VAISALA

TECHNICAL REFERENCE

Antenna Amplifier and Switch RAA111

M210568EN-C

PUBLISHED BY

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CHAPTER 1

GENERAL INFORMATION

This chapter provides general notes for the manual and RAA111.

About This Manual

This manual provides information for installing, operating, and maintaining the Antenna Amplifier and Switch RAA111.

Contents of This Manual

This manual consists of the following chapters:

- Chapter 1, General Information, provides general notes for the manual and RAA111.
- Chapter 2, Product Overview, provides a general overview of RAA111.
- Chapter 3, Functional Description, provides a functional description of RAA111.
- Chapter 4, Operation, describes the operation of RAA111.
- Chapter 5, Technical Specifications, provides technical specifications for RAA111.
- Chapter 6, Parts List, provides parts lists for RAA111.
- Chapter 7, Drawings, contains drawings for RAA111.
- Chapter 8, Troubleshooting, provides contact information for technical support.

Version Information

Table 1 Manual Revisions

Manual Code	Description
M210568EN-C	September 2010. New template.
M210568EN-B	August 2005.

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

The Antenna Amplifier and Switch RAA111 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.

Regulatory Compliances

Antenna Amplifier and Switch RBD121 complies with the following performance and environmental test standards:

CE

Trademarks

DigCORA® and MARWIN® are registered trademarks of Vaisala Oyj.

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

Warranty

For certain products Vaisala normally gives a limited one-year warranty. Visit our Internet pages for more information and our standard warranty terms and conditions: www.vaisala.com/services/warranty.html.

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 provides a general overview of RAA111.

General

The Antenna Amplifier and Switch RAA111 is an antenna amplifier with a two-position antenna switch. RAA111 can be used in conjunction with Vaisala DigiCORA Sounding System equipped with Vaisala Sounding Processing Subsystem SPS311, and with Vaisala MARWIN Sounding System MW32.

RAA111 is well-suited for use with compact, lightweight antenna installations for example in portable systems, but it can also be used in fixed installations where feasible.

Antenna input is selectable either automatically or manually.

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CHAPTER 3

FUNCTIONAL DESCRIPTION

This chapter provides a functional description of RAA111.

General

Inside the unit box there is a component board, which consists of a GaAs FET switch and an antenna amplifier.

The switching unit has three coaxial connectors. They are marked with X3 (OUT), X1 (ANT 1) and X2 (ANT 2).

The contents of an RAA111 unit box can be seen Figure 1 below, which also shows the cabling layout

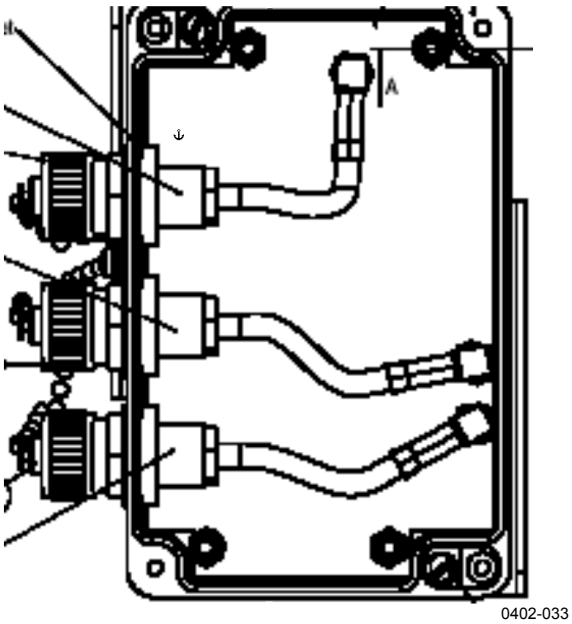

Figure 1 Cabling of RAA111 Unit Box

On the PC board of RAA111, the connected cables are marked X1 (ANT 1), X2 (ANT 2), and X3 (OUT) coming from the corresponding terminals at the outer edge of the box.

GaAs FET Switch

The control signals of the switch and DC operating voltage are fed to the RAA111 unit through a coaxial antenna cable connected to the OUT connector. The control signals are decoupled from the RF signal with inductor L5.

Transistors, connected to the outputs of the decade counter D1, control the FET switch. The desired signal branch is selected by resetting and stepping up of the counter by short breaks in DC power feed. Break of DC voltage exceeding 250 microseconds resets the counter and 50-microsecond break steps the counter upwards.

