

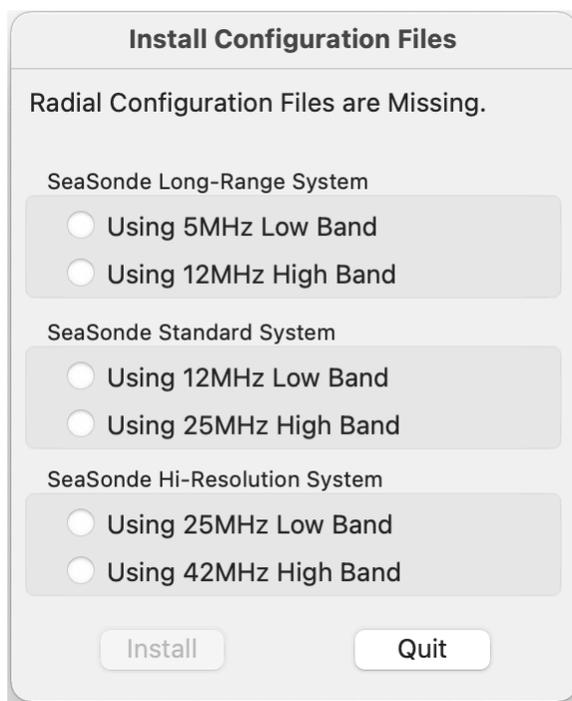
Radial Site Setup

157.01.2112.UG

Dec 31, 2021



You've installed the hardware and you've either just installed the software, Radial Suite Release 21, and pressed the Software Installer's **Quit** button or you've just turned on a new system, only to see that **SeaSondeRadialSetup** has launched. The very first step is to select the SeaSonde that matches your receiver. This matters because we've set a number of default settings that work best depending on whether you're using the 5, 12, 16, 25 or 42 MHz band. If your system is designed for 16.1 MHz, select the 12 MHz and be sure to use the correct Low or High Band position that your system uses.



Install Configuration Files

Radial Configuration Files are Missing.

SeaSonde Long-Range System

- Using 5MHz Low Band
- Using 12MHz High Band

SeaSonde Standard System

- Using 12MHz Low Band
- Using 25MHz High Band

SeaSonde Hi-Resolution System

- Using 25MHz Low Band
- Using 42MHz High Band

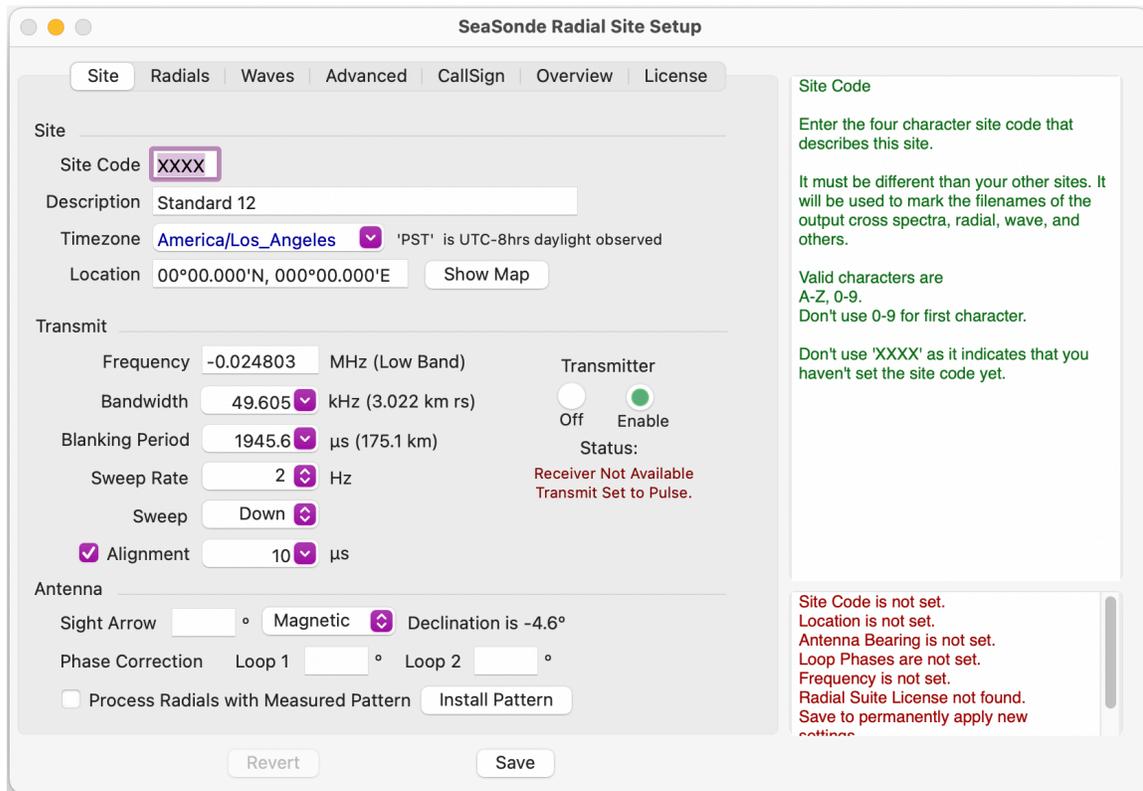
Install Quit

If you don't see this window and instead see the window below that's titled "SeaSonde Radial Site Setup", it's because the configuration files are already installed; otherwise, select the radio button here that best matches your receiver and click the **Install** button. This will install all the default configuration files for a Radial Site. In the future, if any configuration file is lost or corrupted, when the system starts it will automatically run SeaSondeRadialSiteSetup and prompt to install the missing file(s).

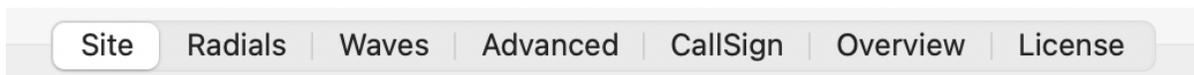
If you're upgrading from a previous Release. First make sure your previous configuration files are installed before running SeaSondeRadialSetup (quit it first if you have to). Run SeaSondeRadialSetup and you will see this Install Configuration Files window prompting you, so it can make several file changes which are not compatible with previous releases.

Also, with previous configuration files and running SeaSondeRadialSetup for the first time, it will prompt you, if your Music parameters, doppler interpolation, and glitch removal do not match the recommended defaults. In this case, you can pick whether to use the recommended setting or your existing setting.

After **SeaSondeRadialSetup** makes sure that all the configs are installed, it opens the following window. Example below is after a new **SeasSonde Standard System with Using 12 MHz Low Band** installed.



