



FUNcube Dongle

SDR-RADIO.com Console

SDR-RADIO.com

Table of Contents

Contents

1	INTRODUCTION.....	4
2	HARDWARE INSTALLATION.....	5
2.1	CONNECTING THE DONGLE.....	5
2.2	ADJUSTING THE OUTPUT LEVEL.....	5
2.3	SPUR REDUCTION.....	6
2.4	IMAGE REJECTION.....	7
3	SOFTWARE INSTALLATION	8
3.1	INSTALLING THE SYSTEM	8
3.2	STARTING THE CONSOLE	10
4	USING THE CONSOLE	11
4.1	START YOUR DONGLE	11
4.1.1	<i>Soundcard</i>	11
4.1.2	<i>Control Interface</i>	11
4.1.3	<i>Connection Errors</i>	12
4.2	FUNCUBE DONGLE PANE.....	12
4.2.1	<i>Center Frequency</i>	13
4.2.2	<i>Frequency Calibration</i>	13
4.2.3	<i>Satellite Selection</i>	13
4.2.4	<i>Track & Plot</i>	14
4.3	CONSOLE SETTINGS	15
5	SATELLITES	16
5.1	HOME LOCATION.....	16
5.2	OPTIONS	16
5.3	NEXT PASSES.....	17
5.4	DOPPLER CORRECTION.....	18
5.5	ROTATORS	18
5.6	ANNOUNCEMENTS.....	18
5.7	GOOGLE EARTH INTEGRATION.....	19

5.8	RECORDING OPTIONS	20
6	IMAGE VIEWER	21
6.1	STARTING.....	21
6.2	WAVE FILE	22
6.3	MORE.....	22
6.3.1	AGC	22
6.3.2	<i>Appearance</i>	23
6.3.3	<i>Windows</i>	23

1 Introduction

The SDR-RADIO.com console is an advanced solution for SDR receivers. The system requirement is any computer running Windows XP or higher.

For FUNcube Dongle owners the console offers almost everything you need in one package:

- No licence is required (it's free),
- Satellite support including:
 - Tracking,
 - Doppler correction,
- NOAA weather image viewer,
- Full range of modes, filters and other DSP options.



The dongle has a relatively open front end without any filtering. As a result the dongle's ability to receive weak signals can be compromised if you are in the vicinity of strong transmissions, for example from mobile phones or FM broadcast stations.

2 Hardware Installation

Connecting your dongle to the computer.

2.1 Connecting the Dongle

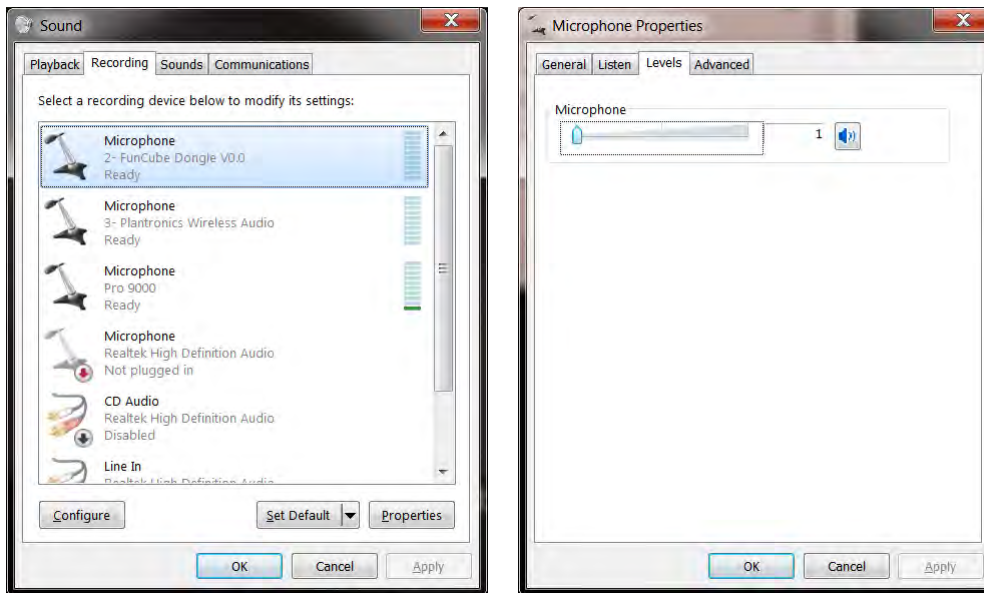
Plug the FUNcube Dongle into a USB port on your computer. The HID drivers required by the dongle are normally shipped with Windows XP and higher. If the console is running you must restart the console for the changes to be detected.

