

# **SDR Server (V2)**

# The ultimate software for your SDR station



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# **1** Introduction

Welcome to the second generation SDR console from SDR-Radio.com. This new server takes the technology developed in version 1 and adds many improvements to bring you the most advanced SDR solution available today.

### **1.1 Technology**

The server consists of two components:

- 1. A Windows service,
- 2. A user interface to configure the service.

By using a service the server can run 'lights out'. If your computer is running then the service will be running, it really is that simple.

This user guide describes the server user interface in detail.

#### 1.1.1 Audio

The audio is compressed using the new Opus codec, see <u>http://www.opus-codec.org/</u> for more information. This new codec offers excellent quality and very low latency; features important for the demanding user.

#### 1.1.2 Waterfall

The waterfall data is compressed using an advanced algorithm which is a combination of Huffman, LZSS and delta differences.

#### 1.1.3 Networking

The networking uses two TCP/IP channels: one for command and control, the other for data transport. More information is available later in this document.

# 2 Server Manager

The server manager is started either from the Windows Start menu or the Tools panel in the console's ribbon bar.



The manager is a simple tabbed dialog; the options in each tab will now be explained.

To configure the service you must have administrator privileges enabled.

# **3 Service**

SDR Server version 2.0 build 1373 (64-bit)								
4 Service	Status Accounts Radios Network On Air Logfiles							
Install	Remove     Start     Start							
Service name:	SDR-Radio.com Server							
Display name:	SDR-Radio.com Server							
Data folder:	C:\ProgramData\SDR-RADIO.com\							
Executable :	C:\Program Files\SDR-RADIO-PRO.com\SDRServerService. 📸							
Start type:	$\checkmark$ Start service when Windows starts							
Account:	NT AUTHORITY\LocalService							
Password:								
	U Default Settings							
✓ The s	service is running							
CPU: 0.0%	Size: 99.9 MB On-Air							

This window configures the service, the default settings are recommended.

- > The service uses the LocalService account.
- > Select the 'Start service...' checkbox to start the service when the computer starts.

From Microsoft's website: "The LocalService account is a predefined local account used by the service control manager. It has minimum privileges on the local computer and presents anonymous credentials on the network."

### 3.1 Service

For reference the service properties are shown below:

SDRServerService.exe Properties								
General Compatib	lity Security Details Previous Versions							
Property Description File description Type File version Product name Product version Copyright Size Date modified Language Original filename	Value SDR Server (the service) Application 1.0.0.1 SDR Server Service 2.0 Copyright (C) 2013 by SDR-RADIO.com GmbH 0 bytes English (United Kingdom) SDRServerService.exe							
Remove Properties and Personal Information								
	OK Cancel Apply							

# 4 Status

	SDR Server version 2.0 build 1373 (64-bit)															
4		Serv	ice St	atus	Accounts	Rad	ios N	letwork	On Ai	r Log	files	Help				⊳
	Q Registry Width															
E.	:	Addre	83				τ	Jser	Time On			Elapsed	Radio			•
1		LAN>	iFive (	192.168	3.5.112	)	3	Simon	2013-05	-03 22:	02:54	0:00:41	Perseus	1.0, 0398	1-21	
2	2	LAN>	STAR-TR	EK-ROCH	KS (192	.168.5.	100) :	Simon	2013-05	-03 22:	03:28	0:00:07	NetSDR,	KV000005,	192	
3	8															Ξ
4	ł															
:	5															
•	5															
1																
8																Ψ.
					1	1									•	
ŧ	-	Total	Input	FFT	UDP	VFO-A	VFO-B	VFO-C	VFO-D	VFO-E	VFO-I	7				^
1		0.12%	0.00%	0.00%	0.00%	0.12%	0.00%	0.00%	0.00%	0.00%	0.009	,				
2	2	0.60%	0.07%	0.02%	0.00%	0.41%	0.01%	0.01%	0.03%	0.03%	0.039	1				
	3															=
4	ł															
	5															
															ļ	
	, ,															Ŧ
	CPU	: 1.1%			Size	: 535.9 N	IB			On-/	Air					

This window is display only, it shows the current connections and the CPU used by the main threads of each connection.

- Select Registry to start the registry editor opened at the folder where the settings are stored.
- > Select Width to fit the column widths to the displayed data.

