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MANUAL

PCD - Precision Conical Dipole Antenna

SEIBERSDORF LABORATORIES

R F E n g i n e e r i n g

MANUAL
Precision Conical Dipole Antenna

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Precision Conical Dipole Antenna, PCD, Antenna, CalStan/10.0
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Contact

Seibersdorf Labor GmbH
RF Engineering
T +43(0) 50550-2882 | F +43(0) 50550-2813
rf@seibersdorf-laboratories.at
www.seibersdorf-laboratories.at/rf

VAT no.: ATU64767504, Company no. 319187v, DVR no. 4000728
Bank account: Erste Bank, sort code 20111, account no. 291-140-380-00

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1. PRODUT DESCRIPTION

The Seibersdorf Labor GmbH *Precision Conical Dipole Antenna PCD* are ultra broadband antennas for:

- Site validation measurements according to CISPR 16-1-4 in fully anechcoic rooms.
- Exposure evaluation next to mobile communication facilities (e.g. base stations)
- Accurate RF radiation safety measurements (e.g. broadcast stations)
- All purposes of broadband precision field-strength measurements.

2. SPECIFICATIONS

2.1. General

Humidity:	Protect this product against water and temperature extremes which can cause internal condensation.
Temperature of operation:	+10°C to +40°C
Power, damage level	+20 dBm
Field strength, damage level	100 V/m
Connector type:	SMA female

2.2. Technical data for PCD3100

Frequency range:	30 MHz – 1 GHz
Dimensions:	Antenna width: 21 cm total Support length: 15 cm

2.3. Technical data for PCD8250

Frequency range:	80 MHz – 3 GHz
Dimensions:	Antenna width: 13 cm total Support length: 15 cm