Decreasing DC voltage triggers a monostable circuit D2-A. Output of this circuit resets monostable circuit D2-B for 200 microseconds. Increasing DC voltage steps up the counter D1. Increasing DC voltage is also input to D2-B - in case of the break is less than 200 microseconds - output of D2-B is forced to zero state by the output of the D2-A. In case the break is longer than 200 microseconds, triggering of the D2-A is enabled and the output of the circuit resets the counter D1.

Counter states 0 and 1 select the RF signal paths ANT 1 and ANT 2 respectively. Counter state 7 switches on current to the noise diode V5 by setting transistor V9 in conducting state. Noise signal from the diode V5 connects through capacitor C11 to the amplifier, this arrangement is used to test LNA (Low Noise Amplifier).

At powering of the antenna switch, the signal path ANT 1 is activated as follows. The capacitor C29 causes delay of power feed to the input of the amplifier A5, generating reset to the counter D1.

Low-Noise Amplifier

Antenna switch connects to a low-noise balanced amplifier based on PHEM transistors.

The DC supply (+12 V) required by the amplifier and the diode switch comes from the UHF receiver through a coaxial antenna cable.

Circuit Description

There are two identical amplifier branches in the balanced amplifier. RF-signal connects from the FET switch to a hybrid coupler A2 through 3 stage ceramic coaxial band pass filter Z1 tuned at 403 MHz. Amplifier A3 distributes signal to two identical branches. The following description refers to the components of one branch.

The capacitor C6 connects the signal from the hybrid coupler to the gate of the PHEM transistor V3 through the matching inductance L4 and strip line. The transistor V1 regulates the bias voltage connected to the gate through the inductance L1.

Inductance L2 and a capacitor integrated on the PCB form a feedback circuit for compensating of harmonic signals.

The resistor R6, capacitor C9 and strip line stub at the drain of V3 stabilize the amplifier. Current to the V3 (60 mA) flows through resistor R5. Voltage drop in the resistor controls the bias voltage regulator, transistor V1, keeping the current constant. Diode V2 compensates the temperature dependent emitter-base voltage of the V1. Hybrid circuit A3 combines the signals of both branches

+12 V DC power through the coaxial cable from the receiver connects via decoupling inductance L5 to the voltage regulator A4, which provides + 7 V supply voltage to LNA (Low Noise Amplifier) and control logic of the switch. Diode V4 decouples the capacitor C12 from the +12 V power line so, that voltage at the input of amplifier A5-A drops down along with voltage breaks sent from the receiver for diode switch control.

Figure 2 below shows a common frequency response curve measured of the RAA111.

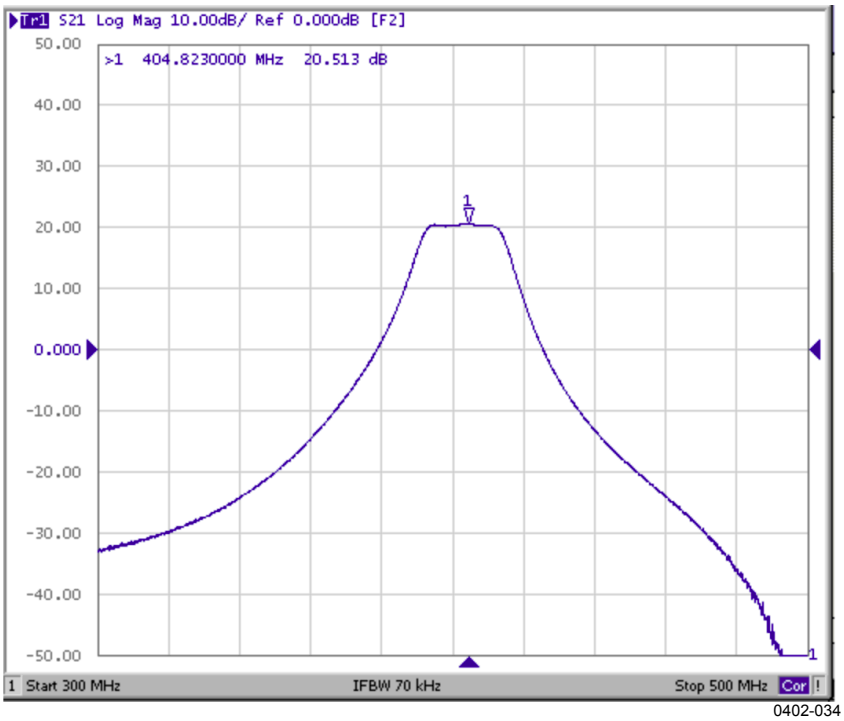

Figure 2 Frequency Response Curve of RAA111

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CHAPTER 4
OPERATION

This chapter describes the operation of RAA111.

