SEIBERSDORF LABORATORIES

FREQUENTLY ASKED SOLUTIONS


# MANUAL

## PRD - Precision Reference Dipoles

SEIBERSDORF LABORATORIES

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

# MANUAL
# Precision Reference Dipoles

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Version 2.0

# Notice

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# 1. GENERAL INFORMATION

## 1.1. Product Description

Seibersdorf Laboratories *Precision Reference Dipoles* PRD are highly accurate reference dipoles for site validations, antenna calibrations and emission testing according to CISPR [3] and ANSI [4] standards in the frequency range 30 MHz to 1000 MHz.

The dipoles are built of cylindrical elements of fixed length that can be screwed into the feeds. The element diameters are 18 mm (30 MHz - 250 MHz) and 3 mm (300 MHz - 1000 MHz). Symmetrical feeds are achieved by broadband baluns consisting of precision 180°-hybrid couplers.

A table of free-space antenna factors at the resonance frequency is included in the manual. Individual balun calibration factors are supplied with each antenna.

## 1.2. Specifications

### 1.2.1. Balun

Specifications apply at 22° ± 5°.

| | |
|---|---|
| Frequency Range | 30 MHz - 1000 MHz |
| Input Impedance (nominal) | 50 Ω |
| Maximum input power (any port) | 20 dBm |
| Connector | SMA type |
| Balanced port impedance (nominal) | 100 Ω |
| Maximum balanced port V.S.W.R | 1.1 |
| Maximum phase unbalance | 2° |
| Maximum amplitude unbalance | 0.2 dB |

### 1.2.2. Dipoles

| | |
|---|---|
| Resonance frequencies | 30, 35, 40, 45, 50, 60, 70, 80, 90, 100, 120, 125, 140, 150, 160, 175, 180, 200, 250, 300, 400, 500, 600, 700, 800, 900 and 1000 MHz |
| Uncertainty at resonance frequency[1] | 0.15 dB (95.5 %, k=2) |
| Uncertainty within ±15 % bandwidth | 0.25 dB (95.5 %, k=2) |
| Maximum field strength exposure: | |
| 30 MHz - 50 MHz dipoles | 5 V/m |
| 60 MHz - 100 MHz dipoles | 10 V/m |
| 120 MHz - 200 MHz dipoles | 20 V/m |
| 250 MHz - 1000 MHz dipoles | 40 V/m |

### 1.2.3. Environmental Requirements

**Humidity**: Protect this product against water and temperature extremes which can cause internal condensation

**Temperature of operation**: 10°C to 40°C

[1] valid for ideal test site, constant environment conditions and an additional 6 dB attenuator on the dipole connector

### 1.2.4. Antenna Factors

In Table 1, 2 and Figure 1, 2 you will find the calculated PRD free-space antenna factors $AF_{FSc}$. (Calculated with the Seibersdorf Laboratories program *Antenna*, load impedance 100 Ω)

**Table 1:**
Calculated free-space antenna factors of 18 mm element diameter dipoles

| Frequency [MHz] | $AF_{FSc}$ [dB(1/m)] |
|---|---|
| 30 | -5.26 |
| 35 | -3.92 |
| 40 | -2.76 |
| 45 | -1.74 |
| 50 | -0.83 |
| 60 | 0.76 |
| 70 | 2.10 |
| 80 | 3.26 |
| 90 | 4.28 |
| 100 | 5.19 |
| 120 | 6.78 |
| 125 | 7.13 |
| 140 | 8.11 |
| 150 | 8.71 |
| 160 | 9.27 |
| 175 | 10.05 |
| 180 | 10.29 |
| 200 | 11.21 |
| 250 | 13.14 |

**Table 2:**
Calculated free-space antenna factors of 3 mm element diameter dipoles

| Frequency [MHz] | $AF_{FSc}$ [dB(1/m)] |
|---|---|
| 300 | 14.74 |
| 400 | 17.24 |
| 500 | 19.17 |
| 600 | 20.76 |
| 700 | 22.10 |
| 800 | 23.25 |
| 900 | 24.28 |
| 1000 | 25.19 |

To get the real free-space antenna factor $AF_{PRD}$ at the 50 Ω type SMA connector of the PRD, the individual balun attenuation $ATT_{balun}$ must be added to the calculated PRD antenna factor.

$$AF_{PRD}\ [\mathrm{dB(1/m)}] = AF_{FSc}\ [\mathrm{dB(1/m)}] + ATT_{balun}\ [\mathrm{dB}]$$