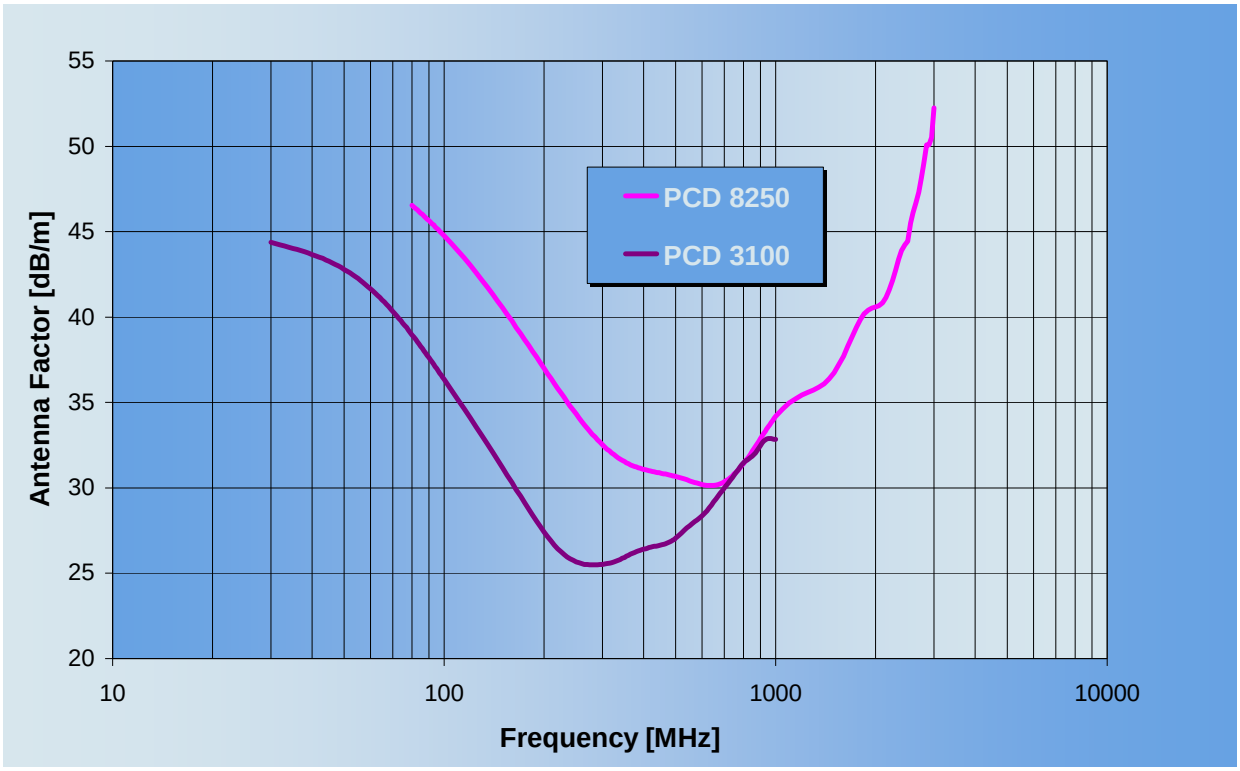


Figure 1: Typical antenna factor of PCD antennas

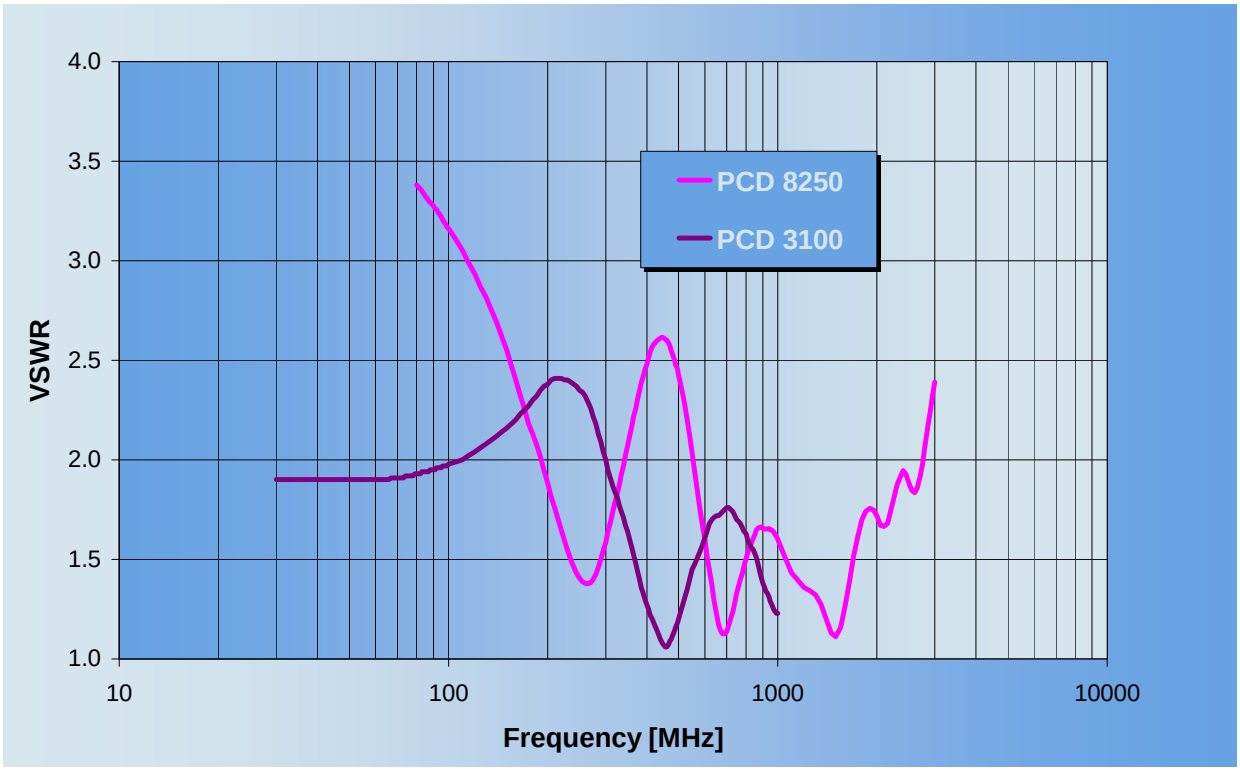


