Schmid & Partner Engineering AG

s p e a g

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# IMPORTANT NOTICE

## USAGE OF THE DAE4

The DAE unit is a delicate, high precision instrument and requires careful treatment by the user. There are no serviceable parts inside the DAE. Special attention shall be given to the following points:

**Battery Exchange**: The battery cover of the DAE4 unit is fixed using a screw, over tightening the screw may cause the threads inside the DAE to wear out.

**Shipping of the DAE**: Before shipping the DAE to SPEAG for calibration, remove the batteries and pack the DAE in an antistatic bag. This antistatic bag shall then be packed into a larger box or container which protects the DAE from impacts during transportation. The package shall be marked to indicate that a fragile instrument is inside.

**E-Stop Failures**: Touch detection may be malfunctioning due to broken magnets in the E-stop. Rough handling of the E-stop may lead to damage of these magnets. Touch and collision errors are often caused by dust and dirt accumulated in the E-stop. To prevent E-stop failure, the customer shall always mount the probe to the DAE carefully and keep the DAE unit in a non-dusty environment if not used for measurements.

**Repair**: Minor repairs are performed at no extra cost during the annual calibration. However, SPEAG reserves the right to charge for any repair especially if rough unprofessional handling caused the defect.

**DASY Configuration Files:** Since the exact values of the DAE input resistances, as measured during the calibration procedure of a DAE unit, are not used by the DASY software, a nominal value of 200 MOhm is given in the corresponding configuration file.

**Important Note:**
**Warranty and calibration is void if the DAE unit is disassembled partly or fully by the Customer.**

**Important Note:**
**Never attempt to grease or oil the E-stop assembly. Cleaning and readjusting of the E-stop assembly is allowed by certified SPEAG personnel only and is part of the annual calibration procedure.**

**Important Note:**
**To prevent damage of the DAE probe connector pins, use great care when installing the probe to the DAE. Carefully connect the probe with the connector notch oriented in the mating position. Avoid any rotational movement of the probe body versus the DAE while turning the locking nut of the connector. The same care shall be used when disconnecting the probe from the DAE.**

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

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

Accredited by the Swiss Accreditation Service (SAS)
**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** **Audix**
**New Taipei City, Taiwan**

**Certificate No: DAE4-1337_Mar23**

# CALIBRATION CERTIFICATE

| | |
|---|---|
| Object | DAE4 - SD 000 D04 BM - SN: 1337 |
| Calibration procedure(s) | QA CAL-06.v30<br>Calibration procedure for the data acquisition electronics (DAE) |
| Calibration date: | March 31, 2023 |

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 | 29-Aug-22 (No:34389) | Aug-23 |
| **Secondary Standards** | **ID #** | **Check Date (in house)** | **Scheduled Check** |
| Auto DAE Calibration Unit | SE UWS 053 AA 1001 | 27-Jan-23 (in house check) | In house check: Jan-24 |
| Calibrator Box V2.1 | SE UMS 006 AA 1002 | 27-Jan-23 (in house check) | In house check: Jan-24 |

| | Name | Function | Signature |
|---|---|---|---|
| Calibrated by: | Dominique Steffen | Laboratory Technician | |
| Approved by: | Sven Kühn | Technical Manager | i.V. |

Issued: March 31, 2023

## 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 = 6.1μV , 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** | 405.439 ± 0.02% (k=2) | 405.303 ± 0.02% (k=2) | 405.598 ± 0.02% (k=2) |
| **Low Range** | 3.97799 ± 1.50% (k=2) | 4.00789 ± 1.50% (k=2) | 4.02006 ± 1.50% (k=2) |

