# 13. CALIBRATION CERTIFICATES

The following pages include the probe calibration used to evaluate HAC for the DUT.

PCTESTÔ HAC REPORT	SAPCTEST:	FCC MEASUREMENT REPORT	SANYO	Reviewed by: Quality Manager
HAC Filename:	Test Dates:	EUT Type:	FCC ID:	Page 36 of 70
HAC.0505160369-R2.AEZ	May 16-18, 2005	Tri-Mode Dual-Band Phone	AEZSCP-56H	. ago oo o o

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



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S Swiss Calibration Service

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Client RC test

Certificate No: ER3-2332\_Jan05

#### CALIBRATION CERTIFICATE Object ER3DV6 - SN:2332 Calibration procedure(s) QA CAL-02:v4 Calibration procedure for E-field probes optimized for close near field evaluations in air January 31, 2005 Calibration date: 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 $\pm$ 3%C and humidity < 70%. Calibration Equipment used (M&TE critical for calibration) Cal Date (Calibrated by, Certificate No.) Scheduled Calibration Primary Standards 10 # May-05 Power meter E4419B GB41293874 5-May-04 (METAS, No. 251-00368) MY41495277 5-May-04 (METAS, No. 251-00388) May-05 Power sensor E4412A Aug-05 Reference 3 dB Attenuator SN: 88054 (3c) 10-Aug-04 (METAS, No. 251-00403) May-05 3-May-04 (METAS, No. 251-00389) Reference 20 dB Attenuator SN: S5086 (20b) Reference 30 dB Attenuator SN: S5129 (30b) 10-Aug-04 (METAS, No. 251-00404) Aug-05 SN: 2328 6-Oct-04 (SPEAG, No. ER3-2326\_Oct04) Oct-05 Reference Probe ERSDV6 19-Jan-05 (SPEAG, No. DAE4-817\_Jan05) Jan-06 D&F4 SN: 617 Secondary Standards Scheduled Check ID# Check Date (In house) 18-Sep-02 (SPEAG, in house check Oct-03) Power censor HP 8481A MY41092180 In house check: Oct 05 RF generator HP 8648C U\$3642U01700 4-Aug-99 (SPEAG, in house check Dec-03) In house check: Dec-05 US37390565 18-Oct-01 (SPEAG, in house check Nov-04) In house check: Nov 05 Network Analyzer HP 6753E Nama Function Sionature Calibrated by: Approved by: issued: February 19, 2005 This calibration certificate shall not be reproduced except in full without written approval of the laboratory

Certificate No: ER3-2332\_Jan05

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PCTESTÔ HAC REPORT	SPCTEST	FCC MEASUREMENT REPORT	SANYO	Reviewed by: Quality Manager
HAC Filename:	Test Dates:	EUT Type:	FCC ID:	Page 37 of 70
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Schmid & Partner **Engineering AG** Zeughausstrasse 43, 8004 Zurich, Switzerland



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## Glossary:

NORMx,y,z sensitivity in free space DCP diode compression point Polarization φ φ rotation around probe axis

Polarization 9 9 rotation around an axis that is in the plane normal to probe axis (at

measurement center), i.e., 9 = 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:

- NORMx,y,z: Assessed for E-field polarization  $\vartheta = 0$  for XY sensors and  $\vartheta = 90$  for Z sensor (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide).
- NORM(f)x,y,z = NORMx,y,z \* 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 NORMx (no uncertainty required).

Certificate No: ER3-2332\_Jan05

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PCTESTÔ HAC REPORT	PCTEST	FCC MEASUREMENT REPORT	SANYO	Reviewed by: Quality Manager
HAC Filename:	Test Dates:	EUT Type:	FCC ID:	Page 38 of 70
HAC.0505160369-R2.AEZ	May 16-18, 2005	Tri-Mode Dual-Band Phone	AEZSCP-56H	

# Probe ER3DV6

SN:2332

Manufactured: Calibrated:

September 9, 2003 January 31, 2005

## Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

Certificate No: ER3-2332 Jan05

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	Quality Manager
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а	FCC ID: al-Band Phone AEZSCP-56H

## DASY - Parameters of Probe: ER3DV6 SN:2332

Sensitivity in Free Space  $[\mu V/(V/m)^2]$  Diode Compression<sup>A</sup>

NormX 1.34  $\pm$  10.1 % (k=2) DCP X 95 mV NormY 1.47  $\pm$  10.1 % (k=2) DCP Y 95 mV NormZ 1.64  $\pm$  10.1 % (k=2) DCP Z 97 mV

## **Frequency Correction**

X 0.0 Y 0.0 Z 0.0

Sensor Offset (Probe Tip to Sensor Center)

X 2.5 mm Y 2.5 mm Z 2.5 mm

Connector Angle 139 °

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%.

