



Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 0108**

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Multilateral Agreement for the recognition of calibration certificates

Glossary:

NORM _{x,y,z}	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
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:

- 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 3.0, November 2013

Methods Applied and Interpretation of Parameters:

- *NORM_{x,y,z}*: Assessed for E-field polarization $\vartheta = 0$ for XY sensors and $\vartheta = 90$ for Z sensor ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide).
- *NORM(f)_{x,y,z}* = *NORM_{x,y,z}* * *frequency_response* (see Frequency Response Chart).
- *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.
- *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_x* (no uncertainty required).

Probe ER3DV6

SN:2480

Manufactured: March 31, 2009
Calibrated: January 11, 2016

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

DASY/EASY - Parameters of Probe: ER3DV6 - SN:2480

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu\text{V}/(\text{V}/\text{m})^2$)	2.03	1.47	1.80	$\pm 10.1\%$
DCP (mV) ^B	99.6	100.7	102.8	

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	169.2	$\pm 3.5\%$
		Y	0.0	0.0	1.0		151.7	
		Z	0.0	0.0	1.0		149.9	
10011-CAB	UMTS-FDD (WCDMA)	X	3.23	66.6	18.6	2.91	133.8	$\pm 0.5\%$
		Y	3.14	66.0	18.1		118.8	
		Z	3.15	66.5	18.4		117.3	
10012-CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps)	X	2.83	68.0	18.7	1.87	138.0	$\pm 0.5\%$
		Y	2.53	66.2	17.7		120.7	
		Z	2.97	69.3	19.2		119.2	
10021-DAB	GSM-FDD (TDMA, GMSK)	X	19.16	100.0	28.8	9.39	136.6	$\pm 1.7\%$
		Y	10.83	93.6	26.2		145.8	
		Z	23.29	99.5	27.8		125.7	
10039-CAB	CDMA2000 (1xRTT, RC1)	X	4.86	67.2	19.5	4.57	138.9	$\pm 0.9\%$
		Y	4.59	66.3	18.9		117.4	
		Z	4.43	65.7	18.6		110.4	
10081-CAB	CDMA2000 (1xRTT, RC3)	X	3.98	66.4	19.0	3.97	134.1	$\pm 0.7\%$
		Y	3.76	65.4	18.2		115.1	
		Z	3.77	65.7	18.4		114.2	
10100-CAB	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	6.33	67.4	20.1	5.67	109.7	$\pm 1.9\%$
		Y	6.39	67.7	20.1		130.3	
		Z	6.29	67.3	19.7		130.0	
10108-CAC	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	6.15	66.6	19.6	5.80	108.4	$\pm 1.2\%$
		Y	6.29	67.4	20.0		128.1	
		Z	6.19	67.0	19.7		127.8	
10154-CAC	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	6.35	68.3	20.8	5.75	147.4	$\pm 2.5\%$
		Y	5.95	66.8	19.7		125.0	
		Z	5.84	66.4	19.4		125.4	
10169-CAB	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	5.12	66.8	20.0	5.73	130.1	$\pm 1.4\%$
		Y	4.87	66.4	19.7		110.1	
		Z	4.87	66.0	19.4		111.5	