## Connector Angle

| | |
|---|---|
| **Connector Angle** to be used in DASY system | 8.5 ° ± 1 ° |

## Appendix (Additional assessments outside the scope of SCS0108)

### 1. DC Voltage Linearity

| High Range | | Reading (μV) | Difference (μV) | Error (%) |
|---|---|---|---|---|
| Channel X | + Input | 200036.17 | 0.51 | 0.00 |
| Channel X | + Input | 20008.38 | 2.33 | 0.01 |
| Channel X | - Input | -20004.15 | 1.92 | -0.01 |
| Channel Y | + Input | 200036.21 | 0.65 | 0.00 |
| Channel Y | + Input | 20005.95 | 0.02 | 0.00 |
| Channel Y | - Input | -20007.68 | -1.48 | 0.01 |
| Channel Z | + Input | 200036.32 | -1.74 | -0.00 |
| Channel Z | + Input | 20003.89 | -2.03 | -0.01 |
| Channel Z | - Input | -20007.63 | -1.42 | 0.01 |

| Low Range | | Reading (μV) | Difference (μV) | Error (%) |
|---|---|---|---|---|
| Channel X | + Input | 2001.21 | -0.16 | -0.01 |
| Channel X | + Input | 201.19 | -0.13 | -0.07 |
| Channel X | - Input | -198.81 | -0.34 | 0.17 |
| Channel Y | + Input | 2001.27 | -0.05 | -0.00 |
| Channel Y | + Input | 199.83 | -1.25 | -0.62 |
| Channel Y | - Input | -199.97 | -1.31 | 0.66 |
| Channel Z | + Input | 2001.54 | 0.15 | 0.01 |
| Channel Z | + Input | 199.98 | -1.19 | -0.59 |
| Channel Z | - Input | -200.04 | -1.38 | 0.69 |

### 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 | -7.96 | -10.51 |
| | - 200 | 11.58 | 9.36 |
| Channel Y | 200 | -14.19 | -14.56 |
| | - 200 | 12.27 | 11.91 |
| Channel Z | 200 | -0.26 | -0.39 |
| | - 200 | -1.40 | -1.63 |

### 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 | - | 0.62 | -3.50 |
| Channel Y | 200 | 7.30 | - | 3.13 |
| Channel Z | 200 | 9.34 | 4.24 | - |

## 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** | 16062 | 16212 |
| **Channel Y** | 16119 | 16326 |
| **Channel Z** | 16293 | 15908 |

## 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** | 0.35 | -0.85 | 1.37 | 0.34 |
| **Channel Y** | -1.02 | -2.00 | 0.28 | 0.40 |
| **Channel Z** | -0.62 | -1.58 | 0.19 | 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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**Accreditation No.: SCS 0108**

**Client** **Audix**
**New Taipei City**

**Certificate No.** **EX-3855_Sep23**

# CALIBRATION CERTIFICATE

| | |
|---|---|
| Object | EX3DV4 - SN:3855 |
| Calibration procedure(s) | QA CAL-01.v10, QA CAL-12.v10, QA CAL-14.v7, QA CAL-23.v6, QA CAL-25.v8<br>Calibration procedure for dosimetric E-field probes |
| Calibration date | September 20, 2023 |

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 NRP2 | SN: 104778 | 30-Mar-23 (No. 217-03804/03805) | Mar-24 |
| Power sensor NRP-Z91 | SN: 103244 | 30-Mar-23 (No. 217-03804) | Mar-24 |
| OCP DAK-3.5 (weighted) | SN: 1249 | 20-Oct-22 (OCP-DAK3.5-1249_Oct22) | Oct-23 |
| OCP DAK-12 | SN: 1016 | 20-Oct-22 (OCP-DAK12-1016_Oct22) | Oct-23 |
| Reference 20 dB Attenuator | SN: CC2552 (20x) | 30-Mar-23 (No. 217-03809) | Mar-24 |
| DAE4 | SN: 660 | 16-Mar-23 (No. DAE4-660_Mar23) | Mar-24 |
| Reference Probe ES3DV2 | SN: 3013 | 06-Jan-23 (No. ES3-3013_Jan23) | Jan-24 |

| Secondary Standards | ID | Check Date (in house) | Scheduled Check |
|---|---|---|---|
| Power meter E4419B | SN: GB41293874 | 06-Apr-16 (in house check Jun-22) | In house check: Jun-24 |
| Power sensor E4412A | SN: MY41498087 | 06-Apr-16 (in house check Jun-22) | In house check: Jun-24 |
| Power sensor E4412A | SN: 000110210 | 06-Apr-16 (in house check Jun-22) | In house check: Jun-24 |
| RF generator HP 8648C | SN: US3642U01700 | 04-Aug-99 (in house check Jun-22) | In house check: Jun-24 |
| Network Analyzer E8358A | SN: US41080477 | 31-Mar-14 (in house check Oct-22) | In house check: Oct-24 |

| | Name | Function | Signature |
|---|---|---|---|
| Calibrated by | Aidonia Georgiadou | Laboratory Technician | |
| Approved by | Sven Kühn | Technical Manager | |

