



Software Defined Radio – SDR

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Agenda

- **Speaker Introduction**
- **Topic Introduction**
- **SDR – Definition**
- **SDR – Demonstration**
- **Useful Links**
- **Speaker Contact for Q&A**

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- Amateur Extra Class Radio Licensee
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Software Defined Radio - SDR

Definition:

A **software-defined radio (SDR)** system is a **radio** communication system which uses **software** for the modulation and demodulation of **radio** signals. An **SDR** performs significant amounts of signal processing in a general-purpose computer, or a reconfigurable piece of digital electronics.

Software Defined Radio

The SDR Concept

The IEEE defines a software-defined radio as a “radio in which some or all of the physical layer functions are software-defined.” Physical-layer functions include, but are not limited to, tuning, antenna diversity, down conversion, synchronization, modulation and demodulation.

In other words, an SDR is to a physical transceiver what a Virtual Machine (VM) is to a physical server. The properties of an SDR can be modified dynamically similar to the way a VM can dynamically alter RAM, #CPU's, disk space and peripherals.

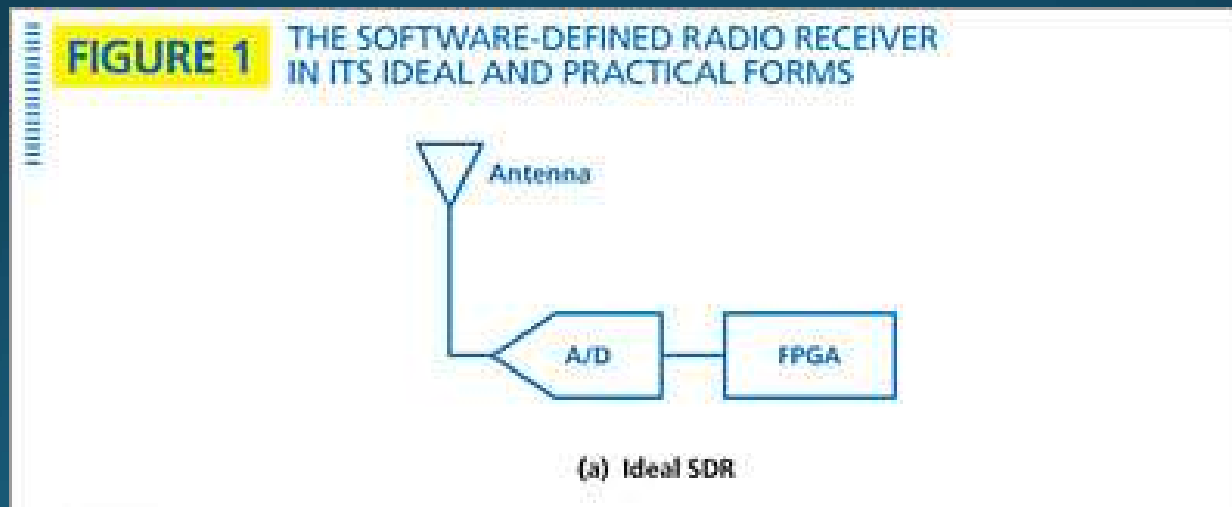
Conventional Radio vs. SDR

- Conventional radio systems - Composed mostly of hardware, and as such cannot easily be re-configured.
- SDR is a wireless communication system with the ability to reconfigure by changing the software used to implement functions typically done by hardware in a conventional radio.

In an SDR transmitter, software is used to implement different types of modulation procedures, while analog-to-digital converters (ADCs) and digital-to-analog converter (DACs) are used to change from one type of signal into another. Typically, an SDR receiver uses an ADC to change the analog signals from the antenna into digital signals that are processed using software on a general-purpose processor.