If any drivers are missing please refer to <http://www.funcubedongle.com/> for technical assistance.

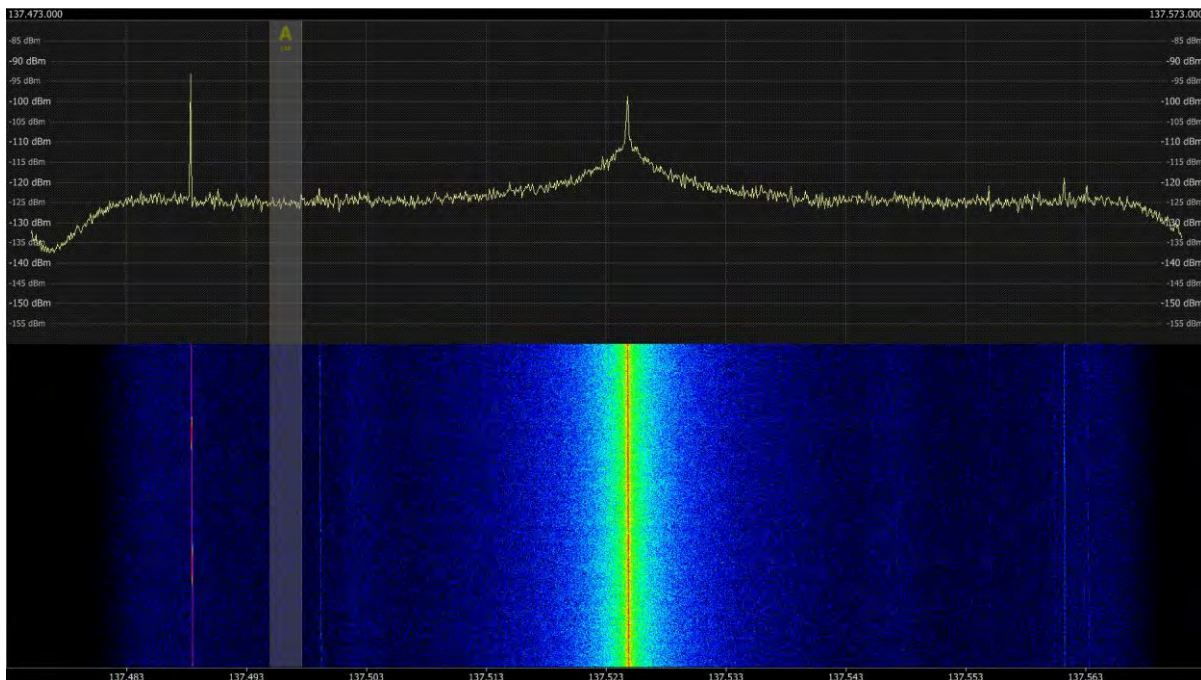
2.2 Adjusting the Output Level

The Dongle appears as a soundcard on your computer; you must reduce the output level otherwise the Dongle will overload the console.

1. Either
 - a. From the *Control Panel* select *Sound*, then *Playback*.
 - b. Right-click on the speaker icon in the system tray and select *Playback devices*.
2. Look for the FUNcube Dongle entry in the *Recording* devices.
3. Double-click on the entry to display the properties.
4. Select *Levels* and reduce to 1.

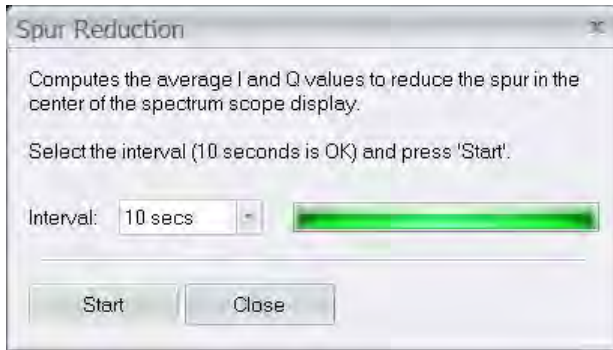


2.3 Spur Reduction



The spur in the middle of the display is caused by a DC offset in the dongle. The spur cannot be completely eliminated but can be reduced considerably.

From the *Options* dropdown in the FUNcube Dongle pane select *Spur reduction*. When you do this the input gain is reduced to the minimum to remove extraneous influences. Select a time interval and press *Start*.



After the analysis is complete press *Close*, the original input gain is restored to the value prior to selecting this option.