Issued: September 21, 2023

## Glossary

| | |
|---|---|
| TSL | tissue simulating liquid |
| NORMx,y,z | sensitivity in free space |
| ConvF | sensitivity in TSL / NORMx,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 $\varphi$ | $\varphi$ rotation around probe axis |
| Polarization $\vartheta$ | $\vartheta$ rotation around an axis that is in the plane normal to probe axis (at measurement center), 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:

a) IEC/IEEE 62209-1528, "Measurement Procedure For The Assessment Of Specific Absorption Rate Of Human Exposure To Radio Frequency Fields From Hand-Held And Body-Worn Wireless Communication Devices – Part 1528: Human Models, Instrumentation And Procedures (Frequency Range of 4 MHz to 10 GHz)", October 2020.
b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

## Methods Applied and Interpretation of Parameters:

- *NORMx,y,z*: Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not affect the $E^2$-field uncertainty inside TSL (see below *ConvF*).
- *NORM(f)x,y,z = NORMx,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.
- *DCPx,y,z*: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal. 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 $f \leq 800$ 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 *NORMx,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 *NORMx* (no uncertainty required).

# Parameters of Probe: EX3DV4 - SN:3855

## Basic Calibration Parameters

| | Sensor X | Sensor Y | Sensor Z | Unc ($k = 2$) |
|---|---|---|---|---|
| Norm ($\mu$V/(V/m)$^2$) [A] | 0.47 | 0.17 | 0.12 | ±10.1% |
| DCP (mV) [B] | 98.9 | 93.7 | 94.7 | ±4.7% |

## Calibration Results for Modulation Response

| UID | Communication System Name | | A dB | B $dB\sqrt{\mu V}$ | C | D dB | VR mV | Max dev. | Max Unc[E] $k = 2$ |
|---|---|---|---|---|---|---|---|---|---|