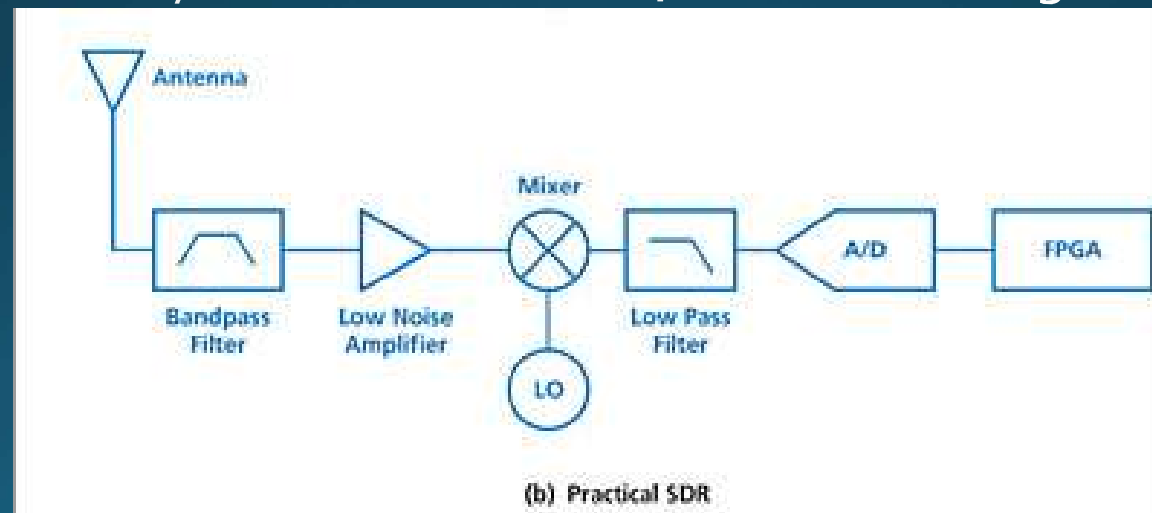
Software Defined Radio

The Holy Grail for software radio designers is a device with the antenna connected directly to an analog-to-digital (A/D) converter, as shown in Figure 1(a). In this idealized implementation, the radio signal immediately is digitized and there are no hardware-specific components. In other words, one hardware platform handles all frequencies and all airlink standards.



Software Defined Radio

The receiver of Figure 1(a) cannot be realized in practice. The A/D converter does not have infinite bandwidth or infinite dynamic range, and all A/D converters have poor noise figures. Contemporary land-mobile-radio receivers employ a bandpass filter and low noise amplifier (LNA) in front of a conventional superheterodyne downconverter, as shown in Figure 1(b).



The Traditional Transceiver

A traditional HF/UHF/VHF transceiver has many dials, knobs and switches and lacks a waterfall display but may have analog meters



Current Production SDR

Here is an image of a current model of SDR manufactured by Flex Radio in Austin, TX.

- Note – There is no display, dials or knobs on the radio



SDR Controls and Display

The display and controls for the SDR transceiver are provided by

- Connecting it to a computer
- Using a specially designed front panel (additional cost)

