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Accreditation No.: **SCS 0108**

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**Glossary:**

NORM <sub>x,y,z</sub>	sensitivity in free space
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C, D	modulation dependent linearization parameters
En	incident E-field orientation normal to probe axis
Ep	incident E-field orientation parallel to probe axis
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 1309-2005, " IEEE Standard for calibration of electromagnetic field sensors and probes, excluding antennas, from 9 kHz to 40 GHz", December 2005
- b) CTIA Test Plan for Hearing Aid Compatibility, Rev 3.1.1, May 2017

**Methods Applied and Interpretation of Parameters:**

- *NORM<sub>x,y,z</sub>*: Assessed for E-field polarization ϑ = 0 for XY sensors and ϑ = 90 for Z sensor (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide).
- *NORM(f)<sub>x,y,z</sub>* = *NORM<sub>x,y,z</sub>* \* *frequency\_response* (see Frequency Response Chart).
- *DCP<sub>x,y,z</sub>*: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- *PAR*: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- *A<sub>x,y,z</sub>*; *B<sub>x,y,z</sub>*; *C<sub>x,y,z</sub>*; *D<sub>x,y,z</sub>*; *VR<sub>x,y,z</sub>*; *A, B, C, D* are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. *VR* is the maximum calibration range expressed in RMS voltage across the diode.
- *Spherical isotropy (3D deviation from isotropy)*: in a locally homogeneous field realized using an open waveguide setup.
- *Sensor Offset*: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- *Connector Angle*: The angle is assessed using the information gained by determining the *NORM<sub>x</sub>* (no uncertainty required).

# DASY/EASY - Parameters of Probe: ER3DV6 - SN:2368

## Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ( $\mu\text{V}/(\text{V}/\text{m})^2$ )	1.71	1.62	1.82	$\pm 10.1\%$
DCP (mV) <sup>B</sup>	98.5	100.0	102.3	

## Calibration results for Frequency Response (30 MHz – 3 GHz)

Frequency MHz	Target E-Field V/m	Measured E-field (En) V/m	Deviation E-normal in %	Measured E-field (Ep) V/m	Deviation E-normal in %	Unc (k=2) %
30	77.1	76.4	-1.0%	77.3	0.3%	$\pm 5.1\%$
100	77.1	78.5	1.9%	77.8	0.9%	$\pm 5.1\%$
450	77.2	78.7	2.0%	77.9	1.0%	$\pm 5.1\%$
600	77.1	78.4	1.6%	77.7	0.7%	$\pm 5.1\%$
750	77.1	78.2	1.5%	77.8	0.9%	$\pm 5.1\%$
1800	142.9	141.4	-1.0%	140.9	-1.5%	$\pm 5.1\%$
2000	135.1	134.2	-0.7%	133.5	-1.2%	$\pm 5.1\%$
2200	127.6	125.8	-1.4%	127.2	-0.3%	$\pm 5.1\%$
2500	125.4	125.6	0.2%	127.1	1.4%	$\pm 5.1\%$
3000	79.4	77.9	-1.8%	80.9	2.0%	$\pm 5.1\%$

## Calibration Results for Modulation Response

UID	Communication System Name		A dB	B dB $\sqrt{\mu\text{V}}$	C	D dB	VR mV	Max dev.	Unc <sup>E</sup> (k=2)
0	CW	X	0.0	0.0	1.0	0.00	166.4	$\pm 3.0\%$	$\pm 4.7\%$
		Y	0.0	0.0	1.0		199.3		
		Z	0.0	0.0	1.0		204.0		
10021-DAC	GSM-FDD (TDMA, GMSK)	X	20.94	99.5	28.1	9.39	136.2	$\pm 2.2\%$	$\pm 4.7\%$
		Y	8.73	84.8	23.0		114.6		
		Z	26.26	99.6	28.0		146.5		
10172-CAG	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	7.82	75.6	27.3	9.21	106.2	$\pm 3.8\%$	$\pm 4.7\%$
		Y	9.12	81.0	30.1		130.7		
		Z	11.49	85.4	31.1		145.0		
10173-CAG	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM)	X	8.29	76.5	27.8	9.48	105.5	$\pm 3.8\%$	$\pm 4.7\%$
		Y	9.50	81.4	30.3		130.8		
		Z	12.51	87.3	32.1		145.8		

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%.