# **5** Accounts

SDR	SDR Server version 2.0 build 1373 (64-bit)									
	Service	Status	Accounts	Radios	Network	On Air	Logfiles 🕨			
Ad	Add Edit Delete									
Enable	Userna	Comme	ent							
	Monty Robin	In Amer	rica							
👿 👻	Simon	Heroic S	Spiderman							
CPU: 0.	0%		Size: 5	38.3 MB			On-Air			

Every connection uses an account.

### 5.1 Add

### 5.1.1 Basic

Account		x
Basic	Basic information	
Data Recording		
Time Limits	Super user	
Help	Username: Simon	
	Password: Strong	
	Show characters	
	Comment: A very harassed programmer	ן ר
	OK Cance	el 🛛

The Basic screen displays the main fields:

Enabled,

- Super user (for future use),
- Username,
- > Password (select 'Show characters' to display the password),
- Free-format comment.

The password strength is computed in accordance with Google's recommendations, for more information <u>https://accounts.google.com/PasswordHelp</u>.

#### 5.1.2 Data Recording

Account	
Basic	Data recording folders
Data Recording	✔ Enable data file (IQ) recording
Time Limits	Data file storage folders
Help	X:\RemoteDataRecordings V:\Recordings \\NAS-002\Recordings\MW 2012-04-18 to 2012-04-19 Overni X:\Data Recordings\10MHz Wide
	OK Cancel

Select 'Enable data file...' to enable data recording from the console.

Create one or more data file storage definitions. The console user can create recordings in any of these folders.

#### 5.1.3 Time Limits

Account	• • • • • • • • • • • • • • • • • • •
Basic	Time limit management
Data Recording	Maximum connection time:
Time Limits	2 hours V
Help	Minimum interval between reconnection:
	OK Cancel

Use this screen to restrict the connection time and the reconnection interval. If the reconnection interval is set to 10 minutes then at least ten minutes must elapse before the user can reconnect.

# 6 Radios

BDR Server version 2.0 build 1377 (64-bi	t)		_ 🗆 🗙
Service Status Accounts Rai	dios Netv	vork On Air	Logfiles 🕨
Search Add Edit	Delete		
Afedri-SDR (LAN) Afedri-SDR (USB) Ettus Research (all models)	oftRock SDR	Frequency 0 - 30 MHz 0 - 50 MHz	Serial 03981-2107-5FAE F50000044DED10
FUNcube Dongles Microtelecom: Perseus Pappradio	/FM dongle	80 - 2000 MHz 0 - 50 MHz 0 - 50 MHz	00000577 LD000047 KV000005
RFspace: NetSDR and SDR-IP RFspace: SDR-IQ and SDR-14		0 - 50 MHz 0 - 50 MHz 0 - 50 MHz	IV001292
RTL SDR (TCP) RTL SDR (USB) SDR MK1.5 Andrus		0 - 50 MHZ	EEKIBK20P
SoftRock (Si570) SoftRock (XTAL)			
CPU: 0.0% Size: 0.0	МВ		On-Air

Here you maintain a list of radios the user can start. You either search automatically or add manually.

Each radio definition contains a Range field – this is the frequency range displayed in the Frequency Explorer in the console. After using Search you must check the range and make any changes as necessary.

### 6.1 Search

Select *Search*, and then select an option from the dropdown menu. The software searches for radios matching the search criteria and prompts you to add the new definitions to the list.

After adding new definitions you can change the definition name and frequency range by highlighting an entry and pressing Edit.

### 6.2 Add

This window is used to add definitions for Ethernet radios, only use it if you cannot find the radio using the search option.

Radio Defin	ition		x			
DII:	RFspace: NetSDR and SDR-1 💌	Add New	-			
Title:	NetSDR	New definitions can only be added for				
Model:	Basic	<ul><li>selected ethernet radios:</li><li>Afedri,</li></ul>				
Serial:	XY0011345Z					
Address:	201.42.12.33	RFspace netSDR and SDR-IP,     SDB MI11 F Andrew				
Port:	50000	SDR MK1.5 Andrus.				
Options:	None	Only use this option if a radio cannot be				
		discovered using the search option.				
Range:	0 • to: 50 • MHz	The Title and Model fields are mandatory.				
ОК	Cancel	Edit	Ŧ			

### 6.3 Edit

Radio Defir	ition	-	X
DII:	RFspace001	Add New	
Title:	NetSDR (X2)	New definitions can only be added for	
Model:	NetSDR	selected ethernet radios:	=
Serial:	KV000005	• Afedri,	
Address:	192.168.5.107	RFspace netSDR and SDR-IP,     SDR Mk1 5 Andrus	
Port:	50000	S SER MIKES AND US.	
Options:	Sound enabled, Reflock	Only use this option if a radio cannot be	
		discovered using the search option.	
Range:	0 ▼ to: 50 ▼ MHz	The Title and Model fields are mandatory.	
ОК	Cancel	Edit	Ŧ

Here you can change an existing definition:

- > Address is the radio address in dotted format.
- > Port is the port used by the radio for incoming commands.
- > Range is the frequency range displayed in the frequency explorer in the console.

