Pi-Star Setup:

I'm assuming that you have already put the Pi-Hat on the Pi, and an SD Card imaged with Pi_Star. If not then go do those steps. (Pi-Star how-to's can be found elsewhere on the wbe.)

Connect the LAN cable and then power on the Pi.

The Pi should start up. (I assume that your router has enabled DHCP to assign an IP address to the Pi) After about 1 minute you should be able to access the Pi-Star interface via your browser.

Click on this link:
http://pi-star/admin/

Username: pi-star
Password: raspberry

Now you should expect an empty Pi-Star setup, if you do not end up directly on the configuration page, click **Configuration** in the upper right corner.

Now let's go through the configuration, I always show first the picture and then info about the picture. **Please always click on "Save" after each picture, as more options become visible as others are enabled.**
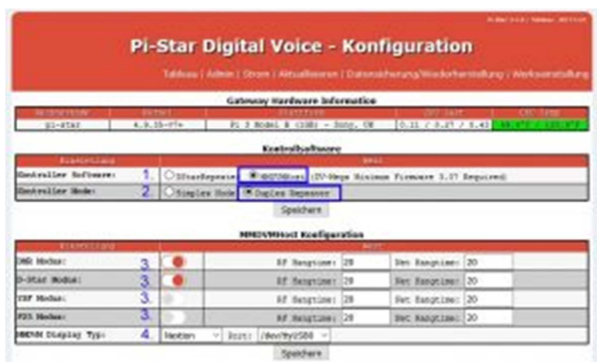
1. Here we select "**MMDVMHOST**"
2. Select "**Duplex Repeater**" here
3. At this point we **can enable which digital modes** we want to use on our repeater.
-> Since I am only interested in DMR and DSTAR, interesting I will only enable these two modes.
4. If you have a **display** then **select** the type and where it is located as shown in the picture. If your display is connected to the modem board, select 'modem'

Click 'SAVE'

1. please <u>do not change</u> unless you know what you are doing
2. Enter the **call of your repeater here**
-> In my case there is my private call because the repeater is only in the test
3. Enter here the **6-digit DMRid** for the repeater
-> In my case here is the extended BrandMeister DMRid
-> you take your private DMRid and add 2 more numbers at the back and thus have your own ID for your hotspot or test repeater which can be found on the BrandMeister web under hotspots
4. The **RX frequency** in MHz (specify with point instead of comma)
5. The **TX frequency** in MHz (specify with point instead of comma)
6. The latitude (**LAT**) of the location in decimal format
7. The longitude (**LONG**) of the location in decimal format
8. Location of the repeater (**place name**)
9. **Germany, DE** (or your country)
10. URL of the **repeater homepage** (select **manual** on the right)
11. **Select** here **STM32-DVM / MMDVM_HS - Raspberry Pi Hat (GPIO)**
-> With some changes of the configuration you get the indication that the modem settings must be adjusted again, then again here the Pi Hat select.
12. Select **Public**
13. Select **Europe / Berlin** (or adapted to your location)
14. **Select the** desired **language** for the " **Tableau - Page** ", here **german_en** , or your desired language

TO SAVE

DMR configuration

1. **Select BM_Germany_2621 here**
-> I have here BM_Germany_2622, the back-up server selected so not be surprised. If you come from another country then select the appropriate BM_Master. Of course it is synonymous DMRPlus, but I have not tested.
2. Here you can see links to the BrandMeister info or admin area
3. Please select **1** as **color code**
4. leave **disabled**
5. **Keep** it **enabled** , if there is a problem that Motorola has radio dropouts while other manufacturers can receive everything you can disable the Talker Alias / InVoice GPS here

TO SAVE

D-STAR configuration

1. **Select RPT1** , here **B for 70 cm** and **C for 2 m** repeater
-> yes I know B stands for me and I have a 2m frequency
2. **RPT2** , here you can not change anything
3. Do not change anything here
4. Select the desired **standard** reflector here, I have selected DCS001 / R for Bavaria here.
-> right you can still Startup (at the start of the PI) or Manual (only active if you connect yourself) select
5. Do not change anything here
6. choose the **language of** the repeater **announcements** , here German or whatever language you want to hear.
7. Activate the **time announcements** , select on or off according to what you want

TO SAVE

Leave everything here on **private** , unless you know what you are doing and want to allow external access to the MMDVM.

