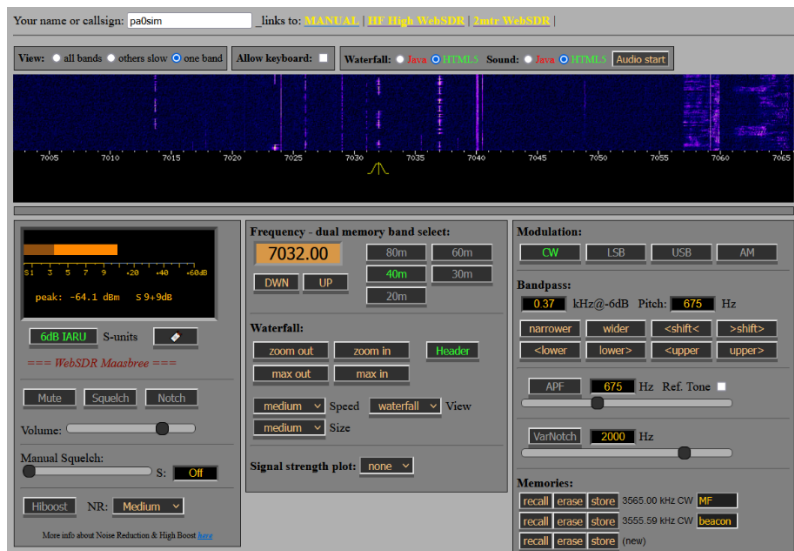# WebSDR Maasbree

Low: 80m-20m
High: 17m-10m
2m: 144-146MHz

User Manual version 2.16

PA0SIM/PE0MJX

This manual is written specific for the Maasbree WebSDR GUI. The GUI is a modified version of the standard GUI.

WebSDR is a very strong concept developed and implemented by:
PA3FWM Pieter-Tjerk de Boer
More information: http://www.websdr.org

Information specific for the Maasbree WebSDR is available at:
http://www.websdrmaasbree.nl/

Index

1 WebSDR page layout

1.1 The WebSDR

Starting at the top:
- Input for your call or name (sets a cookie e.g. for saving memories)
- Link to this **Manual**, links to the **Low** (80m-20m), **High** (17m-10m) and **2mtr** WebSDR
- Selections waterfalls, allowing keyboard input, Java or HTML5
- Waterfall (blue area)
- Frequency scale (black area)

Then from left to right three blocks:
- S-meter
  Selection 6dB or 3dB S-units, update URL with settings
  Mute, Squelch, Notch
  Volume control
  Manual Squelch
  Hiboost, Noise Reduction
- Frequency input
  Fine tuning
  Band select dual memory
  Waterfall control
  Header button
  Signal strength plot setting
- Modulation selection
  Bandpass settings
  APF and manual Notch filter
  Memories

Note: Browser zoom in and out: hold CTRL and press the + or - key to zoom in or out.
Or change screen resolution!

1.1.1   Text colors on buttons

The text on buttons can have three colors: grey, **yellow** and **green**.
Grey: button action not active
Yellow: button can be clicked for action, color doesn't change
Green: the button action is selected or toggled

1.2   Info of WebSDR users
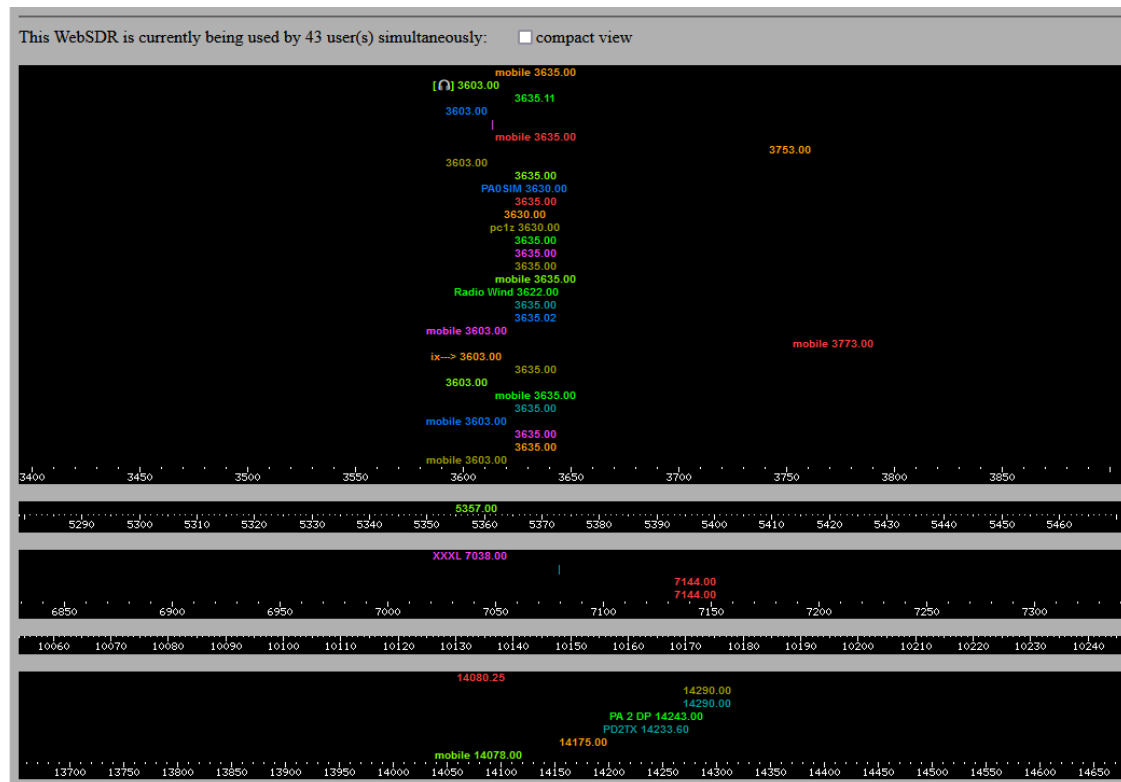
On top the total number of users present on the WebSDR is displayed.
Each band has its own black field in which the users are shown at their frequency by call or name and tuned frequency. If no name or call is entered, only the tuned frequency is shown (instead of IP address). Length of name or call is limited to 8 characters.
Selecting *compact view* reduces the info to vertical lines reducing the size of this part of the WebSDR page.

