4.19 | 65.60 | 15.56 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 4.63 | 65.36 | 16.07 | | 150.0 | |
| | | Z | 4.50 | 65.15 | 15.72 | | 150.0 | |

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|-----------|---|---|--------|--------|-------|------|-------|---------|
| 10460-AAA | UMTS-FDD (WCDMA, AMR) | X | 1.27 | 75.41 | 20.14 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 1.05 | 70.71 | 17.81 | | 150.0 | |
| | | Z | 0.86 | 66.76 | 15.37 | | 150.0 | |
| 10461-AAA | LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, QPSK, UL Subframe=2,3,4,7,8,9) | X | 100.00 | 127.84 | 32.72 | 3.29 | 80.0 | ± 9.6 % |
| | | Y | 100.00 | 123.27 | 31.69 | | 80.0 | |
| | | Z | 6.47 | 83.77 | 20.46 | | 80.0 | |
| 10462-AAA | LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9) | X | 1.26 | 63.91 | 10.22 | 3.23 | 80.0 | ± 9.6 % |
| | | Y | 14.90 | 86.82 | 19.02 | | 80.0 | |
| | | Z | 1.81 | 64.45 | 10.77 | | 80.0 | |
| 10463-AAA | LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9) | X | 0.85 | 60.00 | 7.76 | 3.23 | 80.0 | ± 9.6 % |
| | | Y | 4.74 | 73.69 | 14.47 | | 80.0 | |
| | | Z | 1.46 | 62.00 | 9.21 | | 80.0 | |
| 10464-AAA | LTE-TDD (SC-FDMA, 1 RB, 3 MHz, QPSK, UL Subframe=2,3,4,7,8,9) | X | 100.00 | 124.65 | 31.09 | 3.23 | 80.0 | ± 9.6 % |
| | | Y | 100.00 | 121.04 | 30.50 | | 80.0 | |
| | | Z | 5.02 | 79.91 | 18.70 | | 80.0 | |
| 10465-AAA | LTE-TDD (SC-FDMA, 1 RB, 3 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9) | X | 1.13 | 62.86 | 9.67 | 3.23 | 80.0 | ± 9.6 % |
| | | Y | 9.25 | 81.62 | 17.45 | | 80.0 | |
| | | Z | 1.69 | 63.74 | 10.38 | | 80.0 | |
| 10466-AAA | LTE-TDD (SC-FDMA, 1 RB, 3 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9) | X | 0.85 | 60.00 | 7.71 | 3.23 | 80.0 | ± 9.6 % |
| | | Y | 3.78 | 71.31 | 13.57 | | 80.0 | |
| | | Z | 1.40 | 61.59 | 8.96 | | 80.0 | |
| 10467-AAA | LTE-TDD (SC-FDMA, 1 RB, 5 MHz, QPSK, UL Subframe=2,3,4,7,8,9) | X | 100.00 | 125.03 | 31.26 | 3.23 | 80.0 | ± 9.6 % |
| | | Y | 100.00 | 121.26 | 30.60 | | 80.0 | |
| | | Z | 5.32 | 80.71 | 18.99 | | 80.0 | |
| 10468-AAA | LTE-TDD (SC-FDMA, 1 RB, 5 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9) | X | 1.17 | 63.15 | 9.83 | 3.23 | 80.0 | ± 9.6 % |
| | | Y | 10.30 | 82.81 | 17.81 | | 80.0 | |
| | | Z | 1.71 | 63.90 | 10.47 | | 80.0 | |
| 10469-AAA | LTE-TDD (SC-FDMA, 1 RB, 5 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9) | X | 0.85 | 60.00 | 7.71 | 3.23 | 80.0 | ± 9.6 % |
| | | Y | 3.80 | 71.39 | 13.60 | | 80.0 | |
| | | Z | 1.40 | 61.60 | 8.96 | | 80.0 | |
| 10470-AAA | LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK, UL Subframe=2,3,4,7,8,9) | X | 100.00 | 125.05 | 31.26 | 3.23 | 80.0 | ± 9.6 % |
| | | Y | 100.00 | 121.29 | 30.60 | | 80.0 | |
| | | Z | 5.31 | 80.70 | 18.98 | | 80.0 | |
| 10471-AAA | LTE-TDD (SC-FDMA, 1 RB, 10 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9) | X | 1.16 | 63.09 | 9.79 | 3.23 | 80.0 | ± 9.6 % |
| | | Y | 10.21 | 82.69 | 17.77 | | 80.0 | |
| | | Z | 1.70 | 63.86 | 10.44 | | 80.0 | |
| 10472-AAA | LTE-TDD (SC-FDMA, 1 RB, 10 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9) | X | 0.85 | 60.00 | 7.70 | 3.23 | 80.0 | ± 9.6 % |
| | | Y | 3.77 | 71.31 | 13.56 | | 80.0 | |
| | | Z | 1.40 | 61.57 | 8.94 | | 80.0 | |
| 10473-AAA | LTE-TDD (SC-FDMA, 1 RB, 15 MHz, QPSK, UL Subframe=2,3,4,7,8,9) | X | 100.00 | 125.02 | 31.24 | 3.23 | 80.0 | ± 9.6 % |
| | | Y | 100.00 | 121.25 | 30.59 | | 80.0 | |
| | | Z | 5.30 | 80.66 | 18.96 | | 80.0 | |
| 10474-AAA | LTE-TDD (SC-FDMA, 1 RB, 15 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9) | X | 1.15 | 63.05 | 9.77 | 3.23 | 80.0 | ± 9.6 % |
| | | Y | 10.08 | 82.57 | 17.73 | | 80.0 | |
| | | Z | 1.70 | 63.84 | 10.43 | | 80.0 | |
| 10475-AAA | LTE-TDD (SC-FDMA, 1 RB, 15 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9) | X | 0.85 | 60.00 | 7.70 | 3.23 | 80.0 | ± 9.6 % |
| | | Y | 3.75 | 71.25 | 13.54 | | 80.0 | |
| | | Z | 1.39 | 61.55 | 8.93 | | 80.0 | |

| | | | | | | | | |
|-----------|---|---|-------|-------|-------|------|------|---------|
| 10477-AAA | LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9) | X | 1.12 | 62.81 | 9.63 | 3.23 | 80.0 | ± 9.6 % |
| | | Y | 9.29 | 81.66 | 17.43 | | 80.0 | |
| | | Z | 1.68 | 63.69 | 10.35 | | 80.0 | |
| 10478-AAA | LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9) | X | 0.85 | 60.00 | 7.69 | 3.23 | 80.0 | ± 9.6 % |
| | | Y | 3.71 | 71.13 | 13.49 | | 80.0 | |
| | | Z | 1.39 | 61.52 | 8.91 | | 80.0 | |
| 10479-AAA | LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, QPSK, UL Subframe=2,3,4,7,8,9) | X | 16.34 | 98.15 | 26.22 | 3.23 | 80.0 | ± 9.6 % |
| | | Y | 8.05 | 85.58 | 23.31 | | 80.0 | |
| | | Z | 4.44 | 75.80 | 19.08 | | 80.0 | |
| 10480-AAA | LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9) | X | 8.15 | 82.28 | 19.17 | 3.23 | 80.0 | ± 9.6 % |
| | | Y | 9.14 | 82.89 | 20.82 | | 80.0 | |
| | | Z | 4.48 | 72.61 | 16.42 | | 80.0 | |
| 10481-AAA | LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9) | X | 4.98 | 75.50 | 16.46 | 3.23 | 80.0 | ± 9.6 % |
| | | Y | 7.94 | 80.29 | 19.62 | | 80.0 | |
| | | Z | 4.00 | 70.70 | 15.36 | | 80.0 | |
| 10482-AAA | LTE-TDD (SC-FDMA, 50% RB, 3 MHz, QPSK, UL Subframe=2,3,4,7,8,9) | X | 3.11 | 72.47 | 16.27 | 2.23 | 80.0 | ± 9.6 % |
| | | Y | 4.49 | 76.30 | 19.03 | | 80.0 | |
| | | Z | 2.84 | 69.51 | 15.71 | | 80.0 | |
| 10483-AAA | LTE-TDD (SC-FDMA, 50% RB, 3 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9) | X | 3.23 | 69.48 | 14.33 | 2.23 | 80.0 | ± 9.6 % |