2.4 Image Rejection

Another problem with soundcard-based SDR solutions is images – select *Image Rejection* from the *Options* dropdown in the FUNcube Dongle pane and follow the instructions.

3 Software Installation

Installing the SDR-RADIO.com console. Note: if upgrading you do *not* need to uninstall the current kit.

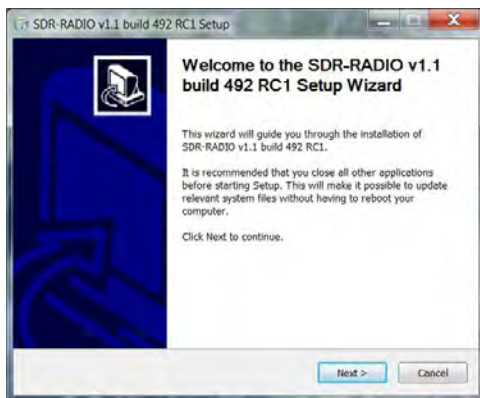
It is recommended that you connect the dongle before installing and starting the software.

3.1 Installing the system

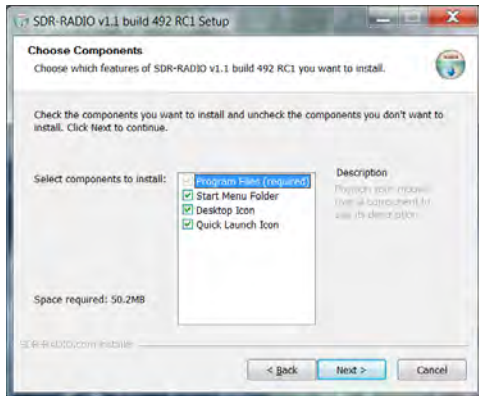
The SDR-RADIO.com software is supplied as a standard Windows installation kit, the filename format is: SDR-RADIO_v<version>b<build>.exe, for example SDR-RADIO_v1.1b492.exe is version 1.1 build 492.

The program files are compiled as 32-bit executables, the kit can be installed on any 32- or 64-bit system using Windows XP or higher.

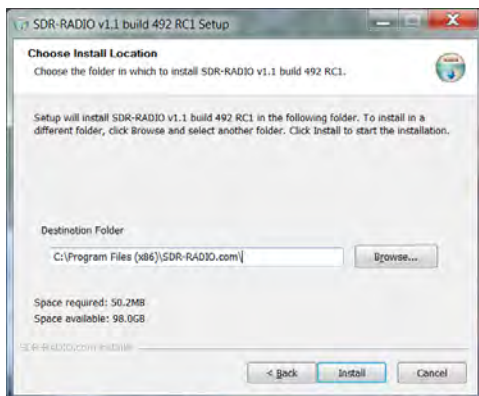
Installation typically takes only a few seconds.



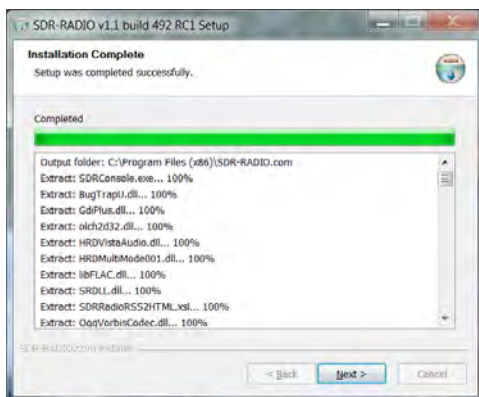
The first window displays the version and build number. Press *Next* to continue.



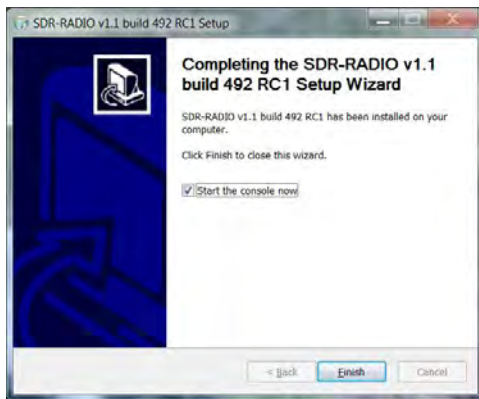
Select the components to be installed, normally you install everything. Press *Next* to continue.



Select the folder where the files are installed. The suggested default obeys the Windows convention of always installing programs in the Program Files folder. Press *Install* to start the installation.



The installation window's progress bar shows the state of the program installation. Press *Show details* for a full list of the files installed.