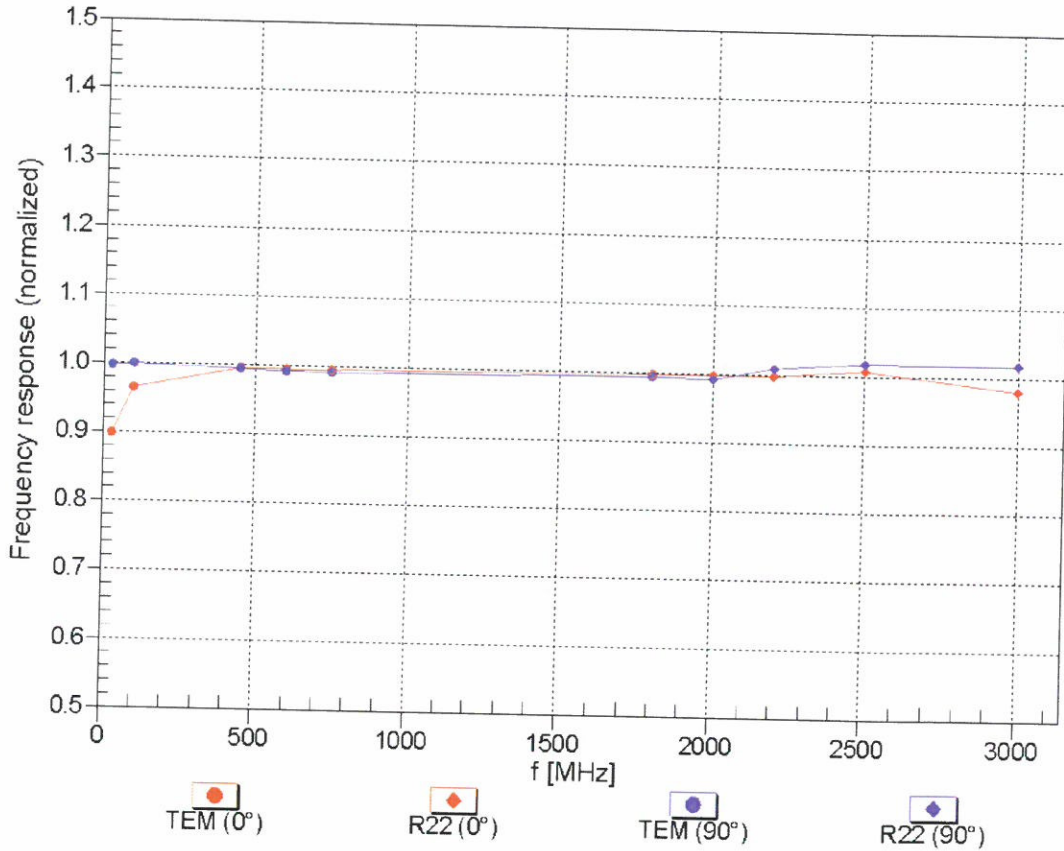
10175-CAC	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	5.14	67.0	20.1	5.72	130.0	±1.4 %
		Y	4.82	66.1	19.5		110.1	
		Z	4.87	66.0	19.4		110.8	
10295-AAB	CDMA2000, RC1, SO3, 1/8th Rate 25 fr.	X	15.70	99.1	40.5	12.49	120.8	±2.5 %
		Y	9.83	87.4	36.2		89.3	
		Z	16.94	99.2	39.3		108.4	
10297-AAA	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	6.22	66.9	19.9	5.81	108.1	±1.9 %
		Y	6.28	67.4	20.0		128.1	
		Z	6.21	67.0	19.8		129.1	

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%.

^B Numerical linearization parameter: uncertainty not required.

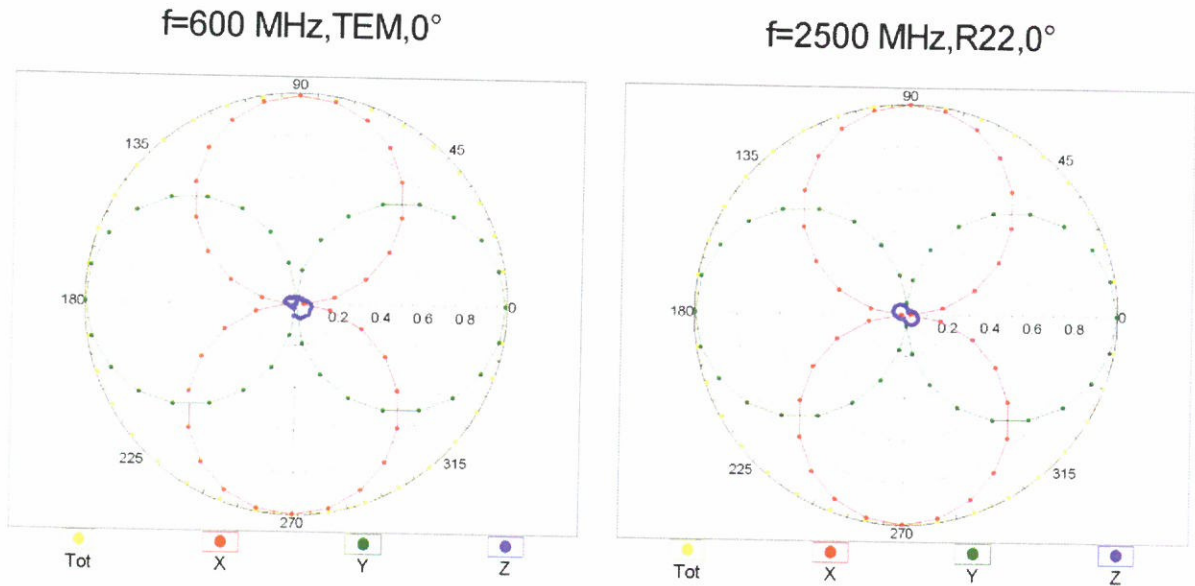
^E Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