| | | Y | 6.12 | 77.20 | 19.06 | | 80.0 | |
| | | Z | 3.70 | 69.78 | 15.41 | | 80.0 | |
| 10484-AAA | LTE-TDD (SC-FDMA, 50% RB, 3 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9) | X | 2.99 | 68.30 | 13.84 | 2.23 | 80.0 | ± 9.6 % |
| | | Y | 5.80 | 76.19 | 18.70 | | 80.0 | |
| | | Z | 3.62 | 69.26 | 15.20 | | 80.0 | |
| 10485-AAA | LTE-TDD (SC-FDMA, 50% RB, 5 MHz, QPSK, UL Subframe=2,3,4,7,8,9) | X | 3.90 | 76.03 | 18.96 | 2.23 | 80.0 | ± 9.6 % |
| | | Y | 4.65 | 76.77 | 19.89 | | 80.0 | |
| | | Z | 3.19 | 70.88 | 17.04 | | 80.0 | |
| 10486-AAA | LTE-TDD (SC-FDMA, 50% RB, 5 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9) | X | 3.22 | 69.78 | 15.73 | 2.23 | 80.0 | ± 9.6 % |
| | | Y | 4.07 | 71.59 | 17.54 | | 80.0 | |
| | | Z | 3.24 | 68.15 | 15.55 | | 80.0 | |
| 10487-AAA | LTE-TDD (SC-FDMA, 50% RB, 5 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9) | X | 3.17 | 69.19 | 15.46 | 2.23 | 80.0 | ± 9.6 % |
| | | Y | 4.05 | 71.16 | 17.36 | | 80.0 | |
| | | Z | 3.26 | 67.91 | 15.45 | | 80.0 | |
| 10488-AAA | LTE-TDD (SC-FDMA, 50% RB, 10 MHz, QPSK, UL Subframe=2,3,4,7,8,9) | X | 3.89 | 74.31 | 19.36 | 2.23 | 80.0 | ± 9.6 % |
| | | Y | 4.74 | 75.31 | 19.78 | | 80.0 | |
| | | Z | 3.62 | 70.94 | 17.62 | | 80.0 | |
| 10489-AAA | LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9) | X | 3.61 | 70.11 | 17.53 | 2.23 | 80.0 | ± 9.6 % |
| | | Y | 4.17 | 70.61 | 18.05 | | 80.0 | |
| | | Z | 3.61 | 68.29 | 16.66 | | 80.0 | |
| 10490-AAA | LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9) | X | 3.68 | 69.86 | 17.43 | 2.23 | 80.0 | ± 9.6 % |
| | | Y | 4.25 | 70.34 | 17.96 | | 80.0 | |
| | | Z | 3.72 | 68.19 | 16.64 | | 80.0 | |
| 10491-AAA | LTE-TDD (SC-FDMA, 50% RB, 15 MHz, QPSK, UL Subframe=2,3,4,7,8,9) | X | 3.96 | 72.11 | 18.69 | 2.23 | 80.0 | ± 9.6 % |
| | | Y | 4.74 | 73.16 | 19.02 | | 80.0 | |
| | | Z | 3.92 | 70.03 | 17.39 | | 80.0 | |
| 10492-AAA | LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9) | X | 3.88 | 69.01 | 17.48 | 2.23 | 80.0 | ± 9.6 % |
| | | Y | 4.46 | 69.66 | 17.87 | | 80.0 | |
| | | Z | 4.00 | 67.90 | 16.78 | | 80.0 | |

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|-----------|--|---|------|-------|-------|------|------|---------|
| 10493-AAA | LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9) | X | 3.93 | 68.84 | 17.41 | 2.23 | 80.0 | ± 9.6 % |
| | | Y | 4.52 | 69.48 | 17.82 | | 80.0 | |
| | | Z | 4.08 | 67.81 | 16.77 | | 80.0 | |
| 10494-AAA | LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK, UL Subframe=2,3,4,7,8,9) | X | 4.32 | 73.69 | 19.20 | 2.23 | 80.0 | ± 9.6 % |
| | | Y | 5.29 | 75.06 | 19.58 | | 80.0 | |
| | | Z | 4.18 | 71.25 | 17.73 | | 80.0 | |
| 10495-AAA | LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9) | X | 3.92 | 69.34 | 17.70 | 2.23 | 80.0 | ± 9.6 % |
| | | Y | 4.53 | 70.19 | 18.09 | | 80.0 | |
| | | Z | 4.04 | 68.27 | 16.95 | | 80.0 | |
| 10496-AAA | LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9) | X | 3.98 | 69.05 | 17.60 | 2.23 | 80.0 | ± 9.6 % |
| | | Y | 4.58 | 69.81 | 17.97 | | 80.0 | |
| | | Z | 4.12 | 68.07 | 16.91 | | 80.0 | |
| 10497-AAA | LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, QPSK, UL Subframe=2,3,4,7,8,9) | X | 1.72 | 64.88 | 11.75 | 2.23 | 80.0 | ± 9.6 % |
| | | Y | 3.58 | 73.16 | 17.12 | | 80.0 | |
| | | Z | 2.20 | 66.42 | 13.58 | | 80.0 | |
| 10498-AAA | LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9) | X | 1.30 | 60.00 | 8.13 | 2.23 | 80.0 | ± 9.6 % |
| | | Y | 2.81 | 67.13 | 13.70 | | 80.0 | |
| | | Z | 1.98 | 62.85 | 11.00 | | 80.0 | |
| 10499-AAA | LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9) | X | 1.32 | 60.00 | 7.98 | 2.23 | 80.0 | ± 9.6 % |
| | | Y | 2.75 | 66.54 | 13.31 | | 80.0 | |
| | | Z | 1.95 | 62.46 | 10.68 | | 80.0 | |
| 10500-AAA | LTE-TDD (SC-FDMA, 100% RB, 3 MHz, QPSK, UL Subframe=2,3,4,7,8,9) | X | 3.82 | 75.04 | 19.03 | 2.23 | 80.0 | ± 9.6 % |
| | | Y | 4.55 | 75.62 | 19.66 | | 80.0 | |
| | | Z | 3.32 | 70.66 | 17.20 | | 80.0 | |
| 10501-AAA | LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9) | X | 3.45 | 70.22 | 16.55 | 2.23 | 80.0 | ± 9.6 % |
| | | Y | 4.10 | 71.10 | 17.69 | | 80.0 | |
| | | Z | 3.41 | 68.23 | 15.99 | | 80.0 | |
| 10502-AAA | LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9) | X | 3.48 | 69.95 | 16.36 | 2.23 | 80.0 | ± 9.6 % |
| | | Y | 4.15 | 70.89 | 17.57 | | 80.0 | |
| | | Z | 3.47 | 68.14 | 15.91 | | 80.0 | |
| 10503-AAA | LTE-TDD (SC-FDMA, 100% RB, 5 MHz, QPSK, UL Subframe=2,3,4,7,8,9) | X | 3.83 | 74.06 | 19.24 | 2.23 | 80.0 | ± 9.6 % |
| | | Y | 4.68 | 75.11 | 19.69 | | 80.0 | |
| | | Z | 3.58 | 70.77 | 17.54 | | 80.0 | |
| 10504-AAA | LTE-TDD (SC-FDMA, 100% RB, 5 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9) | X | 3.59 | 69.99 | 17.46 | 2.23 | 80.0 | ± 9.6 % |
| | | Y | 4.16 | 70.53 | 18.00 | | 80.0 | |
| | | Z | 3.60 | 68.21 | 16.61 | | 80.0 | |
| 10505-AAA | LTE-TDD (SC-FDMA, 100% RB, 5 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9) | X | 3.66 | 69.75 | 17.36 | 2.23 | 80.0 | ± 9.6 % |
| | | Y | 4.23 | 70.25 | 17.91 | | 80.0 | |
| | | Z | 3.70 | 68.11 | 16.59 | | 80.0 | |
| 10506-AAA | LTE-TDD (SC-FDMA, 100% RB, 10 MHz, QPSK, UL Subframe=2,3,4,7,8,9) | X | 4.28 | 73.52 | 19.12 | 2.23 | 80.0 | ± 9.6 % |
| | | Y | 5.24 | 74.92 | 19.51 | | 80.0 | |
| | | Z | 4.15 | 71.12 | 17.66 | | 80.0 | |