Table 3 is an example of a typical PRD free-space antenna factor $AF_{PRD}$

**Remark:** You have to use $AF_{PRD}$ for field strength measurements with a single dipole.

**Figure 1:** Calculated free-space antenna factors of 18 mm dipoles

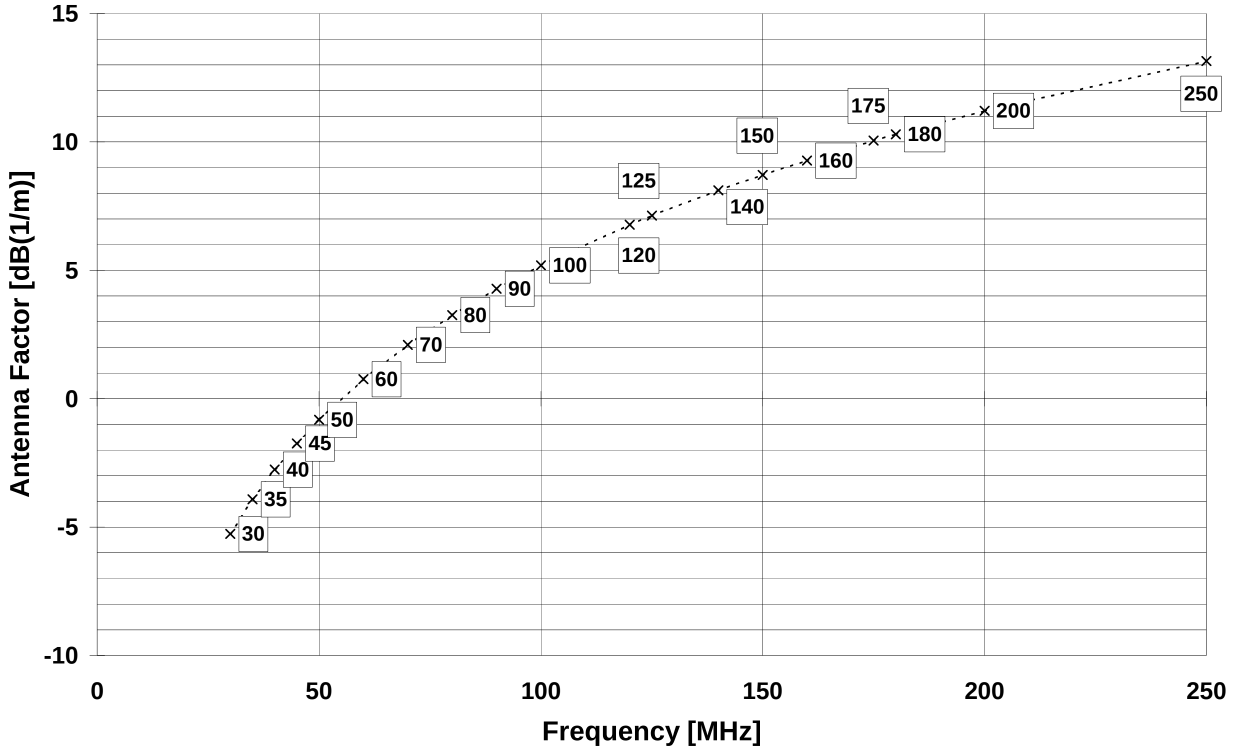



**Figure 2:** Calculated free-space antenna factors of 3 mm dipoles

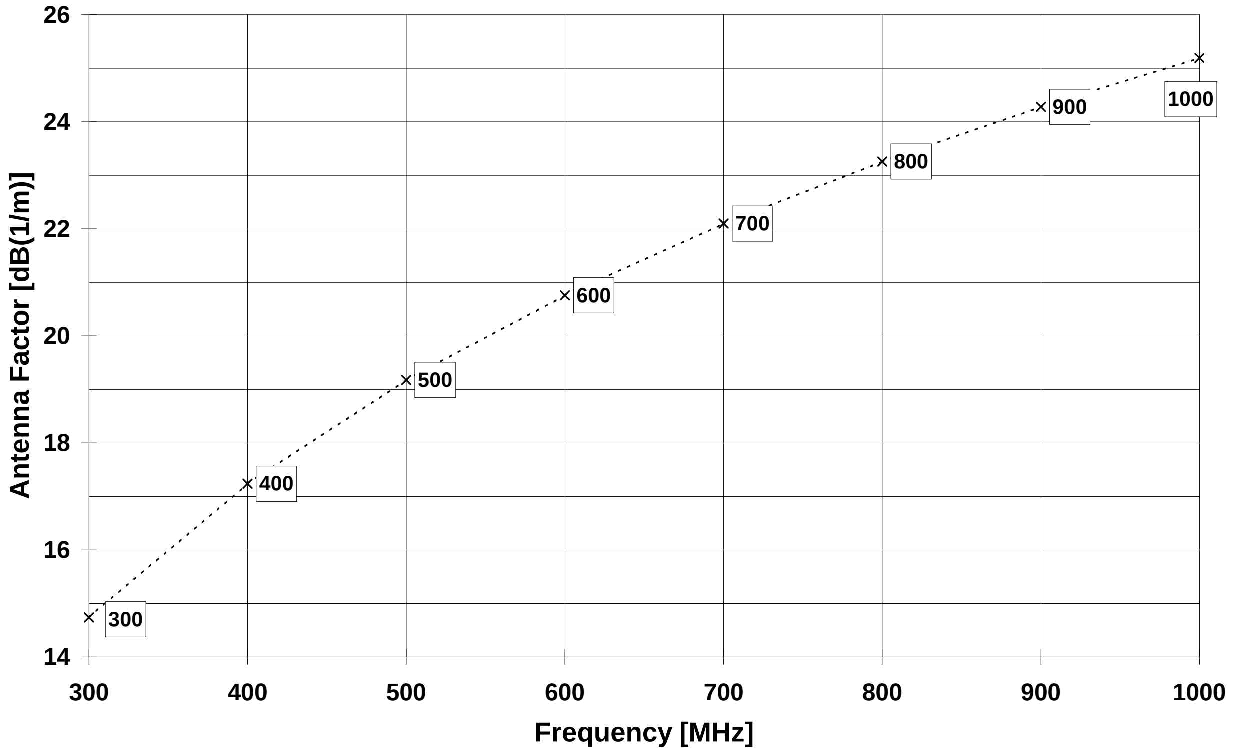


**Table 3:**
Typical PRD free-space antenna factor AFPRD

| Frequency [MHz] | $AF_{FSc}$ [dB(1/m)] | SNxyz $ATT_{balun}$ [dB] | $AF_{PRD}$ [dB(1/m)] |
|---|---|---|---|
| 30 | -5.26 | 9.71 | 4.45 |
| 35 | -3.92 | 9.73 | 5.80 |
| 40 | -2.76 | 9.74 | 6.98 |
| 45 | -1.74 | 9.75 | 8.01 |
| 50 | -0.83 | 9.77 | 8.94 |
| 60 | 0.76 | 9.79 | 10.55 |
| 70 | 2.10 | 9.81 | 11.91 |
| 80 | 3.26 | 9.83 | 13.09 |
| 90 | 4.28 | 9.85 | 14.13 |
| 100 | 5.19 | 9.87 | 15.06 |
| 120 | 6.78 | 9.90 | 16.67 |
| 125 | 7.13 | 9.90 | 17.03 |
| 140 | 8.11 | 9.92 | 18.04 |
| 150 | 8.71 | 9.93 | 18.65 |
| 160 | 9.27 | 9.95 | 19.22 |
| 175 | 10.05 | 9.96 | 20.01 |
| 180 | 10.29 | 9.97 | 20.26 |
| 200 | 11.21 | 9.99 | 21.20 |
| 250 | 13.14 | 10.03 | 23.17 |
| 300 | 14.74 | 10.07 | 24.81 |
| 400 | 17.24 | 10.15 | 27.39 |
| 500 | 19.17 | 10.23 | 29.40 |
| 600 | 20.76 | 10.30 | 31.06 |
| 700 | 22.10 | 10.39 | 32.48 |
| 800 | 23.25 | 10.47 | 33.73 |
| 900 | 24.28 | 10.57 | 34.85 |
| 1000 | 25.19 | 10.69 | 35.88 |

**Hint:** You will find the individual balun attenuation data $ATT_{balun}$ and the calculation of your PRD free-space antenna factor in your **Balun Calibration Data and Antenna Factor Sheet**.

