RF-KIT
POWER AMPLIFIER

Assembly and adjustment instructions for linear amplifier RF2K-S

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Dear customer,

Congratulations on your purchase of a RF-KIT linear amplifier!

RF-KIT devices offer innovative and reliable technology, functionality and appealing design.

If, in spite of our careful quality control, you have any reason to complain or have a question about the device, please contact the dealer you trust or even directly to RF-KIT.

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1.1 Explanation of symbols

Warnings

Warnings are marked by a warning triangle.
In addition, signal words indicate the nature and severity of the consequences if the measures to avert the hazard are not followed.

The following signal words are used in this document:

- **NOTE** means that property damage may occur.
- **WARNING** means that serious or even life-threatening personal injury may occur.
- **DANGER** means that serious or life-threatening personal injury will occur.

Important information without danger to people or property is marked by the adjacent symbol. These informations are boanded by lines above and below the text.

1.2 Important informations

Symbol	Meaning
▶	Instruction
➔	Reference to a position in the document
●	Enumeration/List entry
-	Enumeration/List entry (2^{nd} level)

1.3 Environment protection

Disposal of packaging

The packaging protects the device against damage during transport. The packaging materials are selected according to environmentally friendly and disposal-related aspects and thus recyclable.

The return of the remaining packaging parts, such as packaging straps, PE bags, etc., into the material cycle saves raw materials and reduces waste.

If you plan to dispose of the packing by yourself, please locate the nearest recycling center.

Before the device can be used, any necessary adjustments must be carried out!

A **Raspberry Pi® 4 Model B** must also be installed (not supplied).
In order to prevent the device from being put into operation without these adjustments and installation works having been carried out, suitable measures have been taken which must be reversed for operation within the scope of the adjustment and installation works.

Note:
The device is not ready for operation when delivered! Although it can be switched on, it will not generate any HF-power.

To carry out the adjustments you need some tools and measuring instruments:

- Phillips screwdriver and small screwdriver
- Reference wattmeter
- Digital Multimeter
- Soldering station

In addition, the device must be connected to a control transmitter and an dummy load:

- Control transmitter (TRX) with adjustable output power
- 2 coaxial cables (approx. 1 m) with correctly fitted connectors PL-259
- 50 Ω dummy load; load capacity min. 1 kW

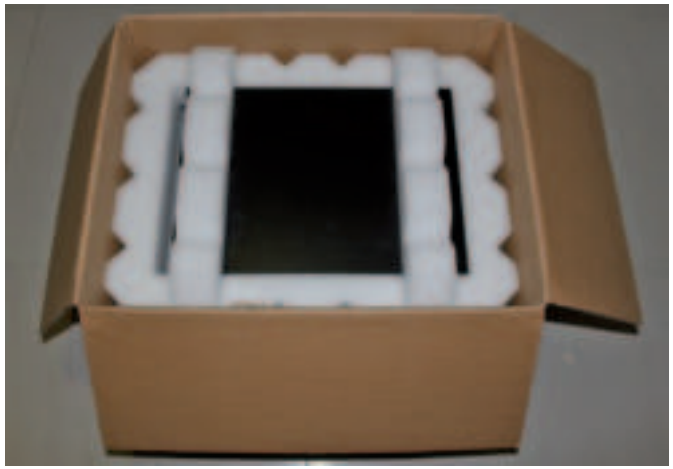
For the internal cabling you need:

- 2x USB-cable (USB-Mini to USB; approx. 0.5 m)
- 1x HDMI-cable (HDMI-Micro to HDMI; approx. 0.5 m)

These 3 cables are included in the delivery, in addition to a power plug and a piece of coaxial cable with SMA plug.

Step 1: Unpacking the device

▶ Open the shipping carton carefully and remove the device.



▶ After unpacking the device, inspect it for shipping damage.

▶ Report any damage immediately to the shipping company or dealer. Keep the shipping carton.

▶ Place the device on a stable work surface and have ready the required tools.

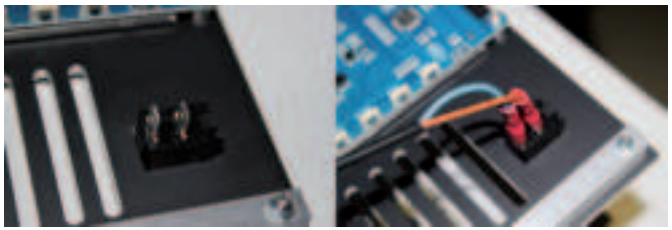
Step 2: Removing the housing cover

▶ Loosen 4 lateral countersunk screws and then remove the housing cover.

Step 3: Removing the front panel

▶ Loosen 2 countersunk screws each on the left and right to detach the front panel from the device frame.

► Disconnect the cable between the **power supply** and the **power switch (1)**.



Step 4: Installing current operating system on Micro SD card

The device is supplied with a **Micro SD card**, which must be loaded with the current operating system for the device.

To download the latest operating system you need a so-called "FTP program" (e.g. "FileZilla", "WinSCP" or similar).

You can obtain the corresponding data as a Zip file from the following addresses:

Version **"International"**:

Server:	Port:	User:	Password:
access816807157.webspace-data.io	22	u100014070-rf2ksi	RF2K-S-int

Version **"US"**:

Server:	Port:	User:	Password:
access816807157.webspace-data.io	22	u100014070-rf2ks_w	RF2K-S-usa

Version **"Canada"**:

Server:	Port:	User:	Password:
access816807157.webspace-data.io	22	u100014070-rf2ks_ve	RF2K-S-ve

Save the downloaded and unzipped file to the supplied **Micro SD card** using the disk imager software "Win32 Disk Imager".