| 10507-AAA | LTE-TDD (SC-FDMA, 100% RB, 10 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9) | X | 3.90 | 69.27 | 17.66 | 2.23 | 80.0 | ± 9.6 % |
| | | Y | 4.51 | 70.14 | 18.06 | | 80.0 | |
| | | Z | 4.02 | 68.21 | 16.91 | | 80.0 | |

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|-----------|---|---|------|-------|-------|------|-------|---------|
| 10508-AAA | LTE-TDD (SC-FDMA, 100% RB, 10 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9) | X | 3.97 | 68.96 | 17.55 | 2.23 | 80.0 | ± 9.6 % |
| | | Y | 4.57 | 69.75 | 17.93 | | 80.0 | |
| | | Z | 4.11 | 68.00 | 16.87 | | 80.0 | |
| 10509-AAA | LTE-TDD (SC-FDMA, 100% RB, 15 MHz, QPSK, UL Subframe=2,3,4,7,8,9) | X | 4.54 | 71.87 | 18.48 | 2.23 | 80.0 | ± 9.6 % |
| | | Y | 5.35 | 73.05 | 18.77 | | 80.0 | |
| | | Z | 4.54 | 70.32 | 17.38 | | 80.0 | |
| 10510-AAA | LTE-TDD (SC-FDMA, 100% RB, 15 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9) | X | 4.34 | 68.76 | 17.59 | 2.23 | 80.0 | ± 9.6 % |
| | | Y | 4.97 | 69.73 | 17.95 | | 80.0 | |
| | | Z | 4.53 | 68.16 | 17.00 | | 80.0 | |
| 10511-AAA | LTE-TDD (SC-FDMA, 100% RB, 15 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9) | X | 4.39 | 68.51 | 17.51 | 2.23 | 80.0 | ± 9.6 % |
| | | Y | 5.00 | 69.40 | 17.85 | | 80.0 | |
| | | Z | 4.59 | 67.95 | 16.96 | | 80.0 | |
| 10512-AAA | LTE-TDD (SC-FDMA, 100% RB, 20 MHz, QPSK, UL Subframe=2,3,4,7,8,9) | X | 4.78 | 73.48 | 18.98 | 2.23 | 80.0 | ± 9.6 % |
| | | Y | 5.80 | 75.09 | 19.41 | | 80.0 | |
| | | Z | 4.67 | 71.54 | 17.71 | | 80.0 | |
| 10513-AAA | LTE-TDD (SC-FDMA, 100% RB, 20 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9) | X | 4.24 | 69.00 | 17.69 | 2.23 | 80.0 | ± 9.6 % |
| | | Y | 4.89 | 70.17 | 18.11 | | 80.0 | |
| | | Z | 4.41 | 68.40 | 17.07 | | 80.0 | |
| 10514-AAA | LTE-TDD (SC-FDMA, 100% RB, 20 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9) | X | 4.26 | 68.58 | 17.56 | 2.23 | 80.0 | ± 9.6 % |
| | | Y | 4.87 | 69.63 | 17.95 | | 80.0 | |
| | | Z | 4.44 | 68.04 | 16.99 | | 80.0 | |
| 10515-AAA | IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps, 99pc duty cycle) | X | 1.03 | 64.84 | 16.18 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 1.01 | 63.76 | 15.35 | | 150.0 | |
| | | Z | 0.97 | 62.74 | 14.37 | | 150.0 | |
| 10516-AAA | IEEE 802.11b WiFi 2.4 GHz (DSSS, 5.5 Mbps, 99pc duty cycle) | X | 1.37 | 87.37 | 25.57 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 0.82 | 76.24 | 20.55 | | 150.0 | |
| | | Z | 0.54 | 67.46 | 15.73 | | 150.0 | |
| 10517-AAA | IEEE 802.11b WiFi 2.4 GHz (DSSS, 11 Mbps, 99pc duty cycle) | X | 0.93 | 68.34 | 17.75 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 0.89 | 66.40 | 16.42 | | 150.0 | |
| | | Z | 0.81 | 64.28 | 14.78 | | 150.0 | |
| 10518-AAA | IEEE 802.11a/h WiFi 5 GHz (OFDM, 9 Mbps, 99pc duty cycle) | X | 4.48 | 67.19 | 16.57 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 4.66 | 66.80 | 16.35 | | 150.0 | |
| | | Z | 4.59 | 66.60 | 16.12 | | 150.0 | |
| 10519-AAA | IEEE 802.11a/h WiFi 5 GHz (OFDM, 12 Mbps, 99pc duty cycle) | X | 4.64 | 67.36 | 16.66 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 4.88 | 67.08 | 16.48 | | 150.0 | |
| | | Z | 4.79 | 66.86 | 16.25 | | 150.0 | |
| 10520-AAA | IEEE 802.11a/h WiFi 5 GHz (OFDM, 18 Mbps, 99pc duty cycle) | X | 4.50 | 67.33 | 16.59 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 4.73 | 67.07 | 16.42 | | 150.0 | |
| | | Z | 4.64 | 66.83 | 16.17 | | 150.0 | |
| 10521-AAA | IEEE 802.11a/h WiFi 5 GHz (OFDM, 24 Mbps, 99pc duty cycle) | X | 4.43 | 67.32 | 16.58 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 4.66 | 67.08 | 16.41 | | 150.0 | |
| | | Z | 4.57 | 66.82 | 16.16 | | 150.0 | |
| 10522-AAA | IEEE 802.11a/h WiFi 5 GHz (OFDM, 36 Mbps, 99pc duty cycle) | X | 4.49 | 67.45 | 16.68 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 4.71 | 67.07 | 16.44 | | 150.0 | |
| | | Z | 4.62 | 66.87 | 16.22 | | 150.0 | |

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|-----------|--|---|------|-------|-------|------|-------|---------|
| 10523-AAA | IEEE 802.11a/h WiFi 5 GHz (OFDM, 48 Mbps, 99pc duty cycle) | X | 4.40 | 67.41 | 16.59 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 4.58 | 66.97 | 16.31 | | 150.0 | |
| | | Z | 4.50 | 66.74 | 16.07 | | 150.0 | |
| 10524-AAA | IEEE 802.11a/h WiFi 5 GHz (OFDM, 54 Mbps, 99pc duty cycle) | X | 4.44 | 67.39 | 16.66 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 4.66 | 67.02 | 16.43 | | 150.0 | |
| | | Z | 4.57 | 66.80 | 16.19 | | 150.0 | |
| 10525-AAA | IEEE 802.11ac WiFi (20MHz, MCS0, 99pc duty cycle) | X | 4.46 | 66.48 | 16.28 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 4.62 | 66.06 | 16.02 | | 150.0 | |
| | | Z | 4.54 | 65.85 | 15.79 | | 150.0 | |
| 10526-AAA | IEEE 802.11ac WiFi (20MHz, MCS1, 99pc duty cycle) | X | 4.60 | 66.79 | 16.40 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 4.82 | 66.46 | 16.16 | | 150.0 | |
| | | Z | 4.72 | 66.22 | 15.93 | | 150.0 | |
| 10527-AAA | IEEE 802.11ac WiFi (20MHz, MCS2, 99pc duty cycle) | X | 4.53 | 66.77 | 16.35 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 4.74 | 66.44 | 16.12 | | 150.0 | |
| | | Z | 4.64 | 66.19 | 15.88 | | 150.0 | |
| 10528-AAA | IEEE 802.11ac WiFi (20MHz, MCS3, 99pc duty cycle) | X | 4.54 | 66.78 | 16.38 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 4.75 | 66.46 | 16.15 | | 150.0 | |
| | | Z | 4.66 | 66.21 | 15.91 | | 150.0 | |
| 10529-AAA | IEEE 802.11ac WiFi (20MHz, MCS4, 99pc duty cycle) | X | 4.54 | 66.78 | 16.38 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 4.75 | 66.46 | 16.15 | | 150.0 | |