# 7 Network

### 7.1 Connections

SDR Server version 2.0 build 1373 (64-bit)	
4 Service Status Accounts Radios Network On Air	Logfiles 🕨
Connections Bandwidth Audio Codec	₽
Incoming Connections (TCP/IP)	
Listen on: Any (recommended)	
Port: 7999 Default port is 7999	
Windows Firewall Control Panel	
Refresh Add Port Windows Firewall is Off	
CPU: 0.0% Size: 0.0 MB	On-Air

You cannot change these values while the service is started.

These options control incoming connections:

- > Listen on either any network address or just a single address,
- > The port number for incoming connections (default is 7999).

If your computer has more than one network adapter – for example Wi-Fi and wired it makes sense to only allow incoming connections on the wired connection as this is less prone to interruptions.

### 7.2 Bandwidth



Here you adjust the FFT (waterfall) data for both WAN and LAN connections.

- > FFT size: the number of data points sent for each line shown in the waterfall.
- > Resolution: the number of bits per data point.
- > Max lines/second: the maximum number of waterfall (FFT) lines per second.
- Max queue size: the maximum number of unsent messages before bandwidth throttling algorithms are used. When the unsent message queue size exceeds this value waterfall (FFT) data is discarded first, then audio data.

To reduce the network bandwidth use lower values for FFT size, Resolution and Max lines/second.

### 7.3 Audio Codec



This software uses the Opus Interactive Audio Codec to reduce network bandwidth when sending audio between the server and the console. For more information about Opus visit <a href="http://www.opus-codec.org/">http://www.opus-codec.org/</a>.

There are various options which can be set in the encoder (runs on the server), these are described below.

The opus encoder supports three coding modes (the default used in the server is OPUS\_APPLICATION\_AUDIO):

- VOIP gives best quality at a given bitrate for voice signals. It enhances the input signal by high-pass filtering and emphasizing formants and harmonics. Optionally it includes in-band forward error correction to protect against packet loss. Use this mode for typical VoIP applications. Because of the enhancement, even at high bitrates the output may sound different from the input.
- Audio gives best quality at a given bitrate for most non-voice signals like music. Use this mode for music and mixed (music/voice) content, broadcast, and applications requiring less than 15 ms of coding delay.

The encoder supports a hint which helps the encoder's mode selection (the default used is OPUS\_AUTO):

- Auto (default)
- Voice Bias thresholds towards choosing LPC or Hybrid modes.

- Music Bias thresholds towards choosing MDCT modes.
- Maximum bitrate, default value is 40 kbps.

These values cannot be changed:

- The encoder's expected packet loss percentage is set to 1%.
- Complexity is set to the highest complexity (uses most CPU, produces best results), the value is 10.

# 8 On-Air

💹 SDR Server	version 2.0 b	ouild 1373 (6	4-bit)						X
4 Service	Status	Accounts	Radios	Network	On Air	Logfiles	Help		⊳
🔽 Enable upd	ates	Save	SDRSp	ace Serve	er IP Addres	ss required			^
On-Air Server	(Upload)				Wha	t is On-Air	.7		
Address:	http://v2space	e.wces.net/sd	rshare.asp	ĸ	vviia				
Username:	sername: simon You			You	You enable the optional On-Air support to				
Password:	ord: a2d7704d34			make	make your server visible on a public or				
					of vo	our server	and car	connect with just a	
Default Server	r Account (Opti	onal)			few	keystroke	s.	· · · · · · · · · · · · · · · · · ·	=
Username:	Guest				Who	n anablad	undata	a ara cont	
Password:	FortKnox				appr	oximately	everv t	en seconds to the	
					cent	ral server.	,-		=
Station Descri	ption				0	Vin Com (on			
Name:	Server Crates				Un-4	Air Server			
IP address:					The a	address of	the we	bpage to which the	
Lat/Lon:	46.812500 9.291667		serve	server information is uploaded. You will					
					alloc	ated eithe	er by the	e system administrator	
Homepage:	www.sdr-radi	o.com			(inte	rnal websi	ites) or	by registering (public	
Antenna:	Pixel Technolo	ogies RF PRO-	18		sites	).			
Location:	Laax, Switzer	land			Defa	ult Server	Accou	nt	
Comment:	Welcome to n	ny SDR radio							÷ [
CPU: 0.0%		Size:	0.0 MB			On-Air			*

#### What is On-Air?

You enable the optional On-Air support to make your server visible on a public or private website so other users see the status of your server and can connect with just a few keystrokes.