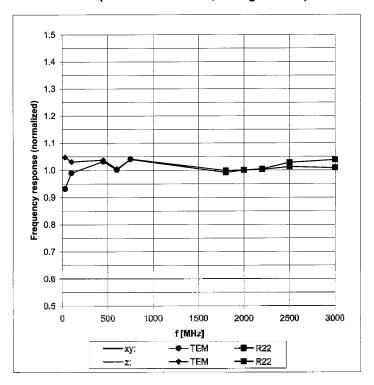
Certificate No: ER3-2332\_Jan95 Page 4 of 9

The state of the s	CC MEASUREMENT REPORT	SANYO	Quality Manager
	* *	FCC ID:	Page 40 of 70
		71	7,1

<sup>&</sup>lt;sup>A</sup> numerical linearization perameter: uncertainty not required

# Frequency Response of E-Field

(TEM-Cell:ifi110 EXX, Waveguide R22)

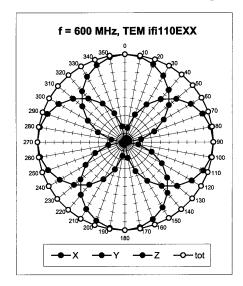


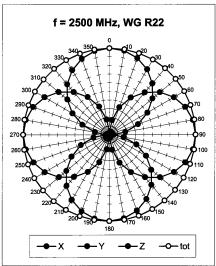
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

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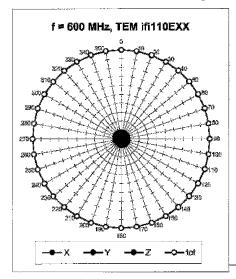
PCTESTÔ HAC REPORT	PCTEST	FCC MEASUREMENT REPORT	SANYO	Reviewed by: Quality Manager
HAC Filename:	Test Dates:	EUT Type:	FCC ID:	Page 41 of 70
HAC.0505160369-R2.AEZ	May 16-18, 2005	Tri-Mode Dual-Band Phone	AEZSCP-56H	. ago oo

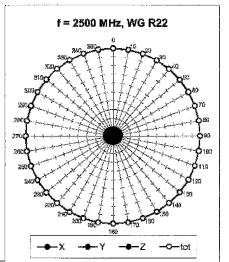
Receiving Pattern ( $\phi$ ),  $\vartheta = 0^{\circ}$ 





Receiving Pattern ( $\phi$ ),  $\vartheta$  = 90°



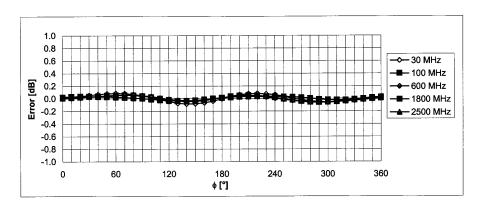


Certificate No: ER3-2332\_Jan05

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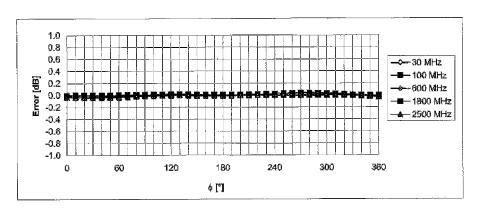
PCTESTÔ HAC REPORT	PCTEST	FCC MEASUREMENT REPORT	SANYO	Reviewed by: Quality Manager
HAC Filename:	Test Dates:	EUT Type:	FCC ID:	Page 42 of 70
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Receiving Pattern ( $\phi$ ),  $\vartheta = 0^{\circ}$ 