| | | Z | 4.66 | 66.21 | 15.91 | | 150.0 | |
| 10531-AAA | IEEE 802.11ac WiFi (20MHz, MCS6, 99pc duty cycle) | X | 4.52 | 66.84 | 16.38 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 4.76 | 66.60 | 16.18 | | 150.0 | |
| | | Z | 4.66 | 66.32 | 15.93 | | 150.0 | |
| 10532-AAA | IEEE 802.11ac WiFi (20MHz, MCS7, 99pc duty cycle) | X | 4.39 | 66.72 | 16.32 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 4.61 | 66.47 | 16.13 | | 150.0 | |
| | | Z | 4.51 | 66.18 | 15.86 | | 150.0 | |
| 10533-AAA | IEEE 802.11ac WiFi (20MHz, MCS8, 99pc duty cycle) | X | 4.55 | 66.87 | 16.39 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 4.77 | 66.48 | 16.13 | | 150.0 | |
| | | Z | 4.67 | 66.24 | 15.89 | | 150.0 | |
| 10534-AAA | IEEE 802.11ac WiFi (40MHz, MCS0, 99pc duty cycle) | X | 5.09 | 66.73 | 16.38 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 5.26 | 66.58 | 16.18 | | 150.0 | |
| | | Z | 5.19 | 66.36 | 15.98 | | 150.0 | |
| 10535-AAA | IEEE 802.11ac WiFi (40MHz, MCS1, 99pc duty cycle) | X | 5.14 | 66.89 | 16.46 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 5.33 | 66.72 | 16.24 | | 150.0 | |
| | | Z | 5.25 | 66.50 | 16.04 | | 150.0 | |
| 10536-AAA | IEEE 802.11ac WiFi (40MHz, MCS2, 99pc duty cycle) | X | 5.03 | 66.89 | 16.44 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 5.20 | 66.71 | 16.22 | | 150.0 | |
| | | Z | 5.12 | 66.47 | 16.01 | | 150.0 | |
| 10537-AAA | IEEE 802.11ac WiFi (40MHz, MCS3, 99pc duty cycle) | X | 5.08 | 66.84 | 16.42 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 5.27 | 66.68 | 16.21 | | 150.0 | |
| | | Z | 5.18 | 66.44 | 16.00 | | 150.0 | |
| 10538-AAA | IEEE 802.11ac WiFi (40MHz, MCS4, 99pc duty cycle) | X | 5.15 | 66.81 | 16.44 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 5.37 | 66.74 | 16.28 | | 150.0 | |
| | | Z | 5.28 | 66.49 | 16.06 | | 150.0 | |
| 10540-AAA | IEEE 802.11ac WiFi (40MHz, MCS6, 99pc duty cycle) | X | 5.09 | 66.80 | 16.45 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 5.28 | 66.69 | 16.27 | | 150.0 | |
| | | Z | 5.20 | 66.47 | 16.06 | | 150.0 | |

| | | | | | | | | |
|-----------|---|---|------|-------|-------|------|-------|---------|
| 10541-AAA | IEEE 802.11ac WiFi (40MHz, MCS7, 99pc duty cycle) | X | 5.06 | 66.68 | 16.38 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 5.26 | 66.60 | 16.22 | | 150.0 | |
| | | Z | 5.18 | 66.36 | 16.00 | | 150.0 | |
| 10542-AAA | IEEE 802.11ac WiFi (40MHz, MCS8, 99pc duty cycle) | X | 5.22 | 66.77 | 16.43 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 5.41 | 66.64 | 16.25 | | 150.0 | |
| | | Z | 5.33 | 66.43 | 16.05 | | 150.0 | |
| 10543-AAA | IEEE 802.11ac WiFi (40MHz, MCS9, 99pc duty cycle) | X | 5.28 | 66.79 | 16.47 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 5.50 | 66.65 | 16.27 | | 150.0 | |
| | | Z | 5.41 | 66.46 | 16.08 | | 150.0 | |
| 10544-AAA | IEEE 802.11ac WiFi (80MHz, MCS0, 99pc duty cycle) | X | 5.42 | 66.77 | 16.34 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 5.55 | 66.69 | 16.17 | | 150.0 | |
| | | Z | 5.48 | 66.48 | 15.98 | | 150.0 | |
| 10545-AAA | IEEE 802.11ac WiFi (80MHz, MCS1, 99pc duty cycle) | X | 5.61 | 67.23 | 16.53 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 5.75 | 67.07 | 16.30 | | 150.0 | |
| | | Z | 5.67 | 66.87 | 16.11 | | 150.0 | |
| 10546-AAA | IEEE 802.11ac WiFi (80MHz, MCS2, 99pc duty cycle) | X | 5.46 | 66.92 | 16.38 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 5.64 | 66.96 | 16.27 | | 150.0 | |
| | | Z | 5.56 | 66.72 | 16.06 | | 150.0 | |
| 10547-AAA | IEEE 802.11ac WiFi (80MHz, MCS3, 99pc duty cycle) | X | 5.54 | 67.00 | 16.42 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 5.73 | 67.04 | 16.29 | | 150.0 | |
| | | Z | 5.64 | 66.77 | 16.07 | | 150.0 | |
| 10548-AAA | IEEE 802.11ac WiFi (80MHz, MCS4, 99pc duty cycle) | X | 5.73 | 67.79 | 16.78 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 5.99 | 67.96 | 16.73 | | 150.0 | |
| | | Z | 5.87 | 67.64 | 16.48 | | 150.0 | |
| 10550-AAA | IEEE 802.11ac WiFi (80MHz, MCS6, 99pc duty cycle) | X | 5.52 | 67.07 | 16.47 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 5.66 | 66.92 | 16.25 | | 150.0 | |
| | | Z | 5.58 | 66.70 | 16.06 | | 150.0 | |
| 10551-AAA | IEEE 802.11ac WiFi (80MHz, MCS7, 99pc duty cycle) | X | 5.47 | 66.93 | 16.36 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 5.67 | 66.99 | 16.25 | | 150.0 | |
| | | Z | 5.59 | 66.76 | 16.05 | | 150.0 | |
| 10552-AAA | IEEE 802.11ac WiFi (80MHz, MCS8, 99pc duty cycle) | X | 5.43 | 66.87 | 16.34 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 5.58 | 66.77 | 16.15 | | 150.0 | |
| | | Z | 5.50 | 66.55 | 15.96 | | 150.0 | |
| 10553-AAA | IEEE 802.11ac WiFi (80MHz, MCS9, 99pc duty cycle) | X | 5.49 | 66.84 | 16.35 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 5.67 | 66.82 | 16.21 | | 150.0 | |
| | | Z | 5.59 | 66.61 | 16.01 | | 150.0 | |
| 10554-AAA | IEEE 1602.11ac WiFi (160MHz, MCS0, 99pc duty cycle) | X | 5.84 | 67.09 | 16.40 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 5.94 | 67.05 | 16.25 | | 150.0 | |
| | | Z | 5.88 | 66.85 | 16.07 | | 150.0 | |
| 10555-AAA | IEEE 1602.11ac WiFi (160MHz, MCS1, 99pc duty cycle) | X | 5.95 | 67.36 | 16.52 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 6.09 | 67.37 | 16.39 | | 150.0 | |
| | | Z | 6.01 | 67.14 | 16.19 | | 150.0 | |