When enabled updates are sent approximately every ten seconds to the central server.

#### On-Air Server

The address of the webpage to which the server information is uploaded. You will need a Username and Password which are allocated either by the system administrator (internal websites) or by registering (public sites).

#### **Default Server Account**

Optionally supply the Username and Password for a server account (see Accounts tab in this program).

#### Station Description

Here you provide information about your station configuration. The IP address is important - this is your public IP address.

Latitude and Longitude are in decimal degrees.

The URL is an optional website where other users see details about your station.

# 9 Logfiles

## 9.1 Session

🔣 SDR Server version 2.0 build 1373 (64-bit)
Service Status Accounts Radios Network On Air Logfiles
Show on-air updates
2013-05-04 07:09:56, SDR Server Service 2.0 build 1373
2013-05-04 07:09:56, C:\Program Files\SDR-RADIO-PRO.com\SDRServerSe 2013-05-04 07:09:56, May 1 2013 16:00:27
2013-05-04 07:09:56, Data folder C:\ProgramData\SDR-RADIO.com\ 2013-05-04 07:09:56, Product folder C:\Windows\ServiceProfiles\Loca
2013-05-04 07:09:56, Mapped logfile 16,384 KB
2013-05-04 07:09:56, Max server connections 10
2013-05-04 07:09:56, Max VFOs per server 6
2013-05-04 07:09:56, COM CoInitialize success
2013-05-04 07:09:56, IPP ippEnableCpu, ippStsNoErr: No error, it's
2013-05-04 07:09:56, ippInit, ippStsNoErr: No error, it's
2013-05-04 07:09:56, ippStaticInit, ippStsNoErr: No error, it's
2013-05-04 07:09:56, IPP library ippsy81.lib+
2013-05-04 07:09:56, version 6.1 build 137.36
2013-05-04 07:09:56, build Sep 28 2009
2013-05-04 07:09:56, CPU is high power -
CPU: 0.0% Size: 0.0 MB On-Air

The session logfile shows detailed information since the service started. If on-air updates are enabled and you select the 'Show on-air updates' checkbox then the updates are added to the session logfile for the next five minutes.

### 9.2 History

SDR Server version 2.0 b	uild 1373	(64-bit)		
	Accounts	Radios N	etwork	On Air Logfiles 🕨
	Geo Lo	cation		⊳
	08::2	21::03z		
Timestamp (UTC)	User A	ddress	#	Action 🔺
2013-05-01 19::00::39	Simon 1	92.168.5.112	206	Starting Perseus 1
2013-05-01 19::01::45	Simon 1	92.168.5.112	206	Stopping Perseus 1
2013-05-01 19::01::46	Simon 1	92.168.5.112	206	Disconnected
2013-05-01 19::21::13	1	92.168.5.112	207	Connected, locatio
2013-05-01 19::21::14	Simon 1	92.168.5.112	207	Login
2013-05-01 19::21::18	Simon 1	92.168.5.112	207	Starting Perseus 1
2013-05-01 21::05::30	Simon 1	92.168.5.112	207	Stopping Perseus 1
2013-05-01 21::05::31	Simon 1	92.168.5.112	207	Disconnected
2013-05-03 20::02::45	1	92.168.5.112	208	Connected, locatio
2013-05-03 20::02::46	Simon 1	92.168.5.112	208	Login
2013-05-03 20::02::52	Simon 1	92.168.5.112	208	Starting Perseus 1
2013-05-03 20::03::20	1	192.168.5.100	209	Connected, locatio
2013-05-03 20::03::20	Simon 1	192.168.5.100	209	Login
2013-05-03 20::03::28	Simon 1	92.168.5.100	209	Starting NetSDR, $\mathbf{K}$
2013-05-03 20::03::39	Simon 1	92.168.5.100	209	Stopping NetSDR, e
2013-05-03 20::03::39	Simon 1	192.168.5.100	209	Disconnected
2013-05-03 20::31::16	Simon 1	92.168.5.112	208	Stopping Perseus 1 👻
•				4
CPU: 0.0%	Size	e: 99.6 MB		On-Air

A history of connections made to server and radios started.

