

## USER'S GUIDE

### Vaisala Telemetry Antenna RB31



## PUBLISHED BY

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# CHAPTER 1

## GENERAL INFORMATION

This chapter provides general notes for the manual and Vaisala Telemetry Antenna RB31.

### About This Manual

This manual provides information for installing, operating, and maintaining Vaisala Telemetry Antenna RB31.

### Contents of This Manual

This manual consists of the following chapters:

- Chapter 1, General Information, provides general notes for the manual and Vaisala Telemetry Antenna RB31.
- Chapter 2, Product Overview, gives a general description of the RB31 antenna system.
- Chapter 3, Installation, explains the unpacking and setting up of the antenna.
- Chapter 4, Operation, provides additional information for using the RB31 system.
- Chapter 5, Maintenance, provides information on RB31 maintenance.
- Chapter 6, Technical Data, provides the technical specifications.
- Chapter 7, Parts List, contains the parts list for Vaisala Telemetry Antenna RB31.
- Chapter 8, Drawings, contains the essential drawings for RB31.
- Chapter 9, Technical Support, provides information on technical support.

## Version Information

**Table 1**      **Manual Revisions**

Manual Code	Description
M210538EN-J	March 2015. Updated information on cable lengths.
M210538EN-H	June 2013. Added radiation patterns and updated information on antenna cable attenuation.
M210538EN-G	June 2012. Parts list updated.
M210538EN-F	May 2012. Information on installation added.
M210538EN-E	February 2012. Information on grounding cable added.
M210538EN-D	September 2010. New template.
M123456EN-C	Previous version.

## Documentation Conventions

Throughout the manual, important safety considerations are highlighted as follows:

**WARNING**

Warning alerts you to a serious hazard. If you do not read and follow instructions very carefully at this point, there is a risk of injury or even death.

**CAUTION**

Caution warns you of a potential hazard. If you do not read and follow instructions carefully at this point, the product could be damaged or important data could be lost.

**NOTE**

Note highlights important information on using the product.

## Safety

RB31 delivered to you has been tested for safety and approved as shipped from the factory. Note the following precautions:

**WARNING**

Ground the product and verify outdoor installation grounding periodically to minimize shock hazard.

**CAUTION**

Do not modify the unit. Improper modification can damage the product or lead to malfunction.

## ESD Protection

Electrostatic Discharge (ESD) can cause immediate or latent damage to electronic circuits. Vaisala products are adequately protected against ESD for their intended use. It is possible to damage the product, however, by delivering electrostatic discharges when touching, removing, or inserting any objects inside the equipment housing.

To make sure you are not delivering high static voltages yourself:

- Handle ESD sensitive components on a properly grounded and protected ESD workbench.
- When an ESD workbench is not available, ground yourself to the equipment chassis with a wrist strap and a resistive connection cord.
- If you are unable to take either of the above precautions, touch a conductive part of the equipment chassis with your other hand before touching ESD sensitive components.
- Always hold component boards by the edges and avoid touching the component contacts.

## Recycling



Recycle all applicable material.



Dispose of batteries and the unit according to statutory regulations. Do not dispose of with regular household refuse.

## Trademarks

MARWIN® is a registered trademark of Vaisala Oyj.

Windows® is a registered trademark of Microsoft Corporation in the United States and/or other countries.

## Warranty

Visit our Internet pages for standard warranty terms and conditions:

[www.vaisala.com/warranty](http://www.vaisala.com/warranty).

Please observe that any such warranty may not be valid in case of damage due to normal wear and tear, exceptional operating conditions, negligent handling or installation, or unauthorized modifications. Please see the applicable supply contract or Conditions of Sale for details of the warranty for each product.



## CHAPTER 2

# PRODUCT OVERVIEW

This chapter gives a general description of the RB31 antenna system.

## Introduction to RB31

Vaisala Telemetry Antenna RB31 is a directional UHF antenna used with Vaisala sounding systems to receive radiosonde signals in the 400 MHz meteorological band. RB31 can be used in conjunction with a sounding system equipped with Vaisala Sounding Processing Subsystem SPS311.

The main idea when planning the antenna arrangement was to obtain a radiation pattern providing a good signal during sounding under any wind conditions.

RB31 is well-suited for use in fixed installations. The antenna has no moving parts; the radiation pattern of the antenna can be electrically directed to track the flying radiosonde.

## Construction

Vaisala Telemetry Antenna RB31 consists of the directional antenna segments, Antenna Amplifier and Switch RBD121, radome, antenna base, and antenna cable.