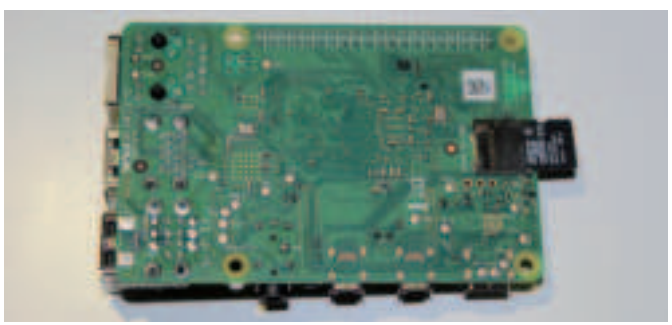
"Win32 Disk Imager" is available as freeware for Microsoft Windows as a version for installation. The free software must therefore be installed after downloading, which requires administrative rights on the computer.

Installing a version of the operating system other than that intended for your country will void the warranty.

Step 5: Installing Raspberry Pi® 4 Model B

► Remove 4 pre-assembled screws from the spacer bolts provided for fixing the **Raspberry Pi® 4 Model B**.

► Insert the **Micro SD card** preprogrammed in Step 4 into the slot provided in the **Raspberry Pi® 4 Model B**.



(continued on next page)

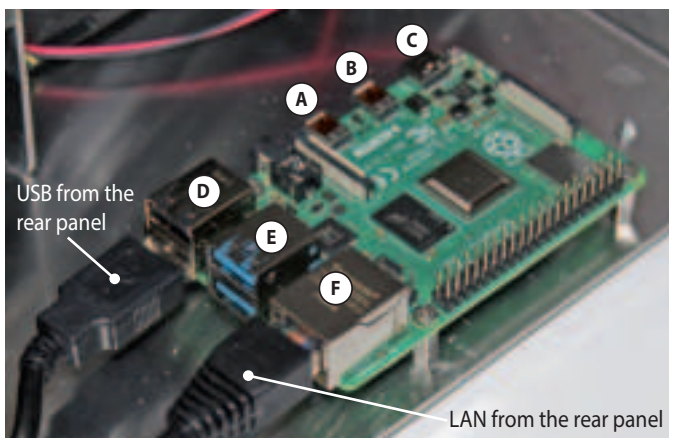
- Place the **Raspberry Pi® 4 model B** on the spacer bolts as shown in the picture below and secure it with the 4 screws previously removed from the spacer bolts.

Step 6: Connection controller board with Raspberry Pi® 4 Model B

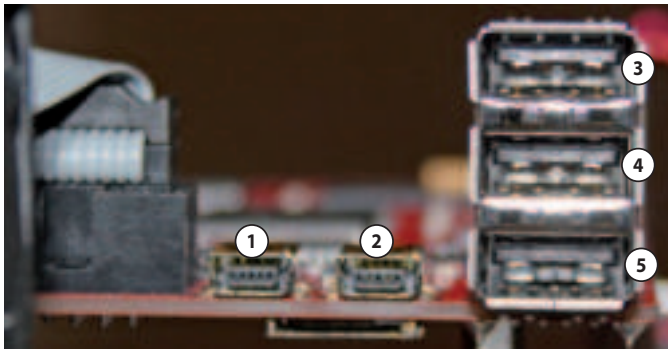
Now the **Raspberry Pi® 4 model B** must be carefully connected to the **controller board**, **Touchscreen (2)** using the 3 cables supplied.
2 cables from the **connection sockets at the rear panel** for USB and LAN are also to be connected with the **Raspberry Pi® 4 model B**.

Always take care to avoid any mechanical stress on soldered sockets of all components.
Especially the HDMI sockets of the **Raspberry Pi® 4 Model B** are wellknown to be particularly sensitive in this respect!

- Connect the USB cable already present in the device to "**D lower** - USB" on the **Raspberry Pi® 4 Model B**.
- Connect the LAN cable already present in the device to "**F** - LAN" on the **Raspberry Pi® 4 Model B**.

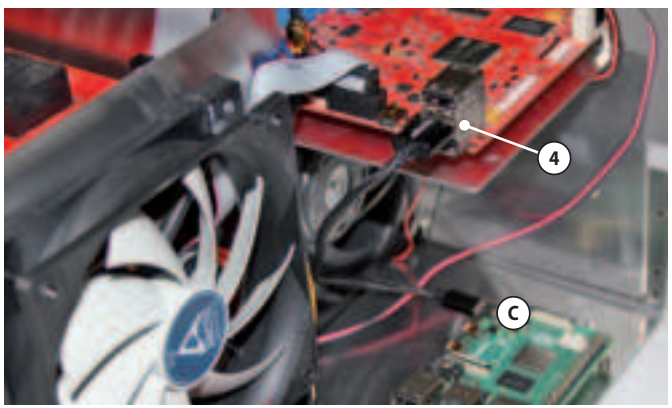


Raspberry Pi® 4 Model B:
A - Micro HMDI / **B** - Micro HMDI / **C** - Power supply / **D, E** - 2x USB / **F** - LAN



Controller board: 1 - Mini USB / **2** - Mini USB / **3** - USB / **4** - USB / **5** - USB

