

D-STAR

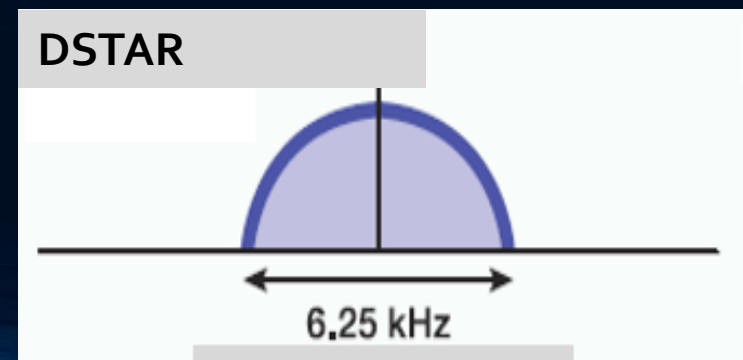
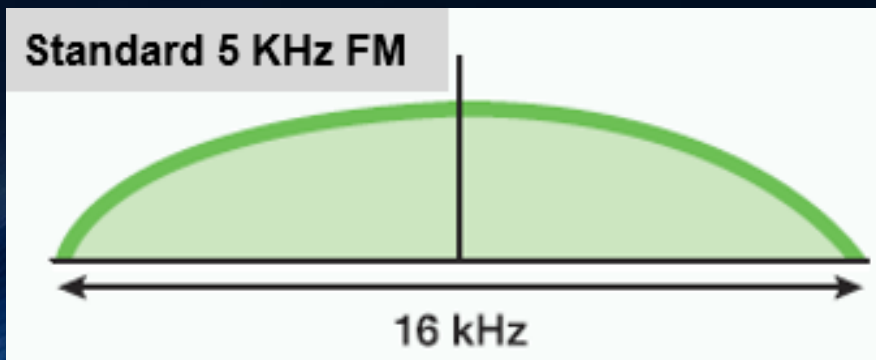
Digital Smart Technology for Amateur Radio

JOHN DAVIS, WB4QDX



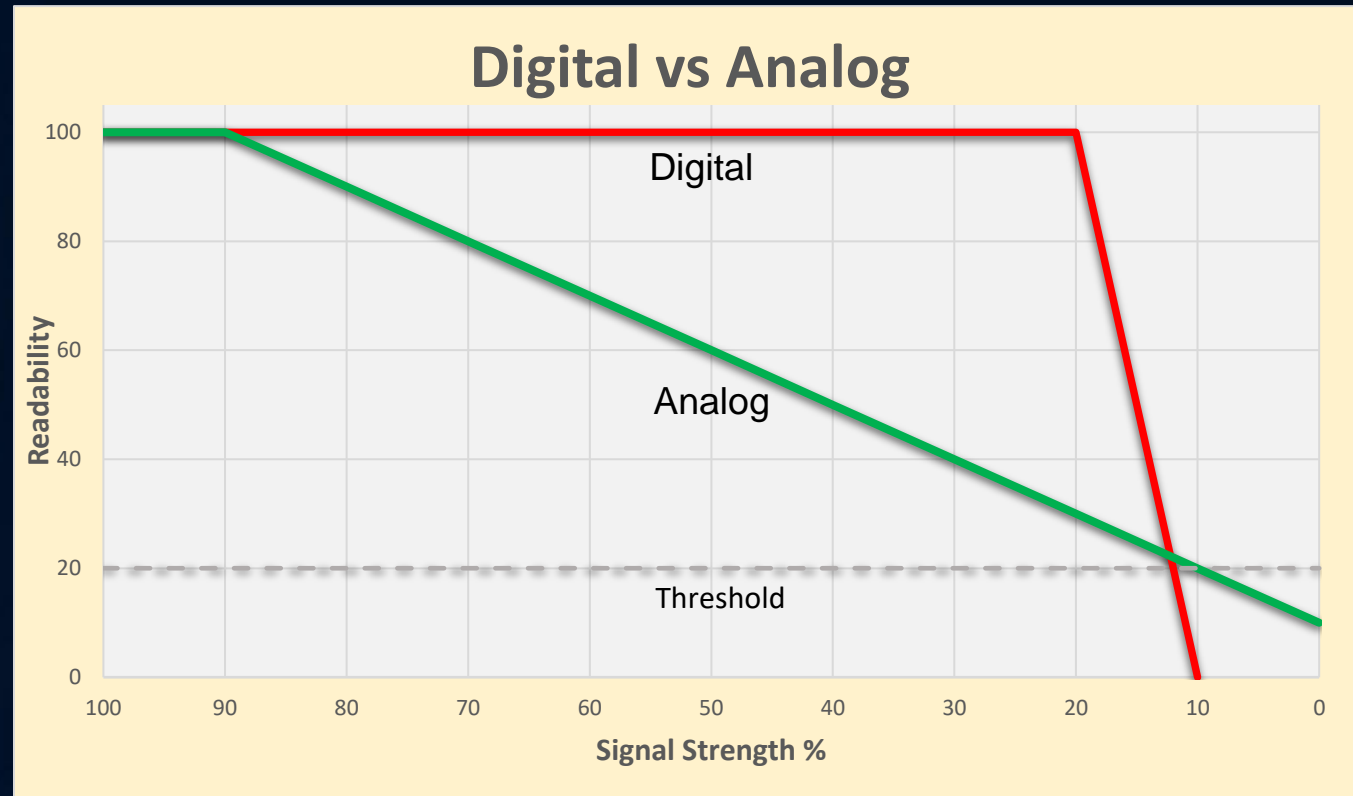
Digital Basics

- Voice (analog) is converted to data (1s and 0s)
- Data (text, etc.) may be added to voice to produce a single data stream containing voice and data
- Radio is modulated as a data carrier
- Occupied bandwidth is determined by data bit rate and type of modulation
- Generally, digital voice and data occupies less spectrum than analog FM@16 KHz (D-STAR@6.25 KHz, DMR@7.6 KHz, Fusion *digital*@9.36 KHz)



Digital Behavior

- Digital voice does not gradually degrade in quality as signal level decreases



What is D-STAR?