The task of setting up the software is divided into sections as indicated by the task bar across the top. Clicking on any of these titles will jump to that section, but for the typical site setup, you will only need the Site and the CallSign sections.



The highlighted **Site** tab is currently shown and is divided up into three sections: Site, Transmit, and Antenna. We'll get to these in a moment, but first, note that the panel with green text on the top right is a help panel which dynamically updates to show useful information about each entry when the cursor is hovered above it or you are typing in an edit field. If you put the mouse over the Site Code field, you will see the following.

Site Code

Enter the four character site code that describes this site.

It must be different than your other sites. It will be used to mark the filenames of the output cross spectra, radial, wave, and others.

Valid characters are
A-Z, 0-9.

Don't use 0-9 for first character.

Don't use 'XXXX' as it indicates that you haven't set the site code yet.

The panel on the bottom right is an indication of what needs to be set in the system before it will run. You'll notice for this new example site, that we need to enter a site code, a location, an antenna bearing, frequency, and a Release 21 or higher license. I did not mention Loop Phases, because the system will still run. On a new system, you do not know what the Loop Phases are initially, because you'll need to run it for a little while to calculate them from the diagnostics or do an antenna pattern; where upon, you'll need to come back to SeaSondeRadialSetup and enter them.

Site Code is not set.
Location is not set.
Antenna Bearing is not set.
Loop Phases are not set.
Frequency is not set.
Radial Suite License not found.
Save to permanently apply new settings

You'll need a Release 21 license file to run all the SeaSonde software.

Site - Site Section

Site Radials Waves Advanced CallSign Overview License

Site

Site Code

Description

Timezone 'PST' is UTC-8hrs daylight observed

Location

Site Code

The first step is to select and enter a four character site code. All data files for the site will use this site code in the filename and in the metadata. Each site should use a different site code or you will run into a lot of confusion. You might want to consult with CODAR Support to check for it being a unique site code among the world.

The first character must be an alphabet character or SeaSondeRadialSetup will beep. This is followed by three alphanumeric characters. SeaSondeRadialSetup won't let you type more than four. If you type less than four character the others will be set to 'X'. You cannot use "XXXX" as that's used by the system to decide that the site code is not set.

WARNING: Changing the site code later can have some unintended consequences such as data and log files that are no longer visible to the file management (Archivalist) and external browsing (RadialWebServer).

Description

Enter a description for the site that's a little more descriptive than the four character site code. This description will also be included in the Radial and Wave output files.

Timezone

On new sites, the timezone will show whatever the Computer's system timezone is set to. Most SeaSonde users use "UTC". Using a timezone that observes daylight savings is slightly problematic and highly not recommended. While the software will record the UTC offset, the file time stamps and timed data within a file will have an hour jump once a year and an hour overlap once a year when the daylight saving changes. This entry accepts many differently named timezones by entering the abbreviation or major city or by entering UTC/GMT or UTC+x. Be sure the UTC offset looks correct as many abbreviations overlap and it will use only the first one in the system's list. Note, when you click the Save button, SeaSondeRadialSetup will update the Computer's system timezone. It's important that the Computer and Radial Configuration timezones match.

Location

Enter in the latitude and longitude location of your receive antenna. Accuracy should be better than a 100m to not add bias to the radials and measured pattern; any GPS reading near the antenna is good enough. This entry will support entering many different forms of lat, lon locations formats. Once you press enter or leave the field, it will change to dd°mm.mmmE, ddd°mm.mmm'N format. The Show Map button will open the entered location in the default Browser in Google Maps.

Site - Transmit Section

Site Radials Waves Advanced CallSign Overview License

Transmit

Frequency MHz (Low Band)

Bandwidth kHz (3.022 km rs)

Blanking Period μ s (175.1 km)

Sweep Rate Hz

Sweep

Alignment μ s

Transmitter
 Off Enable

Status:
Receiver Not Available
Transmit Set to Pulse.

The transmit section configures the receiver for the the first time. New un-configured Receivers will have either a zero or this odd looking small negative frequency as a default.

Note that changing these settings with a receiver connected will change the receiver as you enter them; however, they won't be permanent power-on settings until "Save" is done

Transmitter

First time: Connect the receiver and set the Transmitter to "Off" (new receiver should already be set to off). Don't turn the Transmitter to "Enable" until you have the assembled transmitter antenna connected to the transmitter and have all the settings entered first.

Center Frequency

Enter your approved frequency that your SeaSonde was designed for to transmit on and hit return.

Whenever you enter a frequency that changes the band such as this initial setup, SeaSondeRadialSetup will do a default on the receiver and configure it depending on the band. If you wish to re-trigger this default configuration, then enter 0 (be sure to hit return) and then enter your frequency again.

When you enter a frequency for the first time or one that changes bands, SeaSondeRadialSetup will configure a number of other settings for best defaults.

Frequency	Bandwidth	Range Resolution	Blanking Rate	Sweep Rate	Radial Doppler Bins
0 to <10 MHz	25.734	2.912 km	1945.6 μ s	1 Hz	1024
10 to <20 MHz	49.63 kHz	3.020 km	972.8 μ s	2 Hz	512
20 to <30 MHz	99.259 kHz	1.510 km	486.4 μ s	4 Hz	1024
\geq 30 MHz	298.697 kHz	502 m	212.8 μ s	4 Hz	1024

Note that when using SHARES, all SeaSondes on the multi-static network must have the exact same Frequency, Bandwidth/Range Resolution, Blanking and Sweep Rate. If different, they will cause increased noise floor and interference.

Bandwidth

Enter the approved bandwidth allowed for the site, if you need a different one that the default. The bandwidth controls the range resolution show in text to the right.

The smaller the range resolution, the more bandwidth required by the system. The Help panel will show how much bandwidth is required for entered range resolution. When you hit return or exit the edit box, the receiver will be updated with this entry. The entry will change to the nearest value the hardware is capable of.

Blanking Period

Enter the desired blanking period, if you need a different one that the default. The blanking period also sets a

maximum range roll off, which is shown in the Help panel. Setting this entry too small might reduce range while setting this entry too large will reduce signal in early ranges.

Timing Alignment

For sites using SHARES, each site must have a timing alignment that aligns its broadcast within the network so that they don't interfere with each other and can see the bistatic echo from the other sites. For one site, the alignment doesn't really matter. For two sites, it's fairly simple to prevent interference. For three or more sites, the alignment can be very complex; see CODAR Support for help. When this setting is checked, the receiver will monitor the alignment every 10 seconds to see if the timing needs to be re-aligned.

Note, don't leave the entry at the default 65537.