General

RAA111 can be used in conjunction with the Vaisala DigiCORA equipped with Vaisala Sounding Processing Subsystem SPS311, and with Vaisala MARWIN Sounding System MW32.

Operation Modes

Antenna input (ANT 1 or ANT 2) is selectable either automatically or manually. Refer to the relevant sounding system manual 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.

The feeder cable is connected to the OUT connector of the Antenna Amplifier and Switch RAA111.

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CHAPTER 5
TECHNICAL SPECIFICATIONS

This chapter provides technical specifications for RAA111.

Table 2 RAA111 Technical Specifications

Property	Value
Frequency range	400 - 406 MHz SWR 1.5 max
Noise figure	2.5 dB max
Gain	20 dB typical
Output impedance	50 Ω nominal
Power input	DC through RF cable +10 ... +12 V / 130mA typical
Connectors	Coaxial N-type female
Temperature range	-40... +55 °C

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CHAPTER 6

PARTS LIST

This chapter provides parts lists for RAA111.

RBD121 Antenna Switching and LNA Unit

Table 3 Semiconductors

Reference	Part No.	Description
V3 V6	210652	2 ATF-54143
V7-9	15495	8 SST3904
V1 V10	11138	2 SST3906
V2 V4 V11	15976	4 LL4148
V5	210627	1 ST-2
A4	19949	1 MIC29204BM
A5	16450	1 TLC272ID
D1	15522	1 4017B
D2	16369S	1 4528B

Table 4 Capacitors

Reference	Part No.	Description
C12	25578	Tantal electrolytic capacitor 33u
C5 C7 C17	26835	Tantal electrolytic capacitor 10u
C29	15621	Surface mounted ceramic capacitor 100n
C3 C7 C21 C23 C26	15160	Surface mounted ceramic capacitor 10n
C4 C18 C19 C22 C27	15162	Surface mounted ceramic capacitor 1n
C1-2	15489S	Surface mounted ceramic capacitor 120p
C6 C10 C13 C14	15163	Surface mounted ceramic capacitor 100p
C9 C20	15804	Surface mounted ceramic capacitor 4p7
C11	15802	Surface mounted ceramic capacitor 1p5

Table 5 Resistors

Reference	Part No.	Description
R8-9	15878	10R
R6 R14	18714	17R8
R5 R16	18719	46R4
R7 R10	18147	51R
R15		383R
R27 R37	15592	1k5
R18 R24	18984	9k10
R35	18123	10k0
R3 R12 R13 R26	18047S	12k
R1 R19 R20 R25	18607	15k
R2 R22	18411	33k2
R30 R36	18599	39k2
R11 R32	18606	68k1
R21 R28 R29 R33	18127	100k
R34	18797	221k
R31	18128	274k
R17	18604	332k
R38	18131	2M2

Table 6 Cables

Reference	Part No.	Description
Cable 1		Internal connection cable (3 pcs.)
X1	15297	N-type panel jack, Suhner type 24N-50-2-4/133 NE
X2	212156	SMA-angle plug, Suhner type 16SMA-50-2-105C
1	2482	Coaxial cable RG188 A/U

Table 7 Connectors

Reference	Part No.	Description
X1-3	210914	SMA Connector PCB straight Suhner type 82SMA-50-0-1

Table 8 Coils

Reference	Part No.	Description
L1 L3L5 L8 L9 L10 L11	18637S	470nH
L2 L4 L6 L7	19239S	8nH

Table 9 Others

Reference	Part No.	Description
Z1	210637	Band-pass Filter, Temex CF12S3-403-A
A2-3	210646	Hybrid Coupler, Anaren 11303-3

CHAPTER 7
DRAWINGS

This chapter contains drawings for RAA111.

