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

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **Nokia TX**

Certificate No: **H3-6058_Jan05**

CALIBRATION CERTIFICATE

Object	H3DV6 - SN:6058
Calibration procedure(s)	QA CAL-03.v4 Calibration procedure for H-field probes optimized for close near field evaluations in air
Calibration date:	January 20, 2005
Condition of the calibrated item	In Tolerance

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 E4419B	GB41293874	5-May-04 (METAS, No. 251-00388)	May-05
Power sensor E4412A	MY41495277	5-May-04 (METAS, No. 251-00388)	May-05
Reference 3 dB Attenuator	SN: S5054 (3c)	10-Aug-04 (METAS, No. 251-00403)	Aug-05
Reference 20 dB Attenuator	SN: S5086 (20b)	3-May-04 (METAS, No. 251-00389)	May-05
Reference 30 dB Attenuator	SN: S5129 (30b)	10-Aug-04 (METAS, No. 251-00404)	Aug-05
Reference Probe H3DV6	SN: 6182	6-Oct-04 (SPEAG, No. H3-6182_Oct04)	Oct-05
DAE4	SN: 617	29-Sep-04 (SPEAG, No. DAE4-617_Sep04)	Sep-05

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092180	18-Sep-02 (SPEAG, in house check Oct-03)	In house check: Oct 05
RF generator HP 8648C	US3642U01700	4-Aug-99 (SPEAG, in house check Dec-03)	In house check: Dec-05
Network Analyzer HP 8753E	US37390585	18-Oct-01 (SPEAG, in house check Nov-04)	In house check: Nov 05

	Name	Function	Signature
Calibrated by:	Nico Vetterli	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: January 20, 2005

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

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Glossary:

NORMx,y,z	sensitivity in free space
DCP	diode compression point
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 1309-1996, " IEEE Standard for calibration of electromagnetic field sensors and probes, excluding antennas, from 9 kHz to 40 GHz", 1996.

Methods Applied and Interpretation of Parameters:

- *X,Y,Z_a0a1a2:* Assessed for E-field polarization ϑ = 90 for XY sensors and ϑ = 0 for Z sensor (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide).

- *X,Y,Z(f)_a0a1a2= X,Y,Z_a0a1a2* frequency_response* (see Frequency Response Chart).

- *DCPx,y,z:* DCP are numerical linearization parameters assessed based on the data of power sweep (no uncertainty required). DCP does not depend on frequency.

- *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 *X_a0a1a2* (no uncertainty required).

Probe H3DV6

SN:6058

Manufactured: October 15, 1999
Last calibrated: February 17, 2004
Recalibrated: January 20, 2005

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: H3DV6 SN:6058

Sensitivity in Free Space [A/m / $\sqrt{(\mu V)}$]

	a0	a1	a2
X	2.707E-03	-4.652E-5	7.140E-6 ± 5.1 % (k=2)
Y	2.566E-03	-3.251E-5	1.098E-5 ± 5.1 % (k=2)
Z	2.897E-03	-2.415E-4	1.963E-5 ± 5.1 % (k=2)

Diode Compression[1]

DCP X	86 mV
DCP Y	86 mV
DCP Z	85 mV

Sensor Offset   (Probe Tip to Sensor Center)