Figure 2: Typical VSWR of PCD antennas

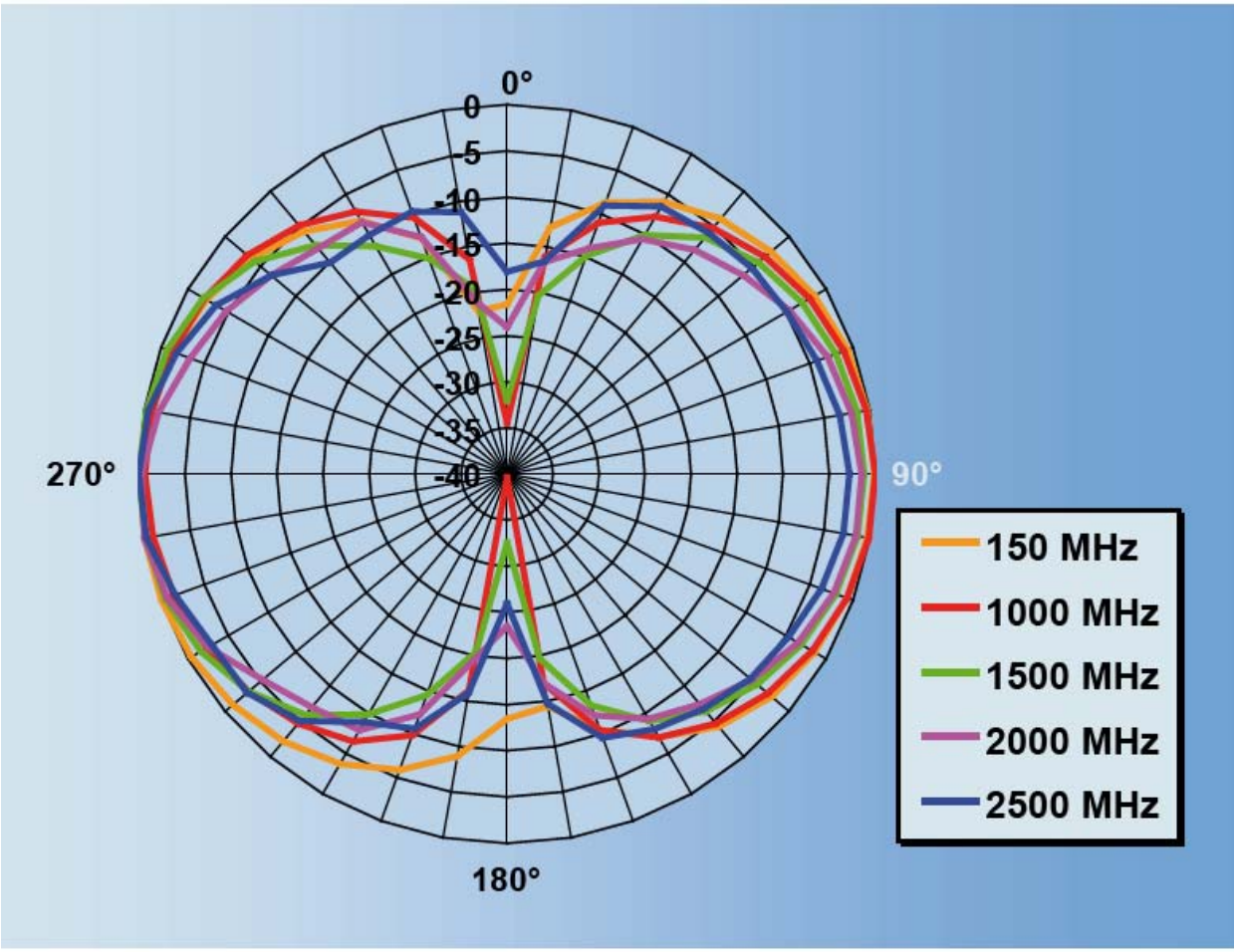


Figure 3: Typical radiation pattern of PCD 8250 antenna (E-Plane)