## 1.2.5. Site Attenuation Values

In Table 4 you will find the NEC[2] calculated values of theoretical site attenuation $\boldsymbol{SA_c}$ for Seibersdorf Laboratories PRD. These values should be used for measurements according to the CISPR [3]. Please replace the values of the corresponding table in the standard with the exact values of Table 4. The Table in the standard is an example only, and not valid when using Seibersdorf Laboratories PRD. The values are given for a measurement distance of $d$ = 10 m, a height $h_t$ = 2 m of transmit antenna and a fixed height $h_r$ of the receiving antenna.

**Table 4:**
Numerical values of calculated Site Attenuation SAc for Seibersdorf Laboratories PRD.

| $f$ MHz | $h_r$ m | $R_{we}$ mm | $L_a$ m | $SA_c$ dB | $f$ MHz | $h_r$ m | $R_{we}$ mm | $L_a$ m | $SA_c$ dB |
|---|---|---|---|---|---|---|---|---|---|
| 30 | 4.00 | 9.00 | 4.744 | 21.00 | 160 | 2.00 | 9.00 | 0.863 | 26.43 |
| 35 | 4.00 | 9.00 | 4.058 | 20.94 | 180 | 2.00 | 9.00 | 0.765 | 27.47 |
| 40 | 4.00 | 9.00 | 3.545 | 20.60 | 200 | 2.00 | 9.00 | 0.687 | 29.36 |
| 45 | 4.00 | 9.00 | 3.146 | 20.69 | 250 | 1.50 | 9.00 | 0.546 | 30.38 |
| 50 | 4.00 | 9.00 | 2.827 | 21.11 | 300 | 1.50 | 1.50 | 0.4711 | 32.47 |
| 60 | 4.00 | 9.00 | 2.349 | 22.15 | 400 | 1.20 | 1.50 | 0.3517 | 34.89 |
| 70 | 4.00 | 9.00 | 2.008 | 21.80 | 500 | 2.30 | 1.50 | 0.2802 | 37.00 |
| 80 | 4.00 | 9.00 | 1.753 | 20.94 | 600 | 2.00 | 1.50 | 0.2327 | 38.34 |
| 90 | 4.00 | 9.00 | 1.555 | 21.46 | 700 | 1.70 | 1.50 | 0.1988 | 39.58 |
| 100 | 4.00 | 9.00 | 1.396 | 22.93 | 800 | 1.50 | 1.50 | 0.1735 | 40.90 |
| 120 | 4.00 | 9.00 | 1.159 | 25.14 | 900 | 1.30 | 1.50 | 0.1538 | 41.83 |
| 140 | 2.00 | 9.00 | 0.990 | 27.22 | 1000 | 1.20 | 1.50 | 0.1380 | 42.69 |