Transmitter

The Off button disables the drive to the transmitter while the enable button enables the transmitter drive as long as there's no watch trips.

Site - Antenna Section

Site | Radials | Waves | Advanced | CallSign | Overview | License

Antenna

Sight Arrow ° Magnetic Declination is -4.6°

Phase Correction Loop 1 ° Loop 2 °

Process Radials with Measured Pattern

Sight Arrow.

Using a compass, measure the antenna site arrow and enter it here. Using the previously entered receiver location, the siting is adjusted to store Loop1 bearing True in the configuration files. The help panel will show the Loop1 bearing which is saved into configs and is 45 degrees clockwise plus the magnetic declination from the site arrow.

Phase Correction

These two entries are the phase adjustments needed for an ideal pattern. When first setting up a site, they are unknown and should be left blank. After configuration, the system is then run for at least a few hours; longer is better and DiagDisplay is used to view the .rdt files to get an estimated correction to be entered later here. If a measured pattern is done, then the measured pattern phases should be entered here instead. If you use the Install Pattern button to install a pattern file into the configs, the Phase Corrections will automatically be set.

Process Radials with Measured Pattern

When checked and a measured pattern is installed, radial and waves are processed with the measured pattern. Radial processing will still create ideal radials as well, since these become a good diagnostic to check if the measured pattern no longer fits the actual antenna pattern or something else has happened.

The **Install Pattern** button will ask you to select a pattern file. You will typically be looking in the pattern folder created by **CrossLoopPatterner** containing the filename MeasPattern.txt or PATT_*.patt.

SeaSondeRadialSetup will copy it into RadialConfigs as MeasPattern.txt and ensure it has 1 degree resolution while archiving any previous pattern.

Done with Site Section

After you've entered the site settings it should look something similar to this example site.

The screenshot shows the 'SeaSonde Radial Site Setup' application window. The 'Site' tab is selected, showing the following configuration:

- Site Code:** DUNE
- Description:** Dune Beach HMB
- Timezone:** UTC (dropdown menu)
- Location:** 37°27.956'N, 122°26.764'W (with a 'Show Map' button)
- Transmit Section:**
 - Frequency:** 13.500000 MHz (Low Band)
 - Bandwidth:** 49.630 kHz (3.020 km rc)
 - Blanking Period:** 972.8 μs (87.6 km)
 - Sweep Rate:** 2 Hz
 - Sweep:** Down
 - Alignment:** 10 μs
- Transmitter:** Off (radio button)
- Status:** Receiver Not Available, Transmit Set to Off
- Antenna Section:**
 - Sight Arrow:** 257 ° Magnetic (dropdown menu) Declination is 13.1°
 - Phase Correction:** Loop 1 [] ° Loop 2 [] °
 - Process Radials with Measured Pattern (button)
 - Install Pattern (button)

On the right side, there are two informational panels:

- Site Settings:** Enter basic site description, location, approved transmit waveform, and antenna configuration.
- Warning Panel:** Loop Phases are not set. Transmitter is OFF. Radial Suite License not found. Save to permanently apply new settings.

At the bottom of the window are 'Revert' and 'Save' buttons.

Notice, that there's less red text in lower right.

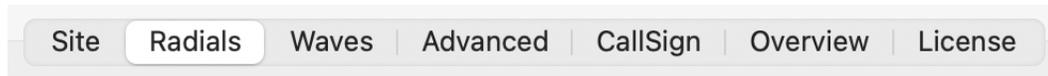
Loops phases can be set later when we figure out what they are.

A Radial Suite license for R21 or later needs to be installed.

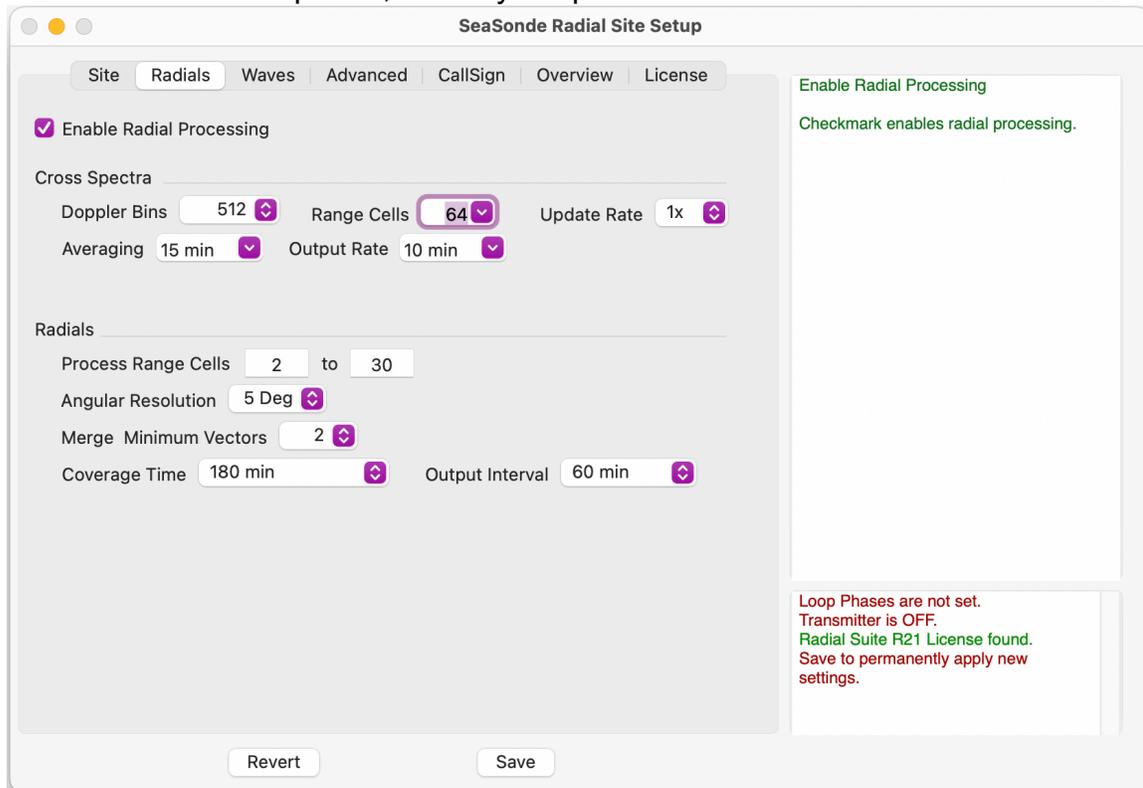
If the transmitter and antenna are fully set up, then click on "Enable" to start transmitting. If the VSWR is too high, SeaSondeRadialSetup will switch back to "Off" within a minute after enabled. You should then review the antenna and cables before trying "Enable" again.