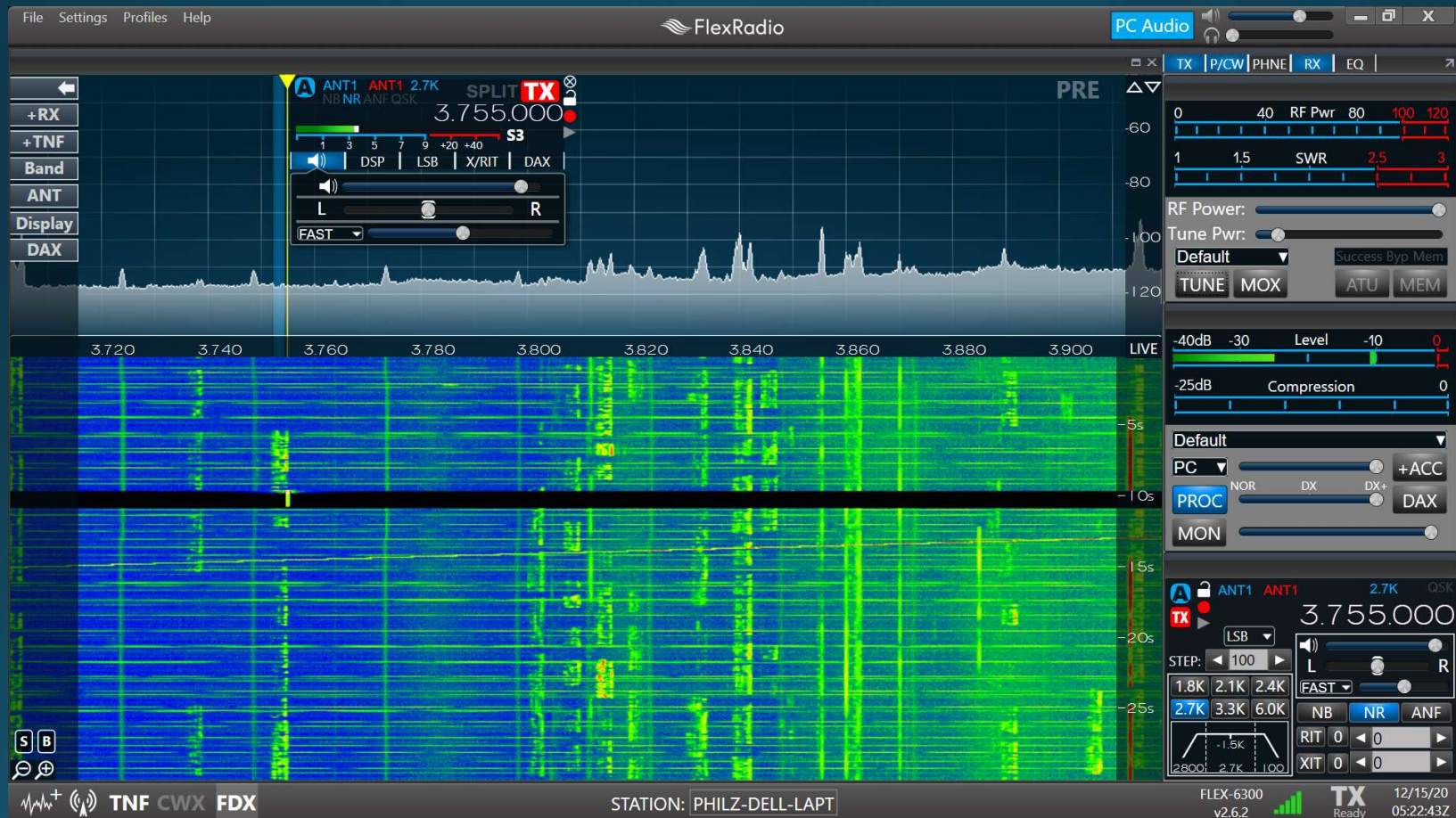


Traditional Transceiver vs. SDR

Comparing a traditional transceiver with the current SDR offering from Flex Radio



SDR Controls and Display – Rec/Xmit

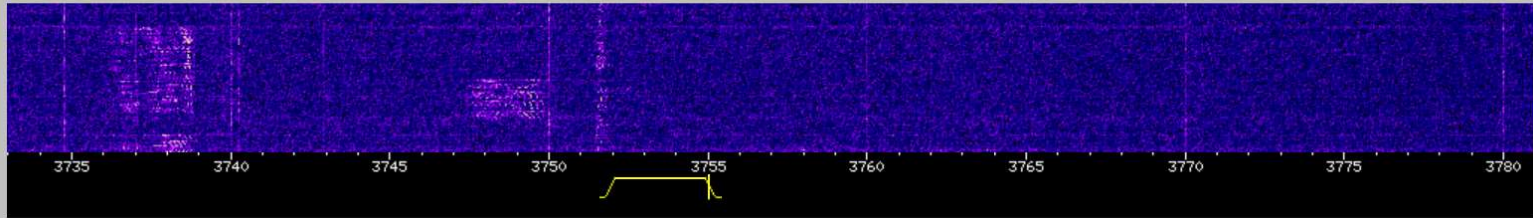


Web SDR Controls and Display (Rec)

Your name or callsign:

View: all bands others slow one band blind Allow keyboard:

Waterfall: Java HTML5 Sound: Java HTML5 [Chrome audio start](#)




0524 UTC 2324 Local (Your computer)

Frequency: kHz Mode: **LSB**

160 80cw 80ph 75ph 40cw 40ph 20cw 20ph

Or tune by clicking/dragging/scrollwheel on the frequency scale.

Memories: (new)



-89.7 dBm avg; -83.5 dBm peak

Mute Squelch Notch1
 Notch2 High Boost
DSP Noise Reduction:
Audio buffering:
Buffering may help with drop-outs and/or slow connections.
Volume:

Audio recording:

Signal strength plot:

Mode/Bandwidth:
2.80 kHz @ -6dB; 3.26 kHz @ -60dB.



PassBand Tuning (PBT):

Or drag the passband edges on the frequency scale. PBT & IF Shift code by Weert Websdr.

Waterfall view:

Or zoom with scrollwheel.

http://www.websdr.org/

<p>WebSDR Wismar (Germany) by DO7AX http://dlwis-websdr.ham-radio-op.net:8901/ JO53RV; 31 users</p>	3.188 - 4.212 MHz	84m Delta Loop 1.6-32MHz bandpass filter, RTL-SDR and a Ham It Up Plus HF Upconverter
	6.578 - 7.602 MHz	
	13.688 - 14.712 MHz	
	144.788 - 145.812 MHz	
	438.288 - 439.312 MHz	
 <p>WebSDR in C3 Ordino - ANDORRA PRINCIPALITY - ARDAM Ham Radio Association - RX 4 pcs FuncubeDongle Pro+ http://sdr.radioandorra.org/ JN02SN; 25 users</p>	7.008 - 7.200 MHz	Half wave Dipole.
	5.262 - 5.454 MHz	Short dipole.
	3.610 - 3.802 MHz	Half wave Dipole.
	14.043 - 14.235 MHz	
<p>KFS WebSDR HF receiver system on the Pacific coast south of San Francisco http://69.27.184.62:8901/ CM87j; 45 users</p>	1.804 - 1.996 MHz	"Omni" (TCI 530 LP) w/preamp
	3.450 - 3.642 MHz	"Omni" (TCI 530 LP)
	3.620 - 3.812 MHz	
	3.810 - 4.002 MHz	
	6.943 - 7.135 MHz	Switched between "Omni" (TCI 530) and "SE Sector" (TCI 527B @ 135 deg.)
	7.125 - 7.317 MHz	
	13.990 - 14.182 MHz	"Omni" (TCI 530 LP)
14.165 - 14.357 MHz		
<p>Home of K3FEF and W3TKP in Milford, Pennsylvania, NE USA. 160/80/40/30/20/17M and more! http://websdr.k3fef.com:8901/ FN21mh; 42 users</p>	0.000 - 2.048 MHz	130 ft Long Wire
	3.276 - 5.324 MHz	ZS6BKW w/ RPA-1Plus LNA
	5.326 - 7.374 MHz	
	8.876 - 10.924 MHz	
	10.976 - 13.024 MHz	
	13.476 - 15.524 MHz	
	16.576 - 18.624 MHz	
 <p>160m, 60m, 80m, 40m and 17m SDR's from Nantwich in Cheshire http://backgreensdr.org:8901/ IO83RA; 53 users</p>	1.804 - 1.996 MHz	204 foot long double size G5RV
	3.600 - 3.792 MHz	
	5.237 - 5.428 MHz	
	7.008 - 7.200 MHz	
	14.130 - 14.322 MHz	
	18.019 - 18.211 MHz	
<p>RW3PS websdr in Tula, Russia http://tulasdr.fids.ru:8901/ KO84ND; 57 users</p>	1.353 - 2.377 MHz	Inverted V and RTL-SDR V3
	2.626 - 4.674 MHz	Inverted V and SDRplay RSP1A
	6.972 - 7.228 MHz	