| 0 | CW | X | 0.00 | 0.00 | 1.00 | 0.00 | 132.5 | ±2.8% | ±4.7% |
| | | Y | 0.00 | 0.00 | 1.00 | | 137.8 | | |
| | | Z | 0.00 | 0.00 | 1.00 | | 120.7 | | |
| 10352 | Pulse Waveform (200Hz, 10%) | X | 1.99 | 63.38 | 8.38 | 10.00 | 60.0 | ±3.6% | ±9.6% |
| | | Y | 4.00 | 69.91 | 12.84 | | 60.0 | | |
| | | Z | 3.52 | 68.86 | 12.22 | | 60.0 | | |
| 10353 | Pulse Waveform (200Hz, 20%) | X | 0.82 | 60.00 | 5.87 | 6.99 | 80.0 | ±2.5% | ±9.6% |
| | | Y | 2.19 | 67.57 | 10.67 | | 80.0 | | |
| | | Z | 2.04 | 67.08 | 10.19 | | 80.0 | | |
| 10354 | Pulse Waveform (200Hz, 40%) | X | 0.48 | 60.00 | 4.81 | 3.98 | 95.0 | ±1.5% | ±9.6% |
| | | Y | 0.49 | 60.15 | 5.64 | | 95.0 | | |
| | | Z | 0.52 | 60.67 | 5.53 | | 95.0 | | |
| 10355 | Pulse Waveform (200Hz, 60%) | X | 0.28 | 60.00 | 3.99 | 2.22 | 120.0 | ±2.3% | ±9.6% |
| | | Y | 9.25 | 158.86 | 4.68 | | 120.0 | | |
| | | Z | 6.13 | 78.14 | 3.43 | | 120.0 | | |
| 10387 | QPSK Waveform, 1 MHz | X | 1.65 | 67.92 | 15.41 | 1.00 | 150.0 | ±2.7% | ±9.6% |
| | | Y | 1.50 | 64.07 | 13.80 | | 150.0 | | |
| | | Z | 1.54 | 64.52 | 14.20 | | 150.0 | | |
| 10388 | QPSK Waveform, 10 MHz | X | 2.19 | 68.69 | 16.13 | 0.00 | 150.0 | ±1.0% | ±9.6% |
| | | Y | 2.02 | 66.25 | 14.60 | | 150.0 | | |
| | | Z | 2.25 | 67.99 | 15.48 | | 150.0 | | |
| 10396 | 64-QAM Waveform, 100 kHz | X | 2.27 | 67.60 | 17.54 | 3.01 | 150.0 | ±0.8% | ±9.6% |
| | | Y | 2.64 | 68.18 | 17.68 | | 150.0 | | |
| | | Z | 2.54 | 67.87 | 17.52 | | 150.0 | | |
| 10399 | 64-QAM Waveform, 40 MHz | X | 3.48 | 67.43 | 16.00 | 0.00 | 150.0 | ±4.1% | ±9.6% |
| | | Y | 3.35 | 66.02 | 15.22 | | 150.0 | | |
| | | Z | 3.55 | 67.08 | 15.78 | | 150.0 | | |
| 10414 | WLAN CCDF, 64-QAM, 40 MHz | X | 4.77 | 65.94 | 15.76 | 0.00 | 150.0 | ±6.6% | ±9.6% |
| | | Y | 4.60 | 64.13 | 14.88 | | 150.0 | | |
| | | Z | 4.81 | 64.93 | 15.32 | | 150.0 | | |