1.3   WebSDR information

This part of the page shows some relevant links to WebSDR related information.
The **Sysop messages** are used for updating users and informing about important changes.

2   Waterfall
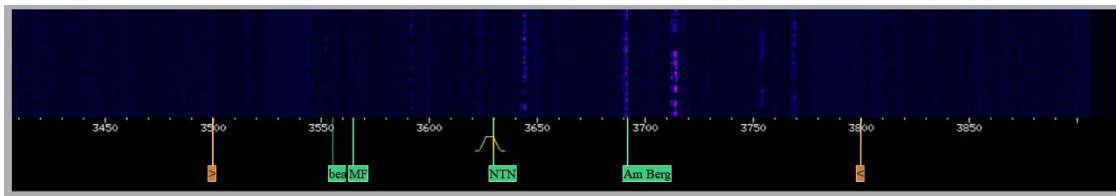
The *blue* **waterfall** shows the spectrum of the band over time by scrolling upward. Noise level is dark blue. How dark depends on the present noise level on that band.
The stronger the signal the lighter the vertical lines it writes in the waterfall.
On e.g. 80m band, if fully zoomed in, the total width is 16kHz. The waterfall width is 1024 pixels, so each vertical line in the waterfall is 16kHz/1024=16Hz. If fully zoomed out the width is 512kHz and each vertical line is 500Hz. The smaller the bandwidth for each vertical line the less noise is captured and the better a weak signal will be visible in the waterfall.

The *black* part of the waterfall is the **frequency scale**. It shows the frequency and the labels.
The tuned frequency is indicated by the vertical yellow line and by the yellow bandwidth symbol.
Green labels are the memories and the orange labels the preset band limits.
The mouse can be used to tune the frequency, the bandpass filter and to select labels by clicking.

3   Frequency tuning

The WebSDR supports multiple methods for tuning the frequency and selecting band.

3.1   Using the mouse on the frequency scale
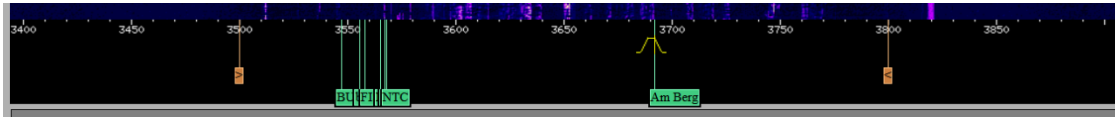
Frequency can be changed by:
- Clicking with the Left Mouse Button (LMB)

The frequency is set by clicking with the Left Mouse Button (LMB) at the location of the frequency. The frequency is selected when the LMB is released.
- Dragging the cursor

By holding the LMB and moving the mouse the frequency is changed by dragging.
- Rotating the scroll wheel

By rotating the mouse wheel up or down the frequency shifts up or down. **The frequency step is 50Hz for AM(FM), 31.25Hz for SSB and 10Hz for CW.**

3.2   Direct input in frequency field
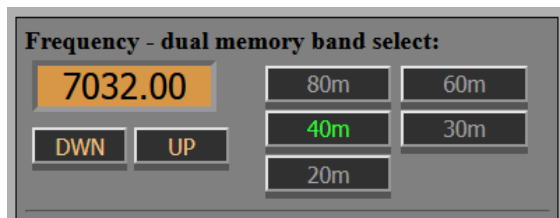
The numerical keyboard can be used to input the frequency directly.
The **DWN** and **UP** buttons are for fine tuning. A single 10Hz step up or down is made by a short click on a button. When keeping the button pressed the frequency changes with increasing step size.