SDR – Software Defined Radio

Demo

<https://youtu.be/zlpEx9Mr-Jc>

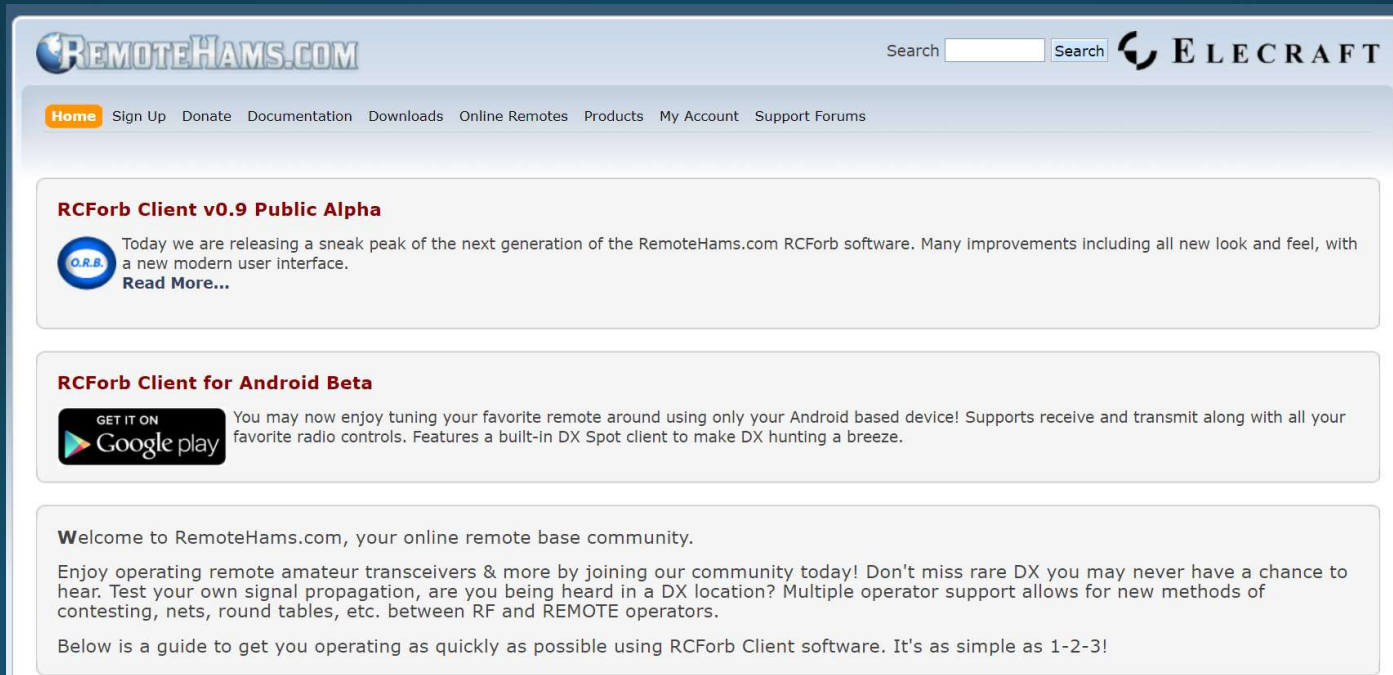
SDR – Alternatives

Web Accessible Transcievers -RemoteHams
<http://remotehams.com/>

PC/Phone/Tablet Transceiver -EchoLink
<https://secure.echolink.org/>

RemoteHams – <http://remotehams.com/>

- Web based listing of Amateur Radios accessible over the internet



The screenshot shows the homepage of RemoteHams.com. At the top left is the logo "REMOTEHAMS.COM". To the right is a search bar with the text "Search" and a "Search" button, followed by the "ELECRAFT" logo. Below the logo is a navigation menu with links: Home (highlighted), Sign Up, Donate, Documentation, Downloads, Online Remotes, Products, My Account, and Support Forums. The main content area features three sections:

- RCForb Client v0.9 Public Alpha**: A blue circular icon with "O.R.B." inside. Text: "Today we are releasing a sneak peak of the next generation of the RemoteHams.com RCForb software. Many improvements including all new look and feel, with a new modern user interface. [Read More...](#)"
- RCForb Client for Android Beta**: A "GET IT ON Google play" badge. Text: "You may now enjoy tuning your favorite remote around using only your Android based device! Supports receive and transmit along with all your favorite radio controls. Features a built-in DX Spot client to make DX hunting a breeze."
- Welcome to RemoteHams.com, your online remote base community.**
Enjoy operating remote amateur transceivers & more by joining our community today! Don't miss rare DX you may never have a chance to hear. Test your own signal propagation, are you being heard in a DX location? Multiple operator support allows for new methods of contesting, nets, round tables, etc. between RF and REMOTE operators.
Below is a guide to get you operating as quickly as possible using RCForb Client software. It's as simple as 1-2-3!

RemoteHams – Steps to Use

Step 1 - Sign Up



The first step is to register for an account. This will allow you to access our forums, gain access to remotes, join clubs and interact with the community!

[Sign Up](#)

[Click Here to Sign Up](#)

Use your callsign as your username!

Step 2 - Download RCForb Client



Do you want to remotely control a ham radio site? RCForb Client v0.8 is now available with lots of new features and layout! Some of the new features include new Skin Editor, CW Keying, Rotator Support, new DX Spots engine and more!

[Download](#)

Minimum Requirements:

- Windows XP, Vista, 7 or 8
- .NET Framework 4.0
- Adobe Flash Player Active X
- 1.0 GHz CPU
- 1GB RAM

Step 3 - Login, Select a Remote and Enjoy!



On first load, RCForb Client will ask for you to login and will remember your login details. The program will load into a "lobby" view. Double-click on a remote in the lobby and you're off!

After playing with the client and familiarizing yourself with how to operate a remote station using RCForb Client, you may want to setup a remote of your own.

Step 4 - Help the Community Grow, Share Your Radio



Help the community grow by sharing your radio. Build a multi-op club remote station or have fun sharing your remote with your friends! You have full control over all security. RCForb Server supports radios, amps, rotators and switches providing the ability to remote your whole shack with a single piece of software.

[Download](#)

Minimum Requirements:

- Windows XP, Vista, 7 or 8
- .NET Framework 4.0
- 1.0 GHz CPU
- 1GB RAM

RemoteHams – List of Stations

The screenshot displays the RemoteHams software interface. At the top, there are tabs for 'Audio', 'Control Devices', 'Virtual Devices', and 'Layout'. Below these are various controls for speakers (SPKR), microphone (MIC), volume (VOL), and buffering (CONFIG). The main area features a search bar and a table of stations. The table has columns for Orb Id, Remote Station, Radio, City, State, and Country. Below the table, there are statistics for online users and a 'Default Sorting' option. On the right side, there are panels for 'Relay', 'Amp', and 'Rotator'. At the bottom, there are 'Chats' and 'MACROS' sections.

Orb Id	Remote Station	Radio	City	State	Country
14476	K5KNM	TS-590	Rio R...	NM	USA
8993	KJ4TN- IC-7300- BIRMINGHAM, AL	Ic-7300	Birmin...	AL	United St...
4109	W6RYO TS-870	TS-870	Alta L...	CA	United St...
9174	K6IXA	TS-2000	Atwa...	CA	United St...
8543	KI6RRN 2m	Icom	La Mesa	CA	United St...
2398	N6ID Club Radio Elecraft K3s www.n6ij.org	K3	Marina	CA	United St...
18298	WD6R	FT-1000D	Newb...	CA	United St...
46	WA6LIE's Elecraft K3	K3	Salinas	CA	United St...
9740	vvv	Ic-7600	Salinas	CA	United St...
10236	WA6LIE's FT-857 VHF/UHF only	FT857	Salinas	CA	United St...
15849	K0D	Enter m...	Salinas	CA	United St...

Online: 290 | RX: 85 | TX: 205 | Clubs: 179 | Non-Clubs: 111 | Synchronized @ 11:55 AM

Chats: [Empty chat window]

MACROS: CQ, TU, SNN, CALL, F5, F6, F7, F8

RemoteHams – Control of a Station

The screenshot displays the RemoteHams software interface, which is used for controlling a radio station. The interface is divided into several sections:

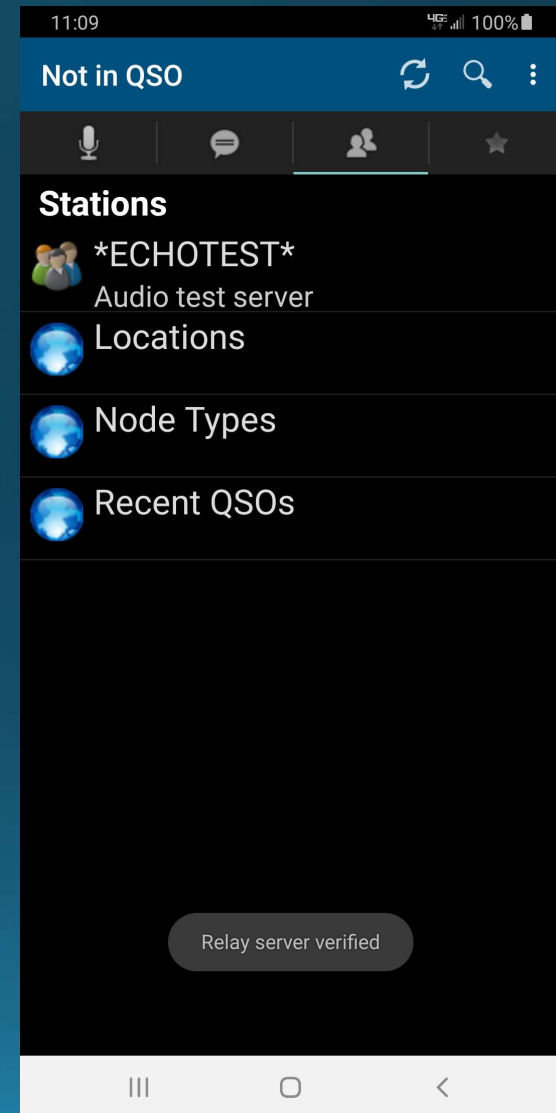
- Top Panel:** Includes tabs for "Audio", "Control Devices", "Virtual Devices", and "Layout". It features sliders for "VOL" and "MIC", and buttons for "ON" and "OFF".
- Left Panel:** Contains a "Number Pad" and "Bands" section.
- Center Panel:** The main control area, featuring a digital display showing "2021/3/5 星期五 01:53:59" and "ic-7600". The display also shows "TOT: 180 seconds" and "58". Below the display are various control buttons and sliders, including "NB Level" (33%), "NR Level" (53%), and "Notch" (55%).
- Right Panel:** Contains a "Relay" section, an "Amp" section, and a "Rotator" section.
- Bottom Panel:** Includes a "Chats" section with a message: "[System | 2021-03-05 01:53:50 +08:00] Club only .ANT2". It also has a "Send ASK Help" button and a "MACROS" section with buttons for "CQ", "TU", "SNN", "CALL", "F5", "F6", "F7", and "F8".

RemoteHams - Requirements

- Download the application
- Install the Client
- Upload “Official Copy” of FCC license for transmit
- Open the application
- Select a station
- May require permission from the owner to control or transmit

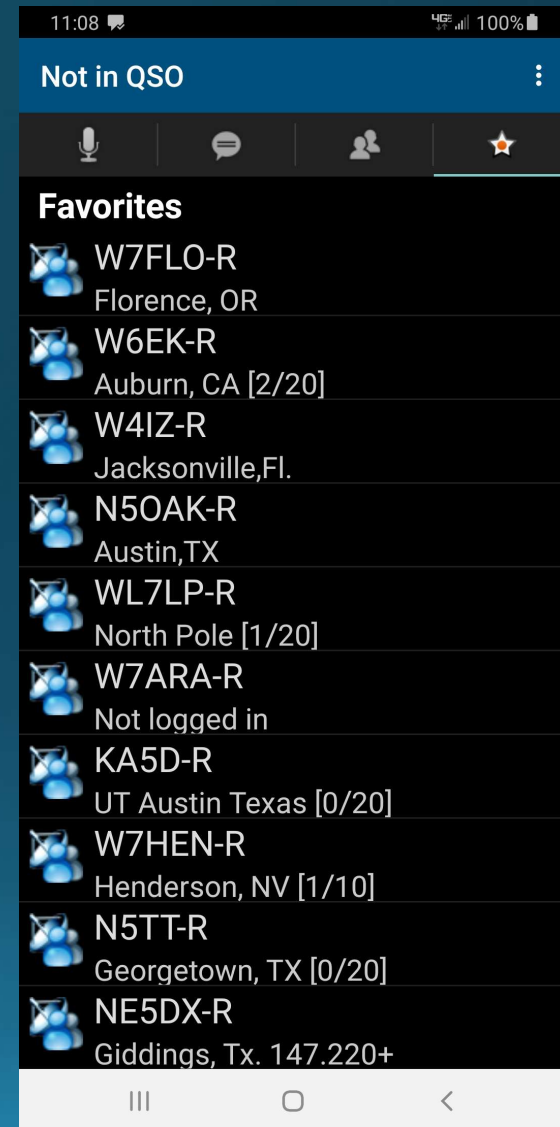
Echolink – Logged In

- Opening screen
- Allows for searching (magnifying glass)
- Previous stations (QSOs)