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

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

## DASY/EASY - Parameters of Probe: ER3DV6 - SN:2368

### Sensor Frequency Model Parameters

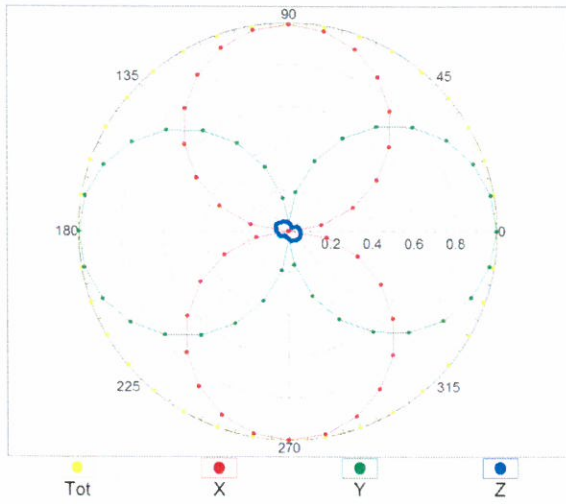
	Sensor X	Sensor Y	Sensor Z
Frequency Corr. (LF)	-1.72	-1.37	0.42
Frequency Corr. (HF)	0.00	0.00	0.00

### Other Probe Parameters

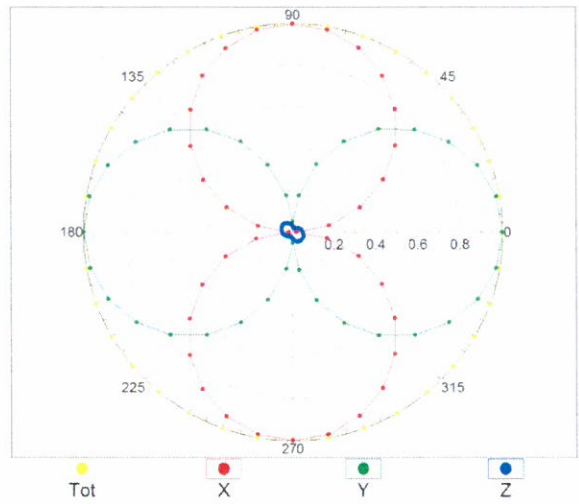
Sensor Arrangement	Rectangular
Connector Angle (°)	-67
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	8 mm
Probe Tip to Sensor X Calibration Point	2.5 mm
Probe Tip to Sensor Y Calibration Point	2.5 mm
Probe Tip to Sensor Z Calibration Point	2.5 mm