Table 10 Drawings

Code	Description
DRW214709	Antenna Amplifier RAA111
DRW214494	Circuit Diagram of RAA111
DRW214495	Components Layout of RAA111

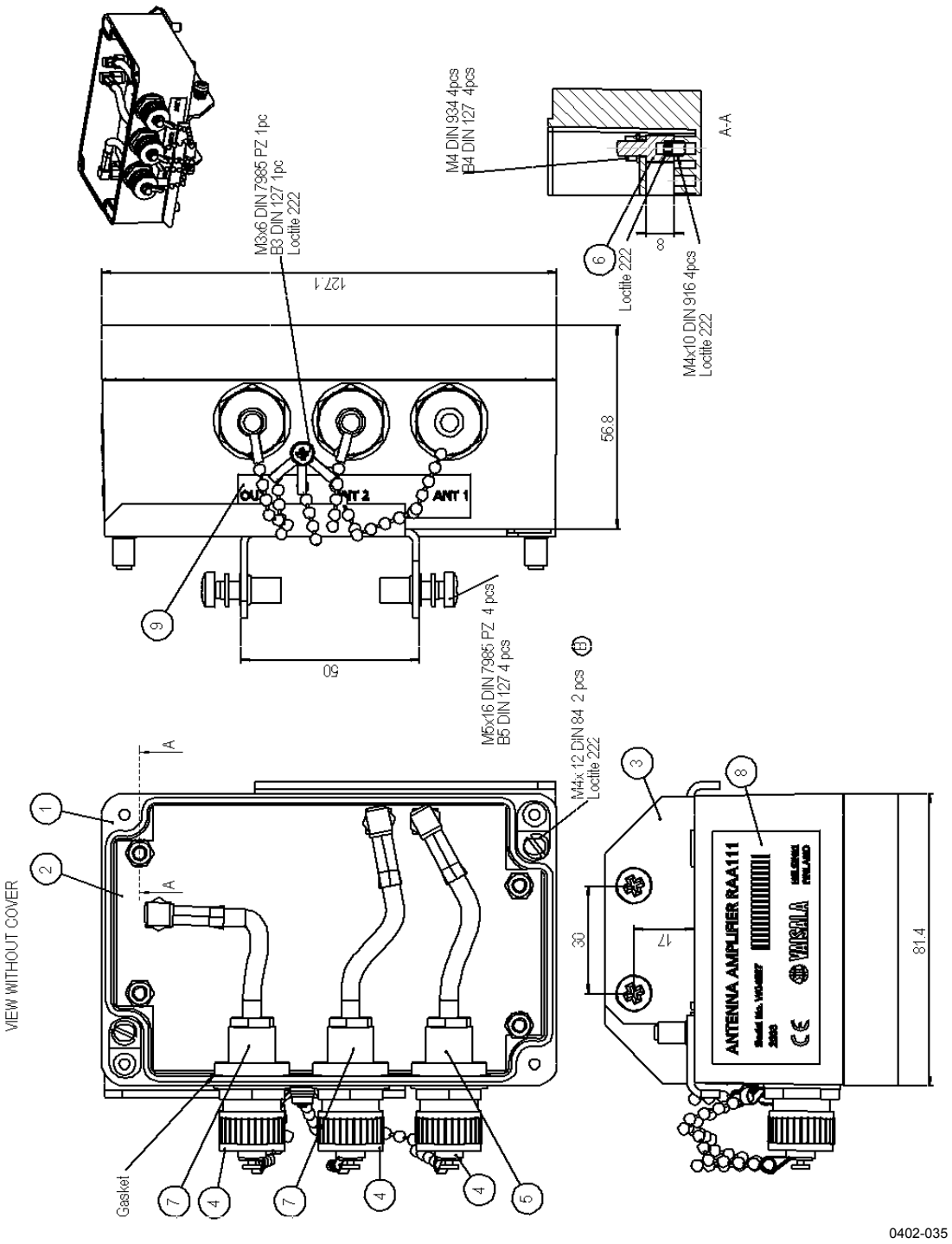


Figure 3 Antenna Amplifier RAA111

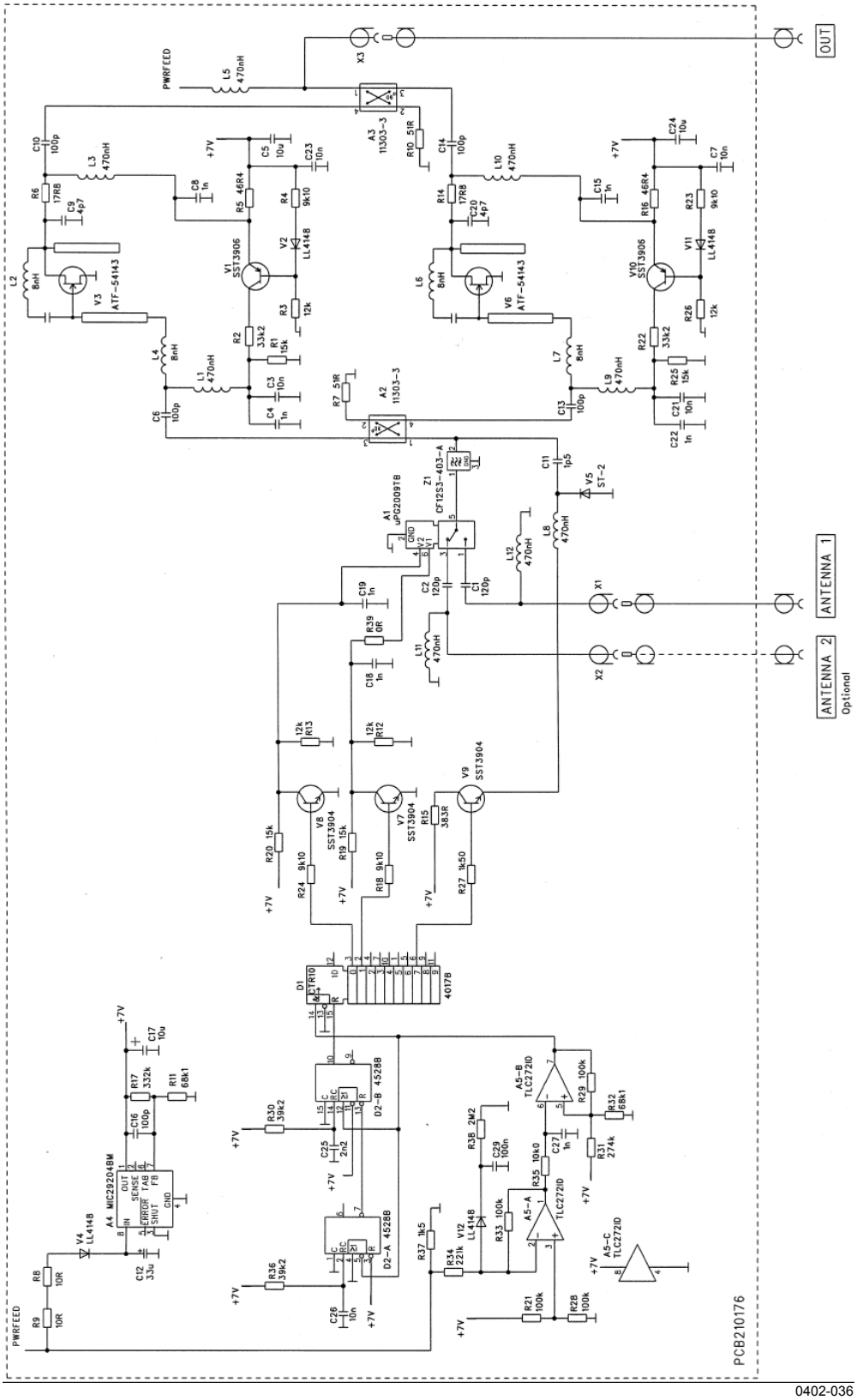


Figure 4 Circuit Diagram of RAA111

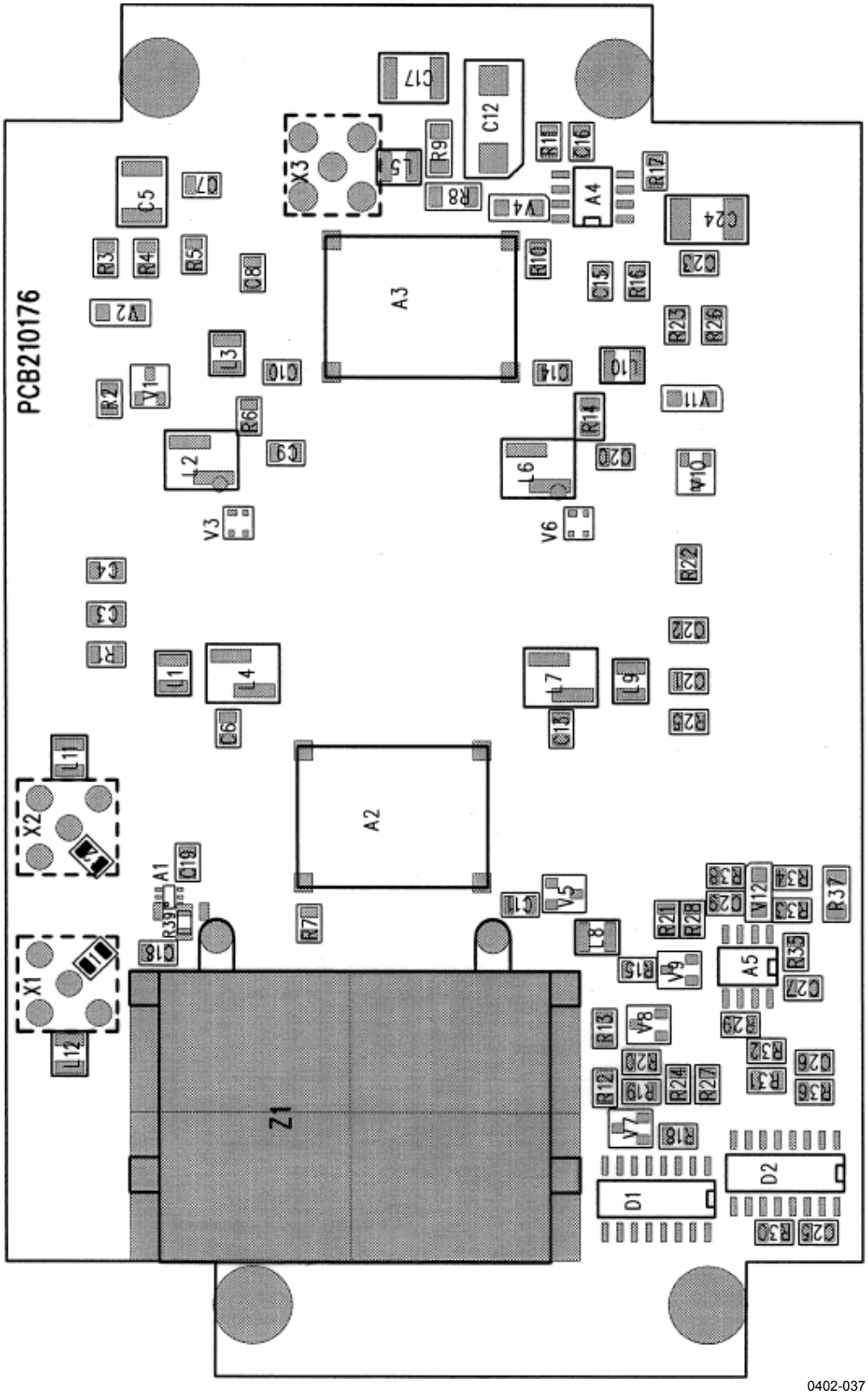