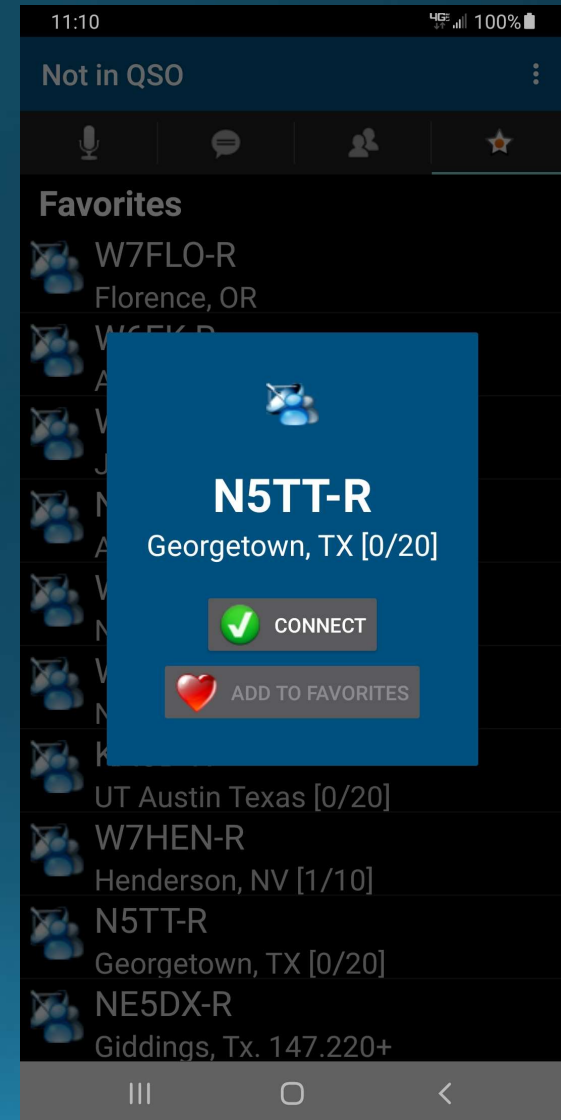
Echolink – Station List

- Showing a list of stations online



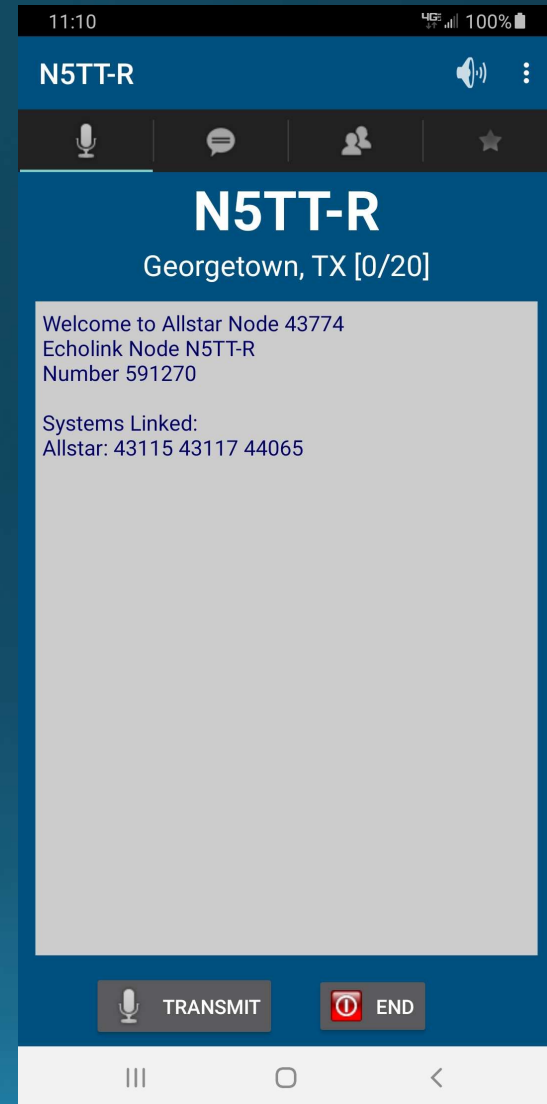
Echolink – Connecting

- Connecting to a node (N5TTR)
 - Shows no other connections [0/20]
 - Shows location, Georgetown, TX



Echolink - Connected

- Showing connected to N5TT-R
 - Echolink Node Number (591270)
 - Allstar nodes also connected
 - 43115
 - 43117
 - 44065
- Currently in "Receive" mode
- Able to "Transmit"
 - "TRANSMIT" button shown