- D-STAR is an open standard for digital voice and data designed specifically for Amateur Radio
- One of several digital modes used in Amateur Radio
- Developed by Japan Amateur Radio League (JARL)
- Uses AMBE vocoder chip from DVSI to convert analog speech to data and vice versa

What Can DSTAR Do?

- Transmit or receive voice and 1200 baud data simultaneously on 2m, 70cm with no TNC required (1.2 GHz, 2.4 GHz and 10 GHz on some models)
- 128 Kb data transmission on 1.2, 2.4, and 5.8 GHz with Internet connectivity (Ethernet bridge to Internet with IP address)
- D-PRS (digital APRS) automatic position reporting simultaneous with voice with GPS
- Transmit pictures at 3600 bps
- Operates in digital simplex or through repeaters, reflectors and hotspots
- Reflectors act as conference bridge for linking multiple repeaters (DPLUS, DCS and XRF Reflectors in operation worldwide)
- Flexible repeater linking under use control
- Hotspots allow voice and data access to D-STAR via Internet connection (similar to EchoLink)

What's New in DSTAR

- V3.2 DSTAR repeater software released mid-2024 updates end-of-life CentOS linux operating system and Icom gateway software
- IC-905 covering 144, 440, 1200, 2400, 5600 and adds 10GHz with the optional transverter



For DSTAR Repeater Owners and Admins

- Do I need to upgrade my repeater?
- Almalinux 9 Linux operating system replaces CentOS 7 which went end-of-life in June 2024.
 - No more security or feature updates available
 - Almalinux is the free, open-source successor to CentOS with a large foundation supporting development
- Icom V3.2 gateway software available free from Icom to existing repeater owners
- Simplified instructions and script available for easy installation and backup of existing systems for upgrade
- Popular utility programs upgraded for V3.2 compatibility
 - Dp, Monlink, DplusReport, DSTARMON, etc
- No changes required for users and radios

The Registration Process

- Do I need to register to get on DSTAR?
- Why register?
- Registering your callsign allows access to more functions on DPLUS repeaters
- Register on your local or the closest system, if possible
- Register on **one and only one** system (*Recommended registration on regist.dstargateway.org*)
- Registration is a three-step process (*all three steps must be completed*)

Basic Radio Programming Review

- MYCALL (MY) – My very own FCC call (program once in radio)
- URCALL (UR) – What I want to do (link, unlink, etc)
- RPT1 – The repeater (or hotspot I am transmitting into)
- RPT2 – Where I want my signal to go (usually to the gateway/Internet)

Typical Repeater (talk)