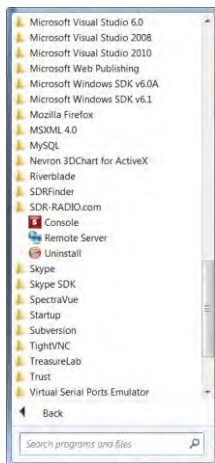


That's it – the software is installed, if *Start the console now* is checked then the console is started when you press *Finish*.

3.2 Starting the console

After installing the software you start the console from either:

- The Start menu,
- The Desktop icon, or
- The Quick start (depends on operating system version).



4 Using the Console

Here we will start the dongle soundcard and perform the most common tasks when receiving signals.

4.1 Start your Dongle

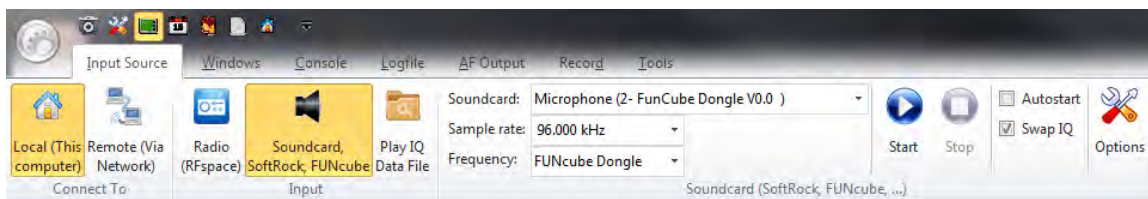
There are two stages to starting the dongle:

1. Start the soundcard to get the output (IQ) data,
2. Establish connection to the dongle via the HID driver to set the frequency and adjust the dongle's other options.

4.1.1 Soundcard

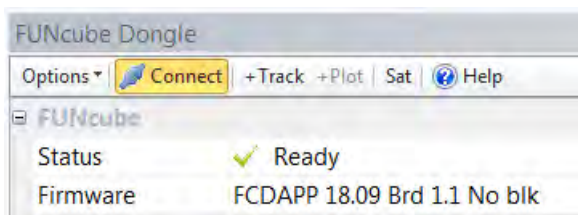
To start your dongle's soundcard:

1. Make sure the *Input Source* pane of the ribbon bar is displayed, if not double-click where you see *Input Source* at the top of the console.
2. In the *Soundcard*, *SoftRock*, *FUNCube* group the recording devices (soundcards) enabled on the computer are shown.
3. Select the FUNCube Dongle soundcard and set the sample rate to 96 kHz (see below).
4. In the Frequency dropdown make sure FUNCube Dongle is selected.
5. Make sure *Swap IQ* is checked.
6. Press *Start*!



4.1.2 Control Interface

The dongle is configured and controlled via a Human Interface Device (HID) driver. When the dongle's soundcard is started a connection should also be made to the dongle, if not just press *Connect* in the FUNCube Dongle pane's toolbar. When a connection is made you will see output similar to that below:



Here we have a revision 1.1 board (serial number is 2711) with firmware 18i loaded.

4.1.3 Connection Errors

The console attempts to open the dongle for exclusive access (other programs cannot make changes while the console is using the dongle). If you see an error message:

Error opening dongle,no access to file because in use by other process

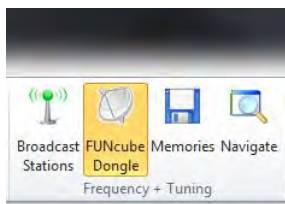
then the dongle is already opened by another program.

From the Options dropdown in the FUNcube Dongle pane uncheck the option 'Open for Exclusive Access'. When this option is unchecked the dongle is opened allowing access to other programs.

The 'Open for Exclusive Access' option is supported to prevent other programs modifying the settings while the dongle is in use by the console.

4.2 FUNcube Dongle Pane

When you started the soundcard (above) the FUNcube Dongle pane should be displayed automatically. If this pane is not displayed or you have accidentally hidden it just select *FUNcube Dongle* from the *Frequency + Tuning* group of the *Windows* pane of the ribbon bar.



In this pane you can set:

- Center Frequency.
- Enable Doppler compensation when tracking satellites.
- Adjust gains etc.
- Satellite selection.
- Enable rotator support.