Radials Tab

Select the Radials tab to review radial processing.



Enable Radial Processing is checked by default. Unchecking will disable radial processing but will still create cross spectra, but only keep a limited amount.



Radials - Spectra Section

Site Radials Waves Advanced CallSign Overview License

Cross Spectra

Doppler Bins 512 Range Cells 64 Update Rate 1x

Averaging 15 min Output Rate 10 min

The spectra settings were set to the best default values when you entered the frequency. If you have more range from the system, you might want to increase the number of Range Cells here. The maximum distance is the number of Range Cells times the Range Resolution from the bandwidth used. If in doubt, leave the Range Cells at 40 for now. Note that the last range cell that can be processed is the number of Range Cells minus 1.

Cross Spectra are basic processing of the echo into signal power over range and velocity. The analysis of cross spectra produces radial and wave results.

Doppler Bins

In order to get velocity, we need to collect echo over the number of desired doppler bins for each sweep. The more doppler bins the finer the velocity resolution, but the longer it takes. A standard range systems defaults to using 512 dopplers with 2 Hz sweep rate which takes 256 seconds to collect or 4.267 minutes. Previous Suite releases used an FFT which required the number of doppler bins be a power of 2. With R21, we are using a semi-DFT which can have sizes of 1,3,5 or 15 times a power of 2 as seen on the right.

- 256
- 320
- 384
- 480
- ✓ 512
- 640
- 768
- 960
- 1024
- 1280
- 1536
- 1920
- 2048
- 2560
- 3072
- 3840
- 4096

Range Cells

Is the number of range cells to save for each cross spectra. Reasonable size is typically between 30 and 100. You want make sure you cover more than the range were you expect sea-echo by at least 10 range cells more. Increasing the range cells also increases the size of the cross spectra files significantly.

Update Rate

The default is one and not typically changed. Higher values cause the sweep collected for each cross spectra to overlap. An update rate of 2 will cause each cross spectra to use half the data from the previous cross spectra but you get a faster cross spectra update and twice as much data.

Averaging and Output Rate

Sets the temporal timing of the cross spectra from SeaSondeAcquisition (CSQ) into averaged and ship/interference reduced CSS cross spectra which are processed into short-time radials. Longer times allows for better ship and interference reduction. Note that these settings ignore the granularity of the CSQ.

Radials - Radials Section

Site Radials Waves Advanced CallSign Overview License

Radials

Process Range Cells to

Angular Resolution 

Merge Minimum Vectors 

Coverage Time  Output Interval 

Process Range Cells

Range cells to process within the spectra number of ranges above.
Minimum range cell is 2.

Angular Resolution

The short-time radials from each CSS cross spectra are process using a 1deg antenna pattern. This sets the possible reduction for the merged final radial output.

Merge Minimum Vectors

The merging of the short-time radials must have at least this many vectors for each location over the merger time to make it to the final radial output.

Coverage Time

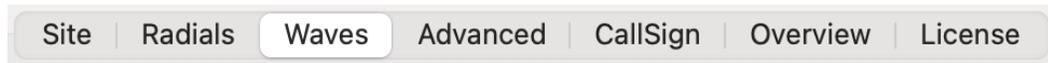
Sets the final radial coverage time in terms of number of short-time radials to merge.

Output Interval

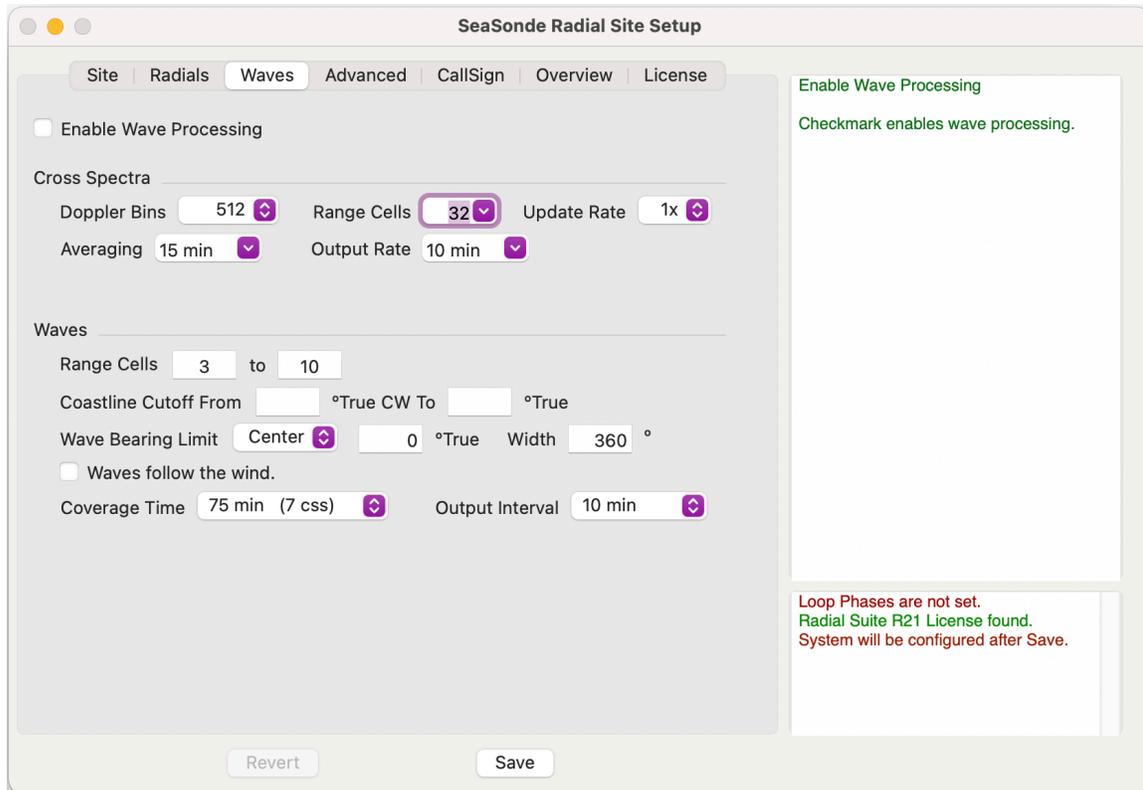
Sets how often a new final radials is formed. Note if smaller than Coverage time then there's some overlap in the data. The Output Interval is a multiple of the spectra Output Rate above.

Waves Tab

Select the Radials tab to review radial processing.



Wave Processing is not enabled by default. Checkmark to enable. For best results, wave processing should have coastline bearings set and a measured pattern.