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

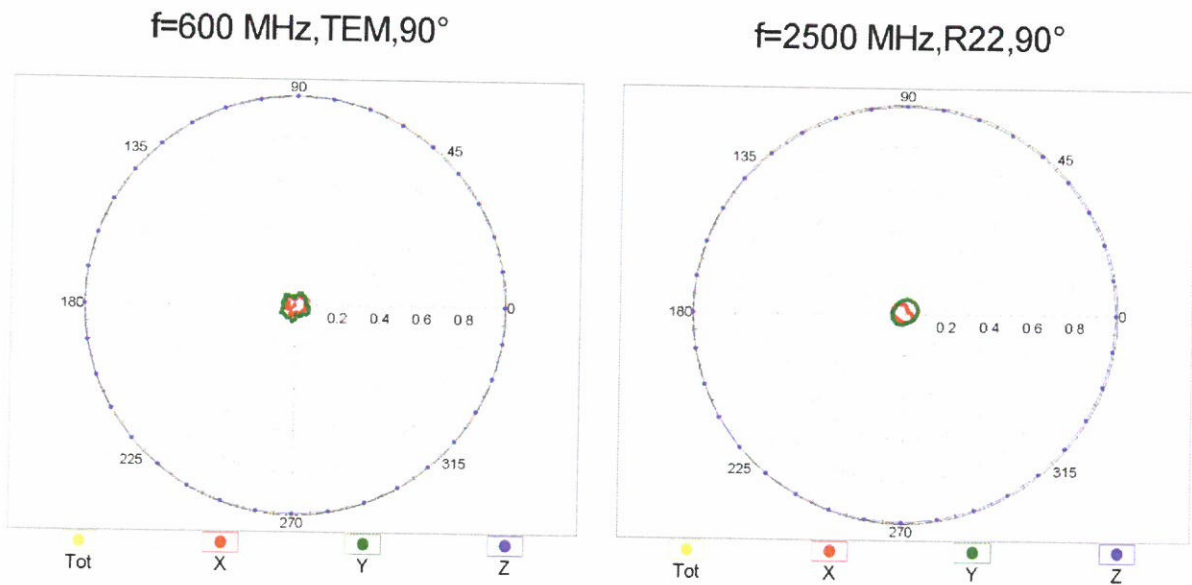


Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ (k=2)

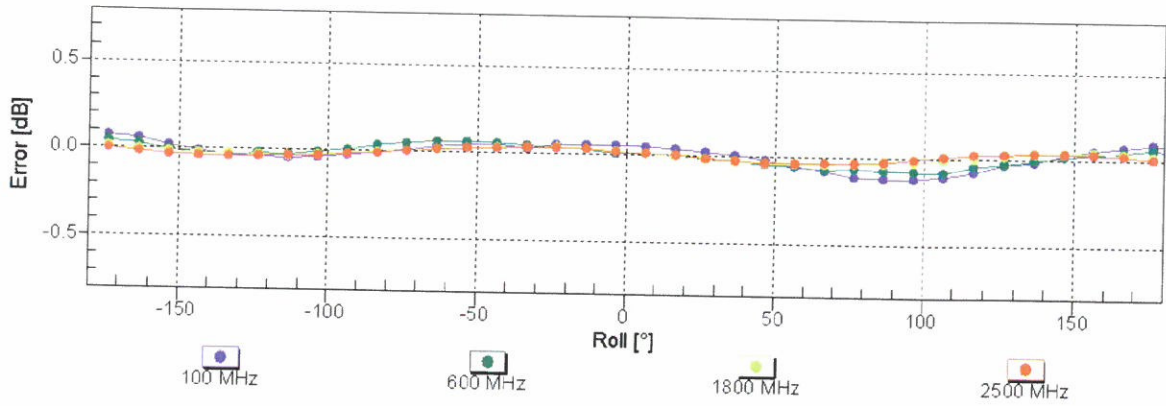
Receiving Pattern (ϕ), $\vartheta = 0^\circ$