| 10556-AAA | IEEE 1602.11ac WiFi (160MHz, MCS2, 99pc duty cycle) | X | 5.98 | 67.45 | 16.56 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 6.10 | 67.39 | 16.39 | | 150.0 | |
| | | Z | 6.03 | 67.18 | 16.21 | | 150.0 | |
| 10557-AAA | IEEE 1602.11ac WiFi (160MHz, MCS3, 99pc duty cycle) | X | 5.93 | 67.31 | 16.50 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 6.09 | 67.35 | 16.39 | | 150.0 | |
| | | Z | 6.01 | 67.12 | 16.19 | | 150.0 | |

| | | | | | | | | |
|-----------|---|---|-------|--------|-------|------|-------|---------|
| 10558-AAA | IEEE 1602.11ac WiFi (160MHz, MCS4, 99pc duty cycle) | X | 5.96 | 67.43 | 16.58 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 6.14 | 67.53 | 16.50 | | 150.0 | |
| | | Z | 6.06 | 67.28 | 16.29 | | 150.0 | |
| 10560-AAA | IEEE 1602.11ac WiFi (160MHz, MCS6, 99pc duty cycle) | X | 5.96 | 67.30 | 16.55 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 6.14 | 67.38 | 16.46 | | 150.0 | |
| | | Z | 6.06 | 67.14 | 16.26 | | 150.0 | |
| 10561-AAA | IEEE 1602.11ac WiFi (160MHz, MCS7, 99pc duty cycle) | X | 5.90 | 67.30 | 16.59 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 6.05 | 67.33 | 16.47 | | 150.0 | |
| | | Z | 5.97 | 67.09 | 16.27 | | 150.0 | |
| 10562-AAA | IEEE 1602.11ac WiFi (160MHz, MCS8, 99pc duty cycle) | X | 5.97 | 67.52 | 16.70 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 6.20 | 67.78 | 16.70 | | 150.0 | |
| | | Z | 6.10 | 67.49 | 16.47 | | 150.0 | |
| 10563-AAA | IEEE 1602.11ac WiFi (160MHz, MCS9, 99pc duty cycle) | X | 6.05 | 67.43 | 16.61 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 6.51 | 68.26 | 16.88 | | 150.0 | |
| | | Z | 6.42 | 68.01 | 16.67 | | 150.0 | |
| 10564-AAA | IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 9 Mbps, 99pc duty cycle) | X | 4.79 | 67.15 | 16.65 | 0.46 | 150.0 | ± 9.6 % |
| | | Y | 4.99 | 66.89 | 16.50 | | 150.0 | |
| | | Z | 4.91 | 66.68 | 16.27 | | 150.0 | |
| 10565-AAA | IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 12 Mbps, 99pc duty cycle) | X | 5.00 | 67.58 | 16.97 | 0.46 | 150.0 | ± 9.6 % |
| | | Y | 5.25 | 67.37 | 16.83 | | 150.0 | |
| | | Z | 5.16 | 67.16 | 16.61 | | 150.0 | |
| 10566-AAA | IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 18 Mbps, 99pc duty cycle) | X | 4.83 | 67.41 | 16.78 | 0.46 | 150.0 | ± 9.6 % |
| | | Y | 5.08 | 67.24 | 16.66 | | 150.0 | |
| | | Z | 4.99 | 67.00 | 16.41 | | 150.0 | |
| 10567-AAA | IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 24 Mbps, 99pc duty cycle) | X | 4.88 | 67.87 | 17.20 | 0.46 | 150.0 | ± 9.6 % |
| | | Y | 5.11 | 67.62 | 16.99 | | 150.0 | |
| | | Z | 5.02 | 67.41 | 16.78 | | 150.0 | |
| 10568-AAA | IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 36 Mbps, 99pc duty cycle) | X | 4.73 | 67.14 | 16.52 | 0.46 | 150.0 | ± 9.6 % |
| | | Y | 4.99 | 66.97 | 16.41 | | 150.0 | |
| | | Z | 4.89 | 66.73 | 16.15 | | 150.0 | |
| 10569-AAA | IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 48 Mbps, 99pc duty cycle) | X | 4.86 | 68.08 | 17.32 | 0.46 | 150.0 | ± 9.6 % |
| | | Y | 5.05 | 67.63 | 17.01 | | 150.0 | |
| | | Z | 4.97 | 67.46 | 16.82 | | 150.0 | |
| 10570-AAA | IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 54 Mbps, 99pc duty cycle) | X | 4.87 | 67.85 | 17.21 | 0.46 | 150.0 | ± 9.6 % |
| | | Y | 5.09 | 67.48 | 16.95 | | 150.0 | |
| | | Z | 5.01 | 67.31 | 16.75 | | 150.0 | |
| 10571-AAA | IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 90pc duty cycle) | X | 1.23 | 65.85 | 16.68 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 1.28 | 65.62 | 16.38 | | 130.0 | |
| | | Z | 1.20 | 64.12 | 15.14 | | 130.0 | |
| 10572-AAA | IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps, 90pc duty cycle) | X | 1.26 | 66.61 | 17.14 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 1.30 | 66.27 | 16.76 | | 130.0 | |
| | | Z | 1.21 | 64.64 | 15.46 | | 130.0 | |
| 10573-AAA | IEEE 802.11b WiFi 2.4 GHz (DSSS, 5.5 Mbps, 90pc duty cycle) | X | 15.61 | 122.59 | 34.86 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 7.32 | 105.62 | 29.57 | | 130.0 | |
| | | Z | 1.41 | 77.28 | 19.61 | | 130.0 | |
| 10574-AAA | IEEE 802.11b WiFi 2.4 GHz (DSSS, 11 Mbps, 90pc duty cycle) | X | 1.59 | 75.46 | 21.51 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 1.56 | 73.46 | 20.23 | | 130.0 | |
| | | Z | 1.30 | 69.51 | 17.90 | | 130.0 | |

| | | | | | | | | |
|-----------|---|---|------|-------|-------|------|-------|---------|
| 10575-AAA | IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 90pc duty cycle) | X | 4.57 | 66.90 | 16.65 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 4.78 | 66.67 | 16.55 | | 130.0 | |
| | | Z | 4.70 | 66.43 | 16.27 | | 130.0 | |
| 10576-AAA | IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 9 Mbps, 90pc duty cycle) | X | 4.60 | 67.11 | 16.74 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 4.81 | 66.83 | 16.61 | | 130.0 | |
| | | Z | 4.72 | 66.59 | 16.34 | | 130.0 | |
| 10577-AAA | IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 12 Mbps, 90pc duty cycle) | X | 4.78 | 67.36 | 16.89 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 5.04 | 67.16 | 16.78 | | 130.0 | |
| | | Z | 4.94 | 66.91 | 16.52 | | 130.0 | |
| 10578-AAA | IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 18 Mbps, 90pc duty cycle) | X | 4.68 | 67.55 | 17.03 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 4.93 | 67.32 | 16.88 | | 130.0 | |
| | | Z | 4.83 | 67.07 | 16.62 | | 130.0 | |