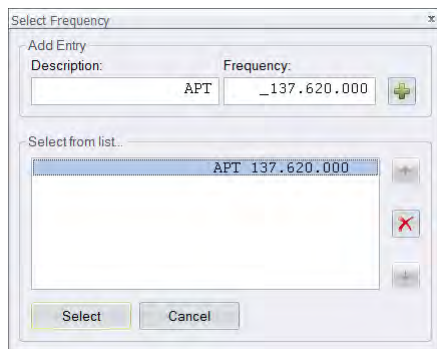
4.2.1 Center Frequency

One way to tune the dongle is by selecting Freq from the Frequency group:

Frequency	
Center (Set)	137.620.007 (0) Freq
Band	VHF II
Doppler \pm	+2,397.3
Doppler Enable	<input checked="" type="checkbox"/>
Doppler Invert	<input checked="" type="checkbox"/>
PLL Lock	✓ Yes
Correction	-19.00 ppm

This method is design primarily to support satellites where you will usually use the same center frequency for each satellite.

When you press *Freq* the Select Frequency window is displayed; here you maintain a list of frequencies which are automatically saved for the currently selected satellite.



The 'Select Frequency' dialog box contains an 'Add Entry' section with 'Description' (APT) and 'Frequency' (_137.620.000) fields, a 'Select from list...' section with a list box containing 'APT 137.620.000', and 'Select' and 'Cancel' buttons at the bottom.

If the frequency selected is within the range supported by your dongle the PLL will lock.

4.2.2 Frequency Calibration

The dongle frequency is calibrated by adjusting the value shown in the correction field, this value is in parts per million (ppm). Calibrate against a signal source of known accuracy.

4.2.3 Satellite Selection

Select *Sat* from the pane's toolbar to display the Satellites window where you select the current satellite.

Satellites						
<div> <div>All Satellites</div> <div>Favourites Only</div> <div>Visible Now</div> <div>30 Minutes</div> <div>60 Minutes</div> <div>Definitions</div> </div>						
Vis	Name	AOS	LOS	Duration	Alt. kms	Period
	AO-07	20:10:26	20:29:32	19:06	1447.5	1:54:48
	CO-55	20:09:15	20:22:54	13:39	829.4	1:41:17
	COMPASS	20:30:49	20:39:21	8:32	637.3	1:37:03
	CP3	20:18:03	20:32:40	14:37	763.7	1:39:04
	DO-64	20:21:18	20:28:09	6:51	630.6	1:37:00
	FO-29	20:17:13	20:20:40	3:27	1046.6	1:46:22
	FO-70	20:13:21	20:17:35	4:14	641.4	1:37:29
	HAWKSAT1	20:13:16	20:20:07	6:51	299.9	1:30:32
	MAST	20:28:36	20:43:09	14:33	739.6	1:38:59
	MET-2/21	20:23:43	20:35:10	11:27	970.5	1:44:00
	OKEAN-4	20:00:00	20:13:12	13:12	627.7	1:37:01
	OOREOS	20:23:03	20:28:15	5:12	635.1	1:37:26
<div> <div>Select</div> <div>Cancel</div> </div>						

Here you filter the display by either:

- All satellites, or
- Only the entries in the favourites list.

The visibility options are:

- Visible now,
- Visible in the next 30 minutes, or
- Visible in the next 60 minutes.

If none of the above is selected then no visibility filtering is applied.

4.2.4 Track & Plot

The current satellite's track and plot are displayed by selecting *Track* and *Plot* from the pane's toolbar. This is an excellent way to see exactly what the current satellite is doing.



4.3 Console Settings

The FUNcube dongle's visible bandwidth is same as the sample rate selected when starting the dongle soundcard, usually 96 kHz. To set the displayed bandwidth the console's waterfall and spectrum either click the [span] button or right-clcik in the waterfall and select 100 khz from the popup menu.

5 Satellites

The console has built-in support for satellites:

- Selection of Keplerian data sources,
- Doppler correction,
- Pass display,
- Current track and footprint.

5.1 Home Location

To successfully track a satellite you must first enter your home locations latitude and longitude. Select *My Information (Lat, Lon ...)* from the Options dropdown in the FUNcube Dongle pane and make sure the Height, latitude and Longitude are correct.

Program Options

Appearance
Console
Defaults
Scope + Waterfall

Account Profiles
Antenna Switch
Data Decoder
External Radios
Filters
IQ Data Files
Maps
Memories
MIDI Devices
My Information
Navigator
Recording
RFspace
Satellites
Serial Ports
SoftRock
UDP Forward

My Information

Name: Simon Arthur Hore
Callsign / ID / ... HB9DRV
Location: Laax, CH

Height: 0 (in meters)
Latitude: North 46.812500°
Longitude: East 9.291667°
Locator: JN46PT

Measurements: ☐ Imperial (miles) ☒ Metric (kilometers)

The values in the My Information fields are used when interfacing with other programs, for example:

- SDR-RADIO.com remote server,
- SDR-RADIO satellite tracking (Q4 2011),
- Logbooks & similar.