### Antenna Segments

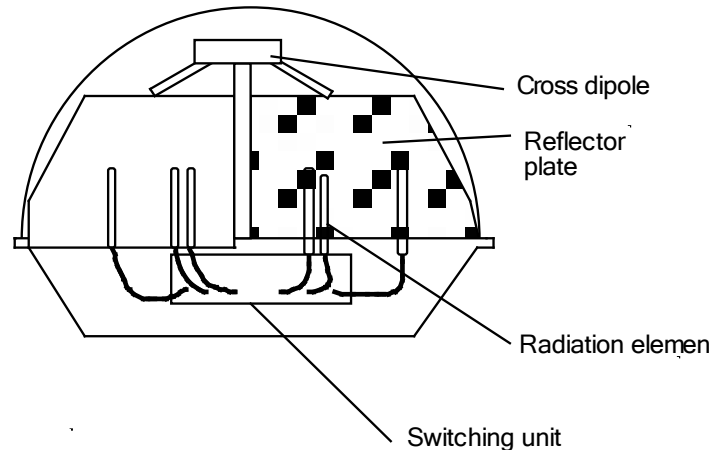
The antenna consists of six antenna segments for horizontal reception and one segment for upwards direction.

Each horizontal segment is a folded ground plane antenna with a 60° corner reflector. This type of antenna provides a favorable front-to-back ratio and directivity. Maximum gain direction is towards the horizon, where the distance between the radiosonde and the receiver is at its greatest and the field intensity at its weakest. The gain of an antenna element, at 0° elevation angle, is 12 dB (over 1/2 wave antenna).

For the upwards direction - or high elevation angles - the antenna is equipped with a cross dipole. The cross dipole has radiators bent down to

enable the antenna to receive transmissions having extensive polarization fluctuation.

One antenna segment at a time is connected for the reception. The antenna switch is controlled to make the selection between seven directions: North (N), North-East (NE), South-East (SE), South (S), South-West (SW), North-West (NW) and Upwards (90°).



0211-101

**Figure 1      Antenna Elements**

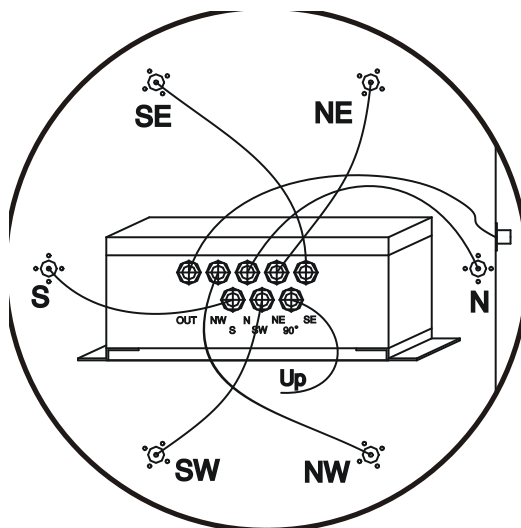
## Antenna Amplifier and Switch RBD121

Cables from the antenna elements connect to coaxial connectors at the Antenna Amplifier and Switch RBD121.

The antenna amplifier and switch has eight coaxial connectors. They are marked with OUT (antenna signal output), NW (North-West), N (North), NE (North-East), SE (South-East), S (South), SW (South-West) and 90° (upwards).

The OUT connector is connected to the cable from the output terminal of RB31 on the through-hole plate. The other terminals are connected to the antenna radiators: 90° to the cross dipole and the others to the corner radiator of the marked direction.

Figure 2 on page 9 shows the cabling scheme of RBD121.



0312-117

**Figure 2 Cabling Principle of RDB121 Unit**

For more detailed information on RDB121, refer to Antenna Amplifier and Switch RDB121 Technical Reference.

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## CHAPTER 3

# INSTALLATION

This chapter explains the unpacking and setting up of the antenna.

## Selecting Installation Site

For best results, select an installation site for the antenna set that is:

- Open, in other words, clear of obstacles such as buildings, dense forests, or high metal masts.
- Even, in other words, the ground is even and relatively firm.

A single tree does not affect signal reception to any significant degree, unless it is exceptionally dense or very close (less than 20 meters from the antenna set). Sparse forest can cause some attenuation but is usually not a real hindrance.

Other antenna masts and metal structures of small diameter do not disturb reception if situated more than 20 meters away from the antenna set. However, metal roofs or other large surfaces may reflect signals, causing short-duration fading. If the antenna set is screened by a large building, reception may be impossible.

## Unpacking

The antenna is delivered as a single functional unit including the radome and the internal parts (antenna elements, antenna amplifier and switch) with all connections completed. Therefore, unpacking is a simple operation and requires no special instructions.