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

Receiving Pattern ( $\phi$ ),  $\theta$  = 90°



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

Certificate No: ER3-2332\_Jan05

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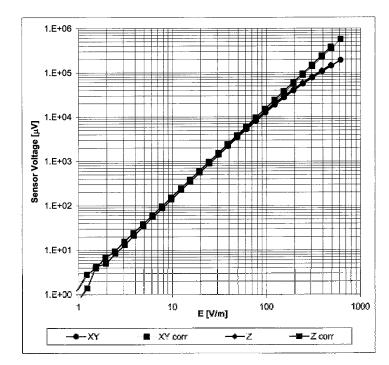
PCTESTÔ HAC REPORT	PCTEST	FCC MEASUREMENT REPORT	SANYO	Reviewed by: Quality Manager
HAC Filename: HAC.0505160369-R2.AEZ	Test Dates: May 16-18, 2005	EUT Type: Tri-Mode Dual-Band Phone	FCC ID: AEZSCP-56H	Page 43 of 70
TAC.0303 100309-R2.AEZ	IVIAY 10-10, 2005	The wode Dual-Band Phone	AEZSUP-30H	

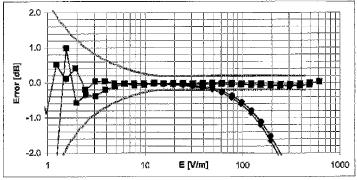
© 2005 PCTEST Engineering Laboratory, Inc.

January 31, 2005

## **Dynamic Range f(E-field)**

(Waveguide R22, f = 1800 MHz)





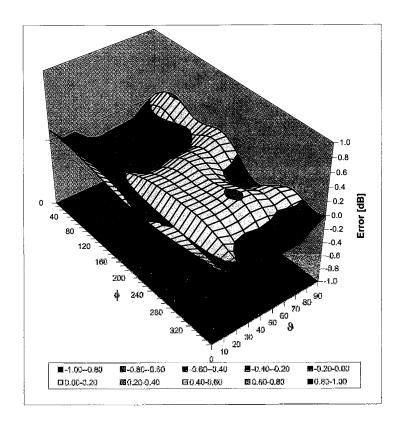
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Certificate No: ER3-2332\_Jan05

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PCTESTÔ HAC REPORT	PCTEST	FCC MEASUREMENT REPORT	SANYO	Reviewed by: Quality Manager
HAC Filename:	Test Dates:	EUT Type:	FCC ID:	Page 44 of 70
HAC.0505160369-R2.AEZ	May 16-18, 2005	Tri-Mode Dual-Band Phone	AEZSCP-56H	

# Deviation from Isotropy in Air Error ( $\phi$ , $\vartheta$ ), f = 900 MHz



Uncertainty of Spherical Isotropy Assessment: ± 2.6% (k=2)

Certificate No: ER3-2332\_Jan05

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PCTESTÔ HAC REPORT	PCTEST	FCC MEASUREMENT REPORT	SANYO	Reviewed by: Quality Manager
HAC 0505160360 P2 AE7	Test Dates:	EUT Type:	FCC ID:	Page 45 of 70
HAC.0505160369-R2.AEZ	May 16-18, 2005	Tri-Mode Dual-Band Phone	AEZSCP-56H	

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Accreditation No.: SCS 108

Certificate No: H3-6180 Oct04

#### PC Test **CALIBRATION CERTIFICATE** H3DV6 - SN:6180 Object QA CAL-03.v4 Calibration procedure(s) Calibration procedure for H-field probes optimized for close near field evaluations in air October 6, 2004 Calibration date: In Tolerance Condition of the calibrated item 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) Cal Date (Calibrated by, Certificate No.) Scheduled Calibration Primary Standards GB41293874 5-May-04 (METAS, No. 251-00388) May-05 Power meter E4419B May-05 MY41495277 5-May-04 (METAS, No. 251-00388) Power sensor E4412A Aug-05 Reference 3 dB Attenuator SN: S5054 (3c) 3-Apr-03 (METAS, No. 251-00403) May-05 Reference 20 dB Attenuator SN: S5066 (20b) 3-May-04 (METAS, No. 251-00389) 3N: S5129 (30b) 3-Apr-03 (METAS, No. 251-00404) Aug-05 Reference 30 dB Attenuator 17-Dec-03 (SPEAG, No. H3-6065\_Dec03) Dec-04 Reference Probe H3DV6 BN:5065 26-May-04 (SPEAG, No. DAE4-617\_May04) May-05 DAE4 SN: 617 Scheduled Check Check Date (in house) Secondary Standards Power sensor HP 8481A MY41092180 18-Sep-02 (SPEAG, in house check Oct-03) In house check: Oct 05 In house check: Dec-05 RF generator HP 8648C US3642U01700 4-Aug-99 (SPEAG, in house check Dec-03) In house check: Nov 04 18-Oct-01 (SPEAG, in house check Nov-03) Network Analyzer HP 8753E US37390585 Function Name Technical Manager Calibrated by: Katja Pokovic Approved by: Issued: October 23, 2004 This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