Note: For details on UID parameters see Appendix

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

[A] The uncertainties of Norm X,Y,Z do not affect the $E^2$-field uncertainty inside TSL (see Pages 5 and 6).
[B] Linearization parameter uncertainty for maximum specified field strength.
[E] Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

# Parameters of Probe: EX3DV4 - SN:3855

## Sensor Model Parameters

| | C1 fF | C2 fF | $\alpha$ $V^{-1}$ | T1 $ms V^{-2}$ | T2 $ms V^{-1}$ | T3 ms | T4 $V^{-2}$ | T5 $V^{-1}$ | T6 |
|---|---|---|---|---|---|---|---|---|---|
| x | 35.3 | 265.70 | 36.15 | 7.18 | 0.00 | 4.98 | 0.34 | 0.23 | 1.00 |
| y | 56.0 | 450.28 | 40.47 | 4.78 | 0.61 | 5.06 | 0.08 | 0.52 | 1.01 |
| z | 57.9 | 463.16 | 40.13 | 4.18 | 0.47 | 5.06 | 0.00 | 0.50 | 1.01 |

## Other Probe Parameters

| | |
|---|---|
| Sensor Arrangement | Triangular |
| Connector Angle | 22.2° |
| 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 |

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

# Parameters of Probe: EX3DV4 - SN:3855

## Calibration Parameter Determined in Head Tissue Simulating Media

| f (MHz)[C] | Relative Permittivity[F] | Conductivity[F] (S/m) | ConvF X | ConvF Y | ConvF Z | Alpha[G] | Depth[G] (mm) | Unc ($k = 2$) |
|---|---|---|---|---|---|---|---|---|
| 750 | 41.9 | 0.89 | 10.03 | 10.52 | 10.27 | 0.36 | 1.27 | ±12.0% |
| 835 | 41.5 | 0.90 | 10.43 | 10.01 | 9.78 | 0.36 | 1.27 | ±12.0% |
| 900 | 41.5 | 0.97 | 9.44 | 9.53 | 9.87 | 0.36 | 1.27 | ±12.0% |
| 1450 | 40.5 | 1.20 | 8.30 | 8.06 | 9.08 | 0.46 | 1.27 | ±12.0% |
| 1750 | 40.1 | 1.37 | 8.61 | 8.95 | 9.39 | 0.27 | 1.27 | ±12.0% |
| 1900 | 40.0 | 1.40 | 8.48 | 8.80 | 9.25 | 0.28 | 1.27 | ±12.0% |
| 2000 | 40.0 | 1.40 | 8.07 | 8.36 | 8.79 | 0.29 | 1.27 | ±12.0% |
| 2450 | 39.2 | 1.80 | 7.95 | 8.18 | 8.57 | 0.29 | 1.27 | ±12.0% |
| 2600 | 39.0 | 1.96 | 7.67 | 7.96 | 8.31 | 0.28 | 1.27 | ±12.0% |
| 3300 | 38.2 | 2.71 | 6.74 | 7.10 | 7.43 | 0.33 | 1.27 | ±14.0% |
| 3500 | 37.9 | 2.91 | 6.57 | 6.94 | 7.23 | 0.34 | 1.27 | ±14.0% |
| 3700 | 37.7 | 3.12 | 6.17 | 6.51 | 6.79 | 0.34 | 1.27 | ±14.0% |
| 3900 | 37.5 | 3.32 | 6.42 | 6.76 | 7.05 | 0.36 | 1.27 | ±14.0% |
| 4100 | 37.2 | 3.53 | 6.25 | 6.59 | 6.87 | 0.36 | 1.27 | ±14.0% |
| 5200 | 36.0 | 4.66 | 5.34 | 5.70 | 5.93 | 0.33 | 1.60 | ±14.0% |
| 5300 | 35.9 | 4.76 | 5.27 | 5.58 | 5.79 | 0.33 | 1.63 | ±14.0% |
| 5500 | 35.6 | 4.96 | 4.77 | 5.07 | 5.33 | 0.36 | 1.70 | ±14.0% |
| 5600 | 35.5 | 5.07 | 4.62 | 4.94 | 5.21 | 0.34 | 1.75 | ±14.0% |
| 5800 | 35.3 | 5.27 | 4.69 | 5.04 | 5.24 | 0.33 | 1.86 | ±14.0% |

[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. Validity of ConvF assessed at 6 MHz is 4–9 MHz, and ConvF assessed at 13 MHz is 9–19 MHz. Above 5 GHz frequency validity can be extended to ±110 MHz.
[F] The probes are calibrated using tissue simulating liquids (TSL) that deviate for $\varepsilon$ and $\sigma$ by less than ±5% from the target values (typically better than ±3%) and are valid for TSL with deviations of up to ±10%. If TSL with deviations from the target of less than ±5% are used, the calibration uncertainties are 11.1% for 0.7 - 3 GHz and 13.1% for 3 - 6 GHz.
[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.