## Installing the Antenna

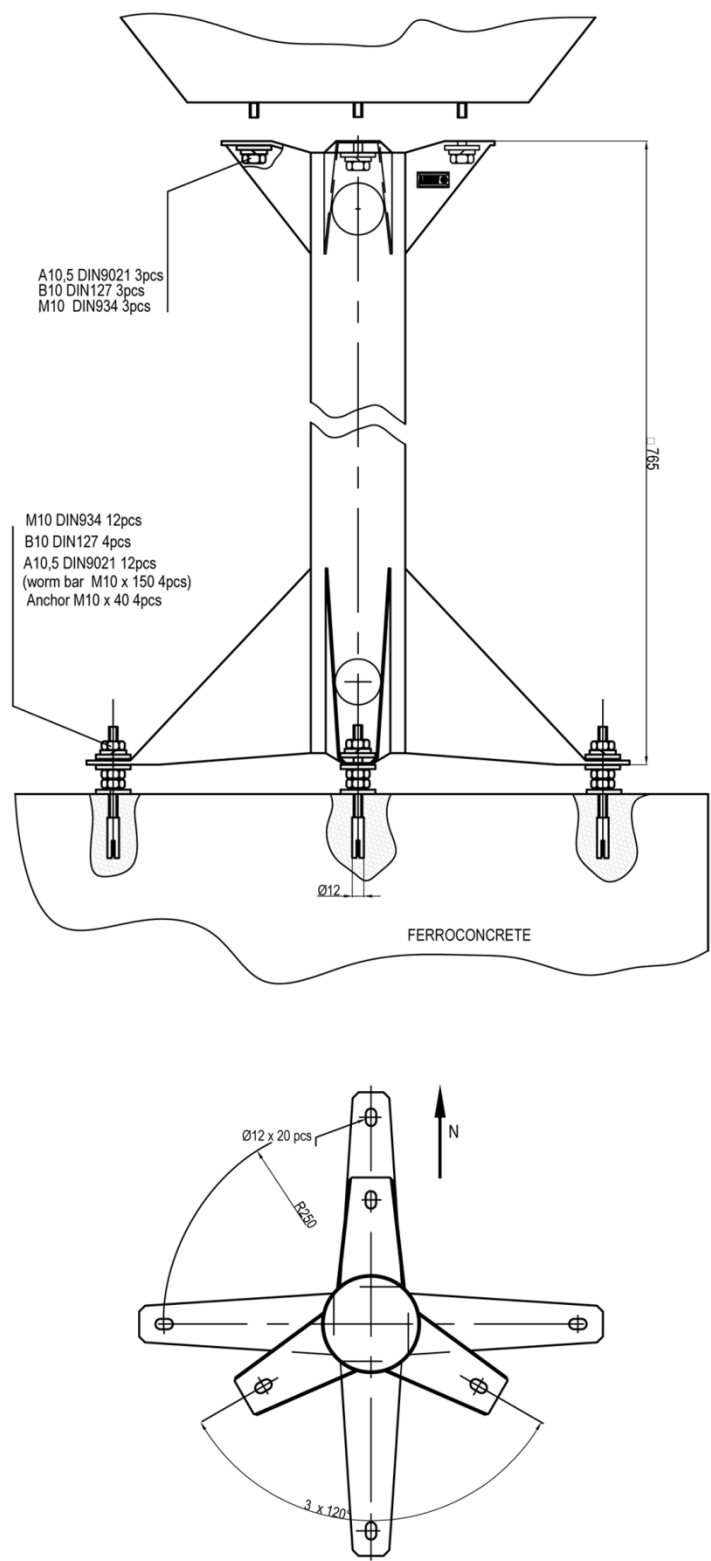
See Figure 3 on page 13 for information on how to install RB31 to a concrete foundation.

For antenna base installation, refer to assembly drawing DRW214844 at the end of this manual.

The antenna is installed with the "N" side pointing to the north.

The antenna cable is connected to the corresponding connector at the antenna base.

For connecting the antenna as a part of the sounding system, see the appropriate sounding system manual.



1205-054

Figure 3 RB31 Installation

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## CHAPTER 4

# OPERATION

This chapter provides additional information for using the RB31 system.

## Operation Modes

The antenna consists of six segments, of which one at a time is connected to for the reception. Selection is made between seven directions: North (N), North-East (NE), South-East (SE), South (S), South-West (SW), North-West (NW) and Upwards (90°).

Antenna segment is selectable either automatically or manually. Refer to the appropriate sounding system User's Guide for details on manual and automatic operation modes.

In automatic mode the antenna element giving the highest signal strength is connected for reception. The selection of the antenna element does not disturb the sounding.

## Options

### Length of the Antenna Cable

The standard length of the antenna cable is 30 meters and the attenuation of the standard cable type (RG-213/U) is 13 dB/100 m at 400 MHz.

Other cable types and lengths are possible, but for full system performance, the attenuation of the antenna cable should be less than 10 dB.

**Table 2      Antenna Cable Length**

Vaisala Code	Cable Length
RBZ21SP	33 meters
RBZ21SSP	75 meters

## Grounding

Because antennas can act as lightning rods, a separate lightning protection grounding must be taken into consideration according to local equipment and personnel. To protect structures, equipment and personnel, a low-resistance path to the ground (ground electrode) must be provided for the current of the lightning strike.

A good grounding also protects the personnel against hazardous touch voltages under fault conditions; therefore, the grounding system must get proper attention.