Figure 5 Components Layout of RAA111

CHAPTER 8
TROUBLESHOOTING

This chapter provides contact information for technical support.

Technical Support

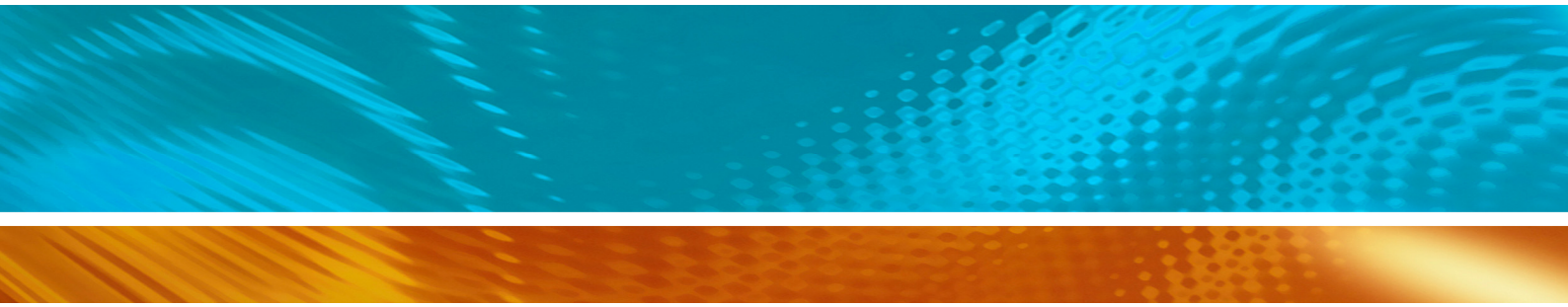
For technical questions, contact the Vaisala technical support by e-mail at helpdesk@vaisala.com. Provide at least the following supporting information:

- 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.

Product Returns

If the product must be returned for service, see www.vaisala.com/services/return.html.

For contact information of Vaisala Service Centers, see www.vaisala.com/services/servicecenters.html.



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