Name: Your name (or nickname).

Callsign: if you are an amateur enthusiast you probably have a callsign or shortwave club membership number, if so enter this here.

Location: town, county, state.

Height: in meters above sea level (masl), used by satellite tracking (Q4 2011) as part of Doppler correction.

Latitude & Longitude: used in the maps to indicate your location and also used by satellite tracking as part of Doppler correction. It is essential that you enter an exact latitude / longitude for satellite tracking to help provide the best possible Doppler correction. If you are not sure of your co-ordinates visit <http://maps.google.com/>.

Locator: a geographic coordinate system used by amateur radio operators see

5.2 Options

From the Options dropdown in the FUNcube Dongle pane select *Satellite Options...* Here you can:

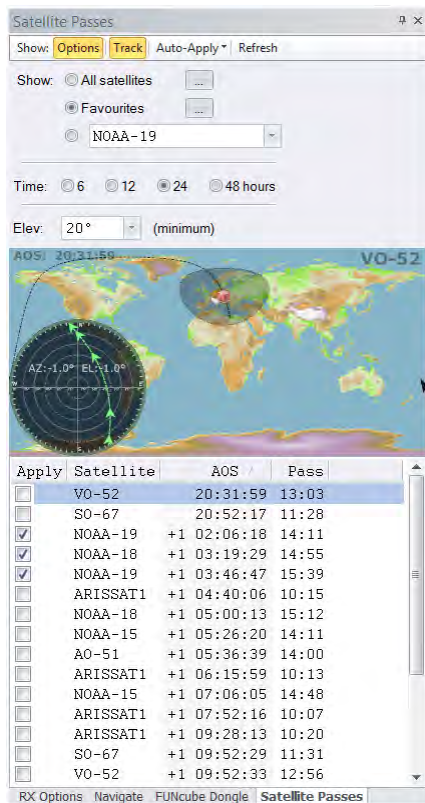
- Select the files containing Keplerian data (required to track satellites accurately),
- Configure the format of the map used for the current track display,

- Select a list of Favourite satellites

The Keplerian data should be recent – don't use a URL which provides old data. For more information about the data file format visit http://en.wikipedia.org/wiki/Orbital_elements .

5.3 Next Passes

You will always want to know the next passes for your satellites. To display the Satellite Passes pane select *Satellite Passes* from the Options dropdown in the FUNCube Dongle pane.



Of particular interest is the *Auto-Apply* option. When enabled the satellite in the checked passes is selected automatically in the FUNCube Dongle pane a few seconds before AOS.

Use this option to select the passes you want monitor.

5.4 Doppler Correction

To apply Doppler correction for the current satellite:

1. Make sure the correct center frequency is selected,
2. Check *Doppler Enable*,
3. Check *Doppler Invert* (required because Swap IQ is selected when starting the soundcard).

The current Doppler offset is shown in the Doppler \pm field. When the satellite is visible this value is updated twenty times per second. As a satellite passes overhead the rate of change of this correction can be very high – higher than you could compensate for with manual tuning.

Frequency	
Center (Set)	137.620.007 (0) Freq
Band	VHF II
Doppler \pm	-1,399.3
Doppler Enable	<input checked="" type="checkbox"/>
Doppler Invert	<input checked="" type="checkbox"/>
PLL Lock	✓ Yes
Correction	-19.00 ppm

5.5 Rotators

The console interfaces with third-party programs which in turn connect to your rotator. The interface used is known as Dynamic Data Exchange (DDE).

In the FUNcube Dongle pane select the required format or None if rotator support is not needed.

Rotator	
Rotator	Nova
DDE Advice	NOAA-16 AZ:321.6 EL:-0.9 RR:0.8684003362 AH:N

5.6 Announcements

Enable Text-To-Speech announcements to avoid missing interesting passes!