- MY – WB4QDX
- UR – CQCQCQ
- RPT1 – WD4STR C
- RPT2 – WD4STR G

Linking

- MY – WB4QDX
- UR – REF030CL
- RPT1 – WD4STR C
- RPT2 – WD4STR G

Note:
Same programming for Hotspots

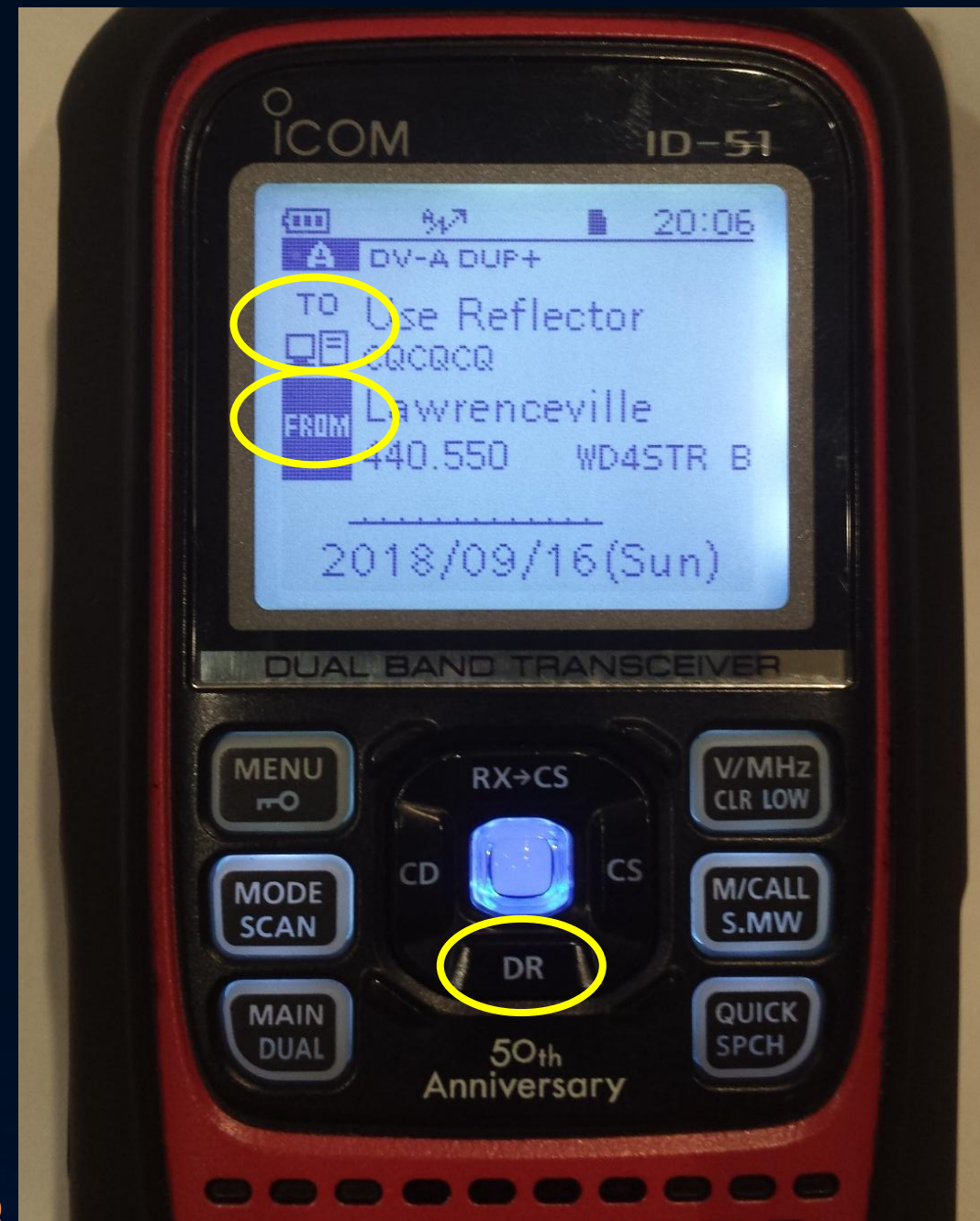
DR Mode – Easiest to Use

- DR Mode is Digital Repeater Mode
- Current generation of radios have two sets of memories
 - Regular Memories for traditional frequency storage (Manual method)
 - Repeater List is geocoded for location-based lookup
- Easy to Use
 - Press DR
 - Select Source Repeater in **FROM** field
 - Pick by region
 - Find Nearest Repeater to current location
 - Select function in **TO** field
- Automatic Programming of Radio



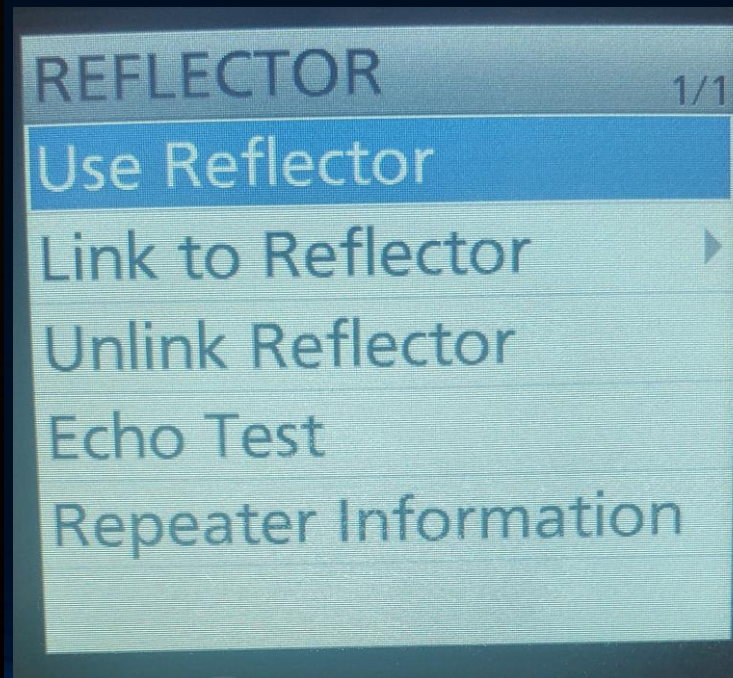
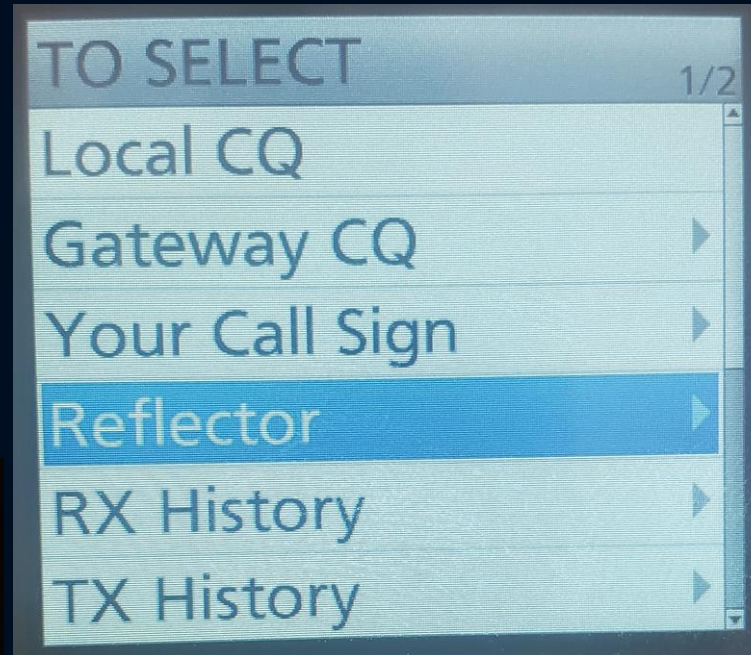
Using DR Mode

- **DR Mode** (Digital Repeater Mode) allows quick selection of repeaters and using linking commands without custom programming
- Uses stored database of repeaters in memory and on SD card
- *Press and hold DR below blue center button to activate DR Mode*
- **FROM** – Sets local repeater you are using
- **TO** – Determines what you want to do with your signal (talk, link, unlink)



DR Mode Tip

- Always set TO to "Use Repeater/Use Reflector"



Tips and Caution Using Hotspots

- Only have ONE hotspot powered at a time
- **Never have two hotspots running on the same frequency (causes unintentional linking two reflectors together!)**
- Program multiple Internet sources in Hotspot in order of preference