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

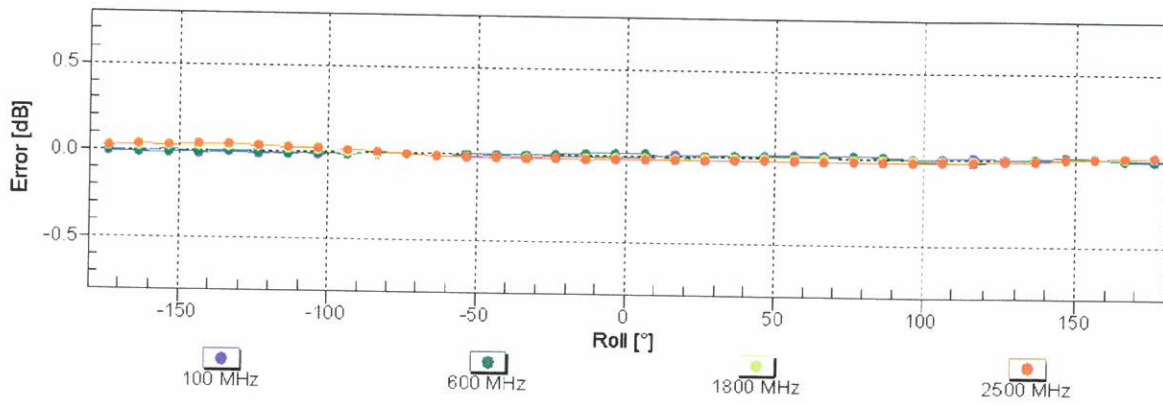


Receiving Pattern (ϕ), $\vartheta = 0^\circ$



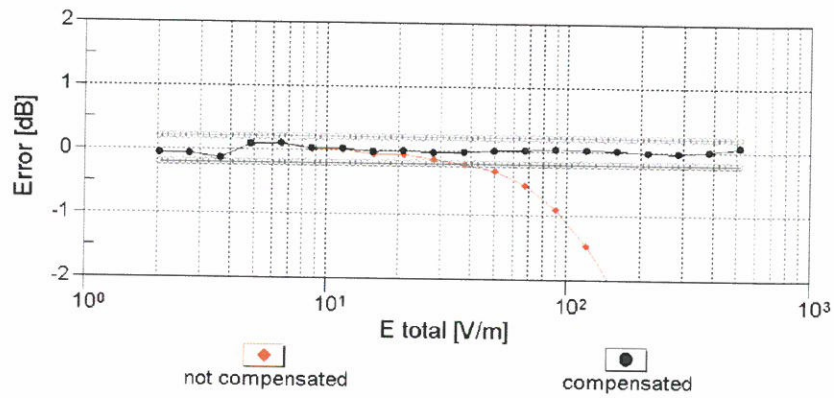
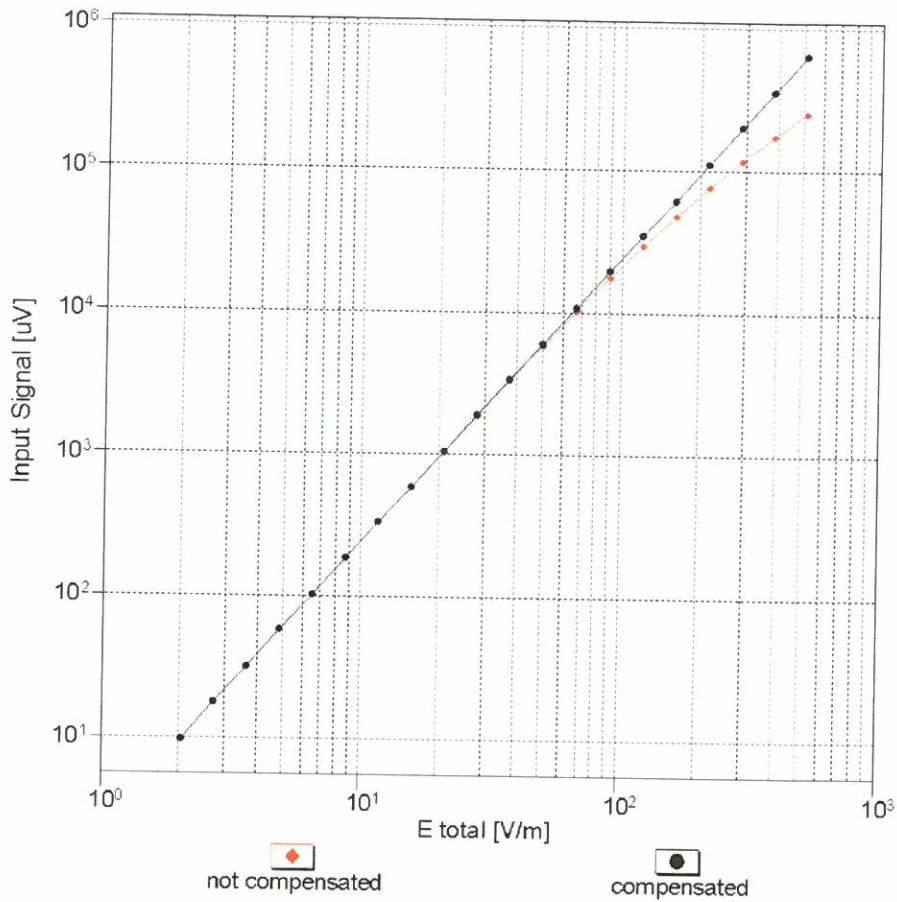
Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ ($k=2$)