Waves - Spectra Section

Site | Radials | **Waves** | Advanced | CallSign | Overview | License

Note: Wave Processing is not intended to be used with 42MHz band.

New for R21, Wave processing is separated from Radial processing. This means that wave can different cross spectra and temporal averaging. Some preliminary studies have shown that longer temporal averaging and shorter doppler bins gives better results; Codar will be doing some further studies and will suggest improved settings.

Enable Wave Processing

Cross Spectra

Doppler Bins	512	Range Cells	32	Update Rate	1x
Averaging	15 min	Output Rate	10 min		

Doppler Bins

In order to get velocity, we need to collect echo over the number of desired doppler bins for each sweep. The more doppler bins the finer the velocity resolution, but the longer it takes. A standard range systems defaults to using 512 dopplers with 2 Hz sweep rate which takes 256 seconds to collect or 4.267 minutes. Previous Suite releases used an FFT which required the number of doppler bins be a power of 2. With R21, we are using a semi-DFT which can have sizes of 1,3,5 or 15 times a power of 2 as seen on the right.

Range Cells

Is the number of range cells to save for each cross spectra. Reasonable size is maximum you think you'll every see second order up to end of first order. Increasing the range cells also increases the size of the cross spectra files significantly.

Update Rate

The default is one and not typically changed. Higher values cause the sweep collected for each cross spectra to overlap. An update rate of 2 will cause each cross spectra to use half the data from the previous cross spectra but you get a faster cross spectra update and twice as much data.

Averaging and Output Rate

Sets the temporal timing of the cross spectra from SeaSondeAcquisition (CSQ) into averaged and ship/interference reduced CSS cross spectra which are processed into short-time radials. Longer times allows for better ship and interference reduction. Note that these settings ignore the granularity of the CSQ.

Waves - Waves Section

Site | Radials | **Waves** | Advanced | CallSign | Overview | License

Waves

Range Cells to

Coastline Cutoff From °True CW To °True

Wave Bearing Limit °True Width °

Waves follow the wind.

Coverage Time

Range Cells

Sets the start to stop range cells to process. The start cannot be less than 1 and the stop cannot be greater than number of cross spectra range cells minus 1. Set start range cells farther out if the area around the site is too shallow for the frequency used. Early range cells also have a tendency for wave to saturate; hence the default start of 3. Set the stop to be as far as you can get reasonable second order to process.

Coastline Cutoff

In order to process correctly, the model needs to know where the ocean echo is coming from. Using SeaDisplay or Google Earth, measure bearings from the site's location to the left hand side to where it sees water and go clockwise to measure the stop bearing where you expect the site to not get any ocean echo.

Wave Bearings Limit

If you know where waves are expected to come from, enter them here as either an angular sector using a center bearing and coverage width or as a start to stop bearing like you did in Coastline Cutoff.

Waves follow the wind.

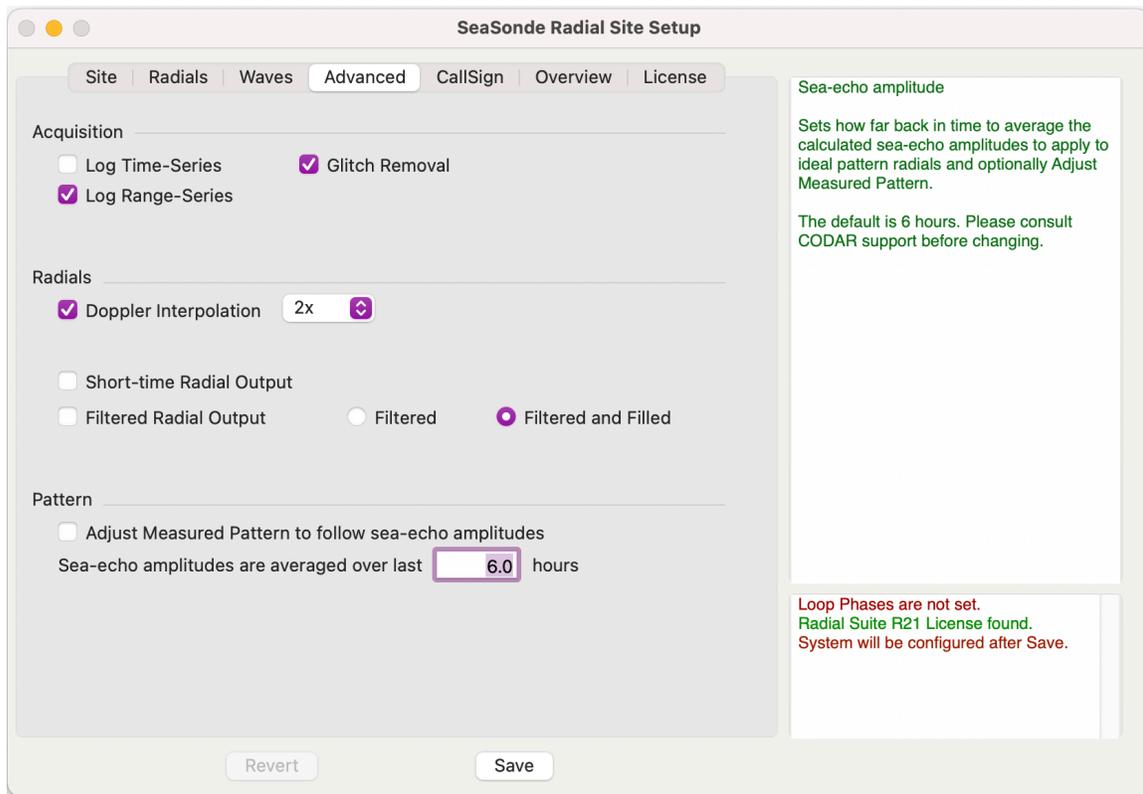
Checkmark if you know that all the wave results are following the wind direction. Currently this is mostly determined automatically, but sites that are highly sheltered from the open ocean can set this.

Coverage Time and Output Interval

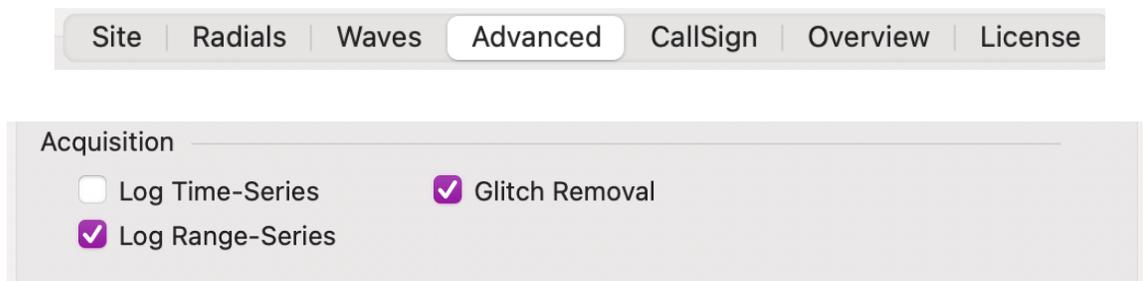
Set the averaging and output interval. Both are in terms of CSS processed.