Wireless settings Save

Disable reconnect when no internet access detected
 Save settings below to all configuration profiles

| | |
|----------------|-------------------|
| SSID #1: | FN-QDX-24 |
| Key #1: (hide) | gawb4qdx |
| BSSID #1: | a1:b2:c3:d4:e5:f6 |
| SSID #2: | JD-S10 |
| Key #2: (show) | |
| BSSID #2: | a1:b2:c3:d4:e5:f6 |
| SSID #3: | GTW |
| Key #3: (show) | |
| BSSID #3: | a1:b2:c3:d4:e5:f6 |
| SSID #4: | WD4STR-44Net |
| Key #4: (show) | |
| BSSID #4: | a1:b2:c3:d4:e5:f6 |

WiFi Info

WiFi Regulatory Domain (Country Code): US

| | | | |
|-----------|--------|-----------------|------------|
| Network 0 | Delete | SSID: FN-QDX-58 | PSK: |
| Network 1 | Delete | SSID: FN-QDX-24 | PSK: |
| Network 2 | Delete | SSID: S10-JD | PSK: |
| Network 3 | Delete | SSID: GTW | PSK: |

OpenSpot4 Pro Quick Setup

Quick setup Cancel

Please select the type of your radio.

| | |
|------|--------|
| DMR | D-STAR |
| C4FM | NXDN |
| P25 | POCSAG |

Do you want to set up location broadcasting and forwarding GPS position data from your transceiver to the APRS network?

APRS

Quick setup « Back Cancel

General D-STAR settings

Radio frequency (MHz):

Please select the network/server type to continue.

| | | |
|-----------------------------|-----------------------|-----------------------------|
| REF/XRF | DCS/XLX | Gateway |
| BrandMeister | DMRplus/MARC/TGIF/XLX | |
| FCS | YSFReflector | NXDNReflector |
| SharkRF IP Connector client | | SharkRF IP Connector server |

ZUMspot Configuration

- Using W0CHP firmware

Hostname: pi-star WPSD Ver. # 0ddb80478

WPSD Digital Voice - Configuration

15:36:38, May 8 Dashboard Admin Power Advanced WPSD Update Backup/Restore Factory Reset

General Configuration

| | | |
|----------------------------|---|--|
| Hostname: | <input type="text" value="pi-star"/> | ⚠ Do not add suffixes such as ".local", etc. Note: A reboot is required for this change to take effect. |
| Node Callsign: | <input type="text" value="WB4QDX"/> | ⚠ Do not add suffixes such as "-G" |
| DMR/CCS7 ID: | <input type="text" value="3113044"/> | ℹ Required for DMR Mode & DMR Cross-Modes (If you don't have one, get a DMR ID from RadioID.Net) |
| NXDN ID: | <input type="text"/> | ℹ Required for NXDN Mode & NXDN Cross-Modes (If you don't have one, get an NXDN ID from RadioID.Net) |
| Radio Mode: | <input checked="" type="radio"/> Simplex <input type="radio"/> Duplex | ℹ Duplex mode requires Dual-Hat/Duplex Modems |
| Radio Frequency: | <input type="text" value="438.600.000"/> MHz | |
| Radio/Modem Type: | <input type="text" value="DV-Mega Raspberry Pi Hat (GPIO) - Single Band (70cm)"/> | |
| Modem Baud Rate: | <input type="text" value="115200"/> | |
| System Time Zone: | <input type="text" value="America/New_York"/> | Time Format: <input checked="" type="radio"/> 24 Hour <input type="radio"/> 12 Hour |
| Dashboard Language: | <input type="text" value="english_us"/> | |
| Update Notifier: | <input type="radio"/> Disabled <input checked="" type="radio"/> Enabled | Enables / Disables automatic dashboard software update notifications. When enabled, software update availability is displayed in the dashboard header. |