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



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

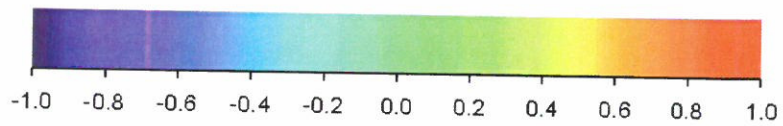
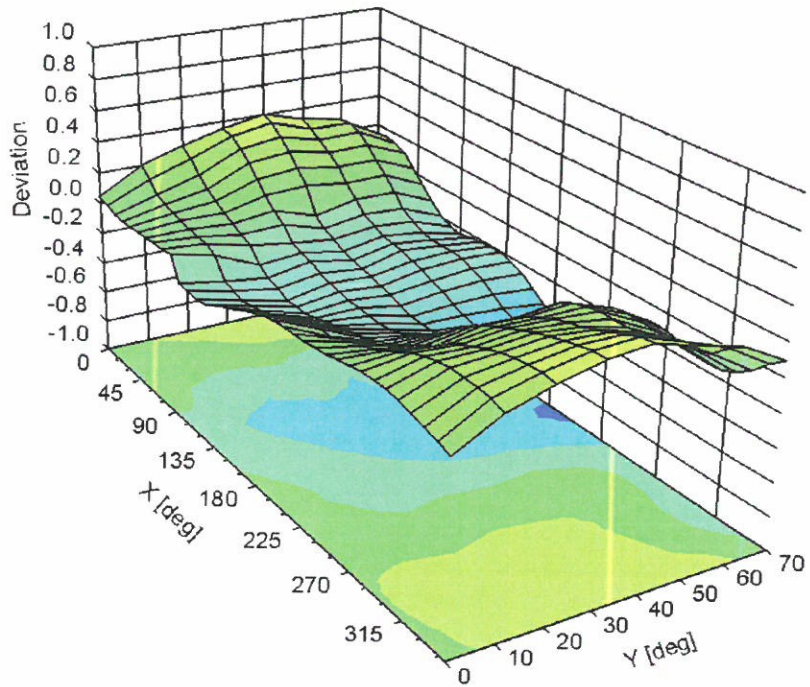
Dynamic Range f(E-field) (TEM cell , f = 900 MHz)



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

Deviation from Isotropy in Air

Error (ϕ, θ), $f = 900 \text{ MHz}$



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

DASY/EASY - Parameters of Probe: ER3DV6 - SN:2480

Other Probe Parameters

Sensor Arrangement	Rectangular
Connector Angle (°)	16.5
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