3. SETS AND OPTIONS

NB1	**Field Nose Basic** package, 80 MHz – 3 GHz Antenna PCD8250 with calibration (A2Fj), automatic antenna rotator, coaxial cable with ÖKD certificate (L1a), measurement software NOSE Basic, SW-documentation, all packed in one transportation case.
NO1	Alternative **large antenna elements** for PCD8250 to change the frequency range of this antenna to 30 MHz – 1 GHz, delivered with typical antenna factor. For precise measurements we recommend to order an individual calibration according our CALIBRATIONS pricelist (A2i).
NO2	Automatic PCD **antenna rotator**, frequency range is 10 MHz to 3 GHz with N-female connector and ¼" mount for tripods. The rotator is controlled and powered via USB (5 m USB cable included) by PC and delivered with an ÖKD certificate for the integrated cable.
NO5	**Coaxial cable**, 10 MHz – 3 GHz, length 5 m, N-male connectors and traceable ÖKD calibration of cable attenuation.
NO6	**Coaxial cable**, 10 MHz – 3 GHz, length 10 m, N-male connectors and traceable ÖKD calibration of cable attenuation.
NO7	**Ferrite beaded coaxial cable**, 10 MHz – 3 GHz, length 10 m, N-male/SMA-male connectors, including traceable ÖKD cable loss calibration.
NO8	**Coaxial cable**, 100 MHz – 18 GHz, length 5 m, SMA-male/N-female connectors and traceable ISO 17025 calibration of cable attenuation.
NO9	**Rf-adapter**, N/SMA, SMA/SMA or N/N each plug either male or female. Please specify exactly within your order.
NO10	Manual **antenna rotator** for field strength measurements in three orthogonal directions. The rotator can be fixed on tripods with 1/4" mount.
NO11	**Antenna holder** to mount a PCD antenna in horizontal or vertical polarisation on a tripod (1/4" mount).
NO12	**Wooden tripod**, height of antenna with manual or automatic antenna rotator is from 1 m to 2 m, transport size: 65 cm x 13 cm x 13 cm, weight: 3 kg
NO13	**Transportation case** for PCD8250, a rotator and cables.
NO15	Measurement **software NOSE Pro** for control of spectrum analyser and automatic antenna rotator, for ambitious measurement tasks, long term measurements and advanced evaluations of measurement data.
NO16	**Upgrade** of Software NOSE Pro for NOSE Basic users.
AO1	PCD **antenna case**, transportation case for PCD3100 or PCD8250 antenna, additional PCD radiation elements and cables.
RO5	**Antenna coupler** CU8250 for precise system check with PCD3100 or PCD8250 antennas.

SW4	**NSA FAR module** for CalStan 10.0 software NSA for fully anechoic rooms according to following standards and procedures: CISPR 16-1-4 ed.2-2007 (Site Reference), CISPR 16-1-4 ed.2-2007 (NSA method), Seibersdorf Transmission Loss Method.
SW6	**Experimental measurement module** for CalStan 10.0 software measurement of RF Power Level, Field Strength, S11, S21 with additional control of signal generator and antenna mast if applicable for customer specific applications (e.g. Ambient Noise, Table influence, …).

4. OPERATION

4.1. Mounting the PCD on an Antenna Mast

You can use the W ¼ inch thread on the bottom of the mounting base. The thread length of the used W ¼ inch screws must be less than 12 mm. Otherwise the cable inside the mounting base will be damaged.

For convenient operation of the PCD in horizontal and vertical polarisation we recommend to use the optionally available H+V (horizontal and vertical) antenna holder.

For field strength measurements with omnidirectional characteristic we recommend our Field Nose Basic system (see chapter 5.3). The special Add3D holder and rotator together with the control software realises the three orthogonal positions by simple turns of 120° of the holder on his platform.