X	3.0 mm
Y	3.0 mm
Z	3.0 mm

Connector Angle   87 °

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%.
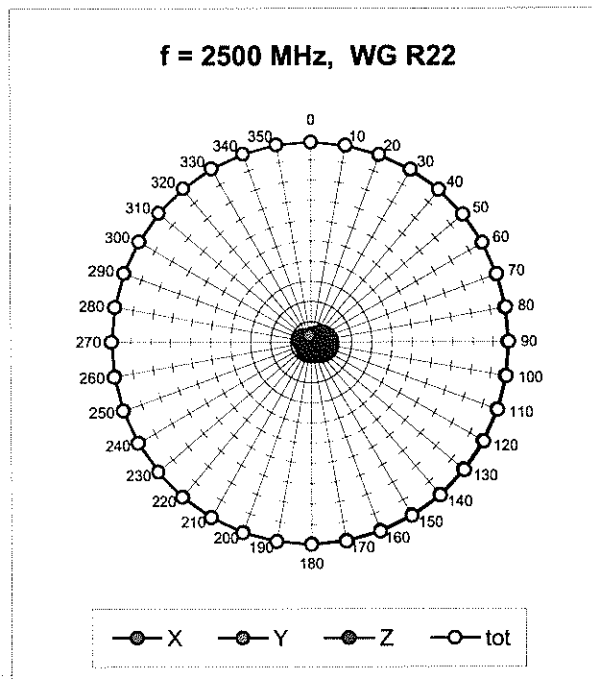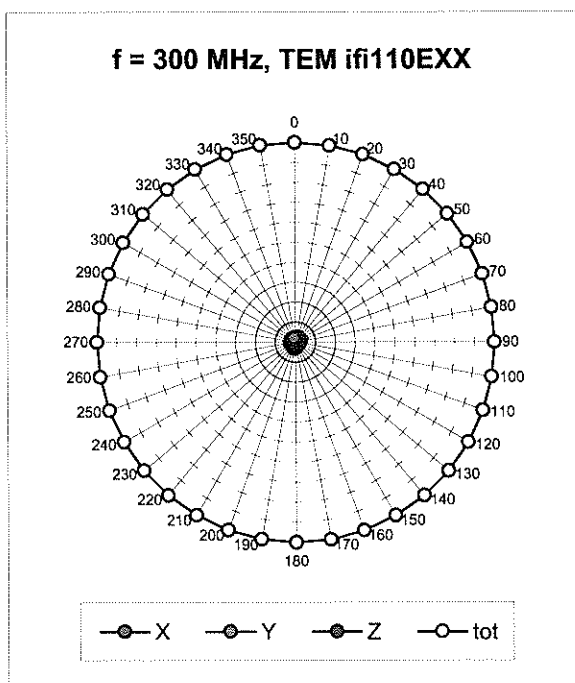

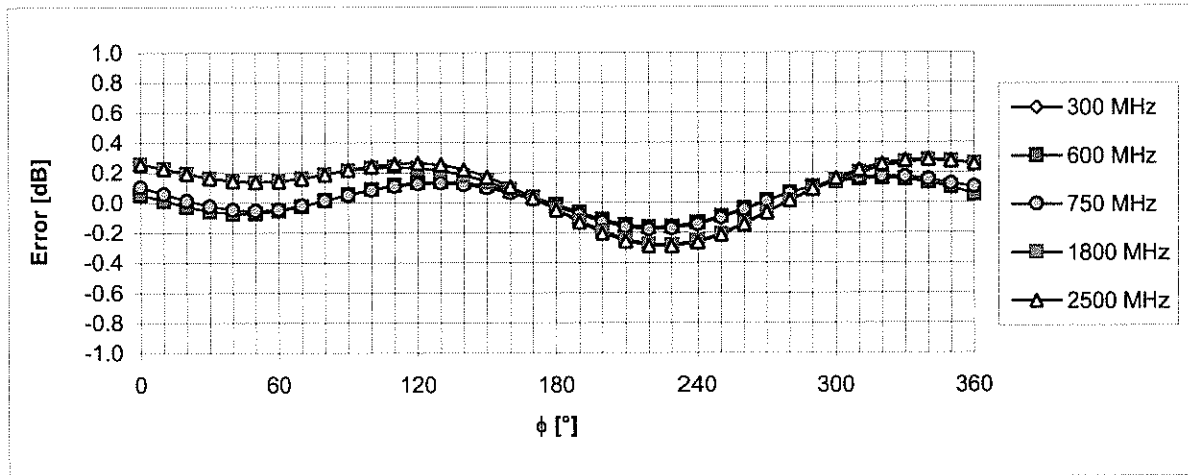[1] numerical linearization parameter: uncertainty not required