If you changed something here click on SAVE again.

Here you can configure the built-in **WLAN** from the Raspberry PI3, if you want to use Wi-Fi please make the settings under " **Configure WiFi** " here.
-> I do not use WiFi at the MMDVM, so at the point for the moment no instructions, but I'm sure that you get it even without me

For **remote access,** please do not change anything , unless you know what you are doing and want to allow external access to your PI.

That was it so far once with the basic settings.

Now we start the PI again by clicking on " **Power** " and then on " **Reboot** "
http: //pi-star/admin/power.php

After about 2 minutes, the PI and MMDVMHOST restarted and you should on the admin page
http: // pi-star / admin /

See all this is connected, possibly already come in the first talks. The whole thing looks like this:

EXPERT mode

Incidentally, this is the link to " **Expert Mode** ":
http: // pi-star / admin / expert /

Here you can then set more stuff as well as the MMDVMHOST, at the point that would be too early.

DR1XE Setup:

Turn on the DR1XE **without** a cable connected to the MMDVM. You should be greeted with this display.

It is also possible that 'AUTO' is activated. I'm assuming that, like me, you may have "played around" in the configuration menus.

So if you see the above display, click on **SETUP.** It should show this view:

NOTE:

If you see a line of text in between the two frequency boxes that indicates PANEL and DSP code versions – STOP!! You have a DR-1XFR or DR-2X which are NOT compatable with MMDVM type devices.

With **UP LINK** and **DOWN LINK** you can enter your frequencies, tap the frequency and enter the frequency on the next page. (**UP LINK** is the repeater's **receive** frequency - **DOWN LINK** is the repeater's **Transmit** frequency)

NOTE:
If you intend to use the DR-1X's internal controller for analog backup (or the inhibit/COS wire connected to the DVM) you *MUST* set a CTCSS tone for decode. If this is NOT set, ANY incoming signal (including digital ones) will cause the DVM board to go into inhibit mode. [Not desired]

Next, tap the **button** at the bottom right where **F** is.
The following view opens:

NOTE:

If you cannot get the "Packet Speed" dialog box to come up – STOP!! You have a DR-1XFR or DR-2X which are NOT compatable with MMDVM type devices.

Now **tap** " **UP LINK** " in the upper left corner until the display shows " **Packet Speed 9600bps** " (as shown in the picture).

Deviation should be on "**WIDE**". If not, tap to change it from NARROW to WIDE.

Under "**ID SET**", enter the call for the repeater, it looks like this:
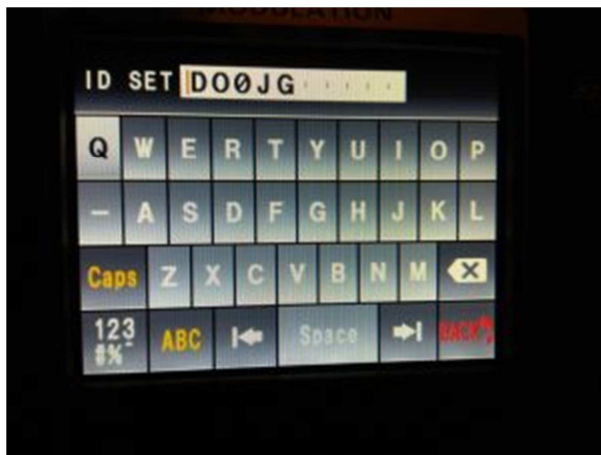
This **ID** is not used for digital operation using MMDVM, but will be used for analog revert. (If enabled)

The **settings** for **MODE / REMOTE** look like this:

Set as shown in the photo.