Advanced Tab

The Advance Tab contains a few extra settings that are not normally changed.



Advanced Tab - Acquisition section



These three settings change SeaSondeAcquisition and will take effect after a Save and SeaSondeAcquisition has finished its current cross spectra doppler collection.

Log Time-Series

Tells SeaSondeAcquisition to record its rawest data of voltage sample each chirp (single sweep) over time. Time Series can be imported in SeaSondeAquisition with new settings if desired. The amount of data stored is much larger than saving Range-Series.

Log Range-Series

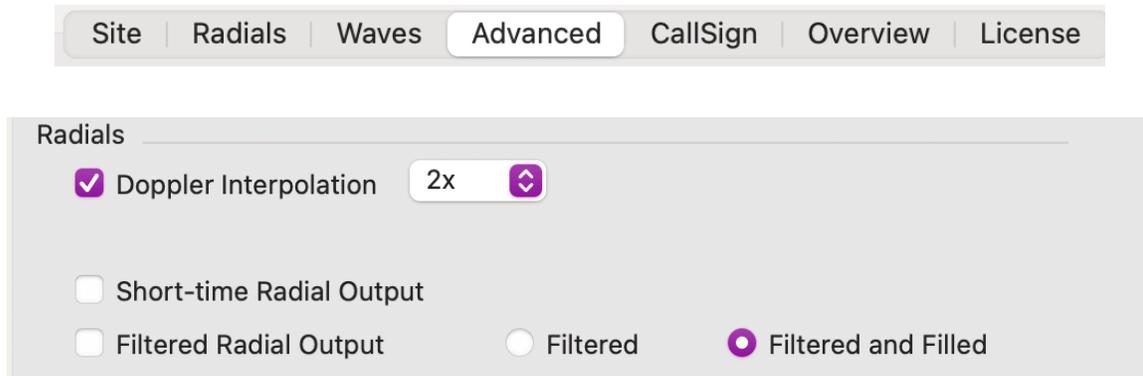
Tells SeaSondeAcquisition to record first- transform of power vs range for each chirp (single sweep) limited to the number of radials set for radial processing. Range series can be imported into SeaSondeAquisition for doppler processing. Note that you cannot increase ranges beyond what was recorded.

Glitch Removal

Applies a filler algorithm for fixing up range series during doppler processing that would cause heavy FFT

frequency smearing due to power drop outs and spikes. Drop outs can be due to Transmitter or Transmit antenna issues. Spikes can be due to lightning and short bursts of interference. When invoked, Glitch Removal writes notices to the Sentinel logs; lots of these messages, specially drop outs, can indicate a problem. The Callsign broadcast requires Glitch Removal as the receiver will be blanked in the middle of doppler collection during callsign broadcast.

Advanced Tab - Radials section



Site | Radials | Waves | **Advanced** | CallSign | Overview | License

Radials

Doppler Interpolation 2x

Short-time Radial Output

Filtered Radial Output Filtered Filtered and Filled

Doppler Interpolation

This applies a linear interpolation to the doppler power before doing radial processing. Signal echo rarely falls directly on a doppler bin, so this interpolation helps to recover a few more radial velocities.

Short-time Radial Output

If for some reason, you want to explore the radial results per cross spectra, check this. The output will be located in the RadialShorts folder.

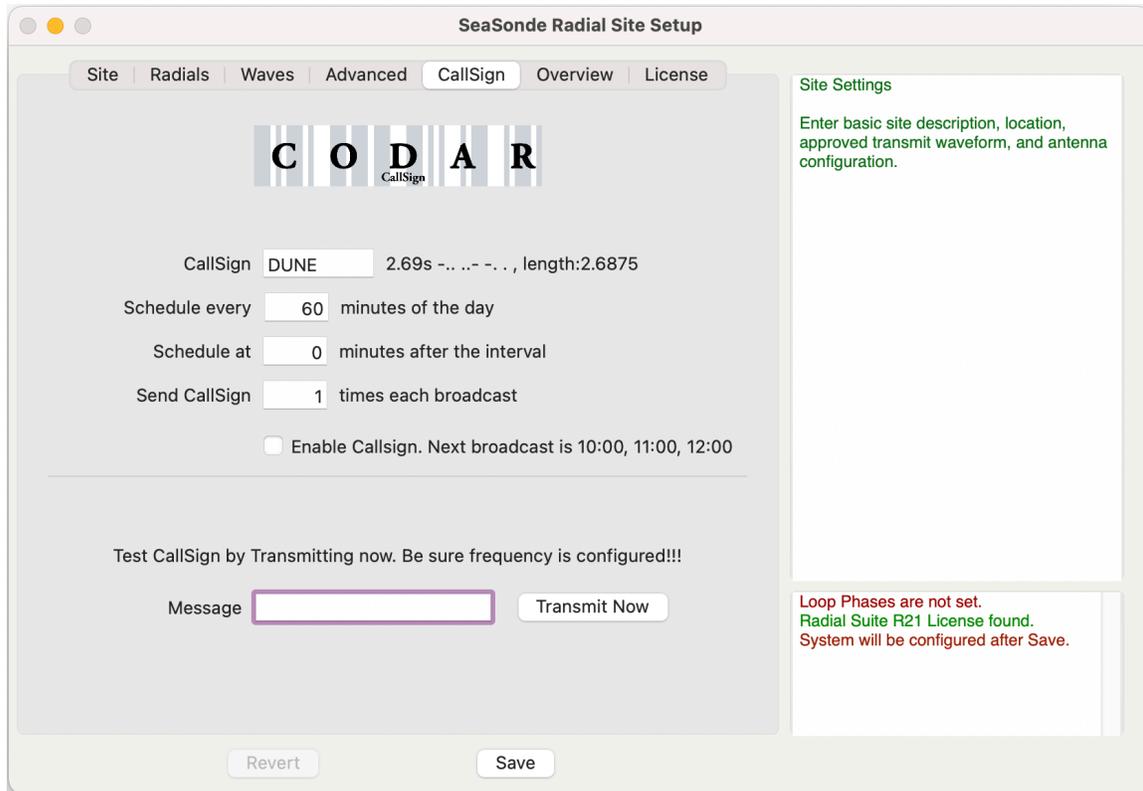
Filtered Radial Output

Filter out radials that don't match others and optionally fill in missing radials. The output will be located in the RadialFiltered folder.