3.3   Band selection buttons
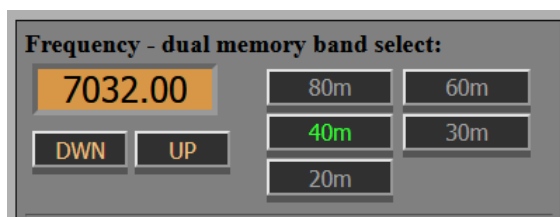
Each band selection button has two memories containing frequency and mode. De default settings are a SSB and a CW frequency. Clicking on the button toggles between both memories. The frequency, mode and zoom factor are the frequency, mode and zoom factor used on that band/memory when leaving.
The "update URL" button (chapter 16) stores the band button memory settings in the URL.

3.4   **Memories**
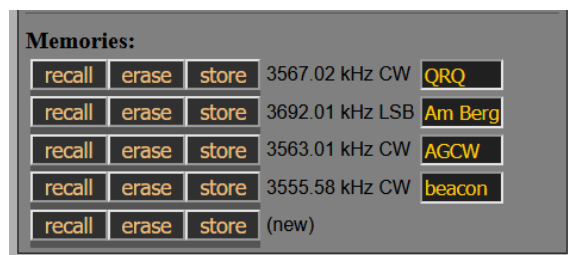
Frequency, mode and bandpass settings can be stored in memories.
Memories can also be used e.g. to store different bandpass settings for a single mode.

3.5   **Labels in waterfall**
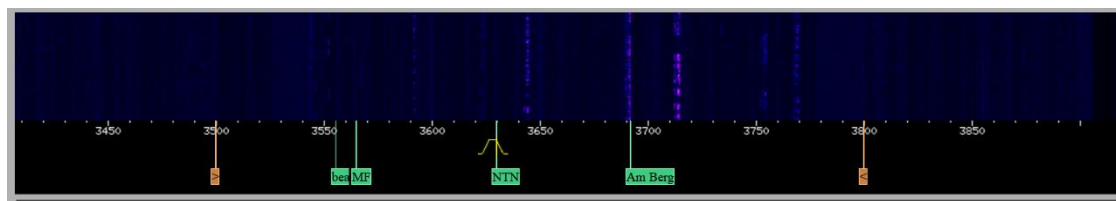
Each memory has a corresponding label with the same name in the waterfall having a **green**
color. Clicking on that label recalls the memory. *However when clicking on a label the current
setting of the bandpass is maintained*.

3.6   **Using the keyboard**

The use of keyboard shortcuts can be allowed by selecting by ticking "**Allow keyboard**" just
above the waterfall. It is a fast and convenient way of controlling the WebSDR.
The following shortcuts are available:

j k ← →	frequency down/up
	step size is 10Hz steps
	combined with **Shift** step size is 500Hz
	combines with **CTRL** or **ALT** step size is 2.5kHz
b B	band up/down
u l c a f	USB/LSB/CW/AM/FM
z Z	center/zoom waterfall
g	enter frequency
m s n	toggle mute/squelch/notch
r	toggles between normal and inverse manual squelch
	(inverse squelch: audio volume of weak signals is enhanced)

4   **WebSDR tuning step 31.25Hz => 1Hz**

The basic WebSDR frequency tuning step is 31.25Hz. The frequency can be set much more
accurate, but the WebSDR does not follow smaller steps. The 31.25Hz step is fixed by the Fast
Fourier Transform (FFT) processing in the WebSDR. This step also applies to the bandpass
filter settings (chapter 8). *Updated to 1Hz tuning step, see chapter 23.*

5   Waterfall settings and header button

Zoom out for a larger part of the spectrum.
Zoom in for a smaller part of the spectrum.
Max out shows the full bandwidth of the amateur band.
Max in is the maximum zoom possible on that band.

Rolling **speed**: very slow, slow, medium and fast.
Size: small, medium, large, larger and off.
View: spectrum, waterfall, weak signal waterfall and strong signal waterfall.

5.1   Zooming and dragging the waterfall with the mouse

The waterfall can be zoomed in and out by rotating the mouse wheel while keeping the cursor over the waterfall. By holding the LMB and moving the mouse the waterfall can be dragged. The waterfall fully zooms in when clicking twice with the mouse on the same frequency on the bottom in the black frequency scale.