The next thing is to set the "Mode" in which the DR1XE should work, we expect these settings afterwards.

To be able to adjust these settings, the cable between the DR1X and Pi-Hat must be plugged in. Some settings can be changed without plugging in the cable, but the fields will not turn "yellow" without the cable plugged in cable.

The repeater's screen *should* look as in the picture; everything must be set to "yellow".

For 'normal' operation, the DR-1X's screen should show as above. If not, the repeater will not be "engaged".

10. Calibrate MMDVM

Now it's about the sausage and we get to the point where it gets a bit more complicated for most people.

If you want, you can also test how the DR1XE runs without calibration.

Mine was amazingly well matched. DSTAR worked right away, it will probably be the case with you as it is not that sensitive.

On DMR I could at least hear something, not very clean and send was not possible but I expected worse.

First we tune the TX from the repeater, who does not have a spectrum analyzer here now has to grab as I do a trick and a **RTL SDR stick** to repurpose.
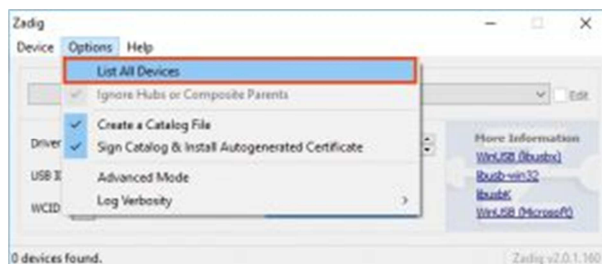
Now we put the stick in the PC and wait until Windows has installed its drivers.

For the stick we have to replace the driver again, for this we use the program " **Zadig** " which we can download here.
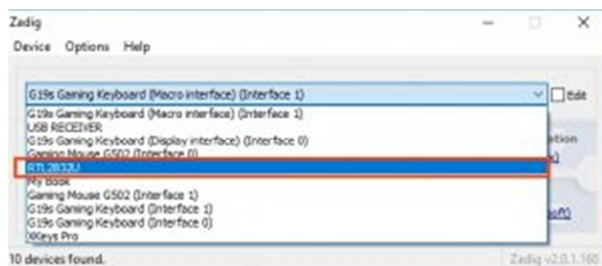
http://zadig.akeo.ie/
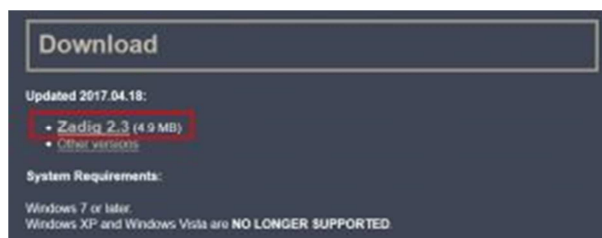
Unpack the packed file, change to the directory and then start the " **zadig.exe** ".

Under **Options** select the item " **List All Devices** "

Then **select** your **stick** in the **drop down** menu.
-> may be that the new stick calls something different, but should actually start **with RTL** .
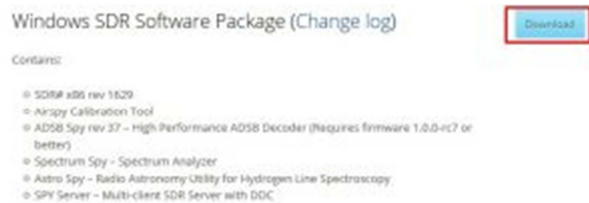
Now we click on " **Replace Driver** "

That's the way it should look, please do not click on it, the screenshot is for information only.

Now we can **close Zadig** again.