Node Location & Info Settings

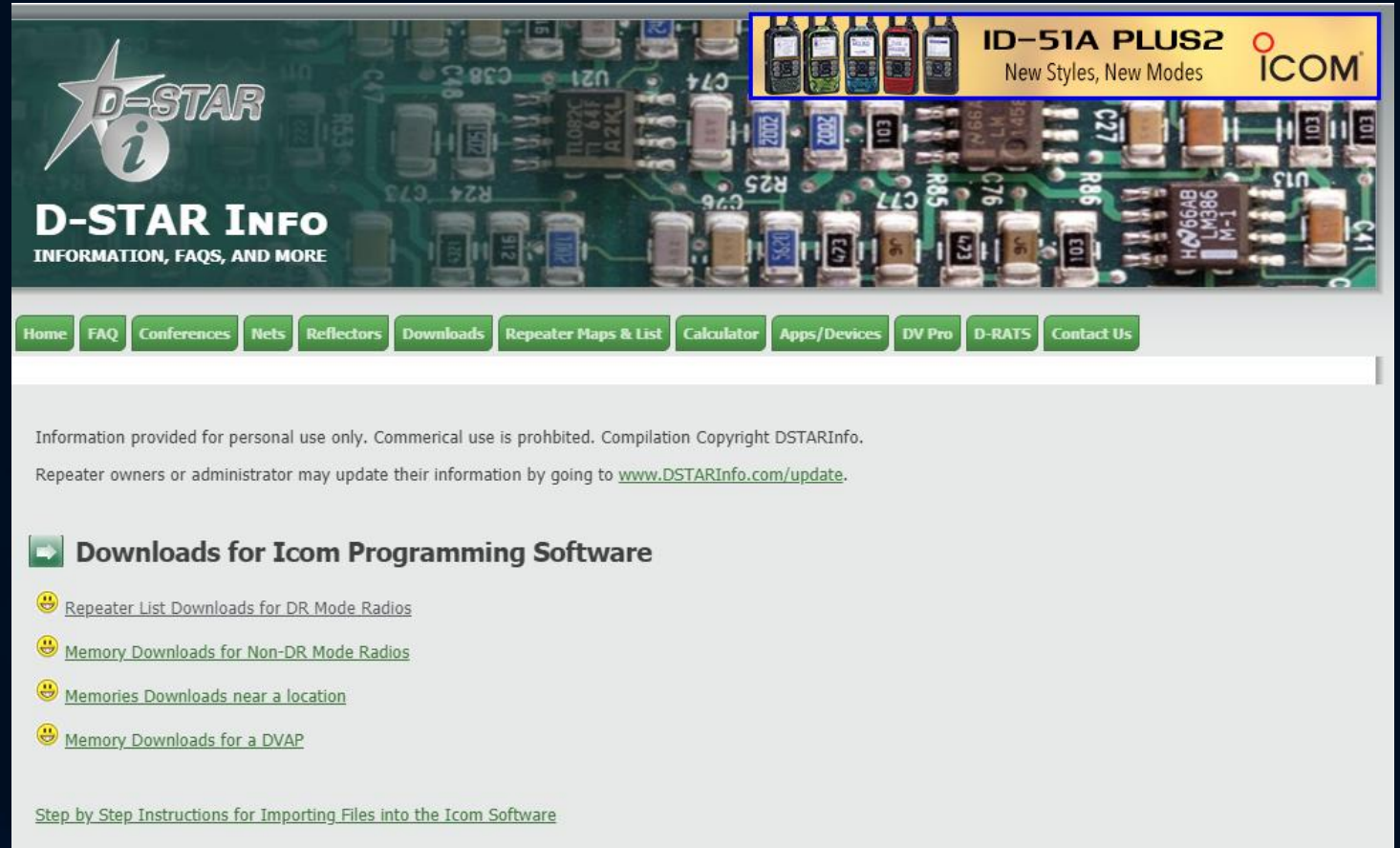
| | | |
|-------------------|--------------------------------------|--|
| Latitude: | <input type="text" value="34.1569"/> | degrees (positive value for North, negative for South) |
| Longitude: | <input type="text" value="-83.717"/> | degrees (positive value for East, negative for West) |

Why Update Memories?

- Current generation D-STAR radios come pre-loaded with an international database of repeaters
- Pre-loaded data is great to get on the air out of the box, but does not have most current list of repeaters
- Updating memories can provide more repeaters in an area
- Sources of updated repeater data
 - DstarInfo.com
 - RT Systems software (Uses DstarInfo.com data)

DstarInfo.com Data

- www.DstarInfo.com
- Select Downloads tab
- Select type of download desired
 - DR Mode radios
 - Non-DR Mode radios
 - Near a location
 - DVAP, hotspot downloads



The screenshot shows the D-STAR INFO website interface. At the top, there is a banner for the ICOM ID-51A PLUS2 radio with the text "New Styles, New Modes" and the ICOM logo. Below the banner is the D-STAR INFO logo and the text "D-STAR INFO INFORMATION, FAQs, AND MORE". A navigation bar contains several green buttons: Home, FAQ, Conferences, Nets, Reflectors, Downloads, Repeater Maps & List, Calculator, Apps/Devices, DV Pro, D-RATS, and Contact Us. Below the navigation bar, there is a disclaimer: "Information provided for personal use only. Commercial use is prohibited. Compilation Copyright DSTARInfo. Repeater owners or administrator may update their information by going to www.DSTARInfo.com/update." Below the disclaimer, there is a section titled "Downloads for Icom Programming Software" with a green arrow icon. This section lists four download links, each preceded by a smiley face icon: "Repeater List Downloads for DR Mode Radios", "Memory Downloads for Non-DR Mode Radios", "Memories Downloads near a location", and "Memory Downloads for a DVAP". At the bottom of the page, there is a link for "Step by Step Instructions for Importing Files into the Icom Software".

DstarInfo.com Data

- Enter location (***use coordinates**) and Lookup Location
- Select radio model
- Enter number of empty repeater slots (reserves memory slots for hotspots)
- Enter percent FM
- Download to get CSV file

D-STAR Repeater Downloads Version - 2.3.0 - 23 September 2022

Please Enter Coordinates

Enter Latitude Enter Longitude

We found the following location:

Latitude 34.157 Longitude -83.716
Maidenhead Grid EM84dd

Select Radio

Radio Specifications

| | |
|----------------------------|---------------------------------|
| Manufacturer | Icom |
| Standard Memories | 500 |
| Repeater List Length | 2500 |
| Your Call Sign List Length | 300 |
| Name Display Length | 16 |
| Empty Repeater Slots | <input type="text" value="0"/> |
| Percent FM | <input type="text" value="20"/> |