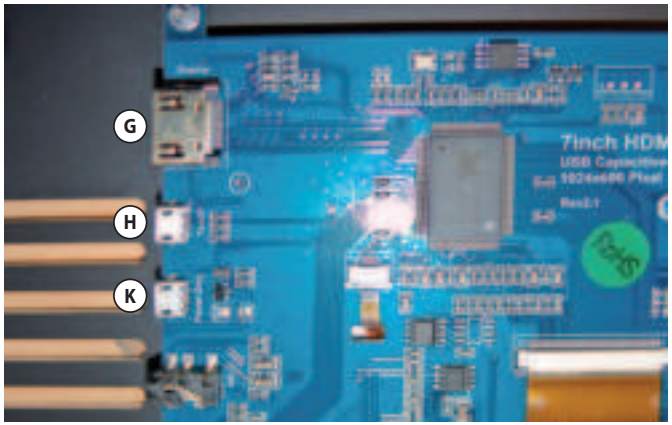
- Connect "**4** - USB" on the **Controller board** to "**C** - Power supply" on the **Raspberry Pi® 4 Model B**.



- Connect "**1** - Mini USB" on the **Controller board** to "**D upper** - USB" on the **Raspberry Pi® 4 Model B**.

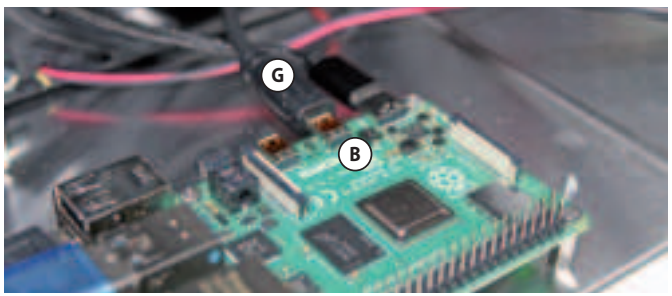
The socket "**2** - Mini USB" of the **Controller board** will not be used and therefore remains free.

Step 7: Connection Touchscreen (2) to Raspberry Pi® 4 Model B



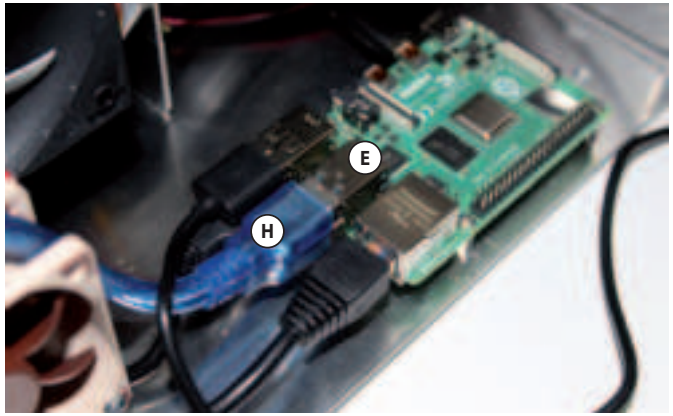
Touchscreen: "**G** - HDMI" / "**H** - USB" / "**K** - Power supply"

▶ Connect "**G** - HDMI" of the **Touchscreen (2)** to "**B** - Micro HMDI" on the **Raspberry Pi® 4 Model B**.



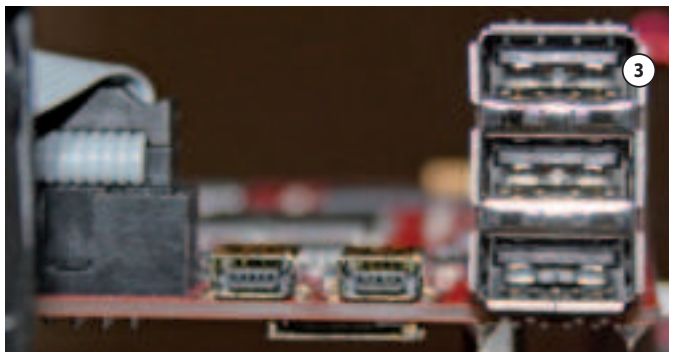
Socket "**A** - Micro HMDI" on the **Raspberry Pi® 4 Model B** will not be used and therefore remains free.

▶ Connect "**H** - USB" of the **Touchscreen (2)** to "**E** - USB" on the **Raspberry Pi® 4 Model B**.



Step 8: Connection Touchscreen (2) to Controller board

▶ Connect "**K** - Power supply" of the **Touchscreen (2)** to "**3** - USB" on the **Controller board**.



Step 9: Preparatory work for alignment

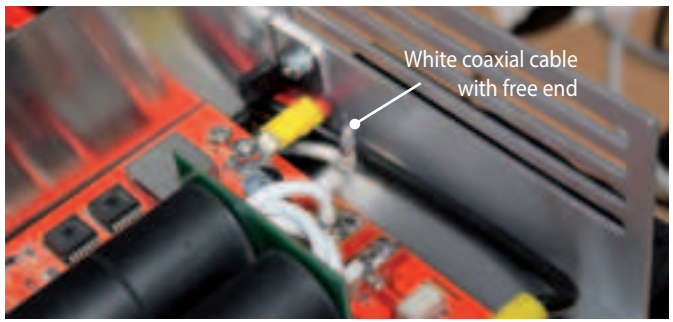
A suitable plug for the **Power jack (9)** is included in the delivery. With this plug, together with a sufficiently dimensioned mains cable and a country-specific mains plug, the user has to prepare a mains cable suitable for at least 16 A current consumption (cable cross-section >1.5 mm²).

