FunCube Dongle Pro+

By Bob Grove W8JHD

In our March issue we introduced readers to a powerful, midget receiver, the FunCube Dongle SDR (Software Defined Radio). Covering 60-1700 MHz, that initial product was developed in the U.K. to enable hobbyists to monitor the amateur radio Cube satellites.

The original cube was remarkable, allowing a 90 kHz bandwidth to be observed as a spectrum display. But as critical parts, of which there are 100, became scarce, designer Howard Long realized that an entirely new design was necessary. This more than doubled the original parts count on the six-layer circuit board, but more importantly, it increased the functional limits of the tiny radio as well as increased its frequency stability with a new TCXO (temperature-compensated crystal oscillator).

As was the original dongle, the new one gets its 5-VDC power from the USB port of the computer. Howard doesn't supply a driver for his products, but there are several free downloads available on the Net. We prefer SDR#, available at **www.sdrsharp.com**. At this writing, the most recent version is 1.0.0.1113.

Using this software package, the new Funcube Dongle Pro+ receives 150 kHz – 260 MHz and 410 MHz – 2 GHz while displaying a 192 kHz sweep span. Its reception modes are AM, NFM, WFM USB, LSB, DSB, CW-U, and CW-L.

Selectivity bandwidths for all modes are continuously adjustable to suit the listener. All frequencies are expressed in Hertz, and frequency accuracy to 1-Hz is possible when the TCXO is keyboard-calibrated to a standard like WWV.

The spectrum analyzer span can be adjusted from virtually zero to its maximum 192 kHz span. There are two spectrum displays, both in real time: The traditional signal spikes and the time-revealing waterfall. Their proportional

heights are vertically adjustable from zero to full page by dragging the horizontal frame bar that separates the two displays. The baseline can be offset as desired, and the spikes exaggerated.

The receiver sensitivity is nominally 0.15 microvolts for 12 dB SINAD over the majority of its tuning range. The TXCO stability is typically 1.5 ppm. VHF/UHF noise figure is 3.5 dB.

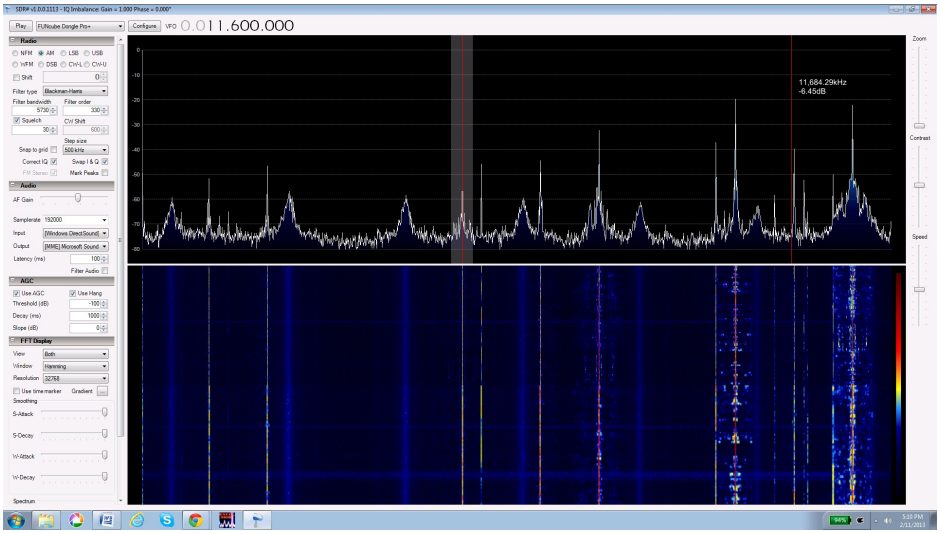
Due to the small size of the dongle, an SMA connector is provided for antenna connection, while a conventional USB plug mates with the computer port.

A 5-VDC bias-T voltage can be selected to run on the antenna line for activation of remote accessories like an antenna-mounted preamplifier. It is activated by a check box in the configuration menu.

❖ Limitations

While the performance of such a low cost, multifunctional device is exceptional, there are some concessions. Lack of front-end selectivity produces many image products throughout its tuning range. These can of course, be largely minimized by external tuning, but that compromises the miniaturization of the system.

The dynamic range is somewhat limited, producing audio distortion on strong local signals. This can be improved by temporarily disabling the front end (LNA) RF stage in the configure mode.