CallSign Tab



The CallSign tab manages the CallSign broadcast identification and scheduling.



Important:

CallSign feature requires Receiver firmware v3.2 or higher installed. The firmware updater is in the Tools folder and is best updated by contacting CODAR Support at support@codar.com.

A callsign is usually managed by your frequency authority. The callsign will interrupt the normal chirped output and broadcast a morse code amplitude keying with a chip rate of 62 ms. You will be able to hear this clearly with any HF AM receiver set to anywhere within the SeaSonde bandwidth.

Note that when the callsign runs, the SeaSonde receiver is blanked and will compensate with the Glitch Removal algorithm. Sending callsign multiple times is not recommended.

Enable CallSign

Checkmark this to enable the callsign broadcast on the specified periodic schedule. It won't actually be enabled until you Save.

CallSign

Enter your callsign here. The typically call sign is 6 alphanumeric characters and is assigned by a frequency authority. As you type, the time to broadcast this is shown to the right as well as a morse code representation with dots and dashes.

Schedule every

Enter the hours and minutes to periodically schedule the callsign through out the day. This means a 0 hours and 20 minutes will schedule the callsign to broadcast at 00:00, 00:20, 00:40, 01:00, 01:20 and so on. The default HF agreement for callsigns is to broadcast every 20 minutes.

Schedule at

Sets an offset in minutes after Schedule interval to start the broadcast. Each site within range, should have a different offset; otherwise, it might be very difficult to pick out who's who.

Send call sign

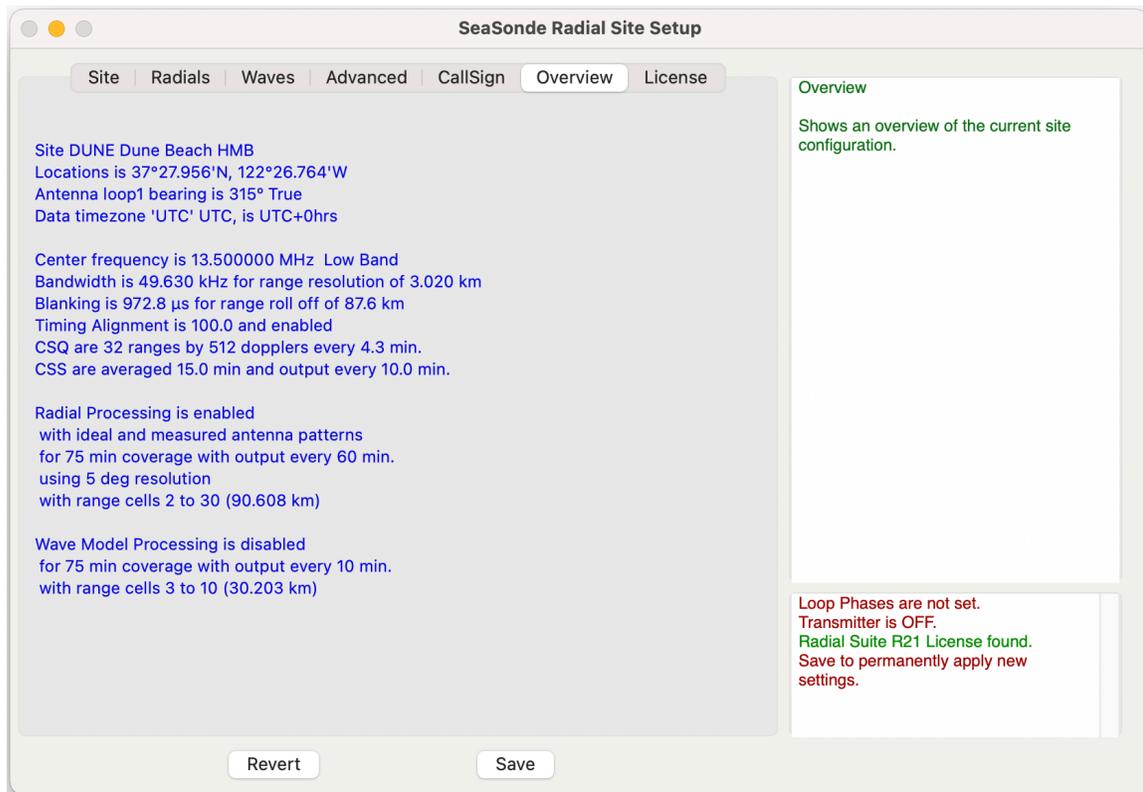
is the number of times to broadcast the call sign each scheduled time. The default is once. Repeats will take more time away from the data collection.

Message

is a test entry to immediately broadcast any message in morse code when you click the Transmit Now button. If you leave the message entry blank, it will use the CallSign entered above. After you type a message, it will show the message decoded below as morse code dot and dashes. You can type a long message, but the firmware sequencer can only handle about 8 chars (depends on message) at a time and will insert a word space where this happens.

Overview tab and Save

The Overview Tab will show you a summary of all the settings you've entered.

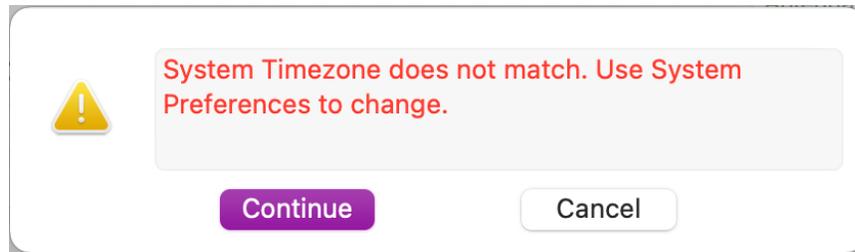


Time to review and then click the **Save** button.

Don't hit the **Revert** button, unless you want to discard all changes and revert back to the last saved configuration.