| 10579-AAA | IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 24 Mbps, 90pc duty cycle) | X | 4.43 | 66.68 | 16.24 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 4.71 | 66.69 | 16.25 | | 130.0 | |
| | | Z | 4.59 | 66.34 | 15.91 | | 130.0 | |
| 10580-AAA | IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 36 Mbps, 90pc duty cycle) | X | 4.47 | 66.74 | 16.26 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 4.75 | 66.68 | 16.26 | | 130.0 | |
| | | Z | 4.64 | 66.35 | 15.93 | | 130.0 | |
| 10581-AAA | IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 48 Mbps, 90pc duty cycle) | X | 4.59 | 67.62 | 16.99 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 4.83 | 67.38 | 16.83 | | 130.0 | |
| | | Z | 4.73 | 67.09 | 16.54 | | 130.0 | |
| 10582-AAA | IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 54 Mbps, 90pc duty cycle) | X | 4.35 | 66.42 | 16.00 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 4.66 | 66.46 | 16.06 | | 130.0 | |
| | | Z | 4.54 | 66.09 | 15.70 | | 130.0 | |
| 10583-AAA | IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps, 90pc duty cycle) | X | 4.57 | 66.90 | 16.65 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 4.78 | 66.67 | 16.55 | | 130.0 | |
| | | Z | 4.70 | 66.43 | 16.27 | | 130.0 | |
| 10584-AAA | IEEE 802.11a/h WiFi 5 GHz (OFDM, 9 Mbps, 90pc duty cycle) | X | 4.60 | 67.11 | 16.74 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 4.81 | 66.83 | 16.61 | | 130.0 | |
| | | Z | 4.72 | 66.59 | 16.34 | | 130.0 | |
| 10585-AAA | IEEE 802.11a/h WiFi 5 GHz (OFDM, 12 Mbps, 90pc duty cycle) | X | 4.78 | 67.36 | 16.89 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 5.04 | 67.16 | 16.78 | | 130.0 | |
| | | Z | 4.94 | 66.91 | 16.52 | | 130.0 | |
| 10586-AAA | IEEE 802.11a/h WiFi 5 GHz (OFDM, 18 Mbps, 90pc duty cycle) | X | 4.68 | 67.55 | 17.03 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 4.93 | 67.32 | 16.88 | | 130.0 | |
| | | Z | 4.83 | 67.07 | 16.62 | | 130.0 | |
| 10587-AAA | IEEE 802.11a/h WiFi 5 GHz (OFDM, 24 Mbps, 90pc duty cycle) | X | 4.43 | 66.68 | 16.24 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 4.71 | 66.69 | 16.25 | | 130.0 | |
| | | Z | 4.59 | 66.34 | 15.91 | | 130.0 | |
| 10588-AAA | IEEE 802.11a/h WiFi 5 GHz (OFDM, 36 Mbps, 90pc duty cycle) | X | 4.47 | 66.74 | 16.26 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 4.75 | 66.68 | 16.26 | | 130.0 | |
| | | Z | 4.64 | 66.35 | 15.93 | | 130.0 | |
| 10589-AAA | IEEE 802.11a/h WiFi 5 GHz (OFDM, 48 Mbps, 90pc duty cycle) | X | 4.59 | 67.62 | 16.99 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 4.83 | 67.38 | 16.83 | | 130.0 | |
| | | Z | 4.73 | 67.09 | 16.54 | | 130.0 | |
| 10590-AAA | IEEE 802.11a/h WiFi 5 GHz (OFDM, 54 Mbps, 90pc duty cycle) | X | 4.35 | 66.42 | 16.00 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 4.66 | 66.46 | 16.06 | | 130.0 | |
| | | Z | 4.54 | 66.09 | 15.70 | | 130.0 | |

| | | | | | | | | |
|-----------|---|---|------|-------|-------|------|-------|---------|
| 10591-AAA | IEEE 802.11n (HT Mixed, 20MHz, MCS0, 90pc duty cycle) | X | 4.72 | 66.97 | 16.76 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 4.93 | 66.73 | 16.63 | | 130.0 | |
| | | Z | 4.85 | 66.51 | 16.38 | | 130.0 | |
| 10592-AAA | IEEE 802.11n (HT Mixed, 20MHz, MCS1, 90pc duty cycle) | X | 4.85 | 67.28 | 16.89 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 5.10 | 67.07 | 16.76 | | 130.0 | |
| | | Z | 5.01 | 66.85 | 16.51 | | 130.0 | |
| 10593-AAA | IEEE 802.11n (HT Mixed, 20MHz, MCS2, 90pc duty cycle) | X | 4.77 | 67.16 | 16.75 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 5.03 | 67.02 | 16.67 | | 130.0 | |
| | | Z | 4.93 | 66.76 | 16.39 | | 130.0 | |
| 10594-AAA | IEEE 802.11n (HT Mixed, 20MHz, MCS3, 90pc duty cycle) | X | 4.83 | 67.35 | 16.92 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 5.08 | 67.17 | 16.80 | | 130.0 | |
| | | Z | 4.99 | 66.92 | 16.54 | | 130.0 | |
| 10595-AAA | IEEE 802.11n (HT Mixed, 20MHz, MCS4, 90pc duty cycle) | X | 4.79 | 67.31 | 16.82 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 5.06 | 67.14 | 16.71 | | 130.0 | |
| | | Z | 4.95 | 66.87 | 16.44 | | 130.0 | |
| 10596-AAA | IEEE 802.11n (HT Mixed, 20MHz, MCS5, 90pc duty cycle) | X | 4.73 | 67.29 | 16.82 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 4.99 | 67.14 | 16.71 | | 130.0 | |
| | | Z | 4.89 | 66.86 | 16.43 | | 130.0 | |
| 10597-AAA | IEEE 802.11n (HT Mixed, 20MHz, MCS6, 90pc duty cycle) | X | 4.68 | 67.16 | 16.68 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 4.95 | 67.07 | 16.62 | | 130.0 | |
| | | Z | 4.84 | 66.78 | 16.32 | | 130.0 | |
| 10598-AAA | IEEE 802.11n (HT Mixed, 20MHz, MCS7, 90pc duty cycle) | X | 4.67 | 67.44 | 16.97 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 4.93 | 67.31 | 16.88 | | 130.0 | |
| | | Z | 4.82 | 67.03 | 16.60 | | 130.0 | |
| 10599-AAA | IEEE 802.11n (HT Mixed, 40MHz, MCS0, 90pc duty cycle) | X | 5.39 | 67.39 | 16.95 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 5.60 | 67.32 | 16.82 | | 130.0 | |
| | | Z | 5.51 | 67.07 | 16.58 | | 130.0 | |
| 10600-AAA | IEEE 802.11n (HT Mixed, 40MHz, MCS1, 90pc duty cycle) | X | 5.51 | 67.80 | 17.12 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 5.77 | 67.81 | 17.04 | | 130.0 | |
| | | Z | 5.65 | 67.49 | 16.76 | | 130.0 | |
| 10601-AAA | IEEE 802.11n (HT Mixed, 40MHz, MCS2, 90pc duty cycle) | X | 5.41 | 67.56 | 17.02 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 5.64 | 67.51 | 16.91 | | 130.0 | |
| | | Z | 5.54 | 67.24 | 16.65 | | 130.0 | |