5.2   Header button

The **Header** button toggles the header part of the page (*with sysop messages!*) minimizing the need for scrolling.

6   Selecting Mode
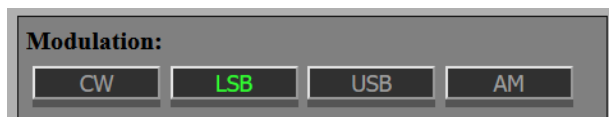
The button with the **green** text indicates the selected mode.

7   Bandpass display
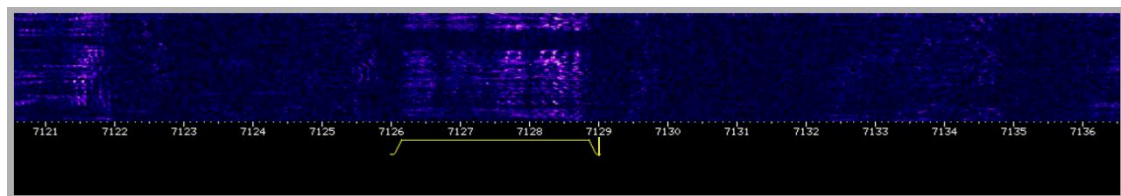
As a visible check the bandpass filter is displayed in **yellow** on the frequency scale just below the waterfall. It shows the passband and carrier frequency (the vertical line). For CW, instead of the carrier/BFO frequency, the receiving frequency is displayed in the middle of the passband assisting "zero beat" tuning. The WebSDR supports dragging the filter slopes using the mouse, *but the Bandpass buttons are much preferred.*

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8   Bandpass buttons
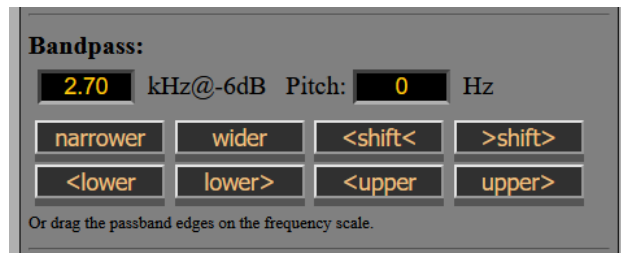
The bandwidth is controlled by the **narrow** and **wider** button. Slope step is 31.25Hz.
The **shift** buttons shift the pass band filter over frequency.
The **lower** buttons shift only the lower frequency slope of the pass band.
The **upper** buttons shift only the upper frequency slope of the pass band.

The resulting -6dB bandwidth (kHz) and CW pitch (Hz) is displayed.

The step size is made mode dependent to minimize the number of clicks needed.
Changed Bandpass settings are stored for each mode and for the duration of the session.
Switching between modes doesn't reset Bandpass settings.

9   Audio settings

9.1   Mute

Mutes the audio. Space bar and Enter key toggle muting.

9.2   Squelch

Mutes the audio when no signal is present. Space bar and Enter key toggle the squelch.

9.3   Notch

Automatically filters out interfering carriers. Space bar and Enter key toggle the notch action.

9.4   Volume

Controls the audio volume. After the control dot is clicked the level can be changed using the arrow keys. With the cursor over de control the mouse wheel can be used also to change the level (Firefox only).

9.5   Manual Squelch

Slider sets the threshold in S-units for manual squelch. Audio is attenuated (not muted) for noise and signal levels lower than the threshold. Squelching is slower for CW.
Mainly intended for CW and crowded bands.

10   Signal strength S-meter
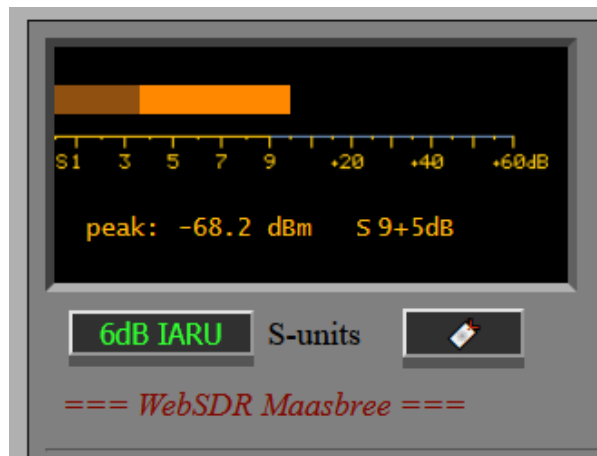
The S-meter displays the peak signal strength by a moving **yellow** bar and the current signal strength by a **darker yellow** bar.
The peak signal strength in dBm and in S-units are displayed at the bottom of the S-meter.
Displaying in S-units supports reading the S-meter for signal reports.