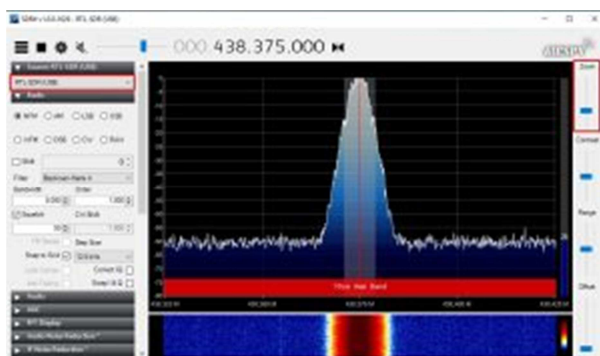Next we need the program **SDRsharp** which we can download here
https://airspy.com/download/

Unpack the packed directory (there is no installation routine) and go to the directory.

There the **BAT file** with the name:
install-rtlsdr.bat
If you forget that, you are like me and you spend eternity debugging.

Then we can start the actual program by double-clicking **SDRSharp.exe**

The **RTL-SDR stick should be** selected in the upper **left** corner of the red marked area. On the **right** in the marked area you will find the **Zoom function** . Although not really overlooked, I overlooked them and tried everything possible to zoom in ^ ^

The first thing you should do is familiarize yourself with the program, the **frequency** can be changed, for example **,** by **clicking** directly **on the numbers** , counting **up** for **high** , **down** for counting **down** .

If you want you can even sync your stick so that then the red line is nice in the middle of the signal, for the adjustment itself we do not need it necessarily because we only look here for a "pattern".

To adjust, you best select a radio station, then click on the gear and you can correct the frequency below in the marked area.

There is also the slider with the name "Gain" which you should move to calibrate to the right, after completing the calibration shift the slider to the left again.

Next, we need to connect to our Raspberry PI, using the good old program " **Putty** " which we can download here
https://www.chiark.greenend.org.uk/~sgtatham/putty/latest.html

Here then at the marked point the **32 or 64 bit version** down load, depending on what a system you have.

Now we **start Putty**
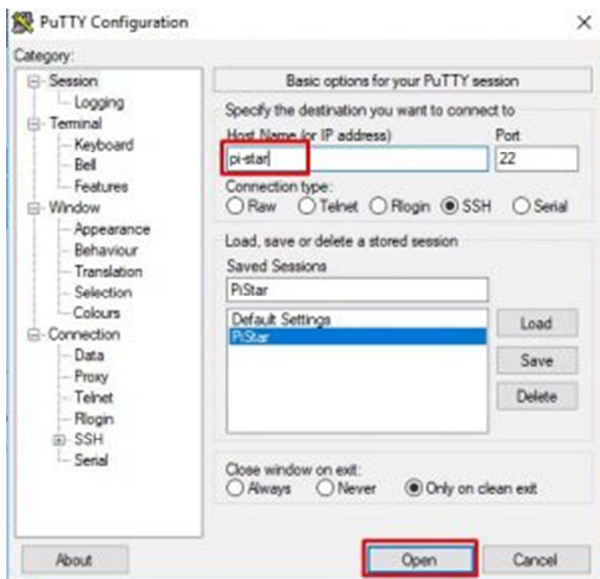
Enter **Host "pi-star"** and click on " **Open** " below.

The **username** is: **pi-star**
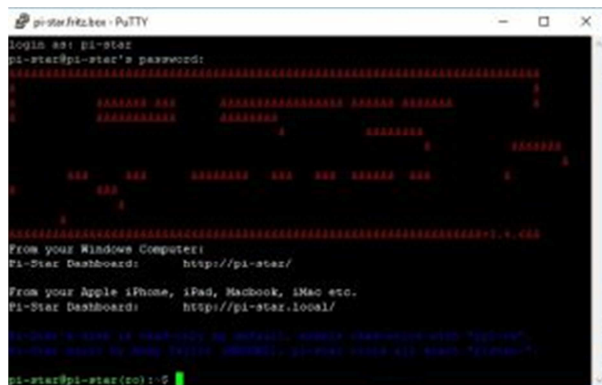then press **ENTER** .