For accurate measurements, it is very important to keep conductive and massive dielectric parts away from the PCD. Therefore, please mount the antenna always on non-metallic platforms. To achieve the best performance, do not mount the PCD on the plastic supports of your antenna mast directly. Use polystyrene foam as support where applicable.

4.2. Operating Precautions

- Never operate the product outside of specifications
- Never use ¼ inch threads longer than 12 mm to fix the mounting base on any mast
- Never apply any kind of mechanical stress or shock to any part of this product
- Do not open the balun boxes or the antenna mounting bases. This could result in damage or reduced electrical performance and accuracy
- After using this product, please store it in the supplied case
- Prevent from dust, dirt and water
- Temperature of operation: 10°C to 40°C
- Maximum input power: 20dBm
- Maximum field strength: 100 V/m

5. MEASUREMENTS

For doing accurate measurements, it is very important to keep conductive and massive dielectric elements away from the PCD, especially at higher frequencies. Always mount the dipoles on non-metallic platforms.

For best performance do not mount the PCD on large and massive plastic supports. Use polystyrene foam when no proper antenna holder is available.

Hint: An additional attenuator (minimum 3dB) at the balun output should be used to reduce the uncertainty caused by mismatch error.

Hint: To reduce secondary radiation from the antenna cable a ferrite beaded cable should be used. This cable is optionally available in 5 m and 10 m length.

5.1. Simple Field Strength Measurements

To indicate the field strength, the antenna factor, the cable loss and the matching pad attenuation have to be added to the receiver reading.

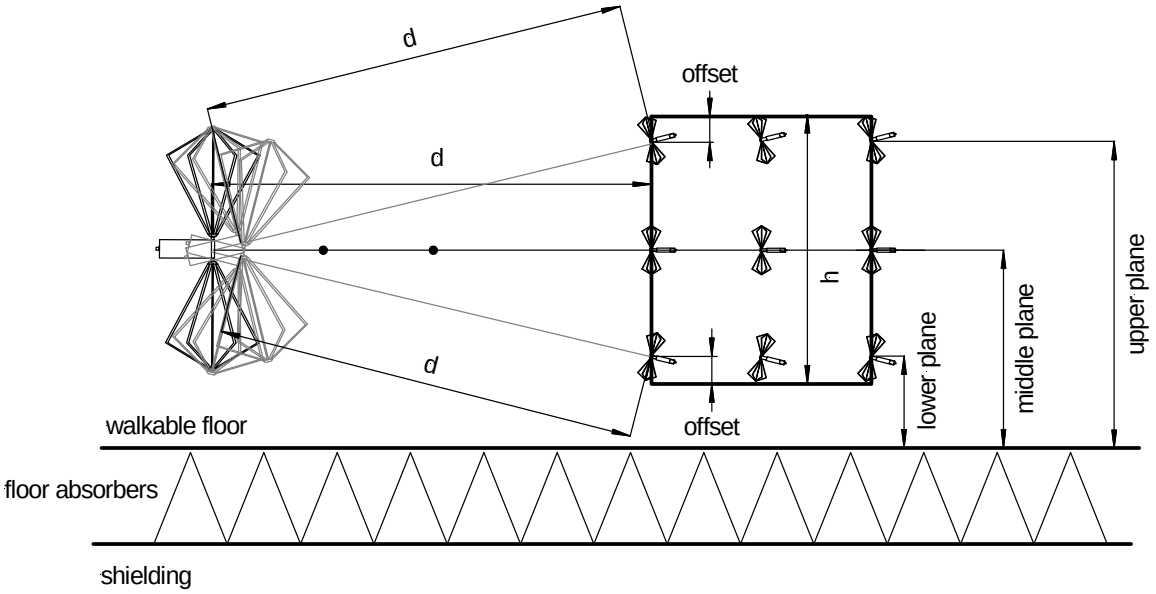
$$E[\text{dB}\mu\text{V/m}] = U_{receiver}[\text{dB}\mu\text{V}] + AF_{PCD}[\text{dB/m}] + ATT_{cable}[\text{dB}] + ATT_{attenuator}[\text{dB}] \qquad (1)$$

