MOONRAKER

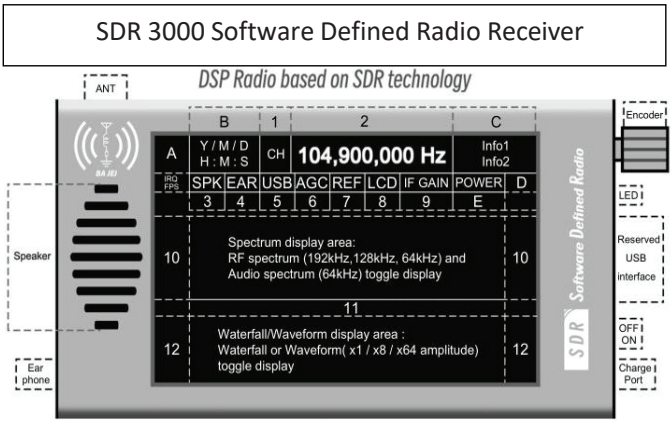
SDR 3000 Software Defined Radio Receiver

Quick Start Guide

Produced by the Radio Society of Great Britain www.rsgb.org

R1.0

Contents.



1, Product description：

SDR-101 is a DSP digital demodulation radio based on SDR software-defined radio architecture. It has a 192kHz width spectrogram and waterfall display capability, and uses 16bit sampling to produce a high dynamic receiver with CW, AM, SSB, FM demodulation functions. The whole machine adopts an all-aluminum alloy CNC shell, with a 4.3-inch 800x480 resolution high-brightness IPS LCD display, while maintaining a compact and pocket size body.

Perfect to take to the outdoors, and enjoy the natural scenery and the fun of listening anytime, anywhere!

2. What's in the Box

SDR3000 4.3" screen unit x1
USB-A to USB type -C cable x1
SMC Rod Antenna (expanded length 70cm, closed length 14 cm) x1
Resistive Screen Touch Pen x1
Manual x1

3. Getting Started

Now you have your SDR 3000 receiver the first thing to do before using it is to charge it! You will need a) the receiver and b) the supplied USB cable. Simply plug the type C end of the cable into the end of the receiver (see the illustration on page 2) then plug into a suitable charging source a phone charger is generally a good recommendation. You will see the LED on the side of the receiver light up and blink Red. The table below shows the various states during charge and operation.

Status		**Red**	**Green**
Charge	**Charging**	**Blink**	**Off**
	Full	**Off**	**On**
Discharge	**Discharging**	**Off**	**On**
	Low battery	**Off**	**Blink**

Once you have some charge then connect the antenna and switch on the receiver using the small slide switch located next to the USB-c socket on the side of the case. The colour screen will burst into life with its waterfall display taking Centre stage. The frequency is displayed at the top of the screen with the primary settings on the line below. The means of accessing these are by the use of the rotary encoder which is used in combinations of press and rotate.

The controls that are accessed in the particular combinations are detailed below:

Twelve items can be selected by the rotary encoder

1. Channel selection: 1-99
2. Frequency setting: 100k – 149MHz, minimum step 1Hz
3. Speaker volume (SPK): 0~35dB, 1dB step
4. Earphone volume (EAR): 0~35dB, 1dB step
5. Mode: CW, LSB, USB, AM, WFM, STE (FM stereo), I/Q
6. AGC setting: OFF, SLOW, MID, FAST
7. Reference level (REF): -99~99dB, 1dB step
8. Backlight brightness (LCD): 1%~99%
9. IF GAIN: -12~67dB, 1dB step
10. Spectrum style: Green fill, green line, blue fill, White line
    Spectrum bandwidth settings : RF spectrum (192kHz, 128kHz, 64kHz) and Audio spectrum (64kHz)
11. Waterfall area settings： Waterfall or Waveform (x1 / x8 / x64 amplitude)

There are a few items that cannot be controlled via the rotary encoder:

A. battery level display
B. date and time settings
C. radio information display: preset radio name capability
D. display of current spectrum bandwidth
(POWER) input power display

To adjust a parameter a short press on the rotary encoder will select items 1-5 or press and hold the encoder and the rotate to select items 1-12

4.Tuning the receiver

Setting a frequency, is done either 1 KHz at a time via the encoder or more easily by using the stylus and taping the frequency display. Once pressed the direct input screen will be displayed, input the required frequency and enter. Once back at the main screen you can

then change the various other parameters as required i.e. speaker or ear volume gain, mode of operation, the waterfall display will then show the received frequency breakdown and allow you to tune using the rotary encoder for fine adjustment to taste. If you wish to store your settings and frequency to one of the 99 channels simply press the encoder for more than 1 second and it will be stored.

5.Specification

Basic parameters

Display technology: 4.3-inch IPS 800x480 resolution DC dimming bright LCD. Control method: resistive touch screen + rotary encoder Frequency range: 100k – 149MHz. Working mode: CW, AM, SSB single sideband (LSB/USB), WFM, FM broadcast stereo (requires earphones)
Frequency steps:

1Hz/10Hz/100Hz/1kHz/10kHz/100kHz/1MHz/10MHz.