A short piece of coaxial cable with one attached SMA plug ("Pigtail") is also included:

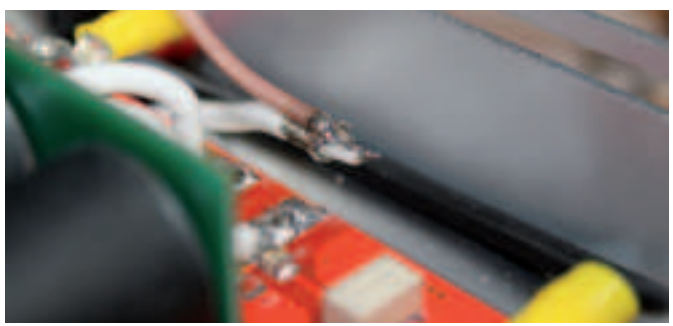
- ▶ Strip off approx. 15 mm of insulation at the free end of the "Pigtail" and tin it.

In the rear area of the power amplifier module, directly in front of the rear panel, there is the free end of a white coaxial cable.

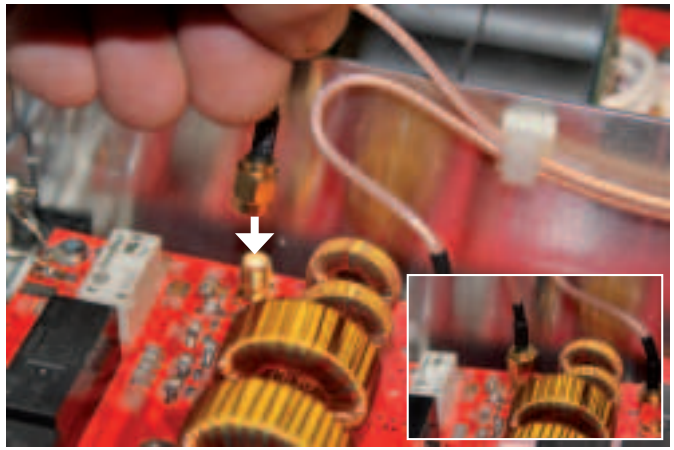
This coaxial cable normally lies flat between the board of the power amplifier module and the rear panel and has been angled upwards for better visibility in the following picture.



- ▶ Solder the "Pigtail" to the free end of the white coax cable.



- ▶ Connect SMA-plug "Pigtail" to TX/RX-Tuner-module.



Now the power amplifier module is bypassed and the control signal is looped through. All functions of the device can be tested in this way without generating power.

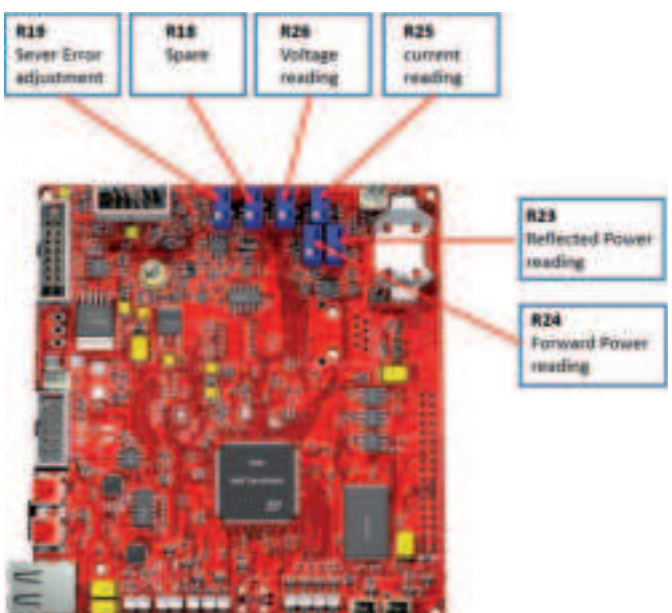
- ▶ Check all plug connections for tight fit, freedom from mechanical tension and correct connection.
- ▶ Connect TRX to **Exciter input (17)**.
- ▶ Connect Dummy load to **ANT1 (6)**.
- ▶ Establish PTT connection via **PTT (7)**.
- ▶ Connect the device to earth via the **Ground connector (11)** on the rear panel.
  Use a cable with the shortest possible length and the largest possible cross-section.
- ▶ Connect the unit to the mains using the power cable via the **Power jack (9)** on the rear panel.

Adjustment

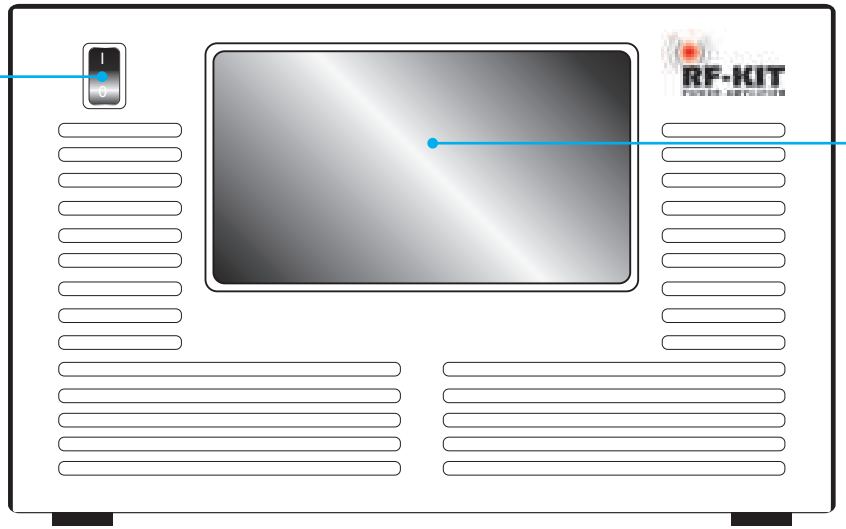
Switch on the unit with **On/Off (1)**. Wait until the main screen is displayed on the **Touchscreen (2)**.
The following adjustments are made using setting
Tuner Mode: Auto - Bypass:

- Adjustment voltage display
- Test of frequency measurement and lowpass filter circuit
- Forward power display, reflected power display and SWR-display. These power-based adjustments are carried out in the 20 m band (14 MHz).

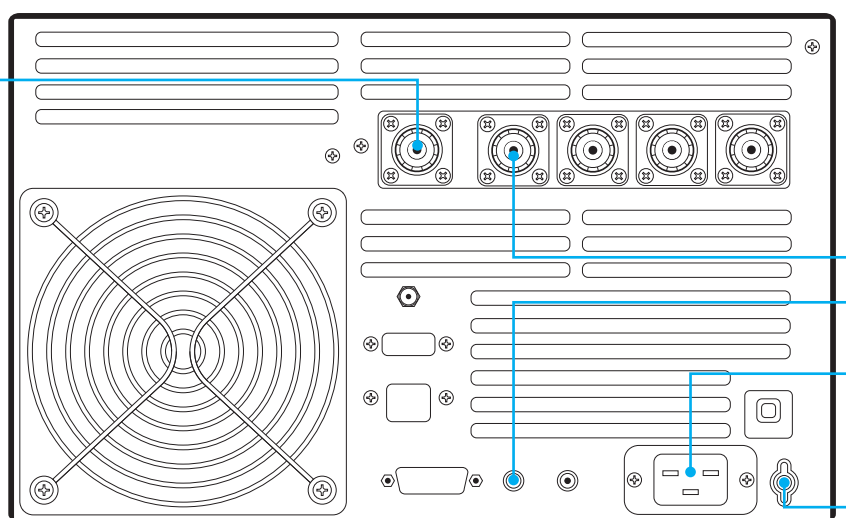
Fig. below: Position of the potentiometers relevant for the adjustment on the **Controller board**.



Front panel:

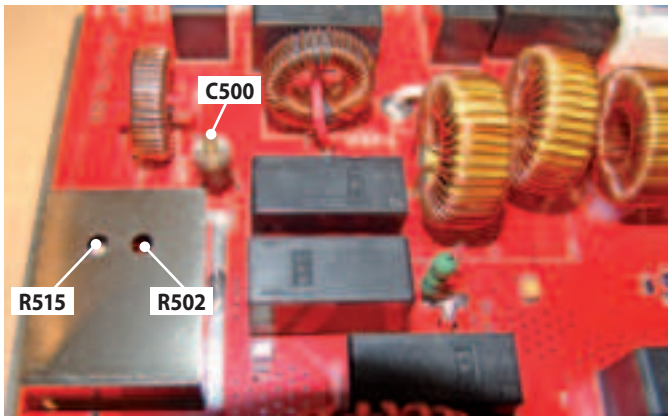


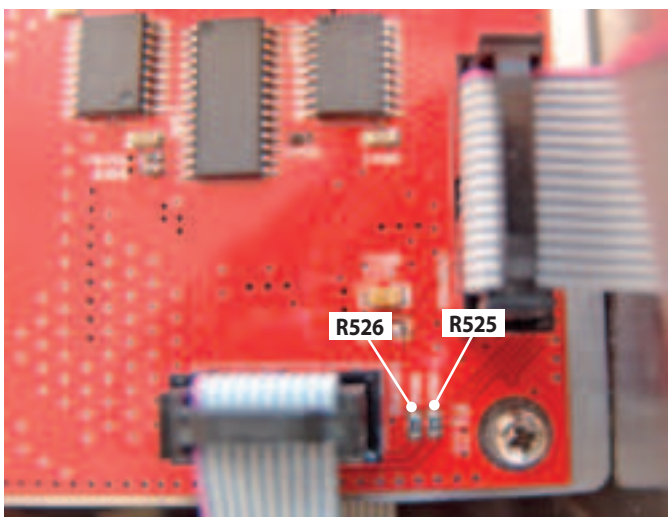
Rear panel:



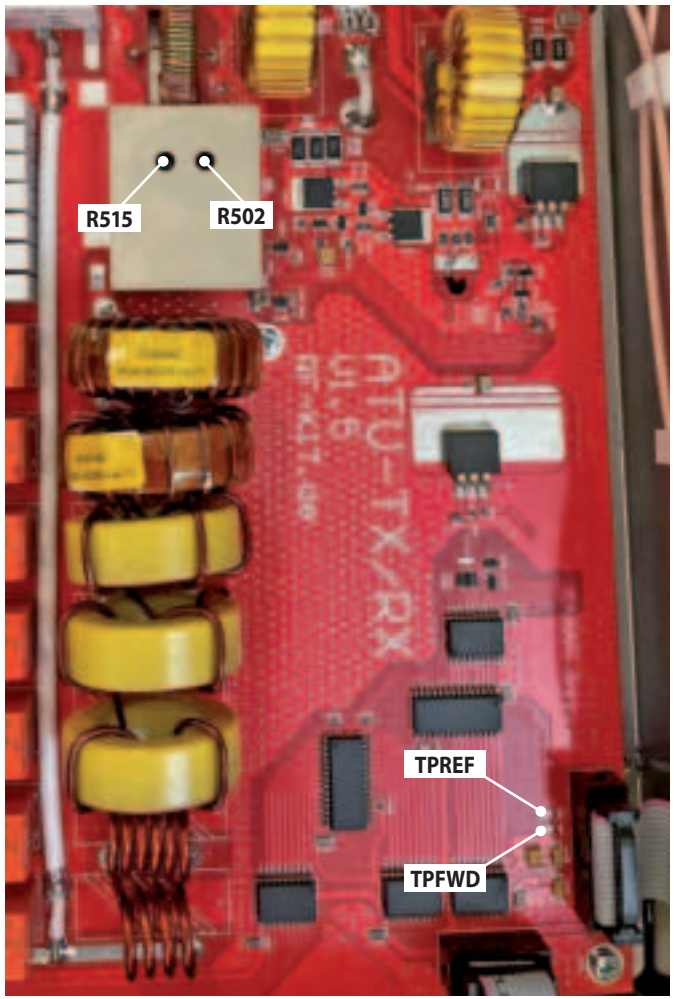
1 **On/Off**
2 **Touchscreen**
6 **ANT 1**
7 **PTT**
9 **Power jack**
11 **Ground connector**
17 **Exciter input**

Position of the adjustment elements and measuring points on the Tunerboard (up to V1.2)





Position of the adjustment elements and measuring points on the Tunerboard (from V1.5)



Step 10: Adjustment voltage display

- Adjust voltage display at the **Touchscreen (2)** (*Menu → Calibration → Poti Config:* "Indication area **Voltage**") with **R26** on the **Controller board** to 53,5 V.

Step 11: Test of frequency measurement and lowpass filter circuit

- Set the transmit power of the TRX to **5 W** (CW/AM/FM) reading on your reference wattmeter.
- Connect TRX to **Exciter input (17)**.
- Connect Dummy load to **ANT1 (6)**.
- Operate **PTT**.

The frequency display of the PA should match that of the control transmitter +/- 2 kHz.

- Check whether the display of the current band filter also changes on the **Touchscreen (2)** when the frequency or band is changed and whether the correct band filter is displayed.

There are control LEDs on the **Lowpass Filter Board**:

- Check for all bands whether the band filters are also changed when the frequency or band is changed and whether the correct band filter is selected (corresponding LED lights up **red**).
- Release **PTT**, stop transmitting.

Adjustment power display
The following power-based adjustments are carried out in the 20 m band (14 MHz).

Step 12: Adjustment forward power display (low)

- Set the transmit power of the TRX to **5 W** (CW/AM/FM) reading on your reference wattmeter.
- Connect TRX to **Exciter input (17)**.
- Connect Dummy load to **ANT1 (6)**.
- Operate **PTT**.
- Adjust **R502** on the **Tunerboard** for 1.6 V at measuring point **R525 (V1.2) / TPFWD (V1.5)**.
- Release **PTT**, stop transmitting.

Step 13: Adjustment forward power display (high)

- Set the transmit power of the TRX to at least **50 W or more** (CW/AM/FM) reading on your reference wattmeter.
- Connect TRX to **Exciter input (17)**.
- Connect Dummy load to **ANT1 (6)**.
- Operate **PTT**.
- Set **R24** on the **Controller board** so that on the **Touchscreen (2)** (main screen) the transmit power supplied by the TRX is displayed with the correct value as **forward power**.
- Release **PTT**, stop transmitting.

Step 14: Adjustment reflected power display (low)

- Set the transmit power of the TRX to **5 W** (CW/AM/FM) reading on your reference wattmeter.
- Connect TRX to **ANT 1 (6)**.
- Connect Dummy load to **Exciter input (17)**.
- Operate **PTT**.
- Adjust **R515** on the **Tunerboard** for 2.7 V at measuring point **R526 (V1.2) / TPREF (V1.5)**.
- Release **PTT**, stop transmitting.

Step 15: Adjustment reflected power display (high)

- Set the transmit power of the TRX to at least **50 W or more** (CW/AM/FM) reading on your reference wattmeter.
- Connect TRX to **ANT 1 (6)**.
- Connect Dummy load to **Exciter input (17)**.
- Operate **PTT**.
- Set **R23** on the **Controller board** so that on the **Touchscreen (2)** (main screen) the transmit power supplied by the TRX is displayed with the correct value as **reflected power**.

The bargraph of the reflected power on the main screen will deflect full, but the digital power display will still show the value to be adjusted correctly.

- Release **PTT**, stop transmitting.

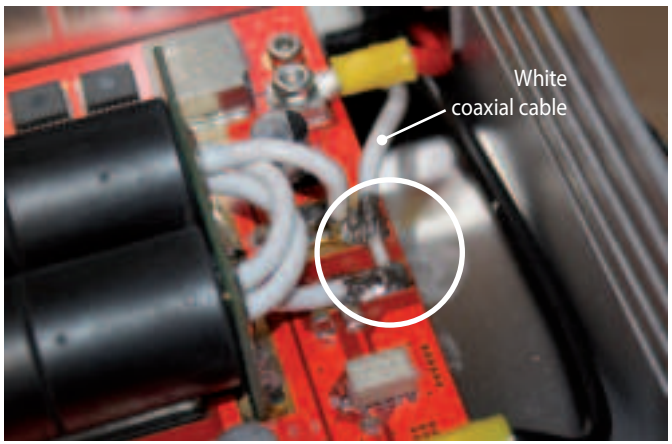
The following step is valid for Tunerboard V1.2 only!