Attach the grounding cable as follows:

1. Attach the grounding cable (= down conductor) separately from the other cables, and secure it firmly at intervals of one meter or less.
2. Make sure the bending radius is not less than 200 mm (eight inches). All bends must be smooth and never over 90 degrees.

**CAUTION**

Never let the excess cable form loops.

3. Route the grounding cable to the ground as directly as possible. Cut any excess cable. Do not let the excess cable form loops.

## Grounding Cable

The grounding cable is weather, UV and ozone-resistant, and also suitable for direct burial.

**Table 3**      **Grounding Cables**

Vaisala Part Number	Cable Length	Other Information
CBL210160-4M	4 meters	35 mm <sup>2</sup> stranded copper with jacket and M8 tube cable lugs on both cable ends
CBL210160-SPEC	Can be ordered separately at custom length	
CBL210160-800		Inner grounding cable

## CHAPTER 5

# MAINTENANCE

This chapter provides information on RB31 maintenance.

## Avoiding Corrosion

Sensitive parts of the antenna are protected by the plastic dome and are thus not prone to mechanical damage. The cover also protects the parts from rain and openings at its base allow condensed water to drip off. Nevertheless, from time to time it is advisable to inspect the antenna for possible corrosion damage and ensure that the connectors are in good condition.

## Disassembling the Antenna

When disassembling the antenna, the rim bolts are loosened first (see the drawing at the end of this manual). The cover can then be removed. The antenna elements and the cross dipole are accessible. If any of the elements is damaged, it is replaced.

At the lower part of the antenna there is a service hatch, through which the cables and connectors are accessible. For some service operations, such as those involving the RBD121 Antenna Amplifier and Switch, the dome must be removed and the antenna reflector plate tilted upwards.

In case any of the antenna elements seems to be insensitive, the most common reason is a loose cable connector or a malfunction in the antenna switching unit.

## Basic Troubleshooting

If the antenna operates poorly as a whole, check first that the DC supply input is found at the end of the antenna cable. If the supply voltage is in order, the fault is possibly in the antenna amplifier.

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## CHAPTER 6

# TECHNICAL DATA

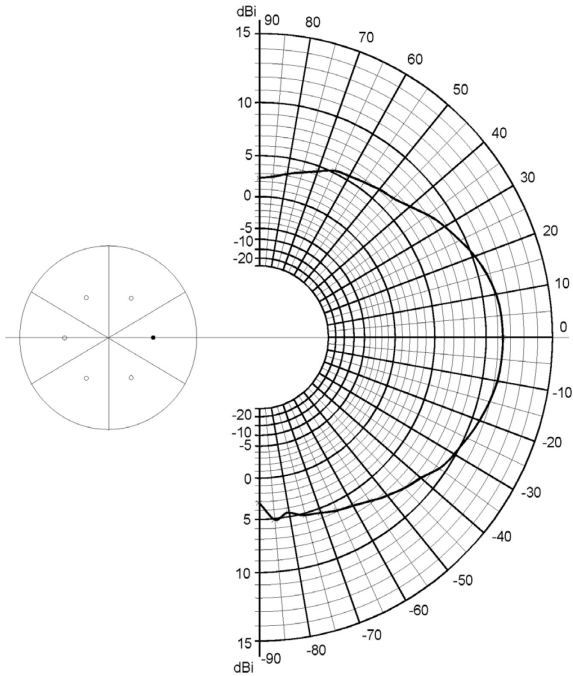
This chapter provides the technical specifications.

**Table 4      Telemetry Antenna RB31 Specifications**

Feature	Specification
<b>Antenna</b>	
Frequency range	400 ... 406 MHz
Horizontal directivity	8 dBi
Vertical directivity	-3 dBi
Polarization near horizon	Vertical
Polarization at zenith	Circular
Number of corner reflectors	6
<b>Amplifier</b>	
Gain	20 dB typical
Noise figure	<2 dB
Power input	+10 ... 12 VDC, 130 mA through RF cable
Output impedance	50 ohms, VSWR <1.5
<b>Telemetry range</b>	
Telemetry range with Vaisala Digital radiosonde	350 km under normal sounding conditions
<b>Mechanics</b>	
Connector	Coaxial 7/16
Maximum diameter	1.1m
Height without pedestal	0.8 m
Height with pedestal	1.55 m
Weight	32 kg
Standard cable length	33 m (greater lengths possible with low-loss cable)
<b>Environmental Conditions</b>	
Operating temperature range	-40 ... 55° C
Operating humidity range	0 ... 100 % RH
Operating precipitation	Unlimited
Maximum wind speed	65 m/s
Storage temperature	-50 ... +100 °C
Storage humidity	0 ... 100 % RH