[2] Note: If you are using the Software Antenna to calculate the $SA_c$ , the values could vary by an amount of ± 0.02 dB to the values given in the Table 4 due to small differences in the underlying NEC software version.

In Table 5 and Table 6 you will find the theoretical normalized site attenuation values $A_N$ ,the NEC[3] calculated values of theoretical site attenuation $SA_c$ and the sum of antenna factors of Seibersdorf Laboratories PRD for the specified geometry and polarisation. These values should be used for measurements according to the CISPR 16-1-5 [3] or ANSI C63.4 [4] standard.

If you are using the theoretical normalized site attenuation values $A_N$ given in the standards, you should use the NEC calculated values of column $AF_{TX} + AF_{RX}$ for the sum of PRD antenna factors.

To simplify the search of maximum received signal, in column $h_r$ the theoretical height of maximum received signal is given.

The values in Table 5 are given for horizontal polarisation, a measurement distance of $d$ = 10 m and a height $h_t$ = 2 m of the transmit antenna. The height $h_r$ of the receiving antenna is adjusted between 1-4 m for maximum received signal.

The values in Table 6 are given for vertical polarisation, a measurement distance of $d$ = 10 m and a height $h_t$ = 2.75 m of the transmit antenna. The height of the receiving antenna is adjusted between 1-4 m for maximum received signal. There are restrictions in the scan height $h_r$ , the lowest tip of the receive dipole is kept 25 cm or more from the conducting ground plane.

[3] Note: If you are using the Software Antenna to calculate the $SA_c$ , the values could vary by an amount of ± 0.02 dB to the values given in the Table 4 due to small differences in the underlying NEC software version.

**Table 5:**
Numerical values for site validation measurements according to ANSI or CISPR.
**Horizontal polarisation, d = 10 m, $h_t$ =2 m**

| Frequency [MHz] | $A_N$ [dB] | $AF_{TX} + AF_{RX}$ [dB(1/m)] | $SA_c$ [dB] | $h_r$ [m] |
|---|---|---|---|---|
| 30 | 24.1 | -3.10 | 21.00 | 4.00 |
| 35 | 21.6 | -0.66 | 20.94 | 4.00 |
| 40 | 19.4 | 1.20 | 20.60 | 4.00 |
| 45 | 17.5 | 3.19 | 20.69 | 4.00 |
| 50 | 15.9 | 5.21 | 21.11 | 4.00 |
| 60 | 13.1 | 8.96 | 22.06 | 3.42 |
| 70 | 10.9 | 10.90 | 21.80 | 4.00 |
| 80 | 9.2 | 11.74 | 20.94 | 4.00 |
| 90 | 7.8 | 13.53 | 21.33 | 3.79 |
| 100 | 6.7 | 15.58 | 22.28 | 3.40 |
| 120 | 5.0 | 19.67 | 24.67 | 2.84 |
| 125 | 4.6 | 20.47 | 25.07 | 2.73 |
| 140 | 3.5 | 22.33 | 25.83 | 2.44 |
| 150 | 2.9 | 23.14 | 26.04 | 2.28 |
| 160 | 2.3 | 23.91 | 26.21 | 2.14 |
| 175 | 1.5 | 25.46 | 26.96 | 1.95 |
| 180 | 1.2 | 26.15 | 27.35 | 1.90 |
| 200 | 0.3 | 28.44 | 28.74 | 1.71 |
| 250 | -1.7 | 31.76 | 30.06 | 1.37 |
| 300 | -3.3 | 35.18 | 31.88 | 1.14 |
| 400 | -5.8 | 40.54 | 34.74 | 3.05 |
| 500 | -7.6 | 44.50 | 36.90 | 2.42 |
| 600 | -9.3 | 47.64 | 38.34 | 2.00 |
| 700 | -10.7 | 50.26 | 39.56 | 1.60 |
| 800 | -11.8 | 52.64 | 40.84 | 1.40 |
| 900 | -12.9 | 54.66 | 41.76 | 1.24 |
| 1000 | -13.8 | 56.39 | 42.59 | 1.12 |