| 10602-AAA | IEEE 802.11n (HT Mixed, 40MHz, MCS3, 90pc duty cycle) | X | 5.54 | 67.73 | 17.02 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 5.72 | 67.51 | 16.82 | | 130.0 | |
| | | Z | 5.62 | 67.22 | 16.56 | | 130.0 | |
| 10603-AAA | IEEE 802.11n (HT Mixed, 40MHz, MCS4, 90pc duty cycle) | X | 5.62 | 68.07 | 17.33 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 5.82 | 67.83 | 17.11 | | 130.0 | |
| | | Z | 5.72 | 67.58 | 16.87 | | 130.0 | |
| 10604-AAA | IEEE 802.11n (HT Mixed, 40MHz, MCS5, 90pc duty cycle) | X | 5.49 | 67.68 | 17.12 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 5.60 | 67.27 | 16.82 | | 130.0 | |
| | | Z | 5.51 | 67.03 | 16.58 | | 130.0 | |
| 10605-AAA | IEEE 802.11n (HT Mixed, 40MHz, MCS6, 90pc duty cycle) | X | 5.51 | 67.70 | 17.12 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 5.70 | 67.55 | 16.96 | | 130.0 | |
| | | Z | 5.61 | 67.31 | 16.72 | | 130.0 | |
| 10606-AAA | IEEE 802.11n (HT Mixed, 40MHz, MCS7, 90pc duty cycle) | X | 5.26 | 67.01 | 16.63 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 5.49 | 67.08 | 16.60 | | 130.0 | |
| | | Z | 5.39 | 66.79 | 16.33 | | 130.0 | |

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|-----------|---|---|------|-------|-------|------|-------|---------|
| 10607-AAA | IEEE 802.11ac WiFi (20MHz, MCS0, 90pc duty cycle) | X | 4.58 | 66.35 | 16.43 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 4.76 | 66.03 | 16.25 | | 130.0 | |
| | | Z | 4.68 | 65.79 | 15.98 | | 130.0 | |
| 10608-AAA | IEEE 802.11ac WiFi (20MHz, MCS1, 90pc duty cycle) | X | 4.73 | 66.71 | 16.58 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 4.98 | 66.46 | 16.42 | | 130.0 | |
| | | Z | 4.87 | 66.20 | 16.15 | | 130.0 | |
| 10609-AAA | IEEE 802.11ac WiFi (20MHz, MCS2, 90pc duty cycle) | X | 4.62 | 66.54 | 16.40 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 4.87 | 66.34 | 16.28 | | 130.0 | |
| | | Z | 4.76 | 66.05 | 15.99 | | 130.0 | |
| 10610-AAA | IEEE 802.11ac WiFi (20MHz, MCS3, 90pc duty cycle) | X | 4.68 | 66.72 | 16.58 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 4.92 | 66.49 | 16.43 | | 130.0 | |
| | | Z | 4.81 | 66.21 | 16.15 | | 130.0 | |
| 10611-AAA | IEEE 802.11ac WiFi (20MHz, MCS4, 90pc duty cycle) | X | 4.59 | 66.51 | 16.42 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 4.84 | 66.32 | 16.29 | | 130.0 | |
| | | Z | 4.73 | 66.02 | 16.00 | | 130.0 | |
| 10612-AAA | IEEE 802.11ac WiFi (20MHz, MCS5, 90pc duty cycle) | X | 4.59 | 66.66 | 16.46 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 4.85 | 66.48 | 16.33 | | 130.0 | |
| | | Z | 4.74 | 66.16 | 16.03 | | 130.0 | |
| 10613-AAA | IEEE 802.11ac WiFi (20MHz, MCS6, 90pc duty cycle) | X | 4.58 | 66.47 | 16.30 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 4.87 | 66.40 | 16.24 | | 130.0 | |
| | | Z | 4.75 | 66.06 | 15.92 | | 130.0 | |
| 10614-AAA | IEEE 802.11ac WiFi (20MHz, MCS7, 90pc duty cycle) | X | 4.55 | 66.74 | 16.59 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 4.80 | 66.57 | 16.46 | | 130.0 | |
| | | Z | 4.69 | 66.26 | 16.16 | | 130.0 | |
| 10615-AAA | IEEE 802.11ac WiFi (20MHz, MCS8, 90pc duty cycle) | X | 4.58 | 66.31 | 16.16 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 4.84 | 66.15 | 16.08 | | 130.0 | |
| | | Z | 4.73 | 65.83 | 15.77 | | 130.0 | |
| 10616-AAA | IEEE 802.11ac WiFi (40MHz, MCS0, 90pc duty cycle) | X | 5.21 | 66.65 | 16.56 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 5.41 | 66.58 | 16.44 | | 130.0 | |
| | | Z | 5.33 | 66.33 | 16.20 | | 130.0 | |
| 10617-AAA | IEEE 802.11ac WiFi (40MHz, MCS1, 90pc duty cycle) | X | 5.28 | 66.84 | 16.63 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 5.47 | 66.68 | 16.45 | | 130.0 | |
| | | Z | 5.38 | 66.45 | 16.22 | | 130.0 | |
| 10618-AAA | IEEE 802.11ac WiFi (40MHz, MCS2, 90pc duty cycle) | X | 5.18 | 66.90 | 16.68 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 5.37 | 66.76 | 16.51 | | 130.0 | |
| | | Z | 5.28 | 66.49 | 16.27 | | 130.0 | |
| 10619-AAA | IEEE 802.11ac WiFi (40MHz, MCS3, 90pc duty cycle) | X | 5.18 | 66.65 | 16.49 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 5.39 | 66.59 | 16.37 | | 130.0 | |
| | | Z | 5.30 | 66.32 | 16.11 | | 130.0 | |
| 10620-AAA | IEEE 802.11ac WiFi (40MHz, MCS4, 90pc duty cycle) | X | 5.26 | 66.66 | 16.54 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 5.51 | 66.68 | 16.46 | | 130.0 | |
| | | Z | 5.40 | 66.39 | 16.19 | | 130.0 | |
| 10621-AAA | IEEE 802.11ac WiFi (40MHz, MCS5, 90pc duty cycle) | X | 5.27 | 66.82 | 16.75 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 5.48 | 66.74 | 16.60 | | 130.0 | |
| | | Z | 5.39 | 66.50 | 16.37 | | 130.0 | |
| 10622-AAA | IEEE 802.11ac WiFi (40MHz, MCS6, 90pc duty cycle) | X | 5.27 | 66.93 | 16.80 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 5.48 | 66.86 | 16.65 | | 130.0 | |
| | | Z | 5.39 | 66.62 | 16.42 | | 130.0 | |

| | | | | | | | | |
|-----------|---|---|------|-------|-------|------|-------|---------|
| 10623-AAA | IEEE 802.11ac WiFi (40MHz, MCS7, 90pc duty cycle) | X | 5.14 | 66.42 | 16.40 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 5.37 | 66.46 | 16.34 | | 130.0 | |
| | | Z | 5.27 | 66.17 | 16.07 | | 130.0 | |
| 10624-AAA | IEEE 802.11ac WiFi (40MHz, MCS8, 90pc duty cycle) | X | 5.34 | 66.68 | 16.59 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 5.56 | 66.62 | 16.48 | | 130.0 | |
| | | Z | 5.47 | 66.37 | 16.24 | | 130.0 | |