### 9.3 Geo Location



This product includes GeoLite data created by MaxMind, available from <a href="http://www.maxmind.com">http://www.maxmind.com</a>.

Optionally use these free IP geolocation databases to discover information about a specific IP address, this is shown in the Status window. The database files are in csv format, downloadable from http://dev.maxmind.com/geoip/geolite . The databases to download are:

- ➢ GeoLite City (CSV/zip), and
- ➢ GeoLite Country (CSV/zip).

Unpack the contents of these files to a folder on your computer, and then select these files in the fields above. The default filenames are:

- GeoLiteCity-Blocks.csv
- GeoLiteCity-Location.csv
- IpToCountry.csv

The files are copied to this product's installation folder. After importing you must stop and start the service.

# 10 Help

### **10.1 Firewall**

This software uses two TCP connections for communicating between the console and server, also some radios such as the Net-SDR use TCP and UDP, so you must open up the correct ports in your firewalls.

#### 10.1.1 Console

The console connects to the server using TCP, the default port is 7999 (the port is shown in the Network Connection window on the server).

• TCP outgoing on port 7999

#### 10.1.2 Server

The server accepts TCP connections on port 7999 (as selected in the Network Connection window on the server).

• TCP incoming on port 7999

#### 10.1.3 Radios

Ethernet-based radios use TCP and/or UDP so you must know which ports are being used.

#### 10.1.3.1 RFspace

The RFspace Net-SDR and SDR-IP use the same port for incoming TCP connection and outgoing UDP packets, the default is 50,000. This port assignment is user-configurable.

- TCP outgoing on port 50,000
- UDP incoming on port 50,000

#### 10.1.3.2 Ettus Research

The Ettus radios use a default port of 49152 for UDP control and receiving UDP packets. This port assignment is user-configurable.

• UDP outgoing and incoming on port 49152.

# **11 Network Protocol**

All networking uses TCP/IP. The console creates two connections with the server:

- Command and status,
- > Audio and FFT data.

Although one connection could be used the aim is to have the audio streaming with the lowest possible latency, hence the two-channel approach. Nothing which is sent on the command channel affects the data channel.

The information presented here is by no means complete; it servers only to outline the technology used. If necessary the exact protocol and message formats will be documented at a later date.

### **11.1 Command Channel**

All commands are sent as UTF-8 XML, the XML is compressed using Lempel–Ziv–Storer– Szymanski (LZSS) to reduce bandwidth.

The messages sent are:

- Connection
  - Ack, sent by the console every 500 milliseconds as a keep alive message.
     The message contains a timestamp used to determine the round trip time.
  - Login, sent when establishing a connection.
  - $\circ$  UpdateDemod, updates the demodulation options for a VFO channel.
- Radio
  - Start, sent when starting a radio.
  - Stop, sent when stopping a radio.
  - UpdateRadio, update the radio settings such as RF gain.
- Data (IQ) Recording
  - RecorderStart, starts data (IQ) recording on the server.
  - RecorderStop, stops data (IQ) recording on the server.
- Data (IQ) Playback
  - PlaybackFiles, server returns a list of recordings for a specific folder.
  - PlaybackFileInfo, server returns detailed information for a specific recording file.
  - PlaybackFileGain, adjusts the gain in the player.

- PlaybackFilePause, pauses playback.
- PlaybackFileRepeat, sets the repeat option for the player.
- PlaybackFileSpeed, adjust the playback speed (supplies feedback and rate information required for smooth playback).
- PlaybackFileStart, starts playback.
- PlaybackFileStop, stops playback.
- Radio Settings
  - GetDialogOptions
  - SetDialogOptions

### **11.2 Data Channel**

The data channel is used by the server to send audio and waterfall (FFT) data to the console.

The audio is compressed using Opus, the FFT data is compressed using an advanced algorithm which is a combination of Huffman, LZSS and delta differences.

If there is insufficient bandwidth waterfall data is dropped to keep the audio flowing.

# **12 Troubleshooting**

# 12.1 Compatibility

The version 2 server is only compatible with the version 2 console.

### 12.2 Firewalls

Beware of firewalls, for more information see page 23.

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