Step 16: Adjustment SWR-measuring bridge (up to V1.2 only!)

- Switch the device to **"Standby"** using the switching area **"Standby"**.
- Choose the 6 m-Band (50 MHz).
- Set the transmit power of the TRX to **5 W** (CW/AM/FM) reading on your reference wattmeter.
- Connect TRX to **Exciter input (17)**.
- Connect Dummy load to **ANT1 (6)**.
- Operate **PTT**.
- Adjust **C500** on the **Tunerboard** to display minimum SWR at the **Touchscreen (2)** (main screen).

Step 17: Looping in the PA module

- ▶ Disconnect SMA plug "Pigtail" and unsolder its free end from the white coaxial cable.
- ▶ Solder the free end of the white coaxial cable to the output of the PA module.



There are 2 bias jumpers on the PA module. On delivery both jumpers are in position "BIAS OFF".

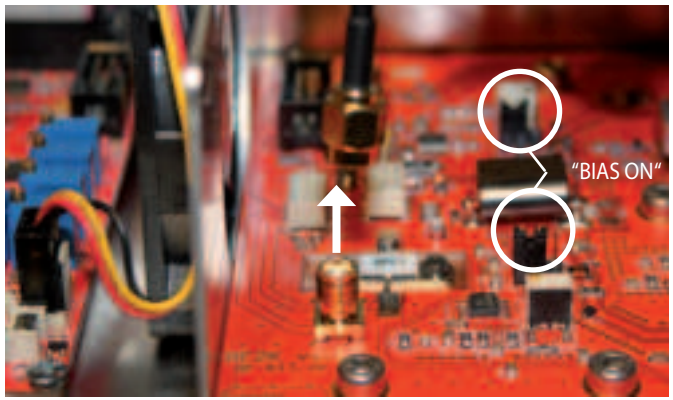
- ▶ Set both jumpers to position "BIAS ON".

Delivery status: "BIAS OFF"

Operating status: "BIAS ON"

Step 18: Adjustment display current consumption

- ▶ Remove SMA plug from input SMA socket PA module.



- ▶ Switch the device to **"Operate"** by tapping switching area **Standby**.

Now **LED "53 V-On"** lights up.

- ▶ Connect TRX to **Exciter input (17)**.
- ▶ Connect Dummy load to **ANT1 (6)**.
- ▶ Set the transmit power of the TRX to **5 W** (SSB).
- ▶ Operate **PTT**, whistle briefly into the microphone until both Bias-LED light up **green**.
- ▶ Keep **PTT** pressed.
- ▶ Adjust **Quiescent current** with **R25** on the **Controller board** until 3.6 A is displayed on the **Touchscreen (2)**.
- ▶ Release **PTT**, stop transmitting.
- ▶ Plug the SMA plug back into the input SMA socket PA module.

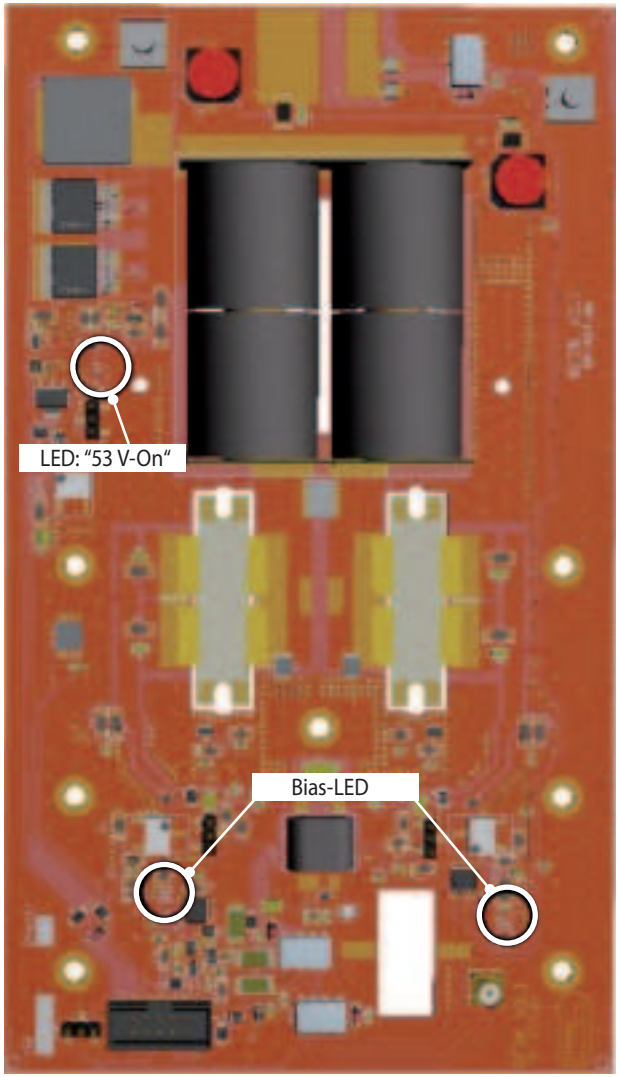


Fig. right: PA module

Step 19: Severe Error Alarm

- ▶ Connect TRX to **Exciter input (17)**.
- ▶ Connect Dummy load via Reference wattmeter to **ANT1 (6)**.
- ▶ Tune TRX to a frequency in the 20 m band (14 MHz).
- ▶ Adjust **R19** on the **Controller board** about 10 turns counterclockwise.
- ▶ Switch the device to **"Operate"** by tapping switching area **Standby**.
- ▶ Set the transmit power of the TRX to **5 W** (CW/AM/FM) reading on your reference wattmeter.
- ▶ Operate **PTT**.