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

f=600 MHz, TEM,  $0^\circ$

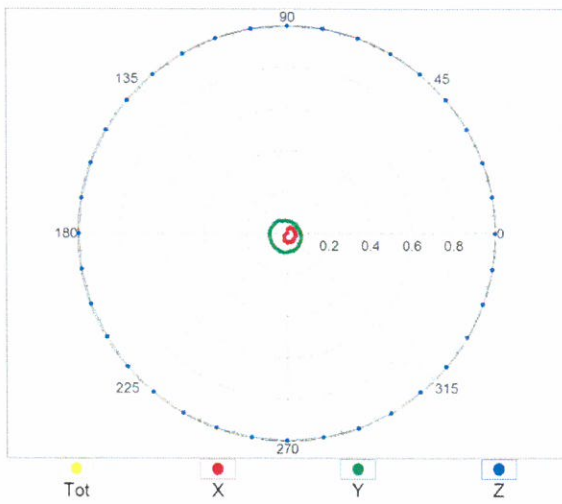


f=2500 MHz, R22,  $0^\circ$

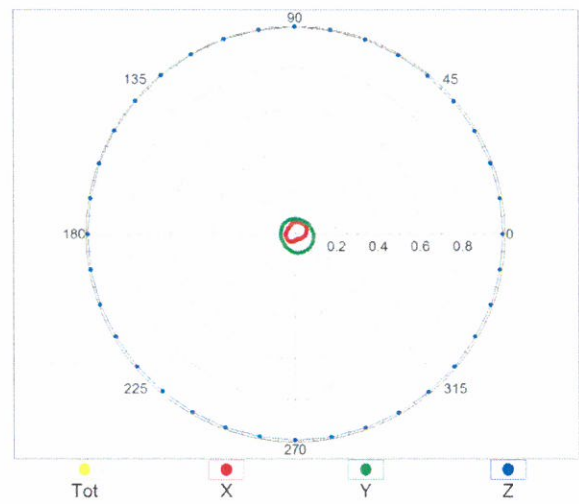


### Receiving Pattern ( $\phi$ ), $\vartheta = 90^\circ$

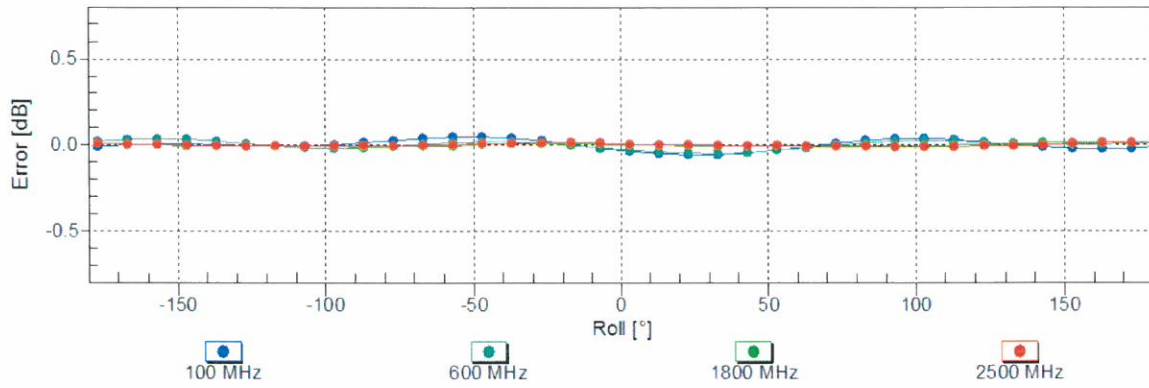
f=600 MHz, TEM,  $90^\circ$



f=2500 MHz, R22,  $90^\circ$

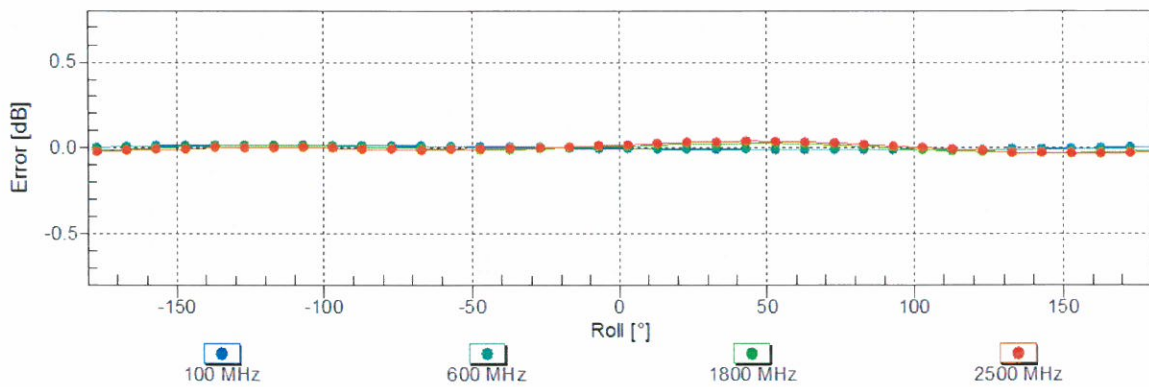


### Receiving Pattern ( $\phi$ ), $\vartheta = 0^\circ$



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