Certificate No: H3-6180\_Oct04

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PCTESTÔ HAC REPORT	PCTEST	FCC MEASUREMENT REPORT	SANYO	Reviewed by: Quality Manager
HAC Filename: HAC.0505160369-R2.AEZ	Test Dates: May 16-18, 2005	EUT Type: Tri-Mode Dual-Band Phone	FCC ID: AEZSCP-56H	Page 46 of 70

Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland



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S Swiss Calibration Service

Accreditation No.: SCS 108

Accredited by the Swiss Federal Office of Metrology and Accreditation
The Swiss Accreditation Service is one of the signatories to the EA
Multilateral Agreement for the recognition of calibration certificates

## Glossary:

NORMx,y,z DCP sensitivity in free space diode compression point

Polarization  $\phi$ 

φ rotation around probe axis

Polarization 9

3 rotation around an axis that is in the plane normal to probe axis (at

measurement center), i.e., 9 = 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 9 = 90 for XY sensors and 9 = 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).

Certificate No: H3-6180\_Oct04

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P	PCTESTÔ HAC REPORT	S PCTEST	FCC MEASUREMENT REPORT	SANYO	Reviewed by: Quality Manager
Н	IAC Filename:	Test Dates:	EUT Type:	FCC ID:	Page 47 of 70
H	AC.0505160369-R2.AEZ	May 16-18, 2005	Tri-Mode Dual-Band Phone	AEZSCP-56H	•

# Probe H3DV6

SN:6180

Manufactured: Calibrated: July 6, 2004 October 6, 2004

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

Certificate No: H3-6180\_Oct04

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PCTESTÔ HAC REPORT	PCTEST	FCC MEASUREMENT REPORT	SANYO	Reviewed by: Quality Manager
HAC Filename:	Test Dates:	EUT Type:	FCC ID:	Page 48 of 70
HAC.0505160369-R2.AEZ	May 16-18, 2005	Tri-Mode Dual-Band Phone	AEZSCP-56H	1 ago 10 01 10

## DASY - Parameters of Probe: H3DV6 SN:6180

Sensitivity in Free Space [A/m / √(µV)]

a0 a1 a2 X 2.490E-03 1.788E-05 -2.842E-05 ± 5.0 % (k=2) Y 2.681E-03 3.017E-05 -3.113E-05 ± 5.0 % (k=2) Z 2.912E-03 -1.610E-05 1.858E-05 ± 5.0 % (k=2)

## Diode Compression<sup>1</sup>

DCP X 85 mV DCP Y 85 mV DCP Z 87 mV

Sensor Offset (Probe Tip to Sensor Center)

X 3.0 mm Y 3.0 mm Z 3.0 mm

Connector Angle 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%.

Certificate No: H3-6180\_Oct04

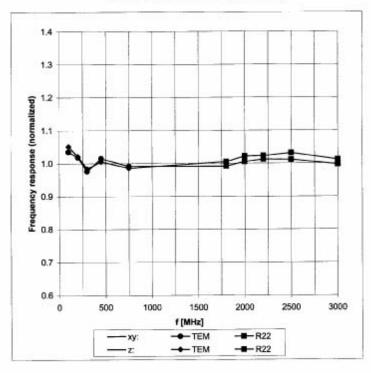
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PCTESTÔ HAC REPORT	PCTEST	FCC MEASUREMENT REPORT	SANYO	Reviewed by: Quality Manager
HAC Filename:	Test Dates:	EUT Type:	FCC ID:	Page 49 of 70
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<sup>1</sup> numerical linearization parameter: uncertainty not required

## Frequency Response of H-Field

(TEM-Cell:ifi110, Waveguide R22)