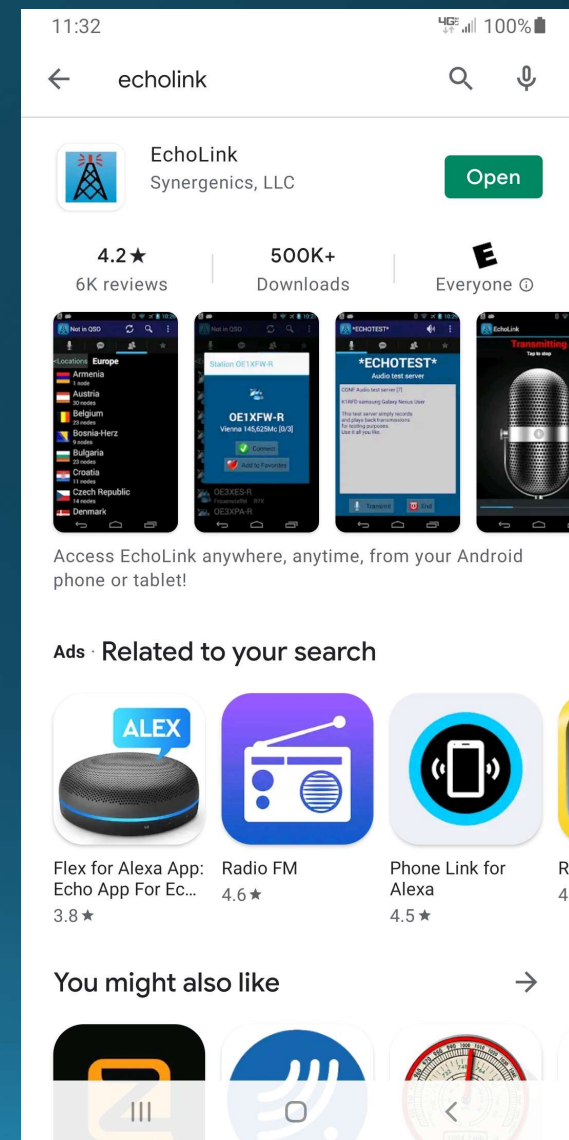
Echolink - Transmitting

- Shown currently transmitting
 - Tap microphone image to stop transmitting



Echolink - Requirements

- Any FCC Amateur Call Sign
- Download the application
- “Register” with an email address
- Respond to email from EchoLink
- Upload “Official Copy” of FCC license
- Receive confirmation from EchoLink
- Open application and use EchoLink



Useful Links for Software Defined Radio

- Web SDR's – <http://www.websdr.org/>
 - <http://websdr.k3fef.com:8901/>
 - <http://69.27.184.62:8901/>
 - <http://sdr.n4but.com/>
 - <http://na5b.com:8901/>
- Featured SDR – Flex Radio
 - <https://www.flexradio.com/>
- SDR Wiki
 - https://en.wikipedia.org/wiki/Software-defined_radio

Questions?

Thank you !



- Phil Bautista – AA5EX
 - KG5UFE@GMAIL.COM
 - <https://www.qrz.com/db/AA5EX>

RemoteHams – <http://remotehams.com/>

- RemoteHams application – Listing of stations

The screenshot shows the RCForb (Online Remote Base) application interface. The window title is "RCForb (Online Remote Base) by RemoteHams.com". The interface includes a menu bar with "File", "Options", and "Upload Amateur Radio License". There are also buttons for "New Version!", "Skins", "Reserved Slots", "Windows", and "Help".

The main area is titled "Lobby" and contains a search bar, "Connect", "Find Next", "Sync", and "Auto Refresh" buttons. Below this is a table listing stations with columns for "Remote Name", "Radio", "TX", "City", "State", and "Country". The table is currently displaying a list of stations, with the first one highlighted in blue.

Remote Name	Radio	TX	City	State	Country
REPETIDORA SUL MINEIRA - PY4RBJ	VHF	<input checked="" type="checkbox"/>	IPIUNA	MG	BRASIL
*****N1ASS 4 BAND REMOTE*****YEASU FTDX-5000 AND A SPE EXPERT 2KFA AMP.FROM THE PUCKER BRUSH*****	FTDX-5000	<input checked="" type="checkbox"/>	DECKER	MI	A United States
Grupo Fernão Dias de Radiocidadão - GFD	Aquario R...	<input checked="" type="checkbox"/>	M...	MG	BRASIL
Remote SP	K3	<input checked="" type="checkbox"/>	Polichno	Swiet...	POLAND
3z9dx HF, VHF, UHV, Satelite Oscar100	Ic-7100	<input checked="" type="checkbox"/>	Sucha		AAA
VK2AAU Costas Radio	Ic-7300	<input checked="" type="checkbox"/>	Sydney	NSW	Australia
VK3CNE	Ic-7300	<input checked="" type="checkbox"/>	Briar Hill	Vic	Australia
VK-Remote	K3	<input checked="" type="checkbox"/>	Melbourne	Victoria	Australia
VK6XT	Ic-7300	<input checked="" type="checkbox"/>	BroomeHill	WA	Australia
VK6AHR Hills Amateur Radio Group (www.harg.org.au)	FTDX-3000	<input checked="" type="checkbox"/>	Perth	West...	Australia
VK6SR - Southern Electronics Group (www.hamradio.org.au)	FT-991	<input checked="" type="checkbox"/>	Perth	West...	Australia
OE9DGV	KX3	<input checked="" type="checkbox"/>	Hohenems	Vbg	Austria
ON7WP-JO21B	TS-590	<input checked="" type="checkbox"/>	Heist-op-d...	Belgi...	Belgium

Below the table is a "Chat Room" section with the text "RCForb (Online Remote Base) Client v0.8 Remote Control of Your Ham Radio Station!". It includes a message input field, "Smilies", "Ask", and "Send" buttons, and a "Users" list on the right.