Default IARU setting is 6dB per S-unit. All Japanese transceivers use 3dB per S-unit.
Selecting the 3dB S-units, by clicking on the 6dB IARU button, helps comparing the WebSDR with other locations and transceivers.
It also shows why 6dB is a more logical choice at quiet locations. A consequence of the 3dB/S-unit, as on the Japanese transceivers, the S-meter reading drops below S0 on quiet bands.
For signal levels S9 and higher the S-meter indications are equal for both settings.
The WebSDR S-meter is not a RMS meter. Subtract about 5dB for RMS noise levels.

The S-meter indication is set on all bands as if the antenna has an antenna factor **AF=-9dB**.
The antenna is not (yet) calibrated. Instead computer simulation/calculation is used.

11   Signal strength plot
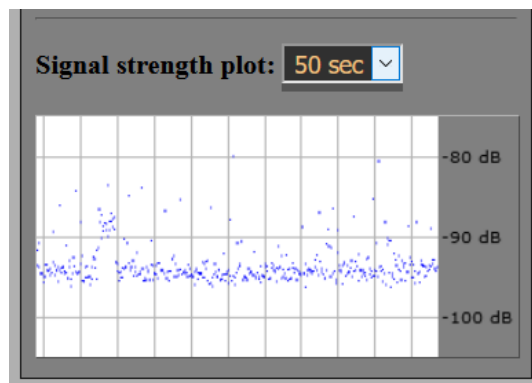
Plots the signal level (dBm) over time.
Total plot time can be None, 50 seconds, 5 minutes, 15 minutes or 1 hour.

12   CW settings
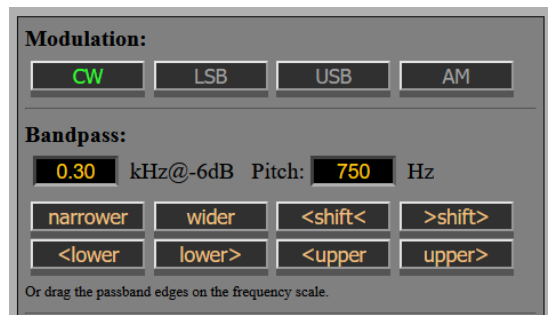
The WebSDR uses *lower sideband* CW. In CW mode the receiving frequency is the center frequency of the passband. The frequency is indicated by a vertical yellow line on the frequency scale in the middle of the passband assisting "zero beat" tuning.
By shifting the pitch using the he **shift** buttons to -750Hz, *higher sideband CW* can be set.

12.1   Pitch setting for CW

CW pitch can be set by the **shift** buttons in 10Hz steps. When using the **lower** and **upper** buttons the pitch steps in 10/2=5Hz. See also chapter Bandpass display for visual feedback and chapter Tuning step. 750Hz is the default CW pitch.
The memories store all CW settings. Recalling a memory sets also the pitch. Clicking on CW labels behaves differently. The current setting of the pitch(/shift) is maintained.

12.2   Using the squelch for CW

The **Squelch** can be used for CW, but needs a >800Hz bandwidth to work properly.

13   Using Space bar and Enter key

Hitting the **space bar** clicks or toggles the last clicked button.
The Mute, Squelch, Notch, Label and 6dB/3dB S unit button can be toggle using the space bar. But also e.g. the Zoom in, Narrow and Shift button can be click with the space bar.
The **enter key** also clicks, but holding it repeats the clicking.

14   Java or HTML5

Nowadays most browsers use the preferred HTML5 and a selection for Java will not be necessary.

15   Audio start button for browsers
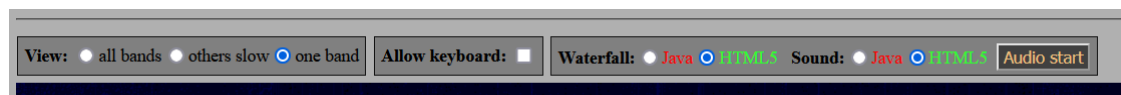
Firefox, like Chrome, now also needs enabling audio.
All browser will show the **Audio start** button. Clicking this button starts audio.
You can changing the Autoplay Firefox settings for the WebSDR: Autoplay Firefox setting , or by: Other Autoplay Firefox settings

16   User preferred settings with bookmarks

Bookmarks make it possible for the user of the Maasbree WebSDR to start with his own preferred settings.

The WebSDR starts with default settings. Most users however will change settings according their preference. Each time a user starts the WebSDR, the same changes have to be done again and again. That is not very convenient.
Frequency and mode already can be added to the default URL and saved as a bookmark.
For the Maasbree WebSDR this is extended to support much more settings.