CSV File Output

| Group No | Group Name | Name | Sub Name | Repeater | Gateway C | Frequency | Dup | Offset | Mode | TONE | Repeater | RPT1USE | Position | Latitude | Longitude | UTC Offse |
|----------|------------|-------------|----------|----------|-----------|-----------|------|--------|------|------|----------|---------|----------|----------|-----------|-----------|
| 4 | Canada | Burlington | Ontario | VE3RSB B | VE3RSB G | 442.0375 | DUP+ | 5 | DV | OFF | 82.5Hz | Yes | Approxim | 43.36 | -79.86 | -05:00 |
| 4 | Canada | Fonthill- C | Ontario | VE3PLF B | VE3PLF G | 444.725 | DUP+ | 5 | DV | OFF | 82.5Hz | Yes | Approxim | 43.05 | -79.3 | -05:00 |
| 4 | Canada | Hamilton | Ontario | VE3WIK B | VE3WIK G | 443.6375 | DUP+ | 5 | DV | OFF | 82.5Hz | Yes | Approxim | 43.39 | -79.97 | -05:00 |
| 4 | Canada | Hamilton | Ontario | VE3WIK C | VE3WIK G | 145.33 | DUP- | 0.6 | DV | OFF | 82.5Hz | Yes | Approxim | 43.39 | -79.97 | -05:00 |
| 4 | Canada | Leamingto | Ontario | VE3LNK C | VE3LNK G | 145.69 | DUP- | 0 | DV | OFF | 82.5Hz | Yes | Approxim | 42.06 | -82.6 | -05:00 |
| 4 | Canada | Little Curr | Ontario | VE3RXR C | VE3RXR G | 145.31 | DUP- | 0.6 | DV | OFF | 82.5Hz | Yes | Approxim | 45.96 | -81.93 | -05:00 |
| 4 | Canada | Little Curr | Ontario | VE3RXR B | VE3RXR G | 442.05 | DUP+ | 5 | DV | OFF | 82.5Hz | Yes | Approxim | 45.96 | -81.93 | -05:00 |
| 4 | Canada | London | Ontario | VE3TTT B | VE3TTT G | 442.3 | DUP+ | 5 | DV | OFF | 82.5Hz | Yes | Approxim | 42.99 | -81.24 | -05:00 |
| 4 | Canada | Maple | Ontario | VA3ITL B | VA3ITL G | 442.2125 | DUP+ | 5 | DV | OFF | 82.5Hz | Yes | Approxim | 44.11 | -79.19 | -05:00 |
| 4 | Canada | Mississau | Ontario | VA3PMO B | VA3PMO G | 444.25 | DUP+ | 5 | DV | OFF | 82.5Hz | Yes | Approxim | 43.59 | -79.64 | -05:00 |
| 4 | Canada | Mississau | Ontario | VE3RSD C | VE3RSD G | 147.54 | DUP- | 0 | DV | OFF | 82.5Hz | Yes | Approxim | 43.6 | -79.78 | -05:00 |
| 4 | Canada | Mississau | Ontario | VE3RSD B | VE3RSD G | 443.8125 | DUP+ | 5 | DV | OFF | 82.5Hz | Yes | Approxim | 43.6 | -79.78 | -05:00 |
| 4 | Canada | Newmark | Ontario | VE3YRK C | VE3YRK G | 147.18 | DUP+ | 0.6 | DV | OFF | 82.5Hz | Yes | Approxim | 44.06 | -79.45 | -05:00 |
| 4 | Canada | Newmark | Ontario | VE3YRK B | VE3YRK G | 444.5125 | DUP+ | 5 | DV | OFF | 82.5Hz | Yes | Approxim | 44.06 | -79.45 | -05:00 |
| 4 | Canada | Niagara on | Ontario | VA3YYZ C | VA3YYZ G | 144.93 | DUP+ | 0.6 | DV | OFF | 82.5Hz | Yes | Approxim | 43.22 | -79.13 | -05:00 |
| 4 | Canada | Niagara on | Ontario | VA3YYZ B | VA3YYZ G | 442.6875 | DUP+ | 5 | DV | OFF | 82.5Hz | Yes | Approxim | 43.22 | -79.13 | -05:00 |
| 4 | Canada | Norfolk | Ontario | VE3HJ B | VE3HJ G | 444.55 | DUP+ | 5 | DV | OFF | 82.5Hz | Yes | Approxim | 42.93 | -80.28 | -05:00 |
| 4 | Canada | PeterBorc | Ontario | VE3SSF C | VE3SSF G | 147.36 | DUP+ | 0.6 | DV | OFF | 82.5Hz | Yes | Approxim | 44.31 | -78.32 | -05:00 |
| 4 | Canada | Simcoe Cc | Ontario | VE3LSR C | VE3LSR G | 145.19 | DUP- | 0.6 | DV | OFF | 82.5Hz | Yes | Approxim | 44.54 | -79.66 | -05:00 |
| 4 | Canada | Simcoe Cc | Ontario | VE3LSR B | VE3LSR G | 444.35 | DUP+ | 5 | DV | OFF | 82.5Hz | Yes | Approxim | 44.54 | -79.66 | -05:00 |
| 4 | Canada | St Cathari | Ontario | VE3NUU B | VE3NUU G | 443.8375 | DUP+ | 5 | DV | OFF | 82.5Hz | Yes | Approxim | 43.24 | -79.21 | -05:00 |
| 4 | Canada | Thornhill | Ontario | VE3EBX B | VE3EBX G | 444 | DUP- | 0 | DV | OFF | 82.5Hz | Yes | Approxim | 43.8 | -79.55 | -05:00 |
| 4 | Canada | Toronto | Ontario | VA3DVN E | VA3DVN G | 444.7375 | DUP+ | 5 | DV | OFF | 82.5Hz | Yes | Approxim | 43.97 | -79.43 | -05:00 |
| 4 | Canada | Toronto | Ontario | VA3SLU B | VA3SLU G | 442.4125 | DUP+ | 5 | DV | OFF | 82.5Hz | Yes | Approxim | 43.97 | -79.43 | -05:00 |
| 4 | Canada | Toronto | Ontario | VE3YYZ B | VE3YYZ G | 442.7 | DUP+ | 5 | DV | OFF | 82.5Hz | Yes | Approxim | 43.65 | -79.38 | -05:00 |
| 4 | Canada | Toronto | Ontario | VE3YYZ C | VE3YYZ G | 144.94 | DUP+ | 0.6 | DV | OFF | 82.5Hz | Yes | Approxim | 43.65 | -79.38 | -05:00 |
| 4 | Canada | Uxbridge | Ontario | VE3RPT B | VE3RPT G | 443.225 | DUP+ | 5 | DV | OFF | 82.5Hz | Yes | Approxim | 44.04 | -79.07 | -05:00 |
| 4 | Canada | Windsor | Ontario | VA3WDG B | VA3WDG G | 445.825 | DUP- | 0 | DV | OFF | 82.5Hz | Yes | Approxim | 42.25 | -82.96 | -05:00 |
| 4 | Canada | Windsor | Ontario | VE3ZIN C | VE3ZIN G | 147.42 | DUP- | 0 | DV | OFF | 82.5Hz | Yes | Approxim | 42.32 | -82.97 | -05:00 |
| 20 | USA Midw | Cabot | Arkansas | W5STR B | W5STR G | 442.475 | DUP+ | 5 | DV | OFF | 82.5Hz | Yes | Approxim | 35.01 | -92.13 | -06:00 |
| 20 | USA Midw | Little Rock | Arkansas | K5NSX C | K5NSX G | 145.17 | DUP- | 0.6 | DV | OFF | 82.5Hz | Yes | Approxim | 34.48 | -92.29 | +04:30 |