# Parameters of Probe: EX3DV4 - SN:3855

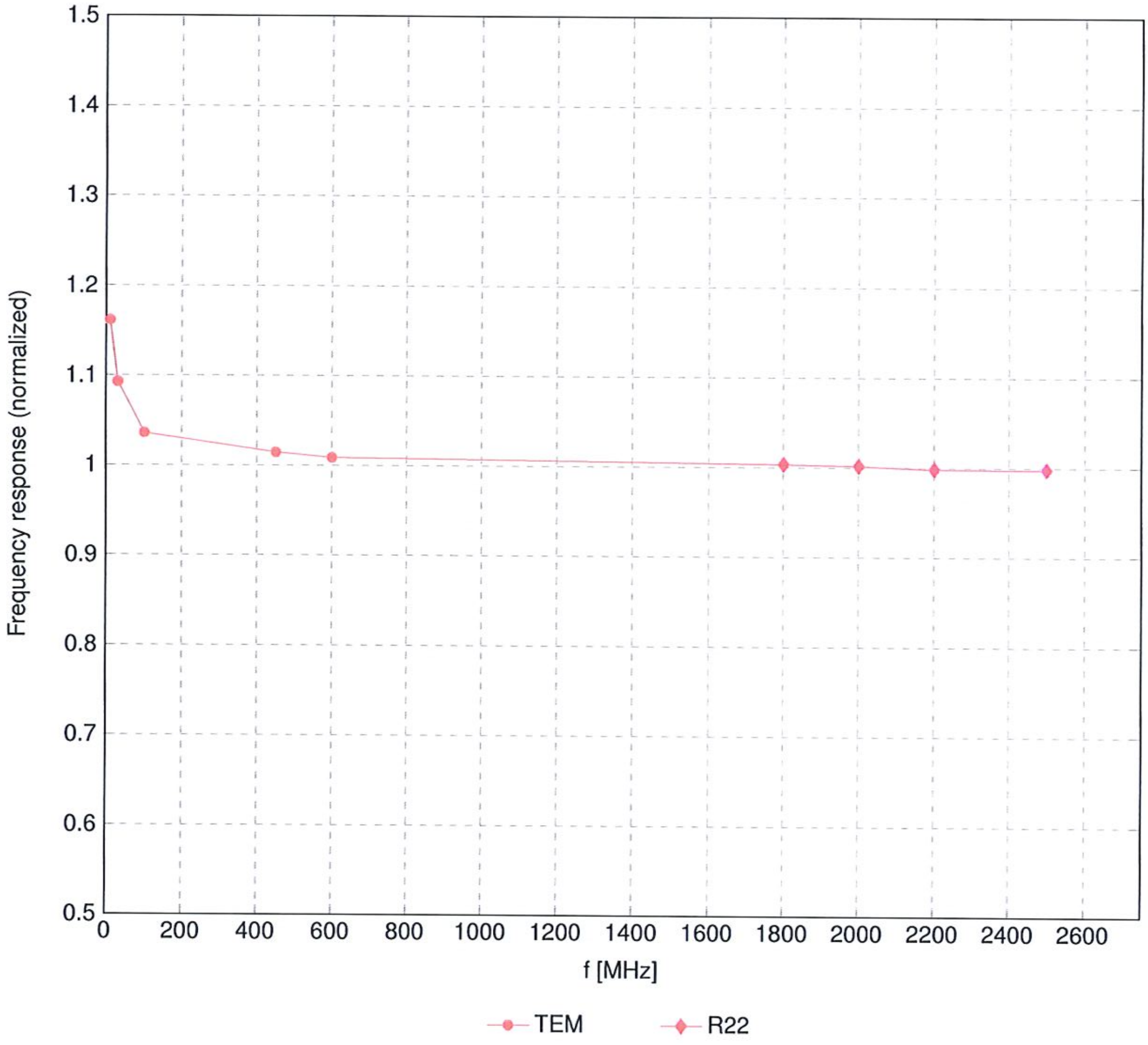
## Calibration Parameter Determined in Head Tissue Simulating Media

| f (MHz)[C] | Relative Permittivity[F] | Conductivity[F] (S/m) | ConvF X | ConvF Y | ConvF Z | Alpha[G] | Depth[G] (mm) | Unc ($k = 2$) |
|---|---|---|---|---|---|---|---|---|
| 6500 | 34.5 | 6.07 | 5.25 | 5.72 | 5.91 | 0.20 | 2.50 | ±18.6% |

[C] Frequency validity at 6.5 GHz is −600/+700 MHz, and ±700 MHz at or above 7 GHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[F] The probes are calibrated using tissue simulating liquids (TSL) that deviate for $\varepsilon$ and $\sigma$ by less than ±10% from the target values (typically better than ±6%) and are valid for TSL with deviations of up to ±10%.
[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; below ±2% for frequencies between 3–6 GHz; and below ±4% for frequencies between 6–10 GHz at any distance larger than half the probe tip diameter from the boundary.