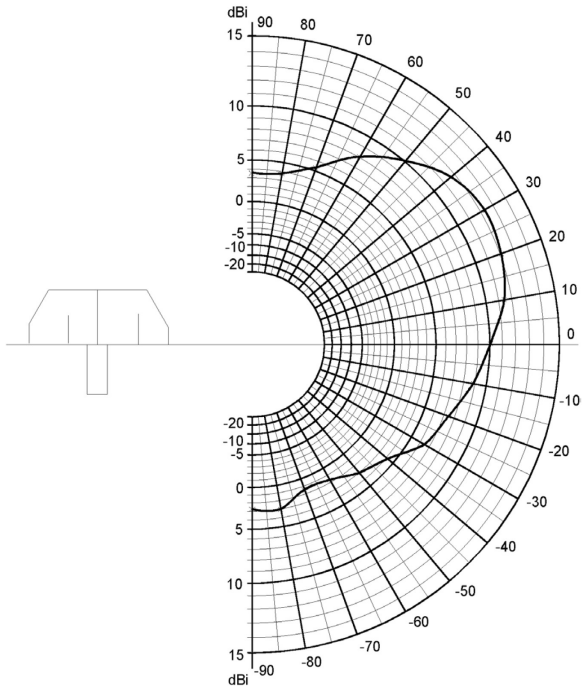
# RB31 Radiation Pattern

Figure 4 below and Figure 5 below illustrate RB31 radiation patterns for H and E planes.



1306-137

**Figure 4      RB31 H Plane Pattern, Elevation 12 Degrees**



1306-138

**Figure 5      RB31 E Plane Pattern**

# CHAPTER 7

## PARTS LIST

This chapter contains the parts list for Vaisala Telemetry Antenna RB31.

The numbers in column **Ref.** in Table 5 refer to Figure 7 on page 25 and Figure 8 on page 26.

**Table 5 RB31 Parts**

Ref.	Part No.	Qty	Description	Notes
1	RBD121	1	Antenna amplifier and switch	RBD121
2	2504	1	Antenna stand	2504RB, incl. 58-62
3	2634	1	Mounting flange (alt. for 2)	2634RB, incl. 24, 25, 26, 56, 57
4	RB45009	1	Cross dipole, with cable	RB45009
6	15416ZZ	1	Cable, RBD121 - out (internal)	15416ZZ
7	2578ZZ	6	Cable, RBD121 - radiator	2578ZZ
8	RBZ21SP	1	Cable, RBD121 – receiver 33m	RBZ21SSP 75 m
9	CBL210160-4M	1	Cable, outside grounding	CBL210160-4M
10	CBL210160-800	1	Cable, inner grounding	CBL210160-800
11	RB3198	6	Radiation element	RB3198
12	60214	1	Reflector plate	RB2316
13	2837	1	Protecting cover, upper	RB1202
14	2838	1	Protecting cover, lower	RB1186
15	60217	1	Cable support	RB4276
16	212263	1	Through hole plate	DRW214879
17	2616	1	Gasket tape	2 x 10
18	60215	1	Service hatch	RB4280
19	2343	1	Gasket tape	3 x 6
21	212811	4	Cross head screw	M6 x 30 DIN7985Z
22	4340	4	Spring washer	B6 DIN127
23	4814	4	Hexagon nut	M6 DIN934
24	16267	3	Plain washer	A10.5 DIN 9021
25	4342	3	Spring washer	B10 DIN127
26	3069	3	Hexagon nut	M10DIN934
27	4477	2	Hex. socket head screw	M6 x 16 DIN912
28	4340	2	Spring washer	B6 DIN127
29	4814	2	Hexagon nut	M6 DIN934
30	12866	1	Hexagon screw	M8 x 50 DIN933
31	12669	6	Star washer	A8,4 DIN6798
32	4815	1	Hexagon nut	M8 DIN934
33	1336	3	Hexagon thin nut	BM8 DIN439
34	3828	1	Hex. socket head screw	M8 x 25 DIN912
35	12669	3	Star washer	A8.4 DIN6798

Ref.	Part No.	Qty	Description	Notes
36	4815	2	Hexagon nut	M8 DIN934
37	25015	18	Cross head screw	M3 x 8 DIN7985Z
38	3939	18	Spring washer	B3 DIN127
39	4776	18	Hexagon nut	M3 DIN934
40	3823	8	Socket head screw	M8 x 30 DIN912
41	12510	8	Plain washer	D25/8.4 DIN9021
42	12511	8	Rubber washer	25/8 x 2
43	4818	8	Plain washer	A8.4 DIN 125
44	4341	8	Spring washer	B8 DIN127
45	4815	8	Hexagon nut	M8 DIN934
46	15784	2	Cross head plate screw	B4.2 x 16 DIN7981Z
47	25135	7	Cross head screw	M4 x 12 DIN7985Z
48	5074	7	Plain washer	A4,3 DIN125
49	4337	7	Spring washer	B4 DIN127
50	4812	7	Hexagon nut	M4 DIN934
51	212469	4	Cross head flat screw	M3 x 12 DIN965
52	3939	4	Spring washer	B3 DIN 127
53	4776	4	Hexagon nut	M3 DIN934
54	4477	5	Hex. socket head screw	M6 x 16 DIN912
55	4340	5	Spring washer	B6 DIN127
56	3845	4	Hex. socket head screw	M10 x 50 DIN912
57	3069	4	Hexagon nut	M10 DIN934
58	3069	12	Hexagon nut	M10 DIN934
59	4342	4	Spring washer	B10 DIN127
60	16267	12	Plain washer	A10.5 DIN9021
61	60172	4	Stud	M10 x 150
62	0952	4	Wedge bolt	M10