As long as it is about a few settings, a user could add them manually. But there are many settings users would like to change to their personal preferences. That will be difficult and it is easy to make errors. Apart from the fact it will take too much time to do it manually.
To support starting the WebSDR with preferred settings the **UPDATE URL button** is added to the WebSDR GUI below the S-meter:
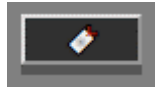
This button updates the URL in the address bar of the browser with the current settings of the WebSDR. The updated URL can be saved as a bookmark with an appropriate name. _Multiple different preferred settings can be saved in an easy and fast way._ When selecting one of the saved bookmarks, the WebSDR will use the corresponding settings. The bookmark can also be dragged to the desktop to be available as shortcut.

The extra settings for the Maasbree WebSDR are after the mandatory + in the URL. (the defaults are between brackets)

frequency in kHz		(3630)
mode		(lsb)
+		
w	waterfall view	0-3 (1)
n	noise reduction	0-5 (0)
h	header	0/1 (1)
s	squelch	0/1 (0)
z	zoom	0-5/6 (0)
a	APF frequency	300-1000 (750)
m	manual squelch	0-9 (0)
v	volume	-20 -> 6 (0)
fl/fh	bandpass settings (bandwidth and shift/pitch)	
FLA	bandpass low freq for all modes	mode 1-5, frequency*1000
FHA	bandpass hi freq for all modes	mode 1-5, frequency*1000
MS	selected active memory for each band	1 or 2
BM	settings band memories	A/B 1-2, band, mode 1-5 and frequency

Note: frequency and mode in the URL are kept compatible to the standard websdr.
All settings are in pairs of one or two characters and a number.
Pairs can have any order, however BM has to be at the end.

Example:

CW:
http://sdr.websdrmaasbree.nl:8901/?tune=7033.00CW+w2n2h0s0z6a650m2.8v-4fl-826fh-574

waterfall view	weak sigs
noise reduction	medium
header	no header
squelch	no squelch
zoom	max in
APF freq.	650Hz
manual squelch	2.8 S-unit
volume	-4
pitch	700Hz
bandwidth	340Hz

……. for all modes the bandpass settings and the contents of the band button memories is stored in de URL.

17   Receiver bandwidth

On the 80m, 40m, 20m, 15m, 12m and 10m bands we use the SDRplay **RSP1a** SDR receiver. For best large signal behavior and minimizing ADC overloading, bandpass filters are applied in the IF. On 80m the bandwidth is 300kHz, on 40m/12m 200kHz and on 20m/15m/10m 600kHz. On 20m/15m/10m the effective bandwidth is limited by noise shaping to 460kHz.

The **FiFi** SDR and **sound card** are used on 60m and 30m. On 17m only a **FiFi** is used. The effective bandwidth is about 130kHz. That is the result of the frequency behavior of both the FiFi and sound card. In addition the noise level in the sound card increases for frequencies at the band edges (noise shaping).

18   Noise shaping

The WebSDR supports an **8-bit** interface for RTL dongles and RSP1a receivers. It not yet supports 16-bits. This limits the dynamic range for quantization noise and ADC overloading by strong signals.

The Maasbree WebSDR applies noise shaping on 80m/40m/20m/15m/12m/10m to increase this dynamic range by lowering the quantization noise. On 80m by 11dB. On 40m, 20m, 15m, 12m and 10m by 18dB**.

This allows signals to be correspondingly stronger before ADC overload occurs. Noise shaping shows up as an increased noise level _outside_ the amateur band at the band edges in the waterfall. This noise is _masked_ (attenuated) in the WebSDR. Because of this masking the waterfall brightness is equalized over all bands (no change in S-meter reading).

** translated in effective bits:
- 11dB adds 1.83 bit ==> **9.83 bit** on 80m (@512kHz)
- 18dB adds 3 bit   ==> **11 bit** on 40m/12m (@512kHz) and 20m/15m/10m (@1024kHz)

Note: the ENOB of the RSP1a is higher than 10.4 for these sample rates, rather 12 bits.

In a 2800Hz bandwidth the dynamic range (for quantization noise and ADC overloading):

	80m	40m/12m	20m/15m/10m	
8 bit	49.9	49.9	49.9	dB
processing gain	22.6	22.6	25.6	dB
noise shaping	11	18	18	dB
	83.5	90.5	93.5	dB

The sensitivity is set to receive a few dB band noise over the quantization noise.

Note: the websdr S-meter is not an accurate RMS meter.