❖ Let's Try it Out

After loading the software, the receiver appears on screen, awaiting the PLAY command to

Table 1: Funcube Dongle Pro Plus Startup Settings

(SDR# v1.0.0.1113)

On **http://sdrsharp.com/index.php/downloads**, download SDR# Dev (Rev. 1113 or higher), save SDR-nightly, select SDR sharp (application) and follow instruction to unzip the files. Select run, pin shortcut icon to task bar.

Press PLAY, select FUNcube Dongle Pro+

CONFIGURE: LNA Enable (Check), Mixer Gain (Check), IF Gain (0), Bias T (Uncheck)
Frequency correction (2.3; set as needed to WWV comparing AM to USB /LSB)

FILTER TYPE: Hamming

MODE SETTINGS	Filter Bandwidth	Filter Order	CW Shift	Step Size
NFM	8000	50		12.5 kHz
AM	6000	50		1 kHz
LSB	2400	50		100 Hz
USB	2400	50		100 Hz
WFM	180000	50		100 kHz
DSB	6000	50		100 Hz
CW-L	300	50	800	100 Hz
CW-U	300	50	800	100 Hz

SQUELCH: (75 NFM, 30 AM aircraft)
SNAP TO GRID: (Uncheck)
STEP SIZE: 1 kHz (Set as desired)
CORRECT IQ: (Check)
SWAP I & Q: (Check)
FM Stereo: (Uncheck)
MARK PEAKS: (Uncheck unless desired to flag signal peaks)

FILTER AUDIO: (Uncheck)
AGC: Use AGC (Check), Use Hang (Check), Threshold dB (-100), Decay (1000), Slope (0)

FFT DISPLAY: View (Both), Window (Hamming), Resolution (32768), Use time marker (Uncheck), Gradient (All colors), S-Attack (100%), S-Decay (100%, W-Attack (100%), W-Decay (100%), Spectrum Offset (0%), Range (50%)

ZOOM: 0%
CONTRAST: 50%
SPEED: 50%

To enter a frequency, place the mouse cursor over left-most digit and right click. Next, remembering that the frequency is in hertz, place the cursor over the left-most digit representing the new frequency and type the new frequency; press ENTER.

To change the relative heights of the spectrum display and waterfall display, drag the center bar between them.

To reduce distorted reception because of strong-signal overload, select the CONFIGURE box and uncheck LNA Enable

Table 2: Specifications

Guaranteed frequency range: 150kHz to 240MHz and 420MHz to 1.9GHz
Typical frequency coverage: 150kHz to 260MHz and 410MHz to 2.05GHz
Maximum span: 192 kHz, real time
Modes: AM, NFM, WFM, USB, LSB, DSB, CW-L, CW-U
TCXO specified at 0.5ppm (in practice about 1.5 ppm)
Standard SMA female antenna port
USB male connection
Eleven discrete hardware front end filters including:
- 6MHz 3dB bandwidth (10MHz at -40dB) SAW filter for the 2m band.
- 20MHz 3dB bandwidth (42MHz at -40dB) SAW filter for the 70cm band
- Third- and fifth-order LC bandpass filters for other bands

Front end LNA IP3 30dB
Typical noise figures:
- 50MHz 2.5dB
- 145MHz 3.5dB
- 435MHz 3.5dB
- 1296MHz 5.5dB

Typical NFM 12dB SINAD sensitivity measurements:
- 145MHz 0.15uV
- 435MHz 0.15uV

No additional drivers required for Linux, OSX or Windows
Integrated 5V bias T switchable from software
USB power required: 5 VDC @ 160 mA

be pressed. Next, a box of SDR receiver models is consulted to select the FunCube Dongle PRO+.

In order for the Dongle to work right off the bat, we have included a recommended list of settings (Table 1). Using those settings, we found the FunCube Dongle Pro+ to be a delight to use, with excellent reception throughout its tuning range.

Filter bandwidths can be custom adjusted to suit the requirements of the operator. Frequency entry is done by the user's computer keypad. The current frequency is cleared by right clicking the left-most box, then typing in the numerals in their respective boxes. The cursor can be slewed back and forth, selecting and fine-tuning the frequency. Alternatively, the cursor can be placed on any digit in the frequency display and toggled up and down in those units.

Tuning steps for slewing the cursor may be selected from among 27 step sizes ranging for 1 Hz to 500 kHz. They cleverly include all current standard channelization spacings, such as 6.25 and 12.5 kHz for NFM, 8.33 kHz for European VHF aero, and 9 kHz for European MW AM.

Since there are no instructions for the third-party driver, we have included startup settings that worked well during our review.

We found audio recovery, sensitivity, and signal stability in all modes including SSB to be outstanding. It is our understating that third party efforts are developing scanner software. We hope additional efforts will provide wider spans for the spectrum display.