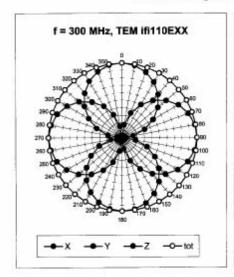
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

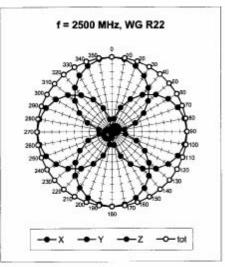
Certificate No: H3-6180\_Oct04

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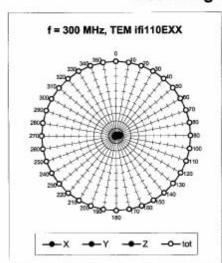
PCTESTÔ HAC REPORT	PCTEST	FCC MEASUREMENT REPORT	SANYO	Reviewed by: Quality Manager
HAC Filename:	Test Dates:	EUT Type:	FCC ID:	Page 50 of 70
HAC.0505160369-R2.AEZ	May 16-18, 2005	Tri-Mode Dual-Band Phone	AEZSCP-56H	. ago oo o o

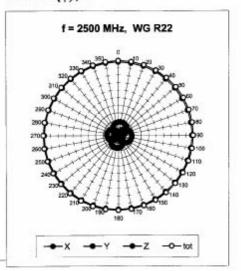
Receiving Pattern ( $\phi$ ),  $\vartheta$  = 90°





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



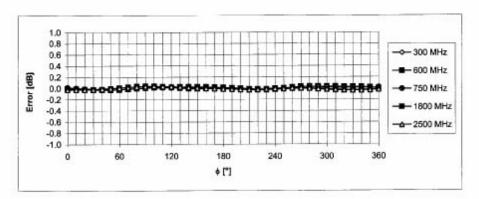


Certificate No: H3-6180\_Oct04

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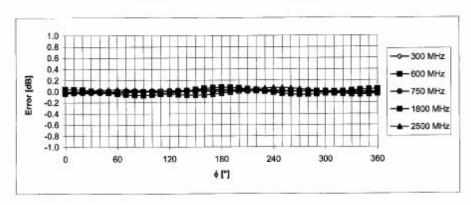
PCTESTÔ HAC REPORT	PCTEST	FCC MEASUREMENT REPORT	SANYO	Reviewed by: Quality Manager
HAC Filename:	Test Dates:	EUT Type:	FCC ID:	Page 51 of 70
HAC.0505160369-R2.AEZ	May 16-18, 2005	Tri-Mode Dual-Band Phone	AEZSCP-56H	. ago 5. 0170

Receiving Pattern (6), 9 = 90°



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

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



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

Certificate No: H3-6180\_Oct04

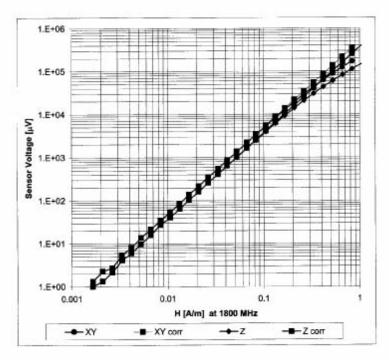
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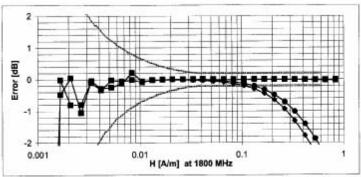
PCTESTÔ HAC REPORT	PCTEST	FCC MEASUREMENT REPORT	SANYO	Reviewed by: Quality Manager
HAC Filename:	Test Dates:	EUT Type:	FCC ID:	Page 52 of 70
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October 6, 2004

## Dynamic Range f(H-field)

(Waveguide R22, f = 1800 MHz)





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

Certificate No: H3-6180\_Oct04

H3DV6 SN:6180

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PCTESTÔ HAC REPORT	SAPCTEST	FCC MEASUREMENT REPORT	SANYO	Reviewed by: Quality Manager
HAC Filename: HAC.0505160369-R2.AEZ	Test Dates:	EUT Type: Tri-Mode Dual-Band Phone	FCC ID:	Page 53 of 70
HAC.0505160369-RZ.AEZ	May 16-18, 2005	Th-Mode Dual-Band Phone	AEZSCP-56H	