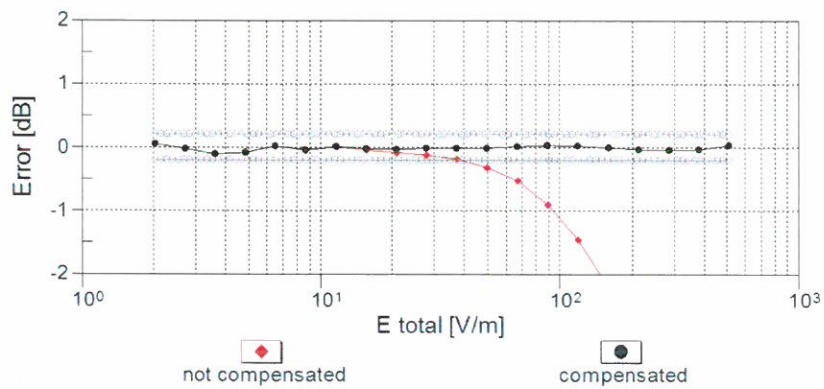
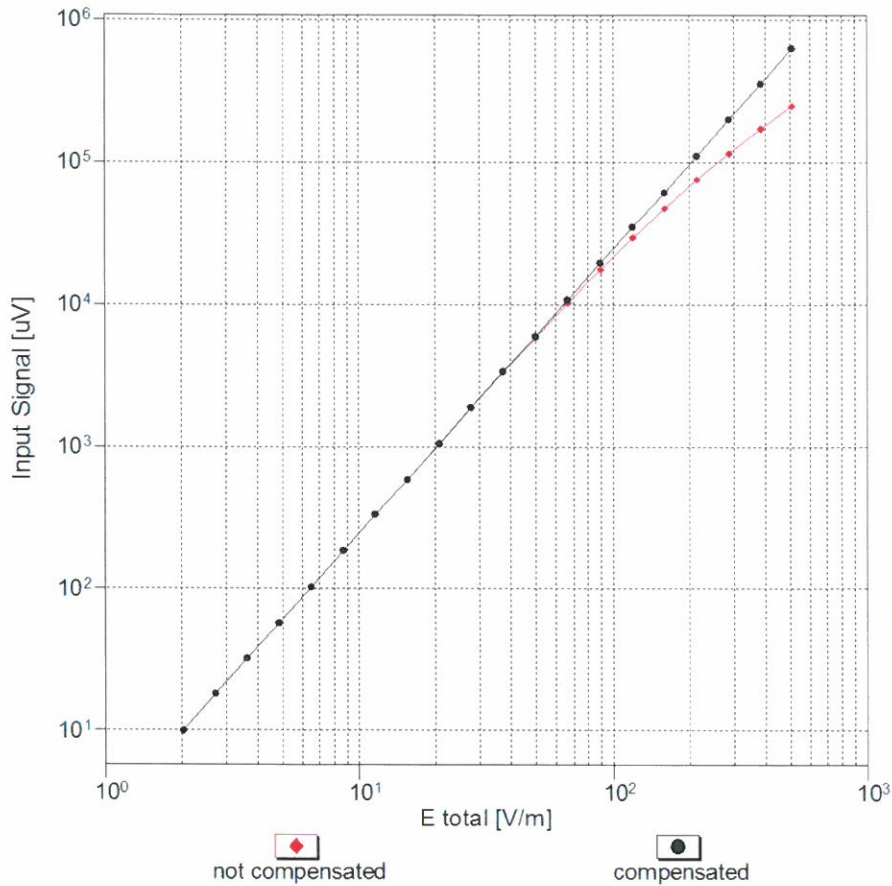
### Receiving Pattern ( $\phi$ ), $\vartheta = 90^\circ$



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



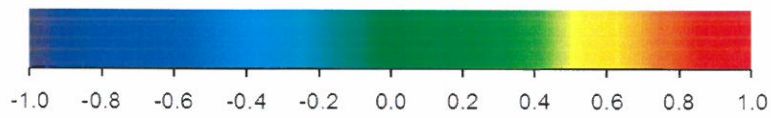
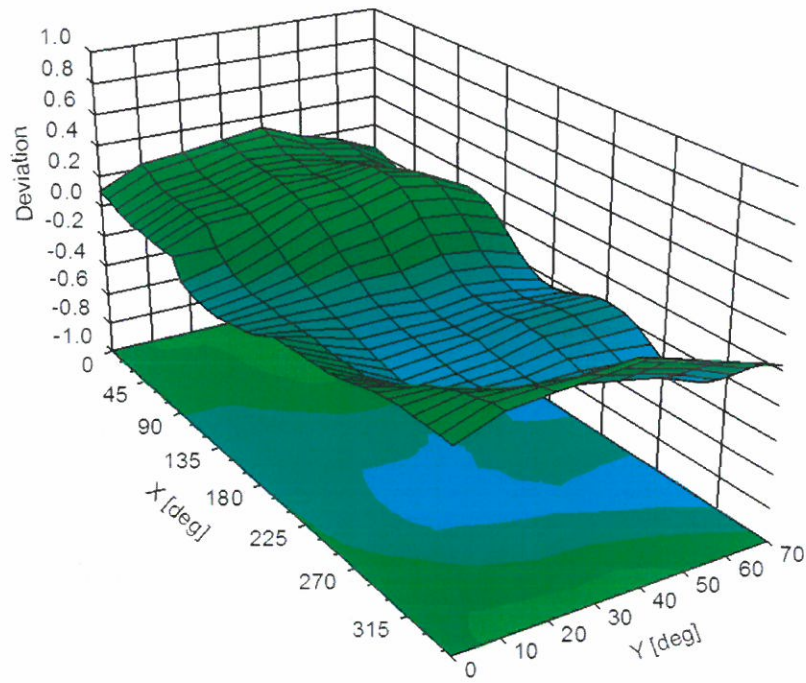
### Dynamic Range f(E-field) (TEM cell, f = 900 MHz)



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

# Deviation from Isotropy in Air

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



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