The **password** is: **raspberry**
then press **ENTER**

So the console of the Raspberry Pi with Pi-Star Image welcomes us.

The program which we have to start is called
" **Pistar-mmdvmcal** "

If we want to start the program without root rights, we get the following error message
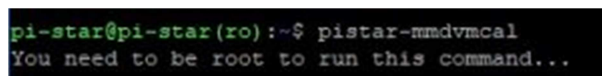
So we do the following
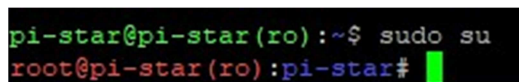
and enter " **sudo su** " and then press **ENTER** again.

So we are greeted by the calibration program which we can **stop** by **pressing** " **Q** " or " **q** " at any time.

Now we press the **key "D"** (big D, so press **SHIFT and D** "what we following is confirmed

Now we **press** the **spacebar to switch** on the **transmitter.** Pressing the space bar again switches the transmitter off.

At this point, the spirits are divorced

The 84% method

The value 84% has not grown on "my crap" but comes from the instructions of Wilm DL4OCH
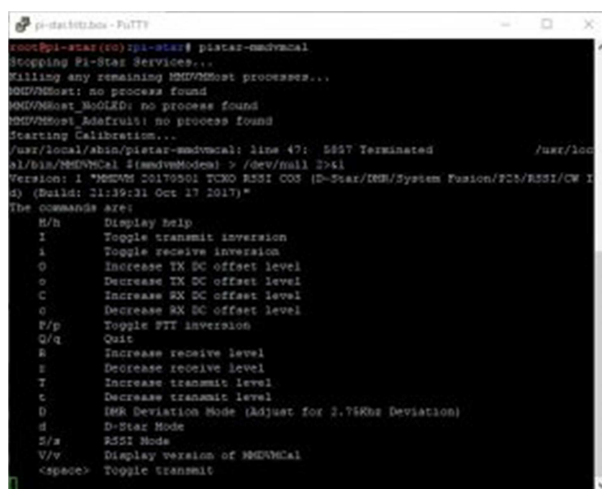http://dl4och.de/?p=231

In the PDF manual linked there you will also find screenshots of how the whole thing looks like with a proper spectrum analyzer.

Why he now takes there just 84% unfortunately I do not know and in retrospect when adjusting the RX branch has then turned out that the 84 (or 80) are too much hub.

Anyway, this tutorial should show you the way how I matched my MMDVM and tried the 84% method.

The next step is to increase the **TX level** by pressing the **"T" key** (large T, ie **SHIFT and T**) to 84%, which will confirm us as follows

Info: If we press " **t** " (**small T**) then we can **decrease** the **percentage of** the TX level again.
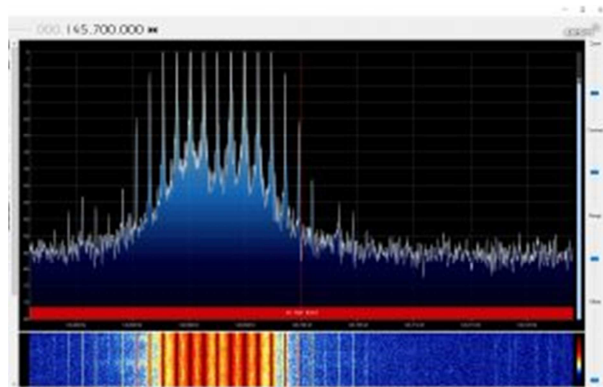
Something about SDRsharp should show us the whole thing.
-> Do not be surprised that the red line is not in the middle, because I had not calibrated the stick, but yes, as mentioned above, nothing to the point.