Frequency Response of H-Field

(TEM-Cell:ifi110, Waveguide R22)
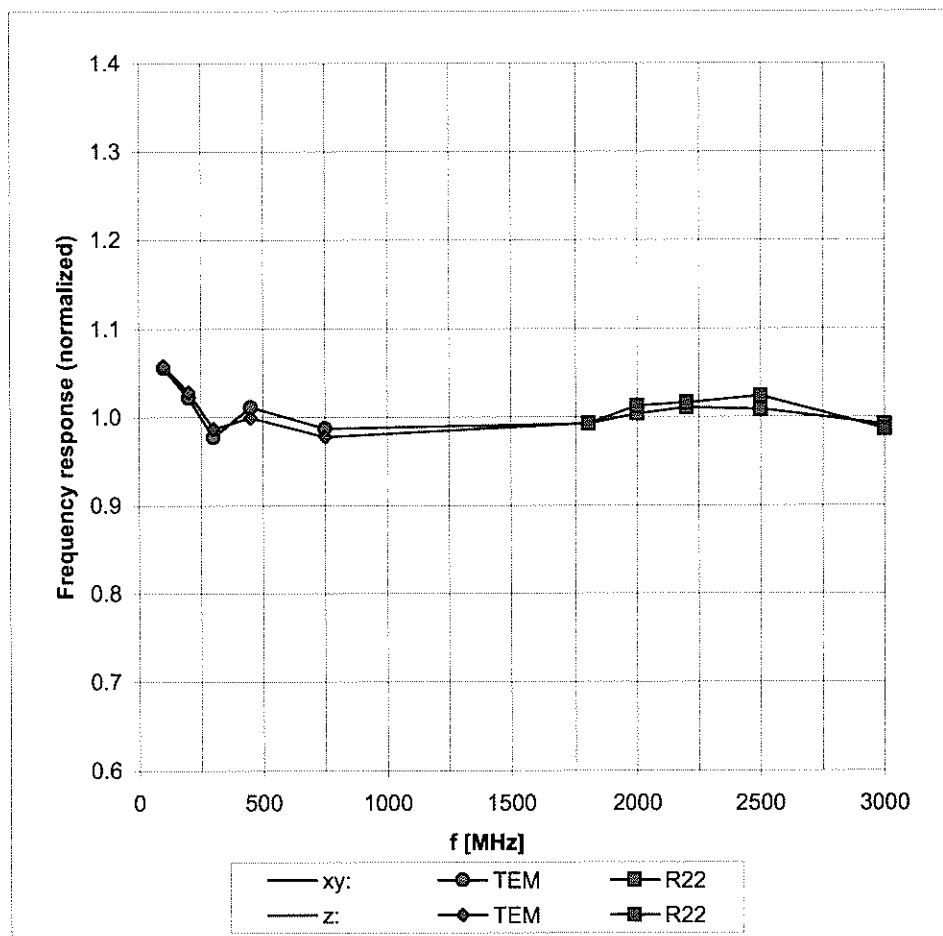
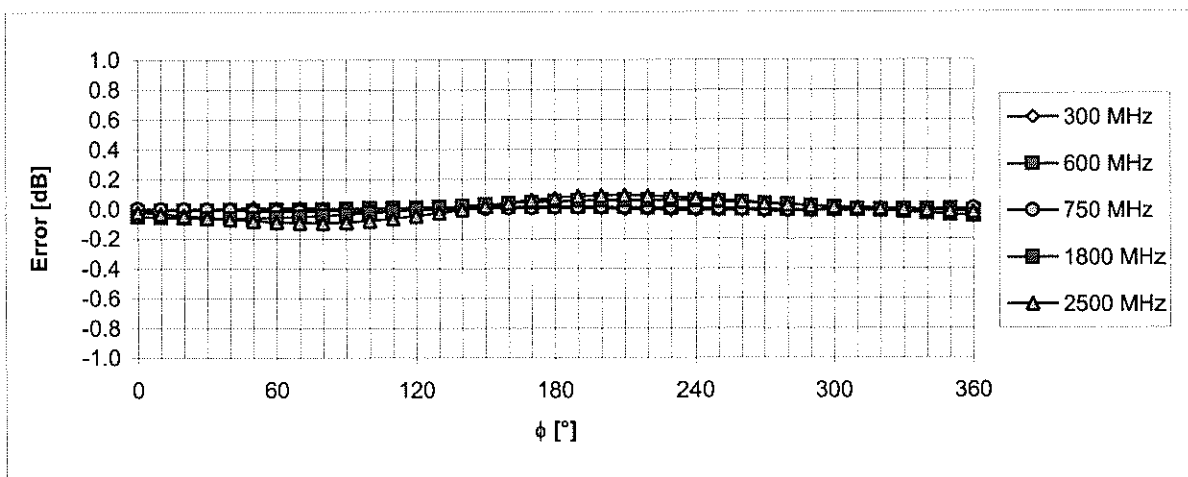**Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)**

