

# Specifications

and Operator Manual of the Ferrite Antenna

## RFA2B



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## Specifications

Dimensions (W x H x D):	160 mm x 93 mm x 32 mm (without connectors and attachments)
Frequency range:	137 kHz ... 2.0 MHz
Frequency deviation:	$\leq 3\%$
Intrinsic noise power (Q=99%):	$\leq -136$ dBm/Hz (measured at 1 MHz)
IP3 Out (Q=99%):	$\geq +20$ dBm (2x -10 dBm measuring tone at 1 MHz)
Maximum output voltage:	$\geq 0.7$ V <sub>eff</sub> , 1 dB compression
Power supply voltage:	+5.7 V ... +13.8 V, <b>maximum +15.0V!</b>
Power supply:	max. 50 mA
RF output:	SMA 50 ohms
Weight:	$\leq 0.35$ kg
Environmental conditions:	-25 °C ... +40 °C ambient temperature, IP65
Compliance:	CE according to DIN EN 55013, EN 55020, EN 60065 RoHS / WEEE Directive, ear-Reg. 27676700

All specifications are subject to design changes!

## Safety precautions

**Please always keep the following safety precautions in mind!**

**Never connect the device to any other voltage than indicated in the specifications. Under no circumstances should the the device come into contact with the mains voltage of 230 V ~!**

**It is essential to observe the lightning protection regulations for the outdoor operation of electrotechnical systems! The antenna must be properly equipped with lightning protection when installed outside a protected area (e.g. house). The RF bypass must be equipped with overvoltage protection. In case of lightning hazard, immediately take the antenna out of operation and disconnect it safely from other devices (remove RF connection)!**

**Observe the permitted temperature range for starting up the device! Do not switch the device on or off again if this range is exceeded or fallen below!**

**Devices for indoor use: Do not expose it to moisture, never put liquid-filled containers on top of the unit. Do not allow frost, dew, condensation or rain reach the device! If moisture (like rainwater) came in contact or has accidentally entered the device, switch it off immediately! Send the device to the manufacturer for inspection!**

**Always transport the device either in solid cardboard or wooden boxes (e.g. the delivery packaging), or transport it by firmly gripping the housing! The device may cause injury in the event of a fall due to its own weight!**

**Do not expose this equipment to mechanical stress caused by impact, pressure, vibration or shock which exceed that commonly used in the home with the use of electronic devices! The control elements and specifically the front window of the display are very sensitive to pressure or impact. Never operate a control element with a force that exceeds the required level.**

**If you notice any damage to the device, immediately take it out of operation (remove power supply)! If necessary, send it to the supplier for repairs.**

**Would you like to dispose the device due to damage or no more usability, send it back to the supplier or return it to your local waste collection center. Never dispose of the appliance elsewhere, such as household waste. It pollutes our environment!**

# Operator Manual

## Basic function

The RFA2 is a reception antenna for use with receivers with 50 Ohm coaxial input. It operates in a narrow band as a tuned active antenna with an integrated antenna element (ferrite rod) and an integrated amplifier. Power is supplied via the RF cable ("remote power supply") and the antenna is tuned via digital remote control.

The antenna and its associated electronics are built into a splash-proof plastic housing. All components including the ferrite rod, its winding as well as an electrostatic shielding of the winding and the amplifier ("Faraday cage") are located on a circuit board.

With the ferrite rod, the RFA2 operates as a "magnetic antenna" with predominantly the magnetic component of the EM field. Like all magnetic antennas, it has a bidirectional 8-shaped directional characteristic. The main reception directions are transverse to the longitudinal axis of the housing (to the right and left), the zeros in the longitudinal direction (to the front and back). All-round reception can be approached upwards and downwards, but with reduced sensitivity. The antenna must be properly aligned for optimal reception. "Optimal" reception can be achieved by maximizing the desired useful level or minimizing any interfering signals that may be present.

Ferrite antennas are selective antennas (resonant circuit). They must be tuned to the desired reception frequency. For this purpose, an electronic circuit in the RFA2 realizes the tuning by means of switchable or variable capacitors and switchable inductance of the ferrite rod's coil. It is controlled by a microprocessor. To set the desired frequency, it receives digital control signals via the RF line.

To ensure sufficient selectivity and reception voltage, the RFA2 possesses an amplifier with a Q multiplier circuit ("Q-multiplier"). The so-called quality of an oscillating circuit determines its bandwidth and its resonance voltage. As the quality increases, the bandwidth decreases and the voltage increases. A feedback system is used in the RFA2 to increase the quality. It is automatically set by the microprocessor in such a way that a high quality is available without too much signal being fed back. Otherwise this would lead to self-excitation (oscillation) and the antenna itself would become the transmitter.

The quality can be set from maximum (99%) to minimum (0%). By reducing the quality, the bandwidth of the antenna can be increased (retuning is not necessary as often when changing frequencies). However, this is done at the expense of the reception voltage. With the reception voltage, however, the inherent noise or the received ambient noise also decreases. This is why smaller quality settings are often useful, as they hardly or not at all degrade the SNR, but increase the bandwidth and reduce distortion. High quality settings are only required for high selection requirements or for very small reception signals in a low-noise and low-interference environment.

The quality values are relative values between maximum quality (shortly before the start of self-excitation) and complete shutdown of the multiplication factor. Without quality multiplication (0%), the reception level and bandwidth result according to the currently active inductances and capacities of the tuning. The values are therefore strongly frequency dependent. A quality setting of 99% also results in a frequency-dependent bandwidth, but the reception level is always calibrated so that it only changes by a maximum of  $\pm 2$  dB between adjacent tuning steps.