Next we have to **turn** on the **TX Poti** on the **Pi-Hat board to do** the fine-tuning. The TX Poti is located to the left of the SubD connector and is labeled TX.
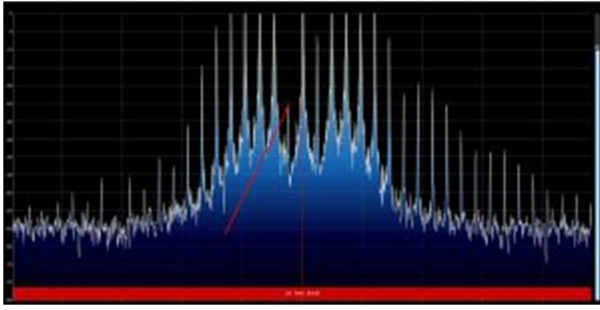
Now we turn on the pot until the "tip" "moves" down (as you can see on the screenshot)

In the case of the 84% method, this was not the middle as expected, but one to the left of the middle. At the point and at the time I put the whole thing in the shoes of the stick, it was possibly only too much hub was not in my mind.

With the method we have to **subtract from 84% about 5%** which then gives a value of **80%** which we have to **enter** at **TXLevel** in the **MMDVMHOST** . (Explanation why and why Wilm explained in his PDF)

Where that is registered, I'll show you the other method.

At the point beforehand mentioned (is difficult to classify here now) that the 80 were too much hub for me and the emissions were zerklötzelt.

Maybe you can hear at this point so purely in DMR to see if the emissions are clear and clear. Of course, it is always difficult because there may also be interference from the network or on the RX side of the other relay.

If you have another relay like I have for comparison then you can switch that back and forth by fast yes check, or you take a 2nd radio.

I just got fed up with the 80 again the 50 at TXLevel and everything was clean. In a re-test today while I wrote this guide, I have again determined the value of 52.5% with the pistar-mmdvmcal where we had Bessel 0. (where the middle "rash" is below)

If we deduct from the 52.5% then 5% we are in about 50% of what I have registered, lucky hits ^^

Comment by DD3JI:
I use the mmdvm-modem of dl7tj, version2 (with rssi), with fully turned up tx-poti and level 84% I have not managed to set bessel-zero, only at 87.5% (with open poti) went the bessel zero level abruptly back to then at 88% and higher again rise significantly

The 0% to XX% method

There is also a manual for adjustment by spectrum analyzer
https://www.f5uii.net/en/installation-calibration-adjustment-tunning-mmdvm-mmdvmhost-raspberry-motorola-gm360/5/

Where a little different is done. This only works with the **RTL Stick** if we unplug the antenna from the stick to further weaken the input signal.

The functionality is here that we start the TX again by using the spacebar, then again press "D" big but this time with a small "t" turn the TXLevel down to 0%. So we see something like this:
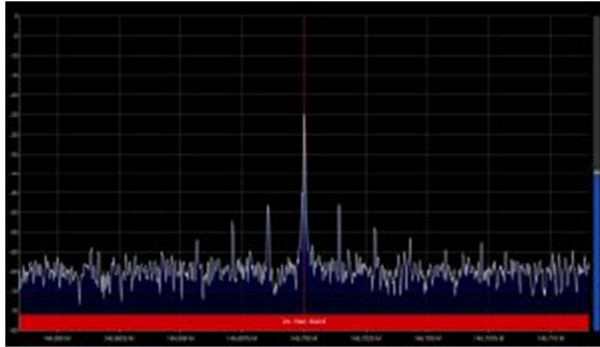
Now it means using the "T" key (large T) to hear the TX level so far until the average rash goes down again slightly.