## CHAPTER 8

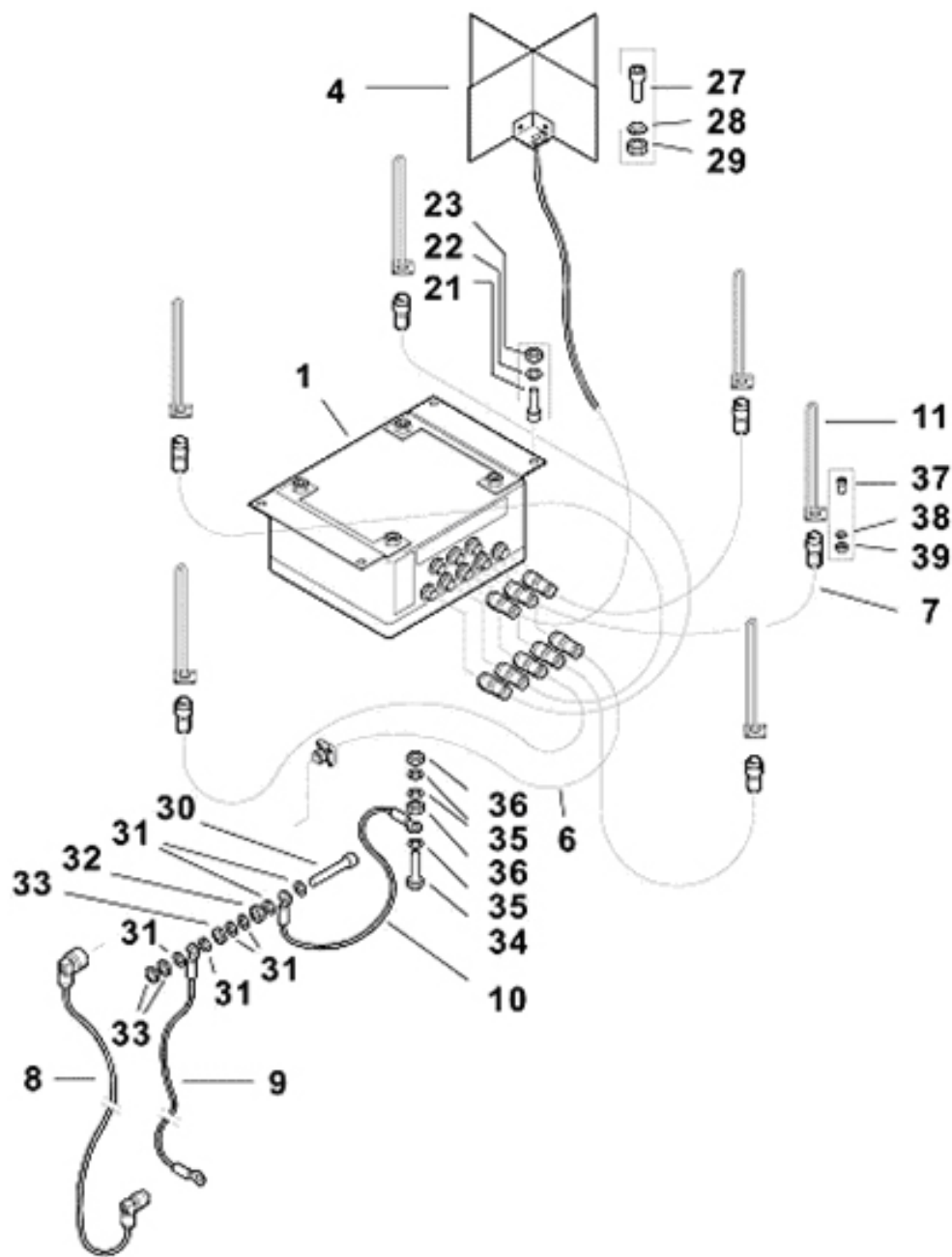
# DRAWINGS

This chapter contains the essential drawings for RB31.