What About Hotspots?

- Use TO in DR Mode to connect to reflectors



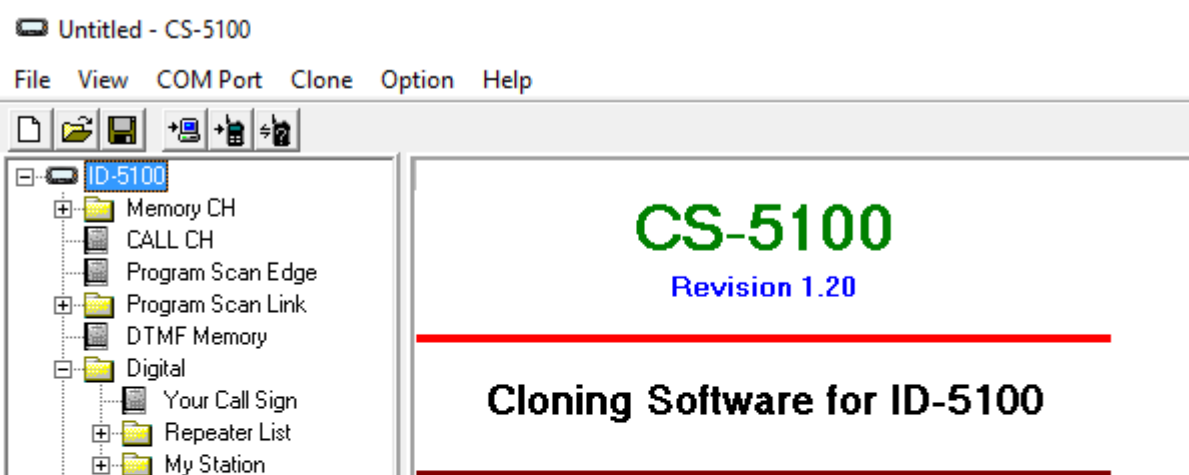
| No. | Type | Name | Sub Name | Call Sign | | Frequency | | | |
|-----|-------------|------------------|----------|--------------------|-------------------|----------------|------|-------------|------|
| | | | | Repeater Call Sign | Gateway Call Sign | Operating Freq | DUP | Offset Freq | Mode |
| 0 | DV Repeater | JD Openspot4 Pro | | WB4QDX D | WB4QDX G | 437.600000 | DUP+ | 0.000000 | DV |
| 1 | DV Repeater | JD ZUMspot UHF | | WB4QDX B | WB4QDX G | 438.600000 | DUP- | 0.000000 | DV |
| 2 | DV Repeater | JVP ZUMspot UHF | | WB4JVP B | WB4JVP G | 439.600000 | DUP+ | 0.000000 | DV |
| 3 | DV Simplex | JD DVAP VHF | | — | — | 145.790000 | — | — | DV |
| 4 | DV Simplex | JD DVAP UHF | | — | — | 438.600000 | — | — | DV |
| 5 | DV Simplex | DVAP Default VHF | | — | — | 146.550000 | — | — | DV |
| 6 | DV Simplex | DVAP Default UHF | | — | — | 446.550000 | — | — | DV |
| 7 | DV Repeater | DV Mega UHF Cont | | RPTRCTLB | WB4QDX G | 441.000000 | DUP+ | 0.000000 | DV |
| 8 | DV Repeater | DV Mega VHF Use | | WB4QDX C | WB4QDX G | 145.670000 | DUP+ | 0.600000 | DV |
| 9 | DV Repeater | DV Mega VHF Cont | | RPTRCTL C | WB4QDX G | 145.670000 | DUP+ | 0.600000 | DV |
| 10 | DV Simplex | VHF DV Simplex | | — | — | 145.670000 | — | — | DV |
| 11 | DV Simplex | UHF DV Simplex | | — | — | 445.670000 | — | — | DV |

Getting It Into the Radio

- Import into the Icom software (File > Import) then save to radio (also Import to RT Systems)

OR

- Copy CSV file to CSV folder on SD Card pre-formatted in radio
- Import file from radio menu (Menu > SD Card > Import)



Untitled - CS-5100

File View COM Port Clone Option Help

CS-5100
Revision 1.20

Cloning Software for ID-5100

| Name | Date modified | Type |
|---------|--------------------|-------------|
| Capture | 4/16/2019 11:28 PM | File folder |
| Csv | 4/16/2019 11:28 PM | File folder |
| Decode | 4/16/2019 11:28 PM | File folder |
| QsoLog | 4/16/2019 11:28 PM | File folder |
| Reply | 4/16/2019 11:28 PM | File folder |
| RxLog | 4/16/2019 11:28 PM | File folder |
| Setting | 4/16/2019 11:29 PM | File folder |
| Voice | 4/16/2019 11:28 PM | File folder |
| VoiceTx | 4/16/2019 11:28 PM | File folder |