Possibly (since we have no more antenna tuned) under settings (the gear icon) take the RF gain a bit high, but make sure that the rashes remain in the display
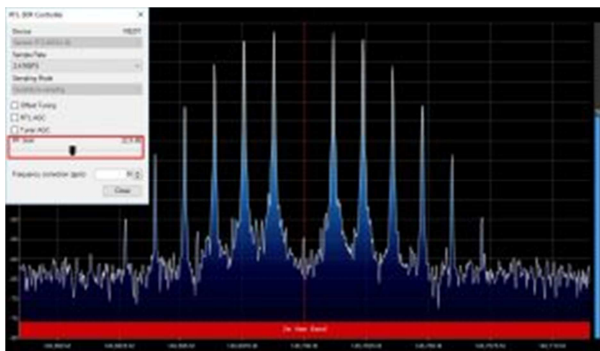
Now, as with the 84% method, turn it back on the TX Pot until the median rash is as far down as possible.

Now we switch off the transmitter with the spacebar and finish the program with "q" (or "Q")

The TX level which we have now set with the pistar mmdvm, we deduct here again 5%.

In my case, that was **52.5% - 2.625** then what about **50%** are (**only enter whole numbers**)

This value must now be entered in the **MMDVMHost** , for this we need to switch to **expert mode** in Pi-Star
http: // pi-star / admin / expert /

and there to the point MMDVMHOST (you can click here)
http: //pi-star/admin/expert/edit_mmdvmhost.php

There then at the point **DMRTXLevel enter** the value

	Modem	
Port	/dev/ttyAMA0	
TXInvert	1	
RXInvert	0	
PTTInvert	0	
TXDelay	100	
RXOffset	0	
TXOffset	0	
DMRDelay	0	
RXLevel	90	
TXLevel	50	
CWIdTXLevel	50	
D-StarTXLevel	50	
DMRTXLevel	50	
YSFTXLevel	50	
P25TXLevel	50	
RSSIMappingFile	/usr/local/etc/RSSI.dat	
Trace	0	
Debug	0	

Speichern

and click on **SAVE** which leads to a restart of the MMDVMHOST which takes about 1 minute.

That was the adjustment of the TX branch.

11. Match RX

The Wilm (DL4OCH) has already described this very well in his manual for a MMDVM image, I will refer to his instructions adapted to Pi-Star Image:
http://dl4och.de/MMDVM_Abgleich_V0.02.pdf

First we have to go to the **expert mode MMDVMHOST**
http: //pi-star/admin/expert/edit_mmdvmhost.php

activate the following settings (only adjust the marked ones):

log
Display Level = 2

modem
RxLevel = 80
Debug = 1

Now we click on **SAVE** (no matter which save button) and if the **MMDVMHOST** does not **restart** (watch display) then under **Configuration -> Power** a **reboot** manually.
http: //pi-star/admin/power.php

Next, we open the **log view** under **Admin -> Log** :
http: //pi-star/admin/live_modem_log.php

Now we **send** with our **radio** either on the **TG9** (only if no reflector is connected) or on the 262997 (Echo function with BrandMeister) and can hear us so also immediately. Of course we can send on any TG, but we should not disturb other OMs, which would be the case if we use routed TGs.

Something like that should then look like the entries appear there.
Now, it's about **adjusting the right threshold** by using the **RX potentiometers** (labeled on the board) on the **PI-Hat** .

Target according to various instructions should be to reach a **value** of **750** . Me and another OM, however, have found that here a **mean** of about **700-720 works** better so I tried to set the **mean** to **700** , this is not so easy because the values vary quite a bit.

If you do not get to the average with the help of the RX potentiometer then you have to adjust the value of the RXLevel in the MMDVMHOST, so I also had to increase from 80 to 90.

That's been it, just change the values in the MMDVMHOST back:
http: //pi-star/admin/expert/edit_mmdvmhost.php

log
Display Level = 0

modem
Debug = 0

Of course RXLevel does not change back.

SAVE and under **Admin -> Run power** a **reboot** should not restart the **MMDVMHOST** by itself.

I hope I could help you something □

For the RX adjustment, there should also be a method about the LEDs on the board, as soon as I have kept me busy I will submit this here.