Schmid & Partner

Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland

Client

Certificate No: CD1880V3-1002\_Feb05

Calibration procedure(s)  Calibration date:  Condition of the calibrated item	QA CAL-20 v2 Calibration proce February, 23, 200	dure for dipoles in air.	
	February, 23, 200	<b>15</b>	
Condition of the calibrated item			
	In Tolerance	7.14	
Calibration Equipment used (M& Primary Standards	TE critical for calibration)	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Yower meter EPM E442	GB37480704	12-Oct-04 (METAS, No. 251-00412)	Oct-05
ower sensor HP 8481A	US3720 <b>278</b> 3	12-Oct-04 (METAS, No. 251-00412)	Oct-05
teference 20 d8 Attenuator	SN: 5086 (20g)	10-Aug-04 (METAS, No 251-00402)	Aug-05
leference 10 dB Atlenuator	SN: 5047.2 (10r)	10-Aug-04 (METAS, No 251-00402)	
			Aug-05
	SN 2326	06-Oct-04 (SPEAG, No. ER3-2328_Oct04)	Oct-05
	SN 2328 SN 601		•
)AE4	1	06-Oct-04 (SPEAG, No. ER3-2328_Oct04)	Oct-05
0AE4 Secondary Standards	SN 601	06-Oct-04 (SPEAG, No. ER3-2328_Oct04) 07-Jan-05 (SPEAG, No. DAE4-901_Jan05)	Oct-05 Jan- <b>0</b> 6
0AE4 Secondary Standards Power sensor HP 8481A	SN 601	06-Oct-04 (SPEAG, No. ER3-2328_Oct04) 07-Jan-05 (SPEAG, No. DAE4-801_Jan05) Check Date (in house)	Oct-05 Jan-06 Scheduled Check
OAE4 Secondary Standards Power sensor HP 6481A Power sensor HP 6481A	SN 601 1D# MY41092312	06-Oct-04 (SPEAG, No. ER3-2328_Oct04) 07-Jan-05 (SPEAG, No. DAE4-301_Jan05) Check Date (in house) 10-Aug-03 (SPEAG, in house check Jan-94)	Oct-05 Jan-06 Scheduled Check In house check: Oct-05
DAE4 Secondary Standards Power sensor HP 8481A Power sensor HP 8481A RF generator Agilent E8251A	SN 601 1D# MY41092312 MY41093315	06-Oct-04 (SPEAG, No. ER3-2328_Oct04) 07-Jan-05 (SPEAG, No. DAE4-801_Jan05) Check Date (in house) 10-Aug-03 (SPEAG, in house check Jan-04) 10-Aug-03 (SPEAG, in house check Jan-04) 4-Aug-03 (Agilent) 18-Oct-01 (SPEAG, in house check Nov-04)	Oct-05 Jan-06 Scheduled Check In house check: Oct-05 In house check: Oct-05 In house check: Aug-05 In house check: Nov-05
DAE4 Secondary Standards Power sensor HP 8481A Power sensor HP 8481A RF generator Agilent E8251A Network Analyzer HP 8763E	SN 601 1D # MY41092312 MY41093315 US41140111	06-Oct-04 (SPEAG, No. ER3-2328_Oct04) 07-Jan-05 (SPEAG, No. DAE4-901_Jan05) Check Date (in house) 10-Aug-03 (SPEAG, in house check Jan-04) 10-Aug-03 (Agilent)	Oct-05 Jan-06 Scheduled Check In house check: Oct-05 In house check: Oct-05 In house check: Aug-05
DAE4 Secondary Standards Power sensor HP 8481A Power sensor HP 8481A RF generator Agilent E8251A Network Analyzer HP 8763E	ID # MY41092312 MY41093315 US41140111 US37390586 54208	06-Oct-04 (SPEAG, No. ER3-2328_Oct04) 07-Jan-05 (SPEAG, No. DAE4-801_Jan05) Check Date (in house) 10-Aug-03 (SPEAG, in house check Jan-04) 10-Aug-03 (SPEAG, in house check Jan-04) 4-Aug-03 (Agilent) 18-Oct-01 (SPEAG, in house check Nov-04)	Oct-05 Jan-06 Scheduled Check In house check: Oct-05 In house check: Oct-05 In house check: Aug-05 In house check: Nov-05
Reference Probe ER3DV6 DAE4 Secondary Standards Power sensor HP 8461A Power sensor HP 6461A Ref generator Agilent E8251A Network Analyzer HP 8763E Probe H3DV6 Calibrated by:	ID # MY41092312 MY41093315 US41140111 US37390585 54208 SN: 6065	06-Oct-04 (SPEAG, No. ER3-2328_Oct04) 07-Jan-05 (SPEAG, No. DAE4-801_Jan05)  Check Date (in house) 18-Aug-03 (SPEAG, in house check Jan-04) 18-Aug-03 (SPEAG, in house check Jan-04) 4-Aug-03 (Agilent) 18-Oct-01 (SPEAG, in house check Nov-04) 10-Oct-04 (SPEAG, No. H3-6065-Oct04)	Oct-05 Jan-06 Scheduled Check In house check: Oct-05 In house check: Oct-05 In house check: Aug-05 In house check: Nov-05 Calibration, Oct-05