DSTAR in Georgia

| Location | Repeater | Frequency | Dup | Offset |
|------------------|----------|-----------|------|--------|
| Albany | KJ4KLD C | 144.9600 | DUP+ | 2.5 |
| Albany | KJ4KLD B | 440.7000 | DUP+ | 5 |
| Appling/Augusta | KJ4PYA C | 145.0800 | DUP+ | 1.4 |
| Appling/Augusta | KJ4PYA B | 440.6500 | DUP+ | 5 |
| Athens/Jackson C | KJ4PXY B | 440.6375 | DUP+ | 5 |
| Athens/Jackson C | KJ4PXY C | 144.9800 | DUP+ | 2.5 |
| Atlanta | W4DOC B | 440.6000 | DUP+ | 5 |
| Atlanta | W4DOC C | 145.3500 | DUP- | 0.6 |
| Ball Ground | KK4WIB C | 147.4250 | DUP- | 0 |
| Ball Ground | KK4WIB B | 442.4875 | DUP- | 0 |
| Braselton | KE4TV B | 440.5875 | DUP+ | 5 |
| Buford | KJ4BDF B | 440.7250 | DUP+ | 5 |
| Clermont | W4CBA C | 145.2000 | DUP- | 0.6 |
| Clermont | W4CBA B | 444.3375 | DUP+ | 5 |
| Cleveland | K4GAR B | 440.5125 | DUP+ | 5 |
| Columbus | W4CVY B | 443.5750 | DUP+ | 5 |
| Columbus | WB4ULK B | 444.6125 | DUP+ | 5 |
| Covington | WA4ASI C | 146.9250 | DUP- | 0.6 |
| Dallas | WX4PCA C | 145.3400 | DUP- | 0.6 |
| Dallas | WX4PCA B | 440.5750 | DUP+ | 5 |
| Dalton | KA4RVT B | 444.5000 | DUP+ | 5 |
| Dalton | KA4RVT C | 145.3300 | DUP- | 0.6 |
| Dublin | KJ4YNR C | 145.1800 | DUP- | 0.6 |
| Dublin | KJ4YNR B | 440.5250 | DUP+ | 5 |
| Ellijay | W4HHH B | 443.9875 | DUP+ | 5 |
| Evans | WB6BA B | 440.6000 | DUP+ | 5 |
| Fayetteville | KK4GQ B | 442.5625 | DUP+ | 5 |
| Forsyth | KK4JPG C | 145.0800 | DUP+ | 1.4 |
| Gainesville | KJ4ZLL B | 441.8625 | DUP+ | 5 |
| Gainesville | KJ4ZLL C | 145.1200 | DUP- | 0.6 |
| Griffin | W4AMI C | 145.4800 | DUP- | 0.6 |
| Hinesville | KQ4BBQ C | 144.6200 | DUP+ | 0.6 |
| Jasper/Oglethorp | KJ4PYC C | 145.0800 | DUP+ | 1.4 |
| Jasper/Oglethorp | KJ4PYC B | 440.6625 | DUP+ | 5 |

| Location | Repeater | Frequency | Dup | Offset |
|------------------|----------|-----------|------|--------|
| Jersey | WC4RG C | 145.3000 | DUP- | 0.6 |
| Jersey | WC4RG B | 443.0000 | DUP+ | 5 |
| Kathleen | WY4EMA B | 440.5750 | DUP+ | 5 |
| LaGrange | WB4BXO B | 440.5125 | DUP+ | 5 |
| Lawrenceville | WD4STR B | 440.5500 | DUP+ | 5 |
| Lawrenceville | WD4STR C | 145.0600 | DUP+ | 1.4 |
| Lookout Mountain | N4LMC C | 145.1600 | DUP- | 0.6 |
| Macon | WX4EMA B | 440.6250 | DUP+ | 5 |
| Macon | WX4EMA C | 145.3400 | DUP- | 0.6 |
| Marietta | W4BTI B | 440.6875 | DUP+ | 5 |
| Midway | KG4LVN C | 146.9400 | DUP- | 0.6 |
| Morganton | KM4MAD C | 145.4000 | DUP- | 0.6 |
| Pembroke | KJ4GGV B | 440.7000 | DUP+ | 5 |
| Pembroke | KJ4GGV C | 145.2800 | DUP- | 0.6 |
| Rome | W4VO C | 145.3800 | DUP- | 0.6 |
| Rome | W4VO B | 440.6250 | DUP+ | 5 |
| Sandersville | W4SAN C | 145.3200 | DUP- | 0.6 |
| Sandersville | W4SAN B | 444.5375 | DUP+ | 5 |
| Savannah | KK4SGC B | 440.5875 | DUP+ | 5 |
| Savannah | KK4SGC C | 144.9400 | DUP+ | 2.5 |
| Stone Mountain | WX4GPB B | 440.7000 | DUP+ | 5 |
| Stone Mountain | WX4GPB C | 144.9600 | DUP+ | 2.5 |
| Thomasville | KJ4PYB C | 145.0800 | DUP+ | 1.4 |
| Thomasville | KJ4PYB B | 440.6500 | DUP+ | 5 |
| Tifton | W4PVW B | 444.5625 | DUP+ | 5 |
| Tifton | W4PVW C | 145.1200 | DUP- | 0.6 |
| Valdosta | W4VLD B | 443.7125 | DUP+ | 5 |
| Valdosta | W4VLD C | 145.1400 | DUP- | 0.6 |
| Villa Rica | WR4VR C | 145.2400 | DUP- | 0.6 |
| Waleska | KI4GOM C | 145.0200 | DUP+ | 1.4 |
| Warm Springs | KJ4KLE C | 144.9200 | DUP+ | 2.5 |
| Warm Springs | KJ4KLE B | 440.6750 | DUP+ | 5 |
| Waynesboro | K4BRK B | 444.1000 | DUP+ | 5 |



Questions?