**Table 6:**
Numerical values for site validation measurements according to ANSI or CISPR.
**Vertical polarisation, d = 10 m, $h_t$ =2.75 m**

| Frequency [MHz] | $A_N$ [dB] | $AF_{TX} + AF_{RX}$ [dB(1/m)] | $SA_c$ [dB] | $h_r$ [m] |
|---|---|---|---|---|
| 30 | 18.6 | -2.14 | 16.46 | 3.10 |
| 35 | 17.4 | -0.45 | 16.95 | 2.70 |
| 40 | 16.2 | 1.66 | 17.86 | 2.40 |
| 45 | 15.1 | 3.50 | 18.60 | 2.20 |
| 50 | 14.2 | 5.03 | 19.23 | 1.95 |
| 60 | 12.6 | 8.31 | 20.91 | 1.65 |
| 70 | 11.3 | 11.10 | 22.40 | 1.40 |
| 80 | 10.2 | 13.37 | 23.57 | 1.22 |
| 90 | 9.2 | 15.38 | 24.58 | 1.10 |
| 100 | 8.4 | 17.03 | 25.43 | 1.00 |
| 120 | 7.5 | 19.73 | 27.23 | 1.00 |
| 125 | 7.3 | 20.42 | 27.72 | 1.00 |
| 140 | 5.5 | 22.80 | 28.30 | 4.00 |
| 150 | 4.7 | 23.89 | 28.59 | 3.89 |
| 160 | 3.9 | 25.02 | 28.92 | 3.62 |
| 175 | 3.0 | 26.48 | 29.48 | 3.32 |
| 180 | 2.7 | 26.99 | 29.69 | 3.22 |
| 200 | 1.6 | 28.79 | 30.39 | 2.90 |
| 250 | -0.6 | 32.64 | 32.04 | 2.30 |
| 300 | -2.3 | 35.79 | 33.49 | 1.90 |
| 400 | -5.0 | 41.43 | 36.43 | 2.92 |
| 500 | -6.9 | 44.60 | 37.70 | 1.14 |
| 600 | -8.4 | 47.90 | 39.50 | 1.92 |
| 700 | -9.8 | 50.55 | 40.75 | 1.64 |
| 800 | -11.0 | 52.85 | 41.85 | 1.42 |
| 900 | -12.0 | 54.84 | 42.84 | 1.26 |
| 1000 | -13.0 | 56.72 | 43.72 | 1.14 |