Receiving Pattern (φ), ϑ = 90°

f = 300 MHz, TEM ifi110EXX

f = 2500 MHz, WG R22

Receiving Pattern (φ), ϑ = 0°

f = 300 MHz, TEM ifi110EXX

f = 2500 MHz, WG R22
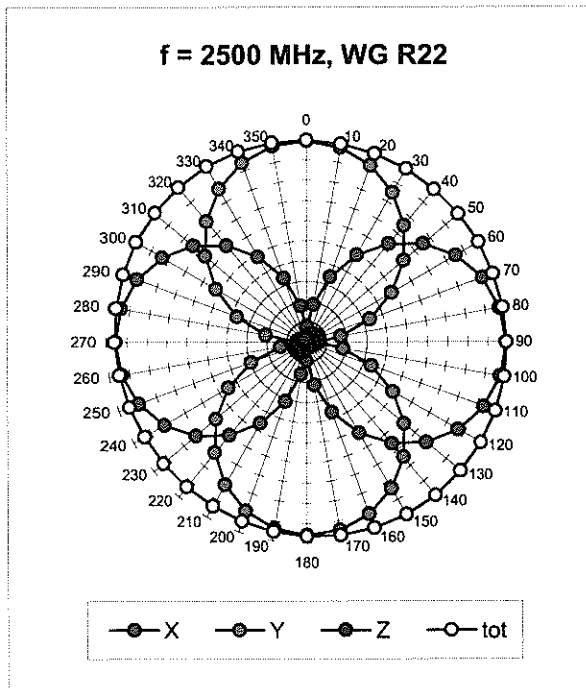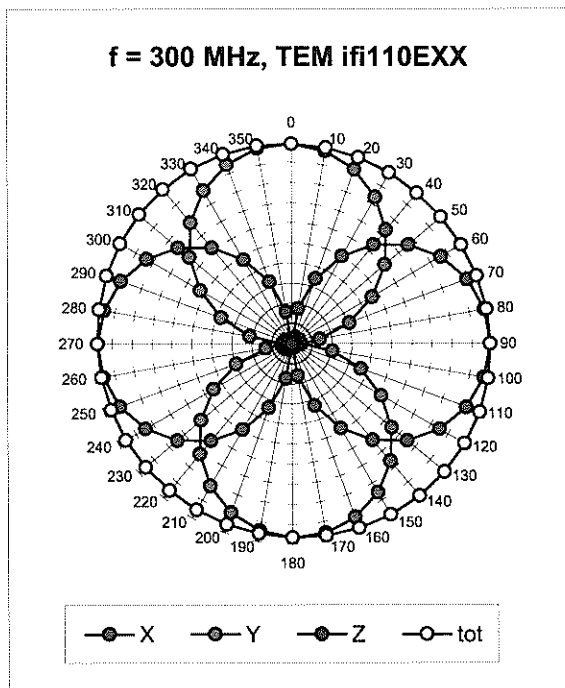
Receiving Pattern (ϕ), $\vartheta = 90°$