With high quality settings, the bandwidth becomes so narrow (approx. 1 - 5% of the frequency) that the adjustment error in the tuning becomes noticeable. The error depends on the ferrite rod and the temperature and causes the point with the highest reception level (middle of the resonance curve) to deviate from the set frequency. By utilizing close-tolerance components (1%) and tuning capacitors with adapted temperature coefficients to compensate for the deviation of the ferrite rod, the error remains smaller than half the bandwidth under almost all circumstances. This means that even if the tuning deviates, a reception level of at most 3 dB less than the possible maximum level is still achieved. The desired reception frequency can always be brought into the middle of the current bandwidth (highest reception level) by adjusting the tuning slightly (fine tuning).

## Connections and controls

The RFA2B possesses a standard SMA connection socket for the RF cable (see picture on page 1). The antenna can be mounted outdoors. The coaxial cable with plug should then also be suitable for outdoor use. In the case of permanent external installation, the connection point should be securely sealed with vulcanizing tape or similar.

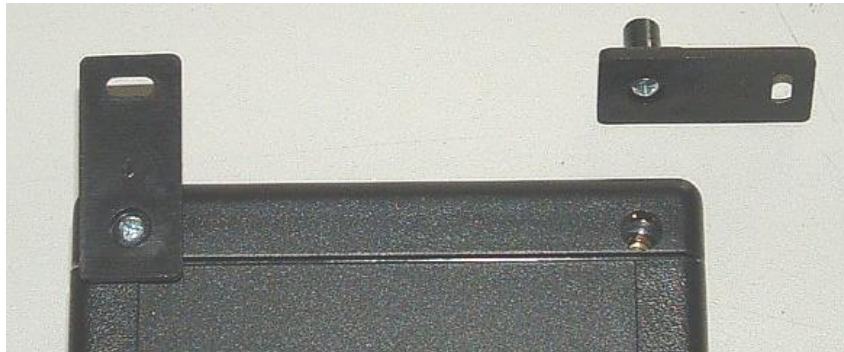
**Caution!** If the antenna is exposed to direct sunlight for a long time, it can become very warm. It should be set up so that it is in the shade for most of the day (especially around the middle of the day).

*Note:* The antenna is hermetically sealed. However, extreme pressure changes can be compensated for by the seal between the housing shells and by the coaxial socket. In the case of permanent outdoor installation, however, it is recommended to drill a small hole (approx. 1 - 1.5 mm) at the lowest point (closest to the ground) of the housing. (**Caution**, do not drill further into the housing to avoid damaging the electronics!) This makes pressure equalization easier and enables any condensation liquid that may develop to run off or to evaporate.

4 mounting feet are available for mounting the antenna on any non-conductive (!) surface. These can be inserted into the holes in the housing screw connection on the rear. They can be rotated freely (any angle to the side of the housing is possible). Fastening takes place by inserting into the holes and screwing in short self-tapping screws to spread the sleeves and thereby clamping them in the housing holes. This means that after screwing the feet to a wall or the like, the antenna can be pulled off with a little force and then put back on again. This allows the antenna to be removed without tools, e.g. for theft protection, in extreme weather conditions or long periods of non-use.

*Note:* To screw the feet firmly to the housing, the hole in the sleeve of the feet can be drilled out to 3 mm. The original housing screws must be removed (attention, do not separate the housing shells!) and the foot can be screwed directly to the housing with an M3x20 cylinder head screw. Make sure that it is watertight (put the rubber seal back on the original screw)!

**Important note:** Do not operate the RFA2 close to metal or other conductive objects. When receiving the RFA2, do not place it on conductive surfaces such as a receiver housing. Even poorly conductive surfaces, like different types of paintwork on table tops, can impair reception and cause interference.



The housing feet are simply pushed on as standard and clamp in the holes of the housing screw connection.

## Power supply and remote control

The RFA2B draws its power supply exclusively via the RF cable (5.7 ... 15 V). It is also used for remote control. It is possible to set the frequency and the quality. The control takes place via a data telegram according to the RS-232 standard with the parameters 9E2 125 baud. A "1" bit is transmitted by a low voltage (quiescent voltage of the power supply, min. 5.7 V), a "0" bit by a voltage increased by min. 1 V and max. 3 V (max. 15 V).

These data telegrams and thus the remote control can be generated with the aid of the RSW4 control unit or directly by remote power supply from an RDR51 "Pocket", RDR53 "sPocket" or RDR55 receiver (automatically synchronized with the frequency setting, from certain serial numbers of the devices).

The structure of the data telegrams for producing your own control units / software is shown below. Each data word must be transmitted in 9E2 format (1 start bit, 9 data bits, even parity bit, 2 stop bits) at 125 baud.

Quality setting RFA (1 word, only data bits shown):

1. bit	2. bit	3. bit	4. bit	5. bit	6. bit	7. bit	8. bit	9. bit
G0	G1	G2	G3	G4	G5	G6	1	1

G[6..0]: Quality value, 127 = 99%, 0 = 0%.

Frequency setting RFA (2 words, only data bits shown):

1. bit	2. bit	3. bit	4. bit	5. bit	6. bit	7. bit	8. bit	9. bit
F0	F1	F2	F3	F4	F5	F6	F7	0

1. bit	2. bit	3. bit	4. bit	5. bit	6. bit	7. bit	8. bit	9. bit
F8	F9	F10	F11	F12	F13	F14	0	0

F[14..0]: Frequency in kHz, values less than 137 are limited to 137, values greater than 2000 to 2000.

For further information, see description of control unit RSW3/4.