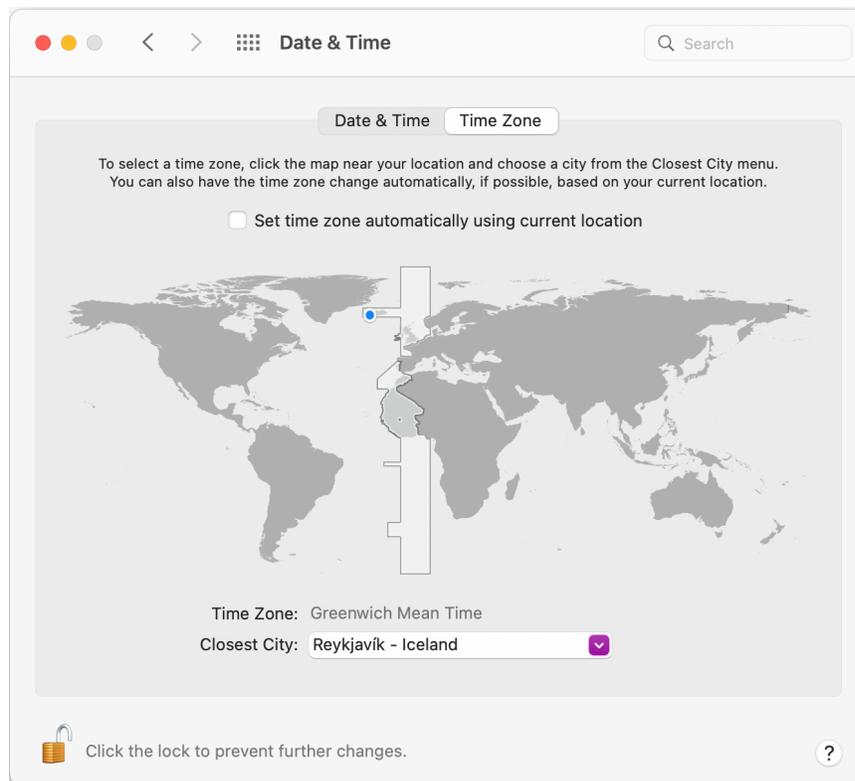
The **Save** button updates all the appropriate Radial Configuration files and tells the receiver to store the settings as the power up settings. This cannot be undone; however, a backup of previous configs is created and time stamped in BackupConfigs folder.

When you hit the Save button, you might see this dialog.



For real-time systems the System timezone needs to be the same as your configuration. Either change the System Preferences or the SeaSonde configuration to match. If Radial Suite Offline, then having a different timezone is ok for offline processing.

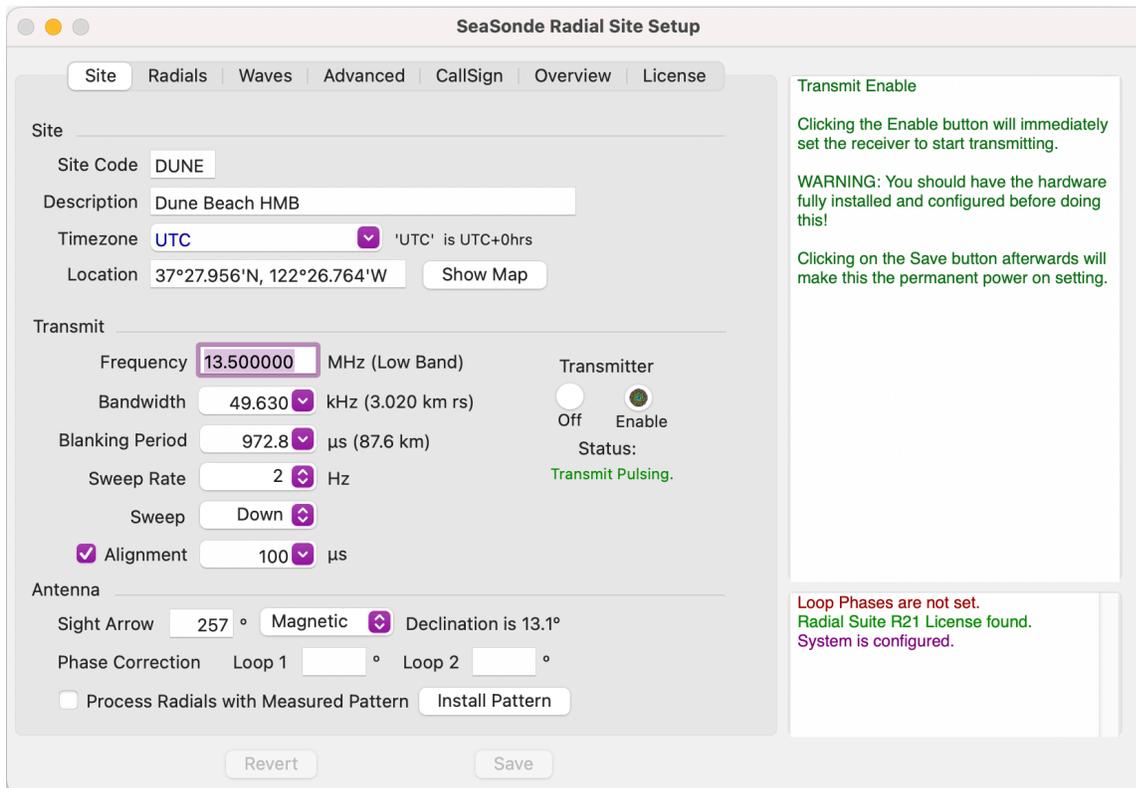
If using UTC, then System Preferences should be set to **Reykjavik - Iceland**. *Don't use London as most cities within the Greenwich Mean Time use daylight savings.*



Finishing

If you've saved your settings but Tx is off, then when you've finished setting up your antenna and are ready, run SeaSondeRadialSetup again and set the Transmitter to Enable. If the VSWR is poor, SeaSondeRadialSetup will turn the transmitter off after a moment.

If you have not install your Codar license file yet, see the Licensing guide.

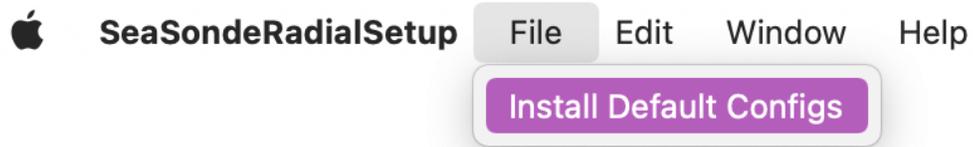


If all ready to go, Quit SeaSondeRadialSetup and run Sentinel application or restart the computer which launch all the real-time applications.

When Sentinel starts up, if any configuration files are missing, then it will launch SeaSondeRadialSetup instead of the real-time applications. SeaSondeRadialSetup will prompt you to re-install the missing file(s). Be sure to check your settings.

Installing New Default Configs

Under the file menu, you can install brand new default configuration files.



This will bring up the Install Configuration Files windows seen at the start of this document. The previous configuration folder will be archived with current date in BackupConfigs folder. After new default configs are installed, you will need to configure the settings.

Revision History

First Dec 31, 2021 - Radial Suite R21

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