At this writing, Howard Long is waiting for FCC approval. Until then, it is unlawful for the Dongle to be merchandised in the U.S. Grove Enterprises is awaiting notification for distribution. In the meantime, however, they cannot provide price or delivery information, although their European distribution seems to be in the $200 range plus shipping.

Interested experimenters are encouraged to keep up with progress on this front by visiting Howard's website: **www.funcubedongle.com**

Sangean WFR-28 Radio

By Larry Van Horn N5FPW

I am a big fan of Internet radio. So much so we have quite a few of them in our household. So any chance I get to review a new I-Radio is a lot of fun and something that I look forward to. Recently, I had the chance to review another new entry in this growing marketplace and can say that Sangean has another winner in their new radio the WFR-28 Radio.

❖ Features

The Sangean WFR-28 is a combination Internet radio and audio media streaming device that is fully portable. With it users can listen to over 13,000 radio stations from NPR, FOX news, CNN, BBC, CBS to KROQ, and over 35,000 podcasts as well as to your regular FM band (87.5 -108 MHz) with a RDS (Radio Data System).

WFR-28 features include Frontier Silicon's IR 2.2 network audio software that provides the most complete, versatile and easy-to-use software available for the next generation Internet-connected audio systems. The WFR-28 delivers some real nice sound well beyond its size, and bass and treble controls let you further adjust that sound to your liking. The built-in clock with dual alarms can wake you to FM radio, Internet radio or buzzer. This platform can serve as a network music player so it can play music stored on your computer.

DLNA, UPnP and Windows 7 Certification is supported to enhance music sharing and playing. The WFR-28 even supports remote control by iPhone and iPod touch thanks to the iSangean App.

This radio does require a broadband wireless Internet connection for all media play functions except for FM band reception and auxiliary/USB inputs. Consequently, you can listen directly from your wireless router with no PC or Mac required. Jacks include: DC in, Aux-in, Line-out, Headphones and USB Port. This unit may be operated by the supplied AC adapter or four D cells (not supplied).

❖ iSangean App Available

iSangean is the remote control app for Sangean Internet radios and media streamers for your iPhone or iPod touch. The app allows selection of Internet radio stations, selection and control of media for UPnP/DLNA music streaming from a local computer, server or NAS device, as well as control of FM radio and other functions (where these functions are present on the radio). The Now Playing screen provides radio station or media information with direct control of the radio volume. iSangean is available for download in the iTunes App Store.

❖ Bottom Line

You are going to get big sound in a small package. The WFR-28 delivers sound well beyond its size. The built-in digital EQ audio controls let you further adjust the sound.

The WFR-28 delivers a solid radio listening experience, complete with a built-in external telescopic antenna for clear FM reception. Add to that the ability to listen to over 13,000 Internet stations worldwide and you can save your favorite Internet stations as well as your FM stations on your presets.

The only down side to this unit is no remote control. But if you have an iPhone/iTouch the iSangean more than fills that role.

Overall, if you are looking for a good entry level Internet portable receiver with FM band receive capability, at a reasonable price; take a good look at the WFR-28.

This unit sells for $150 and is available from Grove Enterprises.

Technical Specifications

- Product Description - WFR-28 WiFi Internet / FM-RDS / Network Player / USB Portable Radio
- Tuner - Internet radio, FM-RDS waveband
- Station Presets - 10 (Five FM, Five Internet)
- Internet Radio - Over 13,000 stations worldwide, search by country, genre and my favorite radios
- Display - 1.3-inch LCD display with adjustable backlight
- Alarms - Dual alarm timer with HWS (Humane Wake System) buzzer and radio, Sleep timer and snooze functions
- Speaker - Single full range speaker, RMS output power 1.2 Watts
- Audio EQ - Normal / Flat / Jazz / Rock / Movie / Classic / Pop / News / Custom sound effects and bass/treble control
- Input/Output Jacks - FM wire external antenna, aux-in, USB, and headphone
- USB - MP3 playback, MP3 and WMA compatible, plug and play, UPnP / DMR music streaming (DLNA 1.5 compliant)
- Ethernet Technology - Ethernet
- Wi-Fi Standard - IEEE 802.11b/g
- Power Source Type - Plays on rechargeable and dry-cell batteries, built-in rapid battery charger, AC Adapter 7.5V/1.6A
- Size - 5.83-inches/148mm (H) by 2.44-inches/62mm (L) by 9.3-inches/273 mm (W)
- Weight - 1 pound 14 ounces/851 grams
- Manufacturer Website Address: **www.sangean.com**
- List Price - $150