19   Noise blanking

The WebSDR in Maasbree receives multiple electric fence pulses which are very annoying. Noise blanking is being applied on the **80m** and **40m** band. The noise blanker is programmed in GNUradio companion and operates between the RSP1a driver and the WebSDR software. For more info: [WebSDR Maasbree Noise Blanking](#)

20   Attenuator 6dB (80m, 40m, 20m, 15m, 12m, 10m)

When a RSP1a receiver signals ADC overloading a **6dB** attenuator is *temporarily* enabled (at least 15 seconds). AGC overloading is signaled well before overloading will occur!
Very strong signals like Over The Horizon Radar (OTHR) and occasionally contest stations are able to signal overload. Also local thunderstorms can overload the RSP1a receivers and trigger the 6dB attenuator.
Overloading happens mostly when band conditions are very good and noise levels have increased also. So the 6dB attenuator does not always affect the sensitivity of the WebSDR that much.
Note: no AGC is used in the IF of the RSP1a receivers*.*

21   WebSDR time out

A time out of 4 hours is used to stop non-active users from using the WebSDR.

22   WSPR (PH4RTM)

The WebSDR runs WSPR on 80m, 40m, 20m, 15m, 12m, 10m using the call **PH4RTM**. Thanks PA3FWM.
Note: If no user is on that band, the WebSDR stops listening and stops reporting WSPR for that band.

Local thunderstorms can affect the reported SNR not only by triggering the 6dB attenuator.

Note: when an overload triggers the 6dB attenuator, the reported SNR can be up to 6dB lower depending on the actual band noise level. The settings of the RSP1a receivers are logged and can be tracked:
http://hf.websdrmaasbree.nl/80m.txt
http://hf.websdrmaasbree.nl/40m.txt
http://hf.websdrmaasbree.nl/20m.txt
http://sdr.websdrmaasbree.nl:8902/15m.txt
http://sdr.websdrmaasbree.nl:8902/12m.txt
http://sdr.websdrmaasbree.nl:8902/10mL.txt
HIGH: is de default high sensitivity setting.
NORMAL: is the 6dB attenuator setting after an overload.

Note: for accurate SNR reports by WSPR the AGC on your receiver has to be switched off:
http://www.pa0sim.nl/WSPR_AGC_impact.pdf

For more info about comparing SNR using WSPR:
http://www.pa0sim.nl/Published%20Articles.htm
Or do it yourself:
https://wspr.live/gui/d/HM1HZwp4k/snr-comparison?orgId=1&var-station1=PD0OHW&var-station2=PH4RTM&var-mode=rx&var-target=%25&var-band=3&var-not_mode=tx&from=now-2d&to=now
Note: the small "i" in the left upper corner of a plot shows what is being calculated.

23   Noise Reduction, APF and Manual Notch (Utah)

➔ *These are WebSDR functions implemented for the Utah WebSDR by Clint KA7OEI.*
They were kind enough to share the code with us. Thanks Clint!
See for more info: http://www.sdrutah.org/info/dspnr.html

Adopted for the Maasbree WebSDR are:
- a low pass filter to reduce aliasing
- DC removal minimizing popping (15Hz high-pass filter)
- CW peaking filter (APF) bandwidth 66Hz
- Reference tone generator for CW peaking filter (toggle mute for best checking)
- manual Variable Notch filter
- LMS noise reduction (NR)
- 6dB "high" boost (Hiboost)
- 1Hz frequency tuning step

Note: The Digital Signal Processing is performed on the audio after AGC and passband filter. That is fine for noise reduction. On a quiet band it is also fine for the APF. However signals outside the APF passband will modulate the AGC and so the signals strength within the passband. This can be minimized by reducing or shifting the passband bandwidth.
With or without the variable notch, a strong notched carrier or CW signal will already have modulated the AGC. Advantage of the variable notch is that it will minimize a CW signal better than the automatic notch.
Turning on the APF and NR increases the latency with about 5msec respectively 10msec.
Note: this processing runs on your own computer and will increase your processor load!

### 23.1   CW

Noise reduction and APF are very effective for CW. Noise reduction can be used very well for searching the band for weak CW signals or in a CW net, because it doesn't need accurate tuning like the APF. Noise reduction and APF perform better with a passband bandwidth setting larger than the default 300Hz, for instance 500Hz. With a smaller passband bandwidth ringing increases. The noise reduction LMS filter needs more bandwidth to better find the filter coefficients. CW peaking filter (APF) has a constant bandwidth set to 66Hz, supporting higher CW speed. It needs accurate tuning of RX or APF frequency.
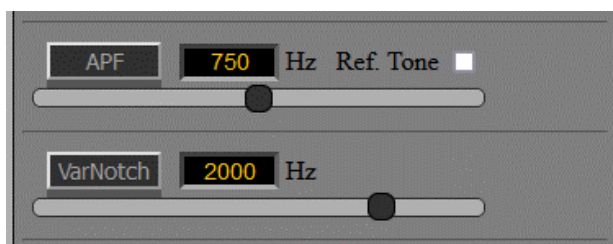**Note: *sliders, when selected, can be tuned by the arrow keys!***

23.2   Speech

Hiboost enhances the higher frequencies >1500Hz. It can sometimes improve speech intelligibility especially in combination with noise reduction.
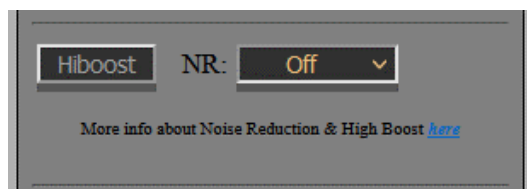
Hiboost and Noise Reduction settings

Audio Peak Filter (APF), Reference Tone and Variable Notch settings

24   2mtr WebSDR Maasbree

The 2mtr GUI is a bit different and adapted for VHF.
Note: S-meter S9 is -93dBm.