5.2. Free Space Site Attenuation Measurements

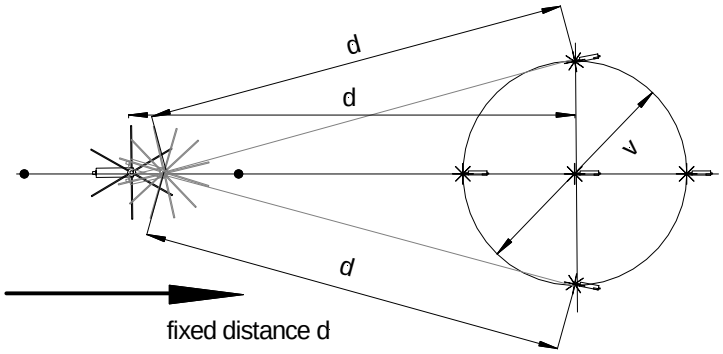
To validate fully anechoic EMC test chambers according to CISPR 16-1-4 a small transmit antenna with dipole like characteristic and a maximum dimension of 40 cm is required. The PCD 3100 is suited best for this type of measurements.

The measurements of the Freespace Normalized Site Attenuation (FSNSA) are done in the frequency range from 30 MHz to 1 GHz with broadband antennas in horizontal and vertical polarisation in the fully anechoic chamber. The volumetric test method is applied. The transmit antenna is placed at 5 measurement positions in 3 heights and 2 polarisations. The receive antenna is kept in a constant distance in the height of the center plane and adjusted (tilted) in direction of the receive antenna. A precise calibration of the antennas is required. Figure 4 shows the setup.

a)



b)



c)

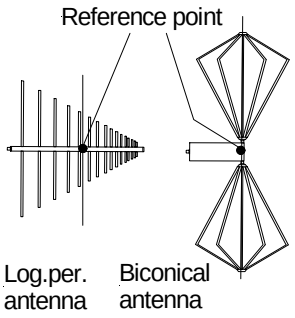


Figure 4: Measurement positions in the test volume for FSNSA measurements (shown only in vertical polarisation)
a) side view: Rx antenna for front position
b) top view: Rx antenna for centre position
c) reference points of the antennas

5.3. EMF Field Strength Measurements (Field Nose)

FIELD NOSE Basic set (Figure 5) consists of a receiving antenna, the automatic antenna rotator, the NOSE Basic measurement software and required USB and RF cables. For traceable measurements the antenna, all used RF-cables and the measurement receiver (spectrum analyzer) have to be individually calibrated. The Rotator, the tripod cables and NOSE software are available optionally.