| 10625-AAA | IEEE 802.11ac WiFi (40MHz, MCS9, 90pc duty cycle) | X | 5.51 | 67.05 | 16.84 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 5.94 | 67.60 | 17.02 | | 130.0 | |
| | | Z | 5.85 | 67.36 | 16.78 | | 130.0 | |
| 10626-AAA | IEEE 802.11ac WiFi (80MHz, MCS0, 90pc duty cycle) | X | 5.53 | 66.66 | 16.50 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 5.68 | 66.62 | 16.38 | | 130.0 | |
| | | Z | 5.60 | 66.40 | 16.16 | | 130.0 | |
| 10627-AAA | IEEE 802.11ac WiFi (80MHz, MCS1, 90pc duty cycle) | X | 5.78 | 67.30 | 16.79 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 5.92 | 67.14 | 16.59 | | 130.0 | |
| | | Z | 5.84 | 66.92 | 16.37 | | 130.0 | |
| 10628-AAA | IEEE 802.11ac WiFi (80MHz, MCS2, 90pc duty cycle) | X | 5.53 | 66.65 | 16.39 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 5.74 | 66.79 | 16.36 | | 130.0 | |
| | | Z | 5.65 | 66.51 | 16.11 | | 130.0 | |
| 10629-AAA | IEEE 802.11ac WiFi (80MHz, MCS3, 90pc duty cycle) | X | 5.63 | 66.79 | 16.45 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 5.82 | 66.85 | 16.38 | | 130.0 | |
| | | Z | 5.74 | 66.60 | 16.14 | | 130.0 | |
| 10630-AAA | IEEE 802.11ac WiFi (80MHz, MCS4, 90pc duty cycle) | X | 5.95 | 67.97 | 17.05 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 6.32 | 68.49 | 17.20 | | 130.0 | |
| | | Z | 6.17 | 68.05 | 16.86 | | 130.0 | |
| 10631-AAA | IEEE 802.11ac WiFi (80MHz, MCS5, 90pc duty cycle) | X | 5.89 | 67.93 | 17.23 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 6.21 | 68.27 | 17.26 | | 130.0 | |
| | | Z | 6.09 | 67.93 | 17.00 | | 130.0 | |
| 10632-AAA | IEEE 802.11ac WiFi (80MHz, MCS6, 90pc duty cycle) | X | 5.77 | 67.44 | 17.00 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 5.90 | 67.22 | 16.76 | | 130.0 | |
| | | Z | 5.82 | 67.00 | 16.55 | | 130.0 | |
| 10633-AAA | IEEE 802.11ac WiFi (80MHz, MCS7, 90pc duty cycle) | X | 5.60 | 66.87 | 16.54 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 5.83 | 67.02 | 16.49 | | 130.0 | |
| | | Z | 5.72 | 66.69 | 16.23 | | 130.0 | |
| 10634-AAA | IEEE 802.11ac WiFi (80MHz, MCS8, 90pc duty cycle) | X | 5.59 | 66.92 | 16.62 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 5.81 | 67.01 | 16.55 | | 130.0 | |
| | | Z | 5.71 | 66.73 | 16.31 | | 130.0 | |
| 10635-AAA | IEEE 802.11ac WiFi (80MHz, MCS9, 90pc duty cycle) | X | 5.44 | 66.12 | 15.93 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 5.70 | 66.39 | 15.99 | | 130.0 | |
| | | Z | 5.59 | 66.05 | 15.69 | | 130.0 | |
| 10636-AAA | IEEE 1602.11ac WiFi (160MHz, MCS0, 90pc duty cycle) | X | 5.96 | 67.00 | 16.57 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 6.08 | 67.01 | 16.47 | | 130.0 | |
| | | Z | 6.01 | 66.78 | 16.25 | | 130.0 | |
| 10637-AAA | IEEE 1602.11ac WiFi (160MHz, MCS1, 90pc duty cycle) | X | 6.10 | 67.36 | 16.74 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 6.25 | 67.39 | 16.63 | | 130.0 | |
| | | Z | 6.17 | 67.14 | 16.41 | | 130.0 | |
| 10638-AAA | IEEE 1602.11ac WiFi (160MHz, MCS2, 90pc duty cycle) | X | 6.11 | 67.36 | 16.71 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 6.25 | 67.36 | 16.60 | | 130.0 | |
| | | Z | 6.17 | 67.12 | 16.38 | | 130.0 | |

| | | | | | | | | |
|-----------|--|---|-------|--------|-------|------|-------|---------|
| 10639-AAA | IEEE 1602.11ac WiFi (160MHz, MCS3, 90pc duty cycle) | X | 6.07 | 67.26 | 16.71 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 6.25 | 67.37 | 16.65 | | 130.0 | |
| | | Z | 6.16 | 67.11 | 16.42 | | 130.0 | |
| 10640-AAA | IEEE 1602.11ac WiFi (160MHz, MCS4, 90pc duty cycle) | X | 6.05 | 67.22 | 16.62 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 6.27 | 67.44 | 16.63 | | 130.0 | |
| | | Z | 6.17 | 67.12 | 16.37 | | 130.0 | |
| 10641-AAA | IEEE 1602.11ac WiFi (160MHz, MCS5, 90pc duty cycle) | X | 6.13 | 67.23 | 16.65 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 6.27 | 67.20 | 16.53 | | 130.0 | |
| | | Z | 6.19 | 66.96 | 16.31 | | 130.0 | |
| 10642-AAA | IEEE 1602.11ac WiFi (160MHz, MCS6, 90pc duty cycle) | X | 6.16 | 67.45 | 16.94 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 6.34 | 67.53 | 16.85 | | 130.0 | |
| | | Z | 6.25 | 67.29 | 16.64 | | 130.0 | |
| 10643-AAA | IEEE 1602.11ac WiFi (160MHz, MCS7, 90pc duty cycle) | X | 6.00 | 67.14 | 16.67 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 6.17 | 67.21 | 16.60 | | 130.0 | |
| | | Z | 6.08 | 66.93 | 16.36 | | 130.0 | |
| 10644-AAA | IEEE 1602.11ac WiFi (160MHz, MCS8, 90pc duty cycle) | X | 6.08 | 67.39 | 16.82 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 6.38 | 67.85 | 16.95 | | 130.0 | |
| | | Z | 6.26 | 67.49 | 16.66 | | 130.0 | |
| 10645-AAA | IEEE 1602.11ac WiFi (160MHz, MCS9, 90pc duty cycle) | X | 6.23 | 67.50 | 16.83 | 0.46 | 130.0 | ± 9.6 % |
| | | Y | 6.74 | 68.44 | 17.18 | | 130.0 | |
| | | Z | 6.68 | 68.29 | 17.00 | | 130.0 | |
| 10646-AAB | LTE-TDD (SC-FDMA, 1 RB, 5 MHz, QPSK, UL Subframe=2,7) | X | 13.71 | 101.95 | 34.43 | 9.30 | 60.0 | ± 9.6 % |
| | | Y | 31.42 | 116.20 | 38.46 | | 60.0 | |
| | | Z | 15.59 | 99.47 | 32.52 | | 60.0 | |
| 10647-AAA | LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK, UL Subframe=2,7) | X | 12.18 | 100.02 | 33.95 | 9.30 | 60.0 | ± 9.6 % |
| | | Y | 30.06 | 116.00 | 38.55 | | 60.0 | |
| | | Z | 14.66 | 98.82 | 32.42 | | 60.0 | |
| 10648-AAA | CDMA2000 (1x Advanced) | X | 0.74 | 65.73 | 11.50 | 0.00 | 150.0 | ± 9.6 % |
| | | Y | 0.86 | 65.73 | 12.88 | | 150.0 | |
| | | Z | 0.73 | 63.45 | 11.13 | | 150.0 | |

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