**Table 6      List of Drawings**

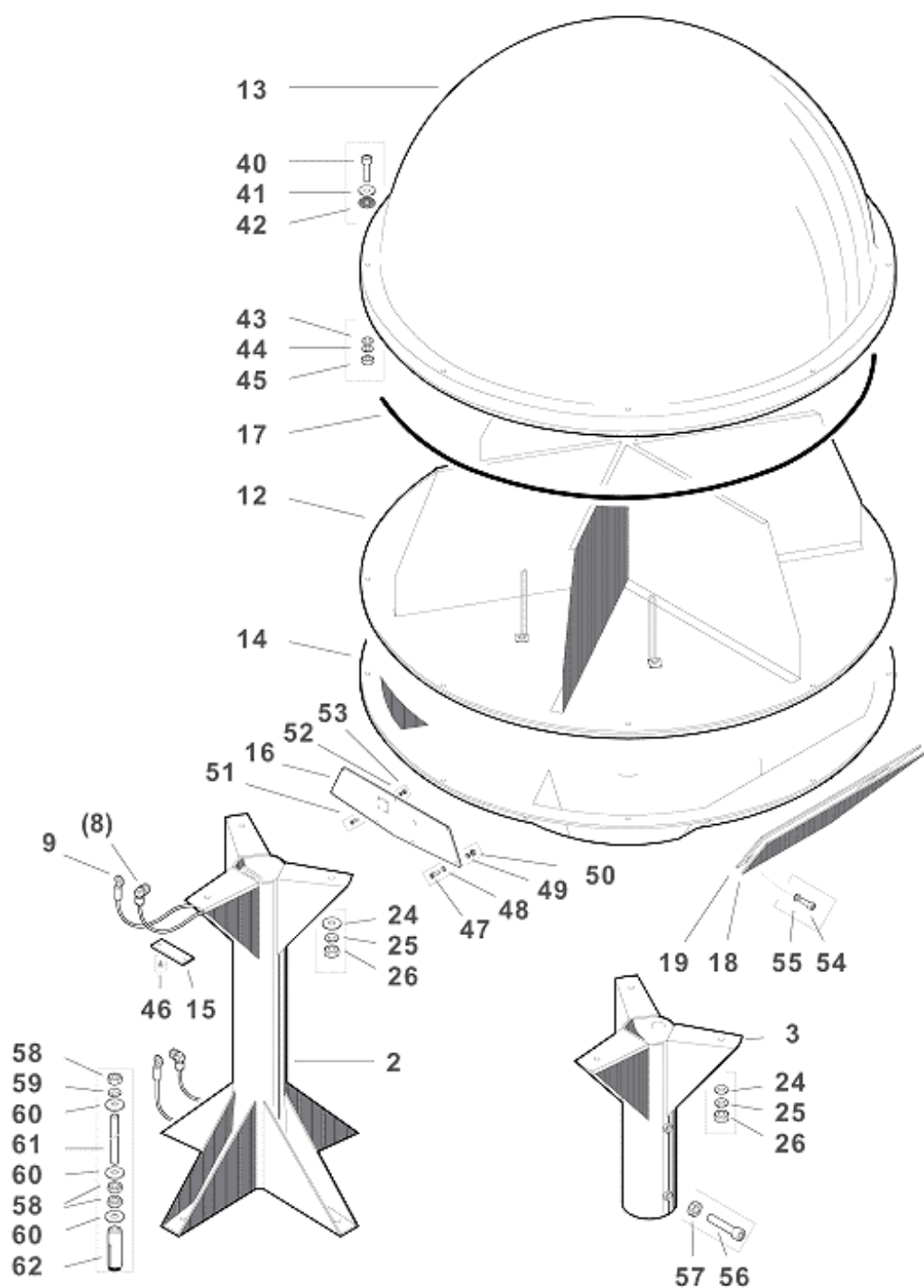
<b>Description</b>	<b>Drawing Code</b>
RB31 Antenna, Assembly Drawing	DRW214844
RB31 Antenna, Exploded View	DRW215823
RB31 Cabling, Assembly Drawing	DRW214883