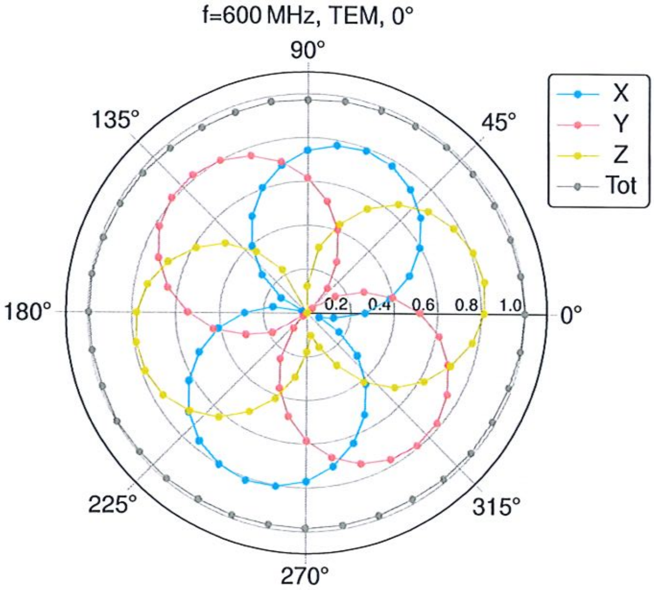
## Frequency Response of E-Field

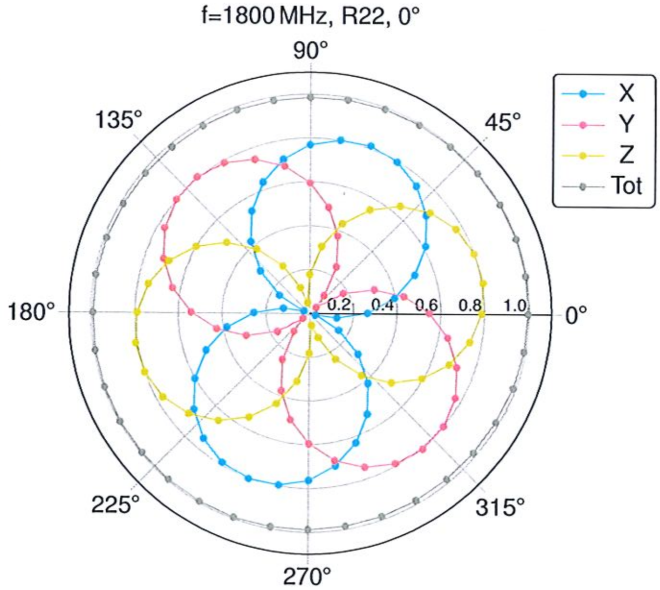
**(TEM-Cell:ifi110 EXX, Waveguide:R22)**

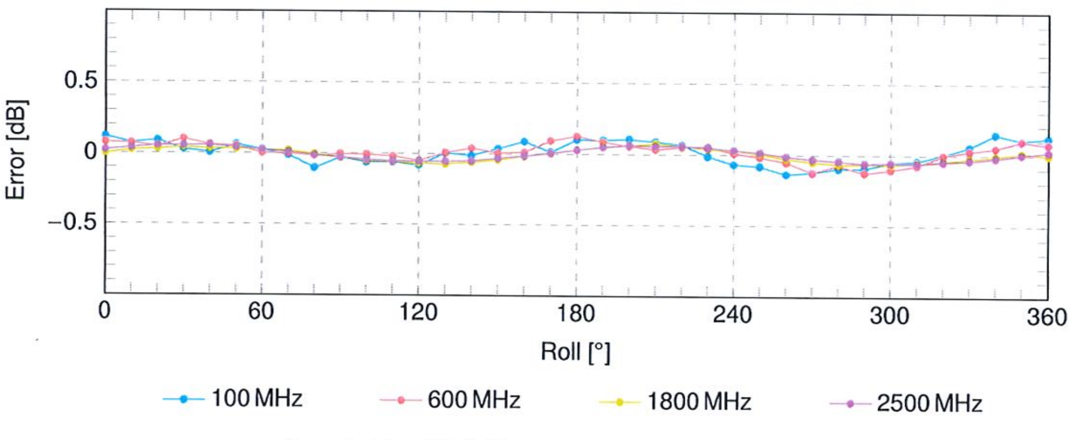



Uncertainty of Frequency Response of E-field: ±6.3% (k=2)