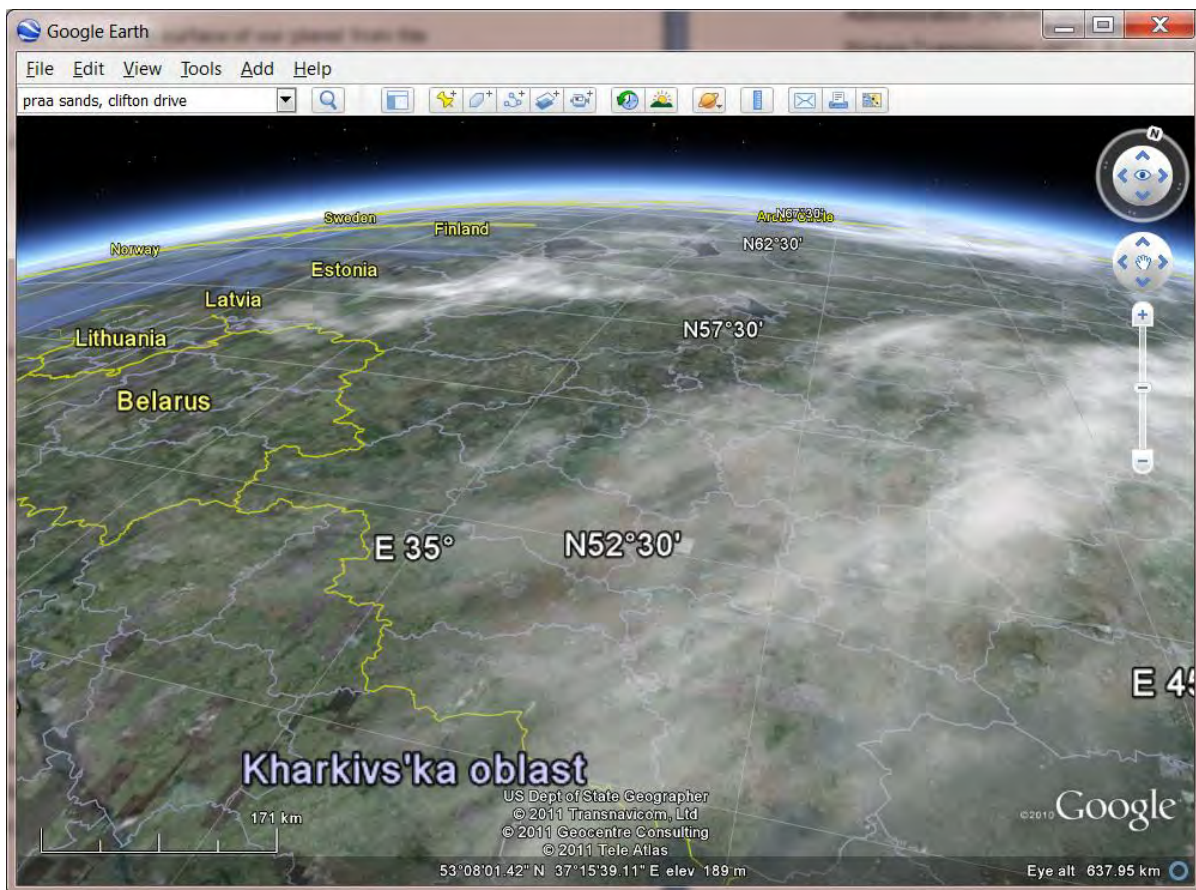
From the Options dropdown in the FUNcube Dongle pane make sure *Pass Announcements* is Enabled for AOS and LOS (Acquisition of Signal and Loss of Signal).

5.7 Google Earth Integration

The console interfaces with Google Earth to show you the surface of our planet from the passenger seat of the satellite. You may not be able to see satellites from space (you can see the International Space Station (ISS)) but the satellites can see you!

From the Options dropdown in the FUNcube Dongle pane select *Google Earth*: a second toolbar is displayed with two options, *Enable* and *Tilt*. Press *Enable* to start Google Earth if not already started, use *Tilt* to adjust the angle between the satellite and the earth.

If for some reason Google Earth does not start use the Task Manager to check whether it is currently running – if so kill it and start again.