If a **Severe Error Alarm** is already triggered now, **R19** on the **Controller board** must be adjusted further counterclockwise. This will continue until the alarm message disappears.

- ▶ Gradually increase the transmit power of the TRX until 500 W is displayed on the reference wattmeter (the power display of the PA display may still show a different value, as it will be calibrated in the next step).
- ▶ Keep **PTT** pressed.
- ▶ Adjust the **PAF** display with **R19** on the **Controller board** until the value "1100" is displayed.
  (*Menu → Calibration → Poti Config:* "Indication area **PAF**")
- ▶ Release **PTT**, stop transmitting.

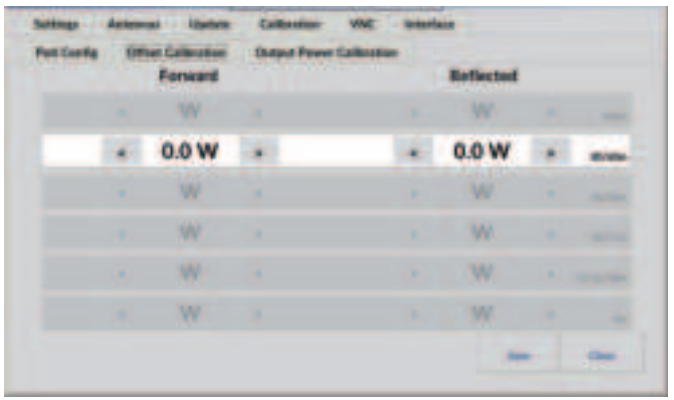
Step 20: Adjustment forward power display (full power)
This adjustment is carried out in the 80 m-Band (3.5 MHz).

- ▶ Connect TRX to **Exciter input (17)**.
- ▶ Connect Dummy load via Reference wattmeter to **ANT1 (6)**.
- ▶ Operate **PTT**.
- ▶ **Slowly increase** the TRX transmit power **from 5 W** until Reference wattmeter reads **1000 W** (CW/AM/FM).
- ▶ Set **R24** on the **Controller board** so that on the **Touchscreen (2)** (main screen) **Forward power** is displayed with 1000 W.
- ▶ Release **PTT**, stop transmitting.

Step 21: Fine adjustment power display via the menu
Please also note the description in the operating instructions
(➔ page 14, "**Offset Calibration**")

Go to

Menu → Calibration → Offset Calibration:



The unavoidable frequency-dependent deviations of the linearity of the directional coupler used for internal power measurement can be minimized for each bandpass range. The adjustment should be performed at an output power of 1 kW. Use your preferred reference wattmeter for the adjustment.

Selection of the bandpass range is done automatically during transmission. The detected band is highlighted.

- ▶ Adjust the internal power display by tapping switching areas **> (increase value)** respectively **< (decrease value)**.

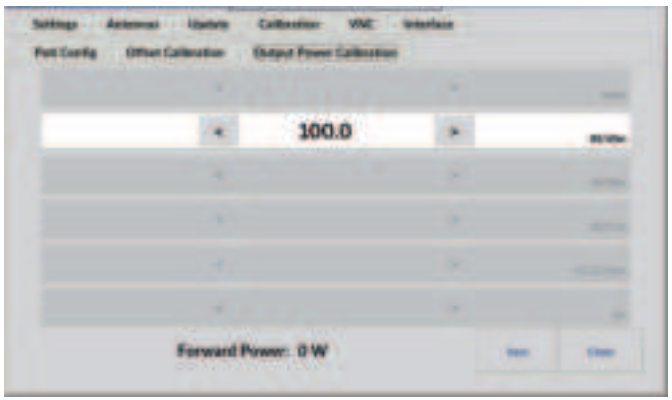
Brief actuation changes the value in the indication area **Forward** by 0.1 W. Longer actuation changes the value continuously.

- ▶ Press the switching area **Save** to store the settings.
- ▶ Repeat this procedure for each bandpass range to be adjusted.

Step 22: Optional power fine tuning via the menu
Please also note the description in the operating instructions
(➔ page 15, "**Output Power Calibration")**

Go to

Menu → Calibration → Output Power Calibration:



The output power generated at a given control power can be adjusted optionally within certain limits for each bandpass range.

The 6 m band requires a higher control power than the other frequency ranges and should therefore always be set to "100".

Selection of the bandpass range is done automatically during transmission. The detected band is highlighted.

- ▶ Adjust the output power by tapping switching areas **> (increase value)** respectively **< (decrease value)**.

Brief actuation changes **Calibration Value** by 1 digit.
Longer actuation changes the value continuously (factory setting: 100.0).

Display area **Forward Power** constantly informs you about the currently generated output power.

- ▶ Press the switching area **Save** to store the settings.
- ▶ Repeat this procedure for each bandpass range to be adjusted.

RF-KIT
POWER AMPLIFIER

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