# 2. INSTALLATION

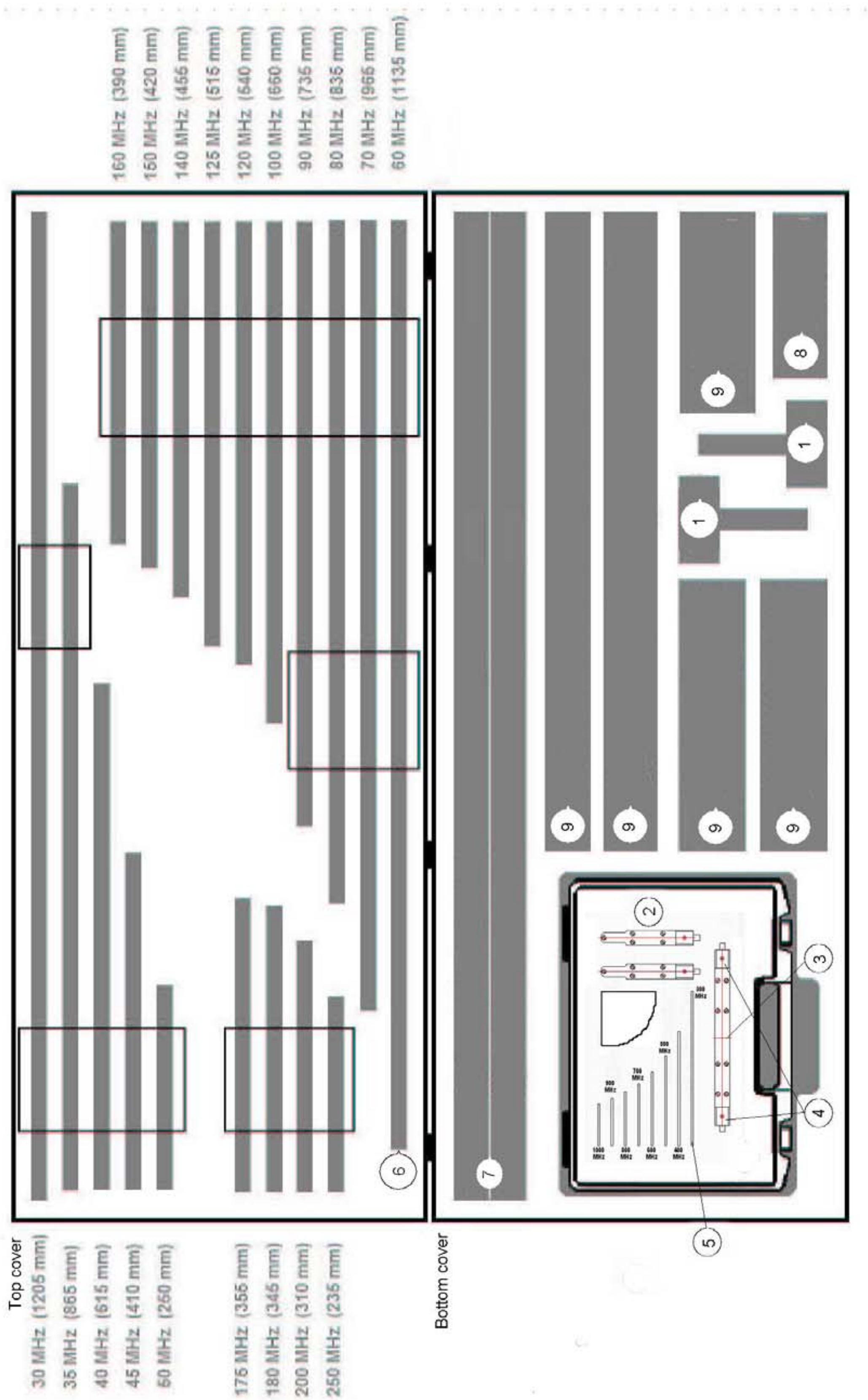
## 2.1. Contents

The contents of shipment should be as listed in the table below. The numbers are referring to the figure on the next page. This list is valid for a set of PRD (2 units).

| Qty | Description | SL part name | Reference Designation |
|---|---|---|---|
| 2 | mounting bases 30 - 250 MHz | PRD-L | 1 |
| 2 | support beams for dipoles 30 - 50 MHz | PRD-LS | 7 |
| 19 | 18 mm antenna elements<br>(4 of each frequency)[4] | PRD-A | 6 |
| | support beam mounting material | | not shown |
| 2 | mounting bases 250 - 1000 MHz | PRD-H | 2 |
| 8 | 3 mm antenna elements (4 of each frequency) | PRD-M | 5 |
| 1 | "thru" calibration kit | PRD-C | 3 |
| 2 | baluns (mounted on calibration kit) | PRD-B | 4 |
| | mounting material | | 8 |
| | Cut-offs for optional holder,<br>PRD mount on INNCO mast | | 9 |
| | Documents:<br>Balun Calibration Data and AF-Factor Sheet<br>PRD User's Guide | | not shown |
| | Software with instructions<br>(depending on purchase) | | not shown |

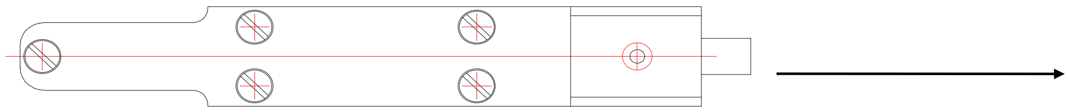
[4] The elements for 30 MHz - 50 MHz are screwed on the outer tips of the 60 MHz elements

**Figure 3**: Contents of carrying case



## 2.2. Connecting the Baluns

To disconnect a balun from the calibration kit or the mounting bases, you have to unscrew the balun first. Than you can carefully remove the balun by slipping it horizontally out of the base by using your thumb.



For connecting the baluns, slip them without use of force until they fit. Than you have to screw the baluns before connecting them to a cable.

**Caution:** The tiny connectors on the symmetrical side of the balun and antenna feed section are not user replaceable and should be protected from dirt, any kind of mechanical shock and accidental damage.

**Hint:** You can do a simple check of the balun and mounting base electric contacts by measuring the impedance between balun ground (metallic case or SMA connector) and the small metallic bolts or dipole elements at the front end of the dipole. You should obtain a value of approx. 31 Ohm (± 0.5 Ohm), depending of the accuracy of your DC Ohmmeter. A very high impedance (e.g. MOhm range) indicates a failure of the electric contacts!

## 2.3. Mounting the Support Beam

**Caution:** If you want to use the 30 MHz to 50 MHz dipoles, the L-shaped support beams must be mounted first for mechanical protection of the dipole mounting bases and to avoid hanging down of the outer tips of the dipole elements

First unscrew the plastic nuts. After that you can attach the support beams and fix them manually by using the plastic nuts again. It is not necessary to remove the dipole elements. On the outer tips of the 60 MHz dipole elements you can screw in the 30 MHz to 50 MHz dipole elements.

**Hint:** Remove the support beams for frequencies above 50 MHz to achieve the specified accuracy.

## 2.4. Screwing the Dipole Elements

Pick up the 3 mm dipole elements from the case by using both hands to avoid bending of the elements. Screw on the dipole elements without use of force until they fit on the mounting base to guarantee a low impedance contact and the specified resonance frequency.