5.8 Recording Options

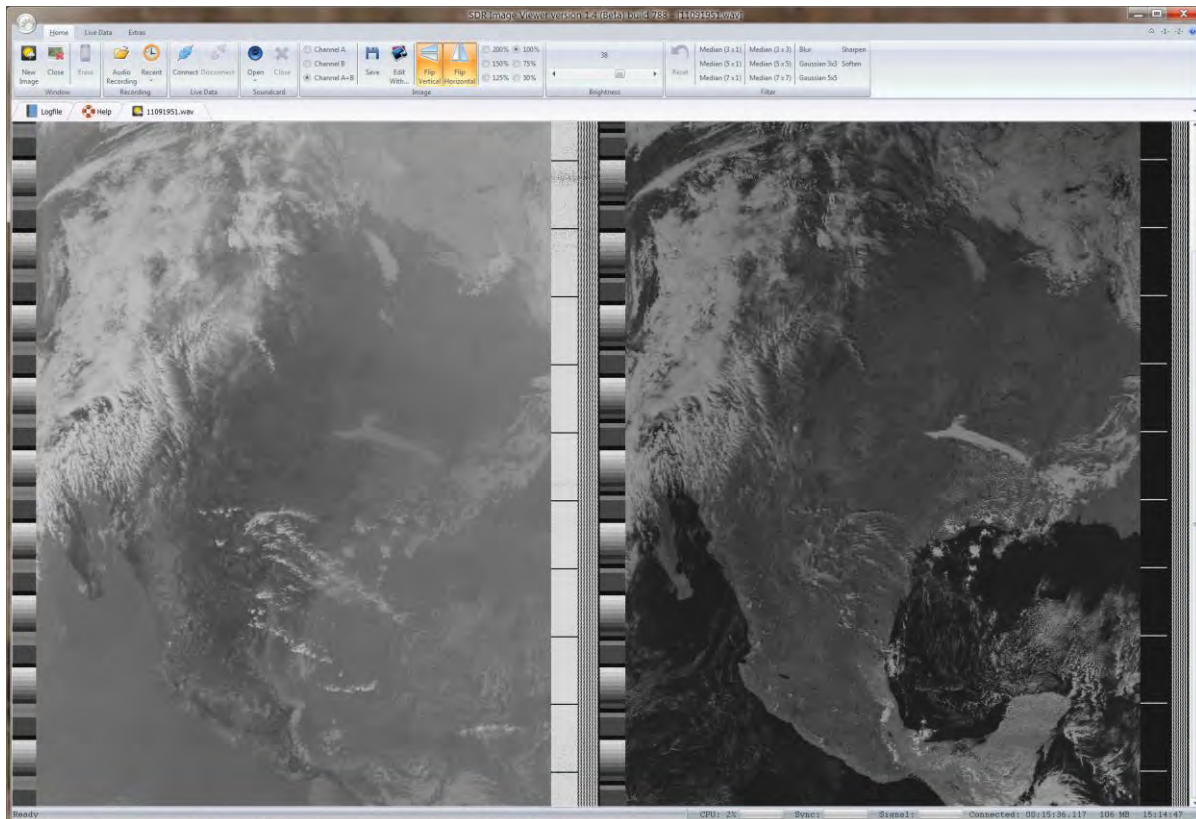
The console supports recording and playback using IQ data files (the IQ data is the raw data received from the dongle before any DSP processing takes place).

Select *Recording Options...* from the *Options* dropdown in the FUNcube Dongle pane to display the Recording Options toolbar. Of interest is the *Automatic* option – recording starts when the currently selected Satellite is visible (AOS) and ends when it is no longer visible (LOS).

6 Image Viewer

As well as the amateur radio satellites there are National Oceanic and Atmospheric Administration (NOAA) weather satellites on 137MHz which transmit images using Automatic Picture Transmission (APT). A basic but effective APT viewer is supplied in the SDR-RADIO.com console.

During Q4 of 2011 support will be added for slow-scan tv as used by satellites and the international space station.



6.1 Starting

From the *Options* dropdown in the FUNCube Dongle pane select *Image Viewer (NOAA, ...)*.

Input comes from either a wave file, a soundcard or via a UDP connection with the SDR-RADIO.com Console.

You normally use a UDP connection between the console and the image viewer:

1. In the console select the *AF Output* pane in the ribbon bar and enable the *UDP server*.
2. In the image viewer select the *Live Data* pane in the ribbon pane and enable the UDP client.

The UDP connection is fixed at 48,000Hz, 16-bits, single channel.

Look at the status bar in the image viewer, it shows the relative signal level and the synchronisation status. The live data signal level is independent of the audio output level in the console.

For the weather satellites (NOAA-15...) in the console select WFM (Wide FM at 48kHz) and adjust the bandwidth so that in the Audio Spectrum it shows about 17.5kHz - the filters will be covering the input from the satellite.

6.2 Wave File

A wave file usually has a WAV file extension <http://en.wikipedia.org/wiki/WAV> and is the most common format used for storing uncompressed audio.

The wave file must obey the following criteria:

- Sample rate between 11,025 and 48,000 HZ.
- Sample size of 8 or 16 bits.
- Single channel.

6.3 More

6.3.1 AGC

In the SDR-RADIO.com Console switch the AGC to OFF for best decoding of the picture. If AGC is OFF and the picture is all white (no contrast) then the AGC gain is too high, reduce the gain until contrast appears.

6.3.2 Appearance

In the Extras pane select the style of your choice, style is a personal preference.

6.3.3 Windows

You can open as many image windows as needed but only one window can be used for the reception of Live data.