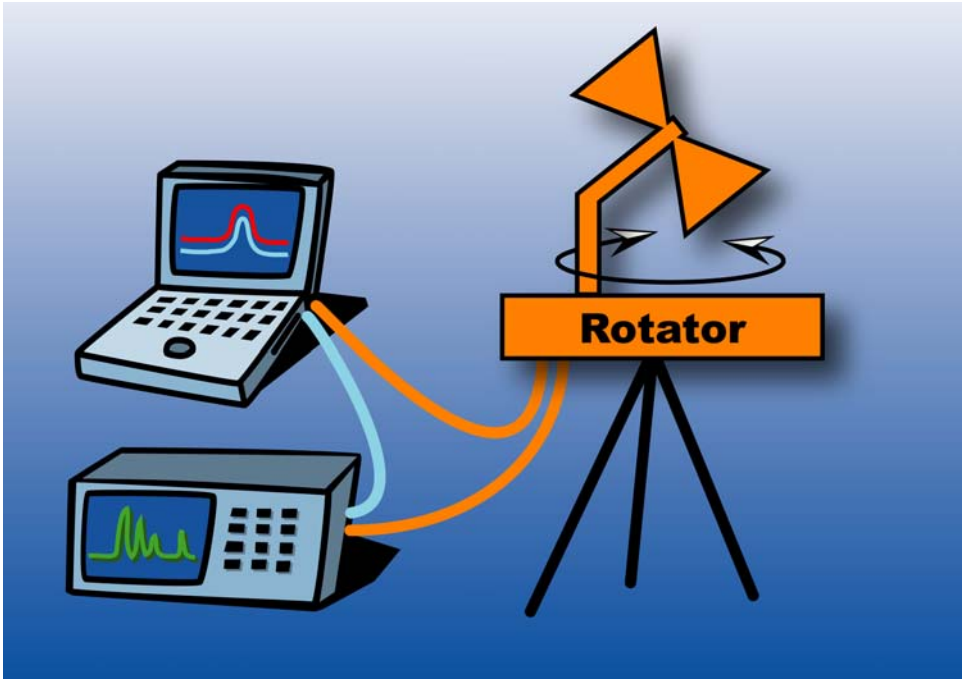


Figure 5: PCD antenna used in Nose Basic

The **Add3D** method we have developed and implemented in **NOSE software** is based on the **frequency selective** measurement method with a receiver or spectrum analyser and uses a **broadband omnidirectional receive antenna**. The directional characteristic of this antenna is similar to that of an elementary dipole. Therefore the effective field strength can be obtained from three voltage measurements with orthogonal orientation (e.g.: x-, y- and z- axis) of the antenna: U_x, U_y and U_z [V].

The field-strengths are calculated in linear quantities:

$$E_i = U_i \cdot AF, \quad i = \{x, y, z\} \tag{2}$$

The effective field strength E_{eff} [V/m] is calculated as follows:

$$E_{eff} = \sqrt{E_x^2 + E_y^2 + E_z^2} \quad = \quad \sqrt{U_x^2 + U_y^2 + U_z^2} \cdot AF \tag{3}$$

Where AF is the antenna factor in linear quantities [1/m]. All contributions (U, AF) and therefore also E_{eff} are frequency dependent.

The measurements in 3 orthogonal directions are done with one antenna. Therefore the only problem that remains is that the readings do not happen at the same time. To avoid measurement errors due to rapidly changing signals sufficiently long measurement times with max-hold acquisition have to be chosen at each direction.

The acronym **Add3D** stands for **Add**ition of **3 D**imensional Field Components according to Eq 3.

+ The measurement procedure is simple and time efficient as it is controlled by software **NOSE**. The operator positions the antenna in the three different orientations, the software sets the receiver bandwidth and the frequency range and stores the measured data.
+ The measurements are done in the frequency range of interest, the appropriate limit values can be applied
+ Out of band signals play no role if the receiver is well designed.
+ With one set of measurements (3 directions) the effective field strength's of all neighbouring base stations (operating at different frequencies) can be determined. This is a great time saving advantage for mapping the field distribution.
+ The **Add3D** is a precision measurement method that combines the advantages of the field probe (isotropic behaviour) with that of frequency selective measurements.

6. WARRANTY

The General Terms of Delivery issued by the Austrian Electrical and Electronics Industry Association of January 2002 are valid.

The Seibersdorf Labor GmbH warrants that our products are free from defects in workmanship and materials, under normal use and service, for a period of one year from the date of shipment. During the warranty period, the Seibersdorf Labor GmbH will, at its option, either repair or replace those products or parts which prove to be defective.

LIMITATION OF WARRANTY

Warranty does not apply to:

- Normal wear and tear of materials
- Products which have been improperly installed, maintained, or used.
- Products which have been operated outside of specifications
- Products with unauthorised modifications

ASSISTANCE

For any assistance, please contact Seibersdorf Labor GmbH. Address is provided at the bottom of this page.

CONTACT

Seibersdorf Labor GmbH
RF Engineering
2444 Seibersdorf, Austria

www.seibersdorf-laboratories.at/rf
Fax: +43 (0) 50550 - 2813