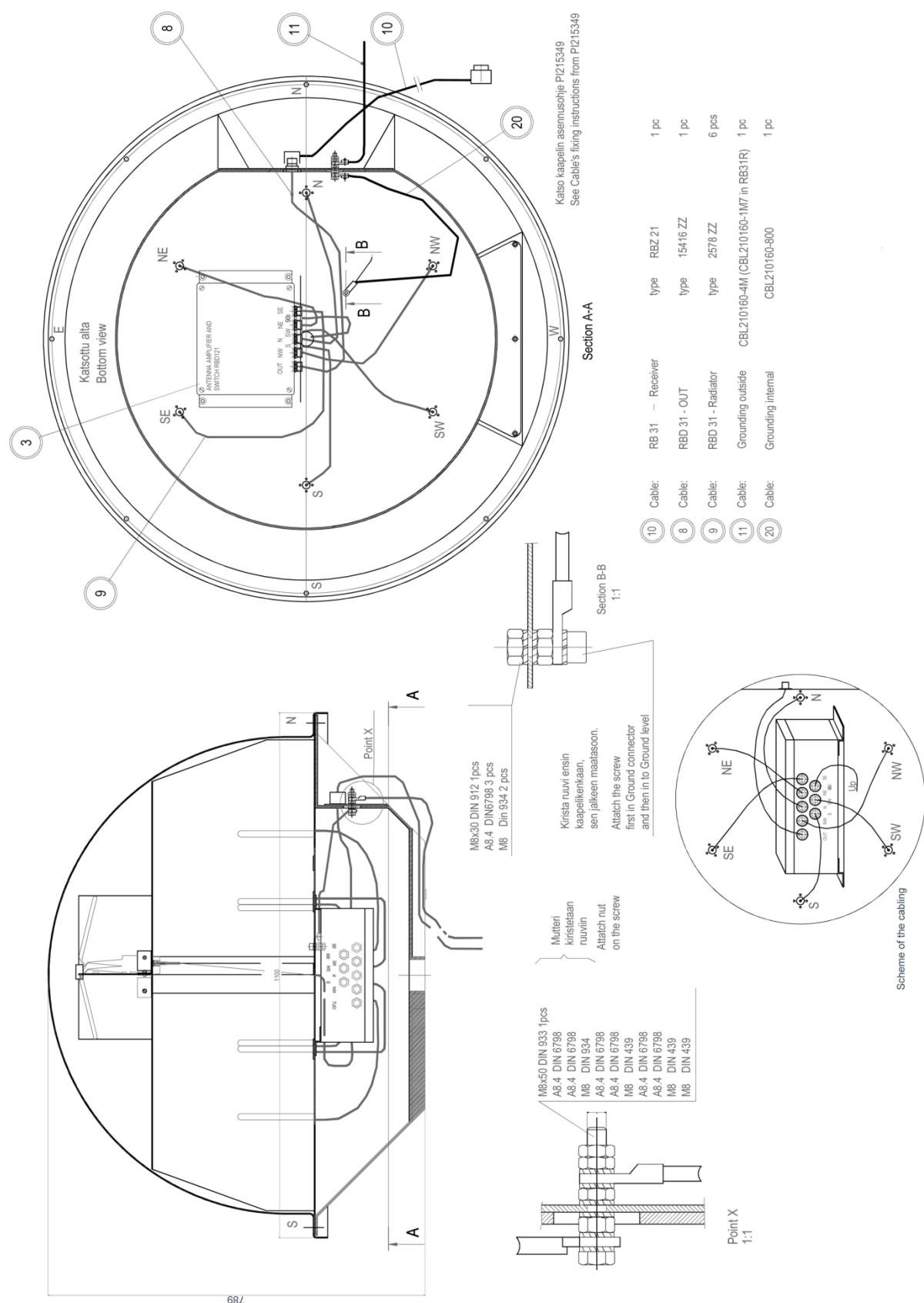


1202-114

Figure 7 RB31 Antenna, Exploded View, Part I



**Figure 8 Antenna RB31, Exploded View, Part II**



**Figure 9 RB31 Antenna Cabling, Assembly Drawing**

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## CHAPTER 9

# TECHNICAL SUPPORT

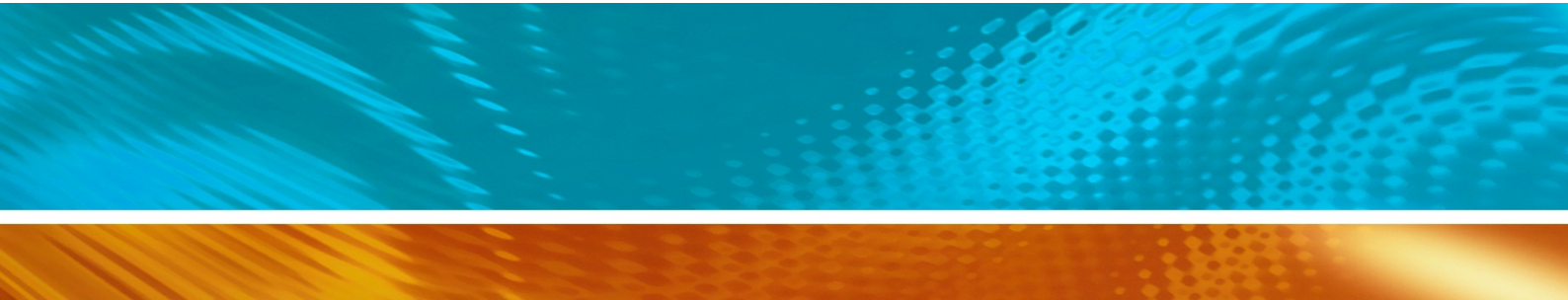
This chapter provides information on technical support.

## Technical Support

For technical questions, contact the Vaisala technical support by e-mail at [helpdesk@vaisala.com](mailto:helpdesk@vaisala.com). Provide at least the following supporting information:

- Name and model of the product in question
- Serial number of the product
- Name and location of the installation site
- Name and contact information of a technically competent person who can provide further information on the problem.

For Vaisala Service Center contact information, see [www.vaisala.com/servicecenters](http://www.vaisala.com/servicecenters).



[www.vaisala.com](http://www.vaisala.com)