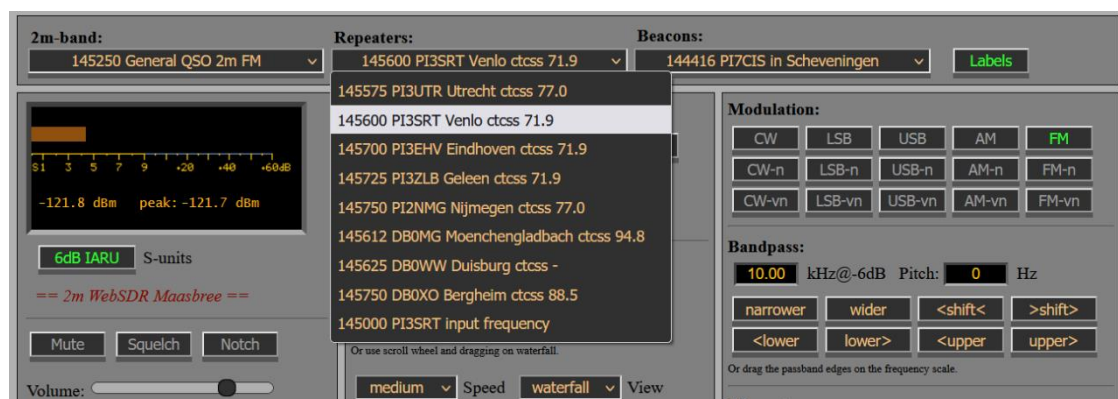### 24.1   Low and high band

The 2m band is split in a low band (144MHz-145MHz) and a high band (145-146MHz).
The low band uses a horizontal polarized omnidirectional big wheel antenna. The high band a
vertical Diamond300. No low noise amplifiers at the antennas, only coax cable to the RSP1a's.

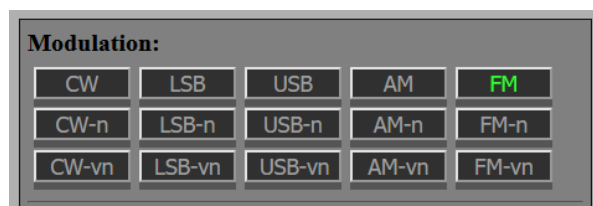### 24.2   Preselect frequency selection

On the 2mtr WebSDR the preselect buttons are implemented by 3 menu selections: **2m band**,
Repeaters and **Beacons**.
Clicking on the displayed frequency, say *145250 General QSO 2m FM,* will set the WebSDR
frequency.
By holding de Left Mouse Button instead of clicking, other frequencies in a menu can be
selected.

24.3   Modulation buttons

For each mode a *narrow* and *very narrow* bandpass filter setting button is added.
FM is of course also present.

25   Using Audacity for recording

Audacity can be used to record the audio from the WebSDR directly when selecting
"Windows WASAP":
https://forum.audacityteam.org/t/how-to-record-streaming-from-a-website-solved/43829/3
After recording you can select, cut, etc. etc. and save in your format of choice.

26   Links

HF low WebSDR
http://hf.websdrmaasbree.nl/
http://sdr.websdrmaasbree.nl:8901

HF high WebSDR
http://hf-h.websdrmaasbree.nl/
http://sdr.websdrmaasbree.nl:8902

2mtr WebSDR
http://2m.websdrmaasbree.nl/
http://sdr.websdrmaasbree.nl:8905

Technical info pages WebSDR
http://www.websdrmaasbree.nl/

Files for the article "QSK CW met een WebSDR" Electron July 2020, pp 327-328 (Dutch)

For accurate SNR reports by WSPR the AGC on your receiver has to be switched off
http://www.pa0sim.nl/WSPR_AGC_impact.pdf

For more info about comparing SNR using WSPR:
http://www.pa0sim.nl/Published%20Articles.htm
Or do it yourself:
https://wspr.live/gui/d/mTzRNYQGk/receiver-snr-comparison?orgId=1
Update link for WSPR SNR compare:
==> WSPR SNR compare <==

See for more info on the Utah signal processing: http://www.sdrutah.org/info/dspnr.html