## Receiving Pattern ($\phi$), $\vartheta = 0°$



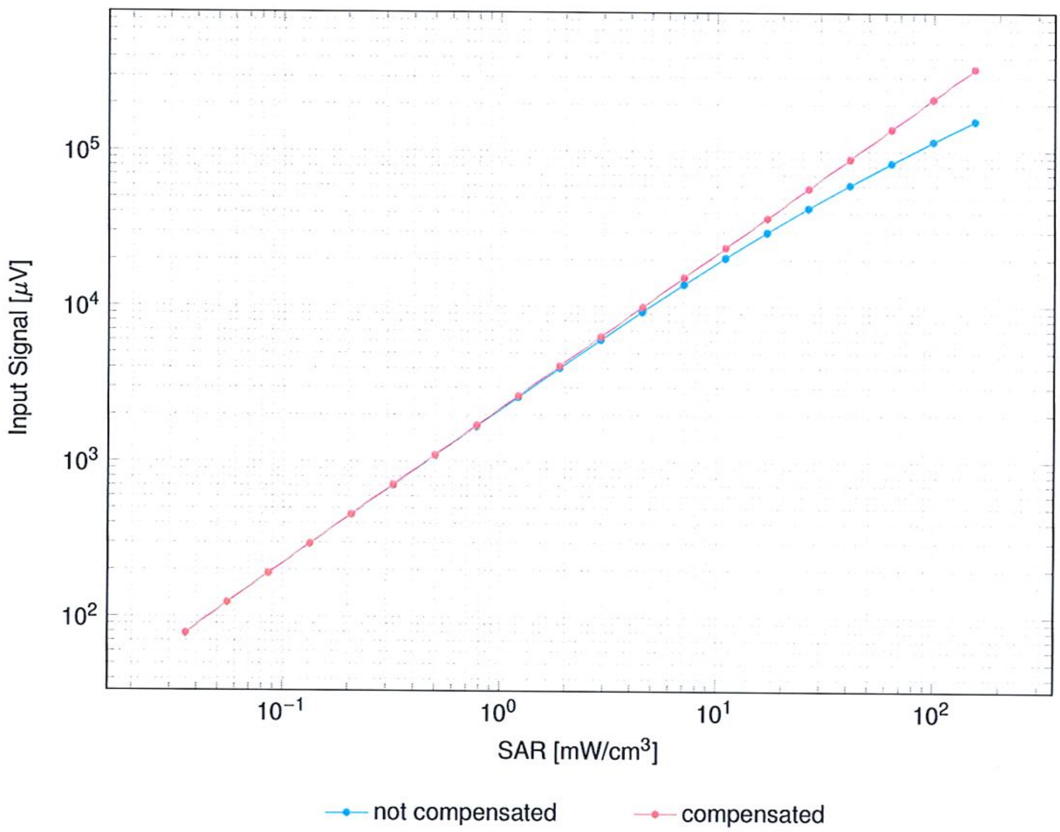



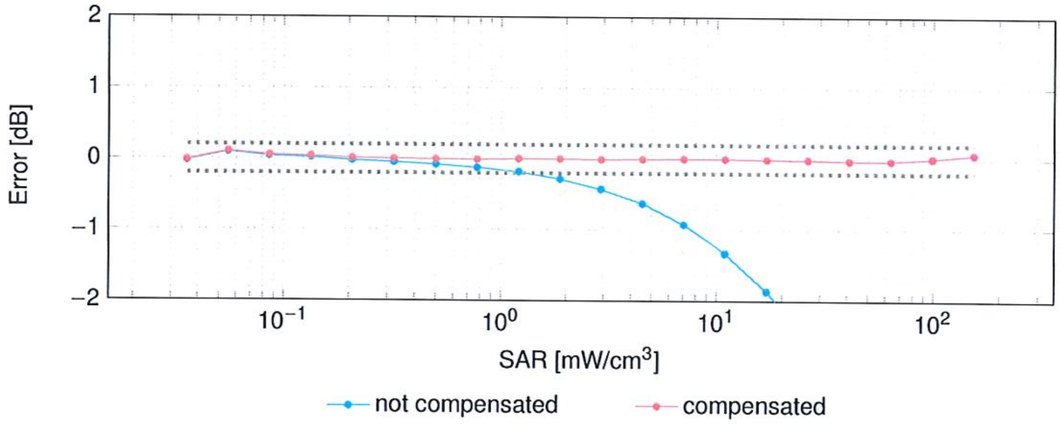




Uncertainty of Axial Isotropy Assessment: ±0.5% (k=2)

## Dynamic Range f($SAR_{head}$)

(TEM cell, $f_{eval} = 1900$ MHz)




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