## 2.5. Mounting the Dipoles on a Mast

You can use the W ¼ inch thread on the bottom of the mounting bases.

**Caution:** The thread length of the used W ¼ inch screws must be less than 12 mm. Otherwise the cable inside the mounting base can be damaged.

For the higher frequency dipoles (300 –1000 MHz), we recommend to use the maximum possible separation between the mounting base and the massive plastic parts of your mast.

# 3. OPERATION

## 3.1. Operating Precautions

- Never operate the product outside of specifications
- 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

## 3.2. Measurements

For doing accurate measurements, it is very important to keep conductive and massive dielectric elements away from the PRD, especially at higher frequencies. Always mount the dipoles on non-metallic platforms. For best performance do not mount the PRD on large and massive plastic supports. Use polystyrene foam where applicable.

To avoid errors on an open area test-site caused by temperature change, please measure periodically the cable and balun loss.

**Hint:** An additional attenuator (minimum 6dB) at the dipole output (and input) should be used to reduce the uncertainty caused by mismatch error. It must be used to achieve the specified accuracy.

### 3.2.1. Field Strength Measurements

To indicate the field strength, the antenna factor, the cable loss and the attenuators should be added to the receiver reading.

$$E[\mathrm{dB\mu V/m}] = U_{receiver}[\mathrm{dB\mu V}] + AF_{PRD}[\mathrm{dB/m}] + ATT_{cable}[\mathrm{dB}] + ATT_{attenuators}[\mathrm{dB}]$$

**Caution:** The PRD antenna factor $AF_{PRD}$ is height dependent for horizontal polarisation above ground plane, especially for the lower resonance frequencies dipoles. We recommend the use of height correction factors calculated by the Seibersdorf Laboratories software *ANTENNA*.

### 3.2.2. Site Attenuation Measurements

Start your site attenuation measurement with the determination of cable (including attenuators) and balun attenuation $ATT_{cable\&balun}$[dB] over the whole PRD frequency range. For this job, please mount baluns on the calibration kit using both screws. Than connect your cable (with attenuator and adapters) to the calibration kit. In the second step, you should measure the transmission loss $TL_{PRD}$[dB] between a pair of dipoles at the test-site configuration you have selected. You obtain the site attenuation $SA_{site}$[dB] by subtracting the cable and balun loss data from the transmission loss measurement result.

$$SA_{site}[\mathrm{dB}] = TL_{PRD}[\mathrm{dB}] - ATT_{cable\&balun}[\mathrm{dB}]$$

Your test-site setup, consisting of antenna heights, distance and frequency should be selected in a way, that you will obtain a constructive interference between the direct wave and the reflected wave. You can calculate the optimal setup and the theoretical site attenuation $SA_c$[dB] by using the Seibersdorf software *ANTENNA*.

**Hint:** If you want to achieve maximum accuracy, e.g. for validation of Antenna-Calibration Test-Site according to CISPR [3], you have to use NEC calculated theoretical site attenuation by using the Seibersdorf software *ANTENNA*

To increase the accuracy of normalised site attenuation NSA measurements according to CISPR [3] or ANSI [4], you can add the numerical calculated sum of antenna factors given in Table 5 and 6 to the theoretical NSA values specified in the standards to get theoretical $SA_c$.

You will obtain the NSA deviation $\Delta_{NSA}$ by subtracting the theoretical site attenuation $SA_c$[dB] from your measurement result $SA_{site}$[dB].

$$\Delta_{NSA}[\mathrm{dB}] = SA_{site}[\mathrm{dB}] - SA_c[\mathrm{dB}]$$

An additional requirement for measurements with high accuracy is the necessity to use the tuned dipoles only at their resonance frequency or within ±15% bandwidth.

### 3.2.3. Antenna Calibration using the Reference Antenna Method (RAM)

In our calibration laboratory, we apply the following method for the calibration of our customers antennas (antenna under calibration, AUC).

In order to enable swept-frequency techniques and save calibration time, the reference antenna method (RAM) is applied in two steps. The second step is optional, if you want to calibrate other dipoles or time consumption is not so important.

### 3.2.4. Calibration of a broadband transfer standard antenna (TSA) by substitution against the Precision Reference Dipoles (PRD)

A field is set up by a broadband transmit antenna on the OATS. Horizontal polarization is used in order to minimize any influences of the vertically oriented feed cables. Two sets of TL measurements are made: First, the receive antenna is a PRD at each frequency. Then, the TSA is used as receive antenna, see Figure 4a. Both PRD and TSA are operated at a fixed height. Transmit and receive antenna heights are chosen in a way that the receive antenna is positioned in or near to a relative maximum of the field-strength. In the frequency range of 300 - 1000 MHz this will require different heights of the transmit antenna (frequency-dependent) together with a fixed height of the receive antenna. The distance must be chosen large enough, so that there is a plane wave impinging on the receive antenna. This is necessary to avoid errors due to different lengths and averaging volumes of the two antennas used in the substitution measurement. At a distance of 10 m, far-field conditions will be achieved even at 30 MHz. Finally, the antenna factors of the PRDs are calculated using software *ANTENNA* and the antenna factor of the TSA is calculated from

$$AF_{TSA} = AF_{PRD} + (TL_{TSA} - TL_{PRD}) \quad [\mathrm{dB(1/m)}]$$

for each frequency.