This calibration certificate is issued as an intermediate solution until the specific calibration procedure its submitted and accepted in the frame of the accreditation of the Calibration Laboratory of Schmid & Partner Engineering AG (based on ISO/IEC 17025 International Standard)

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Schmid & Partner Engineering AG

Zeughausstrasse 43, 8004 Zurich, Switzerland

### References

[1] ANSI-PC63.19-2003 (Draft)

American National Standard for Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids.

## Methods Applied and Interpretation of Parameters:

- Coordinate System: y-axis is in the direction of the dipole arms. z-axis is from the basis of the antenna
  (mounted on the table) towards its feed point between the two dipole arms. x-axis is normal to the other axes.
  In coincidence with standard [1], the measurement planes (probe sensor center) are selected to be at a
  distance of 10 mm above the the top edge of the dipole arms.
- Measurement Conditions: Further details are available from the hardcopies at the end of the certificate. All
  figures stated in the certificate are valid at the frequency indicated. The forward power to the dipole connector
  is set with a calibrated power meter connected and monitored with an auxiliary power meter connected to a
  directional coupler. While the dipole under test is connected, the forward power is adjusted to the same level.
- Antenna Positioning: The dipole is mounted on a HAC Test Arch phantom using the matching dipole positioner with the arms horizontal and the feeding cable coming from the floor. The measurements are performed in a shielded room with absorbers around the setup to reduce the reflections. It is verified before the mounting of the dipole under the Test Arch phantom, that its arms are perfectly in a line. It is installed on the HAC dipole positioner with its arms parallel below the dielectric reference wire and able to move elastically in vertical direction without changing its relative position to the top center of the Test Arch phantom. The vertical distance to the probe is adjusted after dipole mounting with a DASY4 Surface Check job. Before the measurement, the distance between phantom surface and probe tip is verified. The proper measurement distance is selected by choosing the matching section of the HAC Test Arch phantom with the proper device reference point (upper surface of the dipole) and the matching grid reference point (tip of the probe) considering the probe sensor offset. The vertical distance to the probe is essential for the accuracy.
- Feed Point Impedance and Return Loss: These parameters are measured using a HP 8753E Vector Network
  Analyzer. The impedance is specified at the SMA connector of the dipole. The influence of reflections was
  eliminating by applying the averaging function while moving the dipole in the air, at least 70cm away from any
  obstacles.
- E-field distribution: E field is measured in the x-y-plane with an isotropic ER3D-field probe with 100 mW forward power to the antenna feed point. In accordance with [1], the scan area is 20mm wide, its length exceeds the dipole arm length (180 or 90mm). The sensor center is 10 mm (in z) above the top of the dipole arms. Two 3D maxima are available near the end of the dipole arms. Assuming the dipole arms are perfectly in one line, the average of these two maxima (in subgrid 2 and subgrid 8) is determined to compensate for any non-parallelity to the measurement plane as well as the sensor displacement. The E-field value stated as calibration value represents the maximum of the interpolated 3D-E-field, 10mm above the dipole surface.
- H-field distribution: H-field is measured with an isotropic H-field probe with 100mW forward power to the
  antenna feed point, in the x-y-plane. The scan area and sensor distance is equivalent to the E-field scan. The
  maximum of the field is available at the center (subgrid 5) above the feed point. The H-field value stated as
  calibration value represents the maximum of the interpolated H-field, 10mm above the dipole surface at the
  feed point.

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