Spectral bandwidth:192kHz,128kHz,64kHz, FFT real-time spectrum display
Antenna interface: SMC male, impedance 50Ω, maximum input power -20dBm
Reference crystal: TCXO 26MHz ±0.5ppm

Audio interface: support ordinary 3.5mm earphone or CTIA (American Standard) interface earphone Speaker power: maximum 3W, 4Ω multimedia speaker
Charging port: USB Type-C, 5.0V/2A Current consumption: about 250mA @ 5V
Battery capacity: 5000mAh/3.7V, 18.5Wh

Use time: about 10-12 hours, depending on the volume and brightness settings of the machine. Channel saving: 99 channels can be preset, preset radio station name, station frequency and demodulation mode.

Body size: 160 x 86 x 22mm (L x W x H) (without protrusions) Body weight: about, 310g (host only)

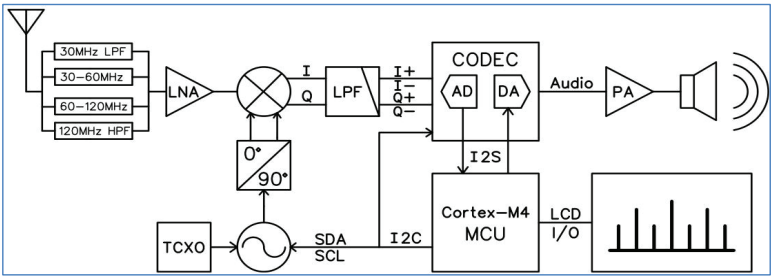
Receiver parameters

RF preamp gain: fixed 20dB Circuit Type: Zero IF ZIF Sideband suppression: ⩾ 55dB

Frequency Range	Sensitivity	Demodulation	
MW:520k~1710kHz	10uV, SINAD 12dB	AM	CW bandwidth : About 800Hz CW side tone : About 800Hz SSB bandwidth : About 2.6kHz AM bandwidth : About 9kHz WFM bandwidth : About 192kHz I/Q bandwidth : About 192kHz
SW:3M~30MHz	1uV, SINAD 12dB	AM	
	0.25uV, SINAD 12dB	SSB/CW	
FM:87M~108MHz	1.5uV, SINAD 12dB	WFM	
	2.0uV, SINAD 20dB	WFM	
AIR:118M~137MHz	2.0uV, SINAD 12dB	AM	

Test conditions: 50-ohm input impedance, preamp 20dB on, AGC

E. Receiver Block Diagram



The clock generator Si5351 generates two quadrature square wave signals with variable frequency as they are excited it creates an ultra-low noise ZIF zero-IF receiver. The IQ signal obtained after mixing is output to the CODEC and collected by the MCU, and the DSP algorithm in the MCU, this completes the demodulation and display of the signal.

Tayloe mixer references: An Ultra Low Noise, High Performance, Zero IF Quadrature Product Detector and Preamplifier.

Frequency of operation

ITU Region 3	Start	Stop	Modulation
Longwave	100,000	300,000	
Medium-wave	300,000	1,800,000	AM
HAM Radio 160 metres	1,800,000	2,000,000	
Medium-wave	2,000,000	3,000,000	
Shortwave	3,000,000	3,500,000	
HAM Radio 80 metres	3,500,000	3,900,000	
Shortwave	3,900,000	5,351,500	
HAM Radio 60 metres	5,351,500	5,366,500	
Shortwave	5,366,500	7,000,000	
HAM Radio 40 metres	7,000,000	7,200,000	LSB
Shortwave	7,200,000	10,100,000	
HAM Radio 30 metres	10,100,000	10,150,000	
Shortwave	10,150,000	14,000,000	
HAM Radio 20 metres	14,000,000	14,350,000	USB
Shortwave	14,350,000	18,068,000	
HAM Radio 17 metres	18,068,000	18,168,000	
Shortwave	18,168,000	21,000,000	
HAM Radio 15 metres	21,000,000	21,450,000	
Shortwave	21,450,000	24,890,000	
HAM Radio 12 metres	24,890,000	24,990,000	
Shortwave	24,990,000	28,000,000	
HAM Radio 10 metres	28,000,000	29,700,000	
Shortwave	29,700,000	30,000,000	
VHF Band	30,000,000	50,000,000	
HAM Radio 6 metres	50,000,000	54,000,000	
VHF Band	54,000,000	64,000,000	
FM broadcast	64,000,000	108,000,000	WFM
Airband Navigation	108,000,000	118,000,000	
Airband Voice	118,000,000	137,000,000	AM
VHF Band	137,000,000	144,000,000	
HAM Radio 2 metres	144,000,000	148,000,000	
VHF Band	148,000,000	149,000,000	

Guidance Notes

The Receiver adopts SDR architecture for its operation, if there is a strong broadcasting station nearby you may experience harmonic interference the phenomenon is also known as mirror radio.

The input impedance of the antenna interface is 50 Ohms. For the medium wave radio mode, it is recommended to connect a dedicated medium wave loop antenna for better matching and listening.

Please observe caution when using the earphone and ensure that the volume level is tuned down before use as a very high level of amplitude can be achieved.