### 3.2.5. Calibration of a customer's antenna (AUC) by substitution against the transfer standard antenna (TSA)

The procedure is exactly the same as above, where both TSA and AUC are operated as receive antennas at the same distance used before, see Figure 4b. Now the calibration can be performed in frequency scans over the whole frequency range where the AUC shall be calibrated. The antenna factor of the AUC is calculated from

$$AF_{AUC} = AF_{TSA} + (TL_{AUC} - TL_{TSA}) \quad [\mathrm{dB(1/m)}]$$

for each frequency.

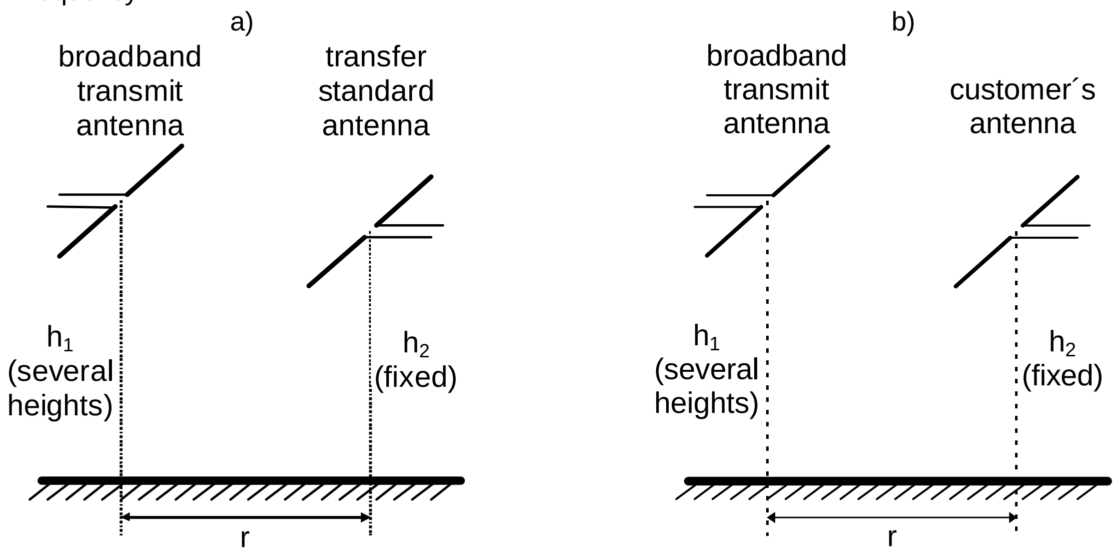



**Figure 4**: Antenna calibration by suing a reference antenna

# 4. CERTIFICATE

THE FOLLOWING TESTS HAVE BEEN PERFORMED BEFORE DELIVERY:

- Measurement of the individual Balun loss
- Measurement of the combined Balun Loss
- Check of the proper fitting of baluns and mounting bases
- Check of the proper fitting of baluns and “thru” calibration unit

The product PRD is in conformity with the following directives and standards:

- EMC directive 89/336/EEC and later amendments: As EMC passive device no EMC emission or susceptibility is possible. Anyway an ESD-Test is performed and passed to check the immunity against ESD (which could damage internal components)
- EN 61 000-6-4: Generic
- EN 61 000-4-2: ESD

# 5. LITERATURE


[1] H.Garn, M.Buchmayr, W.Müllner, J.Rasinger: "Primary standards for antenna factor calibration in the frequency range of 30 to 1000 MHz", IEEE Trans.Instrumentation Measurem., vol. 46, no. 2, April 1997

[2] H.Garn, M.Buchmayr, W.Müllner: "Tracing antenna factors in the range of 30 - 1000 MHz to basic quantities", OEFZS-4799, April 1997

[3] CISPR 16-1-5 First edition 2003-11 " Specification for radio disturbance and immunity measuring apparatus and methods – Part 1-5: Radio disturbance and immunity measuring apparatus – Antenna calibration test sites for 30 MHz to 1 000 MHz", November 2003

[4] ANSI C63.4-2003 (Revision of ANSI C63.4-2001), "American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz." 30.1.2004.

[5] H.Garn, M.Buchmayr and W.Müllner: "Tracing antenna factors of precision dipoles to basic quantities", IEEE Transactions on Electromagnetic Compatibility, vol. 40, no. 4, November 1998

# 6. WARRENTY

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.

## CONTACT

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