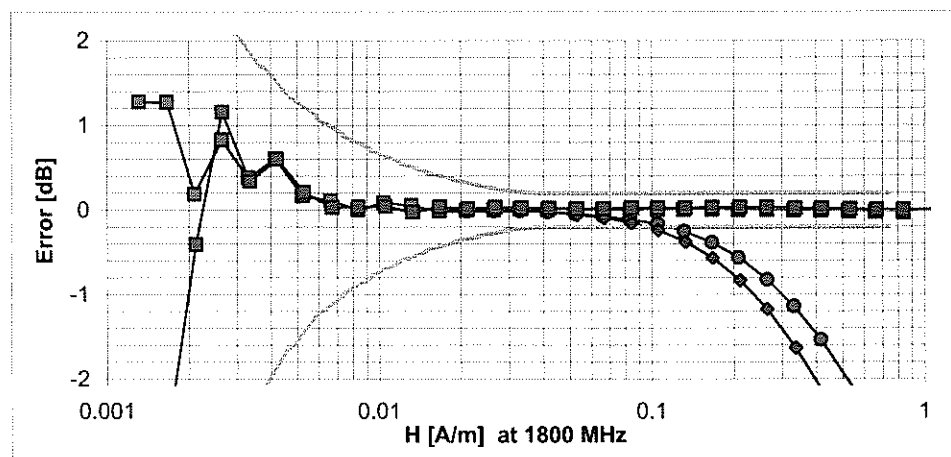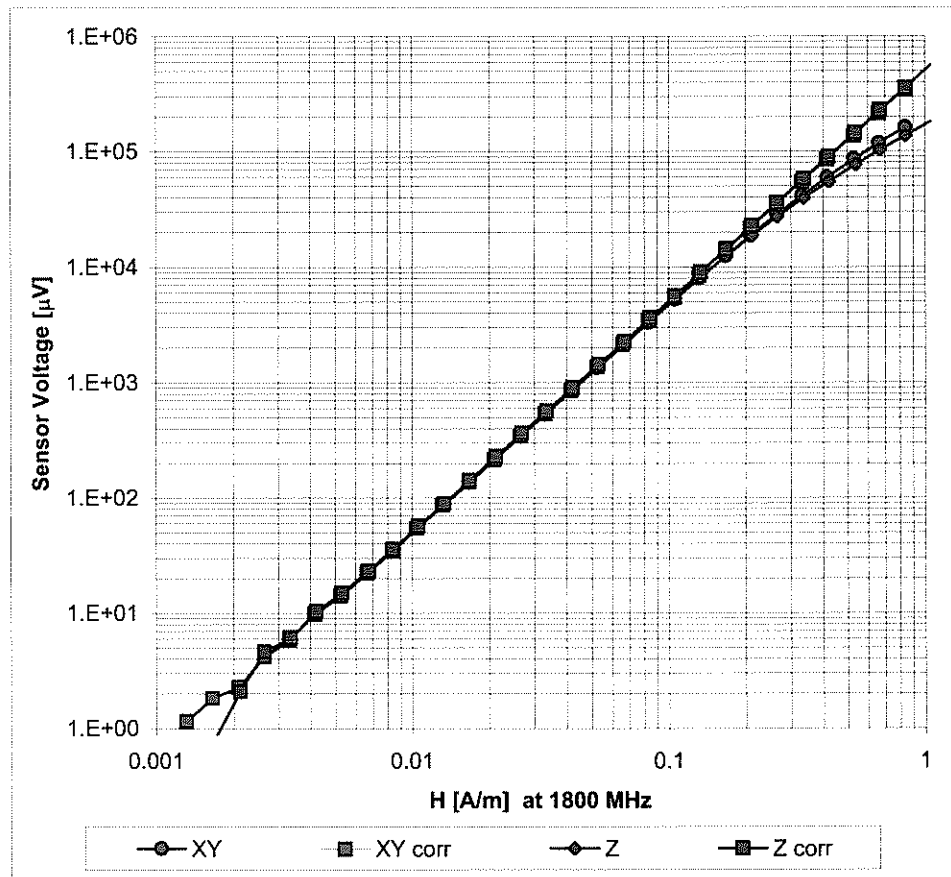**Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)**

Receiving Pattern (ϕ), $\vartheta = 0°$

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

Dynamic Range f(H-field)
(Waveguide R22, f = 1800 MHz)

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